MILITARY PRODUCTS

Globe Motors™

EXPERTS IN MOTION CONTROL

COMPANY-WIDE COMMITMENT TO QUALITY…

9000 QS CERTIFIED

9001 ISO CERTIFIED

At Globe Motors, we're committed to providing customers with products and services that meet or exceed their requirements—on time, every time. This commitment is not just a baseline for performance, it is the least we can do to provide the highest level of support.

Globe Motors' quality policy affects every employee and work process. From top management to our customer service representatives, from research and development to application support, our entire organization is involved in the process of quality.

Major changes in the way our organization approaches the quality process have resulted in better customer service, better products, and better after-the-sale support. At Globe Motors, quality is a long-term partnership with our customers.

Steve McHenry
Vice President & General Manager

Headquarters
Dayton, Ohio

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Globe Motors™

GLOBE DC MOTORS

Globe Motors manufactures permanent magnet DC motors up to 0.2 horsepower (149.20 watts). These motors can be combined with a number of options such as integral planetary gear trains, clutches, brakes and filters.

GEARMOTORS

Almost any Globe motor can be furnished as a gearmotor. An extensive selection of standard gear ratios is available to meet your speed and torque requirements. Globe planetary gear trains offer efficiencies well over 80% per reduction stage for most models, while larger sizes offer efficiencies up to 93%.

DELIVERY

When you need a prototype, a large stock of standard catalog units is available from our distribution network for delivery in 24 hours. In addition, Globe maintains facilities that are geared to quickly handle the largest production order to meet your needs.

PERMANENT MAGNET MOTORS

In DC motors of 0.1 horsepower (74.60 watts) or less, a permanent magnet field is most useful. Comparing motors below 1.25" in diameter, permanent magnet motors run cooler than wound field types because no power is expended to maintain a magnetic field.

The permanent magnet field functions perfectly for thousands of hours of operation and lasts indefinitely on the shelf.

Permanent magnet motors are easily reversed by changing the polarity of the voltage applied to the connecting terminals. They are capable of high-stall torque and function perfectly in long-duty cycle applications.

Dynamic braking is easily obtained by merely applying a short circuit to the motor terminals after voltage is removed. With Globe permanent magnet motors, this usually results in less than 20 armature revolutions coast.

Figure 1 illustrates a speed-torque/current-torque curve for a permanent magnet motor. Each curve is a theoretical straight line since the permanent magnet field and armature winding are constant in a given motor. Current varies in proportion to torque, and the slope of this curve is a torque constant (K_T) in oz. in./amp.

Figure 2 shows that with the permanent magnet motor, no load speed varies inversely with field strength and stall torque varies directly with field strength. In this illustration, curve “a” is the lowest value, curve “b” is the nominal and curve “c” is the maximum value of field strength.

Figure 3 indicates the result of changing the applied voltage to a permanent magnet motor. No load speed changes proportionally to voltage, resulting in a family of parallel speed-torque curves. Remember that voltage determines speed, and only torque will determine current.

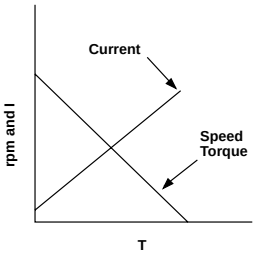


Fig. 1: Permanent Magnet Motor Curve

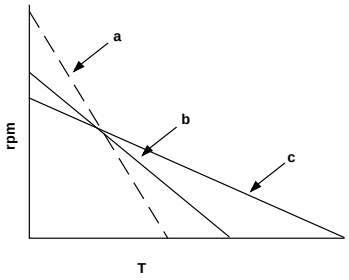


Fig. 2: Speed Tolerance Characteristics

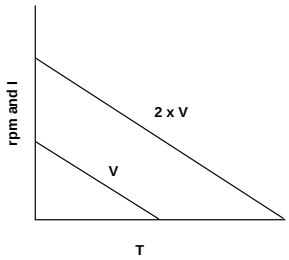
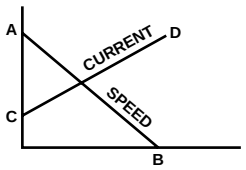


Fig. 3: Voltage Change Effect on Speed

How To Draw Speed Torque Curve



A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

DC MOTOR CONSTANTS

Motor constants are parameters used to define motor characteristics. Torque constant (K_T) and resistance (R) completely define a permanent magnet motor in terms of determining speeds, torques, efficiencies, currents, etc.

DC motor brushes produce a non-linear voltage drop at the commutator somewhat similar to the forward voltage drop of a silicon diode. It is customary to add a 1- to 2-volt drop factor for this when calculating performance using K_T and R. However, the K_T and R values shown in this catalog are adjusted so that this is not necessary. Motor performance calculations for these motors will indicate actual performance when lead or terminal voltage is used and the torques are within the normal operating range of no load to one-half of stall.

For motors 1.25" diameter and smaller, any errors out to stall should be less than 5%. At the power levels near stall on motors 1.50" and larger, both brush drop and field distortion due to input current are a much larger factor and actual torques near stall will be less than expected.

In this catalog, all values of K_T are in oz. in./amp. Conversion to other units is as follows:

oz. in./amp x .706155 = Newton centimeters/amp
oz. in./amp x 7.06155 = milli-Newton meters/amp
oz. in./amp x 72 = gm cm/amp
oz. in./amp x .0625 = lb. in./amp
oz. in./amp x .0052 = ft. lbs./amp

The voltage constant K_E in volts/1,000 rpm is obtained from the equation $K_E = K_T/1.35$.

The motor constant $K_M = K_T/\sqrt{R}$. This constant is a measure of motor "size," but for comparison be sure that equal units are used.

The no-load-torque value shown in this catalog for each motor series includes all no load losses and can be considered a nominal value over the speed ranges where it is anticipated that the unit will be used. While brush and bearing friction are relatively independent of speed, other factors such as grease viscosity, windage, hysteresis and electrical losses will change as exponential functions of speed. The most noticeable variation from unit-to-unit or test-to-test will be caused by temperature effects on grease viscosity. When more exact calculations are required, you may assume that one-half of the no load losses occurs at zero rpm and that these losses will follow a linear curve from this point to the listed catalog speed value.

K_T and R values in this catalog are all nominal values at +25°C and should not be considered as minimum or maximum.

FORMULAS

When the no load torque is known, an actual speed-torque-current curve can be drawn using:

$$\text{Stall Torque} = \left[\left(K_T \times \frac{\text{volts}}{R}\right) - \text{No Load Torque}\right]$$

$$\text{No Load Current} = \frac{\text{No Load Torque}}{K_T}$$

$$\text{No Load Speed} = \frac{[\text{volts} - (\text{No Load Current} \times R)]}{K_E}$$

$$\text{Stall Current} = \frac{\text{volts}}{R}$$

The speed of any torque can be found using the basic motor performance equation below.

$$\text{Speed (krpm)} = \frac{V-(I_aR)}{K_E} = \frac{V}{K_E} - \frac{\text{Torque} \times R}{K_EK_T}$$

V = applied voltage
I_a = armature current @ load
R = armature resistance
K_E = voltage constant for given motor design and winding

When K_E is $\frac{\text{volts}}{\text{krpm}}$, speed will be in krpm

Torque = Load Required + No Load Torque

$$\text{Slope of Speed-Torque Curve} = \frac{R}{K_EK_T} \text{ (krpm/oz. in.)}$$

$$\text{Mechanical Time Constant (seconds)} = \frac{100\,\pi \times \text{Inertia} \times \text{Res.}}{3 \times K_EK_T} = \frac{135\,\pi \times \text{Inertia}}{3\,(K_M)^2}$$

$$\text{RPM at Peak Efficiency} = \frac{\text{No Load rpm}}{1+\sqrt{\frac{\text{No Load Current}}{\text{Stall Current}}}}$$

$$\text{Current at Peak Efficiency} = \sqrt{\text{No Load Current} \times \text{Stall Current}}$$

Note: The above are correct when Inertia is in oz. in. sec.^{2}, K_E is volts/krpm and K_T is in oz. in./amp. Remember that the speed is always in thousands of rpm whenever K_E is used.

PULSE WIDTH MODULATION

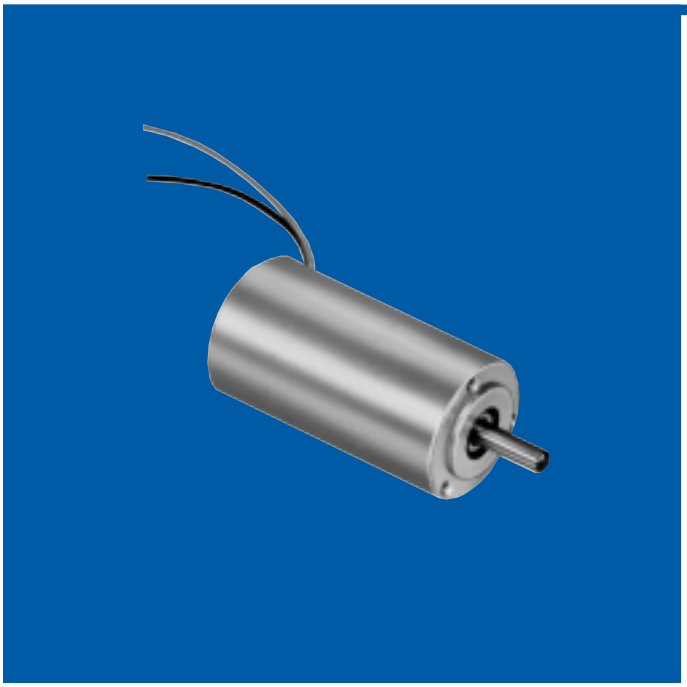
Most Globe standard DC motors have low electrical time constants (0.3 to 0.6 milliseconds) and mechanical time constants in the 10- to 25-millisecond range. When using pulse width modulated power, be sure to keep the frequency high enough to obtain the velocity uniformity needed for your system. While some systems will work as low as 40 to 50 Hz, 1000 Hz is suggested as a low limit.

These motors have a "Q" of well over 10, so that voltage spike suppression is usually needed to protect the circuits. The diode commonly used for this purpose dissipates part of the inductive energy as heat (I^2R loss) in the motor winding. Because this loss will increase with frequency, very high frequencies should be carefully considered. Motor tests show no advantages in using the 5 kHz to 20 kHz range.

SD MOTORS

DC Permanent Magnet Motors

A-1200



Dimensions

general design specification

power rating: .0025 hp (1.9 W)

voltage: 6 to 50 VDC

weight: 1.75 ounces

armature: Dynamically balanced

inertia: 2.55 x 10^{-5} oz. in. $sec.^2$

electrical time constant: 0.5 milliseconds max

mechanical time constant: 40.0 milliseconds max

typical no load torque: 0.2 oz. in.

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 40-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" #26 AWG leads per MIL-W-16878/4

housing: Aluminum

marking: Per MIL-STD-130

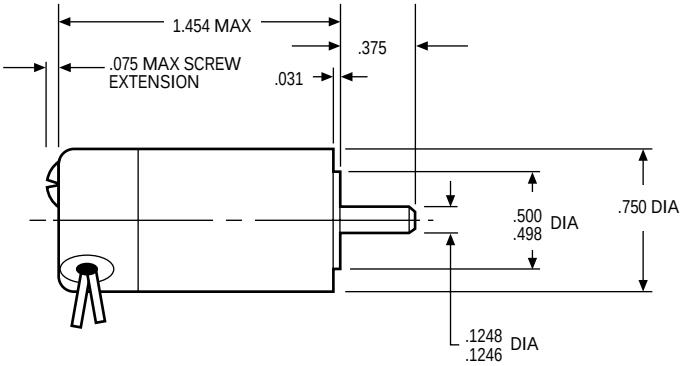
life: 1,000 hours continuous duty for 27 VDC units

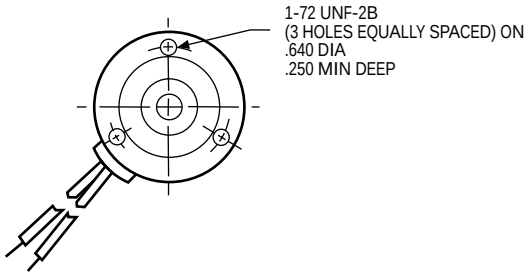
winding temperature rise: 17°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

winding insulation rating: 130°C (higher temperature windings available)

options available:

- Gear train (see A-1230 for details)
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Servo mounting
- Pinion shaft





ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

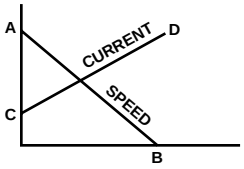
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NUMBERS*
6	14,500-17,500	.10	1.6	.58	1.00	4.17	.43	1.44	136A208-17
6	12,000-14,000	.28	1.2	.48	1.00	2.64	.54	2.27	136A208-16
6	9,000-10,500	.28	.9	.38	.82	1.62	.70	3.70	136A208-15
12	13,000-15,500	.22	1.6	.27	.53	1.86	.96	6.46	136A208-14
12	9,500-11,000	.37	1.2	.19	.50	1.05	1.36	11.40	136A208-13
12	8,500-10,000	.28	.9	.17	.38	.75	1.51	16.00	136A208-12
12	6,500-8,000	.22	.7	.14	.28	.49	1.84	24.50	136A208-1
27	13,000-16,000	.22	1.4	.12	.24	.74	2.16	36.30	136A208-2
27	10,000-12,500	.31	1.1	.09	.22	.47	2.70	57.10	136A208-3
27	9,000-10,500	.24	.8	.08	.16	.31	3.25	86.40	136A208-4
27	7,000-8,500	.24	.6	.07	.14	.21	3.89	130.00	136A208-5
50	12,500-15,000	.15	.7	.06	.10	.24	4.10	219.00	136A208-7
50	11,500-13,500	.25	1.0	.05	.12	.26	4.65	196.00	136A208-6

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

*When You Order

Units shown above are standard and may be ordered by part number. Remember to include armature winding dash number, EXAMPLE: 136A208-2

How To Draw Speed Torque Curve

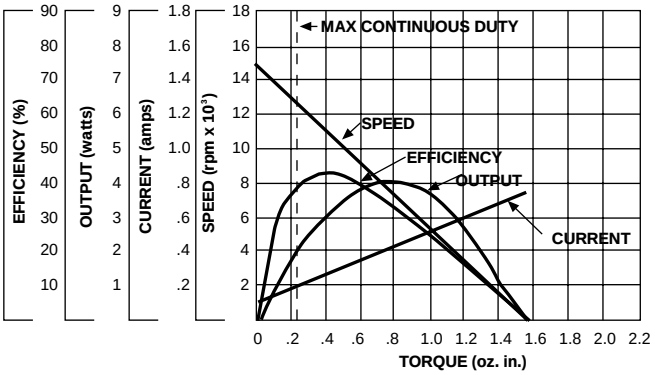


A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

Typical Performance

Part No.: 136A208-2

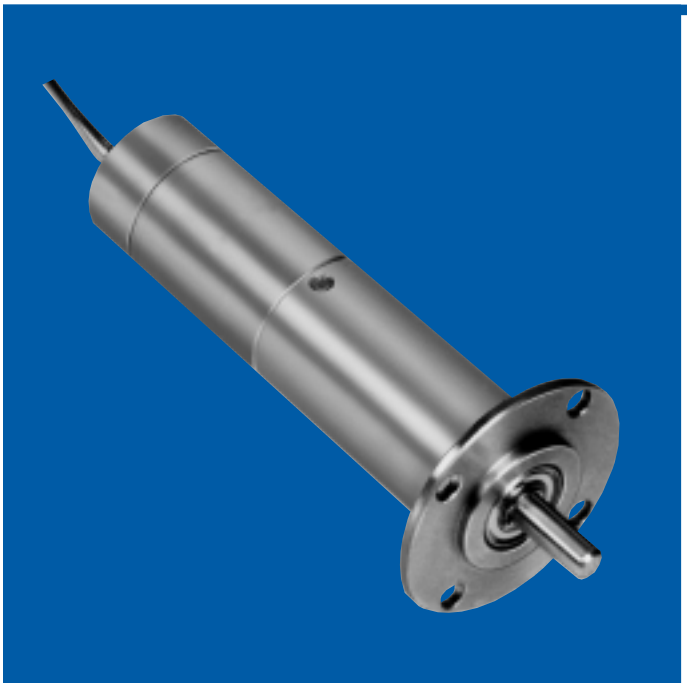
Voltage: 27 VDC



SD GEARMOTORS

DC Permanent Magnet Planetary Gearmotors

A-1230



Dimensions

general design specification

torque rating: Up to 300 oz. in. maximum continuous torque

weight: 4 to 5 ounces depending on ratio

gears: Planetary gearing system. All gears are heat treated for consistently reliable performance and long life

shaft: Precision-ground No. 416 stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average unit will have less than 3°

gear inertia: 1.8 x 10^{-6} oz. in. $sec.^2$ @ input max

bearings: Output shaft uses double-shielded life-lubricated ball bearings for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" #26 AWG leads per MIL-W-16878/4

housing: Aluminum

mounting flange: No. 303 stainless steel per ASTM A582

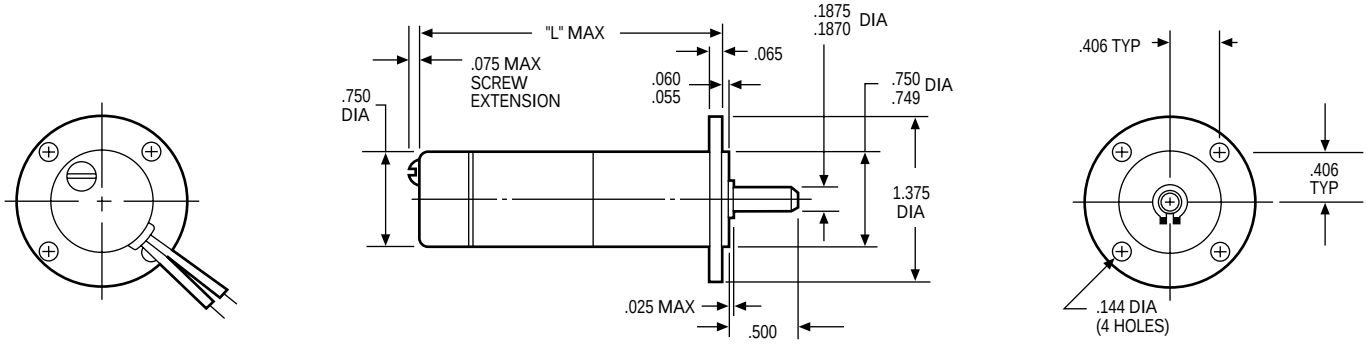
gear train housing: Stress-proof steel

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

options available:

- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Internal slip clutch



ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

SPEED REDUCTION RATIO	MAXIMUM CONTINUOUS TORQUE (oz. in.)	TORQUE MULTIPLIER RATIO	L MAX (in.)	STANDARD PART NUMBER PREFIX* enclosed type
3.82:1	0.7	3.1		168A249
5.77:1	1.1	4.6	2.45	168A250
14.58:1	2.3	9.3		168A223
22.03:1	3.5	14.0	2.64	168A224
33.28:1	5.2	21.0		168A225
55.66:1	7.0	28.0		168A226
84.11:1	10.0	43.0		168A227
127.1:1	16.0	65.0	2.81	168A228
192:1	23.0	93.0		168A229
321:1	32.0	130.0		168A230
485:1	50.0	200.0		168A231
733:1	75.0	300.0	2.98	168A232
1,108:1	113.0	450.0		168A233
1,853:1	150.0	600.0		168A234
2,799:1	225.0	900.0		168A235
4,230:1	300.0	1,400	3.16	168A236
6,391:1	300.0	2,100		168A237
10,689:1	300.0	2,800		168A238
16,150:1	300.0	4,200		168A239
24,403:1	300.0	6,400	3.33	168A240
36,873:1	300.0	9,700		168A241

Max Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life. Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque of gearbox
Max Intermittent Torque = 2 x Max Cont. Torque
Minimum Gearbox Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor armature windings (bottom chart) can be used with any of the gear ratios listed above. To order, state the gear train standard part number prefix, plus a motor armature winding dash number. EXAMPLE: 168A249-1 is a 3.82:1 SD gearmotor with a “-1” armature winding, 12 volts, 7,000 rpm, 0.40 oz. in. torque, etc.

Basic Motor Data

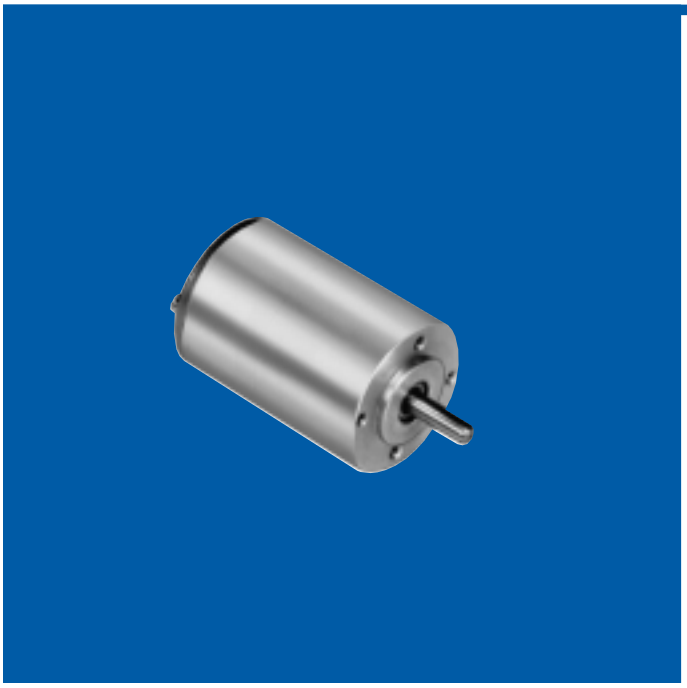
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	ARMATURE WINDING DASH NUMBER*
6	14,500-17,500	.10	1.6	.58	1.00	4.17	.43	1.44	-17
6	12,000-14,000	.28	1.2	.48	1.00	2.64	.54	2.27	-16
6	9,000-10,500	.28	.9	.38	.82	1.62	.70	3.70	-15
12	13,000-15,500	.22	1.6	.27	.53	1.86	.96	6.46	-14
12	9,500-11,000	.37	1.2	.19	.50	1.05	1.36	11.40	-13
12	8,500-10,000	.28	.9	.17	.38	.75	1.51	16.00	-12
12	6,500-8,000	.22	.7	.14	.28	.49	1.84	24.50	-1
27	13,000-16,000	.22	1.4	.12	.24	.74	2.16	36.30	-2
27	10,000-12,500	.31	1.1	.09	.22	.47	2.70	57.10	-3
27	9,000-10,500	.24	.8	.08	.16	.31	3.25	86.40	-4
27	7,000-8,500	.24	.6	.07	.14	.21	3.89	130.00	-5
50	12,500-15,000	.15	.7	.06	.10	.23	4.10	219.00	-7
50	11,500-13,500	.25	1.0	.05	.12	.26	4.65	196.00	-6

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

SS MOTORS

DC Permanent Magnet Motors

A-1400



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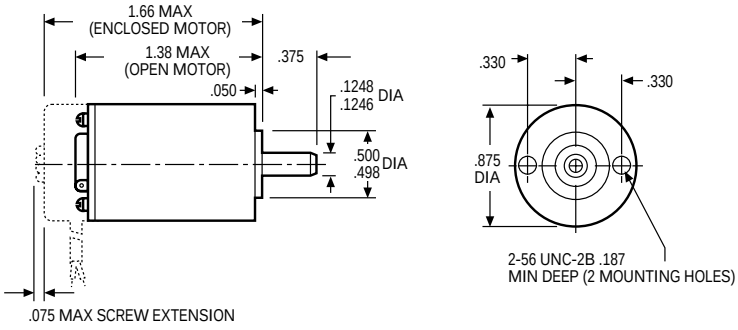
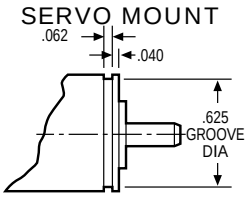
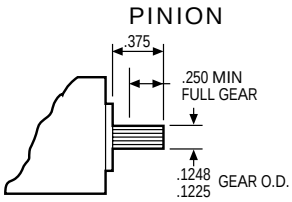






PINION DATA: NUMBER OF TEETH - 13
DIAMETRAL PITCH - 120
PRESSURE ANGLE - 20°
MEAS. OVER. .0144 DIA
PINS - .1272/.1262
AGMA 9 IS STANDARD. OTHER PINIONS ARE AVAILABLE. PINION AVAILABLE WITH BOTH TAPPED HOLE AND SERVO MOUNT UNITS

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

general design specification

power rating: .004 hp (3 W)

voltage: 6 to 50 VDC

weight: 2 ounces

armature: Dynamically balanced

inertia: 2.55 x 10^{-5} oz. in. $sec.^2$

electrical time constant: 0.5 milliseconds max

mechanical time constant: 20.0 milliseconds max

typical no load torque: 0.23 oz. in.

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 40-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: Open motor has solder terminals. Enclosed motor has 8" shielded cable per MIL-C-7078 #26 AWG conductors per MIL-W-16878/4

housing: Aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: 15°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

winding insulation rating: 130°C (higher temperature windings available)

options available:

- Gear train (see A-1430 for details)
- Electromechanical brakes
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Integral tachometer generators

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	ARMATURE DASH NUMBER*
6	11,000-13,500	.28	1.90	.460	1.00	4.10	.58	1.44	-17
6	8,500-11,000	.38	1.50	.370	1.00	2.70	.73	2.27	-16
12	13,500-17,000	.22	2.60	.270	.54	3.20	.95	3.70	-15
12	10,000-13,000	.33	2.00	.210	.54	1.90	1.32	6.46	-14
27	17,000-20,000	.17	3.60	.200	.26	2.40	1.83	11.40	-13
27	15,000-18,000	.20	3.10	.140	.25	1.70	2.05	16.00	-12
27	12,000-15,000	.25	2.40	.110	.24	1.15	2.50	24.50	-1
27	10,000-13,000	.31	1.80	.100	.23	.76	2.94	36.30	-2
27	8,000-10,500	.45	1.40	.080	.23	.48	3.67	57.10	-3
27	6,500-9,000	.45	1.10	.070	.20	.32	4.41	86.40	-4
27	5,500-7,500	.36	.82	.060	.15	.21	5.29	130.00	-5
50	10,000-13,000	.32	.97	.050	.13	.23	5.58	219.00	-7
50	8,500-10,500	.42	1.20	.055	.13	.26	6.32	196.00	-6

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

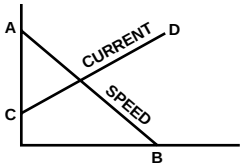
STANDARD PART NUMBER PREFIX*	TAPPED HOLE MOUNT	
	Housing	Shaft
41A100	Open	Plain
41A552	Open	Pinion
41A119	Enclosed	Plain
41A676	Enclosed	Pinion

STANDARD PART NUMBER PREFIX*	SERVO MOUNT	
	Housing	Shaft
41A499	Open	Plain
41A677	Open	Pinion
41A678	Enclosed	Plain
41A679	Enclosed	Pinion

*When You Order

Complete part number consists of the standard part number plus an armature dash number. EXAMPLE: 41A119-1 is 27 VDC, 12,000-15,000 rpm enclosed motor with tapped hole mount and plain shaft

How To Draw Speed Torque Curve

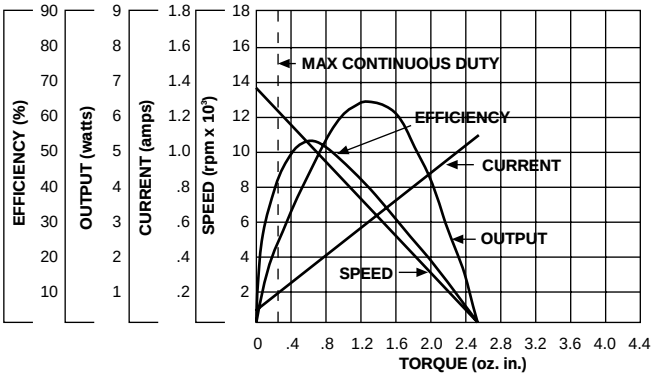


A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

Typical Performance

Part No.: 41A100-1

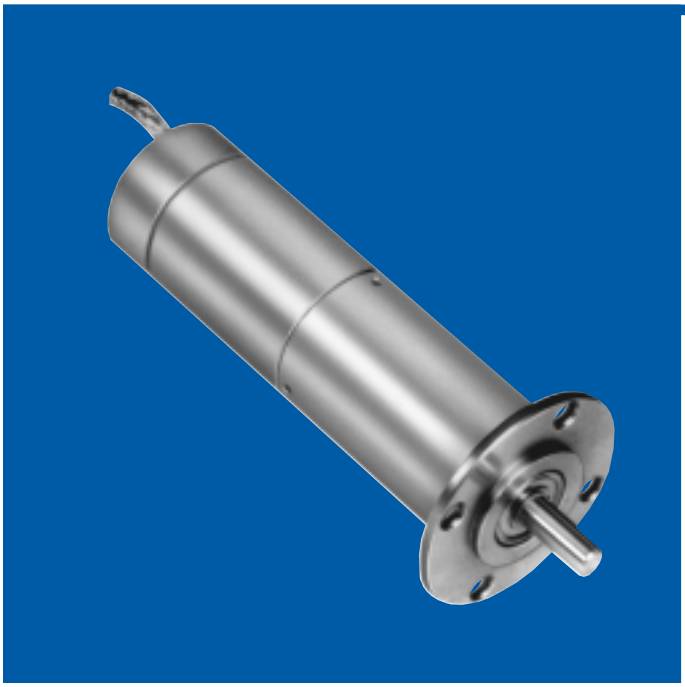
Voltage: 27 VDC



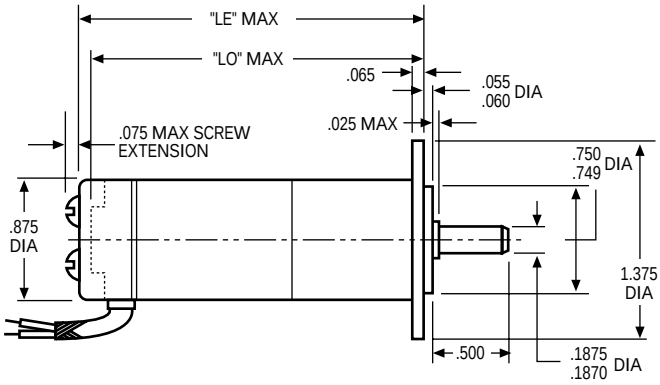
SS GEARMOTORS

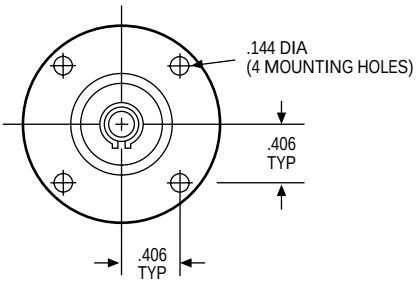
DC Permanent Magnet Planetary Gearmotors

A-1430



Dimensions





general design specification

torque rating: Up to 300 oz. in. maximum continuous torque

weight: 5 to 7 ounces depending on ratio

gears: Planetary gearing system. All gears are heat treated for consistently reliable performance and long life

shaft: Precision-ground No. 416 stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average unit will have less than 3°

gear inertia: 1.8×10^{-6} oz. in. sec.^{2} @ input max

bearings: Output shaft uses double-shielded, life-lubricated ball bearings for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: Open motor has solder terminals. Enclosed motor has 8" shielded cable per MIL-C-7078 #26 AWG conductors per MIL-W-16878/4

housing: Aluminum

mounting flange: No. 303 stainless steel per ASTM A582

gear train housing: Stress-proof steel

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

options available:

- Internal slip clutch
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Integral tachometer generators
- Electromechanical brakes

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

SPEED REDUCTION RATIO	MAXIMUM CONTINUOUS TORQUE (oz. in.)	TORQUE MULTIPLIER RATIO	STANDARD PARTS PREFIX*			
			enclosed type		open type	
			dimension LE (in.)	part no. prefix*	dimension LO (in.)	part no. prefix*
3.82:1	1.0	3.1		43A197		43A196
5.77:1	1.5	4.6	2.56	43A200	2.27	43A199
14.58:1	3.0	9.3		43A140		43A100
22.03:1	4.5	14.0	2.78	43A141	2.50	43A101
33.28:1	7.0	21.0		43A142		43A102
55.66:1	10.0	28.0		43A143		43A103
84.11:1	14.0	43.0		43A144		43A104
127.1:1	21.0	65.0	2.95	43A145	2.67	43A105
192:1	30.0	93.0		43A146		43A106
321:1	45.0	130.0		43A147		43A107
485:1	70.0	200.0	3.11	43A148	2.84	43A108
733:1	100.0	300.0		43A149		43A109
1,108:1	150.0	450.0		43A150		43A110
1,853:1	200.0	600.0		43A151		43A111
2,799:1	300.0	900.0		43A152		43A112
4,230:1	300.0	1,400	3.28	43A153	3.00	43A113
6,391:1	300.0	2,100		43A154		43A114
10,689:1	300.0	2,800		43A155		43A115
16,150:1	300.0	4,200		43A156		43A116
24,403:1	300.0	6,400	3.45	43A157	3.17	43A117
36,873:1	300.0	9,700		43A158		43A118

Max. Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life. Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque of gearbox
Max Intermittent Torque = 2 x Max Cont. Torque
Minimum Gearbox Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor armature windings (bottom chart) can be used with any of the gear ratios listed above. To order, state the gear train standard part number prefix, plus a motor armature winding dash number. EXAMPLE: 43A197-1 is a 3.82:1 SS gear train with a "-1" armature winding, 27 volts, 13,500 rpm, 0.25 oz. in. torque, etc.

Basic Motor Data

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE		CURRENT			CONSTANTS		ARMATURE DASH NUMBER*
		max rated (oz. in.)	** theoretical stall (oz. in.)	max no load (amps)	max rated load (amps)	** nominal stall (amps)	K_T (oz. in./ amp)	R (ohms)	
6	11,000-13,500	.28	1.90	.580	1.00	4.10	.58	1.44	-17
6	8,500-11,000	.38	1.50	.470	1.00	2.70	.73	2.27	-16
12	13,500-17,000	.22	2.60	.340	.54	3.20	.95	3.70	-15
12	10,000-13,000	.33	2.00	.265	.54	1.90	1.32	6.46	-14
27	17,000-20,000	.17	3.60	.230	.26	2.40	1.83	11.40	-13
27	15,000-18,000	.20	3.10	.170	.25	1.70	2.05	16.00	-12
27	12,000-15,000	.25	2.40	.140	.24	1.15	2.50	24.50	-1
27	10,000-13,000	.31	1.80	.120	.23	.76	2.94	36.30	-2
27	8,500-10,500	.45	1.40	.100	.23	.48	3.67	57.10	-3
27	6,500-9,000	.45	1.10	.090	.20	.32	4.41	86.40	-4
27	5,500-7,500	.36	.82	.070	.15	.21	5.29	130.00	-5
50	10,000-13,000	.32	.97	.065	.13	.23	5.58	219.00	-7
50	8,500-10,500	.42	1.20	.070	.13	.26	6.32	196.00	-6

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

CM GEARMOTORS

DC Permanent Magnet Planetary Gearmotors

A-1930

general design specification

torque rating: Up to 600 oz. in. maximum torque

weight: 3.4 to 4.0 ounces depending on ratio

gears: Planetary gearing system. All gears are heat treated for consistently reliable performance and long life

shaft: Precision-ground, No. 416 nitrided stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average unit will have less than 3°

gearmotor inertia: 2.5 x 10^{-5} oz. in. $sec.^2$

bearings: Double-shielded, life-lubricated ball bearings for -55°C to +85°C operation.

cables/leads: 12" leads #26 AWG per MIL-W-16878/4

mounting flange: Aluminum

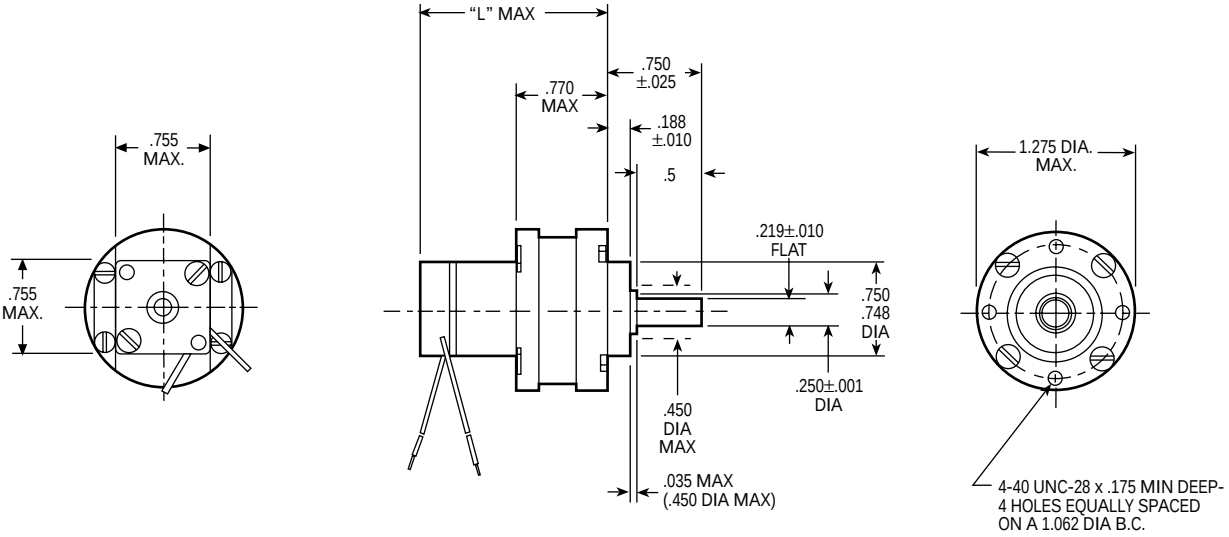
marking: Per MIL-STD-130

typical no load torque: 0.30 oz.in.

winding temperature rise: 24°C per watt

maximum allowable winding temperature: 180°C

Dimensions



ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

SPEED REDUCTION RATIO	MAXIMUM CONTINUOUS TORQUE (oz. in.)	TORQUE MULTIPLIER RATIO	L MAX (in.)	STANDARD PART NUMBER PREFIX*
18.78:1	10.4	13	1.373	477A100
27.94:1	15.2	19	1.373	477A101
81.37:1	37.6	47	1.506	477A102
121.10:1	56.8	71	1.506	477A103
147.70:1	68.8	86	1.506	477A104
352.60:1	138.4	173	1.639	477A105
524.60:1	206.4	258	1.639	477A106
639.90:1	252.0	315	1.639	477A107
780.60:1	307.0	384	1.639	477A108

.250" dia. shaft units limited to 600 oz.in. maximum torque.
Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque
Gearbox Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor armature windings (bottom chart) can be used with any of the gear ratios listed above. To order, state the gear train standard part number prefix, plus a motor armature winding dash number. EXAMPLE: 477A100-1 is an 18.78:1 gearmotor with a “-1” armature winding, 6 volts, 4,300 rpm, .8 oz. in. torque, etc.

Basic Motor Data

VOLTAGE (VDC)	±15% SPEED no load (rpm)	TORQUE		CURRENT			CONSTANTS		ARMATURE WINDING DASH NUMBER*
		max rated (oz. in.)	nominal stall (oz. in.)	nominal no load (amps)	nominal rated load (amps)	nominal stall (amps)	K_T (oz. in./ amp)	R (ohms)	
6	4,300	.8	1.7	.19	.69	1.26	1.6	4.6	-1
12	4,400	.8	1.7	.09	.35	.66	3.17	18.0	-2
24	4,500	.8	1.7	.05	.18	.33	6.15	72.7	-3

No load current in this chart applies to the gearmotor

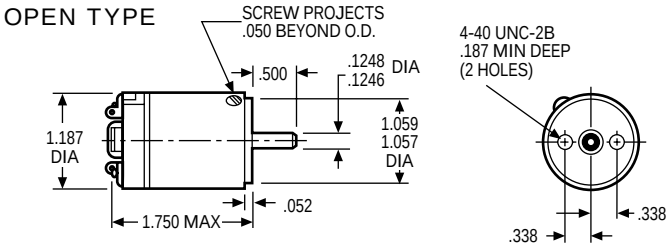
MM MOTORS

DC Permanent Magnet Motors

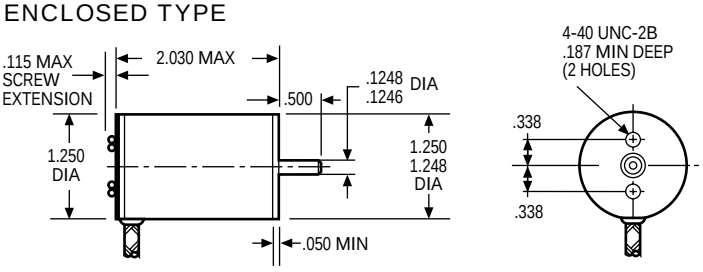
A-2000

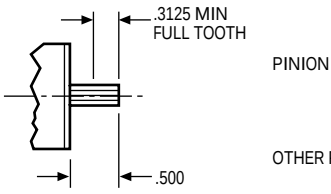
Dimensions

OPEN TYPE



ENCLOSED TYPE





PINION DATA: NUMBER OF TEETH - 10
DIAMETRAL PITCH - 96
PRESSURE ANGLE - 20°
MEAS. OVER. .018 DIA PINS - .1285/.1275
OTHER PINIONS ARE AVAILABLE

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

general design specification

power rating: .01 hp (7.5 W)

voltage: 4 to 50 VDC

weight: Open type - 3.5 ounces
Enclosed type - 5.0 ounces

armature: Dynamically balanced

inertia: 5.2 x 10^{-5} oz. in. $sec.^2$

electrical time constant: 0.5 milliseconds max

mechanical time constant: 20.0 milliseconds max

typical no load torque: 0.40 oz. in.

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 45-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG conductors per MIL-W-16878/4

cover: Open type - aluminum
Enclosed type - brass

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units per

winding temperature rise: 8°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

winding insulation rating: 130°C (higher temperature windings available)

options available:
- Gear train (see A-2030 for details)

Standard Part Numbers and Data

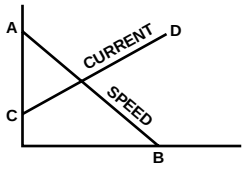
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./amp)	CONSTANTS ** R (ohms)	STANDARD PART NO.* open type plain shaft	open type pinion	enclosed type plain shaft	enclosed type pinion
6	12,000-14,000	.75	4.6	.80	2.00	9.90	.58	.66	3A998-5	3A1524-5	3A1002-5	3A1525-5
12	18,000-21,400	.50	7.4	.56	1.20	11.80	.77	1.11	3A998-24	3A1524-24	3A1002-24	3A1525-24
12	14,500-17,000	.70	5.9	.50	1.20	7.50	.97	1.75	3A998-3	3A1524-3	3A1002-3	3A1525-3
12	12,400-14,700	.75	4.6	.40	1.20	5.10	1.12	2.56	3A998-21	3A1524-21	3A1002-21	3A1525-21
12	11,000-13,000	1.00	4.6	.35	1.20	4.60	1.26	2.87	3A998-4	3A1524-4	3A1002-4	3A1525-4
24	19,200-22,800	.35	7.4	.30	.60	6.30	1.45	4.17	3A998-7	3A1524-7	3A1002-7	3A1525-7
24	16,000-19,000	.60	5.8	.25	.60	3.80	1.74	6.30	3A998-1	3A1524-1	3A1002-1	3A1525-1
24	11,500-14,000	1.00	4.6	.18	.60	2.10	2.42	11.02	3A998-2	3A1524-2	3A1002-2	3A1525-2
24	10,700-12,700	1.00	3.6	.17	.60	1.60	2.60	15.00	3A998-8	3A1524-8	3A1002-8	3A1525-8
24	9,600-11,400	1.00	2.9	.15	.50	1.10	2.90	21.00	3A998-22	3A1524-22	3A1002-22	3A1525-22
24	8,000-10,000	1.00	2.9	.13	.45	.93	3.48	25.20	3A998-10	3A1524-10	3A1002-10	3A1525-10
24	6,000-7,000	.80	2.3	.08	.30	.55	4.65	42.30	3A998-11	3A1524-11	3A1002-11	3A1525-11
50	14,300-17,000	.70	4.8	.11	.30	1.30	4.06	37.00	3A998-25	3A1524-25	3A1002-25	3A1525-25
50	9,500-11,500	1.00	3.8	.08	.30	.71	6.00	69.00	3A998-16	3A1524-16	3A1002-16	3A1525-16
50	8,000-10,000	1.00	3.0	.07	.20	.50	6.77	98.00	3A998-12	3A1524-12	3A1002-12	3A1525-12
50	6,700-8,000	.80	2.4	.05	.16	.30	8.71	159.00	3A998-15	3A1524-15	3A1002-15	3A1525-15
50	4,600-5,500	.80	1.9	.04	.12	.20	10.83	249.00	3A998-13	3A1524-13	3A1002-13	3A1525-13

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

*When You Order

Units shown above are standard and may be ordered by part number.
Remember to include the armature winding dash number.
EXAMPLE: 3A998-10

How To Draw Speed Torque Curve

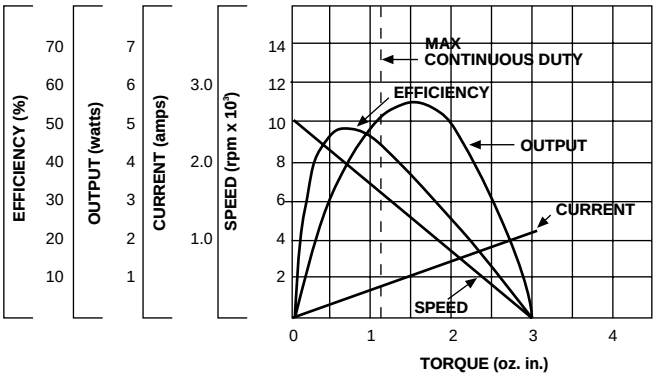


A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

Typical Performance

Part No.: 3A998-10

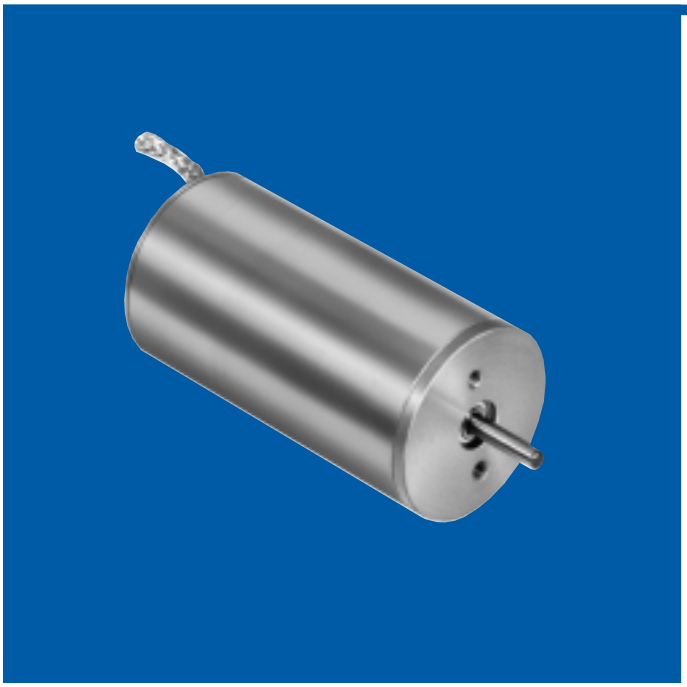
Voltage: 24 VDC



LL MOTORS

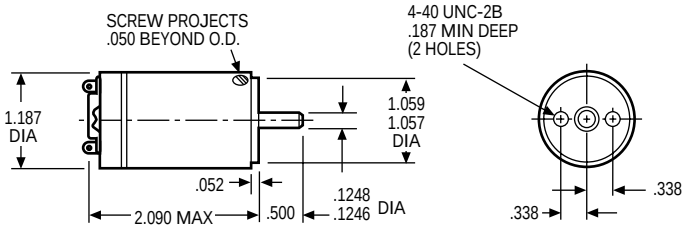
DC Permanent Magnet Motors

A-2006

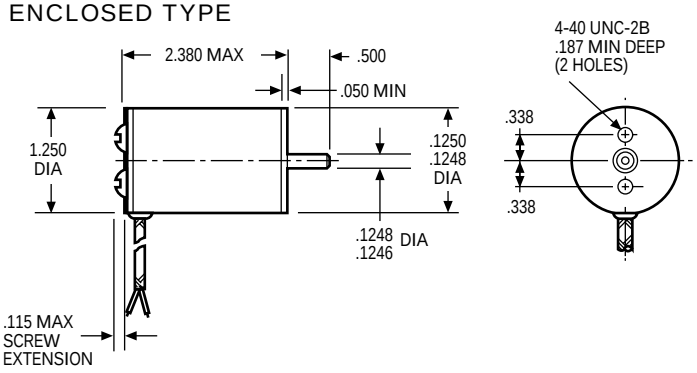


Dimensions

OPEN TYPE



ENCLOSED TYPE



ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

general design specification

power rating: .015 hp (11.2 W)

voltage: 6 to 75 VDC

weight: Open type - 5.2 ounces
Enclosed type - 8.5 ounces

armature: Dynamically balanced

inertia: 7.4 x 10^{-5} oz. in. $sec.^2$

electrical time constant: 0.5 milliseconds max

mechanical time constant: 15.0 milliseconds max

typical no load torque: 0.50 oz. in.

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 45-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG leads per MIL-W-16878/4

cover: Open type - aluminum
Enclosed type - brass

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: 7°C per watt w/8.00" x 8.00" x .25" aluminium heat sink

winding insulation rating: 130°C (higher temperature windings available)

options available:

- Gear train (see A-2030 for details)

Standard Part Numbers and Data

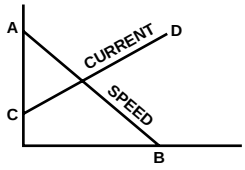
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NO.* open unit	STANDARD PART NO.* enclosed unit
6	7,600-9,400	1.60	5.5	.70	2.00	7.00	.90	.80	3A999-5	3A1003-5
12	11,500-14,000	1.10	8.7	.52	1.70	8.40	1.20	1.35	3A999-24	3A1003 24
12	9,000-11,000	1.70	6.9	.42	1.50	5.30	1.51	2.13	3A999-3	3A1003-3
24	16,000-19,000	.75	11.0	.36	1.00	7.30	1.74	3.12	3A999-21	3A1003-21
24	14,400-17,000	.85	11.0	.32	.85	6.50	1.96	3.50	3A999-4	3A1003-4
24	12,000-14,500	1.00	8.7	.28	.80	4.50	2.26	5.08	3A999-7	3A1003-7
24	10,400-12,300	1.10	6.9	.23	.75	3.00	2.71	7.68	3A999-1	3A1003-1
24	7,400-8,900	1.60	5.5	.17	.70	1.70	3.77	13.43	3A999-2	3A1003-2
24	6,900-8,200	1.80	4.3	.16	.65	1.20	4.05	18.28	3A999-8	3A1003-8
24	6,200-7,400	1.80	3.4	.14	.60	.89	4.52	25.59	3A999-22	3A1003-22
24	5,200-6,200	1.20	3.4	.12	.45	.74	5.42	30.70	3A999-10	3A1003-10
50	7,600-9,400	1.50	5.7	.09	.25	.92	7.25	51.55	3A999-11	3A1003-11
75	14,000-17,000	1.00	8.6	.10	.29	1.60	6.33	45.10	3A999-25	3A1003-25
75	9,000-11,000	1.70	6.8	.07	.29	.85	9.63	84.10	3A999-16	3A1003-16
75	8,000-10,000	1.80	5.4	.06	.26	.60	10.56	119.40	3A999-12	3A1003-12
75	6,500-8,000	1.20	4.3	.05	.20	.37	13.58	194.00	3A999-15	3A1003-15
75	4,500-5,300	1.00	3.4	.04	.10	.23	16.89	303.00	3A999-13	3A1003-13

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

*When You Order

Units shown above are standard and may be ordered by part number.
Remember to include armature winding dash number.
EXAMPLE: 3A999-6

How To Draw Speed Torque Curve

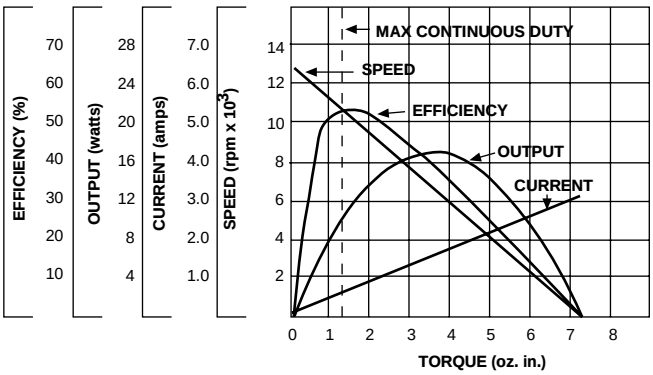


A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

Typical Performance

Part No.: 3A999-1, 3A1003-1

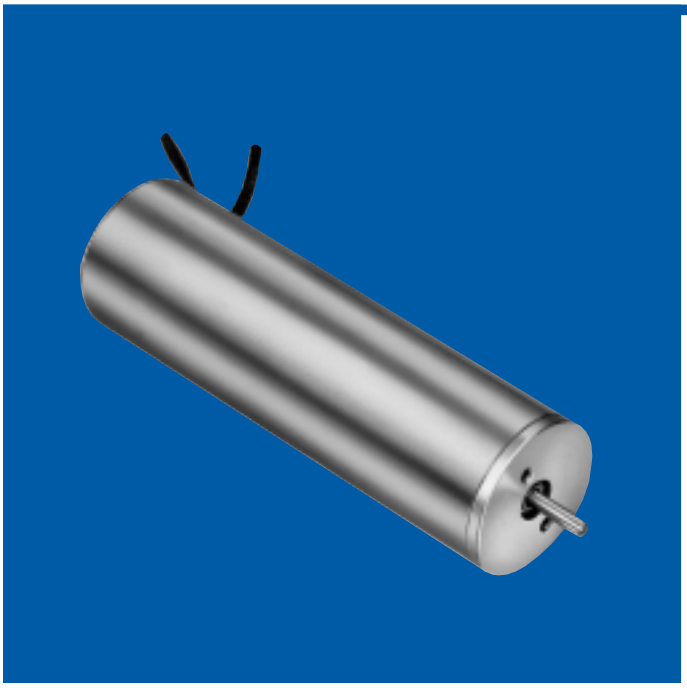
Voltage: 24 VDC



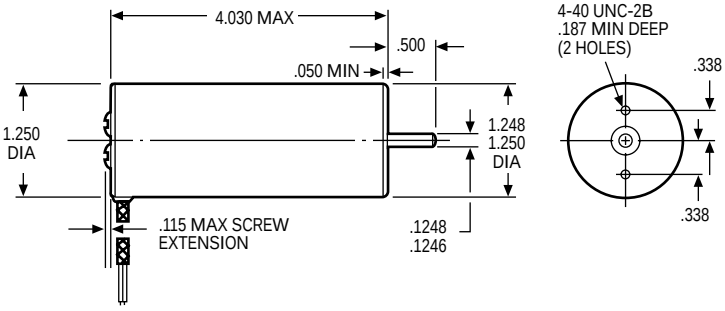
LL MOTORS W/TACHOMETER

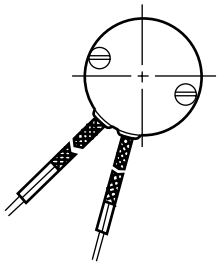
DC Permanent Magnet Motors

A-2016



Dimensions





general design specification

power rating: .01 hp (7.5 W)

voltage: 6 to 75 VDC

weight: 10.0 ounces

armature: Dynamically balanced and skewed for low speed operation

inertia: 9.8×10^{-5} oz. in. sec.^{2}

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 45-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life lubricated for –55°C to +85°C operation. Special lubricants available

cables/leads: Motor leads 12" #22 AWG double conductor shielded cable. Conductor per MIL-W-16878/4. Shielding per MIL-C-7078 red and black. Tach leads #26 AWG double conductor shielded cable. Conductor per MIL-W-16878/4. Shielding per MIL-C-7078 white/red, white/black

cover: Brass

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units per

winding temperature rise: 7°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

no load torque: 0.75 oz. in.

winding insulation rating: 180°C

tachometer output:

5.4 volts ± .27 volts @ 3,600 rpm with 10,000 ohm load (1.5 volts/1,000 rpm)

10.8 volts ± .54 volts @ 3,600 rpm with 10,000 ohm load (3.0 volts/1,000 rpm)

options available:

- Gear train (see A-2030 for details)

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NUMBER* 1.5 VDC/ 1,000 rpm tachometer	STANDARD PART NUMBER* 3.0 VDC/ 1,000 rpm tachometer
6	7,600-9,400	1.4	5.5	1.00	2.00	7.00	.90	.80	3A1731-5	3A1732-5
12	11,500-14,000	.9	8.7	.78	1.70	8.40	1.20	1.35	3A1731-24	3A1732-24
12	9,000-11,000	1.5	6.9	.62	1.50	5.30	1.51	2.13	3A1731-3	3A1732-3
24	16,000-19,000	.5	11.0	.54	1.00	7.30	1.74	3.12	3A1731-21	3A1732-21
24	14,400-17,000	.6	11.0	.48	.85	6.50	1.96	3.50	3A1731-4	3A1732-4
24	12,000-14,500	.8	8.7	.41	.80	4.50	2.26	5.08	3A1731-7	3A1732-7
24	10,400-12,300	.9	6.9	.35	.75	3.30	2.71	7.68	3A1731-1	3A1732-1
24	7,400-8,900	1.4	5.5	.25	.70	1.70	3.77	13.43	3A1731-2	3A1732-2
24	6,900-8,200	1.6	4.3	.23	.65	1.20	4.05	18.28	3A1731-8	3A1732-8
24	6,200-7,400	1.6	3.4	.21	.60	.89	4.52	25.59	3A1731-22	3A1732-22
24	5,200-6,200	1.0	3.4	.17	.45	.74	5.42	30.70	3A1731-10	3A1732-10
50	7,600-9,400	1.3	5.7	.13	.25	.92	7.25	51.55	3A1731-11	3A1732-11
75	14,000-17,000	.8	8.6	.15	.29	1.60	6.33	45.10	3A1731-25	3A1732-25
75	9,000-11,000	1.5	6.8	.10	.29	.85	9.63	84.10	3A1731-16	3A1732-16
75	8,000-10,000	1.6	5.4	.09	.26	.60	10.56	119.40	3A1731-12	3A1732-12
75	6,500-8,000	1.0	4.3	.07	.20	.37	13.58	194.00	3A1731-15	3A1732-15
75	4,500-5,300	.8	3.4	.06	.10	.23	16.89	303.00	3A1731-13	3A1732-13

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

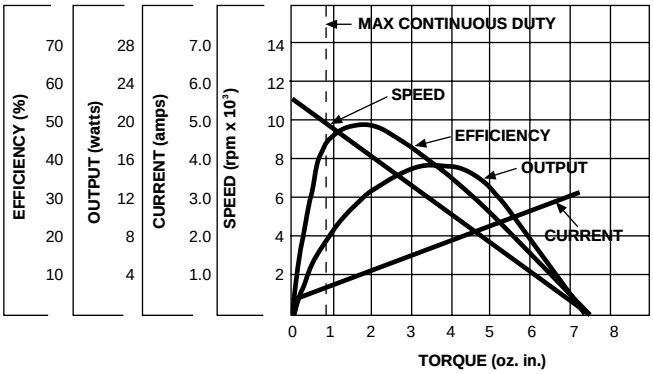
*When You Order

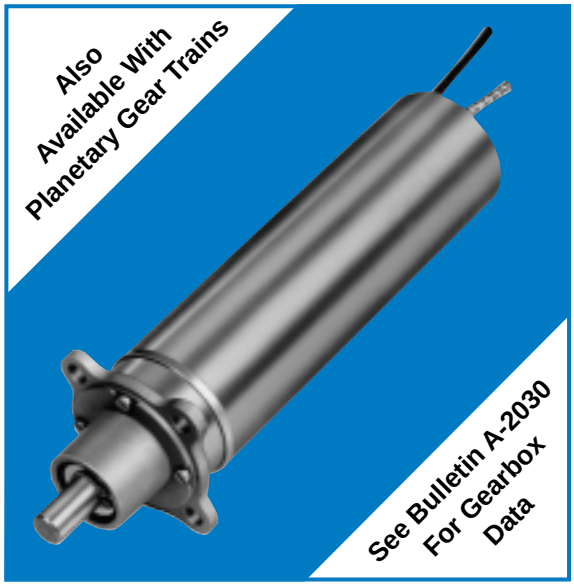
Units shown above are standard and may be ordered by part number. Remember to include armature winding dash number. EXAMPLE: 3A1731-1

Typical Performance

Part No.: 3A1731-1, 3A1732-1

Voltage: 24 VDC

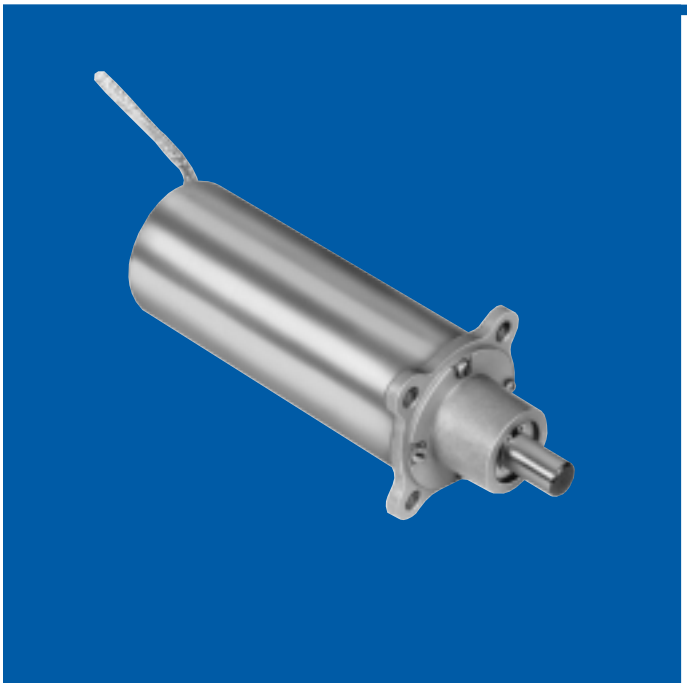




MM GEARMOTORS

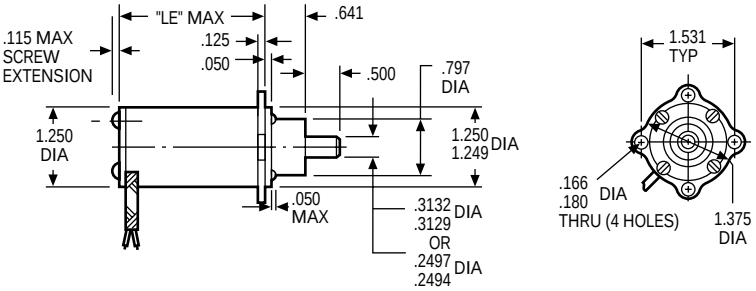
DC Permanent Magnet Planetary Gearmotors

A-2030

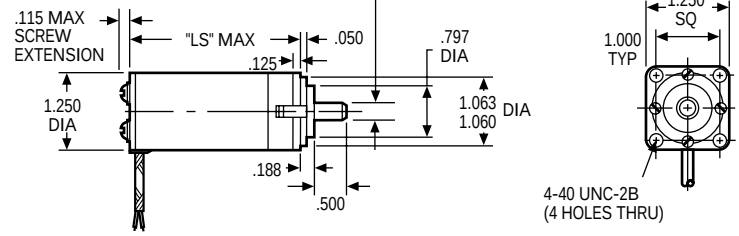


Dimensions

EARED FLANGE



SQUARE FLANGE



general design specification

torque rating: Up to 1,250 oz. in. maximum continuous torque

weight: 6 to 15 ounces depending on ratio

gears: Planetary gearing system. All gears are heat treated for consistently reliable performance and long life

shaft: Precision-ground, No. 416 nitrided stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average unit will have less than 3°

gear inertia: 4.2 x 10^{-6} oz. in. $sec.^2$ @ input max

bearings: .250" dia. shaft uses double-shielded, life-lubricated ball bearings for -55°C to +85°C operation. A .313" dia. shaft uses needle bearings. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG conductors per MIL-W-16878/4

cover: Brass

mounting flange: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

options available:

- Internal slip clutch
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Integral tachometer generators (See A-2016 for details)
- Electromechanical brakes

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data
Type MM

SPEED REDUCTION RATIO	MAXIMUM CONTINUOUS TORQUE (oz. in.)	TORQUE MULTIPLIER RATIO	TYPE MM STANDARD PART NUMBER PREFIX*				dim. LE (in.)	dim. LS (in.)
			EARED FLANGE		SQUARE FLANGE			
			.313" shaft	.250" shaft	.313" shaft	.250" shaft		
18.78:1	12	12.0	5A537	5A2292	5A538	5A2312	2.44	2.90
27.94:1	17	17.0	5A539	5A2293	5A540	5A2313		
81.37:1	41	41.0	5A541	5A2294	5A542	5A2314		
121.10:1	62	62.0	5A543	5A2295	5A544	5A2315	2.56	3.02
147.70:1	75	75.0	5A545	5A2296	5A546	5A2316		
352.60:1	145	145.0	5A547	5A2297	5A548	5A2317		
524.60:1	215	215.0	5A549	5A2298	5A550	5A2318		
639.90:1	262	262.0	5A551	5A2299	5A552	5A2319	2.83	3.29
780.60:1	320	320.0	5A553	5A2300	5A554	5A2320		
1,528.00:1	500	500.0	5A555	5A2301	5A556	5A2321		
2,273.00:1	740	740.0	5A557	5A2302	5A558	5A2322		
3,382.00:1	1,100	1,100	5A559	5A2303	5A560	5A2323	3.20	3.66
4,126.00:1	1,250	1,350	5A561	5A2304	5A562	5A2324		
6,621.00:1	1,250	1,730	5A563	5A2305	5A564	5A2325		
9,851.00:1	1,250	2,580	5A565	5A2306	5A566	5A2326		
12,016.00:1	1,250	3,150	5A567	5A2307	5A568	5A2327	3.34	3.80
17,879.00:1	1,250	4,700	5A569	5A2308	5A570	5A2328		
21,808.00:1	1,250	5,700	5A571	5A2309	5A572	5A2329		

.250" dia. shaft units limited to 600 oz. in. maximum continuous duty torque. Use .313" dia. shaft if torque requirements exceed this value
Max Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life
Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque of gearbox
Max Intermittent Torque - 2 x Max Cont. Torque
Momentary Stall Torque - 5 x Max Cont. Torque (2,000 oz. in. max)
Minimum Gearbox Efficiency - Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor armature windings (bottom chart) can be used with any of the gear ratios listed above. To order, state the gear train standard part number prefix, plus a motor armature winding dash number. EXAMPLE: 5A537-1 is an 18.78:1 MM gearmotor with a “-1” armature winding, 24 volts, 17,500 rpm, 0.60 oz. in. torque, etc.

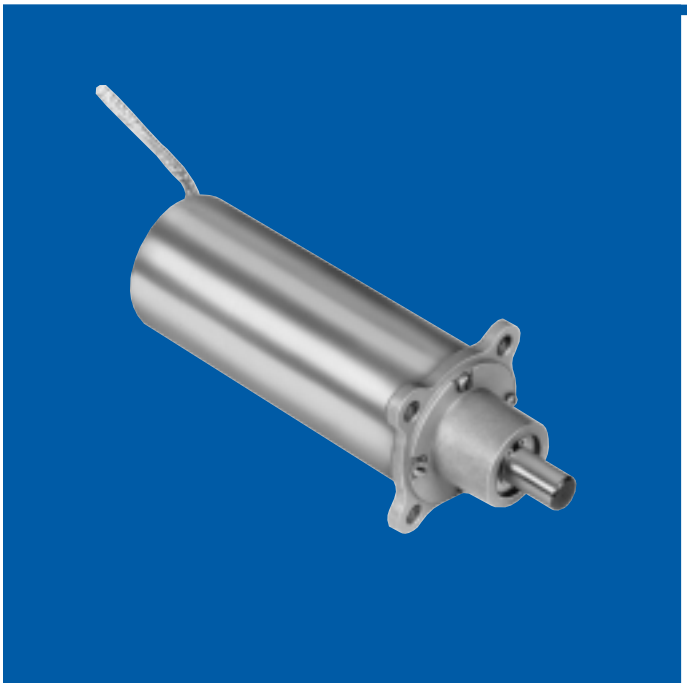
Basic Motor Data
Type MM

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE		CURRENT			CONSTANTS		WINDING DASH NUMBER*
		max rated (oz. in.)	** theoretical stall (oz. in.)	max no load (amps)	max rated load (amps)	** nominal stall (amps)	K_T (oz. in./ amp)	ARMATURE R (ohms)	
6	12,000-14,000	.75	4.6	.96	2.00	9.90	.58	.66	-5
12	18,000-21,400	.50	7.4	.69	1.20	11.80	.77	1.11	-24
12	14,500-17,000	.70	5.9	.60	1.20	7.50	.97	1.75	-3
12	12,400-14,700	.75	4.6	.50	1.20	5.10	1.12	2.56	-21
12	11,000-13,000	1.00	4.6	.44	1.20	4.60	1.26	2.87	-4
24	19,200-22,800	.35	7.4	.39	.60	6.30	1.45	4.17	-7
24	16,000-19,000	.60	5.8	.31	.60	3.80	1.74	6.30	-1
24	11,500-14,000	1.00	4.6	.22	.60	2.10	2.42	11.02	-2
24	10,700-12,700	1.00	3.6	.21	.60	1.60	2.60	15.00	-8
24	9,600-11,400	1.00	2.9	.19	.50	1.10	2.90	21.00	-22
24	8,000-10,000	1.00	2.9	.16	.45	.93	3.48	25.20	-10
24	6,000-7,000	.80	2.3	.11	.30	.55	4.65	42.30	-11
50	14,300-17,000	.70	4.8	.14	.30	1.30	4.06	37.00	-25
50	9,500-11,500	1.00	3.8	.09	.30	.71	6.00	69.00	-16
50	8,000-10,000	1.00	3.0	.08	.20	.50	6.77	98.00	-12
50	6,700-8,000	.80	2.4	.06	.16	.30	8.71	159.00	-15
50	4,600-5,500	.80	1.9	.05	.12	.20	10.83	249.00	-13

**Because of brush drop and field distortion, current and torque indicated will not always be attainable
No load current in this chart applies to the gearmotor

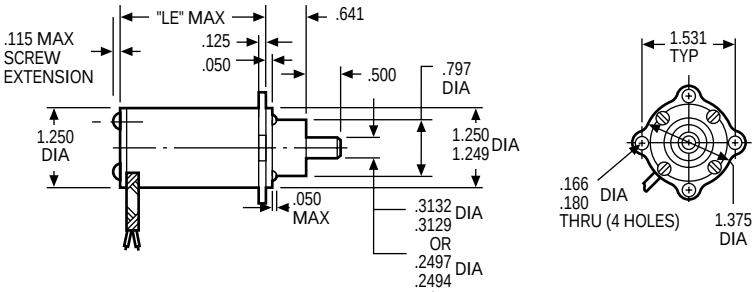
LL GEARMOTORS

DC Permanent Magnet Planetary Gearmotors

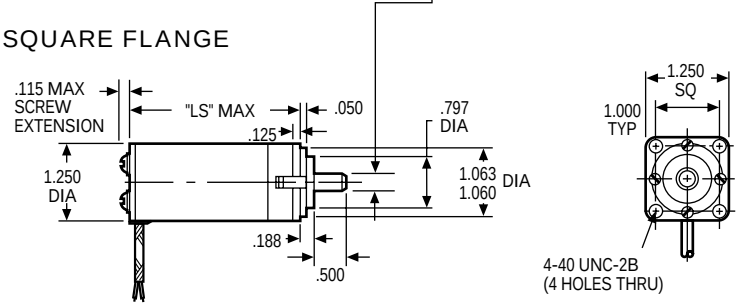


Dimensions

EARED FLANGE



SQUARE FLANGE



general design specification

torque rating: Up to 1,250 oz. in. maximum continuous torque

weight: 6 to 15 ounces depending on ratio

gears: Planetary gearing system. All gears are heat treated for consistently reliable performance and long life

shaft: Precision-ground, No. 416 nitrided stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average unit will have less than 3^{o}

gear inertia: 4.2×10^{-6} oz. in. $sec.^2$ @ input max

bearings: .250" dia. shaft uses double-shielded, life-lubricated ball bearings for -55°C to +85°C operation. A .313" dia. shaft uses needle bearings. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG conductors per MIL-W-16878/4

cover: Brass

mounting flange: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

options available:

- Internal slip clutch
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Integral tachometer generators (See A-2016 for details)
- Electromechanical brakes

Standard Part Numbers and Data
Type LL

SPEED REDUCTION RATIO	MAXIMUM CONTINUOUS TORQUE (oz. in.)	TORQUE MULTIPLIER RATIO	TYPE LL STANDARD PART NUMBER PREFIX*				dim. LE (in.)	dim. LS (in.)
			EARED FLANGE		SQUARE FLANGE			
			.313" shaft	.250" shaft	.313" shaft	.250" shaft		
18.78:1	20	12.0	5A501	5A2332	5A502	5A2352	2.79	3.23
27.94:1	29	17.0	5A503	5A2333	5A504	5A2353		
81.37:1	70	41.0	5A505	5A2334	5A506	5A2354		
121.10:1	105	62.0	5A507	5A2335	5A508	5A2355	2.92	3.38
147.70:1	128	75.0	5A509	5A2336	5A510	5A2356		
352.60:1	247	145.0	5A511	5A2337	5A512	5A2357		
524.60:1	366	215.0	5A513	5A2338	5A514	5A2358		
639.90:1	445	262.0	5A515	5A2339	5A516	5A2359	3.19	3.64
780.60:1	544	320.0	5A517	5A2340	5A518	5A2360		
1,528.00:1	850 **	500.0	5A519	5A2341	5A520	5A2361		
2,273.00:1	1,250 **	740.0	5A521	5A2342	5A522	5A2362		
3,382.00:1	1,250 **	1,100	5A523	5A2343	5A524	5A2363	3.56	4.02
4,126.00:1	1,250 **	1,350	5A525	5A2344	5A526	5A2364		
6,621.00:1	1,250 **	1,730	5A527	5A2345	5A528	5A2365		
9,851.00:1	1,250 **	2,580	5A529	5A2346	5A530	5A2366		
12,016.00:1	1,250 **	3,150	5A531	5A2347	5A532	5A2367	3.69	4.14
17,879.00:1	1,250 **	4,700	5A533	5A2348	5A534	5A2368		
21,808.00:1	1,250 **	5,700	5A535	5A2349	5A536	5A2369		

.250" dia. shaft units limited to 600 oz. in. maximum continuous duty torque. Use .313" dia. shaft if torque requirements exceed this value
Max Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life
Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque of gearbox
Max Intermittent Torque = 2 x Max Cont. Torque
Momentary Stall Torque = 5 x Max Cont. Torque (2,000 oz. in. max)
Minimum Gearbox Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor armature windings (next page) can be used with any of the gear rations listed above. To order, state the gear train standard part number prefex, plus a motor armature winding dash number. EXAMPLE: 5A501-1 is an 18.78:1 LL gearmotor with a “-1” armature winding, 24 volts, 11,000 rpm, 1.1 oz. in. torque, etc.

Basic Motor Data
Type LL

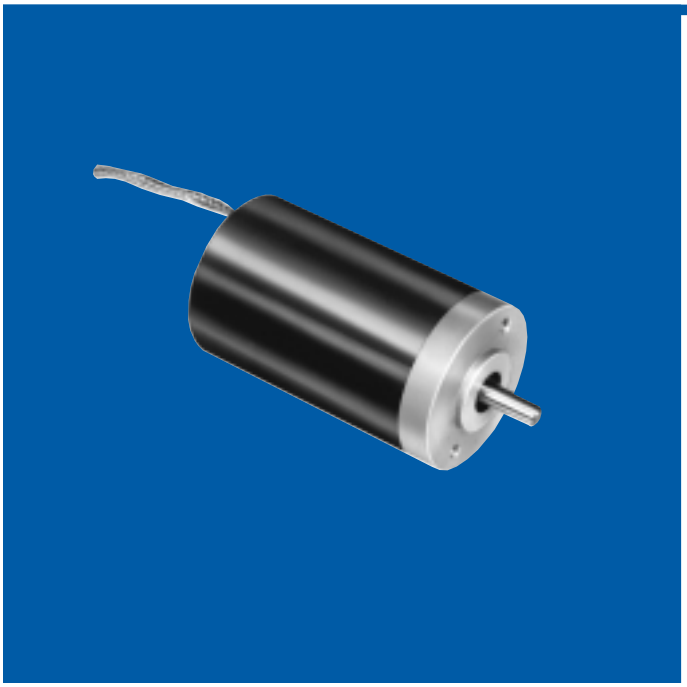
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE		CURRENT			CONSTANTS		WINDING DASH NUMBER*
		max rated (oz. in.)	** theoretical stall (oz. in.)	max no load (amps)	max rated load (amps)	** nominal stall (amps)	K_T (oz. in./ amp)	ARMATURE R (ohms)	
6	7,600-9,400	1.60	5.5	.78	2.00	7.00	.90	.80	-5
12	11,500-14,000	1.10	8.7	.63	1.70	5.30	1.20	1.35	-24
12	9,000-11,000	1.70	6.9	.47	1.50	5.30	1.51	2.13	-3
24	16,000-19,000	.75	11.0	.45	1.00	7.30	1.74	3.12	-21
24	14,400-17,000	.85	11.0	.37	.85	6.50	1.96	3.50	-4
24	12,000-14,500	1.00	8.7	.33	.80	4.50	2.26	5.08	-7
24	10,400-12,300	1.10	6.9	.28	.75	3.00	2.71	7.68	-1
24	7,400-8,900	1.60	5.5	.20	.70	1.70	3.77	13.43	-2
24	6,900-8,200	1.80	4.3	.19	.65	1.20	4.05	18.28	-8
24	6,200-7,400	1.80	3.4	.17	.60	.89	4.52	25.59	-22
24	5,200-6,200	1.20	3.4	.15	.45	.74	5.42	30.70	-10
50	7,600-9,400	1.50	5.7	.10	.25	.92	7.25	51.55	-11
75	14,000-17,000	1.00	8.6	.12	.29	1.60	6.33	45.10	-25
75	9,000-11,000	1.70	6.8	.08	.29	.85	9.36	84.10	-16
75	8,000-10,000	1.80	5.4	.07	.26	.60	10.56	119.40	-12
75	6,500-8,000	1.20	4.3	.06	.20	.37	13.58	194.00	-15
75	4,500-5,300	1.00	3.4	.05	.10	.23	16.89	303.00	-13

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

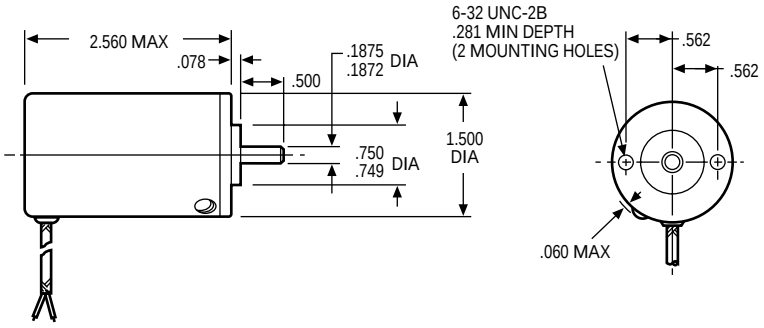
BD MOTORS

DC Permanent Magnet Motors

A-2400



Dimensions



general design specification

power rating: .022 hp (16.4 W)

voltage: 6 to 115 VDC

weight: 9 ounces (255 grams)

armature: Dynamically balanced

inertia: 3.7 x 10^{-4} oz. in. $sec.^2$

electrical time constant: 0.5 milliseconds max

mechanical time constant: 25.0 milliseconds max

typical no load torque: 0.65 oz. in.

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 40-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double-shielded, life-lubricated for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG conductors per MIL-W-16878/4

cover: Aluminum

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: 5.5°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

winding insulation rating: 130°C (higher temperature windings available)

options available:

- Gear train (see A-2430 for details)
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Integral tachometer generators (see Bulletin A-2415)

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

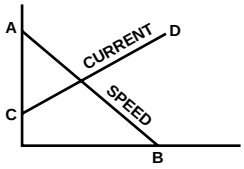
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NUMBERS*
6	10,000-12,000	2.3	19.0	1.30	4.6	35.00	.67	.18	100A104-3
6	8,000-9,500	3.2	15.0	.97	4.6	22.00	.86	.29	100A104-4
12	12,500-14,500	1.8	24.0	.76	2.3	27.00	1.10	.46	100A104-5
12	10,000-12,000	2.4	19.0	.60	2.3	17.00	1.39	.74	100A104-6
12	8,000-9,500	3.2	15.0	.49	2.3	11.00	1.74	1.13	100A104-7
12	6,200-7,300	3.5	11.0	.44	2.5	7.00	2.22	1.88	100A104-8
27	11,000-13,000	2.0	22.0	.30	1.0	9.80	2.79	3.04	100A104-9
27	9,000-10,500	2.8	17.0	.24	1.0	6.40	3.47	4.82	100A104-10
27	7,000-8,500	3.6	14.0	.20	1.0	3.90	4.35	7.58	100A104-11
50	10,500-12,500	2.1	20.0	.16	.5	4.60	5.45	12.20	100A104-12
50	8,000-9,500	2.8	16.0	.13	.5	2.90	6.85	18.10	100A104-13
50	6,500-8,000	3.7	13.0	.10	.5	1.80	8.64	30.80	100A104-14
50	5,000-6,000	3.5	10.0	.08	.4	1.20	10.87	48.30	100A104-15
115	13,000-15,500	1.6	18.0	.09	.3	2.30	9.95	56.30	100A104-16
115	11,000-13,000	2.2	14.0	.07	.3	1.50	12.17	87.00	100A104-17
115	9,000-10,500	2.8	11.0	.06	.3	.95	14.87	135.00	100A104-18
115	7,000-8,500	3.6	9.0	.05	.3	.61	18.79	207.00	100A104-19
115	6,000-7,000	2.9	7.0	.04	.2	.40	22.46	332.00	100A104-20
115	4,500-5,500	2.7	6.5	.04	.2	.26	27.29	507.00	100A104-21

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

*When You Order

Units shown above are standard and may be ordered by part number.
Remember to include armature winding dash number.
EXAMPLE: 100A104-7

How To Draw Speed Torque Curve

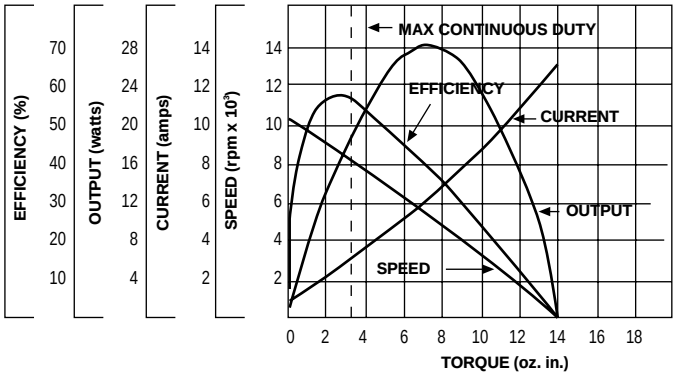


A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

Typical Performance

Part No.: 100A104-7

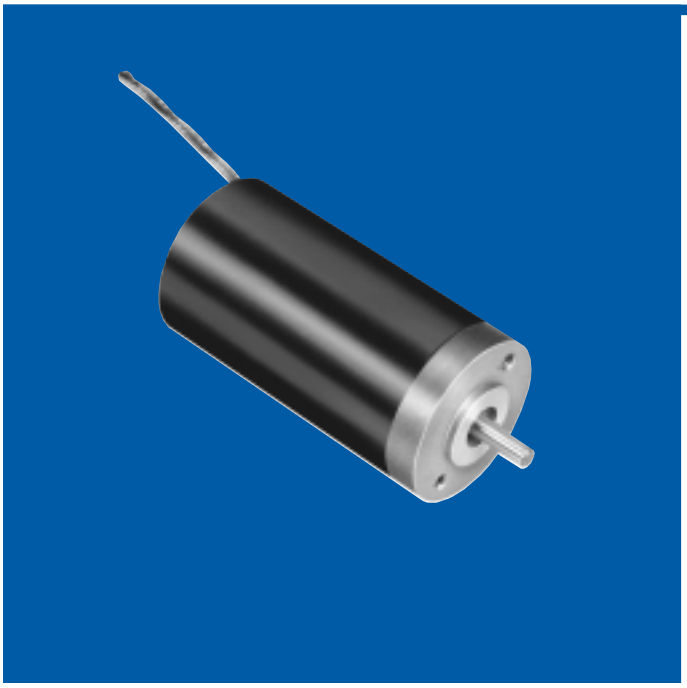
Voltage: 12 VDC



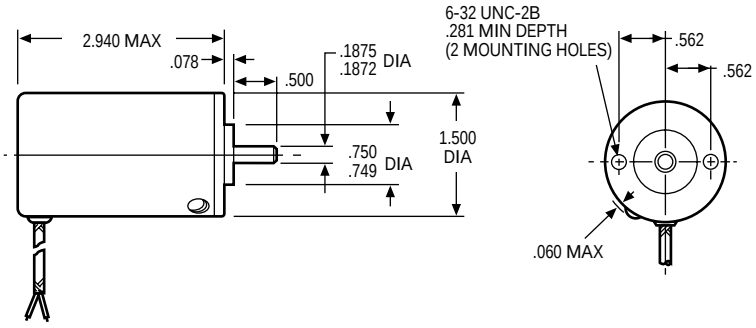
BL MOTORS

DC Permanent Magnet Motors

A-2406



Dimensions



general design specification

power rating: .033 hp (24.6 W)

voltage: 6 to 115 VDC

weight: 11.3 ounces

armature: Dynamically balanced

inertia: 5.7 x 10^{-4} oz. in. $sec.^2$

electrical time constant: 0.5 milliseconds max

mechanical time constant: 25.0 milliseconds max

typical no load torque: 0.75 oz. in.

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 40-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG conductors per MIL-W-16878/4

cover: Aluminum

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: 5°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

winding insulation rating: 130°C (higher temperature winding available)

options available:

- Gear train (see A-2430 for details)
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Integral tachometer generators (see Bulletin A-2420)

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

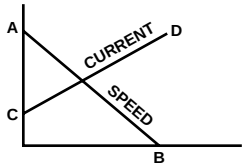
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NUMBERS*
6	8,500-10,500	4.0	29.0	1.200	6.50	45.00	.80	.14	100A108-2
6	6,500-8,000	5.0	23.0	.930	6.50	28.00	1.01	.24	100A108-3
12	10,000-12,500	3.3	37.0	.710	3.50	36.00	1.30	.39	100A108-4
12	8,500-10,500	4.4	29.0	.560	3.50	22.00	1.66	.62	100A108-5
12	6,500-8,000	5.0	23.0	.440	3.50	14.00	2.10	1.00	100A108-6
12	5,100-6,200	5.5	18.0	.400	3.00	9.00	2.63	1.50	100A108-7
27	9,200-11,000	3.7	33.0	.280	1.40	12.00	3.35	2.50	100A108-8
27	7,000-9,000	5.0	27.0	.220	1.40	8.00	4.21	4.10	100A108-9
27	5,500-7,000	6.0	21.0	.180	1.40	5.20	5.24	6.40	100A108-10
50	8,500-10,500	3.8	31.0	.150	.72	5.90	6.57	10.10	100A108-11
50	6,500-8,000	5.0	25.0	.120	.74	3.70	8.23	16.00	100A108-12
50	5,500-7,000	6.5	20.0	.090	.73	2.40	10.34	25.00	100A108-13
50	4,500-5,500	7.5	16.0	.075	.66	1.50	13.05	41.00	100A108-14
50	3,500-4,500	6.0	12.5	.055	.43	.94	16.41	65.00	100A108-15
115	8,500-10,500	4.2	22.0	.065	.34	1.90	15.02	75.00	100A108-16
115	7,000-9,000	5.0	17.0	.055	.40	1.20	18.38	116.00	100A108-17
115	5,500-7,000	5.0	14.0	.045	.28	.77	22.60	180.00	100A108-18
115	4,500-5,500	4.2	11.0	.035	.19	.50	28.37	267.00	100A108-19
115	4,000-5,000	3.5	8.8	.030	.14	.33	33.91	420.00	100A108-20
115	3,000-4,000	2.9	8.1	.025	.10	.21	41.21	645.00	100A108-21

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

*When You Order

Units shown above are standard and may be ordered by part number.
Remember to include armature winding dash number.
EXAMPLE: 100A108-8

How To Draw Speed Torque Curve

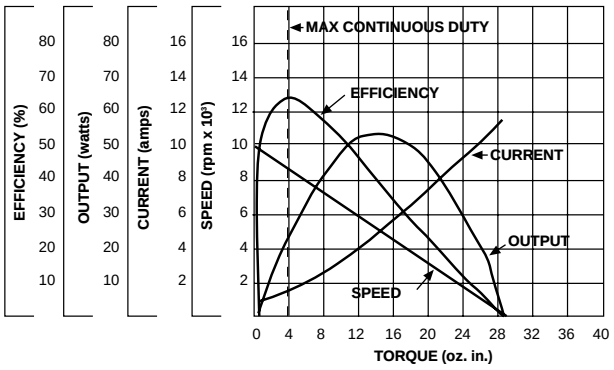


A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

Typical Performance

Part No.: 100A108-8

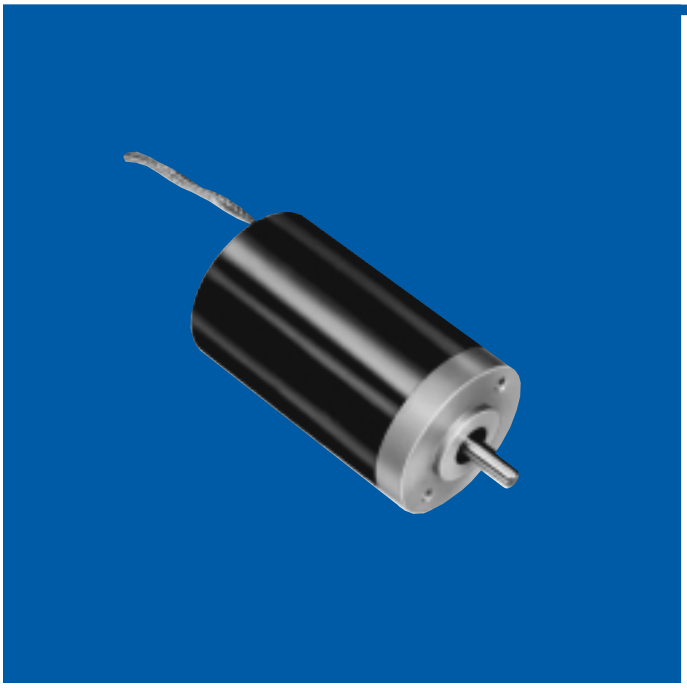
Voltage: 27 VDC



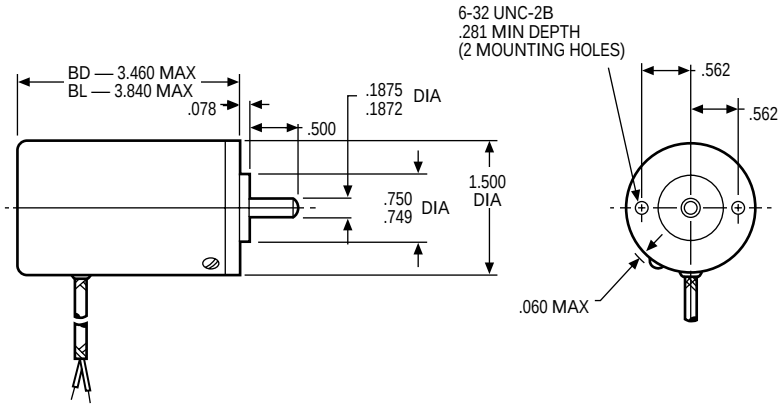
BD/BL MOTORS W/SERIES BRAKE

DC Permanent Magnet Motors

A-2410



Dimensions



general design specification

power rating: BD — .01 hp (7.5 W)
BL — .02 hp (14.9 W)

voltage: 27 and 110 VDC

weight: BD — 14 ounces
BL — 16 ounces

armature: Dynamically balanced

inertia: BD — 5.3 x 10^{-4} oz. in. sec.^{2}
BL — 7.3 x 10^{-4} oz. in. sec.^{2}

electrical time constant: 2.0 milliseconds max

mechanical time constant: 55.0 milliseconds max

typical no load torque: BD — .65 oz. in.
BL — .75 oz. in.

brake holding torque: 3.00 oz. in. minimum

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 40-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG conductors per MIL-W-16878/4

cover: Aluminum

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: BD — 5.5°C per watt;
BL — 5.0°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

winding insulation rating: 130°C (higher temperature windings available)

options available:

- Gear trains (see A-2430 for details)
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO (CHARTED VARIABLE)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

Type BD

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	VARIABLE LEAD COLOR	STANDARD PART NUMBERS*
27	14,000-16,500	1.50	16.0	.39	1.26	7.6	2.22	3.58	RED/ORG	100A805-8
27	11,000-13,000	2.00	12.7	.30	1.24	4.8	2.79	5.64	RED/YLW	100A805-9
27	9,000-10,500	2.25	9.7	.24	1.10	3.0	3.47	9.02	RED/GRN	100A805-10
27	7,000-8,500	2.50	7.8	.20	.94	2.0	4.35	13.88	RED/BLU	100A805-11
110	8,500-10,000	1.75	5.3	.60	.20	.4	14.97	275.00	BLK/WHT	100A805-18

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

Type BL

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	VARIABLE LEAD COLOR	STANDARD PART NUMBERS*
27	11,500-14,000	2.50	21.0	.40	1.60	8.50	2.63	3.2	RED/ORG	100A806-7
27	8,500-10,500	3.00	17.0	.28	1.50	5.30	3.35	5.1	RED/YLW	100A806-8
27	7,000-9,000	3.25	13.0	.22	1.25	3.25	4.21	8.3	RED/GRN	100A806-9
27	5,500-7,000	3.50	10.0	.18	1.10	2.20	5.24	12.7	RED/BLU	100A806-10
110	7,000-9,000	2.50	7.0	.06	.24	.45	18.38	256.0	BLK/WHT	100A806-17

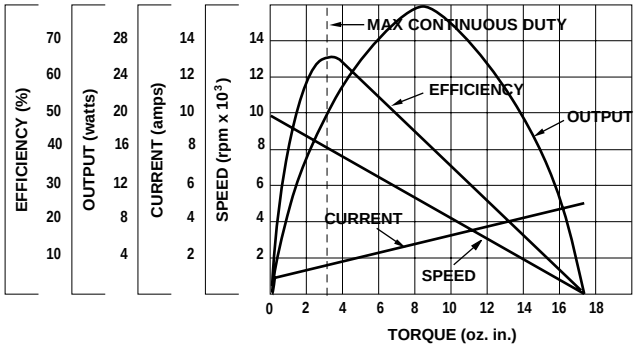
**Because of brush drop and field distortion, current and torque indicated will not always be attainable

*When You Order

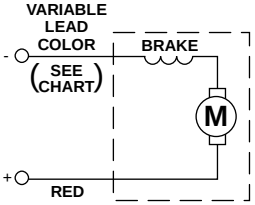
Units shown above are standard and may be ordered by part number. Remember to include armature winding dash number.
EXAMPLE: 100A806-8

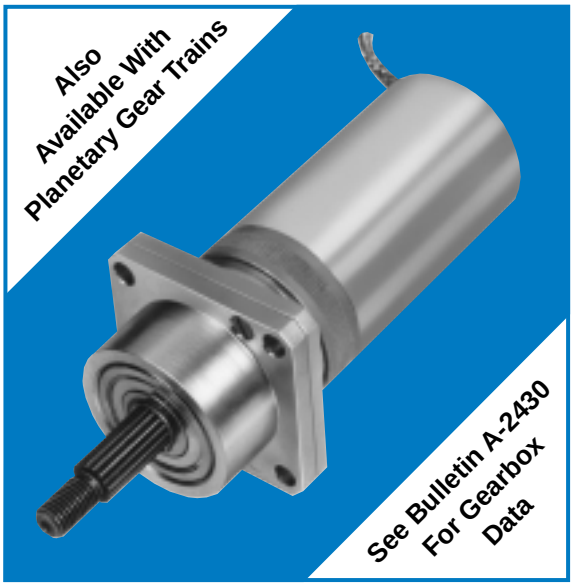
Typical Performance

Part No.: 100A806-8
Voltage: 27 VDC



Schematic Wiring

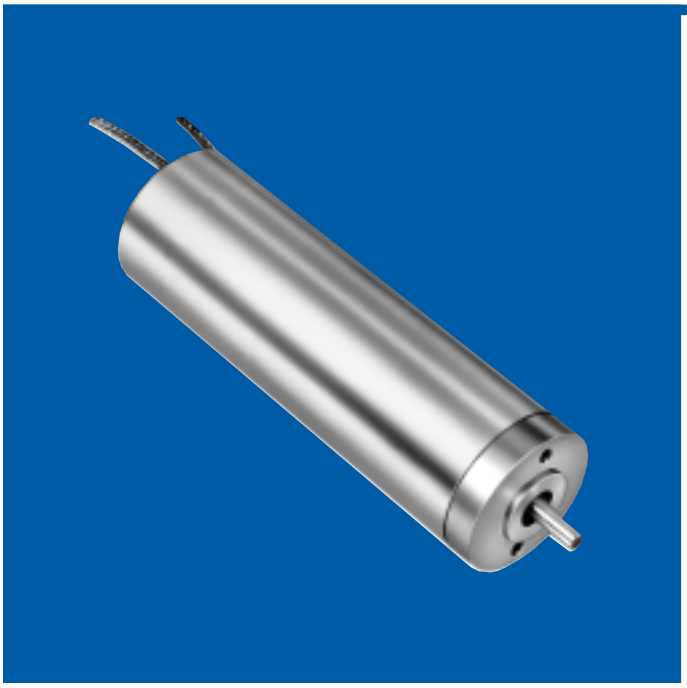




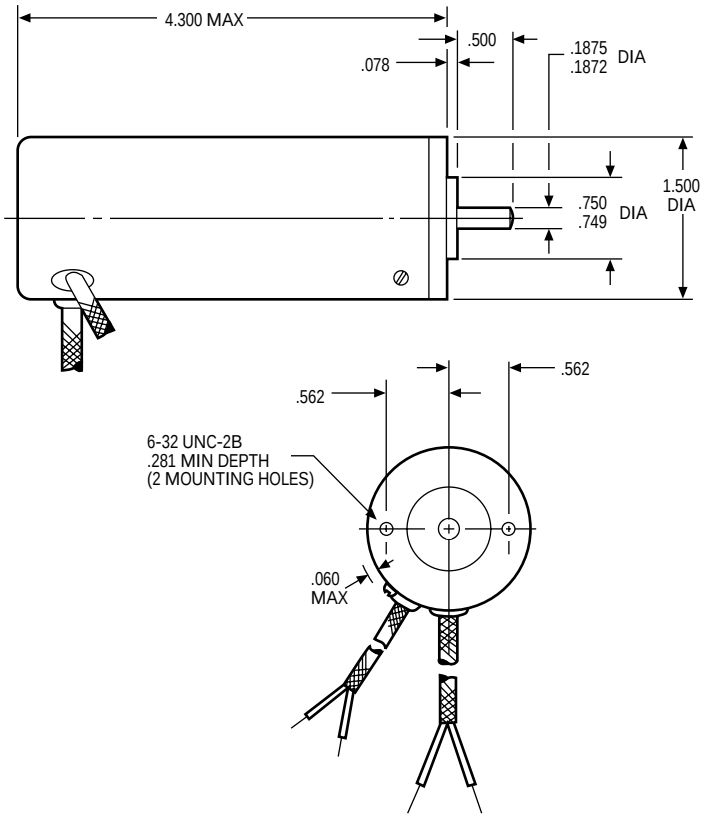
BD MOTORS W/TACHOMETER

DC Permanent Magnet Motors

A-2415



Dimensions



ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
WHITE/RED TACH LEAD WILL BE +
CW - REVERSE POLARITY

general design specification

power rating: .022 hp (16.4 W)

voltage: 6 to 115 VDC

weight: 13 ounces

armature: Dynamically balanced and skewed for low-speed operation

inertia: 3.94 x 10^{-4} oz. in. $sec.^2$

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 40-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 12" tach leads #26 AWG double conductor shielded cable conductor per MIL-W-16878/4. Shielding per MIL-C-7078 white/red, white/black. Motor leads #22 AWG double conductor shielded cable conductor per MIL-W-16878/4. Shielding per MIL-C-7078 red & black

cover: Aluminum

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: 5.5°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

no load torque: 0.9 oz. in.

winding insulation rating: 180°C

tachometer output:

- 1.5 VDC/1,000 rpm tach
  5.4 VDC ± .27 @ 3,600 rpm with 10,000 ohm load
- 3.0 VDC/1,000 rpm tach
  10.8 VDC ± .54 @ 3,600 rpm with 10,000 ohm load

options available:

- Gear train (see A-2430 for details)

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NUMBER* 1.5 VDC/ 1,000 rpm tachometer	STANDARD PART NUMBER* 3.0 VDC/ 1,000 rpm tachometer
6	10,000-12,000	2.1	19.0	1.70	4.6	35.00	.67	.18	100A753-3	100A754-3
6	8,000-9,500	3.0	15.0	1.30	4.6	22.00	.86	.29	100A753-4	100A754-4
12	12,500-14,500	1.6	24.0	1.00	2.3	27.00	1.10	.46	100A753-5	100A754-5
12	10,000-12,000	2.2	19.0	.81	2.3	17.00	1.39	.74	100A753-6	100A754-6
12	8,000-9,500	3.0	15.0	.65	2.3	11.00	1.74	1.13	100A753-7	100A754-7
12	6,200-7,300	3.3	11.0	.51	2.5	7.00	2.22	1.88	100A753-8	100A754-8
27	11,000-13,000	1.8	22.0	.40	1.0	9.80	2.79	3.04	100A753-9	100A754-9
27	9,000-10,500	2.6	17.0	.32	1.0	6.40	3.47	4.82	100A753-10	100A754-10
27	7,000-8,500	3.4	14.0	.26	1.0	3.90	4.35	7.58	100A753-11	100A754-11
50	10,500-12,500	1.9	20.0	.21	.5	5.45	12.20	12.20	100A753-12	100A754-12
50	8,000-9,500	2.6	16.0	.16	.5	2.90	6.85	19.10	100A753-13	100A754-13
50	6,500-8,000	3.5	13.0	.13	.5	1.80	8.64	30.80	100A753-14	100A754-14
50	5,000-6,000	3.3	10.0	.10	.4	1.20	10.87	48.30	100A753-15	100A754-15
115	13,000-15,500	1.4	18.0	.11	.3	2.30	9.95	56.30	100A753-16	100A754-16
115	11,000-13,000	2.0	14.0	.09	.3	1.50	12.17	87.00	100A753-17	100A754-17
115	9,000-10,500	2.6	11.0	.08	.3	.95	14.87	135.00	100A753-18	100A754-18
115	7,000-8,500	3.4	9.0	.06	.3	.61	18.79	207.00	100A753-19	100A754-19
115	6,000-7,000	2.7	7.0	.05	.2	.40	22.46	332.00	100A753-20	100A454-20
115	4,500-5,500	2.5	6.5	.04	.2	.26	27.29	507.00	100A753-21	100A754-21

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

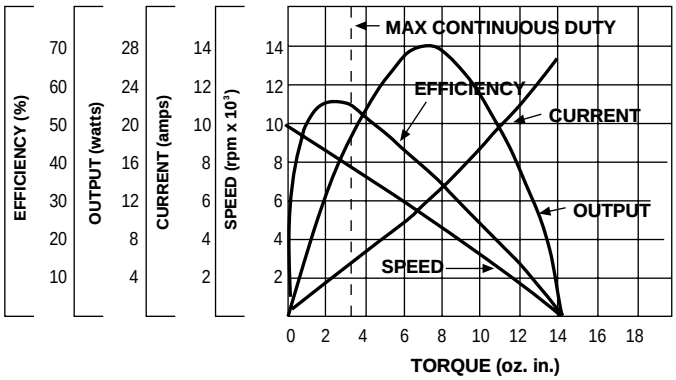
*When You Order

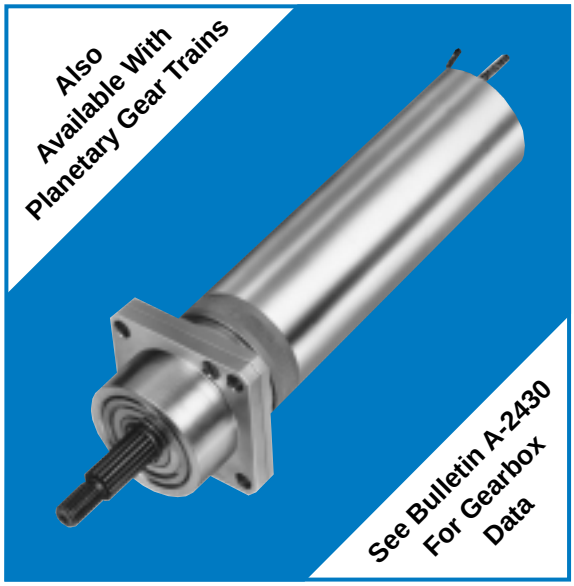
Units shown above are standard and may be ordered by part number. Remember to include armature winding dash number. EXAMPLE: 100A753-7

Typical Performance

Part No.: 100A753-7

Voltage: 12 VDC

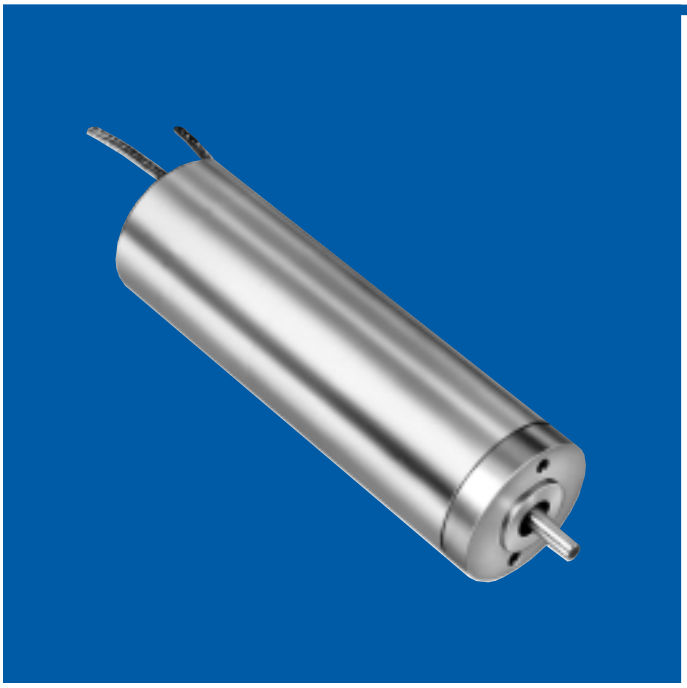




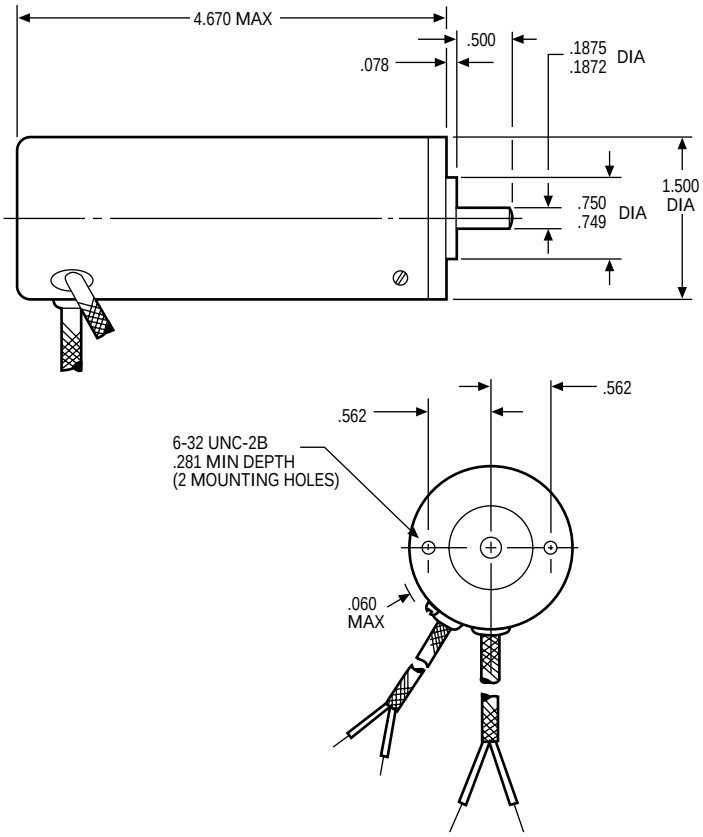
BL MOTORS W/TACHOMETER

DC Permanent Magnet Motors

A-2416



Dimensions



ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
WHITE/RED TACH LEAD WILL BE +
CW - REVERSE POLARITY

general design specification

power rating: .033 hp (24.6 W)

voltage: 6 to 115 VDC

weight: 15 ounces

armature: Dynamically balanced and skewed for low-speed operation

inertia: 5.94 x 10^{-4} oz. in. $sec.^2$

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 40-50) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 12" tach leads #26 AWG double conductor shielded cable conductor per MIL-W-16878/4. Shielding per MIL-C-7078 white/red, white/black. Motor leads #22 AWG double conductor shielded cable conductor per MIL-W-16878/4. Shielding per MIL-C-7078 red & black

cover: Aluminum

frame: Die-cast aluminum

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: 5°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

no load torque: 1.0 oz. in.

winding insulation rating: 180°C

tachometer output:

- 1.5 VDC/1,000 rpm tach
  5.4 VDC ± .27 @ 3,600 rpm with 10,000 ohm load
- 3.0 VDC/1,000 rpm tach
  10.8 VDC ± .54 @ 3,600 rpm with 10,000 ohm load

options available:

- Gear train (see A-2430 for details)

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NUMBER* 1.5 VDC/ 1,000 rpm tachometer	STANDARD PART NUMBER* 3.0 VDC/ 1,000 rpm tachometer
6	8,500-10,500	3.8	29.0	1.60	6.50	45.00	.80	.14	100A755-2	100A756-2
6	6,500-8,000	4.8	23.0	1.20	6.50	28.00	1.01	.24	100A755-3	100A756-3
12	10,000-12,500	3.1	37.0	.96	3.50	36.00	1.30	.39	100A755-4	100A756-4
12	8,500-10,500	4.2	29.0	.75	3.50	22.00	1.66	.62	100A755-5	100A756-5
12	6,500-8,000	4.8	23.0	.60	3.50	14.00	2.10	1.00	100A755-6	100A756-6
12	5,100-6,200	5.3	18.0	.48	3.00	9.00	2.63	1.50	100A755-7	100A756-7
27	9,200-11,000	3.5	33.0	.37	1.40	12.00	3.35	2.50	100A755-8	100A756-8
27	7,000-9,000	4.8	27.0	.30	1.40	8.00	4.21	4.10	100A755-9	100A756-9
27	5,500-7,000	5.8	21.0	.24	1.40	5.20	5.24	6.40	100A755-10	100A756-10
50	8,500-10,500	3.6	31.0	.19	.72	5.90	6.57	10.10	100A755-11	100A756-11
50	6,500-8,000	4.8	25.0	.15	.74	3.70	8.23	16.00	100A755-12	100A756-12
50	5,500-7,000	6.3	20.0	.12	.73	2.40	10.34	25.00	100A755-13	100A756-13
50	4,500-5,500	7.3	16.0	.10	.66	1.50	13.05	41.00	100A755-14	100A756-14
50	3,500-4,500	5.8	12.5	.08	.43	.94	16.41	65.00	100A755-15	100A756-15
115	8,500-10,500	4.0	22.0	.08	.34	1.90	15.02	75.00	100A755-16	100A756-16
115	7,000-9,000	4.8	17.0	.07	.40	1.20	18.38	116.00	100A755-17	100A756-17
115	5,500-7,000	4.8	14.0	.06	.28	.77	22.60	180.00	100A755-18	100A756-18
115	4,500-5,500	4.0	11.0	.04	.19	.50	28.37	267.00	100A755-19	100A756-19
115	4,000-5,000	3.3	8.8	.04	.14	.33	33.91	420.00	100A755-20	100A756-20
115	3,000-4,000	2.7	8.1	.03	.10	.21	41.21	645.00	100A755-21	100A756-21

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

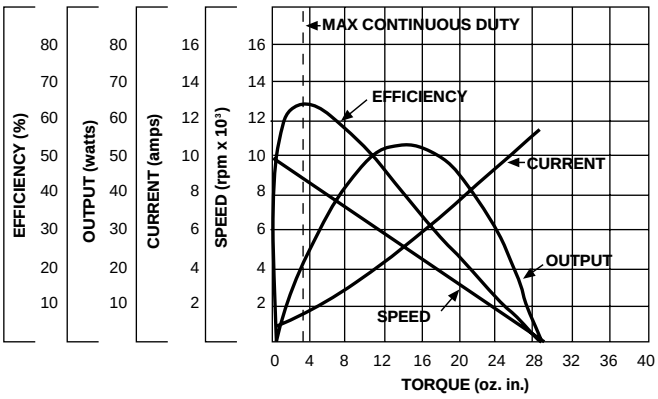
*When You Order

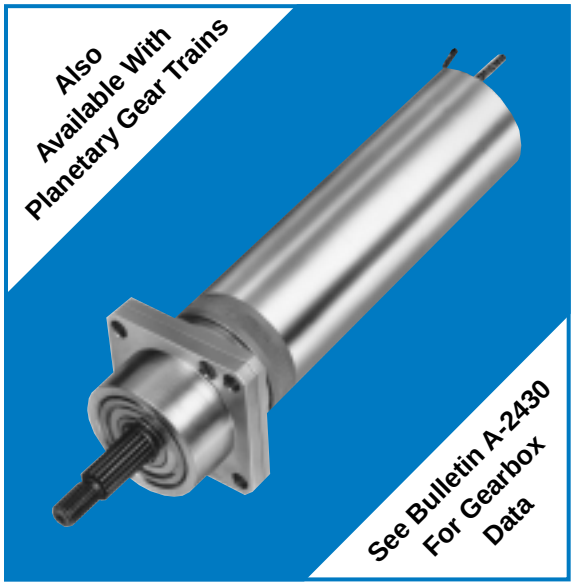
Units shown above are standard and may be ordered by part number. Remember to include armature winding dash number. EXAMPLE: 100A755-8

Typical Performance

Part No.: 100A755-8

Voltage: 27 VDC



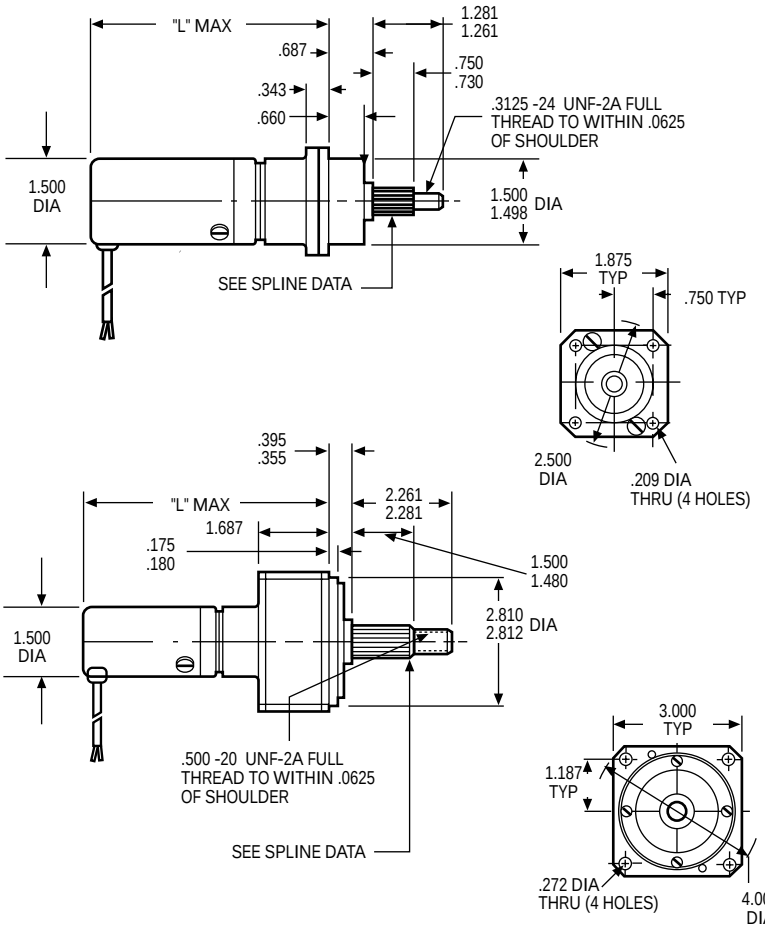


BD/BL GEARMOTORS

DC Permanent Magnet Planetary Gearmotors

A-2430

Dimensions



ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

general design specification

torque rating:

1.875" flange:	3.00" flange:
100 lb. in., continuous duty	550 lb. in., continuous duty

weight:

1.875" flange:	3.00" flange:
1.4 to 2.0 lbs. depending on ratio	5.6 to 6.3 lbs. depending on ratio

gears: Planetary gearing system. All gears are heat treated and ride on ball or roller bearings for greatest efficiency and long life

shaft: Carbon steel shaft per ASTM A304 with 18-tooth spline serrations per ANS B92.1-1970 heat-treated to RC 45-48 (1.875" flange) and RC 29-33 (3.00" flange)

backlash: Varies with reduction but average unit will have less than 3°

gear inertia: 1.4×10^{-5} oz. in. sec.^{2} @ input max

bearings: Output shaft uses double-shielded, life-lubricated ball bearings for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" shielded cable per MIL-C-7078 #22 AWG conductor per MIL-W-16878/4

mounting flange: Cold drawn steel

geartrain housing: Stress-proof steel

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

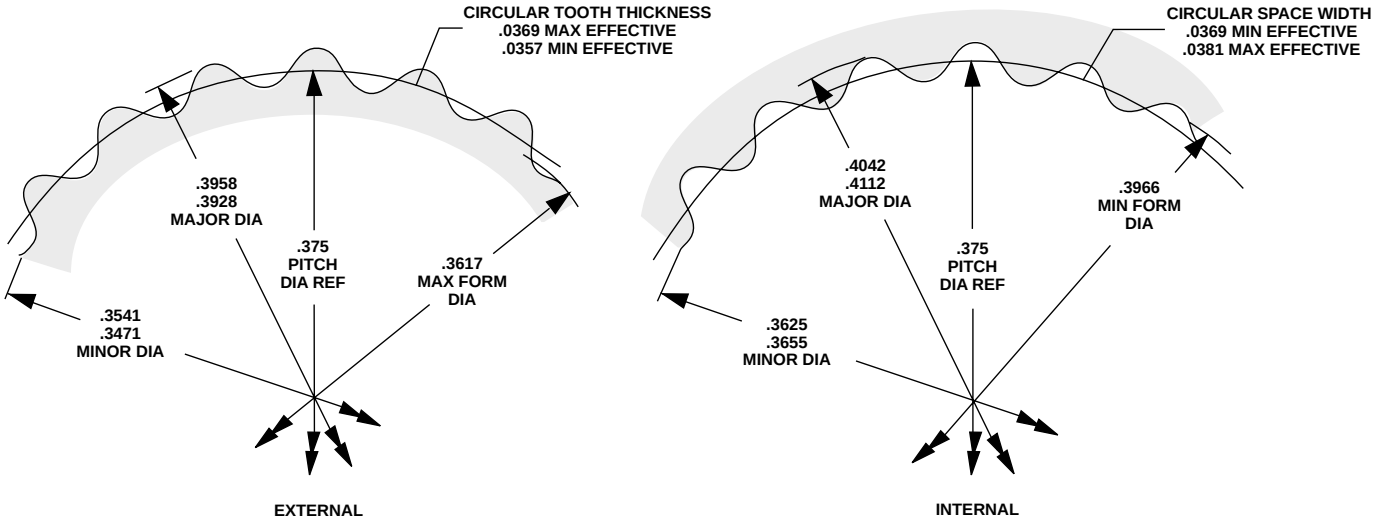
options available:

- Electromechanical brakes
- RFI filters to meet MIL-I-6181, MIL-1-26600 or MIL-STD-461
- Integral tachometer generators (see Bulletins A-2415 and A-2416 for details)

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

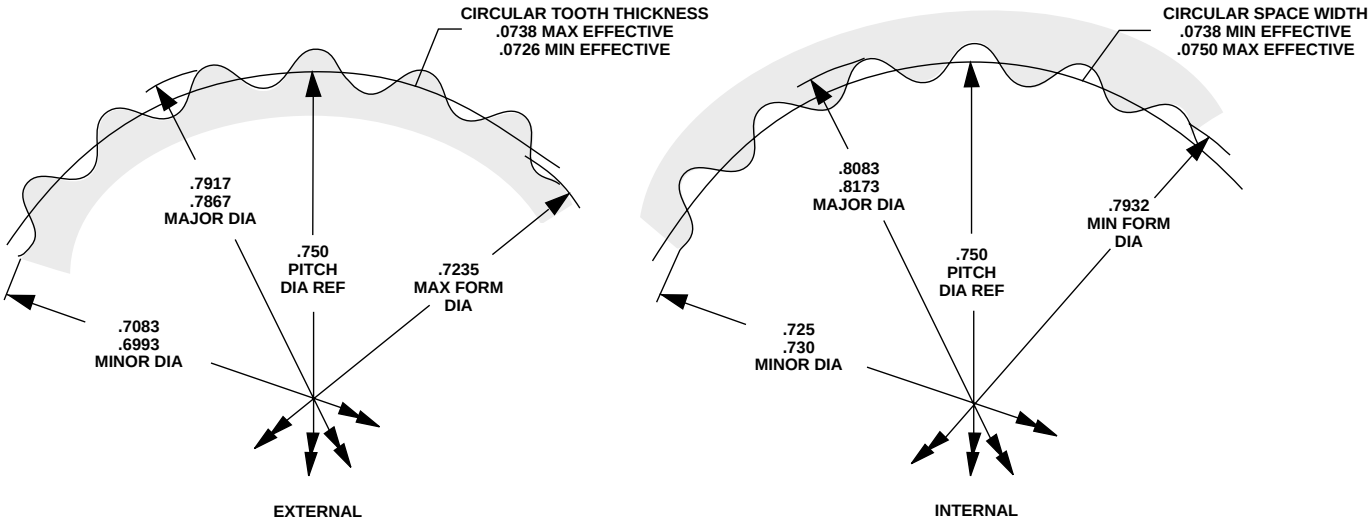
Spline Data

1.875" Flange



INVOLUTE SPLINE PER ANS B92.1-1970 (GLOBE SPEC 3S95)
18 TEETH
48/96 PITCH
45° PRESSURE ANGLE
EXTERNAL SPLINE — MIN DIMENSION OVER TWO .040" DIA PINS .4398" REF
INTERNAL SPLINE — MAX DIMENSION BETWEEN TWO .040" DIA PINS .3174" REF
NOTE: FOR PROTOTYPES, GLOBE MOTORS WILL BROACH THRU-HOLES FOR NON-HARDENED MATING PARTS WITH AN I.D. OF .3575/.3585" AS A STARTING DIAMETER

3.00" Flange



INVOLUTE SPLINE PER ANS B92.1-1970 (GLOBE SPEC 3S96)
18 TEETH
24/48 PITCH
45° PRESSURE ANGLE
EXTERNAL SPLINE — MIN DIMENSION OVER TWO .080" DIA PINS .8819" REF
INTERNAL SPLINE — MAX DIMENSION BETWEEN TWO .080" DIA PINS .6321" REF
NOTE: FOR PROTOTYPES, GLOBE MOTORS WILL BROACH THRU-HOLES FOR NON-HARDENED MATING PARTS WITH AN I.D. OF .7195/.7205" AS A STARTING DIAMETER

Standard Part Numbers and Data

1.875" Flange

SPEED REDUCTION RATIO	TORQUE MULTI-PLIER	MAX. CONT. RATING (lb. in.)	TYPE BD		TYPE BL	
			"L" max (in.)	STD. PART NO. PREFIX*	"L" MAX (in.)	STD. PART NO. PREFIX*
3.81:1	3.5	1.1		102A152		102A170
5.54:1	5.1	1.6	3.34	102A153	3.72	102A171
14.5:1	13.0	4.1		102A156		102A174
21.1:1	19.0	6.0	3.53	102A157	3.91	102A175
30.7:1	27.0	8.6		102A158		102A176
55.3:1	47.0	14.6		102A160		102A178
80.4:1	68.0	21.0	4.09	102A161	4.47	102A179
117:1	99.0	31.0		102A162		102A180
170:1	144.0	45.0		102A163		102A181
211:1	171.0	53.0		102A189		102A199
306:1	248.0	77.0		102A190		102A200
445:1	360.0	100.0	4.28	102A191	4.66	102A201
647:1	524.0	100.0		102A192		102A202
941:1	762.0	100.0		102A193		102A203
1,166:1	896.0	100.0		102A1061		102A1066
1,696:1	1,305	100.0		102A1062		102A1067
2,466:1	1,900	100.0	4.47	102A1063	4.85	102A1068
3,584:1	2,760	100.0		102A1064		102A1069
5,211:1	4,000	100.0		102A1065		102A1070

3.00" Flange

SPEED REDUCTION RATIO	TORQUE MULTI-PLIER	MAX. CONT. RATING (lb. in.)	TYPE BD		TYPE BL	
			"L" max (in.)	STD. PART NO. PREFIX*	"L" MAX (in.)	STD. PART NO. PREFIX*
306:1	248	77		102A929		102A939
445:1	360	122	5.38	102A930	5.75	102A940
647:1	524	164		102A931		102A941
941:1	762	238		102A932		102A942
1,166:1	896	280		102A933		102A943
1,696:1	1,305	407		102A934		102A944
2,466:1	1,900	550	5.55	102A935	5.92	102A945
3,584:1	2,760	550		102A936		102A946
5,211:1	4,000	550		102A937		102A947

Max Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life
Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque of gearbox
Max Intermittent Torque = 2 x Max Cont. Torque
Momentary Stall Torque = 5 x Max Cont. Torque
Minimum Gearbox Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor armature windings (see chart, next page) can be used with any of the gear ratios listed above. To order, state the gear train standard part number prefix, plus a motor armature winding dash number. EXAMPLE: 102A152-8 is a 3.81:1 BD gearmotor with a “-8” armature winding, 12 volts, 6,700 rpm, 3.5 oz. in. torque, etc.

Basic Motor Data
Type BD

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	ARMATURE WINDING DASH NUMBER*
6	10,000-12,000	2.3	19.0	1.40	4.6	35.00	.67	.18	-3
6	8,000-9,500	3.2	15.0	1.10	4.6	22.00	.86	.29	-4
12	12,500-14,500	1.8	24.0	.85	2.3	27.00	1.10	.46	-5
12	10,000-12,000	2.4	19.0	.70	2.3	17.00	1.39	.74	-6
12	8,000-9,500	3.2	15.0	.55	2.3	11.00	1.74	1.13	-7
12	6,200-7,300	3.5	11.0	.44	2.5	7.00	2.22	1.88	-8
27	11,000-13,000	2.0	22.0	.34	1.0	9.80	2.79	3.04	-9
27	9,000-10,500	2.8	17.0	.27	1.0	6.40	3.47	4.82	-10
27	7,000-8,500	3.6	14.0	.23	1.0	3.90	4.35	7.58	-11
50	10,500-12,500	2.1	20.0	.18	.5	4.60	5.45	12.20	-12
50	8,000-9,500	2.8	16.0	.15	.5	2.90	6.85	19.10	-13
50	6,500-8,000	3.7	13.0	.11	.5	1.80	8.64	30.80	-14
50	5,000-6,500	3.5	10.0	.09	.4	1.20	10.87	48.30	-15
115	13,000-15,500	1.6	18.0	.09	.3	2.30	9.95	56.30	-16
115	11,000-13,000	2.2	14.0	.08	.3	1.50	12.17	87.00	-17
115	9,000-10,500	2.8	11.0	.07	.3	.95	14.97	135.00	-18
115	7,000-8,500	3.6	9.0	.06	.3	.61	18.79	207.00	-19
115	6,000-7,000	2.9	7.0	.05	.2	.40	22.46	332.00	-20
115	4,500-5,500	2.7	6.5	.05	.2	.26	27.29	507.00	-21

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

Type BL

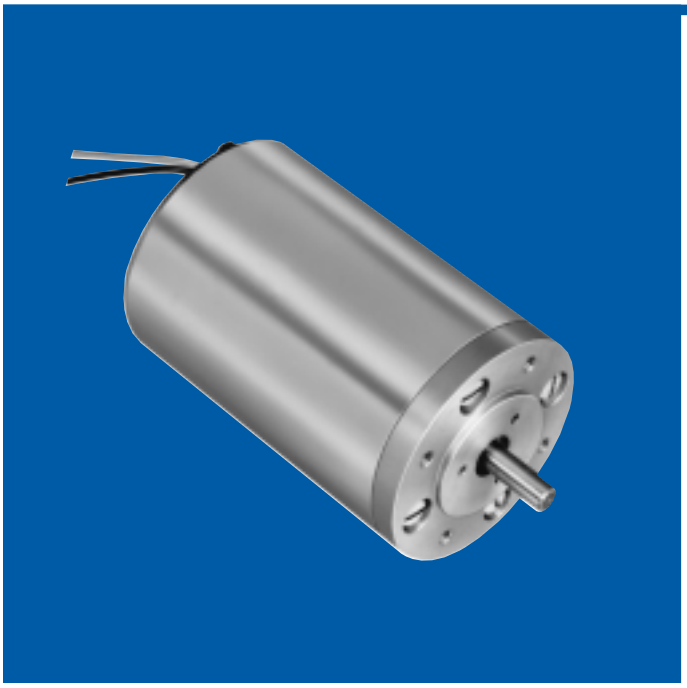
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	ARMATURE WINDING DASH NUMBER*
6	8,500-10,500	4.0	29.0	1.30	6.50	45.00	.80	.14	-2
6	6,500-8,000	5.0	23.0	1.00	6.50	28.00	1.01	.24	-3
12	10,000-12,500	3.3	37.0	.77	3.50	36.00	1.30	.39	-4
12	8,500-10,500	4.4	29.0	.61	3.50	22.00	1.66	.62	-5
12	6,500-8,000	5.0	23.0	.49	3.50	14.00	2.10	1.00	-6
12	5,100-6,200	5.5	18.0	.40	3.00	9.00	2.63	1.50	-7
27	9,200-11,000	3.7	33.0	.31	1.40	12.00	3.35	2.50	-8
27	7,000-9,000	5.0	27.0	.25	1.40	8.00	4.21	4.10	-9
27	5,500-7,000	6.0	21.0	.20	1.40	5.20	5.24	6.40	-10
50	8,500-10,500	3.8	31.0	.17	.72	5.90	6.57	10.10	-11
50	6,500-8,000	5.0	25.0	.13	.74	3.70	8.23	16.00	-12
50	5,500-7,000	6.5	20.0	.11	.73	2.40	10.34	25.00	-13
50	4,500-5,500	7.5	16.0	.09	.66	1.50	13.05	41.00	-14
50	3,500-4,500	6.0	12.5	.06	.43	.94	16.41	65.00	-15
115	8,500-10,500	4.2	22.0	.08	.34	1.90	15.02	75.00	-16
115	7,000-9,000	5.0	17.0	.07	.40	1.20	18.38	116.00	-17
115	5,500-7,000	5.0	14.0	.05	.28	.77	22.60	180.00	-18
115	4,500-5,500	4.2	11.0	.04	.19	.50	28.37	267.00	-19
115	4,000-5,000	3.5	8.8	.04	.14	.33	33.91	420.00	-20
115	3,000-4,000	2.9	8.1	.03	.10	.21	41.21	645.00	-21

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

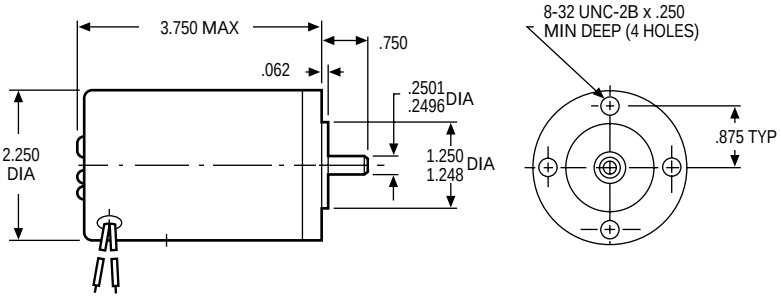
GRP MOTORS

DC Permanent Magnet Motors

A-3600



Dimensions



general design specification

power rating: .083 hp (61.9 W)

voltage: 6 to 115 VDC

weight: 1 lb. 13 oz.

armature: Dynamically balanced

inertia: 2.3 x 10^{-3} oz. in. $sec.^2$

electrical time constant: 0.5 milliseconds max

mechanical time constant: 20.0 milliseconds max

typical no load torque: 2.25 oz. in.

protection: Varnish impregnated

shaft: Precision-ground, through-hardened (RC 45-55) 420 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Alnico V

bearings: Double shielded, life-lubricated for -55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" #20 AWG lead wire per MIL-W-16878/4

cover: Aluminum

frame: Die-cast aluminum alloy

marking: Per MIL-STD-130

life: 1,000 hours continuous duty for 27 VDC units

winding temperature rise: 3°C per watt w/8.00" x 8.00" x .25" aluminum heat sink

winding insulation rating: 130°C (higher temperature windings available)

options available:

- Integral tachometer generators
- Electromechanical brakes
- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461
- Gearheads (see A-2430 for details)

ROTATION (VIEWED FROM SHAFT END)
CCW - POSITIVE VOLTAGE TO RED (+), NEGATIVE VOLTAGE TO BLACK (–)
CW - REVERSE POLARITY

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

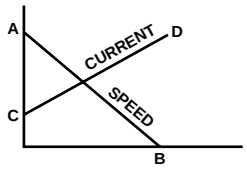
VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE ** theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT ** nominal stall (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	STANDARD PART NUMBERS*
6	4,700-5,300	8.0	40	2.00	7.00	45.0	1.6	.15	166A100-4
12	6,300-7,000	8.0	54	1.34	6.00	47.0	2.4	.28	166A100-5
12	4,700-5,300	12.0	50	1.00	5.80	28.0	3.2	.47	166A100-6
27	8,500-9,500	10.0	99	.80	3.40	40.0	4.0	.75	166A100-7
27	6,500-7,300	13.0	96	.62	3.40	25.0	5.2	1.23	166A100-8
27	5,300-5,900	16.0	89	.50	3.30	16.0	6.4	1.92	166A100-9
27	4,200-4,800	16.0	72	.40	2.70	10.0	8.0	3.01	166A100-10
50	6,300-7,100	14.0	107	.32	1.90	11.8	10.0	4.77	166A100-11
50	4,900-5,500	14.5	83	.25	1.50	7.5	12.8	7.59	166A100-12
50	3,900-4,400	15.0	66	.20	1.20	4.7	16.0	12.12	166A100-13
115	7,300-8,100	12.0	123	.16	.90	6.8	20.0	19.12	166A100-14
115	5,900-6,500	15.5	99	.14	.85	4.4	24.8	29.36	166A100-15
115	4,700-5,300	16.0	80	.12	.70	2.8	30.8	46.30	166A100-16
115	3,700-4,100	15.0	62	.09	.50	1.8	38.8	74.10	166A100-17
115	3,000-3,400	14.5	51	.07	.45	1.2	48.0	115.90	166A100-18
115	2,400-2,700	14.0	41	.06	.35	.8	59.6	180.00	166A100-19

**Because of brush drop and field distortion, current and torque indicated will not always be attainable

*When You Order

Units shown above are standard and may be ordered by part number.
Remember to include armature winding dash number.
EXAMPLE: 166A100-8

How To Draw Speed Torque Curve

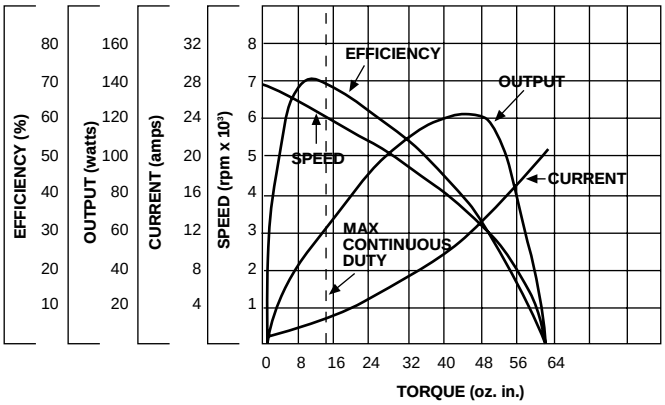


A no load speed (nominal) (rpm)
B stall torque (oz. in.)
C no load current (amps)
D stall current (amps)

Typical Performance

Part No.: 166A100-8

Voltage: 27 VDC



GLOBE AC MOTORS

In an AC motor, the current repeatedly changes its direction of flow through the circuit many times every second; hence the name alternating current. One directional reversal is referred to as an alternation, and two alternations equal one cycle.

Globe Motors manufactures AC motors up to .10 horsepower in both induction and hysteresis synchronous designs. These AC motors are designed for use on 400 Hz frequency in both single and three-phase power systems. A leader in the development of AC motors, Globe is able to supply these devices in a wide variety of styles incorporating many advanced features. These motors can also be combined with a number of options such as integral planetary gear trains, clutches, and brakes.

GEARMOTORS

Almost any Globe motor can be furnished as a gearmotor. An extensive selection of standard gear ratios is available to meet your speed and torque requirements. Globe planetary gear trains offer efficiencies well over 80% per reduction stage for most models; while larger sizes offer efficiencies up to 93%.

DELIVERY

When you need a prototype, a large stock of standard catalog units is available from our distributors for delivery in 24 hours. In addition, Globe maintains facilities that are geared to quickly handle the largest production order, to meet your needs.

INDUCTION MOTORS

Globe induction motors are manufactured using a squirrel cage rotor utilizing both aluminum and copper bars. Speed and torque can be tailored to individual requirements by changing the conductivity of the rotor bars. This permits very versatile curve matching.

For a graphic comparison on induction motor speed/torque characteristics, to those of the constant speed hysteresis synchronous motor, refer to Figures 1 and 2.

HYSTERESIS SYNCHRONOUS MOTORS

Synchronous motors operate at a constant speed determined by the number of poles and frequency. With the hysteresis synchronous motor the output is velvet smooth and can be as constant as the power supply frequency. Globe hysteresis motors are manufactured using a special alloy in the rotor which has a marked hysteresis loop. This results in a motor that has extremely good starting torque and pull-up torque, necessary to bring relatively large loads up to synchronous speed.

COMMON BORE CONSTRUCTION

Globe manufactures both induction and hysteresis synchronous AC motors using a common bore construction. This type construction allows smaller air gaps to be used which improves motor efficiency by maintaining exceedingly close concentricity between the rotor and stator bores. The stator bore is honed to maintain exact roundness and size at the time of manufacturing. With this improvement in efficiency as a standard construction feature, higher power outputs are available in smaller overall physical sizes.

INSULATION SYSTEMS

Insulation life is frequently the limiting factor on the maximum motor output capabilities. At Globe Motors, the insulation system has been exhaustively improved to increase reliability and life. Globe Motors is ever mindful of its responsibility to maintain the quality image and product integrity that has been earned over the years. For example, epoxy slot insulation is standard on most motors. AC motors use high temperature wire in the insulation system which is superior to that required by ordinary environmental conditions. This is done as a standard feature to help improve motor quality and enhance long life. Motor fields are impregnated with varnish to ensure that conductors are well insulated and secured.

BEARING TEMPERATURE

Since the limiting factor on motor output is heat dissipation, in some cases the life of the unit is purely a function of the grease in the bearing. Using 1,000 hours as an arbitrary running life, 350°F (177°C) becomes the maximum temperature which the bearing lubricant will withstand. Thus bearing life is extremely important in any proper evaluation of life figures.

APPLICATION FACTORS

AC motor selection is based upon the required speed and torque together with life and environmental conditions. Since motor life is a function of both ambient temperature and generated temperature, often times heat sinks can be utilized effectively to reduce motor temperature. Duty cycle operation also can reduce motor size and improve life.

$$\text{Horsepower} = \sqrt{\frac{Hp_1{}^2(t_1) + Hp_2{}^2(t_2) + \ldots}{t_1 + t_2 = \ldots . {}^1/_2\, t \text{ idle}}}$$

Increased equivalent heating horsepower is available by operating the motor at HP_1 for t_1 seconds, Hp_2 for t_2 seconds, etc. and having off or idle time "t" seconds.

Internal temperature rise may be calculated using the following relationship:

Temperature Rise by winding resistance measurements.

$$°C \text{ rise} = \frac{\text{Hot Resist.}}{\text{Cold Resist.}} \ (234.5 + \text{Cold Amb. Temp.}) — (234.5 + \text{Hot Amb. Temp.})$$

POWER REQUIREMENTS

The horsepower to drive the load can be calculated using the formula:

$$\text{Horsepower} = \frac{\text{oz. in. (or mNm x .1416) torque x rpm}}{1.015 \times 10^6}$$

While torque to accelerate a particular inertia load can be calculated by the following relationship:

$$\text{Torque in oz. in. (or mNm x .1416) required to accelerate} = \frac{.1047 \times \text{rpm} \times \text{inertia}}{\text{time (seconds)}}$$

rpm = Speed change rpm

Inertia = Inertia of load plus motor rotor in oz. in. sec.^{2} (or gm cm^2 x 1.416 x 10^{-5})

Gearmotor inertia follows a square law.

Output shaft inertia = Rotor inertia x (gear ratio)^2

During prototype experimentation, it is often advantageous to check out a motor that is fairly close to the calculated load and by adjusting the voltage you can pinpoint the torque load more exactly. For example, on induction motors, torque varies as a square of voltage while on hysteresis synchronous motors, it is approximately a linear function. By connecting the prototype motor to the load and adjusting the voltage, the exact requirements of the application can be ascertained with a great deal of accuracy.

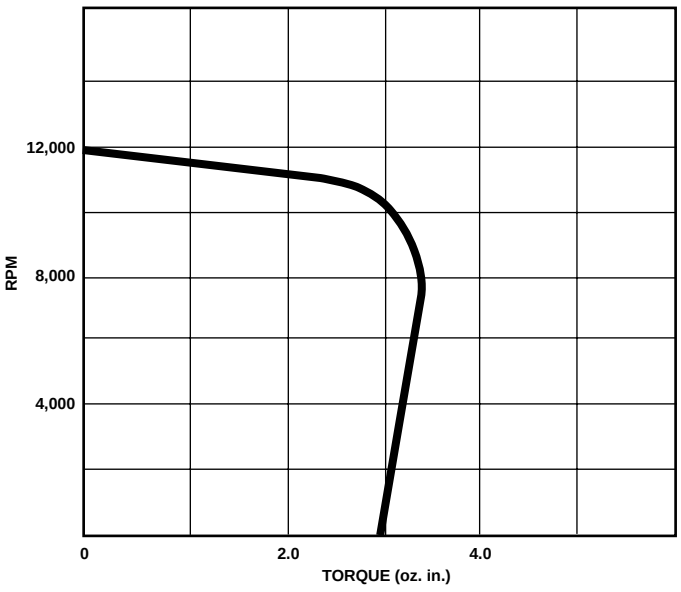


Figure 1: Induction

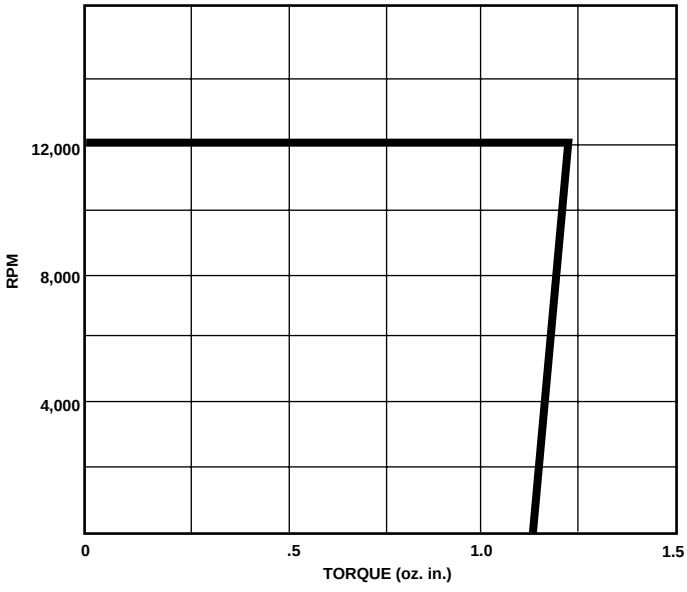
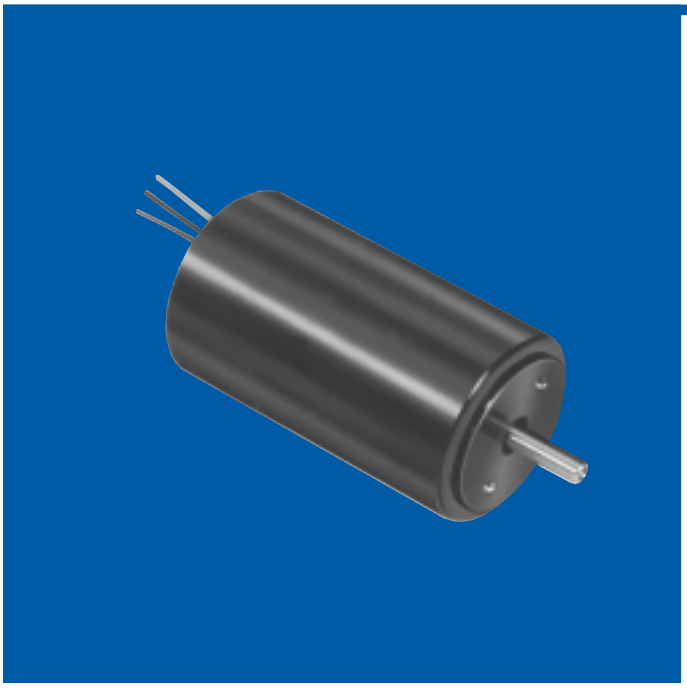


Figure 2: Hysteresis Synchronous

MC MOTORS

AC Hysteresis Synchronous and Induction Motors



general design specification: MIL-M-7969

power rating:

Induction — Up to 1.5 oz. in.
Hysteresis Synchronous — Up to 0.85 oz. in.

voltage and frequency: 115 and 200 VAC @ 400 Hz

weight: 6.5 ounces

inertia:

Induction — 8 x 10^{-5} oz. in. sec.^{2}
Hysteresis Synchronous — 2 Pole: 7.7 x 10^{-5} oz. in. sec.^{2}
— 4 Pole: 6.4 x 10^{-5} oz. in. sec.^{2}
— 6 Pole: 7.1 x 10^{-5} oz. in. sec.^{2}

shaft: Precision-ground No. 303 or 416 stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

bearings: Double shielded, life-lubricated for –55°C to + 85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" #26 AWG leads per MIL-W-16878/4

housing: Aluminum

marking: Per MIL-STD-130

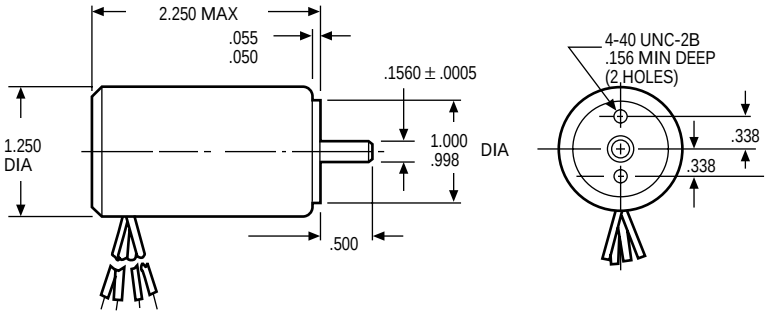
life: 200 to 1,000 hours continuous duty depending upon the voltage, frequency and number of poles

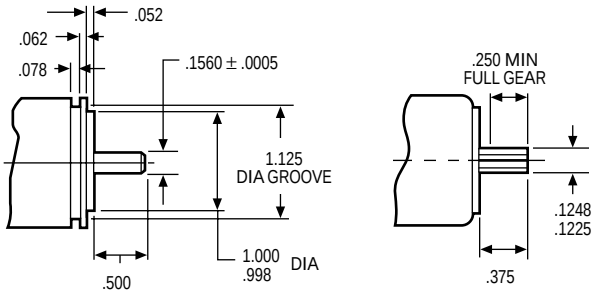
options available:

- Gear train (see B-2030 for details)
- Length. MC motors are available in 4 lengths with output torque being proportional to length as follows:

TYPE	LENGTH (in.)	TORQUE
MC (Standard)	2.25	See Chart, opposite page
MCS	1.75	0.5 x standard torque
MCL	2.75	1.5 x standard torque
MCLL	3.25	2.0 x standard torque

Dimensions





PINION DATA: NUMBER OF TEETH —13
DIAMETRAL PITCH — 120°
PRESSURE ANGLE — 20°
AGMA 9 IS STANDARD
OTHER PINIONS ARE AVAILABLE

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

Hysteresis Synchronous

VOLTAGE (VAC)	FRE-QUENCY (Hz)	POLES	PHASE	SCHEMATIC	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	PHASING CAPACITOR (wvac)	SYNC SPEED (rpm)	MAX RATED LOAD @ SYNC. SPEED (oz. in.)	MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER* TAPPED HOLE MOUNT
115	60	2	1	C	WHT	1.00	200	3,600	.70	.50	12	12	18A108
115	60	4	1	C	BLK	1.00	200	1,800	.65	.50	12	12	18A107
115	60	6	1	D	YLW	1.00	200	1,200	.50	.40	12	12	18A437
115	400	2	1	A	BLK	.180	350	24,000	.80	.55	23	33	18A1003-2
115	400	2	3	B	BLK	NOT REQ'D		24,000	.80	.80	20	30	18A1004-2
115	400	4	1	A	GRN	.082	500	12,000	.65	.45	17	20	18A1005-2
115	400	4	3	B	GRN	NOT REQ'D		12,000	.85	.85	16	21	18A1006-2
115	400	6	1	D	GRY	.150	400	8,000	.45	.25	16	18	18A250
200	400	2	3	B	BLK	NOT REQ'D		24,000	.80	.80	20	30	18A1008-2
200	400	4	3	B	GRN	NOT REQ'D		12,000	.75	.75	14	18	18A1009-2

Induction

VOLTAGE (VAC)	FRE-QUENCY (Hz)	POLES	PHASE	SCHEMATIC	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	PHASING CAPACITOR (wvac)	MIN SPEED @ RATED LOAD (rpm)	RATED LOAD (oz. in.)	MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER* TAPPED HOLE MOUNT
115	400	2	1	A	BLK	.180	350	21,000	1.00	.80	16	32	18A1003-1
115	400	2	3	B	BLK	NOT REQ'D		22,000	1.50	1.50	16	40	18A1004-1
115	400	4	1	A	GRN	.082	500	10,000	1.00	1.00	17	28	18A1005-1
115	400	4	3	B	GRN	NOT REQ'D		10,500	1.50	1.50	14	28	18A1006-1
200	400	2	3	B	BLK	NOT REQ'D		22,000	1.50	1.50	16	40	18A1008-1
200	400	4	3	B	GRN	NOT REQ'D		10,500	1.50	1.50	14	28	18A1009-1

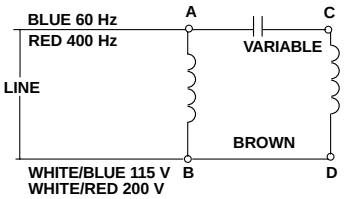
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200v line to line

*When You Order

Units shown above are standard and may be ordered by part number.
Remember to include dash number, EXAMPLE: 18A1003-2.

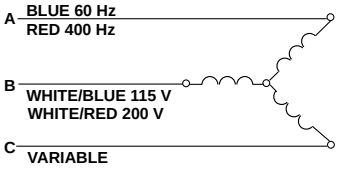
Schematic Wiring

A



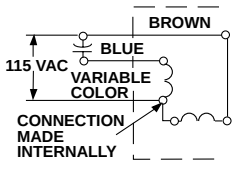
CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE C & D

B



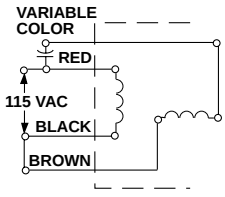
ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE ANY TWO LEADS

C



CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION CONNECT LINE TO BLUE INSTEAD OF BROWN

D



CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE RED & BLACK

MC GEARMOTORS

AC Hysteresis Synchronous and Induction Planetary Gearmotors

B-2030

general design specification: MIL-M-7969

torque rating: Up to 1,250 oz. in. maximum continuous torque

weight: 9 to 12.5 ounces

gears: Planetary gearing system. All gears are heat-treated for consistently reliable performance and long life

shaft: Precision-ground 416 nitrided stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average unit will have less than 3°

gear inertia: 5.1 x 10^{-6} oz. in. $sec.^2$ @ input max

bearings: .250" dia. shaft uses double-shielded, life-lubricated ball bearings for –55°C to +85° C operation. .313" dia. shaft uses needle bearings. Special lubricants available for temperature extremes

cables/leads: 8" #26 AWG leads per MIL-W-16878/4

mounting flange: Die-cast aluminum

gear train housing: Stress-proof steel

marking: Per MIL-STD-130

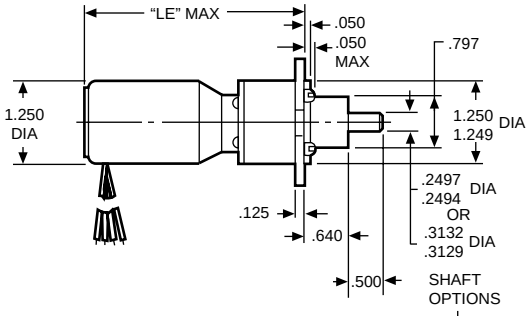
life: 200 to 1,000 hours continuous duty depending upon the voltage, frequency and number of poles and gear ratio selected

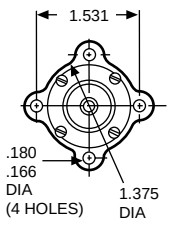
options available:

- Slip clutches

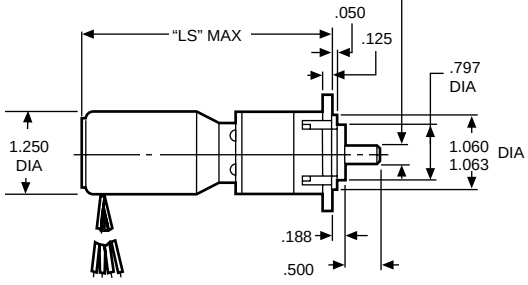
Dimensions

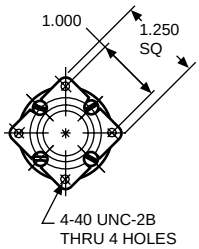
EARED FLANGE





SQUARE FLANGE





NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Basic Motor Data

Hysteresis Synchronous

VOLT-AGE (VAC)	FRE-QUENCY (Hz)	POLES	PHASE	SCHE-MATIC	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	(wvac)	MOTOR SYNC. SPEED (rpm)	NORMAL RATED LOAD @ SYNC. SPEED (oz. in.)	MOTOR MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER PREFIX* EVEN RATIO eared flange .250" shaft	EVEN RATIO square flange .250" shaft	ODD RATIO eared flange .250" shaft	ODD RATIO eared flange .313" shaft	ODD RATIO square flange .250" shaft	ODD RATIO square flange .313" shaft
115	60	2	1	C	WHT	1.00	200	3,600	.70	.50	12	12	33A603	33A613	33A648	33A513	33A643	33A638
115	60	4	1	C	BLK	1.00	200	1,800	.65	.50	12	12	33A604	33A614	33A649	33A514	33A644	33A639
115	60	6	1	C	RED	1.00	200	1,200	.50	.40	12	12	33A1214	33A1215	33A1217	33A1216	33A1219	33A1218

Hysteresis Synchronous

VOLT-AGE (VAC)	FRE-QUENCY (Hz)	POLES	PHASE	SCHE-MATIC	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	(wvac)	MOTOR SYNC. SPEED (rpm)	NORMAL RATED LOAD @ SYNC. SPEED (oz. in.)	MOTOR MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER PREFIX* ALL RATIOS eared flange .250" shaft	eared flange .313" shaft	square flange .250" shaft	square flange .313" shaft
115	400	2	1	A	BLK	.180	350	24,000	.80	.55	23	33	33A2008	33A2108	33A2208	33A2308
115	400	2	3	B	BLK	NOT REQ'D		24,000	.80	.80	20	30	33A2010	33A2110	33A2210	33A2310
115	400	4	1	A	GRN	.082	500	12,000	.65	.45	17	20	33A2012	33A2112	33A2212	33A2312
115	400	4	3	B	GRN	NOT REQ'D		12,000	.85	.85	16	21	33A2014	33A2114	33A2214	33A2314
115	400	6	1	B	ORG	.150	400	8,000	.45	.25	16	18	33A2016	33A2116	33A2216	33A2316
200	400	2	3	B	BLK	NOT REQ'D		24,000	.80	.80	20	30	33A2018	33A2118	33A2218	33A2318
200	400	4	3	B	GRN	NOT REQ'D		12,000	.75	.75	14	18	33A2020	33A2120	33A2220	33A2320

Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

Induction

VOLT-AGE (VAC)	FRE-QUENCY (Hz)	POLES	PHASE	SCHE-MATIC	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	(wvac)	MOTOR MIN SPEED @ RATED LOAD (rpm)	MOTOR RATED LOAD (oz. in.)	MOTOR MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER PREFIX* ALL RATIOS eared flange .250" shaft	eared flange .313" shaft	square flange .250" shaft	square flange .313" shaft
115	400	2	1	A	BLK	.180	350	21,000	1.00	.80	16	32	33A2007	33A2107	33A2207	33A2307
115	400	2	3	B	BLK	NOT REQ'D		22,000	1.50	1.50	16	40	33A2009	33A2109	33A2209	33A2309
115	400	4	1	A	GRN	.082	500	10,000	1.00	1.00	17	28	33A2011	33A2111	33A2211	33A2311
115	400	4	3	B	GRN	NOT REQ'D		10,500	1.50	1.50	14	28	33A2013	33A2113	33A2213	33A2313
200	400	2	3	B	BLK	NOT REQ'D		22,000	1.50	1.50	16	40	33A2017	33A2117	33A2217	33A2317
200	400	2	3	B	GRN	NOT REQ'D		10,500	1.50	1.50	14	28	33A2019	33A2119	33A2219	33A2319

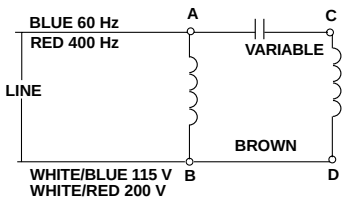
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

*When You Order

The standard Part Number Prefix can be used with any of the Speed Reduction Ratios listed on the following two pages. The complete part number consists of the Standard Part Number Prefix plus the Speed Reduction Ratio desired. EXAMPLE: 33A2012-20 is a 4 pole, 12,000 rpm, 115 vac, 400 Hz hysteresis synchronous motor, coupled to a 20:1 even ratio gear train with a final output speed of 600 rpm. The unit has an eared flange and a .250" dia. output shaft

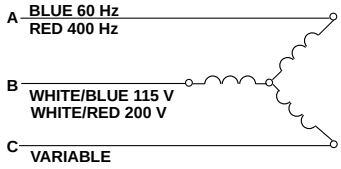
Schematic Wiring

A



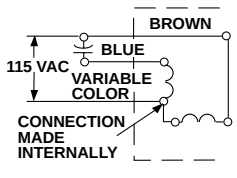
CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE C & D

B



ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE ANY TWO LEADS

C



CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION CONNECT LINE TO BLUE INSTEAD OF BROWN

Ratios and Performance

Odd Ratios

SPEED REDUCTION RATIO	TORQUE MULTIPLIER RATIO	*GEAR TRAIN MAX CONT. RATING (oz. in.)	GEAR TRAIN EFFICIENCY (%)	FINAL OUTPUT SPEED (HYST.) 400 cycles			MIN SPEED @ RATED LOAD (IND.) 400 cycles				DIMENSION	
				24,000 input	12,000 input	8,000 input	22,000 input	21,000 input	10,500 input	10,000 input	LE (in.)	LS (in.)
4.33:1	3.2	5.4	75	5,538.462	2,769.231	1,846.231	2,309.00	2,425.00	4,850.00	5,081.00	2.87	3.28
5.28:1	4.0	6.8	75	4,545.455	2,272.727	1,515.152	1,894.00	1,989.00	3,977.00	4,167.00	2.87	3.28
18.78:1	12.0	20.0	64	1,277.955	638.977	425.985	532.00	559.00	1,118.00	1,171.00	2.87	3.28
27.94:1	17.0	29.0	64	858.984	429.491	286.327	358.00	376.00	752.00	787.00	2.87	3.28
81.37:1	41.0	70.0	51	294.949	147.474	98.316	123.00	129.00	258.00	270.00	3.02	3.42
121.1:1	62.0	105.0	51	198.183	99.091	66.061	83.00	87.00	173.00	182.00	3.02	3.42
147.7:1	75.0	128.0	51	162.491	81.250	54.163	68.00	71.00	142.00	149.00	3.02	3.42
352.6:1	145.0	247.0	41	68.066	34.032	22.688	28.00	30.00	60.00	62.00	3.28	3.68
524.6:1	215.0	366.0	41	45.749	22.874	15.249	19.00	20.00	40.00	42.00	3.28	3.68
639.9:1	262.0	445.0	41	37.506	18.752	12.501	16.00	16.00	33.00	34.00	3.28	3.68
780.6:1	320.0	544.0	41	30.745	15.372	10.248	13.00	13.00	27.00	28.00	3.28	3.68
1,528:1	500.0	850.0*	33	15.706	7.853	5.235	6.50	6.90	13.00	14.00	3.66	4.06
2,273:1	740.0	1,250*	33	10.558	5.279	3.519	4.40	4.60	9.20	9.60	3.66	4.06
3,382:1	1,100	1,250*	33	7.096	3.548	2.365	3.00	3.10	6.20	6.50	3.66	4.06
4,126:1	1,350	1,250*	33	5.816	2.908	1.938	2.40	2.50	5.10	5.30	3.66	4.06
6,621:1	1,730	1,250*	26	3.624	1.812	1.208	1.50	1.60	3.20	3.30	3.78	4.18
9,851:1	2,580	1,250*	26	2.436	1.218	.812	1.00	1.10	2.10	2.20	3.78	4.18
12,016:1	3,150	1,250*	26	1.997	.998	.665	.83	.87	1.70	1.80	3.78	4.18
17,879:1	4,700	1,250*	26	1.342	.671	.447	.56	.59	1.10	1.20	3.78	4.18
21,808:1	5,700	1,250*	26	1.100	.550	.366	.26	.46	.48	.96	3.78	4.18

Even Ratios

SPEED REDUCTION RATIO	TORQUE MULTIPLIER RATIO	*GEAR TRAIN MAX CONT. RATING (oz. in.)	GEAR TRAIN EFFICIENCY (%)	FINAL OUTPUT SPEED (HYST.) 400 cycles			MIN SPEED @ RATED LOAD (IND.) 400 cycles				DIMENSION	
				24,000 input	12,000 input	8,000 input	22,000 input	21,000 input	10,500 input	10,000 input	LE (in.)	LS (in.)
4:1	3.0	5.1	75	6,000.00	3,000.00	2,000.000	5,500	5,250	2,625	2,500	2.87	3.28
5:1	3.8	6.5	75	4,800.00	2,400.00	1,600.000	4,400	4,200	2,100	2,000	2.87	3.28
6:1	4.5	7.7	75	4,000.00	2,000.00	1,333.300	3,300	3,500	1,750	1,667	2.87	3.28
16:1	10.0	17.0	63	1,500.00	750.00	500.000	1,375	1,313	656	625	2.87	3.28
20:1	13.0	22.0	63	1,200.00	600.00	400.000	1,100	1,050	525	500	2.87	3.28
24:1	15.0	26.0	63	1,000.00	500.00	333.300	917	875	438	417	2.87	3.28
25:1	16.0	27.0	63	960.00	480.00	320.000	880	840	420	400	2.87	3.28
30:1	19.0	32.0	63	800.00	400.00	266.600	733	700	350	333	2.87	3.28
36:1	23.0	39.0	63	666.60	333.30	222.200	611	583	292	278	2.87	3.28
64:1	33.0	56.0	52	375.00	187.50	125.000	344	328	164	156	3.02	3.42
80:1	41.0	70.0	52	300.00	150.00	100.000	275	263	131	125	3.02	3.42
96:1	49.0	83.0	52	250.00	125.00	83.300	229	219	109	104	3.02	3.42
100:1	51.0	87.0	52	240.00	120.00	80.000	220	210	105	100	3.02	3.42
120:1	61.0	104.0	52	200.00	100.00	66.600	183	175	88	80	3.02	3.42
125:1	64.0	109.0	51	192.00	96.00	64.000	176	168	84	80	3.02	3.42
144:1	74.0	126.0	51	166.60	83.30	55.555	153	146	80	69	3.02	3.42
150:1	77.0	131.0	51	160.00	80.00	53.333	147	140	70	67	3.02	3.42
180:1	92.0	156.0	51	133.33	66.66	44.444	122	117	58	56	3.02	3.42
216:1	110.0	187.0	51	111.11	55.55	37.037	102	97	49	46	3.02	3.42
256:1	105.0	179.0	41	93.75	46.87	31.250	86	82	41	39	3.28	3.68

*Max Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life. Max rated torque of motor selected x torque multiplier ratio must not exceed these values
Max Intermittent Torque = 2 x Max Cont. Torque
Momentary Stall Torque = 5 x Max Cont. Torque (2,000 oz. in. max)
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100
.250" dia. shafts are limited to 600 oz. in. cont. duty torque. Use .313" dia. shaft if torque requirements exceed this value

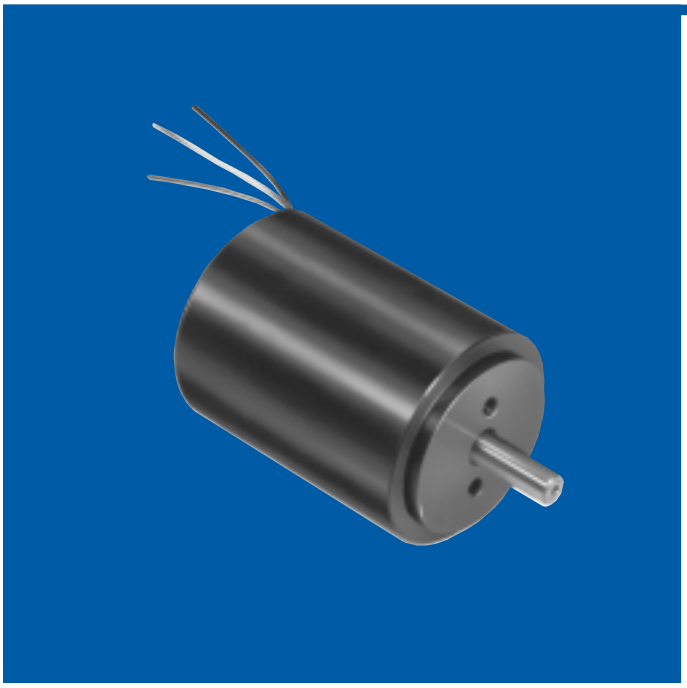
Ratios and Performance

Even Ratios (con't.)

SPEED REDUCTION RATIO	TORQUE MULTIPLIER RATIO	*GEAR TRAIN MAX CONT. RATING (oz. in.)	GEAR TRAIN EFFICIENCY (%)	FINAL OUTPUT SPEED (HYST.) 400 cycles			MIN SPEED @ RATED LOAD (IND.) 400 cycles				DIMENSION	
				24,000 input	12,000 input	8,000 input	22,000 input	21,000 input	10,500 input	10,000 input	LE (in.)	LS (in.)
320:1	130.0	221.0	41	75.00	37.50	25.000	69	66	33	31	3.28	3.68
384:1	157.0	267.0	41	62.50	31.25	20.833	57	55	27	26	3.28	3.68
400:1	164.0	279.0	41	60.00	30.00	20.000	55	53	26	25	3.28	3.68
480:1	197.0	335.0	41	50.00	25.00	16.666	46	44	21	20	3.28	3.68
500:1	205.0	349.0	41	48.00	24.00	16.000	44	42	21	20	3.28	3.68
576:1	236.0	401.0	41	41.66	20.83	13.888	38	36	18	17	3.28	3.68
600:1	246.0	418.0	41	40.00	20.00	13.333	37	34	18	17	3.28	3.68
625:1	256.0	435.0	41	38.40	19.20	12.800	35	34	17	16	3.28	3.68
720:1	295.0	502.0	41	33.33	16.66	11.111	31	29	15	14	3.28	3.68
750:1	306.0	520.0	41	32.00	16.00	10.666	29	28	14	13	3.28	3.68
864:1	352	598	41	27.770	13.888	9.259	25.0	24.0	12.0	12.0	3.28	3.68
900:1	370	629*	41	26.660	13.333	8.888	24.0	23.0	12.0	11.0	3.28	3.68
1,024:1	334	568*	33	23.430	11.718	7.812	21.0	21.0	10.0	9.7	3.65	4.06
1,080:1	442	751*	41	22.220	11.111	7.407	20.0	19.0	9.7	9.3	3.28	3.68
1,280:1	416	707*	33	18.750	9.375	6.250	17.0	16.0	8.2	7.8	3.65	4.06
1,296:1	530	901*	41	18.510	9.259	6.172	17.0	16.0	8.1	7.7	3.28	3.68
1,536:1	500	850*	33	15.620	7.812	5.208	14.0	14.0	6.8	6.5	3.65	4.06
1,600:1	522	887*	33	15.000	7.500	5.000	14.0	13.0	6.6	6.3	3.65	4.06
1,920:1	625	1,063*	33	12.500	6.250	4.166	11.0	11.0	5.5	5.2	3.65	4.06
2,000:1	652	1,108*	33	12.000	6.000	4.000	11.0	11.0	5.3	5.0	3.65	4.06
2,304:1	750	1,250*	33	10.410	5.208	3.472	9.5	9.1	4.6	4.3	3.65	4.06
2,400:1	780	1,250*	33	10.000	5.000	3.333	9.2	8.7	4.4	4.2	3.65	4.06
2,500:1	815	1,250*	33	9.600	4.800	3.200	8.8	8.4	4.2	4.0	3.65	4.06
2,880:1	940	1,250*	33	8.333	4.166	2.777	7.6	7.3	3.6	3.5	3.65	4.06
3,000:1	980	1,250*	33	8.000	4.000	2.666	7.3	7.0	3.5	3.3	3.65	4.06
3,125:1	1,020	1,250*	33	7.680	3.840	2.560	7.0	6.7	3.4	3.2	3.65	4.06
3,456:1	1,130	1,250*	33	6.944	3.472	2.314	6.4	6.1	3.0	2.9	3.65	4.06
3,600:1	1,170	1,250*	33	6.666	3.333	2.222	6.1	5.8	2.9	2.8	3.65	4.06
3,750:1	1,220	1,250*	33	6.400	3.200	2.133	5.9	5.6	2.8	2.7	3.65	4.06
4,096:1	1,070	1,250*	26	5.859	2.929	1.953	5.4	5.1	2.6	2.4	3.78	4.18
4,320:1	1,410	1,250*	33	5.555	2.777	1.851	5.1	5.1	2.4	2.3	3.65	4.06
4,500:1	1,470	1,250*	33	5.333	2.666	1.777	4.9	4.7	2.3	2.2	3.65	4.06
5,120:1	1,340	1,250*	26	4.687	2.343	1.562	4.3	4.1	2.1	2.0	3.78	4.18
5,184:1	1,690	1,250*	33	4.629	2.314	1.543	4.2	4.1	2.0	1.9	3.65	4.06
5,400:1	1,760	1,250*	33	4.444	2.222	1.481	4.1	3.9	1.9	1.9	3.65	4.06
6,144:1	1,610	1,250*	26	3.906	1.953	1.302	3.6	3.4	1.7	1.6	3.78	4.18
6,400:1	1,680	1,250*	26	3.750	1.875	1.250	3.4	3.3	1.6	1.6	3.78	4.18
6,480:1	2,110	1,250*	33	3.703	1.851	1.234	3.4	3.2	1.6	1.6	3.65	4.06
7,680:1	2,010	1,250*	26	3.125	1.562	1.041	2.9	2.7	1.4	1.3	3.78	4.18
7,776:1	2,530	1,250*	33	3.086	1.543	1.028	2.8	2.7	1.4	1.3	3.65	4.06
8,000:1	2,100	1,250*	26	3.000	1.500	1.000	2.80	2.60	1.30	1.30	3.78	4.18
9,216:1	2,390	1,250*	26	2.604	1.302	.868	2.40	2.30	1.10	1.00	3.78	4.18
9,600:1	2,520	1,250*	26	2.500	1.250	.833	2.30	2.20	1.10	1.00	3.78	4.18
10,000:1	2,620	1,250*	26	2.400	1.200	.800	2.20	2.10	1.10	1.00	3.78	4.18
11,520:1	3,010	1,250*	26	2.083	1.041	.694	1.90	1.80	.91	.87	3.78	4.18
12,000:1	3,140	1,250*	26	2.000	1.000	.666	1.80	1.80	.88	.83	3.78	4.18
12,500:1	3,280	1,250*	26	1.920	.960	.640	1.80	1.70	.84	.80	3.78	4.18
13,824:1	3,620	1,250*	26	1.736	.868	.578	1.60	1.50	.76	.72	3.78	4.18
14,400:1	3,780	1,250*	26	1.666	.833	.555	1.50	1.50	.73	.69	3.78	4.18
15,000:1	3,940	1,250*	26	1.600	.800	.533	1.50	1.40	.70	.67	3.78	4.18
15,625:1	4,100	1,250*	26	1.536	.768	.512	1.40	1.30	.67	.64	3.78	4.18
17,280:1	4,520	1,250*	26	1.388	.694	.462	1.30	1.20	.61	.58	3.78	4.18
18,000:1	4,710	1,250*	26	1.333	.666	.444	1.20	1.20	.58	.56	3.78	4.18
18,750:1	4,910	1,250*	26	1.280	.640	.426	1.20	1.10	.56	.53	3.78	4.18
20,736:1	5,430	1,250*	26	1.157	.578	.385	1.10	1.00	.51	.48	3.78	4.18
21,600:1	5,660	1,250*	26	1.111	.555	.370	1.00	.97	.49	.46	3.78	4.18
22,500:1	5,900	1,250*	26	1.066	.533	.355	.98	.93	.47	.44	3.78	4.18
25,920:1	6,790	1,250*	26	.926	.463	.308	.85	.81	.41	.39	3.78	4.18
27,000:1	7,070	1,250*	26	.888	.444	.296	.81	.78	.39	.37	3.78	4.18
31,104:1	8,150	1,250*	26	.771	.385	.257	.71	.68	.34	.32	3.78	4.18
32,400:1	8,500	1,250*	26	.740	.370	.246	.68	.65	.32	.30	3.78	4.18
38,800:1	10,200	1,250*	26	.617	.308	.205	.57	.54	.27	.26	3.78	4.18
46,656:1	12,200	1,250*	26	.514	.257	.171	.47	.45	.23	.21	3.78	4.18

FC MOTORS

AC Hysteresis Synchronous and Induction Motors



Dimensions

general design specification: MIL-M-7969

power rating:

Induction — Up to 2.5 oz. in.
Hysteresis Synchronous — Up to 1.2 oz. in.

voltage and frequency: 115 and 200 VAC @ 400 Hz

weight: 11.5 ounces

inertia:

Induction — 2.4×10^{-4} oz. in. sec.^{2}
Hysteresis Synchronous — 2 Pole: 1.7×10^{-4} oz. in. sec.^{2}
— 4 Pole: 1.4×10^{-4} oz. in. sec.^{2}
— 6 Pole: 1.3×10^{-4} oz. in. sec.^{2}

shaft: Precision-ground 416 stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

bearings: Double-shielded, life-lubricated for –55°C to + 85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" #26 AWG leads per MIL-W-16878/4

housing: Aluminum

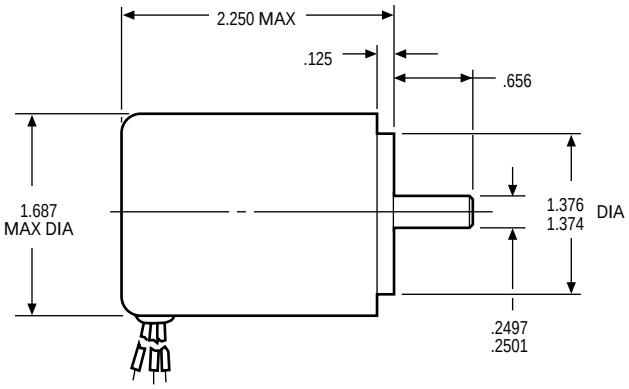
marking: Per MIL-STD-130

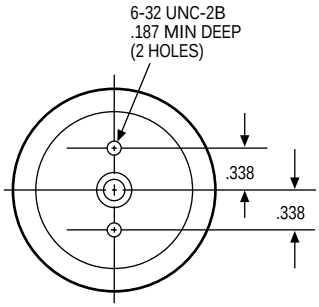
life: 200 to 1,000 hours continuous duty depending upon the voltage, frequency and number of poles

options available:

- Gear train (see B-2730 for details)
- Electromechanical brakes
- Lengths. FC motors are available in 4 lengths with output torque being proportional to length as follows:

TYPE	LENGTH (in.)	TORQUE
FC (Standard)	2.25	See Chart, opposite page
FCS	1.75	0.5 x standard torque
FCL	2.75	1.5 x standard torque
FCLL	3.25	2.0 x standard torque





NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

Hysteresis Synchronous

VOLT-AGE (VAC)	FREQUENCY (Hz)	POLES	PHASE	SCHEMATIC WIRING	VARIABLE LEAD COLOR		PHASING CAPACITOR		SYNC SPEED (rpm)	MAX RATED LOAD @ SYNC SPEED (oz. in.)	MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts)		STANDARD PART NUMBER* TAPPED HOLE
					B	C	(µF)	(wvac)				no load	rated load	
115	60	2	1 or 3	C	WHT	YLW	3.00	200	3,600	1.0	1.0	20	20	75A121-2
115	60	4	1 or 3	C	WHT	GRN	2.00	200	1,800	1.0	1.0	11	12	75A120-2
115	60	6	1 or 2	D	WHT	GRY	1.50	200	1,200	.8	.8	20	20	75A119-2
115	400	2	1	A		BLK	.22	400	24,000	1.0	1.0	28	40	75A1003-2
115	400	2	3	B		BLK	NOT REQ'D		24,000	1.0	1.0	23	37	75A1004-2
115	400	4	1	A		GRN	.12	500	12,000	1.0	1.0	19	24	75A1005-2
115	400	4	3	B		GRN	NOT REQ'D		12,000	1.2	1.2	21	26	75A1006-2
115	400	6	1	D	BLK	GRY	1.30	200	8,000	.5	.5	35	45	75A107-2
200	400	2	3	B		BLK	NOT REQ'D		24,000	1.0	1.0	24	38	75A1008-2
200	400	4	3	B		GRN	NOT REQ'D		12,000	1.2	1.2	21	28	75A1009-2

Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

Induction

VOLT-AGE (VAC)	FREQUENCY (Hz)	POLES	PHASE	SCHEMATIC WIRING	VARIABLE LEAD COLOR		PHASING CAPACITOR		MIN SPEED @ RATED LOAD (rpm)	RATED LOAD (oz. in.)	MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts)		STANDARD PART NUMBER*
					B	C	(µF)	(wvac)				no load	rated load	
115	60	2	1 or 3	C	WHT	YLW	3.00	200	3,000	1.4	1.4	18	20	75A121-1
115	60	4	1 or 3	C	WHT	GRN	2.00	200	1,300	1.0	1.0	11	12	75A120-1
115	60	6	1 or 2	D	WHT	GRY	1.50	200	600	1.0	1.0	15	17	75A119-1
115	400	2	1	A		BLK	.22	400	21,500	1.5	.8	19	50	75A1003-1
115	400	2	3	B		BLK	NOT REQ'D		22,500	2.5	2.5	10	65	75A1004-1
115	400	4	1	A		GRN	.12	500	10,000	1.5	1.5	15	31	75A1005-1
115	400	4	3	B		GRN	NOT REQ'D		11,000	2.5	2.5	12	40	75A1006-1
200	400	2	3	B		BLK	NOT REQ'D		22,500	2.5	2.5	10	65	75A1008-1
200	400	4	3	B		GRN	NOT REQ'D		11,000	2.5	2.5	12	40	75A1009-1

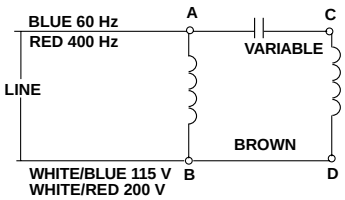
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

*When You Order

Units shown above are standard and may be ordered by part number.
Remember to include armature winding dash number, EXAMPLE:
75A1003-2.

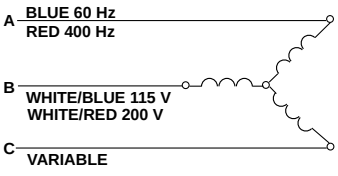
Schematic Wiring

A



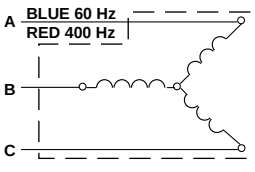
CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE C AND D

B



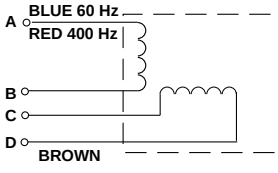
ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE ANY TWO LEADS

C



TO RUN SINGLE-PHASE, CONNECT LINE TO A AND C; FOR CLOCKWISE ROTATION, CONNECT CAPACITOR B TO C; FOR COUNTERCLOCKWISE ROTATION, CONNECT CAPACITOR B TO A

D

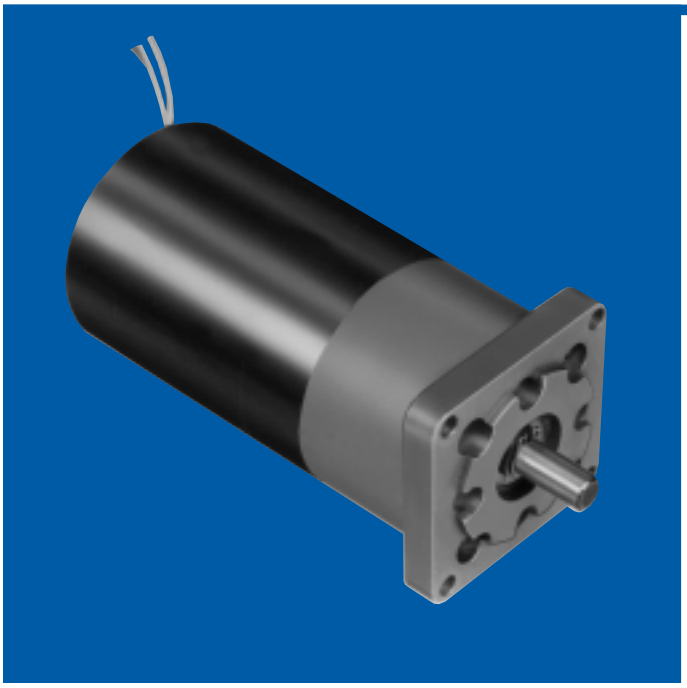


TO RUN SINGLE-PHASE, CONNECT LINE TO A AND B; FOR CLOCKWISE ROTATION, CONNECT B TO D AND CONDENSER TO A AND C; FOR COUNTERCLOCKWISE ROTATION, REVERSE C AND D

FC GEARMOTORS

AC Hysteresis Synchronous and Induction Planetary Gearmotors

B-2730



Dimensions

general design specification: MIL-M-7969

torque rating: Up to 1,250 oz. in. maximum continuous torque

weight: 16.5 to 20 ounces

gears: Planetary gearing system. All gears are heat treated for consistently reliable performance and long life

shaft: Precision-ground No. 416 nitrided stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average unit will have less than 3°

gear inertia: 5.1 x 10^{-6} oz. in. $sec.^2$ @ input max

bearings: .250" dia. shaft uses double-shielded, life-lubricated ball bearings for –55°C to +85°C operation. A .313" dia. shaft uses needle bearings. Special lubricants available for temperature extremes

cables/leads: 8" #26 AWG leads per MIL-W-16878/4

mounting flange: Die-cast aluminum

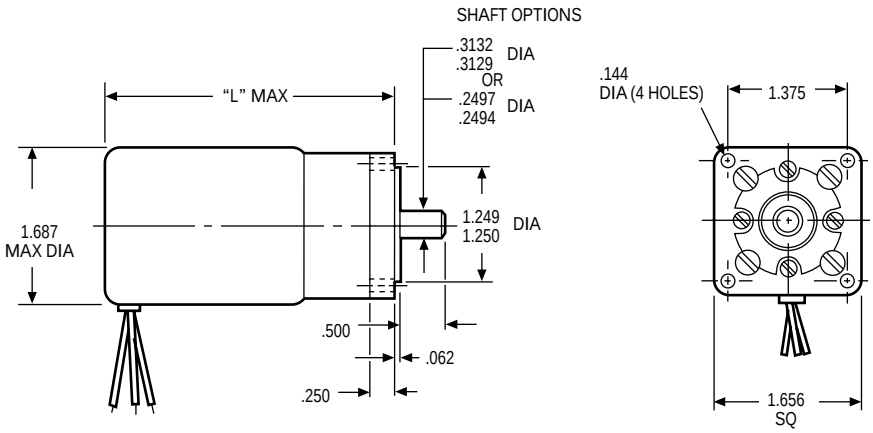
gear train housing: Stress-proof steel

marking: Per MIL-STD-130

life: 200 to 1,000 hours continuous duty depending upon the voltage, frequency, number of poles and gear ratio selected

options available:

- Electromechanical brakes
- Slip clutches



NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Basic Motor Data

Hysteresis Synchronous

VOLT-AGE (VAC)	FRE-QUENCY (Hz)	POLES	PHASE	SCHE-MATIC	VARIABLE LEAD COLOR B	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	PHASING CAPACITOR (wvac)	MOTOR SYNC. SPEED (rpm)	NORMAL RATED LOAD @ SYNC. SPEED (oz. in.)	MOTOR MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER PREFIX* EVEN RATIO .250" shaft	STANDARD PART NUMBER PREFIX* ODD RATIO .250" shaft	STANDARD PART NUMBER PREFIX* ODD RATIO .313" shaft
115	60	2	1 or 3	D	WHT	YLW	3.00	200	3,600	1.0	1.0	20	20	83A138	83A510	83A116
115	60	4	1 or 3	D	WHT	GRN	2.00	200	1,800	1.0	1.0	11	12	83A137	83A509	83A115
115	60	6	1	C	WHT	GRY	1.50	200	1,200	.8	.8	20	20	83A136	83A508	83A114

Hysteresis Synchronous

VOLT-AGE (VAC)	FREQUENCY (Hz)	POLES	PHASE	SCHEMATIC	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	PHASING CAPACITOR (wvac)	MOTOR SYNC SPEED (rpm)	NORMAL RATED LOAD @ SYNC (oz. in.)	MOTOR MOTOR MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER PREFIX* ALL RATIOS .250" shaft	STANDARD PART NUMBER PREFIX* ALL RATIOS .313" shaft
115	400	2	1	A	BLK	.22	400	24,000	1.0	1.0	28	40	83A1008	83A1108
115	400	2	3	B	BLK	NOT REQ'D		24,000	1.0	1.0	23	37	83A1010	83A1110
115	400	4	1	A	GRN	.12	500	12,000	1.0	1.0	19	24	83A1012	83A1112
115	400	4	3	B	GRN	NOT REQ'D		12,000	1.2	1.2	21	26	83A1014	83A1114
115	400	6	1	B	ORG	1.30	200	8,000	.8	.8	35	45	83A1016	83A1116
200	400	2	3	B	BLK	NOT REQ'D		24,000	1.0	1.0	24	38	83A1018	83A1118
200	400	4	3	B	GRN	NOT REQ'D		12,000	1.2	1.2	21	28	83A1020	83A1120

Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

Induction

VOLT-AGE (VAC)	FREQUENCY (Hz)	POLES	PHASE	SCHEMATIC	VARIABLE LEAD COLOR C	PHASING CAPACITOR (µF)	PHASING CAPACITOR (wvac)	MOTOR MIN SPEED @ RATED LOAD (rpm)	RATED LOAD (oz. in.)	MIN PULL UP TORQUE (oz. in.)	MAX POWER (watts) no load	MAX POWER (watts) normal rated load	STANDARD PART NUMBER PREFIX* ALL RATIOS .250" shaft	STANDARD PART NUMBER PREFIX* ALL RATIOS .313" shaft
115	400	2	1	A	BLK	.22	400	21,500	1.5	.8	19	50	83A1007	83A1107
115	400	2	3	B	BLK	NOT	REQ'D	22,500	2.5	2.5	10	65	83A1009	83A1109
115	400	4	1	A	GRN	.12	500	10,000	1.5	1.5	15	31	83A1011	83A1111
115	400	4	3	B	GRN	NOT	REQ'D	11,000	2.5	2.5	12	40	83A1013	83A1113
200	400	2	3	B	BLK	NOT	REQ'D	22,500	2.5	2.5	10	65	83A1017	83A1117
200	400	4	3	B	GRN	NOT	REQ'D	11,000	2.5	2.0	12	40	83A1019	83A1119

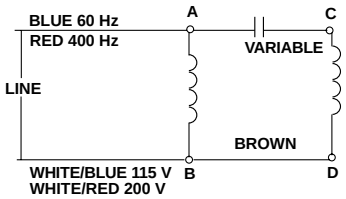
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

*When You Order

The Standard Part Number Prefix can be used with any of the Speed Reduction Ratios listed on the following two pages. The complete part number consists of the Standard Part Number Prefix plus the Speed Reduction Ratio desired. EXAMPLE: 83A1012-20 is a 4 pole 12,000 rpm, 115 vac, 400 Hz hysteresis synchronous motor coupled to a 20:1 even ratio gear train with a final output speed of 600 rpm. The unit has a .250" output shaft

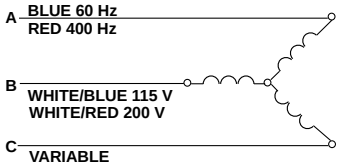
Schematic Wiring

A



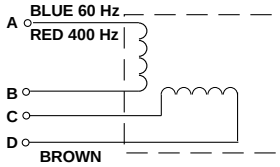
CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE C & D.

B



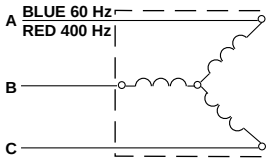
ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING SHAFT END). FOR CCW ROTATION REVERSE ANY TWO LEADS.

C



SINGLE-PHASE OPERATION
CW ROTATION.
LINE TO C AND D; A AND C COMMON; AND CAPACITOR BETWEEN B AND D.
CCW ROTATION.
LINE TO C AND D; B AND C COMMON; AND CAPACITOR BETWEEN A AND D.

D



SINGLE-PHASE OPERATION
CW ROTATION.
LINE TO A AND C; CAPACITOR BETWEEN B AND C.
CCW ROTATION.
LINE TO A AND C; CAPACITOR BETWEEN A AND B

Ratios and Performance

Odd Ratios

SPEED REDUC-TION RATIO	TORQUE MULTI-PLIER RATIO	*GEAR TRAIN MAX CONT. RATING (oz. in.)	FINAL OUTPUT SPEED (HYST.) 400 Hz			MIN SPEED @ RATED LOAD (IND.) 400 Hz				DIM. "L" (in.)
			24,000 rpm input	12,000 rpm input	8,000 rpm input	22,500 rpm input	21,500 rpm input	11,000 rpm input	10,000 rpm input	
4.33:1	3.2	5.4	5,542.725	2,771.362	1,847.575	5,196	4,965	2,540	2,309	3.190
5.28:1	4.0	6.8	4,536.862	2,268.431	1,512.287	4,261	4,072	2,083	1,894	3.190
18.78:1	12.0	20.0	1,277.955	638.977	425.985	1,198	1,145	586	532	3.190
27.94:1	17.0	29.0	858.984	429.491	286.327	805	769	394	358	3.190
81.37:1	41.0	70.0	294.949	147.474	98.316	276	264	135	123	3.325
121.1:1	62.0	105.0	198.183	99.091	666.061	186	177	91	83	3.325
147.7:1	75.0	128.0	162.491	81.250	54.163	152	145	74	68	3.325
352.6:1	145.0	247.0	68.066	34.032	22.688	63	61	31	28	3.594
524.6:1	215.0	366.0	45.749	22.874	15.249	42	41	21	19	3.594
639.9:1	262.0	445.0	37.506	18.752	12.501	35	34	17	16	3.594
780.6:1	320.0	544.0	30.745	15.372	10.248	29	28	14	13	3.594
1,528:1	500.0	850.0*	15.706	7.853	5.235	15	14	7.2	6.5	3.964
2,273:1	740.0	1,250*	10.558	5.279	3.519	9.9	9.4	4.8	4.4	3.964
3,382:1	1,100	1,250*	7.096	3.548	2.365	6.6	6.4	3.3	3.3	3.964
4,126:1	1,350	1,250*	5.816	2.908	1.938	5.4	5.2	2.7	2.4	3.964
6,621:1	1,730	1,250*	3.624	1.812	1.208	3.4	3.2	1.7	1.5	4.099
9,851:1	2,580	1,250*	2.436	1.218	.812	2.3	2.2	1.1	1.0	4.099
12,016:1	3,150	1,250*	1.997	.998	.665	1.9	1.8	.92	.83	4.099
17,879:1	4,700	1,250*	1.342	.671	.447	1.2	1.2	.62	.56	4.099
21,808:1	5,700	1,250*	1.100	.550	.366	1.0	.98	.50	.46	4.099

Even Ratios

SPEED REDUC-TION RATIO	TORQUE MULTI-PLIER RATIO	*GEAR TRAIN MAX CONT. RATING (oz. in.)	FINAL OUTPUT SPEED (HYST.) 400 Hz			MIN SPEED @ RATED LOAD (IND.) 400 Hz				DIM. "L" (in.)
			24,000 rpm input	12,000 rpm input	8,000 rpm input	22,500 rpm input	21,500 rpm input	11,000 rpm input	10,000 rpm input	
4:1	3.0	5.1	6,000.000	3,000.000	2,000.000	5,625.00	5,375.00	2,750.00	2,500.00	3.190
5:1	3.8	6.5	4,800.000	2,400.000	1,600.000	4,500.00	4,300.00	2,200.00	2,000.00	3.190
6:1	4.5	7.7	4,000.000	2,000.000	1,333.300	3,750.00	3,583.00	1,585.00	1,667.00	3.190
16:1	10.0	17.0	1,500.000	750.000	500.000	1,406.00	1,344.00	688.00	625.00	3.190
20:1	13.0	22.0	1,200.000	600.000	400.000	1,125.00	1,075.00	550.00	500.00	3.190
24:1	15.0	26.0	1,000.000	500.000	333.300	938.00	896.00	448.00	417.00	3.190
25:1	16.0	27.0	960.000	480.000	320.000	900.00	860.00	420.00	400.00	3.190
30:1	19.0	32.0	800.000	400.000	266.600	750.00	717.00	350.00	333.00	3.190
36:1	23.0	39.0	666.600	333.300	222.200	625.00	597.00	292.00	278.00	3.190
64:1	33.0	56.0	375.000	187.500	125.000	352.00	336.00	164.00	156.00	3.325
80:1	41.0	70.0	300.000	150.000	100.000	281.00	269.00	138.00	125.00	3.325
96:1	49.0	83.0	250.000	125.000	83.300	234.00	224.00	115.00	104.00	3.325
100:1	51.0	87.0	240.000	120.000	80.000	225.00	215.00	110.00	100.00	3.325
120:1	61.0	104.0	200.000	100.000	66.600	188.00	179.00	91.00	83.00	3.325
125:1	64.0	109.0	192.000	96.000	64.000	180.00	172.00	88.00	80.00	3.325
144:1	74.0	126.0	166.600	83.300	55.550	156.00	149.00	69.00	69.00	3.325
150:1	77.0	131.0	160.000	80.000	53.330	150.00	143.00	73.00	67.00	3.325
180:1	92.0	156.0	133.300	66.660	44.440	125.00	119.00	61.00	56.00	3.325
216:1	110.0	187.0	111.100	55.550	37.030	104.00	100.00	51.00	46.00	3.325
256:1	105.0	179.0	93.700	46.870	31.250	88.00	84.00	43.00	39.00	3.594

*Max Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life. Max rated torque of motor selected x torque multiplier ratio must not exceed these values
Max Intermittent Torque = 2 x Max Cont. Torque
Momentary Stall Torque = 5 x Max Cont. Torque (2,000 oz. in. max)
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100
.250" dia. shafts are limited to 600 oz. in. continuous duty torque. Use .313" dia. shaft if torque requirements exceed this value

Ratios and Performance

Even Ratios (con't.)

SPEED REDUCTION RATIO	TORQUE MULTIPLIER RATIO	*GEAR TRAIN MAX CONT. RATING (oz. in.)	FINAL OUTPUT SPEED (HYST.) 400 Hz			MIN SPEED @ RATED LOAD (IND.) 400 Hz				DIM. "L" (in.)
			24,000 rpm input	12,000 rpm input	8,000 rpm input	22,500 rpm input	21,500 rpm input	11,000 rpm input	10,000 rpm input	
320:1	130.0	221.0	75.000	37.500	25.000	70.00	67.00	34.00	31.00	3.594
384:1	157.0	267.0	62.500	31.250	20.830	59.00	56.00	29.00	26.00	3.594
400:1	164.0	279.0	60.000	30.000	20.000	56.00	54.00	28.00	25.00	3.594
480:1	197.0	335.0	50.000	25.000	16.660	47.00	45.00	23.00	21.00	3.594
500:1	205.0	349.0	48.000	24.000	16.000	45.00	43.00	22.00	20.00	3.594
576:1	235.0	401.0	41.600	20.830	13.888	39.00	37.00	19.00	17.00	3.594
600:1	246.0	418.0	40.000	20.000	13.333	38.00	36.00	18.00	17.00	3.594
625:1	256.0	435.0	38.400	19.200	12.800	36.00	34.00	18.00	16.00	3.594
720:1	295.0	502.0	33.300	16.600	11.111	30.00	30.00	15.00	14.00	3.594
750:1	306.0	520.0	32.000	16.000	10.666	30.00	29.00	15.00	13.00	3.594
864:1	352.0	598.0	27.777	13.888	9.259	26.00	25.00	13.00	12.00	3.594
900:1	370.0	629.0*	26.666	13.333	8.888	25.00	24.00	11.00	11.00	3.594
1,024:1	334.0	568.0*	23.437	11.718	7.812	22.00	21.00	11.00	9.70	3.964
1,080:1	442.0	751.0*	22.222	11.111	7.407	21.00	20.00	10.00	9.30	3.594
1,280:1	416.0	707.0*	18.750	9.375	6.250	18.00	17.00	8.50	7.80	3.964
1,296:1	530.0	901.0*	18.518	9.259	6.172	17.00	17.00	8.50	7.70	3.594
1,536:1	500.0	850.0*	15.625	7.812	5.208	15.00	14.00	7.20	6.50	3.964
1,600:1	522.0	887.0*	15.000	7.500	5.000	14.00	13.00	6.90	6.30	3.964
1,920:1	625.0	1,063*	12.500	6.250	4.166	12.00	11.00	5.70	5.20	3.964
2,000:1	652.0	1,108*	12.000	6.000	4.000	11.00	11.00	5.50	5.00	3.964
2,304:1	750.0	1,250*	10.416	5.208	3.472	9.80	9.30	4.80	4.30	3.964
2,400:1	780.0	1,250*	10.000	5.000	3.333	9.40	9.00	4.60	4.20	3.964
2,500:1	815.0	1,250*	9.600	4.800	3.200	9.00	8.60	4.40	4.00	3.964
2,880:1	940.0	1,250*	8.333	4.166	2.777	7.80	7.50	3.80	3.50	3.964
3,000:1	980.0	1,250*	8.000	4.000	2.666	7.50	7.20	3.70	3.30	3.964
3,125:1	1,020	1,250*	7.680	3.840	2.560	7.20	6.90	3.50	3.20	3.964
3,456:1	1,130	1,250*	6.944	3.472	2.314	6.50	6.20	3.20	2.90	3.964
3,600:1	1,170	1,250*	6.666	3.333	2.222	6.30	6.00	3.10	2.80	3.964
3,750:1	1,220	1,250*	6.400	3.200	2.133	6.00	5.70	2.90	2.70	3.964
4,096:1	1,070	1,250*	5.859	2.929	1.953	5.50	5.20	2.70	2.40	4.099
4,320:1	1,410	1,250*	5.555	2.777	1.851	5.20	5.00	2.50	2.30	3.964
4,500:1	1,470	1,250*	5.333	2.666	1.777	5.00	4.80	2.40	2.20	3.964
5,120:1	1,340	1,250*	4.687	2.343	1.562	4.40	4.20	2.10	2.00	4.099
5,184:1	1,690	1,250*	4.629	2.314	1.543	4.30	4.10	2.10	1.90	3.964
5,400:1	1,760	1,250*	4.444	2.222	1.481	4.20	4.00	2.00	1.90	3.964
6,144:1	1,610	1,250*	3.906	1.953	1.302	3.70	3.50	1.80	1.60	4.099
6,400:1	1,680	1,250*	3.750	1.872	1.250	3.50	3.40	1.70	1.60	4.099
6,480:1	2,110	1,250*	3.703	1.851	1.234	3.50	3.30	1.70	1.60	3.964
7,680:1	2,010	1,250*	3.125	1.562	1.041	2.90	2.80	1.40	1.30	4.099
7,776:1	2,530	1,250*	3.086	1.543	1.028	2.90	2.80	1.40	1.30	3.964
8,000:1	2,100	1,250*	3.000	1.500	1.000	2.80	2.70	1.40	1.30	4.099
9,216:1	2,390	1,250*	2.604	1.302	.868	2.40	2.30	1.20	1.00	4.099
9,600:1	2,520	1,250*	2.500	1.250	.833	2.30	2.20	1.10	1.00	4.099
10,000:1	2,620	1,250*	2.400	1.200	.800	2.30	2.20	1.10	1.00	4.099
11,520:1	3,010	1,250*	2.083	1.041	.694	2.00	1.90	.95	.87	4.099
12,000:1	3,140	1,250*	2.000	1.000	.666	1.90	1.80	.90	.83	4.099
12,500:1	3,280	1,250*	1.920	.960	.640	1.80	1.70	.88	.80	4.099
13,824:1	3,620	1,250*	1.736	.868	.578	1.60	1.60	.80	.72	4.099
14,400:1	3,780	1,250*	1.666	.833	.555	1.60	1.50	.76	.69	4.099
15,000:1	3,940	1,250*	1.600	.800	.533	1.50	1.40	.73	.67	4.099
15,625:1	4,100	1,250*	1.536	.768	.512	1.40	1.40	.70	.64	4.099
17,280:1	4,520	1,250*	1.388	.694	.462	1.30	1.20	.64	.58	4.099
18,000:1	4,710	1,250*	1.333	.666	.444	1.30	1.20	.61	.56	4.099
18,750:1	4,910	1,250*	1.280	.640	.426	1.20	1.10	.59	.53	4.099
20,736:1	5,430	1,250*	1.157	.578	.385	1.10	1.00	.53	.48	4.099
21,600:1	5,660	1,250*	1.111	.555	.370	1.00	1.00	.51	.46	4.099
22,500:1	5,900	1,250*	1.066	.533	.355	1.00	.96	.49	.44	4.099
25,920:1	6,790	1,250*	.926	.463	.308	.87	.83	.42	.39	4.099
27,000:1	7,070	1,250*	.888	.444	.296	.83	.80	.41	.37	4.099
31,104:1	8,150	1,250*	.771	.385	.257	.72	.69	.35	.32	4.099
32,400:1	8,500	1,250*	.740	.370	.246	.69	.66	.34	.30	4.099
38,880:1	10,200	1,250*	.617	.308	.205	.58	.55	.28	.26	4.099
46,656:1	12,200	1,250*	.514	.257	.171	.48	.46	.24	.21	4.099

BRUSHLESS DC MOTORS AN-10

Globe Motors manufactures Brushless DC (BLDC) motors with power outputs to 0.45 hp (335 watts). BLDC motors are continuing to gain in popularity because of the numerous performance advantages when compared to typical brush type DC motors.

The main difference between the two concepts is the means of commutating the motor coils. In order for any DC motor to operate, the current to the motor coils must be continually switched relative to the field magnets. In a brush type unit, this is accomplished with carbon brushes contacting a slotted commutator cylinder which has each motor coil connected to a corresponding bar of the commutator. The switching continues as the motor rotates. With this arrangement, there are physical limitations to speed and life because of brush wear.

In a BLDC motor, the position of the rotor is sensed and continually fed back to the commutation electronics to provide for appropriate switching. This rotor position sensing can be accomplished in many ways, but Globe has standardized on Hall Effect devices which generally provide optimum size and the best environmental capabilities versus cost. Since there are no carbon brushes to wear out, a BLDC motor can provide significantly greater life being now only limited by bearing wear.

BLDC motors also offer additional advantages as by-products of the inherent construction:

1. Higher efficiencies
2. High torque to inertia ratios
3. Greater speed capabilities
4. Lower audible noise
5. Better thermal efficiencies
6. Lower EMI characteristics

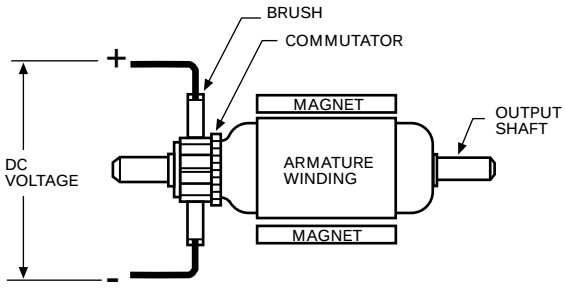
In a BLDC system, the coil windings are typically stationary, while the field magnets are part of the inner rotating member. This allows the heat generated in the windings to be transferred directly to the motor housing and any adjacent heat sinks, thus providing cooler operation. The temperature rise per watt (TPR) is typically less than a brush type motor of comparable size.

Since the field magnets are on the inner rotor, the inertia is less than brush type motors, thus providing faster acceleration rates for the BLDC unit.

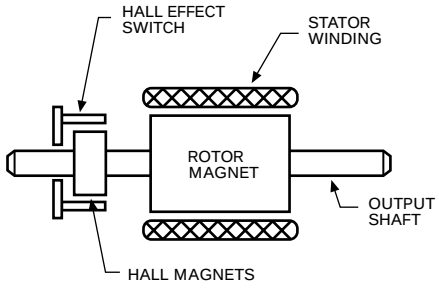
Brushless DC motors can operate in a wide variety of environmental conditions while still providing the linear speed torque characteristics found in brush motors.

For assistance in matching a BLDC motor with a controller, contact a Globe Motors Application Engineer. For your convenience, the appropriate wiring schematics are illustrated on the individual motor data sheets on the following pages.

BRUSH DC MOTOR



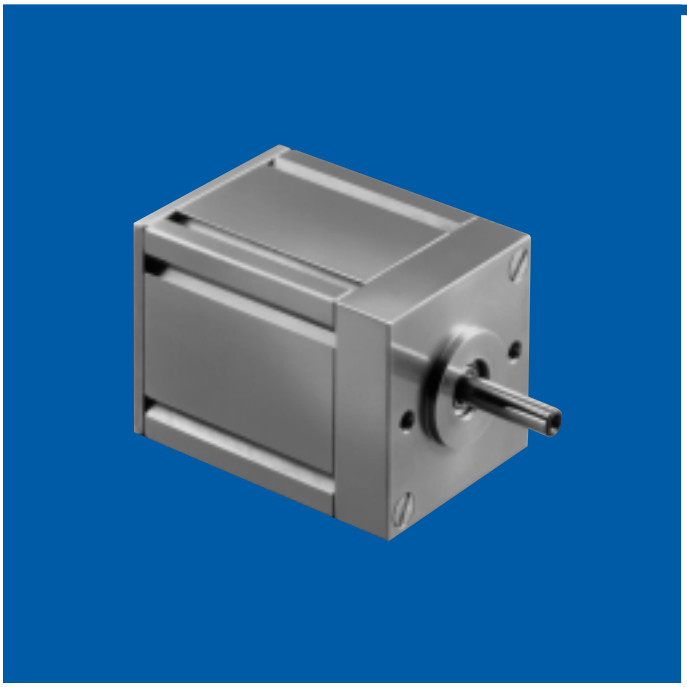
BRUSHLESS DC MOTOR



NB-15 MOTORS

Brushless DC Permanent Magnet Motors

AN-1500



peak power rating: .094 hp (70.1 W)

voltage: 27 VDC nominal

weight: 12 ounces

shaft: Precision-ground, 400 series stainless steel per ASTM A582. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

magnets: Molded samarium cobalt

bearings: Double shielded, life-lubricated for –55°C to +85°C operation

cables/leads: 8 lead wires (MIL-W-16878/4) 18" minimum covered with shielding per QQ-B-575

motor housing: Aluminum

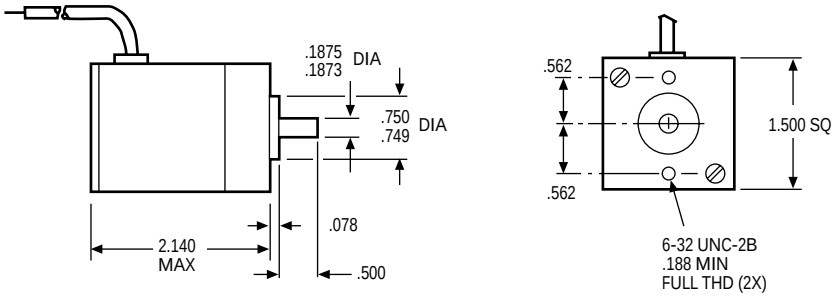
sensors: Integral hall effect

marking: Per MIL-STD-130

options available:

- Gear train

Dimensions



NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Motor Characteristics

ITEM	ABBREVIATION	UNITS	REFERENCE VALUE
Motor Constant ($K_T/\sqrt{R}$)	Km	oz. in./$\sqrt{W}$	2.45
Electrical Time Constant	Te	msec.	0.59
Mechanical Time Constant	Tm	msec.	9.2
Max Cont Input Power	P	W	119
Temperature Rise†	TPR	°C/W	3.2
Max Winding Temperature		°C	180
Rotor Inertia	Jm	oz. in. sec^2	0.0004
Number of Poles			4
Winding Connection			3 phase WYE

†Assumes motor is mounted to 8.00" x 8.00" x .25" aluminum heat sink

Winding Characteristics

		TORQUE		CURRENT			CONSTANTS		
VOLTAGE (VDC)	SPEED no load (rpm)	max rated (oz. in.)	** theoretical stall (oz. in.)	max no load (amps)	max rated load (amps)	** theoretical stall (amps)	K_T (oz. in./ amp)	R (ohms)	STANDARD PART NUMBERS*
27	12,500-15,500	8.5	60.00	.35	4.40	22.00	2.75	1.23	557A103-1
27	9,000-11,000	8.5	48.00	.30	3.40	13.00	3.76	2.13	557A103-2

**Because of motor losses and the variable types of commutation/drive electronics, stall currents and torques will not always be attainable
NOTE: Alternate windings (voltage, speed) are available

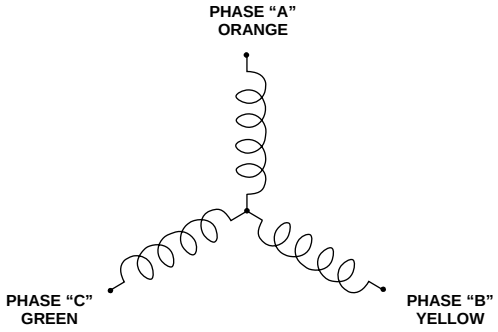
*When You Order

Units shown above are standard and may be ordered by part number. Remember to include motor winding dash number,
EXAMPLE: 557A103-1

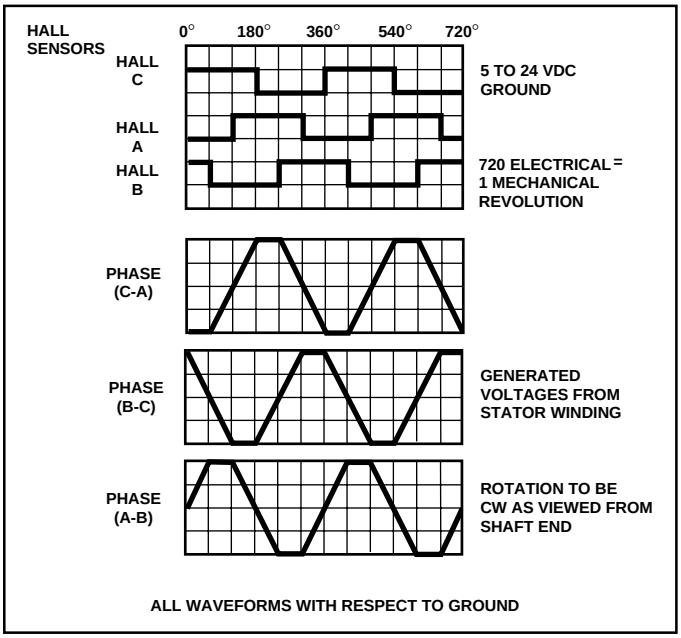
Lead Wire Designation

LEAD WIRE COLOR CODE			
LEAD	COLORS	AWG	DESCRIPTIONS
+ VDC	RED/WHITE	24	HALL SENSORS
GROUND	BLACK/WHITE	24	
HALL "A"	ORANGE/WHITE	24	
HALL"B"	YELLOW/WHITE	24	
HALL "C"	GREEN/WHITE	24	
PHASE "A"	ORANGE	20	MOTOR LEADS
PHASE "B"	YELLOW	20	
PHASE "C"	GREEN	20	

Motor Coil Connections



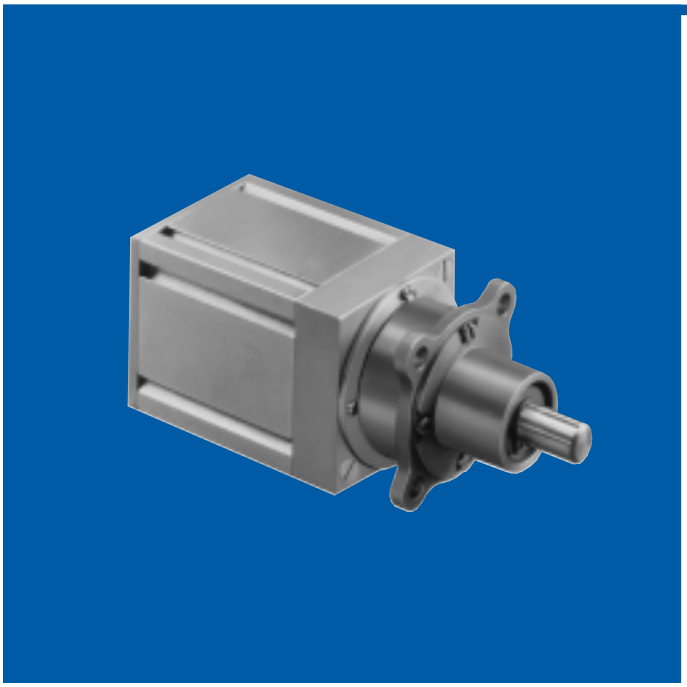
Commutation and Connection Diagrams



NB-15 WITH 1¼" GEAR TRAIN

Brushless DC Gearmotors

AN-1530



torque rating: Up to 1,250 oz. in. maximum continuous torque

weight: 12 to 18 ounces depending on ratio

gears: Planetary gearing system. All gears are heat treated for consistently reliable performance and long life

shaft: Precision-ground, No. 416 nitrided stainless steel. Options: length, smaller diameter, flats, pinions, gears, holes (through or tapped), threaded ends and tapers. Type of steel used may change depending upon variation selected

backlash: Varies with reduction but average backlash is less than 3°

gear inertia: 4.2 x 10^{-6} oz. in. $sec.^2$ @ input max

bearings: .250" dia. shaft uses double-shielded, life-lubricated ball bearings for –55°C to +85°C operation. A .313" dia. shaft uses needle bearings. Special lubricants available for temperature extremes

cables/leads: 8 lead wires (MIL-W-16878/4) 18" minimum covered with shielding per QQ-B-575

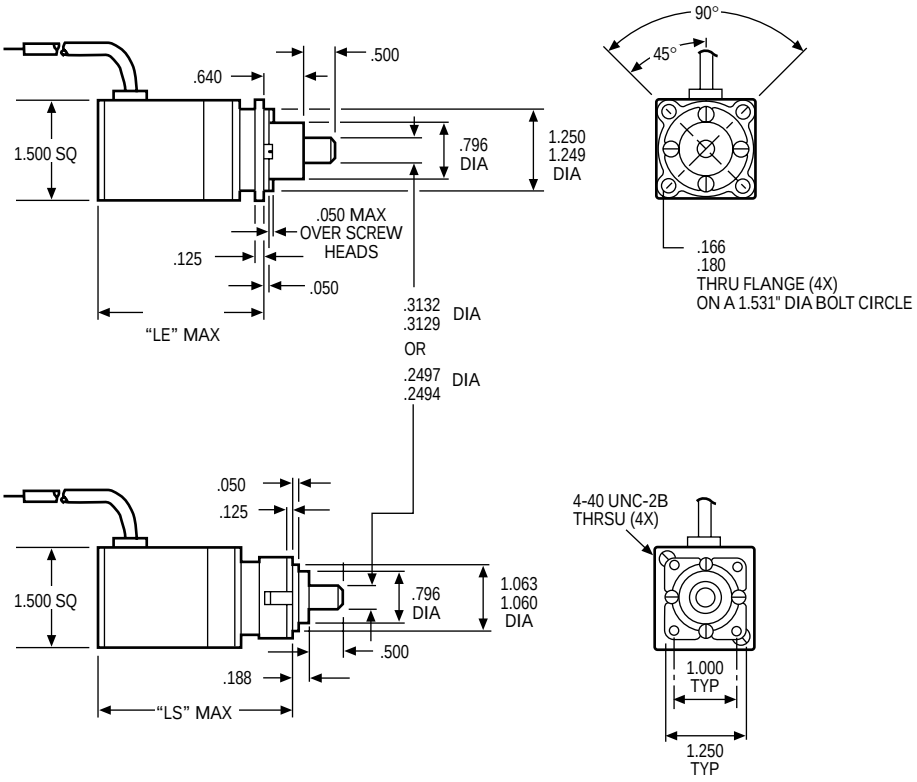
mounting flange: Die-cast aluminum

marking: Per MIL-STD-130

options available:

- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461

Dimensions



NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

SPEED REDUCTION RATIO	MAXIMUM CONTINUOUS TORQUE (oz. in.)	TORQUE MULTIPLIER RATIO	STANDARD PART NUMBER PREFIX*				EARED FLANGE dim. LE (in.)	SQUARE FLANGE dim. LS (in.)
			EARED FLANGE		SQUARE FLANGE			
			.313" shaft	.250" shaft	.313" shaft	.250" shaft		
18.78:1	20	12.0	559A211	559A251	559A231	559A271	2.672	3.116
27.94:1	29	17.0	559A212	559A252	559A232	559A272		
81.37:1	70	41.0	559A213	559A253	559A233	559A273		
121.10:1	105	62.0	559A214	559A254	559A234	559A274	2.810	3.251
147.70:1	128	75.0	559A215	559A255	559A235	559A275		
352.60:1	247	145.0	559A216	559A256	559A236	559A276		
524.60:1	366	215.0	559A217	559A257	559A237	559A277		
639.90:1	445	262.0	559A218	559A258	559A238	559A278	3.080	3.520
780.60:1	544	320.0	559A219	559A259	559A239	559A279		
1,528.00:1	850	500.0	559A220	559A260	559A240	559A280		
2,273.00:1	1,250	740.0	559A221	559A261	559A241	559A281		
3,382.00:1	1,250	1,100	559A222	559A262	559A242	559A282	3.450	3.890
4,126.00:1	1,250	1,350	559A223	559A263	559A243	559A283		
6,621.00:1	1,250	1,730	559A224	559A264	559A244	559A284		
9,851.00:1	1,250	2,580	559A225	559A265	559A245	559A285		
12,016.00:1	1,250	3,150	559A226	559A266	559A246	559A286	3.580	4.025
17,879.00:1	1,250	4,700	559A227	559A267	559A247	559A287		
21,808.00:1	1,250	5,700	559A228	559A268	559A248	559A288		

**.250" dia. shaft units limited to 600 oz. in. maximum continuous duty torque. Use .313" dia. shaft if torque requirements exceed this value
Max Cont. Torque: The values in this column are based upon gear train strength and capability for 1,000 hrs. minimum life
Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque of gearbox
Max Intermittent Torque = 2 x Max Cont. Torque; Momentary Stall Torque = 5 x Max Cont. Torque (2,000 oz. in. max)
Minimum Gearbox Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor windings (bottom chart) can be used with any of the gear ratios listed above. To order, state the gear train standard part number prefix, plus a motor winding dash number. EXAMPLE: 559A102-1 is an 18.78:1 NB gearmotor with a "-1" winding, 27 volts, 14,000 rpm, 7.00 oz. in. torque, etc.

Winding Characteristics

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE		CURRENT			CONSTANTS		MOTOR WINDING DASH NUMBERS*
		max rated (oz. in.)	theoretical stall (oz. in.)	max no load (amps)	max rated load (amps)	theoretical stall (amps)	K_T (oz. in./ amp)	R (ohms)	
27	12,500-15,500	8.5	60.0	.35	4.40	5.0	2.75	1.23	-1
27	9,000-11,000	8.5	48.0	.30	3.40	5.0	3.76	2.13	-2

Note: Alternative windings (voltage, speed) available.

Motor Characteristics

See Bulletin AN-1500

Lead Wire Designation

See Bulletin AN-1500

Commutation and Connection Diagrams

See Bulletin AN-1500

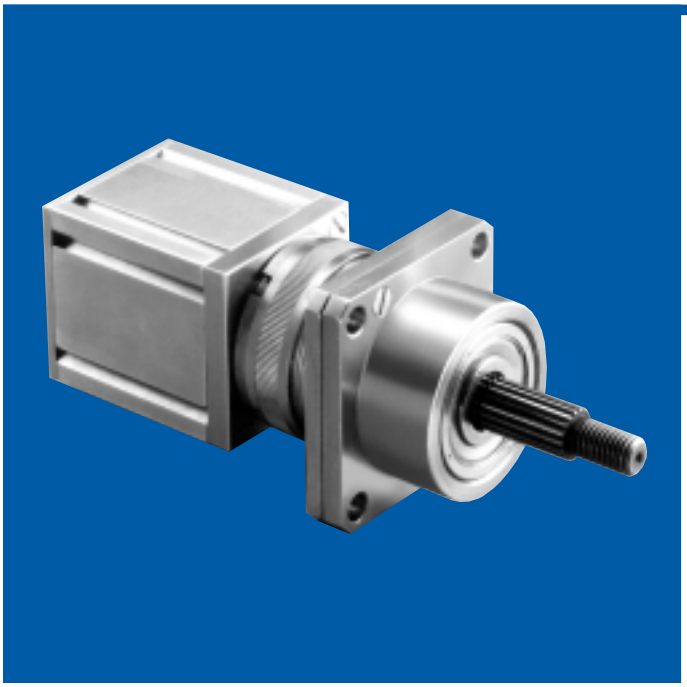
Motor Coil Connections

See Bulletin AN-1500

NB-15 WITH 1.875" & 3" GEAR TRAINS

Brushless DC Gearmotors

AN-1532



torque rating:

1.875" flange:	3.00" flange:
100 lb. in., continuous duty	550 lb. in., continuous duty

weight: Motor/gear/electronic connector module

1.875" flange:	3.00" flange:
1.4 to 2.0 lbs. depending on ratio	5.6 to 6.3 lbs. depending on ratio

gears: Planetary gearing system. All gears are heat treated and ride on ball or roller bearings for greatest efficiency and long life

shaft: Carbon steel shaft per QQ-S-624 with 18-tooth spline serrations per ANS B92.1-1970 heat treated to RC 45-48 (1.875" flange) and RC 29-33 (3.00" flange)

backlash: Varies with reduction but average unit will have less than 3°

gear inertia: 1.4×10^{-5} oz. in. sec.^{2} @ input max

bearings: Output shaft uses double-shielded, life-lubricated ball bearings for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8 lead wires (MIL-W-16878/4), 18" minimum

mounting flange: Cold drawn steel

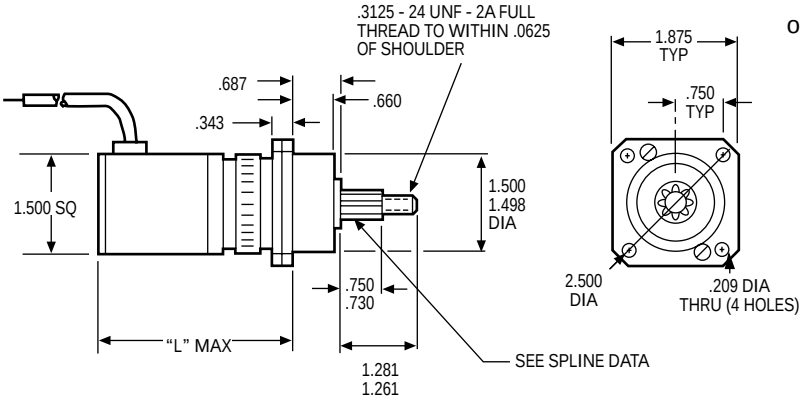
gear train housing: Stress-proof steel

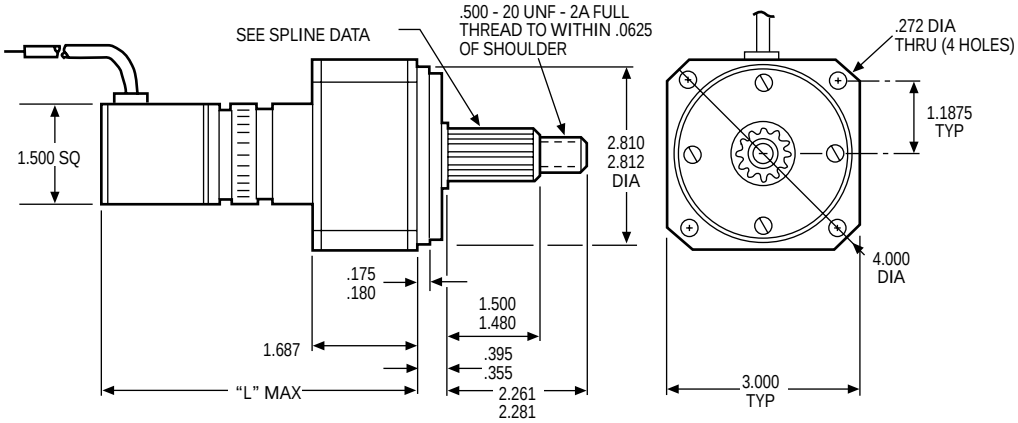
marking: Per MIL-STD-130

options available:

- RFI filters to meet MIL-I-6181, MIL-I-26600 or MIL-STD-461

Dimensions

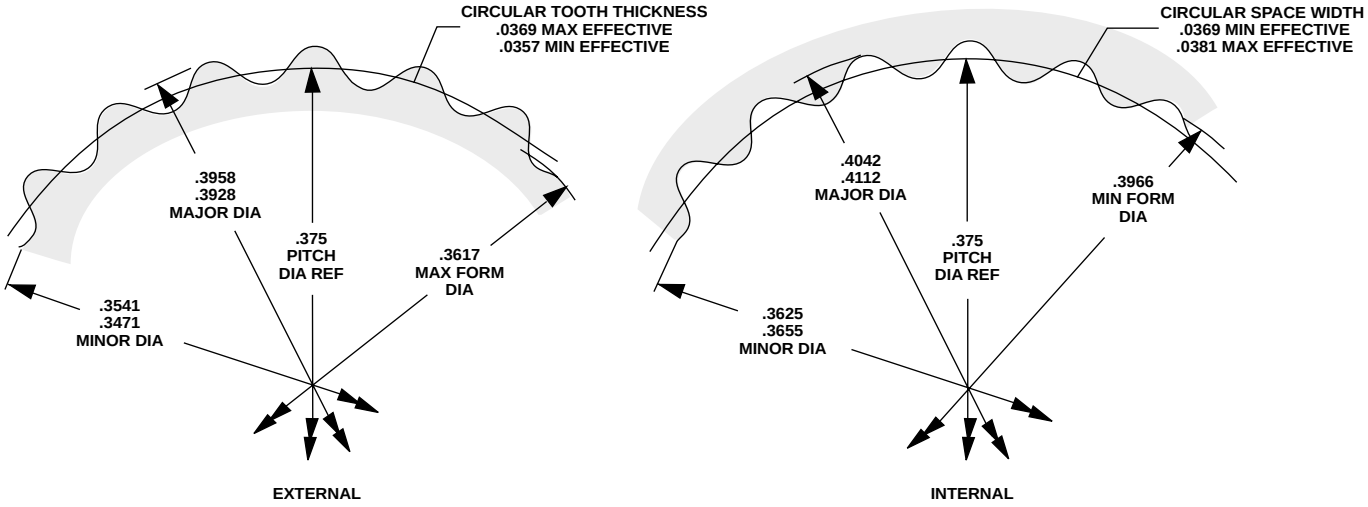




NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

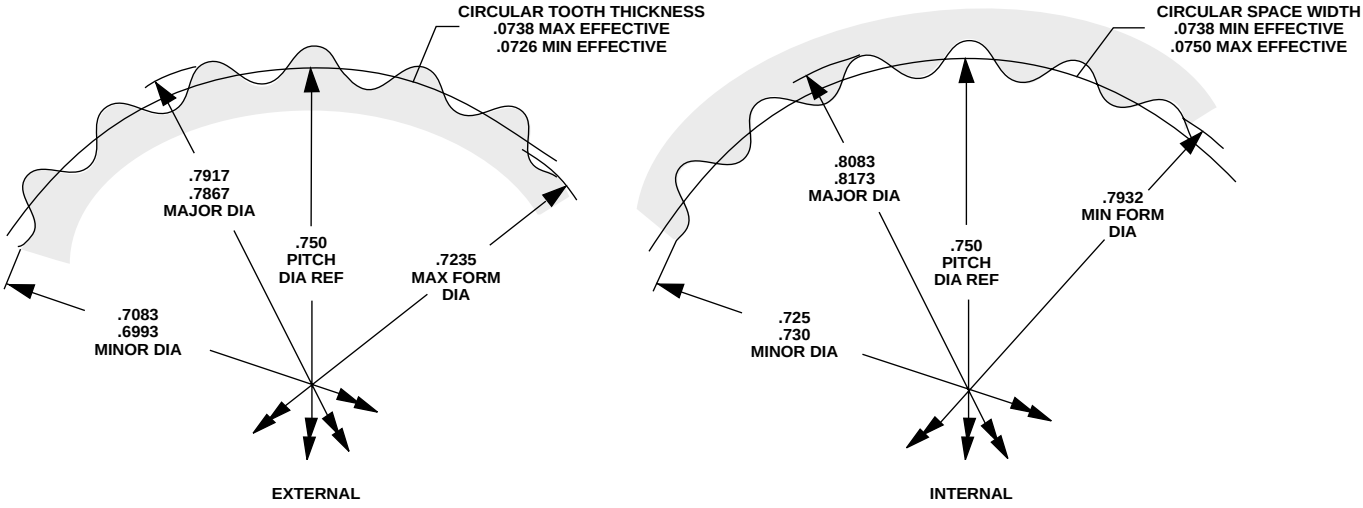
Spline Data

1.875" Flange



INVOLUTE SPLINE PER ANS B92.1-1970 (GLOBE SPEC 3S95)
18 TEETH
48/96 PITCH
45° PRESSURE ANGLE
EXTERNAL SPLINE — MIN DIMENSION OVER TWO .040" DIA PINS .4398" REF
INTERNAL SPLINE — MAX DIMENSION BETWEEN TWO .040" DIA PINS .3174" REF
NOTE: FOR PROTOTYPES, GLOBE MOTORS WILL BROACH THRU-HOLES FOR NON-HARDENED MATING PARTS WITH AN I.D. OF .3575/.3585" AS A STARTING DIAMETER

3.00" Flange



INVOLUTE SPLINE PER ANS B92.1-1970 (GLOBE SPEC 3S96)
18 TEETH
24/48 PITCH
45° PRESSURE ANGLE
EXTERNAL SPLINE — MIN DIMENSION OVER TWO .080" DIA PINS .8819" REF
INTERNAL SPLINE — MAX DIMENSION BETWEEN TWO .080" DIA PINS .6321" REF
NOTE: FOR PROTOTYPES, GLOBE MOTORS WILL BROACH THRU-HOLES FOR NON-HARDENED MATING PARTS WITH AN I.D. OF .7195/.7205" AS A STARTING DIAMETER

NB-15 WITH 1875" & 3" GEAR TRAINS

Brushless DC Gearmotors

AN-1532

Standard Part Numbers and Data

1.875" Flange

SPEED REDUCTION RATIO	TORQUE MULTI-PLIER	MAX CONT. RATING (lb. in.)	"L" max (in.)	STANDARD PART NO. PREFIX*
3.81:1	3.5	1.1		559A180
5.54:1	5.1	1.6	3.075	559A181
14.5:1	13.0	4.1		559A182
21.1:1	19.0	6.0	3.260	559A183
30.7:1	27.0	8.6		559A184
55.3:1	47.0	14.6		559A185
80.4:1	68.0	21.0	3.830	559A186
117:1	99.0	31.0		559A187
170:1	144.0	45.0		559A188
211:1	171.0	53.0		559A189
306:1	248.0	77.0		559A190
445:1	360.0	100.0	4.010	559A191
647:1	524.0	100.0		559A192
941:1	762.0	100.0		559A193
1,166:1	896.0	100.0		559A194
1,696:1	1,305	100.0		559A195
2,466:1	1,900	100.0	5.000	559A196
3,584:1	2,760	100.0		559A197
5,211:1	4,000	100.0		559A198

3.00" Flange

SPEED REDUCTION RATIO	TORQUE MULTI-PLIER	MAX CONT. RATING (lb. in.)	"L" max (in.)	STANDARD PART NO. PREFIX*
306:1	248	77		559A199
445:1	360	122	5.080	559A200
647:1	524	164		559A201
941:1	762	238		559A202
1,166:1	896	280		559A203
1,696:1	1,305	407		559A204
2,466:1	1,900	550	5.260	559A205
3,584:1	2,760	550		559A206
5,211:1	4,000	550		559A207

Max Cont. Torque: The values in this column are based upon gear train strength
Max rated torque of motor selected x torque multiplier ratio must not exceed maximum continuous torque of gearbox
Max Intermittent Torque = 2 x Max Cont. Torque
Momentary Stall Torque = 5 x Max Cont. Torque
Minimum Gearbox Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100

*When You Order

Each of the basic motor windings (see chart, next page) can be used with any of the gear ratios listed above. To order, state the gear train standard part number prefix, plus a motor winding dash number. EXAMPLE: 559A180-1 is a 3.81:1 NB gearmotor with a “-1” armature winding, 27 volts, 14,000 rpm, 7.00 oz. in. torque, etc.

Motor Characteristics

ITEM	ABBREVIATION	UNITS	REFERENCE VALUE
Motor Constant ($K_T/\sqrt{R}$)	Km	oz. in./$\sqrt{W}$	2.45
Electrical Time Constant	Te	msec.	0.59
Mechanical Time Constant	Tm	msec.	9.2
Max Cont Input Power	P	W	119
Temperature Rise†	TPR	°C/W	3.2
Max Winding Temperature		°C	180
Rotor Inertia	Jm	oz. in. sec^2	0.0004
Number of Poles			4
Winding Connection			3 phase WYE

†Assumes motor is mounted to 8.00" x 8.00" x .25" aluminum heat sink

Winding Characteristics

VOLTAGE (VDC)	SPEED no load (rpm)	TORQUE max rated (oz. in.)	TORQUE theoretical stall (oz. in.)	CURRENT max no load (amps)	CURRENT max rated load (amps)	CURRENT max peak (amps)	CONSTANTS K_T (oz. in./ amp)	CONSTANTS R (ohms)	MOTOR WINDING DASH NUMBERS*
27	12,500-15,500	8.5	60.0	.35	3.0	22.0	2.75	1.23	-1
27	9,000-11,000	8.5	48.0	.30	3.0	13.0	3.76	2.13	-2

Note: Alternative windings (voltage, speed) available.

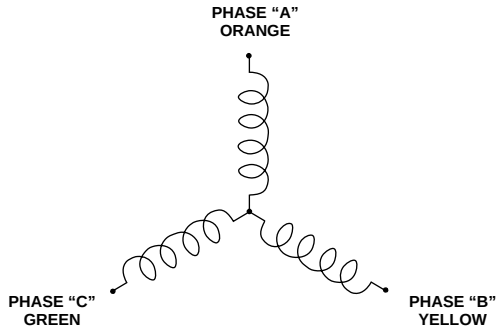
*When You Order

Units shown above are standard and may be ordered by part number. Remember to include motor winding dash number,
EXAMPLE: 557A103-1

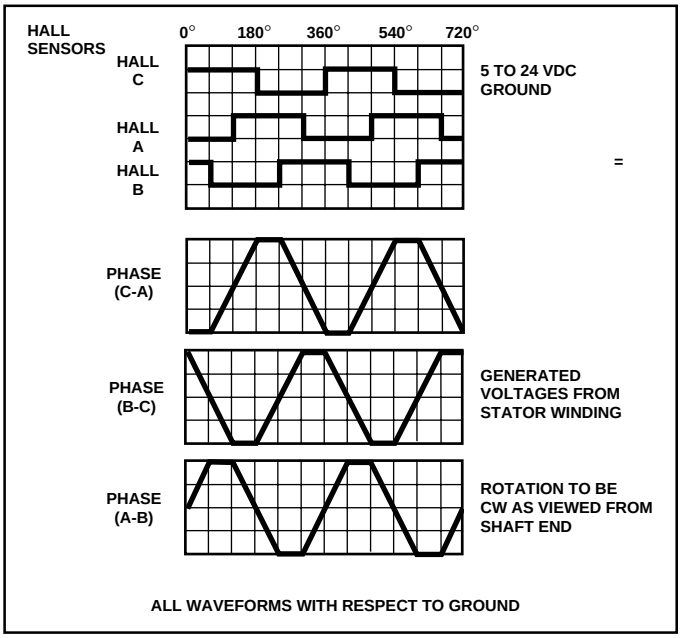
Lead Wire Designation

LEAD WIRE COLOR CODE			
LEAD	COLORS	AWG	DESCRIPTIONS
+ VDC	RED/WHITE	24	HALL SENSORS
GROUND	BLACK/WHITE	24	
HALL "A"	ORANGE/WHITE	24	
HALL"B"	YELLOW/WHITE	24	
HALL "C"	GREEN/WHITE	24	
PHASE "A"	ORANGE	20	MOTOR LEADS
PHASE "B"	YELLOW	20	
PHASE "C"	GREEN	20	

Motor Coil Connections



Commutation and Connection Diagrams



GLOBE MOTORS FANS AND BLOWERS

Globe Motors manufactures a complete line of standard AC, DC and BLDC tubeaxial and vaneaxial fans and blowers. In addition to the standard line of products, custom AC, DC and BLDC centrifugal and vaneaxial blowers can be made available to meet your specific application. The following data provides introductory information on the types of standard axial-flow Globe fans and blowers. For similar information on centrifugal-flow Globe blowers, please refer to the Devices section of this catalog, Bulletin D-2000.

DELIVERY

When you need a prototype, a large stock of standard catalog units is available from our distributors for delivery in 24 hours. In addition, Globe maintains facilities that are geared to quickly handle the largest production order to meet your needs.

PERFORMANCE CHARACTERISTICS

All axial-flow devices (propeller, tubeaxial, vaneaxial or multi-stage) have essentially the same performance characteristics. All are distinguished by the fact that pressure is proportional to lift produced by the rotating airfoils of the impeller. As for any airfoil, there is a point (B on Figure 1) beyond which the impeller stalls; that is, the pressure (lift) decreases with decreasing flow. This explains the dip in the performance curves of each of these types. It is virtually impossible to operate satisfactorily in region B to C. Flow pulsations, increased audio noise and a decrease in efficiency occur. Stable performance and maximum efficiency are in the A to B range.

PROPELLER FANS

Propeller Fans consist of a propeller rotating within a mounting ring or orifice and include provisions for motor supports. These are sometimes supplied without the mounting ring, in which case the customer mounting panel serves as the fan orifice. Propeller Fans (see Figure 2) are the simplest, most economical and least efficient axial flow devices.

TUBEAXIAL FANS AND BLOWERS

Tubeaxial fans and blowers (see Figure 3) consist of an impeller rotating within a full cylindrical housing, which also provides motor support struts. The term tubeaxial, as presently used by manufacturers, implies more efficient airfoil blades, closer tip clearance and generally cleaner flow patterns than the propeller fan. This results in greater pressure capability and higher efficiency. The typical air-discharge pattern is spiral.

VANEAXIAL BLOWERS

The vaneaxial blower (see Figure 4) is the sophisticated brother of the tubeaxial, just as the tubeaxial represents an improvement over the propeller fan. Guide vanes are inclined on either the inlet or outlet side of the impeller. The vanes reduce the rotational “whirl” pattern of the air stream which results in:

1) Higher pressure before stall, and
2) Increased efficiency

The typical air-discharge pattern is a straight line.

MULTI-STAGE AXIAL-FLOW BLOWERS

The multi-stage axial-flow blower (see Figure 5) is essentially two or more vaneaxial blowers mounted on a common shaft within the same housing, in series. The first vaneaxial blower, or stage, feeds the second stage with axial flow at the design point. Static pressure available is roughly the product of the number of stages and stall pressure of a single stage. Multi-stage units are capable of the highest pressures attainable by an axial device for a given size and speed. They are necessarily somewhat heavier and more expensive than the other axial units.

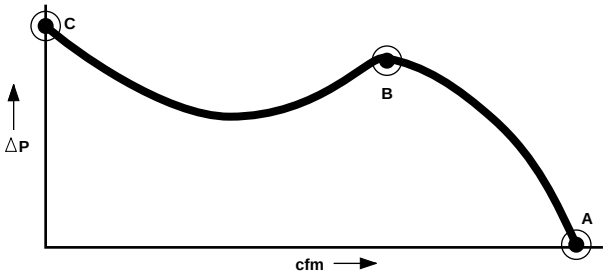


Fig. 1: Typical Axial-Flow Fan and Blower Performance

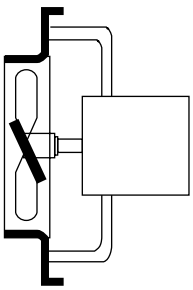


Fig. 2: Typical Propeller Fan

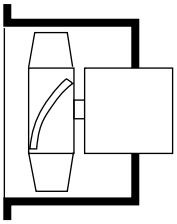


Fig. 3: Typical Tubeaxial Fan

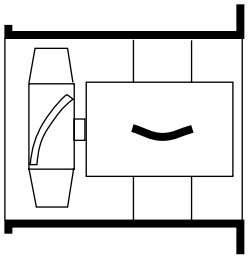


Fig. 4: Typical Vaneaxial Blower

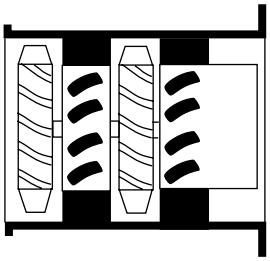


Fig. 5: Typical Multi-Stage Axial-Flow Blower

SYSTEM APPLICATION

Figure 6 shows performance curves of the four types of axial-flow devices discussed. All units are the same diameter and operate at the same speed. System resistance curves OA and OB are plotted versus the performance curves. It can be easily seen that in many instances the flow rate through system OA can be tremendously increased with no increase in size or speed by changing the design of the air-moving device. A propeller fan in the system will deliver air as shown at (1), tubeaxial fan or blower (2), vaneaxial blower (3), two stage, multi-stage (4). In the case of system OB, only a multi-stage will perform efficiently. The curve OB intersects the curves of other types in the stall region, which is unstable. In the case of OA both the multi-stage and the vaneaxial fan or blower will work, but the vaneaxial unit is a more economical choice.

ADVANTAGES OF AXIAL-FLOW FANS AND BLOWERS

1. Highest overall efficiencies available
2. In-line flow for easy mounting
3. Motor cooled by airstream for cool-running, long-term performance
4. Compact overall envelope dimensions to conserve valuable space

SPECIFYING FANS AND BLOWERS

To specify an air-moving device intelligently, the operating point of the system should be known. Too often a specification will be written as “40 cfm minimum at 1.0" H_20” and a fan selected on this basis. The fan curve in Figure 7 shows the performance of a unit that exceeds the specified minimum. Curve OAB represents the actual system resistance curve.

This fan produces 68 cfm at 1.0" H_20, well beyond the minimum required, yet will produce only 40 cfm in the system due to pulsating flow — and that’s not reliable. Another common error is attempting to obtain a safety margin by overstating the requirement. Instead of the 40 cfm at 1.0" H_20 (as above), the requirement is written as 60 cfm at 1.0" H_20, curve OCD (Figure 7). Even the fan manufacturer is helpless at this point. A unit recommended for operation at 60 cfm at 1.0" H_20 will not work satisfactorily in the actual system, curve OAB, since the point of intersection with the fan curve is at 40 cfm. If a safety margin is required, the most fool-proof method of obtaining it is by overstating static pressure by some reasonable percentage.

The user must realize, however, that he is going to pay for that margin in increased power input, possible increase in unit size and possible decrease in life.

Because Globe makes thousands of motor variations, virtually any speed-torque-size combination is already available to meet blower power requirements. Please keep in mind that a relatively larger, slower speed unit will tend to have longer life and run more quietly than a miniature high speed unit with the same performance. Globe fans and blowers are built from standard modular components to meet exact application requirements. Globe also has complete facilities for producing shrouds, screens and special mounting configurations.

STANDARD OR CUSTOM

Globe Motors offers a complete line of fans and blowers for a wide variety of cooling and air moving applications. Often requirements may be met with several different types — the best being determined by your design requirements and cost objectives. Globe engineers are available to discuss your problems and suggest optimum solutions ranging from standard, readily available units to specially designed air moving devices for critical applications.

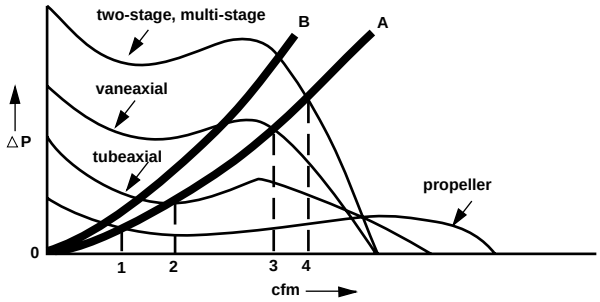


Fig. 6: Comparison of Typical Axial-Flow Performance Curves

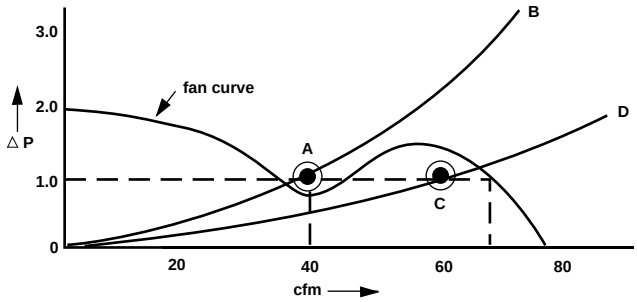


Fig. 7: Typical System Resistance Curve

HOW TO SELECT

To aid you in determining your fan or blower requirements we have provided a simplified approach to fan and blower selection.

THE ESSENTIALS

To properly select a particular fan or blower for a specific application, the detailed requirements must be known. These include the normal motor specifications and those peculiar to air-moving devices. The following discussion will enable the user to apply a clear understanding of airflow in selecting a suitable unit.

COOLING AIR REQUIRED

The values established by the method described below tend to be conservative. For example, the method treats laminar airflow only; when turbulent flow conditions exist, the cooling requirements are decreased.

$$\text{cfm} = \frac{\text{watts dissipated x a constant}}{\text{allowable temperature minus inlet temperature °F}}$$

Standard Air Conditions – Air density, for many applications, is taken at standard conditions (70°F at 29.92" of mercury). The constant 3.16 is a function of the specific heat of air at these standard conditions. The formula for standard air conditions is:

Equation 1.

$$\text{cfm} = \frac{\text{watts}}{\text{Temp. Rise °F}} \times 3.16$$

Variable Density – When standard air conditions cannot be assumed, you may use the constant 0.1784 as a function of the specific heat of air near sea level. Change in the specific heat due to pressure and temperature changes has not been considered, and in most cases it is negligible. To calculate cfm for non-standard air conditions, use the formula:

Equation 2.

$$\text{cfm} = \frac{\text{watts x T °R}}{\text{Temp. Rise °F x Pb}} \times 0.1784$$

T °Rankine = absolute temperature = 459.6° + °F
Pb = barometric pressure in inches of mercury

Example: A solid state inverter has hot spots which must be maintained at 150°F maximum. Tests indicate that with 150°F hot spot temperature, the package stabilizes at 100°F. Cooling air available at the inlet has an ambient temperature of 70°F. Standard air conditions are assumed. Total dissipation of all components in the box is 1000 watts. Using Equation 1:

$$\text{cfm} = \frac{1000 \times 3.16}{(100° - 70°)} = 105.3$$

About 105 cfm will satisfy the heat removal requirements of the system.

STATIC PRESSURE

The static pressure or pressure drop the fan must work against can sometimes be guessed at from experience with similar situations. To design for an assumed static pressure, however, is risky unless requirements are not critical.

It is preferable to make a test setup and determine actual static pressure at any known flow rate. The pressure drop (P) is a function of the velocity squared (V^2) and the density of the fluid (p). Knowing one point of flow and pressure makes possible the plotting of the system resistance curve by using the formula:

Equation 3:

$$\frac{\Delta P_2}{\Delta P_1} = \frac{p_2 V^2_2}{p_1 V^2_1}$$

where subscript 1 represents measured values.

It has been determined, using Equation 1, that 105 cfm of air is required to maintain safe operating temperatures throughout a solid state inverter. Using any air-moving device for which a performance curve is available, measure the static pressure in the inverter package with the test unit running at rated voltage. This can be done easily with a simple U-tube water manometer. See Figure 8.

The static pressure is 2.0" H_20 as read by the difference between the two columns. Now refer to the performance curve of the test unit (Figure 9). The test unit should be producing 150 cfm at 2.0" H_20. The system resistance curve (Figure 10) may now be plotted, using 150 cfm at 2.0" H_20 as the known point and Equation 3.

Static pressure required at the designated flow rate of 105 cfm is from Equation 3.

$$\Delta P_2 = \frac{105^2}{150^2} \times 2.0" = 0.98" \text{ } H_2O$$

It can be seen from the above, that there is only one possible point of operation for a particular blower in a fixed system.

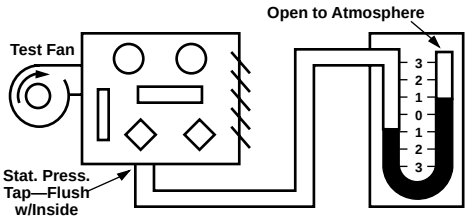


Fig. 8: U-Tube Water Manometer Diagram

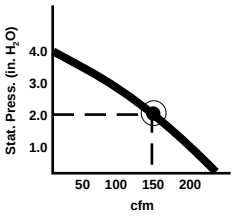


Fig. 9: Test Unit Performance Curve

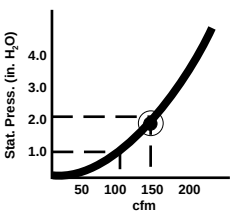


Fig. 10: System Resistance Curve

FAN LAWS

For a change in speed:

$$\frac{cfm_1}{cfm_2} = \frac{rpm_1}{rpm_2}$$

$$\frac{\Delta P_1}{\Delta P_2} = \left(\frac{rpm_1}{rpm_2}\right)^2$$

$$\frac{BHP_1}{BHP_2} = \left(\frac{rpm_1}{rpm_2}\right)^3$$

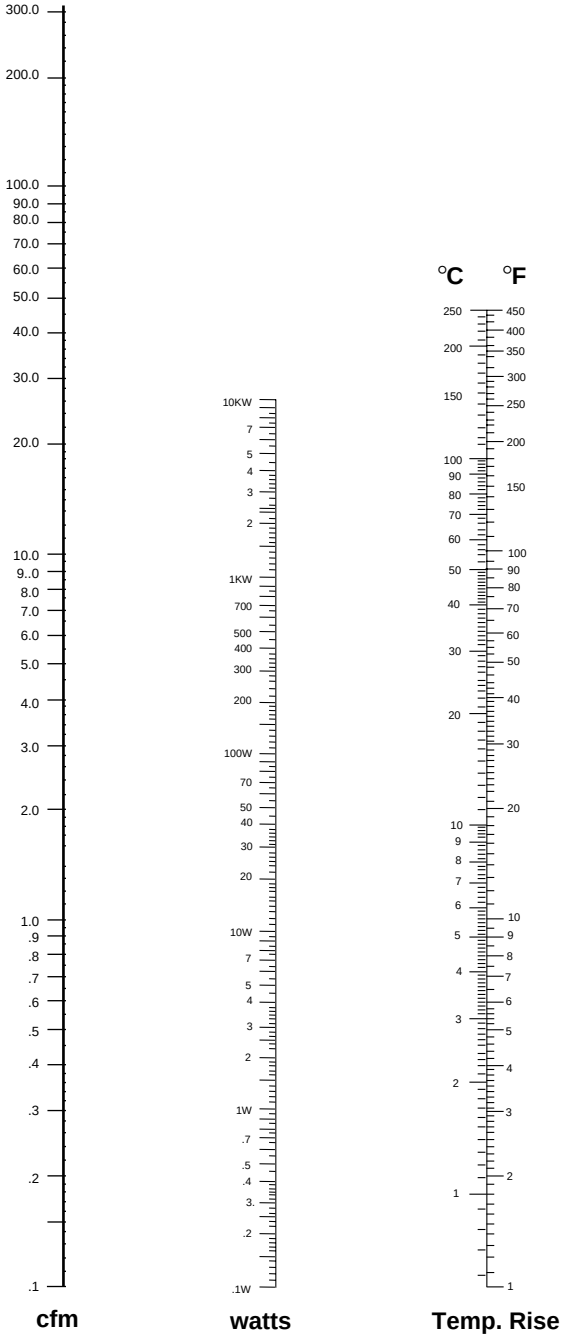
For a change in density (p) at constant speed:

$$\frac{\Delta P_1}{\Delta P_2} = \frac{p_1}{p_2}$$

$$\frac{BHP_1}{BHP_2} = \frac{p_1}{p_2}$$

ALTITUDE — PRESSURE CHART

ALTITUDE		PRESSURE			
(feet)	(meters)	in. Hg	mm Hg	psi	bars
Sea Level		29.920	759.968	14.7000	1.0134
500	152	29.380	746.252	14.4300	.9948
1,000	305	28.860	733.044	14.1800	.9776
2,000	610	27.820	706.628	13.6700	.9424
3,000	914	26.810	680.974	13.1900	.9093
4,000	1,219	25.840	656.336	12.7000	.8755
5,000	1,524	24.890	632.206	12.2300	.8431
7,500	2,286	22.650	575.310	11.1200	.7666
10,000	3,048	20.580	522.732	10.1000	.6963
15,000	4,572	16.880	428.752	8.2800	.5708
20,000	6,096	13.750	349.250	6.7500	.4653
25,000	7,620	11.100	281.940	5.4500	.3757
30,000	9,144	8.880	225.552	4.3600	.3006
40,000	12,192	5.540	140.716	2.7200	.1875
50,000	15,240	3.436	87.274	1.6890	.1164
60,000	18,288	2.132	54.153	1.0480	.0722
70,000	21,336	1.322	33.579	.6490	.0447
80,000	24,384	.820	20.828	.4030	.0278
100,000	30,480	.316	8.020	.1550	.0107
150,000	45,720	.044	1.128	.2181	.0015
200,000	60,960	.010	.256	.0050	.0003

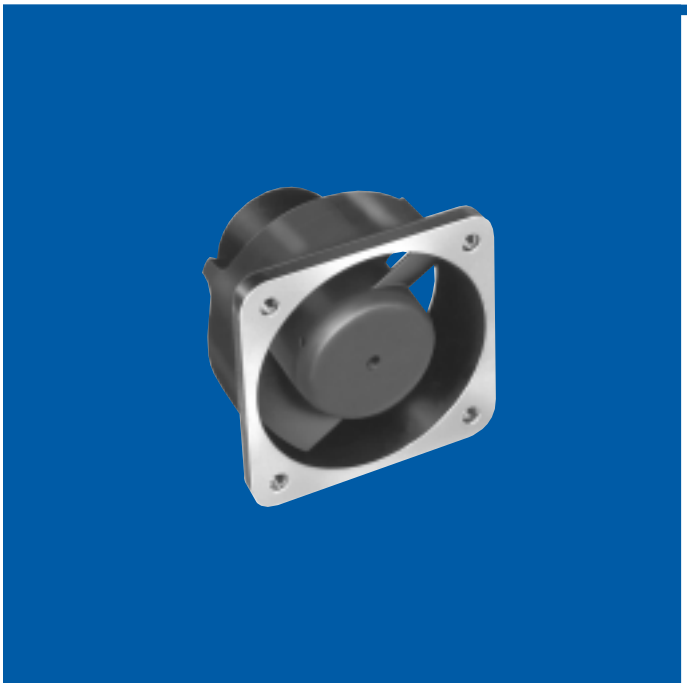


Equation 1
Standard Air Conditions
Sea Level

SS, MM & LL BLOWERS

DC Tubeaxial Blowers

C-4160



general design specification

airflow: Up to 58 cfm @ free air

voltage: 27 VDC

impeller: Dynamically balanced, precision-cast aluminum

housing: Precision-cast aluminum

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" #22 AWG min. single conductor lead wire per MIL-W-16878/4

electrical connections: Leads are provided for Type MM and LL, and solder terminals for Type SS

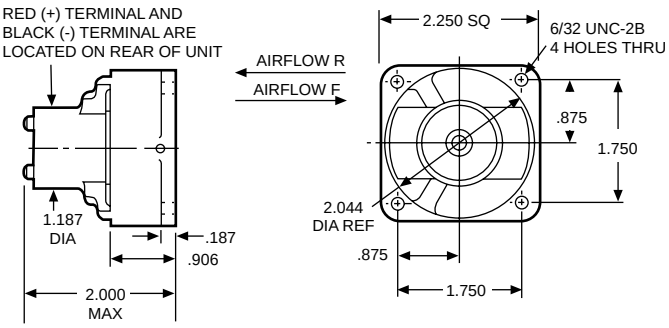
mounting: Standard mounting is by four tapped holes in flange

marking: Per MIL-STD-130

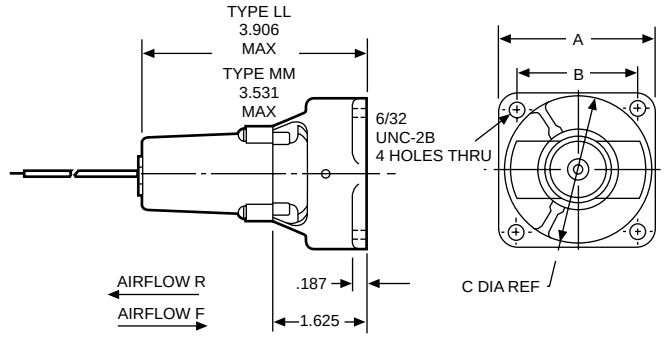
life: 1,000 hours minimum

Dimensions

TYPE SS



TYPE MM & LL



TYPE	DIMENSIONS			STANDARD PART NUMBERS*	
	A (in.)	B (in.)	C (in.)	(airflow R)	(airflow F)
MM	2.250	1.750	2.125	19A514	19A523
LL	2.625	2.125	2.500	19A522	19A524

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

	TYPE	VOLTAGE (VDC)	SPEED min (rpm)	AIRFLOW typ @ free air (cfm)	POWER INPUT max (watts)	CURRENT FREE AIR max (amps)	WEIGHT max (oz.)	STANDARD PART NUMBERS*
AIRFLOW F	SS	27	10,000	25	5.4	.2	5.0	19A554
	MM	27	10,000	25	10.8	.4	7.8	19A523
	LL	27	11,000	58	16.2	.6	9.5	19A524
AIRFLOW R	SS	27	10,000	25	5.4	.2	5.0	19A544
	MM	27	10,000	25	10.8	.4	7.8	19A514
	LL	27	11,000	58	16.2	.6	9.5	19A522

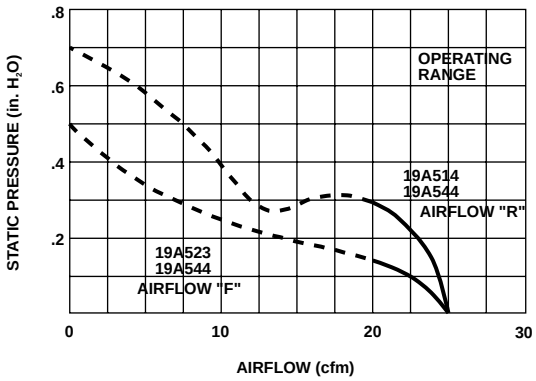
*When You Order

Units shown above are standard and may be ordered by part number. Type MM and Type LL units meet radio noise requirements of MIL-1-6181 when a 16 mesh screen is placed over the mounting end. Type SS units can be modified to meet the same requirements on special order

Typical Performance

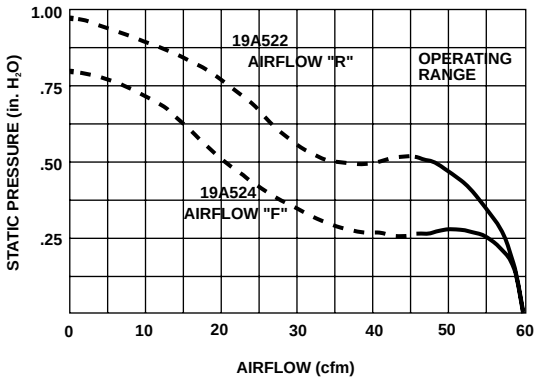
Part Nos.*: 19A514, 19A544, 19A523, 19A554

Operating Point: 20 cfm @ .30" H_2O
20 cfm @ .15" H_2O

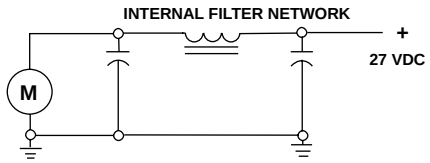


Part Nos.*: 19A522, 19A524

Operating Point: 45 cfm @ .50" H_2O
45 cfm @ .30" H_2O



Schematic Wiring (Type MM & LL)

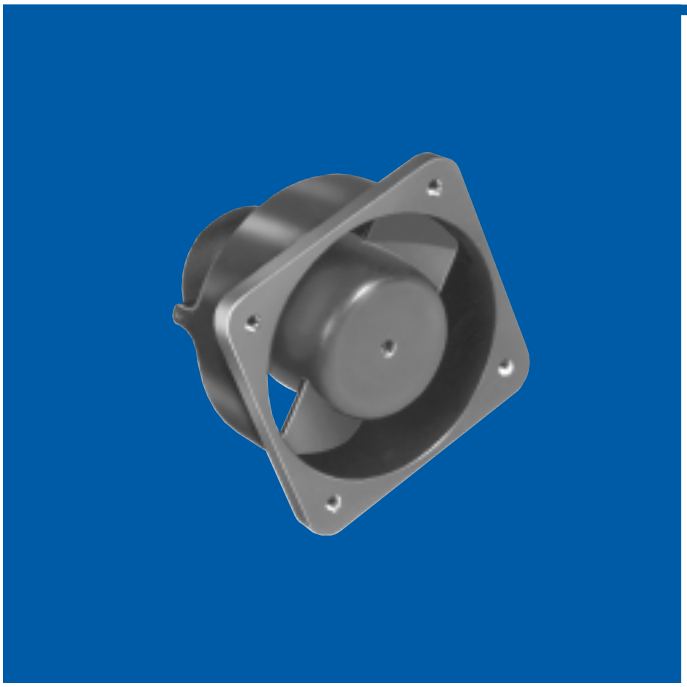


TO OBTAIN SPECIFIED AIRFLOW

SC & MC BLOWERS

AC Tubeaxial Blowers

C-4166



general design specification: Motor to MIL-M-7969

airflow: Up to 62 cfm (29.3 L/sec.) @ free air

voltage: 115 VAC; 60 and 400 Hz

impeller: Dynamically balanced, precision-cast aluminum

housing: Precision-cast aluminum

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" #26 AWG min. per MIL-W-16878/4 exposed length

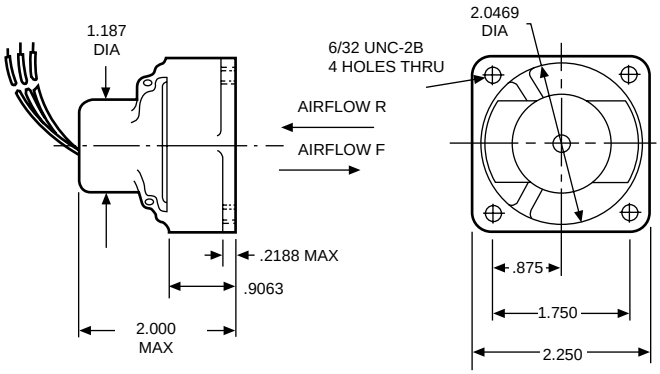
mounting: Standard mounting is with tapped holes in flange of base

marking: Per MIL-STD-130

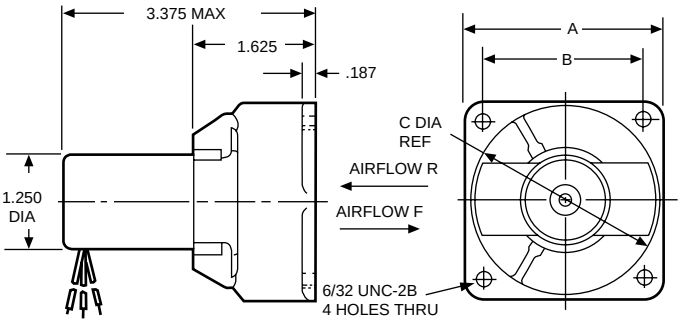
life: 1,000 hours min at 71°C

Dimensions

TYPE SC



TYPE MC



TYPE MC DIMENSIONS			STANDARD PART NUMBERS*	
A (in.)	B (in.)	C (in.)	(airflow R)	(airflow F)
2.625	2.125	2.500	19A533 19A526	19A540 19A527
2.250	1.750	2.047	19A590	19A591

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Globe Motors™

Standard Part Numbers and Data

	TYPE	VOLTAGE (VAC)	FRE-QUENCY (Hz)	PHASE	SPEED min @ free air (rpm)	AIRFLOW min @ free air (cfm)	POWER INPUT max (watts)	WEIGHT max (oz.)	SCHEMATIC	VARIABLE	CAPACITOR (µF)	CAPACITOR (wvdc)	STANDARD PART NUMBER*
AIRFLOW F	SC	200	400	3	15,000	45	30	5.0	B	BRN	—	—	19A653-3
		115	400	1 or 3	15,000	45	30	5.0	B	BLK	.800	600	19A653-1
		27	400	1 or 3	15,000	45	30	5.0	B	WHT	12.000	100	19A653-2
	SC	200	400	3	9,800	30	12	5.0	A	BRN	—	—	19A651-3
		115	400	1 or 3	9,800	30	12	5.0	A	BLK	.330	400	19A651-1
		27	400	1 or 3	9,800	30	12	5.0	A	WHT	5.000	100	19A651-2
	MC	115	400	1	11,800	37	14	8.5	C	BLK	.068	1,000	19A591
		115	400	1	11,000	62	20	9.0	C	RED	.080	1,000	19A527
		115	60	1	3,600	20	11	9.0	D	—	.500	300	19A540
AIRFLOW R	SC	200	400	3	15,000	50	30	5.0	B	BRN	—	—	19A652-3
		115	400	1 or 3	15,000	50	30	5.0	B	BLK	.800	600	19A652-1
		27	400	1 or 3	15,000	50	30	5.0	B	WHT	12.000	100	19A652-2
	SC	200	400	3	9,800	30	12	5.0	A	BRN	—	—	19A650-3
		115	400	1 or 3	9,800	30	12	5.0	A	BLK	.330	400	19A650-1
		27	400	1 or 3	9,800	30	12	5.0	A	WHT	5.000	100	19A650-2
	MC	115	400	1	11,800	37	14	8.5	C	BLK	.068	1,000	19A590
		115	400	1	11,000	58	20	9.0	C	BLK	.080	1,000	19A526
		115	60	1	3,600	20	11	9.0	D	—	.500	300	19A533

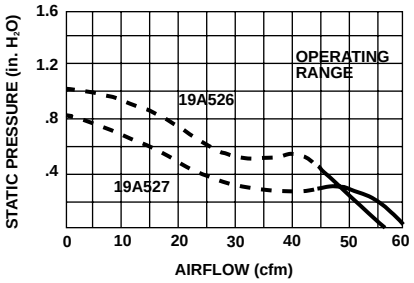
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

*When You Order

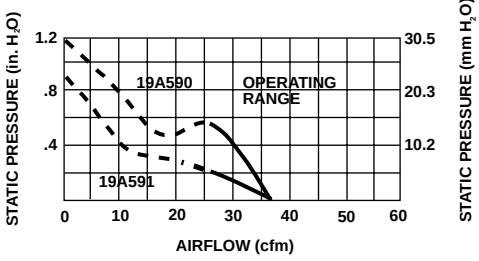
Units shown above are standard and may be ordered by part number. Motor windings, voltage, frequency, speed, current and airflow can usually be modified to fit your needs

Typical Performance

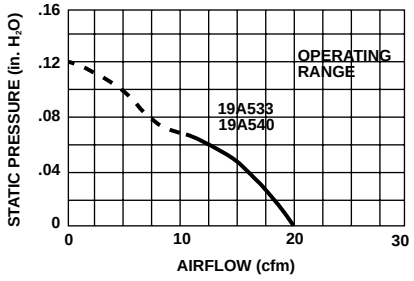
Part Nos.: 19A526
19A527



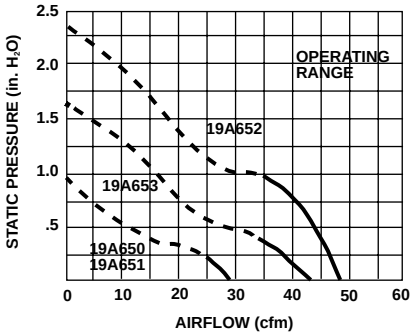
Part Nos.: 19A590
19A591



Part Nos.: 19A533
19A540

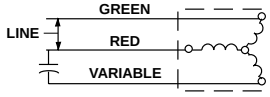


Part Nos.: 19A650
19A651
19A652
19A653



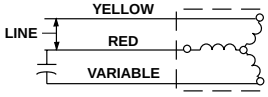
Schematic Wiring

A



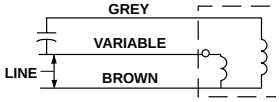
CCW ROTATION VIEWED FROM IMPELLER END
3 PHASE SEQUENCE VARIABLE-RED-GREEN

B



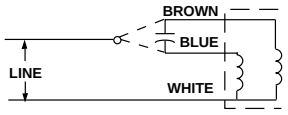
CCW ROTATION VIEWED FROM IMPELLER END
3 PHASE SEQUENCE VARIABLE-RED-YELLOW

C



CCW ROTATION VIEWED FROM IMPELLER END

D



P/N 19A533 CONNECT LINE TO WHITE & BLUE FOR CCW ROTATION VIEWED FROM IMPELLER END
P/N 19A540 CONNECT LINE TO WHITE & BROWN FOR CW ROTATION VIEWED FROM IMPELLER END

VAX-1.5-DC BLOWERS

DC Vaneaxial Blowers

C-5120

general design specification

airflow: 19 cfm max @ free air (50 VDC). 16 cfm max @ free air (27 VDC)

voltage: 27 or 50 VDC

impeller: Dynamically balanced, precision cast aluminum

housing: Precision die-cast aluminum

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

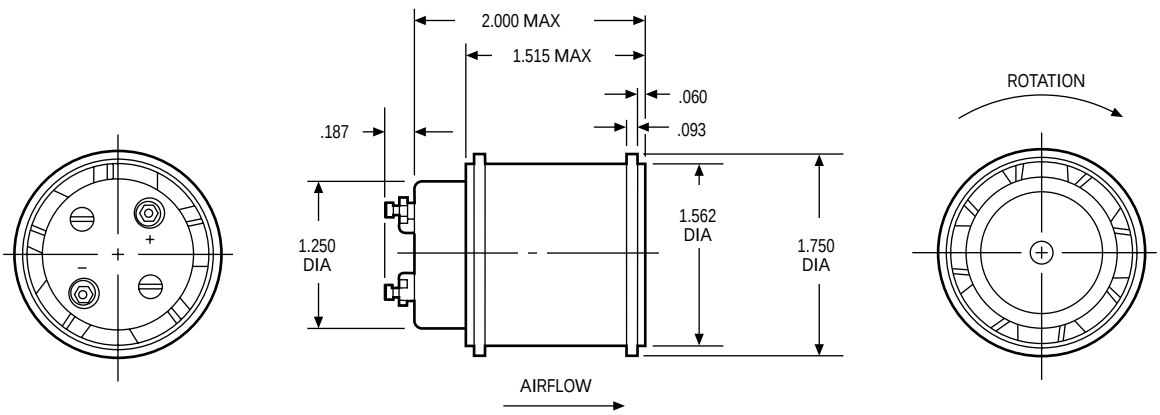
electrical connections: Solder terminals are standard. Leads are optional

mounting: Mounting is made by clamping around diameter or by clamping to servo flange at either end

marking: Per MIL-STD-130

life: 500 hours @ 50 VDC; 300 hours @ 27 VDC

Dimensions



ROTATION FOR SPECIFIED AIRFLOW
POSITIVE VOLTAGE TO (+), NEGATIVE VOLTAGE TO (-)

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

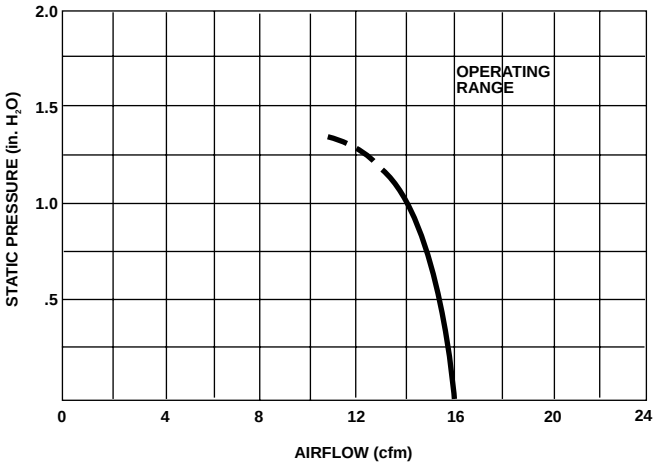
VOLTAGE (VDC)	SPEED min @ free air (rpm)	AIRFLOW typ @ free air (cfm)	POWER INPUT max (watts)	CURRENT max @ free air (amps)	WEIGHT max (oz.)	STANDARD PART NUMBER*
50	20,000	19.0	17.5	.35	5.0	19A1345-2
27	18,500	16.0	17.5	.65	5.0	19A1345-1

*When You Order

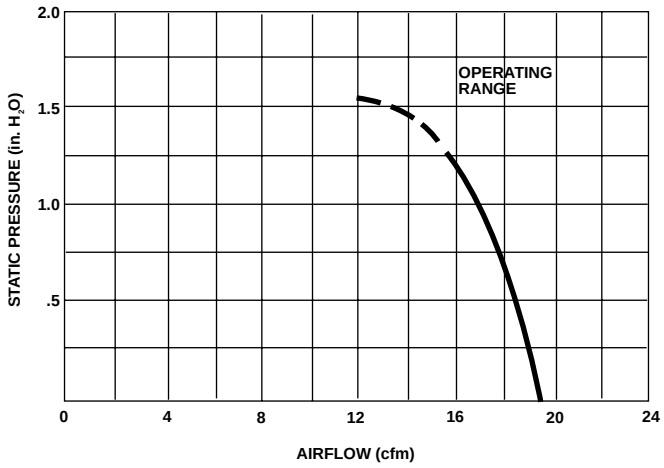
Units shown above are standard and may be ordered by part number. Motor windings, voltage, speed, current and airflow can usually be modified to fit your needs

Typical Performance

Part No.: 19A1345-1: 14 cfm at 1.0" H_2O



Part No.: 19A1345-2: 15 cfm at 1.3" H_2O



VAX-1.5-AC BLOWERS

AC Vaneaxial Blowers

C-5126

general design specification: Motor to MIL-M-7969

airflow: Airflow to 18 cfm static pressure to 1.5 H_20

voltage: Available in standard and special voltages. 400 Hz and 800 Hz single and 3 phase

impeller: Dynamically balanced, precision cast aluminum

housing: Precision die-cast aluminum

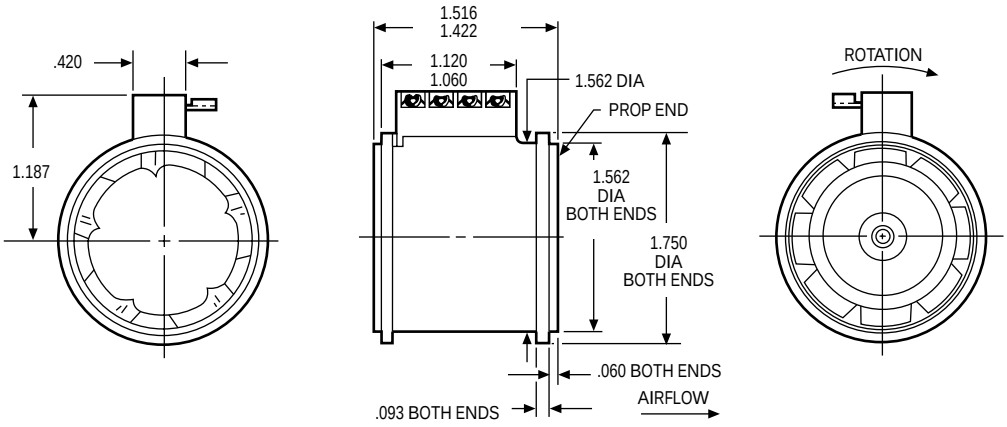
electrical connections: Solder terminals are standard. Leads are optional

mounting: Mounting is made by clamping around diameter or by clamping to servo flange at either end

marking: Per MIL-STD-130

life: 2,000 hrs. minimum depending upon rating and temperature

Dimensions



NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

VOLTAGE (VAC)	FRE-QUENCY (Hz)	PHASE	SPEED min @ free air (rpm)	AIRFLOW min @ free air (cfm)	POWER INPUT max (watts)	CURRENT max @ free air (amps)	CAPACITOR 200 vac (μF)	WEIGHT max (oz.)	STANDARD PART NUMBER*
115	400	1	21,500	17.5	25.0	.19	.25	4.5	19A1233
115	400	1	12,000	10.0	7.5	.06	.10	4.5	19A1197
200	400	3	22,500	18.0	24.0	.15	—	4.5	19A2537

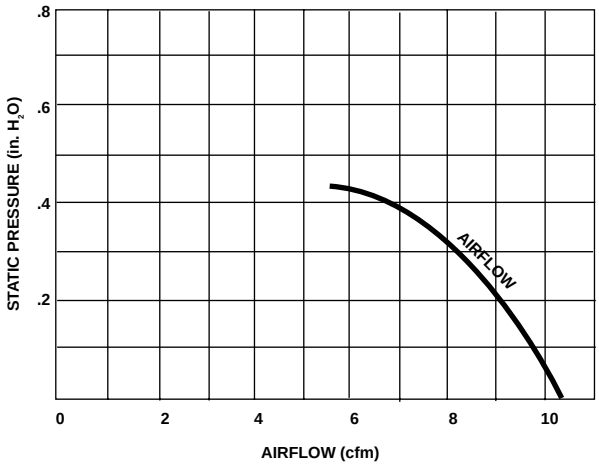
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200 V line to line

*When You Order

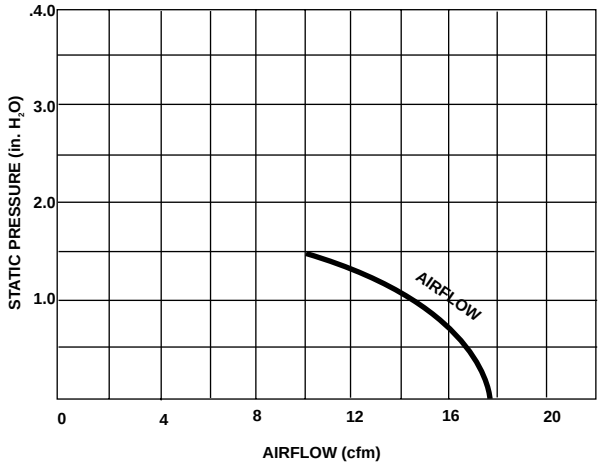
Units shown above are standard and may be ordered by part number. Motor windings, voltage, frequency, speed, current and airflow can usually be modified to fit your needs

Typical Performance

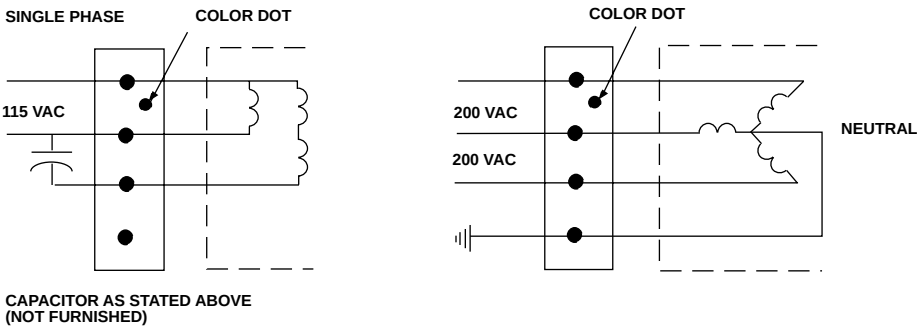
Part No.: 19A1197: 5.5 cfm @ .45" H_2O



Part No.: 19A1233: 10.0 cfm @ 1.5" H_2O



Schematic Wiring



VAX-2-DC BLOWERS

DC Vaneaxial Blowers

C-5160

general design specification

airflow: 35 cfm @ 1.5" H_20. 27 cfm @ .6" H_20

voltage: 26 VDC

impeller: Dynamically balanced, precision cast aluminum

housing: Precision die-cast aluminum

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

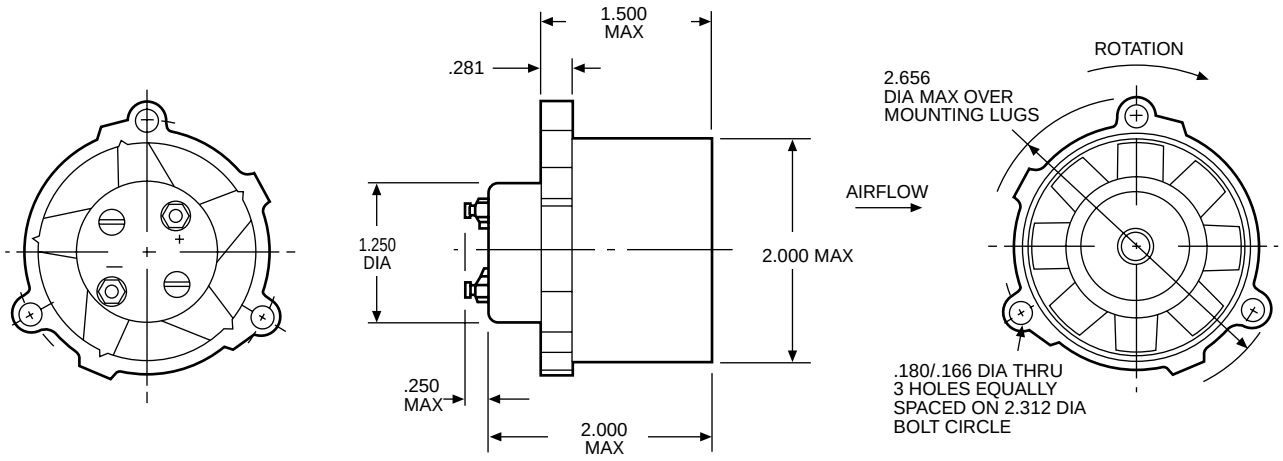
electrical connections: Two solder terminals are provided. Leads, shielded cable and RFI filters also available on special units

mounting: Standard mounting is by means of three bolts through flange, or by clamping around diameter

marking: Per MIL-STD-130

life: 500 hours minimum constant duty at 16,500 rpm and 85°C

Dimensions



ROTATION FOR SPECIFIED AIRFLOW
POSITIVE VOLTAGE TO (+), NEGATIVE VOLTAGE TO (-)

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

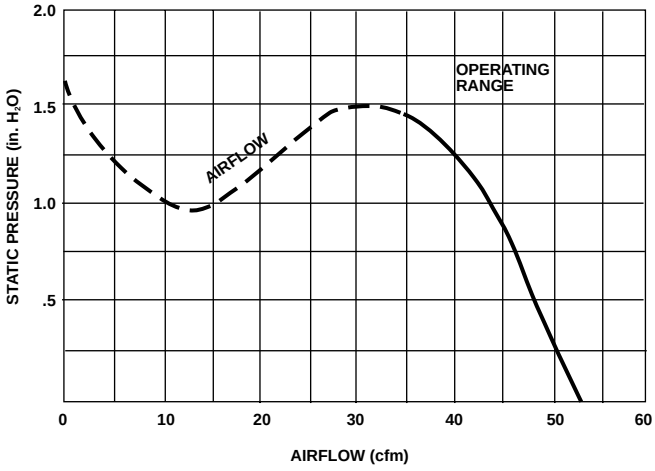
VOLTAGE (VDC)	SPEED min @ free air (rpm)	AIRFLOW typ @ free air (cfm)	POWER INPUT max (watts)	CURRENT max @ free air (amps)	WEIGHT max (oz.)	STANDARD PART NUMBER*
26	16,500	53	29.0	1.15	5.0	19A1771
26	11,000	35	11.2	.43	5.0	19A2525

*When You Order

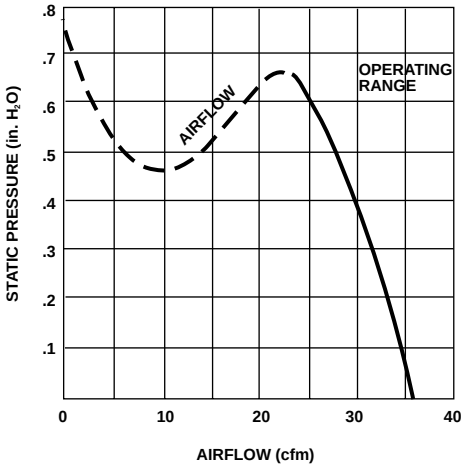
Units shown above are standard and may be ordered by part number. Motor windings, voltage, speed, current and airflow can usually be modified to fit your needs

Typical Performance:

Part No.: 19A1771
Voltage: 26 VDC
Operating Point: 37 cfm @ 1.5" H_2O



Part No.: 19A2525
Voltage: 26 VDC
Operating Point: 27 cfm @ .6" H_2O



VAX-2-AC BLOWERS

AC Vaneaxial Blowers

C-5166

general design specification: Motor to MIL-M-7969

airflow: 50 cfm @ 2.1" H_20

voltage: 115 VAC, 1 or 3 phase; 200 VAC, 3 phase

impeller: Dynamically balanced, precision cast aluminum

housing: Precision die-cast aluminum

bearings: Double shielded, life-lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremesp

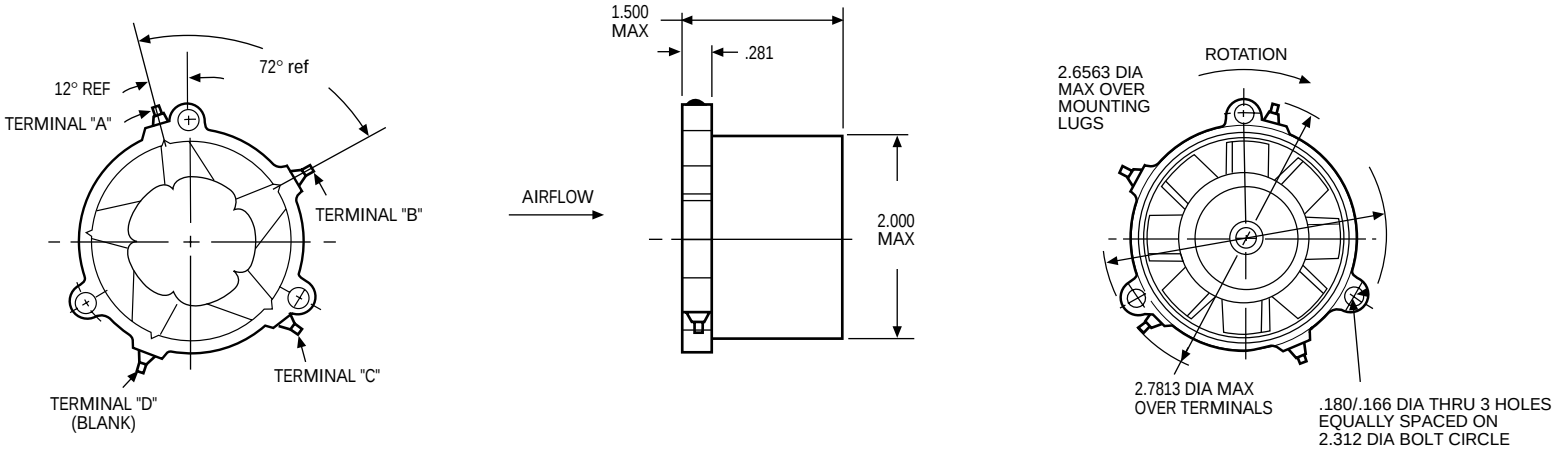
electrical connections: Solder terminals are standard. Leads are optional

mounting: Mounting can be made by three bolts through flange or by clamp around housing

marking: Per MIL-STD-130

life: 1,000 hours at 125°C, 19,500 rpm; 2,000 plus hours at 125°C, 11,000 rpm

Dimensions



NOTE: Optional leads are #32 AWG leads per MIL-W-16878/4 with exit at location of terminal “D” (8")

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Globe Motors™

Standard Part Numbers and Data

VOLT-AGE (VAC)	FRE-QUENCY (Hz)	PHASE	SPEED min @ free air (rpm)	AIRFLOW min @ free air (cfm)	POWER INPUT max (watts)	CAPACITOR (µF)	CAPACITOR (wvdc)	WEIGHT max (oz.)	SCHEMATIC WIRING	STANDARD PART NUMBER* (with terminals)	SCHEMATIC WIRING	STANDARD PART NUMBER* (with leads)
115	400	1	10,000	35	20	.15	220	5.0	A	19A2533	A	19A2535
115	400	1	19,000	65	55	1.50	400	5.0	A	19A790	A	19A1199
115	400	3	19,500	65	45	—	—	5.0	A	19A790	A	19A1199
200	400	3	10,500	33	15	—	—	5.0	B	19A1150	D	19A1200
200	400	3	19,500	65	45	—	—	5.0	C	19A774	C	19A1198

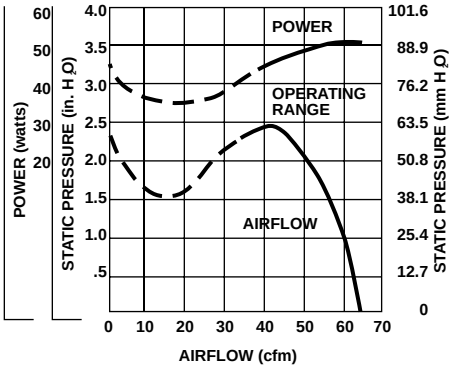
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line-to-line

*When You Order

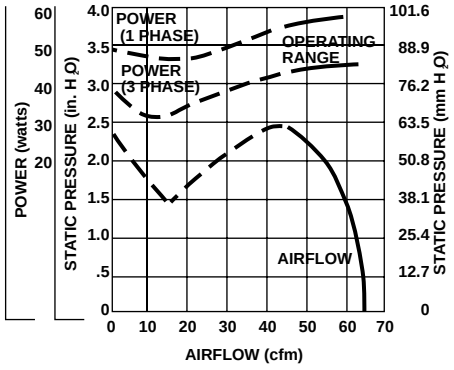
Units shown above are standard and may be ordered by part number. Motor windings, voltage, frequency, speed, current and airflow can usually be modified to fit your needs

Typical Performance

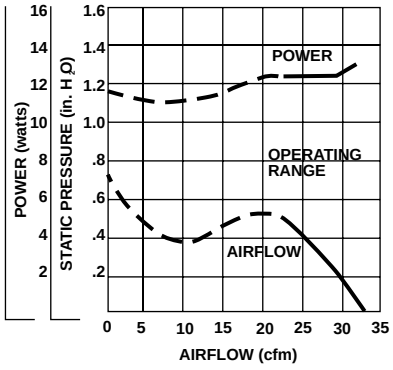
Part No.: 19A774, 19A1198
Voltage: 200 VAC
Operating Point: 50 cfm @ 2.1" H_2O



Part No.: 19A790, 19A1199
Voltage: 115 VAC
Operating Point: 47 cfm @ 2.1" H_2O

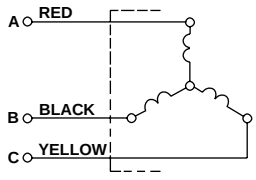


Part No.: 19A1150, 19A1200
Voltage: 200 VAC
Operating Point: 21 cfm @ .5" H_2O



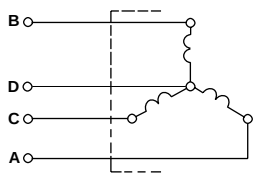
Schematic Wiring

A



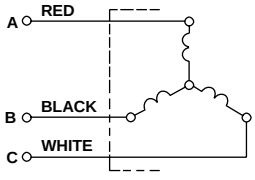
ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING PROP. END). TO RUN SINGLE PHASE CONNECT LINE TO A & C, CAPACITOR TO B & C

B



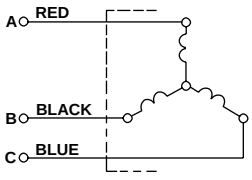
ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING PROP. END)

C



ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING PROP. END)

D

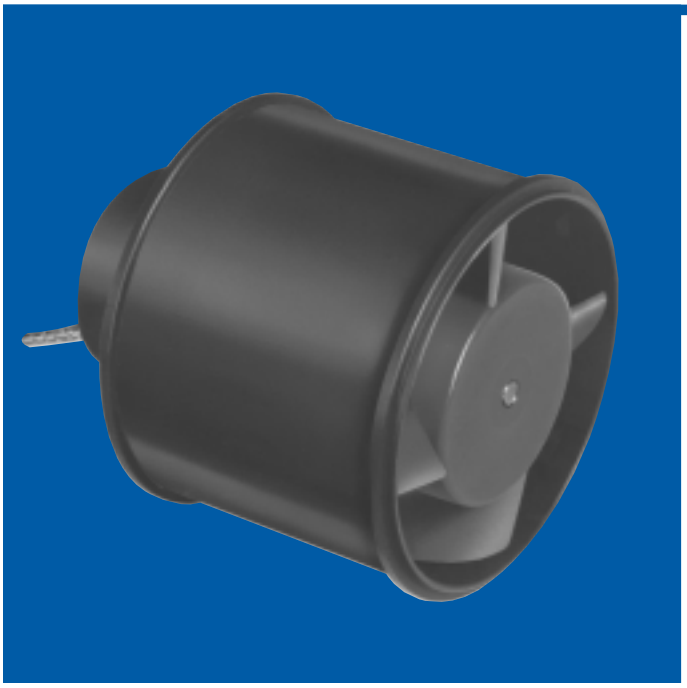


ABC PHASE SEQUENCE FOR CW ROTATION (VIEWING PROP. END)

VAX-3-DC BLOWERS

DC Vaneaxial Blowers

C-5240



general design specification

airflow: 70 cfm @ 1.5" H_20

voltage: 12 or 28 VDC

impeller: Dynamically balanced, precision cast aluminum

housing: Precision die-cast aluminum

bearings: Double shielded, life lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

cables/leads: 8" min. shielded cable per MIL-C-7078, #22 AWG conductors per MIL-W-16878/4

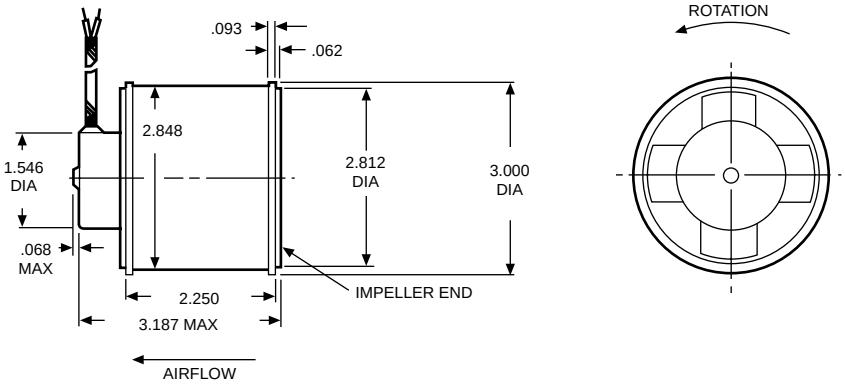
electrical connections: Shielded leads are provided. RFI filters available on special order

mounting: Mounting is made by clamping around diameter or by clamping to servo flange at either end

marking: Per MIL-STD-130

life: 500 hours constant duty at 28 VDC

Dimensions



ROTATION FOR SPECIFIED AIRFLOW
POSITIVE VOLTAGE TO (RED), NEGATIVE VOLTAGE TO (BLACK)

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

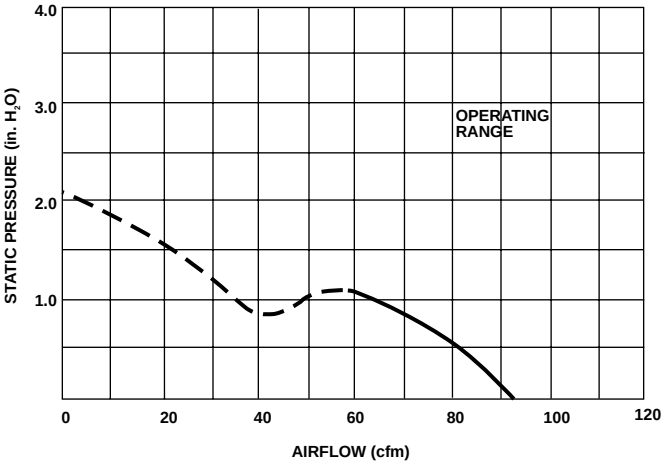
VOLTAGE (VDC)	SPEED min @ free air (rpm)	AIRFLOW typ @ free air (cfm)	CURRENT max @ free air (amps)	WEIGHT max (oz.)	STANDARD PART NUMBER*
12	11,700	95	2.75	16.0	19A820
28	13,000	110	1.50	16.0	19A827

*When You Order

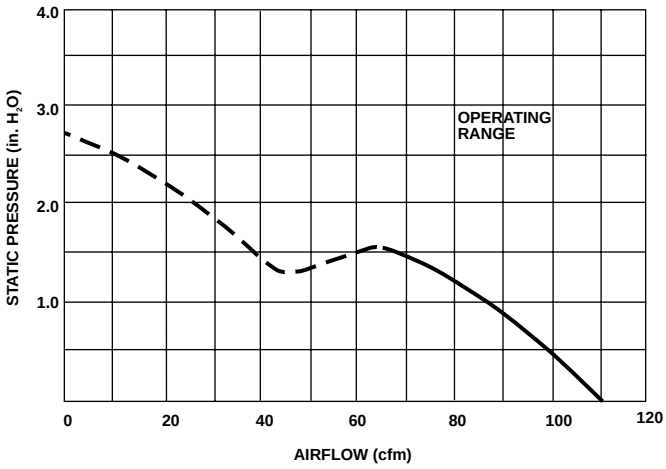
Units shown above are standard and may be ordered by part number. Motor windings, voltage, speed, current and airflow can usually be modified to fit your needs

Typical Performance:

Part No.: 19A820
Voltage: 12 VDC
Operating Point: 60 cfm @ 1.2" H_2O



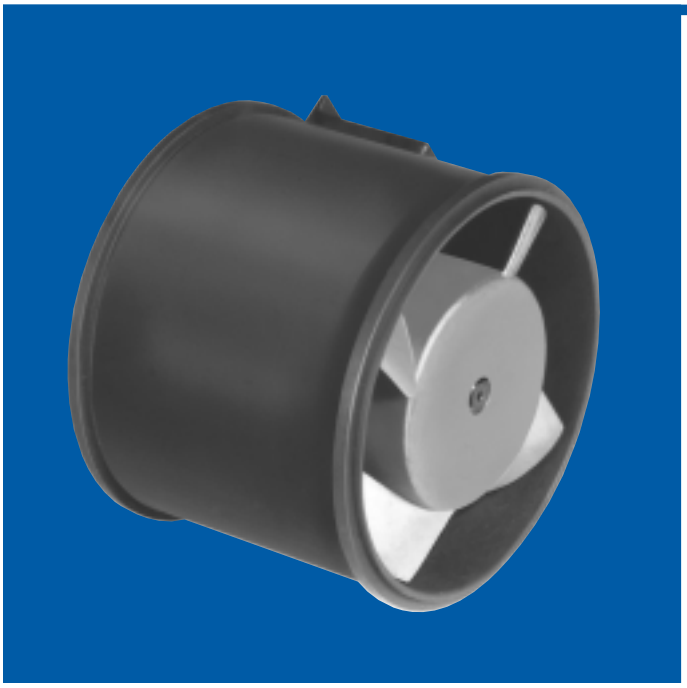
Part No.: 19A827
Voltage: 28 VDC
Operating Point: 70 cfm @ 1.5" H_2O



VAX-3-AC BLOWERS

AC Vaneaxial Blowers

C-5246



general design specification: Motor to MIL-M-7969

airflow: 105 cfm @ 3.3" H_20 (3-phase); 105 cfm @ 2.7" H_20 (1-phase)

voltage: 115 or 200 VAC

impeller: Dynamically balanced, precision cast aluminum

housing: Precision die-cast aluminum

bearings: Double shielded, life lubricated for –55°C to +85°C operation. Special lubricants available for temperature extremes

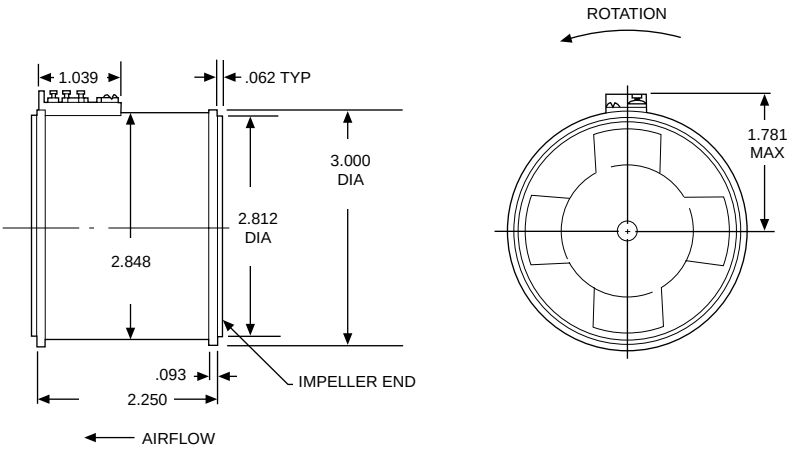
electrical connections: Solder terminals are standard. Leads are optional

mounting: Standard mounting is by clamping to servo flange on either end, or by clamping around diameter

marking: Per MIL-STD-130

life: 500 hours at 125°C ambient. Three-phase units 1,000 hours at 100°C ambient

Dimensions



NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Standard Part Numbers and Data

VOLTAGE (VAC)	FREQUENCY (Hz)	PHASE	SPEED min @ free air (rpm)	AIRFLOW min @ free air (cfm)	POWER INPUT max (watts)	CAPACITOR (µF)	CAPACITOR (wvdc)	WEIGHT max (oz.)	SCHEMATIC WIRING	STANDARD PART NUMBER*
115	400	1	19,500	162	160	.8	400	15	A	19A764
115	400	3	11,000	90	33	—	—	15	B	19A2541
115	400	3	20,500	167	160	—	—	15	B	19A798
200	400	3	11,000	92	24	—	—	15	B	19A2542
200	400	3	20,000	167	150	—	—	15	B	19A751

Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

High Altitude Blowers

VOLTAGE (VAC)	FREQUENCY (cps)	PHASE	SPEED sea level (rpm)	AIRFLOW min @ free air sea level (cfm)	AIRFLOW @ free air at altitude	WEIGHT max @ (oz.)	SCHEMATIC WIRING	STANDARD PART NUMBER*
208	400	3	17,000	140	162	15	B	19A2543
200	400	3	12,500	100	155	15	B	19A2544

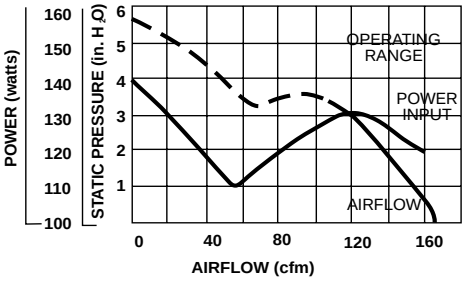
Note: All 3-phase voltages are line to line. MIL-STD-704 is 200V line to line

*When You Order

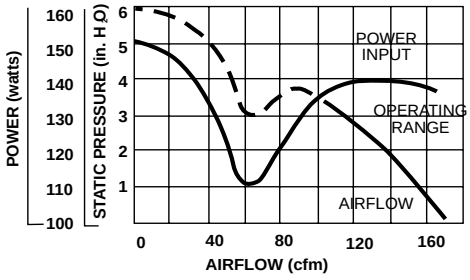
Units shown above are standard and may be ordered by part number. Motor windings, voltage, frequency, speed, current and airflow can usually be modified to fit your needs

Typical Performance

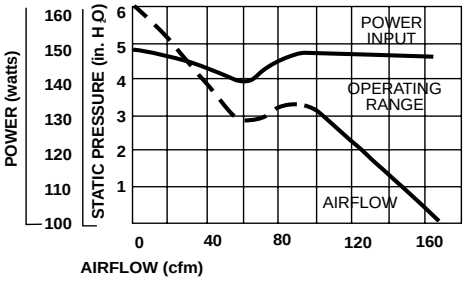
Part No.: 19A751
Operating Point: 105 cfm @ 3.3" H_2O



Part No.: 19A798
Operating Point: 105 cfm @ 3.3" H_2O

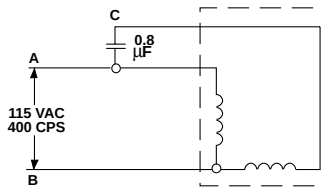


Part No.: 19A764
Operating Point: 105 cfm
@ 2.7" H_2O



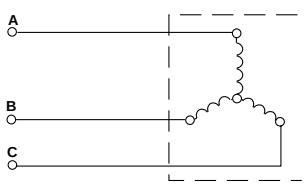
Schematic Wiring

A



CCW ROTATION
(VIEWING IMPELLER END)

B



ABC PHASE SEQUENCE FOR
CCW ROTATION
(VIEWING IMPELLER END)

DEVICES

Your motion design solution may be found in one of hundreds of our off-the-shelf products that are listed in the “Standard” section of this catalog; or an answer may be arrived at by modifying one of our standard products. However, if you need a custom design for your application we can answer that need, too. This section of the catalog provides a brief overview of some of the typical custom motion devices that we have developed over the last 40 years. The diversity of products shown is only a small sampling of the broad breadth of our capabilities in designing and manufacturing custom devices. If a custom design is what you need, you have found “the right source”.

Products discussed in this section of the catalog include:

- Limited Rotation Torque Motors
- Centrifugal Pumps
- Positive Displacement Pumps
- Linear Actuators
- Rotary Actuators
- Axial-Flow Blowers
- Centrifugal Blowers
- Generators

LIMITED ROTATION TORQUE MOTORS

The limited rotation torque motor, often referred to as a torquer, provides a controlled and measurable rotation within a designated torque range.

Globe torquers are brushless designs available in either two or four pole configurations. Angular excursion ranges can be less than 10° to 120° or more. A typical example of a limited rotation torque motor is illustrated in Figure 1.

A Globe limited rotation torque motor is your design solution when you need:

- compact size
- controlled & measurable rotation
- consistent & repeatable motion
- ripple free torque
- long service life, and
- quiet operation

DC PUMPS

Globe Motors offers both centrifugal and positive displacement gear pumps for a wide variety of applications. Bilge pumps, transfer pumps, and fuel pumps for both MIL-spec and industrial applications can be designed and manufactured to meet your specific requirements.

CENTRIFUGAL PUMPS

The Globe centrifugal or radial flow type pumps develop pressure by the centrifugal force moving the liquid as it enters the center of the impeller, forcing it through the impeller passageways into the casing of the pump and on to the discharge.

The shape and number of impeller vanes determines the performance characteristics of the pump. There are basically two types of impellers, open and closed. The closed impeller design is generally utilized with clean, low viscosity fluids.

The design of the volute casing is critical as it must produce an equal liquid velocity around the pump impeller’s circumference. It is the volute casing that converts velocity energy into pressure energy.

The type of fluid pumped and other specific system design requirements will determine the pump configuration and the type of seal required. Advantages of the Globe centrifugal pump include:

- the availability of a magnetic coupling to eliminate shaft seals
- the capability to pump multiple fuels
- the capability to pump high volumes of fluid

POSITIVE DISPLACEMENT GEAR PUMPS

At Globe Motors, we manufacture involute internal and external gear pumps (see Figure 2). One gear is driven by a quality Globe DC permanent magnet motor, with the other gear acting as an idler.

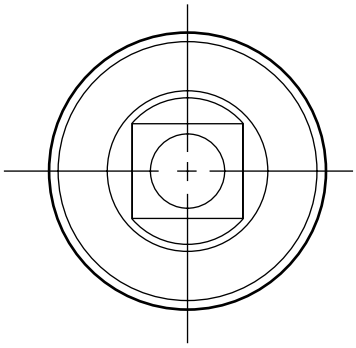
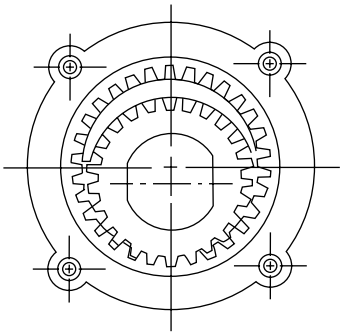
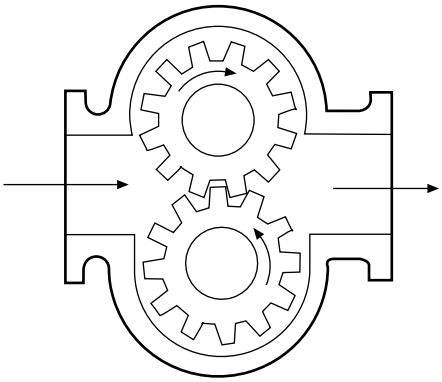


Figure 1: Limited Rotation Torque Motor



Internal Involute



External Involute

Figure 2: Positive Displacement Gear Pumps

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

In operation, a partial vacuum is formed by the unmeshing of the rotating gears, drawing fluid into the pump. The fluid is then carried to the other side of the pump between the rotating gear teeth and the housing, and discharged through the outlet.

Specific advantages of Globe gear pumps include:

- uniform discharge with negligible pulsations
- consistent delivery at a set rotor speed
- small space requirements
- minimal weight
- high volumetric efficiencies

The use of a shaft seal or a magnetically coupled unit will be determined by the type of fluid pumped and the system design requirements.

LINEAR AND ROTARY ACTUATORS

Actuators, whether linear or rotary, convert electric energy to mechanical energy through the combination of an electric motor and a gear train (Figure 3). A wide range of gear reducers gives Globe maximum flexibility using standard parts to minimize design time and production start-up. When linear motion is required, a drive screw is added to the configuration (Figure 4). Motion is controlled by mechanical stops, limit switches, or more precise positional feedback systems.

Our experienced motion design engineers can build your actuation device around all of the following variables:

- input voltage
- load rates
- cycle time
- stroke limits and positional tolerances
- military environmental requirements, and
- package size

CUSTOM BLOWERS

Vaneaxial, tubeaxial and centrifugal blowers are all offered in custom packages for both MIL-spec and industrial applications.

Axial flow blower characteristics are described in detail on Bulletin C-10 of this catalog, followed by several bulletin sheets illustrating our standard product line. Please contact our application engineers for modifications or to discuss the unique parameters of your axial flow requirements.

GENERATORS

Engine-driven tachometers, along with both AC and DC signal generators, are offered by Globe Motors for both military and industrial applications. Engine tachometers are utilized on various fixed-wing aircraft and helicopters and are designed to meet MS specifications. Signal generators are built both as separate units for incorporation within your system, or integrated as part of any Globe motor, providing velocity feedback to accurately control the speed of various devices.

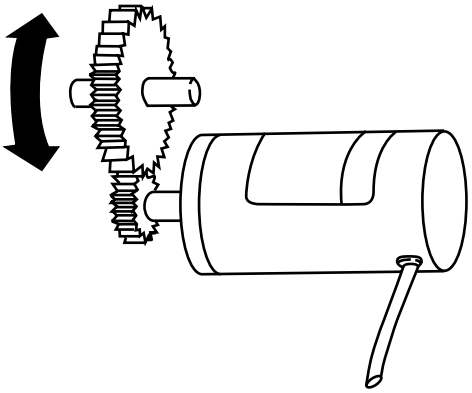


Figure 3: Rotary Actuator—
Electric Motor With Spur Gear Train

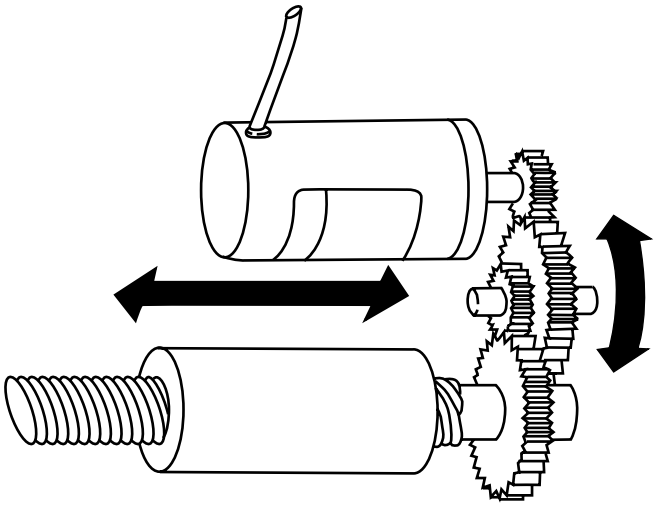
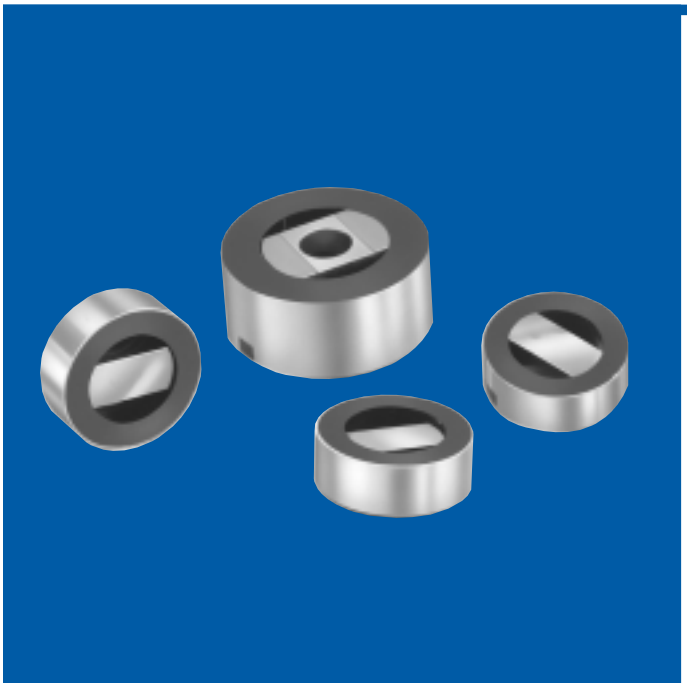


Figure 4: Linear Actuator—
Electric Motor and Spur Gear Train With Drive Screw

LIMITED ROTATION TORQUE MOTORS D-1200



General

Globe Motors designs and manufactures limited rotation torque motors that provide extensive torque ranges and rotation rates to handle your most demanding applications.

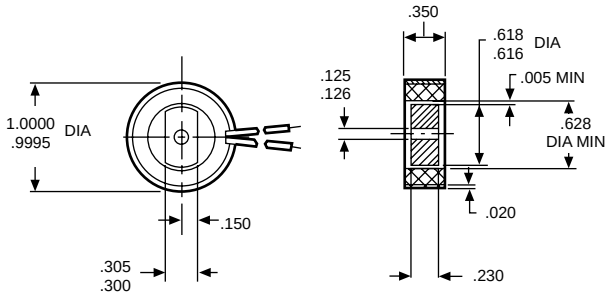
Built to meet MIL-spec and industrial requirements, these units offer:

- brushless design for long service life and quiet operation
- ripple-free torque
- compact size

Our experienced design and application engineers stand ready to assist you with motion control solutions; and our vertically integrated manufacturing provides the capability needed to deliver prototypes quickly.

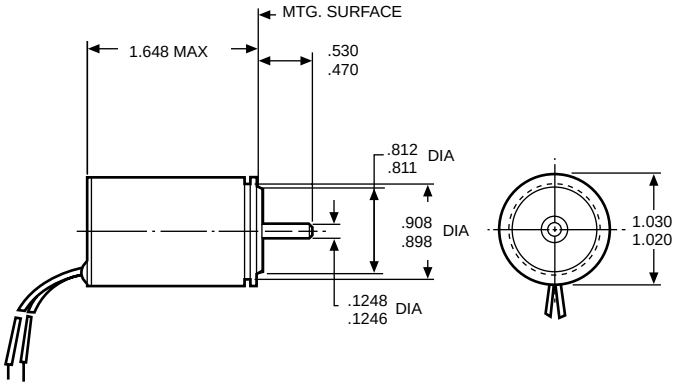
NOTE: For design assistance, contact Globe Motors

P/N 365A239



Application: Land Track Vehicle Thermal Night Sensor

P/N 365A235



Application: Aircraft Radar System Tachometer Feedback

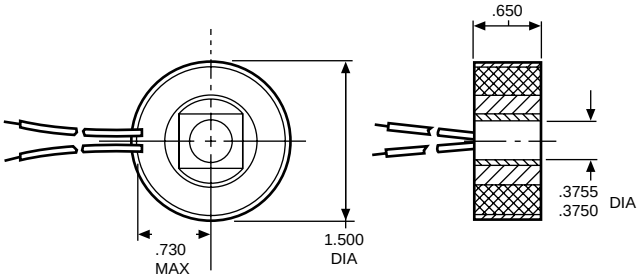
NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Performance Data

PART NUMBER		365A239	365A235	365A241	365A242
*VOLTAGE FOR CONTINUOUS TORQUE		14	115	8.5	20
PEAK TORQUE	(oz. in.)	1.3	1.5	10.0	16.0
PEAK POWER	(watts)	18	8	50	80
CONTINUOUS TORQUE	(oz. in.)	.5	1.3	4.6	7.0
CONTINUOUS POWER AT 25°C	(watts)	3	7	8.5	16
ANGULAR EXCURSION	(degrees)	60	120	70	50
TORQUE SENSITIVITY	(oz. in./amp)	2.5	23.5	4.6	9.0
MECH. TIME CONSTANT	(msec.)	23	29	20	29
BACK EMF	(V/rad/sec.)	.018	.166	.035	.063
RESISTANCE AT 25°C	(ohms)	65	1900	8.5	25.0
ELECT. TIME CONSTANT	(sec.)	3×10^{-4}	5×10^{-4}	5.5×10^{-4}	2×10^{-4}
MOTOR CONSTANT (K_M)	(oz. in.)	.31	.53	1.58	1.8
ROTOR INERTIA	(oz. in. sec.^{2})	16×10^{-6}	60×10^{-6}	360×10^{-6}	670×10^{-6}
WEIGHT	(oz.)	0.6	2	3.4	4

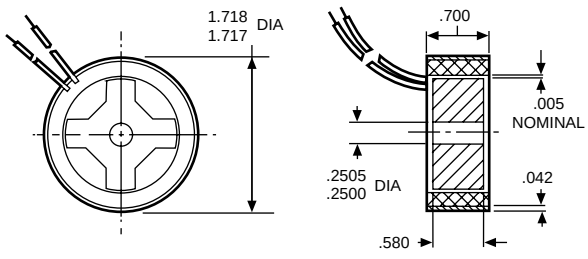
*Unit mounted on 4.00" x 4.00" x .25" min size heat sink, winding insulation rating of 155°C

P/N 365A241



Application: Missile Guidance System

P/N 365A242



Application: Land Track Vehicle Fire Control Mirror Deflector

General

Globe Motors designs and manufactures both centrifugal and positive displacement gear pumps to meet MIL-spec and industrial requirements.

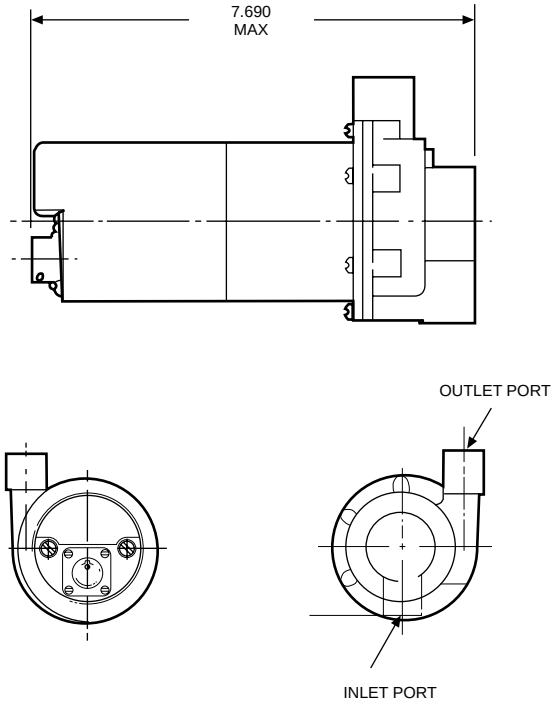
These pumping units are being used as bilge pumps, transfer pumps and fuel pumps in a broad range of applications, handling a wide variety of fluids and fuels. Sealing options are available to meet your needs. The type of fluid pumped and the specific system design requirements determine the pump configuration and the type of seal required.

Our experienced design and application engineers stand ready to assist you with fluid handling solutions; and our vertically integrated manufacturing provides the capability needed to deliver prototypes quickly.

NOTE: For design assistance, contact Globe Motors

Centrifugal Pump

P/N164A286



Application: Land Track Vehicle Transfer Fuel Pump

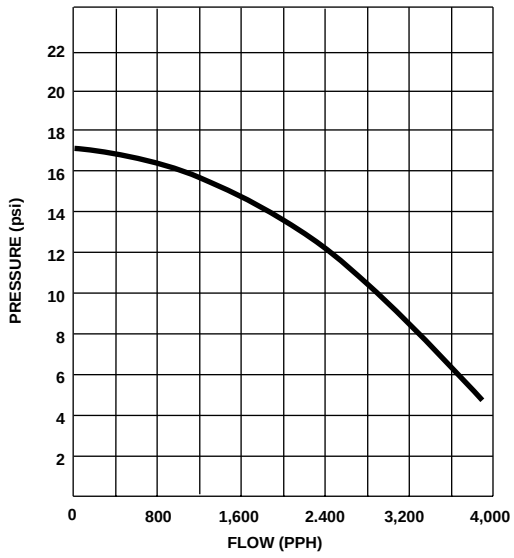
Pump Design: In-Line Centrifugal Pump w/ Magnetic Coupling

Voltage: 18-30 VDC

Rated Performance: 2,400 PPH @ 12 psi. Pumping JP-4

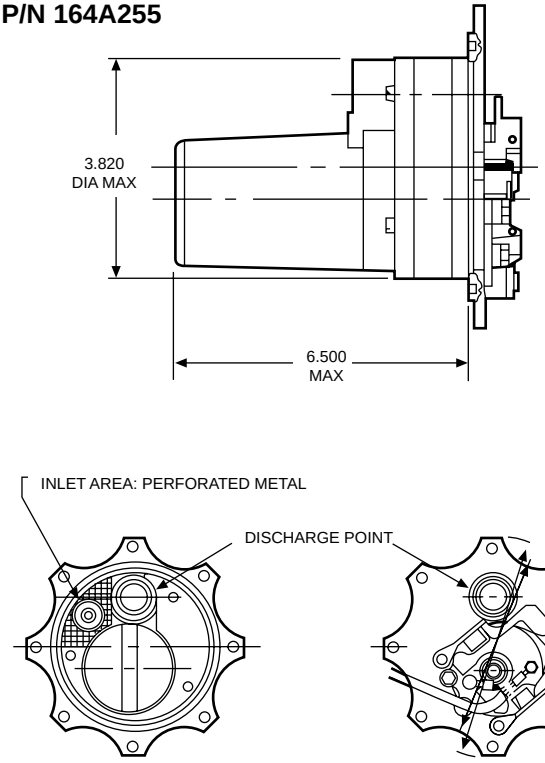
Performance Data

P/N 164A286



NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Centrifugal Pump
P/N 164A255



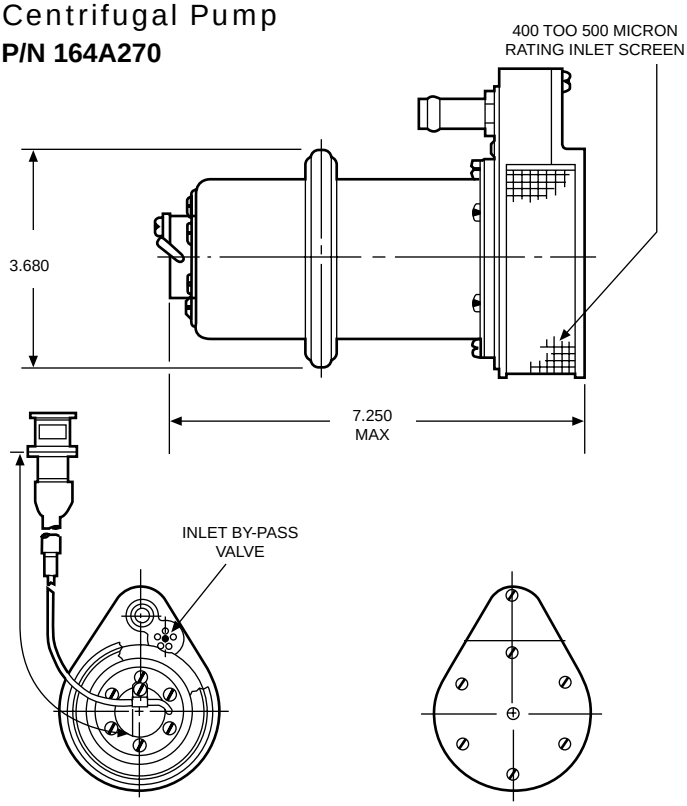
Application: Rotary Aircraft Fuel Boost Pump (motor can be replaced w/o draining fuel tank)

Pump Design: Cartridge-Type Centrifugal Pump w/Magnetic Coupling

Voltage: 28 VDC

Rated Performance: 516 PPH @ 11.25 psi. Pumping JP-4

Centrifugal Pump
P/N 164A270



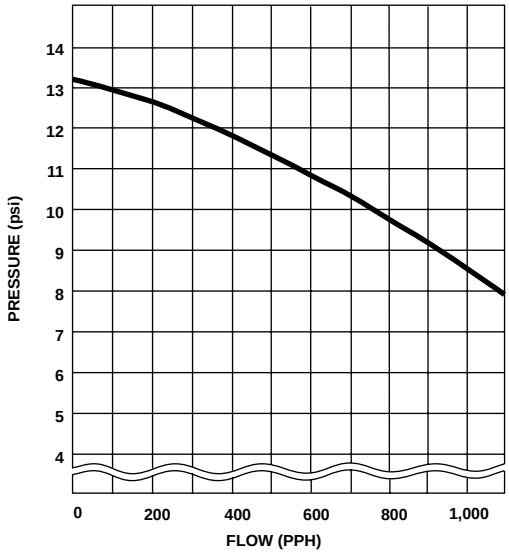
Application: Land Track Vehicle Fuel Boost Pump

Pump Design: Submerged Centrifugal Pump w/Magnetic Coupling

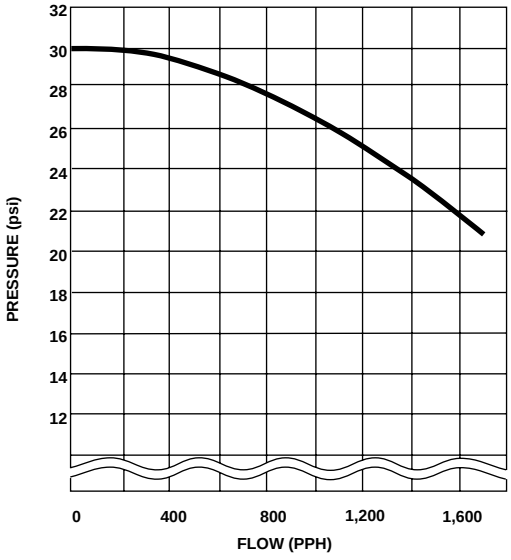
Voltage: 28 VDC

Rated Performance: 800 PPH @ 27.5 psi. Pumping DF-2

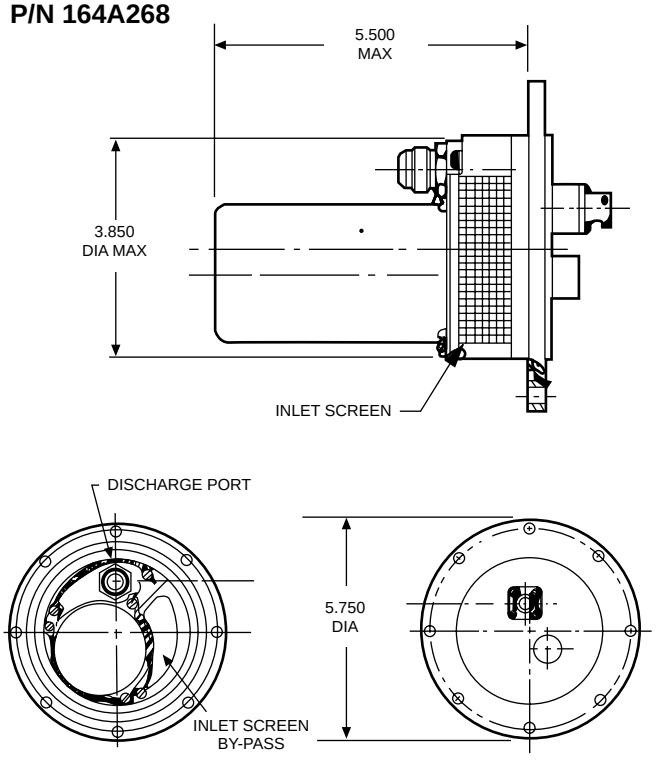
Performance Data
P/N 164A255



Performance Data
P/N 164A270



Centrifugal Pump
P/N 164A268



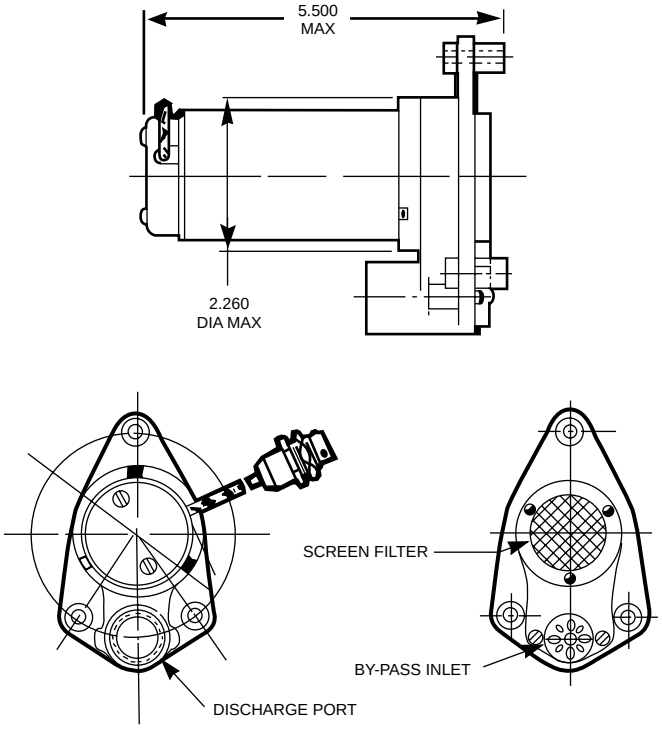
Application: Aircraft Fuel Boost Pump

Pump Design: Submerged Centrifugal Pump w/Magnetic Coupling

Voltage: 28 VDC

Rated Performance: 1,400 PPH @ 16 psi. Pumping JP-4

Centrifugal Pump
P/N 164A288



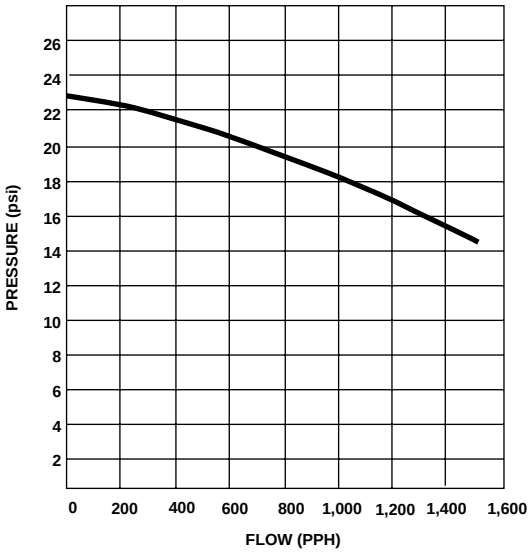
Application: Rotary Aircraft Fuel Boost Pump

Pump Design: Submerged Centrifugal Pump w/Magnetic Coupling

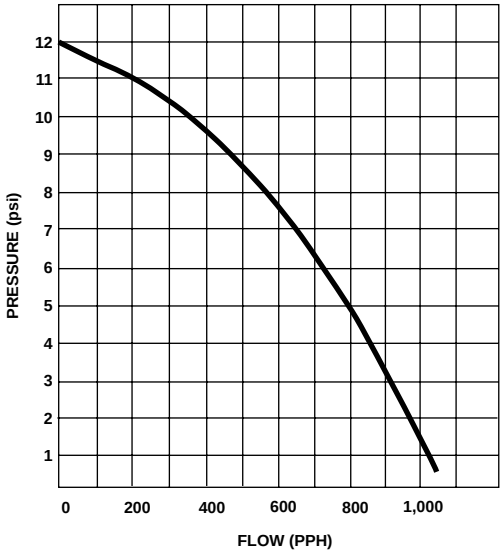
Voltage: 27 VDC

Rated Performance: 400 PPH @ 9.5 psi. Pumping JP-4

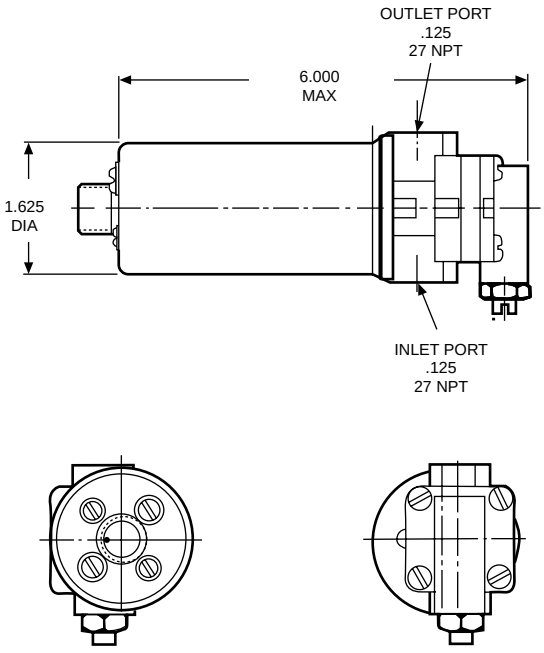
Performance Data
P/N 164A268



Performance Data
P/N 164A288



Positive Displacement Gear Pump
P/N 164A284



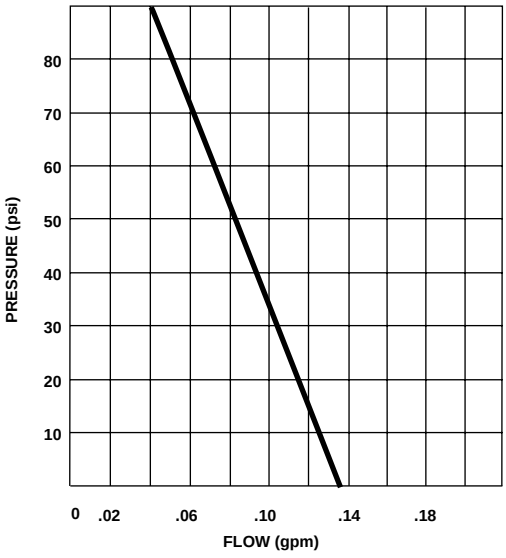
Application: Land Vehicle Multi-Fuel Engine Pre-Heater

Pump Design: In-Line Gear Pump

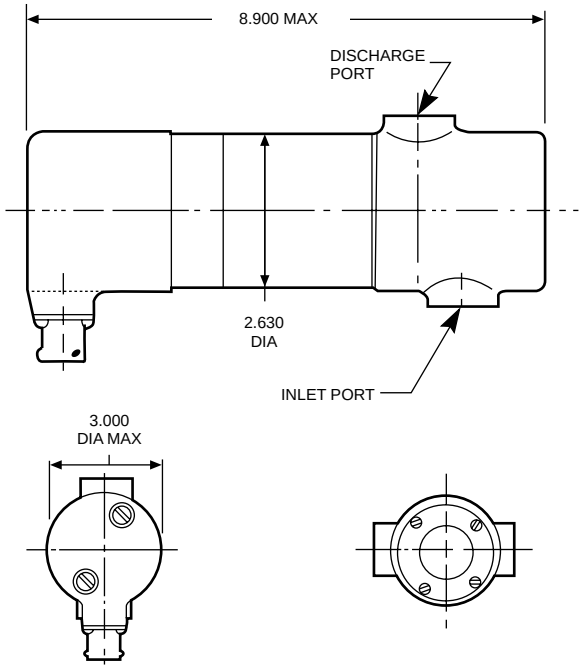
Voltage: 14 VDC

Rated Performance: .05 gpm @ 90 psi. Pumping DF-1 (Intermittent Duty)

Performance Data
P/N 164A284



Positive Displacement Gear Pump
P/N 164A285



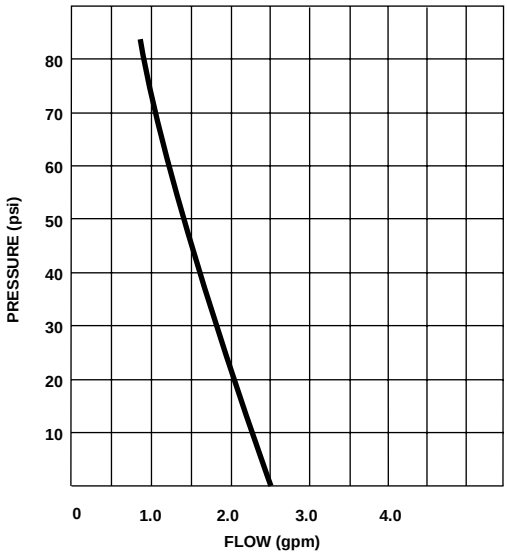
Application: Land Track Vehicle Turbine Exhaust Smoke Generator

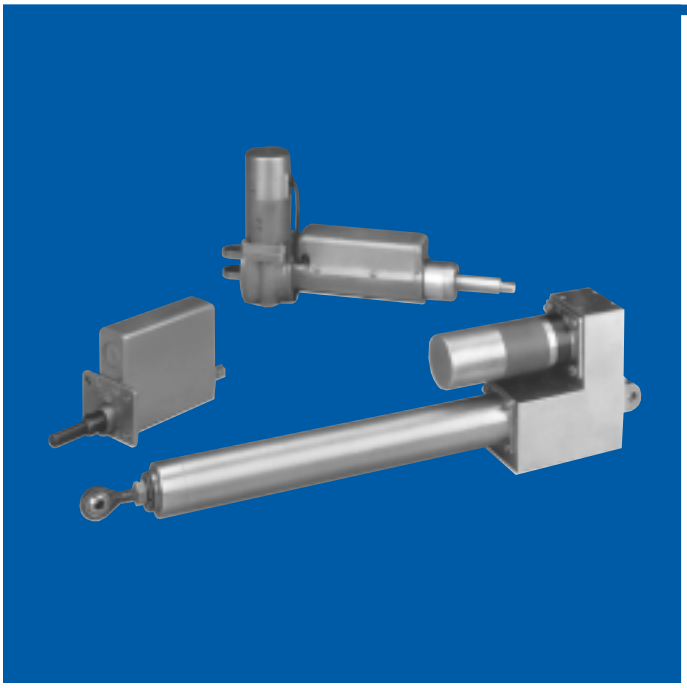
Pump Design: In-Line Gear Pump

Voltage: 28 VDC

Rated Performance: 1.4 gpm @ 62 psi. (Intermittent Duty)

Performance Data
P/N 164A285





General

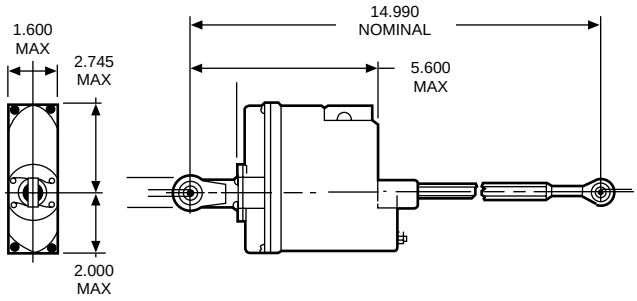
Globe Motors designs and manufactures precision linear actuators to meet both MIL-spec and industrial requirements. Custom designed to meet your specific application, these units offer:

- reliable, consistent stroke
- smooth push-pull linear force
- tension/compression ranges to 3,000 lbs.
- rates of travel to suit your needs, and
- mechanical stops or positional feedback systems

Our experienced design and application engineers stand ready to assist you with motion control solutions; and our vertically integrated manufacturing provides the capability needed to deliver prototypes quickly.

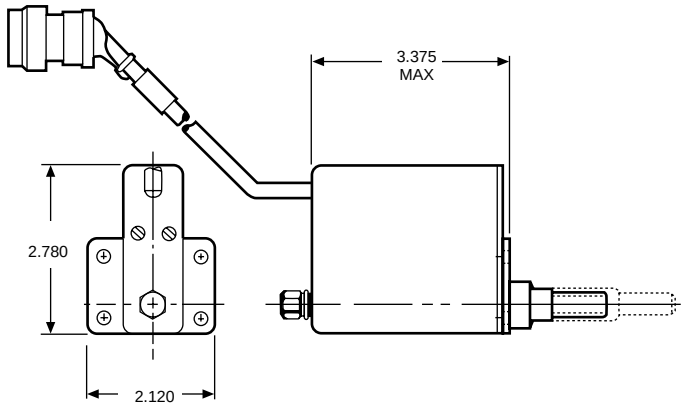
NOTE: For design assistance, contact Globe Motors

P/N 65A201



Application: Aircraft Throttle Control
Nominal Voltage: 28 VDC
Rate: .24 in./sec.
Stroke: 1.5 in.
Rated Load: 7 lbs.

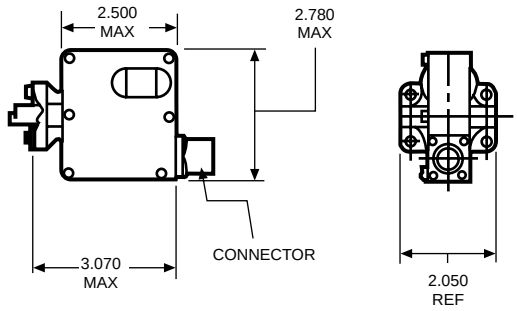
P/N 65A202



Application: Munitions, Safe and Arm Locking Pin
Nominal Voltage: 28 VDC
Rate: 4.0 in./min.
Stroke: 1.0 in.
Rated Load: 300 lbs.

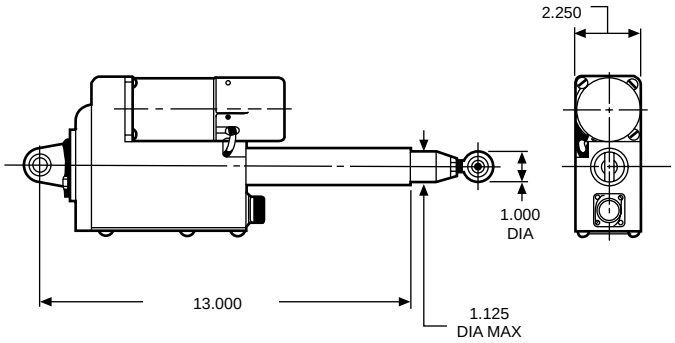
NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

P/N 65A203



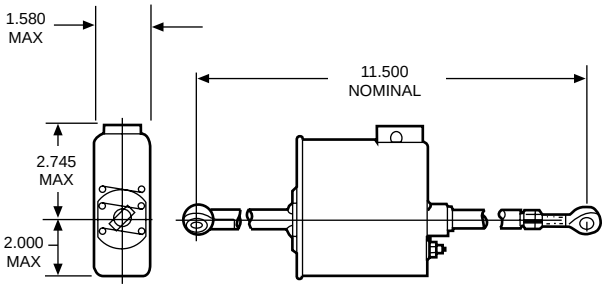
Application: Aircraft Spoiler System (Hydraulic Valve Actuator)
Nominal Voltage: 115 VAC, 400 Hz
Rate: .17 in./sec.
Stroke: 0.125 in.
Rated Load: 300 lbs.

P/N 65A205



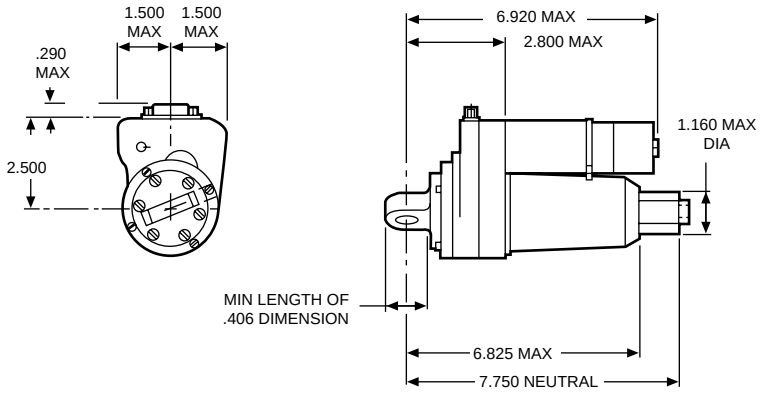
Application: Rotary Aircraft Rescue Hoist Boom Control
Nominal Voltage: 28 VDC
Rate: .4 in./sec.
Stroke: 8.5 in.
Rated Load: 900 lbs.

P/N 65A204

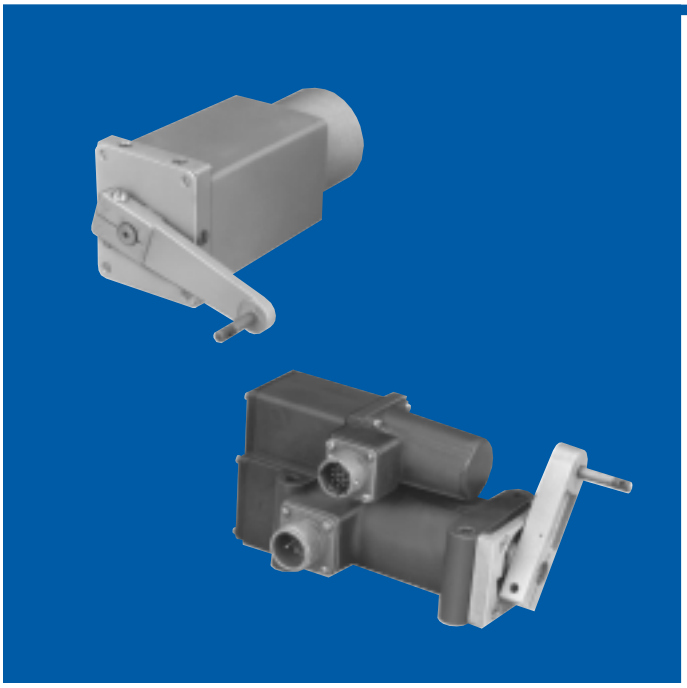


Application: Rotary Aircraft Fuel Control System
Nominal Voltage: 28 VDC
Rate: .19 in./sec.
Stroke: 2.0 in.
Rated Load: 7 lbs.

P/N 65A206



Application: Missile Fin Control
Nominal Voltage: 28 VDC
Rate: 1.0 in./sec.
Stroke: 1.4 in.
Rated Load: 2,880 lbs.



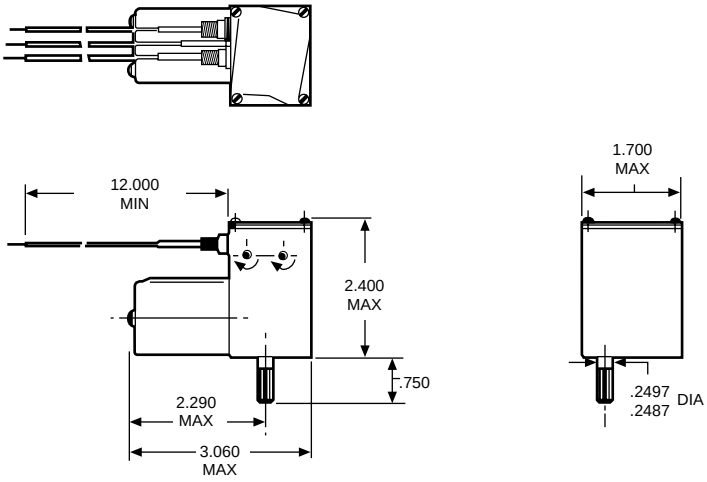
General

Globe Motors designs and manufactures rotary actuators to meet your specific MIL-spec or industrial requirements. All actuators offered are powered by Globe motors, long-recognized for performance quality. The rotary actuators listed here are intended only to provide a sampling of the wide range of units that have been designed and manufactured by Globe Motors.

Our experienced design and application engineers stand ready to assist you with motion control solutions; and our vertically integrated manufacturing provides the capability needed to deliver prototypes quickly.

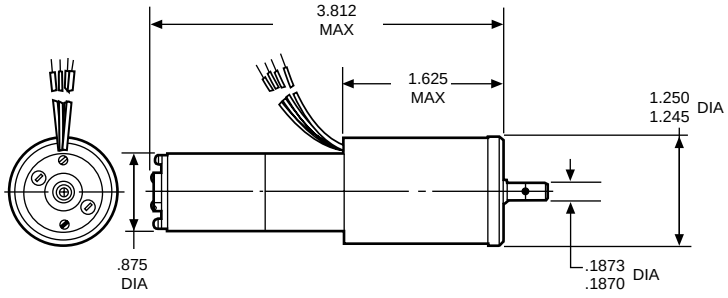
NOTE: For design assistance, contact Globe Motors

P/N 67A353



Application: Jet Engine Hydraulic Valve Control
Nominal Voltage: 26 VDC
Rate: 4°/sec.
Travel: 44°
Rated Load: 10 lb. in.

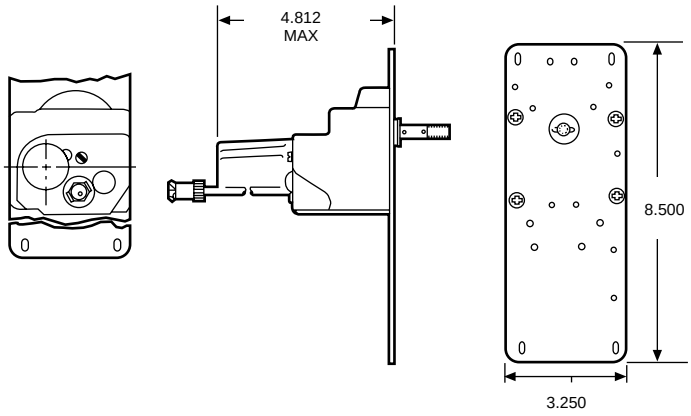
P/N 67A332



Application: Avionics Antenna Coupler
Nominal Voltage: 28 VDC
Rate: 28 rev./sec.
Travel: 16.8 rev.
Rated Load: 2.0 oz. in.

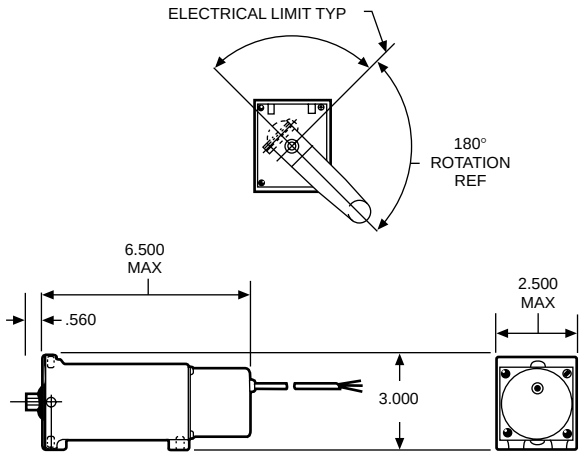
NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

P/N 67A333



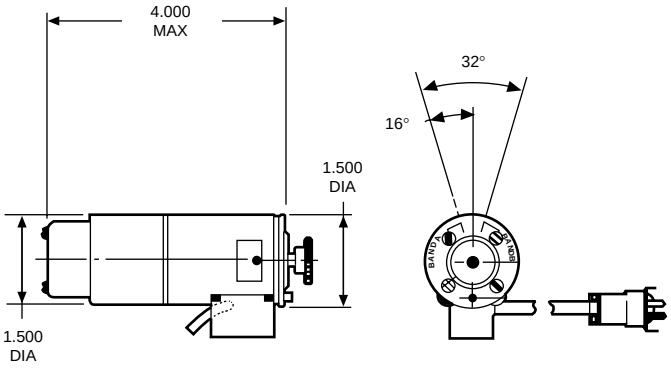
Application: Autopilot Servo Actuator
Nominal Voltage: 24 VDC
Rate: 17 rpm
Travel: Continuous
Rated Load: 15 lb. in.

P/N 67A335



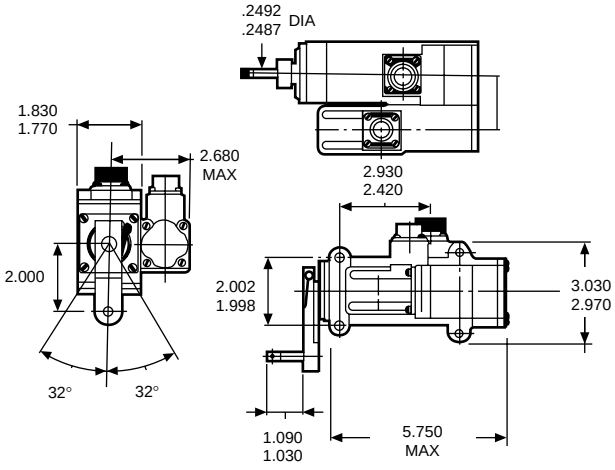
Application: Autopilot Actuator
Nominal Voltage: 28 VDC
Rate: 1.5 rpm
Travel: 180°
Rated Load: 175 lb. in.

P/N 67A334



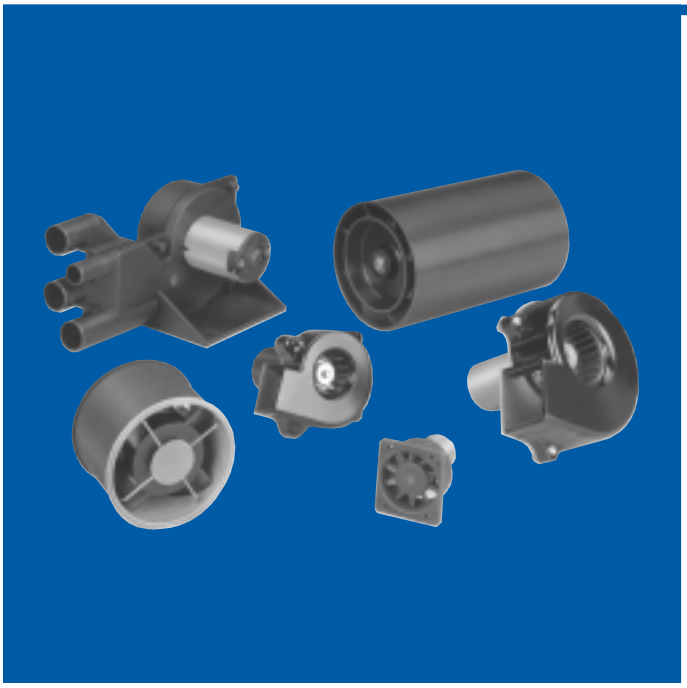
Application: Radio Band Switch Actuator
Nominal Voltage: 22 VDC
Rate: 16°/sec.
Travel: 32°
Rated Load: 85 oz. in.

P/N 67A336



Application: Rotary Aircraft Autopilot
Nominal Voltage: 115 VAC, 400 Hz
Rate: 1°/sec.
Travel: 62°
Rated Load: 10 lb. in.

AC & DC BLOWERS



General

Globe Motors manufactures custom-designed axial-flow and centrifugal blowers to meet MIL-spec and industrial requirements.

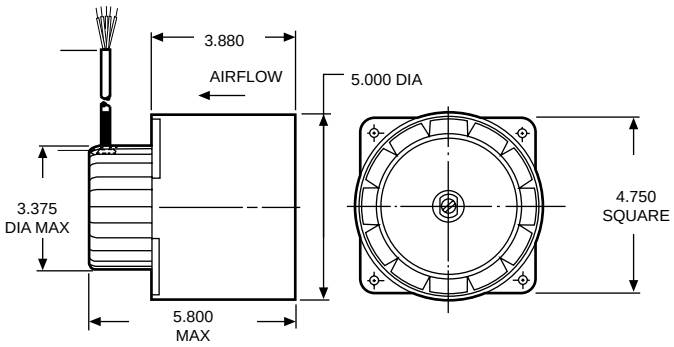
Whether it's a miniature blower for spot cooling of electronic components, or a larger unit with greater air flows for compartment inlet or exhaust venting, Globe can custom design and build the blower that you need. And for reliable, worry-free performance, all blowers offered are powered by quality Globe AC or DC motors.

Our experienced design and application engineers stand ready to assist you with cooling solutions; and our vertically integrated manufacturing provides the capability needed to deliver prototypes quickly.

NOTE: For design assistance, contact Globe Motors

AC Vaneaxial Blower

P/N 19A2931



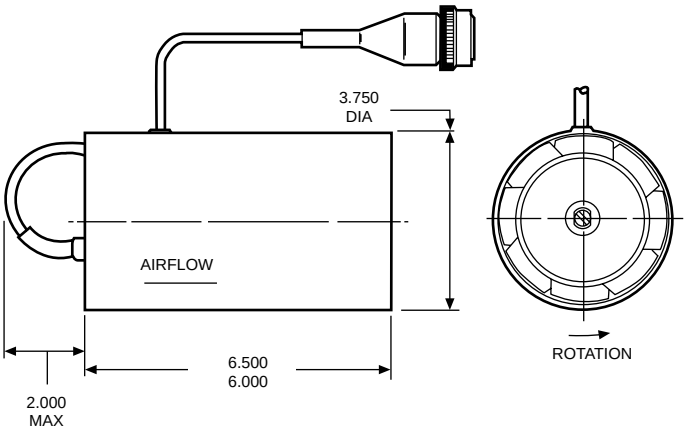
Application: Aircraft Electronic Radio Component Cooling

Input Power: 200 VAC, 400 Hz, 3 Phase

Performance: 800 cfm @ .5 in. H_2O @ 70,000 ft.

DC Vaneaxial Blower

P/N 19A2932



Application: Land Track Vehicle Crew Compartment Ventilation

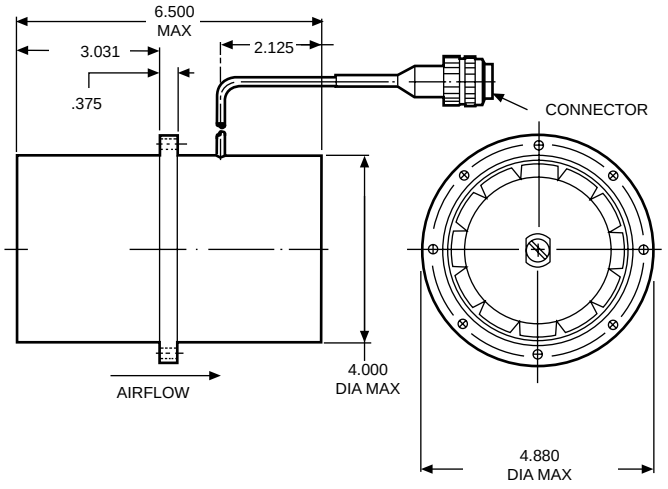
Input Power: 26 VDC

Performance: 100 cfm @ 7.0 in. H_2O

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

AC Vaneaxial Blower

P/N 19A2933



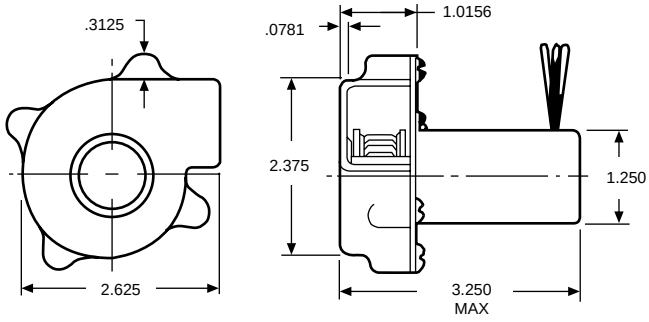
Application: Missile Launch Magazine Exhaust System

Input Power: 115 VAC, 400 Hz, 3 Phase

Performance: 80 cfm @ 3.5 in. H_2O

AC Centrifugal Blower

P/N 19A518



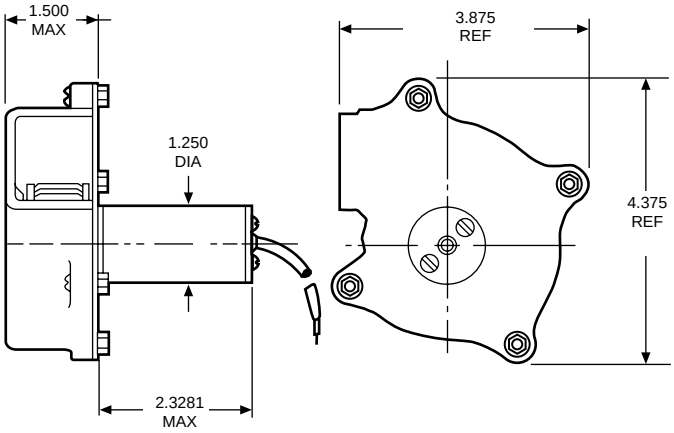
Application: Ground Communication Electronic Component Cooling

Input Power: 115 VAC, 400 Hz, Single Phase

Performance: 17.5 cfm @ free air

DC Centrifugal Blower

P/N 19A1864



Application: Avionics Communication Electronic Component Cooling

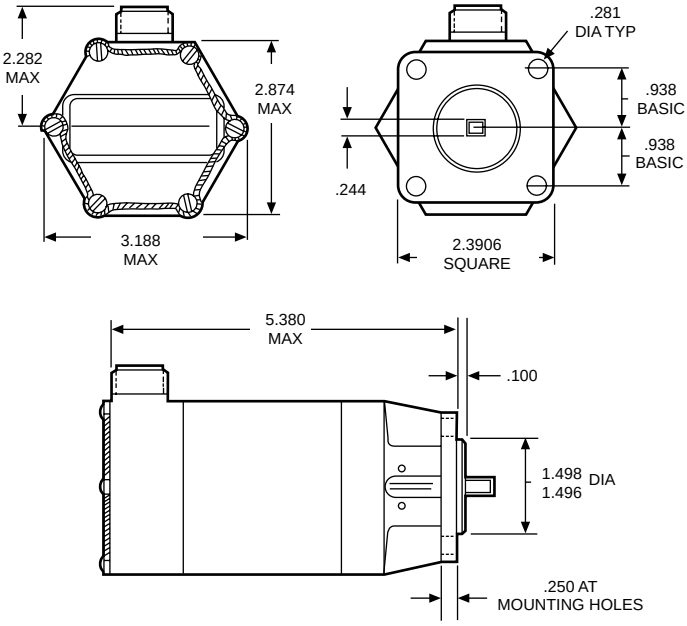
Input Power: 27 VDC

Performance: 33 cfm @ free air

TACHOMETER GENERATORS

Type LC

P/N 22A593



General

The generators shown above are typical designs available on standard orders. Globe Motors' extensive experience in manufacturing precision miniature electric motors and motor-driven devices makes it possible to design and produce generators with the extra characteristics to suit each application. Type LC and YC generators are built to meet MIL-G-5413. Type UC is built to meet MIL-G-26611.

In addition to these special configurations, Globe Motors produces AC generators in basic sizes similar to Type SC and Type MC AC motors.

Please consult Globe Motors for further information or send complete application data for a quotation or engineering recommendation.

Note: For design assistance, contact Globe Motors

voltage: 19.5-21.0 VAC, 3-Phase, 41.67 Hz

speed: 1,250 rpm

rotor: Permanent magnet

bearings: Double-shielded stainless steel ball bearings

electrical load: Three 30 OHM delta-connected

electrical connection: Receptacles per MS 3102-R-14S-7P

life: Test requirement 1,000 hours

mounting: Flange mounting per MS 25038-1

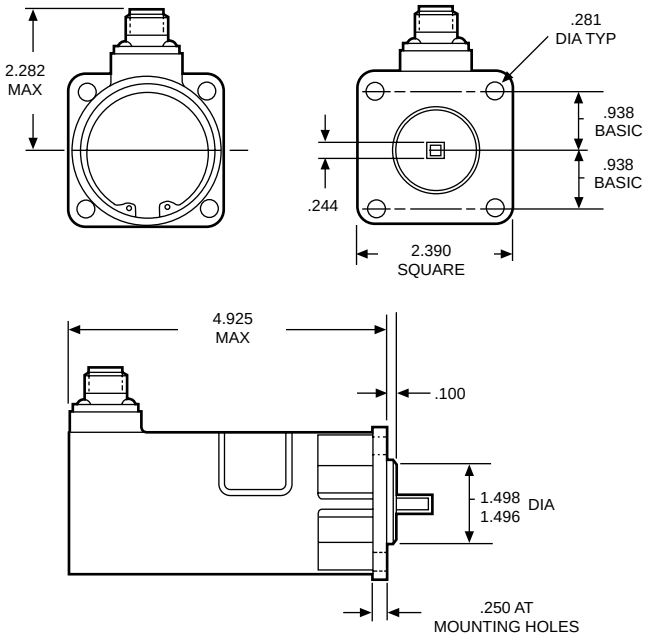
marking: Per MIL-STD-130

qualified to: QPL-5413-22
MS 25038-1

NOTE: Consult factory prior to preparing spec control prints. Dimensions are for reference only

Type YC

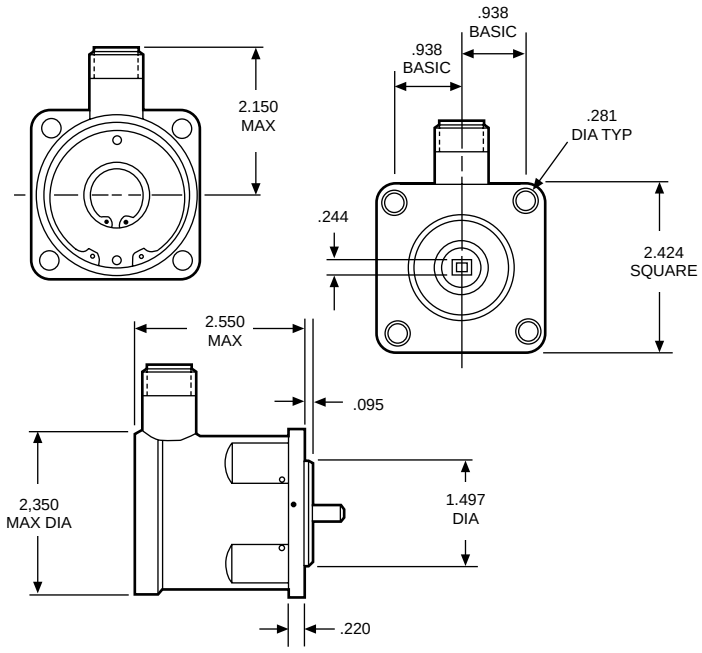
P/N 22A606



voltage: 19.5-21.0 VAC, 3-Phase, 41.67 Hz
speed: 1250 rpm
rotor: Permanent magnet
bearings: Double-shielded stainless steel ball bearings
electrical load: Three 40 OHM WYE-Connected
electrical connection: Receptacles per MS 3102-10SL-3P
life: Test requirement 1,000 hours
mounting: Flange mounting per MS 25038-2
marking: Per MIL-STD-130
qualified to: QPL-5413-22
MS 25038-2

Type UC

P/N 22A703 GEU-7/A QPL-26611-19



voltage: 20.5-21.5 VAC, 3-Phase, 70 Hz
speed: 4,200 rpm
rotor: Permanent magnet
bearings: Double-shielded stainless steel ball bearings
electrical load: Three 40 OHM WYE-Connected
electrical connection: Receptacles per MS 33678-12S-3P
life: Test requirement 1,000 hours
mounting: Flange mounting per MIL-G-26611
marking: Per MIL-STD-130
qualified to: QPL-26611-19
MIL-G-26681
GEU-7/A

CUSTOM MILITARY PRODUCTS

Designed and Manufactured for Quality and Reliability

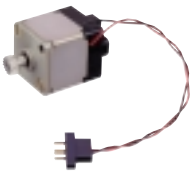
Globe Motors designs and manufactures the highest quality electromechanical devices to control motion systems in a variety of Missile, Manned Military Vehicle, and High Performance Industrial applications.

A broad portfolio of standard products are readily available worldwide through our distribution network, often within 48 hours; however, many satisfied customers routinely utilize our highly vertically integrated custom design and manufacturing capability.

Pictured here is a representative sample of the types of custom motion devices currently in production, each carefully configured to exacting customer requirements.

For quality motion devices, manufactured in world-class facilities, at competitive prices, contact Globe Motors.

- PM & Brushless DC Motors & Gearmotors
- AC Motors & Gearmotors
- Rotary & Linear Actuators
- Centrifugal & Positive Displacement Gear Pumps
- Frameless Brush & Brushless Torquer Motors
- Tachometer Generators
- Vaneaxial, Centrifugal & Tubeaxial Blowers



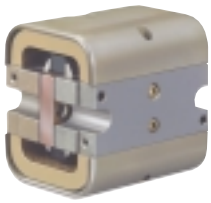
MISSILE
Dual Field of View
Rare Earth Drive Motor

MISSILE
Lens Focus Adjustment
Rare Earth Linear Actuator

FLIR ASSEMBLY
Detector Positioning
Rare Earth Torque Motors

RPV DRONE
Electronics Spot Cooling
1" Cube

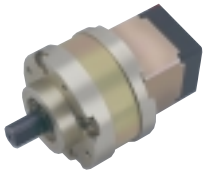
TANK
Centrifugal Fuel
Transfer Pump



MISSILE
Hydraulic Valve Control
Linear Soleniod

TORPEDO
Fin Drive Gearmotor

ARMY GROUND COMMUNICATIONS
Electronics Spot Cooling



AIRCRAFT
Night Vision Mirror
Positioning

NAVY SHIP
Gun Pedestal Stow Pin
Linear Actuator

AIRCRAFT
Engine Tachometer
Generator

MISSILE
Rare Earth Fin Drive Linear
Actuator

MISSILE
Fin Drive DC
Motor

RPV DRONE
Fuel Adjustment Rotary
Actuator

AIRCRAFT
Engine Tachometer
Generator

MILITARY VEHICLE
Diesel Fuel Pre-Heater
Gear Pump

HELICOPTER
Auto PIlot Servo Rotary
Actuator

ARMORED PERSONNEL CARRIER
Breech Exhaust Vaneaxial
Blower

MISSILE
Fin Drive Rare Earth
BLDC Linear Actuator

MISSILE
Gimbal Positioning
Limited Rotation Motor

MISSILE
Gimbal Platform Position
Rare Earth Torquer Brake

HELICOPTER
Fuel Adjustment Droop
Compensator Linear Actuator

HELICOPTER
Hydraulic Valve Control
Rotary Actuator

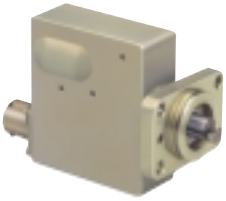
MISSILE
Gyro Spin Frameless Torque
Motor (Brushless)

NAVY SHIP
Electronics Cooling in Long Range
Communications Equipment -
Centrifugal Blower

LASER
Ruby Rod Cooling With Ethylene
Glycol - Centrifugal Pump

MISSILE
Gimbal Platform Position Rare
Earth Frameless Torquer
(Brush Type)

ARMY GROUND COMMUNICATIONS
Electronics Cooling Centrifugal
Blower



MILITARY AIRCRAFT
Spoiler System Hydraulic Drive
Linear Actuator

HELICOPTER
Quick Change In-Tank
Cannister Centrifugal
Fuel Pump

TANK
Smoke Generator Gear Pump

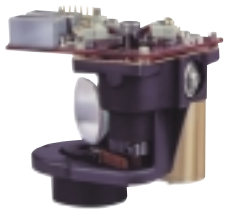
LAND TRACK VEHICLE
In-Tank Centrifugal
Fuel Pump

CRYOGENIC SYSTEM
1/4 W Mini Cooler
BLDC Flywheel

MISSILE
Roll Fin Actuator w/
Tachometer Generator

MILITARY AIRCRAFT
Pilot Suit Ventilation Centrifugal
Blower

HELICOPTER
Auto Pilot Servo Rotary
Actuator



ARMORED PERSONNEL CARRIER
Line of Sight Change Rotary
Actuator/Mirror Assembly

MISSILE
Gimbal Positioning Torquer
With Feedback
Potentiometer

HELICOPTER
Window Defog Vaneaxial
Blower

AIRCRAFT
Cabin Cooling Centrifugal
Blower

AIRCRAFT
In-Tank Centrifugal Fuel
Boost Pump

MISSILE
Governed DC Motor Driving
Wheel Developing IR Signal

LAND TRACK VEHICLE
Cabin Ventilation Vaneaxial
Blower

TANK
Azimuth Drive Actuator

Conversion Factors

METRIC CONVERSION FACTORS

length:
inches x 25.4 = millimeters
inches x 2.54 = centimeters
meters x 39.37 = inches
kilometers x .621 = miles

area:
square inches x 6.452 = square centimeters
square feet x .0929 = square meters

volume:
cubic inches x 16.39 = cubic centimeters
cubic inches x .0164 = liters
cubic inches x 4.33 x 10^{-3} = gallons
cubic feet x .028 = cubic meters
cfm (cubic feet/min.) x .472 = liters/second

mass:
ounces x 28.35 = grams
pounds x .454 = kilograms

force:
ounces x .278 = Newton
ounces x 28.35 = ponds
kiloponds = kilograms (force)

torque:
oz. in. x 72.01 = gm cm
oz. in. x 7.06155 = milli-Newtonmeters (mNm)
oz. in. x .706155 = Newtoncentimeters (Ncm)
Nm x 141.612 = oz. in.
lb.in. x 112.985 = milli-Newtonmeters (mNm)
kilopond meters x 9.807 = Nm

inertia:
oz. in. sec.^{2} x 7.06155 x 10^4 = gm cm^2
oz. in. sec.^{2} x 7.06155 x 10^{-3} = kg m^2
oz. in. sec.^{2} x 386 = oz. in.^{2}
oz. in. sec.^{2} x .1676 = lb. ft.^{2}

pressure:
pascal = Newton/meter^2
1 atmosphere = 760 mm hg @ 0°C
1 atmosphere = 101.3 kilopascals
1 atmosphere = 760 torr
1 atmosphere = 14.7 lb./in.^{2}
inches H_2O x .036 = lbs./in.^{2}
inches H_2O x 25.4 = mm H_2O

fluid flow:
cfm x .472 = liters/second
cfm x 1.699 = cubic meters/hour
gallons/minute x .134 = cfm
gallons/minute x 231 = cubic inches/minute
gallons/minute x 501 = lbs./hr. (water)
gallons/minute x 400 = lbs./hr. (JP4 Kerosene)
gallons/minute x 350 = lbs./hr. (gasoline)

power:
volts x amps = watts (DC)
volts x amps x power factor = watts (AC)
ft. lbs./sec. x 1.818 x 10^{-3} = hp
hp x 746 = watts
oz. in. x rpm x 9.917 x 10^{-7} = hp
oz. in. x rpm x 7.4 x 10^{-4} = watts

WINDAGE LOAD

torque to drive smooth surface cylinder/disk:
torque = 4.7 x 10^{-5} x density x (krpm)^2 x (dia.)^4 x [(5 x len.) + dia.)]
Where:
density = density of air (lbs./ft.^{3} = .075 @ sea level)
krpm = thousands of rpm
dia. = diameter of cylinder in inches
len. = length of cylinder in inches
torque = oz. in.

power to drive fans: (@ sea level)

$$hp = \frac{\text{cfm x water gauge pressure (inches)}}{\text{6,350 x fan efficiency}}$$

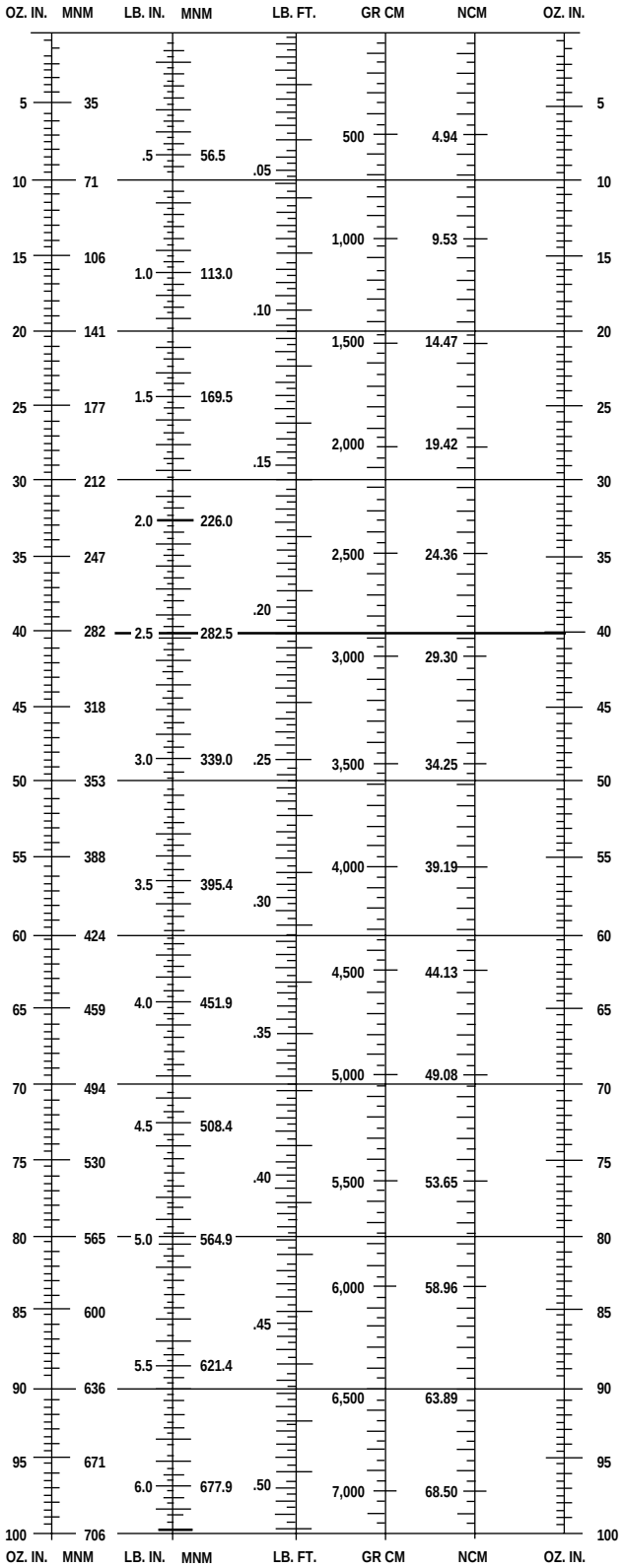
cfm = cubic feet/minute

power to drive pumps:

$$hp = \frac{\text{gallons per minute x psi}}{\text{1,715 x efficiency of pump}}$$

Where:
efficiency = approximately .1 to .5
psi = lbs./in.^{2}

TORQUE CONVERSION CHART



PART NUMBER CROSS REFERENCE INDEX

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19A	Blowers	68 - 83; 96 - 97
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33A	MC Gearmotor	44 - 47
41A	SS Motor	8 - 9
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65A	Linear Actuator	92 - 93
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559A	NB 15 Gearmotor	58 - 63

Abbreviation Standards

hp	Horsepower
W	Watt
cfm	Cubic feet per minute
L/sec.	Liter per second
mNm/amp	milli-Newton meter per ampere
oz. in./amp	Ounce inch per ampere
in.	Inch
mm	Millimeter
gm cm/amp	Gram centimeter per ampere
lb. in./amp	Pound inch per ampere
ft. lbs./amp	Foot pound per ampere
krpm/mNm	Kilo-rpm per milli-Newton meter
oz. in.	Ounce inch
mNm	milli-Newton meter
oz. in. sec.^{2}	Ounce inch second squared
gm cm^2	Gram centimeter squared
gm cm	Gram centimeter
VDC	Volt direct current
VAC	Volt alternating current
kg	Kilogram
lb. in.	Pound inch
oz.	Ounce
gm	Gram
cm	Centimeter
rpm	Revolution per minute
amp	Ampere
kHz	Kilohertz
µF	Microfarad
wvac	Working volt alternating current
psi	Pound per square inch
V/rad/sec.	Volt per radian per second
PPH	Pound per hour

Other Globe Motors Products Available

9001 ISO CERTIFIED 9000 QS CERTIFIED

Globe Motors' complete line of subractional DC and brushless DC motors and gearmotors are standard solutions for automotive, medical, industrial, business equipment, defense, aerospace, and other high-performance applications.

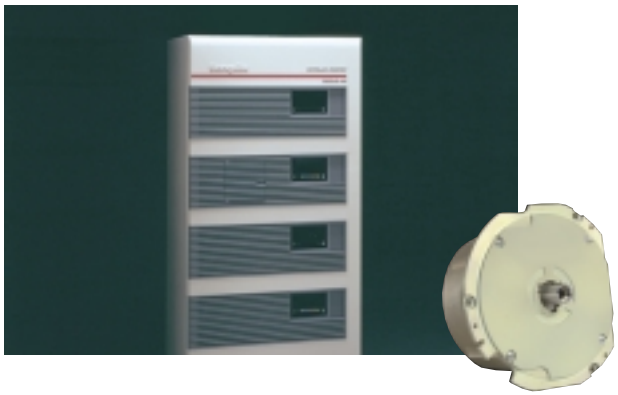
Globe's building-block approach to design enables customers to choose from an array of options—high-torque planetary geartrains and spur gear reductions, ceramic and rare earth magnetics, feedback systems, insulation and bearing types, as well as lead wire and terminal options.

With an impressive portfolio of motors and gearmotors, actuators, commercial cooling fans, blowers, torquers, and pumps, Globe Motors has the capability to solve the toughest motion control challenge.

Specifications for Globe Motors products are available immediately on our web page at:

http://www.globe-motors.com

Or, you can request a copy of other Globe Motors catalogs and literature by returning the postage-paid reply card at the back of this catalog.



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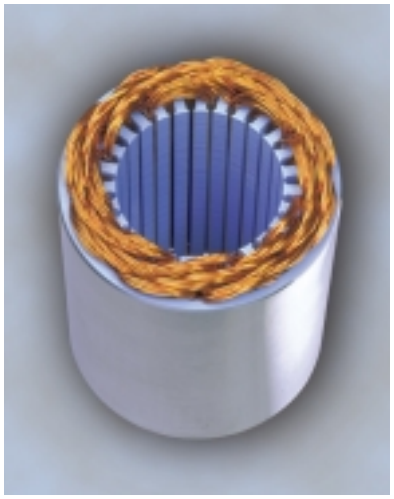
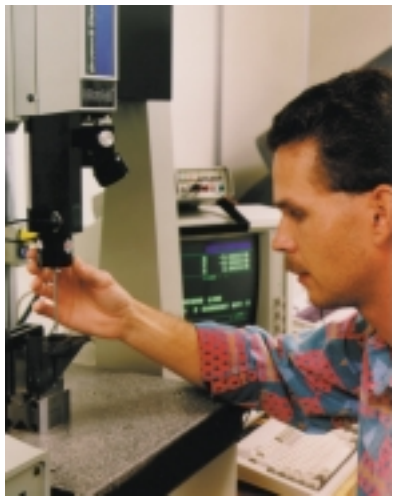
GLOBE MOTORS SOLUTIONS MEET THE HIGHEST PERFORMANCE STANDARDS

Globe Motors™

Manufacturing Plant
Dothan, Alabama





For over half a century, the Globe Motors name has meant turnkey, motion control solutions for automotive, aerospace, industrial, defense, business equipment, medical, and other high-performance applications.

Globe Motors' application engineers are experienced in reviewing requirements and identifying one of our standard solutions. When needs are unique, Globe's engineering team works with you to create the optimal design for your custom product.

Globe's motion control assemblies can be designed by our experts to increase durability, reduce weight, decrease size, lower cost, or other custom requirements based on your design criteria. Globe's assemblies can also be specified to survive environmental stresses such as high and low temperatures, shock and vibration, and altitiude or pressure extremes.

Put the Globe Motors' team on your next product.

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