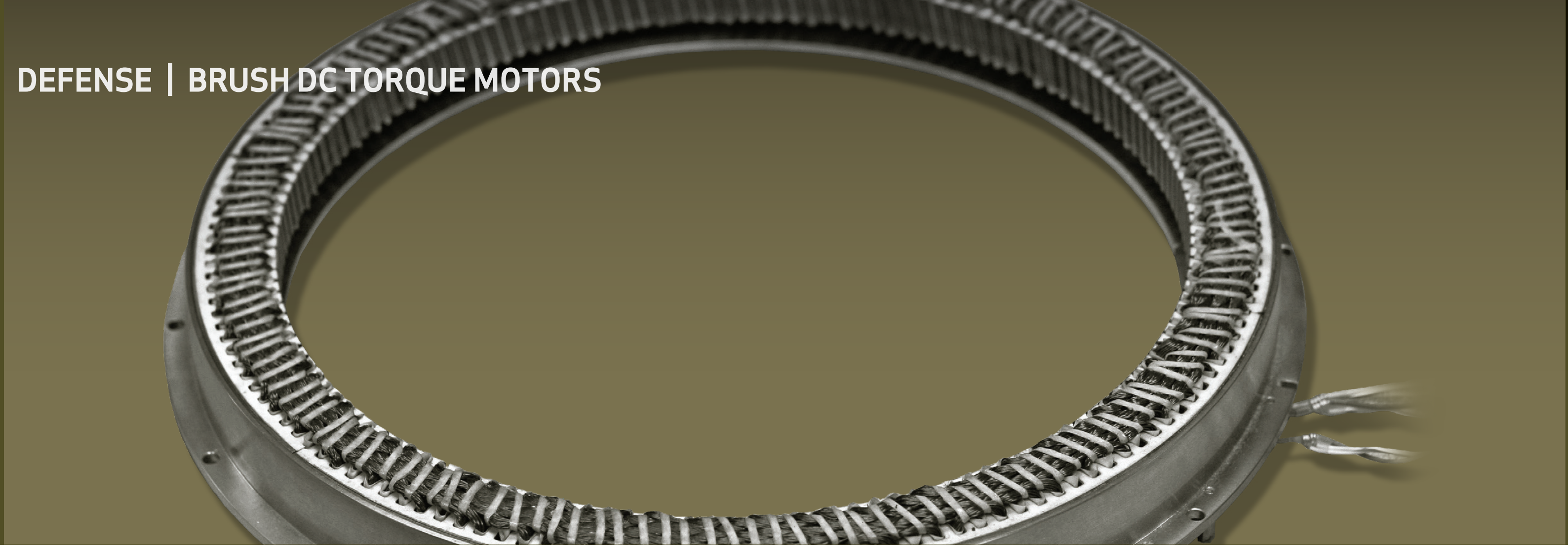
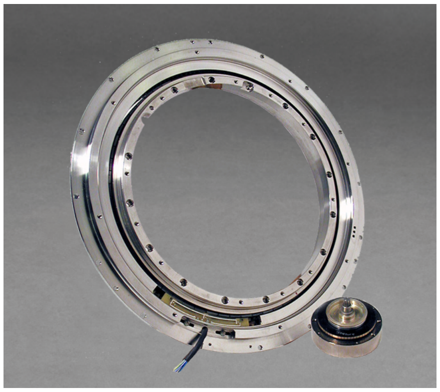


BRUSH DC TORQUE MOTORS



Moog designs and manufactures precision motion technology components and subsystems for defense, aerospace and industrial applications.

Our specialty DC brush torque and servomotors can be supplied housed with a variety of shaft configurations but typically as a direct drive rotor / stator part-set that will be directly attached to the load. This form of attachment eliminates backlash and increases servo stiffness for an optimized direct drive system.

DC torque motors are used in applications that require high torque at slow speeds with input power minimized. Our DC servomotors are used in applications that require high speed and positional accuracy. Custom controllers can be supplied on a design-to-specification basis.

FEATURES

- Double insulated high temp magnet wire minimizes leakage current, promotes superior insulation
- Molded brush block assembly features interchangeable brush blocks, optimizing brush position on commutator. Brush contour is done on automatic tooling rather than "run-in" individually.
- Brushes mechanically fastened to brush spring in addition to soldering assures brush alignment during soldering operation plus proper mechanical and electrical bond between brush spring and brush.
- Stable high temp encapsulation material minimizes movement or working of windings under large temperature variations. This high temp material will not crack under temperature variations, and eliminates voids, exposed windings and humidity traps.
- Special magnetic material alloy allows higher torque per unit of volume, higher torque to inertia ratio.
- Plated magnet assemblies resist environmental extremes and require no special handling
- Rare earth magnets typical
- High torque and low speed
- High torque to inertia ratio
- Low speed with high accuracy
- Compact
- Large axial holes through armature for easy application to shafts and bosses

TYPICAL APPLICATIONS

- Speed and rotation control systems
- Gimbals for FLIR and inertial navigation systems
- Stabilized gun and fire control systems for combat vehicles
- Fire control radars for land and shipboard defense
- Cockpit instrumentation for military and commercial aircraft
- Space and vacuum instruments, actuation systems and momentum wheels

BRUSH DC TORQUE MOTORS

Design Considerations
All diameters listed have finished, ground lamination surfaces. They can be complemented with rings and hubs for mounting convenience.

Moog torque motors are normally delivered in kit form.

If you require integral bearings such as, a cartridge assembly containing a torquer motor and synchro, potentiometer or similar component, we can design the entire assembly to your mechanical dimensions and performance requirements.

Mounting Considerations
Since torque motors are normally delivered in kit form, you provide the mounting surfaces and bearings. When you design the mechanics of the mount, be sure to observe these rules:

1. Eccentricities from the inner member mounting surface should not exceed 0.002 inches for Alnico designs and 0.004 inches for rare earth motor designs.

2. Surfaces in contact with the permanent magnet portion of the motor must be non-magnetic.

3. The bore of the mounting surface should be perpendicular to the mounting seat within 0.001 inch for Alnico designs and 0.002 inches for rare earth designs.

Electrical Considerations
For each mechanical configuration shown, different winding designs to modify torque, torque sensitivity, DC resistance, and so on, can be supplied by Moog to suit your special system requirement. In each case, you have the option of selecting one of the existing designs or specifying a new winding designed to meet your special requirements. If your power source (voltage or current) is limited, the mathematical relationships shown in Table 1 will allow you to calculate a particular performance characteristic at the voltage or power capability of your existing power supply.

The following frame sizes represent only a small sampling of the total range manufactured. Consult factory for additional designs. Refer to our online documentation for product updates.

- Brush torque motors range from 1.125 to 10.2 inches O.D.
- Tachometers range in similar configurations and specifications.
- Torque motors and tachometers are designed to meet the requirements of MIL-E-5400.
- All published parameters are considered nominal (25°C) unless otherwise specified.
- We are currently tooled on some items to house the torque motor on its own bearings and incorporate, if required, a potentiometer and a tachometer.
- Windings can be modified for specific applications.

Brush type DC cube servomotors are also available from Moog.

Conversion Factors
For convenience of calculation or comparison, the following constants are provided for rapid conversion to or from the units Moog uses to express torque motor parameters.

TABLE 1

Parameter	Symbol	Units	Relationship To Published Parameter
Electrical Time Constant	τ_E	ms	L_M / R_M
Mechanical Time Constant	τ_M	ms	$J_M \bullet R_M$ $K_E \bullet K_T$
Power Input, Stalled At Peak Torque (25°C)	P_P	watts	$V_P \bullet I_P$
Viscous Damping Coefficients Zero Source Impedance Infinite Source Impedance	 F_O F_I	 oz-in per rad/s oz-in per rad/s	$K_T \bullet K_E$ R_M Small % of F_O
Motor Friction Torque (Actual)	T_F	oz-in	T_F
Maximum Power Rate	P	oz-in / s^2	T_P^2 / J_M
Maximum Theoretical Acceleration	$\propto_M$		T_P / J_M
Theoretical No Load Speed	ω_{NL}		V_P / K_E

[1] T_F is specified as a maximum value and includes brush friction, magnetic detent and test fixture bearing friction which is considered negligible.

[2] In cases where motor is to be operated at some voltage less than V_P due to power supply limitations the new ω_{NL} becomes V_A / K_E where V_A = voltage applied.

CONVERSION TABLE

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