Feature: Motion Control

Brush cartridges advance dc motors

By Mike Lefebvre

Since the primary cause of failure in brush-commutated dc motors over time is ongoing brush wear caused by the interface between brush and commutator, manufacturers have sought to slow the wearing process by targeting brush assemblies, brush size and brush materials.

New materials are creating ever-smaller motor packages

The traditional method for mounting brushes in dc motor assemblies has been to solder the brushes onto standard cantilever springs to enable the required constant contact with the commutator. The conventional spring design, however, exhibits inherent drawbacks as force levels diminish over time, often resulting in premature motor failure.

This problem can be overcome by housing brushes within a specially designed cartridge and utilizing torsion springs to ensure desired even force over the life of a motor.

The cartridge brush assembly fits into the motor base and consists of a two-piece, high-temperature plastic snap-together assembly in which each of two brushes is seated securely within its own specially constructed slot.

This cartridge design restricts the brushes to traveling in a track in a desired linear motion. The design further can provide for an ideal region of pressure for brushes to withstand the detrimental effects of mechanical wear.

The introduction of the "SuperBrush" (in selected Pittman brand brush-commutated dc motors) has paved the way for potentially longer brush life. "SuperBrushes" contain 60% more brush material and offer the correlated potential for longer motor life compared with smaller (and quicker-wearing) conventional brushes.

Several sizes of dc brush motors are available.

An increasing variety of alternative brush materials can be specified as another means to help prolong effective brush life. Electrographitic is one among many relatively new (and durable) brush materials now offered by manufacturers in addition to standard copper graphite brushes to curb the problems associated with brush wear. Combinations of materials can be engineered for optimal life and electrical characteristics. Selecting the right brush material for each specific application can optimize overall motor life.

As end-products get smaller, so do the "envelopes" for the motors. The irony is that while small brush dc motors offer minimal room to house components, the demand for power output associated with larger motors is unrelenting.

As an example illustrating one way to realize power from small-diameter motors, manufacturers increasing turn to extended motor lengths to deliver more continuous torque.

Other benefits from added motor length are the capability to dissipate more heat at a faster rate than is possible with shorter motors (which, in turn reduces the potential for undesired heat buildup) and the availability of expanded room to house components.

Advances in materials have further enabled designers to keep motor performance levels high in ever-smaller motor packages. An example is our pending thinner bonded neodymium magnet in development for introduction this year in selected series of brush-commutated dc motors, which can provide both design and performance advantages.

Two-pole permanent magnet stators in brush-commutated dc motors generally are constructed of ceramic magnets (which are enclosed in heavy-gauge steel return rings). The new thinner bonded neodymium magnet is more powerful but takes up less space than conventional ceramic-only types.

This impacts positively on the development of specially adapted armatures. The availability of smaller, thinner magnet materials allows for larger-motor armatures to be designed into smaller motor frames. This can imbue a small motor with a capability to produce more continuous torque and, consequently, more power.

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Circle DPN 323

A SuperBrush dc motor with a referenced cartridge assembly in the foreground with two larger-than-usual brushes visibly protruding.