

Novak Electronics Inc.

17032 Armstrong Ave, Irvine, CA 92614

Web: www.teamnovak.com

April 2011

BENEFITS OF AN EPOXY-DIPPED STATOR

Lately racers are realizing that there is tremendous value in epoxying the wound stators in brushless motors under extreme racing conditions. The following article will explain the benefits and science behind this manufacturing technique, and help you decide if purchasing a Novak epoxy-dipped wound stator is right for you and your racing style.



The Novak 540 Epoxy Dipped Stator (#S6617E)

Benefits of Epoxy

Due to torque and vibration created by the alternating current during operation, brushless motor stator coils are subjected to very high mechanical forces under typical racing conditions. Picture it as a super-fast and very forceful tug-of-war between the coils and the magnets. This constant pulling and pushing of current through the coils causes the coils to move in sync with the drive frequency. This force increases as the load on the motor increases.

The [Novak Ballistic 540 Brushless Motor - 17.5 turn](#) has a Kt value (*oz-in of torque per amp of current*) of approximately 0.7 amp. During normal acceleration, the motor draws about 100 amps. This translates into 66 oz-in (or 4.1 lb-in) of torque in a Ballistic 17.5T motor—based on a 95%-efficient motor and an equal and opposite reaction of force in the coils. (For more information on this physical law, review [Newton's Third Law of Motion](#)).



The Novak Ballistic 540 Brushless Motor

Imagine 4.1 pounds of force pushing on the motor's coils. Over time, this movement will cause some damage to the coils. In order to improve the motor's reliability, and possibly extend its life, the stator is epoxy dipped.

Dipping them in epoxy provides the windings with an additional degree of mechanical strength, particularly in the unsupported end wind. The coils are also strengthened where they enter the slot of the stator, in order to resist the tug-of-war forces caused by the torque reaction described above.

In other words, the epoxy coating prevents coil movement caused by the changing magnetic fields created during motor operation. It is ideal to prevent the stator wires from rubbing against each other, because this vibration can eventually wear out the insulation coating, causing a short in the coil and motor failure.

Thermal Benefits

Another advantage of an epoxy-dipped stator is that it also displaces air (which is a barrier to cooling) from inside the coil, and replaces it with resin. This is superior because it improves the thermal conductivity of heat from the inside of the windings, to the lamination on the *outside* of the windings. And since the laminations are on the outside, they also help to dissipate heat into the ambient air. Epoxy dipping the stator will help it to transfer heat and perform better.

In fact, an epoxy-dipped stator is 7.8 times better in heat conductivity than air. And one dipped in epoxy with thermal additives makes it a whopping 73 times better (Novak is currently researching this option). See the table below.

Thermal Conductivity (W/m °C)*	
Air	0.024
Standard Epoxy	0.188
Epoxy with Thermal Additive	1.700

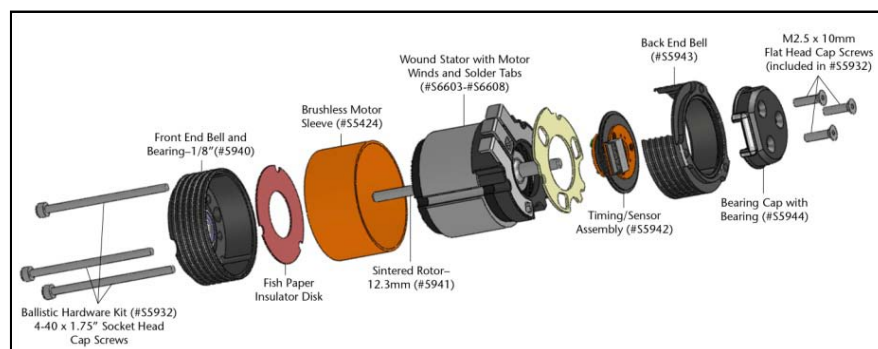
*(1W/m °C = 0.5779 Btu/(ft-hr °F))

Additional Benefits

Finally, having a Novak epoxy-dipped stator will provide a degree of environmental protection against moisture, as well as improving the electrical insulation between the winding and the stator.

Clearly the advantages of having an epoxy-dipped stator are many: It reduces damaging vibration in the coils, adds strength to the end winds, helps to keep the motor cooler, provides protection against moisture and improves the electrical insulation.

Driving your vehicle with a Novak Epoxy-Dipped Stator should help your motor's reliability and lead to many more laps around the track. Have fun racing!



The inside of a Novak Ballistic 540 Brushless Motor

To learn how to replace a wound stator by watching Novak's YouTube video, [click here](#).