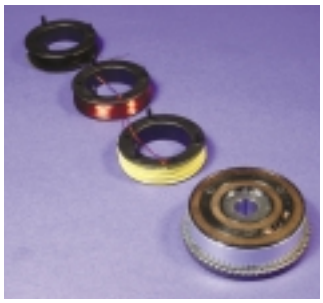
Feature: Motion Control

Vehicle tailgates keep moving with customized coils



Electromagnetic clutch from bobbin to clutch assembly.

By Adrian Carson

To make the vehicles we drive safer, better performing and more convenient to operate, auto manufacturers have added an increasing number of electronically controlled systems and devices. In many of these systems, a key component linking the "logical" world of electronic signals to the "mechanical" world of gears and levers is an electromagnetic coil. And, while coils or solenoids are a familiar and well proven technology, ensuring that they meet all specs for performance, reliability and manufacturability requires specialized expertise and close teamwork among the designers, component manufacturers and assembly manufacturers.

Polymer Technologies (polymer.ca) is a Tier II automotive supplier based in Cambridge, ON, that specializes in building parts for other electrical and electromechanical component manufacturers. In 2003, Polymer began tooling up to make an electromagnetic clutch to be used in a power-operated tailgate for a new generation of SUVs built by a major North American automaker. These tailgates were designed so the driver can open or close them from a switch mounted on the dash, or via a remote activator on a key fob.

The design called for a clutch that engages when the gate is opened or closed by an electric motor. When the clutch is disengaged, the motor and gear train are disconnected from the tailgate so it can be moved freely by hand. The core of the clutch is an electromagnetic coil mounted in a metal housing. The clutch is engaged when an electric current flows through the coil, creating a magnetic force that pulls the two faces of the clutch firmly together.

Polymer Technologies needed a special coil winding to be built into this part. Demands were stringent: not only must the clutch coil be able to operate reliably at ambient temperatures ranging from -40° to 80°C, but must also be capable of withstanding severe shock and vibration and to function reliably for over 40,000 operating cycles. "As well as meeting our customer's temperature and shock plus vibration requirements, we wanted a coil that was considerably smaller than the ones that had been used previously in similar assemblies," said Mike Stevens, Polymer's program manager for the product. "Off-the-shelf items were out of the picture, so we turned to TransERA Electronics for a solenoid specifically engineered for this application."

Figure 2: Core winding facility at TransERA-plant in Waterloo.

One issue that was of particular concern was ensuring that the coil windings would stay firmly in place on the supporting bobbin. It was found that under extreme temperature and vibration conditions, loosely wound coils could slide around the bobbin, straining the wire near the connectors until they failed. Fixing this required changes to the bobbin design and the development of a special variable-tension winding technique. Protective tape was applied around the coil to keep the conductor firmly in place for final assembly.

TransERA also needed to ensure that "zero-defect" product quality would be maintained faultlessly as production ramped up to over 400,000 units per year.

"The requirements for this product were among the most stringent we have ever encountered," underlined Michael Ritchie, vice president and general manager of Polymer. "The development process wasn't always easy, but we had an excellent partner in TransERA. If all suppliers were this helpful in going the extra mile, projects would go much more smoothly."

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