

eMobility fluids

Early collaboration and relevant fluid testing reduce risk and can give a real competitive edge to automotive engineers as time-to-market is compressed

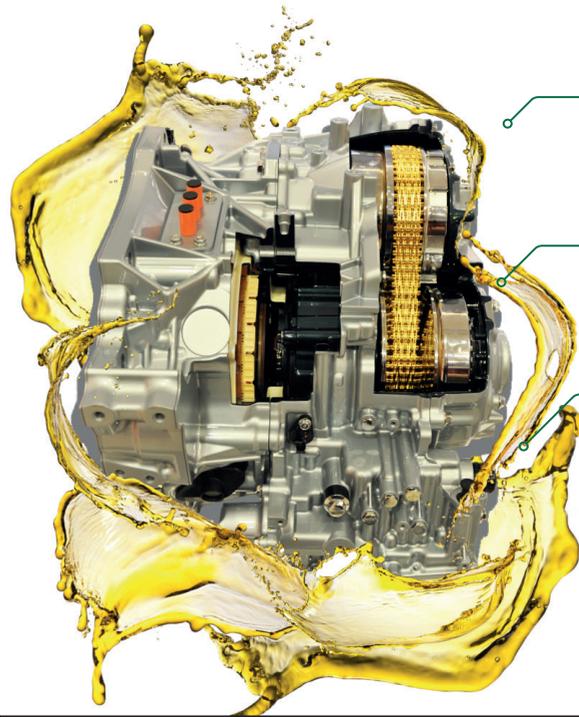
▶▶ As the electric revolution intensifies, automotive hardware is advancing at an unprecedented pace, bringing greater risk of product recalls, warranty claims and field issues. Accelerated development leaves many questions unanswered – including which performance additives and resulting transmission lubricants to use.

The realistic testing of custom-engineered lubricants, using appropriately balanced additive chemistry, can enhance hardware performance and mitigate risks. However, the few available tests for electrical properties of lubricants are largely unproven in this arena. Most come from other applications, such as stationary power transformers, and it's unclear whether results are relevant to eTransmissions. Which conductivity test conditions are applicable to electric devices? Are hybrids different in this respect?

Without sufficient time for extensive real-world field trials, proven lubricant tests are essential for generating more reliable answers for engineers. Pioneering OEMs need to support their hardware designs with tailored testing: quick, relevant and reliable performance tests that are cost-efficient and able to be independently verified.

Partnering with oil marketers and additive specialists is the solution, although few organizations possess the expertise, test rigs and labs to deliver results fast. Having developed hundreds of OEM-specific testing solutions over the years, Afton Chemical has been quick to identify and solve key eMobility fluid challenges.

"The question is, how will lubricants interact with electrified parts" asks Chris Cleveland,



ABOVE: THE NEW FLUID CHANGES THAT COME WITH ELECTRIFICATION

research and development manager at Afton. "Safety is a priority, as is protecting the electromechanical component function. Lubricants that prevent electrical fields from diffusing can also provide efficiency gains."

Electrical properties are one of the least well-defined aspects of eMobility lubricants. New hardware needs a tailored solution, but it's not simple: temperature plays a major role and as fluids age, polar oxidation products and metal wear particles can elevate conductivity beyond the initial limits.

"Fluid compatibility is the next concern, electrified drivetrains include conductive rare metals and copper, such as in control system sensors and eMotors. Solder and protective coatings also need to be factored in," adds Cleveland.

Incompatibility can cause untold component damage, and the risk is exacerbated by lower viscosity fluids designed to drive further fuel economy gains. Thinner lubricants offer less film protection, making higher additive concentrations necessary to protect both gears and bearings. This can increase the likelihood of chemical incompatibility with electronic parts. Striking the balance between low viscosity and compatibility requires expertise and appropriate testing.

With fluids thinner than water at room temperature, and eMotors running at more than 20,000rpm, the electrical, compatibility and thermal demands on fluids must also be complemented by effective foam control.

"There's also thermal stability to consider," explains Cleveland.

ELECTRIFIED PARTS

- Fluid electrical properties
- Low conductivity for safety
- Low dissipation for efficiency
- Consistent in aged-fluid

METALS AND COATINGS

- Fluid compatibility with:
 - Solder
 - Copper
 - Rare metals
 - Coatings

HIGH SPEED AND TEMPERATURES

- Thermal conductivity
- Heat capacity
- Oxidative stability
- Foam prevention

"Today's electric motors run faster and hotter than ever before. Sumps are smaller and transmissions are more enclosed, so temperatures rise. Only a fluid with both high heat capacity and good thermal conductivity will dissipate heat effectively without breaking down.

"Put together, these challenges are why Afton Chemical has been developing new prototype tech for eMobility," says Cleveland. "It's part of Afton's commitment to our customers and OEM partners to enable the development of more efficient transmission technology."

"Most of our OEM partners come to us with more questions than answers," notes Dr Harald Maelger, senior OEM relationship manager and hybrid expert at Afton. "The beauty of working with hardware and lubricant development together, from the earliest design stage, is that more factors get considered and tested earlier. That helps meet the need for speed as well as reliability." ☺

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