ELECTRIC VEHICLE FLUIDS

With the rise of hybrid and electric vehicles (EVs), the automotive industry is going through one of the most profound shifts in its history. For consumers, the headlines are generally about how automakers are going green, which is undoubtedly positive news. But for OEMs, e-mobility represents some of the biggest engineering and design changes—and challenges—in the industry's history. At Shell, we're working alongside OEMs to help manage those challenges.

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There's no doubt that e-mobility is here to stay. Questions about the dependability, speed, and distance range of hybrids and EVs have been answered to the satisfaction of a significant, and growing, number of consumers—to the point where demand is steadily shifting in favor of them over internal combustion engine (ICE) vehicles. By 2031, production of electrified vehicles is expected to reach 50 percent of all vehicles made.

Along with consumer demand, of course, is the fact that automakers must meet ever stricter carbon dioxide emission targets and fuel economy mandates imposed by governments. The need is especially important given the projection that global car parc will approximately double by 2045. But automakers have responded not just with hybrids and EVs that are better for the environment. They're delivering on consumers' needs for vehicles that travel farther, drive better, and cost less than their predecessors of just a few years ago.

For now, at least, they won't all be the same kind. Hybrid electric vehicles (HEVs), which continue to improve technologically, increasingly compete for attention with plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs). But despite their differences, to one degree or another they all rely on electric powertrains, which are rapidly becoming more sophisticated and technologically demanding to meet consumers' expectations.

This includes the fluids in them. To most consumers, fluids in hybrids and EVs are all but invisible. But those in the automotive industry know how crucial they are—particularly because, once added to the sealed environments in these vehicles, they need to perform at optimum levels over the vehicle's lifetime. The first fill couldn't be more important.

Shell E-Fluids

If anything, the technical requirements placed on fluids in hybrids and EVs are much greater than they are in ICE vehicles. Their core job of preventing wear, reducing friction, and being efficient is still essential, but as e-mobility technology advances, so is the role that fluids play in electrical compatibility and thermal management. Simply put, the fluids developed for ICE vehicles generally fall short of the performance requirements of hybrids and EVs. And the gap will only widen as the powertrains in those vehicles become more sophisticated.

Shell has been working to close the gap. As the leading global lubricants manufacturer for the last 12 years, we have recently developed a line of fluids engineered specifically for the high-tech powertrains of hybrids and EVs. And significantly, these developments have taken place not just from the research in our own laboratories, but also by working in close technical partnership with OEMs and component manufacturers for more than 20 years.

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This is key because in the still-developing e-mobility industry, there is far less brand-to-brand uniformity across hybrid and EV powertrains than there is in conventional vehicles. In fact, electric motor design is unique to each OEM—e.g., the insulation material, winding technology, rotor/stator setup—which makes engineering fluids for hybrids and EVs that much more challenging. But in working with various OEMs, Shell has engineered fluids that effectively and efficiently meet a broad range of performance requirements. We've done this by employing a number of dedicated screening methods, such as copper wire corrosion testing, high-speed foaming testing, and state-of-the-art technology for high-speed driveline test rigs.

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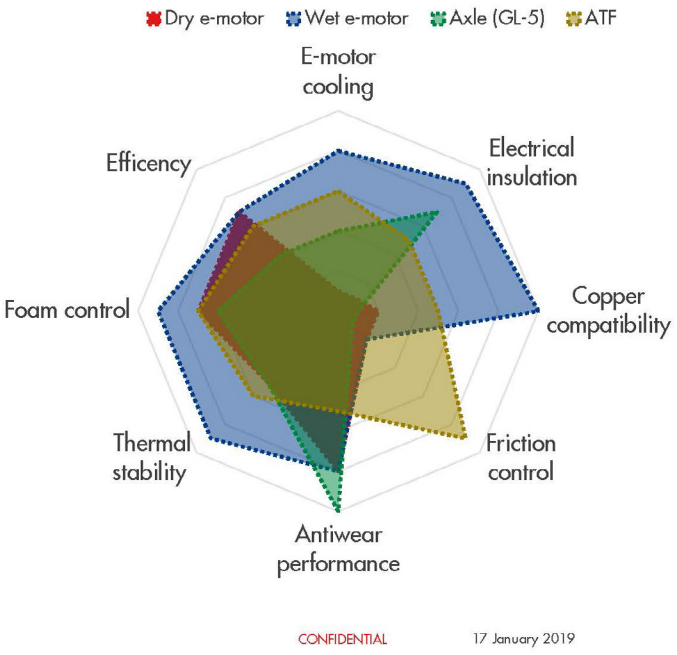
These methods and our collaboration with OEMs have resulted in fluids engineered for both the wet e-motors being designed for the newest generation of electric vehicles, as well as the dry e-motors that have dominated e-mobility up to this point.

For wet e-motors, with their integrated design, fluid needs to do two essential jobs at once: lubricate the gearbox and cool the electric motor. And copper compatibility is the all-important factor. On the one hand, these motors need a fluid that works quickly enough for proper gear protection, which requires additives to facilitate that process. But those same additives can corrode copper, a potentially serious problem in e-motor windings—especially when fluid is filled for life.

Shell knows that OEMs and component manufacturers require fluids with the proper chemistry to keep these opposing needs in balance. And with only one fill, there's just one chance to get it right. We've engineered e-fluids that provide friction protection for gearboxes and thermal protection for motors while offering superior copper compatibility and electrical characteristics. In the high-voltage environment of wet e-motors, they provide protection from corrosion—and from the resulting shortcuts that reduce power. All while remaining stable over time.

And while wet e-motors may be the new generation of e-mobility, dry e-motors haven't gone away. E-fluids like the ones Shell has developed are finding increasing applicability in dry e-motors, as OEMs design them to be more compact and more high performance, which results in lower fluid volumes but higher stress on the lubricant.

Christopher Dobrowolski, Shell E-Fluids Technology Expert, says of the latest dry e-motors, "It's the same story as with wet e-motors. OEMs are integrating electrical power components to make the electric drive units more compact, but increasing the overall performance output. This adds significantly higher technical requirements on the lubricant."



One need that both wet e-motors and dry e-motors share is fluids that offer antifoaming qualities. As OEMs design more compact motors to save weight and space, there are higher rotational speeds to contend with. Increasingly, this means that more electric vehicles will need transmissions to manage the high RPMs of the motors. But the high-stress environment of these transmissions can allow air to get into them and cause fluids to foam, which means they lose their ability to protect the components' surfaces. This is another area where Shell's new-generation e-fluids stand up to the technical requirements of e-mobility OEMs.

And as we look to the future of e-mobility, Shell will work with OEMs on new cooling technologies for EV batteries. This need will be particularly important as fast charging technologies improve—a big selling point from a consumer standpoint. But higher charging speeds will likely come at a cost of increased temperatures, as electricity generates heat. Shell knows that the need for thermal management will be vital, and we will continue our history of collaboration with auto industry partners in this area as well.

The automotive industry is undergoing some of the biggest technological changes in its history, bringing e-mobility to a world that is both increasingly on the move and mindful of its environment. As hybrids and EVs continue to deliver a higher level of performance for consumers, we will continue our history of partnership with OEMs to engineer the most advanced, reliable e-fluids in the industry.

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