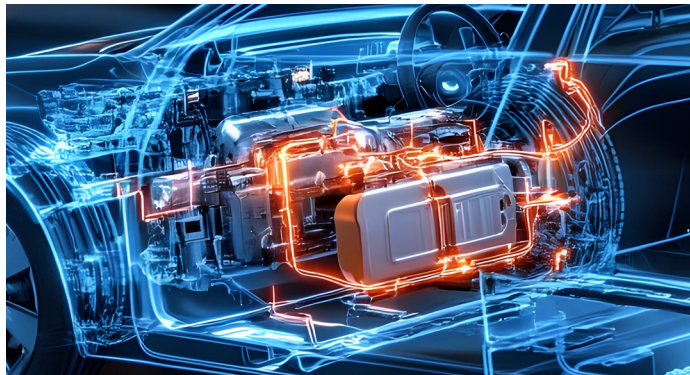


Electric Driveline Fluids: Why Electric Vehicles Still Need Oil



The automotive industry is undergoing one of the most significant transformations in its history. Driven by increasingly stringent emissions regulations, technological innovation and the global pursuit of sustainable transportation, battery electric vehicles (BEVs) have become a major part of the modern mobility landscape.

Unlike conventional vehicles powered by internal combustion engines (ICE), electric vehicles (EVs) have fewer moving parts and do not require engine oil changes. This has led to a widespread misconception among vehicle owners - and even some workshops - that EVs are essentially "maintenance-free" when it comes to lubricants.

This assumption of EVs not needing routine maintenance is, of course, far from reality. In fact, due to this misconception, EVs are known to fail routine technical inspections more often than their traditional ICE counterparts because of faults in, or excessive wear on, components that would otherwise have been subject to scheduled maintenance – braking components for example.

However, it is the misconception that EVs do not need 'oil changes' is perhaps the most significant of all when it comes to overall vehicle reliability, performance and longevity.

Modern electric drivetrains still rely on highly specialised fluids to lubricate gears, protect bearings, manage heat and, in some applications, directly cool the electric motor itself. As the electric vehicle parc continues to grow worldwide, understanding the role of Electric Driveline Fluids (EDF) becomes increasingly important for workshops, distributors and technicians.

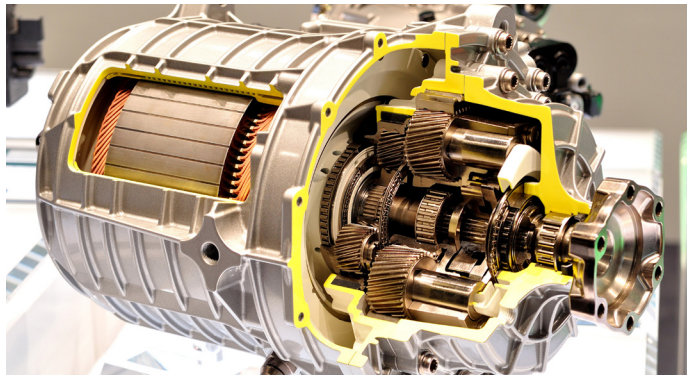
Why Do Electric Vehicles Need Lubricants?

Every electric vehicle contains an electric motor and, in most cases, a reduction gearbox that transfers torque from the motor to the wheels. Even though an electric motor is considerably more efficient than an internal combustion engine, significant heat is generated inside the drivetrain. High rotational speeds, electrical currents, gear meshing and bearing loads create operating conditions that require dedicated lubrication and cooling. Modern electric motors can operate at speeds exceeding 20,000 rpm, which places significantly higher requirements on lubricant performance than many conventional transmissions.

Wet and Dry E-Axes: Understanding the Difference

One of the most important concepts in electric powertrain design is the distinction between dry and wet e-axis systems. A typical e-axis combines the electric motor and gearbox within one compact unit. Depending on the manufacturer, the lubrication concept may differ considerably.

In a dry e-axis, the electric motor and gearbox are housed together but remain physically separated. The lubricant only serves the gearbox section and does not come into contact with the electrical components of the motor. Cooling of the e-motor is achieved through a separate cooling circuit, either directly or indirectly. Because the fluid never contacts the high-voltage electrical components, electrical insulation properties are not a primary design requirement.



A wet e-axis adopts a completely different approach. The electric motor and gearbox share the same lubricant, meaning that the fluid lubricates the gears while simultaneously cooling the electric motor windings. This design improves cooling efficiency and enables more compact drivetrain packaging. However, it also creates substantial challenges for lubricant engineers because the fluid is now exposed directly to copper windings, magnet coatings, electrical insulation materials and power electronics.

Key Performance Requirements for Electric Driveline Fluids

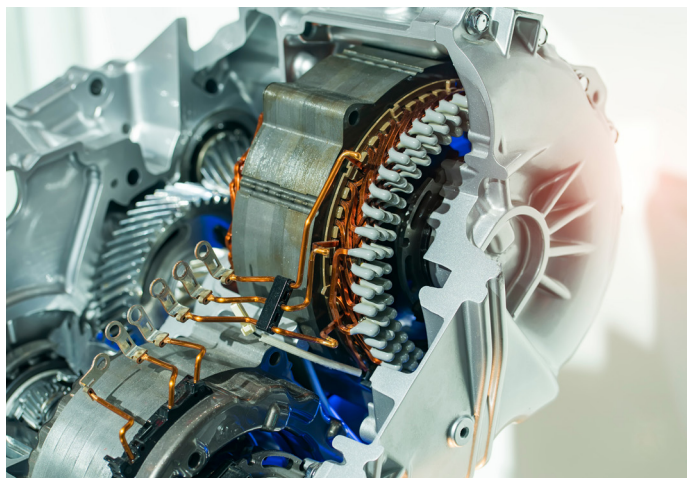
Electric Driveline Fluids are specifically engineered for use in electric drive units and e-axes. Unlike conventional transmission oils, EDFs must meet a much broader range of performance requirements, which vary depending on the design of the electric drivetrain. In particular, a distinction must be made between dry e-axis and wet e-axis architectures, as each places different demands on the lubricant.

Requirements for Dry E-Axis Applications

In a dry e-axis, the lubricant is primarily responsible for protecting and cooling the gearbox, while the electric motor is cooled through a separate system. As a result, the fluid must ensure reliable operation of gears and bearings under high rotational speeds and elevated thermal loads.

One of the key objectives of a modern EDF is to improve drivetrain efficiency by reducing internal losses. This is achieved through carefully optimised friction characteristics, advanced additive technology and low-viscosity base oils. In addition to maximising efficiency, the fluid must provide long-term protection against wear, oxidation and thermal degradation.

Compared with conventional transmission oils, dedicated EDF formulations are specifically designed for the operating conditions found in electric drivetrains, including higher rotational speeds, lower operating viscosities and increased demands on material compatibility.



For dry e-axis systems, an EDF should offer:

- High wear protection for gears and drivetrain components
- Reliable bearing protection
- Optimised friction performance for maximum efficiency
- Effective thermal management and heat dissipation
- Carefully balanced viscosity characteristics
- Compatibility with modern materials and sealing systems
- Minimised evaporation losses
- Excellent oxidation resistance for extended service life

Additional Requirements for Wet E-Axis Applications

Wet e-axes present a significantly greater challenge for lubricant designers. In these systems, the same fluid is used not only to lubricate the gearbox but also to cool the electric motor directly. As a result, the lubricant is in contact with the high-voltage components, copper windings and insulation materials inside the motor. In addition to all the requirements of a dry e-axis fluid, wet EDFs must exhibit carefully controlled electrical and chemical properties. The fluid must support efficient motor cooling while protecting sensitive electrical components from corrosion, degradation and premature ageing.

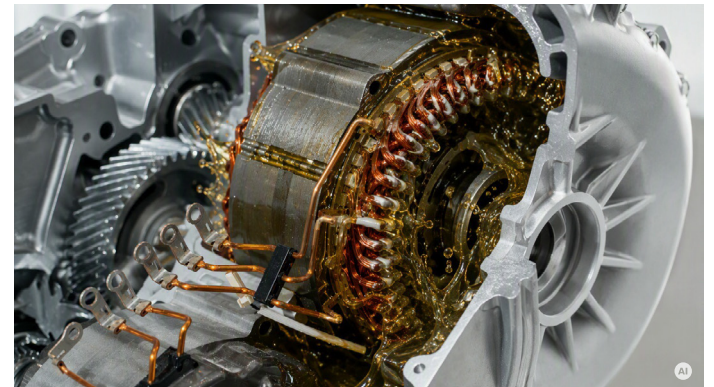
Material compatibility becomes particularly critical because prolonged exposure to the lubricant can affect copper conductors, coating systems and insulation materials. At the same time, the fluid must maintain appropriate electrical behaviour to ensure the safe and reliable operation of the electric drive unit.

Therefore, a high-performance EDF for wet e-axis applications must provide additionally:

- Excellent compatibility with copper windings and protective coatings
- Suitable electrical insulation properties
- Enhanced corrosion protection for electrical and metallic components
- Stable electrical characteristics throughout its service life

The febi Electric Driveline Fluid Range

febi currently offers four premium performance EDFs developed to meet the specific requirements of modern electric drivetrains. Formulated using high-quality low-viscosity base oils (PAO or HC synthetic technology) and advanced additives, they provide excellent wear protection, corrosion resistance, oxidation stability, cleanliness and overall drivetrain efficiency.



Together, these four products provide workshops and distributors with dedicated solutions for the servicing and maintenance of modern electric drivetrains – whether the vehicle manufacturer recommends it or not.

Tesla, for example, does not specify an official service interval for its electric drive units. However, febi recommends replacing the EDF every 80,000 km or four years to help maintain optimum performance and durability.

Naturally, this approach is not universal, and some EV manufacturers do include fluid replacement in their maintenance schedules. BYD, for example, specifies that the oil in the electric drive unit should be changed after the first 30,000 km or 24 months, and then every 48,000 km or 24 months thereafter.

These examples clearly demonstrate that Electric Driveline Fluids should not always be regarded as lifetime-fill products and can play an important role in ensuring the long-term reliability and efficiency of modern electric drivetrains.

Rely on tested, OE matching quality replacement parts from febi. The entire range of lubricants and fluids can be found at: partsfinder.bilsteingroup.com.

The febi brand is part of the bilstein group, the umbrella organisation for several other strong brands. Further information is available at: www.bilsteingroup.com.



EDF-1 (febi 195456)
Developed for wet e-axis applications with friction control requirements, as specified by Mercedes-Benz MB 237.12.



EDF-2 (febi 184251)
Designed for wet e-axes with direct-cooled electric motors. Recommended for Tesla Model 3 and Model Y, as well as Tesla vehicles from model year 2021 onwards requiring TESLA EDF-2 or KAF1 specifications.



EDF-3 (febi 1002379)
A high-performance EDF developed for a wide range of Asian electric vehicle applications with direct-cooled e-motors. Meets the requirements of the BOT 383 specification.



EDF-4 (febi 1002154)
An ultra-low viscosity EDF developed for dry e-axis systems, where motor cooling and transmission lubrication are separated. Suitable for applications requiring Mercedes-Benz MB 237.11 and BOT 384 performance levels.