

Fluids for next generation EV drivetrains



Tuneable, Group V base oils for
next-generation electric vehicle
gearboxes, transmissions and
e-axes

Cargill[®]



Fluids for electric vehicles - overview



- The automotive market is rapidly changing and interest in vehicle electrification is growing as countries enact new emissions legislation and move to ban new sales of internal combustion engine (ICE) vehicles.
- Standard automatic transmission fluids (ATFs) are not optimised for electric vehicles (EVs), and further development of fluids is needed to meet the requirements of EV drivetrains.
- Lubricant standards are still being developed for EVs and there are many competing technologies and designs for their drivetrains.
- EV transmissions are subject to high torque at low speeds, electrical fields, high voltages and greater localised heat loads which requires novel fluid solutions.
- Fluids must have specific performance requirements including low electrical conductivity, low viscosity, low traction as well as protecting against wear and good thermal heat transfer properties.

How can we help?

We already manufacture Group V ester base oils for low wear, oxidatively stable automotive lubricant formulations, and are developing base oils for the next generation of electric vehicles. Our ester technology is tuneable to your exact needs and improves performance of Group III and Group IV based automatic transmission lubricants.

New product developments

We are developing products in two main categories:



Very low viscosity Group V ester base oils offering a very low coefficient of traction when formulated into Group III, IV or V base oils, suitable for formulating next generation gearbox and e-axle lubricants.



Unique Perfad™ traction reducing co-base fluids to reduce traction and wear in a Group III, IV or V based formulation, while thickening and increasing viscosity index. Suitable for replacing PAO100 and standard high viscosity esters.

DE 10766: Very low viscosity Group V ester base oil development product

In Group III and Group IV base oils, the addition of 20% DE 10766:



- Reduces traction even under high loads and slow speeds
- Reduces wear
- Improves add-pack solubility

20% DE 10766 reduces traction even in very harsh conditions

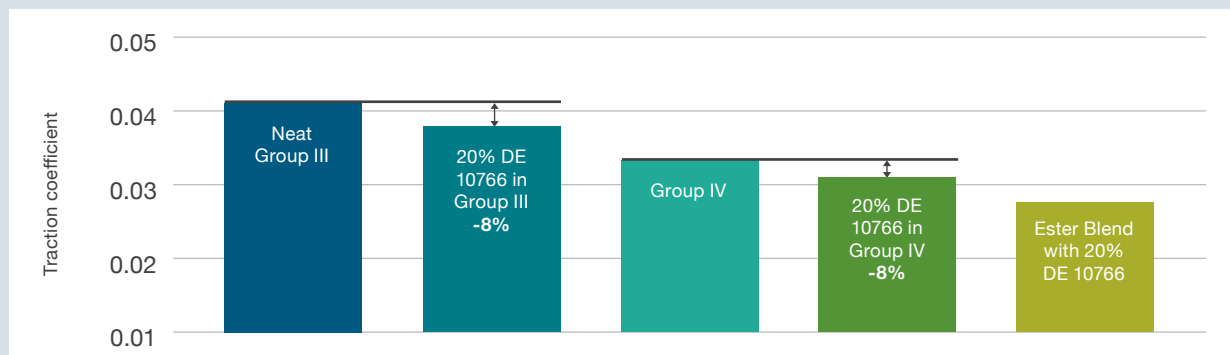


Figure 1 Adding 20% of DE 10766 reduces traction by 8% vs. an untreated group III or IV base oil. All formulations 4.5 cSt

Compared to a neat Group III or Group IV base oil, DE 10766 has:

- Significantly lower NOACK volatility
- Higher breakdown voltage
- Significantly increased oxidation stability
- No adverse impacts on copper wire insulation materials and elastomer seals

Parameter	Value
Speed	0.2 m/s
Temperature	40 °C
Load	25 N
SRR	50%

Unique Perfad™ traction reducing co-base fluids for EV oils

Reducing traction vs. a PAO 100 thickened formulation in Group III

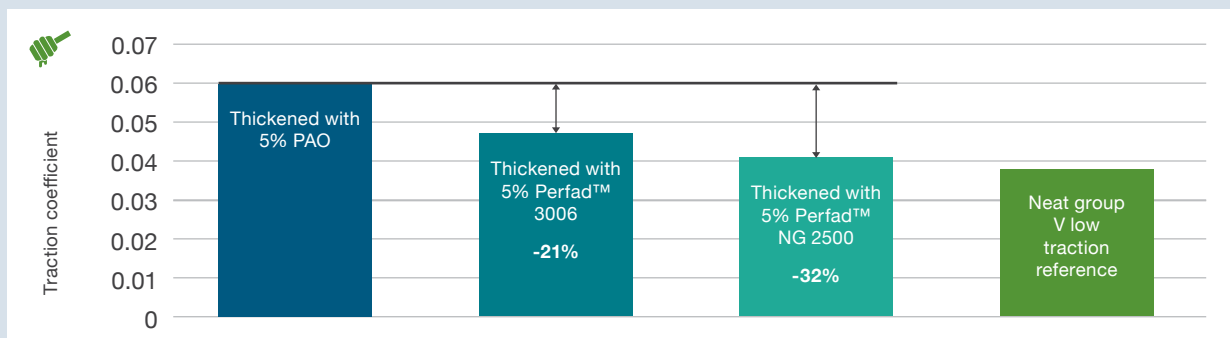


Figure 2 Adding 5% Perfad 3006 or Perfad NG 2500 offers up to 32% reduction in traction coefficient vs. a PAO100 thickened formulation in group III. All tested at a KV40 of 26 cSt

We used an oxidatively stable polyol ester solubiliser to ensure complete solubility of the additives

In Group III and Group IV base oils, the addition of 5% Perfad 3006 or Perfad NG 2500:

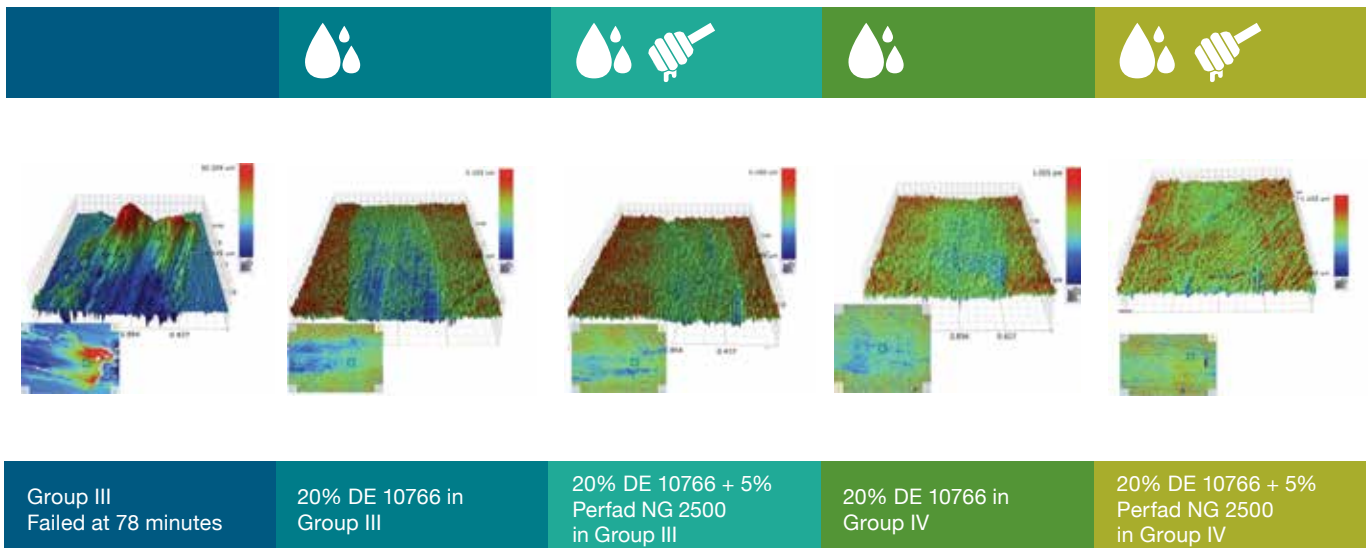
- Reduces traction coefficient by up to 32% vs. a PAO100 thickened formulation
- Improves pressure viscosity coefficient of fluid, increasing film strength and wear performance
- Improves viscosity index
- Maintains viscosity in the KRL shear loss test (20 hours, 40°C)

Parameter	Value
Speed	0.1 m/s
Temperature	60 °C
Load	60N
SRR	40%
KV40	26 cSt

Formulating with both 20% DE 10766 (low viscosity base oil) and 5% Perfad NG 2500 (traction reducing co-base fluid) in Group IV:

- Reduces traction further compared to just the addition of DE 10766
- Reduces wear even further vs. 20% DE 10766 only
- Using the same additive package, DE 10766 and Perfad NG 2500 improves FZG A10/16.6R/90 results by 2 load stages in a Group IV formulation

Visualising wear reduction in the FZG SRV gear contact mimic test



Other application areas:

We are developing a portfolio of products for electric vehicle applications, including:



High viscosity thickeners: Shear stable thickening power for wear protection in EV gearboxes, transmissions and e-axes



Low viscosity dielectric coolants for immersion cooled EV batteries and drivetrains

This document is a short overview of a larger dataset.

Please contact us for further information.



About us

The Energy Technologies business in Cargill Bioindustrial creates, makes and sells specialty chemicals and additives for the global energy market. Working in close collaboration with our customers, we apply sustainable concepts and deep scientific expertise so that together we can efficiently power the world of tomorrow.

At our core, we are experts in synthetic ester and polyalkylene glycol chemistries, taking products from lab scale through to full manufacturing. Investing in the development of new chemistries allows us to support our customers in meeting new industry challenges.

For those who dare to imagine a brighter future, we establish long lasting relationships and create bespoke industry solutions through our integrated research & development and global manufacturing capabilities. Being both global and local, you have direct access to our network of technical experts. We look forward to talking to you.

Further information

Cargill Bioindustrial sales and distribution are coordinated through an extensive worldwide network of technical and commercial experts. For further information or guidance please contact us:

energy_technologies@cargill.com

Non-warranty

This document is provided for your information and convenience only. All information, statements, recommendations and suggestions are believed to be true and accurate but are made without guarantee, express or implied. WE DISCLAIM, TO THE FULLEST EXTENT PERMITTED BY LAW, ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE and FREEDOM FROM INFRINGEMENT and disclaim all liability in connection with the storage, handling or use of our products or information, statements, recommendations and suggestions made by Cargill. All such risks are assumed by you/user. The labelling, substantiation and decision making relating to the regulatory approval status of, the labelling on and claims for your products is your responsibility. We recommend you consult regulatory and legal advisors familiar with applicable laws, rules and regulations prior to making regulatory, labelling or claims decisions for your products. The information, statements, recommendations and suggestions contained herein are subject to change without notice. Tests conducted by Cargill labs unless otherwise noted. ©2022, Cargill, Incorporated. All rights reserved. 1017MS/ET/0823/6/EN

