

WITH 63 MT
LOADS **OUR**
TESTING IS
TOUGHER

Giving CO₂ the slip

Emissions legislation in the United States has led to the development of a new generation of eco-friendly engine lubricants. Peter Shakespeare investigates

The American Petroleum Institute's (API) FA-4 standard is enabling heavy duty on-highway diesel engine manufacturers to further enhance their engines to reduce fuel consumption and CO₂ emissions.

The API FA-4 standard was released alongside the CK-4 specification in the US on 1 December 2016. It is like CK-4 lubricants, which were developed for engines that meet EPA10 emissions standards – similar to Euro VI. Both consist of a high-temperature, high-shear (HTHS) fluid that is said to perform well at both high and low temperatures. Its properties are said to reduce degradation of particulate filters, offer protection against catalyst poisoning, reduce engine wear and piston deposits. But the biggest difference is that the FA-4 lubricants are ultra-low viscosity, which enhances their fuel-saving properties significantly.

ACEA, the European Automobile

Manufacturers' Association, classifies standards for lubricants used by manufacturers in the EU. Its E9 (16) standard is equivalent to CK-4. The organisation is about to issue a new heavy-duty diesel engine lubricant classification, F11, which is equivalent to FA-4. These oil sequences – as ACEA terms them – define the minimum quality level of a product for use by ACEA members.

Notwithstanding ACEA's delay in classifying the new engine oil, lubricant manufacturers in Europe are already rolling out oils that meet or better the FA-4 standard based on requirements set by the OEMs. For example, German-owned Fuchs has recently announced its first product to meet the API FA-4 standard, Titan Cargo 228.61 SAE 5W30. That oil is suitable for new Mercedes-Benz trucks and buses. It has been approved by the





© ras-slava - stock.adobe.com

Tough just got tougher.

Tested with 2X the average load*.

DURON™ next generation are the most durable heavy duty diesel engine oils we've ever made. ACEA E6, E7 and E9 ready - to protect your fleet, however much you're hauling, however tough it gets. Because tough is just the way we like it.

NOW YOU KNOW WHAT WE MEAN BY **DURON. THE TOUGHER. THE BETTER.™**



HEAVY DUTY DIESEL ENGINE OILS
FIND OUT MORE. THE SOONER. THE BETTER.

DURONTHETOUGHERTHEBETTER.COM

*As tested in Canada in independent field trials by Petro-Canada Lubricants.

OEM to its specification 228.61, Low-SPAsh [sulphur, phosphorous and ash] Multigrade Service Engine Oils, for the FE1 type of OM 470 and 471 Euro VI engines. (Other oils approved to 228.61, according to the OEM, are: Mobil Delvac XHP ESP 5W-30, Shell Rimula Ultra E Plus, Total Rubia Optima 2600 XFE 5W-30, and the OEM's own-brand product.)

The key word used by Fuchs is 'new', as FA-4 lubricants are not backward-compatible. OEMs are having to make modifications to engines to enable them to use the new ultra-low viscosity oil. Andy Brown, UK automotive technical manager at Fuchs Lubricants UK explains that HTHS relates to the viscosity of the lubricant. It is a test that measures the viscosity of the oil under shear (high lateral mechanical forces) at 150°C. CK-4 has a HTHS viscosity of greater than 3.5 mPa.s. FA-4 has a

viscosity between 2.9 and 3.2, so is significantly lower. Because it's lower, it imparts less internal fluid drag on engine components, so requires less effort to pump it around the engine. That's where fuel-efficiency gains can be generated.

A similar picture is painted by Shawn Whitacre, senior staff engineer, heavy-duty engine oil technology, Chevron Lubricants, which last month relaunched its heavy-duty oil brand in Europe under a new name, Texaco Delo. He states: "It is clear that the journey to low viscosity [oil] is gathering pace in on-highway. This is a direct consequence of the push to reduce CO₂. It is likely, looking at potential future ACEA standards, that lower-viscosity HTHS oils will not have backwards compatibility for older engines, which require HTHS viscosity of greater than 3.5."



“If you go thinner in terms of viscosity and the oil film, you must enhance anti-wear additives”

Andy Brown



FA-4 oils rely on their chemistry to protect engine parts, says Brown at Fuchs. He explains: “The other side of the equation is the additives that are used to help to maintain the life of the oil and to protect against wear. There are parts of the engine where you cannot get a pressurised oil film, like you would in a main bearing. If you go thinner in terms of viscosity and the oil film, you must enhance anti-wear additives. These areas are the upper cylinder, piston, cams, cam lobes and piston rings. Here, the additives provide most of the lubrication. Typically, a zinc-based compound is used, but now it is a complex petrochemical additive that provides chemical protection, as opposed to an oil film.”

In engineering terms, Brown says that ultra-low viscosity lubricants require much higher quality finishes on moving components (as indicated pictorially on p30-31). A comparatively poor machining finish on a bearing surface – as seen under an electron microscope – needs a thicker oil film to form a protective coating. So a thinner, low-viscosity oil requires that much better a finish. This is one reason why FA-4 oils are not backward-compatible.

Another factor is employing the right type of oil pump, explains the automotive technical manager. It is much harder to maintain oil pressure with a low viscosity oil. For example, gear pumps can suffer from cavitation; in other words, they start to turn in the fluid rather than pushing it around the system. So

if the resistance to moving the oil around the system becomes too high, the pump becomes less effective and cannot maintain the required oil pressure. This will also affect any part of the engine that is hydraulically driven, including variable valve timing.

If operators were to put an FA-4 lubricant into a current or legacy engine, various problems would occur: foremost of which is that it would wear out very quickly, adds Brown. This means that, over the next few months and years, as the OEMs move to FA-4 lubricant-compatible engines, operators buying new vehicles will have to stock different standard engine oils for topping up, and be very careful that drivers use the correct oil.

WHY BOTHER?

Lubricants coordinator at engine and truck OEM Volvo Group, Bengt Otterholm, summarises the benefits of the new engine oil. He reports that, compared to a 10W30 CK-4 oil, a 10W30 FA-4 oil would offer approximately a 0.5% fuel economy gain. If a typical long-haul truck consumes 30 litres per 100km, it would use around 36,000 litres of fuel per year. That means FA-4 would save 180 litres of fuel, per year, per truck.

He adds: “It seems a small number, but compared with other things you can do to the truck, such as engines, transmissions, other hardware, or aerodynamic changes, it is a low-cost way of saving some fuel.”

Otterholm confirms that Volvo is making some changes to its engine design to enable new models to use FA-4. “With low viscosity lubricants, you get lower oil pressure. Normally that is

not too much of a concern, as most components rely on oil flow. But some rely on oil pressure for their correct operation: for example, the engine brake actuates at a certain oil pressure. If you cannot generate that pressure, the engine brake won’t work. We have made changes to our engines to ensure there is less pressure loss, by modifying parts of the engine that create the pressure drops.”

In terms of the lubricant cost, lower viscosity oil should not be more expensive to produce, according to Otterholm. Volvo uses its own lubricant specification, which tracks API and ACEA standards, but does not rely on them. The OEM has specified a much higher quality oil for its new FA-4 compatible trucks and buses; this will be more expensive than the conventional engine oil it specifies for its Euro VI vehicles now.

On the other hand, the new oil allows the truck to run for longer periods between oil drains; that enhanced capability offers operator savings. Otterholm says that the fuel economy gain, plus extended oil drain intervals, will easily cover the additional cost of the new lubricant. Volvo’s FA-4 adapted engines will go into series production in early 2019. Otterholm adds that it is working on a ‘FA-4 plus’ lubricant for its vehicles, which will be brought to market in late 2019.

A scan of the lubricant manufacturers shows that most now have a FA-4 compatible product, and the European OEMs are playing catch-up with their hardware, along similar lines to the Volvo Group. The environmental benefits of the new oil are not revolutionary, but when it comes to cutting CO₂, every little drop helps. [IE](#)

FURTHER INFORMATION

API FA-4 information for artic operators – <https://is.gd/oheson>

ACEA Oil Sequences 2016 – <https://is.gd/esodiq>

