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PC-12 development advancing - so what does this mean for the lubrication industry?



It was December 1, 2016, when the first heavy-duty diesel oils licensed under the American Petroleum Institute (API) CK-4 and FA-4 categories were launched – the fruition of the PC-11 initiative. The launch was years in the making, as were the new products developed under the new API Service Categories. Now, the industry is again poised to introduce two new oil categories that will eventually supersede API CK-4 and FA-4.

In March 2021, the Truck and Engine Manufacturers' Association (EMA) wrote to the API Diesel Engine Oil Advisory Panel (DEOAP) formally requesting the creation of new oil categories to address the evolution of engine technology. After an evaluation period, API announced its agreement in January 2022, officially launching the “proposed category” or PC-12 initiative. The first licensed PC-12 products are slated to launch in Q1 2027 – a fairly tight time frame by industry standards.

Naturally, this decision has raised a few questions. What is driving the need for new heavy-duty oil categories currently? How will the new categories differ from the existing standards? And what are the implications for lubricant manufacturers?

Yet more stringent emission standards

The primary driver behind PC-12 was the announcement by the US Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) to introduce stricter emission control standards for heavy-duty trucks starting with the 2027 model year. CARB will start transitioning to lower nitrogen oxide (NOx) standards in model year 2024, and by model year 2027 it is expected that the emissions will be 90% lower when compared to today's standards. On December 2022, the EPA finalized their “Control of Air Pollution from New Motor Vehicles: Heavy Duty Engine and Vehicle Standards” for federal regulations on NOx and particulate emissions. The EPA regulations will take effect starting with model year 2027 trucks. Ever since the EPA began imposing NOx limits back in the 1980s, the window of emissions acceptability has continually shrunken. However, current standards

established in 2010 have only been partially successful at curbing NOx emissions. Truck emissions stay within the EPA limits only when the vehicles are driving at speeds greater than 50 miles per hour on the highway. When trucks are driving more slowly on urban or suburban streets, their emissions can far exceed EPA limits. Recognizing this disparity, the regulators saw a need for more stringent controls to achieve historically low emission limits.

Among the requirements in these newly proposed regulations is the mandate for heavy-duty OEMs to build more effective and durable exhaust aftertreatment systems. The industry is now developing aftertreatment technology designed to bring NOx levels down to the extremely low amounts prescribed by the EPA and CARB. This new technology will require lubrication solutions that will enable the aftertreatment hardware to meet two goals: to more effectively scrub pollutants out of heavy-duty exhaust, and to function properly over a longer service life than current systems allow. That is what prompted the EMA to request the creation of the two new oil categories.

So, what's the difference?

The PC-11 initiative called for the creation of two separate subcategories. API CK-4, which brought along some unique tests, was intended to be backwards-compatible for existing vehicles using oils formulated to the prior API CJ-4 standard. API FA-4 was intended to usher in lower-viscosity oils to support the fuel economy benefits made possible by newer engine technology introduced in 2017. Similarly, the PC-12 initiative currently underway calls for two categories, again distinguished by backward compatibility and fuel economy considerations. (Though the categories have not been officially named, industry insiders are already referring to them informally as “CL-4” and “FB-4.”)

One priority for PC-12 oils is to support the proper functioning and long-term durability of new aftertreatment technology. This will require extensive research and careful planning on the part of lubricant formulators. The additive chemistry and ash content in the oil can have a significant effect on the performance of the aftertreatment equipment. Formulators must take extra care to avoid unintentionally introducing chemical components that might impair the systems' functioning.

The EMA's wish list, however, does not end with the aftertreatment systems. In addition to figuring out chemical limits on phosphorous, sulfur, and the resulting ash, PC-12 calls on lubricant producers to improve on API CK-4 and FA-4 requirements on a number of measures, including soot control and oxidation performance. The initiative further calls for new, even lower viscosity grades in the new F category, with high-temperature/high-shear (HTHS) levels as low as 2.6 with ultra-low viscosity grades for improved fuel economy. The industry is continuing their test development process to evaluate these performance areas for PC-12.

Further proposed differences include two new tests, Ford 6.7L valvetrain wear test and Detroit Diesel DD13 Scuffing Test. In addition, we can expect to see enhanced oxidation control from today's current levels.

Finally, there is work underway to understand which tests will be used to replace both the Mack T-11 and Mack T-12 tests due to the shortage of parts and how to ensure backwards compatibility is preserved where needed.

Expect increased complexity

For lubricant manufacturers, PC-12 is expected to introduce greater complexity than PC-11. Viscosity grades are likely to proliferate. Formulations must address not only the regulatory requirements for cleaner air, but also the OEMs' demands that extend to areas beyond clean air. Even within the heavy-duty, on-highway OEM segment, different manufacturers will likely have their own specific performance requirements and expectations – as will the off-highway segment, which is not subject to the same emission requirements as on-highway trucks.

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Additive suppliers, meanwhile, may potentially contend with a much tighter chemical “box” for emissions. They will need to carefully screen elements to determine precisely how to deliver the performance expected of PC-12 – what are the right elements and what is the right balance to achieve the desired results?

While we are expecting a first license date in Q1 2027, some lubricant manufacturers will want to be sure they have viable PC-12 products as much as a year in advance, adding to the pressure to accelerate development. Fortunately, no one is starting from scratch. The industry can benefit from and build upon what was learned in the course of PC-11 development. And the industry is coalescing around the initiative.

Chevron Oronite is part of the working group steering the PC-12 project, which includes representatives from oil producers and additive suppliers, as well as OEMs, the API, the American Society for Testing and Materials (ASTM), and various laboratories in the supply chain. The challenge for these industry participants will be to balance complexity and find viable pathways that lead to reliable solutions for suppliers, manufacturers, and ultimately the end-user fleets and operators.

The thought and effort that goes into PC-12 will be the industry’s legacy to future generations. Chevron Oronite is closely working with our lubrication industry partners and heavy-duty engine manufacturers toward our shared goals and solutions for energy efficiency, emissions reduction, lower carbon and developing solutions to meet PC-12 requirements.

We will keep you informed in the following months on the PC-12 progress and, in the meantime, reach out to your Oronite sales rep for more information.

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