# BMB Transportation Group

**April 2006 Newsletter**

**The next generation of engine oil represents a significant change from the current formula. Experts say it will be better able to handle heat and help reduce emissions. But you will need to pay attention to oil drain interval recommendations. Here is what you need to know about PC-10/CJ-4.**

# Putting the Pieces Together

**Editor's Note:** The introduction of the next generation of low-emission diesel engines in January is driving changes in engine oils, diesel fuel and engine exhaust filtration. In this and the next two issues, LIGHT & MEDIUM TRUCK will examine the changes and how they affect fleets.

This month's story explains why a new engine oil formula was needed, what it does and what, if anything, you need to do.

In May, on the eve of the introduction of ultra-low-sulfur diesel into the market, we will give you the latest update on the fuel, look at when and where it will be available, what it will cost and what fleet managers need to do to prepare for it.

In June, we'll close out the series with the latest information on the 2007 model-year engines, including a detailed look at the new exhaust filtration systems, what they will cost and how to maintain them.

## CJ-4 Is Almost Ready - Are You?

**By Chip Cassano**

The next generation of diesel engine oil - now referred to as PC-10 (for Proposed Category) but soon to change its name to the official designation CJ-4 - is in the final testing stages and will soon be available on the market. The American Petroleum Institute is expected to issue a license for the new oil formula in mid-October, but several oil suppliers said they will have products for sale before then.

By several accounts, the new oil is not just an update of current formulas but a leap in the evolution of engine lubricants. CJ-4 has been specifically engineered to aid the next generation of low-emission diesel engines in meeting 2007 emission standards.

"Up until CJ-4, each category was essentially built off the previous category, usually by putting more performance additives in the oil - more dispersants, more detergents, more antioxidants," said Dan Arcy, technical marketing manager for Shell Lubricants.

But the 2007 engines, with their diesel oxidation catalysts and particulate filters, will require a much cleaner formula. Those additives - in the concentrations currently used - would do more harm than good to the new engines and their sophisticated exhaust filtration systems if left in the oil, said Arcy.

Phosphorous, for instance, serves as an anti-wear agent. (In fact, in traditional oils, higher phosphorous levels typically equate to a higher grade of oil.) Sulfated ash was added to help neutralize the corrosive acids that form in the combustion process when sulfur mixes with water and forms sulfuric acid; the ash also improves the oil's lubricating capabilities.

But the ash and other metallic components of the traditional additives are incombustible. They would remain in the system and threaten to foul the sophisticated filters that will be on the new engines, increasing maintenance costs and adding to the emissions.

For the first time, limits are being placed on certain additive components in the fresh oil. Sulfated ash will be limited to 1.0%, phosphorous to 0.4%, and sulfur to 0.12%. As a result, oil manufacturers have had to look to a variety of proprietary blends that include newer, cleaner and often more expensive additives and components in order to deliver the combination of performance and purity that the new engines and standards demand.

Further, the new oil must do two things better than the current formula. It must handle the higher operating temperatures produced by the increased percentage of exhaust gas recirculation that many engine manufacturers are using to lower NOx emissions. At the same time, the oil cannot increase emissions or otherwise shorten the lifespans of oxidation catalysts, diesel particulate filters and other devices needed to meet the 2007 standards.

"Engine development is an evolutionary process," said Rodica Baranescu, manager of fuel, lubricants and coolants for International Truck and Engine Corp.'s engine group. "We never start from zero because there's a hundred years of development in diesel and gasoline engines. But after a point, you have to change the paradigm, and that was the case for 2007."

The questions that remain are simple but important: Will the oil perform as advertised? And will it cost more - up front or in more frequent service intervals?

The good news is that most of those in the know agree that CJ-4, when used in the upcoming low-emission engines and in concert with ultra-low-sulfur diesel, will represent a significant step forward in the the evolution of engine lubricants.

"People understand that computers and cellphones are upgraded frequently," said Jim McGeehan, global manager for diesel engine oil technology at Chevron Global Lubricants, "but I'm not sure they know that we've been upgrading the quality of engine oils every three years for almost two decades. We've gone from API CE to CF-4, CG-4, CH-4, CI-4, CI-4 Plus, and now API CJ-4. We've been on top of every aspect of the different engine changes and, provided owners maintain the proper oil-drain intervals, we've basically eliminated oil-related failures."

McGeehan's opinions carry a unique authority; for almost 20 years, he has chaired the American Society for Testing and Material Heavy-Duty Oil Classification Panel. He calls CJ-4 "the most robust API oil category ever developed in the U.S."

While CJ-4 represents new technology, it can hardly be termed experimental.

"The United States is one of the last developed areas in the world to finally put restrictions on the chemicals in finished lubricants," said Alex Bolkhovsky, commercial vehicle lubricant technical adviser for ExxonMobil Lubricants and Specialties. "We've actually been working on low-SAPS [sulfated ash, phosphorous and sulfur] oils for more than a decade now in other areas of the world. And gasoline engines have been using these low-SAPS oils for more than 20 years. So we have been able to incorporate a lot of that knowledge in the development of PC-10."

Bolkhovsky estimated that the company's PC-10 prototype has already logged between 3 million and 4 million road miles; by the time the oil is released to market, he expects that figure to rise to 10 million miles or more on a wide variety of trucks.

"From the beginning, this oil was a development of the oil industry, the additive companies and the vehicle and engine people," said International's Baranescu. "It was a cooperative effort, and all of it has been progressing as planned; thus far, we don't see any show-stoppers."

**Too Good to Be True?**

Not everyone is ready to offer CJ-4 such a ringing endorsement. Jerry Wang, director of chemical technology for Cummins Inc., agreed that, once 2007 low-emission engines and ultra-low-sulfur fuels are in place, he expects drain intervals to remain unchanged and anticipates no problems with engine performance, reliability, or durability. However, he voiced reservations about the transition period leading up to the CJ-4 rollout.

"Because manufacturers want to get their product out into the market, initially API will allow them to label new oil as CI-4, which is the current category, even though it is actually a low-SAPS oil," he said. And although the oil has been touted as compatible with older engines, CJ-4 has a lower total base number, an indicator of an oil's ability to handle contaminants and reduce the corrosive effects of acids, as a result of its lower sulfated ash and detergent content.

"Reducing TBN is fine if you use ultra-low-sulfur fuel, which has very little sulfur to begin with and, therefore, less acid to neutralize," Wang said. "However, during the transition period, there's a real possibility that a customer could continue using the same drain intervals without knowing that this is a lower TBN oil and not knowing that he is still buying high-sulfur fuel."

Add to that the fact that vehicles that operate off-road will still be allowed to use the old, high-sulfur fuels - at least until 2010 - and you have the potential for ongoing confusion and eventual repercussions. Wang encouraged readers to pay meticulous attention to manufacturer recommendations, since drain intervals - at least during the transition period - might well change.

Kevin Ferrick, manager of API's engine oil program, acknowledged Wang's concerns but pointed out that API has previously allowed companies to brand new oils under older categories because it offers them the opportunity to get fill lines and distribution points ready before an official licensing date.

Although API traditionally does not comment on drain intervals, an attachment to the ballot soliciting feedback on CJ-4 prior to approval contains the following caveat: "The use of these oils with greater than 15 ppm [0.0015% by weight] sulfur fuel may impact aftertreatment system durability and/or oil drain interval."

Finally, there is the issue of cost. And while every expert we spoke with agreed that engine oil prices were bound to rise with the introduction of CJ-4, none were willing to hazard a guess as to how much.

In reality, if most drain intervals remain unchanged, as many predict, the cost increase may be negligible. According to ExxonMobil's Bolkhovsky, for an average equipment user, the cost of oil amounts to between 1% and 2% of total maintenance costs.

Jason Phelps, customer communications representative for Caterpillar Inc., reported that not only did he not anticipate compatibility issues with CJ-4, but early test data from the company's new midrange C7 and C9 engines showed the ultra-low-sulfur fuels and oils yielding a 2% to 4% improvement in fuel economy. If those results could be achieved, the savings could offset the increase in the cost of the oil. Furthermore, if the oils do show good backward compatibility when they hit the market, they may find a larger customer base than initially expected and that may serve to bring down retail prices as well.

Regardless, it is the first in a series of changes occuring this year and next that will significantly affect diesel truck operations and costs. Be prepared.

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