

# Choose Mobil Delvac for Performance Leadership Now, and Always

## Most frequently asked questions about PC-10

### *What is PC-10 and why do we need oils that meet the PC-10 requirements?*

PC-10, also known as API CJ-4, stands for Proposed Category 10. It all started in September of 2002, when EMA (Equipment Manufacturer Association) requested the development of a new engine oil category due to the expectation that current lubricants, which meet the API CI-4 or API CI-4 PLUS specifications, would cause durability issues with aftertreatment devices used in future equipment. The new category, identified as PC-10 at that time, was requested to result in lubricants that would protect engines and be compatible with aftertreatment devices designed to meet the 2007 EPA Emissions requirements as well as provide backwards compatibility for equipment already on the road.

### *What is meant by "aftertreatment devices"?*

"Aftertreatment devices" refer to equipment that is used to treat the exhaust gas coming out of the engine in order to reduce the amount of undesired emissions contained in the exhaust gas. In a normal passenger car, the catalytic converter would be an aftertreatment device. While heavy duty trucks don't contain catalytic converters, some do contain a diesel oxidation catalyst. Additionally, in order to meet the 2007 emissions requirements, 2007 model year trucks will have particulate filters. It is in order to protect these and future potential aftertreatment devices that the PC-10 (API CJ-4) category is being developed.

### *When will I see PC-10 products available?*

The current industry timeline would have the API analog of PC-10, API CJ-4, be allowed for first license on October 15, 2006. However, there will likely be products available before that timeframe that meet the API CJ-4 specification or even specific OEM requirements. **However, before first license in October, if you plan to buy an API CJ-4 ready product, make sure it is licensed against the API CI-4 PLUS specification to ensure that your older equipment is protected.**

### *What are the chemical differences between PC-10 and the current CI-4 PLUS oils?*

Many aftertreatment devices are susceptible to durability issues associated with levels of engine oil ash, phosphorus, and sulfur. Since engine oils contain these components in different additives, one of the requirements of PC-10 (API CJ-4) is a maximum limit for these components while API CI-4 PLUS had no such limits. The chart below shows the limits for these three components for PC-10 compared to typical levels currently found in commercial API CI-4 PLUS products.

	PC-10 Limit	Typical API CI-4 PLUS Level
Ash	1.0% max	1.2-1.6%
Phosphorus	0.12% max	0.12-0.15%
Sulfur	0.4% max	0.5%

### *What is ash/sulfated ash and why is it important?*

In an engine oil, ash is the non-combustible portion of various metallic additives such as detergents and anti-wear additives. Oil with high levels of ash will

contain more metallic additives. The ash reduction in PC-10 will result in the increased use of new non-metallic additives in place of the more traditional metallic additives currently used for detergents and anti-wear. Since metallic detergents are also the preferred TBN containing compounds in an oil, the reduced ash explains why PC-10 oils will have lower TBN levels.

### *Will the new PC-10 product formulations be backwards compatible to API CI-4 PLUS engine oils (i.e. can a PC-10 product be used in older engines)?*

Currently, it is expected that many, if not all, finished oils will not only be licensed against API CJ-4, but also against API CI-4 PLUS, meaning that they would be backwards compatible. As a result, it would allow the use of a single oil for model year 2007 as well as older equipment.

### *Will the new formulations cost more?*

Each time a new requirement is mandated by industry or regulatory, the bar on performance is raised to a higher level and thus more complex additive technologies and higher quality base stocks are required. Additionally, test protocols are lengthier and much more expensive than that required before. All this, unfortunately, translates to higher product costs to the consumer. How much? It would be very difficult to speculate with any degree of accuracy at this point (January 2006). The latter half of 2005 saw unprecedented flux in crude oil prices and, while said flux has become somewhat less drastic as we enter into 2006, the market is still very unpredictable.

### *What are the consequences of using a non PC-10 oil in a 2007 (or newer) equipment?*

Since aftertreatment devices are sensitive to ash, phosphorus, and sulfur, use of a product that doesn't meet the PC-10 chemical limits could significantly reduce the life of the particular filter that will be used in all 2007 equipment and diesel oxidation catalyst that will be used in some 2007 equipment. In addition, this could lead to the potential of back pressure issues that would significantly reduce the operating efficiency of the engine. Also, PC-10 oils will offer improved performance due to some operating factors of 2007 engines. Most importantly, use of PC-10 (API CJ-4) oils will be required for warranty purposes by all major OEM's.

### *What are the performance improvements of a PC-10 oil compared to an API CI-4 PLUS oil?*

As often occurs with designs that either add power or reduce emissions, the internal environment of the 2007 engine is expected to be even harsher than what is found today. Most notably in influencing these conditions is the fact that EGR rates in 2007 equipment are expected to double from where they are today. Since exhaust gas carries with it heat and soot, that means that heat and soot levels in 2007 engines will be higher and harsher than today. As a result, PC-10 oils will be formulated to better deal with higher levels of heat and soot through better resistance to oxidation and thermal degradation, better resistance to high temperature deposits, and better dispersancy of soot and contaminants.

### *Will the use of aftermarket additive treatments improve API CI-4 PLUS oils to PC-10 requirements?*

Aftermarket additive treatments are never recommended for any Mobil Delvac product, be it the current API CI-4 PLUS product or the future PC-10 product. Engine oils are formulated with a balanced additive system to provide optimized



*Our leadership in lubricant innovation provides our customers with enhanced peace of mind, and makes us the company to beat in heavy duty engine oil technology.*

performance for equipment. The use of these aftermarket additives could throw this balance off. Additionally, many OEMs now specifically recommend against the use of these additives in their service manuals. As for the ability to boost an API CI-4 PLUS product to PC-10 performance with an additive, that is also not possible. Since PC-10 actually requires a reduction in ash, phosphorus, and sulfur compared to API CI-4 PLUS products, PC-10 actually will require a complete rebalance of additives instead of just a boost.

*How will ODIs (oil drain intervals) for both older and newer engines be impacted when using a PC-10 formulated product? Can I extend my ODIs in new engines? Will I have to cut back my ODIs in older engines?*

PC-10 oils are being developed for backwards compatibility. That means for customers following their OEM recommended drain intervals, we expect that PC-10 products will have no impact on drain interval. However, customers who are extending their drain interval will need to revalidate that those intervals are still appropriate with both PC-10 oils as well as 2007 equipment. Many customers who are extending their drain intervals will be able to continue to do so.

*Will there be a visual difference between the current products and a PC-10 formulated product?*

Since all current products will require reformulations to meet PC-10 requirements, there could be visual changes, though it is not a necessity. As a result, in order to confirm that a product meets the new requirements later this year, make sure that it says that it meets the API CJ-4 specification, and API CJ-4 is found in the API donut.

*Since PC-10 will be part of the next API level, how do I react to OEMs that announce their own specifications in advance of API CJ-4 timing?*

Many OEM's will release their own specifications ahead of PC-10 timing since they may have a very small number of 2007 equipment on the road for which they will need an oil. If you are one of these customers that obtains 2007 equipment before first license of the API CJ-4 category in October of 2006, please contact your ExxonMobil sales contact or distributor.

*How does Caterpillar's recent announcement of their new ECF-2 and ECF-3 specifications fit into PC-10?*

Full details of the Caterpillar specification are not yet known. What is known is that Caterpillar ECF-3 will be similar to API CJ-4, but with an effective date in June, 2006 instead of October, 2006. This specification will be effective early to cover the small amount of 2007 Caterpillar equipment that will be put in service in 2006. On the other hand, Caterpillar ECF-2 is actually a replacement for Caterpillar ECF-1. This specification would cover API CH-4, CI-4, and CI-4 PLUS oils, but will not become effective until sometime in 2007.

*Will ExxonMobil have a fully qualified product before it's licensable?*

ExxonMobil is well positioned to launch a fully qualified product before licensing should we desire to do so. However, our launch timing will be a function of market need and first licensable date by the API, not a matter of being "first in market" before our competition. There is nothing to be gained by being first in market if there is little or no demand for a fully qualified product.

*Has ExxonMobil been doing any field testing of PC-10 oils?*

ExxonMobil has been testing oils that will provide technology for PC-10 for over a decade. However, field testing of oils specifically designed to meet the PC-10

specification began in early 2005. As of January, 2006, we have accumulated several million miles on our PC-10 formulations in over 80 test trucks, including trucks that are equipped with 2007 equipment as well as current and older designs.

*I have a mixed fleet of Class 3 and higher. How does PC-10 impact me? Do I need to have two separate oils?*

While the choice of how many oils you want to carry is completely up to you, for any equipment you were currently using an API CI-4 or API CI-4 PLUS oil, PC-10 oils will be just fine.

*For years you've been telling me high TBN is one of the most crucial properties of an oil. Now it's not? How come? "How will lower TBN affect 2006 and older engines?"*

TBN is and always will be important. However, the TBN number for a new oil is a lot less relevant than an oil's ability to retain TBN over its drain. TBN, which stands for total base number, is an indication of an oil's ability to neutralize acids that build up during service. There are three main type of acids that form in the engine; sulfuric acid due to the sulfur in fuel, nitric acid due to nitrogen in the air, and organic acids due to the thermal breakdown of the lubricant. Due to the reduced sulfur in diesel fuel and the ability of PC-10 to better withstand thermal degradation, fewer acids will be formed in the engine in all equipment when the fuels and oils come into use. Combine this with the fact that PC-10 oils are being designed to provide optimized TBN retention, and the lower starting TBN number is a lot less to worry about. Despite all this, in some applications, particularly those using 500 ppm fuel, TBN may be the limiting factor when attempting to extend drain intervals.

*How will sulfur content of fuel impact 2007 engines and aftertreatment devices? Can I use a PC-10 product with current fuels? How about with high sulfur fuels used in off-highway equipment?*

Aftertreatment devices are not only impacted by sulfur in the oil. In fact, they are even more impacted by the sulfur in the fuel since so much more fuel than oil passes through an engine. As a result, in preparation for 2007 equipment, on-highway diesel sulfur will be reduced to a maximum of 15 ppm from today's maximum of 500 ppm. In addition, off-highway diesel sulfur levels will also be reduced from current 5000 ppm max to 500 ppm max. This is being done due to potential issues of contamination during pipeline transport as well as for continued emissions reduction in off-highway equipment. All refineries will begin manufacture of these Ultra Low Sulfur Diesel (15 ppm) and 500ppm diesel by June, 2006 while some are even making these fuels today. To account for these future fuel compositions, PC-10 oils are being developed for use with both 15 and 500 ppm sulfur diesel fuel.

*Can I use a PC-10 oil in gasoline engines? If so, which ones?*

Just like today's API CI-4 and CI-4 PLUS oils, most PC-10 oils will also carry API S category claims for use in gasoline engines. Just check the API S claim on PC-10 products and compare it to what's required in the vehicle owner's manual to make sure the oil is appropriate.

*So why use the Mobil Delvac family of products over competitive products?*

Quite simple...wouldn't YOU want to use the technology chosen by the world's five largest heavy duty engine builders?