ENGINE OILS

Early editions of last week's article, "API Pulls Plug on 'Energy Conserving,'" included incorrect information about engines used in tests for current and upcoming API engine oil specifications. The Sequence VID test uses a 2009 Cadillac V6 engine, and the Sequence VIE test under development as a replacement for Sequence VID uses a 2012 Cadillac engine.

Subcommittee D02.B approves revisions to ASTM D4485

AUSTIN, Texas, 10/12/15—The ASTM D4485 revision to incorporate the new API CK-4 and API FA-4 heavy duty engine oil categories was approved by ASTM Subcommittee D02.B on automotive lubricants on Dec. 9, 2015, which met here. ASTM D4485 is the Standard Specification for Performance of Active API Service Category Engine Oils.

API CK-4 is the official nomenclature for PC-11A and **API FA-4** is the official nomenclature for PC-11B. Prior to receiving these official designations from the American Petroleum Institute (API), which will licenses the oils, these categories were called PC-11 for Proposed Category 11. First licensing date of these new categories is scheduled for Dec. 1, 2016.

API CK-4 will replace API CJ-4 and is expected to be backwards compatible with no changes to current viscosity minimums (HTHS ≥ 3.5 mPa·s). API FA-4 is distinctly different than current API claims (HTHS 2.9 to ≤ 3.2 mPa·s - IT PROBABLY WAS ≤ 3.5).

The subcommittee ballot passed without a negative vote after Chevron Oronite withdrew its negative, following revisions to the draft ballot which were made "to clarify a few things." Rather than trying to update Annex 5 of the document, Annex 6 was created for the API CK-4 category, which was deemed "more user friendly."

The API Lubricants Group voted to send out a letter ballot to its members to seek approval for the use of API CK-4 and API FA-4 in the API Service Symbol Donut; to ballot the API CK-4 and API FA-4 Standards User Language; and to approve the first licensing date of Dec. 1, 2016 for these new heavy-duty engine oil categories.

High temperature high shear (HTHS) viscosity of engine oils is a critical property that relates to the fuel economy and durability of a running engine. The drivers behind lowering HTHS viscosity are new global governmental regulations to improve fuel economy (FE) and lower greenhouse gases (GHG) in new vehicles. Lower HTHS viscosity tends to improve FE and lower GHG but higher HTHS viscosity affords better wear protection so a careful balance must be found when formulating an engine oil.

Sufficient HTHS viscosity is critical in preventing engine wear in the critical ring/liner interface area by maintaining a protective oil film between moving parts. One method used to measure HTHS viscosity is ASTM D4683. Oil is introduced between a rotor and a stator at the test temperature of 150°C. The rotor experiences a reactive torque to the oils resistance to flow (viscose friction) and this torque response level is used to determine the HTHS viscosity.

HTHS viscosity by ASTM D4683 has been found to relate to the viscosity providing hydrodynamic lubrication in light duty and heavy duty engines.

HTHS viscosity has also been found to relate to fuel economy. The oil has to be thick enough to maintain separation of the critical moving parts but thin enough to allow for fuel efficient operation.

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V.S.S. Sarma Ignorance is bliss. You may be able to meet 20W-50 SAE J300 limit of 16.3-21.9 cSt at 100 Deg C using a combination of 150 BS and 500 / 600 SN. But how do you match CCS viscosity of 9,500 cP Max @ -15 Deg C and MRV of 60,000 cP Max @ -20 Deg C ?

Basic issue is that **you cannot formulate a 20W-50 or for that matter, any multi-grade using a Bright Stock because low temperature tests do not pass.** There will be lubrication related failures.

But then, only an intelligent user can catch the blender and I am sure many Chinese users do not know SAE J300 limits. Also is the fact that additive manufacturers do not suggest the formulation as they have not carried out engine tests. Do not use Bright Stock to blend multi-grades.

Blenders' compensation of high viscosity BS 150 with low viscosity 150 SN is another joke because the blend will then be known as dumbbell blend. The flash points by COC and PMCC methods vary hugely in such blends. Volatility of low viscosity is a problem. When you need a certain viscosity you should use the nearest base oils on either side of viscosity to make a blend.

As far as engine oils are concerned, since engine tests are involved, let us go strictly by the approved formulations advised to us by the additive supplier. If a component is to be replaced, let us consult with the additive supplier. In general, PPDs can be changed from one PMA to another. PMA. Similarly one source of PAO can be changed with another. But if any other component is to be changed there is a test protocol Base Oil changes should be done following ATIEL code of practice. http://www.atiel.org/images/code-of-practice/ATIEL%20Code%20of%20Practice%20Issue%2019%20-%20September%202013.pdf

VI Improver should not be used in a Natural Gas Engine Oil.

muzaffar hussain I prefer making 20w50 with SN 600 or SN 500 with SN 150 or SN 350, seriously I avoid using BS 150 in 20W50. Because due to presence of Bs150 there certainly arises lots of complications like crystallization of wax at temperate of -9 or -12 due to Bs150 , MRV, cranking viscosity will also be effected.

With presnesce of higher molecular weight of hydrocarbons like SN500 along with SN150 will Not show a major increase in noack may be less than 6%

Ashok Pati Viscometric properties for a multigrade motor oil with SAE 20W/50 viscosity grade were studied in the presence of different viscosity index improvers. The neat base blends contained increasing percentages of a bright-stock.

Measured viscometric properties for both the neat and VI improved blends included the following: kinematic viscosity, viscosity increase by incorporation of a VI improver, viscosity index, specific viscosity and thickening tendency. These measurements were carried out over a wide temperature range.

Increase of the bright-stock content showed that most of the VI improvers behave as thickeners. Polyalkylmethacrylate and styrene-isoprene copolymers were found to be the only exception from such behaviour for the VI improvers.

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Boris Zhmud In general, you would go for VM in a **monograde** only if you cannot get a high viscosity base stocks. As compared to BS, OCP type polymers most commonly used as "bright stock replacement" are detrimental for solubility and lubricity. Styrenic polymers and polyol esters are better for solubility and lubricity but may undermine oxidation stability. In either case, you won't be able to get the same HTHS and Noack as with BS (unless you use hPAOs). You may also wish to consider **Plasmoil** bases (v100 = 360 cSt, FP=270 C, AP=85 C, VI=300!) as an alternative. In general, today, it isn't difficult to formulate well-balanced quolity monograde products without BS, if price is not your objective. Unfortunately, it's rarely so in practice.

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Bearing surfaces on the piston bearings in a General Motors/Electromotive Division (GM/EMD) emergency diesel generator (EDG) engines. The piston wristpin bearing inserts in GM/EMD diesel engines have a silver substrate beneath
a lead-tin overlay. An increasing concentration of silver in the lube oil is an indicator of excessive wear of the bearing surfaces.
In January of 2015, the silver content from EMD #1 increased from 0.1 ppm to 0.2 ppm. A laboratory data analyst contacted plant personnel to report the increase and discuss the situation. It was decided to halve the sampling frequency for this unit. Subsequent samples showed a steady increase in the reported silver, peaking at 0.6 ppm.

Following plant procedures, a shutdown of the engine was initiated. Further examination revealed component damage. The silver had been displaced from the wristpin bearing surfaces to the carrier bearing surfaces blocking one of the lubricating oil channels.
The partially blocked oil channel prevented normal oil flow at the bearing-to-wristpin interface. There also would have been base metal-to-base metal contact which would have led to catastrophic bearing failure and critical engine damage.
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V.S.S. Sarma
We are using a low MW PPD along with a high MW polymer VM in engine oil formulations. Then we have the base oils with varying characteristics. What we see in the physical data is the net effect of these molecules. A PPD stops wax agglomeration thus facilitating flow at low temperatures. If a PPD brings down the Pour Point to say -9 Deg C but CCS has to be measured at -25 Deg C what use is this PPD? Formulating a product is thus a balancing act and in my experience, following the additive supplier's advice is the best that a blender can do; but then, we can not 'reduce costs' using untested combinations. More than the PPD, base oils affect CCS and blenders need to avoid dumbbell blends to get excellent CCS, HTHS and MRV data.
Mazher Nizamuddin
To pass CCS you must add low viscosity (low MW) base oil i.e. SN 150/N 150/ 4/ CST/2 CST in respective groups to achieve desired CCS limits.

Qingyi Gao PPD is more effective to get lower MRV.

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Diesel Particulate Filters Need Service to Maximize Efficiency

In North America, Europe, Japan, and soon Brazil, heavy highway diesel engine particulate matter emissions regulations force the use of diesel particulate filters (DPFs) to trap and oxidize carbon soot in the exhaust. Installation of DPFs allowed diesel builders to retune engines (more specifically, to adjust fuel injection events) to achieve cooler combustion which reduces the formation of harmful nitrous oxides (NOx) but at the expense of boosting output of unburned carbon soot. The increased unburned carbon soot particulate emissions are handled by the DPF.

The porous ceramic filter element substrates in DPFs can be cordierite, silicon carbide, or aluminum titanate. Active regeneration is used in heavy diesel highway vehicles, wherein a periodic rich injection (late injection in combustion chambers or direct injection of fuel into the exhaust stream) lights off and combusts the accumulated fine (micron-size class) carbon soot. Exhaust backpressure sensors signal when regeneration is required, and the process is completed automatically with no driver intervention. Active DPFs are at least 99% effective in trapping carbon soot particulates. DPFs are commonly installed behind the truck cab and are similar in size and shape to a conventional truck muffler.


Source: Clean Diesel Specialists Inc

Starting in 2007, the US Environmental Protection Agency (EPA) made DPFs mandatory for highway diesels, as there is no other cost effective means to achieve the low soot emissions limits. Suppliers typically offer warranties for these filters for 500,000 miles. The filter element has reached the end of its life when holes or cracks appear that allow unfiltered exhaust to flow downstream. During its lifetime, the DPF are typically removed and cleaned 2-3 times. The range of DPF service intervals, according to diesel engine builders, is between 80,000 miles (in severe service) and 250,000 miles (under ideal conditions). The typical long haul heavy duty diesel truck travels more than 80,000 miles per year so depending on the severity of the duty cycle, off-truck cleaning of the DPF could take place between once a year and once every three years. That service interval has been steady, with no appreciable extension of service life, in recent years. Commercial off-truck DPF servicing costs between $100 and $150, and takes 30 minutes to process plus 30 minutes for removal and reinstallation. DPF cleaning machines made by Donaldson and others use pulsed shop air (around 100 psi [pounds per square inch]) to blow out and vacuum out accumulated ash particles, which are primarily oxides of metals. For extremely clogged DPFs, Donaldson's process begins with a pulsed-air blasting, followed by extended (6-hour) thermal regeneration in separate apparatus to extract remaining carbon soot or hydrocarbons, and then a final pulsed-air cleaning to extract residual ash. Competing machines use steady, not pulsed, air blasts. Large diesel truck fleet operators usually have their own DPF cleaning machines. Air flow readings before and after cleaning verify that the DPF is ready for reinstallation.

The primary source of ash constituents that can build up in DPFs are chemical additives in engine lube oil, such as organometallic detergents which are needed in the engine oil to neutralize acids and to keep the internal parts of the engine clean. Other sources of the metallic derivatives that form ash can originate from engine wear (iron, copper, lead, silicon, etc.), diesel fuel (sodium, potassium), coolant leaks (sodium, potassium) and air contaminants (silicon). Lubricant borne ash deposits are based primarily on calcium and magnesium. Modern engine oils, such as API CJ-4, have been developed with limited ash content which helps extend the intervals between DPF cleaning. These lubricants not only meet stringent ash limits to allow the successful use of DPFs, but they also pass rigorous engine tests to ensure the lubricant will protect all aspects of engine performance even better than previous generations of oil. That makes these new oils mandatory for use in newer, DPF equipped, vehicles, but also recommended for older engines.

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Roads in China and other parts of Asia are expected in coming years to see an increasing number of trucks that are equipped with selective catalytic reduction and which therefore require the use of **diesel exhaust fluid**.

Operators would be wise to select certified DEFs, an official from the American Petroleum Institute said during a lubricant conference here last week.

“There are things that can go wrong if you use a diesel exhaust fluid that is not properly formulated or has not been properly stored,” Senior Engineer Dennis L. Bachelder told the China International Base Oils & Additives Conference, which was held in conjunction with the Inter Lubric exhibition. “Use a certified DEF brand you can trust.”

Selective catalytic reduction is one of several technologies – along with exhaust gas recirculation and diesel particulate filters – used on the most modern trucks and passenger cars to help reduce emissions of pollutants and greenhouse gases. Used first on ships and in large stationary diesel engines, SCR injects the DEF into the exhaust stream in the presence of a catalyst that promotes a chemical reaction turning nitrous oxides into nitrogen, water and small amounts of carbon dioxide.

SCR has for several years been used on almost all new trucks in the United States and Europe. So far it is relatively rare in China and much of Asia, but it is expected to become commonplace as those areas adopt stricter emissions standards.

As a consumable, the DEF must be repeatedly replenished. Known in Europe as Ad-blue and in Australia as AUS32, the fluid is stored in a small tank next to the fuel tank. According to Bachelder, operators risk causing deterioration to the catalyst or malfunction of the SCR system if the fluid does not meet a precise formulation – 32.5 percent urea and 67.5 percent demineralized water.

"If the fluid is mixed with water that is not demineralized, you're going to have problems," he said. DEF freezes at 12 degrees F and begins to separate and evaporate above 86 F, requiring temperature controls on the tank in which it is stored.

Bachelder added that DEF proper storage is also important. DEF corrodes aluminum, so it must be kept in plastic or stainless steel tanks. It also must be protected from sunlight and has a shelf-life of one to two years.

API, which is based in Washington, D.C., conducts a program to certify DEFs that comply with ISO 22241, an international standard. Applicants submit paperwork documenting that their fluid is properly formulated, has been tested using acceptable methods and is properly stored and handled by the manufacturer. Marketers meeting those requirements are licensed to display API's DEF certification mark.

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V.S.S. Sarma

Except for one 2 stroke engine oil TISI 1040 no engine oil specifies a minimum VI. Even in the case where specified, it is a mere 95 minimum.

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Chris Starling

Molybdenum in diesel engines usually comes from piston rings and oil additives. Molybdenum is used as an alloy in some piston rings in the place of Chromium. Molybdenum is also used as a friction-reducing additive in some oils. Soluble Molybdenum can be used as an antioxidant additive.

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Some researches indicated that the best operation area of lube's HTHS Viscosity should be around 2.3 to 2.6 mPa.s. But market penetration of low viscosity fluids such as 5W20, 0W20, 0W16 is really very slow.

V.S.S. Sarma

What use is this if on fuel you save money but on lube & engine, you lose more ? Engines wear out faster with low viscosity oils and lube consumption will also go up. Because of California's CAFE requirement, vehicle manufacturers are thrusting low viscosity grades.

Mikhail Fedotov

There is no connection with low viscosity and wear. Additive package helps. Japanese cars are running on OEM oils with SAE 0w-16 for 2-3 years already (SAE class was not shown before as it did not exist). American cars are from 2000s are running on SAE xw-20 - no issues at all.
The biggest question how to keep low volatility for low viscosity fluids, especially if we look at new developments for ultra low HTHS below 2.3. (SAE 0w-12, SAE 0w-8).

V.S.S. Sarma

I have some personal examples here in Dubai when a car fleet owner changed from 20W50 to 10W30. Huge engine failures happened for want of lubrication.

Mikhail Fedotov

Well, my comment has applied to car/engine original requirements, not that you can easily switch from HTHS >3,5 to HTHS <2.9 or something similar. But majority of Japanese and US engines requirements currently are below HTHS 2.9. Of course in extreme conditions we may see that it's better do not think about fuel economy, but just to protect rather than save 0,5% fuel... :-)

V.S.S. Sarma

The HTHS determines the film strength at elevated temperatures. Any compromise on this aspect will be detrimental to engine life. Further, the driver will feel loss of power or that the engine RPM would be going down. I will always ensure conformance to SAE J300 besides the basic characteristics of the specification applicable.

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There's a DI package for engine oil to be blended with group Ⅲ or synthetic base oil like PAO to meet API performance SM through SN/CI-4 with different dosage. As they could both reach API SM, then what's the necessity of using synthetic base oil since it's more expensive?

V.S.S. Sarma

Blender has no flexibility to change base oil or additive. We should go by the test data presented by the additive manufacturer along with the composition that validated the test data. Ask the four additive companies formulary advice indicating what all specifications you are looking for. Once you receive the four offers, study them, select them based on technical pass after which you cost these formulations. Select the lowest cost formulation that meets the target specifications. We do not have any chance to change base oil or additive once the same is selected based on techno-economic considerations.

Ravi Tallamraju

Reason for adding PAO is mainly to meet some of the very tough engine and bench test challenges imposed by European OEM specifications and also to meet the tough viscometric requirements on wide span viscosity grades like 0W-30 / 0W-40/ 5W-40 etc.
If you only need API specifications , there is no real technical need for PAO for most engine oils - Gr-III base oils are more than enough. Addition of PAO can still help - but will increase cost unnecessarily. More PAO can cause poor solvency and can affect seals too if it is not balanced with esters or some Gr- I/ II.
Agree with Mr. Sarma's assessment about restrictions on changing anything on the formulations . Some of the approval testing (example - **CI-4 and above can cost > 1.5 million $ to complete** . Average **API SN GF-5 testing can cost approximately $250K** / formulation .
If you want to change the additive / base oils - it can require this level of investment - hence not all additive companies (except the big four) can offer such products for API license / OEM approvals.

Gerardo Paras

Toyota and other manufacturers, are now in the process (advanced) to run engines in the tropics with a 16W vis, they´re braking the paradigm, such a low vis for such ambient temps in the tropics!!!!!! amazing, but this will be ready by 2018 or so. this engines will be highly efficient, lower emissions as friction will be reduced during operation.

V.S.S. Sarma

While you are formulating, tell your additive supplier your interest of using certain base oils (like you can say 'I want to use Nexbase Gr 3' OR 'I want to use PAO') and also certain additives (like you can say 'I want to use LZ 7077 as the Viscosity Modifier'). Then you tell what all specs you are looking for - API, ACEA, OEM, JASO, etc. Leave the matter then to the additive suppliers to revert to you with suggested formulations and costs of additives. Select the most suitable of these formulations and stick to it for few years until the specification becomes obsolete OR the formulation becomes obsolete OR more cost-effective formulations are developed.

In my experience, I wish to say that Gr 3 base oils mimic the performance of PAOs mostly. The only difference is in the area of Noack volatility. PAOs have lower volatility compared to Gr 3 products. If I give 100 marks to PAO-based formulation, I give 95 marks to a well-made Gr 3 based formulation. For this small, negligible difference, the price difference is too high to bear.

A lot of marketing hype is created around PAO-based engine oils. At the end of it all, it is Dollars that matter for the lube oil producing companies, it seems.

Chris Brook

My experience with **CCS on the Cannon CCS-2100 is that PAO is far superior to GP III** viscosity equivalents. **GP IIIs tend to have better lubricity** properties than PAOs.

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The lubricant in a crankcase engine is subjected to very complex conditions, with many different conditions in different parts of the engine, variable patterns of driving behavior, and, critically, the contamination of the lubricant by reactive combustion gases and particulates. This makes it very difficult to relate engine/lubricant performance to simple bench tests, and a key feature of engine oil development and testing is the use of engine tests to assess the behavior of the lubricant in the complex combination of conditions present in a firing engine.

GF-6A will cover existing engine oil grades while GF-6B will cover new grades with viscosities lower than 0W-20. Re-cently the Japanese automaker Honda requested two lower viscosity grades (0W-12 and 0W-8) be added to the Engine Oil Viscosity Grade Classification System. At the time of this article’s publication, the first license date for PC-11 will be in December 2016. GF-6 will probably move to a March 2018 first license date. The third engine oil specification is the second generation GM specification known as dexos1TM that is due to be implemented in September 2016.

Martin Birze, The Lubrizol Corp.’s regional business manager, passenger car additives in Wickliffe, Ohio, says, “the proposed GF-6 specification is a significant upgrade that addresses the demands of new engine technology. This technology requires higher-performing engine oils to enable efficiency while also delivering the higher fuel economies required by mandated regulations. “GF-6 is unprecedented in its proposed inclusion of six new engine tests. Four are replacement tests being updated with new hardware, and two are entirely new tests. The specification will push the industry’s approach to engine oil formulation to greater heights.”

STLE-member Kaustav Sinha, global project manager for Chevron Oronite Co. LLC in Bellaire, Texas, overseeing the GF-6 development, provides an overview of the six new engine tests being developed for GF-6. Says Sinha: “The Sequence IIIH oxidation/deposit and Sequence IVB valve train wear tests will get engines and test procedures developed by two new Original Equipment Manufacturers (OEMs), Chrysler and Toyota, respectively. Ford is refreshing the Sequence V sludge performance test and also developing two brand new tests (low speed pre-ignition (LSPI) and chain wear) for the category. GM is refreshing the Sequence VI fuel economy test.”

STLE Fellow Dr. Simon Tung, global OEM liaison manager for Vanderbilt Chemicals LLC in Norwalk, Conn., says, “In moving beyond GF-5 requirements, GF-6 will incorporate increased fuel economy through the oil change interval, enhanced oil robustness for spark-ignited internal combustion engines, formulations to help minimize the occurrence of low-speed engine pre-ignition and wear protection for various engine components.” Tung makes two additional important points about the reason for developing GF-6. He says: “Each of the new tests addresses requests by OEMs based upon the needs of modern, high-tech engines. With these new technologies come new requirements of the lubricants that enable them. The new tests also address the increasingly limited availability of older engine parts. Simply put, engines used to run tests under GF-5 are reaching the end of their useful life, and parts are limited or unavailable, necessitating replacement tests to meet new engine requirements."

Tiffany Murphy, marketing manager for PCMO for Afton Chemical in Richmond, Va., says, "The GF-6 category will again seek to define an engine oil with improved durability characteristics and better fuel economy performance to help equipment manufacturers meet the future EPA CAFE targets."

STLE-member Dr. Frank DeBlase, Chemtura Fellow-petroleum additives in Middlebury, Conn., has focused his research on novel anti-wear agent, antioxidant and friction modifiers. Says DeBlase on the new subcategory GF- 6B: "The new lower viscosity GF-6B oil (0W-16 or 5W-16), with a lower high-temperature high-shear (HTHS) viscosity, should deliver improved fuel economy and lower green-house gas emissions but will require additional engine protection. Therefore, new tests are being developed to assess increased fuel economy performance and engine durability. These requirements will be addressed by new lubricant and additive technologies."

DeBlase believes that changes in the treat rate of certain additives and use of more durable base oils are needed for GF-6 in general and specifically GF-6B. He states, "The lower viscosity GF-6B oils will likely require more effective friction modifiers and anti-wear additives. Maintaining boundary lubrication and wear protection by using more sulfur- and phosphorus-containing metal antiwear and friction modifiers might compromise pollution control devices or generate higher deposits. The preferred choice to mitigate this problem is additional organic friction modifiers and antiwear additives for even greater boundary lubrication while maintaining elastohydrodynamic lubrication."

DeBlase continues, "The longer drain intervals required in GF-6 will be assisted by more oxidation-resistant base oils such as gas-to-liquid synthetic oils, polyalphaolefins, polyolesters or polyalkylene glycols. Extended drain intervals also will require the use of more or better antioxidants and additives capable of providing sustained boundary lubrication over high mileage intervals."

Steve Haffner, North America crankcase market manager for Infineum USA L.P. in Linden, N.J., gives his perspective on GF-6. He says, "The new PCMO specification is being developed to protect the newer hardware being introduced into the field including smaller displacement, direct-injected gasoline engines. These new oils will be expected to deliver enhanced oil robustness and wear protection as well as increased fuel economy throughout the oil change interval."

Phil Hutchison, Asia Pacific regional technical manager for Evonik Oil Additives in Singapore, offers this analysis on the role of VI improvers: "The real choice affecting VI improver selection will be deciding the contribution the oil marketer can realize from an improvement in fuel economy. Careful selection of the VI improver, such as the use of a comb polymer, can reduce viscosity at intermediate oil temperatures and directly influence fuel economy. The VI improver type should be considered as a formulation tool alongside other additives such as friction modifiers and can be selected to achieve the desired fuel economy performance level."

Precision matrix for the **Chrysler Oxidation and Deposit Engine Oil Certification Test** is projected to be completed by mid-September, according to Kaustav Sinha, Chevron Oronite's global project manager for **ILSAC GF-6/Dexos**. Precision matrix testing started on July 21.

Sinha gave an update on the test at the 2015 JSAE/SAE Powertrains, Fuels and Lubricants International Meeting in Kyoto, Japan this week.

The Chrysler Oxidation and Deposit Engine Oil Certification Test is one of six engine tests that will be part of ILSAC GF-6, the new passenger car engine oil specification being developed by American and Japanese light-duty vehicle manufacturers. ILSAC GF-6 licensing is projected to be ready by early 2018.

The test uses a **2014 PentaStar 3.6-L V6 engine**. The test that it will replace, **the Sequence IIIG,** runs on a **1996 GM Powertrain 3800 V6 engine**, which is no longer in production. It runs for 90 hours, with a six-ounce addition of oil every 20 hours. SwRI, IAR, Lubrizol, Afton and Ashland have installed the test and contributed to the prove-out matrix data generation.

So far, the matrix team has completed 12 tests out of the 28 tests that will be run in the precision matrix. Five labs, using seven engine test stands, are participating in the precision matrix.

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Richard Widman about **what's good about ILSAC GF-5**

There is a huge advantage in cars with catalytic converters. We see a lot of clogged ones with cheap SM or older oils. Lubrizol has or had a nice spyder graph with the advantages.

Ameet Sevekar

GF-5 is designed specifically to address, enhance Fuel economy & add to oil robustness. So, you can have e.g. API SN oil performance which in addition could be GF-5 as well, meaning, its capable of providing FE.

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Maximum allowable limit of wear metals depends on the engine and conditions it is used in. The OEM's can provide you with data listing their upper limits but this will still vary by each specific unit within its application.

Samir Azzi:

for diesel engines, normally every OEM would have different limits related to the metals used in his engine parts. Type of application of your equipment is also important:

Once you can identify the above, providing limits would be more appropriate..However in general, here below are common limits for Diesel Engines:

* Iron >100ppm critical
* Cromium >15 ppm critical
* Lead > 40 critical
* Copper > 45 critical
* Tin > 20 ppm, critical
* Al > 20 ppm critical
* Silicon > 15 ppm critical
* Sodium > 30 ppm critical

But what is more important than the above figures is to monitor the trends of your wear metals in used oil analysis.

Douglas McGregor

Ashis, I second the comments provided by Samir above. In my opinion and experience, condemnation limits are meaningless. A useful and successful preventative maintenance program involving used oil analysis will utilize trend data (statistical analysis of data trends) to determine when to "flag" a given result as abnormal and in need of further investigation. Often times, the abnormal result will be well below a given condemnation limit, but may allow for an issue to be addressed prior to reaching a condemnation limit, when it will be likely too late to address and avoid more costly maintenance actions. Perhaps the information I found in my files from Cummins regarding this issue will be helpful as well... provided below:

"Used oil analysis can monitor engine oil contaminant levels and provides evidence of dirt ingress, excessive fuel contamination (dilution), coolant leaks, excessive soot accumulation, and abnormal wear.

Elevated levels of silicon in the used oil indicate dirt contamination of the oil, usually caused by faulty intake filtration. At times, dirt contamination occurs through the oil side of the engine from contaminated engine oil. The used oil can also contain abnormal levels of copper and lead from bearing material wear, without extremely elevated levels of chromium and iron.

Abnormal wear causes abnormal accumulation of wear metals in the used oil. Condemnation limits are not possible except for engines in an application operating at one site on a single engine oil. The wear metal content of an oil sample depends on the engine, the load factor, the capacity of the lubricating system, the miles or hours on the oil, the engine oil consumption rate and so on. Engines with large oil capacities result in lower wear metal levels than engines with smaller oil capacities because the particles are suspended in a larger volume of oil. Low oil consumption engines exhibit higher wear metal levels than high oil consumption engines because of the absence of dilution by new oil between oil changes. Engine oil consumption rate can change the wear metal content of the used oil by a factor of two and mask doubling wear rates which can indicate engine damage. Wear rates are unknown unless the engine oil consumption is known. Wear metal levels vary nearly linearly with the miles or hours on an oil sample. Doubling the miles or hours on an oil sample nearly doubles the wear metal content of a used oil sample. Wear metal content of a used oil sample is almost meaningless information without the engine oil consumption rate, the miles or hours on the oil sample, and a new oil analysis.

Abnormal wear, which can indicate a problem, usually only involves elevated levels of one or two metals. Detection of elevated levels of a wear metal is best performed by comparing the levels in the used oil sample to the levels in previous oil samples from the same engine. Engine components containing copper and lead can become chemically active with a change in the additive chemicals in the oil that is often accompanied by switching to a different brand of oil. This often results in dramatically increased levels, often ten times, of copper or lead in used oil. Increased levels from this source is not reason for excessive concern. These components will become passive after a few oil changes with different oil. Wear metal levels will then slowly decline back into the normal range for the engine.

Never disassemble an engine based solely on used oil analysis. Perform additional troubleshooting to determine if a problem exists. If a problem is suspected based on oil analysis, cut open the full flow oil filter and look for wear metal particles that are trapped by the filter and easily visible."

Oil analysis is relevant from the third analysis and with the information below:
* using conditions
* type of lubricant
* oil hours
* motor hours
* type of motor, brand, model,...
* oil, diesel quality
* maintenance operation

Mile Stojilkovic

The engine oils, origin of elements can be of additives, wear, from fuel from the air and liquid cooling. Metals from the additives may be Zn, Ca, Ba, or Mg, and indicate the consumption of additives. Metals originating from wear are: Fe, Pb, Cu, Cr, Al, Mn, Ag, Sn and point to increased wear in those parts of the mechanism. The elements that originate from the coolant as Na and B, and increased content indicates the penetration of coolant. Increased content of Si or Ca, which originate from the air, indicates defective or bad air filter.

Damanik Ramidi

I Have experience at Oil monitoring practice Of Heavy equiptment at mining operation, specially at Coal and Copper mining, both Open Pit and underground. The main type application of Diesel Engines with above 3000 HP:

* (Fe) >95 ppm critical and Fe > 45 warning
* (Cr)>15 ppm , critical and Cr > 5 warning
* Lead (Pb) > 80 critical and Pb > 25 warning
* Copper (Cu) > 30, critical and Cu >10 warning
* Tin (Sn) > 15 ppm, critical and Sn > 5 warning
* Aluminium (Al) > 16ppm, critical and Al > 8 warning
* Silicon (Si) > 35 ppm, critical and Si > 15 warning
* Sodium (Na) > 100 ppm, critical and Na> 50 warning
* (Ni) > 15 ppm, critical and Ni > 5 warning

kapil verma

iron 250ppm and silicon 50ppm

Shraddha Bhide

Hello Sir, I just read your comments now. I would suggest you to use Centrifugal Filtration to remove all particulate contaminants up to 1 micron. Oilmax Systems is one of the name. Please visit www.oilmaxsystems.com for more information. Also direct your queries to export@oilmax.co.in

Doug Smith

centrifugal systems are becoming known for hiding a problem in an engine. This type of system makes it nearly impossible to diagnose any problems through trending.
I have seen several new diesel truck engines that seized bearings and il analysis trending showed very little wear metals. There is such a thing as filtering too well!

James Vais

Bearings seizure is not due to excessive oil filtration but rather on failure to monitor oil pressure. Centrifugal pumps typically are not used as a primary lube oil system because they do not provide positive displacement.

Doug Smith

JAMES, you're out to lunch. My reference was to the centrifugal filtratiin systems as previously mentioned. They are getting mor popular in trucking andeven though it filters great, it is too good for oil sampling to be reliable.

James Vais

Doug I apologize. Yes, I agree that centrifugal filtration is a bit over kill when in constant operation. Filtration into the sub-micron level is a bit overkill and can hide potential issues. At the same rate these systems should only be used when necessary. An example would be after an oil analysis and a clear bil of health given the oil can be cycled through the centrifuge system rather than recycled.

James Coxhead

It is true that centrifugal filtration can hide a problem, I would recommend a by pass filtration system so yo can collect particles in the range 2-5 microns that can retain wear particles as well as those relatives to oil degradation.

Karim Ibrahim, MBA

Permissible limits for engine wear definitely differs from one type of engine to another and differs quite significantly from one protection level to another. So if engine is on older type of oil, the classic wear tables are of value while the figures they offer are not realistic with the more modern, higher protection oils. I am pro depending on trend with the exception of dirt contamination which should be taken seriously at any notable level. I have also found that if the levels seem to climb significantly, acidity is often the culprit, more often than not, if top-up is delayed till oils reach low volume levels.

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Gongde Liu Vice chief engineer at Petrochina Dalian Lube R&D Institute

Will Mack T11 be eliminated from the new PC-11 specification

Mack T11 included in API CI4 plus and CJ4 tests the oil's high soot treat capacity(6.7%soot with no more than 15 cSt viscosity increase).Diesel oil's extremely high soot dispersancy leads large package dosage and hard properties balance. Actually, no such high soot produced and thus no such high soot dispersancy required in reality application.Will T11 be eliminate from the new specification and a much mild test T8E reused in place?

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Elman Pendzhiev head of R&D Dep. in "VMPAUTO" LLC

Decrease of HTHS viscosity of engine oils

In January 2015 new version of SAE J300 (Engine Oil Viscosity Classification) was published. Now we have SAE 12 and SAE 8 engine oils with very low HTHS viscosities. Such oils should be used in engines with new design. Does anyone knows what are the peculiarities of these new engines? Do they exist? Is it real future of ICE's or just platform for new experiments?

There is also another topic for discussion. We monitored some engine oils during service intervals. What we found is that in some cases HTHS viscosity dropped. In one case the drop only after 3000 km mileage was so strong, that oils turned from SAE 30 to SAE 20. It may cause serious wear in ICE to my mind. Is there any articles covering such situations? Or may be such drops of HTHS are povided by designers of engines and nothing bad is going to happen?

The 100°C kinematic viscosity (KV100) ranges of the new viscosity grades overlap to provide adequate formulating space for these grades.

Besides adding the SAE 16 grade, the new revision to J300 also revises the minimum high-temperature viscosity range of SAE 20. “In the past, an SAE 20 oil’s kinematic viscosity, measured at 100°C (212°F) was 5.6 cSt (centistokes) to less than 9.3 cSt," Covitch explained. "This was a much broader range than SAE 30, 40, 50, or 60, and the lower part of the old SAE 20 range was not being utilized. Therefore, the minimum kinematic viscosity was increased to 6.9 cSt to bring the range of SAE 20 in line with that of the higher-viscosity grades.”

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ILSAC GF-6 introduction pushed back to January 2018

13 March 2015 | Lubricants

The earliest release of ILSAC GF-6, the new passenger car engine oil category being developed for North America and Japan, will be January 2018 due to continued challenges relating to new tests for that category, according to Teri Kowalski, principal engineer at Toyota Motor Corp.

Speaking at F+L Week 2015 at the Pan Pacific Singapore on 12 March, Kowalski said the development of this performance category is unprecedented in several ways. Six engine tests are being developed for this category—four are replacing old tests (Sequence IIIG - Oxidation and Deposits, Sequence IVA - Valvetrain Wear, Sequence VG - Sludge and Varnish, Sequence VID - Fuel economy) and two are brand new (Timing Chain Wear and Low-Speed Pre-Ignition).

Additionally, a new heavy-duty diesel category, PC-11, is being developed in parallel to replace the current API CJ-4. With both being developed at the same time, Kowalski said, both human and material resources are being taxed, as many of the same people are working on both categories.

Because of these new challenges, it is not surprising that the category has so far been about four and a half years in the making. With only one new test, GF-5 took four years to develop, Kowalski added. But, she said, “we are seeing the light at the end of the tunnel.” All parties involved have signed the Memorandum of Agreement and agreed on the Needs Statement last December.

All funding for the precision matrix also has been collected. Matrix test labs and reference oils have also been designated. The precision matrix is expected to begin in May and will take at least three months.

There are two pressure points for completing the testing: first, four out of the five tests for the current GF-5 are going to cease being available in 2016 and 2017. “OEMs [original equipment manufacturers] want to take advantage of the fuel economy benefits of oils that comply to these higher specifications,” said Kowalski, “and they can’t do that until the oils are available in the marketplace.”

PC-11 will be introduced before GF-6 and the oil marketers have requested that there be a nine-month separation between PC-11 and GF-6 first licensing date.

Two sub-categories of GF-6 are being developed. GF-6A is fully backward-compatible, whereas GF-6B is designed for low-viscosity engine oils.

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GM dexos™ Licensed Oils List Keeps Growing

The number of General Motors approved dexos™ oils continues to grow, not only significantly, but exponentially, much more than straight line growth. When OEM/Lube News reported last in August 2014, the total number of dexos1™ oils on the approved oils list was 224 and the total number of dexos2™ oils was 96. There are now 359 dexos1™ oils and 119 dexos2™ oils presently listed. When we reported in March 2013, the total number of approved dexos1™ oils on the list was only 105 and the total number of dexos2™ oils was only 75.

There are now over one-hundred Licensees, at least 10% more than the number of licensees at the start of 2014.

Jo Lynne Parsons, dexos™ Project Manager at the Center for Quality Assurance, which administers the program for GM, told OEM/Lube News "The number of dexos™ products offered continues to increase for several reasons, but two main ones come to mind, as follows:

First, 2014 saw an increase in the number of licensed 0W-20 and 5W-20 dexos™ products. As vehicle and fuel efficiency requirements become more demanding, more GM vehicles are specifying lower viscosity engine oils. The efforts of both licensed blenders and additive companies in responding to these shifts and meeting the challenges through the development of new formulations is a key factor in successfully meeting the needs of GM vehicle owners"

"Another trend seen throughout 2014, was a large increase in the number of private label lines licensed under the dexos™ program, further expanding availability so that dexos™ licensed oils are readily available for GM vehicle owners around the world." Parsons told OEM/Lube News.

The global supply of dexos™ continues to expand as more marketers join the program. With the first license term ending and the second dexos™ license term beginning with a start date of January 1, 2015, the majority of lubricant suppliers exercised an early extension of their dexos™ licenses.

2015 will also see the introduction of the new dexos1™ specification. The roll-out is now underway. Additive companies have been engaged in communication sessions regarding the new specification, so that they can develop the additive packages for the new specification. Blenders will start to see the new formulations later in 2015 and will be able to register products before GM vehicles requiring the new dexos1™ specification need to be serviced.

Midland, MI-based Center for Quality Assurance develops, implements, and administers licensing programs for OEM-specified fluids such as engine oils and transmission fluids. With over 25 years of experience working with industry partners, CQA's licensing programs provide OEMs with a convenient process to qualify fluid suppliers, expand global availability of approved fluids, and monitor ongoing fluid quality in the marketplace. OEMs can then focus on developing their next generation of equipment and fluid specifications, while CQA manages the programs that support those developments.

The official GM lists include dexos1™ oils, specifically designed to meet the needs of GM gasoline engines, and dexos2™ oils, specifically designed to meet the needs of GM's light-duty diesel engines. dexos2™ is also the recommended service fill oil for European gasoline engines.

For the latest complete list of dexos1™ licensed oils http://www.centerforqa.com/gm/dexos1-brands

For the latest complete list of dexos2™ licensed oils http://www.centerforqa.com/gm/dexos2-brands

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Fuel Saver Oils - Myth or reality ?

Stewart Bannister   Senior Accounts MGR / Technical Advisor

Stay away from chlorine. Seals do not like it.

The answer is yes you can save a considerate amount on fuel expenses by treating your entire driveline and removing any rolling friction with a premium quality grease. I have been implementing tests around Australia as the product has experienced some amazing results in the U.S proving massive savings on fuel and maintenance. If you would like to find out more then please get in contact via my page as I do not want to start a full blown war on someone elses thread. What I will say though is why would you put a material harder than the surface you are trying to protect in your equipment for short time benefit that ultimately destroys everything it touches.
Things I can help with
* Cold starts
* Saving Fuel
* Saving on maintenance
* Extend the life of EGR systems (regeneration)
* Remove heat and friction (75%)
* Reduce emissions
* Reduce labor costs or redirect labor
All without upsetting your current oil supplier (too much). What we prefer to do is work together to establish a good relationship instead of a hostile one.

Gongde Liu   Lube R&D Dept. Manager at PetroChina Dalian Lube R&D Institute

For engine oils, viscosity is the main issue on fuel saving, e.g,low viscosity oil means low internal-friction, better cold-starting and lower fuel consumption, that's why low viscosity grades as 5W-30, and even 0W-20 are more and more accepted by the markets. While fuel efficiency is also a very complicated and complex issues, besides the viscosity mentioned above, the engine oil's formula/properties, the fuel, the oil drain interval,the engine status and even the drivers skill are all contribute to the fuel efficiency. As to the topic above, generally synthetic 5W30 will show some fuel saving than that of the mineral 10W40,say 2-3%,but you must pay attention to the fact the longer drain interval will fade away the effect to some extend.

Chris Brook   Crown Oil - Technical - Fuels & Lubricants

Don't forget fuel efficient drive-line lubricants too.

HDDO axle lubes are shifting towards synthetic xW/90 instead of xW/140.

A small percentage of moly can achieve some good coefficient of friction reductions too, these are usually already found in the AD pack but we can tweak them even further depending on the application/requirements.

Boris Zhmud   Chief Technology Officer at Applied Nano Surfaces AB

On average, mechanical losses in an IC engine account for 10-20% of fuel consumed. Therefore, by changing, e.g. from SAE40 (14 cSt at 100C) to SAE30 (11 cSt at 100C), one may expect max 3-6% fuel economy. See for instance www.sveacon.se/lectures/tribology.pdf, p.28.

Bret Wiseman   CHPP Training Supervisor - Anglo American Metallurgical Coal - Looking for a New Challenge

Real world.. We would use synthetics and (controversial item) a Teflon metal treatment in our rally cars. (full drive train) Full throttle life expectancy of these engines is 500 miles. At 3200 miles we did a tear down and reused most of the components. I was so impressed with the results that I used the same system in my 1985 Nissan diesel which was still running just fine at just under 1,000,000 km, Still have it. Reduction of the friction in the complete drive train resulted in a >6% fuel economy. As this was a company vehicle the logs confirmed this. Take it as you want.

Andy Griffin   BP Castrol Automotive and Industrial Lubricants Technical Advisor

Industry trends show OEM's chasing fuel efficiency and emissions as their main target, especially with the upcoming rules regarding 130g/km European CO2 emissions. The key to this is new engine technology development and lower viscosity fluids. Many manufacturers are now specifying 0W-20 grades to increase MPG and reduce emissions. There is an SAE 16 and lower grades down to SAE 4 in the pipeline for future develpoments. Even changing the formulation of an oil with the same viscosity to a later one such as5W-30 Ford 913-C to 913-D can show savings of 0.5 - 0.7%.

One thing to bear in mind though, you can't just throw an ACEA A1/B1 or A5/B5 (low HTHS) oil into an engine designed to run an A3/B4 (high HTHS) as the oil may be too thin to protect the engine at high temperatures. If you have an application that asks for an A3/B4, just drop the viscosity to a 0W-30, or 5W-30 - but stick with A3/B4 or C3 to ensure adequate protection.

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SAE Adds Two New Grades SAE 8 and 12 to J300

SAE revision to J300; latest update includes two new high-temperature viscosity grades

22 January 2015 | Automotive Lubricants

SAE International has published an update to SAE J300 on 20 Jan. 2015. SAE J300 defines the limits for a classification of engine lubricating oils in rheological terms only.

This revision continues the process of extending the SAE Engine Oil Viscosity Classification system to lower high-temperature high-shear rate (HTHS) viscosities by adding two new high-temperature viscosity grades – SAE 12 and SAE 8 – to SAE J300 with minimum HTHS viscosities of 2.0 and 1.7 mPa?s, respectively.

The development of ever-lower-viscosity engine oils has been a longtime goal of original equipment manufacturers. In 2011, Honda presented data at the ICIS Asian Base Oils & Lubricants Conference which showed that future engine oils designed for automobile fuel economy improvement would require new viscosity classifications below the then-current SAE system. Honda concluded that cooperation between the automotive, engine oil and additive industries would be a key factor in developing these oils, given the imminent need for these new SAE classifications. Reiterating this need, the Rationale Statement for J300 JAN2015 states, "This revision continues the process of extending the SAE Engine Oil Viscosity Classification system to lower high-temperature high-shear-rate (HTHS) viscosities by adding two new high-temperature viscosity grades—SAE 12 and SAE 8 – to SAE J300 with minimum HTHS viscosity of 2.0 and 1.7 mPa•s respectively. The benefit of establishing new viscosity grades is to provide a framework for formulating lower HTHS engine oils in support of the ongoing quest of Original Equipment Manufacturers (OEMs) to improve fuel economy."

• SAE 8 is defined as having minimum kinematic viscosity at 100 degrees C of 4.0 centiStokes, and a KV100 maximum of less than 6.1 cSt. Its high-temperature/high-shear-rate viscosity at 150 C is 1.7 mPa•s (minimum).
• SAE 12's KV100 limits are 5.0 cSt (minimum) and less than 7.1 cSt (maximum); the grade's HTHS viscosity minimum is 2.0 mPa•s.

As SAE points out, the KV100 ranges of the new viscosity grades overlap in order to provide adequate formulating space for the grades. It urges formulators to review Section 6 of the updated document, for guidance on how to assign a single high-temperature viscosity grade to an engine oil with KV100 in the overlap regions.

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The SAE 16 viscosity grade was added to SAE J300: Engine Oil Viscosity Classification in April 2013. The J300 revision was requested by a consortium of passenger car OEMs to provide a viscosity grade lower than SAE 20.

The 100°C kinematic viscosity (KV100) ranges of the new viscosity grades overlap to provide adequate formulating space for these grades. SAE 8 is defined as having minimum kinematic viscosity at 100 degrees C of 4.0 cSt, and a KV100 maximum of less than 6.1 cSt. Its high-temperature/high-shear-rate viscosity at 150C is 1.7 mPas (minimum). SAE 12's KV100 limits are 5.0 cSt (minimum) and less than 7.1 cSt (maximum); the grade's HTHS viscosity minimum is 2.0 mPas.

"The main driving force for using lower-viscosity oils is to lower hydrodynamic friction, thereby increasing fuel economy," said Michael Covitch of Lubrizol, Chair of the SAE International Engine Oil Viscosity Classification (EOVC) task force, when the SAE 16 viscosity grade was added to J300.

He explained the new grade will be specified in the future by OEMs for cars specifically designed to use new low-viscosity oils. It is not deemed to be suitable for use with older engines or newer vehicles not designed for such low-viscosity oils."

When the SAE 16 viscosity grade was introduced, Covitch said "If we continued to count down from SAE 20 to 15 to 10, etc., we would be facing continuing customer confusion issues with popular low-temperature viscosity grades such as SAE 10W, SAE 5W, and SAE 0W. By choosing to call the new viscosity grade SAE 16, we established a precedent for future grades, counting down by fours instead of fives: SAE 12, SAE 8, SAE 4."

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SAE International has stretched the lower boundaries of engine oil viscosity categories, adding two new grades – SAE 8 and SAE 12 – to SAE J300, the Engine Oil Viscosity Grade Classification System.

The new grades were added at the request of Japanese automaker Honda. Their inclusion in J300 creates a globally recognized set of parameters to define oils of that are lighter than SAE 16, previously the lightest grade. It also raises the possibility that the new grades could be incorporated into industry engine oil performance standards, such as the API S series of light-duty oil specifications.

Lubrizol's Mike Covitch, chairman of the SAE Engine Oil Viscosity Classification Task Force, told Lube Report the task force acted on Honda's request to define the two new grades, which were added two years after the definition of SAE 16.

Honda has for years successfully lubricated a number of ultra-fuel-efficient passenger car models in Japan with a Honda-approved engine oil that sports SAE 8's characteristics. That history led the original equipment manufacturer to push for the new grades to be added to SAE J300, opening the door for wider use around the globe.

Covitch doesn't believe that Honda's genuine oil was labeled with an SAE viscosity grade in Japan, however, because the grade was not yet defined by SAE J300. "With the re-issue of J300 JAN2015, it is now free to do so," he said. "You might expect to see such products in the Japanese marketplace in the near future and with the creation of official SAE viscosity grades, you could begin to see SAE 8 and perhaps SAE 12 oils appearing outside of Japan, should Honda or any other OEM begin exporting or building vehicles that specify them in other countries.

"There is certainly a desire to have such oils available in North America as soon as feasible, since they could then be eligible for use in fuel economy certification procedures," he added.

Bob Proctor, manager and principal engineer with Honda Research & Development in Raymond, Ohio, United States, affirmed that his company was able to supply Covitch's SAE task force with technical data to support the new grades' definitions. "I shared mostly the applications of the lower viscosity grades for vehicles in the Japan market, which was consisting of the grades at the time that ultimately fit the viscosity ranges used to establish the SAE 8 grade."

Proctor added that Honda has plans for further application and growth for SAE 8 in Japan, "as well as initial applications starting in China and even Europe. At this time we have no immediate plans for application of an SAE 8 or SAE 12 grade in the North American market, although we are considering the future carefully for these grades."

The development of ever-lower-viscosity engine oils has been a longtime goal of original equipment manufacturers. In 2011, Honda presented data at the ICIS Asian Base Oils & Lubricants Conference which showed that future engine oils designed for automobile fuel economy improvement would require new viscosity classifications below the then-current SAE system. Honda concluded that cooperation between the automotive, engine oil and additive industries would be a key factor in developing these oils, given the imminent need for these new SAE classifications.

Reiterating this need, the Rationale Statement for J300 JAN2015 states, "This revision continues the process of extending the SAE Engine Oil Viscosity Classification system to lower high-temperature high-shear-rate (HTHS) viscosities by adding two new high-temperature viscosity grades – SAE 12 and SAE 8 – to SAE J300 with minimum HTHS viscosity of 2.0 and 1.7 milliPascal-seconds, respectively. The benefit of establishing new viscosity grades is to provide a framework for formulating lower HTHS engine oils in support of the ongoing quest of Original Equipment Manufacturers (OEMs) to improve fuel economy."

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Shell Launches New PC-11 Website

The Shell Rotella brand has launched a new website called WhatisPC11.com to help educate and inform people about the next generation of diesel engine oils known as API Proposed Category 11 (PC-11). Shell Rotella created the website to be a resource for topics such as the fundamentals of PC-11, impending changes, testing updates, and how it is expected to affect new, current and older engines when the category replaces API CJ-4 engine oils by 2017.

"PC-11 is a constantly developing specification and new information is available regularly to guide the industry through the expected changes," said Kate Faucher, global marketing projects lead for Shell Lubricants. "The new Shell Rotella interactive PC-11 website will serve as a resource for fleets, owner/operators and anyone driving a diesel powered pickup truck or operating equipment to learn more about PC-11 and how it will affect their business."

WhatisPC11.com shares the journey of the creation of PC-11, why a new oil standard is necessary, and how new lower viscosity oils are being developed. Unlike past categories that are backward compatible with the previous category, the new category will have two subcategories, one that is backward compatible to older engines and one that will work with upcoming engine designs. Therefore, education about both oils will be vitally important to ensure seamless integration for every industry affected by this change.

"With two subcategories and new engine hardware tests, there will be lots of questions about how the oils will be formulated and which oil should be used for different applications," said Dan Arcy, OEM technical manager for Shell Lubricants. "As we formulate and test the new oils, Shell Lubricants can offer valuable resources to those operating diesel engines both on- and off-highway to support them through the transition over the next few years."

WhatisPC11.com will cover the following topics and more:
· Why a new engine oil specification is needed
· How the two subcategories are different and will be distinguished in the marketplace
· What PC-11 will mean for fleets, owner/operators, construction, agriculture and diesel pickup trucks
· Changes to diesel engine technology
· The type of testing done to make PC-11 a reality
· How Shell Lubricants is developing its new Shell Rotella PC-11 heavy duty engine oils

PC-11 Background
The new API PC-11 category is being driven by changes in engine technology to meet emissions, renewable fuel and fuel economy standards for reduced CO2 and other greenhouse gas emissions. In addition, changes in engine hardware and operating conditions that better represent new engine technology in the marketplace since the last heavy-duty engine oil category was introduced in 2006. Several engine tests need upgrading and older test hardware is expected to become unavailable. When the new PC-11 is first licensable, it will have been almost 10 years since the current category was introduced.

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Gongde Liu   Lube R&D Dept. Manager at PetroChina Dalian Lube R&D Institute

For engine oils, viscosity is the main issue on fuel saving, e.g,low viscosity oil means low internal-friction, better cold-starting and lower fuel consumption, that's why low viscosity grades as 5W-30, and even 0W-20 are more and more accepted by the markets. While fuel efficiency is also a very complicated and complex issues, besides the viscosity mentioned above, the engine oil's formula/properties, the fuel, the oil drain interval,the engine status and even the drivers skill are all contribute to the fuel efficiency. As to the topic above, generally synthetic 5W30 will show some fuel saving than that of the mineral 10W40,say 2-3%,but you must pay attention to the fact the longer drain interval will fade away the effect to some extend.

Chris Brook   Crown Oil - Technical - Fuels & Lubricants

Don't forget fuel efficient driveline lubricants too.
HDDO axle lubes are shifting towards synthetic xW/90 instead of xW/140.
A small percentage of Moly can achieve some good coefficient of friction reductions too, these are usually already found in the AD pack but we can tweak them even further depending on the application/requirements.

Stewart Bannister   Senior Accounts MGR / Technical Advisor

there are products out there that do reduce metal on metal friction and added to any oil will improve the economy and increase power (dyno reports are available). yes Hur Hussain we have seen a reduction in fuel costs of 15% but in conjunction with a diesel additive. I don't like advertising the company I represent in a forum so if you want to find out more please get in contact. I have treated average oils and outperformed every oil on the market tested at customer request. For example I treated a drum of oil used by a leading top fuel drag car for $300 costing them a total of $2300 and replaced the oil they were using that cost them $4000. Larger trucking companies that have adopted our product are reporting an overall saving of 30% p.a.

Stewart Bannister   Senior Accounts MGR / Technical Advisor

Agree Brett. Stay away from chlorine. Seals do not like it.

Boris Zhmud   Chief Technology Officer at Applied Nano Surfaces AB

On average, mechanical losses in an IC engine account for 10-20% of fuel consumed. Therefore, by changing, e.g. from SAE40 (14 cSt at 100C) to SAE30 (11 cSt at 100C), one may expect max 3-6% fuel economy. See for instance www.sveacon.se/lectures/tribology.pdf p.28.

Bret Wiseman   CHPP Training Supervisor at Anglo American Metallurgical Coal

Real world.. We would use synthetics and (controversial item) a Teflon metal treatment in our rally cars. (full drive train) Full throttle life expectancy of these engines is 500 miles. At 3200 miles we did a tear down and reused most of the components. I was so impressed with the results that I used the same system in my 1985 Nissan diesel which was still running just fine at just under 1,000,000 km, Still have it. Reduction of the friction in the complete drive train resulted in a >6% fuel economy. As this was a company vehicle the logs confirmed this.

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Sept. 18's "GF-6 Coming Jan. 2017" was based on a decision made at a June 13, 2013 meeting of the Auto-Oil Advisory Panel, which is a panel within the American Petroleum Institute's Lubricants Group.

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In India, Castrol will be the lubricant supplier for Triumph Motorcycles and will supply the fully synthetic, high-performance, Castrol Power1 Racing engine oil to Triumph dealerships throughout India.

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The JASO T903 standard is the only standard that addresses minimum performance requirements for **motorcycle and scooter** engine oils. The 2011 issue introduced a change in the friction classification criteria, with the objective of better reflecting the requirements of commercially available wet clutch materials.

Next JASO revision will still focus on friction classification with the introduction of the new standard wet clutch material and new reference oil used in the SAE#2 test, with the objective being to bring the specification as close as possible to actual hardware requirements. The next, big step forward for the JASO T903 standard would be the introduction of a mechanical rig test capable of discriminating oils in terms of wear and pitting protection. This would enable the removal of the current limit of 800 ppm phosphorus and enable the introduction of highly catalyst compatible formulation technology.

“There are significant differences depending upon region, and sometimes even country,” confirms Zoli. “In Europe, part or fully synthetic lubricants are predominant and oil changes happen on a yearly basis, which corresponds to a drain interval of between 4,000 and 10,000 kilometers – although this is highly dependent on user attitude. In North America motorcycle use tends to be seasonal and drain intervals are typically shorter than in Europe - often between 3,000 and 5,000 kilometers. And here mineral based lubricants still have the largest market share."

Zoli explains how the picture is very different in the developing economies. “In India, South East Asia, Africa and Latin America motorcycles are generally used all year round, and drain intervals can be as low as 1,000 kilometers in countries such as Vietnam and Thailand. Currently the lubricants used in many developing countries are mineral based SAE 20W-XX. However, the requirements of Japanese OEMs mean that high quality, fuel efficient oils, which are typically SAE 10W-30 or 40, are rapidly gaining a share of the market.”

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The architecture and operating conditions of a car and a motorcycle engine are completely different and so are lubrication requirements. A modern car oil has a low friction coefficient which can cause issues in wet clutch, and its detergent and dispersant system has not been optimized for the high operating temperatures typical of a motorcycle engine. Also its viscosity characteristics are tuned towards around different speed and load profiles. More and more, car and motorcycle engine oils are becoming different lubricant categories.
http://www.infineuminsight.com/insight/jun-2014/meeting-regional-requirements

NMMA lubricant certifications

The 2T and 4T engines that power **outboards** have very different lubrication requirements. In 2T engines, the oil mixes with the fuel and lubricates the engine as it passes through, and is then burned along with the fuel. But, 4T engines are lubricated by oil that is pumped from and returned to a sump.

Despite the differences, the key objectives of OEMs producing these engines are the same: reducing emissions to satisfy EPA requirements, and extending the life of their engines to reduce warranty problems and increase customer satisfaction.

To meet these objectives OEMs have introduced advanced 2T and 4T outboard engine technologies, which place severe demands on engine lubricants.

In response, the NMMA maintains three categories in its lubricant quality certification programme to help boaters choose an oil that will protect the engine throughout its life.

Issue 1: Passenger car lubricants cannot protect 4T engines

Water presents one of the largest concerns regarding the protection of outboard engines because, whether it is salt or fresh, it can lead to the formation of rust on engine parts. Passenger car engine oils (PCMOs) are simply not designed to provide the level of rust protection these engines require.

> "You might think that you could use a passenger car motor oil in a marine engine, but actually they require specifically formulated oils. Marine engines operate in a high humidity environment, with a lot of water around, and passenger car motor oils have not been formulated to cope in this environment."
>
> Tom Marhevko, NMMA

But it is not only in their rust prevention capabilities that PCMO formulations fall short of the performance requirements demanded by outboard engines. Because 4T outboard engines run faster than car engines, spend long periods running at the extremes of speed and can spend long periods out of use, they have very specific requirements for improved bearing durability, wear protection and shear stability.

> "Boat owners want to turn on their boat and then run across the water at full speed, much different to the way we use a passenger car. So the oil has to accommodate that type of usage, and that is what marine oils are formulated to do. Tom Marhevko, NMMA

Leisure marine operating conditions	Formulation requirement	Can PCMO deliver?
Water	Rust protection	No
Fast engine speed	Improved shear stability	Insufficient
Long periods at extremes of speed	Bearing durability Wear protection	Insufficient
Aging boat population	Advanced hardware protection	Insufficient

However, formulating lubricants to deliver all these attributes to outboard engines is not straightforward. It is not simply about maximising performance in all these areas, the lubricant formulator must strike a careful balance between the chemistries designed to provide wear and rust protection because the underlying components compete with each other for the surface of the engine parts.

In our view, this fact alone means it highly unlikely that a PCMO can be formulated to successfully do the job.

Clearly the best advice for boaters who want to ensure they protect their engines is to look for the NMMA logo on the oil they select, and/or use the OEM oil. This is becoming increasingly important as the formulation of oils designed for use in passenger cars moves even further away from the ideal standard required to offer the protection that marine engines need.

Infineum is working with its customers, along with the NMMA, to help inform boaters so that they can make the right lubrication choices.

Issue 2: The increased use of ethanol in gasoline

The second concern facing the recreational boating industry relates to the Renewable Fuel Standard (RFS-2), which requires US fuel to contain 36 billion gallons of renewable fuel by 2022. To help meet these aims, the US Environmental Protection Agency (EPA) has introduced ethanol as an energy saving initiative and an alternative to petroleum-based fuels.

> "While the NMMA is not opposed to the use of ethanol as an additive in gasoline, it is concerned that current engines are not designed to be compatible with gasoline containing more than 10% ethanol."
>
> Tom Marhevko, NMMA

Regardless of this fact, the EPA is proposing to change the automotive and light-duty truck certification fuel to E15 (15% ethanol) in its Tier 3 Motor Vehicle Emission and Fuel Standards, which means E15 is expected to become the predominant fuel in the US marketplace in the next 10-15 years.

A series of engine evaluations, conducted by Mercury Marine and Volvo Penta, under the direction of the Department of Energy (DOE) National Renewable Energy Laboratory (NREL), concluded that E15 fuels not only severely damage marine engines, but also cause them to exceed EPA emission standards.

> "E15 burns hotter, and in a marine engine this can mean the valves start to crack, what’s more marine engines are just not timed to use E15."
>
> Tom Marhevko, NMMA

The potential for boat owners to accidently use fuel with a percentage of ethanol above 10% will increase significantly if E15 becomes the primary fuel in the marketplace. Current labelling prohibits the use of E15 in engines, other than post 2001 passenger cars, and is mandatory for any retailer who choses to sell the fuel.

The continued demand for two-stroke oils reflects the fact that, unlike the motorcycle market, the engine population is transitioning very gradually from two-stroke (2T) to four-stroke (4T) engines. This is partially owing to the durability of older carburetted 2T engines, and the continued use of 2T direct fuel injection (DFI) for high horse power applications. However, this 2T engine weight advantage is diminishing, as lighter 4T engines are being introduced.

> “In the last year about 220,000 outboard units were sold around the world. About 15% of those were two-stroke – ten years ago it was just the opposite, with about 15% being four-stroke.” Tom Marhevko, NMMA

With factory shipments now predominantly 4T engines, lubricant demand for four-stroke FC-W™ and FC-W™(CAT) will continue to increase. However, the overall outboard oil market volume is expected to decline with 4T engines using less oil than 2T engines.

http://www.infineuminsight.com/insight/mar-2014/outboards-rev-up

============================

From CH-4 oil to CI-4 (By (Leroy) Martin Graves (Jr.))

Suggest comparing the Noack volatility results for the two oils. In general, synthetics would be expected to have a lower Noack value (good thing) than a similar traditional mineral oil based product. However, to formulate a lower viscosity (assuming 5W-40) synthetic, you would likely use lower viscosity basestock (potentially higher volatility) and add more VI improver (potentially shear/heat sensitive). Checking the 40/100/VI of the used oil might indicate if you're losing ("burning") a lot of light ends (from the lighter base stock, viscosity would increase as a result of the loss) or shearing down the VII (viscosity may go down, at least temporarily). Of course potential soot contamination and fuel dilution may make this interpretation difficult, if it is not to an extreme. The lower viscosity oil may also find it easier to "leak" if the equipment is getting up in service time.

===

Alexey Muralev

Head of Technical Service Department at Kulan Oil

Actually diesel and gasoline engine oils are different in terms of additive package. But for light applications the differences are not so big.
API had issued CF specification for passenger diesel cars in 1994, the specification now is obsolete! So API CF doesn't mean anything now actually.
Look for other approvals/specs, if your oil has ACEA A3/B3-08 or VW 505 00/507 00 then you can use it in diesel engines, otherwise i wouldn't recommend it.

Diesel engine oils require more detergent/dispersant additives as you need to handle soot. Gasoline engine oils require a lot less.

Ali Durrani

Management, Sales, Marketing, Branding, Lubricants and Lubrication, and Maintenance

Usually such engine oils are test against API SN (Gasoline engine test) and API CF(Diesel Engine Test). Where OEM recommends(Gasoline) the use of API SN it can be used and where it

Recommends(Diesel)the use of CF it can be used. The multi-fleet oils comes when you have a number of of Gasoline engine vehicles and a a few Diesel engine vehicles you can rationalise to one product. In this case the oil is designed for gasoline engine oil and can meet diesel CF requirement. Diesel engine oils are high on detergents vs dispersant(but the trend is changing) Gasoline engine oils are high on dispersant. So it is basically a compromise you can get much better long term protection if you sue diesel engine oil in diesel engines. But as Alexey pointed out other specs should also be checked and API CF is obsolete and API SN is the latest spec.

Richard Widman

Owner, Widman International SRL

As was said earlier, basically all the SN oils have enough additives to also qualify for the obsolete CF spec. That means that although they are not really recommended for Diesel engines, they will cover the basics. They certainly would not be recommended for extended drains or extended use, and not in the higher compression engines for their much lower anti-wear additives (+/- 30% lower).

The current specs for Diesel oils should be CI-4 and CJ-4. The way the rules are written, just about any CI-4 or CJ-4 oil (meets the latest diesel tests for those classifications) can tack on a gasoline classification at the end, therefore giving you a CJ-4/SN. That means it has enough detergent and anti-wear, anti-foam, evaporation rate, etc. for Diesel, so obviously for gasoline engines that need less. BUT is not really an SN. It does not meet ILSAC requirements for gasoline engines and will damage catalytic converters. So there is no longer a true "fleet oil" unless you do not have catalytic converters on any of your fleet. Yes, this creates a lot of confusion. Just about every day someone writes me to say they have found a good SN oil for their new car, and what do I think of it. Looking it up I find it is a CJ-4/SN. Not recommended for catalytic converters.

V.S.S. Sarma

Technical Manager

New diesel vehicles & engines are technologically very advanced and they need oils specified for them. In fact, an oil specified for a diesel vehicle fitted with a particulate filter may not be suitable for other diesel engines!

Petrol engine lubrication is far simpler than a diesel engine lubrication. Using a petrol engine oil in a diesel situation is not a well-thought idea. However, you have some old diesel engines and you want to rationalise the number of grades in your workshop - then use this approach but then be sure on low drain intervals in diesels. Similarly, a diesel engine oil is over-treated for a petrol situation and may cause early wear.

Where catalytic converters are present, you need oil with controlled Phosphorous content. Low SAPS (Sulphated Ash, Phosphorous, Sulphur) oils are common in the modern engines. Please consult the vehicle manual for the oil to be used - specification, viscosity, drain interval.

V.S.S. Sarma

Technical Manager

Ali Durrani - To avoid compatibility issue between a TBN booster & a DI package, I use the same DI package at slightly higher treat dosage to achieve higher TBN needed by a market. Sometimes, DI packages don't like the TBN boosters and the finished product will react adversely by foaming excessively. I don't buy TBN boosters as I depend on DI package to provide the requisite TBN. There are very few products wherein a minimum TBN is prescribed and I go by the standard products, not the boosters being marketed by the fly-by-night operators who do not carry out engine tests. Any way, the TBN boosters and the DI packages both cost approximately USD 4,000 a tonne and it doesn't make financial sense to use an unknown / untested TBN boosters.

There are a large number of blenders who use only the TBN boosters to blend oils because people confuse TBN with quality. If you check many of these engine oils, other elements like Calcium, Zinc, Magnesium, Boron, Molydenum, etc will not be present.

Ali Durrani

Management, Sales, Marketing, Branding, Lubricants and Lubrication, and Maitenance

Sarma : Agreed if you use a TBN booster that is not compatible with the DI pack but your suppliers are able to provide you with TBN booster that match the DI pack might not be as effective cost wise comparing to sulphonate 400TBN booster. Multinational established brands also use TBN booster but they select it wisely. There is a proper way of doing it a TBN booster is more cost effective to boost TBN than increasing the DI pack dosage. Cannot comment on who does what and why but there is a way to increasing the TBN which is acceptable,
You have to check your economics when adding something extra, Is it Justified??

Allen A Aradi

Senior Fuels Technologist - Shell Global Solutions (US) Inc.

Back to the original question - For marketing logistics, it would be great for a lubricants producer if they could invent one lubricant that worked for everything. That is one extreme. However, closer to reality is invention of a dual-purpose lubricant such as the one mentioned by Dilupa, for both diesel and gasoline engines.

The problem is, the moment you start generalizing across engine/fuel types you are on your way to establishing the label, "jack of all trades, master of none". Therefore, my first rule of thumb in selecting a lubricant for an engine is, start with the group specific for that engine/fuel type, and then drill down to one most suitable with regard to your driving habits, environment, and desired change intervals.

Allen A Aradi

Senior Fuels Technologist - Shell Global Solutions (US) Inc.

Now on the "TBN" issue:

True, sulfur in the fuel is the main reason for a TBN spec for engine lubricants. However, sulfur is not the only source of acids exchanged in cross-talk between combustion chamber and crankcase.

By-products of combustion containing acidic moieties such as carboxylic acids are also present and on crossing over into the crankcase can degrade lubricant and eventually lead to corrosion. That is why a TBN spec is essential for all lubricants going into the crankcase of internal combustion engines.

Richard Widman

Owner, Widman International SRL

Unfortunately instead of coming together, we are going farther apart. 15 years ago I carried a universal oil in 4 viscosities. I now have to stock 18 viscosity/spec combinations. And that is without getting into the Dexos and other single purpose engine oils. But I do not believe in selling anything older than SN or CI-4.

As the engine manufacturers strive for more fuel economy and environmental goals they add specific components and make it more difficult to combine things.

Ali Durrani

Management, Sales, Marketing, Branding, Lubricants and Lubrication, and Maitenance

The thing in most of the Dual spec oils the first one is the one against which oil is designed and it usually has enough chemistry to meet the older spec. of the second. API SN/CF designed for gasoline engine but meets the requirement of certain diesel engines. API CI4/SL(meets the engine test requirement not necessarily the SAPS and bench tests) designed for diesel engine but not cover everything of gasoline.

On TBN , Allen I agree with the decrease in fuel sulfur the acid level did not go down because the newer engine higher pressures and higher temp resulting in more nitric acids. From one type of acid the other takes over.

Richard I think the multi fleet oil never took off without a compromise in the past as well but the newer engines are much more demanding and have very specific requirements. Like in the newer oils backward compatibility in say gasoline engine oil will also become an issue.

I guess getting into a specialised and expensive world.

SAMMY SAMUELSON

CEO/SalesEngineer,Consultant at SpecialtyAutomotiveMgt.Systems

There are Synthetic Oils that meet both Gasoline and Diesel engine requirements .
Some oils are specified for Gasoline engines only, and have a SN API rating.
The latest Diesel API is CJ-4 and CJ-4-Plus, more often than not also come with
a SM or SN API ,all of which are retroactive or suitable for engines back to1973
when the Unleaded Gas ,Computers ,and Catalytic Converters all were introduced.
Oh yes, and the 5000 mile Oil Drain as well in 1973.
Jiffy Lube is today being Class Action sued for fraud for telling people they must change oil at 3000 miles, when OEMS recommend 5000-7500 miles plus !
No warranty can be voided because of extended oil drains unless by Analysis it is found that from the manufacturer it was not up to specifications.
Oil Analysis supersedes all opinions in a Court of Law, and is accepted by the Court
as such !
There are many opinions about zinc and phosphorus needed for older engines, I just wonder are they now using less expensive additives that protect as well?
How many oils out there are just marketing ploys? There are so many ,and many motorists become confused as to what really works for them!

Richard Widman

Owner, Widman International SRL

Sammy, I agree with all but the first part. I CJ-4/SN is NOT suitable for a gasoline engine with a catalytic converter, and therein lies the confusion for the average motorist. Yes, it protects the engine as well as a SN, at the cost of the converter. It is very suitable for my classic cars, whether in synthetic or mineral. I use Synthetic CI-4 in my classics mostly because I can leave them all year, whether I drive that car 1000 km or 10,000 km.

Sarma, Technical Manager

Control on Phosphorous & Sulphur are built into API-SN (and also ILSAC GF-5) specification to take care of Caltalytic Converters. The same are controlled (at higher levels) in CJ-4 as well. If you can find a 0W20, 0W30, 5W20, 5W30, 10W30 oil of SN level (limits are max Sulphur of 0.5%, maximum Phosphorous of 800 ppm) & CJ-4 (limits are maximum Sulphur of 0.4% & maximum Phosphorous of 1,200 ppm) level with Phosphorous level not more than 800 ppm, CJ-4 oil can be used in a car without affecting the converters. In fact CJ-4 controls even the Sulphated Ash content also. Only problem that I see is the high additive content of CJ-4 that may promote wear in a passenger car. Another aspect that I need to verify is - is there any CJ-4 oil with lower than 800 ppm of Phosphorous content. Phosphorous comes in through ZDDP additive that is essential to control wear and a minimum of 600 ppm of Phosphorous is essential.

Richard Widman

Owner, Widman International SRL

That is the point. CJ-4 oils all (that I know of) have 1000 to 1200 ppm of phosphorous, so are therefore not suitable for converters.

Where do you get the statement. "Only problem that I see is the high additive content of CJ-4 that may promote wear in a passenger car."? I have used 10W-30 CI-4 oil in my 2002 Toyota Hi-Lux for 350,000 km with 1 to 2 ppm of iron in 6000 to 7000 km changes, used daily in the city and climbing dirt mountain roads with drums of oil. I don't think there is a formulation that produces less wear than that. At 350,000 km it does not drop more than 4 mm on the dipstick between changes.

V.S.S. Sarma

Technical Manager

Richard - Long ago, Chevron actually did a trial with a highly treated diesel engine oil in a passenger car and found that wear was high. I remember the guy's name as Mark Logan. He called it 'catastrophic wear'. In your case, 6-7,000 KM is really not a big deal with these advanced diesel oils, you know.

SAMMY SAMUELSON

CEO/SalesEngineer,Consultant at SpecialtyAutomotiveMgt.Systems

What about the Diesel Particulate Filters on Diesel Engines?
They have to be cleaned once a year!

V.S.S. Sarma

Technical Manager

Sammy Samuelson - If the DPF doesn't function, the diesel emissions can be deadly. So, we have to clean the DPFs regularly. CARB controls a lot of emissions.

James West

Sales/Account Management

Here in the states you can run 15/40 in a gas engine with no issue. 15/40 has friction modifiers that work great in these engines given the friction that occurs. You will also get better protection at start up.

Obviously you can't use PCMO like 5/20 10/30 on diesel engines given the soot loads and other factors that occur in these engines.

If you have a brand new car in warranty, then stick with the OEM spec.

Richard Widman

Owner, Widman International SRL

There are 5W-30 and 10W-30 CI-4 and CJ-4 oils for the diesels, so lets not confuse viscosity with API classifications and uses. The 5W-30 isn't as common yet in the states since the smaller diesels are just starting to get approved for US operation.

SAMMY SAMUELSON

CEO/SalesEngineer,Consultant at SpecialtyAutomotiveMgt.Systems

Yes, there are 5W30 oils with Diesel API ratings SN/ CJ-4,and CJ-4,Plus , just not that many. The SN is the latest API for Gas Engines, however the CF is next to go obsolete,
as the CJ - 4 supersedes the former.
Most of the OEM'S reduced the oil pressure, as pressure is heat , tightened the clearances and tolerances ,then subsequently went to the 0w20 and the 5w20 viscosities to gain more power, improve fuel mileage and dissipate the heat . They also recommend at least a Synthetic Blend , and are recommending Full Synthetic Oils in more and more applications.
The 1992 and later Corvette Engines use Full Synthetic Oil ,or the warranty is voided !
So, think about it America ,why aren't we using A merican M ade S ynthetic Oil in all applications? " Change your Thinking not your Oil !" Oil Analysis is the Blood Test for
your the Oil!

SAMMY SAMUELSON

CEO/SalesEngineer,Consultant at SpecialtyAutomotiveMgt.Systems

V.S.S Sarma ,
The cleaning requirement by the C.A.R.B.is one year for D.P.F's . Using a good fuel additive can be a factor in making that happen , although excessive idling , quick starts , and lugging , change results very quickly !
Adding a By-Pass Oil Filtration System that removes Soot ,is another way of extending the life of the DPF, as well as removing moisture that helps to create Soot ! In addition the By-Pass Filter will allow extended oil drain intervals ,coupled with the Oil Analysis!

Richard Widman

Owner, Widman International SRL

I doubt that, too, and that (CI-4 or CJ-4) is the primary recommendation for classic cars with flat tappet engines. As I mentioned above, until the SN came out, that is all I used in gasoline engines, and have lots of miles to prove it works.

But, it is not good at all for catalytic converters, and you will get better mileage and protection in modern cars with SN in addition to the converter protection.
Most of the SN oils are suitable for car diesels, not heavy duty diesels. That is where the CF comes in, and you will see them recommended as such on the new generation of automotive diesels en economy and luxury cars.

Chris Brook

Technical Support Specialist at Batoyle Freedom Group

Top Contributor

BMW Longlife-04 covers both Petrol (gasoline) and Diesel light engines.

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Richard Widman

Owner, Widman International SRL

Sarma, I see that a lot here. Tractors that recommend CF-4 oils. I put CI-4 (group II) oils in them and run double the hours (500) with half the wear metals. It is not really appreciated by the tractor sales people because with the CI-4 the engines run 25,000 hours. The companies are used to the revenue from rebuilds between 8000 and 12,000 hours when people use CF-4 and change at 250 hours.

Honda insists on putting 15W-40 in their cars. They have complaints about noisy valve trains and clogged converters. Those that follow my advice and put 5W-20 SN in them have quieter engines with more power and less gas consumed.

The Kia manuals here give a huge range of oils to use, all the way up to 20W-50. The dealer was concerned about the noises and let me play with what they recommend for the US. 5W-20, with the option of 5W-30 in hot climates (here is 20-38C). We took 3 identical cars in their shop with 5000 km on them and changed oils with different viscosities, from 5W-20, 5W-30, 10W-40 and 15W-40. We drained, filled, listened, compared, etc. The 5W-30 was so quiet the mechanic thought the engine was off.

Toyota puts GL-5 80W-90 in transmissions. Owners that follow my advice and replace it with GL-4 75W-90 can't believe the difference.

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To prevent corrosive wear, timely oil changes are necessary, especially when high sulfur fuel is used. It is a bit ironic that an older engine, which consumes or leaks more oil than a new engine, will be better protected from corrosive wear by virtue of the makeup oil, which contains neutralizing additives that must be periodically added.

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CJ-4/SN is NOT suitable for a gasoline engine with a catalytic converter, and therein lies the confusion for the average motorist. Yes, it protects the engine as well as a SN, at the cost of the converter. It is very suitable for my classic cars, whether in synthetic or mineral. I use Synthetic CI-4 in my classics mostly because I can leave them all year, whether I drive that car 1000 km or 10,000 km.

REPLY:
SN level (limits are max Sulphur of 0.5%, maximum Phosphorous of 800 ppm) & CJ-4 (limits are maximum Sulphur of 0.4% & maximum Phosphorous of 1,200 ppm) level with Phosphorous level not more than 800 ppm, CJ-4 oil can be used in a car without affecting the converters. In fact CJ-4 controls even the Sulphated Ash content also. Only problem that I see is the high additive content of CJ-4 that may promote wear in a passenger car. Another aspect that I need to verify is - is there any CJ-4 oil with lower than 800 ppm of Phosphorous content. Phosphorous comes in through ZDDP additive that is essential to control wear and a minimum of 600 ppm of Phosphorous is essential.
Follow Schalk

What are the main differences in between ESP-Emission System Protection engine oil and normal engine oil ?

If we use high ash lubricants for low ash required machine,what are the problems can occurred?

Nicolás Federico Demaría • Hi Dilupa,
The main problem will be a premature obstruction of the three way catalyst (in the case of a gasoline powered motor) or the DPF (Diesel Particulate Filter). Check engine light on and engine power loss will be the signal to let you know something wrong has happened!

Schalk Bruwer • 'lo Dilupa
It is such an involved topic to try and address in a discussion forum like this but let us try. 4 parameters are controlled on internal combustion engines - HC(from unburnt fuel and lube), NOx, CO and particulate matter. Emission control devices combined with improved engine performance are required to meet these parameters. The basic principle is that metals (measured by sulphated ash(Sa) method), sulphur and phosphorus (referred to as SaPS) are seen to poison emission control devices . As such their concentrations determine high or low SaPS.

To give one example. There is the balance between this poisoning concern and engine protection with regards to fuel efficiency. Lower viscosity oils are needed for FE but they adversely affect anti-wear performance(thinner films). As such to counter the thin films more anti-wear performance is required by S and P and Zn (ZDDP) but they are seen to poison emission control devices. As such very tricky

To answer your second question: problems are that the sophisticated engine management system will shut the engine down when emissions are not controlled (ineffective equipment) due to too high SaPS oils used. As such inconvenience, service penalties and maintenance costs will eventuate

Bradley Cosgrove • It depends on system design. Most small cars are designed not to replace DPF, so if it has to be replaced the entire exhaust system needs to be replaced. HD trucks generally have replacable DPF. Most catalyst should last 10 year / 240,000 km if correctly maintained.

Alexey Muralev • Maybe it will sound a little barbaric, but most people here just cut out catalyst/DPF with welding apparatus and put some steel wire in form of cotton-balls. That absolves a problem with DPF or catalyst, but the emmisions are uncontrolled. I don't recommend you to do the same!

Actually bad fuel won't give ash, so it is safe for DPF. The high level of sulfur will have negative influence on the efficiency of SCR.

There is also problem with lower resistance to acid attack from low SAPS oils, so you would be changing them more often.

Schalk Bruwer • The emission control devices can be replaced. They are not cheap though and as Alexey has indicated they will most probably be taken off equipment so long as you can over-ride the engine management. The sulphur in the fuel will poison devices much quicker than normal engine oils. Enough alkalinity in lubes to counter the acids will be a more important than to worry about emission devices as the fuel will destroy them anyhow.

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Larry Ludwig, CLS, OMA, CMFS

~~The API CI-4 Plus is a supplemental category to the API CI-4 service classification. API CI-4 Plus was first licensed on September 1, 2004. The API CI-4 Plus category was developed in response to field problems being reported by some OEMs, particularly Mack in the areas of soot dispersion and shear stability. OEMs were concerned that the API CI-4 service classification used early assumptions about hardware and operating conditions. The tests used and limits for these tests were set without field correlation. Because of the time frame implemented by the EPA in the consent decree with heavy-duty diesel engine OEMs to meet the 2002 emission requirements, it was virtually impossible to test and work out all of the issues facing the various engine builders with the use of EGR.~~

~~The field problems Mack was experiencing consisted of high soot levels at low drain intervals, high viscosity increases at low soot levels, high levels of acid condensate in the intake system and shearing of the engine oil out of viscosity grade in its ASET vocational engines, which are used in severe vocational applications such as refuse and dump trucks. These engines employ the use of internal EGR, which allows a certain percentage of the exhaust gases to remain in the cylinder from the previous cycle. This results in the formation a higher amount and different kind of soot particles that can thicken the engine oil much more rapidly and is more abrasive.~~

~~In addition to these field problems there were concerns by Caterpillar, which uses ACERT Technology, rather than EGR that the high ash, high TBN formulations used to meet CI-4 would lead to higher piston deposit levels. These concerns lead to Caterpillar to introduce the CAT ECF-1 specification, which puts a “cap” on the engine oil’s sulphated ash content~~

~~and total base number for engine oils that meet the API CI-4 service classification. Companies that employed the use of EGR responded with oil specifications designed to make sure that the engine oils TBN did not drop below a level, which would rob the engine oil of its ability to provide the proper acid neutralization capabilities to protect the engine from the effect of acidic corrosion. Cummins Engine Company for example revised their CES 20078 specification to place a limit of 10 TBN minimum in order to assure the proper acid neutralization capacity.~~

~~Rather than open the door to an endless proliferation of engine model and brand specific and the development of totally new service category, the engine OEMS, lubricant manufacturers and marketers, and additive companies asked the API for an enhancement to its CI-4 category. The result was CI-4 Plus. The CI-4 Plus supplemental category took just shy of 12 months to come into being compared to the typical 2 to 3 year time frame taken to develop an API Service Classification and is the result of a “gentlemen’s agreement” of sorts among all of the engine manufacturers to develop the supplement to address soot induced viscosity thickening problems and would be the last API service classification until late 2006 early 2007, when the EPA’s new emission regulations come into effect resulting in the development and implementation of the API CJ-4 category.~~

~~In order to pass the CI-4-Plus Supplemental Category the engine oil must pass all of the laboratory bench and engine sequence tests for CI-4 and meet the following requirements:~~

~~1. Pass the Mack T-11 Test or be listed on Mack’s EO-N Premium Plus-03 specification.~~

~~The Mack T-11 tests is 300 hour test that utilizes a Mack E-Tech V-Mac III engine with EGR that measures the engine oil’ soot dispersancy and viscosity control at high soot levels (6% soot). To pass the test the engine oil must not exhibit greater than a 12 cSt increase in viscosity at 100 C over the fresh oil after 90 pass through the Bosch Injector Shear Test ASTM D-7109.~~

~~2. Stay in viscosity grade after 90 pass through the Bosch Injector Shear Test ASTM D-7109. The Bosch Injector Shear Test ASTM D-7109 is used to evaluate the percent viscosity loss of multi-grade engine oils resulting from degradation of the engine oil’s viscosity index improvers. The engine oil is passed through a diesel injector nozzle at a shear rate that causes the engine oil’s viscosity index improvers to degrade. Typically in this test the engine oil is cycled through the diesel injector for 30 cycles in order to closely represent the severity that is seen during engine operation. However in the field there has been a growing concern among OEM’s, especially those that produce heavy duty diesel engines that this 30 cycle limit is not severe enough to protect equipment in the field. It had been observed that certain products meeting the 30-cycle limit had been shearing out of viscosity grade during service and not providing the proper lubricant film needed to protect the engine from increased wear, especially under high soot level conditions.~~

~~3. Exhibit no greater than a 13% evaporative loss as determined by the NOACK Volatility Test ASTM D-5800. This lower evaporative loss protects the engine from the formation of deposits on critical engine parts.~~

V.S.S. Sarma CI-4+ was introduced in 2006, with greater soot control over API CI-4 , Mack T-8E moving to Mack T-11.

Robert Duncan Equipment World Staff, Oct.'16
If you’re running 2006 or older trucks and off-road equipment there is no urgent need to migrate away from CI-4 or CI-4 PLUS oils. These are robust oils in their own right. But when you buy your first 2007 or later model on-highway truck, you’ll need to decide if you

want to stick with the old oils and clean the DPF more frequently, or step up to CJ-4. (But again, there is no choice unless your 2007 engine manufacturer approves the use of the older oils.) Then you have to make a decision whether or not to stock and use two different types of oil or go with a one-oil solution and recoup the extra cost of CJ-4 with extended drain intervals or increased engine and component life.

Larry Hajek no mention of Cummins? crosshead wear from agglomerated soot?? the desperation to improve soot dispersancy??? History is very subjective.
Better oil always equals longer drain and better deposit control.

Basant Saharan Simply put Ci4+ is just better then Ci4 due to better soot control and long drain intervals, also little more fuel economy in field trial specially in tractors. TATA motors started recommending 60000 drain interval.

Lubricant Specialists
I am looking for a paper or a book about TBN depletion in synthetic HDEO or a comparative between mineral and synthetic oil TBN depletion.

V.S.S. Sarma • Ariel Hernandez: There are marine oils with 70 TBN, SAE 50 grades. Overbased detergents with TBN over 400 are now available. Achieving any TBN is not a big technological challenge. Only care we should take is that the developed formulation must pass the relevant engine, bench and physical tests.

Basic question still remains the same - how good are synthetics in cotrolling TBN depletion. Synthetic base oils have very low Sulphur, very high saturates, very high viscosity index. These characteristics play vital role in engine oil's performance. For the same DI package, I would expect synthetics to perform a lot lot better and provide longer drain periods and lower TBN depletion owing to the quality of the base oil. However, a practical test should be undertaken.

Larry Ludwig, CLS, OMA, CMFS • Regardless of the type base stock being used in the formulation of the engine oil it does not affect the engine oil's TBN depletion rate. This is wholly a function of the engine oil's detergent and dispersant additive system. Measurement of the engine oil's TBN in conjunction with monitoring for wear metal, oxidation, nitration and soot level trends during use is critical in order to control potentially harmful acids that can be created.
In an engine the formation of acids can come from a variety of sources. These sources can include but are not limited to the following:

Fuel sulfur ==> SOx ==> Strong sulfurous/sulfuric acids
NOx in combustion process ==> Strong nitrous/nitric acids
Oxidation byproducts ==> Weak organic acids

If the engine contains Exhaust Gas Recirculation (EGR) to control emissions this cancreate acidic materials in the intake systems and combustion chambers. These acids are formed when nitrogen from the air and sulphur from the fuel is converted during the combustion process into nitrogen and sulphur oxides and comes into contact with the water vapor present in the exhaust stream. The water reacts with the nitrogen and sulphur oxides to form a mist of nitric and sulfuric acids. These acids when fed back into the power assembly of the engine can become concentrated resulting in corrosive wear. High acid levels can also accelerate the depletion of the engine oil's alkaline reserve, which is known as total base number (TBN) and reduce its usefulness.

EGR engines run hotter since the engine's coolant is used to cool the recycled exhaust gases. EGR technology has the engine ingest not only the intake air, which is normally only 100ºF (37.8°C) but also up to 40% of the exhaust gases at temperatures well above 200°F (93°C). As a result the engine oil's temperature is increased. This increase in engine oil temperature can accelerate the rate of the engine oil's oxidation. Oxidation can degrade the engine oil causing the creation of acidic components that can further deplete the engine oil's alkaline reserve, lead to increased deposit formation and a dramatic increase in the engine oil's viscosity.

Use of biodiesel also raises additional concerns around acid build-up in the crankcase especially if the engine employs the use of post injection strategies.

Post-injection is the introduction of fuel late in the combustion cycle as part of an advanced control strategy to reduce emissions Some OEMs use post-injection in their strategies to "regenerate" or burn off soot accumulated in diesel particulate filters (DPF). Injecting fuel late in the combustion cycle does not combust the fuel but vaporizes it as the fuel is carried downstream through the exhaust to create an exothermic reaction, which burns off the collected soot in the DPF.

Post-injection of fuel into the cylinders is intended to vaporize in the cylinder but not combust, exiting then through the exhaust valves and travelling downstream where the introduction of the unburned fuel to the catalyst creates an exothermic reaction incinerating the collected soot. Inevitably the heavier fractions of fuel will not vaporize during post-injection and in liquid form can adhere to the cylinder walls. Through the slapping motion of the pistons and oil rings, the unburned fuel from post-injection can make its way through the tight, hot quarters between the piston, rings and cylinder walls. The fuel accumulates in the crankcase and dilutes the oil, which is a major concern regarding engine wear and longevity.

Post-injection fuel injection results in elevated levels of fuel dilution regardless of what type of diesel fuel is being used. However the rates of fuel dilution and the effects on the engine oil are more pronounced when biodiesel fuel blends are burned. The rate of fuel dilution with the use of biodiesel is higher due to biodiesel's viscosity, density, and surface tension characteristics. These characteristics increase the fuel's droplet size as it is being injected into the combustion chamber. The droplet characteristics and the lower volatility characteristics combined with the spray pattern and wall impingement patterns used in post-injection allows any non-combusted biodiesel to go past the rings, contact the cylinder liner and be scraped into the oil sump .

Because biodiesel is less volatile and has a narrower boiling range than petroleum base diesel fuel, it will have a tendency to become concentrated in the engine crankcase with the levels of unburned fuel building up over time. In the field some OEMs have seen anywhere from 15 to 30% fuel dilution. This build up can reduce the engine oil's viscosity resulting in a higher risk of engine component wear. In addition, fuel injector deposits that may have been formed by the use of biodiesel can disrupt the fuel spray patterns, further exacerbating the rate of fuel dilution.

Other issues associated with the use of biodiesel fuel that can affect the performance of the engine oil are its impact on the ability of the engine oil to protect against corrosion, the formation of engine deposits and the effect of oxidation.

The increased risk of corrosion to engine bearings is a significant concern. The oxidation products and the presence of unsaturated free fatty acids in the biodiesel are known to be aggressive towards journal bearings that contain lead and copper such as the engine's main and rod bearings Biodiesel fuels that contain significant quantities of unsaturated and polyunsaturated fatty acid esters can exhibit poor oxidative stability. In the crankcase these unsaturated and polyunsaturated fatty acid esters can undergo oxidative polymerization, resulting in degradation of the engine oil that can lead to the formation of engine deposits and sludge and the thickening of the oil. The formation of deposits especially on the pistons can not only lead to increased wear but also to piston ring sticking. Stuck rings allow more blow-by gases and soot to enter the sump, thereby promoting further viscosity increases and degradation of the engine oil. This increase in viscosity also affects the engine oil's low temperature pumpability. The level of oxidation is dependent upon the rate of fuel dilution, the concentration of biodiesel used (e.g. B20 which is a bend of 20% biodiesel and 80% petroleum diesel fuel), the quality level of the diesel fuel, the source of the biodiesel's feedstock (e.g. soybean, canola, palm, animal fats), the engine operating conditions and the quality of the engine oil.

TBN measures the engine oil's ability to neutralize acids that are formed by combustion or oxidative breakdown. TBN is not a measure of an engine oil' s overall performance and a engine oil with a higher TBN number of say 12 or 14 as opposed to one that has a TBN of 10 is better than the engine oil with the lower. An engine oil's starting TBN is less important than the TBN of the engine oil during service. The engine oil must have the ability to retain its TBN reserve that is contributed by both the detergents and dispersants during the entire drain interval. If acid levels are allowed to build up in the engine during use this can result in:

• Increased bearing corrosion
• Increased wear to critical engine component
o Journal bearings
o Piston rings
o Cylinder liners
o Valve-train components

There are two things that are critical to know about TBN than its starting number: how it is measured and the rate at which it depletes.

There are two accepted ASTM test methods used to measure TBN. They are the ASTM D-2896 Standard Test Method for Base Number of Petroleum Products by Potentiometric Acid Titration and ASTM D-4739 Standard Test Method for Base Number Determination by Potentiometric Hydrochloric Acid Titration. The TBN rating of the engine oil is affected by the test method used. If the two methods were used to measure the same new oil each method would give a different answer. The ASTM D-2896 method will produce a higher TBN rating than the ASTM D-4739 method by as much as 2 numbers. Use of just one test method only to evaluate TBN can lead to the TBN trap and a numbers game. Both test methods are similar in that they involve adding a measured amount of acid to the engine oil until all of the basic components have been completely neutralized. In an engine oil lubricant formulation there are different additive systems that can contribute to the engine oil's overall ability to neutralize acidic byproducts of combustion and degradation. The additive systems that provide contribution to the acid neutralization characteristics of the engine oil are detergents, dispersants, and anti-oxidants. Each of these additive systems provides a alkalinity base reserve for the engine oil's acid neutralization capabilities. However, the capability of these additive systems to neutralize acids differs depending upon the strength of the type of acid used.

The difference between the two methods used to measure TBN comes in the choice of acid used and the type of solvent system that the engine oil is dissolved into run the tests. The ASTM D-2896 uses a stronger acid and a more polar solvent than the ASTM D-4739 test method. This combination of a stronger acid and more polar solvent system results in all of the base present in the engine oil that is being tested becoming completely neutralized. The use of the ASTM D-2896 Method only determines the total concentration of basic materials present that might react with an acid and captures TBN depletion only as a function of strong acid contamination such as sulfuric acid. The ASTM D-2896 test method ignores the acidic contribution from weak acids such as nitric acid and organic acids. Because of this aspect it is ineffective in measuring a used heavy-duty diesel engine oil's ability to neutralize any acidic components during use. In essence the ASTM D-2896 only measures the high end of alkalinity, thus indicating that more base being left in the engine oil than what is truly present is for continued service. In some cases the used engine oil's TBN can equal that of the new oil. In addition the ASTM D-2896 test method can be adversely affected by the presence of wear and contaminant metals. The strong acid used in this test method can titrate some of these metals indicating more base being left that what is truly present and advisable for continuing service especially if oil drain intervals are being extended.

Because of this aspect the ASTM D-2896 is primarily used to determine the TBN of fresh engine oils (unused). However, there are some laboratories that still use the ASTM D-2896 test method to measure the TBN of used engine oils. This is because the test method is easier and faster to run.

What is important and more critical is using a test method to evaluate the overall effectiveness of the engine oil to retain its TBN during use. This test method is the ASTM D-4739 method. The results obtained by the use of the ASTM D-4739 test method are more reliable, because this method more accurately reflects the level of acid neutralizing power left in the engine oil during use. The ASTM D-4739 test method measures the TBN contribution from the detergents (also known as the hard base or strong base TBN) and takes into account TBN depletion from both strong and most types of weak acids that can be encountered. Further this test method can measure relative changes that occur in the engine oil during use under oxidizing and other service conditions. In essence it provides a better and a more accurate indication of serviceability.

As was stated previously the most important feature of TBN and perhaps the most critical than how high the TBN is rated for a new engine oil is the rate at which it is depleted during use. In order to be effective in protecting engine parts against the effects of acid, engine oils must not only have a high enough of a TBN but also have good TBN retention.. The later characteristic represents the engine oil's ability to shield against acid over a long period of time- not just when the engine oil is fresh. Some heavy-duty diesel engine oils start with a high TBN, then drop and lose their neutralizing ability quickly. Other engine oils detergent/dispersant additive chemistries deplete at a slower rate and maintain their alkalinity for a much longer period of time. Thus the real value of TBN is not in determining an engine oil's quality; it is in making sure the engine oil does not become corrosive at the end of the drain period. Therefore, the engine oil's additive chemistry must be carefully balanced.

The key to technology excellence and carefully balancing TBN retention is utilizing the right balance of detergents, dispersants and other key additives to ensure maximum engine protection. The engine oil must have the ability to retain its TBN reserve (alkalinity reserve) that is contributed by both the detergents and dispersants during its entire drain interval.

~~Of these two additives, it is detergents that offer the best alkalinity reserve. Though dispersants are a necessary additive for the formulation of engine oils, and engine oil's total TBN that is derived through the use of high dispersant chemistry does not offer adequate protection an engine needs against the corrosive attack of acidic combustion by-products. Dispersants are more rapidly depleted than detergents because of the way they chemically react with acids that are formed and by the way they react with other particulate contaminants. Detergents, on the other hand, because they chemically react with the acids and any other particulate contaminants that are present in the engine oil, have the ability to retain their TBN reserve over longer periods of time, thus providing a more protective form of TBN over the entire drain period of the engine oil.~~

~~Using this proper balance of detergent and dispersants in conjunction with using the proper balanced anti-oxidant system to control the rate of acid production from the thermal degradation of the engine oil provide the best effect for maintaining alkalinity reserve over the engine oil's entire drain interval. Employing the use of this stagey to effectively maintain TBN at all times throughout the entire oil drain interval provides relatively cheap insurance against acid build-up in the engine and thus is part of the equation in extending oil drain intervals.~~

~~Finally, though the use of TBN measurements is important in extending drain intervals, it should not be used as the only sole basis for oil drain extensions. TBN has to be used in conjunction with measurements and trend analysis of wear metals, soot, oxidation and nitration levels and viscosity increase. Copper and lead levels should be carefully monitored since elevated levels of both wear metals accompanied by increased oxidation are signs of bearing corrosion. In addition to these factors the engine's fuel and oil consumption rates, fuel quality (% of biodiesel used), sump capacity, ambient operating temperatures, amount of idling time and the overall maintenance practices by the operator have to be taken into consideration whenever oil drain intervals are going to be extended. In addition many engine OEMs have varied drain intervals that are dependent upon the severity of vehicle service, weight of load being hauled and service environment. These have to be also factored into the equation when attempting oil drain intervals.~~

~~Use TBN wisely but do not use it alone.~~

• As Sarma stated you have to monitor the TBN during use. You also have to properly trend these results in conjunction with other used oil analysis parameters such as monitoring for oxidation and wear metals. The key is that the engine oil must retain its TBN during use. Just having an initial high TBN does not ensure that the engine oil being used is better,

Acid build-up in an engine can come from three sources:

1. The fuel's sulfur content
2. NOx in the combustion process. This can form nitic and nitirous acids
3. Oxidation by products.

If the engine contains exhaust gas recirculation (EGR) for reduction of NOx emissions this can further aggravate the build up of acids. Cooled exhaust gases create acidic materials in the intake systems and combustion chambers. These acids are formed when nitrogen from the air and sulphur from the fuel is converted during the combustion process into nitrogen and sulphur oxides and comes into contact with the water vapor present in the exhaust stream. The water reacts with the nitrogen and sulphur oxides to form a mist of nitric and sulfuric acids. These acids when fed back into the power assembly of the engine can become concentrated resulting in corrosive wear. High acid levels can also accelerate the depletion of the engine oil's alkaline reserve, which is known as total base number and reduce its usefulness. EGR technology has the engine ingest not only the intake air, which is normally only 37.8°Cbut also up to 40% of the exhaust gases at temperatures well above 93°C. As a result the engine oil's temperature is increased. This increase in engine oil temperature can accelerate the rate of the engine oil's oxidation. Oxidation can degrade the engine oil causing the creation of acidic components that can further deplete the engine oil's alkaline reserve, lead to increased deposit formation and a dramatic increase in the engine oil's viscosity

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significant quantities of unsaturated and polyunsaturated fatty acid esters can exhibit poor oxidative stability. In the crankcase these unsaturated and polyunsaturated fatty acid esters can undergo oxidative polymerization, resulting in degradation of the engine oil that can lead to the formation of engine deposits and sludge and the thickening of the oil. The formation of deposits especially on the pistons can not only lead to increased wear but also to piston ring sticking. Stuck rings allow more blow-by gases and soot to enter the sump, thereby promoting further viscosity increases and degradation of the engine oil. This increase in viscosity also affects the engine oil’s low temperature pumpability. The level of oxidation is dependent upon the rate of fuel dilution, the concentration of biodiesel used (e.g. B20 which is a bend of 20% biodiesel and 80% petroleum diesel fuel), the quality level of the diesel fuel, the source of the biodiesel’s feedstock (e.g. soybean, canola, palm, animal fats), the engine operating conditions and the quality of the engine oil.

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The key to technology excellence and carefully balancing TBN retention is utilizing the right balance of detergents, dispersants and other key additives to ensure maximum engine protection. The engine oil must have the ability to retain its TBN reserve (alkalinity reserve) that is contributed by both the detergents and dispersants during its entire drain interval.
Of these two additives, it is detergents that offer the best alkalinity reserve. Though dispersants are a necessary additive for the formulation of engine oils, and engine oil's total TBN that is derived through the use of high dispersant chemistry does not offer adequate protection an engine needs against the corrosive attack of acidic combustion by-products. Dispersants are more rapidly depleted than detergents because of the way they chemically react with acids that are formed and by the way they react with other particulate contaminants. Detergents, on the other hand, because they chemically react with the acids and any other particulate contaminants that are present in the engine oil, have the ability to retain their TBN reserve over longer periods of time, thus providing a more protective form of TBN over the entire drain period of the engine oil.
Using this proper balance of detergent and dispersants in conjunction with using the proper balanced anti-oxidant system to control the rate of acid production from the thermal degradation of the engine oil provide the best effect for maintaining alkalinity reserve over the engine oil's entire drain interval.

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Richard Widman • There are local and regional oils that are sold on price where TBN drops from 11 or 12 to 4 or so in 200 hours. I can put a good US oil in the same engine and the starting value of 11 will drop to 7 or 8 in 500 hours. So if you change brands, you start all over with your findings.

And even within same brand, for the reasons stated by Larry, fuel dilution, soot formation, and other factors will vary the results. With the oils I'm using, we really end up more worried about the fuel dilution, soot accumulation, and dirt ingress. The only times I've seen low TB with this oil is when there is high fuel or soot.

Manish Patel • TBN depletion is linear, but will depend on duty cycle, load, PM, Fuel consumption and sulfur in fuel.

Richard Hassebrock • On the contrary, I see TBN depletion being rather non-linear, with a greater rate of depletion in the early part of the drain cycle and a slower rate of depletion through the mid-range of the cycle with perhaps an increase in the rate at the very end or late stages of the drain cycle.

V.S.S. Sarma • In spite of drastic cut in fuel Sulphur levels, TBN continues to be specified as part of specification for fresh oil, mainly by the Europeans. Look at the following information that I have (I need to maintain this as a blender):

ACEA C3-07, 08, 10 - 6 Min; ACEA C4-07, 08, 10 - 6 Min; ACEA E4-07, 08, 08 Issue 2 - 12 Min; ACEA E6-08, 08 Issue 2 - 7 Min; ACEA E7-08, 08 Issue 2 - 9 Min; ACEA E9-08, 08 Issue 2 - 7 Min; ACEA A1/B1-10 - 8 Min; ACEA A3/B3-10 8 Min; ACEA A3/B4-10 - 10 Min; ACEA A5/B5-10 - 8 Min; MB 229.1 - 6 Min; MB 229.3 - 7 Min; MB 229.31 - 6 Min; MB 229.5 - 8 Min; MB 229.51 - 6 Min; VW 501.01 - 7 Min; VW 502.00 - 7 Min; VW 505.01 - 7 Min; Renault RN 0700 / 0710 - 8 Min; Renault RN 0720 - 6 Min; PSA B71 2295 - 8 Min (Outside EC 10 Min); PSA B71 2294 - 8 Min (Outside EC 10 Min); PSA B71 2296 - 8 Min (Outside EC 10 Min); PSA B71 2290 - 3 Min. (Outside EC 6 Min); PSA NIV.2 ACEA A3/B4 Specification 2010 71 2300 - 8 Min (Outside EC 10 Min); PSA Service Oils - Low SAPs ACEA C3 Specification 2010 B71 2297 - 3 Min (Outside EC 6 Min); MB 228.0 - 6 Min; MB 228.1 - 6 Min; MB 228.2 - 8 Min; MB 228.3 - 8 Min; MB 228.31 - 7 Min; MB 228.5 - 12 Min; MB 228.51 - 7 Min;

As for Americans, they are silent about TBN requirement but perhaps go by the 20 times the fuel Sulphur level norm.

Karim Ibrahim • From a lifetime working with used engine oils. TBN will drop in a pretty linear manner under similar working and engine cnditions. NOw even though this may seem rather general, you'll find practical value when working with diff markets and diff segmnts within the same market, thus your off-road clients in market X that use a specific type of fuel, no coolant and drive this mix of trucks that are on the average X years old should have a pretty linear and prdictable rate of TBN depletion. However, be careful that this segment in another nearby market using a different quality of fuel can have a pretty different lifetime or the oil. Within the same market, I predict you'll get the feeeling for the oil's TBN life after a few dozen analysis. For any help in interpretation pls drop me an e-mail anytime on karimkfct@yahoo.com

There are oils in this market (15W-40) that shear down 11.5 or 12 cSt in 100 to 150 hours in heavy equipment and farm tractors. Others that will easily pass the 500 to 700 hour mark in the same equipment. Take a group II with a natural VI of over 100 and you only have to gain 30 points or less in VI. If it is naturally a 90 VI, you need to add more. And there are a lot of different grades (read prices) of VI improvers that other people can expand upon better than I can.
It also varies with the equipment. The hardest on shearing that I've found over the years is on the Lincoln Diesel Welders (if I remember correctly it is a Deutz engine, but I don't remember the series) where oils that can easily do 500 hours without shear in a CAT engine will show some shearing at around 280 in that welder, from the size and rpm of the cam and crank gears where they mesh.

By Richard Widman

Multigrades must meet a variety of viscosity tests before the products reach users. For

example, a 15W40 should meet the following viscosity characteristics:
1) Kinematic Viscosity @ 100 Deg C - 12.5 to 16.3 cSt
2) Low temperature cranking viscosity (CCS) at (-) 20 Deg C - 7,000 Centipoise Max
3) Low temperature pumping viscosity (MRV) at (-) 25 Deg C - 60,000 Centipoise Max
4) High Temperature High Shear test at 150 Deg C - 3.7 Centipoise Min
A viscosity index polymer has to be so carefully selected that the finished product must meet all the above viscosities.
If the finished product meets all the above data, it will have no problems in the field. Europeans don't allow change of polymer once a formulation is finalized. Americans are silent about it but insist on the above tests.
By Sarma
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V.S.S. Sarma

The whole purpose of a lubricant is to reduce friction and wear. The question is that way very relevant. However, in the case of engine oils, wear is controlled by passing the oil in different tests other than the 4-ball test which is a low temperature, static test and hence not representative of engine conditions of high heats, temperatures and pressures. By 1964, when API-SC was published, control of wear was recognized as an important engine oil parameter and Sequence IIA, IIIA and V tests were developed to understand the cam wear and intake valve tip wear. Subsequently various engine oils were developed with various test criteria to determine wear. Important specifications and their wear tests are as under:

API-SC: Seq II, III, V
API-SD: Seq IIB, IIIB, VB
API-SE: Seq IIIC, IIID, VC or VD
API-SF: Seq IIID, VD
API-SG: Seq IIIE, VE
API-SJ: Seq IIIF, IV A
API-SL: Seq IIIF, IV A, VE,
API-SM: Seq IIIG, IV A
API-SN: Seq IIIG, IV A,
ILSAC GF-4: Seq IIIG, IV A, VG
ILSAC GF-5: Seq IIIG, IV A, Phosphorous not more than 600 ppm
API-CE: NTC 400
API-CF-4: T-10
API CG-4: RFWT
API CH-4: T-12, RFWT
API CI-4: RFWT
API CJ-4: ISB, RFWT
ACEA 2007, 2008, 2010, 2012: TU3M, OM 602A, OM 364 LA, Cummins ISM, Mack T-10, T-12, D6987, OM 646 LA
US MIL-L-46152D, E, 2014E, F, H: Seq IIIE, Seq VE, Caterpillar TO-2, TO-3, TO-4, TO-4M, D6975, Allison graphite & paper friction test, T-10
Global DH-1, DHD-1: M354, T-9, RFWT, 4D34T4
dexos-1, 2: TU3M, T-95, IIIG, OM 646 LA, DUR021, DUR019
MB 229.1, 3, 31, 5, 51, 52: M271, OM 646 LA
BMW: N42
VW 502.00, 504.00, 505.00, 505.01, 507.00: PV 5106, RNT Wear test
RN0700, 0710, 0720: AW Properties test, TU3M, OM 602 LA, OM 602 A
PSA B71 2290, 2294, 2295, 2296, 2297, 2300 : 4 Ball wear
MB 228.0, 228.1, 228.2, 228.3, 228.31, 228.5, 228.51: OM 646 LA, OM 501 LA, Cummins ISB EGR, D5596

MAN M 3275-1, M3277, 3575: OM 501 LA, OM 646 LA, MAN Test
Volvo VDS-4: Cummins ISB, T-12, D5596
MTU Type 1, 2, 2.1, 3, 3.1: OM 364 LA, OM 441 LA, OM 611, OM 646 LA
Caterpillar ECF-1a, 2, 3: Mack T-12, T-10, T-9, ISM EGR, Cummins ISB, RFWT
Cummins 20078, 20081: Mack T-12, T-10 EGR, JASO M-354-2000, Cummins ISB EGR, Seq IIIF, RFWT
DDC 93K214, 215, 218: OM 501 LA, Mack T-10 EGR, JASO M 354-2000, RFWT
Mack EO-N PP 03, EO-O: Mack T-10 EGR, Cummins ISB EGR, RFWT

The above tests are very comprehensive and represent more complex situations than the 4 ball wear conditions.

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Typically, the BN of 1% SA oils is around 7.5. The interesting point to note is that not all the alkalinity comes from detergents ie. Ca/Mg Sulphonates. Some of it is from ashless components.
BN retention in these types of oil are poor when used with high S diesel (>500ppm).
Note that the 1% ash products, like API CJ-4 and ACEA E6 are designed to be used in diesel engines operating on ULSD. BN retention in these conditions is less critical.

I very much doubt you can get 12-15BN with a 1% ash product. In any event, the oil will not be suitable for use with high S diesel.

With 1.25% ash, you can get up to 12BN, but again a substantial amount would have to come from dispersants.

We have had some experience with 1% ash products (API CJ-4) in S.Africa and can confirm that, in some instances, poor BN retention has been reported.

Based on this, it would be safe to say that 1% ash HDDO is not recommended with high S diesel (HSD)

Petr,

Good to hear you are busy and keeping the grey matter alive.

I only get to CT about 2-3 times a year these days, but will try to meet with you next time. We are moving into very nice offices overlooking the ocean end January.
We look forward to entertaining you on your visit to Durban.

We do enjoy substantial Engen business.Most of the Dieselubes, RR and XOM Marine. The new tender award was made earlier this year.

On base oils, we trade in mainly Safor base oils and have a joint import arrangement with another local company who have storage capacity at IVS.
Imports involve Group I (various sources), Chevron Gr II, Yubase

and Ultra S Group IIIs.

To supplement the Oronite range of additives, we have distributer agreements with BRB Int. Mainly SP gear additives and ATF; Some Zn-free hydraulic, turbine and a few other specialties.

Also recently appointed as distributer for Evonik (Rohmax) for Sub-Saharan Africa, excluding S.Africa, where LL&E have been their long-standing partner. This comes into effect next year.

Clariant have verbally confirmed that Umongo will distribute their Brake Fluid and Coolants in Sub-Saharan Africa.

Ranjith Ramkissoon
Technical Director
Umongo Petroleum Additives (Pty) Ltd
082-4255381
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ranjith@umongo.co.za

You may know that I joined Umongo Petroleum (distributer for Oronite) in March 2008, essentially doing what I used to do at Protea with the Afton business.
We are based in Umhlanga Ridge and operate with a staff compliment of 10, managing about 10 000mt of additive and 20 000mt of base oils annually.

V.S.S. Sarma • All detergents are Sulphonates, Phenates & Salicylates of Barium, Calcium, Sodium and Magnesium metals. All engine oil additives (known as detergent inhibitor packages or DI packages) contain these metals. But every 1% presence of Barium gives rise to 1.7% of Sulfated ash; 3.09% in the case of Sodium; 3.40% in the case of Calcium and 4.95% in the case of Magnesium. Additive packages which contain these metals will contribute to Sulfated Ash accordingly. (There are other components in additives which also contribute to Sulfated Ash but since you asked about Magnesium and Calcium, I am limiting the discussion to these metals).

But there are limits to Sulfated Ash in engine oils. I am listing some of these limits for your reference. CJ-4 Oil - 1% Max; ACEA A1/B1-04 - 1.3%; ACEA A3/B3-04 - 1.5%; ACEA A3/B4-04 1.6%; ACEA A5/B5-04 - 1.6%; ACEA C1-04 0.5%; ACEA C2-04 0.8%; ACEA C3-07 0.8%; ACEA C4-07 0.5%; ACEA E2-96 Issue 5 - 2%; ACEA E4-07 2%; ACEA E6-04 Issue 2 - 1%; ACEA E7-04 Issue 2 - 2%; ACEA A1/B1-08 1.3%; ACEA A3/B3-08 1.5%; ACEA A3/B4-08 1.6%; ACEA A5/B5-08 - 1.6%; ACEA C1-08 - 0.5%; ACEA C2-08 - 0.8%; ACEA C3-08 - 0.8%; ACEA C4-08 - 0.5%; ACEA E4-08 2%; ACEA E6-08 - 1%; ACEA E7-08 - 2%; ACEA E9-08 1%; ACEA A1/B1-10 1.3%; ACEA A3/B3-10 - 0.9 to 1.5%; ACEA A3/B4-10 - 1.0 to 1.6%; ACEA A5/B5-10 - 1.6%; ACEA C1-10 - 0.5%; ACEA C2-10 - 0.8%; ACEA C3-10 - 0.8%; ACEA C4-10 - 0.5%; ACEA E4-08 Issue 2 - 2%; ACEA E6-08 Issue 2 - 1%; ACEA E7-08 Issue 2 - 2%; ACEA E9-08 Issue 2 - 1%; MIL-PRF-2104H SAE 40, 15W40, 5W40 grades - 1.5%; Global DH-2-05 - 0.9 to 1.1%; Global DL-1-05 XW30, XW20 - 0.6%; etc, etc. There is a huge list that I follow while blending.
In my experience, it is always preferred to have Calcium based additives, but not Magnesium based. Any TBN boost if required, we can always use a Calcium Sulfonate whereas in a Magnesium based package, if we use the common place Calcium Sulphonate, the engine oil will fail; there will be excessive foaming.

Magnesium detergents have the potential to form less ash than calcium detergents due to their lower molecular weight and can be used to reduce sulfated ash levels in lubricants. Magnesium sulfonates have been shown to reduce piston ring wear and corrosion, but they are less effective at neutralizing weak acids and preventing bearing corrosion. For this reason, magnesium detergents are often used in combination with calcium detergents in lubricant formulations.

Lubricant-Derived Ash – In-Engine Sources and Opportunities for Reduction
dspace.mit.edu/bitstream/handle/1721.1/61614/704739979.pdf

Richard Widman • One more thing, I have seen a Komatsu report where they ban oils with over 90% of the DI package Mg. They list as dangerous over 50% Mg, and very dangerous when it passes 70%. As I remember, and there is probably a chemist here to clarify, it is overly agressive on metal parts, and also has more effects on seal longevity, even in hydraulics.

V.S.S. Sarma • Alexey Muralev: The reaction of Sulphuric acid with Magnesium or Calcium and others gives rise to ash resident for measurement as well as volatile matters.

Please look at the following two references in this regard:

http://www.konnaris.com/Portals/0/Search/calculations.htm

http://dspace.mit.edu/bitstream/handle/1721.1/61614/704739979.pdf?sequence=1

V.S.S. Sarma • Alexey Muralev: You may want to know how these factors have been worked out.
I will give you one example of Magnesium (4.95).
The chemical reaction is: Magnesium + Sulphuric Acid = Magnesium Sulphate + Hydrogen.
i.e. Mg + H_2SO_4 -> $MgSO_4$ + H_2
The molecular weights are:
Magnesium - 24.305; Hydrogen - 2.01588; Sulphur - 32.065; Oxygen - 31.9988.
Left Hand side weight = 24.305 + 2.01588 + 32.065 + 2 x 31.9988 = 122.38348
Right Side equation: Hydrogen is 2.01588.
Therefore, Magnesium Sulphate weight = 122.38348 - 2.01588 = 120.3676
It means that 24.305 gms of Mg will produce 120.3676 gms of Magnesium Sulphate ash.
Therefore the ratio for Magnesium is: 120.3676/24.305 = 4.9523

Alexey Muralev • Ahh, ok. It is just a matter of calculation. Although 24 g of Mg will complexate with 5 times more Salycilates than 24 g of Ba. Therefore if you make the same concentration of additives in oil Ba ones will yield 2 times more ash in gramms than Mg ones.
That was my point, although I've got yours.

V.S.S. Sarma • Alexey Muralev: Factors are as under:
Phosphorous & Nitrogen - 0; Copper - 1.252; Manganese - 1.291; Lead - 1.464; Molybdenum - 1.5; Zinc - 1.5; Barium - 1.7; Potassium - 2.33; Sodium - 3.09; Boron - 3.22; Calcium - 3.4; Magnesium - 4.95; Lithium - 7.92

V.S.S. Sarma • Chemical formula of different chemistries:
Calcium Phenate $C_{12}H_{10}CaO_2$;
Calcium Sulfonate $C_{56}H_{86}CaO_6S_2$
Calcium Salicylate $C_{14}H_{10}CaO_6$

V.S.S. Sarma • Sulphonates are very popular, cheap. They control piston deposits on the lower portions. Phenates are costlier but keep the upper parts of pistons clean. Salicylates have built-in friction modification properties. I manage with sulphonates and in very few applications, top-treat engine oil with a phenate booster.

James Ashworth • HDEO detergent/dispersent additives are derived from sulphonates or phenates or combinations of the two. These are the Ford Fiestas of the HDEO additive world. For Ferraris, go to a major additive supplier and ask for salycilates, which have far superior TBN retention.
Be prepared to pay more for quality or opt for a cheap compromise.

V.S.S. Sarma • Is it API-related specification such as CI-4 Plus or CJ-4 ? Or ACEA specification ? Or a OEM's own ? Or is it a JASO DH-1 kind ? Formulation is based on this criterion. Add to this criterion the local statutory aspects such as Flash Point, Pour point, TBN. In some areas, users want higher viscosities within the same SAE Viscosity, take care of the same. Optimise the doasages of PPD, TBN booster, Viscosity modifier. Ensure that elements such as Sulphur, Phosphorous, Sulphated Ash, Volatility, etc meet the desired specification. You get your formulation.
Because of the complexity involved, I have developed a computer software for this purpose. If I give the desired specification like say Caterpillar TO-4 and Allison C-4 to the system, the system gives me the formulation.

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In Technical Bulletin 21/2012, **Ford** announced a new engine oil WSS-M2C913-D viscosity SAE **5W-40**.

This oil can be used in nearly all diesel engines, Ford (except for the Ford Ka TDCi 2009> and Galaxy 1.9 TDi 2000-2006). Oil is recommended for all diesel engines Ford, requiring 913-B or 913-C.

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Bradley Cosgrove • The issue you will have is the CI-4 oil has high SAPS and those will plug the DPF. CJ-4 is a lower SAPS oil and will not plug the DPF.

Richard Hassebrock • While it is true that CI-4 engine oils do contain higher levels of SAPS, and therefore can potentially cause more rapid contamination of the DPF, of more concern is actually the rate of oil consumption in an engine. An engine that consumes more oil via the combustion chamber will emit more contaminants into the exhaust stream than an engine that consumes less oil. So a loose engine consuming CJ-4 oil will plug the DPF faster than a tight engine using a CI-4 lubricant.

Dilupa, if you follow Best Practices in your maintenance operation, then Best Practice would be to use a CJ-4 quality oil in an engine that is fitted with a DPF. If you must use a CI-4 oil because of availability problems with CJ-4 products, then you can expect to have shorter service periods with the DPF, unless the engine is tight and consumes little oil, in which case you may get by without excessive ash accumulation in the DPF.

Hussam Adeni • Beware the sulphur in fuels. If Sri Lanka has adopted Euro IV fuels (bellow 500 ppm Sulphur) CJ4 would be fine. Otherwise CI4.

Extracts from reports to support above are posted below:
......API-CJ4: Introduced in 2006. For high-speed, four-stroke engines designed to meet 2007 model year on-highway exhaust emission standards. CJ-4 oils are compounded for use in all applications with diesel fuels ranging in sulfur content up to 500 ppm (0.05% by weight). However, use of these oils with greater than 15 ppm (0.0015% by weight) sulfur fuel may impact exhaust after treatment system durability and/or oil drain...

..... When using CJ-4 oil with higher than 15 ppm sulfur fuel, consult the engine manufacturer for service interval.

(http://www.epa.gov/blackcarbon/2012report/Appendix4.pdf)
....the availability of low sulfur diesel fuel is imperative for many emissions control strategies. Sulfur in fuel will poison the catalysts that are built into passive DPFs, thus rendering them ineffective. DPFs work ideally with 50 ppm or less sulfur diesel fuel (“low-sulfur diesel”). Thus, nations that have adopted low sulfur requirements for diesel fuel of 50 ppm or less

are best positioned to adopt more stringent emission standards for new motor vehicles, and have more flexibility to target emissions from in use vehicles.

Richard Widman • High SAPS oils begin to cause problems in EGR valves and are particularly bad in engines with catalytic converters in the exhaust gases.

Even with high sulfur you should probably go with the CJ-4 if you have engines designed for it, just adjusting the change intervals appropriately. You will find in most of our 3rd world that a lot of the oils that claim to be CI-4 and have high SAPS will lose their TBN very rapidly and actually last less than a good CJ-4. But UOA is the only way to really see that and determine the correct hours.

By Rod Crowe

If you are really concerned about accurate fuel dilution results GC is the answer. I agree that any fuel entry is not "normal" but at levels less than the OEM normal, the manufacturer will not investigate for customers. Reacting at less than 3% will cause trucks to be sent into delears for repairs and they will not find the cause or just refuse to fix it.
Volvo trucks limit is 6% fuel dilution! prior to the oil analysis showing this level they will not investigate for a fleet owner. Additionally with diesel particulate filters in service! fuel dilution is increasingly common and vehicles will have a high level indicator on the oil dipstick as a measure of fuel dilution.

Jason:

Hi Richard, Yes Techenomics operate a number of laboratories located in Australia, South East Asia and Mongolia. My experience with samples identifying fuel dilution around 2-5% is quite interesting. With samples indicating 2% and above, we call our clients to let them know immediately, generally I would be speaking with Maintenance Superintendents, Engineers, Shift Supervisors and sometimes diesel fitters, normally I do not speak with the OEMS as they are not the client. Under these circumstances, the maintenance personnel try to get out and look at the equipment as soon as possible, dependent on where the equipment is working, such as a Loader, Shovel or Excavator, production may not allow this machine to be stopped, downtime can be extremely expensive so I guess maintenance have to weigh up the odds, they may allow the equipment to operate up until it has reached the unsafe point of 5%.

On other occasions were the OEM has been the client, they tend to react straight away to determine the cause of fuel leak, I guess this is because the equipment is still under warranty or under contract hire. OEMS appear to be more actively involved when analysis identifies issues within a sample, as where Maintenance have Production to deal with.
Richard Hassebrock Field Engineer at Castrol Heavy Duty Lubricants

Thanks for your response Jason. In my experience OEM's can sometimes have certain models of engines that routinely exceed 5% fuel dilution, and correcting the issue can be difficult and expensive, and so I've seen the OEM's push back and tell our lab customers that they do not consider the fuel dilution to be a problem and will not cover additional repairs to try to correct it. I've even seen emails from one OEM that they considered up to 10% fuel dilution to be acceptable. The engines with common elevated fuel dilution conditions tend to use post combustion injection or in-cylinder injection for the DPF regeneration. But these issues are not limited to that technology. I've seen this problem before on engines prior to the introduction of exhaust after-treatment devices. Elevated injection pressures seem to have increased the occurrence. This can create confusing situations for consumers when they receive conflicting information from their lab/lube engineer and their OEM equipment supplier.

Fuel dilution is often happened esp.for TGDI engines, what is the secure up limit of fuel in engine oil, does anyone have such experience?

Clean Boost Max... works outstanding.... there are more problems with the fuel. are you running into plugged filters? black slim? its taking out injectors causing all kinds of issues,
if so its taken me two years to figure it out and 5 different labs to find the exactly what it was Cat couldn't tell me what it was. If your running into these symptoms contact me and i will forward you the data explaining what it is and the cure and filtration will not fix the problem its just a band-ad end very expensive. I love filtration but when you are plugging filters ever week it get very expensive. we test over 30 additives and found one that worked the best! most cost effective EPA approved lowered injection failure 38% increased fuel efficiency 5% lowered emissions 40% it we were amazed with the results of the product.. never have I been a believer in additives? I am now...
Octadecanamide via GCMS which is the smoking gun, we have seen this chemistry rapidly plug filter throughout the US in bio and non-bio here is your answer to the question above.

Jason Davis
Really, 10%? I have never seen a sample with that much fuel dilution before and we analyse well over 20,000 sample each month. As mentioned in my article, from my experience with Heavy equipment is that at 10% dilution the oil level within the sump would rise and more than likely combust in the crankcase.
There is no possible way we would allow ourselves to making a statement that 10% was acceptable unless the OEMS had oil analysis trends that prove the equipment generally ran at high temperatures and Viscosity, TAN, TBN and lowered flashpoint had not been affected by this nature.
Our job is to look after the equipment and report the findings, I have not seen an Oil that can handle up to or above 10% fuel dilution, the viscosity would drop away to almost nothing, the TBN would lower to the point where it could no longer fight off acids, hence TAN would increase causing acid corrosive build-up. These all have the ability to cause extensive damage prior to the engine being destroyed in its own fire...

Maybe I should write another blog on the impacts Fuel Dilution has on viscosity, TAN, TBN and lowered flashpoint?

In the case of Automobile Engine Oils - I have copied this great article as reference for you.

A professional paper written by: D. Ljubas, H. Krpan, I. Matanoviæ

According to the published results, oil films should be stable up to 10 wt% of fuel dilution.15 Some authors followed certain specific parameters of oils in the case of dilution with fuel9 – e.g. friction moment in dependence with the load: mineral oils even at 1% of fuel dilution loose their properties considerably and at 7% dilution they loose their properties of wear protection totally. In the same experiment synthetic oils showed better stability resistance, but also with 7% of dilution with fuel they loose most of their lubrication properties. Other authors observed that for gasoline-fuelled engines the maximal level of oil dilution is 4%4, but some of them give general warnings, e.g. amount of fuel in engine oil of 5% is high enough to lower considerably the flash point or to
weaken considerably the oil film stability.

Download paper here - http://hrcak.srce.hr/file/75680
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Mitsubish diesel generator engine S12R lubricated with API CF-4 15W-40 diesel engine oil happend main bearing/journal serious damage and even the main journal broken, what' are the possible causes?

Richard Hassebrock

Field Engineer at Castrol Heavy Duty Lubricants

The bearings from the failed engine tell the story of what happened. All bearings, main and connecting rod, should be removed, cleaned with a solvent to remove the oil (don't wipe them) and laid side by side in order, front to back, and examined, both sides (lubricating side and the back side as well). Also, the main caps and the saddles. Take plenty of photos. What do the surfaces of the other bearings look like? What is left of the failed bearing? There may be information on what is left of that bearing, or on the main cap, the saddle, the matting surfaces, the bolts, etc. Everything needs to be examined closely. There are many possible causes, improper assembly/installation, overload, contamination, lack of lubrication, etc. In any case, the other bearings may show you the evidence. Damage to the surfaces of the other bearings can give you clues as to what happened. In the case of contamination or lack of lubrication, typically the surfaces of the other bearings will also show damage, giving you indications as to the cause of failure. I also like to inspect and photograph the exterior of the engine. Does it show evidence of a lot of oil leakage? If the bearings show evidence of a lack of lubrication and the exterior of the engine shows evidence of a lot of leakage, well, put 2 and 2 together. Are their records of how often the engine oil is topped up, and how much oil is added each time. That will also help. Get a copy of the path of oil flow through the engine, and look for where in that path the failed bearing resides. Is it the first bearing to receive oil from the oil galley, or the last one to receive oil, or one in the middle?

Hopefully you saved a sample of oil from the failed engine, does it show contamination? What about the oil analysis history? Are there any trends that give any clues as to what happened?

Here's a webpage with information that may help: http://www.knowyourparts.com/product-category/types-of-engine-bearing-damage/

Here's another: http://www.dvcmachine.com/technical-articles/29-main-bearing-failure-chart

Here's another nice one: http://www.nb-cofrisa.com/docs/web_fallos_ing.PDF

Richard Widman

Owner, Widman International SRL

Right.. And when pulling the bearings, look at the passageways behind them. Are they blocked?

Madan Pal   Research Tribologist at Daido Metal Europe

I agree with comment from Richard Hassebrock. You can tell a lot about mechanism of failure just looking at the condition of bearings ID and OD and journal surface. Measurements of bearing free-spread, wall thickness, and oil clearance before and after use can also assist. In this particular case, if one or more bearings suffered edge loading and the main journal was broken then this could have been caused by excessive bearing specific load (fatigue failure). A general modelling of minimum oil film thickness and maximum oil film pressure for the engine operating condition will give you an idea what has happened. Seizure, foreign particle or other failure mechanisms could be investigated by detailed analysis of engine oil, iron-printing of bearings surface, cross-sections, SEM etc.

Patrick Swan   Managing Member at Aswan Consulting

It sounds as though the crankshaft has broken through the failed main bearing journal. The investigation must include the crankshaft and not just the bearings. Richard sets out very well the procedure to use when investigating bearing failures, that investigation should be done, and quite possibly the remaining crankshaft bearings will be in reasonable condition. Crankshaft fractures are generally fatigue failures, which can be initiated by a fault in the crankshaft or the presence of an abnormal vibration.
The parts of a fractured crankshaft journal will key together during continued engine operation, which makes the fracture faces rub or fret together, and the slight misalignment causes wear and failure of the affected main bearing. Sometimes the first evidence of a broken crankshaft is failure of the big end bearing that is supplied through the affected main bearing.

Gongde Liu   Lube R&D Dept. Manager at PetroChina Dalian Lube R&D Institute
The customer blamed it on the oil based on the following statements:
From the oil side:
The oil was a normal API CF-4 15W-40, with the viscosity at 40℃ was 113.0 mm2/s and TBN 7.98 mg KOH/g for flesh oil, and the used oil analysis didn’t show any apparent deterioration when the engine broken happened.
While the customer declared that the OEM of the engine required the oil should be API CF 15W-40 with the viscosity at 40℃: 100～110 mm2/s and a minimum TBN of 11 mg KOH/g.
Thus the customer blamed the engine broken on the oil based on the following items:
1. The oil grade: API CF-4, not CF as the OEM required.
2. Viscosity at 40℃: 113.0 mm2/s, didn’t fall in 100～110 mm2/s
3. TBN: 7.98 mg KOH/g, lower than 11 mg KOH/g as required.
While I read the “Users guide and maintenance manual-Mitsubishi Diesel engine S 12 R”, in which the “ Recommended Engine Oil” as below:
Use class CD (recommended) and CF engine oils. Class CE and CF-4 engine oils are designed for diesel fuel with a sulfur content of less than 0.5% and less than 0.2%, respectively. Since the sulfur content of most Class-A heavy oil exceeds 0.5%, do not use Class CE or CF-4 engine oil when using Class-A heavy oil as fuel.

I understand from above that CF-4 oil is acceptable if the fuel S% is lower than 0.2%, the customer confirmed this kind of diesel was used (lower than 0.2%).
From the engine side: the engine was dismantled and inspected after 2 years since this broken down happened. The inspection information as following:
1. The 6th connecting rod bearing severe deformed and ablation(thermal corrosion). Connecting rod bearing cap showed some high thermal characteristics caused by friction
2. The 3rd,4th , 6th main bearing severe deformed and ablation (thermal corrosion), the bearing positioning bump were worn out. And the bearings showed apparent rotation evidence
3. The 6th ,12nd liner broken. All the other cylinder are normal, the liner surfaces were smooth and wetted with lubricants with normal oil films, no evidence of scuffing or sticking.
4. Oil in the crankcase found some coolant, and in the crankcase there were some debris from the broken of liners, bearing alloys and bearing caps and etc.

Richard Widman Owner, Widman International SRL

Your last point is key. If there is coolant in the oil, you should expect bearing failure at some point. Operators should stop equipment when they find themselves adding coolant regularly.

Richard Hassebrock

Field Engineer at Castrol Heavy Duty Lubricants

I don't think you've finished the failure analysis yet, you can't blame the failure on the oil at this point. What caused the breaking of the liners? What caused the deformation of the bearings? What caused the thermal corrosion? Without seeing the parts, this description sounds like a lack of lubrication. Re point #4, was used oil analysis performed on the oil? What was the viscosity? What was the water content. Glycol contamination of the oil can cause extreme increase in viscosity, with the end result being lack of lubrication and failure of the bearings. As the connecting rod bearing fails it can allow enough movement of the connecting rod to make contact with the liner resulting in breakage. I think Richard is correct in his comment above.

Doug Rolls

Lubrication Specialist

I think that Richard has really identified the issue. Oil analysis would have likely identified a glycol leak prior to failure. Glycol contamination would certainly cause the issues that have been described. Blaming the oil is common but ill-informed.

Gongde Liu   Lube R&D Dept. Manager at PetroChina Dalian Lube R&D Institute

As there were no oil sampling and testing just before the engine broken, so as to the coolant in the crankcase(engine oil), we could not tell whether the coolant leaking caused the bearing failure and the followed engine broken, or the engine broken caused the coolant leaking into the crankcase.Something a bit like Chicken or Egg.
As this happened several years ago, no more or any straight information we could get. I firmly believed that the oil should not be the scapegoat just based on these information. Even for the lack of lubrication, from the parts inspection, the mis-assembling like that the bearings are installed with incorrect orientation thus the oil feeder hole were closed, or the bearing cap bolts have not been tightened sufficiently, which would make the bearing moving in the bearing seat.......All these lubrication starving are caused by machine itself, nothing to do with the lubricant.

George Abernathy   Fluid Product Specialist at Steiner Metalworking & Industrial Supply Co.

Thanks to all for great info! I think Richard hit it on the head. It was negligence on their part and we all can write what it "could've been", but you did find coolant in the crankcase.

Can you scrape the failed areas and test with an FTIR for glycols/coolant deposition. If the coolant formed a "passive layer" of burnt glycol(s) on it, the oil will not get into the asparities in the material for boundary lubrication.

It's a "bugger" in determining something that happened two years later, with no routine oil analysis to determine WHEN it occurred during the life of this.

My real question is; IS THIS ONE OR NUMEROUS MOTORS that failed with them in Gongde's last mechanical comment?

Richard Widman

Owner, Widman International SRL

I've seen a number of engine failures blamed on oil. That is why I like to be called when the engine is torn down. it is a lot more telling. There are thousands of Ford Ranger pickups made in Thailand with the air intake down low next to the fan. Dozens here have seized up and the Ford dealer says oil is to blame for the emulsion.

One of the things I tell people is to stop and put all the possible causes and non-causes on the white board. One interesting point that always gets there intention is that in a batch I import with maybe 40 drums of the same product, it is in hundreds of similar engines and similar conditions. In the case of this discussion with Ford, he could not explain how it worked well in EcoSports, Explorers, Expeditions, Rangers from other countries, but was to blame for the Thailand Ranger failures that looked like mayonnaise inside.

Mark O'Brien   Lubrication Excellence Champion

I have instigated a few technical service investigations due to clients claiming damage from bad lubricants. The lab found for other causes each time; poor quality bearings, grease mixing and wrong grease for the application. When the bosses started yelling, the mechanics blamed the lube technician who returned the favor. Then they all blamed the grease or oil. Then the lab comes through with the truth.

Mark O'Brien

Lubrication Excellence Champion

If the coolant is there, the proof should be easily seen on dipsticks and the underside of the filler cap. It will not look like a coating of oil.

Xiao Ma   Piston development specialist at DAF Trucks N.V.

How is the situation now? Has the root cause(s) been identified yet?

Unfortunately crank-train related failures is probably the most challenging failure analysis that one could encounter in an engine, largely due to the complexity of the problem and the massive collateral damage that happens immediately after, which could have disguised the hint of the very first chain of events.

Common crank-train failure events that we have tackled here do not typically end up blaming the oil. Rather, manufacturing defects / assembly errors of the crank train components are the topmost engine/crank train killers. Some points to consider:

Main / big end bearing initiated failure:
- Insufficient bearing fixation (shell back laser marking / bearing crush out of spec,etc.) results in rotation of the bearing shell (mostly main bearing) which blocks the oil passage and lack of lubrication;
- Top "running-in" layer of the main/conrod bearing quality is below standard and has depleted and is torn quickly (usually very short mileage to survive);

Piston / small end initiated failure:
- Insufficient piston cooling leading to seizure of the piston skirt and then everything follows. This would for sure cause a broken liner and coolant in oil of course; depending on how prompt the engine is pulled out of action, the complete damage extent can very significantly;
- Conrod bearing machining out of spec.

You didn't describe the appearance of the pistons but I assume they have also been damaged.

Not to mention when one /some of the other key engineering dimensions (bearing clearance, parallelism, etc.) out of spec, which for sure could result in complete crank train failure. I assume the manufacturing capability of the crank train components is well known and that chance that you get out of spec parts is low.

Advise is to have all crank train parts throughly inspected. Good news is different failure modes on the journal bearings would manifest themselves completely, which would help you figure out the final seconds of the engine failure and chain of events. If necessary, implement kepner tregoe technique to identify root cause(s) as it's usually complicated.

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Syed Sadath Hussain   Lubrication Field Engineer

Typically, TBN 40 **Marine Engine oils** meets the specs requirements of API CF. They are suitable for Trunk Piston Engines (TPE) running on HFO with S ranging 3.0 to 3.5 %wt. The niche property of a Marine Engine oil is to readily separate from water, as there is always a high possibility of water ingress.

Dolf van Asbeck   Technical Support Engineer at Shell Global Marine Products Ltd

Good day Mazher. The term marine cylinder oil properly refers to the lubrication of 2-stroke engine cylinders (2-stroke slow speed engines). There are some old 4-stroke designs that have separate cylinder lubrication.

Most 2-stroke cylinder oils are 50cSt, and there are 40cSt oils available for the purpose. There are 40BN oils in this category.

For four-stroke trunk piston engines (medium speed), the crankcase oil is typically SAE 40, BN 40. These oils are common for engines using a heavy fuel oil (typically ISO-F-8217, RMA, RMG, RMK with sulphur levels up to/>3%). However, the final choice is dependant on operating conditions. Many operators choose a 30BN because it is cheaper up front (though total cost of ownership is usually higher).

API - There are no API Service Classifications for marine engines.

Suppliers quote API CF because that is the only recognised standard that there is with any relevance. It replaced the now obsolete API CD during 1994 and has not changed since. API CF is an automotive high speed diesel service classification created for European and Japanese requirements at the time the American manufacturers diverged to API CE.
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Nitration in Gas Engine Oils (Syed Bukhari)

I want to bring in an important issue of Nitration in Gas Engine Oils. Many of us understand that its due to external causes and more related to maintenance practices a power house manager adopts, and actually have less to do with additives and base oil. Need answer to help understand this phenomena and possible causes related to it and if any one can help suggest good practices to have less nitration in Gas engines or hint towards the maintenance solutions and checks that can solve this problem.

Kausar Rizwan

Nitration is the chemical degradation of crankcase of caused by the reaction of nitrogen oxides produced during the combustion process.
Low crankcase oil temperature accelerate the rate of nitration.
In gas engines,nitration is the predominant factor that determines lubricant life.
Nitrogen oxide by-products enter the oil during normal operation because of blow-by past the compression rings.

Nitration is dependent of Base Oils and Additive Chemistry and of course operation and maintenance practices as well such as Air Fuel Ratio, Crankcase Ventilation, Spark timing and engine overload etc.

If the Base oils and Additive used in a Gas engine are of inferior quality or market general type, the rate of nitration will be higher as compared to a premium base oil and high quality additive technology.

Jean-Michel Demaret

Nitration is related to the temperature of the gas during combustion. The hotter in the combustion chamber the more Nitrous oxide is created.
The ratio air to gas is important the nitration peak is around 19:1 (air : gas). This is when the engine is the most efficient. You can decrease the nitration concentration in the exhaust gas in modifying the engine to run lean (pre combustion chamber). NOx will be a lot less. Usually gas engines are designed to run lean or stoichiometric (rich) .
If you operate rich 16:1 you get less efficiency of the engine and more oxidation. In an engine well tuned the oil nitration results should be higher than the oxidation results.

The FTIR reads only C=N (double bond, alkene). The alkenes are poorly dissolved in the oil and will create varnish.
You may have blow by gas and contaminant getting in the sump, these are nitro compounds which can be seen on a different wavelength (I may be wrong). These Nitro compounds are seen in larger quantity at low load hence cold sump.
If the base stock is well saturated (Group II) less amide (precursor of alkene) are created. The additives package has to be performant against nitration (Anti oxidant package can be tuned to anti nitration as well, I may be wrong).
The oil is not going to reduce the nitration, but it can last longer if it is a good gas engine oil, Regulations regarding NOx in exhaust gas is different in every country.

Asad Perwaiz

All the factors mentioned above by different individuals are valid but many times I tried to gathered the relative data from customers like air / fuel ratio, crankcase pressure, oil temperature, etc but all time customers provided me no abnormality. I personally experienced that different models of gas engines has different rate of nitration. It also has a great deal to do with engine design. Some models show high rate of nitration and in some model I had never experienced a single case of nitration.

Even in some cases I advised customers to adjust NOx but no considerable decrease in nitration was noticed even after NOx adjustment. Poor piston rings sealing is the most important factor for me because in all cases of nitration I also noticed low oil consumption

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Sludge in Gas Engine Rocker Arm, please share your experience

Jean-Michel Demaret

You have over extended your oil change interval in regards of the performance of your oil and the quality of the gas. Once the detergent or overbased dispersent have reached a low level, the sludge starts to appear first in the rocker arms area. It is a tell tale. If you cannot play in decreasing the sulphur content of the gas (landfill) or water content (coal seam methane), check if you can get an oil with higher TBN (depending on OEM perhaps). Reduce the temperature of the engine by decreasing the fuel injection and running leaner. The easiest as a first step is to decrease your oil change interval. You must see other signs through your oil analysis such as low TBN and increased viscosity.

Muhammad Hassan Abbasi

Thank Jean for the valuable input.
Well in this particular case, the engine had a history of one extended drain interval, where the engine was allowed to run, 600 more hours after tbn condemning value.
But interestingly the daily top up quantity also reduced by 2 liters, what can we interpret from it?
Crankcase ventilation pressure was not measured throughout, since there is no exhaust recovery.
But can you kindly share some light on why would an engine ask for less oil, on same load?

Dave Anderson   Fresno Area Sales Manager at Elbert Distributing Inc.

Try BG Products
MOA to raise TBN to keep engine clean and sludge free.

Dolf van Asbeck   Technical Support Engineer at Shell Global Marine Products Ltd
Check for changes of routine by the shift engineers. Is there a defined operating sump level or has the engine been allowed to reduce to a lower level than 'normal'?

Muhammad Hassan Abbasi   Lubrication Engineer at MAL Pakistan Limited
I believe since there is no overhead make up tank, and oil make up is done manually on variable intervals, So yes the oil level might have dropped at certain period.

Can you kindly share your valuable experience, on what could be the reason that SLOC value decreases abnormally?

Dr. Rajan Mookken   Super annuated as GM(Lubricant Technology after 37 years at Indian Oil Corporation R&D Centre, Faridabad

Is there any significant drop in TBN or any wrong top-up? The current oil has to improve its detergency level. Discuss with the oil provider.

Dolf van Asbeck   Technical Support Engineer at Shell Global Marine Products Ltd

Sorry, I should have been more complete. I do not know why, but we have noticed that engines not maintained at reasonably constant sump levels can display variable oil consumption levels. I have seen this particularly where staff allowed the sump to approach the lower minimum, and then top up to the upper maximum. This resulted in increased consumption rate until the sump volume returned to a level that it stabilises at, and then a decreasing rate for a while as the sump level started to drop again.

Topping up a little and often to keep the level close to the point where an engine seems to 'stabilise' its sump volume is a better practice if you are managing your oil consumption closely. If you are calculating SLOC from logged top up figures then you have to be certain that the volumes supplied are accurate. Remember that you are calculating g/kW.hr, so the top up volume should be made in calibrated containers and reported as best they can be in millilitres. Not rounded up from 1 and a half to 2L!!

However, do not let me sidetrack you too much. Jean-Michel's answer is closer to what you originally asked about!!

Mile Stojilkovic

Director for Development and Marketing of Lubricants – NISOTEC

For gas engines must use oil for gas engines with low sulfated ash (0.5 - 1%, m/m, max. depends on the requirements of the engine manufacturer). Make sure the oil is a good choice.

Muhammad Hassan Abbasi

Oil for sure is the high quality leading company's 0.5 ash , fulfilling OEM 's all requirements.

Brett W.

We have been doing some testing on a couple of gas engine applications and have seen the same issue, sludge......These were large Cat engines that showed a white powder build up on the tops of the pistons as well.

As Mile's stated, the oil should be compatible with low ash but the solutions for a large by-pass filtration system that was designed by a local group. We just finished all the last quarter evaluation for the group on the engines and the sludge and white powder is gone....and they extended oil drain intervals 3 fold.

Schalk Bruwer   Owner at Advnce Fluid Performance Ltd

Dear Muhammed I think you have got good information to work with from good comments coming from JM and Dolf. You have not mentioned the source of the gas. White deposits on piston tops are normally related to gas(fuel) quality and the best known are siloxanes coming from land fill fuels. I think the filtration referred to by Brett W is referring to fuel(gas) filtration to remove siloxanes, sulphur, chlorine and other contaminants and as such the disappearance of the white deposits. By the way the white powder is SiO_2 which is very abrasive and is a result of siloxanes being exposed to high T and P.

Jean-Michel Demaret

If the gas is landfill gas, likely the deposit is siloxane, but with natural gas the deposit can be calcium from the detergent additives.

Muhammad, Dolf gave you the most likely answer, sump level. You may also consider the possibility of valves guide clearance reduction. A certain amount of oil enter in the combustion chamber through the valves guides. The additives (sulphated ash) protect your valves from recession (reducing). If the OEM have changed their clearances, the wrong type of guides has been installed, or there is some varnish building up in your valves guides you may see a decrease of the consumption.

Brett W.   Technical Consultant LubeTrak/Spectro Scientific

Schalk, you are correct, it talked with the group via email today, they did two styles of filtration that solved the issue at hand. They had installed a in-line fuel filtration system using a version of a coalescere and the engine was a by-pass unit with a replaceable cartridge. LinkedIn is a great place to meet experts for sure, thanks guys.

John Lorenzo, CLS   HCM,Pdm Reliability Engineer Specialist at Rio Tinto/Kennecott

Bypass filtration extends drains to 1000 hours filter grabs 99.9% of the moisture single pass and filters down to one micro. i have them on 988 cat loaders down f150 trucks and get P.C.
ISO codes of 17/15/13 at 500 hours on our 988 loaders and haul trucks out gas LD fleet
ISO readings are 15/13/11 with a 1000 hours on the oil we sample every 250 hours.

John Christopher Kowsky   Professional Lubrication Consultant

As a Lubrication Consultant since the '80's, I cannot emphasize enough the value of By-Pass Filtration. An added benefit, stated above, is the reduction in petroleum dependency. Cleaner engines, requiring less oil to not only requisition, but to later, dispose of. You will find that your oil's additive package retains it's effectiveness longer, with the contaminants removed. The added oil capacity of By-Pass Filtration also contributes to cooler oil temperatures. Think quality here, in your Petroleum product as well as your By-Pass Filtration product.

Gerald L. Munson, CLS   Managing Partner at Fluid Assets, LLC Sr. Partner at McCormick and Munson, LLC

Muhammad, I have to agree with both Jean-Michel and Brett Winberg. If there is sludge, the Oil / additive package is overloaded and or depleted. Your choice is to change the oil more frequently or find a way to remove the contamination, if the TBN is still at an acceptable level. Maintaining the oil level is critical.

I have experience with Jenbacher Gen Sets using depth filters to remove emulsions and spent additives. As Brett relates the oil was very clean and the oil and machine life was extended.

V.S.S. Sarma   Technical Manager

Formulation may be a problem here. Blending of SAE 40 with SN 500 and BS 150 can give rise to such a problem. Instead, they should use straight run SN 600 / SN 650 to make this grade.

Fernando Oscar Bilotti   Senior Field Engineer Support - Argentina Area -Minería y Marine & Aviation Lubricants en Axion Energy S.R.L.
I've conduced several Gas engine inspection in the past, in general Wakesha (Now GE) and some Caterpillar gas engines, and I saw an amount of sludge or deposits like brown / dark or green gel. We analyze the used oil analisys and found Na (Sodium) and some K (Potasium), and the conclussion was (water -glycol) refrigerant leaks. This porblem is very common in this engines in the rocker arms and oxidize the oil very quicky. some times the leaks are in the o-rings, seals,o directly cracked heads. You need to check the used oil analysis to chec Sodium and Potasium, because in general the water is evaporated in the combustion chamber but the Sodium (corrosion inhibitor) continue in the used oil. Pleas check refrigerant leaks too and verify if the water -glycol is approved for the OEM, because somes refigeranet are used for Diesel engines but not for gas engines according to the metallurgy, example Iron insted of Aluminium.