AMSOIL®

Service Line

NEWS AND IDEAS FROM AMSOIL

New AMSOIL Diesel Oil Meets CJ-4

New emission standards go into effect in 2007 that require more stringent nitrous oxide (NOx) and particulate emissions reductions in on-road light- and heavy-duty diesel vehicles, and most engine manufacturers have incorporated increased exhaust gas recirculation (EGR) rates of 25-35% to meet them. New low-emission engine models with high EGR rates dump excessive amounts of soot and acids into the oil, accelerating wear in the cylinder walls. Increased EGR rates also mean 2007 diesel engines run hotter than their predecessors, requiring diesel oils with improved oxidation resistance to prevent thermal runaway and maintain engine protection.

The introduction of Ultra Low Sulfur Diesel (ULSD) fuel in June 2006 dropped diesel fuel sulfur levels from 500 ppm to 15 ppm in order to meet 2007 particulate limits, provide compatibility with NOx after-treatment systems and enable high EGR rates.

In addition, in order to further reduce particulate emissions, diesel particulate filters (DPF's) have been incorporated into all 2007 American diesel engines, forcing diesel oils to balance engine protection with DPF life. Increased EGR, although effectively decreasing NOx emissions, results in less efficient combustion and increased levels of soot. Traditionally, detergent additives in diesel oils have effectively prevented power-cylinder wear, piston deposit formation, oil consumption, rust and valve train wear, while an additive known as ZDDP has effectively provided wear protection for the valve train system and other components, as well as oxidation inhibition. The problem, however, is that ZDDP and many detergents contain ingredients that plug diesel particulate filters, including sulfated ash, phosphorus and sulfur.

Due to the negative effects of sulfated ash, phosphorus and sulfur on diesel particulate filters, ASTM agreed to accept limitations in these areas and incorporate new additive chemistry for diesel oil category CJ-4. Sulfated ash provides lubricity and alkalinity (TBN) to counteract acid formation during combustion. While most API CI-4 oils are composed of 1.50 percent ash, new API CJ-4 diesel oils are limited to 1.0 percent ash, dropping TBN levels from 10 to 14 with average CI-4 oils to eight with CJ-4 oils. Lower sulfated ash, phosphorus and sulfur levels, as well as increased soot loading, affect an oil's ability to provide protection over extended drain intervals.

Synthetic 5W-40 Premium Diesel Oil (DEO)

AMSOIL Synthetic 5W-40 Premium Diesel Oil (DEO) is the premium choice diesel oil for model year 2007 and newer heavy-duty and pickup truck diesel engines requiring API CJ-4 emission quality oil standards. It delivers extraordinary lubrication in diesel engines found in commercial, fleet and personal vehicles. Formulated with the latest additive technology and the most advanced synthetic base oils, AMSOIL Synthetic 5W-40 Premium Diesel Oil exceeds the higher performance demands of modern engines. It withstands the stress of heat, soot and acids to help prevent deposits, corrosion and wear, and its broad viscosity range offers superior protection over a wide temperature range. Synthetic 5W-40 Premium Diesel Oil resists breakdown and is recommended for the longest service interval established by the engine, vehicle or equipment manufacturer. Drain intervals may be extended based on oil analysis. AMSOIL Synthetic 5W-40 Diesel Oil is a low sulfated ash, phosphorus and sulfur formulation that meets and exceeds modern specifications for emission quality diesel oil. It is compatible with all exhaust treatment devices and is designed to extend the service life of particulate filters.

AMSOIL Synthetic 5W-40 Premium Diesel Oil replaces 5W-40, 10W-40 and 15W-40 viscosity oils, and is "backwards compatible" with pre-2007 diesel engines. Synthetic 5W-40 Premium Diesel Oil *may* be used in pre-2007 diesel engines, but for increased protection and performance for extended drain intervals, AMSOIL still recommends Synthetic Heavy Duty Diesel & Marine Motor Oil (AME), Series 3000 Synthetic 5W-30 Diesel Oil (HDD), Synthetic 10W-30/SAE 30 Diesel Oil (ACD) or Synthetic Blend 15W-40 Gasoline and Diesel Oil (PCO).

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AMSOIL Synthetic Diesel Oils for Pre-2007 Diesel Engines

AMSOIL offers four premium quality synthetic diesel oils for 2006 and earlier EGR equipped and non-EGR equipped diesel vehicles. AMSOIL Synthetic 15W-40 Heavy Duty Diesel and Marine Motor Oil (AME), Series 3000 Synthetic 5W-30 Heavy Duty Diesel Oil (HDD), Synthetic 10W-30/SAE 30 Heavy Duty Diesel Oil (ACD) and Synthetic Blend 15W-40 Gasoline and Diesel Oil (PCO) surpass the most stringent diesel oil specifications for 2006 and earlier diesel engines, including API CI-4 PLUS. These oils offer superior protection and performance for extended drain intervals in non-EGR equipped engines, and drain intervals may be extended by oil analysis in pre-2007 EGR-equipped engines.

Synthetic Diesel Oil Sales Projected to Increase

Because synthetic base stocks have significantly better thermal stability than conventional base stocks, synthetic diesel oils are expected to become increasingly popular in the growing diesel market.

Why Motor Oil Deteriorates

It is common knowledge that, at some point, engine oil must be changed. It's something that is preached relentlessly to vehicle owners by parents, quick lubes and oil companies. But consumers are widely unaware of what exactly makes oil changes necessary.

Many factors contribute to a motor oil's demise, but it is essentially the accumulation of contaminants in the oil and chemical changes in the oil itself that make a motor oil unfit for further service. With time, it is inevitable that the oil will be contaminated by dirt or sludge, or succumb to the extreme pressures or temperatures found inside an engine. AMSOIL Motor Oils are formulated with the industry's most advanced synthetic base stocks and additive packages to combat the forces that deteriorate conventional oils.

Extreme Heat

Today's engines are running hotter than ever. More horsepower, turbo chargers and aerodynamic styling have created extremely hot environments that receive less cooling from outside air. High heat leads to oil oxidation, deposits and thickening in conventional oils.

Because they are made from impure, irregular molecules, conventional motor oils are more susceptible to the effects of heat. The small, light molecules in conventional oil tend to evaporate as the oil is heated, leaving large, heavy molecules behind and leading to oil consumption and an increase in the oil's viscosity. If those large, heavy molecules are chemically unstable, they may also break-down and form deposits on component surfaces, further inhibiting the release of heat into the oil stream.

Even in relatively mild temperatures, oxygen works to break down some of the chemicals in conventional lubricants. The extreme heat in engines actually promotes oxidation. When conventional oil contaminants break down, they coat components with varnish, deposits and sludge and leave the lubricant thick, hard to pump and with very poor heat transfer ability.

Extreme Cold

Cold temperatures cause oil to thicken. Conventional lubricants contain paraffins (wax) which cause them to thicken in cold temperatures as the paraffin gels. At startup, this can leave working parts unprotected for as long as five minutes while the oil warms to a temperature that allows it to flow.

Common Contaminants

Dust and dirt from the air enter the engine through faulty air cleaners, some oil fill caps and crankcase ventilation systems. Normal engine wear produces small metal particles that are picked up and circulated by the oil. The abrasive particles of road dust and dirt increase the rate of wear and generate larger metal particles. Those particles are equally abrasive and the rate of wear accelerates with a snowball effect. While filtration removes most of these contaminants, some remain and are left to circulate with the oil.

Combustion Byproducts

Combustion produces several byproducts that also act as contaminants. Water and acids lead to sludge, rust and corrosion. Soot and carbon create sludge and varnish and can clog filters. Unburned fuel in liquid form is deposited on cylinder walls where it leaks past the rings into the crankcase. Sludge deposits collect on oil pump screens, limiting the flow of oil to vital engine parts and resulting in rapid and destructive wear. When oil becomes contaminated, its viscosity changes. With soot, dirt, oxidation or sludge, viscosity increases; with fuel dilution it decreases.

Internal Forces

Engines create a great deal of internal pressure. Extreme pressure can break the oil film between moving parts, resulting in boundary lubrication conditions. Movement inside the engine agitates the fluid, trapping air and forming bubbles or foam. Because air is compressible, the ability of the fluid film to prevent contact is reduced. And because the mixed air contains oxygen, it promotes oil oxidation.

Additives are Only a Temporary Solution

Careful research and experimentation led lubricant manufacturers to specific chemicals that combat various problems faced by motor oils. These chemical additives are added to base oils as a package. Typical additive packages can include rust and corrosion inhibitors, detergents, dispersants, antifoaming agents, oxidation inhibitors and viscosity index improvers. Each additive is designed to aid the base oil in the protection of components, but additives have their limits.

While these additives are created to perform specific tasks, they are also subjected to the same extreme environment experienced by the base oil, and each additive is affected by different variables in different ways. For example, viscosity index improvers are used to reduce the thinning effects caused by operation at elevated temperatures. They are the key components that allow for the production of multigrade oils. However, the long molecules in viscosity index improvers are subject to shearing in service, which reduces their ability to minimize fluid viscosity loss. Permanent shearing of viscosity index improvers can result in piston ring sticking due to deposit formation, increased oil consumption and accelerated equipment wear.

High quality additives perform best and last longer when paired with high quality synthetic base oils.

It's All in the Molecules

Conventional lubricants are made from refined petroleum, a naturally occurring and impure substance. The varied and non-uniform size and shape of the molecules that make up conventional oils lend themselves to con-

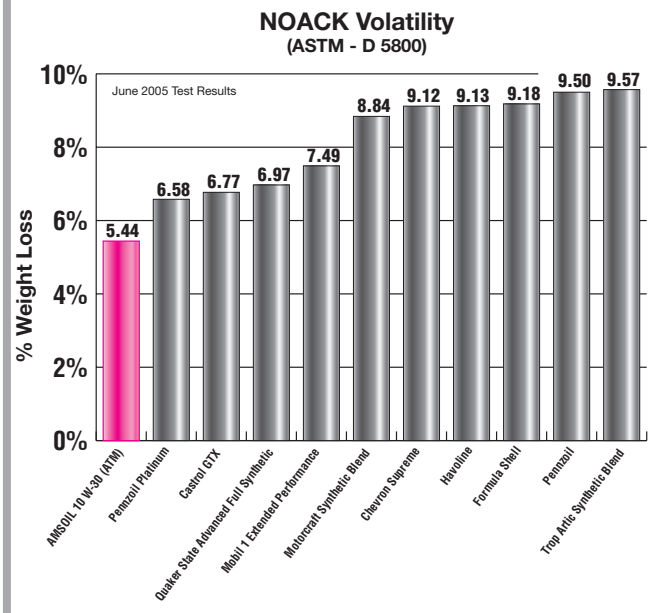
tamination. They cannot withstand extreme heat or cold, and they burn off and succumb to oxidation, leading to the development of deposits and component wear.

AMSOIL Synthetic Motor Oils are Superior

AMSOIL Synthetic Motor Oils provide extended equipment life, reduced maintenance costs, better performance, improved fuel economy and extended drain intervals through the use of high-quality synthetic base stocks and superior additive packages.

Because they are derived from pure chemicals, synthetic lubricants contain no unnecessary molecules. Their smooth lubricating molecules slip easily across one another, improving the lube's ability to reduce friction, which in turn improves wear control, heat control and fuel efficiency. In addition, uniformly sized synthetic lubricant molecules resist thinning in heat and thickening in cold, decreasing the need for viscosity index improvers and increasing the lube's ability to maintain its viscosity.

Because AMSOIL synthetic lubricants contain only strong, uniform molecules, they are much more resistant to thermal and oxidative breakdown. AMSOIL synthetics are virtually impervious to breakdown at normal operating temperatures and can be used in higher temperatures than conventional oils without breaking down. AMSOIL Synthetic Motor Oils keep components free of varnish, deposits and sludge.



The NOACK Volatility Test determines the evaporation loss of lubricants in high temperature service. The more motor oils vaporize, the thicker and heavier they become, contributing to poor circulation, reduced fuel economy and increased oil consumption, wear and emissions. AMSOIL Synthetic Motor Oil resists high temperature volatilization better than other motor oils. AMSOIL Synthetic Motor Oil maintains peak fuel efficiency and reduces oil consumption and emissions.

Extended Drain Intervals

Not only do AMSOIL Synthetic Motor Oils provide protection that is unquestionably superior to conventional oils, but they remain fit for service many times longer as well. Heat and oxidation are the main enemies of lubricant base stocks. The excellent resistance of synthetic lubricants to thermal and oxidative breakdown allows them to be safely used for much longer drain intervals than conventional lubricants. Their uniform and smooth molecular structure allows AMSOIL Synthetic Motor Oils to operate with less friction and better heat control than conventional lubricants.

The Choice is Clear

When AMSOIL Synthetic Motor Oil was introduced in 1972 it was ahead of its time. Today, engine designers have goals of increased fuel economy, reduced exhaust emissions, more performance out of smaller engines and greater durability, increasing the demands placed on motor oils and requiring continuous upgrades. AMSOIL remains at the forefront of the engine oil market by continuing to provide oils that are ahead of their time. No other motor oil is guaranteed for 25,000 miles or one year in normal service, and no other motor oil can match the performance and protection provided by AMSOIL Synthetic Motor Oils.

AMSOIL Continues to Impress Long-Time User

Willard Rusk of Littleton, Colo. was first introduced to AMSOIL motor oil in the late fall of 1972 by a friend while stationed at Ft. Hood, Texas. The first car Rusk used AMSOIL in was his 1965 Buick Le Sabre. The car was well-maintained and had accumulated 65,000 miles.

"To find out what AMSOIL would do for me we first did a thorough tune-up and got the engine running right to factory specifications," said Rusk.

They flushed the engine, rechecked the engine tuning and installed a new filter and AMSOIL 10W-40 Synthetic Motor Oil.

"After driving the block a couple of times I could tell all ready that the engine was running better," said Rusk. "The proof came when we connected the tachometer and found that the idle RPM had increased by almost 350 RPM over specification."

After resetting the idle RPM, Rusk continued with his usual record keeping and found that his mileage had increased an average of two to four mpg. After 4,000 miles, Rusk had a sample of oil tested at an oil analysis lab in Ft. Hood that did the analysis for aircraft oils. Rusk also delivered a fresh sample from an unused gallon container of AMSOIL to the lab.

AMSOIL customer Willard Rusk outside his home with his 1980 GMC Sierra Grande one-ton pickup.

"The people at the analysis lab couldn't believe that the sample from my car had been in the engine for six months and 4,000 miles," said Rusk. "There was such a negligible amount of wear materials in the sample from my engine they thought we had given them two fresh samples. They actually had me bring my car around so they could draw the sample themselves and rerun the tests."

The results were the same.

Today Rusk drives a 1980 GMC Sierra Grande one-ton pickup with a 454 cubic inch 7.4L engine. Of course he still uses AMSOIL, Series 2000 20W-50 Racing Oil in the crankcase and AMSOIL 80W-90 Gear Oil in the differential. The front wheel bearings and all grease points are lubed with AMSOIL grease.

The AMSOIL *Service Line* sent courtesy of your Servicing AMSOIL Dealer.

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