

# Get Ready for Classic-Car Season

Summer means hitting the local car shows and cruising the main drag in your classic car or hot rod.

Classic-car owners sometimes ask if they need to add a lead substitute to their gasoline. For decades, Tetraethyllead was added to gasoline to reduce engine knock and help prevent valve-seat recession. Once lead's negative effects became clear, regulators began phasing it out in the 1970s. But, what about classic-car engines from the 1950s and 1960s that were built with leaded gasoline in mind? Do they require a lead substitute?

## Why lead was added to gasoline

First, let's look at the primary reasons lead was added to gasoline in the first place.

- Increase octane to help reduce engine knock
- Protect against valve-seat recession

## Protects against pre-ignition

Gasoline's octane rating indicates its ability to withstand compression before igniting. During operation, the piston travels up the cylinder and compresses the fuel/air mixture in preparation for ignition. Compression heats the mixture to help it ignite more easily and burn more completely. Compressing the fuel/air also maximizes the volume packed into the cylinder, which boosts power and efficiency. All other factors being equal, that's why engines with higher compression ratios typically put out more power.

If the compressed, heated gasoline reaches its ignition point too soon, however, it will auto-ignite prior to the spark plug firing. This disrupts

engine timing, reduces power and can damage the engine. It's important to use gasoline with the correct octane rating for your engine to avoid pre-ignition. Higher-compression engines require higher-octane gas.

Chemists discovered in the 1920s that Tetraethyllead added to gasoline was a cost-effective solution to pre-ignition and helped engines run better.

## Protects against valve recession

Lead also emerged as an effective way to protect against valve-seat recession, which can occur under high-rpm, high-heat, high-load conditions. As the intensely hot exhaust valve hammers against the valve seat thousands of times per minute, the two components can momentarily fuse together in a process called "microwelding." Once the valve opens, the microweld tears apart. Multiply this by thousands of times and the valve seat deteriorates until the valve no longer seats properly. This leads to compression and power loss, in addition to catastrophic failure if the valve breaks off.

## Hardened valve seats introduced

By the mid-1970s, we'd become aware of lead's negative effects on human health, the environment and automotive catalytic converters. As



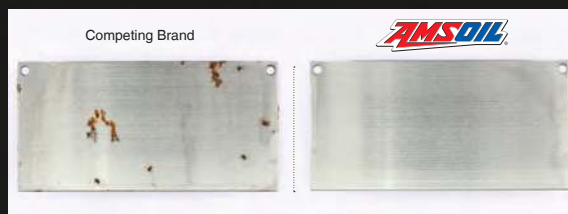
- **Improves** performance
- **Removes** carbon deposits
- **Maximizes** power
- **Reduces** engine knock
- **Excellent** as a lead substitute in classic cars

regulators began working to eliminate lead from gasoline (and other products), engineers began designing engines with unleaded gas in mind. To combat microwelding, they used hardened valve seats, which are more resilient to valve recession.

But, what about classic-car engines built prior to widespread use of hardened valve seats?

## AMSOIL Delivers Superior Rust Protection

In industry-standard testing, AMSOIL Z-ROD® completely prevented rust formation while a leading competitor did not.<sup>11</sup>



<sup>11</sup>Based upon in-house testing of AMSOIL Z-ROD 10W-40 and a leading competitor obtained on 7/25/2019 in ASTM D1748-10.





- Engineered for classic vehicles
- High-zinc formula
- Protects against rust during storage

### Do Classic-Car Engines Need High-Zinc Oil?

This is one of the most common questions we receive regarding older engines in classic cars and hot rods. For the best protection, we recommend using a high-zinc oil, such as Z-ROD® Synthetic Motor Oil, in these engines.

### What is high-zinc motor oil?

Zinc dialkyldithiophosphate (ZDDP) is the most common zinc-based additive and is used primarily as an anti-wear agent to help prevent engine wear. It also provides corrosion and oxidation protection.

However, because the zinc and phosphorus found in ZDDP can negatively affect catalytic converters, it has been phased out of motor oil formulations in recent years.

Reducing ZDDP has drawbacks. Older vehicles with flat-tappet camshafts and high-tension valve springs or other modifications that create high contact pressures can suffer premature wear due to reduced ZDDP levels.

For the best protection, use high-zinc and high-phosphorus motor oil to offer extra protection for flat-tappet cams, lifters and other components.

### How do ZDDP additives work?

ZDDP anti-wear additives are heat-activated, meaning they provide wear protection in areas of increased friction.

As temperatures rise and surfaces come closer together, ZDDP decomposes and the resulting chemistry protects critical metal surfaces.

When parts move during operation, any sliding or rolling motion takes place on top of or within the ZDDP anti-wear film, which reduces metal-to-metal contact. This helps prevent wear so enthusiasts can keep their classic cars or hot rods running great for years.



**Flat-tappet lifters can wear down sooner compared to roller lifters due to increased pressure. Z-ROD Synthetic Motor Oil contains added ZDDP to protect lifters against wear and help maintain power.**

### Lead substitutes offer an answer

To solve the problem, many enthusiasts add a lead substitute to their gasoline. Lead substitutes contain chemicals that form a sacrificial layer to inhibit microwelds and protect valve seats.

### Do I need a lead substitute?

If you've rebuilt the motor or done work to the cylinder heads, it's likely that hardened valve seats were used, which means a lead substitute isn't necessary.

However, if the engine is original and uses stock valve seats (i.e. non-hardened), we recommend using a lead substitute for added protection. This is especially true if your operating conditions border on "severe" territory. For a cast-iron, high-compression-ratio engine of that era, it doesn't take much to wind up the rpm, turn up the heat and operate in conditions that promote valve-seat recession. Using a lead substitute offers peace of mind that your classic is protected.

### AMSOIL DOMINATOR® Octane Boost = excellent lead substitute

DOMINATOR Octane Boost works great as a lead substitute in classic cars. It contains MMT (Methylcyclopentadienyl manganese tricarbonyl), which is a metallic additive that creates a sacrificial barrier on valve seats to help prevent recession and keep your engine running strong.

Not only that, as its name suggests, it boosts octane up to four numbers, which is just as important in older high-compression engines that were made with leaded gas in mind. It increases engine response and power in all two- and four-stroke gasoline-fueled engines. Just one treatment reduces engine knock, improves ignition and helps fuel burn cleaner.

It's another product in your arsenal when you talk to classic-car owners this summer.



The First in Synthetics®

## DOMINATOR® Octane Boost

### Improves Performance in all Two- and Four-Stroke Gasoline-Fueled Engines

AMSOIL DOMINATOR® Octane Boost (AOB) significantly increases engine response and power in all two- and four-stroke gasoline-fueled engines by increasing octane up to four numbers. Just one treatment reduces engine knock, improves ignition and helps fuel burn cleaner. DOMINATOR Octane Boost is the recommended octane boost for all high-performance off-road and racing applications. Most users find one 12-ounce bottle of DOMINATOR Octane Boost for 15 gallons of gasoline provides the ideal performance increase. DOMINATOR Octane Boost is also excellent as a lead substitute at the same treat rates in collector automobiles, older off-road equipment and pleasure vehicles.

#### What is “engine knock” and why does it matter?

“Knock” is an uncontrolled and explosive ignition of a hydrocarbon fuel, such as gasoline, in the combustion chamber. It causes a knocking or pinging sound, robs the engine of power and, left unchecked, causes serious engine damage. Fuel’s tendency to knock is measured by its octane number. Lower numbers denote greater knock tendency; higher numbers denote greater knock control. Knock may be eliminated with the appropriate octane number.

#### AMSOIL PRODUCT WARRANTY

AMSOIL products are backed by a Limited Liability Warranty. For complete information visit [www.amsoil.com/warranty.aspx](http://www.amsoil.com/warranty.aspx).

#### HEALTH & SAFETY STATEMENT

This product is not expected to cause health concerns when used for the intended applications and according to the recommendations in the Safety Data Sheet (SDS). An SDS is available online at [www.amsoil.com](http://www.amsoil.com) or upon request at (715) 392-7101.

**Keep Out of Reach of Children.** Recycle used oil and bottle.



- Improves performance
- Removes carbon deposits
- Maximizes power
- Reduces engine knock
- Improves ignition
- Improves responsiveness
- Helps fuel burn cleaner



The First in Synthetics®

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Referral # 779

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## Z-ROD® Synthetic Motor Oil

### Modern Technology for Classic Cars

AMSOIL Z-ROD Synthetic Motor Oil is specially engineered for classic and high-performance vehicles. It features a high-zinc formulation to prevent wear on flat-tappet camshafts and other critical engine components, along with a proprietary blend of rust and corrosion inhibitors for added protection during long-term storage. Z-ROD Synthetic Motor Oil is designed to perform on the street and protect during storage.

#### Protects Flat-Tappet Cams

The lifters and cam lobes on flat-tappet camshafts common to classic and high-performance vehicles slide rapidly against one another, producing high friction and heat. The friction between the two components can eventually wear down the cam and affect valve operation, ultimately resulting in lost engine power and reduced efficiency. In addition, these areas are splash-lubricated rather than pressure-lubricated like other areas of the engine, which adds extra strain on anti-wear additives such as the zinc and phosphorus in zinc dialkyldithiophosphate (ZDDP).

AMSOIL Z-ROD Synthetic Motor Oil is formulated with high levels of ZDDP to protect flat-tappet cams, lifters, rockers and other areas susceptible to wear. Its high-zinc, high-phosphorus formulation provides the extra wear protection these critical splash-lubricated components require.

#### Provides Long-Term Rust & Corrosion Protection

Z-ROD Synthetic Motor Oil is formulated with a unique blend of rust and corrosion inhibitors to ensure maximum protection during long-term storage. To prove its effectiveness, AMSOIL submitted Z-ROD Synthetic Motor Oil to the Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet (ASTM D1748-10). This test evaluates the rust-preventive properties of oil under high-humidity conditions, similar to those faced by a covered hot rod in a damp garage. The metal coupon treated with AMSOIL Z-ROD Synthetic Motor Oil showed no signs of rust.

#### AMSOIL Delivers Superior Rust Protection

In industry-standard testing, AMSOIL Z-ROD completely prevented rust formation while a leading competitor did not.<sup>1</sup>



<sup>1</sup>Based upon in-house testing of AMSOIL Z-ROD 10W-40 and a leading competitor obtained on 7/25/2019 in ASTM D1748-10.

\*All trademarked names are the property of their respective owners and may be registered marks in some countries. No affiliation or endorsement claim, express or implied, is made by their use.



- **Engineered** for classic vehicles
- **High-zinc** formula
- **Protects** against rust during storage

## TYPICAL TECHNICAL PROPERTIES

### AMSOIL Z-ROD® Synthetic Motor Oil

	10W-30 (ZRT)	10W-40 (ZRD)	20W-50 (ZRF)
Viscosity @ 100 °C, cSt (ASTM D445) . . . . .	12	14.9	19.5
Viscosity @ 40 °C, cSt (ASTM D445) . . . . .	75.5	97.5	152.6
Viscosity Index (ASTM D2270) . . . . .	154	159	147
Flash Point, °C (°F) (ASTM D92) . . . . .	238 (460)	242 (468)	244 (471)
Fire Point, °C (°F) (ASTM D92) . . . . .	260 (500)	260 (500)	260 (500)
Pour Point, °C (°F) (ASTM D97) . . . . .	-42 (-44)	-39 (-38)	-36 (-33)
Noack Volatility, % weight loss (g/100g) (ASTM D5800) . . . . .	5.5	3.1	3.0
High-Temperature/High-Shear Viscosity @150°C, 1.0 X 10 <sup>6</sup> s <sup>-1</sup> , cP (ASTM D5481) . . . . .	3.2	4.3	5.7
Four-Ball Wear @ 40 kgf, 75°C, 1200 rpm, 1 hr, scar diameter, mm (ASTM D4172) . . . . .	0.33	0.33	0.34
Total Base Number (ASTM D2896) . . . . .	9.0	9.0	9.0

### APPLICATIONS

Use Z-ROD Synthetic Motor Oil in engines that require either 10W-30, 10W-40 or 20W-50 motor oil and an API SL or earlier specification. ZDDP levels in Z-ROD Synthetic Motor Oil exceed the limits of API SM and newer specifications.

### COMPATIBILITY

AMSOIL Z-ROD Synthetic Motor Oil is compatible with conventional and other synthetic motor oils. Mixing Z-ROD Synthetic Motor Oil with other oils, however, will shorten the oil's life expectancy and reduce its performance benefits.

Z-ROD Synthetic Motor Oil is safe for automotive seals. After-market oil additives are not recommended for use with Z-ROD.

### SERVICE LIFE

Because engines in classic cars, hot rods and other performance vehicles are generally modified, a universal oil drain interval recommendation for these applications cannot be given. Responsibility for determining the drain interval duration rests with the owner. As a general service guideline, the maximum drain interval for Z-ROD Synthetic Motor Oil should not exceed 5,000 miles or two years, whichever comes first.

### AMSOIL PRODUCT WARRANTY

AMSOIL products are backed by a Limited Liability Warranty. For complete information visit [AMSOIL.com/warranty.aspx](http://AMSOIL.com/warranty.aspx).

### HEALTH AND SAFETY

This product is not expected to cause health concerns when used for the intended applications and according to the recommendations in the Safety Data Sheet (SDS). An SDS is available online at [AMSOIL.com](http://AMSOIL.com) or upon request at (715) 392-7101. **Keep Out of Reach of Children.** Recycle used oil and bottle.



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# Half-Million-Mile VW\* Beetle\* Still Running Strong

Most people can't believe it when Randy Melvin tells them his 2000 Volkswagen Beetle has 500,000 miles (804,700 km) on it. The UPS tractor-trailer driver from Troutman, N.C. commutes 125 miles (201 km) round trip between home and Winston-Salem, N.C. each day. When it came time to purchase a new vehicle back in 1999, he opted for a VW TDI due to its high estimated fuel economy, despite the car's poor reviews.

"If you go back to the *Consumer Reports* reviews on that 2000 Beetle, they're terrible," said Melvin. "My dad said, 'Why are you getting that? The reviews are so bad.'" But Melvin knew a Volkswagen mechanic nearby whom he trusted, and he wanted the fuel-economy benefits of a diesel.

"At the time, the Volkswagen TDI was hard to get a hold of; you had to be in the right place at the right time," said Melvin. After 20 years, the 1.9L turbodiesel five-speed manual still gets 46 mpg.

## **AMSOIL exclusively since almost day one**

After buying the car, the dealership performed the first three oil changes using Castrol.\* Then Melvin switched to AMSOIL synthetic diesel oil exclusively and today uses Signature Series 5W-30 Max-Duty Synthetic Diesel Oil.

A shop mechanic and AMSOIL Preferred Customer with whom Melvin worked piqued his interest in AMSOIL products after sharing a testimonial about a truck

driver who'd eclipsed 1 million miles using AMSOIL products.

The car has run excellent all these years. Melvin hasn't performed any engine maintenance, except replacing the alternator, air compressor and routine timing-chain service.

"It's proven to me, especially if you can get a half-million miles with no engine failure whatsoever," he said. "The thing runs just as powerfully as it ever did." Melvin used to have a pre-owned 2001 Volkswagen with the same 1.9L diesel engine. "It only had 192,000 miles (309,000 km), but my 2000 would have run circles around it."

## **People can't believe it**

How do people react to his story? "They just can't believe [the car] has half a million miles on it," said Melvin. "Because I've worked at night the entire 20 years I've owned the car, it sits in the garage mainly in the daytime, so it pretty much looks like a brand-new car.



"I change oil every 10,000 miles (16,000 km), and with conventional oil changing every 3,000 (4,800 km), you're going to spend more money, not counting the labor. To me, it's a no-brainer."

## **Drive it until it quits**

"I've always believed you should drive a car until it quits," said Melvin. "To me, buying a car every two to three years isn't beneficial." With the help of AMSOIL products, it may be a while before Melvin's Beetle quits running. "I just think it's a good product. It's proven to me, and I can tell that to anybody," he said. "I'll probably work until I'm 62, so I hope to put at least another 150,000 miles (241,000 km) on it."





# Signature Series Max-Duty Synthetic Diesel Oil

Maximum-duty protection for your hardest-working diesel engines

Protect your investment in diesel power and confidently extend drain intervals with our top-grade synthetic diesel oil. AMSOIL Signature Series Max-Duty Synthetic Diesel Oil delivers **6X more wear protection\***, delivering the extra protection your diesel deserves. Advanced synthetic technology provides excellent viscosity control and outstanding extreme-temperature performance, while minimizing oil consumption. The result: protection that's boosted to the max.



## Maximum Engine Protection

Wear on rings and cylinder liners leads to increased oil consumption and loss of compression, resulting in reduced horsepower and fuel economy. Independent testing shows Signature Series Max-Duty delivers 6X more wear protection than required by the Detroit Diesel DD13 Scuffing Test for Specification DFS 93K222, delivering extra protection so you can push your diesel with peace of mind.

## Viscosity Control

Using top-tier synthetic base oils, Signature Series Max-Duty is naturally resistant to oxidation and the thickening effects of soot contamination. That, along with boosted detergent/dispersant additives, keeps soot particles suspended independently, helping prevent the formation of larger, wear-causing particles. Viscosity increase is minimized and soot-related wear is controlled. Lower volatility also helps Signature Series Max-Duty Diesel Oil retain its viscosity after high-temperature service for maximum engine protection and efficiency.

## Excels in Extreme Temperatures

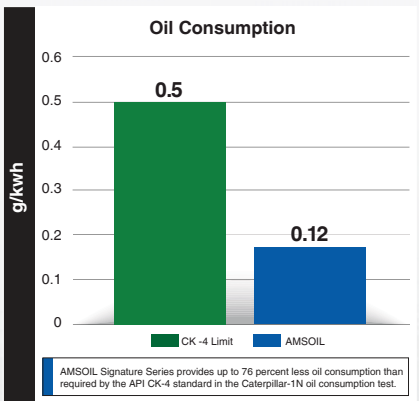
Signature Series Max-Duty Synthetic Diesel Oil resists thermal (heat) breakdown better than conventional and competing synthetic diesel oils. Unlike conventional oils, Signature Series contains no wax, staying fluid in sub-zero temperatures for easier starting, improved oil flow and reduced wear. Signature Series 0W-40 (DZF) has a broad viscosity range that offers 4X better cold-cranking ability than a 15W-40 oil in the ASTM D5293 cold-cranking viscosity test, making it excellent for use in both hot-operating engines and cold-weather starting extremes.

## Minimizes Oil Consumption

Signature Series Max-Duty has a low rate of volatility (burn-off), reducing oil consumption during operation and passing less oil vapor into the combustion chamber. It provides up to 76 percent less oil consumption than required by the API CK-4 standard in the Caterpillar-1N oil consumption test.

## Keeps Turbos Clean

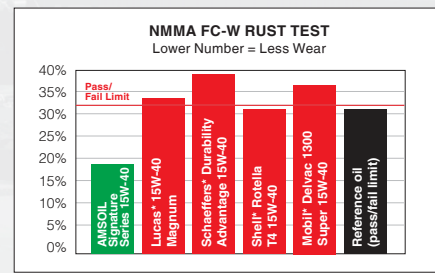
AMSOIL Signature Series Max-Duty Synthetic Diesel Oil provides protection boosted to the max, delivering up to **60% better turbo cleanliness<sup>1</sup>** and withstanding the extra demands you place on the turbo when pulling heavy loads or updating the tune for maximum horsepower.



## Protects Against Rust

Provides up to **2X better rust protection<sup>K</sup>**

Test results describe and represent properties of oils that were acquired on the dates listed in Table 1 (see [www.amsoil.com/rusttest.aspx](http://www.amsoil.com/rusttest.aspx)). Results do not apply to any subsequent reformulations of such oils or to new oils introduced after completion of testing. All oils were available to consumers at the time of purchase. Testing was completed in November 2017.



<sup>1</sup>Based on specification standards of CAT C13 2nd Ring Top Land Carbon testing. <sup>K</sup>Based on industry standard testing using the NMMMA FC-W Rust Test. <sup>\*</sup>Based on independent testing in the Detroit Diesel DD13 Scuffing Test for specification DFS 93K222 using 5W-30 as worst-case representation

<sup>\*\*</sup>All trademarked names and images are the property of their respective owners and may be registered marks in some countries. No affiliation or endorsement claim, express or implied, is made by their use. All products advertised here are developed by AMSOIL for use in the applications shown.

## TYPICAL TECHNICAL PROPERTIES

### AMSOIL Signature Series Max-Duty Synthetic Diesel Oil

	5W-30 (DHD)	10W-30 (DTT)	0W-40 (DZF)	5W-40 (DEO)	15W-40 (DME)
Kinematic Viscosity @ 100°C, cSt (ASTM D445)	12.0	12.1	15.7	15.4	15.6
Kinematic Viscosity @ 40°C, cSt (ASTM D445)	72.3	78.2	92.8	94.5	112.4
Viscosity Index (ASTM D2270)	162	151	180	173	147
CCS Viscosity @ °C, cP (ASTM D5293)	5384 (-30)	4858 (-25)	5776 (-35)	5555 (-30)	4134 (-20)
Pour Point, °C (°F) (ASTM D97)	-43 (-45)	-42 (-44)	-48 (-54)	-43 (-45)	-40 (-40)
Four-Ball Wear Test (ASTM D4172), Scar, mm	0.45	0.46	0.47	0.46	0.45
NOACK Volatility, % weight loss (g/100g) (ASTM D5800)	8.6	5.4	10.9	9.2	5.1
Total Base Number (ASTM D2896)	10.1	10.1	10.1	10.1	10.1
High-Temperature/High-Shear Viscosity, cP (ASTM D5481)	3.5	3.5	4.2	4.3	4.5
Sulfated Ash Content, wt. %	0.91	0.99	0.99	0.99	1.0

## APPLICATIONS

Use in diesel engines and, where appropriate, gasoline engines requiring any of the following specifications:

	5W-30 (DHD)	10W-30 (DTT)	0W-40 (DZF)	5W-40 (DEO)	15W-40 (DME)
API CK-4/SN, CJ-4, CI-4+, CF	X	X	X	X	X
API SN+	X				
API CF-2				X	X
Volvo VDS4.5, VDS4, VDS3	X	X	X	X	X
Mack EOS-4.5, EO-O	X	X	X	X	X
Renault RLD-4, RLD-3	X	X	X	X	X
Cummins CES20086, CES20081	X	X	X	X	X
Caterpillar ECF-2, ECF-3, ECF-1-a	X	X	X	X	X
DDC 93K218, 93K215, 93K214	X	X	X	X	X
DFS 93K222	X	X		X	X
ACEA E9, E7	X	X	X	X	X
ACEA E6	X				
MB 228.31	X	X		X	X
MB 228.51	X				
MAN 3575	X	X	X	X	X
MAN 3677	X				
MTU Type 2.1, II, I	X	X	X	X	X
MTU Type 3.1	X				
JASO DH-2	X	X	X	X	X
Allison TES439				X	X
Deutz DQC III-10LA	X	X	X	X	X
Scania LA-2	X			X	X
Chrysler MS 10902	X		X	X	X
Ford WSS-M2C171-F1		X	X	X	X
Ford WSS-M2C214-B1	X				
Deutz DQC IV-10LA	X				

## COMPATIBILITY

Signature Series Max-Duty Synthetic Diesel Oil is compatible with other conventional and synthetic engine oils. Mixing AMSOIL diesel oils with other oils, however, will shorten the oil's life expectancy and reduce its performance benefits. AMSOIL does not support extended drain intervals where oils have been mixed.

Aftermarket oil additives are **not recommended** for use with AMSOIL synthetic diesel oils.

## TECHNICAL SERVICES

For immediate answers to your technical questions call (715) 399-TECH (8324) between 8 a.m. and 5 p.m. Central time or email [tech@amsoil.com](mailto:tech@amsoil.com).

## SERVICE LIFE

### Diesel Engine Service Life

**Heavy-Duty On-/Off-Road:** Three times (3X) OEM<sup>1</sup> recommendation, not to exceed 60,000 miles/600 hours or one year, whichever comes first.

**Turbodiesel Pickup:** Two times (2X) OEM<sup>1</sup> recommendation, not to exceed 25,000 miles or one year, whichever comes first.

**Competition Service Life:** Provides lasting protection for multiple events. Use oil analysis to determine appropriate drain intervals.

### Gasoline Engine Service Life

Two times (2X) OEM<sup>1</sup> recommendation, not to exceed 15,000 miles or one year, whichever comes first.

### Drain intervals may be extended further with oil analysis.

**Note:** Extended drain intervals are not recommended for performance-modified engines, when using biofuels containing more than 10 percent ethanol or 15 percent biodiesel (B15) or for 2007-2009 Caterpillar\* C13 and C15 on-highway engines. Extend drain intervals beyond OEM recommendations in these instances only with oil analysis. **Note:** 2007-2010 Dodge\*\*, Ford\*\* and GM\*\* turbodiesel pickups are also not recommended for extended drain intervals when using Signature Series Max-Duty 5W-30 Diesel Oil (DHD).

<sup>1</sup> Refer to your owner's manual for OEM drain interval recommendations and guidelines for severe and normal service.

## PRODUCT WARRANTY

Using AMSOIL synthetic lubricants or practicing extended drain intervals does not void your new vehicle or equipment manufacturer's warranty. All AMSOIL lubricants and filters are covered by the AMSOIL Limited Warranty. For complete information visit [www.amsoil.com/warranty.aspx](http://www.amsoil.com/warranty.aspx).



## HEALTH & SAFETY

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