

Keep It Clean and Mind Your Fluids:

Ten Tips to Keeping Your Caterpillar ACERT™ Engine-Equipped Truck Running, Profitable, and Out of the Repair Shop

By Matt Torrence & Daniel Williams

Most people spend more time and energy going around problems than in trying to solve them.

-Henry Ford

Knowledge is power.

- Sir Francis Bacon

Introduction

With the introduction of ACERT Technology into on-highway truck and bus engines, Caterpillar has been credited with achieving a major breakthrough in clean diesel technology. An ACERT engine's unique air management, precision combustion, advanced electronics, and exhaust aftertreatment systems work together to lower your truck's particulate and NOx emissions and bring you into compliance with the various clean air regulations affecting diesel operators around the country.

An ACERT engine differs from a conventional truck engine in several important ways, and maximizing its performance requires a few maintenance techniques that you may not have performed on traditional engines. This paper will discuss ten often-overlooked maintenance procedures essential to getting the most out of your ACERT engine-equipped truck.

¹ "ACERT Diesel Engines: A Huge Gamble Pays Off Big Time for Caterpillar." *Equipment World* Jan. 2004.

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Know Your ACERT Engine: A Review²

ACERT Technology is a system that reduces emissions at the point of combustion. The technology capitalizes on Caterpillar's expertise in four core engine systems: fuel, air, electronics, and aftertreatment. It is a unique and revolutionary systems solution that enables Caterpillar engines to meet today's clean air regulations and that establishes the building blocks for attaining tomorrow's more stringent standards.

Air Management System: By using turbochargers to force cool, clean air into the combustion chamber and by using electronics to control the air volume required at various loads and speeds, complete combustion is achieved. The results are improved engine response, increased fuel economy, and better performance.

Fuel System: One of three fuel systems—HEUI, common rail, or MEUI—is used in engines with ACERT Technology (C7 and larger). Small, multiple shots of fuel are injected into the combustion chamber at the appropri-

ate time to achieve better fuel economy and lower emissions. The amount of fuel injected and timing is determined by the engine Electronic Control Module (ECM).

Advanced Electronics: The advanced Cat electronics package used in engines with ACERT Technology integrates the systems to achieve reduced emissions while yielding excellent fuel economy and performance.

Aftertreatment: While the fuel and air systems manage the combustion processes for reduced nitrogen oxide emissions, in some cases, additional technology is needed for particulate reduction. To reduce particulates in the exhaust of the muffler, a diesel oxidation catalyst is used.

It is important that you understand the unique procedures involved in properly maintaining an ACERT engine—this information will keep you from wasting valuable business time over failure due to neglected maintenance. The following list will address ten tips to prevent costly repairs to your ACERT engine-equipped truck and to avoid the associated downtime.

² "How ACERT™ Technology Meets Emissions Requirements Without Sacrificing Performance." Caterpillar: Home. Caterpillar. 22 July 2009 <<http://www.cat.com/cda/components/fullArticle?m=48920&x=7&id=142378>>.



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1. Get Your Valves Adjusted With Your First Oil Change

A proper first-time valve adjustment is essential to getting the most out of your ACERT engine, but many operators and technicians forget this crucial early maintenance procedure, since self-adjusting engine valves have made the practice obsolete in most automotive applications. High-performance ACERT engines, however, experience a short break-in period in which their valves' clearance increases slightly during early use. Caterpillar recommends having a trained service provider adjust your engine's valves during its first oil change to ensure proper clearance. This relatively quick procedure sets the valves correctly for the next 250,000 miles of use, and it improves performance throughout the life of your truck's engine.

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between 5 and 7 microns rapidly degrades fuel injectors, so proper filter selection is essential to your engine. Well-maintained fuel systems ensure that only the smallest droplets of fuel are injected into your engine's cylinder to optimize ignition of the fuel in the cylinder—this maintains your ACERT engine's factory-designed performance and emissions for its entire lifespan. Remember, **never** pre-fill a fuel filter you plan to install in your ACERT engine! Pre-filling a fuel filter adds unfiltered fuel to the clean side of these filters, introducing wear particles to the filtered fuel side of the filter medium. One half of a teaspoon of particles will destroy a new injector. When you change your fuel filters, simply lubricate their seals with a small amount of fuel, install them, and let the engine circulate its fuel normally, after ignition.

2. Choose The Correct Fuel And Oil Filters For Your Engine

Incorrect fuel and oil filter selection is a common problem for ACERT owners, but it's easily remedied—and can make a big difference in your engine's longevity and performance. Caterpillar's engineers recommend fuel filters with a minimum flow rate of 95 gallons per hour (GPH) for C7 and C9 engines, and 129 GPH for heavy-duty C13 and C15 engines. Lower-flow filters will rob your engine of power, derating it and possibly stopping it entirely. Check with your filters' manufacturer for the correct filter rating before installing them—this is a common oversight.

You should also make sure that your engine's filters are properly rated for correct particle filtration: primary fuel filters in ACERT engines must be rated to remove particles 10 microns and larger at 98% efficiency (absolute rating) and secondary fuel filters must remove particles larger than 2 microns at 98% efficiency. Contamination

Your ACERT engine also requires a slightly higher-efficiency oil filter than you're probably used to using. Cat's engineers found that the industry's standard filter, rated to remove particles larger than 30 microns (absolute), is insufficient for ACERT applications, so Caterpillar's Filter division developed a high-efficiency oil filter rated to remove 22 micron (and larger) particles at 98% efficiency. Using these filters will prevent damage to your truck's internal moving parts, decrease downtime, and increase your engine's serviceability. A small investment in the correct filters can save you thousands of dollars in repairs over the life of your engine and improve your performance, horsepower, and acceleration. You'll feel the difference!

3. Extend Your Oil Change Intervals With Oil Analysis

Caterpillar recommends a specific oil change interval for your ACERT engine, but in practice, you can easily extend it by thousands of miles and operating hours by

combining properly-rated filters with oil analysis from a trained provider. Naturally, this will save you a lot of money!

Oil analysis spots problems in your engine before they happen by analyzing your oil at the molecular level. Your local oil analysis technician can detect sediment, contamination, and elemental imbalances using oil analysis, and is able to identify wear and fatigue trends within your engine. Oil analysis is like a blood test for your engine, and can alert you to potentially catastrophic problems long before they compromise your truck's performance.

Competitively-priced fluid analysis services are available from numerous trained providers across the country for a variety of engine systems and applications. There's no hard and fast rule to determine how often you should have your engine's oil analyzed, but since it costs less than an oil change and has substantial predictive value, you should get in touch with your service provider's oil analysis supervisor—he'll be happy to give you some suggestions to help you determine the appropriate intervals.

4. Clean Your CRS With Every Oil Change (C7 and C9 Engines)

Your ACERT engine's Caterpillar Regeneration System (CRS) regenerates your engine's diesel particulate filter (DPF) by increasing the temperature in your truck's exhaust system, which oxidizes soot trapped in the DPF. This regeneration process allows the DPF to continue to operate efficiently, but like any other vehicular system, your CRS requires periodic maintenance. Caterpillar recommends introducing cleaning fluid into your engine's CRS every 50,000 miles, but it is wiser to inject the cleaner with every oil change—make it a part of your regular maintenance routine. You may wish to contact a trained service provider to perform this procedure, as special safety measures should be taken when dealing with the cleaner—it's somewhat caustic, and should be handled with care.

5. Don't Forget To Replace Your OCV Filter

Your heavy-duty (C13, C15) ACERT engine is equipped with an Open Crankcase Ventilation (OCV) filter that traps pollutants from the engine and lets air out of the crankcase. This progressive system reduces your engine's output of regulated pollution, but just as in similar systems, the filters don't last forever. You should change your OCV filter every 90,000 miles or 4,500 hours. Replacing this filter, which costs about \$35, can prevent unnecessary downtime: Caterpillar's engineers designed the ACERT engine to derate when its OCV filter is clogged, alerting you of the need for maintenance of this important component.

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6. Maintain Your ELC Coolant

The Extended Life Coolant (ELC) in your ACERT engine represents a significant improvement in engine coolant technology; however, it does require slightly different maintenance than conventional coolant. If your engine's supply of coolant runs low, make sure to use a 50/50 mixture of water and ELC when you

replenish it. If no ELC is available, use water only. Standard coolant will contaminate the ELC and damage the additive package to prevent engine part protection, so never add it to an ELC system! In a pinch, if you add water alone, you can easily drain some of the coolant and re-concentrate the system when you reach your destination.

Correct use of Extender in your ELC system is also essential to getting the most out of your ACERT engine. When used properly, Extender (combined with premixed ELC) will raise the expected life of your coolant to 600,000 miles, or 12,000 hours. It's important to remember, though, that Extender should only be used at 300,000 miles or 6,000 hours—the halfway point in your ELC's lifespan. Although Extender adds nitrates and prevents liner erosion in your ACERT engine's cooling system, it can't be used more than once: at 600,000 miles or 6,000 hours, you'll have to drain and dispose of the old fluid.

⁴ Gould, Jim. "The History of Load Banks." *Worldwide Independent Power* Sept. 2008: 20. Print.

A final tip to getting the most out of your ACERT engine's ELC system is to take advantage of coolant fluid analysis service from a trained provider. Just like oil analysis, coolant analysis can predict your engine's maintenance needs and prevent costly repairs. Coolant analysis measures Ph, additive package levels, and sediment in your engine's fluid systems, and can detect component wear, as well. Compared to the cost of engine repair after catastrophic failure, coolant analysis is highly affordable, especially considering that you only need to do it every other oil change.

7. Don't Sweat Condensation

By now, the importance of monitoring your ACERT engine's fluids should be very apparent. One thing you don't need to worry about, though, is the formation of water droplets on your engine's oil filter cap or dipstick. Water vapor circulates and condenses in ACERT engine crankcases normally, and it isn't indicative of a problem. Unless your oil turns gray or otherwise discolors, save yourself time and money and don't worry about condensation.

8. Understand Your Warning Lights

The warning lights on your ACERT engine-equipped truck's dash convey a lot of useful information about your engine's status. But every light is not indicative of an immediate problem, and correctly understanding what they mean can save you thousands of dollars in towing and diagnostics charges. Request an ACERT warning light chart (LEDT8906) from your service provider and familiarize yourself with its different messages. The lights will tell you if a problem is serious enough to require a trip to the shop, if you can continue to safely operate the truck, or if the engine needs immediate service. Why pay to tow a truck, or remove it from service, when it isn't necessary?

Also, if your ACERT engine didn't come with an in-dash warning light system, talk to a trained service provider about installing one. Chances are you'll be surprised at how inexpensively they can do the job.

9. Update Your Software

Like most modern engines, your ACERT engine is equipped with a sophisticated onboard computer, which monitors various environmental and internal factors and adjusts your engine for peak performance. Caterpillar's team of engineers are always on the lookout for potential improvements to your onboard computer's software, and they occasionally find tweaks and updates that can improve your performance. Owners of '04 through '06 ACERT engines, for example, can take advantage of a software update from Cat that improves performance by updating the engine's Variable Valve Actuators (VVA) system operation. For '07 to '09 ACERT engines, Caterpillar engineers have released software updates to improve the Caterpillar Regeneration System (CRS). Why not take advantage of similar performance improvements?

Your Caterpillar dealer will be happy to check and update your ACERT engine's onboard computer under warranty to address known, inherent problems, and will update your non-warrantied equipment for the price of labor only. Software updates help your service provider's technicians, too—improvements to your engine's diagnostic systems let them identify and solve problems faster and more efficiently, saving you labor and diagnostic fees.

10. Don't Stand Idle

Minimizing idling has been a major issue lately, given skyrocketing fuel prices and increasing public concern about emissions. Your ACERT engine requires only minimal idling to perform at peak capacity, so you don't need to pay for fuel to keep it idling. When you start your engine, give the truck about three minutes of idle time to ensure fluid circulation, and then start driving. Use a light throttle until your engine reaches its optimal operating temperature—the time it takes you to get to a highway on-ramp is usually enough. There's no need to idle when you reach your destination, either, as long as you drive conservatively after leaving the freeway: the reduced horsepower demand will allow your ACERT engines' turbo components to cool sufficiently, so you can turn the truck off when you reach your destination without worrying about additional idling.

Conclusion: **Keep It Clean and Mind Your Fluids**

Your Caterpillar ACERT engine is a group of complex systems, but maintaining it doesn't have to be difficult. Conceptually, your ACERT engine's maintenance schedule is not dramatically different from that of a conventional engine: filters and fluids must be periodically replaced, a maintenance schedule should be adhered to, and engine components must be monitored for wear.

ACERT-equipped engines are not untested technology: truck engines with ACERT Technology log more than 70 million miles each day, and Caterpillar ships 16,000 ACERT engines a day³. As long as you mind your fluids, take advantage of fluid sampling and other diagnostic opportunities, and keep everything clean, you will experience years of trouble-free service, excellent reliability, and optimal return on your investment in a Caterpillar ACERT engine.

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