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INSIDE

6.7L HEAD STUDS

FORD EGR Fix

HOW **WATER/METHANOL INJECTION** WORKS

EVENTS

**ALLIGATOR
DYNO DAY**

**WEEKEND
ON THE EDGE**

POWER FROM WATER

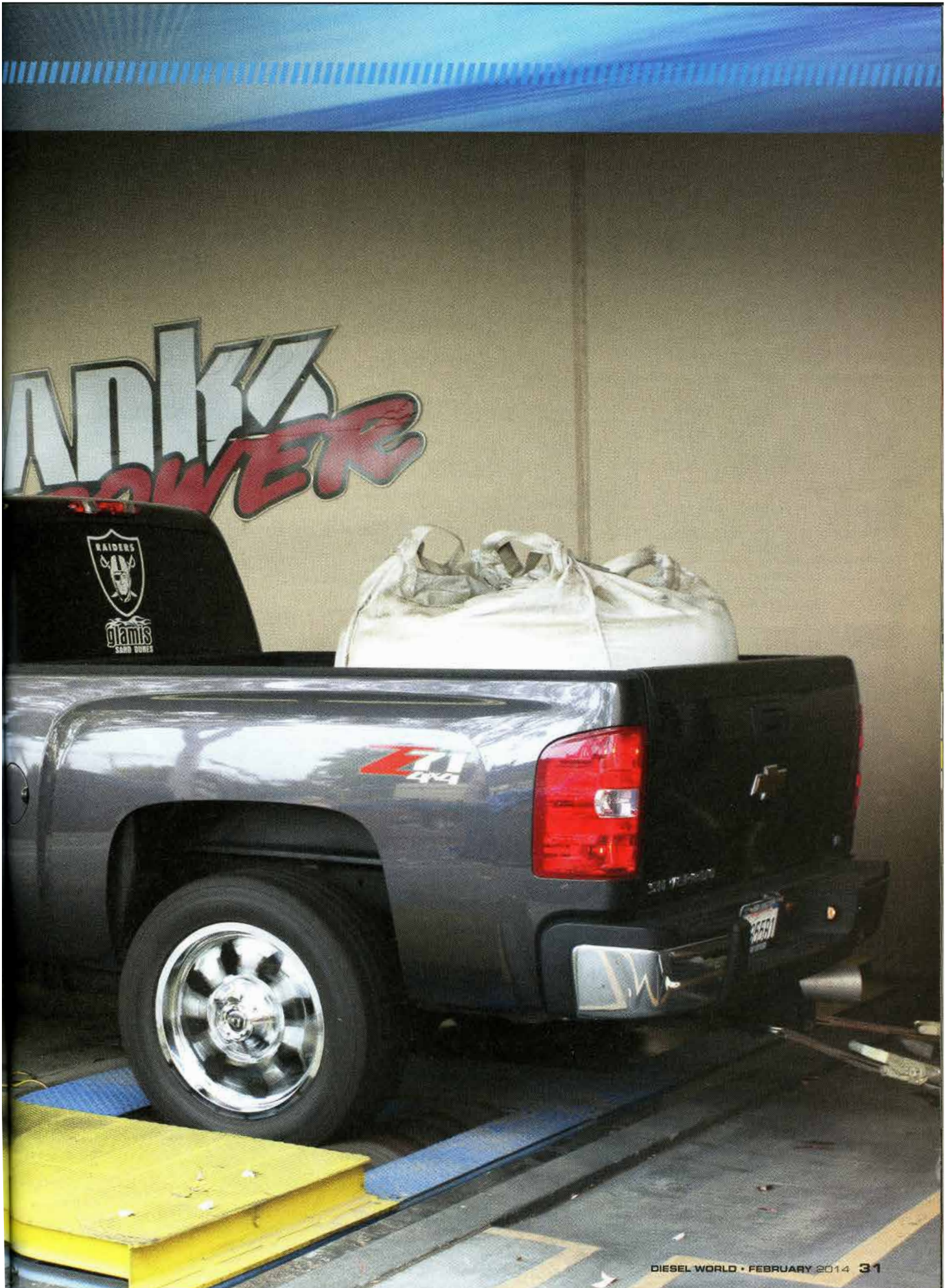
The Science Behind Banks Power's New Water/Methanol System

BY TRENT RIDDLE

PHOTOS BY TRENT RIDDLE
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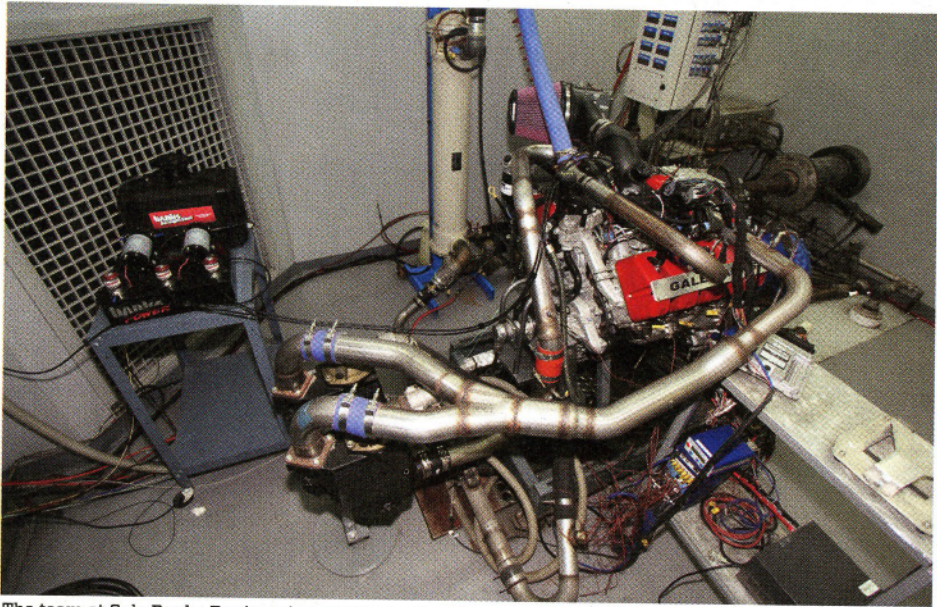
Water injection has been around almost as long as the internal combustion engine. It was first used to improve power, allow higher compression and save fuel on fighter planes during WWII. Both the Allies and Axis air forces used water injection in some applications. After the war, mechanics and engineers brought the technology to the racetrack. Today, water, or more properly water/methanol injection, is becoming an acceptable and even common upgrade for diesel and gasoline engines. Lyle Cummins in his book *Diesel's Engine: Volume One*, states that while Rudolph Diesel didn't invent water (water/methanol) injection, he did call for its use on his engines.





What happens in a water or water/methanol injection system is simple. The injection of these fluids as a mist cools the intake air. Cooler air means denser air, giving more oxygen for a given volume. This denser air results in more power produced, and the cooler intake charge also helps to reduce EGT and emissions, a more than 50-percent reduction in emissions in some testing.

In addition to increasing power, and reducing EGT in diesel applications, water/methanol injection can also produce fuel savings. This is because the power increase comes without an increase in the fuel delivered to the cylinders. Of course, you'll have to resist the



The team at Gale Banks Engineering spent countless hours on the engine dyno and on the chassis dyno tuning the Banks Straight-Shot and Double-Shot systems for optimal power and performance gains.

Make Mine a Double Shot

Knocking Back a Water/Meth Mix

By Steve Temple

While water/meth has been used for years, as far back as WWII in fighter planes, but adding it to my '96 Dodge Ram dually was a new experience for me. Since the dual benefits for diesels of cooling and extra power are well known, I was eager to see how well it would work on my trusty 12-valve Cummins.

Before getting into the performance results, though, it should be noted that the engine was optimized with a number of other performance parts (Banks Ram-Air intake system, Twin-Ram intake manifold, Banks Sidewinder turbo, and 4-inch Monster Exhaust, plus ARP head studs).

All of these components no doubt contributed to enhancing the intake and output as well, so delineating the effect of water/meth alone is not feasible in this particular application. Even so, it does point to the value of approaching engine upgrades as a system or overall strategy, rather than a single tactic. After all, what's the good of trying to produce more power with water/meth if the engine isn't breathing better as well?

Given that qualification, what's it like to drive with a Banks Double-Shot water/methanol injection system? Well, the short answer is that it's real easy. The monitor mounted on the windshield pillar has a simple digital display of the EGT (Exhaust Gas Temperature), and it can be programmed to provide boost pressure numbers as well. Basically it's a set-it and forget-it setup.

As for EGT readouts, we were already very familiar with the route over Donner Pass near Lake Tahoe, and knew what to expect from many previous trips. In the past, the EGT would bump up to the dreaded 1,250-degree mark (where turbo damage can result), but with the Banks Double-Shot we saw significantly

lower temps, anywhere from 50 to 150 degrees less. And the throttle response running through those mountain passes was prodigious. With all of the aforementioned performance parts working together, dyno results show a 60-hp gain and more than 300 lb/ft of torque.

There's just one thing to change. The Banks water/meth fluid can be stored in the windshield washer reservoir, but we've decided to plumb lines for a bigger tank in the bed for a couple of reasons. First, a windshield washer is a necessity in the frosty climate of the High Sierras. And two, on a drive from Los Angeles to Reno, we drew down on the smallish tank fairly quickly. So it's good to have more of a reserve so your engine can gulp down all the water/meth you need.

Here's the data:

POWERPACK WITH STRAIGHT-SHOT TEST RESULTS

BASELINE PP W/ SS GAIN

Peak HP: 241.3 hp @ 2,200 - 305.0 hp @ 2,200 +63.7 hp (26.4%)

HP, Best Gain: 237.0 hp @ 2,400 - 302.0 hp @ 2,400 +65.0 hp (27.4%)

Peak Torque: 584.0 lb/ft @ 2,000 - 745.8 lb/ft @ 2,200 +161.8 lb/ft (27.7%)

Torque, Best Gain: 584.0 lb/ft @ 2,000 - 745.8 lb/ft @ 2,200 +161.8 lb/ft (27.7%)

Peak Boost: 34.3 psi @ 2,200 - 36.4 psi @ 2,200 +2.1 psi

Intake Manifold Temp: @ 30 psi

Boost: 152° F - 115° F -37°

Peak EGT: 0-60 mph 1,405° F - 1,420° F +15°

EGT @ Top of Third Gear, Full Load: 1,405° F - 1,400° F -5°

Comp In Density @ 1,800 RPM: 91.5% - 93.4% +1.9%

Intake Manifold Density @ 30 PSI Boost: 197.8% of amb - 210.1% of amb +12.3%

urge to push down harder on the accelerator to enjoy the added power more, or you'll lose the mileage edge.

You may be wondering why use a water/meth mix, rather just water. The truth is, you can use water alone, and some folks do. However, the methanol in the mix has proven to increase power over water alone, and works as an antifreeze too. Consider that about 30-percent methanol lowers the freezing point by 52 degrees F, or down to -20 F. Not only is methanol an antifreeze, it's also a secondary fuel, resulting in higher power gains over water alone.

The latest water/methanol injection system on the market is from Gale Banks Engineering. They actually offer two systems—the Straight-Shot and the Double-Shot. The Straight-Shot is a single-stage system that's perfect for most users. The Double-Shot is a two-stage



Here you can see the user-adjustable electronic gauge/control unit for the Straight-Shot and Double-Shot systems. It's mounted below the Banks iQ 2.0, another great upgrade for your rig.



For dyno testing and development, the Banks team pushed the Banks Straight-Shot and Double-Shot systems using this test bed system that used two pumps and three solenoids. It was determined that for production systems, the cost-to-benefit ratio indicated fewer of each would work just fine.

unit that adds a second-stage water/methanol injection nozzle. The Double-Shot is said to be capable of power gains of 175 hp-plus.



This is the Double-Shot system with two solenoids. The single pump has enough delivery for all street and most race applications.



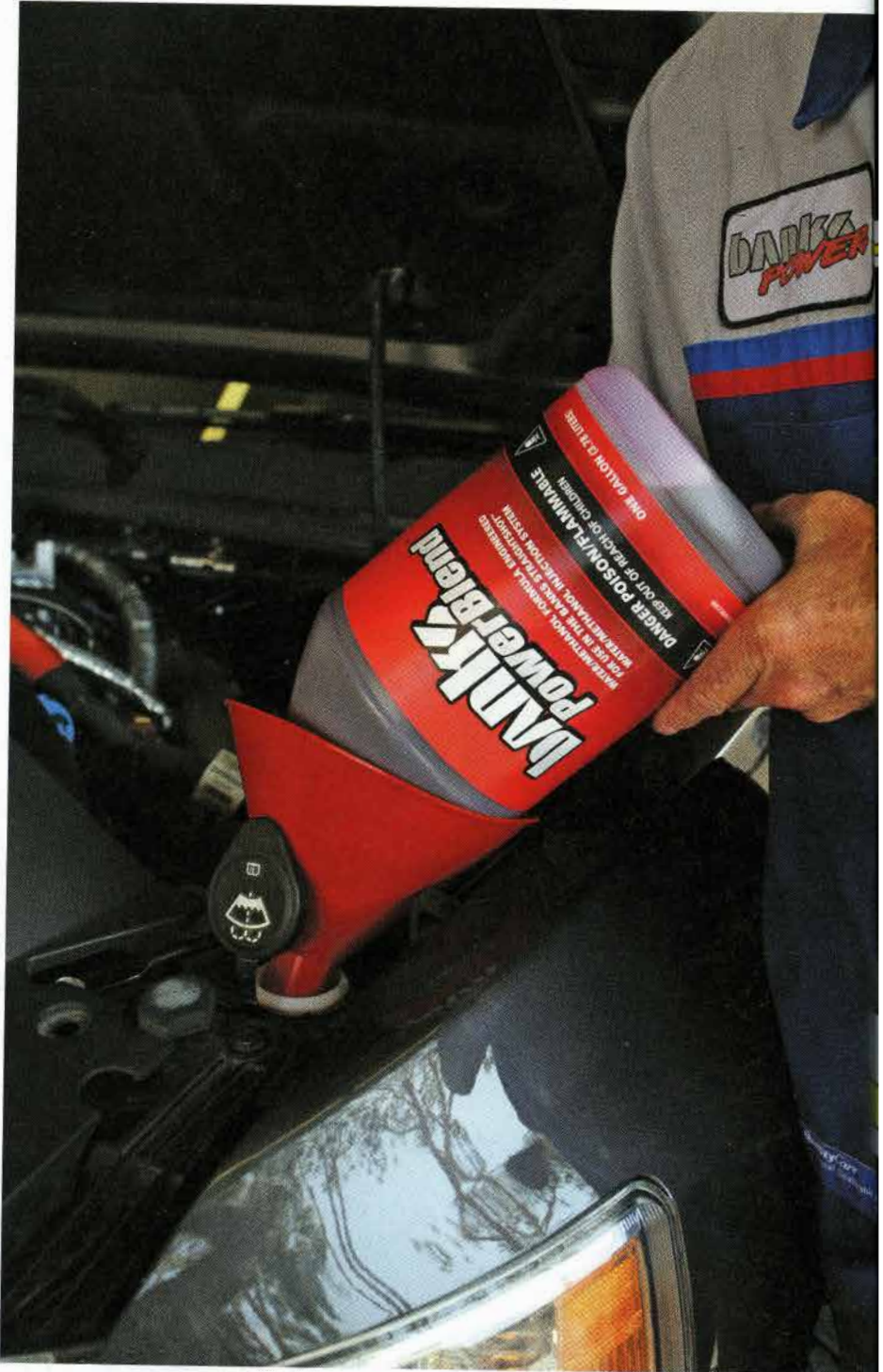
The key to the performance of the Banks water/methanol injection system's smooth operation and great power gains is due to lots of time on the dyno. Small tweaks can mean big gains, but this takes development time and lots of "what-if" testing to get it right.

Banks Straight-Shot and Double-Shot systems both come with a digital controller, plug-and-play wiring, the highest volume pump on the market for greater flow and adjustable position injection nozzles. The system trigger options can be set based on boost pressure, throttle position, EGT or a combination of either boost or throttle, plus the EGT. There has even been use of the systems, as secondary or additional setups, to cool intercoolers and brakes on race applications.

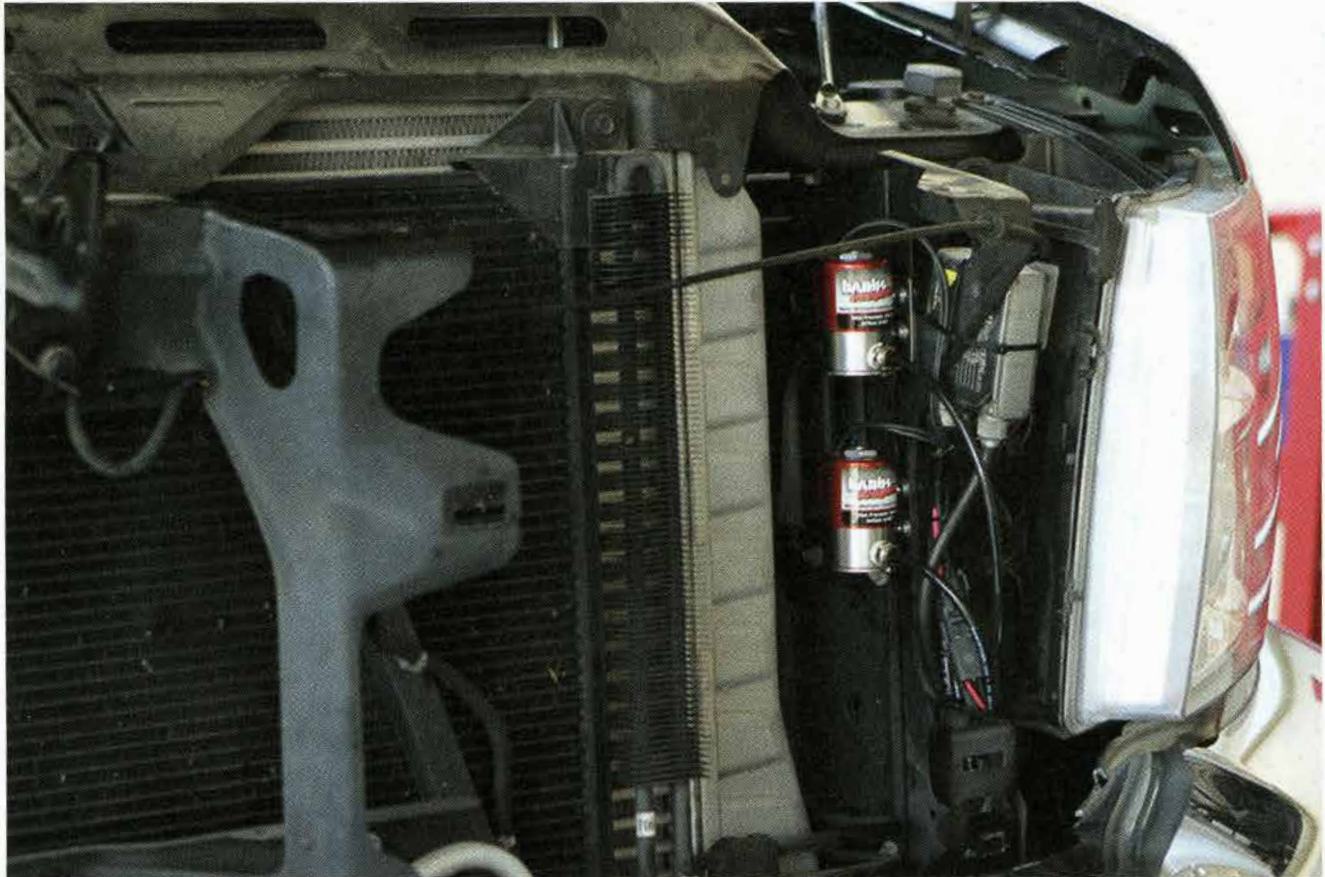
While there are several water/methanol injection kits on the market today, we couldn't cover them all here. Look for more information on water/methanol injection in future issues of DW. The bottom line is that water/methanol Injection improves power and saves fuel. Maybe it's time you considered an upgrade for your vehicle. DW



The Banks Straight-Shot and Double-Shot systems come with a unique and proprietary injection nozzle or nozzles. These units rotate 360-degrees and this means you can ensure that the injection stream and line routing are pointed in the right direction, no matter what the tapped mounting-hole orientation is.



The key ingredient to any water/methanol system is the mixture being injected. Like other companies, Banks offers a ready-to-run water/methanol mixture. You can run water but then you run the risk of freezing at low temperatures. In addition, the quality of the water is of high importance. Tap water with a high mineral content will likely clog your injection nozzles.



Here you see the two solenoids for a Double-Shot system mounted to the side of the core support. They can be mounted any place you like, even in different locations, if space constraints don't allow a closer proximity mounting.



The windshield washer tank can be used with the Banks Straight-Shot and Double-Shot systems for the water/methanol fluid. If this is not desirable, they do offer multiple tanks as add-ons. The sizes available are 3/4, 2 1/2, 5- or 7-gallon.

SOURCE

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