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PROJECT

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## PLUS

- 12-VALVE MODS FOR TOWING
- 850 HORSEPOWER FROM A 7.3L?



# Tech

# Combo Plate

## Banks' New Cummins 12-Valve Power Package

BY STEVE TEMPLE  
PHOTOS COURTESY OF BANKS POWER

**W**hen the subject of the 12-valve Cummins diesel comes up, words like "bulletproof," "simple" and "reliable" are often used in the same sentence. The fact that the 12-valve has such good bones explains why it's a favorite of tuners, racers and engine swappers alike. Why? It's a simple design that can be inexpensively upgraded to produce big power. Since it's mostly a mechanical engine, relying on the proven Bosch P7100 fuel pump, electronics are minimal and working with mechanical upgrades that are bulletproof has been proven over the years.





No surprise, then, that Gale Banks of Banks Power wanted to add more 12-valve options to the company's extensive line of diesel power adders. "We had planned to do that for some time, but didn't have access to an engine," he admitted. After locating a semi-stock '96 Dodge with the 12-valve, the Banks procedure was put in place: repeated testing and documentation so you can back up what you offer with solid documentation.

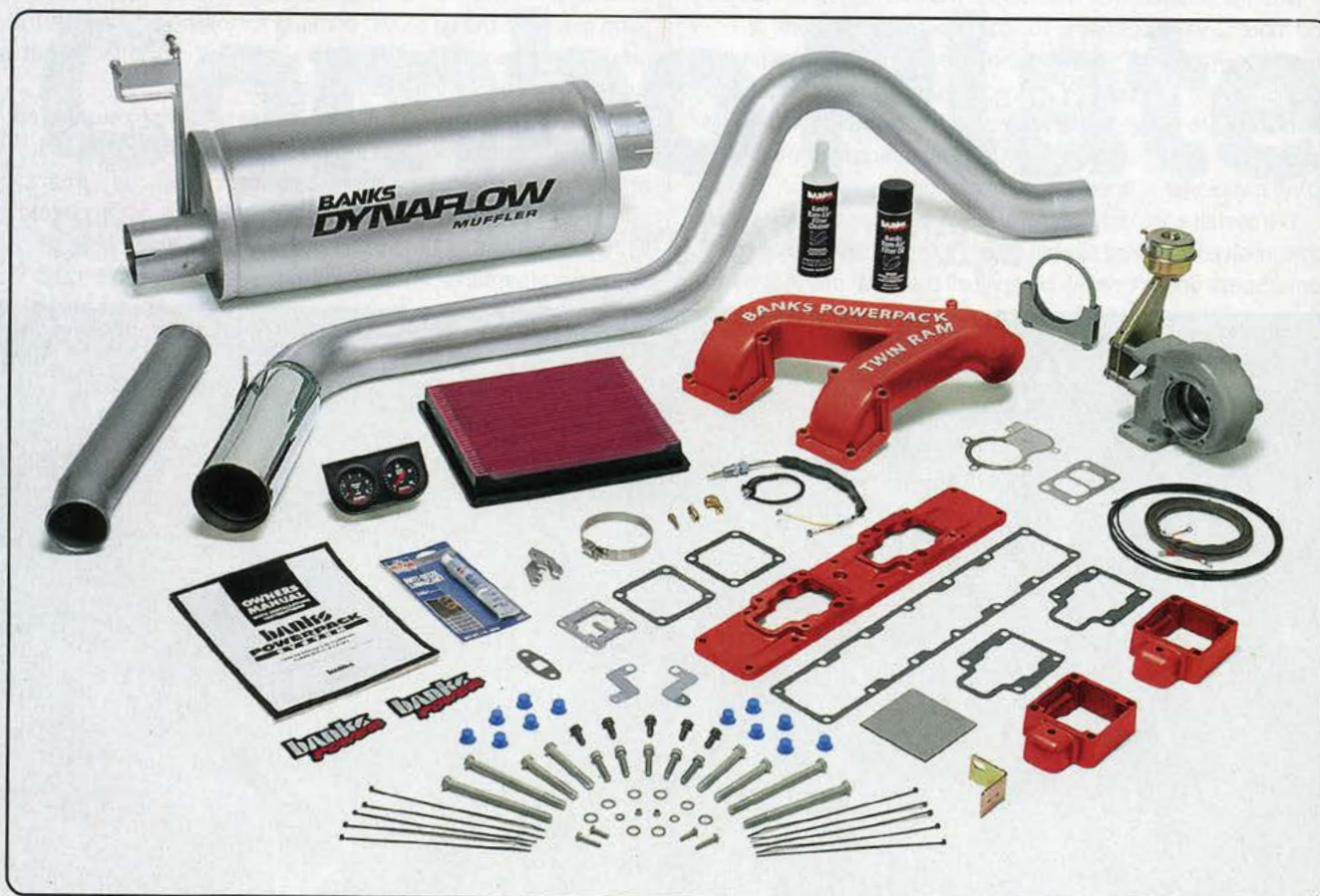
The overall approach was fairly direct, but the specifics were far more involved, requiring several different combinations of components. Space doesn't permit covering all the variations that were

evaluated, so we'll focus on simply the before/after results. Keep in mind that since this rig is used primarily for towing and hauling, the power upgrades were targeted for a work-truck configuration, not a dragster or double-throw-down hot rod.

As part of the process, output at the rear wheels (measured on the Banks chassis dyno) was 160 hp at 2,400 rpm, and 380 lb/ft at 1,700 rpm. Note that the engine baseline numbers came from a pure stock 12-valve tested earlier by Banks. Our guinea pig is fitted with real-world mods that most 12-valve owners have done: #8 fuel plate, aftermarket intake along with an upgraded turbo and







The Banks PowerPack includes the following components: Ram-Air, Sidewinder Turbo with a big-head wastegate actuator, a Twin-Ram intake manifold, boost and EGT gauge, fuel calibration plate, and a Monster exhaust.

exhaust manifold. No changes to the fuel delivery system were done throughout the project.

The first step was bolting on a Banks PowerPack, consisting of a Ram-Air cold-air intake, a Twin-Ram intake manifold, a somewhat larger prototype of the Sidewinder Turbo with a Big Head wastegate actuator, and a Banks Monster exhaust. The gains were immediate and significant: 94.4 hp at 2,200 rpm, hitting a peak of 249 hp. As for torque, the dyno recorded an increase of 227.6 lb/ft at 2,000 rpm, topping out at 608.4 lb/ft. Those numbers amount to a 60 percent or more increase in output, both in horsepower and torque, with the modifications already done to the motor. Interestingly, by way of comparison, on a totally stock 5.9L Cummins, peak torque is typically at 1,750 rpm, so the powerband curve not only increased, substantially with the addition of the Banks PowerPack, but also moved somewhat.

Those power numbers proved out on the street, too: the 0-60 mph time, when unloaded, dropped from 12.75 to 9.69 seconds, more than three seconds quicker for a 24-percent improvement. When towing, the 0-60 mph time dropped 34 percent, from 39.67 to 26.01 seconds.

Adding the Banks Straight-Shot water/meth system on top of the PowerPack produced even bigger gains across the board. Peak output recorded on the dyno was 305.2 hp (more than 105 hp, or



1 After thorough cleaning of the threads, the ARP studs are test fitted and checked for fitment.

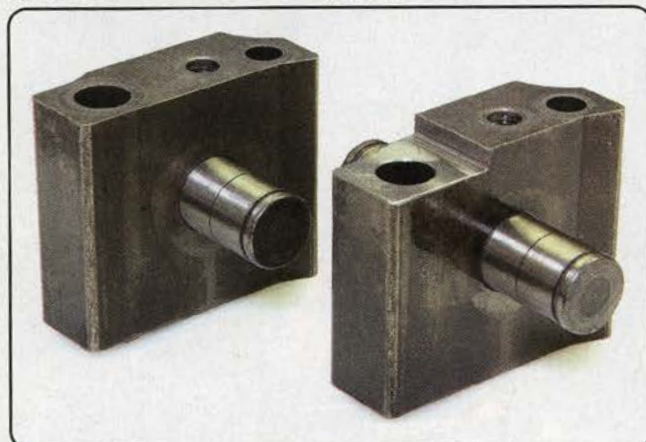
97 percent), and 745.8 lb/ft (a gain in excess of 365 lb/ft, or 92 percent). Clearly, the addition of Banks' Straight-Shot water/meth system makes some serious power on the dyno utilizing a 50/50 mix of water and methanol.

On the road, the truck flew through the mountain passes in the High Sierras between Reno and Sacramento. The throttle response

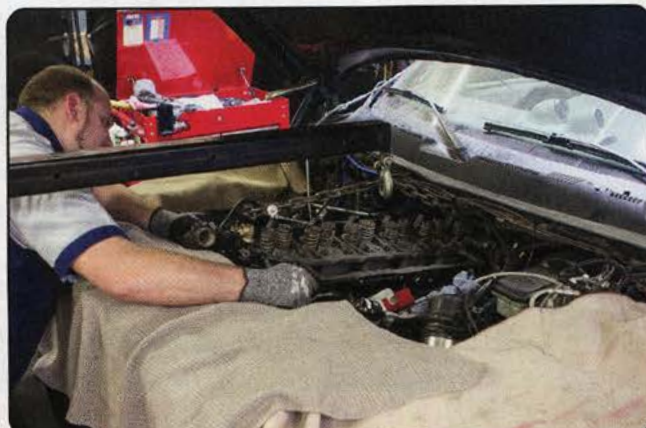




**2** The solenoid for the Banks Straight-Shot water/meth system doesn't take up much space, and can be mounted right next to the battery, or wherever else is convenient.



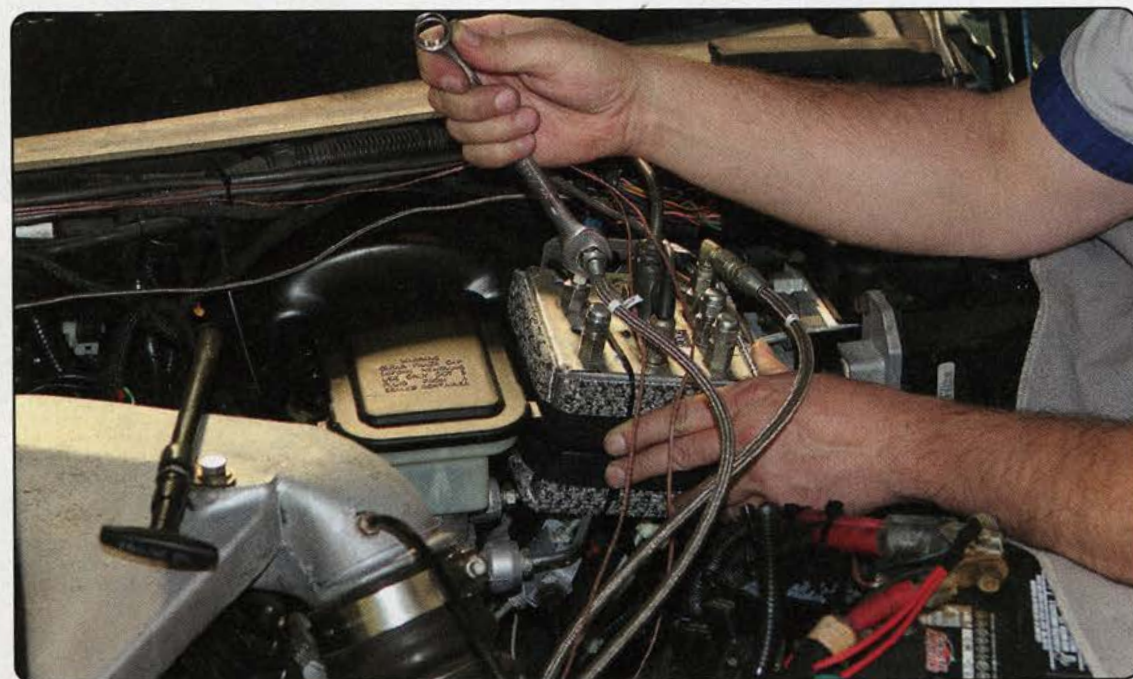
**3** Milling the rocker shaft stands is a required modification so there's sufficient clearance for the nuts and washers on the ARP head studs.



**4** After some issues were discovered with the head gasket and valve bowl, a remanufactured factory head, supplied by Valley Auto Parts, replaced the original unit.



**5** The ARP studs are put in only finger tight, so when torque is applied to the nut, the stud will stretch only on the vertical axis. Be sure to apply a generous amount of thread sealer or Loctite to prevent air pockets that might result in leaks. Because the head gasket will compress upon initial torquing, re-torque the bolts after the engine has been run.



**6** Banks temporarily installed a pressure transducer box for data acquisition.





7 This pile of electronics is for data acquisition, along with an opacity meter and tachometer.



8 These high-accuracy pressure transducers evaluate air density and other variables.

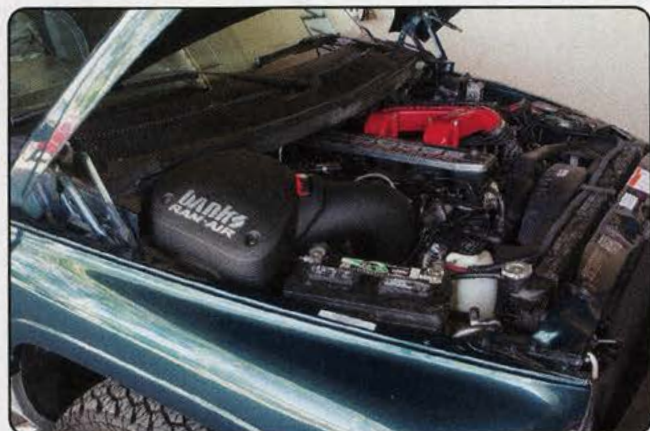


9 Here's the completed install of Banks PowerPack with Double-Shot water/meth system.



was so much improved it felt like a completely different rig. When pulling onto the highway, it's a real kick to have that much more power on tap when you need it.

But there are other benefits, too. As noted in a previous article on the water/meth system in this truck, the EGT (exhaust gas temperature) was anywhere from 50 to 150 degrees lower on a steep



**10** The Banks Ram Air system replaces the factory filter with a cold-air induction system. This setup provides increased air density, measured as a percentage of ambient at the turbocharger inlet. In stock form, air density was 91.5 percent of ambient, but the Banks Ram-Air system increased that by 3.5 percent to 94.0 percent. This might not sound like a huge gain in air, but every bit means a better burn.



**11** For this particular project, a larger, experimental wastegated turbocharger was used to deliver greater air density and reduce EGT, in anticipation of the water-methanol injection. Peak boost more than doubled, going from 16.4 psi stock to 34.4 psi, a gain of 18 psi.

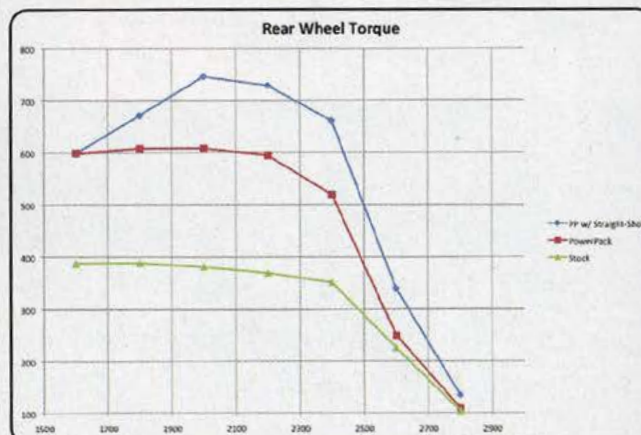
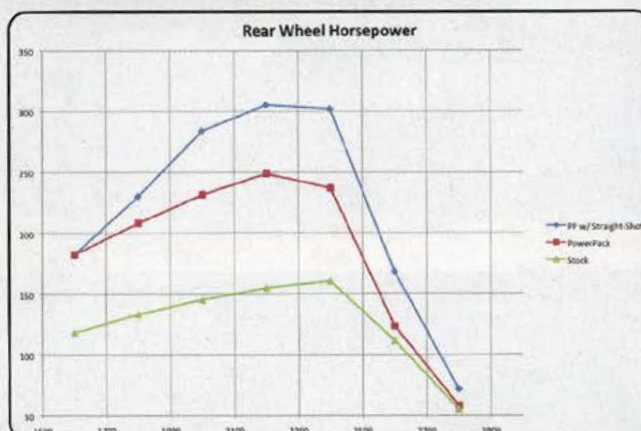
## Insurance Policy

Any Cummins engine builder worth his salt knows the benefit of adding head studs to an engine with increased combustion chamber pressures which come from more boost or more bang. They're especially needed when upgrading a turbo to keep the head gasket from expanding and possibly rupturing, due to the factory head bolts stretching.

For extra strength and durability, ARP's head studs are made from 8740 chromoly steel and have a 190,000-psi tensile-strength rating. They are precision centerless-ground and thread-rolled to Mil-S-8879 specs, with a black oxide finish for corrosion resistance. More importantly, they provide even clamping force. The kits come complete with hardened washers and high-strength hex nuts.



**12** The Banks Monster exhaust, which includes both a downpipe and a 4-inch cat-back tube, reduces exhaust backpressure, dropping from 1.6 psi (stock) to .6 psi.





climb up to Lake Tahoe, which we've run many times before. We also hooked up a 30-foot trailer for a trip "over the hill" to evaluate the towing performance, and what was once a slow, hot slog on previous trips, was now much faster, cooler and easier.

We should mention a few caveats here, however. While the addition of water-methanol injection increases power substantially, it can increase EGT to unsafe levels unless air density is improved as

well (such as with the Banks PowerPack). So when using water/meth as a power enhancer, be sure to increase your engine's air density as well, or cut back on the ratio of methanol to water. Note, too, that while water-methanol will inevitably increase EGT, water injection alone can be used to decrease EGT.

With the PowerPack components installed, Banks recorded a peak EGT with water injection of 1,295 degrees, 50 degrees cooler than with no injection, and 110 degrees cooler than the baseline configuration. Under normal driving conditions (not fully loaded at partial throttle) drivers may notice a decrease in EGT with water-methanol injection active, due to non heat-soaked conditions. (Which basically means that only under heavy loads at full throttle will the EGT typically increase with water/meth.)

In addition, during the process of pulling more power out of 5.9L Cummins, Banks technicians noticed that the head was starting to lift off the block. The age of the engine might have been a factor here, because upon removal, a crack was discovered in one of the valve bowls as well. For an extra measure of insurance, a remanufactured cylinder head replaced the original unit, which was secured with ARP studs.

All told, while we really appreciate the dramatic improvements in performance provided by the Banks PowerPack and Straight-Shot water/meth systems, we actually put an even higher priority on one simple improvement: the EGT. Knowing how critical that heat level can be for long-term durability, especially on a truck that regularly tows and hauls up steep inclines, we were truly gratified to see how much lower the EGT now is when climbing through Donner Pass. This fundamental fact bodes well for the long-term life of a truck that we'll be counting on for many more miles of heavy use. **DW**

## Make Mine A Double

On the Banks Straight-Shot system, the Double-Shot option allows for specific tailoring of the injection curve to better match engine demands. The dual-stage water-methanol injection system for this particular application consists of a 5-gph nozzle for the first stage, with the start of injection at a 30-percent flow at 12 psi, and 100 percent at 30 psi.

For the second stage, there's a 12-gph nozzle, with the start of injection at a 30-percent flow at 30 psi, and 100 percent at 35 psi. Although water/meth solutions are widely available, the injection fluid supplied, Banks PowerBlend (MW50), includes an anti-corrosion additive. Note that with the Double-Shot option, fluid consumption can run fairly high, so if you get that option, install the largest tank available (rather than using the reservoir for the windshield washer).



### SOURCE

**BANKS POWER**  
877-700-8816  
[www.bankspower.com/12v](http://www.bankspower.com/12v)

## Going With The Flow

The photos and diagram shows the differences in airflow between factory and the Banks Twin-Ram intake manifold. It effectively doubles the inlet area, and optimizes air distribution into the cylinder head, delivering boosted air proportionately into all six cylinders. This equalization does away with lopsided internal temperatures, balancing air density between cylinders for a smoother engine output.

