

4.0 JEEP TECH, TUNING TIPS & DYNO TESTS

OPEN LOOP vs CLOSED LOOP - One of the biggest problems with the late model 4.0 Jeeps is the factory computer keeps the engine in closed loop (lean 14.7 AF ratio) at wide open throttle (WOT) and eventually allows it to revert to the preferred open loop (rich/power 11-12 AF ratio). These are 2 basic modes any modern vehicle operates in - closed loop and open loop.

Closed loop (economy mode) is used for best fuel economy and lowest emissions but is too lean for WOT. Closed loop works best when the vehicle is starting, idling, cruising, mildly accelerating or decelerating.

Open loop is for WOT acceleration and maximum power so it must be rich (11-12 AF ratio) to supply the additional fuel for the engine.

When more fuel does not accompany more HP, the result is a leaner hotter combustion which can melt pistons, rings, valves and spark plugs. With supercharging, open loop is an absolute must. The last thing a supercharged boosted powerful engine wants at WOT is oxygen sensors forcing the engine to remain lean for fuel economy when it instead needs more fuel for the additional power. Kenne Bell re-calibrates the factory ECM and forces the engine into open loop at WOT, thereby lowering the AF ratio from a weak lean 14.7 to a powerful safe 12.5 AF ratio.

SELF CONTAINED OIL SYSTEM vs. "ORIFICE FED"

Contrary to what you may have heard, pressure-orifice oiling is not necessary or recommended to prevent supercharger damage when the vehicle is on an incline. A self contained oil system, as used on all Kenne Bell 1.33, 1.5, 1.7, 1.8, 2.0, 2.2 and 2.4 kits is a far better, less complicated and less risky approach than oiling through an easily clogged mini orifice. Most of the centrifugal superchargers lubricate the supercharger with engine oil. This complicated system requires tapping into an oil pressure fitting, running a line to the supercharger, installing a very small orifice to meter the oil which is prone to plugging from engine contaminants. Then a drain line must be connected to the supercharger. A hole must be drilled or punched into the oil pan and a drain line must connect the supercharger to the pan. The real danger is that if the tiny oiling orifice plugs, the gears, rotors and supercharger are typically destroyed AND the metal shavings from the chewed up gears ends up in you engine oil pan. Because of these inherent potential problems, Kenne Bell prefers our tried and proven (14 years of street and off road experience) self contained oil system wherein you simply fill the front gear case with oil just like a rear end, transmission or engine. The oil reservoir is designed to lubricate the gears, regardless of the vehicle/supercharger angle. Oil level is checked with a dipstick.

POTENTIAL - We were impressed. The 4.0 inline 6 Jeep engine is very responsive to Twin Screw supercharging. In typical Kenne Bell fashion, we also tested cool air kits, throttle bodies, chips and exhaust. It produces a remarkable amount of power at relatively low boost levels with only the supercharger. With experimental 15 psi boost, we made 401 engine HP from the 190HP production engine. It takes a very healthy V8 small block to make that power. As with any increase in power (air flow) with the Speed Density system used on all Chrysler products, a new calibration is required.

SPEED DENSITY SYSTEM - At Kenne Bell, we're experienced in the tuning of these systems. It's not an easy task. All Chrysler products use a Speed Density system which DOES NOT and CANNOT AUTOMATICALLY ADJUST FUEL FOR POWER/AIR FLOW INCREASES. A mass air system such as the Ford and GM will "compensate" but the Jeep will not. The Speed Density system utilizes 1. vacuum, 2. throttle position, 3. RPM to regulate fuel and spark delivery. There is NO air flow measurement. The stock ECM must be re-calibrated because it was factory programmed for a specific power level and fuel injector size. So if you're buying a kit that does not re-calibrate the stock ECM . . . good luck! It cannot possibly furnish an adequate, safe and linear fuel supply/power curve. No way. Anyone in doubt can check out the data in our tests.

EXHAUST - The standard Kenne Bell test to determine exhaust system potential is to cut off the muffler and exhaust pipe. This netted 9HP with a 300HP supercharged engine. The stock 190HP engine gain would be less as the air flow through the exhaust is 285 cfm (190HP) vs. 450 cfm (300HP). With the Gibson exhaust, we saw 6HP at 300HP engine.

THROTTLE BODY & THROTTLE BODY SPACERS - We saw no power gain from stock or supercharged applications with the 65mm throttle body. The stock 60mm is large enough for a good 300HP.

COOL AIR KIT - The stock "hot underhood air" inlet system is so restrictive and hot that boost increased .5 psi with our Cool Air Kit. The Kenne Bell Cool Air Kit increased power by 13HP. NEVER use an exposed underhood filter or suck hot underhood air into a filter. The Kenne Bell Cool Air Kit is included in all 4.0 supercharger kits.

RE-CALIBRATION - The Kenne Bell OPTIMIZER II™ made 15HP. If you decide not to supercharge the 4.0, our recommendation is the Kenne Bell Cool Air Kit, Kenne Bell OPTIMIZER II™ and Gibson exhaust.

IGNITION - Stock works fine. Use 1 heat range cooler plug with supercharger 6-8 psi and 2 heat ranges cooler 9-15 psi. Kenne Bell BOOST-A-SPARK™ Ignition should be used for boost levels above 10 psi.

BOOST (Competition) - You're going to ask, so we may as well give you the information. The HP potential of the 4.0 is tremendous. Maximum boost for the kit with our 1330 (1.33L) supercharger is approx. 8.5 psi with a 2-1/8" pulley. We've run as much as 15 psi in the engine with our higher capacity 1700 supercharger (1.7L). The standard kit uses the 1330 (1.33L) supercharger. Substituting the 1700 for the 1330 will raise boost a whopping 7 psi with the same pulley. The catalytic converters must be removed for the 8.5 psi kit and the 15 psi kit as both are too restrictive for these higher boost levels. These high boost kits are designed for off road WOT (wide open throttle - full boost) competition or hill climbing.. They are not 50 State Legal or recommended for street use or "cruising" in low boost (see Catalytic Converters). 90% of our sales are the standard boost street kits but there are those competition guys who want the most from their 4.0.

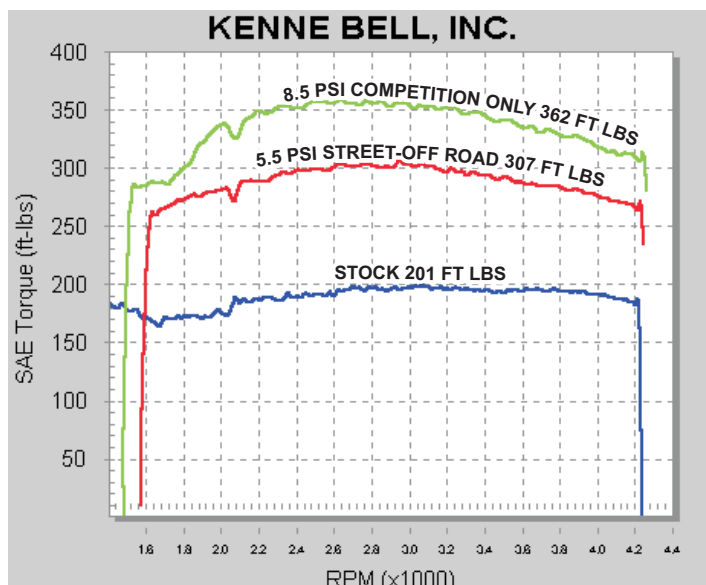
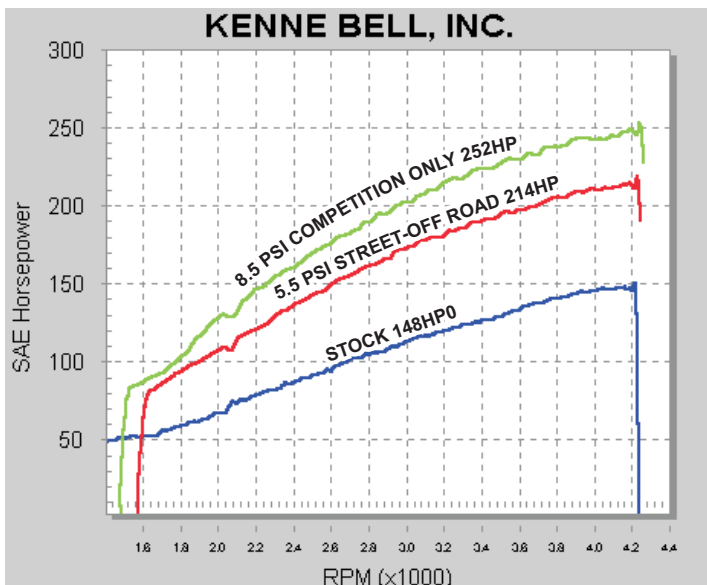
CATALYTIC CONVERTERS - There's approx. 5HP in removing them at the stock 190HP level and 10HP at 300HP supercharged. The cats are too restrictive for boost above 6 psi.

OIL - Redline synthetic is the best we ever tested for the engine, trans and rear. Expect 10HP by switching from mineral to Redline oil.

HEADERS - The best we've tested on our dyno are by Doug's Headers (909) 788-4878.

REAR WHEEL vs. ENGINE HP - All Kenne Bell dyno tests are rear wheel HP and torque. To determine engine HP, divide rear wheel HP by .78.

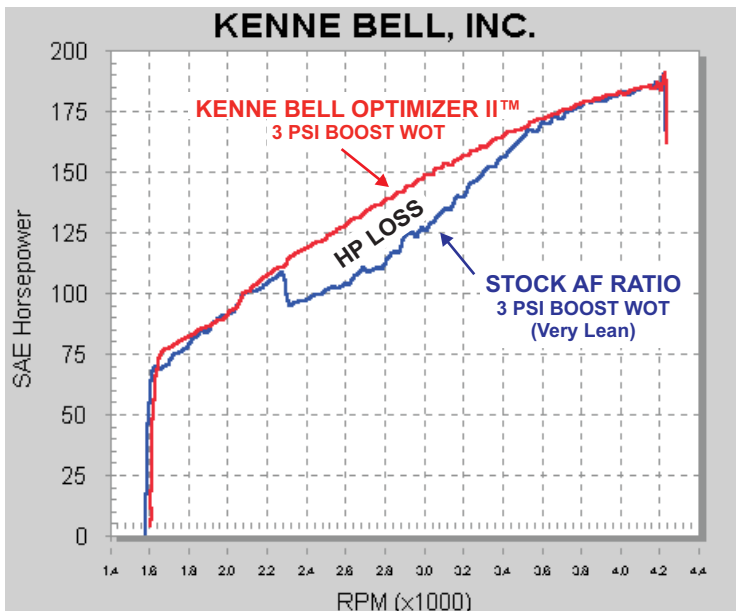
As with all our kits, we attempt to dyno test as many associated products as possible and answer the most frequently asked questions. Kenne Bell is not a one kit manufacturer. In addition to our 4.0 Jeep, we offer kits for most Chrysler products (4.7, 5.2, 5.9 Dodge, 5.7 Hemi), Ford, GM and Mazda. Kenne Bell is the Number 1 Twin Screw kit manufacturer. All dyno and emissions testing, product development and calibration is done in house with Kenne Bell vehicles. The dyno tests are not estimates, guesses or distortions. We tested the Jeep in 100% stock condition and then with exhaust, throttle body, Kenne Bell OPTIMIZER II™ and Kenne Bell Cool Air Kit. Note that all dyno tests were purposely started at approx. 1500 rpm to give our customers data on the kits performance at the low rpm so often used by Jeep owners. Compare the HP and torque to the stock engine and other kits.



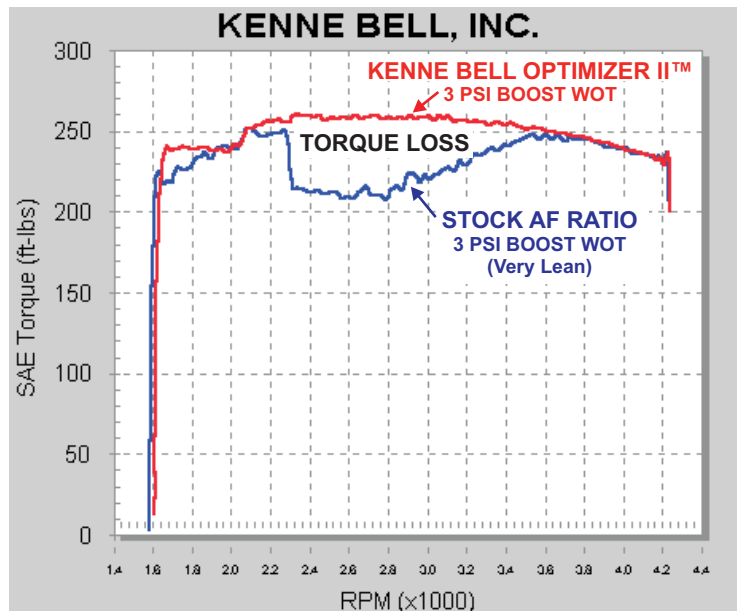
**HP & TORQUE COMPARISON
STOCK vs. KENNE BELL SUPERCHARGED**

INTERCOOLED BOOST		ENGINE	REAR WHEEL		
BOOST	PULLEY	HP	TQ	HP	TQ
0	STOCK	190	235	148	201
5.5	2-5/8	283	383	214	307
<i>8.5 psi kit is competition off road only with no cats</i>					
8.5	2-1/8	327	452	252	362

Never just look at "peak" power numbers. Check out the HP and torque at ALL ENGINE SPEEDS. Kenne Bell Kits produce fat flat torque curves from 1500 to 5500. There's no waiting for the rpm and boost to build up with this kit. The boost, power and torque are there at any rpm. Tests compare 100% stock 4.0 '02 Jeep. No other products (exhaust, headers etc.) were added to any of the dyno runs. Check 4.0 Tech and Tuning Tips for more information.



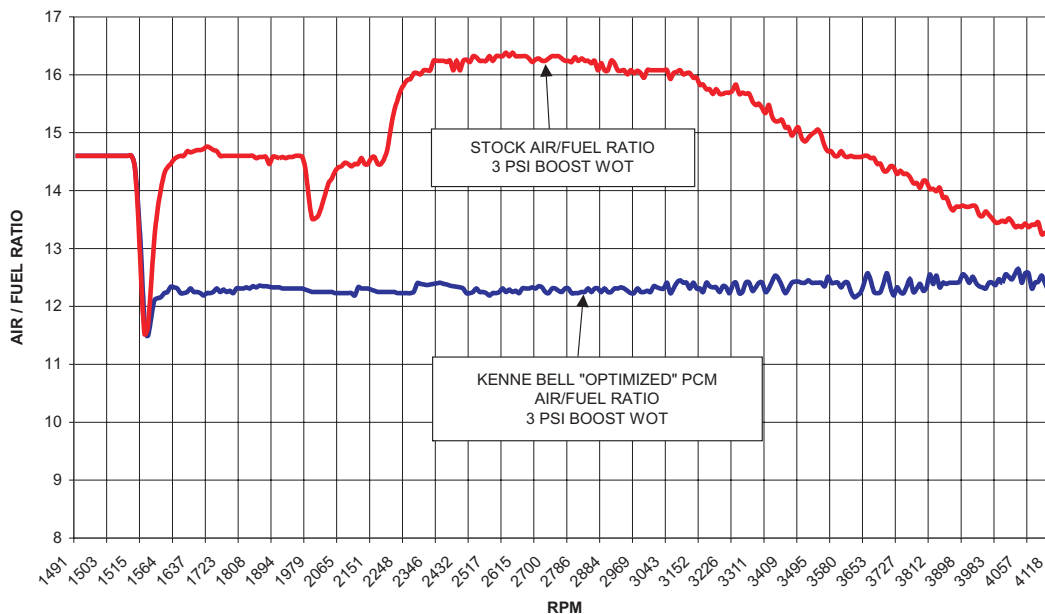
KENNE BELL OPTIMIZER II™ vs STOCK ECM



KENNE BELL OPTIMIZER II™ vs STOCK ECM

Look at how the lean wandering AF ratio affects HP and torque at WOT. Check out all that lost power and torque. Up to 25HP and 50 ft lbs are lost without the Kenne Bell OPTIMIZER II™ re-calibration of the stock ECM. These tests were conducted at only 3 psi boost and gets even worse, of course, at higher boost levels. Yes, our kits require your ECM be sent to us for re-calibration, but as you can see from the HP and torque losses, even at 3 psi it is necessary.

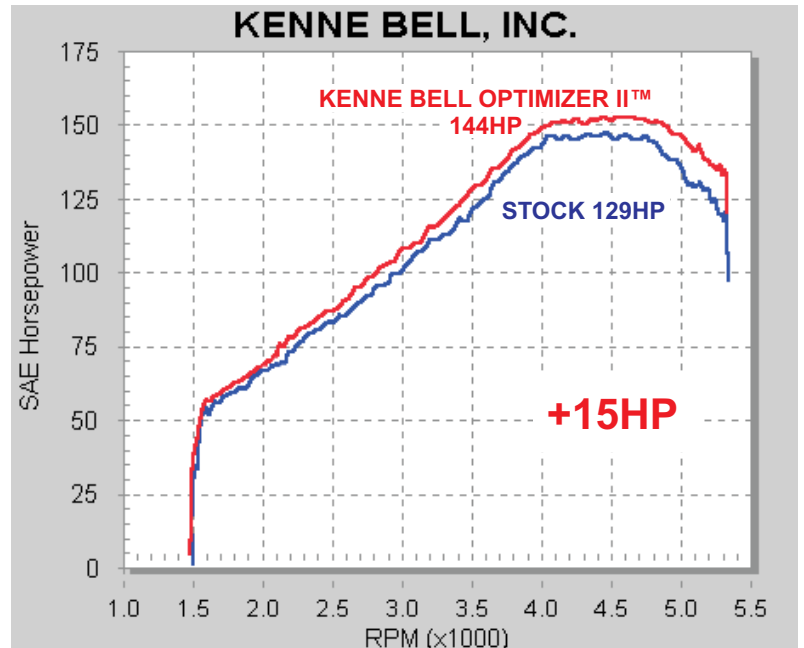
4.0 SUPERCHARGED INTERCOOLED JEEP AIR/FUEL COMPARISONS OF UNMODIFIED FACTORY PCM vs KENNE BELL PROGRAM - Wide open throttle runs



The graph above was datalogged from a 3 psi dyno run to compare the Kenne Bell "flatline" 12.1-12.5 AF ratio to the unmodified factory ECM AF ratio of 16.3-13.2. So, someone told you "The AF ratio is O.K. without re-calibrating the stock ECM." Still don't believe that the factory ECM has to be modified for a supercharger? Read on. Check out what the AF (air fuel) ratio looks like at a mere 3 psi boost with an unmodified factory ECM vs. one with the Kenne Bell program (OPTIMIZER II™). *Note: The ideal AF ratio range for a supercharged engine is 11-12.5. 13.5 is dangerously lean and the 16+ in the above example is ridiculously lean. An excessively lean AF ratio not only reduces HP and torque, it can damage the engines pistons, rings, bearings, rods etc. Ratios below 11.1 are too rich and also kill HP. Remember that engines do not run better on "more" fuel. They run best on "ideal" AF ratio. The basic problem with using the stock ECM program at WOT with a supercharger is the ECM is locked in "lean" closed loop at WOT until 2200 rpm, then goes to crazy lean and finally tapers into acceptable 12's - but only at 5000 rpm. Your engine can be destroyed by then! Now, without modifying this fuel curve through the factory ECM, how is it possible to alter this ridiculous fuel curve into a flat, safe, consistent delivery of fuel to the engine at WOT? It isn't. The only way to achieve safe consistent AF ratio and power is with the Kenne Bell OPTIMIZER II™ (see 12.2 ratio in graph). And larger injectors are not the answer unless the stock ECM is re-calibrated. If the injectors should lower the dangerously lean AF ratio to 12.5 or 25% between 2300 and 3000 rpm, then what happens at 4000, 5000 - or the 14.7 ratio (closed loop) between 1500 and 2300. Obviously, the 4.0 Jeep demands larger injectors and a re-mapped "flatline" fuel curve. AF ratios that vary a whopping 25% are simply not acceptable for performance or engine reliability.*

OPTIMIZER II™

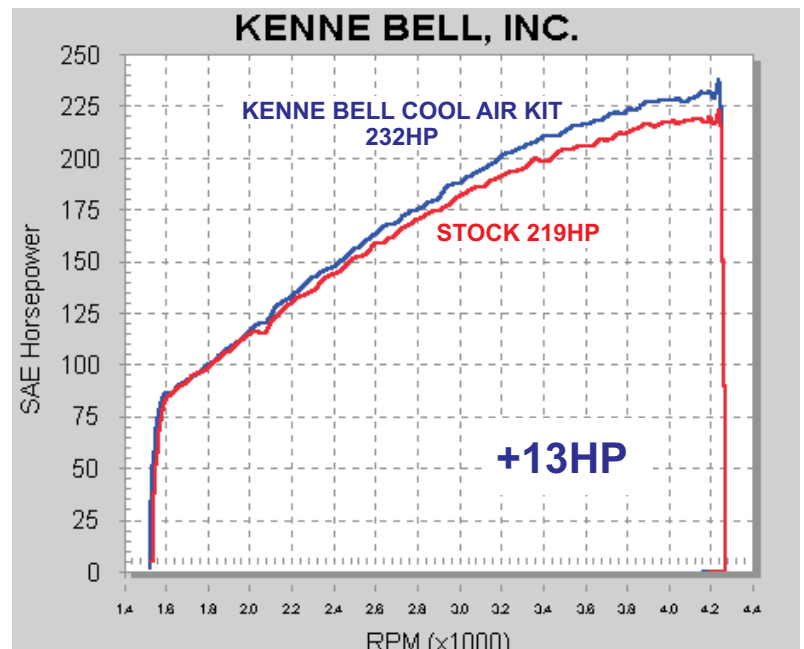
The Kenne Bell OPTIMIZER II™ optimizes the fuel and spark in the stock ECM (see catalog or website for more detailed information). Developed on the Kenne Bell dyno with our Jeep Wrangler during our supercharger kit development program. Big 15HP gain at 5000. Great companion product to the Kenne Bell Cool Air Kit. Requires premium fuel. No other changes required. *Note: Stock ECM must be sent to Kenne Bell for reprogramming. To purchase the OPTIMIZER II™ Upgrade, simply fill out the OPTIMIZER II™ Order Form, attach the Label and send us your PCM.*



KENNE BELL OPTIMIZER II™ vs STOCK

COOL AIR KIT

Kenne Bell has been engineering cool air kits for 30 years. Our new 4.0 Cool Air Kit was also developed on the Kenne Bell dyno. Same kit supplied with our supercharger kits. It is a direct bolt on replacement for the stock restrictive filter assembly. Big 600HP cone filter and plastic canister to insulate filter from heat. Cool air is fed through the fenderwell into the Kenne Bell canister thereby eliminating hot underhood air. Jeep underhood air temp can reach 200+ degrees. Every 10° rise in inlet temp will reduce HP approx. 1%.



KENNE BELL COOL AIR KIT vs STOCK INLET