

# KENNE BELL

## TECH, TUNING TIPS & DYNO TESTS

### 4.6 GT Dyno Test Summary

The test vehicle was an '02 Mustang GT, 100% stock except for a cat back exhaust. The Kenne Bell Twin Screw Supercharger Kit was then added. Included in the kit is the Kenne Bell BOOST-A-PUMP™, 36 lb injectors and MONO CHIP (SWITCH CHIP® is optional \$99 extra). All 3 are absolutely necessary for proper operation and tuning of this kit.

#### PULLEY SIZE / BOOST / PULLEY RATIO / PEAK HP

Supercharger Pulley	Pulley Ratio	Boost Rating	Kit Type ★=Standard Kits 6 psi & 9 psi	Stock Meter, TB & Filter	Add Kenne Bell Cool Air Kit	Add Kenne Bell 90mm Meter (no screen)	Add 70mm Throttle Body	Add 75mm Throttle Body	Add Kenne Bell 75mm Inlet Kit
Stock	-	0	-	245	250	250	250	250	250
3-7/8"★	1.67	6	Non Intercooled	351	357	361	365	365	365
3-1/2"	1.85	8	Intercooled	379	382	387	395	395	396
3-1/4"★	2.00	9	Intercooled	405	408	418	427	428	431
3-1/8"	2.08	10	Intercooled	416	422	432	442	441	449
3"	2.16	11	Intercooled	434	441	449	452	452	461
2-7/8"	2.26	12	Intercooled	447	456	469	471	470	484
2-3/4"	2.36	14	Intercooled	463	476	489	492	490	507

Note: See Catalog and Website for more info on Kenne Bell Supercharger Kits, Throttle Bodies, 90mm Meter, Cool Air Kit, Gauges, BOOST-A-SPARK™, Tech & Tuning Tips, Dyno Tests etc.

**NOTE:**  
90mm meter, 75mm throttle body and cool air kit will increase boost 1-1.5 psi in the 9-14 psi range.

- Divide rear wheel HP above by .85 to determine engine (flywheel) HP.
- One belt works with all pulley sizes 3-3/8" - 2-3/8".
- 6 psi kit is Non Intercooled.
- 8-14 psi kits are Intercooled.
- Kenne Bell MONO CHIP (POWER) included with all kits. SWITCH CHIP® (2 calibrations - POWER & SHOOT OUT) is \$99 extra.
- 507HP is limit of 36 lb kit injectors.
- Kenne Bell BOOST-A-SPARK™ Ignition highly recommended after 10 psi boost.
- Always use 1 heat range cooler spark plug for supercharging.
- Thoroughly clean back of supercharger pulley and front seal ring with lacquer thinner so all grease or oil is removed. This is a FRICTION drive.
- Keep engine rpm below 6000. DO NOT remove rev limiter.

### INTRODUCTION

The Kenne Bell Lightning and Cobra Supercharger Upgrade Kits were a resounding success. Who can deny the new Twin Screw makes gobs of power and torque. The 4.6 kit is probably the most exciting and rewarding new kit we've ever engineered. The late '99 up 4.6 was a very willing and efficient recipient for supercharging. HP is more than double (507 vs. 245 stock) and approx. 50 more HP than an '03 Eaton Cobra at 8-9 and 14 psi. Now that is IMPRESSIVE! The 4.6 Twin Screw Kits are available in "9 psi Intercooled" (405HP) and "6 psi Non Intercooled" (351HP) as compared to 245HP stock. And you won't get sleepy or hungry waiting for the boost (HP and torque) to build up. The "Intercooled" Kit can run up to 14 psi boost (507HP) with pulley changes. No chip re-calibrating is necessary, even with cool air kit and throttle body (only an octane change is required). The 90mm does require a chip calibration. 507RWHP converts to over 600 engine HP! Pulleys are available in 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 psi and can be changed in a few minutes to fit any application. The same belt is used with all pulleys allowing easy quick boost adjustments. The "Non Intercooled" Kit is designed so it can be upgraded to the "Intercooled" Kit. The Kenne Bell MONO CHIP included with the kit is calibrated to maintain a consistent AF ratio through a wide HP and boost range (6-14 psi) so ongoing "upgrading" is not necessary. Just add octane as required. The kit makes impressive power numbers at any rpm and boost level with zero "boost drop off," yet it is flexible, tuneable and upgradeable.

### TESTING

As is our policy with all kits, we attempt to answer any technical questions you might have about our 4.6 kit and how it relates to other products i.e. inlet, exhaust, fuel system etc. Kenne Bell has spent many hours testing and analyzing the HP potential of other bolt on products at various HP levels. Since positive displacement superchargers are particularly sensitive to inlet losses, we devoted considerable dyno time to inlet components (cool air kits, filters, throttle bodies, mass air meters, inlet tubes etc.). The testing resulted in some new exciting Kenne Bell products. Check out the dyno tests. Keep in mind that these are not just "quicky" dyno tests. The tests were all done "the Kenne Bell way." To maintain accuracy and credibility, we monitored and data logged AF ratio, boost, fuel psi, inlet temp, ambient temp, intercooler water temp in and out, spark timing, load, ECT, MAF, OAT (outlet air temperature), vacuum (loss) behind the filter, meter, throttle body etc.

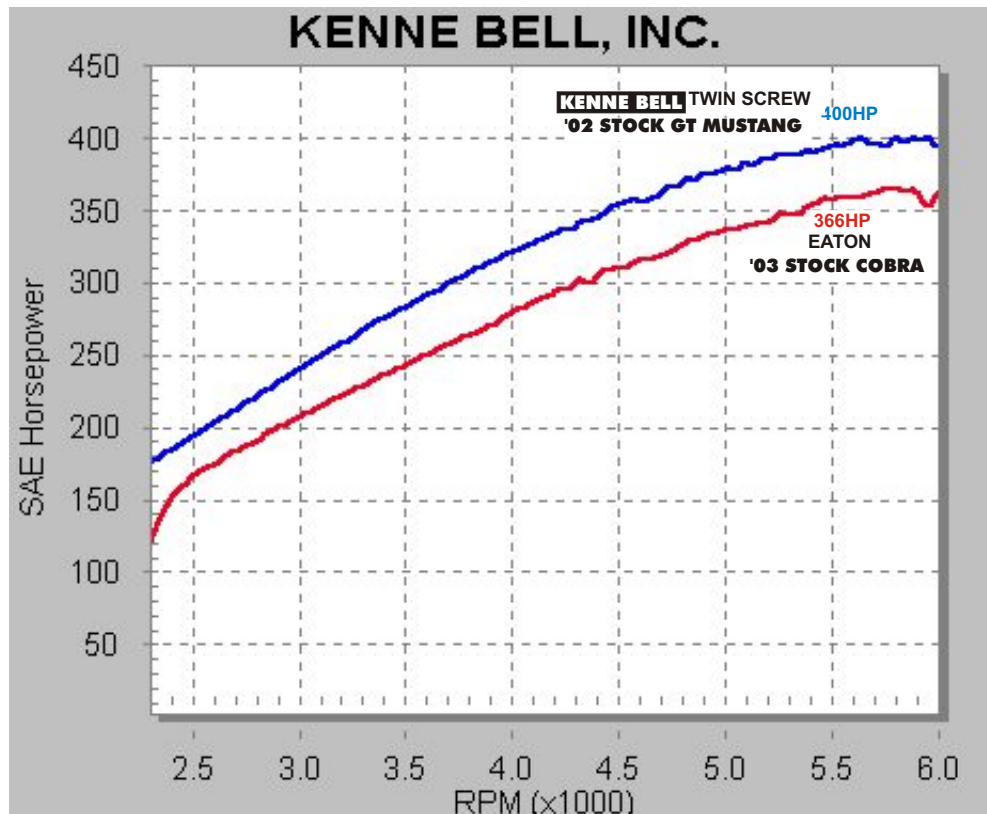
Note: The '02 GT test car was 100% stock except for a cat back exhaust. See first column for dyno HP tests with supercharger kit added.

First the media compared a Kenne Bell Twin Screw to the factory Eaton/Roots on a 4.6 2V GT Mustang. Then the superchargers were compared on a 5.4 2V Lightning. Next on a 4.6 4V Cobra (see Website for media reprints).

Since the '03 Eaton supercharged Cobra appears to be the benchmark for new Musclicar performance, we compared the stock '03 Eaton supercharged 4.6 Cobra to a Kenne Bell supercharged 4.6 '02 GT Mustang at the same 8-9 psi boost (9 psi street/8.5 psi dyno). Note: Peak "street boost" is typically .5 psi higher than "dyno boost." The two primary power variables, AF ratio and timing were also the same, 11:1 and 22° respectively.

The Cobra made a respectable 366HP, but the Kenne Bell Supercharged GT topped it with an incredible 400HP for a 34HP edge at 9 psi. The difference at 13.5 peak boost was an equally impressive 46HP (463HP vs. 417HP). With the Kenne Bell Cool Air Kit, 75mm and "Big Tube" and 90mm meter, the power jumped from 463 to 507HP at the same 13.5 psi boost. With matching inlet components including CoolAir Kit, the Cobra made 451, still 56HP short of the 4.6's 507HP.

The 4.6 2V engine impressed us. It is very responsive to the Kenne Bell Twin Screw concept. They are the perfect match. A free breathing highly efficient Ford engine with all the seat pinning low and mid range performance that only a Kenne Bell engineered Twin Screw kit can provide. And there's no power or boost drop off at high rpm. Ask the almighty Cobra how it feels about all this.



**STOCK '03 4.6 COBRA vs KENNE BELL SUPERCHARGED '02 2V GT MUSTANG**  
**REAR WHEEL HORSEPOWER & TORQUE**  
(DIVIDE BY .85 FOR ENGINE HP & TORQUE)

## TECH & TUNING TIPS 4.6 Mustang GT

**4.6 2V ENGINE** - In 1996, we designed a kit for the 4.6. The '96-'98 engines were rated at 215-225HP. Then in 1999, Ford stepped up the power to 260. The increase was due mostly to improved heads. The 4.6's impressive power numbers could not be achieved if the VE (volumetric efficiency) was not potentially high to begin with. We were able to more than double the rear wheel power (245-507HP) with only 14 psi (approx. 2 atmospheres) of boost. Using the .85 conversion factor from RWHP (rear wheel horsepower) to EHP (engine horsepower) the 507RWHP equates to 596EHP. That is one hell of a lot of HP potential. The supercharger has plenty more power left in it, but the 75mm throttle body limits the HP (see "2.6L 4.6 GT Tech Tips). Yes, we've made 550RW / 647E horsepower at 18 psi, but that's "competition only" and isn't recommended. So combining an ultra efficient 90% Kenne Bell supercharger with the high VE 4.6 and a free breathing inlet and the perfect combination is born. It's efficient enough to make more HP than a stock Cobra at both 9 and 14 psi. Pound for pound of boost, this kit on a 4.6 is hard to beat.

**INLET SYSTEM OVERVIEW** (See 4.6 Dyno Test Summary) - The Kenne Bell inlet manifold is designed to accept either the stock, 70mm or 75mm throttle bodies. The manifold itself is capable of handling 600+HP. Extrude honing of either the inlet or discharge manifolds is not necessary. Although the factory throttle body and or meter are adequate for a stock HP engine, a larger throttle body and chip calibrated meter will increase power with a supercharger at any boost or power level. Actual gains will depend on HP level/boost (see Dyno Tests). Look for 6-12HP for the Kenne Bell Cobra Cool Air Kit, 4-13 for the Kenne Bell 90mm Meter, 4-11 for the 70mm Throttle Body and no gain for the 75mm with the stock inlet hose. *The stock rubber inlet hose between the mass air meter and throttle body is restrictive.* It didn't flow sufficient air to support the 75mm throttle body so we designed a new larger hi-flo molded plastic tube to match the big 75. Then it came to life. This Kenne Bell 75mm "Big Tube" Kit (F2003) coupled to the 75mm Throttle Body (F2004) is then good for up to 20HP over the stock tube and 65 mm, and 15HP more than the stock tube and 70mm. Again, DO NOT use the 75mm without the Kenne Bell 75mm Tube Kit.

**AIR FLOW** - As with any other inlet or exhaust component(s) "if there's no restriction, there can't be any gain." Raising HP/air flow in and out of the engine incrementally increases potential restriction and losses. At Kenne Bell, we use special atmospheric pressure sensors to analyze these restrictions. We work with superchargers, manifolds, meters, throttle bodies, heads, exhaust, headers etc. on a daily basis. We are a R&D and manufacturing company with a rich heritage in vehicle tuning. For example: We mount a sensor behind each component to measure it's respective restriction, if any. Imagine a vacuum gauge behind the filter, MAF meter, throttle body, front and rear of the inlet manifold. Is there any better way of monitoring the component restriction? (See "Inlet System Development and Testing").

**COOL AIR KITS** - Like meters or throttle bodies, the best product is the one that registers "0" restriction for the particular application. Equally important is it cannot be exposed to hot underhood air. When will everyone get this right? A 10° increase in inlet temperature will reduce power 1%. It can be 200° under the hood vs. 70° in the fenderwell. Do the math. This is how dynos are calibrated for ambient temperature. Kenne Bell Cool Air Kits are all "cool air suckers" and HP rated, not guessed at. The Kenne Bell Cobra Cool Air Kit (F1009) fits the Cobra and GT 4.6 engines and is highly recommended at any power level. Both have "0" loss at 700HP with "0" restriction. See Dyno Tests for HP gains. Note that the higher the engine HP, the greater the increase in power from a Kenne Bell Cool Air Kit.

**MAF METERS** - There's another saying around Kenne Bell, "There's a size for every application. Some are just right, some too small and some too big." Some meters make more power by leaning out the air fuel ratio and nothing from the larger size. If a meter or any other component has "0" restriction, it simply cannot improve performance. However, in the case of meters, it's always best to choose one on the larger size, if it's accompanied by a matching chip for the particular mass air slope (the flow at any rpm) and size. Adding the Kenne Bell 90mm Meter requires a new Kenne Bell SWITCH CHIP®. NEVER install an aftermarket meter on our kits without a properly calibrated chip.

### MASS AIR METER SCREEN

We test everything. Another neat feature of the Kenne Bell Cobra Cool Air Kit is that it is designed to be run with or without the mass air meter screen. Removing the screen increases HP so we recommend leaving it out when using the Kenne Bell Cool Air Kit.

- At 433HP, removing the screen increases power 4HP.
- Removing the screen is not a good idea if eliminating the filter.
- Always index your meter. Install it at exactly the same angle as stock.

### THROTTLE BODY SPACERS & INLET FANS

No power gains whatsoever according to our dyno. There's a big inline fan that claims "35+HP and 31% increase in MPG!?" It was tested by Richard Holdener. It made 2-3HP at very low rpm-not 35!

### THROTTLE BODY

The stock 65mm throttle body is 616 cfm, our 70mm is 726 cfm and the 75mm is 850 cfm. Both the 70mm and 75mm make good power over the 65mm. Note that the 75mm can only be used with the "Big Tube" Inlet Kit as the stock tube between the meter and throttle body is restrictive. It only flows 600 cfm, barely enough for the 70mm. Up to 25HP increase at higher HP levels with the 75mm and "Big Tube." The 70mm is a direct bolt on and makes up to 11HP over the stock 65mm.

### INTERCOOLERS

We've thoroughly researched and tested the Ford and aftermarket 4.6 Intercoolers. The Kenne Bell design is so efficient - it's almost 90% - we've concluded that it's best left as is. We data logged a mere 1 psi loss at 9 psi (400HP). It won't get any better than this. If someone claims they have a better one, ask to see all the data and not just the rhetoric. Intercooling is not new to Kenne Bell. We've been engineering and selling intercoolers since 1987 for the infamous Buick Turbo V6's and then the Syclone/Typhoon. With the new air to water technology, our tests indicate that our air to water can match the air to air efficiency.

## INTERCOOLER COOLING

Kenne Bell was first to test and clarify this industry misconception. Intercoolers DO NOT make more power by cooling the air. There is no way that lowering the charge temperature after the supercharger with an intercooler, a larger intercooler or ice water can magically inject more oxygen molecules and increase HP. For actual third party witnessed tests, see "Miata Madness" in Kenne Bell Tech Tips on our website. Although these tests were run on a Miata, we've also tested Mustangs, Dodges, and GM applications with the same results. Believe the Kenne Bell tests. Read our tech articles. Save your money. Lowering the coolant temperature AFTER a supercharger only allows the engine to run more spark or boost on a given fuel octane. However, a lower coolant temp does resist detonation. That is very good, but you can't run an ice cooler on the street for very long. That's not practical. Yes, lowering the air temperature BEFORE the supercharger will, of course, increase power 1% for every 10°.

## INTERCOOLER COOLANT

Never run tap water only in an aluminum intercooler or engine, unless your goal is to make it corrode and leak. Water is the best coolant known to man. If you choose to use water only, use distilled water. Coolant will not freeze, even at temperatures below 32°. Put ice cubes in a coolant container and the coolant will read 50°. Touch the probe to an ice cube and it reads 32°. As mentioned before, cooler intercooler fluid does not increase power. We first learned this in 1986, 17 years ago when testing our Buick Turbocharged GN's. I personally froze intercoolers with CO2, NOS, NO2, Syltherm, and acetone. In our company's 35 years of existence there aren't many concepts we haven't tried or tested. One thing is for certain, cooling the air after the supercharger, with no other changes to the engine, will not and cannot increase HP.

## FUEL SYSTEM OVERVIEW

We speak from experience. Kenne Bell uses a sophisticated one of a kind fuel flow bench capable of testing injectors, pumps, fuel lines, fuel rails, regulators, filters, chips or any other component related to fuel systems or hydraulic engineering. The flow bench, coupled with our dyno, scanners, data acquisition, and other tools allows us to pass on our findings to our customers. We recommend reading "Fuel Pump Figuring" on our website. The 4.6 GT, Cobra and Lightning fuel systems have been extensively tested on the Kenne Bell flow bench and dyno. They are markedly different in operation. Those who spout free advice proclaiming "you need bigger injectors, bigger pumps, adjustable regulator, bigger fuel rails, more fuel, etc..." would be better to first ask 1. How much power the engine is making? 2. What the AF ratio is, 3. Total timing, 4. Boost, 5. Fuel pressure, and perhaps 6. What kind of fuel system is it? The stock 4.6 GT, Cobra and Lightning fuel lines and rails are adequate for at least 750HP. We've make 940HP with stock fuel rails.

To summarize, more fuel doesn't necessarily make more HP. Ideal AF ratio always makes best power. Higher fuel pressure always increases fuel flow but is not acceptable at idle or part throttle. Avoid adjustable regulators. The best method of increasing fuel pressure on a returnless system like the 4.6 GT is with a Kenne Bell BOOST-A-PUMP™. That's precisely what it was designed for. FMU's aren't recommended on the 4.6 GT nor are adjustable regulators, inline pumps or larger in tank pumps. It may appear that we are overstating the importance of the BOOST-A-PUMP™ and the BOOST-A-SPARK™, but all we're attempting to do is give our customers the benefit of our experience. As Diablo Chip dyno operator, Pat Stajdel said after dyno testing Nitrous Pete's Kenne Bell supercharged Cobra, "We couldn't even dyno test it without the BOOST-A-PUMP™ and BOOST-A-SPARK™. They solved all the fuel and ignition problems, even at 24psi boost."

## FUEL PRESSURE REGULATORS

In 1990, Kenne Bell was the first to introduce a billet aluminum adjustable regulator. The Lightning still utilizes a regulator and a return system. Today we wish we had never seen one. They create far more tuning and driveability problems than they overcome. An adjustable regulator can safely increase fuel pressure around 8psi. This 6% richer fuel mixture can help at WOT. Beyond 8psi there are idle and driveability problems as the EEC has difficulty trimming the fuel. That means washed cylinder walls, ruined cats, fouled plugs, etc. Obviously, we don't recommend them for the Lightning, the Cobra (returnless) or 4.6 GT (returnless). Fuel management is best handled with the Kenne Bell SWITCH CHIP® and the BOOST-A-PUMP™ (up to 507RWHP). HP levels above 507HP requires larger injectors and a revised SWITCH CHIP®.

## FUEL PRESSURE

Leave the fuel lines, rails, pumps, and fuel line stock. The stock fuel pressure is 32 psi at idle. From our experience in tuning, the 36lb Kenne Bell injector is all done at 507HP. AF ratio jumped from 11:1 to 12:1 at this power level. Although 12.1 is acceptable (AF ratios of 12.5 make best power and can be used if there is sufficient octane and the MAF meter is accurate). *NOTE: If the HP gain is the result of higher boost, don't forget to allow for that inlet manifold back pressure. Based on our years of testing, we're determined that 10psi of fuel pressure will affect AF ratio 8%. 5psi is 4% etc. To determine the new flow rate of an injector:*

$$\sqrt{\frac{\text{New Pressure}}{\text{Old Pressure}}} \times \text{Old Flow Rate} = \text{New Flow Rate}$$

Again, keep in mind that the boost increase must be subtracted from the injector pressure.

In conclusion, we use 36lb injectors and the BOOST A PUMP™ at 507RWHP. Get a good calibrated fuel pressure gauge like the Kenne Bell and pay particular attention to any fuel pressure drop off.

The 4.6 GT uses the latest returnless fuel system (no regulator). It constantly regulates Delta (more on this later) fuel pressure to a mere 40 psi, even at WOT. The stock pump is adequate for stock use, but with supercharger boost, the added inlet manifold pressure restricts the fuel exiting the injector. Example: At 10 psi boost the 35 lb/hr injector is only a 30 lb/hr injector (40 psi-10 psi inlet manifold pressure forcing fuel back into the injector = 30 psi effective pressure). At 40 psi, there would be no fuel whatsoever exiting the injector. Adding 10 psi of boost drops the injector rating from 35 to 30lbs. At 20 psi boost, the injector is a 24lb. There is no regulator to increase fuel pressure with boost. Therefore, the best solution is to stabilize fuel pressure with a BOOST-A-PUMP™ and modify the chip fuel strategies for a safe consistent AF ratio from 6-14 psi. This requires a dyno and all the tuning tools. The Kenne Bell SWITCH CHIP® is the answer. It's already calibrated. Did you know that if fuel pressure is increased on a 4.6 GT, the EEC shortens the injector pulse width to reduce fuel flow? And if the pressure is below 39 psi, the EEC reduces fuel pressure. Hopefully, you can see the 4.6 GT needs both the BOOST-A-

PUMP™ and SWITCH CHIP®, and why dyno testing and data acquisition is so important.

## IN TANK PUMPS

The Kenne Bell BOOST-A-PUMP™/SWITCH CHIP® will supply enough fuel for 507HP with 35lb injectors. Leave the fuel system as is unless exceeding 507HP. Then 42lb or 55lb injectors are the next choice. The BOOST-A-PUMP™ combined with the stock pump is not maxed out at 507HP. There is still some left. Note: Kenne Bell has specialized in fuel systems for 16 years. We have our own fuel flow bench. We developed the BOOST-A-PUMP™ to solve all the inherent problems of larger in tank pumps, inline pumps and regulators. "Use the fuel only when you need it or you'll heat it."

## INLINE PUMPS

Another product whose time has passed. Noise, lag, surging, and fuel heating have plagued this concept for years. We call them "vampire" pumps because they suck the in tank pump dry (down to 0 psi). Use the BOOST-A-PUMP™ for 1-50% more fuel at WOT. It's so easy to install, doesn't heat the fuel (fuel begins to boil at 95 degrees), operates only under boost and eliminates the inline pump pressure "lag"-the last thing you need with a supercharger. Contrary to the "myth" that increasing voltage to the pump shortens its life, all high pressure pumps are rated to safely run up to 17.5 volts.

## WHY HEAT FUEL?

Why heat fuel? For the 50 yrs I've been around drag strips, the racers use "cool cans" to cool the fuel. I've never seen a "fuel heater," have you? Then don't increase the in tank pump size on systems with a regulator. A regulator controls pressure by relieving, bleeding, or recirculating it back to the tank. Larger than stock in tank pumps force the regulator to bypass the unnecessary fuel. The added fuel flow through the orifices in the regulator and the return fuel line creates friction, pressure loss, and HEAT. Fuel begins to boil at 95°. Higher temperatures reduce octane. Be smart, not fuelish. Bigger pumps are not necessarily better. In conclusion, design the system so the pump flow more closely matches the engines fuel requirements or simply use the BOOST A PUMP to increase fuel delivery only when needed. That's why there's a Kenne Bell BOOST-A-PUMP™. See "Fuel Pump Figuring" on our website.

## SUPERCHARGER PULLEYS

Use only Kenne Bell plated steel pulleys. We DO NOT recommend aluminum supercharger drive pulleys or "saw slotting" pulleys for street use. It eats belts. A pulley change on our Twin Screw takes a few minutes (see literature for pulley size availability) and covers a range from 5-14 psi. Note: Actual pulley boost will vary up to 1.5 psi depending on the inlet system and power level. Less inlet loss means more boost.

## BELT WRAP

Surface area contact is the key to efficient belt performance. The larger the supercharger pulley, the more surface area available to grip the belt. Use the formula:  $3.14 \times \text{Pulley Diameter} = \text{Pulley Circumference}$  for 360 degrees. Example: 2.5" vs. 3" pulley.  $3.14 \times 2.5 = 7.85$ " whereas  $3.14 \times 3 = 9.42$ " (20% more surface area). A good serpentine pulley system design maximizes the degrees of belt wrap around the pulley. And 8 ribs are better than 6 rib belts because the additional ribs provide 33% more surface area. Therefore, the Kenne Bell is easier on belts and can run smaller pulleys than the Eaton because it requires 38HP less to drive - and uses larger diameter pulleys.

## SERPENTINE BELTS

Use Kenne Bell or Dayco. Cross ribbed belts do not work as well as solid rib belts. It takes engine HP to drive any supercharger, whether it is a Twin Screw, Centrifugal, or Roots type. The more efficient the supercharger, the less HP is required to drive it and the less engine HP (parasitic loss) is wasted. For example: at 14.5psi and 695 cfm, the Eaton 112 consumes 84HP at 13000rpm. The Kenne Bell Twin Screw uses only 58HP (30% and 26HP less) and typically requires 2 less belt ribs to drive. Belt width (6, 8 or 10 rib) recommendations should be left to the supercharger manufacturer. We use a 6 rib belt on the 4.6 GT.

## IGNITION COILS

Have you ever looked at the massive wiring a CD system requires vs. the 1 wire hook up of a Kenne Bell BOOST-A-SPARK™? The concept of one larger coil and a CD ignition is passe. Ford has switched to a "coil over" system with one coil per cylinder. The BOOST A SPARK concept attaches to the primary coil feed wire and increases energy to the coils from 1-50% higher than any ignition system available on the market today. It supplies over 2 amps at the plug, 10 times more than the OEM system. And it's a "long spark" and not a "short spark" like CD's. The Kenne Bell BOOST-A-SPARK™ is not necessary below 10psi, but is highly recommended from 11psi and higher on the 4.6 GT, Cobra and Lightning. The stock systems won't fire the plugs 100% beyond 15psi.

## ENGINE COOLANT

75% water 25% coolant is best ratio vs. the OEM recommended 50/50 ratio. Coolant is also a higher viscosity and requires more water pump HP to circulate. Water Wetter by Red Line Oil Co. is a coolant additive that can reduce "air bubble insulation" between the engine coolant jackets and the coolant itself. When the bubbles are present, they tend to air insulate the liquid from the engine metal, reduce heat transfer, impair the cooling process, and create hot spots which can cause detonation.

## SPARK PLUGS

Use one heat range cooler Denso T20EPR-U or NGK TR6. Gap at .035". The Kenne Bell BOOST-A-SPARK™ dialed to the "max" position with these plugs will fire to +26 psi. Use setting of 25% up to 21 psi. The BOOST-A-SPARK™ is the best insurance against engine misfire and backfire in either a Cobra or a Lightning. *NOTE: Torque plugs to factory specs. DO NOT overtighten. The threads in Ford heads are sensitive.*

## EXHAUST SYSTEMS

Sorry but we've seen little or no gain on a 4.6 GT. We do know that the Bassani cat back system with X-pipe and no pre-cats makes 15HP. That's as good as it gets. There will be more upcoming tests. The results will appear in Muscle Mustangs and Fast Fords Magazine. At 14psi, with stock exhaust and cats, we made 507HP. The Bassani is the best we've tested. Cats? I've never seen "high flow" cat(s) ever make any power over a stock cat. A cat will typically burn up 10HP on a 300HP engine. Dual cats lower it to 5HP. Run 600HP through duals (300HP per cat) and you're back to a 10HP drop.

## HEADERS

Long tubes make very little, if any, power or actually lose power according to our customer reports. They eliminate the pre-catalytic converters. That isn't 50 state legal. And don't confuse any power gains from removing the pre-cats with header gains. Pre-cat and cat removal will net around 10HP. In our opinion, headers for the 4.6 GT aren't worth the small peak power gains and expense. Always keep in mind that any power gain from exhaust (headers, cat back, and cats) is incrementally proportional to engine air flow/HP and reduced back pressure. That's why some products make "0" Hp on stock or +100HP engines but more on a +200HP engine. Every component has its limits. *Example: If the headers make 20HP at 700HP but nothing a 400, 500, and 10HP at 600HP why would you buy headers for an engine that will never make 600 or 700HP?*

## 4.6 GT CHIP TECHNOLOGY

The new 4.6 GT is very difficult to dyno test because of all the new variables i.e. boost, fuel pressure, cat modeling, closed-open loop, etc. There are several functions that must be stabilized and monitored for meaningful dyno tests. The 4.6 GT processor is unique. It uses a different strategy and format than earlier Ford processors. What works on the older EEC's doesn't work on the 4.6 GT. Our extensive dyno testing and data logging of air fuel ratio, boost, temperatures, etc. revealed some serious leaning out problems when increasing boost and horsepower with the stock calibration. For example, on the earlier '99-'02 Mustang returnless fuel systems, the simple addition of the proven Kenne Bell BOOST-A-PUMP™ increased fuel pressure and fuel delivery (approx. 8% per 10 psi), thereby compensating for the lean out. However, when pressure is increased on the later 4.6 GT's, the processor cuts back the injector pulse width, eliminates the additional fuel, and leans the engine. This is not acceptable.

The Kenne Bell SWITCH CHIP®/BOOST-A-PUMP™ combo will provide optimum spark and air fuel ratio from 245-507HP with 36lb injectors. There are two basic methods of increasing power with a chip-timing and fuel (optimum air fuel ratio). 11:1 is safest but is less power and 12.5 is leaner and best power. The optional Kenne Bell SWITCH CHIP® has two positions, POWER and SHOOTOUT. It won't get any better than this. AF ratio is set at 11:1 in the POWER mode and 10% leaner 12:1 in the SHOOTOUT mode. SHOOTOUT mode also has more aggressive spark timing (use octane here!). Expect up to 20HP in the SHOOTOUT mode but USE WITH CAUTION. 12:1 is LEAN and more prone to detonation (knock). If engine knocks, GET OFF THE GAS.

There are five ways to reduce knock. Retard timing, richen the mixture, increase octane, lower the boost or lower the temperature. Retarding the timing requires reshaping the spark curve so spark advance is reduced after 3500. The downside is that you lose 3-4HP per 1 degree of retard. 1psi of boost is 13HP. The easiest approach is to install a larger pulley and lower the boost-or add octane via mixing or straight 100-103 unleaded. You can "chase" knock and horsepower with a chip by changing fuel and spark curves (richer on top) and spark (retarding at higher rpm). If your goal is to diddle with these curves, go right ahead. We prefer the Kenne Bell approach of ideal fuel and spark calibration at all rpm. Then you juggle pulleys (boost) or octane to control knock. Sound easier? It is. *Note: We can only make recommendations and suggestions based on our dyno testing with the Kenne Bell SWITCH CHIP®.* You may wish to have your 4.6 GT custom tuned by the Kenne Bell Installer of your choice. Hopefully, you've read all of our Tech and Tuning Tips and other information and now better understand chip calibration.

We would also highly recommend reading the Eaton vs. Twin Screw comparison test "Snake Bite Hit" in the March '03 issue of Mustang 5.0 Magazine. It contains invaluable information and some great comparison tests.

## REV LIMITERS

NEVER increase engine rpm on supercharged engines. It's higher rpm, that through inertia loading, places greater stresses on the rods, pistons, and crank. (12.5% increase in rpm increases the loads 50%) Think about that one. Let the supercharger and boost work for you. It increases power incrementally at any rpm. Never overrev the engine and hit the rev limiter. On all Kenne Bell kits, the fuel injectors are not ramped but instead shut completely off. The fuel pumps remain on so there's a big fuel pressure spike. Keep supercharger rpm at a minimum by not over-speeding the engine. We don't ever recommend raising the rev limiter. Excessive rpm also causes "overboosting" because of the engine's reduced VE (volumetric efficiency).

## SUPERCHARGER RPM

Check the rpm in the 1/4 mile lights and at the shift points. Divide pulley size into crank size and multiply by engine rpm. Keep supercharger to 18000 maximum. Example: 6.5" divided by 2.5 = 2.6 ratio x 6000 rpm = 15,600 supercharger rpm. Use the torque and HP generated by the boost of the supercharger and not engine rpm. If the supercharger rpm at the end of the 1/4 mile calculates as excessive, then raise the gear ratio (lower numeric ratio). The higher engine torque from the supercharger will pull a higher gear. The 4.6 GT does not need to be revved beyond 6000 through the gears. DON'T OVER REV THE ENGINE. LET THE SUPERCHARGER WORK FOR YOU.

## BOOST

Expect about 16RWHP per psi boost with the Kenne Bell supercharger. 1.5 octane will support 1psi boost (test conducted by Kenne Bell for Muscle Mustangs and Fast Fords Magazine). 1 AF ratio=2 octane. 20 degree ambient or charge temperature=1 octane and 1 degree spark advance=1/2-3/4 octane. For more tuning tips see "Jim Bell's Supercharged/Turbocharged Performance Guide." Always remember that boost doesn't hurt an engine. It's the lack of sufficient octane that causes detonation whether the engine is supercharged or naturally aspirated.

## FUEL INJECTORS (DELTA PRESSURE)

We've said it before. More fuel doesn't make more power by itself. Ideal fuel/air fuel ratio makes the most power (around 12.5-13.0:1). We've seen stock 42lb injectors make 617HP at 12:1 and 85psi. The tables below list fuel flow in lbs/hr. for a 42 lb injector at 0psi, 15psi, and 20psi boost. Note how injector flow drops as boost increases and how it increases with fuel pressure. Yes, your 42lb injector flow is actually only 34lbs at 15psi. The flow out of the injector must overcome the manifold boost/back pressure of 15 psi.

FUEL PSI	BOOST		
	0 PSI	15 PSI	20 PSI
45	42	34	31
55	46	39	37
65	50	43	41
75	54	48	46
85	58	52	51

## NITROUS

We don't recommend any "dry" Nitrous system for a supercharged 4.6 GT, Cobra or Lightning. You're playing with fire. There's no easier way to blow an engine. If you must run Nitrous; 1- use a "wet" system and 2- have it custom tuned on a dyno with an accurate air fuel meter and the necessary tuning software and equipment before you even think about stepping on it. If you have to use this stuff, then add a Kenne Bell BOOST-A-PUMP™ for insurance.

## BUILT ENGINES

Kenne Bell has been around since 1968. We've built our share of engines. Quite often enthusiasts falsely believe that upgraded rods and pistons are necessary when they are not. The 4.6 doesn't have billet rods, but always remember what breaks rods. It's high engine rpm. Keep it down to 6000 max. Supercharging actually reduces inertia loading on the rods. And watch the detonation. Detonation increases heat which helps melt the upper ring lands. Forged pistons melt at about the same temperature as cast or hypereutectic. Forged are stronger and hold up much better under detonation, but cast lived very well in the turbocharged Buick V6's and Syclyone V6's at 25psi.

Choose your chip carefully and censor the advice you receive. "The world is full of experts who speak from inexperience." We highly recommend to use ONLY Kenne Bell chips with our kits.

## GEARS

Stock gears work very well with the Kenne Bell Twin Screw as these superchargers produce more torque at low rpm. Size for size, no other supercharger has a flatter fatter torque curve because no other supercharger makes as much boost in the low and mid range. Our superchargers have different requirements. They don't need low gears and/or high engine revs to generate boost. Gears don't make horsepower!

- Best 1/4 mile gear for the 4.6 GT is 3.73's.
- Keep supercharger rpm (drive ratio x engine rpm = supercharger rpm) to 18000 max.  
*Example: 3.27 x 5500 = 17985 or 3.0 x 6000 = 18000.*
- Ratio is determined by crankshaft pulley size divided by supercharger pulley size.  
*Example: The 4.6 GT engine rpm should be maximum 6000 rpm with a supercharger (2.73 ratio x 6000 = 16380).*

## TRANSMISSION

The Mustang has a strong trans. The Kenne Bell SWITCH CHIP® is recommended to firm up shifts and keep shift rpm points from "drifting". *NOTE: As power increases, the trans rpm shift points increase and must be lowered back to the stock shift rpm.* It doesn't help performance to over rev the 4.6. Max shift rpm should be 6000. All you're doing is needlessly over-revving the engine and supercharger. If you plan on upgrading or rebuilding the transmission, the #1 authority on this transmission is Injctech@comcast.net.

## SYNTHETIC OIL

Red Line is the best we've ever tested. We've documented a 15HP gain and 20 degree temperature reduction from synthetic oil in the engine, trans and rear end. The next best choice is good old Mobile 1 Synthetic.

## GAUGES

There are two gauges you can't do without, a boost and a fuel pressure gauge. We offer a great cockpit boost and fuel gauge package (see Catalog or Website). NEVER install a mechanical fuel gauge inside the cockpit. The Kenne Bell Electric Fuel Pressure Gauge is calibrated on our fuel flow bench and is a perfect match for our Boost Gauge.

## CAMS

Sorry, we don't have much data on 4.6 cams except the Comp Cams XE266HR 216/222 works great on the street.

## IGNITION TIMING / OCTANE / BOOST TUNING

Ideal spark timing is around 23°. For consistency, all our dyno testing was performed at 23° with an AF ratio of 11:1. Changing timing (advancing and retarding) or AF ratio (rich or lean) between runs is confusing and misleading. Our intent was to illustrate the performance gains of the Kenne Bell supercharger kits with various boost levels and bolt on products. With maximum available pump gas octane varying from 91 (California and Arizona) to 92 in some States and 93-94 in others, it is impossible to design a kit for maximum performance. With our 4.6 2V, 1 psi of boost will require approx. 1.5 octane and 1 octane will support 2° of additional spark (see "Jim Bell's Supercharged & Turbocharged Performance Guide" for more tuning tips). Since 1° timing = 4HP and 1 psi boost = approx. 16HP, octane has a big effect on the maximum HP that can be extracted from these engines. If it knocks, add octane, lower boost or reduce total spark timing - or a combination. If your goal is to make maximum power from this kit and fuel octane is not an issue, then run 23°-25°, 12.5AF ratio and 14 psi. 12.5 will make 11 more HP than 11.0. This kit makes a lot of HP - and cylinder pressure. If there's any doubt about octane level for competition - go overboard and use 100 unleaded or a mix. Don't let it knock. The Kenne Bell SWITCH CHIP® is recommended for quick easy timing changes where maximum performance with higher octane (94-100) is being used.

## FUEL OCTANE THE KENNE BELL EQUATIONS

We should all appreciate and understand the importance of fuel octane. Unfortunately, because of our laws and politics, the maximum available unleaded pump octane varies from 91-94 depending on the State. Here's the **Kenne Bell Octane Equation**, based on our years of experience, that you may find helpful.

**"1 octane will support an increase of 2/3 (two thirds) psi boost, 3/4° (three quarters) timing, 20° ambient temp, 1/2 (one half) point in AF ratio, 1/4 (one quarter) point in compression and 30% humidity."**

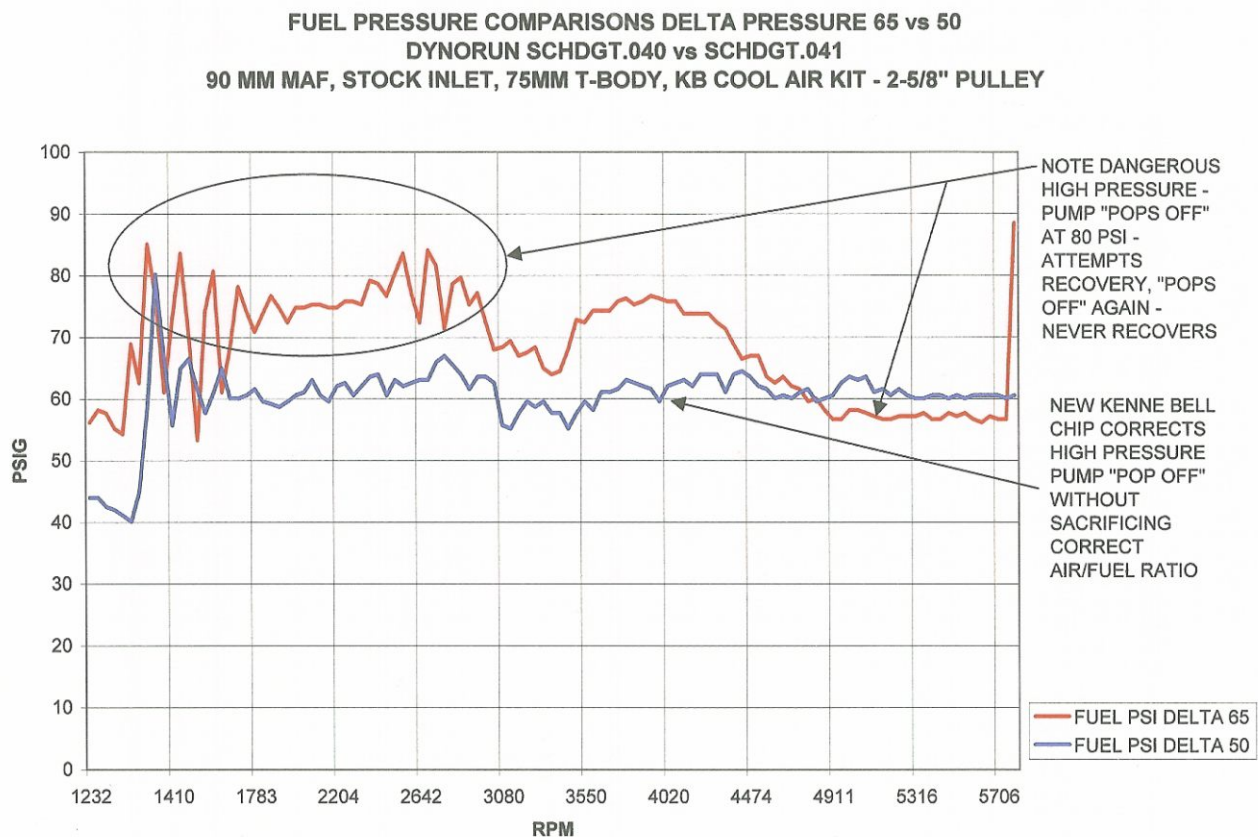
Also keep this guide in mind when tuning your car. Tuning? Ignition timing and AF ratio are the ONLY methods of increasing engine power. There is no "third" or "secret" dimension. Don't be misled or duped. Tuning is not removing, replacing or modifying parts. Here's the **Kenne Bell Tuning Equation**.

**"After attaining IDEAL AF ratio and ignition timing, figure 1° = 4HP and 1 AF ratio = 8HP."**

The above equation results may vary somewhat, but they're a good reference point. We're not here to argue or debate anyone's experience. Our goal is to help educate Kenne Bell customers.

## LEAN MIXTURES

Example: Yes, there is some power left in your 4.6 by leaning the engine from 11:1 to 13. We made 380HP at 7.0 psi, 3-1/4" pulley and 23° of timing on our non intercooled test car. And we can increase the 405HP at 9 psi to 425HP. Just don't go there unless you have sufficient octane and experience in tuning.

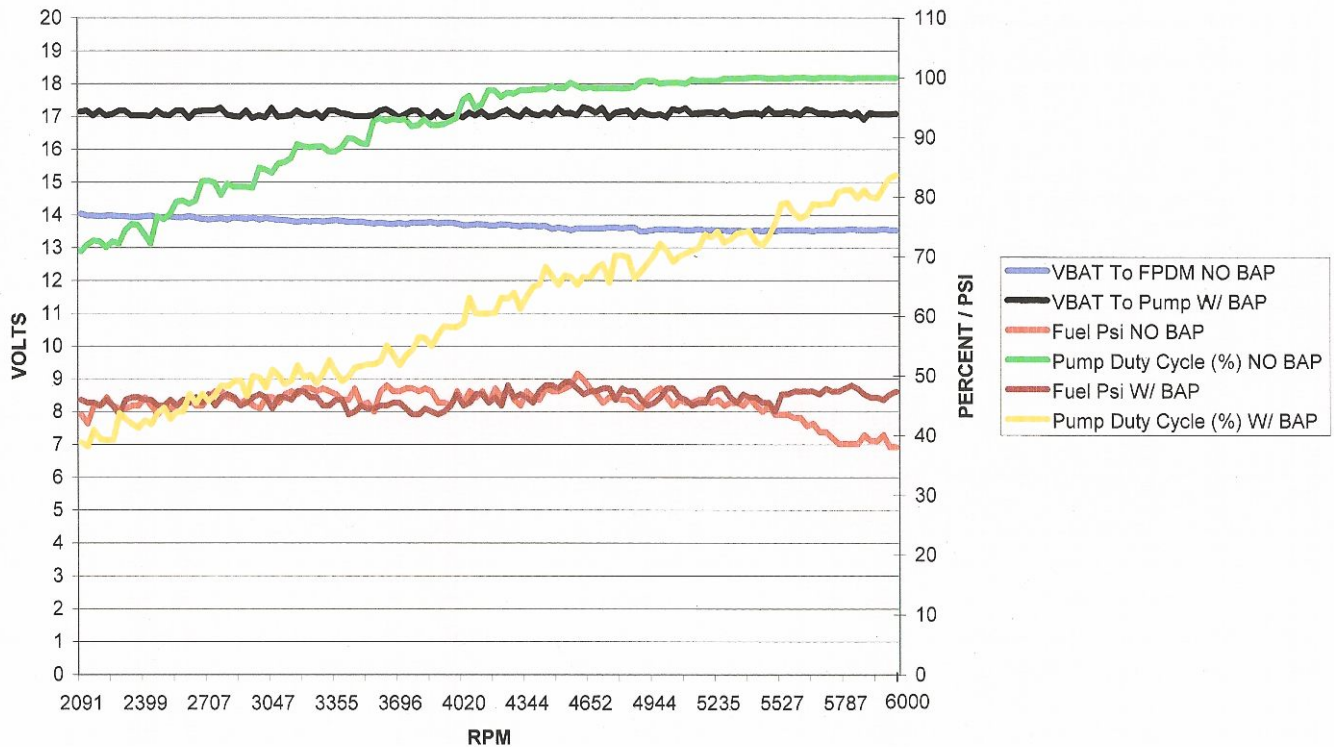


Here's an example of why chip calibration, injectors, mass air meter and fuel pump must work in harmony for the 4.6. This is a dyno run with correct fuel calibration and a chip **improperly** calibrated (fuel pressure varies from 55-85 psi and "pops off" at 80 psi). Note how higher fuel pressure is not always better. Question: Is this what happens when a larger pump is installed in lieu of a Kenne Bell BOOST-A-PUMP™? Think about it.

## RETURNLESS FUEL SYSTEMS

There is an abundance of theories and opinions on these systems. We believe the Kenne Bell BOOST-A-PUMP™ is unquestionably the best approach to increasing fuel delivery on a Ford returnless system. The Kenne Bell data logged graph below is undeniable proof of what happens to a stock pump and how the BOOST-A-PUMP™ overcomes insufficient fuel delivery. Take the case of our new 4.6 2V Mustang GT kit. We replaced the stock 4.6 19lb injectors with 36's, tapped in on one wire, added the BOOST-A-PUMP™ and supported 507HP with the stock pump. We didn't even raise fuel pressure. And the BOOST-A-PUMP™ had at least another 50HP of capacity left (557HP). So do you really need to drain the fuel, remove the tank, replace the stock pump and add larger fuel lines and rails that aren't necessary? That's a lot of complexity, work and labor cost. Good for the mechanic, but not for you. To help you better understand how the Kenne Bell BOOST-A-PUMP™ works, you may want to study the data logged tests on the 4.6 507HP Mustang.

'02 GT MUSTANG KENNE BELL SUPERCHARGED / INTERCOOLED  
BOOST-A-PUMP TESTS - NO BOOST-A-PUMP vs BOOST-A-PUMP INSTALLED  
6 PSI KIT 3-3/8" PULLEY - WOT 3rd GEAR RUN



### PUMP DUTY CYCLE

First of all, note how the stock pump was maxed out at around 4100 rpm with only 6 psi and 351HP. The pump duty cycle (green) is 100%. It's no longer cycling. That means it's all used up. The pump clearly cannot produce any additional fuel. With the BOOST-A-PUMP™ added (yellow), the duty cycle is only 80% and the injector pulse width has backed off from it's 100% duty cycle. Adding our BOOST-A-PUMP™ and 36lb injectors increased HP potential to 507HP.

### VBAT (VOLTAGE to PUMP)

The stock pump voltage is 13.5 (blue). The BOOST-A-PUMP™ increases the voltage to 17 volts (purple). That is how we up the stock pump capacity (remember the "myth" about voltage).

### FUEL PRESSURE

As can be seen from the comparison between the "Fuel PSI NO BAP (orange)" and "Fuel PSI W/BAP (red)", the stock pump is in real trouble and drops off dramatically at 5500, even with only 6 psi and 351HP. At this point, the EEC is commanding a given 11:1 AF ratio. Both the fuel pump and injectors are at 100% duty cycle. There is insufficient flow from the pump so the pressure drops and the engine leans out resulting in damaged pistons. Needless to say, it would get much worse at a higher power level than 351HP and 6 psi. Fuel pressure would then drop at a lower rpm and lower pressure. Conclusion: Use a BOOST-A-PUMP™ on any modified 4.6 that exceeds 300HP.

## OTHER PRODUCTS

A Kenne Bell Chip is included in all our 4.6 kits. It is calibrated to our injectors and should not require any recalibration up to 500HP. However, Kenne Bell can't possibly have all the answers all of the time about everyone else's products - or how a vehicle or it's components are modified. Case in point: We caution any Kenne Bell customer who changes mass air meters without recalibrating the chip. Any product (exhaust, headers, heads etc) that may improve HP will increase air flow and can "lean out" the engine. In a properly calibrated chip, the mass air meter compensates for the additional power/air flow by increasing injector pulse width (fuel flow) or regulating fuel pressure. Once the injector is maxed out, it must be upgraded and the chip recalibrated for the larger injectors. At 507HP, we see the Kenne Bell injectors are maxed because the engine begins leaning out from our calibrated 11:1 to 12:1. That is the "tuning limit."

## THE LIMITS

The fuel injectors are not the only limiting factor on a stock block 4.6 2V. It's the stock rods and pistons. They simply weren't designed for ultra high horsepower. We recommend H-beam billet rods and forged 8:1 custom forged pistons like the Cobra has chosen. A slightly shorter rod length accompanied by a deeper dish piston that increases swept volume about 10cc would also lower CR a full point allowing 2 more psi boost on a given octane. There are companies who supply "built" short blocks. Check with them on their power ratings.

## OCTANE - BOOST GUIDE (4.6 GT KIT)

Always use the HIGHEST FUEL OCTANE AVAILABLE. We recognize that fuel octane varies from State to State. All baseline dyno tests were run at 11:1 AF ratio and 23° timing to avoid confusion. Since the amount of boost an engine will tolerate depends on fuel octane, we vary the boost of our kits slightly with pulley size (see below). Therefore, for 91 octane, pulley size may be 1/8" larger than shown in the dyno tests. This allows us to maximize the kit output/boost for a particular fuel octane rating. If your engine knocks for any reason, GET OUT OF IT! If experiencing detonation, we recommend lowering boost level or increasing octane in lieu of retarding timing. It isn't excess timing, boost or lean fuel mixture that damages engines - it's the resulting detonation/knock/ping. See "Jim Bell's Supercharged/Turbocharged Performance Guide". Note: We only recommend NOS #12007 Off Road (red can) octane booster. One can in 8-1/2 gallons is 2.5 octane.

MINIMUM FUEL OCTANE	MAXIMUM RECOMMENDED BOOST	
	NON INTERCOOLED	INTERCOOLED
91	5	8
92-94	6	9
97 BLEND	8	11
100	10	14

## FUEL LEVEL

Never operate the vehicle in boost with less than a quarter tank of fuel. Low fuel level can cause the fuel pump to cavitate resulting in low fuel pressure. This can cause detonation that may result in severe engine damage. Get in the habit now and treat a quarter tank as if it is empty.

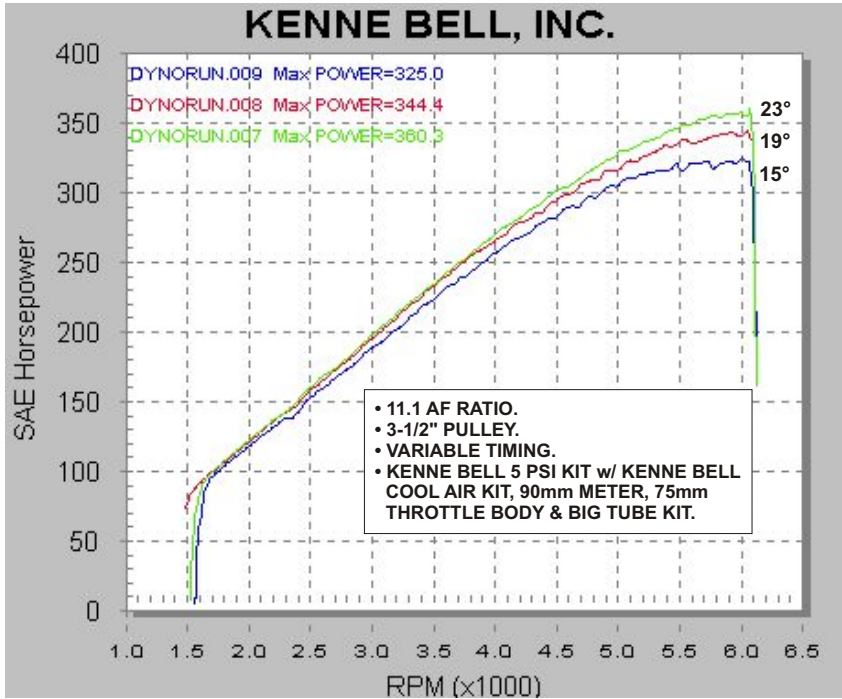
## TRACTION CONTROL (LATE MODELS)

Traction control is a very nice feature to have, although it may cause some very serious problems with your supercharged engine. When the factory traction control system is activated, it will lean the engine considerably and remove ignition advance in an attempt to reduce engine horsepower output. The rear brakes will also be activated to eliminate wheel spin. This, in theory makes for a very sound system. For a supercharged engine, this is not an ideal method. Traction control is to be used at the discretion of the driver.

# KB Supercharged Tech & Tuning Tips

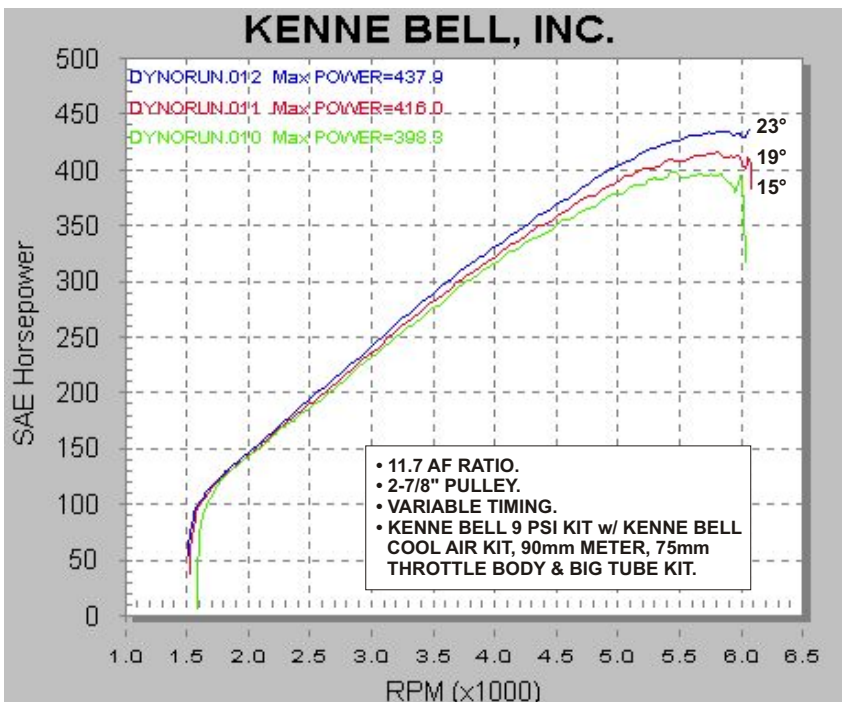
Kenne Bell Supercharged 4.6 GT

## IGNITION TIMING vs HP



### 5 PSI NON INTERCOOLED

HP	TIMING	AFR	BOOST	DYNO RUN
358	23°	11.0	5	.007
341	19°	11.0	5	.008
324	15°	11.0	5	.009
307	11°	11.0	5	-



### 9 PSI INTERCOOLED

KENNE BELL 90mm, 75mm BIG TUBE, COOL AIR KIT

HP	TIMING	AFR	BOOST	DYNO RUN
437	23°	11.2	9	.012
416	19°	11.2	9	.011
398	15°	11.2	9	.010
381	11°	11.2	9	-

## TIMING & HP

One of the most confusing and abused areas in Mustang supercharging is HP ratings. The following will hopefully clear up any misunderstanding about Kenne Bell kit ratings.

Since the beginning, the aftermarket manufacturers of supercharger kits were aware that optimum ignition timing produced the most power. This "optimum" timing is determined by accurate dyno testing, whether it be Kenne Bell, the OEM or a tuner. Everyone's goal, obviously, is to run the engine at this ideal timing without engine knock/detonation. Unfortunately, because of timing variables such as elevation, fuel octane, ambient temperature, humidity, AF ratio, compression ratio, coolant temperature and sensors, the optimum ignition timing/maximum HP cannot be achieved under all conditions in every vehicle all of the time.

Even the OEM's have 87, 89, 91 and 92 fuel calibrations. That is precisely why a vehicle calibrated to run on 87 octane can experience HP gains from a "chip" designed to run additional spark with 91 octane. Not exactly rocket science once you put things in perspective. Again, with all else equal, it is ONLY timing and AF ratio that regulate engine HP. That's it. There is no 3rd dimension to power tuning. The old Kenne Bell formula of:

**1 OCTANE = .66 psi BOOST (11HP), 1° TIMING (4HP), .5 AF RATIO, 20° AMBIENT, 30% HUMIDITY, 1000' ELEVATION, 15° COOLANT TEMP** emanates from years of supercharging experience. It's a great guide and basis for understanding "tuning." To cope with the variations, early 5.0 supercharger kits, for example, utilized a manual adjustable knob to "retard" ignition timing. At that time, no one was that concerned about how this timing retard affected the HP rating of a kit. Rate the kit at "X" HP and let the customer or tuner deal with all the variables by turning the knob down for street use and then up (advanced timing) for racing with higher octane fuel or dyno testing. Otherwise the kit would have to be rated at 300HP at 30°, 284HP at 26°, 268HP at 22° etc. Would all kit manufacturers rate their kits at the same optimum timing - or retarded timing for the worst conditions and lowest octane premium fuel (91 instead of 94)? And when we sold chips with the kits and the tune (timing) was conservative, the dyno tuners criticize the manufacturer for "not knowing what we were doing" or "being conservative." Ford's most complex calibration parameters of the 4.6 changed tuning forever. There are no more retard knobs. Ford now controlled timing. So, with the introduction of our 4.6 kit, we decided to rate our kits at optimum timing (23°) where all modular motors (Cobra 4V, Lightning 2V, GT 2V etc.) make maximum power. We have explained in detail, with no B.S. tech and dyno tests, why we chose this approach.

In summary, your Kenne Bell kit calibration is conservative and may not produce the advertised 23° HP ratings - but it damn sure can if there's adequate fuel octane, low temperature etc. We've NEVER had a complaint about the kit not feeling incredibly strong. And always keep in mind that the IAT and ECT sensors retard the timing as temperatures increase thereby providing some protection to the engine, just as Ford intended. If we fix or "lock" the timing, this built in protection against detonation is negated. We chose not to eliminate this safety feature and allow the timing to "float." We have no choice but to be conservative with our customers. Therefore, our kits are street calibrated for approx. 18° timing. The Kenne Bell SWITCH CHIP® offers both 18° POWER (street) and 23° SHOOT OUT (maximum HP with 100 octane). The exception is the '01 Bullitt and GT which have .75 higher compression ratio and must run 6° less timing. '01 was the only year the 4.6's used these heads. It's unfortunate because .75CR only increases power by 1.5% or 3-5HP depending on whether it's naturally aspirated or supercharged.

We do not recommend any type of "timing adjustor" on the mass air meter or anywhere else on the engine nor do we recommend injectors or meters other than those that WE have calibrated for our kits. We are very sorry but it simply is not practical, feasible or cost effective for Kenne Bell to evaluate and test all the meters, injectors, water injection kits and other switches, knobs, adjustors, plates etc. being promoted for the 4.6. When one or more of these products are installed and the system then "doesn't run right," it is Kenne Bell that gets the call for help. Then there's the supercharged engines worst enemy - the hot air sucking (no canister around the filter) exposed underhood filter. Do you think 100°-120° hotter air from these things might affect the IAT sensor and ignition timing - and HP?

Again, we recommend the Kenne Bell Cool Air Kit, 90mm Meter, 75mm Throttle Body, Big Tube Kit and SWITCH CHIP®. These dyno tested and proven products were designed specifically and exclusively for the Kenne Bell 4.6 Supercharger Kits. At 14 psi, the 4.6 will make an amazing 500+ rear wheel HP. Work with a proven combination and don't attempt to change or circumvent it for the sake of change.

## PULLEY ADJUSTMENTS

1/8" in pulley size will vary boost 1 psi, power by 16HP and requires 1-1/2 octane. Pulleys are available in 1 psi increments.

2.5° timing accounts for 9HP (4HP per degree).

## THE DON'TS (FOR KENNE BELL 4.6 GT KITS)

- ① DON'T ever let the engine knock.
- ② DON'T use an exposed hot air underhood filter. Use Kenne Bell Cool Air Kit.
- ③ DON'T use fuel injectors other than Kenne Bell.
- ④ DON'T use mass air meter other than Kenne Bell.
- ⑤ DON'T use chips other than Kenne Bell.
- ⑥ DON'T allow "tuners" to mess with the Kenne Bell calibration.
- ⑦ DON'T use timing or sensor adjustors of any kind.
- ⑧ DON'T use underdrive pulleys.
- ⑨ DON'T use water injection, timing adjustors, mass air meter adjustors etc. - and most important . . . .
- ⑩ DON'T REDESIGN THE KIT BECAUSE SOMEONE ELSE SAYS, THINKS OR HEARD YOU SHOULD. . . . . ! Kenne Bell engineered the kit and calibrated it. We know it best. Call us if you have a problem or special application.

**References:** "Octane Boost Guide" Kenne Bell 4.6 Tech Tips, "Jim Bell's Supercharged/Turbocharged Performance Guide"

# TROUBLE SHOOTING

## 4.6 GT BULLITT

### THE ENGINE KNOCKS

Timing too high for fuel octane.

**Solution:** ① Drop boost 1 psi ② use higher octane fuel or ③ have Kenne Bell re-calibrate chip for less timing.

Underhood exposed filter.

**Solution:** GET RID OF IT.

Aftermarket mass air meter.

**Solution:** GET RID OF IT and get Kenne Bell 90mm and SWITCH CHIP®.

Air pockets, low fluid or pump not operating.

**Solution:** Remove plug and check for fluid level. Then start engine, look in plug hole to see if fluid is circulating.

Stock spark plugs.

**Solution:** Replace stock plugs with Denso U-Groove T2OEPR-U.

Vacuum leaks.

**Solution:** Re-check installation. Vacuum or exhaust leaks - even pinhole leaks - hurt mileage, affect idle and part throttle driveability.

Insufficient fuel pressure.

**Solution:** Get a gauge and check it. Should be boost psi +40 psi.

### UNDERSTANDING TIMING VARIATIONS

No one can deny that all Kenne Bell Kits make for incredible HP and torque gains at any timing.

The stock IAT and ECT sensors reduce spark when the inlet air temp and/or engine coolant temp readings rise. That is programmed into all new GT's. On very cold days the sensors advance timing. Although timing may vary, our standard POWER chip calibration locks in the AF ratio at a safe rich 11-11.2. This will not vary until the engine runs out of injector (approx. 507RWHP). Note: The SHOOT OUT chip leans out the engine to approx. 12.5 and sets the base timing at 23°. The engine will make more power than advertised but higher octane fuel is required.

### CAUTION: POWER LIMITATIONS OF STOCK 80mm METER

#### 4.6 Mustang GT

The Kenne Bell 9 psi kit will produce 405HP at 23° and 11.1 AF ratio. The stock 80mm meter is limited. At 408RWHP, the meter is "pegged" or maxed out at 5 volts and does not supply adequate fuel for the engine. This dangerously lean condition can cause serious engine damage. That means no larger throttle body, SWITCH CHIP®, advanced timing etc. after 408HP with the stock 80mm meter. We refuse to even sell a SWITCH CHIP® for our 9 psi kit with an 80mm meter. SWITCH CHIPS® are available ONLY for the 90mm assembly is running 9 psi. Once the Kenne Bell 90mm Mass Air Meter assembly and chip are added, HP levels may be elevated (see "Tech, Tuning & Dyno Tests").

### CAUTION: FUEL INJECTORS

Our kits are calibrated for a specific Kenne Bell fuel injector. The injectors are included in the kit. Use only Kenne Bell supplied injectors.

### CAUTION: CHIPS, RE-CALIBRATIONS & "TUNES"

• All kits also include a Kenne Bell chip calibrated or "tuned" specifically for ① the kit ② injectors and ③ meter. DO NOT change them unless consulting us.

• DO NOT have anyone "diddle" with the Kenne Bell calibration unless consulting us first. No secrets here. There are 2 ways to make more power - more ignition timing and leaner AF ratios. We know very well how to do this at Kenne Bell.

• DO NOT use "meter adjusting knobs," "sensor tweakers," larger fuel pumps, chips, "timing adjusters" etc.

If in need of more HP, look first to the Kenne Bell Cool Air Kit, 90mm Mass Air Meter / SWITCH CHIP® and then the Kenne Bell 75mm Throttle Body - proven dyno tested parts that make more HP by reducing inlet restrictions (see Kenne Bell Dyno Tests and Tech Tips for more information).