KENNE BELL BOOST-A-PUMP / COBRA vs FOCUS vs WALBRO FUEL PUMP TESTS and a Few Discussions About Injectors and the HP They Support

Normally we don't comment in detail on subjects unless our products are misunderstood or being bashed. We've fielded way too many calls, emails and posts wherein Kenne Bell customers are criticized for or discouraged from using our Boost-A-Pump. Well, it's time we set the record straight.

So you believe that replacing your dual 119 lph Cobra pumps (238 lph total) with dual SVT Focus 143 lph pumps (286 lph total) is the answer? Really? Kenne Bell flow bench tests indicate the Focus pumps offer a mere 20% flow increase over the stock Cobra pumps! All pump "ratings" herein are based on 80 psi unless otherwise specified.

And you've been told by the "experts" that the dual Cobra pumps with the Kenne Bell Boost-A-Pump that we supply to hundreds of our '03 Cobra kit owners, as part of the kit, will not support high HP levels and you should install larger pumps and forget the Boost-A-Pump. Let's take a look at the real flow bench "facts". Our in-house tests clearly show the Boost-A-Pump, with the stock Cobra pumps flows a whopping 378 lph or almost 60% more fuel - 3 times the flow increased by the Focus pumps without the BAP: 286 - 238 = 48 vs 378 - 238 = 140 more lph!

There are quite a few Cobra owners who purchased the Focus pumps or are thinking about 'converting", that are sure to ask these questions:

Q: Can I use the Boost-A-Pump with my Focus pumps so I can match or exceed the stock Cobra / BAP combination?

A: No. Not, unless you remove the stock fuse completely (bypass it) and install a larger fuse holder that can house a 40 AMP fuse. The stock fusebox houses a 30 AMP (maximum that we know of) mini-fuse for the pumps and cannot accommodate a fuse big enough to handle the added current draw from the dual Focus pumps. Next, you better look at the wiring size from the fuse center to the FPDM to make sure the wire is sized correctly to handle 40 AMPS.

Q: How high pressure can I run the Focus pumps at to get the maximum delta pressure required to make the high HP?

A: The Focus pumps "blow off" at 85 psi (remember delta injector operating pressure + boost = rail pressure). Don't forget - there is a 10 psi loss from the output of the pump to the injector, so use 75 psi as your max for figuring max delta vs. boost. The Focus pumps cannot flow any more fuel at higher pressures. The stock Cobra pumps do not incorporate internal "blow off" valves, and can be run at higher pressure than the Focus pumps.

Q: How large an injector then, can the two systems (Focus / no BAP vs Stock / with BAP support?

A: Let's do the math: Two Focus pumps at 143 lph = 286 lph = 417 lbs of fuel / 8 cyl = 59 lb

(actual flow) injectors. That's IF 100% of the fuel discharged from the pumps gets to the injectors. Keep in mind that the Focus pumps are only 20% larger than stock, but the HP increase we're talking about is up to 100% higher than stock.

Now, let's talk two Cobra / BAP combination pumps at 189 lph = 378 lph = 627 lbs of fuel / 8 cyl = 78 lb (actual flow) injectors. Obviously, the Boost-A-Pump has a comfortable safety margin that can compensate for line and rail losses or pressure fluctuations, a partially clogged fuel filter and equally important; voltage losses and / or fluctuations. Remember, the BAP is also a ***voltage regulator***. And finally, the Cobra / BAP combination has already been tested with 63 lb injectors up to 700+ rwhp (814 ehp), with room to spare.

Q: Are there any other issues will I run into when installing the Focus pumps?

A: We found several other issues.

THE OBVIOUS
Dropping the tank is no picnic. Better have the right fuel line disconnect tools, start out with a totally empty tank, and / or wear a splash proof / fire proof suit. When removing the fuel pump assembly, be VERY careful when pulling the assembly out, otherwise you'll break off a little piece of the fuel level sending resistor, and the level will never read correctly again.

ELECTRICAL HOOKUP
The electrical connectors are different between the two pump types. This means the Focus pump connectors have to be "adapted" to the old pump wiring harness. This is not "plug-and-play". Plan on spending some serious time cutting the old harness off and soldering (yes soldering) connections that will then be submerged in your fuel tank. Whoever is doing this better do them "like factory". Who would want soldered connections floating around their fuel tank?.

FUEL LINE HOOKUP
Again, the pumps connect to the outgoing fuel lines differently. To "adapt" the Focus pumps, the factory hoses must have the "ear clamps" cut off, then you better have the new correct size "ear clamps" to reattach these onto the Focus pumps, or you'll end up pinching the hoses with some sort of scary screw-type clamp (make sure it's all stainless, and the right size - doesn't sound too reliable, does it?).

PLUG AND PLAY?
We have seen some "Plug and Play" Focus setups for around $325 plus a core charge of $300 for your stock pumps - oops, hope you don't want to ever put the stock one's back in, otherwise, that's $625 plus shipping. Next add labor costs to do all this. The Boost-A-Pump is included in our kit at $0 extra charge, only takes about 1 to 1-1/2 hrs to install, and when used with the stock Cobra pumps, far outflows the Focus pumps.

Q: Are there any factory issues with Focus pumps?

A: You might want to check out this link. "... as of 09 September 2002, 18 crashes and 4 injuries

have been attributed to the failed fuel pumps after the vehicle's engine failed to due a lack of fuel. *The defective fuel pumps fail without notice."*

http://www.blueovalnews.com/2003/cars/focus.fuelpump03n01.htm

Still want to go the Focus pump way?

Or better yet, as some suggest, you should spend thousands of dollars to convert to a "dual return system" with 2 of the largest Walbro GSS342 / 255 lph pumps. But 2 of these pumps only flow 316 lph at 80 psi (same pressure tested rating as all the above), or 20% less than the Kenne Bell BAP / Cobra pump combo. Oops! That would be a big waste of money while creating some serious tuning and driveabilty problems. We tested the pressure drop in the fuel system right out of the tank and at the beginning and end of the fuel rail at 700 rwhp and there was a 7 psi loss in the filter / fuel line and 3 psi loss in the rail. Replacing the stock fuel line with a 3/8" will drop the filter / fuel line loss to about 2 psi. We tested the Cobra fuel filter at 203 lph flow at 80 psi in and it only dropped ½ psi out, so a clean filter isn't the restriction, the fuel line is. We'll be posting some more useful information soon on fuel line sizing in a future thread.

Now that we've published all the pump flow numbers (see charts below) and you get a chance to review them, we think you'll agree: "Is it a really a good idea to replace the 378 lph Kenne Bell Boost-A-Pump / Cobra stock pump combo with the 286 lph Focus dual pumps (less the Boost-A-Pump)"? Or, how about a high dollar 316 lph dual Walbro pump setup with a return line, or Aeromotive 273 lph? Compare the above scenarios to the easy installation of a Boost-A-Pump. Cut into one FPDM wire hook up to "input" and "output", connect the ground, and run the pressure switch to a boost source. That's it.

Here's a quick summary of the pump tests:

Kenne Bell BAP/Stock Pump Combo..... 378 lph

Dual Walbros (no BAP)..... 316 lph

Dual Focus (SVT, no BAP)..... 286 lph

Stock Cobra..... 238 lph

Never overlook voltage variations. 1 Volt is 10% fuel capacity. The Boost-A-Pump is also a voltage *regulator* and therefore compensates for voltage fluctuations in your electrical system. And, contrary to the opinions of some, the BAP will actually INCREASE the life of the pumps because they do not have to work as hard with the increased voltage and amperage supplied by the BAP (see our post at http://www.modularfords.com/forums/showthread.php?t=7819 - LOOK AT THE CHARTS). Note how much LESS duty cycle is imposed on the pump when the BAP is used? LESS DUTY CYCLE = LONGER PUMP LIFE.

Also, look for two great references on our website covering pertinent formulas, technical information and the Boost-A-Pump:

http://www.kennebell.net/techinfo/techinfo-general.htm

and: http://www.kennebell.net/accessories/boostapump/boostapump.htm

Failure of pumps caused by the BAP are non-existent. They are as reliable as the sunset, as with our Boost-A-Spark ignition system. We use the Boost-A-Pump on virtually every kit (they are included at no added cost). We have never seen a failed pump that was caused by a Boost-A-Pump. Why, then, do some resist using the Boost-A-Pump? Our guess is they just don't understand the principle of its operation or benefits, or are unaware of the performance gain from their pumps or they are being talked out of using them by those wanting to sell them "a better alternative".

One aftermarket parts vendor has been quoted as saying:
"**I do not use the boost-a-pump. I believe the boost-a-pump will kill the life expectancy of the pumps. I also believe the least amount of aftermarket electronics you put on your car the the less chance there is of that part failing. Basically, if you did not install the part it cannot fail.**" This strikes us as odd, since this very same vendor is quick to sell you all kinds of his "***aftermarket electronics***" like computer chips, pumps, fans, mass air meters, etc... Aren't these "***aftermarket electronics***"? Again, the BAP is part of our kit (included at no extra charge) and is required or we would not include it. Why on Earth would anyone remove an integral part of our kit?

Remember, the pumps and the pressure they operate at are only one part of the equation. There's boost, delta pressure (injector nozzle tip operating pressure), fuel lines, rails and most important, chip tuning and injector sizing.

"A dozen fuel pumps will not supply enough fuel if the injectors are not sized properly and the tuning is not right".

For a better understanding of fuel systems we highly recommend reading "Fuel Pump Figuring" http://www.kennebell.net/media/media-home.htm article by Miles Cook at Super Ford.

All flow tests are shown at 80 psi (remember to ALWAYS ask what the pressure was at the flow rate being quoted - you must get this into your head if changing / altering your fuel system). It has much more meaning than a simple rating. To show a better (higher) flow rating if we were selling pumps or injectors (which we're not to '03 Cobra owners), we could just give you the highest flow number, but that would be at the lowest pressure. Your engine doesn't run on the lowest pressure, so the highest number (or some rate other than what your engine operates at) is misleading and will get you into trouble.

The pumps were tested at 40 and 60 psi also. Flow will increase approximately 40% when pressure is reduced from 80 to 40 psi. This is normal for any fuel pump: as flow increases, pressure decreases, as flow decreases, pressure increases.

Note that the Kenne Bell BAP / Stock Cobra Pump Combo delivers 59% more fuel than the stock Cobra system and 33% more than the Focus SVT pumps. Also note the SVT Focus pumps

PUMP TEST RESULTS WITH and WITHOUT BOOST-A-PUMP

DATE ---> 12/09/03 BY -----> bm

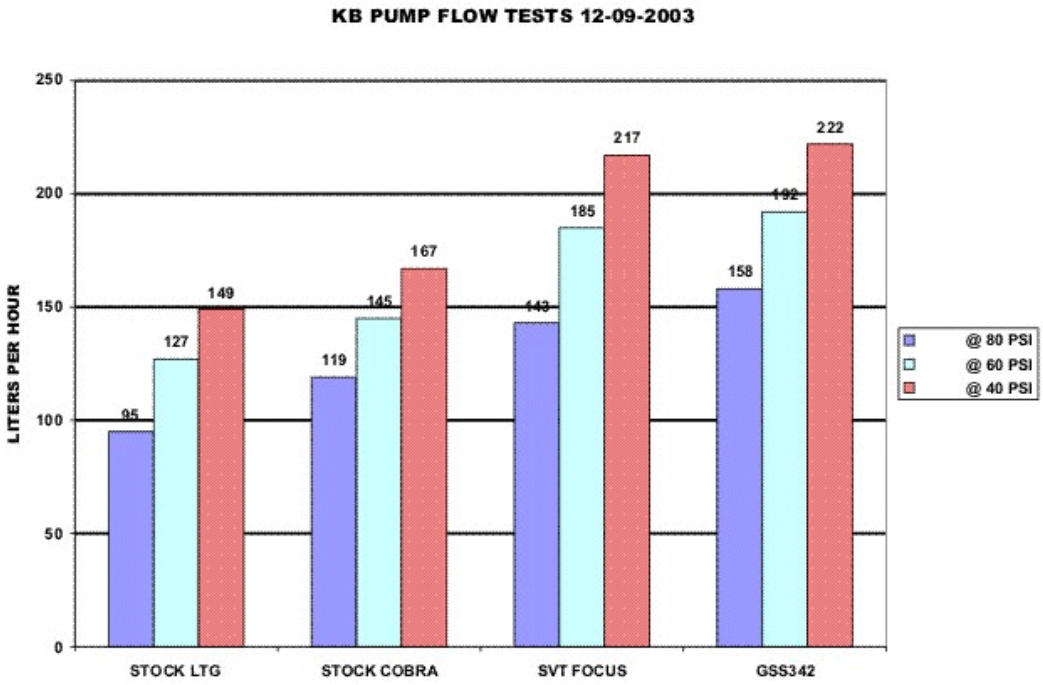
Test conducted using Stoddard Sovent PUMP TEST V+-> 13/17

PUMP Tested	Test Volts	@ 80 PSI		@ 60 PSI	
		1 PUMP	2 PUMPS	1 PUMP	2 PUMPS
STOCK GT 4.6 2V	13.0	65	N/A	115	N/A
STOCK GT 4.6 2V W/ BAP	17.0	152	N/A	201	N/A
STOCK SVT LIGHTNING	13.0	95	190	127	254
STOCK SVT LIGHTNING W/ BAP	17.0	158	316	181	362
STOCK SVT '03 COBRA	13.0	119	238	145	290
STOCK SVT '03 COBRA W/ BAP	17.0	189	378	215	430
SVT FOCUS	13.0	143	286	185	370
SVT FOCUS W/ BAP	1	1	1	1	1
WALBRO GSS342	13.0	158	316	192	384
WALBRO GSS342 W/ BAP	17.0	227	454	274	548

All flows are in Liters Per Hour
1 - When used with BAP, Focus pumps draw excessive amperage and require external fusing. SPECIAL NOTE: These pumps "pop-off" at 85 psi

are only a mere 20% better than the stock Cobra pumps - not 65% as some claim.

At Kenne Bell, we have a computerized fuel flow bench. We can - and often do - remove the entire fuel system from a vehicle and flow test pumps, fuel lines, rails, injectors, filters etc.



ENGINE HP AND "ACTUAL" INJECTOR FLOW

We're often asked:

"How come he can make more HP with 39# stock injectors than I can with 55's.?" "What fuel pressure do I need?"*"How much HP can I make with this injector?"

There are a lot of variables in making HP. Many aren't understood or even considered in the overall equation. We are fully aware of the confusion that exists about fuel systems as the basics of flow and pressure are seldom understood.

Here's a formula that we use to determine safe potential engine HP from ACTUAL INJECTOR FLOW for a supercharged Ford V8 at a safe 11.5:1 Air/Fuel Ratio and 85% injector duty cycle:

(ACTUAL INJECTOR FLOW x .85 x 8 x 2) = ENGINE HP.

EXAMPLE: (38.5 (Cobra stock injector at 39 psi delta) x .85 x 8 x 2) = 523 ehp

ENGINE HP x CORRECTION FACTOR (DYNOJET) = rwhp

EXAMPLE: 523 x .86 = 450 rwhp

It's IMPORTANT to remember this is a guide for delivering 11.5:1 all the way to redline AND it is based on 39 delta psi. Anyone with the knowledge and right software / hardware can make

more HP with this same injector if a) you raise the delta psi, and/or b) extend the duty cycle and/or c) run the engine leaner. 10% leaner from 11.5 to 12.65 = 10% less fuel used to make the same hp - or 10% more fuel to make 10% more hp. At 650 hp using the 10% savings in A/F Ratio can make as much as 65 MORE HP, or 705 hp with the same amount of fuel.

Another EXAMPLE:

'03 Cobra 55lb rated | 46.7 actual at 39 psi delta | 59 psi rail | 20 lbs boost

(46.7 x .85 x 8 x 2) = 635 ehp | 635 ehp x .86 = 546 rwhp

Now, let's raise the fuel rail pressure to 85 psi with the Kenne Bell chip and Boost-A-Pump.

'03 Cobra 55lb rated | 60.5 actual at 65 psi delta | 85 psi rail | 20 lbs boost

(60.5 x .85 x 8 x 2) = 822 ehp | 822 ehp x .86 = 707 rwhp

This an additional 161 rwhp or 29.5% more power with the SAME injector!

The intent of the two examples above is to illustrate how fuel pressure greatly affects injector output potential.

Now, when someone tells you "You don't need the Kenne Bell Boost-A-Pump", "You need volume, not pressure", "You need Focus pumps", "You need 255's", "You need bigger rails and fuel lines", etc. you can at least arrive at your own conclusions.

And, yes you can use larger injectors such as our 63# at the stock delta pressure, as we did on Earl's car to make 700 rwhp.

Let's plug the injector we used on Earl's car into the equation:

'03 Cobra 63lb rated | 63 actual at 39 psi delta | 64 psi rail | 25 lbs boost

(63 x .85 x 8 x 2) = 856 ehp | 856 ehp x .86 = 736 rwhp (we made 700 before the ignition quit firing above 25 psi)

Now, let's increase the delta pressure by 10 psi to 49.

'03 Cobra 63lb rated | 71 actual at 49 psi delta | 74 psi rail | 25 lbs boost

(71 x .85 x 8 x 2) = 965 ehp | 965 ehp x .86 = 830 rwhp

Our standard '03 Cobra upgrade supercharger kit utilizes the stock 39/42 injectors with a BAP. Our Kenne Bell "Cobra and Lightning Tech and Tuning Tips" at http://www.kennebell.net/superchargers/ford/cobra03/cobra03-tech.htm and in our literature states that our kits will produce 617 rwhp @ 19 psi with this fuel system, Kenne Bell Switch Chip and Cool Air Kit.

Let's use the formula again to see how this compares to more actual test data:

'03 Cobra 39/42lb rated | 51 actual at 65 psi delta | 84 psi rail | 19 lbs boost

(51 x .85 x 8 x 2) = 693 ehp | 693 ehp x .86 = 595 rwhp

We clearly state that we made 617 rwhp at a leaner 12.1 A/F Ratio and in the "'03 Cobra Chip Technology" section, we state the difference between the POWER 11.1 A/F R mode and SHOOTOUT mode in our Switch Chip is worth "up to 20hp". 595 + 20 = 615 rwhp. That's close enough to 617 rwhp.

Always keep A/F Ratio in mind when someone makes a relatively high hp claim with a marginal fuel system, as 13.5 A/F Ratio (a very lean mixture) always makes the most power. By comparing our thousands of data logged dyno runs, we were able to verify the above formula for predicting potential ehp when an actual injector flow is known (at that vehicle's delta operating pressure).

A stock 39 lb Cobra injector can flow 33 to 51 lbs from 30 to 65 psi, the KB 63 lb injector can flow 54 to 83 lbs at static flow (100% duty cycle or full-on), just so you know the effect of pressure vs. flow through the injector. Actual flow can only be determined by delta pressure (nozzle tip pressure). So when someone tells you they are making "X" hp, be sure and ask "At what delta pressure?", then use the formula to check it. Be sure to factor in rwhp vs, ehp!

As we said at the beginning of this thread, there have been far too many uninformed negative comments about the Kenne Bell Boost-A-Pump. Many of you have requested we respond to this. We always do our level best to supply you accurate unbiased test data, proven theories and facts as we have witnessed them. Considerable time was spent testing the pumps, fuel lines, filters and injectors. We hope this information is helpful.