



#### 4/4 Zetec 1.8 Silvertop Changed to 2.0 Blacktop

By Bob C

I bought my car 3 years ago with the intention of 'playing' with it and trying to improve it or at least modifying it in ways more to my liking. I changed the front suspension to the Suplex / SSL system with new dampers all round, added a Librands exhaust manifold and rebuilt the brakes. I stripped out the old Ford ECU and wiring and replaced it with a Standalone Omex ECU...

Then I turned to the engine. About a year ago, I was lucky enough to pick up a brand new 2.0 Litre Blacktop Zetec engine at a very good price to replace the 1.8 Litre older Silvertop Zetec engine. Not a lot wrong with the old engine but I wanted to play.

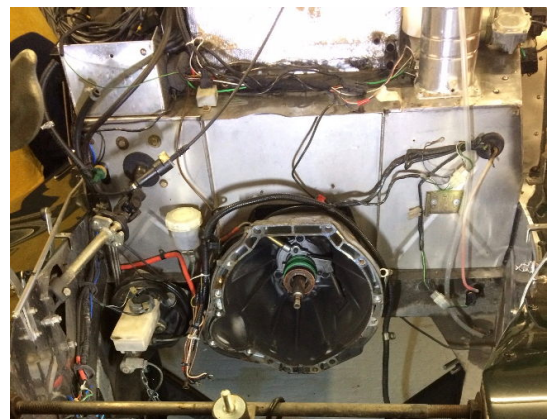
The Silvertop and Blacktop Zetec engines are very similar but as I was to find out, they are not identical as some 'experts' would have one believe. However, I had done a lot of research so I was fairly confident that I would be able to overcome any issues it would throw up such as:

1. They moved the oil filter so it interferes with the right-hand engine mount. I had to change which engine mounting bolts it used with a bit of cutting, grinding and welding.

2. The bottom hose and water pump is different and the inlet is a different size. The pump rotates in the opposite direction so an idler is needed. Thankfully off the shelf at Retro-Ford.

3. Because of the water pump change, the alternator has to be moved to the other side of the engine. Again, Retro-Ford make a kit to do this but it then ended up very close to where the brake pipe goes through the inner wing and a whole clump of wires so modifications were needed to make it work with a safe operating clearance.

4. The intake manifold is different so the vacuum take-offs for the MAP sensor and brake servo had to be modified to connect up. No kits available but not the biggest challenge.





5. The throttle body is different so it needed a new intake and filter system (which I'm still not happy with but it works) and changes to the throttle cable end.

6. I've used the 1.8L Silvertop flywheel which in effect is the same as a lightened 2.0L flywheel for better throttle response and acceleration. I used the old clutch so that will need looking at if I significantly up the torque.



7. The new Blacktop sump would not work with the standard gearbox bell housing and starter motor arrangement so I had to modify the old Silvertop sump to work on the Blacktop engine.

8. ECU mapping. The Blacktop uses different injectors and operates at 3.8 bar fuel pressure compared with 2.7 bar on the Silvertop. I had the flow rates checked for both types of injector and calculated what difference the pressure would make. (not linear but a wealth of data on the internet). I then modified an old Silvertop ECU calibration to allow for the increased engine capacity and different injector flow rate.

This has all taken me about 6 weeks of intermittent work to actually do but many more weeks of thinking, planning and head scratching.

Yesterday I filled the engine with running in oil and fresh coolant and double checked (more like quadruple checked) everything. I had left the battery on charge overnight to make sure I had enough voltage for numerous engine starting attempts.

I offered up prayers to every God I could think of then cycled the fuel pump a few times to ensure full pressure in the unlikely event that the engine did start. I also hooked up the computer to the ECU to check all the vital information and provide some initial feedback from the data-logging.

I turned the key and almost jumped out of my skin as the engine burst into life immediately on the first cranking attempt.

Don't panic I said, that's what was supposed to happen (in my dreams) but quick, check the oil pressure. Phew, 5 bar. Alternator charging Ok, rev counter (which works from the alternator) reading correctly.

I kept the engine between 2000 and 3000 rpm until the temperature started to get up to normal (another tick in the box, the revised cooling system seems to work) then with some trepidation I took my foot off the pedal and waited for the engine revs to die down and stall. To my great surprise and joy it didn't stall but sat nice and smooth at 950 rpm.



Engine now getting well up to temperature and the fan kicked in at precisely the correct temperature and then went off again at the hysteresis point. (Another tick in the box)

I turned the engine off and went looking for leaks but there were none and the computer logging showed that everything was working as it should although probably running a bit on the rich side.

Today I played with the fuel mapping and took some of the fuel out of the calibration to lean the mixture slightly but you can't really tell what it's doing on a static run up. It was more of a gut feel at this stage.

So the BIG moment arrives. Time to get out on the road and see if it is actually drivable in the real world. I reconnected the computer, switched on the data-logging and turned the key. To my amazement it fired first time again so no messing around waiting for it to warm up, get out on the road and see what happens.

To my amazement (I think I used that phrase before) it just pulled away and accelerated normally and even from that first moment I could tell this was going to be good. I can already tell the throttle response is there and I'm sure I can feel much better bottom end torque.

After about 15 minutes I stopped to check the computer was not showing any untoward signs and had a quick look under the bonnet for signs of leaks or other nasties.

Started up again and set off on another lap of my test track and began to get a warm satisfied feeling as I gradually opened her up a bit more. Pulled out of a junction, 1st gear, 2nd gear, go on give it a bit more welly.

Accelerating smoothly at about 3/4 throttle then \*\*\*\*\* the engine started to misfire. I lifted the throttle and tried again but no joy, it was still misfiring.

It wouldn't rev past 4000 rpm, it just kept misfiring. Then I remembered that I had set the rev limiter to 4000 in case I had an engine runaway at start up and I had forgotten to reset it for the road test. Stupid boy.

Pulled over, reset the rev limit to 6000 and tried again. Wow. Clean all the way past 5000 albeit only using 3/4 throttle.

So in this Christmas festive season, It seems that dreams can come true so I'll get it on the dyno this coming Wednesday and give it a couple more hours of breaking in then set about refining the fuel and ignition map.

At this stage I'll limit it to 6000 rpm and won't spend long sessions at full throttle but I am so excited as I'm convinced this engine is a big step forward for my Mog.



I had managed to get some good running during December in spite of the bad weather then took Mog to the Dyno for it's final set up and to get some power runs done.

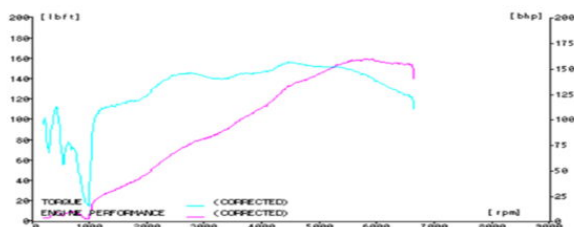
We finished off the running in process at medium load and revs with some occasional blipping up to the higher speed and load cells in the mapping table. As expected, I had set things a bit too rich and was also running the ignition timing a few degrees retarded for safety. During the low / medium running we did all the steady state mapping to get the mid-range spot on and also tweaked some of the transient tables to get crisper throttle response.

After about 3 hours running, we drained out the running in oil which was thankfully nice and clean and put in a good old fashioned 20/50 so we could start to push the engine.

My tuner has worked on many Zetec engines so I have a lot of confidence in him but even then, when he said it was time to give it some welly after only about 300 miles I did have some trepidation.

6500rpm when you're driving the car sounds fantastic. Standing next to a new engine on the dyno, it's positively scary as you wait for a conrod to appear through the side of the block. It sounds more like 10,000 rpm.

TORQUE #1: 6  
Tmax = 156.6 lbft at n = 4450 rpm v = 86.7 mph  
Prated= 139 bhp nspecs= 6000 rpm vmax = 100 mph  
Pavg = 159.2 bhp at n = 5920 rpm v = 115.3 mph  
Ptol = 14.1 % Pwheel= 127.5 bhp Ploss = 29.1 bhp  
Pmax = 159.3 bhp at v = 112.5 mph n = 5770 rpm  
Ptol = 14.2 % Pwheel= 129.4 bhp Ploss = 27.4 bhp  
Temp. = 48 F Press.= 977 mbar k = 1.017 (DIN)  
PASSENGER CAR GEAR REAR WHEEL DRIVE  
DIS DOUBLE SPARK



Anyway, he obviously knew what he was talking about because we completed the high-end mapping and did the full power runs without incident. I've added a screen shot of one of the dyno runs to give some idea of where we ended up and I am very pleased with almost 160bhp @ 5920rpm power and 156lbft at 4450rpm torque in my 4/4.

My intake is a bit of a lash up at the moment and I still have to sort out a bit of lumpiness in the torque curve but I have to say the kick it now gives when you get towards 2500 rpm is brilliant and it feels as though it just keeps pulling. The numbers are excellent for a still tight new engine with a standard 400 cell cat.

I'll get a few more miles under the belt and play with the intake setup but I am overjoyed with the result so far. (Before the lockdown, I had managed to get almost a thousand miles on the engine but now I can't wait to get out onto some nice dry, warm roads and really get the feel of the new power curve. (Should be fun on 165 tyres.)

*Thanks to Bob for this article, originally published as two-parts in Burble and Blatt.*