

To: Inboard Tech Committee and 2.5 Liter Stock Class racers

Subject: Ford Focus 2.0 liter Zetec Trials Report

From: Bill Walti

Date: August 13, 2010

I have been given permission to run trials on the Zetec 2.0 liter engine for the 2.5 Liter Stock class. At some point I imagine that 2.5 L owners will be asked to vote on whether this engine should be added to those allowed for this class, so I thought it would be helpful if you knew something about the engine and its performance.

I have run about 10 hours of lake testing and only one heat of racing. (The belt tensioner bearing failed wiping out the welds on the crank trigger. The shop manual recommends renewing the tensioner with each belt change. I should have listened.). I intend to enter more races this summer.

The Zetec was used in the Ford Focus and many European Ford affiliated cars from years 2000,through 2004, so there are plenty of these engines available. Since those years the Zetec was supplanted by the all aluminum DOHC chain-timed Duratec, which remains in use today.

Here are the specs on the 2.0 Zetec:

Engine type	Four-cylinder, in-line, DOHC
Displacement	1989cc
Bore	3.341inches
Stroke	3.467inches
Firing order	1-3-4-2
Camshafts	One intake and one exhaust

Engine description:

Sixteen valves, fiberglass intake manifold,cast iron cylinder block,cast aluminum lower crankcase,cast aluminum cylinder head, pressed steel oil pan,5 main bearings,single timing belt serves both cams,lubrication by eccentric-rotor trochoidal pump,electronic fuel injectors, crank trigger activated coils (2coils-one coil per 2 cylinders), computer controls (ECU)with sensors.

APBA Zetec Rules

- Stock refers to as installed in 2000-2004 Ford Focus automobiles, not SVO or high performance parts
- Bore-Max 3.382" Stroke-3.467 +or- .003"

- Stock crankshaft (may be ground .023"undersize bearing journals)
- Stock or Stock replacement Pistons and Rings(.058",.068",.120")
- Stock Piston Pins (.787"x.475"x2.284") steel
- Stock Connecting Rods
- Stock or stock replacement oil pump-pick up may be modified-must remain wet sump
- Any oil pan modifications-must remain wet sump
- Piston deck height-minimum .010" down in the bore
- Head-Stock dual overhead cam. No porting-No polishing-No grinding-No abrasive cleaning-No acid or corrosive treating. No angle milling-No changed valve angles
- Head combustion chamber C.C.-minimum 46.5
- Valve seat in head-maximum 3 angles
- Intake valves head diameter max-1.263" seat on valve 45 degrees-max 1 angle
- Exhaust valves head diameter max-1.102" seat on valve 45 degrees-max 1 angle
- All valve stems minimum .236"
- Stock valve retainers-steel
- stock intake manifold-No SVO,sensors may be installed(MAP,MAT, etc)
- Stock throttle body
- Stock fuel log, Stock injectors (17 lbs /hr.)
- Any fuel pump-Any fuel pressure regulator
- Any ignition
- Any electronic engine management control for fuel and ignition(stock, Meta-squirt, Electromotive, Haltech, etc)
- Stock camshafts max lift-Intake 0.350" Exhaust 0.343"
- Stock intake/exhaust cam lobe separation must be maintained
- Stock exhaust manifold connected to 3" diameter exhaust pipe-Pipe maximum length 24"
- Stock flex plate flywheel
- No aluminum blocks
- No vari-cam

Transfer from Willard Wilson to Bill Walti

- Willard Wilson tested this engine for several years. He ran it on an engine dyno and entered 5 races installed in his Jones hydro. He believes he has collected enough data, at least in his mind, to establish the feasibility of the Zetec as an optional engine in 2.5L stock class. The Tech Committee wanted written reports,(not Willard's style), so he withdrew from the Zetec trials program.
- I bought Willard's engine support parts (Electromotive Engine Controls-TECgt computer[including a 127page users manual and program CD], a high output electric fuel pump ,fuel regulator and filter, oil pan, crank trigger assembly,and intake manifold wired for the TECgt ECU). All of this saved me a lot of time and money. Willard has been very helpful and supportive with encouraging suggestions.
- I had to modify my hull to receive the engine. My 1995 Jamie Auld designed hydro has a 4"deep belly pan built into the tunnel. I had always run a 2000cc Pinto at 7 degrees shaft angle with 2-1/2"center line clearance from the bottom at the coupling. The Zetec and all current modern aluminum 4 cylinder engines require an additional 2" depth to receive the added separate crankcase. I rebuilt the belly pan to accept the engine.(I could have changed the prop shaft angle instead, but I prefer the lower shaft angle).
- The engine adds an aluminum crankcase to stiffen the lower end and has a built-in windage tray. With the pan removed and the engine turned upside down, you can't see the crankshaft or any of the reciprocating parts.
- Willard's pan holds only 2-1/2 quarts of oil. He raced it that way but I don't have his courage to enter a turn at speed with only 2-1/2 quarts in the engine. I added a 2 quart accumulator under 30lbs of air pressure to serve as a preoiler as well as to offer a safety margin of oil.
- Electromotive Engine Controls has dealers in most states. There is only Vic Sais in Northern Cal where I live and he also tunes engines with these ECUs. He tested my wiring and showed my son and I how to use a lap top to adjust the various settings. A word about these computers:

Notes:

- In the course of testing, especially at the race site, I have encountered two opposed opinions..."It's about time APBA let us test modern engines"...and,"I don't like computer engines, no one can tell if you hopped-up the engine".

- Once I get the engine sorted-out I don't touch the engine or the ECU.. The ECU takes care of fuel-air imbalance, temperature change, timing adjustment and altitude differences. THE ECU CANNOT MAKE A STOCK ENGINE FASTER THAN THE FACTORY MADE IT UNLESS THE RACER ALTERS THE ENGINE COMPONENTS. If the cam has a .350"lift, the computer can't alter that. If the engine has stock injectors and throttle body, the computer can't enlarge the orifices. The computer can't make the stock coils any hotter than the factory built-in limits.
- The engine uses an Electromotive Crank Trigger, so there is no distributor. (The coupling assembly is a welded stack of : timing belt sprocket, crank trigger and chain coupling)
- At Willard's suggestion, I have not opened the engine. I bought a complete 2002 Zetec,2.0 from an ad on Craig's List, for \$300. I installed a new timing belt and new stock platinum spark plugs. My idea here is to run it so stock that it serves well as an entry-level engine. If something goes wrong, I'll spend another \$300.for a used engine and save \$1,000.for an engine rebuild.
- Exhaust system
 - The Zetec has very short tubular header pipes that dump down into the bilge of the hydro.The Zetec rules require a 24"x3"dia. collector pipe. My engine compartment is 16"wide at the belly pan , 24"wide overall, so the pipes come very close to the walls of the compartment.
 - I bought a new header flange, cut the pipes flush to the original flange, flipped them 180 degrees and welded them to the new flange. This now has the collector pipe exit upward and out.
 - Still, at Black Lake,WA, Western Div. in July I charred part of the inner walls, melted the nylon of the elastic stop nuts, and fried a breather hose exiting the block. I now have 1/8'thick aluminum heat shields installed between engine and headers and between headers and inner walls. I also heat wrapped all the pipes and constructed a 4" dia. Ram air tube from a front opening in the engine cowling..
 - I believe auto-type -headers don't belong in a race boat. I recommend changing them to Zoomies, straight out and up.

Performance

- Willard tested the engine on his dyno and ran in 5 races in 2008-2009. This engine weighs just about the same as the Pinto-340 lbs. He says the Zetec has a little better acceleration than the 2300 Ford , otherwise it has about the same performance.
- I find the engine sits very low in my hull. The Pinto intake manifold, carb and valve train all were higher in my hull than this Zetec. My son John drives the boat and reports the engine runs at 6800rpms. My Pinto ran at 6200-6500rpms. I set the rev-limiter in the ECU at 7000rpms. The GPS speedo tops out at 75mph with a 10"x17"Mercury Lab

prop that I ran on the Pinto.

- At this point I don't believe the Zetec will beat the first place boats but it has the potential to get a share of thirds,--maybe a 2nd place with luck.
- John and I plan to race both days at Spanaway, Tacoma,WA the second week in Sept. We should have a better feel about the engine's competitiveness after that.
- I currently believe the Zetec is a feasible addition to the 2.5L class. It is plentiful, inexpensive as a used engine, reliable and once set it can be left alone like a passenger car.

I will write another report at the close of the racing season.