THE EXPERT STEWART SANDERSON

Having worked as a tuner for 17 years, Stewart 'Stu' Sanderson is one of the most-respected names in the business.

A Level 5-trained fuel-injection technician, Stu has worked for a Ford Rallye Sport dealer, a well-known fuel-injection specialist and various tuning companies.

Eight years ago he joined forces with Kenny Walker and opened up Motorsport Developments near Blackpool (01253 508400, **www.remapping.co.uk**), specialising in engine management live remapping, as well as developing a range of Evolution chips which are now sold all over the world.

He is the creator and administrator of **www.passionford.com**, which he started in 2003. It has grown rapidly from a few friends contributing, to one of the biggest Ford communities on the web.

Stu's enviable knowledge of the workings of modern-day Ford performance engines means that every month he's just the man to explain how and why things work, and importantly how they can be improved.

Words: Stewart Sanderson and James Wills

ALL THE SMALL THINGS

GOT A SMALL TURBO ESCOS? WE LOOK AT THEIR MOST COMMON FAULTS AND HOW TO CURE THEM.

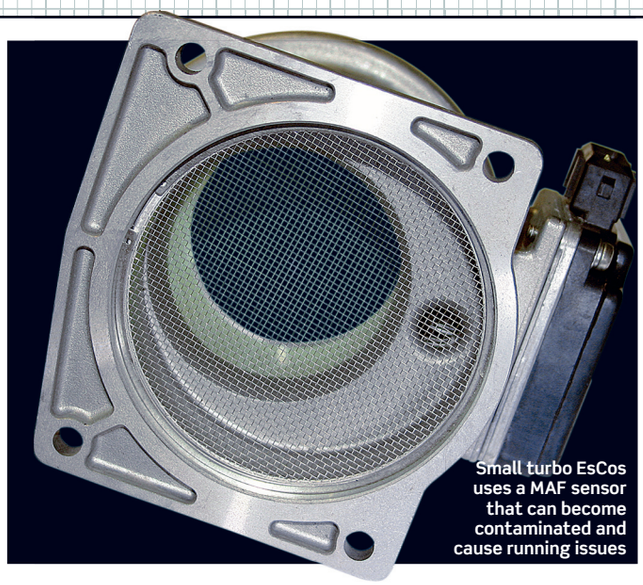
MASS AIR FLOW SENSORS

Unlike its predecessors the small turbo EsCos uses a MAF or Mass Air Flow sensor that accurately measures the volume of air entering the engine. Failure or inaccurate readings from this sensor can cause poor fuelling characteristics under all driving conditions, but is most noticeable on cruise and light throttle.

The sensor has a heated wire built in to the unit. It uses the temperature change and current required to keep this temperature constant to measure the volume of air passing it. This heated wire can become contaminated with small dirt particles during normal operation, but is affected highly by the use of oiled air filters. The purpose of the oil is to catch dirt and dust, but unfortunately some of the oil particles will flow through the air stream and catch on the sensor unit making it more prone to catch dirt particles just as the oiled air filter does!

Cleaning the unit is simple, just remove it from its housing and carefully clean the heated wires using a special MAF cleaner. If they have been damaged or the contamination is too heavy they will need to be replaced.

There are other common failures though that are very hard to diagnose, such as counter errors, but there isn't space to discuss such technicalities here.


Small turbo EsCos uses a MAF sensor that can become contaminated and cause running issues

BAD CHIPS

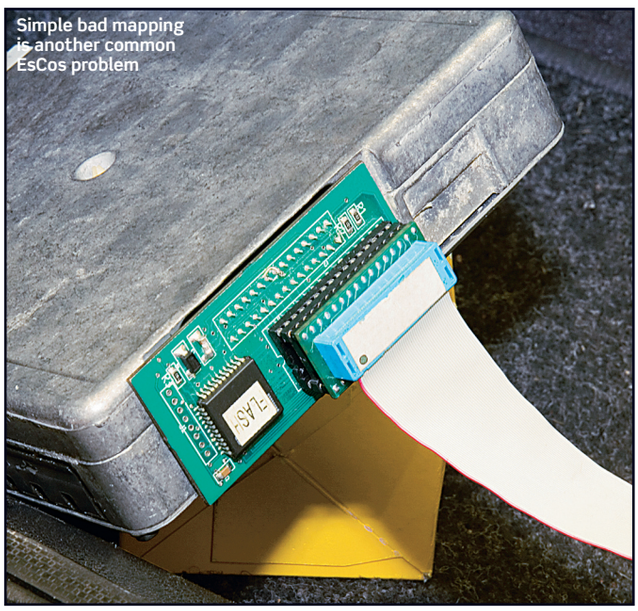
We see a lot of tuned small turbo Escort Cosworths on all forms of chips and modules, unfortunately many are sub standard and actually quite dangerous for the engine and the owner's wallet!

Poor checksum calibrations can report a ROM failure and have garages changing ECUs etc trying to fix them. In reality there isn't a problem to speak of other than the chip's calibrator didn't know how to correct the checksum on the file he recalibrated.

Boost control strategies can be an interesting issue. If the calibrator didn't know how to calibrate an EEC car properly you will have a boost control solenoid that cycles rapidly at idle causing premature wear and early failure of the solenoid as well as a really annoying clicking at idle! Some companies even advise you to unplug this valve.

The most shocking of all chip problems we see is the fact that some cars run leaner with the chip fitted than if we remove it! Many companies resort to using higher-pressure fuel regulators to maintain a stable air/fuel ratio on boost. Although there's nothing physically wrong with this, it can cause severe strain on the already weak fuel pump and cause problems later when a different chip is fitted and the uneducated owner knows nothing about the regulator change.

Finally, the connections on the ECU port where the chip plugs in can corrode and cause problems if the contacts are poor between chip and ECU. It's worth cleaning them before any chip installation.

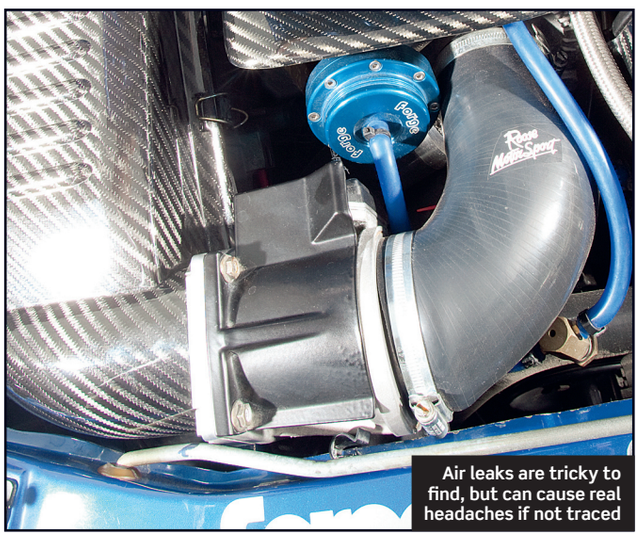

Simple bad mapping is another common EsCos problem

AIR LEAKS

All of the YB Cosworth range suffers badly from air leaks and the small turbo model is no different. Leaking boost hoses and inlet gaskets are sadly very common and cause a large amount of running issues, sadly most of these leaks are completely invisible.

Finding air leaks is not always as simple as it sounds, as some may only make themselves known at a given boost pressure. Reference pipes to the related engine sensors and regulators should be checked for splits and cracks, as well as making sure the joints to the sensors themselves are airtight.

Leaking plenum and inlet gaskets are common and cause a drop in manifold depression and uneven idle speeds. This is more critical on cars like the small turbo model, which is equipped with closed-loop fuelling control as standard. Air leaks can have a huge effect on this system and cause large fuelling and running issues. The best way to find air leaks is to simulate boost pressure and physically fill the whole inlet system with compressed air. We test all of our set-up cars to 3bar, and almost all of them have several leaks! These leaks also mean your turbocharger is working harder than it has to in order to create its desired plenum pressure.


Air leaks are tricky to find, but can cause real headaches if not traced

The standard small turbo EsCos has a non-adjustable fuel pressure regulator

FUEL PRESSURE REGULATORS

The button-type fuel pressure regulators fitted to these vehicles are normally very reliable, however they are available in several base pressures as the regulator itself is not adjustable.

It is vital that the correct fuel pressure regulator is used for the specific map that has been written for the vehicle. Failure to do so can cause huge fuelling issues and could easily result in an engine rebuild if the pressure is wrong.

Checking the operating pressure of these regulators is simple, clean the outer part of the regulator and use a magnifying glass to read the small writing on its side. A standard 3.5bar regulator will be stamped with '350 KPA'. Our own packages only ever use the standard fuel pressure, but we've seen some cars running a 5bar base pressure! You can imagine what will happen if you mismatch the chip and regulator with less than the required pressure – bye bye pistons!

Coil packs live under the plastic cover in the middle of the EsCos's cam cover

COIL PACKS

The small turbo model has a pair of coil packs fitted into the cam cover; these are connected to the opposing cylinder with a short HT lead. The coil packs can become troublesome with age and cause all sorts of misfire issues. Being positioned on the top of the engine means the coil packs are subjected to lots of heat and vibration, added to the fact every time you want to remove the spark plugs you have to disturb the coil packs and their associated wiring, gives plenty of reason for early failure.

Diagnosing this particular coil pack system can be fairly simple if the coil fails completely. If this is the case you will lose spark to two cylinders. However, HT lead shorts, intermittent misfires, poor current supply and poor wiring connections can be quite the opposite!

SPARK PLUGS

The choice of spark plug for these vehicles is critical. We commonly see the incorrect heat range of spark plug being used, which can lead to severe engine damage. Several types of spark plug have incorrect resistance levels for this system and we find they just won't work correctly with these coil packs, causing poor running and misfires under load.

Another common problem is cam cover oil leaks. This fills the internals of the head with oil and in turn fills the plug holes, which causes misfires and plug contamination.

Poor fuelling characteristics can lead to spark plug contamination and fouling, resulting in a number of driveability issues.

PRESSURE BYPASS VALVE FAILURE

The small T28 turbochargers have an integral pressure bypass valve, or dump valve to most people, built into the compressor housing. These often go unnoticed and we've even seen cars with an external valve fitted too! The valve is located on the lower part of the compressor housing, and has a rubber membrane diaphragm fitted as standard. These diaphragms often split and cause large air leaks to the vacuum side of the inlet, as well as losing boost pressure.

A diagnosis of this failure is quite simple. Pull off the reference pipe connected to the valve, place a single piece of pipe in its place and suck on the end. The valve should be airtight and hold a vacuum, if not it's leaking! Uprated Kevlar diaphragms are available that last much longer and are stronger than the standard items.

It should also be noted that using external dump valves with cars fitted with MAF sensors is unwise, as the MAF sensor is measuring the amount of air entering the engine, and for that reason blowing most of it out to atmosphere can confuse things as the MAF meter will have ensured the fuel will have been added to the cylinders to cope with it.

WIRING DEGRADATION

As the cars get older, the wiring loom will start to suffer. Potential issues include the engine bay wiring loom multi plugs directly under the passenger side bonnet vent where they constantly get wet! Failure or corrosion of these plugs can cause serious driveability issues as well as being one of the main culprits for engine failures, as every engine sensor signal to the ECU runs through these loom plugs. Some of the faults given can even be weather and temperature related.

If these plugs are in poor condition or corroded it may be possible to clean and protect them from the elements, but in most cases it is necessary to hard wire them and remove the plugs altogether and re-route the loom to a more sensible position.

We also see a number of wiring issues caused by poor repairs or alarm installations. It is critical to ensure all repairs or connections made to these looms is up to a good standard and will last the test of time, otherwise you are asking for trouble.

FUEL PUMPS

The fuel pumps fitted to these vehicles are mounted in the fuel tank, and are pushed reasonably hard even under standard power. We find most of them can't cope with our 300bhp Stage 1 package and require replacement because they simply don't flow enough fuel.

The pump holds a small particle filter at its base. These can become blocked if the fuel tank has had dirty fuel in it and this restricts fuel flow. The fuel pump has a rubber seal on its pressure feed connection. If the pressure is increased too high these seals can start to leak and cause a substantial drop in fuel pressure, which can be fatal for your engine.

A fuel pump's operating voltage is critical and should be measured under full load. We see many cars with fuel pump voltages heading into the 10v range when under boost with the lights etc on. This is asking for trouble! This voltage should be as close to battery voltage as possible, around 14v is optimum.

"IF THE MULTI PLUGS ARE IN POOR CONDITION OR CORRODED IT MAY BE POSSIBLE TO CLEAN AND PROTECT THEM FROM THE ELEMENTS."

GENERAL SET-UP

All of the issues mentioned in this article should be spotted if not rectified in a general set-up procedure. Knowledge of how this engine management systems works is critical when making sure they operate correctly and safely. This means the long term life span of the engine will be increased as well as making sure it is as cost effective to run as possible.

It is extremely important to have accurate fuel, detonation and boost monitoring equipment. Any inconsistent readings there can be fatal so it's well worth taking a trip to someone who has the right equipment. A general price for a set-up range from £100-£150, and can take several hours to complete. For this price all adjustable engine sensors will be tweaked and adjusted, base and cruise fuel levels will be checked as well as the fuelling and boost flat out under full load. There really is no excuse for poor maintenance and we recommend these set-ups are carried out annually to ensure ultimate reliability.

NEXT MONTH
DIESEL TECHNOLOGY