

# AECSTechnical Article ~ Gappy Golf

This article is a true description of a technical help desk problem and how it was solved.

**Vehicle:** VW Golf Mk4 2000 1.8Ltr 20 Valve AGN Jap import.

## Problem presented to the help desk

The car presented to the workshop was 'flat spotting' during moderate acceleration. These cars only need a service every 15,000 Km's according to the owner. It was bought from a reputable vehicle importer 12,000 km's ago with a full service included in the agreed sale price.

It had been connected to a scantool and an emission tester by a garage who could find nothing wrong.

The car was presented to us for further investigation. Just to check the work the other garage had done and for a bit of practice for a new AECs employee we connected it to the AVL DiX diagnostic emission tester, scantool and later the scope.

## Scan for faults

As so often reported by equipment sales people, you start by looking for faultcodes.

No fault codes. Everything is good then, isn't it?

Let's look further at life data streaming, the AVL DiX scantool is good with that as it gives reference values.

I am looking with system knowledge at the data strings and look in particular for adaption values which are border line, just good one moment and just not good the other.

VW GOLF Mk.IV (1J1) 1.8 08.97 06.05 92 AGN Read measured value block Display group 009			
	Actual values		Reference values
Engine speed	800	rpm	rpm
Lambda controller	1	%	-10...+10 %
Lambda sensor voltage	0.2	V	0...1.0 V
Lambda learn value at idle (additive)	-5	%	-10...+10 %

Basic settings 009

Back + - Print

Figure 1 Life data screen shot of AVL DiScan880



For example the Lambda (A/F ratio) Learn value at idle. This value shows -5%. Based upon the printed reference values you can be sure that this value is not border line.

Look further on the next screen (data block 10) for Lambda learn value at part load:

VW GOLF Mk.IV (1J1) 1.8 08.97 06.05 92 AGN Read measured value block Display group 008			
	Actual values		Reference values
Injection time	2.9	ms	2.0...5.0 ms
Lambda learn value at idle (additive)	-5	%	-10...+10 %
Lambda learn value, part load (multiplicative)	-2	%	-8...+8 %

Figure 2 (data block 10) for Lambda learn value at part load:

The -2% reading shows that the adaption value at partload is even closer to the target value of 0%.

No relief here. The mixture adaption values (long fuel trims) are not showing any signs of trouble.

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## Emission testing.

I am all for an emissions test, I strongly believe that emissions testing is the only way how we as an industry can move forward, improve our credibility and increase our workload. But let's face it, it does not always point out that there is trouble, or where the trouble is. I asked our new employee to measure the emissions just like the previous garage. After all it could be that for example the other garage's emission tester was incorrectly calibrated and therefore displaying incorrect values.

We measured the emissions at idle and at high idle. Please note that the engine was at operating temperature, but that the temperature probe was not inserted in the oil dipstick tube. We deemed it unnecessary to measure the engine temperature as it was not an official emissions inspection, we were just investigating. The Nitrous Oxide (NO) was not being measured.

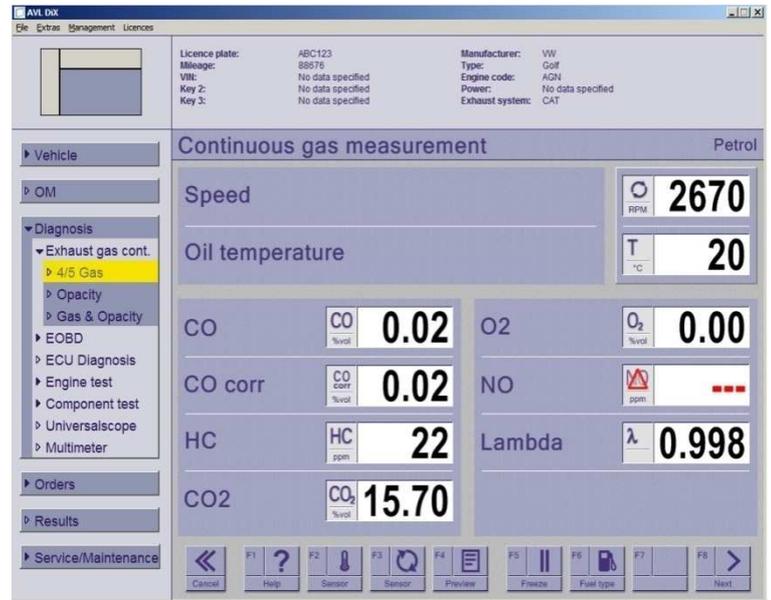


Figure 4 High idle emissions measured with the AVL DiGas 480.

Again absolutely beautiful results! It is obvious that the Catalyst is working well even at higher exhaust gas flow rates, and the small fluctuations of the Lambda figure around 1.00 indicate a fine working oxygen sensor. If you have to try to find something wrong then the HC's are again a little elevated, but nothing to worry about, certainly no indicator that work needs to be done.

### Catalist

When reading these emission results it should be taken into the equation that the catalytic converter (Cat) actively promotes the reaction between O<sub>2</sub> and CO in to CO<sub>2</sub> and between HC and O<sub>2</sub> into H<sub>2</sub>O and CO<sub>2</sub>. This reaction generates heat. The actual CO HC and O<sub>2</sub> values could be a lot higher and that the actual CO<sub>2</sub> value could be a lot lower upstream of the Catalist.

This does mean that you need to put more weight into the Lambda figure (calculated A/F ratio) and CO corr(ected) figure.

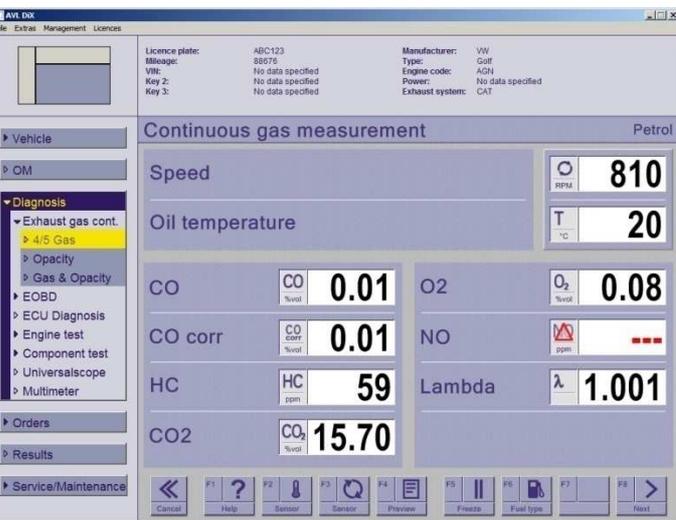


Figure 3 Idle emissions as measured with the AVL DiGas 480.

I really like these emissions, very high CO<sub>2</sub>, very low CO, very low O<sub>2</sub> and a Lambda of just a nudge over 1.00. The only small reservation I have is the level of HC's. All it shows is a good working catalyst and a good working Oxygen (Lambda) sensor. The slightly raised HC's could be the result of for example injector wear/contamination, raised EGR, poor ignition, intake manifold contamination (disturbing the airflow), oil vapour, etc. Nothing shocking, don't get me wrong.

So everything was beautiful then; no fault codes, no adaption values off, emissions good? The customer must be imagining the flat spot.



## Measuring is gold!

No! I am sure that this car had a problem, snapping the throttle in the workshop made it backfire in the manifold. Enough time wasted on 'easy' ways to find the problem; just get on with it! Use system knowledge plus an ATS scope and see where we get.

The coil used on the VW is a dual DIS coil pack with ignitor attached to it.

We should have connected to ignition primary and injection, but for now the new colleague needed experience with HT (high tension) measurements.

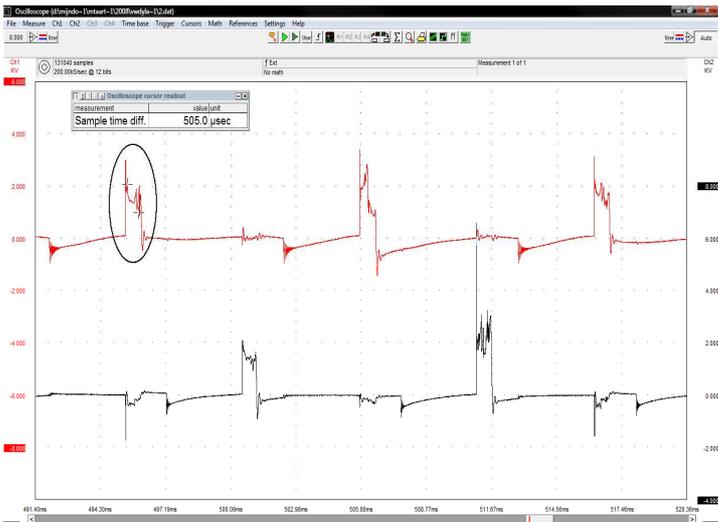


Figure 5 Secondary ignition measurement on both DIS coils.

Instantly it becomes obvious that the spark duration is not long enough!

## Why, and what to fix?

So what are we going to do about it? I always teach to consider all possibilities before carrying on, and then start measuring the easiest or most probable. This is where skill comes in.

The short spark duration could be the result of bad primary connections, a damaged coil/ignitor or worn sparkplugs.

The sparkplugs were replaced during the full service 12,000 km's ago (so the customer said), so it is possible that they are worn. For sure is that a short spark duration will create misfire under load. This could be the 'flat spotting' the customer was talking about.

Let's first look at the power supply of the coil and earth of the ignitor as both are easy to measure, and easier than taking the sparkplugs out.



Figure 6 ATS 5000 Dual channel secondary vs ignitor earth measurement.

Earth Loss on CH2 indicates a minor 0.184V loss. Nothing to worry about!

The power supply indicated 0.92V loss which is a little on the high side, but not enough to drop the spark duration down to less than half of what it should be.

## 100,000 km's?

Out with the plugs!



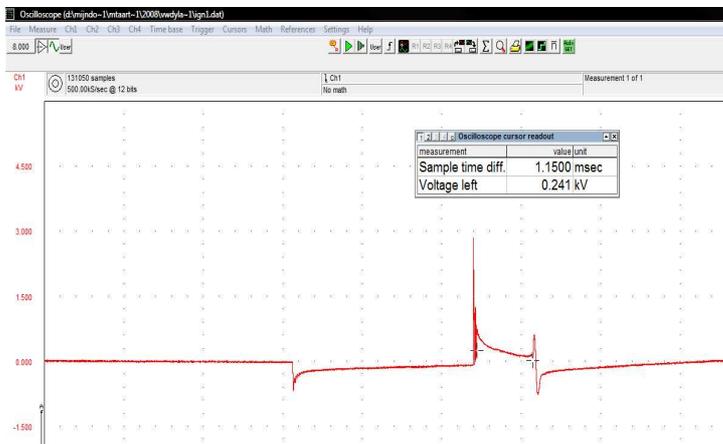


**Figure 7** The fine iridium tip of the positive sparkplugs had completely burned away.

Too easy! The fine iridium tip of the positive sparkplugs had completely burned away. The arc plate on the negative plugs was also completely burned away!

Iridium plugs are long life plugs, I guessed that the approx. 4 mm gap on this (non genuine) plug was the result of at least 100,000 km's or so. That on a 88,000 km vehicle.... I wondered what happened here!

After the proper VW triple electrode spark plugs were fitted the spark time was beautiful, and the car was running without any problems.



**Figure 8** Ignition measurement after sparkplugs had been replaced.

The customer commented that the car had never ran this well.

### Conclusion

Amazing how any garage can get stuck on even the simplest of jobs. Sparkplugs are usually the item that gets replaced even before any diagnostics takes place (often for no good reason at all). I tell you, it's been a long time ago since I was involved in diagnosing worn sparkplugs!

### 5 minutes.

By the time we were finished looking at all the aspects of the job it was 3 hours later.

This job in anger would have been done in probably less than 5 minutes with just the ATS 5000 or AVL DiX scope. I would have started with ignition over injection. Instantly the ignition would have shown up. Two more quick measurements to confirm the power supply and earth circuits, and then on to the spark plugs. I would have charged one hour diagnostic labour to the customer.



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