



Maurice Donovan (aka MD)

## BACK TO THE BASICS

Thanks to all our readers for the great feedback. It appears we have much in common. Most of our readers are independent repairers and like my workshop, we never know what interesting repairs will arrive on the doorstep.

In this issue I would like to share with you an interesting repair story from a colleague, Michael Wood in the USA. I am sure many of us can relate in one way or another to the frustration and time involved when we are faced with a challenging job. In this edition I hope Michael's story (written by him) will help all of us to learn and realise we are not alone when we have to face these difficult jobs. Not all of us will agree with Michael's diagnostic procedure with this job and I'm sure he wishes he could start over as well.

## Just when you think that a job will be straight forward...

-by Michael Wood (USA)



The vehicle booked in today is a VW Jetta TDI (Diesel) Turbo. Note, the vehicle had 174,000 (miles) on the clock. It was in the workshop to have various repairs done, including clutch, diagnosis of some glow plug codes, EGR issues, timing belt etc. (The owner had a quote from another workshop of around \$4,000! We initially thought this was excessive and quoted a lower price and got the job.)

I decided to tackle the clutch and timing belt first. I pulled the car into my bay with the clutch making an awful noise but we already knew we have to replace it.

I have never worked on a VW TDI before. I am a firm believer in the fact that there is never any room for error so I read thru the procedure twice. It all went smoothly for the most part. The clutch and timing belt part of the repair seemed to go together well so it was time for my first test drive. The job took much longer than I would've liked but I'd much rather be right than fast. In hindsight I should have driven it before the repairs started so I would have a performance comparison.

So I finally got to drive the vehicle. Now this is not only the first TDI I've worked on but it's also the first one I've ever driven. So I had no point of reference to go by of how this vehicle really should perform. I drove off down the road and I noted that it felt much more sluggish than the 1.8 turbo A4 I worked on the previous week. But as far as I know it's what it should be, a little sluggish off the line but much better at higher rpms.

**"With hindsight I can see that my mass air flow readings pointed in the direction of the turbo. Sometimes it's hard to remember that over-fueling symptoms (billowing black smoke) may be contributed to lack of air instead, and the low air flow and low boost pressure readings clearly showed the turbo problem. Lesson learned the hard way."**

The customer had requested the vehicle back ASAP so I assumed other/additional repairs could wait and that they could bring the vehicle back.

So I called the customer and invited them down to drive as they may prefer to hold off on the other issues on the job (EGR cooler and glow plug issue).

The customer arrives and appears satisfied and pays for the repairs and leaves. A few minutes later the car comes right back and the customer states that it's not fixed and that it drives like it did previously and she was under the impression that the problem of the sluggish hesitation on take-off was clutch slippage.

So I drove the car with the customer riding with me. I pull out onto the road and off we go - no slippage and not even that sluggish. She says it didn't do it the first time, "just wait." So I turn down the first side street and come to a stop and take off again only this time the car hesitates and is sluggish!

I explained that the engine hesitation could be caused by a number of things. After a few more stop and go's I realize that the hesitation coincided exactly with a strange noise from the engine compartment. Easy enough (I thought), find the cause of the noise and find the cause of the hesitation.

We get back to the workshop and I pull the car over our pit and had someone sit inside and rev the engine a few times while

I tried to identify the cause of the noise. This was fairly easy to discover once I removed the cloth heat shield that snaps around the EGR cooler vacuum actuator. The sound was exhaust leaking out of the cooler where there is a bypass shaft flap for the EGR cooler.

(The bypass flap sends exhaust right to the intake on a cold motor and when the motor warms up, the flap rotates and sends the exhaust gasses to the EGR cooler before going into the intake. The shaft bushing is prone to wear out. The flap is part of the EGR cooler.)

The hole for the shaft was probably 3 or 4 times the size of the shaft and the strange noise would go away when the vacuum actuator would finally un-stick the lever on the shaft and pull it over.

Again I think, okay, easy enough. Simply replace the EGR cooler, the EGR Cooler had already been recommended to be replaced, which made it easy for me to get my customer's ok on this job. I thought I was on a sure win and would finally nail this job.

### I reasoned

- 1- That the exhaust leak was not allowing the turbo to function as it should,
- 2- That the EGR cooler was not allowing proper flow of exhaust gases and throwing the fuel delivery off.



All I was certain of was that the noise and hesitation coincided exactly at the same time and that it needed to be replaced no matter what.

I replaced the EGR cooler and gaskets, pretty easy job, not much you can screw up with it. Let the car down, start it and all is well... right?

## Wrong.

This turned out to be only the real beginning of this saga. Now the real issues start to rear there ugly head and my schooling truly begins.

Next test drive. It seems to be idling fine. I go to back out of the workshop and as I give it some pedal I feel it bog down again. Now, instead of being a little sluggish, it will hardly move - it's got no power at all.

Back in the workshop again. I popped the hood and had someone press the pedal and it almost died! I walk around the back and sure enough there's hardly any exhaust coming out the tailpipe. I raise the car up on the hoist, loosen the exhaust up at the centre joint and separate it - still hardly any flow at all. I move forward to the front pipe and start loosening the clamp at the turbo and it starts whistling out before I even get the clamp loose.



Cat converter I thought? But how could a cat that clogged run as good as it did even with some exhaust leaks? I still don't know the answer to that question, but it is what it is. I was sure of one thing for certain and that's that it needed a cat for sure as it was definitely clogged up and had to be replaced.

When it's fitted I fire it up and expect to be able to take it for a test drive and say goodbye to this adventure once and for



all. I turn the key it fires right up, I select reverse and check the mirror, and now it starts pumping out black smoke like a freight train!

I couldn't believe it. My first thought was that something had to have gotten screwed up in the install of the cat. I put it back on the hoist and start looking for anything that might have been disconnected or damaged. My search revealed nothing. It was a straight forward job.

## Time For Some Serious Research!

First thing is to double-check our work. I pull the timing covers back off and check that... it's good. Check the cooler work and the cat work, everything looks good.

(I hit the computer first and check our IATN database (International Automotive Technicians Network) is an online shared resource and members shared known fixes library, for similar problems.)



I found many others that had similar symptoms. I read those and the fixes. That led me to references on TDI forums and other websites where I started gaining some understanding of how things worked on this vehicle's engine.

My scantool revealed code P0131, which indicated a O2 sensor b1s1 signal too low. I believed that code was more of a symptom than the problem. The thing I really lacked the most was knowing what the data I was viewing on the VCDS scantool was supposed to look like.

So, what will set a P0131 code? Possible causes to look at...

- Faulty Front Heated Oxygen Sensor Bank 1
- Front Heated Oxygen Sensor Bank 1 harness is open or shorted
- Front Heated Oxygen Sensor Bank 1 circuit poor electrical connection
- Inappropriate fuel pressure
- Faulty fuel injectors
- Intake air leaks may be faulty
- Exhaust gas leaks

I found that when I removed vacuum to the VNT/VGT (Variable Nozzle Turbine/ Variable Geometry Turbocharger) actuator that the car didn't smoke anymore and it drove similar to the way it did when I first drove it. So I pulled off the vacuum solenoid. At the time I could not find any testing procedures, to me it looked straight forward like your normal vacuum solenoid. I applied power, blew through it with and without power (activated) and got leakage either way. Great, I thought here it is, problem found.

I now know this Jetta solenoid valve is a duty cycle solenoid and relies on different frequencies. It allows the pressure to equalise across input and outlet hoses allowing the vacuum to be converted to a variable vacuum control for the turbo actuator.

(I now know that this is not a regular vacuum solenoid, the testing procedure is best carried out by using a scan tool and not the old ways we used to test these.)

[MD: Modern technology has changed the way we now fix cars. Once it was common sense how a mechanical or an electrical mechanism worked, but not anymore. Everything has become scientific and vastly complicated. Due to the speed of technology I can understand why Michael would think like he did. In fact I would bet 80 to 90% of today's techs would and have done the same tests as Michael. Stories like this serve to educate us.]

My scantool told me that when the black smoke was pumping out the exhaust that the mass air flow readings were very low (voltage). And that coupled with all I'd read about the problems similar to mine were being caused by a bad MAF sensor. I replaced the sensor only to find I was still faced with the same problem. This served to remind me of the value of using a scope which I should have used to confirm my suspicions, or in this case proven the sensor to be ok.

Knowing the issues caused by carbon I decided to pull the EGR out and cleaned it. I also checked the EGR cooler vacuum solenoid - it checked out ok.

I spoke to our local VW dealer about this car's issues and they offered their top TDI tech to look at it.

They diagnosed it and told us that the EGR switching valve (\$123) needed replacing. Now we thought they meant the EGR valve because we tested the EGR solenoid switch and knew it was working, so we ordered a new EGR Valve assembly. We fitted the new EGR valve, you guessed, no change.

I have gone thru this car with a fine tooth comb over and over. All I could do





really at this point is relax and think. I started looking under the hood yet again. Touching nothing and testing nothing.

Just going thru everything in my head as my gaze moved ever so slowly across the engine. As I move my eyes, I'm mentally recalling every test of every part and the results of those tests.

Somewhere between everything I've done and every scrap of info that I had spent hours upon hours tracking down and analysing I've missed something somewhere.

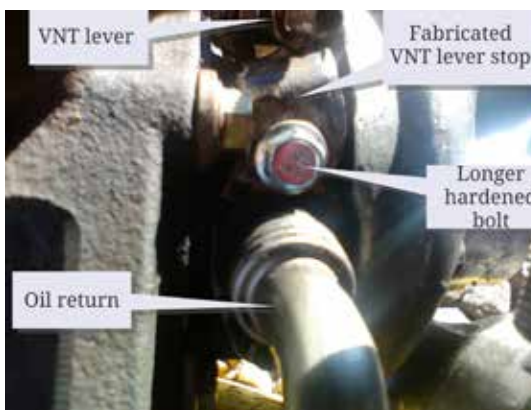
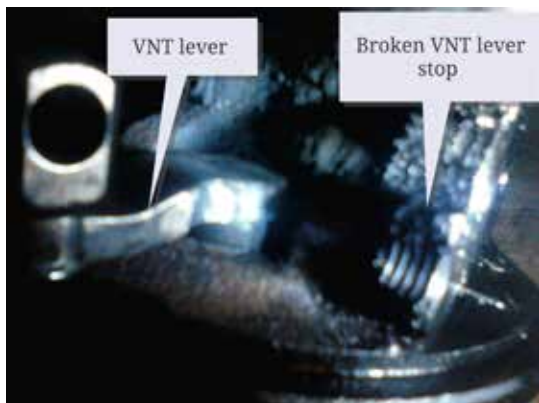
To me it had to have something to do with either the EGR system or the changes in exhaust flow. I knew timing and compression were dead on. And even though it had obvious fuelling issues as it poured out black smoke I was certain this was more an effect and not the cause.

I called my partner over and I showed him exactly how to duplicate the problem and issues from the driver's seat. Then I went back under the hood and began looking for the elusive cause of my on-going challenge.

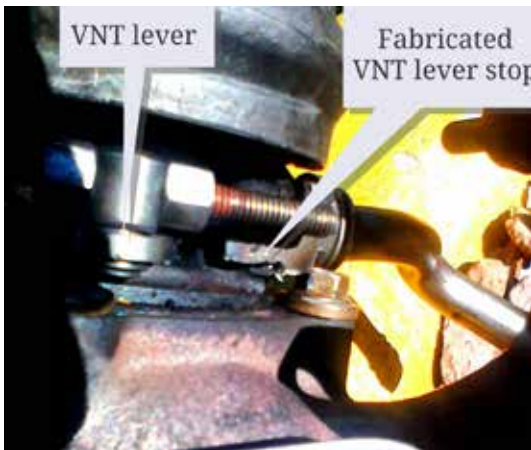
And that's when I caught it in action. I was watching the VNT (Variable Nozzle turbo) / VGT (Variable-geometry turbocharger) actuator when I noticed it start to move on throttle then it dropped and bounced a little and the black smoke started pouring out again.

## BINGO!

Finally after all this time and effort something went my way. I tested that actuator many times with a hand vacuum pump for smooth operation many times and did so again now. The results were still the same, it moved smoothly without any binding whatsoever. So I set it up to be able to run it and operate it manually and bingo no smoke! Now I had tested the control for this many times as well and even replaced the solenoid and that all tested fine. Only one thing left to do was to pull the turbo off and clean it out and check if something was being affected by turbo pressure. There had to be some type of mechanical failure.



As soon as I got it out I discovered the problem. The stop screw for the VNT/VGT lever was gone completely. There is no way to see this with the turbo in the car. The piece of the turbo casting that retained the stop screw was also broken off completely, and as you can see in the pictures this was allowing the lever to go beyond its range of travel.



What I really don't understand is that the OEM's put a sensor on the VNT/VGT actuator, so why is there no code that corresponds with the lever moving beyond its normal range? I am sure that that was addressed with the newer electric VNT motors.

Back to the task at hand. I had the turbo out so I went ahead and dismantled it and cleaned all the carbon out. I really wanted to see first-hand the internals.

I had to try and determine where this lever needed to stop before I could determine how to make it stop. With it apart it was very easy to see exactly where the vanes needed to travel and stop. It's really an incredible thing to see how something can have such an effect on so many different things when we're only talking maybe 10mm, 12mm at the very most of movement of one little lever, but it did. It affected almost every other critical sensor that's used for the operation of this engine.

I cleaned and reassembled the turbo, except for the actuator for now. The unit also had a broken housing and was missing the lever stop. I decided that the best way to go is to make a stop

As you can see in the picture the fix was really simple and easy.

I reinstalled the turbo, which went back nice and smoothly. Fire it up hit the pedal and it revs up nicely! Finally it was fixed! And that's when I got to see just how much pep these motors really have.

## The Moral Of The Story:

There's no way for any of us to know all there is in this field. Even the local dealer was stumped with this one. The good techs are the ones that know this and know how to gather and comprehend information and apply it. Sometimes it means you lose your

ass on a job but if you walk away with more knowledge and the satisfaction of fixing a tough one, it's worth it. The love of learning is why I do what I do and even after all these years I still have to go back to school regularly. The only difference is the beauty of the internet allows me to be the teacher as well as the student.

## Conclusion

MD: Michael, thank you for sharing your story, I could sense your passion for learning and to take on and solve a difficult job. You did not give up until you solved this issue. If I was to offer some comment, it would be to

remind you, experience is the teacher of many a good technician, but experience is only a part of what makes up a good technician in today's world of the modern vehicles. We need access to information. We need to know the ins and outs of the system that we are working on. We need sound advice and the pooling of resource from follow techs throughout the world.

I also want to highlight the fact that our customer's problems are not our problems. We often take on our customer's problems and make them our own, when in reality the problem belongs to our customer not us. I find thinking in this manner helps us to charge for our time and service without feeling guilty, it also helps us to leave our work at work when we are at home.

Thanks to Michael E. Wood, Head Tech Marzocchi Imports (formerly American Auto & Imports)