



# Its set, leave it alone!



## By Clinton Brett, Diesel Help Australia

Turbo adjustment screws: It's tempting to alter these because you are frustrated and looking for that quick fix to a long diagnosis.

Adjustment screws are like a wet paint sign on the park bench, some people cannot resist touching. Fortunately touching wet paint only leaves a smudge on someone's workmanship, altering the screws on a turbo leads to larger problem than you had to start with.

The fault is still present. Must be the new turbo, it's faulty and needs adjustment. 'I didn't move it much' maybe only half a turn...

Turbo specialists use precision calibration test benches, and their adjustments are set according to the manufacturer's specifications. That means when you come across a turbo with adjustment screws, whether they are sealed or not DO NOT ALTER them.



An all too common problem, someone replaces a turbo only to find out the turbo related fault code or a performance issue is still present. In some cases, the diagnosis has been handballed to another workshop and they themselves spend significant time diagnosing only to discover the screws on the turbo or the actuator shaft have been altered. If you suspect the turbo is faulty after fitting, then take it up with the supplier. Don't take matters into your own hands and start 'tweaking' screws otherwise there's no coming back from this, instant void of warranty.

One of the most popular occasions these screws have been tampered with, is when an actuator is replaced. Unfortunately, some believe the actuator can be replaced separately without replacing the turbo. This practice is incorrect. You MUST replace the turbo and actuator as a whole assembly to avoid repeat failure. A common cause of actuator failure is the internal vanes sticking, jamming within the turbo. This in turn increases the load on the actuator resulting in failure of electronic components. Same goes with pneumatic actuators. The rubber diaphragm is under extreme tension from the sticking vanes, thus damages the diaphragm.



As a diesel fuel injection specialist, I have seen the impact of tampering with adjustment screws. I still remember how much the fuelling would change by altering the max fuel screw rotary fuel pumps. I called upon local Australian aftermarket turbo manufacturer Cateran Turbos regarding the screw adjustments and what affect it has on a turbo performance. David Inall the company's engineering and technical support has been extremely helpful assisting me with the information of the pneumatic and electronic design turbos. David an ex-Garrett Engineer, has been instrumental in developing the Cateran product range.

On earlier design wastegate turbos, the effect of changing adjusting screws on this type can cause damage to non-electronic systems and on later electronic can easily set a fault code or cause low power. The more modern design variable geometry turbo (VGT) or Garrett trademark VNT.

David said if there is an error in turbo VNT calibration, it is far more likely to bring on a Check Engine Light (CEL) in a Euro5 (post 2016), than a pre-2005 (Euro2), application. These turbos have 3 separate; however, interconnected VNT flow set points.



## Min, Med and Max Flow.

Min Flow is set by a small grub screw in the side of the bearing housing. Incorrect calibration of this Min Flow point will almost certainly bring on the CEL if not immediately, certainly after driving any distance. The grub screw sizes vary from M6 x 1.0 x 20 to M4x 0.7 x 20, depending upon the turbo model. Generally speaking, ¼ turn of the grub screw, (0.25 to 0.17 mm) will be sufficient to move the turbo VNT calibration out of specification. A random alteration of the Min Flow Grub Screw has approximately a 1 in 80 chance of being correct.

Med Flow is set by adjusting the length, (via a turnbuckle) of the actuator rod which connects the actuator Cannister to the actuator lever which operates the nozzle ring within the VNT turbine housing. While not as sensitive from a CEL perspective as the Min Flow setting, incorrect calibration of the Med Flow Point will almost certainly lead to poor vehicle driveability, often evidenced by vehicle "bucking", while attempting to maintain a steady cruise at typical highway speeds. If the Med Flow setting is sufficiently incorrect, though, it will also bring on the CEL.

## Max Flow:

This is not adjustable in the usual sense of the word, as it is set via the total rod travel of the pneumatic actuator. Consequently, it is affected by the design of several different components, including the actuator arm, the actuator cannister mounting bracket, spring inside the actuator cannister etc.

In practice, however, it can sometimes be altered by changing the indexing relationship of the end housing to which the actuator canister bracket is mounted, (either compressor or turbine, depending upon turbo model), to the bearing housing. The potential problem being this will also immediately effect Min and Med Flow settings. The preceding, totally interconnected flow settings are the



reason that calibration of the apparently simple pneumatic actuator controlled VNT turbo, is only ever possible on a purpose designed VNT turbocharger Flow Bench.

There are only around half a dozen of the machines in Australia and Cateran's is one of them using the CIMAT Turbo Test Duo which has both core assembly balancing and dynamic flow bench VNT calibration capabilities.



The electronic VNT design turbo is different again. Something to discuss another time. So basically, it is impossible to correctly alter the calibration of any VNT Turbo in field. One might occasionally fluke some level of improvement in each case, however, that is what it would be, a FLUKE and not the basis of professional mechanical service and support, by any definition.

Without prejudice, there are several turbo suppliers who do not have the facility to check the turbo for operation before sale. It literally enters one door from the freight company and exits their warehouse in the same untouched box to you the unsuspecting buyer who then becomes the supplier to your customers.

Further discussions with Cateran Turbos I wanted to get a clearer picture on their quality control (QC) process. To ensure all their turbos are fit for service, each time a new shipment arrives from their overseas manufacturing plant, the turbos are tested on the CIMAT followed by an independent inspection by a QC agent of their products.

Be aware of cheap import copies and poor quality turbos. Refuse your customer when ask to fit a 2nd hand turbo or one the new one they purchased from Marketplace. We have witnessed several failures as a result with the most popular being internal variable vanes grabbing or incorrect calibration. They stick, jam or have been set incorrectly from the factory without the appropriate (QC) processes in place. This leads to faults, wasted diagnostics time and complete engine failure. There are so many variables that can cause a turbo failure so once fitted to an engine, started, and ran it is a component that is difficult to prove it was the cause of the failure. Therefore, it is important to research



the aftermarket supplier/manufacturer and before making the purchase and thoroughly read the companies installation guide.

Any quality supplier will provide these, for example Cateran turbo installation guide. We also have more than 10 turbo related technical bulletins. Before quoting the turbo replacement it is vital that you inform your customer of the additional work involved to replace a turbo successfully without experiencing issues afterwards. Refer to my TAT article from issue 61 for more info on turbos.

*\*Images obtained under license agreement with HaynesPro Workshop Data and Haynes AllAccess.*

*Haynes Australia Pty Ltd grants Diesel Help Australia permission to republish this material.*

*\*Specifications obtained under license agreement with Cateran Turbos Solutions*

*Cateran Turbos Solutions grants Diesel Help Australia permission to republish this material.*

*For technical assistance or more information visit [www.dieselhelp.com.au](http://www.dieselhelp.com.au)*



## Diesel Help Australia

We provide an experienced voice to guide you through a proven process to locate the problem and its solution

## Diesel Diagnostics and Training

Not all mechanics signed up for diesel. Our services are adaptable to light and heavy industry technicians. We provide you with an understanding of what you are diagnosing and why, then guide you to a successful outcome.



Phone Diagnostics



Training Online & In-class



Technical Bulletins



Diagnostic Equipment



### CONTACT US

[www.dieselhelp.com.au](http://www.dieselhelp.com.au)  
[info@dieselhelp.com.au](mailto:info@dieselhelp.com.au)  
+61 432 738 003