Tuning Your VE pump for a *GTurbo*

INTRODUCTION

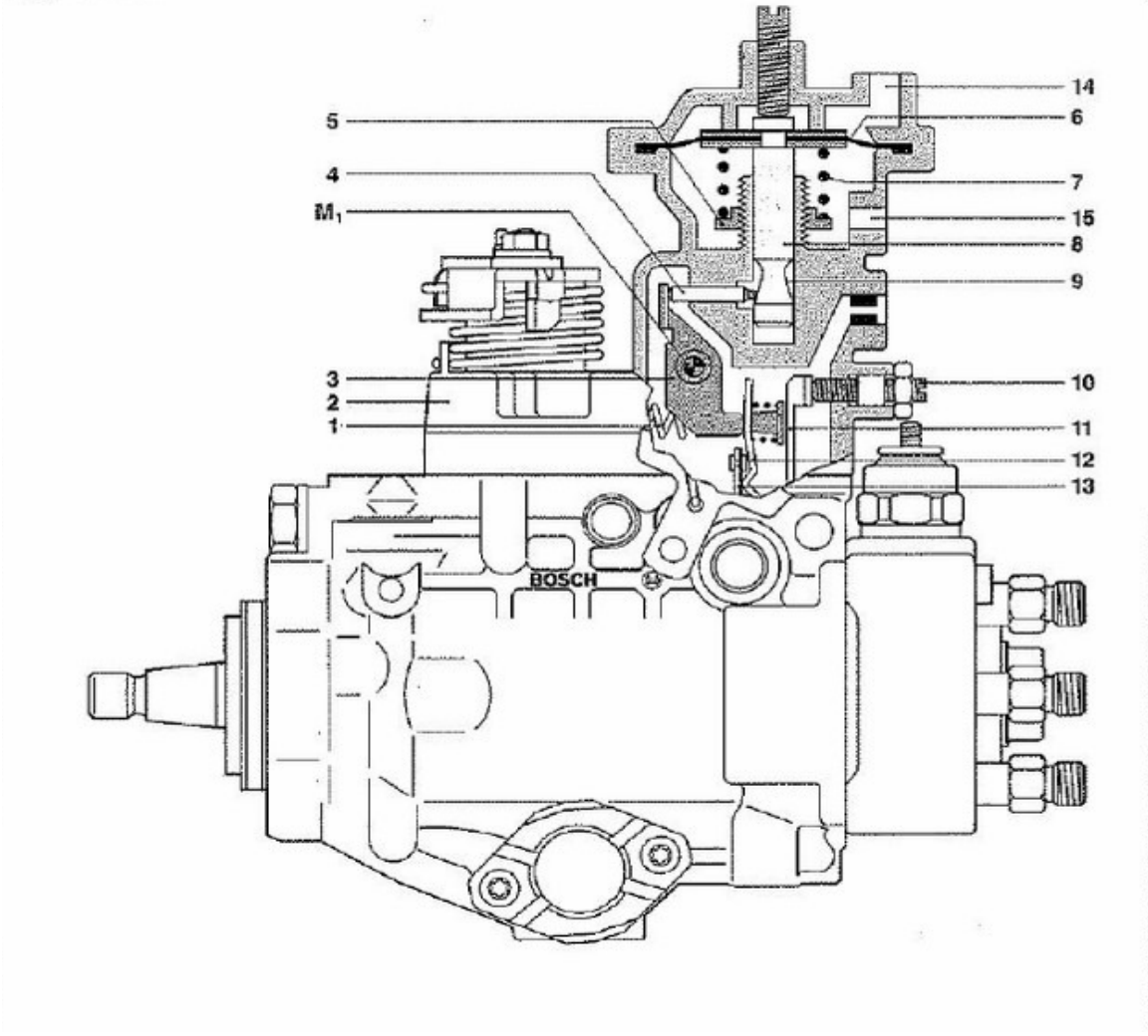
After installing a GTurbo, your efficiently produced 20psi+ boost pressure will enable the tuner to substantially increase the fuel flow from the pump compared to standard.

There are two areas that can be adjusted. There is the main fuel screw and this adjusts the overall potential fuel flow. Then there is the aneroid which has a task of governance of the fuel with relation to boost.

It is through the understanding of the limitations of the std pump that the following tuning strategy is employed.

Basic pump details as follows:

Fig. 7: Distributor injection pump with manifold-pressure compensator (LDA)
1 Governor spring, 2 Governor cover, 3 Reverse lever, 4 Guide pin, 5 Adjusting nut, 6 Diaphragm, 7 Compression spring, 8 Sliding pin, 9 Control cone, 10 Full-load adjusting screw, 11 Adjusting lever, 12 Tensioning lever, 13 Starting lever, 14 Connection for the charge-air, 15 Vent bore.
M_1 pivot for 3.



THE ANEROID FUNCTION

The aneroid is a device that changes the maximum fuel flow based on boost pressure. The purpose is to enable the adjustment of the maximum fuel to ensure too rich air fuel ratio's (AFR) do not occur effectively minimizing smoke etc.

Functionally, the boost pressure enters the top of the aneroid where there is a rubber diaphragm. The diaphragm is part of an assembly that includes a rod with a sloped profile machined into it and the whole assembly is pretensioned by a large spring. The spring tension is adjusted by a large nut (or toothed wheel) that the spring is seated on.

As boost pressure increases, the diaphragm pushes against the spring. A certain amount pressure equates to a certain amount of depression of the assembly. Changing the spring pretension changes this relationship between pressure and movement. For example, winding the toothed wheel to increase the tension reduces the movement of the assembly for a given amount of boost, specifically the rod (or "fuel pin", or "aneroid pin").

The aneroid pin has a profile (see picture below). There is an aneroid pin follower which is a spring loaded piece that rubs on the pin, as the pin moves up and down, the follower moves in and out and it is this movement that internally adjusts the amount of maximum fuel. It is important to note that the maximum fuel is actually governed by the setting of the main fuel screw; the aneroid can only adjust within the limits that this is set to.

THE MAIN FUEL SCREW

Turning this screw clockwise increases the main fuel over the entire operating range of the engine and therefore your idle speed will need to be reset. The main fuel screw is found near the pump distributor head (just above it). It consists of ~ 8mm head on a long bolt with a 12mm locking nut. If original, there will be a swaged on piece intended to prevent unknowing fools from playing with the settings, therefore this needs to be removed. Do this by removing the bolt and counting the number of turns required to unwind it. Remove swage, re-install and wind in the same number of turns that was wound out. Start engine and make sure idle speed is ok. Don't adjust idle speed yet.

ADJUSTMENT PHILOSOPHY

Now that you know how each part basically works and their interdependent action, then you must also understand some limitations with factory aneroid pin profile and position:

- when winding in the main fuel screw as much as is required to provide extra fuel, off boost fuel will be too high and result in a lot of smoke before the boost comes up and leans off the AFR. Simple adjustments will not fix this.

- when increasing boost pressure, over boost fuel cut might actually cut fuel
- the aneroid profile will not allow maximum fuel (even at the point before fuel cut) and can be optimized.

So what to do?

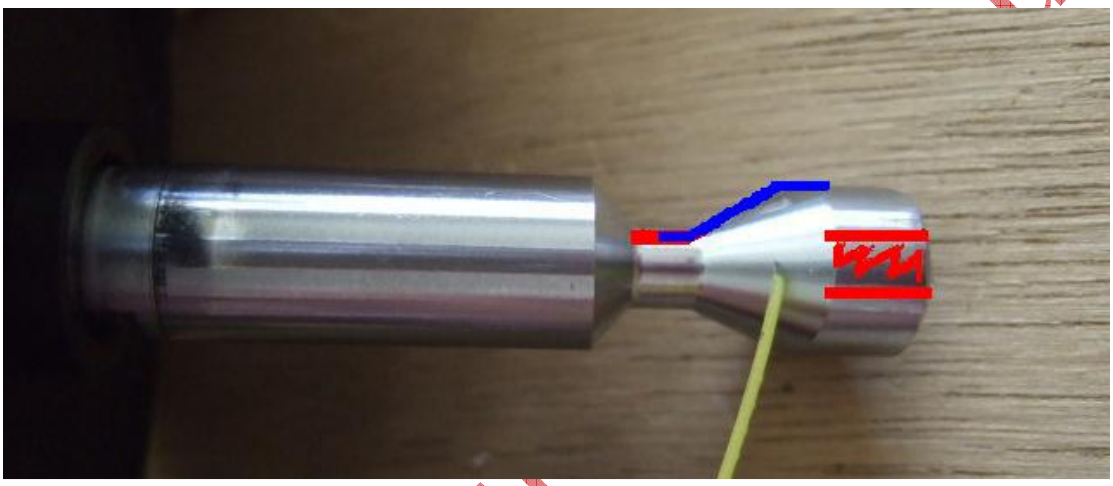
(1) adjust and modify aneroid pin
(2) optimize spring tension.
(3) wind up main fuel screw
(4) fine tune spring tension.

ADJUSTMENT PROCEDURE

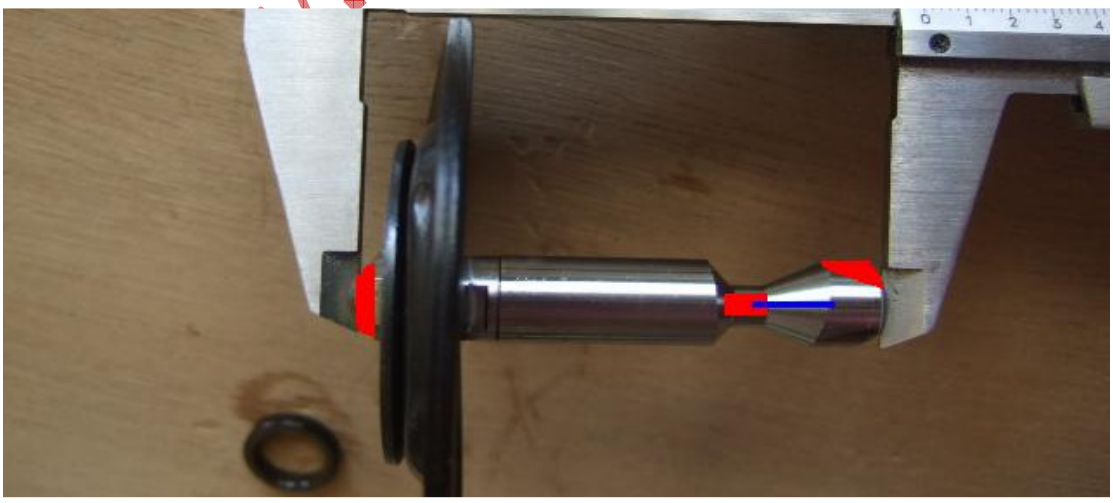
(1) Adjust and modify aneroid pin

In summary, the pin follower needs to ride up "just" on the off boost flat and just off the end of the factory taper on to the extended part of the taper that you will grind…. The blue is the area of profile being followed, the red is area to grind.

To access this, you need to remove the 4 allen key head screws that hold the aneroid cap on the pump.

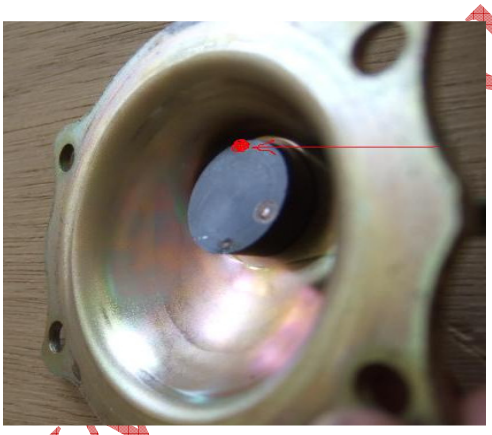


The narrow red section is cutout to allow the pin to be reinstalled without having to remove the pin follower pretentioner under the throttle linkage. This is a real plus as particularly in later models that have a throttle position sensor, access is a real pain…



The marking for taper on the right side is unfortunately out of phase by 180 (my bad…)

Here is a sample of a clients modified aneroid pin – it is very well done. I recommend following this.



Grinding this plate is sometimes necessary to get the pin to rise high enough. This disk is normally rotated to allow more or less off boost fuel (usually more). This is not a problem now, we will have too much anyway…. So it is a redundant piece (mostly)

(2) Set spring tension

The spring tension as a starting point needs to hold the pin such that it moves off the flat with ~1psi if setting for 20psi max boost (Grunter) ~ 3psi boost if setting for 25psi max boost (Bad Boy). The reason for this is that even after the

adjustment, which allows the aneroid function to pull out as much fuel as it can, it will still be a bit rich under hard acceleration from idle (due to increase in overall max fuel by the main fuel screw – note that at this point, you wont have adjusted the main fuel screw, so in fact it will be more sluggish off idle until you do adjust it. But, once adjusted to the required setting, the above preload 11-3psi will be helpful and the sluggish behavior non existent), in particular for the "Bad Boy". Having this 2-3psi buffer before additional fuel is allowed serves to clean up the smoke by leaning off the AFR.

(3) Adjust main fuel screw

With engine running, wind in main fuel screw a turn, "stab" the throttle hard, check for smoke. Usually you adjust this so that there is a good puff but not abnoxious. Idle should raise from std 650rpm to ~ 1100rpm. This needs to be adjusted back to 650rpm by adjusting the throttle stop on the pup. However, don't adjust idle until you are happy with the main screw adjusted point.

Check that aneroid pin is getting to max fuel position (where you ground out the pin for extra follower depression). If it is, then adjust main fuel so that it is light grey mild smoke, almost totally clean exhaust.

(4) Optimise spring tension

The edges of the teeth of the spring pretensioner are accessible through a small hole on the side of the aneroid enabling easy adjustment. Increase or decrease tension to get the desired boost response countered against emissions (smoke). Your done ☺

1HDT results look something like this. 1HDFT look a little better.

DISCLAIMER

While I haven't had a failure tuning in this manner in 5 years, this is your engine and I have no idea on the history or wear or any other aspects of your engine. This is for informational value only and should you wish to tune yourself then it is totally your responsibility.