

N75 valve investigation/ Tdi engine

I submitted this to tdiclub.com, because the information I found there was very helpful in tracking down the problem with my Tdi.

Since the problem seems to be reasonably common, I thought this document might help some other members, and show how a very small manufacturing cost reduction can cause reliability problems. It was quite fun to track it down.

I have drawn a schematic of the operation of the N75 valve, and there are photographs of the inside. The valve is working perfectly, now.

Symptoms

There is a sudden change in engine performance, and the engine has marked reduction in power.

It seems as if the power improves a little with higher rpm: 70mph (120kph is possible, but it takes a long time to accelerate).

The engine is smooth, and starts as normal.

There is no warning light. In fact, the engine behaves completely normally, except the power output is very low.

Fuel economy changes from about 6.9L/100kms to 7.2L/100kms.

Root Cause

The N75 valve is not sealing the Vacuum line when de-energised, due to a fine particle deposit on the valve seat. This is because a fine filter is not installed on the ATM line of the N75 valve, and the installation relies on the main engine air filter.

Recommendation

Install an additional air filter (pneumatic type) on the ATM line to the N75 valve (Pierburg supply this built into the N75 as an optional extra).

Tests

The tests can be made without complicated tools.

Start the engine, and while revving it, check the VGT (Variable Geometry Turbine) actuator. It ought to move slightly.

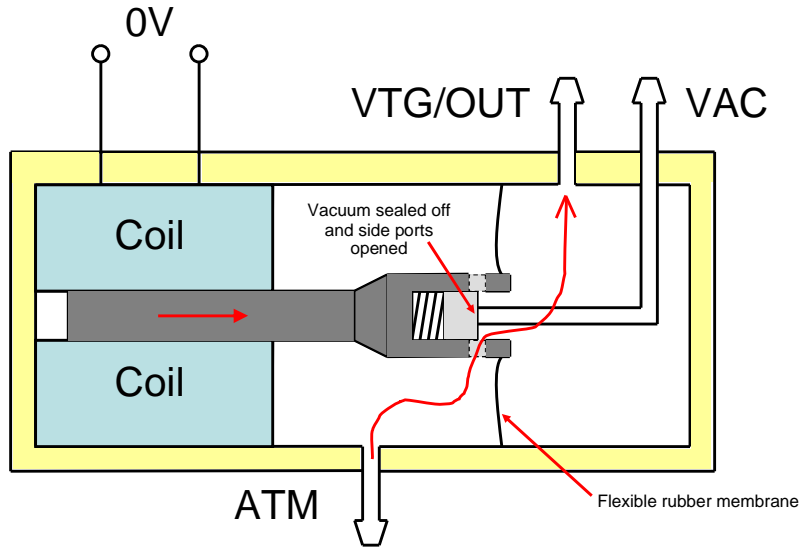
If not, then now carry on with the next tests:

Stop the engine, and disconnect the vacuum line leading to the N75 valve (keep it connected to the valve). Suck on the pipe. You should be able to suck little or no air through it. If air comes through it very easily, then we need to check where the problem is.

It could be

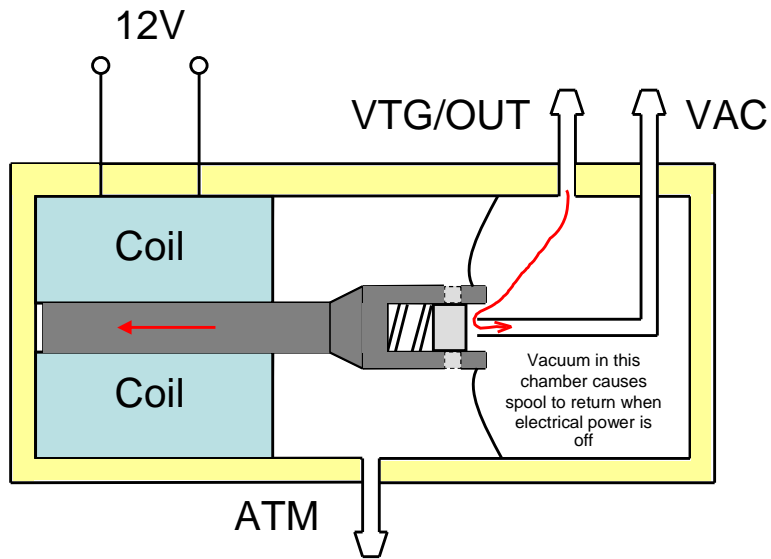
1. The vacuum pipe leading to the N75 valve has a hole in it.
 - a. Disconnect it at the bottom, block it with your finger and suck on it again to check it. There might be a small accumulator on the vacuum line. Check this pipe and accumulator for leaks, too.
2. The VGT actuator diaphragm is leaking.
 - a. As a sanity check, pull off the pipe from the actuator and connect a temporary pipe to it. Suck on the pipe and watch the actuator move.
3. The N75 valve is internally leaking from the ATM (atmosphere) connection
 - a. Check by blocking the pipe on the ATM connection. This might be easier at the air filter end. Put your finger over this pipe to stop air going into the N75 valve. Then try to suck air again. If the air cannot be sucked, then it is extremely likely that the N75 has an internal leak.

The N75 valve design



N75: De-energised state

Note: if vacuum seal is leaking, then vacuum (VAC) can suck from atmosphere (ATM)



N75: Energised state

In my Passat, I found that the N75 design is OK, but the application of it is not. The ATM connection draws air continuously from the 'clean' side of the air filter, and it is exhausted to the vacuum line, during the operation of the valve and the VGT actuator. Pierburg (manufacturer) have an option for an integrated air filter, but this option is not taken by VW. Unfortunately, the air from the clean side of the air filter is not clean enough, and the very fine dust builds up inside the N75 valve. This finally causes sticking or bad sealing. Perhaps an inline pneumatic filter should be inserted into the ATM take off at the main air filter?

Note that there is no spring return on the valve spool. The vacuum itself is used to close the valve. If you test it at the workbench, you will need to temporarily block the control port (which is normally connected to the VGT actuator), while applying vacuum to set the valve into the right position.

The N75 valve can be repaired with care!

It needs some careful bending of the steel sleeve which is used to clamp the valve to the solenoid. I had no choice in my country (1 month order for a replacement), and it was successfully put back into service. I worked the steel clamp open with a screwdriver and small hammer after mounting the valve in a vice. Be patient: it takes some time. Do it little by little and work around, then go back and open it some more, until it can be slipped off together with the valve, from the solenoid.

(To re-assemble, a pair of pliers is required to bend the steel round again. Again, take your time, and don't forget to test it).

Once inside, use electrical contact cleaner (but be careful of solvents) and clean tissue. Light Lithium grease must be re-applied to the valve spool which slides inside the solenoid. Check that the small seal inside the valve spool can move up and down (it is set inside the 4 holes, and can be seen down the centre of the spool).

Temporarily hold it back together to test. A 12v dc supply would be handy at this point. Suck on the vacuum line using a small pipe, temporarily block the control line with your finger, to set the valve, and then rapidly pulse the 12v dc on the solenoid contacts (any polarity will be OK). You should be able to detect when the solenoid is moving the valve, and the air is suddenly allowed to pass. In normal operation, the solenoid always has some pulses. The number of pulses (more accurately: the length of time the solenoid is switched on compared to how long it is switched off) determines the average vacuum that is applied to the VTG actuator. I read somewhere that it can be about 250 pulses per second.

Finally, when re-installing, don't forget to connect the pipes up correctly (yes, I got it wrong!!): very embarrassing.

Next are some photographs of the inside of the valve:

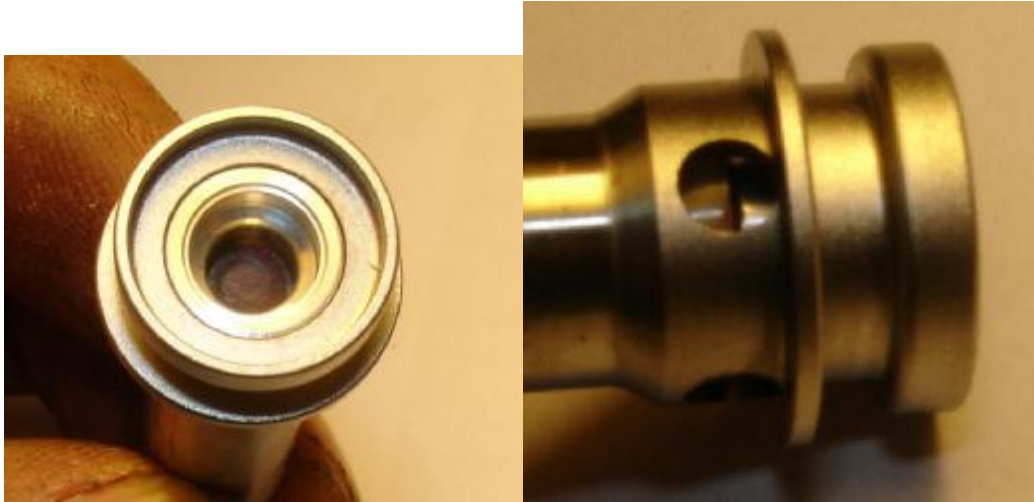
This photo shows the solenoid on the left, the spool (shiny rod), the rubber diaphragm or membrane, which fits over the spool, and the head. The steel clamping band is not shown. Remember which way round the diaphragm is. The top shown here should face right.



A close up of the spool, showing ports (4) in the side.



The part of the spool which gets dirty is inside here. The bottom of the hole is a seal which can move further inside. The area inside the 4 ports also gets dirty. The photo shows after I cleaned it. Sorry, I didn't think to take photos when it was dirty.



The valve head is shown next. The centre pipe is the vacuum line, which is connected to the bottom pipe connector (VAC). The other connection is OUT, connected to the VGT actuator. The end of the pipe normally seals against the seal shown at the bottom of the hole in the spool, in the de-energised state.



Dave Scott, Thailand, Sept 2006.