Limp Mode Diagnosis Guide

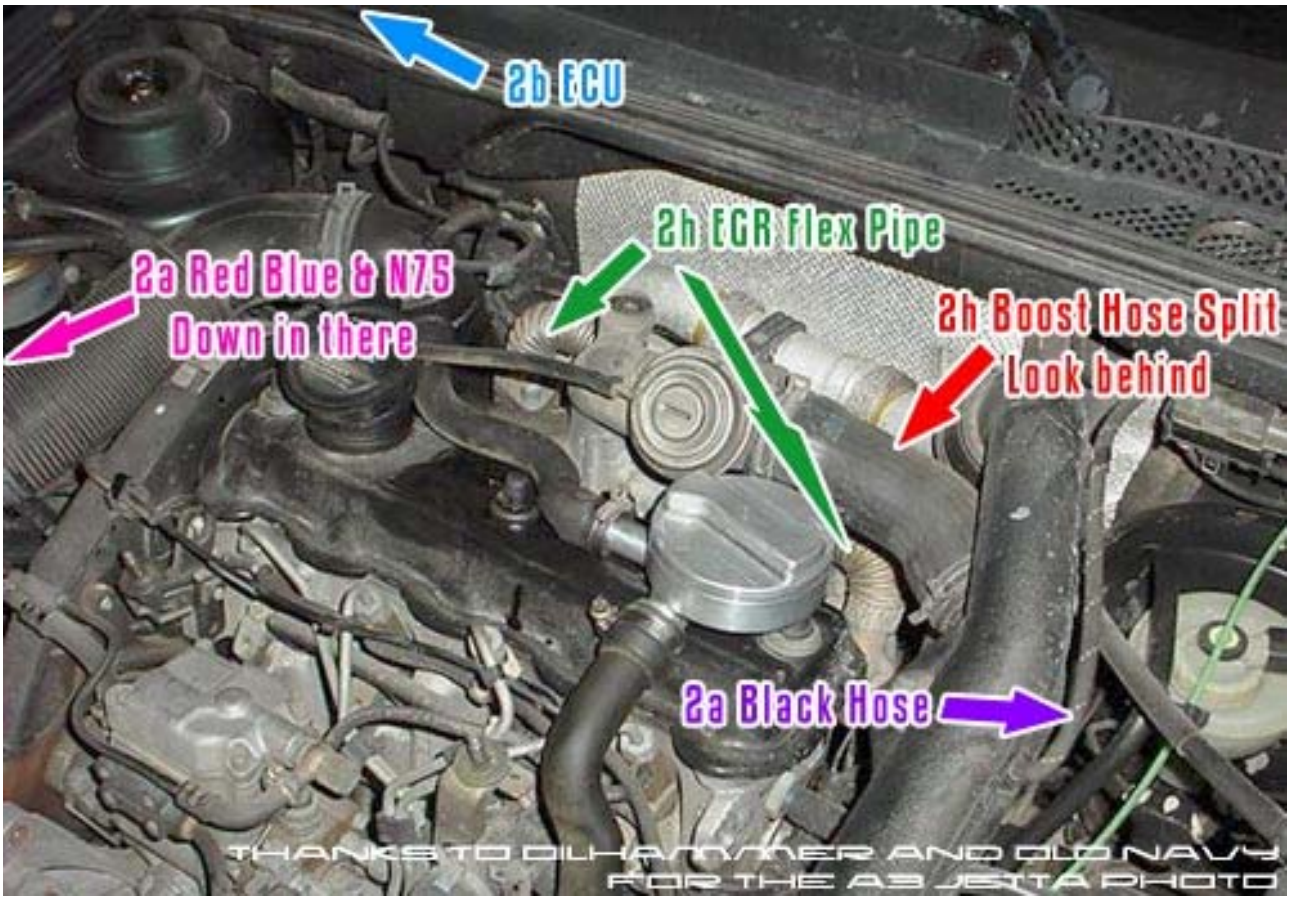
(http://forums.tdiclub.com/showthread.php?t=75959)

This post is written in response to the number of times that TDI owners complain about "lack of power". It is a supplement to what is contained in the TDIFAQ troubleshooting section, specific to the A3 and B4 cars and is as thorough and systematic as possible, and it is linked to from the general "How-To" thread elsewhere on these forums.

Main symptom: Car lacks power, or temporarily has power but then abruptly loses power under certain conditions. The conditions under which it loses power are generally repeatable.

1. **Scan the ECU for codes.** DO NOT try to skip this step, otherwise you may end up "barking up the wrong tree" for a long time. VAG-COM or a lookup in the Bentley shop manual result in a text explanation of the codes
    a. If you get "Injection start regulation - intermittent", adjust the mechanical pump timing to get it within specifications as described in the TDIFAQ or the shop manual. If pump timing appears to be within specifications, but the code still comes back after being cleared, check for leaks in the fuel system, because air bubbles can interfere with the mechanism that automatically adjusts the injection timing, and also make sure the fuel filter is good and that the fuel tank contains the proper grade of diesel fuel.
    b. If you get the "00575 Intake manifold pressure control difference - intermittent" code, go to step 2.
    c. If you get codes related to the catalyst temperature sensors or the supplementary injector pump, you have a hardware problem with those components or a wiring problem related to those components. These codes apply ONLY to a 1996 Passat TDI in North American specification and ONLY to models having the "BK" ECU. Other models do not have the hardware in question and cannot have these codes set. The most likely circumstance leading to these codes is: wrong ECU for the vehicle, wrong catalyst without the temp sensors in the vehicle, wiring harness damaged or not plugged in, deliberate removal or circumvention of the sensors or the electrical portion of the pump.
    d. If you get codes related to glow plug operation, these are NOT relevant for power loss situations.
    e. If you get codes related to EGR "exhaust gas recirculation" control, clean out the intake manifold as described in the TDIFAQ and perform the recalibration procedure described in the TDIFAQ.
    f. If you get codes related to the "mass air meter", make sure it is plugged in at the harness connector (near air filter) and make sure the wiring is not damaged. Note: this is the MAF sensor. Actual failure of MAF sensors is extremely rare on these vehicles. Do NOT replace the MAF sensor on an A3 or B4 unless all other possibilities of power loss have been exhausted.
    g. If you get NO codes, go to step 3.

2. **Troubleshooting the "00575 Intake manifold pressure control difference" code**. Usual symptoms: car temporarily runs OK after being started, but particularly in the higher gears, it loses power abruptly after a period of running under load. Power may or may not return temporarily by taking load off the engine and then resuming, and generally returns temporarily after switching off the ignition until the same load conditions occur again.



   a. Locate the "blue" and "red" hoses under the hood. Also locate the small diameter black hose at the center/rear of the engine compartment which connects to one of the black plastic intake pipes. If the latter black hose is not connected, there is your problem! If it IS connected, unplug it from the intake pipe and see if you can feel leaks by blowing into it by mouth. Leaks? There's your problem - replace it (or plug it in at the other end, if it has become disconnected at the ECU). No? How well does the hose fit on its connection point? If the rubber is hardened up and not sealing well, replace it. It is absolutely critical that there be no leaks anywhere in this hose or its connection points.

   b. Remove the trim panel above the windshield wiper linkage, and access the ECU. Unplug the small black hose from the ECU (this is the other end of the hose discussed above). Make sure you can blow through it with it disconnected from the ECU. No? It's plugged (or kinked). Replace it.

   c. Obtain a pressure gauge and suitable hoses and fittings so as to allow system pressures to be checked. Gauge should read 0 to 30 psi. A gauge with a higher pressure range can be used, but accuracy of readings will not be as good.

   d. Connect the pressure gauge to a "T" fitting installed at the "red" colour coded hose. This is straight off the turbo compressor discharge. Arrange for the gauge to be visible from the driver's seat. Drive. Before the engine goes into a "limp" mode, get it to 3rd gear at 2500 rpm. Floor the accelerator. Normal response is for "boost" pressure to go to 12 psi and stabilize (chipped cars will go somewhat higher). If the boost pressure goes up too high

and does not come down until the engine goes into "limp" mode, possible causes are: You have not done steps 2a and 2b properly, N75 boost control solenoid valve sticking in "gimme more boost" position, turbo wastegate stuck hose or control unit filled with contamination preventing movement. If the boost pressure never reaches 12 psi, possible causes are: low fuel delivery or wrong fuel in tank or clogged fuel filter, grossly wrong injection timing (will set other codes - check if within specifications - see TDIFAQ), wastegate stuck open, N75 control valve stuck open, clogged exhaust or catalyst, clogged air intake or intake manifold, major leak of boost pressure to atmosphere.

e. It is possible to confirm if the ECU is "seeing" the proper boost pressure, to determine if you have done steps 2a and 2b properly. Connect VAG-COM, arrange to monitor requested and measured intake manifold pressure, drive around, compare to reading from mechanical gauge. Full load above 2200 rpm should give 1800 millibars requested and actual, and that's 12 psi "actual" gauge pressure. NOTE: the VAG-COM readings are "absolute" and include atmospheric pressure, the gauge readings are "gauge" and do not include atmospheric pressure.

f. It is also useful to compare readings from the "red" hose to the "black" hose at the intake pipe connection just before the intake manifold. They should give the same results. Otherwise, there is a leak in one of the control hoses. Find the leak and fix it, this will probably solve your problem.

g. **To check the N75**, remove the mechanical gauge from the red hose and install it on the blue hose (signal to wastegate). Drive. Floor the accelerator above 2200 rpm in third gear, and note response. The gauge should read ZERO until you floor the accelerator above 2200 rpm, at which point it should give a "spiky" reading in the 5 to 7 psi range.

    i. If the blue hose gives the same reading as the red hose, even at lighter engine load and lower engine speed, and the boost pressure is lower than it should be at 2200 rpm full load, then the N75 valve is stuck in the "gimme less boost" position. Replace.

    ii. If the blue hose gives a zero reading under all circumstances and boost pressure is LOW under all circumstances, go to step 2h.

    iii. If the blue hose gives a zero reading under all circumstances. but initial boost response is going above 12 psi before the engine goes into "limp" and there is normal power until the engine goes into "limp", then there is either a major leak in a control hose at or near the N75 valve, or the hoses at the N75 are not connected properly, or the N75 valve is stuck and needs to be replaced.

    iv. If the blue hose gives zero at less than full load / 2200 rpm, but then at full load above 2200 rpm it goes all the way to full boost pressure, then the wastegate is stuck closed. Before condemning the turbocharger, make sure the actuator housing for the wastegate isn't full of oil.

h. **Turbo not developing pressure - further troubleshooting.** Possible causes: Major boost leak in intake pipe, or clogged intake system or intake manifold, or clogged exhaust system or catalyst, or low power due to low fuel delivery for reasons unrelated to the turbocharger system, or major internal problems with the turbocharger.

    i. Under normal circumstances, a leak on the high-pressure side of the intake system will result not only in low power but also a lot of black smoke from the exhaust. This may not happen, though, if the engine goes into "limp" before you ask for load on the engine.

    ii. Refer to step 3 for identification of intake system clogging and intake manifold restrictions.

iii. If fuel delivery is low due to some other fault with the fuel system or the engine or the electronics, then there will not be boost pressure. If VAG-COM reports less than 36 mg/stroke while driving in 3rd gear at 2500 rpm immediately after you put your foot to the floor, then the ECU is limiting fuel delivery for some reason (possibly low air intake - possibly it is already in limp mode for some other reason. This test must be done BEFORE the engine goes into "limp mode"). If VAG-COM is reporting more than 36 mg/stroke, then it's trying to deliver fuel, but it's not happening. Clogged fuel filter, clogged injectors, bad injector pump, wrong injectors for the engine, air leak into the fuel system is preventing fuel from being delivered. fuel leakage on the high-pressure side of the pump.

iv. With regards to boost leakage, a very common problem is that the rubber connectors between the various parts of the intake system develop "splits" as the rubber ages and hardens. Take apart the intercooler pipes and connectors - ALL of them - and inspect every inch of their length and perimeter for leaks. Start with the rubber elbow that connects to the intake manifold - it's the one that splits most often - and usually the split is on the back, towards the bottom, not easily visible without taking it off the engine! Another common spot for leaks is the horizontal steel pipe coming off the turbo compressor at the top rear of the engine. The wire mesh support sometimes rubs through the steel pipe.

v. A major leak in the EGR pipes can also rob power by causing leakage on the exhaust side. Any such leakage ought to be readily apparent (by noise) with the engine running.

vi. With regards to the exhaust system and the catalyst, problems can only be isolated with certainty by drilling a hole in the downpipe upstream of the catalyst, welding on a suitable pipe fitting, then installing a suitable pipe connected to a pressure gauge. Any more than a couple or three psi of exhaust back-pressure under any load condition is too much. Alternatively, the exhaust system can be temporarily disconnected from the turbocharger and a temporary down-pipe made up to see what happens ... make sure the exhaust isn't going to be aimed at anything that could be damaged by high temperature if you try this, and don't drive it for any longer than necessary to isolate whether this is the problem area.

vii. If the wastegate is closed, and the N75 is not telling it to open when it shouldn't, and the exhaust isn't clogged, and the intake isn't restricted anywhere, and the injection timing is good, and the FUEL isn't restricted anywhere, and the MAF is showing a proper reading, and the EGR isn't open when it shouldn't be ... then the turbo may be bad.

3. **Troubleshooting power loss when no codes are being set**
    a. In VAG-COM, go to "measuring blocks" which show requested and actual airflow into the engine.
    b. With the engine at warm idle and all major accessories switched off, give the accelerator a quick "blip". After the engine returns to idle speed, note the requested and actual air flow rates. The specification range for later models is 220 to 370 mg/stroke, but some earlier models can show more than 400 mg/stroke if EGR settings have been changed in the adaptation settings (this is acceptable). Note that the duty cycle of the EGR solenoid, shown on the same screen, indicates that the solenoid is active (duty cycle probably between 20% and 80%). The important thing is that the specified and requested indicate close to the same number.
    c. Now, remove the top engine cover, and remove the small control hose from the EGR diaphragm housing - this is the round silver housing at the extreme rear of the engine compartment, installed on the intake manifold. Start the engine, give the accelerator a quick "blip", and within 1 minute, use your finger confirm that there is vacuum to this control hose. If there is not, there is a problem with the EGR solenoid valve, or a problem with one of the hoses between the vacuum pump, the EGR solenoid valve, and the EGR valve.
    d. Leave the EGR control hose disconnected, return inside the vehicle with VAG-COM operating and showing measuring blocks requested and actual airflow. Give the accelerator a quick "blip". Requested intake air should be as before, but measured intake air should be 480 +/- 20 mg/stroke.
    e. With the EGR control hose still disconnected, have a test drive and see what happens. It is possible that the MIL will come on due to the temporarily inoperative EGR system - this is not important, just clear it afterward. The important thing to note is whether the car has returned to its normal power level.
    f. Interpretation**:** The "normal" response has been described above. If the operation is otherwise:
        i. Measured air volume less than requested during test 3b, EGR duty cycle is low, no vacuum to EGR control hose, measured air volume remains low during test 3d, no difference in test 3e: Either the MAF sensor is not "seeing" the full airflow into the engine due to a major intake leak or restriction or severely clogged air filter, or the EGR valve itself is physically blocked from closing, or the MAF sensor is contaminated or bad, or the intake manifold is severely blocked (see TDIFAQ).
        ii. Test 3b is OK, has vacuum to EGR control hose, but MAF sensor reads low during test 3d, no difference in test 3e: Same as above, but the condition is not as severe.
        iii. Without regard for any of the other tests, but test 3e results in a return to normal power level: EGR solenoid valve is bad or the hoses are wrongly connected to it. Replace it or fix the problem.
    g. Further insolation of problem area: Unplug the MAF sensor, release the clamp at either end of the flexible intake pipe, release the top of the air filter housing, remove the top of the airbox. Inspect air filter, replace if necessary. Inspect the flexible intake pipe and the rigid pipe leading from the elbow to the turbocharger intake, and repair/replace if any significant leaks are found. Below the air filter, note that there is a dome-shaped screen in the bottom of the airbox. Remove it. It will probably be clogged. It can easily be cleaned ... it will clog again ... or it can be left out, with the job of cleaning the air left to the air filter. Upon re-assembly, don't forget to plug in the MAF sensor!

h. Further isolation of problem area: Locate the EGR valve (see above). Locate the black connector in the pipe connected to the intake manifold, immediately below this point. Unclamp this location and look/feel inside the intake manifold, particularly at and just beyond the EGR valve plunger, which you will see inside the manifold. If there is a large build-up of black deposit here, more than perhaps 1/8" thick, remove and clean out the intake manifold as described in the TDIFAQ. Perform the EGR adaptation as decribed in the TDIFAQ to slow down the rate of recurrence.

i. Further insolation of problem area: If it is suspected that the EGR valve is not closing, it can be checked by unbolting the pipe leading to the bottom of the EGR valve and probing the opening with a suitable small piece of wire. With no vacuum applied, the plunger should be fully closed. If vacuum is applied with a suitable hand vacuum pump, the plunger should open, and immediately close when the vacuum is released.

j. With the above steps performed, and the EGR valve confirmed to be closed, repeat step 3d. Also perform the "official" MAF test: in third gear, while monitoring MAF using VAG-COM, floor the accelerator at 2200 rpm. It should show >800 mg/stroke, but this is not valid if the engine is not developing proper boost pressure. If actual intake manifold pressure is reported to be >1800 millibars (or a boost gauge shows 12 psi or more), then the test is valid. This should indicate whether the MAF is bad - it is extremely unlikely. (Vehicles which have had wiring between the MAF and the ECU tampered with - e.g. those with some types of tuning-boxes or the infamous "Epsilonian device" - look for faults in those components before blaming the MAF.)