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Engine maintenance and tuning tips.

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Oh! I nearly forgot. Someone previously asked me what my VW experience was. Okay, here it is. I've worked on several--'78 diesel Rabbit, 2 '81 diesel Rabbits, '84 Quantum (5 cyl), '84 Jetta GLI (fabulous car), '90 Audi 100 and a '91 Jetta. I've installed shocks, springs, complete exhausts, stereos, alternators, gauges, a transmission (that really didn't need to be swapped...I got nervous about the mainshaft circlip thing), rear axles, braided steel brake lines, brake rotors, drums, rear brake cylinders, camshafts, parking brake cables (what a pain), water pumps (smile), stress bars (upper ones are easy), sway bars, etc. I almost got to swap head gaskets on a diesel once. It started to run really bad and when I pulled the head off I discovered the #2 connecting rod bolts had broken--the piston hit the valves. Oops.

Yes, VW Digifant can perform as can any engine management system. Here is what I've discovered thus far... **Most tips really apply to any and all engines**, not just VWs.

NOTE!! When you start your project car, get some advice about what to buy and what parts work together and what parts don't. Don't blow your wad on one item and have to skimp on the rest. Balance is the best approach. I.E., don't use your stock springs with really stiff shocks or don't opt for drilled and slotted brakes and have to buy Hakiko's discount tires. You get the idea... Also, don't neglect yourself. Invest some time in a driving school. At the least, buy a book like Bob Bondurant on High Performance Driving and read and heed it. He has many good tips for street driving.

1. Get a free flow exhaust. One that is dyno-proven. Go from the head to the tailpipe. Make sure you get a performance muffler and mandrel-bent pipes--they have smooth bends (no kinks or necked down areas) necessary for high exhaust flow. [Techtonics Tuning](#) is my favorite. **Use a dual port exhaust manifold.** If you're gonna spend the money, make it count. You can also wrap it with a high heat wrap to retain heat and move the exhaust gases even faster... [See my Diesel performance page...](#) A [SuperTrapp](#) muffler allows you to tune your exhaust to vary your engine's power curve.

⌞ Why a dual port manifold? A dual port manifold helps scavenge more exhaust gases out of the cylinder (it creates a low pressure area in the exhaust pipe) thus making more room for fresh air and fuel. More power! Originally featured on the 1.6L GTIs and most factory performance cars...

2. Open up the airbox! On VW Digifant cars (others are probably similar) remove airbox, take out the restrictor, the vacuum control and such and seal up the hole to the hot air stove on the exhaust manifold (unless you're really worried about cold weather/cold engine performance). This will help a lot. Dyno proven by Automotive Performance Systems on a '90 Passat--**good for 2-3hp!** You also get a nice intake howl when you put your foot down. [Picture](#)

⌞ How to: remove the 2 rubberband hold downs, loosen the intake duct clamp at the airflow sensor, take off the airflow sensor wiring connector, and loosen the clamp on the hot air hose (I removed mine). Now, undo the clamps and remove the top. The air filter might stick, just pull it loose. In the bottom, you'll see what looks like a funnel ending at a flapper of sorts. Remove the funnel. It will come out the front (you have to hold your mouth just right). If that's all you want to do, put in your K&N and reinstall the top on the bottom then put the airbox back in the car. Reconnect everything and road test. You'll hear a throaty growl when you floor the loud pedal. To seal up between the airbox and the headlight enclosure, I used a piece of foam and cut a hole to match the airbox opening. This helps ensure you only get cold air. If you really want to go all out, remove the flapper and the vacuum actuator and

the hot air inlet. Then seal the holes with some of the pieces you removed and some RTV to glue them on (what I did--why not, you're not using them). You could leave the holes open but that lets in hot engine compartment air, reducing the amount available and hence reducing power! Cold air intake (and cost--I'm cheap) are the two reasons I did this mod. Yeah, snowmobile air filters are popular but see the next tip...

This reminds me. I remember reading that the typical engine compartment temp. is approx. 160°F. Now, for every 10°F temp increase, your engine loses 1%hp. On a 100°F day with a snowmobile style air filter you've already lost 6%! (160-100=60; 60/10=6). On a 60° day you've lost 10%!! Not good. **This would likely show up in city driving when airflow through the engine compartment is low.**

Ram air. A well-known racing team with a Porsche 944 Turbo has a ram air intake and according to dyno testing they've only seen about 3hp increase at 150 mph. The increase is proportional to velocity squared. So at typical highway speeds (65mph or so) you may only see 1hp. **However, it's free.** In a motorcycle magazine I read a few months back, a Ninja had the lowest dyno hp yet on the road it's top speed (around 150mph) was higher than two bikes with more dyno hp (like 1 or 2 more). However, the Ninja had a very well thought out ram air intake with two boxes (plenums) along the intake path which seemed to augment the intake airstream by providing a ready source of (slightly) pressurized air. Top speeds were around 150mph or so... VW appears to do something similar with the airbox and the intake manifold. One bike that is a real feat of engineering is the Yamaha Thundercat. No, it's not available here. But Yamaha really did their airflow homework. It's put together so effectively that the intake increases the compression ratio by 1 or 2 points!

2.1 The intake pipe. I've done some measuring, comparing the Digifant airflow sensor outlet area (4 sq in) to the pipe square area (about the same) and the throttle body area (over 7 sq in). The airflow sensor has the smallest area therefore replacing the intake pipe will yield little or no gain. It may help smooth the airflow but the sensor is the high airflow (read high power) limiting factor. On CIS cars the "S" pipe could be replaced with a 3" pipe with a 45° (roughly) bend at one end (aka Sewer Pipe). This maintained a constant diameter from the airflow sensor (80mm, app 3") thus minimizing airflow directional changes and maintaining velocity better. Does it improve horsepower? I don't know. NOTE; according to a chart denoting tuning tips in the Dec '90 issue of European Car, Digifant is good for 160hp.

2.2 Porting the cylinder head and intake and exhaust manifolds. Several small gains can be made here as well as engine smoothness increases. Don't go crazy when removing material. Tom Cloud's [page](#) covers his work on a GT-40 engine (big block Ford) but I read through it and summarized it here...

- ◀ *Remove all burrs in intake and exhaust passages--they obstruct airflow.
- *Polishing combustion chambers prolongs onset of deposits.
 - after this you can cc the chambers (if you're really anal...) --making them the same size makes compression the same cylinder to cylinder--helps produce more even power. Doing this requires using some plexiglass, a buret, some (white) grease, some mineral spirits and a clean cylinder head surface.
- *Remove combustion chamber burrs--this avoids hot spots.
- *Hand lap valves to ensure good seal. Don't depend upon spring pressure.
- *Match port cylinder head to both manifolds--continues smooth airflow.
- *Valve guide bosses--just blend material around them to create a smooth contour --you don't want to weaken the area!
- *Remove ridges around valve seats in combustion chamber and ports--**most airflow differences are at low valve lifts!** Why? Your valves spend much more time at low lifts than they do at high lifts.
- *Intake airflow is more important than exhaust flow. Yes, exhaust is important but if you don't get air in, you don't have to worry about it going out...

Use a dremel with high speed steel (for Aluminum) or stone bits (for cast iron) and wind it out. Get a mask and some hearing protection. Trust me. You don't want to smell cast iron for two days after you're done... I mention this on my [diesel performance page](#) when I talk about match porting the exhaust manifold to the downpipe. You don't want to use the stone on aluminum because the stone loads up (with aluminum). High speed steel gets dull REAL quick on cast iron so use the stone there. It's slow going but it works.

3. Get a K&N air filter. It costs the same as the paper replacement yet you never need to replace it. Great if you're environmentally conscious or just want to reduce the amount of maintenance you do. Just clean it every 50,000 miles. I

use laundry detergent and water and let it air dry overnight (**no compressed air!!**).

4. Do you plan on keeping the car for a while? I mean over 100,000 miles. Use synthetic engine oil --I use Mobil 1. If you don't want to spring for synthetic be sure to change the oil at 3000 or 3500 miles. --For the environmental types there are now oils that include 25% re-refined oil--i.e., recycled oil that's been refined and the impurities removed. Just as good as conventional oils.-- Oil wears out and gets dirty with combustion by-products. Use a good filter and change it with every oil change. If a filter fills up with dirt it starts by-passing. Meaning the oil still flows through the engine but not through the filter. You get the idea. I use NAPA--it's really a WIX filter with a NAPA part number. (WIX is good stuff) Fram isn't constructed as well. I've seen inside both. I tried the Mobil oil filter. It has synthetic fiber inside instead of paper and is touted to stop more contaminants. \$10 a shot though, ouch. I don't think it's worth it. I'll stick with NAPA.

⚡ Why synthetic oil? It's more expensive, but cleans much better and resists breakdown (i.e. heat and pressure literally tearing down the oil) better than conventional oils. With conventionals you really need to change oil regular, i.e. 3,000 miles. The products most people and most quick lubes use won't last much beyond that. Synthetics pour easier and flow better also--especially in cold weather. When they first came out, synthetics got a bad rap because they were so high detergent, they'd clean out the gaps in engines gaskets (that the conventional oil previously plugged) and cause them to leak oil. Nowadays, gaskets seal much better and resist that tendency.

With a diesel, I heartily recommend synthetic **OR** changing the oil and filter at 2,000 miles or so. Diesels really get the oil dirty and they have more internal friction due to the increased compression--**they are much harder on oil**.

Another tip. Shake your oil bottles a little before you dump them into the engine. There's a little additive that tends to settle out when the bottle sits for a long period of time. Anyhow, this additive--antifoam agent--prevents oil from foaming during engine operation. **Very important as air is a poor lubricant.**

5. **ALWAYS run good fuel.** I use Amoco Ultimate (premium 93 octane) or (**UPDATE**) Sinclair (no Amoco here in Oklahoma). I've tried other flavors (Texaco and Shell) but these work the best. Also, avoid gasohol whenever you can if you own either VWs or Audis. For diesels, make sure the fuel is fresh. Truck stops are a good prospect. Amoco makes Premier Diesel and Union 76 offers Super Diesel. Both have a little higher cetane rating -- a measure of the fuel's energy rating.

6. I'm using Jacobs plug wires. However, Blue Ignitors are purported to be good stuff. (I've not tried them) Factory ends and such. Anyhow, Jacobs wires have really low electrical resistance --approximately 1500 ohms for the longest wire on my car versus the shortest stock wire at 7500 ohms! These do work but you need to modify just a little. Don't even try the ignition. Digifant don't play that. The car runs well with Jacobs wires and stock ignition. These wires allow you to open up your plug gaps another 0.015" or 0.020" thus exposing more spark to the fuel/air mixture... On a 1.8L 8v, this equates to 0.042"-0.047". (I'm currently running 0.042".) Go above 0.050" (as Jacobs tech reps recommend) and at low rpm and with heavy throttle input the car will stumble a lot as the ignition can't spark across the gap with so much air pressure. (You kinda blow out the spark) It's really weird to be going along in 5th @ 1500-1600rpm and stand on the gas and feel the car slow down...until you release the gas pedal some.

I've also been told to avoid using Platinum plugs with the Jacobs wires--something about not storing or carrying enough energy through the wires...seems to work just fine for me though.

So what is this bigger gap going to do for you? The larger gap exposes more spark to fuel/air mixture, thus helping light the fire and giving you a more complete burn. This helps economy. Just don't overdo it. Too large a gap is really hard to light off during starting. (You'll notice this if your gaps get up around 0.050" or so...)

⚡ Oh. The Jacobs wire modification is simple. I had to do this when I discovered that one of the wires arced directly from the wire to the cylinder head--clearly visible at night. Rub some car wax on each spark plug at the top where the wire end covers it. Let the wax dry (**DON'T WIPE IT OFF**) and apply a bead of silicon (RTV) around the top of the plug (I used **red**). Now install the plug wires onto the plugs. Actually, **do the plug wires one at a time**. It's really a pain to figure out the correct order if you screw it up... Let the car sit overnight and then pull the wires off one at a time just to ensure they'll obey. Stick them back on and you're done. The wax acts as a release agent. RTV does a fine job of keeping the spark in.

7. Diesels: make sure your injections spray at the proper pressure. Too low and they really affect performance.

Remember, always replace the heat shields each time you remove the injectors. Also check your glow plugs as this can be a quick tipoff to poor injector performance. I've seen some glow plugs with half the tip gone! Also, if the car starts hard in cool weather, check to see if the fuse or fuseable link (on the firewall in US built Rabbits) is still good. Glow plugs don't work without juice... I push started my car for a week once 'til I figured that one out.

8. Use distilled water in both your battery and your cooling system. Yes, both. Why? Plain tap water has lots of minerals and other goodies that are okay for drinking but bad for engine and battery internal parts. Minerals and such tend to accelerate corrosion of copper, aluminum, iron, etc. Distilled water doesn't have all of this stuff - essentially pure H2O so the impact on internals is much lower as water is a very stable molecule. (Reactive things start the corrosion process)

9. Use good spark plugs. I've modified mine (Bosch Supers) so that the finger is rounded and terminates just above the electrode tip. Why? It worked good on my pushmower. I figure I'm unshrouding the spark a little more. Look at some Allied Signal spark plugs. They do the same thing but have a fancy electrode tip. Bosch Platinums look similar to what I did... **UPDATE:** Bosch Platinums allow the engine to start a little easier and run smoother. I've found I can run a little larger plug gap also...(0.003" more--I'm running 0.045" gaps now--I really didn't want to go over 0.050")

10. Want to remove corrosion from copper wires around the battery? Coat them with ketchup. It works. You may have to clean it off later and repeat (depending upon how bad the corrosion is) but it should come out clean.

11. Slotted or drilled rotors are expensive and it's hard to get long pad life since the rotor surface tends to chew them up more. I slot the brake pads instead. Just cut a groove with a hacksaw through the pad --perpendicular to rotor rotation--and that's it. However, I've found that brake dust tends to fill that skinny groove so this last brake job I used my Sears angle grinder and cut a 1/8" slot. The slot allows the brake dust a place to escape and helps keep the heat down.



12. I learned the hard way not to put Bosch Platinum+4 spark plugs in my Audi 100. It starts harder and stumbles more after starting. The original and best plugs are...NGK BP6ET or Bosch W7DTC. Triple electrodes that really do the trick. I called my local Audi dealer and they pull these Bosch plugs out at 60,000 miles just to check them! Not necessarily for replacement...

Do you have any tips? Was this page helpful? Give me the details and I'll add them to my list...
Send them to: glim2@earthlink.net