

Please give credit where credit is due! These DIY's were completed ENTIRELY by Gary Thompson, Ph.D. Please make sure to say thanks to Gary, and if you ever see him at a bar, buy em a beer. These DIY's are more complete than anything Bentley has ever written!!

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Please also note that these DIY's are to be used for REFERENCE ONLY. While Gary has probably forgotten more about VW's than the rest of us will ever learn in our lifetime, neither he nor me are responsible if you screw something up. Bottom line - dont touch your car if you dont know what you are doing.

REMOVING AND CLEANING A MKIV THROTTLE BODY (THROTTLE VALVE CONTROL MODULE)

The following outlines the procedure for removing and cleaning the drive-by-wire (DBW) throttle body (officially known as the throttle valve control module) on a MKIV VW. The procedures were based on a 99.5 Jetta GLS VR6 and may be different on MKIV cars with different engines (1.8T, 2.0), body styles (Golf, GTI, New Beetle) and from different model years. Specifically, the

procedures for removing and reinstalling the throttle body (herein referred to as TB) may differ due to slight differences in the design and orientation of the TB, however, the general removal/reinstallation procedures, as well as the cleaning procedures should be very similar. Please do these procedures at your own risk and be ready to make small adjustments while doing them. Also, please be observant while removing parts so that they go back together correctly.

Before proceeding any further, I must make it clear that the DBW TBs used on the MKIV vehicles are high-precision, electro-mechanical devices. If you damage the servos and sensors which control the motion and position of the throttle valve (also known as the butterfly valve) while performing this procedure, there is a very great chance that your engine will not run correctly and the TB will need to be replaced. Since a new TB costs around \$500, this is something that you will obviously want to prevent from happening. Therefore, be extremely careful when performing the procedure and heed the warnings and cautions that are given. I am not, nor will be held responsible if you mess up your TB while doing this procedure.

This DIY is broken up into three parts...

Part I deals with the removal of the TB from the intake circuit. Two methods for removing the TB are given. The first method is the "quick and dirty" method and requires that the least number of things be disconnected/removed in order to disconnect the TB. I did not perform this procedure, so I have no idea how long it takes. Nevertheless, I have supplied it for all the minimalist DIYers out there who like to keep things simple. (Note: If you follow this method, you may notice that the pictures posted for this method do not actually show anything disconnected. Please disregard these inconsistencies. Since I did not perform this procedure, I did not have the appropriate pictures and used those taken after everything was already reassembled. Just follow the written directions, using the photos only as a reference, and you should have no problems.) The second method is the "slow and thorough" method and requires that significantly more things be disconnected. The advantages of this method are that it (1) allows various other parts of the intake system, such as the main intake tube and PCV circuit to be examined and cleaned and (2) unclutters the "workspace", making it significantly easier to remove the coolant lines from the TB. This method is the one that I followed when cleaning my TB and I recommend that others use it as well. If you're familiar with this area of the engine bay, it will take approximately 30-60 mins to remove the TB using this method.

Part II deals with the cleaning of the TB. The cleaning procedure should take 30-60 mins or more, depending greatly on how dirty your TB is and how careful and thorough you are when cleaning it.

Part III deals with the adaptation of the TB to the engine control module (ECM) using a VAG-COM or other suitable scan tool. It is not absolutely necessary to perform this procedure, however doing so immediately following the reinstallation of the TB will help insure the smooth operation of the engine when it's first started.

The tools/parts needed to perform the procedures are:

- 1) 10mm wrench or socket (to disconnect negative battery lead)
- 2) Appropriate tool for removing hose clamps. If you have the stock spring clamps, a pair of channel lock pliers works great for this purpose since the jaws are roughly perpendicular to each other (helps prevent clamps from slipping in plier jaws) and the jaw width can be adjusted for each particular clamp size. If you have screw-type clamps, you'll need the appropriate screwdriver.

- 3) 5mm hex/Allen wrench (to remove TB from intake manifold)
- 4) Phillips screwdriver (only needed in "slow and thorough" method if removing MAF housing from air filter housing)
- 5) Flat blade screwdriver (to help remove spark plug wire boots from coilpack - not needed for "quick and dirty" method)
- 6) T30 Torx driver (to remove engine cover pieces - not needed for "quick and dirty" method)
- 7) Can of intake/TB cleaner
- 8) Q-tips or something similar (to gently scrub away the TB deposits)
- 9) Sheet of plain white paper
- 10) Paper towels or rags

optional ...

- 11) New TB-to-manifold gasket. The Bentley manual instructs that this gasket should be replaced when the TB is removed, but more than likely it can be reused. Mine was still in excellent shape so I reused it. If you are uncomfortable doing this, purchase a new gasket.
- 12) VAG-COM or other suitable scan tool (for performing adaptation of TB to ECM).

PART I - REMOVING THE THROTTLE BODY

1. The TB is located at the back of the engine bay between the air intake hose and the intake manifold and is indicated by the yellow arrow in picture below.



2. The TB is shaded blue in the picture below.

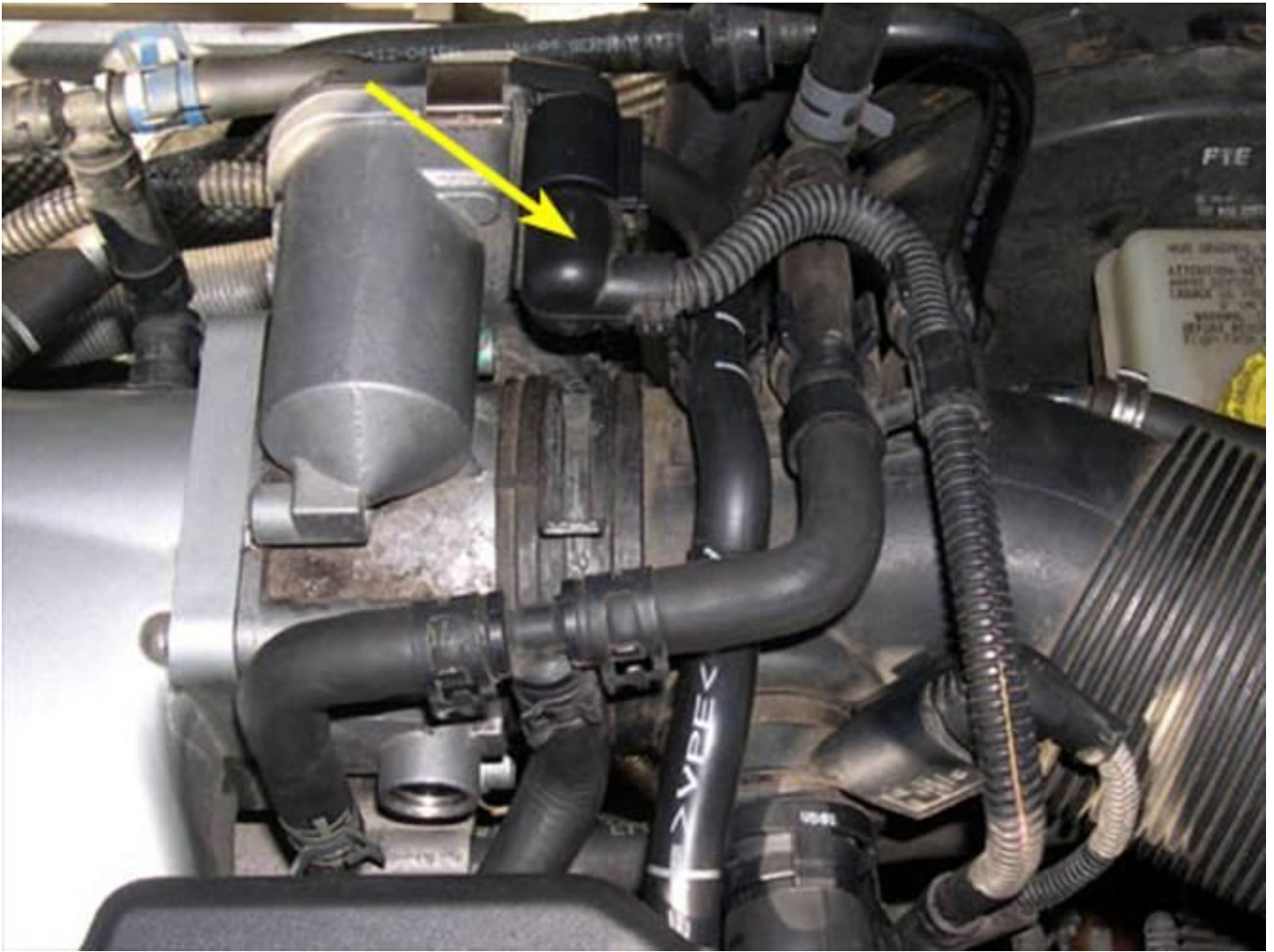


- To follow the "quick and dirty" removal method, follow steps 3 through 11.
- To follow the "slow and thorough" removal method, follow steps 12 through 30.

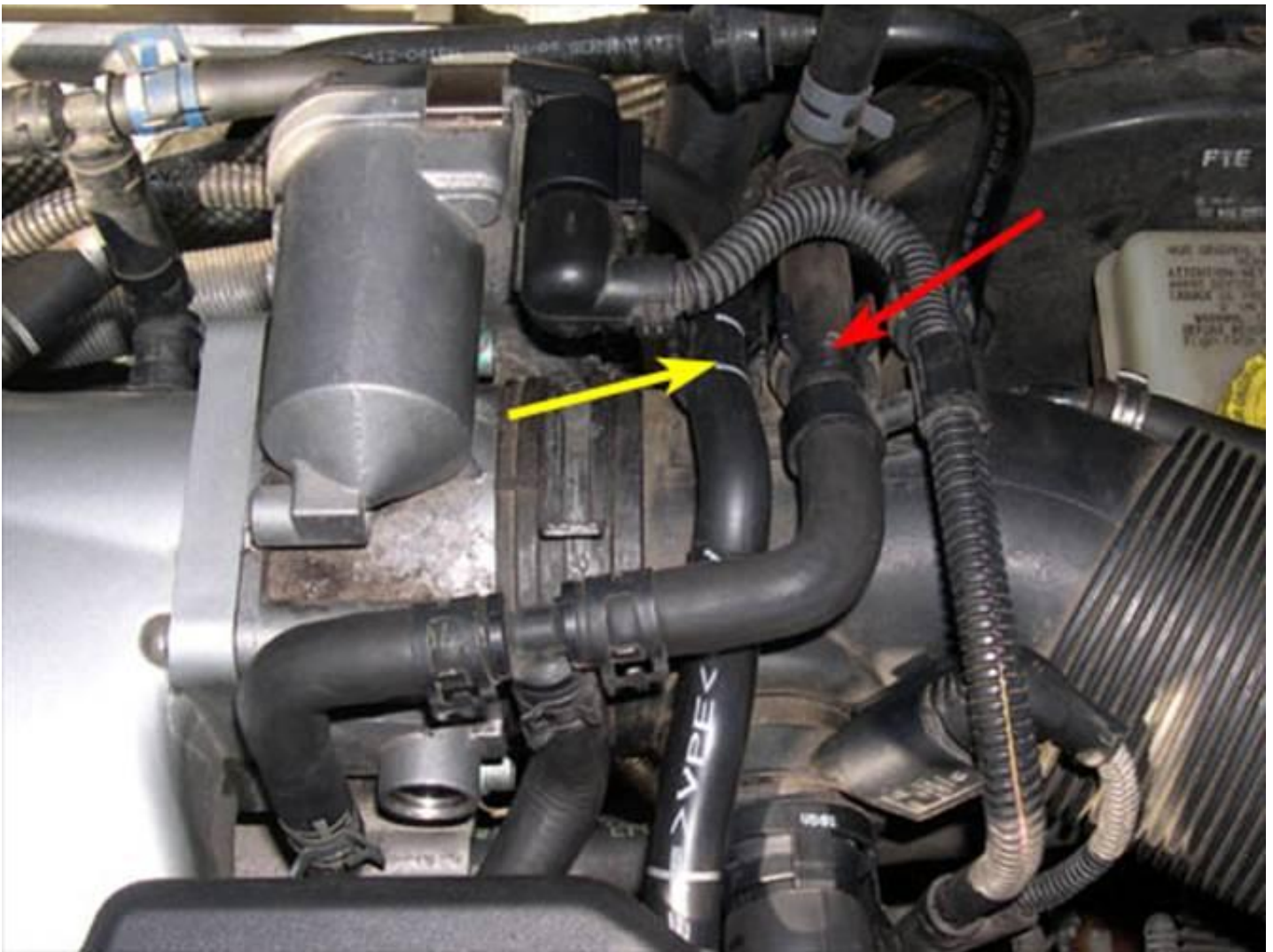
QUICK AND DIRTY REMOVAL METHOD

3. Remove the battery box cover and disconnect the negative (-) battery lead from the battery using a 10mm wrench or socket. Secure the lead away from the (-) battery post so that it does not accidentally touch it while you're working on the car.

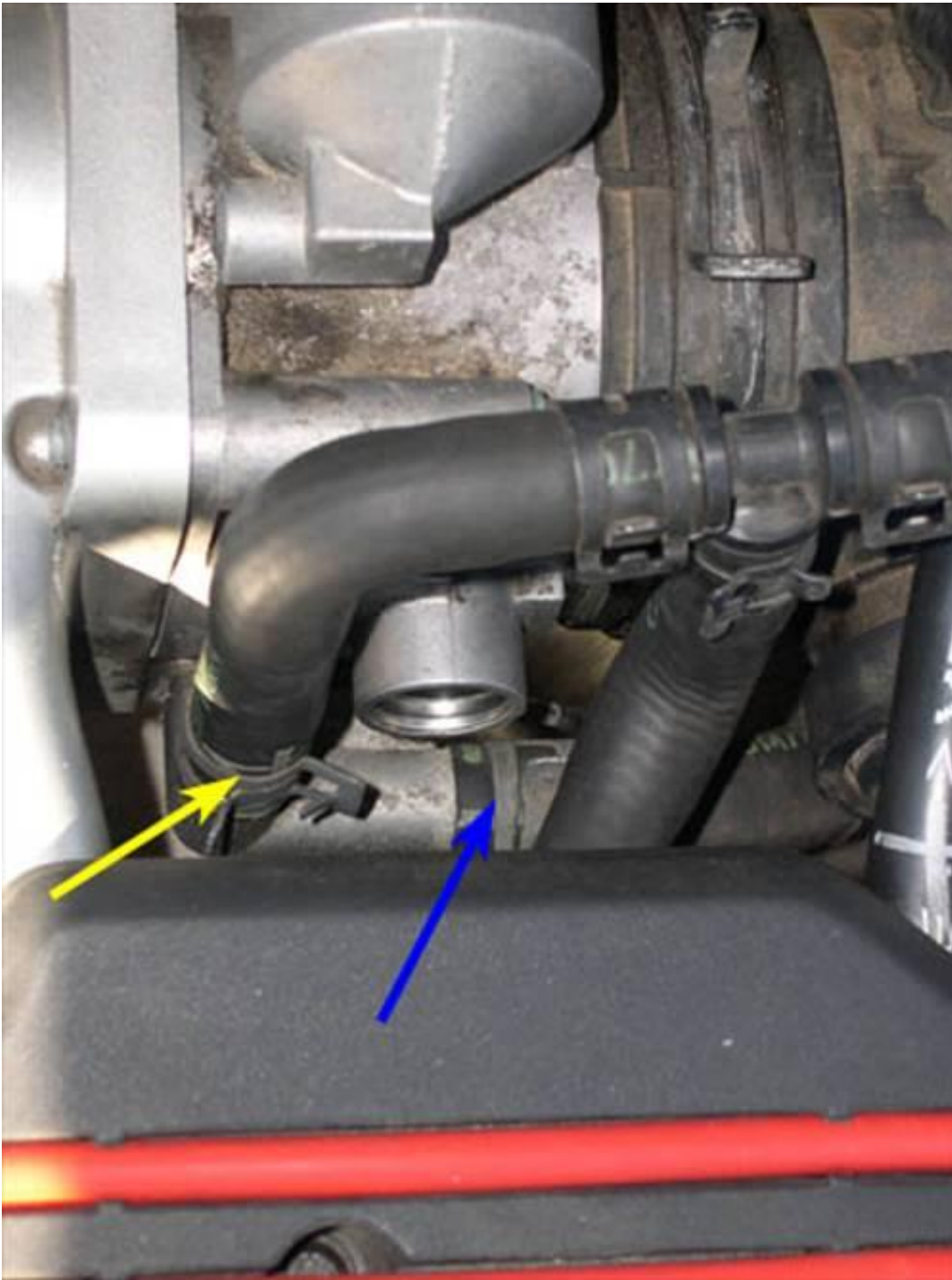
4. Disconnect the harness connector from the TB. The connector is indicated by the yellow arrow in the picture below.



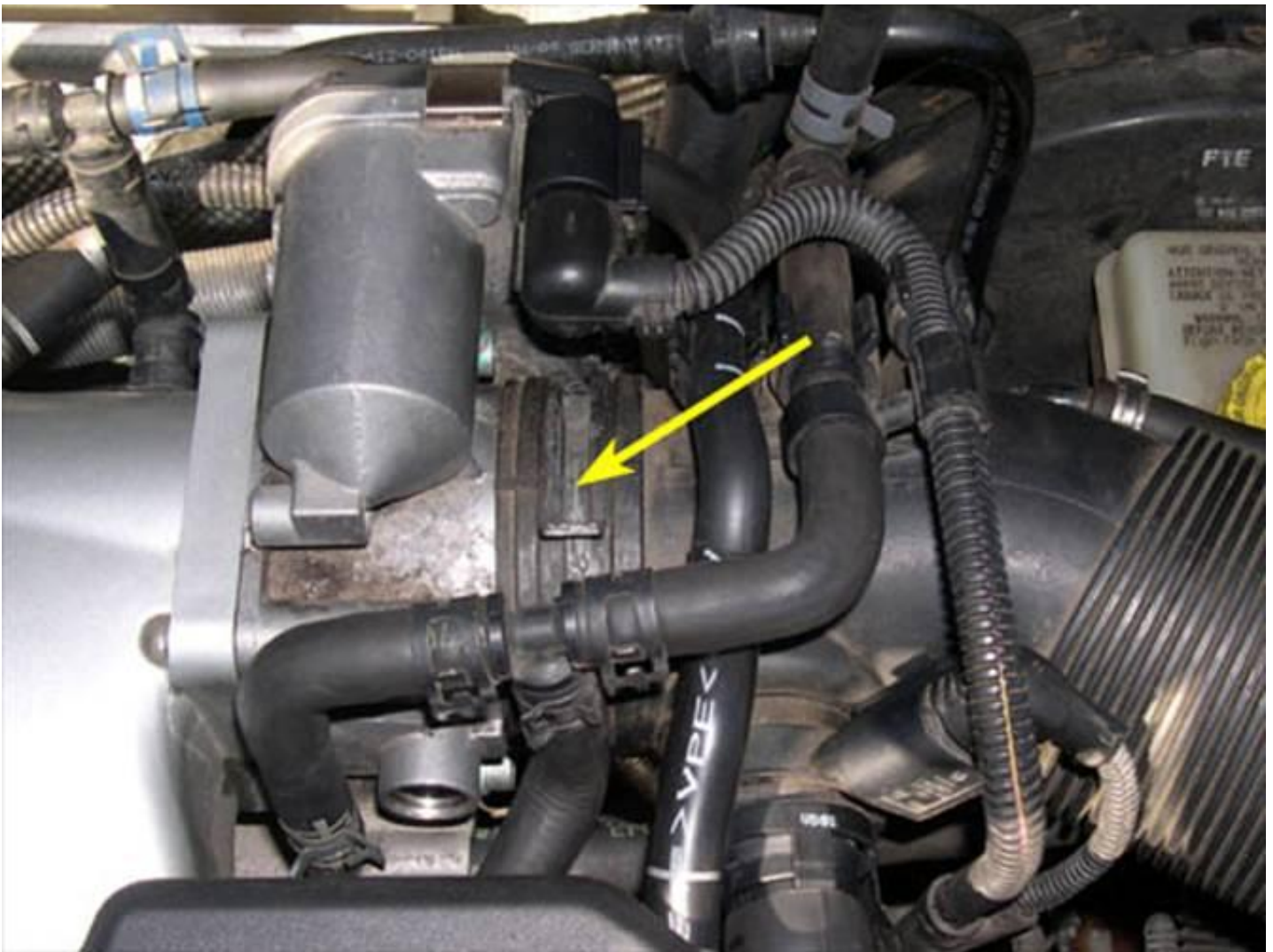
5. Unclip the coolant hose (red arrow in picture below) and the PCV vacuum-assist hose (yellow arrow in picture below) from the top of the air intake tube.



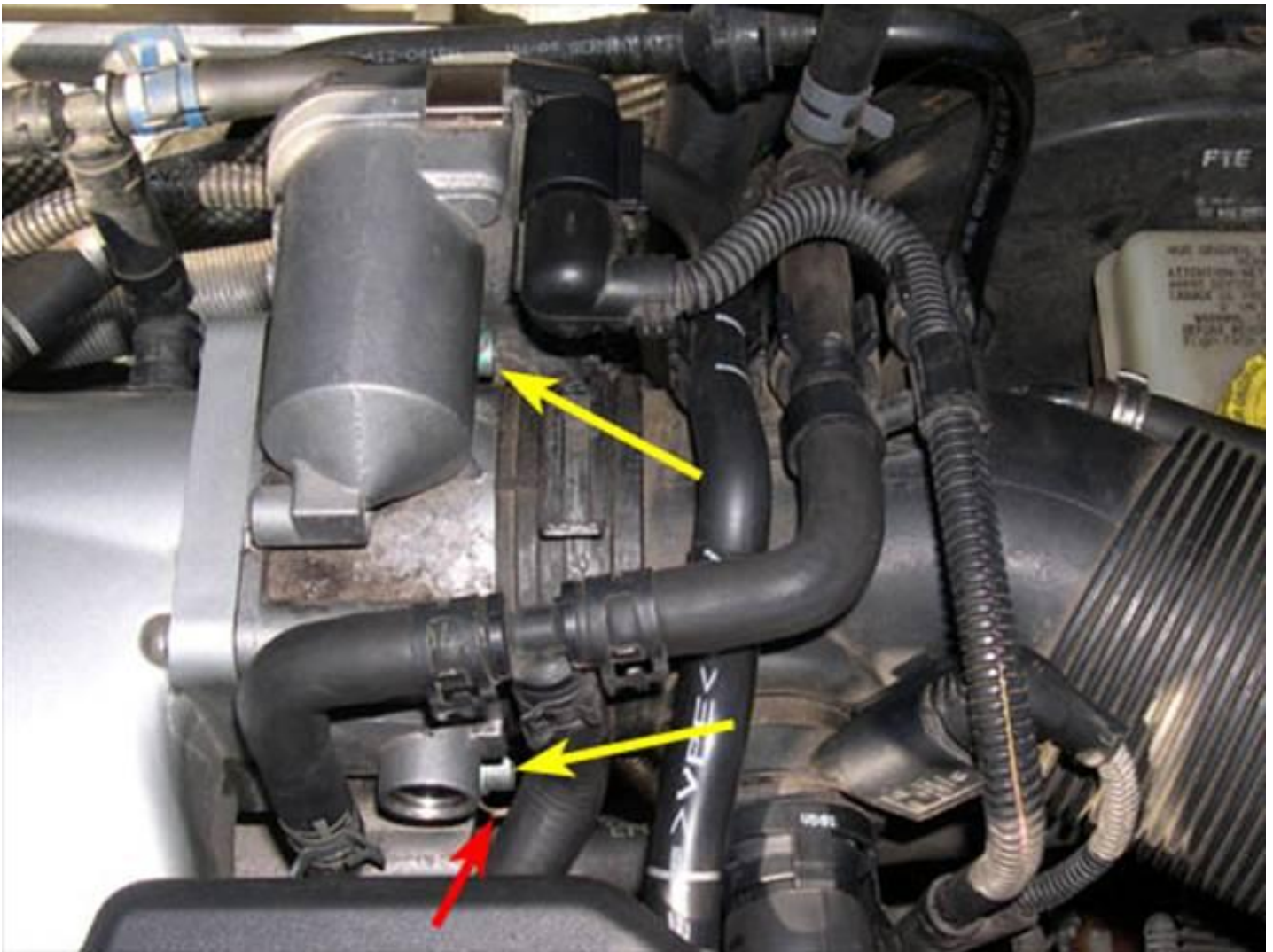
6. Disconnect the upper coolant hose (yellow arrow in picture below) and lower coolant hose (blue arrow in picture below) from the TB. To do this, use the appropriate tool (pliers or screwdriver) to release the tension from the hose clamp, slide the clamp down the hose and out of the way (for spring clamps, make sure the clamp is moved past the end of the nipple inside the hose or the clamp will reapply pressure to the nipple when released), and then pull the hose off of it's nipple.



7. Release the tension from the clamp securing the main air intake tube to the TB (indicated by yellow arrow in picture below) and then slide the intake tube off of the TB.



8. Using a 5mm hex/Allen wrench, remove the 4 long bolts that secure the TB to the intake manifold. There is one bolt at each corner of the TB, two of which are indicated by the yellow arrows in the picture below. Support the weight of the TB as you remove the last bolt. You wouldn't want the TB to fall - it is a delicate, high-precision device. Note that one of the bolts also secures a ground wire to the TB (indicated by red arrow in picture below). In my case, the ground wire was secured by the lower, front bolt, but a different bolt may be used in your car. Remember which bolt the wire was attached with so that it can be reinstalled in the same position.



9. While holding the main intake tube and coolant/vacuum hoses out of the way, pull the TB up and off of the intake manifold.

CAUTION: Be careful not to let ANYTHING fall into the intake manifold while the TB is removed. You don't want any foreign objects being sucked into the engine when it's first started - this may cause severe damage!

10. The yellow arrow in the picture below indicates the gasket that seals the rear of the TB to the intake manifold. Prior to reinstalling the TB (new or existing), either replace the gasket with a new one or decide to reuse the existing one. If you decide to reuse the existing gasket, make sure to clean it by wiping it with a rag or paper towel to remove any debris or contaminants that may be on the mating surface. (The red arrow in the picture below shows a better view of the ground connection that is secured to the TB by one of its mounting bolts.)

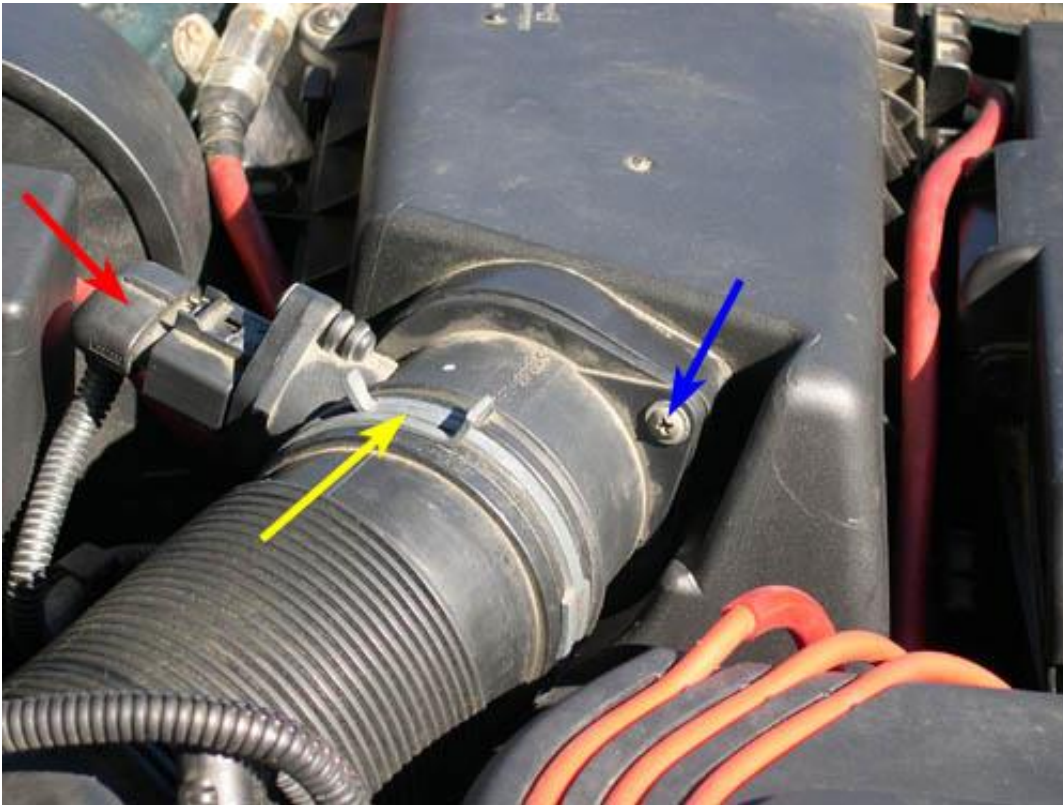


11. If you are replacing the TB, install the new unit by following steps 3 through 9 in reverse and then proceed to Part III (TB adaptation). If you are cleaning your existing TB, proceed to Part II.

SLOW AND THOROUGH REMOVAL METHOD

12. Remove the battery box cover and disconnect the negative (-) battery lead from the battery using a 10mm wrench or socket. Secure the lead away from the (-) battery post so that it does not accidentally touch it while you're working on the car.

13. Release the tension from the clamp securing the main air intake tube to the MAF housing (indicated by yellow arrow in picture below) and then slide the intake tube off of the housing. If you're like me and are paranoid that anything you do under the hood can potentially harm the poorly-designed MKIV MAFs, you may also want to remove the MAF and put it in a safe place. It is not necessary to do this in order to remove the TB, but you never know with these MAFs. If you want to remove the MAF housing from the air filter box, disconnect the MAF harness connector (red arrow in picture below), remove the two Phillips screws that secure the MAF housing to the air filter box (one of the screws is indicated by the blue arrow) and GENTLY slide the housing out of the filter box. There is a large gasket sealing the two which snaps into the opening in the filter box, so it may require some force to separate them.



14. Carefully remove the spark plug wires from the ignition coilpack by pulling the rubber wire boots off of the posts on the coilpack, as shown in the picture below. This may be difficult due to the suction created by the seal between the boots and posts. I used a flat blade screw driver to carefully slide the boots off of the posts. (Be careful not to rip the boots if you do this or the engine may misfire when moisture is present.) I recommend that you mark each wire so that it is reinstalled on the correct post later on.



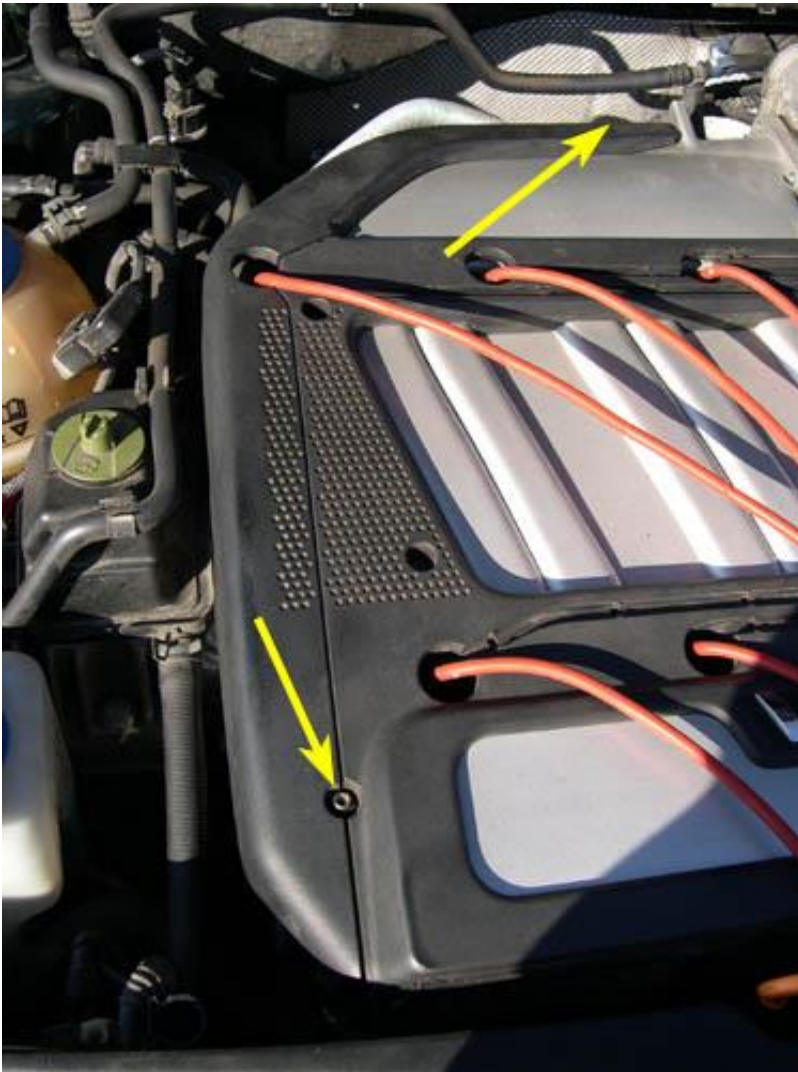
15. Unclip the spark plug wires from the channels in the engine cover, as shown below.



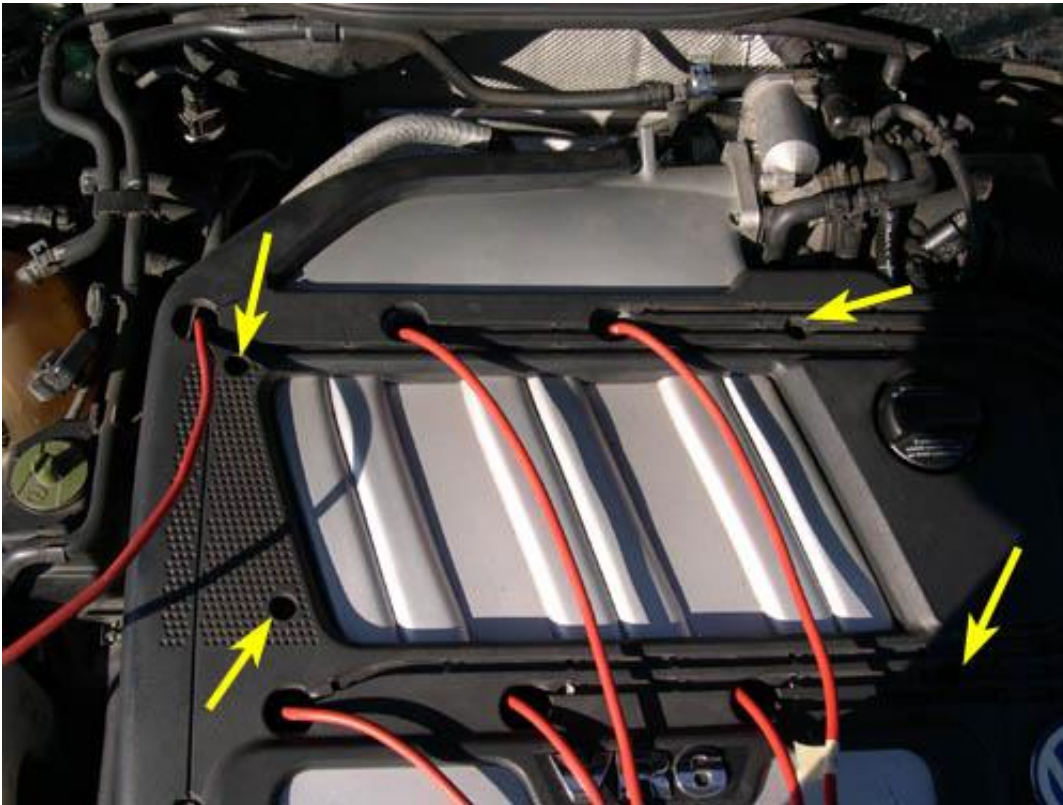
16. Remove the small engine cover piece with the VW logo on it by removing the single T30 Torx screw, indicated by the yellow arrow in the picture below.



17. Remove the long, thin engine cover piece on the passenger's side of the engine by removing the two (2) T30 Torx screws indicated by the yellow arrows in the picture below.



18. Remove the main engine cover piece by removing the four (4) T30 Torx screws indicated by the yellow arrows in the picture below. As you lift up on the cover piece, you will need to thread the spark plug wires through their respective holes in the cover in order to fully remove it.

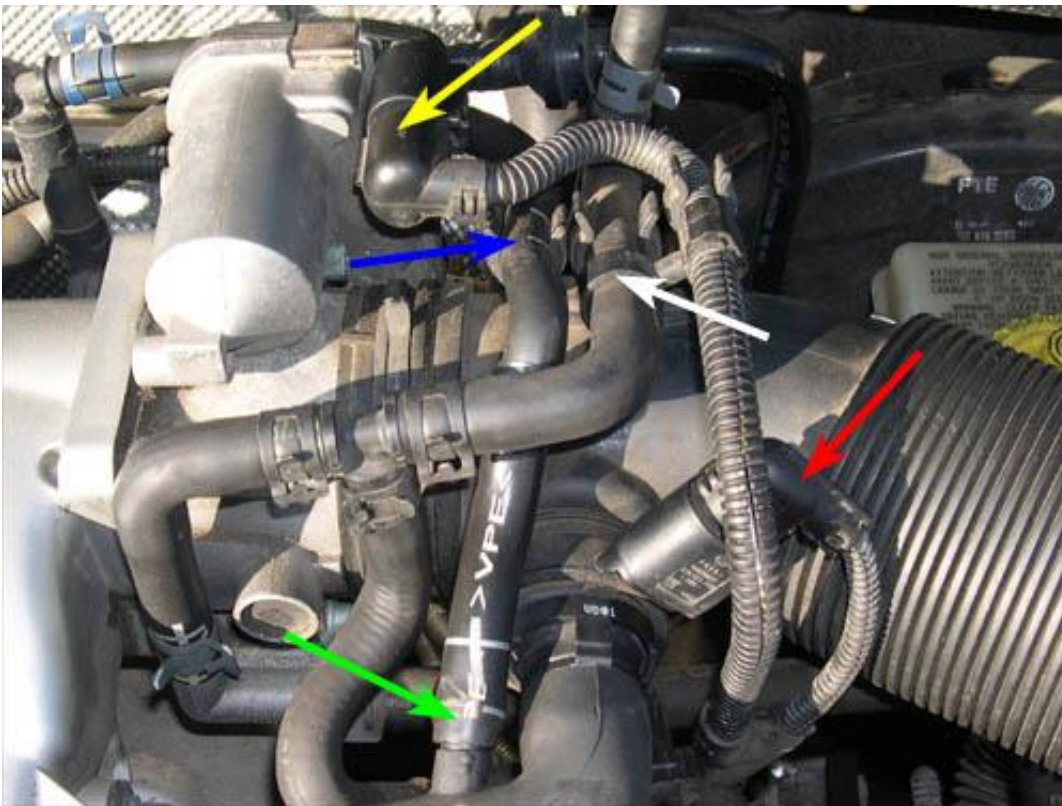


19. The picture below shows how the top of the engine should look with the three engine cover pieces removed.

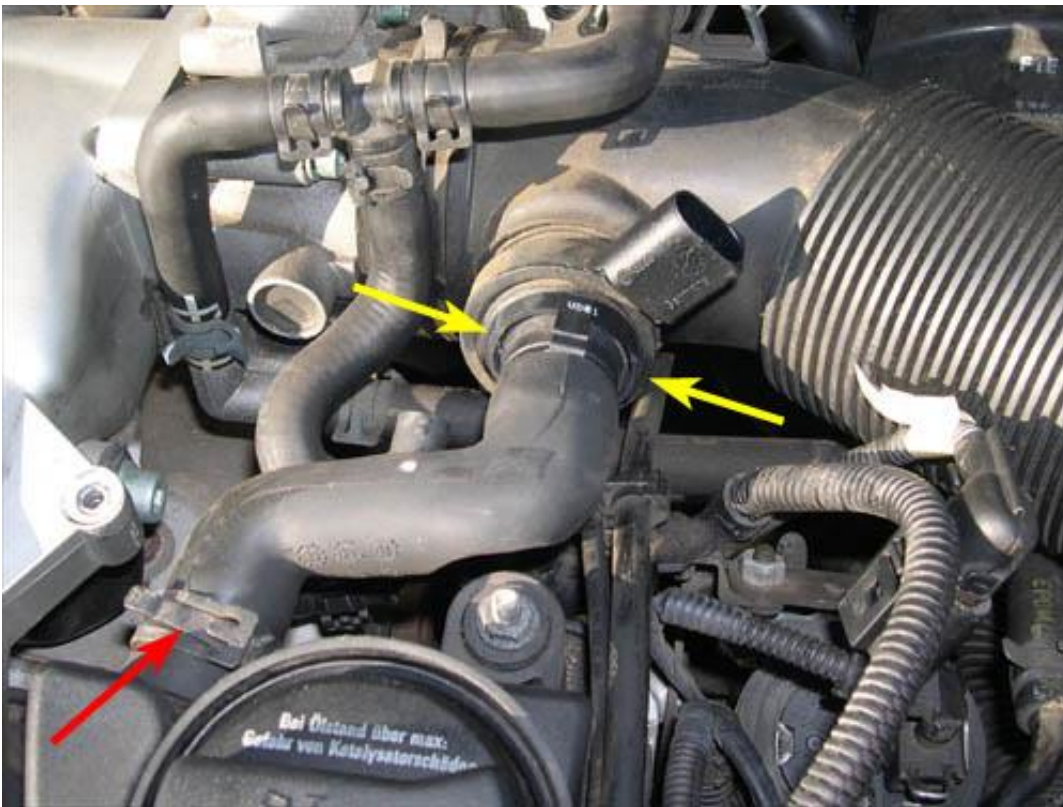


20. Disconnect the electrical harness connectors for the TB (yellow arrow in picture below) and PCV valve heater (red arrow in picture below). Next, unclip the TB harness connector lead from the

top of the coolant hose which passes over top of the main air intake tube (white arrow in the picture below) and move the lead out of the way. Finally, disconnect the vacuum-assist hose (green arrow in picture below) from the PCV valve S-hose (between valve cover and main intake tube), unclip the hose from the top of the main intake tube (blue arrow in picture below) and move the hose out of the way.



21. Disconnect the PCV S-hose from the PCV valve on the main intake tube by pushing the two serrated tabs together (yellow arrows in picture below) and carefully pulling the hose off. If you want to also clean the inside of the PCV S-hose (there WILL be oil in it), release the tension from the clamp on the other end of the S-hose (red arrow in picture below), slide the clamp up the hose a bit and then pull the hose off of its nipple. (Note the position of the bend in the S-hose relative to the bolt/nut just to the rear of the oil cap. There should be sufficient room between the hose and bolt so that the bolt does not cut into the hose. There is a depression on the underside of the hose at the bend to provide more clearance. Make sure to reinstall the hose in the same position later on so that abrasion does not occur.)

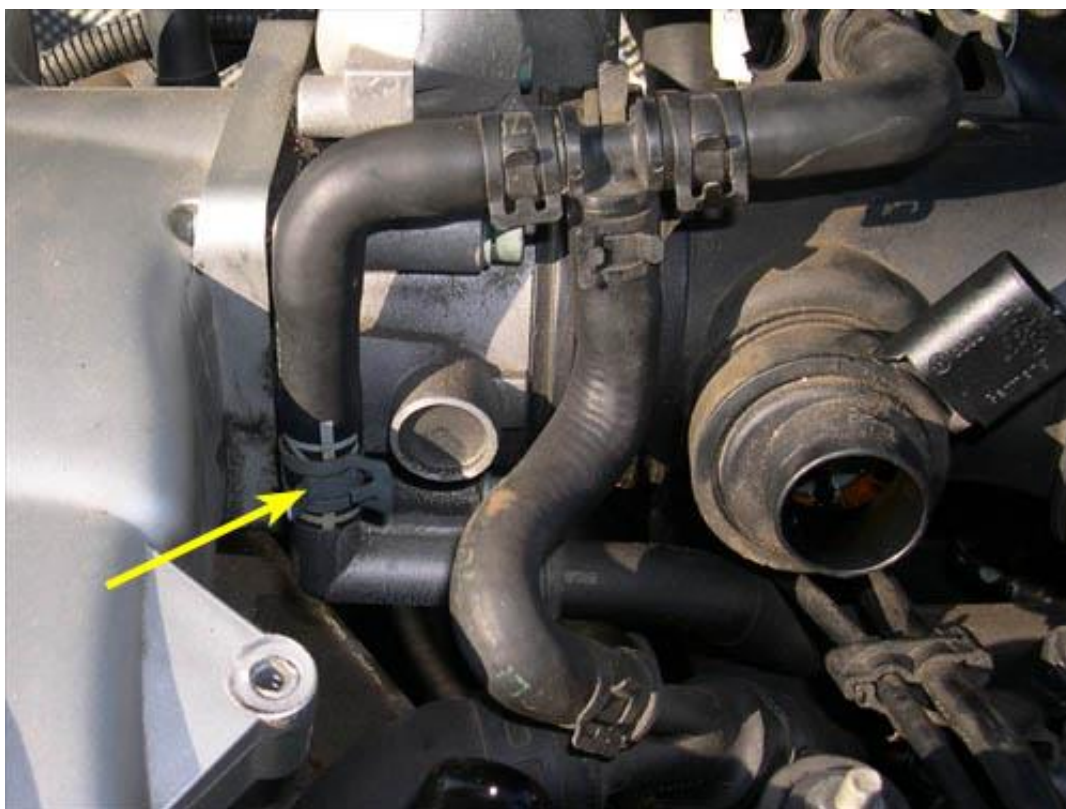


22. The picture below shows the inside of the PCV valve/heater on the main intake tube. If you look closely, you can see the abundance of condensed oil vapors.



23. Disconnect the upper coolant hose (yellow arrow in picture below) from the TB. The nipple on the TB is approximately 1" long, so the clamp has to be moved up the hose at least that much in

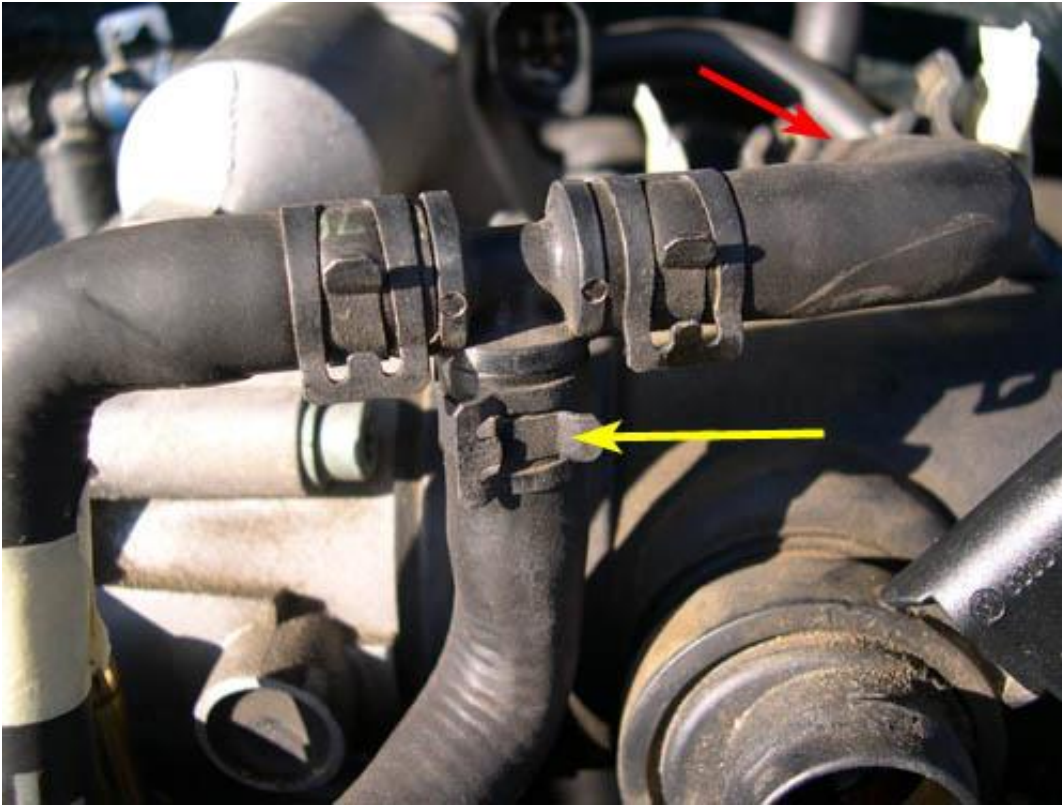
order to remove the hose from the nipple.



24. Disconnect the lower coolant hose (yellow arrow in picture below) from the TB. Again the nipple on the TB is approximately 1" long, so the clamp has to be moved down the hose at least that much in order to remove the hose from the nipple.



25. Disconnect the vertical coolant hose (yellow arrow in picture below) from the T-junction in front of the TB/main air intake tube. Next, unclip the horizontal portion of the coolant hose T-junction from the top of the main intake tube (red arrow in picture below) and then move the hose out of the way. At this point, there should be no coolant hoses attached to the TB, nor should there be any coolant hoses or electrical leads passing over the top of the main intake tube.



26. Release the tension from the clamp securing the main intake tube to the TB (indicated by yellow arrow in picture below) and then slide the intake tube off of the TB.

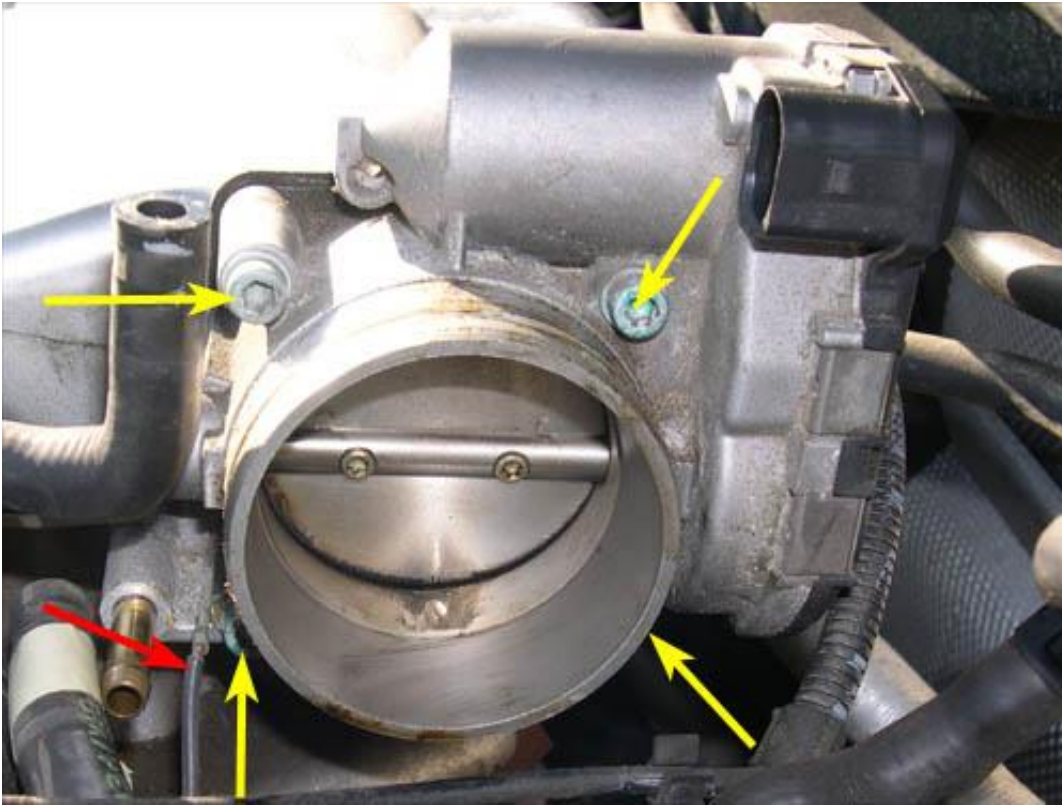


27. The picture below shows the large amount of condensed oil vapor in the main intake tube due to the PCV circuit. I wiped this oil off the inside of the tube with a paper towel. (I can only imagine how much oil is in the intake manifold and elsewhere in the engine. Someday I'll clean it all out.)



28. Using a 5mm hex/Allen wrench, remove the 4 long bolts that secure the TB to the intake

manifold. There is one bolt at each corner of the TB, as indicated by the yellow arrows in the picture below. Support the weight of the TB as you remove the last bolt. You wouldn't want the TB to fall - it is a delicate, high-precision device. Note that one of the bolts also secures a ground wire to the TB (indicated by red arrow in picture below). In my case, the ground wire was secured by the lower, front bolt, but a different bolt may be used in your car. Remember which bolt the wire was attached with so that it can be reinstalled in the same position.



CAUTION: Be careful not to let ANYTHING fall into the intake manifold while the TB is removed. You don't want any foreign objects being sucked into the engine when it's first started - this may cause severe damage!

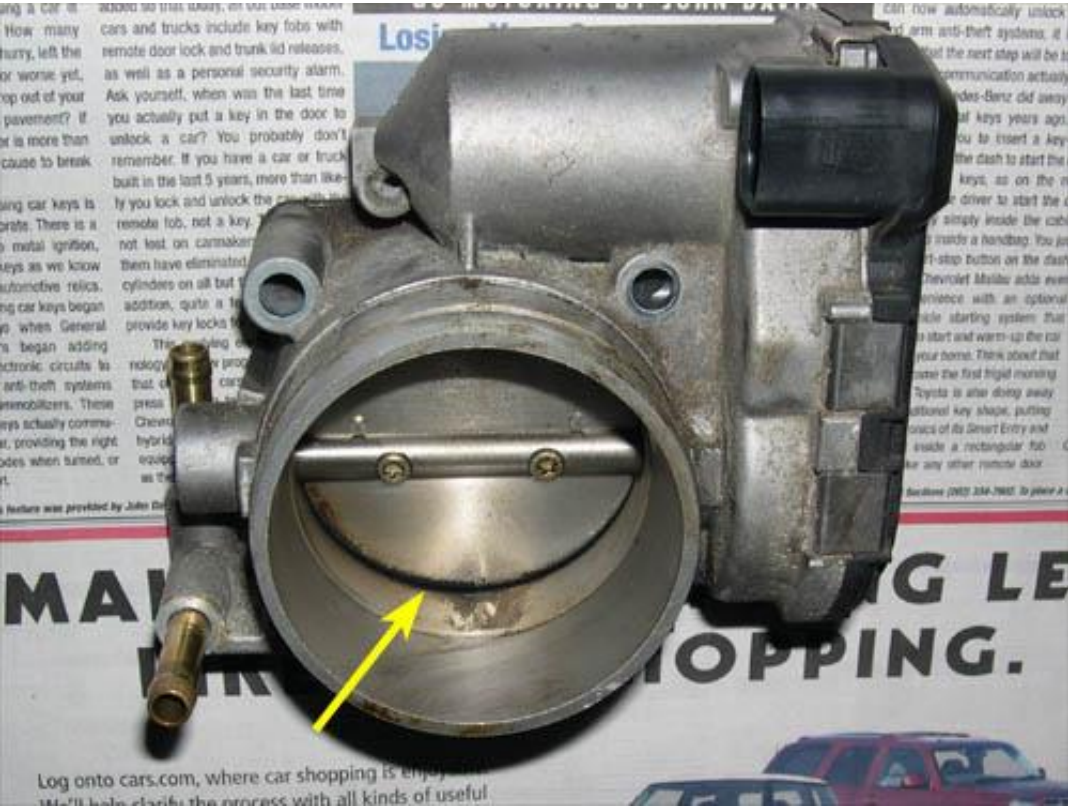
29. The yellow arrow in the picture below indicates the gasket that seals the rear of the TB to the intake manifold. Prior to reinstalling the TB (new or existing), either replace the gasket with a new one or decide to reuse the existing one. If you decide to reuse the existing gasket, make sure to clean it by wiping it with a rag or paper towel to remove any debris or contaminants that may be on the mating surface. I determined that the gasket in my car was in good enough shape to be reused, so that's what I did. No biggie. (The red arrow in the picture below shows a better view of the ground connection that is secured to the TB by one of its mounting bolts.)

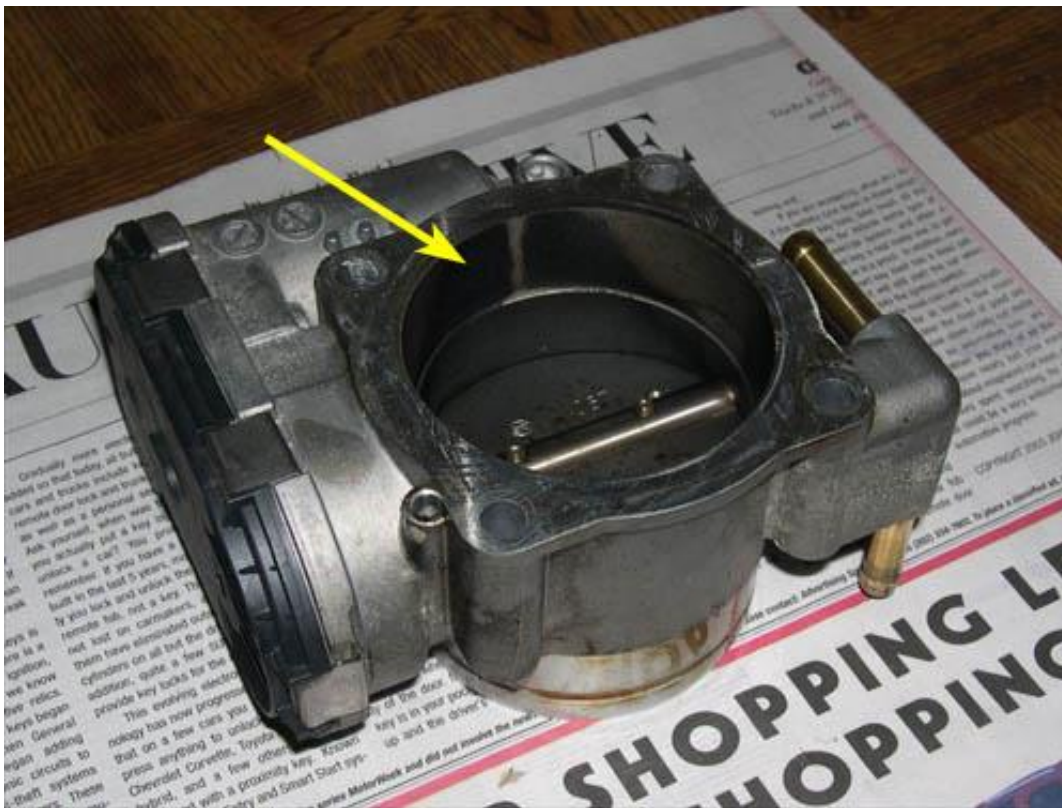
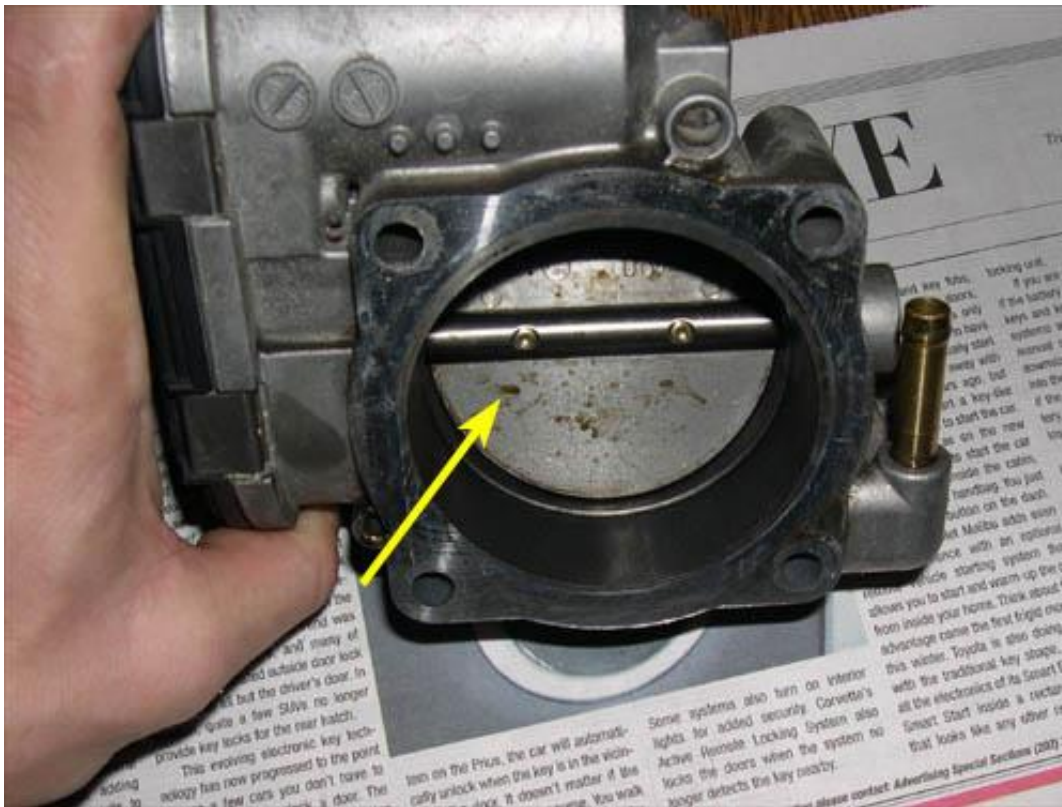


30. If you are replacing the TB, install the new unit by following steps 12 through 28 in reverse and then proceed to Part III (TB adaptation). If you are cleaning your existing TB, proceed directly to Part II.

PART II - CLEANING THE THROTTLE BODY

1. The four pictures below show different views of the inside of the throttle body. The yellow arrows in these pictures point to the oil, gum, varnish and other crap that deposits itself inside the TB over time. In my case, most of the deposits were located between the edge of the throttle valve and the TB wall (valve at idle position or fully closed) and on the roof of the TB wall behind the throttle valve.





2. To insure the proper operation of the TB, it is imperative that the deposits in the above pictures be removed. IMO, the most critical of these deposits are those which lie between the edge of the throttle valve and the TB wall. Normally there is a small 1-2mm gap between the edge of the valve and the wall. At idle, the valve remains fully closed and the air passing through this gap allows the engine to idle smoothly. As deposits build up in this gap, the amount of air that can pass through decreases and the ECM/DBW system must compensate by resetting the idle position of the valve

from fully closed to open a few degrees or so. Naturally, as the amount of deposits increases, an increasing larger compensation must be made by the ECM. At some point, the ECM cannot compensate by opening up the valve any further and the following OBDII code is commonly stored:

17990 - Idle Adaptation Limit Reached
P1582 - 35-00 - -

Cleaning the TB often gets rid of the code, since it allows the throttle valve to be fully closed at idle, i.e., no idle adaptation is needed.

NOTE: The above description is MY understanding of how the TB operates at idle. If this is incorrect, please inform me and I will change/remove the description.

3. In order to safely clean the inside of the TB, you will need a can of intake/TB cleaner (the stuff I used is shown in the picture below - make sure to choose something that is relatively gentle and will not harm DBW TBs - some carb-type cleaners are not), something to gently scrub off the deposits on the throttle valve and on the TB wall (I used Q-tips and paper towels) and a sheet of ordinary white paper.



4. Cut the paper into thin, triangular pieces approximately 1" x 4" (size is not critical), as shown in the picture below. Also shown are some EXTREMELY dirty Q-tips that had already gone at the deposits in the TB by the time I took this picture.



5. To clean the TB, spray the TB cleaner onto the deposits inside the TB, allow it to soak in for a few seconds and then gently scrub away the deposits with the Q-tips and/or paper towels. Using this method, you should be able to remove all of the deposits EXCEPT for those between the edge of the throttle valve and TB wall. We'll get to those deposits shortly. First, here are some VERY important warnings.

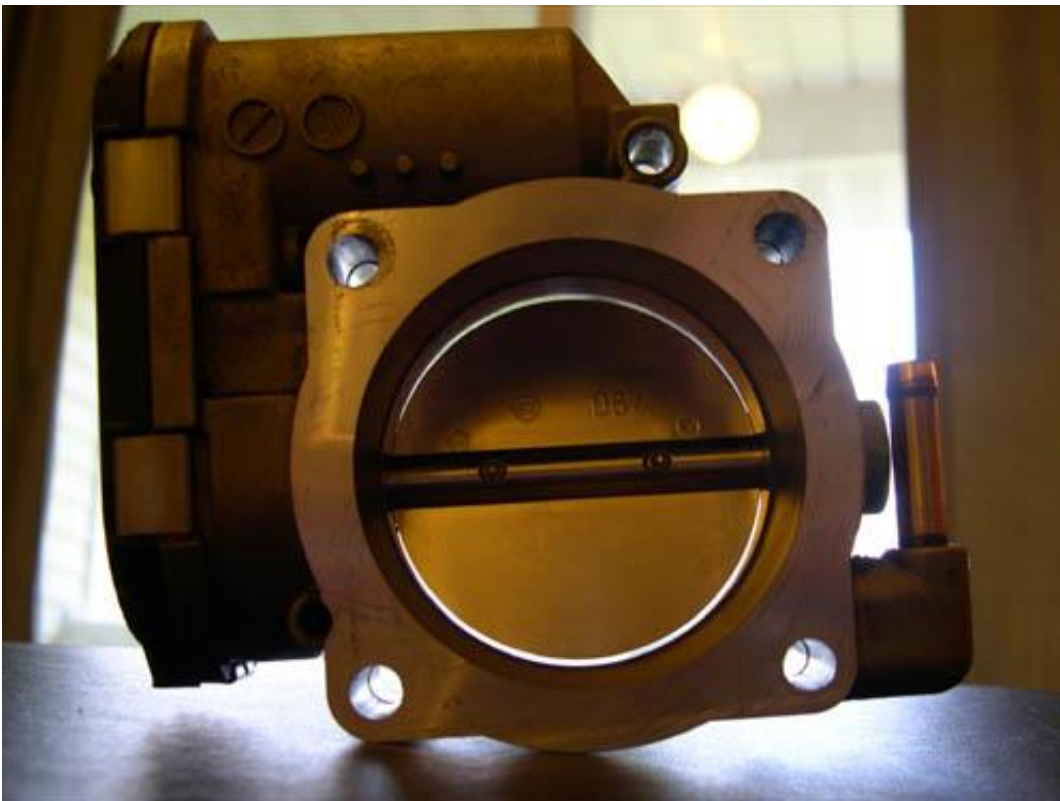
WARNING: When spraying the TB cleaner inside the TB, I HIGHLY recommend that you hold the TB with the electronic control module portion of the TB ABOVE the body of the TB. Orienting the TB in this manner while cleaning it will help prevent the cleaner from leaking past the seals between the TB body and control module and possibly damaging it. While the seals should be a sufficient barrier to this happening, why take the chance with a \$500 piece of equipment.

WARNING: Be careful not to press too hard against the throttle valve while cleaning it.

Unlike a drive-by-cable (DBC) TB in which the throttle valve is allowed to move freely and is held closed by a spring, the position of the throttle valve in a DBW TB is controlled electrically, most likely by a high-precision stepper motor. Because of this, the throttle valve will not move freely and can be easily damaged if forced to move against the resistance of the stepper motor. This does not mean that you cannot apply a small amount of pressure to the throttle valve with the Q-tip when cleaning it. Just be careful not to use too much pressure. When in doubt, use the least amount of pressure needed to remove the deposits and you should be OK.

6. Since the throttle valve will not move freely due to stepper motor used by the DBW throttle valve controller, you cannot simply move the throttle valve out of the way to remove the deposits that collect between the edge of the throttle valve and the TB wall. Instead, I recommend that you use the small strips of paper to clean this area. Spray a little TB cleaner into the gap between the edge of the throttle valve and the TB wall and use the corner of one of the strips of paper to carefully scrape the deposits out of the gap. Once the deposits have been removed from a small area of the gap, slide the paper into the gap completely and move it back and forth to scrape the deposits out of the gap, similar to using dental floss to remove food from between your teeth. Spray additional cleaner into the gap as needed during this procedure. Using this method, it should be possible to remove virtually all of the deposits from the gap. Most likely, the gap near the axle for the throttle valve will be too narrow to get the paper into it, so there may be a very small amount of deposit left remaining in the gap near the axle. This is not a big deal.

7. The picture below show how the gap between the edge of the throttle valve (in the fully closed position) and the TB wall should look once the deposits are removed from it.



8. The pictures below show various views of the TB following the cleaning procedure. No big

surprise that it looks much better than it did prior to the cleaning.





9. The pictures below of paper towels and Q-tips used during the cleaning procedure illustrate that while the TB did not look that dirty, quite a bit of deposits were removed during the cleaning process.



WARNING: Prior to reinstalling the TB, make sure to let it dry thoroughly or damage to the

electronic control module or throttle position sensors may result. To speed up the process, I inserted clean strips of paper into the gap between the edge of the throttle valve and TB wall to remove the cleaner held in there by capillary forces. Following this, I allowed to the TB to sit for approximately 30 mins before reinstalling it. I recommend that you wait this long or more before reinstalling your TB.

10. The picture below shows the cleaned TB ready to be reinstalled.



11. To reinstall the TB, follow the steps for the removal method in Part I that you used in reverse, and then proceed to Part III.

PART III - ADAPTING THE THROTTLE BODY

The following section shows how to perform the adaptation of the TB to the ECM. The procedure given will be specific to a VAG-COM scan tool, however it may be possible to also do this with another scan tool. Please consult the documentation for a scan tool other than VAG-COM to see if it is capable of performing this procedure.

According to the MKIV Bentley CD, the throttle body adaptation "teaches the engine control module (ECM) ... the throttle valve control module stop positions and a comparison graph between throttle valve potentiometer and throttle position sensor." While it is beneficial to perform this procedure whenever the TB is removed or the battery is disconnected, I do not believe that it is absolutely necessary that it must be done manually with a scan tool. If you do not perform this procedure before starting the engine the first time after reinstalling the TB, the engine may idle high

and/or run rough for a short while, but the adaptation will be performed automatically after a short period of time. The behavior of the engine should return to normal once the adaptation is performed and other learned values are set. (This is one reason why the engine often runs rough for a short while after the battery is disconnected.) Therefore, do not fret if you do not have a VAG-COM and cannot perform the adaptation described below. It will occur on its own. Think about it, if it didn't occur by itself, car owners would be forced to return to the dealer after EVERY time they disconnected their batteries or their batteries went dead. They'd be swamped with customers needing a TB adaptation. To prevent this, the engine control system must have been designed in such a way that the car can relearn or adapt any values/parameters that it needs for normal operation on its own.

That being said, if you own a VAG-COM, I highly recommend that you perform the adaptation procedure outlined below. I did this after cleaning my TB and the behavior of my engine was completely normal the first time I started the car.

Note: These directions may vary slightly depending on the version of VAG-COM that you own, but the general procedure should be identical.

ADAPTATION PROCEDURE

1. Connect the VAG-COM cable to your car's OBD port, boot up the computer and start the VAG-COM software.
2. Turn off all electrical consumers, e.g., lights, radio, fans, etc.
3. Insert your car key and turn the ignition to the "ON" position.

WARNING: DO NOT START THE ENGINE!!!

4. In the VAG-COM software, click on the "SELECT" button in the "SELECT CONTROL MODULE" section.
5. Select the "01-ENGINE" control module from the list of common modules.
6. Once the VAG-COM has connected to the engine control module, select "MEAS. BLOCKS - 08" from the "BASIC FUNCTIONS" section.
7. In one of the "GROUP" boxes, type "060" and hit "ENTER" on your keyboard to access Measuring Block 060. Values in the four fields to the right of the "GROUP" box should appear. The values in Fields 1 through 4 are the angle sensor 1 position, angle sensor 2 position, learn step counter and adaptation condition, respectively.

WARNING: Do not touch the accelerator pedal while performing the adaptation procedure contained in the next few steps.

8. Click on the "SWITCH TO BASIC SETTINGS" button to switch to the (go figure) Basic Settings section. The TB adaptation will begin immediately. While the adaptation is running, you may hear sounds coming from the TB, the step counter in Field 3 will increase (up to 8 or 9, depending on your engine) and Field 4 will say "ADP. RUNS". When the adaptation is complete, the step counter in Field 3 will stop increasing and Field 4 will switch to either "ADP. OK" or "ERROR".
9. If Field 4 says "ADP. OK", then the adaptation has been performed successfully and nothing further needs to be done. If Field 4 says "ERROR", an error occurred during the adaptation procedure and further diagnosis is needed. Consult the troubleshooting steps in the Bentley CD if this occurs.
10. Once the adaptation procedure is complete (either successful or unsuccessful), click on the "SWITCH TO MEAS. BLOCKS" to exit the Basic Settings section.
11. Exit out of the VAG-COM software and disconnect the cable from the OBD port.
12. Start the car and see if everything runs OK. It should.
13. That's it. You're done. 😊

EFFECT OF CLEANING ON TB ADAPTATION PARAMETERS

In order to determine what the effect of cleaning my TB was, I performed adaptations just prior to and just after the cleaning process. Prior to the cleaning process, the following values for the two throttle position sensors were found:

Field 1 (Sensor 1) - 12.5%
Field 2 (Sensor 2) - 86.3%

Since the polarity of the sensors is reversed, the value for Sensor 1 will increase as the throttle valve opens and the value for Sensor 2 will decrease. Therefore, if the cleaning had any effect on the idle position of the TB, the value in Field 1 should decrease and the value in Field 2 should increase (both signifying a closing of the throttle valve). Following the cleaning process, the following values for the two throttle position sensors were found:

Field 1 (Sensor 1) - 11.7%
Field 2 (Sensor 2) - 87.5%

Based on this test, it is apparent that cleaning the TB had a measurable effect on the position of the throttle valve at idle. The real-life effect of this difference is still yet to be seen though.