DIY: Crackpipe R&R By VW Vortex's darisd

Honorable mention to the Dr - VgRt6 (Gary) for help working out the minutiae of this procedure.
This DIY describes how to replace the thermostat housing and coolant distribution pipe (AKA crack pipe) on the MKIV AFP VR6 motor (very similar procedure for AAA VR6 engines). This covers most of the weak spots in the coolant distribution system. If you have a leak in one spot, consider replacing as much as you can afford. At the very least, replace all o-rings and the thermostat. Next most important, replace the sensors, housing, and pipe. If you have not done so already, you might as well replace the water pump. Check hoses for condition and replace as necessary. If you do not replace the plastic parts, at least check them very carefully for stress cracks and repair with JB Weld or other high density epoxy product as necessary.
The chrome, billet crack pipe installed in this DIY can be ordered from www.GruvenParts.com in either chrome or polished finish. You will truly never have to reference these instructions again!! To order, just click on the pic below :

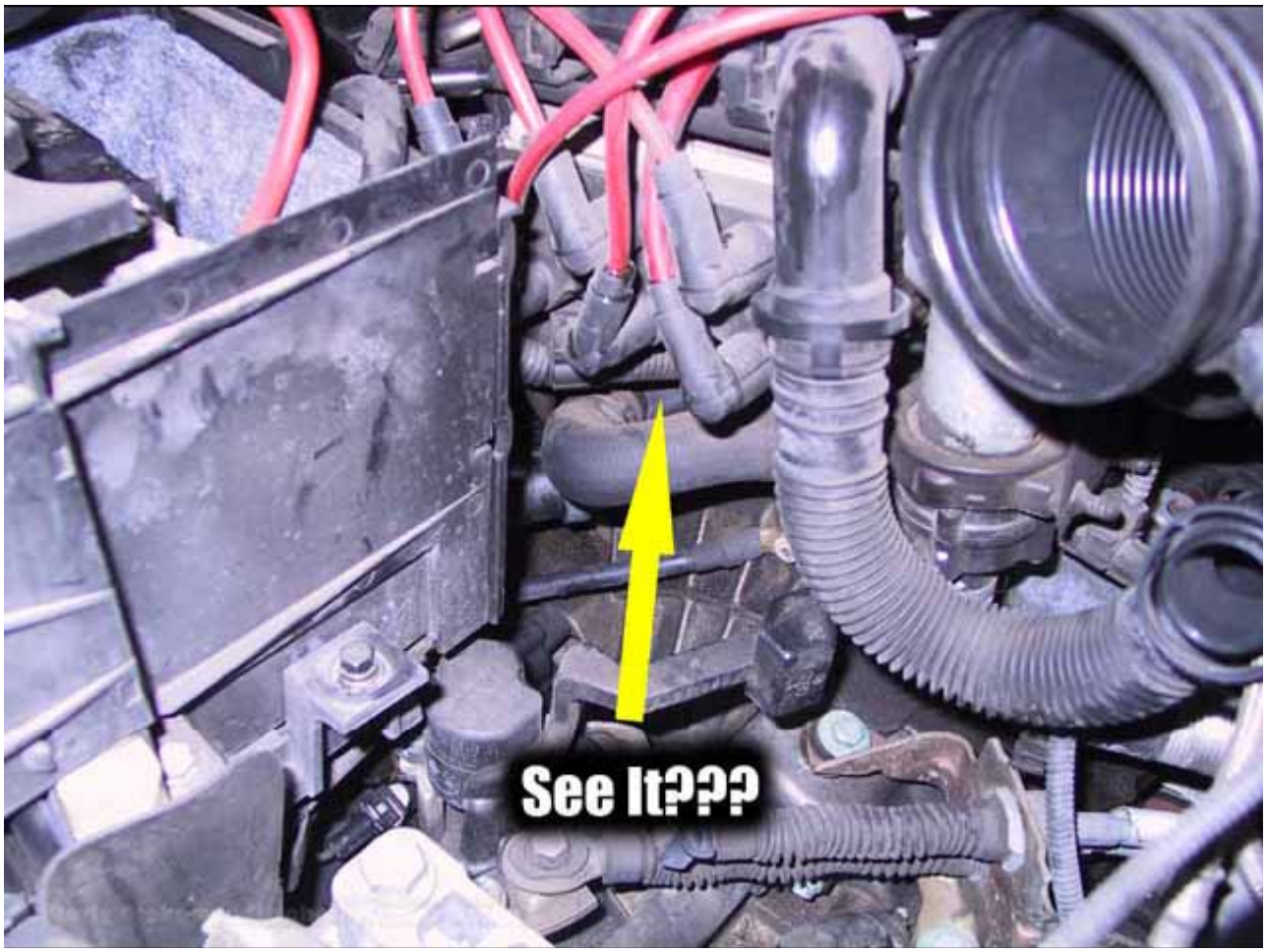
Note from www.GruvenParts.com -- You should consider replacing ALL spring type hose clamps with screw type clamps. You will find the spring clamps very difficult to get at to remove. Its easy to make a mistake and not seat the spring clamps fully as well, resulting in leaks. The screw type clamps are very easy to install, using a 5 or 6 mm socket on a swivel head. Just a hint! – Paul

Tools:
Spark Plug Wire Puller
5mm Hex socket or similar. It should be short (no long t-shaped wrenches)
10 and 13 mm sockets
Various socket extensions
Flathead screwdrivers (thin and wide)
Phillips head screwdriver
Channel-locks or similar wrench for hose clips (short handles good)
Parts:
Thermostat Housing
Thermostat Housing Seal
Thermostat
Thermostat Cover
ECU Temp sensor
AC Switch
2 sensor O-Rings
Crack Pipe (www.GruvenParts.com billet pipe, or stock) [*if you feel like doing all this again in a few more years – Paul, www.GruvenParts.com]*
Screw-style hose clamps (5 at 2 inch max dia, 1 at 1 inch max dia)

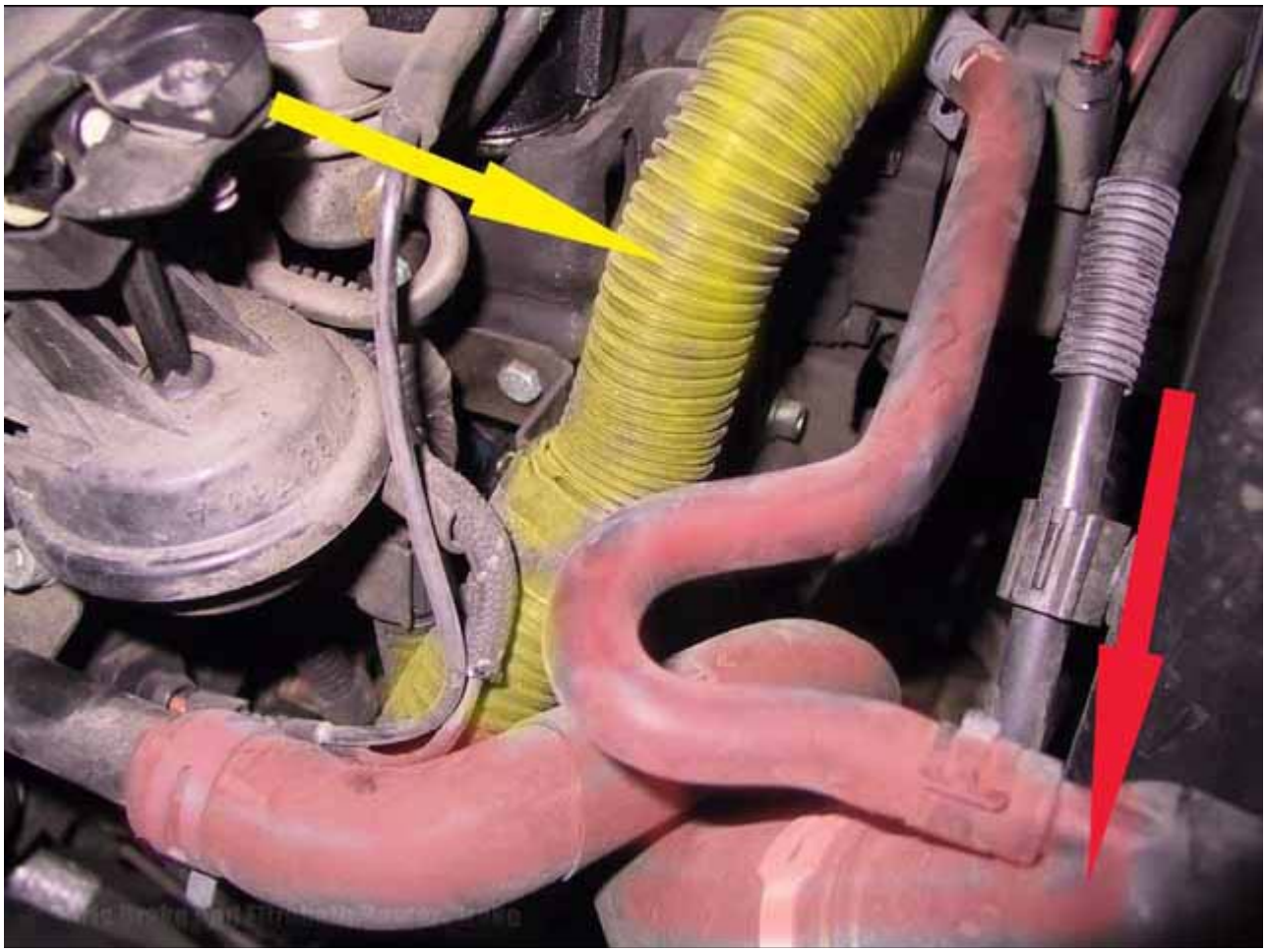
Stuff:
Alot of paper towels
Grease (optional)
RTV Silicone Sealant (optional)
Threadlocker or Anti-Sieze (optional)
Prerequisite:
Get the lock carrier assembly to the service position using this DIY:
Lock Carrier to Service Position

Precautions and Obvious Stuff:
Wear gloves and skin covering clothing at all times, and consider eye protection. Change your clothing if it becomes soaked in coolant. Coolant can soak through skin if left for long enough. G12 is extremely poisonous stuff. It contains Ethylene Glycol, Diethylene Glycol, and Sodium Hydroxide, just to name the most dangerous ingredients. It has a sweet taste and smell, and is attractive to children and animals for this reason.
Even a small amount can cause irreversible damage to your liver and kidneys. Ethylene Glycol in the bloodstream catalyzes into several harmful intermediaries, mostly acids, ending in things like Oxalic Acid that can lead to crystals in your urine. The early stages of poisoning feel similar to ethyl alcohol intoxication. I strongly recommend you abstain from alcohol consumption while working with coolant for this reason. If you even suspect that you have been poisoned: take a shower, get yourself out of the garage, and call your doctor. Early intervention could save your life and has a high success rate. Death from glycol poisoning is SLOW and PAINFUL. You have been warned!

Part 1: Getting Things Off
1: Remove the airbox. This will give you access to the back of the thermostat housing. The airbox is attached with two 10-mm screws and is held in place with a rubber damper. When you are done you can now see a small sliver of the thermostat housing, as in this picture:



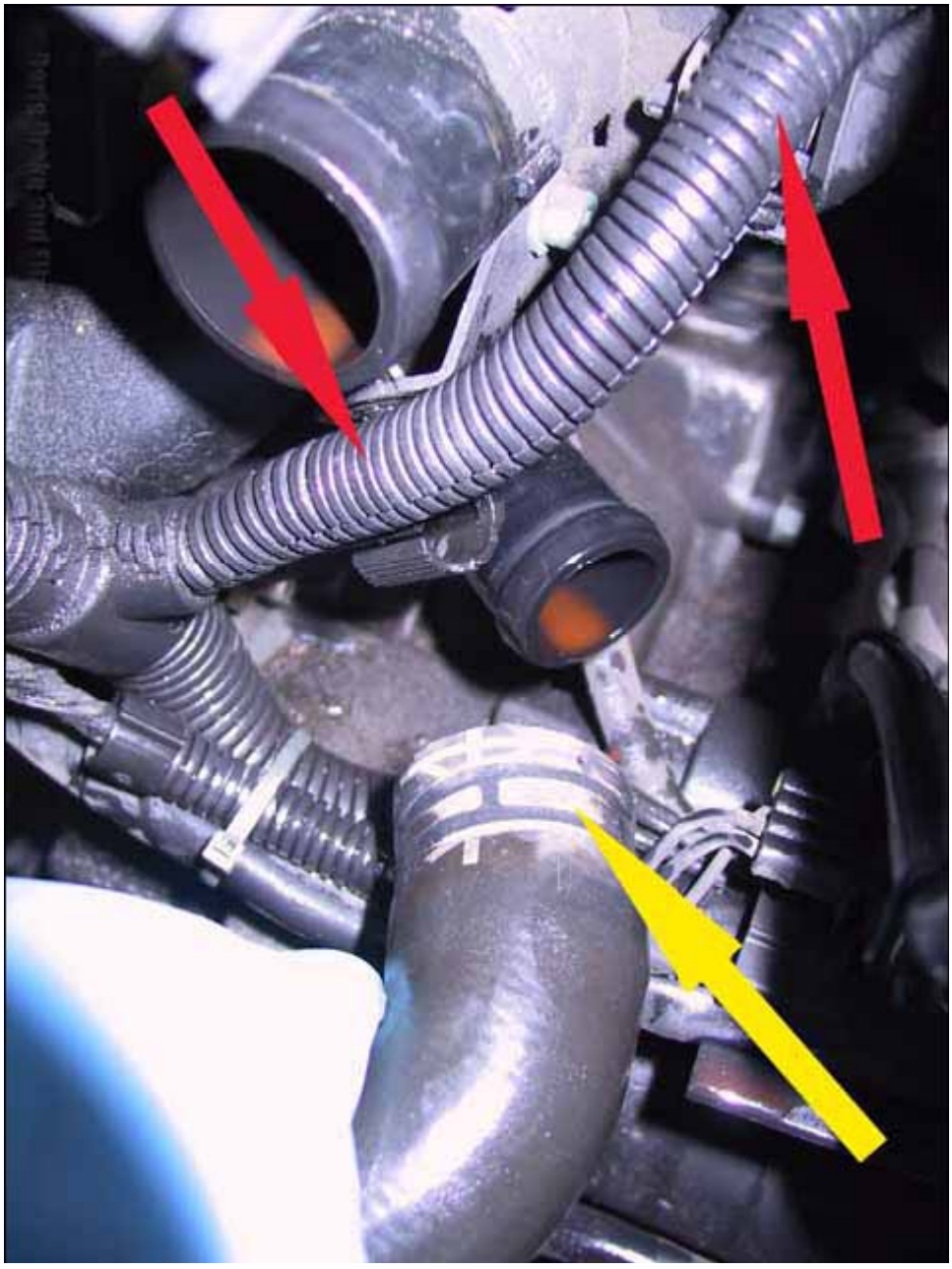
2: Remove the top engine cover (the thing with the chrome Vr6 emblem). This gives you easier access to the coolant and smog pump lines just beneath the coil. To do this first pull the spark plug wires using the tool and pull them from their channels, then remove the six or so T25 Torx screws. Then remove the oil filler cap and pull the cover, and replace the oil filler cap. I would also put the screws for the cover back in their holes just to keep track of them.
Now it is time to get some hoses out of the way. Here is the view you should see from the front of the vehicle. This image has been colorized. Yellow is the smog pump feed hose, and red is the upper-coolant-manifold-spaghetti thingy.



3: Get the smog pump supply line out. This is the plastic corrugated hose that has the rubber protectors on it that seems to be snaking around the outside of this morass. You may have to cut a zip tie. Squeeze the connectors on the fatter textured sides and pull straight back to get them off. The connectors may stick, keep in mind that they are sealed with o-rings so see if a little twist sets them free.

4: Now focus on getting the y-shaped coolant hose manifold thingy on the front part of the thermostat housing out. You already have the coolant hose coming out of the top of the radiator off it. Now remove all the other connections that the hoses coming from this manifold-assemblage have. The connections are: throttle body (connects to a steel rail next to the coil pack), aux radiator (connects to a steel rail in front of the intake manifold) and thermostat housing. The hose that attaches just to the right of the sensors on the thermostat housing will be EXTREMELY tight work, be prepared to curse but rest assured that someone got it there and you can get it off if you keep at it. This is what it looks like when it is free.

5: Now remove the lower thermostat housing hose. This one is particularly difficult to get at as well. See the yellow arrow in this image:

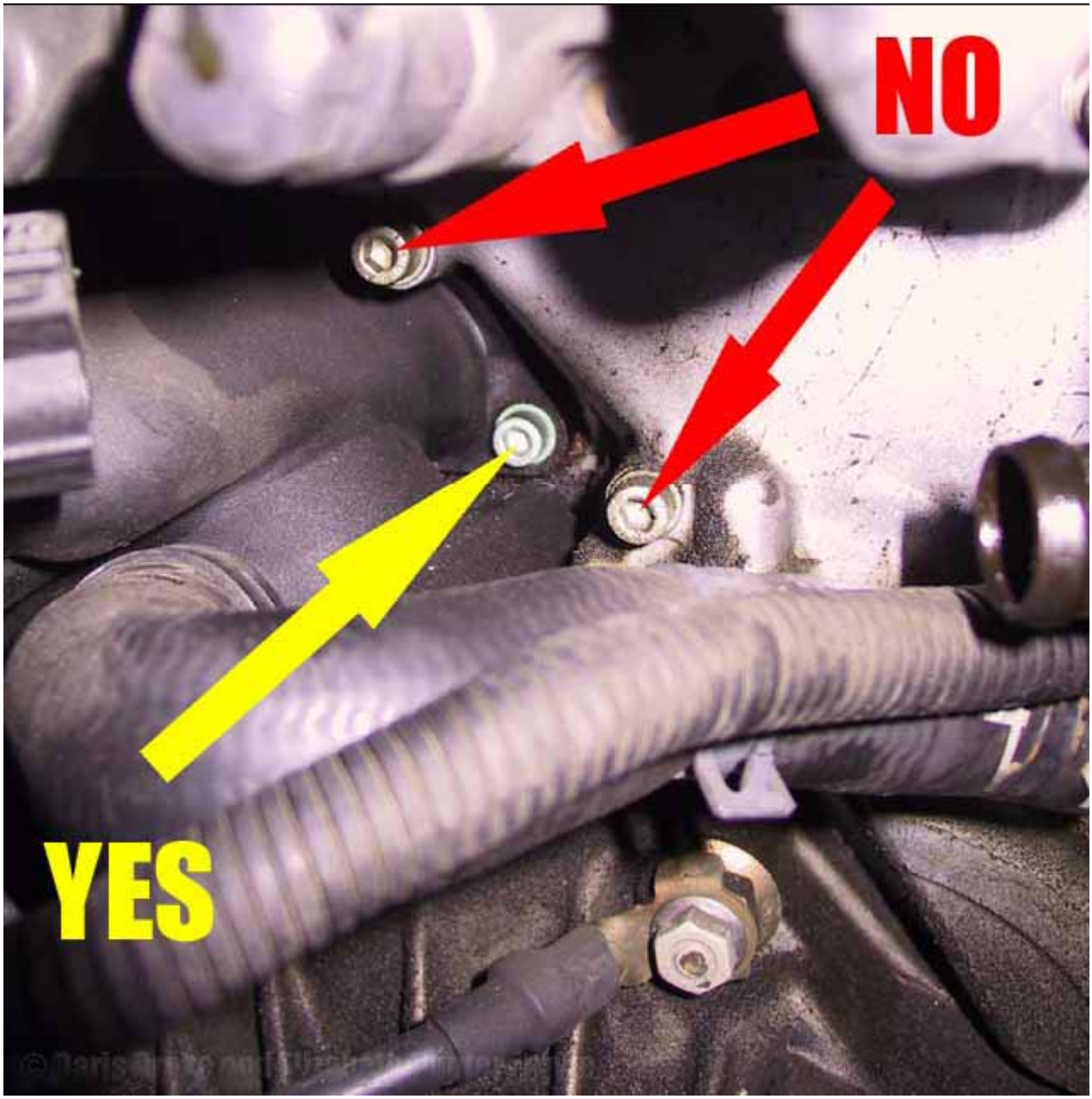


6: Carefully unclip the electrical conduit attached to the bracket on the outside of the thermostat housing. See the image above, the red arrows. Two are shown, there are three total. Now we will move to the back part of the housing.

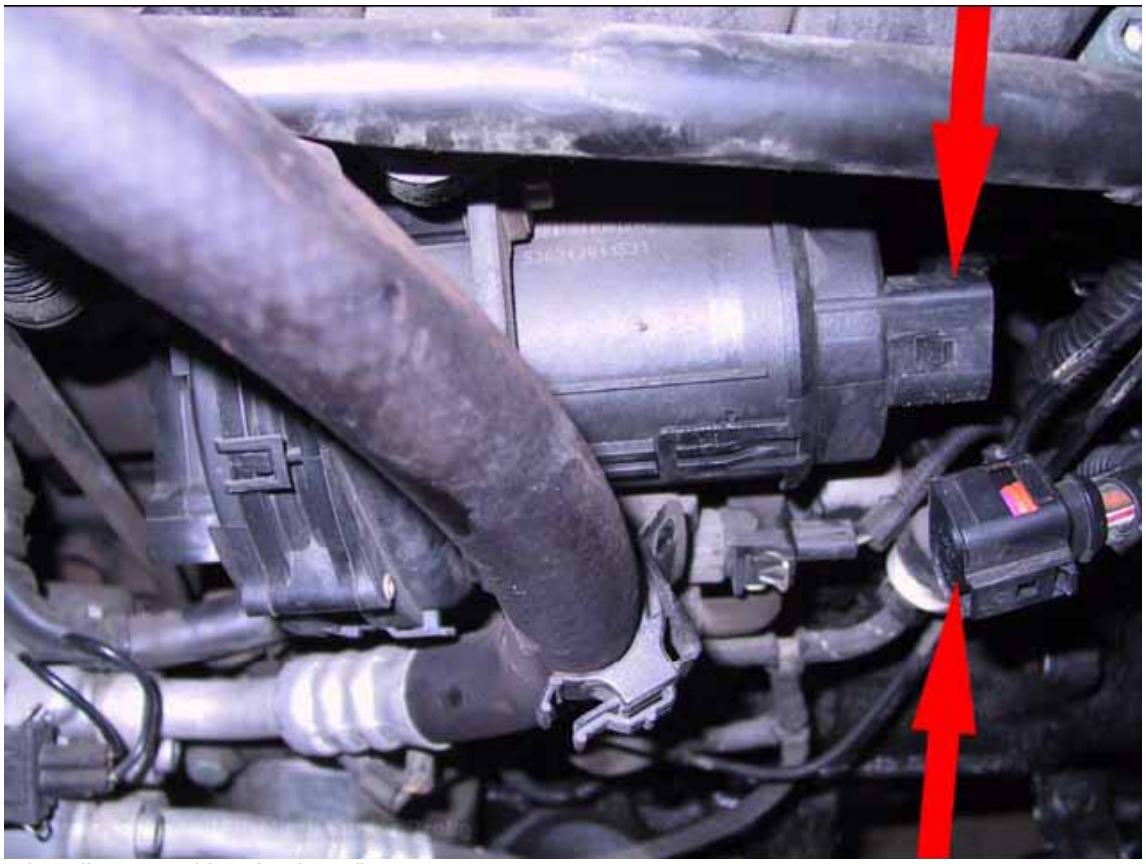
7: Remove the hose going to the afterrun-pump which angles sharply off the back side of the thermostat housing. See the image above of the area behind the airbox for an idea of the hose I speak of. Of all the hoses, this is the hardest to get off. I had to remove both sides, starting with the side closest to the pump first so that I could bend the hose far enough to get my channel-locks in to the other clamp. The extreme angle of the hose where it attaches to the thermostat housing will make getting the clamp out of the way challenging. Whatever you do, be careful not to mar or cut the hose. Hoses get $$$$ fast.
Now you have everything out of the way to get the thermostat housing out.

8: Remove the three bolts holding the housing to the aluminum head. There are two long bolts that are on the front-top, and one small one tucked behind the housing. Here is a picture of the longer screws and the bracket. Pay close attention to the orientation of the bracket, you will want to put this on the same way.

Here is a picture of where this smaller one is located. Be sure you have the right bolt, as the other two pictured are for the timing chain cover.



9: Remove the thermostat housing. First break the seal free and then work it out through the front of the vehicle. Set it aside for the next section so we can check sensor condition etc.
Now we need to get the coolant distribution (crack) pipe out. Take a look at the situation. At this point you probably cannot even see the pipe, except the business end that slides into the thermostat housing. The main thing in your way is the smog pump, but there are also sensor connectors, wires, air hoses, all sorts of things in your way.
First we will remove the smog pump. This is very tricky. Note that the pump is connected to a plastic bracket that snaps onto a robust metal bracket that shares screws for the intake manifold. This configuration makes it easy to assemble but difficult to remove. Refer to these pictures and take a minute to feel around for the three bolts you will need to remove first.
Before:



After (plastic bracket in yellow, metal bracket in red):

10: Unplug the Smog Pump. This is a large plug close to the end of the crack pipe. See the "before" picture, red arrows. Also unclip the relay that is clipped to the pump bracket near the bottom.

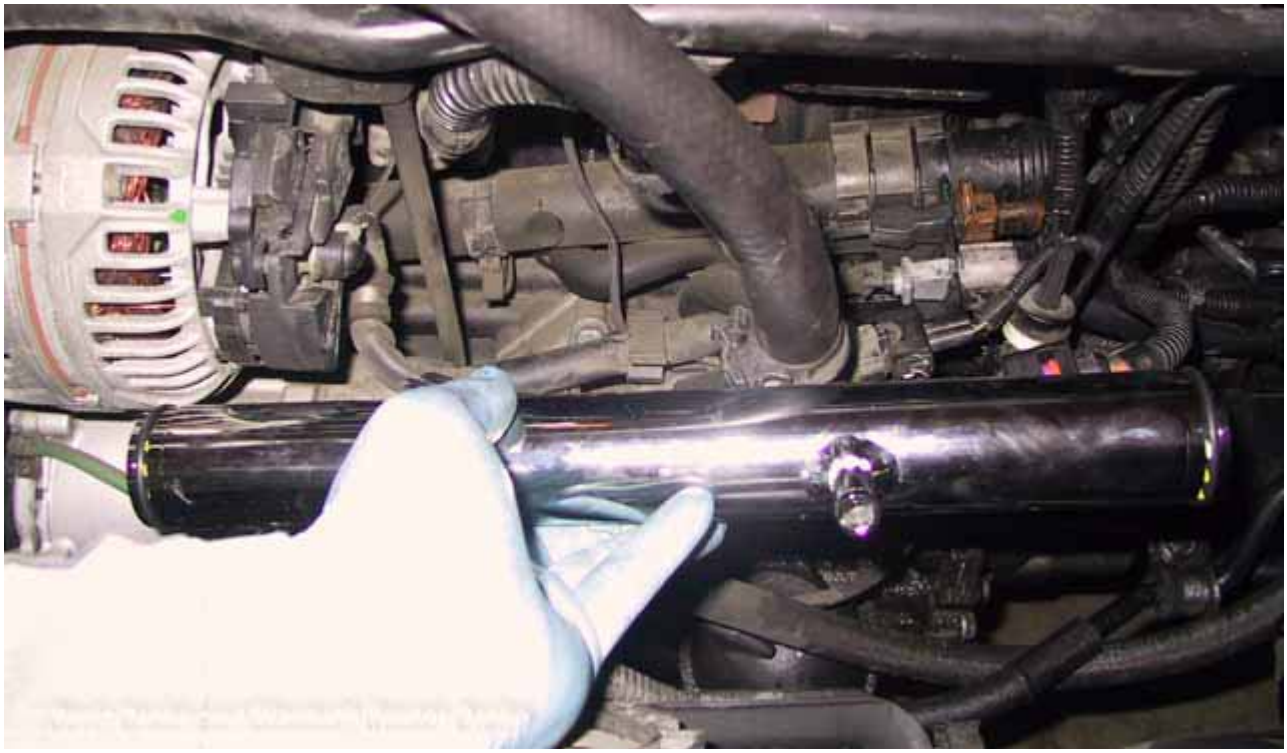
11: Disconnect and remove the smog pump send hose. This is a high pressure hose and will be a little more difficult to remove than the intake side, but is not impossible.

12: Remove the screws attaching the pump to the plastic bracket (5 mm hex). The front two are not a problem. The back one is more difficult. You will either need a long extension for a socket, or some very creative work. Try a hex socket on a long extension. The hardest part here is getting the socket into the bolt.

13: Now get the pump out of there, going between the alternator and the large AC hose. It is a tight fit but believe me it comes out eventually. If it seems like you are breaking things, continue to step 14 and see if you can get the bracket off simultaneously.

14: Now get the bracket off. This is necessary to get the oil cooler send hose off the crack pipe. Look carefully at the "after" picture above. Get a wide but sharp screwdriver and insert it under the plastic retaining clip (two yellow arrows in picture), and give it a little twist, pulling and rocking the bracket back and forth. Both parts are quite tough, so do not feel like you have to baby them.

ALTERNATE SMOG PUMP REMOVAL PROCEDURE: If you have done this before, and you were conscientious to lubricate and clean the clip well, it should be possible to unclip the entire assembly from the metal bracket. This is trickier but could save you ten or so minutes. Next we will remove the crack pipe. Here is a picture of the pipe on my car, with a shiny new pipe to show the orientation. This chromed billet pipe is made by A2T2 (Paul) and you can buy it direct from him at www.GruvenParts.com. If you have a camera, take a quick picture of where the wires and brackets are located, as yours may be different. As we will see, the tolerances between parts and systems here are measured in millimeters.



15: Drain the crack pipe. This one is messy. The drain has to be accessed from underneath the car, and is just next to the block where the water pump housing fits. The stock pipe will need a flathead screwdriver and a turn or two, then it pops off. WEAR EYE PROTECTION!!!

16: Take the oil cooler water send hose off the pipe. This one is tricky but at least you can see it easily. More coolant will spill. I swear, we are almost done!

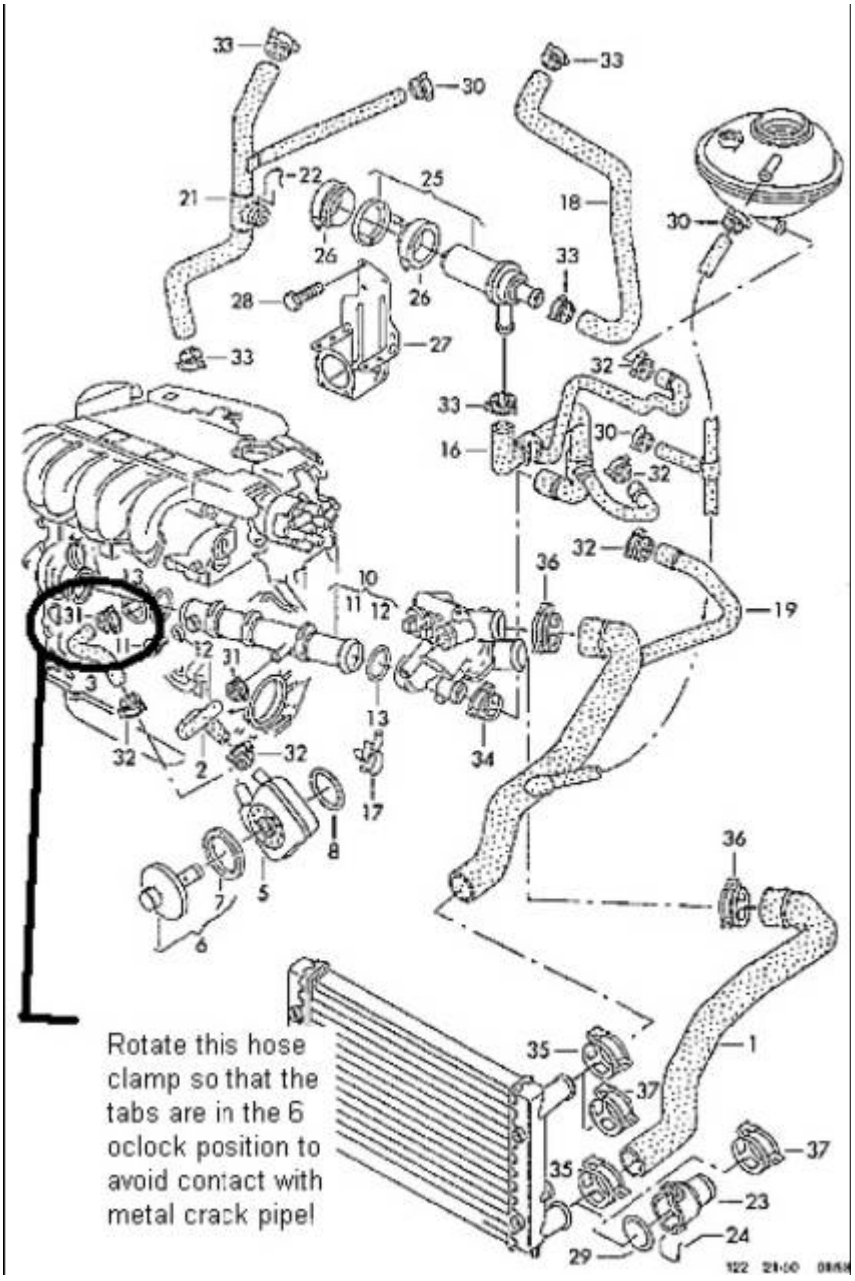
17: Free the plastic cable/plug bracket to the right of the oil cooler hose nipple. The two connectors come out easily, and the wire harness clip on the bottom just needs to be snapped open. Be careful as this is not the most beefy part. Pop it off the bosses and set it aside.

18: Pull the crack pipe from the car. More coolant will spill.

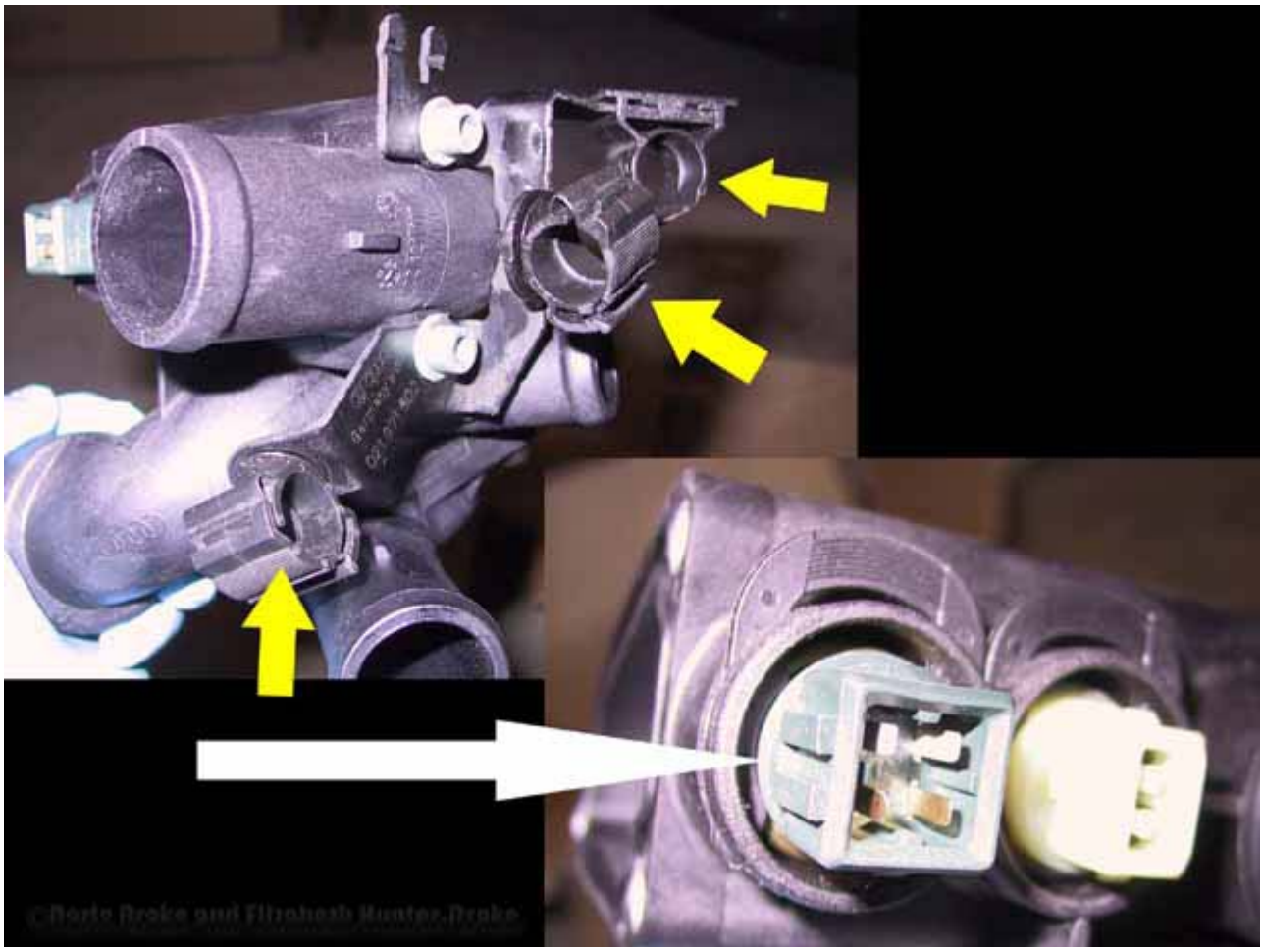
You are done. Take a break, change your clothes, etc.

Part 2: Reassembly

19: Fit the crack pipe to the block. Expert tip: it is hard to get your eye in there, but check the hole where the pipe fits into the block for corrosion or scale, and remove with 400-grit sandpaper if you find any. If you are re-using the old unit remember to replace the o-rings. If you are using the billet crack pipe from www.GruvenParts.com, verify that the hose clamp for the block-coolant-exit-hose (just behind where the pipe goes, to the left of where the nipple is on the pipe) is completely below the the 9-oclock and 3-oclock positions to avoid contact with the pipe, which would cause this hose to be cut by the clamp and possibly the crack pipe to not even fit correctly. Refer to this picture - Place a small amount of lubricant, coolant or grease, on both rubber o-rings of the pipe. Alternately, you could use RTV on one side at a time (block side for this step) and work it in wet. Slide it into place in the block, twisting it slightly to keep the o-ring from being cut or bound. **It should slide in like a hot knife in butter**. If not, verify that you have the right alignment, check for obstructions, check for scale inside the throat, and try again. Just remember to be patient as the o-rings are the only thing holding the water in.



20: Get the thermostat housing ready for installation. Replace the o-rings on your two sensors. Be VERY careful with these, **do not twist them off or on, just pull straight back**. Daris twisted his and the bases cracked free of the housings, forcing him to replace them. PAY ATTENTION TO ORIENTATION WHEN YOU INSTALL THESE! See the image or compare to the orientation of the sensor plugs in the harness to see what side should be where. The three tabbed sides of the two plugs SHOULD be at the 1, 9, and 6-oclock positions. See the white arrow in the image below. Again, NO TWISTING ALLOWED! The larger of the two (temp sensor) is fairly expensive so be careful. Remember to replace the thermostat (it is inside the housing). Expert advice: use a tiny bead of RTV to seal the thermostat in. Finally, put the wiring loom clip on with the two longer bolts (align as with the yellow arrows below). You should have something that looks like this:



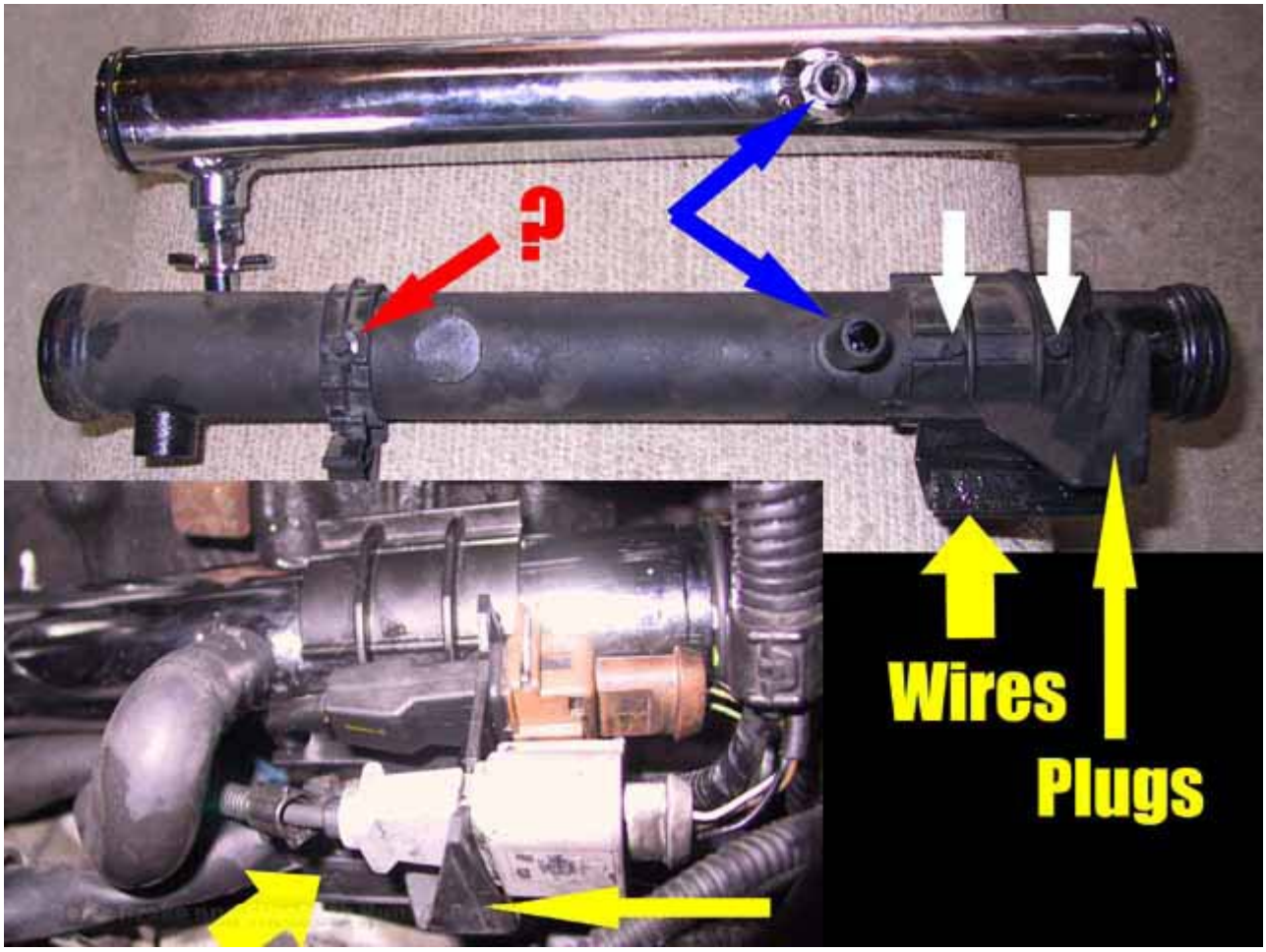
Now check the mating surface with the head. There could be a fair amount of crud here. If this is very dirty and it does not come off with a rag and elbow grease, carefully clean the surface. Use a small flathead screwdriver CAREFULLY for the hard crusty stuff, like a dentist would pick plaque off your teeth. Finish with a dremel with the conic bronze wire polishing tool to finish the surface. Remember, this is aluminum. Expert tip: If there is any deep galling or pitting, patch with JB Weld and sand it flat with 400 grit paper.

21: Install the thermostat housing. First get some grease and put it in the channel for the rubber o-ring that seals. Not too much (See the science note above for why). Fit the rubber o-ring in. Be observant: IT SHOULD NOT WANT TO POP OUT OF THE CHANNEL! If it has a tendency to do this, try more grease. If it does not stay in place even then, consider the possibility that you have the wrong or a bad gasket. The important thing is that this o-ring should stay put while you fiddle with the three bolts getting it in place. Now get the two long bolts and the wire harness bracket on. If you want, put some blue threadlocker or anti-sieze on these. Working from the front of the car, wiggle the housing in between the battery, hoses, and conduits. Once in place, veryify that the seal is still in the channel by peeking in with a flashlight. Now start the two long bolts. Just START them. Now we need to start the back bolt. Again, blue threadlocker if you have it. It is difficult to get this one started, but be patient. It helps if you do not have the other two bolts in too far. Be CAREFUL not to cross-thread these: aluminum is softer than you think. Also, check that there is no binding with the crack pipe, and that this can still rotate inside its two cups easily, and before continuing make sure that the nipple on the crack pipe comes out straight and level.
Now the tedious part. Slowly work each of the three bolts one at a time into the head. Try starting with one, screwing until the gap is about a couple millimeters, then get them all going a turn at a time. This is important to ensure that the gasket does not bubble out, which would force you to tear down and start over if it caused a leak, or worse fail on you later. TAKE YOUR TIME. Final torque is 10N-m/7ft-lbs.

22: Clip the wire loom into the thermostat-housing clips. There should be three clips (see the yellow arrows in the image above).

23: Replace the hoses accessed from the area where the airbox goes. Replace the hose going between the thermostat housing and the after-run pump, back by the shifter mechanism. Now replace the hose coming from the bottom of the radiator, which fits onto the housing pipe below the thermostat. We strongly recommend using screw-style clamps for these three, to facilitate future replacements, and face the screw ends towards the airbox.

24: Replace the air filter housing. Remember to reattach the smog pump air supply hose. You are now done with the back section.



25: Finish the crack pipe installation. See the image above. Note that the part marked with the red arrow is from what I could tell completely useless, I threw it away. Fit the crack pipe harness clip over the crack pipe (white and yellow arrows). Note that the billet pipe from www.GruvenParts.com does not have the bosses for this clip (white arrows) but they do not really do much except keep the harness clip from rotating (you can easily just use zip ties if you want). Clip the two sensor plugs into this (thin yellow arrows), and clip the wire conduit below it inside the trap on the bottom (fat yellow arrows). Replace the oil cooler coolant supply hose onto the nipple (blue arrows). Do NOT use a screw style clamp here: there is not enough clearance between this hose and the smog pump bracket for you to place the screw on top of the nipple, and any other orientation is more of a pain to access than it is worth. The clip ends should be just below the 9-oclock position. More specifically, the clip ends have to be completely below horizontal or the smog pump bracket will not fit at all.

26: Attach the hoses to the front of the thermostat housing, aux radiator rail, and throttle body supply attachment points. Use screw-style clamps for the attachment to the thermostat housing and aux rad supply, the smaller feed for the throttle body does not require a screw style clamp. The point here is making access to these hose clamps easy without requiring removal of the lock carrier, which as you have seen is a pain. Point the mechanisms of these two new screw clamps up.

27: Attach the smog pump. Clean and apply a little oil or grease on the metal retainer that the plastic bracket attaches to, this facilitates installation. Attach the smog pump to the bracket. Now, working slowly, move the pump in through the space between the alternator and the AC hose. Once in place, jam the plastic bracket over the metal retainer. If you have difficulty doing this, attach the bracket first then the smog pump, but this will be more difficult due to the clearances and the difficult access to that back screw.

28: Finish the smog pump. Attach the supply and pressure hoses. Clean all attachments and apply some grease to keep the o-rings in good shape. Plug the unit in.

29: You are done. Check for any loose ends, and proceed with replacing the lock carrier assembly (See the prerequisite). Check for any leaks carefully on fill and startup.