

# 2010

1991 BMW 750iL

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## M70 TOPEND RECONDITION

Overall general cleaning and resealing intake manifolds, safety-wiring oil spray bar banjo bolts, replacing hoses & valve cover gaskets.

## Intake Manifold Gasket & Valve Cover Gasket refurbish

Car: 1991 BMW 750iL, mfg 4/91

### **Symptoms:**

Very bad oil leaks from the valve covers along with pentosin leaks from somewhere...

Rough idle when cold, spark plugs needed changing and most of the fuel & vapor lines were brittle and leaking from age and engine heat.

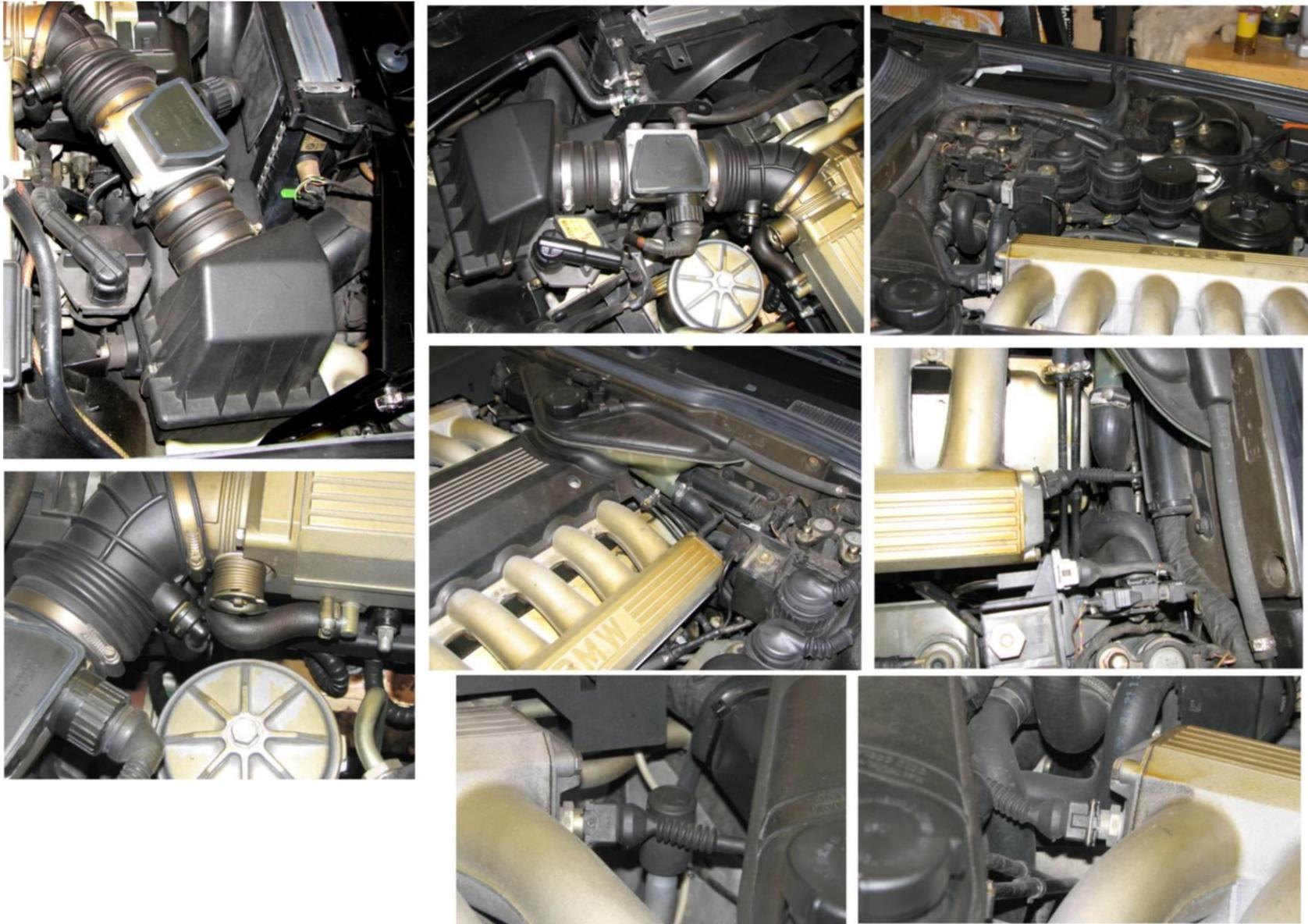
The following pages are picture intensive and serve as a detailed documentation of the processes I followed in trying to fix the issues as well as any pointers and lessons learned I picked up along the way. Hopefully they can also serve as a valuable reminder of how to put things back together again 😊.

In my opinion, if one was just interested in replacing the valve cover gaskets & resealing the intake manifolds, the job could easily be done on a Saturday, but if more is planned such as drilling the oil-spray bar banjo bolts, safety wiring, repainting valve covers, replacing plugs, replacing hoses, rebuilding injectors, etc. one would be hard pressed to complete all these steps in a day. I was in no hurry and the job took a month of casual work weekends, plus I spent a bit more time than necessary on the cosmetic aspects of the work. (I also ended up rebuilding the hydraulic booster and replacing the master cylinder.)

**Note:** If you are planning to replace fuel and vapor hoses, it will make life easier to just cut them off during the disassembly stages and replace with new as you reassemble. I've included hose types & measured lengths at the end of this procedure.

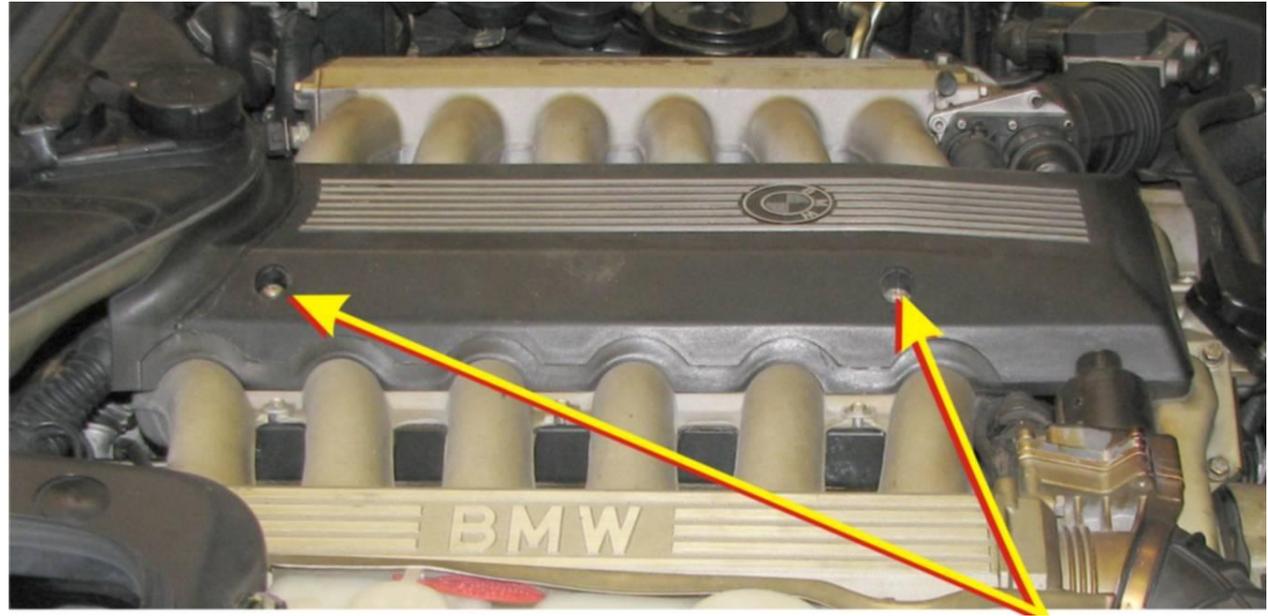


This is a view of my engine bay before I began. If this is your car, take a good look, it may be awhile before it looks complete again.



Not knowing how long this would take plus the fact I can never remember the “before” details, I took a number of pictures around the engine bay to document general fuel line layout, cable & wire routing, connectors, etc.

## Remove Noise Suppressor



Begin by removing the top cover/noise suppressor - give the four screws (two shown above) on the top a 1/4 turn and remove the suppressor. (Pull straight up).



Picture from E31 Instructional

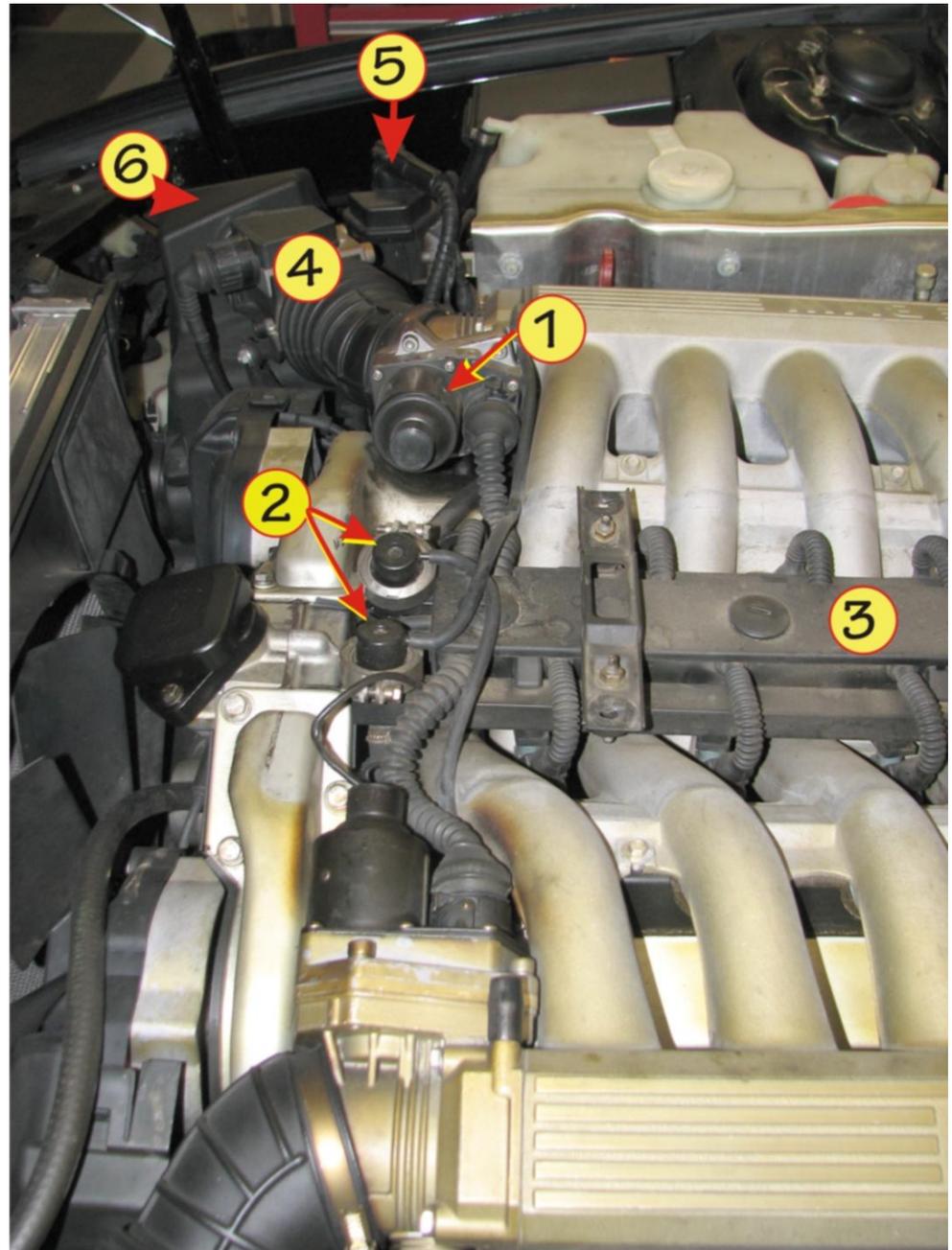
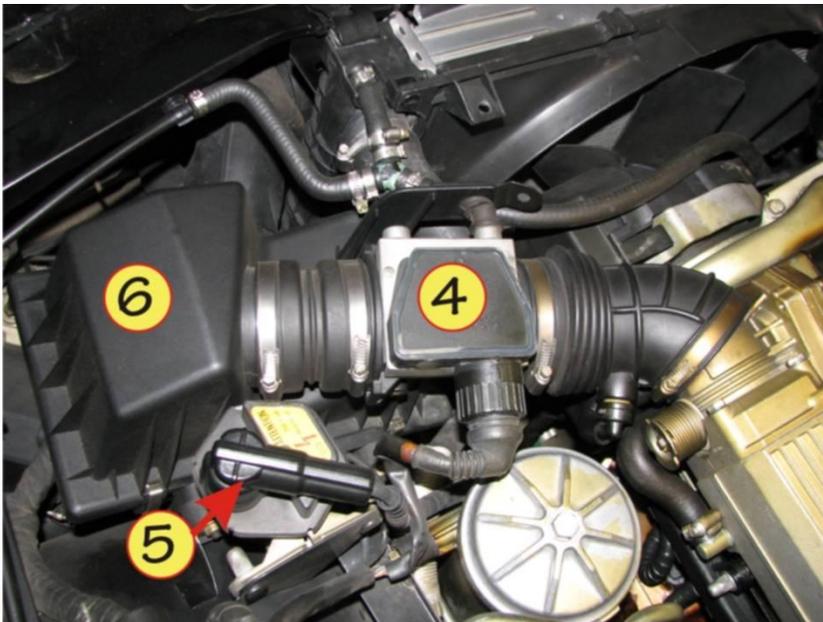
This view shows the top cover/noise suppressor removed.

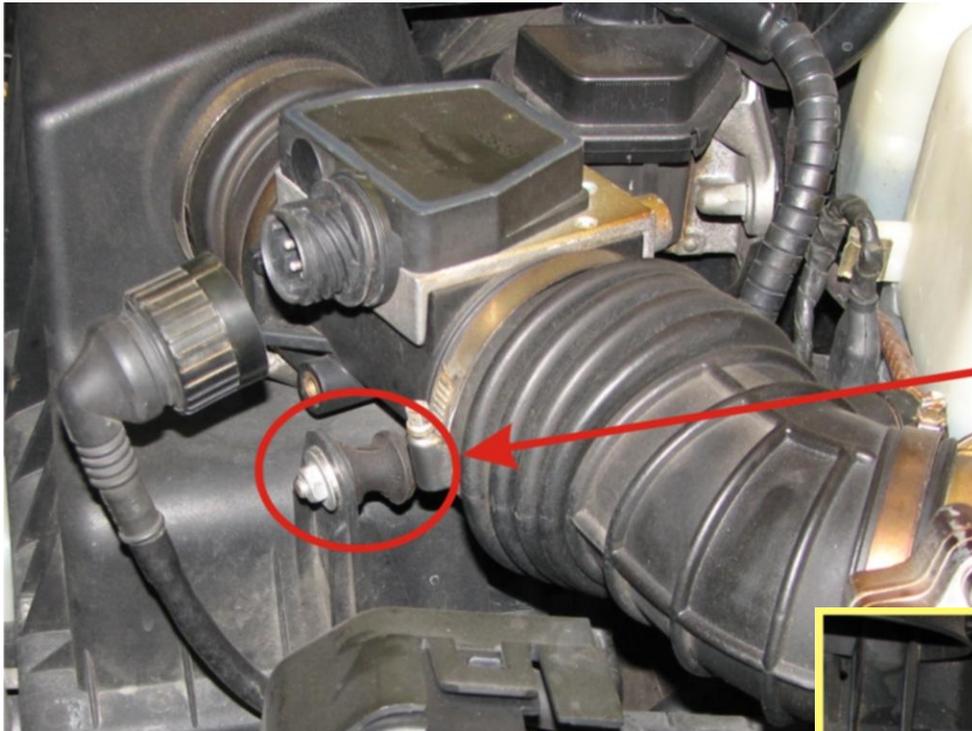
## Initial Disassembly

This view shows the items requiring removal:

- ① DK Motor/Throttle body
- ② Fuel Pressure regulators/Fuel rails
- ③ Fuel Injector Wire Housing
- ④ MAF (Mass Air Flow) Sensor
- ⑤ Ignition coil (disconnect only)
- ⑥ Air Filter/covers

Note the vacuum lines from the pressure regulators - these most likely need to be replaced due to heat and age.



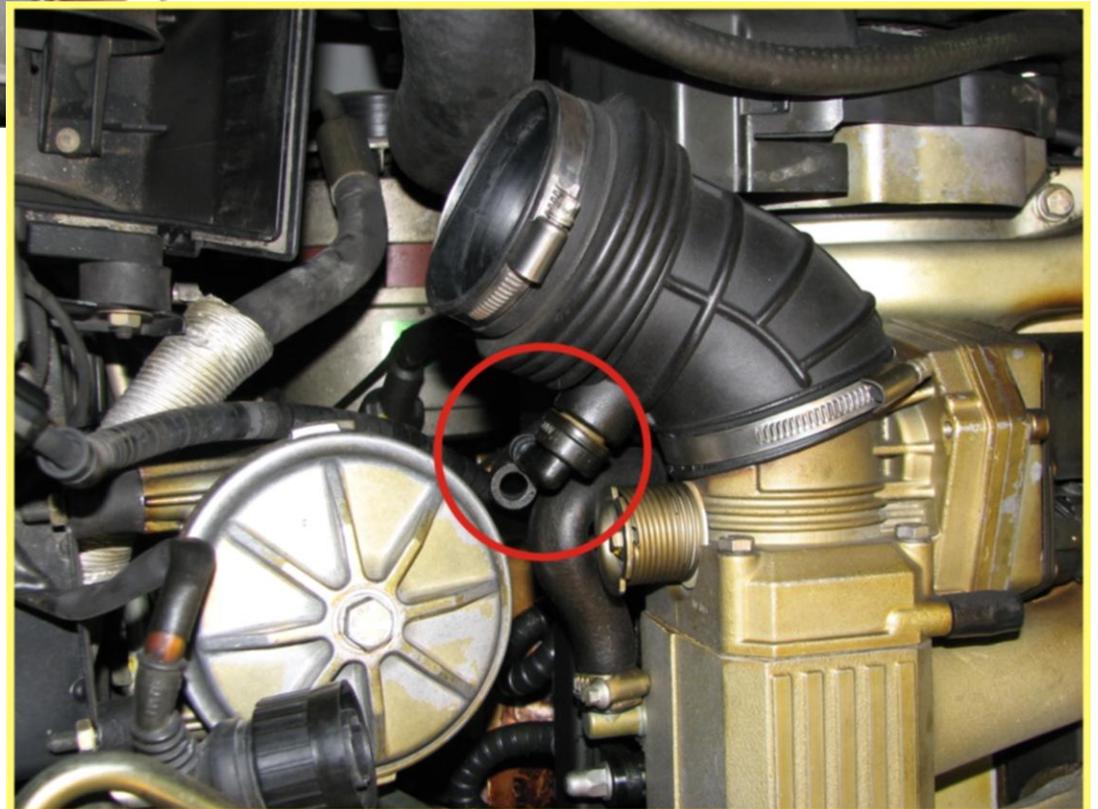


Left

### MAF and Airbox Removal

The right MAF (Mass Air Flow) electrical connector un-screwed and pulled off to the side. Next loosen all the hose clamps, (both sides of the MAF), unclip the air filter box cover and remove. The air filter should come out with it, if not remove it now.

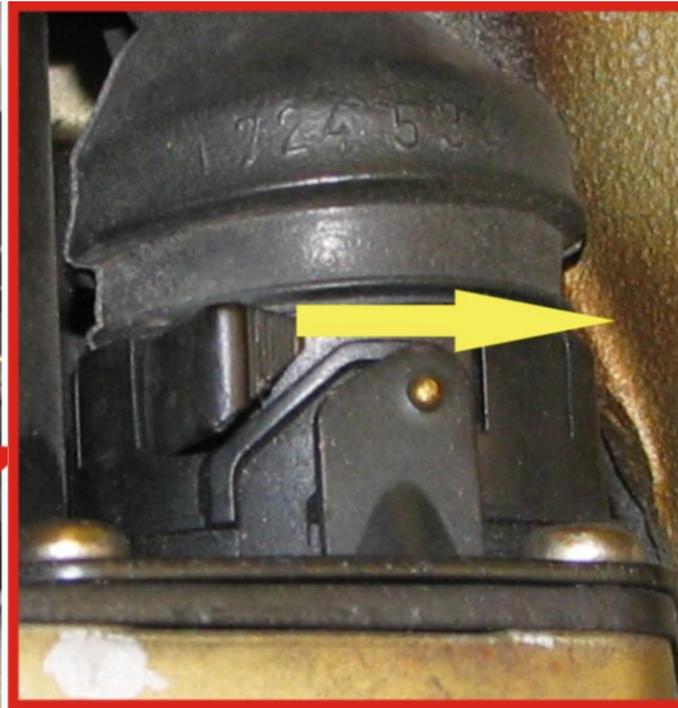
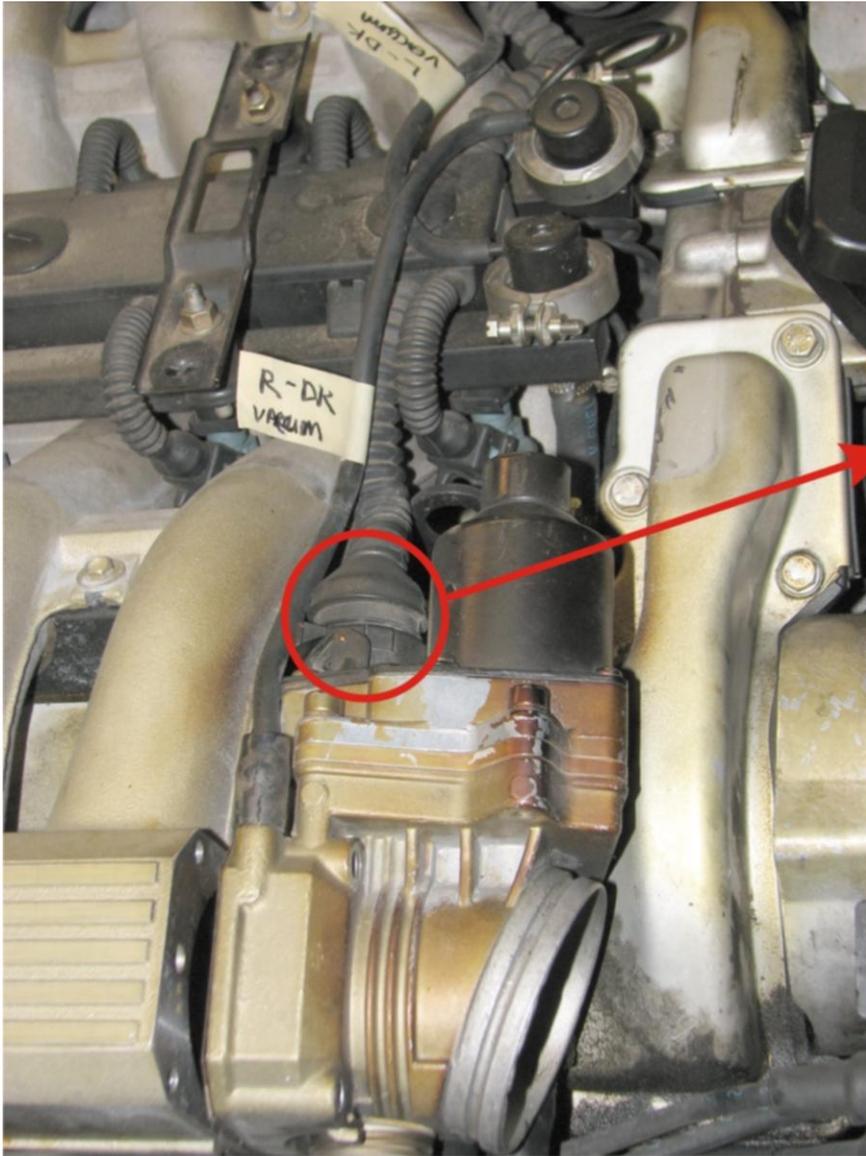
Next remove the 10mm nut on the rubber mount, and work off the MAF, (rocking it left to right to break the seal.) Typically this rubber mount also needs replacement, the old version is shown here.



Right

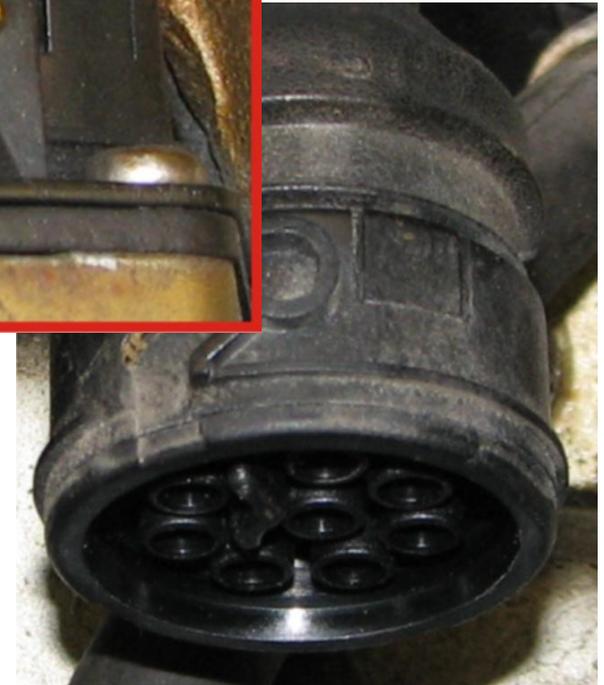
This view shows the left MAF & air filter cover removed. Note the breather hose has a check valve with elbow. This is also found on the right side as well. This connects into a hose from the PCV valve.

To remove the breather elbow, pull straight up and it should slide out.



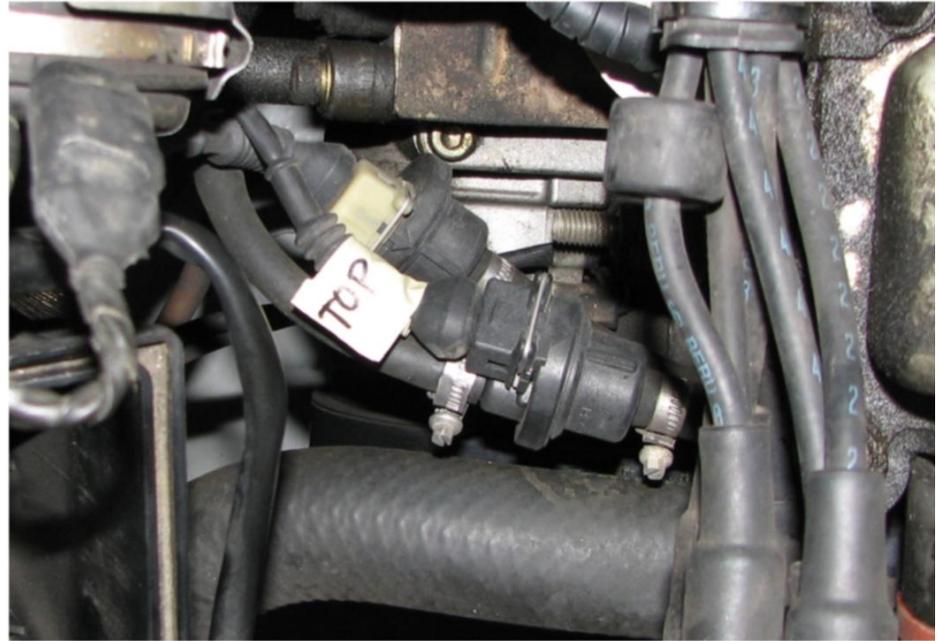
**Left**  
DK conn. detail.  
To remove; the  
tab is pushed to  
the right. (yellow  
arrow) This has  
the effect of le-

vering the connec-  
tor out as you push.  
Both of these were  
very tight. If too  
hard, leave them  
until the throttle  
body/ DK assy is  
removed. Then you can grab the tabs on both sides  
simultaneously for better leverage.



Left photo shows the right breather hose, MAF & air box lid removed. I labeled the vacuum hose for later ID/replacement. The photo above also shows Qty 4, 10mm bolts from the throttle body to the intake manifold already removed.

### **DK Motor Connector Removal**



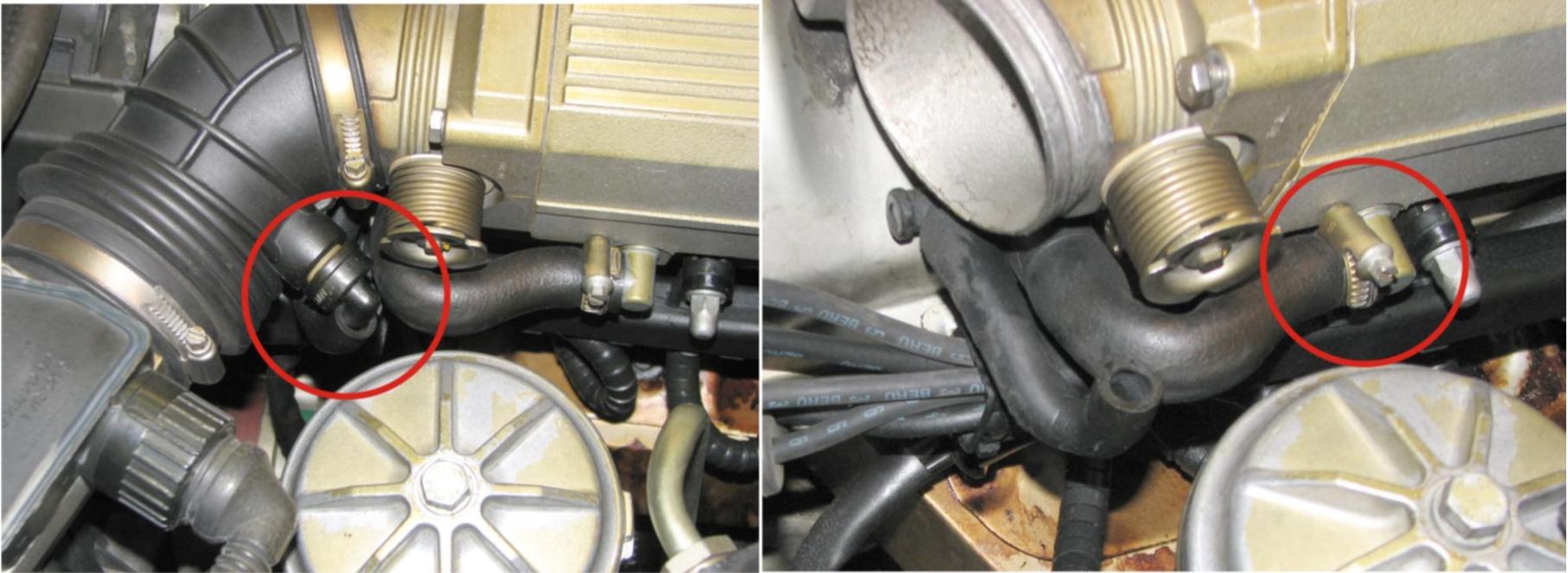
Above:

This view shows the right DK/throttle body and air filter cover removed. Note the connector above the filter box. (circled) This is one of two fuel tank breather valves (electric solenoid valves). The one shown is the upper valve and has a black connector. Not shown is one beneath it with a tan/white connector. The hose shown above goes to the left DK/throttle body. I was not able to disconnect as it snapped in half while I was trying to remove it.

Above:

This view shows both the connectors, the black labeled with "top" and the tan/white just to the rear of it. The hoses that connect to these valves go to the DK assemblies. The hose leading from the tan/white connector goes to the right DK assembly. On mine, this hose had an additional section of hose over it, perhaps as a guard against chaffing or heat from the engine.

Both of the hoses going from the fuel tank breather valves to the DK motors were hardened with age. These are not high pressure fuel lines so they can be replaced with low pressure 8mm fuel lines.



Above:

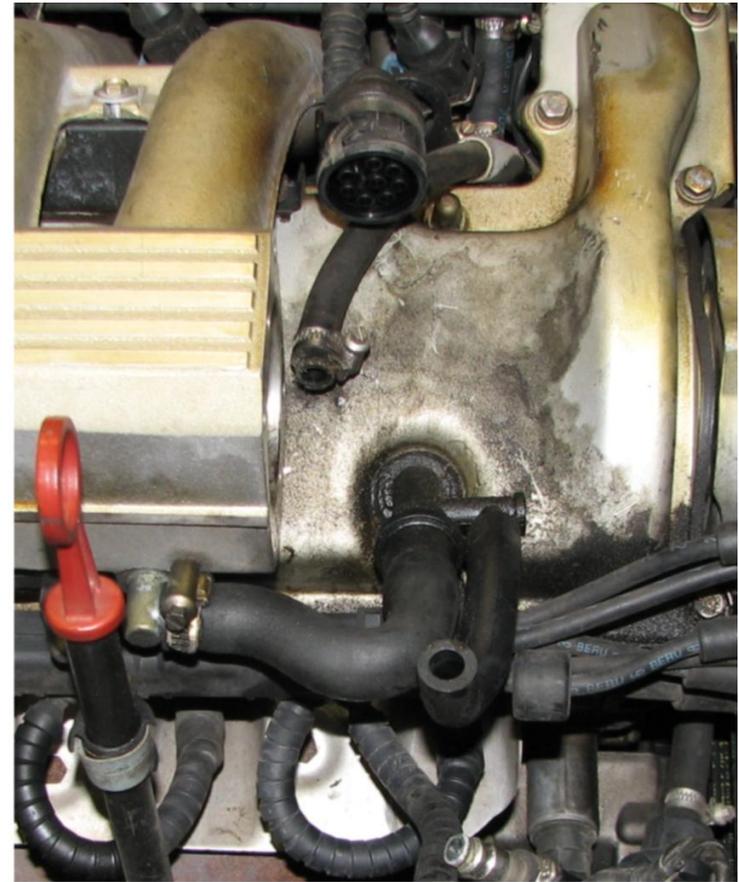
**“PVC System Documentation”** shots:

Note the check valve still connected to the breather hose and the PVC hose clamped to the intake manifold plenum. This is the left side.

Convention for this document going forward is when sitting in the driver's seat, left is the “driver's” left and right is the passenger side.



**Left Side**



**Right Side**

The pictures above show the **PCV valves** and assorted hoses. Each has a hose teeing off the main tube with a 90 degree bend. This is where the check valve barb fits. In the photo of the right side, note the hose that passes under the DK connector and drapes over the valve cover. This hose is from the tan/white connector solenoid valve. (You can also make out the chaffing guard right where it bends over the valve cover. In the picture of the left side, the hose just to the left of the DK connector is the hose from the black connector solenoid valve that broke when I was trying to remove it from the DK.

Both PCV valves, check valves and PCV valve cover grommets will be replaced.



Remove the PCV valves by pulling them up and out of the rubber seals/grommets. Both of these seals will most likely need to be replaced on your engine as they typically have hardened and leak.

**TOP:** This is the right **PCV rubber seal/grommet** in the valve cover.

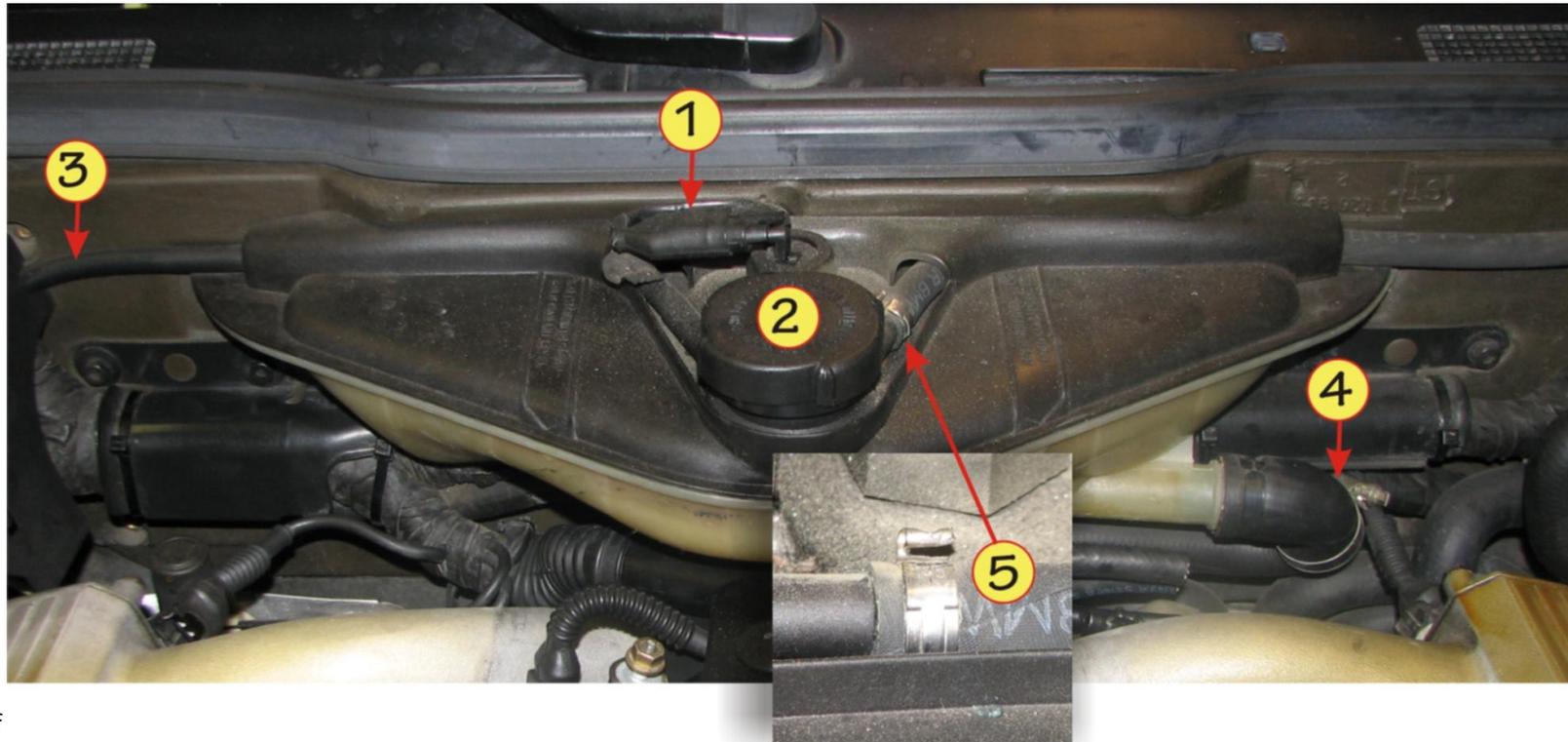


**BOTTOM:** This is the left PCV valve rubber seal/grommet in the valve cover after the PCV valve has been removed.

## Expansion Tank Removal

The next few pages of pictures were taken out of the actual order in which they were performed. I started out trying to minimize the amount of part removal but found I continually needed more maneuvering space. So at this point you might as well remove the coolant expansion tank, the windshield washer reservoir and the power cable (B+ terminal) to the alternator connection. (If you don't do the latter, you'll get some nasty sparks...)

1. Disconnect the coolant level sensor, (just behind the cap) ① This just pulls apart.
2. Remove the cap ② and using a turkey baster, remove as much coolant as possible.
3. Pull the overflow drain hose ③ from right bulkhead.
4. Loosen the hose clamp ④ from where the tank connects to rubber hose. Picture below shows it already loosened and the clamp slid down.
5. Remove the radiator overflow connection. ⑤ Use side cutters or Dremel tool with cut-off wheel.



## Hose removal tools:

I found the two tools at the right indispensable for removing coolant/fuel hoses. They break the seal without damage to the hose or connector. They're very cheap, both came from [www.HarborFreight.com](http://www.HarborFreight.com)

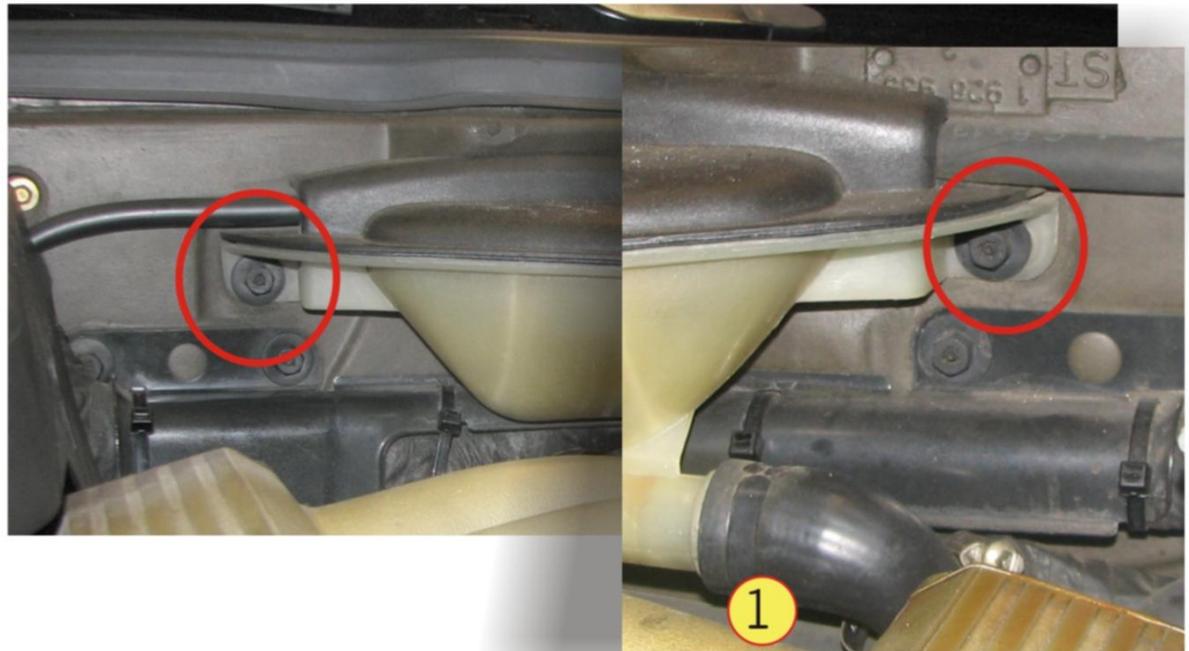
## Expansion Tank Removal

Remove the 2 plastic retaining nuts: **(circled)**

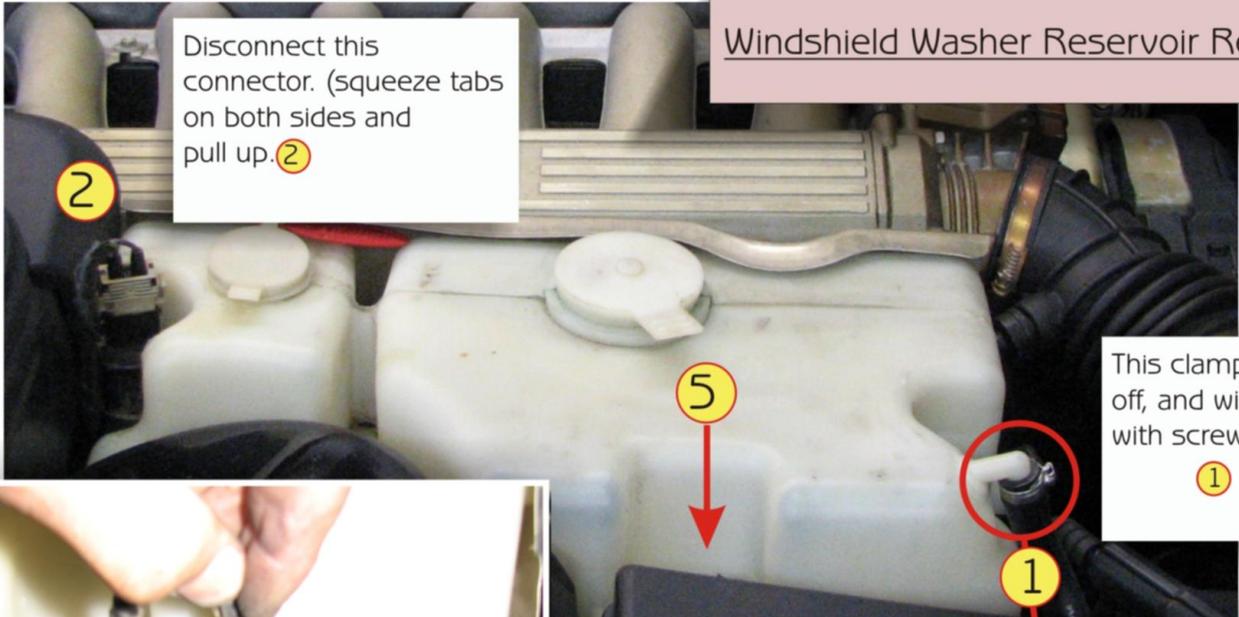
These two nuts hold the coolant expansion tank to the firewall. Use a 10mm socket to unscrew.

Ensure you have a towel under the hose to catch the coolant that will spill when you pull off the tank. ①

The radiator overflow line (item 5 in previous page) pulled off its connector with a bit of prying using the lower pick tool in the picture above.

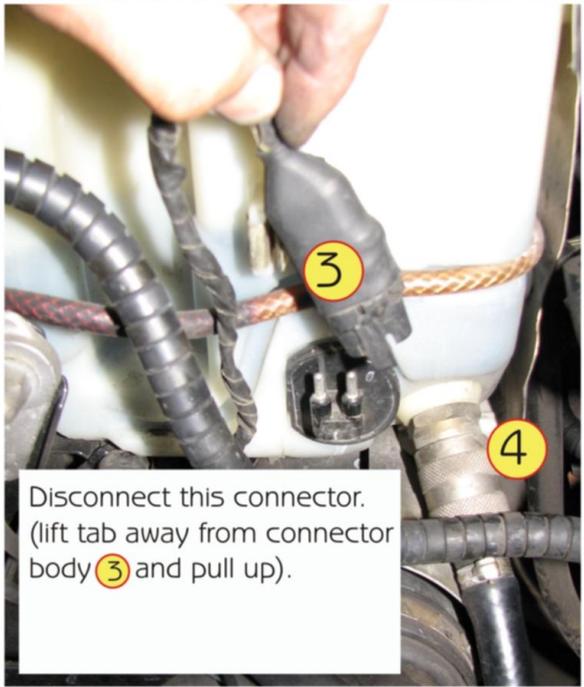


## Windshield Washer Reservoir Removal



Disconnect this connector. (squeeze tabs on both sides and pull up. ②)

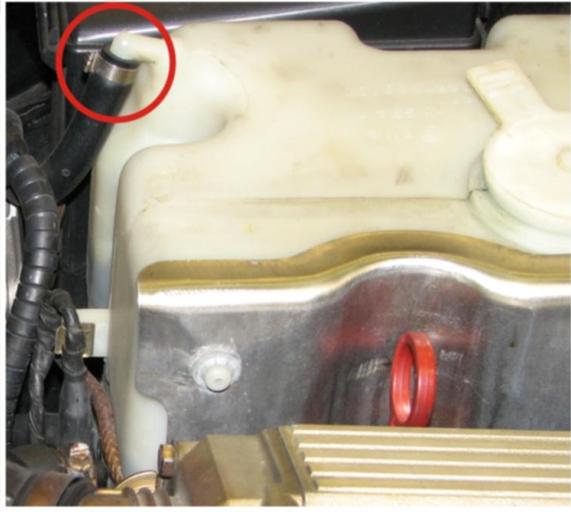
This clamp was also cut off, and will be replaced with screw type. ①



Disconnect this connector. (lift tab away from connector body ③ and pull up).

There is a 10 mm bolt clamping the tank to a bracket down here. Remove the bolt and the tank should now lift straight up. ⑤

The SS connector fitting is just like that on an air hose. Grasp the knurled sleeve and push up, pulling the hose downward. ④



Disconnect Power washer tank out of the way . I left the braided hose attached to the tank.



Power Cable Removal

Above:  
Remove the Positive Batt. terminal cover by grasping and pulling straight out. It's a tight fit so you'll need to do some pulling and pushing to pop it free. Note the heavy cable running from the bottom, it goes to the alternator.



Windshield Washer Reservoir



Power Cable Removal

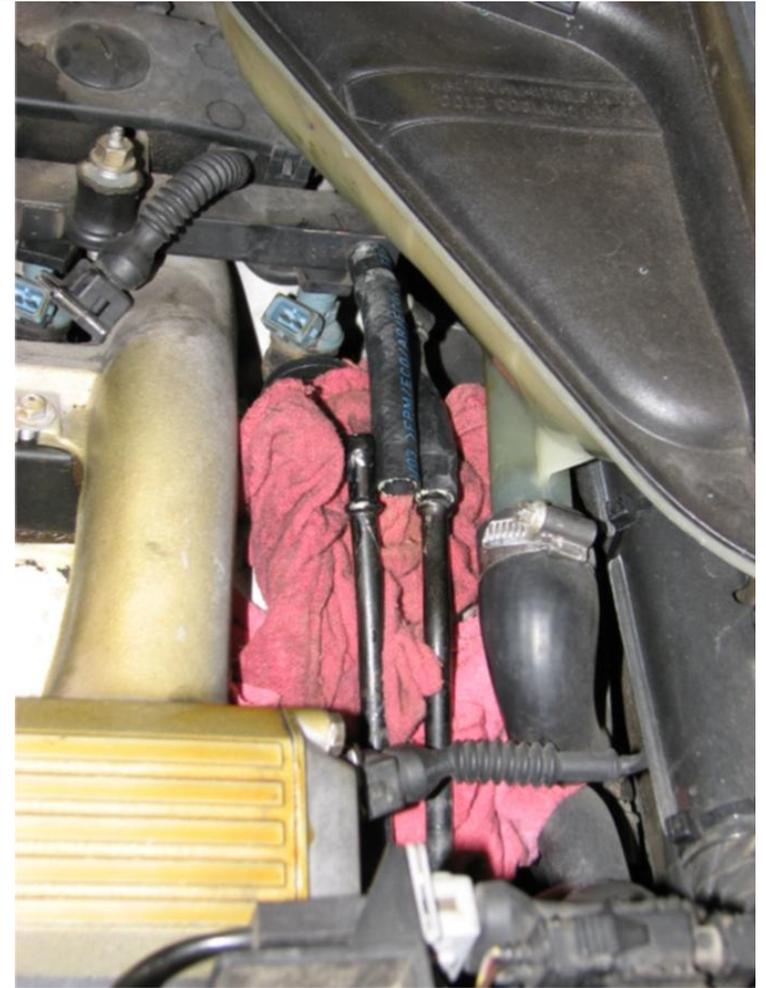
Left:  
This view shows the battery cable cover removed, the alternator cable disconnected (covered with tape) to prevent accidental grounding when working by the alternator. This cable was connected to the lower right stud, (nut was put back on.) I later disconnected the bolt in front of the rear, right passenger seat to kill all power to the car.

## Disconnect Rear Fuel Hoses

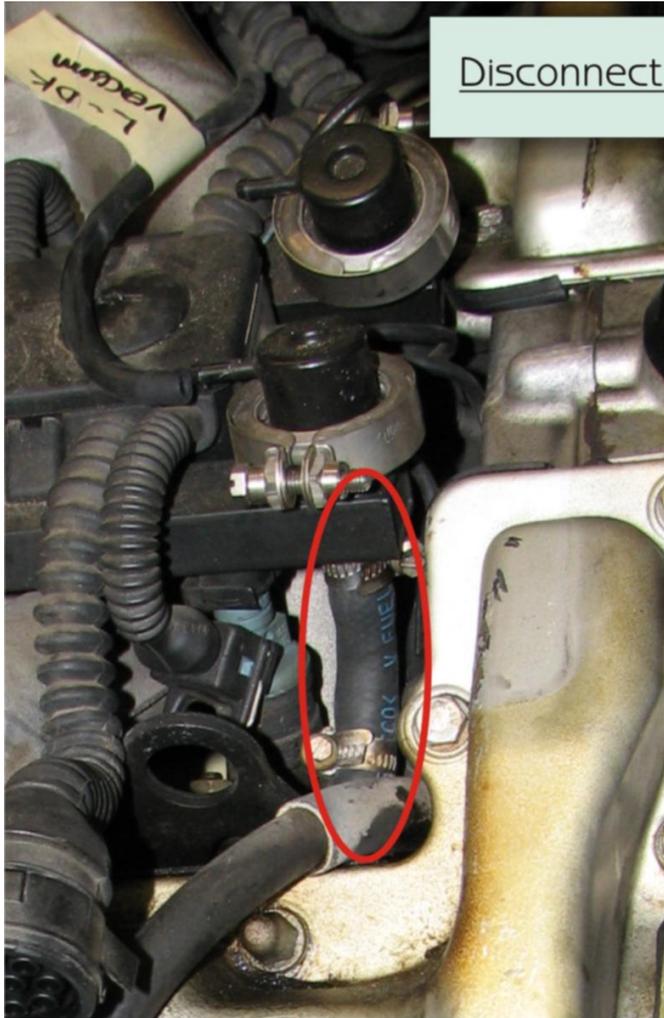


These are the rear high pressure fuel line hoses feeding the fuel rails. In the view at the left, note the top hose feeds the left side fuel rail and the bottom hose goes over to the right fuel rail.

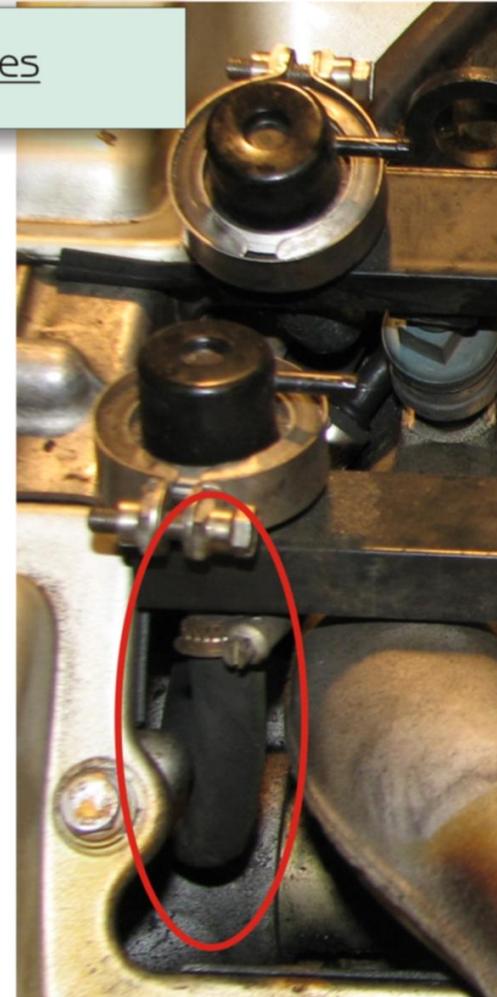
Don't mix these up! Mark them as necessary before you remove. Once you have the hose clamps loosened, remove the hoses from the lines. Gas will spill so be prepared.



Disconnect Front Fuel Hoses



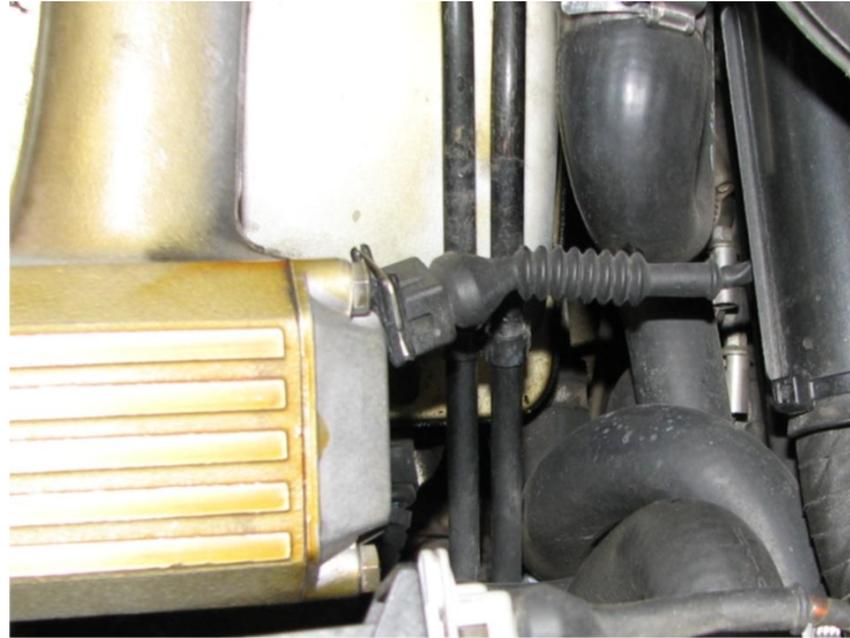
Right engine view



Left engine view

Front Fuel Lines - disconnect (Under Fuel Regulators)

There are two sections of high pressure fuel hose that connect to the front of the fuel rails, both beneath the fuel regulators. At this point I just removed the hose from each regulator. The goal is too free the fuel rails from anything securing them.

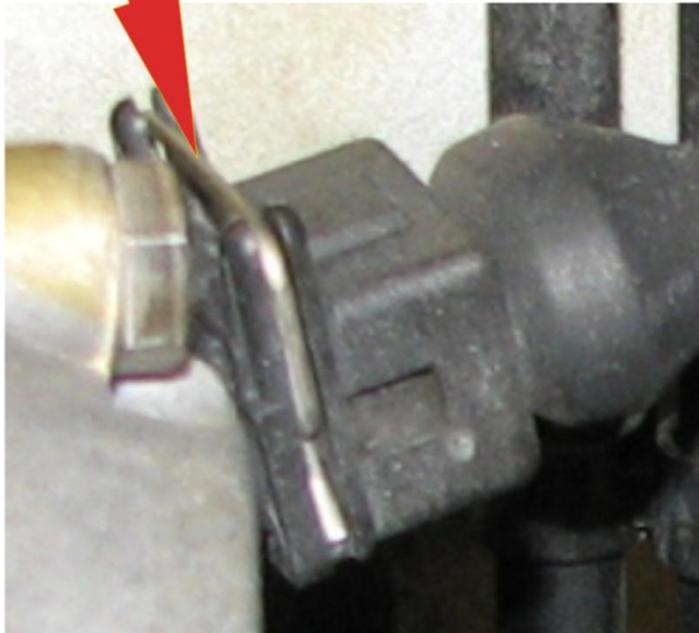


### Temperature Sensor Removal/Hints

The two pictures above show the *temperature sensors* located at the rear of each intake manifold plenum.

Disconnect these now by squeezing the metal bail down into the body of the connector. Arrow shows direction. Unplug connector.

In the upper left photo, note the gas fuel line running underneath the temperature sensor is secured to the valve cover with a 10 mm bolt.



## Pulse Sender/Cylinder ID (right)

This is a view of the right side Pulse Sender [top plug ] **(circled)**. This connector block is black and the cable goes to the left side of the block) The connector beneath it is the Cylinder Identifier (1 through 6 ) and leads to spark plug wire No. 6 on the right bank. This connector block is tan/white.



## Pulse Sender/Cylinder ID (left)

This is a better view showing the left side Pulse Sender (top plug). This connector block is black and goes to the right side of the block) The connector block beneath it is for the Cylinder Identifier (7 through 12 ) and leads to a spark plug wire on the left bank. This connector block is tan/white.



## Pulse Sender/Cylinder ID : NOTES

To help me remember where the connectors went, I labeled a couple prior to unplugging. As you can see to the right, these unplug in the same manner as the temp. sensors on the intake manifolds. Squeeze the bail in and pull out the plug.

Don't cross these plugs when reassembling!

### Pulse Sender/Cylinder ID Hints

## Cylinder ID

This view shows the right Cylinder ID plug with its "doughnut" around spark plug wire No. 6.





### Pulse Sender/Cylinder ID connector Removal

**(Circled)** This shows the location of the four 10 mm (socket) bolts that hold the connector retaining clips to the cylinder head. They're hard to see as they're covered in grunge.

### Pulse Sender/Cylinder ID Removal

Connector Blocks in Clips This shows the bolts removed with the connectors (still held by their mounting clips.) I chose not to separate the connectors from the clips because I didn't want to get them mixed up. I

carefully threaded them under the oil filler spout when I removed the injector wire harness.

## Remove Fuel Injector Connectors

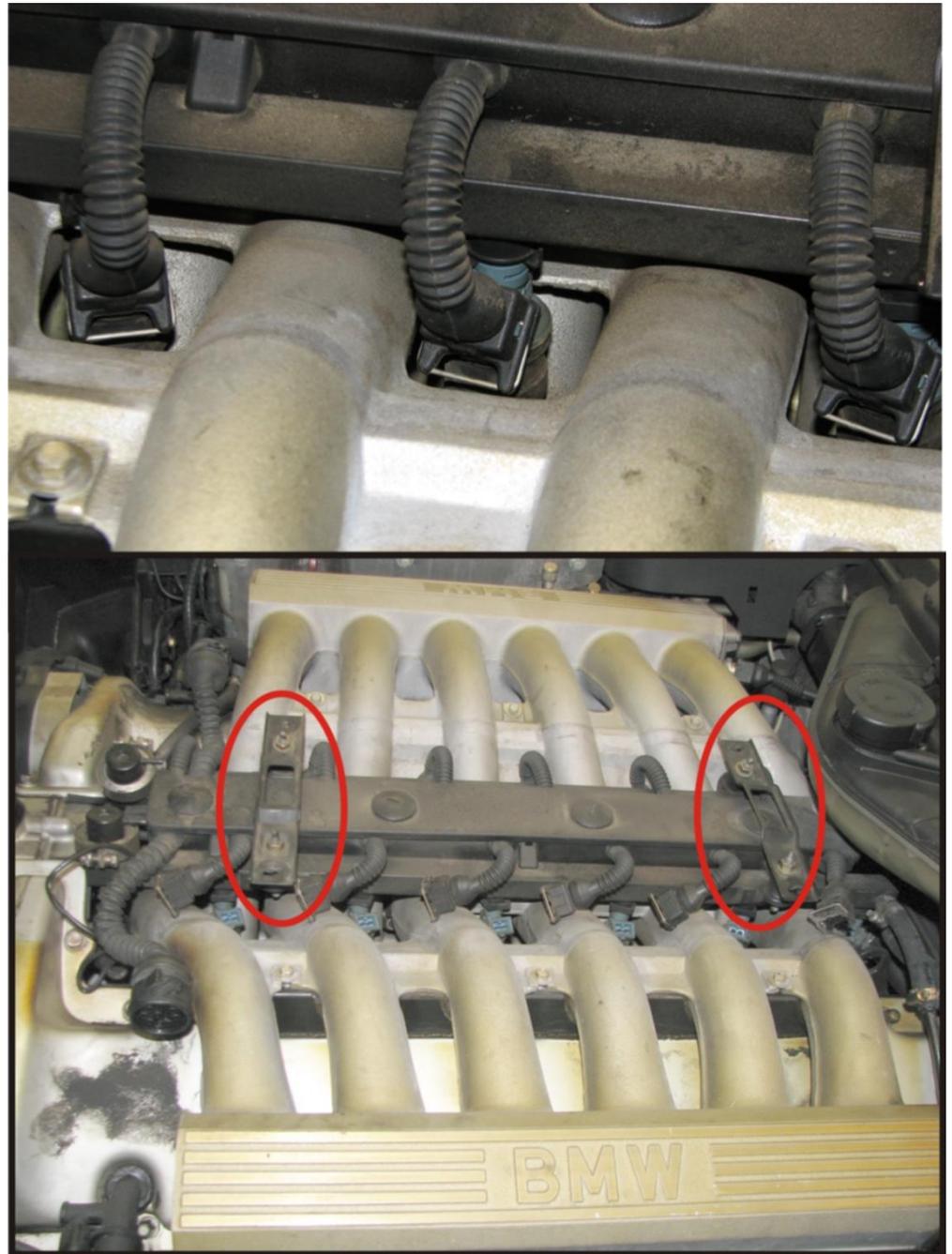
Disconnect all the fuel injector connectors. This is the same plug style as the temp sensors, simply squeeze the metal bail towards the body and pull the plug out in one motion.



## Fuel Injector Connector Removal

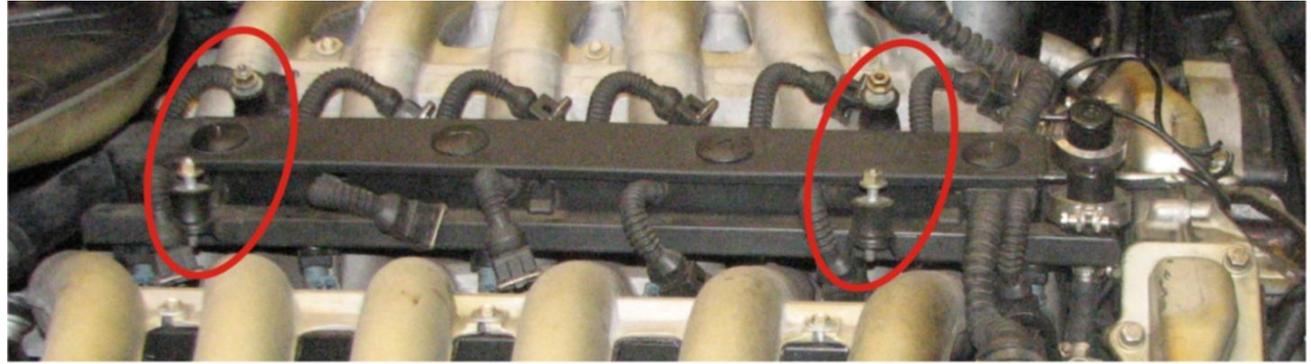
Injectors for cylinders 7 through 12 unplugged. Do the same for cylinders 1-6.

Note the front and rear brackets where the noise suppressor attaches. These will be removed next. **(circled)**

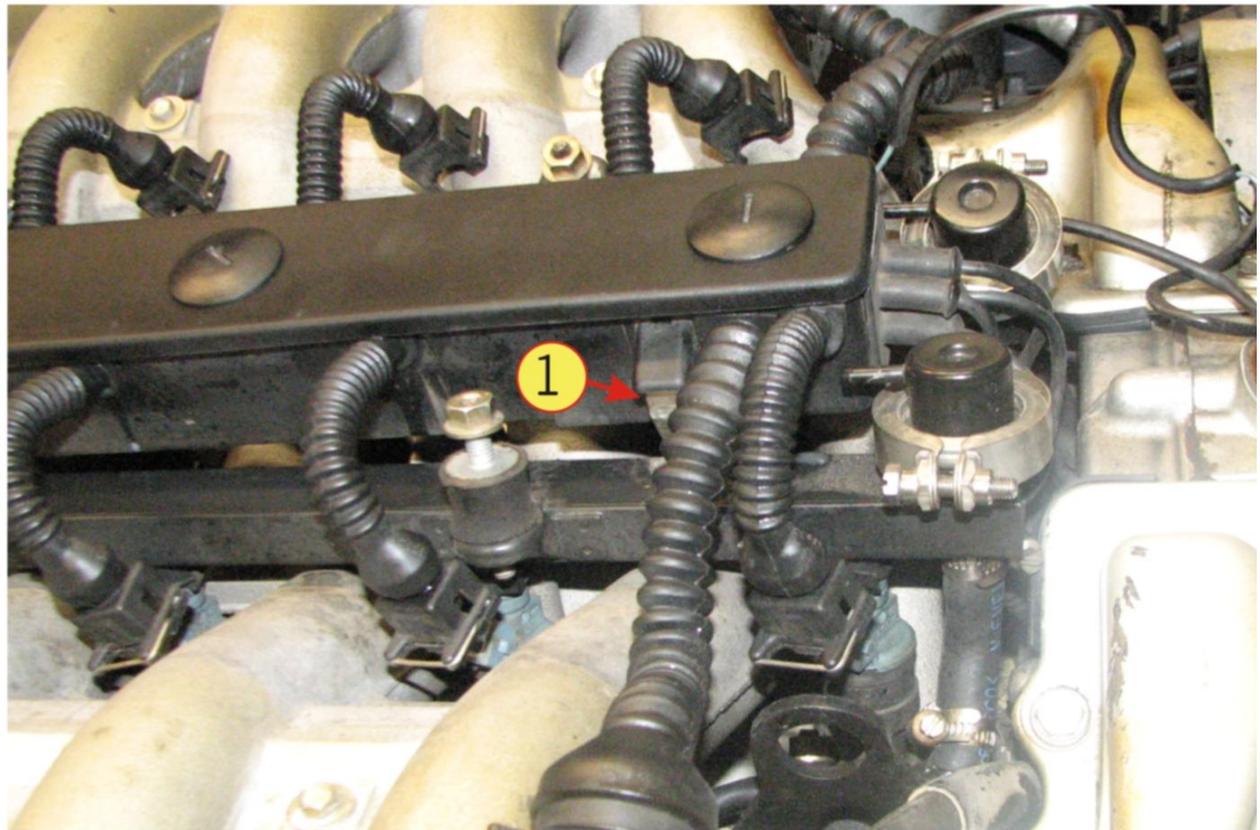


## Fuel Injector Harness Removal

The front and rear brackets removed. **(Circled)**



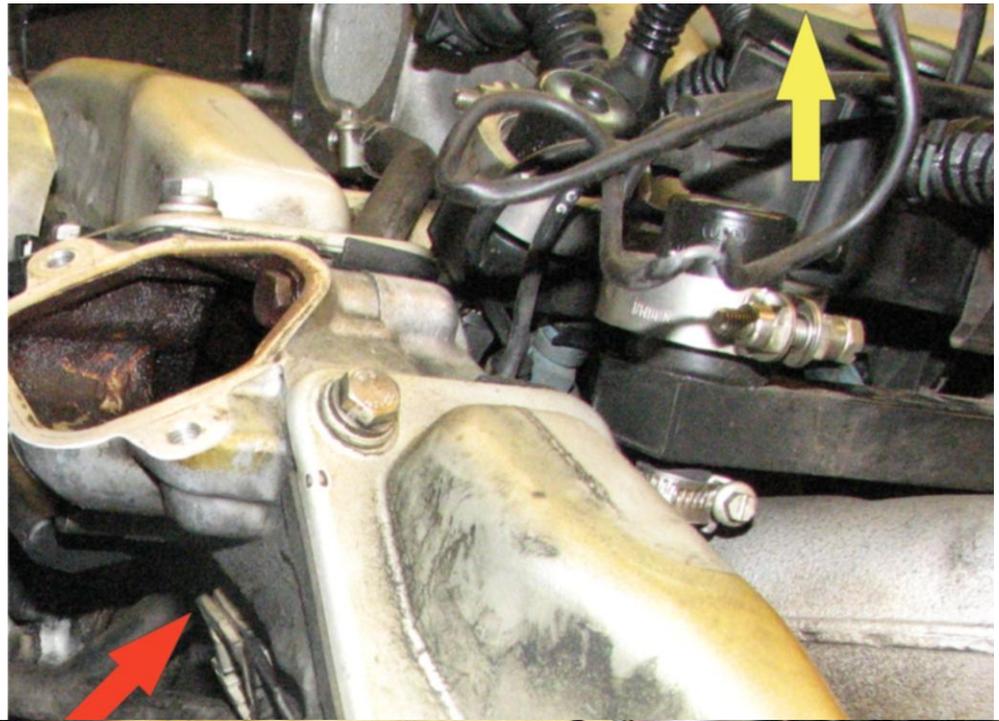
Begin prying up the harness enclosure ①. There are 6 clips that wedge it between the fuel rails.



## Fuel Injector Harness Removal

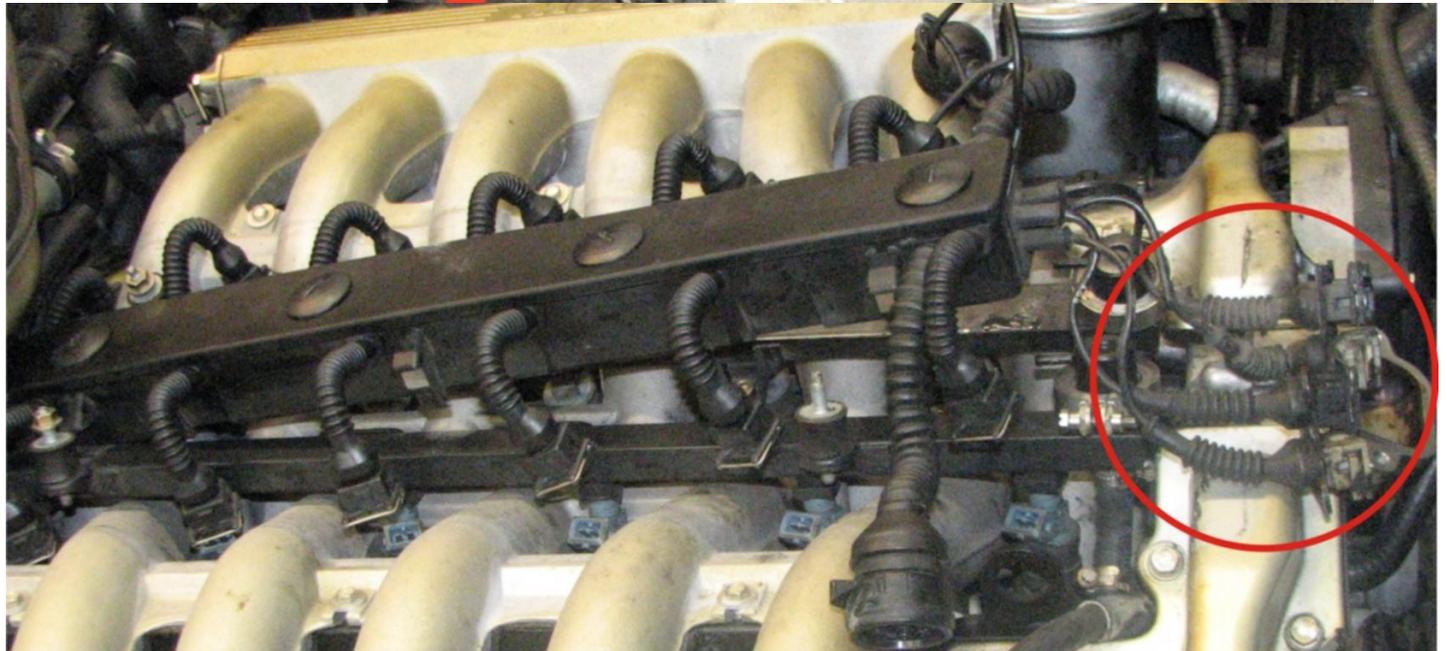
Hold up the front of the harness enclosure (yellow arrow) while you carefully feed the connector/mounting clips assembly under the oil filler spout (Red Arrow)

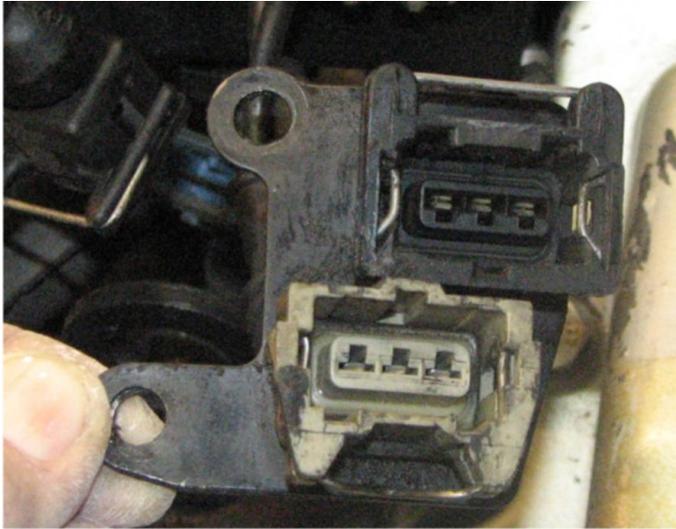
Lift up the whole length of the harness enclosure until all the retaining clips are released.



## Fuel Injector Harness Removal

Connectors successfully threaded through the opening under the oil filler. (circled)





## Cleaning Pulse Sender/Cylinder ID Connectors

I used silicone spray and a soft bristle brush to gently dissolve and clean the grease on the connector terminals. I then sprayed with DeoxIT® Contact Cleaner. (Great stuff)



## Harness Enclosure

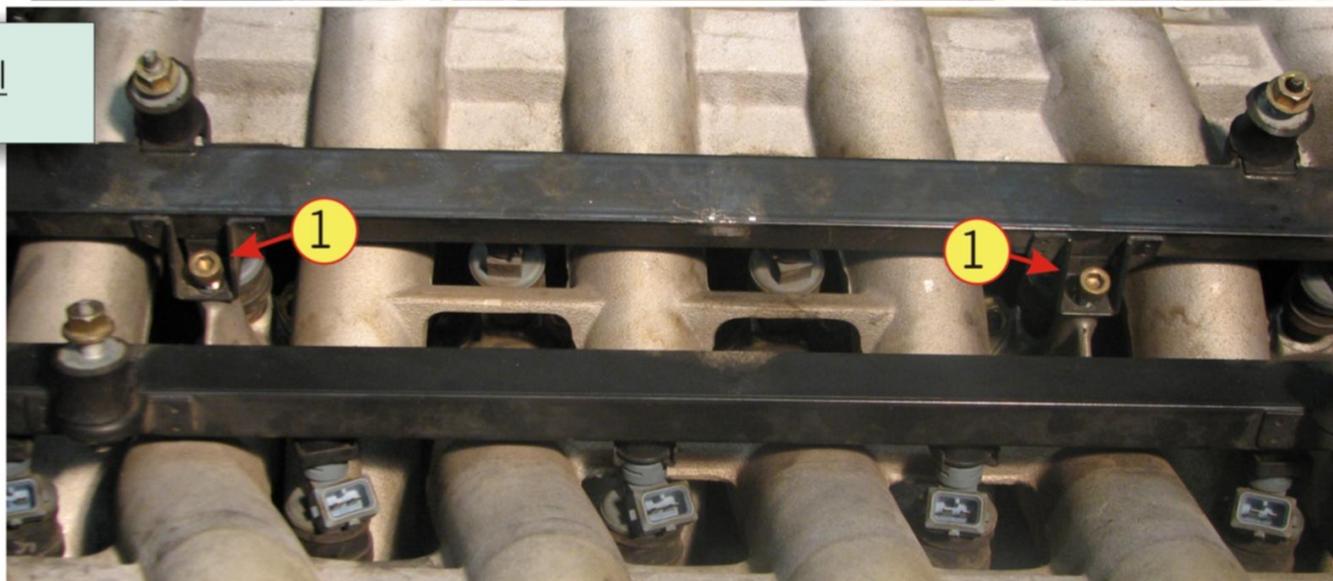
Secure the harness enclosure so it is out of the way. I tied it between my rear view mirrors.



## Fuel Rail Removal

Remove the four socket head screws. Mine required a 5 mm allen driver. ①

Two are shown.



## Fuel Rail Removal:

The fuel rails can now be removed. They are held in by the tension of the O-rings on each injector-to-manifold port.

It's probably not recommended, but I used a pry bar and applied VERY LIGHT pressure on one end of the rail as I wiggled and pulled the rail up. Once it started to give, the rest popped out easier. Be careful, you don't want to bend or tweak the fuel rail.

The fuel rails can now be removed. They are held in by the tension of O-rings of each injector (fitted into the manifold).



## Injector Port



All of my injector ports were “sludged” up as the picture shows. I’m told this is normal when using non-synthetic oil, but if synthetic is used, the sludge is reduced.



## Manifold Removal

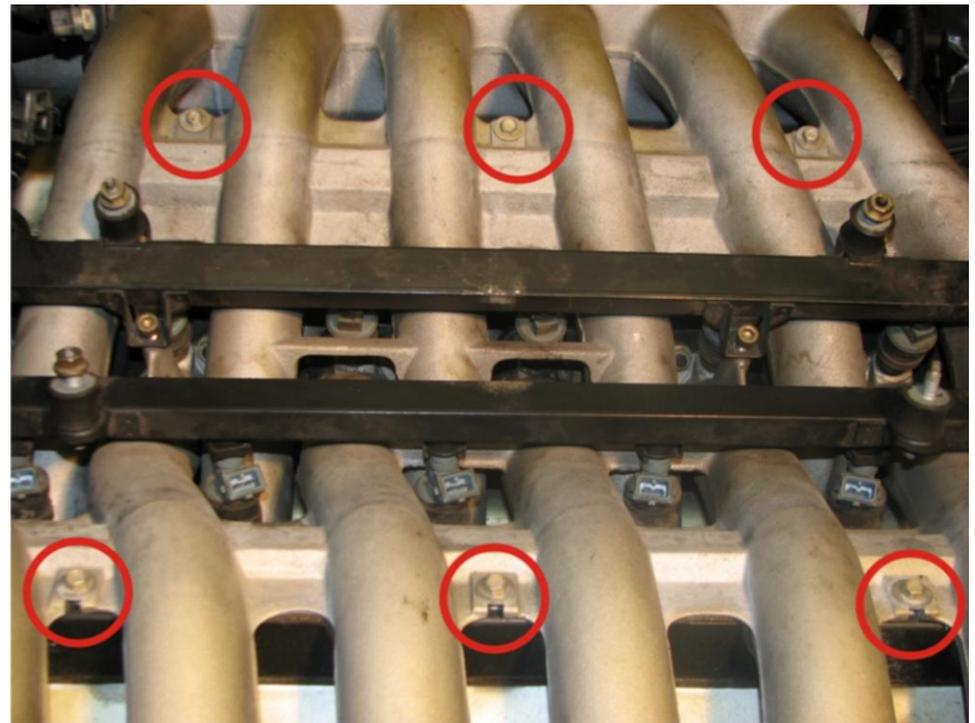
You will need your collection of socket extensions, universal joints & wobble extensions to reach the 24 10 mm nuts that mount the manifold to the head. I found that u-joints as is are too flexible to hold their position while trying to locate a socket on a nut so I taped mine with either electrical tape (above) or masking tape. This actually worked well. I mainly used a 3/8" set for the upper nuts and 1/4" drive set for the lower nuts (lower profile.) For the lower nuts, its necessary to go underneath the runners (must remove the sound suppressor). The nuts will most likely drop as you unscrew but they can be recovered once the manifold is removed.

## Intake Manifold Removal

Note: this picture is out of sequence but is shown for illustrative purposes.

Remove the sound suppressors/baffles under the intake manifold. There are 3 6mm socket bolts on each set. These are captive bolts, unscrew until fully extended then slide suppressor out. **(circled)**

It is necessary to remove these to allow the socket extension to reach the nuts on the bottom of the manifold hold-down nuts.

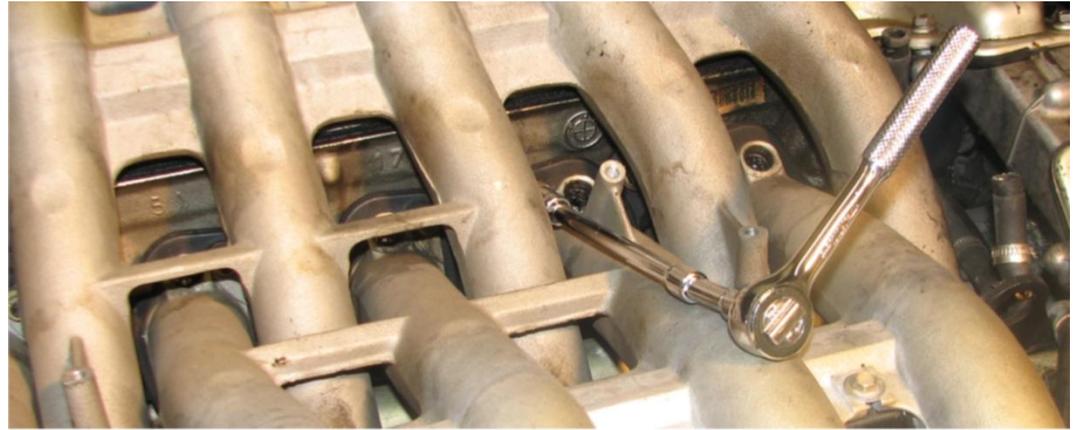


## Manifold Removal

Focus on one bank first. This makes it easier to remove the second one.

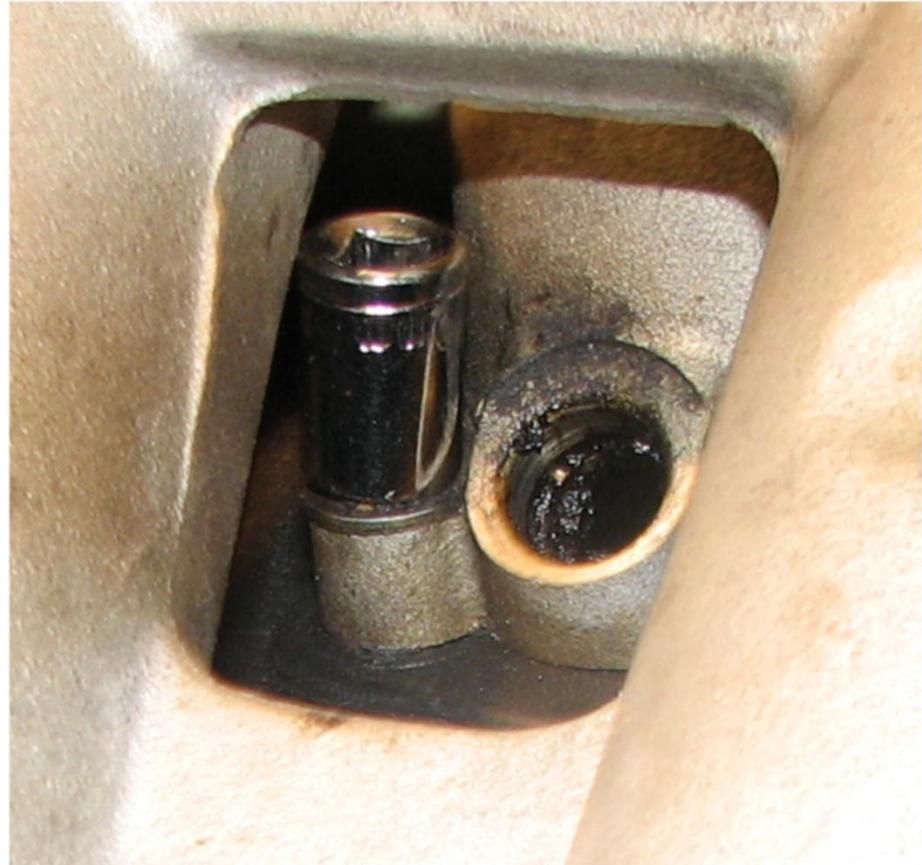
Top row of nuts are easily reached with 3/8" drive ratchet, but a 1/4" is needed for the two under the horizontal rib.

These are M6 threaded studs, 10mm socket required.



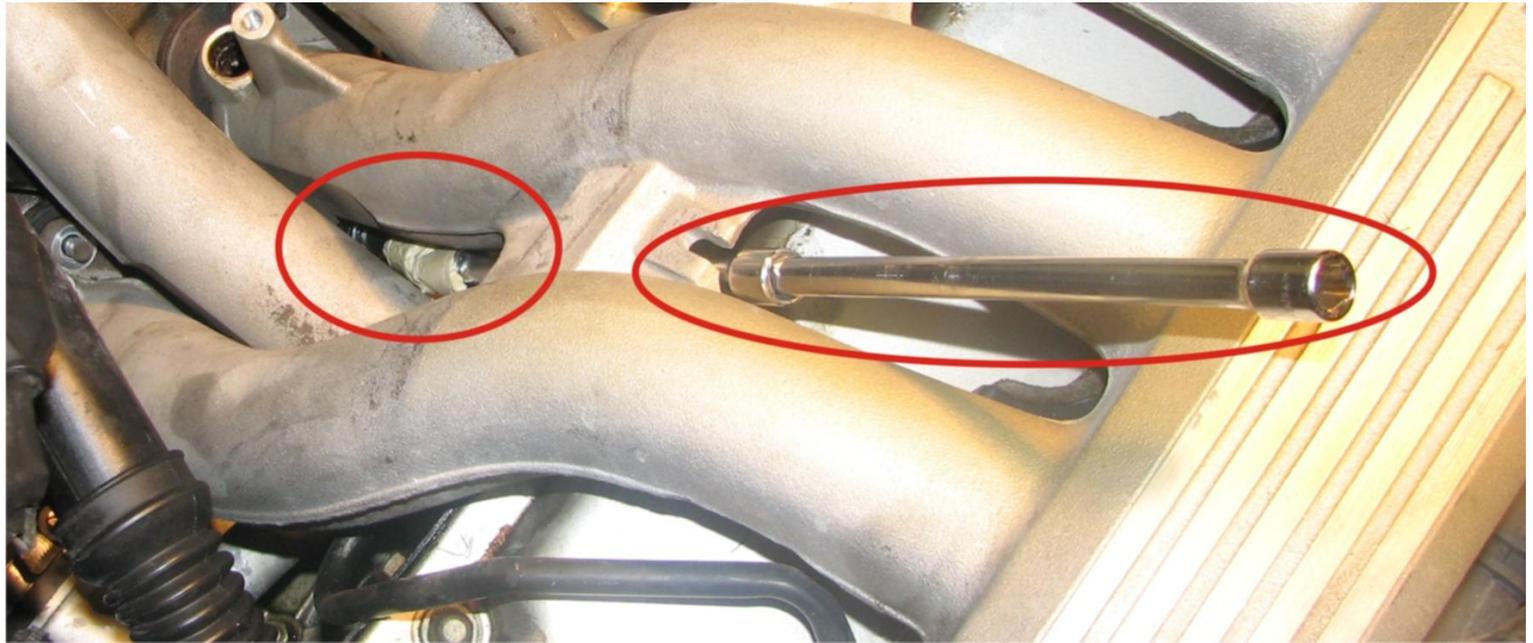
## Manifold Removal

This shows a 1/4" drive 10mm socket tilted by a runner. It's too tall to fit square on the nut and I didn't want to chance rounding the head, so I ground off about 3/16" overall.



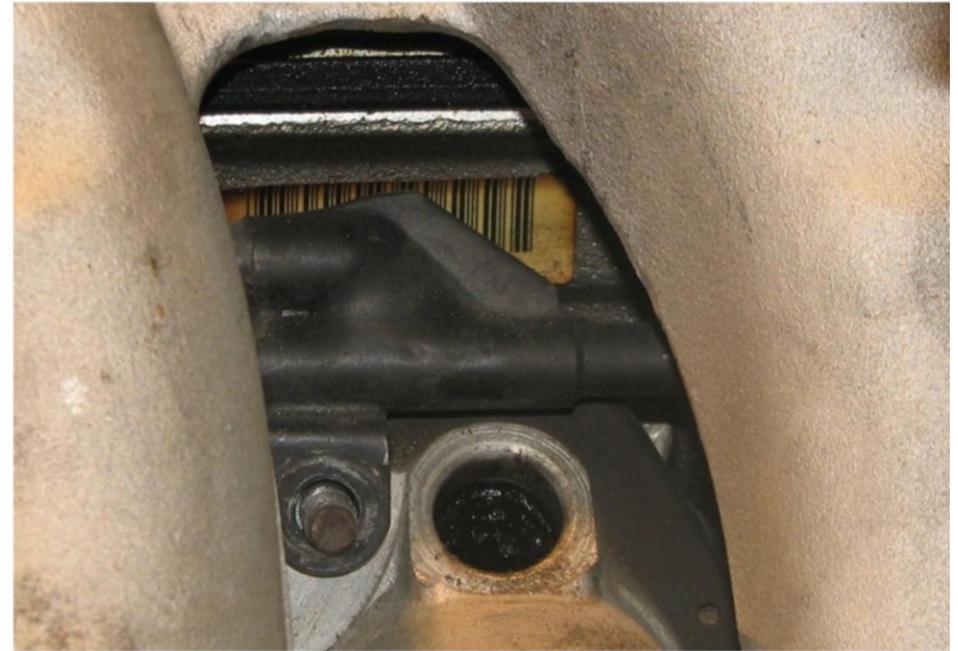
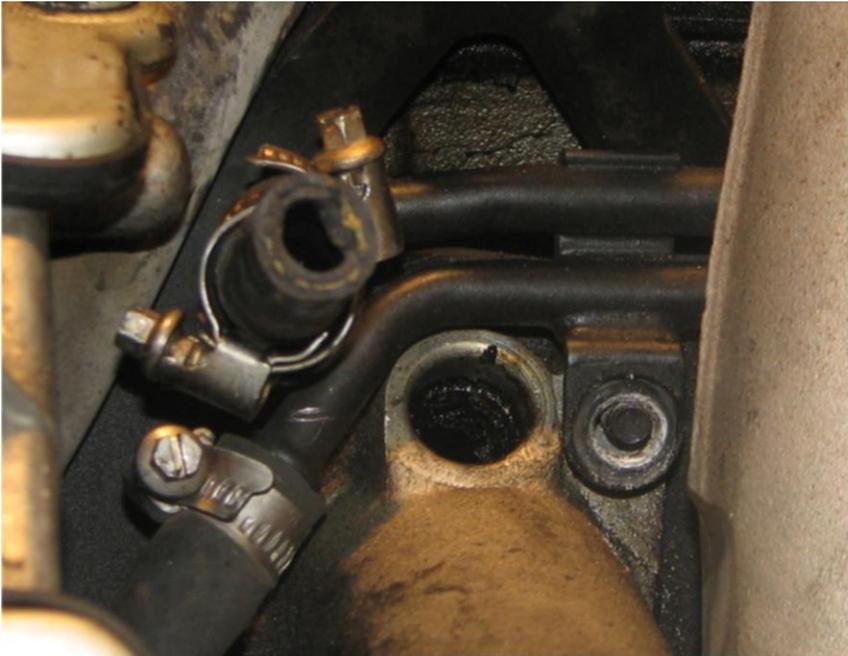
## Manifold Removal

I used my 1/4" set for the bottom nuts. Go underneath the manifold with a taped-universal joint for port 11.



## Manifold Removal

After removing all the 10mm manifold nuts, remove the four acorn nuts (2 on each side) that mount the plenum to the valve cover. I pulled off the left manifold first but I don't think it matters. **Note:** removing acorn nuts frees the ignition wire loom.



## Manifold Removal; right side

Note the hard fuel line mounting tabs above. These need to be lifted out of the way prior to removing the manifold.



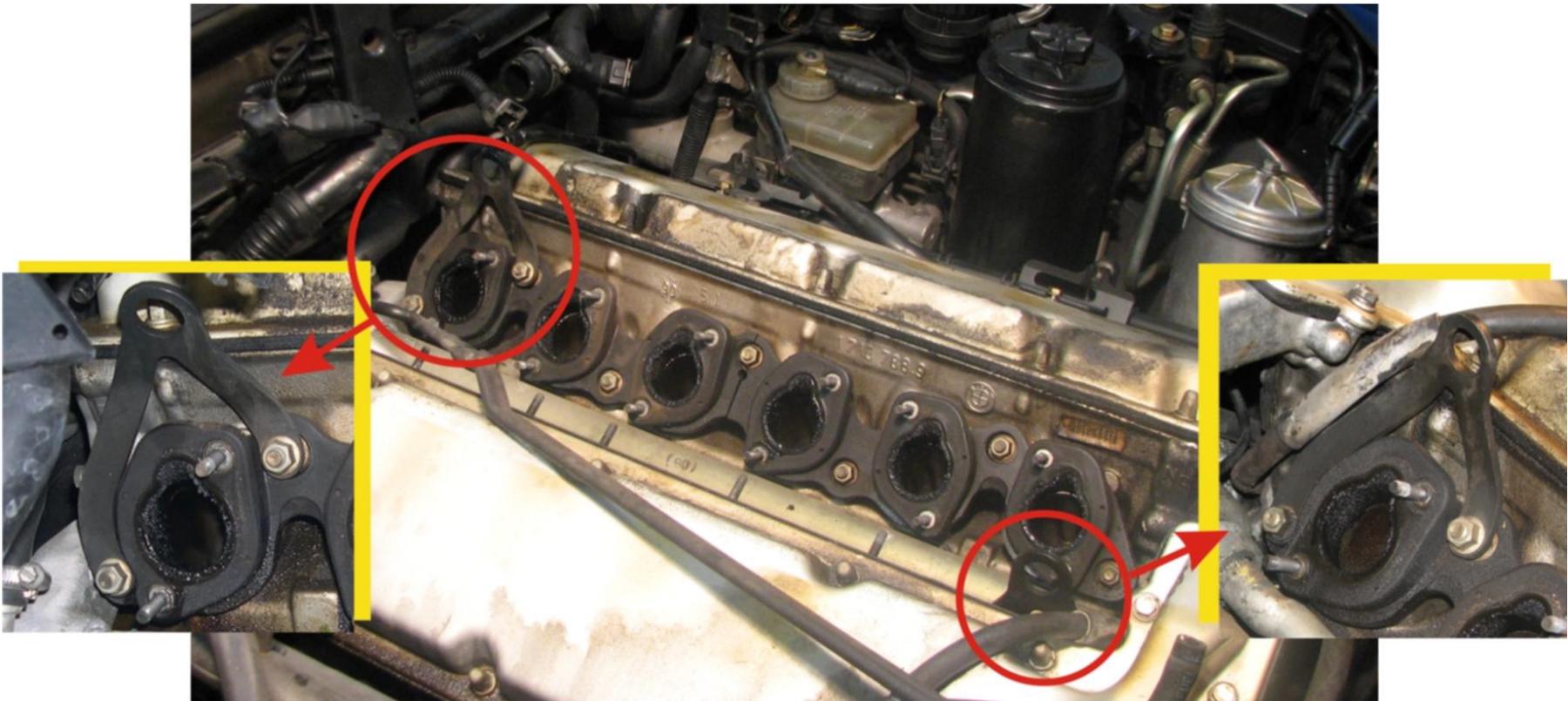
## Manifolds Removed (View of Left bank)

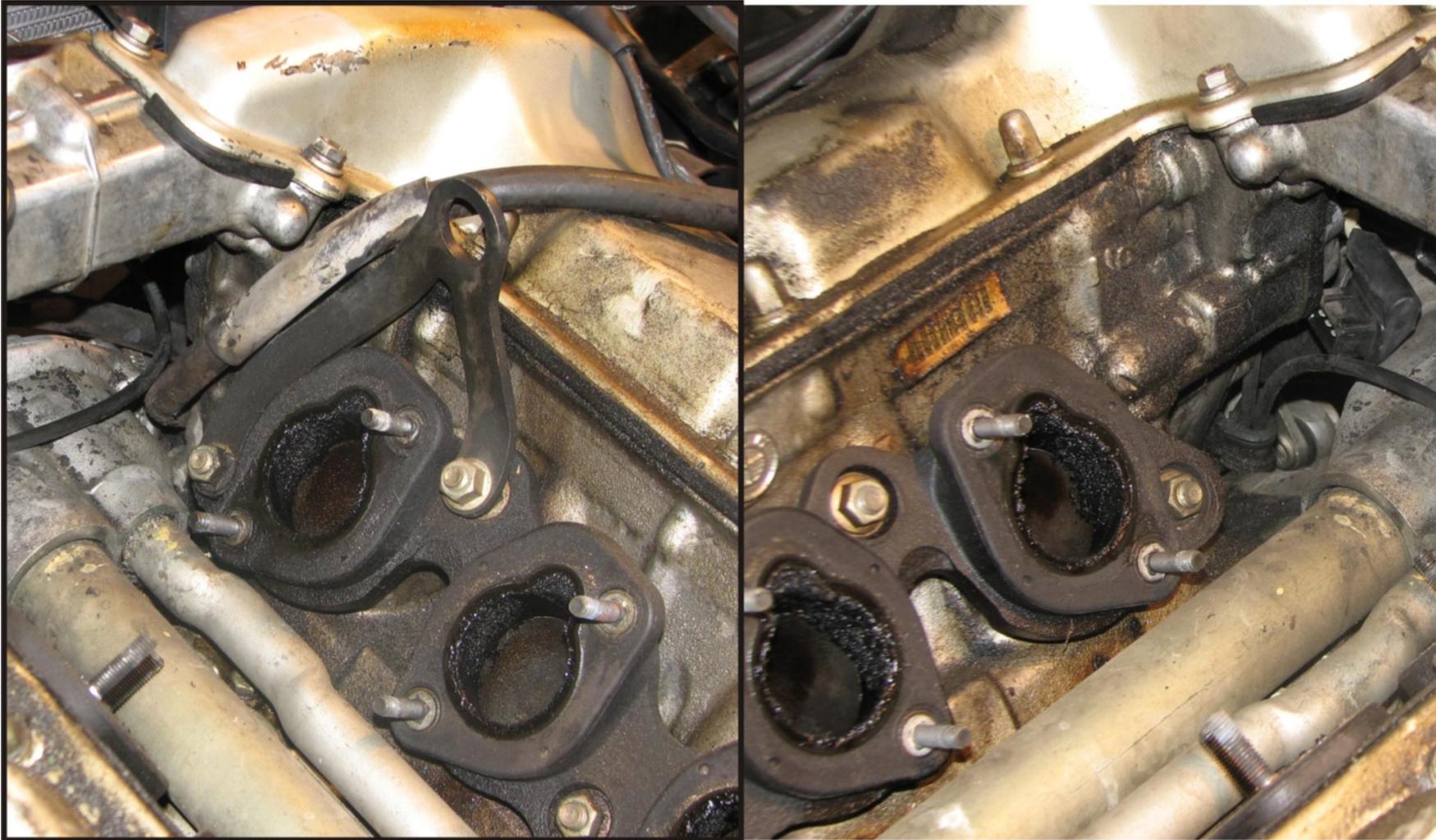
Next step is to remove the manifold gasket retaining nuts. These are M8 studs, 12mm socket required.

## Removing Manifold Retaining Nuts

There are 18, 12 mm nuts, (9 on each side.)

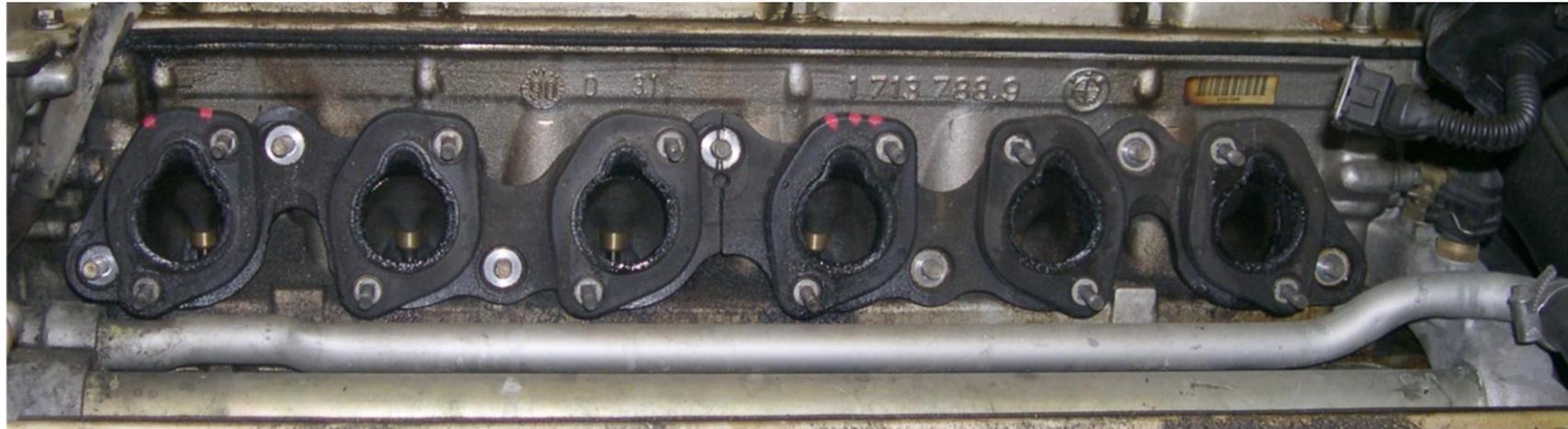
Note the engine lift brackets. **(circled)** There are two nuts on each of the bracket retaining studs, (two securing it and once removed, two more holding down the gasket).





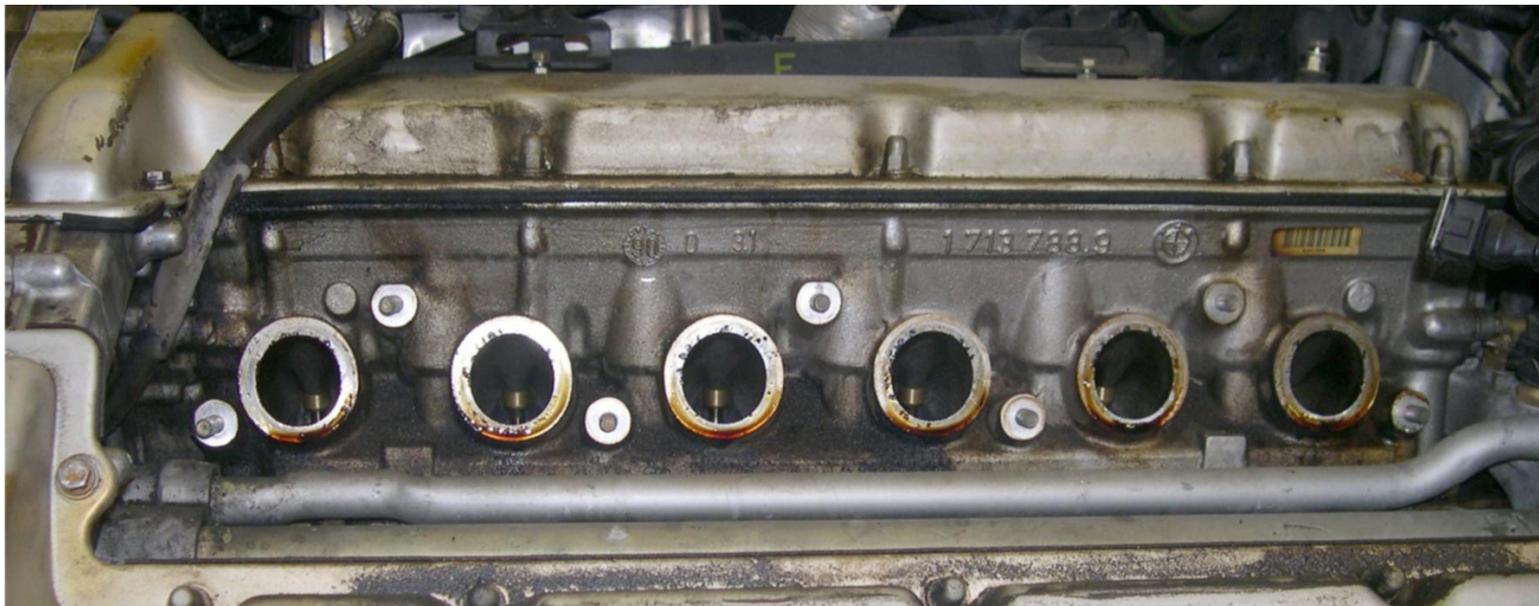
## Removing Manifold Retaining Nuts

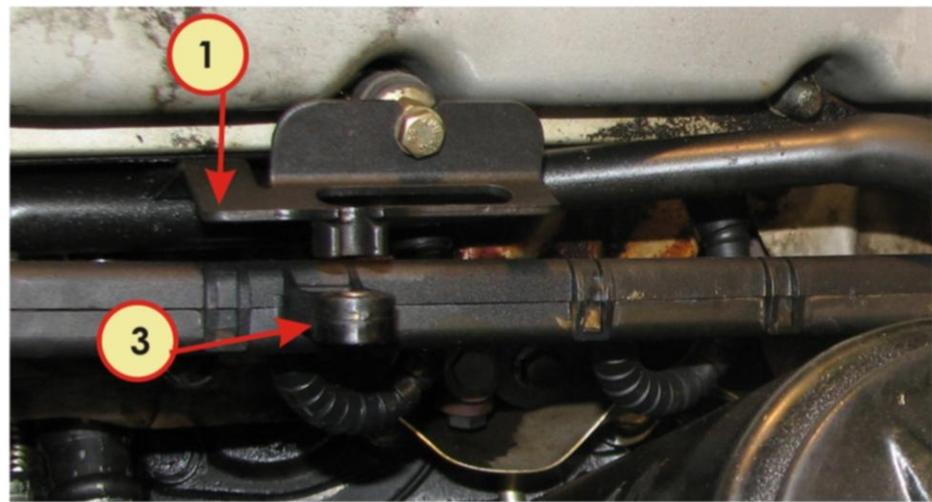
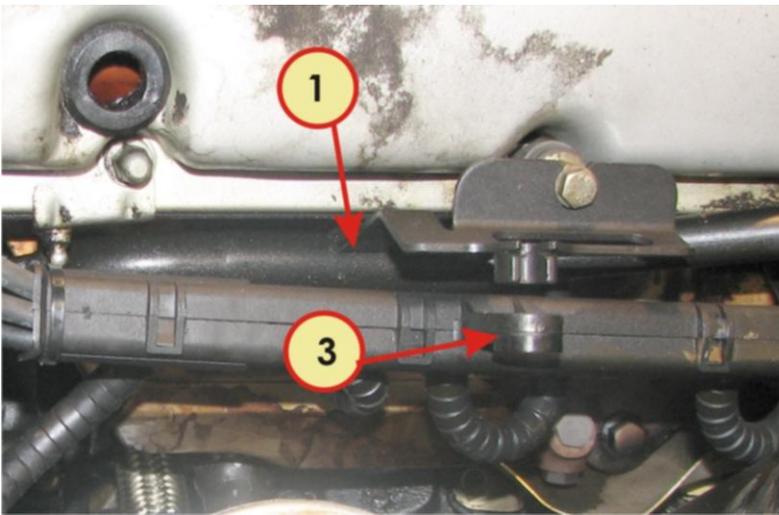
View showing general condition of gaskets prior to cleaning.



## Manifold Gaskets

The manifold gasket sections are interchangeable, but since I plan on only cleaning and reinstalling them, I marked them so I could return them to their original positions.

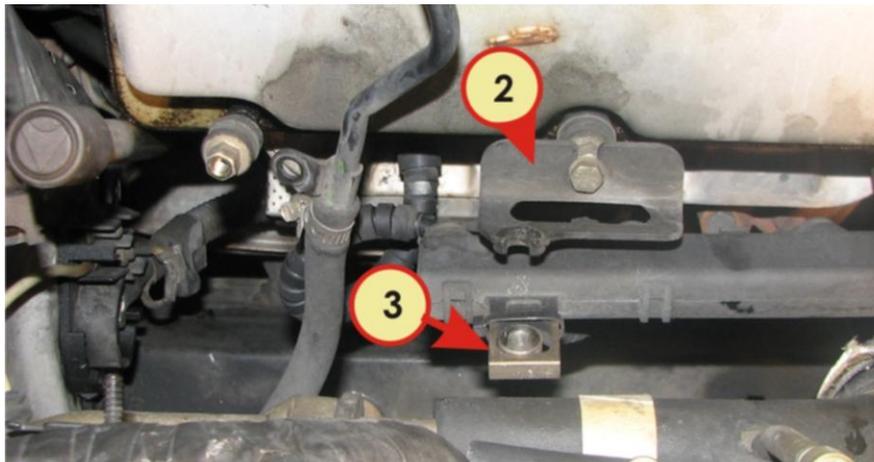


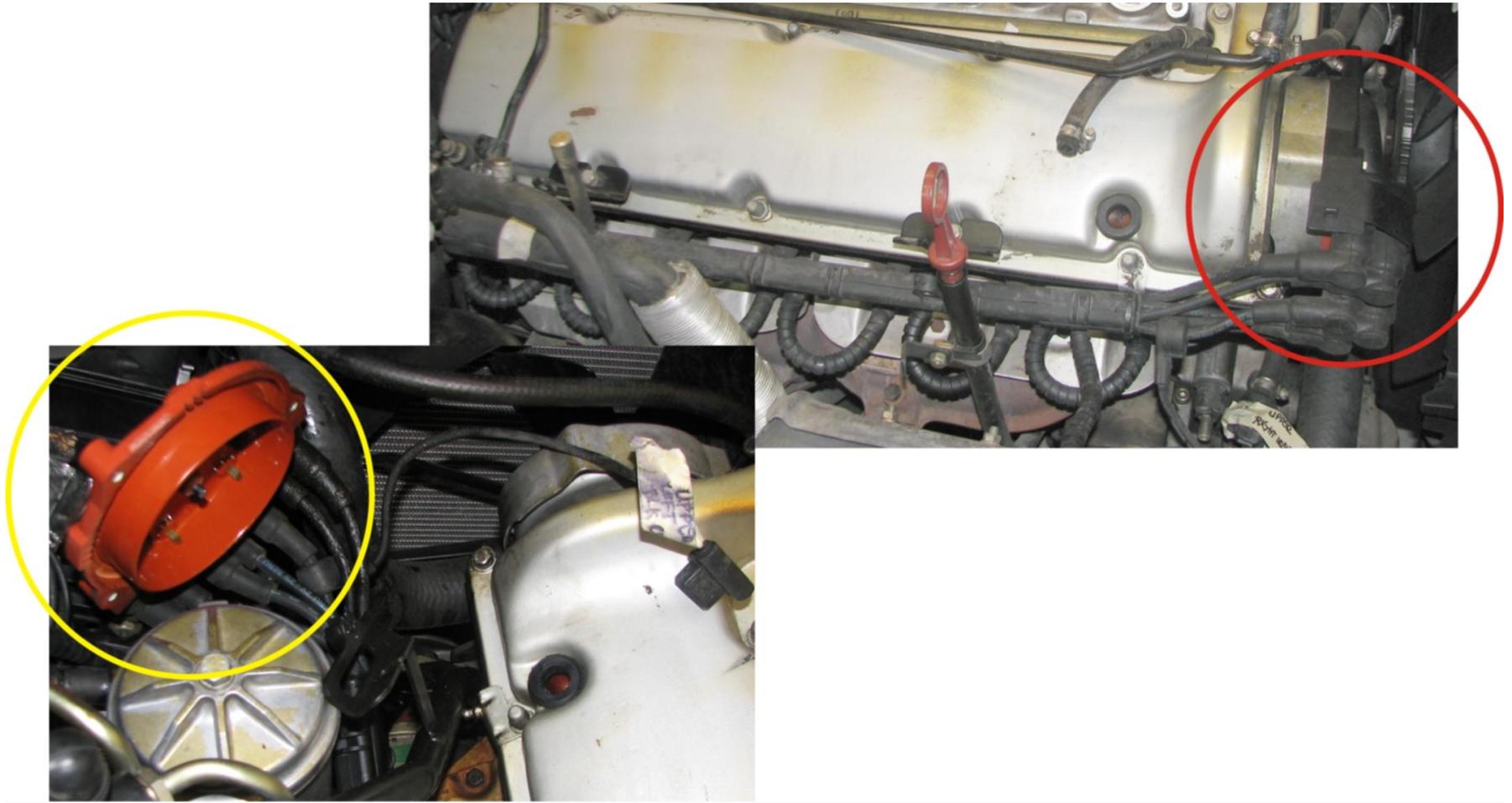


### Remove the Ignition Wire Looms

The acorn nuts were removed in a previous step prior to removing the intake manifolds. In the views above, the left bank manifold brackets are attached to the power cable tube. ① Since I already disconnected this cable at the terminal block end, I left it connected to the alternator and pivoted it to the front, out of the way.

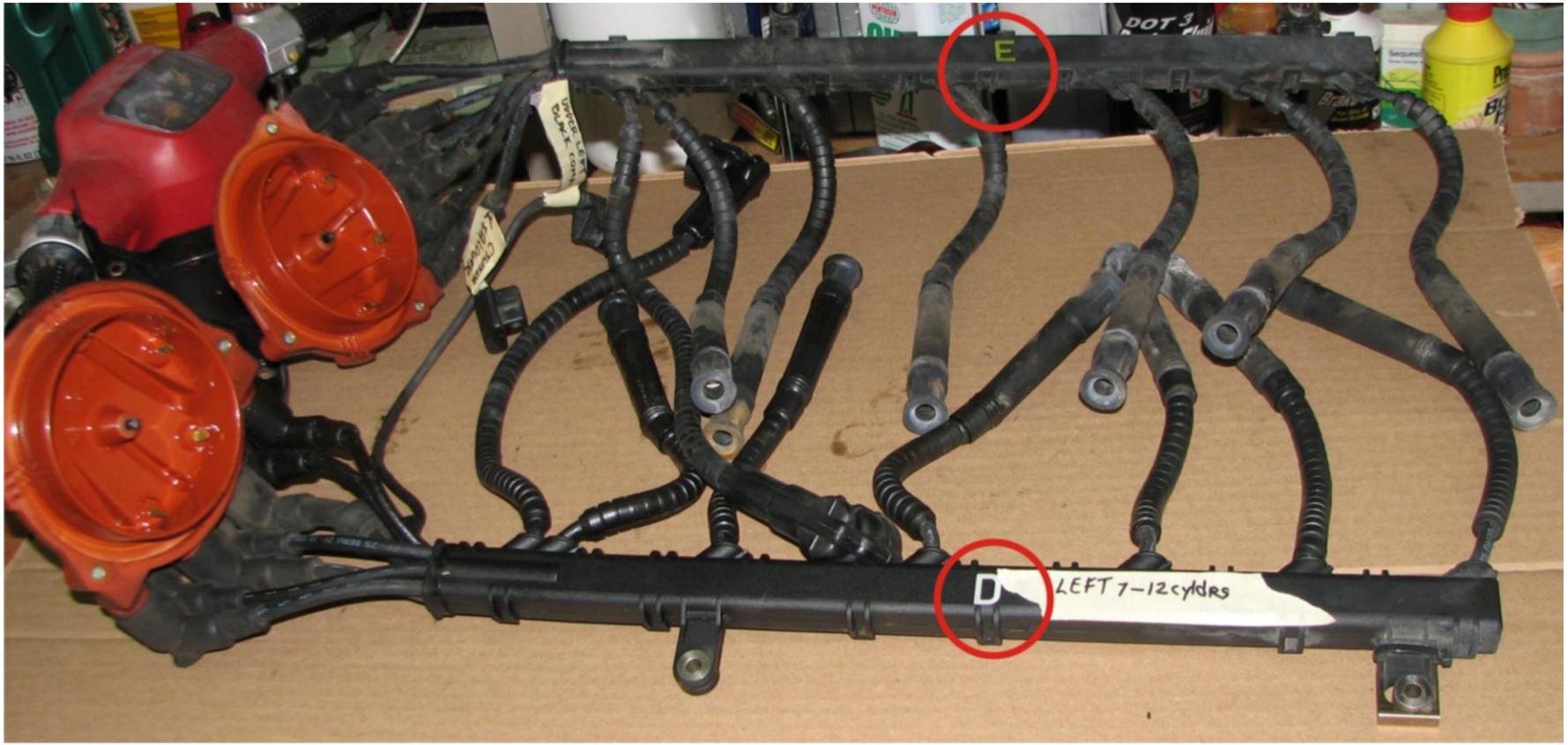
In the views below, the right bank valve cover brackets are bolted to the rubber mounts of the valve cover. ② The ignition loom has two thick spacers /washers ③ where it attaches to the bracket.





## Remove the Ignition Wire Looms

Unbolt the distributor cap covers and remove the loom from each bank, being careful when pulling the cables from the spark plugs. Use a boot remover if you have one.

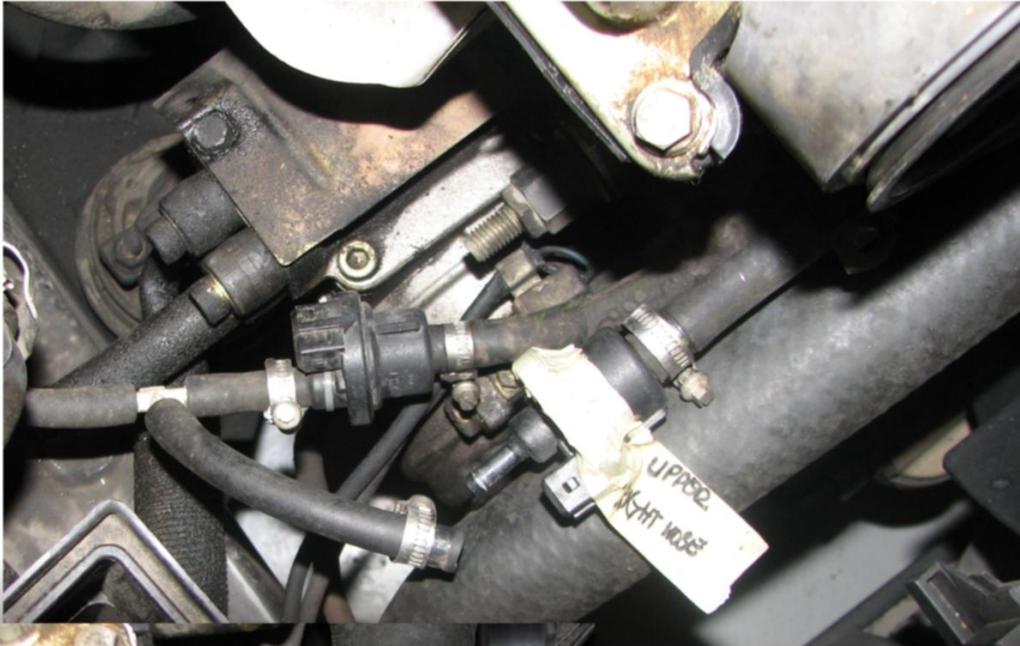


## Ignition Wire Looms

This view shows both looms removed, note the left bank loom channel has a “D” marking on it and the right bank has an “E” marked on it. **(circled)** The rubber boots are still soft & flexible; I’ll clean and treat the insides with silicone grease prior to reinstallation.

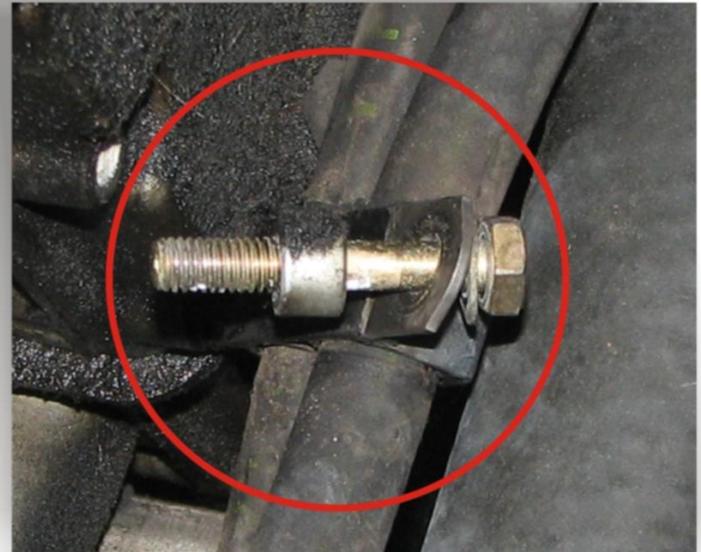
### Evaporative Emission Lines - Remove

Next I disconnected the switches/valves from the evaporative emission hoses (these go to DK/Throttle bodies).



### Evaporative Emission Lines - Remove

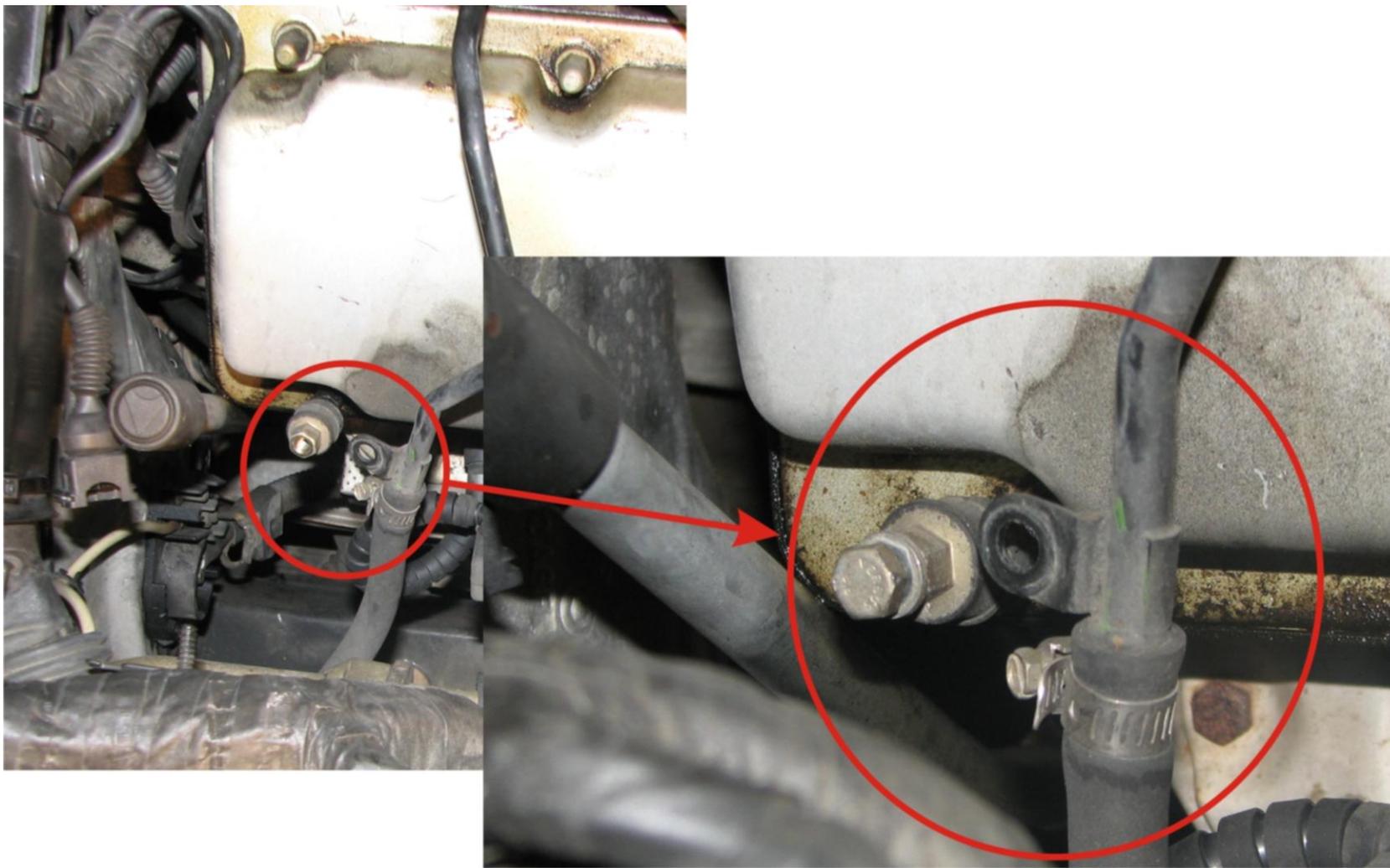
Remove the retaining bolt just above the cam chain tensioner.



## Evaporative Emission Lines

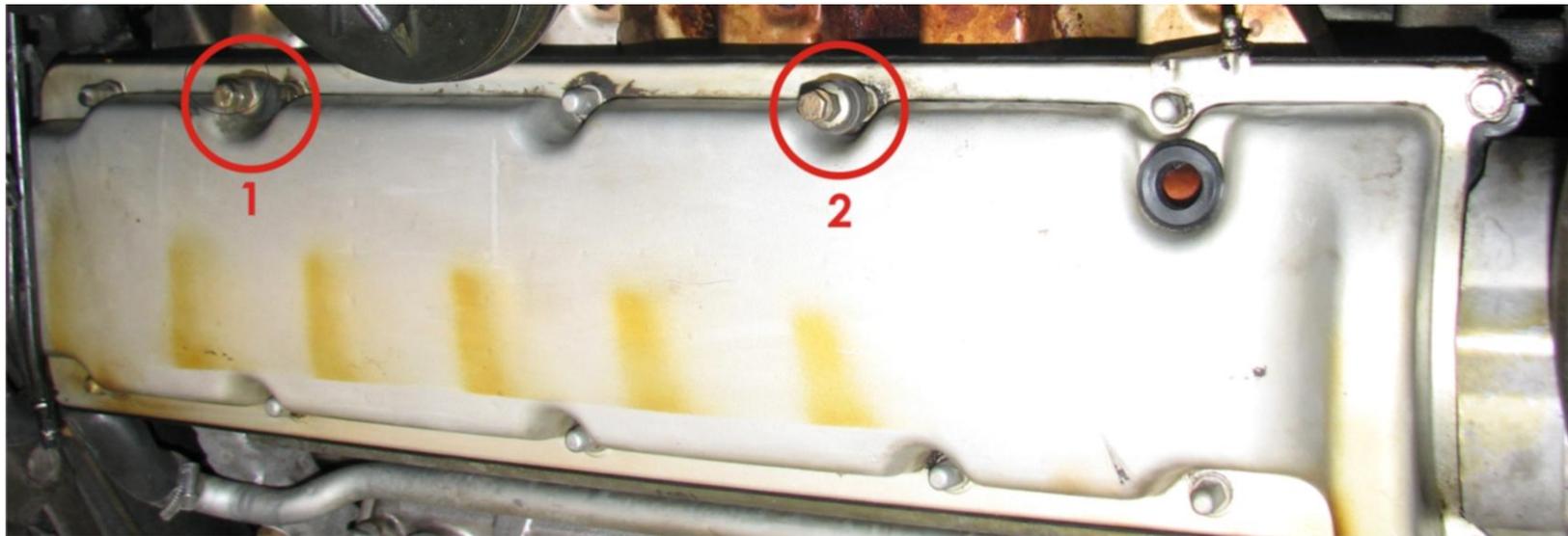
Here's a view of the fuel emission lines removed. Now's a good time to replace those brittle, hardened lines with new 8mm fuel hose. For my car, the top hose (goes to right bank) is approx. 28.8" (73.15 cm) long. The lower hose going to left bank is approx 22.25" (56.52 cm) long.





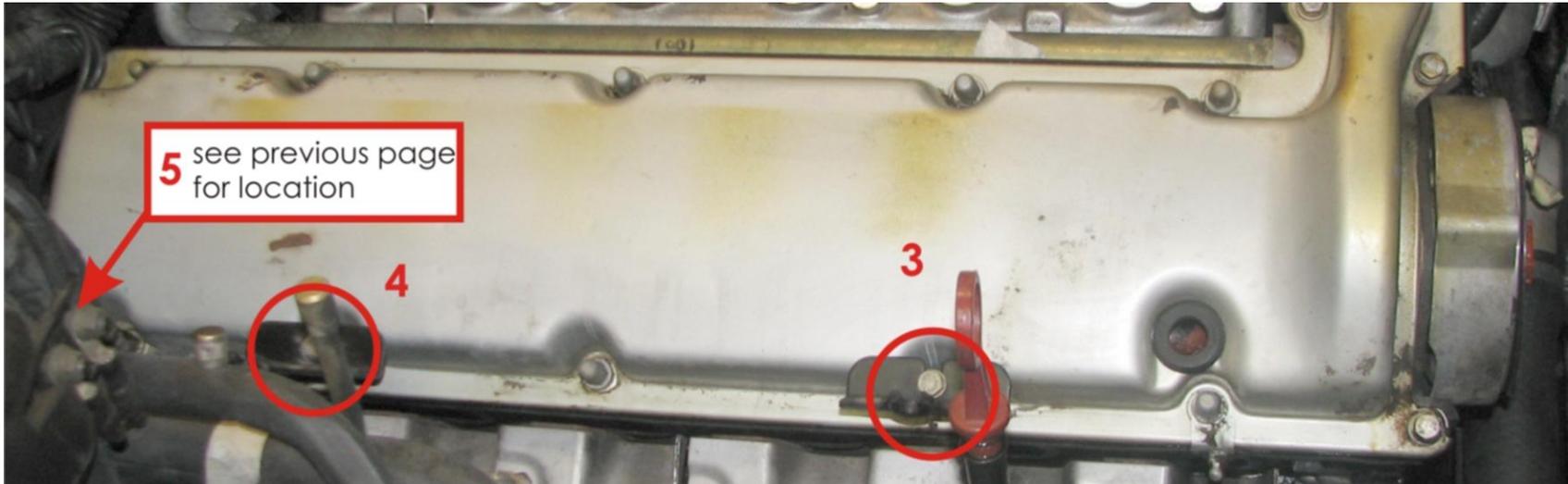
Remove Hard Fuel line [right bank]

Now's a good time to remove miscellaneous hardware prior to valve cover removal.



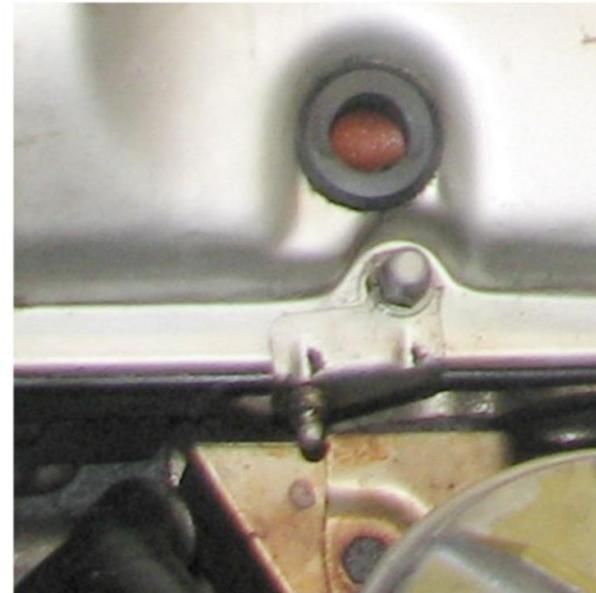
### Rubber Mount

The intake manifold mounting brackets from the left bank in the above view are attached to the power cable tube. This is not the case for the right bank, they are shown below attached to the rubber mounts )  
If the rubber mounts are deformed and hardened, they should be replaced. (5 each, PN 64 53 6 919 520)



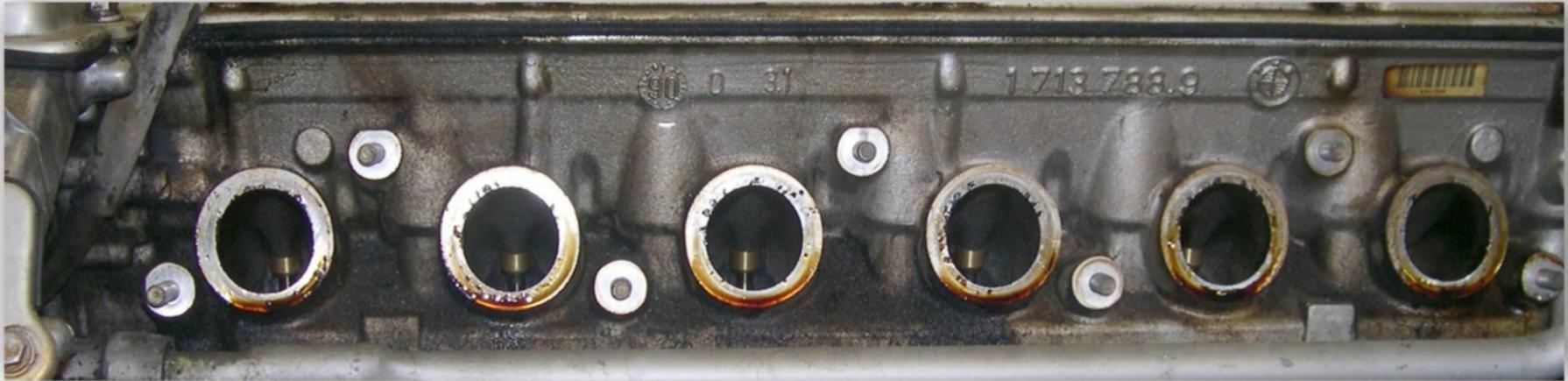


Ball Bracket?  
On both valve covers, just below the PCV valve grommet are brackets with a ball-pin? Nothing was connected to these on my car.



Right Bank Bracket Mount.....Orientations

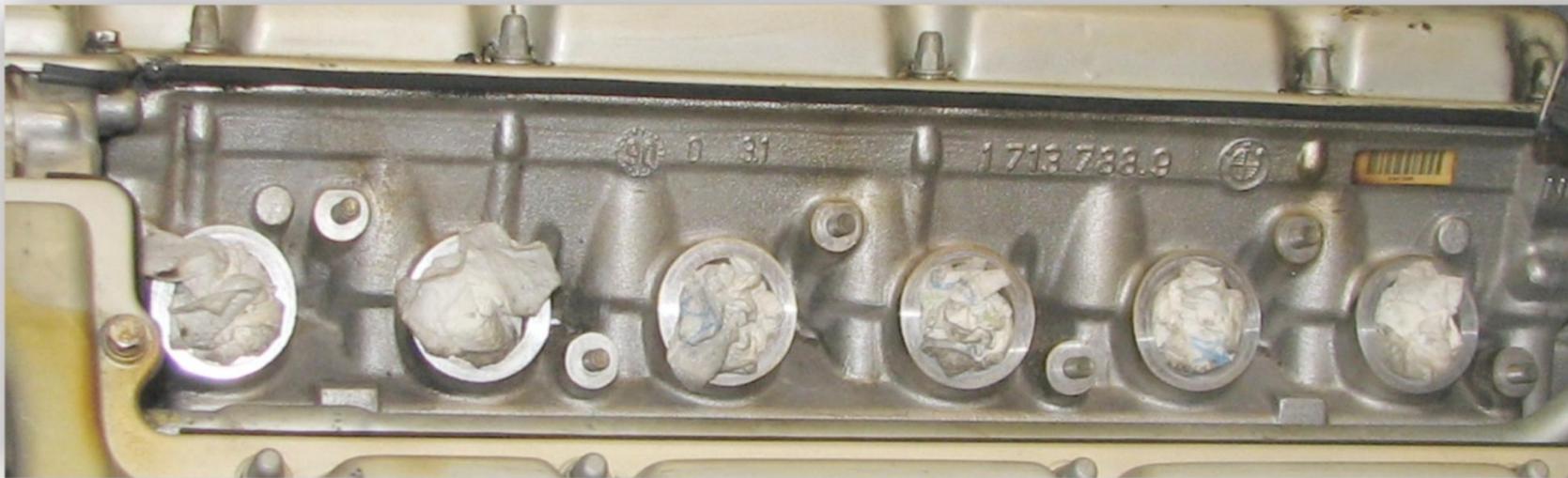
Note the stand-off/extension on the hard fuel line mount on the far right.



## Cleaning Opportunity

Now's a good time to clean off all the oily grease & grime around the intake ports using your favorite environmentally friendly cleaner. After 10 min of that, I reverted to good ol' hydrocarbon based VOC's!

(I plugged the ports with paper towels while cleaning)





## Remove Valve Cover

Remove the bolts over the timing chain and balance of acorn nuts and lift off the valve covers.

Some of the oil spray bar banjo bolts **1** were relatively loose, and for some reason there were only 3 crush washers per side, on the top of the spray bar. I pulled all the banjo bolts and drilled the heads for safety wire. While the spray bar is out, clean the spray holes & clean/flush the lines.



## Drill Banjo Bolts

I center-punched the bolt heads and drilled them out with a 0.70" dia (1.78 mm) drill bit.

I will be using .040 Stainless Steel safety wire. (Harbor Freight SKU 08895)

## Safety Wire Pliers



If you don't have safety wire pliers, do yourself a favor and buy a pair, (Harbor Freight SKU 45340 6" or 45341 9" Safety Wire Pliers) they're cheap and make the job much easier than using regular pliers or a cordless drill.



STEP 1



STEP 2



STEP 3



STEP 4



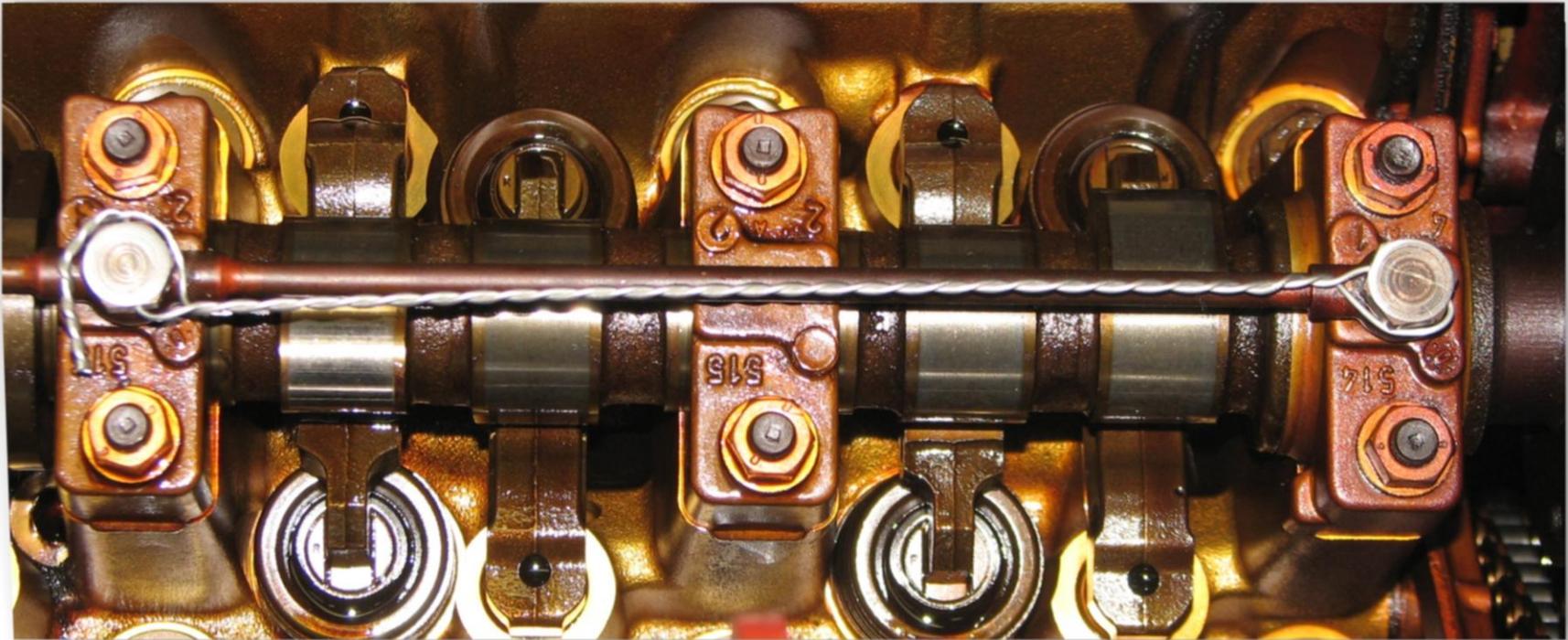
STEP 5



STEP 6  
FINAL TWIST



STEP 7



## Safety Wire

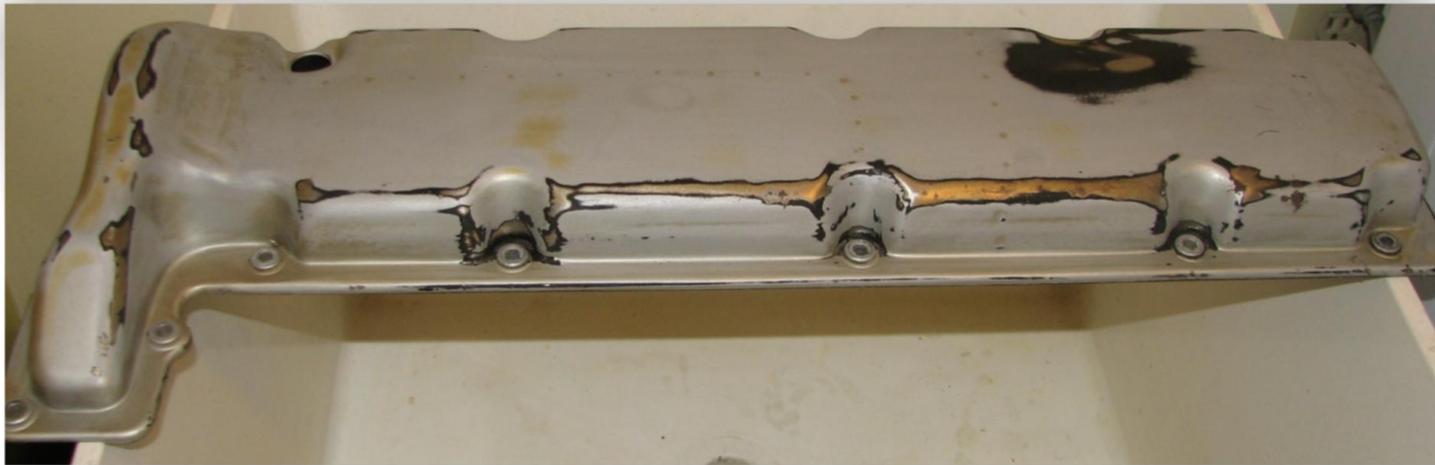
I wired my bolts in pairs, they can also be wired individually to the spray bar itself.

It's a good idea to mark the bolt heads for drilling before they're removed so you can ensure optimal placement of the holes for safety wire. I did this, but my markings became useless when I added the missing crush washers. When torqued to their spec, the drilled holes were no longer in the optimal placement. [Torque per Bentley: 12 Nm (98 in-lbs)]

After this step, you can finally start putting things back together!

## Prepping the Valve Covers

My covers were looking a bit shabby so I decided to clean and paint. I first ran them through the dishwasher (wife was out), using extra heat, "pots & pan" cycle, and a booster cocktail of dish soap, Simple Green and a methyl silicate based shop cleaner. This cleaned most of the oily grease and I finished up with a parts brush and Castrol SuperClean. I sanded (240-320-400-600) then painted with some "Hammered" paint that I had leftover from a previous project. The Hammerite paint is very forgiving, it covers imperfections, encapsulates rust and its tough - good stuff. Repaired chips are also invisible.



## Installing the Valve Covers

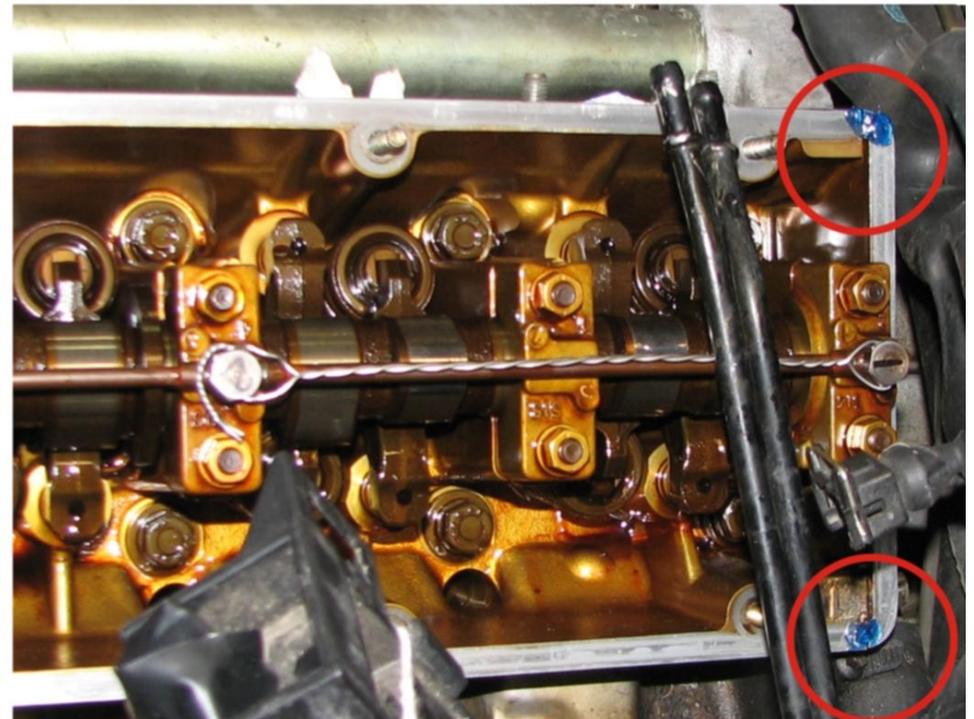
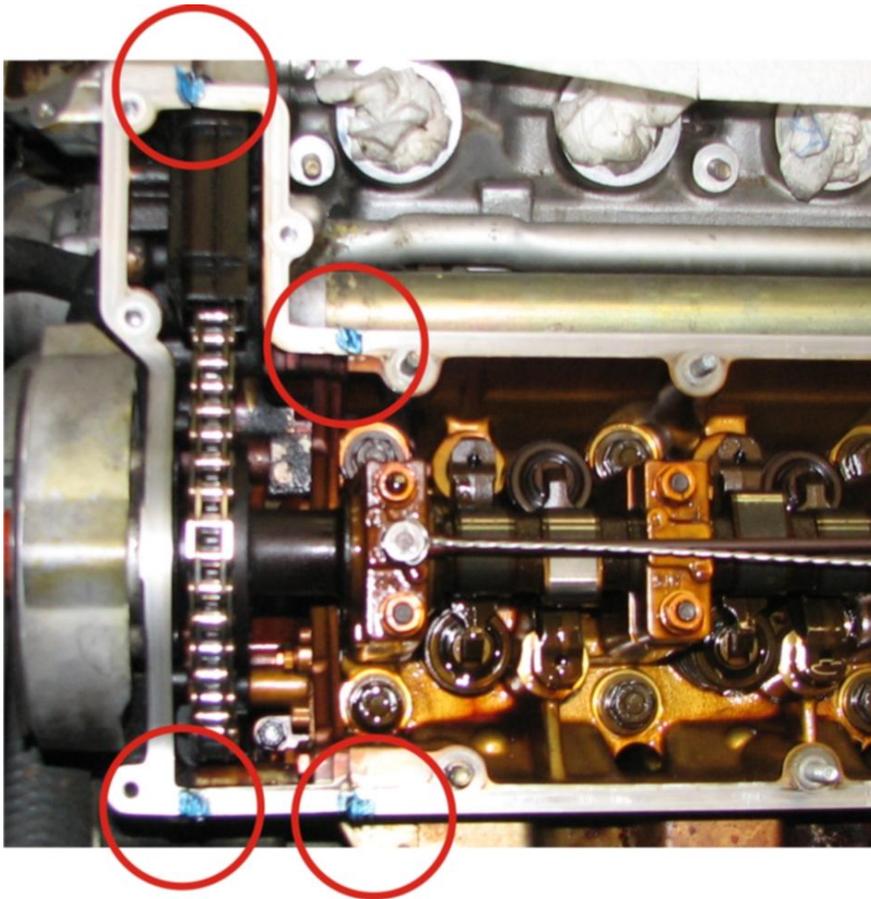
By now you should have removed the old gasket & prepped as required for installation. In order to prevent shifting problems, use Hylomar at 4 or 5 places to “tack” the gasket to the valve covers. Fit the new gaskets to the covers making sure they’re cleanly seated around each thick washer-like standoff. Clean the mating surface of the engine so it is clean, dry and free of grease and oil.



## Installing the Valve Covers

Apply Hylomar sealant over the seams of the camshaft front cover and rear valve train cover. See locations below: (for ease in installation, tack the gasket to the cover with the Hylomar) Allow the solvent to flash off, then mount the valve covers.

**BE CAREFUL NOT TO DISLodge THE GASKET!!** (after I completed the whole build, I started it up and had a tremendous oil leak because the gasket had had slipped. On the positive side, the whole process to put in a new gasket only took 6 hours and a Saturday.)

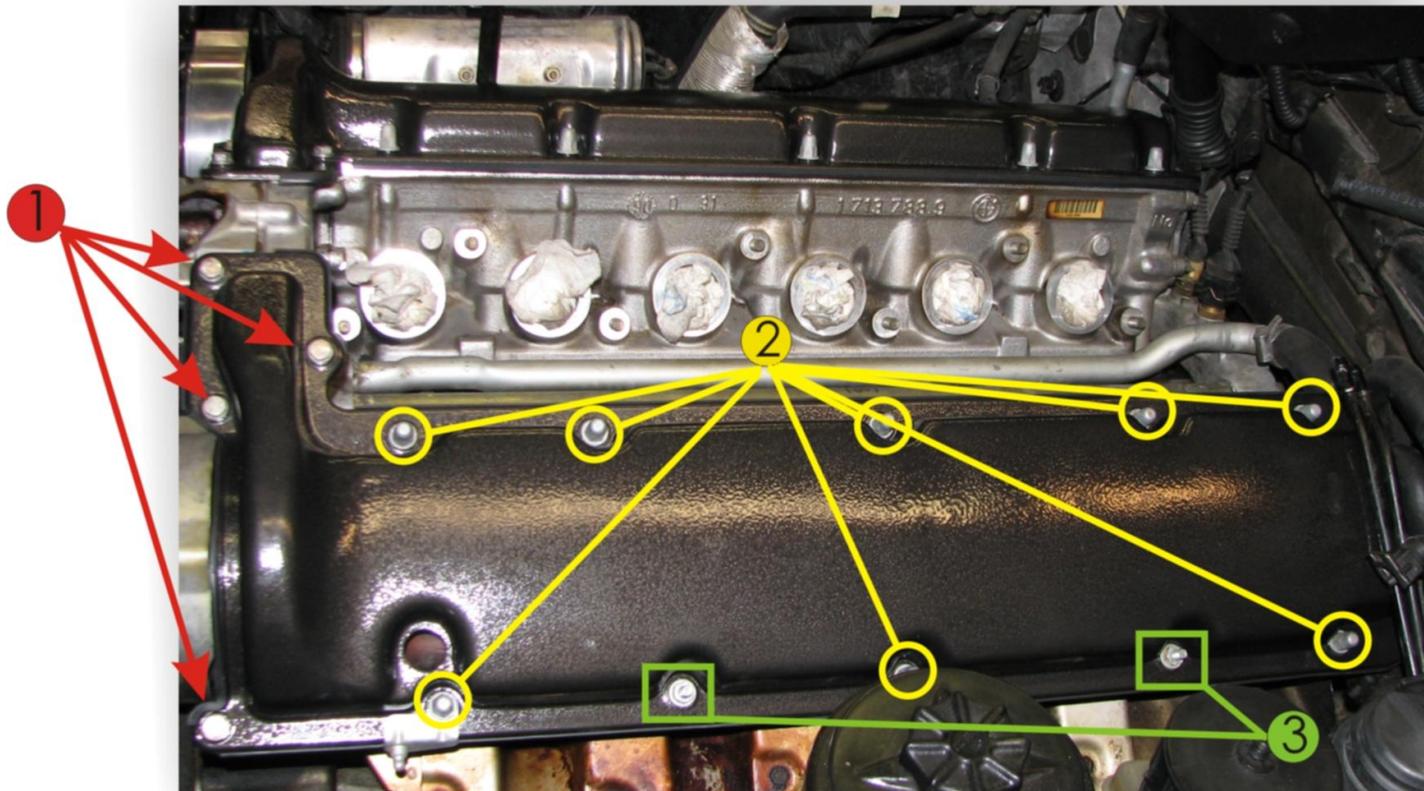


## Installing the Valve Covers

Bolt down the valve covers ensuring proper location of the various fasteners.

1. Cap Nuts Qty 4, around the cam sprocket bulge. ①
2. Acorn Nuts, left bank uses 8, right bank uses 7 (the right rear corner uses rubber mount & cap screw) Don't forget the "ball tipped bracket" beneath the PCV valve opening. ②
3. Nut w/attached washer, left bank uses two, right bank uses three ③ same locations as below plus the right rear.

Torque spec for all these fasteners is 10 Nm (89 in-lb) ~ 7.5 ft-lbs [M6 bolt], use a star tightening pattern starting from the center and moving out.



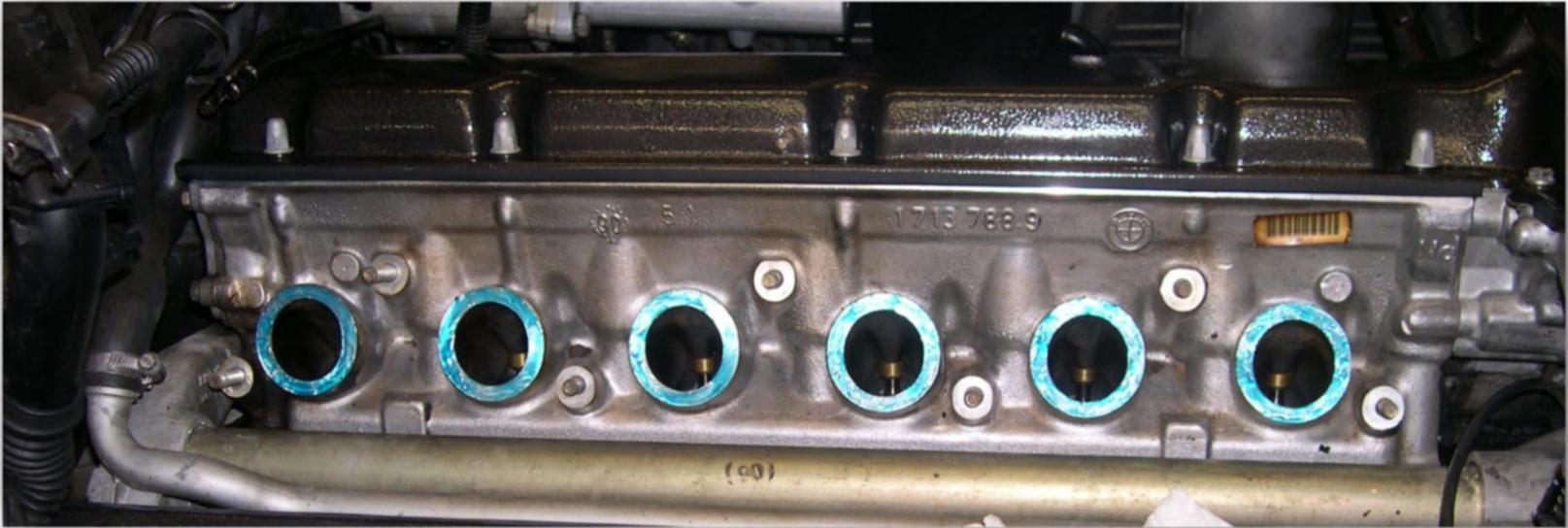
## Manifold Gaskets

When I first removed these, I marked and laid them out to keep them organized as I would be replacing them in their original locations.

Note the sludge on the intake ports below.

These were thoroughly cleaned in solvent prior to reassembly.





## Installing Manifold Gaskets

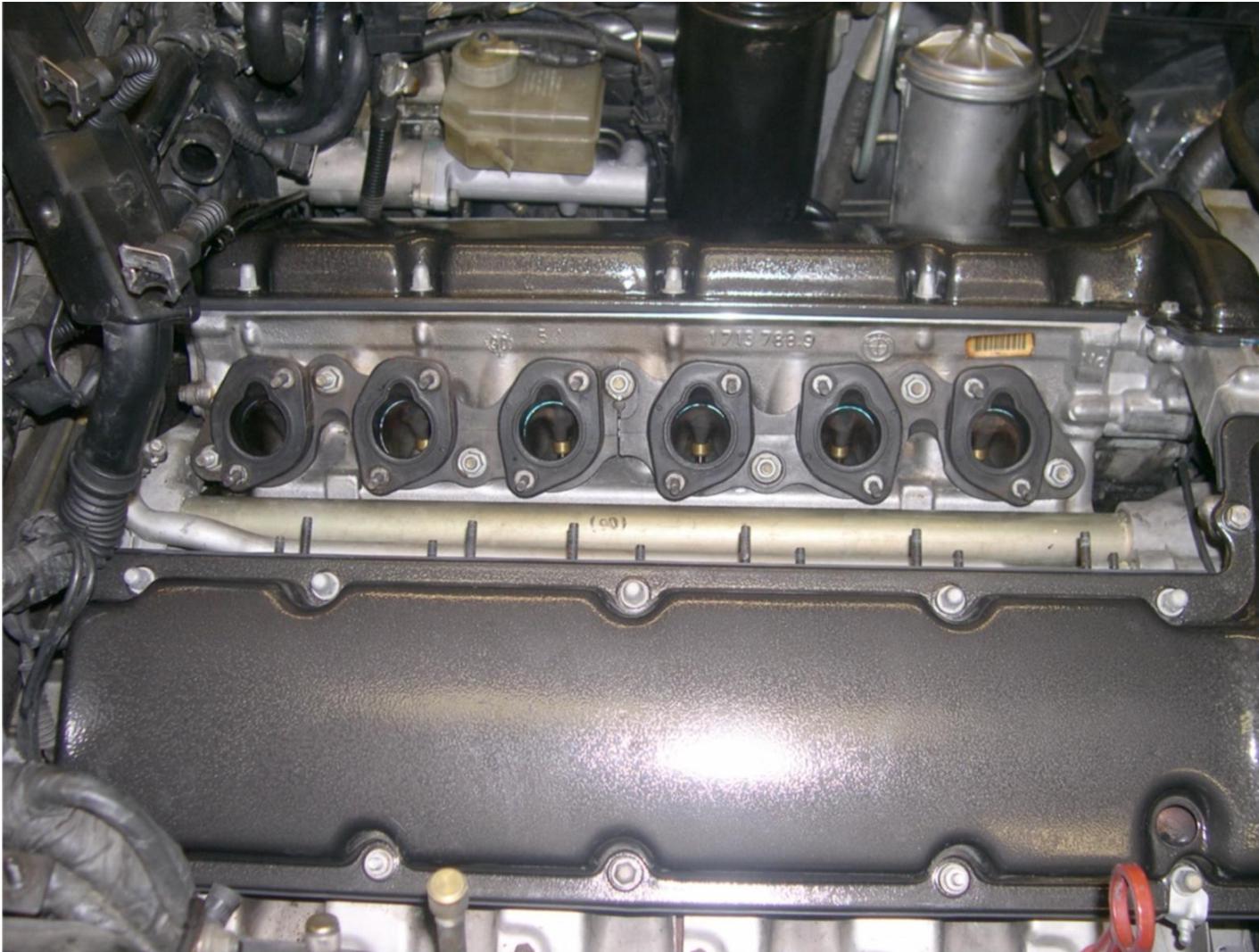
Apply the Hylomar sealant to the intake port gasket surface (do both banks). Apply a thin, even coat ensuring it covers the whole mating surface. (It might be easier to apply the Hylomar to the gaskets) Allow the sealant to flash off the solvent, then align the intake gaskets to their mounting studs and slide into place.

Torque in a star pattern from the center out; snugging them up in stages before applying final torque. (M8) 24 Nm (~18 ft-lb) These nuts use a 12mm socket.



## Manifold Gaskets installed

Prior to installing the intake manifold, complete all other ancillary tasks next (next page).



## **Prior to Intake Manifold Installation:**

1. Replace all the spark plugs, ESPECIALLY No. 12; it'll never be easier to do than now!
2. Clean & condition ignition cables, (dielectric grease on the boots at a minimum)
3. If not replacing distributor cap and rotor, dress (clean) the contacts with fine silicon carbide sandpaper and clean thoroughly with contact cleaner. (I used Dexoit) Since my caps & rotors were nearly new, I followed this path.
4. Replace all fuel hoses, vacuum hoses and vapor recovery control hoses.
5. Reconnect the electric solenoid fuel valve hoses (vapor recovery hoses)
6. Clean all engine electrical grounds

### ***(High points of these tasks at the end of this write-up)***

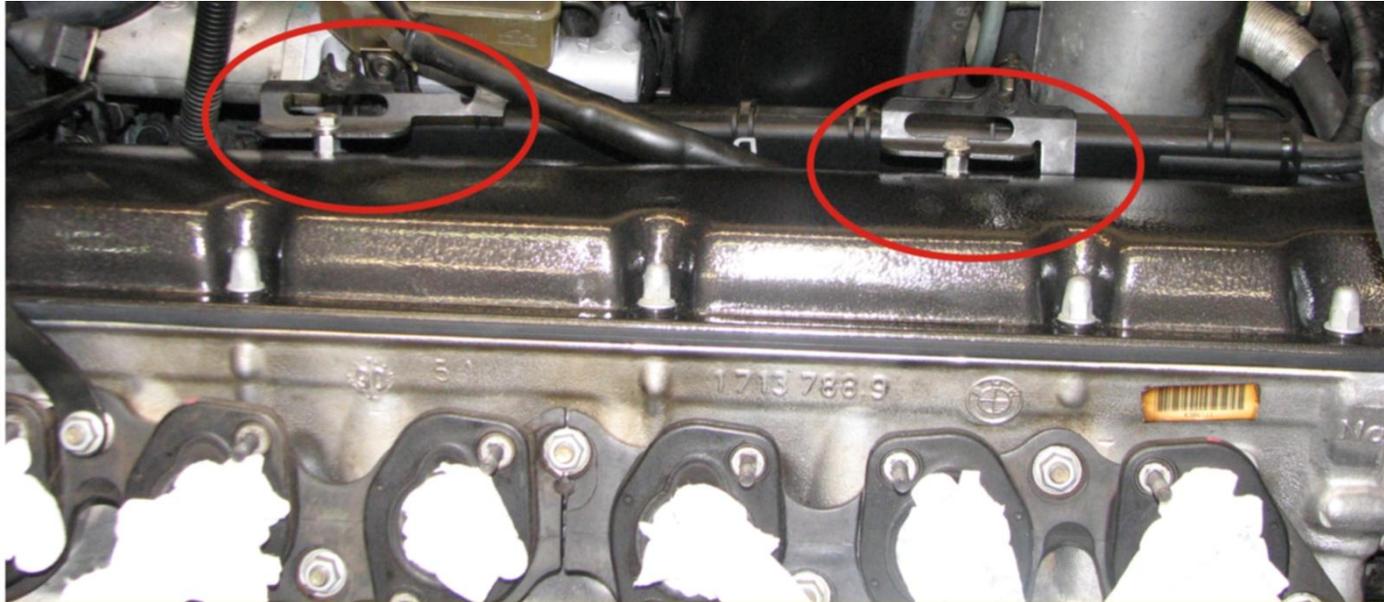
The following actions were necessary on my car and will have separate write-ups on them.

1. Leaky hydraulic booster (H31) - Replace the O-Ring
2. Leaking Master Cylinder, - Replace the Master Cylinder
3. Leaking auxiliary pump, - Replace the pump
4. Clean & rebuild fuel injectors
5. Recondition the DK motors

## Mount Valve Cover Hardware; Left Bank

Install the rubber mounts & Intake manifold plenum brackets. On the left bank, (below) the brackets are integrated into the alternator power cable tube. **(circled)**

NOTE: The PCV valve gasket was replaced at this point also.

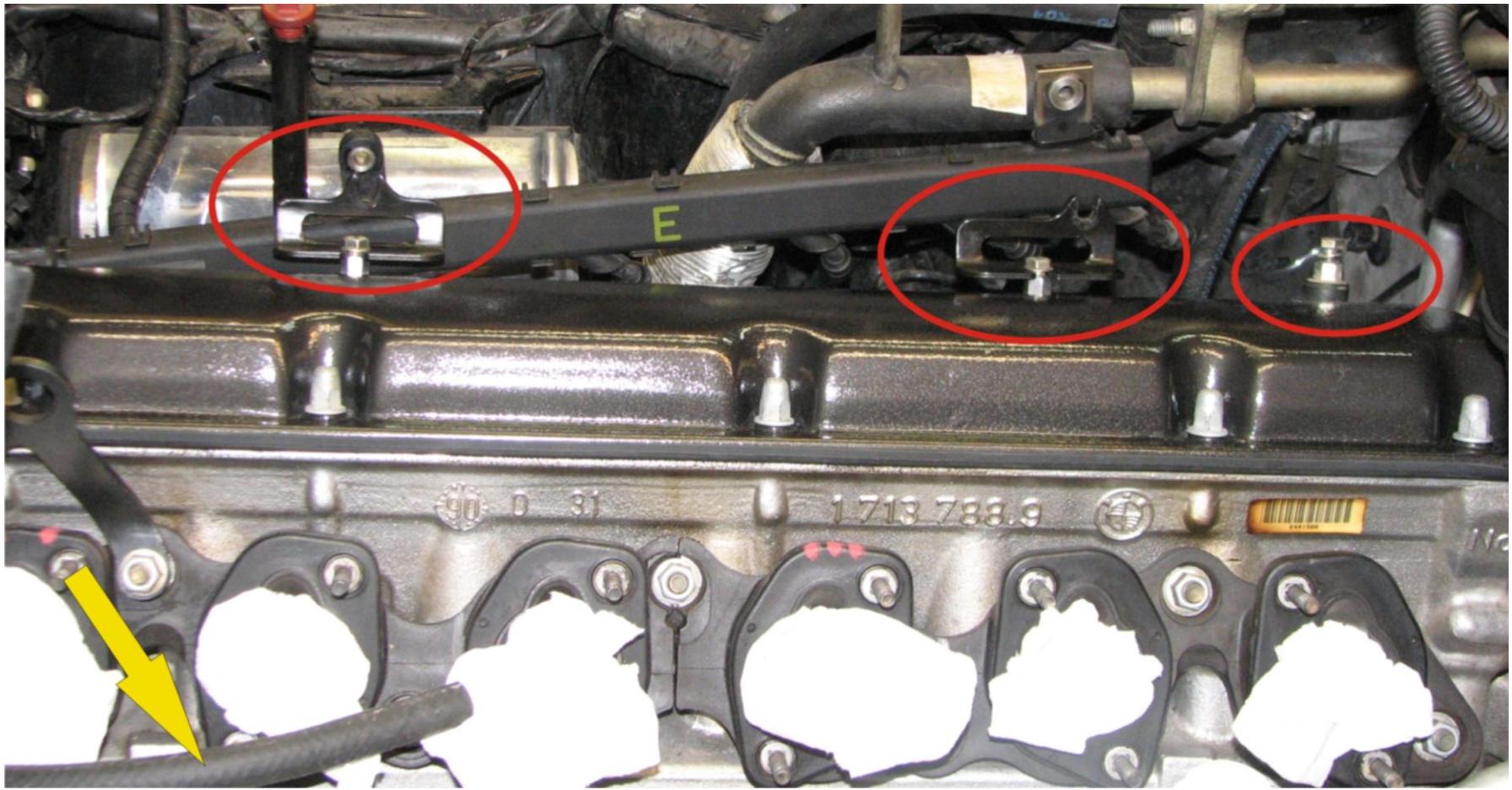


## Mount Valve Cover Hardware; right Bank

View showing the right bank with brackets in correct orientation.

If you haven't already done so, install the ignition wire looms & distributor covers.

Note: hose (yellow arrow) originates from the fuel solenoid valve and will connect to right DK motor.

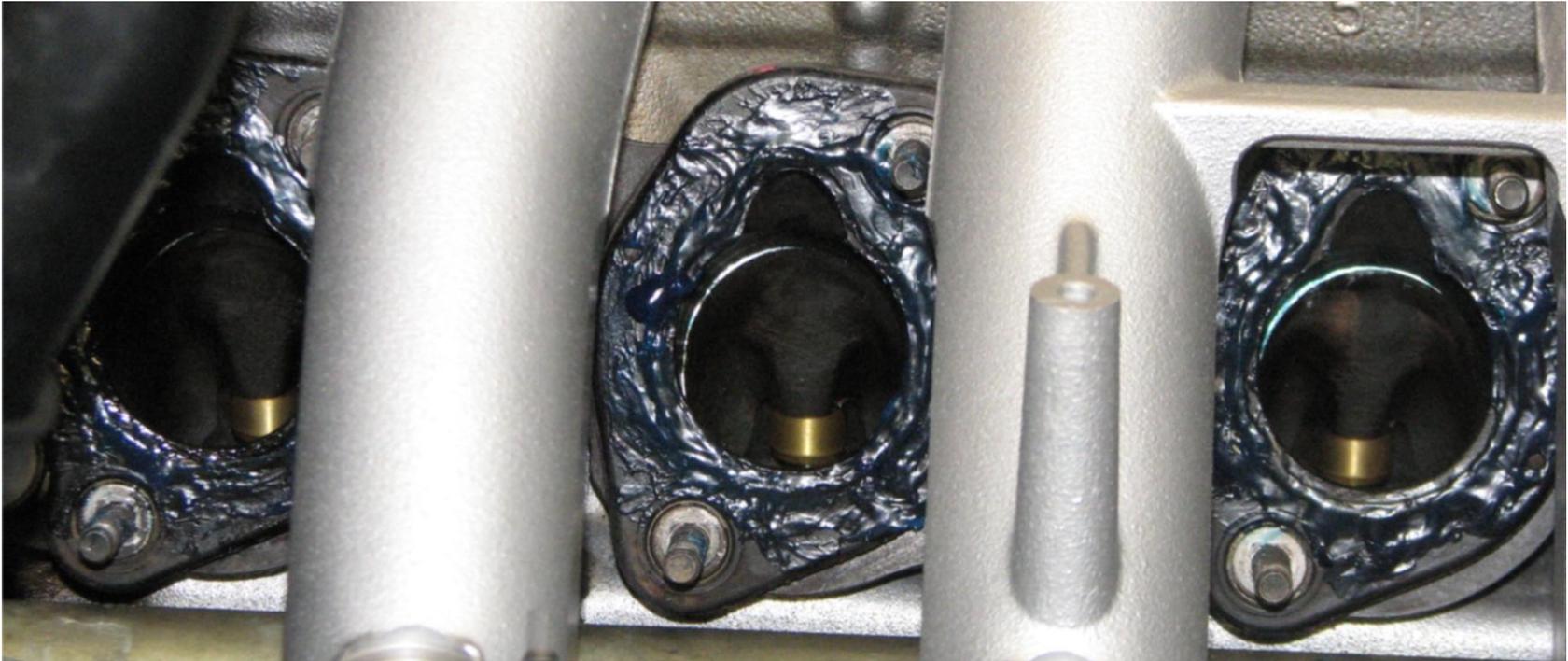


## Apply Hylomar to Intake Gaskets

This view shows a close up of the Hylomar applied to the gasket. You might consider applying it to the manifold flange instead, it'll be easier and more accurate. **I put too much on the gaskets below!**

Be sure to let the solvents flash off before installing the manifolds.

Start with the right bank first - place the noise suppressor on the valve cover.

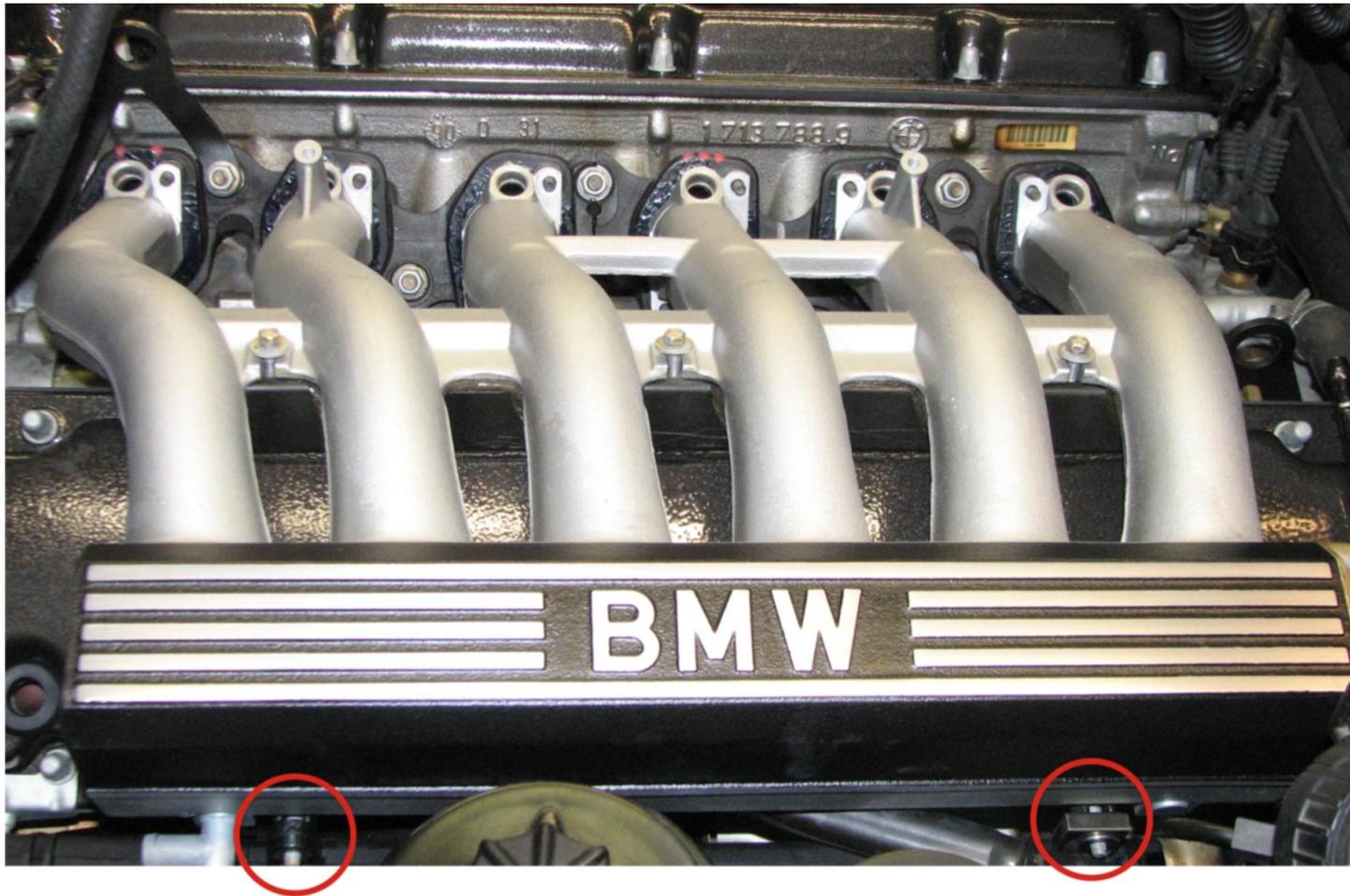


## Mounting Intake Manifold, pre-steps

Before bolting down the manifold, you can position the noise suppressor by its bolts or just let it rest on the valve cover.

Next, align the studs on the plenum with their respective valve cover -mounted brackets.

See below highlights. I also attached the ignition wire loom as shown below.



## Position Fuel Line/ Torque Manifold Nuts:

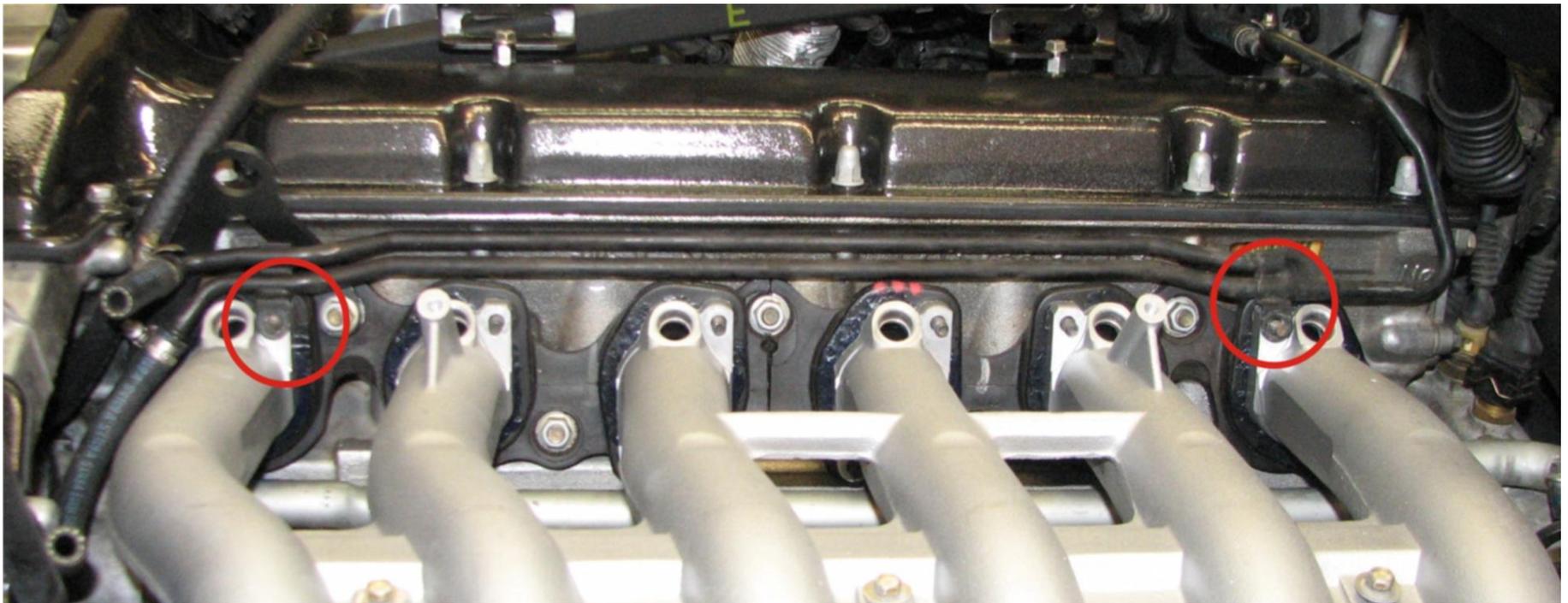
Position the fuel tubing so its mounting tabs are located over the manifold studs. Note: New fuel hoses already in place. Begin snugging down the 10 mm socket nuts.

Bentley has a misprint! (on section 113-26) It states:

“Intake Manifold to Cylinder Head 22 Nm (17 ft-lb)” **NO NO NO,**

These are M6 studs, they require **10 Nm (7.5 ft-lb)**

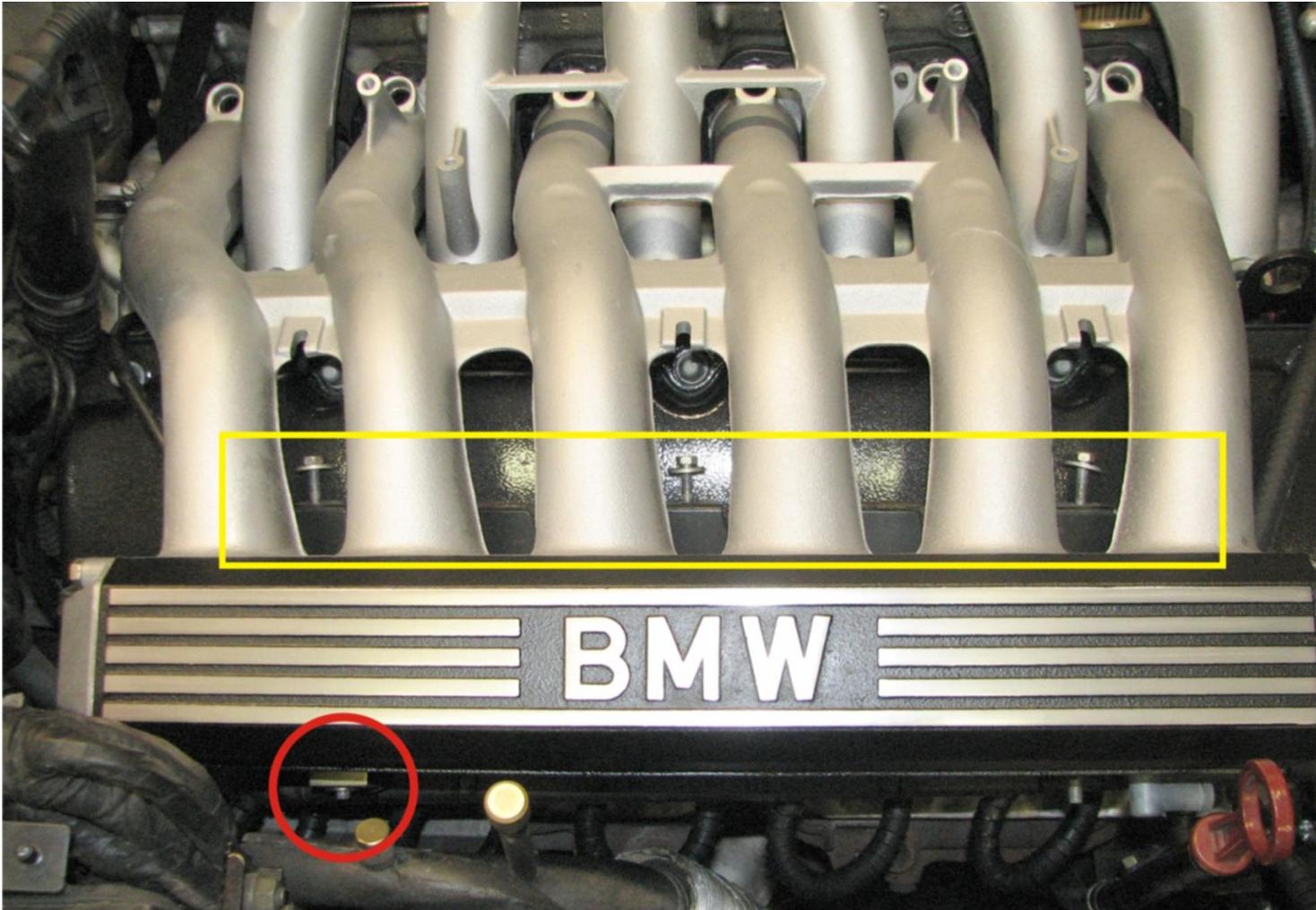
***Unless you are extremely lucky, you will end up dropping a nut or two during installation - to prevent this, I super-glued 8mm dia. rare earth magnets into my 10mm sockets. I also found it easier to use only my ¼” drive sockets and extensions.***



## Mounting Intake Manifold, Left Bank

Repeat the previous steps -shown below the noise suppressor has not yet been positioned.

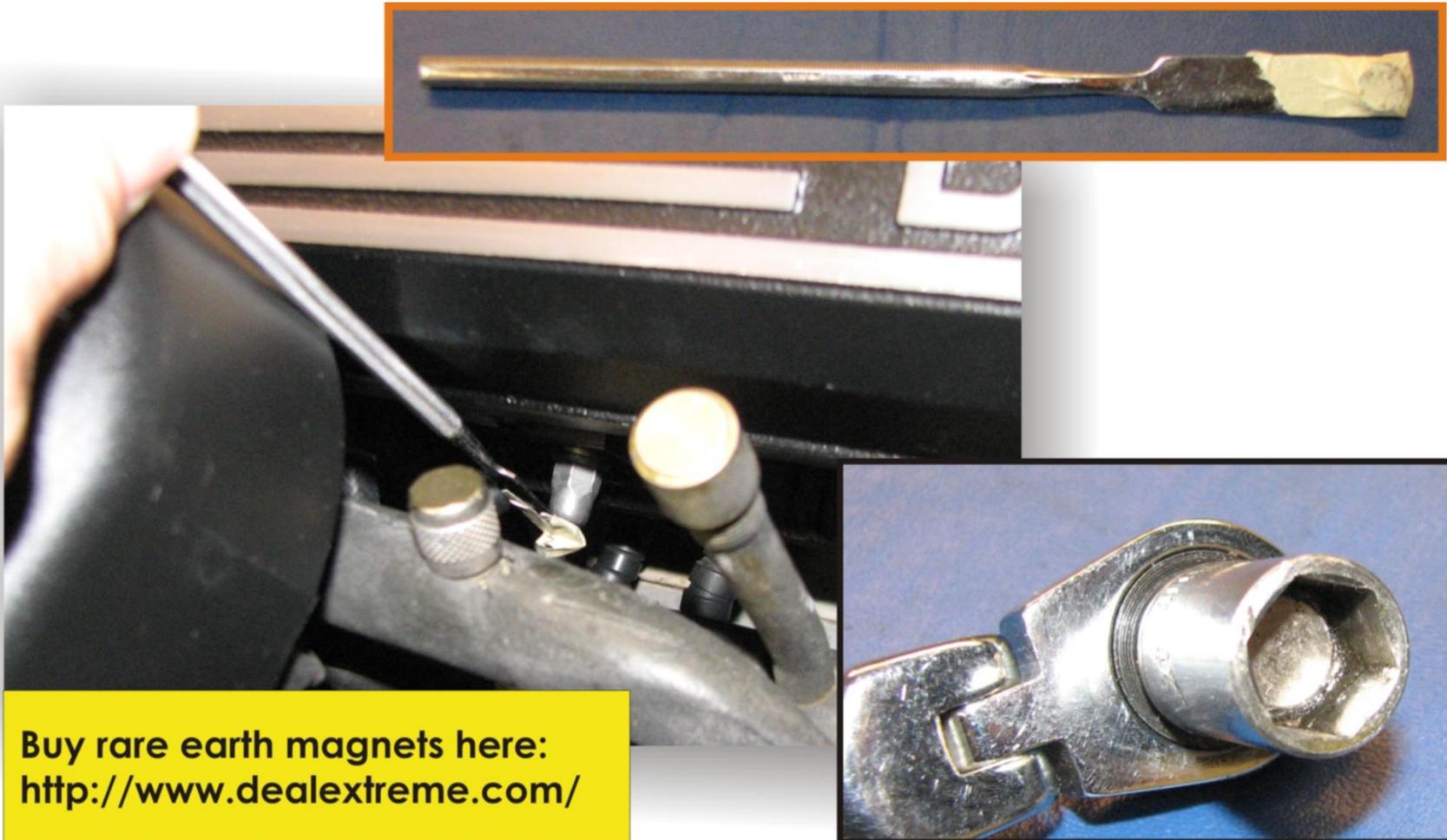
The ignition loom is located on the plenum studs. Note how little thread is exposed on the mounting stud on the left.



## Mounting Hints - rare earth magnets

I taped a magnet to a dental mixing spatula and used it to hold the acorn nut on the plenum stud while I started it with a finger, I also started a manifold nut this way too. See below left.

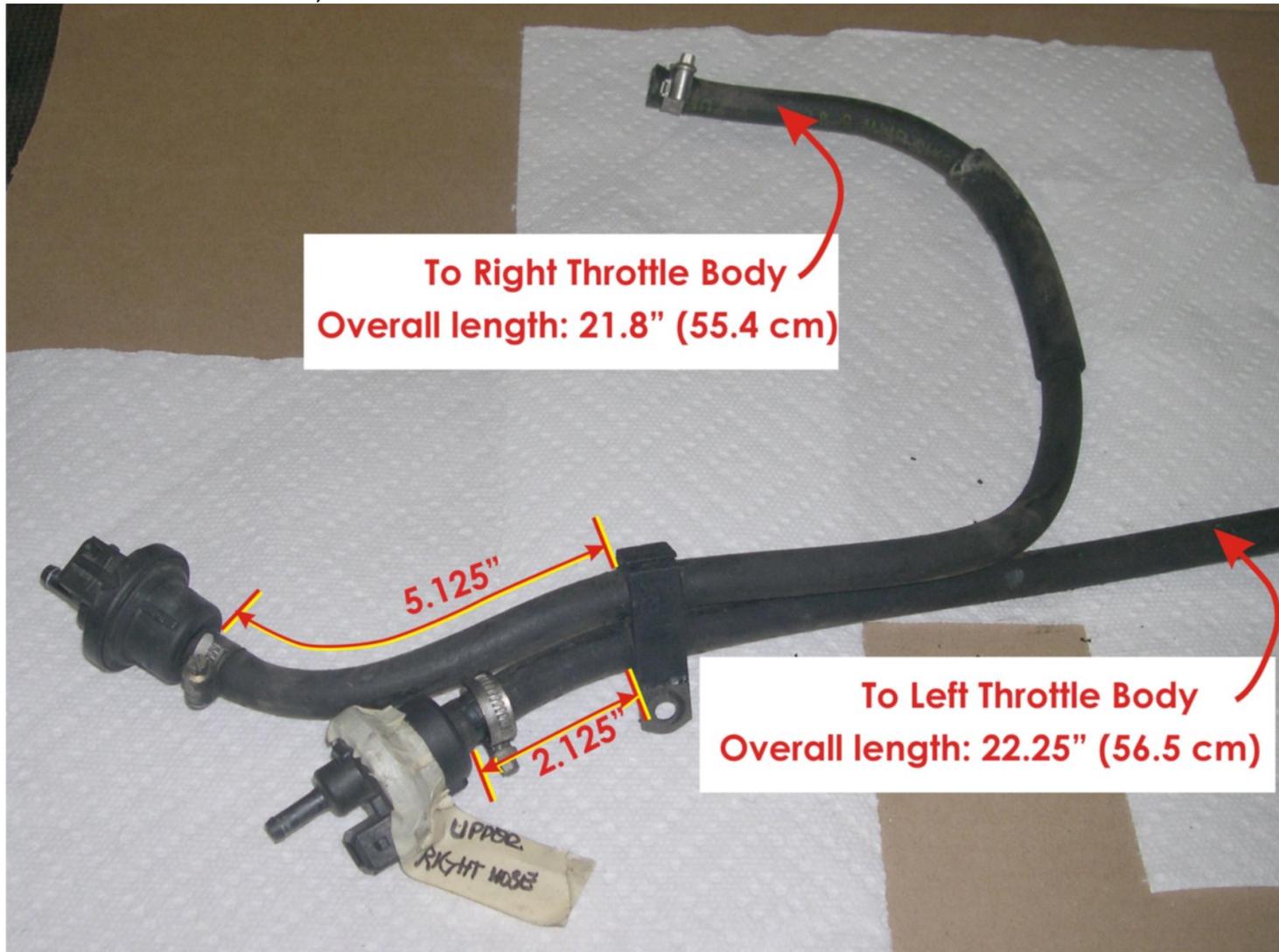
The lower right shows a 10mm socket with a couple magnets glued at the bottom. Be careful, too many and it'll be strong enough to pull the socket from the ratchet.



**Buy rare earth magnets here:  
<http://www.dealextreme.com/>**

## Emission Hoses

These are 8mm low pressure fuel hoses. Lengths shown are as measured from my car. This will help if you are estimating how much hose to buy.

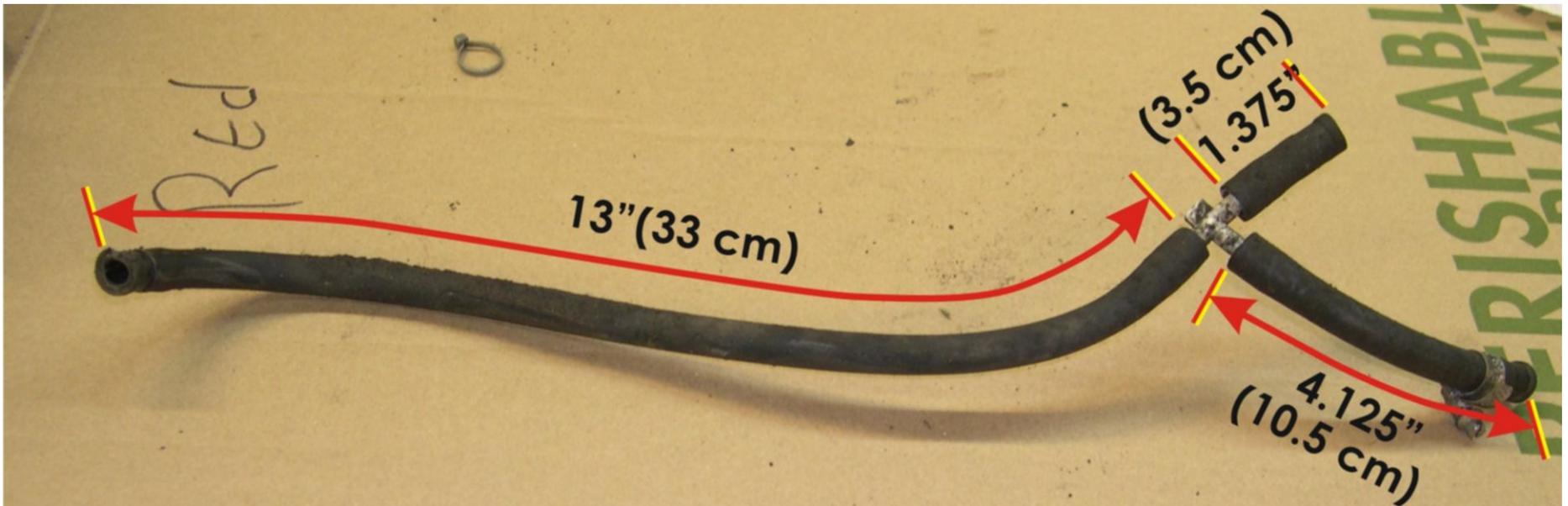


## Emission Hoses

These are std 1/4" (6.3mm) braided fuel line, (low pressure);

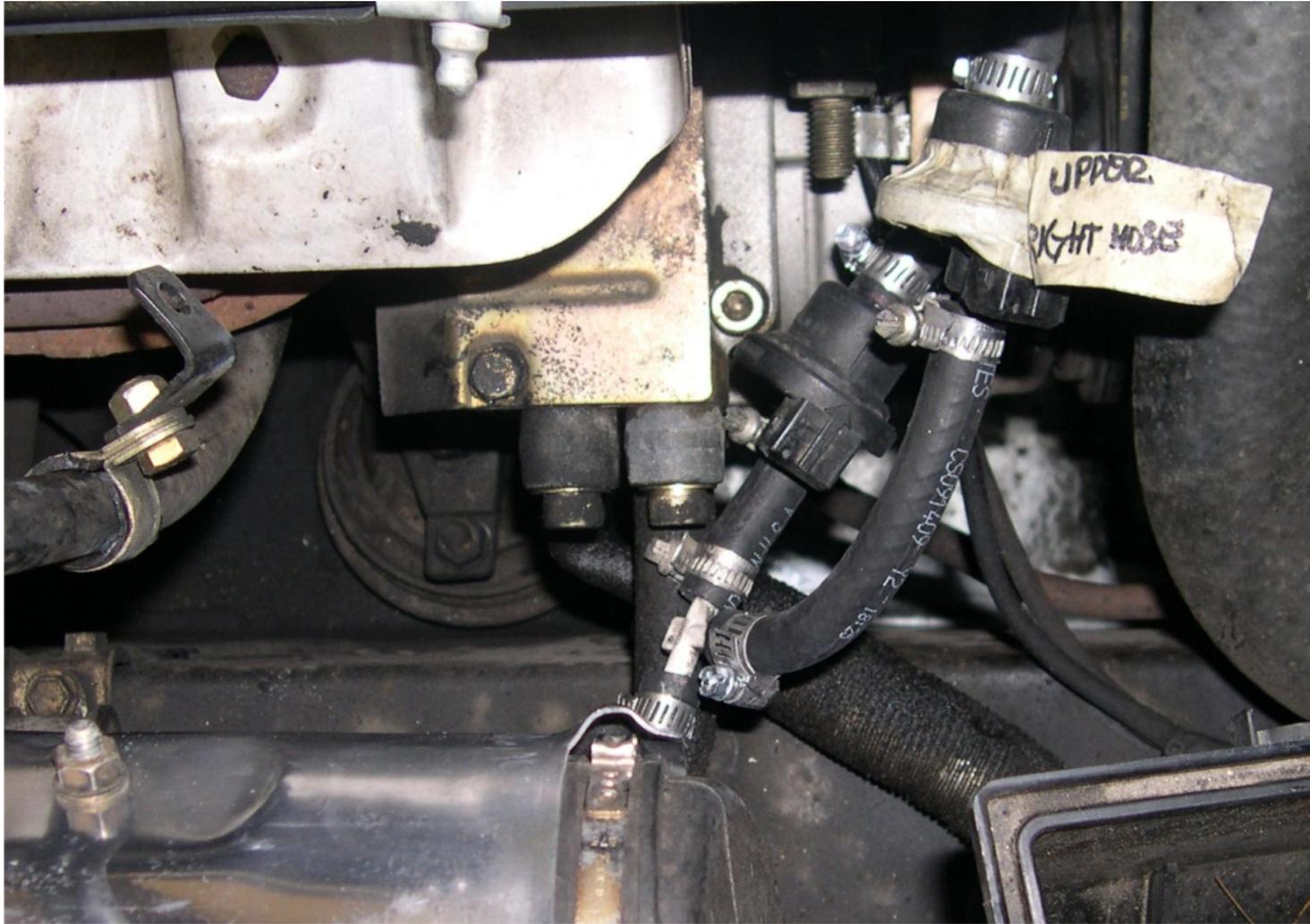
There is another section that I omitted, it runs from the small vapor tank (?) to the right fender well next to the hard fuel line, I don't have the length, but a guess would be about 18-22" (45.7 -55.8 cm)

Not shown are the thin 4mm ID vacuum hoses running from the DK/throttle bodies to the fuel regulators. Allow 12" (30.5 cm) for each side. (This is a little long, but easy lengths to buy.)



## Emission Hoses - Assembled

I replaced the factory crimped clamps with typical screw-type hose clamps.



## Torques:

Fuel rail to Cylinder Head 10 Nm (89 in-lb) ~ 7.5 ft-lbs

Valve Cover 10 Nm (89 in-lb) ~ 7.5 ft-lbs M6 bolt

Spark Plug to Cylinder Head 23+/- Nm (17 +/- 2 ft-lb)

Intake Manifold to Cylinder Head M6 10 Nm (7.5 ft-lb)

Oil spray bar to cylinder head: 12 Nm (98 in-lbs) M70 Engine

Distributor Cap to Distributor housing: 4 Nm (34 in-lb)

Rotor to Rotor Flange: 2.8 Nm (25 in-lb)

Brake MC to Hydraulic Brake Booster: 28 Nm (20 ft-lb)

Brake Fluid Line to Master Cylinder  
M10 Coupling 19 Nm (15 ft-lb)  
M12 Coupling 17 Nm (13 ft-lb)