- E90 328xi DIY for:
    - Crank shaft position sensor
    - Intake manifold gasket replacement
    - Valve cover / valve cover gasket replacement
    - Ignition coil removal and replacement
    - Spark plug replacement
    - Most of the work required to change your starter motor
    - Most of the work for replacing the eccentric shaft position sensor
- Notes:
    - **Disconnect your battery prior to doing this job. Seriously.** **You're going to have your intake manifold removed which means that the injection ports for where your fuel is shot into your valves and mixed with oxygen is going to be exposed. I have bumped some of hot components with a tool that was also in contact with "ground" at the same time and it is very easy to do on this car, especially with the battery being located in the trunk of the vehicle. You're going to be working around multiple areas with a voltage potential. If you don't do this you could risk creating a spark that could lead to unfortunate consequences.**
    - Initially I had the crankshaft sensor die, but I put it off as I was able to limp the vehicle along and it didn't give me too much trouble that is untill...
    - I had a coil on pack die! at which point the car became basically un drivable
    - My vehicle coded out for the following error messages
        - 2A94 (Crankshaft Sensor)
        - 29E0 (Fault: Misfire detection cylinder 2 in 4 firing order)
        - 29D9 (Fault: Misfire Cyl 6)
        - 29D2 (Fault: Misfire detection error summation)
        - 29CE (Fault: to misfire at low fuel level)
    - I had an oil leak that I had been putting off for some time but decided to tackle because the replacement of the crank shaft position sensor would have some "synergy" with the valve cover gasket replacement
    - My vehicle at this point in time:
        - Has 172k miles approximately
    - My vehicle (prior to this job) has the following modifications (you may need to adjust accordingly)
        - Bilstein sport shock absorbers
        - H&R sport lowering springs
        - E90 M3 rear sway bar
        - E90 m-sport 19" factory rims
        - UPR Front Sway Bar

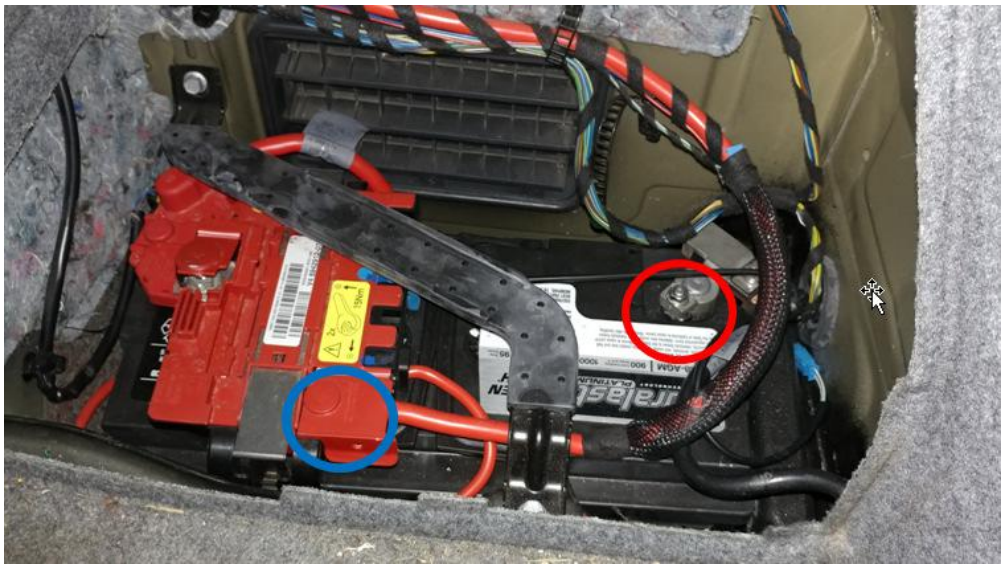
        - UPR Short shift Kit
        - UPR stainless steel brake lines
        - 335xi brakes with stoptech hardware
        - ZHP BMW weighted shift knob 25117896886

    - All instructions and information in this document here-in are for **REFERENCE ONLY**. I bear no responsibility for the consequences of attempting to perform any work on anyone else's vehicle. If unsure consult reputable resources.
    - This job is about as close to open heart surgery you can do on this car. If you're someone who loves to drop small parts in the middle of doing a job on your car...try not to
- Additional resources
    - RealOEM.com for parts numbers and diagrams
    - Bentley shop manual (I don't have access to this but I have seen some snippets of this and it seems like it might be useful)
- Tools required -- in no particular order
    - Snap ring pliers
    - Pliers
    - Flat head screw drivers (thin and small are best), possibly a dental pick set as well
    - Metric socket set
    - external torx socket set (shallow and deep) You may want a narrow deep socket for the valvetronic motor screws
    - Universal joint adaptors
    - many sizes of socket extensions
    - Torque wrenches (need to be able to do maximum of 85 ft-lbs and a minimum of ~6 ft-lbs) I have 2 torque wrenches but I am contemplating buying a smaller inch-lb type model
    - Air tools or battery operated tools
    - Possibly a jack and jack stands... I'm pretty tall and my car is lowered so I get a lot of back pain working on the top of my motor while in the car
    - A telescoping magnet (for picking up dropped parts)
    - an inspection mirror (for inspecting the back of the block)
    - hex socket keys
- Parts required

and now for the procedure!

- Park car
- Open trunk and remove the passenger side trunk liner. Rotate the thumb-fastener 90 degrees and pull the trunk liner out by pulling upwards and towards the center of the vehicle.

- Disconnect both terminals of the battery 10mm mm on (-) terminal strap (red circle), 13 mm on positive relay (blue circle underneath flip up cap)

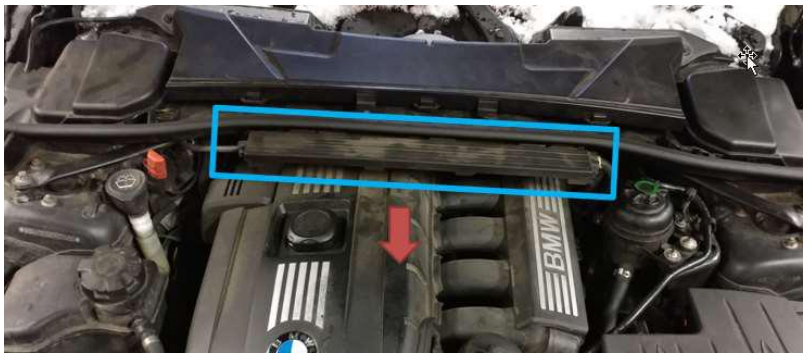


- Open hood. Remove wiper arm retainer nuts (2x 15mm sockets)

- Remove electrical box cover and brake fluid covers

- Remove rain sensors from cowling. (Twist and pull from retainers)

- Remove over-engine wire loom by pulling forward separate covers and separate wires



- Remove large wire loom from cowling assembly. (pry open with thin and small flat bladed screwdriver

- Remove cabin air-filter (6 x 8mm hex cap bolts)

- Remove cowling bolts

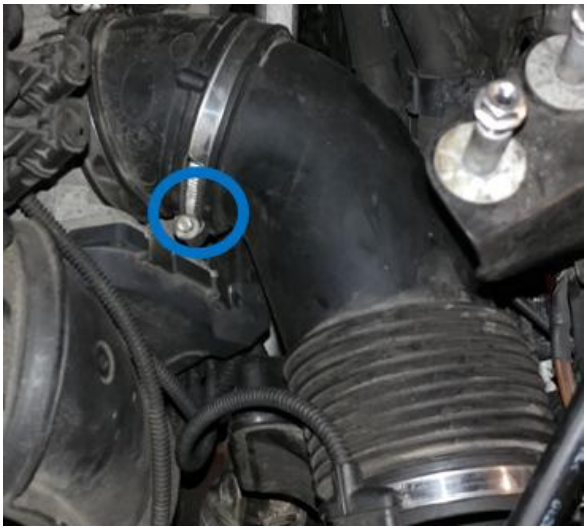
- Remove engine cover (3x 5mm hex key)

- Remove vacuum accumulator hold down bolts (2x 10mm hex nuts)

- Remove intake snorkel (torx bit and clips)

- Remove airbox (2 x 10mm bolts); (5mm hex on strap) disconnect MAF sensor wire. (1x clips at intake. (screwdriver, pry and wiggle to break free).

- Remove elbow and Helmholtz resonator; 1x 5mm bolt on strap

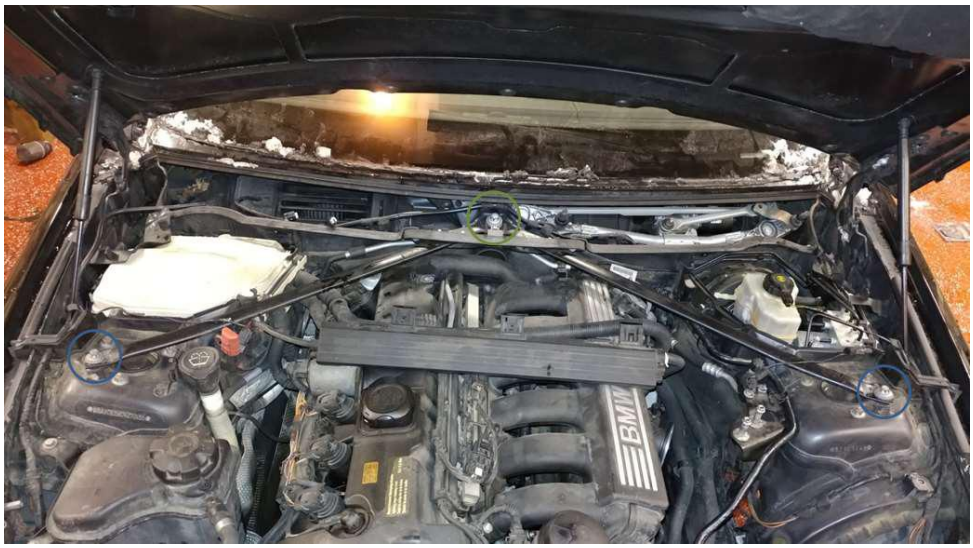


- Disconnect vacuum line

- Disconnect vacuum line from standoff

- Remove cowling, disconnect windshield washer wires

- Disconnect and remove upper shock tower braces (2x E12 bolt (dark blue circle) and 1x E14 bolt(dark green circle))

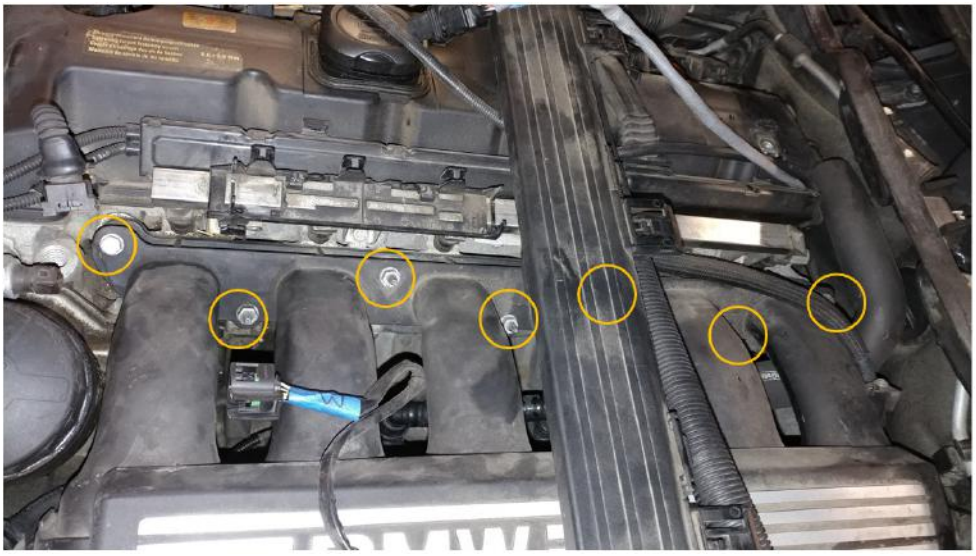


- Disconnect O2 sensor relays (mark wires for reassembly)

- Disconnect temp sensor near oil filter housing, (compress lock tab and pull away from base of sensor)

- Open main junction box (2 tabs, one at front and one at rear of box) slide tabs in directions indicated on box

- Remove intake manifold bolts and nuts (7x bolts and nuts (11mm socket))



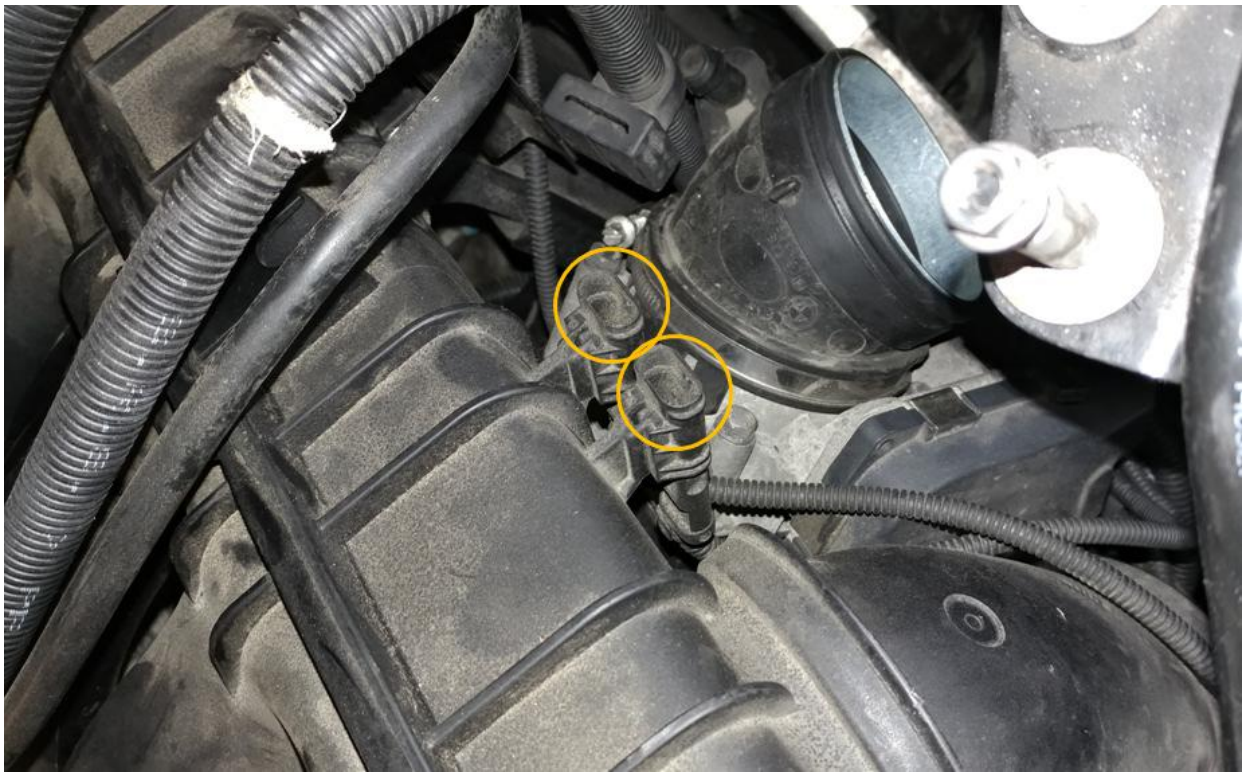
- Disconnect positive wire from passenger side interconnect and wire loom, (13mm socket)

- Manipulate intake manifold until you can remove from the vehicle

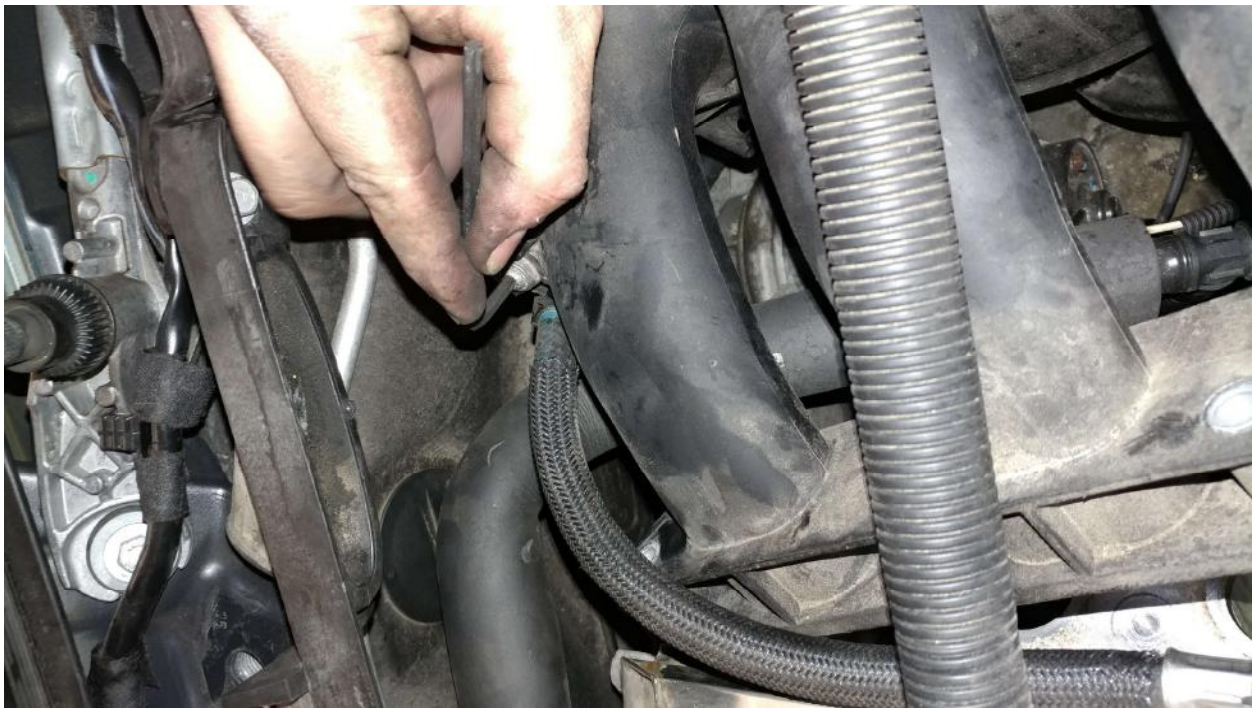
- Separate lower wire loom from intake manifold (un-clip and move out of way) -- Remove all connected electrical wiring as well taking care to ensure proper and safe removal of each connector

- Remove vacuum lines from manifold (3x vacuum lines -- 2 are pictured one is underneath intake manifold -- press on sides of connector and pull away) (1x vacuum line has electrical connector -- disconnect by lifting tab and pulling wire away as shown).

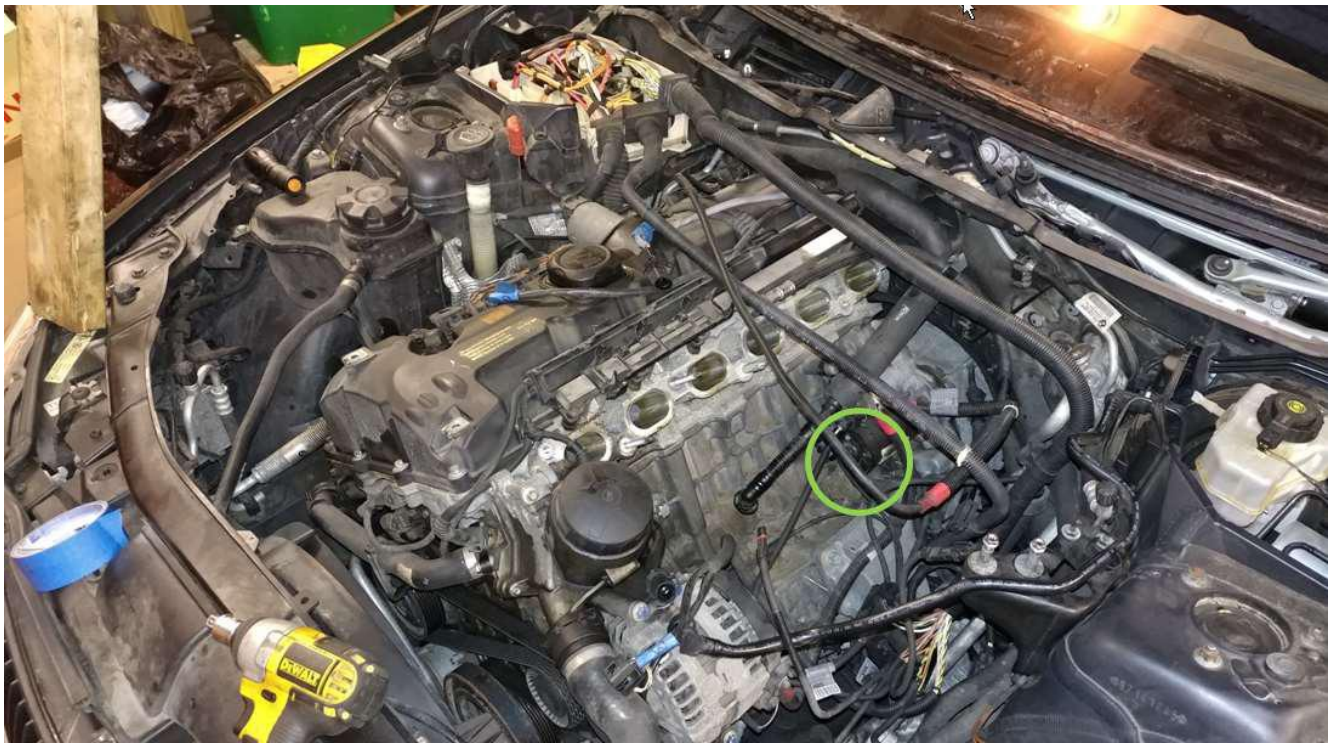
- Remove these (I'm not sure what they are -- maybe some acoustic sensors for the prevention of knock??)



- Remove high pressure fuel line stay from intake manifold (1x T25 bit screw -- aft side of intake manifold)



- Manipulate intake manifold and remove it from vehicle, engine should appear as shown (note: **DO NOT DROP ANYTHING INTO YOUR INTAKE VALVES! COVER THEM UP IF YOU NEED TO!)**. Crank angle position sensor is circled in green.



- You should have approximately these parts on the floor of your garage at this point:

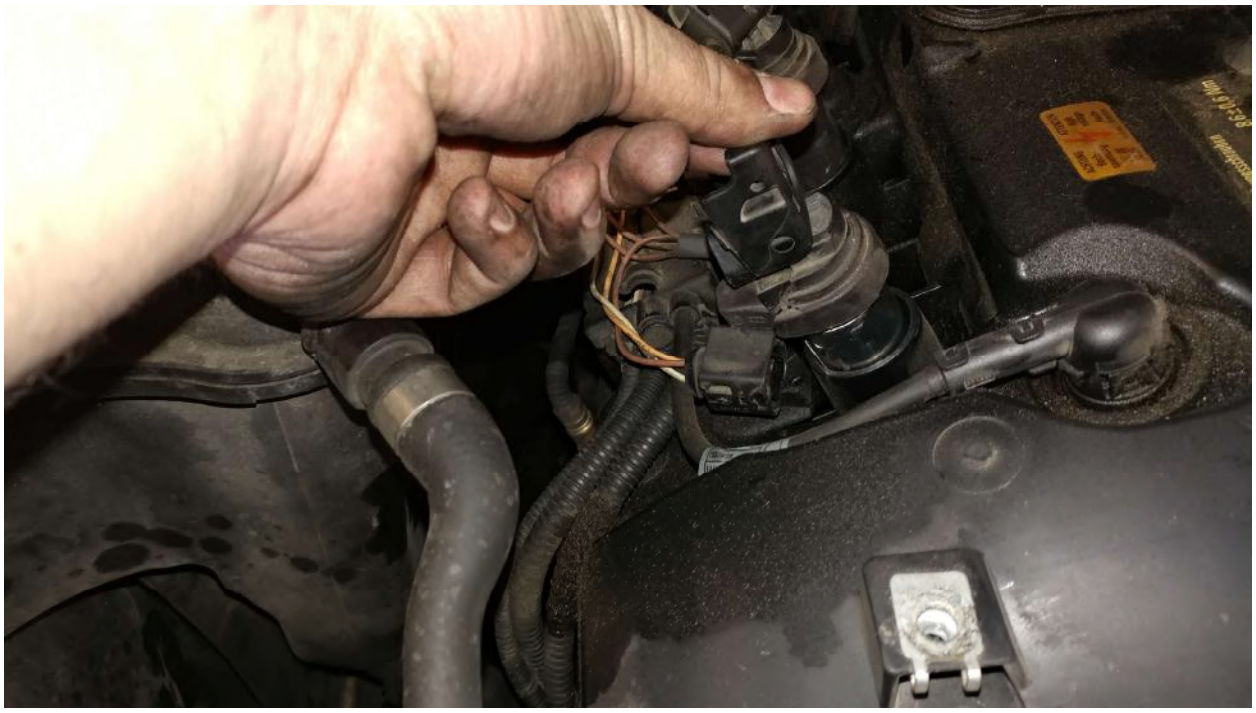
- Remove crank angle position sensor, (1x E10 bolt), remove old o-ring and replace sensor as necessary.

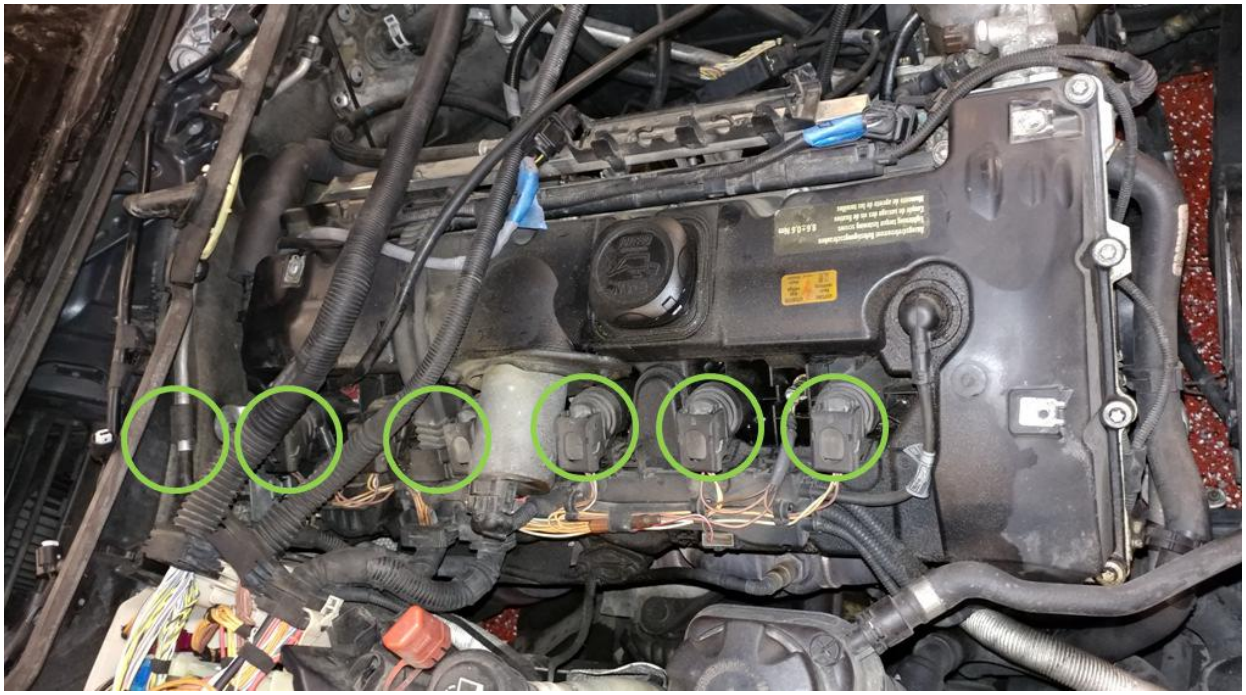
Take care to ensure that o-ring from original sensor is removed as well (see green o-ring).

IF YOU'RE JUST DOING THE CRANK ANGLE POSITION SENSOR YOU CAN STOP AND REPLACE EVERYTHING YOU JUST REMOVED. IF YOU'RE DOING THE VALVE COVER GASKET SKIP THE CRANK ANGLE SENSOR AND KEEP GOING

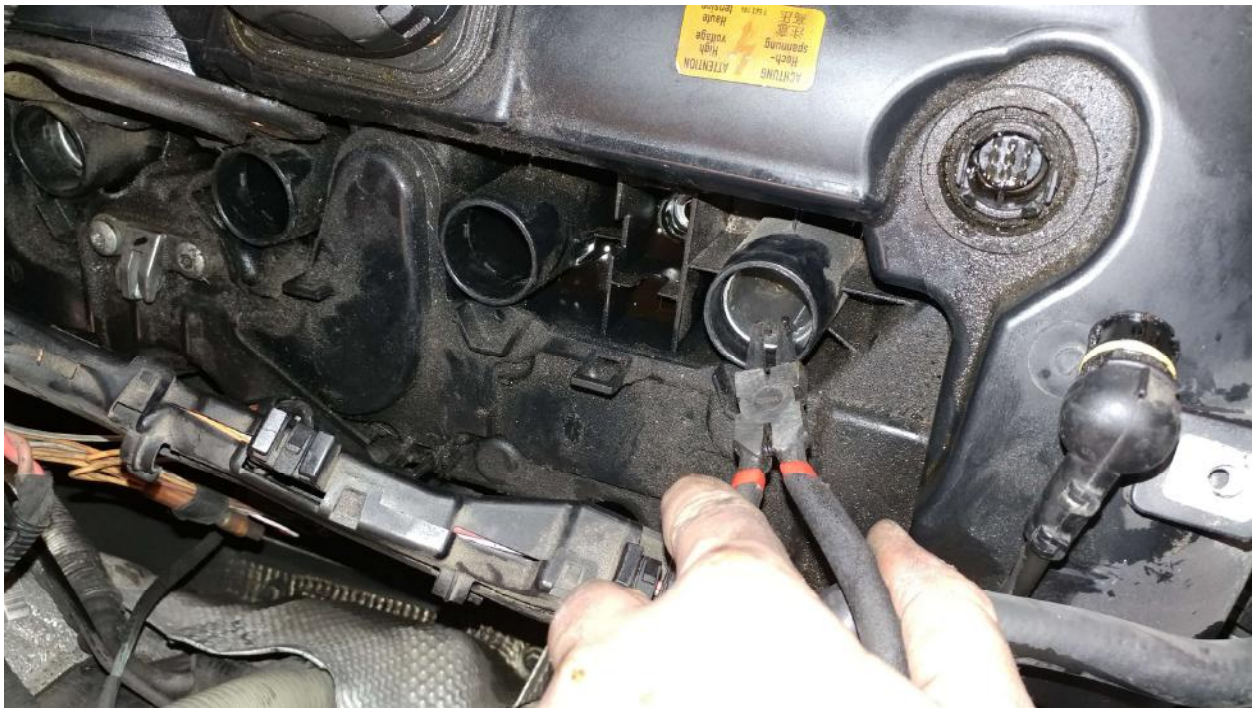
This would also be an OK time to replace your starter if you decide to do so

- Disconnect and remove 6x coil on plugs, (pry wire up by tab and pull outwards). I like to use a long screwdriver for this and use the valve cover as a leverage point

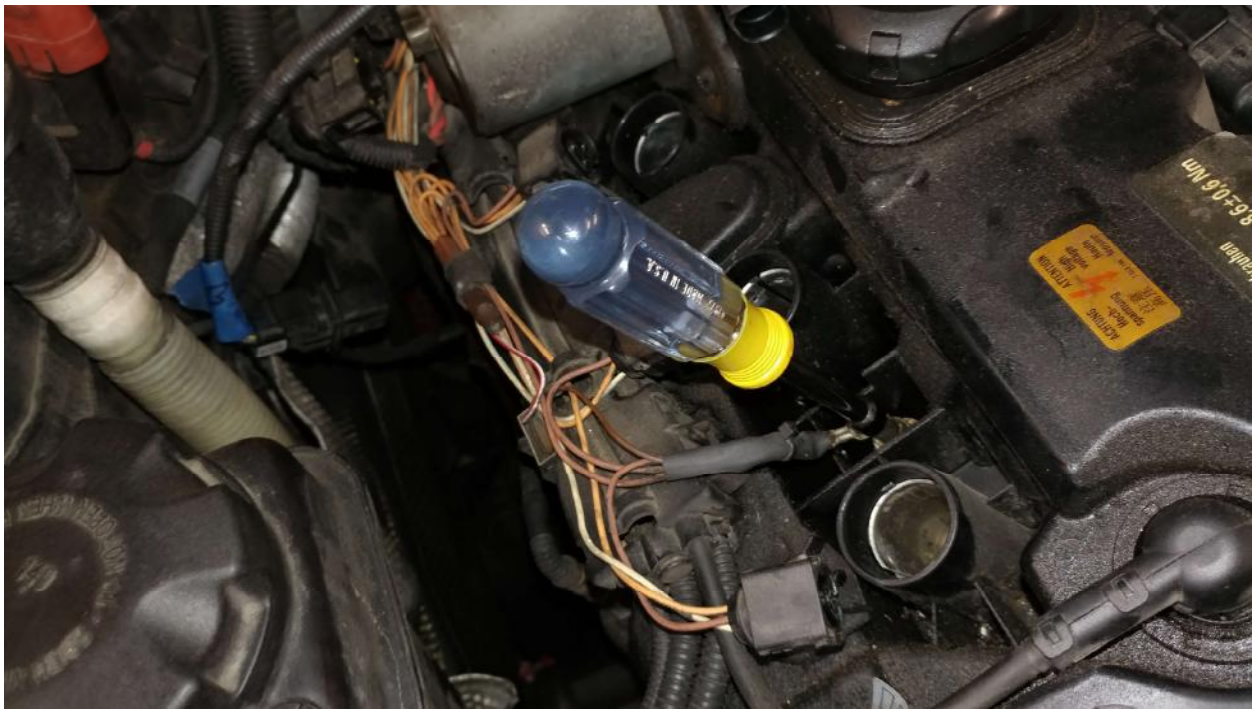




- Remove coil plug tubes (6 pcs) using snap ring pliers



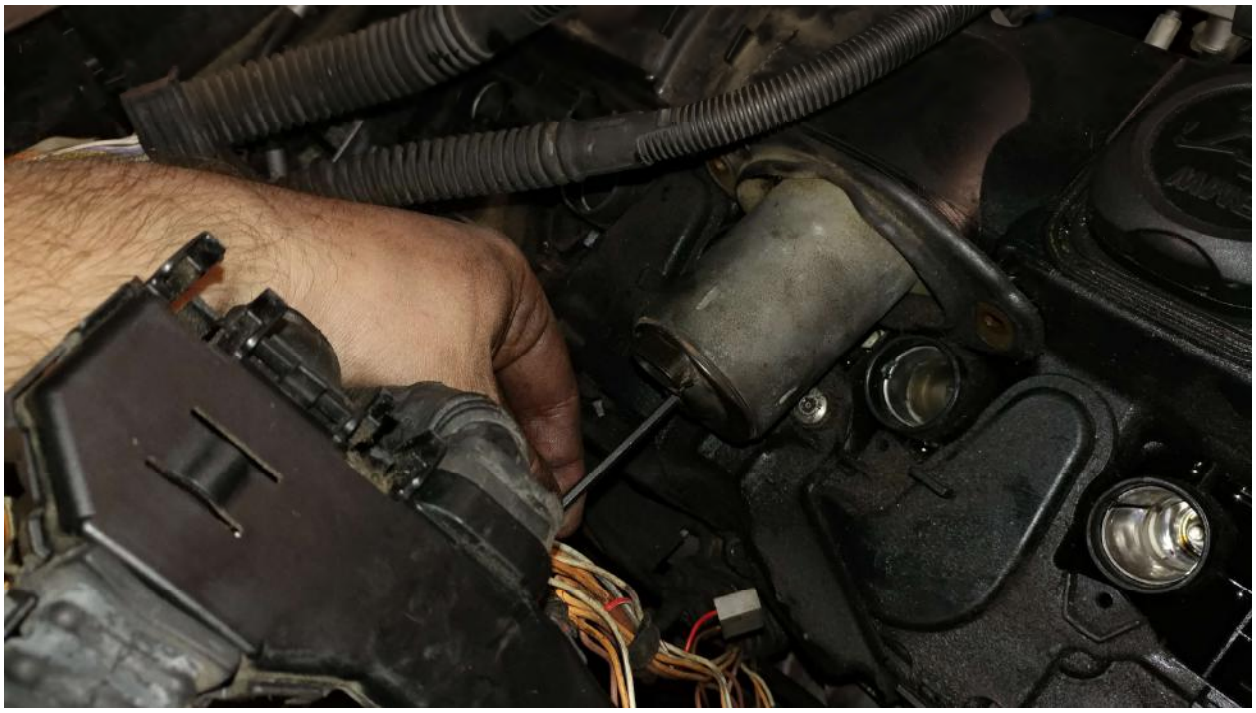
- Disconnect ground nuts on injector harness (2x 5/16" nuts? (metric sizes didn't fit well) one at front and one at back). Remove standoffs underneath nuts.

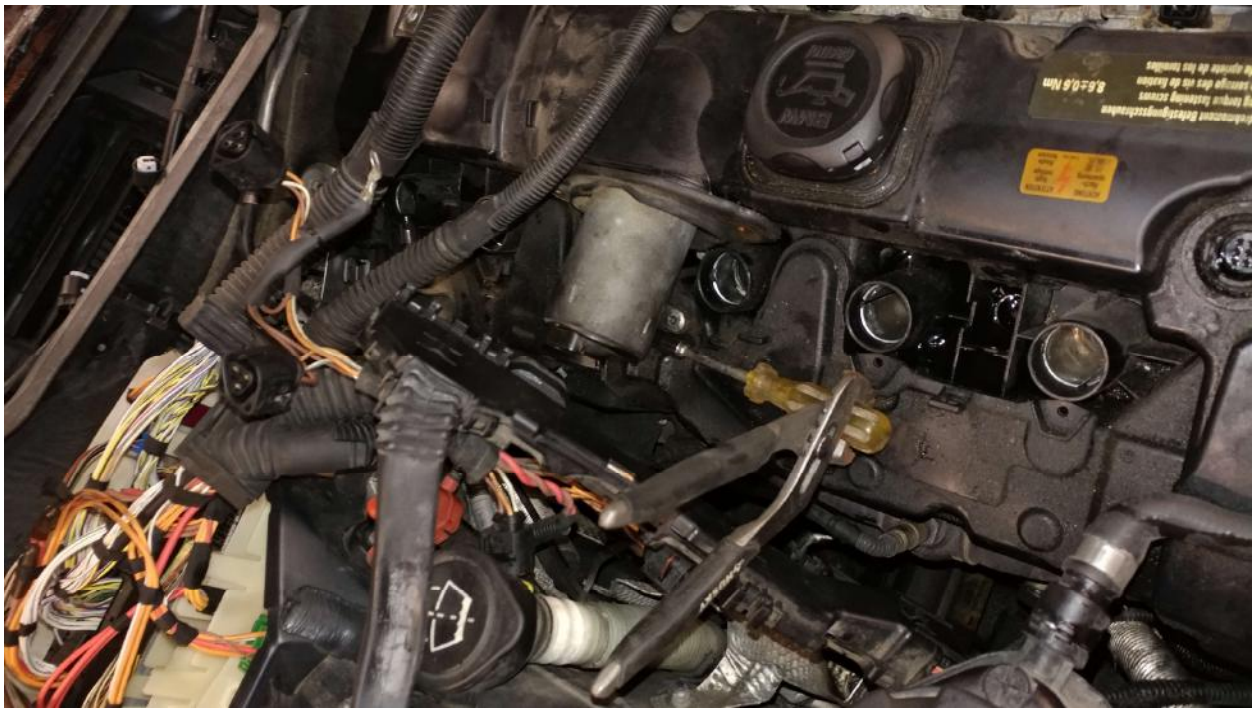


- Disconnect valvetronic servo motor from injector loom

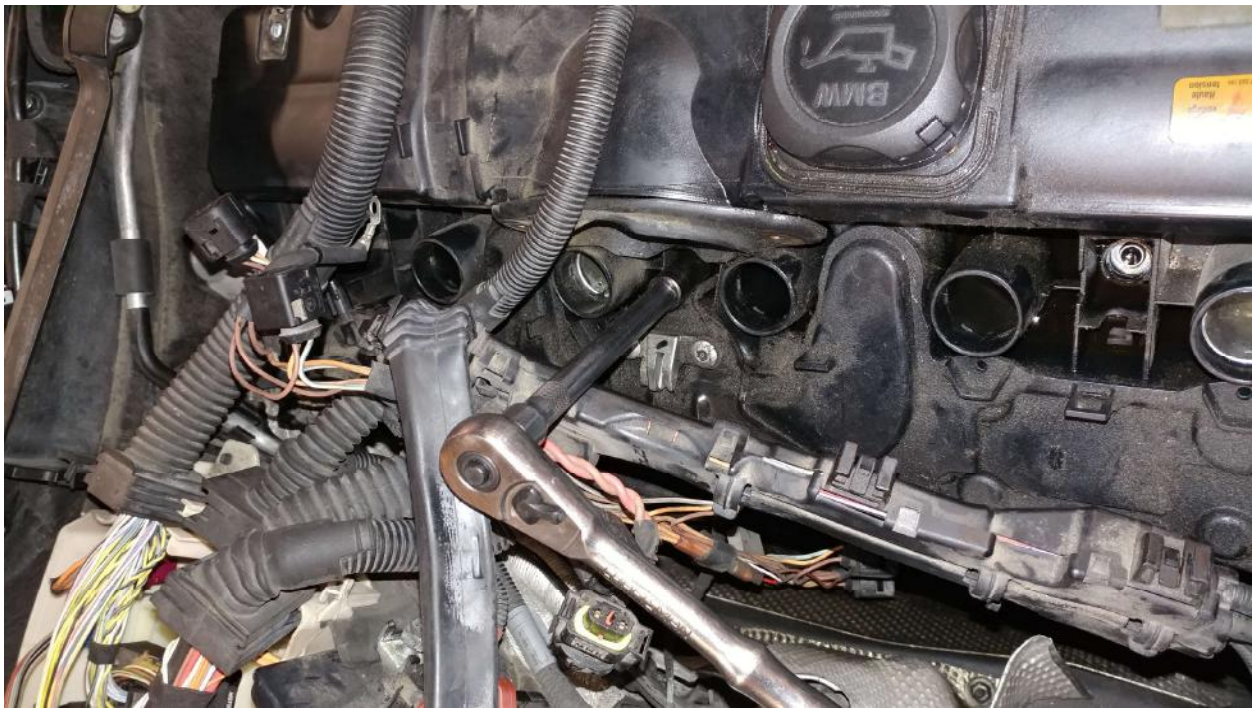
- Remove valvetronic servo bolts (2x E8 on flange and 1x on bottom)

- Remove valvetronic servo, insert 4mm allen wrench into end of servo motor, rotate clockwise until resistance is felt, then pull servo horizontally outwards.





- Remove bolt under valvetronic servo (10mm socket)



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- Remove position sensor relay connection wire from top of valve cover (pry tabs on sides outwards and lift up)

- Remove 6x injector plugs from loom (pry tabs away from plugs and pull away)

- Remove vacuum line from back of valve cover (same style compression tab as other vacuum lines)
- Remove coolant expansion tank bolts and slide out of way (2x 10mm bolts)

- Remove valve cover bolts (E10 bolts)

- Manipulate the valve cover gasket until you are able to remove it from the vehicle. If you correctly removed all of the bolts from the VC the gasket should be able to be removed EASILY! If there is any resistance you probably didn't get all of the bolts!
- Behold the gorgeous valve train of the N52 (angels singing, babies laughing, etc)!

- Clean and wipe all sealing surfaces on the top of the head. Take note of any burnt oil. Use something soft like non-marring plastic tools or a credit card. Any pinpoint leaks of the VCG will likely present themselves as BURNT oil and be black. Take care to ensure that no contaminants enter the engine. Also **DO NOT DROP ANYTHING INTO YOUR ENGINE AT THIS POINT**
- Replace valve cover gasket to valve cover

- Reinstall valve cover to motor
- Take care to ensure that valve cover gasket does not slip out of valve cover during reassembly, this process is VERY AWKWARD given the length of the engine. Every other operation in this job can easily be done by one set of hands. I usually will have someone assist with moving wires out of the way for this portion of this job. (I've done this a few times).
- Reinstall bolts to VC
- Reinstall grounding studs (10mm hex socket, 8.6N-M)
- Reinstall center bolt to valve cover under valvetronic (10mm hex, 8.6 N-M)
- Reinstall valvetronic motor bolts (3x E8 bolts, 7Ft-lb)
- Reinstall coolant expansion reservoir bolts (2x 10mm hex)
- Replace spark plug tubes
- Replace coil on packs
- Reinstall vacuum line to VC
- Reinstall COP wires
- Reinstall passenger side engine wire loom
- Reassemble valvetronic wire
- Reinstall grounding straps
- Reinstall fuel injector loom (confirm all clips seated)
- Reinstall vanos connectors
- Reinstall coolant temp sensor
- Reinstall intake manifold
- Reinstall lower wires and vacuum lines on intake manifold
- Reinstall intake manifold bolts
- Reinstall all upper cowling, wire looms etc.