

CBU CLEAN LESSONS LEARNED
2011 335d, 115,000 miles

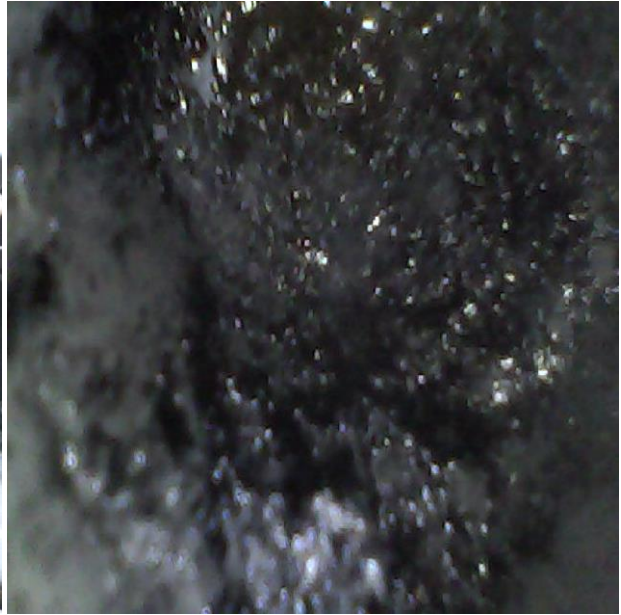
Just finished CBU cleaning one of my two 335d. I've owned it since 32,000 miles, have a Frantz bypass oil filter installed, and am religious about changing filters/oil and other preventive maintenance. It's a California car and has to pass smog every other year so acceptable mods are slim. I have Reingold for analysis and maintenance support, and an Innova 3120 OBD II scanner for checking I/M monitor status for smog.

Recently, codes for glow plugs #3 and #5 went from intermittent to steady. I had changed the controller at 50,000 miles so I assumed that the glow plugs had followed suit and set about pulling the intake manifold to change them (stupid me—the glow plugs tested fine. It was the control module which can be changed without pulling the manifold!).

I recommend cleaning your engine before you begin. Warm the engine, remove the top cover, spray the engine liberally with Gunk Engine Brite and let it sit for ½ hour or so. Spray it liberally with a 50:50 mixture of Simple Green (or Awesome or Orange Cleaner) and let it sit a bit more then hose it down with a pressure washer. Pay particular attention to the areas around the intake manifold, injectors and glow plugs.

When I pulled the intake manifold, this is what I saw. I couldn't button it up in that state so I set about the cleaning.





Left – caking inside intake runners in rocker cover. Right – yes, there is a valve in this photo!

Preliminary work is covered by BMW B 11 03 14 Preliminary Work Note that special tool 13 0 170 on page 10 is not required. Simply lift the lock (2 on the diagram) and the connection (1 on the diagram) will lift right up and the return line will pop off the injector.

There is a lot of questionable information and opinions out there on the internet that should be disregarded so beware. If the poster hasn't actually done the job, take the observation with a grain of salt.

Read "N54 Intake Valve Blasting" by e90man. It is well written and provides much useful information as do videos by A A Rodriguez and others.

The BMW Group Carbon Blaster pamphlet shows you what "clean" valves look like on page 19. Note from the valve on the left that there will remain a "shadow" of buildup at the front (just barely visible) and back of the valve where these areas are partly shielded from the walnut shells.



Clean valve with residual carbon “shadow”

SI B 11 03 14 Diesel Intake Carbon Cleaning provides additional detail on cleaning procedure. A fancy blaster is not required—the 50 lb portable blaster (Item 37025) and 24 grit fine walnut shells (Item 92155) from Harbor Freight work great. I bought the fancier blaster but didn't use it because it didn't have a quickly adaptable gun.

I used a small portable vacuum which I had cleaned well before starting and fitted with a set of mini vacuum adapters from Harbor Freight. Clean your vacuum before you begin and between each valve blasting to permit you to gauge the effectiveness of the blast by viewing the amount of walnut shells captured in the vacuum. The mini adapters enable you to get down into the valve plenums and other tight places. Beware that carb cleaner will melt the mini adapter plastic.

While some posters recommend sifting and re-using walnut shells, I do not recommend this practice. Used shells will work but the little bits of gunk that remain after sifting will significantly degrade or even stop the flow of shells through the blaster hose. Often times you will have blasted with no media flow or significantly reduced flow and the job will take a LOT longer with less satisfactory results. One box of shells is more than ample for the job and you would be much better off to use clean shells as the blast will be more effective and a lot faster.

CBU consists of a firm layer of soot adhered to the walls of the air passages/parts/valves generally covered with a gooey tar-like top coating. My buildup was so intense that I opted to first scrape to remove as much build up as I could from accessible areas then vacuum up the debris. The carving tools from Harbor Freight (item 34152) were my “go to” scraping tools but would not reach all the way down to the valve crowns. I fashioned some additional scrapers from ¼ inch brake line in order to reach further in.

Scraping the runners on the intake manifold sent considerable crud into the main plenum. The CBU is awful stuff and makes a quite a mess. I opted to remove and clean the throttle body, EGR valve and swirl flaps myself but took the manifold to a local machine shop for a professional cleaning. The manifold came back looking like new and was \$45 well spent!

The throttle valve was relatively clean and without much soot. A little scraping, wire brushing (brass wire) and paint thinner followed by a carburetor cleaner rinse took care of that.

The EGR valve was heavily caked. Scraping, carb cleaner, and elbow grease got it looking very clean.

The swirl flaps are metal flaps in a plastic housing that has a silicone rubber-like sealing surface for the flaps. It took quite a bit of scraping, light brushing and care not to damage the silicone seal but came clean as well. I no longer have a blasting cabinet or I would have soda blasted them.

With the intake manifold out of the way I pulled the glow plugs. I didn't have the luxury of a warm engine so pre-treated them 3-in-One penetrating oil (yes, they now make it in a squirt bottle and it's a great alternative to a spray can). After 30 mins or so I used a 1/4 inch torque wrench to very slightly tighten each glow plug (click plus ever so little) then reversed the torque wrench to loosen them (click plus ever so little). With constant pressure (click plus or click plus a little more) they very subtly gave way then came right out. I will tell you that giving way feels exactly like it would if they were to shear so be cautious but brave. It was interesting to note that they were all clean and tested the same as new with my ohm meter. Bet it was the control module all along and I didn't need to pull the manifold. Damn.

Injector removal is straight forward. I bit the bullet for an ABN diesel injector tool from Amazon. The ABN tool has the proper adapter for the M14-1.5 threads at the top of the injector and, once the retainers are unbolted, the injectors come out with a little upward tapping from the fuel fitting. Take time to vacuum around the injectors before you pull them and be aware that a bit of junk collects in the injector bore above the center o-ring. A little 3-in-1 Vacuum out the bore as soon as the injector is out. Check to ensure the copper crush washer comes out as well--#5 remained in the bore but I easily picked it out with the mini-adapter-equipped vacuum. Be careful of the tips of the injectors and cover the M14-1.5 fuel studs on the injectors and the common rail to keep the crud out.

I don't see how you could do a proper CBU clean without pulling the valve cover which wasn't that big a chore in the overall scheme of the repair. Removing it permits easy cleaning of the intake channels in it, ready access to the intake ports in the head, and a better go at the valves which are buried deep inside and require considerable effort and blasting to clean.

With a little warmth and coercion, the 1/2 inch gray vinyl thread protectors at Lowes (Part 137985, 3 for \$1.48) work well to protect the fuel fittings on the injectors and the fuel rail. 3/8 inch caps are too loose a fit in my opinion.

I bagged the fuel return line in a plastic shopping bag and laid it aside.

In removing the valve cover, there are two E7 bolts at the rear, left side (viewed from the front of the car). While the one securing the injector cable loom faces vertically upward and is accessible with a ¼ inch drive ratchet, the other faces the firewall and is not accessible. Using the easily accessible bolt head as a template and triangular and round jeweler's files, I fashioned an E7 flat wrench from the hole in the end of one of those throw-away sheet metal wrenches you get with certain Harbor Freight tools. It only took about 15 mins to make and worked like a champ. It's now in my "special tools" drawer.



The BMW media blaster cylinder head adapters (81292356967 and 81292356966) are a necessity. The swirl port adapter fit snugly while the tangential port adapter was loose but effective once the vacuum was switched on. Each required six or nine wraps of electrical tape around the horn to get a snug fit in the vacuum cleaner hose.

Accessing the tangential ports presented no concerns but I covered the engine with painter's plastic to keep walnut shells out of the valve train when doing the swirl ports. I recommend reinforcing the painter's plastic with 2 inch painter's tape in the vicinity of the swirl port, cutting a hole in the tape/plastic slightly larger than the swirl port flange, cleaning the swirl port flange with carb cleaner and a rag, then placing 2 inch painter's tape atop the plastic and swirl port flange. The tape will stick to the flange and hold the plastic in place. Take an Exacto knife to cut along the swirl port outline. This will keep the stray walnut shells out of the rocker arms and camshafts. Make sure the plastic covers the back of the head and is taped in place—light breezes will move it otherwise with accumulated shells going into places you wish they hadn't. I was able to easily remove the few shells that made their way past the plastic with the mini-adapter equipped vacuum.



From the CBU SIB, I scaled and fashioned the BMW blasting wands from 5/16 inch brake line (silver color, NAPA part 813-1245). Upon first use, I quickly determined they were too long, unwieldy, and not very effective. With a little experimentation, help from a tubing bender (AutoZone part 52403 25440) and my trusty brake line flaring tool, I fashioned both straight and curved wands that can get back into the nether reaches of the valve chambers. I also fashioned some scraping tools out of 1/4 inch brake line (green color) that permit reaching the valves a little better, but it's a blind alley that you have to work in. The brake line is very stiff and makes an effective raw material for scrapers. Don't make them too sharp as you can scratch the aluminum head/runners.



Ensuring that the valves are closed is easy-cheesy with the valve cover off. The cam lobes are circle-arc which makes it simple to tell when the valves are shut. I taped the firing order onto the radiator shroud for reference then used a remote starter button to bump the engine until the high points of the lobes

for the cylinder I wanted to work on were vertical. I then double checked valve closure by applying a little LP compressed air to the glow plug port and listening/checking for air coming out of the injector port only. Note that the tangential and swirl ports are separate and not in communication with one another (as one poster incorrectly opined).

When blasting, it is often useful to insert the wand through the port adapter then into the port to ensure best access to the valve. Lower the port adapter to seal with the flange, switch on the vacuum and have at it with the walnut shells. A magic marker works well for applying reference lines to the wand if you are concerned with pulling it out too far but I found this not to be an issue. More important is to pull the wand from the adapter then the adapter from the port before you switch off the vacuum. Both the wand and the adapter will leak walnut shells onto the painter's plastic if you don't. A little LP compressed air will move the shells away from the port but many get trapped in the folds of the plastic, so be aware and ensure the camshaft valley is covered.

My 46 year old Sanborn 2 HP compressor did the job with the 5/16 inch sized wands. Good for about 20 seconds of blasting before she kicks on, I blasted for up to a minute at a time without issue. The compressor easily kept up with my blast, look, try a different adapter, blast again rhythm. Kind of like your 15 year old dog—she can still go for walks with you but you have to give her frequent rests to catch her breath. I put a fan on her to help her cool off more quickly.

A good borescope is critical to this job—you can't do it without one. My 5.5 mm borescope for Android from ebay with its 6 ft limp cable was my preferred scope but the free borescope applications from Google Play kept crashing and became a significant detriment. With no other reasonable options available, I spent nearly \$40 at Home Depot for a Klein borescope for Android (item 092644692987). While unwieldy due to the armored cable, the Klein scope can go micro USB or Type C, is Apple compatible, and was effective with my Android 10.0 cell phone.

Cleaning the valves and plenums is a slow and repetitive process. When you can, scraping is faster than blasting. I don't like carb cleaner except for final cleanup—MAKE SURE THE VALVES ARE CLOSED. I did spray carb cleaner on a particularly hard and durable deposit on the valve and let it rest overnight, but I am not sure if it was the carb cleaner or fresh clean walnut shells that contributed to its eventual removal. Scrape, vacuum, scrape some more, vacuum some more, blow/vacuum, inspect, change wands, scrape some more, blast some more, inspect again, about 10-20 or more times. Did I say slow?

CAUTION: CARB CLEANER IS VOLATILE! DON'T USE IT IN CONJUNCTION WITH A VACUUM CLEANER! If you use carb cleaner in the plenum, cover the port with a rag afterward and use LP air to gently blow the carb cleaner out. Continue with the LP air until there is no more smell of carb cleaner then you can resume blasting and vacuuming. Make sure you cover the port with a rag while blowing or you will get a face full of it!

My go-to tool for scraping/chipping the intake runners was the stainless steel carving set from Harbor Freight (34152). They have two tools in particular in that set that are perfect for the intake runners and can reach down to the valves but not all of the valve and stem.

Develop a rhythm and a process. Always, always, always check to ensure your valves are closed, and then check again! It's easy to get distracted!

Once completed I double checked all valves for cleanliness and walnut shell residue. In doing so, I found one valve I had skipped!



Once a valve has been blasted clean, double check for walnut shell residue *BEFORE YOU ROTATE THE ENGINE!* Residual shells can be removed from a clean valve by using an air blow gun in conjunction with the port adapter/vacuum cleaner. Adding a piece of flexible tubing to the end of the gun enables you to reach into the deeper recesses to blow the particles out and up to the port adapter/vacuum.



Have new vacuum lines available. This process exposes some vacuum lines that are tough to reach otherwise and presents a good opportunity to replace them.

When installing the gasket in the head cover, make sure you seat the bolts properly in the gasket. A A Rodrigues shows you how to do this in his excellent video.

During reassembly after cleaning, I used new gaskets, seals and o-rings where required.

“Aw Shucks!” issues (me, especially)

1. If you’re pulling codes for glow plugs, it may be the glow plug control module.
2. Ensure you have the injector hold down clamps the right way around when you re-install the injectors. They will go in “upside-down,” but will be too high and the fuel line will not reconnect properly.
3. Use silicone grease on seals and o-rings so you don’t spin them on assembly.
4. Double check all fuel lines and fittings “tight” from the common rail to the injectors. A loose (even slightly loose) fitting will cause a “crank, no start” situation as the rail will not build sufficient pressure to fire the cylinder.
5. Be very cautious when re-fitting the intake manifold to the head. The metal washer on those little red rubber grommets the bolts pass through is easily bent and the grommets are easily dislodged and can disappear in the engine bay.
6. Make sure the charge pipe fitting has securely connected and locked onto the throttle valve. If not, the engine will idle okay but surge and go into limp mode if you try to drive it.
7. Don’t stress over extraneous error codes (faults) after re-assembly. Be persistent, use your common sense, think of which connector you forgot to reconnect, reconnect it, clear the faults, and try again.

CALIFORNIA RESIDENTS – Disconnecting your battery will clear your I/M Monitor which will cause you to fail smog until they are ALL reset. You will need a copy of the BMW OBD II Drive Cycle procedures, a decent code scanner, and an appropriate stretch of highway to carry out the reset procedure. I have Rheingold/ISTA but am not familiar enough with that software to know if it will work for resetting I/M sensors. I used my Innova 3120 CAN OBD II scanner but the AutoLink AL-319 scanner is more intuitive and a heck of a lot cheaper at less than \$50. To date, I have been through “How to Do BMW OBDII Drive Cycle for Smog Check” by ilovjdmtoy in WorkshopCars and “Federal Test Procedure (FTP) Drive Cycle” for BMW—simply driving the car up onto the freeway and around town didn’t work. I have managed to reset all but HTR and EGR. Will try again tomorrow morning... at 4:00 a.m... to avoid SOCAL traffic...

