

Camaro '12 - '13 LFX

Upper Air Intake Disassembly / Cleaning / Reassembly

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Introduction

After reading numerous articles, manuals and camaro5.com forum posts I became concerned that my '12 Camaro LFX engine might have significant oil buildup in the air intake pathways and carbon buildup on the valves due to the positive crankcase ventilation (PCV) design. The PCV design coupled with the initial 14K miles without a catch can led me to believe previous oil ingestion was causing a rough idle, adversely affecting performance, reducing mileage and potentially reducing the useful service life of my engine. I had an "upper induction cleaning" done at the local dealer to clean out the existing oil in the air intake system using the BG chemical cleaning system. After that my LFX engine was running much better. However I suspected there was more that could be done. To this end, I felt a manual cleaning was in order. This document describes how to disassemble, clean the air intake pathways/valves and reassemble the air intake system on a '12-'13 LFX engine. I learned how to perform this procedure by reviewing GM produced service documentation for the '12-'13 Camaro LFX engine. The GM documentation is not reproduced in this document due to copyright restrictions.

The LFX composite intake manifold (indicated by the green arrow) below is what will be removed and subsequently reinstalled by this procedure.



Disclaimer

THE AUTHOR ASSUMES NO LIABILITY WHATSOEVER OR WARRANTS THIS PROCEDURE. WHILE IT CAPTURES THE GM PROCEDURE DISASSEMBLY AND REASSEMBLY STEPS, THE USER IS COMPLETELY RESPONSIBLE FOR THEIR OWN HEALTH, SAFETY, VEHICLE AND ANY POTENTIAL VEHICLE OR PROPERTY DAMAGE, ADVERSE EFFECTS OR WARRANTY VOIDING ISSUES THIS PROCEDURE MAY CAUSE. IF IN DOUBT, DO NOT PERFORM THIS PROCEDURE OR HAVE IT PERFORMED BY A GM TRAINED ASE CERTIFIED MECHANIC. READ THE ENTIRE DOCUMENT BEFORE STARTING THE PROCEDURE.

Time Required

3 - 8 hours (depends on cleaning “chemical soaking” time)

Location Required

Well lit area where direct artificial light (e.g. fluorescent) can shine on the engine taking into account the shadow caused by the hood.

Well ventilated area as certain cleaning chemicals should not be used in an enclosed space due to inhalation and excessive exhaust on initial engine restart issues.

Parts

1. Air Intake Gasket (optional - AC Delco 12646459)

Tools Required

1. Torque wrench (calibrated - available in lb-ft)
2. 10mm open ended wrench
3. Standard socket wrench
4. Socket wrench extension
5. 13mm socket
6. 10mm socket
7. Flash light (Mag-Lite recommended)
8. Long flat-head screw driver
9. Channel locks
10. Soft rags (T-shirt remnants)
11. Paper towels
12. Long “hooked - end” instrument (dental pick like device)

Tools Suggested

1. Front fender paint protection mechanic’s body cover (2)
2. Front end paint protection mechanic’s body cover

3. Gloves
4. Shop Vac/Blower

Cleaning Chemicals (optional)

1. Throttle Body spray cleaner
2. BG 44K or Seafoam spray cleaner

Disassembly Steps

1. Let car sit long enough for the engine to be completely cold as you risk injury working on a hot engine.
2. Put car in Park or Neutral with the emergency brake engaged.
3. Disconnect negative battery terminal in trunk using 10mm open ended wrench. You will have to remove the carpet and spare tire cover. If you have a spare tire you will need to remove it to access the battery.
4. Open the hood.
5. (Optional) Place fender (2) and front end paint protection mechanic's body covers over vehicle body.
6. If car has GM strut tower brace remove it using 13mm socket to loosen 6 bolts, 3 per side.



7. Remove air intake pipe between the throttle body and air cleaner. Use the long flat-head screw driver to loosen the clamps on both ends and disconnect the clean side PCV hose. Pull the air intake pipe off the throttle body and air cleaner. **Note: Clean any oil in the air intake pipe coming from the clean side PCV hose connector.**



8. Remove the engine (intake manifold) cover by removing the oil cap and lifting off the engine cover.
9. Remove the rear (fixed) intake manifold cover by first inserting the long flat-head screw driver into the two retainers in the slot provided to: 1) lift up the center section and then 2) remove the retainer outer bodies.





You should now have full access to the air intake manifold. In the next steps you will disconnect all the items connected to it with the exception of the throttle body.

10. Remove the PCV dirty-side air tube which is attached to the top center of the plastic air intake manifold.

If you DO NOT have a catch can, first remove the far end of the air tube from the back of the passenger side camshaft cover by pressing the release clip and lifting the connector up. Work the far end loose and bring it forward. As you bring the far end forward you will rotate the near end of the dirty-side air tube counter clockwise (direction of the arrow) to release it from the plastic intake manifold.

If you DO have a catch can, then you only have to rotate the dirty air tube connected to the catch can output port to release it. You DO NOT have to remove the catch can.

In both cases lift the near end of the PCV dirty-side air tube up to remove it.



11. Remove the fuel pipe shield by loosening and then removing the 2 - 10mm bolts at the rear of the air intake manifold using the open ended wrench. Remember the tightness of these bolts when you remove them as there is no documentation to the required torque value. NOTE: There probably is no torque value stated as a torque wrench will not fit in the available space. Be careful as these bolts loosen so they do not fall into the engine compartment.



12. Disconnect the brake booster vacuum hose from the air intake manifold by compressing the clamp with channel locks. Looking at the intake manifold from the front of the vehicle, this hose is located on the right (driver side) rear of the intake manifold.



13. Remove the electrical connector and hose from the Purge Solenoid. Looking at the intake manifold from the front of the vehicle, these two items are located on the left (passenger side) rear of the intake manifold.



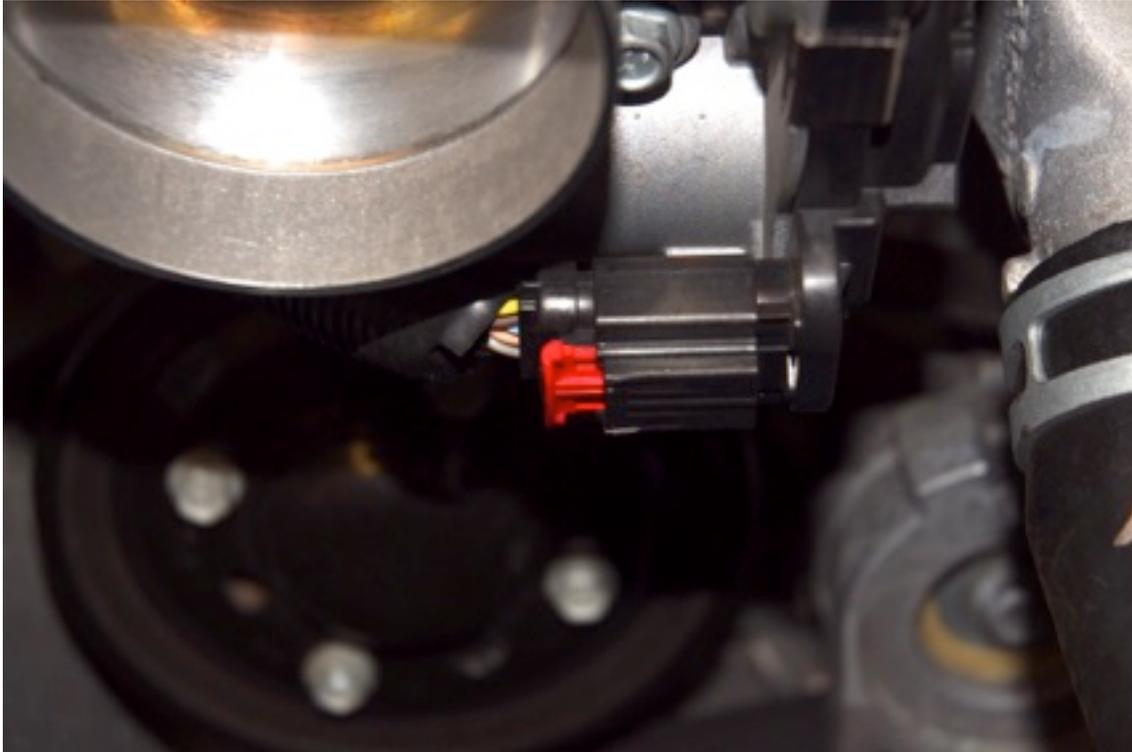
The electrical connector is removed by pressing a release on the underside of the connector and then pulling the connector off slowly while gradually moving it back and forth.

The hose is removed by pressing the white clip in and gradually working the hose off. If this doesn't work well for you, the other end of the hose is easily removed and the air intake manifold hose end can be left on the Purge Solenoid.

14. Disconnect the MAP sensor electrical connector. Looking at the intake manifold from the front of the vehicle, this item is located on the center rear of the intake manifold. The electrical connector is removed by pressing a release on the connector and then pulling the connector off slowly while gradually moving it back and forth. After the connector is released, the wire tie wrap needs to be removed from the intake manifold. The tie wrap is easily replaceable at any auto parts store. However, the tie wrap has a red stripe painted on it. As such, I did not think it wise to replace this tie wrap. Instead, use channel locks to SLOWLY push the tie wrap up out of its mounting hole while working the tie wrap back and forth. TAKE YOUR TIME! There is another tie wrap on the other side of the intake manifold (driver side). Remove that one as well using the same procedure. TAKE YOUR TIME!



15. Remove the throttle body electrical connector. Looking at the intake manifold from the front of the vehicle, this item is located on the center front of the intake manifold. This connector is a simple slide lock. Pull the red slide lock to the left and the gradually move the connector back and forth to remove it.



16. Loosen all 6 intake manifold bolts (top) using the 13mm socket. You can use the socket extension on the front 5. You will not be able to use the extension on the rear bolt as there is not sufficient clearance.
17. Remove the front 5 intake manifold bolts by pulling them up and out. Place them in a safe area noting their position in the intake manifold. I do not believe any specific re-installation order is necessary, I simply did not want to tempt fate.
18. Lift up on the intake manifold while holding the rear bolt as high up as you can. The rear bolt will not come out completely until the intake manifold has come loose from the gasket/engine housing as it there is not sufficient clearance. Once the intake manifold has detached from the gasket, angle (throttle body end down) the intake manifold to allow you to remove the rear bolt. Place the rear bolt with the others. Keep the intake manifold in it's current orientation for the first cleaning steps (below).

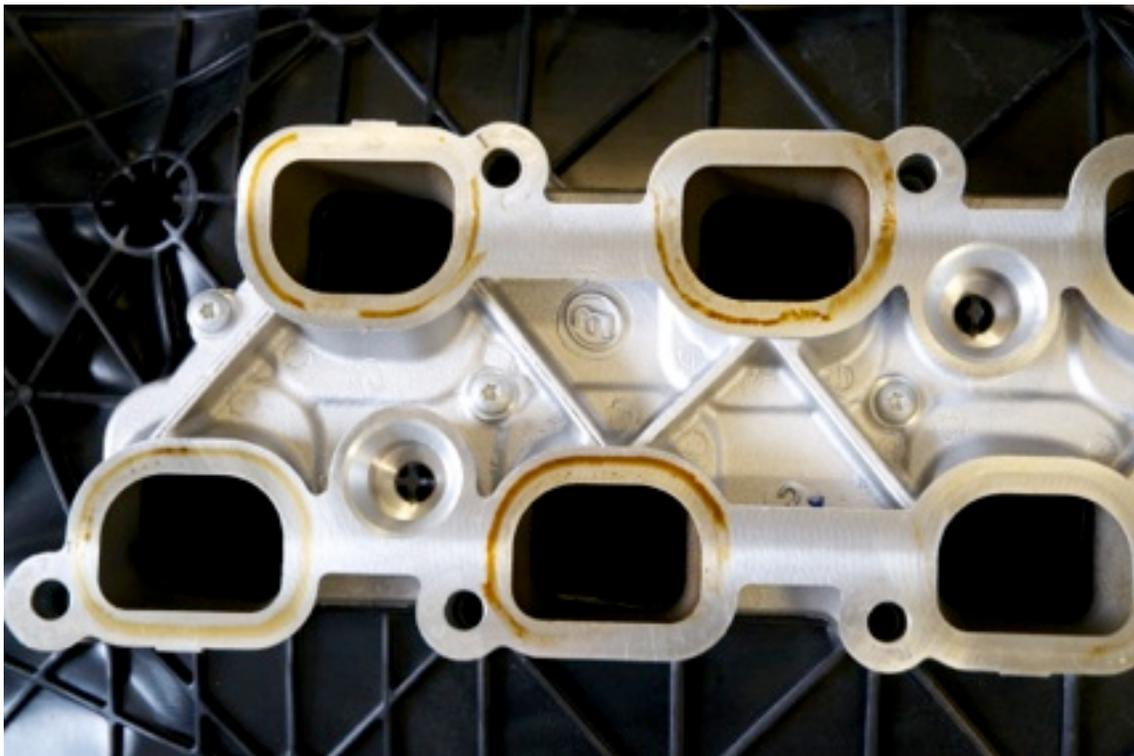
19. Remove the throttle body from the plastic intake manifold. Remove the throttle body using a 10mm socket to remove the 4 bolts.

Cleaning Steps

20. Just inside the plastic intake manifold there is an oil catch basin on the bottom. If it has oil in it clean it out now with a paper towel so it will not make a mess when you invert the intake manifold in subsequent steps.

21. Use throttle body spray cleaner and rag to clean the front and backside of the throttle body. Set throttle body aside in a safe place.

22. Invert plastic intake manifold to take a look at the bottom. Clean any oil off the aluminum piece.



23. My gasket (see following image) had visible oil on it so I took it off the engine body for cleaning. Note the orientation of the gasket for later re-installation.



The gasket sits on a rubberized spacer. Note the orientation of the front pointing arrow on the spacer for later re-installation. After removing the spacer (and cleaning it), the top of the engine appeared as in the following picture.



Notice all the oil on the top of the air inlet ports themselves. This is oil that leached in even with the tight seals of all the components. So there was a great deal of oil in the ports at some point. Also notice the oily color of my inlet ports? This latent oil told me I had cleaning to do.

24. Remove lower piece of aluminum from plastic intake manifold and clean (optional). This piece was dirty on my car as shown in step #22. I planned on using the throttle body cleaner to clean out the rough aluminum ports (6). However my throttle body cleaner spray said not to use it directly on plastic. As such I used a Torx screw driver to remove the aluminum piece before cleaning. ***(I'm sorry I forgot the size of the Torx screw driver.) There are 6 blue gaskets, one for each intake port, that will be visible once you separate the aluminum piece from the main intake manifold. Do not allow these gaskets to come into contact with the throttle body cleaner spray.***

25. Clean plastic intake manifold. On my car this item was already very clean due to the upper induction cleaning. I just wiped out all the bottom ports with paper towels and basically found nothing. I pushed a rag into the front to remove what little oil I could see. ***You'll have to do this twice as it internally splits into left and right halves.*** If yours is very dirty then you will mostly likely need to use a **plastic safe** chemical to saturate and clean it out. I believe Seafoam spray or Seafoam DeepCreep spray meets this need. However please read the product labels **FIRST** to be sure. If you go for a saturation cleaning then I would suggest removing the MAP sensor and Purge Solenoid from the top of the plastic intake manifold first. **It is very important to get the plastic intake manifold clean. If you don't then the oil in it will be sucked down into your air intake ports at some point. DO NOT TRY TO SEPARATE THE TOP AND BOTTOM HALVES FOR CLEANING. THEY ARE GLUED AND SNAPPED TOGETHER.**

26. Use a flashlight to look down into your intake ports. This is a sampling of what I saw.





From what I am told this is actually fairly clean for a 15K mile engine. However the carbonization on the valves is very apparent. My goal was to remove this carbon buildup. Note: You may be looking at something like the following if you have not

been using a catch can. **If yours looks like the picture below you might as well start with your disposable paper towels / rags now!**



27. Cleaning the intake ports and valves.

There are five objectives:

- 1) Clean the oil / carbon from the intake ports / valves
- 2) Minimize getting any of the oil / carbon into the cylinders
- 3) Minimize any cleaning chemical in the cylinders
- 4) Do not deeply scratch (score) the valve stems as this will weaken them
- 5) Do not bend or otherwise damage the valves

In this step I will describe a simple and relatively safe approach. In the appendix I will describe a more advanced approach.

I used twelve t-shirt based rags as you need one for each valve (6 x 2). I used a long screw driver to hook the rag and push it down to the valve stem. I then used a dental pick taped to another long screw driver to hook the rag and then **GENTLY** pull the rag back up and around the valve stem. Once in place I saturated the rag with Seafoam spray. Once saturated I used the screw driver to **GENTLY** push more of the rag back down into the port and onto the valve. The idea was to fill the “valve side” of the port with a saturated rag. I did this for each of the 6 input ports first on

the “left” valve. I let these rags sit for a couple hours. Next I pulled the rags **GENTLY** back and forth around the valves to clean them and surrounding area. In some cases I got a lot off. In other cases, not so much. It depended on how open the particular valve was. I **GENTLY** pulled the rags out and cleaned the upper parts of the port by rubbing with the rag. I used a shop vac in each cylinder just in case a chunk of oil/carbon was loose. Next I repeated the process for the “right” valves in each input port. When done I used my car dryer (Stihl electric leaf blower) to dry out the ports.

Reassembly Steps

28. Replace the spacer noting the orientation arrows.
29. Replace the gasket noting the proper orientation indentations. If yours shows signs of wear, replace the gasket. (See “parts” on page #2)
30. If you removed the aluminum bottom of the intake manifold, reinstall it now. Pay attention not to over tighten the Torx screws as they are seating in plastic. If you replaced your gasket, then replace the blue gaskets on the aluminum bottom of the intake manifold. Both gasket types are included in the AC Delco kit.
31. Insert the back bolt into the intake manifold.
32. Carefully place the intake manifold almost on top of the gasket. Leave an air gap so you can insert the back bolt into its proper hole by looking at the manifold from the side while standing at the driver side fender. You may need to use your flashlight for this step.
33. As you seat the intake manifold pay attention to the two fuel pipe air shield bolt mounting holes so they are aligned properly. As you will recall these are at the very back of the intake manifold (See step #11 above).
34. Press the intake manifold down onto the gasket and work into place. It will be slightly loose at this point.
35. Hand tighten the two fuel pipe air shield bolts (10mm).
36. Insert the other 5 intake manifold bolts and hand tighten them.
37. Set your torque wrench for 18 lb ft.

38. Tighten the intake manifold bolts in the following order:

back of manifold

	5
3	2
1	4
6	

front of manifold

DO NOT OVER TIGHTEN. THIS IS AN ALUMINUM BLOCK!

39. Tighten the bolts again in a second pass.

DO NOT OVER TIGHTEN. THIS IS AN ALUMINUM BLOCK!

40. Use the 10mm wrench to tighten the two fuel pipe air shield bolts at the back of the intake manifold.

41. Reinstall the throttle body. Start all four bolts. Hand tighten the bolts such that no bolt is significantly ahead of the others. Use the torque wrench for the final tightening to 9 lb ft per bolt.

DO NOT OVER TIGHTEN. THIS IS A PLASTIC INTAKE MANIFOLD!

42. Reinstall and reconnect all components previously removed or disconnected.

TAKE YOUR TIME AND DO NOT MISS ANYTHING!

43. If you removed the GM strut tower brace, reinstall it using a torque value 16 lb ft per bolt.

44. Reinstall the negative battery terminal.

NOTE: YOU MAY HAVE TO RESET THE CLOCK AND REINDEX YOUR WINDOWS PER THE DRIVER INFORMATION CENTER (DIC) MESSAGES.

45. Start the engine. You may have some initial rough running and the Check Engine Light (CEL) may illuminate if you left an appreciable amount of cleaning chemical in any of the engine cylinders. You may also have some significant exhaust smoke based on the cleaning chemical you used. This should pass within about 2-4 minutes. If not, turn the key off and try again. If the rough running, CEL light and exhaust do not clear quickly, you probably broke something or didn't put it back correctly. If so, turn the car off. Disconnect the negative battery terminal and retrace

your steps.

If you do have significant amounts of thick exhaust smoke (more than a minute's worth) based on your cleaning chemical in use, then you should probably change your oil and filter very soon to remove any carbon deposits that may now be in your oil.

Appendix - Advanced Cleaning

As you looked into your different input ports you should have noticed the valves in different positions. Some are open. Some are closed. Others are in between.

For the closed valve input ports you can add your cleaning chemical directly as the closed valves will stop the liquid from draining into the cylinder.

Spray a **very small** amount of cleaning chemical into the “perceived” closed valve input port to determine if it pools or drains out. If it pools (wait a few seconds to be sure), then add more to fill up the port and allow the chemical to do its job. After chemically soaking the input port / valves for the required amount of time you can remove the chemical by using a rag or a suction device (e.g. wet dry vac, turkey baster, etc.). If the port / valves are clean, wipe the port out with a rag. Then let it air dry or blow it out (e.g. car dryer, compressed air, etc.) to dry. Proceed onto the next closed valve input port.

If the valves and input port are not clean, you can scrub them. A nylon or brass brush tend to work well. **DO NOT USE STAINLESS STEEL BRUSHES.** You can find the brushes at most auto parts stores. The brass brushes in rifle / gun cleaning kits are also reported to work well as they provide long rigid handles to work with. I’d suggest a kit for a 9MM or larger. Look for these at your local sporting goods store. Add cleaning chemical as needed while scrubbing. As stated above, make sure the input port / valves are dry when you’re done cleaning them.

For the open valve input ports you will need to rotate the engine crankshaft to cause the open valves to close. There is a 19mm bolt at the bottom front of the engine.



You can turn this bolt with your socket or torque wrench to rotate the crankshaft. When turning the crankshaft you will encounter compression resistance from the already closed / closing valves. The best way to alleviate this pressure is to remove the spark plugs. To remove the spark plugs you will need a 5/8" spark plug socket (rubber insert) with a 6" socket extension. Be careful with the spark plugs to avoid cracking the ceramic insulator.

Repeat the cleaning procedure for each input port as you close its valves until all 6 input ports and 12 valves are clean.

Note: When rotating the crankshaft it is best to have an assistant observe the closing valves in the input ports so you can just focus on turning the crankshaft.

Before reinstalling the spark plugs, look closely at the tips. If they are fouled with oil / carbon, replace them. Set your torque wrench to 15 lb ft for spark plug reinstallation. **DO NOT OVER TIGHTEN. THIS IS AN ALUMINUM BLOCK!**