WA Technology

Adding a Catch Can to a 2014 Z51 & 2017 Grand Sport

(and why I won't add one to my C8!)

The addition of a catch can to a Grand Sport is presented first, followed with the more detailed description provided of the initial install in our 2014 Z51. An Appendix has extra related material to "coking."

The Grand Sport has a significantly modified PCV system from the dry sump in the 2014 Z51. Tried to define what the new system does to be confident a Catch Can would NOT cause any harm and perhaps how effective it might be.

I'll first cover the differences, a test performed and deduction defining, at least at idle, the source of the clean air that must enter the crankcase so it can exit with the purged oil residue and combustion products through the PCV system.

WHAT ABOUT THE C8? **Frankly since I collected about half the oil with my Grand Sport than my 2014 Z51, I think GM did a fine job of keeping oil and condensing oil mist in the crackcase. I expect they did even more for the C8. For my street driving, with a low percentage of WOT, don't think it's needed!**

PCV Systems:

In the 1960's, before the EPA dictated PCV (Positive Crankcase Ventilation) systems be used to ingest and combust the blowby past the piston rings, oil mist, oil drops and oil vapor burned after hitting the hot pistons, etc. cars employed "road draft tubes." Appendix has more details.

Catch Can:

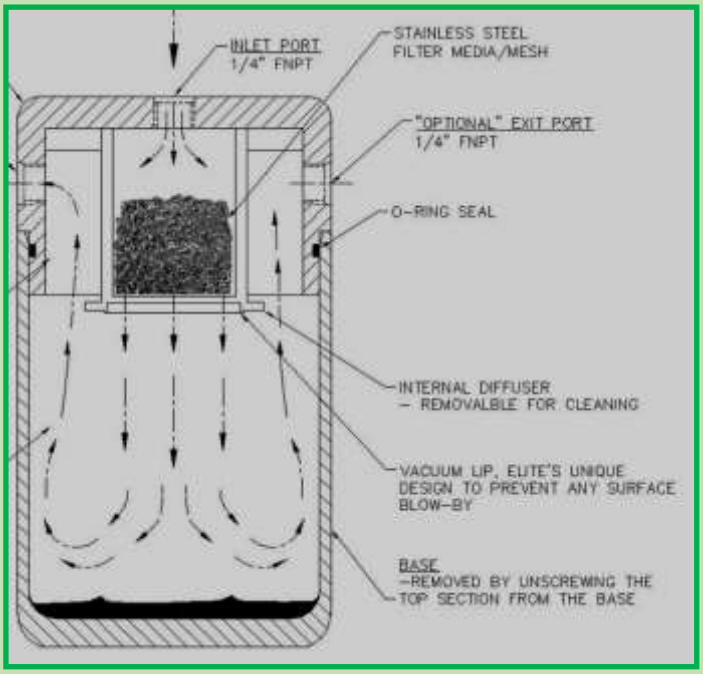
In short, a "Catch Can" catches and collects some of that crankcase "stuff" before it goes into the intake manifold. Once there, along with air, it flows past the very hot intake valves where some bakes on the hot valve stem and valve back. That baked oil and "stuff" is called "coking." With a DI engine, like the LT1 and LT4 there is no gasoline passing over the intake valves with the air and oil as it did in the C6 and prior Vettes. In those engines with port injection or carburetors, gasoline, with additives, was able to clean off this "stuff" before it could bake on the back of the intake valves.

However, the material the "Catch Can" collects *MUST* be frequently removed (every few thousand miles) discarded, or it could cause problems. GM and the EPA are not going to allow such a device to be added if there is not a guarantee it will be properly maintained. *Since many don't even monitor and correct their engine oil level, etc, as is recommended, that cannot be assured.*

Enter the “Catch Can”

A “catch can” has been used for a number of years to minimize the crankcase blow-by and oil mist from entering the intake. In race cars the concern about this “stuff” entering the intake is not the long term “coking” or contamination but the inferior performance caused mixing oil etc. with the air fuel mixture. It does burn, but not as uniform and affects performance to some degree.

Some of the early “cans” were very simple, just allowing the crankcase vapors to condense before being sent on to the intake. For cars used as daily drivers the newer designs include a number of improved features. The picture upper right is the E2 model I purchased from Elite Engineering.



On the left is a schematic of the E2 from their website. It simply replaces the existing hose from the crankcase to the Intake. The inlet on the top of the “can” takes the vapors and residual from the crankcase and before it goes directly to the intake hose barb, as it does in the stock LT1, it passes through stainless ribbon media as shown. This allows oil vapors to agglomerate into large drops and pass through what they call an “internal diffuser.” It is a perforated plate that retains the stainless media. They include a “vacuum lip” to stop the flow from immediately going to the exit ports located near the top of the can. This slows the flow and the oil particles collect in the bottom of the can. There are two exit ports. One can exit just connects to the existing hose barb in the intake manifold. The other requires a hole to be drilled in the air intake duct ahead of the throttle body.

I decided not to use the second exit for two reasons. **First, after considering the way I drive the car, not tracking, its none-supercharged and my spurts at WOT are short in duration, it didn’t appear the second line was really needed. The second reason is I am still trying to fully understand is when the pressure in the intake manifold side of the throttle body is higher than in the duct before the throttle body such that the higher pressure in the crankcase would have a preference to go in that line. One explanation is the reversion pressure pulses in the intake manifold that occur. However even at WOT the average pressure *is still lower* in the manifold than in the air duct before the throttle body! It must be for air to flow in that direction!**

Perhaps because of the reverse pressure spikes from the manifold to the intake tube, that is when outflow from the "catch can" would preferentially go through that added line. In ~5 years I have not seen evidence that adding that line is a significant benefit in my situation! See attached Appendix for information about the pressures related to this issue.

Also, the car can be converted back to stock by simply removing the Catch Can and lines and replacing the OEM PCV hose that were removed! *In fact, did that when I sold the 2014 Z51 so the "Can" could be put on the Grand Sport!*

Clean Oil Separator:

The "catch can" takes care of the oil residual from the PCV system but there is one more oil contamination issue to consider for the 2014 Z51 dry sump engine. With that dry sump engine, a scavenge oil pump attempts to remove all the oil from the crankcase to an external tank. To accomplish this, this pump must also pull in air. This oil/air mixture is brought to the external tank. However only oil not air-entrained oil must be returned to the engine, via an oil delivery pump. Therefore, this oil tank is internally designed to separate the air. The "burped" air, as it is sometimes referred to, is delivered back to the air intake. In the 2014 LT1 dry sump enters after the air cleaner. This air may contain a small amount of oil mist. This mist is carried with the air and is ingested by the engine. The amount of oil mist can be minimized. Looking at the "clean oil separator" construction, it functions in a similar way to the "catch can." The exiting air from the oil tank is passed through media in the "oil separator" that replaces the oil inlet cap. As shown in the above picture, this cap replacement is higher and if disassembled contains similar media as the "catch can." The air and oil mist enter the bottom of the can and the mist can agglomerate into oil droplets that fall back into the tank. It has to be removed when adding oil, at which point it can also be disassembled by unscrewing the outer shell and the parts cleaned.

For the Grand Sport, there is not a need for the Clean Side Oil Separator as there is not a line from the dry sump tank to the air inlet tube for "burping" air. That burped air is "*probably"* routed, some way, back to the crankcase via hoses going into one of the valve covers. *Can't be sure.*

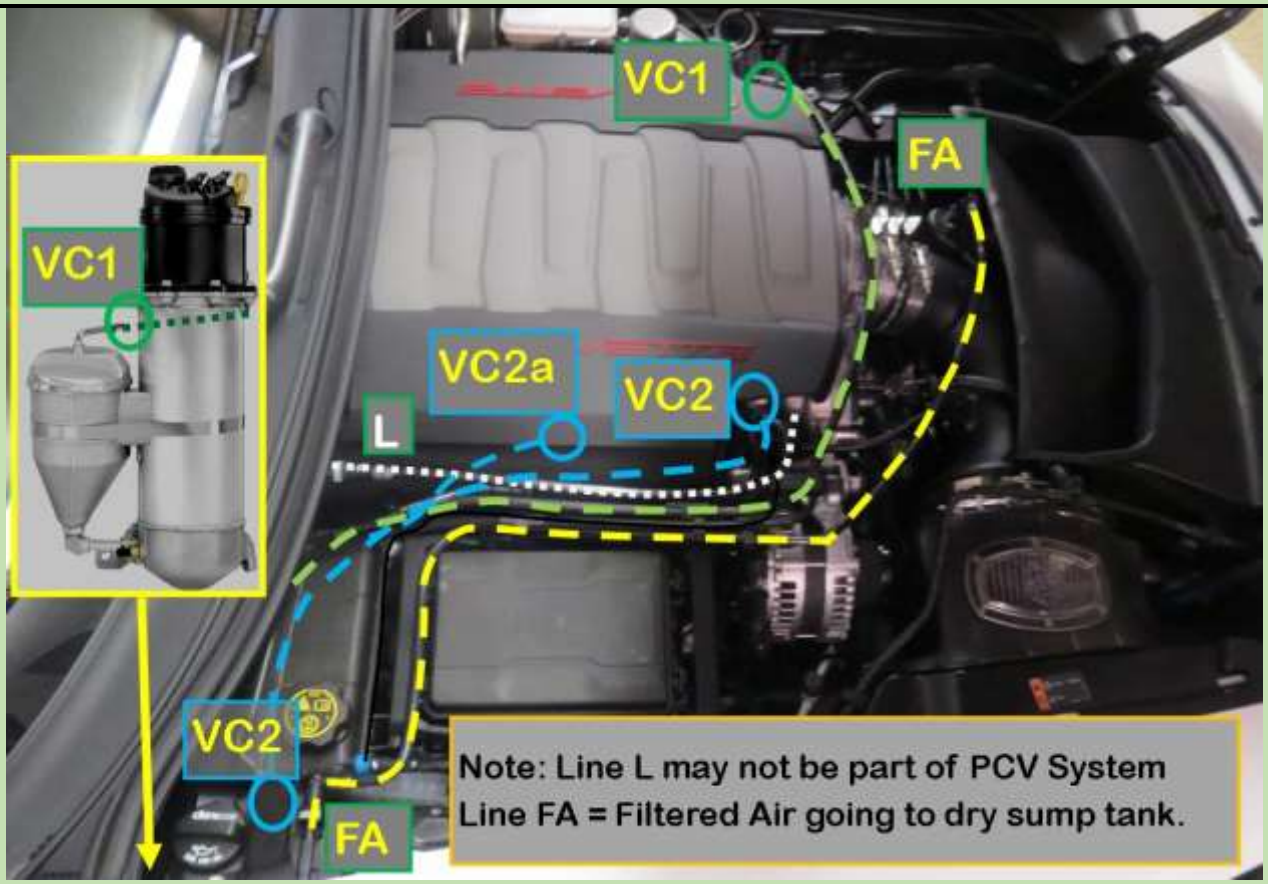
A test was made with results presented that validates what one catch can manufacturer stated, that the single line going from the air intake tube to the dry sump tank is bringing in the needed clean air to the PCV system. Therefore, the burped air issue is "*probably"* managed by the hoses and valves connected from the dry sump tank to the engine valve covers.

INSTALL CATCH CAN ON 2017 GRAND SPORT

Before installing a "Catch Can" in the Grand Sport I wanted to define the differences from the 2014 Z51 in the lines going from the engine to the dry sump tank. The need was reinforced by recent comments from Tadge Juechter, the Corvette Chief Engineer (see Appendix) of changes made in dry sump systems. One key difference is the 2014 Z51 dry sump had two lines going to the air intake tube. One to bring clean air into the crackcase for the PCV system and the other to take burped air from the dry sump tank to the air intake tube. The Grand Sport only has one. First question, *what is that line for?*

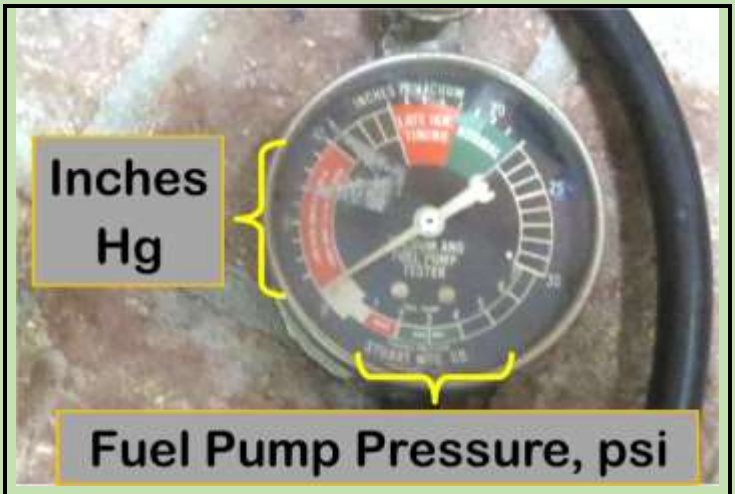
Pic below shows the lines coming from the engine to the dry sump tank and the one going to the air intake tube. Following that pic is a comment from a catch can producer and our test result that indicates line "FA" brings Fresh Air from the air intake tube after the air filter into the dry sump tank. Still have no idea what line "L" does. It goes from a fitting on the front of the engine to somewhere behind the engine that is not visible. May or may not have anything to do with the PCV system!

Line VC1 goes from the driver's side valve cover to the small auxiliary dry sump tank that is attached to the large tank. Line VC2 & VC2a go from the passenger side valve cover to the top of the main dry sump tank! What all those lines carry and when is not clear! The oil/air scavenge pump probably provides a small vacuum in the crackcase so the pressures involved that dictate how air, air carrying crackcase "stuff" are small and the paths cannot be deduced from the info available. I'm sure GM has done the best job possible of designing the PCV system to minimize "coking."



The Grand Sport has essentially the same PCV valve/hose arrangement as my 2014 Z51 (pic right.) It has a short PCV hose that goes to a passage to the intake manifold in a similar place as the 2014 C7 Z51.

I was catching and discarding about an ounce of "stuff" in the "Catch Can" every 1000 miles. An ounce that was not available to bake on the back of the intake valves. The reduction in oil flowing through the Grand Sport PCV hose is significant. Now collecting about a half once of "stuff"/1000 miles!



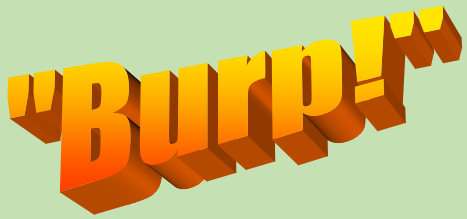
The 2014 Z51 had two hoses going to the air inlet tube, one to take fresh air into the crankcase, the other for burped air from the dry sump tank. The Grand Sport only has one. What does it do?

A catch can manufacturer replied to that question I asked on a forum. He said it was to bring air into the dry sump tank for the PCV system.

Hmm, then what about the burped air, where does it go? Devised a test using a vacuum gauge to validate the comment.

Connected a vacuum/pressure gauge to outlet from the dry sump tank going to the hose attached to the air intake tube. Question, with the engine running, was there air flow coming out causing pressure and indicating the line is for transporting burped air to the intake tube? Or was there a vacuum indicating it would be pulling in clean air to replace the air that was being pulled, with crankcase "stuff," through the PCV valve and hose and entering the intake manifold?

The answer, it was a slight vacuum when operating on a cold engine at high idle. This validated the catch can manufacture who said that line was the source for fresh air!



When investigating oil foam formation, it was found high speed pumps can cause foam to occur. What better place than in an oil scavenge pump also pumping lots of air?

***Can't say for sure*.**

Hmm, if that line is for fresh air to the dry sump tank, where does the burped air go? *Probably* back through one of the valve cover lines. Can't really define the pressures involved or flow directions with the given information.

Also wonder, if the "burped air" is now not going to the engine air intake- why is there still the 500-mile oil change for only dry sumps. Possible answer is suggested left.

Cleaned the Catch Can removed from the 2104 C7 Z51 including the stainless steel filter media with alcohol.

Moved a ground connect where the can bracket will be placed to the ground 3 inches toward the front of the car. Two grounds fit easily. Tighten both securely to the aluminum frame.

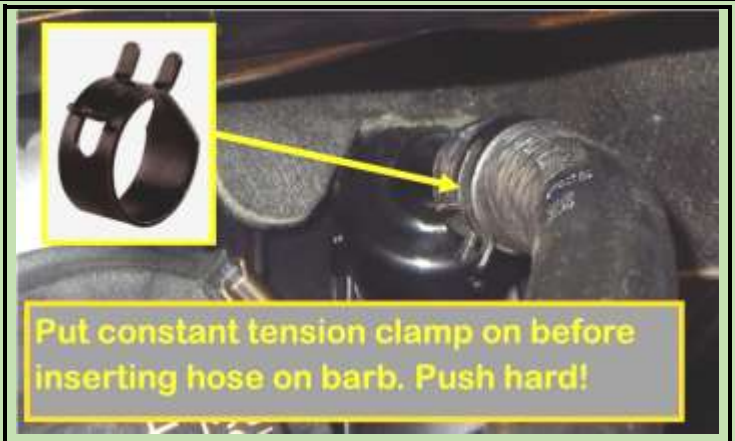
Used an 8mm stud and a Nylon Locking Nut to secure the bracket. Provides a solid mount.

Removed the driver's side plastic rocker arm cover. Comes off with your fingers. See 2014 install that follows for details.

This gave the access needed to the OEM PCV hose. With the 2014 also loosened the plastic valley cover but not needed for access for the Grand Sport.

The trick in releasing the clamps on the PCV hose is to press the release side with the tip of a large screwdriver.

Place the flat end on the release tab and press while pulling the fitting off of the barb. Worked for both hose ends. Off in minutes.



Though I might have to use a longer "can" hose than on the 2014 but the lengths were perfect.

Constant tension hose clamps come with the Elite "Can." Installed it in the correct area before putting on the barb and just pushed on with enough force to have the hose fully on the hose barb.

CAPTURE RESULTS IN GRAND SPORT

With limited data in two checks it appears the new PCV system has accomplished a significant reduction in oil going from the crackcase to the intake manifold. It is still captured in the "can" but instead of 1 oz/1000 miles, in two checks it collected only 0.50 oz/1000 miles. A 2-fold reduction.

Still better to collect that 1/2 ounce/1000 miles than have it go into the intake manifold and some amount bake on the hot intake valve. We'll continue to monitor the volume collect and update this information if there are observed changes.

This is the short OEM PCV hose. Will keep if needed to return to stock. Could be accomplished in <10 minutes!

DETAILS, CATCH CAN INSTALL ON 2014 Z51

This is what Elite delivered. It consists of their E2 "catch can," a "clean air oil separator," hoses, fittings, and hose clamps.

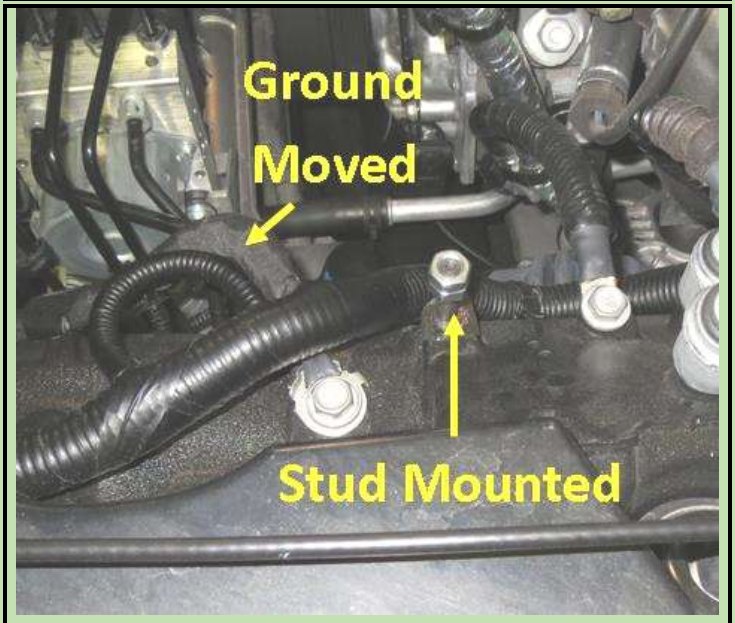
I selected the extra cost AN end fittings since the screw fitting connections make it easier for cleaning (they also look cool, similar to the branded stainless AN lines on my Pro Street Rod!)

The billet aluminum attachment bracket is separate and has a machined fit. It is easily installed with the supplied screws. I used some blue Loctite.

The “clean oil separator” has the same screw configuration and captive large “O” ring seal (red arrow) as the OEM oil tank cap.

I also ordered a check valve in case there was: 1) one in the existing OEM line from crankcase to intake (there was not) and 2) if I was going to add the second hose later. It is definitely needed in that case so air doesn’t flow from the second hose to the “can” reducing the amount of blow-by coming from the crankcase. The check valve prevents air passing in that direction. In my install it was not needed or used, no reason to restrict air movement so just matched the OEM system.

The first issue was to move the ground connection so the catch can could be mounted by itself on a stud placed in the hole instead of using the exiting screw. Since it is necessary to remove the “can” for cleaning, no need to repeatedly screw into the C7 aluminum frame. Note, three ground connections are visible in this view. I simply moved the ground to the connection on the left (red arrow) - it fit fine! Not sure why GM has all three separate connections. I switched these when the “can” was ordered and as expected it has had no negative effect.



Brought the OEM screw to my local Ace Hardware and purchased a short 8mm stud and installed it into the threaded boss on the frame using double nuts. The nuts were then removed and the “can” held in place with a Nylon lock nut. The relocated ground is visible in this picture. Even then the electrical connection is better than it would be if placed on top of the anodized aluminum bracket as suggested in the install instructions!

I removed the valve cover plastic covers and also loosened the top plastic engine cover studs. This helped gain access to the needed hoses and barbs. If you have small hands (I don't) you may get by without removing these items but it also allowed me to take these pictures. Just grab the inside edge of the cover with both hands and pull up. That is one hand in proper position while the other holds the camera!

This is the back side of a valve cover- plastic cover. The top two rubber cups engage the tops of four studs that hold down the engine plastic cover. The bottom shows the two hooks like attachments that slip into slots that secure it to the engine.

After removing the valve cover- plastic covers there are four long studs that need to be removed. These have a 10mm nut at the bottom. Thought this would be easy as I just needed to use my 10mm deep socket. However, the balls on the stud top were larger than the socket ID near the top! Was able to wedge a 10mm box end wrench on the nuts. Fortunately, it only required a slight turn to loosen since that is all the room available! They then unscrewed by hand.

These are the four posts that were removed and where the ball on top fits into the rubber socket in the valve cover-plastic cover. The pic also shows the crankcase to intake OEM PCV system hose that was removed. Press in on the gray tab and it releases the catch that holds the fitting on to the barb. Press hard while pulling. This hose has no check valves etc.; it is simply a large ID hose. Decided not to use the purchased check valve since it would be somewhat more restrictive and was not on the OEM system. Will save it if I decide to install the second exit hose from the can. For now, that can exit hole is blocked with a 1/4"inch NPT plug.

To remove the engine cover would require disconnecting more than needed for access to the hose barbs. Used a piece of wood to wedge the front up. Inserted the two short hose in the kit on the two barbs where the OEM hose shown above was removed. Left them the original length, for now. Note I put the clamp on prior to inserting the top hose on the barb. That hose will go to the "can" side outlet. It slipped on with the clamp in position with modest force and access issues. It would be difficult, with my fat hands, if I tried to expand and slip the clamp down after the hose was placed on the barb.

The "can" fittings were installed and aligned so the hose had a minimum bend. I used thread sealer. The hoses were cut to the length needed with an anvil cutter (a single blade razor could be used.) If you make them too long they could rub on parts as the engine moves when running. Measure twice and cut once, if too short, you're out of luck!

I installed the AN fittings on the hose and threaded them on to the "can" fittings.

"Catch Can" Install Completed

Installing the "Clean Oil Separator"

I removed the radiator air duct to take these pictures and to better see the hose connection. Four 7mm bolts hold it in place. The right-angled fitting shown in the picture is removed the same as others, press in on the gray button and pull.

The long hose supplied with the kit is placed on the hose barb in the air duct. It is then routed through the plastic clamps where the OEM hose was removed. Unlike the OEM hose, which is stiff and pre-bent, it is not. But it fits fine.

The "Clean Oil Separator is made in several parts but comes assembled. The plastic base screws in the same as the original oil cap. Then there is an "O" ring sealing the aluminum insert to the plastic base. These were difficult to separate in my case. In fact, a Forum comment got me to try.

This is a finished photo of the plug supplied (right) that is placed over the barb where the OEM hose was removed. The hose from the air intake is placed on the barb on the "separator."

Note, when adding oil, you need to pull the "separator" out of the plastic holder that is screwed into the dry sump tank.

"Clean Oil Separator" Install Complete

Comment About the Elite Engineering Product:

Both the "catch can" and "clean oil separator" are well made and have an excellent finish. The threaded parts fit perfectly and are easy to assemble. The hose and clamps are fine quality. They look great, OEM and professionally installed in the engine compartment.

Time to Check Oil Level Accumulation and Cleaning:

If you want an OEM type appearance, spend the extra $26 and get the Military AN fittings. I have the proper aluminum AN wrench for my Street Rod where all fuel lines are AN fittings but you can put masking tape on an 11/16-inch wrench to protect the finish.

As noted on the install, I moved the electrical ground connection and installed a stud to replace the bolt. Makes it easy to remove the assembly. Here you can see the small amount accumulated which is about the same amount I removed a month after install. Only about an ounce in ~1000 miles. But better the ounce is removed than some baking on the intake valves! Side view shows the height of the container that houses the ribbon like stainless wool. It catches oil vapors and mist and causes it to form larger drops that fall into the bottom on the can.

This is a top view. As with all the construction, the threads are cut perfectly and screw precisely into the inside machined top of the can. Very professional. Had there been more accumulation, would have run mineral spirts trough the stainless ribbon to clean it.

Cleaning the "Clean Oil Separator"

This process is straight forward. The bottom machined aluminum baffle unscrews from the one-piece black top, as shown left. Pour some mineral spirits in the top over the stainless ribbon and watch it pour from the outlet hose barb. It will run clean quickly. When it runs out clear it's clean.

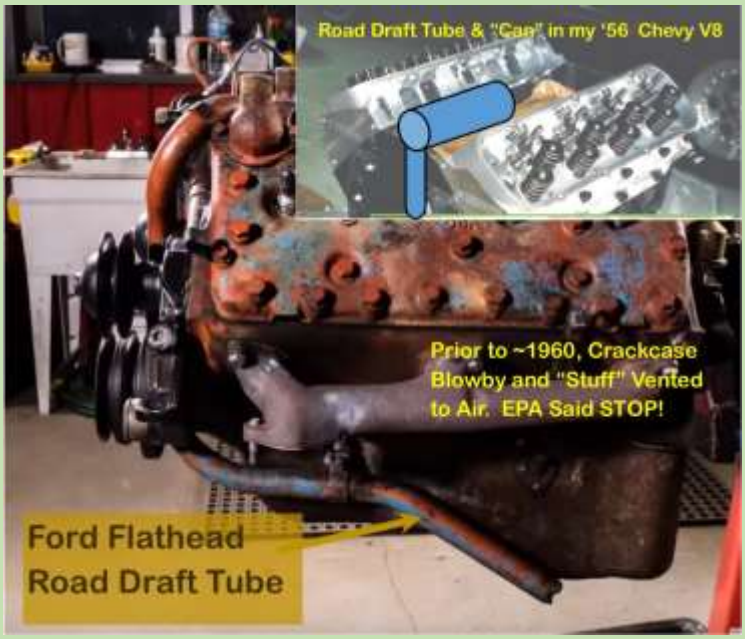
Mineral spirts evaporates quickly.

APPENDIX

This appendix covers several subjects:

1. **Why the need?**
2. **Why the need for the second "catch can" exit hose?**
3. **Problems with "coking" in Direct Injection Engines**

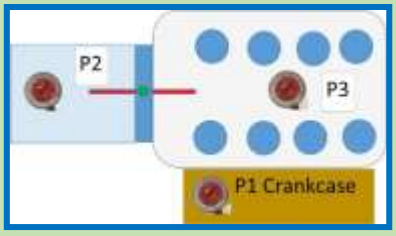
Internal combustion engines have combustion chamber blowby entering the crackcase. Fine oil mist is created by oil flowing from rod and main bearings hitting a high speed spinning crackshaft. Some of those particles hit the bottom of the very hot pistons and burn(oxidize!) All that "stuff" has to go somewhere or it will build pressure in the crackcase. Prior to the 1960's it was common to use what was called a "road draft tube."



Recall the one on my'56 small block V8 Chevy. It consisted of a soup can size container filled with steel wool that was located in the lifter valley under the intake manifold. It had a ~3/4 inch diameter tube attached that went from the can and exited near the bottom of the oil pan. When the car was moving all the blowby and other "stuff" in the crankcase came out in the atmosphere. If you burned oil, "smoke" would come out from under the car. Not good for the environment! In the 1960's the EPA rightfully said stop dumping that stuff in the air! Today PCV systems suck that crankcase "stuff" into the intake manifold so it can be burned in the combustion chamber.

Need for the Catch Can Second Outlet Hose

OK a Catch Can can help collect and condense some oil vapor so it doesn't go into the intake and bake on the bak of the hot intake valves. I have tried to define if the second outlet were attached as directed to the inlet side of the throttle body, when the pressure would be lower than in the manifold or the downstream side of the throttle body. Is the second line needed for a naturally aspirated engine? I have not defined why but I accept since a number offer that feature it is of some benefit in some situations. But why?



The schematic left shows the pressures and locations in question. The OEM hose where the "catch can" system was added is between the crankcase, P1 and the intake manifold P3. Since our business is controlling gas through a hole (Argon for welding) I used those rather complex flow equations to define the pressure difference P2 to P3 at wide open throttle (WOT.) Looking at the LT1, at 6500 rpm the air flow through the throttle body at WOT will be about 700 cubic feet of air per minute (CFM.) That assumes an unrealistic 100% volumetric efficiency but that is good enough for our calculations. The throttle body is 3.4 inch (87mm) diameter. If the pressure at P2 is atmospheric, 14.7 psia, then to flow 700 CFM of air through a 3.4 inch diameter hole (forgetting losses due to the throttle plate etc) would require about 0.5 psi higher P2 pressure than P3. Therefore the manifold pressure P3 would be about 14.2 psi. I also assume the crankcase pressure is positive, i.e. greater than 14.7 psia. That could be wrong depending on the dry sump oil scavenger pumps. In some racing engines they use very large

pumps to create a vacuum, which can add significant hp! One report shows that a 10 psia crankcase pressure (a 4.7 psi vacuum) achieved a 15 hp increase at high rpm! It is attributed to reduced windage.

Elite, in a forum post, indicated that "…*the 2nd port is a factor anytime the throttle is opened from 2/3 to WOT by using the suction (*lower pressure than in the crankcase*) present upstream of the throttle body when reversion pulses in the intake manifold cancel any measurable vacuum. Then the PVC system stops evacuating and pressure builds in the crankcase possibly pushing oil vapors backwards out of the fresh side inlet allowing oil injection*." They no doubt have real pressure data so I accept their proposition. Although the P3 "average pressure" must be slightly lower than P2 too have 700 CFM flow in that direction (flow goes from high to low pressure.) However, higher pressure short pulses exist! Perhaps if tracking the car where it can be at WOT for a long time that second line is a benefit. However my WOT situations, although often frequent are for very short duration. Relative to the amount of miles I put on my daily driver the time at WOT is insignificant.

As the throttle closes from WOT the pressure in the manifold reduces and even more blow-by would go to the manifold and little, if any, to the downstream connection. A check valve would have to be put in the hose placed before the throttle body to prevent the higher P2 pressure flowing air back through the can to the lower pressure P3.

BOTTOM LINE, SECOND OUTLET HOSE NOT USED

For two reasons I kept the one exit hose set-up. First, the amount of my WOT is in short bursts and a very small fraction of my driving. Frequent but not high on a percentage basis! The second reason is it can be returned to stock with little effort if, which I did when the 2014 was sold to install it on the Grand Sport!.-

Reduces Oil Residue Problems

The Stingray LT1 engine has great performance. One reason is the higher compression tolerated because of the more efficient Direct Injection (DI.) Similar to a diesel engine; fuel is injected directly in the combustion chamber. However, this advance has a downside, there is nothing to help clean the oil residuals coming from the positive crankcase ventilation (PCV) system. In the 1960's blow-by past the piston rings was no longer allowed to be vented to the atmosphere as was prior practice. This vented crankcase air also contains fine oil mist created when the fast spinning crankshaft impacts oil particles. Some of this fine mist is heated to high temperatures as it contacts the hot piston. This combination of combustion products and contaminated oil is feed back into the engine intake by what is referred to as the PCV system. A PCV valve controls the amount allowed to enter the engine as manifold vacuum varies.

Direct Injection Causes Some Problems:

The oil residue can accumulate and bake on the back of the hot intake valves. This is referred to as "coking." This changes the carefully contoured passages that promote high horsepower and smooth performance. With carbureted or port injection the gasoline with cleaning additives, washes past the intake passage and hits the back of the intake valve. This cleans those surfaces and minimizes residual build-up. However, with direct injection (DI) there is no gasoline to help clean this residual and keep it from accumulating. Only air and PCV residuals pass the valve! This is not just a Corvette problem; it has been a concern for Ferrari, Porsche, B&W and others who have introduced high performance DI engines before GM. The 2009 Ferrari 458 Italia's 560 hp 4.5 liter V8 is a DI engine. Their forum posts indicate "coking" is concern and there are discussions about using an intake cleaning process at each oil change that employs a vapor or liquid cleaner added to the intake with the engine running!

Toyota has an engine that uses DI and port injection that they use periodically! In fact, so does the ZR1, primarily when peak power is needed but it will wash some of the oil residue away before it can bake and created 'coking."

Another Possible Reason to Do Something

An article in the December 2014 issue of Hot Rod magazine quotes several GM engineers who were discussing the LT4 with the author Brandan Gillogly. John Rydzweski, Assistant Chief Engineer for Small Block V 8's was one of the two engineers.

This is a quote by the author NOT one of the GM engineers:

"A little bit of oil on a port-injection engine can help lubricate valves, but because the Gen 5 V8's (all C7's as the LT1) are Direct Injected, there's no fuel washing the back of the intake valve. That means oil in the PCV system can end up sticking to the back of the intake valves impeding airflow and eventually preventing the valves from seating properly."

I emailed Gillogy and asked about that statement. He responded and said it was discussed during his interview. This is not a simple problem that GM uniquely solved! I'm sure they did all they could but without a long term history of how the car performs the way folks drive, it will take time to find out.

You may recall the oil company ads that talked about the cleaning additives they added to their gasoline:

The picture left is from Shell and shows "coking" without their cleaning additive and a clean valve with it. The picture right shows "coking" without cleaning additives and with varying amounts added; 1.1, 1.7 and 2.7 units. As noted, it gets less with added amounts.

However with a DI engine the gasoline is injected directly into the combustion chamber and the back of the valves never see it! It's worse than no additive since gasoline by itself is a pretty good cleaner! A DI engine doesn't have what we all have been experiencing for years with carburetors and port injection!

Don't think you're doing any cleaning of the valve backs by running the engine at high rpm and "blowing it out" with a rich mixture! The only thing passing over the valves will be more air and PCV blow-by!

Is it a Real Performance or Just a Cosmetic Issue?

A question was asked and the Chief Corvette Engineer, Tadge Juechter, who provided this answer in July 2015 in a monthly Corvette Forum Column called *"Ask Tadge":*

Question:
Is there any issue known with deposit buildup on the back side of the intake valves due to not having a port injection system?

Is GM aware of, and if so do they have any plans for correction with the intake valve coking issue present in the direct injection platforms as a result of the PCV system. Many members of the community are seeing an excessive amount of oil and carbon deposit buildup on the intake valves after only 5,000-10,000 miles and worse with even higher mileage engines on the C7. While I understand the purpose of the PCV system as it relates to emissions, with the introduction of direct injection there is no longer a cleaning process in place that would be naturally present such as from a port injection system.

Tadge Answered, Quoting Exactly:
"Good technical question. The short answer is: No, we have not seen any issue with deposit buildup on the back side of the intake valves due to not having a port injection system.

You correctly point out that the continuous flow of clean air and gas over the intake valve tends to keep it very clean. That has been a characteristic of small block V8's for decades. Of course, appreciation of that characteristic is limited to those who disassemble their engines. Most customers are unaware.

Given that all SIDI engines give up that benefit in favor of other important attributes, we did extensive testing to make sure there were no customer-observable penalties. We intently looked for unusual deposit formation during the entire Gen 5 Small Block development phase (4 years) as well as the 200,000 mile in-vehicle long term testing. We have not seen anything unusual and zero performance degradation. Granted, deposit formation on SIDI engine intake valves is greater than what is seen with PFI engines, but the Gen 5 engines are typical for SIDI engines, and in fact better than other SIDI engines we have benchmarked. So the bottom line is that we believe the carbon build up is only

an internal cosmetic issue, not anything that will affect customers over the life of their cars."

A more recent posted comment from Tadge about the PCV stem relative to what is reported to be a "Catch Can" system recently added to the Camaro (which is NOT what it is!) Quoting:

"The Corvette's dry sump tank looks relatively simple on the outside but the internals are really quite complex. The top third of the tank contains a PCV air/oil separation system. On the Corvette, PCV lines route from the valve covers to the air/oil separator on top of our dry sump tank. Oil from PCV air is separated and returned to the lube system through the oil tank. The PCV separation system on Camaro V8 performs a similar function except oil is returned to the engine oil pan from the PCV separator's drain back tube. The Camaro V8 PCV air/oil separator is more complex than a "catch-can" since it not only separates oil from PCV air it provides a drain back path for this oil to be reused by the lube system.

"Catch-Can" systems that do not have a drain back path for separated oil run the risk of poor oil pressure performance over time as oil is removed from the lube system.

The bottom line is that both cars use optimized engineering solutions for their lube systems based on vehicle architectural considerations."

My view of the comments: **Tadge admits there is carbon build-up, they looked for "unusual deposits" in their 4 years of development, and found the Gen 5 is typical of SIDI engines (*which some car companies admit are a problem because of carbon deposits*) but believe the carbon build-up is a cosmetic issue and not something that will affect customers "*over the life of their cars."***

In addition, with 5 years of history there is no documented evidence this "cosmetic issue" has caused performance problems.

So a deposit will occur, the remaining question, is there a way to minimize it?

Tadge's comments about the dry sump reflect the different hose arrangement in my Grand Sport. In fact it does have some ability to return some oil residue back into the oil reservoir. However the Grand Sport, although having additional lines and using hoses from the valve covers to the dry sump tank *still has a PCV hose coming from the crankcase and going to the intake manifold!*

Pic left shows essentially the same PCV (Positive Crankcase Ventilation) valve and short hose taking crankcase fumes, burnt oil from droops and mist hitting the hot pistons etc. and "injects it in the intake system then combusts it I the combustion chamber. That still means this oily "stuff" passes over the backs of the hot intake valve and can cause "coking."

If the new system does in fact produce significantly less oil "stuff" the three should be less in a "Catch Can" to catch! The single outlet Elite Catch Can I added to the 2014 will do no harm.

Understand Tadge's comment about the use of a catch can, quoting above:

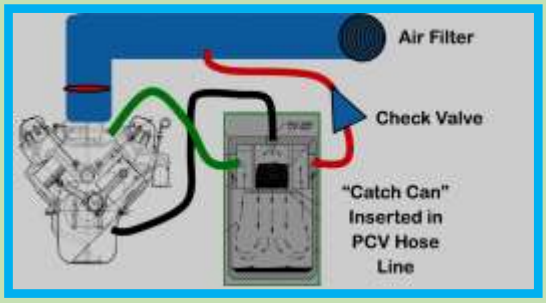
"Catch-Can" systems that do not have a drain back path for separated oil run the risk of poor oil pressure performance over time as oil is removed from the lube system."

Since many folks don't check oil level or tire pressure as they should how could GM expect them to 1) empty a catch can so it doesn't clog with oil and 2) be sure there is sufficient oil in the system? They can't!

However don't understand this part of the statement: *"..as oil is removed from the lube system."* The PCV system, by definition, removes some oil from the system and pulls it into the combustion chamber to be burned! Some oil is lost as it performs that function. All the "Catch Can" does is collect some of the oil so it can be discarded before it has a chance to bake on the intake valves. However if the collected oil is not periodically removed from the "Can" it would block the PCV function and cause engine and emissions issues.

Problems Reported with Catch Cans

One catch "catch can" manufacturer offers a two outlet can and includes a check valve in the plumbing. A check valve is needed in a "can" having two outlets, one outlet in the intake manifold (where the OEM PCV hose goes) and another added to a hole cut into the air intake tube. That requires a check valve OR air flow would occur from the line in the air intake tube though the "can" to the intake manifold and reduce any flow from the crackcase! *It was reported that they made an error on some shipments and the valve was placed in the wrong flow direction!* Can see where that would void warranty!



If a Catch Can is So Good Manufacturers Would Add One!

Hmm, many folks don't check their oil level when recommended! Would they check the oil in the "Can," empty and dump it every few thousand miles? If they did where would they put it? (I put mine i the container used for changing oil.)

Doubt the EPA would allow a system to be added that needs to be frequently checked, the oil collected the *properly discarded* to assure emissions levels are maintained!

Why I Added a Catch Can

Some Vette Owners are OCD and worry about fingerprints on the car and use a handkerchief to close the door to avoid them! BUT unlike some who have no idea what the inside of an engine is supposed to look like for max performance-I do and care!

Pic right is the car I built while in high school! That Olds engine I stuffed in may not look great outside but is was bored 1/8 inches with new pistons, ¾ race cam and polished heads and ports. Could see yourself in the polished surface!

More recently, I assembled the 502 cid Chevy crate engine in my Street Rod. I saw all those nice shinny CNC contoured air passages GM spent time to assume max air flow. Hate to think of the back of the carefully contoured intake valves having "baked on oil" disturbing the flow! Fortunately the 850 Holley double pumper has lots of gasoline passing over them that cleans off any PCV "stuff" before it can cause "coking!"

YOUR CAR DO AS YOU WISH- TO EACH THERE OWN!