

# Corvair Positive Crankcase Ventilation (PCV)

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Positive Crankcase Ventilation (PCV) is often misunderstood. First some basics about crankcase ventilation. Next a function explanation. Finally, a discussion of PCV misconceptions.

When the air fuel mixture is compressed and ignited in the cylinder some combustion gases get by the piston rings into the engine crankcase and must be vented. Originally this was done with a “draft” tube connected to the engine that let crankcase gases vent to the atmosphere. The draft tube was designed to send crankcase gasses down and out along the bottom of the vehicle and hopefully not into the passenger compartment. This is an “open” crankcase ventilation system.

GM’s military program in the 1940’s devised a “closed” crankcase ventilation system to prevent water from entering the crankcase when a vehicle forded water. After research and testing, a system was developed that was not costly to implement or detrimental to engine operation. It is now referred to as “Positive Crankcase Ventilation” (PCV).

The adoption of PCV to civilian automobiles was in response to a couple of issues:

- Luxury automakers were keenly aware of “odors” from the engine compartment that were not acceptable to owners. This was before air conditioning was common.
- By the 1950’s it was recognized that crankcase gases comprised as much as 50% of hydrocarbon emissions from vehicles to the atmosphere! Airborne emissions were becoming a health issue in some areas of the nation.

By the late 1950’s GM research laboratories released the design for use by the rest of the automotive industry. Initially required on 1961 vehicles sold in California, by 1964 most vehicles were equipped with a PCV system.

The Corvair PCV system was implemented in model year 1963. The first design used a spring loaded check valve, often called a “PCV valve”. The 1964 models replaced the PCV valve with a fixed orifice as part of the vacuum balance tube. The exception was 1964 and 1965 air conditioned equipped cars which used a PCV valve. The FC models also used a PCV valve system. These vehicles required a low profile dual air cleaner system that used a PCV valve.

So how does the Corvair PCV work? The crankcase gases do not escape to the atmosphere, but are ingested via the intake manifold or carburetors to be burned as part of the air fuel mixture.

The crankcase gasses MUST vent to both the intake manifold and carburetors ( via the air cleaner) so the carburetor air/fuel mixture is not compromised by varying engine speeds and loads. This may seem complicated, but in fact the system is elegantly simple by design as follows:

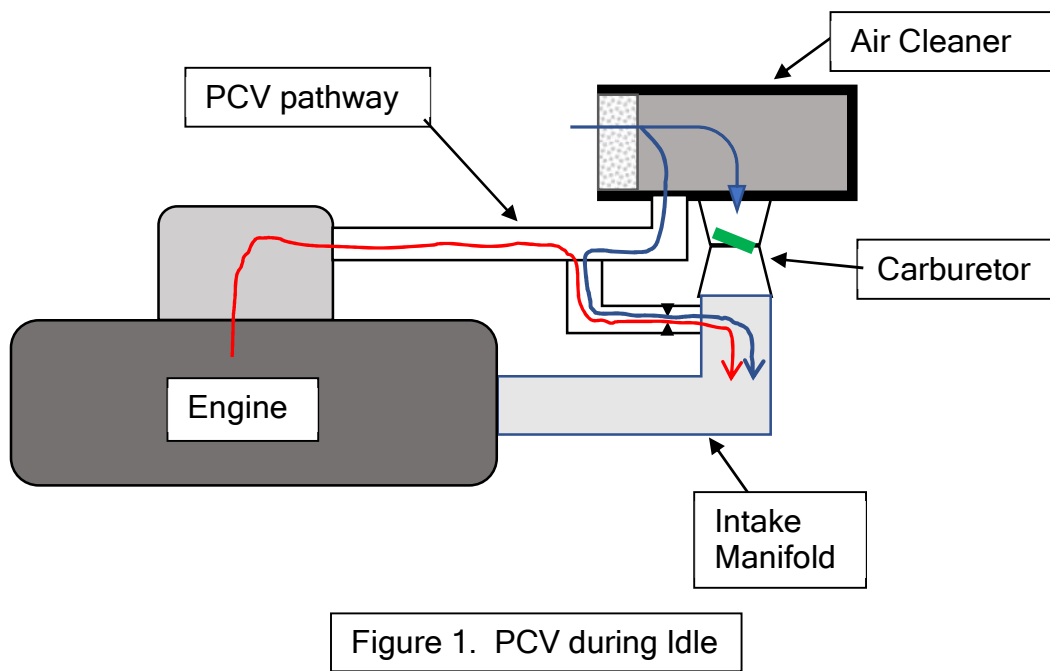
- Crankcase gasses are pulled into the intake manifold by vacuum via a metering PCV valve or a fixed orifice in the vacuum balance tube. This results in a constant impact on the air fuel mixtures that can be compensated for by the carburetor design/calibration.
- Variations in the crankcase gasses volume and intake manifold vacuum pressure are compensated for by a path to the air cleaner and carburetors to ensure a proper metered flow into the intake manifold.
  - When engine vacuum is high and crankcase gasses volume is low, air from the air cleaner mixes with the crankcase gasses to maintain atmospheric pressure at the input to the PCV valve or fixed orifice.
  - When engine vacuum is low and crankcase gases volume is high, the excess crankcase gasses go to the air cleaner to be ingested via the carburetor. This maintains atmospheric pressure at the input to the PCV valve or fixed orifice.

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This allows the air/fuel mixture to remain within optimal parameters during varied engine operations as follows:

- **IDLE** - Manifold vacuum is HIGH and crankcase gases volume is not adequate enough to meet the flow volume demanded by the PCV valve or fixed orifice. A connection to the air cleaner allows filtered air to flow FROM the carburetor air cleaner to ADD to the gasses FROM the crankcase. This prevents a vacuum from forming in the crankcase, but more importantly, it maintains the proper metered air flow via the PCV valve or fixed orifice into the manifold so the carburetor air and fuel mixture is stable. Refer to figure 1.
- **WIDE OPEN THROTTLE** - Manifold vacuum is LOW and crankcase gasses volume is greater than can be consumed by the intake manifold metering device. The crankcase gasses not ingested into the intake manifold go TO the air cleaner and are pulled into air drawn into the carburetor(s) and consumed in the cylinder by combustion. The throttle is open enough to produce a positive airflow through the air cleaner to ensure the crankcase gases do not escape out to the atmosphere. Refer to figure 2.
- **VARIABLE ENGINE OPERATION/LOAD** - The manifold vacuum and crankcase gases volume change in response to; throttle positions between idle and wide open, and varying engine load conditions when driving. This dynamic condition is accommodated by the PCV system dual path from the crankcase to the metered port to the intake manifold and carburetors via the air cleaner.

The Corvair PCV system uses metal tubes and hoses to connect the crankcase to both the intake manifold and air cleaner. Refer to the appropriate model year Corvair Chassis Shop Manual for configuration and service procedures. The PCV system should be inspected to ensure the system is not blocked by debris, especially the metering valve or orifice, at every engine oil change interval. Model years 1964 through 1969 Chassis Shop Manuals state the fixed orifice size is 0.062" for all engines except the turbo that has a 0.089" orifice size. NOTE: The 1965 Chassis Shop Manual incorrectly says all engines used a 0.089" fixed orifice size.



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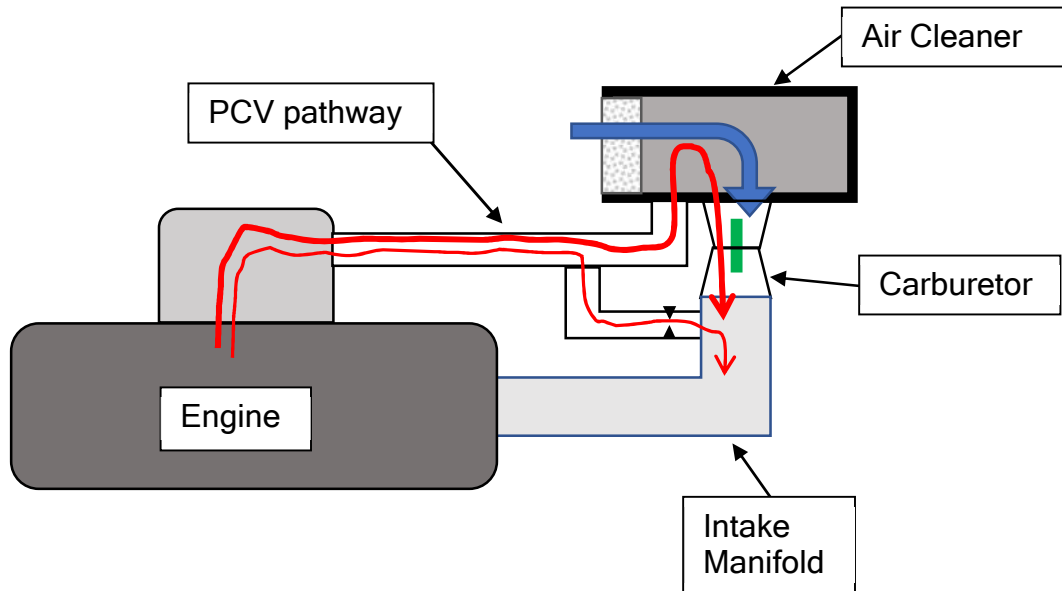


Figure 2. PCV during Wide Open Throttle

#### Misconceptions about the PCV system:

- **The engine runs better if the PCV system is removed. FALSE.**
  - This was a common misconception about early systems due to the combination of PCV with other emissions controls. PCV does not negatively affect engine operation, but the other emissions control systems often did cause poor engine operation!
  - A properly functioning PCV reduces emissions and it is irresponsible to disconnect the PCV.
- **You don't have to connect the PCV to both the engine vacuum and air cleaner. FALSE**
  - This is one of the most confusing issues. The crankcase **MUST** be connected to both the engine vacuum and air cleaner.
  - Why?
    - The engine crankcase gasses must be consumed by combustion via the intake manifold vacuum or the carburetor via the air cleaner.
    - The engine crankcase and input to the PCV valve or fixed orifice, must be at the same atmospheric pressure present at the air cleaner for proper PCV operation.
- **Without the stock air cleaner, you can connect the PCV tube to a free standing air filter. DANGER**
  - A popular modification is to remove the original Corvair air cleaner assembly and install an after market air cleaner(s). Under certain engine operations crankcase gasses will be expelled out the free standing air filter and drawn into the engine cooling fan. These gasses contain poisonous carbon monoxide that could enter the heater system when it is operated and find its way to the passenger compartment causing illness or death!!
  - It is recommended you use an after market air filter assembly with a PCV hose fitting, or purchase a filter to carburetor adapter with a PCV hose fitting.
- **PCV cycles fresh air through the engine to reduce oil temperature. YES AND NO**
  - This is **NOT** the primary function of the PCV system, although on some "V" engines it is a minor side effect. It is **NOT** a function of the Corvair PCV. Some owners have run a PCV hose from the

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Corvair oil filler tube to the air cleaner to emulate the “V” engine PCV path, but as in some “V” engines it can result in engine oil transfer to the air cleaner assembly at higher RPM. The Corvair engine has a baffle between the crankcase and engine top cover to reduce engine oil ingestion into the PCV system.

- **The PCV system requires no maintenance - FALSE.**

- Engine crankcase gases contain products that will accumulate in the PCV system. The rate of accumulations depends on engine operation, and the duration of intervals between engine oil changes. When the Corvair was manufactured the service manual recommended an inspection of the PCV system whenever the engine oil is changed. In particular either the PCV valve or vacuum balance tube orifice must be inspected for accumulation of deposits from crankcase gasses. DO NOT damage, or alter the size, of the fixed orifice if it requires cleaning. On vehicles equipped with a PCV valve, it is replaced as needed. The “needed” guidelines for replacement tend to be vague and the typical practice in the 1960’s was to replace the PCV valve at the time of the “tune-up” at 12,000 miles, or once a year - whichever came first. It should be noted the “tune-up” period was more of a default by service departments, not per manufacturer’s guidelines.

**NOTE: As stated here previously:** Model years 1964 through 1969 Chassis Shop Manuals state the fixed orifice size is 0.062” for all engines except the turbo that has a 0.089” orifice size. The 1965 Chassis Shop Manual incorrectly states all engines used a 0.089” fixed orifice size.

- **A note of caution about worn engines.** If the piston, ring, and engine cylinders are worn beyond specification, then excess combustion gases into the engine crankcase (called “blow-by”) will results in a mixture of oil and deposits called “sludge” accumulating in the PCV system. Sludge could block portions of the PCV system resulting in poor engine operation and a pressurized engine crankcase causing excessive oil leakage from the engine.