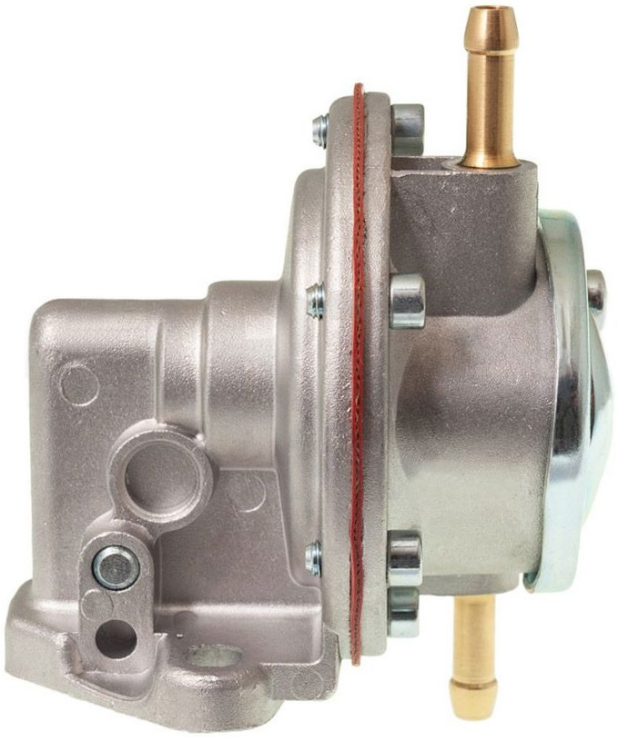
2CV HARD LUCK STORIES

Revision 5



2CV Fuel Pump

Graeme Dennes

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Away From Home Problem 1:

While away from home, our orange 2CV would run for perhaps 2-3 km, then almost die from what seemed like fuel starvation, but, with much encouragement it would (blurp, blurp, blurp, just) come good again , and after a couple of kangaroo hops, off we'd go again (blurp, blurping blurping), with the process being repeated. Fuel was not overflowing from the carburettor, which would otherwise indicate a failed float valve. It seemed probable that it was being caused by either dirty fuel (possible), a restriction in the fuel line from rubbish from the tank (less likely), a dirty fuel filter (possible, but the filter had just been changed), a sticking carburettor float valve (repeated cycling with a sticking action is very unlikely), dirt in or around the carburettor jets (possible), or a fuel pump failure (possible). It could also have been due to rubbish trapped in the fuel filter, whereby the very act of fuel being drawn through the fuel filter by the pump pulls on the rubbish sufficiently to cause the filter to block itself off, when the engine would stop or almost stop, at which point the rubbish would fall away again, allowing fuel to pass, and repeating the cycle. However, as the fuel filter had just been replaced as noted, I discounted that option for the moment. I therefore put my money on the fuel pump diaphragm, so my first step was to disconnect the rubber fuel hose from the carburettor fuel inlet spigot, then start the engine for just a few seconds to check how much fuel was being discharged from the fuel hose. Ah ha, gotcha! It was found to be almost zero. As no spare fuel pump or diaphragm was carried as a spare, RACV Total Care gave us a lift home!

I later confirmed that the fuel pump diaphragm had suffered a small tear, causing the problem. The diaphragm material had also become sufficiently "floppy" such that very little pumping action was occurring anyway.

And what have we learnt? As the fuel pump diaphragm is not generally inspected, my new rule is to change it every five years, reminding myself by an entry in the maintenance log book. If unsure when the diaphragm was last replaced in your car, do it now as a matter of urgency. Always carry a new spare diaphragm or pump with you.

Away From Home Problem 2:

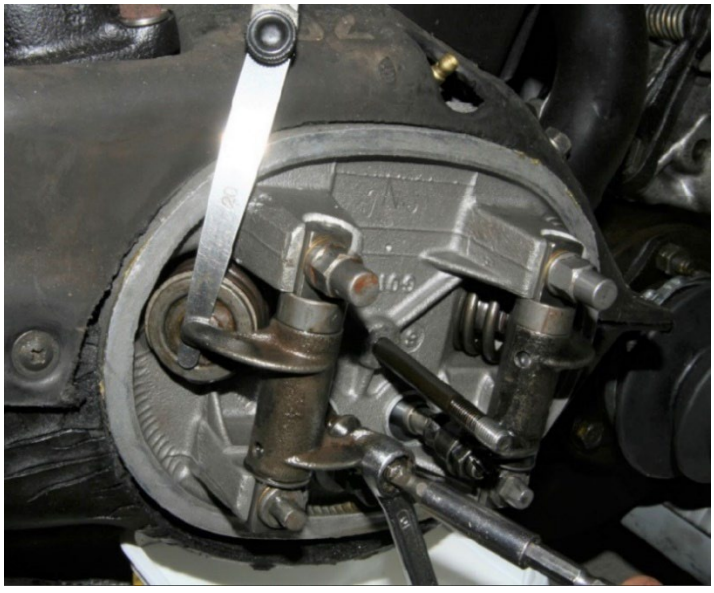
During Raid 2016, the writer's orange 2CV started to blurp, blurping, flop, blurp, then slow down and almost stop, so up went the bonnet. Clearly, the carburettor float valve wasn't shutting off the fuel as fuel was overflowing from the carburettor and running out the inlet manifold drain hole onto the engine. Not a good look! The problem could be caused by incorrect float height, a damaged float or binding float, or a damaged/worn/blocked float valve. The carburettor top cover was removed, both floats appeared intact and visually able to do their job without binding, and both float heights were found to be correct at 18mm (with the gasket in place).

Although the float valve was removed and inspected, it was deemed to be the problem and was replaced with a new one supplied by a fellow Raider. (Thank you Alan!) All fixed!

And what have we learnt? As the internal state of the 2CV float valve is essentially impossible to determine by inspection, my new rule is to change the float valve every five years, reminded by an entry in the maintenance log book. If unsure when the float valve was last replaced in your car, do it now as a matter of urgency. Always carry a new spare float valve with you of the size required for your carburettor.

Away From Home Problem 3:

A very long way from home, another 2CV started showing repeated symptoms over several days of very difficult starting (hot or cold), very rough idle, large out of balance forces in the engine during start up until it reached idling speed, and a strange "hollow-sounding" engine/manifold exhaust sound at idle. At road speed, acceleration and driving seemed to be fairly normal according to the owner, so not a fuel or electrical problem. However, the engine/exhaust sound was not normal at road speed. The air filter was fine. It could have been a low-RPM mode of failure of the fitted 123 ignition unit, but the chances of that are fairly slim, so I decided not to swap the 123 unit over until all other possibilities had been exhausted (no pun intended!). The static ignition timing was checked with a 6mm pin inserted in the crankcase and flywheel. The engine was started (after the drill was removed!!) and the timing was checked at 800-825 RPM with a tachometer and timing light, and all was correct, so no need to adjust the 123 ignition unit. Idle speed was set to 800 RPM with the tachometer. The carburettor idle mixture screw had essentially *no effect throughout most of its range*, so it was returned to three and a half turns out. I removed the carburettor top cover and checked the floats and the float heights. Both float heights were correct at 18mm with the gasket in place. The gasket was in good condition. While the top cover was off, the carburettor jets were removed one at a time and checked for blockages, just to be sure, and all were clear. The fuel bowls were free of dirt material. The top cover was refitted with each cover screw being returned to its same (original) position, just to be sure. To ensure the base of the carburettor was properly sealing against the paper gasket and the thick fibre spacer between the carburettor and the inlet manifold, the four carburettor securing nuts were loosened and then retightened, just to be sure. Still no change to the symptoms.



There was another item which hadn't been checked. Valve clearances. See photo at left. After the engine had fully cooled down, the rocker covers were removed. The head bolts seemed tight but were not further tightened (no torque wrench at hand). The valve clearances were checked, and this is what was found: the two inlet valves were exactly correct at 0.2mm, but both exhaust valves had not only presented with *zero* clearance, but were in fact being held open by some small amount, meaning they were never able to fully close. Definitely not good!

Normally, in the four-stroke engine cycle, the exhaust valves are opened near the bottom of the expansion/power stroke after most of the power from the burning/expanding gas has been extracted from the fuel mixture and converted into work by the pistons acting on the crankshaft.

However, with the exhaust valves always open at the point of ignition and on the expansion stroke, the valve faces and seats are being subjected to the blisteringly high temperatures of the burning mixture from the top to the bottom of the expansion stroke!

Further, the exhaust valves were receiving no cooling as they never came into contact with the valve seats. This would have resulted in the exhaust valves running at very high temperatures and potentially being destroyed. Definitely not good!

After setting the exhaust valve clearances to 0.2mm, the rocker covers and nuts were refitted hand tight, then a further one and one-half turns with the spanner. The idle mixture screw was set to three and one half turns outwards (counter-clockwise) from being (gently!) seated. The engine started immediately, and the strange engine sound had gone. After checking there were no oil leaks from the rocker cover gaskets, the idle speed was adjusted to 825 RPM in conjunction with adjustment of the idle mixture screw. The oil was topped up. All seemed fine as far as could be determined.

On analysis, I expect the large out of balance forces (the engine was pounding the engine mounts after it fired and until it reached idling speed) was because only one cylinder was firing during start up and idle because the other cylinder couldn't raise the necessary compression pressure required to ignite the fuel mixture because its exhaust valve was being held open for too long. However, it still managed to start on one cylinder which already had a held-open exhaust valve! How the car even started leaves me astounded. Above idling speed and up to driving speed, the (slightly) held-open exhaust valves would have had less effect on engine power, as by then, both cylinders would be firing and providing their part of the total engine power with plenty of air-fuel mixture being drawn in at the higher engine RPMs, so the small amount of mixture escaping during the compression and expansion strokes via the open exhaust valves, along with the reduced compression pressures, may not be easily noticed. If only one cylinder was operating at idle, it would help to explain why adjustment of the idle mixture screw had such little effect.

With the exhaust valves held open in this manner, the basic engine timing diagram (crankshaft angle vs valve open/close positions) was quite displaced from the correct settings. This, coupled with only one cylinder operating at idle, could well have caused the weird engine/manifold/exhaust note. It also means that instead of all the fuel-rich air mixture previously drawn in on the inlet stroke remaining in the cylinder to be compressed on the compression stroke, some of it was escaping (being pushed out) via the held-open exhaust valve and pushed into the exhaust manifold and cross box where it was later ignited in an explosive manner by the next burst of hot burnt gasses discharged on the following exhaust stroke. This too would have changed the engine sound.

It seems very odd that the inlet valve clearances were on specification but the exhaust valve clearances had not only closed up to zero so the rocker arms were always in contact with the valve stems, but the adjustment screws had been positioned even further inwards (clockwise) to where the valves were no longer able to close. The adjusting lock nuts appeared to be tight!

Could it have been due to the locknuts not being adequately tightened, allowing/causing the rocker adjustment screws to rotate in a clockwise direction under the influence of the net mechanical forces at work, driving the valves further out of the heads. Perhaps it was only because the locknuts had tightened up that prevented the valves being pushed even further into the combustion space, and into the domain of the piston!! I'm at a loss to explain how this situation could arise if the exhaust valves had been set correctly last time they were adjusted.

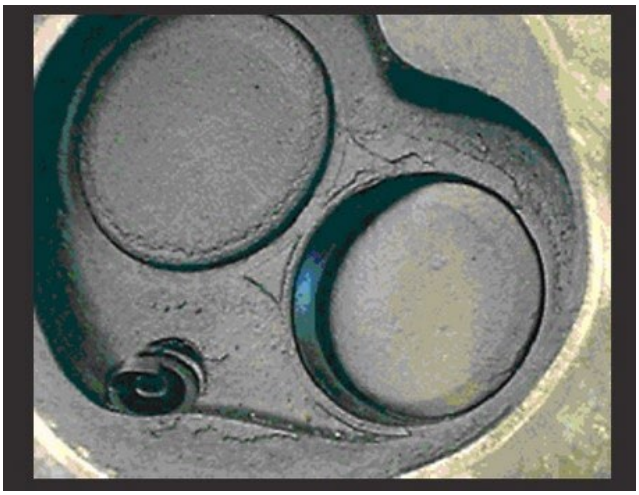
I don't know whether heat damage has occurred to the exhaust valves due to the exhaust valves being held open, preventing heat transfer from the valve heads to the valve seats for cooling. Only an inspection of the valves after the heads are removed will tell.

Is exhaust valve recession the underlying cause of the loss of exhaust valve clearance? The symptoms could certainly indicate that. The valves could still have been held open whether seat recession had occurred or not, so it's not clear.

But then, how does the valve seat continue to wear without the valve in contact with it? Strange. However, the running symptoms had only just started, so how would the exhaust valve seats get to such an advanced state of wear so quickly? One day all is fine. The next day, major problems appear!

Of course, I really don't know how long this problem had been brewing, "hidden from sight", and it might say volumes more about the tolerance and resilience of the 2CV engine to continue running despite having significant internal "health" problems!

The writer understands, although no formal evidence has been located (can the reader assist?), that at some point in the 1980s, Citroen issued a statement certifying that 602cc engines were safe running on 98 octane *unleaded* fuel and that no changes were required to the specifications, maintenance procedures or parts when doing so.



This implies hardened exhaust valve seats were used in 602cc engines. If this is the case, then it's most unlikely to be exhaust valve recession, but it still could be. The engine heads will require removal and inspection. The valve at the lower right in the photo at left (not a 2CV) has a bad case of valve recession. The valve seat has worn away quite severely, allowing the valve to sit quite deeply into the head. A head repair *will* be needed to fit at least one new valve seat and one new valve.

In summary, at each annual service, set the valve clearances. It only takes a few minutes. Refer to the writer's article, *2CV Valve Clearance Adjustment* for the complete procedure.

If unsure when the valve clearances were last set, *do this task now as a matter of urgency*. It won't take you long. Also, using multi-use rocker cover gaskets makes the job even easier.

And What Have We Learnt?

We can never prevent all failures in our old cars or even failures from newly fitted parts, but by preventative maintenance actions such as those above, we go a long way towards minimising the risk of such failures happening out on the open road. Besides, experience tells us that it's way easier to attend to these things at home than on the side of the road!

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FINAL STATEMENT

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