2CV BRAKE SAGA

Revision 3

Graeme Dennes

THE TALE OF THE DUCK THAT ALMOST COOKED ITS GOOSE

Revision 3

By Graeme Dennes

The following sequence of events occurred with our 1974 orange 2CV (Duck à l'orange) after it had undergone a brake system "transplant" to convert it from a drum-brake DOT 4 system to a disc-brake LHM system. The physical changeover of the front drums to discs had its own set of issues with the drive hubs on the gearbox which were eventually resolved.

I'd been preparing the car in readiness for its shipment to New Zealand to participate in Raid New Zealand 2018 over February/March 2018 as organised by Dave Rogers and Peter Dekker. Herein lies the tale of the events surrounding the fitment of the disc brake components.

1. Fitted new LHM dual-circuit master brake cylinder, new LHM rubber seals for the fluid reservoir, a new fluid reservoir and new brake line seals at the master cylinder.
2. Fitted pre-loved disc brake calipers after installing new pistons, new LHM rubber piston seals and dust seals, new LHM rubber O-rings between the two caliper halves, new LHM brake line rubber seals on all brake line fittings, and a new bleed nipple on the left caliper, just to be sure.

Fig. 1 On Raid NZ 2018. It was a fascinating run!

3. At the rear wheels, I fitted new LHM rear wheel cylinders, new bleed nipples and new LHM brake line rubber seals.
4. Fitted new LHM brake line rubber seals in the rear wheel brake line union. (This is the brake line splitter which feeds the fluid from the master cylinder to the two rear wheel cylinders. Located high up at the top/front edge of the fuel tank.)
5. Added LHM fluid and bled the brakes, after which the pedal went down to around mid-travel and seemed quite firm at that point, and all seemed ok. However, the fluid exiting all three nipples moved *very* slowly during bleeding. Varying the pedal pressure didn't seem to change the rate of the fluid exiting the nipples. The fluid flow from *all* three nipples seemed heavily restricted. Why would this be?
6. However, when the brake pedal was pressed and released, the front wheels remained fully locked while the rear wheels immediately turned freely. Why would this be?
7. Opened the front bleed nipple momentarily and the front wheels immediately turned freely. Mmmm.
8. As a check, I reversed the front/rear brake lines at the master cylinder and bled the system.
9. Once again, little fluid exited the three bleed nipples. On some pedal presses, no fluid was expelled. Why?

10. Returned the front and rear brake lines to their correct ports on the master cylinder.
11. Pressed and released the brake pedal, and now both rear wheels remained locked, while the front wheels were immediately free to turn. Ok. Getting warmer!

Figure 1 Rear brake line union, next to fuel tank

12. Opened a rear bleed nipple momentarily and both rear wheels turned freely.
13. Just to be sure, the rear brake drums were removed and the wheel cylinders and shoes checked for proper operation and proper return (with their bleed nipples open). These were operating correctly. The brake shoes were operating correctly and contacting the drum correctly, and the "horseshoe" springs were doing their job, so no concerns with the rear brakes.
14. Logically, the symptoms point to a faulty brake master cylinder, although it was brand new.
15. Ok. Ordered and received a second new LHM dual-circuit master brake cylinder from a different European supplier and fitted it to car.
16. Bled the brake system.
17. This time, no wheels remained locked after pedal operation. Whew! Now we're starting to get somewhere. Fluid moving slightly better from the bleed nipples, but still well short of the normal response to pedal pressure and nipple opening. Well, after having fitted two new master cylinders and neither having fixed the problems, the fault has to lie elsewhere.
18. However, a new problem has appeared. When the brake pedal is released, the brake pedal (and master cylinder piston) was taking about 10 seconds to return to the fully out (brakes off) position, whereas it should return instantly.

Figure 2 One of the new calipers

19. There were no visible fluid leaks anywhere in the brake system, the fluid level in the reservoir remained constant, the pedal would not go down past a certain point, and the brakes were actuating and stopping the car, so it was taken out for a road test in a quiet backroad area. It didn't appear to have safety concerns.
20. Another new symptom was identified. During the drive, the brakes slowly but surely became fully activated over say 8-10 Km of driving, causing the vehicle to be slowed and brought to a halt. Completely stopped on the side of the road. Couldn't move off. Brakes fully locked on.
21. The brake pedal was fully out and could not be pushed in as it was being pushed out at maximum pressure.
22. Backed-off the brake master cylinder actuating rod lock nuts, leaving 3-5mm of free-play in the pedal. All good.

23. Car was able to be driven off.
24. Full brake lockup returned about 15 minutes later. Get off the road asap! Very little braking had been taking place. Adjusted the brake master cylinder actuating rod once again. All seemed fine. Drove off and reached home without further problems.
25. At this point, the car could not be reliably driven because of risk of the brakes locking up again. This is getting very weird and I'm getting short of time.
26. Perhaps the old brake line rubber seals in the rear brake line union had broken up a little and were partially blocking the return fluid flow to the master cylinder, resulting in the 10-second retraction time of the master cylinder piston. The union had previously been subjected to three hours of high heat to enable the three brake line fittings to be removed. Perhaps the seals had been untouched since the car was new 43 years prior. Still, this symptom was not there previously.
27. Thus, decided to again remove and thoroughly check/clean the rear brake line union for partial blockage, just to be sure. Nothing was found to constrict the fluid flow inside the metal union. All clear. Three new LHM brake line rubber seals were fitted and all three fittings done up securely. No problems there. However, the weak fluid flow during bleeding operations remained, as did the 10-second delay in retraction of the master cylinder piston, so I presumed the roadside brake lock-up problem was also still a possibility.
28. Alright, I'm now getting desperate. Once again, the symptoms point to a faulty master cylinder, but this has already been replaced *twice*, so just keep looking...

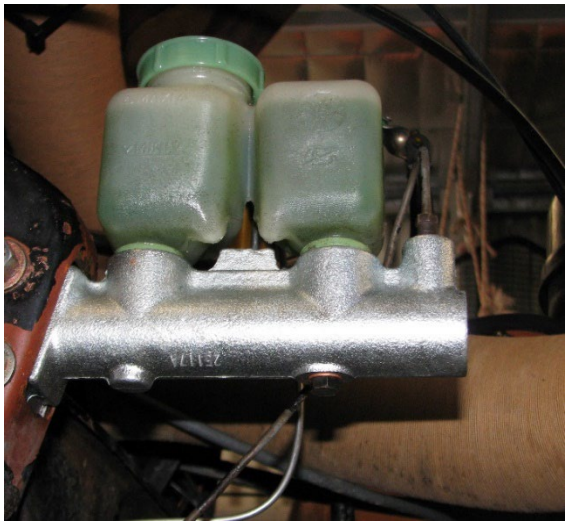

Figure 3 New brake master cylinder and reservoir

29. Could it be caused by (unstable) corrosion build-up in the fluid path inside the pre-loved brake calipers, causing poor fluid flow from the calipers? Still, there is so very little fluid flow to/from the calipers as the pistons are "in contact" with the brake pads at all times. However, the calipers were previously heavily corroded around the piston surfaces and it took a considerable effort (some hours) of much heat, pressure and gratuitous verbal advice to remove the old pistons. But then, this shouldn't cause poor fluid flow from the rear bleed nipples as there is no connection between the two hydraulic circuits.
30. To this time, I'd fitted two new master cylinders, pre-loved calipers with new pistons and new seals, two new rear wheel cylinders, confirmed proper adjustment and operation of the rear brake assemblies twice, thoroughly cleaned the rear brake line union twice, and changed every brake line rubber seal in the entire braking system several times! (I never reuse brake line seals, even if it has only been tightened for a minute!). The weird bleeding issue and delayed brake pedal return issue remained, and so did the risk of brake lockup on the road.
31. Ok. It's now 11.00 PM on the Sunday night before the car had to be driven to the freight company in Melbourne the next morning for the car's shipment to New Zealand. Therefore it was deemed that we would need to organise a hire car in New Zealand for the Raid in view of the imminent "death" of the Duck. Um, darn!!

32. So as a desperate man now, and in complete disbandment of all logical diagnostic reasoning for doing so, I decided to remove the known good brake calipers from our green car and fit them to the orange car. What else could it be? There are only so many items in the brake system, and I'd already attended to them ALL, and some more than once!!!
33. After the "new" calipers were fitted, the system was bled again. There wasn't much change to the bleeding behaviour, and the pedal still took several seconds to fully return. In summary? No change at all. Ok, so it's not the calipers. (The temperature's risin' and the juke box is about to blow the fuse!).
34. Now I'm in complete and utter desperation mode. Free-fall mode. Throw me out with the bathwater. In the hands of the gods. The only spares I have access to are in the shed with me. All logical reasoning has been exhausted, I'm exhausted and I'm on hands and knees begging the car for forgiveness!! (Haven't I always treated you well and cared for you?)
35. So in a true and final act of crash-and-burn defiance and desperation, the known good master cylinder in the green car was removed and fitted to the orange car. Yep, the third master cylinder!
36. The brakes were bled. In short, (cover your ears!!!) – Eureka. Eureka! Eureka! The bleeding operation was instantly successful and totally normal, the pedal feel was absolutely normal, and the pedal returned instantly to its fully-out position when the foot was lifted. No wheels remained locked up. Everything felt and acted normal. Still, it still needs a test drive to confirm that all is finally correct.
37. However, this is a little late in the evening, er, morning, for a test drive, as I put the last spanner down at 4.00 AM and went for a little shuteye. I slept soundly, but I reckon I still had a smile on my face when I drifted off to sleep!
38. Drove the car to the shipping company that morning (and as the test drive!!) and all was good, albeit with the master cylinder and calipers borrowed from the green car. Pedal operation was normal, brakes felt normal, no brake lockups. All good.
39. The car travelled over 7000Km during Raid NZ, and the brakes performed as expected.
40. After returning home from the magnificent run with the New Zealand Raid group and after picking up the car from the shipping company, the master cylinder and calipers were removed and returned to the green car from whence they came. A third new master cylinder was ordered from a third parts supplier, along with new calipers. These were subsequently received and fitted to the Duck, and all was finally perfect. What a saga. All it took was three new master cylinders!!! So much for modern QA!

Summary

There's nothing more thrilling or better able to focus one's attention than taking a car for a test drive in Melbourne's morning peak hour traffic to test the brakes after a complete brake system rebuild, and especially in view of the range of crazy symptoms and problems experienced beforehand. What a hoot! (Yeah, right…).

Yes, two brand new master cylinders of different brands and different part numbers from different major European spare parts suppliers were faulty, with weird but not totally dissimilar symptoms. They were physically different products and with completely different packaging - brand, colours, part numbers, labels, barcodes, etc.

Perhaps they were from the same OEM batch from somewhere on the globe. That seems probable, but I don't know and perhaps I'll never know.

Is there a lesson here? Unfortunately for us 2CV owners, the answer is perhaps yes, and it is this: just because a new part is purchased from a reputable supplier doesn't mean the part was manufactured *and tested by the manufacturer* in accordance with Citroen's specifications and standards. But then, when looking ahead and hoping for good spare parts outcomes in the future for our 2CVs, I prefer to think it was all just bad luck this time. I really do hope so...

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