

Brake Master Cylinder Overhaul

by *Andréa Nistri*

Servicing or repairing a Fulvia often raises the temptation (or the necessity) of D.I.Y. Clearly some people are far more engineering-minded than myself and they can competently tackle quite complex jobs. Nevertheless, it is likely that some LMC members with only limited mechanical experience like myself might be put off from relatively simple repairs because they have little or no access to a complete workshop manual. I am very lucky to have the Fulvia factory manual and armed with this publication I have decided to overhaul the brake master cylinder of my Fulvia coupé S2. The same procedure applies to the later Fulvia saloons, HFs and Sports. I think that this information will be useful also to S3 owners although this model is not covered in my book, which was printed before their production.

I am rather sensitive to the subject of master cylinders since when I was living in North America the master cylinder of my VW failed at a busy junction on the Washington beltway and I was lucky to avoid an accident (I was already driving with a broken leg in plaster, but that is another story!). The Fulvia master cylinder overhaul was carried out about a year ago and it has been very successful including a clean pass at the MOT. Here I am going to discuss the overhaul procedure I used with my own experience drawn from the instructions in the manual.

First of all, my advice is to acquire a second hand cylinder (see comments at the end of this article) as this may well supply essential bits to repair your own unit. Moreover, one might use it as comparison when the reassembling has to start. Second, I found the whole procedure time-consuming and I suggest that this is one of those jobs ideally done in stages over a period of time while the car is in a garage (e.g. during the winter hibernation).

To start with, the brakes must be bled. This is most conveniently done by removing a front wheel and connecting a piece of plastic tubing to each one of the bleed nipples (covered by a small black rubber cap) found on the front brake caliper. Slacken off the nipples with a 8mm hexagonal or bihexagonal spanner (never use an open end spanner) and collect in a jar all the brake fluid while a helper is repeatedly pressing the brake pedal. Discard the old brake fluid. Then disconnect the brake lines from the master cylinder: they are likely to be very tight and may need several treatments with penetrating oil. To undo them from the master cylinder it is important to use a proper tool such as the 10mm brake/fuel lead spanner made by Williams or others. Apply rags and plastic sheets under the master cylinder to collect any brake fluid spillage.

With luck and, more importantly, with the proper spanner the flare nuts connecting the lines to the cyl-

inder will come undone. In my case two of them were fully seized up; hence I had to cut their lines and separate them in a vice. If this happens there is no need to panic. Remove the severed brake lines also at the caliper end near the brake pipes, and take them to a specialist garage or shop to have new ones cut and made for you. All fittings and lines are standard and fairly inexpensive and do not have to be Lancia special parts. Refer to the schematic diagram of the Fulvia brake system in the owners' book in order to connect each line both at the master cylinder end and at the caliper end. This is, of course, a very important point to check when reassembling the system.

Having eventually disconnected the sprouting brake lines from the master cylinder, disconnect the electrical lead to the brake fluid reservoir and also undo the two nuts fixing the cylinder to the servo. Then pull away gently the cylinder while checking that you are not dropping washers or seals. After this all remaining work is to be carried out at the bench. Perhaps the most important tools will now be pen and paper to draw in great detail how the various parts are assembled together. Follow also the picture in the Fulvia parts book shown here (reference to these numbers will be made in the text). Alternatively, but less informatively, you can look at Fig. 27 (p.32) of the Fulvia concise repair shop manual which should be available through the Club.

Clean the master cylinder with petrol or Gunk solution. Clamp it in a large vice interposing two pieces of lead (for example from an old water pipe) to avoid damage, and with a 3mm Allen key remove the nuts (1) around the plastic reservoir (26). Lift the reservoir cap (34) and the filter underneath (7). Gently remove the body of the reservoir with the two plastic parts (16, 8) of the float system. You can now see two circular wells: unscrew and remove the two plunger-stopping screws (37) at the bottom of the wells. Unclamp the master cylinder and fix it in the upward position. Squirt a lot of penetrating oil around the top edge of the large bolt (35) on the front of the cylinder. Repeat this treatment for several days if possible. Removal of this bolt is possibly a difficult exercise as it is normally very tight. Hence, clamp again the cylinder horizontally using the lead pieces and with a 32mm socket try to undo it. A sharp blow with a mallet to the socket wrench might undo it. Remove slowly by hand the bolt since it holds in position a powerful spring. Remove the spring (18) and the washer (23). You are now ready to extract the content of the cylinder.

Use a narrow piece of soft wood to push out from the back through the front all the parts inside (gentle tapping may be necessary). Thus you will push out in order the front plunger (33), a second spring (longer than the first one) and the rear plunger (32).

Wash carefully with alcohol the inside of the cylinder and examine its inner surface; if scratched or corroded it will call for replacement. Then pick up the rear plunger, remove its circlip (3) and slide off the round bit (29) beneath it. Look for damaged parts which will be replaced. Remove the rubber seal and washer and fit a new one after cleaning with alcohol and lubricating with special brake rubber grease. Lift and replace the back rubber seal of the rear plunger (note its correct

Silicone brake fluid. Keyhole saw.
Cheque for workshop manual.
Penetrating oil on nipples
Door light.

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position with the "lip" forward) and the ring seal (14) immediately inside the rear of the cylinder body.

Now to the front plunger; remove the small circlip (2) with miniature pliers, then the two parts (31,30) holding the small spring (20) and the black seal. Slide off the two components of the plunger (33), clean them and lubricate them while checking that they can move freely. Fit the new rubber seals in position. Refit the parts in their right order while checking your figure.

The reassembly procedure may now start. After careful lubrication with the special rubber grease, push slowly through the front opening the rear plunger (32), then the long spring (19), using a piece of wood to position it. Look through the hole of the plunger-retaining screw (37) in the rear well of the reservoir as the plunger components advance through the cylinder body. Only when you see the narrow bore part of the plunger through this viewing hole, stop pushing and tighten the rear plunger-stopping screw. Then check that the rear plunger can slide properly inside the cylinder. While looking through the hole of the front plunger-stopping screw (37), push the front plunger (33) into the body until you see the narrow bore part of

this plunger. Stop and tighten the plunger-stopping screw after making sure that it does not catch the plunger itself. Now fit the spring and its washer, and tighten the large front bolt. The other parts are fitted in reverse order of disassembly.

Some final comments on the master cylinder seals. I was able to buy new original Lancia seals (quite expensive too at about £15 in Italy) which are difficult to get in this country as well as in Italy. If you cannot get the original Lancia seals, buy the best you can find and compare them with your old seals for shape and dimensions. I have not been able to find a new ring seal to fit between the reservoir and the cylinder body. Having completed the job, it is then necessary to refill the system with new brake fluid and bleed the air from all four calipers (six nipples in total). The Lancia recommended sequence is to start with one front caliper top nipple, then the other front wheel top nipple, then the centre nipples of the front calipers and finally the rear caliper nipples. Make a final check for fluid leaks and correct braking efficiency by applying steady normal pressure to the brake pedal for 2 or 3 minutes while examining the whole system.

One last word of caution when buying secondhand master cylinders. There is no certain method to tell whether they are O.K. other than taking them apart. I have seen six secondhand cylinders and only three were alright inside, a 50% failure rate. ■

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described how to overhaul the Fulvia brake master cylinder. I subsequently thought that a description of the overhauling procedure of the brake calipers might represent a useful follow-up to the first article. Again I wish to point out that the method reported herewith was obtained by combining the information in the factory workshop manual with my own experience.

Secondly, the procedure and the pictures reported here refer *only* to the Girling calipers fitted to Fulvias built between July 1970 and June 1976.

Thirdly, as far as spare parts are concerned, one would need as a minimum a set of caliper rubber seals (front and back ones) which fortunately are still available through Club specialists.

If new pistons are required, the situation is less favourable. A recent enquiry revealed that Girling had only five large front pistons left in their central store (Girling part no. 64320787) and none whatsoever of the small pistons (64321391).

With regard to the actual overhaul of the front caliper refer to figure 1 and the numbers quoted there. Start by opening up the locking plate blocking the two large screws which fix the caliper to the hub. With the special brake lead spanner described in my previous article undo the joint between the brake hoses and the brake pipes and remove the caliper fixing screws (they are likely to be tight). Place the caliper on a bench. Examine the brake hoses; if damaged, cut them near their joint with the caliper (the reason for this will be clear later). If the hoses are perfectly sound, separate them from the very short pipes going to the caliper and then remove the latter from the caliper itself.

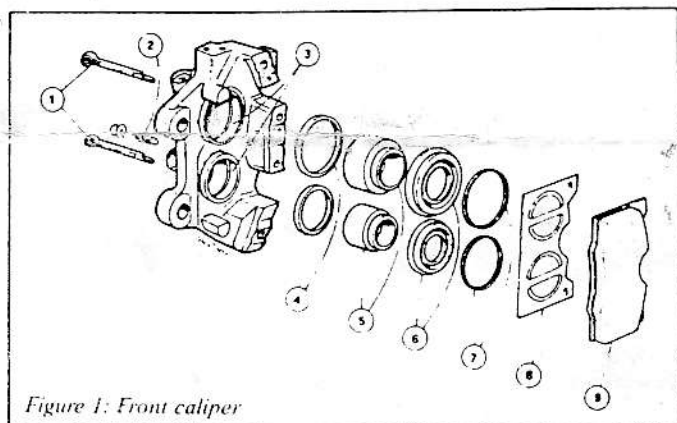


Figure 1: Front caliper

Bearing in mind that brake dust contains asbestos with its potential health hazard, remove this dust with a vacuum cleaner.

Alternatively, submerge the caliper completely in a paraffin bath and continue the dismantling while the caliper is wet and no dust can be scattered. Saw off the tip of a large nail and hammer it to drift out the pad retaining pins (1). Remove and discard the pads (9) but save and clean the antisqueal shims (8). Remove the metal rings (7) fixing in position the piston rubber covers (6). Clean carefully the area of contact between the pistons (5) and the cylinders (3) and apply, if necessary, some penetrating oil.

The next step is to extract the four pistons. This is the most difficult part of the job since one or more pistons may be seized up. Suspect this possibility if you find damaged covers (6) and/or the brakes have not been used for a long time. Moreover the small pistons, which operate the auxiliary braking system, are usually far more stubborn than the large ones. The only way of getting the pistons out without damaging them is with compressed air. One can use the air line of a petrol station (if the attendant can be persuaded to agree) or a good foot

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pump. In any case the pressure necessary to eject the piston is rather high (probably 3 or 4 bars). It is essential to use an adaptor (the type employed to inflate air beds) to convey the high pressure jet. The adaptor must be tightly pushed into the severed brake hose or into the caliper threaded hole accepting the short brake pipe. Start by tackling the circuit of the large pistons.

Prepare pieces of strong timber and interpose one of them in the gap between pistons. With the aid of a helper operating the pump and air line, apply the air pressure. Almost certainly one piston will tend to pop out (take care that it cannot harm anyone) but its opposite will not move. Hence it is important to push and hold back with the wood pieces the mobile piston while continued air pressure can persuade the other piston to move. If one piston pops out while the other is stuck, the first one will have to go back into its cylinder and be kept there with a wood wedge while more air pressure is applied. Needless to say, patience and determination are necessary to get out all four pistons with this method. Of course, the small pistons must be extracted by pressurizing their respective circuit.

Afterward, remove the rubber seals (4) with great care (use a toothpick) and examine the cylinders and pistons for scoring. Check that the seal seats are not damaged otherwise a new caliper is necessary. Never try to separate the caliper into the two constituent parts because this would effectively put an end to the caliper use given that no spare screws and seals are provided. Clean the pistons, cylinders and circuits carefully with alcohol and blow them dry. Remove and clean the bleed nipples. If you are not storing the caliper, reassemble the parts in reverse order of dismantling and fit new rubber seals and covers. Cylinders, pistons and seals must be lubricated only with the special brake rubber grease.

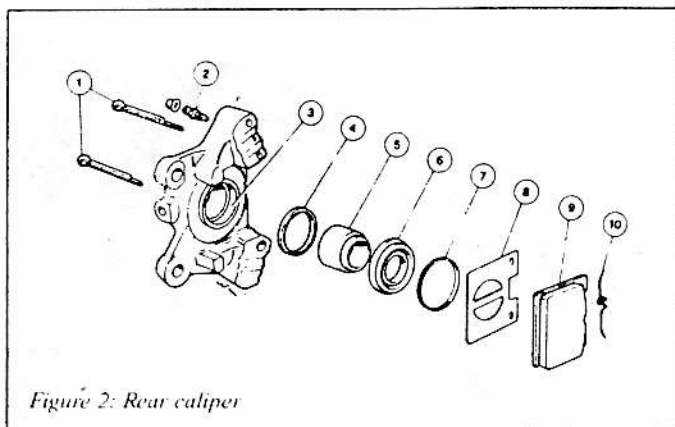


Figure 2: Rear caliper

With regard to the rear caliper refer to figure 2. The method of overhaul is essentially similar to that used for the front calipers. One should, however, note that rear pistons can be even more difficult to extract than front ones. In general the same points will also apply; do not try to separate the caliper into its two halves, take care when removing the cylinder seals, and use only the special rubber grease for lubrication.

A final comment is that some preventive measures against brake caliper malfunction may be taken by regularly changing the brake fluid and by checking that the piston rubber covers are intact and clean when brake pads are changed.