

Dual Circuit Brakes for a UK Spec. Europa

Ok, yet another tale of someone installing a non-OEM master cylinder in their Europa. This probably won't be of great interest to you guys on the left of the pond, but for anyone with a UK or European car it might be of help. So here goes.

The standard system consists of a single circuit m/cyl of 0.7" bore with servo assistance. I replaced the m/cyl with a 0.75" one several years ago and thus had a slightly higher pedal pressure with less travel. The single servo is located in the engine bay & brake pipes convey fluid from the front to rear servo & then back again for the front brakes.

The plan is to replace the single circuit m/cyl with a tandem m/cyl at 0.7" bore, to remove the servo assistance and replace the front pads with Greenstuff pads in the hope that this alleviates the lack of servo assistance. If pedal pressures are unacceptable then to re-install the original & a second servo unit as per the US spec Europa Specials.

The OEM m/cyl as used on the Export Spec Europas is now very difficult to source and appears to be only available via specialists at appropriately high prices. (£180 seems to be the going rate if you can find one). However there are more affordable options available if you are prepared to do some modifications and as such I purchased a tandem m/cyl intended for the Triumph Spitfire 1500, part GMC226 for approximately £75. This has the same bore and flange pattern as the existing single circuit m/cyl although the actuating rod will need to be swapped over for the Lotus one.

Fig 1 : Master Cylinders



However this will not be a straightforward installation.

Firstly the reservoir is a push-fit & sloping wedge-shaped item because the m/cyl is mounted at an angle on the Triumph bulkhead. This isn't a big deal because the UK Europa employs a remote system anyway whatever cylinder is used.

The second problem is that the brake pipes exit on the LHS of the cylinder. On a LHD car this isn't an issue as they exit towards the wheel arch where there will be plenty of room, but with RHD I found that the secondary circuit pipe was a very tight fit against the fibreglass floor of the front compartment.

I decided to modify the bodywork underneath the radiator to give more access for the front brake pipe outlet.

Although not essential, this will make installation and maintenance easier in the future and there will be no significant impact on the radiator mounting or front boot space.

Fig 2 : Modification from below (radiator showing)



So a small cut-out was made as shown in the photograph, using a combination of dremel & hacksaw blades from either above or below.

A repair section was moulded by the simple process of making a cardboard template to fit the cut-out section, lining this with tin-foil & then laying up 2/3 layers of matting.

I removed this from the mould in a plastic state which allowed me to offer it up to the hole & trim where necessary using a pair of scissors - much easier than when the resin has full hardened !

Fig 3 : Repair section in place (view underneath)



Then it's simply bonded into place as shown in Fig. 3, finished off with surface tissue, left overnight & finally given a coat of matt black paint to tidy it up. It's not the world's neatest job but it looks on a par with the rest of the boot interior and is certainly fit for purpose.

Right, the next stage is to remove the OEM part & bolt in the new one. As can be seen from Fig. 4 the actuating rods need to be changed over, or at least the Tandem push rod needs modifying & threading to accept the Lotus extension. I decided against modification because the diameter of the new one is slightly less than the OEM rod and hence the resultant thread didn't look strong enough to me for a critical item.

Fig. 4 : Actuating Rod Extension



With the new master cylinder modified it's installation time, a simple bolt in job.

Points to note - the new cylinder has metric threaded fittings for the brake unions so you'll need some modern couplings. I used new brake pipes rather than modify the old ones, the cost is minimal and although it takes more time, it's much easier to work with new materials than old.

I set the primary circuit goes to the front brakes, the secondary to the rear brakes on a front/rear split.

The reservoir now needs to be remote and as with the OEM installation, it is all very close to the steering rack bellows.

I used 90deg plastic elbows coming out of the first chamber and a straight connector for the second (forward) chamber.

In practice the new installation is fractionally lower than the OEM m/cyl & brake pipe but I still decided to fabricate a small aluminium cover, as shown in the Fig 5, to isolate the rack bellows and the filler pipework.

Fig. 5 : Inlet Pipe Arrangement



Fig. 6 shows another view of the installation, showing the newly modified fibreglass which allows better access to the forward brake pipe.

It would be possible to do the job without the fibreglass modifications, but this way means a more shallow bend on the front pipe, is less of a struggle and makes spotting any leaks at the front pipe much easier.

Fig. 6 : Modified undertray gives better access



The two filler pipes go through the original hole into the front boot with the new 2 chamber reservoir mounted on a new bracket in the same place as the OEM single reservoir.

Fig 7 : Remote Reservoir with level switch



Fig. 7 shows the new reservoir complete with a low level switch, crudely wired to a dashboard light. I say crudely because at the moment the only way to test it's working is to lift the cap up !

The reservoir and switch are common parts for modern kit car builds and easily available. Mine came for around £20 from Ebay and listed as a "Land Rover" standard part.

(You can also see the yellow dust and overspray from last summer's respray still hanging on in the radiator top. I really must get around to cleaning up... hmm, best not to rush these jobs, eh ?)

The Greenstuff pads were installed several weeks ago for the MoT, so it's job done, time for road testing.

Well, how different is in practice with no servo and a smaller m/cyl bore ?

Hmm, now this is a strange one. I know the servo was working properly and as expected the reversion to a 0.7" bore has restored the pedal travel to it's original design, but the overall impression is that removing the servo has had very little impact on the braking performance in terms of pedal pressure.

It's still very easy to lock the front wheels with a deliberate stab to the brake pedal, and if you brake normally with a gradual increase in pressure then basically there's nothing to choose between the systems in terms of usability.

Update 2016 :

I started off with EBC Greenstuff pads which are commonly used for non-servo applications on classic cars in the UK. For nothing else other than plain curiosity I decided to try some Mintex pads with M1144 compound because I used them on the Elise and found they had a great initial bite.

I was impressed with the M1144 material and started to think about reducing pedal travel. There's nothing wrong with the system as it stands but most modern cars have very little travel and switching between them is disconcerting for the first couple of miles.

I became obsessed with the idea, even to the extent of measuring the amount of movement for the pads (hence pistons) at the callipers and calculating the expected movement. If you're interested the theory came in as 3.8cm at the pedal, in practice I seemed to be getting between 3.5 and 4cm, probably depending on slight variable pad retraction.

There's only 2 ways I can see of reducing travel without a complete system re-design, either replace the master cylinder with a larger bore or modify the pedal leverage ratio. I chose the latter and although it increases the effort you need to brake, I can't say it's a big deal. Heavier than an assisted car as you'd expect and in practice I've only reduced the travel to 3.0cm, but it does make a noticeable difference.

Or maybe it's all in my own mind.....