9.0 Brakes

9.1. INTRODUCTION

You've all heard how the stars alter their brake balance - this is simply the ratio of front wheel braking effort (pressure) to rear. On road cars this balance is not adjustable; because the car is designed only for tarmac use, far more effort is put onto the front system than the rear, which is fine for road events. On the loose though, you want to balance the car under braking without locking up at the front and slithering off into the pine trees, so more effort is required at the back which helps get the tail out as well.

Unfortunately, whilst every modern single seater racing car incorporates an adjustable balance bar, it's not so easy on a production car, and the only efficient way found is using the compete works axle incorporating rear disc brakes. In most cases a drum system will literally burn itself out if too much effort is put through it. We shall now try to cover a selection of braking systems which should include all or most of the suitable components which you can then permutate according to the spec of your car and, above all, your budget. Gp 1 brakes will be covered at a later point.

If you are the proud owner of a late Mk I Mexico with direct servo, or a Mk II Sport, Mexico, RS1800 or RS2000, the first thing to do is to chuck away that awful push-rod operated system, which only makes for insensitive brakes, and lack of accessibility in the engine compartment. From here on, things start to become complicated. First of all, if you are running a Mk II Sport, it is advisable to discard your front suspension assemblies completely; the reason being that Mk II Sport struts have integral steering arms.

Then, go for Mexico/RS2000 type Bilstein struts, be it Group 1 struts, World Cup type struts or Group 4 struts, again according to your pocket. This will enable you to use, as a first step, the production Mk I/U Mexico/ RS2000 9. 6" discs, together with type . 16 Girling calipers and DS11 pads. Remember that there are two types of pads according to whether you have P16 or M (for metric) 16 calipers.

Front brake disc finis code	601 0149 (Mainstream)
Front hub (metric studs)	604 1132
Front hub (A/F studs)	151 9138 DS11
pads P16 Caliper finis code	905 0571
pads M16 Caliper finis code	905 2124

The next step up is to use the Group 1 RS2000 ventilated disc kit. The discs (9. 6") bolt on to the above mentioned hubs.

This conversion, incidentally, is OK for Group 2, since you are not increasing the area of the friction surface.

Ventilated disc brake kit finis code	905 1676
Backplate kit " "'	905 1556

The backplate kit is optional (but compulsory in Group 1), since Group 2 and Group 4 regs allow their removal.

The next and ultimate step is to use the Boreham set-up which consists of 10½" vented discs and Formula 2 calipers, although these must be homologated for your vehicle if you intend running in Group 2 (more details later).

9. 2. PEDAL BOX AND MASTER CYLINDERS

Let's turn now to pedal boxes and master cylinders.

RS Parts were, until recently, selling a triple master cylinder pedal box with adjustable balance bar as used on the works cars. Unfortunately, it was a rather expensive item, and has since been discarded in favour of a complete pedal box kit, available under finis codes:

Hydraulic clutch 905 2599

Cable clutch 905 3064

The kit comes complete with a fully modified bare pedal box, master cylinders, all relevant pedals (less throttle pedal) and balance bar assembly. The pedal box is basically a Mk II Escort box, and fits both Mk I and Mk II bodies. The beauty of it all? It will cost you half as much as the old pedal box.

A very important point here is that unless you are running full house brakes (ie, 10½" vented fronts, four pot front calipers and rear discs) there is no necessity to use any servos at all (which again makes things cheaper, right?). As a point of interest, all competitive Mk II Group 1 RS2000's run the Group 1 vented disc kit, a 905 3064 pedal box, and production Mk II RS2000 rear brakes with DS11 pads and VG95 linings, without servo! An added bonus here is increased brake sensitivity on snow and ice.

9.3. REAR WHEEL SLAVE CYLINDERS

You have a choice here. Either Mk I Capri 3 litre 9" rear brakes or the production Mk II Sport /Mexico /RS2000 assemblies which also carry 9" rear drums. Mk I RS2000's used 8" drums in production, but Mk I RS1600's and Mexicos had 9" drums.

One easy way of helping rear braking using drum rear brakes, is to use 9" drums and larger rear wheel cylinders. It's not nearly as efficient as the rear discs but costs little by comparison. Change the back plate and drums if necessary, and replace the wheel cylinders with the 7/8" units from the 3 litre Capri Mk I. Standard Mexico and RS 1600 cylinder is 0. 7" diameter. Standard rear linings should be retained but DS11, or equivalent, front pads with standard disc (P16) Calipers should be used, or go for complete 3 litre brakes.

The advantage of the Capri 3 litre units is that the linings are very wide (again watch out in Group 2 as it is forbidden to increase the width of the linings), but you will have to modify the handbrake linkage and redrill the backplates (see rear axle chapter).

The Mk II rear brake assemblies have a fairly good self adjusting mechanism and a selection of rear wheel cylinders, as follows:

Standard wheel cylinder	**finis code**
¾" (19.05mm)	6023398
13/16" (20.64mm)	602 5668

VG95 shoes - finis code

905 2876	Mk II braking system
905 1630	Capri 3 litre

9.4. MAKING AN ADJUSTABLE PEDAL BOX

As briefly mentioned earlier, the works system can be described as follows:

Dual master cylinder pedal box 10½" ventilated front discs
Formula 2, 4 pot front calipers
10" solid rear discs with separate footbrake and handbrake calipers
Two Lockheed 2. 5:1 servos.

Competitions Department still use the old type pedal box, based on the Mk I unit, as was available from RS Parts, although eventually going onto the Mk II type pedal box. Master cylinder sizes are: . 700" for brakes and clutch.

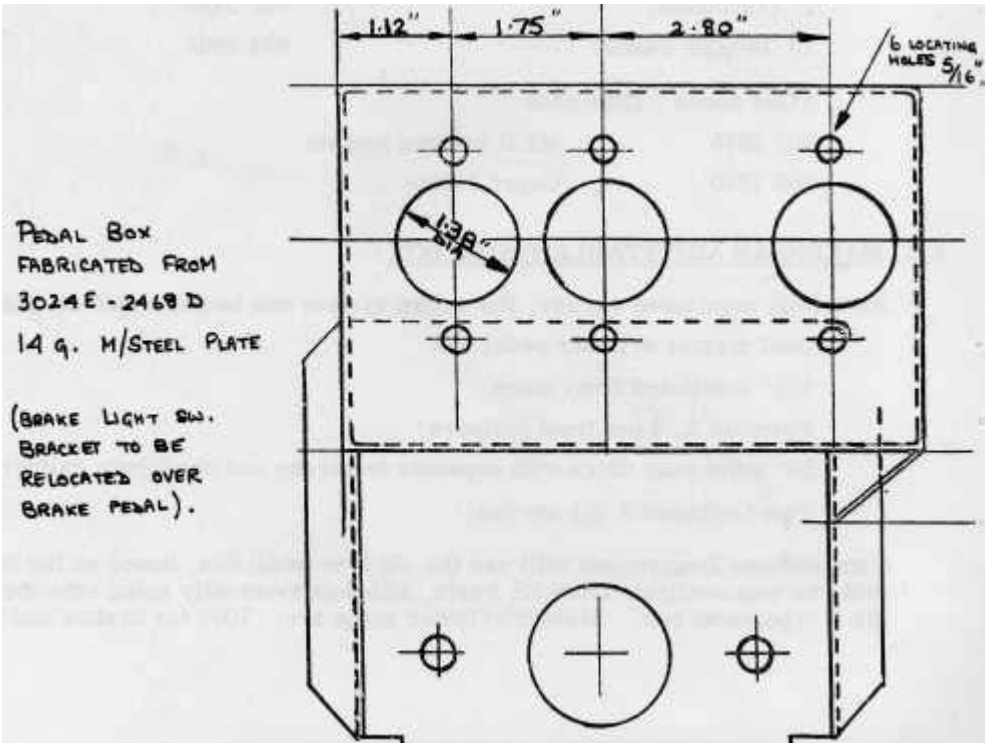
As the Mk I Pedal box bolts onto the vertical bulkhead panel via 4 studs, our shells have a strengthening plate welded on the engine side of the bulkhead to prevent the pedal box from flexing. The Mk II type box, incidentally, bolts on via 2 studs through the bulkhead, and two bolts onto the top cowl panel.

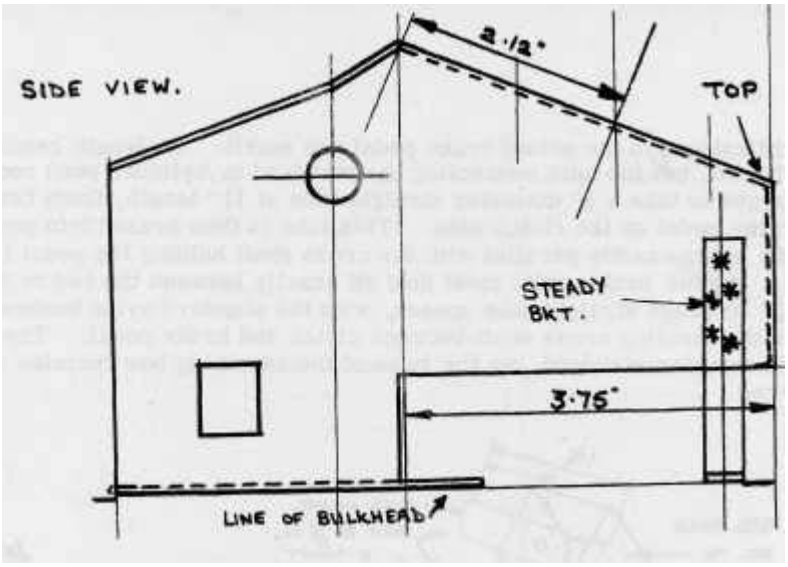
You can use Transit reservoirs to feed the master cylinders.

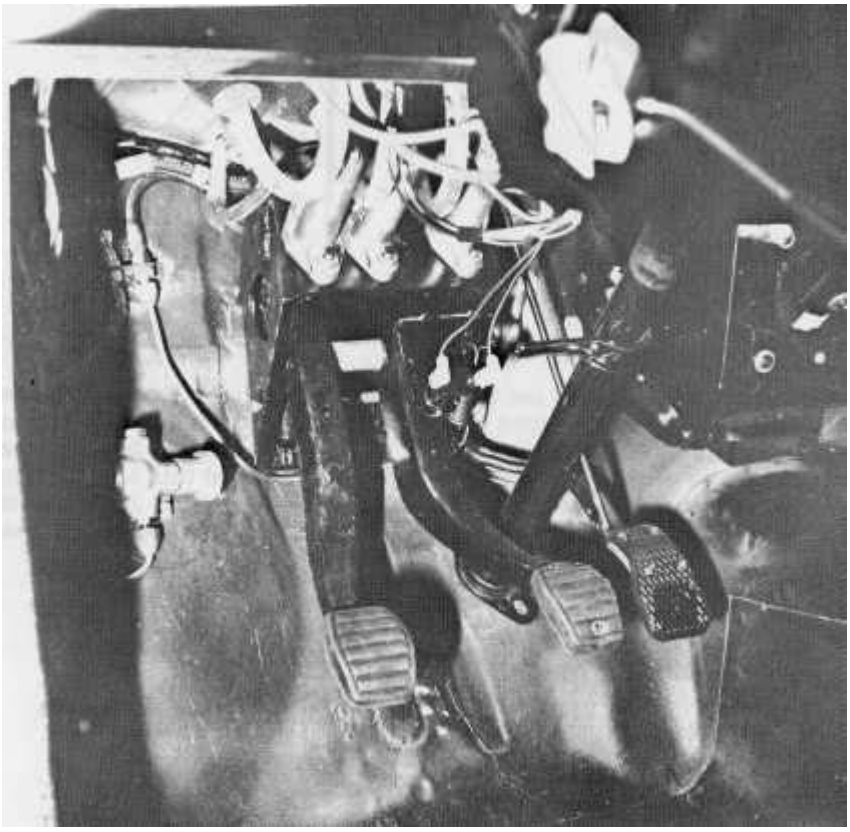
Another tip here is to use flexible hoses between master cylinders and bulkhead unions. This will allow you to unbolt the pedal box and work on it, if the need arises, without having to disconnect any unions.

A word of warning first: the basic Mk I hydraulic pedal box, is no longer available, so you will have to find a second-hand one, as this is the basis of the 'works' pedal box.

Starting with the pedal box from RS 1600/Mexico. As each circuit (front and rear) will have its own master cylinder operated directly from the pedal, the box has to be extended to accommodate an extra cylinder. The clutch m/cylinder remains in position, with the first brake cylinder 1. 75" to its right, viewed from the driving seat. The mounting surface for the cylinders, welded on at the same angle as the existing face, must then extend a further 2. 8" to the vertical centre line of the 3rd cylinder and then another l½" to its edge. The pedal box is 'boxed' for strength and accepts the 3rd standard . 7" Girling cylinder, as already employed by clutch and brake.

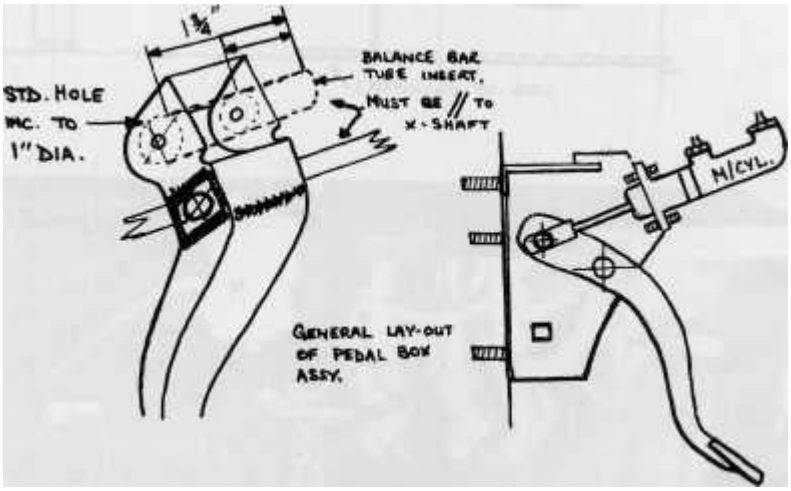

1.12"
1.75"
2.80"
6 LOCATING HOLES 5/16"
1.38"
PEDAL BOX
FABRICATED FROM
3024E - 2468D
14 g. M/STEEL PLATE
(BRAKE LIGHT SW. BRACKET TO BE RELOCATED OVER BRAKE PEDAL).


SIDE VIEW.
2.12"
TOP
STEADY BKT.
3.75"
LINE OF BULKHEAD

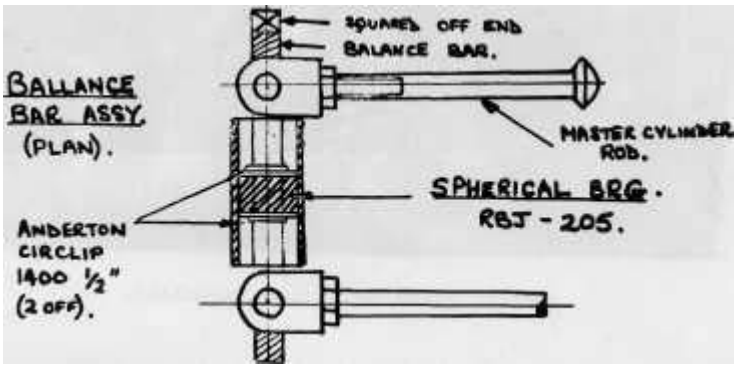


Above: Works pedal box installed

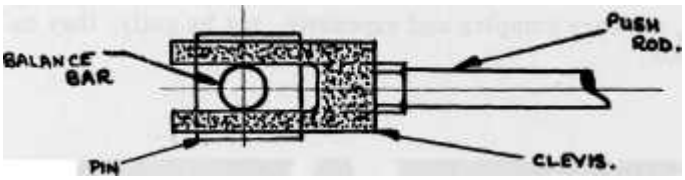
Modifications to the actual brake pedal are small. Its length remains unaltered, but the hole connecting the standard m/cylinder push rod is enlarged to take a 1" diameter straight tube of 1¾" length, flush fitting with the pedal on the clutch side. This tube is then brazed into position in the hole, exactly parallel with the cross shaft holding the pedal in the box. box. As the brake pedal must now sit exactly between the two m/cylinders, a l¼" 10 gauge straight tube spacer, with the standard nylon bushes, slides over the locating cross shaft between clutch and brake pedal. The cross shaft remains standard, as the base of the assembly box remains unaltered.



Having set up the pedal box for the balance bar, this now has to be made up and fitted. The tube brazed to the pedal houses the adjustable mechanism which is a solid ½" threaded bar approx 4" long with a RBJ -20S Rose bearing circlipped to its centre. The left to right movement of this bar, having been connected to the m/cylinder push rods alters the pivot point and hence the braking ratio. To facilitate adjustment when the box is in situ, the end of the balance bar should be squared off.



The yoke and trunion which forms a u/joint type link between bar and m/cylinder push rods can be made up as tiie diagram. Although there is no set part no. for this, most racing car manufacturers will be able to supply a mechanism for you, which is far easier than trying to make one yourself.



Now the box is almost complete, the throttle pedal will have to be bent to clear the outside extension of the pedal box, and extended upwards to meet the throttle cable. Lastly, the sensor for the brake light switch will have to be remounted above the pedal.

9.5. WORKS BRAKES

As we said earlier, Competitions Department use 10½" vented front discs and Formula 2, 4 pot calipers, available from A. P. Racing, the basic part no. for the Caliper being CP 2361.

The discs, bells and calipers will be available from RS Parts, although finis codes for these have not been allocated.

The rear end set-up has changed several times over the years, but basically Boreham started off with what were called thin rear solid discs, and two separate calipers for footbrakes and handbrake.

At approximately the time of changing to large studs, the back brakes were converted, using thicker discs and different calipers, although the change of studs and brakes were not connected.

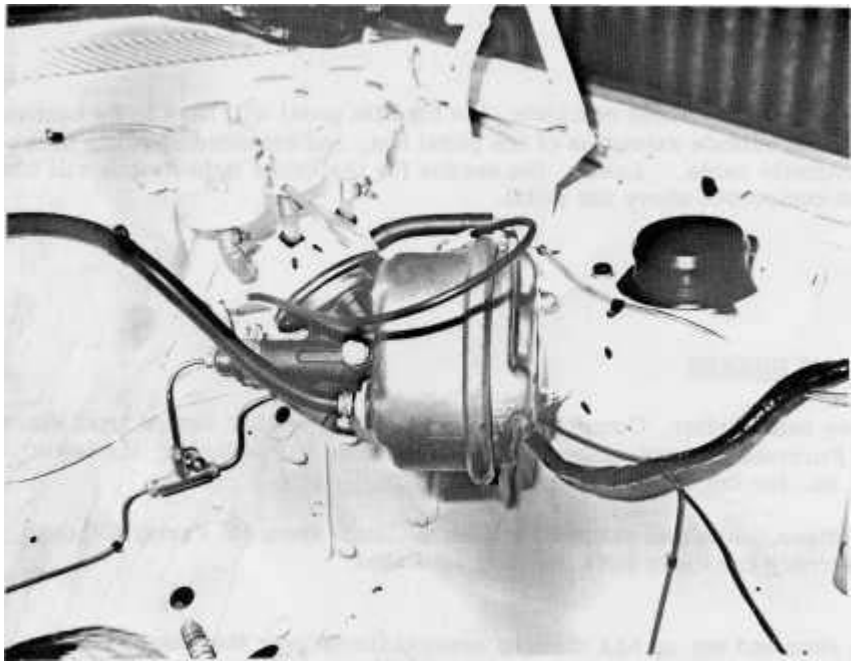
	'Thin disc' twin Caliper system	'Thick disc' twin Caliper system
Footbrake Caliper	CP 2213	CP 2383
Handbrake Caliper	CP 2195	CP 2213

9.6. SERVOS

The servos used were basically Mini Cooper S units fitted with a different valve by AP racing (giving 2:1 ratio), but now the units are available with current spec 2. 5:1 ratio, direct from AP.

Yet again, the late type rear brakes and servos will be available from RS Parts.

As you can see, all very complex and expensive, but by golly, they do stop a car quickly.



Front servo location. Note in/cylinder reservoirs

Rear brakes servo. Pay special attention to even regulations: the interpretation of FIA rules differs according to scrutineers about having servos inside the car. Servos will not be allowed inside the car from 1978 onwards for international Group 2 and 4 events.

NB: It is illegal to run a motor car on the roads in the UK with only an hydraulic handbrake. An MOT efficient mechanical handbrake must be in working order on the car at all times.

9.7. BEDDING IN PADS

Lastly, a word of advice on using handbrake pads.

When using high efficiency braking material, a lining which has a long life will of necessity take longer to 'bed-in' than linings of the more normal type. To obtain the maximum efficiency, it is essential to condition the surface of the material and this, once established, will remain throughout its life. The following procedure is therefore recommended during the initial 'bedding-in' period.

1. Driving the car normally the brakes should be used lightly but frequently for the first 150-200 miles.

2. The brakes should be used hard, giving several heavy applications, preferably from the medium range speeds until some falling off in efficiency is noted. (This is the surface conditioning process and is accompanied by slight fade and a rather pungent smell of hot brake lining.)

3. Allow the brakes to cool. Braking should then be continued for several further applications until stabilized conditions are reached, no further increase in pedal pressure being required for a given deceleration.