

## SECTION J

### BRAKING SYSTEM

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J. 1 - GENERAL DESCRIPTION

The brakes of the disc type are hydraulically operated. Pressure on the brake pedal forces fluid from the master cylinder into cylinders at the wheels, exerting pressure on pistons which actuate the brake pads. A vacuum operated servo is incorporated in the system to ensure light pedal application.

The handbrake is mechanically operated, through a cable linkage and operates on the rear brakes. It is quite independent of the hydraulic system in operation.

On vehicles designed for markets requiring dual braking systems and to comply with the laws existing in those markets, the braking system is split into two separate hydraulic units with its own master cylinder, two brakes (either front or rear). The object of the dual systems being that in the unlikely event of a leak developing or a brake pipe splitting, at either front or rear of the car, the driver is not in a position of having no brakes and is thus able to stop in the event of a failure.

Also incorporated in the braking system is a pressure differential warning valve and a 'brake fail' warning lamp with test switch. The lamp will glow RED if a failure occurs anywhere within the braking system, or if the test switch is operated.

Maintenance

The combined master cylinder brake fluid reservoir is located at the rear end of the engine compartment, it being mounted on the pedal box assembly.

Check fluid level at intervals of every 5,000 miles (8,000 km.) topping - up if necessary to within  $\frac{1}{2}$ in. (12 mm.) of the top, using only the specified fluid (see Section 'O').

Brake Adjustments

When properly adjusted there should be a  $\frac{1}{4}$ in. (6 mm.) free movement of the brake pedal before the piston in the brake master cylinder begins to move. When checking this setting take care that the carpets are not fouling the pedal.

No manual adjustment to compensate for brake pad wear is provided or indeed necessary, since the correct pad-to-disc relationship is maintained hydrostatically as the brakes are operated.

Brake Pads

Pads should be examined at regular intervals. Always use genuine pads on replacement.

It should be understood that a metallic hiss is apparent with disc brakes. This is normal and should not be considered as a fault. If a metallic squeal is heard this is general indication of brake pads OVERDUE for replacement. Under no circumstances allow the pads to wear below  $\frac{1}{16}$ in. (1.6 mm) thickness.

Servo Unit Air Filter(s)

The filter element(s) should be renewed at intervals of every 10,000 miles (16,000 km).

Hydraulic Pipes and Connections

It is of vital importance that there are no leaks in the hydraulic system, therefore it is essential that these should be checked periodically, when the brakes are receiving normal maintenance inspection.

All bundy pipes should be inspected throughout their entire length at intervals NOT EXCEEDING 6 months, i.e. before and after the winter months. This is particularly important where salt and grit (which are both corrosive), are used in the clearance of snow and ice.

Brake Seals, Hoses and Fluid.

The brake manufacturers recommend that at intervals not EXCEEDING 40,000 miles (65,000 km) or 3 years, whichever is reached first, that the braking system be completely overhauled and all washers, seals and hoses renewed. Hydraulic servo units should be stripped, all old seals discarded, component parts cleaned and examined and if in good condition, the unit rebuilt with the appropriate service kit. All fluid should be drained, the system flushed with a correct cleaning fluid, then refilled with new fluid (see Section 'O') at intervals of every 18 months.

J. 2 - BLEEDING THE SYSTEM.

'Bleeding' is the process of removing air from the pipe line and cylinders and is necessary whenever any part of the system has been disconnected, or the level of fluid in the master cylinder reservoir has been allowed to fall so low that air has been drawn into the master cylinder.

When seals are worn it is possible for air to enter the caliper cylinders without any sign of leaking fluid, and cause a 'spongy' pedal action, which is the usual indication of bubbles of air in the system.

The equipment that is necessary for bleeding is a supply of brake fluid (see Section 'O'), a rubber bleed tube and a 7/16in A/F spanner. A small spanner should be used as bleed screws should never be overtightened (see 'TECHNICAL DATA').

Fill up the reservoir with the approved fluid direct from the can and the level should be maintained during bleeding.

Bleeding should start at the rear left-hand wheel. Unscrew the bleed nipple enough to allow the fluid to be pushed out, half a turn, and proceed to each wheel in turn from the farthest to the nearest to the master cylinder, pumping the fluid through



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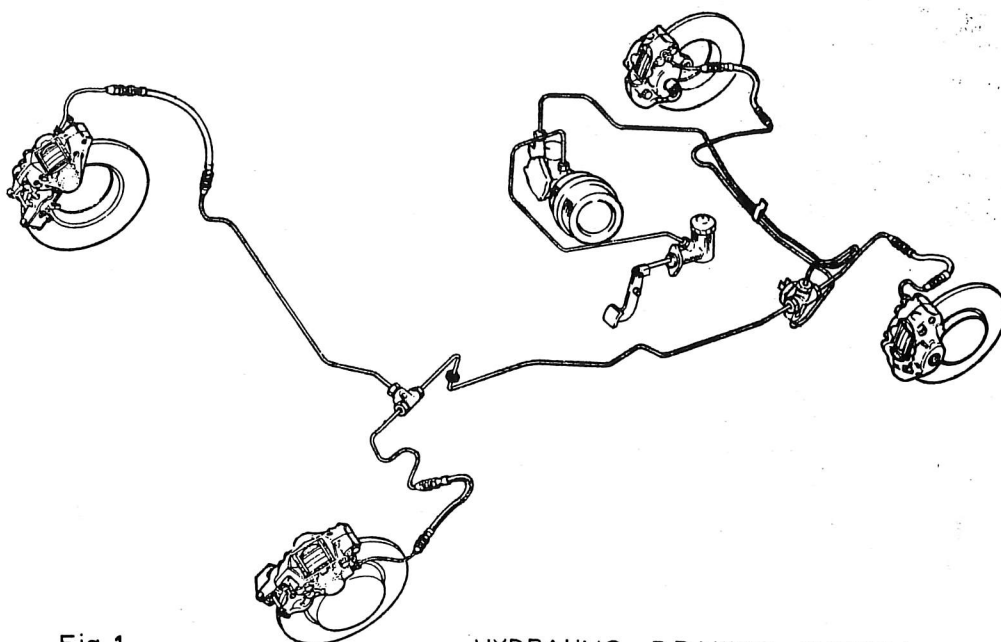


Fig. 1.

HYDRAULIC BRAKING SYSTEM

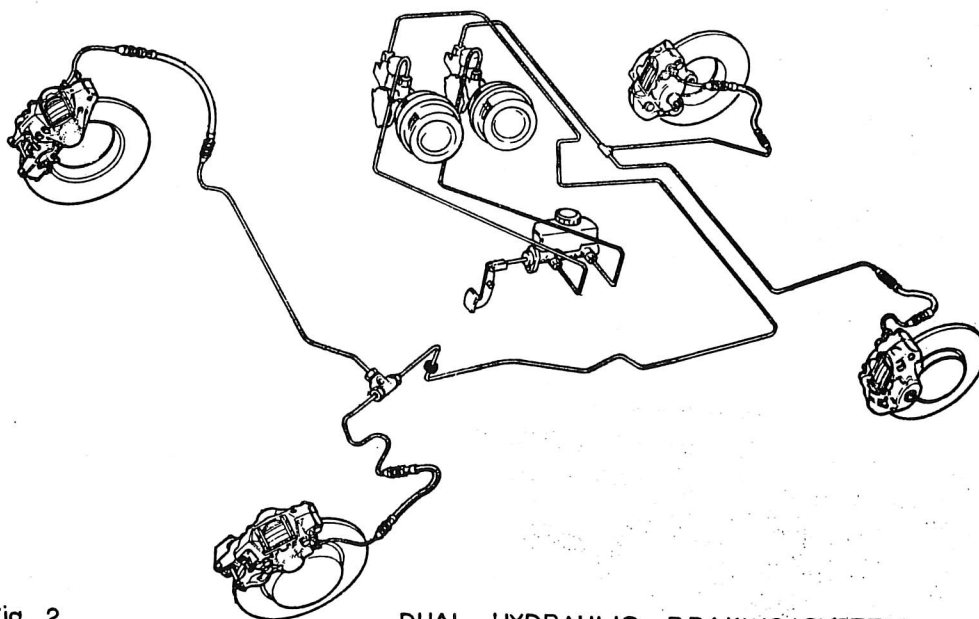


Fig. 2.

DUAL HYDRAULIC BRAKING SYSTEM

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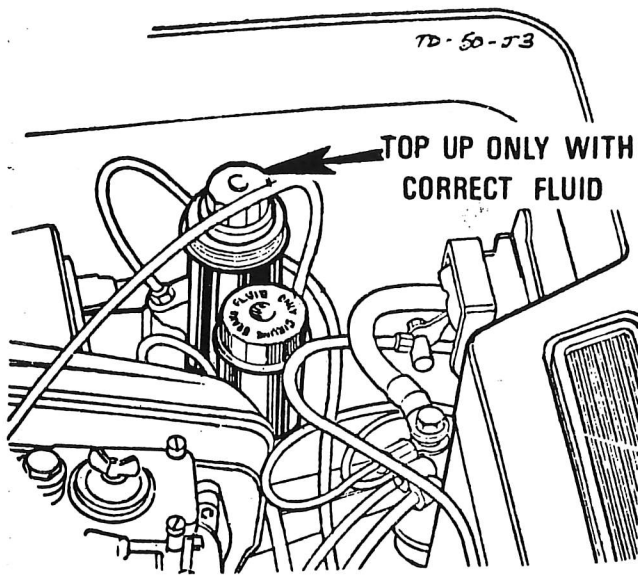


Fig. 3. POSITION OF FLUID RESERVOIR

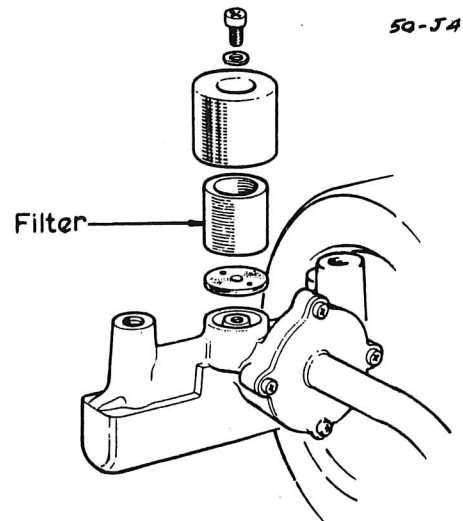


Fig. 4. SERVO FILTER

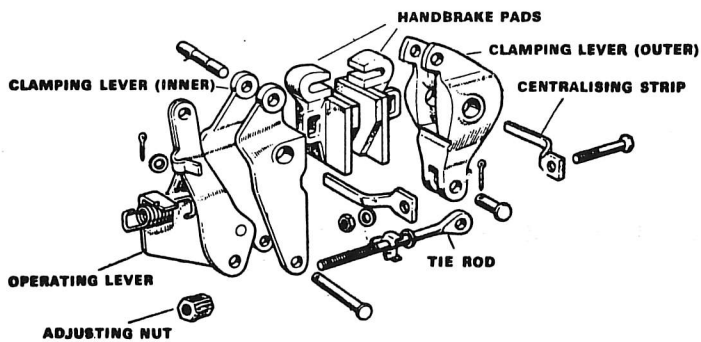
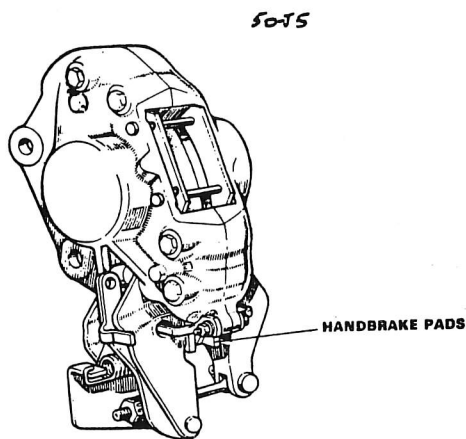


Fig. 5. HANDBRAKE CALIPER COMPONENTS

until no more bubbles appear then closing the bleed screw on a downward stroke of the pedal.

The pedal should be operated by a succession of rapid long and short strokes. The pedal is pushed down through its full stroke, followed by two or three short rapid strokes, and then allowed to fly back to the stop with the foot right off. It is unnecessary to stamp hard on the pedal but a quick full stroke is required. If the floor mat obstructs the full stroke of the pedal it should be removed.

After all four wheels have been bled check the pedal stroke. If there is a springy feeling to the pedal bleed again at each nipple to finally confirm that all air has been eliminated.

A slight variation of the routine is favoured by some operators. They prefer to go round the system twice. The first time (to fill the system) each bleed screw is closed as soon as fluid is being discharged regardless of the small bubbles that may be present and the second time round only a few strokes at each bleed screw are needed to finally discharge the air.

Springiness of the brake pedal can have other causes than air in the system. Flexing of the pedal lever, of the pedal mounting or of the master cylinder mounting is not uncommon and can be seen if looked for. Other causes not so easily seen are badly fitted pads and warped or otherwise distorted pads.

#### Tandem Master Cylinder

Bleed the rear brakes first, commencing with the left hand-wheel, then bleed the front brakes starting with the left-hand wheel. Use only a light pedal action and DO NOT push the pedal through at the end of its stroke. Do NOT 'try' the pedal until the system is fully bled as either action will cause the plunger to move and actuate the brake fail warning lamp.

If during the bleeding procedure the plunger operates the switch and the warning lamp is on, the bleedscrew must be closed and the bleedscrew at the other end of the car opened (if bleeding the front brakes, open a bleedscrew on a rear brake and vice versa).

A steady pressure must then be applied to the pedal until the lamp goes out, when the pressure must be released immediately and the bleedscrew closed. Otherwise the piston will move too far in the opposite direction and require resetting again.

When the lamp goes out a 'click' will be felt on the pedal as the piston moves back.

J. 3 - PAD REPLACEMENTFront

1. Remove the front wheels (see Section 'G').
2. Remove any accumulated road filth from around the brake pad in the calipers.
3. Pull out the pad retaining pin clips, withdraw the retaining pins and remove the brake pads and shims.
4. To enable the new pads to be fitted, push the pistons into their bores. This action will cause fluid to be returned to the master cylinder, which, if it has recently been topped up, may overflow. To avoid this, examine the fluid level and, if necessary, remove a quantity of fluid.
5. Fit new brake pads in car sets (both wheels), and shims ensuring that both are correctly fitted. The shims fitted incorporate an arrow which must point in the direction of forward rotation of the wheel.
6. Refit retaining pins and secure with the retaining pin clips.
7. Operate the brake pedal several times to bring the pads into the correct adjustment. Check that the pads are free to move slightly, this indicates that the retaining pins are not fouling the pad.
8. Replace the front wheels.

Rear

1. Pad replacement for the rear brakes is carried out in a similar fashion to the front pads replacement.
2. It should be noted (for identification purposes) that the retaining pins do not pass through the pad plates, nor are shims fitted.

Handbrake

1. Remove the rear wheels (see Section 'G').
2. Release the nut and remove the bush and bolt securing the handbrake actuating rod to the operating lever on the caliper. Do not misplace the bush.
3. Unscrew and remove completely the operating lever adjusting nut from its tie-rod.
4. Release the nut and remove the bolt securing the centralising straps.
5. Swing the clamping levers away from the disc to give as much working clearance as possible, then unhook the worn pads from the pivot pins.

6. Before replacing the pads, which is a direct reversal of the removal procedure, apply a liberal quantity of Girling Brake Grease to all pivot points.
7. After refitting pads, adjust by means of the adjuster nut to give a maximum clearance of .003in (.076mm.) at each side of the disc.

J. 4 - FRONT CALIPERS

To Remove

1. Remove the front wheel (see Section 'G').
2. Remove the brake pads (Section 'J.3'). If it is intended to overhaul the caliper assembly, depress the brake pedal to bring the pistons into contact with the disc, thus facilitating the removal of pistons.
3. Remove the fluid pipe from ~~its union on~~ the caliper and fit a plug to avoid unnecessary wastage of fluid, or the possible ingress of foreign matter.
4. From the inner face of the caliper, release the two mounting bolts and remove caliper from the car.

To Replace

1. Replace the caliper and secure to its mounting plate with the two bolts, tightening them to the torque loading given in 'TECHNICAL DATA'.
2. Remove the plug and replace the fluid pipe to its union on the caliper.
3. Push the pistons sufficiently into their bores to allow the pads to be replaced together with their shims.
4. Replace the front wheel.
5. Bleed the braking system (Section 'J.2').

J. 5 - REAR CALIPERS

To Remove

1. Remove the rear wheel (see Section 'G').
2. Remove the brake pads (Section 'J.3'). If it is intended to overhaul the caliper assembly, depress the brake pedal to bring the pistons into contact with the disc, thus facilitating the removal of pistons.
3. Disconnect the handbrake actuating rod from the operating lever on the caliper.
4. From Chassis No.50/1333 it will be necessary to remove the upper dirt shield, this being secured by 4 No 10.self-locking UNF. nuts.
5. Remove the fluid pipe from its union on the caliper and fit a plug to avoid unnecessary wastage of fluid, or the possible ingress of foreign matter.

6. From the outer face of the caliper, remove the locking wire securing the mounting bolts, release bolts and remove caliper from the car.

#### To Replace

1. Replace the caliper and secure to its mounting on the wheel bearing housing with the two bolts, tightening them to the torque loading given in 'TECHNICAL DATA'. Wire lock the bolts after tightening, ensuring that the wire will not allow the bolts to release themselves.
2. Remove the plug and replace the fluid pipe to its union on the caliper.
3. If removed, replace the upper dirt shield using new nuts for its retention.
4. Push the pistons sufficiently into their bores to allow the pads to be replaced.
5. Replace the handbrake actuating rod to the operating lever on the caliper.
6. Replace the rear wheel.
7. Bleed the braking system (Section 'J.2').

#### J. 6 - CALIPER OVERHAUL

##### To Remove

1. Remove the caliper (Section 'J.4' of 'J.5').

NOTE: The calipers are made in two paired halves which are bolted together. Under NO CIRCUMSTANCES MUST the two halves be separated.

##### To Dismantle - Front

1. Remove the outer sealing ring securing the dust cover and pull off cover.
2. Remove the piston and withdraw the inner sealing ring.
3. Repeat these operations for the other cylinder.

##### To Dismantle - Rear

1. Pull the dust cover from its location.
2. Remove the piston and withdraw the inner sealing ring.
3. Repeat these operations for the other cylinder.

##### Inspection and Cleaning

1. Wash the pistons and piston bores in commercial alcohol, methylated spirit or brake fluid (see Section 'O'). Do NOT use a mineral-based fluid such as petrol, paraffin or carbon tetrachloride, etc.
2. Ensure that the pistons and their bores are free from score marks. If not, replace with new pistons and calipers as necessary.

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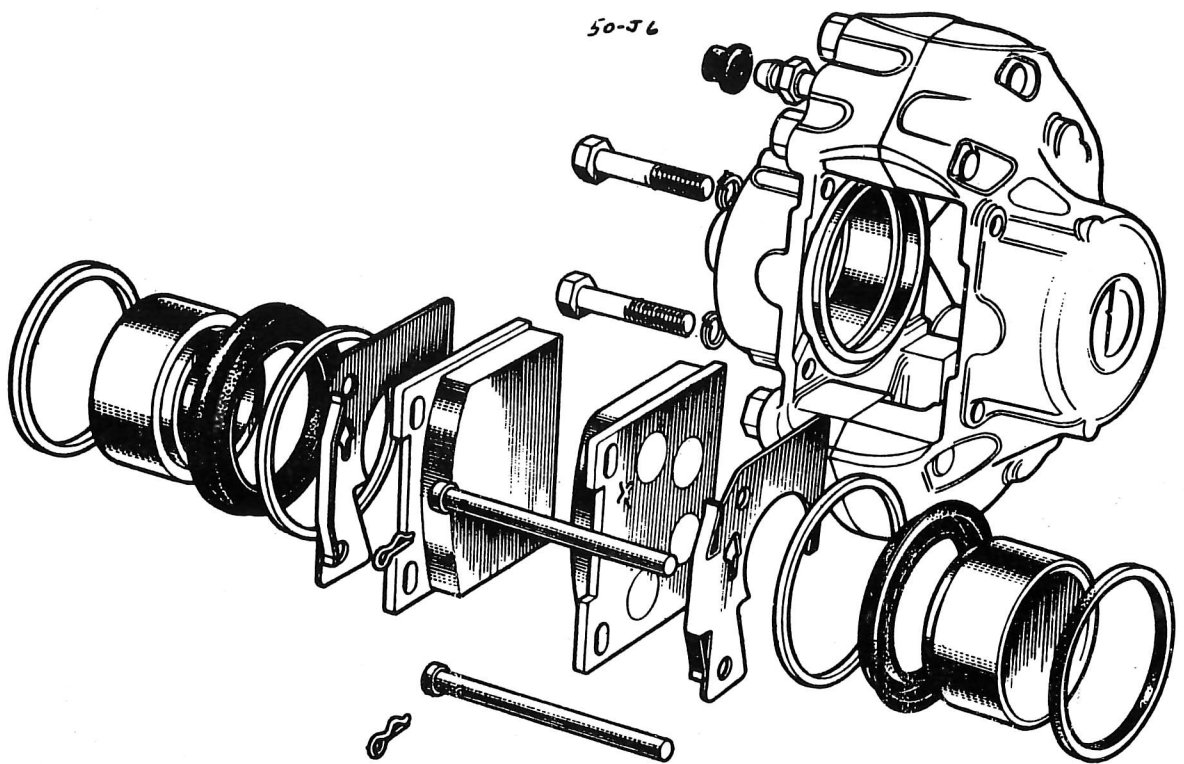


Fig. 6. FRONT BRAKE COMPONENTS

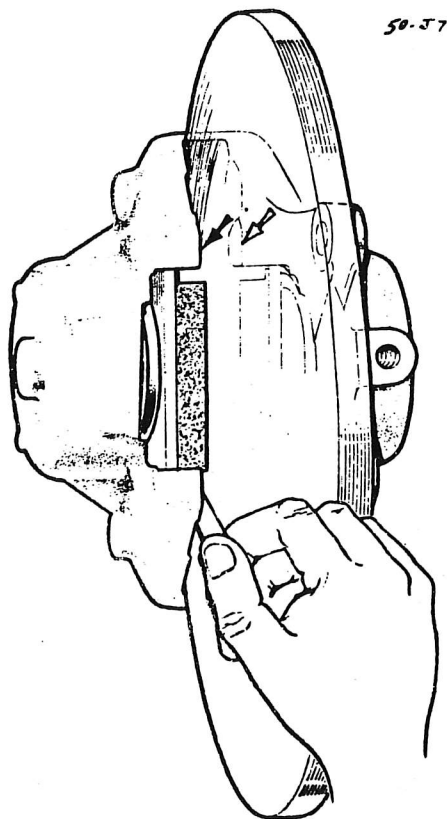


Fig. 7. CHECKING GAP BETWEEN  
CALIPER & DISC

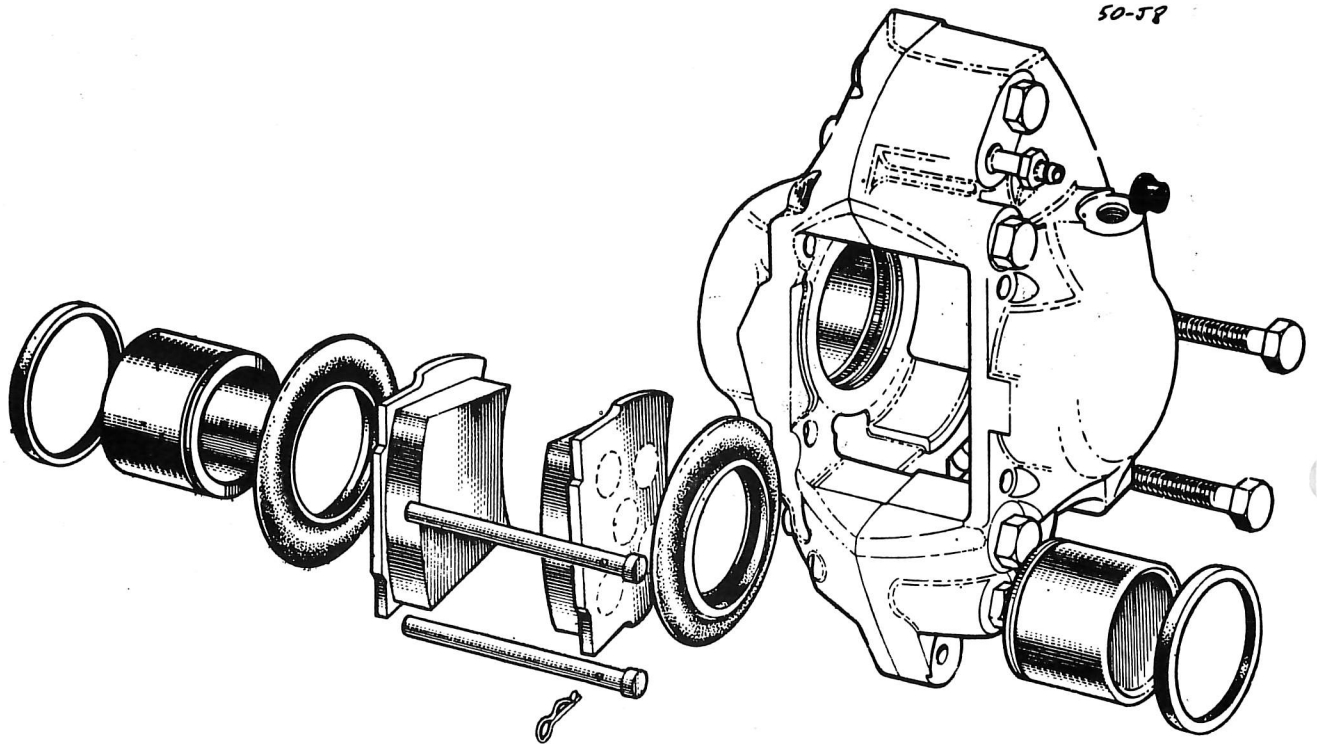


Fig. 8. REAR BRAKE COMPONENTS

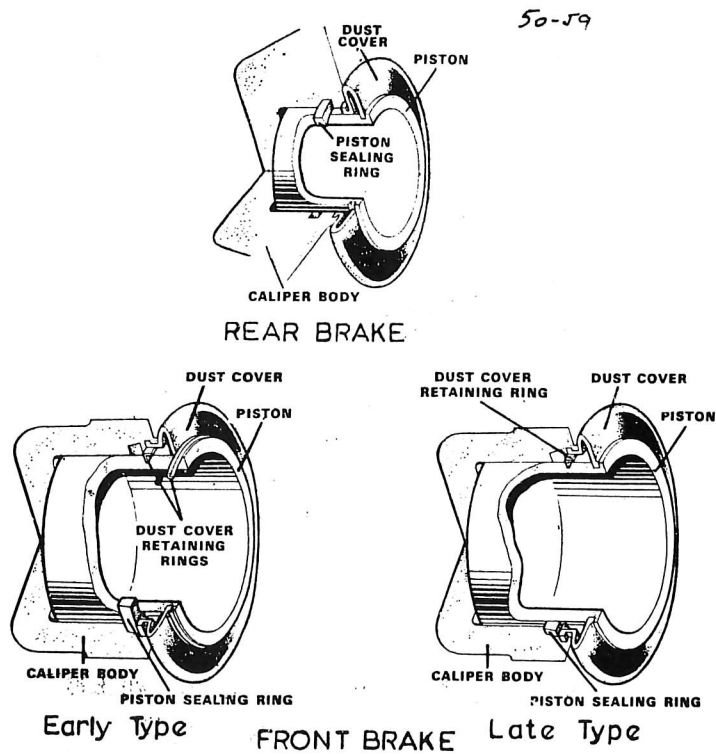


Fig. 9. CALIPER PISTONS & SEALING RINGS



To Reassemble - Front

1. Replace the inner sealing ring, followed by the piston (crown end first).
2. Replace the dust cover and outer sealing ring.
3. Repeat these operations for the other cylinder.

To Reassemble - Rear

1. Replace the inner sealing ring, followed by the piston (crown end first).
2. Replace the dust cover.
3. Repeat these operations for the other cylinder.

To Replace

1. Refit the caliper (see Section 'J.4' or 'J.5') and bleed the system. (Section 'J.2').

J. 7 - FRONT CALIPER MOUNTING PLATE/DUST SHIELD

To Remove

1. Remove the wheel (see Section 'G').
2. Remove the brake caliper (Section 'J.4').
3. Remove the front hub (see Section 'G').
4. Remove the bolts securing the caliper mounting plate, and caliper dust shield to the vertical link. Note that the two lower bolts also retain the steering arm.

To Replace

1. Replacement is direct reversal of the removal procedure. Tighten all bolts to the torque loading given in 'TECHNICAL DATA'.

J. 8 - REAR BRAKE DIRT SHIELDS

To Remove

1. Remove rear wheel (see Section 'G').
2. Release the 4 self-locking nuts securing the upper shield to its mounting bracket.
3. From the upper face of the lower shield, release the self-tapping screws with their spire nuts securing the shield support clips to the wishbone.
4. Release the locknut securing the flexible hose to the upper mounting bracket, then slacken jubilee clip securing the bracket to the damper.

To Replace

1. Replacement is a direct reversal of the removal procedure. Note that the brake flexible hose is not chafing, or twisted before securing its locknut.

2. Use new self-locking nuts to secure the upper shield to its mounting bracket.

### Fitting Dirt Shields

Dirt shields have been fitted in current production from Chassis No. 50/1333. They can be fitted to earlier cars than this and are available in a Kit under Part No. 50 J 6073.

1. Remove the rear wheels (see Section 'G').
2. Remove existing bundy pipes from 3-way to flexible hoses and from hoses to calipers. Insert plugs in pipe ends to avoid ingress of any foreign matter. Discard the bundy pipes removed.
3. Remove each flexible hose from its brackets on chassis and damper. Carefully straighten the chassis bracket to a horizontal plane.
4. Fit new bundy pipes 50 J 6012 (30.5in. 77.4 cm.) and 50 J 6013 (14.5in. 36.8 cm.) from 3-way to L/H rear and R/H rear respectively chassis brackets. Ensure that bundy pipes cannot vibrate against any obstruction. Refit flexible hoses as illustrated in Fig.10.
5. Fit mounting brackets 50 J 0129 L/H and 50 J 0130 R/H to their respective dampers, ensuring that they are as close as possible to the spring abutments and the front edge is at 90° to the drive line.
6. Fit 8.5in (22 cm.) long bundy pipes between the calipers and the flexible hoses, bending as necessary.
7. The upper shields can now be fitted to their respective mounting brackets using the 8 (4 each side) No.10 self-locking nuts for their retention.
8. Fit the 'P' clips to the wishbone as illustrated in Fig.10. Offer up the lower shields to the wishbones and secure the 'P' clips to the shields with the self-tapping screws and spire nuts.
9. After satisfactorily fitting the shields, bleed the braking system (Section 'J.2'), then refit the rear wheels (see Section 'G').

### J. 9 - FRONT BRAKE DISC.

#### To Remove

1. Remove the front hub (see Section 'G').
2. From the rear of the hub, extract the four bolts which retain the disc.

#### To Replace

1. Clean the mating faces of both the disc and hub. These must be scrupulously clean if disc run-out is to be avoided.
2. Insert the bolts through the disc and into the hub, tightening them to the torque loading given in 'TECHNICAL DATA'.

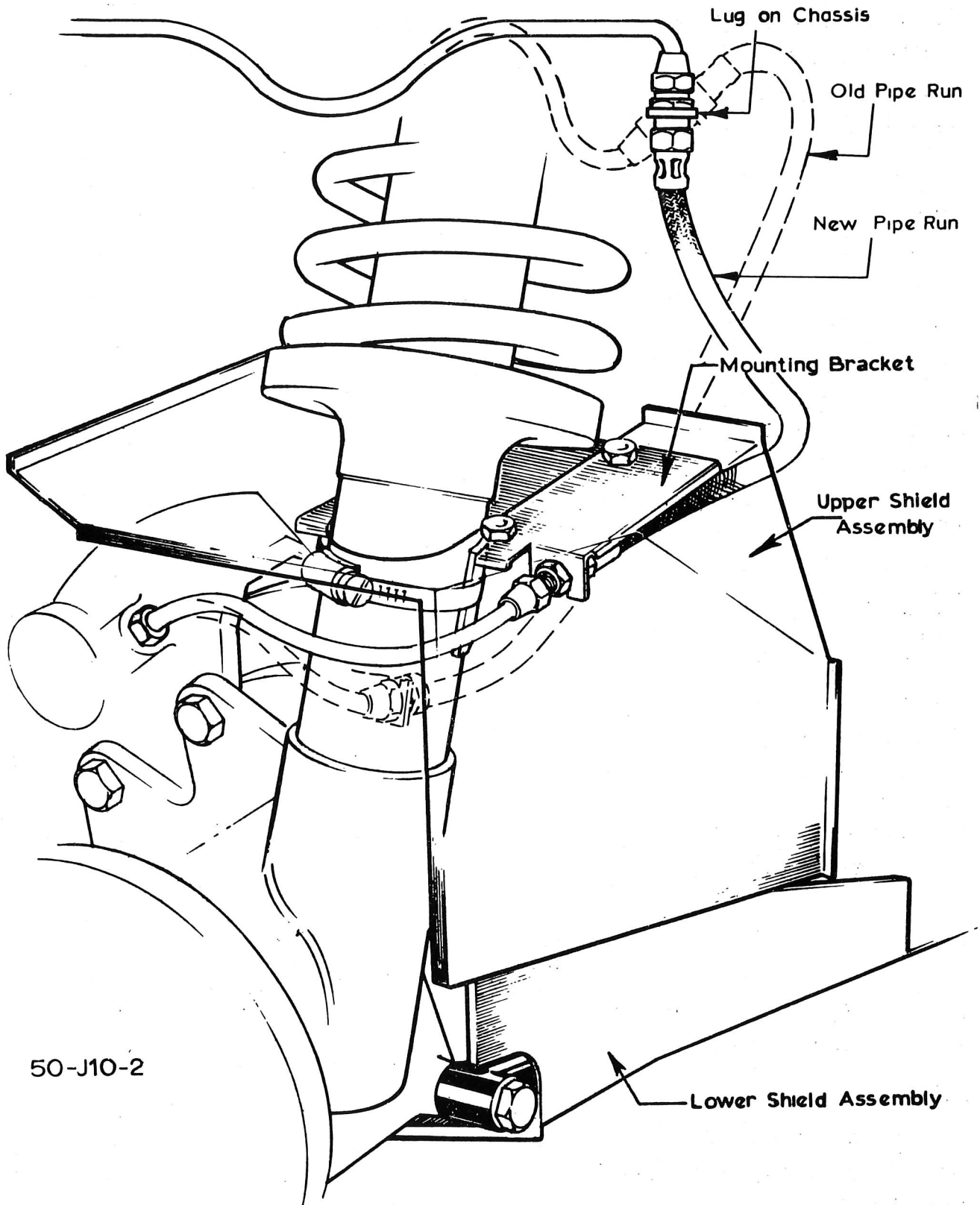


Fig. 10. REAR BRAKE DIRT SHIELDS

3. Replace the disc and hub assembly (see Section 'G').
4. Using a magnetic-based dial gauge mounted on the front upper wishbone, check the run-out of the disc which must be within the dimension given in 'TECHNICAL DATA'. Should a reading in excess of this figure be recorded, the cause of the excessive run-out, i.e. distorted disc, dirt between mating faces of disc and hub, or mal-adjusted hub bearings, etc., must be eliminated.

#### J.10 - REAR BRAKE DISC

1. Remove the rear wheel (see Section 'G').
2. Lower the outer end of the wishbone and push down to clear disc. (See Section 'D').
3. Remove the brake caliper (Section 'J.5').
4. Remove the outboard Rotoflex coupling noting that three of the retaining bolts also secure the brake disc (see Section 'R').
5. Turn disc to clear outboard drive shaft and remove.

#### To Replace

1. Replacement is a direct reversal of the removal procedure. Ensure that the mating faces of disc and outboard drive shaft are scrupulously clean if disc run-out is to be avoided. Tighten the bolts to the torque loadings given in 'TECHNICAL DATA'.
2. Using a magnetic dial gauge mounted on the damper, check the run-out of the disc as detailed in paragraph '4' of Section 'J.9'.

#### J.11 - PEDAL BOX

Three different pedal boxes have been fitted in Production since the inception of the Lotus Elan + 2. These are:-

50 J 604	From 50/0001 to 50/0366
A50 J 604	From 50/0367 onwards
C50 J 604	From 50/0857 onwards, Federal cars.

The removal and replacement procedure for the differing types of pedal box are all basically similar, as follows.

#### To Remove

1. Remove the throttle pedal cable (see Section 'L'). Disconnect the brake and clutch fluid pipes at their respective master cylinders, fitting plugs into the ends of the pipes to avoid unnecessary wastage of fluid and the ingress of foreign matter. Remove the cables from the stop lamp switch and from the 'low fluid' indicator on master cylinder cap.

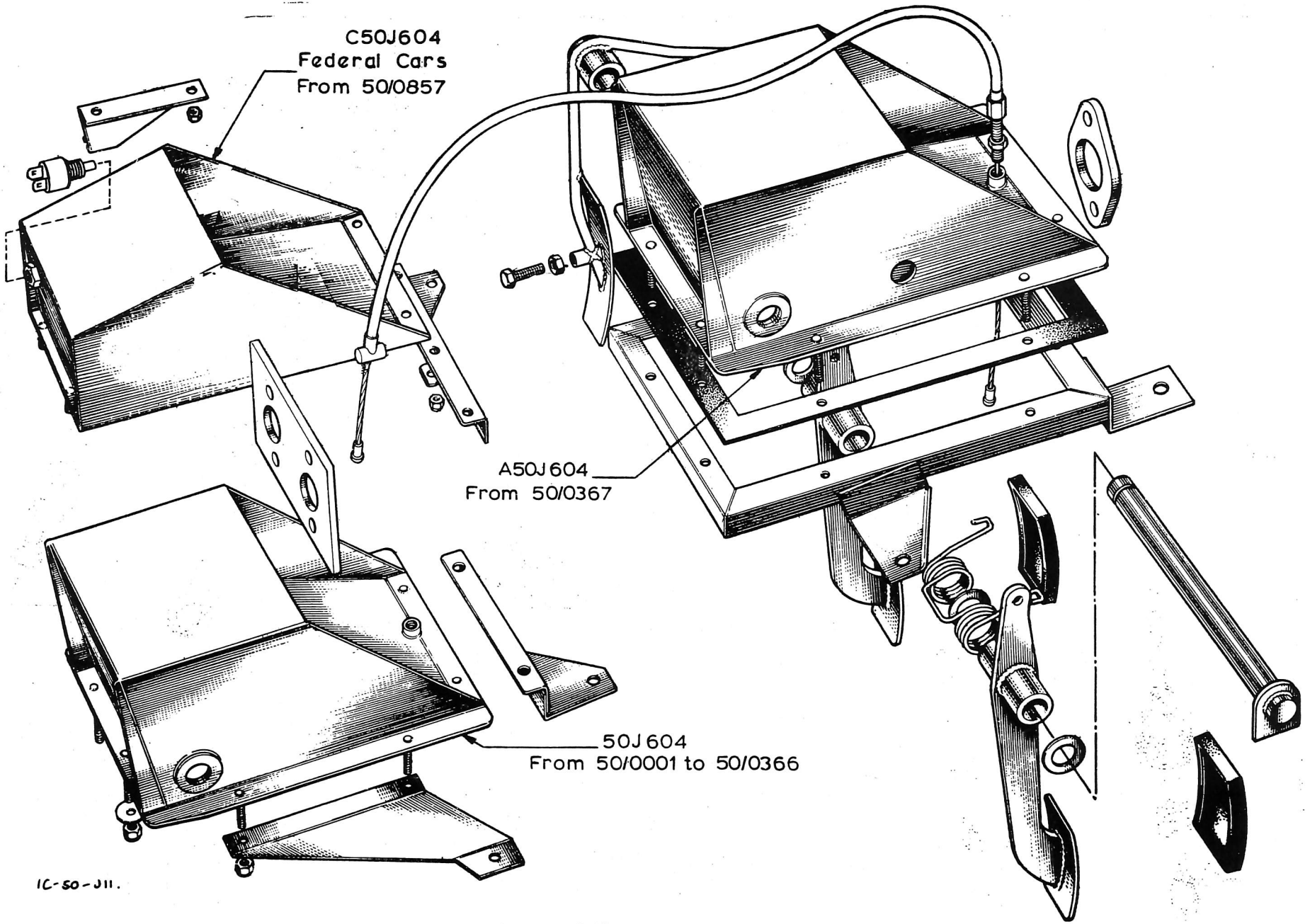


Fig. 11. PEDAL BOX COMPONENTS

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1C-50-J12.

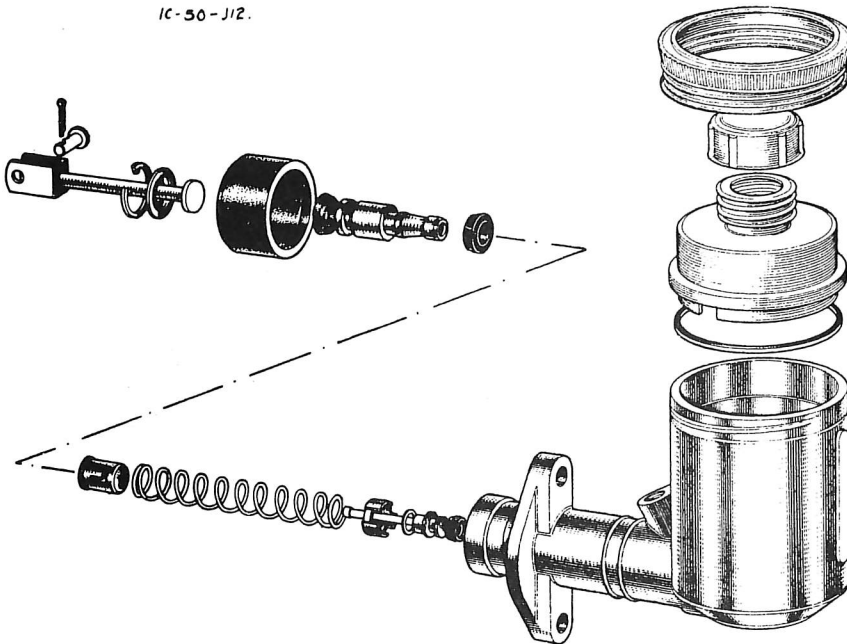


Fig.12. MASTER CYLINDER

1C-50-J13.

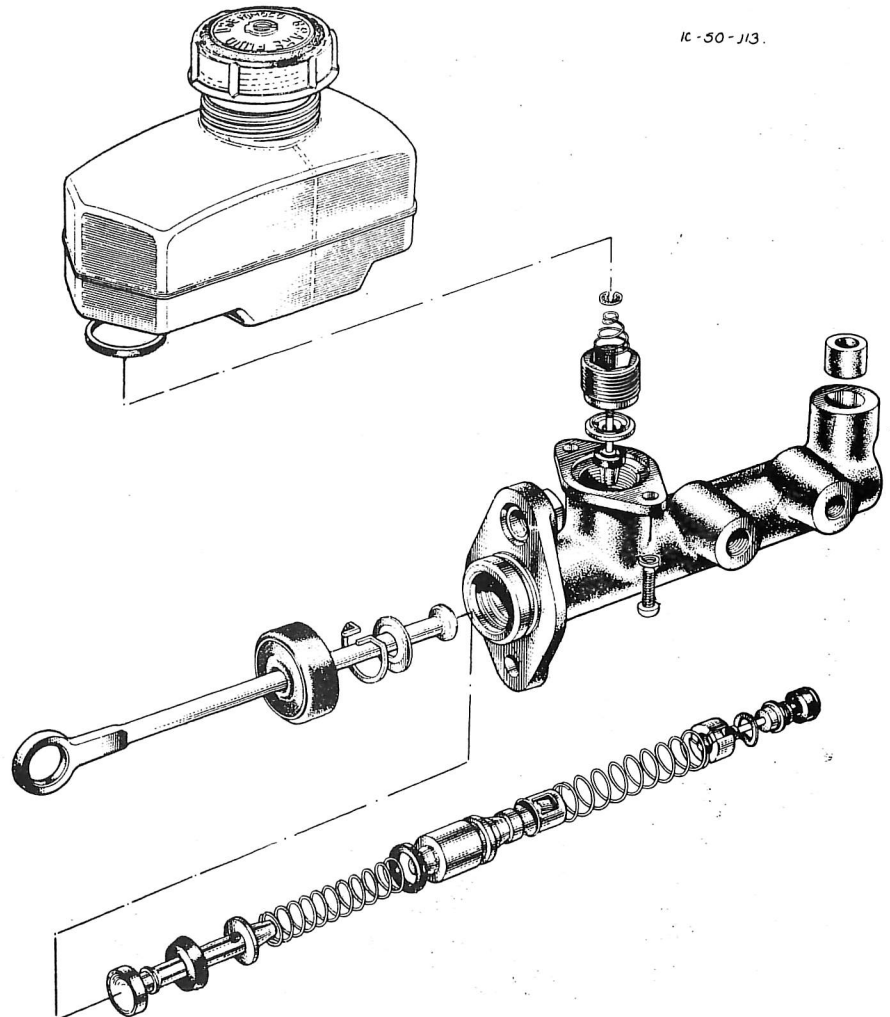


Fig.13. TANDEM MASTER CYLINDER

2. From the upper face of the interior of the foot well, remove the nuts securing the pedal box. Remove the pedal box as an assembly complete with its pedals and mounting gasket.

To Dismantle

1. Remove the split pins, securing the master cylinder push rods clevis pins, which attach the brake and clutch pedals to their respective push rods.
2. From the outside of the pedal box, remove the circlip retaining the pedals cross-shaft
3. Push out the cross-shaft taking care not to misplace the shims between the inner sides of the pedal box and the pedals. Lift out the pedals together with the return spring.
4. Remove the nuts and bolts securing the master cylinders to the pedal box.

To Rebuild

1. Mount the master cylinders to the pedal box together with their spacers (if fitted) and secure with their nuts and bolts. Tighten the nuts to the torque loading given in 'TECHNICAL DATA'.
2. Rebuild the pedals into the box on their cross-shaft, using the shims in the positions from which they were removed. Ensure the pedals spring is lying in its correct position and its ends are secure over the pedals. Retain the cross-shaft with its circlip.
3. Using new split pins, secure the clevis pins retaining the master cylinder push rods to their respective pedals.

To Replace

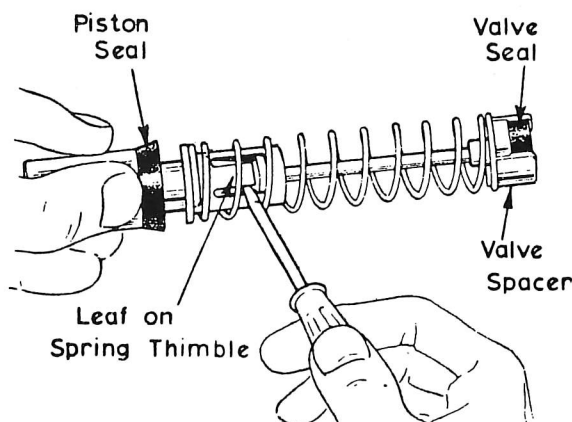
1. Using a new gasket to which has been applied a continuous strip of 'Prestik', replace the pedal box to the car. Again using 'Prestik', seal the pedal box to the car.
2. Replace the hydraulic fluid pipes to the master cylinders, after removing the plugs from the ends of the pipes. Bleed both the brake (Section 'J.2') and clutch (see Section 'Q') systems.
3. Replace the cables on the stop lamp switch (where this is fitted on end of master cylinder) and to the 'low fluid' indicator on master cylinder cap. Replace the throttle pedal cable ensuring that full travel is available of the pedal. If necessary, release the locknut on throttle stop and adjust stop to achieve this condition, retightening locknut after adjustment.

J.12 - MASTER CYLINDERTo Remove

1. Remove the pedal box (Section 'J.11').
2. Remove the split pin and withdraw the clevis pin securing the master cylinder push rod to the brake pedal. Remove the nuts and bolts retaining the master cylinder to the pedal box.

To Overhaul

1. Remove the rubber boot. Withdraw the circlip and remove the push rod.
2. Pull the piston and valve assembly from the cylinder. (Twin assembly on tandem master cylinder).
3. The piston is held in the spring thimble by a leaf which engages under a shoulder on the front of the piston. Carefully lift this leaf and remove the piston.

Fig.14. DISMANTLING SEALS TD-50-09

4. Compress the spring and move the retainer to one side which will release the end of the valve stem from the retainer.
5. Slide the valve spacer and shim off the valve stem.
6. Remove the rubber valve seal and the piston seal, if necessary.
7. Wash all parts in methylated spirit, commercial alcohol or approved brake fluid. Do not use mineral base fluids such as petrol, paraffin or carbon tetrochloride.
8. Inspect the piston and cylinder for score marks and the rubber seals for damage to the sealing lips. Renew any parts that appear unsuitable for further service.
9. Fit the piston seal to the piston with the sealing lips towards the spigot end and the valve seal to the valve stem with the lip towards the front of the valve.



10. Replace the shim washer on the valve stem together with the seal spacer so that the legs of the spacer are towards the valve seal. Ensure that the shim is fitted concentrically on the rear shoulder of the valve stem so that its convex face abuts the shoulder flange.
11. Fit the return spring over the valve stem and insert the spring thimble into the end of the return spring. Compress the spring and engage the boss on the valve stem in its recess in the spring retainer.
12. Insert the spigot end of the piston into the spring thimble and secure by pressing down the leaf so that it locates against the shoulder of the piston.
13. Replace piston assembly into the cylinder, refit push rod with its retaining circlip. Replace rubber boot.

To Replace

1. Mount the master cylinder to the pedal box and secure with its nuts and bolts, tightening these to the torque loading given in 'TECHNICAL DATA'.
2. Attach the push rod to the brake pedal with its clevis pin and a new split pin.
3. Replace the pedal box.

J.13 - MULTI-BRANCH UNIONS

To Remove

1. Disconnect the brake pipes from the respective unions. Plug the ends of the pipes, particularly the pipe from the master cylinder, to avoid unnecessary wastage of hydraulic fluid or the ingress of foreign matter.
2. Remove the nut and bolt (or setscrew) securing the union to its location.

To Replace

1. Replace and secure the union to its location, tightening bolts to the torque loading given in 'TECHNICAL DATA'.
2. Replace the pipes after removing the plugs, tightening unions to the torque loadings given in 'TECHNICAL DATA'.
3. Ensure that all brake pipes are not fouling any other parts of the vehicle. Note that prior to chassis No. 50/0090, the rear supply pipe may be fouling the exhaust system in the vicinity of the gearbox mounting.
4. Bleed the braking system (Section 'J.2').

J.14 - SERVO UNIT

Two types of servo unit have been fitted in Production, these being the Mk.IIA and Mk.IIB. Externally the Mk.IIA has a flat plate bolted on to the body, whereas the Mk.IIB body is in two halves which are held together with a retaining band. In certain territories the body of this latter type also incorporates the non-return valve. Where the non-return valve is not incorporated in the servo unit, it will be found in the vacuum supply pipe from the engine.

Internally, the main difference is that the vacuum piston on the Mk.IIA has been replaced by a diaphragm in the Mk.IIB.

Dismantling either of the two servo units is NOT recommended and will not be described here. After 40,000 miles (65,000 km.) or 3 years, whichever is reached first, the servo unit should be replaced together with vacuum hose by new parts.

Testing the Servo Unit(s)

It is assumed that any faults connected with the braking system such as contamination, air in the system, fluid leaks, etc. have all been diagnosed and eliminated.

1. Start the engine and as the brake is applied, it should be possible to hear the 'hiss' of the air inlet and, with a hand on the centre of the front shell, feel the movement of the unit working. With the brakes held on, there should be no 'hiss' from the air inlet.

Unsatisfactory result of the above test could be caused by lack of vacuum, a faulty non-return valve or a fault within the unit. Rectify as required.

2. Run the engine for half a minute, switch off, leave for two minutes, apply the brake and the servo unit should operate and the operation should be detected as in '1'.

Unsatisfactory result of this test indicates leaking gaskets. air valve or rubber grommet.

Run the engine, clamp the hose and repeat test, if satisfactory the non-return valve is faulty.

To test for a leaking air valve, run the engine and place a finger over the air inlet, if the suction is only slight the air valve is satisfactory and the leak is elsewhere.

3. Run the engine and apply the brake hard and hold it down for 10 to 20 seconds - there should be no perceptible creep of the pedal. If pedal creep is evident, it indicates leaks or scored bores in the hydraulic components. If the pedal

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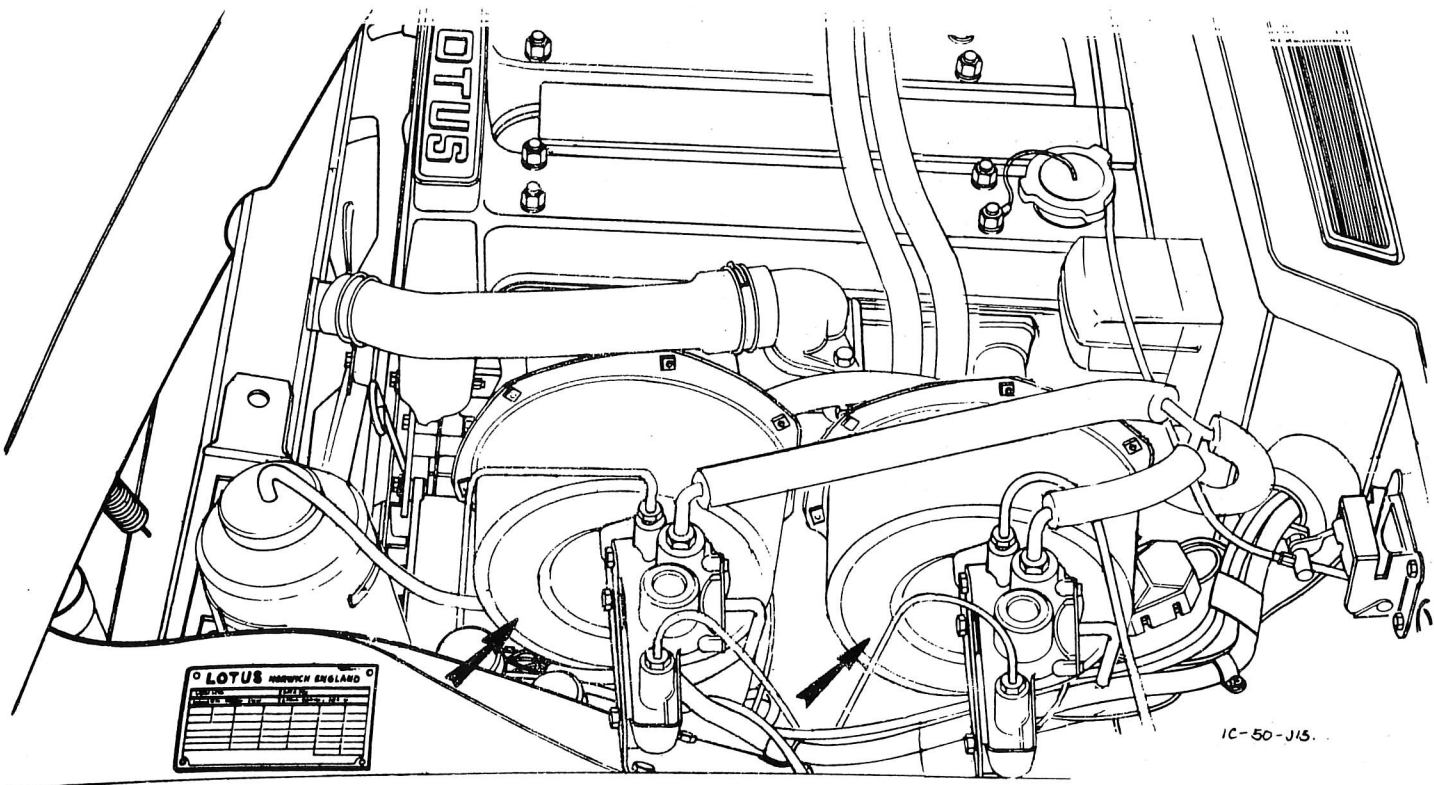


Fig.15. SERVO UNITS (FEDERAL CARS)

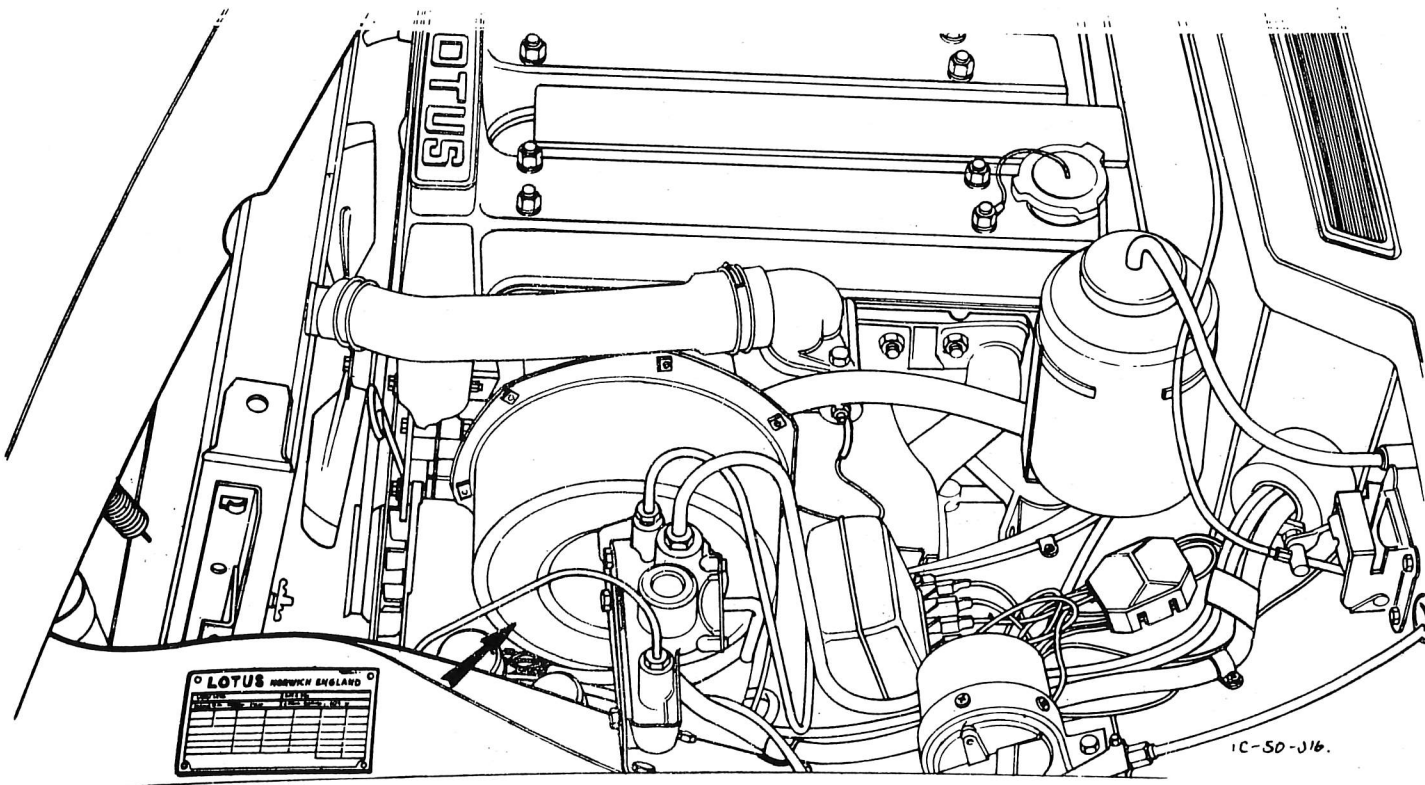


Fig.16. SERVO UNIT

pushes back, the hydraulic connections may have been wrongly connected of there is a fault in the unit.

Unsatisfactory result of this test can only be found by elimination.

Check for leaks and if no leak of hydraulic fluid is evident, clamp each hose successively and repeat test each time. Finally, plug the master cylinder outlet and test. If creeping of the pedal is evident when the hoses are clamped, and the pedal is solid when the master cylinder outlet is plugged, the servo unit is faulty.

#### To Remove

1. Remove hydraulic and vacuum pipes from the servo unit. In the case of U.S.A. Federal cars, it will be necessary to remove the pipes from both units. Plug the ends of all pipes to avoid the ingress of foreign matter.
2. Remove the setscrews securing the servo unit(s) to the mounting bracket(s).

#### To Replace

1. Replacement is a direct reversal of the removal procedure, using clips (Part No. 50 J 6076) with screws (Part No. RSTS 0812) for the retention of the vacuum pipes.
2. Bleed the braking system (Section 'J.2'), after replacing the pipes.

### J.15 - HANDBRAKE

#### To Adjust

1. Fully release the handbrake lever on the facia.
2. Raise the rear of the car until the wheels are free to rotate. Adjust the handbrake pads on the rear calipers (by means of the knurled nuts) to give a maximum clearance on either side of the disc of .003in (.076 mm.).
3. Take up any excess slack in the cable by means of the adjuster which is located on the R/H engine mounting support bracket.

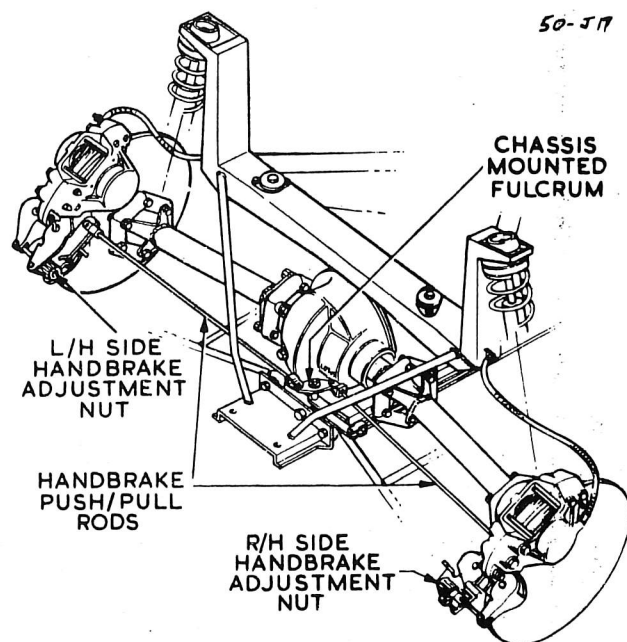


Fig. 17. HANDBRAKE MECHANISM

Cable

To Remove

1. Fully release handbrake lever and cable adjuster, so that there is as much slack as possible in cable, then pull the cable forwards (towards rear of car) to free it from its clevis.
2. Slacken the bolt at the forward end of the handbrake lever outer casing. From the upper end of the outer casing, release the pin retaining the handbrake lever, pull out the lever, then release cable.
3. Remove the cable adjuster from its location, then fully remove the faulty cable.

To Replace

1. Replacement of the handbrake cable is a direct reversal of the removal procedure. Note that the tube clamping bolt on the forward end of the handbrake lever should only be 'nipped' to tighten, fully tightening will cause the tube to collapse.
2. Adjust cable after fitting as given under 'To Adjust'.

Handbrake Lever

To Remove

1. Release the handbrake cable from the lever (see 'To Remove Cable').
2. Release both the lower and upper bolts securing the outer casing of the handbrake lever to its support brackets.

To Replace

1. Reverse the removal instructions.

Handbrake Linkage

To Remove

1. Remove rear wheels (see Section 'G') and place chassis stands under wishbones to give simulated ride height.
2. Release the outer ends of the actuating rods at the calipers, taking care not to misplace the spacer from the clevis. Fully slacken the handbrake cable (see 'To Adjust').
3. Extract the nut and bolt securing the lever spindle/swivel tree assembly to the chassis and remove assembly from car.

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IC-50-J18.

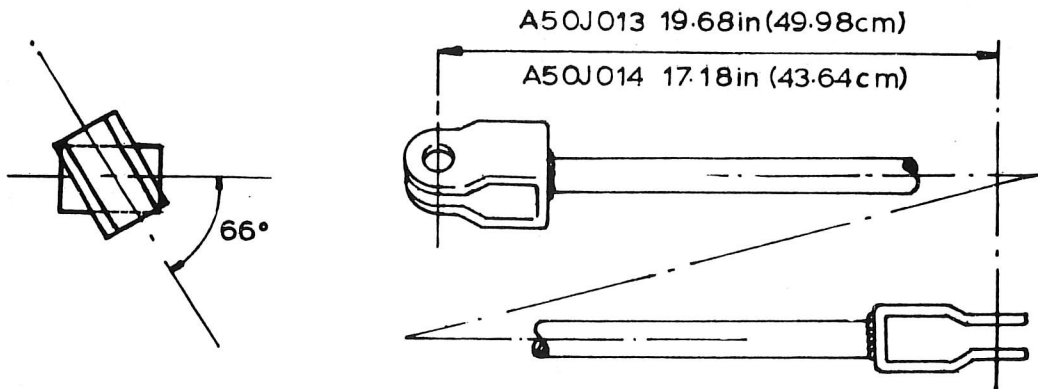


Fig.18. SHOWING RELATIVE ANGLES & LENGTHS BETWEEN ROD ENDS

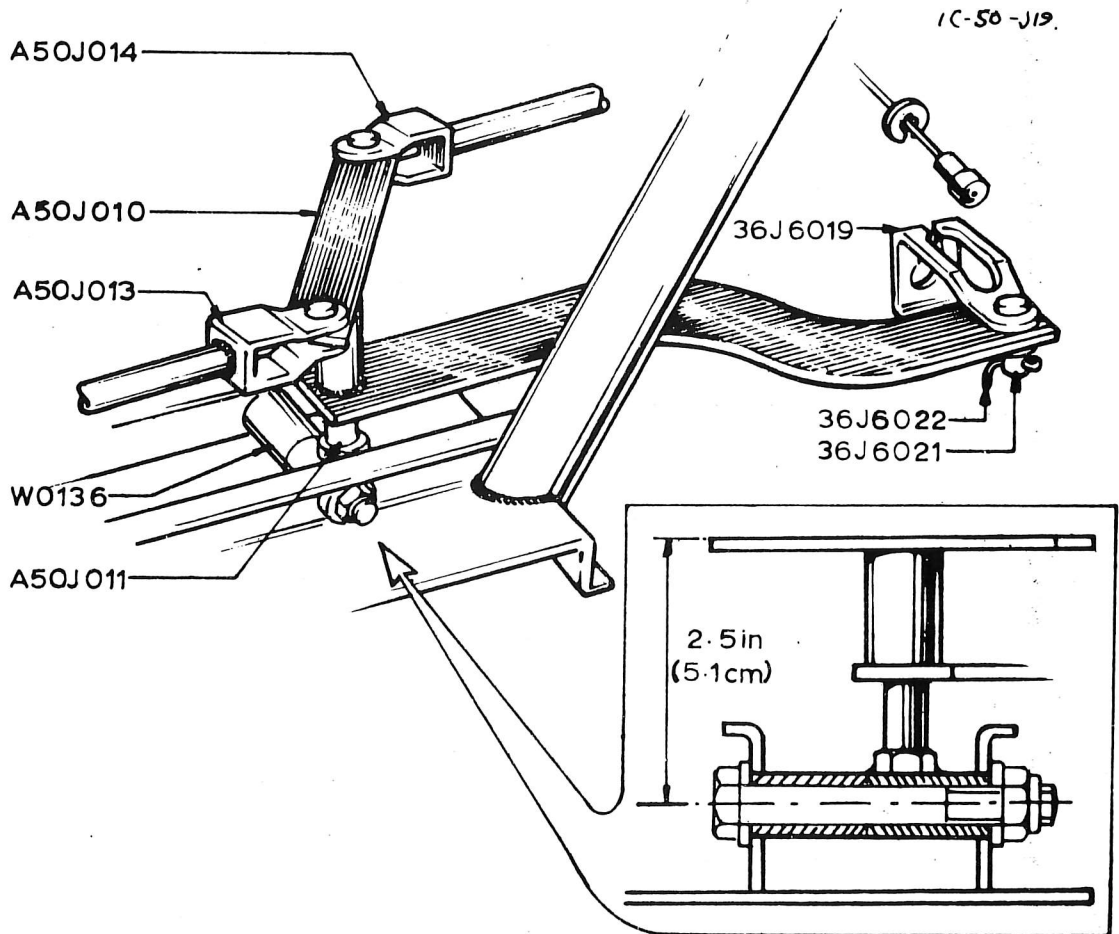


Fig. 19. HANDBRAKE LINKAGE & ACTUATING RODS ASSEMBLY

To Replace

From Chassis No. 50/1142 an improved handbrake linkage was fitted in Production, therefore this system is given here.

Parts Required:-

50 J 011	Lever spindle	1 off
50 J 010	Lever assembly	1 off
W 0136	Spacer	1 off
A50 J 013	Actuating rod, LH *	1 off
A50 J 014	Actuating rod, RH *	1 off
36 J 6021	Clevis pin **	1 off
36 J 6019	Clevis **	1 off
36 J 6022	Split pin	1 off

Parts marked '\*' can be made from the existing actuating rods already fitted to the car.

Parts marked '\*\*' will already be in existence on cars up to Unit No.50/0750, so can be used in the new application.

1. Assemble the lever spindle (50 J 011) to the lever assembly (50 J 010) ensuring that the spindle has been adequately greased (use Shell Retinex 'A') BEFORE assembly. Screw the spindle fully up, then turn back TWO FULL TURNS, this giving the required setting height of 2.5in (63.5 mm.) for assembly to the chassis. Attach the clevis (36 J 6019) to the lever tube through the .265in. (6.75 mm) diameter hole, using the clevis pin (36 J 6021) and securing with the split pin (36 J 6022).
2. Remove the existing handbrake actuating rods by extracting the split pins and clevis pins securing them to the now discarded lever assembly. These actuating rods can be modified to conform with the new rods (A50 J 013 and 014) by removing an end, cutting the rod to the desired length and then re-welding the end to the rod, ensuring that the ends are re-welded at the angles given in Fig.18. Re-attach the actuating rods to the lever assembly with the clevis pins and new split pins.

## Actuating rod lengths:-

50 J 031	20.30 in (51.56 cm.)	superseded by
A50 J 013	19.68 in. (49.98 cm.)	
50 J 014	17.70 in. (44.96 cm.)	superseded by
A50 J 014	17.18 in. (43.64 cm.)	

3. When re-attaching the ends to the rods, use a 'nickle-bronze' welding process



ensuring that the weld runs completely around the rod. Alternatively, the new rods could be used.

NOTE: When re-assembling the rods to the swivel tree it is essential that the SHORTEST rod is fitted to the RIGHT-HAND side.

4. Fit the new assembly to the chassis as in Fig.19 and connect the outer ends of the actuating rods to their locations on the rear calipers, ensuring that the spacer is in the clevis before securing with the clevis pins and new split pins.
5. Lubricate all pivot points with Shell Retinax 'A' grease before adjusting the handbrake cable.
6. Adjust handbrake cable, then refit rear wheels.

J.16 - FAULT FINDING

<u>Fault</u>	<u>Cause</u>	<u>Action</u>
Fade:-	Incorrect pads. Distorted Pads. } Overloaded vehicle. Excessive } braking. Old hydraulic fluid }	Replace the pads, decrease vehicle load or renew hydraulic fluid as necessary.
Spongy Pedal:-	Air in system. Pads distorted. } Weak master cylinder mounting }	Bleed system. Check master cylinder mounting and pads.
Long Pedal Travel:-	Discs running-out pushing } pads back. Distorted } damping shims. } Misplaced dust covers. }	Check that disc run-out is not excessive. Replace as necessary.
Brakes Binding:-	Brakes or handbrake maladjusted } No clearance at master cylinder } push rod. Seals swollen. } Seized pistons. Shoe springs } weak or broken. } Servo faulty. }	Check the brake adjustment and handbrake linkage. Check for clearance at the master cylinder, seized pistons or weak shoe spring. Repair or replace parts as necessary. Fit new servo.
Hard pedal - poor braking:-	Incorrect linings. Glazed } linings. Linings wet, greasy } or not bedded correctly. Servo } unit inoperative. Seized } caliper pistons. Worn dampers } causing wheel bounce. }	Replace the shoes, or if glazed, lightly rub down with rough sandpaper. Check caliper for damage and repair as necessary. Fit new dampers.
Brakes pulling:-	Seized pistons. Variation in } linings. Unsuitable tyres or } pressures. Worn dampers. } Loose brakes. Greasy linings. } Faulty drums, suspension or } steering. }	Check the tyres and pressures seized pistons, greasy linings, or loose brakes; then check suspension, steering and drums. Repair or replace as necessary. Fit new dampers.
Fall in Fluid Level:-	Worn disc pads. External leak } Leak in servo unit }	Check the pads for wear and for hydraulic fluid leakage. Fit new servo.



<u>Fault</u>	<u>Cause</u>	<u>Action</u>
Brake squeal or Pad rattle:-	Worn retaining pins. Worn discs. No pad damping shims or springs. With new pads or discs, brakes being used too lightly causing glazing of pads.	Renew retaining pins or discs. Fit damping shims or springs. Use heavier braking action.
Uneven or excessive pad wear:-	Discs corroded (by salt). Disc badly scored.	Check the disc for corrosion or scoring and replace if necessary.
Slow action of servo unit:-	Blocked filter or restricted air inlet. Faulty vacuum hose or connections.	Change filter. Tighten vacuum connections. Replace vacuum hose.
Lack of assistance on heavy braking. Servo operating only when engine is running. Poor slow running of engine:-	Air leaks in servo, low vacuum. Air leaks in gasket non-return valve, diaphragm or air valve, vacuum hoses. Faulty non-return valve.	Check for vacuum leaks. Tighten connections. Replace vacuum hose or non-return valve. Fit new servo.
Pedal pushes back:-	Hydraulic inlet and outlet pipes incorrectly connected. Major fault in servo.	Re-connect pipes. Fit new servo.

NOTE: Pad Squeal— Where squeal is attributed solely to pads, the manufacturers, Girling Ltd., will NOT replace pads under Warranty.

#### ADDITIONAL INFORMATION

##### J.17 - BRAKE SERVO NON-RETURN VALVE 'KNOCKING'

Brake servo non-return valve 'knocking' is caused by the valve 'pulsing' at each induction stroke of the engine. This noise is then magnified by being transmitted through the metal vacuum pipe which passes behind and in front of the body bulkhead, to the servo unit.

The noise can be subdued by inserting a small piece of foam rubber between the metal vacuum pipe and the body bulkhead.

##### J. 18 - METRIC CALIPERS

Commencing at the following Chassis Numbers, all front calipers now have metric threads for the pipe connections.

72050744 L to 72050753 L inclusive )	) U.K.
and 72060768 L onwards )	
72050235 M	Export
72050275 N	North America

The calipers can be identified by,

- a. New calipers are supplied with BLACK transit plugs fitted in union bores.
- b. Previously specified calipers are fitted with RED transit plugs.
- c. Pad retaining pins on METRIC calipers are of 3/16 in. (4.76 mm.) diameter.
- d. Pad retaining pins on pre-metric calipers are of 1/4 in. (6.35 mm.) diameter.