

## SECTION J

### BRAKING SYSTEM

<u>Section</u>	<u>Description</u>	<u>Page</u>
J.1.	General description	3.
J.2.	Bleeding the system	4.
J.3.	Pad replacement	8.
J.4.	Front calipers	9.
J.5.	Rear calipers	9.
J.6.	Caliper overhaul	10.
J.7.	Front caliper mounting plate/dust shield	13.
J.8.	Front disc brake	13.
J.9.	Rear brake disc	14.
J.10.	Pedals	14.
J.11.	Master cylinder	16.
J.12.	Multi-branch unions	17.
J.13.	Servo unit (when fitted)	17.
J.14.	Handbrake	20.
J.15.	Fault finding	23.
	<u>Additional Information</u>	
J.16	Rear Brake Hose Armouring Spring	24.
J.17	Master Cylinder Extension Cap	24.

ILLUSTRATIONS

<u>Fig. Nos.</u>	<u>Description</u>	<u>Page</u>
1.	Hydraulic braking system	5.
2.	Braking system with servo	5.
3.	Brake fluid reservoir	6.
4.	Servo filter	6.
5.	Handbrake caliper components	6.
6.	Front brake components	11.
7.	Checking gap between caliper & disc	11.
8.	Rear brake components	12.
9.	Caliper pistons & sealing rings	12.
10.	Master cylinder	15.
11.	Tandem master cylinder	15.
12.	Dismantling seals	15.
13.	Servo unit	18.
14.	Handbrake mechanism	21.
15.	Handbrake linkage & actuating rods assembly	21.

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 3,000 miles (5,000 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

a general indication of brake pads OVERDUE for replacement. Under no circumstances allow the pads to wear below 1/16 in. (1.6 mm.) thickness.

#### Servo Unit Air Filter

The filter element should be renewed at intervals of every 6,000 miles (10,000 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

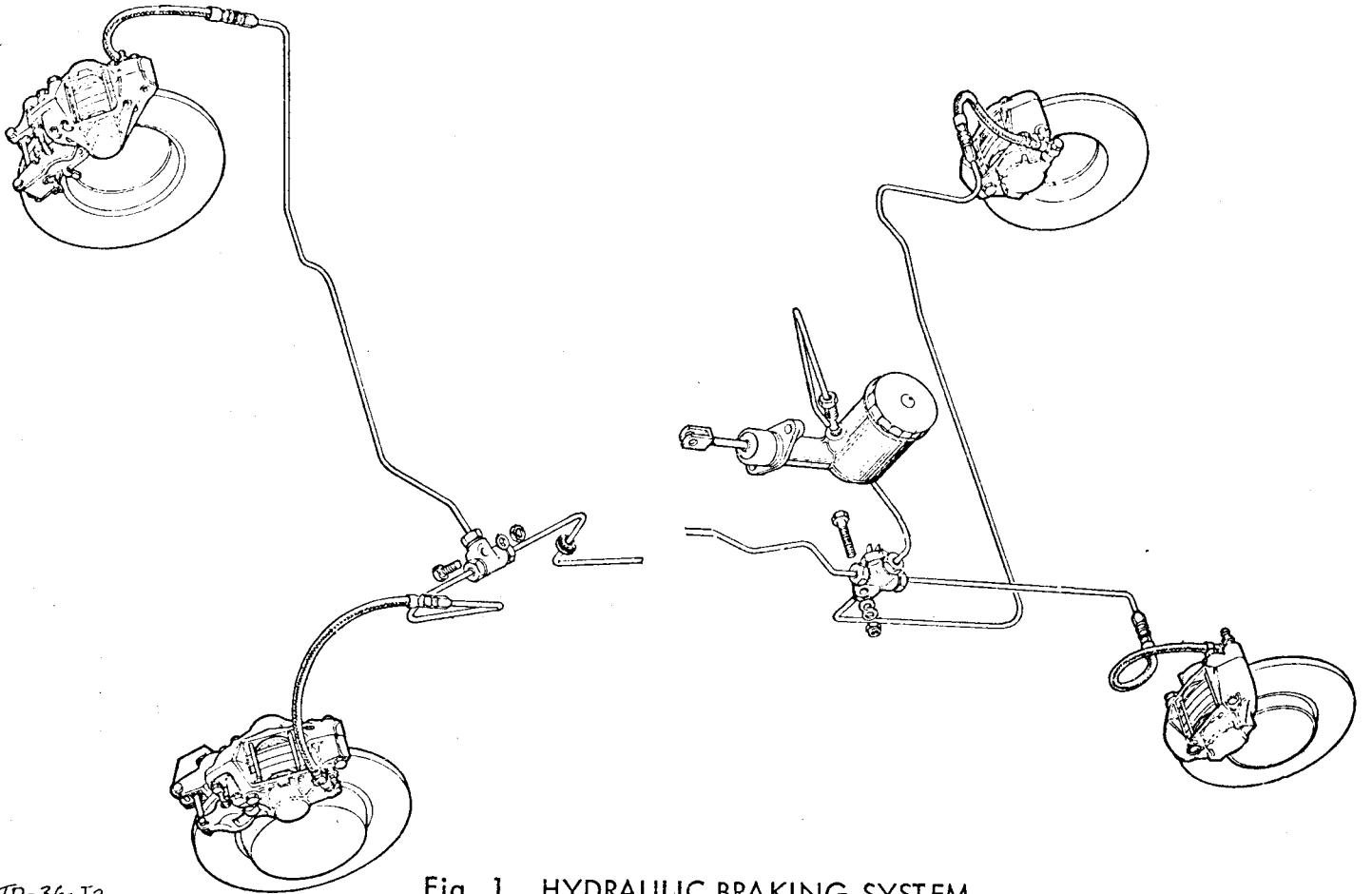
'Bleeding' is the process of removing air from the pipe line and cylinders and is necessary whenever any part of the system has been disconnected, or the level of fluid in the master cylinder reservoir has been allowed to fall so low that air has been drawn into the master cylinder.

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 7/16 in. A/F spanner. A small spanner should be used as bleed screws should never be overtightened (see 'Technical Data').

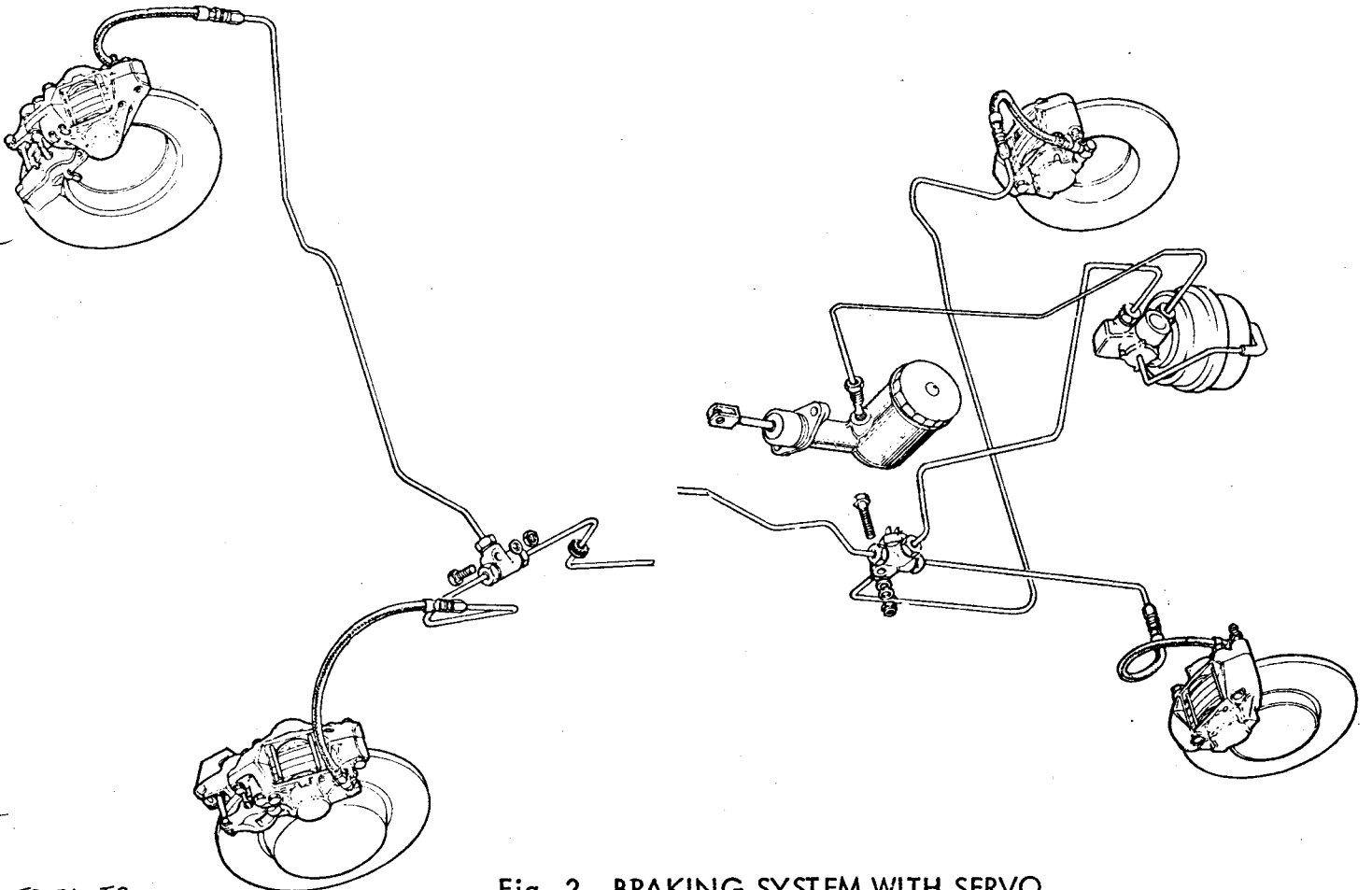
Fill up the reservoir with the approved fluid direct from the can and the level should be maintained during bleeding.

Bleeding should start at the rear left-hand wheel. Unscrew the bleed nipple enough



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Fig. 1. HYDRAULIC BRAKING SYSTEM



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Fig. 2. BRAKING SYSTEM WITH SERVO

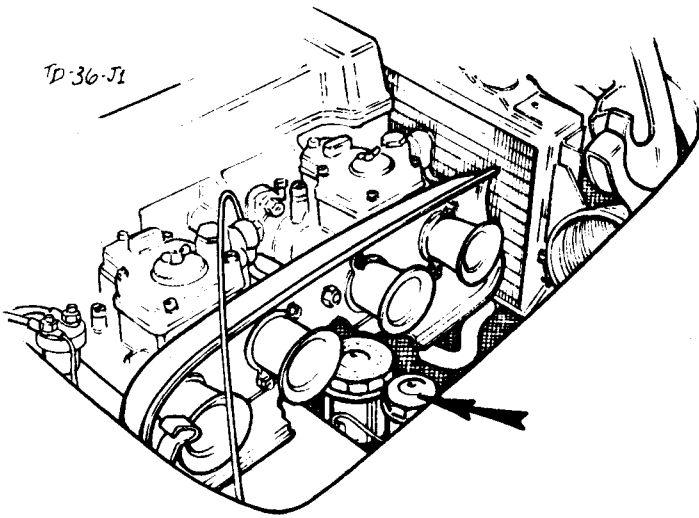


Fig. 3. BRAKE FLUID RESERVOIR

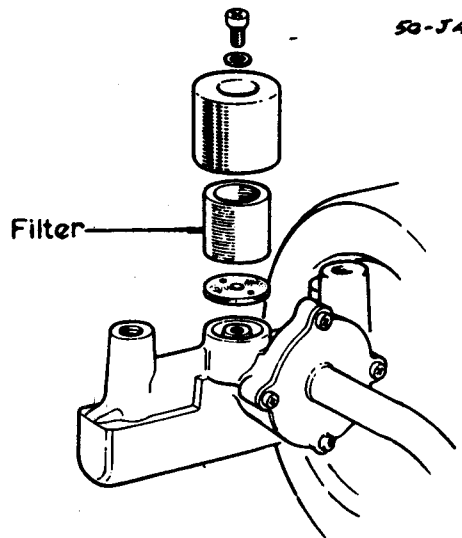


Fig. 4. SERVO FILTER

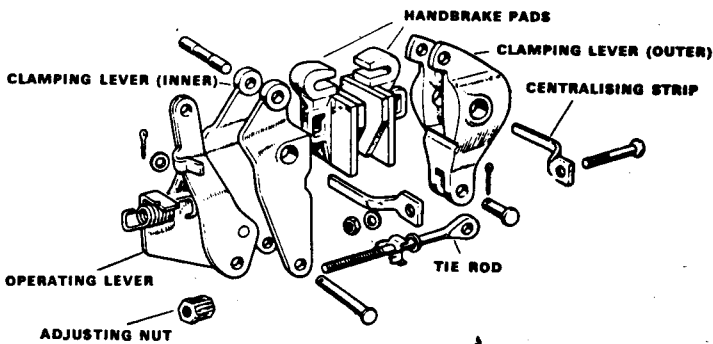
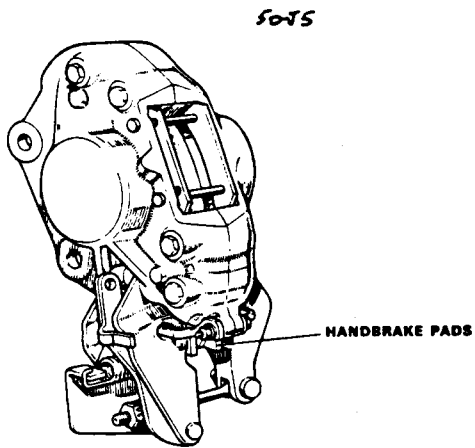


Fig. 5. HANDBRAKE CALIPER COMPONENTS

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 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 the 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 REPLACEMENT

Front

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 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. Renew centralising straps if necessary.

7. After refitting pads, adjust by means of the adjuster nut to give a maximum clearance of .003 in. (.076 mm.) 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 the 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 OVERHAULTo Remove

1. Remove the caliper (Section 'J.4' or '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.

To Re-assemble - 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.