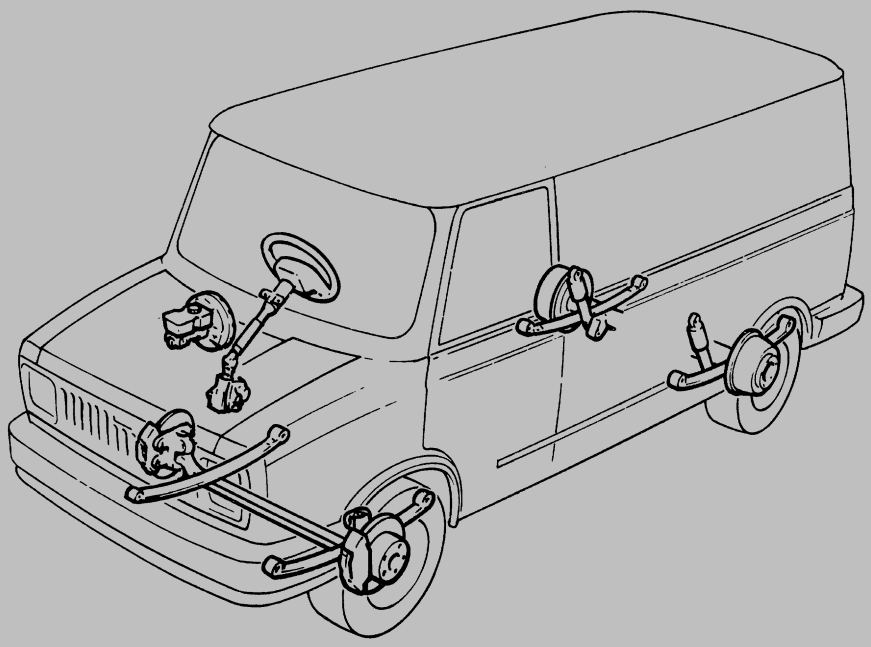
Service Workbook

Steering, Suspension and Brakes



REAR ROAD SPRING – 400

(Overslung suspension 1991 model year on)

From 1991, MY 400 vehicles have been fitted with an overslung rear suspension system, so called because the spring is 'slung' over the axle instead of under as has been the case; this new suspension is fitted to all 400 models except air suspension vehicles.

The springs retain a single taper leaf design but with revised camber, and at the rear are attached to new shackles. The spring eye bushes and the shackle bushes are a new 70 mm design; the two spring eye bushes are identical, and the shackle bushes are identified from them by an orange paint spot.

Other changes include new shock absorbers, and a new, common rear anti–roll bar installation for both SWB and LWB versions of twin rear wheel models. The rear axle has revised spring and damper mounting brackets.

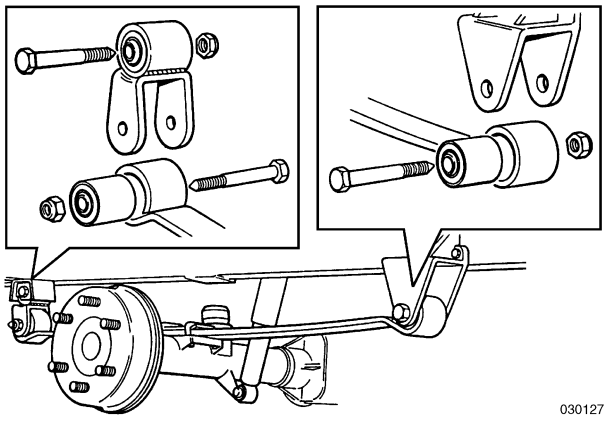


Fig.4 Overslung rear suspension

Remove

1. Chock front wheels, support chassis on stands forward of axle and remove rear road wheels.
2. Support the axle.
3. To remove spring, remove:
   - 'U' bolts; discard nuts.
   - Top shackle bolt
   - Spring front eye bolt.
4. Remove spring rear eye bolt to release shackle.

Refit

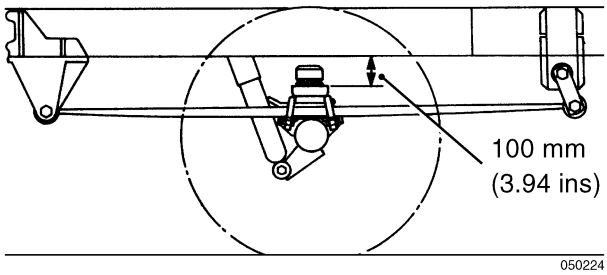


Fig.5 Dimension for part–loaded condition

5. Spring refitting is the reverse of removal procedure, but the following points must be noted:
   - Spring can be fitted either way round.
   - Fit new 'U' bolt nuts and tighten progressively to correct torque.
   - **NOTE:** The rubber mounted components of the rear suspension (i.e. spring, shackle and damper mountings) must only be tightened to the correct torque after the vehicle is lowered to the ground and loaded to the dimension shown in fig.5.
   - Tighten road wheel nuts to correct torque.
   - Check load sensing valve adjustment.

300/400 models – rear spring – front eye bush (70 mm)
– air suspension – flexi–link bush

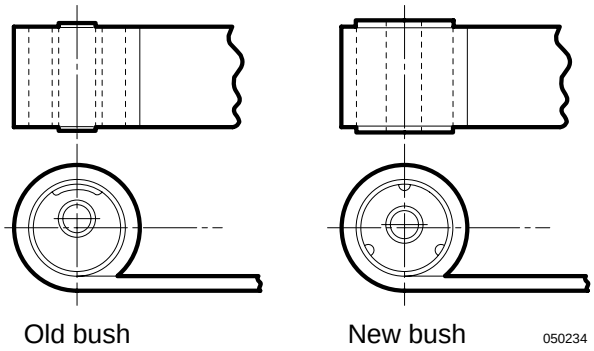


Fig.17 Rear spring, front eye offset bush

This bush has an offset centre tube, the offset being towards the top.
A new bush was introduced during 1987, which is interchangeable with the earlier type but must be fitted in pairs. The latest type is identified by the three small cutaways in the rubber (see fig. 17), as opposed to the elongated slot of the earlier type.

The bush must be fitted with the offset tube at 90° to the spring leaf, with the short offset uppermost.
Use 14 mm (fully threaded) centre rod with bronze nut and adaptors A, B, C, F.

Remove
Chock front road wheels.
Raise rear of chassis until springs to be serviced are in a 'no–load' condition.
NOTE: If only one front eye bush is to be renewed, it is necessary to remove eye bolt on opposite spring to allow spring eye to drop clear of its mounting bracket.

Remove appropriate spring eye bolts and slacken shackle bolts.
If necessary, raise chassis further until bush(es) to be changed are clear of obstruction.

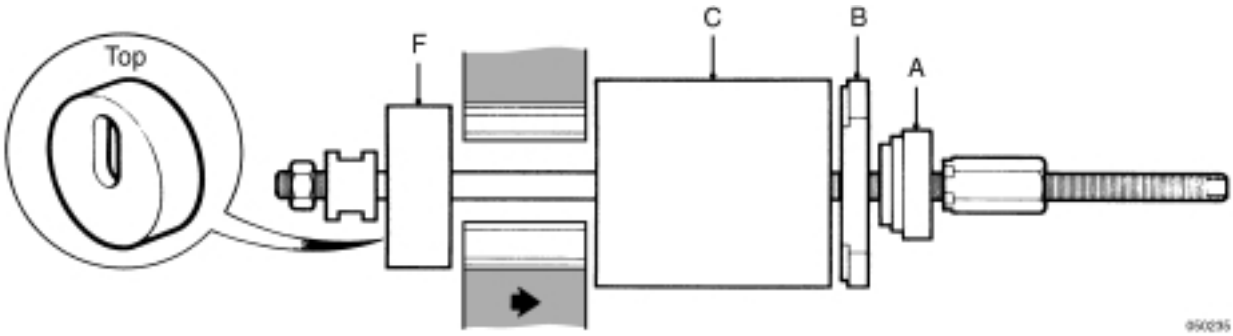


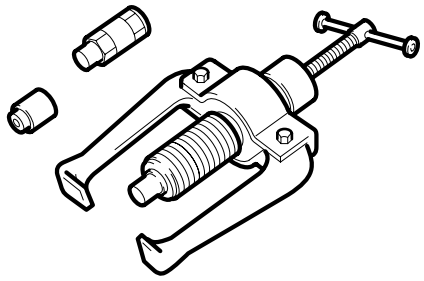
Fig.18 Removing 300/400 rear spring front eye bush (70 mm)

Assemble components from tool kit as shown in fig.18.
Insert larger diameter (14 mm), fully threaded centre rod (longer rod) in spring eye, fit adaptor 'F' with slot offset to top, threaded block and secure with lock nut.

Fit tube 'C', adaptor ring 'B', trunnion 'A' and bronze nut.
Align all components, ensuring adaptor 'F' still has offset slot to top and is positioned so that it will pass through spring eye, and tighten bronze nut to extract bush.

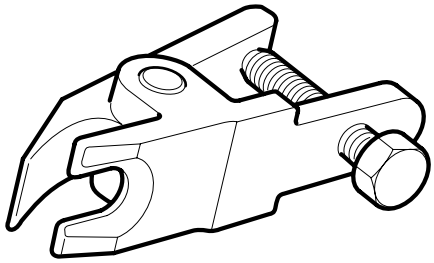
SPECIAL TOOLS

0485022 (252A)



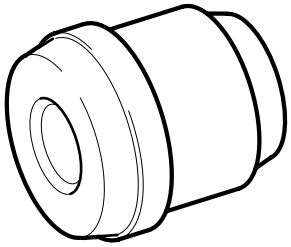
Hydraulic Steering Arm Remover

18G 1063A



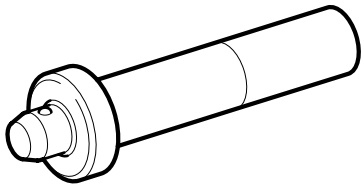
Ball Joint Separator

0480041 (18G 134CC)



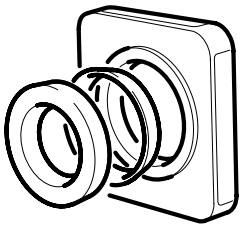
Front Hub Bearing Replacer Adaptor

0499809 (18G 134)



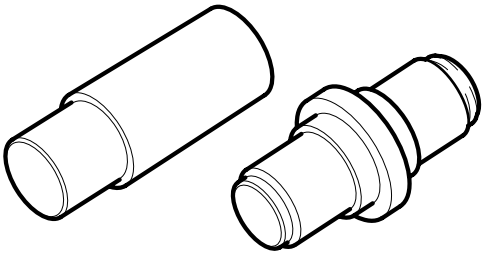
Drive Handle

0480042 (370)*



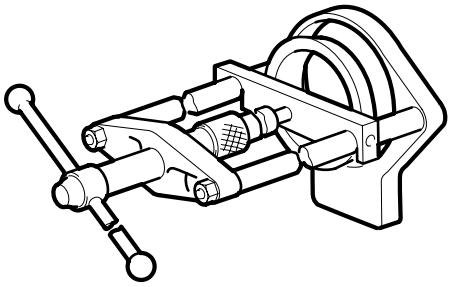
Base Plate

0499905 (18G 1470)



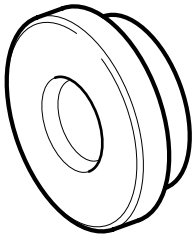
Swivel Pin Bearings Remover/Replacer

0484860 (18G 47)*



Hand Press (See alternative 370)

0499910 (18G 134DV)



Front Hub Inner Oil Seal Replacer Adaptor

*** 0480042 (370)** Base Plate is an alternative to **18G 47** for use with a hydraulic press.

NOTE: The tools having a 7 digit number are available Multipart Distribution Limited.

6. Mark the position of the clamp bracket on the track rod, then slide it to extend the damper by 10 to 15 mm (0.4 to 0.6 in). Tighten the clamp bolts to a torque of 47 – 54 Nm (35 – 40 lbf ft).

7. Check that the steering will turn to both full lock positions before the damper reaches either extent of its travel.

SWIVEL PINS – 200/300/400

Tools required: 18G 1063A, 0484860 (18G 47), 0499905 (18G 1470)

Dismantling

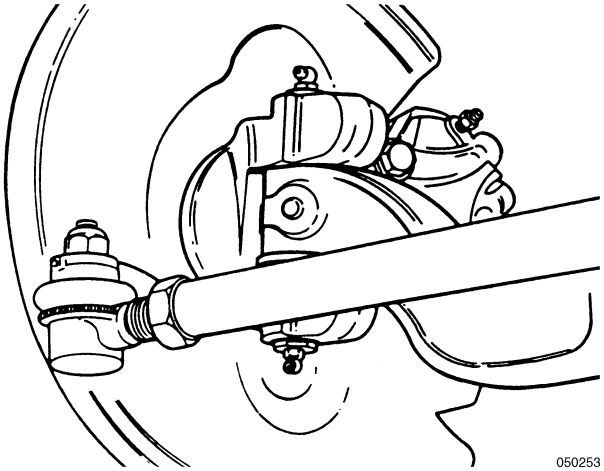


Fig.12 Swivel hub

1. Chock the rear wheels, raise the front of the vehicle and support on axle stands. Remove the front road wheels.

2. Unbolt the brake caliper and support it to avoid damaging the flexible hydraulic hose.

   Inspect the two caliper retaining bolts and discard if damaged. Discard the bolts if micro–encapsulated.

3. Use ball joint separator 18G 1063A to separate the steering ball joint(s) at the swivel hub.

4. Remove the hub grease cap, split pin, nut retainer, nut and bearing retaining washer.

5. Pull off the hub assembly and recover the outer bearing. Remove the disc shield.

6. Restrain the swivel pin sealing caps and remove the upper and lower grease nipples. Remove the circlips and withdraw the upper and lower sealing caps. Remove and discard the ‘O’ rings.

7. Remove the nut and spring washer from the cotter pin; use a drift to drive out and discard the cotter pin.

8. Support the weight of the swivel hub and drive out the swivel pin.

9. Withdraw the swivel hub and recover the shim and thrust bearing. Remove and discard the inner ‘O’ rings (if fitted).

10. Use press 0484860 (18G 47) and tool 0499905 (18G 1470/1) to press the upper needle roller bearing out of the swivel. Repeat this operation to remove the lower needle roller bearing.

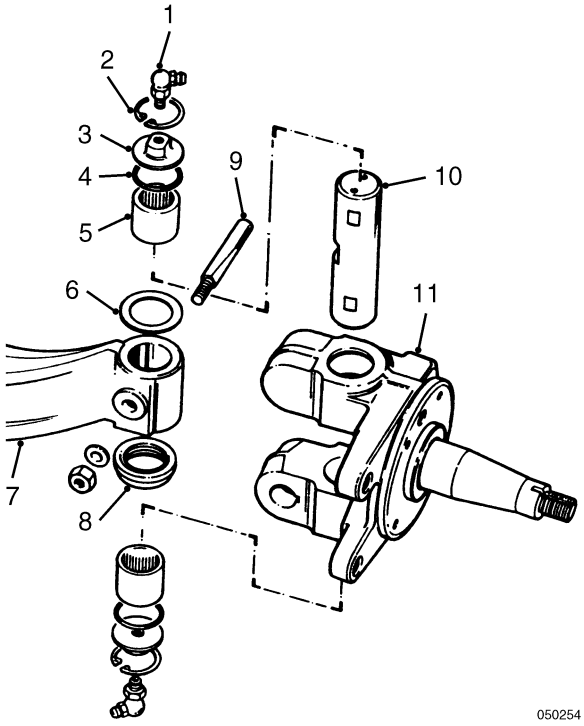


Fig.13 Swivel assembly

1. Grease nipple
2. Circlip
3. Sealing cap
4. ‘O’ ring
5. Needle roller bearing
6. Shim
7. Axle beam
8. Thrust bearing
9. Cotter pin
10. Swivel pin
11. Swivel hub/stub axle

BURMAN STEERING BOX

Introduction

The Burman steering box is a recirculating ball type and was introduced progressively on all models in early 1989. It can be quickly identified in situ by its hexagon headed filler plug, and by an end plate on top of the box to retain the worm shaft.

OVERHAUL – 200 (from early 1989)/400

Dismantling

1. Remove the steering box from the vehicle, and remove the filler plug to drain the oil.
2. Release the rocker arm adjuster on the side cover.
3. Remove the side cover and discard the gasket.
4. Withdraw the rocker shaft, and capture the thrust button on the main nut. Extract and discard the 'O' ring seal from the rocker shaft bore.
5. Remove the external dust shield from the worm shaft, examine it for damage and renew if necessary.
   NOTE: The worm shaft is supported at both ends by uncaged ball bearings. The following procedure will assist in dismantling without losing the balls.
6. Without disturbing the end plate, remove the four Allen screws retaining it to the housing. Then exert downward pressure on the worm shaft whilst lifting off the end plate, together with the shim pack and gaskets.
   Discard the gaskets, and remove and discard the seal from the end plate.
7. Position a receptacle under the housing to catch balls to be displaced from the worm shaft bearings, then carefully lift and remove the shaft through the side cover aperture.
   Recover the upper bearing track.
   Count the number of balls displaced from the upper and lower races. Ten balls are fitted in each race.
8. Remove the lower bearing track; it is a slide fit in the housing.
   Note that the upper and lower tracks are different thicknesses; the lower track is the thinner of the two.
9. Carefully unscrew the main nut from the worm shaft and capture the 27 balls. Some of these balls will have remained in the transfer tube which must not be removed from the main nut.
   NOTE: These 27 balls are not the same size (they are larger) than the 20 balls in the worm shaft races, and should be kept separate.

Inspection

Thoroughly clean the housing and all components. Inspect the worm shaft for damage and wear, and in particular check the bearing registers on the shaft and the two bearing tracks.
Check all the balls for wear and pitting and inspect the bearing surfaces on the main nut.
Clean out the oil groove in the rocker shaft bore.
Renew all suspect components, and all seals, gaskets, etc.

Reassembly

NOTE: It is important to use the specified Z MAX C4 grease to retain the balls during assembly, as the grease must be miscible with the oil to be added later.

10. Fit the lower (thinner) bearing track in the housing. Liberally apply Z MAX C4 grease to the track, and position 10 smaller balls in the grease.
11. Fill the grooves in the main nut with the same grease and fit the 27 larger balls.
    NOTE: When correctly fitted there is a space of approximately one ball's width.
12. Lubricate the worm shaft, and thread it into the main nut to approximately half way up the shaft.

300 MODELS

Application	SINGLE LINE SYSTEMS			DUAL FRONT LINE SYSTEMS
	STANDARD **Non V8 up to 3500 kg G.V.W. with standard front axle**	**HEAVY DUTY** **Chassis cowl. Heavy duty front axle above 1350 kg. Special order over 3500 kg G.V.W.**	**VENTILATED DISC** **V8 option. Ambulance specification. Police specification.**	**Special order**
Master cylinder type	AP Phase 3	AP Phase 3	AP Phase 3	AP Phase 2
Master cylinder diameter	22,2 mm	25,4 mm	25,4 mm	22,2 mm
Servo	Type 50	Type 65	Type 65	Type 65
Delay valve fitted	Yes	Yes	Yes	Yes
Front caliper pistons	4 x 26	4 x 46	4 x 46	4 x 26
Disc size	276 x 14,3 mm	276 x 14,3 mm	276 x 24 mm	276 x 14,3 mm
Load sensing valve fitted	Yes	Yes	Yes	Yes
Rear drums	254 x 70 mm (254 x 57 mm for 15 HA axle)	254 x 70 mm	254 x 70 mm	254 x 57 mm (15 HA axle)
Rear wheel cylinder diameter	17,46 mm	17,46 mm	17,4 mm (20,32 mm for 4050 kg chassis cowl)	15,87 mm

Load Sensing Valve
The load sensing valve is installed into the hydraulic system between the master cylinder and the rear brakes, it is now fitted to many 200 models and to all 300/400 vehicles. It is mounted on the chassis and is connected by an arm to the rear axle, to ‘measure’ the vehicle load and vary accordingly the fluid pressure available to the rear brakes.

A brake valve is fitted to all air suspension models in place of the load sensing valve and has a similar function. See Service Workbook **‘Air Suspension’** for details.

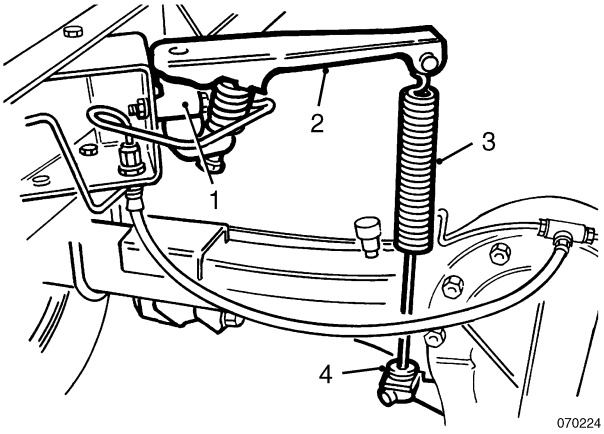


Fig.8. Load Sensing Valve

1. Load sensing valve
2. Lever arm
3. Load sensing spring
4. Adjustment block

The load sensing valve is preset and is not serviceable; it must be replaced as a complete unit.

The position of the lever arm is adjustable at the lower end of the spring. If a new load sensing valve is fitted, or if incorrect adjustment is suspected, adjust the setting as detailed in the appropriate section of this service workbook.

The setting varies, dependent on the model to which it is fitted, and this setting is given on a plate fixed to the left hand cab step.

BLEEDING THE BRAKE SYSTEM 200/300/400

Important Points

1. Absolute cleanliness must be observed when bleeding the brakes.
2. Always use lint–free cloth or paper towelling for cleaning purposes.
3. Ensure no dirt or grit enters the system, and that all equipment to be used is free from fuel, paraffin or any form of mineral oil.
4. Only the specified brake fluid must be used – do not use Mineral Oil.
5. Never use brake fluid that has been bled from the system; it will be aerated, contain too much moisture and be contaminated with foreign particles.
6. Brake fluid is hygroscopic, i.e. it will absorb water from the atmosphere, so it is essential that exposure of the fluid is limited to the time taken to fill the system.
7. Dispose of used brake fluid correctly. Do not empty into drains, pollute water systems or pour onto the soil.
8. Always remove floor mats or any object which could obstruct a full stroke of the brake pedal.
9. Do not allow brake fluid to contact the paint–finished surfaces as the paintwork could be damaged.

Major Overhaul Brake Bleeding Recommendations

When the complete brake hydraulic system has been disconnected or the major components (i.e. master cylinder or caliper(s)) have been overhauled, excessive amounts of air will be admitted into the hydraulic system which may cause an inefficient and prolonged brake bleed procedure. Therefore, prior to bleeding the brake system using the appropriate procedure, it is recommended that the following additional operations are implemented:

- Fit brake bleed nipples to the master cylinder outlets and remove the pressure failure switch.
- Prior to fitting to the servo unit, position the master cylinder on a work bench and partially fill the reservoir with clean, new brake fluid. Bleed each nipple in turn ensuring that both primary and secondary chambers are air–free. Fit the master cylinder to the servo unit.
- Remove the bleed nipples, one at a time, from the master cylinder and re–connect the respective brake pipes.
- Bleed the primary circuit first followed by the secondary circuit.

  NOTE: The master cylinder primary chamber is nearest to the servo unit. The brake caliper primary circuit is the rearmost (standard discs) or uppermost (ventilated discs); both primary circuits are bled at bleed nipple ‘A’. The secondary circuit is bled at the central bleed nipples ‘B’ and ‘C’.

Bleeding Procedure

The following procedures cover bleeding the complete primary and secondary systems. If only one system has been disturbed, bleeding need only be done on that system providing air has not entered the other system.

Overhaul Procedure

Dismantling

1. Drain any contents of the master cylinder reservoir into a container, then thoroughly clean the body of the assembly using a recommended cleaner. Mount the master cylinder, reservoir uppermost in a soft jawed vice, and detach the servo if removed as an assembly.

2. Remove the two screws retaining the fluid reservoir, lift off the reservoir and remove the two rubber seals from the cylinder recesses.

3. Remove the secondary piston stop pin from the secondary feed port. On some types the pin will be tight; if so, use a soft metal rod to push the primary piston down its bore, this will move the secondary piston and release the stop pin.

4. Carefully extract the circlip from the bore mouth and withdraw the primary piston and spring, followed by the secondary piston and spring.
   NOTE: In Phase 3 type master cylinder the primary piston and spring is an assembly which is renewed as a unit complete with seals.

5. Using a small brass rod, carefully remove the seals, piston washers, and spring retainers (on secondary piston only – Phase 3 types).

   Note the position of all components; in particular note the position and size of the seals which vary in thickness and in internal and external diameter.

6. If it is required to dismantle the pressure failure assembly, unscrew the switch, then remove the end plug and copper washer and withdraw the metal distance piece, the piston and spring assembly and the plastic spacer. Carefully remove the two ‘O’ rings from the piston.

Inspection

7. Clean all parts thoroughly with brake fluid, dry with a lint free cloth, and carefully inspect the metal components for faults and wear.
   CAUTION: A replacement assembly will always be required where the cylinder bores, after cleaning, show the slightest sign of corrosion or scoring.

   The fluid feed and by–pass port drillings in the cylinder body must be clear, also the drillings in the head of each piston.

   Check that the filler cap vent hole is clear. Examine carefully the pressure failure piston and spring sub–assembly.

Re–assembly

Scrupulous cleanliness is essential, therefore ensure that the hands are free of grease and dirt.

Before re–assembly, the cylinder bores and rubber components should be lubricated with new brake fluid.

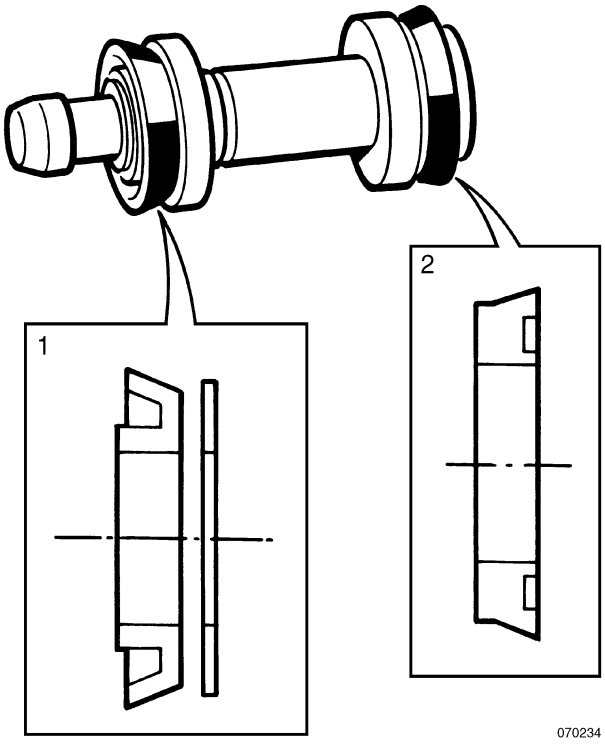


Fig. 20 Secondary piston seals
1. Primary seal
2. Reverse seal

8. Commence the re–assembly by identifying the seals from the repair kit.

   The two secondary piston seals are different; the seal at the nose of the piston is thicker, has a smaller internal diameter and has a straight lip (as opposed to a stepped lip).