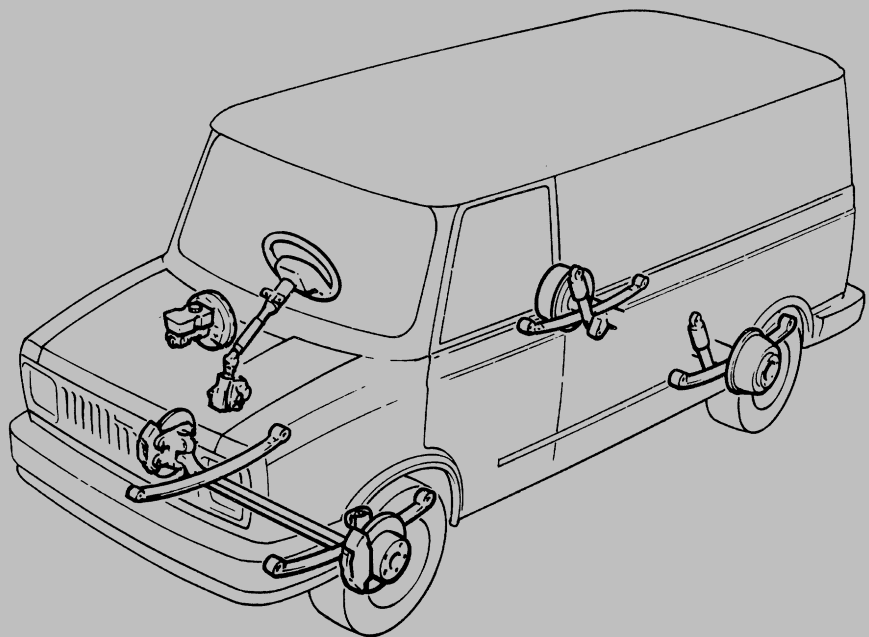


Service Workbook

Steering, Suspension and Brakes





SUSPENSION STEERING BRAKES

Service Workbook

This Service Workbook, which is in three sections, covers the Suspensions, Steering and Brakes fitted to the 200/300/400 range of vehicles. It is primarily designed to assist skilled technicians in the efficient repair and maintenance of these vehicles, but can also be used as a reference workbook for training purposes. This service workbook should always be consulted prior to servicing or repair work.

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INTRODUCTION

WARNINGS and **CAUTIONS** are given throughout this Service Workbook in the following form:

WARNING: Procedures which must be followed precisely to avoid the possibility of personal injury.

CAUTION: This calls attention to procedures which must be followed to avoid damage to components.

NOTE: This calls attention to methods which make a job easier to perform.

REFERENCES

References to the left or right hand side in this Service Workbook are made when viewing the vehicle from the rear.

To reduce repetition, operations covered in this Workbook do not always include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and, if necessary, a road test of the vehicle is carried out particularly where safety related items are concerned.

GENERAL PRECAUTIONS

1. Suspensions, steering and brakes are safety related, therefore all precautions stated in the Service Workbook must be strictly adhered to.
2. The wheel and tyre sizes/specifications fitted as original equipment on LDV vehicles are selected as suitable for use. Replacements must always be to the recommended specification.
3. Correct tyre pressures are important, both for steering lightness and for safety, and may be subject to legal requirements. Always ensure manufacturers recommended pressure figures are adhered to.
4. When disconnecting the vehicle battery, always disconnect the earth return (negative) cable first, and then the positive cable. On twin battery installations, disconnect both earth return (negative) cables first, and then the positive cables.
When reconnecting the battery(s), connect the positive cable(s) first, then the negative cable(s).
5. When testing the vehicle:
 - Do not release the handbrake before the steering lock has been disengaged.
 - Do not remove or attempt to move the ignition key to position 'O' of the steering lock while the vehicle is moving; the vehicle cannot then be steered.
 - Freewheeling with the engine switched off is dangerous as assistance from the brake servo is not available under these conditions.



GENERAL PRECAUTIONS (Continued)

6. When replacing/refitting rubber bushed suspension components the weight of the vehicle must be on its road wheels before finally tightening the fixing bolts to the correct torque.
7. When fitting road wheels, it is important to tighten the road wheel nuts to the correct torque.
8. Do not work under the vehicle when supported only by a jack; always use safety stands.
9. Brake fluid precautions:
 - At all times use the recommended brake fluid.
 - Never leave fluid in unsealed containers. It absorbs moisture quickly and can be dangerous if used in the braking system in this condition.
 - Dispose of used brake fluid correctly. Do not empty into drains, pollute water systems or pour onto the soil.
 - Fluid drained from the system or used for bleeding is best discarded.
 - The necessity for absolute cleanliness cannot be over-emphasised.

10. Components containing asbestos:

WARNING: Certain components such as some rear brake shoes, clutch linings, clutch plates and brake bands in automatic transmissions, heat shields and certain gaskets fitted to vehicles may contain asbestos.

Inhaling asbestos dust is dangerous to health. The following safety instructions must therefore be observed when working on these components.

- Wear a protective breathing mask.
- Never use an airline or blow dust from components. Clean friction components using methylated spirit.
- Replace worn components.
- Operate if possible out of doors or in a well ventilated place.
- Preferably use hand tools or low speed tools equipped, if necessary, with an appropriate dust extraction facility. If high speed tools are used, they should always be so equipped.
- If possible, dampen before cutting or drilling. Dampen dust and place in a properly closed receptacle and dispose of it safely.



REPAIRS AND REPLACEMENTS

When replacement parts are required, it is essential that only genuine LDV parts are used.



SUSPENSIONS

CONTENTS

	Page
Technical data	4
Service summary	4
Torque wrench settings	5
Road springs	
– general	6
– front	6
– rear	7
Spring & chassis bushes – remove/refit	10
– 200 models	13
– 300/400 models	17
Shock absorbers	22
Anti-roll bar	
– front	23
– rear	24

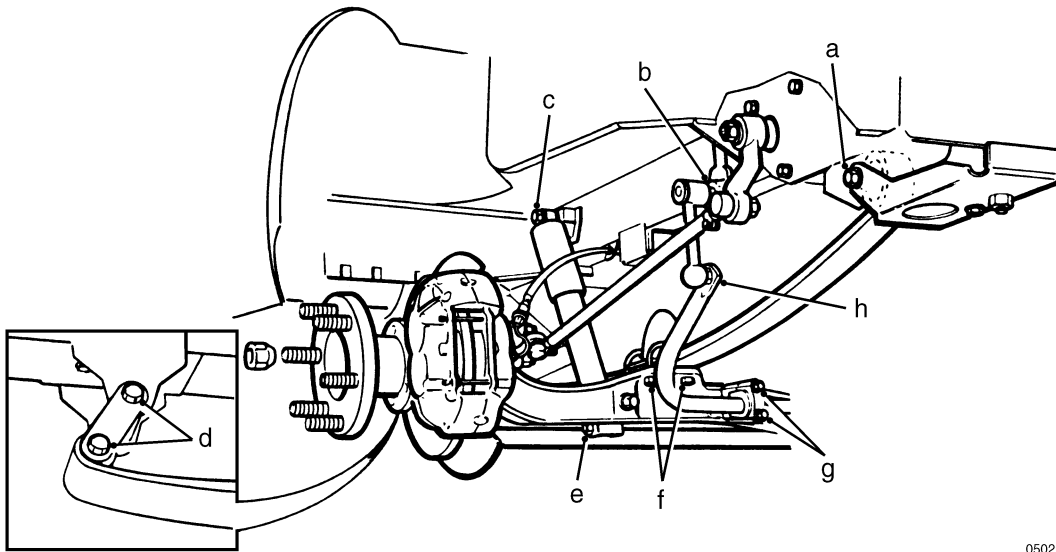
TECHNICAL DATA

200	FRONT & REAR	– Semi-elliptic composite leaf springs and telescopic hydraulic shock absorbers.(Steel springs 1994 MY on)
300/400	FRONT & REAR	– Single taper leaf springs and telescopic hydraulic shock absorbers.

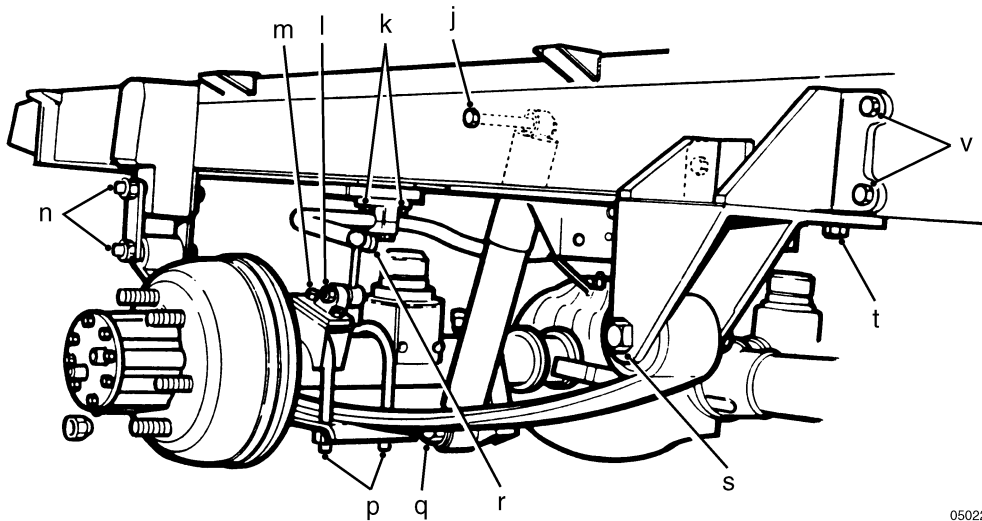
SERVICE SUMMARY

See Service Job Sheet for specific Service operations.
See Vehicle Handbook for service intervals.

TORQUE WRENCH SETTINGS



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050222

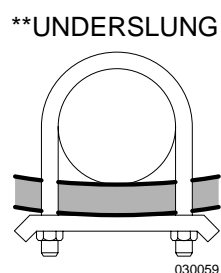
TORQUE WRENCH SETTINGS

Front & Rear Suspension – 200

	Fig. Ref	Nm	lbf ft
Spring front bolt	a, s	57 – 81	42 – 60
Front spring front bolt (chassis cab only)	a	43 – 61	32 – 45
Rear spring front bolt (chassis cab only)	s	43 – 61	32 – 45
Spring shackles	d, n	43 – 61	32 – 45
Shackle bracket to frame		35 – 47	26 – 35
Front spring 'U' bolt nuts	f	68 – 92	50 – 68
Rear spring 'U' bolt nuts	p	58 – 79	43 – 58
Shock absorber mounting bolts	c, e, j, q	38 – 54	28 – 40
Bolt – front shock absorber lower mounting bracket – chassis cab		81 – 95	60 – 70
Nut – front shock absorber upper mounting – chassis cab		11 – 15	8 – 11
Lock nut – front shock absorber upper mounting – chassis cab		20 – 27	15 – 20

Front & Rear Suspension – 300/400

Spring shackle and eye bolts	a, d, n, s	75 – 141	55 – 105
Spring shackle and eye bolts (MY 400 1991 year on)		122 – 149	90 – 110
Front spring 'U' bolt nuts	f	75 – 95	55 – 70
Rear spring 'U' bolt nuts – overslung mounting*		81 – 102	60 – 75
Rear spring 'U' bolt nuts – overslung mounting* (MY 400 1991 year on)		129 – 141	95 – 105
Rear spring 'U' bolt nuts – underslung mounting**	p	183 – 197	135 – 145
Rear spring cast hanger bracket (vertical fixing)	t	61 – 75	45 – 55
Rear spring cast hanger bracket (horizontal fixing)	v	43 – 61	32 – 45
Shock absorber mounting bolts – front	c, e	38 – 54	28 – 40
– rear upper	j	38 – 54	28 – 40
– rear lower	q	68 – 95	50 – 70
– rear upper and lower (MY 400 1991 year on)		38 – 54	28 – 40



Anti-Roll Bar Fixings – 300/400 (Front & Rear)

Mounting bracket to frame	k	41 – 54	30 – 40
Mounting bracket to axle	g, m	67.5 – 88	50 – 65
Anti-roll bar to link	h, r	54 – 81	40 – 60
Link to frame mounting bracket	b, l	20 – 27	15 – 20

Road Wheels

Road wheel nuts – 200		68 – 92	50 – 68
Road wheel nuts – 300/400 (single wheel)		176 – 227	130 – 168
Road wheel nuts – 300/400 (twin wheel)		230 – 280	170 – 206

ROAD SPRINGS – General

A range of front and rear road springs is fitted to both 200 and 300/400 vehicles to suit the specific application. Before fitting a new spring, always ensure it is the correct unit.

The composite spring fitted to 200 vehicles must not be cut, filed, etc. Irreparable damage will be caused to the material which may lead to eventual failure.

During 1993, the 200 Series van reverted to steel springs front and rear.

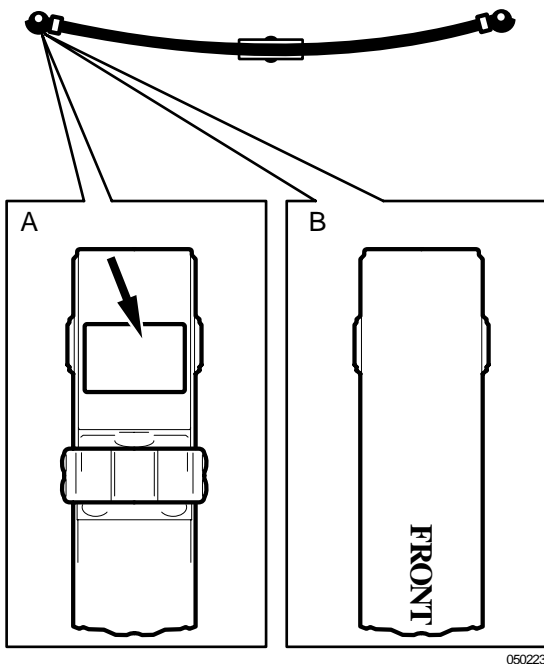


Fig.1 Spring front eye indicator

- either – A Colour coded adhesive label (may be one or two colours)
or – B 'FRONT' stencil

The springs must be fitted the correct way round. On a new spring the front eye is indicated either by a one/two colour coded label adhering to it, or by the word 'FRONT' stenciled on the front half of the spring leaf. (see fig.1)

If a spring is to be removed and refitted, check for one of these indicators before removal and, if obliterated, mark the front eye with paint to ensure correct refitting.

When fitting, final torque tightening of the spring eye and shackle bolts and of the 'U' bolt nuts must be made after the weight of the vehicle is on its road wheels. The 'U' bolt torque must be rechecked at the next service visit to workshops.

FRONT ROAD SPRING – 200

Remove

1. Raise the front of the vehicle and support the body. Remove the road wheel on the side of the spring to be removed.
2. Support the front axle, and remove and discard the four self locking nuts which secure the spring 'U' bolts.
3. Remove the 'U' bolts, saddles, axle buffer and (when fitted) the packing piece, noting their fitted positions. Examine the 'U' bolts and discard if there are any signs of stretching or damage.
4. Remove two nuts and spring washers retaining the shackle plate on one side, then remove the shackle plate.
5. Remove the nut, spring washer and spring front eye bolt and pull the front eye clear of its location.
6. Remove the spring from the shackle pin.

Refit

7. Reverse the operations 1 to 6 noting the following:
 - Fit the spring the correct way round – see 'Road Springs – General'.
 - Refit the axle buffer with the arrow marked 'CENTRE' pointing towards the centre line of the vehicle.
 - The vehicle weight must be on its wheels before tightening the 'U' bolts, the front eye bolt and the shackle pins to the correct torque.
 - Tighten the road wheel nuts to their correct torque.

FRONT ROAD SPRING – 300/400

Remove

1. Raise the front of the vehicle and support the body. Remove the road wheel on the side of the spring to be removed.
2. Support the front axle, and remove and discard the four self locking nuts which secure the spring 'U' bolts.
3. Remove the 'U' bolts, saddles, axle buffer and (when fitted) the packing piece, noting their fitted positions. Examine the 'U' bolts and discard if there are any signs of stretching or damage.
4. Support the spring and remove the front and rear spring eye nuts and bolts.
5. Lift the spring clear.

Refit

6. Reverse operations 1 to 5 noting the following:
 - Fit the spring the correct way round – see 'Road Springs – General'.
 - The weight of the vehicle must be on its wheels before finally tightening the 'U' bolts and spring eye bolts to their correct torque. Tighten the road wheel nuts to their correct torque.

REAR ROAD SPRING – 200

Remove

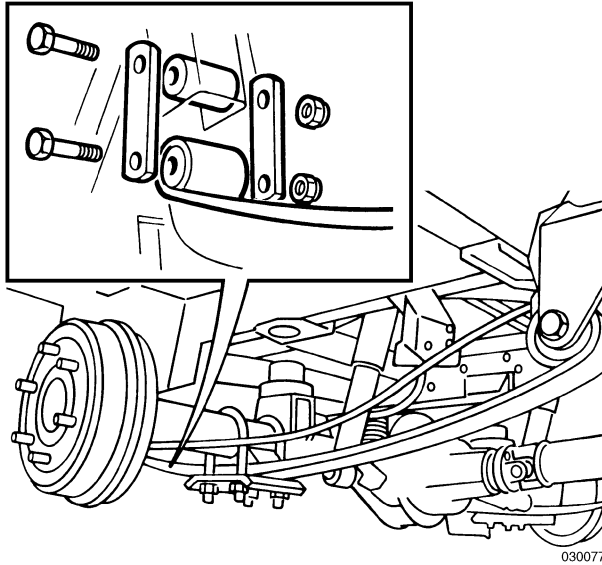
1. Raise the rear of the vehicle and support the body. Remove the road wheel on the side of the spring to be removed.
2. Support the rear axle, and remove and discard the four self locking nuts which secure the spring 'U' bolts. Remove the 'U' bolts and the clamp plate, examine the 'U' bolts and discard if there are any signs of stretching or damage.
3. Remove the nuts and spring washers retaining the shackle plate. Support the spring and remove the plates and shackle pin from the spring.
4. Remove the nut, spring washer and spring front eyebolt. Remove the spring.

Refit

5. Reverse the operations 1 to 4 noting the following:
 - Fit the spring the correct way round – see 'Road Springs General'.
 - The weight of the vehicle must be on its wheels before finally tightening the 'U' bolts, front eye bolt and shackle pins to the correct torque. Tighten the road wheel nuts to the correct torque.
 - Finally check the adjustment of the brake load sensing valve (if fitted).

REAR ROAD SPRING – 300/400

(Underslung suspension 1987 model year on)



030077

Fig.2 Underslung suspension – 300/400

Remove

1. Raise the rear of the vehicle and support the body. Remove the road wheel(s) on the side of the vehicle where the spring is to be removed.
2. Support the rear axle and remove the 'U' bolts and clamp plate securing the spring to the axle; discard the 'U' bolt lock nuts.

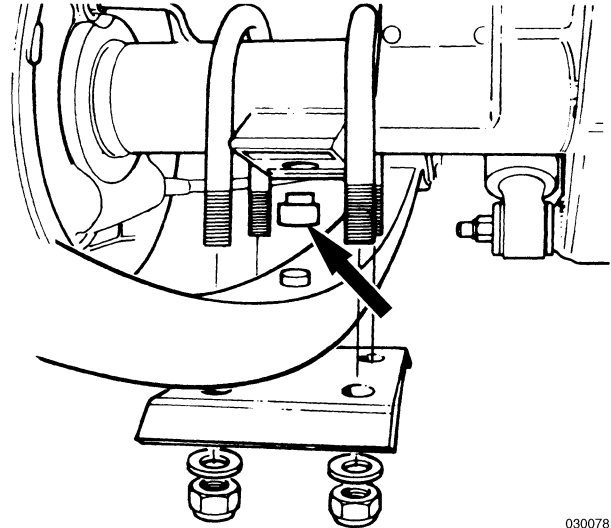
Note the position of any spacers or packing pieces fitted above or below the spring. Discard the dowel fitted between the saddle and the spring spigot.

Examine the 'U' bolts and discard if there are any signs of stretching or damage.

3. Support the spring and remove the front and rear spring eye nuts and bolts.

Refit

4. Reverse the operations 1 to 3 noting the following:



030078

Fig.3 Spring dowel

- Fit a new dowel between the spring spigot and the axle saddle.
- Fit the spring the correct way round – see 'Road Springs General'.
- The weight of the vehicle must be on its wheels before finally tightening the 'U' bolts, spring eye bolts and shackle pins to their correct torque. Tighten the road wheel nuts to their correct torque.
- Finally check the adjustment of the brake load sensing valve.

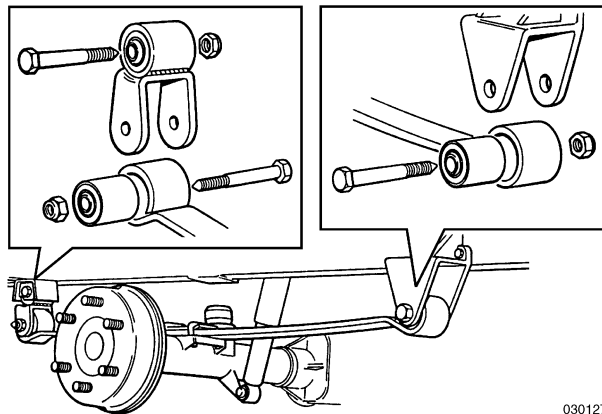
REAR ROAD SPRING – 400

(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.



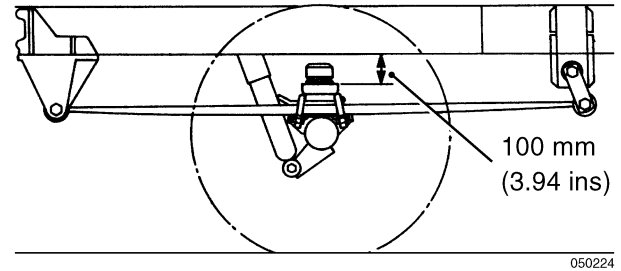
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Fig.4 Overslung rear suspension

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



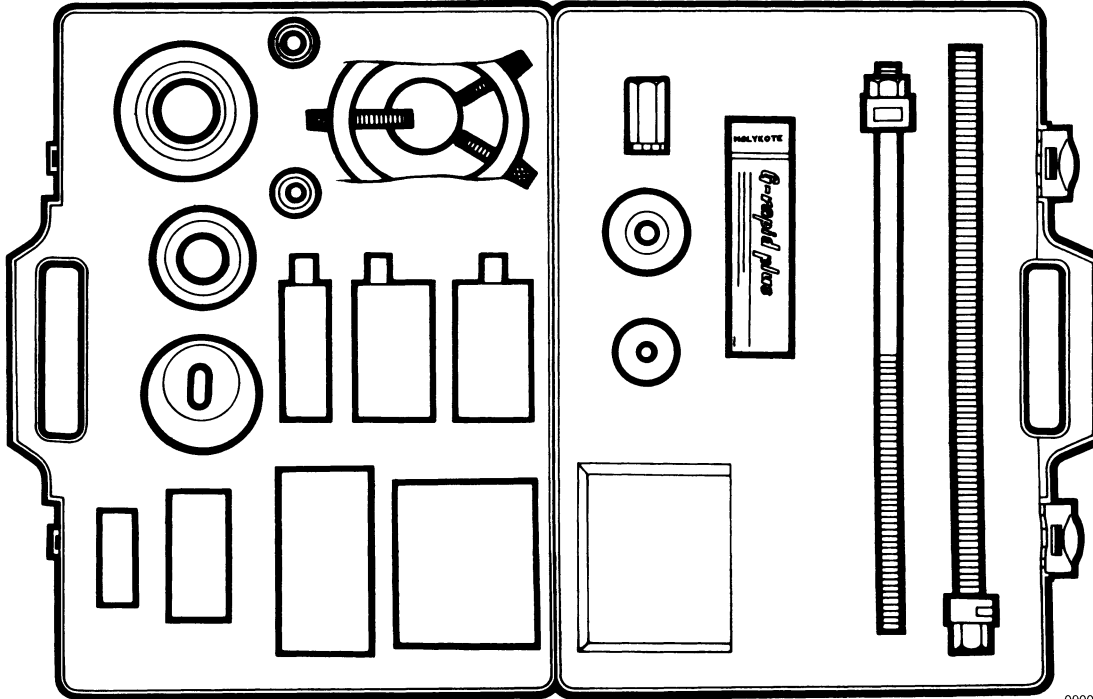
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Fig.5 Dimension for part-loaded condition

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.

SPRING AND CHASSIS BUSHES – remove & refit

Tool required: 0480078



090051

Suspension bush service kit – 0480078

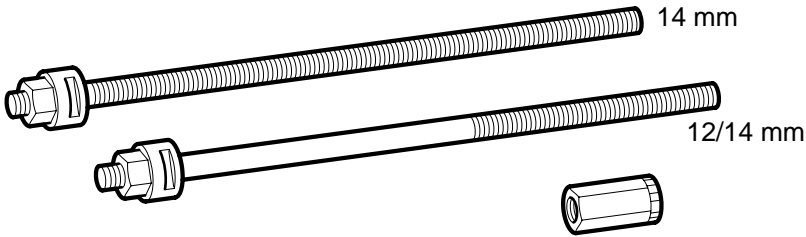
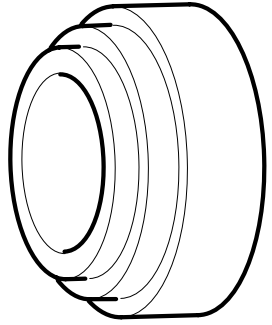
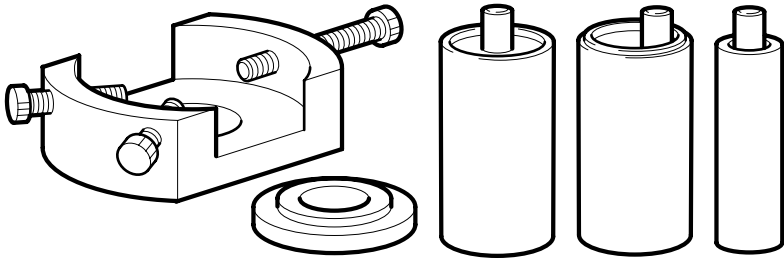
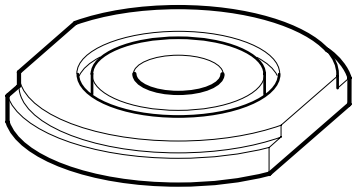
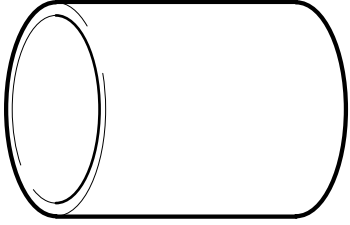
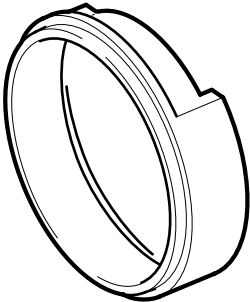
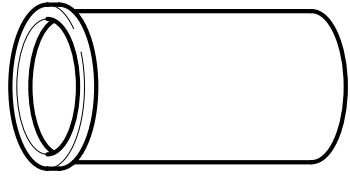
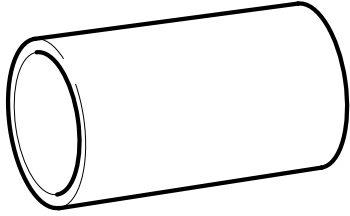
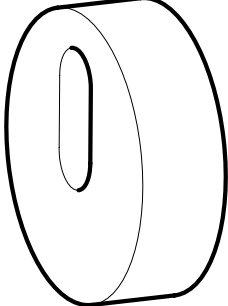
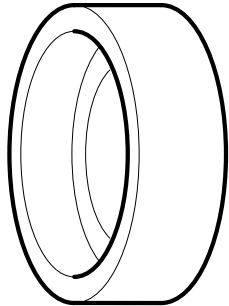
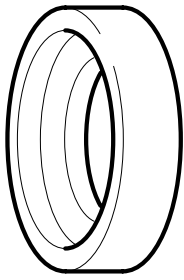
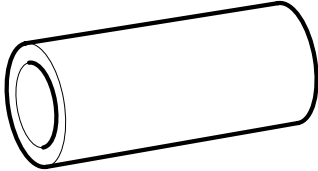
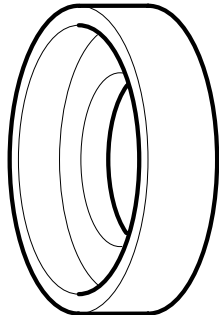
Instructions for use of Suspension Bush Service Kit

GENERAL

1. The service kit is supplied with a tube of Molykote G Rapid plus which must be applied sparingly to the threads in the bronze nut before fitting to its centre rod.
2. Select the correct tool adaptors for each application from the attached 'Application & Use' instructions.
The five tool components for use on 200 composite spring eye bushes are zinc finished, and are identified by the numbers 0480078-1 to 0470078-5.
Adaptors for all other uses have a identification letter stamped on them where necessary.
3. In all applications requiring use of the centre rod, the bronze nut must be fitted to the rod end with the 10 mm flats. Later versions have an 8 mm internal hexagon Allen key socket.
4. Ensure all components are correctly aligned before applying full torque.

CAUTION: Do not attempt to remove/refit 200 composite spring eye bushes with tools other than those specified

SPECIAL TOOL 0480078 – component parts

 <p>14 mm 12/14 mm</p> <p>Centre rods and bronze nut</p>	 <p>A</p>	
 <p>200 composite spring eye adaptors – 0480078-1 to -5</p>	 <p>B</p>	
 <p>C</p>	 <p>CC</p>	 <p>D</p>
 <p>E</p>	 <p>F</p>	 <p>G</p>
 <p>H</p>	 <p>J</p>	 <p>K</p>

**SUSPENSION BUSH SERVICE KIT
APPLICATION CHART**

MODEL	APPLICATION	OPERATION	TOOL COMPONENTS																
			Centre rod*	Threaded block	Lock nut	A	B	C	CC	D	E	F	G	H	J	K			
200	Chassis bushes – front – rear (not chassis cab)	Remove	12/14 mm	•	•										•				
		Refit	12/14 mm	•	•												•		
200	Chassis bushes – rear (chassis cab only)	Remove (stage 1) (stage 2)	12/14 mm	•	•													•	
		Refit	12/14 mm	•	•														•
300/400	Chassis bushes – front/rear Spring eye bushes – front spring – front/rear – rear spring – rear	Remove	14 mm	•	•						•								
		Refit – front chassis bushes, front spring eye bushes. Refit – rear chassis bushes, rear spring rear eye bushes.	14 mm	•	•								•						
300/400	Spring eye bushes – rear spring, front eye	Remove	14 mm	•	•											•			
		Refit	14 mm	•	•												•		
400	Spring eye bushes – rear spring, front eye	Remove	14 mm	•	•														
		Refit	14 mm	•	•														
400	Spring shackle bushes	Remove																	
		Refit																	

* The 12/14 mm rod is part threaded, and the 14 mm rod is fully threaded

200 Composite spring bushes Remove/refit – Use tool components numbered 0480078–1 to 0480078–5

APPLICATION & USE

200 models – chassis bushes, front and rear (except chassis cab rear)

Use 12/14 mm part threaded centre rod with bronze nut and adaptors A, E, H, J.

Remove

Chock road wheels of the axle not being worked on.
Raise chassis until spring shackles are in a 'no-load' condition. Remove shackle pins.

If changing front chassis bush, it may be necessary in certain applications to remove the exhaust and/or gearbox crossmember.
If changing rear chassis bush, remove bush housing from chassis.

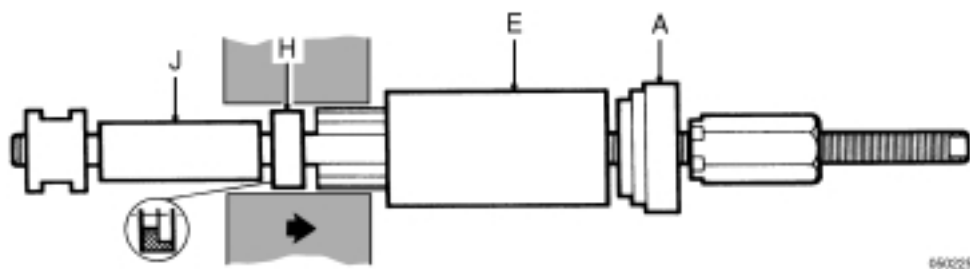


Fig.6 Removing 200 chassis bush (except chassis cab rear)

Assemble tool components as shown in fig.6.
Use smaller diameter (12/14 mm), part threaded centre rod (shorter rod). Fit from gearbox side of chassis for front chassis bushes.
Fit adaptor 'H', spacer tube 'J', threaded block and secure with lock nut.
Fit tube 'E', trunnion 'A' and bronze nut.

Align all components and tighten bronze nut to extract bush.

Refit

Remove all loose debris, rust, etc. from bush location.

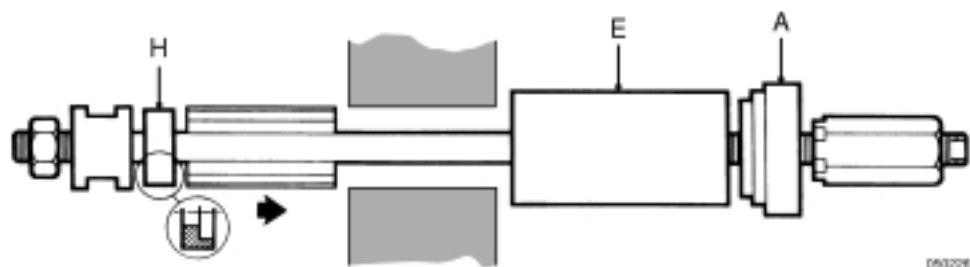


Fig.7 Fitting 200 chassis bush (except chassis cab rear)

New bush is pulled into position from opposite side to which it was removed.
Use same adaptors as for removal but without spacer tube 'J', and assemble as in fig.7.
Pull bush into position. Check that it is located centrally in chassis.
If changing rear chassis bush, refit bush mounting to vehicle. Refit shackle pins.

Torque tighten shackle pin nuts when weight of vehicle is on the ground.

200 models – chassis bushes, rear (chassis cab only)

Use 12/14 mm, part threaded centre rod with bronze nut and adaptors A, E, G, H, J, K.

Remove

Chock front road wheels.
Raise rear of chassis until spring shackles are in a 'no-load' condition.

Remove shackle pins.

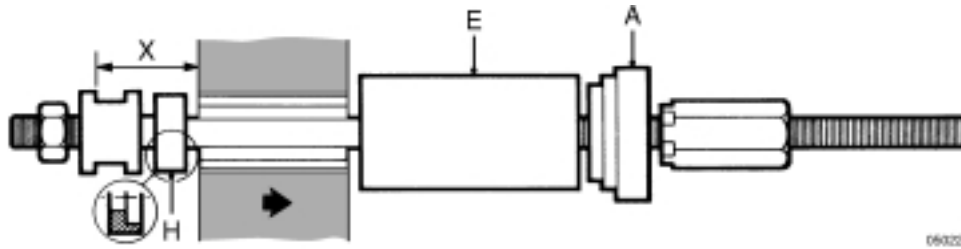


Fig.8 Removing 200 chassis bush – stage 1 (chassis cab rear)

There are two stages to removal procedure.

Stage 1:

Assemble components as shown in fig.8.
Use smaller diameter (12/14 mm), part threaded centre rod (shorter rod). Fit it from the outside face of chassis bracket.
Fit adaptor 'H', threaded block and secure with lock nut.
Fit tube 'E', trunnion 'A' and bronze nut.

Align all components.
Tighten bronze nut and pull bush out until outer side of flat on threaded block is flush with chassis bracket face (distance 'X').
CAUTION: Do not pull further as there is insufficient thread on centre rod for bronze nut.

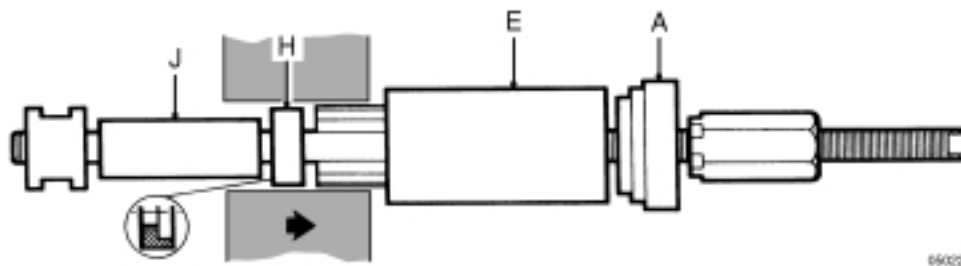


Fig.9 Removing 200 chassis bush – stage 2 (chassis cab rear)

Stage 2:

Remove lock nut and threaded block. Release bronze nut until spacer tube 'J' can be fitted behind adaptor 'H' (see fig.9). Secure with threaded block.

NOTE: There is insufficient space to fit lock nut. Tighten bronze nut to pull bush out, using 10 mm spanner on centre rod to prevent it from turning.

Refit

Remove all loose debris, rust, etc from bush location.

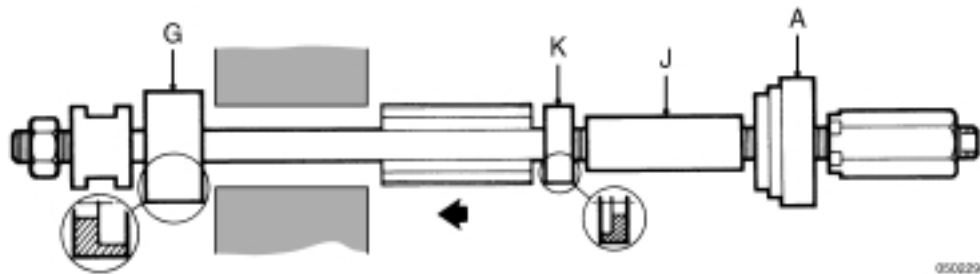


Fig.10 Fitting 200 chassis bush (chassis cab rear)

New bush is pushed into position from same side as removed.

Fit centre rod from the outside (see fig.10).

On the inside, fit adaptor 'G' and secure with threaded block and lock nut.

On the outside, fit the new bush, adaptor 'K', spacer tube 'J', trunnion 'A' and bronze nut.

Tighten bronze nut to push bush into position.

Check that it is located centrally in chassis .

Refit shackle pins.

Torque tighten shackle pin nuts when weight of vehicle is on the ground.

200 models – composite spring eye bushes

Use tools 0480078–1 to 0480078–5 in conjunction with a hydraulic press.

CAUTION: It is important to use this tool correctly to avoid possible damage to the structure of the spring.

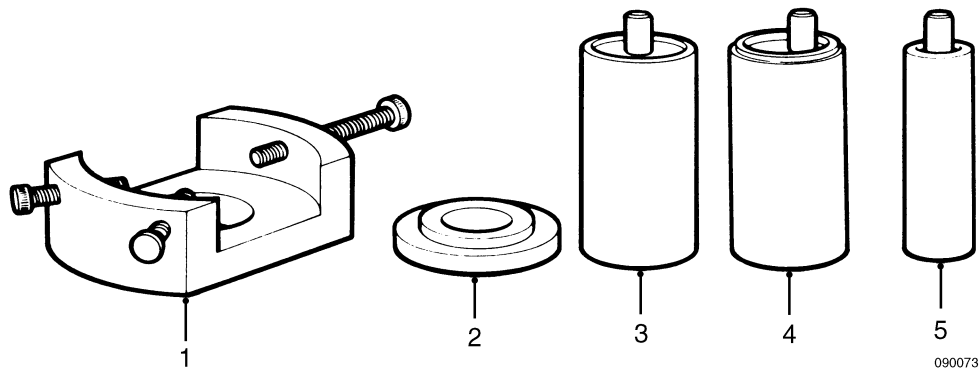


Fig.11 Composite spring eye bush tools

1. Support jig 0480078–1
2. Adaptor 0480078–2
3. Large concentric mandrel 0480078–3
4. Large eccentric mandrel 0480078–4
5. Small concentric mandrel 0480078–5

Remove

Remove spring from the vehicle.

Clean all loose debris, rust etc from bush location to enable bush outer diameter to be defined.

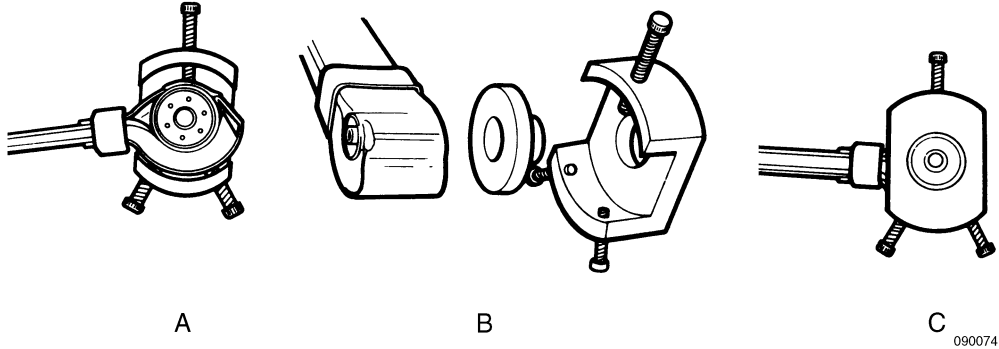


Fig.12 Centralising 200 spring eye in support jig 0480078-1

Position spring eye in support jig 0480078-1 with the two adjacent adjustment thumbscrews on underside of spring eye as shown in fig.12 A.

NOTE: If a small spring bush is being changed, first fit adaptor 0480078-2 in support jig (see fig.12 B).

Using hand pressure only, adjust the three thumbscrews to move spring eye in support jig until bush is central to hole in back of jig (see fig.12 C).

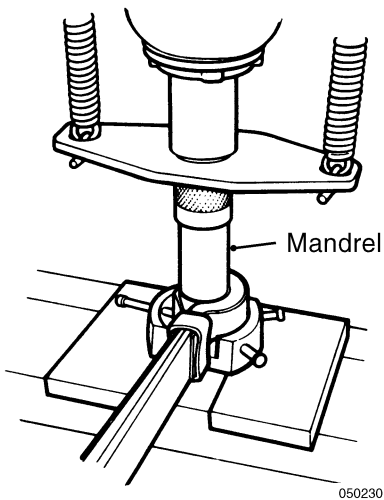


Fig.13 Pressing out composite spring eye bush

Transfer to hydraulic press.

Select correct mandrel, and press bush out of spring eye.

Leave spring eye in support jig in preparation for fitting new bush.

Refit

Press in new bush with same mandrel as used for removal (see fig.13).

NOTE: If a bush with an offset centre tube is being fitted, it must be positioned with offset tube positioned at 90° to spring leaf and with a short offset uppermost (similar to bush position shown in fig.17). Press bush in using mandrel 0480078-4 with offset dowel.

Check that fitted bush is central in eye.

Refit spring to the vehicle.

Torque tighten spring eye bolts and spring 'U' bolts when weight of vehicle is on the ground.

300/400 models – front & rear chassis bushes
– front & rear spring eye bushes (except rear spring, front eye)

Use 14 mm, fully threaded centre rod with bronze nut and adaptors A, B, D, G (and F if refitting rear chassis bushes).

NOTE: Certain older models were fitted with 70 mm bushes at both ends of rear spring. In these cases, refer to instructions for 'Rear Spring – Front Eye'.

Remove

All these bushes can be changed in situ, after carrying out the following operations:

Front chassis bush

Remove gearbox crossmember.
 Remove exhaust (if necessary).

All chassis bushes

Chock road wheels of axle not being worked on.
 Raise chassis until spring shackles are in a 'no-load' condition.
 Remove shackle nuts/bolts.

All spring eye bushes

Chock road wheels of axle not being worked on.
 Raise chassis until springs to be overhauled are in a 'no-load' condition.

To remove bush:

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 (or shackle bolt).

If necessary, raise chassis further until bush(es) to be changed are clear of obstruction.

NOTE: If changing front eye bushes, slacken shackle bolts.

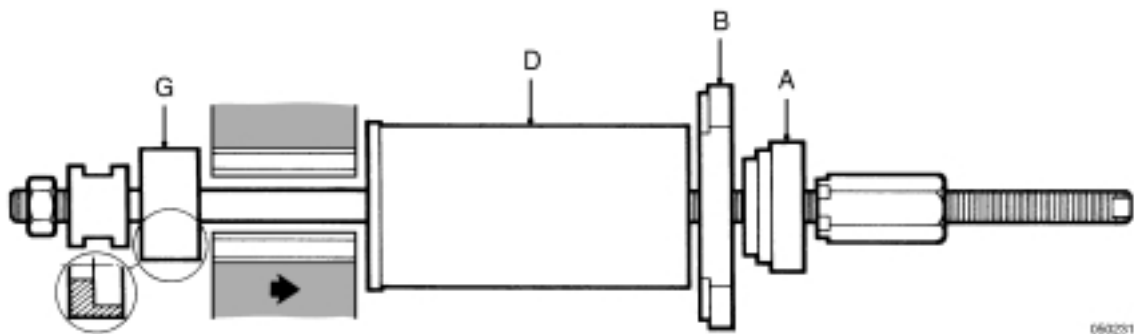


Fig.14 Removing 300/400 chassis and spring eye bushes (except rear spring, front eye)

Assemble components as shown in fig.14. Use larger diameter (14 mm), fully threaded centre rod (longer rod). Fit it from gearbox side for front chassis bush or front spring eye bushes, fit from outside for rear spring rear eye or rear chassis bush. Fit adaptor 'G', threaded block and secure with lock nut.

- NOTE:**
1. If removing front spring chassis bush, centre rod should protrude approximately 25 mm (1 in) from lock nut to ensure opposite end of rod does not foul gearbox as bush is extracted.
 2. If removing rear chassis bush, ensure centre rod cannot foul fuel tank when lock nut is tightened.

Fit tube 'D' with flanged end of tube towards chassis/spring, adaptor ring 'B' ensuring tube 'D' fits into groove, trunnion 'A' and bronze nut.
NOTE: When removing a rear chassis bush, the flat on outside of adaptor ring 'B' is positioned upwards to clear the chassis outrigger.

Align all components and tighten bronze nut to extract bush.

Remove all loose debris, rust, etc. from location.

- Refit**
- Front chassis bushes
 - Front spring eye bushes

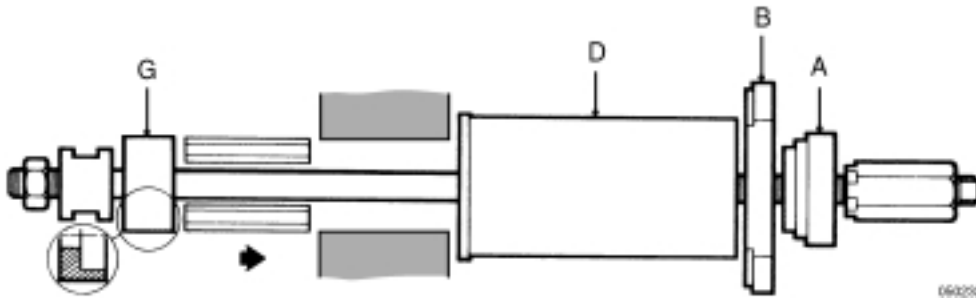


Fig.15 Fitting

- 300/400 front chassis bushes
- 300/400 front spring eye bushes

Bush is pulled into position. Fit centre rod from gearbox side.
 Fit new bush, adaptor 'G', and secure with threaded block and lock nut (see fig 15).
 Fit tube 'D' with flanged end towards chassis/spring eye, and adaptor ring 'B'.

Fit trunnion 'A' and bronze nut, and tighten nut to pull bush into position. Check that it is central in chassis/spring eye.

Complete vehicle reassembly in the reverse sequence to dismantling.

Torque tighten shackles/spring eye nuts/bolts when weight of vehicle is on the ground.

- Refit**
- Rear chassis bushes
 - Rear spring eye bushes

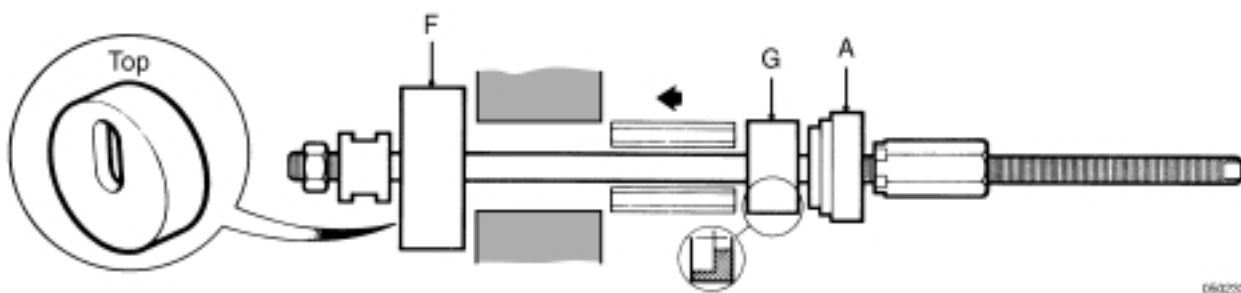


Fig.16 Fitting 300/400 rear chassis bushes and rear spring, rear eye bushes

Bush is pushed in from same side as removed (see fig.16).
 Fit centre rod from the outside. Fit adaptor 'F' with its internal short offset to the top (see fig.16 inset), and secure with threaded block and lock nut.
 Fit new bush, adaptor 'G', trunnion 'A' and bronze nut.

Tighten bronze nut to push bush into position. Check that it is located centrally in chassis.

Complete vehicle reassembly in the reverse sequence to dismantling.

Torque tighten shackles/spring eye nuts/bolts when weight of vehicle is on the ground.

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

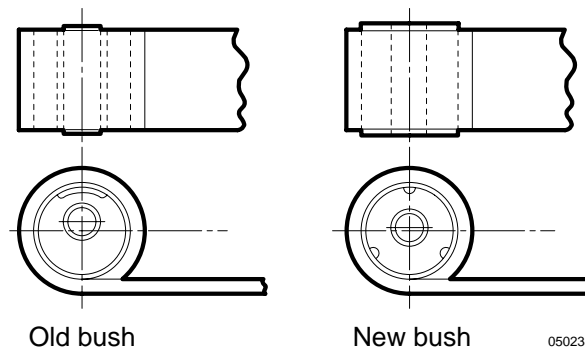


Fig.17 Rear spring, front eye offset bush

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.

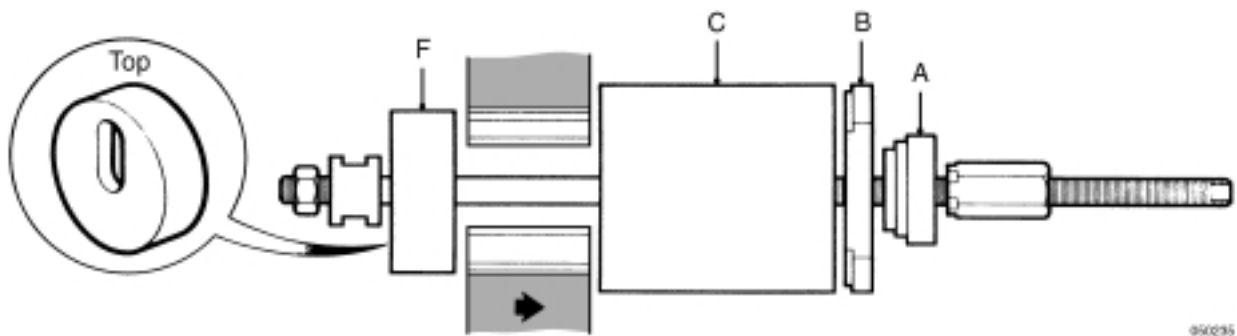


Fig.18 Removing 300/400 rear spring front eye bush (70 mm)

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.

Refit

Remove all loose debris, rust, etc. from bush location.

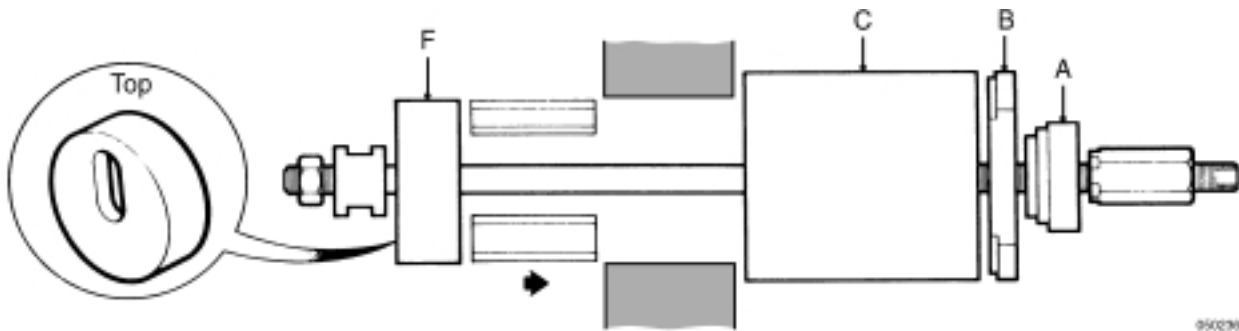


Fig.19 Fitting 300/400 rear spring front eye bush (70 mm)

New bush is pulled into position from opposite side to which it was removed, using the same adaptors (see fig.19).

Insert centre rod and fit new bush, adaptor 'F', threaded block and lock nut.

On other side fit tube 'C', and adaptor ring 'B', ensuring tube 'C' fits over outer step of 'B'. Fit trunnion 'A' and bronze nut.

Position bush so that its offset is to the top as shown in fig.17. Align all components, ensuring adaptor 'F' is positioned correctly, and tighten the bronze nut to pull the bush into spring eye.

CAUTION: Ensure bush remains square to spring eye during initial pulling in.

Check that bush offset is to the top when fitted, and bush is central in spring eye.

Complete vehicle reassembly in the reverse sequence to dismantling.

Torque tighten spring eye/shackle nuts/bolts when weight of vehicle is on the ground.

400 models – overslung suspension (1991 model year on)

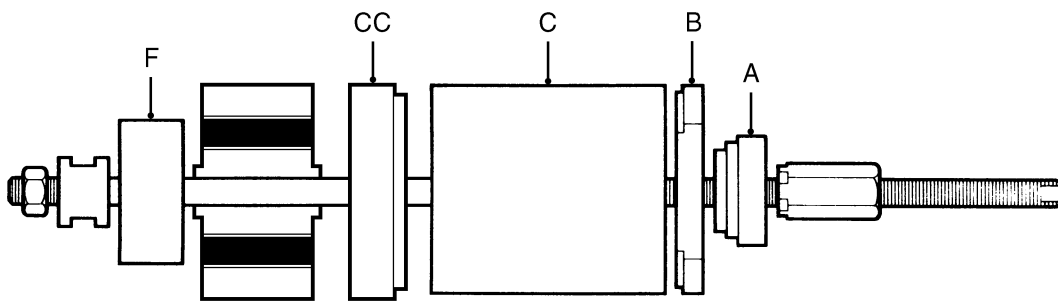
From 1991 MY all 400 vehicles have been fitted with an overslung suspension. The new suspension is fitted to all 400 models except air suspension vehicles.

The springs retain a single taper design but with revised camber and are attached at the rear with new style shackles. The spring eye bushes and 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.

The removal and refitment of the spring and shackle bushes will require the use of tool 0480078 and special tool adaptors.

NOTE: The special tool adaptors are available from:

R.H. Engineering Services
The meads,
Llechwedd
Conway,
Gwynedd LL32 0DR
Tel/Fax: 0492 573320



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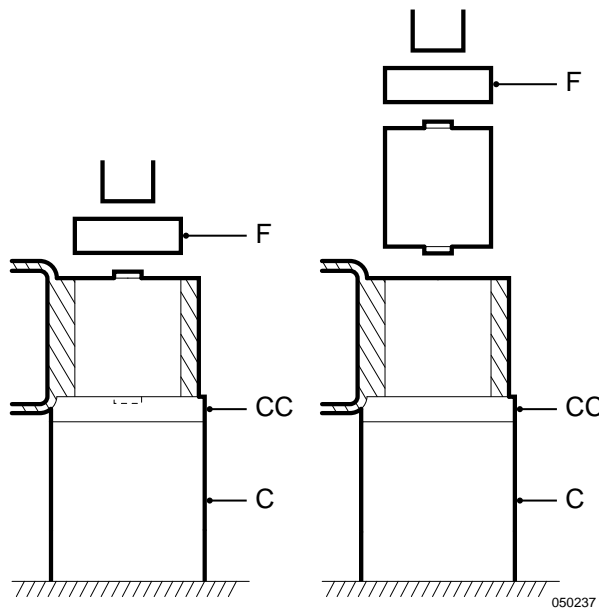
Fig.20 Removing 400 rear spring front eye bush (70 mm) 1991 MY on

Assemble components from tool kit as shown in fig.20.

Insert larger diameter (14 mm), fully threaded centre rod (longer rod) in spring eye, fit adaptor 'F' and threaded block and secure with lock nut. Fit adaptor ring 'CC', tube 'C', adaptor ring 'B', trunnion 'A' and bronze nut.

Align all components and tighten bronze nut to extract bush.

New bush is pulled into position from the opposite side to which it was removed, using the same tools.



050237

Fig.21 Removing 400 spring shackle bush, 1991 MY on

To remove the spring shackle bush, use the components from the tool kit as shown in fig.21 and a suitable hydraulic press.

Place tube 'C' on the press and locate adaptor ring 'CC' on the tube. Position spring shackle on the adaptor ring, with the leg of the shackle to the cut out in the ring. Using adaptor 'F' press the bush from the shackle.

Reverse the removal procedure for fitment of new bush.

SHOCK ABSORBERS

Remove/Refit – 200/300/400

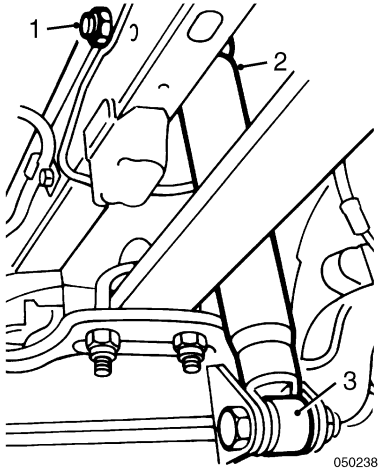


Fig.22 Front shock absorber – 200

1. Upper mounting
2. Shock absorber
3. Lower mounting

Remove

1. Raise the front or rear of the vehicle and support on axle stands.
2. Remove and discard the upper and lower shock absorber mounting self-locking nuts.
3. Remove the mounting bolts and flat washers to detach the shock absorber. Note the position of the washers.

Refit

4. Hold the shock absorber vertically and operate manually to both extents of its travel, until any undamped movement is eliminated.
5. Refit the shock absorber by reversing operations 1 to 3. Fit the washers in the same positions as noted on removal. Use new self-locking nuts, and finally tighten them to the correct torque when the weight of the vehicle is on its road wheels.

FRONT ANTI-ROLL BAR – 300/400

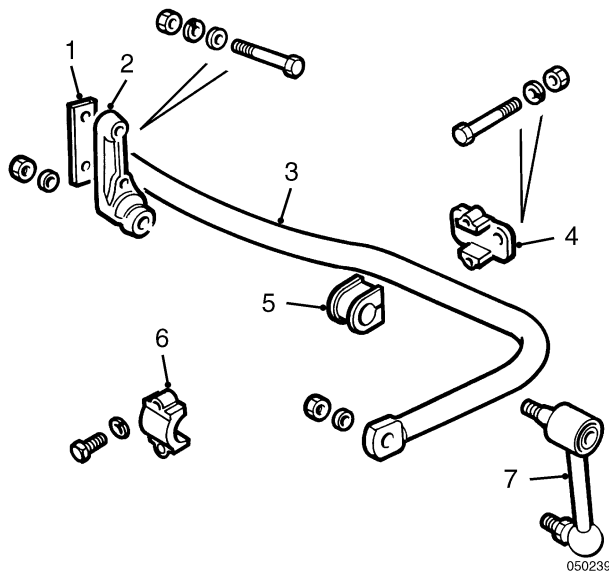


Fig.23 Front anti-roll bar

1. Spacer
2. Attachment bracket – chassis
3. Anti-roll bar
4. Attachment bracket – front axle
5. Rubber bush
6. Bracket cap
7. Vertical connection link

Remove and refit

Remove

1. Position the vehicle on a ramp and apply the handbrake.
2. Disconnect the upper and lower fixings of the vertical connection links and remove the links.

NOTE: 1 The upper fixing is a taper fit.
 2 The hexagon on the lower fixing must be held while releasing the securing nut.

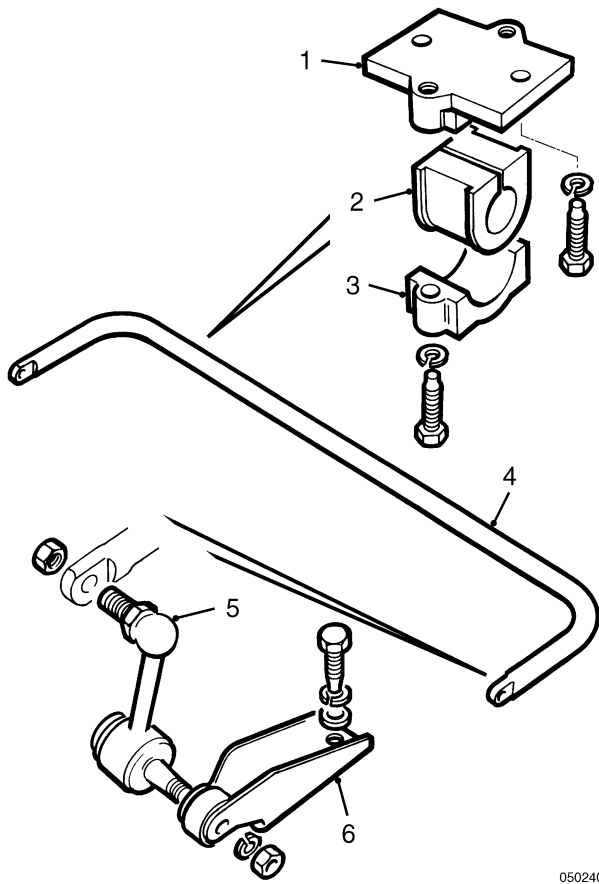
3. Release the two caps to release the anti-roll bar from the axle beam. Remove the two rubber bushes.
4. Inspect the bushes and link joints for wear or oil contamination, and check that the link spindles have not become detached. Renew as necessary.

Refit

5. Fit new rubber bushes on the anti-roll bar, then fit the anti-roll bar to the front axle making sure its central curve faces downwards. Tighten the cap bolts to the correct torque.
6. Fit the vertical connection links and tighten the securing nuts to the correct torque; hold the lower spindle from turning while tightening its nut.

NOTE: If fitting the anti-roll bar in the 'wheel-free' condition, do not tighten the securing nuts/bolts until the weight of the vehicle is on its wheels.

REAR ANTI-ROLL BAR 300/400



050240

Fig.24 Rear anti-roll bar

1. Attachment bracket – chassis
2. Rubber bush
3. Bracket cap
4. Anti-roll bar
5. Vertical connection link
6. Attachment bracket – rear axle

Remove and refit

Remove

1. Position the vehicle on a ramp and apply the handbrake.
2. Disconnect the two mounting brackets from the rear axle.
3. Remove the two caps from the chassis mountings to release the anti-roll bar. Remove the two rubber bushes.

4. To disconnect the vertical connection links:
 - the lower fixing is a taper fit,
 - the hexagon on the upper fixing must be held while releasing its securing nut.
5. Inspect the bushes and link joints for wear or oil contamination, and check that the link spindles have not become detached. Renew as necessary.

Refit

6. Fit new rubber bushes on the anti-roll bar, then fit the anti-roll bar to the chassis. Tighten the cap bolts to the correct torque.
7. Fit the attachment brackets to the rear axle, and tighten the securing bolts to the correct torque.
8. Fit vertical connection links, making sure the upper spindle hexagon is held while tightening its securing nut. Tighten the nuts to the correct torque.

NOTE: If fitting the anti-roll bar in the 'wheel-free' condition, do not tighten the securing nuts/bolts until the weight of the vehicle is on its wheels.

STEERING, FRONT AXLE, FRONT HUBS

CONTENTS

	Page
Technical data	26
Service summary	28
Lubricants	28
Special tools	29
Torque wrench settings	30
Front axle	31
Front hub bearings	32
Steering description	33
Front wheel alignment	34
Drag link ball joints	35
Steering arm/track rod arm	36
Steering drop arm	36
Track rod ball joints	37
Steering damper – 300/400	38
Swivel pins	39
Steering box	
– remove/refit	41
– overhaul ● Gemmer	45
– overhaul ● Burman	49
Steering column – remove/refit	53
– Top column bush	54
– Coupling shaft	55



TECHNICAL DATA

ROAD WHEELS & TYRES

200

road wheels	5J x 14 – pressed steel disc, 5 stud fixing. (Hypress on 280 van, chassis cab & dropside) 1994 MY on (all models): 5.5J x 14 – pressed steel disc (Hypress).
tyres	165 x 14 reinforced radial – City & 200 van 185 x 14 reinforced radial – 230 van – 2,2 and 2,4t van 185 x 14 6 ply radial – 200 minibus – 250 van – 250 minibus & combi – 250 crewbus – 255 dropside – 255 chassis cab – 2,6t all models 185 x 14 8 ply radial – 280 van – 280 dropside – 280 chassis cab – 2,8t all models

300/400

Single rear road wheels	5.5J x 14 – pressed steel disc, 6 stud fixing.
tyres	205 x 14 (6 ply commercial) radial ply – City & 285 SWB van (CS) – 285 LWB chassis cab – 285 LWB dropside – 2,8t models 205 x 14 (8 ply commercial) radial ply – 310 van (SWB & LWB) – 310 LWB high roof van – 310 LWB chassis cab – 310 LWB dropside – 3,1t models
Twin rear road wheels	5J x 14 – pressed steel disc, 6 stud fixing.
tyres	185 x 14 (6 ply commercial) radial ply – 310 minibus (15, 17 & 18 seat) – 350 van (SWB, LWB & LWB HR) – 350 LWB chassis cab & crew cab – 350 LWB dropside – 350 XLWB chassis cab & crew cab – 350 XLWB dropside – 3,5t all models – 400 minibus

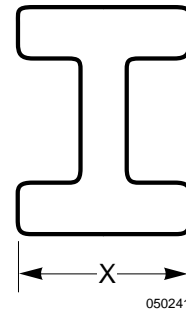
TECHNICAL DATA (Continued)

Front axle (Plated weight)

200	–	24N axle (1275 kg)
300/400	– Standard	28N axle (1375 kg)
	– Heavy duty	30N axle (1500/1600 kg)

300/400 identification	Casting No.	Dimension 'X'
– standard axle	ACR 1015	50 mm (1.97 ins)
– heavy duty axle	ACR 1010	60 mm (2.36 ins)

NOTE: Dimension 'X' measured at centre of underside of beam.



Steering box

	Pre 1989	1989 on
– Make	Gemmer	Burman
– Type	Worm and roller	Recirculating ball
– Ratio	22:1	Variable
– Capacity	0.50 litres (0.87 pts)	0.45 litres (0.79 pts)
– Turns lock to lock	4 ³ / ₄	5 ¹ / ₂

Steering angles

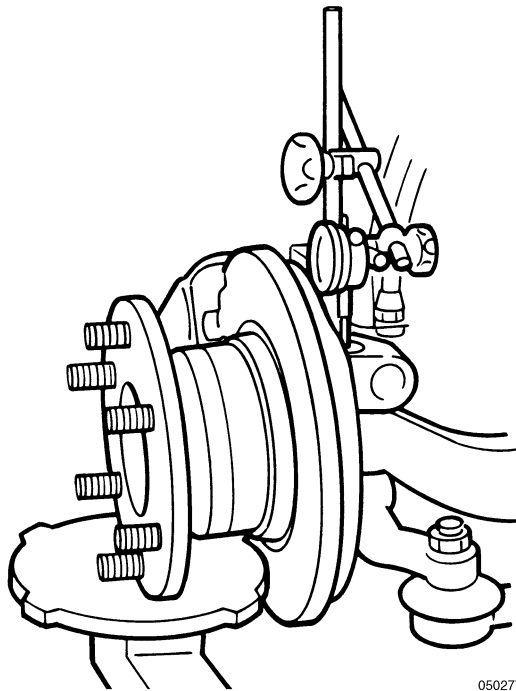
	200	300/400
Camber angle	2° 30' positive	1° 30' positive
Castor angle – unladen	5° positive	5° positive (up to VIN 816952)
		2° positive (from VIN 816953)
Swivel pin inclination	8° 30' positive	9° 30' positive
Angle of inner wheel with outer wheel at 20°	22°	22°
Front wheel alignment	1,6 to 3,2 mm toe-out (¹ / ₁₆ to ¹ / ₈ in toe-out)	0 to 1,6 mm toe-in (0 to ¹ / ₁₆ in toe-in)

Clearances and Tolerances

Front hub bearing end float	0,05 to 0,13 mm	0.002 to 0.005 in
Clearance between top of axle beam and stub axle	0,05 to 0,20 mm	0.002 to 0.008 in

NOTE: A maximum (in Service) clearance of 0,38 mm (0.015 in) is permissible. Check the axle beam/stub axle clearance as follows:

1. Apply the handbrake, raise and suitably support the front of the vehicle on axle stands; remove the road wheels.
2. Thoroughly clean the area around the swivel pin sealing cap. Remove the circlip, sealing cap and 'O' ring then clean all grease from the top of the swivel pin, using a lint free cloth.



050277

Fig.1 Checking axle beam/stub axle clearance

3. Mount a D.T.I. to the brake hose support bracket (fig. 1) with the indicator stylus on the swivel pin; zero the gauge.

CAUTION: Ensure the axle is adequately supported on the axle stands during the following operation.

4. Support the hub with a trolley jack and slowly take the weight of the vehicle on the jack; note the reading on the D.T.I. gauge.
5. Any swivel pin that exceeds the maximum (in Service) clearance must be re-shimmed or overhauled as instructed on page 39.
6. Refit 'O' ring, sealing cap and circlip. Refit road wheels, lower vehicle to ground and tighten the road wheel nuts to the correct torque.
7. Inject Molybdenum grease into the upper grease nipple.

SERVICE SUMMARY

See Service Job Sheet for specific Service operations.

See Vehicle Handbook for service intervals.

LUBRICANTS

Steering box	Multipart Gear Oil SAE EP 90
Swivel pins	Multipart Molygrease
Front hubs	Multipart Multipurpose Lithium L2 type grease

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.

TORQUE WRENCH SETTINGS

Steering

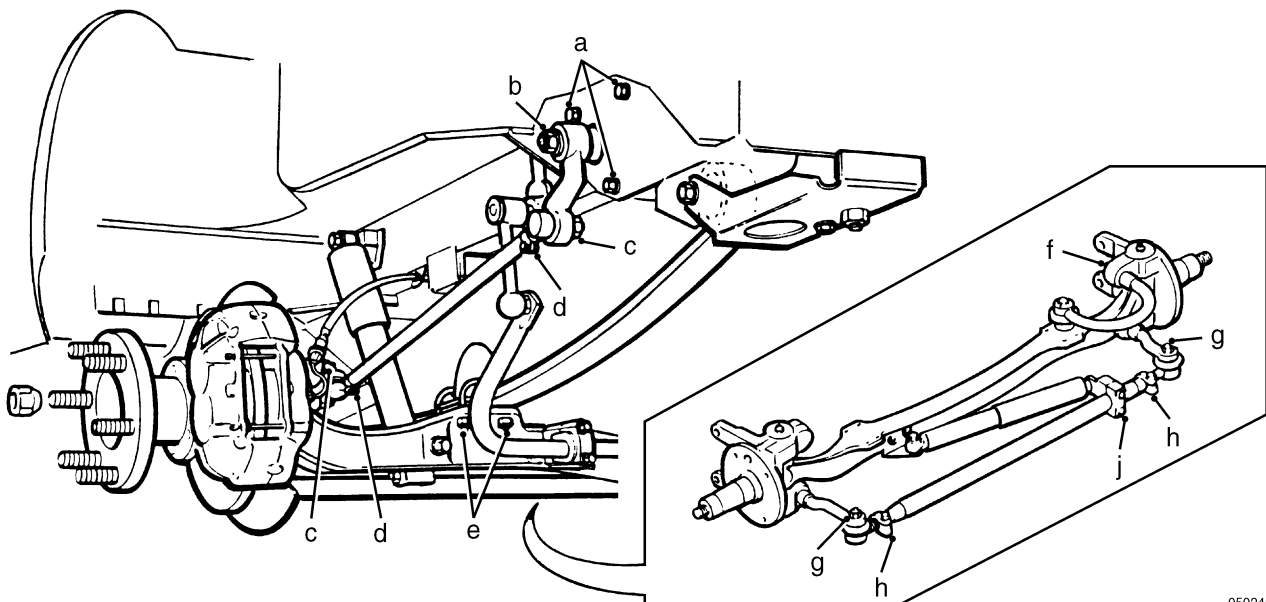
Steering box to frame bolts	a	61 – 81	45 – 60
Drop arm to steering box nut	b	169 – 221	125 – 163
Steering wheel nut		46 – 62	34 – 46
Steering column to fascia bracket		16 – 24	12 – 18
Drag link lock nut – 200		47 – 54	34 – 40
Drag link pinch bolt – 300/400	d	28 – 32	20 – 23
Drag link ball pin nuts – 200	c	46 – 62	34 – 46
Drag link pin nuts 300/400	c	54 – 75	40 – 55
Universal joint pinch bolts		23 – 31	17 – 23
Steering damper clamp to track rod – 300/400	j	47 – 54	35 – 40

Front Axle

Cotter pin nut		15 – 19	11 – 14
Steering arm nut	f	102 – 135	75 – 100
Track rod arm nut		102 – 135	75 – 100
Track rod ball pin nuts – 200	g	46 – 62	34 – 46
Track rod lock nut – 200		108 – 135	80 – 100
Heavy duty track rod lock nut – 200		18 – 22	13 – 16
Track rod ball pin nuts – 300/400	g	54 – 75	40 – 55
Track rod pinch bolt – 300/400	h	28 – 32	20 – 23
Front spring 'U' bolt nuts – 200	e	68 – 92	50 – 68
Front spring 'U' bolt nuts – 300/400	e	75 – 95	55 – 70

Road Wheels

Road wheel nuts – 200		68 – 92	50 – 68
Road wheel nuts – 300/400 (single wheel)		176 – 227	130 – 168
Road wheel nuts – 300/400 (twin wheel)		230 – 280	170 – 206



050242

FRONT AXLE

Remove/Refit – 200/300/400

Remove

Tool required: 18G 1063A

1. Raise the front of the vehicle and support the body. Remove the road wheels.
2. Disconnect the drag link at the steering arm, using 18G 1063A.
3. Disconnect the shock absorbers at the axle.
4. Disconnect both flexible brake pipes, and cap the ends to minimise fluid loss.
5. On 300/400 vehicles remove the support brackets to release the anti-roll bar from the axle.
6. Support the axle, remove the spring 'U' bolts and lower the axle clear.
7. Examine the 'U' bolts and discard if there are any signs of stretching or damage. Discard the self-locking nuts.

Refit

8. Ensure the axle and spring mating surfaces are clean.
9. Offer up the axle to the springs, ensuring that the spigots on the springs locate correctly in the axle beam.
10. On each side fit the axle buffer and the 'U' bolts. Use new nuts to secure the 'U' bolts loosely.
11. On 300/400 vehicles reconnect the anti-roll bar.
12. Attach the shock absorbers to the axle beam, and reconnect the drag link.
13. Fit the road wheels, lower the vehicle to the ground and tighten all the 'U' bolt nuts progressively to the correct torque.

IMPORTANT

14. If any component has been renewed which may affect the steering linkage, it will be necessary to check the settings as described in 'Steering Box Refit Procedure' operations 18 to 20. The wheel alignment must also be checked.
15. Tighten the road wheels to the correct torque.

CAUTION: It is advised that 200 model owners be told to return the vehicle after 1000 miles (1500 kilometres) or one month for the 'U' bolt nuts to be retorqued (Composite leaf spring models).

FRONT HUB BEARINGS – 200/300/400

Tools required: 0499809 (18G 134), 0480041 (18G 134 CC), 0499910 (18G 134 DV)

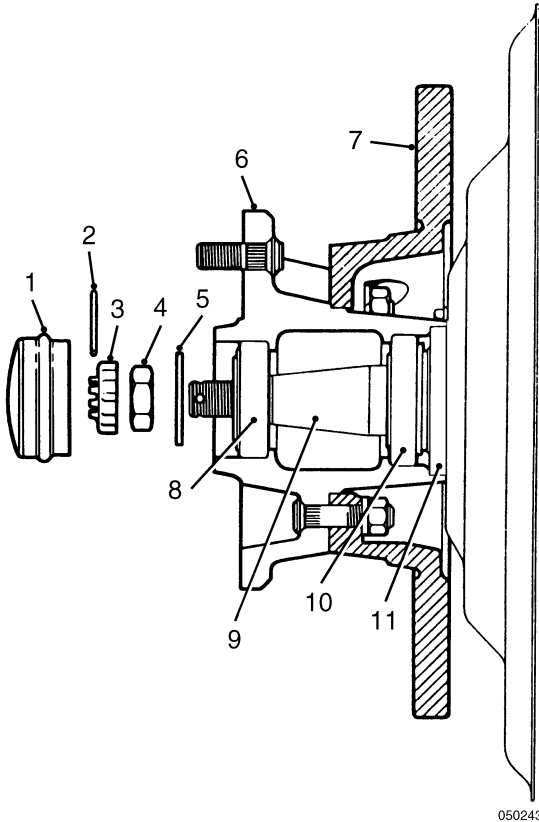


Fig.1 Front Hub

1. Dust cap
2. Split pin
3. Hub nut retainer
4. Hub nut
5. Washer
6. Hub
7. Brake disc
8. Outer hub bearing
9. Stub axle
10. Inner hub bearing
11. Inner oil seal

Dismantling

1. Apply the handbrake and chock the rear road wheels; raise and support the front of the vehicle and remove the front wheels.
CAUTION: Left hand threaded wheel nuts are fitted on the left hand side of the vehicle (300/400 only).
2. Remove the brake caliper, and discard the caliper mounting bolts if micro-encapsulated.
CAUTION: Support the caliper to avoid damage to the flexible brake pipe.
3. Remove the dust cap, split pin, hub nut retainer, hub nut and washer.
4. Withdraw the hub and recover the outer bearing.
5. Remove and discard the inner oil seal, and recover the inner bearing.
6. Using a soft drift, remove the inner and outer bearing cups.
7. Clean all components and examine for wear or damage; renew as necessary.

Reassembly

8. Use 0499809 (18G 134) and 0480041 (18G 134CC) to press the inner and outer bearing cups into the hub until they abut against the machined shoulder.
9. Pack with the correct grade of grease and fit the inner bearing.
10. Lubricate and fit a new inner oil seal using 0499809 (18G 134) and 0499910 (18G 134DV).
CAUTION: Lip of seal must face towards bearing.
11. Use the correct grade of grease to lubricate the stub axle and pack the outer bearing, then fit the hub, outer bearing, plain washer and hub nut. Do not fit the nut retainer or split pin at this stage.

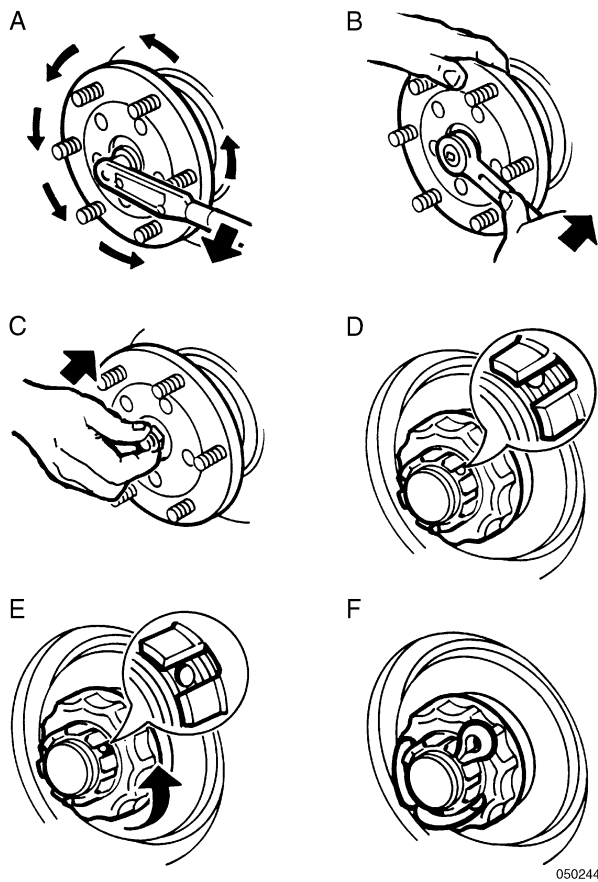


Fig.2 Adjusting front hub end float

12. It is important to adjust the hub bearing end float using the following procedure:
 - a) Use a suitable torque wrench to tighten the hub nut to 7 Nm (5 lbf ft).
NOTE: Spin the hub whilst tightening the nut.
 - b) Slacken the nut without disturbing the hub.
 - c) Tighten the hub nut again, finger tight only.
 - d) Fit the nut retainer so that one arm of the retainer covers the LEFT HAND side of the split pin hole in the stub axle.
 - e) Slacken the nut and nut retainer until the split pin hole is fully exposed, to give the correct bearing end float (see DATA).
 - f) Fit a new split pin, and the dust cap.

13. Fit the brake caliper using new micro-encapsulated fixing bolts, and tighten the bolts to the correct torque.
14. Fit the road wheels, and lower the front of the vehicle to the ground.
15. Tighten the road wheel nuts to the correct torque.
WARNING: Pump the brake pedal to restore the brakes.

STEERING – DESCRIPTION

The steering box has a drop arm attached to its output shaft; the drop arm is attached to the steering arm via an adjustable length drag link.

The steering arm is tapered and keyed fit into the swivel hub on the driver's side of the vehicle, as are the two track rod arms located at the lower end of both swivel hubs.

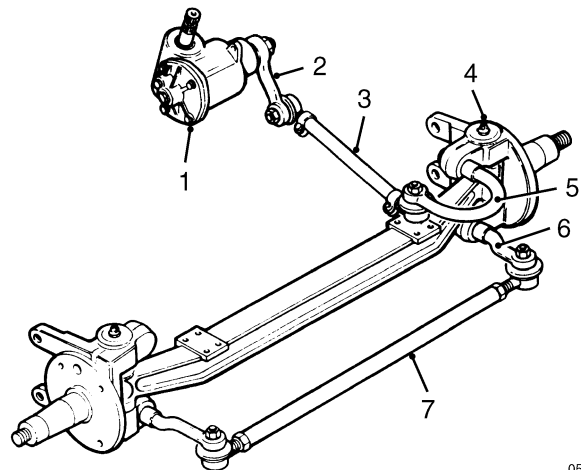


Fig.3 Steering layout

1. Steering box
2. Drop arm
3. Drag link
4. Swivel hub
5. Steering arm
6. Track rod arm
7. Track rod

The track rod arms are linked by a track rod, adjustable for length by the threaded ball joint at each end.

FRONT WHEEL ALIGNMENT 200/300/400

Check

1. The vehicle must be at kerbside unladen condition, with the tyres inflated to the correct pressure. any free movement in the steering linkage must be rectified.
2. Set the wheels in the straight ahead position.
3. Check the alignment by following the instructions laid down by the wheel alignment equipment manufacturer. Compare the figures obtained against those given in DATA. If necessary carry out the adjustment as follows.

Adjust

4. Slacken the track rod ball joint lock nut (or pinch bolt) at each end of the track rod. Rotate the track rod to obtain the correct alignment.
5. In turn hold each track rod ball joint housing at right angles to its ball pin, and tighten its housing retaining nut (or pinch bolt) to the correct torque.

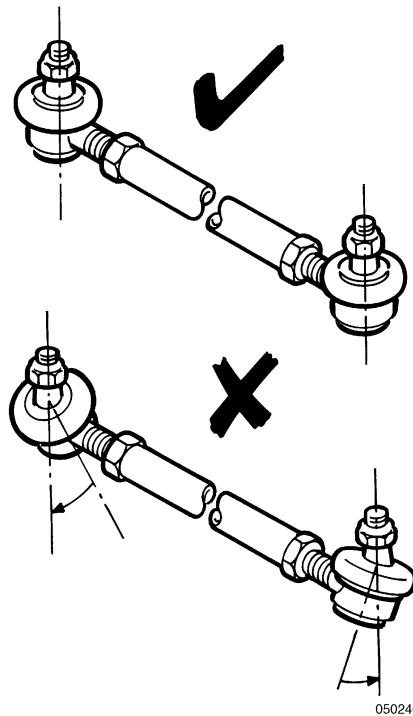


Fig.4 Ball joint alignment

6. When tightened, check that both ball joint housings are in the same plane, i.e. the track rod must be able to articulate.
7. Re-check the wheel alignment.

DRAG LINK BALL JOINTS 200/300/400

Remove/Refit

Remove

Tool required 18G 1063A.

1. Apply the handbrake, raise and support the front of the vehicle.
2. Remove the locknut retaining the ball pin of the ball joint to be changed, and detach the ball joint using 18G 1063A.

If both ball joints are to be changed, detach the other ball joint in the same way and remove the drag link from the vehicle.

3. Note accurately the distance between ball pin centres, then slacken the locking nut and unscrew the ball joint from the drag link counting the number of turns.

Refit

4. Screw the ball joint into the drag link to the position noted during removal, and lightly tighten the locking nut.
NOTE: To ensure the correct steering linkage setting when all components are reconnected, the following procedure must be adopted.
5. Position the front wheels in the straight ahead position. It is important to position the wheels as accurately as possible, preferably using measuring equipment.

6. Establish the straight-ahead position of the steering box by counting the number of turns on the steering wheel from lock to lock; then turn it back by exactly half that number of turns. Check that the scribed line on the top of the steering box shaft points away from the filler plug and directly towards the rear of the vehicle.

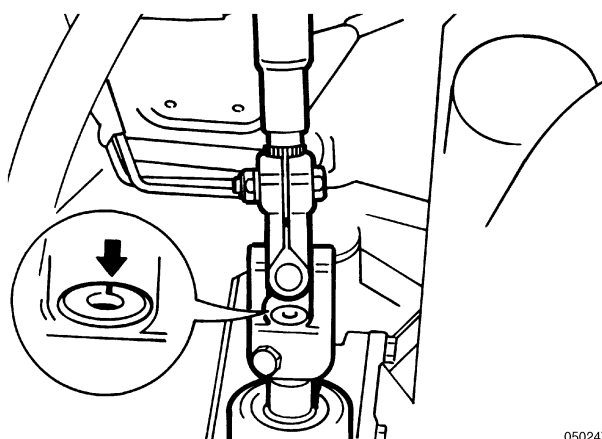
7. Offer up the drag link to the drop arm connection. The ball pin must align with its location in the drop arm without disturbing the position of the steering box or the road wheels.

Adjust the drag link length if it is incorrect, making sure both ball joint threads remain engaged an equal amount, then fit and tighten the ball joint lock nuts, ensuring the joints remain at right angles to the ball pins.

8. Turn the steering wheel to both full lock positions; check that at both points of full lock there is some remaining movement (cush) within the steering box.

CAUTION: This procedure is to ensure that the lock stops on the axles, and NOT the components of the steering box, are being used to prevent further movement when on full lock. If incorrectly set, damage may occur to the internal components of the steering box.

9. Lower the vehicle to the ground and carry out a road test. Check that the steering wheel is in the straight ahead position.



050247

Fig.5 Alignment mark on steering shaft.

STEERING ARM TRACK ROD ARM

Remove/Refit – 200/300/400

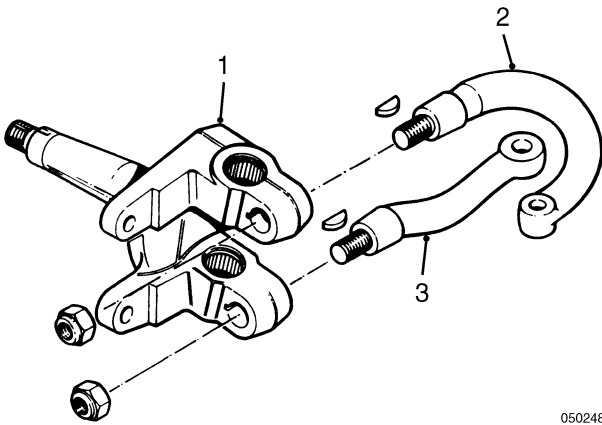
Remove

Tool required: 0485022 (252A).

Both components are removed in the same way, by pressing out.

WARNING: Do not attempt to dismantle any steering components by 'impact' methods.

1. To enable hydraulic puller 0485022 (252A) to be attached securely, the hub must first be removed from the vehicle – see 'Swivel Pin Removal'.



050248

Fig.6 Swivel hub and arms

1. Swivel hub
2. Steering arm
3. Track rod arm

2. To remove the arm, secure the hub in a vice, remove the arm securing lock nut and discard, and press the arm out using tool 0485022 (252A). Note the Woodruff key. **CAUTION:** Make sure the legs of the tool locate on as large an area of the hub face as possible.

Refit

3. Refitting is the reverse of the removal procedure.

Locate the Woodruff key in its keyway, fit the arm with a new lock nut and tighten to the correct torque.

Refit the hub to the vehicle.

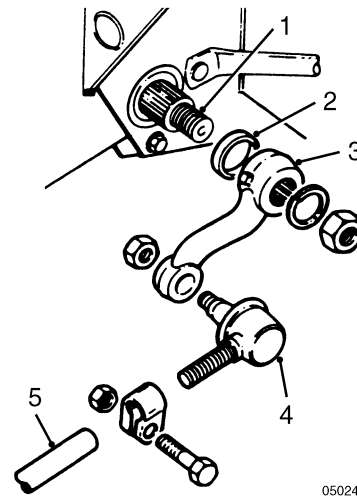
STEERING DROP ARM 200/300/400

Remove/Refit

Remove

Tools required: 0485022 (252A), 18G 1063A.

1. Apply the handbrake and raise and support the front of the vehicle. Remove the front road wheel adjacent to the steering box.



050249

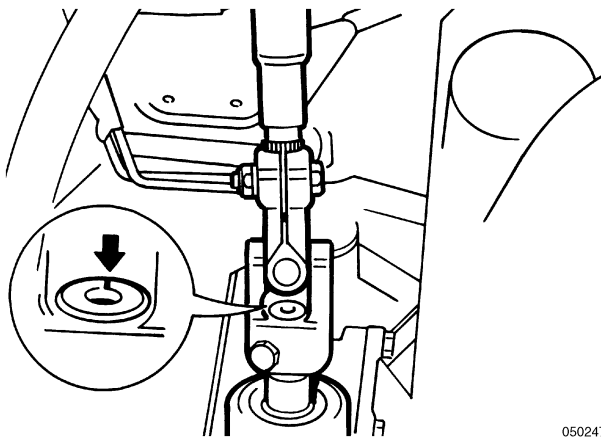
Fig.7 300/400 drop arm

1. Steering box shaft
2. Dust seal
3. Drop arm
4. Ball joint
5. Drag link

2. Remove and discard the lock nut retaining the drag link ball joint pin to the drop arm, and detach the ball joint using tool 18G 1063A.
3. Remove the nut and washer retaining the drop arm to the steering box, then refit the nut to within $\frac{1}{8}$ in of the drop arm. Release the drop arm with tool 0485022 (252A) and remove the nut and drop arm. **NOTE:** On 200 models it is necessary to remove the bumper support bracket to enable a straight pull to be made with tool 0485022 (252A).
4. Check the condition of the foam dust seal on the steering box shaft.

Refit

5. Fit the drop arm on to the steering box shaft (master spline) then fit the securing spring washer and nut. Tighten the nut to the correct torque whilst preventing the steering box shaft from turning.
CAUTION: To ensure the correct steering linkage setting when the drag link is connected, the following procedure must be adopted:
6. Fit the road wheel.
7. Position the front wheels in the straight ahead position. It is important to position the wheels as accurately as possible, preferably using measuring equipment.



050247

Fig.8 Alignment mark on steering shaft

8. Establish the straight-ahead position of the steering box by counting the number of turns on the steering wheel from lock to lock; then turn it back by exactly half that number of turns. Check that the scribed line on the top of the steering box shaft points away from the filler plug and directly towards the rear of the vehicle.
9. Offer up the drag link to the drop arm connection. The ball pin must align with its location in the drop arm without disturbing the position of the steering box or the road wheels.

Adjust the drag link length if it is incorrect, making sure both ball joint threads remain engaged an equal amount, then fit and tighten the ball joint lock nuts, ensuring the joints remain at right angles to the ball pins.

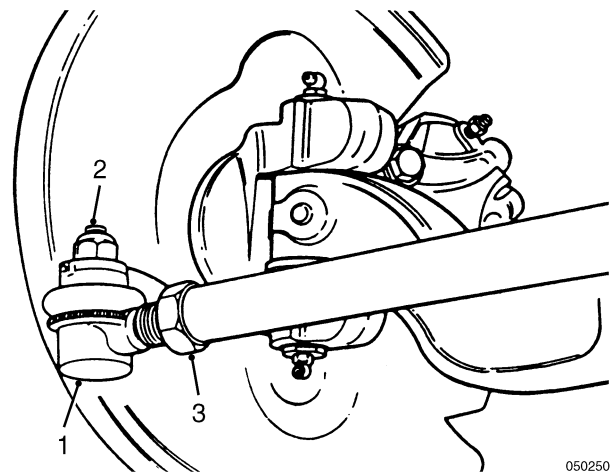
10. Turn the steering wheel to both full lock positions; check that at both points of full lock there is some remaining movement (cush) within the steering box.
CAUTION: This procedure is to ensure that the lock stops on the axles, and NOT the components of the steering box, are being used to prevent further movement when on full lock. If incorrectly set, damage may occur to the internal components of the steering box.
11. Fit the bumper support bracket (200 models), then remove the axle stands, lower the vehicle and tighten the road wheel nuts to the correct torque.
12. Road test the vehicle and reposition the steering wheel to the straight ahead position if necessary.

TRACK ROD BALL JOINTS 200/300/400

Remove and Refit

Remove

Tool required: 18G 1063A.



050250

Fig.9 Track rod end – lock nut type

1. Ball joint
2. Ball pin
3. Lock nut

1. Apply the handbrake and raise and support the front of the vehicle.
2. Slacken the lock nut which secures the ball joint to be removed to the track rod end.
NOTE: On 300/400 vehicles, and on 200 models from VIN 811642, the ball joint is secured to the track rod by a pinch bolt design.

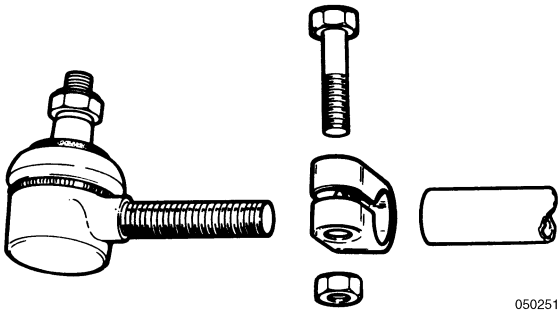


Fig.10 Track rod end – pinch bolt type

3. Remove the ball pin retaining nut, and disconnect the ball joint from the track rod arm using 18G 1063A.
4. Unscrew the ball joint from the track rod, counting the number of turns.

Refit

5. Screw the ball joint into the track rod end by the number of turns counted during removal, and refit the assembly to the track rod arm. Tighten the ball pin nut to the correct torque.
NOTE: If changing both ball joints, ensure they are screwed on an equal number of threads.
6. Lower the vehicle to the ground and adjust the front wheel alignment.

STEERING DAMPER – 300/400

Remove and Refit

Removal of the damper is straight forward, but to fit the unit the following procedure must be adopted:

1. Slacken the clamp bracket on the track rod.
2. Turn the steering to full right hand lock.
3. Note the 'lump' at the end of the smaller tube on the damper. Hold the damper in the horizontal position with the 'lump' downwards, and operate it through its full stroke several times until all free movement is eliminated.

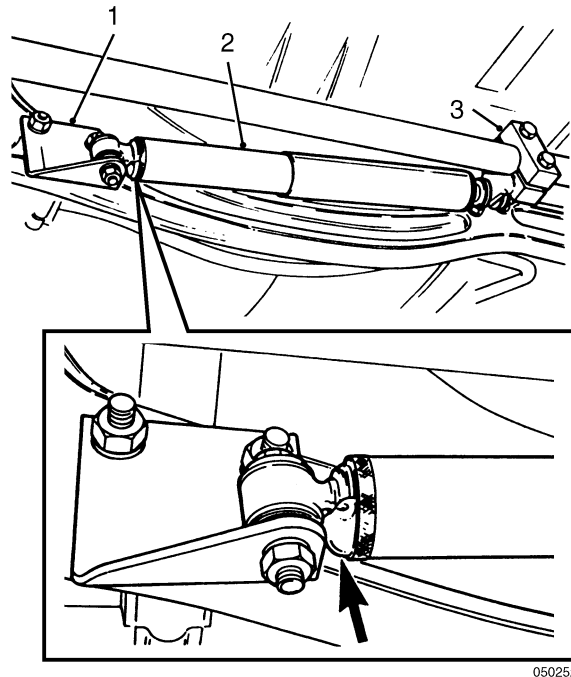


Fig.11 Steering damper

1. Bracket
2. Damper
3. Clamp bracket
4. Maintaining the damper in the horizontal position, fully compress it then attach the mounting at the smaller tube end ('lump' downwards) to the bracket on the axle beam.
5. Hold the damper in the compressed condition and slide the clamp bracket along the track rod until the other mounting can be fitted. Tighten both damper mountings.

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

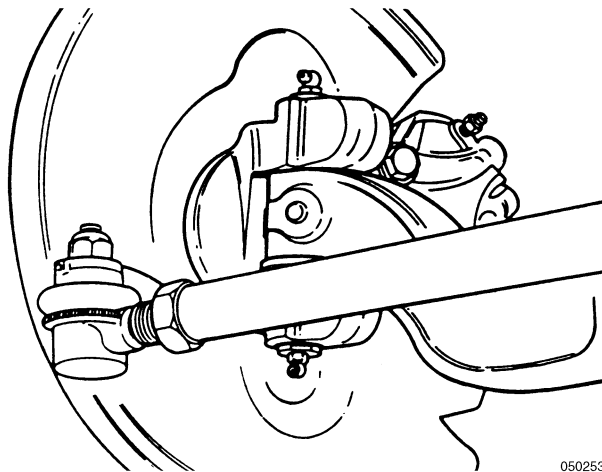


Fig.12 Swivel hub

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.

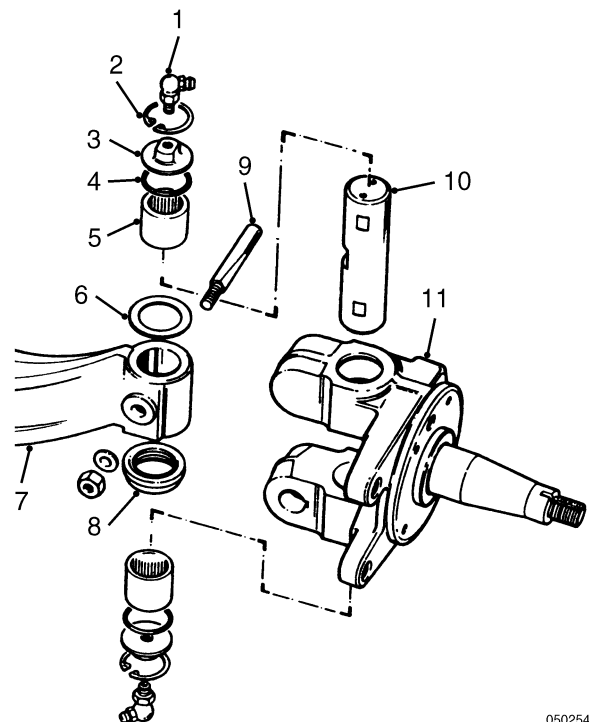


Fig.13 Swivel assembly

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

Reassembly

11. Use press 0484860 (18G 47) and tool 0499905 (18G 1470/2) to press new needle roller bearings into the swivel. The tool will position the bearings correctly in the swivel but the following points must be noted.

NOTE 1: Bearings must be pressed against the strengthened bearing face (flat face) i.e. face with manufacturers name.

NOTE 2: Tool 0499905 (18G 1470/2) must be used to press in (not drift in) the bearings because they are positioned differently in the swivel housing. Use the end of the tool marked 'UPPER 10 mm' to press in the upper bearing, and the end of the tool marked 'LOWER 9 mm' to press in the lower bearing.

Make sure that etched markings on the tool are not erased in use.

12. Locate a new thrust bearing into the lower swivel and position the swivel on the axle.
13. To select the correct end–float shim:
 - a. Fit the swivel pin temporarily.
 - b. Partially load the swivel to simulate the running condition by supporting some of the vehicle weight on the swivel hub. To achieve this, place a jack beneath the swivel hub.
 - c. Select a shim which, when fitted, will give a clearance of 0,05 to 0,20 mm (0.002 to 0.008 in) between the shim and the axle beam.

NOTE: Work to the lower clearance limit within the tolerance band.

A range of 7 shims are available as follows:

mm.	ins
0,91 – 1,10	0.036 – 0.042
1,16 – 1,27	0.046 – 0.050
1,29 – 1,39	0.051 – 0.055
1,42 – 1,52	0.056 – 0.060
1,54 – 1,65	0.061 – 0.065
1,66 – 1,77	0.066 – 0.070
1,80 – 1,90	0.071 – 0.075

14. Release the jack, withdraw the swivel pin, remove the swivel and recover the thrust bearing.
15. Pack the bearings with the recommended Molybdenum grease. Refit the thrust bearing and place the swivel in position on the axle.

16. Coat the new swivel pin with Molybdenum grease, and partially insert it from below. **NOTE:** The swivel pin end face with two holes must face upwards when fitted.
17. Fit the selected end–float shim. To ensure sufficient compression that will enable the shim selected in paragraph 13 to be fitted, partially fit the swivel pin from below then position a suitable tube over the lower end of the swivel pin and use a jack to support the weight of the vehicle while fitting the shim. **NOTE 1:** Make sure the shim is located concentrically before pushing the swivel pin through it. **NOTE 2:** Ensure flat on the pin is aligned with the cotter pin hole.
18. With the shim correctly positioned, remove the jack and push the swivel pin into position.
19. Ensure the swivel pin is correctly located, then tap the cotter pin into position so that the threaded portion of the pin faces towards the front of the vehicle. Fit the cotter pin spring washer and nut, tightening the nut to 15–19 Nm (11–14 lbf ft).
20. Fit new upper and lower 'O' rings, followed by their sealing caps and circlips. Restrain the sealing caps and fit their grease nipples. Pump the correct Molybdenum grease into the lower grease nipple.
21. Fit the disc shield and connect the track rod/drag link ball joint.
22. Fit the hub assembly, and adjust the hub end float as detailed in the section 'Front Hub Bearings'.
23. Fit the brake caliper using new micro–encapsulated bolts, tightened to the correct torque, and fit the road wheels.
24. Remove the axle stands and lower the vehicle. Tighten the road wheel nuts to the correct torque.
25. Pump Molybdenum grease into the upper grease nipple. (With the weight of the vehicle on its road wheels, this will ensure the grease can pass freely on either side of the shim washer).
26. Pump the brake pedal to restore pedal pressure.
27. Check the front wheel alignment and adjust if necessary.

STEERING BOX

Introduction

Early in 1989 the Gemmer steering box was superseded by a Burman unit which has a different overhaul procedure. The Gemmer box is a worm and roller design, whereas the Burman is the recirculating ball type. All 400 vehicles are fitted with the Burman steering box.

To identify the two boxes externally, the Gemmer unit has a square headed filler plug, and the plate to retain the worm shaft is at the bottom of the box. The Burman unit has a hexagon headed filler plug and the worm shaft retaining plate is at the top of the box.

Remove and Refit – 200/300/400

Tools required: 0485022 (252A), 18G 1063A

NOTE: Two types of steering box are fitted (see 'Steering Box Introduction'); they are interchangeable, but the drop arm, washer and nut must also be changed.

Remove

1. Chock the rear wheels, jack up the front of the vehicle and support on axle stands. Remove the front road wheel adjacent to the steering box.
2. Disconnect the drag link from the drop arm using tool 18G 1063A.
3. To remove the drop arm from the steering box, remove the drop arm nut and washer, then refit the nut to within $\frac{1}{8}$ in of the drop arm.

Fit puller 0485022 (252A) and pull off the drop arm. Remove the nut, drop arm, and foam dust seal.
NOTE: On 200 models, to enable the puller to locate correctly, first remove the bumper support bracket.
4. Remove the nut, washer and bolt retaining the column universal joint to the steering box shaft.
5. Inside the cab, drill out or remove with a suitable proprietary tool, the two shear bolts retaining the steering column assembly to the fascia.
6. On 300/400, remove the nut attaching the lower end of the column to the pedal bracket.

7. With the aid of an assistant support the upper steering column and push the universal joint upwards to free it from the steering box shaft.

- 8a. **300/400 V8**
Remove the steering box securing bolts and nuts/bolts.

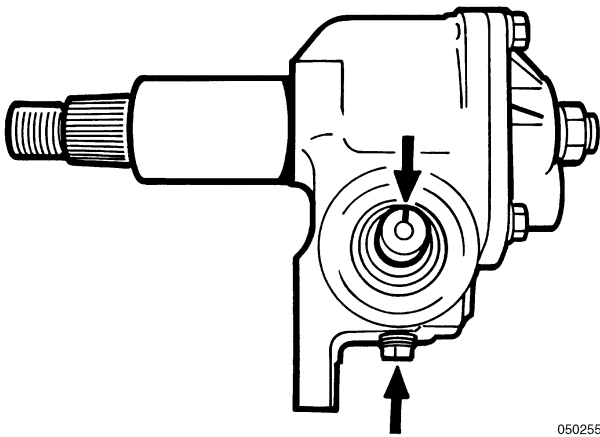
- 8b. **200**
300 (except V8)
400 Petrol (except V8)
Support the engine crossmember before removing the three bolts and nuts/bolts retaining the steering box to the body. On all the above models except 300 diesel it may be necessary to loosen the rear crossmember retaining bolt.

Note the spacer tube fitted in the channel section of the chassis member (not 200 chassis cab).

- 8c. **400 Diesel**
Support the engine, detach the clutch cable from the crossmember and then remove the crossmember.
Remove the right hand engine mounting with its bracket (R.H.D. vehicles), or left hand mounting and bracket (L.H.D. vehicles). Remove the three steering box securing bolts and nuts/bolts.
9. Withdraw the steering box.

Refit

10. Before fitting the steering box it must be turned to its central position as follows:
 - a. Turn the steering box shaft to the full lock position, then turn it back to the opposite lock counting the number of turns from lock to lock.
 - b. Mark the full lock position on the shaft and on the steering box housing.



050255

Fig.14 Alignment mark on steering shaft

- c. Turn the steering shaft exactly half the number of revolutions made in 'a' to establish the central position. The scribed line on the top of the steering shaft should now be opposite the filler plug.

The steering box is now in the straight ahead position, and must not be moved until the steering column, drop arm and drag link have been reconnected.

11. To prevent corrosion, smear PBC grease on the area of the steering box to locate within the chassis frame, then fit the steering box. Secure to the correct torque with bolts and nuts/bolts as appropriate.
NOTE: Fit the spacer tube between the chassis members on the lower bolt, flat face upwards (not 200 chassis cab).
12. If loosened/removed during the removal sequence, fit/tighten the rear crossmember retaining bolt.
NOTE: On 400 Diesel models, fit the engine mounting (with its bracket) and the crossmember. Attach the clutch cable.
13. Engage the steering column lock, and check that the steering box remains in the straight ahead position.

14. Hold the column so that its upper mountings are parallel to the fascia mounting points.

With the aid of an assistant, push the column downwards and engage the lower coupling onto the steering box shaft.

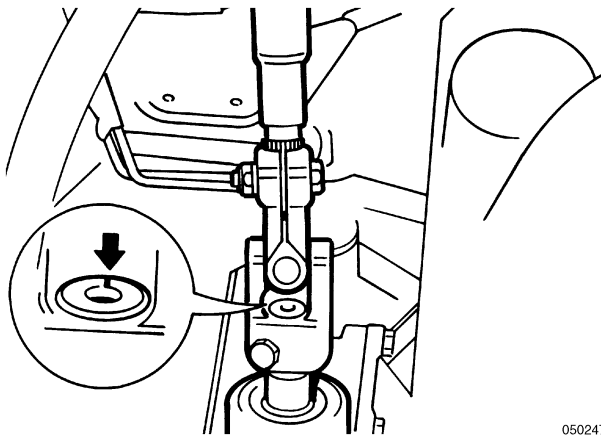
Fit and tighten the lower coupling pinch bolt, plain washer and nut.

15. Loosely fit the nut to attach the column lower mounting (300/400 only), then loosely fit two new shear bolts to the upper mounting.

Check that the steering box remains in the straight ahead position.

Tighten the lower mounting (300/400 only); then tighten and shear the upper mounting bolts.

16. Fit the foam dust seal then fit the drop arm (master spline) and secure with a spring washer and nut. Tighten the nut to the correct torque whilst preventing the steering box shaft from turning.
17. Fit the road wheel.
CAUTION: To ensure the correct steering linkage setting when all components are reconnected, the following procedure **MUST** be adopted.
18. Position the front wheels in the straight ahead position. It is important to position the wheels accurately using measuring equipment.



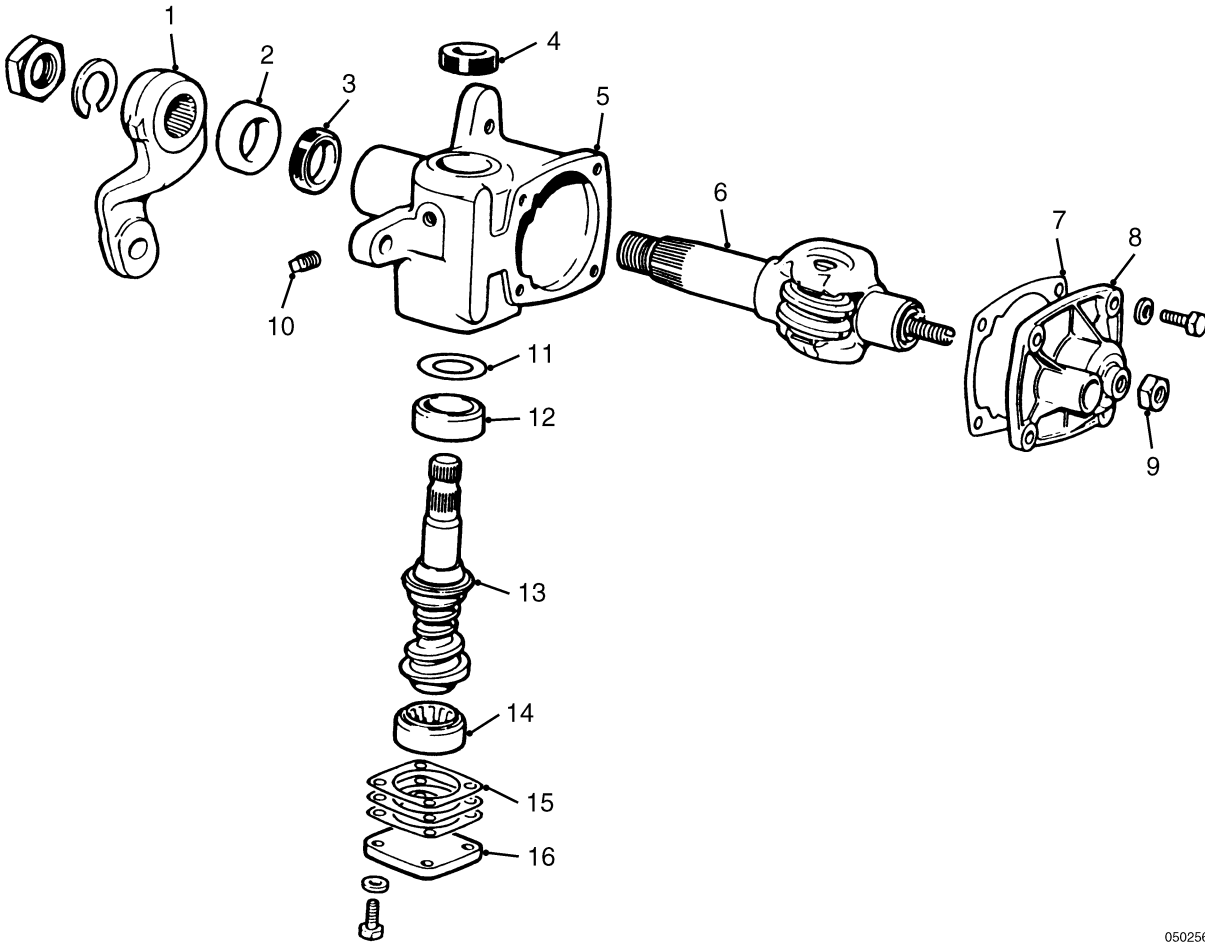
050247

Fig.15 Alignment mark

19. Check that the steering box is still in the straight ahead position, with the scribed line on the top of the steering box shaft pointing directly towards the rear of the vehicle. Offer the drag link to the drop arm connection. The ball joint pin must align with its location in the drop arm without disturbing the position of the steering box or the road wheels.

If the drag link length is incorrect, adjust its length, making sure both ball joint threads are engaged an equal amount. Then fit and tighten the ball pin nut and tighten the ball joint lock nuts to the correct torque.

20. Release the steering lock and turn the steering wheel to both full lock positions; check that at both points of full lock there is some remaining movement (cush) within the steering box.
CAUTION: This is to check that the lock stops on the axles, NOT the components of the steering box, are being used to prevent further movement when on full lock. If incorrectly set, damage may occur to the internal components of the steering box.
21. Fit the bumper support bracket (200 models), then remove the axle stands, lower the vehicle and tighten the road wheel nuts to the correct torque.
22. Road test the vehicle and reposition the steering wheel to the straight ahead position if necessary.



050256

Fig.16 Gemmer steering box

1. Drop arm
2. Dust shield
3. Output shaft oil seal
4. Worm shaft oil seal
5. Housing
6. Output shaft assembly
7. Gasket
8. Side cover
9. Output shaft lock nut
10. Oil filler plug
11. Spacer shim (if fitted)
12. Upper bearing
13. Worm shaft
14. Lower bearing
15. Shims/gasket
16. End cover

STEERING BOX OVERHAUL

Gemmer Box – 200 (pre early 1989)/300

(See 'Steering Box Introduction' for identification of Gemmer and Burman boxes).

Dismantling

1. Remove the filler plug and drain the oil.
2. Unscrew the locknut from the end of the output shaft and remove the four screws retaining the side cover. Turn the adjuster screw clockwise (inwards) to pull the side cover away from the output shaft.
3. Withdraw the output shaft.
4. Remove the 4 screws retaining the end cover and remove cover, shims and gasket.
5. Tap out the worm shaft together with the upper and lower bearings. Remove the oil seal.
6. Drift out the upper bearing outer track, and check to see whether a spacer shim is fitted between it and the housing. If a spacer is fitted it must be retained and refitted on rebuild.
7. Clean all components and examine for wear or damage. Renew any faulty components and both oil seals.

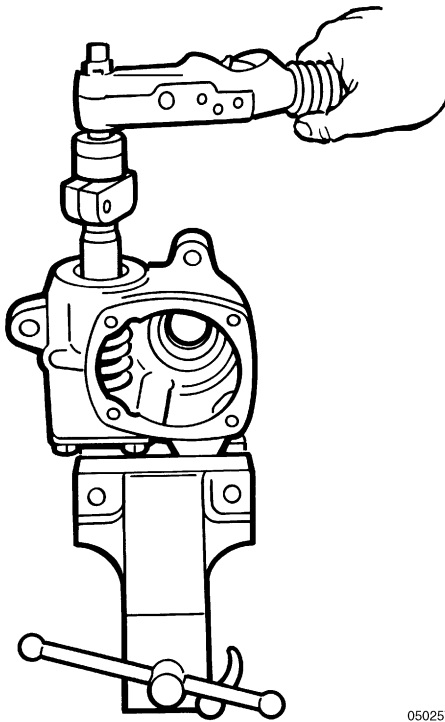
Reassembly

Ensure all bearings and contact surfaces are correctly lubricated before assembly.

8. Drift the upper worm shaft bearing outer track into the housing, ensuring the spacer shim (if fitted) is first positioned in the housing.
9. Reassemble the worm shaft, lubricating the bearings with the recommended oil.
10. Refit the end cover together with the original shim pack, coating the 4 screws with Hylomar. Tighten the screws to the correct torque.

NOTE: Turn the shaft whilst tightening the end cover to 'track' the bearings.

11. Ensure both bearings are adequately lubricated, then carry out a preload test as follows:
 - a. Attach a preload gauge and check the load required to start turning the shaft; it should be 0.87 Nm (8 lbf in). If it is incorrect, adjust the thickness of the end plate shim pack.



050257

Fig.17 Checking worm shaft preload

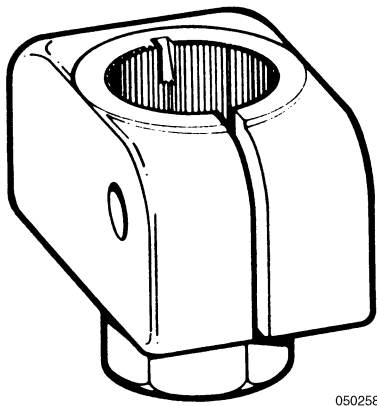
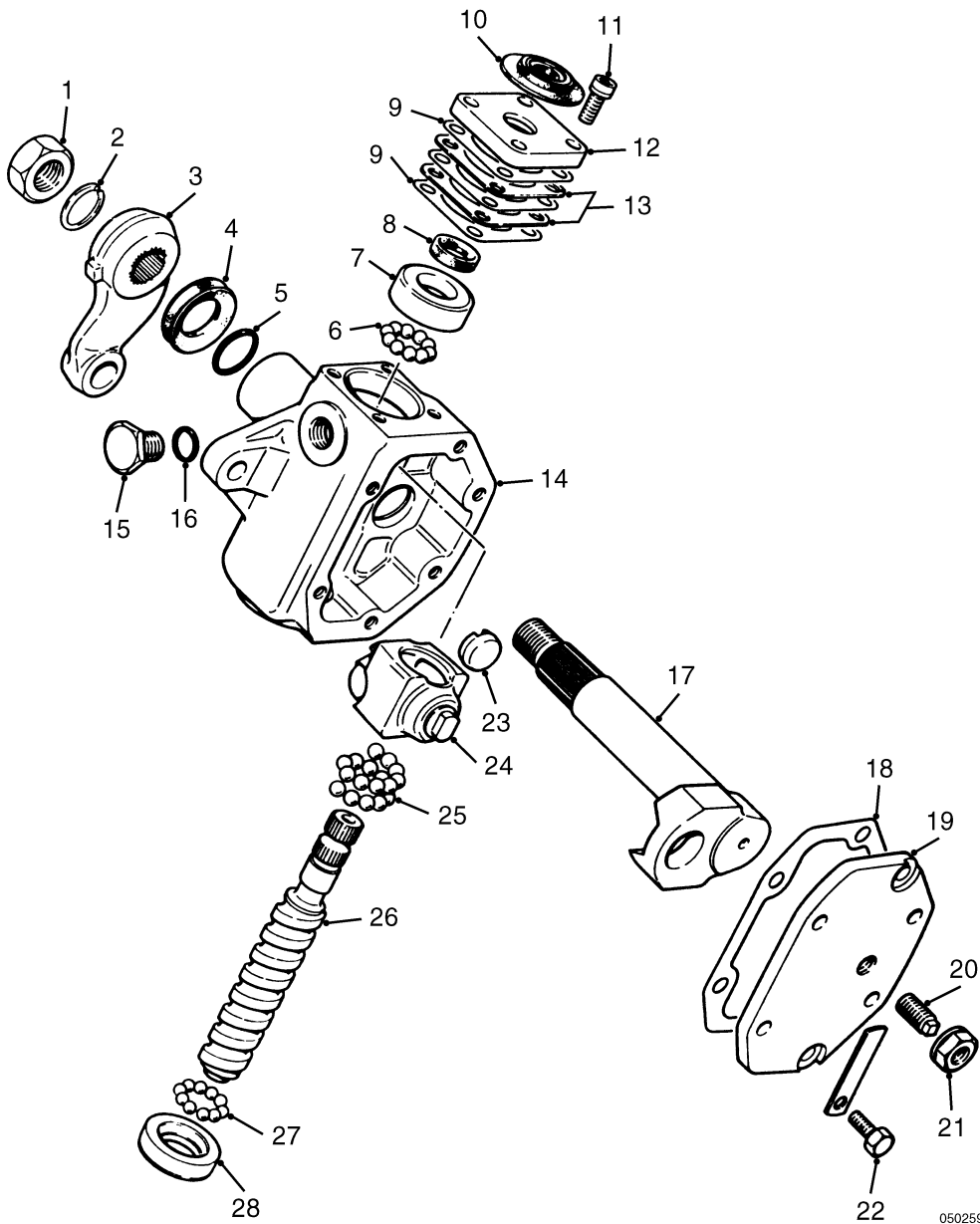


Fig.18 Adaptor Block

- b. It may be found useful to make up an adaptor 'block' as illustrated in fig.18 to fit the preload gauge to the shaft spindle. The 'block' is the splined end of a discarded steering column universal joint with a nut spot welded to it.
12. Fit a new oil seal to the end of the worm shaft housing, lip side inwards. Tap in the new seal until it is flush with the housing, or use tool 18G 1447 if available.
13. Lubricate and refit the output shaft. Using a new gasket fit the output shaft cover, turning the adjuster screw anti-clockwise until the screw bottoms out; then fit the 4 securing screws and tighten them to the correct torque.
14. Temporarily put masking tape around the output shaft splines to protect the seal lip. Then fit the seal, lip side inwards, and tap it in until it is flush with the housing. Remove the masking tape.
15. Carry out the output shaft preload adjustment as follows:
 - a. Turn the adjuster screw clockwise until all backlash is eliminated on the output shaft.
 - b. Turn the worm shaft from lock-to-lock several times to settle all components into their running condition. Centralise the steering box by counting the number of turns lock-to-lock, and then turn back half that number of turns from the full lock position.
 - c. Turn the steering box back half a turn from the central position, attach a preload gauge and measure the load required to start turning the worm shaft forward.
 - d. Adjust the output shaft adjuster screw until the correct preload of 2 Nm (17 lbf in) maximum is obtained in the control (straight ahead) position.
Turn the adjuster screw clockwise to increase the preload and anti-clockwise to decrease.

NOTE: The adjuster screw lock nut must be tightened before each preload check.



050259

Fig.19 Burman Steering box

- | | |
|--------------------------|------------------------------|
| 1. Nut | 15. Filler plug |
| 2. Washer | 16. 'O' ring |
| 3. Drop arm | 17. Rocker shaft |
| 4. Dust seal | 18. Gasket |
| 5. 'O' ring | 19. Side cover |
| 6. Upper race balls (10) | 20. Adjuster |
| 7. Upper bearing track | 21. Lock nut |
| 8. Seal | 22. Bolt |
| 9. Gasket | 23. Thrust button |
| 10. Dust shield | 24. Main nut |
| 11. Allen screw | 25. Recirculating balls (27) |
| 12. End plate | 26. Worm shaft |
| 13. Shims | 27. Lower race balls (10) |
| 14. Housing | 28. Lower bearing track |

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.

13. Liberally apply grease to the upper ball race register on the worm shaft, then without dislodging the balls already fitted, carefully position the shaft into the housing.

Support the shaft upwards whilst positioning the 10 upper race balls in the greased worm shaft register. Secure the balls by fitting their upper track.

14. Position the main nut on the worm shaft so that the thrust button spigot will face outward when fitted, then lower the shaft assembly into the lower race taking care not to dislodge the balls, and at the same time position the upper track in the housing.
Check that the ball sets have remained in position by using a pencil or similar to 'spread' each set in turn. If correct there should be a space of approximately $\frac{1}{2}$ ball width.

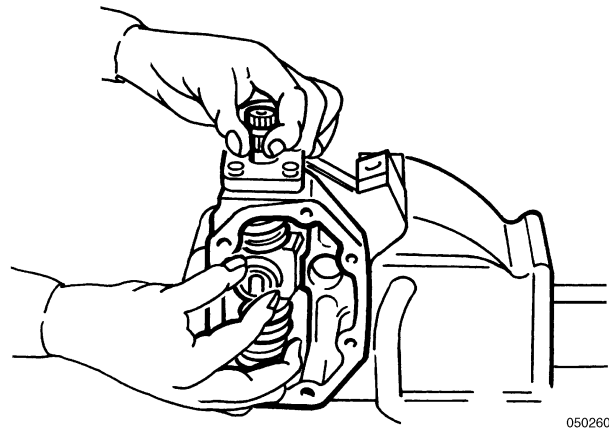
15. Measure the shim pack to give the correct worm shaft preload as follows:

- Fit the end plate without its seal and without gaskets or shims.
- Apply downward pressure to the plate and turn the shaft a few times to 'track' the bearings. Then use a feeler gauge to measure the gap between plate and housing.

Example measurement	0.036 in
Add 0.010 in	+ 0.010 in
	0.046 in

Select shim pack which is 0.002 in less than calculation just made.	- 0.002 in
Shim pack	0.044 in

- Fit the shim pack just selected with two new paper gaskets and tighten the securing Allen screws to the correct torque 22 – 26 Nm (16 – 19 lbf ft).
- Measure the end float of the shaft.
- Progressively reduce the shim pack thickness to eliminate the end float, and until a torque-to-turn the worm shaft is achieved.



050260

Fig.20 Measuring worm shaft torque-to-turn

- To measure the torque-to-turn, hold the main nut in its central position and clear of the sides of the housing.
- When the correct shim pack is fitted, all end float is eliminated and the shaft can just be turned using the fingers only.

Worm shaft torque-to-turn:
0.23 to 0.45 Nm (2 to 4 lbf in).

CAUTION: When reducing the shim pack thickness, do not remove too many shims. An excessive torque-to-turn will damage the balls/seats and the worm.

16. Once the shim pack has been established, remove the end plate again to fit a new end plate seal with its lip facing inwards.
17. Temporarily wrap tape around the shaft splines to protect the seal. Fit the end plate, apply Loctite 270 Studlock to the 4 Allen screw threads then fit and tighten them to the correct torque 22 – 26 Nm (16 – 19 lbf ft). Remove the protective tape.
18. Fit a new 'O' ring in the rocker shaft bore. Lubricate and fit the thrust button onto the main nut and the rocker shaft into its bore, locating the arm of the rocker shaft on to the thrust button.

19. Apply Hylomar to a new side cover gasket and apply Loctite 270 Studlock to the cover securing bolt threads. Fit the cover and tighten the bolts to 22 – 26 Nm (16 – 19 lbf ft).
20. Set the rocker shaft adjustment screw as follows:
 - Establish the central position of the box by counting the number of turns from lock to lock, then turning to half this position.
 - Fit the adjuster screw to the side cover with the lock nut slackened.
22. Fit the steering box to the vehicle. The drop arm retaining nut must be tightened to the correct torque: 155 – 185 Nm (114 – 136 lbf ft).
23. Fill to the level plug aperture with the specified EP 90 oil; fit a new 'O' ring to the filler plug and smear the threads with Hylomar before fitting it. Tighten the filler plug to 70 – 80 Nm (51 – 59 lbf ft).

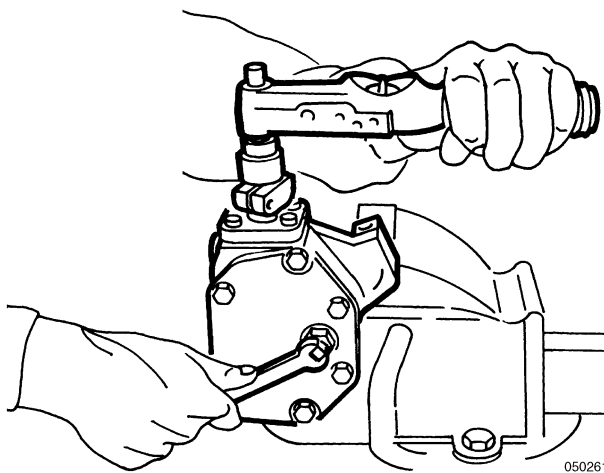
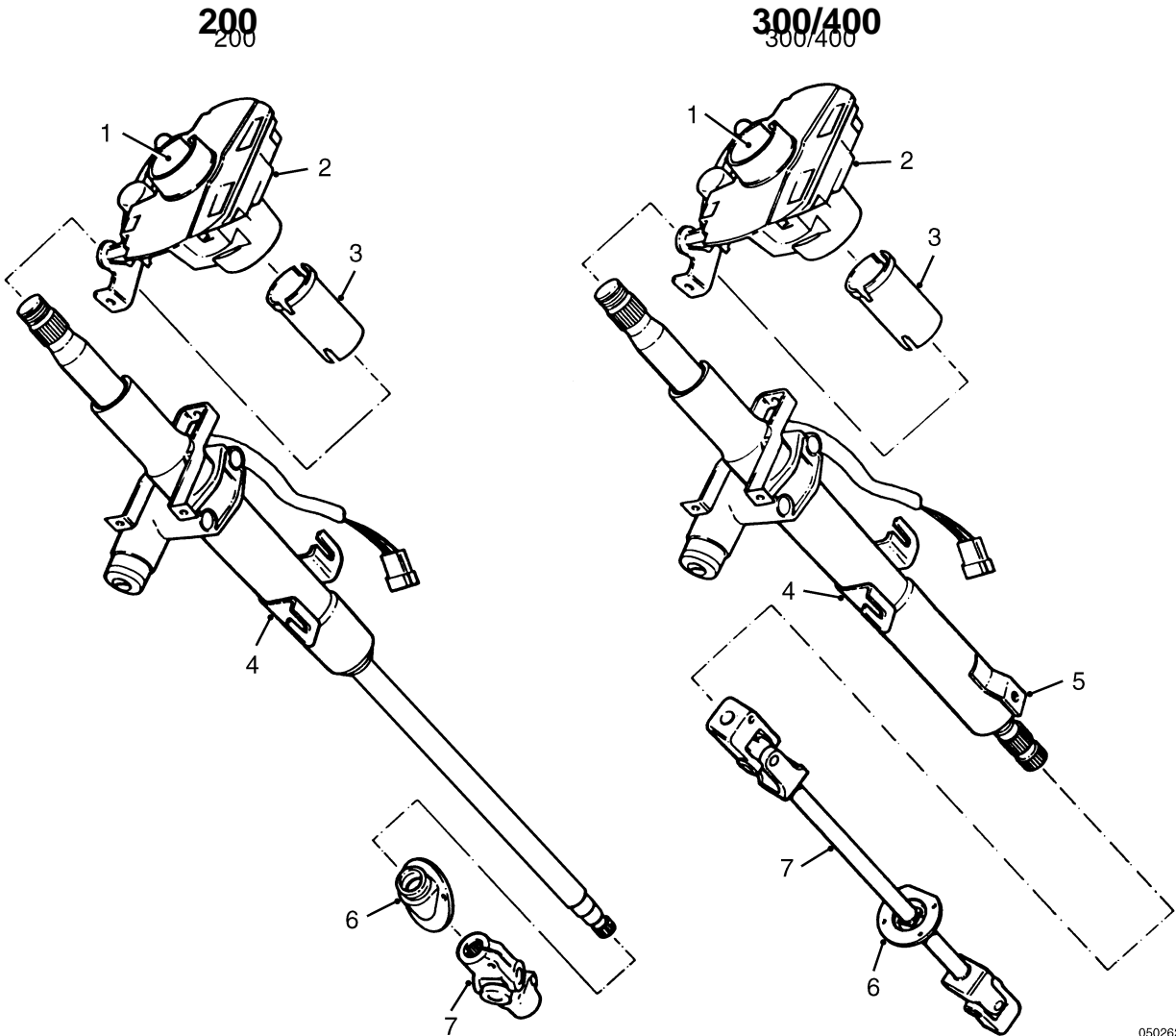


Fig.21 Adjusting rocker shaft

- An adaptor 'block' as shown in fig.18 may be useful to connect the preload gauge to the worm shaft spline. The 'block' is the splined end of a discarded steering column universal joint with a nut spot welded to it.
 - Slowly turn the adjuster to preload the rocker shaft until the torque-to-turn the worm shaft is:
0.90 to 1.36 Nm (8 to 12 lbf in).
 - Tighten the lock nut to the correct torque: 65 – 75 Nm (48 – 55 lbf ft).
 - Check that the box remains in the straight ahead position and recheck the torque-to-turn. Readjust if necessary.
21. Fill with Molygrease the recess in the worm shaft dust shield, before fitting it over the shaft.



050262

Fig.22 Steering column assembly

1. Direction indicator cancelling sleeve
2. Switch mounting plate
3. Column top bush
4. Column upper mounting
5. Column lower mounting
6. Bulkhead sealing gaiter
7. Coupling shaft

STEERING COLUMN & LOCK

Remove/Refit – 200/300/400

Remove

1. Disconnect the battery(s), negative terminal(s) first.
2. Remove the upper pinch bolt from the steering column universal coupling shaft.
3. Remove the steering wheel, and the two halves of the steering column cowl.
4. Unclip the two column switch fibre optics cables, then unclip the two switch assemblies (lighting and wiper controls), and the fibre optic illumination bulb. Release the ignition switch harness multiplug.
5. Remove the two upper column retaining shear bolts, either by centre punch and drilling out, or remove with a suitable proprietary tool.
6. Remove the column lower mounting nut (300/400 only).
7. Lift out the steering column.
8. Remove the two shear bolts to release the column lock.
- 13a. **(200 only)** Fit the two shear bolts attaching the upper column to the fascia rail. Pull the outer column tube upwards as far as it will go before tightening and shearing the bolts.
- 13b. **(300/400)** Loosely fit the nut to attach the column lower mounting, then loosely fit two new shear bolts to the upper mounting. Tighten the lower mounting nut then tighten the lower mounting nut then tighten and shear the upper mounting shear bolts.
14. Connect the ignition switch multiplug.
15. Fit the wiper switch, the lighting switch and the fibre optics illumination bulb. Clip into place the two fibre optics cables.
16. Fit the two halves of the steering column cowl.
17. Turn the direction indicator cancelling sleeve so that the slot is to the top, then fit the steering wheel ensuring that the tongue on the hub locates in the slot in the sleeve. Tighten the steering wheel nut to the correct torque and fit the finisher pad.
18. Check that the direction indicator cancelling mechanism operates correctly.
19. Connect the battery(s), positive terminal(s) first.

Refit

9. Examine the column gaiter in the bulkhead and replace if perished or split.
10. Fit the column lock to the steering column with new shear bolts; check to ensure the lock is correctly seated on the column before finally tightening to shear the bolt heads.
11. Position the road wheels in the straight ahead position, and engage the column lock.
12. Fit the steering column into position, engaging the column in the universal coupling; fit and tighten the coupling pinch bolt.

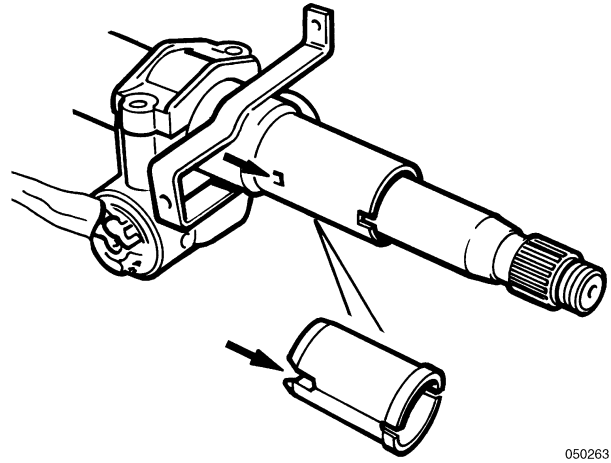
STEERING COLUMN TOP COLUMN BUSH

Remove/Refit – 200/300/400

Remove

1. Disconnect the battery(s), negative terminal(s) first.
2. Remove the steering wheel finisher pad and the steering wheel.
3. Remove the two halves of the steering column cowl.
4. Unclip the two column switch fibre optic cables, then unclip the two column switches (lighting and wiper control). Release the fibre optics illumination bulb.
5. To remove the column switch mounting loosen the mounting plate screw located directly under the column, and pull off the mounting plate.
NOTE: It may be necessary to tap the screw gently to release its taper.
6. Use a suitable tool to carefully withdraw the column bush. Make a note of its fitted position.
 - a – longer tongues downwards
 - b – split in bush aligns with indent in column.

Refit



050263

Fig.23 Column top bush

7. Clean off all foreign matter around the bush location area inside the column.
8. Lubricate sparingly the inside bearing surface of a new column bush, then carefully press it into place, aligning it as described in 6 above.
9. Complete the reassembly by reversing operations 1 to 5.
NOTE: When fitting the steering wheel, ensure the tongue on the steering wheel hub locates in the slot in the direction indicator cancelling sleeve.
10. Check that the direction indicator cancelling mechanism operates correctly.

STEERING COLUMN COUPLING SHAFT

Remove and refit – 200/300/400

Remove

1. Turn the front wheels to the straight ahead position. Check the position of the scribe line on the end face of the steering box shaft; it should be pointing rearwards.

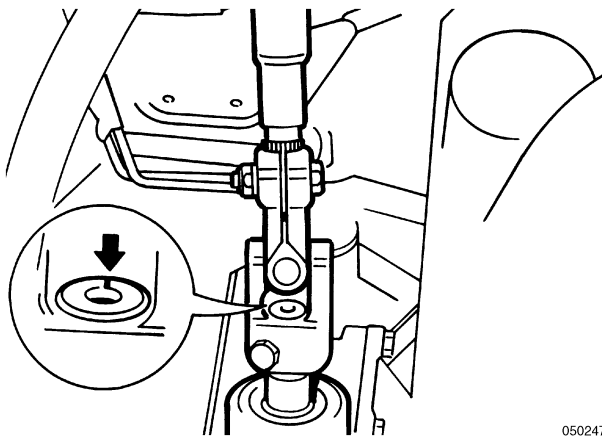


Fig.24 Steering box alignment mark

2. Remove the nuts, washers and bolts retaining the upper and lower universal joints of the coupling shaft to the steering column and steering box shaft respectively.
3. Drill out the two shear bolts which retain the steering column assembly to the fascia.
4. On 300/400 models remove the nut attaching the lower end of the column to the pedal bracket.
5. Check that the steering box is still in the straight ahead position, then pull the steering column upwards just sufficient to allow the coupling shaft to be removed.

Refit

6. Check that the scribe line on the end face of the steering box shaft is pointing directly rearwards, then fit the coupling shaft to it.
7. With the aid of an assistant, hold the steering column so that its upper mountings are parallel to the fascia mounting points, then push the column downwards to engage it into the coupling shaft upper universal joint.
8. Fit and tighten both coupling pinch bolts with their plain washers and nuts. On completion, check that the scribe line on the steering box shaft points directly rearwards.
9. Loosely fit the nut to attach the column lower mounting (300/400 only), then loosely fit two new shear bolts to the upper mounting.
10. Tighten the lower mounting (300/400 only); then tighten and shear the upper mounting bolts.

BRAKES

CONTENTS

	Page
Technical data	58
Service summary	62
Lubricants	62
Special tools	62
Torque wrench settings	63
Brakes introduction/description	64
Preventive maintenance	73
Fault diagnosis	74
Bleeding	80
Front brake pads	82
Caliper	83
Disc (including disc run-out)	86
Master cylinder/servo – remove/refit	87
Master cylinder overhaul	88
Brake pedal	92
Load sensing valve	93
Rear drum brakes – 200	95
– 300/400 (including drum run-out)	98
Handbrake and cables	102



TECHNICAL DATA

Divided hydraulic servo-assisted system with discs at front (ventilated discs on V8), leading and trailing shoe drums at rear on 200 and duo servo at rear on 300/400.

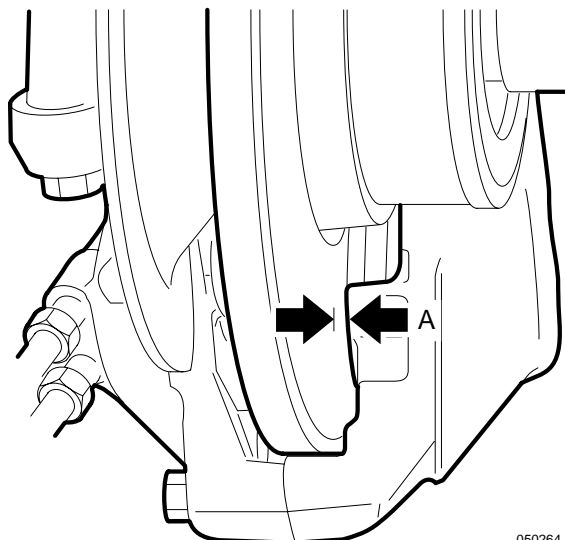
From late 1989 a load sensing valve (brake valve on air suspension vehicles) is fitted to all models. Previously on 200 models it was fitted only to chassis cab vehicles.

A dual front line system has been progressively introduced to the model range. It incorporates two independent circuits to the front calipers and is now fitted to all models except 200, 230, 250 and 255 chassis cab.

Machining tolerances

Standard disc	– maximum run out		0,10 mm (0.004 in)
	– maximum disc thickness variation		0,05 mm (0.002 in) radially
	– disc thickness new		14,17 to 14,42 mm (0.558 to 0.568 in)
	– maximum machining		0,38 mm (0.015 in), off either face.
	– minimum serviceable disc thickness		12,67 mm (0.500 in)
Ventilated disc	– maximum run out		0,10 mm (0.004 in)
	– maximum disc thickness variation		0,05 mm (0.002 in) radially
	– disc thickness new		23,87 to mm (0.94 to 0.946 in)
	– maximum machining		up to 1 mm (0.04 in), off either face.
	– minimum serviceable disc thickness		22,37 mm (0.88 in)
Rear drum	– maximum run out at any position		
	on friction surface	200	0,12 mm (0.005 in)
		300/400	0,15 mm (0.006 in)
	– drum internal diameter	200	228,6 to 228,72 mm (9 to 9.005 in)
		300/400	254 to 254,25 mm (10 to 10.01 in)
	– minimum serviceable diameter	200	227,1 (8.94 in)
	300/400	252,5 mm (9.94 in)	
– maximum machining		up to 1,5 mm (0.060 in) on diameter.	

WARNING: The maximum disc machining tolerances quoted for the standard and ventilated discs are only permissible providing the dimension between the disc and caliper pad abutments (dimension 'A') does NOT exceed 3.8 mm (0.148 in); the brake discs MUST be renewed as a matched pair if this dimension is exceeded.



050264

200 MODELS

Application	SINGLE LINE SYSTEMS			DUAL FRONT LINE SYSTEMS	
	UP TO VIN 860412	FROM VIN 860413	FROM VIN 860413	UP TO VIN 860412	FROM VIN 860413
	All except 280 models	280	200 230 250 255 (chassis cab)	Special Order	280 Combi Minibus Crew Bus
Master cylinder type	AP Phase 2	AP Phase 2	AP Phase 2	AP Phase 2	AP Phase 2
Master cylinder diameter	22,2 mm	22,2 mm	22,2 mm	22,2 mm	22,2 mm
Servo	Type 50	Type 50	Type 50	Type 65	Type 65
Delay valve fitted	Yes	Yes	Yes	Yes	No
Front caliper pistons	2 x 36	4 x 26	2 x 36	4 x 26	4 x 26
Disc size	276 x 14,3 mm	276 x 14,3 mm	276 x 14,3 mm	276 x 14,3 mm	276 x 14,3 mm
Load sensing valve fitted	chassis cab only	chassis cab only	Yes	Yes	Yes
Rear drums	229 x 44 mm	229 x 44 mm	229 x 44 mm	229 x 44 mm	229 x 44 mm
Rear wheel cylinder diameter	20,32 mm	20,32 mm	20,32 mm	20,32 mm	20,32 mm

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.	
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

400 MODELS

	SINGLE LINE SYSTEMS			DUAL FRONT LINE SYSTEMS	
	HEAVY DUTY Chassis cowl. Heavy duty front axle above 1375 kg. Special order over 3500 kg G.V.W.	VENTILATED DISC V8 option. Ambulance specification. Police specification.	STANDARD All 400 except crew cab, V8, or 1500 kg front axle.	STANDARD All 400 up to and including 350. (normal or air suspension)	VENTILATED DISC 1500 kg front axle. PSV. Chassis cowl. Ambulance. Minibus. V8.
Master cylinder type	AP Phase 3	AP Phase 3	AP Phase 3	AP Phase 3	AP Phase 3
Master cylinder diameter	25,4 mm	25,4 mm	22,2 mm	22,2 mm	23,8 mm
Servo	Type 65	Type 65	Type 50	Type 50	Type 65
Delay valve fitted	Yes (not chassis cowl)	Yes	Yes	Yes	Yes (not PSV or chassis cowl)
Front caliper pistons	4 x 46	4 x 46	4 x 26	4 x 26	4 x 46
Disc size	276 x 14,3 mm	276 x 24 mm	276 x 14,3 mm	276 x 14,3 mm	276 x 24 mm
Load sensing valve fitted	Yes	Yes	Yes	Yes	Yes
Rear drums	254 x 70 mm	254 x 70 mm	254 x 57 mm (15 HA axle 254 x 70 mm 16 HA axle)	254 x 70 mm	254 x 70 mm
Rear wheel cylinder diameter	17,46 mm	17,46 mm (20,32 mm for 4050 kg chassis cowl)	15,87 mm	15,87 mm	17,46 mm



SERVICE SUMMARY

See Service Job Sheet for specific Service operations.

See Vehicle Handbook for service intervals.

LUBRICANTS AND FLUIDS

Brake fluid specification FMVSS 116 DOT 4.

Use only the following fluids:

- Multipart DOT 4 (part No.0513910)
- AP Lockheed SUPER DOT 4
- Castrol UNIVERSAL (DOT 4)
- Mobil UNIVERSAL (DOT 4)
- Esso BRAKE FLUID (DOT 4)
- Shell BRAKE FLUID (DOT 4)

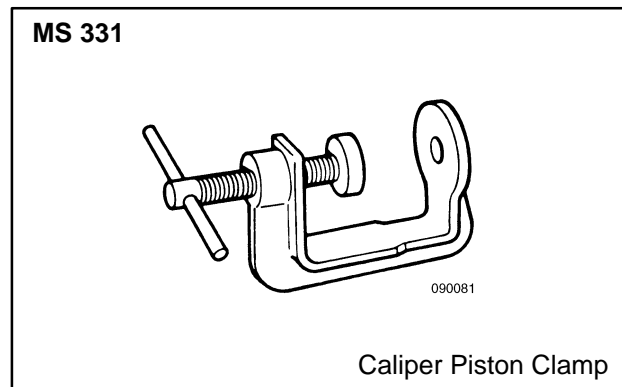
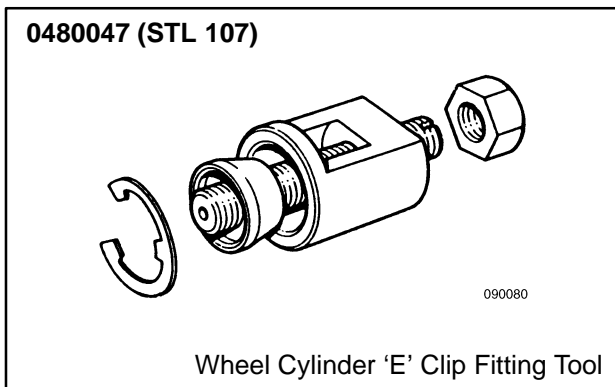
Brake lubricants:

Adjusters, pivot points, shoe contact points etc.
Poly Butyl Cuprysil (PBC) Grease
Lockheed high temp. anti-seize copper grease LPK 104
Rocol J 166

Wheel cylinder rubber boots:
Lockheed Rubberlube LPK 102

Disc brakes:
Caliper seals and pistons
Lockheed LPK 101 lubricant

SPECIAL TOOLS





TORQUE WRENCH SETTINGS

	Nm	lbf ft
Brakes		
Brake caliper mounting bolts	75 – 88	55 – 65
Disc to hub nuts	34 – 46	25 – 34
200		
Back plate bolts	43 – 52	32 – 38
300/400 (Single wheel 15 HA)		
Brake back plate bolts	69 – 80	51 – 59
Brake drum retaining screw	3.5 – 4.5	2.6 – 3.3
300/400 (Twin wheel 16 HA)		
Brake back plate bolt (7/16" UNF 'S')	81 – 94	60 – 69
Brake back plate bolt (7/16" UNF 'X')	68 – 81	50 – 60
Drum retaining screw	3.5 – 4.5	2.6 – 3.3
Brake Pipe Connections		
Internal tube nuts (M10 x 1)	14 – 17	10.3 – 12.5
Internal tube nuts (M12 x 1)	20 – 24	14.7 – 17.7
External tube nuts	17 – 20	12.5 – 14.7
External to internal tube nut	11 – 13.5	8 – 10
Bleed screws (M10 x 1) – 200	8 – 10	6 – 7.5
Bleed screws (M7 x 1) – 200	5.5 – 6	4 – 4.5
Bleed screws (M12 x 1) – 300/400	15 – 19	11 – 14
Hose fitting port – 200	13.5 – 16	10 – 12
Front brake hose banjo bolt – 200	27 – 34	20 – 25
Caliper bleed screws	7.9 – 10.1	5.8 – 7.5
Road Wheels		
Road wheel nuts – 200	68 – 92	50 – 68
Road wheel nuts – 300/400 (single wheel)	176 – 227	130 – 168
Road wheel nuts – 300/400 (twin wheel)	230 – 280	170 – 206

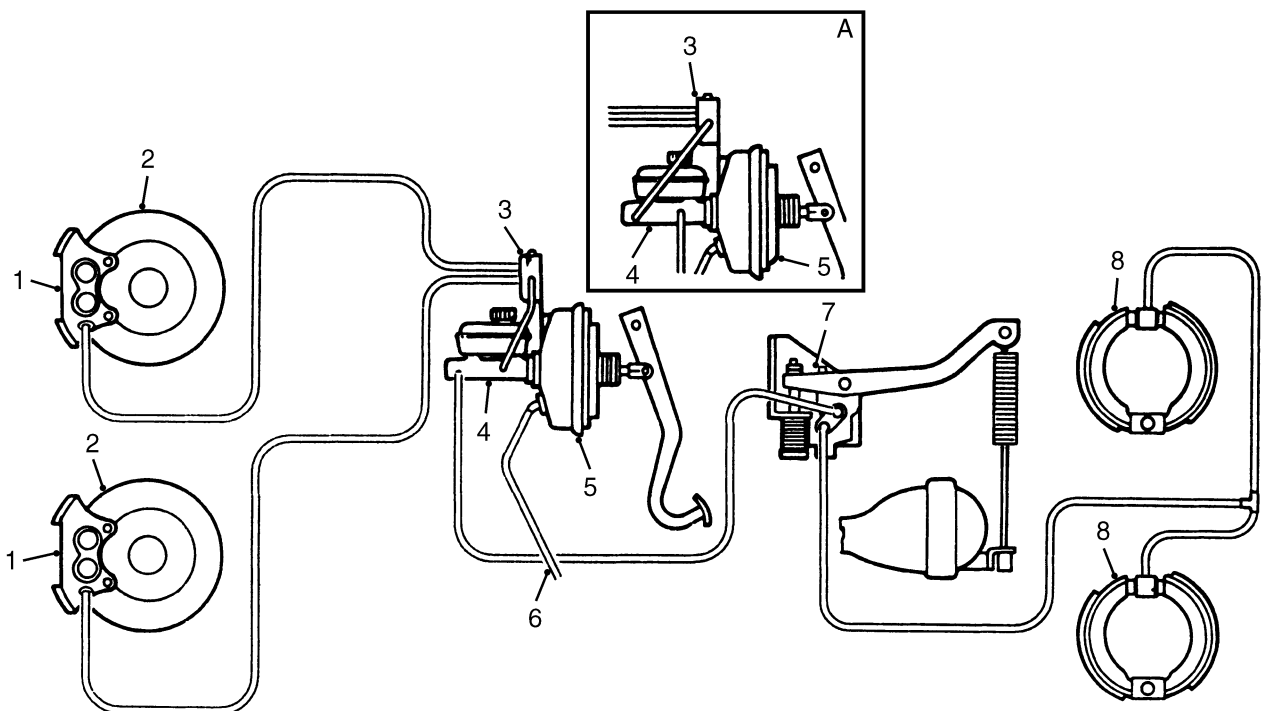
BRAKING SYSTEM

INTRODUCTION

Two types of braking systems are fitted to LDV vehicles:

- Single line system (front/rear split)—Early vehicles.
- Dual front line system (front/front – rear split)—Later vehicles.

Single Line System (Front/Rear Split)



070217

Fig.1 Single line layout

- A. Alternative master cylinder pipe layout
1. Front caliper (two piston or four piston type)
 2. Brake disc
 3. Delay valve
 4. Tandem master cylinder
 5. Direct acting servo
 6. Vacuum pipe from manifold (or from Diesel engine vacuum pump)
 7. Load sensing valve (not fitted on some 200 models).
 8. Rear drum brake

Fluid displaced from the master cylinder when the driver applies the brakes passes through a delay valve to the front calipers, and through a load sensing valve to the rear drums. (Load sensing valve not fitted to pre 1990 MY 200 models except chassis cab).

In this layout the tandem master cylinder ensures separate braking to the front and rear brakes. If one system fails – for example a fluid leak in the rear circuit – the front system will continue to operate, albeit the foot pedal stroke will be longer, and the overall effectiveness of the system will be less due to the loss of the rear brakes. In a similar manner, if a leak occurs in the front circuit, the rear system will continue to operate.

Dual front line system (HI Split)

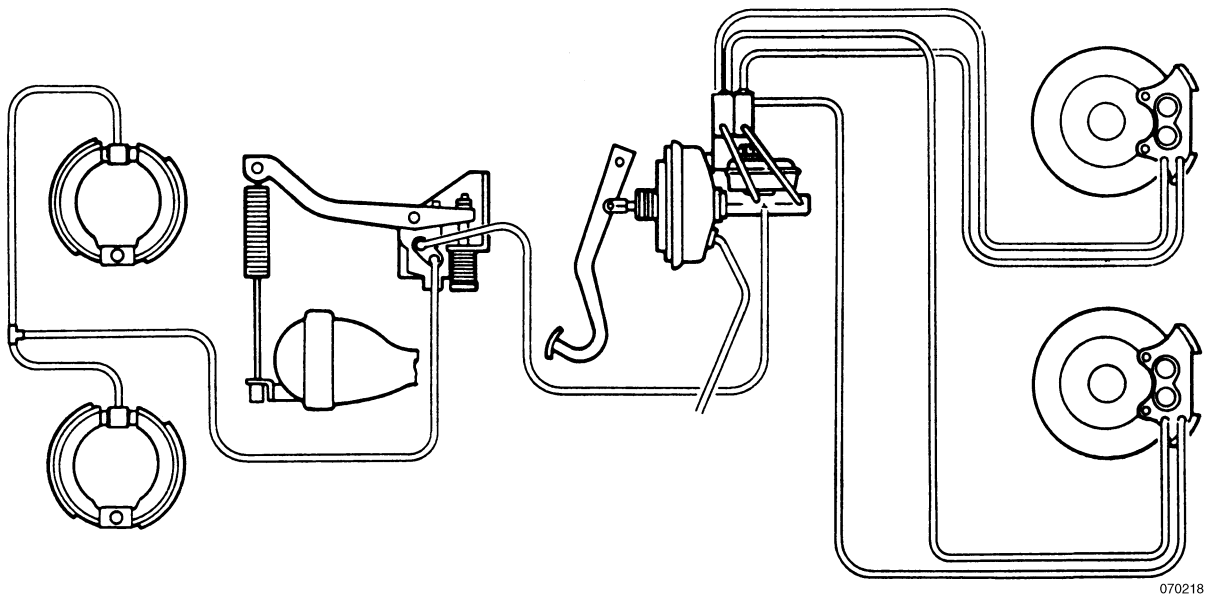


Fig.2 Dual front line layout

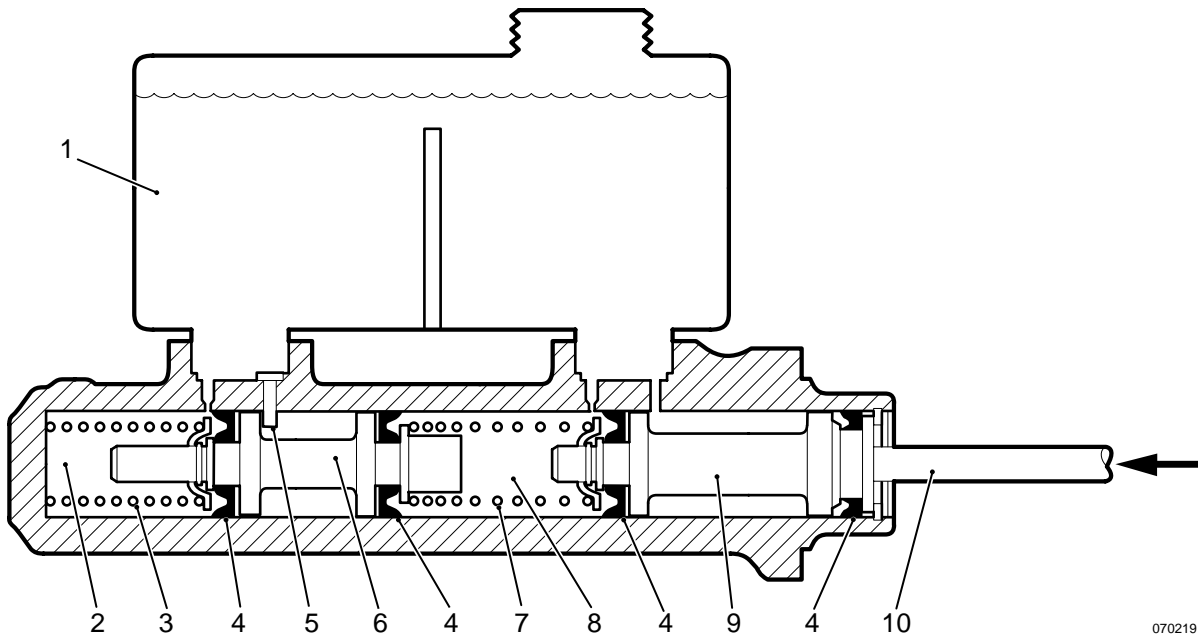
This system is similar in operation to the single line system except that it has two entirely separate circuits to each front brake caliper.

Within each caliper are two pairs of pistons, but in this installation the pairs are split and connected to the separate circuits.

This system enables partial front wheel braking to be maintained when a fluid leak occurs in one of the front circuits.

DESCRIPTION

Master Cylinder



070219

Fig.3 Tandem Master Cylinder

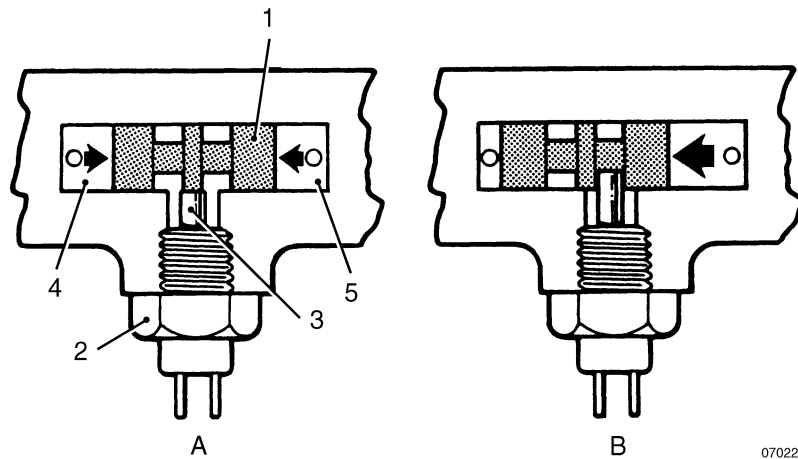
- | | |
|----------------------------|--------------------------|
| 1. Brake fluid reservoir | 6. Secondary piston |
| 2. Secondary chamber | 7. Primary piston spring |
| 3. Secondary piston spring | 8. Primary chamber |
| 4. Seal | 9. Primary piston |
| 5. Stop pin | 10. Servo push rod |

Application of the brake pedal will cause the servo push rod to move the master cylinder primary piston down its bore. Initial movement of the piston will cause the seal to close off the port to the fluid reservoir, and further movement will displace fluid from the primary chamber to either the front brake calipers or to the rear wheel cylinders depending on the system layout.

Continued movement of the pedal and primary piston means that both fluid pressure and primary piston spring pressure will act on the secondary piston and cause it to move down its bore. Initial movement will close the secondary piston port to the fluid reservoir and further movement will displace fluid from the secondary chamber to the front or rear circuit not serviced by the primary chamber.

In this way the fluid displaced to operate the front disc brake calipers and the rear drum brakes are kept separate, and failure of one circuit will not affect the braking efficiency of the other circuit. Note the divider in the fluid reservoir to maintain separate supplies to each circuit.

If failure of one circuit should occur, for example the primary circuit, when the brake pedal is applied there will be no pressure build up in the primary chamber of the master cylinder. The primary piston will therefore move down its bore until it contacts the secondary piston and apply the brake circuit connected to the secondary chamber. The driver will become aware of the failure by increased pedal movement as well as by the reduction in braking performance, and the pressure failure warning light will illuminate.



070220

Fig.4 Pressure failure warning (latching type)

A. System normal

B. System failure

1. Piston
2. Pressure failure switch
3. Switch plunger
4. Brake fluid from secondary chamber
5. Brake fluid from primary chamber

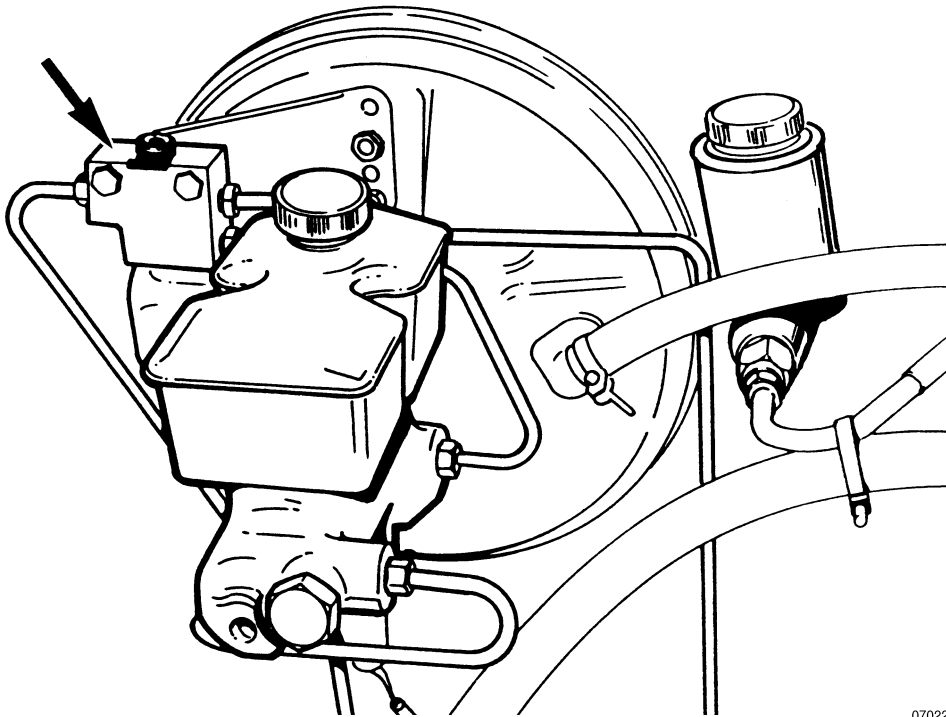
Pressure failure warning

Integrated within the master cylinder is a fluid pressure warning system containing a piston and an electrical switch.

When the braking system is working correctly, equal fluid pressure on either side of the piston ensures it remains in the central position (position 'A'), and the switch is open circuit because the switch plunger is held up by the centre 'land' on the piston. If a failure occurs in one circuit, for example the primary circuit, there will be no pressure on that side of the piston. Normal fluid pressure on the secondary side when the brake pedal is applied will move the piston across; the switch plunger will drop and close the electrical circuit to the pressure failure warning light on the instrument panel, causing it to light and warn the driver.

Delay Valve (when fitted)

The delay valve is fitted in the hydraulic line between the master cylinder and the front brakes, to ensure a correct front-to-rear brake balance during initial application of the pedal; this is because the hydraulic pressure required initially to operate the rear brakes is higher than the front.



070221

Fig.5 Delay valve

When the brakes are applied, fluid passes through the delay valve to the calipers. At a low pre-set pressure the by-pass valve will close; pressure is then withheld from the front circuit while unrestricted pressure is fed direct from the master cylinder to the rear drum brakes.

At a higher pre-set pressure the main valve lifts off its seat, and allows controlled hydraulic pressure to the front brakes.

NOTE: The rubber dust cover on the top of the valve protects the by-pass valve stem. If difficulty is experienced during bleeding of the front calipers, depress the protruding stem of the valve throughout the bleeding operation.

The delay valve is not serviceable, it must be changed as a unit.

Front Brakes

The disc type front brakes are operated hydraulically by fluid pressure from one chamber of the tandem master cylinder, and via the delay valve.

The standard 200 vehicle (except 2,80 tonnes GVW and certain special order vehicles) has two-piston calipers, whereas all other vehicles use larger capacity four-piston calipers. Certain 300/400 vehicles are fitted with ventilated front discs.

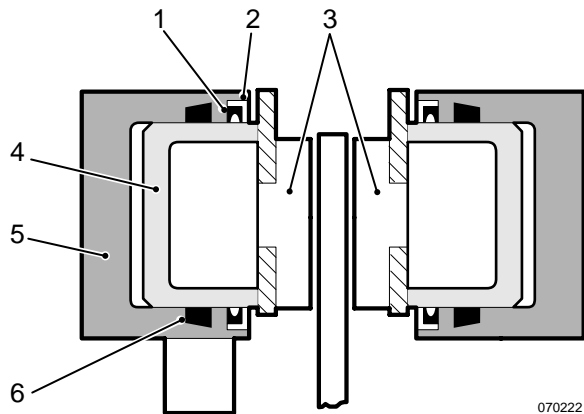


Fig.6 Section through typical caliper

1. Wiper seal
2. Wiper seal retainer
3. Brake pads
4. Piston
5. Caliper
6. Brake fluid seal

When the footbrake is operated, hydraulic pressure is applied equally behind each piston. The pistons are forced inwards, pressing the two brake pads to tighten against the revolving brake disc in a clamping action and stop it from turning.

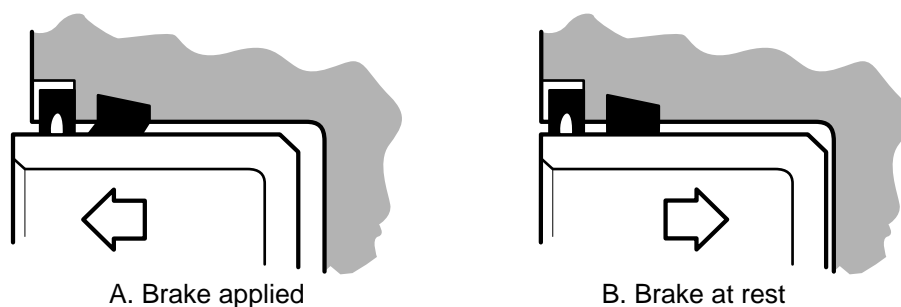


Fig.7 Piston and seals

The fluid seal is square in section, and the seal groove machined in the caliper is tapered. When the brake is applied, piston movement to apply the brake pads causes the fluid seals to distort in the tapered grooves (see illustration 'A').

When the brake pedal is released and the pressure behind the pistons drops to zero, the seals adopt their original shape (see illustration 'B') and retract the pistons clear of the disc.

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.

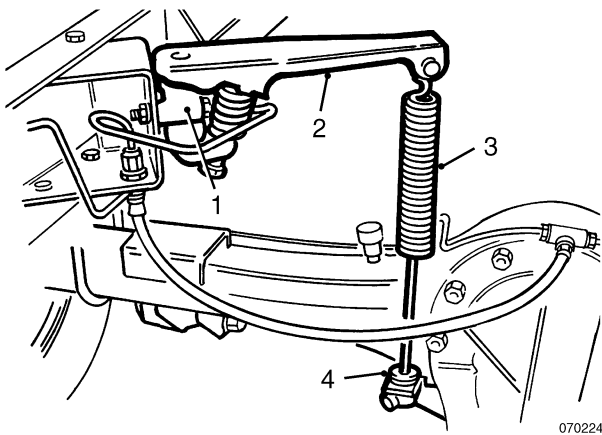


Fig.8. Load Sensing Valve

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

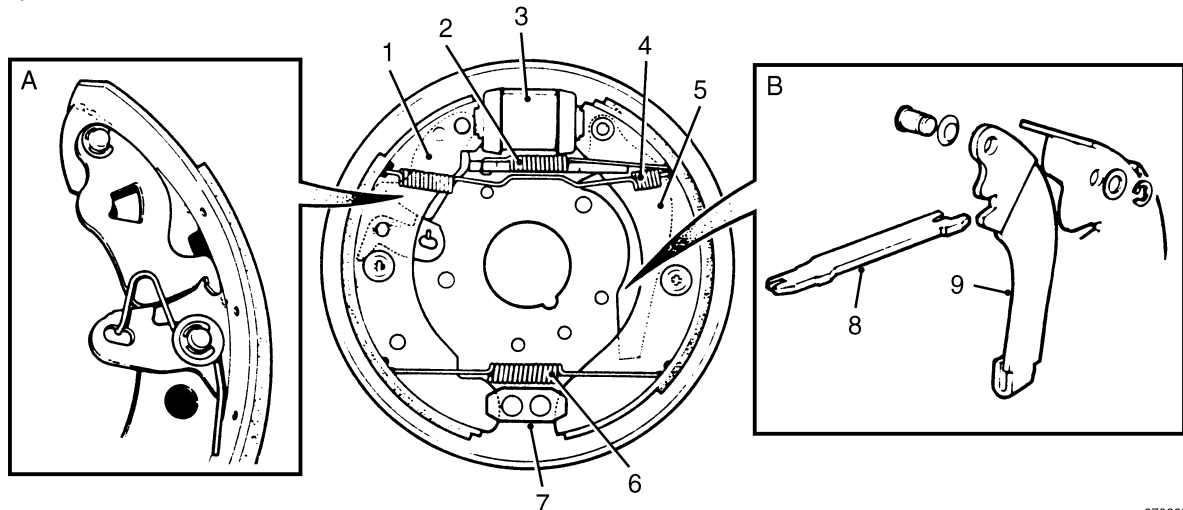
The load sensing valve is preset and is not serviceable; it must be replaced as a complete unit.

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.

Rear Brakes

The drum type rear brakes are operated hydraulically by fluid pressure from one chamber of the tandem master cylinder. Further pressure control is provided by a load sensing valve (where fitted).



070225

Fig.9 Rear brake – 200

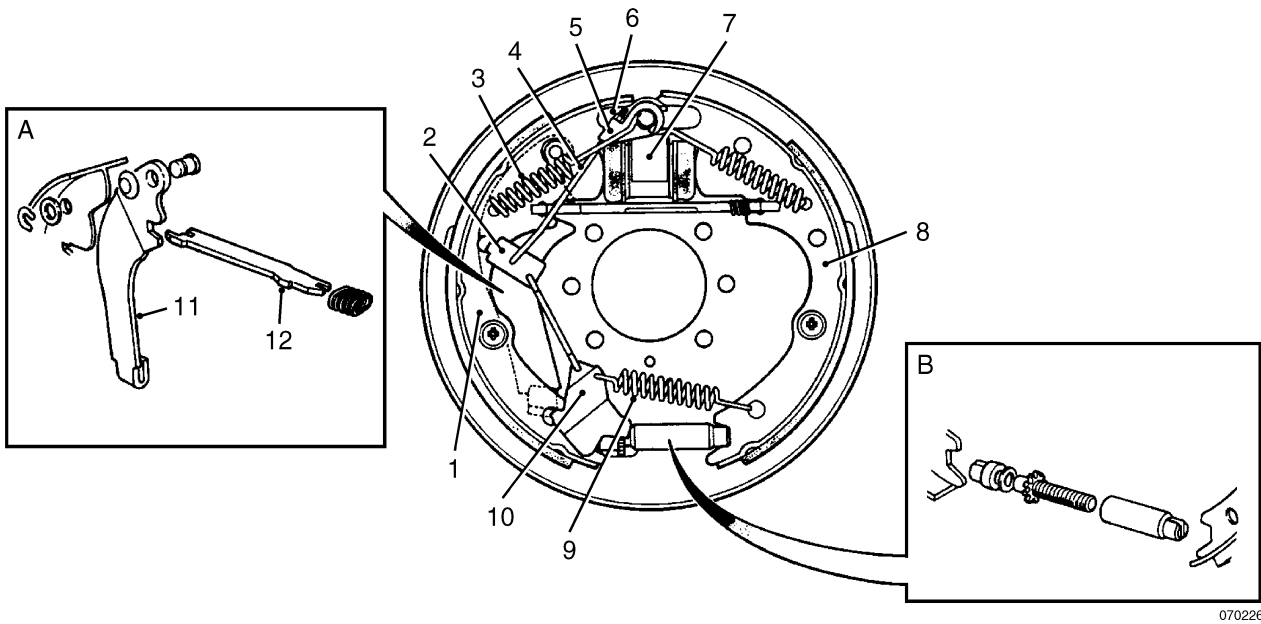
A. Automatic adjusting mechanism on primary (leading) shoe

B. Handbrake mechanism on secondary (trailing) shoe

1. Primary (leading) shoe
2. Cross lever spring
3. Wheel cylinder
4. Pull-off spring
5. Secondary (trailing) shoe
6. Tension spring
7. Fixed abutment
8. Cross lever
9. Handbrake lever

The rear drum brakes of 200 and 300/400 vehicles operate in a different way. On 200 (see fig.9) the shoes pivot on the fixed abutment; when the brakes are applied, pressure to the double acting wheel cylinder pushes the top of both shoes outwards into contact with the drum. The primary shoe continues to be pulled on by the 'wrap-round' (self servo) action of the turning drum; fluid pressure within the wheel cylinder continues to act on its rear piston to push the secondary shoe onto the drum.

When the footbrake is released, and fluid pressure in the wheel cylinder falls to zero, the shoes are pulled away from the drum by the pull-off spring.



070226

Fig.10 Rear brake (RH side) – 300/400

- A. Handbrake mechanism on secondary shoe**
- B. Automatic adjusting mechanism**

1. Secondary shoe
2. Pivot plate
3. Pull-off spring
4. Adjuster rod
5. Adjuster rod bracket
6. Adjuster nut
7. Wheel cylinder
8. Primary shoe
9. Tension spring
10. Adjuster plate
11. Handbrake lever
12. Cross lever

The rear brake design on 300/400 is known as a duo servo type, see fig.10. In it the automatic adjuster assembly is not anchored to the backplate, which allows the shoes to centralise to the drum and provide a degree of self servo.

On all vehicles the automatic rear brake adjustment is made by the footbrake, but the mechanism for making the adjustment is mechanical and differs depending on the model.

BRAKE PREVENTIVE MAINTENANCE

In addition to the scheduled brake fluid change, periodic inspection of the brake components is recommended. As the vehicle ages and as a precaution against the effects of wear and deterioration, it is necessary to make a more searching inspection and renew parts as necessary.

It is recommended that:

- Disc brake pads, drum brake linings, hoses and pipes should be examined at intervals no greater than 12,000 miles (20,000 km).
- Under normal operating conditions, brake fluid **MUST** be changed completely every 24 months or 24,000 miles (40,000 km).
- If the vehicle is frequently subjected to severe driving or operating conditions, it may be necessary to change the brake fluid at shorter intervals.
- All fluid seals in the hydraulic system and all flexible hoses should be renewed every 4 years or 96,000 miles (160,000 km). At the same time the working surfaces of the pistons and bores of the master cylinder, wheel cylinders, and other slave cylinders should be examined and new parts fitted where necessary.
- The direct acting servo should be replaced or overhauled every 5 years or 96,000 miles (160,000 km) whichever is the sooner.

Care must be taken to observe the following points:

- At all times use the recommended brake fluid.
- Never leave fluid in unsealed containers. It absorbs moisture quickly and can be dangerous if used in the braking system in this condition.
- Fluid drained from the system or used for bleeding is best discarded.
- Dispose of used brake fluid correctly. Do not empty into drains, pollute water systems or pour onto the soil.
- The necessity for absolute cleanliness throughout cannot be over-emphasized.



Fig.11 Asbestos warning label

Components containing Asbestos

Safety Instructions

WARNING: Certain components such as some rear brake shoes, clutch linings, clutch plates and brake bands in automatic transmissions, heat shields and certain gaskets fitted to the vehicle may contain asbestos. Inhaling asbestos dust is dangerous to health. The following safety instructions must therefore be observed when working with these components.

- Wear a protective breathing mask.
- Never use an airline or blow dust from components.
- Clean friction components using methylated spirit.
- Replace worn components with recommended replacements.
- Operate if possible out of doors or in a well ventilated place.
- Preferably use hand tools or low speed tools equipped, if necessary, with an appropriate dust extraction facility. If high speed tools are used, they should always be so equipped.
- If possible, dampen before cutting or drilling.
- Dampen dust and place in a properly closed receptacle and dispose of it safely.



BRAKING SYSTEM FAULT DIAGNOSIS

- ***SYMPTOM*** *Fall of fluid level in master cylinder reservoir*

POSSIBLE CAUSE

ACTION NECESSARY

- | | |
|---|---|
| 1. Normal friction pad/brake lining wear. | Top up the fluid reservoir to the correct level, then check daily for the next few days. If the level again falls significantly, carry out the procedure for "hydraulic fluid leak". |
| 2. Hydraulic fluid leak. | Visually check all hydraulic system components and connections for leaks, where necessary peeling back the rubber gaiters. Tighten any loose connections found, but if the leak persists, the suspect component or assembly must be repaired or replaced. |

- ***SYMPTOM*** *Excessive travel of the footbrake pedal or handbrake lever*

POSSIBLE CAUSE

ACTION NECESSARY

- | | |
|--|--|
| 1. Failure to one circuit in a dual line braking system (indicated by pressure failure warning light). | Carry out procedure for "hydraulic fluid leak" to isolate fault. If no leak is apparent, dismantle the master cylinder, if the bore and pistons are in perfect condition, service the assembly using the appropriate repair kit, otherwise replace the complete master cylinder. |
| 2. Excessive pad 'push back' caused by worn or incorrectly adjusted wheel bearings. | Adjust or renew the wheel bearings as specified in this Service Workbook. |
| 3. Handbrake cable out of adjustment or inoperative rear brake auto adjusting mechanism. | Adjust the handbrake cable as detailed in this Service Workbook. If the fault persists remove the brake drums and check that the automatic rear adjusters are functioning correctly. Rectify as necessary. |

- ***SYMPTOM Spongy brake pedal***

POSSIBLE CAUSE

1. Fluid level drop in master cylinder reservoir allowing air to enter hydraulic system.
2. Faulty rubber brake hose.

ACTION NECESSARY

Thoroughly bleed the system, refill reservoir to the correct level and carry out procedure for "hydraulic fluid leak".

Check all hoses for leakage or ballooning under pressure. Replace any defective hoses as necessary.

- ***SYMPTOM Brake drag***

POSSIBLE CAUSE

1. Hydraulic pressure build up in master cylinder.
2. Rubber cups or seals swollen due to brake fluid contamination by petrol, paraffin or mineral oil, etc.
3. Servo push rod held down by incorrect adjustment of brake light switch.

ACTION NECESSARY

Slacken the tube nuts at the master cylinder, if this releases the brakes there may be contaminated brake fluid in the system causing the rubber components to swell, blocking the by-pass ports and trapping the hydraulic pressure. Refer to "action necessary" below.

Contamination may sometimes be confirmed by the characteristic smell in the fluid reservoir. Although the degree of swelling is relative to the severity of contamination, when withdrawn from the cylinder usually the swollen rubber seals may be easily recognised as oversize. All rubber parts such as cups, seals and flexible hoses must be changed. Thoroughly flush the system before fitting the new parts.

Re-adjust brake light switch.



● **SYMPTOM Brake drag (a particular brake drags)**

POSSIBLE CAUSE

ACTION NECESSARY

- | | |
|---|--|
| 1. Disc pads seized or sticking in a caliper recess. | Remove the split pins and retaining springs, withdraw the pads and shims (if fitted), then thoroughly clean the caliper recess with a damp cloth. Do not blow out with an airline as it could be harmful to inhale the dust. Clean all dirt from the pads and lightly smear the back of the steel backing plates with Lockheed Disc Brake Lubricant carefully avoiding the friction material. Refit the pads and springs and retain with the split pins. Pump the pedal to restore the brakes and check that the disc revolves freely. |
| 2. Seized piston/s in disc brake caliper or wheel cylinder. | Remove the disc pads or brake drum as applicable, then carefully depress the footbrake pedal to check movement of the piston/s in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder assembly must be replaced. |
| 3. Obstruction in a flexible brake hose. | Isolate the fault, disconnect brake hose to confirm complaint then renew the defective brake hose. |
| 4. Incorrect adjustment or seizure of the handbrake assembly. | Examine the handbrake cable, clevis pins and yokes etc, also the handbrake mechanism at the backplate, if necessary removing the brake drum to confirm correct operation. Adjust the handbrake as necessary. |
| 5. Weak or broken brake shoe pull-off springs. | Remove the brake drum and carefully examine the assembly. If "possible cause" is confirmed replace defective springs. |

● ***SYMPTOM Unbalanced braking with pull or judder***

POSSIBLE CAUSE	ACTION NECESSARY
1. Loose caliper mounting bolts, loose backplate, steering and suspension components, tyre pressures.	Check the security of the brake assemblies and for wear on the steering and suspension parts, also ensure that the tyres are of correct type, in good condition and at the recommended pressures.
2. Disc pads or shoe linings contaminated with oil, grease or hydraulic fluid.	Examine the pads or shoes to confirm complaint, then establish the cause of contamination and rectify by replacing any defective parts. A minor degree of friction material contamination may be removed with fine emery cloth, but at the same time moisten with a damp cloth, it could be harmful to inhale the dust. Otherwise if contamination is severe the disc pads or brake shoes must be replaced in sets irrespective of their state of wear.
3. Different grades of friction pad/lining material used as an axle set.	Remove the disc pads or brake shoes and check that the friction material is not of different grades. Otherwise replace the pads or shoes in complete axle sets.
4. Seized piston/s in disc caliper or wheel cylinder.	Remove the disc pads or brake drum as applicable, then carefully depress the footbrake pedal to check movement of the piston/s in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder assembly must be replaced.
5. If associated with judder, surface condition and run out of disc, or excessive run out or distortion of brake drums.	Ensure that the wheel bearings are not worn or out of adjustment. Replace or adjust as necessary. Minor disc friction surface imperfections may be removed with a fine emery cloth, if in doubt, check the disc run out which ideally must not be more than 0,10 mm (0.004 in). If disc run-out is excessive, machine or renew as necessary. Check and compare the thickness of the disc at various points around the friction surface, if a thick/thin condition is confirmed machine or renew the disc. Rear brake drum judder may be detected by gently applying the handbrake at low speed; check drum run-out which should not be more than 0,12 mm (0.005 in) 200 models, or 0,15 mm (0.006 in) 300/400 models.



● **SYMPTOM Brakes inefficient giving increased brake pedal effort**

POSSIBLE CAUSE

ACTION NECESSARY

- | | |
|--|---|
| 1. Servo unit inoperative. | With the engine "off" depress the brake pedal several times to exhaust all vacuum from the servo unit, during this operation the air control valve should hiss every time the pedal is pressed. With all vacuum gone apply light pressure to the brake pedal and restart the engine. If the servo is working the pedal will appreciably sink down as the servo operates. With the brakes held on there should be no hiss from the air inlet. These tests are not exhaustive, and therefore if the servo unit gives cause for doubt as to its performance it is advisable to replace the unit. |
| 2. Lack of vacuum. | Check vacuum (suction) is available in rubber hose leading to servo when engine is running. Hose leads to inlet manifold—petrol, vacuum pump—diesel engined vehicles. |
| 3. Glazed or worn out friction pads or brake shoes. | Glazed surfaces on pads or shoes can be carefully removed by rubbing down with emery cloth, but at the same time moisten with a damp cloth; it could be harmful to inhale the dust. Otherwise if worn down to the stated limits replace the pads or shoes. |
| 4. Damaged or rusty friction surface of brake disc. | Examine the brake discs for cracks, scoring, or a rust deposit which after being subjected to heat by the pads give the friction surfaces a black appearance. Minor surface imperfections may be removed with fine emery cloth but such faults, if severe, render the disc inefficient. Therefore if in any doubt, renew the part. |
| 5. Disc pads or shoe linings contaminated with oil, grease or hydraulic fluid. | Examine the pads or shoes to confirm complaint then establish the cause of contamination and rectify by replacing any defective parts. A minor degree of friction material contamination may be removed with fine emery cloth; it could be harmful to inhale the dust. Otherwise if contamination is severe the disc pads or brake shoes must be replaced in sets irrespective of their state of wear. |
| 6. Seized piston/s in disc brake caliper or wheel cylinder. | Remove the disc pad or brake drum as applicable, then carefully depress the footbrake pedal to check movement of the piston/s in the suspect assembly. If a piston is seized, the complete caliper or wheel cylinder assembly must be replaced. |

- ***SYMPTOM Disc brake squeal***

POSSIBLE CAUSE

1. High frequency pad vibration.
2. Loose caliper mounting bolts.

ACTION NECESSARY

Withdraw the friction pads, also if fitted, the shims. Lightly smear the shims, the metal backplate and metal edges of the pad with Lockheed Disc Brake Lubricant. Do not allow the lubricant to contaminate the friction material. Refit the pads and secure with the springs and retaining pins.

Confirm this possible cause then rectify by tightening mounting bolts to the torque recommended figure.

- ***SYMPTOM Drum brake squeal***

POSSIBLE CAUSE

1. Lack of lubrication and/or excessive lining dust in brake assembly.

ACTION NECESSARY

Remove the brake drum, then the shoes and other parts and clean assembly. Do not blow out with an airline; it could be harmful to inhale the dust. Remove with a vacuum cleaner or wipe clean with a damp cloth. Lightly smear with Lockheed Expander, lubricate the tips of the shoes, the cylinder and abutment slots; also the area of the backplate where the brake shoe platforms make contact. Ensure that the friction surface of the drum is clean, and do not allow the grease to contact the shoe linings, rubber parts or the friction surface of the drum.



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

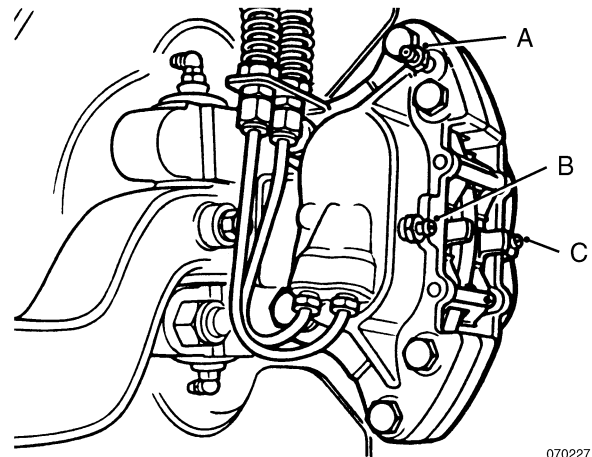
The following procedures cover bleeding the complete primary and secondary systems. If only one system has been disturbed, bleeding need only be done on that system providing air has not entered the other system.

Single Line System (Front/Rear Split)

1. Check that all pipe and hose connections are tight and all bleed screws are closed. Top up the master cylinder reservoir with the recommended brake fluid.
2. Disconnect the wiring connection to the pressure failure switch, then remove the switch.
3. Attach a bleed tube to the bleed screw on the rear brake furthest from the master cylinder. Open the bleed screw half a turn.
4. With the aid of an assistant press the brake pedal slowly through its full stroke and allow it to return unassisted. Continue this sequence until a flow of clean brake fluid is obtained, and then tighten the bleed screw at the end of a downward stroke.
CAUTION: Ensure sufficient fluid is maintained in the master cylinder at all times.
5. Repeat operations 3 and 4 for the bleed screw on the other rear brake.
6. Repeat operations 3 and 4 on the bleed screw on each front brake caliper in turn, starting with the caliper furthest from the master cylinder.
NOTE: If difficulty is experienced in bleeding the front brakes satisfactorily, remove the rubber dust over from the delay valve and depress the plunger beneath it for the duration of the front brake bleeding procedure.
7. Top up the reservoir fluid level.
8. Refit the pressure failure switch and reconnect the wiring.
9. Switch on the ignition and start the engine so that the servo becomes operational. Apply pressure to the brake pedal several times and check that the brake failure warning light does not illuminate when the handbrake is released.
10. Carefully check the hydraulic system for leaks.
11. Drive the vehicle and test the brakes; pedal travel should be short and feel solid with no indication of 'sponginess'. The vehicle should pull up squarely.

Dual Front Line System (HI Split)

1. Remove the pressure failure switch and bleed the rear brakes as instructed in "Single Line System (Front/Rear Split)", operations 1 to 5.



070227

Fig.12 Bleeding front brakes – Dual front line system.

2. At the front brakes two bleed tubes are required. Start at the caliper furthest away from the master cylinder and attach the tubes to the two lower screws 'B' and 'C'. Slacken both these screws at the same time to bleed, and tighten both at the end of a downward stroke when air-free fluid is obtained.
3. Bleed the upper screw 'A' on the same caliper.
4. Repeat operations 2 and 3 on the opposite caliper.
NOTE: To assist bleeding, remove the cover on the delay valve appropriate to the front circuit being bled, and hold the plunger depressed during the bleeding operations.
5. Top up the reservoir fluid level.
6. Refit the pressure failure switch and reconnect the wiring to it.
7. Switch on the ignition and start the engine to make the servo operational. Apply pressure to the brake pedal several times and check that the brake failure warning light does not illuminate when the handbrake is released.
8. Carefully check the hydraulic system for leaks.
9. Road test the vehicle.

FRONT BRAKE PADS – 200/300/400

Removal and Refit

NOTE: There are differences between 2 and 4 piston front brake assemblies fitted to LDV vehicles, but pad changing procedures are similar.

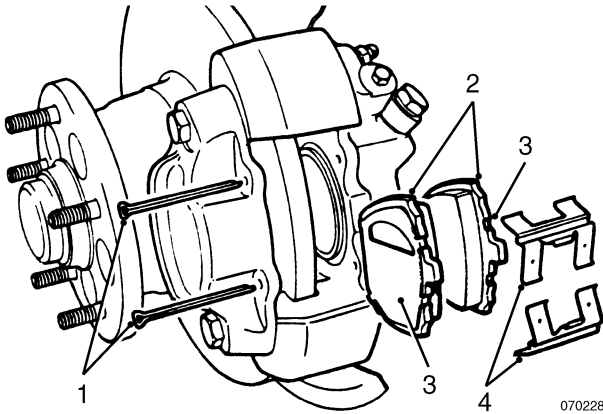


Fig.13 200 front brake caliper

1. Split retaining pin
2. Brake pads
3. Shims
4. Anti-rattle springs

Remove

1. Apply the handbrake and chock the rear wheels. Raise and support the front of the vehicle and remove the road wheels.
2. Working on one caliper at a time, remove the pad retaining pins and anti-rattle springs, then extract the brake pads. Pad shims are fitted on 2-piston units.
3. Examine the piston locations for signs of fluid leakage past the seals.
4. Clean the dust from the calipers using methylated spirit – do NOT blow off. Rotate the disc by hand and remove any scale and rust from the edges, also scrape the pad locating surfaces free of rust.
5. Examine the disc for wear. If the wear pattern is uneven, this may be due to excessive disc run-out or hub end-float.

Refit

6. To fit new pads, the pistons must first be pushed back in their bores. Do this by attaching a bleed pipe and container to the appropriate bleed screw. Slacken the screw slightly and push back the piston(s). Repeat with the opposing pistons(s).
NOTE: Make sure the piston(s) opposite the piston(s) being pushed back is not displaced during this operation.
7. Fit the new pads (and pad shims on 2 – piston units). Secure with the anti-rattle springs and new split pins.
CAUTION: The anti-rattle springs fitted to standard disc calipers have different length legs. When refitting the anti-rattle springs, it is essential that the longer length legs of each spring face each other.
8. Repeat operations 2 to 7 on the opposite front caliper.
NOTE: Pads must always be changed in sets of four.
9. Check the fluid level in the master cylinder then apply the foot brake several times to position the pads, topping up the master cylinder as necessary.
10. Refit the road wheels and lower the front of the vehicle. Tighten the road wheel nuts to the correct torque.
11. Road test the vehicle.

WARNING: The driver/operator must be advised that during the first 200 miles (320 km) the brake pads will ‘bed-in’. During this period, the brake pads should be not be subjected to harsh or excessive use.

FRONT BRAKE CALIPER 200/300/400

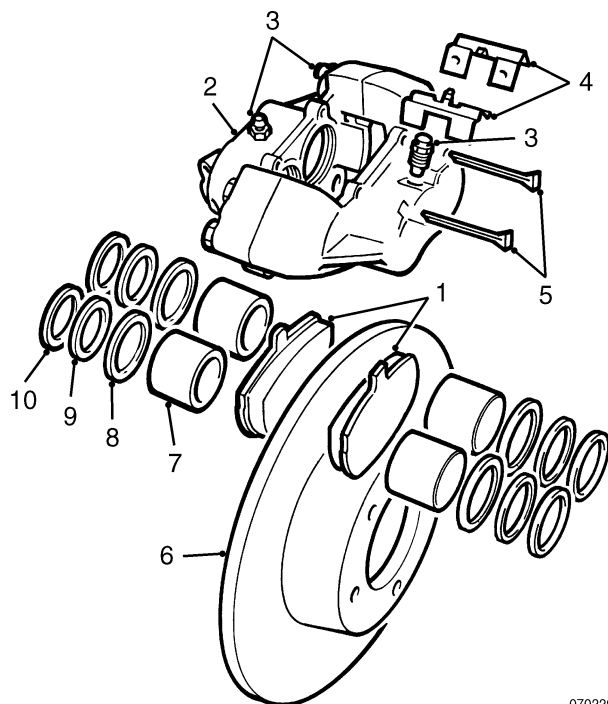
Remove, overhaul, refit

Tool required: MS 331

Two basic types of caliper are fitted, a two piston type on 200 except 2.8 ton GVW and certain special order vehicles, which are fitted with a four piston type as are all 300/400.

In addition, where the dual front line braking system is fitted to 200, 300 and 400 vehicles, a four piston caliper with two hydraulic pipe connections and three bleed screws is employed.

The four piston version is manufactured with two different piston sizes to suit specific applications, but the principles of overhaul procedure are the same for all calipers.



070229

Fig.14 4-piston caliper – dual front line braking system.

1. Brake pads
2. Caliper
3. Bleed screws
4. Anti-rattle springs
5. Pad retaining pins
6. Brake disc
7. Piston
8. Wiper seal retainer
9. Wiper seal
10. Fluid seal

Remove

1. Chock the rear road wheels, then raise and support the front of the vehicle on stands. Remove the front road wheel(s).
2. Seal the master cylinder reservoir using plastic film before disconnecting the brake hose from the pipe connections on the support bracket. Seal the hose ends to prevent the ingress of dirt.
3. Remove the caliper mounting bolts (and the hose support bracket where fitted), and discard the bolts if micro-encapsulated. Withdraw the caliper assembly from the brake disc.

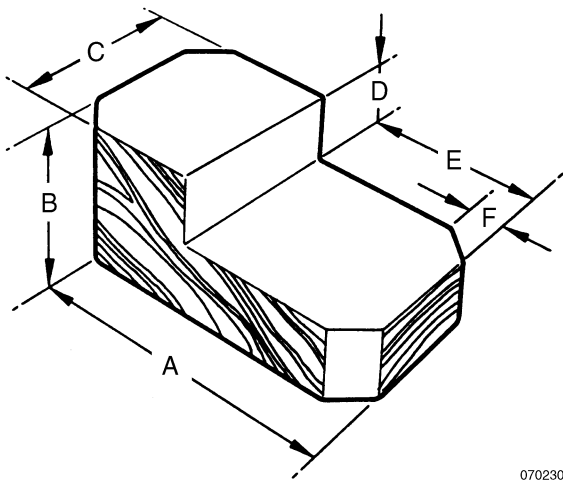
Overhaul

CAUTION: Do not attempt to separate the caliper body.

4. Withdraw and discard the pad retaining split pins, and withdraw the anti-rattle springs and brake pads. Note the positions of the anti-rattle springs, and on 2-piston calipers the relative position of the pads and their shims (handed).
5. Thoroughly clean the caliper body, use only brake cleaning fluid or denatured alcohol.
6. Remove one piston as follows:
 - a) **2-piston caliper**
Restrain one piston, then apply air pressure to the hydraulic port to blow out the other piston.

WARNING: Ensure fingers cannot be trapped when the piston is blown out.

CAUTION: A quantity of fluid will be released.



070230

Fig.15 Piston retaining block dimensions

A.	90 mm	3.5 in
B.	45 mm	1.75 in
C.	50 mm	2.0 in
D.	20 mm	0.8 in
E.	45 mm	1.75 in
F.	10 mm	0.4 in
	at 45°	at 45°

b) 4–piston caliper

Retain three of the pistons by inserting a hardwood block made to the dimensions shown in fig.15. Apply air pressure to the port to partially eject the piston. Remove the block and extract the piston by hand.

WARNING: Ensure fingers cannot be trapped when the piston is blown out.

CAUTION: A quantity of fluid will be released.

If the piston is tight, reconnect the caliper to the brake hose and carefully apply hydraulic pressure to eject the piston. The above **WARNING** and **CAUTION** apply.

Renew the caliper assembly if a piston has seized or is corroded.

7. Extract the retainer and wiper seal from the mouth of the bore, and the fluid seal from the bore.

Clean the bore and piston with brake cleaning fluid or denatured alcohol; renew the caliper if the bore is scored or has corrosion damage.

NOTE: Absolute cleanliness is essential when reassembling.

8. Coat the new seals in LPK 101 lubricant. Ease the piston seal into its groove in the bore using the fingers only; note that the inner edge of the seal is held proud by the section of the groove.
9. Fit the wiper seal either way round, and its retainer; press the retainer into position until it is flush with the bore mouth.
10. Smear the piston with LPK 101 lubricant and then insert it squarely into the bore; push it fully into the caliper using, if necessary, piston clamp MS 331.
11. **a) On 4–piston calipers**
Turn the block and fit new seals to the remaining piston bores in turn by repeating operations 5b to 10.

b) On 2–piston calipers

Restrain the piston just overhauled, then fit new seals to the opposing bore by repeating operations 5a to 10.

Refit

12. Position the caliper and brake hose support bracket (if fitted) on to the swivel hub and fit the hose.
Clean the threads of the caliper mounting bolts and then apply Loctite 270 to the threads. Fit and tighten the caliper mounting bolts to the correct torque (fit new bolts if micro-encapsulated).
CAUTION: Check that the hose is not twisted, and cannot foul components when the steering is turned to both full lock positions.
13. Install the brake pads, ensuring the pad shims (fitted in 2-piston calipers) are correctly located. Fit the anti-rattle springs and new retaining split pins.
CAUTION: The anti-rattle springs fitted to standard disc calipers have different length legs. When refitting the anti-rattle springs, it is essential that the longer length legs of each spring face each other.
14. Remove the plastic film from the master cylinder reservoir, then bleed the complete brake system as detailed in the section "Bleeding the Brake System".
15. Operate the brake pedal a few times to position the brake pads, then recheck the fluid level. Check all components just overhauled for leaks.
16. Refit the road wheel(s), lower the vehicle to the ground and tighten the wheel nuts to the correct torque.
Carry out road test.

WARNING: The driver/operator must be advised that during the first 200 miles (320 km) the brake pads will 'bed-in'. During this period, the brake pads should be not be subjected to harsh or excessive use.

BRAKE DISC – 200/300/400

Remove and Refit

Tools Required: 0480041 (18G 134), 0499910 (18G 134DV)

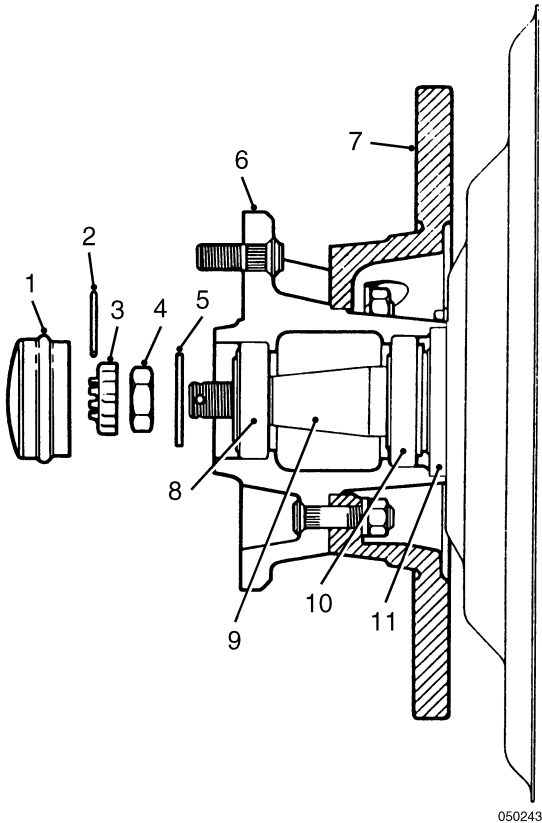


Fig.16 Front Hub

1. Dust cap
2. Split pin
3. Hub nut retainer
4. Hub nut
5. Washer
6. Hub
7. Brake disc
8. Outer hub bearing
9. Stub axle
10. Inner hub bearing
11. Inner oil seal

Remove

1. Apply the handbrake, chock the rear wheels, raise and support the front of the vehicle and remove the front road wheels.
CAUTION: Left hand threaded nuts are fitted on left hand side of the vehicle (300/400 only).

2. Remove the brake caliper, and discard the caliper mounting bolts if micro-encapsulated.
CAUTION: Support the caliper to avoid damage to the flexible brake pipe.
3. Remove the dust cap, split pin, hub nut retainer, hub nut and washer.
4. Withdraw the hub and recover the outer bearing.
5. Remove and discard the inner oil seal, and recover the inner bearing.
6. Remove the securing nuts and spring washers to release the disc from the hub.

Refit

7. If a new disc is to be fitted, degrease the disc with a suitable solvent.
8. Clean the mating faces of the disc and hub, then fit the disc and tighten the retaining nuts to the correct torque.
9. Grease and fit the inner bearing.
10. Lubricate and fit a new inner oil seal using 0480041 (18G 134) and 0499910 (18G 134DV).
CAUTION: Lip of seal must face towards bearing.
11. Grease the stub axle and the outer bearing, then fit the hub, outer bearing, plain washer and hub nut.
12. Adjust the front hub end-float as detailed in the Steering section 'Front Hub Bearings'.
13. Fit the brake caliper using new micro-encapsulated fixing bolts and tighten to the correct torque.
14. Fit the road wheels and lower the front of the vehicle to the ground.
15. Tighten the road wheel nuts to the correct torque.
WARNING: Pump the brake pedal to restore the brakes.
16. Road test the vehicle.
CAUTION: If new discs have been fitted, the driver/operator should be cautioned, and advised to avoid harsh or excessive braking during an initial period.

Disc Run-out Check

See also 'Disc Thickness Variation Check' below.

1. Jack up the front of the vehicle and support firmly under the axle. Remove the front road wheels.
2. Temporarily adjust the hub nut of the disc to be checked just sufficient to eliminate hub end float.
3. Mount the base of a dial gauge on the ground or on a rigid part of the hub. Position the stylus approximately 5 mm (0.25 in) in from the outside diameter of the disc. Preload and zero the gauge.
4. Measure the disc run-out by noting the maximum gauge deflection whilst slowly turning the disc through 360°.
5. Repeat operations 3 and 4 on the other side of the same disc.
6. If the run-out on either side exceeds the maximum disc run-out dimension given in data:
 - a. Remove the disc from the hub and refit it in a different position, making sure that mating faces are clean. Recheck the run-out.
 - b. If the run-out is still excessive, the disc must be machined or renewed, as necessary. (See also section below – 'Disc Thickness Variation Check').
7. Repeat operations 2 – 6 on the opposite disc.
8. Having completed the checks, the hub adjustment must be reset to the correct end-float as detailed in the Steering section 'Front Hub Bearings'.
9. Fit the road wheels and lower the front of the vehicle to the ground.
10. Tighten the road wheel nuts to the correct torque.

Disc Thickness Variation Check

Even if the measured run-out figure established in the 'Disc Run-out Check' above is within tolerance, it is possible to have an excessive thickness variation due to corresponding thick/thin points on opposing faces.

Check the variation as follows:

1. Mark with chalk the high and low points noted during the run-out check.
2. Measure the thickness of the disc at these points with a micrometer. Compare these measurements with information in 'Data', and machine or renew the disc as necessary.

BRAKE MASTER CYLINDER/SERVO 200/300/400

Remove and Refit

Remove the master cylinder

1. Disconnect the battery, negative terminal first.
2. Disconnect the pressure failure warning switch wires at the master cylinder.
3. Disconnect the brake pipes at the master cylinder, and plug the exposed ports and pipes to prevent fluid loss and dirt ingress. **CAUTION:** Do not allow brake fluid to contact painted surfaces as the paintwork could be damaged.

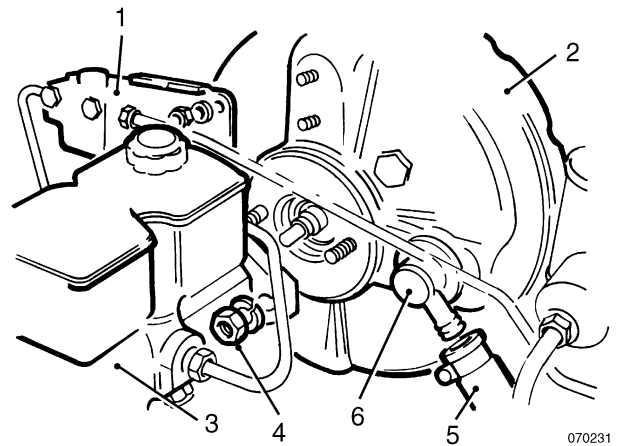


Fig.17 Brake master cylinder and servo – 200

1. Delay valve
 2. Brake servo
 3. Brake master cylinder
 4. Master cylinder securing nuts
 5. Vacuum pipe
 6. Non-return valve
4. Remove the two nuts securing the master cylinder to the servo and detach the master cylinder. **CAUTION:** Do not depress the brake pedal while the master cylinder is removed.

To remove the servo after removal of master cylinder.

5. Disconnect the vacuum pipe at the servo.
6. Disconnect the brake pipes from the pressure delay valve on the servo, then release the two nuts to detach the pressure delay valve and bracket from the servo.

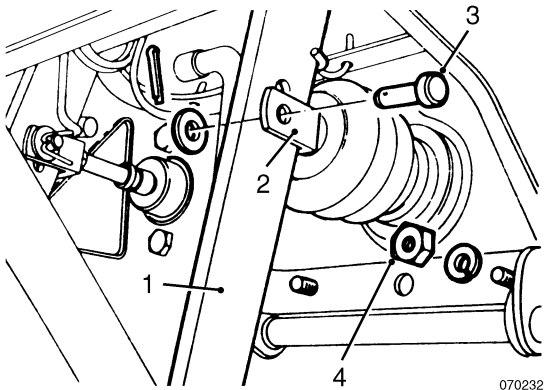


Fig.18 Servo attachment

1. Brake pedal
2. Brake servo push rod
3. Clevis pin
4. Servo retaining nut

7. Inside the vehicle, disconnect the push rod from the brake servo by removing the clevis pin.
8. Release the servo, by removing the four retaining nuts and spring washers.

Refit

9. Reverse operations 3–8.
NOTE: There are two push rod attachment holes in the brake pedal lever; the push rod is attached to the lower hole.
10. Top up the master cylinder reservoir with the correct specification of brake fluid.
CAUTION: Do not allow brake fluid to spill onto paintwork.
11. Bleed the brakes as described in the brake bleeding section, and refit the pressure failure warning switch wires.
12. Ensure the brake fluid level is topped up, reconnect the battery (positive terminal first), and road test the vehicle.

BRAKE MASTER CYLINDER – 200/300/400

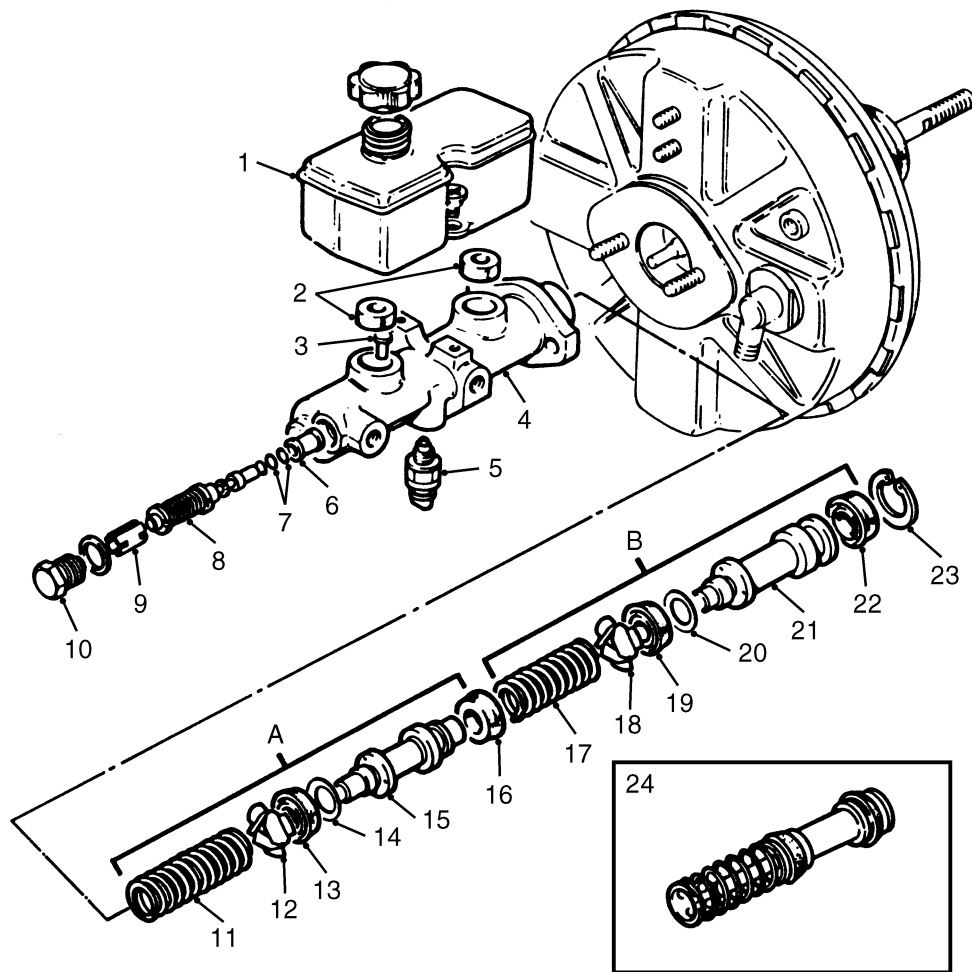
A number of different brake master cylinder and servo assemblies are fitted to LDV vehicles to suit the specific requirement of each vehicle.

As can be seen from the brake specification chart, different master cylinder types, master cylinder bores and servo types are used to achieve optimum braking on each model.

For servicing purposes the master cylinder can be divided into two types:

- AP Phase 2 type
- AP Phase 3 type

The Phase 2 type master cylinder contains a primary piston assembly which can be overhauled, whereas the primary piston assembly in Phase 3 unit is preset by the manufacturer and must be replaced as an assembly.



070233

Fig.19 Brake master cylinder – Phase 2 type (Phase 3 type primary piston assembly in inset).

- | | |
|----------|---|
| A | Secondary piston components |
| B | Primary piston components |
| 1. | Reservoir |
| 2. | Seals |
| 3. | Stop pin |
| 4. | Body |
| 5. | Pressure failure warning switch |
| 6. | Plastic spacer |
| 7. | 'O' rings |
| 8. | Pressure failure piston and spring assembly |
| 9. | Distance piece (if fitted) |
| 10. | End plug |
| 11. | Secondary piston spring |
| 12. | Spring retainer |
| 13. | Primary seal |
| 14. | Piston washer |
| 15. | Secondary piston |
| 16. | Reverse seal |
| 17. | Primary piston spring |
| 18. | Spring retainer |
| 19. | Primary seal |
| 20. | Piston washer |
| 21. | Primary piston |
| 22. | Secondary seal |
| 23. | Circlip |
| 24. | Primary piston 'B' and spring assembly (fitted in Phase 3 type in place of items 17 to 22). |

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.

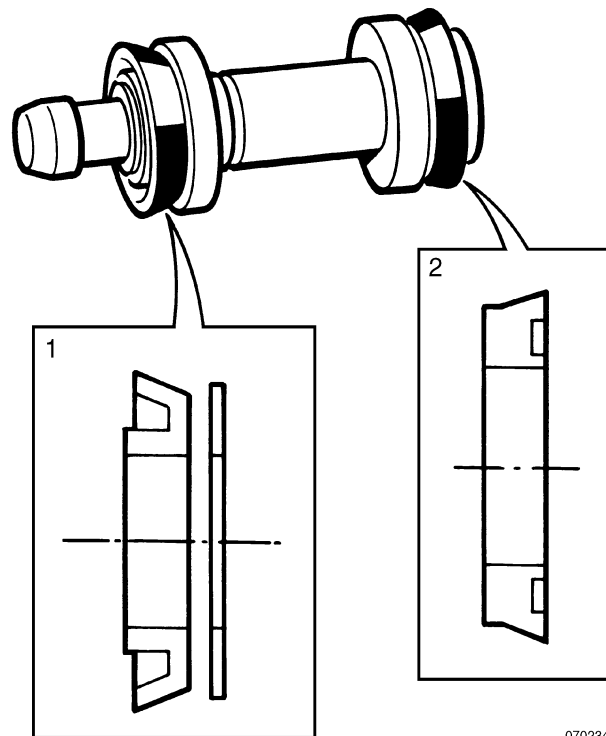
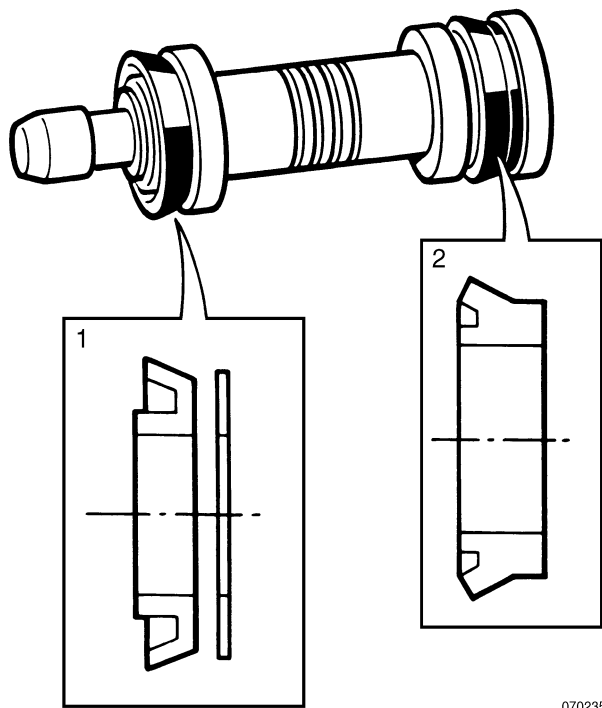


Fig. 20 Secondary piston seals

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).

9. Locate a new piston washer on the head of the secondary piston. Using the fingers only, ease a new primary seal over the piston nose, lip last, so that it seats up to the piston head and holds the piston washer in place.
10. Carefully ease the secondary piston reverse seal, lip last, into the groove in the opposite end of the piston.
Fit the spring retainer and spring onto the secondary piston nose.



070235

Fig.21 Primary piston seals (Phase 2 type master cylinder)

1. Primary seal
2. Secondary seal

11. Phase 2 type master cylinder only.

Fit a new piston washer on to the head of the primary piston followed by a new primary seal, lip last. This seal is identical to the seal fitted over the nose of the secondary piston.

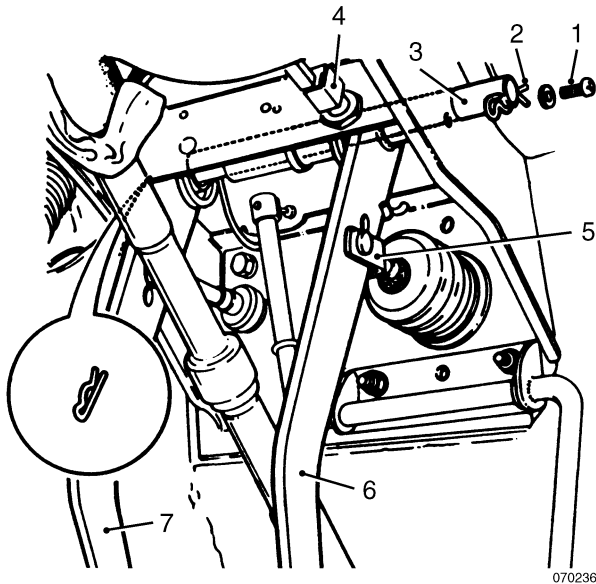
Fit a new secondary seal, lip first into the groove at the bored end of the primary piston (i.e. the lip faces in the same direction as the seal at the opposite end). This seal has a similar stepped lip to the seal on the secondary piston, but has a larger internal diameter and is thicker.

Fit the spring retainer and spring onto the primary piston nose.

12. Making sure all components are well lubricated with brake fluid, carefully fit the built-up secondary piston assembly into the master cylinder bore, spring end first, making sure the lip of the leading seal does not fold back.
13. Repeat the above operation to fit the primary piston assembly, ensuring neither seal lip folds back. Then fit the retaining circlip, making sure it is correctly seated in its groove.
14. Use a soft metal rod to push the primary piston down the bore until it stops, then insert the stop pin into either of the two adjacent secondary feed port holes.
15. If removed, refit the pressure failure assembly as follows:
 - a. Carefully seat the two new 'O' ring seals into their grooves on the piston and spring assembly.
Lubricate all components with brake fluid.
 - b. Fit the plastic spacer into the master cylinder bore, followed by the piston and spring assembly, taking care not to damage the rings.
 - c. Insert the metal distance piece (if separate to the end plug) and fit the end plug with a new copper washer. Tighten the end plug to 45 Nm (33 lbf ft).
 - d. Fit the pressure failure switch and tighten to a torque of 1.7 Nm (15 lbf in). Do not overtighten.
16. Check that the stop pin is still correctly located, then fit the two reservoir rubber seals. Fit and tighten the reservoir with its two securing screws to 6.8 Nm (5 lbf ft). Do not overtighten
17. Refit the master cylinder to the servo unit and tighten the securing nuts to 17 Nm (13 lbf ft). If the master cylinder and servo were removed as an assembly, refit the assembly to the vehicle.
18. Reconnect the fluid pipes, tightening the tube nuts to the specified torque.
19. Refill the reservoir with the recommended brake fluid and bleed the system thoroughly. Replenish the reservoir and check the hydraulic system for leaks before road testing the vehicle.
CAUTION: Do not allow brake fluid to spill onto paintwork.

BRAKE PEDAL ASSEMBLY AND BUSHES – 200/300/400

Remove and Refit



6. Unhook the brake and clutch pedal return springs from their pedals.
7. Withdraw the pedal shaft to release the brake pedal.
NOTE: If difficulty is experienced in withdrawing the pedal shaft, remove the clevis pin securing the clutch push rod to free the clutch pedal pivot.
8. Inspect the pivot bushes and replace if worn or damaged.

Refit

9. Refit the assembly by reversing operations 1 – 8; ensure the servo push rod clevis is fitted to its original hole in the pedal arm:
lower hole – brake pedal
upper hole – clutch pedal

Check that the brake stop light switch operates correctly, and is not over-adjusted so that the pedal cannot return fully; adjust as necessary.

Fig.22 Pedal Assembly

1. Spring clip securing screw
2. Spring clip
3. Pedal shaft
4. Brake stop light switch
5. Brake master cylinder push rod
6. Brake pedal
7. Clutch pedal

Remove

1. Disconnect the battery, negative terminal first.
2. Remove the parcel shelf, and if necessary remove the heater ducting to the fascia vent.
3. Remove the clevis pin securing the push rod to the brake pedal, identifying for reassembly in which of the two holes in the pedal arm the clevis pin is located.
4. Remove the screw and plain washer securing the spring clip to the pedal bracket.
5. Remove the spring clips at each end of the pedal shaft.

BRAKE LOAD SENSING VALVE

Fitted to 200 chassis cabs and certain special order vehicles, and to all 300/400 vehicles.

Description

The valve is installed into the hydraulic braking system between the master cylinder and the rear brakes. It is fitted to sense the vehicle load by 'measuring' the distance between the chassis and the rear axle, and varies accordingly the fluid pressure available to the rear brakes.

The valve assembly is preset and locked when built, it is therefore non serviceable and must only be replaced as a complete unit.

IMPORTANT

Under the following circumstances the load sensing valve setting must be checked and adjusted if necessary:

- After commissioning a new vehicle that has been fitted with a purpose built conversion or any specialised equipment permanently installed (eg. lifting crane).
- Rear spring change.
- After fitting new load sensing valve.
- Every 24,000 miles (40,000 km).
- Any work carried out which may affect the relative distance between the rear axle and the underside of the body.

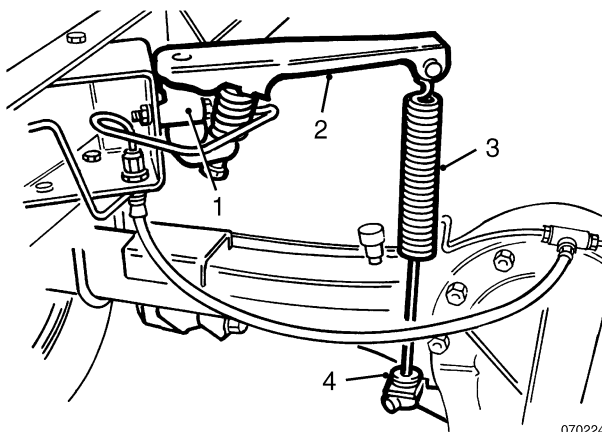


Fig.23 Load sensing valve

1. Valve
2. Lever arm
3. Sensor spring
4. Adjuster block

Remove/Refit

Remove

1. To disconnect the sensor spring, use hand pressure to restrain the spring whilst releasing the adjuster block at the axle mounting.
2. Disconnect the brake pipes at the valve and seal them to prevent the ingress of dirt.
3. Remove the nuts/bolts securing the valve to the mounting bracket to release the valve.

Refit

4. Refitting is the reverse of operations 1 to 3, then bleed the brakes as described in the brake bleeding section.
5. Adjust the load sensing valve as described below.

Adjustment

Accurate adjustment of the load sensing valve is important to effective operation of the brakes under varying load conditions. The adjustment must be made as follows.

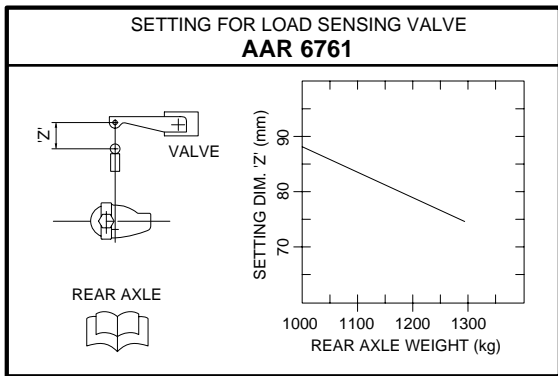
SETTINGS FOR LOAD SENSING VALVE 285 & 310 VANS ALL MODELS			
UNLADEN REAR AXLE WT. (kg)	AXLE TRAVEL TO LADEN 'A' (mm)	SETTING DIM 'Z' (mm)	
530	57	94	
630	53	90	
730	49	85	

FOR SETTING INSTRUCTIONS SEE DRIVERS HANDBOOK

070237

Fig.24 Load sensing valve setting data label. (Sample)

1. Identify the setting data given on the label located on the left hand cab step, and note the unladen rear axle weights listed.
2. With the vehicle in an unladen condition, position the rear wheels only on a weighbridge and take a weight reading. If the weight does not correspond to one of those listed on the label, add weight at the rear of the vehicle until it does.



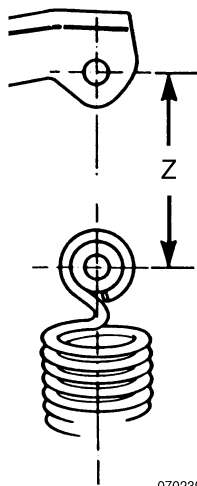
070238

Fig.25 Graph type setting data label

NOTE: Fig. 25 shows the latest label, attached to the bottom of the nearside door, which employs a graph to enable a setting dimension to be obtained for varying unladen weights. With this type of label therefore it is not necessary to have to add weight to the vehicle.

The labels shown are only examples; each model has its own setting label.

- Position the vehicle on a lift or over a pit. Disconnect the spring eye clevis pin clip and restrain the spring to remove the clevis pin. **CAUTION:** Ensure that the vehicle is positioned on a level surface.

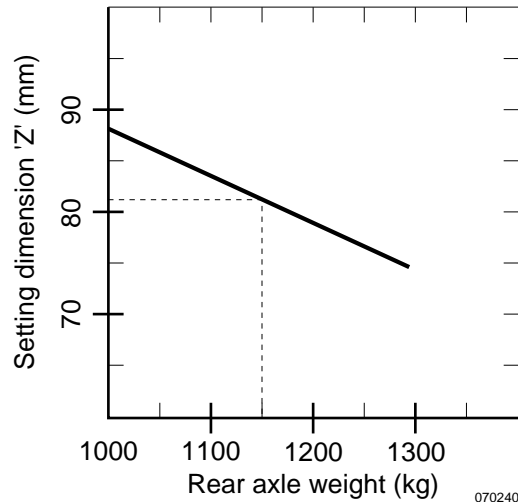


070239

Fig.26 Checking spring setting 'Z'

- Lift the spring into a vertical position and eliminate all slack at the lower mounting bracket. Measure the distance 'Z' between the centre of the spring eye and the centre of the load sensing valve arm eye.

- Compare the measurement against that shown on the label for the unladen rear axle weight checked previously. If the measurement is incorrect, slacken the adjuster block fixing screw and move the adjuster block up or down the spring rod until the correct setting is achieved. Tighten the fixing screw.



070240

Fig.27 Load setting graph example

- Fig.27 shows an example of how the graph type label is used. The dotted line gives the setting to be used (81 mm) for an unladen rear axle weight of 1150 kg.
- Refit the spring eye clevis pin and clip.

REAR BRAKE SHOES AND WHEEL CYLINDER – 200

Description

The rear drum brakes are a leading/trailing shoe design, operated hydraulically by a double acting wheel cylinder.

The handbrake is actuated by a cable attached to the secondary (rear) shoe.

The brakes are self-adjusting by a linkage actuated by the hydraulic operation. Hand adjustment can be made via an access hole in the backplate opposite the adjusting mechanism, after removing a rubber sealing plug.

Remove

1. Chock the front wheels. Raise the rear of the vehicle, support on axle stands and remove the rear road wheels.
2. Remove the brake drum.
If difficulty is experienced in removing the drum, remove the rubber plug from the back plate, and use a small screwdriver to depress the adjuster and retract the brake shoes.
NOTE: Before commencing the dismantling procedure, take careful note of the positions of the shoes, springs, linkages etc.
3. Remove the shoe steady springs.
4. Carefully lever the shoes out of the fixed abutment slots and wheel cylinder slots. Unhook the springs starting at the top on the primary (leading) shoe, and release the handbrake cable from the trailing shoe to detach the shoes. Release the cross lever from the trailing shoe.
5. Prevent ejection of the wheel cylinder pistons by restraining them with soft wire or an elastic band.
CAUTION: Take care not to damage the rubber gaiters.
6. Detach the self-adjusting mechanism from the primary shoe, and the handbrake lever from the secondary shoe.

Inspection

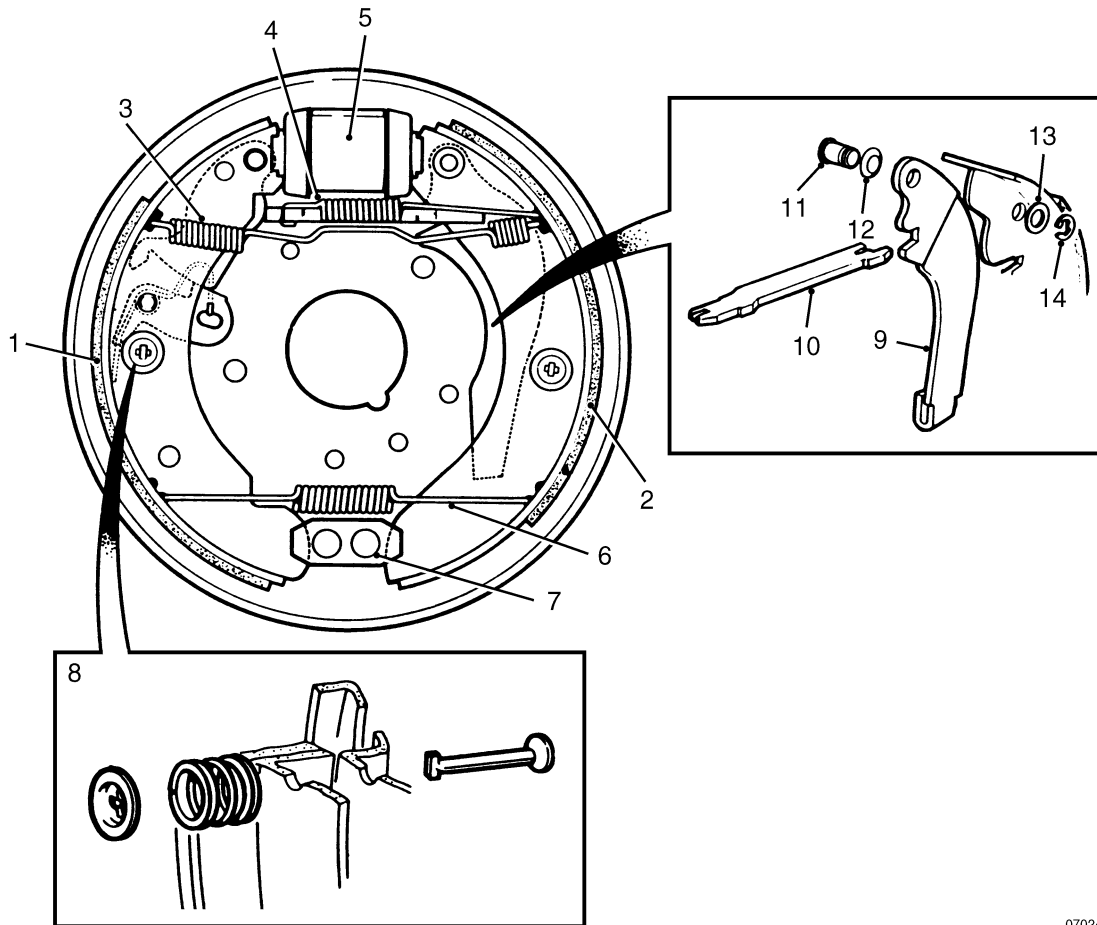
7. Remove all dust and dirt from the back plate, spring linkages etc.

WARNING: Do not blow out asbestos dust with an air line; it can be a serious health risk should the dust be inhaled.



See safety instructions in 'Preventive Maintenance' section.

8. Examine the brake drum for scoring and the brake linings for wear, scoring or contamination; renew the components as necessary.
NOTE: When checking lining wear, the secondary shoe linings are of much thinner section than the primary linings. Also the primary shoe linings are tapered towards the wheel cylinder.
9. Check the springs and adjuster mechanisms for wear and damage; renew as necessary.



070241

Fig.28 Rear brake – 200 (L.H. side)

1. Primary (leading) shoe
2. Secondary (trailing) shoe
3. Pull-off spring
4. Cross lever spring
5. Wheel cylinder
6. Tension spring
7. Fixed abutment
8. Steady spring
9. Handbrake lever
10. Cross lever
11. Pivot pin
12. Spring washer
13. Plain washer
14. Circlip

Wheel cylinder

10. Release the hydraulic pipe from the wheel cylinder, and cap the end to prevent fluid loss. Remove the bleed screw.

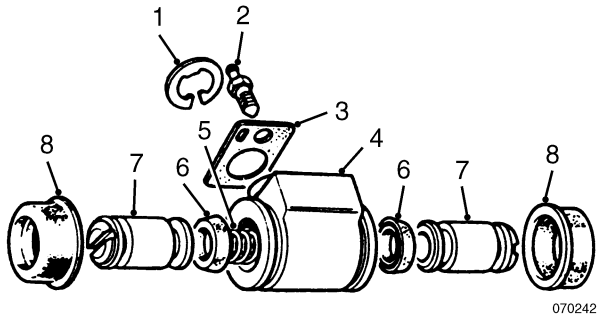


Fig.29 Wheel cylinder components

1. 'E' clip
2. Bleed screw
3. Gasket
4. Wheel cylinder
5. Spring
6. Piston seals
7. Pistons
8. Rubber gaiters

11. Remove the 'E' clip securing the wheel cylinder and withdraw the cylinder. Discard the gasket.
12. To overhaul the wheel cylinder, remove the rubber gaiters and withdraw the pistons. Clean all components with methylated spirit or clean brake fluid – do not use paraffin or petrol. Fit a new wheel cylinder assembly if the bore of the cylinder is scored or worn.
13. Immerse components in clean brake fluid and assemble wet, fitting new seals to the pistons using the fingers only. Smear the inside of the rubber gaiters with Rubblerlube LPK 102 or equivalent.
CAUTION: Larger diameter of seal must face AWAY from the slotted end of the piston.
14. Fit the wheel cylinder using a new gasket and secure with a new 'E' clip; a special tool is available for fitting the 'E' clip from Multipart Distribution, part number 0480047 (STL 107). Refit the bleed screw and connect the hydraulic pipe.

Shoe fitting

15. Smear all pivot points with PolyButyl Cuprysil (PBC) type high melting point grease.
CAUTION: Do not lubricate the ratchet teeth on the self-adjuster plates.
16. Assemble the handbrake lever to the secondary shoe (thin lining).
17. Assemble the adjuster mechanism to the primary shoe, noting the correct positions for the thin and thick plain washers.
18. Fit the cross lever and spring to the secondary shoe, then connect the handbrake cable to the shoe and position it on the backplate.
19. Offer up the primary shoe to the backplate and fit the tension spring.

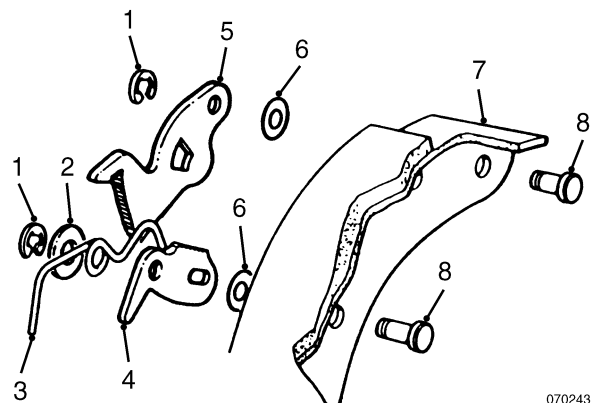


Fig.30 Self adjusting mechanism (L.H. side)

1. Circlip
 2. Thick plain washer
 3. Spring
 4. Small adjuster plate
 5. Large adjuster plate
 6. Thin plain washers
 7. Primary shoe
 8. Pivot pins
20. Attach the upper pull-off spring to the primary shoe, whilst manoeuvring both shoes into their fitted locations.
CAUTION: The upper springs are NOT interchangeable from one side of the vehicle to the other, and are colour coded.
 21. Fit the shoe steady springs and the brake drum.



22. Bleed the brakes (see brake bleeding section for correct procedure).
23. Operate the hand and footbrakes to adjust and centralise the brake shoes.
24. Check the handbrake operation and adjust if necessary (see section 'Handbrake Adjustment' for details).
25. Fit the road wheels and lower the vehicle to the ground; tighten the wheel nuts to the correct torque.
Carry out a road test.

REAR BRAKE SHOES AND WHEEL CYLINDER – 300/400

Description

The rear drum brakes are a duo servo design, operated hydraulically by a double acting wheel cylinder.

The brakes are self-adjusting by a linkage actuated by the hydraulic (footbrake) operation; this occurs when the vehicle is driven in reverse. Hand adjustment can be made via an access hole in the backplate opposite the adjuster screw, after removing a rubber sealing plug.

There are two other access holes in the backplate, also sealed with rubber plugs, which allow visual inspection of the brake linings.

The handbrake is actuated by a cable attached to the secondary (rear) shoe.

1. Chock the front wheels. Release the handbrake and slacken the rear road wheel nuts. Jack up and support the rear of the vehicle, and remove the road wheels, and brake drum.
NOTE: Before commencing the dismantling procedure take careful note of the positions of the shoes, springs, linkages etc.
2. Depress and turn the shoe steady pin washers to release the pins and springs; extract the steady pins from the inboard side of the backplate.
3. Turn the adjuster fully in, then spread the lower end of the shoes to disengage the adjuster assembly from the shoe webs.

4. Push the shoes together and release the adjuster plate from the secondary shoe. Unhook the spring from the heel of the primary shoe to separate the shoes.
5. Pull both shoes outwards to release the handbrake cross lever and its anti-rattle spring. Pivot the primary shoe outwards and upwards from the axle and remove the shoe and pull-off spring.
6. Remove the secondary shoe and handbrake lever assembly, also the adjuster rod and pull-off spring from the pivot post. Disconnect the secondary shoe from the handbrake lever pivot pin.
7. Prevent ejection of the wheel cylinder pistons by restraining them with soft wire or an elastic band around the cylinder body.
CAUTION: Take care not to damage the rubber gaiters.

Inspection

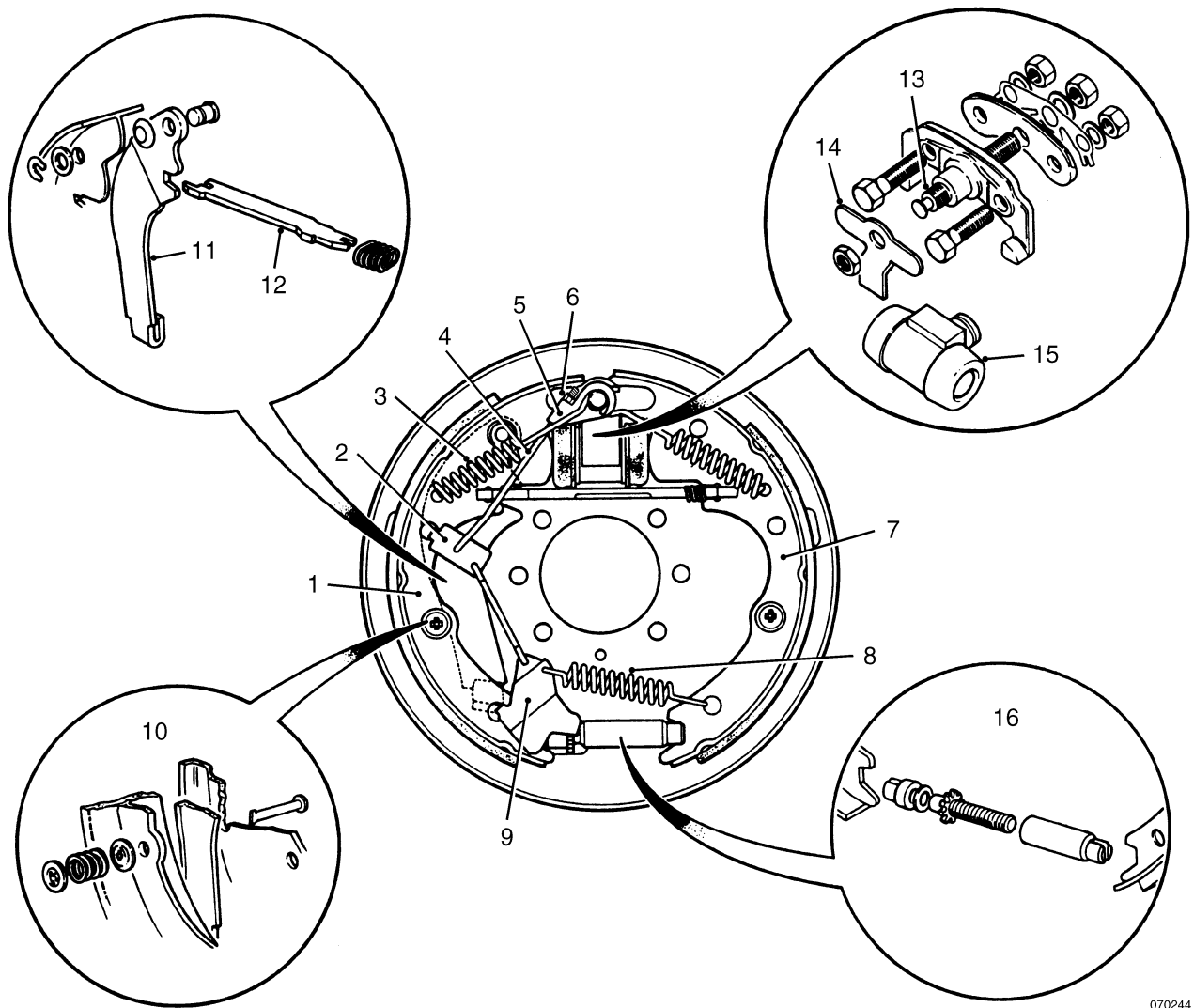
8. Remove all dust and dirt from the backplate, springs, linkages etc.

WARNING: Do not blow out asbestos dust with an air line; it can be a serious health risk should the dust be inhaled.



See safety instructions in 'Preventive Maintenance' section.

9. Look for signs of leakage from the wheel cylinder, inspect gaiters, flexible hoses and metal brake pipes for damage or corrosion. Rectify as necessary.

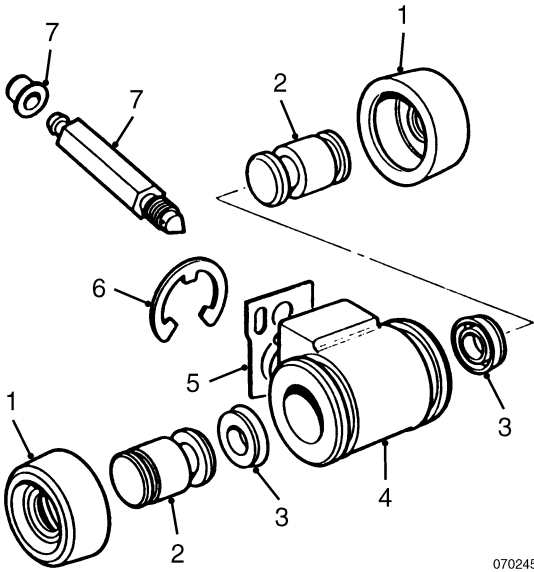


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Fig.31 Rear Brake – 300/400 (Right hand side illustrated)

1. Secondary shoe
2. Pivot plate
3. Pull-off spring
4. Adjuster rod
5. Adjuster rod bracket
6. Adjuster nut
7. Primary shoe
8. Tension spring
9. Adjuster plate
10. Steady spring assembly
11. Handbrake lever
12. Cross lever
13. Pivot post
14. Steady plate
15. Wheel cylinder
16. Adjuster assembly

Wheel cylinder



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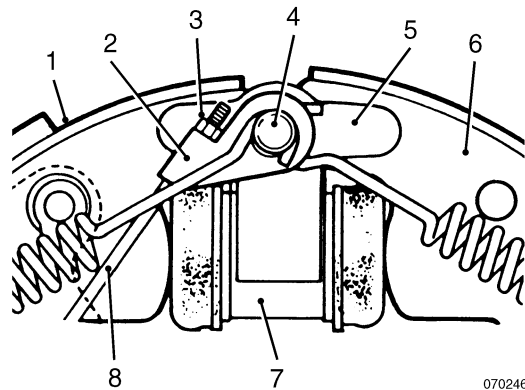
Fig.32 Wheel cylinder components

1. Dust cover
 2. Piston
 3. Piston Seal
 4. Wheel cylinder body
 5. Joint washer
 6. Spring clip
 7. Bleed screw
10. Release the hydraulic pipe from the wheel cylinder and cap the end to prevent fluid loss.
 11. Remove the steady plate and the bleed screw.
 12. Release the spring clip and remove the wheel cylinder and joint washer.
 13. To overhaul the cylinder remove the rubber gaiters and withdraw the pistons. Clean all components and fit a new unit if the bore of the cylinder is scored or worn.
 14. Immerse components in clean brake fluid and assemble wet, using new seals, flat face towards the piston. Smear the inside of the rubber gaiters with Rubberlube LPK 102 or equivalent.
 15. Using a new gasket, fit the wheel cylinder securing with a new 'C' clip. Refit the bleed screw, hydraulic pipe and steady plate.

Shoe fitting

CAUTION: Secondary (rear) shoe has the longer lining.

16. All metal to metal contact points should be lightly lubricated with Poly Butyl Cuprysil (PBC) type high melting point grease, e.g. shoe tips, slots in cross lever, areas where shoe platforms rub against backplate etc. Smear the threads of the adjuster with Molybdenum Disulphide grease.
17. Attach the secondary shoe to the handbrake lever, assembling the pivot pin, washers etc as shown in the illustration.
18. Position the eye of the adjuster rod bracket onto the pivot post, adjuster rod upwards. Offer up the secondary shoe and pull-off spring on top of the eye of the adjuster rod.
19. Locate the secondary shoe on the pivot post and fit the rear steady pin and spring.
20. Hook one end of the other pull-off spring into the primary shoe and the other end behind the eye of the adjuster rod bracket. Locate the shoe onto the pivot post.



070246

Fig.33

1. Secondary shoe
2. Adjuster rod bracket
3. Adjuster nut
4. Pivot post
5. Steady bracket
6. Primary shoe
7. Wheel cylinder
8. Adjuster rod

21. Pull the lower end of the primary shoe up and install the handbrake cross lever onto the secondary shoe.
NOTE: The anti-rattle spring is fitted at the primary shoe end of the cross lever, which is fitted with its flat side towards the backplate.
22. Lower the primary shoe into its operating position, at the same time locating the front of cross lever into the shoe. Make sure both shoes are now correctly located on the pivot post.
23. Fit the self adjusting linkage to the secondary shoe and attach the tension spring to the primary shoe.
24. Ensure the adjuster assembly is set to minimum adjustment, then fit it with the adjuster wheel at the secondary shoe end.
25. Fit the front steady pin and spring, and centralise the shoes.

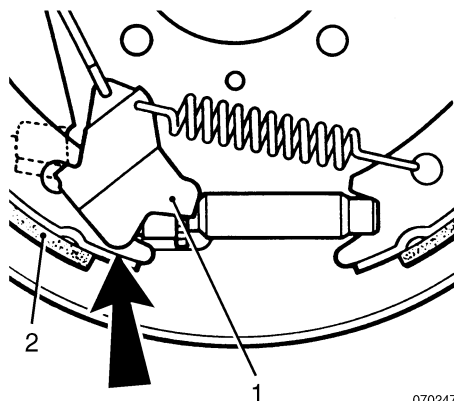


Fig.34 Checking adjuster plate clearance

1. Adjuster plate
 2. Secondary shoe
26. Check the clearance between the base of the adjuster plate and the inside of the secondary shoe platform; it should be 0,25 to 0,76 mm (0.010 to 0.030 in). If it is incorrect, adjust the nut at the pivot post end of the adjuster rod.

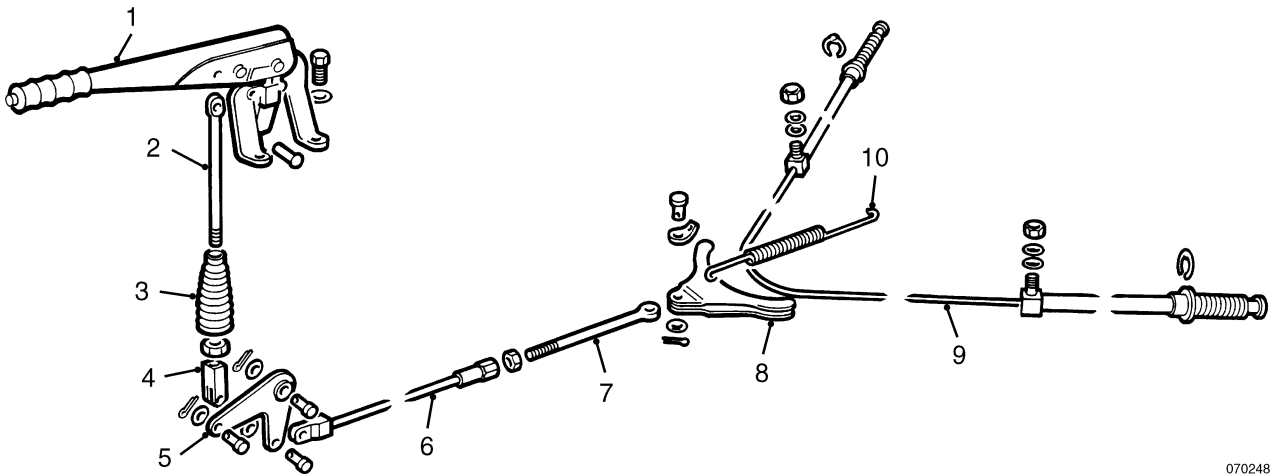
27. Offer up the brake drum. Adjust the shoes by turning the toothed adjuster wheel so that the drum will just go on. Fit the drum. Operate the brake pedal several times to settle the shoes, then remove the drum and recheck the clearance between the base of the adjuster plate and the secondary shoe. Readjust if necessary.

When the drum is fitted there should be a minimum clearance between shoe and drum of 0,6 to 1,0 mm (0.025 to 0.040 in).
28. Refit the drum and road wheel, and lower the rear of the vehicle. Tighten the road wheel nuts to the correct torque.
29. Drive the vehicle in reverse and operate the brakes hard several times to achieve final adjustment of the brake shoes.
30. Check the handbrake operation and adjust if necessary (see section 'Handbrake Adjustment' for details).
31. Road test the vehicle.

BRAKE DRUM RUN-OUT CHECK

1. Jack up the rear of the vehicle and support the axle rigidly on stands. Remove the road wheels.
2. Mark the position of the drum relative to its hub, then remove the drum.
3. Refit the drum back-to-front, aligning the marks.
4. Place the base of a dial gauge on the ground or on a rigid part of the axle. Position the gauge stylus in the centre of the brake shoe contact area of the drum and at right angles to it. Pre load the gauge and zero it.
5. Slowly turn the drum through 360° and note the gauge deflection (run-out).

HANDBRAKE – 200/300/400



070248

Fig.35 Handbrake mechanism (200)

1. Handbrake lever assembly
2. Pull rod
3. Gaiter
4. Fork end
5. Bellcrank lever
6. Front cable
7. Adjuster rod
8. Compensator
9. Rear cable
10. Return spring

6. Repeat the checking operation with the stylus positioned at both the outer and inner sides of the contact area.
7. The deflection should not exceed the run-out dimension given in 'data'. If excessive, machine or renew the drum as necessary.
8. Repeat operations 2 to 7 on the other drum.
9. Fit the drums and road wheels, and lower the rear of the vehicle to the ground. Tighten the road wheels to the correct torque.
10. If the drum has been machined, check the foot and hand-brake adjustment and road test the vehicle.

HANDBRAKE ADJUSTMENT 200/300/400

Check and adjust

Check

1. Chock the front wheels, release the handbrake and then re-apply it, using a vertical pull of 10 – 20 kg (22–44 lbs) measured at the centre of the grip on the handbrake lever. Count the number of 'clicks' on the ratchet mechanism until the handbrake is fully on.

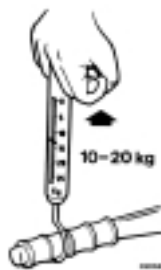


Fig.36 Checking handbrake adjustment

2. Note the colour of the release button on the handbrake lever. If correctly adjusted, the handbrake should operate in the following number of clicks:

Black release button	5 – 8 clicks
Grey release button	2 – 5 clicks

NOTE: On 300/400 vehicles the automatic adjustment mechanism in the rear brakes operates only when the vehicle is driven in reverse. If the handbrake movement is excessive, drive the vehicle backwards and brake hard several times (using the footbrake), and then re-check the handbrake adjustment.

CAUTION: The handbrake must not be allowed to operate with less than the specified number of 'clicks'. If it is, the automatic adjusters in the rear brakes will not function correctly.

Adjust

3. Chock the front wheels, raise the rear of the vehicle and support on stands located under the axle.
4. Release the handbrake and check that both wheels turn freely; any signs of brake binding on either wheel must be investigated and rectified before proceeding.
5. Slacken the lock nut on the adjuster at the rear end of the front handbrake cable.
6. Turn the adjuster until the following number of clicks can be counted when a vertical pull of 10 – 20 kg (22–44 lbs) measured at the centre of the grip on the handbrake lever will fully apply the brakes.

Black release button	5 – 8 clicks
Grey release button	2 – 5 clicks

Tighten the adjuster lock nut. Check that both rear wheels can still turn freely when the handbrake is released.

CAUTION: Do not over-adjust the cable to give less than the specified number of clicks.

7. Lower the rear of the vehicle to the ground.



HANDBRAKE LEVER – 200/300/400

Remove and Refit

Remove

1. Chock the rear road wheels and release the handbrake.
2. Under the vehicle, release the handbrake pull rod clevis from the bellcrank lever.
3. Inside the cab disconnect the wire to the handbrake warning light switch and release the pull rod gaiter from its location.
4. Remove the three bolts to detach the handbrake assembly from the floor panel.

Refit

5. Refitting is the reverse of operations 1 – 4, but check that the handbrake pull rod gaiter is correctly located in the floor.
6. Check the handbrake operation and adjust if necessary (see section 'Handbrake Adjustment' for details).

FRONT HANDBRAKE CABLE – 200/300/400

Remove and Refit

Remove

1. Chock the rear wheels and release the handbrake.
2. Under the vehicle, release the handbrake cable return spring from the chassis crossmember.
3. At the bellcrank lever, remove the split pin, anti-rattle washer and clevis pin to release the front of the cable.
4. Slacken the cable adjuster lock nut and unscrew the adjuster sleeve to release the cable.

Refit

5. Refitting is the reverse of operations 2 to 4.
6. Check the handbrake operation and adjust if necessary (see section 'Handbrake Adjustment' for details).

REAR HANDBRAKE CABLE – 200

Remove

1. Chock the front wheels, raise the rear of the vehicle and support it on stands. Remove the road wheels and brake drums.
2. Disconnect the return spring from the compensator, and remove the clevis pin to release the compensator from the front handbrake cable.

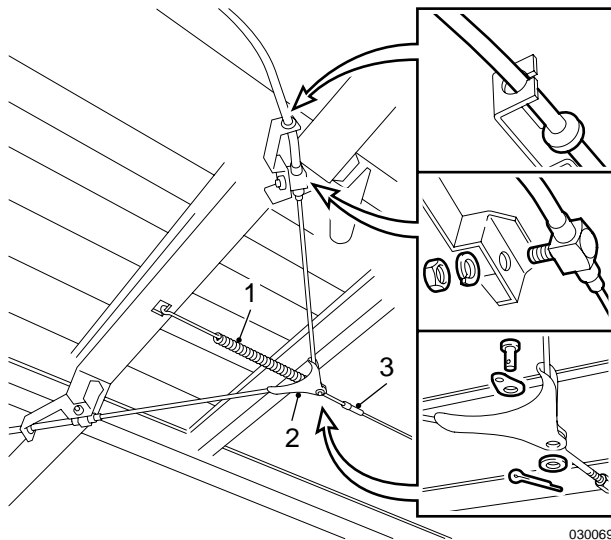


Fig.37 Handbrake cable

1. Handbrake return spring
 2. Compensator
 3. Cable adjuster
3. Working on one brake assembly at a time, release both shoe steady springs and ease the lower end of both shoes out of the fixed abutment.
 4. Remove the 'C' clip securing the handbrake outer cable to the backplate at its entry point.
 5. Prise the end of the inner cable upwards to release it from the handbrake lever attached to the rear shoe. Pull the cable clear of the backplate.
 6. Repeat operation 3 to 5 at the other brake assembly.
 7. Release the cable at the underbody mounting points, and slide the cable out of the compensator.

Refit

8. Fit the compensator at the mid-point of the cable.
9. Working at one brake assembly, insert the cable through the back plate and compress the cable spring while attaching the inner cable to the handbrake lever on the rear shoe.
When fitted, make sure the inner cable is fully down into the slot in the lever, so that the spring locates in the cutaway area.
10. Fit the 'C' clip to secure the outer cable to the backplate.
11. Refit the shoes into the fixed abutment and secure with the steady springs.
Fit the brake drum and the road wheel.
12. Repeat operations 9 to 11 at the other brake assembly.
13. Operate the foot brake pedal a few times to settle the brake shoes.
14. Fit the cable to the underbody mountings and connect the compensator to the front cable using a new split pin. Refit the return spring.
15. Check the handbrake operation and adjust if necessary (see section 'Handbrake Adjustment' for details).
16. Lower the vehicle to the ground and tighten the road wheel nuts to the correct torque.
17. Check the operation of both hand and footbrake.

REAR HANDBRAKE CABLE – 300/400

Remove

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

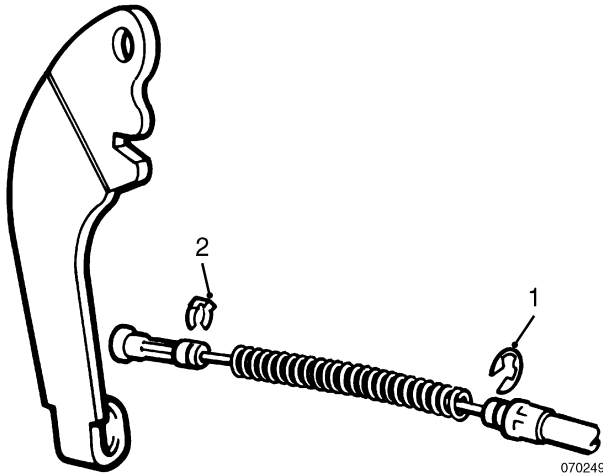


Fig.38 Cable attachment at brake

1. 'E' Clip
2. 'C' Clip

2. Remove the 'E' clip retaining the outer cable to the backplate.
3. Remove the 'C' clip which retains the inner cable to the handbrake lever.
4. Pull the handbrake lever forward and release the inner cable, then pull the cable assembly clear of the backplate.

On twin rear wheel axles

- 5a. Repeat operations 2 to 4 on the opposite side.
- 5b. Disconnect the cable at the compensator and at both abutments on the chassis.

On single rear wheel axles

6. The cable can be split at a cable joint clip near the compensator.

If one cable only is to be changed, disconnect it at the clip, and at the chassis abutment.

The right hand cable also has to be released from the compensator.

Refit

Refitting is the reverse of the removal procedure. A pair of long nosed pliers may be of assistance when fitting the clips.

7. Check that the brake linkage has not been disturbed before fitting the brake drum.
8. Check that the brake shoes are correctly adjusted. Ensure that the access slot plugs are refitted.
9. Check the handbrake operation and adjust if necessary (see section 'Handbrake Adjustment' for details).
10. Refit the road wheels and lower the rear of the vehicle to the ground; tighten the wheel nuts to the correct torque. Check the operation of both hand and foot brakes.

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