

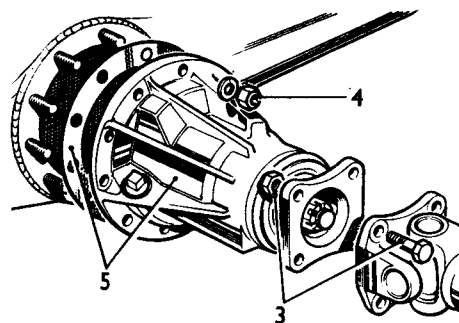
## DIFFERENTIAL ASSEMBLY

Remove and refit 54.10.01

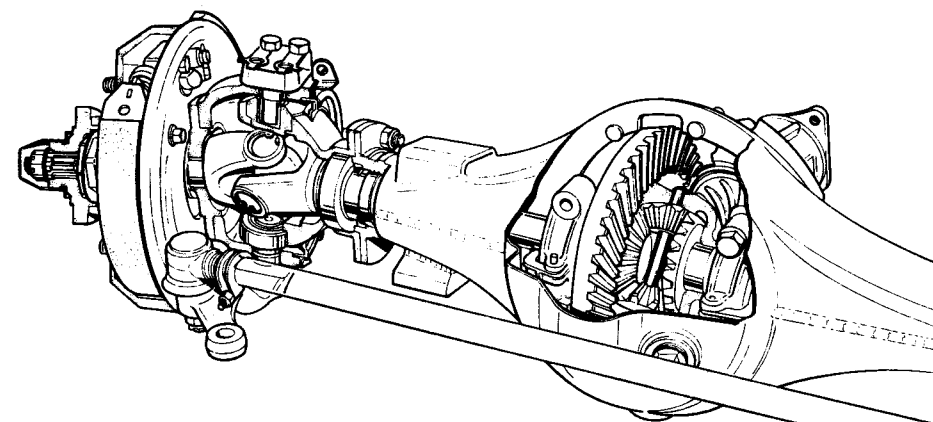
Service tool: 601763 Ball joint extractor

### Removing

- 1 Remove the half shafts and swivel axles. 54.20.01.
- 2 Drain the differential housing.
- 3 Disconnect the front propeller shaft at the front axle.
- 4 Remove the nuts and spring washers securing the differential to the axle.
- 5 Withdraw the differential assembly and gasket.



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### Refitting

- 6 Ensure that the mating faces of the differential flange and axle casing are clean. Renew the gasket.
- 7 Reverse instructions 1 to 5.
- 8 Bleed the brakes.

## DIFFERENTIAL ASSEMBLY

Overhaul 54.10.07

Service tools:

Press 47

Pinion height gauge. 605004.

Pinion head bearing remover. 18G 47 BK.

Pinion bearing track remover/replacer. 262757, 262757/1.

Spanner bearing nuts. 530105.

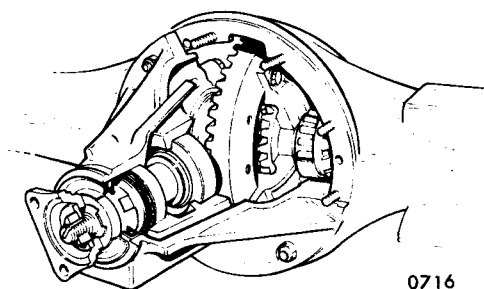
Dial gauge. 18G 191.

Flange holder. 18G 1205.

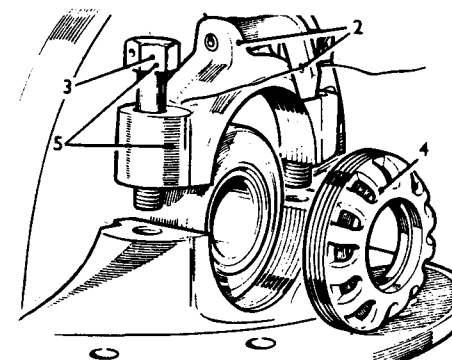
### Dismantling

It is essential that differential components are marked in their original positions and relative to other components so that, if refitted, their initial setting is maintained. Note that the bearing caps must not be interchanged.

- 1 Remove the differential assembly from the axle. 54.10.01.
- 2 Drift out the roll pin securing the bearing nut locking fingers to the bearing caps. Remove the locking fingers.
- 3 Slacken the bearing cap bolts.
- 4 Remove the bearing adjusting nuts.
- 5 Remove the bearing cap bolts and bearing caps.



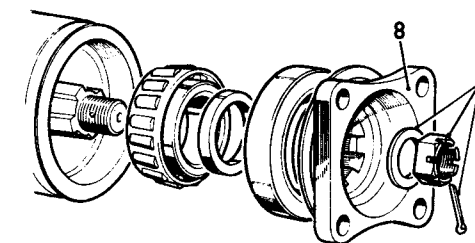
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- 6 Lift out the crown wheel, differential unit and bearings.
- 7 Remove the split pin, slotted nut and washers securing the pinion flange. Flange holder tool 18G 1205.
- 8 Withdraw the pinion flange.

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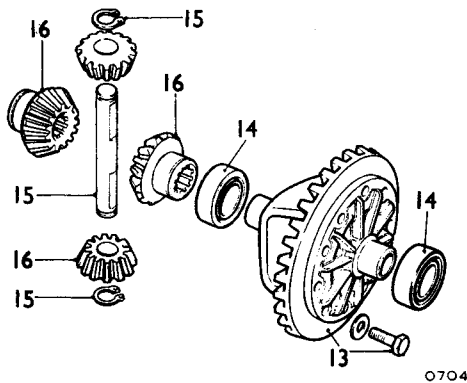


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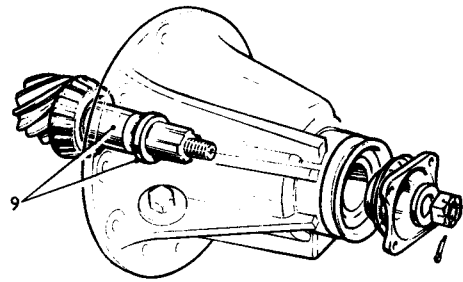
- 9 Withdraw the pinion complete with pinion head bearing and outer bearing shims. Withdraw the shims.
- 10 Remove the pinion flange oil seal, spacer and bearing. Discard the oil seal.
- 11 Remove the pinion head bearing track and shim and the outer bearing track from the differential housing. Tool 262757.
- 12 Remove the pinion head bearing. Tool 18G 47 BK.
- 13 Remove the bolts and washers securing the crown wheel to the differential flange. Withdraw the crown wheel.
- 14 Remove the differential carrier bearings.
- 15 Remove the circlips securing the differential cross shaft. Extract the cross shaft.
- 16 Withdraw the differential gears and pinions.
- 17 Thoroughly clean all components.

#### Inspecting

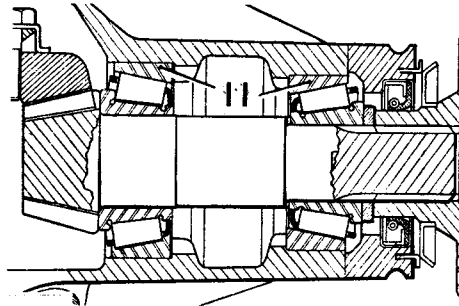
- 18 Check all bearings for wear and/or pitting.
- 19 Check all gears for wear, scuffing, pitting and damaged teeth.
- 20 Note: The crown wheel and pinion are supplied as a matched set, and also the pinion housing and bearing caps.



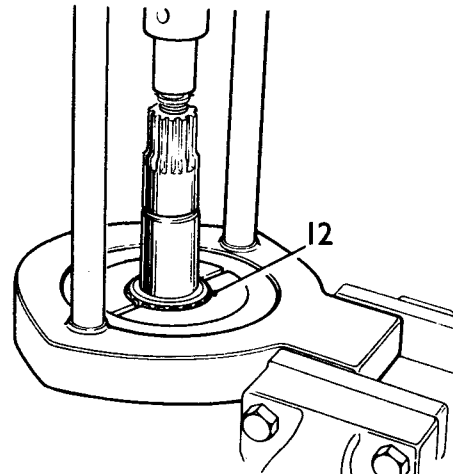
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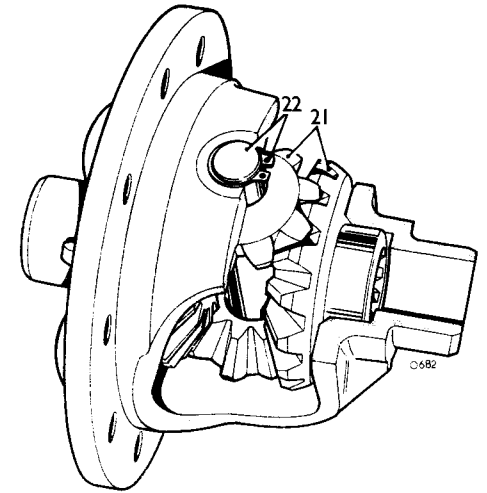


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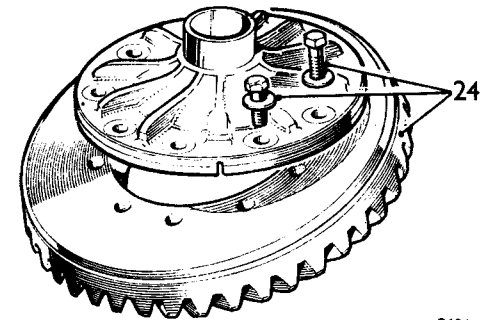
#### Assembling

##### Differential gears

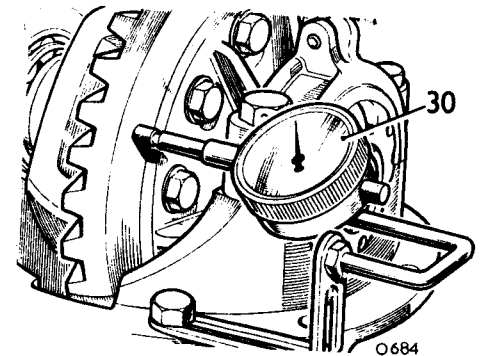
- 21 Fit the differential gears to the differential housing.
- 22 Fit the differential cross shaft and retaining circlips.
- 23 Check the gears for freedom of rotation and backlash. Nominal backlash should be present. Excessive backlash will necessitate renewal of the gears and/or the differential housing. No provision is made for backlash adjustment.
- 24 Ensuring that the differential housing flange and crown wheel are thoroughly clean fit the crown wheel. Fit the crown wheel bolts and washers and evenly tighten.
- 25 Fit the carrier bearings and bearing tracks.
- 26 Place the differential housing complete with crown wheel and bearings in the pinion housing.
- 27 Fit the bearing caps and bolts. Do not fully tighten the bolts.
- 28 Fit the bearing adjusting nuts and adjust to obtain zero end-float.
- 29 Tighten the bearing cap bolts.
- 30 Using a dial gauge check the crown wheel for run-out. This should not exceed 0,10 mm (0.004 in.). If excessive run-out is recorded remove the crown wheel and examine crown wheel and mounting flange for burrs, grit etc. Refit the crown wheel and recheck. Run-out, attributable to a buckled or damaged differential housing flange can be corrected only by renewing the differential gear housing.
- 31 When satisfied that run-out is within the specified limits remove the differential housing from the pinion housing.
- 32 Remove the crown wheel bolts and refit them using Loctite Studloc. Evenly tighten the bolts to 6,3 to 7,6 kgf. m (45 to 55 lbf. ft.).



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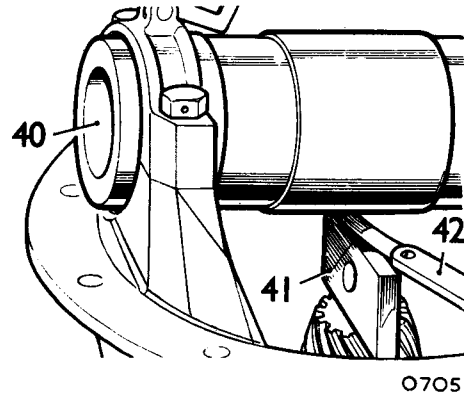
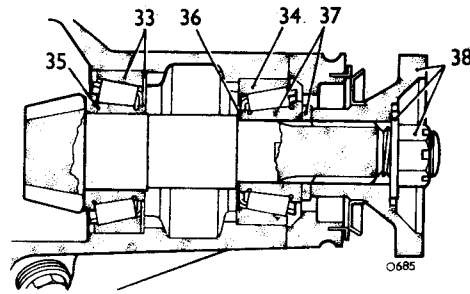
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**Pinion**

- 33 Fit the pinion head bearing track and the original shim to the pinion housing. Tools 262758, 262757. If the original shim was damaged or mislaid use a new shim of at least 1,27 mm (0.050 in.) thickness.
- 34 Fit the pinion outer bearing track to the pinion housing.
- 35 Fit the pinion head bearing to the pinion.
- 36 Slide the original shim (bearing pre-load) into position on the pinion shaft. If the original shim was damaged or mislaid use a new shim of at least 4,06 mm (0.160 in.) thickness.
- 37 Enter the pinion in its location in the pinion housing and fit the outer bearing and spacer.
- 38 Fit the driving flange, washer and nut. Do not fit the oil seal at this stage.
- 39 With the pinion flange nut tightened to a torque of 9,6 to 16,5 kgf. m (70 to 120 lbf. ft.) the force required to rotate the pinion shaft should be within 6,9 to 28,7 kgf. cm (6 to 25 lbf. ins.) when initial inertia has been overcome. Change the bearing pre-load shim as necessary to obtain this requirement. A thicker shim will reduce pre-load; a thinner shim will increase pre-load.
- 40 Locate the pinion height gauge in the pinion housing and secure with the bearing caps.



**NOTE:** Four variations of height gauge are in use. These are 601998, 262761, 600299 and 605004; any of these gauges may be used.

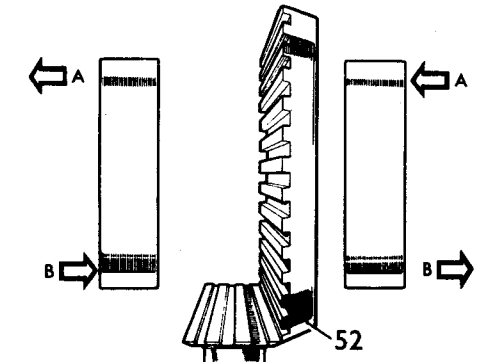
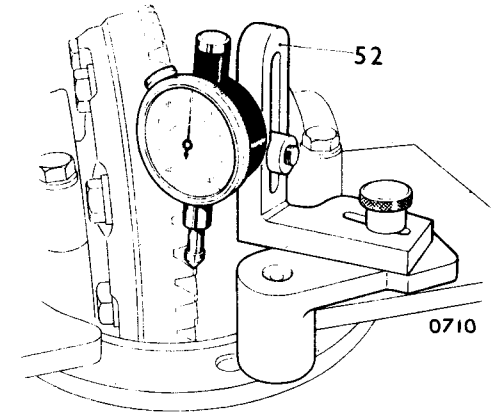
- 41 Place the slip gauge on the pinion face and hold firmly in place.

- 42 Using feeler gauges measure the clearance between the slip gauge and the height gauge.  
The required clearance is:  
Height gauges 601998, 262761 and 600299. – 0,07 to 0,10 mm (0.003 to 0.004 in.).  
Height gauge 605004. – 0,28 to 0,30 mm (0.011 to 0.012 in.).  
Determine the shim thickness required for the pinion head bearing to obtain the above requirement.

- 43 Remove the pinion head bearing track and substitute a shim of the calculated thickness.

**NOTE:** Adjustment to the pinion head shim will necessitate an equal plus or minus adjustment to the bearing pre-load shim.

- 44 Refit the pinion head bearing and recheck clearance (Instruction 42).
- 45 If clearance is satisfactory remove the pinion height gauge. If clearance is incorrect repeat instruction 43.
- 46 Remove the pinion flange.
- 47 Smear the outer periphery of the new pinion flange oil seal with jointing compound. Fit the oil seal (seal lips towards the pinion).
- 48 Lubricate the seal lips and fit the flange, nut and split pin. Nut torque (70 to 120 lbf. ft.).
- 49 Place the differential housing in the pinion housing.
- 50 Fit the bearing caps and bolts. Do not fully tighten the bolts.
- 51 Fit the bearing adjusting nuts.
- 52 Set crown wheel/pinion backlash to 0,20 to 0,25 mm (0.008 to 0.010 in.) with zero end-float. Move the serrated adjusting nuts in direction A to reduce backlash: move in direction B to increase backlash.
- 53 Tighten both adjusting nuts half a serration.
- 54 Evenly tighten the bearing cap bolts torque 8,3 kgf. m (60 lbf. ft.).
- 55 Recheck crown wheel/pinion backlash.
- 56 Bend the locking fingers to accommodate adjusting nut serrations as required. Fit the locking fingers and roll pins.
- 57 Lubricate the bearings and gears.



**DATA**

Pinion bearing pre-load	7.6 to 13 kgf. cm (7 to 12 lbf. ins.)
Pinion height setting	Gauges. 601998, 262761, 600299 0,07 to 0,10 mm (0.003 to 0.004 ins.) Gauge. 605004 0,28 to 0,30 mm (0.011 to 0.012 in.)
Crown wheel run-out	0,10 mm (0.004 in.)
Crown wheel/pinion backlash	0,20 to 0,25 mm (0.008 to 0.010 in.)

## DIFFERENTIAL ASSEMBLY

From the following axle numbers:  
 109" and 88" Land Rover front axle right hand drive ..... 91133272H  
 109" and 88" Land Rover front axle left hand drive ..... 91452230H  
 88" Land Rover rear axle ..... 90260573G

### Overhaul 54.10.07

#### Service tools:

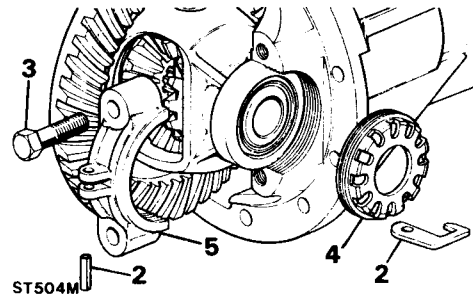
18G 1205	Flange holding wench.
18G 191	Pinion height setting gauge.
18G 191-4	Universal setting block.
18G 47-6	Pinion head bearing remover/replacer
18G 1382	Oil seal replacer.
RO 262757A	Extractor for pinion bearing cups.
RO 262757-1	Replacer — use with RO 262757A.
RO 262757-2	Adaptor tail bearing cup replacer.
RO 530105	Spanner — differential flange and carrier bearing nuts.
RO 530106	Bracket for dial gauge indicator.
MS 47	Press.

#### Dismantling

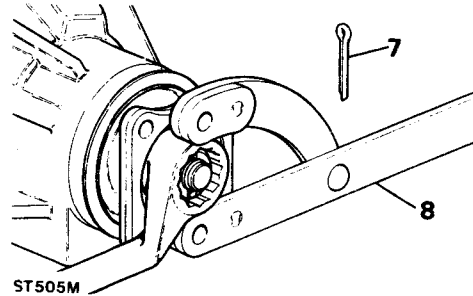
It is essential that differential components are marked in their original positions and relative to other components so that, if refitted, their initial setting is maintained.

**NOTE:** The bearing caps must not be interchanged.

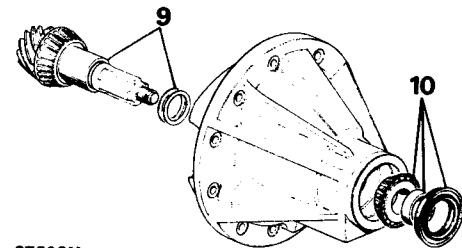
- 1 Remove the differential assembly from the axle. 54.10.01.
- 2 Drift out the roll pin securing the bearing nut locking fingers to the bearing caps. Remove the locking fingers.
- 3 Slacken the bearing cap bolts, and mark the caps for reassembly.
- 4 Remove the bearing adjusting nuts.
- 5 Remove the bearing cap bolts and bearing caps.



- 6 Lift out the crown wheel, differential unit and bearings.
- 7 Remove the split pin securing the pinion flange nut.
- 8 Remove the pinion flange nut using Service tool 18G 1205.

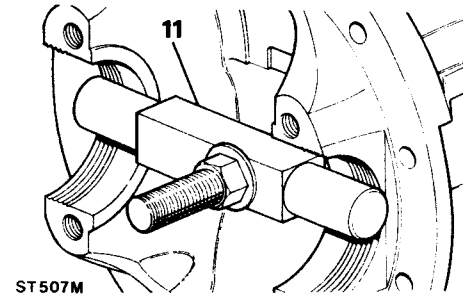


- 9 Withdraw the pinion complete with pinion head bearing and outer bearing shims. Withdraw the shims.
- 10 Remove the pinion flange oil seal spacer and bearing. Discard the oil seal.

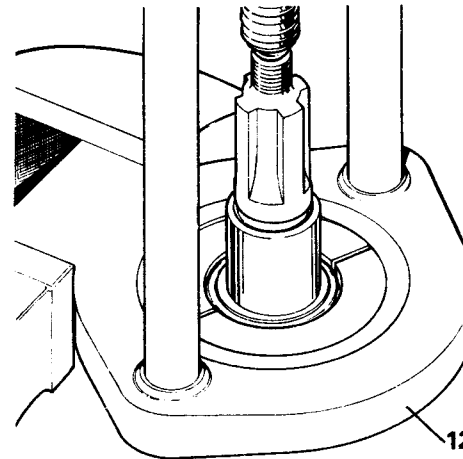


ST506M

- 11 Using Service tool RO 262757A, remove the pinion head bearing track from the differential housing.

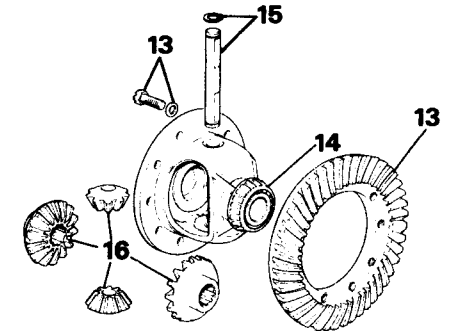


- 12 Remove the pinion head bearing with service tool MS47 and adaptor 18G 47-6.



ST508M

- 13 Remove the bolts and washers securing the crown wheel to the differential flange. Withdraw the crown wheel.
- 14 Remove the differential carrier bearings.
- 15 Remove the circlips securing the differential cross shaft. Extract the cross shaft.
- 16 Withdraw the differential gears and pinions.
- 17 Thoroughly clean all components.



ST509M

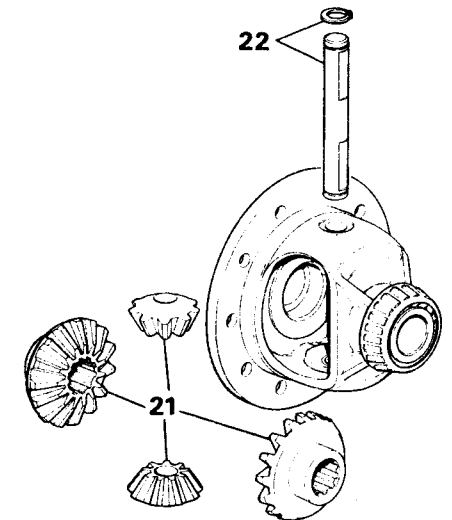
#### Inspecting

- 18 Check all bearings for wear and/or pitting.
- 19 Check all gears for wear, scuffing, pitting and damaged teeth.
- 20 **NOTE:** The crown wheel and pinion are supplied as a matched set, also the pinion housing and bearing caps.

#### Assembling

##### Differential gears

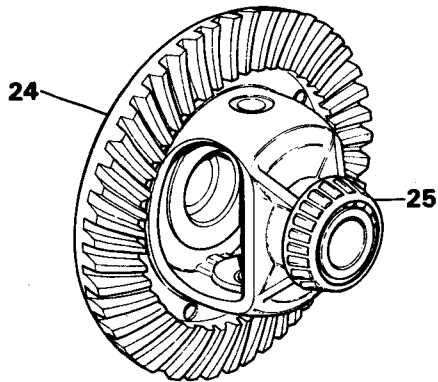
- 21 Fit the differential gears to the differential housing.
- 22 Fit the differential cross shaft and retaining circlips.



ST510M

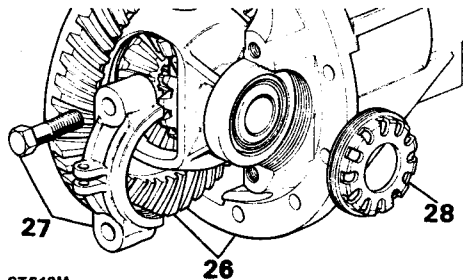
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- 23 Check the gears for freedom of rotation and backlash. Nominal backlash should be present. Excessive backlash will necessitate renewal of the gears and/or the differential housing. No provision is made for backlash adjustment.
- 24 Ensuring that the differential housing flange and crown wheel are thoroughly clean fit the crown wheel. Fit the crown wheel bolts and washers and evenly tighten.
- 25 Fit the carrier bearings using a suitable press or drift and assemble the tracks to the bearings.



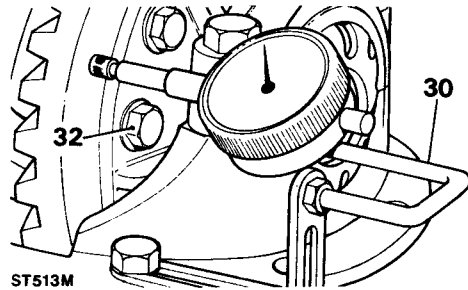
ST511M

- 26 Place the differential housing complete with crown wheel and bearings in the pinion housing.
- 27 Fit the bearing caps and bolts. Do not fully tighten the bolts.
- 28 Fit the bearing adjusting nuts and adjust to obtain zero end-float.
- 29 Tighten the bearing cap bolts.



ST512M

- 30 Using a dial gauge check the crown wheel for run-out. This should not exceed 0.10 mm (0.004 in). If excessive run-out is recorded remove the crown wheel and examine crown wheel and mounting flange for burrs, grit etc. Refit the crown wheel and recheck. Run-out, attributable to a buckled or damaged differential housing flange can be corrected only by renewing the differential gear housing.
- 31 When satisfied that run-out is within the specified limits remove the differential housing from the pinion housing.
- 32 Remove the crown wheel bolts and refit them using Loctite Studloc. Evenly tighten the bolts to 6,3 and 7,6 kgf. m (45 to 55 lbf. ft.).

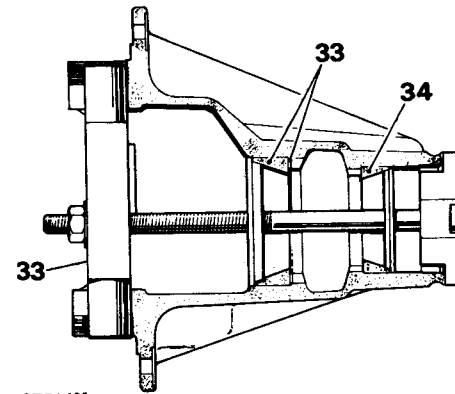


ST513M

#### Pinion

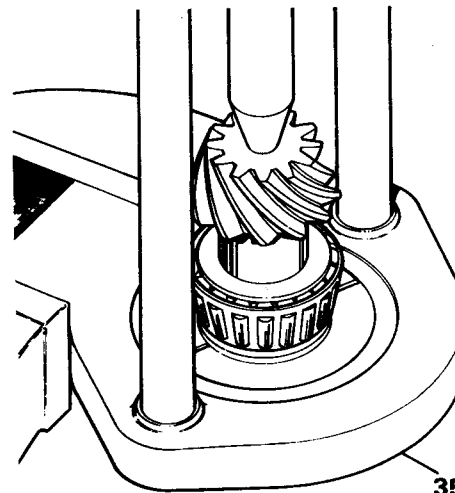
- 33 Fit the pinion head bearing track and the original shim to the pinion housing, using Service tools RO 262757A and RO 262757-1. If the original shim was damaged or mislaid use a new shim of at least 1,27 mm (0.050 in) thickness.
- 34 Fit the pinion outer bearing track to the pinion housing with Service tool RO 262757A and RO 262757-2.

**NOTE:** Instructions 33 and 34 are carried out in one operation, as illustrated.



ST514M

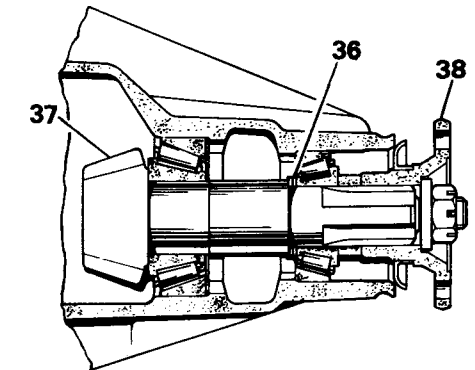
- 35 Fit the pinion head bearing to the pinion using Service tools MS 47 and 18G 47-6.



ST515M

- 36 Slide the original shim (bearing pre-load) into position on the pinion shaft. If the original shim was damaged or mislaid use a new shim of at least 4,06 mm (0.160 in) thickness.
- 37 Enter the pinion in its location in the pinion housing and fit the outer bearing and spacer.

- 38 Fit the driving flange washer and nut.
- 39 Do not fit the oil seal at this stage.
- 40 With the pinion flange nut tightened to a torque of 9,6 to 16,5 kgf. m (70 to 120 lbf. ft.) the force required to rotate the pinion shaft should be within 6,9 to 28,7 kgf. cm (6 to 25 lbf. in) when initial inertia has been overcome. Change the bearing pre-load shim as necessary to obtain this requirement. A thicker shim will reduce pre-load; a thinner shim will increase pre-load.

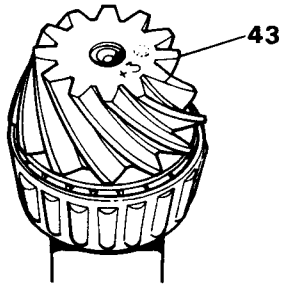


ST516M

#### Drive pinion markings

- 41 Check that the serial number marked on the pinion end face matches that marked on the crown wheel.
- 42 The markings on the end face adjacent to the serial number are of no significance during servicing.
- 43 The figure marked on the end face opposite to the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. *An unmarked pinion must be set at nominal.*
- 44 The nominal setting dimension is represented by the setting gauge block 18G 191-4 which is referenced from the pinion end face to the bottom radius of the differential bearing bore.

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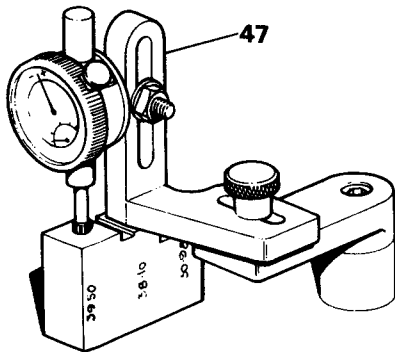
ST517

#### Drive pinion adjustment

- 45 Ensure that the pinion end face is free of raised burrs around the etched markings.  
 46 Remove the keep disc from the magnetised base of dial gauge tool 18G 191.  
 47 Place the dial gauge and setting block on a flat surface and zero the dial gauge stylus on the setting gauge.

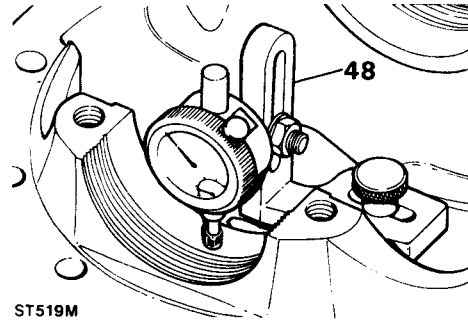
**NOTE:** The setting block has three setting heights as follows:

- 39.50 Rationalised axle.  
 38.10 Pre-rationalised axle.  
 30.93 Salisbury axle.



ST518M

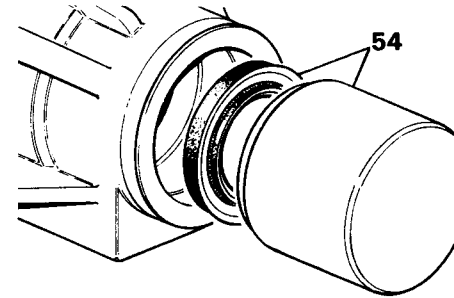
- 48 Position the dial gauge centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore. Note the dial gauge deviation from the zeroed setting.



ST519M

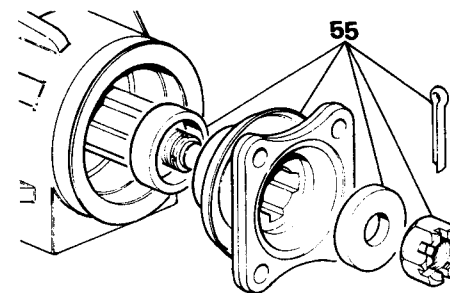
- 49 Repeat on the other bearing bore. Add together the readings then halve the sum to obtain the mean reading. Note whether the stylus has moved up or down from the zeroed setting.
- Where the stylus has moved down, the amount is equivalent to the thickness of the shims that must be removed from under the pinion inner cup to bring the pinion down to the nominal position.
  - Where the stylus has moved up, the amount is equivalent to the additional thickness of shims required to bring the pinion up to the nominal position.
- 50 Before adjusting the shim thickness check the pinion face marking and if it has a plus (+) figure, subtract that amount in thousandths of an inch from the shim thickness figure obtained in the previous item.  
 51 Alternatively, if the pinion has a minus (-) figure, add the amount to the shim thickness figure. Adjust the shim thickness under the pinion inner cup as necessary.  
 52 Recheck the pinion height setting; if the the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of +3, the dial gauge reading should indicate that the pinion is +0.003in.  
 53 Remove the pinion flange.

- 54 Smear the outer periphery of the new pinion flange oil seal with jointing compound. Fit the oil seal (seal lips toward the pinion) using Service tool 18G 1382 oil seal replacer.



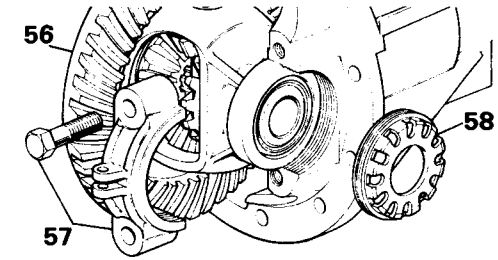
ST520M

- 55 Lubricate the seal lips and apply grease to the seal spring. Fit the distance piece and flange and secure with the washer, nut and new split pin. Tighten the nut to 9.6 to 16.5 kgf. m (70 to 120 lbf. ft.).



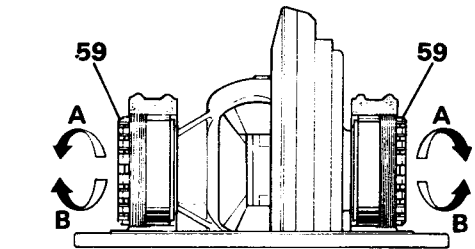
ST521M

- 56 Place the differential housing in the pinion housing.  
 57 Fit the bearing caps and bolts. Do not fully tighten the bolts.  
 58 Fit the bearing adjusting nuts.



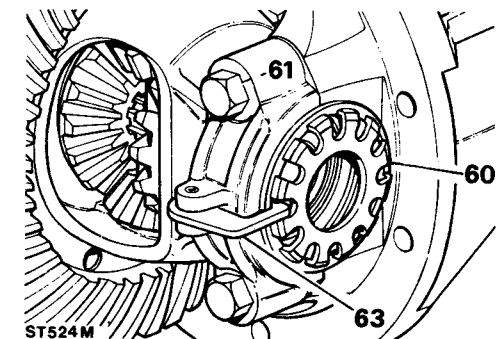
ST522M

- 59 Set crown wheel/pinion backlash to 0,20 to 0,25 mm (0.008 to 0.010 in) with zero end-float. Move the serrated adjusting nuts in direction A to reduce backlash,



ST523M

- move in direction B to increase backlash.  
 60 Tighten both adjusting nuts half a serration.  
 61 Evenly tighten the bearing cap bolts torque 8,3 kgf. m (60 lbf. ft.).  
 62 Recheck crown wheel/pinion backlash.  
 63 Bend the locking fingers to accommodate adjusting nut serrations as required. Fit the locking fingers and roll pins.  
 64 Lubricate the bearings and gears.



ST524M

## PINION OIL SEAL

Remove and refit

54.10.20

Service Tool: 18G 1205. Flange holder.

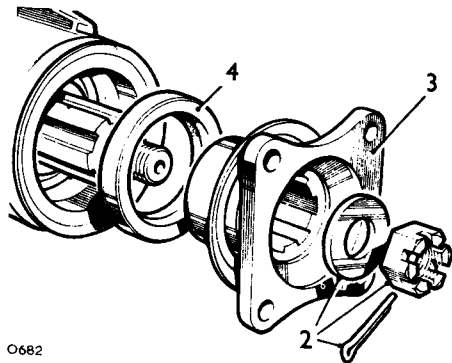
### Removing

- 1 Disconnect the propeller shaft from the front axle driving flange.
- 2 Remove the split pin, nut and washer securing the driving flange. Use tool 18G 1205 to hold the flange when slackening the nut. Do not impose loading on the pinion teeth.
- 3 Withdraw the driving flange.
- 4 Prise out the oil seal and discard.

### Refitting

- 5 Thoroughly clean the seal recess in the pinion housing.
- 6 Smear the outer periphery of the new seal with jointing compound.
- 7 Evenly insert the seal. (Seal lip towards axle.)
- 8 Lubricate the seal lip and the seal contact area on the driving flange.
- 9 Fit the flange, washer and nut. Torque 9,6 to 16,5 kgf. m. (70 to 120 lbf. ft.). Fit a new split pin.
- 10 Connect the propeller shaft to the driving flange.

**NOTE:** Oil seal leakage can be caused by over-filled axle, worn driving flange or a restricted axle breather.



## FRONT AXLE ASSEMBLY

Remove and refit

54.15.01

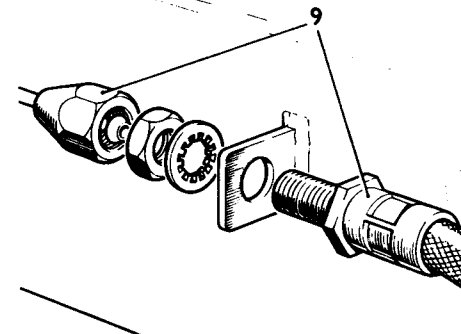
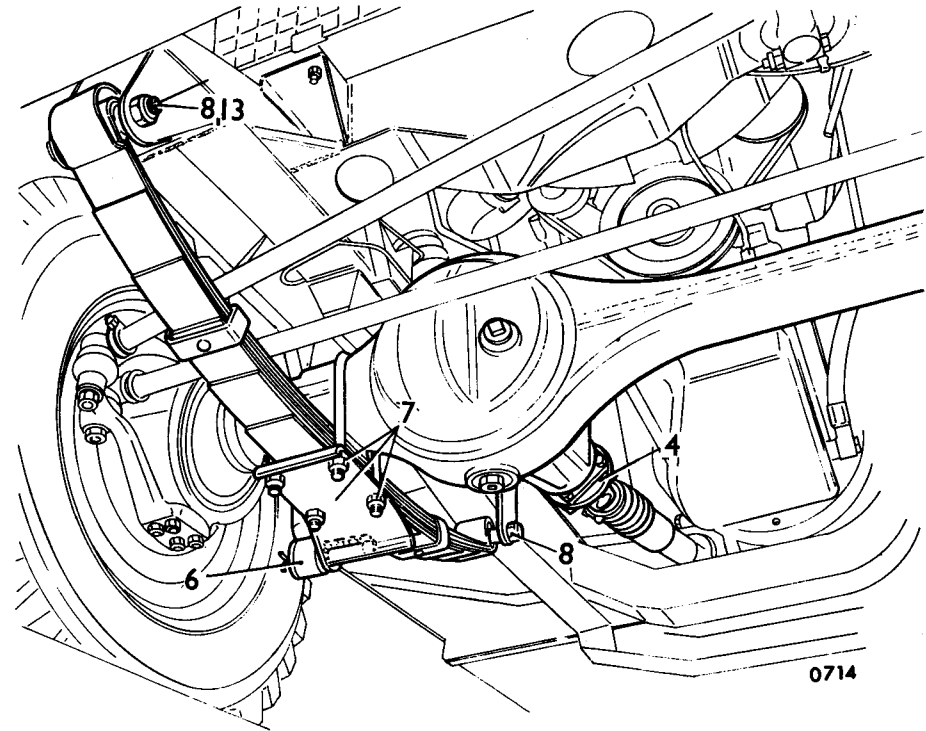
Service tool: 601763. Ball joint extractor.

### Removing

- 1 Slacken front wheel nuts.
- 2 Jack up the front of the vehicle and support the chassis securely on stands.
- 3 Remove the front wheels.
- 4 Disconnect the front propeller shaft from the front axle.
- 5 Disconnect the steering drag link from the relay lower lever using tool 601763 to release the ball joint.
- 6 Disconnect the lower ends of the shock absorbers from the front spring bottom plates.
- 7 Remove the four 'U' bolts and bottom plates securing the axle to the road springs.
- 8 Slacken the front spring shackle bolts.
- 9 Disconnect the front brake pipe unions from the front brake hoses.
- 10 Release the brake hoses from their respective chassis brackets.
- 11 Seal the brake pipe and brake hose to prevent ingress of foreign matter and loss of fluid.
- 12 Support the axle on a jack.
- 13 With an assistant to steady the axle withdraw the front shackle bolts and lower the front of the springs to the ground.
- 14 Carefully lower the jack and withdraw the front axle.

### Refitting

- 15 Using a jack and with the aid of an assistant, locate the axle in its approximate position under the vehicle.
- 16 Raise both front springs and fit the front shackle bolts and nuts. **DO NOT** tighten the shackle bolts, front or rear at this stage.
- 17 Lower the axle on top of the road springs ensuring that the spring centre bolts properly engage their axle locations.
- 18 Fit the 'U' bolts (short 'U' bolts outboard), spring bottom plates and nuts. Torque the nuts evenly to 10,4 kgf m (75 lbf ft).



- 19 Engage the brake hoses in their respective chassis brackets and secure with shakeproof washer and nut. Ensure that the hoses are not twisted or kinked.

- 20 Fit the brake pipes to the brake hoses.
- 21 Connect the propeller shaft to the front axle.
- 22 Connect the drag link to the steering relay lever.
- 23 Connect the shock absorbers to the spring bottom plate.
- 24 Bleed the brakes. 70.25.02.
- 25 Adjust the front brakes as necessary.
- 26 Check and if necessary adjust the steering stop 57.65.03.
- 27 Fit the road wheels.
- 28 Remove the chassis stands and lower the vehicle to the ground.
- 29 Evenly tighten the road wheel nuts. Torque.
- 30 Check axle and swivel joint oil levels and top up as required.
- 31 Tighten all front spring shackle bolts. Refer 60.20.01 instructions 11 to 13.

**AXLE CASE OIL SEAL**

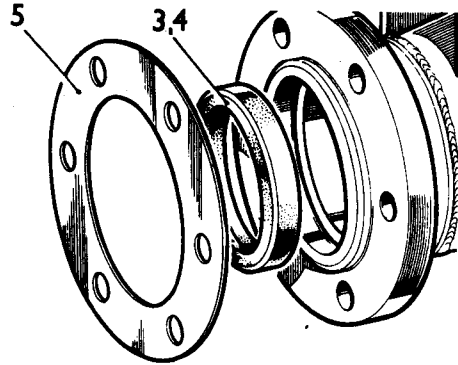
Removing and refit 54.15.04

**Removing**

- 1 Remove the half shaft and swivel axle assembly. 54.20.01.
- 2 Prise out the axle case oil seal.

**Refitting**

- 3 Smear the oil seal outside periphery with jointing compound.
- 4 Fit the oil seal, lip inward towards the axle.
- 5 Fit the joint washer using jointing compound.
- 6 Reverse instruction 1.



0711

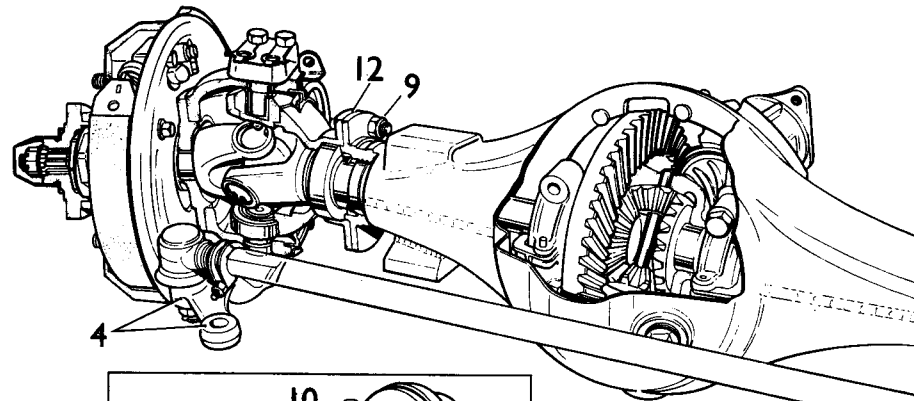
**HALF SHAFT AND SWIVEL AXLE**

Remove and refit 54.20.01

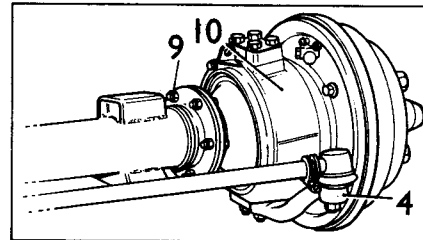
Service tool: 601763 Ball joint extractor.

**Removing**

- 1 Slacken the road wheel nuts associated with the half shaft to be removed.
- 2 Jack up the front of the vehicle and support securely on stands.
- 3 Remove the road wheel.
- 4 Disconnect the track rod end from the track arm. Tool 601763. If the swivel axle to be removed is on the steering wheel side of the vehicle disconnect also the drag link from the steering arm.
- 5 Disconnect the brake pipe union nut from the flexible brake hose.



0712



- 6 Disconnect the flexible brake hose from its bracket.
- 7 Seal the brake pipe and hose to prevent loss of fluid and to prevent the ingress of foreign matter.
- 8 Note the location of the steering stop bracket and the jack stop plate fitted to the axle flange.
- 9 Remove the six bolts and nuts clamping the swivel axle/front axle flanges.
- 10 Withdraw the half shaft and swivel axle assembly.

**Refitting**

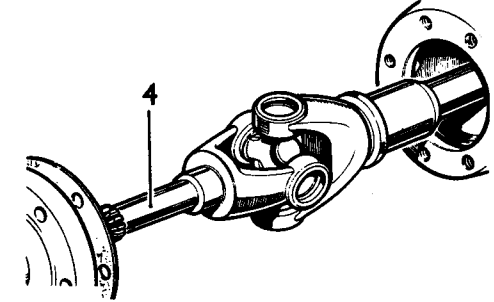
- 11 Thoroughly clean the swivel axle and front axle flanges.
- 12 Using jointing compound fit a new gasket to the axle flange.
- 13 Reverse instructions 1 to 10.
- 14 Bleed the brakes.

**HALF SHAFT**

Remove and refit 54.20.07

**Removing**

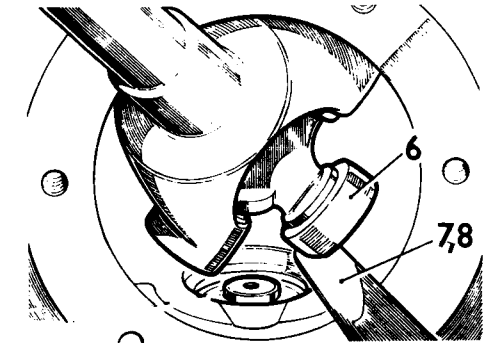
- 1 Drain the swivel housing.
- 2 Remove the wheel hub. 60.25.01.
- 3 Remove the stub axle. 60.25.22.
- 4 Withdraw the axle half shaft complete.



0700

**Refitting**

- 5 Fit the half shaft, long end first, taking care to avoid damaging the axle case oil seal.
- 6 Carry out the following check, item 7, at the top and bottom swivel pins with the yokes at the maximum angle with the chamfered radius closest to the swivel pin end face.
- 7 Rotate the half shaft and check that there is a minimum clearance of 1,2 mm (0.050 in.) between the joint yoke ears and the swivel pin end faces.
- 8 If the clearance is insufficient, increase the chamfer on the yoke ears radius.
- 9 Reverse instructions 1 to 3.



0701



## HALF SHAFT

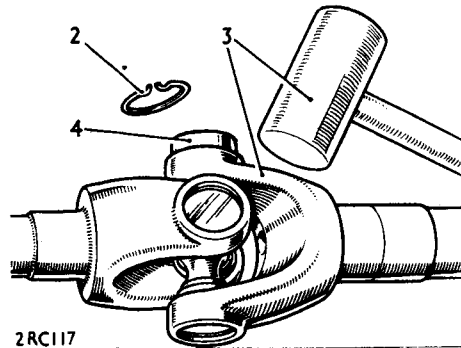
Overhaul

54.20.09

Service tool: 275870. Axle shaft collar remover/replacer

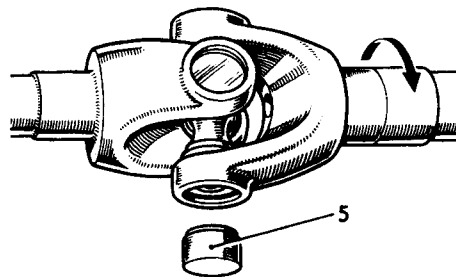
### Dismantling the universal joint

- 1 Remove the half shaft. 54.20.07.
- 2 Remove the circlips from the universal joint.
- 3 With one of the stub shaft yoke lugs uppermost tap the radius of the yoke.
- 4 The top bearing should then begin to emerge from the yoke.



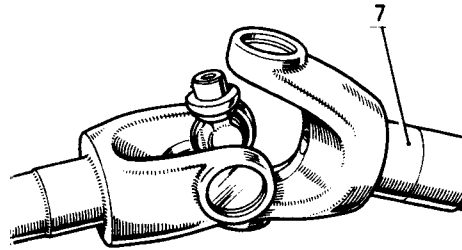
2RC117

- 5 Turn the joint over and withdraw the bearing downwards to retain the needle rollers.
- 6 Repeat items 2 to 5 to remove the opposite bearing.



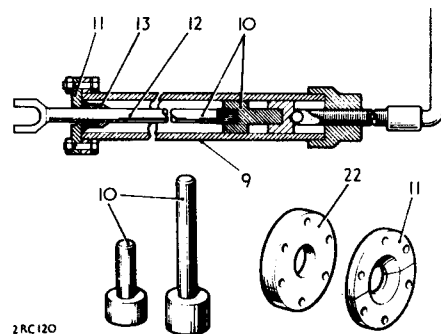
2RC118

- 7 Separate the stub shaft from the spider journals.
- 8 Remove the half shaft bearings in the same manner as already described for the stub shaft.
- 9 Clamp the extractor tube in a vice.



2RC119

- 10 Position adaptor No. 2 or No. 3, as applicable, onto the shaft and insert the assembly into the extractor tube.
- 11 Secure the shaft to the extractor, using adaptor No. 5.
- 12 Screw in the arm and press the shaft from the retainer collar, bearing and conical distance piece.
- 13 Remove the adaptors, discard the retaining collar.



2RC120

### Inspection

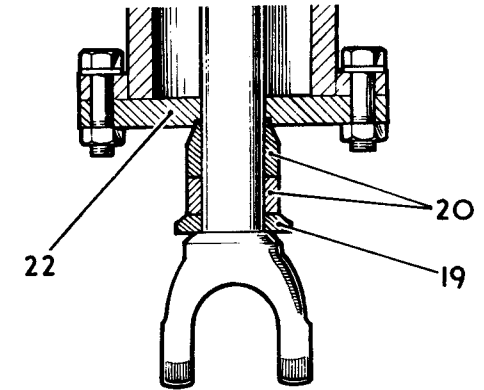
- 14 Examine all components for obvious wear or damage.
- 15 If the journal or bearings for the universal joint show any signs of wear, load markings or distortion, they must be renewed completely.
- 16 The bearing races should be a light press fit in the yoke trunnions.
- 17 In the event of wear taking place in any of the four yoke holes, rendering them oval, a new stub shaft or half shaft must be fitted.
- 18 The bearing inner race must be a light press fit on the axle half shaft.

### Reassembling the half shaft

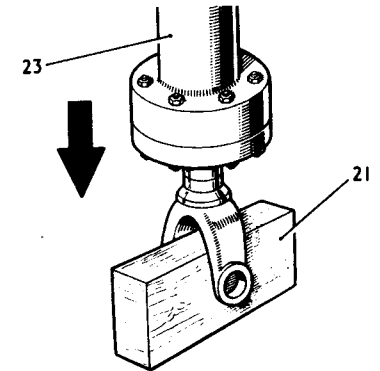
- 19 Fit the conical distance piece over the half shaft with the internal chamfer to the radius on the shaft.
- 20 Place the roller race inner member and a new retaining collar over the half shaft with the chamfer towards the splined end.
- 21 Stand the shaft on end on a block of hard wood.
- 22 Bolt adaptor No. 4 to the tool with the recess towards the collar.
- 23 Drive the collar onto the shaft, using the extractor tube as a ram.

### Reassembling the universal joint.

- 24 Assemble the needle rollers in the bearing races, if necessary using a smear of vaseline to retain them in place.
- 25 Insert the journal in the stub shaft yoke holes, and using a brass drift slightly smaller in diameter than the hole in the yoke, press the first bearing into position, and retain with a circlip.
- 26 Repeat the foregoing operation for the other three bearings.
- 27 Ensuring that all four circlips are firmly located in their grooves.
- 28 Check that the universal joint moves freely. If the joint appears to bind, hold one shaft so that the joint hangs free and tap the yoke ears lightly with a mallet.
- 29 Fit the half shaft and swivel axle assembly 54.20.01.



2RC121



2RC122



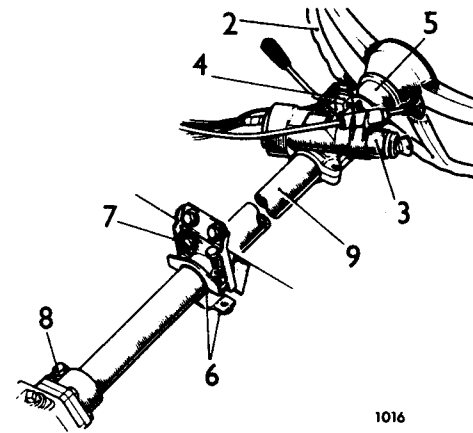
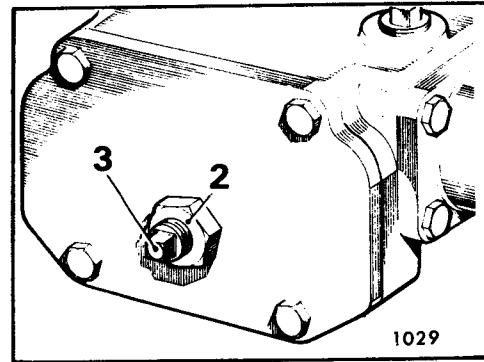
## STEERING BOX

Adjust

57.35.01

### Procedure

- 1 Set the road wheels in the straight ahead position.
- 2 Slacken the adjuster locknut.
- 3 Tighten the adjuster to reduce steering wheel backlash.
- 4 Tighten the locknut.



## STEERING COLUMN TOP BEARING

Remove and refit

57.40.19

### Removing

- 1 Disconnect the battery.
- 2 Remove the steering wheel. 57.60.01.
- 3 Remove the steering column lock. 57.40.31.
- 4 Remove the combination switch. 86.65.55.
- 5 Remove the direction indicator striker assembly and spring.
- 6 Remove the column clamp bracket and rubber.
- 7 Slacken the clamp adjuster bolts.
- 8 Slacken the pinch bolt securing the outer column to the steering box.
- 9 Withdraw the outer column.
- 10 Remove the column top bearing.

### Refitting

- 11 Reverse instructions 1 to 10.

## STEERING DAMPER

Remove and refit

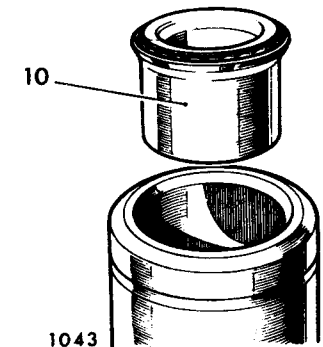
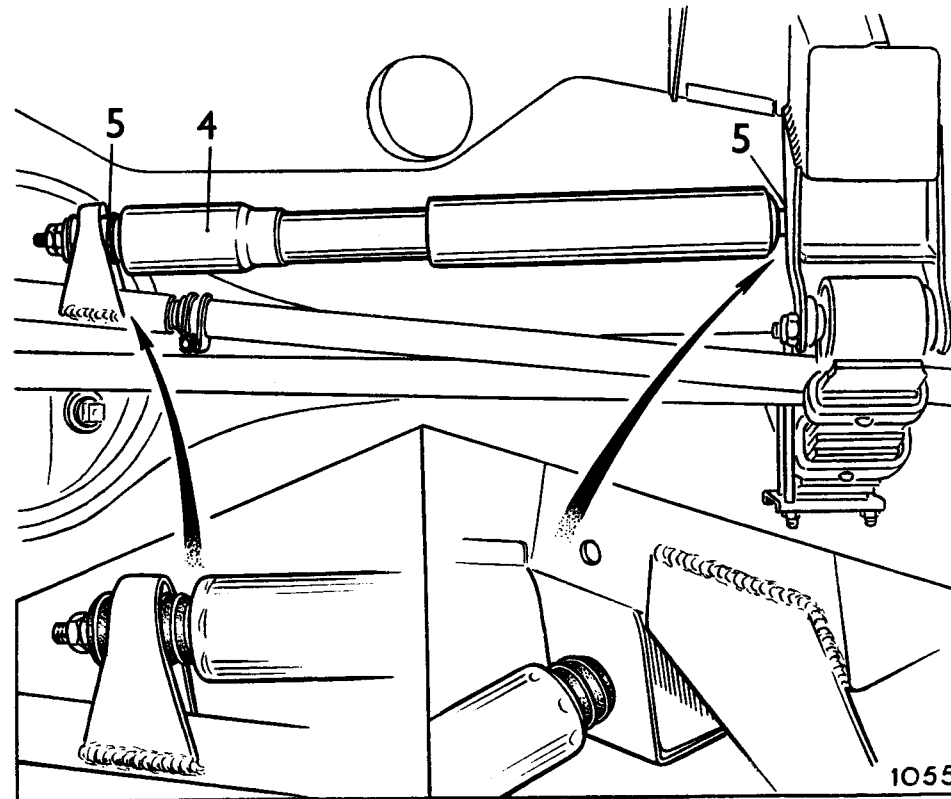
57.35.10

### Removing

- 1 Remove the locknut and nut securing the damper to the chassis bracket.
- 2 Remove the damper outer rubber mounting complete with inner and outer seating washers.
- 3 Repeat instructions 1 and 2 at the drag link end of the steering damper.
- 4 Withdraw the damper.
- 5 Remove the damper inner rubber mountings complete with inner and outer seating washers.

### Refitting

- 6 Fit the inner rubber mountings complete with inner and outer seating washers to both ends of the damper.
- 7 Locate the damper in position on the vehicle engaging the drag link and chassis bracket. Ensure that the sleeved end of the damper is fitted to the chassis bracket.
- 8 Fit the outer rubber mountings and inner and outer seating washers.
- 9 Fit the securing nuts and locknuts.



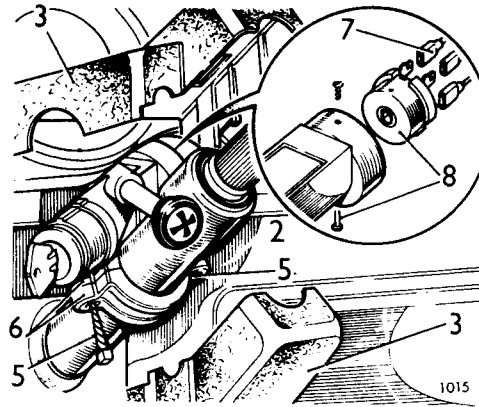
## STEERING COLUMN LOCK/ IGNITION/STARTER SWITCH ASSEMBLY

Remove and refit

57.40.31

### Removing

- 1 Disconnect the battery
- 2 Petrol models – disconnect the choke cable at the carburetter.  
Diesel models – disconnect the 'stop' cable at the injection pump.
- 3 Remove the steering column shroud.
- 4 Remove the lower fascia.
- 5 Using a centre punch carefully unscrew the sheared heads of the steering lock securing bolts. Should the bolts not unscrew using this method, drill the bolt centres and remove the bolts with an 'Easiout' extractor.
- 6 Withdraw the steering column lock and clamp.
- 7 Disconnect the electrical leads from the ignition/starter switch.
- 8 If required remove the fixing screws and remove the switch and also the choke or engine stop control as applicable.



### Refitting

- 9 Reverse instructions 8 as required.
- 10 Connect the electrical leads.
- 11 Reverse instructions 1 to 6.
- 12 Check the operation of the steering locks.  
Petrol models – The steering column should be unlocked when the ignition/starter key is at the 'Services' position and locked when the key is withdrawn.  
Diesel models – The engine stop control should be automatically locked out in the engine stop condition when the steering column is locked and free to return when the '11' position is selected on the lock/starter switch.

## STEERING COLUMN AND BOX ASSEMBLY

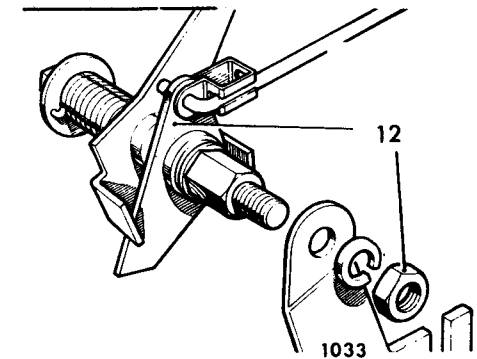
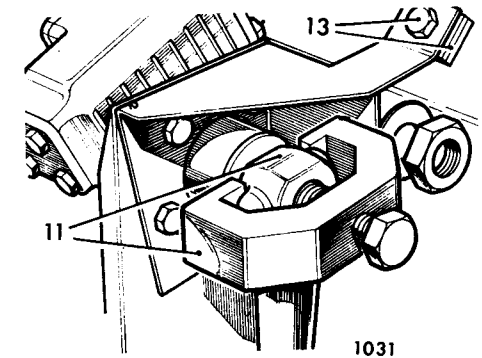
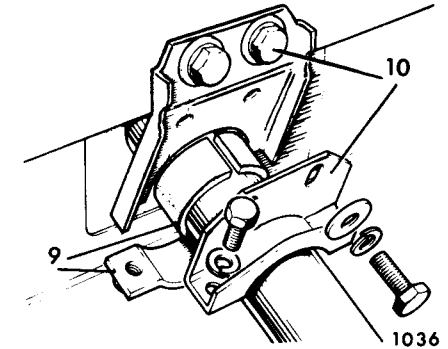
Remove and refit

57.45.01

Service tool: 600000 Drop arm remove  
601763 Ball joint extractor

### Removing

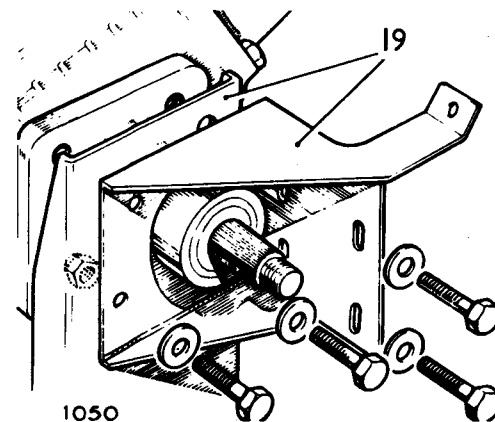
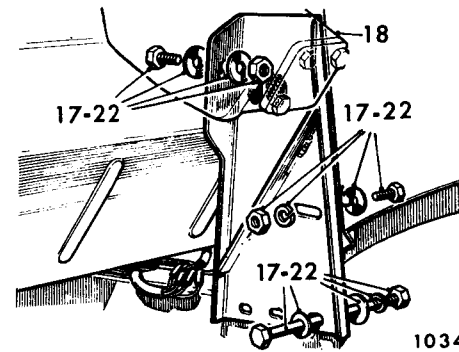
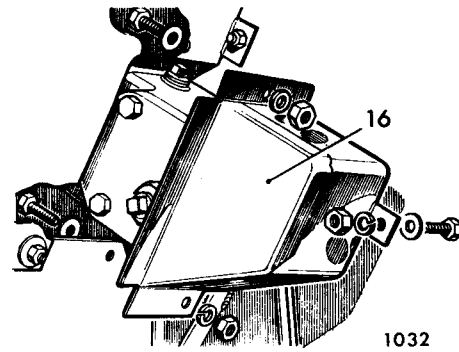
- 1 Fully open or remove the bonnet panel.
- 2 Disconnect the battery.
- 3 R.H. stg. models, remove the air cleaner.
- 4 Remove the steering wheel. 57.60.01.
- 5 Remove the lower fascia.
- 6 Remove the combined switch from the steering column. 86.65.55.
- 7 Where fitted, remove the steering column lock. 57.40.31.
- 8 On vehicles without a steering column lock, unscrew the lock ring and move aside the ignition/starter switch from the mounting bracket.
- 9 Remove the lower clamp bracket and rubber sleeve from the outer column.
- 10 Remove the upper clamp bracket and support bracket from the bulkhead.
- 11 Disconnect the steering drop arm and the attached longitudinal steering tube from the steering box, using tool 600000.
- 12 L.H. stg., 2½ litre Petrol models – disconnect the throttle linkage at the bracket attached to the steering box support bracket.



*continued*

- 13 Remove the fixings, steering box stiffener bracket to the toe box.
- 14 Raise the front of the vehicle and support on stands.
- 15 Remove the front road wheel, fitted to the steering side of the vehicle.
- 16 Remove the steering unit cover box from the wheel arch.
- 17 Remove the fixings, steering box support bracket to toe box, wing valance and chassis.
- 18 Withdraw the steering column and box assembly complete with attached brackets from beneath the front wing.
- 19 If required, remove the stiffener bracket and support bracket from the steering box.

**NOTE:** The steering box can be overhauled without removing the brackets.

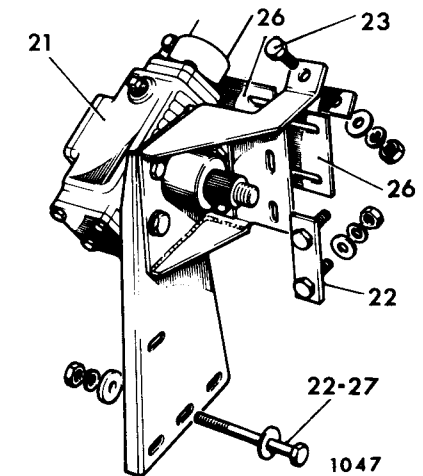
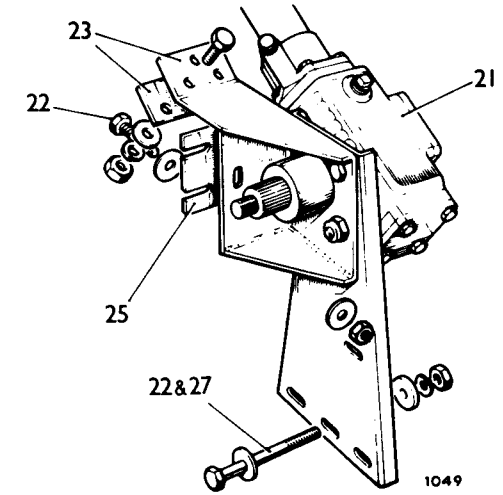


#### Refitting

- 20 If removed, fit the support bracket and stiffener brackets to the steering box. Torque 7,0 to 8,5 kgf. m (50 to 60 lbf. ft.).
- 21 Locate the steering box and bracket assembly, less drop arm, in position on the vehicle.
- 22 Retain the support bracket to the chassis, wing valance and toe box, but do not fully tighten the fixings at this stage.
- 23 Retain the steering box stiffener bracket to the toe box, but do not fully tighten the fixings at this stage. If necessary, fit shim washers between the stiffener bracket and the toe box to prevent distorting the toe box or bracket.
- 24 Reverse instructions 9 and 10.

**CAUTION:** DO NOT strain the steering column. If necessary, adjust the steering box position, using the slotted fixing holes in the support and stiffener brackets, to obtain a snug fit between the clamp upper half and the steering column, before securing the clamp halves.

- 25 L.H. stg. models – insert slotted packing pieces, as required, to take up clearance between support bracket and the toe box.
- 26 R.H. stg. models – insert slotted packing pieces, as required, to take up clearance between the support bracket and stiffener bracket and the toe box.
- 27 Secure the support bracket and stiffener bracket fixings. Torque load for support bracket to chassis fixings is 2,0 kgf. m (15 lbf. ft.).
- 28 Reverse instructions 4 to 13.
- 29 Set the steering box in its mid-position, that is, at the middle of its travel between left hand and right hand locks.
- 30 Set the front wheels in the straight ahead position.
- 31 Engage the drop arm on the steering box splines.
- 32 Fit the lock plate and nut. Nut torque, 8,5 to 11 kgf. m (60 to 80 lbf. ft.).
- 33 Bend over the lock plate.
- 34 Reverse instructions 1 to 3.



## STEERING COLUMN AND BOX ASSEMBLY

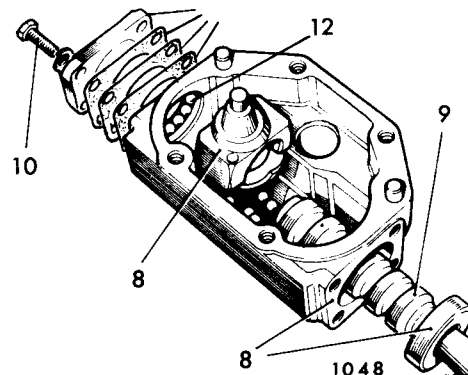
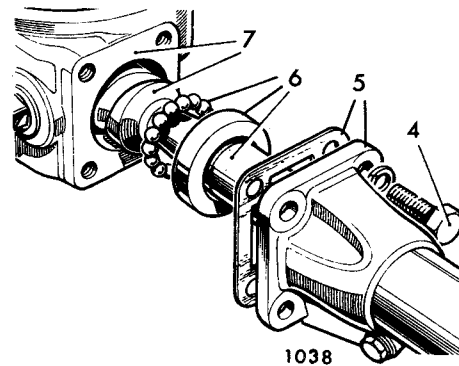
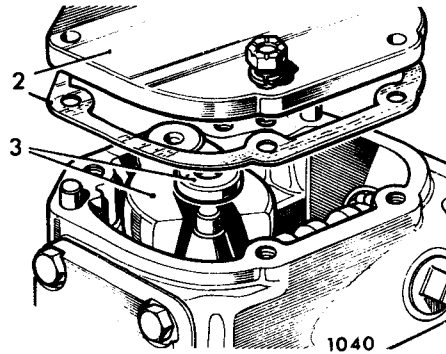
### Overhaul

57.45.07

- 1 Remove the steering column and box assembly from the vehicle. 57.45.01.
- 2 Remove the side cover and gasket and drain the oil from the steering box.
- 3 Rotate the inner steering column to locate the main nut and recirculating tube in its mid-position on the steering worm. Remove the roller for the main nut and the rocker shaft.
- 4 Remove the four bolts securing the steering column flange to the steering box. Removal of the column pinch bolt will facilitate access.
- 5 Withdraw the outer steering column, flange and gasket.
- 6 Gently jerk the inner steering column to extract the steering box upper bearing track and balls (10). Ensure the balls do not spill out when the track is released from the box.
- 7 Rotate the steering worm to release the main nut and recirculating tube.
- 8 Withdraw the main nut and recirculating tube and balls (12).
- 9 Withdraw the steering worm and inner column assembly.
- 10 Remove the four bolts securing the end plate.
- 11 Remove the end plate and shims.
- 12 Remove the lower bearing track and balls (10).
- 13 Remove the rocker shaft oil seal retaining washer and oil seal.
- 14 If rocker shaft bush renewal is intended, remove the bush.
- 15 If outer column top bearing renewal is intended, remove the bearing.

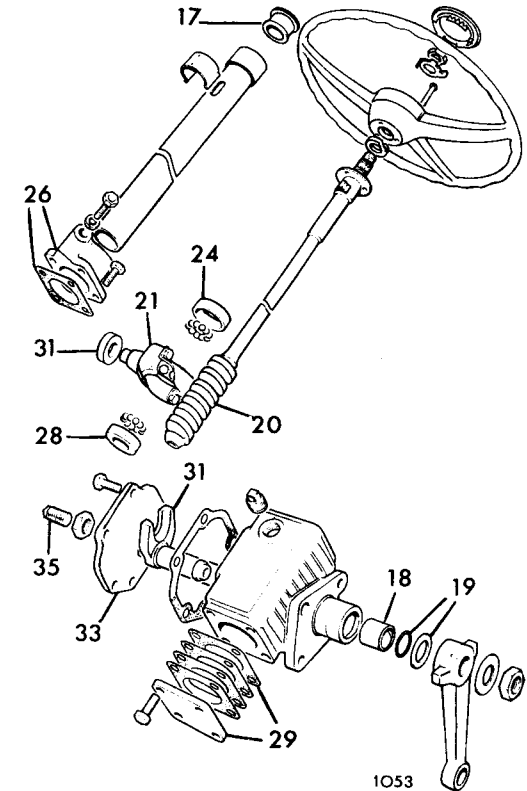
### Inspecting

- 16 Thoroughly clean and examine all components for wear or damage. Renew components as necessary. Wear in components is cumulative when related to steering wheel backlash.



### Assembling

- 17 Fit the top bearing (if removed) to the outer column.
- 18 Fit a new rocker shaft bush (if required).
- 19 Fit the rocker shaft oil seal and retaining washer. Stake the washer.
- 20 Enter the steering worm in the steering box.
- 21 Liberally coat the inner surfaces of the main nut and recirculating tube with grease. Install the balls (12).
- 22 Rotate the steering worm and engage the main nut and recirculating tube ensuring that the balls are not dislodged. Locate the main nut in mid-position in the worm.
- 23 Thoroughly coat the upper and lower bearing tracks with grease. Fit the balls, ten to each bearing track.
- 24 Slide the upper bearing track over the inner steering column and locate the track in the steering box.
- 25 Engage the worm in the bearing track ensuring that the balls are not dislodged.
- 26 Fit the gasket and outer steering column. Note that the column pinch bolt must be adjacent to the steering box filler plug.
- 27 Fit the four bolts to the column flange using Wellseal on the bolt threads.
- 28 Fit the lower bearing track to the steering box ensuring that the balls do not become dislodged.
- 29 Fit the bottom cover and shim pack and secure with the four bolts. Use Wellseal on the bolt threads.
- 30 Check the inner column and worm for freedom of rotation and end-float. There must be an end-float of 2 to 4 lb ins. combined with free rotation of the worm. Adjust by adding or removing shims as required.
- 31 Fit the rocker shaft and the roller for the main nut.
- 32 Slacken the side cover locknut and adjusting screw.
- 33 Fit the side cover and gasket. Apply Wellseal to the securing bolt threads. Fit the bolts and evenly tighten.



- 34 Fill the steering box with fresh oil.
- 35 With the rocker shaft in the mid-position of its travel tighten the adjuster screw to provide a torque at the steering wheel of 10 to 14 lb ins. Do not impose load on the rocker shaft. Tighten the adjusting screw locknut.
- 36 Fit the steering column and box assembly to the vehicle. 57.45.01.

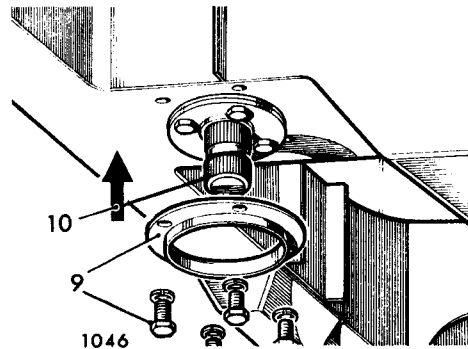
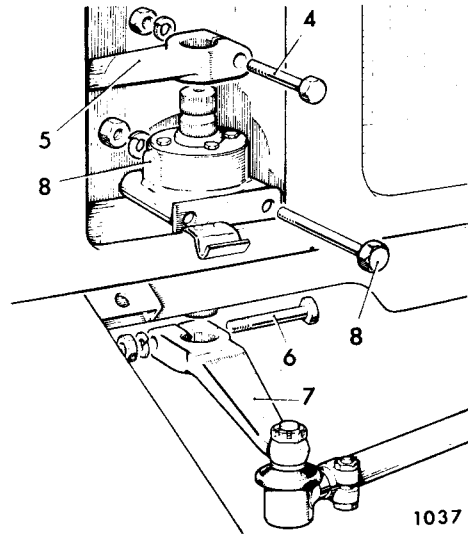
## STEERING RELAY

Remove and refit

57.50.02

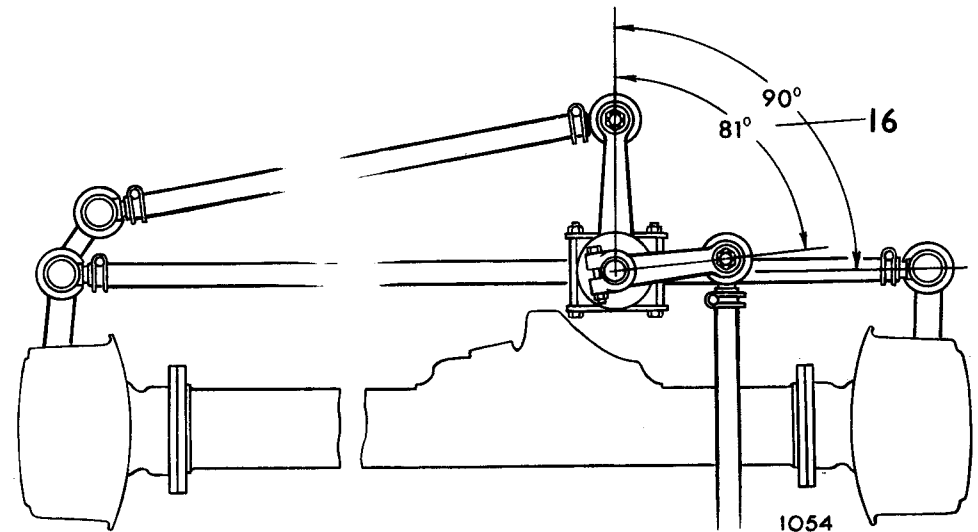
### Removing

- 1 Remove the radiator grille.
- 2 Remove the relay guard bracket.
- 3 Remove from above the relay assembly all fittings which would prevent removal of the relay assembly, e.g. 88 RHD models. The horn, battery, battery box and air cleaner.
- 4 Remove the nut and bolt securing the relay upper lever.
- 5 Detach the upper lever from the relay shaft.
- 6 Remove the nut and bolt securing the relay lower lever.
- 7 Detach the lower lever from the relay shaft.
- 8 Remove the two upper bolts and spring washers securing the relay to the chassis.
- 9 Remove the four bolts and spring washers securing the relay lower flange plate to the chassis. Remove the flange plate.
- 10 Drift the relay assembly upward to release it from the chassis. Care must be taken to avoid damaging the relay shaft splines.



### Refitting

- 11 Ensure that the relay unit is filled with oil.
- 12 Check that the relay location in the chassis is clean. Smear the location hole with grease.
- 13 Insert the relay assembly in the chassis and drift into position. Ensure that the cast projection on the upper side of the relay housing is fitted to the driver's side of the vehicle.
- 14 Fit the lower flange and its four securing bolts.
- 15 Fit the two upper bolts and nuts securing the relay housing to the chassis.
- 16 Fit the upper and lower relay levers and their respective securing bolts and nuts. The angular relationship of the upper and lower relay levers should be  $81^\circ$ . This can be checked by setting the road wheels in the straight ahead position, at which point the relay lower lever should be at  $90^\circ$  to the track rod. The relay upper lever should be inclined forward of the track rod,  $9^\circ$  out of alignment with the track rod.
- 17 Fit the relay guard bracket.
- 18 Fit the components removed to permit withdrawal of the relay housing.
- 19 Fit the radiator grille.



## STEERING RELAY

Overhaul

57.50.08

Service tool: 600536 spring compressor.

- 1 Remove the relay assembly from the vehicle. 57.50.02.

## Dismantling

- 2 Remove two of the securing bolts from the relay top cover. Invert the relay and allow the oil to drain.
- 3 Locate the relay assembly horizontally in a vice.
- 4 Remove the four bolts securing the relay lower cover.

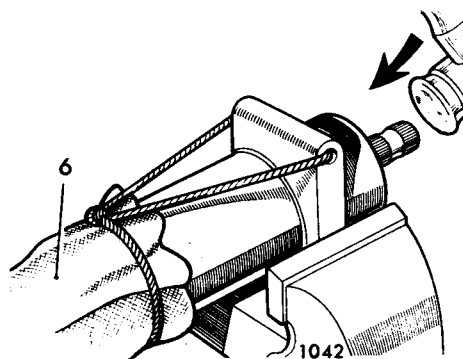
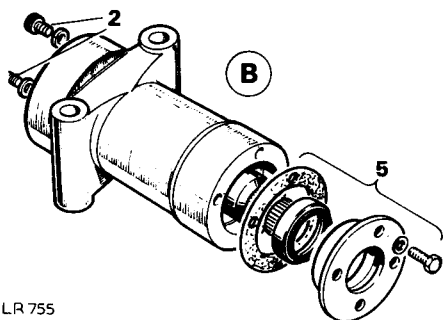
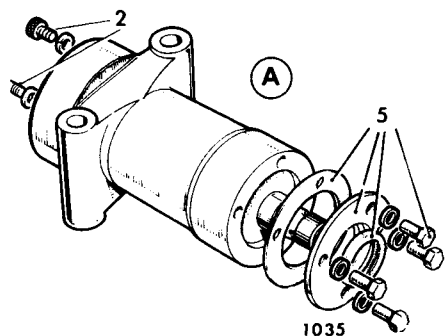
**NOTE:** Illustration 'A' shows the early seal and housing arrangement and Illustration 'B' is the latest condition.

- 5 Remove the lower cover complete with oil seal, gasket and thrust washer. Discard the gasket.
- 6 The relay shaft now has to be drifted through the lower end of the relay housing. Refer to the sectioned illustration of the relay assembly. Note that items 'A' are split bushes with an internal tapered face, against which they are held by a compression spring.

**WARNING:** The relay split bushes and spring will fly apart when released from the housing. Protection must be provided to prevent injury.

Enclose the lower end of the relay assembly with stout material leaving within the material sufficient space to accommodate the relay shaft. Secure the material to the relay housing to form a safety sheath.

- 7 Gently tap the relay shaft into the safety sheath.
- 8 Remove the safety sheath and collect the relay shaft, split bushes, spring and washers.
- 9 Remove the bolts securing the relay upper cover and remove the upper cover complete with oil seal, gasket and thrust washer. Discard the gasket. Remove the oil seal.
- 10 Remove the oil seal from the relay lower cover.



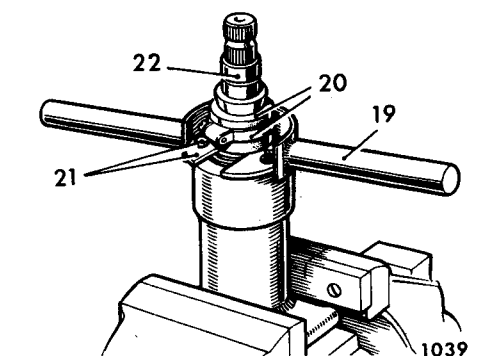
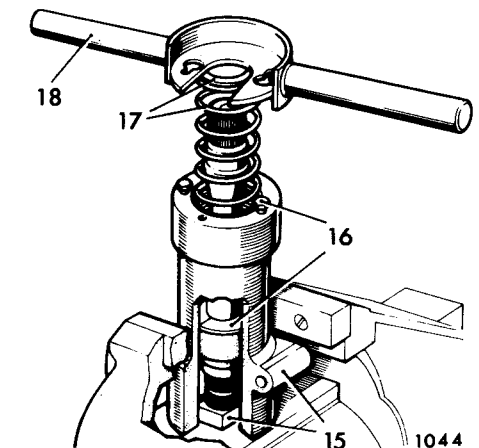
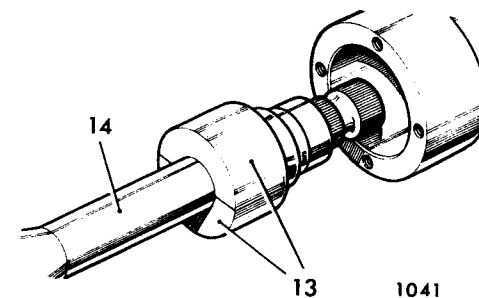
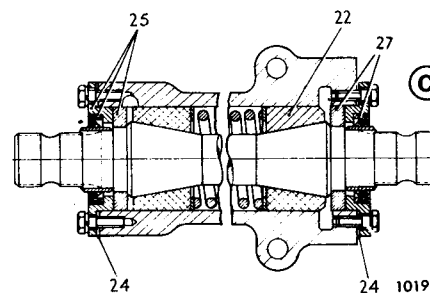
## Inspecting

- 11 Thoroughly clean all components and examine for wear and damage. Renew components as necessary. The free length of the spring should be 170 to 184 mm (6.750 to 7.250 in.).

## Assembling

- 12 Apply jointing compound to the outer periphery of the new oil seals. Fit the oil seals to the relay upper and lower covers (seal lips towards relay housing).
- 13 Locate two halves of the split bush on the top cone of the shaft.
- 14 Insert the assembly of shaft and bush into the housing from the bottom.
- 15 Secure the housing and shaft assembly, bottom end uppermost, in a vice with a 19 mm (0.750 in.) support block under the bottom end of the shaft.
- 16 Insert washer for spring into housing and fit two of the oil seal retainer fixing bolts into the housing diametrically opposite each other.
- 17 Fit the spring and washer.
- 18 Using Service tool 600536, carefully compress the spring.
- 19 Turn the tool to lock in position with the keyhole slots under the heads of the bolts.
- 20 Locate the other split bush in position on the bottom cone of the shaft and secure with a 50 mm (2 in.) hose clip.
- 21 Remove the service tool and the seal retainer fixing bolts.

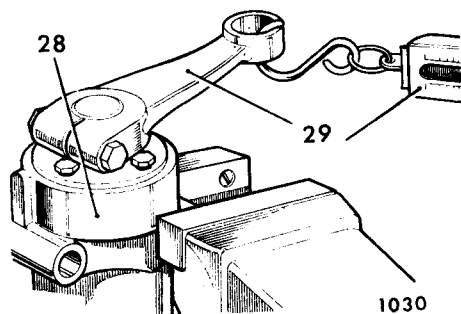
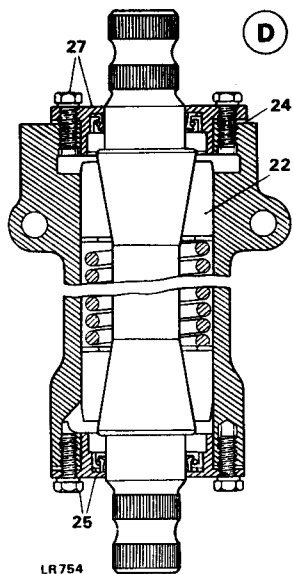
continued



**NOTE:** Cross-section 'C' is the early relay. Illustration 'D' is the latest assembly.



- 22 Remove the assembly from the vice, gently tap shaft into position until the split bush has entered the housing for at least half its length.
- 23 Remove the hose clip and continue to tap the shaft into the housing until the bushes are correctly located in the housing.
- 24 Smear general purpose grease on both sides of the joint washers and fit one to each end of the housing.
- 25 Fit the thrust washer and end cover, complete with seal, to bottom end of the housing only. Use 'Wellseal' or suitable equivalent sealing compound on the threads of the bolt fitted to the breather hole.
- 26 Fill the housing with the correct grade oil.
- 27 Fit the thrust washer and end cover, complete with seal to the top of the housing, using sealing compound on the threads of the four securing bolts.
- 28 Hold the relay unit in a vice.
- 29 Temporarily attach the upper relay lever and use a suitable spring balance to check resistance to rotation of the relay shaft. The resistance, measured on the spring balance, must not be less than 6,8 kg. (15 lb.) and should not exceed 12,2 kg. (27 lb.).  
If the resistance is less than 5,4 kg. (12 lb.), fit a new spring.  
If the resistance is excessive, remove the oil seal retainers and thrust washers, then use a suitable piece of tube to push each split bush in turn, clear of its cone and inject lubricating oil. Reassemble and recheck.
- 30 Fit the relay assembly to the vehicle. 57.50.02.



**DATA**

Relay spring free length .....	170 to 184 mm (6.750 to 7.250 in)
Resistance to rotation, relay shaft .....	6,8 to 12,2 kg (15 to 27 lb) measured using a spring balance

**TRACK ROD BALL JOINTS**

Remove and refit, instructions 6 to 9  
57.55.08

**TRACK ROD**

Remove and refit, instructions 1 to 5  
and 10 to 14  
57.55.09

Service tool: 601763, Ball joint extractor

**Removing, track rod**

- 1 Jack up the vehicle front end and support on stands.
- 2 Remove the front road wheels.
- 3 Remove the fixings from both ball joints.
- 4 Extract the ball joints, using 601763.
- 5 Withdraw the track rod and ball joints.

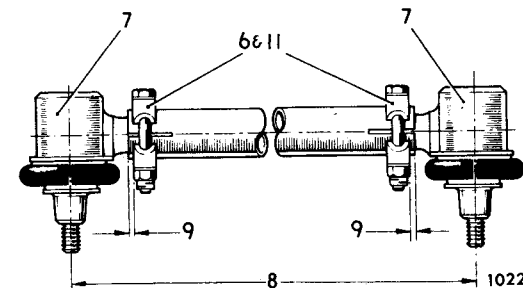
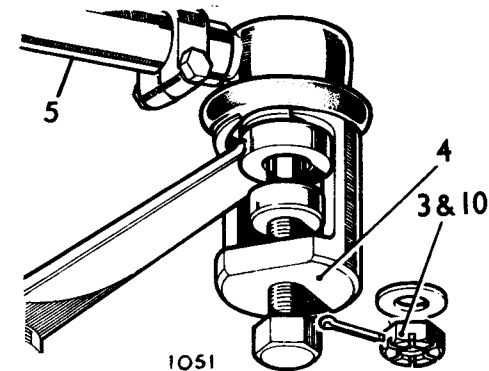
**Removing, ball joints**

- 6 Slacken the ball joints clamp fixings.
- 7 Unscrew the ball joints, L.H. and R.H. thread.

**Refitting, ball joints**

- 8 Screw the ball joints equally until the overall dimension between the ball joint centres is 1030,3 to 1033,4 mm (45.56 to 45.68 in.).
- 9 Position the ball joint clamps 1,58 to 3,17 mm (0.062 to 0.125 in.) from the track rod ends do not tighten the clamp bolts at this stage.

*continued*



**Refitting track rod**

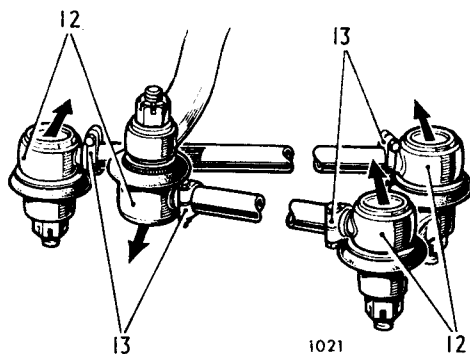
- 10 Reverse instructions 3 to 5. Torque for ball joint fixings 4,0 kgf. m (30 lbf. ft.)
- 11 Check and if necessary adjust the wheel alignment 57.65.01 leaving the clamp fixings slackened.
- 12 Lightly tap the ball joint cups in the direction illustrated to the maximum of their travel to ensure full unrestricted movement of the track rod.
- 13 Tighten the ball joint clamps. Torque load 1,1 to 1,5 kgf. m (8.5 to 10.5 lbf. ft.).
- 14 Reverse instructions 1 and 2.

109 1 ton models are fitted with a two piece track rod. Note that the cranked member must be fitted to provide maximum clearance for the front axle differential housing.

**DATA**

Initial setting dimension for track rod and ball joints .....

Position of ball joint clamps .....



1157 to 1160 mm (45.68 in.)  
measured between ball joint centres  
1,6 to 3,2 mm (0.062 to 0.125 in.)  
from track rod ends

**LONGITUDINAL STEERING  
TUBE BALL JOINTS**

Remove and refit, instructions 9 to 12  
57.55.12

**LONGITUDINAL STEERING  
TUBE**

Remove and refit, instructions 1 to 8  
and 13 to 19  
57.55.13

Service tool: 601763, Ball joint extractor

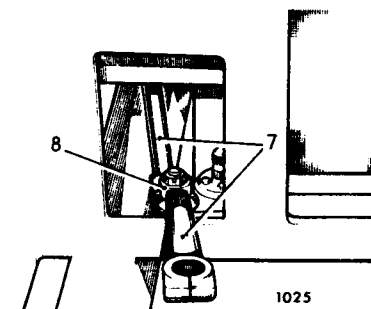
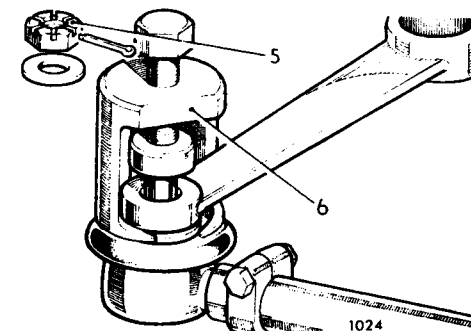
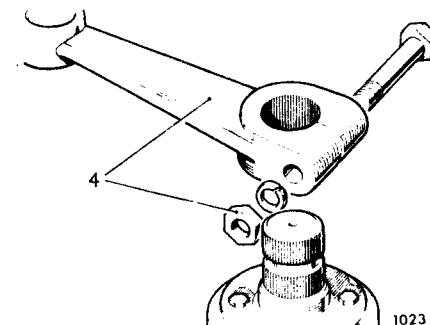
**Removing**

- 1 Remove the bonnet panel.
- 2 If required for access, remove the air cleaner.
- 3 Remove the radiator grille.
- 4 Remove the fixings securing the upper relay lever to the relay unit and prise the lever clear.
- 5 Remove the fixings from the ball joint connecting the longitudinal arm to the steering box drop arm.
- 6 Using service tool 601763 extract the ball joint from the steering box drop arm.

**NOTE:** LH stg. models – It may be necessary to remove the exhaust manifold to provide access for the ball joint extractor.

- 7 Manoeuvre the end of the upper relay lever through the aperture in the grille panel, then, moving the steering box drop arm fully forward, carefully withdraw the upper relay lever and longitudinal arm assembly.
- 8 Remove the fixings and extract the ball joint from the upper relay lever, using 601763.

*continued*



### Removing ball joints

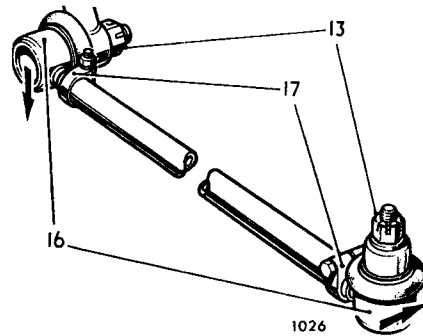
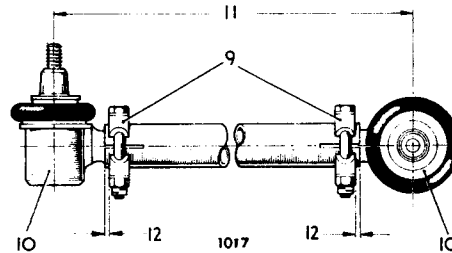
- 9 Slacken the ball joint clamp fixings.
- 10 Unscrew the ball joints, LH and RH thread.

### Refitting ball joints.

- 11 Screw in the ball joints equally until the overall dimension between ball joint centres is 621,4 to 624,6 mm (24.46 to 24.59 in.).
- 12 Position the clamps 1,58 to 3,17 mm (0.062 to 0.125 in.) from the longitudinal tube ends; do not tighten the clamp fixings at this stage.

### Refitting the longitudinal tube.

- 13 Reverse instructions 5 to 8. Torque load for ball joint fixings is 4,0 kgf. m (30 lbf. ft.).
- 14 Place the front wheels in the straight ahead position and the steering wheel in the intermediate position, then connect the upper relay lever to the relay unit, the longitudinal arm may require adjusting slightly to align the splines of the relay lever and unit.
- 15 Tighten the lever pinch bolt. Torque 7,6 kgf. m (55 lbf. ft.).
- 16 Using a mallet, lightly tap the ball joint cups in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the longitudinal arm.
- 17 Secure both ball joint clamps. Torque load 1,1 to 1,5 kfg. m (8.5 to 10.5 lbf. ft.).
- 18 Check the steering lock stops setting. 57.65.03.
- 19 Check the steering, lock-to-lock, for correct functioning. If necessary, adjust the overall length of the longitudinal arm by slackening the ball joint clamps and screwing the arm in or out, as required, then resecure the clamps.



### DATA

Initial setting dimension for longitudinal tube and ball joints .....

Position of ball joint clamps .....

621,4 to 624,6 mm (24.46 to 24.59 in.)  
measured between ball joint centres  
1,6 to 3,2 mm (0.062 to 0.125 in.)  
from tube ends

### DRAG LINK BALL JOINTS

Remove and refit, instructions 6 to 9  
57.55.16

### DRAG LINK

Remove and refit, instructions 1 to 5  
and 10 to 13  
57.55.17

Service tool: 601763, Ball joint extractor

### Removing, drag link

- 1 Jack up the vehicle front end.
- 2 Remove the front road wheel from the side where the drag link is connected to the swivel pin steering lever.
- 3 Remove both drag link ball joint fixings.
- 4 Extract the ball joints, using 601763.
- 5 Withdraw the drag link and ball joints.

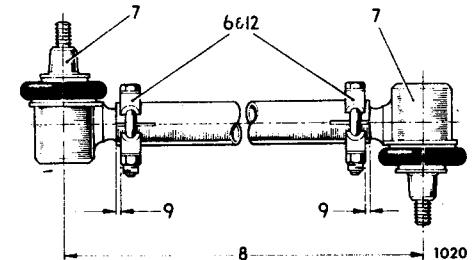
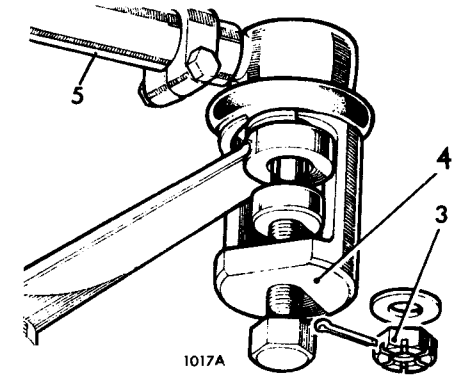
### Ball joints, removing

- 6 Slacken the clamp fixings.
- 7 Unscrew the ball joints, L.H. and R.H. thread.

### Ball joints, refitting.

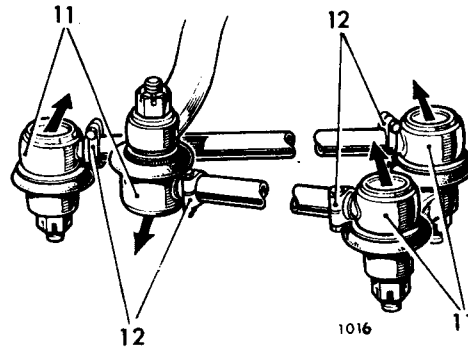
- 8 Screw in the ball joints equally until the overall dimension between ball joint centres is 782,62 to 785,79 mm (30.812 to 30.937 in.).
- 9 Position the clamps 1,58 to 3,17 mm (0.062 to 0.125 in.) from the drag link ends. Do not tighten the clamp fixings at this stage.

*continued*



**Refitting, drag link**

- 10 Reverse instructions 3 to 6. Torque for ball joint fixings 4,0 kgf. m (30 lbf. ft.).
- 11 If the clamps were previously slackened, lightly tap the ball joint cups in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the drag link using a mallet.
- 12 Tighten the ball joint clamps. Torque load 1,1 to 1,5 kgf. m (8.5 to 10.5 lbf. ft.).
- 13 Reverse instructions 1 and 2.



**DATA**

Initial setting dimension for drag and ball joints .....

Position of ball joint clamps. ....

782,62 to 785,79 mm (30.812 to 30.937 in.) measured between ball joint centres.  
1,58 to 3,17 mm (0.062 to 0.125 in.) from drag link ends.

**STEERING WHEEL**

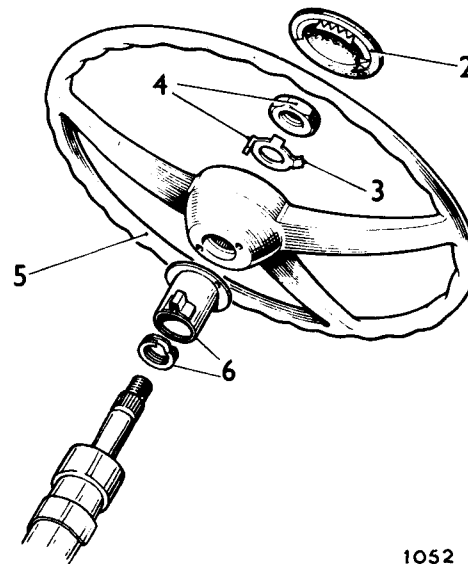
Remove and refit 57.60.01

**Removing**

- 1 Set the road wheels to the straight ahead position.
- 2 Remove the steering wheel centre cover.
- 3 Release the lock tab from the steering wheel nut.
- 4 Remove the steering wheel nut and lock washer.
- 5 Withdraw the steering wheel.

**Refitting**

- 6 Check that the direction indicator cam and double spring washer are in position on the steering column.
- 7 Engage the steering wheel on the column splines (road wheels straight ahead, centre spoke of steering wheel towards driver).
- 8 Ensure that the direction indicator cam engages the steering wheel.
- 9 Fit the lock washer and steering wheel nut.
- 10 Tighten the nut and secure with lock washer tab.
- 11 Fit the centre cover.

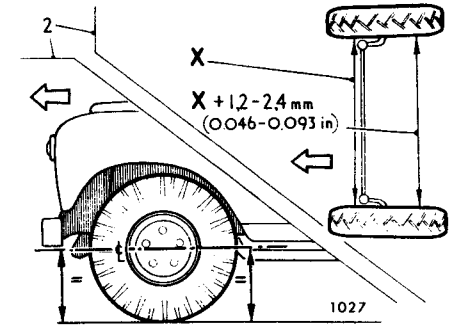


**FRONT WHEEL ALIGNMENT**

Check and adjust 57.65.01

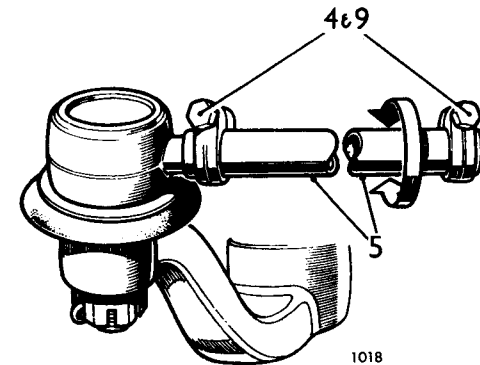
**Checking**

- 1 Set the vehicle on level ground with the road wheels in the straight ahead position, and push it forward a short distance.
- 2 Measure the toe-in with the aid of a tracking stick or suitable proprietary equipment; it should be 1,2 mm to 2,4 mm (3/64 to 3/32 in.) measured at the horizontal centre-line of the road wheels.
- 3 If necessary, adjust the toe-in as follows:



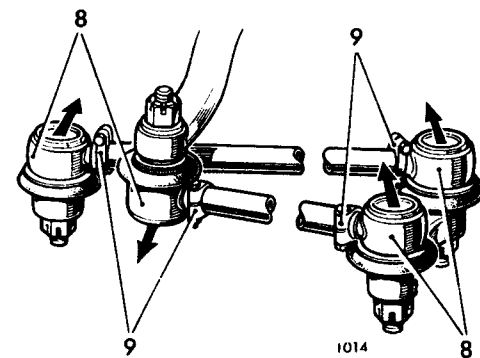
**Adjusting**

- 4 Slacken the clamps securing the ball joint at each end of the track rod.
- 5 Turn the track rod to decrease or increase its effective length as necessary, until the toe-in is correct.
- 6 Push the vehicle rearwards turning the steering wheel from side to side to settle the ball joints. Then, with the road wheels in the straight ahead position, push the vehicle forward a short distance.
- 7 Recheck the toe-in. If necessary carry out further adjustment.
- 8 When the toe-in is correct, lightly tap the track rod ball joints in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the track rod.
- 9 Secure the ball joint clamps. Torque load 1,1 to 1,5 kgf. m (8.5 to 10.5 lbf. ft.).



**DATA**

Front wheel toe-in .....



1,2 to 2,4 mm (3/64 to 3/32 in.) measured at the horizontal centre-line of the road wheels.

## STEERING GEOMETRY

Check

57.65.02

### General

No adjustment is provided for castor, camber or swivel pin inclination. For front wheel alignment (toe-in) refer operation 57.65.01.

It is essential that there is equal thread engagement of all steering tube ends (ball joints).

With the road wheels in the straight ahead position and the steering wheel centralised the steering column lock should engage within + or - 20°.

Steering box movement exceeds that required to obtain full lock to lock steering movement. This excess movement must be evenly divided between right hand and left hand locks and must not be less than 90° steering wheel movement before the stops in the steering box are operative. This adjustment must be made in the drag link only.

### DATA

Vehicles in static unladen condition with coolant, oils and 22,7 litres (5 Imperial gallons) of fuel, tyres at recommended pressures.

Castor angle . . . . .	3°
Camber angle . . . . .	1° 3'
Swivel pin inclination . . . . .	7°
Front wheel toe-in . . . . .	1,2 to 2,4 mm (3/64 to 3/32 in.)

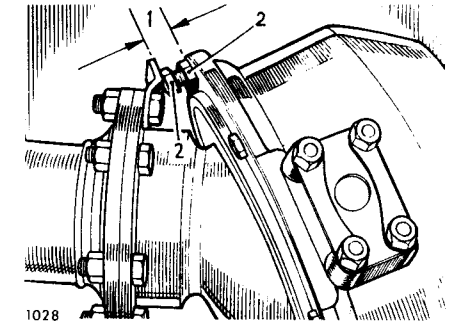
## LOCK STOPS

Check and adjust

57.65.03

### Procedure

- 1 Check that the length of the stop bolt (bolt head to swivel housing) is 12,5 mm (0.50 in.).
- 2 Slacken the locknut and adjust bolt length as necessary. Tighten the locknut.
- 3 Check the steering at full lock and ensure that clearance exists between the tyres and chassis components.



1028



## SWIVEL PIN HOUSING ASSEMBLY

Remove and refit

60.15.20

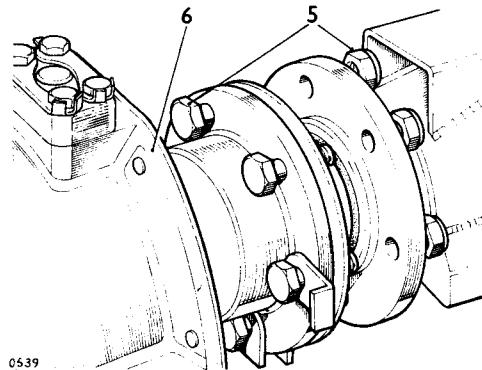
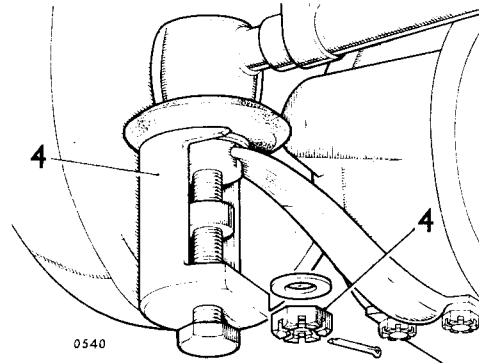
Service tool. 601763. Ball joint extractor.

### Removing

- 1 Remove the front hub. 60.25.01.
- 2 Remove the front stub axle. 60.25.22.
- 3 Withdraw the half shaft.
- 4 Disconnect the track rod at the track arm; tool 601763. If the swivel housing to be removed is fitted to the steering box side of the vehicle disconnect the drag link.
- 5 Remove the bolts and nuts securing the inner flange of the swivel housing assembly to the axle flange. Note the location of the steering stop bracket, and, on the right hand flange only, the position of the jack location stop bracket.
- 6 Remove the swivel pin housing assembly.
- 7 Remove and discard the inner flange gasket.

### Refitting

- 8 Reverse instructions 1 to 7. Torque – track rod end nut 4,0 kfg. m (30 lbf. ft.).



## SWIVEL PIN HOUSING ASSEMBLY

Overhaul

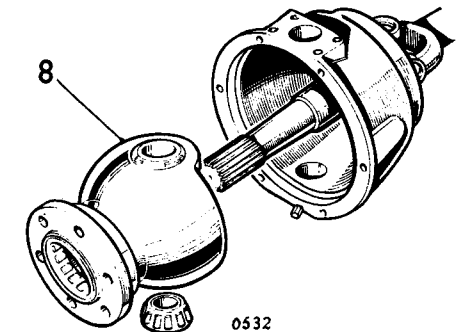
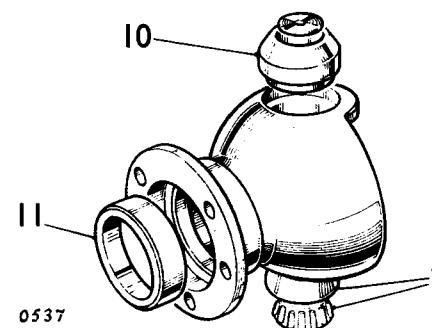
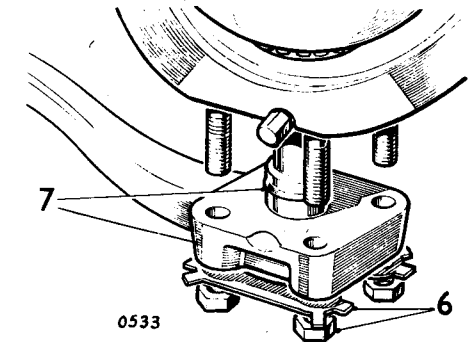
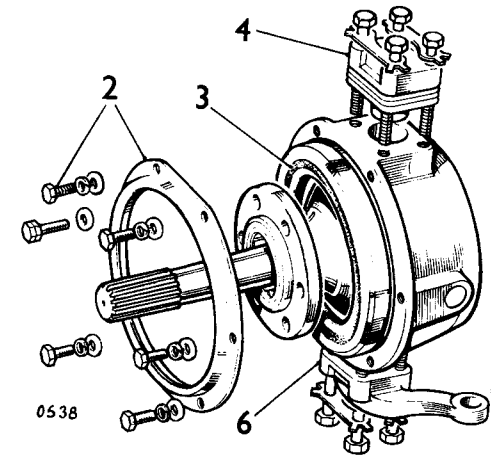
60.15.23

- 1 Remove the swivel pin housing assembly from the vehicle 60.15.20

### Dismantling

- 2 Remove the bolts, spring and plain washers securing the inboard oil seal cover. Note the position of the steering stop bracket, brake hose bracket, and if the swivel unit is fitted to the right hand side of the vehicle, the position of the jack location plate. Withdraw the oil seal cover.
- 3 Prise out and discard the oil seal.
- 4 Release the lock tabs from the upper swivel pin bolts and remove the bolts and lock plates.
- 5 Withdraw the upper swivel pin and shims.
- 6 Release the lock tabs from the track arm nuts and remove the nuts and lock plates.
- 7 Withdraw the track arm complete with the lower swivel pin. Remove and discard the 'O' ring.
- 8 Separate the swivel pin inner and outer housings.
- 9 Remove the lower swivel pin roller bearing and bearing track.
- 10 Press out the Railko bush housing.
- 11 Remove the half shaft bearing track.

*continued*



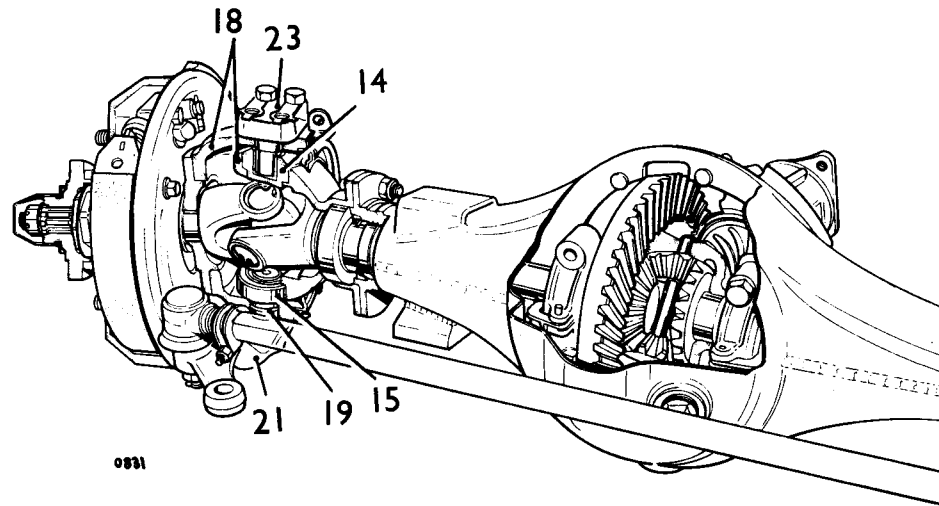
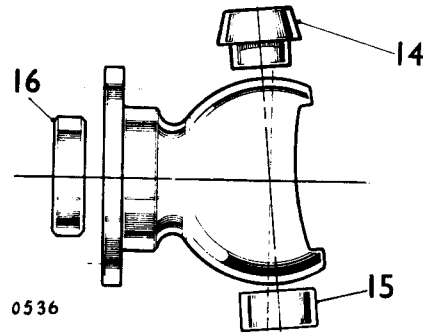
**Inspection**

- 12 Clean and examine all components for wear and damage. Note that fuel or any cleaning fluid must not be applied to the Railko bush as this would impair the damping characteristics of the bush. Renew all components as necessary.

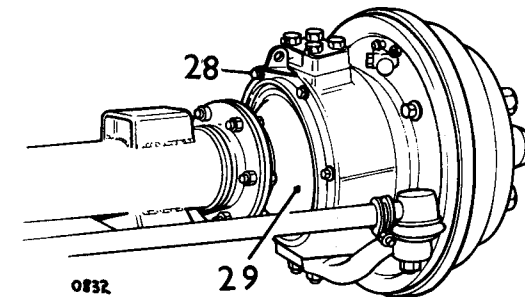
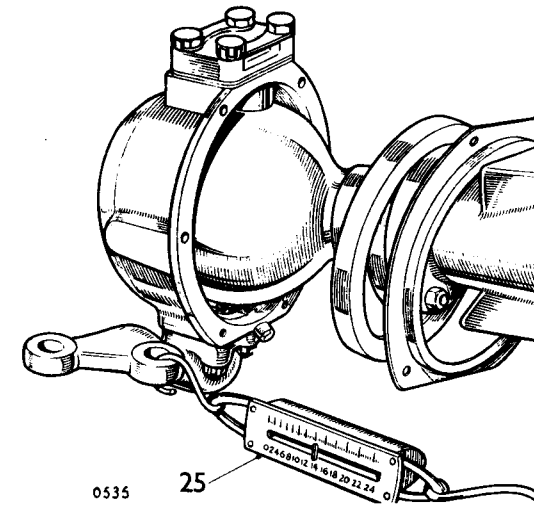
**Assembling**

**NOTE:** If the studs for the track arm have been removed, fit new studs. Coat the short threaded ends of the studs with Loctite 270 and screw them into the swivel housing; torque 5,5 to 6,9 kgf m (40 to 50 lbf ft).

- 13 Using an oil recommended for the swivel pin housing (Refer Division 09) lubricate the Railko bush. Ensure that the thrust disc is in position in the bottom of the bush.
- 14 Fit the Railko bush and housing.
- 15 Fit the lower swivel bearing track and lubricate.
- 16 Fit the half shaft bearing track and lubricate.
- 17 Fit the lower swivel pin roller bearing.
- 18 Fit the inner swivel housing to the outer swivel housing.
- 19 Fit a new 'O' ring to the lower swivel pin/track arm assembly.
- 20 Smear the mating faces of the outer swivel pin housing and lower swivel pin/track arm assembly with Loctite Stud-lock Compound.
- 21 Fit the lower swivel pin/track arm assembly. Ensure that the track arm points to the front of the vehicle.
- 22 Fit the lock plates and nuts. Evenly tighten the nuts. Torque 7,0 to 8,9 kgf. m (50 to 65 lbf. ft.). Bend the lock tabs to secure the nuts.
- 23 Fit the upper swivel pin, original shim(s), lock plates and bolts.
- 24 Evenly tighten the bolts. Torque 7,0 to 8,9 kgf. m (50 to 65 lbf. ft.) but do not bend the lock tabs at this stage.



- 25 Using a spring balance attached to the track rod eye check the resistance to swivel pin movement. This should be within 3,6 to 4,5 kg (8 to 10 lb) when the initial inertia load is overcome. Adjust by adding or removing shims at the top swivel as required.
- 26 Engage the lock tabs at the top swivel bolts.
- 27 Pack the inboard seal with heavy grease. Fit the seal to the outer swivel housing.
- 28 Fit the seal retaining ring, brake hose bracket, steering stop bracket and if applicable (RH swivel only), the jack location plate.
- 29 Check that the seal effectively wipes the spherical face of the inner swivel housing. Adjust if necessary by repositioning the seal retaining ring within the limits of the bolt holes.
- 30 Fit the swivel pin housing assembly to the vehicle. 60.15.20.





## FRONT ROAD SPRING

Remove and refit 60.20.01

### Removing

- 1 Front road springs, driver's side and passenger's side, must not be interchanged. A stiffer spring is fitted to the driver's side. Springs can be identified by the increased camber of the spring fitted to the driver's side and by the part number stamped on the underside of the third leaf.
- 2 Jack the vehicle and support the chassis securely.
- 3 Remove the road wheel.
- 4 With the jack positioned under the front axle relieve the road spring of load.
- 5 Remove the road spring 'U' bolts and ease the lower end of the shock absorbers and spring plate clear of the spring.

- 6 Remove the shackle bolt nuts.
- 7 Slacken the rear upper shackle bolt. Note that the rear shackle bolts are screwed to the tapped holes of the inner shackle link.
- 8 Remove the spring shackle bolts.
- 9 Remove the road springs.

### Refitting

- 10 Reverse instructions 4 to 9 but do not tighten the shackle bolts or shackle bolt nuts. Ensure that the axle is properly located in the spring centre bolt before fitting and tightening the 'U' bolts to 8,0 kgf m (58 lbf ft).

### Spring setting procedure

- 11 The shackle bolts which clamp the centre member of the road spring and hangar bracket bushes must not be tightened until the spring is positioned in the mid-point of its deflection range. This ensures that excessive rotation/shear forces are not imparted to the bush centres. Failure to observe this instruction can adversely affect bush life, especially in off-road conditions which produces large spring deflections.
- 12 Deflect the spring towards the chassis to the required dimension by using a length of chain passed over the chassis and under a lifting trolley jack. Alternatively, lower the vehicle on its wheels and load the vehicle.  
Dimension 'A', 88 in Models, 110,0 to 114,0 mm.  
Dimension 'B', 109 in Models, 118,0 to 122,0 mm.
- 13 Tighten the spring shackle bolts and nuts to 8,3 to 9,7 kgf m (60 to 70 lbf ft).

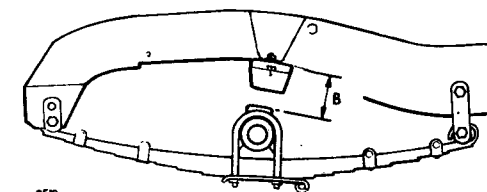
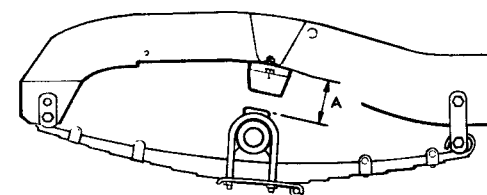
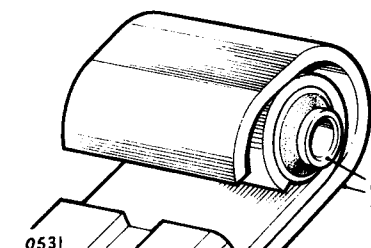
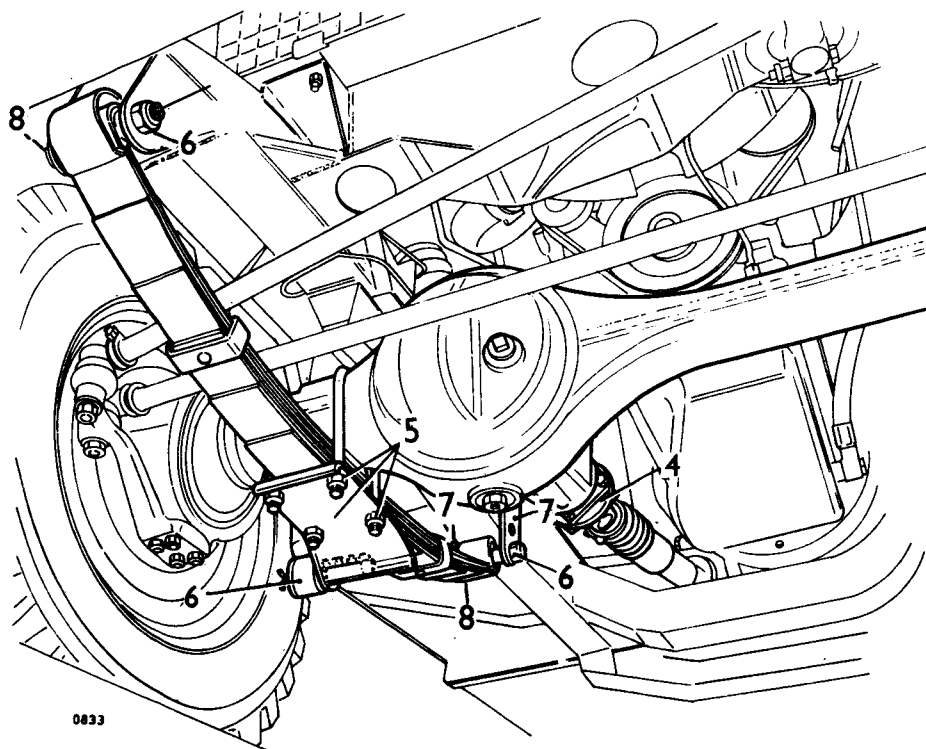
## FRONT ROAD SPRING

Overhaul 60.20.07

- 1 Only the main leaf and second leaf are available as spares items. For spring data refer to Section 04, page 13.

### Spring eye bushes

- 2 Remove and refit using a press. Spring eye bushes must be located centrally in the spring.



## FRONT SPRING HANGAR BRACKET BUSH

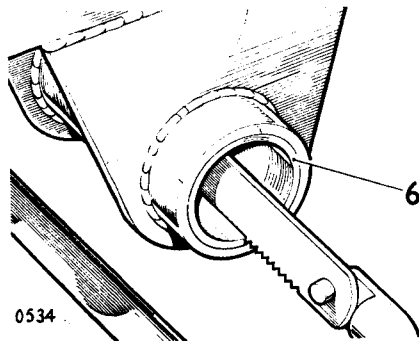
Remove and refit 60.20.31

### Removing

- 1 Jack up the vehicle and support the chassis securely.
- 2 Remove the road wheel.
- 3 Remove the spring shackle lock nuts.
- 4 Slacken the front and the lower rear shackle bolt.
- 5 Remove the rear, upper shackle bolt and swing the shackle links clear of the chassis.
- 6 Using a drift of suitable dimensions, or, preferably a length of solid drawn tubing and a long bolt and washers extract the bush from the hangar bracket. Where difficulty is experienced and the bush inner member and rubber separates from the bush outer shell, the outer shell may be removed by splitting it with a hack-saw. Care must be taken to avoid marking the hangar bracket.

### Refitting

- 7 Clean the hangar bracket bore.
- 8 Using a long bolt and washers pull the new bush into position in the hangar bracket. Ensure it is located centrally in the hangar bracket.
- 9 Fit the rear shackle links and the rear upper shackle bolt but do not tighten at this stage.
- 10 Carry out spring setting procedure, instruction 12 operation 60.20.01.



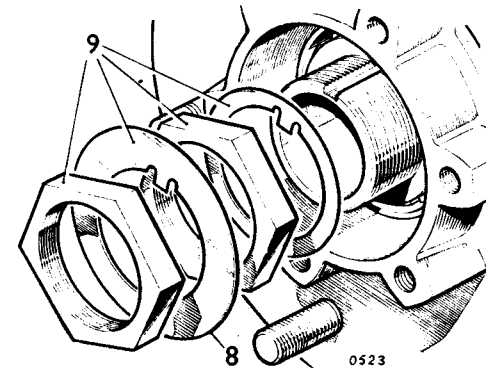
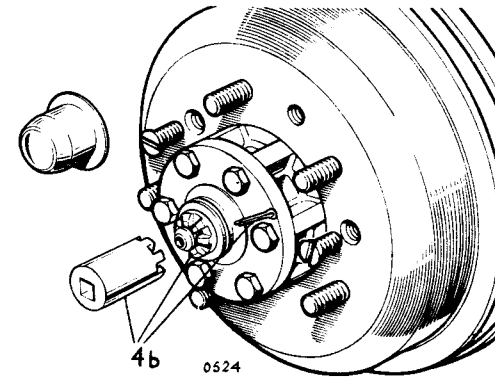
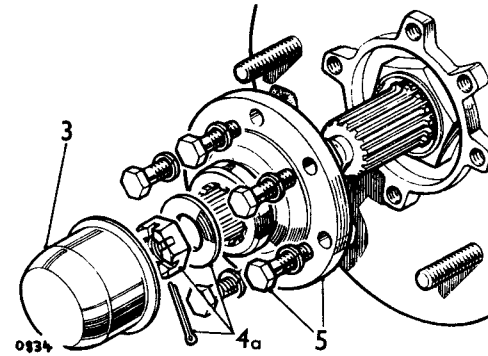
## FRONT HUB ASSEMBLY

Remove and refit 60.25.01

Service tool: RO1010. Spanner for half shaft nut. (109 models only).

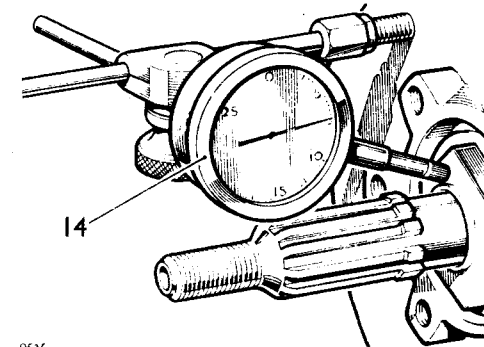
### Removing

- 1 Jack up the vehicle and support securely.
- 2 Remove the road wheel.
- 3 Twist, and slide off the hub cap.
- 4
  - a **88 models.** Remove the split pin and hexagon slotted nut securing the drive shaft to the drive flange. Remove the plain washers and sealing washer. Note that the plastic face of the sealing washer is fitted adjacent to the driving flange.
  - b **109 models.** Remove the split pin and round slotted nut securing the drive shaft to the drive flange (Tool RO1010). Remove the distance piece and Spirolox ring.
- 5 Remove the bolts and spring washers securing the drive flange to the hub. Withdraw the drive flange and gasket.
- 6 Fully slacken off brake shoe adjustment.
- 7 Remove the brake drum. To facilitate removal, tapped, starter holes are provided.
- 8 Straighten the lock tabs securing the hub nuts.
- 9 Remove the hub lock nut lock washer, adjusting nut and thrust washer.
- 10 Withdraw the hub complete with inner and outer bearings and oil seal.



### Refitting

- 11 Ensure that the hub is filled to half capacity with fresh grease.
- 12 Install the hub on the stub axle complete with inner and outer bearings and oil seal.
- 13 Fit the tongued washer and adjusting nut.
- 14 Spin the hub to settle the bearings and tighten the adjusting nut sufficient to provide hub end-float of 0,05 to 0,10 mm (0.002 to 0.004 in.). This can be checked using a dial gauge.
- 15 Fit the lock washer and lock nut. Tighten the lock nut. Bend the lock washer to secure both the lock and adjusting nuts. Recheck end-float.
- 16 Reverse instructions 1 to 7.



## FRONT HUB BEARINGS END-FLOAT

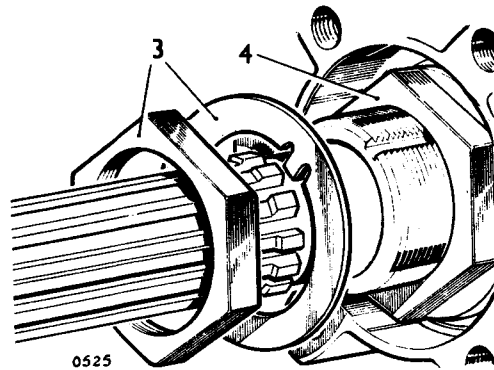
Check and adjust 60.25.13

### Checking

- 1 Carry out instructions 1 to 7 operation 60.25.01.
- 2 Using a dial gauge check hub end-float which should be within 0,05 to 0,10 mm (0.002 to 0.004 in.).

### Adjusting

- 3 Remove the hub bearing lock nut and lock washer.
- 4 Set the adjusting nut as necessary to obtain the required end-float given in 2 above.
- 5 Fit the lockwasher and locknut.
- 6 Bend the lockwasher to secure both the locknut and the adjusting nut. Recheck end-float.
- 7 Reverse instructions 1 to 7 Operation 60.25.01.



## FRONT HUB BEARINGS

Remove and refit 60.25.14

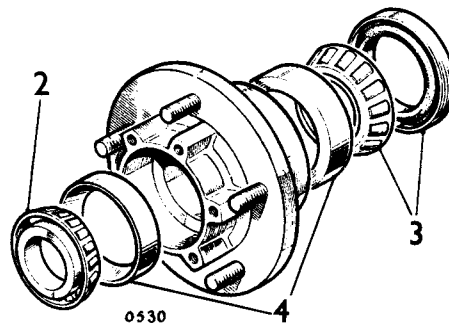
### Removing

- 1 Remove the front hub assembly. 60.25.01, instructions 1 to 10.
- 2 Withdraw the outer bearing.
- 3 Remove the inner bearing and oil seal. Discard the oil seal.
- 4 Remove the inner and outer bearing tracks.
- 5 Thoroughly clean the hub and bearings.

### Refitting

- 6 Fit the inner and outer bearing tracks.
- 7 Fill the hub to half capacity with fresh grease.
- 8 Fit the inner bearing and a new oil seal. Ensure that the seal lip faces towards the bearing and that the seal lip is lubricated.
- 9 Fit the outer bearing.
- 10 Fit the hub to the stub axle.
- 11 Fit the tongued washer and adjusting nut.

- 12 Adjust hub bearing end-float to within 0,05 to 0,10 mm (0.002 to 0.004 in.).
- 13 Fit the lock washer and lock nut. Bend the lock washer to secure both the lock nut and the adjusting nut.
- 14 Fit the brake drum and adjust the brake shoes.
- 15 Reverse instructions 1 to 5. Operation 60.25.01.



## FRONT HUB OIL SEAL

Remove and refit 60.25.15

### Removing

- 1 Remove the front hub, instructions 1 to 10. Operation 60.25.01.
- 2 Remove the oil seal and discard.

### Refitting

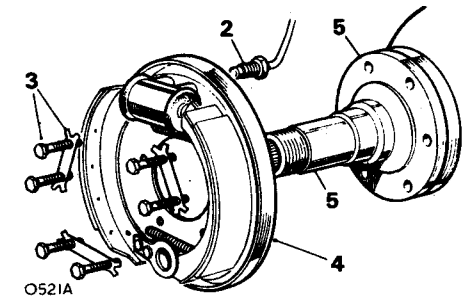
- 3 Fit a new oil seal to the hub, seal lip towards hub inner bearing. Lubricate the seal lip.
- 4 Reverse instructions 1 to 10. Operation 60.25.01.

## FRONT HUB STUB AXLE

Remove and refit 60.25.22  
Overhaul 60.25.24

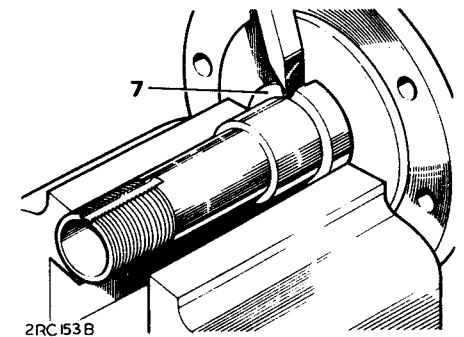
### Removing

- 1 Remove the front hub, instructions 1 to 10. Operation 60.25.01.
- 2 Disconnect the brake pipe at the wheel cylinder. Plug the wheel cylinder and brake pipe to prevent ingress of foreign matter.
- 3 Remove the bolts securing the brake backplate and stub axle to the swivel housing.
- 4 Detach the brake backplate from the stub axle.
- 5 Remove the stub axle and gasket. Discard the gasket.



### Overhaul

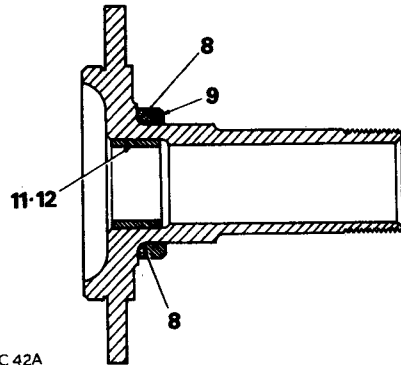
- 6 Examine the stub axle for wear and damage. Check the peripheral surface of the distance collar. This area of the collar forms the running surface of the hub oil seal lip. Wear, or ridging will result in rapid oil seal deterioration and ineffectiveness. Renew the collar if necessary. The collar is a press fit on the stub axle.
- 7 Remove the collar by drilling and splitting, taking care to avoid marking or damaging the stub axle.



continued

**Refitting**

- 8 Smear Bostik 772 sealing compound round the radiused corner on the stub axle where the inner bearing distance piece will seat.
- 9 Press on the new distance collar.
- 10 Remove all visible traces of sealing compound.
- 11 Examine the bush inside the stub axle for wear or damage.
- 12 If necessary, fit a new bush. Check the internal diameter after fitting; this should be 31,72 to 31,85 mm (1.249 to 1.254 in).



4RC 42A

- 13 Grease and fit a new stub axle flange gasket.
- 14 Coat the threads of the bolts securing the back plate and stub axle to the swivel housing with Loctite 270.
- 15 Reverse instructions 1 to 5.
- 16 Bleed the brakes.

**FRONT SHOCK ABSORBER**

Remove and refit 60.30.02

**Removing**

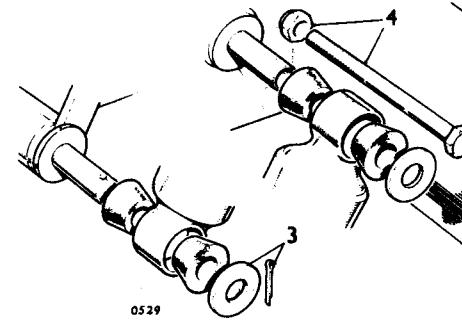
- 1 Jack up the vehicle and support securely.
- 2 Remove the road wheel.
- 3 Remove the split pin and washer securing the lower end of the shock absorber to the road spring plate.
- 4 Remove the bolt, washer and nut securing the upper end of the shock absorber to the chassis.
- 5 Withdraw the shock absorber complete with bushes.

**Checking shock absorber operation.**

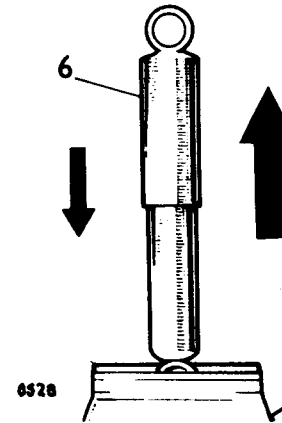
- 6 Hold the shock absorber vertically in a vice.
- 7 The shock absorber employs differential damping having greater resistance on the extension stroke. Check operation by extending and compressing the shock absorber. Resistance should be uniform throughout the length of each stroke. If resistance is erratic or weak, renew the shock absorber. When checking resistance a new shock absorber may be used for comparison.

**Refitting**

- 8 Reverse instructions 1 to 5.



0529



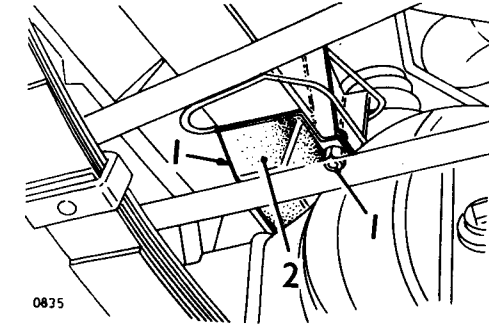
0528

**BUMP STOP**

Remove and refit 60.30.10

**Removing**

- 1 Remove the two bolts, nuts and spring washers securing the bump stop to the chassis.
- 2 Remove the bump stop.



0835

**Refitting**

- 3 Reverse operations 1 and 2.

**SHOCK ABSORBER BUSHES**

Remove and refit 60.30.07

As instructions 1 to 5. Operation 60.30.02.

## SUPPLEMENTARY INFORMATION FOR FRONT AND REAR AXLES

### Axle rationalization

To reduce the number of axle variants modifications have been made to the existing Land-Rover axle hubs, operations for which are included in the 'FRONT SUSPENSION' and 'REAR SUSPENSION' sections. The following information gives details of the modification and the different overhaul procedures.

### The following parts are new:

Intermediate front axle shaft seal.  
Dual lip hub seal.  
Oil catcher (except 88 in Land-Rover rear axle).  
Taper roller bearings.

### The following parts are common to all NEW axles front and rear.

Hub assembly.  
Hub driving member.  
Taper roller bearings.  
Dual lip seal.  
Hub nut cap.  
Hub cap 'O' ring.  
Locknuts and locking washers.  
Stub axles and bearing sleeves.  
Oil catcher.

### Axle identification

The new axles can be identified by changes in the axle Serial number suffixes as follows:

88 in Land-Rover front axle from F to G.  
109 in Land-Rover front axle from E to G.  
88 in Land-Rover rear axle from E to F.

### Where the new axles are fitted

- 1 The 88 in and 109 in Land-Rover have the same front axle, the 88 in being uprated to the 109 in specification. Both are fitted with a Rover differential and 11 in (280 mm) diameter brake drums with twin leading shoes. Oil catchers are also fitted. The hub assembly is retained on the drive shaft with a castle nut and split pin.
- 2 The 88 in Land-Rover rear axle is the same as that fitted to the 109 in vehicle except that the differential is of Land-Rover manufacture instead of Salisbury. The brake drums are 10 in (254 mm) diameter. No oil catcher is fitted.
- 3 The 109 in Land-Rover rear axle is the same as the 88 in rear axle except that the differential is of Salisbury design. No oil catcher is fitted. The brake drums are 11 in (280 mm) diameter. Both 88 in and 109 in Land-Rover rear axles have the hub assembly retained on the drive shaft with a circlip.

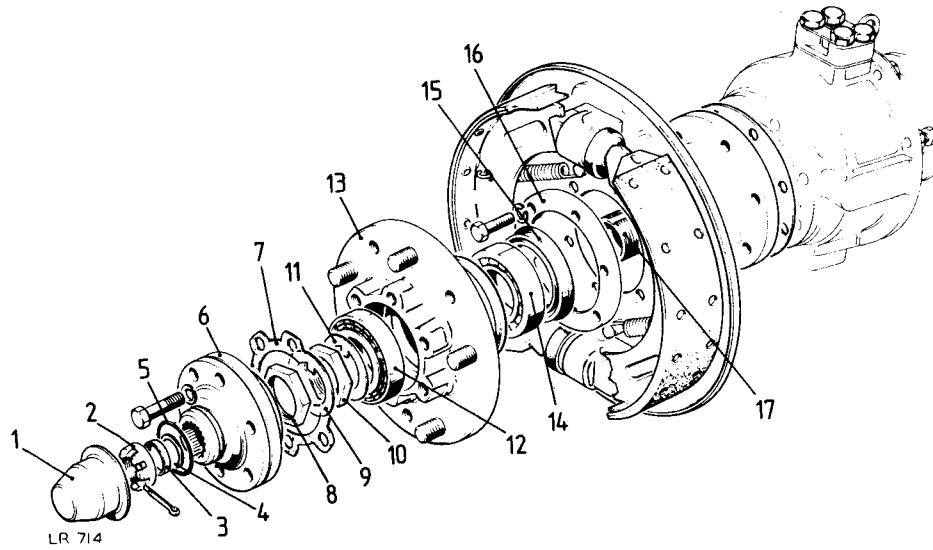
### FREE-WHEELING HUBS (Optional Equipment)

Due to the addition of the intermediate front axle shaft oil seal, free-wheeling hubs fitted to vehicles with rationalized axles cannot rely on the axle oil for lubrication. Approved manufacturers will in future supply pre-lubricated hubs but as old stock may be available it is imperative that all new free-wheeling hubs are checked for pre-lubrication.

If lubrication is required any one of the following may be used:

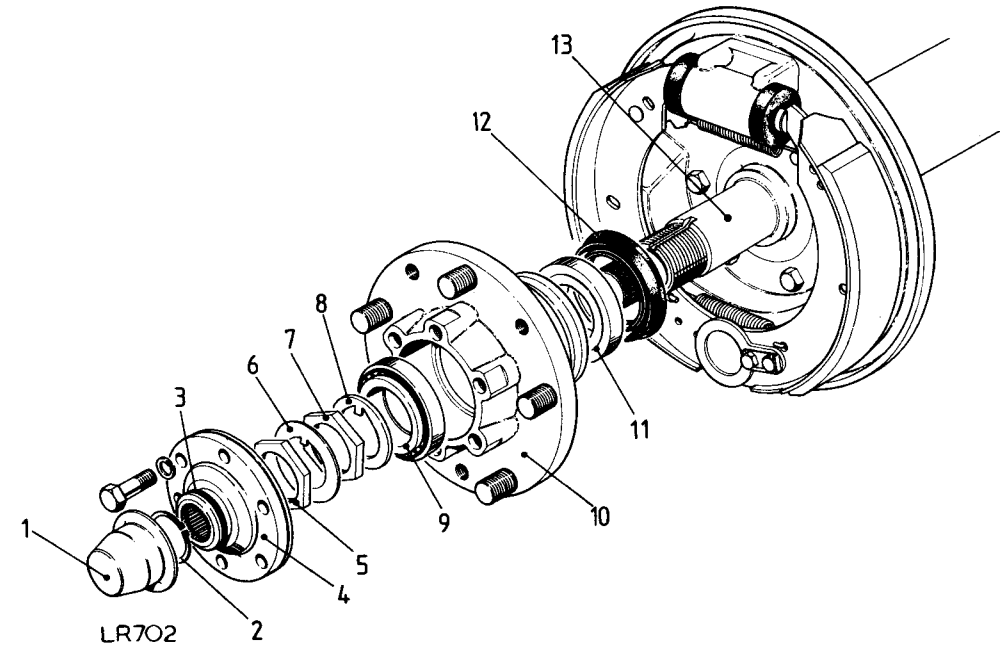
BP	Energrease L2
Castrol	LM Grease
Duckhams	LB 10 Grease
Esso	Multi-purpose Grease H
Mobil	Mobilgrease MP or Mobilgrease Super
Petrofina	Fina Marson HTL2 Grease
Shell	Retinax A
Texaco	Marfak All Purpose Grease

Remove the hub cover plate and smear approximately 3 cm<sup>3</sup> of grease inside the hub over the splines.



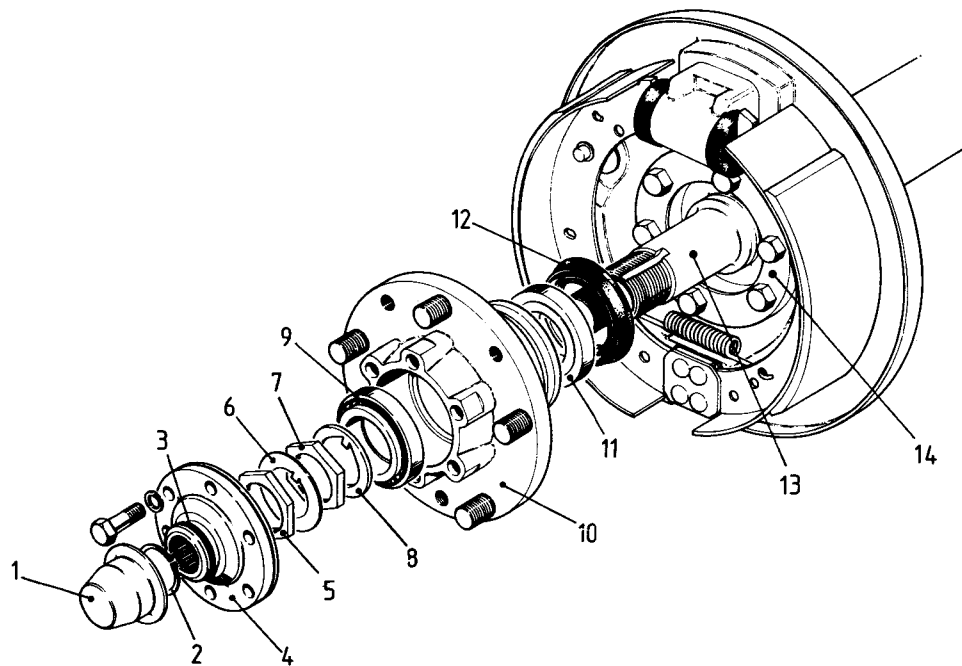
**88 in AND 109 in FRONT AXLE HUB**

- |   |                  |    |                      |
|---|------------------|----|----------------------|
| 1 | Hub cap          | 10 | Inner adjusting nut  |
| 2 | Castle nut       | 11 | Keyed thrust washer  |
| 3 | Distance piece   | 12 | Outer roller bearing |
| 4 | Spirolox ring    | 13 | Hub                  |
| 5 | Hub cap 'O' ring | 14 | Inner roller bearing |
| 6 | Driving member   | 15 | Dual lipped seal     |
| 7 | Joint washer     | 16 | Oil catcher          |
| 8 | Outer locknut    | 17 | Bearing sleeve       |
| 9 | Lock washer      |    |                      |



**88 in REAR AXLE HUB**

- |   |                       |    |                      |
|---|-----------------------|----|----------------------|
| 1 | Hub cap               | 8  | Keyed thrust washer  |
| 2 | Circlip               | 9  | Outer roller bearing |
| 3 | Hub cap 'O' ring seal | 10 | Hub                  |
| 4 | Driving member        | 11 | Inner roller bearing |
| 5 | Outer locknut         | 12 | Dual lipped seal     |
| 6 | Lock washer           | 13 | Bearing sleeve       |
| 7 | Inner adjusting nut   |    |                      |



LR 703

**109 in REAR AXLE HUB**

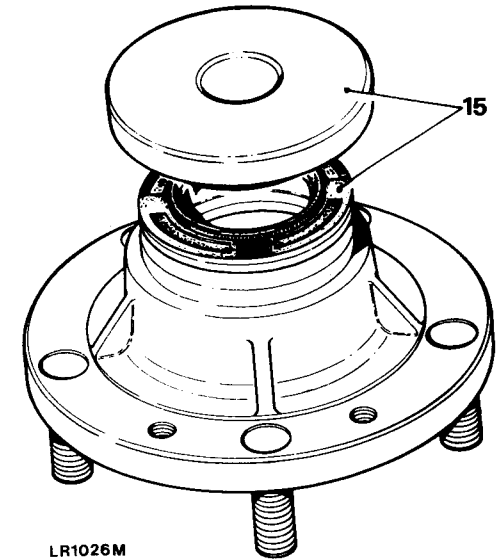
- |   |                     |    |                     |
|---|---------------------|----|---------------------|
| 1 | Hub cap             | 8  | Keyed thrust washer |
| 2 | Circlip             | 9  | Outer bearing       |
| 3 | Hub cap 'O' ring    | 10 | Hub                 |
| 4 | Driving member      | 11 | Inner bearing       |
| 5 | Outer locknut       | 12 | Dual lipped seal    |
| 6 | Lock washer         | 13 | Bearing sleeve      |
| 7 | Inner adjusting nut | 14 | Oil catcher         |

**LAND-ROVER 88 in AND 109 in  
FRONT AXLE HUBS**

Service tool: 18G 1349

**Strip and overhaul procedure**

- 1 Slacken the road wheel nuts, jack up the vehicle, lower onto axle stands and remove the road wheels.
- 2 Remove the three brake drum retaining screws and withdraw the brake drum. If necessary, slacken back the brake adjuster to facilitate removal.
- 3 Lever off the hub cap and remove the following: split pin, castle nut, distance piece and Spirolox ring.
- 4 Remove the six bolts and withdraw the driving member and joint washer.
- 5 Bend back the lock washer, remove the outer and inner locknuts and keyed thrust washer.
- 6 Pull off the hub complete with inner and outer bearings and dual lipped seal.
- 7 Clamp the brake jump-hose and disconnect the brake pipe from the wheel cylinder.
- 8 Remove the six bolts and spring washers and withdraw the oil catcher, backplate, and stub axle complete with oil seal and joint washer.



LR1026M

**Overhauling hub**

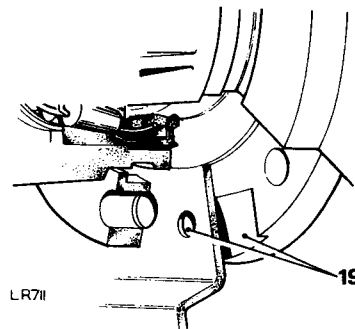
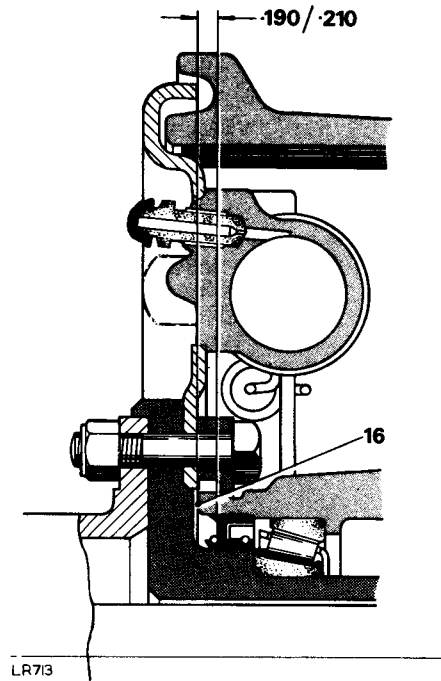
- 9 Remove the oil seal and if new bearings are to be fitted, press or drift out the old bearing cups.
- 10 Examine the road wheel studs and renew any that are worn or damaged.
- 11 Press in new bearing cups up to the shoulder.
- 12 Ensure that there are no imperfections in the hub oil seal housing that could cause damage to the seal.
- 13 Pack the inner bearing with Shell Retinax A grease or equivalent, and fit to the hub.
- 14 While taking care not to touch the seal lips, liberally smear—not pack—the cavity between the seal lips with Shell Retinax A or equivalent.
- 15 To avoid possible damage to the seal and to ensure the correct depth into the hub, press-in the seal, lip side leading, using special tool 18G 1349.

*continued*

- 16 With the cavity side leading, press in the seal so that it is recessed 4,8 to 5,3 mm (0.190 to 0.210 in) from the rear face of the hub.

#### Reassembling hub to axle

- 17 Remove the old oil seal from the bearing sleeve. Grease the outside diameter of the new seal and with the lip side leading press fully home into the bearing sleeve.
- 18 Using a new joint washer, assemble the bearing sleeve to the swivel housing, ensuring that the milled slot is at the bottom.
- 19 Fit the backplate so that the drain hole is in line with the milled slot.
- 20 Using Hylomar SQ 32M, fit and seal the oil catcher to the backplate.
- 21 Mount a dial test indicator so that the stylus rests on the adjusting nut. Slacken the nut back to obtain an end-float of 0,050 to 0,101 mm (0.002 to 0.004 in.).
- 22 Before fitting the hub ensure that the journal on which the dual lipped seal runs is clean and free from damage that could destroy the seal.
- 23 Fit the hub to the bearing sleeve. Pack the outer bearing with grease and fit to the hub.
- 24 Fit the keyed thrust washer and adjusting inner locknut.
- 25 Tighten the adjusting nut, by hand, whilst rotating the hub until all the end-play is taken up.
- 26 Mount a dial test indicator so that the stylus rests on the adjusting nut. Slacken back the nut until an end-float of 0,050 to 0,101 mm (0.002 to 0.004 in) is achieved.
- 27 Fit the keyed lock washer and tighten against the inner nut. Re-check the end-float and lock the nuts.
- 28 Using a new joint washer, fit the hub driving member and retain with the six bolts and spring washers. Tighten to 4,2 to 5,2 kgf m (30 to 38 lbf ft).
- 29 Fit the Spirolox ring, distance piece and castle nut. Using the special hub nut socket RO 1010, tighten to 1,4 to 2,0 kgf m (10 to 14 lbf ft) and secure the nut with a split pin.
- 30 If necessary, fit a new 'O' ring and fit the hub cap.
- 31 Fit the brake drum, and secure with new screws if necessary.



- 32 Adjust the brakes, release the jump hose clamp and bleed the hydraulic system.
- 33 Fit the road wheels, using new nuts if necessary.
- 34 Lower the vehicle, remove the axle stands and finally tighten the wheel nuts to 10.3 to 11.7 kgf m (75 to 85 lbf ft).

## LAND-ROVER 109 in AXLE HUB (With Oil Catcher)

LAND-ROVER 88 in AXLE HUB (Without Oil Catcher) omit instructions 7 and 17

Service tool: 18G 1349

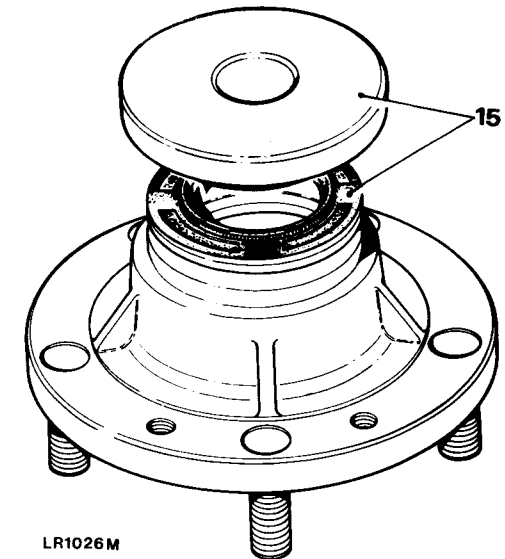
#### Strip and overhaul procedure

- Slacken the road wheel retaining nuts, jack up the vehicle, lower onto axle stands and remove the road wheels.
- Remove the three brake drum retaining screws and withdraw the brake drum. If necessary, slacken the brake adjuster to facilitate removal.
- Lever off the hub cap and remove the axle shaft circlip.
- Remove the six bolts and withdraw the hub driving member and joint washer.
- Unlock the tab washer, remove the outer and inner locknuts and keyed thrust washer.
- Withdraw the hub complete with inner and outer taper roller bearings and dual lipped seal.
- If required, remove the oil catcher and bearing sleeve by removing the six brake backplate retaining nuts and bolts.

#### Overhauling hub

- Remove the dual lipped seal and inner bearing from the hub.
- If new bearings are to be fitted drift or press out the old bearing cups.
- Examine the road wheel studs and renew any worn or damaged ones.
- Press in new bearing cups up to the shoulder.
- Examine the oil seal housing in the hub and remove any burrs that could damage the seal.
- Pack the inner bearing with Shell Retinax A grease or equivalent and fit to the hub.
- While taking care not to touch the seal lips, liberally smear—not pack—the cavity between the seal lips with Shell Retinax A or equivalent.
- To avoid possible damage to the seal and to ensure the correct depth into the hub, press-in the seal, lip side leading, using special tool 18G 1349.

*continued*

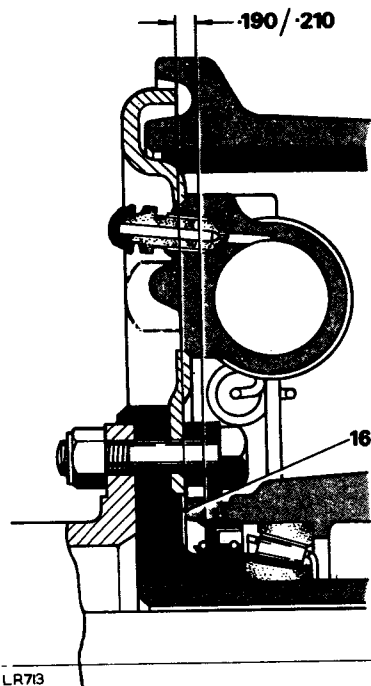




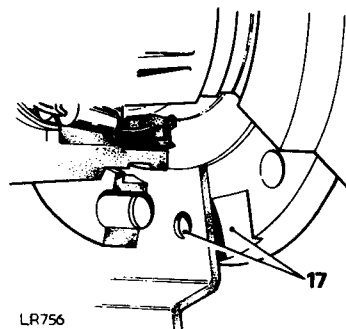
- 16 With the cavity side leading, press in the seal so that it is recessed 4,8 to 5,3 mm (0.190 to 0.210 in) from the rear face of the hub.

**Reassembling hub to axle**

- 17 If removed, assemble the bearing sleeve, backplate and oil catcher to the axle having first smeared Hylomar SQ32M on the face of the oil catcher to seal it to the backplate. Ensure that the milled slot in the bearing sleeve and the drain hole in the backplate line up at the bottom. Secure the assembly to the axle with the six bolts and nuts and tighten to 6,0 to 8,0 kgf m (48 to 59 lbf ft).
- 18 Before fitting the hub, ensure that the journal on which the dual lipped seal runs is clean and free from imperfections that could damage the seal.
- 19 Fit the hub to the bearing sleeve, pack the outer bearing with grease and fit to the hub.
- 20 Fit the keyed thrust washer and adjusting inner nut. Tighten the nut, by hand, whilst rotating the hub until all the end-play is taken up.
- 21 Mount a dial test indicator so that the stylus rest on the adjusting nut. Slacken the nut back to obtain an end-float of 0,050 to 0,101 mm (0.002 to 0.004 in.).
- 22 Fit the tab washer and outer locknut. Tighten the locknut, re-check the end-float and lock the nuts.
- 23 Using a new joint washer, fit the hub driving member and tighten the retaining bolts and spring washers to 4,2 to 5,2 kgf m (30 to 38 lbf ft)
- 24 Fit the circlip to the axle shaft, ensuring that it locates correctly in the groove.
- 25 Fit the hub cap, if necessary using a new 'O' ring seal.
- 26 Fit the brake drum and secure, if necessary with new screws.
- 27 Adjust the brake shoes to the drum.
- 28 Fit the road wheels, using new nuts if necessary.
- 29 Remove the vehicle from the axle stands and finally tighten the wheel nuts to 10,3 to 11,7 kgf m (75 to 85 lbf ft).



LR713



LR756



## REAR HUB

Remove and refit

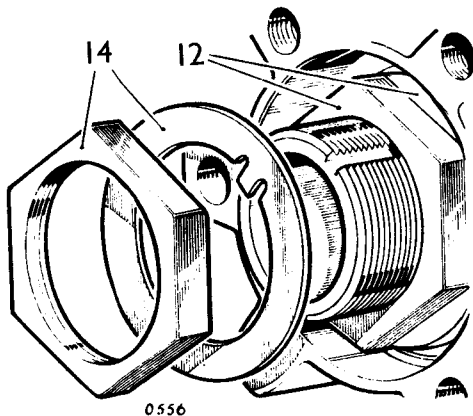
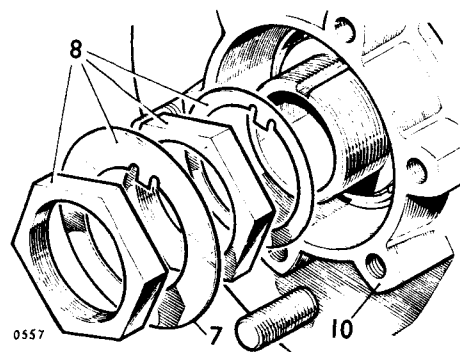
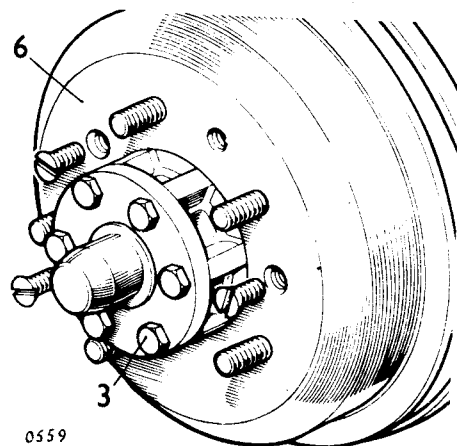
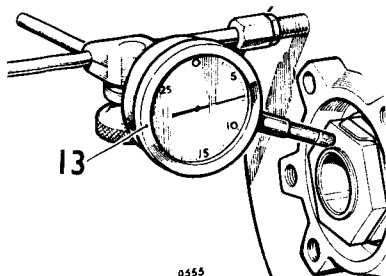
64.15.01

### Removing

- 1 Jack up the vehicle and support securely,
- 2 Remove the road wheel.
- 3 Remove the bolts and spring washers securing the drive flange to the hub.
- 4 Withdraw the half shaft complete with drive flange and gasket.
- 5 Slacken off brake shoe adjustment.
- 6 Remove the brake drum.
- 7 Straighten the lock tabs securing the hub nuts.
- 8 Remove the hub lock nut, lock washer, adjusting nut and tongued washer.
- 9 Withdraw the hub complete with inner and outer bearings and oil seal.

### Refitting

- 10 Fill the hub to half capacity with fresh grease.
- 11 Install the hub on the stub axle complete with inner and outer bearings and oil seal.
- 12 Fit the tongued washer and adjusting nut.
- 13 Spin the hub to settle the bearings and tighten the adjusting nut sufficient to provide hub end-float of 0,05 to 0,10 mm (0.002 to 0.004 in.). This can be checked using a dial gauge.
- 14 Fit the lock washer and lock nut. Tighten the lock nut. Bend the lock washer to secure both the locknut and adjusting nut. Recheck end-float.
- 15 Reverse instructions 1 to 6.

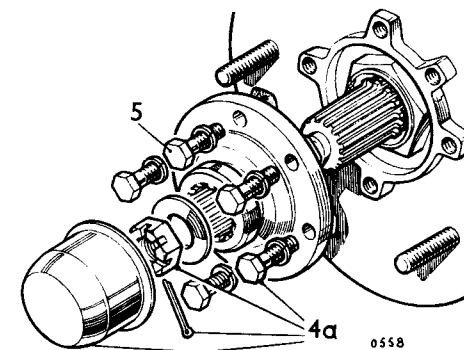


## REAR DRIVE FLANGE

Remove and refit Left hand 64.15.04  
Right hand 64.15.05

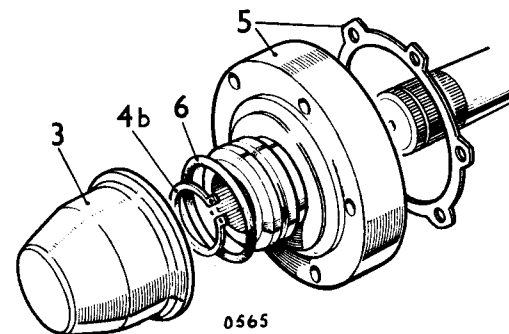
### Removing

- 1 Jack up the vehicle and support securely.
- 2 Remove the road wheel.
- 3 Twist and slide off the hub cap.
- 4 a 88 Models. Remove the split pin, slotted nut, and washer securing the half shaft to the drive flange. Remove the sealing washer. Note that the plastic face of the sealing washer is fitted adjacent to the driving flange.
- b 109 Models. Remove the circlip securing the half shaft to the driving flange.
- 5 Remove the bolts and spring washers securing the driving flange to the hub.
- 6 Withdraw the driving flange and gasket. Remove the 'O' ring from the driving flange if necessary - 109 models only.



### Refitting

- 7 Reverse instructions 1 to 6.



## REAR HUB BEARING END-FLOAT

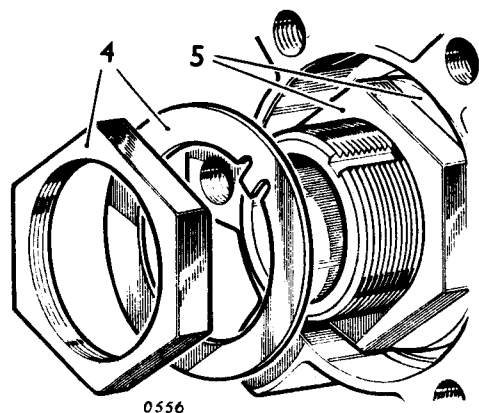
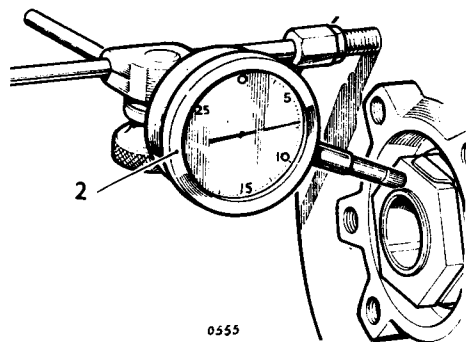
Check and adjust 64.15.13

### Checking

- 1 Carry out instructions 1 to 6, Operation 64.15.01.
- 2 Using a dial gauge check hub end-float. Hub end-float should be within 0,05 to 0,10 mm (0.002 to 0.004 in.).

### Adjusting

- 3 Straighten the lock washer tabs securing the hub locknut and adjusting nut.
- 4 Remove the lock nut and lock washer.
- 5 Set the adjusting nut as required to obtain the required end-float given in 2 above.
- 6 Fit the lockwasher and locknut.
- 7 Bend the lockwasher to secure both the adjusting nut and locknut. Recheck end-float.
- 8 Reverse instructions 1 to 6. Operation 64.15.01.



## REAR HUB BEARINGS

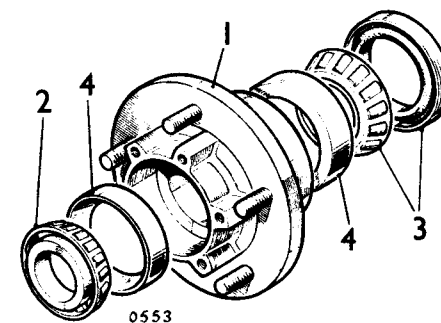
Remove and refit 64.15.14

### Removing

- 1 Remove the rear hub. 64.15.01.
- 2 Withdraw the outer bearing.
- 3 Remove the inner bearing and oil seal. Discard the oil seal.
- 4 Remove the inner and outer bearing tracks.
- 5 Thoroughly clean the hub and bearings.

### Refitting

- 6 Fit the inner and outer bearing tracks.
- 7 Fill the hub to half capacity with fresh grease.
- 8 Fit the inner bearing and a new oil seal. Ensure that the seal lip faces toward the bearing and that the seal lip is lubricated.
- 9 Fit the outer bearing.
- 10 Fit the hub to the stub axle.
- 11 Fit the tongued washer and adjusting nut.
- 12 Adjust hub bearing end-float to within 0,05 to 0,10 mm (0.002 to 0.004 in.).
- 13 Fit the lock washer and lock nut. Bend the lock washer to secure both the lock nut and the adjusting nut.
- 14 Reverse instructions 1 to 6. 64.15.01.



## REAR HUB OIL SEAL

Remove and refit 64.15.15

### Removing

- 1 Remove the rear hub, instructions 1 to 9. Operation 64.15.01.
- 2 Remove the oil seal and discard.

### Refitting

- 3 Fit a new oil seal to the hub, seal lip towards the hub inner bearing. Lubricate the seal lip.
- 4 Reverse instructions 1 to 9. Operation 64.15.01.

## REAR HUB STUB AXLE

Remove and refit Left hand 64.15.20  
Overhaul Right hand 64.15.21

### Removing

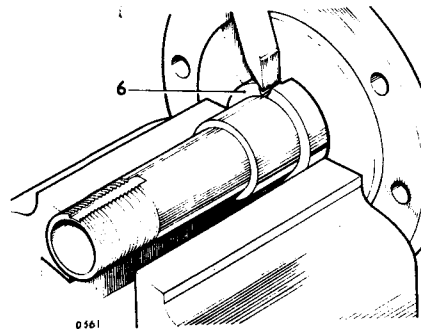
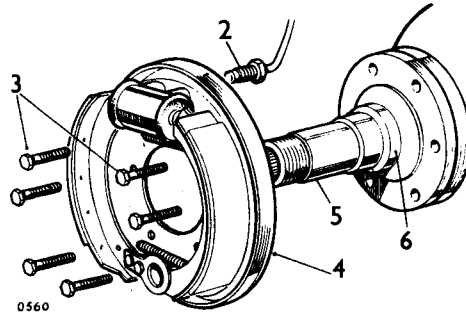
- 1 Remove the rear hub, instructions 1 to 9. Operation 64.15.01.
- 2 Disconnect the brake pipe at the wheel cylinder. Plug the wheel cylinder and brake pipe to prevent ingress of foreign matter.
- 3 Remove the six bolts and nuts securing the brake backplate and stub axle to the rear axle flange.
- 4 Detach the brake backplate from the stub axle.
- 5 Remove the stub axle and gasket. Discard the gasket.

### Overhaul

- 6 Examine the stub axle for wear and damage. Check the peripheral surface of the distance collar. This area of the collar forms the running surface of the hub oil seal lip. Wear or ridging will result in rapid oil seal deterioration and ineffectiveness. Renew the collar if necessary. The collar is a press fit on the stub axle. Remove the collar by drilling and splitting, taking care to avoid marking or damaging the stub axle. Press on a new collar.

### Refitting

- 7 Reverse instructions 1 to 5.
- 8 Bleed the brakes.



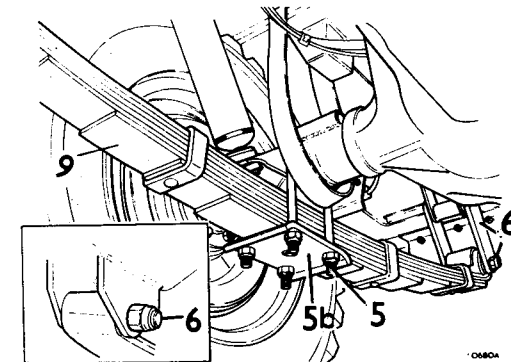
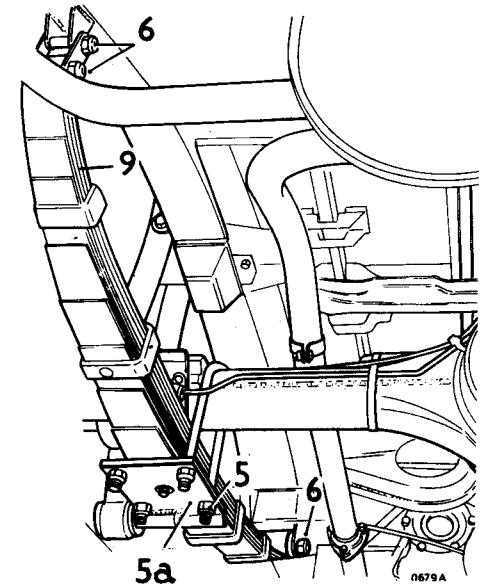
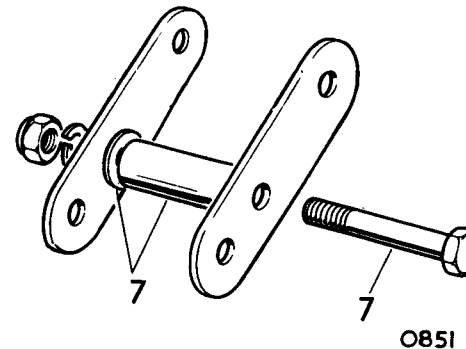
## REAR ROAD SPRING

Remove and refit 64.20.01

### Removing

- 1 Rear springs, driver's side and passenger's side must not be interchanged. Springs can be identified by the increased camber of the spring fitted to the driver's side and by the part number stamped on the underside of the third leaf. The exception to the above is 109 1 ton models. On this vehicle both rear springs are identical.
- 2 Jack up the vehicle and support the chassis securely.
- 3 Remove the road wheel.
- 4 With the jack positioned under the rear axle relieve the road springs of load.
- 5 Remove the road spring 'U' bolts.
  - a 88 models. Slide the spring plate clear of the spring.
  - b 109 models. Remove the spring plate.
- 6 Remove the shackle bolt nuts.
- 7 Slacken the rear, upper shackle bolt. The rear shackle bolts are screwed to the inner shackle links. 109 1 ton models. Slacken the shackle link centre bolt and nut. Note that a spacer and shims are fitted between the shackle links.
- 8 Remove the spring shackle bolts.
- 9 Remove the road spring.

*continued*

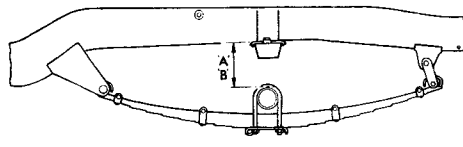


**Refitting**

- 10 Reverse instructions 4 to 9 but do not tighten the shackle bolts or shackle bolt nuts. Ensure that the axle is properly located in the spring centre bolt before fitting and tightening the 'U' bolts to 8,0 kgf m (58 lbf ft).

**Spring setting procedure**

- 11 The shackle bolts which clamp the centre member of the road spring and hangar bracket bushes must not be tightened until the spring is positioned in the mid-point of its deflection range. This ensures that excessive rotation/shear forces are not imparted to the bush centres. Failure to observe this instruction can adversely affect bush life, especially in off-road conditions which produces large spring deflections.
- 12 Deflect the spring towards the chassis to the required dimension by using a length of chain passed over the chassis and under a lifting trolley jack. Alternatively lower the vehicle on its wheels and load the vehicle.  
Dimension 'A', 88 in Models, 142,0 to 146,0 mm.  
Dimension 'B', 109 in Models, 158,0 to 162,0 mm.
- 13 Tighten the spring shackle bolts and nuts to 8,3 to 9,7 kgf m (60 to 70 lbf ft).



ZRC158A

- 14 On 109 in 1 ton models tighten the shackle link centre bolt and nut.

**REAR ROAD SPRING****Overhaul**

64.20.04

- 1 Only the main leaf and second leaf are available as spares items. For spring data refer to Section 04.

When refitting the spring centre bolt it is suggested that the plain nut is substituted by a nut of the self-locking type to prevent the centre bolt slackening in service.

**Spring eye bushes**

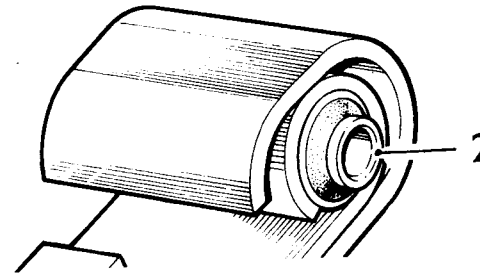
- 2 Remove and refit using a press. Spring eye bushes must be located centrally in the spring.

**REAR SPRING HANGAR BRACKET BUSH****Remove and refit**

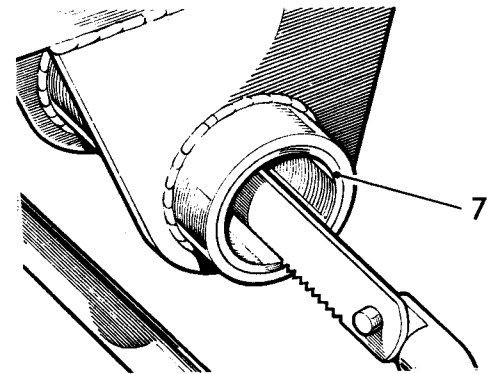
64.20.21

**Removing**

- 1 Jack up the vehicle and support the chassis securely. Retain the jack in position to support the rear axle.
- 2 Remove the road wheel.
- 3 Remove the spring shackle lock nuts.
- 4 Slacken the front shackle bolt.
- 5 **109 1 ton models only.** Slacken the rear shackle centre bolt and nut.
- 6 Slacken the lower rear shackle bolt, remove the upper shackle bolt and swing the shackle links clear of the chassis.
- 7 Using a drift of suitable dimensions, or a length of solid drawn steel tubing and a long bolt and washers extract the bush from the hangar bracket. Where difficulty is experienced and the bush inner member and rubber separate from the bush outer shell the outer shell may be removed by splitting it with a hacksaw. Care must be taken to avoid marking the hangar bracket.



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0534

**Refitting**

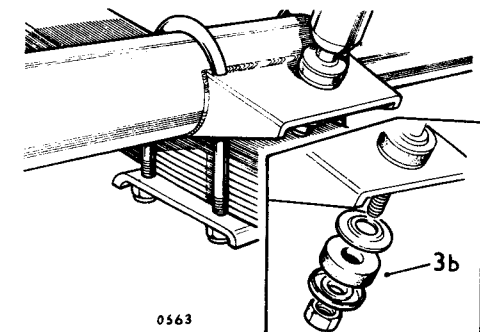
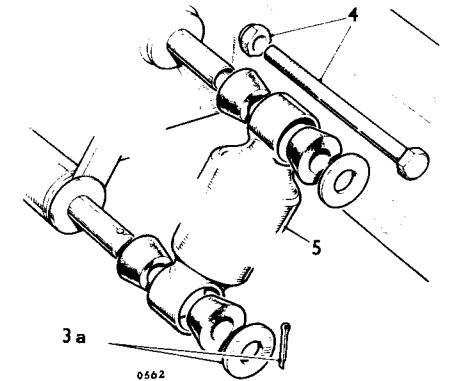
- 8 Clean the hangar bracket bore.
- 9 Using a long bolt and washer pull the new bush into position in the hangar bracket. Ensure it is located centrally in the hangar bracket.
- 10 Fit the rear shackle links and the rear upper shackle bolt but do not tighten at this stage.
- 11 Carry out spring setting procedure, instructions 11 to 13. Operation 64.20.01.

**REAR SHOCK ABSORBER****Remove and refit**

64.30.05

**Removing**

- 1 Jack up the vehicle and support securely.
- 2 Remove the road wheel.
- 3 a **88 models.** Remove the split pin and washer securing the lower end of the shock absorber to the spring plate.
- b **109 models.** Remove the nut securing the lower end of the shock absorber to the axle bracket. Release the shock absorber from the axle bracket and withdraw the two rubber bushes and the four bush seating washers.



- 4 Remove the bolt, washer and nut securing the upper end of the shock absorber to the chassis.

*continued*

- 5 Withdraw the shock absorber complete with bushes.

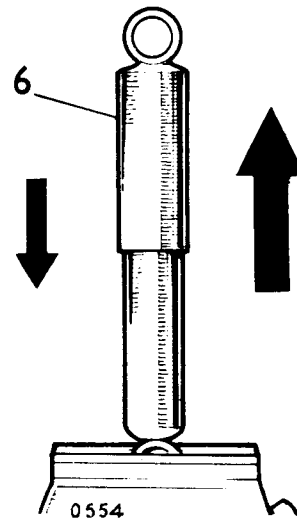
#### Checking shock absorber operation

- 6 Hold the shock absorber vertically in a vice.
- 7 The shock absorber employs differential damping having greater resistance on the extension stroke. Check operation by extending and compressing the shock absorber.

Resistance should be uniform throughout the length of each stroke. If resistance is erratic or weak, renew the shock absorber. When checking resistance a new shock absorber may be used for comparison.

#### Refitting

- 8 Reverse instructions 1 to 5.



#### CHECK STRAP

Remove and refit

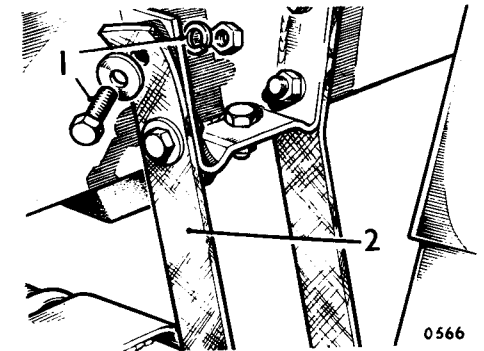
64.30.17

#### Removing

- 1 Remove the bolts, nuts and washers securing the check strap to the chassis.
- 2 Remove the check strap.

#### Refitting

- 3 Reverse instructions 1 and 2.



#### BUMP STOP

Remove and refit

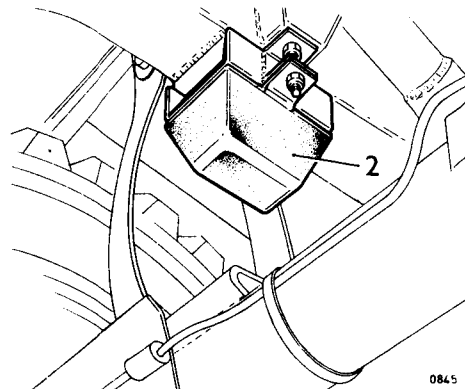
64.30.10

#### Removing

- 1 Remove the two bolts, nuts and spring washers securing the bump stop to the chassis.
- 2 Remove the bump stop

#### Refitting

- 3 Reverse instructions 1 and 2.







## BRAKE WARNING LIGHT

General information 70.00.00

### Warning light function

- 1 An amber warning light marked 'BRAKE' is provided on the instrument panel on models for certain territories only.
- 2 The following brief description of the warning light function is intended as a guide to aid in brake system fault diagnosis.
- 3 The warning light is in series circuit with one or more of the following warning indicator switches to provide a visual indication of brake lining wear, hydraulic fluid leakage or servo vacuum loss, depending on the particular equipment provided on the vehicle:-
  - a A servo mounted vacuum switch which indicates lack of vacuum assistance at the brake servo.
  - b A pedal-box mounted pedal travel switch to give an indication of excess pedal travel caused by brake shoe wear or minor hydraulic leakage.
  - c A chassis mounted pressure differential switch which indicates fluid leakage in the front or rear brake hydraulic systems.
  - d A dash mounted test switch which is push button operated. Failure of the bulb to illuminate on being tested could indicate a faulty bulb or earth connection.

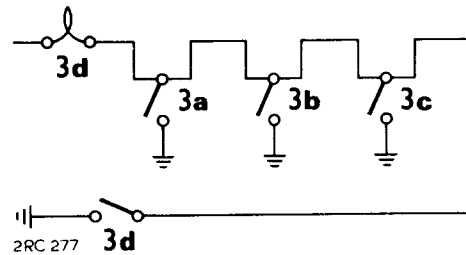
### Fault diagnosis—Brake warning light 'ON'

#### General

- 4 The brake warning light circuit is energised with the ignition switched 'ON' only.
- 5 The warning indicator switches are normally on open circuit and short the circuit to earth, to illuminate the brake warning light, when the switches are closed (refer to the accompanying schematic circuit diagram).

### Procedure—Ignition switch 'ON'—test button fully out from dash.

- 6 Servo vacuum switch—Petrol models (for Diesel models, see item 7).
  - a Ensure vacuum is available at the switch by checking the hose connections for soundness, then running the engine for a short period during which engine overrun conditions are obtained, that is, throttle opened then allowed to quickly close.
  - b With vacuum available, if the brake warning light remains 'ON', disconnect the electrical leads at the vacuum switch and connect together the leads, using a slave Lucar male connector blade.
  - c If the light is extinguished, the vacuum switch is faulty and must be replaced. If the warning light remains 'ON', leave the leads connected together and proceed to the next switch in the circuit.



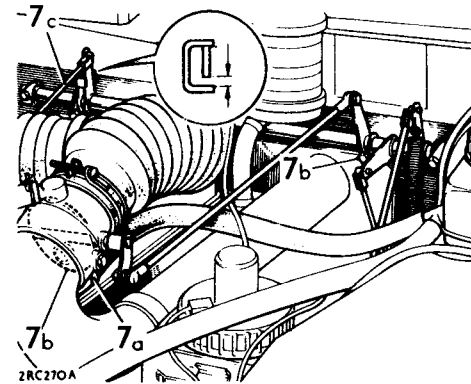
### 7 Servo vacuum switch—Diesel models.

#### General

Before faulting the servo vacuum switch on diesel models, check the following items a to c for correct operation:-

- a Remove the hose and unscrew the non-return valve from the underside of the inlet manifold. Check for the valve sticking closed by blowing with the mouth into the hose connector end of the valve (do not use high pressure air); the air should pass through freely. Renew the valve to rectify.

- b Remove the air inlet hose from the inlet manifold and check that the manifold butterfly valve is fully closed with the accelerator linkage in the idle position. Adjustment is made at the pinch bolt which secures the butterfly valve linkage to the accelerator cross-shaft.



- c If adjustment is required, observe that the space between the front and rear arms of the forked shaft, which actuates the distributor pump linkage, provides a 'lost motion' period during which the accelerator cross-shaft rotates but the pump linkage does not. Set the pump linkage at the cross-shaft pinch bolt such that the butterfly valve will open in advance of the pump linkage.
- d When the foregoing items are satisfactory, carry out the switch checking sequence described in item 6. If a replacement switch does not effect a cure for the warning light 'ON' condition, check the actual depression present in the inlet manifold at overrun conditions, using a suitable gauge interposed between the inlet manifold and the vacuum reservoir tee-piece. Opening and closing the throttle sharply several

times with the engine running should enable a depression of at least 15 in Hg. to be registered on the gauge, this being sufficient to actuate the servo vacuum switch.

- 8 Brake pressure differential switch.
  - a Disconnect the switch leads and interconnect them to remake the circuit.
  - b If the warning light remains 'ON', proceed to check the next switch in the circuit; if the light is extinguished, check for hydraulic system leakage which would cause the differential switch plunger to displace to one end.

NOTE: On dual braking systems, the hydraulic fluid reservoir is divided into two compartments. On 88 models, the front compartment supplies the rear brakes and the rear compartment the front brakes; on 109 models, however, the reverse applies and the front compartment supplies the front brakes, the rear compartment supplies the rear brakes. A difference in fluid levels may indicate which system is leaking. Fluid leaks must be rectified before centralising the switch.

- c To centralise the differential switch plunger, bleed a brake line in the pressurised system (front or rear as applicable) use very slow pedal travel and observe the brake warning light. Immediately the warning light is extinguished, keep a light pressure on the pedal and close the bleed nipple.
- 9 Pedal travel switch
  - a Check that the switch is set (by means of the locknut on the mounting bracket) to operate within 111 to 117 mm (4.37 to 4.60 in.) pedal travel movement towards the floor.
  - b Disconnect the switch leads and interconnect them to remake the circuit.
  - c If the warning light remains on, renew the switch.

## BRAKE DRUMS

- Remove and refit**  
**Front drums** 70.10.02  
**Rear drums** 70.10.03

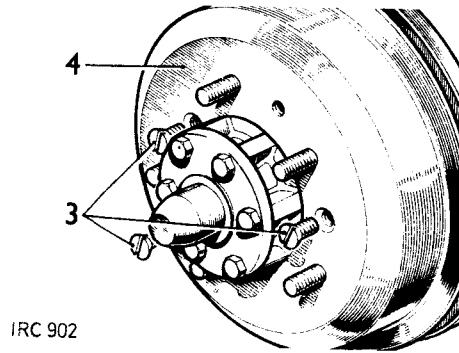
### Removing

- 1 Jack up the vehicle and support securely.
- 2 Remove the road wheel.
- 3 Slacken off the brake adjuster/s at the brake anchor plate.
- 4 Remove the brake drum fixings.
- 5 Withdraw the brake drum.

**WARNING:** Do not blow out the dust in a brake drum; it is dangerous if inhaled.

### Refitting

- 6 Reverse instructions 1 to 5.



IRC 902

## DATA

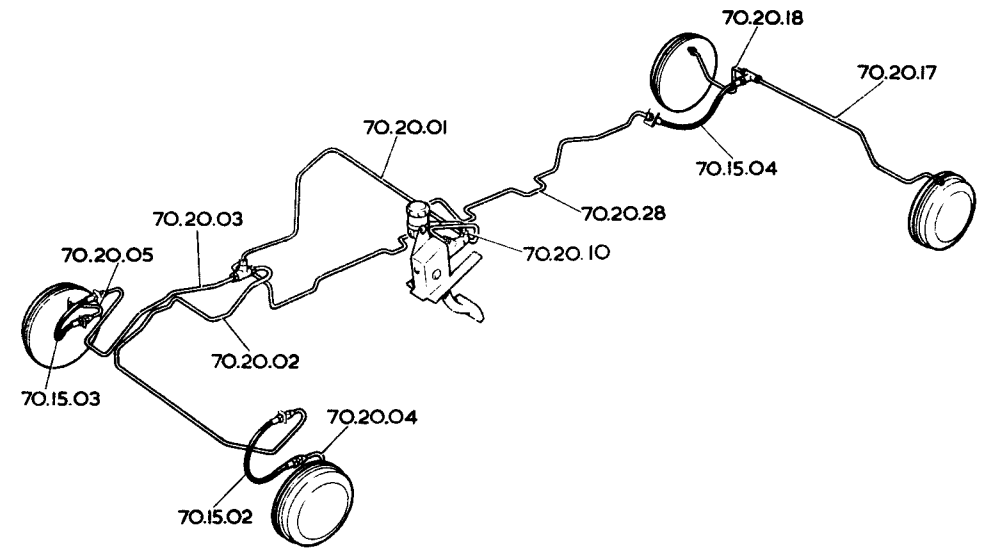
### Brake drums

#### Diameter:

88 in models, front and rear	254 mm (10 in)
109 in models, front and rear	279,4 mm (11.0 in)

#### Reclamation limit:

	<i>Drum diameter</i>	<i>Drum maximum oversize</i>
88 in pre-rationalized front and rear axle	254 mm (10.0 in)	255,52 mm (10.06 in)
88 in current production front axle	279,4 mm (11.0 in)	280,92 mm (11.06 in)
88 in current production rear axle	254 mm (10.0 in)	255,52 mm (10.06 in)
109 in 2¼ litre and 2.6 litre front and rear axle	279,4 mm (11.0 in)	280,92 mm (11.06 in)



IRC 695

## BRAKE HOSES AND PIPES

Single system, non-servo models

### HOSES

<b>Remove and refit</b>	
Front left hand	70.15.02
Front right hand	70.15.03
Intermediate	70.15.04

Feed to master cylinder	70.20.10
Feed to rear left hand cylinder	70.20.17
Feed to rear right hand cylinder	70.20.18
Feed to intermediate hose	70.20.28

### PIPES

<b>Remove and refit</b>	
Feed to front multi-way connector	70.20.01
Feed to front left hand hose connector	70.20.02
Feed to front right hand hose connector	70.20.03
Feed to front left hand cylinder	70.20.04
Feed to front right hand cylinder	70.20.05

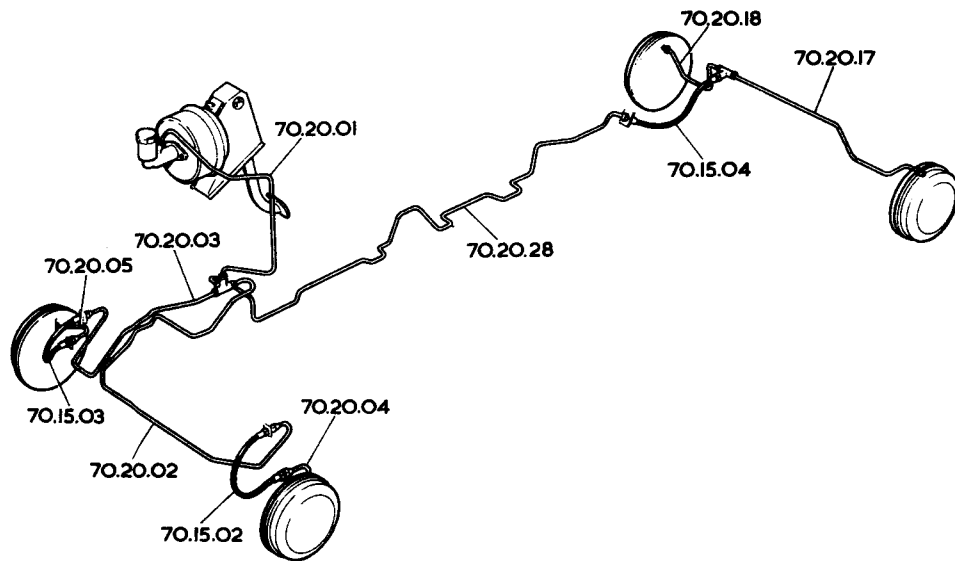
**NOTE:** The operation numbers are included on the brake system illustration to facilitate identification of the individual pipes.

### Removing

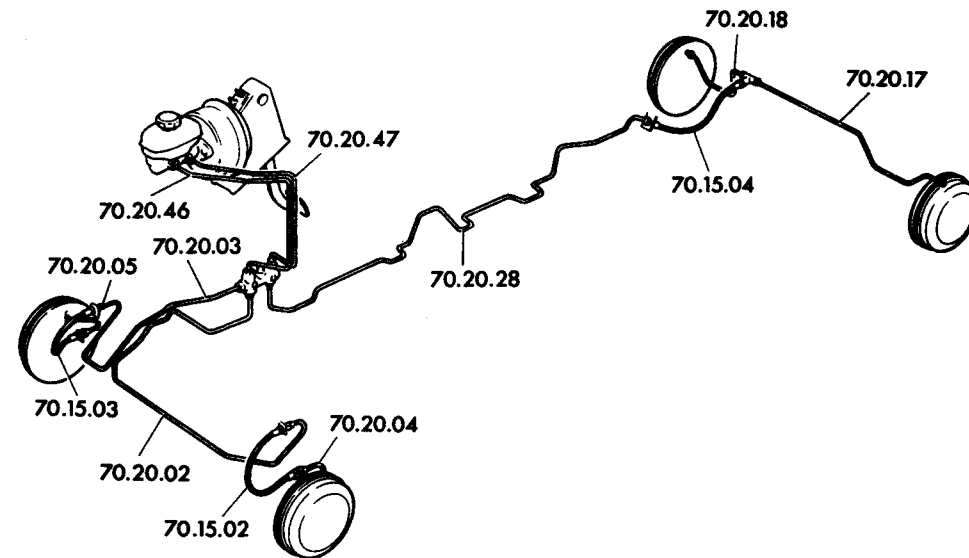
- 1 Disconnect the hose or pipe at both connections.
- 2 Release the clipping.
- 3 Withdraw the hose or pipe.

### Refitting

- 4 Reverse instructions 1 to 3.
- 5 Bleed the brakes 70.25.02.



IRC 696



IRC897

## BRAKE HOSES AND PIPES

Single system models with servo

### HOSES

Remove and refit	
Front left hand	70.15.02
Front right hand	70.15.03
Intermediate	70.15.04

### PIPES

Remove and refit	
Feed to front multi-way connector	70.20.01
Feed to front left hand hose connector	70.20.02
Feed to front right hand hose connector	70.20.03
Feed to front left hand cylinder	70.20.04
Feed to front right hand cylinder	70.20.05

Feed to rear left hand cylinder	70.20.17
Feed to rear right hand cylinder	70.20.18
Feed to intermediate hose	70.20.28

NOTE: The operation numbers are included on the brake system illustration to facilitate identification of the individual pipes.

#### Removing

- 1 Disconnect the hose or pipe at both connections.
- 2 Release the clipping.
- 3 Withdraw the hose or pipe.

#### Refitting

- 4 Reverse instructions 1 to 3.
- 5 Bleed the brakes 70.25.02.

## BRAKE HOSES AND PIPES

Dual system models

### HOSES

Remove and refit	
Front left hand	70.15.02
Front right hand	70.15.03
Intermediate	70.15.04

### PIPES

Remove and refit	
Feed to front left hand hose connector	70.20.02
Feed to front right hand hose connector	70.20.03
Feed to front left hand cylinder	70.20.04
Feed to front right hand cylinder	70.20.05

Feed to rear left hand cylinder 70.20.17  
Feed to rear right hand cylinder 70.20.18

Feed to intermediate hose	70.20.28
Feed to brake failure switch, front system	70.20.46
Feed to brake failure switch, rear system	70.20.47

NOTE: The operation numbers are included on the brake system illustration to facilitate identification of the individual pipes.

#### Removing

- 1 Disconnect the hose or pipe at both connections.
- 2 Release the clipping.
- 3 Withdraw the hose or pipe.

#### Refitting

- 4 Reverse instructions 1 to 3.
- 5 Bleed the brakes 70.25.02.

## FOUR-WAY CONNECTOR, Single system

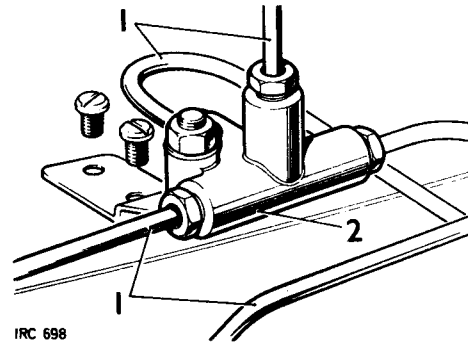
Remove and refit 70.15.35

### Removing

- 1 Disconnect and blank off the four fluid pipes.
- 2 Remove the four-way connector and bracket, located in the engine compartment on top of the chassis R.H. side member.

### Refitting

- 3 Fit the four-way connector with the connection for the rear brakes pipe facing outboard.
- 4 Bleed the brakes. 70.25.02.



IRC 698

## BRAKE FAILURE SWITCH, Dual systems

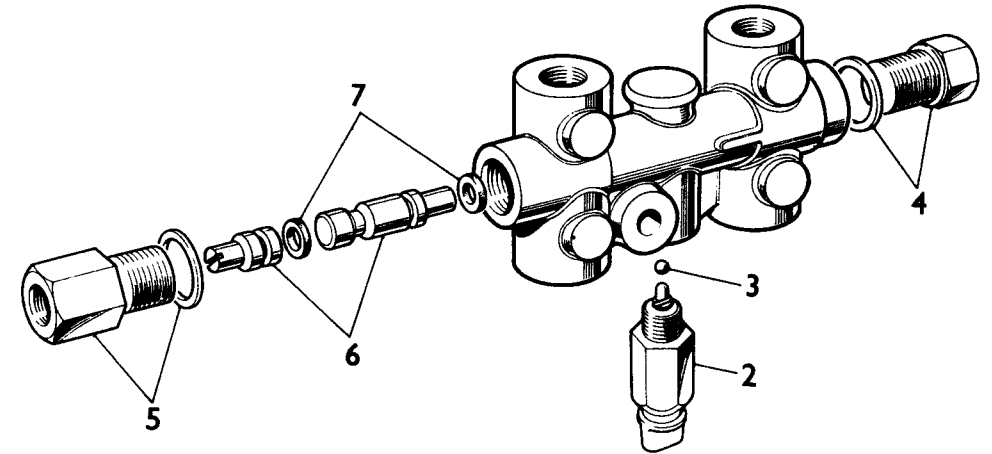
Overhaul 70.15.41

### Dismantling

- 1 Remove the switch assembly. 70.15.36.
- 2 Remove the switch unit from the housing.
- 3 Withdraw the plunger ball.
- 4 Remove the end plug and sealing washer.
- 5 Remove the pipe connector union and sealing washer.
- 6 Push out the two-part shuttle valve, using a soft drift.
- 7 Remove and discard the shuttle valve oil seals.

### Inspecting

- 8 Clean the shuttle valve, end plug, pipe union and five-way connector, using new brake fluid or ethyl alcohol.
- 9 Examine the shuttle valve and its bore in the five-way connector, they must be in perfect condition with no signs of scratches or corrosion, otherwise fit a new switch complete.
- 10 To test the electrical switch, reconnect the leads and actuate the switch plunger by pressing it against an earthing point on the vehicle.



IRC 700A

## BRAKE FAILURE SWITCH, Dual systems

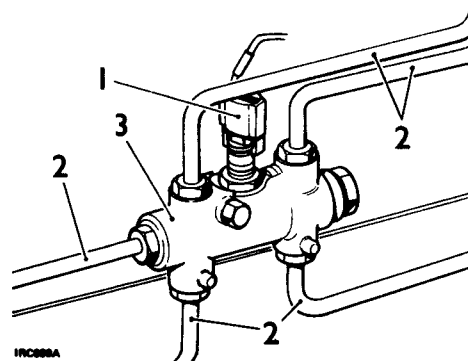
Remove and refit 70.15.36

### Removing

- 1 Disconnect the electrical leads from the brake failure switch, located in the engine compartment at the chassis R.H. side member.
- 2 Disconnect and blank off the five fluid pipes.
- 3 Remove the brake failure switch.

### Refitting

- 4 Secure the brake failure switch in position, with the electrical leads socket uppermost.
- 5 Reverse instructions 1 and 2.
- 6 Bleed the brakes. 70.25.02.



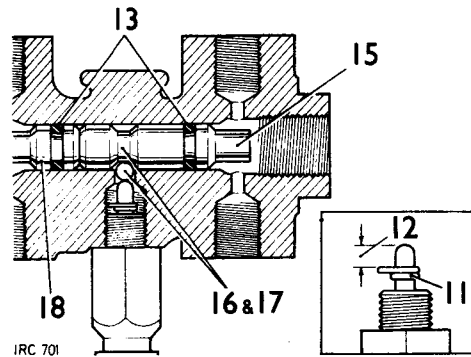
IRC 698A

### Assembling

- 11 If the plunger spring is dislodged, refit with the small coil of the spring toward the switch unit threads.
- 12 Position the plunger spring 4,06 mm (0.160 in.) approximately from the plunger end.

*continued*

- 13 Fit new shuttle valve seals.
- 14 Coat the seals with Girling brake lubricant or clean brake fluid.
- 15 Fit the longer shuttle valve, slotted end last, to the end plug end of the housing bore.
- 16 Position the shuttle valve to align the groove for the plunger ball with the drilling for the ball.
- 17 Fit the ball and switch unit. Torque loading 17,28 kgf. cm (15 lbf. in.).
- 18 Fit the shorter shuttle valve, slotted end last, to the pipe connector end of the housing bore.
- 19 Reverse instructions 4 and 5, using new sealing washers. Torque 2,2 kgf. m (16 lbf. ft.).
- 20 Fit the switch assembly. 70.15.36.



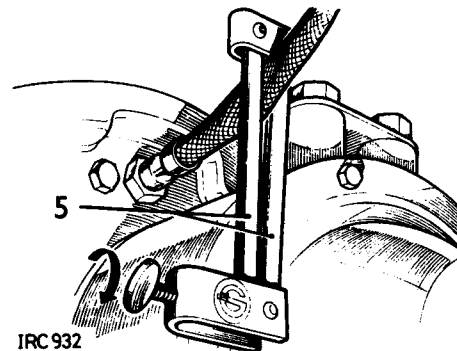
- 6 With clamps fitted on the two front and one rear hose the pedal action should be perfect with no indication of 'sponginess'. If under these circumstances a spongy pedal is apparent, a new or overhauled master cylinder assembly must be fitted and bled and the test repeated.
- 7 If perfect pedal action is obtained with the three hose clamps in position, remove the rear clamp and if the pedal is spongy, the air must be in the rear cylinders. However, if the pedal action is good, remove first one then the other of the two front clamps, repeating the test until the air is located.

#### Wheel cylinder—servicing

- 8 For wheel cylinder servicing only the appropriate hose need be clamped. This keeps the loss of fluid to a minimum and after the service is satisfactorily completed, only the affected parts require bleeding.

#### Brake bleeding procedure

- 9 Slacken off the brake shoe adjusters on each wheel to minimise wheel cylinder volume.
- 10 Attach a bleed tube to the bleed nipple farthest from the master cylinder. Submerge the tube free end in brake fluid in a transparent container.
- 11 Slacken the bleed nipple a half-turn.



- 12 Push down the brake pedal through the full stroke; follow with three short rapid strokes then allow the pedal to fully return.  
Pause for four or five seconds before commencing the next pedal stroke.

**NOTE:** On dual braking systems only, do not use full pedal travel as this may decentralise the shuttle valve plunger in the brake failure switch. Operate the pedal slowly. If during the bleeding procedure the plunger operates the switch and the warning light is on, the bleedscrew must be closed and the bleedscrew at the other end of the car opened (if bleeding the front brakes, open a bleedscrew on a rear brake and vice versa).

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

- 13 Repeat the procedure until fluid discharged from the bleed tube is free of air, then tighten the bleed nipple during a pedal downstroke.
- 14 Repeat the procedure on the remaining wheels, commencing and continuing at the next wheel farthest from the master cylinder.
- 15 Adjust the brakes. 70.25.03.
- 16 If the system is fitted with servo assistance:  
Hold foot pressure on the brake pedal and start the engine. If the vacuum system is functioning correctly, the pedal will move towards the board. If no movement is felt, the vacuum system is not operating.

## BRAKES

Bleed 70.25.02

### General

- 1 Observe strict cleanliness precautions to prevent foreign matter from entering the hydraulic system.
- 2 Use only new supplies of the recommended brake hydraulic fluid (see 09—Lubricants and Fluids).
- 3 Keep the fluid reservoir 'topped up' during bleeding.
- 4 Where the complete hydraulic system is to be refilled, it is advantageous to first charge the system, to each bleed point in turn, before attempting to expel all air from the system.

### Isolating local air pockets

- 5 Use of Girling Brake Service Hose Clamp considerably facilitates the location of air in the system, therefore saving time by locating the hydraulic fault, and saving fluid when servicing the wheel cylinders.

Providing the brake hose is in reasonable condition, damage cannot be caused using the hose clamp, but the use of other tools to clamp the hoses is not recommended as damage may be caused internally to the hose without it being noticed externally.

**BRAKES**

Adjust

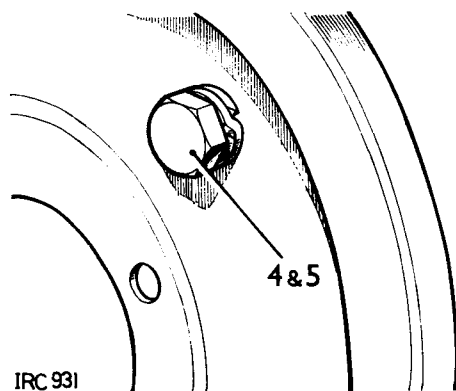
70.25.03

**General**

Two adjusters are provided on each road wheel on 109 models and one adjuster on each wheel on 88 models.

**Adjusting procedure**

- 1 Apply the transmission brake.
- 2 Raise the applicable wheel.
- 3 Ensure that the wheel is free to rotate, back-off the adjuster(s) as necessary.
- 4 Turn the adjuster(s) until the brake shoe(s) contact(s) the wheel drum.
- 5 Back-off two serrations on the adjuster(s).
- 6 Lower the wheel.



IRC 931

**MASTER CYLINDER, Non-servo systems**

Remove and refit

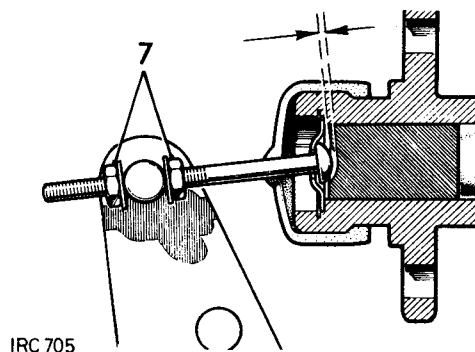
70.30.01

**Removing**

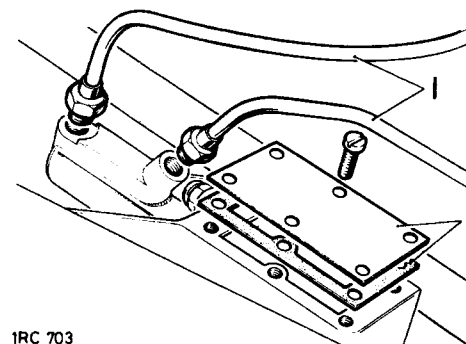
- 1 Disconnect the inlet and outlet pipes from the brake master cylinder.
- 2 Remove the top cover and gasket from the brake pedal bracket.
- 3 Remove the nut and plain washer securing the master cylinder push rod to the brake pedal trunnion.
- 4 Remove the fixings and withdraw the master cylinder from the brake pedal bracket.

**Refitting**

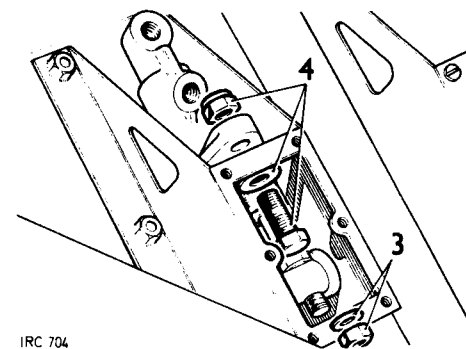
- 5 Reverse 3 and 4, loosely securing the push rod to the trunnion.
- 6 Adjust the push rod, by rotating, to obtain 1,5 mm (0.062 in.) free play between the push rod and the master cylinder piston.
- 7 Tighten the locknuts.
- 8 Reverse instructions 1 and 2.
- 9 Bleed the brake system. 70.25.02.



IRC 705



IRC 703



IRC 704

**MASTER CYLINDER, Servo Systems**

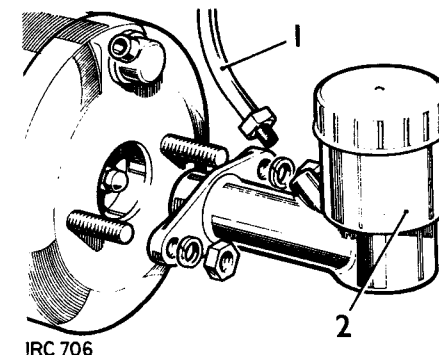
Remove and refit

70.30.01

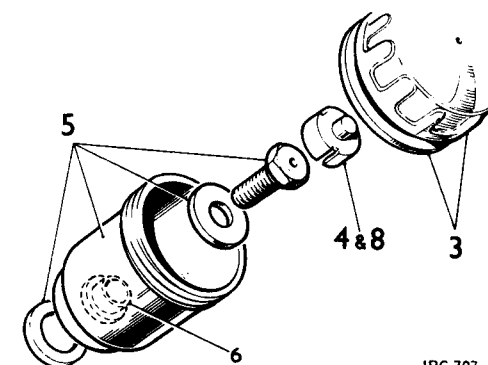
- 1 Disconnect the outlet pipe from the brake master cylinder.
- 2 Remove the fixings and withdraw the master cylinder complete with reservoir.
- 3 Remove the filler cap and filter, where fitted, from the reservoir and drain all the fluid.
- 4 Using long-nosed pliers, withdraw the plastic cover from the reservoir adaptor bolt.
- 5 Remove the adaptor bolt and withdraw the plain washer, reservoir body, and seal.
- 6 DO NOT attempt to remove the distance piece from the base of the reservoir.

**Refitting**

- 7 Smear the seal for the reservoir base with Castrol-Girling rubber grease and place it in position.
- 8 Locate the fluid reservoir in position on the master cylinder, and secure with the plain washer and adaptor bolt. Tighten the adaptor bolt to a torque figure of 2,8 to 3,5 kgf. m. (20 to 25 lbf. ft.).
- 9 Reverse instructions 3 and 4.
- 10 Reverse 1 and 2; master cylinder fixings torque load is 2,2 to 2,6 kgf. m. (16 to 19 lbf. ft.).
- 11 Bleed the brake hydraulic system. 70.25.02.



IRC 706



IRC 707

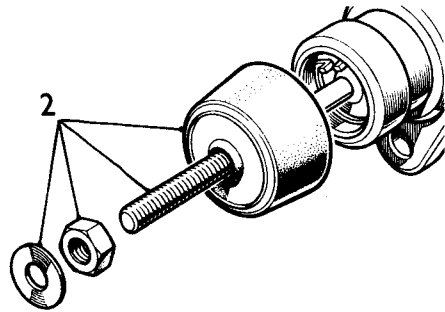
## MASTER CYLINDER, Non-servo systems

Overhaul

70.30.02

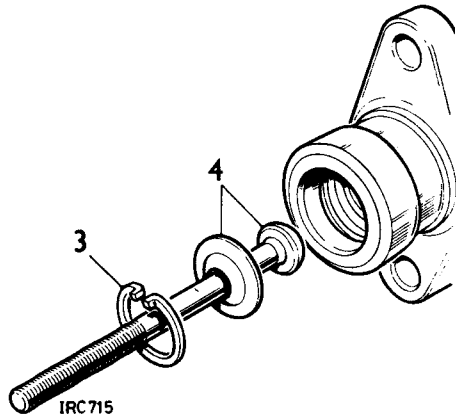
### Dismantling

- 1 Remove the master cylinder. 70.30.01
- 2 Remove the plain washer, nut and rubber cover from the push rod.



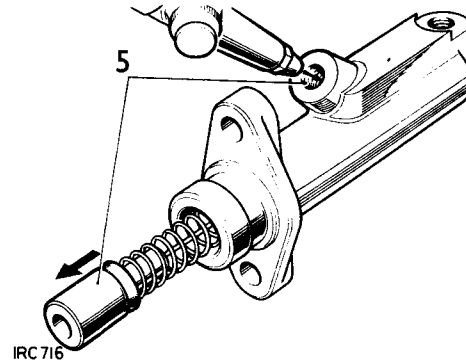
IRC 714

- 3 Remove the circlip.
- 4 Withdraw the push rod and retaining washer.



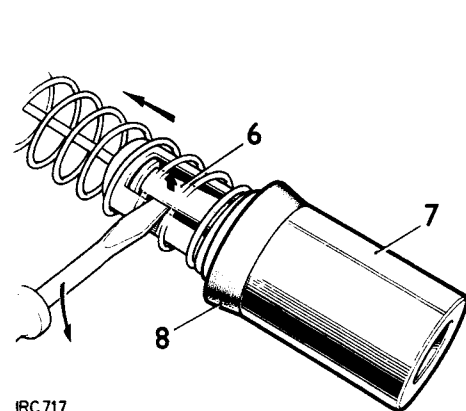
IRC 715

- 5 Withdraw the piston assembly from the master cylinder. If necessary, apply a low air pressure to the outlet port to expel the piston.



IRC 716

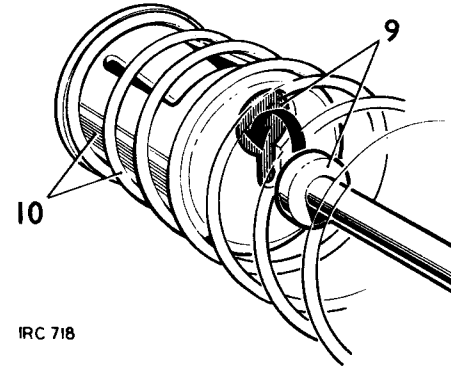
- 6 Prise the locking prong of the spring retainer clear of the piston shoulder.
- 7 Withdraw the piston.
- 8 Remove the piston seal.



IRC 717

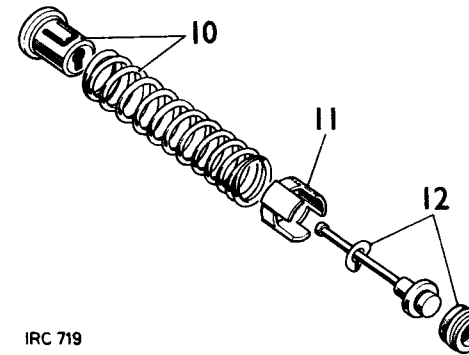
### (Non-servo Systems)

- 9 Compress the spring and position the valve stem to align with the larger hole in the spring retainer.
- 10 Withdraw the spring and retainer.



IRC 718

- 11 Slide the valve spring over the valve stem.
- 12 Remove the spring washer and valve seal from the stem.



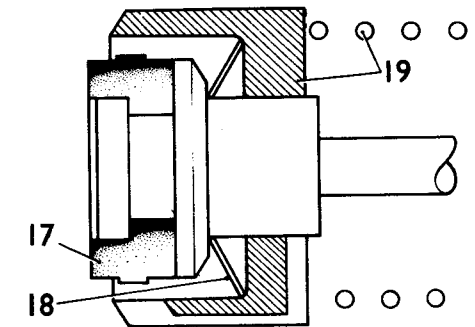
IRC 719

### Inspecting

- 13 Clean all components in Girling cleaning fluid and allow to dry.
- 14 Examine the cylinder bore and piston, ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, renew the master cylinder.
- 15 The seals should be replaced with new components. These items are included in the master cylinder overhaul kit.

### Assembling

- 16 Smear the seals with Castrol-Girling rubber grease and the remaining internal items with Castrol-Girling Brake and Clutch Fluid.
- 17 Fit the valve seal, flat side first, to the end of the valve stem.
- 18 Place the spring washer, domed side first, over the small end of the valve stem.
- 19 Fit the valve spacer, legs first, and the coil spring.



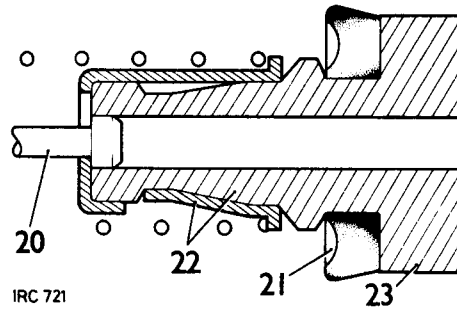
IRC 720

*continued*

- 20 Insert the retainer into the spring and compress until the stem passes through the keyhole and is engaged in the centre.

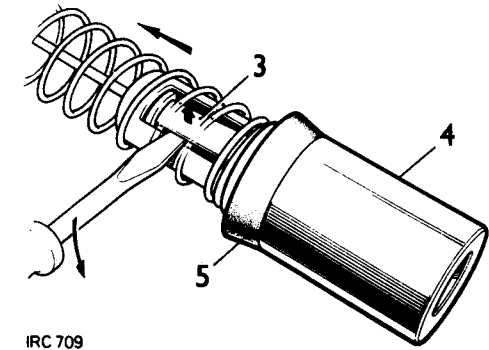
**(Non-Servo Systems)**

- 21 Fit the seal, large diameter last, to the piston.
- 22 Insert the piston into the spring retainer and engage the locking prong.
- 23 Smear the piston with Castrol-Girling rubber grease and insert the assembly, valve end first, into the cylinder.
- 24 Fit the push rod, retaining washer and circlip.
- 25 Smear liberally the inside of the dust cover with Castrol-Girling rubber grease and fit the cover over the push rod and cylinder.
- 26 Fit the locknut and washer to the push rod.
- 27 Refit the master cylinder. 70.30.01.



IRC 721

- 3 Prise the locking prong of the spring retainer clear of the piston shoulder.
- 4 Withdraw the piston.
- 5 Remove the piston seal.
- 6 Compress the spring and position the valve stem to align with the larger hole in the spring retainer.



IRC 709

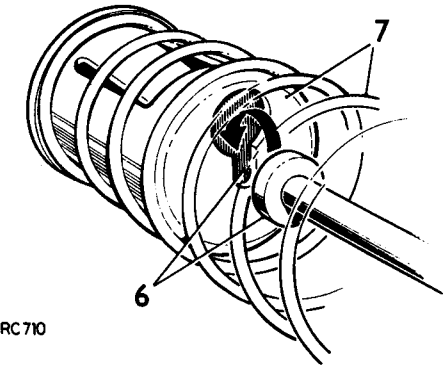
**DATA**

Master cylinder bore size:

- 88 models .....
- 109 models .....

19,05 mm (0.750 in.) diameter  
25,4 mm (1.0 in.) diameter.

- 7 Withdraw the spring and retainer.
- 8 Slide the valve spacer over the valve stem.
- 9 Remove the spring washer and valve seal from the stem.



IRC 710

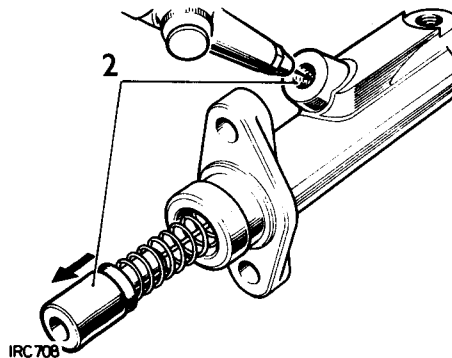
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**MASTER CYLINDER, Servo systems**

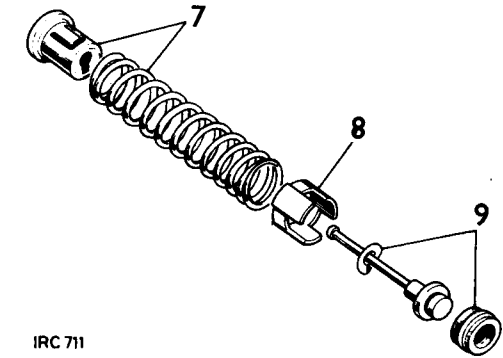
Overhaul 70.30.02

**Dismantling**

- 1 Remove the master cylinder. 70.30.01.
- 2 Withdraw the piston assembly from the master cylinder. If necessary, apply a low air pressure to the outlet port to expel the piston.



IRC 708



IRC 711



### Inspecting

- 10 Clean all components in Girling cleaning fluid and allow to dry.
- 11 Examine the cylinder bore and piston. Ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, fit new replacements.
- 12 The seals should be replaced with new components. These items are included in the master cylinder overhaul kit.

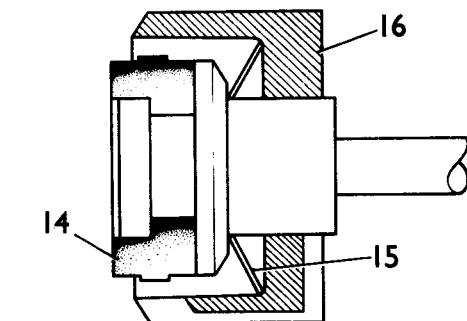
### (Servo systems)

### Assembling

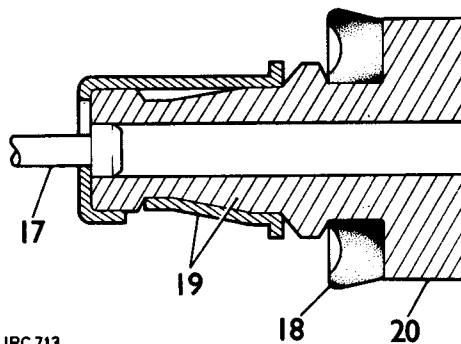
- 13 Smear the seals with Castrol-Girling rubber grease and the remaining internal items with Castrol-Girling Brake and Clutch Fluid.
- 14 Fit the valve seal, flat side first, to the end of the valve stem.
- 15 Place the spring washer, domed side first, over the small end of the valve stem.
- 16 Fit the valve spacer, legs first, then the coil spring.
- 17 Insert the retainer into the spring and compress until the stem passes through the keyhole and is engaged in the centre.
- 18 Fit the seal, large diameter last, to the piston.
- 19 Insert the piston into the spring retainer and engage the locking prong.
- 20 Smear the piston with Castrol-Girling rubber grease and insert the assembly, valve end first, into the cylinder.
- 21 Liberally smear Castrol-Girling rubber grease inside the piston end of the master cylinder.
- 22 Refit the master cylinder. 70.30.01.

### DATA

Master cylinder bore size:  
109 models .....



IRC 712



IRC 713

25,4 mm (1.0 in.) diameter.

## MASTER CYLINDER, Dual systems

### Remove and refit

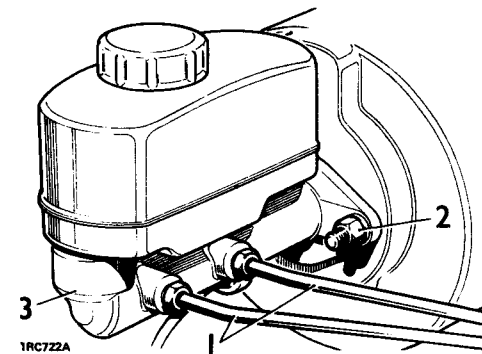
70.30.08

### Removing

- 1 Disconnect the brake pipes.
- 2 Remove the fixings at the flange.
- 3 Withdraw the master cylinder and fluid reservoir complete.

### Refitting

- 4 Reverse 2 and 3. Torque loading 2,2 to 2,6 kgf. m. (16 to 19 lbf. ft.).
- 5 Connect the brake pipes.
- 6 Bleed the brakes. 70.25.02.



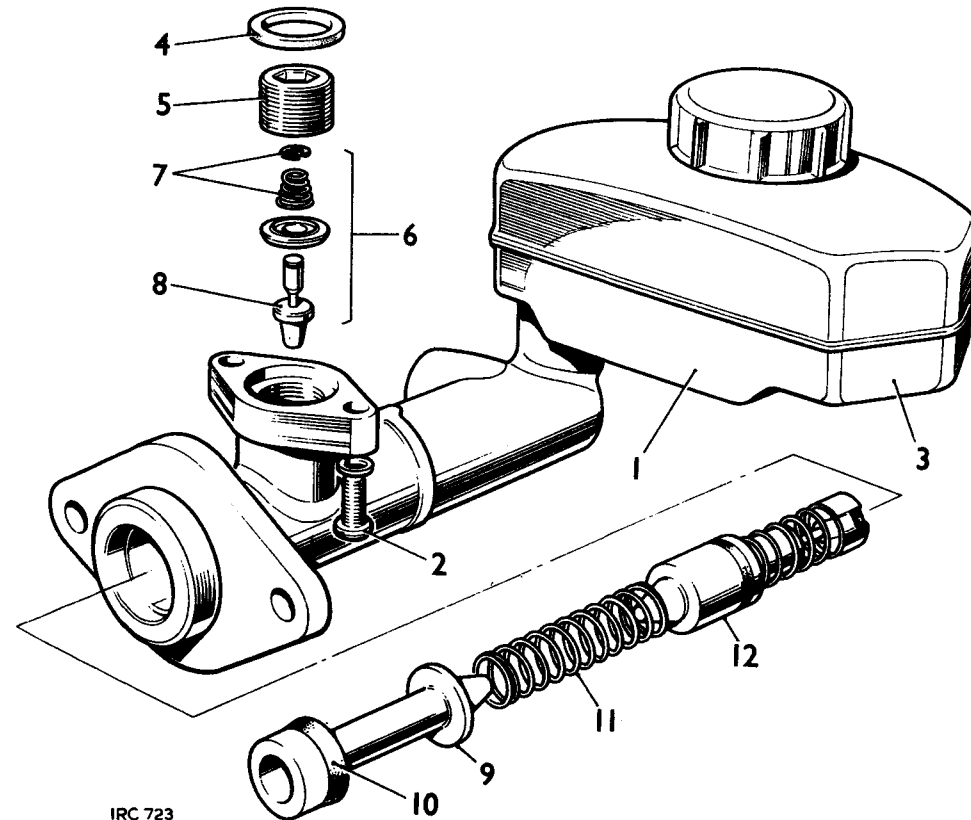
IRC 722A

**MASTER CYLINDER, Dual systems****Overhaul****70.30.09****Dismantling**

- 1 Remove the master cylinder and fluid reservoir complete. 70.30.08.
- 2 Remove the reservoir fixing screws.
- 3 Pivot the reservoir front end aside to expose the master cylinder front inlet bore.

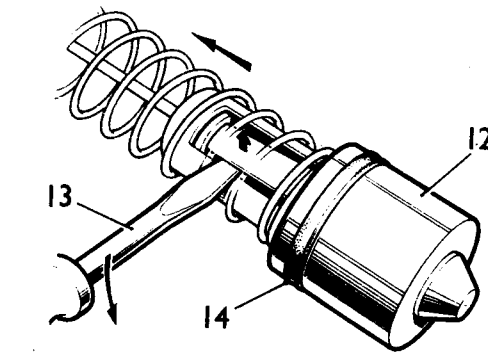
**NOTE:** Do not attempt to remove completely the reservoir which is retained by an internal fixing at the rear inlet bore.

- 4 Withdraw the oil seal ring.



IRC 723

- 5 Unscrew the tipping valve assembly retainer.
- 6 Lift out the tipping valve assembly.
- 7 Remove the retaining circlip and withdraw the spring.
- 8 Withdraw the tipping valve from the seal plate.
- 9 Withdraw the outer piston.
- 10 Remove and discard the oil seal.
- 11 Withdraw the piston spring.
- 12 Withdraw the inner piston and valve assembly.
- 13 Prise the spring retainer locking prong clear of the piston shoulder and withdraw the piston and spring.
- 14 Remove and discard the oil seal.



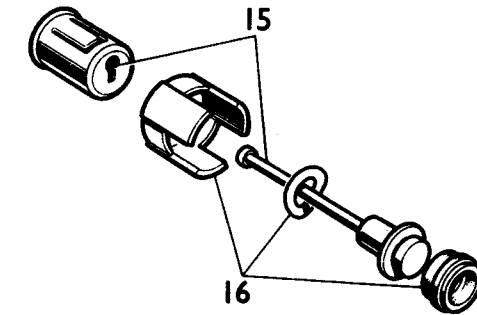
IRC 724

**Inspecting**

- 17 Clean all components in Girling cleaning fluid and allow to dry.
- 18 Examine the cylinder bore and pistons, ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, fit new replacements.
- 19 The seals should be replaced. These items are included in the master cylinder overhaul kit.

*continued*

- 15 Position the valve stem to align with the larger hole in the valve retainer. Withdraw the retainer.
- 16 Slide the valve spacer over the valve stem. Remove the wave washer and valve seal from the stem.



IRC 725