

7. Lift off the rear case assembly.
8. Withdraw the side gear.
9. Slide out the cross-shafts and remove the bevel pinions and thrust washers from the front case assembly.
10. Withdraw the side gear to dismantle the front case assembly.

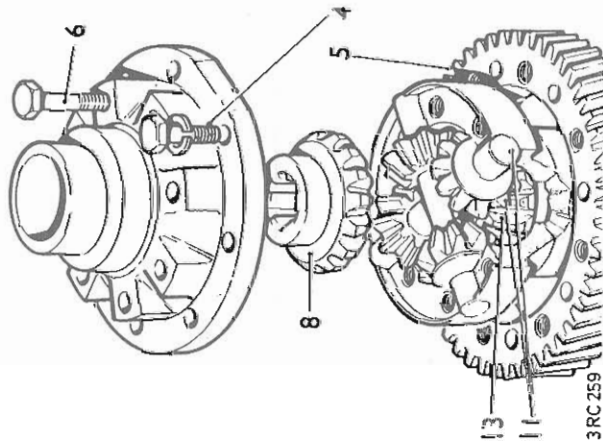
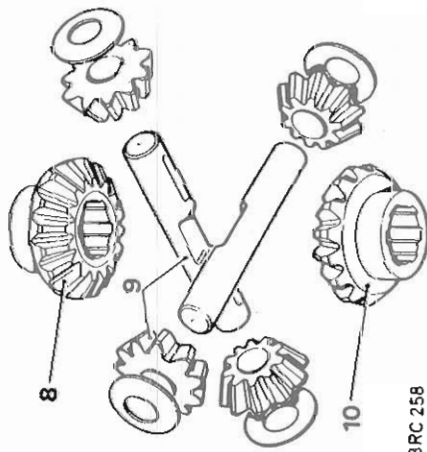
#### Inspecting

**NOTE:** If replacements are required, replace the following items 11 and 12 as sets.

11. Bevel pinions and side gears (set of six).
  12. Cross-shafts (set of two).
  13. Check the gear teeth for damage.
  14. Check all parts for satisfactory general condition.
- NOTE:** The differential case halves are a matched pair, and halves must not be changed individually.

#### Reassembling

15. Fit a side gear into the rear casing.
  16. Fit a side gear into the front casing.
  17. Fit the bevel pinions, thrust washers and cross-shafts into the front casing.
  18. Fit the rear casing to the front casing. Tighten the bolts evenly in sequence. Torque load 5,6 to 6,2 kgf m (40 to 45 lbf ft).
  19. Offer the low gear to the differential casing.
  20. Align the fixing holes and fit the bolts evenly in sequence. Torque load 3,8 to 6,5 kgf m (44 to 47 lbf ft).
  21. Fit the roller bearings and refit the differential unit.
- NOTE:** If the differential case or bearings have been replaced, carry out the 'Differential bearing pre-load check', 37.25.13.

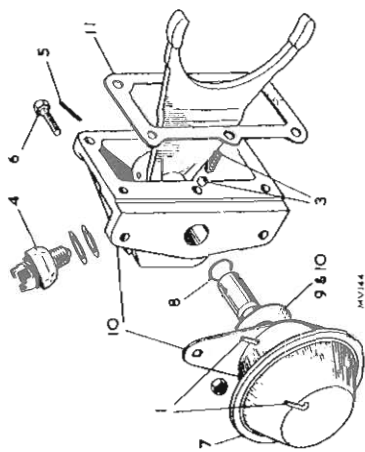


#### DIFFERENTIAL LOCK ACTUATOR ASSEMBLY

- Remove and refit 1 to 3 and 10 37.29.19
- Overhaul 4 to 10 37.29.22

#### Removing

1. Note the vacuum supply hose positions, then disconnect the hoses.
  2. Remove the fixings and withdraw the assembly from the housing.
- NOTE:** If necessary, remove the right-hand front exhaust pipe to improve access.
3. Withdraw the detent spring and ball.



#### Dismantling

4. Remove the differential lock warning switch.
5. Drive out the retaining pin.
6. Remove the actuator fixings.
7. Withdraw the actuator and shaft.
8. Withdraw the 'O' ring seal.
9. Withdraw the joint washer.

#### Reassembling

10. Reverse instructions 4 to 9; coat both sides of the joint washer with Hylomar PL 32M jointing compound.

#### Refitting

11. Reverse instructions 1 to 3. Apply Hylomar PL 32M jointing compound between the actuator and housing joint faces and to the joint washer.

## FRONT PROPELLER SHAFT

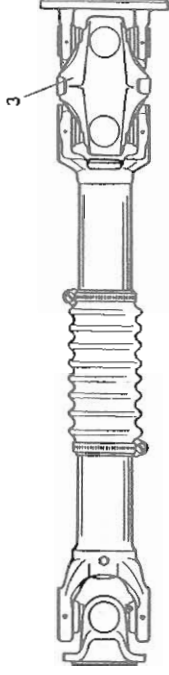
—Remove and refit 47.15.02

## Removing

1. Disconnect the propeller shaft from the front axle and gearbox, marking the respective flanges for refitting purposes.
2. Withdraw the propeller shaft.

## Refitting

3. Locate the propeller shaft in position with the double Hooke's Cardan universal joint towards the rear of the vehicle.
4. Align the axle and gearbox flange markings and fit the securing nuts and bolts.  
Torque 4.2 to 5.2 kgf m (30 to 38 lbf ft).



19 524

## FRONT PROPELLER SHAFT

—Overhaul 47.15.11

## Dismantling

1. Remove the propeller shaft from the vehicle, see 47.15.02.
2. Dismantle the gaiter, sliding joint and conventional front universal joint, as described in the main Repair Operation Manual (operation 47.15.11, instructions 1 to 3 and 5 to 9).

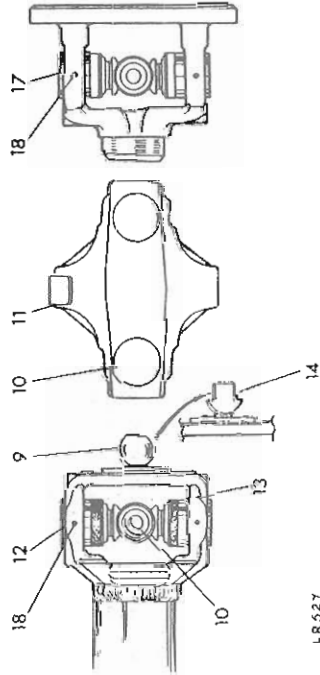
**NOTE:** To dismantle the rear double Hooke's Cardan joint the internally moulded plastic rings retaining the respective bearing cups in the yokes must be sheared by pressing out the bearing cups. This will necessitate the use of a mandril or hydraulic press. It is important to mark one side of the flange yoke, coupling yoke and shaft yoke before dismantling, to identify their relative positions so that propeller shaft balance can be retained on reassembly.

The original production bearing cups and universal joint 'spiders' cannot be reassembled and should be discarded. Service replacement bearing cups are provided with grooves for retaining with conventional circlips. Remove the bearing cups in the order described below.

continued

3. Locate a 1 1/4 in (30 mm) socket on the base of the press to be used, open end upwards.
4. Support the rear part of the propeller shaft assembly horizontally, lining up one of the rearmost coupling yoke bearing cups over the socket on the press base.
5. Use a distance piece of suitable diameter to allow the opposite bearing cup to pass downwards into the coupling yoke when the press is operated to shear the internal plastic seals.
6. Having removed the first bearing cup rotate the propeller shaft 180 degrees and repeat the operation, pressing out the opposite bearing cup.
7. Disengage the trunnions of the 'spider' from the coupling yoke and pull the flange yoke and 'spider' assembly from the centring ball (on the shaft yoke). The ball socket is pressed into the flange yoke.
8. Inspect the ball socket components. These comprise a seal, large washer, ball seats, small washer and a coil spring. If any parts show indications of excessive wear or are broken, prise out the seal and replace them.
- Alternatively, if assembled sockets are available, drift out the old socket and replace the whole assembly in one operation.
9. Inspect centring ball surface. If it shows signs of wear beyond smooth polish it should be replaced by carrying out the following procedure.
10. Using the press remove the two bearing cups remaining in the coupling yoke (see instructions 3 to 6).
11. Remove the coupling yoke by disengaging it from the 'spider' trunnions.
12. Similarly remove the two bearing cups remaining in the shaft yoke which carries the centring ball.
13. Disengage the 'spider' trunnions from the shaft yoke and remove the spider.
14. Carefully grind a flat on each side of the centring ball equally to a minimum of 13 mm (1/2 in) across the flats ensuring that the centring ball mounting stud is not damaged.
15. Grip the flats of the centring ball assembly in a vice to hold and crack the ball and pass a suitable length of rod through the bearing cup holes in the shaft yoke to provide a lever.

continued



L.R.527

16. Using the lever, loosen and remove the centring ball.
17. If necessary remove the spider from the flange yoke by pressing out the bearing cups (see instructions 3 to 6).
18. Remove remnants of plastic from the grooves of all yokes. This is facilitated by driving a small pin through the individual injection holes used in original production.

Reassembling

19. Assemble the conventional universal joint to the front propeller shaft sliding member as described in the main Repair Operation Manual, operation 47.15.11, instructions 12 to 21.
20. Assemble the double-Hooke's Cardan universal joint to the rear part of the propeller shaft in the order described below.
21. Support the propeller shaft vertically on a block of hardwood.

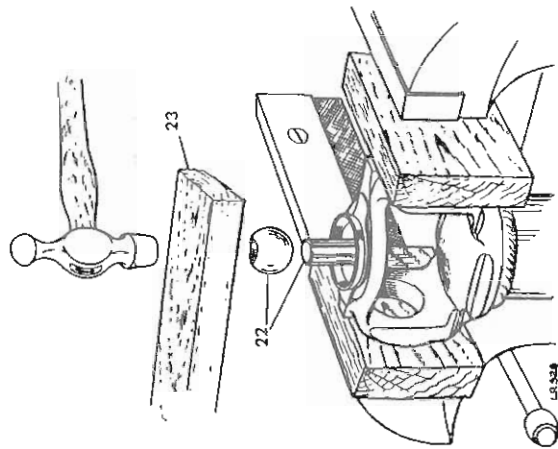
NOTE: If a vice is used as a support, great care must be taken not to burr the shaft yoke. Under no circumstances should the tubular section be clamped.

22. Locate the new centring ball on its mounting stud, which is an integral part of the shaft yoke.
23. Using another block of hardwood to protect the surface finish of the centring ball, hammer the ball onto the mounting stud until it seats firmly against the shoulder at its base. It is most important that the centring ball is correctly seated if the double Hooke's joint is to function efficiently.
24. Ensure that the centring ball socket in the flange yoke is clean.
25. Lubricate the socket components and insert them in the socket cavity in the following sequence: coil spring, small washer, three ball seats (large openings outward to receive ball and joints aligned with the tongues on the inside of the small washer) and the large washer.
26. Apply Hylomar PL 32M to the outer edge of the seal.
27. Lubricate the seal lip and press the seal into the socket until it is flush. The sealing lip should be inclined inwards.

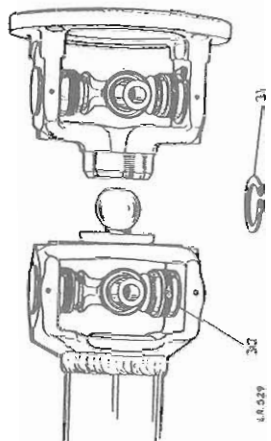
NOTE: Alternatively, if assembled sockets are available the original socket can be drifted out and replaced with the complete assembly in one operation.

28. Finally, fill the socket cavity with grease.
29. Assemble the new 'spiders' and grooved bearing caps into the flange and shaft yokes respectively. The procedure is the same as for the assembly of the conventional universal joint flange yoke detailed in the main Repair Operation Manual, operation 47.15.11 from instructions 12 to 18.
30. However, due to differences in yoke design it is only necessary to press each bearing cup into its yoke until the circlip groove is completely exposed on the inside of the yoke.

continued



L.R.528



L.R.529

## PROPELLER SHAFT

31. Locate and snap each retaining circlip in position.
32. Ensure that the alignment marks on the yokes are correctly positioned.
33. Fit the coupling yoke over the 'spider' trunnions in the shaft yoke, assembling the grooved bearing cups as described above.

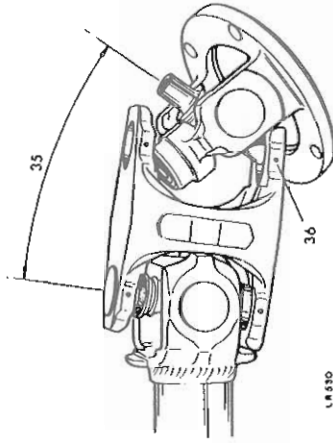
**NOTE:** To complete the assembly of the double Hooke's joint the flange yoke and 'spider' assembly is fitted to the coupling yoke in a similar manner. However, since this operation also involves the engagement of the centring ball socket (pressed into the flange yoke) the following procedure should be adopted.

34. Make sure that the alignment marks on the coupling and flange yoke are correctly positioned.
35. To engage the trunnions in the flange yoke into the 'ears' of the coupling yoke and the socket over the centring ball both 'spiders' in the coupling and flange yokes should first be cocked to their limit in the same direction.
36. Engage the forward cocked trunnion first, simultaneously pressing the socket over the ball.
37. Cock the coupling and flange yokes in the opposite direction to enable the other trunnion to be located in the 'ear' of the coupling yoke.
38. To facilitate the installation of bearing cups cock the coupling yoke to its limit as shown so that the centring ball socket spring is unbraked.
39. Work both bearing cups into the 'ears' of the coupling yokes and over the trunnions. Ensure that both bearing cups are started straight and true.
40. Press against opposite bearing cups, moving the 'spider' to ensure free movement of the trunnions. If there is sudden resistance, stop pressing and check whether any needle rollers have become displaced.
41. As soon as one bearing cup retaining groove clears the inside of the yoke, fit the circlip.
42. Continue to press until the opposite bearing cup circlip can be fitted.

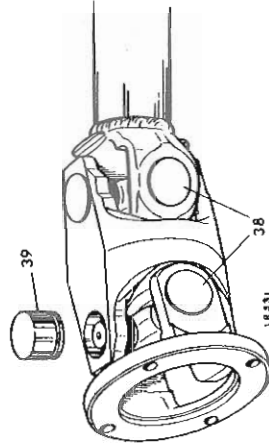
**NOTE:** If difficulties are experienced in fitting these circlips, strike the side of the particular yoke 'ear' sharply with a hammer.

43. Check the freedom of rotation of all trunnions. If too tight, a few sharp raps with the hammer on the sides and roots of the yokes will loosen the bearings. The flange yoke should snap over-centre, up and down or left and right, freely if the double Hooke's joint is correctly assembled.

44. Lubricate and fit the front sliding member and gaiter to the propeller shaft as described in the main Repair Operation Manual, operation 45.15.11, instructions 22, 24 to 26, 28 and 29.



1.4.550



1.4.551

## AXLE CASE OIL SEAL

--Remove and refit

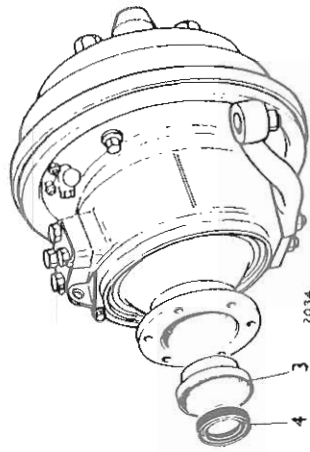
54.15.04

### Removing

1. Remove the half-shaft, see 54.20.07.
2. Remove the swivel from the axle case, see 54.20.01.
3. Prise out the oil seal retaining plate from the swivel housing.
4. Prise out the oil seal.

### Refitting

5. Press the seal into the retaining plate, lip towards axle case.
6. Press the retaining plate and seal into the swivel housing.
7. Refit the swivel to the axle case.
8. Refit the half-shaft, see 54.20.07.



2034

## HALF-SHAFT AND SWIVEL AXLE

--Remove and refit

54.20.01

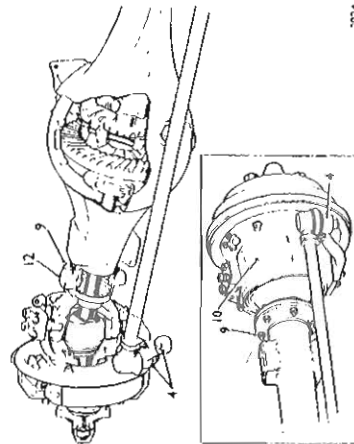
Service tool: 601763 ball joint extractor

### 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, using 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.
6. Disconnect the flexible brake hose from its bracket. 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.



2026

## HALF-SHAFT

—Remove and refit

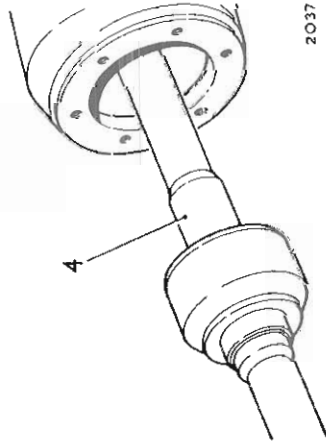
54.26.07

## Removing

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

## Refitting

5. Fit the half-shaft, long end first, taking care to avoid damaging the oil seal in the swivel housing.
6. Reverse instructions 1 to 3.



2037

## STEERING RELAY

—Remove and refit

57.50.02

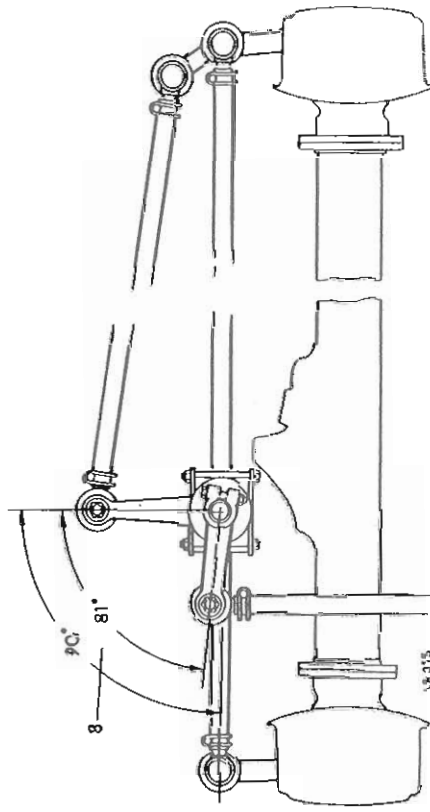
## Removing

1. From under the bonnet, remove the pinch bolt and withdraw the upper lever from the relay shaft.
2. Remove the two upper nuts and bolts securing the relay to the chassis.
3. From under the vehicle, remove the pinch bolt and withdraw the lower lever from the relay shaft.
4. Support the relay and remove the two lower nuts and bolts securing the relay to the chassis.
5. Withdraw the steering relay.

## Refitting

6. Ensure that the relay unit is filled with the correct oil.
7. Locate the relay in position on the chassis with the off-set in the securing lugs downward and secure the assembly with the four nuts and bolts.
8. 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 degrees. 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 degrees to the track rod. The relay upper lever should be inclined forward of the track rod, 9 degrees out of alignment with the track rod.

NOTE: A left-handed-steering arrangement is illustrated; right-handed-steering is symmetrically opposite.



## STEERING

### STEERING RELAY

—Overhaul

57.50.08

1. Remove the relay assembly from the vehicle, see 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.
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 184 mm (7.250 in).

#### Reassembling

The following additional parts are required for temporary use during reassembly.

- Two 6mm socket head set pins, 15mm long.
- Two plain washers 20mm outside diameter and to fit the set pins.
- Two 50mm diameter hose clips.
- 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. Fit the two 6mm set pins and 20mm diameter plain washers to the bottom of the relay housing diametrically opposite to each other.

continued

14. Adjust the two hose clips to a diameter that will retain the split bushes at a slightly smaller diameter than the internal bore of the housing, then place the clips aside.

15. Insert a washer for the spring and the spring into the housing so that they locate on the 20mm washers attached to the bottom of the housing.

16. Fit a split bush and one of the previously adjusted hose clips to a cone on the relay shaft.

17. Locate the second washer for the spring onto the shaft and insert the assembly into the housing.

18. Press the shaft and bush assembly into the housing, compressing the spring until the shaft protrudes from the other end of the housing sufficient to allow the other split bush to be fitted. During this operation the hose clip will slide off the top split bush.

19. Using the second hose clip, secure the lower split bush in position on the shaft.

20. Release the press and remove the steering relay.

21. Remove the set pins retaining the two 20 mm washers and pull the washers from between the relay spring and the split bush.

22. Smear general purpose grease on both sides of a joint washer and fit it to the top of the housing together with the thrust washer and top cover and seal.

23. Apply Loctite Grade 542 to the threads of the end cover bolts and fit the bolts and plain washers to secure the end cover. Torque 0,6 to 0,8 kgf m (5.0 to 6.0 lbf ft).

24. Drive the shaft and lower bush into position in the housing.

25. Fill the housing with the correct grade oil.

26. Fit the joint washer, thrust washer, bottom cover and seal to the housing as previously described.

continued

27. Hold the relay unit in a vice.
28. 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 5.4 kgf (12 lbf) and should not exceed 7.3 kgf (16 lbf). If the resistance is less than 5.4 kgf (12 lbf), 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.
29. Fit the relay assembly to the vehicle, see 57.50.02.

**DATA**

Relay spring free length ..... 184 mm (7.250 in)  
Resistance to rotation, relay shaft ..... 5.4 to 7.3 kgf (12 to 16 lbf) measured using a spring balance

**TRACK ROD BALL JOINTS**

— Remove and refit 6 to 9 ..... 57.55.08

**TRACK ROD**

— Remove and refit 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 1157 to 1160 mm (45.56 to 45.68 in).
9. Position the ball joint clamps 1.6 to 3.2 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, see 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 in 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 ..... 1157 to 1160 mm (45.56 to 45.68 in) measured between ball joint centres  
Position of ball joint clamps ..... 1.6 to 3.2 mm (0.062 to 0.125 in) from track rod ends

**LONGITUDINAL STEERING TUBE BALL JOINTS**

— Remove and refit 1 to 20 ..... 57.55.12

**LONGITUDINAL STEERING TUBE**

— Remove and refit 1 to 3 and 13 to 20 ..... 57.55.13

Service tool: 601763

**Reversing**

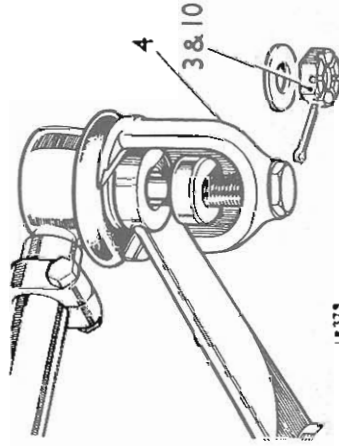
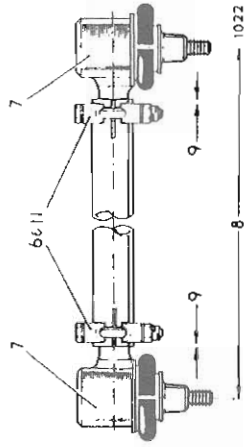
1. Prop open the bonnet.
2. Remove the fixings from the ball joint connecting the longitudinal tube to the steering box drop-arm.
3. Using service tool 601763 extract the ball joint from the steering box drop-arm.

**Right-hand steering**

4. Remove the fixings from the ball joint connecting the longitudinal tube to the relay lever.
5. Using service tool 601763 extract the ball joint from the relay lever and withdraw the longitudinal steering tube from the vehicle.

**Left-hand steering**

6. Remove the fixings securing the upper relay lever to the relay unit and prise the lever clear.
7. Withdraw the longitudinal steering tube and relay lever assembly from the vehicle.
8. Remove the fixings and extract the ball joint from the upper relay lever, using service tool 601763.



Removing ball joints

9. Slacken the ball joint clamp fixings.
10. Unscrew the ball joints, L.H. and R.H. 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. Refit by reversing the removal procedure.
14. Torque tighten ball joint fixings 4,0 kgf m (30 lbf ft) and secure with a new split pin.

Left-hand steering

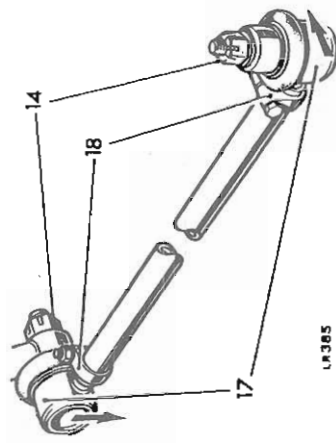
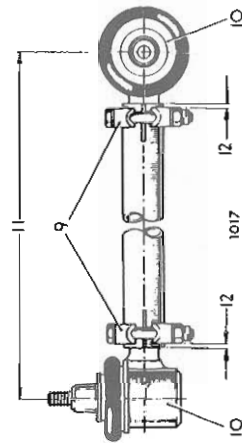
15. Place the front wheels in the straight ahead position and the steering wheel in the intermediate position, then connect the upper relay lever to the relay unit; the longitudinal arm may require adjusting slightly to align the splines of the relay lever and unit.
16. Tighten the lever pinch bolt. Torque 7,6 kgf m (55 lbf ft).

All vehicles

17. 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. Right-hand steering is illustrated, left-hand steering is symmetrically opposite.
18. Secure both ball joint clamps. Torque load 1,1 to 1,5 kgf m (8,5 to 10,5 lbf ft).
19. Check the steering lock stops setting, see 57.65.03.
20. 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 .....	621,4 to 624,6 mm (24.46 to 24.59 in) measured between ball joint centres
Position of ball joint clamps .....	1,6 to 3,2 mm (0.062 to 0.125 in) from tube ends



FRONT WHEEL ALIGNMENT

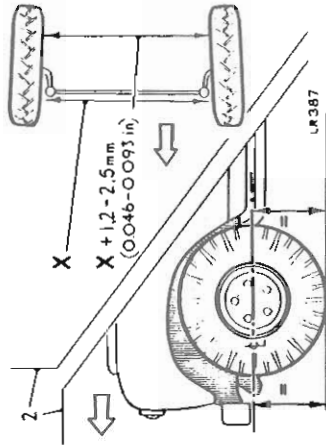
—Check and adjust 57.65.01

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-out with the aid of a tracking stick or suitable proprietary equipment; it should be 1,2 to 2,5 mm (0.046 to 0.093 in) measured at the horizontal centre-line of the road wheels.
3. If necessary, adjust the toe-out 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-out is correct.
6. Push the vehicle rearwards turning the steering wheel from side to side to settle the ball joints. Then, push the road wheels in the straight ahead position.
7. Recheck the toe-out. If necessary carry out further adjustment.
8. When the toe-out 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-out .....	1,2 to 2,5 mm (0.046 to 0.093 in) measured at the horizontal centre-line of the road wheels
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STEERING GEOMETRY

—Check 57.65.02

GenRef#1

No adjustment is provided for castor, camber or swivel pin inclination. For front wheel alignment (toe-out) refer to 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 centralized the steering column lock should engage within + or - 20 degrees.

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 degrees steering wheel movement before the stops in the steering box are operative. This adjustment must be made in the drag link only.

DATA

Vehicle 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	1¼° positive
Swivel pin inclination	7°
Front wheel toe-out	1.2 to 2.5 mm (0.046 to 0.093 in)

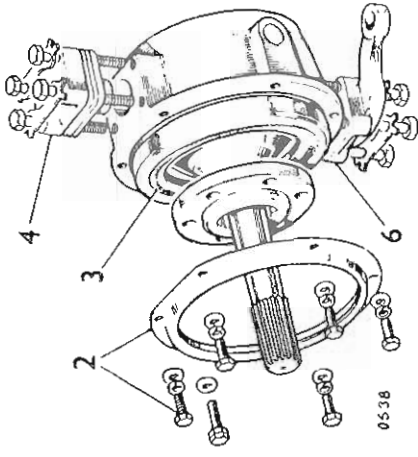
SWIVEL PIN HOUSING ASSEMBLY

—Overhaul 60.15.23

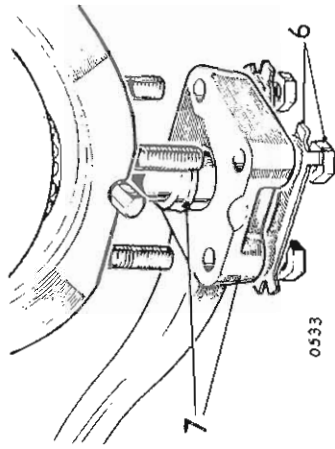
1. Remove the swivel pin housing assembly from the vehicle 60.15.20.

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.



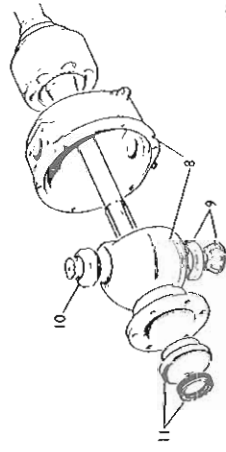
4. Release the lock tabs from the upper swivel pin bolts and remove the bolts and lock plates.
5. Withdraw the upper swivel pin and shims.
6. Release the lock tabs from the track arm nuts and remove the nuts and lock plates.
7. Withdraw the track arm complete with the lower swivel pin. Remove and discard 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. Prise out the oil seal and retainer.

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.

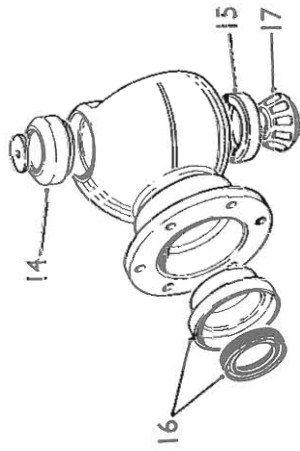


continued

## FRONT SUSPENSION

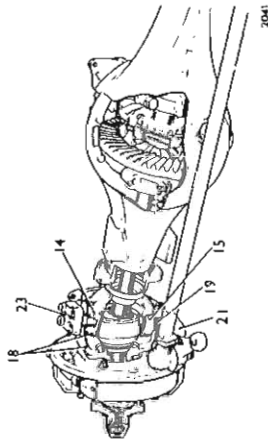
### Reassembling

13. Using an oil recommended for the swivel pin housing (refer to 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 oil seal into the retainer and press the assembly into the inner swivel housing.
17. Fit the lower swivel pin roller bearing.
18. Fit the inner swivel housing to the outer swivel housing.



2040

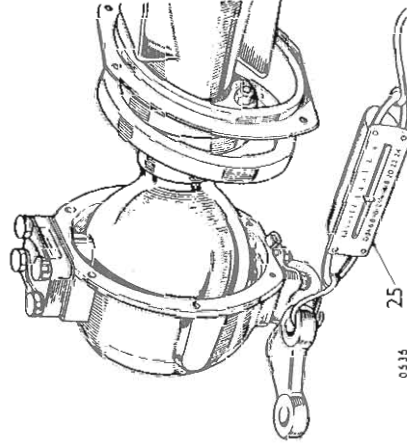
19. Fit a new 'O' ring to the lower swivel pin/track arm assembly.
20. Smear the mating faces of the outer swivel pin housing and lower swivel pin/track arm assembly with jointing compound. Also, apply Loctite Studlock to the track-arm studs.
21. Fit the lower swivel pin/track arm assembly. Ensure that 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.



2041

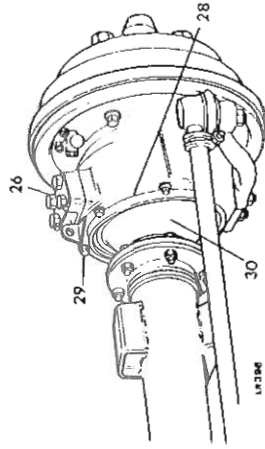
25. Using a spring balance attached to the track-rod eye check the resistance to swivel pin movement. This should be within 3.6 to 4.5 kgf (8 to 10 lbf) when the initial inertia load is overcome. Adjust by adding or removing shims at the top swivel as required.

continued



0315

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 (R.H. swivel only), the jack location plate.
29. Evenly tighten the bolts. Torque 1.0 to 1.2 kgf m (7 to 9 lbf ft).
30. 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.
31. Fit the swivel pin housing assembly to the vehicle, see 60.15.20.



10786

## 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 wheels.
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 a torque of 9.5 to 11.0 kgf m (70 to 80 lbf ft).

continued

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 produce large spring deflections.
12. Deflect the spring towards the chassis until a dimension of 118 to 122 mm (4.700 to 4.800 in) is obtained. Tighten the front spring shackle bolts and nuts. Torque 8.3 to 9.6 kgf m (60 to 70 lbf ft).
13. The spring may be deflected to the required dimension using a length of chain passed over the chassis and under the lifting trolley jack, or alternatively by lowering the vehicle on its wheels and loading the vehicle.

FRONT HUB ASSEMBLY

- Remove and refit **60.25.01**

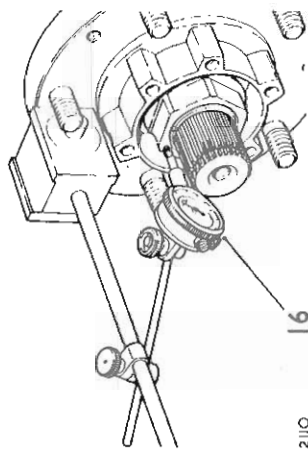
Service tool: 606435A spanner for hub nuts

Removing

1. Slacken the road wheel nuts.
2. Jack up the front of the vehicle and support on a stand.
3. Remove the road wheels.
4. Slacken off the brake shoe adjusters.
5. Remove the brake drum, noting the provision of an extractor tapping, instruction 6.
6. If difficulty is experienced in removing the drum, fit one of the drum fixing screws into the extractor tapping and tighten the screw whilst using a mallet to dislodge the drum.

7. Using grips, twist off the hub cap.
8. Remove the circlip and shim from the axle shaft.
9. Remove the hub driving member and joint washer.
10. Remove the locknuts, lock washer and bearing washer securing the hub, using tool 606435A.
11. Hold the outer roller bearing in position.
12. Withdraw the hub and bearings.

continued



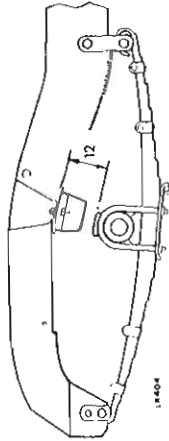
2110

Refitting

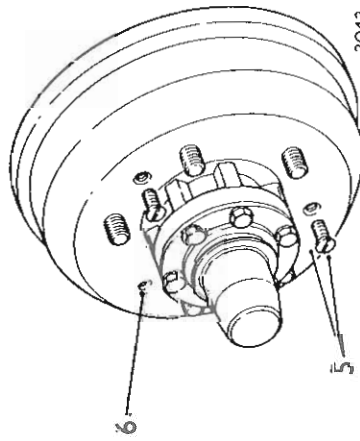
13. Ensure that the hub bearings are packed with fresh grease. Do not pack the hub centre with grease.
14. Install the hub on the stud axle complete with inner and outer bearings and oil seal.
15. Fit the tongue washer and adjusting nut.
16. Spin the hub to settle the bearings and, using spanner 606435A, tighten the adjusting nut sufficient to provide hub end-float of 0.05 to 0.12 mm (0.002 to 0.005 in). This can be checked using a dial gauge.
17. Fit the lock washer and lock nut.
18. Tighten the lock nut. Bend the lock washer to secure both the lock and adjusting nuts. Recheck end-float.
19. Apply general purpose grease to both sides of the joint washer and locate it in position on the hub driving member.
20. Coat the threads of the hub driving member securing bolts with Loctite 270.
21. Fit the hub driving member and joint washer, and tighten the bolts. Torque: 4.2 to 5.2 kgf m (30 to 38 lbf ft).
22. Temporarily refit the circlip, omitting the shim.
23. Draw the axle shaft as far as possible through the hub driving member, by using a suitable bolt screwed into the tapped hole provided in the end of the axle shaft.
24. Using feeler gauges, measure the clearance between the circlip and the hub driving member. The correct clearance is 0.07 to 0.2 mm (0.003 to 0.008 in).
25. Adjust as necessary by selecting a suitable shim from the range available. Shim range 1.12 to 3.10 mm (0.044 to 0.122 in) in 0.15 mm (0.006 in) stages.
26. Remove the circlip, fit the selected shim and refit the circlip. Recheck the clearance with the shim fitted to ensure that it is within the specified limits.
27. Reverse instructions 5 to 7.
28. Adjust the brakes.
29. Reverse instructions 1 to 3.

DATA

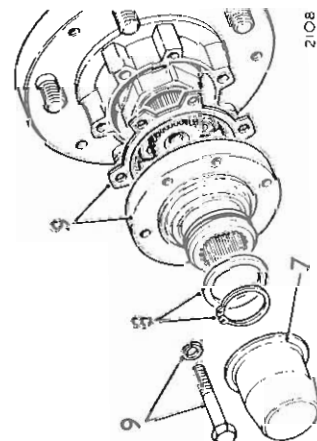
Front hub end-float	0.05 to 0.12 mm (0.002 to 0.005 in)
Front drive shaft end-float	0.07 to 0.2 mm (0.003 to 0.008 in)
Shim range	1.12 to 3.10 mm (0.044 to 0.122 in) in 0.15 mm (0.006 in) stages



1100



2042



2108

## FRONT HUB ASSEMBLY

—Overhaul

60.25.07

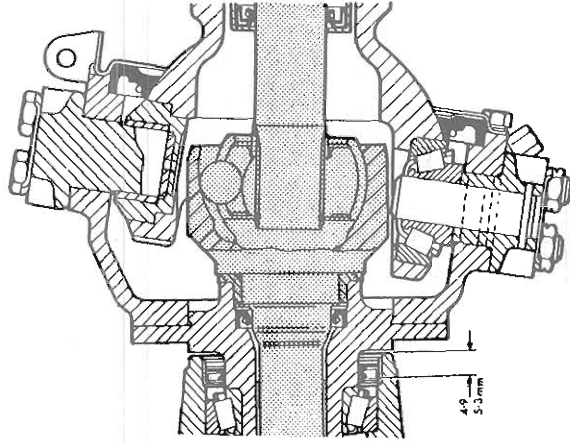
Service tool: 18G 1349 hub oil seal fitting tool

## Dismantling

1. Remove the front hub assembly, see 60.25.01.
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. Pack the roller bearings with fresh grease of the correct grade (see Section 09). **DO NOT** pack the hub centre with grease.
  8. Fit the inner roller bearing.
  9. Liberally smear (not pack) the cavity between the lips of the oil seal with grease, as used for the hub bearings.
  10. Using service tool 18G 1349, press the oil seal into the hub as illustrated.
- IMPORTANT:** The seal must be recessed to the dimension illustrated to ensure correct location and avoid damage.
11. Fit the outer roller bearing.
  12. Refit the front hub, adjusting the hub and drive shaft end-float, see 60.25.01.



LAS04

## FRONT HUB STUB AXLE

—Remove and refit

60.25.22

—Overhaul

60.25.24

## Removing

1. Remove the front hub, see 60.25.01, instructions 1 to 12.
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.

## Overhauling

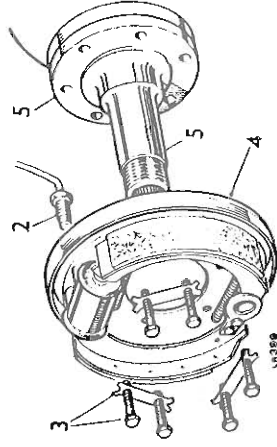
6. Examine the stub axle for wear and damage. Check the area of the shaft that forms the running surface of the hub oil seal lip. Wear or ridging will result in rapid oil seal deterioration and ineffectiveness. If necessary, fit a new stub axle complete.

7. Examine the bush and oil seal in the inner end of the stub axle. If either component shows signs of wear, fit a new oil seal and bush, they should not be renewed individually.

**NOTE:** The bush can be extracted using Special Tool 18G 284 A Q, but the tool must first be modified by grinding the flange end face flat when in its widest position.

## Refitting

8. Grease and fit a new stub axle flange gasket.
  9. Reverse instructions 1 to 5.
- Tightening torques:**  
 Brake anchor plate and stub axle to swivel housing bolts 4.2 to 5.2 kgf m (30 to 38 lbf ft).  
 Front hub driving member bolts 4.2 to 5.2 kgf m (30 to 38 lbf ft).
10. Bleed the brakes.



REAR HUB ASSEMBLY

64.15.07

—Overhaul

Service tool: 18G 1349 hub oil seal fitting tool

Dismantling

1. Remove the rear hub, see 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

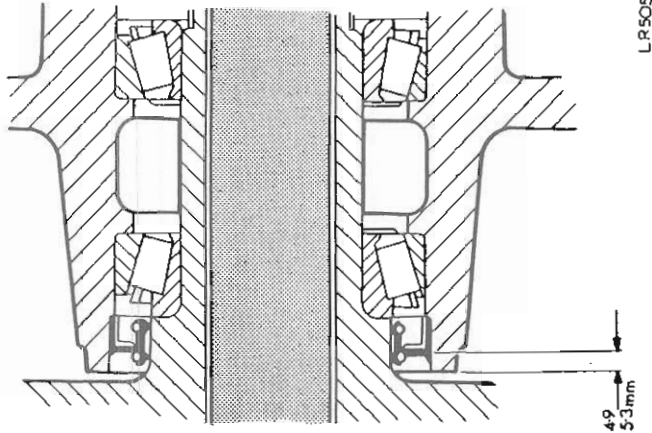
6. Fit the inner and outer bearing tracks.
7. Pack the roller bearings with fresh grease of the correct grade (see Section 09). DO NOT pack the hub centre with grease.
8. Fit the inner roller bearing.
9. Liberally smear (not pack) the cavity between the lips of the oil seal with grease, as used for the hub bearings.
10. Using service tool 18G 1349, press the oil seal into the hub as illustrated.

**IMPORTANT:** The seal must be recessed to the dimension illustrated to ensure correct location and avoid damage.

11. Fit the outer roller bearing.
12. Refit the rear hub, adjusting the hub end-float, see 64.15.01.

DATA

Rear hub end-float ..... 0.05 to 0.12 mm  
(0.002 to 0.005 in)



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.
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 and spring bottom 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.
8. Remove the spring shackle bolts.
9. Remove the road spring.

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 a torque of 9.5 to 11.0 kgf m (70 to 80 lbf ft).

Spring setting procedure

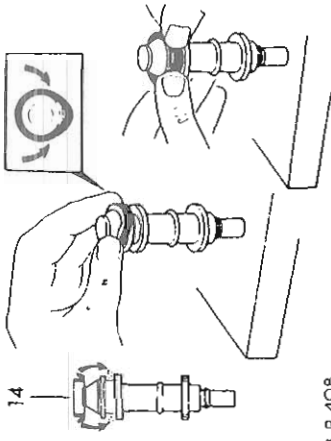
11. The shackle bolts which clamp the centre member of the road spring and bangar bracket bushes must not be tightened until the spring is positioned in the midpoint of its deflection range. This ensures that excessive rotation/shear forces are not imparted to the bush centres. Failure to observe this instruction can adversely affect bush life, especially in off-road conditions which produces large spring deflections.
12. Deflect the spring towards the chassis until a dimension of 158 to 162 mm (6.225 to 6.375 in) is obtained, then tighten the shackle bolts and nuts. Torque 8.3 to 9.5 kgf m (60 to 70 lbf ft).
13. The spring may be deflected to the required dimension using a length of chain passed over the axle and under the lifting trolley jack or, alternatively, by lowering the vehicle on its wheels and loading the vehicle.

MASTER CYLINDER

—Overhaul 70.30.02

Dismantling

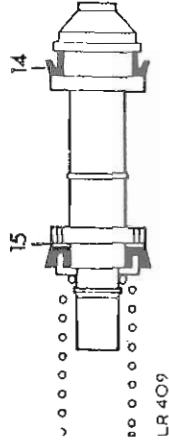
1. Remove the master cylinder, see 70.30.01.
2. Remove the retaining pins and withdraw the fluid reservoir.
3. Lever out the seals.
4. Push the plunger fully down the cylinder bore and withdraw the secondary plunger stop pin.
5. Remove the circlip and withdraw the primary plunger assembly.
6. Tap the cylinder on a soft or wooden surface to remove the secondary plunger assembly.
7. Remove the secondary plunger spring, seal retainer, recuperating seal and washer. Keep the plunger and its spring together at all times.
8. Remove the primary plunger spring, seal retainer, recuperating seal and washer. Keep the plunger and its spring together at all times.
10. Remove the seal from the plunger.



LR 408

Inspecting

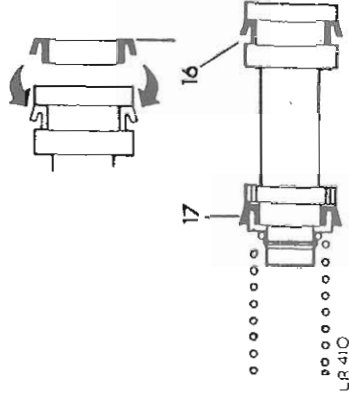
11. Clean all components in Girling cleaning fluid and allow to dry.
12. Examine the cylinder bore and pistons; ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, fit new replacements.
13. The seals should be replaced. These items are included in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



LR 409

Reassembling

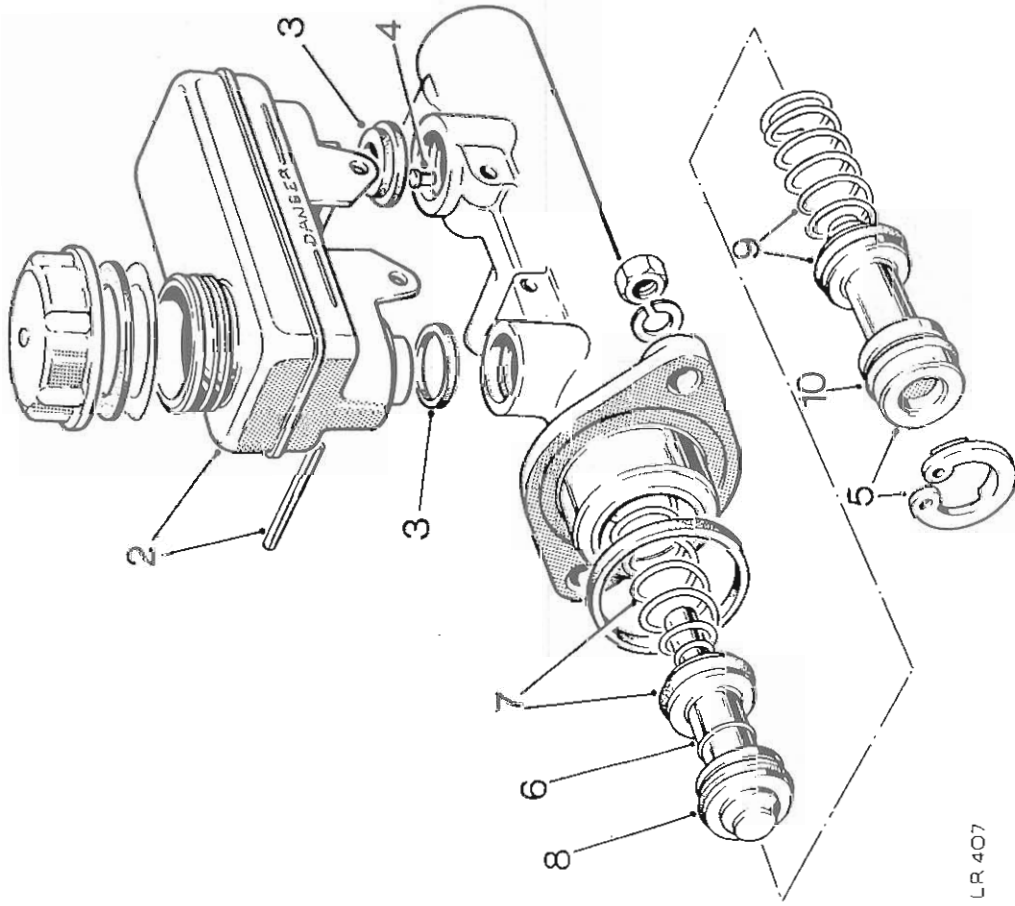
14. Fit a new seal into the groove in the secondary plunger, as follows. Squeeze the seal into an ellipse, then press the raised part of the seal over the flange.
15. Fit the washer, new recuperating seal, seal retainer and spring to the secondary plunger.
16. Fit the seal into the groove in the primary plunger as previously described.
17. Fit the washer, new recuperating seal, seal retainer and primary spring. Ensure that the seals are fitted as illustrated.



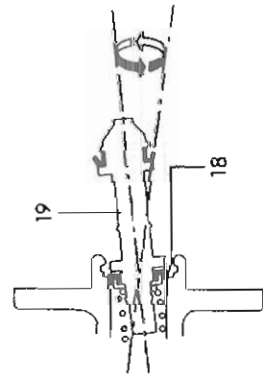
LR 410

NOTE: It is vital that the following instructions are carried out precisely and that generous amounts of unused brake fluid are used to lubricate the cylinder bore and plunger seals to prevent damage to the seals during assembly.

18. Clamp the cylinder in a bench vice, lubricate the secondary plunger seals and the cylinder bore.

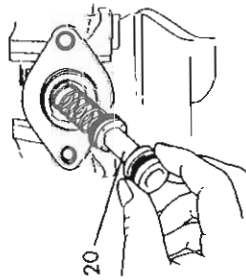


LR 407



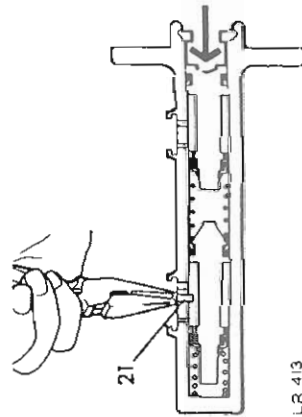
LR 411

19. Offer the plunger assembly to the cylinder until the recuperation seal is resting centrally in the mouth of the bore. Then, ensuring that the seal does not become trapped, gently introduce the plunger with a circular rocking motion as illustrated to ease in the seal, then slowly push the plunger down the bore in one continuous movement.



LR 412

20. Repeat the lubricating and fitting procedure for the primary plunger assembly and fit the retaining circlip.
21. Using a clean screwdriver, slowly press the plunger fully down the bore to enable the secondary plunger stop pin to be fitted in its correct position.



LR 413

22. Lubricate new seals with unused brake fluid and fit one in each inlet port.
23. Lubricate the seals and press the fluid reservoir into position on the cylinder and secure with the retaining pins.
24. Refit the master cylinder, see 70.30.01.

### TRANSMISSION BRAKE, HAND LEVER AND LINKAGE

— Remove and refit 70.45.01

#### Removing

1. Remove the centre seat cushion and lid panel from the seat base.
2. Disconnect the cable from the hand brake lever.
3. Disconnect the cable from the support bracket for the hand brake lever.
4. Release the 'P' clip at the transfer gearbox.
5. Disconnect the cable from the lever at the transmission brake.
6. Release the cable adjuster from the transfer gearbox.
7. Withdraw the cable from the vehicle.
8. Remove the fixings and withdraw the hand brake lever.

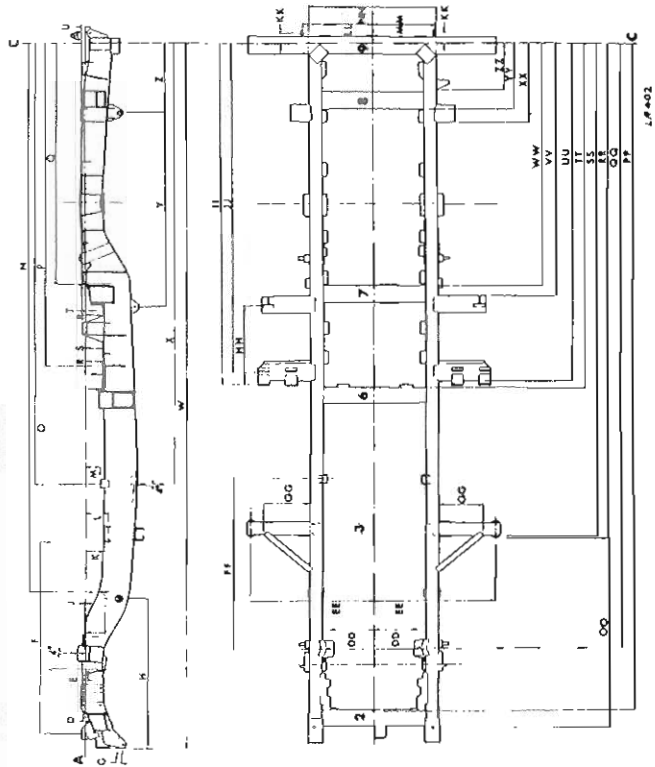
#### Refitting

9. Refit by reversing the removal procedure. Adjust the cable to give three clicks on the ratchet when applying the hand brake.

CHASSIS FRAME

--- Alignment check

76.10.02



ELECTRICAL EQUIPMENT

---General

86.00.00

The electrical system is negative earth, and it is most important to ensure correct polarity of the electrical connections at all times. Any incorrect connections made when reconnecting cables may cause irreparable damage to the semi-conductor devices used in the alternator and regulator. Incorrect polarity would also seriously damage any transistorised equipment such as radio and tachometer etc.

Before carrying out any repairs or maintenance to an electrical component, always disconnect the battery.

The V-drive fan belt used with alternators is not the same as that used with d.c. machines. Use only the correct Rover replacement fan belt. Occasionally check that the engine and alternator pulleys are accurately aligned.

It is essential that good electrical connections are maintained at all times. Of particular importance are those in the charging circuit (including those at the battery) which should be occasionally inspected to see that they are clean and tight. In this way any significant increase in circuit resistance can be prevented.

Do not disconnect battery cables while the engine is running or damage to the semi-conductor devices may occur. It is also inadvisable to break or make any connections in the alternator charging and control circuits while the engine is running.

The electronic voltage regulator employs micro-circuit techniques resulting in improved performance under difficult service conditions. The whole assembly is encapsulated in silicone rubber and housed in an aluminium heat sink, ensuring complete protection against the adverse affects of temperature, dust, and moisture, etc.

The regulating voltage is set during manufacture to give the required regulating voltage range of 14.1 to 14.5 volts, and no adjustment is necessary. The only maintenance needed is the occasional check on terminal connections and wiping with a clean dry cloth.

The alternator system provides for direct connection of a charge (ignition) indicator warning light, and eliminates the need for a field switching relay or warning light control unit. As the warning lamp is connected in the charging circuit, lamp failure will cause loss of charge. Lamp should be checked regularly and a spare carried.

When using rapid charge equipment to re-charge the battery, the battery must be disconnected from the vehicle.

CHASSIS FRAME DIMENSIONS

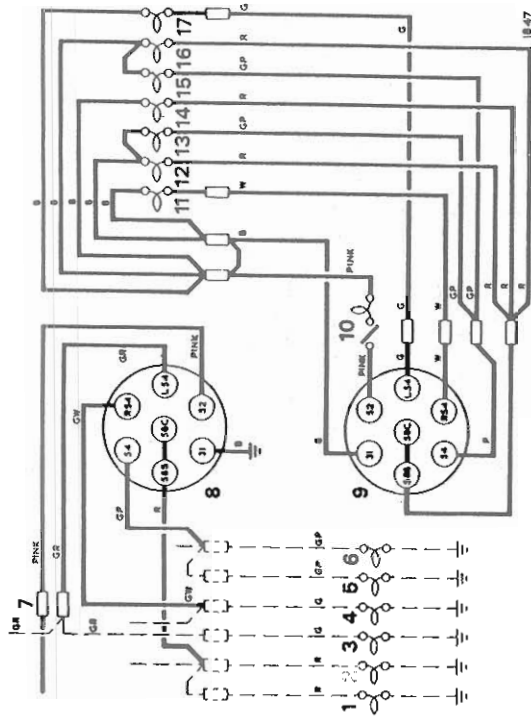
Ref.	mm	inches	Ref.	mm	inches
AA	—	—	DD	269.5	10.610
BB	—	—	EE	750.9	29.562
CC	—	—	FF	636.0(min)	25.039
D	12.0	0.472	GG	277.0	10.905
E	12.7	0.5	HH	489.0	19.251
F	1153.5	45.413	II	2059.0	81.062
G	35.0	1.374	JJ	1981.0	77.992
H	879.5	34.625	KK	62.0	2.440
I	120.6	4.748	LL	432.0	17.007
J	11.0	0.43	MM	387.0	15.236
K	111.5	4.401	NN	30.984	1.216
L	136.5	5.374	OO	787.0	30.984
M	82.5	3.248	PP	1142.5	44.980
N	3270.0	128.740	QQ	4014.5	158.051
O	2630.0	103.543	RR	3637.5	143.208
P	1933.0	76.102	SS	2969.0	116.889
Q	1446.0	56.929	TT	2962.0	116.614
R	101.6	4.000	UU	2075.0	81.692
S	101.2	4.062	VV	2034.0	80.078
T	12.7	0.5	WW	1522.0	59.921
U	20.6	0.811	XX	1435.0	57.283
V	29.4	1.157	YY	475.0	18.700
W	4241.0	166.968	ZZ	398.0	15.669
X	2626.0	103.385		274.0	10.787
Y	1149.5	45.255			
Z	424.0	16.692			

NOTE: The vehicle bumper (not illustrated) is regarded as No. 1 cross-member



## ELECTRICAL EQUIPMENT DATA

Alternator	Lucas 18 AC R battery sensed with transistorized current-voltage regulator
Type	12 volts
Nominal voltage	13.6 to 14.4 volts
Regulating voltage	13.5 volts at 2100 rev/min
Cut-in voltage	Negative
Polarity	4.5 amperes at 6000 alternator rev/min
Maximum output	12 400 rev/min
Maximum output speed	3.2 ohms at 20° C (68° F)
Rotor winding resistance	225 to 368 gf (9 to 13 ozf)
Brush spring pressure	8 mm (0.312 in)
Minimum brush length	
Battery	Lucas C9
Type	60 Ah at 20-hr rate
Capacity	
Distributor	Lucas 35D8
Type	
Ignition Coil	Lucas BA16C6
Type	7 volt ballasted coil
Voltage	
Starter Motor	Lucas 3M100PE
Type	1026 gf (36 ozf)
Brush spring tension	9.5 mm (0.375 in)
Minimum brush length	
Bulb and Sealed Beam	Lucas 411, 12V 45/40W clear
Headlamps with bulbs	
Headlamps with sealed beam units:	
R.H. Sig.	Lucas 54521872 60/45W
L.H. Sig. Europe except France	Lucas 54523079 60/50W
L.H. Sig. except Europe	Lucas 54522231 50/40W
Sidelamps	Lucas 207, 12V 4W
Stop, tail lamps	Lucas 380, 12V 21/5W
Flasher lamps	Lucas 382, 12V 21W
Rear number-plate lamp	Lucas 233, 12V 4W
Instrument panel lights	Lucas 987, 12V 2.2W MES
Warning lights	Lucas 987, 12V 2.2W MES
Warning light, brakes	Lucas 280, 12V 1.5W
Warning light, flashers	Lucas 281, 12V 2W
Interior light	Lucas 382, 12V 21W



CIRCUIT DIAGRAM, TRAILER LIGHTING, NEGATIVE EARTH

## Vehicles

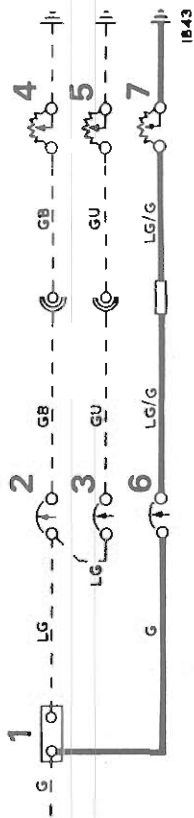
1. Tail lamp, R.H.
2. Tail lamp, L.H.
3. Flasher lamp, L.H.
4. Flasher lamp, R.H.
5. Stop lamp, R.H.
6. Stop lamp, L.H.
7. Stop lamp, L.H.
8. Socket on vehicle

## Trailer

9. Socket on trailer
10. Interior lamp & switch
11. Flasher lamp, R.H.
12. Tail lamp, R.H.
13. Stop lamp, R.H.
14. Number-plate illumination
15. Stop lamp, L.H.
16. Tail lamp, L.H.
17. Flasher lamp, L.H.

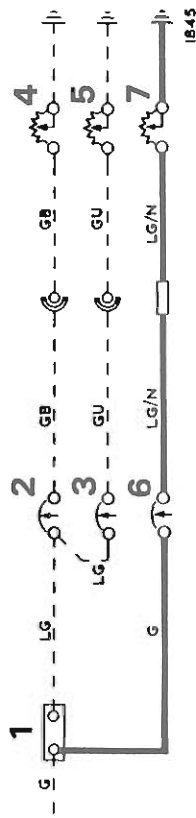
## KEY TO CABLE COLOURS

- B. Black P. Purple  
 N. Brown V. Blue  
 W. White R. Red  
 G. Green L. Light



**Oil Temperature Gauge**

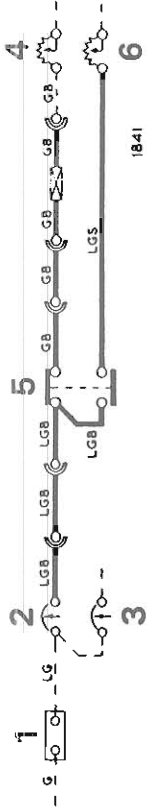
- Existing components
1. Stabilizer unit
  2. Fuel gauge
  3. Water temperature gauge
  4. Water tank transmitter
  5. Water temperature gauge
  6. Oil temperature gauge
  7. Oil temperature transmitter



**Oil Pressure Gauge**

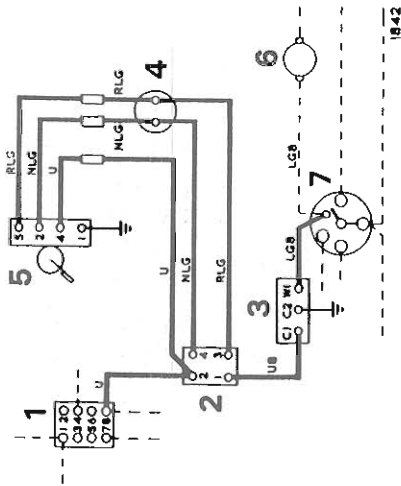
- Existing components
1. Stabilizer unit
  2. Fuel gauge
  3. Water temperature gauge
  4. Water tank transmitter
  5. Water temperature gauge
  6. Oil pressure gauge
  7. Oil pressure transducer

- KEY TO CABLE COLOURS
- B. Black
  - N. Brown
  - W. White
  - G. Green
  - P. Purple
  - U. Blue
  - R. Red
  - L. Light



**Additional L.H. Fuel Tank**

- Existing components
1. Stabilizer unit
  2. Fuel gauge
  3. Water temperature gauge
  4. Rear tank unit
- New components
5. Fuel change-over switches
  6. L.H. side tank unit



**Headlamp Wiper-Washer System**

- Existing components
1. Lighting switch
  2. Headlamp wiper delay unit
  3. Headlamp wiper relay
  4. Headlamp wiper motor
  5. Headlamp wiper motor
  6. Screen washer pump motor
  7. Screen washer switch

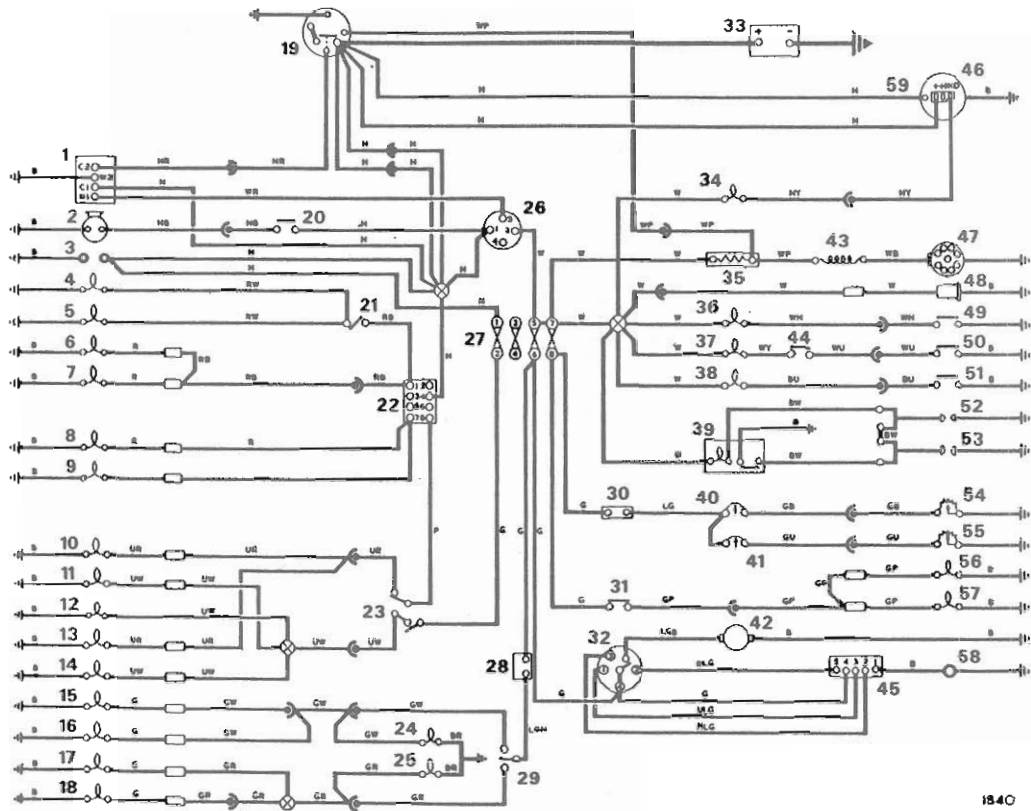
**KEY TO CABLE COLOURS**

- B. Black
- N. Brown
- W. White
- G. Green
- P. Purple
- U. Blue
- R. Red
- L. Light
- S. Slate

## CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Early models with no rear fog lamps

86-3



1840

## KEY TO CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Early models with no rear fog lamps

- |  |  |  |
|--|--|--|
| 1. Starter relay                         | 21. Panel light switches                 | 41. Water temperature gauge                |
| 2. Horn                                  | 22. Lighting switch                      | 42. Screenwash motor                       |
| 3. Inspection sockets                    | 23. Headlamp flash and dip switch        | 43. Coil                                   |
| 4. Speedometer panel illumination        | 24. R.H. indicator warning light         | 44. Choke switch                           |
| 5. Grouped instrument panel illumination | 25. L.H. indicator warning light         | 45. Screen wiper motor                     |
| 6. L.H. tail lamp                        | 26. Ignition switch                      | 46. Alternator                             |
| 7. R.H. tail lamp                        | 27. Fuse unit                            | 47. Distributor                            |
| 8. L.H. side lamp                        | 28. Indicator unit                       | 48. Electric fuel pump                     |
| 9. R.H. side lamp                        | 29. Indicator switch                     | 49. Oil pressure switch                    |
| 10. L.H. headlamp dip beam               | 30. Voltage stabiliser unit              | 50. Choke thermostatic switch              |
| 11. L.H. headlamp main beam              | 31. Stop lamp switch                     | 51. Differential lock warning light switch |
| 12. Main beam warning light              | 32. Two-speed wiper/wash switch          | 52. Shuttle valves switch                  |
| 13. R.H. headlamp dip beam               | 33. Battery                              | 53. Vacuum lock switch                     |
| 14. R.H. headlamp main beam              | 34. Ignition warning light               | 54. Fuel tank unit                         |
| 15. R.H. rear indicator                  | 35. Ballast resistor                     | 55. Water temperature unit                 |
| 16. R.H. front indicator                 | 36. Oil pressure warning light           | 56. L.H. stop lamp                         |
| 17. L.H. indicator                       | 37. Choke warning light                  | 57. R.H. stop lamp                         |
| 18. L.H. rear indicator                  | 38. Differential lock warning light      | 58. Inhibitor socket                       |
| 19. Starter motor (type 36/1100)         | 39. Warning light and test button switch | 59. Battery sensing                        |
| 20. Horn-push                            | 40. Fuel gauge                           |  |

## CABLE COLOURS

B. Black  
P. Purple  
N. Brown  
U. Blue  
W. White  
R. Red  
G. Green  
L. Light

—|— Earth connections via fixing bolts

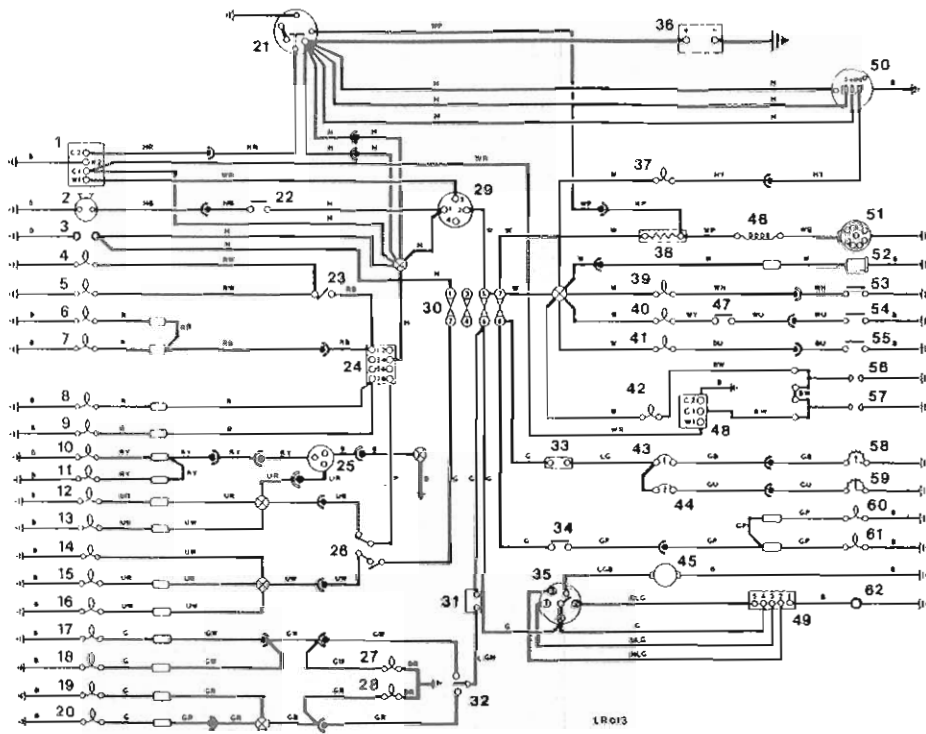
—|—<sup>B</sup> Earth connections via cables

—|— Snap connectors or plugs and sockets

LR 549

## CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Models with rear fog lamps



## KEY TO CIRCUIT DIAGRAM, V8 MODELS, R.H. &amp; L.H. STEERING, NEGATIVE EARTH

Models with rear fog lamps

- |  |  |
|--|--|
| 1. Starter relay                           | 31. Indicator unit                         |
| 2. Horn                                    | 32. Indicator switch                       |
| 3. Inspection sockets                      | 33. Voltage stabiliser unit                |
| 4. Speedometer panel illumination          | 34. Stop lamp switch                       |
| 5. Grouped instrument panel illumination   | 35. Two-speed wiper/wash switch            |
| 6. L.H. tail lamp                          | 36. Battery                                |
| 7. R.H. tail lamp                          | 37. Ignition warning light                 |
| 8. L.H. side lamp                          | 38. Ballast resistor                       |
| 9. R.H. side lamp                          | 39. Oil pressure warning light             |
| 10. R.H. rear fog lamp                     | 40. Choke warning light                    |
| 11. L.H. rear fog lamp (when fitted)       | 41. Differential lock warning light        |
| 12. L.H. headlamp dip beam                 | 42. Warning light and test button switch   |
| 13. L.H. headlamp main beam                | 43. Fuel gauge                             |
| 14. Main beam warning light                | 44. Water temperature gauge                |
| 15. R.H. headlamp dip beam                 | 45. Screen wash motor                      |
| 16. R.H. headlamp main beam                | 46. Coil                                   |
| 17. R.H. rear indicator                    | 47. Choke switch                           |
| 18. R.H. front indicator                   | 48. Electric fuel pump                     |
| 19. L.H. indicator                         | 49. Screen wiper motor                     |
| 20. L.H. rear indicator                    | 50. Alternator                             |
| 21. Starter motor (type 3M100)             | 51. Distributor                            |
| 22. Horn-push                              | 52. Electric fuel pump                     |
| 23. Panel light switch                     | 53. Oil pressure switch                    |
| 24. Lighting switch                        | 54. Choke thermostatic switch              |
| 25. Rear fog lamp switch and warning light | 55. Differential lock warning light switch |
| 26. Headlamp flash and dip switch          | 56. Switch brake fluid pressure            |
| 27. R.H. indicator warning light           | 57. Brake servo vacuum loss switch         |
| 28. L.H. indicator warning light           | 58. Fuel tank unit                         |
| 29. Ignition switch                        | 59. Water temperature unit                 |
| 30. Fuse unit                              | 60. L.H. stop lamp                         |
|  | 61. R.H. stop lamp                         |
|  | 62. Inhibitor socket                       |

## CABLE COLOURS

- B. Black  
 P. Purple  
 N. Brown  
 U. Blue  
 W. White  
 R. Red  
 G. Green  
 L. Light  
 Y. Yellow

Earth connections via fixing bolts

Earth connections via cables

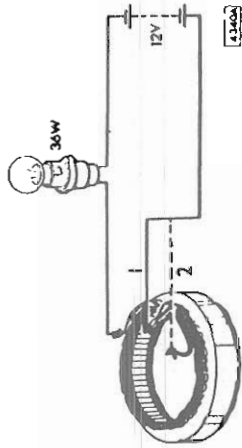
Snap connectors or plugs and sockets

LR 549

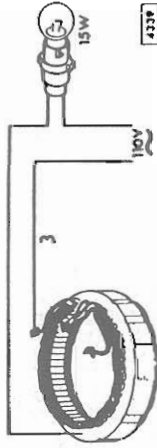
## (c) STATOR—Testing

Equipment required: A 12-volt battery and 36-watt test lamp. A 110-volt a.c. supply and a 15-watt test lamp.

1. Check continuity of stator windings between any pair of wires by connecting in series a 12-volt battery and test lamp of not less than 36 watts. Failure of the test lamp to light means that part of the stator winding is open-circuit and a replacement stator must be fitted.

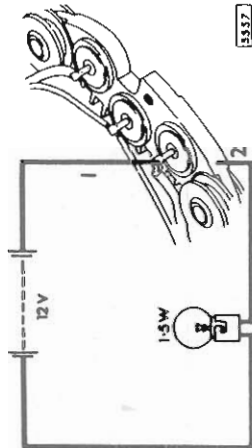


2. Test stator insulation with 110-volt test lamp. Connect test leads to laminated yoke and any one of the three stator cables. If the lamp lights, the stator coils are earthed. A replacement stator must be fitted.



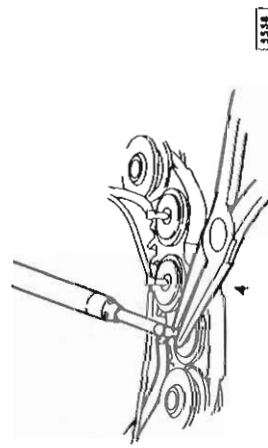
## (d) DIODES—Testing

1. Connect one battery terminal to the heatsink under test.
2. Connect the other battery terminal in series with the test lamp and each diode pin in turn.
3. Reverse connections to heatsinks and diode pins. The lamp should light in one direction only. Should the lamp light in both tests, or not light at all the diode is defective and a new rectifier heatsink assembly must be fitted.



4. To prevent damage to diode assemblies during soldering operations it is important that a thermal shunt is used.

NOTE: Only 'M' grade 45-55 tin-lead solder should be used.



## CONTROL UNIT

—Remove and refit 86.10.24

## Removing

1. Disconnect battery.
2. Remove alternator.
3. Remove alternator end cover by withdrawing two retaining screws.
4. Unsolder stator winding connections at rectifier diodes.

CAUTION: It is essential to use a thermal shunt and a lightweight soldering iron.

5. Note position of cables at rectifier plates and disconnect.
6. Remove three hexagon headed screws securing brush moulding and regulator to slip-ring end bracket.
7. Remove brush gear and regulator from alternator.

## Refitting

Reverse instructions 1 to 7.

## BATTERY

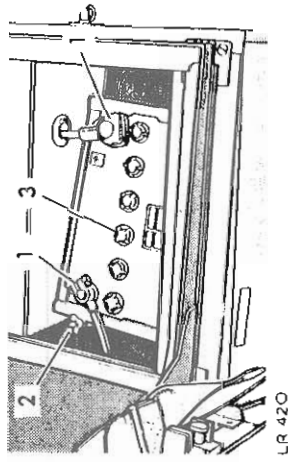
—Remove and refit 86.15.01

## Removing

1. Disconnect the battery.
2. Remove wing nuts and battery retaining frame.
3. Remove battery.

## Refitting

4. Reverse removal procedure, taking care when refitting the battery frame to avoid contact with the battery terminals.



## BATTERIES

## Preparation of batteries for service

## Preparation of dry-charged batteries

Batteries intended for export markets are supplied 'dry-charged' and must be filled with electrolyte of the correct specific gravity (s.g.) according to the climate before being put into service.

Dry-charged batteries leave the manufacturer in a fully charged state but may slowly discharge whilst in storage.

Batteries should not be filled with electrolyte until required for service.

Initial charging after filling is not normally necessary, but a freshening charge at the specified recharging rate for four hours may be advantageous.

Remove the vent covers and fill each cell with electrolyte of the correct specific gravity to the top of the perforated separator guard in one operation.

The temperature of the charging room, battery and electrolyte should be maintained between 15.6°C and 37.7°C (60°F and 100°F). If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

If the temperature of any cell rises above the permissible maximum, the charge must be interrupted until the temperature has fallen to 5.5°C (10°F) below that figure.

During charging, ensure that the electrolyte is level with the top of the separator guard, by the addition of electrolyte of the same specific gravity as used in the initial filling of the battery, until the specific gravity and voltage readings have remained constant for five successive hourly readings.

If the charging continues when the specific gravity has remained constant for five hours, top-up the battery to the level of the separator guard with distilled water. Electrolyte 'frothing' may occur during the first few hours of charging. This can be overcome by REDUCING the charging current.

On completion of charging, check the specific gravity in each cell, to ensure that it is within the specified units at 15.5°C (60°F).

If any cell requires adjustment, some of the electrolyte must be syphoned off and replaced, either by distilled water, or by electrolyte of the specific gravity used originally in the filling of the battery, depending on whether the specific gravity is too high or low.

NEVER TRANSFER ELECTROLYTE FROM ONE BATTERY OR CELL TO ANOTHER.

Continue the charging for an hour to ensure adequate mixing of the electrolyte, and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired specific gravity reading is obtained in each cell. Allow the battery to cool and syphon off any electrolyte above the top of the separator guard.

## Electrolyte filling precautions

When dry, uncharged batteries are filled, heat is created from the mixing of the filling acid with moisture in the plates, and also as a result of chemical action on the negative plates.

With batteries in moulded containers this heat may crack the containers; therefore, batteries must be filled in two stages.

In the first stage the battery should be half-filled and allowed to cool for 6 to 12 hours.

The battery should then be filled to the level of the separator guard and allowed to cool for a further two hours to complete the second stage.

## Initial charging

Ensure that the battery has stood for 12 hours before commencing the initial charging procedure. Ascertain the electrolyte level is correct prior to charging.

The initial charging rate is given in the Specification section.

Charge the battery at the specified rate until the voltage and specific gravity readings show no increase over five successive hourly readings.

The charging duration is from 48 to 80 hours, dependent upon the storage period of the battery. Maximum permissible electrolyte temperature during charge is:  
Climates below 26.6°C (80°F): 37.7°C (100°F).  
Climates over 26.6°C (80°F): 48.8°C (120°F).

Keep the current constant by varying the series resistance of the circuit. This charge should not be broken by long rest periods.

## Preparation of electrolyte

Approximately 790 cc (1½ pint) of sulphuric acid is required for each two-volt cell.

The specific gravity (s.g.) of the electrolyte required when filling is:

Climates normally below 26.6°C (80°F)—1.260 (corrected to 15.5°C (60°F)).  
Climates normally above 26.6°C (80°F)—1.210 (corrected to 15.5°C (50°F)).

Electrolyte is prepared by mixing distilled water and concentrated sulphuric acid to the required specific gravity (usually s.g. 1.840).

The mixing of the electrolyte must be carried out either in a lead-lined tank or in a suitable glass or earthenware vessel.

SLOWLY add the acid to the distilled water. NEVER ADD THE WATER TO THE ACID, as the resultant chemical reaction causes violent spurring of the sulphuric acid.

The approximate proportion of sulphuric acid and distilled water is as follows:

To obtain a specific gravity (corrected to 15.5°C (60°F)) of:  
1.260  
1.210  
Add 1 vol. of acid of 1.840 specific gravity (corrected to 15.5°C (60°F)) to  
3.2 volumes of water (1.260 specific gravity)  
4.3 volumes of water (1.210 specific gravity).

Heat is produced by the mixture of acid and water, therefore the electrolyte should be allowed to cool before taking hydrometer readings and pouring the electrolyte into the battery.

## Hydrometer tests

The specific gravity (s.g.) of acid is measured using a hydrometer. Never take a hydrometer reading immediately after replenishing the battery with distilled water. The readings given by each cell should be approximately the same. If one cell differs appreciably from the others, an internal fault in the cell is indicated. The appearance of the electrolyte drawn into the hydrometer gives an indication of the state of the plates. If the electrolyte is very dirty, or contains small particles in suspension, the plates may be in a poor condition.

The electrolyte specific gravity varies with temperature. All calculations are always corrected to 15.5°C (60°F). This is known as the reference temperature.

NOTE: The temperature must be that indicated by a thermometer actually immersed in the electrolyte and not the air temperature.

For every 2.8°C (5°F) BELOW 15.5°C (60°F), DEDUCT 0.002 from the specific gravity reading to obtain the true specific gravity at 15.5°C (60°F).

For every 2.8°C (5°F) ABOVE 15.5°C (60°F), ADD 0.002 from the specific gravity reading, to obtain the true specific gravity at 15.5°C (60°F).

Recharging from an external supply

If a high discharge rate test indicates that the battery is nearly discharged, and is otherwise in good condition, it should be recharged, either on the vehicle by a period of daytime running, or on a bench from an external supply.

If the battery is to be charged on the bench, the charging rate should not exceed 5 amperes.

The battery is fully charged when the specific gravity of the electrolyte and voltage show no increase over three successive hourly readings. During the charge, the electrolyte level should be checked regularly and replenished as necessary with distilled water.

## Boost charging

Boost charging must be regarded as an emergency measure only.

Boost charging must be limited to a maximum period of one hour only, with a charge rate not greater than the ampere-hour capacity of the battery.

As the battery state-of-charge rises, the charging rate will fall, but must NOT be re-adjusted to the original state.

Ah Rating of Battery	At 10 hr Rate	At 20 hr Rate	MAXIMUM Boost Charging Rate
60Ah	6A	3A	6A

## Maintenance precautions

The maintenance is identical for each type of battery. Wipe away any foreign matter or moisture from the top of the batteries. Use diluted ammonia on a lint-free cloth to neutralize acid spillage or sulphation. Ensure all connections are clean and tight.

Remove the battery vent covers and check the electrolyte level.

Clean the surfaces of the battery connectors and posts, and lightly coat them with petroleum jelly. Each day, inspect the level of electrolyte in the cells.

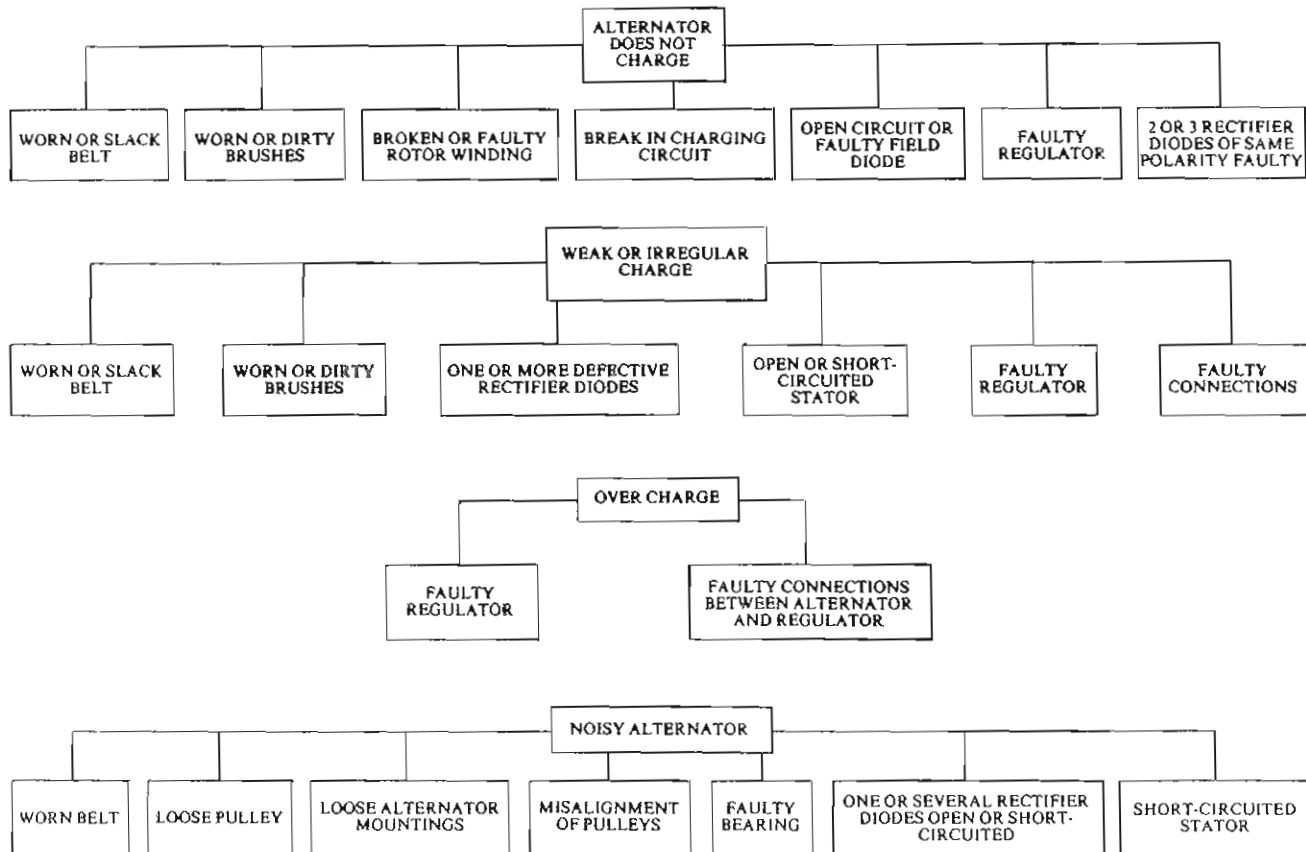
NOTE: Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery on charge, and to a lesser extent when standing idle, can be dangerously explosive.

If necessary, add distilled water to bring the level of electrolyte to the top of the perforated separator guard.

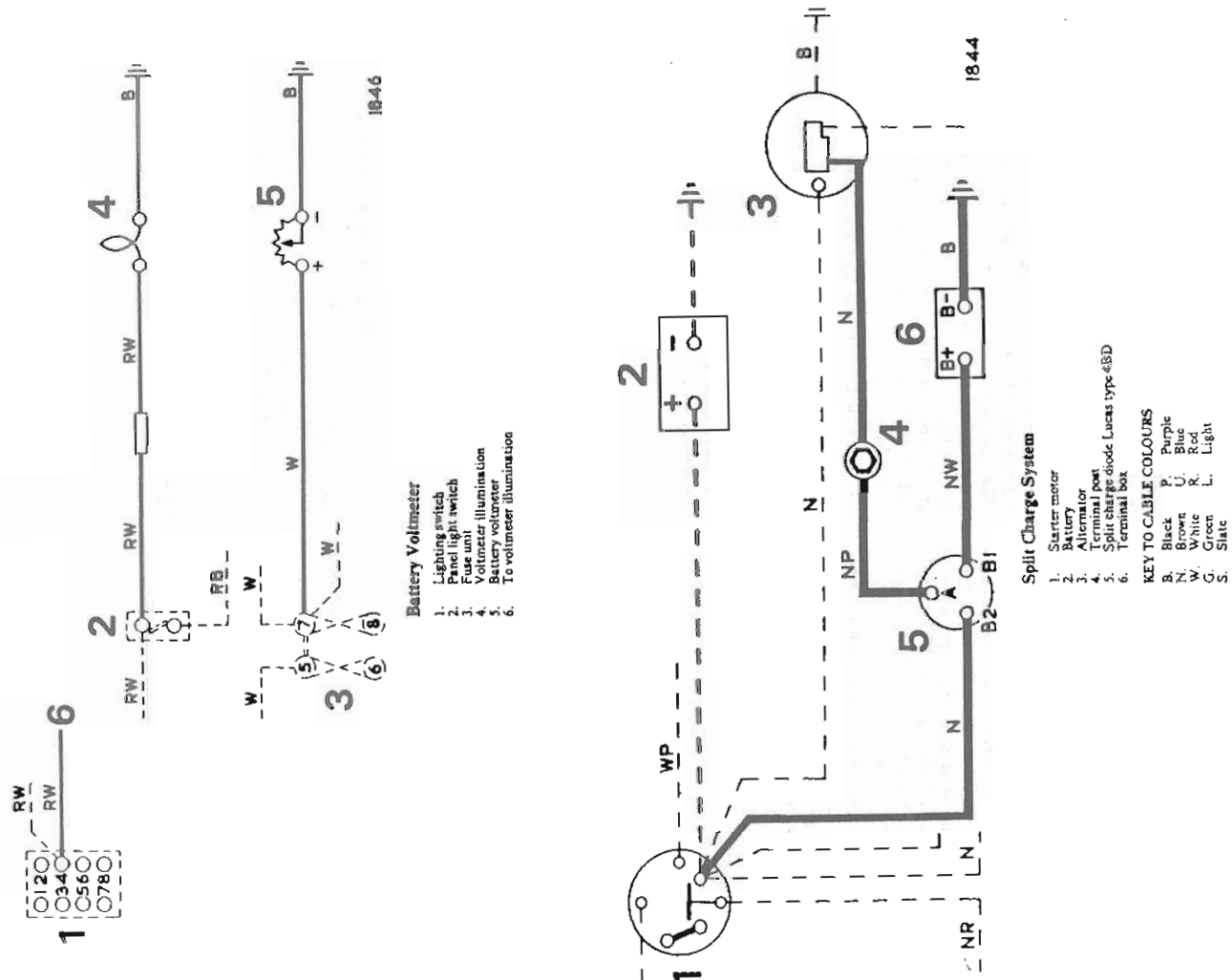
Distilled water should always be used for topping-up. Clean rain water or melted snow can be used in an emergency.

The following MUST NOT BE USED: salt water, chlorinated water, chemically softened water, boiled water or stagnant water.

SYMPTOM AND DIAGNOSIS CHART



CHECK EACH ITEM IN TURN AND RECTIFY IF NECESSARY BEFORE PROCEEDING TO NEXT ITEM.



## ALTERNATOR

—Description 86.10.00

The Lucas alternator type 18ACR fitted to the vehicle is a high output, three-phase machine which produces current at idling speed.

The heatsink-rectifier, terminal block assembly can be removed complete. There are six silicon diodes connected to form a full wave rectifier bridge circuit, and three silicon diodes which supply current to the rotor winding. Individual diodes cannot be removed from the heatsink assemblies. Regulation is by a Lucas type 8TRD control unit mounted in the slip-ring end bracket. There is no provision for adjustment in service.

Individual connectors are used to connect external wiring to the alternator. The alternator's main negative terminals are connected internally to the body of the machine. Provision is made for the connection of external negative wiring if required.

## ALTERNATOR—18ACR

—Test (in situ) 86.10.01

## (a) Output Test

Equipment required: A moving-coil ammeter or multi-range test meter on range 0 to 75 amperes.

This test should be carried out with the alternator at normal temperature. Run cold engine at 3000 rev/min for 3 to 4 minutes.

1. Disconnect battery earth lead.
2. Connect ammeter in series with alternator main output cable and starter solenoid.
3. Remove connectors from alternator. Remove moulded end cover and re-make connectors.
4. Connect jumper lead to short out the 'F' and '-' terminals of the control unit.  
(This makes regulator inoperative by effectively linking 'F' green lead to alternator frame.)
5. Re-connect battery earth lead.
6. Switch on all vehicle lighting, headlights on main beam. Switch on ignition and check warning light is on.
7. Start engine, slowly increase speed to 3000 rev/min. Ammeter reading should equal maximum rated output of:  
4.5 amperes—ACR18.

continued

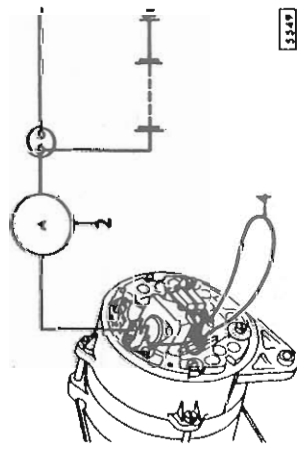
## Surge Protection Device

The surge protection device is a special avalanche-diode, fitted to the outer face of the slip-ring end bracket (not to be confused with a suppression capacitor, similarly fitted in the end bracket). The avalanche-diode is connected between terminal 'IND' and frame and its purpose is to protect the regulator from damage by absorbing high transient voltages which occur in the charging system due to faulty cable connections, or if the cables are temporarily disconnected at the battery whilst the engine is running. (The surge protection device is intended to provide limited protection for the regulator under normal working conditions and therefore the service precaution not to disconnect any of the charging system cables, particularly those at the battery, whilst the engine is running, should still be observed.)

**CAUTION:** No part of the charging circuit should be connected or disconnected while the engine is running.

When using electric arc welding equipment in the vicinity of the engine take the following precautions to avoid damage to the semi-conductor devices used in the alternator and control unit and also the ignition system.

Disconnect battery earthed lead.  
Disconnect alternator output cables.



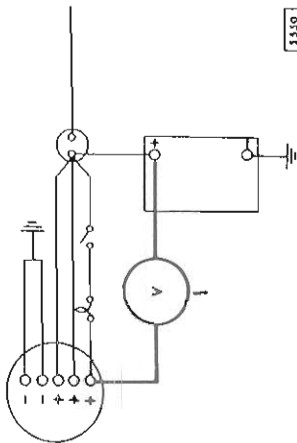
3359

## (b) Voltage Drop Test (in situ)

Equipment required: A moving-coil voltmeter; multi-range test meter on 0 to 30 volt range.

To check for high resistance in the charging circuit.

1. Connect voltmeter between battery +ve terminal and alternator main output terminal.
2. Switch on all vehicle lighting, headlights on main beam.  
Start engine and run at 3000 rev/min. Note voltmeter reading. Stop engine.
3. Transfer voltmeter connections to battery earth and alternator negative terminal.
4. Repeat instruction 2. Note voltmeter reading.
5. Voltage should not exceed 0.5 volts for positive side. Higher readings indicate high resistance in the circuit.



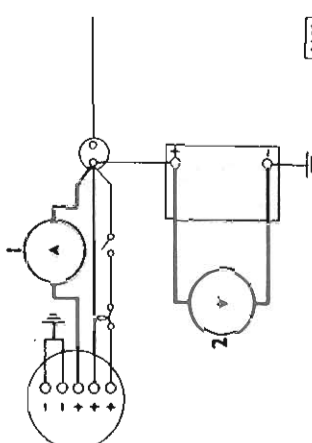
3350

## (c) Control Unit Test

Equipment required: A moving-coil ammeter and moving-coil voltmeter or multi-range test meters.

Circuit wiring must be in good condition and all connections clean and secure. The battery must be in a well charged condition or be temporarily replaced by a charged unit.

1. Connect ammeter in series with starter solenoid and alternator main output cable.
2. Connect voltmeter between battery terminals.
3. Start engine and run at 3000 rev/min until the ammeter reads less than 10 amperes. Voltmeter reading should be between 13.6 volts and 14.4 volts. An unstable reading or a reading outside the specified limits indicates a faulty control unit.



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## ALTERNATOR—18ACR

—Remove and refit

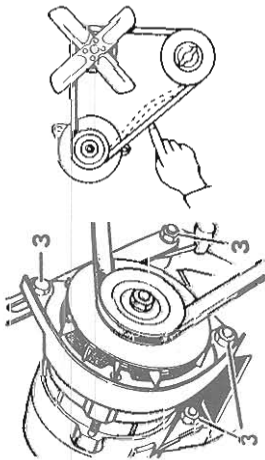
86.10.02

## Removing

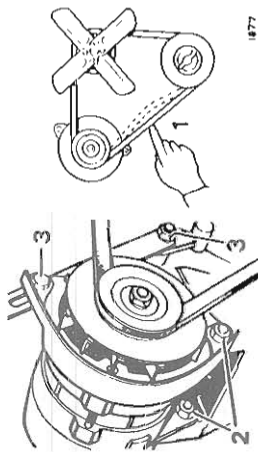
1. Disconnect battery earth lead.
2. Disconnect leads from alternator.
3. Slacken alternator fixings, pivot alternator inwards and remove fan belt.
4. Remove alternator.

## Refitting

5. Attach the alternator lower fixing bolts and nuts.  
**NOTE:** The fan guard is attached to the front fixing.
6. Slacken the alternator adjustment bracket and attach the alternator to the bracket.  
**NOTE:** The fan guard is attached to the adjustment bracket bolt.
7. Fit the fan belt and adjust the belt tension, see 86.10.05.
8. Connect the wiring plug to the alternator.
9. Connect the battery.



L.R.418



1877

## ALTERNATOR DRIVE BELT

—Check and adjust tension

86.10.05

1. Check by thumb pressure between alternator and crankshaft pulleys. Movement should be: 11 to 14 mm (0.437 to 0.562 in).  
If necessary, adjust as follows:
2. Slacken the bolts securing the alternator to the mounting bracket.
3. Slacken the fixings at the top and bottom of the adjustment link.
4. Pivot the alternator inwards or outwards as necessary and adjust until the correct tension is obtained. Tighten the bolt at the top of the adjustment link.
5. Finally tighten the nut securing the bottom of the adjustment link and the two mounting bracket bolts.

## ALTERNATOR—18ACR

## Overhaul

86.10.08

## Dismantling

1. Withdraw two retaining screws and remove moulded slip-ring end cover.
2. Note positions of stator winding connections to rectifier connecting pins.
3. Using thermal shunt and lightweight soldering iron (25 watt), unsolder connections.
4. Note position of cable connectors to rectifier plates.
5. Disconnect cables.
6. Withdraw three hexagon headed screws securing brushbox and regulator to slip-ring end bracket.
7. Remove brushbox moulding and regulator assembly.
8. Slacken rectifier securing nut and remove rectifier.

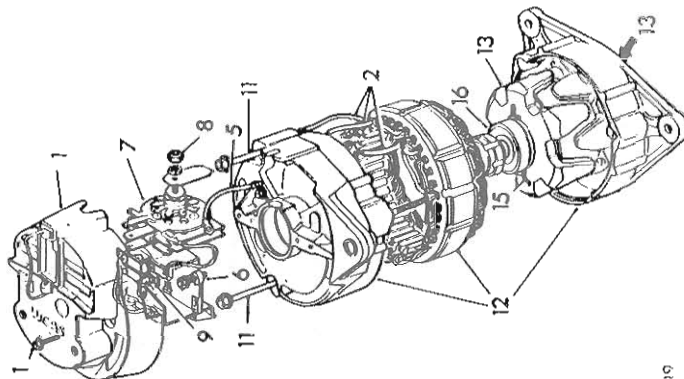
## Brushgear

9. Renew brush and spring assemblies if brushes are worn to 0.312 in (8 mm).
10. Check brush spring pressure with push-type spring gauge to end of brush. Spring pressure should be 9 to 13 ozf (255 to 368 gf or 2.5 to 3.6 N) when brush is flush with moulding.

## Slip-rings

If necessary, clean slip-rings with petrol moistened cloth or very fine glass paper.  
**NOTE:** Do not use emery cloth or similar abrasive.

continued



L.R.419

**Further dismantling**

11. Withdraw three through-bolts.
12. Separate alternator into its major components.
  - a. Slip-ring end bracket.
  - b. Drive end bracket, rotor, fan and pulley.
  - c. Stator laminations and windings.
13. Separate rotor from drive end bracket by removing pulley, fan and shaft key. Press rotor shaft from bearing.
14. Inspect bearings and if satisfactory pack with grease, Shell Alvania 'R.A'.  
NOTE: To pack slip-ring end bearing with grease it is first necessary to remove slip-ring moulding.

**Bearings**

- Slip-ring end:**
15. Unsolder field windings from slip-ring moulding.
  16. Remove slip ring moulding.
  17. Press bearing from shaft.
- Drive end:**
18. Remove circlip and retaining plate from drive end bearing.
  19. Press out bearing.

**Reassembly**

Reverse instructions 1 to 19.

**ALTERNATOR**

— Inspection and testing **86.10.14**

**Brush gear and slip-ring inspection**

The serviceability of the brushes is gauged by the length protruding beyond the brush moulding in the free position. This amount should exceed 0.3 in (8 mm). If renewal is necessary care must be taken to replace the leaf spring at the side of the inner brush.

The surface of the slip-rings should be smooth and free from grease or dirt. Servicing is confined to cleaning with a petrol-moistened cloth or finest grade glass-paper.

NOTE: Emery cloth or similar abrasive must not be used. The slip-rings cannot be machined.

**(a) Brush replacement**

1. Remove the small screws securing the brush retaining plates and regulator cables.
2. Replace brushes with new units and refit brush retaining plates and regulator cables.
3. Brush spring pressure should be checked with a push-type spring tension gauge. This should indicate 9 to 13 ozf (255 to 368 gf) when brush face is flush with the moulding.

continued

86—16

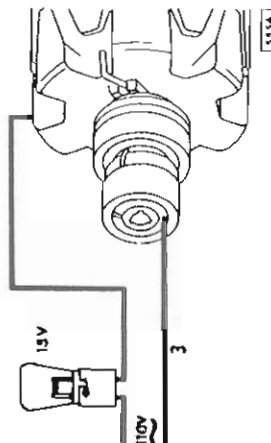
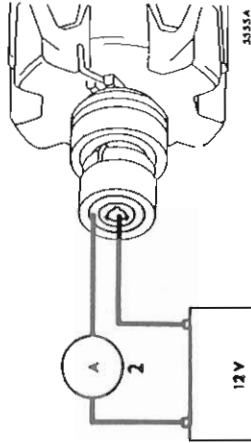
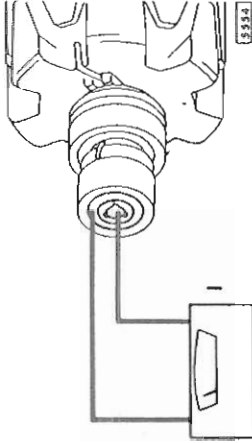
**(b) ROTOR—Testing**

Equipment required: An ohmmeter, or a 12-volt battery and ammeter. A 110-volt a.c. supply and a 15-watt test lamp.

1. Connect the ohmmeter between the slip-rings. Resistance should be 3.2 ohms at 20°C.

2. Alternatively, connect ammeter and battery between slip-rings. The ammeter should read approximately 3 amperes.

3. To test for defective insulation between slip-rings and rotor poles connect the 110-volt supply and 15-watt test lamp between slip-rings and rotor poles in turn. If the lamp lights, the coil is earthed to the rotor core. A replacement rotor, slip-ring assembly should be fitted.



## SPARK PLUGS

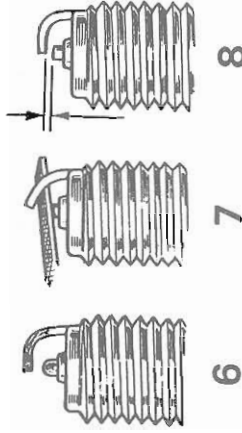
— Remove, clean, adjust and refit 86.35.01

## Removing

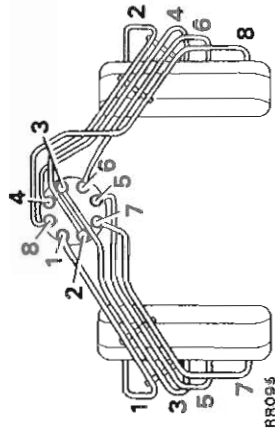
1. Withdraw leads by gripping end shrouds. DO NOT pull leads alone.  
NOTE: Remove the hot air pipe for access to the R.H. plugs as necessary.
2. Using special spanner and tommy bar supplied in vehicle tool kit, remove spark plugs and washers.

## Cleaning

3. Fit plug in plug cleaning machine.
4. Wobble plug with circular motion while operating a abrasive blast for a maximum of four seconds.  
CAUTION: Excessive abrasive blasting will erode insulator nose.
5. Change to air blast only and continue to wobble plug for a minimum of thirty seconds to remove abrasive grit from plug cavity.
6. Wire-brush plug threads, open gap slightly.
7. Using point file, square off electrode surfaces.
8. Set electrode gap: 0.80 mm (0.030 in).
9. Test plugs in accordance with cleaning machine manufacturer's instructions. If satisfactory, refit plugs in engine.  
**IMPORTANT: If new plugs are necessary, refer to Section 0.5**
10. Examine high tension leads, including coil to distributor lead, for insulation cracking or corrosion at end contacts. Fit new leads as necessary.
11. In addition to correct firing order, high tension leads must also be fitted in correct relation to each other to avoid cross firing. Figures in arrowed circles show plug lead numbers.
12. Leads at distributor cap must be connected as illustrated.  
Figures 1 to 8 inclusive indicate plug lead numbers.  
RH—Right-hand side of engine when viewed from rear.  
LH—Left-hand side of engine when viewed from rear.
13. When pushing leads on plugs ensure ferrules within shrouds are firmly seated on plugs. A guide is that shroud ends are within 6 mm (0.250 in) of metal body of plugs.



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## DISTRIBUTOR

— Remove and refit 86.35.10

## Removing

1. Disconnect battery.
2. Disconnect vacuum pipe.
3. Remove distributor cap.
4. Disconnect low tension lead from coil.
5. Mark distributor body in relation to centre line of rotor arm.
6. Add alignment marks to distributor and front cover.

NOTE: Marking distributor enables refitting in exact original position, but if engine is turned while distributor is removed, complete ignition timing procedure must be followed.

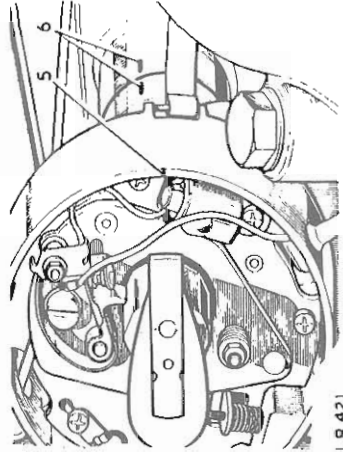
7. Release the distributor clamp and remove the distributor.

## Refitting

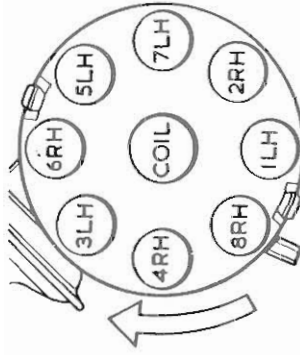
NOTE: If a new distributor is being fitted, mark body in same relative position as distributor removed.

8. Leads for distributor caps should be connected as illustrated.  
Figures 1 to 8 inclusive indicate plug lead numbers.  
RH—Right-hand side of engine when viewed from the rear.  
LH—Left-hand side of engine when viewed from the rear.
9. If engine has not been turned whilst distributor has been removed, proceed as follows (instructions 10 to 17).
10. Fit new 'O' ring seal to distributor housing.
11. Turn distributor drive until centre line of rotor arm is 30° anti-clockwise from mark made on top edge of distributor body.
12. Fit distributor in accordance with alignment markings.  
NOTE: It may be necessary to align oil pump drive shaft to enable distributor drive shaft to engage in slot.
13. Fit clamp and bolt. Secure distributor in exact original position.
14. Connect vacuum pipe to distributor and low tension lead to coil.
15. Fit distributor cap.
16. Reconnect battery.
17. Using suitable electronic equipment, set dwell angle and ignition timing as follows.
18. If, with distributor removed, engine has been turned it will be necessary to carry out the following procedure.

continued



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19. Set engine—No. 1 piston to static ignition timing figure (see Section 05) on compression stroke.
20. Turn distributor drive until rotor arm is approximately 30° anti-clockwise from number one spark plug lead position on cap.
21. Fit distributor to engine.
22. Check that centre line of rotor arm is now in line with number one spark plug lead on cap. Reposition distributor if necessary.
23. If distributor does not seat correctly in front cover, oil pump drive is not engaged. Engage by lightly pressing down distributor while turning engine.
24. Fit clamp and bolt, leaving both loose at this stage.
25. Turn engine back until crankshaft pulley static ignition timing mark passes timing pointer on front cover, then turn engine forward until pointer aligns with the static ignition timing value.
26. Rotate distributor anti-clockwise until contact points just start to open.
27. Secure distributor in this position by tightening clamp bolt.
28. Connect vacuum pipe to distributor and low tension lead to coil.
29. Fit distributor cap.
30. Reconnect battery.
31. Using suitable electronic equipment, set dwell angle and ignition timing as follows:

#### Ignition timing and dwell angle settings

Ignition timing: Refer to Section 05.

Dwell angle: 26° to 28° (58 to 62%)

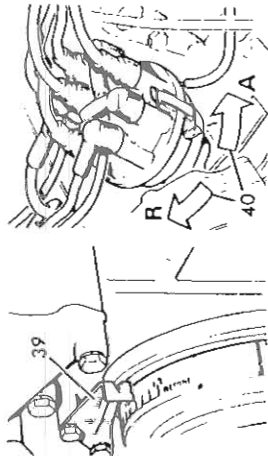
**NOTE:** It is essential that the following procedure is adhered to. Inaccurate timing can lead to serious engine damage.

32. Set ignition timing statically, prior to engine being run, by basic lamp timing method. (This sequence is to give only an approximation in order that engine may be run. On no account should engine be started before this check is carried out.)
33. Start engine and set idling speed to 650 rev/min as detailed in Section 05.

#### Set dwell angle as follows:

34. Set selector knob to 'calibrate' position. Adjust calibration knob to give a zero reading on meter.
35. Couple up Tach-dwell meter to engine following manufacturer's instructions.
36. Set selector knob to 8-cylinder position and Tach-dwell selector knob to 'dwell'. Adjust distributor dwell angle by turning hexagon headed adjustment screw on distributor body until meter reads 26° to 28°. If meter used does not have an 8-cylinder position, set selector knob to 4-cylinder position and adjust at distributor until meter reads 52° to 56°. Uncouple Tach-dwell meter.

continued



LR 423

#### Set ignition timing as follows:

37. Couple stroboscopic timing lamp to engine following manufacturer's instructions, with high tension lead attached into No. 1 cylinder plug lead.  
**NOTE:** The vacuum pipes must not be disconnected from the distributor.
38. Check distributor clamping bolt is slack and engine idle speed is 650 rev/min.
39. Check ignition timing. Stroboscopic lamp must synchronize timing pointer and timing mark on crankshaft pulley to value indicated in Section 05.
40. If necessary, adjust timing. Turn distributor clockwise to retard or anti-clockwise to advance.
41. Tighten distributor clamping bolt.
42. Disconnect stroboscopic timing lamp.

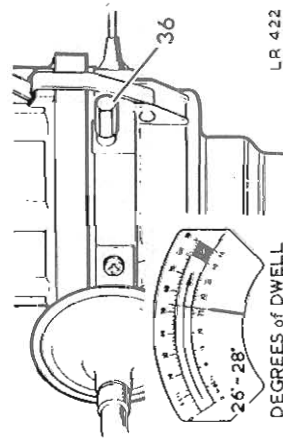
**NOTE:** Engine speed accuracy during ignition timing is of paramount importance. Any variation from the required idle speed, particularly in an upwards direction, will lead to wrongly set ignition timing.

#### Automatic ignition advance mechanism

The distributor incorporates two automatic ignition advance mechanisms—a vacuum-controlled unit related to carburettor choke depression and a centrifugally-controlled unit related to engine speed. Both units are connected to the contact breaker assembly, and operate independently, progressively moving the contact breaker through a small arc about the cam.

A loss of engine performance, particularly a sudden loss, could be due to a malfunction of either of the automatic advance mechanisms, and where suitable electronic engine tuning and testing equipment is available, both units can be checked against the figures detailed in Section 05—Engine Tuning Data.

The test should commence at maximum advance conditions and be checked during deceleration.



LR 422

## DISTRIBUTOR

—Overhaul **86.35.26**

**NOTE:** Four slightly varying designs of distributor may be fitted. The instructions below are generally applicable to all units unless otherwise stated.

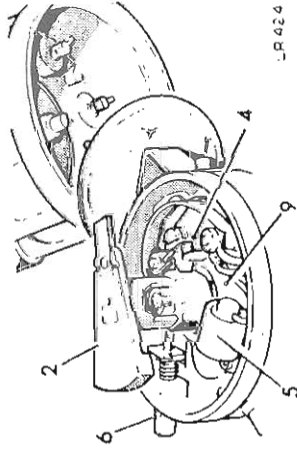
## Dismantling

1. Unclip and remove distributor cap.
2. Withdraw rotor arm and felt lubricating pad.
3. Remove contact spring or remove the nut and lift off the insulating bush together with the low tension and capacitor leads.
4. Remove the Quikafit contact set.
5. Remove the capacitor.
6. Remove the dwell angle adjuster screw and spring.
7. Remove the earth lead from the centrifugal advance cover-plate.
8. Remove the vacuum unit and grommet.
9. Remove the contact breaker base plate.
10. Remove the centrifugal advance cover-plate.
11. Carefully withdraw the two springs from the centrifugal advance unit.
12. Remove the screw from inside the cam and lift off the cam and cam foot.
13. Remove the two weights.
14. Drive out the pin securing the driving gear and remove the gear and tab washer.
15. Check all parts for wear or damage and replace as necessary.

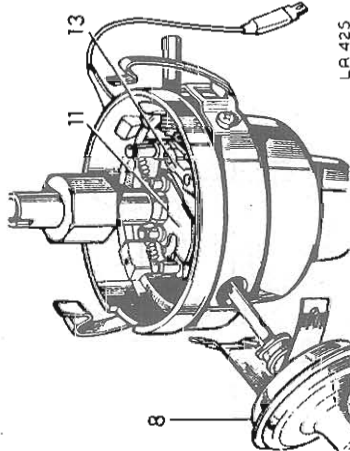
## Assembling

16. Reassemble the distributor by reversing the dismantling instructions.  
**NOTE:** It will assist reassembly if the vacuum advance lever is located to the base plate by the Quikafit contacts before the vacuum unit is secured to the distributor body.
17. When fitting the centrifugal governor springs, take care not to stretch them.
18. When fully assembled the points can be set to a clearance of 0.35 to 0.40 mm (0.014 to 0.016 in) as an initial guide before refitting to the engine.

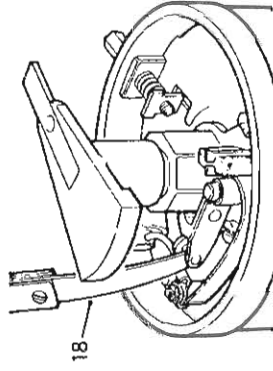
**NOTE:** It is most important that the dwell angle is adjusted to 26° to 28° using specialized equipment when the distributor has been refitted.



L.R.424



L.R.425



L.R.426

## DIFFERENTIAL LOCK ILLUMINATION LAMP

—Remove and refit **86.45.42**

## Removing

1. From behind the fascia withdraw the warning light bulb.
2. Gently press the warning lamp body forward until it can be withdrawn from the fascia.

## Refitting

3. Reverse instructions 1 and 2, ensuring that the locating lugs are correctly positioned.

0093

## BRAKE FAILURE WARNING/TEST BULB

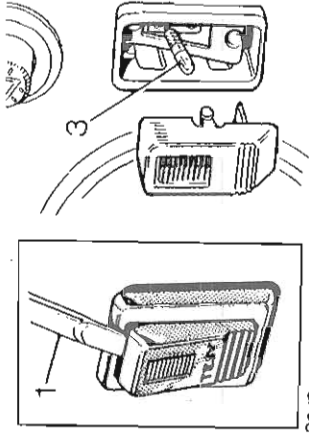
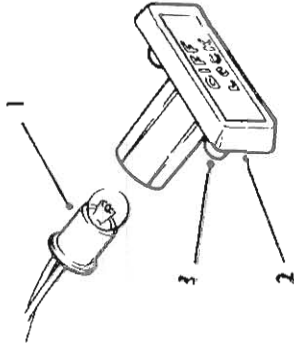
—Remove and refit **86.45.69**

## Removing

1. Depress the lower edge of the rocker switch ('on' position) and insert the blade of a screwdriver between the exposed upper edge of the rocker switch and the switch body.
2. Gently prise off the rocker switch to expose the bulb.
3. Unscrew the bulb.

## Refitting

4. Fit a new bulb.
5. Press the rocker switch into position in the switch body.



L.R.447

## STARTER MOTOR

—Remove and refit 86.60.01

## Removing

1. Place the car on a suitable ramp.
2. Disconnect the battery.
3. Disconnect the leads from the solenoid and starter motor and remove the exhaust heat shield where fitted.
4. Remove the two bolts securing the starter motor to the flywheel housing.
5. Remove starter motor from underneath the vehicle.

## Refitting

6. Reverse the removal procedure.
7. Tighten the bolts securing the starter motor to cylinder block to a torque of 4.0 to 4.9 kgf m (30 to 35 lbf ft).

## STARTER SOLENOID

—Remove and refit 86.60.08

## Removing

1. Place the car on a suitable ramp.
2. Disconnect the battery.
3. Disconnect the leads from the solenoid and starter motor.
4. Remove the two bolts securing the starter motor to the flywheel housing.
5. Remove the starter motor from underneath the vehicle.

NOTE: The starter solenoid is integral with the starter motor. Refer to the starter motor overhaul procedure for dismantling.

## Refitting

6. Reverse the removal procedure.
7. Tighten the bolts securing the starter motor to cylinder block to a torque of 4.0 to 4.9 kgf m (30 to 35 lbf ft).

## STARTER MOTOR—Lucas 3M100PE

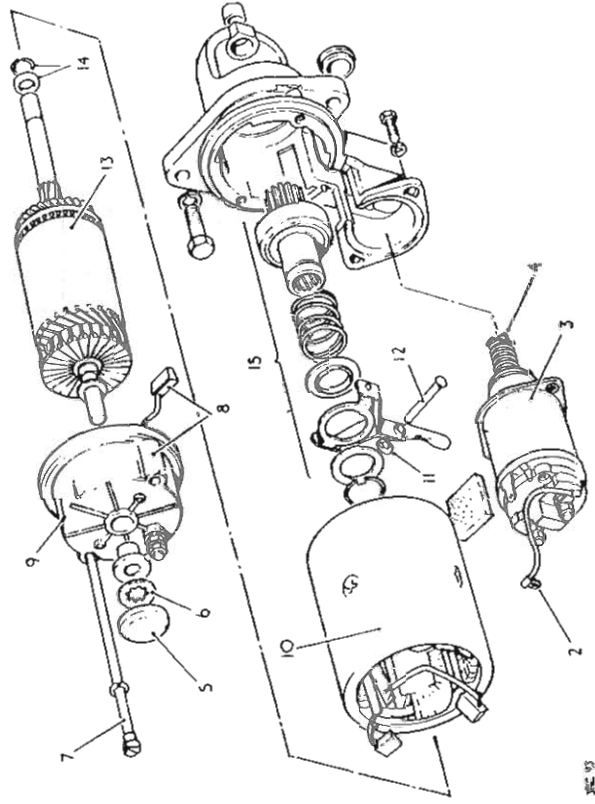
—Overhaul 86.60.13

## Dismantling

1. Remove the starter motor, see 86.60.01.
2. Remove the connecting link between the starter and the solenoid terminal 'STA'.
3. Remove the solenoid from the drive end bracket.
4. Grasp the solenoid plunger and lift the front end to release it from the top of the drive engagement lever.
5. Remove the end cap seal.
6. Using an engineer's chisel, cut through a number of the retaining ring claws until the grip on the armature shaft is sufficiently relieved to allow the retaining ring to be removed.

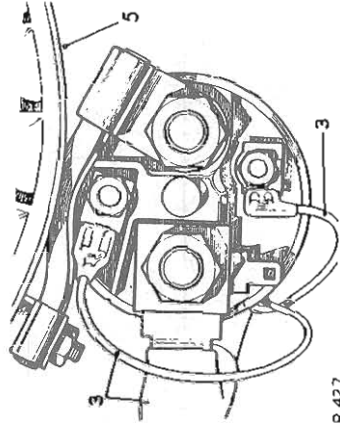
7. Remove the two through-bolts.
8. Partially withdraw the commutator end cover and disengage the two field coil brushes from the brush box.

9. Remove the commutator end cover.
10. Withdraw the yoke and field coil assembly.
11. Remove the retaining ring from the drive engagement lever pivot pin, using the method previously described.
12. Withdraw the pivot pin.
13. Withdraw the armature.
14. Using a suitable tube, remove the collar and jump ring from the armature shaft.
15. Slide the thrust collar and the roller clutch drive and lever assembly off the shaft.



86 63

continued



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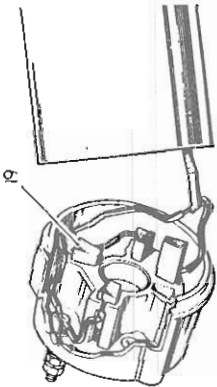
## Inspecting

## Clutch

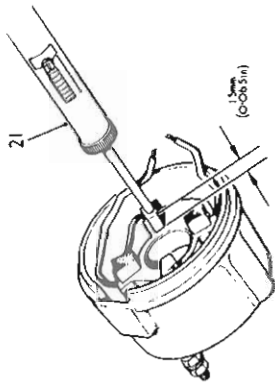
16. Check that the clutch gives instantaneous take-up of the drive in one direction and rotates easily and smoothly in the other direction.
17. Ensure that the clutch is free to move round and along the shaft splines without any tendency to bind. **NOTE:** The roller clutch drive is sealed in a rolled steel cover and cannot be dismantled.
18. Lubricate all clutch moving parts with Shell SB 2628 grease for cold and temperate climates or Shell Retinax 'A' for hot climates.

## Brushes

19. Check that the brushes move freely in the brush box moulding. Rectify sticking brushes by wiping with a petrol-moistened cloth.
20. Fit new brushes if they are damaged or worn to approximately 9.5 mm (0.375 in).
21. Using a push-type spring gauge, check the brush spring pressure. With new brushes pushed in until the top of the brush protrudes about 1.5 mm (0.065 in) from the brush box moulding, the spring pressure reading should be 1.0 kgf (36 ozf).
22. Check the insulation of the brush springs by connecting a 110V a.c. 15W test lamp between a clean part of the commutator end cover and each of the springs in turn. The lamp should not light.



JKC 94



JKC 95

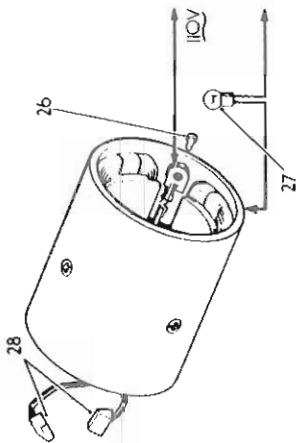
## Armature

23. Check the commutator. If cleaning only is necessary, use a flat surface of very fine glass paper, and then wipe the commutator surface with a petrol-moistened cloth.
24. If necessary, the commutator may be machined providing a finished surface can be obtained without reducing the thickness of the commutator copper below 3.5 mm (0.140 in), otherwise a new armature must be fitted. Do not undercut the insulation slots.
25. Check the armature insulation by connecting 110V a.c. 15W test lamp between any one of the commutator segments and the shaft. The lamp should not light; if it does light, fit a new armature.

continued

## Field coil insulation

26. Disconnect the end of the field winding where it is riveted to the yoke, by filing away the riveted over end of the connecting-eyelid securing rivet, sufficient to enable the rivet to be tapped out of the yoke.
27. Connect a 110V a.c. 15W test lamp between the disconnected end of the winding and a clean part of the yoke.
28. Ensure that the brushes or bare parts of their flexibles are not touching the yoke during the test.
29. The lamp should not light; if it does light, fit a new field coil assembly.
30. Re-secure the end of the field winding to the yoke.



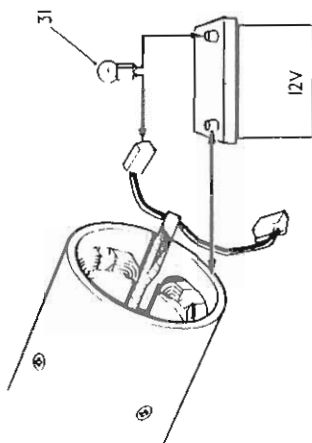
JKC 97

## Field coil continuity

31. Connect a 12V battery-operated test lamp between each of the brushes in turn and a clean part of the yoke.
32. The lamp should light; if it does not light, fit a new field coil assembly.

## Solenoid

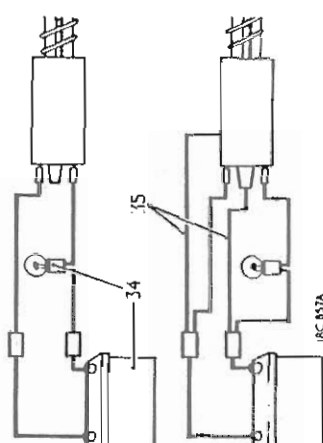
33. Disconnect all cables from the solenoid terminals and connectors.
34. Connect a 12V battery and a 12V 60W test lamp between the solenoid main terminals. The lamp should not light; if it does light, fit new solenoid contacts or a new solenoid complete.
35. Leave the test lamp connected and, using the same 12V battery supply, energize the solenoid by connecting 12V between the small solenoid operating Lucas terminal blade and a good earth point on the solenoid body.
36. The solenoid should be heard to operate and the test lamp should light with full brilliance, otherwise fit new solenoid contacts or a new solenoid complete.



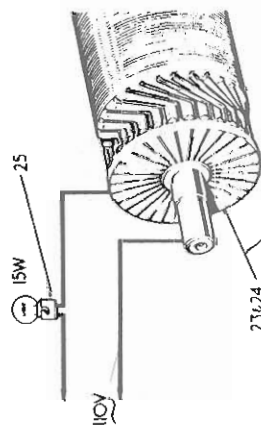
JKC 98

## Reassembling

37. Reverse instructions 1 to 15, including the following:
38. Fit the commutator end cover before refitting the solenoid to facilitate assembly of the block-shaped grommet which, when assembled, is compressed between the yoke, solenoid and fixing bracket.
39. Ensure that the internal thrust washer is fitted to the commutator end of the armature shaft.
40. Tightening torques:
  - Through-bolts 1.1 kgf m (8.0 lbf ft).
  - Solenoid fixing stud nuts 0.6 kgf m (4.5 lbf ft).
  - Solenoid upper terminal nuts 0.4 kgf m (3.0 lbf ft).
41. Set the armature end-float by driving the retaining ring on the armature shaft into a position that provides a maximum of 0.25 mm (0.010 in) clearance between the retaining ring and the bearing bush shoulder.



JKC 95A



JKC 96

## ELECTRICAL EQUIPMENT

### CHOKE WARNING LIGHT SWITCH

—Remove and refit

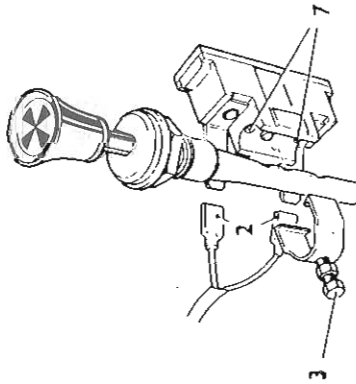
86-65-83

#### Removing

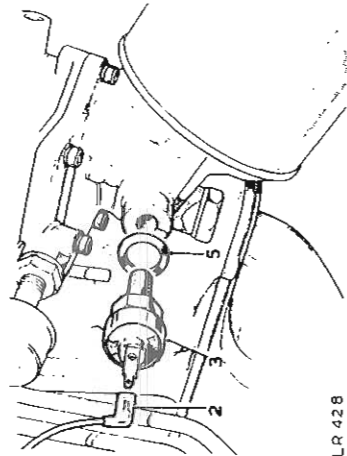
1. Disconnect the battery.
2. Disconnect the electrical leads from the choke switch.
3. Release the clip securing the switch to the choke cable.
4. Remove the switch.

#### Refitting

5. Check that the choke inner cable is adjusted to provide a minimal clearance behind the knob when the knob is pushed in.
6. Check the switch to ensure that the spring loaded plunger projects and is free to move in the switch body.
7. Pull out the choke knob and locate the switch operating plunger in the centre hole in the sleeve of the choke outer cable; the two locating dowels engage in the outer holes.
8. Secure the switch in position and tighten the securing bolt and locknut. Ensure that the bolt is not over-tightened to the extent where it will cause the plunger to jam.
9. Connect the switch leads.
10. Connect the battery.
11. Check switch and light operation.



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LR 428

### OIL PRESSURE WARNING SWITCH

—Remove and refit

88-25-08

#### Removing

1. Disconnect the battery.
2. Disconnect the electrical lead from the switch.
3. Unscrew the switch unit.
4. Remove the switch and sealing washer.

#### Refitting

5. Reverse the removal procedure, using a new sealing washer.

### COOLANT TEMPERATURE TRANSMITTER

—Remove and refit

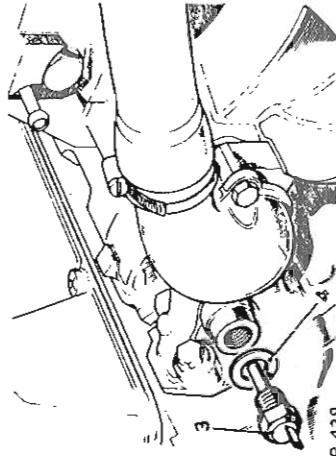
88-25-20

#### Removing

1. Disconnect the battery.
2. Disconnect the electrical lead from the transmitter and (later models) the air cleaner hose.
3. Remove the transmitter from the inlet manifold.

#### Refitting

4. Reverse the removal procedure, using a new joint washer.



LR 429

### SPEEDOMETER CABLE

—Remove and refit

Cable complete 1, 2, 4, 5 and 6

88-30-06

Inner cable 1, 2, 3 and 6

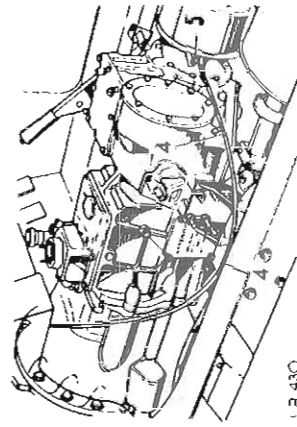
88-30-07

#### Removing

1. Withdraw the instrument panel and disconnect the speedometer cable from instrument.
2. Withdraw the speedometer cable end into the engine compartment.
3. Withdraw the inner cable from the outer.
4. Detach the speedometer cable grommets from the securing clips at the engine, flywheel housing, chassis sidemember and transfer gearbox.
5. Disconnect the cable at the gearbox.

#### Refitting

6. Reverse instructions 1 to 5 as applicable. When replacing the inner cable, grease sparingly with general-purpose grease. Ensure that the inner cable is engaged in the drive slot at the gearbox.



LR 430



**CENTRE POWER TAKE-OFF**

—Description

A centre power take-off, marketed by Messrs. Fairy Winches Ltd, South Station Yard, Whitechurch Road, Tavistock, Devon, fits to the rear of the transfer gearbox, replacing the existing mainshaft rear bearing housing. It is secured by the bearing housing bolts and operated by a slider control situated above the gearbox cover by the driver's seat.

**CENTRE POWER TAKE OFF**

—Remove and refit 90.15.02

**Removing**

1. Remove the exhaust heat shield and silencer.
2. Disconnect any belt drive to the power take-off pulley.
3. Remove the cotter pin to disconnect the control rod.
4. Remove the bolts securing the power take-off unit to the transfer gearbox.
5. Lift off the power take-off unit.

**Refitting**

6. Renew the gasket if damaged.
7. Reverse instructions 1 to 5, ensuring that the power take-off is in the disengaged position before refitting.

Service Tools mentioned in this Manual must be obtained direct from the tool manufacturers:

Messrs. V. L. Churchill & Co. Ltd.,  
P.O. Box 3,  
London Road,  
DAVENTRY,  
Northants,  
England.  
Telephone: 03-272 4461  
Telex: 31326  
Telegrams: Garaquip Daventry Northants Telex

Zenith Carburetter Co. Ltd.,  
Honeypot Lane,  
STANMORE,  
Middlesex,  
England.  
Telephone: 01-204 3388  
Telex: 23571  
Telegrams: Zenicarbur, Norphone, London

Tool No.	Description
<b>ENGINE</b>	
605351	Connecting rod guide rods
605350	Gudgeon pin remover-replacer main tool
18G 1150	Gudgeon pin remover-replacer
18G 115 E	Gudgeon pin remover-replacer adaptor
18G 537	Gudgeon pin remover-replacer torque wrench
18G 587	Gudgeon pin remover-replacer socket spanner
605238	Plastigauge
RO 1014	Rear main oil seal guide
276102	Valve spring compressor
274401	Valve guide remover
600959	Valve guide drift
605774	Distance piece for 600959

**FUEL SYSTEM**

605330	Carburetter balancer
MS80	Mixture adjusting tool (Zenith No. B25860)
B 25243	Idle speed adjusting tool

**CLUTCH**

18G 79	Clutch centralizing tool
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continued

## SERVICE TOOLS

Tool No.	Description
<b>GEARBOX</b>	
RO 1005	Primary pinion centralizing tool
18G 134 DG	Oil seal and feed ring assembly tool
18G 134 (530)	Assembly tool for 18G 134 DG
18G 133S	Reverse shaft extractor
RO 1004	Mainshaft spacer extractor
18G 284	Impulse extractor (general purpose tool)
18G 284 AR	Layshaft bearing extractor
18G 47	General purpose press
18G 47 BA	Layshaft bearing remover adaptor
RO 1003	Dummy shaft intermediate gears
18G 47 BB	Gearbox differential bearing extractor

### FRONT AXLE AND FINAL DRIVE

601763	Ball joint extractor
18G 1349	Hub oil seal fitting tool

### FRONT SUSPENSION

606435 A	Hub nut spanner
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Refer to the main Repair Operation Manual for details of tools that are common to all Land-Rover models



