

# Chapter M

## ELECTRICAL SYSTEM

SECTION	PAGE
M1 Battery	M1
M2 Fuse Panel	M5
M3 Distributor, Ignition Coil and Sparking Plugs	M9
M4 Starter Motor	M17
M5 Alternator and Regulator	M25
M6 Generator	M41
M7 Exterior Lighting	M49
M8 Instruments, Interior Lighting and Accessories	M53
M9 Interior Switches	M59
M10 Relays	M63
M11 Windscreen Wipers, Motors and Washers	M71
M12 Horns	M83
M13 Electrically Operated Window Lifts	M85
M14 Electrically Operated Front Seats	M89
M15 Radio Receiver, Cartridge Player, Loudspeaker and Aerial	M93
M16 Long Wheelbase Cars fitted with Centre Division	M101
M17 Coachbuilt Cars	M103
M18 Heater Blower Motors	M109

# Chapter M

## ELECTRICAL SYSTEM

### Section M1

### BATTERY

#### Introduction

The electrical system is negative earth.

Electrical components not described within this chapter are given in the following list:

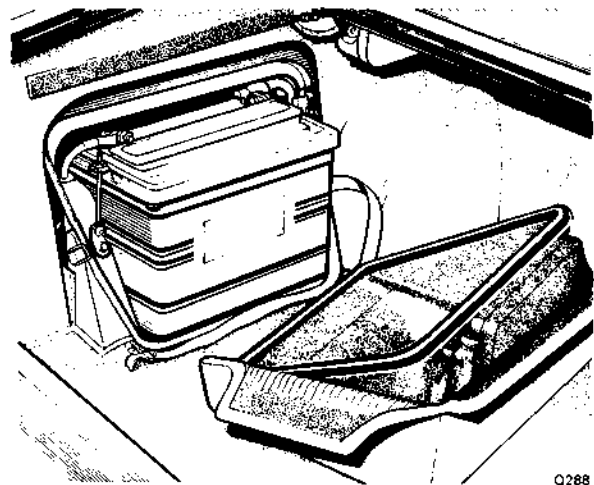
Electric gear change actuator	- Chapter T - Transmission
Electric fuel pumps	- Chapter K - Fuel System
Air conditioning e.g. Servo module, voltage stabiliser	- Chapter C - Air conditioning
Exhaust emission control e.g. Primary & secondary EGR lock-out switches	- Chapter U - Emission Control Systems

**Important** It is imperative that the negative (earth) lead is disconnected from the battery before commencing work on the electrical system or components, or if any electric arc welding is to be used on the motor car

**THE BATTERY MUST NOT BE CONNECTED OR DISCONNECTED WHEN THE ENGINE IS RUNNING.**

#### Battery—To remove (see Fig. M1)

**Important** The acid in the battery is highly corrosive - do not spill.



**FIG. M1 ACCESS TO BATTERY**

1. Remove the trim panel covering the battery in the luggage compartment; the panel is held in position with contact strip or press studs.
2. Unclip the retaining strap.
3. Remove the battery cover and small tools tray.
4. Remove the two battery securing clamps.
5. Disconnect the battery terminals.
6. Protect the carpet with paper and carefully lift the battery from the car.

**Chapter M****Battery—To fit**

Reverse the procedure given for removal, noting the following points.

1. Ensure that the correct battery lead is fitted to the correct terminal, i.e. negative to negative, otherwise damage to electrical components will occur.
2. Verify that the battery terminals are secure and positioned correctly.
3. Smear the terminals with petroleum jelly. (Do not use grease).

**Corrosion**

To remove corrosion from the battery leads and terminal posts, disconnect the leads and wash with hot water or a dilute solution of ammonium carbonate.

The ammonium carbonate solution must be removed with clean water; thoroughly dry the leads and terminal posts with a cloth.

Connect the battery leads to the terminal posts on the battery and smear with petroleum jelly.

**Specific gravity—To check**

1. Remove the battery as described in Battery - To remove.
2. Using a hydrometer, obtain the specific gravity and compare the reading against the figures given in Table 1.

**Battery—To top-up**

1. Remove the battery from the car.
2. Remove the cover from the filling trough.
3. Fill the trough with distilled water.
4. Clean and refit the trough cover.

The cover will press down on each valve and allow an equal amount of distilled water to enter each cell.

5. With a damp cloth, clean the top of the battery; do not use petroleum or paraffin etc.

6. Refit the battery and ensure that the battery terminals are secure and positioned correctly.

**Note** On late European cars, the battery has individual screw vent caps.

**Initial charge—For new batteries**

1. The acid specific gravity figures given in Table 1 are corrected to 15.6°C (60°F). To the specific gravity obtained add 0.004 for every 5.6°C (10°F) above this temperature, e.g. Measured specific gravity at 32.3°C (90°F) is 1.265, corrected specific gravity 1.277.

2. Fill the battery with cool accumulator acid preferably between 4°C (40°F) and 27°C (80°F) of the correct specific gravity given in Table 1.

3. The electrolyte level will fall soon after filling and must be restored by the addition of more electrolyte, after which the battery must be allowed to stand for 3 hours. At the end of this period, topping up will again be necessary to obtain the correct level.

4. The recommended charge rate is 7 amp. for 12 hours. The charge may be interrupted provided that the charging periods are of at least 8 hours and the rest periods not exceeding 16 hours.

5. The charge will not be complete until the total specified charging time has expired, the voltage and specific gravity of each cell has remained constant throughout 5 successive hourly readings and gas is freely emitted from each cell.

**Table 1**

**Dagenite Demon battery****Air Temperature below 32°C. (90°F.)**

Specific Gravity	Condition of Battery
1.270 to 1.290	Fully charged
1.180 to 1.200	Half discharged
1.090 to 1.110	Fully discharged

**Air Temperature above 32°C. (90°F.)**

Specific Gravity	Condition of Battery
1.220 to 1.240	Fully charged
1.150 to 1.170	Half discharged
1.070 to 1.090	Fully discharged

**Lucas Pacemaker battery****Air Temperature below 27°C. (80°F.)**

Specific Gravity	Condition of Battery
1.270 to 1.290	Fully charged
1.180 to 1.200	Half discharged
1.090 to 1.110	Fully discharged

**Air Temperature above 27°C. (80°F.)**

Specific Gravity	Condition of Battery
1.220 to 1.240	Fully charged
1.130 to 1.150	Half discharged
1.050 to 1.070	Fully discharged

6. On completion of the charge, the specific gravity of the acid in each cell should not exceed the values stated in Table 1; if it does, acid must be withdrawn from the cell(s) and an equal volume of distilled water added. The battery should then be charged for a further one hour and the specific gravity measured again.

The final adjustment of the acid level should be made after the battery has been allowed to stand for two hours to allow excess gas to escape and the electrolyte level to fall.

### Battery—To charge

1. Remove the battery from the car.
2. Ensure that the battery charger is switched off.
3. **Connect the battery charger leads to the battery, ensuring that the positive lead of the charger is connected to the positive terminal of the battery and the negative lead to the negative terminal.**
4. Check that the filling trough cover is firmly in position (or screw caps fitted).
5. Switch on the battery charger and adjust the charging current to 7 amps (Max).
6. Periodically measure the specific gravity of the electrolyte with a hydrometer and compare with the values shown in Table 1, when the fully charged value is attained, the charging is completed.

A filled battery should not be allowed to remain in a discharged condition, it should be maintained in a fully charged condition by giving it a fresh charge once a month. The battery should be fully charged before it is put back into service.

## Section M2

# FUSE PANEL

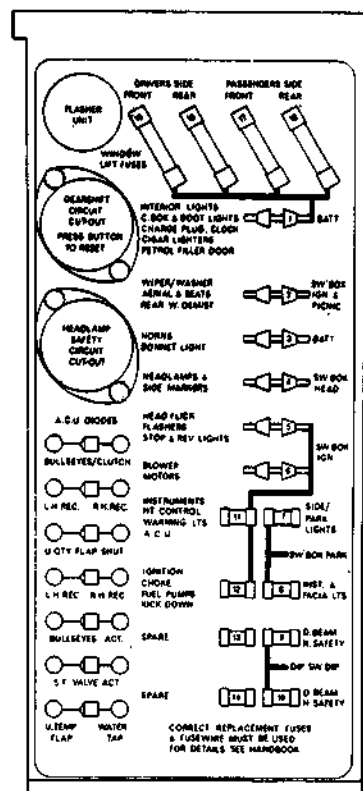
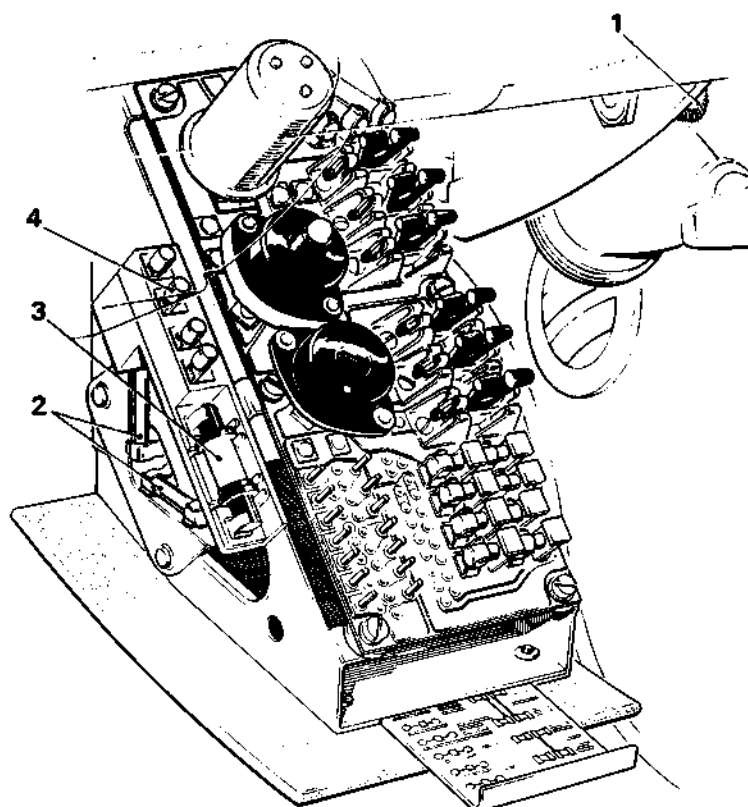
The fuse panel is situated below the facia on the driver's side of the car (see Figs. M2 & M3).

To gain access to the fuse panel, unscrew the knurled retaining screw and lower the panel; an identification plate is fitted between the padded housing and supporting framework.

**Important** It is important to note that if new glass fuses are required, they should be of 'Bulgin' manufacture and of the correct rating.

The fuse panel also houses the direction indicators flasher unit, the thermal cut-out button for the transmission actuator and the thermal cut-out for the headlamps protection circuit.

If a refrigeration unit is fitted to the car, the fuse panel has seven small diodes fitted to prevent feedback from the electric actuators (see Fig. M4). The diodes have the following identification numbers: DD 000 or 49453A. The identification plate clearly shows the positions.



K 685

**FIG. M2 FUSE PANEL (EARLY CARS)**

- 1 Fuse panel knurled retaining screw
- 2 Electrically operated front seat fuses

- 3 Bobbin of spare fuse wire
- 4 Spare fuses (4)

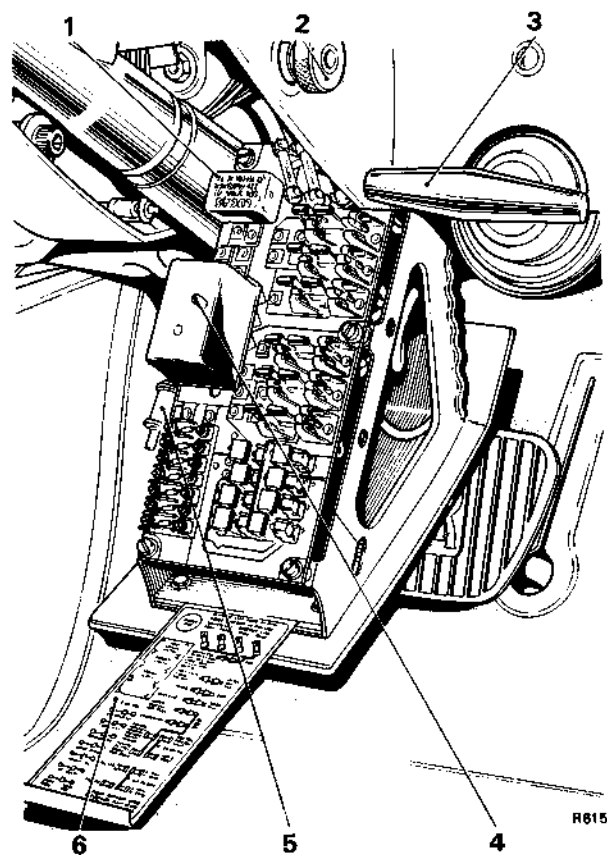
## Chapter M

### Fuse panel—To remove

The glass fuses are fitted with a plastic extractor. The bakelite fuses have an integral grip.

The flasher unit, the thermal cut-out with re-set button and the headlamp protection thermal cut-out have blade terminals. To remove the fuse panel printed circuit base proceed as follows.

1. Remove the knurled retaining screw and the six screws securing the panel to the support framework.
2. Lift the fuse panel carefully from the supporting frame sufficiently to enable the wiring



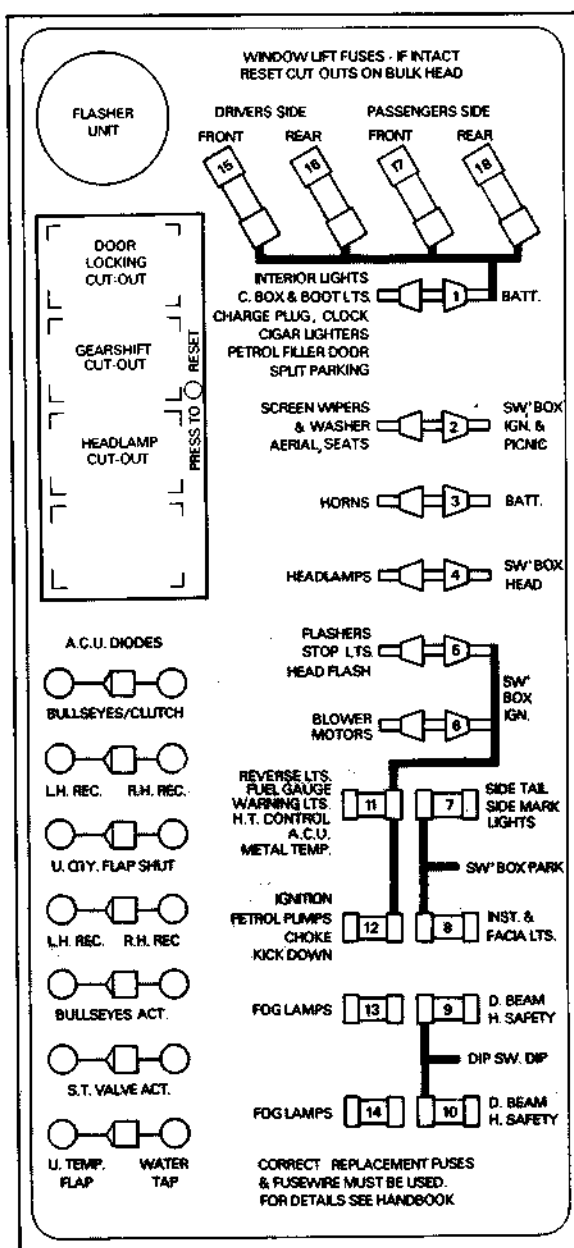
**FIG. M3 ACCESS TO THE MAIN FUSEBOX  
(LATE CARS)**

- 1 Flasher unit
- 2 Fusebox securing screw
- 3 Handbrake
- 4 Thermal cut-out reset button
- 5 Bobbin of spare fuse wire
- 6 Fuseboard identification plate

loom sockets to be detached. Each socket is designed to fit only the terminals from which it was removed.

### Diode—To renew

It is important to note the position of the existing diodes to ensure correct assembly before attempting to renew one or more of the diodes. The red end of the diode is fitted toward the left-hand terminal of the fuse panel. The diode connectors are secured to the fuse panel by small nuts, bolts and washers.



M 975

### Gearchange selector thermal cut-out (see Figs. M2 & M3)

If work is to be carried out on the car with the engine running, it is strongly recommended that the

gear range selector thermal cut-out be removed from the fuse panel. This will isolate the gear range selector.

The gear range selector thermal cut-out is removed by pulling away from the fuse panel.

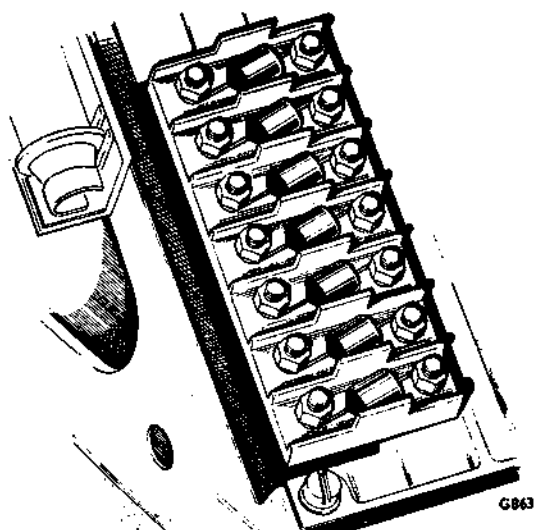


FIG. M4 POSITION OF DIODES ON FUSE PANEL

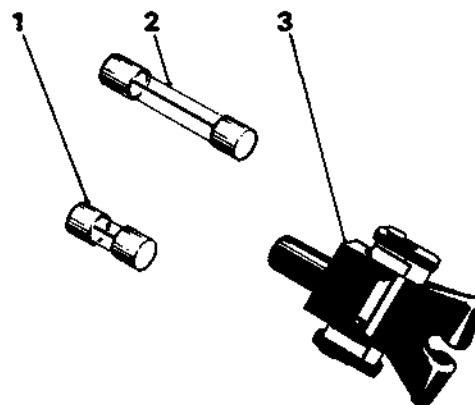


FIG. M5 FUSE IDENTIFICATION

- 1 Small glass fuse - 10 amp. rating
- 2 Large glass fuse - 30 amp. rating
- 3 Bakelite fuse - 22 amp. rating

## Section M3

DISTRIBUTOR, IGNITION COIL  
AND SPARKING PLUGS**Distributor—To remove (not Opus)  
(see Fig. M6)**

1. Remove the distributor cap.
2. Remove the gearchange selector thermal cut-out as described in Section M2.
3. Turn the crankshaft in the normal direction of rotation until 'A1' piston is approaching T.D.C. on the firing stroke. This can be checked by the position of the rotor arm.
4. Remove the cover from the flywheel housing.
5. Rotate the flywheel to the correct ignition timing mark (refer to Table 2).
6. If preferred, the crankshaft damper timing mark and timing points may be used.

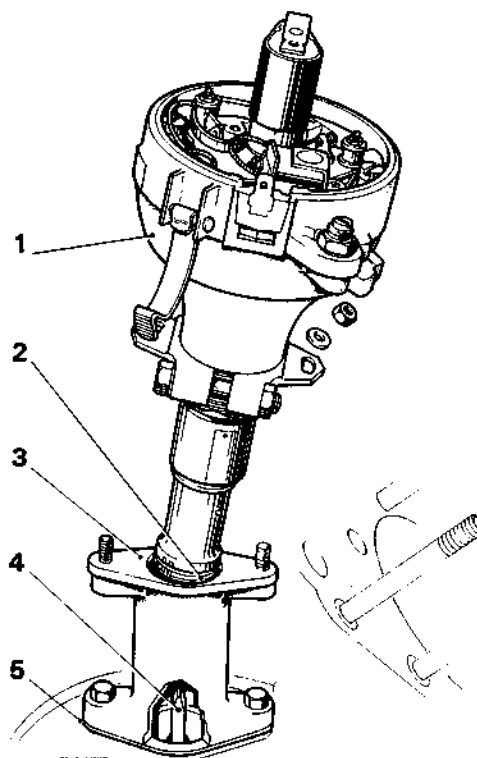
**Note** The flywheel must always be turned in the normal direction of rotation (anti-clockwise when viewed from the rear of the engine). If rotated clockwise, an inaccurate setting may be obtained due to backlash in the timing gears and camshaft end float.

6. Disconnect the low tension lead from the terminal on the distributor casing.
7. Unscrew the two setscrews securing the distributor to the crankcase.
8. Withdraw the distributor.

**Distributor—To fit (not Opus)**

Reverse the procedure given for removal, noting the following points. Should the crankshaft be inadvertently rotated while the distributor is removed from the engine, the correct position for ignition timing should be obtained as follows.

1. Remove 'A' bank rocker cover from the right-



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**FIG. M6 DISTRIBUTOR REMOVAL**

- 1 Distributor body
- 2 'O' ring
- 3 Pedestal
- 4 Distributor driving tongue
- 5 Joint



**Chapter M**

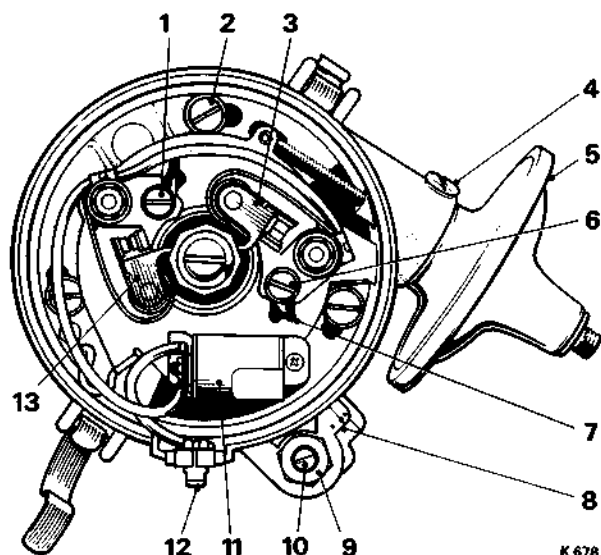
hand side of the engine - when viewed from the driving seat.

2. Rotate the crankshaft by hand at least one full turn in the normal direction of rotation, until the 'A1' inlet valve has opened and just closed.
3. Further rotate the crankshaft in the correct direction of the rotation until the flywheel is at T.D.C.
4. Fit the 'A' bank rocker cover.
5. Renew the neoprene seal at the base of the distributor housing.
6. Fit the distributor with the rotor arm adjacent to the contact breaker adjuster.
7. Set the ignition timing as described in Ignition timing - To set.

**Contact breaker points—To remove**

Cars prior to Car Serial Number 8742

1. Remove the distributor cap and rotor arm.
2. Remove the nuts from the posts to which the contact breaker points are anchored.



**FIG. M7 INTERNAL VIEW OF DISTRIBUTOR**

- 1 Fixed contact plate securing screw
- 2 Contact breaker housing securing screw
- 3 Contact breaker
- 4 Vacuum housing unit securing screw
- 5 Vacuum timing control unit
- 6 Fixed contact securing screw
- 7 Contact breaker gap adjusting slot
- 8 Octane selector scale
- 9 Octane selector adjusting screw lock-nut
- 10 Adjusting screw
- 11 Condenser
- 12 Low tension terminal
- 13 Contact breaker

3. Remove the insulating pieces and electrical connections and lift the contact breaker levers off the pivot points.

4. Remove the screws which secure the fixed contact points.

5. Remove the fixed contact breaker from the distributor.

6. Examine the contact points for 'pitting' and 'piling' and if necessary clean with a fine carborundum stone, ensuring that the contact faces are square. If the contact surfaces are badly damaged they should be renewed.

**Contact breaker points—To adjust**

Cars prior to Car Serial Number 8742

1. Slacken the two screws which secure the fixed contact point.
2. Using a screwdriver in the contact breaker adjusting slot (see Fig. M7), set the gaps to between 0,356 mm. and 0,406 mm. (0.014 in. and 0.016 in.).
3. Lubricate the distributor cam with the approved lubricant (see Chapter D - Lubricants).

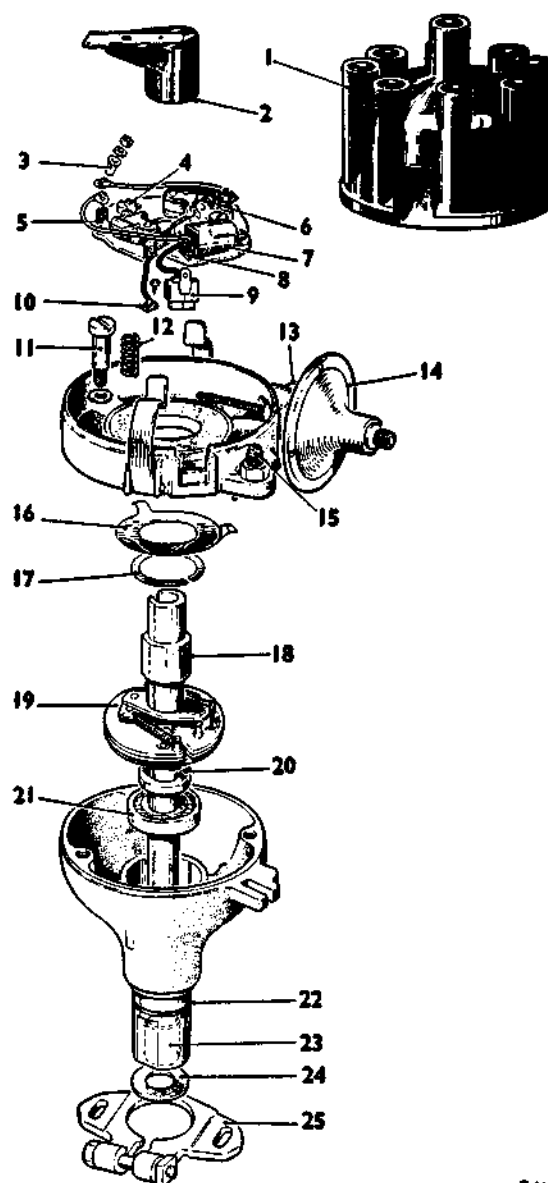
**Ignition timing—To set (static)**

Cars prior to Car Serial Number 8742

1. The ignition timing must be set with the octane selector in the fully advanced position, as follows.
2. Release the lock-nut and set the octane selector scale to 'A' (see Fig. M7).
3. Turn the distributor spindle until the rotor arm aligns with Number 'A1' cylinder ignition period.
4. Release the distributor clamping screw.
5. Rotate the distributor body until the contact breaker points opposite the vacuum housing are just breaking.
6. During the above operation, hold the top of the rotor in the fully retarded position (anti-clockwise rotation) to take up any backlash in the centrifugal advance mechanism.
7. Clockwise rotation of the distributor advances the ignition timing and anti-clockwise rotation retards the ignition timing.
8. To check when the contact points are breaking, use an ignition timing lamp.
9. Tighten the distributor clamping screw to lock the body in position.
10. Rotate the crankshaft two full turns in the normal direction of rotation and with the aid of the ignition timing lamp, again check to ensure that the contact points are just breaking when the rotor arm is in line with Number 'A1' firing position and the flywheel is at T.D.C.

FIG. M8 EXPLODED VIEW OF DISTRIBUTOR

- 1 Distributor cap
- 2 Rotor
- 3 Bush
- 4 Fixed contact retaining screw
- 5 Contact set
- 6 Contact
- 7 Condenser
- 8 Fibre insulating tab
- 9 Low tension terminal
- 10 C.B. earth lead
- 11 Fixed screw C.B. housing
- 12 Spring-screw—C.B. housing
- 13 Vacuum unit fixing screw
- 14 Vacuum unit timing control
- 15 Octane selector adjusting screw—eccentric
- 16 Star spring
- 17 Circlip
- 18 Cam
- 19 Centrifugal timing control
- 20 Distance piece
- 21 Bearing
- 22 Sealing ring
- 23 Bearing bush
- 24 Thrust washer (fibre)
- 25 Securing plate



### Ignition timing—To set (stroboscopic method)

Cars prior to Car Serial Number 8742

To carry out the ignition timing proceed as follows.

1. Run the engine until normal operating temperature is reached and the automatic choke is in the off position.
2. Stop the engine.
3. Check that the octane selector position is in the fully advanced position and that the scale is set to the 'A' mark and adjust if necessary (*see Fig. M7*). Adjustment is carried out by slackening the lock-nut and turning the slotted screw.
4. Ignition timing is carried out on 'A1' cylinder and should be set to 3° B.T.D.C. The 'A' bank is the right-hand side and the 'B' bank is the left-hand side when viewed from the driver's seat.
5. Connect a stroboscope and an electric impulse tachometer to the ignition system as described in the manufacturer's instructions.
6. Start the engine then adjust the throttle stop to give an idle speed of 500 r.p.m.
7. Direct the flashing light of the timer on to the crankshaft damper timing marks and timing pointer.

8. Check and adjust the ignition timing if necessary. To adjust the timing, release the clamp screw on the distributor and rotate the head of the distributor in the appropriate direction until the correct timing is obtained. Clockwise rotation of the distributor head advances the ignition and anti-clockwise rotation retards the ignition. After adjustment has been carried out, tighten the clamp screw and again check the timing to ensure that it has not altered whilst tightening the clamp screw.

9. Adjust the throttle stop to give an idle speed of between 550 r.p.m. and 600 r.p.m.

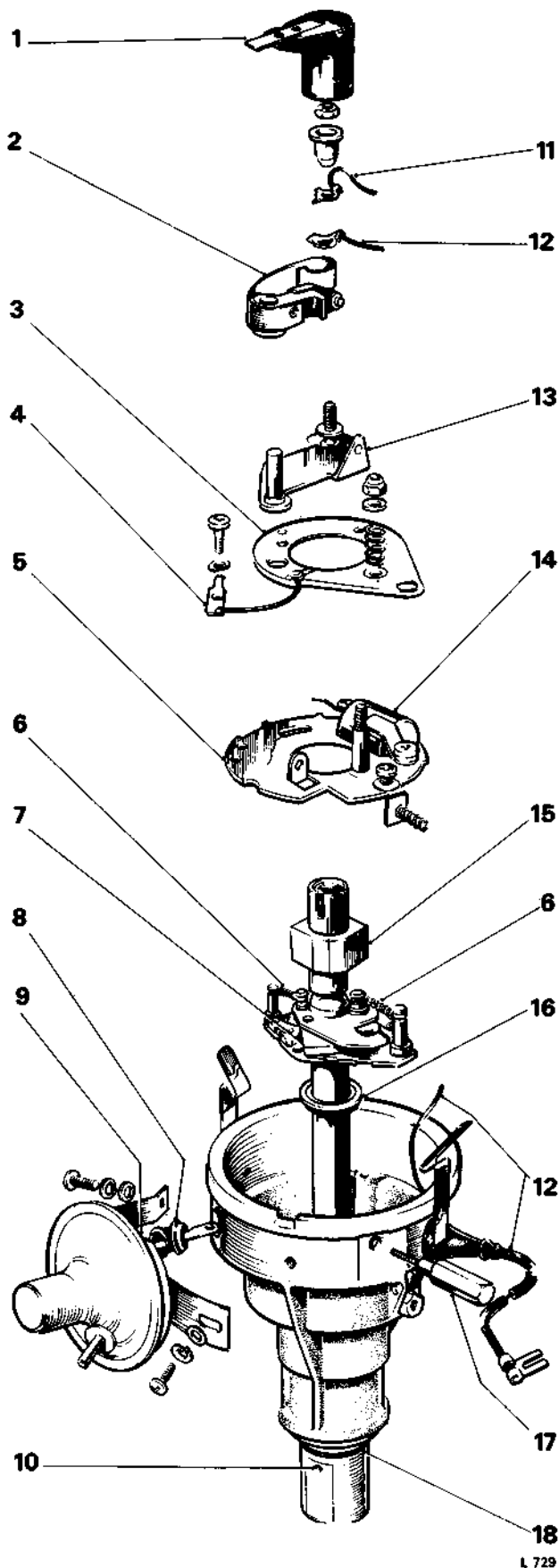
10. Switch off the ignition.

11. Remove the tachometer and stroboscopic timing equipment.

**Note** If the car is operating in a territory where only low octane fuels are available, it will be necessary to retard the ignition to obtain optimum performance.

G44

## Chapter M



**FIG. M9 EXPLODED VIEW 35 D8 DISTRIBUTOR**

- 1 Rotor arm
- 2 Contact breaker
- 3 Contact breaker base plate
- 4 Earth cable
- 5 Contact breaker bearing plate
- 6 Centrifugal timing control springs
- 7 Centrifugal timing control weights
- 8 Grommet
- 9 Vacuum unit
- 10 Oil release hole
- 11 Low tension cable
- 12 Low tension lead
- 13 Fixed contact
- 14 Capacitor
- 15 Cam
- 16 Distance collar
- 17 Contact breaker adjuster
- 18 'O' ring

### Contact breaker points—To remove

Cars from Car Serial Number 8742

1. Remove the distributor cap and rotor.
2. Remove the nut from the terminal post.
3. Remove the electrical connections and contact breaker spring.
4. Remove the moving contact.
5. Unscrew the cheese-headed screw securing the fixed contact.
6. Remove the fixed contact.
7. Examine the contact points for 'pitting' and 'piling', and if necessary clean them with a fine carborundum stone, ensuring that the contact faces are square. If the contact surfaces are damaged, they should be renewed.

### Contact breaker points—To fit

1. Reverse the procedure given for removal.
2. Set the dwell angle as described in Dwell angle To set.

### Dwell angle—To set

Cars from Car Serial Number 8742 without Opus Ignition

1. Fit a dwell angle meter to the engine as described in the manufacturer's instructions.
2. Check that the dwell angle (cam closed position) is between  $26^{\circ}$  -  $28^{\circ}$ .
3. Adjust the dwell angle by turning the hexagonal adjustment screw (see Fig. M9).

**Ignition timing—To set (static)**

**Cars from Car Serial Number 8742 without Opus ignition**

1. Turn the distributor spindle until the rotor arm aligns with Number 'A1' cylinder ignition period.
2. Release the distributor clamping screw.
3. Rotate the distributor body until the contact breaker points are just breaking.
4. During the above operation hold the top of the rotor arm in the fully retarded (anti-clockwise rotation) position to take up any backlash in the centrifugal advance mechanism.
5. Clockwise rotation of the distributor advances the ignition timing and anti-clockwise rotation retards the ignition timing.
6. To check when the contact points are breaking, use an ignition timing lamp.
7. Tighten the distributor clamping screw to lock the body in position.
8. Rotate the crankshaft two full turns in the normal direction of rotation and with the aid of the ignition timing lamp, again check to ensure that the contact points are just breaking when the rotor arm is in line with Number 'A1' firing position and the flywheel is at T.D.C.

**Ignition timing—To set (stroboscopic method)**

**Cars from Car Serial Number 8742**

For cars fitted with the Exhaust Emission Control System, refer to Chapter U - Exhaust Emission Control System.

For all other cars proceed as follows.

1. Run the engine until normal operating temperature is reached and the automatic choke is off.
2. Stop the engine.

**Note** Ignition timing is set to 5° B.T.D.C. on A1 cylinder; A1 cylinder is the front cylinder on the left-hand side when viewed from the front of the engine.

3. Set the dwell angle as described in Dwell angle - To adjust. (Not applicable to Opus).
4. Connect a stroboscope and an electric impulse tachometer to the engine as described in the manufacturer's instructions.
5. Start the engine and adjust the fixed throttle screw to give an idle speed of 800 r.p.m.
6. Direct the flashing light of the timer on to the crankshaft damper timing marks and timing pointer.
7. Check and if necessary adjust the ignition timing. To adjust the timing, release the clamp screw on the distributor and rotate the head of the distributor in the appropriate direction until the correct timing is obtained. Clockwise rotation of the distributor head advances the ignition and anti-clockwise rotation retards the ignition. After adjustment has been carried out tighten the clamp screw and again check the timing to ensure that it has not altered whilst tightening the clamp screw.

8. Adjust the throttle screw to give an idle speed of 600 r.p.m.
9. Switch off the ignition.
10. Remove the tachometer and stroboscopic timing equipment.

**Table 2**

For cars fitted with Emission Control Systems, refer to Chapter U. All other cars are as follows:

Car Serial Number	Timing
Up to 9000	3° B.T.D.C. @ 500 r.p.m.
9001 to 22117	5° B.T.D.C. @ 800 r.p.m.
22118 onwards	15° B.T.D.C. @ 1200 r.p.m.

**Distributor—To dismantle and overhaul**

**Cars prior to Car Serial Number 8742**

An exploded view of the distributor is shown in Figure M8.

**Note** Before dismantling take care to note the position of the parts in relation to each other to ensure correct re-assembly.

1. Remove the distributor from the crankcase as described in Distributor - To remove.
2. Remove the contact breaker points.
3. Remove the condenser.
4. Remove the three spring-loaded screws.
5. Withdraw the upper portion of the distributor to expose the centrifugal advance mechanism.
6. Remove the circlip which retains the star washer on the underside of the contact breaker housing.
7. Lift the contact breaker base plate out of the housing.
8. Remove the screw securing the vacuum control unit and remove the unit.
9. Remove the cam spindle screw and withdraw the cam assembly.
10. Lift the weights, springs and toggles off the action plate.
11. Withdraw the tapered retaining pin securing the driving sleeve to the shaft.
12. Remove the driving sleeve from the shaft; lift off the thrust washer.
13. Press out the driving shaft from the distributor body, taking care not to lose the distance piece positioned beneath the centrifugal timing control mounting plate.

**Distributor—To inspect**

**Cars prior to Car Serial Number 8742**

1. Check the bearing at the top of the distributor body shaft housing. If excessive wear or roughness is detected the bearing should be renewed. The bearing should be removed using a 'Claw' extractor.

## **Chapter M**

2. Renew the neoprene seal located below the bearing.
3. To facilitate removal and fitting of the bearing, heat the distributor body to a temperature of 110 °C. (230 °F.) to 120 °C. (248 °F.).
4. Check the shaft for wear and parallelism.
5. If the shaft is excessively worn, renew the shaft.
6. If a new shaft is fitted, or if the original shaft is to be fitted, renew the bush at the base of the distributor body and ream to size.
7. Check the condition of the centrifugal advance springs; renew if necessary.
8. Check the condition of the contact breaker points; renew if necessary.

### **Distributor—To assemble**

**Cars from Car Serial Number 8742  
(not Opus)**

Reverse the procedure given for dismantling, noting the following points.

1. Fit the distance collar to the shaft before fitting the shaft to the distributor body.
2. Ensure that the vacuum advance peg engages correctly with the vacuum unit spring link.
3. Renew the externally fitted 'O' ring oil seal, situated below the body casting.

### **Distributor—To dismantle**

**Cars from Car Serial Number 8742  
(not Opus)**

An exploded view of the distributor is shown in Figure M9. Before dismantling take care to note the position of the parts in relation to each other to ensure correct assembly.

1. Remove the distributor from the crankcase as described in Distributor - To remove.
2. Remove the distributor cap, rotor arm and contact breaker.
3. Unscrew the contact breaker gap adjuster; remove the adjuster, spring and plastic friction plate.
4. Unscrew and remove the nut, washer and spring that secures the contact breaker base plate.
5. Remove the screw securing the contact breaker base plate earth lead to the contact breaker bearing plate.
6. Lift off the base plate.

**Cars fitted with vacuum retard unit**

7. Remove the two screws securing the vacuum unit bracket to the distributor; remove the unit and rubber grommet.
8. Remove the two screws from the contact breaker bearing plate; lift out the plate.
9. Remove the centrifugal advance springs from their anchor points on the cam foot.
10. Unscrew and remove the screw and felt from the top of the cam; remove the cam.

11. Remove the driving gear and withdraw the shaft and plate assembly from the distributor body.

**Note** Retain the distance collar located on the shaft below this plate.

### **Distributor—To inspect**

**Cars from Car Serial Number 8742  
(not Opus)**

1. Check the bearings at the top and bottom of the distributor body shaft housing. If excessive wear or roughness is detected the distributor body must be renewed.
2. Check the shaft for wear and parallelism.
3. If the shaft is excessively worn, renew the shaft.

### **Distributor—To assemble**

**Cars from Car Serial Number 8742  
(not Opus)**

Reverse the procedure given for removal, noting the following points.

1. Lightly smear the cam spindle, weight pivots and working surfaces of the weights with Rocol 'Moly Pad'.
2. Lubricate the shaft with Retinax 'A' or equivalent grease.
3. Ensure that the distance collar is on the shaft just below the action plate.
4. Ensure that the cam foot pivots are correctly located in the weights before tightening the cam screw.
5. Lubricate the felt pad with engine oil.
6. Smear the contact breaker base plate pivot point (located on the contact breaker bearing plate), the exposed surface of the adjustment plate, the nylon 'pips' on the underside of the base plate, and the vacuum unit linkage (if fitted) with Retinax 'A' or equivalent grease.
7. Smear the contact breaker heel pivot post with Retinax 'A' or equivalent grease.
8. Set the dwell angle as described in Dwell angle - To set.

### **Distributor—Opus ignition**

**Important** On no account must the Opus ignition distributor be dismantled. If a distributor is faulty it must be removed and a new distributor fitted.

### **Sparking plugs—To remove**

1. Remove the high tension plug cables.
2. Unscrew and remove the sparking plugs.

### Sparking plugs—To clean and check

1. Remove the sparking plugs.
2. Thoroughly clean in a suitable sparking plug cleaning machine.
3. Clean off all surplus abrasive material from the plug electrodes and threads with compressed air.
4. Inspect the electrodes for excessive wear.
5. Set the gap to the figures shown in Table 3.

**Table 3**

For cars fitted with Emission Control Systems, refer to Chapter U. All other cars are as follows:

Car Serial Number	Gap
Up to 22072	0,635 mm. (0.025 in.)
22073 onwards	0,76 mm. (0.030 in.)

### Sparking plugs—To fit

Reverse the procedure given for removal, noting the following points.

1. Before fitting the sparking plugs, ensure that the threads are perfectly clean then lubricate with a small amount of 'Graphogen' grease.
2. Ensure that the steel washer is fitted to each sparking plug.
3. Fit and tighten the sparking plugs to between 1,79 kg.m. and 2,35 kg.m. (13lb.ft. and 17 lb.ft.).

### Ignition coil—To remove

1. The coil is situated on the left-hand side of the distributor (when viewed from the driving seat).
2. Disconnect the battery.
3. Disconnect the low tension leads and suppressor.
4. Remove the high tension lead.
5. Remove the two setscrews and spacers securing the coil.
6. Remove the suppressor and coil ballast control.
7. Remove the coil.

### Ignition coil—To fit

Reverse the procedure given for removal, noting the following points.

1. Ensure that the suppressor and low tension leads are fitted correctly. The coil is marked clearly + and -.
2. The suppressor must be connected to the positive coil terminal and the distributor cable to the negative terminal.

## Section M4

# STARTER MOTOR

### Maintenance

The starter motor will operate for long periods before requiring attention and should need servicing only during major engine overhauls but a check should be made from time to time to ensure that the electrical connections are secure and clean.

**Note** The voltage measured in Operation 5 should not exceed by more than 0.6 volt the voltage measured in Operation 7.

If battery voltage is not available, trace the fault. If the external circuits are found to be satisfactory and the starter fails to operate, the starter must be removed and examined.

### Starter motor—To test in position

Starter motor cranks the engine, but at reduced speed.

1. Check the condition and connections of the battery.
2. Check the electrical connections on the starter circuit.

If the performance is still unsatisfactory after the previous checks, remove the starter motor from the car and check the starter motor as described in Starter motor - To bench test.

### Starter does not crank the engine

1. Check the condition and connections of the battery.
2. Check the electrical connections on the starter circuit.
3. Disconnect the low tension (negative) lead from the ignition coil.
4. Connect a Zero to 20 Volt moving coil voltmeter between the starter solenoid switch main input terminal and earth.
5. Operate the starter motor and record the voltmeter reading.
6. Transfer the voltmeter positive lead from the starter solenoid switch main terminal on to the small setscrew terminal.
7. Again operate the starter motor and record the voltmeter reading.

### Starter motor—To remove

1. Place the car on a ramp or over a suitable pit.
2. Disconnect the battery.
3. Remove the electrical connections from the starter motor.
4. Remove the three setscrews and washers which secure the starter motor, then from beneath the car, lower the starter motor between the engine and front sub-frame sidemember.
5. Remove the packing piece(s) fitted between the starter motor flange and the crankcase end face, (if fitted).

### Starter motor—To dismantle (see Fig. M10)

1. Remove the bolt, nut and washer and remove the end cover and sealing ring from the front of the starter motor.
2. Disconnect the flexible copper link between the lower solenoid terminal and the starter motor yoke; remove the brush inspection cover and carefully lift out the brushes.
3. Remove the two nuts securing the solenoid and withdraw the solenoid from the drive-end bracket casting, carefully disengaging the solenoid plunger from the starter drive engagement lever.
4. Remove the two 'through' bolts from the commutator end bracket, then remove the commutator end bracket and yoke from the intermediate drive-end bracket.

## Chapter M

5. Slacken the lock-nut and remove the eccentric pin on which the starter drive engagement lever pivots.

6. Remove the drive-end bracket from the armature and intermediate bracket assembly.

7. Using an aluminium tube of a suitable diameter, (see Fig. M11) remove the thrust washer from the end of the armature shaft extension. Prise the jump ring from its groove and slide the drive assembly and intermediate bracket from the shaft.

8. Prise off the jump ring retaining the operating bush and engagement spring.

If there is excessive sparking at the commutator, check that the brushes are clean and free to move in their boxes and that the spring pressure is correct.

Measuring lock torque and lock current.

Carry out a torque test and compare the results with the values given in Chapter A - General Information. If a constant voltage supply is used, it is important to adjust this to 7.2 Volt at the starter terminal when testing.

### Starter motor—Bench inspection

After dismantling the starter motor examine each component for damage and wear.

### Starter motor—To bench test

Measuring the light running current.

Clamp the starter motor securely in a vice. Using a 12 Volt battery, check the light running current and compare it with the values given in Chapter A - General Information.

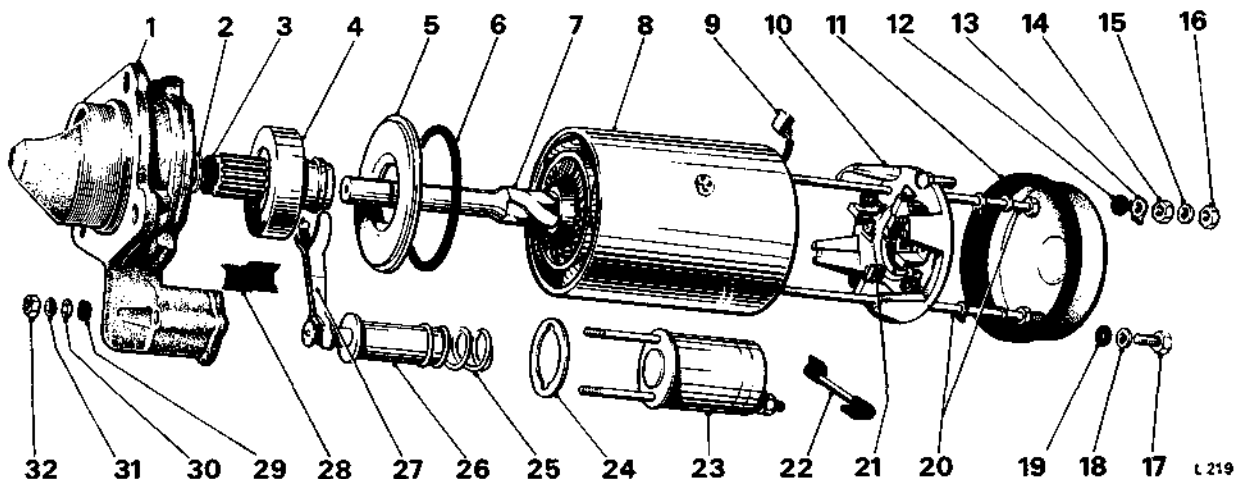
### Brush gear and commutator—To service

1. Remove the starter motor as described in Starter motor - To remove. Clean the unit prior to removing the die-cast alloy cover and sealing ring.

2. Remove the two nuts which secure the die-cast cover and sealing ring to the starter motor; remove the cover.

3. Check that the brushes are of adequate length, the brushes must be renewed if they are worn to 8 mm. (5/16 in.).

4. Check the commutator for signs of 'pitting' and 'burning'. If necessary, clean it with a cloth moistened with petrol. If this proves to be unsatisfactory, the armature must be removed from the starter motor. Check that the bearing diameters



**FIG. M10 EXPLODED VIEW OF STARTER MOTOR**

1 Drive end bracket	10 Commutator end bracket	17 Setscrew	25 Spring—push off
2 Jump ring	11 Alloy end cover (showing rubber seal)	18 Washer	26 Plunger
3 Thrust collar	12 Seal	19 Seal	27 Operating lever (fork)
4 Roller clutch	13 Lock-washer	20 Through bolts and washers	28 Seal (rubber)
5 Intermediate bracket	14 Nut	21 Brush	29 Seal
6 Seal (rubber)	15 Washer	22 Strap—copper	30 Washer
7 Armature	16 Nut	23 Solenoid	31 Washer
8 Yoke		24 Gasket	32 Nut
9 Brush			



are true to centre, then set up the armature between the centres on a lathe and polish the commutator with fine glass paper; on no account should emery cloth or a similar abrasive be used.

5. If the commutator needs to be skimmed, the minimum diameter to which it may be reduced is 39,0 mm. (1.545 in.). After skimming, the commutator surface should be finally polished with very fine glass paper, on no account should emery cloth or a similar abrasive be used.

The insulation segments on the commutator must not be undercut.

### Brushes—To remove

1. There are four brushes in the starter motor, two are connected to the brush boxes and two connected to the free ends of the field coils. Carefully prise open the field connections with a screwdriver and use a soldering iron to remove the solder from the connections. Remove the brushes.

### Brushes—To fit

Reverse the procedure given for removal. When fitting a new brush ensure that it is free in its brush box, noting the following point.

1. New brushes are pre-formed and do not require bedding in.

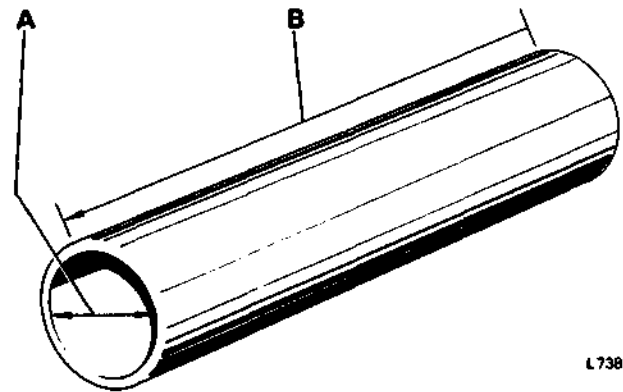
### Brush springs—To service

1. Check the brush spring pressure using a pull-type spring gauge and without the brush in the brush box (see Fig. M12). The spring pressure recorded by the spring gauge at the moment the spring pressure is relieved from the brush box should be 1,1 kg minimum (42 oz).

2. If new brush springs are required ensure that they are correctly fitted (see Fig. M13). If the springs are incorrectly fitted there will be excessive pressure on the brushes resulting in premature brush wear and damage to the commutator.

### Brush gear insulation—To check

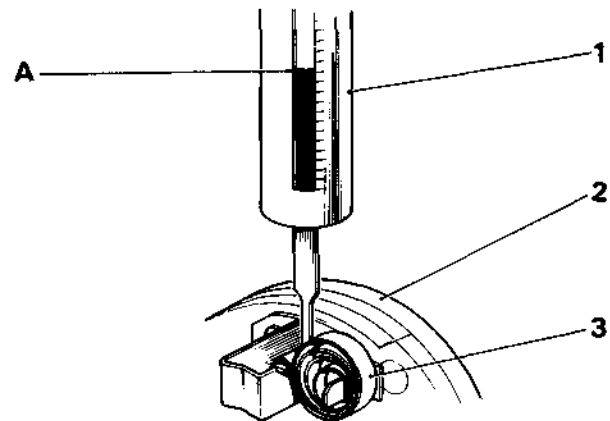
Check the brushgear, using a 110 volt A.C. 15 watt test lamp connected between each of the two insulated brushboxes in turn and a clean unpainted part of the bracket (see Fig. M14). The lamp should not illuminate,



L738

FIG. M11 TUBE DIMENSIONS

A 12,70 mm. (0.050 in.) B 7,62 cm. (3.0 in.)



Q411

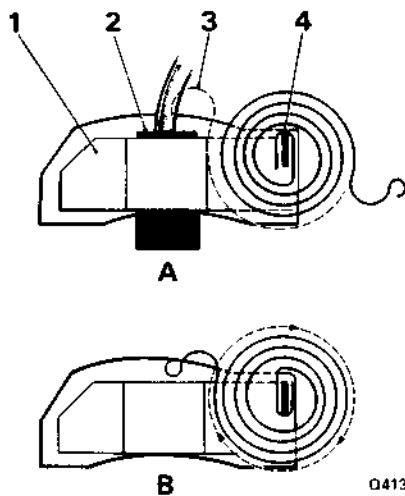
FIG. M12 CHECKING BRUSH SPRING PRESSURE

- 1 Commutator end bracket
- 2 Spring gauge
- 3 Anchor post
- A Pressure reading

### Armature—To check

1. If the solder on the armature has 'thrown' or the conductors have lifted from the commutator segments, the armature should be discarded. This also indicates possible shorting and over-speeding of the motor and the operation of the roller clutch drive should be checked as described in Roller clutch drive - To check.

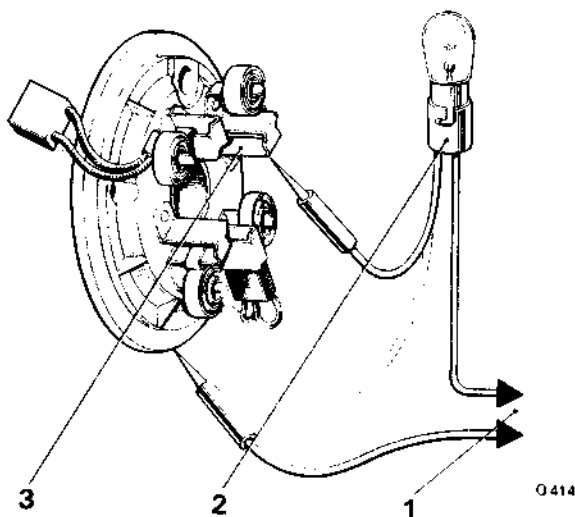
## Chapter M



**FIG. M13 CORRECT FITTING OF BRUSH SPRING**

- 1 Brush box
- 2 Brush
- 3 Normal working position of spring
- 4 Anchor post

A CORRECT (Spring tensioning half-turn)  
B INCORRECT (Spring tensioning full-turn)



**FIG. M14 CHECKING BRUSHGEAR INSULATION**

- 1 110 volt AC mains
- 2 15 watt lamp
- 3 Insulated brush box

2. If the armature shows signs of fouling the pole-shoes, worn bearings or an untrue armature shaft are indicated. Check the armature between centres for eccentricity; renew if necessary.

If the armature is serviceable, the bearings must be renewed (see Bearings - To renew).

3. Check the insulation of each armature segment with a 110 Volt A.C. 15 Watt test lamp connected between the commutator segments and the shaft (see Fig. M15). The lamp will light if the insulation is not satisfactory.

4. Check the armature for short circuit in the windings using 'Growler' equipment and following the manufacturer's instructions.

### Field coils—To remove

1. Using a wheel operated screwdriver, unscrew and remove the four screws securing the pole-shoes.
2. Remove the insulation piece fitted to prevent intercoil connectors from contacting the yoke.
3. Draw out the pole-shoes and coils from the yoke, and lift off the coils.

### Field coils—To fit

1. Fit the new field coils over the pole-shoes and place them in position inside the yoke. Ensure that the taping of the field coils is not trapped between the mating surfaces of the pole-shoes and yoke.
2. Locate the pole-shoes and field coils by lightly tightening the retaining screws and fit the insulation piece between the field coil connections and the yoke.
3. Hold the pole piece in position by means of a pole-shoe expander or mandrel, then tighten the screw, using the wheel operated screwdriver.

### Field coils—To test

To test the continuity of the field coils, proceed as follows.

1. Connect a 12 Volt test lamp and battery between the terminal on the yoke and each brush; ensure that the brushes and their flexible connectors are clear of the yoke. If the lamp fails to illuminate, an open circuit in the field coil is indicated and the coil must be renewed.

To test the insulation of the field coils proceed as follows. (see Fig. M16).

1. Connect a 110 Volt A.C. test lamp between the terminal post and a clean part of the yoke. If the test lamp illuminates it indicates that the field coils are earthed to the yoke and that the field coils must be renewed.

2. The insulated pair of brush holders on the commutator end bracket should also be checked. Clean off all traces of brush dust before testing. Connect a 110 Volt A.C. test lamp between each insulated brush holder and bracket.

If the lamp illuminates this indicates faulty insulation, and the end brackets must be renewed.

### Bearings—To renew

The bearings must be renewed if they are worn to such an extent that excessive side movement of the armature is detected.

1. Press out the bushes in the intermediate and end bracket.

2. On starter motors not fitted with an end cover, remove the bush from the commutator end bracket by inserting a 14 mm. (9/16 in.) tap squarely into the bush and withdrawing the bush with the tap; press in the new bush.

On starter motors fitted with an end cover, press out the bush from the commutator end bracket and press in the new bush, using a highly polished mandrel 0.0127 mm. (0.005 in.) greater in diameter than the shaft which is to fit into the bush.

**Note** The bushes (bearings) are porous bronze and before fitting should be immersed for 24 hours in clean engine oil (S.A.E. 30/40). Porous bronze bushes must not be reamed out after fitting.

Lubricate the bearing surfaces with Rocol 'Molypad' molybdenised non-creep oil, or a similar equivalent.

### Roller clutch drive—To check

If the roller clutch drive is in good condition it will perform the following functions efficiently:

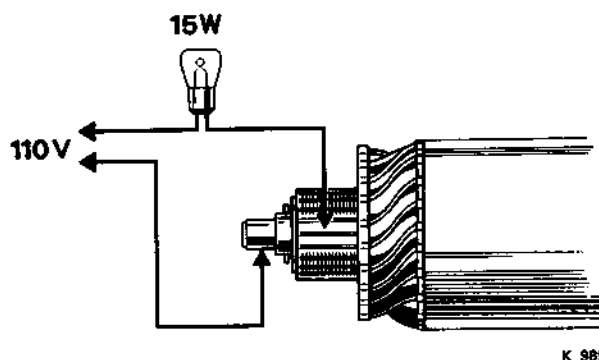
1. Provide instantaneous take-up of the drive in one direction whilst being free to rotate in the other.
2. Ensure that the assembly will move freely along the armature shaft splines without binding or roughness.
3. The operating bush will be able to slide freely along the driving sleeve when the engagement spring is compressed.

All the moving parts should be smeared with Shell Retinax 'A' grease.

### Starter motor—To assemble

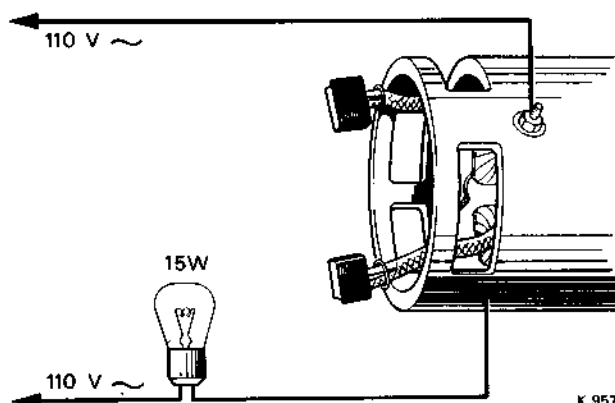
Reverse the procedure given for dismantling, noting the following points.

1. Ensure that the moulded brake shoes are seated squarely; turn them until the ends of the crosspeg in the armature shaft engage correctly with the slots in the shoes.



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FIG. M15 CHECKING ARMATURE INSULATION



K 957

FIG. M16 CHECKING FIELD COIL INSULATION

2. Tighten the 'through' bolts to 1,11 kg.m. (8 lb.ft.). Tighten the solenoid retaining nuts to 0,62 kg.m. (4.5 lb.ft.).

### Pinion movement—To set

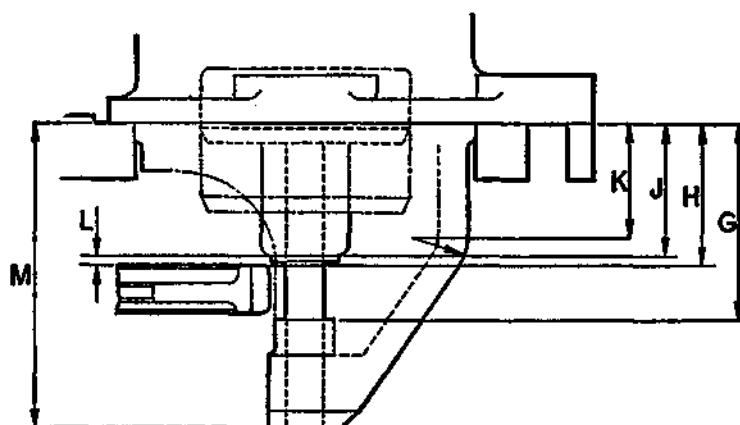
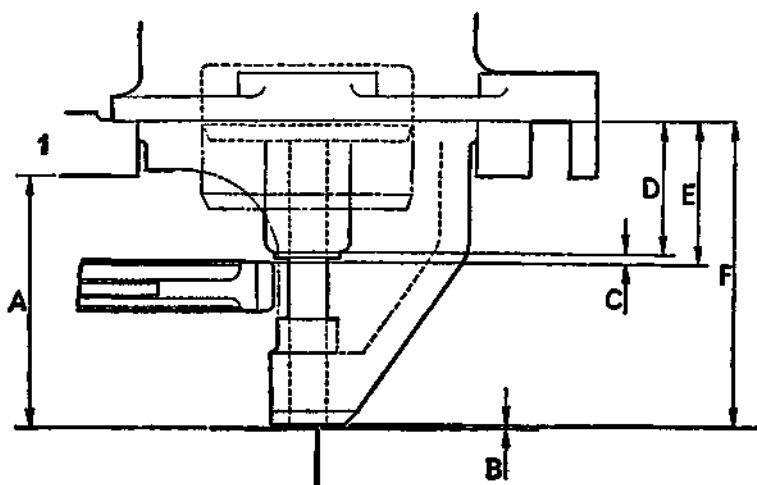
1. Remove the flexible copper link from between the yoke terminal and 'STA' terminal on the solenoid end and connect terminal 'STA' to earth.
2. Connect a 6 Volt supply between the small unmarked setscrew terminal and earth on the solenoid.

**Note** This will energise both the series and shunt windings in the solenoid. The period of energising should be as brief as possible to prevent overheating of the series winding.

## Chapter M

### Arrangement for Torque Converter Transmission without Packing Pieces

- A** 2.614 in. min. (6,641 cm.)  
**B** 0.23 in. min. (5,95 mm.)  
 clearance between gearbox  
 and starter motor  
**C** 0.138 in. min. (3,572 mm.)  
 static clearance  
 0.251 in. max. (6,35 mm.)  
 static clearance  
**D** 1.362 in. - 0.085 in.  
 (3,460 cm. - 2,002 mm.)  
**E** 1.467 in. + 0.061 in. - 0.044 in.  
 (3,731 cm. + 1,588 mm.  
 - 1,191 mm.)  
**F** 3.156 in. max. (8,017 cm.)

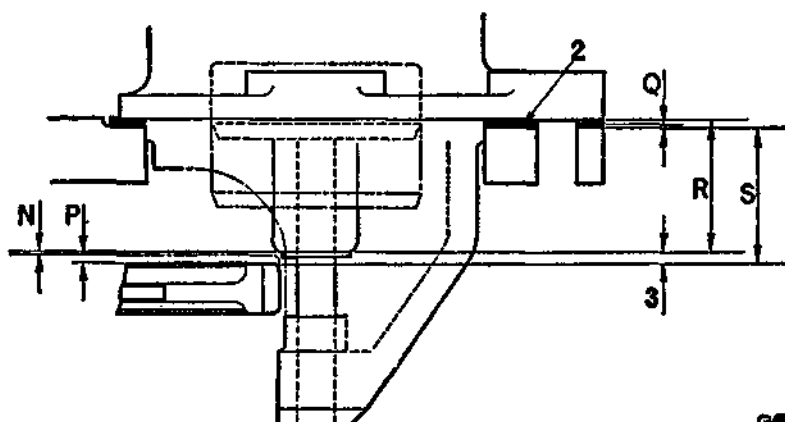


### Arrangement for Four-Speed Automatic Transmission

- G** 2.045 in. min. (5,199 cm.)  
**H** 1.472 in. + 0.063 in. - 0.055 in.  
 (3,738 cm. + 1,588 mm.  
 - 1,193 mm.)  
**J** 1.362 in. - 0.085 in.  
 (3,460 cm. - 2,002 mm.)  
**K** 1.195 in. (3,034 cm.)  
**L** 0.055 in. min. clearance  
 (1,193 mm.)  
 0.258 in. max. clearance  
 (6,352 mm.)  
**M** 3.156 in. max. (8,017 cm.)

### Arrangement for Torque Converter Transmission with Packing Pieces fitted

- N** 0.019 in. (0,398 mm.) min.  
 working clearance  
**P** 0.108 in. (2,778 mm.) max.  
 flywheel float  
**Q** 0.036 in. + or - 0.003 in.  
 (0,795 mm. + or - 0,760 mm.)  
**R** 1.362 in. - 0.085 in.  
 (3,460 cm. - 2,002 mm.)  
**S** 1.467 in. + 0.061 in. - 0.044 in.  
 (3,730 cm. + 1,159 mm.  
 - 1,191 mm.)



**FIG. M7 CLEARANCES BETWEEN PINION & FLYWHEEL**

1 Rear face of crankcase	2 Packing pieces		3 Pinion to flywheel clearance	
	Min. static	Max. static	Min. Working	Packing pieces
1.423 in.—1.459 in. (3,612 cm.—3,706 cm.)	0.127 in. (3,176 mm.)	0.260 in. (6,353 mm.)	0.019 in. (0,398 mm.)	2 off
1.460 in.—1.499 in. (3,709 cm.—3,810 cm.)	0.131 in. (3,117 mm.)	0.261 in. (6,353 mm.)	0.023 in. (0,399 mm.)	1 off
1.500 in.—1.528 in. (3,810 cm.—3,880 cm.)	0.138 in. (3,572 mm.)	0.251 in. (6,350 mm.)	0.030 in. (0,794 mm.)	None

## Chapter M

3. Energise the solenoid to bring the drive assembly into the engaged position. Measure the distance between the pinion and the thrust collar on the armature shaft extension. This measurement must be taken with the pinion pressed lightly toward the armature to take up any slack in the engagement linkage. The correct setting for this distance should be 3,404 mm. to 3,658 mm. (0.134 in. to 0.144 in.) on 17 and 19s solenoids, 0,254 mm. to 0,508 mm. (0.010 in. to .020 in.) on 15s solenoid.

4. To adjust the setting, slacken the eccentric pivot pin lock-nut and turn the screw until the required setting is obtained. The arc of adjustment is 180° therefore ensure that the head of the arrow marked on the pivot pin is set only between the arrowed ends of the arc scribed on the drive end bracket casting. After setting, ensure that the eccentric pivot pin lock-nut is tightened.

5. Re-check the setting.

### Starter solenoid contacts—To check

When carrying out the following checks it must be assumed that the pinion travel has been correctly set.

1. Remove the copper link, connecting solenoid terminal 'STA' with the starter motor terminal and connect terminal 'STA' to earth.
2. Connect a 12 Volt D.C. supply, between the small unmarked solenoid terminal and earth.
3. Connect a 12 Volt 15 Watt test lamp in circuit.
4. Insert a stop in the drive-end bracket to restrict the pinion travel to that of the normal out-of-mesh clearance. An open-ended spanner can be used with its jaws embracing the armature shaft extension.
5. Close the switch to energise the solenoid.
6. The solenoid contacts should close and remain fully closed, as indicated by the test lamp being switched on and emitting a steady light.
7. Switch off and remove the stop.
8. Switch on and hold the pinion assembly in the fully engaged position.
9. Switch off and observe the test lamp.
10. The solenoid contacts should open, as indicated by the test lamp being extinguished.

### Starter motor—To fit

**Important** Ensure that any existing packing pieces are fitted as they provide the correct clearance between the starter motor and the flywheel. If a new starter motor is to be fitted or the original packing pieces have been mislaid proceed as follows. (see Fig. M17)

1. Measure the distance from the mounting face on the crankcase to the edge of the flywheel. If this measurement is 3,706 cm. (1.459 in.) or less, two packing pieces should be fitted. If the measurement reads between 3,709 cm. (1.460 in.) and 3,807 cm. (1.499 in.), one packing piece should be fitted.

2. Packing pieces are not required when the measurement exceeds 3,810 cm. (1.500 in.).

On completion, fit the starter motor and packing pieces, reversing the procedure given for removal.

### Starter motor—Solenoid operated switch Model 2.S.T. and 4.S.T.

The unit is a factory sealed item and requires no service other than to ensure that all electrical connections are clean and correctly tightened. If the unit is found to be faulty, it should be renewed.

#### Switch Model 2.S.T.—To remove

Cars prior to Car Serial Number SRH 5500, SBH 5517, SRX 6771 and LRX 6724

1. Disconnect the battery.
2. Disconnect the electrical connections, noting the cable colouring to facilitate fitting.
3. Remove the two setscrews securing the switch.

#### Switch Model 4.S.T.—To remove

Cars from Car Serial Number SRH 5500, SBH 5516, SRX 6770 and LRX 6724

1. Disconnect the battery.
2. Disconnect the electrical connections, noting the cable colouring to facilitate fitting.
3. Remove the two 2.B.A. nuts, bolts and washers securing the switch to the accelerator bracket.

### Switch—To test

1. Connect a variable Zero to 12 Volt D.C. supply to the main terminals.
2. The plunger must be attracted fully home at between 5 and 9 Volts.
3. After raising the voltage to 12 Volts, the plunger must release at less than 2.5 Volts.
4. The value in ohms of the solenoid winding, measured from the 2.B.A. terminal and the switch body is 2.1 to 2.5 ohms at 20°C (68°F.).

## Chapter M

Starter Motor Fault Diagnosis		
Symptom	Possible Cause	Action
Speed, torque and current consumption low	(a) Battery in poor condition (b) Faulty brushgear connections (c) Commutator in poor condition (d) Faulty connections	(a) Check battery (b) Check connections (c) Clean commutator and skim if necessary (d) Check battery connections and earth leads
Speed and torque low, current consumption high	(a) Tight or worn bearings, bent shaft, armature fouling a pole-shoe or cracked spigot on drive end bracket (b) Insufficient end float (c) Short circuited armature or field coils	(a) Examine components and renew if necessary (b) Check armature end float (c) Check circuits ( see Starter motor - Bench inspection)
Armature does not rotate; low current consumption	(a) Open circuited armature field coil (b) Faulty solenoid unit (c) If the commutator is badly burnt there may be poor contact between brushes and commutator	(a) Check circuits (see Starter motor - Bench test) (b) Check solenoid (c) Check commutator and brushgear
Armature does not rotate; high current consumption	(a) Earthed field winding or short circuited solenoid unit (b) Armature physically prevented from rotating	(a) Check circuits (see Starter motor - Bench test) (b) Remove starter motor from engine and bench test, if the fault persists dismantle starter to determine the fault
Excessive brush movement causing arcing at commutator	(a) Low brush spring tension (b) Brushes worn (c) Worn or eccentric commutator (d) Thrown or high segment on commutator	(a) Check spring tension (see Brush springs - To service) (b) Renew brushes (c) Rectify by skimming on a lathe (d) If a segment(s) has been 'thrown', the armature should be renewed  If a segment(s) is 'high' the fault can be rectified by skimming the commutator on a lathe
Excessive arcing at the commutator	(a) Defective armature windings (b) Sticking brushes (c) Dirty commutator	(a) Check circuit (see Starter motor - Bench test) (b) Check brush spring pressure, and ensure that the brushes are free to move in their boxes (c) Clean commutator; skim if necessary

## Section M5

# ALTERNATOR AND REGULATOR

## C.A.V. Model AC 512 and 440 Regulator

### Alternator

The alternator is a three-phase machine of the revolving field and stationary armature type and is self limiting in current output. Rectification of the output into direct current is provided by six silicon diodes contained in the slip ring end-shield and connected in a three phase bridge circuit between the stator and output terminals. A second rectifier bridge is formed by using three auxiliary diodes in conjunction with three of the six main diodes and these supply the energy for the alternator field coil which is fed through slip rings and brushes. This arrangement of auxiliary diodes prevents the battery from discharging through the field coil when the alternator is stationary.

### 440 Regulator

The regulator is fully transistorised with no moving parts, requires no service attention and is non-repairable. A cut-out relay is not necessary as the diodes in the alternator prevent reverse currents from the battery flowing through the stator when the machine is stationary or when generating less than the battery voltage.

**Important** The transistors in the regulator and diodes in the alternator are sensitive to voltage changes and high temperature, therefore it is essential that the following precautions are taken to avoid damage to the system when carrying out vehicle maintenance:

**THE BATTERY MUST NOT BE CONNECTED OR DISCONNECTED WHEN THE ENGINE IS RUNNING.**

2. Whenever a lead is disconnected it should be identified in relation to its terminal to facilitate reconnection. Short circuiting or reverse polarity no matter how brief will cause immediate and permanent damage to transistors and diodes.

3. The battery must not be disconnected whilst the alternator is running nor should the battery be connected into the system without first checking for correct polarity.

4. Do not use insulation testers on the regulator.

### Maintenance

The charging system requires very little attention but it should be kept free from dirt build-up and a check made if it fails to keep the battery charged. This may be due to a slipping drive belt.

1. Occasionally inspect the driving belt for wear and correct tension and verify that the alternator is properly aligned with respect to the drive. (See Drive belt - To adjust).

2. Keep the alternator clean with a cloth moistened in paraffin or white spirit and ensure that the ventilation slots and air spaces are clear and unobstructed.

3. Remove any dirt accumulated on the regulator housing and ensure that cooling air can pass freely over the casing.

### Alternator—To test in position

1. Connect a 0-50 volt first grade moving coil voltmeter between the regulator negative terminal and the positive terminal marked H1.

2. Connect a 0-100 amp first grade ammeter in series in the alternator positive line.

3. With the battery in a fully charged condition, the system is in correct working order when the following sequence is observed:-

## Chapter M

- a. Switch the ignition on and observe that the warning lamp marked GEN illuminates.
  - b. Switch on all the electrical loads with the exception of the windscreen wipers.
  - c. Start the engine, allow it to run at approximately 1000 r.p.m. and observe that the warning lamp is extinguished.
  - d. Momentarily increase the engine speed to approximately 3000 r.p.m. and observe that the alternator current is approximately 53 amps.
  - e. With the engine running at approximately 1500 r.p.m. switch off all the loads. The voltage should rise to between 14.0 and 14.5 volts and then remain constant, the current reading should drop appreciably.
4. Should there be a fault in the system this will be apparent by one or more of the following symptoms:
- a. If the warning lamp does not illuminate check the bulb and renew if defective.
  - b. If the bulb is serviceable but does not illuminate, check the regulator by first switching off the engine and disconnecting the lead from terminal F on the regulator. Clip this lead to earth and switch on the engine. If the lamp now illuminates the regulator is faulty and must be replaced by a new regulator. If the lamp still remains unlit then the alternator is faulty and requires workshop attention (see Alternator - To dismantle).
- The tests described in 5 may be used to locate the alternator fault. Having located the fault, switch off the engine and reconnect the F lead to F terminal.

5. Tests on the alternator can be carried out on the engine by partial dismantling in the following manner:

### a. Field Winding

Disconnect the leads from F and A terminals on the alternator and remove brush gear moulding (see Fig. M18). Measure the field resistance across the slip rings which should be  $3.2 \text{ ohms} \pm 0.16 \text{ ohms}$ . An appreciably lower field resistance could mean a short circuit between the coils: a higher reading indicates that the contact surfaces of the slip rings need cleaning. A reading of infinity indicates an open circuit in the field.

### b. Brushes

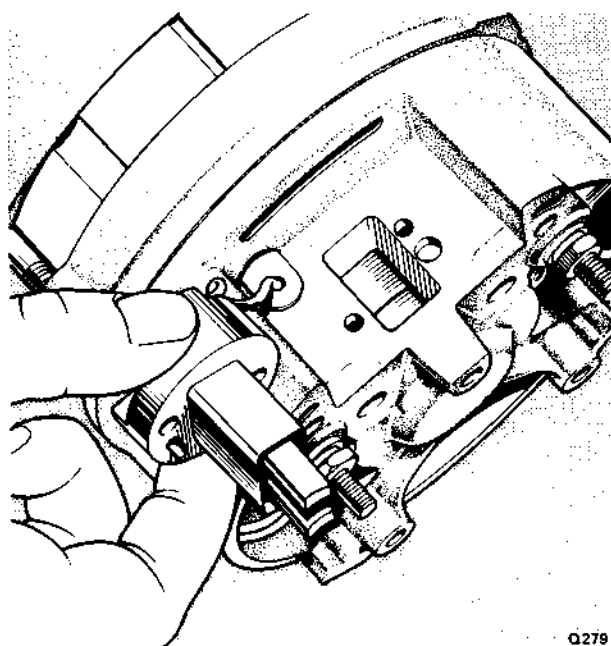
If the field resistance is correct check that the brush length is greater than the minimum length of 7.94 mm. (0.312 in.) and ensure that proper contact with the slip rings is made.

### c. Slip rings

The surface of the slip rings should be smooth and uncontaminated by oil or other foreign matter. The surface may be cleaned with very fine glass paper without fully dismantling the machine. On no account must emery cloth or similar abrasive be used.

### d. Stator winding

Low output or no output at all from the alternator may be due to either a faulty stator or a faulty diode in which case it is difficult to distinguish between the two faults without first dismantling the alternator. In these circumstances it is necessary to remove the stator from the alternator and measure the volts drop across each pair of three stator connections as described in Alternator - Bench testing.



Q279

**FIG. M18 BRUSHGEAR INSPECTION**

## Alternator—To dismantle

(see Fig. M19)

1. Remove the alternator from the car.
2. Unscrew the three screws and detach the baffle from the slip ring end-shield (SRE).
3. Disconnect the lead from terminal A of brush box, remove the retaining screws, spring and plain washers and withdraw the brush box complete with brushes. Discard the gasket.
4. Remove the field terminal retaining nuts, crinkle washers, Lucar blades and insulator from the terminal posts. Withdraw the brushes and field terminal posts from the brushbox. Discard the sealing washers.
5. Remove the pulley nut from the drive end (DE) and withdraw the pulley, fan, woodruff key and fan spacer.
6. Scribe light correlation marks across both end shields and stator to facilitate alignment on assembly.



## Chapter M

7. Remove the three through bolts and spring washers and withdraw the DE shield complete with rotor. If 'Loctite' grade A has been used to secure the through bolts, local heat should be applied with a heated soldering iron to loosen them, the part should not be overheated. If necessary use a hide faced hammer and gently tap the DE shield away from the stator and SRE shield. Do not damage the slip ring when laying the DE shield and rotor assembly on the bench.

**Note** The stator is sandwiched between the two end-shields therefore great care must be taken at this stage to prevent the full weight of the stator from falling onto the three stator phase leads.

8. Lay the stator and SRE shield assembly carefully on the bench with the endshield uppermost.

9. Unsolder the three stator phase leads from the heatsink terminal tags (do not remove tags from heatsinks) and separate the SRE shield from the stator using a hide faced mallet if necessary.

10. Remove and discard the 'O' ring from the shield bearing housing using a sharp pointed probe. Do not damage the 'O' ring groove.

11. Place the DE shield with drive shaft upwards over a suitable large diameter cylinder so that the

rotor is encased within the cylinder and the cylinder sits squarely against the three end shield webs. Support the rotor from underneath and gently press the rotor from the DE shield with a standard fly-press.

**Note** It is unnecessary to strip the diode assembly from the SRE shield unless it is established that there is a fault in one or more of the diodes. Accordingly, the diodes should next be subjected to the tests detailed under Alternator - Bench testing. If a faulty diode is detected proceed as instructed in Alternator - Inspection and repair.

### Alternator—Inspection and repair General

After dismantling, all components which require cleaning should be thoroughly cleaned.

1. Examine all parts for cracking, corrosion, serviceability of threads, score marks and excessive wear. The 'nyloc' pulley nut may be used again provided that the nylon insert is in reasonable condition.

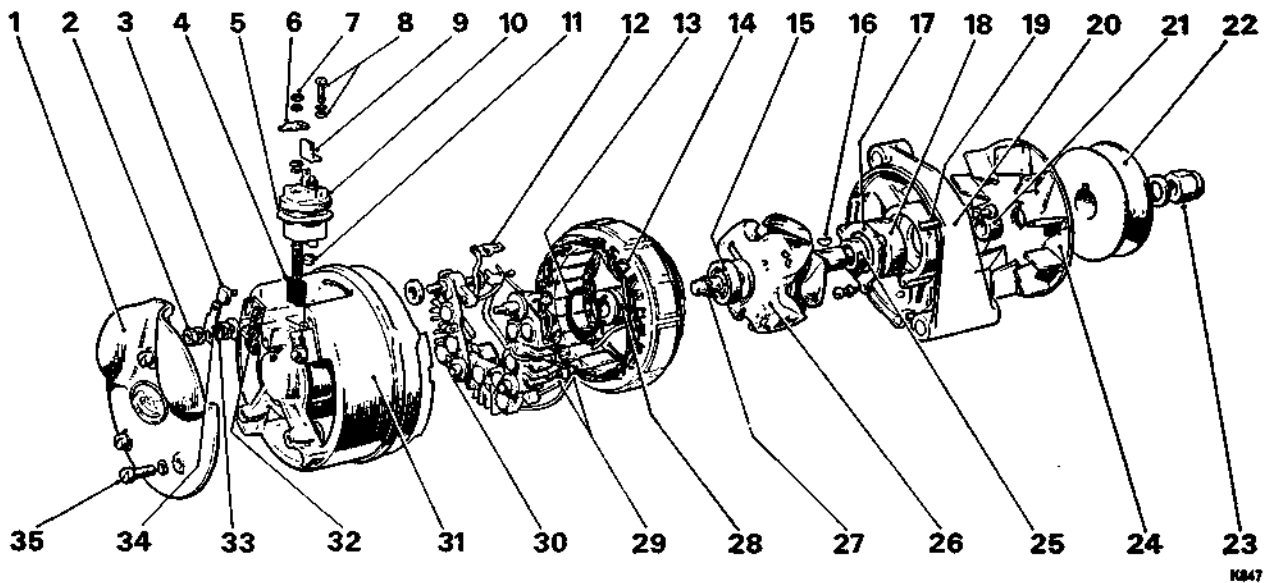


FIG. M19 EXPLODED VIEW OF CAV 512 ALTERNATOR

- 1 Baffle
- 2 Main terminal nut
- 3 Insert
- 4 Brush
- 5 Gasket
- 6 'Lucar' blade
- 7 Field terminal nuts and washers
- 8 Retaining screw and washers
- 9 Insulator
- 10 Brush holder
- 11 Grommet

- 12 'A' lead
- 13 'O' ring
- 14 Stator
- 15 Bearing
- 16 Woodruff key
- 17 Clamp plate
- 18 Bearing
- 19 'Through' bolt
- 20 Drive-end shield
- 21 Fan spacer
- 22 Pulley
- 23 Pulley nut

- 24 Fan
- 25 Bearing spacer
- 26 Rotor
- 27 Circlip
- 28 Slip rings
- 29 Heat sink securing screw
- 30 Diode and heat sink assembly
- 31 Slip ring end shield assembly
- 32 Shroud
- 33 Round slotted nut
- 34 'Lucar' terminal
- 35 Baffle screw

## Chapter M

2. Remove foreign material from rotor shaft and stator using a clean cloth moistened with white spirit.

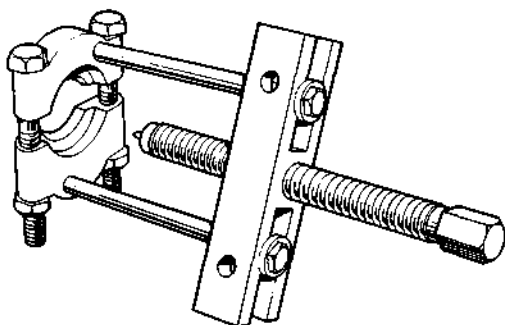
**Caution** Spirit should not be allowed to contact the leads of the stator and must not contaminate the protective coating of the rotor core.

3. Examine the stator windings for security and condition. Check the insulation of the stator leads for deterioration.

4. Check the bearings for excessive play and smoothness of operation. The bearings are sealed and cannot be lubricated therefore any evidence of dryness will necessitate renewal. If the SRE bearing requires replacement it will also be necessary to renew the slip ring.

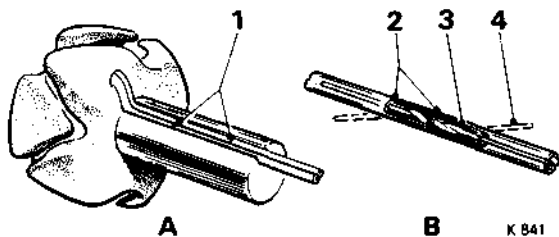
5. Examine the slip rings for signs of wear and scoring. The slip rings may be skimmed to a minimum diameter of 28,5 mm. (1.136 in.) before replacement is necessary.

6. Check carbon brushes for wear. New brushes are 15,9 mm. long (0.625 in.) and the minimum length of usable brushes is 7,9 mm. (0.312 in.).



Q282

**FIG. M20 BEARING EXTRACTOR**



K 841

**FIG. M21 RENEWING SLIP RING  
CONNECTING LEADS**

- 1 Staggered wire cuts
- 2 3 mm sleeving
- 3 2 mm sleeving
- 4 Excess wire removed

### Bearing renewal—Drive end

1. Remove the three screws and washers securing the clamp plate and push out the bearings with a copper drift.
2. Press a new bearing into the housing, ensuring that it is perfectly square to the housing.
3. Place the clamp plate in position and secure with three screws and washers.

### Bearing renewal—Slip ring end

1. Cut the ends of the field leads free from the slip ring terminal posts.
2. Using an extractor (see Fig. M20) withdraw the slip ring assembly. Removal of the slip ring renders it unserviceable and a new one must be fitted.
3. Remove bearing circlip. Adjust the jaws of bearing extractor so that the jaws locate between the outer race and the bearing spacer and withdraw bearing.
4. Examine bearing spacer for cracks and distortion. Clean out groove. Renew spacer if damaged.
5. Detaching the rotor leads from the slip ring assembly imposes mechanical stresses that may weaken the leads and produce the possibility of failure under operating conditions at a later date. It is strongly recommended that the leads are renewed in the following manner (see Fig. M21). Cut the leads so that the subsequent joints are staggered. Trim back the glass-fibre sleeving and lightly twist a new length of Lumex copper wire (21.5 swg) to the existing wire and solder together. Snip off excess wire. Apply a liberal coating of shellac and slide a short length of 2 mm. glass-fibre sleeving over the joint so that it slides inside the existing sleeve. Apply a further coating of shellac and slide on a new length of 3 mm. glass-fibre sleeving to abutt the original sleeve. Apply a final coat of shellac to the outside.
6. Refit the bearing spacer over the rotor shaft so that the moulded groove is in the correct position to contain the field leads from the rotor. Press into position. Press new bearing onto the rotor shaft with a suitable hand press. Refit the circlip, ensuring it is fully seated and a tight fit in its groove. Plug with 'Silcoset' 151 any gap that appears where the leads enter the spacer between the spacer and the rotor claws. Wipe off any surplus 'Silcoset' 151.
7. Place the rotor (drive end downwards) in a hand press so that the weight is supported on the rotor claws. Pass the two field leads through the bore of a new slip ring and locate the slip ring to the shaft with the terminal posts positioned at 90° relative to the shaft lead slot.

8. Place press tool (see Fig. M22) so that the spigot registers in the slip ring bore with the cut-away portion in line with the field leads. Gently press the slip-ring down until the press tool spigot abuts the rotor shaft. Pass the field leads through cut-away portion of press tool as they appear.

9. Trim off the ends of the glass-fibre sleeve to leave approximately  $\frac{1}{4}$  inch projecting beyond the rotor shaft. This will prevent the field leads from shorting onto the shaft during service. Wrap the field leads around the terminal posts of the slip ring, cut to length, and solder in position.

10. Mount the rotor in a suitable lathe, locating the steady on the outer race of the SRE bearing. Lightly skim the slip rings to ensure that they are concentric with the SRE bearing to within 0.05 mm. (0.002 in.). Remove the minimum amount of metal to achieve this degree of concentricity and do not reduce the slip ring diameter to below 28.85 mm. (1.136 in.). To obtain the required surface finish, it is essential that a highly finished diamond or tungsten carbide tipped cutting tool be used for this operation.

### Electrical tests

1. Subject the stator to an insulation test between any terminal tag and the frame. The minimum resistance should be 10 megohms.
2. Connect the stator leads, two at a time to a 20 ampere dc supply and check that the voltage drop in each case is 2.2 volts.

### Slipring end shield diode tests

Connect a test probe in series with a 48 watt 24 volt lamp on the positive terminal of 24 volt dc supply. Connect another test probe to the negative terminal of the dc supply.

Test No.	Test lead Connection (+)	Test lead Connection (-)	Diode under test	Serviceable
1	Each heat sink in turn	D	Positive	Lamp illuminates
2	D	Each heat sink in turn	Positive	No illumination
3	D-	Each heat sink in turn	Negative	Lamp illuminates
4	Each heat sink in turn	D-	Negative	No illumination
5	Each heat sink in turn	A	Auxiliary	Lamp illuminates
6	A	Each heat sink in turn	Auxiliary	No illumination

The opposite reaction to any of the above tests will establish a faulty diode, and the complete associated heat sink must be renewed.

**Note:** If any of the diodes have been replaced or if the polyurethane paint (blue) on the diodes is damaged the diodes must be painted with polyurethane paint. (Early cars only).

### Diode replacement (SRE shield)

**Note:** Individual diodes cannot be replaced and a fault in any diode will entail the renewal of the complete associated heat sink.

1. Carefully separate the Ross Courtney tag from the 'A' lead and pull the lead through the rubber grommet in the end shield. Remove and discard grommet.
2. Remove external positive and negative main terminal nuts, spring washers, terminal post retaining nuts, spring and plain washers.
3. Remove heat sink securing screws (two large cheese headed screws), spring and plain washers from underside of SRE shield. Withdraw complete heat sink assembly.
4. Snip the two copper braids of the faulty heat sink close to the angle terminal tags and unsolder the sleeved lead from the third diode. Remove appropriate nylon retaining washers and withdraw heat sink.
5. Assemble new heat sink ensuring that nylon insulating washers are interposed between adjacent heat sinks. Replace outside retaining washers.
6. Solder the diode braids to the appropriate angle tags. (Note: the length of the braids are such that it is impossible to connect them incorrectly).
7. Solder sleeved wire to remaining diode.

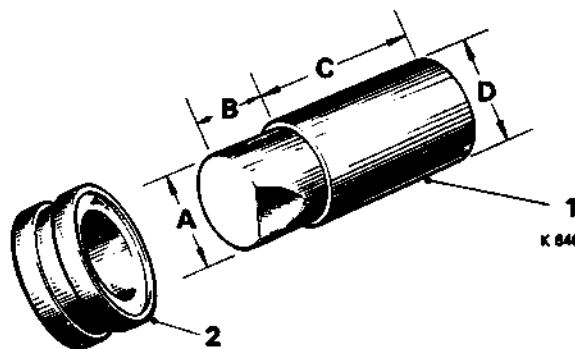


FIG. M22 SLIP RING PRESS TOOL

- A 15.875 0.0254 mm. (0.625 0.0010 in.)  
 B 25.4 mm. (1.00 in.)  
 C 63.5 mm. (2.5 in.)  
 D 19.05 mm. (0.75 in.)

- 1 Tool 2 Slip ring

## Chapter M

**Warning** Excessive heat can cause immediate and permanent damage to diodes. It is recommended that a pair of long nosed pliers be used to grip the diode shank to act as a thermal shunt and that the operation be carried out as quickly as possible.

8. Apply lamp test as detailed under Alternator - Bench testing to ascertain that the diodes are functioning correctly.

9. Thread lead A through a new rubber grommet. If the lead is cotton braided it is advisable to replace this with a Unipren covered lead, size Unipren 4.

10. Replace heat sink assembly in SRE shield. Secure with the two cheese headed screws, plain and spring washers. Replace grommet and A lead, and re-fit Ross Courtney tag.

11. Fit new 'O' ring to groove in internal bore of slip ring housing.

12. Replace plain and spring washers, main terminal post retaining nuts, spring washers and main terminal nuts.

### Assembly

Normal workshop practices should be followed taking special care to keep working surfaces and tools clean.

1. Lay the stator on the bench with the three stator phase leads facing upwards.

2. Invert the end shield and locate it over the stator, so that the three wide spaces on the heat

sink finning coincide with the three stator phase leads. Carefully lower the slip ring end shield to the stator and align scribe marks. Twist stator phase leads once only around heat sink tags and solder.

3. Fit spacer over the rotor drive shaft and insert drive shaft through the bore of the drive end shield ballrace.

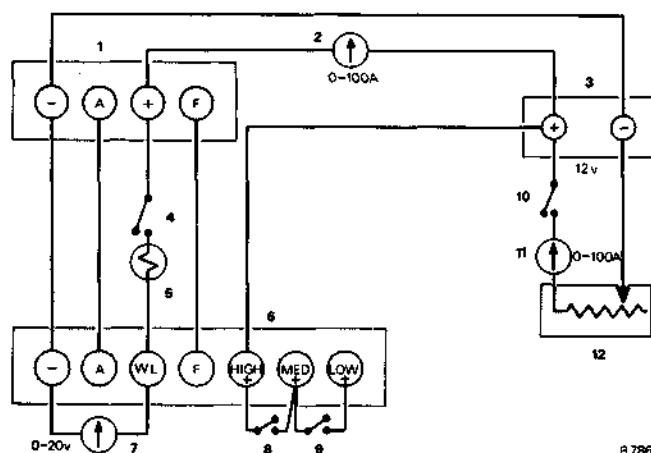
4. Support the rotor, slip rings downwards, between a pair of parallel blocks on a suitable handpress table (great care must be exercised at this stage not to damage the rotor field leads with the blocks). Gently press the drive end shield into place with a suitable piece of tube pressing on the bearing housing.

5. Assemble the rotor and slip ring end shield assembly to the drive end ensuring again that the scribed lines are in alignment. Insert the three through bolts with 'Loctite' grade A applied to the threads and tighten them evenly and progressively whilst gently tapping the slip-ring end shield with a hide faced mallet to draw end shields squarely into position. Finally tighten the through bolts to a maximum torque of 0,52 kg.m. (45 lb.in.).

6. Refit brushes to brush box making sure that the terminals are fully seated. Thread 'O' sealing rings over both the terminal posts and assemble insulator to one of the terminals. Fit Lucar blades and crinkle washers to both terminals and secure with terminal nuts.

7. Fit a new gasket to the brush box moulding and assemble brush gear to the slip ring end shield. Correct positioning is ensured by the locating dowel. Secure with retaining screws, plain and spring washers. Reconnect 'A' lead to terminal post marked 'A', secure with crinkle washer, plain washer and terminal nut.

8. Fit fan spacer machined slot outwards and aligned with keyway. Fit woodruff key, fan pulley and pulley nut. Tighten pulley nut to a torque of 5,3 kg.m. (40 lb.ft.).



**FIG. M23 BENCH TEST CIRCUIT**

- |                 |  |
|-----------------|--|
| 1 Alternator    | 7 Voltmeter                                  |
| 2 Ammeter       | 8 Switch                                     |
| 3 Battery       | 9 Switch                                     |
| 4 Switch        | 10 Switch                                    |
| 5 Ignition lamp | 11 Ammeter                                   |
| 6 Regulator     | 12 Carbon pile resistor<br>(60 amps minimum) |

### Alternator—Bench testing

#### Procedure

1. Before making any connections, test the alternator for earths by non-destructive flash test (or Megohm Meter) with voltage rating of 110 volt. Connect instrument between D+ and earth, D- and earth and A terminal and earth. Make sure always to keep the one probe on the frame so as not to apply full test voltage between any two terminals on the alternator. If Megohm Meter is used the minimum insulation resistance should be 10 megohms.

2. Mount the alternator to the test machine drive and make all connections to the battery and regulator as wiring diagram.

## Chapter M

3. Close switch 4 and observe that the bulb is lit.

4. Start the drive and increase speed until warning lamp is extinguished which indicates that alternator is charging. This should occur below 2000 r.p.m.

5. Reduce alternator speed to 1125 r.p.m. and measure dc voltage between WL and -ve on the 440 regulator. The voltage should be between 12-14 volt.

Load applied	Ammeter reading	Voltage
40-50 amp	50-55 amp	@13-13.6

6. Increase alternator speed to 10,000 r.p.m. and again observe ammeter reading which should be as follows:-

Ammeter reading	Voltage
60-65 amp	@13-14

Adjust battery load as necessary. Run at top speed of 10,000 r.p.m. for 1 minute.

7. Decrease speed to 3000 r.p.m. and switch off loads connected across the battery, the voltage should rise to between 13-14 volts and then remain constant. At the same time the current reading should drop appreciably. This test indicates that the regulator is working correctly.

With switches 8 and 9 open, the voltmeter reading should be between 14 and 14.5 volts. With 8 closed and 9 open the voltmeter reading should be between 13.5 and 14 volts and with both 8 and 9 closed the voltmeter reading should be between 13 and 13.5 volts.

## Alternator

### Lucas Model 20 ACR

**Important** Before commencing work on the alternator, please note the following:

1. If it is necessary to disconnect a lead from the system, the engine must be switched off.

2. Whenever a lead is disconnected it should be identified in relation to its terminal to facilitate reconnection. Short circuiting or reverse polarity no matter how brief will cause immediate and permanent damage to transistors and diodes.

3. The battery must not be disconnected whilst the alternator is running nor should the battery be connected into the system without first checking for correct polarity.

4. Do not use insulation testers on the alternator.

## Routine maintenance

### a. Cleaning

Wipe away any dirt or oil that has collected around the apertures in the moulded cover.

### b. Belt adjustment

Inspect the driving belt for condition and correct tension. If necessary adjust the tension so that an applied force of 3.6 kg. (8 lb.) mid-way between the two pulleys causes the belt to deflect 9.5 mm. (0.375 in.).

**Important** To avoid damage to the alternator when adjusting belt tension, apply leverage only on the alternator drive end bracket, not on any other part of the alternator. The lever should be of a soft material, preferably wood.

### c. Lubrication

The bearings are packed with grease during assembly and will not normally require further lubrication during their service life.

### d. Circuit connections

Ensure that parts of the charging circuit, including the battery, are not disconnected or connected while the engine is running. When connecting an alternator, always observe correct polarity i.e. positive to positive and negative to negative.

## Alternator—To service in position

### Alternator output test

This test should be carried out with the alternator at normal temperature. Run a cold engine at charging speed for 3-4 minutes.

a. With the engine stationary, disconnect the battery earth cable.

b. Connect an ammeter in series with the alternator main output cable.

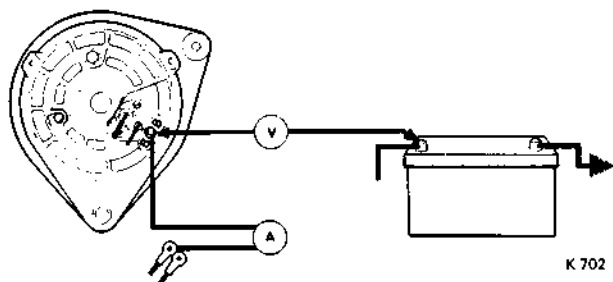
c. Remove the connections from the alternator, remove the moulded cover and remake the connections. Short together the black lead and the large 'Philips' screw securing the metal plate.

d. Connect the battery earth cable.

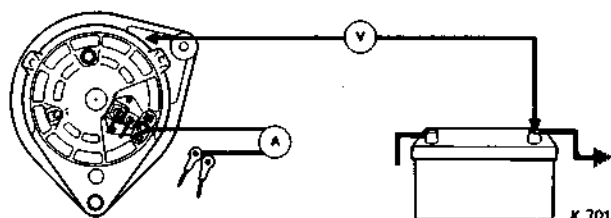
e. Switch on all the vehicle loads (except wipers) and switch on the ignition. Observe that the warning lamp is illuminated.

f. Start the engine and slowly increase the speed. At 3000 r.p.m. the ammeter reading should be 66 amps. Any appreciable deviation from this figure will necessitate removal of the alternator for further examination.

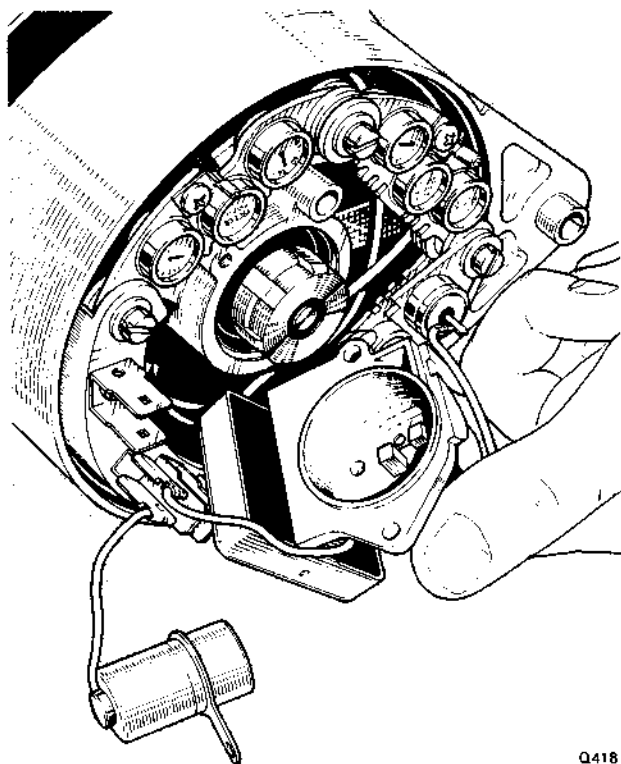
## Chapter M



**FIG. M24 CHARGING CIRCUIT VOLTAGE DROP TESTING  
- INSULATION SIDE**



**FIG. M25 CHARGING CIRCUIT VOLTAGE DROP TESTING  
- EARTH SIDE**



**FIG. M26 BRUSHGEAR INSPECTION**

### Charging circuit—Voltage drop test (see Figs. M24 and M25)

A voltmeter is used to check for high resistance in the charging circuit.

- Connect a 0-1 volt voltmeter between the battery insulated terminal and alternator main terminal.
- Switch on the vehicle lights (headlamps on main beam). Start the engine and run at 3000 r.p.m. Note the voltmeter reading. Switch off engine.
- Transfer the voltmeter connections to the battery earth terminal and alternator earth terminal.
- Start and run the engine at 3000 r.p.m. and note the voltmeter reading.

The voltmeter readings should not exceed 0.5 volt for the insulated side and 0.25 volt for the earth side. Higher readings indicate high resistance in the circuit which must be located and rectified.

### Control unit voltage setting

The charging circuit wiring and connections must be in good order and the battery must be in a well charged condition or temporarily replaced by a charged battery.

- Connect an ammeter in series with the alternator main output cable, connect a 0-20 volt voltmeter across the battery terminals.
- Start the engine and run at charging speed (3000 r.p.m.) until the ammeter reading is less than 10 amps. The voltmeter reading should be within 13.6 - 14.4 volts.

An unstable reading or a reading outside the specified limits indicates that the alternator control unit is faulty and should be replaced.

### Alternator—To dismantle for electrical tests

The following instructions cover the dismantling required to enable the alternator to be tested electrically. If further dismantling becomes necessary as a result of the tests or because the rotor bearings are to be changed, proceed as described in Alternator - Further dismantling.

- Disconnect the battery and alternator cables and remove the alternator from the vehicle.
- Unscrew the two cover securing screws and remove the cover.
- Remove the brush moulding fixing screw.
- To remove the brush moulding complete with the control unit - disconnect the black earth lead. Disconnect the red leads from IND and + terminals. The moulding can now be withdrawn.

## Chapter M

**Brushgear—To inspect (see Fig. M26)**

The brush length when new is 12.7 mm. (0.5 in.). The serviceability of a brush may be determined by measuring the amount by which it protrudes beyond the brush box moulding when in the free position. Replace the brush if there is less than 5 mm. (0.2 in.) protruding. If brushes are changed, take care not to lose the leaf spring fitted at the side of the inner brush.

Check the brush spring pressure using a push type spring gauge. This should indicate 0.255 kg - 0.368 kg (9 - 13 oz) when the brush face is flush with the housing. Sticking brushes may be cleaned with a petrol moistened cloth.

**Sliprings—To inspect**

The surfaces of the sliprings should be smooth and uncontaminated by oil or other foreign matter. Clean the surfaces with a petrol moistened cloth, or if there is evidence of burning, very fine glass paper. On no account must emery paper or similar abrasive be used.

**Rotor—To test**

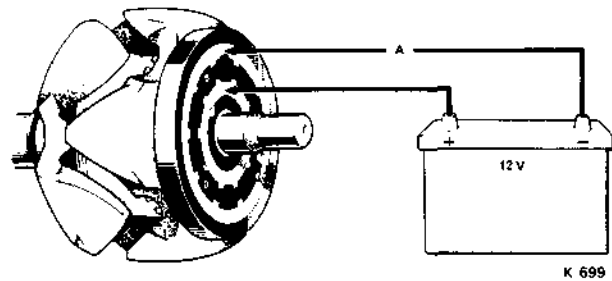
For clarity, the illustrations of the electrical testing of the rotor and stator shows these components isolated from the remainder of the alternator.

Test the rotor winding by connecting either an ohmmeter or a 12 volt battery and ammeter between the sliprings (see Fig. M27). The resistance should be 3.6 ohms at 20 °C or the current approximately 3 amps. Test for defective insulation between one of the sliprings and one of the rotor poles using a 110 volt A.C. mains supply and a 15 watt test lamp. (see Fig. M28). If the lamp illuminates the coil is earthed to the rotor core and a replacement rotor/slipring assembly must be fitted.

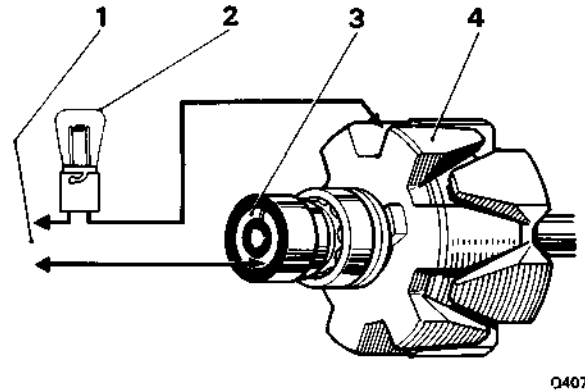
**Stator—To test**

Connect any two of the three stator windings in series with a 12 volt battery and 1.5 watt test lamp (see Fig. M29). Replace one winding with the third winding and repeat the test. If the test lamp does not illuminate on either occasion, the stator winding is open circuit and a replacement stator must be fitted.

Test for defective insulation between the stator coils and the lamination pack with the mains test lamp. Connect the test probes between any of the three cable ends and the lamination pack (see Fig. M30). If the lamp illuminates, the stator coils are earthing and a replacement stator must be fitted.

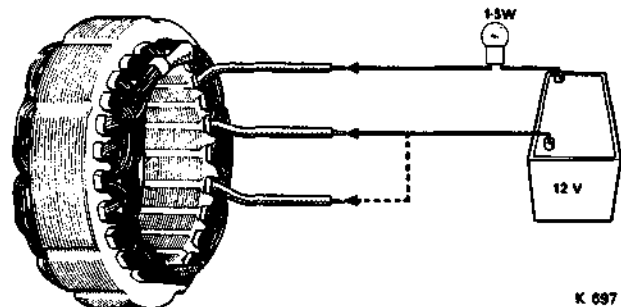


**FIG. M27 MEASURING ROTOR WINDING RESISTANCE WITH BATTERY & AMMETER**



**FIG. M28 INSULATION TEST OF ROTOR WINDING**

- 1 110 volts AC
- 2 15 watt lamp
- 3 Slipring
- 4 Rotor poles



**FIG. M29 STATOR WINDING CONTINUITY TEST**

## Chapter M

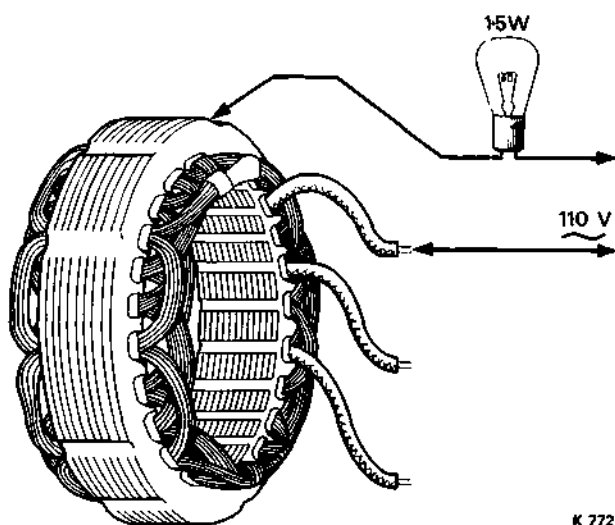


FIG. M30 INSULATION TEST

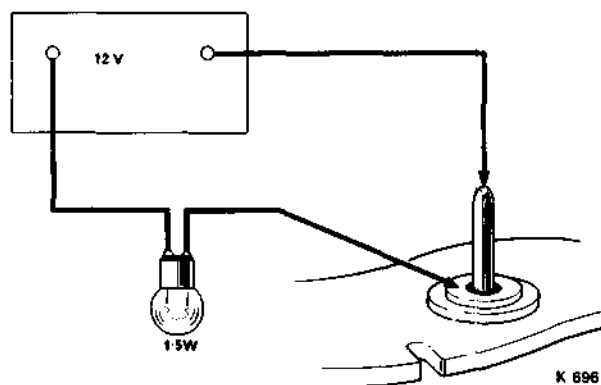


FIG. M31 TESTING DIODES

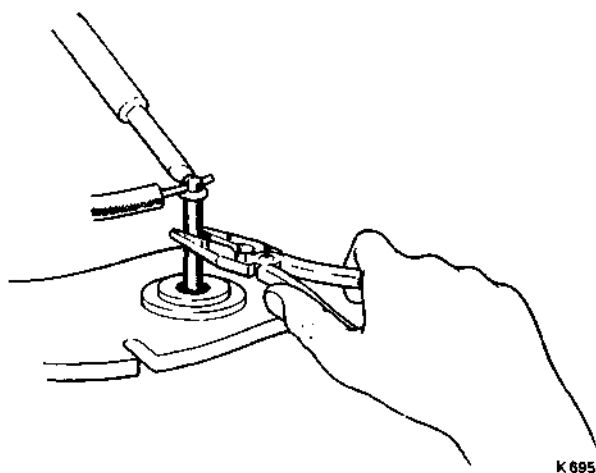


FIG. M32 USE OF THERMAL SHUNT

## Diodes—To test

If a fault in a diode is indicated, remove the rectifier/heatsinks complete. Unscrew the three stator winding connections at each diode heatsink. Remove the four screws which pass through the nylon insulating washers and also the small screw which secures the earthing strip to the bracket and remove the complete assembly.

Connect the pin of a diode in series with a 1.5 watt test lamp and one terminal of a 12 volt battery, connect the other battery terminal to the diode heatsink (see Fig. M31). Observe the test lamp.

Reverse the connections to the diode and again observe the test lamp. If the lamp illuminates in both tests or remains unlit in both tests then the diode is faulty and a new rectifier/heatsink assembly must be fitted. Repeat the tests for each diode.

**Note:** When unsoldering any link wires connected to the diodes always use a thermal shunt (see Fig. M32).

## Alternator—Further dismantling

- a. Remove the heatsink/terminal block assembly.
- b. Withdraw the three through bolts.
- c. Separate the slip ring end bracket and stator assembly from the rotor and drive-end bracket by inserting a lever between the stator and drive-end bracket and carefully prise the two apart until the slip ring end bearing is clear of its housing.

If necessary, the rotor shaft can be pressed out from the drive-end bracket having first removed the shaft nut, washers, pulley, fan & shaft key.

- d. Drive-end bearing

Dismantle the alternator and separate the rotor from the drive-end bracket. Unscrew the three countersunk screws securing the bearing retaining plate, remove the plate and withdraw the drive-end bearing assembly.

- e. Slip ring end bearing

Dismantle the alternator. Unsolder the field winding connections to the slip ring moulding assembly and withdraw the assembly from the rotor shaft. Extract the bearing from the shaft. Fit the new bearing and engage the slip ring moulding with the slot in the motor shaft. Finally, remake the field to slip ring connections using Fry's H.T. 3 solder (or any high melting point solder).

When required, the alternator bearing may be lubricated with Shell 'Alvania' 'RA'.



## Chapter M

**Alternator—To assemble**

Reverse the dismantling procedure, noting the following points:

- Ensure that the slip ring bearing is positioned as far as it will go along the rotor shaft towards the field assembly.
- Ensure that the brushes are in the brush housing before fitting the brush moulding.
- Tighten the through bolts evenly.
- If the rotor and drive-end bracket have been separated, support the inner ring of the drive-end bearing with the distance collar. Do not use the drive-end as a support for the bearing when fitting the rotor.

**Alternator Lucas Model 11 AC****Field isolating device**

With the engine stationary, the control unit and the alternator field windings are isolated from the battery by the normally-open contacts of the Model 6RA relay, the operating coil of which is fed from the ignition switch.

The contacts of the relay are connected in the negative lead of the regulator.

**Maintenance**

Remove any dirt or oil from around the ventilating apertures of the slip ring end cover.

**Lubrication**

The alternator bearings are packed with grease during assembly and do not require periodic attention.

**Terminal connections**

Ensure that all terminal connections are secure.

**Alternator—To test in position**

A fault in the charging circuit should be located as follows:

- Examine the alternator driving belts for wear and correct tension.
- Apply the handbrake and chock the rear wheels. Start the engine and check to ensure that battery voltage is being applied to the rotor winding by connecting a voltmeter between the cable ends normally attached to the field terminals. Stop the engine.
- Disconnect the battery earth lead.
- Withdraw the leads from the alternator field terminals, then using a suitable pair of auxiliary cables, connect the terminals directly to the battery (see Fig. M.23).

- Re-connect the battery earth lead. Start the engine and slowly open the throttle until the engine speed is approximately 1 650 r.p.m. At this speed the ammeter should indicate approximately 40 amps. If a Zero reading is registered on the ammeter, stop the engine and disconnect the leads from the field terminals. Remove the two screws securing the brushbox moulding and remove the brushgear for examination (see *Brushgear - To inspect*).

**Note** When carrying out this operation, on no account should the engine speed exceed 2000 r.p.m., or damage to the diodes will result.

- If necessary fit new brush and spring assemblies and again test the alternator output. If the Zero reading persists, the alternator must be removed from the engine and dismantled for detailed inspection (see *Alternator - To dismantle*).

A low output current reading will indicate a faulty alternator or poor circuit wiring connections. Check the connections while the alternator is connected and running at 1 650 r.p.m. engine speed. Connect a low range voltmeter between the alternator output terminal and the battery insulated terminal (see Fig. M.24), and note the voltmeter reading.

Transfer the voltmeter connections to the alternator frame and battery earth terminal (see Fig. M.25); note the reading.

If either of these readings exceed 0.5 Volt there is a high resistance in the charging circuit, this must be traced and rectified.

If there is no undue resistance in the charging circuit even though the alternator output is low, proceed to dismantle the alternator.

**Alternator—To remove**

- Disconnect the alternator electrical connections.
- Slacken the two upper securing bolts (lower on early cars).
- Slacken the setscrew on the slotted adjuster link.
- Move the alternator inwards towards the engine, in order to release the tension on the driving belt; remove the belt.
- Support the alternator and remove the previously slackened bolts, taking note of the position of the spacers to facilitate assembly.

## Chapter M

### Alternator—To dismantle (see Figs M33 and M34)

1. Remove the shaft nut, spring washer, pulley and fan from the drive-end of the alternator.
2. Unscrew and remove the three 'through' bolts.
3. Mark the drive-end bracket, lamination pack and slip ring cover so that they can be assembled in correct angular relationship to each other.
4. Withdraw the drive-end bracket and rotor from the stator. The drive-end bracket and rotor need not be separated unless it is necessary to examine the drive-end bearing or to renew the rotor.

In this event, the rotor should be removed from the drive-end bracket by means of a hand press, having first removed the shaft key and bearing collar.

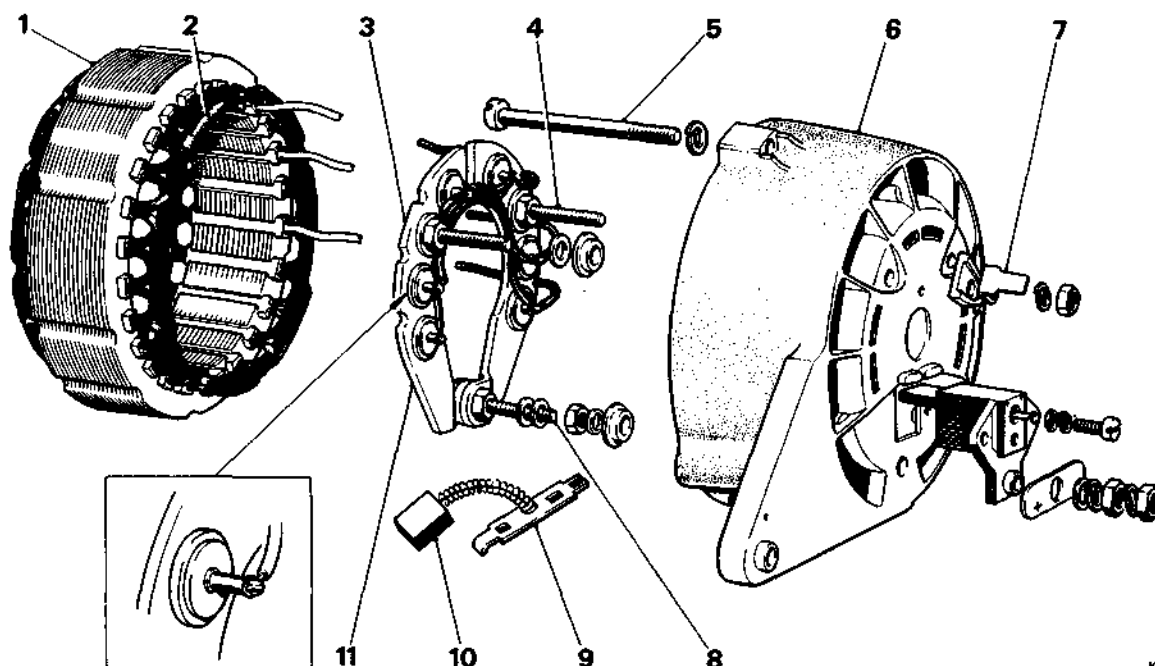
5. Remove the terminal nuts, washers, insulating pieces, brushbox screws and the 2B.A. hexagon-headed bolt from the slip ring end bracket. Retain the two washers fitted between the brushbox moulding and the end bracket.
6. Withdraw the stator and heat sink assemblies from the slip ring end bracket.

7. Close up the retaining tongue at the base of each field terminal blade and withdraw the brush spring and terminal assemblies from the moulded brushbox.

### Brushgear—To inspect

1. Measure the brush length. A new brush is 15,90 mm. (0.625 in.) long, a fully worn brush is 4,00 mm. (0.156 in.) long, and must be renewed at or near this length. The new brush is supplied complete with brush spring and 'Lucar' terminal blade and has merely to be pushed in until the tongue registers. To ensure that the terminal is properly retained, carefully lever up the retaining tongue with a screwdriver blade, so that the tongue makes an angle of 30° with the terminal blade.

2. The nominal brush spring pressures are between 113 g. and 142 g. (4 oz and 5 oz) with the spring compressed to 19,84 mm. (0.781 in.) in length and 212 g. to 242 g. (7.5 oz to 8.5 oz) with the spring compressed to 10,40 mm. (0.406 in.) in length. These pressures should be measured if equipment is available.



K 765

FIG. M33 BRUSHGEAR AND HEATSINKS

- |                          |                       |                    |                       |
|--------------------------|-----------------------|--------------------|-----------------------|
| 1 Stator                 | 4 Warning lamp 'AL'   | 8 Output terminal  | 11 Positive heat sink |
| 2 Star point             | 5 Through bolt        | 9 Terminal blade   | end cathode base      |
| 3 Negative heat sink and | 6 Slip ring end cover | retaining tongue   | diodes                |
| anode base diodes        | 7 Terminal 'AL'       | 10 Slip ring brush |                       |
| (black)                  |                       |                    |                       |

## Chapter M

3. Check to ensure that the brushes move freely in their holders. If at all sluggish, clean the side of the brush with a cloth moistened in petrol; if this fails to effect a cure, lightly polish the side of the brush on a smooth file. Remove all traces of brush dust before fitting the brushes in the holders.

**Note** The brush which bears on the inner slip ring is always associated with the Positive pole of the electrical system, since the lower linear speed of the inner ring results in reduced mechanical wear and helps to offset the higher rate of electrical wear peculiar to the Positive connected brush.

## Rotor-To test

Test the rotor winding by connecting either an ohmmeter (see Fig. M35) or the appropriate battery supply (see Fig. M36) between the slip rings.

1. The reading of field coil resistance should be 3.8 ohms at 20°C (68°F). If the alternative test has been made, the value of the current should be approximately 3.2 amps.

2. Using a 110 Volt (A.C.) mains supply and a 15 Watt test lamp (see Fig. M28), test for defective insulation between one of the slip rings and one of the rotor poles. If the lamp is illuminated the coil is earthing and a replacement rotor/slip ring assembly must be fitted.

No attempt should be made to machine the rotor poles or to true a distorted shaft.

## Sliprings-To inspect

The slip ring surfaces should be smooth and uncontaminated by oil or other foreign matter. Clean the surfaces using a cloth moistened in petrol. If there is evidence of burning, clean with very fine glass paper. On no account must emery cloth or similar abrasives be used. The small current carried by the rotor winding, and the unbroken surface of the slip rings mean that the possibility of scored or pitted slip rings is almost negligible.

## Stator-To test

1. Unsolder the three stator cables from the heat sink assembly, taking care not to overheat the diodes (see Alternator diode heat sink assembly - To renew).

2. Check the continuity of the stator windings, by first connecting any two of the three stator cables in series with a 1.5 Watt test lamp and a 12 Volt battery as shown in figure M29

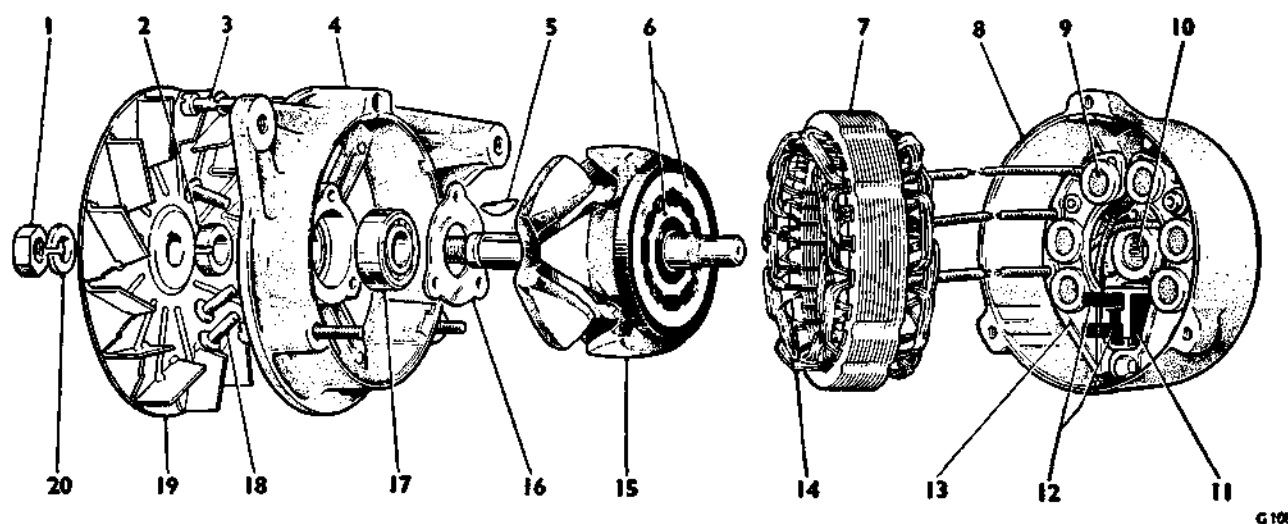


FIG. M34 EXPLODED VIEW OF 11 AC ALTERNATOR

- |                     |                           |                        |                        |
|---------------------|---------------------------|------------------------|------------------------|
| 1 Shaft nut         | 6 Slip rings              | 11 Brush box mouldings | 16 Retaining plate     |
| 2 Bearing collar    | 7 Stator laminations      | 12 Brushes             | 17 Ball bearing        |
| 3 'Through' bolts   | 8 Slip ring end bracket   | 13 Diode heat sink     | 18 Rivets              |
| 4 Drive end bracket | 9 Silicon diodes          | 14 Stator windings     | 19 Cooling fan         |
| 5 Key               | 10 Needle roller bearings | 15 Rotor               | 20 Shaft spring washer |

## Chapter M

3. Repeat the test, replacing one of the two cables by the third cable. Failure of the test lamp to illuminate on either occasion, means that part of the stator winding is open-circuit and the stator must be renewed.

4. Test for defective insulation between the stator coils and lamination pack with the mains test lamp (see Fig. M30).

5. Connect the test probes between any one of the three cable ends and the lamination pack. If the lamp is illuminated, the stator coils are earthing and the stator must be renewed.

6. Before soldering the stator cable ends to the diode pins, carry out the following test.

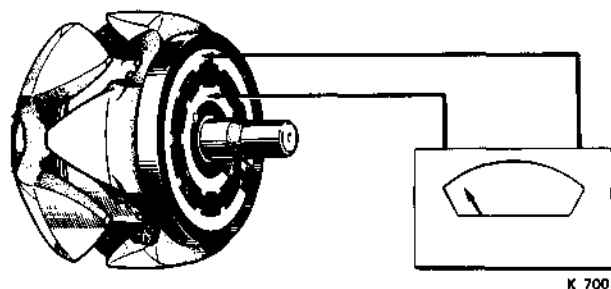
3. The above procedure is adequate for service purposes but for any accurate measurement of diode resistance it is necessary for factory equipment to be available. Since the forward resistance of a diode varies with the voltage applied, no realistic readings can be obtained with battery-powered ohmmeters. However, should a battery-powered ohmmeter be used a serviceable diode will yield 'Infinity' in one direction and some indefinite, but much lower reading in the other.

**Note** Ohmmeters of the type incorporating a hand-driven generator must never be used for checking diodes.

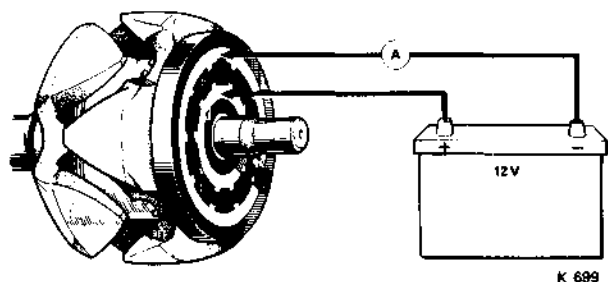
### Diodes—To test

1. Each diode can be checked if connected in series with a 1.5 Watt test bulb across a 12 Volt (D.C.) supply. Test again by reversing the connections (see Fig. M31).

2. The bulb should be illuminated and current should flow in one direction only. Should the bulb be illuminated in both tests, or not be illuminated in either test, this indicates a defective diode and the appropriate heat sink assembly must be renewed.



**FIG. M35 MEASURING ROTOR WINDING**



**FIG. M36 MEASURING ROTOR WINDING  
RESISTANCE**

### Diode heatsink assembly —To renew

The alternator heat sink assembly comprises two parts, one of positive polarity and the other negative (see Fig. M33).

The positive portion carries three cathode base diodes coloured Red and the negative portion carries three anode base diodes coloured Black.

The diodes cannot be renewed individually, but for service purposes, they are supplied already pressed into the appropriate heat sink portion.

When soldering the interconnections, 'M' grade 45-55 tin-lead solder should be used.

Great care must be taken to avoid overheating the diodes or bending the diode pins. The diode pins should be lightly gripped with a pair of long-nosed pliers (which act as a thermal shunt). This operation is shown in Figure M32; and the soldering must be carried out as quickly as possible.

After soldering, the connections must be neatly arranged around the heat sinks, to ensure adequate clearance for the rotor and should be tacked down with 'MMM' EC 1022 adhesive where indicated in Figure M43.

The stator connections must pass through the appropriate notches at the edge of the heat sink.

### Bearings—To renew

Renew any bearings which are worn to such an extent that they allow excessive side movement of the rotor shaft.

The needle roller bearing in the slip ring end bracket cannot be serviced separately. In the unlikely event of this bearing becoming unserviceable a complete end bracket assembly must be fitted.

1. After withdrawing the rotor shaft from the drive-end bracket, renew the drive-end ball bearing race as follows.

2. File away the head of each of the three rivets securing the bearing retaining plate and punch out the rivets.

## Chapter M

3. Press the old bearing out of the bracket.
4. Before fitting the new bearing, ensure that it is clean and packed with an approved melting-point grease.
5. Locate the bearing in the housing and press squarely into position.
6. When fitting the bearing retaining plate, use new rivets.

**Alternator output control unit Model 4 TR**

**Important** The battery must never be disconnected while the alternator is running. Failure to observe this ruling will cause the control unit to be damaged.

**Checking and adjusting**

1. Before checking and adjusting the control unit it must be established that the alternator and the charging circuit wiring are in good condition.
2. Check the battery to control unit wiring which incorporates the field isolating relay. To ensure correct working of the control unit, the resistance of this complete circuit, including the isolating relay, must not exceed 0.1 ohm. Any unduly high resistance must be traced and rectified.

**Control unit—To check**

Do not disturb the existing connections to the alternator and control unit.

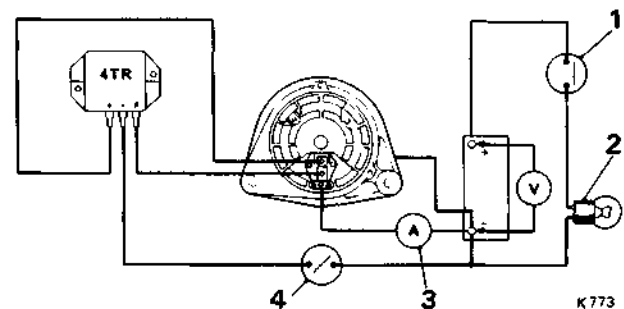
1. Connect a voltmeter of the suppressed-zero type, reading 12 Volt to 15 Volt between the battery terminals and note the reading with all electrical equipment switched off.
2. Switch on an electrical load of approximately 2 amps., e.g. side and tail lighting. Refer to Figure M37.
3. Start the engine and run the alternator at approximately 1 250 r.p.m. engine speed for eight minutes; this ensures that the system voltage has stabilised.
4. If the charging current is still greater than 10 amps continue to run the engine until this figure is reached. The voltmeter should indicate a reading of between 13.9 Volt and 14.3 Volt.
5. If the reading obtained is stable but outside these limits the unit should be adjusted to control at the correct voltage (see *Control unit - To adjust*).
6. If the voltmeter reading remains unchanged (at open-circuit battery terminal voltage) or increases in an uncontrolled manner, the control unit is faulty and must be renewed.

**Control unit—To adjust**

1. Remove the screws from the control unit.
2. From the rear of the unit carefully remove the sealing compound which conceals the potentiometer adjuster.
3. Check that the voltmeter is still firmly connected between the battery terminals.
4. Start the engine, and while running the alternator at 1 250 r.p.m. engine speed turn the potentiometer adjuster slot clockwise to increase the setting or anti-clockwise to decrease, until the required setting is obtained.

**Important** Care must be taken in making this adjustment; a minimal amount of adjuster movement causes an appreciable difference in the voltage reading.

5. Stop the engine and again check the setting: start the engine and run the alternator at 1 250 r.p.m. engine speed.
6. Fit the control unit and disconnect the voltmeter.



**FIG. M37 LUCAS 4 TR CONTROL UNIT TEST CIRCUIT**

- 1 Side and tail lamps circuit switch
- 2 Side and tail lamps
- 3 Ammeter
- 4 Field isolating device

## Section M6

# GENERATOR

### Testing in position

1. Check and if necessary adjust the generator driving belts (see Chapter L).
2. Disconnect the generator (dynamo) leads at the control unit terminals marked 'D' and 'F'.
3. Connect the two leads to the positive terminals of a Zero to 20 Volts voltmeter. Connect the negative lead to a good earthing point.
4. Start the engine but do not allow the generator speed to exceed 1000 r.p.m.
5. If the generator attains normal voltage, check the 'RB 340' control unit, the wiring and the battery connections.

6. If there is no voltage build-up, remove the generator (see *Generator - To remove*) and examine the condition of the brushes and commutator.

7. Hold back each brush spring in turn and move the brush by gently pulling on its flexible connector (see Fig. M39). If the movement is sluggish, remove the brush from its box and ease the sides of the brush by lightly polishing on a smooth file. Clean out the brush boxes if dirty and check the clearances of the brushes in the boxes as sticking of the brushes can occur if clearances are insufficient (see Fig. M40). It is important that the brushes are fitted in their original positions.

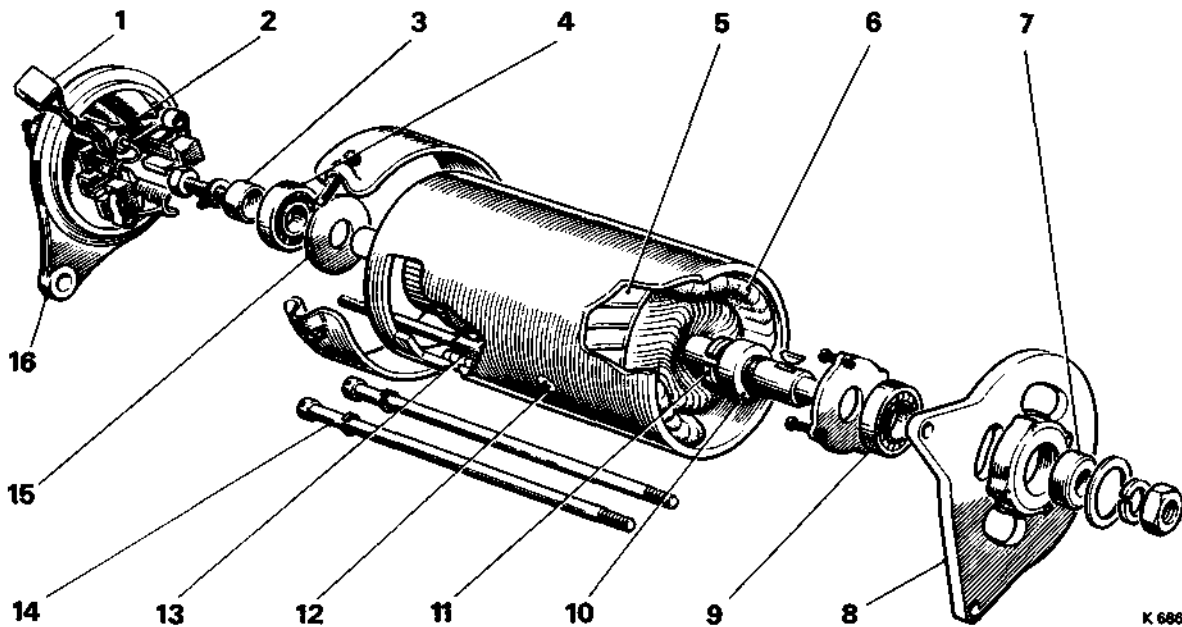
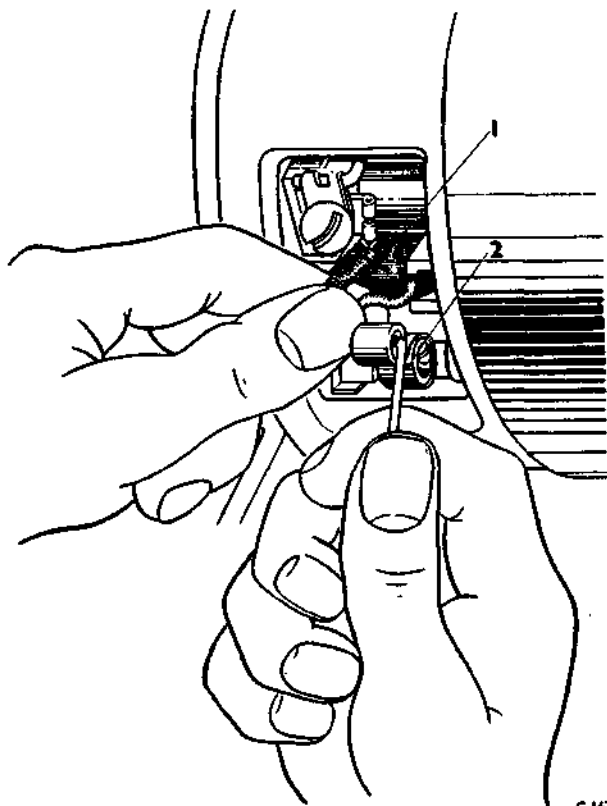


FIG. M38 EXPLODED VIEW OF GENERATOR

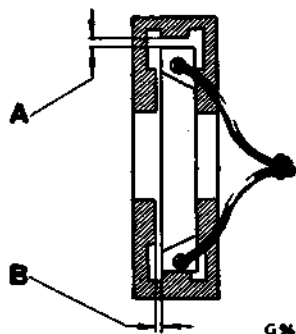
- |                |                     |                             |                              |
|----------------|---------------------|-----------------------------|------------------------------|
| 1 Brushes      | 5 Armature          | 9 Ball bearing              | 13 Field coil terminal block |
| 2 Capacitor    | 6 Field coil        | 10 Bearing spacer           | 14 'Through' bolts           |
| 3 Locking cap  | 7 Pulley spacer     | 11 Shaft collar             | 15 Thrust washer             |
| 4 Ball bearing | 8 Drive end bracket | 12 Pole shoe securing screw | 16 Commutator end bracket    |

## Chapter M



**FIG. M39 CHECKING GENERATOR BRUSHES FOR FREEDOM OF MOVEMENT**

1 Brush                      2 Brush spring



**FIG. M40 BRUSH CLEARANCES**

A 0,457 mm. to 0,644 mm. (0.018 in. to 0.026 in.)  
B 0,101 mm. to 0,304 mm. (0.004 in. to 0.012 in.)

8. Excessive brush wear can cause damage to the commutator if the brush leads come into contact with the running face of the commutator.

9. The minimum acceptable length of the brushes is 8,70 mm. ( $\frac{11}{32}$  in.). It is imperative that they are renewed when near or below this measurement.

10. Generator charging failures can sometimes be attributed to the brush leads fouling the corners of the brush boxes, or by a short circuit between the brush leads and band cover.

The latter of these faults can occur if the insulating sleeves have pulled away from their normal positions, exposing the wires. Always ensure that the wires are completely covered. The following information is included to assist generator overhaul when renewal is impracticable.

### Generator—To remove

1. Slacken the bolts at both ends of the slotted link to release the tension from the driving belts.
2. Remove the driving belts.
3. Disconnect the leads from the rear of the generator.
4. Support the generator and remove the slotted link upper securing bolt, washer, distance piece and nut, noting the position of each to facilitate assembly.
5. Remove the setscrew and washer from the generator front and rear mounting brackets.
6. Remove the generator from the engine compartment.

### Generator—To test

1. Connect a 12 Volt test lamp to the terminal marked 'D' and to the generator casing. Rotate the armature slowly through at least one revolution; the lamp should remain illuminated. If the generator has an open-circuit the lamp will not illuminate.
2. Remove the earthed brush; if the test lamp remains illuminated, the generator has a short circuit to earth.
3. With both brushes removed, transfer the test lead from terminal 'D' to the commutator. If the lamp illuminates, a short circuit in the armature is indicated.
4. Check the field coil with an ohmmeter, or with a voltmeter and ammeter. This should indicate between 5.7 ohms and 6.3 ohms or approximately 2 amps at 12 Volts.

## Generator—To overhaul

1. Release the screw on the band cover and slide the cover clear of the brush apertures in the casing.
2. Check the brush spring tension. The tension should be between 510 g. and 850 g. (18 oz and 30 oz) both measurements being obtained radially to the commutator. (See Fig. M41).
3. Remove the brushes from their boxes and examine the commutator. Discolouration of the commutator may be removed by means of a clean lint-free cloth soaked in petrol or methylated spirits. If this is unsuccessful, insert a strip of fine glass paper through one of the apertures around the commutator and back through the same aperture. Hold the glass paper taut and rotate the commutator in its normal direction (clockwise, viewed from driving end). On no account clean an individual segment as this will produce 'flats' and induce burning when the generator is operating.
4. Remove all traces of abrasive dust.
5. Should the commutator be badly burned, worn or pitted, it should be skimmed on a lathe as described in Commutator - To skim.

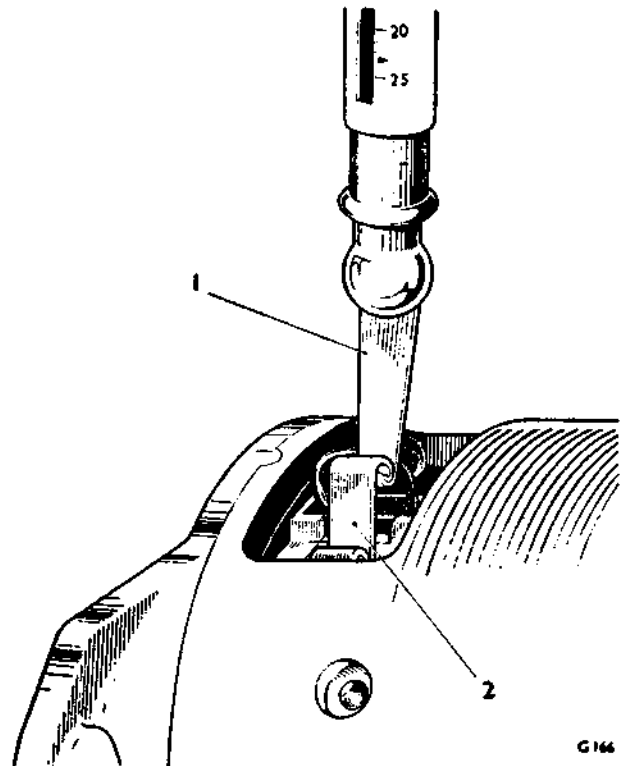


FIG. M41 CHECKING BRUSH SPRING TENSION

1 Spring balance      2 Brush spring

## Generator—To dismantle

(see Fig. M38)

1. Remove the nut and spring washer from the armature shaft.
2. Using the special extractor (RH 7098) withdraw the pulley from the shaft and remove the locating key from its keyway.
3. Unscrew and remove the two 'through' bolts from the casing.
4. Remove the commutator-end bracket from the generator casing.
5. Remove the drive-end bracket complete with armature from the casing.

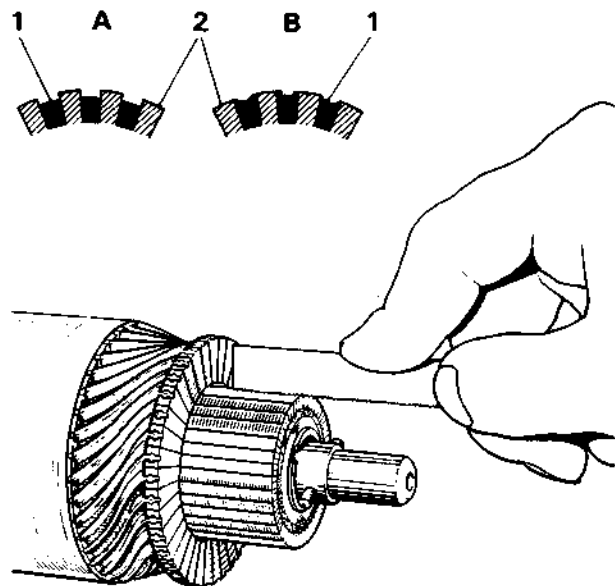


FIG. M42 METHOD OF UNDERCUTTING INSULATORS

1 Insulators      2 Segments  
A Correct method      B Incorrect method

## Commutator—To skim

1. Mount the armature in a lathe.
2. Rotate the armature at a high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary.
3. Remove the armature from the lathe. Under-cut the insulators between the segments to a depth of 0.79 mm. ( $\frac{1}{32}$  in.) using a hack-saw blade ground to the thickness of the insulator (see Fig. M42).
4. Polish the commutator with very fine glass paper.



## **Chapter M**

### **Field coils—To remove**

1. Remove the rivet securing the field coil terminal block to the generator casing.
2. Unsolder the field coil connections.
3. Remove the insulator which is provided to prevent the junction of the field coils from contacting the generator casing.
4. Mark the casing and pole shoes so that the latter can be fitted in their original positions.
5. Using a wheel operated screwdriver, unscrew the two pole shoe securing screws.
6. Draw the pole shoes and coils out of the casing; remove the coils from the pole shoes.

### **Field coils—To fit**

1. Fit the new field coils over the pole shoes and position inside the casing. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the casing.
2. Locate the pole shoes and field coils by lightly tightening the fixing screws. Using the wheel operated screwdriver, fully tighten the screws.
3. Fit the insulation piece between the field coil connections and the casing.
4. Solder the field connections to the field coil terminals block; rivet the terminal block to the generator casing.

### **Drive-end bearing—To remove**

1. Withdraw the screws securing the bearing retaining plate to the end bracket; remove the plate.
2. Press out the bearing.

### **Drive-end bearing—To fit**

1. Pack the new bearing with a high melting point grease.
2. Locate the bearing in the end-bracket housing and press into position.
3. Fit the bearing retaining plate and tighten the securing screws. Lock each screw by centre punching the screw end at three equally spaced points.

### **Commutator end bearing—To remove**

1. Remove the setscrew, tab-washer and retaining cup.
2. Withdraw the bearing from the armature shaft by means of a hand press or 'Claw' type extractor.

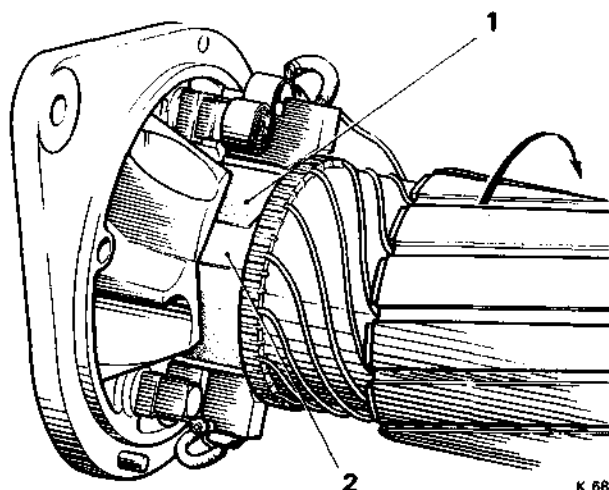
### **Commutator end bearing—To fit**

1. Pack the new bearing with high melting point grease.
2. Press the bearing into position on the shaft, pressure should only be exerted on the inner race of the bearing during this operation.
3. Fit a new tab-washer.

### **Brushes—To bed in**

If new brushes are to be fitted, it is important that the correct brush be used and that a minimum of 75 per cent bedding is obtained on the face with 100 per cent bedding on the trailing edge.

1. To bed-in the brushes, wrap a strip of fine glass paper around the commutator, allowing the two ends to meet. The glass paper should be the same width as the commutator and be positioned with the abrasive side facing outward. Secure the ends of the glass paper to the commutator so that the commutator is completely encircled (see Fig. M43).
2. Temporarily assemble the generator and secure the end covers with the two 'through' bolts.
3. Fit the new brushes and rotate the armature in its normal direction of rotation, until the whole face shows continuous bedding. Remove the brushes from their boxes and dismantle the generator.



**FIG. M43 BEDDING THE BRUSHES**

1 Glass paper     2 Adhesive tape

4. Remove the glass paper and clean away all abrasive dust and carbon.

5. Assemble the generator by reversing the procedure given for dismantling. Fit the brushes within their respective boxes to their original 'bedding-in' positions.

6. The generator should be 'motored' for fifteen minutes by connecting the positive terminal of a 12 Volt battery to the terminal marked 'D', the negative battery terminal to earth on the generator casing and the field terminal of the generator to a 6 Volt supply. This 'motoring' is essential to prevent any brush or commutator burning during service.

### Generator--To fit

Reverse the procedure given for removal, noting the following points.

1. Ensure that all the electrical contacts are clean and secure.

2. Fit the distance pieces in the correct position to maintain alignment between the engine and generator pulleys.

Misalignment will cause premature wear of the driving belts.

3. Check the tension of each driving belt as described in Chapter L - Cooling System.

### Generator Control Box Control box--To check

If the control box is suspected of being faulty, carry out the following tests and checks before fitting a replacement unit.

### General checks

Check if the battery is faulty by substituting a battery known to be in good condition or by using a hydrometer and a 150 amp heavy discharge tester.

1. Check the tension of the generator driving belts (see Chapter L - Cooling System).

2. Check the generator output as follows; disconnect the cables from the generator terminals, then, using a 'jumper lead', link the large generator terminal marked 'D' to the small terminal marked 'F'.

3. Connect a voltmeter between the link and earth, and run the generator up to approximately 1000 r.p.m.; if the voltmeter indicates a rising voltage then the generator is functioning correctly.

4. Examine the condition of the wiring in the charging circuit and carry out continuity tests between the generator, control box and ammeter.

5. Check all earth connections, including the control box.

### Contact points--To examine

1. Remove the two screws securing the control box cover in position; remove the cover.

2. Examine the contact points for oxidization, burning, pitting and poor surface finish. If any of these defects are found, the contacts should be cleaned as described in Contact points - To clean.

### Contact points--To clean

1. To clean the contacts of the voltage or current regulator, use a fine carborundum stone or silicon carbide paper followed by methylated spirits (denatured alcohol).

2. To clean the cut-out relay contacts, use a strip of fine glass paper; do not use a carborundum stone or emery cloth.

If the contacts are satisfactory, adjust the voltage regulator as described in Voltage regulator - To adjust.

### Voltage regulator--To adjust

Checking and adjusting should be completed as rapidly as possible to avoid errors due to heating of the operating coil.

1. Withdraw the cables from the control box terminal blades marked 'B'. Alternatively, insert a strip of paper between the cut-out contacts as shown in Figure M44.

2. Connect a first grade Zero to 20 Volt moving coil voltmeter between the control box terminal marked 'D' and a good earthing point.

**Note** A convenient method of making this connection is to withdraw the feed for the ignition warning lamp from control box terminal 'WL', then clip the voltmeter positive lead to the small terminal blade thus exposed; this blade being electrically common with terminal 'D'.

3. Start the engine and run the generator at 1500 r.p.m.

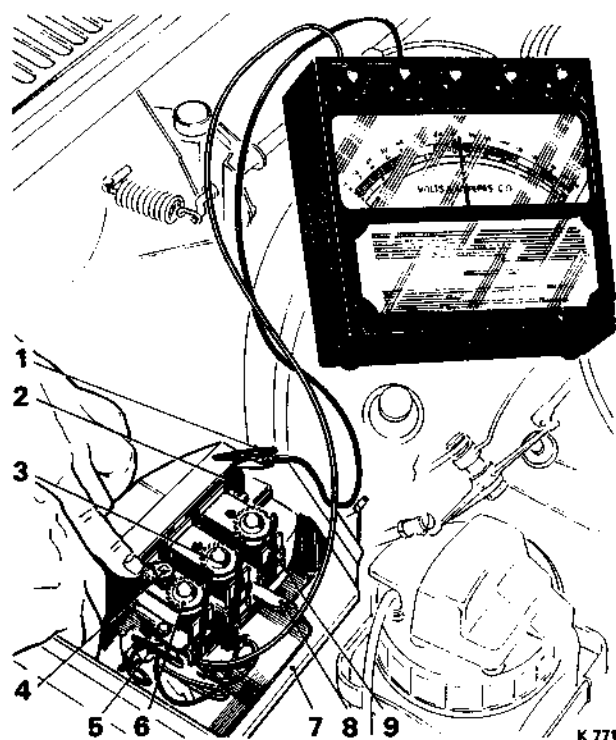
4. Observe the voltmeter pointer.

The voltmeter reading should be steady and read between the appropriate limits given in Chapter A - General Information, according to the ambient temperature. An unsteady reading may be due to dirty contacts. If the reading is steady but occurs outside the appropriate limits, an adjustment should be made as follows.

5. If the control box cover has not already been removed, stop the engine; remove the cover by removing the securing setscrews.

## Chapter M

6. Start the engine and run the generator at 1500 r.p.m.
7. Using 'Lucas' tool (543-817-42), turn the voltage adjustment cam until the correct setting is obtained (turning the tool clockwise raises the setting and turning the tool anti-clockwise lowers the setting).
8. Stop and then re-start the engine and repeat the test to check the regulator settings.
9. Fit the original connections and fit the control box cover.



**FIG. M44 CHECKING VOLTAGE REGULATOR SETTING**

- 1 Bulldog clip connected to earth
- 2 Control box
- 3 C.R. adjustment cam
- 4 Lucas setting tool
- 5 Bulldog clip to terminal 'D'
- 6 V.R. adjustment cam
- 7 Cover
- 8 Strip of paper inserted between cut-out relay contacts
- 9 Cut-out relay adjustment cam

### Current regulator—To adjust

The generator must be made to develop its maximum rated output, whatever the state of charge the battery might be at the time of setting. Therefore, in order to render the voltage regulator inoperative, a 'Bulldog' clip should be used to keep the voltage regulator contacts together.

1. Remove the control box cover.
2. Using a 'Bulldog' clip, short out the contacts of the voltage regulator (*see Fig. M45*).
3. Withdraw the cables from control box terminals 'B', then using a 'jumper lead', connect the cables to the positive side of a first grade Zero to 40 amp moving coil ammeter.
4. Connect the remaining ammeter cable to one of the control box terminal blades marked 'B'.

**Note** It is important to ensure that terminal 'B' carries only this one connection. All other load connections (including the ignition coil feed) must be made to the battery side of the ammeter.

5. Switch on all the lamps, blowers and rear window demister to ensure that the generator develops its full rated output.
6. Start the engine and run the generator at 4000 r.p.m. and observe the ammeter pointer.
7. The ammeter pointer should be steady and indicate a current of between 35 amps and 36 amps. An unsteady reading may be due to dirty contacts. If the reading is too high or too low, an adjustment must be made as follows.
8. Using the special 'Lucas' tool (543-817-42), turn the current adjustment cam until the correct setting is obtained (turning the tool clockwise raises the setting and turning the tool anti-clockwise lowers the setting).
9. Switch off the engine and fit the original connections, remove the bulldog clips.
10. Fit the control box cover.

### Cut-in/cut-out relay—To adjust

To avoid errors due to heating of the operating coil, the cut-in figures, given in Chapter A - General Information, should be checked and adjusted as quickly as possible.

1. Connect a first grade Zero to 20 Volt moving coil voltmeter between the control box terminal 'D' and a good earthing point. Refer to Voltage regulator - To adjust.
2. Switch on an electrical load, e.g. the headlamps.
3. Start the engine and slowly increase the speed and observe the voltmeter pointer.

4. The voltage should rise steadily and then drop slightly at the instant of contact closure. The cut-in voltage is the reading which is indicated immediately before the pointer drops back and should occur between the limits given in Chapter A - General Information. If the cut-in occurs outside the limits, an adjustment must be made. In this event reduce engine speed to below cut-in and proceed as follows.

5. Remove the control box cover by removing the securing screws.

6. Using the special 'Lucas' tool (543-817-42), turn the cut-out relay adjustment cam a small amount in the appropriate direction (turning the tool clockwise raises the setting and turning the tool anti-clockwise lowers the setting).

7. Repeat Operation 6 until the correct setting is obtained.

8. Switch off the engine, fit the original connections and the cover.

### Drop-off voltage—To adjust

1. Withdraw the cables from the control box terminal blades 'B'.

2. Connect the first grade Zero to 20 Volt moving coil voltmeter between the control box terminal marked 'B' and earth.

3. Start the engine and raise the speed to approximately 3000 r.p.m.

4. Slowly decelerate and observe the voltmeter pointer.

5. Opening of the contacts (indicated by the voltmeter pointer falling to Zero) should occur between the limits given in Chapter A - General Information. If the drop-off voltage occurs outside these limits an adjustment must be made as follows.

6. Stop the engine and remove the control box cover.

7. Adjust the drop-off voltage by carefully bending the fixed contact bracket (see Fig. M46). Reducing the contact gap will raise the drop-off voltage and increasing the gap will lower the drop-off voltage.

8. Repeat the test and if necessary, adjust until the correct drop-off setting is obtained.

**Note** This should result in a contact follow-through or blade deflection of between 0,25 mm. to 0,89 mm. (0.010 in. and 0.035 in.)

9. Fit the original connections and the cover.

### Air-gap settings—To adjust

Air gap settings are accurately adjusted during production of the control box and should require no further attention. If the original adjustments have been disturbed they should be set as follows.

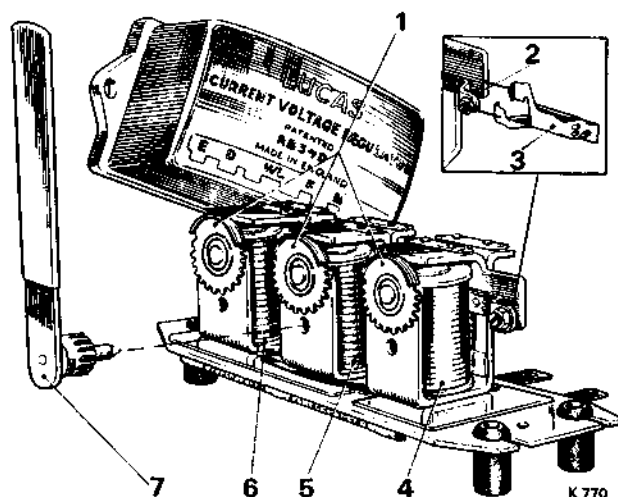


FIG. M45 ADJUSTING CURRENT REGULATOR

- |                                   |                              |
|-----------------------------------|------------------------------|
| 1 Adjustment cams                 | 2 Voltage regulator contacts |
| 3 'Bulldog' clip                  | 4 Voltage regulator          |
| 5 Current regulator               | 6 Cut-out relay              |
| 7 Setting tool (Lucas 543-817-42) |                              |

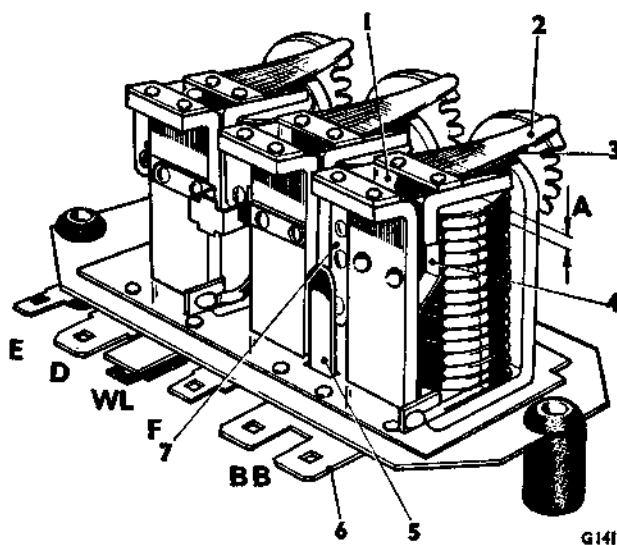


FIG. M46 CUT-OUT RELAY SETTINGS

- |                             |                        |
|-----------------------------|------------------------|
| 1 Phosphor bronze hinge pin | 2 Armature control pin |
| 3 Bi-metal backing spring   | 4 Armature back-stop   |
| 5 Fixed contact bracket     | 6 'B-B' terminal plate |
| 7 Moving contact blade      |                        |

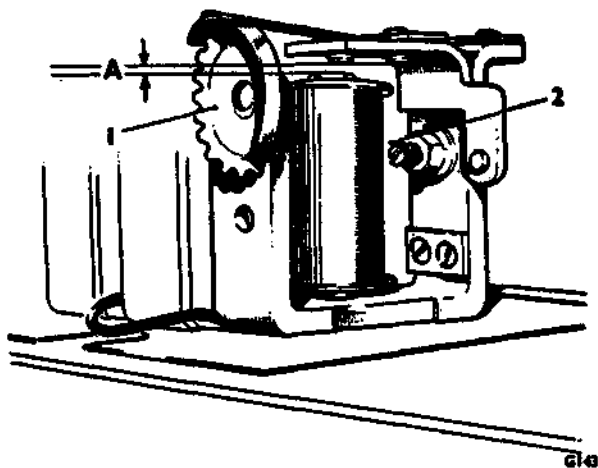
A Armature to bobbin core gap

F 'F' terminal

D 'D' terminal

W.L. Warning lamp terminal

**Chapter M**



**FIG. M47 VOLTAGE REGULATOR & CURRENT REGULATOR SETTINGS**

- 1 Cam
- 2 Contact
- A 1,32 mm. to 1,42 mm.  
(0.052 in. to 0.056 in.)

**Voltage and current regulator  
core gaps—To set**

1. Using the special 'Lucas' tool (549-817-42), turn the adjustment cam anti-clockwise to the point giving minimum lift to the armature tensioning spring.

2. Slacken the adjustable contact locking nut and screw back the adjustable contact.

3. Insert a 1,37 mm. (0.054 in.) feeler gauge between the armature and core face (*see Fig. M47*). The gauge should be inserted as far back as the two rivet heads on the underside of the armature.

4. Retain the gauge in position and press down squarely on the armature, screw in the adjustable contact until it touches the armature contact.

5. Tighten the locking nut and withdraw the gauge.

6. Re-set the voltage regulator and current regulator as described in Voltage regulator - To adjust and Current regulator - To adjust.

**Contact 'follow-through' and cut-out  
relay core gap settings**

1. As a first setting, insert a 0,38 mm. (0.015 in.) feeler gauge between the armature and the copper separation on the core face (*see Fig. M46*).

2. Adjust the fixed contact bracket so that the contacts just touch; remove the gauge.

3. Adjust the armature back stop to give a core gap of between 0,89 mm. to 1,14 mm. (0.035 in. and 0.045 in.).

4. Check the cut-in and drop-off voltage settings.

## Section M7

# EXTERIOR LIGHTING

### Headlamp bulb—To renew

1. Remove the fairing securing screw, raise the lower edge of the fairing and unhook it from the two upper retainers; remove the seal (see Fig. M48).
2. Press the lamp unit against the tension of the adjusting screw spring and turn anti-clockwise until the heads of the screws can pass through the enlarged ends of the slots in the mounting; remove the lamp unit.
3. Detach the terminal socket from the bulb, open the retaining spring clip and remove the bulb from the reflector.

When fitting a new bulb, ensure that the groove and tang of the reflector and bulb assembly respectively are aligned correctly.

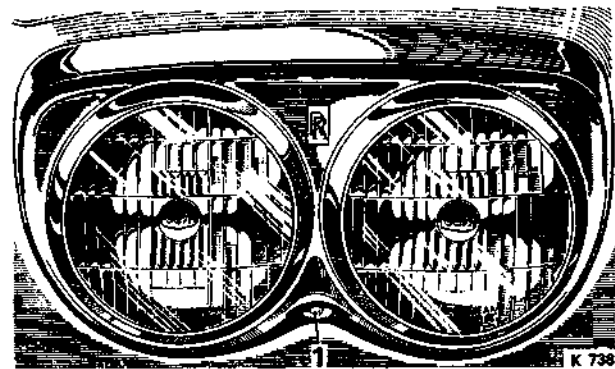


FIG. M48 HEADLAMP SECURING SCREW

1 Securing screw

### Sealed beam unit—To renew

1. Remove the fairing securing screw, raise the lower edge of the fairing and unhook it from the two upper retainers; remove the seal (see Fig. M49).
2. Unscrew but do not remove the three bezel retaining screws.
3. Press the lamp unit against the tension of the adjusting screw spring and turn anti-clockwise until the heads of the screws can pass through the enlarged ends of the slots in the bezel; remove the lamp unit. Before removing the bezel, hold the lamp with one hand to prevent it falling out of the back-shell.
4. For reference purposes, the outer lamp units have twin filaments, the inner lamp units have a single filament. (For correct lamp units refer to Section M19.)

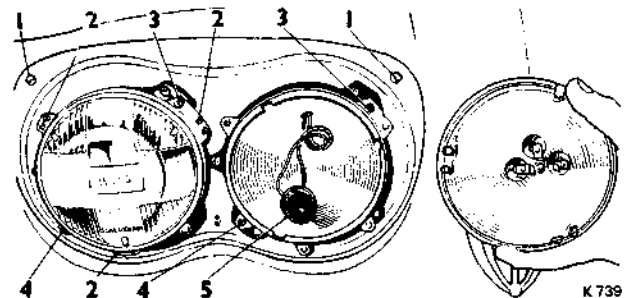


FIG. M49 ACCESS TO SEALED BEAM UNITS

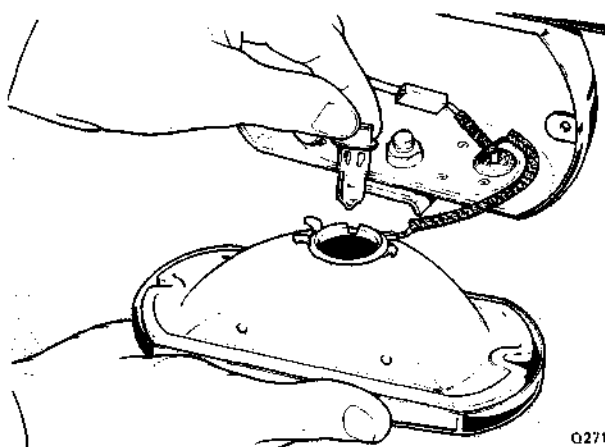
- 1 Location pegs
- 2 Securing screw
- 3 Vertical beam adjusting screw
- 4 Horizontal beam adjusting screw
- 5 Lamp socket

### Alignment and setting

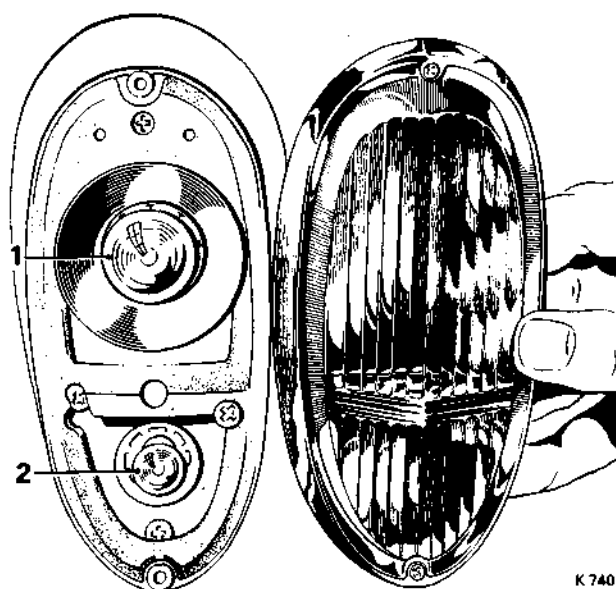
When the headlamp units have been disturbed the alignment of the headlamp beams should be checked and reset if necessary.

In order to obtain optimum results, it is recommended that the Lucas Beam Tester Mk III be used.

## Chapter M

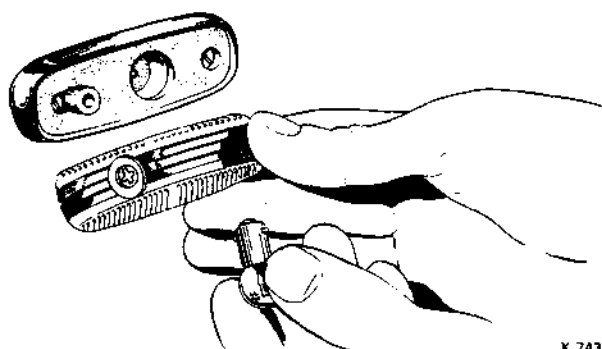


**FIG. M50 FRONT FOGLEAMPS**



**FIG. M51 ACCESS TO SIDE/DIRECTION INDICATOR BULBS**

1 Direction indicator bulb    2 Side lamp bulb



**FIG. M52 ACCESS TO DIRECTION INDICATOR REPEATER BULB**

### Headlamp—To adjust

Cars fitted with sealed beam units.

1. Drive the car onto a flat area, this need not be perfectly level, and ensure that the tyres are inflated to the correct pressures.
2. Remove the headlamp fairings as described in the Headlamp bulb - To renew; clean each lamp lens with a damp 'chamois' leather. Check that the lamps are operating satisfactorily on 'main' and 'dipped' beam, then switch the lamps off.
3. In order to obtain optimum results, it is recommended that the Lucas Beam Tester MKIII be used in accordance with the manufacturers instructions.
4. When the headlamps have been adjusted correctly, fit the headlamp seals and fairings ensuring that the seals do not foul the lamp fairings.

**The lamps illustrated in Figures M50, M53 and M56 apply to early cars.**

### Foglamp bulb—To remove (see Fig. M50)

1. Remove the protective cover and unscrew the two lens securing screws.
2. Withdraw the lens unit complete with the chrome surround and detach the Lucar connector.
3. Remove the spring retaining clip and withdraw the bulb, taking care not to touch the glass.

**Important** If the glass envelope is accidentally touched by hand it must be cleaned with surgical spirit before fitting.

### Front side/direction indicator bulbs —To remove

1. Remove the lens securing screw (see Fig. M52).
2. Remove the bulb.

### Direction indicator repeater lamp bulb—To remove

1. Remove the two lens securing screws (see Fig. M51).
2. Remove the bulb.

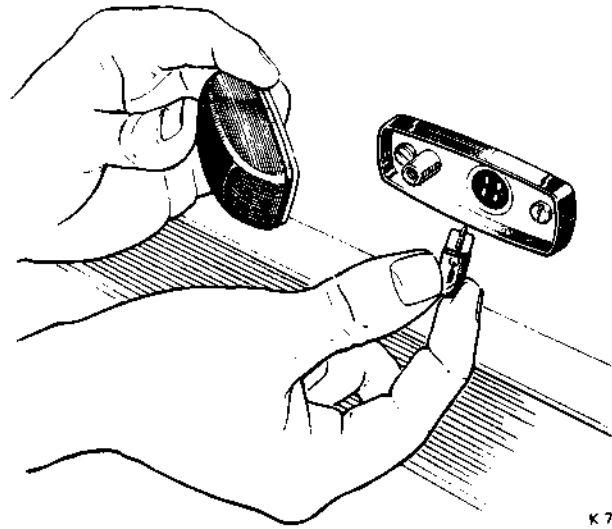
## Chapter M

**Side marker lamp bulb—To remove**

1. Remove the lens securing screw (see Fig. M53).
2. Pull out the capless bulb.

**Rear direction indicator, reversing and stop/tail lamp bulbs—To remove**

1. Remove the trim panels in the luggage compartment, which cover the rear of the lamps.
2. Withdraw the appropriate bulb socket; the bulb socket is held in position by a spring clip which is integral with the socket (see Fig. M54).



K 745

FIG. M53 ACCESS TO SIDE MARKER LAMP BULB

**Reversing lamp bulb—To remove**

Left-hand drive cars from Car Serial Number 6000 and right-hand drive cars from Car Serial Number 5000

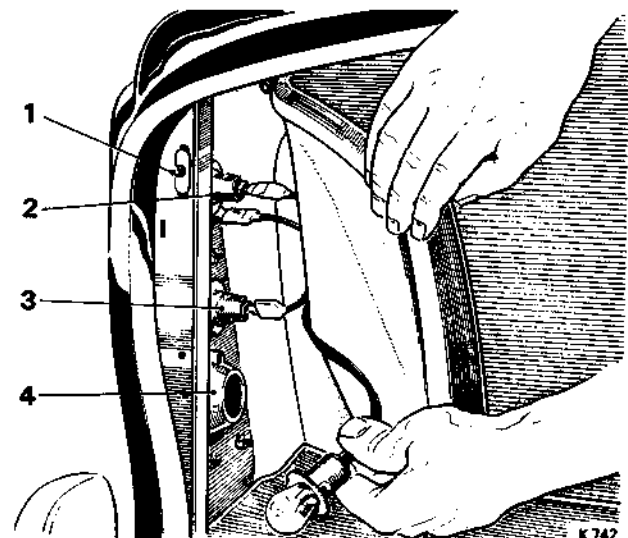
1. Remove the two lens retaining screws (see Fig. M55).
2. Remove the bulb.

**Number plate lamp bulb—To remove**

1. Remove the two lamp securing screws (see Fig. M56) and cover plate.
2. Peel back the rubber cover retaining the glass lens over the appropriate bulb, then remove the lens.
3. Remove the bulb.

**Bonnet lamp bulb—To remove**

1. Remove the two lens securing screws.
2. Remove the bulb.



K 742

FIG. M54 ACCESS TO REAR WING LAMP BULBS

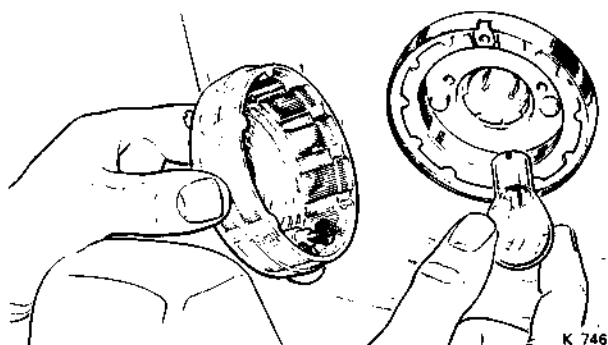
- 1 Trim fastener
- 2 Direction indicator lamp
- 3 Reversing lamp bulb
- 4 Stop/tail lamp bulb

**Luggage compartment lamp bulb—To remove**

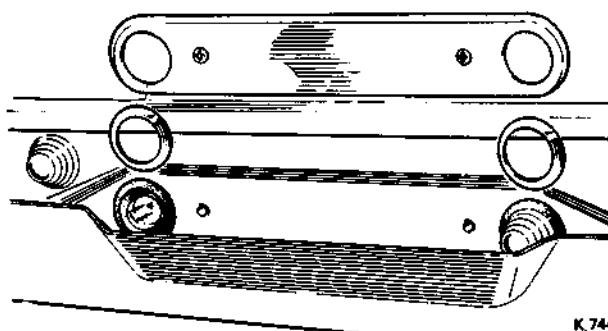
1. Remove the two lens and finisher securing screws.
2. Remove the bulb.



**Chapter M**



**FIG. M55 ACCESS TO REVERSING LAMP BULB**



**FIG. M56 ACCESS TO NUMBER PLATE  
LAMP BULBS**

## Section M8

INSTRUMENTS, INTERIOR LIGHTING  
AND ACCESSORIES**Fuel/oil level indicator**

The fuel level indicator is controlled by a float operated rheostat unit in the fuel tank.

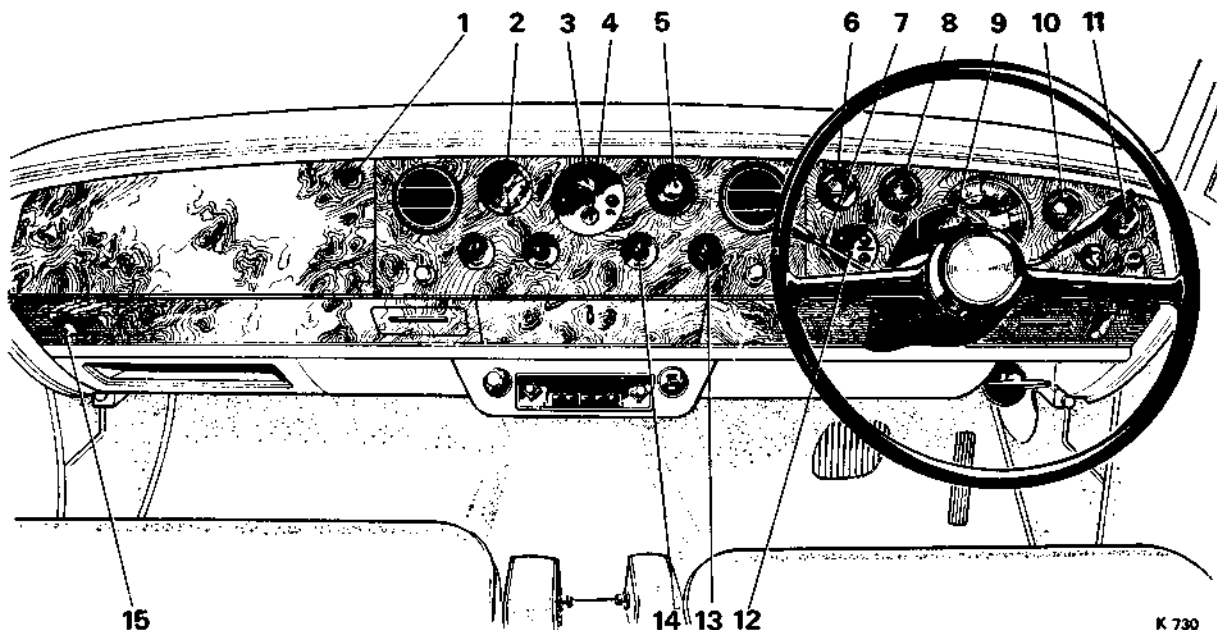
Faulty operation of the indicator may be due to insecure wiring or connections. If the instrument constantly indicates 'EMPTY', check the wiring and connections of the feed wires. If the instrument constantly reads 'FULL' check the earth connections to the indicator body, the fuel/oil change-over switch connections and the wiring of the fuel tank unit. Check the earthing of the fuel tank.

Inaccurate readings are usually caused by a distorted float arm on the rheostat unit. Take care not to foul the baffles in the fuel tank when fitting a new rheostat unit.

**Fuel/oil level indicator—To remove**

Right-hand drive cars prior to Car Serial Number 6791

1. Remove the fuel/oil level change-over switch button.
2. Disconnect the battery.
3. Remove the small panel surrounding the handbrake.



K 730

**FIG. M57 SWITCHES & INSTRUMENTS, RIGHT-HAND DRIVE CARS**

- |                          |                                |                                    |
|--------------------------|--------------------------------|------------------------------------|
| 1 Facia compartment lock | 6 Fuel level indicator         | 11 Ammeter                         |
| 2 Clock                  | 7 Indicator switch             | 12 Main warning lamp panel         |
| 3 Switchbox              | 8 Coolant indicator            | 13 Windscreen wiper/washer switch  |
| 4 Ignition switch        | 9 Gear range selector quadrant | 14 Instruments illumination switch |
| 5 Cigar lighter          | 10 Oil pressure/indicator      | 15 Roof lamps switch               |

## **Chapter M**

4. Release the nut and bolt securing the end of the top roll.
5. Remove the fresh air circular control knob grub screws, then remove the centre and right-hand facia panels, taking care not to damage the wood finish.
6. Unscrew and remove the two screws securing the indicator to the facia.
7. Disconnect the cables from the terminals on the rear of the indicator and withdraw the indicator.

### **Fuel/oil level indicator—To remove**

**Left-hand drive cars prior to Car Serial Number 6000**

1. Remove the fuel/oil level change-over switch button.
2. Disconnect the battery.
3. Remove the small panel surrounding the hand-brake.
4. Release the nut and bolt retaining the end of the top roll.
5. Unscrew and remove the two circular fresh air outlet control knob grub screws, then remove the centre and left-hand facia panels, taking care not to mark the wood.
6. Unscrew and remove the two screws securing the indicator to the facia.
7. Disconnect the cables and withdraw the indicator.

### **Fuel/oil level indicator—To remove**

**Left-hand drive cars from Car Serial Number 6000**

1. Gently prise away the left-hand knee trim pad, which is retained by upholstery clips, taking care not to damage the trim.
2. Disconnect the battery.
3. Unscrew and remove the circular fresh air outlet knob grub screws, then remove the knobs.
4. Remove the gear range selector cowl trim finisher.
5. Remove the centre and left-hand facia panels.
6. Unscrew and remove the two screws securing the indicator to the facia.
7. Disconnect the cables from the terminals on the rear of the indicator, and withdraw the indicator.

### **Fuel/oil level indicator—To remove**

**Right-hand drive cars from Car Serial Number 6791**

1. Gently prise away from the facia, the right-hand knee trim pad, which is retained by upholstery clips, taking care not to damage the trim.
2. Disconnect the battery.
3. Unscrew and remove the circular fresh air outlet knob grub screws; then remove the knobs.
4. Remove the gear selector cowl trim finisher.
5. Remove the centre and right-hand facia panels.

6. Unscrew and remove the two screws securing the indicator to the facia.
7. Disconnect the cables from the terminals on the rear of the indicator; withdraw the indicator.

### **Fuel/oil level indicator—To fit**

**All cars**

Reverse the procedure given for removal.

### **Coolant temperature indicator**

No attempt should be made to carry out repairs on the coolant temperature system; any faults should be rectified by renewing faulty units. Any electrical overload is likely to render the indicator inaccurate, and if any errors in the readings still exist after changing the coolant probe, then the indicator should also be renewed.

### **Coolant temperature indicator—To remove**

**Right-hand drive cars prior to Car Serial Number 6791**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator - To remove.

### **Coolant temperature indicator—To remove**

**Left-hand drive cars prior to Car Serial Number 6000**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator - To remove; noting the following point, remove the left-hand facia board.

### **Coolant temperature indicator—To remove**

**Left-hand drive cars from Car Serial Number 6000**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator - To remove (Cars from Car Serial Number 6000).

### **Coolant temperature indicator—To remove**

**Right-hand drive cars from Car Serial Number 6791**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator - To remove (Cars from Car Serial Number 6791).

### **Coolant temperature indicator—To fit**

**All cars**

Reverse the procedure given for removal.

**Oil pressure indicator**

No attempt should be made to carry out repairs on the oil pressure indicator system; repairs should be carried out only by renewing the faulty units.

To obtain an accurate oil pressure reading it is essential that the oil pressure transmitter is correctly assembled to the crankcase oil filter adaptor. The transmitter should be fitted so that the raised portion of the cover is toward the top, and within 60° either side of the vertical datum. Correct fitting of the transmitter can be attained by fitting additional copper washers to the threaded union; a maximum of two washers is permissible.

**Oil pressure indicator—To remove**

**Right-hand drive cars prior to Car Serial Number 6791**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator - To remove.

**Oil pressure indicator—To remove**

**Left-hand drive cars prior to Car Serial Number 6000**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator - To remove; noting the following point, remove the left-hand facia panel.

**Oil pressure indicator—To fit**

**All cars**

Reverse the procedure given for removal.

**Switch box—To remove**

**Right-hand drive cars prior to Car Serial Number 6791**

Complete Operations 1 to 5 as for Fuel/Oil Level Indicator - To remove, noting the following points.

1. Unscrew and remove the four switch box securing screws.
2. Disconnect the cables from the rear of the switch box.
3. Withdraw the switch box.

**Left-hand drive cars from Car Serial Number 6000**

Complete Operations 1 to 5 as for Fuel/Oil Level Indicator - To remove (Cars prior to Car Serial Number 6000), noting the following points.

1. Unscrew and remove the four switch box securing screws.
2. Disconnect the cables from the rear of the switch box.
3. Withdraw the switch box.

**Switch box—To remove**

**Left-hand drive cars from Car Serial Number 6000**

Complete Operations 1 to 5 as for Fuel/Oil Level

Indicator - To remove (Left-hand drive cars from Car Serial Number 6000), noting the following points.

1. Unscrew and remove the four switch box securing screws.
2. Disconnect the cables from the rear of the switch box.
3. Withdraw the switch box.

**Switch box—To remove**

**Right-hand drive cars from Car Serial Number 6791**

Complete Operations 1 to 5 as for Fuel/Oil Level Indicator - To remove (Right-hand drive cars from Car Serial Number 6791), noting the following points.

1. Unscrew and remove the four switch box securing screws.
2. Disconnect the cables from the rear of the switch box.
3. Withdraw the switch box.

**Switch box—To fit**

**All cars**

Reverse the procedure given for removal.

**Direction indicator lever—To remove**

1. Disconnect the battery.
2. Remove the four screws securing the two halves of the steering column cowl and carefully remove the two halves, taking care not to twist or force them apart.
3. Remove the two  $\frac{7}{16}$  in. A.F. bolts securing the gear range selector switch to the steering column.
4. Unscrew and remove the two socket-headed screws.
5. Withdraw the direction indicator toe-board connection.

**Note** On cars assembled from Car Serial Number SRX 6000 and Car Serial Number SBH 6791, the steering column cowl trim finisher must be removed.

**Direction indicator lever—To fit**

Reverse the procedure given for removal.

The indicators flash at approximately 90 times per minute and are controlled by an indicator (flasher) unit.

If one of the indicator (flasher) bulbs fail, the warning lamp on the Speedometer face will illuminate only once, then remain extinguished.

**Speedometer—To remove**

Complete Operations 1 to 5 as for Fuel/Oil Level Indicator - To remove, noting the following points.

## **Chapter M**

1. Remove the four screws securing the speedometer to the facia.
2. Disconnect the cables, speedometer drive cable, trip cable and warning lamps from the rear of the speedometer; withdraw the speedometer.

### **Speedometer—To fit**

Reverse the procedure given for removal, noting the following point.

1. Ensure that the correct type of speedometer is fitted.

### **Ammeter—To remove**

**Right-hand drive cars prior to Car Serial Number 6791**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator • To remove (Right-hand drive cars).

### **Ammeter—To remove**

**Left-hand drive cars prior to Car Serial Number 6000**

Complete Operations 1 to 7 as for Fuel/Oil Level Indicator • To remove (Left-hand drive cars prior to Car Serial Number 6000), noting the following point.

1. Remove the left-hand facia panel.

### **Ammeter—To fit**

Reverse the procedure given for removal.

### **Speedometer drive cable—To remove**

**Right-hand drive cars with torque converter transmission**

1. Place the car over a pit or ramp, apply the handbrake and chock the rear wheels.
2. Disconnect the battery.
3. Remove the top roll as described in Chapter 5 Body.
4. Remove the speedometer as described in Speedometer • To remove.
5. Disconnect the speedometer cable at the transmission end.
6. Remove the clips securing the speedometer cable to the transmission heat-exchanger pipes.
7. Remove the right-hand heater blower motor to heater box duct.
8. Remove the clip retaining the speedometer cable to the body side member.
9. Carefully remove the two large rubber grommets where the speedometer cable passes through the bulkhead.
10. Withdraw and remove the speedometer cable.

### **Speedometer drive cable—To remove**

**Left-hand drive cars with torque converter transmission**

Carry out Operations 1 to 10 for Speedometer drive cable • To remove (Right-hand drive cars with Torque Converter Transmission), noting the following points.

1. Remove the left-hand blower to heater box duct.
2. Remove the 2 B.A. nut and bolt securing the speedometer cable to the accelerator cross-shaft.
3. Remove the clip securing the speedometer drive cable to the brake actuator undersheet.

### **Speedometer drive cable—To remove**

**Cars fitted with four-speed automatic gearbox**

Carry out Operations 1 to 10 as for Speedometer drive cable • To remove (Right-hand drive cars with Torque Converter Transmission), noting the following points.

1. Remove the two clips securing the speedometer drive cable to the body underframe.

### **Speedometer drive cable—To fit**

Reverse the appropriate procedure given for removal, noting the following point.

1. Fit the clips to the cable, ensuring they are fitted in the position denoted by white plastic tape or, in the case of left-hand drive cars, blue plastic tape.

### **Fuel filler door solenoid—To remove (see Fig. M58)**

1. Disconnect the battery.
2. Unclip and remove the trim panel on the right-hand side of the boot.
3. Disconnect the two cables from the solenoid.
4. Open the petrol filler door and remove the split cotter pin and the 2 B.A. locking nut and bolt on the electrically operated catch.
5. Remove the three 2 B.A. nuts and washers, then remove the switch.

### **Fuel filler door solenoid—To fit**

Reverse the procedure given for removal, noting the following point.

1. Do not fully tighten the 2 B.A. locking nut and bolt, until the fuel filler door closes correctly.

### **Clocks—To remove**

1. Disconnect the battery.
2. Remove the small panel surrounding the handbrake.
3. Release the nut and bolt securing the end of the top roll.

4. Remove the two circular fresh air outlet control knob grub screws; remove the centre facia board.
5. Unscrew and remove the two screws securing the clock to the facia.
6. Disconnect the cables from the terminals on the rear of the clock; withdraw the clock.

### Bulb renewal—Instrument and warning lamp

1. Disconnect the battery.
2. Remove the appropriate indicator (gauge).
3. Withdraw the bulb holder and renew the faulty bulb.

### Gear range indicator illumination bulb—To renew

1. Disconnect the battery.
2. Remove the upper section of the cowl by releasing the four screws in the lower section of the cowl; slacken the screws securing the lower half, which are the longer of the screws; carefully lift off the upper section.

**Note** On left-hand drive cars from Car Serial Number 6000 the steering column cowl trim finisher must be removed.

3. Remove the screw at each end of the indicator scale, then remove the scale and filter, taking care not to damage the indicator needle.
4. Move the gear range selector switch so that the needle is at either of the two extremities. Remove the two screws securing the bulb holder bracket. The bulb can then be removed from its holder.

### Facia compartment illumination—Bulb renewal

1. Disconnect the battery.
2. Unscrew and remove the screw at each end of the lens; then withdraw the lens.
3. Remove the festoon bulb.

### Ignition switch illumination—Bulb renewal

Cars prior to Car Serial Number 6000

1. Disconnect the battery.
2. Unscrew and remove the two screws securing the green lens beneath the extended edge of the top roll; remove the lens.
3. Slide the bulb holder to the left until it is possible to withdraw the bulb holder through the aperture and unscrew the bulb.

### Interior lamp bulb—To renew

1. Disconnect the battery.
2. Remove the lamp bezel together with the lens; the unit is held in position with two spring clips.
3. Remove the bulb.

### Rear armrest lamp bulb—To renew

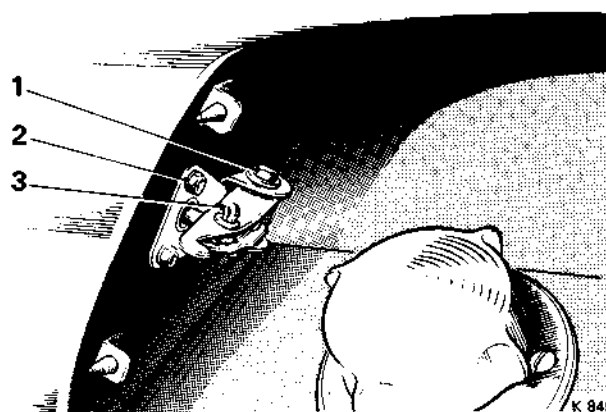
Left and right-hand drive cars prior to Car Serial Number 6000 & 6791 respectively

1. Disconnect the battery.
2. Unscrew and remove the two screws securing the lens beneath the arm rest.
3. Remove the festoon bulb.

### Rear armrest lamp bulb—To renew

Left and right-hand drive cars from Car Serial Numbers 6000 & 6791

1. Disconnect the battery.
2. Gently pull the capless bulb, situated beneath the rear arm rest, from its holder.



**FIG. M58 ELECTRICALLY OPERATED FUEL FILLER DOOR**

- 1 Pivot bolt
- 2 Securing nuts
- 3 Cotter pin

## Section M9

# INTERIOR SWITCHES

When a switch is suspected of being faulty, it must be replaced with a new unit.

**All left and right-hand drive cars prior to Car Serial Numbers 6000 and 6791**

### (Radio balance control - To remove)

1. Disconnect the battery.
2. Pull off the knob.
3. Remove the securing nut and shakeproof washer.
4. Remove the two knobs, securing screws and the receiver facia finishers.
5. Unscrew and remove the two screws securing the receiver trim to the under-facia, lower the trim at the rear, then simultaneously withdraw the front of the trim until it is clear of the receiver spindles.
6. Disconnect the cables from the switch, noting the cable colours to facilitate fitting

### Windscreen wiper/washer switch—To remove

1. Disconnect the battery.
2. Remove the two circular air outlet control knobs, by removing the grub screw on the underside of each knob.
3. Remove the fuel/oil level test switch button by pulling outwards.
4. Remove the screws securing the outer and centre facia panels.
5. Insert a thin probe into the underside of the knob shank to release the tensioned retainer; pull off the knob.
6. Remove the facia panels.
7. Remove the four screws securing the picture plate and switch mounting plate.
8. Remove the picture plate, and carefully withdraw the switch and mounting plate forwards.
9. Unscrew and remove the hexagon headed extension nut and remove the cables from the switch, taking note of the colours to facilitate fitting.
10. Remove the switch.

### Instrument illumination switch—To remove

Proceed as for Windscreen wiper/washer switch - To remove.

### Air conditioning switches—To remove

1. Disconnect the battery.
2. Remove the two circular air outlet control knobs by removing the grub screw on the underside of each knob.
3. Carefully remove the fuel/oil level test switch knob by pulling outwards.
4. Unscrew and remove the screws retaining the outer and centre facia panels, then remove the panels.
5. Insert a thin probe into the underside of the knob shank to release the tensioned retainer, then pull off each knob.
6. Unscrew and remove the four screws securing the picture plate and switch mounting plate.
7. Remove the picture plate and carefully withdraw the switch mounting plate and switches forward.
8. Unscrew and remove the six small screws from the switch mounting plate, then remove the two socket connections from the rear of the switches.
9. Remove the switches.

### Heating and demisting switches—To remove

Proceed as for Air conditioning unit switches - To remove.

### Fuel/oil level and warning lamp test switch—To remove

1. Disconnect the battery.
2. Remove the fuel/oil level and warning lamp test switch button by pulling outwards.
3. Remove the outer facia panel by removing the two securing screws.

## **Chapter M**

4. Unscrew and remove the two screws securing the switch and switch mounting plate to the facia.

5. Disconnect the cables from the rear of the switch, noting the colours to facilitate fitting.

6. Remove the hexagon headed nut and shake-proof washer from the mounting plate and remove the switch.

### **Petrol filler door switch—To remove**

1. Disconnect the battery.
2. Unscrew anti-clockwise the switch securing ring; remove the ring.
3. Push through the switch and disconnect the wiring.
4. Remove the switch.

### **Parking lamp switch—To remove**

1. Disconnect the battery.
2. Carefully remove the fuel/oil level and warning lamp test switch button by pulling outwards.
3. Unscrew and remove the two securing screws from the outer facia panel; remove the facia panel.
4. Remove the three screws securing the picture plate and switch mounting plate to the facia.
5. Disconnect the cables from the rear of the switch, noting the colours to facilitate fitting.
6. Remove the hexagon headed nut and shake-proof washer from the mounting plate and remove the switch.

### **Blower motor switch and passengers roof lamp switches—To remove**

1. Disconnect the battery.
2. Unscrew and remove the four locating screws securing the handbrake handle surround trim.
3. Remove the radio receiver trim and receiver as described in Section M15 of this Chapter.
4. Remove the top roll as described in Chapter S - Body.
5. Unscrew and remove the two socket-headed screws from the steering column clamp, and ease the column away from the facia.
6. Disconnect the main wiring at the rear of the facia, taking note of the colours to facilitate assembly.
7. Unscrew and remove the eight setscrews securing the facia/instrument panel.

One setscrew is situated adjacent to where the steering column clamp bracket fits and secures the instrument board to the mounting bracket. Another setscrew is located opposite the previous one described.

Two setscrews are located at each lower end of the instrument board, the remaining four setscrews are located on the top face of the instrument board and screw into the left-hand and right-hand mounting brackets.

8. Withdraw the facia/instrument board rearwards and disconnect the appropriate switch electrical connections.

9. Unscrew and remove the four screws securing the switch mounting plate to the instrument board; turn the switch through 90° and withdraw from the rear of the instrument board.

### **Rear window demister switch —To remove**

1. Disconnect the battery.
2. Remove the four locating screws securing the handbrake handle surround trim.
3. Working from the rear of the facia, remove the four switch mounting plate securing screws.
4. Disconnect the electrical connections, noting the colours to facilitate assembly.
5. Rotate the switch through 90° and remove.

### **Hazard warning switch—To remove**

1. Disconnect the battery.
2. Remove by rotating in an anti-clockwise direction the knob and securing ring.
3. Withdraw the trim rearwards.
4. Remove the four switch mounting panel securing screws.
5. Disconnect the electrical connections, noting the colours to facilitate assembly; remove the switch.

### **Dipswitch—To remove**

1. Disconnect the battery.
2. Pull off the rubber shoe protector.
3. Remove the carpet.
4. Remove the two 'Philips' switch securing screws.
5. Disconnect the electrical connections, noting the colours to facilitate assembly; remove the switch.

**Left and right-hand drive cars from  
Car Serial Numbers 6000 and 6791**

### **Radio balance control switch —To remove**

1. Disconnect the battery.
2. Remove the top roll as described in Chapter S - Body.



## Chapter M

3. Unscrew and remove the circular fresh air outlet knob grub screws; remove the knobs
4. Remove the gear range selector cowl trim finisher
5. Remove the centre and left-hand or right-hand facia panels.
6. Unscrew and remove the four screws securing the picture plate and switch mounting plate.
7. Pull off the knob.
8. Remove the switch securing nut and shakeproof washer.
9. Disconnect the electrical connections, noting the colours to facilitate assembly.
10. Remove the switch.

### Windscreen wiper/washer switch —To remove

Proceed as for Radio balance control switch - To remove, noting the following point.

1. Insert a thin probe into the underside of the knob shank to release the tensioned retainer; pull off the knob.

### Instrument illumination switch —To remove

Proceed as for Radio balance control switch - To remove, noting the following point.

1. Insert a thin probe into the underside of the knob shank to release the tensioned retainer; pull off the knob.

### Air conditioning switches—To remove

1. Disconnect the battery.
2. Carefully prise away from the centre console with a flat tool the triangular trim pads situated one on each side of the centre console.
3. Unscrew and remove the screws securing the wooden facia panel to the console and slide the facia until it clears the retaining clip at the base; remove the facia.
4. Insert a thin probe into the underside of the knob shank to release the tensioned retainer; pull off the knobs.
5. Disconnect the electrical connections
6. Remove the four switch mounting plate screws and washers.
7. Carefully manoeuvre the switch out of the console

### Heating and demisting switches —To remove

Proceed as for Air conditioning unit switches - To remove.

### Fuel/oil level and warning lamp switches—To remove

1. Disconnect the battery
2. Remove the steering column cowl finisher.
3. Remove the switch button by pulling rearwards.
4. Unscrew and remove the outer facia panel securing screws; remove the facia panel
5. Unscrew and remove the two switch mounting plate retaining screws.
6. Disconnect the electrical connections, noting the colours to facilitate fitting
7. Remove the switch mounting plate by removing the hexagon headed nut; remove the switch and spacer

### Petrol filler door switch—To remove

1. Disconnect the battery.
2. Remove the steering column cowl finisher.
3. Remove the outer facia panel.
4. Remove the switchbox as described in Section M8 - Instruments.
5. Unscrew and remove the switch circular securing nut.
6. Disconnect the electrical connections, noting the colours to facilitate fitting.
7. Remove the switch.

### Parking lamp switch—To remove

1. Disconnect the battery.
2. Using a suitably cranked probe, press in the tensioned knob retainer, simultaneously pull off the knob.
3. Unscrew and remove the two screws securing the escutcheon; remove the escutcheon.
4. Remove the handbrake handle trim panel.
5. Disconnect the electrical connections, noting the colours to facilitate fitting.
6. Remove the hexagon headed nut; remove the switch.

### Heater blower switch—To remove

1. Disconnect the battery
2. Carefully prise away from the centre console with a flat tool, the two triangular trim pads situated one each side of the centre console.
3. Unscrew and remove the screws securing the wooden facia to the console and slide the facia until it clears the retaining clip at the base; remove the facia
4. Disconnect the electrical connections, noting the colours to facilitate fitting

## **Chapter M**

5. Unscrew and remove the three screws retaining the switch to the console.
6. Rotate the switch through 90° and withdraw from the rear of the console.

### **Hazard warning lamp switch—To remove**

1. Disconnect the battery.
2. Using a flat tool, carefully prise away from the centre console the triangular trim pads situated one each side of the centre console.
3. Unscrew and remove the screws securing the wooden fascia to the console and slide the fascia until it clears the retaining clip at the base; remove the fascia.
4. Disconnect the electrical connections, noting the colours to facilitate fitting.
5. Unscrew anti-clockwise the switch knob, then remove the bulb.
6. Using a suitable tool, remove the circular switch securing nut.
7. Remove the switch.

### **Rear window demister switch—To remove**

1. Disconnect the battery.
2. Using a flat tool carefully prise away from the centre console the two triangular trim pads situated one each side of the centre console.

3. Unscrew and remove the screws securing the wooden fascia to the console, and slide the fascia until it clears the retaining clip at the base, then remove the fascia.

4. Disconnect the electrical connections, noting the colours to facilitate fitting.
5. Using a suitable tool remove the circular switch securing nut; remove the switch.

### **Rear interior lamps switch—To remove**

1. Disconnect the battery.
2. Using a flat tool, carefully remove the vanity mirror and veneered surround.
3. Separate the electrical connections, noting the colours to facilitate fitting.
4. Unscrew and remove the four screws securing the switch mounting plate to the rear of the mirror veneered surround.
5. Remove the hexagon headed nut securing the switch to the switch mounting plate.

**Note** On cars from Car Serial Number 6000 a circular securing nut is used as opposed to a hexagon headed nut.

6. Remove the switch.

## Section M10

# RELAYS

The relay box, mounted to the bulkhead in the engine compartment, contains a printed circuit base to accommodate 'Lucas' Type 6RA relays.

Details of these relays, and others used on the car are given in the Data Table at the end of this section.

The relays connect through a printed circuit to loom sockets on the underside of the relay box. There are also relays fitted behind the front cover of the relay box (see Fig. M59).

### Cars not fitted with refrigeration

There are four vacant relay positions on the printed circuit base (three for cars fitted with refrigeration, and one for cars fitted with headlamp dimming).

The relay box also houses a 'Lucas' RB340 current/voltage regulator, and a regulator condenser used to reduce radio interference.

The relay box contains the following relays.

#### On the main printed circuit base

On the main printed circuit base:

- Headlamp flashing relay
- Horn relay
- Headlamp safety relay
- Water tap relay
- Interior lamps relay
- Height control relay
- Headlamp dimming relay (fitted to certain early cars)

#### Behind the front cover

- Coolant probe relay
- Ignition warning lamp/Choke relay (except cars fitted with C.A.V. alternators)
- Brake pressure (accumulator) relay
- Head flick relay (not fitted to cars destined for U.S.A. and Canada)

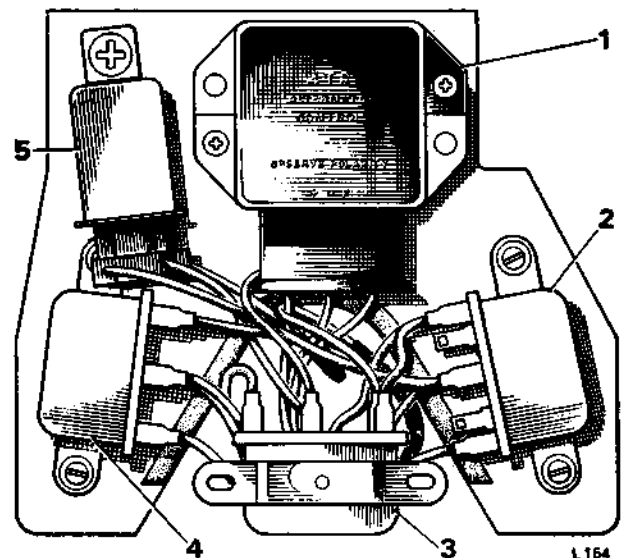
### Cars fitted with refrigeration

An alternator replaces the generator. The relay box houses a 4TR control box (for 'Lucas' 11AC alternator) and a warning lamp control unit. On later cars a C.A.V. 440 control box is used (for C.A.V. 512 alternator).

The relay box contains the following relays.

On the main printed circuit base:

- Headlamp flick relay (not fitted to cars destined for U.S.A. and Canada)
- Horn relay
- Headlamp safety relay

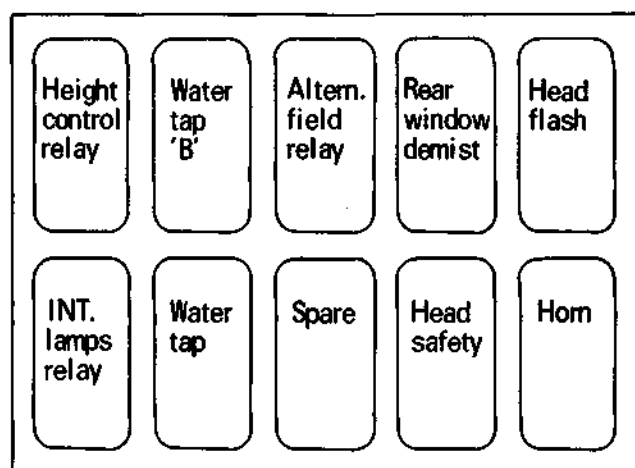


**FIG. M59 RELAY BOX (REFRIGERATED CARS)**

- 1 4TR alternator control unit
- 2 Brake pressure (accumulator) relay
- 3 Coolant probe relay
- 4 Ignition warning lamp/choke relay
- 5 3AW alternator warning lamp control unit

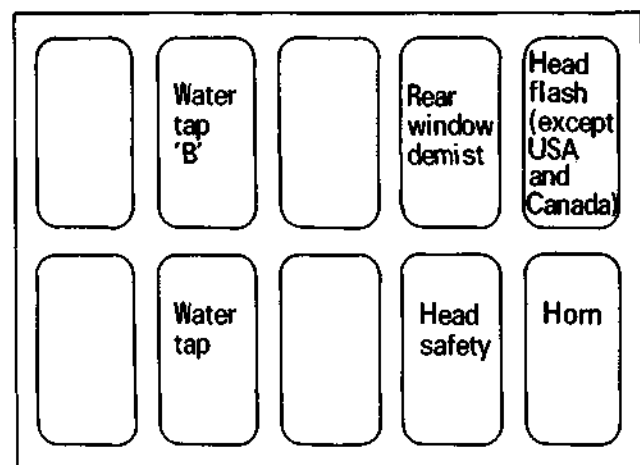
# Chapter M

Water tap relay  
 Interior lamps relay  
 Height control relay  
 Additional water tap relay  
 Alternator field relay (except on cars fitted with C.A.V. alternators)  
 Rear window demister relay  
 Headlamp dimming relay (fitted to certain early cars)



**FIG. M60 EARLY REFRIGERATED CARS**

The spare relay position was used for the headlamp dimmer relay on some early cars.



**FIG. M60 LATER CARS**

On later cars the relay printed circuit contains the following relays:

Headlamp flasher relay (not fitted to cars destined for U.S.A. and Canada)  
 Horn relay  
 Headlamp safety relay  
 Water tap relay  
 Additional water tap relay  
 Rear window demist relay

Also fitted within the relay box is a choke thermal delay switch and a regulator capacitor.

An alternator regulator is fitted behind the front cover.

## Note

To ascertain if a relay is fitted into a particular circuit and if so, what type, reference should be made to the appropriate theoretical wiring diagram.

## Relays—To renew

1. Disconnect the battery.
2. Access to relays situated behind the front cover of the relay box is by removing the four hexagon-headed screws, then drawing forward the cover.

**Note** The coolant probe and head flick relays are secured to the cover, therefore it is essential that no attempt be made to remove the cover completely until the 'Lucar' connectors have been disconnected from the relay terminals.

## Head flick and coolant probe relays

Disconnect the 'Lucar' connectors from the relay terminals, then remove the nuts and bolts securing the relay to the box cover.

Fit a new relay ensuring that it is fitted correctly and that each cable is fitted to the correct terminal.

## Brake pressure (accumulator) relay

Remove the relay in a similar manner used for the previous relay

## Ignition warning lamp—Choke relay (if fitted)

The relay is renewed in a similar manner to that described for the previous relay.

### Relay box—To remove

1. To remove the relay box in order to renew one or more relays, proceed as follows
2. Disconnect the battery.
3. Remove the windscreen washer bottle and cradle from the engine compartment.
4. Remove the two vertical screws and the two horizontal screws which secure the box to the bulkhead.
5. Draw the relay box forward sufficiently to enable the clip, securing the loom, to be removed from its location on the bulkhead; raise the box sufficiently to enable the loom sockets to be disconnected from the printed circuit base.
6. Remove the relay box assembly from the car.
7. Unscrew and remove the four screws securing the printed circuit base and carefully invert the base to gain access to the relays.

**Note** All relays have the terminals disposed at differing positions, making it impossible to fit a relay in an incorrect position, or to fit the correct relay the wrong way round.

### Relay—To test

A simple test may be carried out on any model 6 RA relay as follows.

1. One method of checking for a faulty relay is by substituting for a relay known to be in good condition.
2. Another simple test is to connect the relay winding to a D.C. supply capable of being varied between Zero and 15 Volts, as indicated on a first-grade moving coil Zero to 20 volts Voltmeter
3. A test lamp can be used to indicate contact opening and closing.

### Printed circuit—To renew

To renew a faulty printed circuit, remove the relay box from the car as described in Relay box - To remove; then disconnect the looms and remove all the relays.

1. Remove the printed circuit by removing the four securing nuts and bolts; to fit a new printed circuit reverse the procedure given for removal.
2. Check all relays prior to fitting to the printed circuit, ensuring that the layer of 'Leatheroid' insulator is fitted between the relays and printed

circuit base, otherwise the exposed metallic parts of the circuit will contact the metal outer shell of the relays, causing a short(s) in the circuits.

### Relay box—To fit

Reverse the procedure given for removal, noting the following point.

1. Clip the loom to the bulkhead behind the relay box.

### Relays—Electrically operated seats

Four 'Lucas' 6 RA relays are incorporated in the circuit for the electrically operated front seats. They are situated between the front seats and are identified by the markings 6 RA and the number 33270 stamped on the outer shell, and by the terminal markings 'C2', 'C3', 'W1' and 'W2' (see Fig. M64).

### Seat relays—To renew

The relays are sealed units and if a failure occurs, the faulty relay should be renewed.

For access to the printed circuit into which the relays fit, proceed as follows.

1. Disconnect the battery.
2. If the stowage compartment/occasional seat is in the raised (seat) position between the front two seats, lower the occasional seat into the stowage compartment position.
3. Remove the two 'Philips' headed screws securing the front trim panel. Lift from its support, then remove from the car.
4. The four relays will now be exposed. To facilitate relay removal, disconnect one or two of the cables above and adjacent to the relays; these should be fitted in their original positions.

**Note** It is important that the 'Leatheroid' insulator is fitted between the four relays and the printed circuit, otherwise electrical shorting will result.

### Relays—To renew

Cars after Car Serial Number 6000

1. Disconnect the battery.
2. Remove the left-hand triangular trim pad from the console.
3. The relay board is adjacent to the left-hand side of the console together with the printed circuit.
4. Carefully remove the relays from the board by pulling from their sockets; note the position to facilitate fitting.

## **Chapter M**

**Left-hand drive cars prior to car serial number 6000**

To renew a faulty printed circuit proceed as follows.

1. Disconnect the battery.
2. Disconnect the cables adjacent to the relays at the 'Lucar' connectors and note the position of each for fitting.
3. Disconnect the 5-way plug situated at the centre of the printed circuit.
4. Remove the four self-tapping screws securing the printed circuit; then remove the circuit from the car.

### **Printed circuit—To fit**

**Cars prior to Car Serial Number 6000**

When fitting the new printed circuit, it will be noted that the holes used to retain it to the stowage compartment are off-set. The circuit can be fitted one way only. Ensure that the layer of 'Leatheroid' insulator is fitted between the relays and printed circuit to eliminate electrical shorting.

It is necessary to align the distance tubes to the securing screws to facilitate correct fitting and enable the screws to engage the 'Spire' nuts.

Further fitting is achieved by reversing the procedure given for removal.

Should difficulty be encountered during the above procedure, i.e. with the distance tubes or 'Spire' nuts, an alternative procedure in addition to that previously described for removing the small trim panel, is as follows.

1. Remove the seat cushions and lift up sufficient carpet to expose the four feet of the stowage compartment/occasional seat assembly.
2. Disconnect the wiring socket situated adjacent to each seat mechanism and remove the clip securing the wiring loom to the seat mechanism.
3. Disconnect the incoming cables at the front of the stowage compartment.
4. The two brown cables have 'Lucar' connectors, the black cable and green cable have snap connector fittings.
5. Fit the stowage compartment/occasional seat by reversing the procedure given for removal.

### **Seat printed circuit—To remove**

**Cars after Car Serial Number 6000**

To renew a faulty printed circuit proceed as follows.

1. Disconnect the battery, and remove the left-hand triangular trim pad on the console.
2. Disconnect the cables adjacent to the relays at the 'Lucar' connections and note the position of each to facilitate fitting.
3. Disconnect the 5-way plug situated at the centre of the printed circuit.
4. Carefully lift the printed circuit out of its retaining slot and withdraw through the left-hand side of the console.

### **Relays—Electrically operated windows**

Four 'Lucas' 6 RA relays are incorporated in the wiring circuit for the electrically operated windows. The relay is rubber mounted on each door frame, adjacent to one of the apertures behind the trim and dust cover.

#### **Relays—To renew**

The relays are sealed units and if a failure occurs the faulty relay should be renewed.

1. Disconnect the battery.
2. To gain access to a relay; remove the door handles, door trim and dust cover as described in Chapter S - Body. This will expose the window lift mechanism and relay fixing positions.
3. When working on the rear doors, working space is improved if the window glass is raised to its fullest extent. If the window is partly or even fully lowered, due to the window lift being inoperative, there is still sufficient room for the hand to remove and renew the faulty relay.
4. The small apertures adjacent to the relays are not sufficiently large to enable the relay to pass through but are sufficient to enable the 'Lucar' terminals to be disconnected and to identify the cable colours and terminal identification marks for correct assembly.
5. When fitting the door trim, ensure that the water shield is fitted and that the door dust covering is sealed around its edges, if not, apply 'Dunlop' S81 adhesive to effect the sealing.

### **Relays—Stoplamp failure warning (where fitted)**

One relay is fitted adjacent to the rear of each rear lamp cluster. The relays are rubber mounted to the body frame behind the side panels of the luggage compartment.

The function of each stop lamp relay is to indicate the failure of a stop lamp bulb.

With the ignition 'ON', the facia lamp performs two functions; it indicates to the driver that the handbrake is applied, or of a stop lamp bulb failure when the brake pedal is applied with the handbrake off.

#### **Relays—To renew**

When a failure occurs, the relays must be renewed.

1. Disconnect the battery.
2. Fold-back the luggage compartment trim and disconnect the cable 'Lucar' connectors from the faulty relay.
3. Note the cable colours to relay terminal positions to facilitate correct fitting.
4. Remove the rubbers which secure the relay to the body frame.

**Note** Although the relay terminal connections and cable colours are identical for each relay, it will be noted that the relay fitted to the left-hand side of the car is inverted for fitting.

### Relay—To test

Connect the relay winding to a 12 Volt D.C. supply in series with an ammeter and variable resistance, and by adjusting the current flow, the relay contacts should open with a minimum current of 1.5 amp flowing through the energising coil of the relay.

### Direction indicator (flasher) unit —To maintain

Flasher units are sealed during manufacture, therefore a defective unit must be renewed.

The unit is fitted to the fuse panel (distribution board) adjacent to the steering column (see Section M2 - Fuse panel) and is fitted directly into the printed circuit.

### Fault diagnosis

In the event of a fault occurring in the direction indicator system, the following procedure should be used.

1. Check all indicator bulbs for broken filaments.
2. Refer to main wiring diagram and check all indicator circuit connections.
3. Switch on the ignition.
4. Using a voltmeter, check that 12 Volts is available at the flasher unit terminal marked 'B'.

### Flasher unit renewal

1. Remove from the fuse panel (see Section M2) and fit the new unit.

**Note** Flasher units must be handled with care.

### Dual relay—Automatic transmission electric actuator (Lucas 14 RA)

This is a complex unit and in the unlikely event of a failure it must be renewed.

### Reverse gear lock relay—To renew

The reverse gear lock relay is secured to the instrument panel main support bracket by two screws.

Access to the relay is as follows.

1. Disconnect the leads from the battery, then remove the top roll as described in Chapter S - Body.
2. Disconnect the 'Lucas' connectors from the relay.
3. Remove the two screws securing the relay to the instrument board bracket; remove the relay from the car.

### Relay—Fuel warning lamp dimming

The relay is mounted behind the facia panel and is identified by the number 33285 stamped on its outer shell, and by the terminal markings 'C2', 'C3', 'W1' and 'W2' (see Fig. M69).

### Relay—To renew

This relay is a sealed unit and if found to be faulty it must be renewed.

The relay is mounted on a bracket which, in turn, is mounted on the instrument panel support bracket adjacent to the reverse gear lock relay. Access to the relay is similar to that described for the reverse gear lock relay.

**Note** If a hazard warning system is fitted to the car, the relay incorporated in the system occupies a similar mounting position, sharing the same mounting bolts.

To facilitate renewal, it is necessary to remove the relay(s) mounting bracket from the instrument panel support bracket and to raise the mounting bracket sufficiently to gain access to the faulty relay.

### Relay—To test

The procedure for testing a fuel warning lamp dimming relay is the same as that described for other relays. Also, the warning lamp should dim when the side/tail lamp switch is operated. If this does not occur a fault in the internal resistor is indicated.

### Relay—Hazard warning lamp

This 'Lucas' relay, mounted behind the facia panel, is identified by the number 33231 on its outer shell, and by the terminal markings 'W1', 'W2', 'C2' and 'C3' (see Fig. M65).

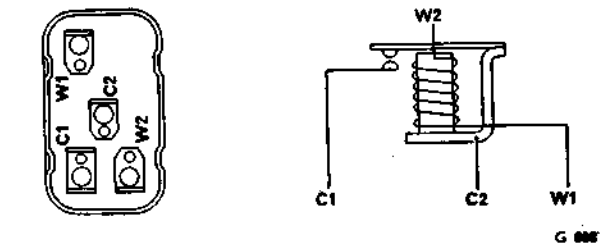
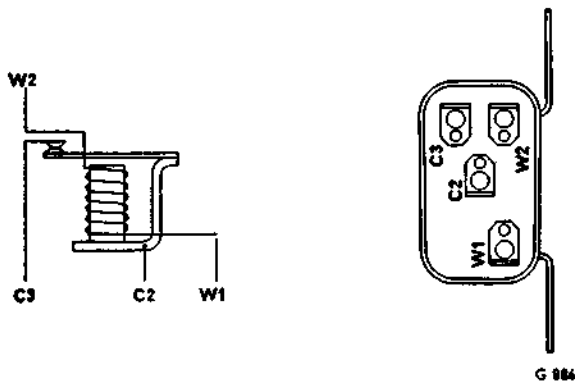
### Relay—To renew

The relay is a sealed unit and if it is found to be faulty it must be renewed.

The relay is mounted to the bracket supporting the fuel warning lamp dimming relay, adjacent to the reverse gear lock relay, and shares the same mounting screws as the dimming relay.

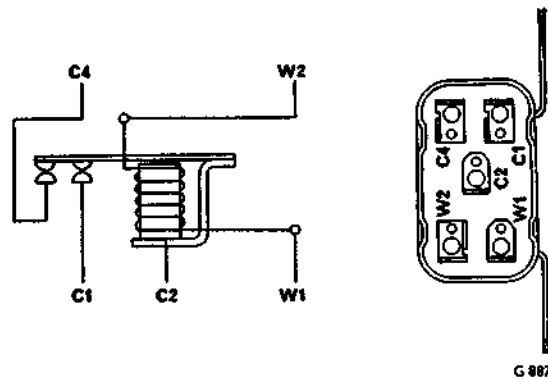
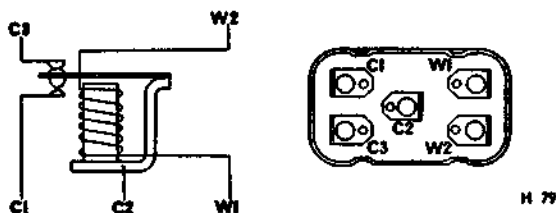
Access to this relay is similar to the instructions given for the reverse gear lock relay.

**Chapter M**



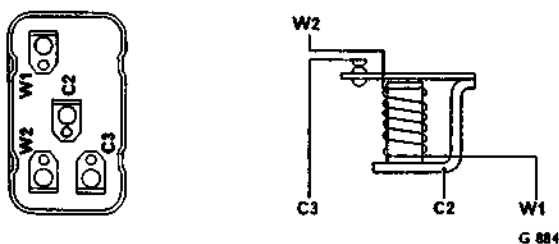
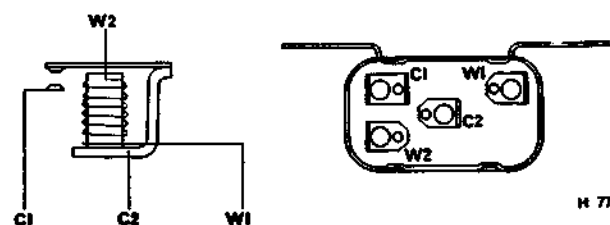
**FIG. M64 HORNS AND ELECTRICALLY OPERATED FRONT SEATS RELAYS**

**FIG. M61 COOLANT LEVEL PROBE RELAY**



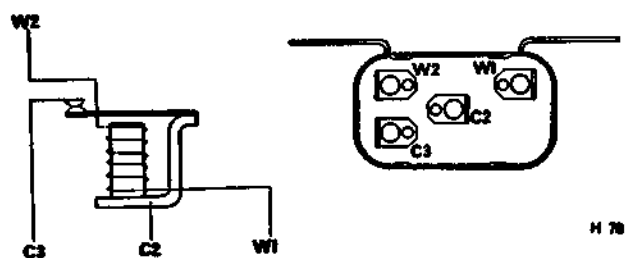
**FIG. M65 BRAKE ACCUMULATOR AND HAZARD WARNING RELAYS**

**FIG. M62 HEIGHT CONTROL INTERIOR LAMPS, WATER TAP AND ALTERNATOR FIELD RELAYS**



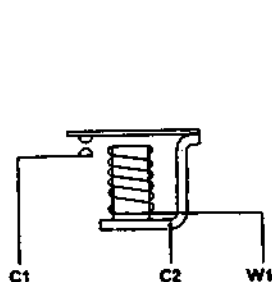
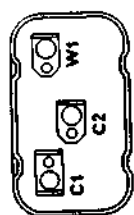
**FIG. M63 HEADLAMP SAFETY, IGNITION WARNING LAMP AND CHOKE, ADDITIONAL WATER TAP AND ELECTRICALLY HEATED REAR WINDOW RELAYS**

**FIG. M66 ELECTRICALLY OPERATED WINDOWS RELAYS**

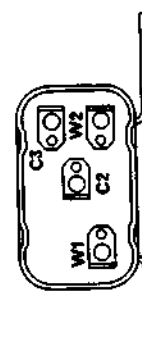
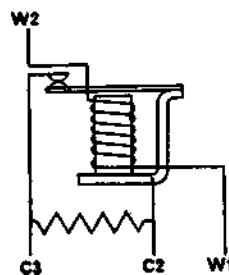


**FIG. M67 STOP LAMP WARNING RELAYS**





G 885



G 883

FIG. M68 HEADLAMP FLASHER RELAY

FIG. M69 FUEL WARNING LAMP DIMMING RELAY

## DATA FOR LUCAS RELAYS MODELS 6 RA

Lucas Part No. and Application	Contact Arrangement	Terminal Markings ('C2' is always associated with the moving contact and is the common terminal in double-contact units)	Resistance of Winding (ohms)	Duty Rating	Cut-in Voltage or Current	Core gap to obtain above (Adjust back stop or top contact bracket)	Drop-off Voltage or Current	Core gap to obtain above (Contacts just making. Adjust height of lower contact bracket)
33271 Headlamp Flasher	One pair (Normally open)	'C1', 'C2', 'W' (Inner end of winding soldered to bobbin core; is therefore electrically common with armature and terminal 'C2')	$15 \pm 7\frac{1}{2}\%$	Intermittent	4 - 9 volts	0,89 mm. - 1,14 mm. (0,035 in. - 0,045 in.)	2,5 volts (min.)	0,30 mm. - 0,46 mm. (0,012 in. - 0,018 in.)
33209 Window Lift	One pair (Normally open)	'C1', 'C2', 'W1', 'W2'	$15 \pm 7\frac{1}{2}\%$	Intermittent	4 - 9 volts	0,89 mm. - 1,14 mm. (0,035 in. - 0,045 in.)	2,5 volts (min.)	0,30 mm. - 0,46 mm. (0,012 in. - 0,018 in.)
33272 Horns and Seats	One pair (Normally open)	'C1', 'C2', 'W1', 'W2'	$15 \pm 7\frac{1}{2}\%$	Intermittent	4 - 9 volts	0,89 mm. - 1,14 mm. (0,035 in. - 0,045 in.)	2,5 volts (min.)	0,30 mm. - 0,46 mm. (0,012 in. - 0,018 in.)
33223 Coolant Level Probe	One pair (Normally closed)	'C1', 'C3', 'W1', 'W2'	$76 \pm 7\frac{1}{2}\%$	Continuous	7 - 10 volts	0,51 mm. - 0,76 mm. (0,020 in. - 0,030 in.)	6 volts (max.)	Not applicable
33270 Headlamp safety Ignition Warning lamp and choke, Additional water tap and Rear window demister	One pair (Normally closed)	'C2', 'C3', 'W1', 'W2'	$76 \pm 7\frac{1}{2}\%$	Continuous	7 - 10 volts	0,51 mm. - 0,76 mm. (0,020 in. - 0,030 in.)	6 volts (max.)	Not applicable
33298 Alternator Field	One pair (Normally open)	'C1', 'C2', 'W1', 'W2'	$76 \pm 7\frac{1}{2}\%$	Continuous	5 - 9 volts	0,51 mm. - 0,76 mm. (0,020 in. - 0,030 in.)	2,5 volts (min.)	0,30 mm. - 0,46 mm. (0,012 in. - 0,018 in.)
33222	One pair (Normally closed)	'C2', 'C3', 'W1'	$76 \pm 7\frac{1}{2}\%$	Continuous	7 - 10 volts	0,51 mm. - 0,76 mm. (0,020 in. - 0,030 in.)	6 volts (max.)	Not applicable

## Section M11

WINDSCREEN WIPERS,  
MOTORS AND WASHERS**'Lucas' 6 W wiper motor self-parking—  
To adjust**

Care should be taken to ensure that the parking procedure adjustments are carried out in strict accordance with the following procedure. Failure to do this may result in irreparable damage to the motor.

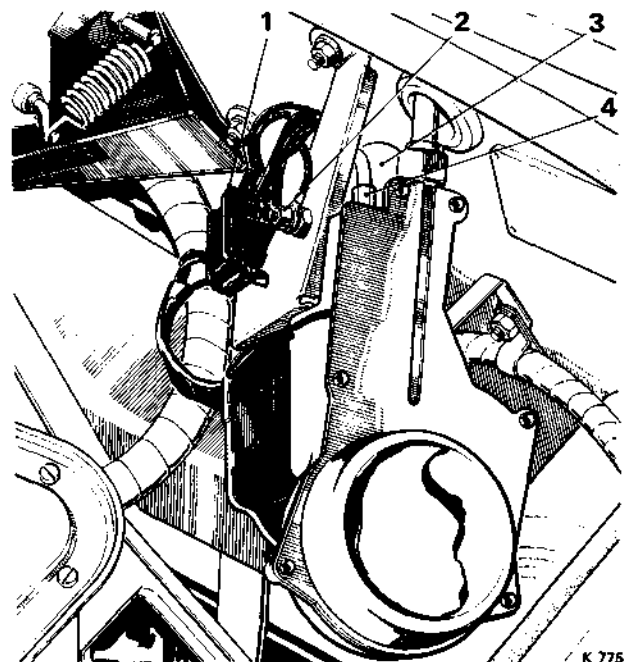
1. With the wiper motor and ignition switch off, adjust the parking switch by turning the knurled nut until the switch threads protrude 20.32 mm. (0.800 in.) from the cross-head (see Fig. M71). This check can be assisted with a gauge inserted behind the cross-head (see Fig. M71).
2. Remove the wiper arms and blades, switch on the motor and allow to operate for approximately 30 seconds, then switch to the parked position.
3. Fit one wiper arm and blade to the right-hand splined wheel box. The wiper blade and arm must point to the left-hand side of the car, with the rubber of the wiper blade lying alongside the rubber glazing seal.
4. Fit the other wiper arm and blade on to the left-hand spindle.

The wiper blade must lie across the parking gauge which should be held against the windscreen and rubber glazing seal in line with the wiper blade latch pivot (see Fig. M72). There will be some free movement of the wiper arm and blade due to 'sponge' in the rack drive. This movement can be ignored if the wiper blade can be set against the gauge as described previously without displacing the other blade. If the left-hand wiper blade cannot be set against the gauge without moving the right-hand wiper blade, it will be necessary to move the arm one spline further on the wheelbox spindle.

5. Ensure that the windscreen is clean and that a steady flow of water is directed on to the screen, then switch on the wiper motor for a few seconds and check that it parks satisfactorily.

**Note** The wiper motor must not be operated with a dry screen or scratching of the screen will result.

6. Ensure that the motor is not left in a stalled condition. Proceed as follows to ensure that the parking switch has operated, and that the wiper motor is switched off. Remove Number 2 fuse from the distribution board and connect a test lamp of not more than 12V. 2.2W. across the fuse retaining clips. The test lamp should not illuminate, thus indicating that the parking switch has operated and that no current is flowing.

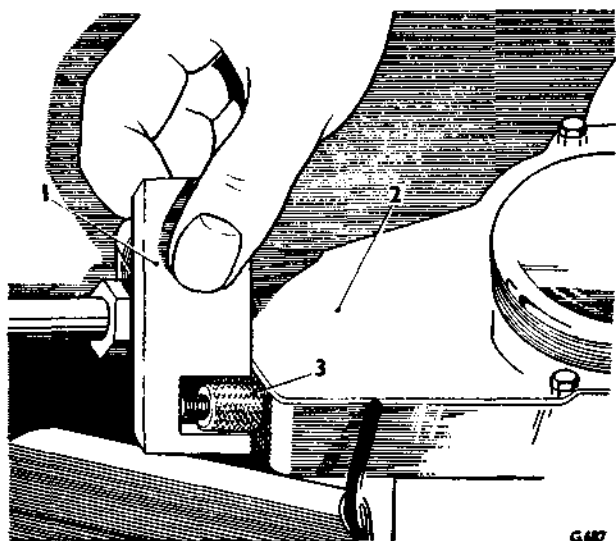


**FIG. M70 'LUCAS' 6 W WIPER MOTOR**

- 1 Wiper motor 5-way plug & socket
- 2 Earthing point
- 3 Condenser
- 4 Parking switch adjustment screw

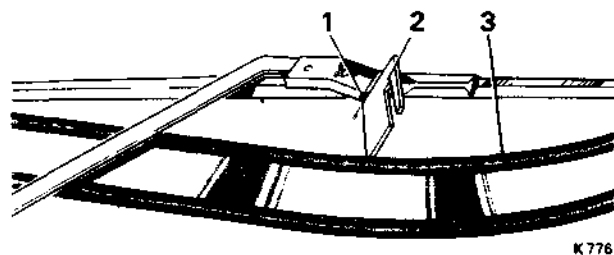
## Chapter M

If the test lamp illuminates, this indicates that the motor is not switched off and that current is flowing and the wiper motor is in a stalled position. Should this occasion arise, the setting instructions previously described should be repeated. The correct settings provide an adequate margin for the parking switch to operate under service conditions.



**FIG. M71 WIPER MOTOR PARKING SWITCH SETTING**

- 1 Parking switch gauge
- 2 Wiper motor cross head
- 3 Parking switch adjuster



**FIG. M72 WIPER BLADE PARKING GAUGE**

- 1 Wiper arm latch pin
- 2 Parking gauge
- 3 Windscreen sealing rubber

### Maintenance—Wiper blades

Excessive friction between apparently satisfactory wiper blades and the windshield may result in a marked reduction in wiping speed when the wiper blades are operating on a windshield that is only partially wet. A further symptom is that the blades become noisy at each end of the wiping arc.

If the wiper blades are suspect, they should be changed with a pair known to be in good condition; if this rectifies the fault, new wiper blades should be fitted.

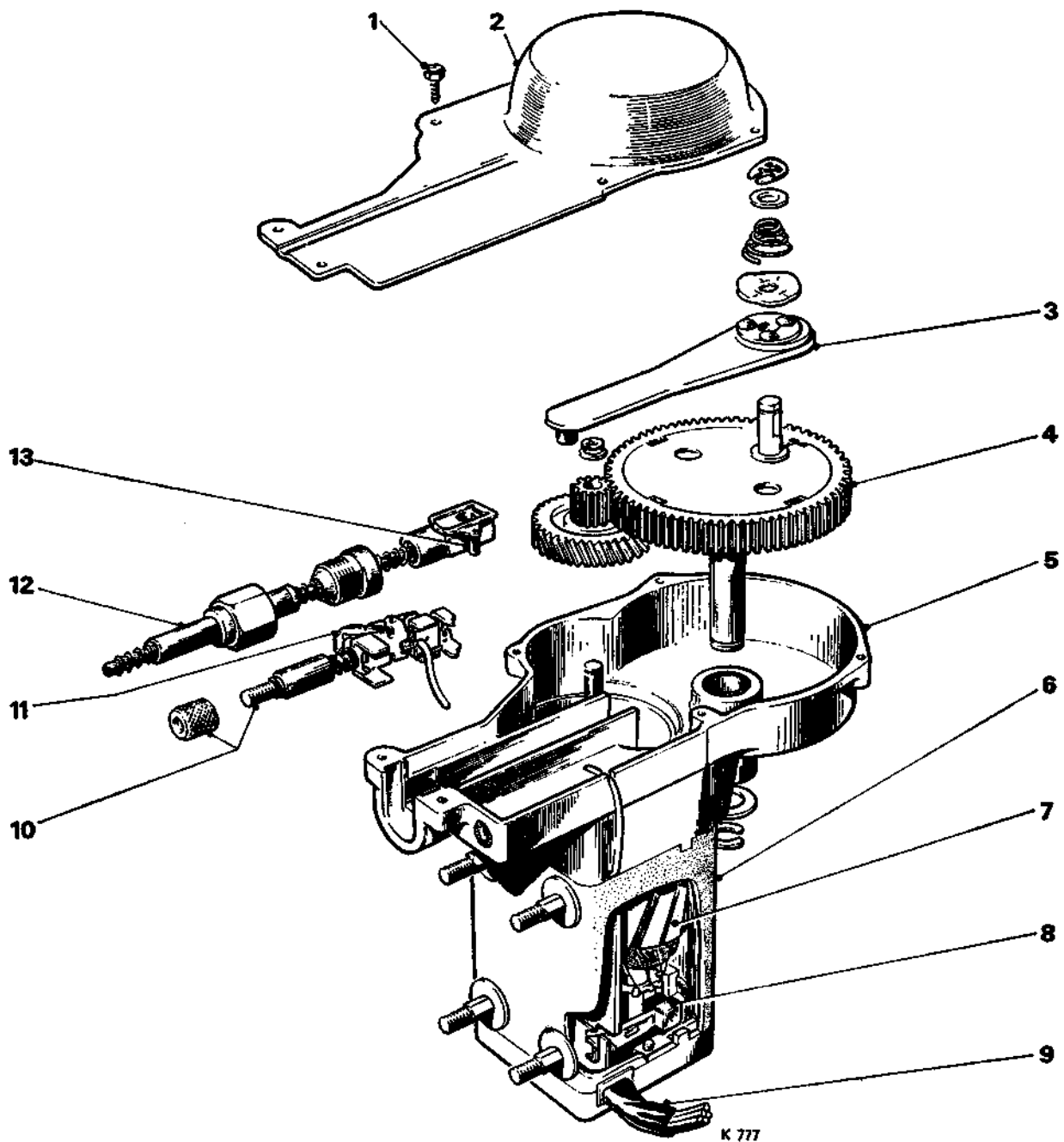
### 'Lucas' 6 W wiper motor—To measure light-running current

1. Unscrew and remove the six self-tapping screws which secure the gearbox cover, then lift off the cover to expose the connecting rod and gearbox (see Fig. M73).
2. Remove the circlip securing the eccentric coupling to the final gear crankpin (for further information see *Anti-streak mechanism*).
3. Remove the connecting rod from the gearbox to release the cross-head and rack.
4. Connect a first grade moving-coil ammeter in series with the wiper motor supply cable and measure the light-running current. The light-running current at normal speed should read between 2.7 amp to 3.4 amp, and at high speed between 2.0 amp to 2.6 amp, with 12 volt supply measured at the motor.

Should the motor not conform to these figures the motor should be renewed.

### 'Lucas' 6 W wiper motor—To dismantle (see Fig. M73)

1. Unscrew and remove the six self-tapping screws securing the gearbox cover and remove the cover.
2. Remove the circlip securing the eccentric coupling to the final gear crankpin (for further information see *Anti-streak mechanism*).
3. Remove the connecting rod eccentric coupling and final gear.
4. Prise off the final gear shaft circlip and washer. Clean the circlip groove before removing the gear shaft from its bearing.
5. Remove the armature end-play stop plate.
6. Remove the intermediate gear circlip and washers. Clean out the circlip groove before removing the gear.
7. Examine all gear teeth for damage and if necessary renew the damaged gears.
8. Unscrew and remove the two through-bolts, insulating tubes and the commutator end bracket from the yoke.
9. Remove the fibre comb-shaped brush arm retainer plate from below the terminal assembly.

**FIG. M73 EXPLODED VIEW OF 'LUCAS' 6 W WIPER MOTOR**

- |                  |                                     |
|------------------|-------------------------------------|
| 1 Screw          | 8 Brushgear                         |
| 2 Gearbox cover  | 9 Cables                            |
| 3 Connecting rod | 10 Parking adjuster                 |
| 4 Gear           | 11 Cross head actuated limit switch |
| 5 Case           | 12 Cable rack protective tubing     |
| 6 Motor housing  | 13 Switch striker pin               |
| 7 Armature       |                                     |

## **Chapter M**

10. Before removing the brushes, note their position in order that they can be replaced correctly.

**Note** The ridges on the running face of each brush must be at right-angles to the commutator slots.

11. Lift the brush levers clear of their location at the pivots and remove the brushgear assembly from the yoke.
12. The armature may now be removed from the gearbox end bearing.

### **'Lucas' 6 W wiper motor—To assemble**

Reverse the procedure given for dismantling, noting the following points.

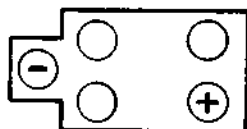
1. Lubricate sparingly the final gear and armature bearings with 'Shell Turbo 41'.
2. Grease liberally the cross-head guide channel, connecting rod assembly, cable rack and gearbox with 'Rocol' M.T. 265.

### **'Lucas' 16 W wiper motor—To measure light running current**

Proceed as for 'Lucas' 6.W. wiper motor - To measure light-running current, noting the following points.

1. With 12V at the motor the light-running current at normal speed should read between 1 and 2 amps, and at high speed between 2 and 3 amps.

(The bottom right blade in the motor socket is the supply, the left offset blade is the return.).



### **Maintenance—'Lucas' 16 W wiper motor**

The motor is of a permanent magnet design and the direction of rotation is dependent upon the polarity of the electrical supply to its terminals. If it becomes necessary to run the motor while it is removed from the car, the negative supply cable should be connected to terminal marked number one, and the positive supply cable to terminal marked number five for normal speed or terminal three for high speed.

### **'Lucas' 16 W wiper motor—To remove (see Fig. M74)**

1. Disconnect the loom socket from the wiper motor plug.
2. Remove both wiper blades.

3. Release the nut which secures the rack tubing to the wiper motor.

4. Slacken the clip which secures the motor and withdraw the motor and rack from the car.

5. Remove the plastic cover and the cover plate from the wiper motor. It should be noted that care must be taken not to introduce dirt into the gearbox assembly.

6. Remove the circlip and washer from the outer end of the drive gear shaft (see Fig. M74). Discard the circlip.

7. Withdraw the gear and parking device assembly from the motor, ensuring that any burrs around the circlip groove of the gearshaft are removed before withdrawal.

**Note** One of the following procedures should now be followed dependant upon which part requires renewal.

### **Replacement of gear and parking device assembly, or renewal of motor (see Fig. M76)**

1. Fit the gear and parking device assembly into the motor, locating the drive rack on the peg of the connecting rod and ensuring that the parking switch slide is fitted to the drive rack and is facing the correct way, as shown in Figure M74. Note the position of anti streak mechanism on output gear crankpin and ensure that it is refitted in the same position. If the pin is fitted 180° out, the tag will break on first park cycle.

2. Using grease from the motor gearbox, lubricate the gear teeth.

3. Fit the dished washer, plain washer and circlip to the outer end of the gear shaft.

4. Fit the plastic cover and the cover plate to the wiper motor.

5. Fit the motor and rack assembly to the car by reversing the procedure given for removal. Ensure that when the motor securing clip is tightened, the alignment between the motor and the rack tubing is not destroyed.

6. Connect the loom socket to the wiper motor and operate the wiper motor for a few seconds and then switch off. This will ensure that the wiper wheelboxes are in the parked position.

7. Fit the wiper blades to the wheelboxes in the parked position.

### **Drive-rack renewal**

1. Withdraw the rack from the motor.
2. Fit the new rack, and replace the drive gear, fitting the dished washer, plain washer and using the new circlip provided. Ensure that the plastic parking switch operating slide is correctly located by the arm on the rack, and that the slide is fitted the correct way around as shown in Figure M74.

Note the position of anti streak mechanism and output gear crankpin.

3. Replace the motor covers and fit the motor and drive rack to the car by reversing the procedure given for removal. Ensure that when the motor securing clip is tightened, the alignment between the motor and the rack tubing is not destroyed.

4. Connect the loom socket to the wiper motor and operate the wiper motor for a few seconds and then switch off. This will ensure that the wiper wheelboxes are in the parked position.

5. Fit the wiper blades to the wheelboxes in the parked position.

### 'Lucas' 16 W wiper motor—To assemble

Reverse the procedure given for dismantling, noting the following points.

1. Lubricate sparingly the final gear and armature bearings with 'Shell Turbo 41'.

2. Grease liberally the cross-head guide channel, connecting rod assembly, cable rack and gearbox with 'Rocol' M.T. 265.

3. Ensure that the output gear crankpin is in the correct position.

### Brushes—To renew - 'Lucas' 16 W wiper motor

Remove and dismantle the motor as described in 'Lucas' 16.W wiper motor - To dismantle. The original specified length of the brushes is sufficient to last the life of the motor. If it becomes necessary to renew the brushes the complete brushgear assembly must be fitted. The brushgear assembly must be renewed if the main (diametrically opposed) brushes are worn to or near 4.80 mm. ( $\frac{1}{16}$  in.) or if the narrow section of the third brush is worn to the full width of the brush.

Ensure that the brushes move freely in their brush box.

### Brush springs—To check - 'Lucas' 16 W wiper motor

1. Using a push-type spring gauge, press on the end face of the brush until the bottom of the brush is level with the bottom of the slot in the brush box.

2. The spring pressure should read 140 g. to 200 g. (5 oz. to 7 oz.), if the pressure reads below these figures the springs should be renewed.

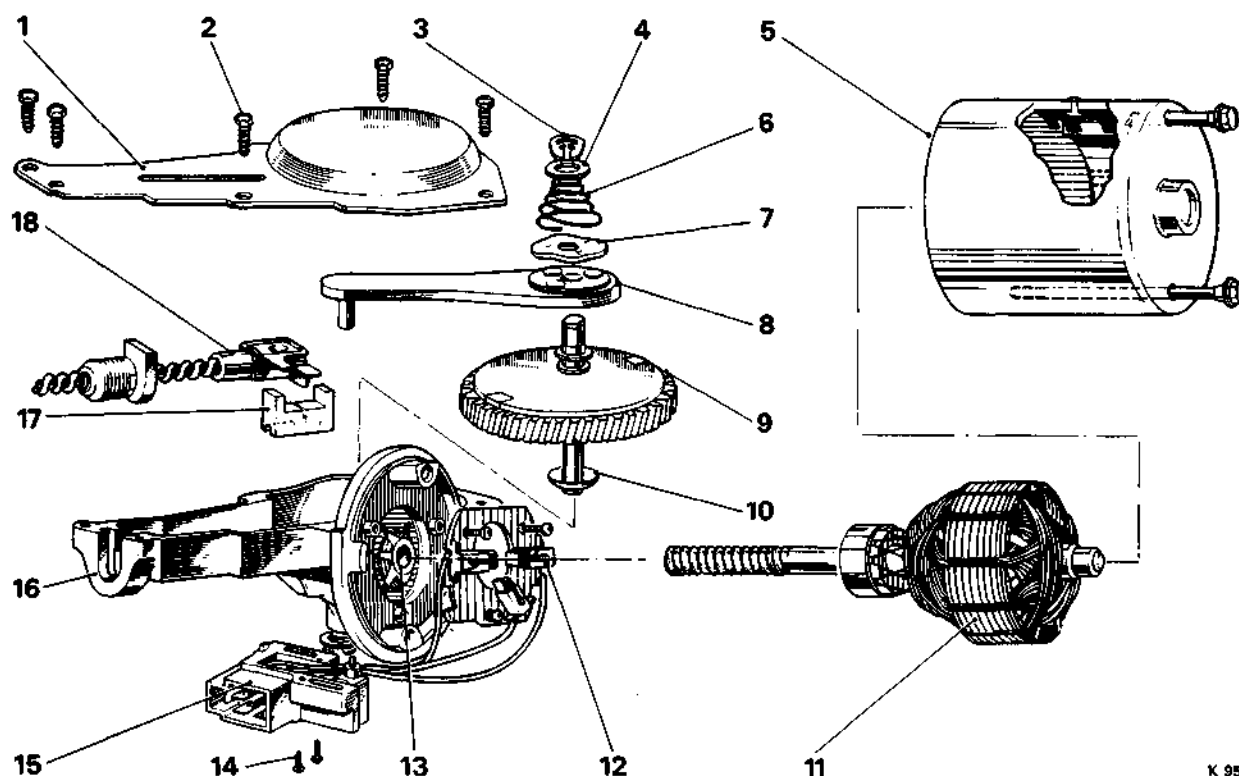


FIG. M74 EXPLODED VIEW OF 'LUCAS' 16 W WIPER MOTOR

- |                 |                   |                              |
|-----------------|-------------------|------------------------------|
| 1 Gearbox cover | 7 Friction plate  | 13 Self-centring bearing     |
| 2 Screws        | 8 Connecting rod  | 14 Securing screws           |
| 3 Circlip       | 9 Gear            | 15 Limit switch assembly     |
| 4 Washer        | 10 Dish washer    | 16 Gearbox                   |
| 5 Yoke          | 11 Armature       | 17 Slider block              |
| 6 Spring        | 12 Brush assembly | 18 Cable rack and cross-head |

K 958

## **Chapter M**

### **Armature insulation—To test (see Fig. M75)**

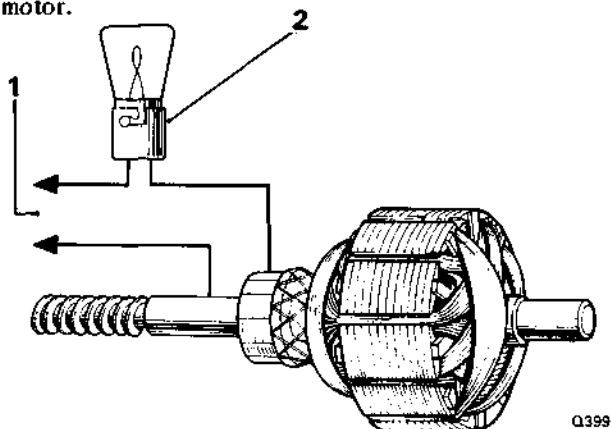
1. Subject the armature to an insulation test.
2. Check the armature windings for short and open circuits.
3. If the commutator is worn, it can be lightly skimmed in a lathe using a diamond-tipped tool.
4. After skimming, undercut the armature slots and remove all burrs by lightly polishing with fine emery.

### **Cable rack and tubing—To examine**

1. Badly kinked or flattened tubing must be renewed. Any bends of a radius less than nine inches must be reformed. Access to the cable rack tubing is gained by the removal of the top roll as described in Chapter S - Body, and by the removal of the refrigeration system evaporator box as described in Chapter C - Air Conditioning System.
2. Insert the hook of a spring balance into the hole on the cross-head (see Fig. M73) and withdraw the rack with the balance. The maximum permissible force required should not exceed 2.72 kg. (6 lb.).

### **Cable rack drive—To renew**

1. Remove the wiper blades and arms.
2. Disconnect the rack from the wiper motor as described in Wiper motor - To remove.
3. Remove the rack from the tubing by carefully pulling from the motor end to release the rack from the wiper arm wheelboxes.
4. Lubricate the new rack with 'Rocol' M.T. 265 grease, then fit into the tubing. It may be necessary to rotate the wheelbox spindles slightly in order to engage the gears with the rack. Fit the rack to the motor.



**FIG. M75 ARMATURE INSULATION TEST**

- 1 110V ~  
2 15W

5. Fit the wiper arms and blades, then check the setting of the parking switch as described in Parking Switch - To adjust.

### **Wheelboxes**

The wheelboxes are lubricated on initial assembly and do not require any maintenance. They are secured in position on the scuttle by a chromium plated nut fitted to the outside of the car.

Loose wheelboxes are a contributory factor to both noisy and faulty wiper operation, therefore ensure that they are secure at all times.

In the unlikely event of a failure of one of the wheelboxes, it must be renewed.

### **Wheelbox—To renew**

1. Remove the top roll and instrument panel as described in Chapter S - Body.
2. Remove the air conditioning equipment located behind the facia, for full details refer to Chapter C - Heating, De-misting and Ventilating System.
3. Remove the wiper blade and arm.
4. Remove the flexible drive.
5. Unscrew and remove the chrome nut and withdraw the wheelbox.

### **Anti-streak mechanism**

The anti-streak mechanism fitted to the 'Lucas' 6.W. and 16.W. wiper motors enables the wiper arms and blades to make a complete wiping cycle before coming to rest in the parked position, thus ensuring there are no streaks on the screen.

It is imperative, when the mechanism has been dismantled, that it is correctly assembled (see Fig. M76).

1. The tag on the driving plate and the recess in the wave washer face towards the outside of the gearwheel.
2. Rotate the eccentric so that the plastic slide is depressing the park switch, fit the wave washer with marks uppermost and just behind tag. Fit the driving plate bush and driving plate with the latch just behind the tag.
3. It is possible to assemble these components 180° from the position previously described. This must be avoided as the mechanism will lock and the driving plate will fracture before the motor is parked.

### **Windscreen washer jets—To clean**

1. Unscrew the knurled portion of each screen jet to expose the slot.

2. Operate the washer motor for a few seconds to clean away any sediment present.

3. If a poor jet of fluid prevails, check the 'Telkathene' washer which may be mis-shapen; renew if necessary.

### Washer unit—To maintain

1. This unit requires no maintenance other than to ensure that the electrical connections are clean and correctly tightened. Ensure that the container is kept clean.

2. If the motor unit fails it should be replaced by a new unit.

### 16 W wiper motor— Parking switch adjustment

The parking switch of this motor is provided with an adjustment to allow for different angles of park. When replacing a drive gear assembly it may be necessary to re-adjust the parking switch to suit the new assembly. Failure to do this may result in one of the following faults:

1. With the wiper switch in the intermittent position and the blades parked on the screen, moving the switch to the off position does not cause the blades to move to the off screen position.

2. When moving the wiper switch from off to intermittent, there is an 8 to 10 second delay before the wiper motor operates.

If a new gear assembly has been fitted and the wiper motor exhibits one of the above faults the relevant following procedure should be adopted.

**Note** Always ensure that the metal top plate is in position and the parking switch securing screws are tight before operating the motor.

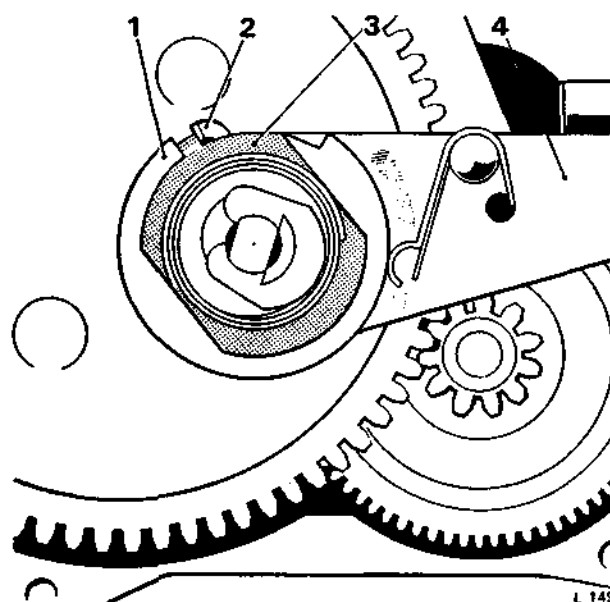
#### Procedure for Fault 1

1. Loosen the rack tube nut and release the clamp from the wiper motor. Care must be taken to ensure that the tube is not completely disconnected otherwise the drive rack may become bent.

2. Rotate the motor until the parking switch is accessible (see Fig. M77). Tighten the rack tube nut. This will allow the motor to be operated and also permit adjustment of the switch.

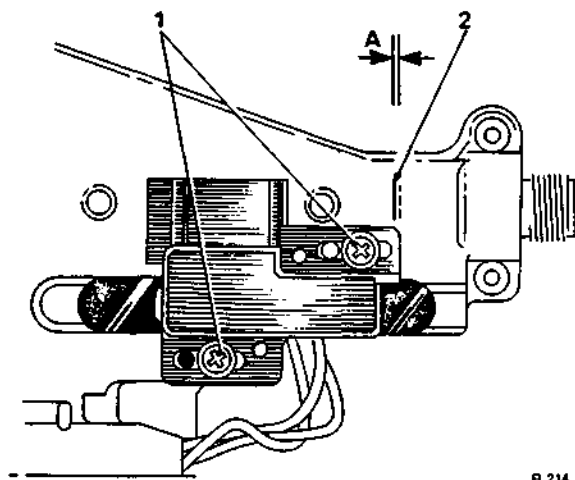
3. Switch on the ignition and slacken the parking switch securing screws and move the parking switch fully inwards towards the gearwheel. Select intermittent wipe, and once the blades have moved, select off. The motor will not reverse and park.

4. Carefully move the limit switch outwards to a position where the motor will reverse and move the blades to the correct parking position. Scribe a line on the motor casing at this point as shown in Figure M77.



**FIG. M76 ANTI-STREAK SETTINGS (FITTED TO ALL CARS FROM CAR SERIAL NUMBER SRX 2110)**

- 1 Wave washer recess
- 2 Drive plate tag
- 3 Tag and eccentric
- 4 Crankpin with eccentric in the extended (Park) position



**FIG. M77 PARKING SWITCH ADJUSTMENT**

- 1 Parking switch securing screws
- 2 Point at which motor operates



## Chapter M

5. Move the limit switch 0.51 mm. (0.2 in.) further outwards from the scribe line (dimension A) and tighten the switch securing screws.
6. Switch off the ignition and re-fit the wiper motor to the mounting bracket.
7. Check all of the wiper functions for correct operations.

### Procedure for fault 2

Before attempting to correct this fault, ensure that the gear assembly fitted is of the latest type. The identification of the two gears is shown in Figure M78.

To adjust the parking switch, proceed as follows:

1. Unscrew the rack nut and release the clamp from the wiper motor.
2. Rotate the motor until the parking switch is accessible. Tighten the rack nut. This will allow the motor to be operated and also permit adjustment of the switch.
3. Switch on the ignition and slacken the parking switch securing screws and move the switch fully inwards towards the gearwheel. Select intermittent

wipe, and once the blades have moved, select off. The motor will not reverse and park.

4. Carefully move the limit switch outwards to a position where the motor will reverse and move the blades to the correct parking position. Scribe a line on the motor casing at this point as shown in Figure M77.

5. Disconnect the socket to the non-adjustable parking switch situated beneath the main gearwheel casing.

6. Move the limit switch fully outwards, select slow wipe and once the blades have moved, select off and allow the motor to reverse and stop.

7. Connect a circuit continuity tester across the non-adjustable switch terminals 2 and 4 (see Fig. M79).

8. If the previous test indicates a circuit, scribe a line on the motor casing at that point.

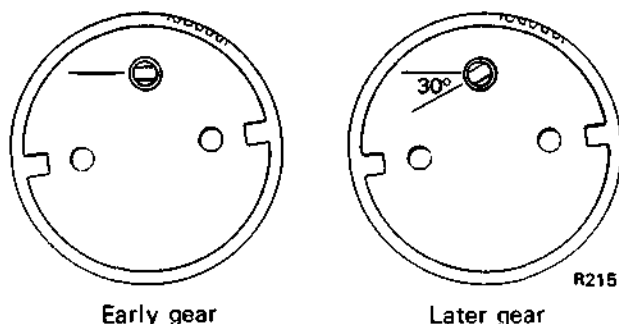
9. If no circuit exists move the parking switch slightly inwards and select slow followed by off.

10. Repeat this operation until circuit continuity is indicated and scribe a line on the casing.

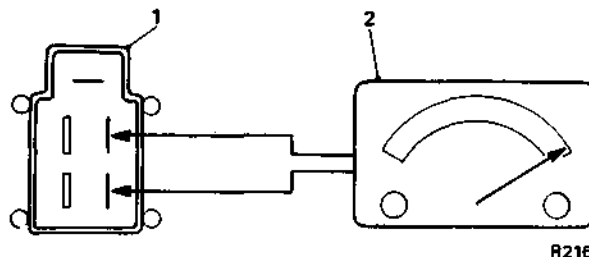
11. Secure the parking switch at a point midway between the two scribed lines.

12. Switch off the ignition and replace the socket in the parking switch and refit the motor to the securing bracket.

13. Check all wiper functions for correct operation.



**FIG. M78 IDENTIFICATION OF GEARS**



**FIG. M79 CONTINUITY TESTING**

- 1 On screen parking switch
- 2 Circuit tester

## Chapter M

## Windscreen Wipers, Motors and Washers Fault Diagnosis (Refer to Figs. M80 - 84)

Symptom	Possible Cause	Action
Wipers fail to operate on NORMAL or FAST speed. INTERMITTENT satisfactory.	No supply voltage at wiper switch. Wiper switch faulty.	Check supply from fuse 2 to terminal 8 of wiper switch. With wiper switch on FAST or NORMAL, check for live feed at switch terminal 10.
Wipers fail to operate on any switch setting.	Supply faulty. Number 2 fuse 'blown'. Wiper motor faulty. Faulty earth connection.	Operate wash/wipe switch, if washer fails to operate check supply at wash/wipe unit and fuse 2. Replace fuse. Disconnect the motor socket and test the motor. Check motor brushes. Check soundness of earth connections at right-hand 'A' post upper earth point, connection 2 of wash/wipe control box and 14B cable at wiper switch.
FAST speed inoperative NORMAL wipe, wash/wipe cycle and intermittent cycle satisfactory.	Wiper switch faulty. Faulty cable connection.	Switch to FAST speed and check for live feed at terminal 5. Check continuity of 14YG cable at motor socket, motor condenser, toeboard socket and wiper switch.
INTERMITTENT wipe cycle inoperative, normal wipe and wash/wipe satisfactory.	Intermittent wipe unit faulty Faulty wiper switch.	Remove auxiliary switch plug from motor and check for continuity between terminals 1 and 3 on the intermittent wipe unit. Allow 7 seconds delay for circuit to charge. At the wiper switch, check for continuity between connections 3 and 4, 12 and 13, 1 and 7 (see previous note).
INTERMITTENT wipe cycle runs continuously. Normal wipe and wash/wipe satisfactory.	Faulty intermittent wipe unit.	Verify that terminals 1 and 3 on the intermittent wipe unit are not made continuously.
INTERMITTENT wipe cycle operates one cycle only.	Intermittent wipe unit faulty.	Replace unit.
Wash cycle satisfactory but wipe cycle inoperative. Normal and Fast speed wipers inoperative.	Wash/wipe control unit faulty.	Switch to intermittent wipe cycle, if intermittent wipe operates, the wash/wipe unit is faulty.

## Chapter M

## Windscreen Wipers, Motors and Washers Fault Diagnosis (Refer to Figs. M80 - 84)

Symptom	Possible Cause	Action
Wash cycle inoperative, wiper cycle satisfactory. Normal and Fast speed wipers satisfactory.	Washer motor faulty.	Check for supply at washer motor terminals and also for correct polarity. Check the fluid level in the container and examine the jets and tubing for blockage and/or leaks.
Wash/wipe inoperative. Normal and intermittent wiper cycles satisfactory.	Faulty supply.	Check for live feed at 14G cable at washer bottle, toeboard socket D and wiper switch.
	Wash/wipe switch faulty.	Connect 14GB cable at washer motor to earth. With 14G connection 'live', the washer should operate indicating a faulty wash/wipe switch.
	Faulty earth from wash/wipe switch.	Check 14B cable at wash/wipe socket and left-hand 'A' post upper earth point.

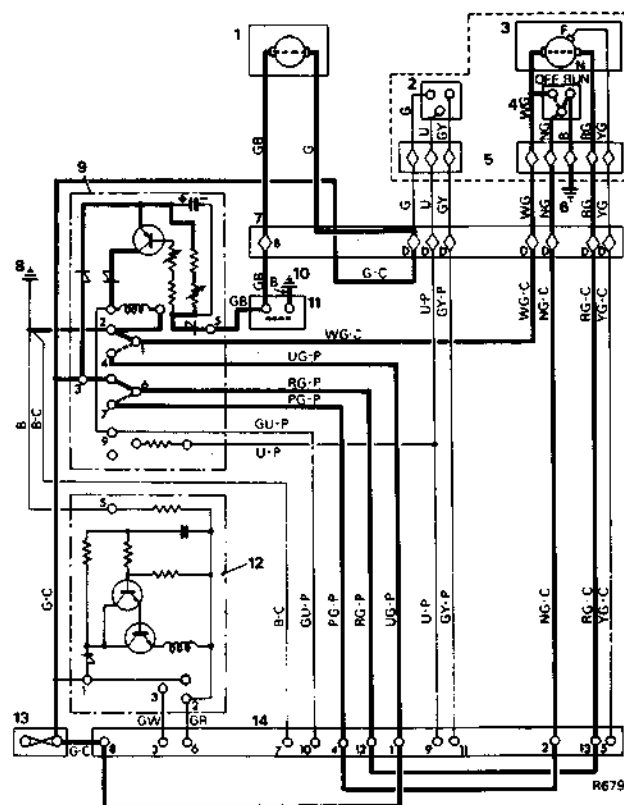


FIG. M80 'OFF' POSITION

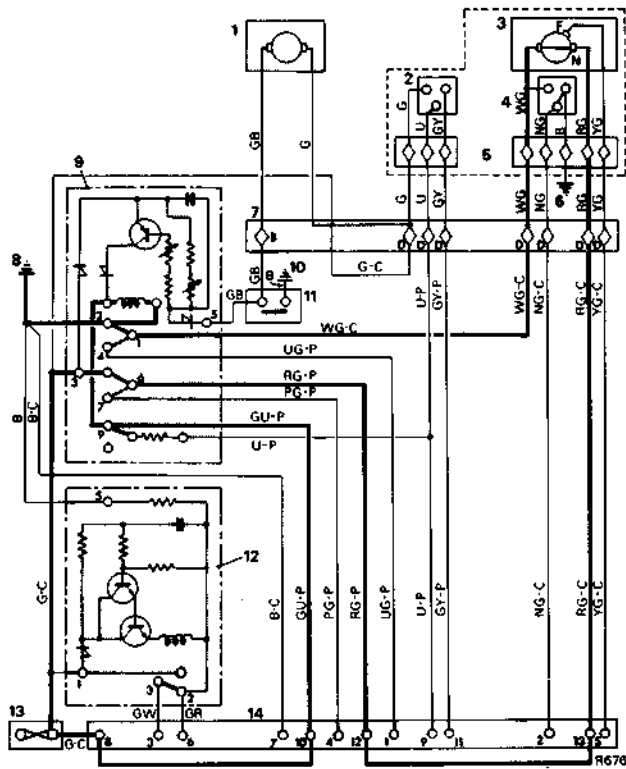
KEY FOR FIGURES M80 TO M84  
WIRING DIAGRAMS

- 1 Washer motor
- 2 'Park on screen' switch (Integral with motor)
- 3 Wiper motor
- 4 'Park off screen' switch (Integral with motor)
- 5 Wiper motor sockets
- 6 Right-hand valance earth
- 7 Toeboard sockets (A & D left-hand, H & K right-hand)
- 8 Left-hand 'A' post upper earth (Right-hand for RHD cars)
- 9 Wash/Wipe unit
- 10 Right-hand 'A' post upper earth (Left-hand for RHD cars)
- 11 Washer switch
- 12 Intermittent wipe unit
- 13 Fuse 2
- 14 Wiper switch

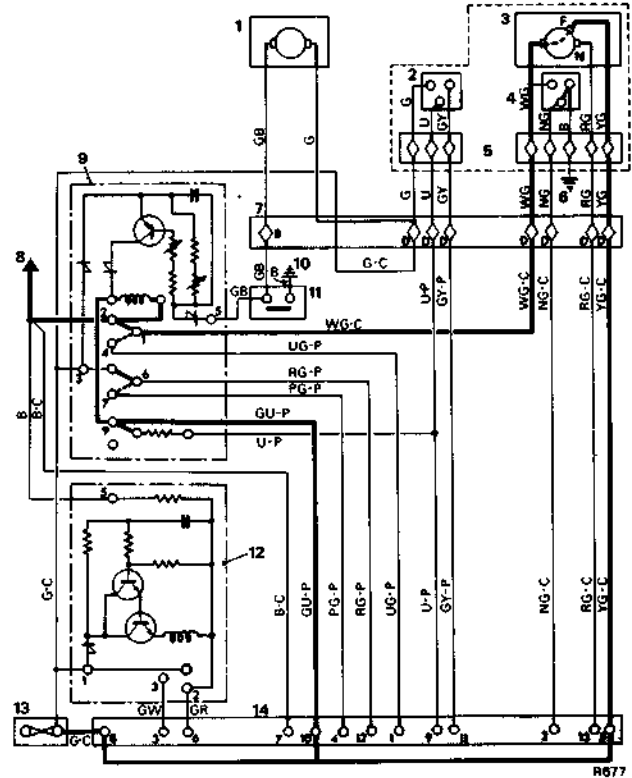
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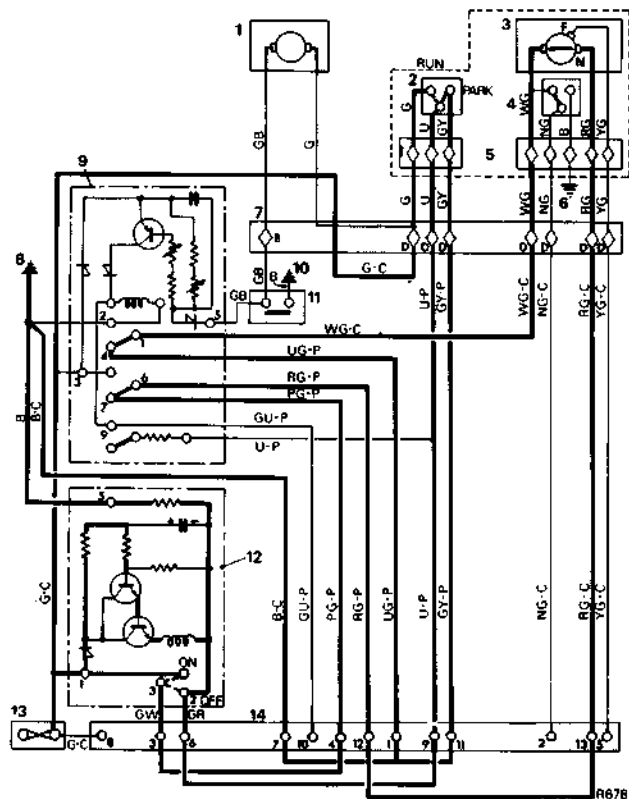
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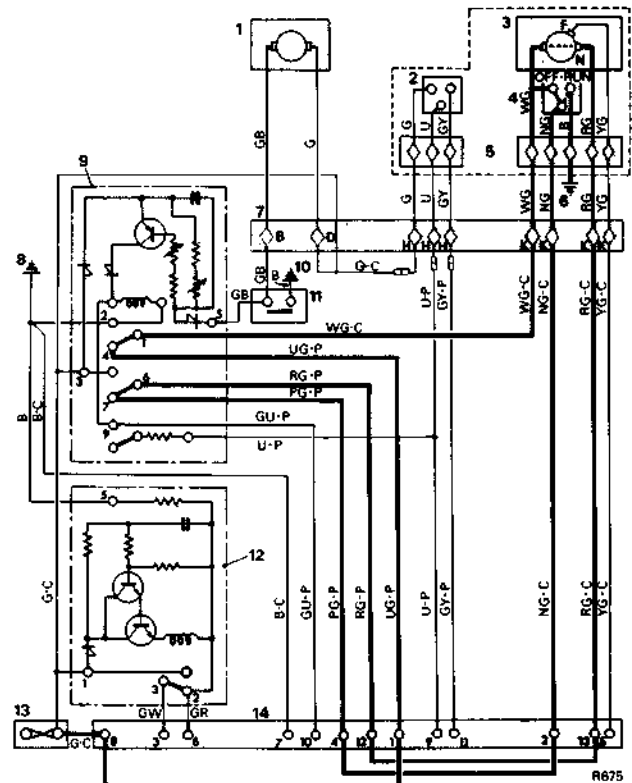
**FIG. M81 NORMAL SPEED**



**FIG. M82 FAST SPEED**



**FIG. M83 INTERMITTENT WIPE**



**FIG. M84 WASH/WIPE**

## Section M12

# HORNS

The horns are mounted beneath the left-hand front wing adjacent to the front of the body underframe.

### Horns—To remove

1. Disconnect the battery.
2. Disconnect the leads to the horns.
3. Remove the four  $\frac{7}{16}$  in. A/F setscrews (two per horn).
4. Carefully remove the horn(s).

### Horns (WT 618 - Early cars)—To adjust

No adjustments are provided to alter the pitch of the horn. A poor note can be attributed to the condition of the contact points, insufficiently tightened mounting brackets or a low voltage at the horns.

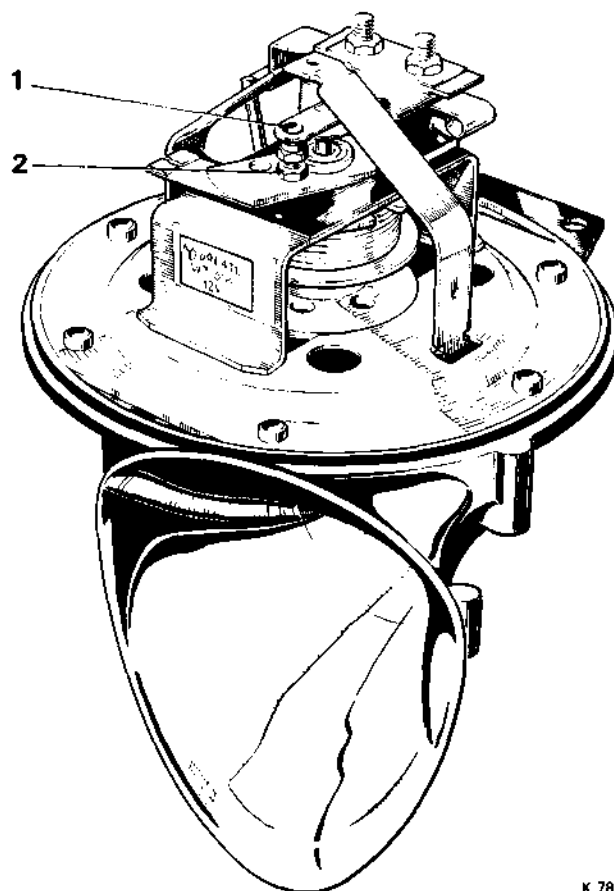
To rectify these faults proceed as follows.

1. Remove the horns as described in Horns - To remove.
2. Clean the contact points.
3. Insert an ammeter in series with the horn, and test with a voltage of 12 Volts at the horn.
4. Screw in the adjustable contact (see Fig. M85) until the horn just fails to sound.
5. Unscrew half-a-turn and lock.
6. Slight re-adjustment may be necessary to 'tune' the horn to obtain the correct pitch. The horn should operate correctly with a minimum voltage of 10 Volts, at the horn. Remove the ammeter. If the horns still give a poor note the horn in doubt should be renewed.

### Horns (WT 7H - Late cars)—To test

The horns (see Fig. M86) are sealed units and the only maintenance required is adjustment to the contacts. These adjustments are effected in a similar manner to those described for the WT618 horns (see Fig. M85).

The mounting for the WT7H horns is different from that used for the WT618 horns. Replacement of a pair of WT618 horns by a pair of WT7H horns will necessitate a new mounting (refer to the Spare Parts List).

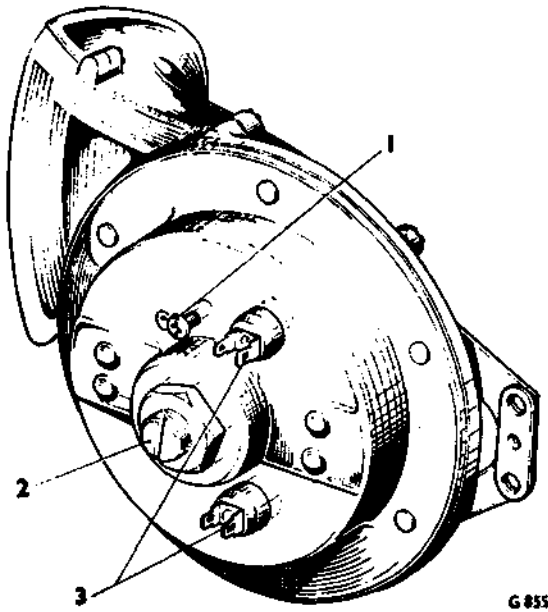


K 782

FIG. M85 WINDTONE HORN WT 618

- 1 Vibrating contact
- 2 Adjustable contact

**Chapter M**



**FIG. M86 WINDTONE HORN WT 7H**

- 1 Adjustable contact
- 2 Vibrating contact
- 3 'Lucar' connectors

**Horn circuit (All types)—To test**

1. Connect the horn relay terminal 'C1' to the main battery terminal of the starter relay. If the horns do not operate, the fault lies in the circuitry forward of the relay.
2. If the horns produce a poor note, check using a voltmeter, the voltage at the horn terminal, the minimum value is 10 Volts for satisfactory operation.
3. To isolate a failure not produced in the previous test, short circuit the 'W2' terminal to earth. This isolates the push button, the lead or the earth connection. Failure of the horn to operate indicates a defective relay.

**'Mixo' TR 129 High & Low**

**Note horns (where fitted)**

These horns are sealed units and maintenance is unnecessary.

**No attempt at adjustment should be made as the horns are manufactured to the relevant European standards**

## Section M13

# ELECTRICALLY OPERATED WINDOW LIFTS

### Window lift mechanism—To dismantle

If the mechanism has not already been removed from the door it should be removed as described in Chapter S - Body.

Care should be taken when handling the window lift, otherwise the special coating on the side of the channel may be partly removed and cause the slide to become noisy in operation.

1. Release the chain tension by slackening the two setscrews securing the upper sprocket chain carrier to the chain tunnel.

2. Remove one of the circlips from the upper sprocket spindle, then remove the spindle together with the remaining circlip; retain the two thin washers.

3. Slide the sprocket down the channel, then remove the two setscrews and washers securing the upper sprocket carrier to the chain channel; remove the carrier.

4. Unscrew and remove the 2 B.A. bolt securing the channel slide to the chain pick-up plate; withdraw the slide.

5. Remove the chain spring link, withdraw the chain from the channel together with the upper sprockets and pick-up plate.

6. Unscrew and remove the nuts securing the buffer mounting plate to the aluminium casing and remove the mounting plate together with the distance tubes; remove the upright chain channel.

7. Unscrew and remove the three nuts and fitted bolts securing the spindle end housing to the aluminium casing; remove the end housing.

8. Collect the thrust washer from the inner face of the end housing, also collect the adjusting washer(s).

9. Remove the large rubber seal.

10. Withdraw the spindle from the casing together with the gear wheel, 'Metalastic' bush and lower chain sprocket.

11. Using a press and applying pressure to the sprocket end of the spindle, remove the gear wheel and sprocket from the spindle.

12. Remove the thrust washer from the casing.

13. Unscrew and remove the setscrews securing the electric motor to the aluminium casing; remove the motor.

On later cars with permanent magnet motors, it is sufficient to disconnect the Lucar connectors and remove the two setscrews securing the motor to the adapter plate.

14. Remove the nylon coupling.

15. Unscrew and remove the 2 B.A. bolts and washers securing the brake solenoid to the casing; remove the solenoid.

16. Remove the brake pad.

17. Remove the brake guide plate, shims and spacer.

18. Using the special spanner (RH 7819), hold the worm shaft firm by fitting the spanner to the splined end of the shaft and removing the nut and washer from the opposite end of the shaft.

19. Withdraw the disc and closing plate.

20. Remove the distance piece.

21. Press the worm drive shaft out of the ball bearing and remove the shaft from the housing.

22. Remove the circlip retaining the ball bearing; press out the ball bearing.

### Electric window lift mechanism —To inspect

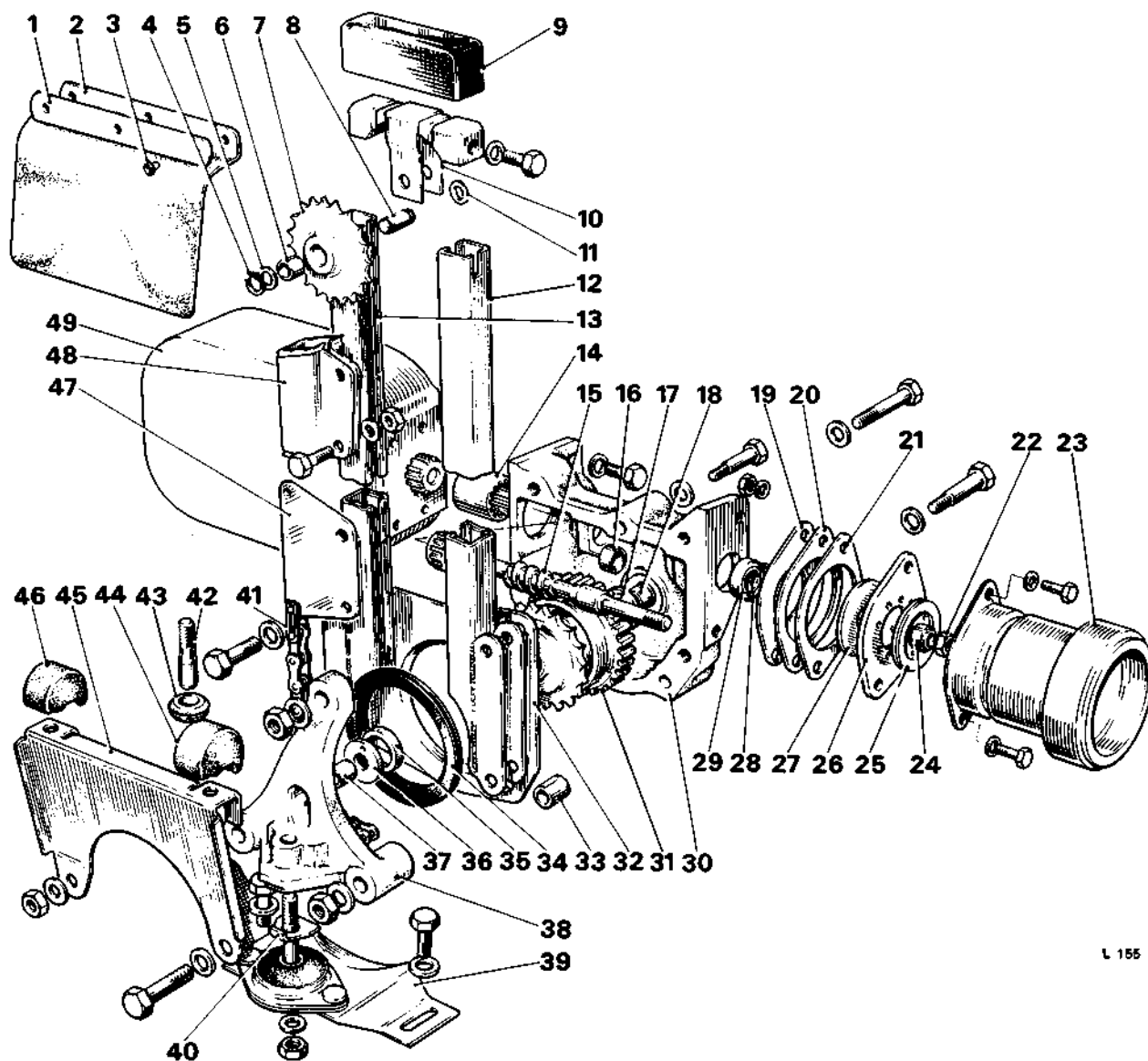
1. Examine all bearing bushes for signs of excessive wear and renew if necessary. Before removing worn bushes, note their position relative to their respective housing faces to ensure the correct assembly of new bushes.

2. Examine the thrust washers for signs of wear and cracking and ensure that their retaining pins are in good condition.

3. Examine the worm and wheel for worn and damaged teeth. When the gears are assembled into position, the backlash should be between 0,08 mm. and 0,18 mm. (0,003 in. and 0,007 in.).

4. Examine the chain for excessive wear by visually inspecting the link pins and by comparing its length against that of a new chain.

## Chapter M



L 155

FIG. M87 EXPLODED VIEW ELECTRICALLY OPERATED WINDOW LIFT

- |                                  |                               |                              |
|----------------------------------|-------------------------------|------------------------------|
| 1 Water shield retaining plate   | 16 Bearing bush               | 33 Distance piece            |
| 2 Water shield                   | 17 Thrust washer              | 34 Dust shield               |
| 3 Rivet                          | 18 Bush                       | 35 Sprocket adjusting washer |
| 4 Bearing pin circlip            | 19 Closing plate-brake flange | 36 Thrust washer             |
| 5 Bearing pin washer             | 20 Thrust plate spacer        | 37 Bearing bush              |
| 6 Bearing bush                   | 21 Shim                       | 38 Tripod                    |
| 7 Sprocket                       | 22 Worm shaft nut             | 39 Bracket assembly          |
| 8 Sprocket bearing pin           | 23 Brake solenoid             | 40 Washer                    |
| 9 Anti-rattle cap                | 24 Distance piece             | 41 Chain                     |
| 10 Bracket assembly-top sprocket | 25 Washer                     | 42 Steady pin                |
| 11 Wave washer-bearing pin       | 26 Brake shoe guide plate     | 43 Grommet                   |
| 12 Chain channel (left-hand)     | 27 Thrust plate               | 44 Stop                      |
| 13 Chain channel (right-hand)    | 28 Bearing circlip            | 45 Bracket-lower mount       |
| 14 Splined coupling              | 29 Bearing                    | 46 Stop                      |
| 15 Wormshaft assembly-gearcase   | 30 Gearcase                   | 47 Pick-up plate             |
|                                  | 31 Driven wheel and sprocket  | 48 Pick-up plate slider      |
|                                  | 32 Closing plate              | 49 Motor unit                |



## Chapter M

5. Examine the rubber seal for perishing, damage and signs that it is losing its resilience.

6. Examine the chain sprockets for wear by comparing them with a new one.

7. Visually check the brake pad for cracks and for excessive wear by comparing with a new one. Also ensure that the pad projections move freely in the guide plate.

8. Thoroughly wash the small ball bearing in clean petrol or white spirit (not paraffin) and examine for corrosion and signs of pitting. If the condition of the bearing is satisfactory it should be smeared with 'Rocol' MT 265 grease then wrapped in greaseproof paper until required for use.

9. Peel back the rubber cover surrounding the electric motor and examine the general condition of the brushgear and commutator. If these components are in poor condition or if their serviceable life is limited, a service exchange motor should be fitted.

If the general condition of the motor is satisfactory, the commutator and brushgear should be cleaned with a petrol soaked cloth and any particles of carbon dust remaining blown off with dry compressed air; ensure that the spent air is directed away from the working parts of the motor.

10. If the brush contact surface of the commutator is lightly scored or blackened by embedded carbon, the brushes should be lifted away from the contact surface and a piece of fine glass paper wrapped around the commutator; the working surface of the paper should be towards the commutator, on no account should emery cloth or a similar abrasive be used.

11. Apply light pressure to the glass paper and simultaneously rotate the armature; continue to do this until the surface of the commutator is thoroughly clean and free from score marks. Remove particles of dust and dirt, using dry compressed air and ensuring that the spent air is directed away from the working parts of the motor.

12. Check that the carbon brushes are perfectly free in their holders; if any tight spots are felt, the brushes should be manipulated until they move freely.

13. Fit the rubber covering.

**Important** When peeling back the rubber cover, care must be taken not to touch the thermal cut-out; if the blade is flexed, the accuracy of the setting cannot be guaranteed.

14. On later cars having permanent magnet motors, if a motor is faulty or suspect it should be replaced by a serviceable motor.

## Electrically operated window lift

## —To assemble

Reverse the procedure given for dismantling, noting the following points.

1. The end float in the lower sprocket spindle should be between 0,13 mm. and 0,25 mm. (0.005 in. and 0.010 in.). To obtain this end float an adjustment washer is provided between the thrust washer and the lower sprocket.

2. The nut securing the brake disc to the worm drive spindle should be tightened to the standard figure quoted in Chapter P - Torque Tightening Figures.

Note that the spanner (RH 7819) will be required to hold the serrated end of the worm shaft while the nut is being tightened.

3. The chain tension should be set so that, with finger pressure, the chain can be moved approximately 6,35 mm. (0.25 in.) on either side of its normal running position.

4. This adjustment should be carried out by using the special tool (RH 7769). Fit the tool over the top of the upper sprocket bracket so that the feet of the tool locate under the sprocket centre boss. Slacken the two setscrews securing the upper sprocket bracket and rotate the centre of the special tool until the above mentioned setting is obtained, after which the two setscrews should be tightened and the tool removed.

5. Shims should be fitted between the spacer and the brake guide plate to give a 0,25 mm. (0.010 in.) minimum clearance between the brake disc and the brake guide plate.

6. The sprocket bearing and chain should be lubricated with 'Rocol' MT 265 grease; the worm, worm bearing and worm wheel teeth should be lubricated with either 'Esso Beacon' or 'Aeroshell' grease.

## Section M14

**ELECTRICALLY OPERATED FRONT SEATS****Electrically operated seat mechanism—  
To remove and dismantle  
(see Fig. M88)****Early cars**

1. Remove the seat cushion.
2. Remove the four 'Plasti-rings' and pins securing the seat mechanism, then remove the seat together with the rake mechanism.
3. Operate the seat switch to move the seat mechanism fully forward, then remove the two socket-headed cap screws and washers securing the seat mechanism to the floor. Then again operate the seat switch to move the seat fully rearward and remove the two socket-headed cap screws and washers securing the seat mechanism to the floor.
4. Disconnect the battery.
5. Disconnect the leads to the solenoids and the electric motor.
6. Remove the extension setscrews securing the clutches to the seat actuating levers.
7. Remove the split-pin and washer retaining the electric motor and worm shaft to their pivot; withdraw the assembly from the pivot.
8. Unscrew and remove the four 2 B.A. setscrews securing the electric motor to the drive housing, then separate the two units.
9. Remove the first four roll pins on the large worm shaft.
10. Rotate in turn each clutch nut, anti-clockwise (as viewed from the front of the seat), and remove the three clutches and solenoids from the worm shaft. Note the position of the clutch nuts in relation to the worm shaft to ensure correct assembly.
11. Remove the four 2 B.A. setscrews securing the cover plate to the drive housing.
12. Withdraw the shaft together with the bearing and gear assembly.
13. Using a punch, tap out the pin securing the worm gear to the shaft.

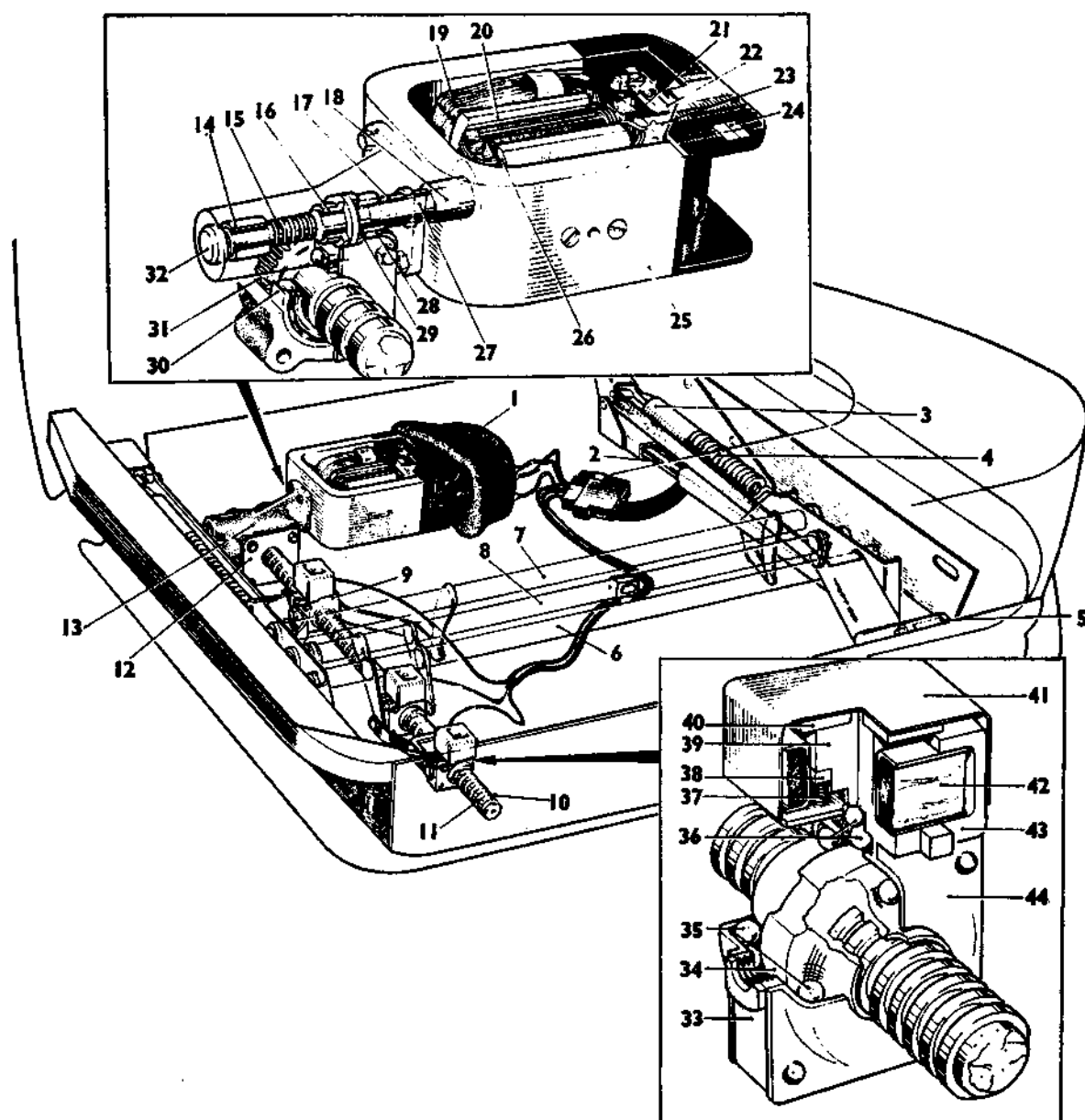
14. Using either a press or a 'Claw' type extractor, remove the gear and ball bearing from the shaft.

15. Remove the spacer, thrust washer and small worm shaft from the gear housing.

**Electrically operated seat mechanism  
To remove and dismantle****Late cars**

1. Remove the seat from the car as described in Chapter S - Body
2. Remove the setscrews securing the clutches to the seat actuating levers.
3. Remove the screw securing the motor to the motor support strut.
4. Remove the split pin and washer retaining the motor gear housing to the pivot; withdraw the assembly from the pivot.
5. Unscrew and remove the four 2 B.A. setscrews securing the motor to the gear housing then separate the two units.
6. Remove the first 4 roll pins from the actuating screw (counting from the front of the seat).
7. Rotate each clutch nut anti-clockwise (viewed from the front of the seats) and remove the three clutch assemblies from the actuating screw. Note the position of each clutch assembly on the actuating screw to ensure correct assembly.
8. Remove the four 2 B.A. setscrews securing the cover plate to the gear housing.
9. Withdraw the actuating screw together with the bearing and gear assembly.
10. Using a punch, tap out the pin securing the worm gear to the actuating screw.
11. Using either a press or 'claw' type extractor, remove the gear and bearing from the shaft.
12. Remove the spacer, thrust washer and small worm shaft from the gear housing.

**Chapter M**



G144

**FIG. M88 VIEW OF ELECTRICALLY OPERATED FRONT SEATS**

- |   |                      |                          |
|---|----------------------|--------------------------|
| 1 Rubber cover  | 13 Gear housing      | 29 Thrust washer         |
| 2 Seat slide  | 14 Bearing           | 30 Bearing               |
| 3 Polythene tube  | 15 Small worm shaft  | 31 Wormwheel             |
| 4 Spring  | 16 Bush              | 32 Plug                  |
| 5 Pin and plastic ring                                    | 17 Bush              | 33 Nut casing            |
| 6 Cross-shaft (for up and down movement at front of seat) | 18 Bush              | 34 Nut                   |
| 7 Cross-shaft (for fore and aft movement of seat)         | 19 Field winding     | 35 Ball race             |
| 8 Cross-shaft (for up and down movement of rear of seat)  | 20 Pole              | 36 Operating balls       |
| 9 Solenoid operated clutch assembly                       | 21 Brushgear         | 37 Plunger return spring |
| 10 Roll pin   | 22 Thermo cut-out    | 38 Retainer              |
| 11 Worm shaft   | 23 Commutator        | 39 Plunger               |
| 12 Cover plate  | 24 End housing       | 40 Plunger top           |
|   | 25 Motor casing      | 41 Cover                 |
|   | 26 Pole              | 42 Coil winding          |
|   | 27 Motor drive shaft | 43 Coil holder           |
|   | 28 Spacer            | 44 Cover plate           |

## Chapter M

## Seat mechanism—To inspect

## All cars

1. Examine the links and link pins for wear and fracture; worn pins will cause the mechanism to rattle.
2. Peel back the rubber covering surrounding the motor and examine the general condition of the brush gear and commutator. If these components are in poor condition or if their serviceable life is limited, a service exchange motor should be fitted.
3. If the general condition of the motor is satisfactory, the commutator and brushgear should be cleaned with a petrol-soaked cloth and any particles of carbon dust remaining should be blown away with dry compressed air; ensure that the spent air is directed away from the working parts of the motor.
4. If the surface of the commutator is lightly scored or blackened by embedded carbon, the brushes should be lifted away from the commutator and the commutator cleaned with a piece of fine glasspaper. Do not use emery cloth or similar abrasive.
5. Apply light pressure to the glass paper and rotate the armature until the surface of the commutator is thoroughly clean and free from score marks. Remove particles of dust and dirt using dry compressed air, ensure that the spent air is directed away from the working parts of the motor.
6. Verify that the carbon brushes are free in the holders.
7. Fit the rubber covering.
8. Thoroughly wash the bearing in clean petrol or white spirit (not paraffin), then examine the bearing for signs of pitting, corrosion or cracking of the balls or tracks.
9. Examine the bearing bushes for signs of excessive wear and replace if necessary. Before removing worn bushes, note their position relative to their respective housing face to ensure correct assembly of the new bushes.
10. Examine the worm and wheel for worn or damaged teeth.

non-electrical working parts should be lubricated with 'Rocol' MT 265 grease, the actuating screw should be lubricated with 'Moly tone' anti-scuffing paste.

Extreme care must be taken not to disturb the thermal cut-out (bi-metal blade, slightly concave, approximately 12.70 mm. x 19.05 mm. (0.5 in. x 0.75 in.) with a contact at the centre). Do not attempt to operate this switch by hand, any cold mechanical operation will alter the current/thermal switching characteristics.

## Seat mechanism—To assemble and fit

## All cars

Reverse the procedure given for removal and dismantling, noting the following points:

1. The worm and wheel gear should have a backlash of between 0.08 mm. and 0.18 mm. (0.003 in. and 0.007 in.).
2. With the exception of the actuating screw all

## Section M15

# RADIO RECEIVER, CARTRIDGE PLAYER, LOUDSPEAKERS AND AERIAL

## Receiver—To remove

Left and right-hand drive cars prior to Car Serial Numbers 6000 & 6791

1. Disconnect the battery.
2. Pull off the control knobs from their spindles. (it is not necessary to remove the aerial and balance control knobs). Remove the spindle lock nuts and receiver fascia finisher.
3. Unscrew and remove the two screws securing the receiver trim to the under-facia.
4. Lower the rear of the receiver trim and simultaneously withdraw the front of the trim clear of the receiver control spindles (see Fig. M89).
5. Disconnect the receiver current supply by disconnecting the in-line 'Lucar' connection (Green/Brown); ensure that the blade remains in the fuse lead.
6. Disconnect the loudspeaker connections from the in-line 'Lucar' connector block.
7. Remove the aerial lead from the receiver socket.
8. Unscrew and remove the four screws securing the receiver to the mounting brackets; accessibility may be improved if the brackets are completely removed.

## Receiver—To remove

Left and right-hand drive cars from Car Serial Numbers 6000 & 6791

1. Disconnect the battery.
2. Pull the control knobs off their spindles. Unscrew and remove the spindle lock-nuts.
3. **Right-hand drive cars only**, remove the two screws securing the air conditioning unit control knobs, remove the two screws securing the wooden fascia panel and carefully lift off.
- Left-hand drive cars only**, carefully lift off the wooden fascia panel.
4. Carefully prise away, using a flat tool, the triangular trim pads situated one each side of the console.

5. Disconnect the receiver current supply by disconnecting the in-line 'Lucar' connection (Brown/Green).
6. Disconnect the loudspeaker connections by disconnecting the in-line 'Lucar' connections and remove the aerial lead from the receiver.
7. Unscrew and remove the four extended-head setscrews securing the receiver brackets to the console.
8. Carefully withdraw the lead connection plugs for the air conditioning unit control switches and lay the plugs safely within the console.
9. Remove the two setscrews securing the receiver brackets to the receiver.
10. Carefully manoeuvre the receiver out of the console.

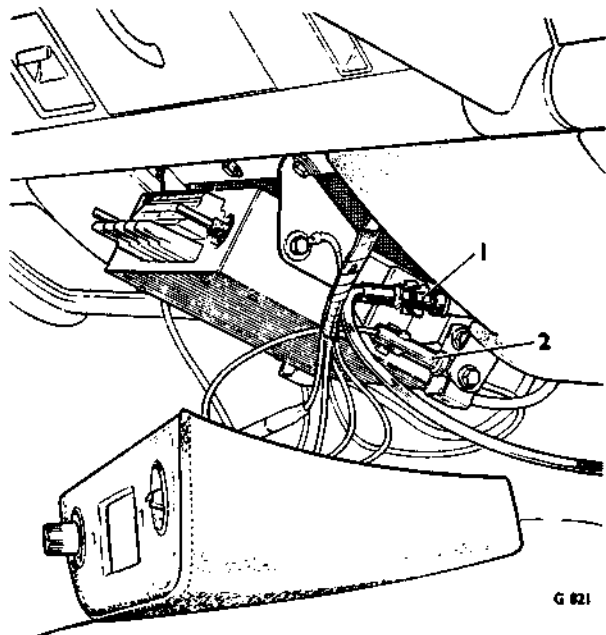


FIG. M89 RECEIVER WITH COVER REMOVED

1 Aerial connection 2 Fuse container

## **Chapter M**

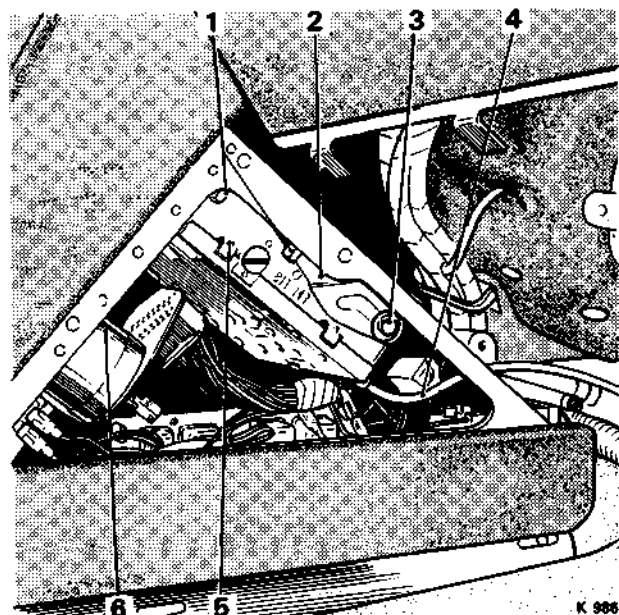
### **Receiver—To remove**

#### **Cars fitted with cartridge player**

1. Disconnect the battery.
2. Remove the control knobs and spindle nuts.
3. Remove the ash-tray and unscrew the 2 B.A. bolts securing the receiver brackets.
4. Withdraw the receiver and disconnect the Lucar connectors, aerial lead and earth braid.

### **Receiver fuse—To renew**

1. Remove the trim as described in Receiver - To remove.
2. Remove the white coloured fuse holder from its clip on the receiver and depress one end of the fuse container against spring pressure and turn anti-clockwise, then remove the fuse.



**FIG. M90 RECEIVER IN CONSOLE TRIM REMOVED**

- 1 Securing setscrews (extended head)
- 2 Receiver mounting bracket
- 3 Mounting bracket securing setscrew
- 4 Aerial lead
- 5 Receiver
- 6 Heating & demisting switch

### **Receiver bulb—To renew**

#### **Radiomobile**

1. Remove the receiver as described in Receiver - To remove.
2. Unscrew and remove the two screws securing the scale retainer and remove the embellisher and scale.
3. Using a screwdriver, carefully lift the small metal lamp shield. Removal of this exposes the blue filter for the bulb.
4. Carefully withdraw the filter and bulb holder; remove the bulb from the holder.

#### **Pye**

1. Remove the receiver as described in Receiver - To remove.
2. Rotate the manual tune spindle to bring the scale pointer to one end of the scale.
3. Unscrew and remove the two screws securing the back-plate, and carefully slide the back-plate sideways to clear the pointer and rest on the flats of the selector push buttons.
4. Push a piece of 4 mm. P.V.C. sleeving over the bulb; unscrew the bulb from its holder.

#### **Motorola**

1. Remove the receiver as described in Receiver - To remove.
2. Unscrew and remove the screw which secures the top cover of the receiver and remove the cover. This screw is positioned at the rear of the receiver.
3. Turn the bulb anti-clockwise.

### **Cartridge player—To remove**

1. Disconnect the battery.
2. Remove the knobs and spindle nuts.
3. Remove the console trim side cheeks, and remove the two nuts securing the mounting bracket.
4. Withdraw the cartridge player and disconnect the leads.

## Chapter M

**Front loudspeaker—To remove**

1. Disconnect the battery.
2. Remove the top roll as described in Chapter S - Body.
3. Unscrew and remove the four 2 B.A. nuts and bolts securing the plywood mounting board in position.
4. Disconnect the leads to the loudspeaker, taking note of the colour of the leads to ensure correct phasing on re-connection.
5. Remove the loudspeaker together with its mounting board.

**Door loudspeaker—To remove**

1. Disconnect the battery.
2. Remove the door trim as described in Chapter S - Body.
3. Remove the screws securing the loudspeaker.
4. Disconnect the leads and withdraw the speaker.

**Aerial—To trim****Radiomobile 980 and 982 VSY**

1. Pull the two control knobs off their respective spindles; unscrew and remove the reach nut and black finisher.
2. The aerial trimmer is adjacent to the manual tuning spindle, access is through the small hole.
3. Extend the aerial to its full extent, then select a weak signal of about 200 metres (1.5 megacycles). Insert a small screwdriver into the hole and turn either anti-clockwise or clockwise. Turn the trimmer until a setting is reached where the signal, having increased in strength, stops increasing and further rotation brings decrease.

**Philips 22 RM 686 - 681**

Proceed as for Aerial - To trim (Radiomobile).

**Motorola ZM 200 A**

1. Carefully prise away, using a flat tool, the triangular trim pads situated one each side of the console.
2. The aerial trimmer is situated at the rear of the receiver and is adjusted by turning the knurled knob in the desired direction.
3. Trim as for Aerial - To trim (Radiomobile 980 and 982).

**Philips N6X/16T**

1. Carefully lever away, using a flat tool, the triangular trim pads which are situated one each side of the console.
2. The aerial trimmer is assembled into the aerial connection flying lead socket and is adjusted by rotating the metal sleeve spirally along the socket.

**Radiomobile 1080/VRR**

1. Pull the two control knobs off their spindles; carefully lift off the wood facia panel.
2. Proceed as for Aerial - To trim (Radiomobile 980 and 982)

**Receiver aerial—To remove**

1. Disconnect the battery and remove aerial leads.
2. If difficulty is found locating these leads, their position will be obvious once the undersheets have been removed from the right-hand front wing. To remove the undersheets, proceed as follows.
3. Apply the handbrake and chock the rear wheels.
4. Using the lever specially provided in the tool kit, carefully remove the embellishers from the right-hand front wheel.
5. Slacken the front wheel nuts; the nuts on the right-hand side of the car have right-hand threads.
6. Position a jack fitted with a hardwood block beneath the front triangle levers pivot points. Jack up the car so that the front wheels of the car are clear of the floor. Support the front of the car on two sets of wooden blocks placed underneath the extremities of the lower triangle levers adjacent to the ball joints.
7. Unscrew and remove the wheel nuts; remove the wheel.
8. Remove the screws securing the rear part of the undersheets.
9. Remove the bonding lead from the valance earth point. (On early cars this may be secured on the engine side of the valance).
10. Remove the aerial feeder from the aerial mast by unscrewing the hexagon nut. (Knurled nut on early cars).
11. Disconnect the two supply leads at the 'Lucar' connectors.
12. Disconnect the earth return braid from the mounting bracket across the anti-vibration mount.

## Chapter M

13. Unscrew and remove the chromium plated bush fitted to the top of the wing. Take care not to damage the chromium plating.

14. Slacken the lower mounting nut securing the aerial assembly to its mounting bracket. It is then possible to slide the assembly free from its mounting.

15. Remove the aerial from underneath the wing together with its mounting rubbers and distance collar.

### Receiver aerial—To fit

Reverse the procedure given for removal, noting the following point (on early cars).

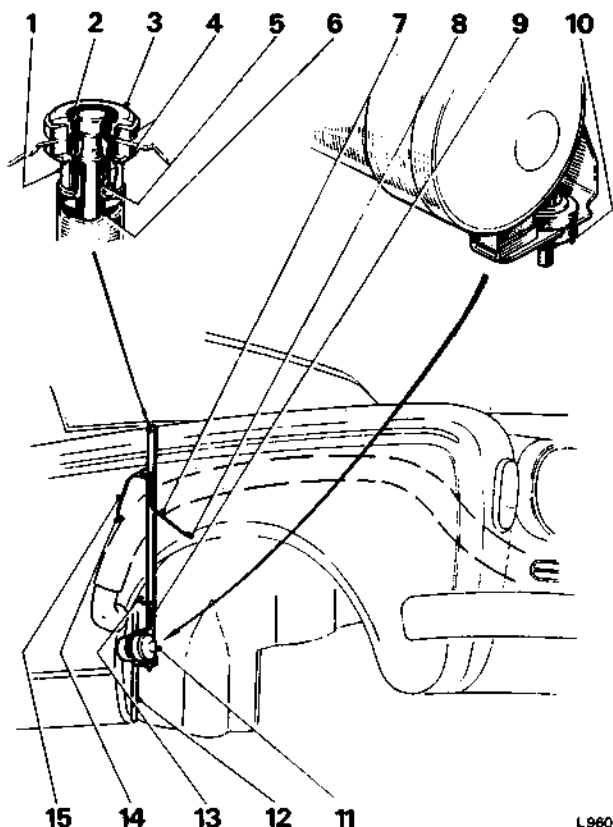
1. Ensure that the distance collar abuts the under-wing surface over the bright metal area around the wing crown hole.

**Note** (Early cars) on re-fitting, ensure that the bonding braid is fitted between the distance collar and valance earth.

### Electrical bonding of the car

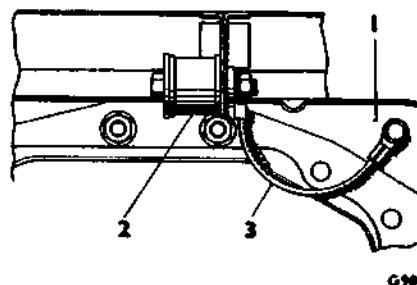
Bonding leads are fitted to minimise radiation from the ignition system and prevent radio receiver reception interference. Figures M92 to M97 show the positions where the tinned copper braided bonding leads are fitted.

It is important that good metal-to-metal contact is maintained between the bonding lead ends and the components or part of body which they adjoin, otherwise the function of the lead is lost.



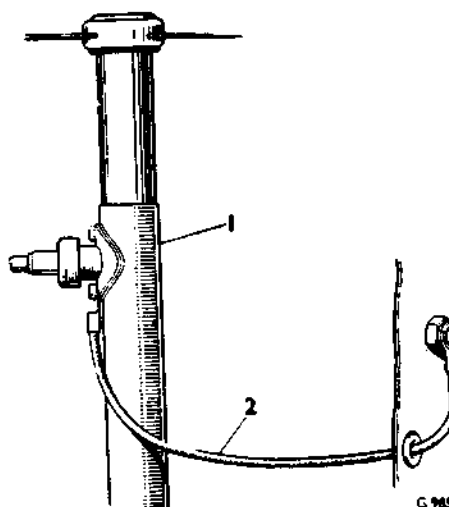
**FIG. M91 POSITION OF RADIO AERIAL**

- |                    |                         |
|--------------------|-------------------------|
| 1 Distance collar  | 9 Electric supply leads |
| 2 Seal             | 10 Mounting rubber      |
| 3 Chrome finisher  | 11 Motor                |
| 4 Mounting rubbers | 12 Heating system drain |
| 5 Threaded adapter | 13 Grommet              |
| 6 Seal             | 14 Grommet              |
| 7 Earth lead       | 15 Aerial lead          |
| 8 Grommet          |                         |



**FIG. M92 FINAL BONDING LEAD**

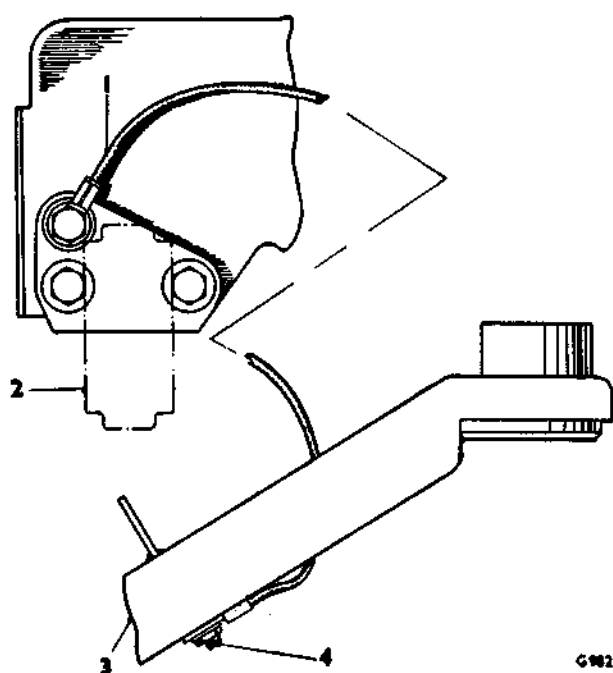
- 1 Final drive cross-member
- 2 Bracket spare wheel carrier
- 3 Bonding lead



**FIG. M93 AERIAL BONDING LEAD**

- 1 Underwing aerial
- 2 Bonding lead

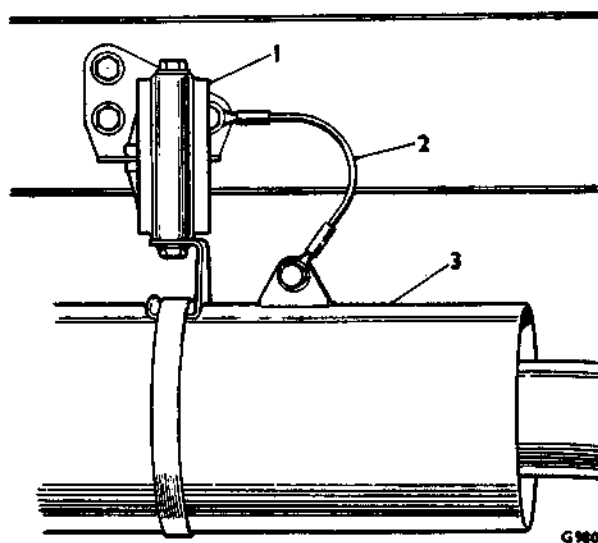




**FIG. M94 RIGHT-HAND TRAILING ARM BONDING LEAD**

- |                |                    |
|----------------|--------------------|
| 1 Bonding lead | 2 Exhaust mounting |
| 3 Trailing arm | 4 Earth            |

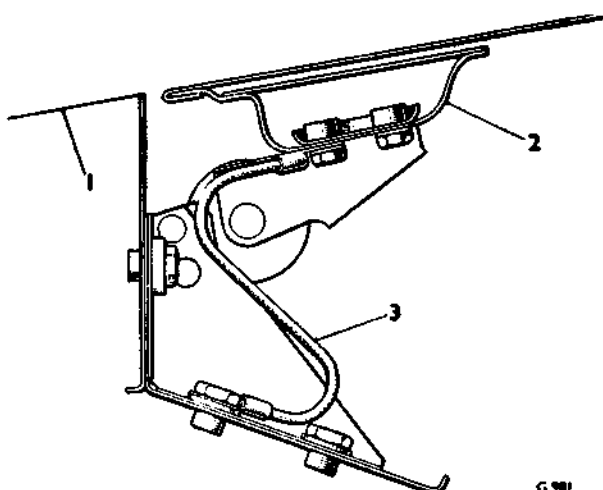
G 982



G 980

**FIG. M96 REAR DAMPER BOX BONDING LEAD**

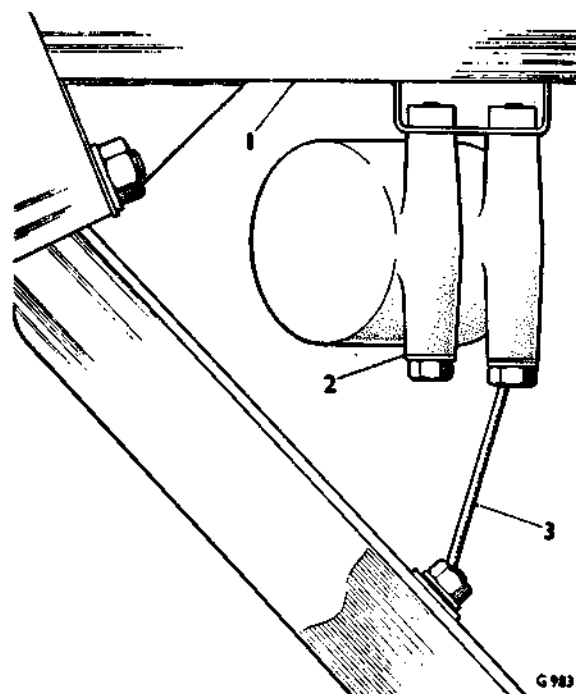
- |                       |              |
|-----------------------|--------------|
| 1 Damper box mounting | 3 Damper box |
| 2 Bonding lead        |              |



G 981

**FIG. M95 BONNET BONDING LEAD**

- |                  |
|------------------|
| 1 Radiator shell |
| 2 Bonnet         |
| 3 Bonding lead   |



G 983

**FIG. M97 LEFT-HAND TRAILING ARM BONDING LEAD**

- |                                |
|--------------------------------|
| 1 Rear suspension cross-member |
| 2 Height control solenoid      |
| 3 Bonding lead                 |

**Chapter M****Fault Diagnosis**

The Fault Diagnosis deals with minor radio faults only. Should the fault be proved beyond the scope of this diagnosis, the radio should be returned to Rolls-Royce Motors Limited, Crewe or London; or to a Distributor whose facilities include radio servicing.

Symptom	Possible Cause	Action
1. Receiver dead - no dial light	1. (a) Blown fuse (b) Faulty fuse holder	1. (a) Fit new fuse (b) Check that the contacts are clean and the spring pressure adequate
2. Receiver dead - dial illuminated	2. (a) Aerial lead has an open circuit or short circuit  (b) Speaker circuit disconnected	2. (a) Check aerial lead by substitution and renew aerial lead if this check rectifies fault  (b) Check connections at speakers and connecting block
3. Weak reception	3. (a) Radio aerial circuit not tuned to aerial  (b) Poor aerial connections	3. (a) Tune by adjustment to aerial trimmer. Adjust the trim until a setting is reached where the signal, having increased in strength stops increasing and further rotation brings a decrease  (b) Clean and tighten connections
4. Intermittent reception	4. (a) Loose aerial connections  (b) Faulty fuse holder assembly	4. (a) Tighten connections  (b) Check fuse holder
5. Interference	5. (a) Faulty speaker(s)  (b) Regulator noise. A 'grating' sound with no regular pattern is an indication of a faulty suppressor capacitor  (c) Generator noise. A whirring sound which rises in frequency with engine speed indicates a faulty suppressor capacitor  (d) Ignition noise. A vibration or crackle that increases in frequency as the engine is accelerated and varies with engine speed	5. (a) Adjust balance control to determine whether any difference in response of front and rear speakers. Renew one or both as necessary.  (b) Check the capacitor by substitution and renew if necessary  (c) Fit a suppressor capacitor to the positive output terminal. This effectively parallels existing capacitor built into generator  (d) Check the coil capacitor by substitution and renew if necessary  Check the distributor high-tension lead knurled nuts Check sparking plug connections and spark plug gaps

**Chapter M**

Symptom	Possible Cause	Action
	(e) Petrol pump noise. A ticking sound which corresponds to the frequency of pump operation	(e) Check petrol pump capacitors by substitution and renew if necessary.
	(f) Wiper motor noise. A continuous 'buzzing' sound	(f) Check wiper motor capacitors by substitution and renew if necessary

## Section M16

# LONG WHEELBASE CARS FITTED WITH CENTRE DIVISION

(Car Serial Number 6598 onwards)

When carrying out any work on the centre division, the utmost precautions in cleanliness must be observed. The trim, being cloth, is easily marked if carelessly handled.

To renew any electrical item fitted to the division console, the console must be detached from the division.

### Division console—To remove

1. Disconnect the battery.
2. Remove each pocket adjacent to either side of the division console, by removing the three nuts found at the lower edge of each pocket; the console securing bolts will now be visible.
3. Unscrew and remove the four bolts securing the division console to the division and carefully allow the console to separate from the division.
4. Disconnect the electrical connections and place the console on a clean working surface.

### Radio—To remove

1. Pull the two control knobs from their spindles.
2. Remove the wooden fascia panel.
3. Unscrew and remove the four screws securing each hot and cold air blower switch.
4. Rotate the switches clear of the receiver.
5. Unscrew and remove the four screws securing the receiver to the console (two screws situated either side of the receiver).
6. Remove the receiver, taking care to retrieve the knob spindle spacers, noting that the small end fits towards the receiver.

### Radio—To trim the aerial

To trim the aerial, proceed as described in Section M15 - Radio Receivers and Loudspeakers.

### Division glass lift switch—To remove

Remove the division console from the division as described in Division console - To remove.

1. Disconnect the electrical connections, noting the colours to facilitate assembly.
2. Remove the two small 'Philips' screws securing the switch mounting plate to the console.
3. Remove the switch.

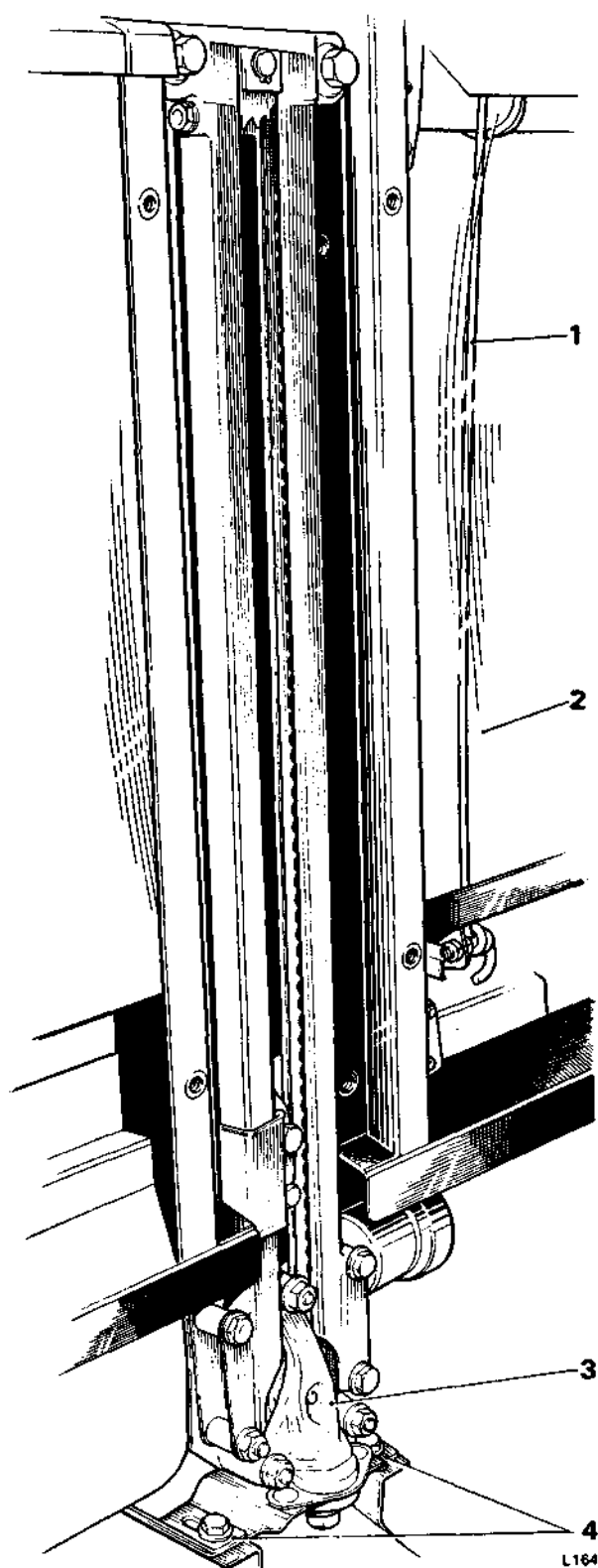
### Aerial switch—To remove

Proceed as for Division glass lift switch - To remove.

### Hot and cold air blowers switch —To remove

1. Remove the division console as described in Division console - To remove.
2. Remove the receiver as described in Receiver - To remove.
3. Rotate the switch through 90° and remove.

## Chapter M



**FIG. M98 DIVISION GLASS LIFT MOTOR  
IN POSITION**

- |         |                     |
|---------|---------------------|
| 1 Cord  | 3 Motor unit tripod |
| 2 Glass | 4 Mounting points   |

### Division glass lift motor—To remove (see Fig. M98)

1. Disconnect the battery.
2. Remove the two front seats as described in Chapter S - Body.
3. Remove the centre buttress panel covering the division glass motor by removing the four  $\frac{7}{16}$  in. A/F setscrews from the vertical piece of the buttress, the four  $\frac{7}{16}$  in. A/F nuts situated at the base and the two  $\frac{9}{16}$  in. A/F setscrews securing the buttress to the tunnel.
4. Remove the two upper chain guard setscrews.
5. Remove the two lower motor retaining setscrews, noting the earth strap fitted to the near-side setscrew.
6. Support the division glass with a suitable prop.
7. Withdraw the motor unit, lower end first, so that the lift tongue disengages from between the two rollers on the division glass frame.
8. Remove the division glass lift motor.

### Division glass lift motor —To overhaul

Proceed as for Window lift mechanism - To overhaul, as described in Section M13 - Electrically operated window lifts.

## Section M17

# COACHBUILT CARS

The Rolls-Royce and Bentley T Series Corniche cars are fitted with the same major electrical components as the standard saloon, i.e. instruments, alternator, dynamo, starter motor, ignition equipment, radio receiver and electrically operated seat motors.

In this Section the overhaul, repair and maintenance of the components special to Coachbuilt cars are described; all other information is given in the appropriate Sections of this Chapter.

In the unlikely event of a Power Operated Hood electrical component becoming faulty, it should be replaced with a new unit.

### Access to power-operated hood components

The electrically operated hood, solenoid valves, motor/pump unit, switch and reservoir are located behind the trim pad situated at the front of the luggage compartment.

To gain access to the components the following procedure must be used.

1. Disconnect the battery.
2. Remove the luggage compartment floor coverings and stow in a safe place.
3. Remove the trim pad situated at the front of the luggage compartment by removing the six screws. Remove the two adjacent trim pads.
4. Unscrew and remove the four 2 B.A. setscrews situated on each side of the assembly box.
5. Carefully withdraw the assembly box.
6. The electrical components will now be accessible for removal or inspection.

**Note** If any electrical component is found to be faulty, it should be replaced with a new unit.

### Motor/pump unit—To remove (see Fig. M99)

1. Remove all hydraulic fluid from the pump reservoir as described in Chapter S - Body.
2. Disconnect the electrical connections from the motor/pump unit, noting the positions to facilitate assembly.
3. Disconnect the hydraulic fluid feed pipe and the hydraulic high pressure supply hose from the motor/pump unit.
4. Fit suitable blanking plugs into the vacant holes to prevent ingress of foreign matter.
5. Remove the two motor/pump unit securing straps secured by four  $\frac{7}{16}$  in. A/F nuts.
6. Remove the motor/pump unit.

### Solenoid valves—To remove (see Fig. M99)

1. Disconnect the battery.
2. Using a syringe, remove all hydraulic fluid from the reservoir.
3. Disconnect the appropriate cable at the junction box (see Fig. M99).
4. Disconnect the hydraulic connections.
5. Remove the two  $\frac{7}{16}$  in. A/F nuts and bolts securing the solenoid valve to the assembly box.
6. Remove the solenoid valve.

### Motor/pump unit switch —To remove

1. Disconnect the battery.
2. Disconnect the electrical connections, noting the position to facilitate assembly.
3. Unscrew and remove the two switch securing nuts and bolts.
4. Remove the switch.

## Chapter M

### Window lift motor—To remove

All cars from Car Serial Number 6000  
(see Fig. M100)

If the window lift motor is found to be faulty, it must be replaced with a new unit.

1. Disconnect the battery.
2. Remove the two screws securing the emergency winder embellisher; remove the embellisher.
3. Lift off the door arm rest.
4. Remove the two arm rest mounting plate securing screws; remove the plate.
5. Remove the six screws located at the lower edge of the door trim pad.
6. Remove the three screws securing the door garnish rail.
7. Lifting vertically, remove the garnish rail.
8. Remove the door trim pad by placing the hands at the centre of the upper and lower edges of the door trim pad. Exert pressure at these points causing the trim pad to 'bell-out'. This operation releases the door trim pad from the two stainless steel retainers at the leading and trailing edges of the door; remove the dust cover.
9. Remove the setscrew securing the drop window to the pick-up plate.

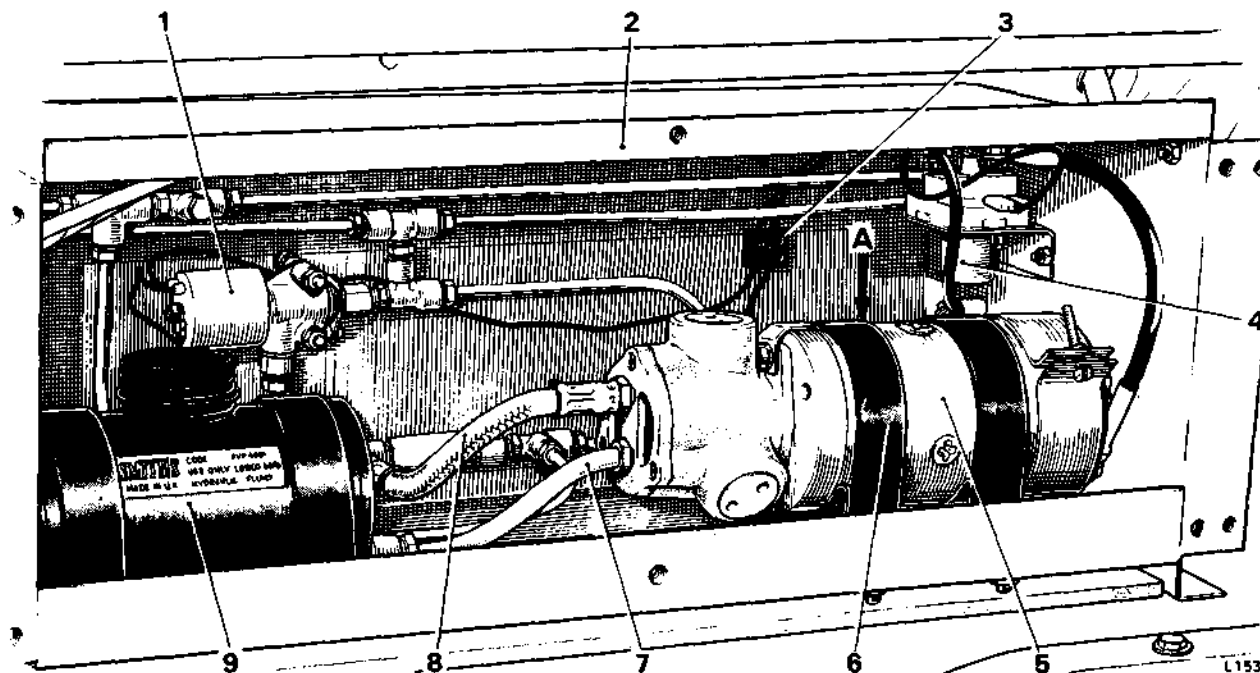
**Note** It is advisable to tape the glass over the window frame to prevent the glass from suddenly dropping (2-Door Saloons only).

10. Remove the screws securing the chainguard to the inner door panel.
11. Disconnect the electrical connections from the terminal box situated on the face of the motor assembly, noting the positions to facilitate fitting.
12. Remove the two setscrews securing the window lift motor to the base of the door.
13. Remove the window lift motor.

### Window lift motor—To remove

All cars prior to Car Serial Number 6000

1. Disconnect the battery.
2. Remove the ventilator window knob by unscrewing the small grub screw situated on the knob shaft.
3. Remove by carefully prising away, the window lift switch finisher.
4. Remove the switch embellisher by removing the two screws.



**FIG. M99 ELECTRICALLY OPERATED HOOD COMPONENTS IN POSITION**

- |  |   |                      |
|--|---|----------------------|
| A Solenoid situated behind motor/pump unit | 3 Connector block                       | 6 Securing strap     |
| 1 Solenoid                                 | 4 Electrically operated switch (4.S.T.) | 7 Low pressure pipe  |
| 2 Components box assembly                  | 5 Motor/pump unit                       | 8 High pressure pipe |
|  |   | 9 Reservoir          |

5. Remove the window lift master switch embellisher in the same manner as described in Operation 3.
6. Remove the remote control handle.
7. Remove the emergency window winder embellisher by unscrewing the two securing screws.
8. Lift off the door arm rest.
9. Remove the two screws securing the arm rest mounting plate.
10. Remove the three screws securing the door garnish rail.
11. Lifting vertically, remove the door garnish rail.
12. Remove the door trim pad by placing the hands at the centre of the upper and lower edges of the door trim pad. Exert pressure at these points causing the trim pad to 'bell-out'.

This operation releases the door trim pad from the two stainless steel retainers at the leading and trailing edges of the door; remove the dust cover.

13. Remove the setscrews securing the drop window to the pick-up plate.
14. Remove the screws securing the chainguard to the inner door panel.
15. Disconnect the electrical connections from the terminal box situated on the face of the motor assembly, noting the positions to facilitate fitting.
16. Remove the two setscrews securing the electric window lift motor to the base of the door.
17. Remove the window lift motor.

### Heater blowers switch—To remove

Cars prior to Car Serial Number 6000

Proceed as described in Section M9 - Interior switches.

### Heater blowers switch—To remove

Cars from Car Serial Number 6000

1. Disconnect the battery.
2. Remove the centre console wooden finisher by removing the four screws.
3. Roll back the floor covering from the centre console.
4. Remove the eight screws securing the console to the floor.
5. Place the console on its side and disconnect the electrical connections; lift out the console.
6. Place the console on a clean working surface; remove the screws securing the switch to the console.
7. Turn the switch through 90° and withdraw from the rear of the console.

### Hazard warning switch—To remove

Cars prior to Car Serial Number 6000

Proceed as described in Section M9 - Interior switches.

### Hazard warning switch—To remove

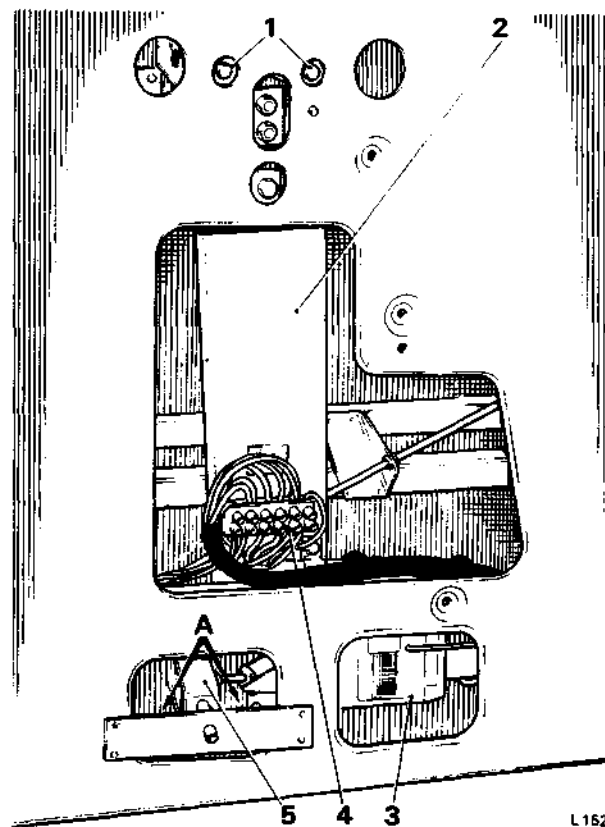
Cars from Car Serial Number 6000

1. Disconnect the battery.
2. Remove the hazard warning switch knob, by unscrewing in an anti-clockwise direction.
3. Remove the bulb.
4. Remove the ashtray by lifting vertically.
5. Remove the switch circular securing nut and withdraw the switch downwards and out through the ashtray aperture.

### Radio receiver—To remove

Cars prior to Car Serial Number 6000

Proceed as described in Section M15 - Radio Receivers and Loudspeakers.



**FIG. M100 ELECTRICALLY OPERATED WINDOW  
LIFT MOTOR IN POSITION**

- A Lower mounts (hidden)
- 1 Upper mounts
- 2 Chain guard
- 3 Motor
- 4 Connector block
- 5 Emergency winder mechanism



## **Chapter M**

### **Radio receiver—To remove**

#### **Cars from Car Serial Number 6000**

1. Disconnect the battery.
2. Remove the two screws situated at the rear edge of the radio receiver console centre panel.
3. Pull the receiver knobs off their spindles.
4. Carefully lift off the wooden fascia.
5. Remove the screws situated at the top edge of the receiver console centre panel; lift off the centre panel.
6. Remove the three screws at the base of the receiver tray, and support the receiver with one hand.
7. Remove the two screws at the top of the receiver adjacent to the fresh air outlet grille.
8. Lower the receiver and remove all electrical connections, noting the colours to facilitate assembly.
9. Remove the aerial lead.
10. Remove the receiver and tray.

### **Quarter-light window lift motor —To remove**

#### **Convertible**

1. Ensure that the quarter light is in the 'up' position.
2. Disconnect the battery.
3. Remove the rear seat cushion.
4. Unscrew and remove the two screws at the base of the back rest squab, lift the squab vertically and remove.
5. Remove the wood finisher from the arm rest by removing the four securing screws (remove the ash-tray and remove three screws on later cars).
6. Remove the rear quarter light wood finisher.
7. Remove the side trim pad securing screws and remove the trim pad.

8. Remove the 'Allen' screw securing the drive to the emergency winder mechanism.
9. Remove the four setscrews securing the whole assembly to the body frame.
10. Disconnect the electrical connections, noting the colours to facilitate assembly.
11. Remove the assembly from the body, taking care not to mark the glass.
12. Remove the motor from the assembly.

### **Rear opening quarter-light motor—To remove**

#### **All two-door saloons**

1. Disconnect the battery.
2. Remove the rear seat cushion.
3. Remove the two screws at the base of the back rest squab, lift the squab vertically and remove from the car.
4. Unscrew and remove the two screws securing the wood finisher to the arm rest. On later cars, remove the ashtray and the three securing screws.
5. Remove the three self-tapping screws securing the trim pad to the body frame.
6. Remove the rear quarter light finisher and trim pad.
7. Disconnect the mechanical window lift drive bolts securing the mechanical drive to the motor drive.
8. Remove the setscrew from the quarter light swivel linkage; open fully the quarter light.
9. Remove the setscrews securing the brass block on the driveshaft, separate the two halves of the block and lift out the drive-shaft.
10. Disconnect the leads to the motor; remove the four screws securing the mechanism to the panel.
11. Remove the motor.

## Electrical Fault Finding Analysis for Power Operated Hood

Symptom	Possible Cause	Remedy
1. The system will not function when the switch is operated	1. (i) Battery voltage has fallen below 9 Volts (ii) The electrically operated switch for the pump motor is faulty (iii) Faulty operating switch (iv) Faulty fuse (v) Faulty motor/pump unit (vi) Break in circuitry (vii) Incorrectly tightened or dirty electrical connections	1. (i) Check battery condition, and replace if necessary (ii) Test the switch as described in Section M4 - Starter Motor (iii) Substitute with one known to be in good condition (iv) Check the fuse on the Distribution board (No. 6) (v) a. Inspect the brushgear, and replace if necessary b. Replace if necessary the motor/pump unit (vi) Check all circuitry for continuity (vii) Check all terminals for tightness
2. Power unit working correctly, but the hood will not open or close	2. (i) Both solenoid valves faulty (ii) Incorrectly tightened or dirty electrical connections (iii) Lack of hydraulic fluid	2. (i) Renew solenoid valves (ii) Check electrical connections (iii) Check level of hydraulic fluid in reservoir
3. The hood will not open although the pump is working	3. (i) The UP solenoid is faulty (ii) Incorrectly tightened or dirty electrical connections (iii) Lack of hydraulic fluid	3. (i) Renew the solenoid valve (ii) Check the electrical connections (iii) Check the level of hydraulic fluid in reservoir
4. The hood will not close although the pump is working	4. (i) The DOWN solenoid is faulty (ii) Incorrectly tightened or dirty electrical connections (iii) Lack of hydraulic fluid	4. (i) Renew the solenoid (ii) Check the electrical connections (iii) Check level of hydraulic fluid in reservoir

## Section M18

## HEATER BLOWER MOTORS

The heater blower motor is a sealed unit for which no maintenance is required other than to ensure that the electrical connections are clean and correctly tightened and that the motor flexible mounts are in good condition.

In the unlikely event of a blower motor failure, the motor should be renewed.

**Heater blower motor—To remove**

All cars prior to Car Serial Number 6000

1. Disconnect the battery.
2. Disconnect the motor electrical connections.
3. Unscrew and remove the three 2 B.A. nuts securing the blower motor to its housing.
4. Carefully withdraw the motor and impeller from its housing.

**Heater blower motor—To remove**

Left-hand drive cars from Car Serial Number 6000

1. Disconnect the battery.
2. Disconnect the motor electrical connections.
3. Remove the wiper motor (only when removing the right-hand blower motor).
4. Unscrew and remove the three 2 B.A. nuts securing the blower motor to its housing.
5. Carefully withdraw the motor unit and impeller from its housing.

**Heater blower motor—To fit**

All cars

Reverse the procedure given for removal, noting the following points.

1. Ensure that the cables are correctly connected to the motor. The yellow/green cable is connected to the terminal marked positive (+ve) and the black

cable is connected to the terminal situated on the opposite side of the blower motor.

**Note** It is imperative that the yellow/green cable is connected to the correct terminal otherwise blower motor rotation will be reversed.

2. Ensure that the seal is in good condition; renew if necessary.
3. Ensure that the motor flexible mounts are in good condition; renew if necessary.

**Blower motor impellor (fan)—To remove**

Early cars

1. With the blower motor removed, unscrew and remove the hexagon headed cone nut securing the impeller to the motor shaft.
2. Remove the impeller from the shaft.

**Blower motor impellor (fan)—To fit**

Early cars

Reverse the procedure given for removal, noting the following point.

1. When the cone nut is fully tightened, the distance measured from the end face of the nut to the end of the motor drive shaft must read 15,875 mm. (0.625 in.).

**Blower motor impellor (fan)—To remove**

Later cars

1. With the blower motor removed, remove the small 'Allen' screw located on the side of the impeller boss.
2. Remove the impeller from the shaft.

## **Chapter M**

### **Blower motor impellor (fan)—To fit**

#### **Later cars**

Reverse the procedure given for removal, noting the following point.

1. When the impeller is secured to the motor drive shaft, the distance measured from the end face of the impeller boss to the end of the motor drive shaft must read 15,875 mm. (0.625 in.).