

SUB-SECTION O5

CHAPTER 17

COMBINED DIRECTION INDICATOR, HEADLIGHT AND HORN SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the combined switch:

- (1) Disconnect the battery earth lead.
- (2) Remove both halves of the switch shroud from the steering column (six screws in all. The seventh (larger) screw is for the fuse box. Do not remove).

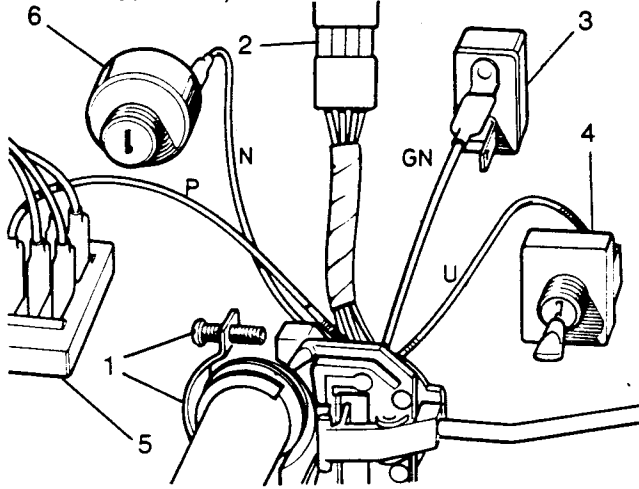


Fig O5.21

- (3) Refer to Fig O5.21. Unscrew the bolt (1) to release the switch from the steering column.
- (4) Withdraw the combined switch sufficient to disconnect the main harness (2) at the plug connector.

(5) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

(6) Disconnect the switch leads from the flasher unit (3), lighting switch (4), fuse box (5) and ignition switch (6). Note that only the leads connected to the switch unit are to be disconnected at the other units.

(7) Withdraw the combined switch.

REPLACEMENT

2. Replace the combined switch unit as follows:

(1) Connect the leads from the switch unit to the flasher unit (3), lighting switch (4), fuse box (5) and ignition switch (6) as shown in the illustration above.

(2) Fit the switch unit into position.

(3) Refit the instrument panel to the dash.

(4) Connect the main harness (2) to the plug connector.

(5) Secure the switch unit with the clamp and bolt (1).

(6) Replace the two halves of the shroud.

(7) Reconnect the battery earth lead.

Lead colours:

G - Green
N - Brown
P - Purple
U - Blue

SUB-SECTION O5

CHAPTER 18

FUSE BOX - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fuse box:
 - (1) Disconnect the battery earth lead.
 - (2) Remove the upper half of the switch shroud from the steering column (four screws).

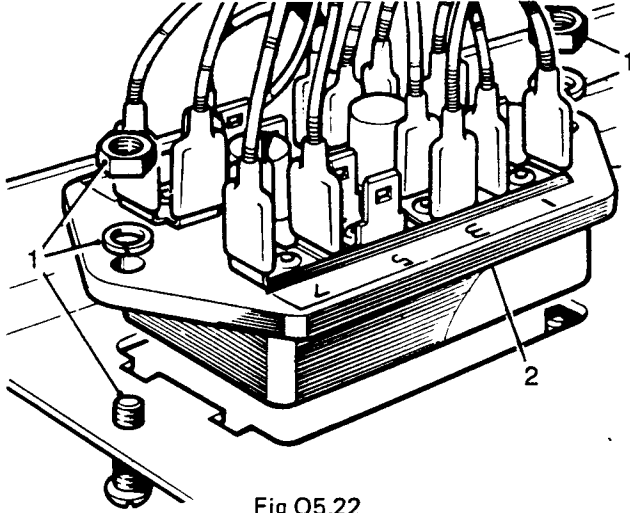


Fig O5.22

- (3) Refer to Fig O5.22. Disconnect all leads from the fuse box.
- (4) Remove the fuse box fixings (1) and (2) and lift the fuse box out of the lower shroud.

REPLACEMENT

2. To replace the fuse box:
 - (1) Fit the fuse box into the lower shroud and secure with the screws, lockwashers and nuts (1) and (2).
 - (2) Connect the leads to the fuse box:

Terminal	Lead Colour
1	Brown
2	Purple
3	Brown
4	Brown*
5	White
6	3 x Green
7	White
8	2 x Green

- (3) Replace the upper shroud.
- (4) Check that the four fuses and two spares are all 17 amps with a 35 amp blow rate.
- (5) Reconnect the battery earth lead.

*NOTE

It is important that the brown lead to terminal 4 is the lead from the hazard unit (see wiring diagram).

SUB-SECTION O5

CHAPTER 19

SPEEDOMETER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the speedometer from the instrument panel:
 - (1) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

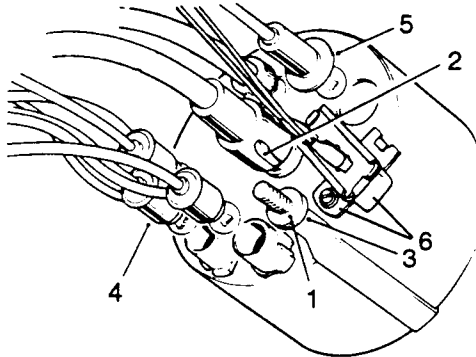


Fig O5.23

- (2) Refer to Fig O5.23. Remove the knurled nuts (1) at the speedometer clamp brackets.
- (3) Withdraw the earth lead eyelets (3) and shakeproof washers from the clamp studs.
- (4) Depress the spring clip and withdraw the speedometer cable (2).
- (5) Withdraw the speedometer clear of the instrument panel.
- (6) Withdraw the warning lamp (4) and illumination lamp (5) bulb holders.
- (7) Disconnect the leads from the instrument voltage stabiliser (6).
- (8) Remove the speedometer.

REPLACEMENT

2. To replace the speedometer:

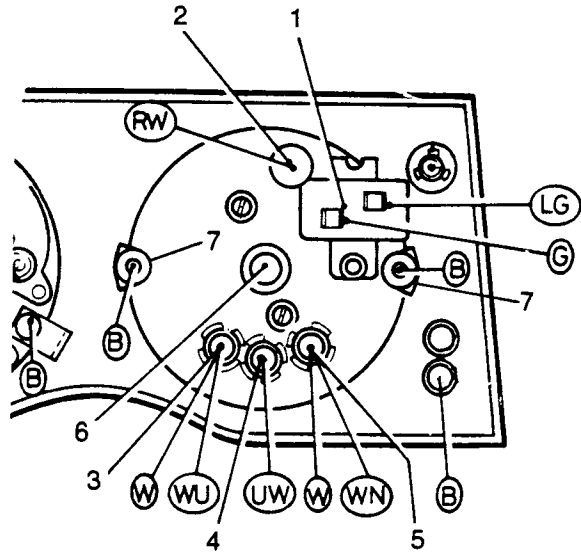


Fig O5.24

- (1) Refer to Fig O5.24. Hold the speedometer in front of the instrument panel, refit the warning and illumination lamp holders and leads to the following:
 - a. The voltage stabiliser (1).
 - b. The illumination hole (2).
 - c. The cold start warning lamp mounting (3).
 - d. The headlamp main beam warning lamp mounting (4).
 - e. The oil pressure warning lamp mounting (5).
- (2) Fit the speedometer into the instrument panel and reconnect the speedometer drive cable into its fitting (6).
- (3) Replace the earth lead eyelets, shakeproof washers and clamp brackets. Secure with the knurled nuts (7).
- (4) Refit the instrument panel to the dash.

Lead colours:

W - White
B - Black
U - Blue
N - Brown
G - Green
R - Red
L - Light

SUB-SECTION 05

CHAPTER 20

OIL PRESSURE WARNING SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. The oil pressure warning switch is attached to the right hand lower side of the engine, below the ignition coil and adjacent to the engine mounting. Remove the switch as detailed below:

- (1) Disconnect the battery earth lead.
- (2) Disconnect the electrical lead from the switch.
- (3) Unscrew the switch.
- (4) Remove the switch and sealing washer.

REPLACEMENT

2. To replace the switch:

- (1) Fit the switch into position using a new sealing washer.
- (2) Screw the switch home.
- (3) Connect the electrical lead to the switch unit.
- (4) Reconnect the battery earth lead.

SUB-SECTION 05

CHAPTER 21

COOLANT TEMPERATURE TRANSMITTER - REMOVAL AND REPLACEMENT

REMOVAL

1. The coolant temperature transmitter is fitted to the thermostat housing on the left hand upper side of the engine just above the water pump and oil filter. To remove the transmitter:
 - (1) Drain the cooling system.
 - (2) Disconnect the electrical lead from the transmitter.
 - (3) Remove the transmitter from the thermostat housing.

REPLACEMENT

2. Replace the transmitter as follows:
 - (1) Fit the transmitter into position using a new sealing washer.
 - (2) Connect the electrical lead to the transmitter.
 - (3) Refill the cooling system with the correct water and inhibitor solution and add antifreeze if required.

SUB-SECTION O5

CHAPTER 22

FUEL CONTENTS GAUGE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fuel contents gauge:

- (1) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

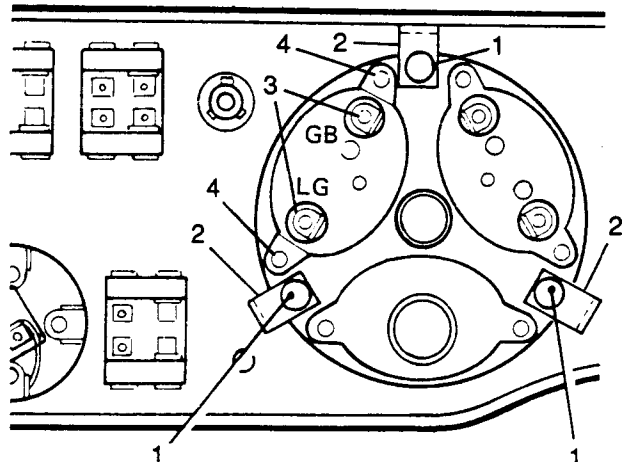


Fig O5.25

- (2) Refer to Fig O5.25. Remove the three knurled nuts (1) at the grouped instruments clamp brackets (2).
- (3) Withdraw the three earth lead eyelets and shakeproof washers.
- (4) Withdraw the grouped instrument clear of the instrument panel.

(5) Disconnect the 'Lucar' connectors (3).

(6) Remove the fixing screws (4) and withdraw the gauge.

REPLACEMENT

2. To replace the fuel contents gauge:

- (1) Fit the gauge into the grouped instrument and secure with the fixing screws (4).
- (2) Reconnect the Lucar connectors as illustrated.
- (3) Fit the grouped instrument into the instrument panel.
- (4) Refit the shakeproof washers and earth lead eyelets.
- (5) Replace the clamp brackets (2) and secure with the three knurled nuts (1).
- (6) Fit the instrument panel to the dash.

Lead colours:

G - Green
B - Black
L - Light

SUB-SECTION 05

CHAPTER 23

FUEL TANK GAUGE UNIT - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the unit:

- (1) Disconnect the battery earth lead.
- (2) Remove the inspection cover in the rear floor.

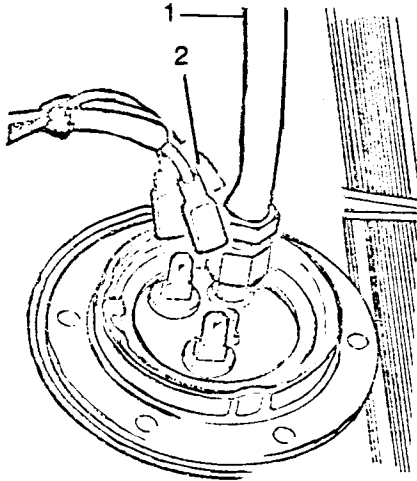
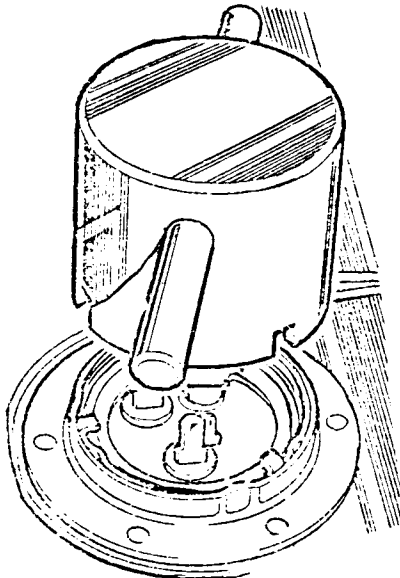


Fig O5.26

- (3) Refer to Fig O5.26. Disconnect the fuel pipe (1) at the fuel tank gauge unit.
- (4) Note the position of the electrical leads (2) and disconnect them from the unit.



- (5) Refer to Fig O5.27. Using special tool 600964 turn the gauge unit locking ring counterclockwise until the indents in the locking ring align with the lugs on the tank.

(6) Withdraw the locking ring.

(7) Withdraw the complete fuel gauge unit.

(8) Remove the rubber seating ring.

REPLACEMENT

2. Replace the gauge unit as follows:

- (1) Lightly smear the joint faces on the gauge unit, the sealing washer and the fuel tank with Bostik adhesive No 772 or a suitable alternative.
- (2) Insert the gauge unit and seating washer into the tank and engage the two lugs in the gauge unit base plate into the cutouts in the fuel tank flange.
- (3) Fit the locking ring and using special tool 600964 turn the ring clockwise until it is locked.
- (4) Connect the fuel pipe to the unit.
- (5) Reconnect the electrical leads.
- (6) Reconnect the battery earth lead.

SUB-SECTION O5

CHAPTER 24

BLACKOUT STOP LAMP - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the lamp:
 - (1) Disconnect the battery earth lead.

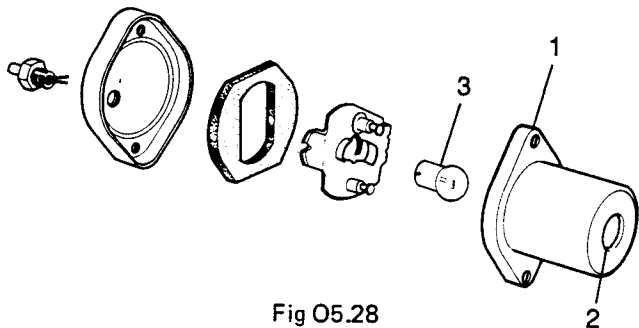


Fig O5.28

- (2) Refer to Fig O5.28. Remove the lens cover fixings (1) and pull off the lens.
- (3) Remove the bulb (3) if required.
- (4) Remove the fixings for the cover in the rear of the load area behind the lamp (two self tapping screws and one nut) and lift the cover away.
- (5) Disconnect the lamp leads at the snap connectors making a note of which socket each lead comes from.
- (6) Remove the two nuts holding the lamp to the wall and pull the lamp body away.

REPLACEMENT

2. Replace the lamp as follows:
 - (1) Position the lamp on the rear wall and secure with the two nuts and washers.
 - (2) Reconnect the lamp leads at the snap connectors.
 - (3) Replace the bulb.
 - (4) If removed, replace the lens (2) into the cover, locating the grooves in the lens over the protrusions inside the cover.
 - (5) Fit the lens cover and secure with the two screws (1).
 - (6) Replace the cover in the load area and secure with the two self tapping screws and the screw, washers and nut.
 - (7) Reconnect the battery earth lead.

SUB-SECTION O5

CHAPTER 25

NUMBER PLATE LAMP - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the lamp:

(1) Disconnect the battery earth lead.

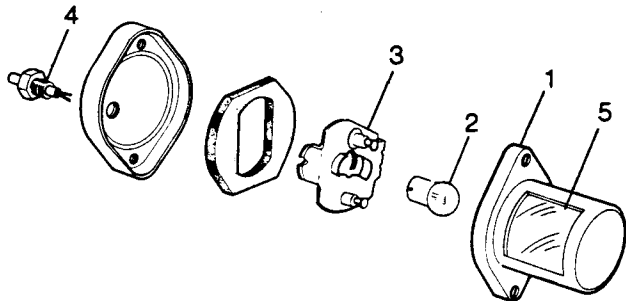


Fig O5.29

- (2) Refer to Fig O5.29. Remove the lens cover fixings (1).
- (3) Remove the bulb (2).
- (4) Disconnect the lamp leads at the connectors on the carrier (3) making a note of which connector each lead comes from.
- (5) Unscrew the hollow bolt (4) through which the leads are routed.
- (6) Remove the two nuts holding the lamp to the wall and pull the lamp body away.

REPLACEMENT

2. Replace the lamp as follows:

- (1) Position the lamp on the rear wall and secure with the two nuts and washers.
- (2) Feed the leads through the rear body of the lamp and tighten the hollow bolt (4).
- (3) Reconnect the leads to their connectors on the carrier (3).
- (4) Replace the bulb (2).
- (5) If removed, replace the lens (5) into the cover, locating the grooves in the lens over the protrusions in the cover.
- (6) Fit the lens cover and secure with the two screws (1).
- (7) Reconnect the battery earth lead.

SUB-SECTION O5

CHAPTER 26

BLACKOUT SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the blackout switch:
 - (1) Disconnect the battery earth lead.
 - (2) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

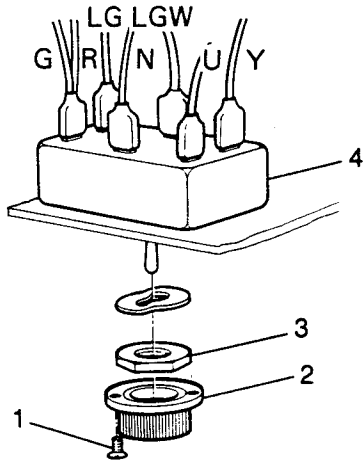


Fig O5.30

- (3) Refer to Fig O5.30. Remove the fixings (1) for the switch safety housing (2) and remove the housing.
- (4) Remove the nut (3) and wave washer from the switch knob.
- (5) Disconnect the leads from the back of the switch (4).
- (6) Withdraw the switch.

REPLACEMENT

2. Replace the switch as follows:
 - (1) The switch is symmetrical and may be fitted either way round. Place the switch in position and secure with the wave washer and nut.
 - (2) Connect the leads to the switch as shown in Fig O5.28.
 - (3) Refit the switch safety housing (2) and secure with the two self tapping screws (1).
 - (4) Replace the instrument panel.
 - (5) Reconnect the battery earth lead.

Lead colours:

G - Green
R - Red
N - Brown
W - White
U - Blue
Y - Yellow
L - Light

SUB-SECTION O5

CHAPTER 27

INSTRUMENT PANEL - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the instrument panel as follows:

(1) Disconnect the battery earth lead.

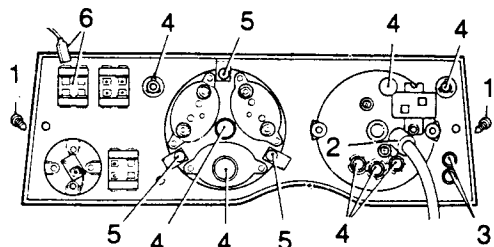
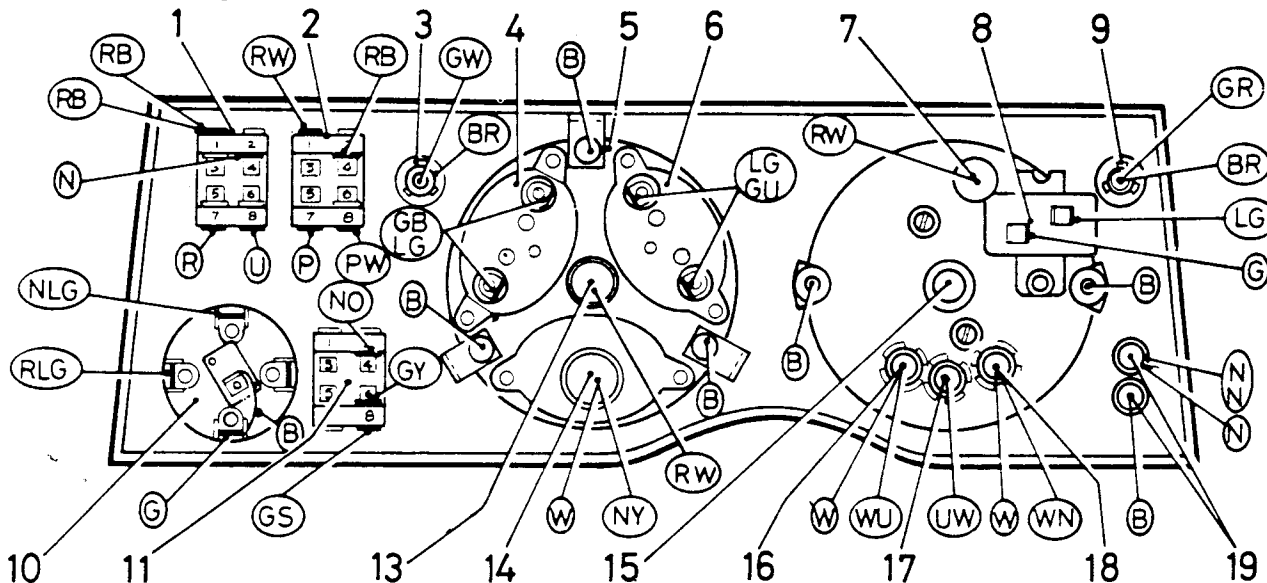


Fig O5.31

(2) Refer to Fig O5.31. Remove the instrument panel fixings (1).



Key to instrument panel and wiring

Lead colours:

- 1. Lighting switch
- 2. Panel light switch
- 3. RH turn indicator warning light
- 4. Fuel contents gauge
- 5. Grouped instruments
- 6. Coolant temperature gauge
- 7. Panel illumination light
- 8. Instruments voltage stabilizer
- 9. LH turn indicator warning light
- 10. Wiper/washer switch

- 11. Heater switch
- 13. Panel illumination light
- 14. Battery charge warning light
- 15. Speedometer drive head
- 16. Cold start warning light
- 17. Headlamp mainbeam warning light
- 18. Oil pressure warning light
- 19. Inspection lamp sockets

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

(3) Withdraw the instrument panel clear of the dash. If necessary, remove the steering wheel. At this stage the panel is in a position where individual lamps, switches and instruments can be removed. Continue if the complete panel is to be withdrawn.

(4) Depress the spring clip and withdraw the cable assembly from the speedometer (2).

(5) Withdraw the instrument panel sufficient to gain access to the wiring connections.

(6) Remove the inspection lamp socket leads (3).

(7) Withdraw all warning and illumination lamp leads and bulbs complete with holders (4).

(8) Disconnect the earth lead terminals at the knurled nuts (5) on the grouped instrument.

(9) Disconnect all 'Lucar' connectors (6).

(10) Withdraw the instrument panel and instruments complete.

REPLACEMENT

2. To replace the instrument panel:

- (1) Refer to Fig O5.32. Reconnect the Lucar connectors with the lead colours in the positions indicated.
- (2) Refit the warning and illumination lamps and holders. The positions and lamp lead colours are also shown in the illustration above.

- (3) Reconnect the inspection lamp socket leads.
- (4) Refit the speedometer cable assembly.
- (5) Replace the instrument panel in the dash and secure with the two fixing screws.
- (6) Reconnect the battery earth lead.

SUB-SECTION O5

CHAPTER 28

HAZARD WARNING SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the switch:

(1) Disconnect the battery.

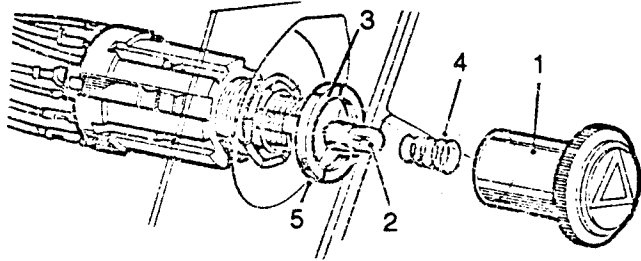


Fig O5.33

- (2) Refer to Fig O5.33. Unscrew the hazard warning switch knob (1) taking care not to lose the bulb and spring (4).
- (3) Pull out the warning lamp bulb (2).
- (4) Remove the self tapping screws holding the panel on which the hazard warning lamp switch and test switch are mounted. Ease the panel forward away from the dash.
- (5) Unscrew the locking ring (3) holding the switch to the panel and remove, together with the wave washer.
- (6) Pull out the switch from the rear of the panel.

(7) Disconnect the electrical leads round the periphery of the switch.

(8) Disconnect the black centre lead.

REPLACEMENT

2. Replace the switch as follows:

(1) Connect the black lead through the centre of the switch.

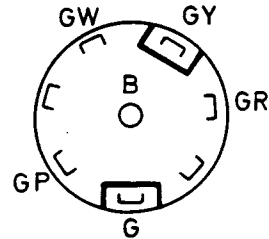


Fig O5.34

- (2) Refer to Fig O5.34. Reconnect the electrical leads to the periphery of the switch.
- (3) Fit the switch into the panel and secure with the wave washer and lock ring.
- (4) Fit the hazard warning switch bulb and screw on the knob.
- (5) Replace the panel and secure with the self tapping screws.
- (6) Reconnect the battery.

Lead colours:

G - Green
W - White
Y - Yellow
R - Red
P - Purple

SUB-SECTION CONTENTS LIST

SUB-SECTION O6

CLEANING, REPAIR AND OVERHAUL PROCEDURES

CHAPTER	DESCRIPTION	PAGE
1	OVERHAULING THE ALTERNATOR	O6.1
2	OVERHAULING THE STARTER MOTOR	O6.9

SUB-SECTION O6

CHAPTER 1

OVERHAULING THE ALTERNATOR

DISMANTLING

1. To dismantle the alternator:

(1) Remove the alternator (see Sub-section O5, Chapter 1).

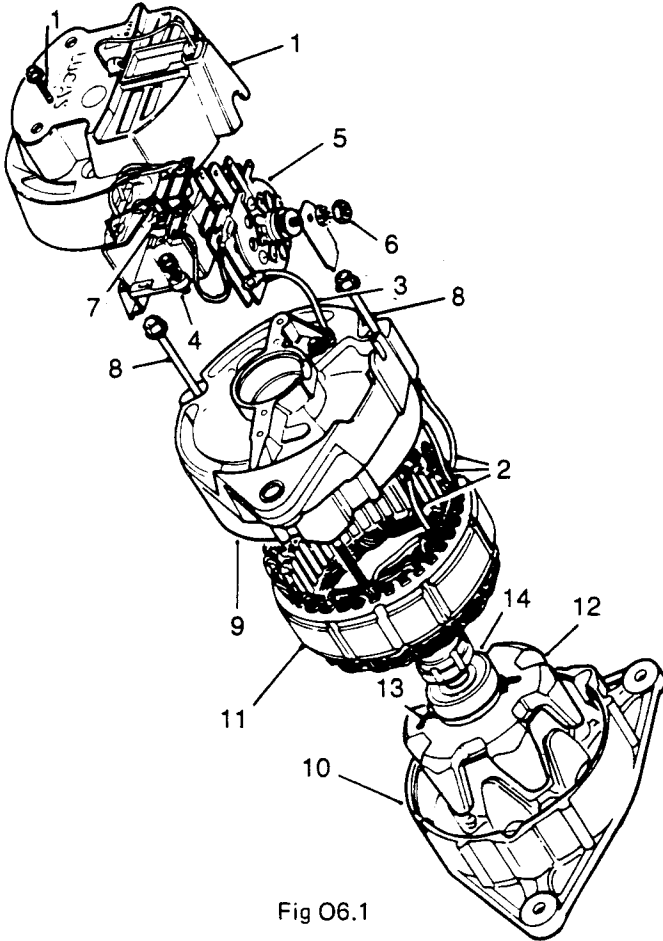


Fig O6.1

- (2) Refer to Fig O6.1. Withdraw two retaining screws and remove moulded slip-ring end cover (1).
- (3) Note positions of stator winding connections (2) to rectifier connecting pins.
- (4) Using thermal shunt and lightweight soldering iron (25 watt), unsolder the connections.
- (5) Note position of cable connectors to rectifier plates. Disconnect the cables (3).
- (6) Withdraw three hexagon headed screws (4) securing brushbox and regulator to slip-ring end bracket.
- (7) Remove brushbox moulding and regulator assembly (5).

(8) Slacken rectifier securing nut (6) and remove rectifier.

BRUSHGEAR INSPECTION

2. The serviceability of the brushes is gauged by the length protruding beyond the brush moulding in the free position. This amount should exceed (8 mm). If renewal is necessary care must be taken to replace the leaf spring at the side of the inner brush.
3. Renew brush and spring assemblies ((7) on Fig O6.1) if brushes are worn to 8 mm. To replace a brush:

(1) Remove the small screws securing the brush retaining plates and regulator cables.

(2) Replace brushes with new units and refit brush retaining plates and regulator cables.

4. Check brush spring pressure with push-type spring gauge to end of brush. Spring pressure should be 225 to 368 gf when brush is flush with moulding.

SLIP-RING INSPECTION

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

CAUTIONS

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

FURTHER DISMANTLING

6. Continue dismantling the alternator. Note that Fig O6.1 still applies.
 - (1) Withdraw three through-bolts (8).
 - (2) Separate the alternator into its major components:
 - a. Slip-ring and bracket (9).
 - b. Drive end bracket, rotor, fan and pulley (10).
 - c. Stator laminations and windings (11).
 - (3) Separate the rotor (12) from the drive end bracket by removing the pulley, fan and shaft key.
 - (4) Press the rotor shaft from the bearing.

7. Remove the slip-ring end bearing: (Fig O6.1 still applies).

(1) Unsolder the field wind rings (13) from the slip-ring moulding.

(2) Remove the slip-ring moulding (14).

(3) Press the bearing from the shaft.

8. Remove the drive end bearing:

(1) Remove the circlip and retaining slate from the drive end bearing.

(2) Press out the bearing.

BEARING INSPECTION

9. Inspect the bearings for wear, flat spots or other damage and replace if necessary.

10. Pack the bearing with Shell Alvania RA grease.

ROTOR TESTING

11. To test the rotor an ohmmeter, a 110 volt ac supply and a 15 watt test lamp are required. If an ohmmeter is not available a 12 volt battery and an ammeter may be used as an alternative. Test the rotor as follows:

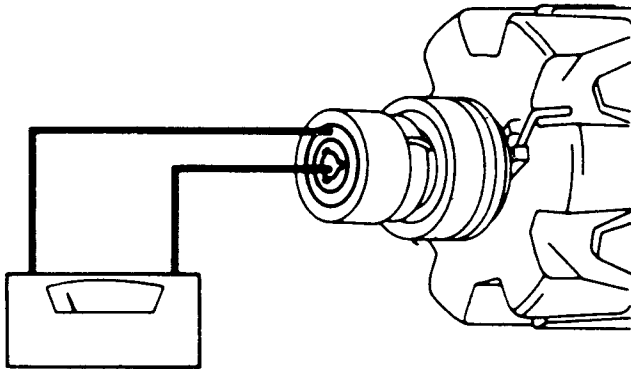


Fig O6.2

(1) Refer to Fig O6.2. Connect the ohmmeter between the slip-rings.

(2) Check that the resistance is 3,2 ohms at 20°C.

ALTERNATIVE METHOD

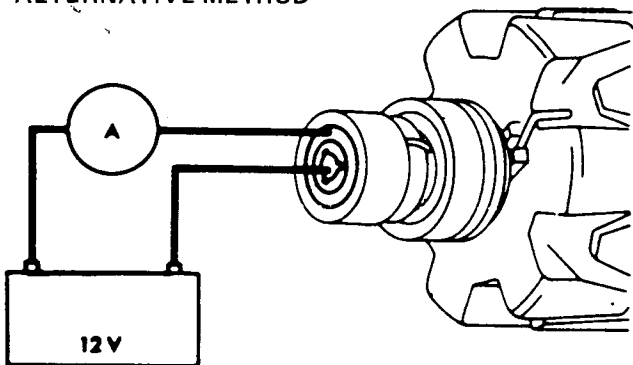


Fig O6.3

(3) Refer to Fig O6.3. Connect an ammeter and battery between the slip-rings.

(4) Check that the ammeter reads approximately 3 amps.

12. To test for defective insulation between the slip-rings and rotor poles:

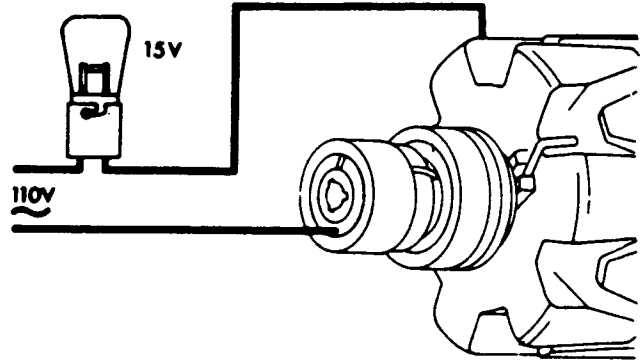


Fig O6.4

(1) Refer to Fig O6.4. Connect a 110 volt ac supply between each slip-ring and the rotor poles in turn.

(2) If the lamp lights, the coil is earthed to the rotor core and a replacement rotor and slip-ring assembly should be fitted.

STATOR TESTING

13. For this test, a 12 volt battery with a 36 watt test lamp and a 110 volt ac supply with a 15 watt test lamp are required.

To test the stator:

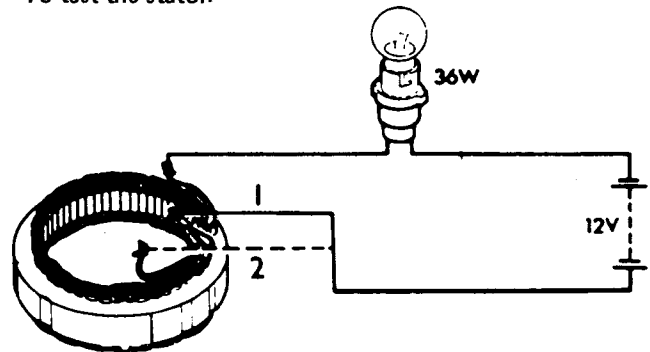


Fig O6.5

(1) Refer to Fig O6.5. Check continuity of stator windings between any pair of wires by connecting in series a 12-volt battery and test lamp of not less than 36 watts. Failure of the test lamp to light means that part of the stator winding is open circuit and a replacement stator must be fitted.



Fig O6.6

- (2) Refer to Fig O6.6. Test stator insulation with 110-volt test lamp. Connect test leads to laminated yoke and any one of the three stator cables. If the lamp lights, the stator coils are earthed. A replacement stator must be fitted.

DIODE TESTING

14. To test the diodes a 12-volt battery and a 1,5 watt test lamp are required. Test as follows:

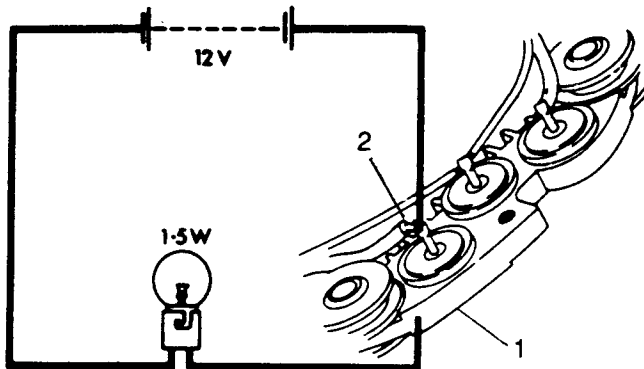


Fig O6.7

- (1) Refer to Fig O6.7. Connect one battery terminal to the heatsink under test (1).
- (2) Connect the other battery terminal in series with the test lamp and each diode pin (2) in turn.
- (3) Reverse connections to heatsink and diode pins. The lamp should light in one direction only. Should the lamp light in both tests, or not light at all the diode is defective and a new rectifier heatsink must be fitted.

NOTES

1. To prevent damage to diode assemblies during soldering operations it is important that a thermal shunt is used.
2. Only 'M' grade 45-55 tin-lead solder should be used.

REASSEMBLY

15. To reassemble the alternator:

- (1) Replace the drive end bearing, retaining plate and circlip.
- (2) Replace the slip-ring end bearing onto the shaft.

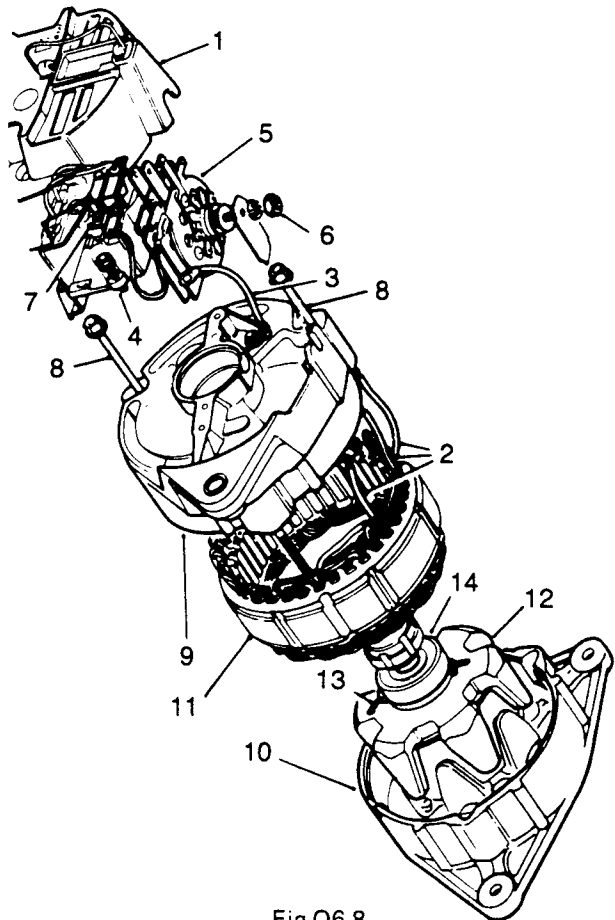


Fig O6.8

- (3) Refer to Fig O6.8. Replace the slip-ring moulding (14).
- (4) Resolder the field windings (13) to the slip-ring moulding.
- (5) Press the rotor shaft into the slip-ring end bearing.
- (6) Reconnect the rotor (12) to the drive end bracket, fitting the pulley, fan and shaft key.
- (7) Fit together the slip-ring end bracket (9), the drive end bracket (10) and the stator (11). Secure with the through bolts (8).
- (8) Replace the rectifier and tighten the securing nut (6).
- (9) Replace the brush box moulding and regulator assembly (5) and secure to the slip-ring end bracket with the three box head screws (4).
- (10) Reconnect the cables (3) to the rectifier plates in the position noted in paragraph 1, step (4).

(11) Using a thermal shunt and 25 watt soldering iron solder the stator winding connection (2) to the rectifier connecting pins. The positions of the connectors were noted in paragraph 1, step (2).

(12) Replace the moulded slip-ring end cover (1) and secure with the two retaining screws.

(13) Replace the alternator (see Sub-section O5, Chapter 1).

SUB-SECTION O6

CHAPTER 2

OVERHAULING THE STARTER MOTOR

DISMANTLING

1. First, remove the starter motor (see Sub-section O5, Chapter 5).
2. Remove the solenoid as follows:

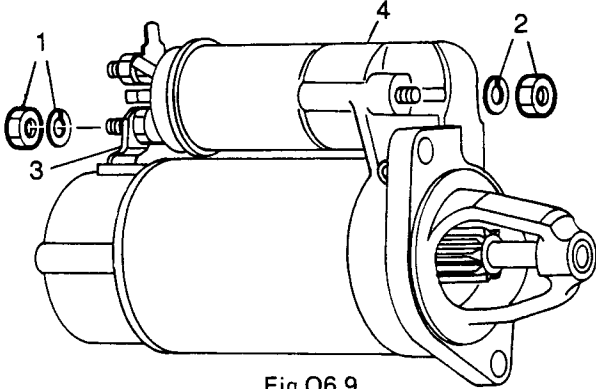


Fig O6.9

- (1) Refer to Fig O6.9. Remove the nut and washer (1) which secures the solenoid-to-starter connecting link to solenoid terminal STA.
- (2) Remove the two nuts (2) and washers securing the solenoid to the fixing bracket.
- (3) Pull back the connecting link (3) from the solenoid terminal and at the same time lift the terminal end of the solenoid clear of the connecting link and withdraw the major part of the solenoid from the fixing bracket (4).

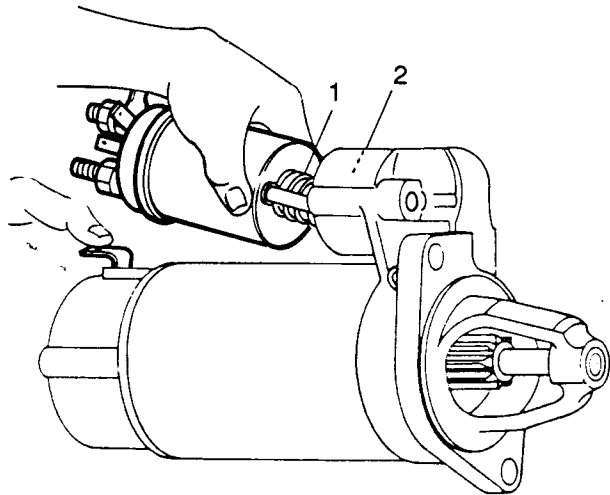


Fig O6.10

- (4) Refer to Fig O6.10. Remove the plunger (1) from the drive engagement lever (2) by gripping the plunger in the hand and applying an upward lift at the front of the plunger.

3. Remove the commutator end cover:

NOTE

Before removing the end cover ensure that a replacement Spire retaining ring is available for use during reassembly. This is necessary because this type of retaining ring is a press fit on the armature shaft and if the original fitting of the ring is disturbed, it becomes unsatisfactory for further use.

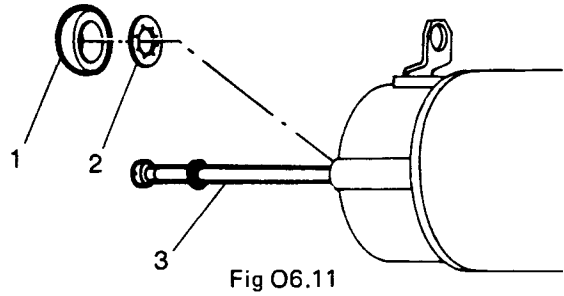


Fig O6.11

- (1) Refer to Fig O6.11. Remove the end cap (1) to gain access to the retaining ring (2).
- (2) Using an engineer's chisel cut through a number of the retaining ring claws until the grip on the armature shaft is sufficiently relieved to allow the ring to be removed. Remove the ring.
- (3) Remove the two through bolts (3).

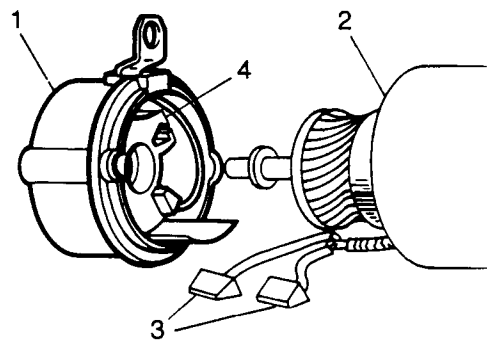


Fig O6.12

- (4) Refer to Fig O6.12. Partially withdraw the commutator end cover (1) from the yoke (2) and disengage the two field coil brushes (3) from the brush box moulding (4).
- (5) Withdraw the commutator end cover.

4. Remove the armature and roller clutch:

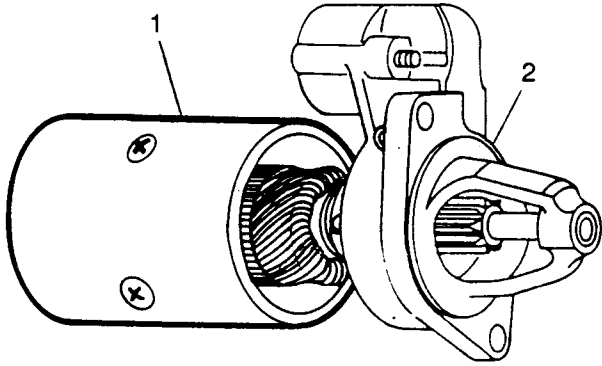


Fig O6.13

- (1) Refer to Fig O6.13. Withdraw the yoke (1) from the armature assembly (2).

NOTE

Do not disturb the field coil assembly in the yoke.

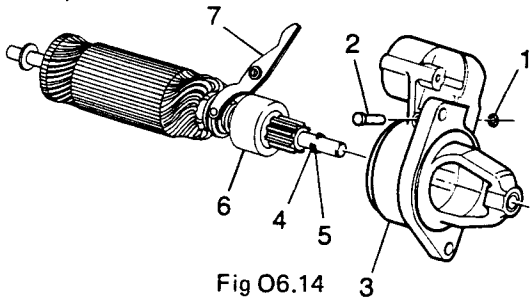


Fig O6.14

- (2) Refer to Fig O6.14. Remove the Spire retaining ring (1) from the drive engagement lever pivot pin (2).

NOTE

Ensure that a new Spire retaining ring is available for reassembly.

- (3) Withdraw the pivot pin (2).
- (4) Withdraw the fixing bracket (3) from the armature assembly.
- (5) Using a tubular tool (a box spanner for instance) drive the thrust collar (4) squarely off the jump ring (5).
- (6) Remove the jump ring from the groove in the armature shaft and slide the ring off the shaft.
- (7) Slide the thrust collar and the roller clutch drive (6) and lever assembly (7) off the shaft.

INSPECTION - ARMATURE

5. Check that the commutator face is clean and free from burn spots and grooving. If either or both of these are found, use a flat surface of very fine glass paper to remove the spots or grooving. Clean the commutator with a petrol moistened cloth.

6. If the burn spots or grooves are too deep to be removed with glass paper the commutator may be skimmed. The minimum thickness to which the commutator copper may be skimmed before the armature must be replaced is 3,5 mm. Terminate any skimming operation by polishing the commutator surface with a flat pad of very fine glass paper and then wiping it clean with a petrol moistened cloth.

CAUTION

Do not undercut the insulation slots.

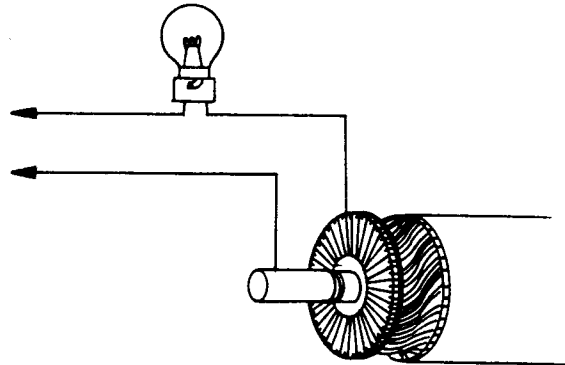


Fig O6.15

7. Refer to Fig O6.15. Check armature insulation by connecting a 110 V ac supply in series with a 15 W test lamp between the armature shaft and each commutator segment in turn. For satisfactory insulation the lamp should not light.
8. If the armature shows signs of 'thrown' solder or lifted conductors, overspeeding of the armature is indicated and the operation of the roller clutch drive should be checked (see para 19).
9. Short circuited armature windings (indicated by a high current consumption, low light running speed and low lock torque performance) can only be detected by the use of specialised armature testing 'Growler' equipment. If this equipment is not available, the only alternative is to check the armature by substitution.
10. If the armature laminations have been in contact with the pole shoes the armature bearings are probably excessively worn. First, check that the pole shoes are tight and that the armature runs true in a lathe. Then, check the inner diameter of the bearings. The bearings must be changed when the diameter exceeds 11,20 mm for the commutator end cover bearing, and 12,09 mm for the drive end fixing bracket bearing. (See para 26 for changing the bearings).

INSPECTION - BRUSHGEAR

11. Check that the brushes move freely in the brush box moulding. Sticking brushes should be cleaned with a petrol moistened cloth. Brushes which are worn down to approximately 9,5 mm in length must be renewed (See para 31).

12. Measure brush spring pressure:

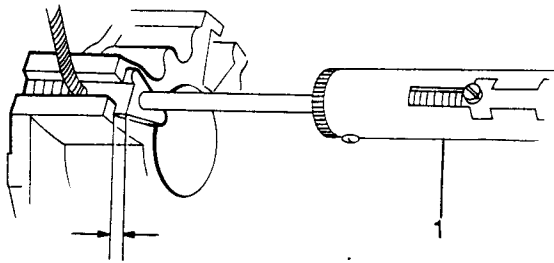


Fig O6.16

- (1) Refer to Fig O6.16. Position a new brush in each of the brush boxes in turn.
 - (2) Press on top of the brush with a push-type spring gauge (1) until the top of the brush protrudes by about 1,5 mm from the brush moulding (dimension A).
 - (3) Check that the spring gauge reading is 10,0 N.
13. Check the insulation of the brush springs by connecting a 110 V, 15 W test lamp between a clean part of the end cover and each of the springs in turn. The lamp should not light.
14. Check that the connecting link grommet is in good condition.

INSPECTION - YOKE AND FIELD COIL ASSEMBLY

15. Inspect the field coils in situ for signs of obvious faults. Check the inter-connecting joints between coils, the earthed connection of the field winding where it is riveted to the yoke and look for discolouration (due to burning) of the winding insulation tape, which could indicate short-circuited windings or a short-circuit between the windings and the yoke. A visible fault will eliminate the need for testing and in such cases if necessary the field coil assembly should be removed from the yoke to enable it to be repaired or renewed.
16. If there are no obvious signs of a fault, the field coil continuity and the insulation between the field coils and yoke can be checked without removing the field coil assembly from the yoke.
17. Check field coil continuity by connecting a 12 V battery operated test lamp between either of the field coil brushes and a clean part of the yoke. The lamp should light.
18. **Field coil insulation:** Before being able to check the insulation between the field coils and yoke, it will first be necessary to disconnect the earthed end of the winding from the yoke. Before disconnecting the windings (See para 32) determine whether it is justified. Consider the light running and lock torque or alternatively consider the fault symptoms. If the speed and torque were low, and the current consumption high, or the fault symptom was low cranking speed, faulty field winding insulation could be the cause and this interpretation of the starting motor performance would justify disconnecting the earthed end of the field winding to enable a positive check to be carried out.

19. The field winding insulation can be checked (after disconnecting the winding at the yoke) by connecting a 110 V, 15 W test lamp between the disconnected end of the winding and a clean part of the yoke. **The lamp should not light.** Ensure that neither of the brushes, or bare parts of their flexible leads contact the yoke during the test.

20. **Field coil resistance:** Due to the very low resistance of the field coil conductors, the presence of a short-circuit between the field coil windings can only be determined by specialised equipment. If the results of all previous testing has been satisfactory, short-circuited field coil windings could be the cause of the fault and the field coil assembly should now be further proved by substitution. To change the field coils see para 32.

INSPECTION - ROLLER CLUTCH DRIVE ASSEMBLY

21. Check the clutch action. The pinion should have instantaneous take-up of the drive in one direction and be free to rotate in the other.
22. Check that the assembly moves freely along the armature shaft splines. The armature shaft splines and moving parts of the engagement lever should be liberally smeared with Shell SB.2628 (cold climates) or Retinax 'A' (hot climates). The roller clutch mechanism is a sealed unit, which is pre-packed with sufficient grease to last the life of the starter motor. In the unlikely event of the clutch action becoming faulty, it will not be possible to rectify the fault and the whole of the drive assembly will have to be renewed.

INSPECTION - SOLENOID

23. Check solenoid winding resistance by connecting a good quality ohmmeter between solenoid terminal STA and a good earth point on the solenoid body. A reading of 1,01 to 1,07 ohms indicates that the windings are in a satisfactory state.
24. An alternative method of carrying out the above test is to connect a 0 to 20 A moving coil ammeter in series with a 12 V battery, solenoid terminal STA and a good earth point on the solenoid body. A reading of 11,2 to 11,8 amps should be obtained.
25. Associated with the solenoid plunger are three springs: the plunger and drive return spring, the drive engagement spring which is incorporated inside the plunger to overcome the difficulty of engaging the pinion on occasions of tooth-to-tooth abutment, and the 'lost motion' spring which is assembled to the connecting part of the solenoid plunger to provide a measure of lost motion in the drive operating mechanism as the drive commences to disengage. It is sufficient to check only that the springs are not broken. In the case of the drive engagement spring (inside the plunger), to check the spring it will be necessary to ensure that a spring-loaded pull action exists between the plunger body and the connecting part of the plunger.
26. The solenoid incorporates a very small additional Lucar terminal blade (marked IGN), which is for use in conjunction with ballast ignition systems. It is sufficient to check that this terminal becomes electrically connected to the solenoid main input terminal, when the solenoid is energised.

27. Should the above tests give satisfactory results the only other fault would be the solenoid contacts and these should be changed (See para 33).

REPLACING THE BEARINGS

28. The armature bearings, fitted in the commutator end cover and the drive end fixing bracket, are self-lubricating porous-bronze bushes.

29. New bushes must be completely immersed in Shell 'Turbo 41' oil, or in clean engine oil, for 24 hours at room temperature, before they are fitted. Alternatively, if the lubricant is heated to a temperature of 100°C, 2-hours immersion of the bushes is sufficient, providing the lubricant is allowed to cool before the bushes are removed.

30. The bushes must not be reamed after fitting otherwise the self-lubricating qualities will be impaired.

31. Worn bushes should be removed by using a wheel-operated press. Alternatively, support the bearing housing and then with a mandrel carefully tap the bush out of the cover or bracket.

32. New bushes should be pressed into position by means of a shouldered polished mandrel with dimensions as follows:- commutator end cover bush 11,117 mm, drive end fixing bracket bush 12,011 mm.

RENEWING THE BRUSHES

33. Renew the brushes as follows:

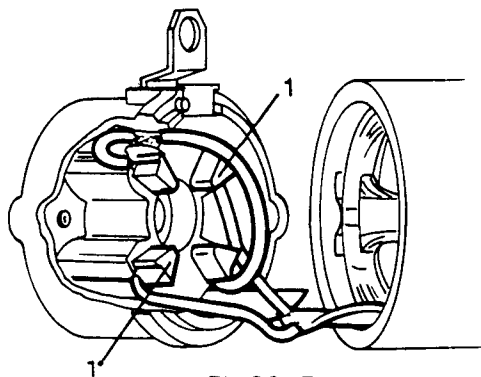


Fig O6.17

(1) Refer to Fig O6.17. For the field coil brushes (1) cut the brush flexible leads leaving approximately 6 mm of lead each side of the coil end.

(2) Solder the new brushes to the remaining ends of the old leads.

NOTE

Use only resin-cored type solder.

(3) For the other two brushes, replace them complete with terminal link and moulded rubber grommet.

(4) Check that the brushes are in the positions shown in the figure.

RENEWING THE FIELD COILS

34. Fit new field coils as follows:

(1) Disconnect the end of the field winding where it is riveted to the yoke. To do so, file away the riveted-over end of the connecting eyelet securing rivet sufficiently to enable the rivet to be tapped out of the yoke.

(2) Remove the four pole shoe screws with a wheel-or-power-operated screwdriver.

(3) Withdraw the field coil from the yoke.

(4) Wipe clean the inside of the yoke and the insulating pieces through which the through-bolts locate.

(5) Loosely fit the new field coil assembly (with pole shoes) into the yoke, with the threads of the pole shoe fixing screws only partially engaged.

(6) Assemble the through bolt insulating pieces into the yoke by sliding the shoulders of the insulating pieces between the field coils and the yoke in a position 180° apart and 90° each side of the field coil brush connection point.

(7) Tighten the pole shoes progressively to a torque of 40 N.m.

(8) Make a good earth connection between the end of the field winding and the yoke.

RENEWING THE SOLENOID CONTACTS

35. To renew the contacts:

(1) Remove the two screws securing the terminal and base assembly to the solenoid.

(2) Apply a hot soldering iron alternately to each of the two soldered terminal connections and wait for the solder to run free.

(3) Shake most of the melted solder out of the joints by tapping the solenoid terminal ends sharply down on the bench.

(4) Clamp the solenoid body in a vice (terminals uppermost) and while applying a constant pull on the moulded cover, apply the soldering iron alternately to the two soldered connections until the terminal and base assembly is freed.

(5) When remaking the soldered connections avoid dry-soldered joints by ensuring that the parts are clean and adequately heated before applying the solder.

(6) Tighten the terminal and base fixing screws to a torque of 2,44 N.m.

REASSEMBLY

36. Reassemble the starter motor as follows:

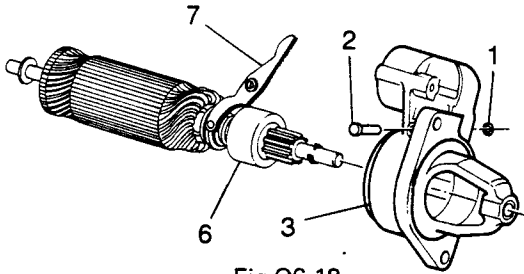


Fig O6.18

- (1) Refer to Fig O6.18. Slide the roller clutch drive (6) and lever assembly (7) and the thrust washer onto the armature shaft.
- (2) Fit the jump ring into the groove in the armature shaft and drive the thrust washer squarely onto the jump ring.
- (3) Refit the fixing bracket (3) to the armature assembly and secure with the pivot pin (2) through the bracket and the bore in the drive engagement lever.
- (4) Fit a new Spire retaining ring (1).

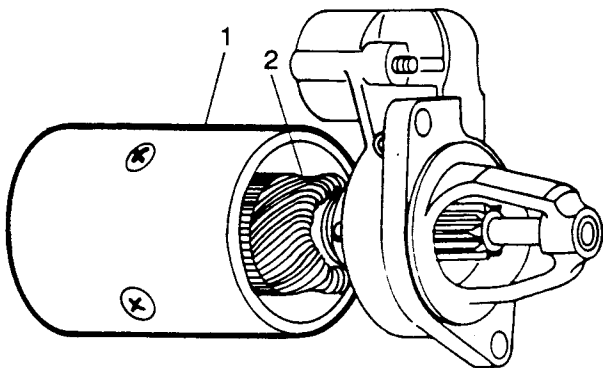


Fig O6.19

- (5) Refer to Fig O6.19. If it has been removed, fit the internal thrust washer (3) to the commutator end of the armature shaft.
- (6) Fit the yoke (1) over the armature assembly (2).

37. Fit the commutator end cover:

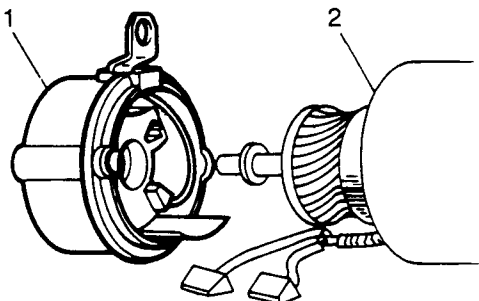


Fig O6.20

- (1) Refer to Fig O6.20. Hold the commutator end cover (1) close to the yoke (2) and fit the brushes into their correct housings in the brush box moulding.

(2) Fit the commutator end cover to the yoke and align the holes for the through bolts.

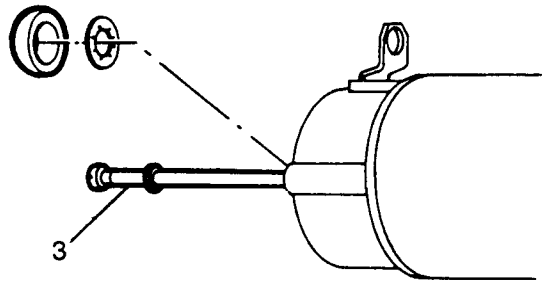


Fig O6.21

(3) Refer to Fig O6.21. Fit the two through bolts (3) and tighten to a torque of 10,84 N.m.

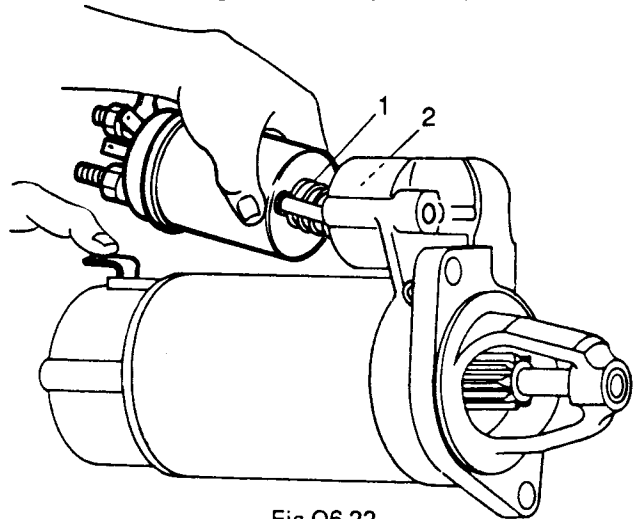


Fig O6.22

(4) Refer to Fig O6.22. Fit the solenoid plunger into the fixing bracket. Hold the plunger (1) and use a downward push to engage the drive engagement lever (2).

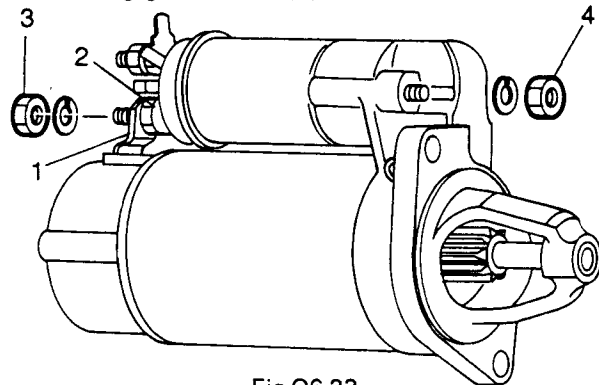


Fig O6.23

- (5) Refer to Fig O6.23. Pull back the connecting link (1) and lower the solenoid into position on top of the starter motor.
- (6) Engage the solenoid terminal STA over the connecting link (2).
- (7) Replace the nut and washer (3) on terminal STA.
- (8) Fit the two nuts and washers (4) securing the solenoid to the fixing bracket and tighten to 6,1 N.m.

(9) Drive a new Spire retaining ring onto the armature shaft into a position which provides a maximum of 0,25 mm clearance between the retaining ring and the bearing bush shoulder.

(10) Replace the end cap to the commutator end cover.

SUB-SECTION 07

MAINTENANCE

INTRODUCTION

1. The electrical system is relatively trouble free if maintained in good condition. However, regular inspections are needed to keep the system in this condition.

BATTERY

2. Check electrolyte level at least once per week and if necessary, top up with distilled water until the electrolyte is about 10 mm above the top of the plates.

3. The battery terminals should be kept free of oxidation products (a white powdery substance). Whenever this is found it should be wiped off with a clean, dry cloth and a smear of acid resistant grease (vaseline for example) should be applied to the terminals. Note that good contact must be maintained between the battery terminal and the connecting lead; grease must not be applied to the mating surfaces.

LIGHTS

4. Bulbs are liable to failure at any time without warning. Because of this, frequent checks of lamp operation should be made and faulty bulbs replaced immediately.

5. Lenses should at all times be kept free of mud and dirt. They should be wiped with a clean, damp cloth whenever practical.

WIRING

6. The leads between the various electrical circuits are an important part of the system. Where clips or grommets are used the wires should be firmly held in position. Wires trapped between metal parts, especially where they pass across sharp edges should be suitably protected against chafing. Mud or moisture on leads, especially close to terminals, can cause short circuits and failure of circuits.

7. The wiring should be checked for the points made above at regular intervals and immediate remedial action taken where required. Disconnect and reconnect terminals occasionally to ensure good contact is maintained between mating surfaces.

FUSE CHANGING

8. If more than one lamp or service fails at the same time the fuses should be examined and a blown fuse replaced. If the same fuse blows again immediately on switching on, check the circuits concerned for a short circuit to earth.

9. To change a fuse:

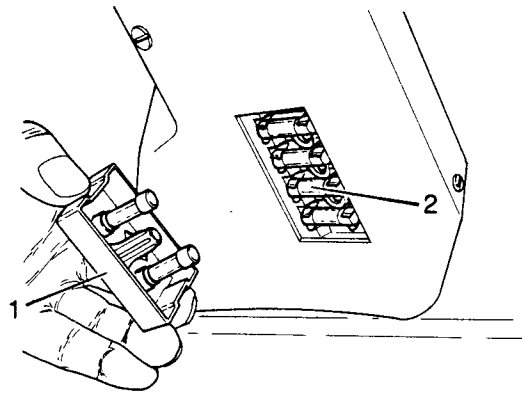
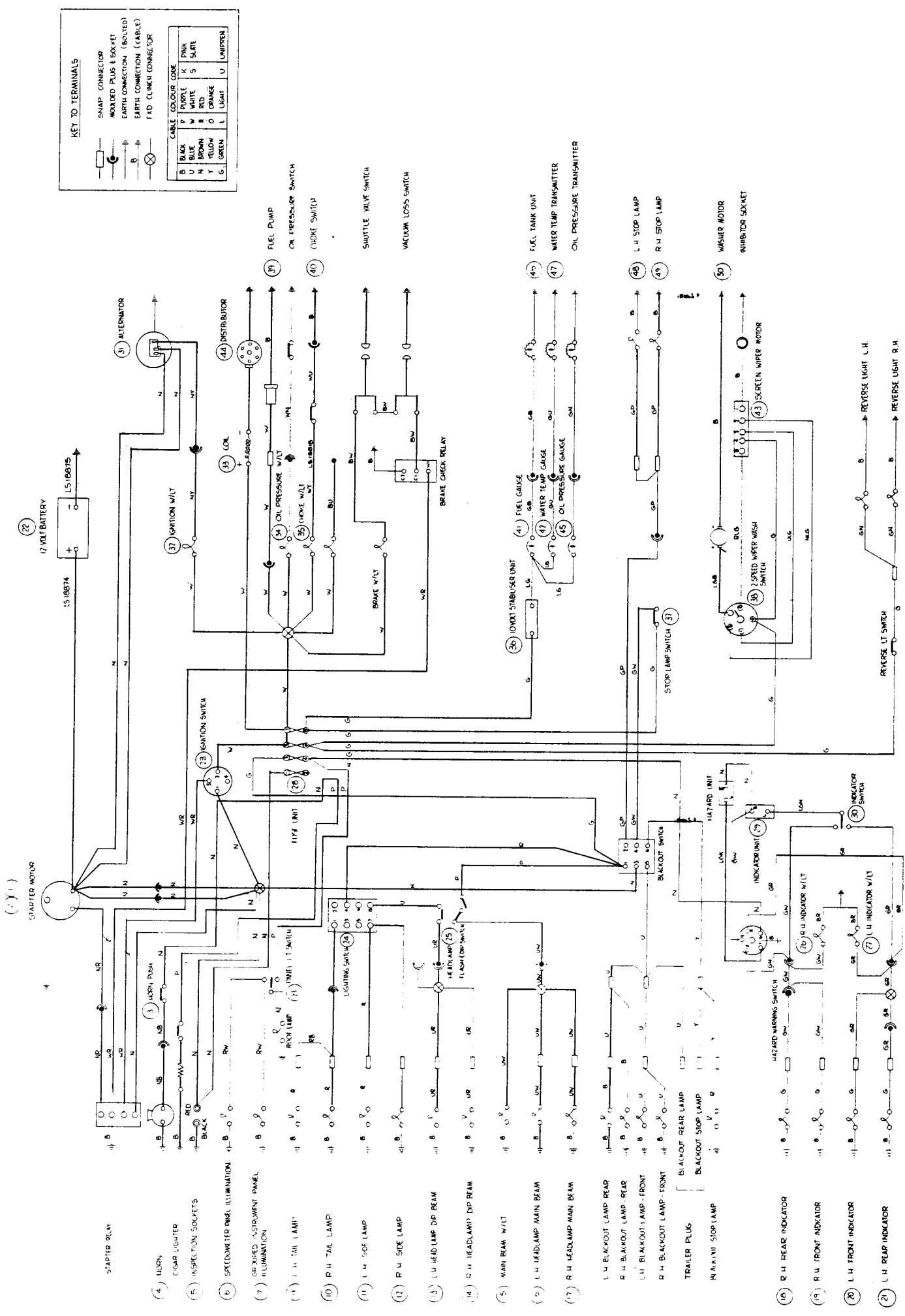


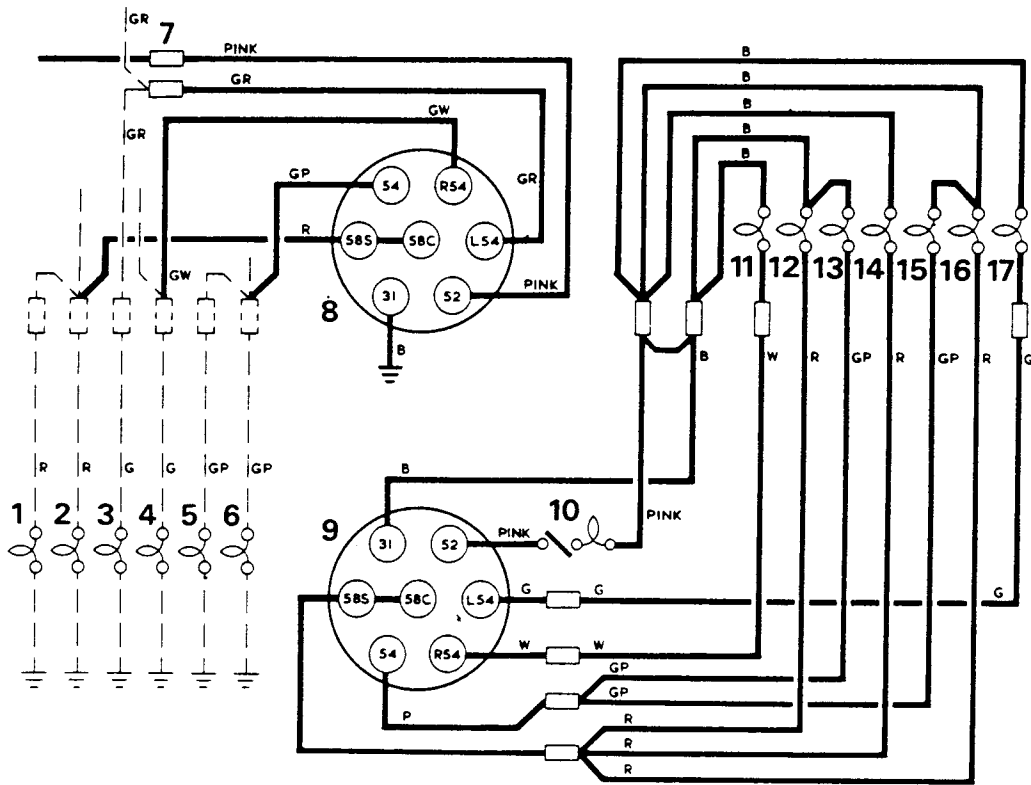
Fig O7.1

- (1) Refer to Fig O7.1. Pull off the fuse box cover (1).
- (2) Pull the ruptured fuse (2) out of its clips and discard.
- (3) Clip a fresh fuse into position.
- (4) Replace the fuse box cover.



- | | | | |
|-----|---------------------------------------|-----|--|
| 1. | Starter motor | 27. | Warning light, indicator LH |
| 2. | Solenoid, Starter motor | 28. | Fuses, 1 to 4, 35 amp, blow, 17 A normal working |
| 3. | Switch for horns | 29. | Indicator unit, flasher |
| 4. | Horn | 30. | Switch, direction indicators |
| 5. | Inspection sockets | 31. | Alternator, Lucas 16 ACR |
| 6. | Speedometer panel illumination | 32. | Warning light, ignition |
| 7. | Grouped instrument panel illumination | 33. | Ignition coil |
| 8. | Switch panel, lights | 34. | Warning light, oil pressure |
| 9. | Tail lamp, LH | 35. | Warning light, choke |
| 10. | Tail lamp, RH | 36. | Voltage stabiliser, fuel, water, and temperature gauge |
| 11. | Side lamp, LH | 37. | Switch, stop lamp |
| 12. | Side lamp, RH | 38. | Switch, windscreen wiper |
| 13. | Headlamp, LH dipped beam | 39. | Fuel pump |
| 14. | Headlamp, RH dipped beam | 40. | Switch, cold start, warning light |
| 15. | Warning light, headlamp main beam | 41. | Fuel gauge |
| 16. | Headlamp, LH main beam | 42. | Water temperature gauge |
| 17. | Headlamp, RH main beam | 43. | Screenwiper motor |
| 18. | Direction indicator lamp, rear RH | 44. | Distributor |
| 19. | Direction indicator lamp, front RH | 45. | Switch, oil pressure |
| 20. | Direction indicator lamp, front LH | 46. | Fuel tank unit |
| 21. | Direction indicator lamp, rear LH | 47. | Water temperature transmitter unit |
| 22. | Battery | 48. | Stop lamp, LH |
| 23. | Switch, ignition and starter | 49. | Stop lamp, RH |
| 24. | Switch, lights | 50. | Screenwasher motor |
| 25. | Switch, headlamp flash and dip | | |
| 26. | Warning light, indicator RH | | |

KEY FOR VEHICLE WIRING DIAGRAM



CIRCUIT DIAGRAM, TRAILER LIGHTING, NEGATIVE EARTH

Vehicle

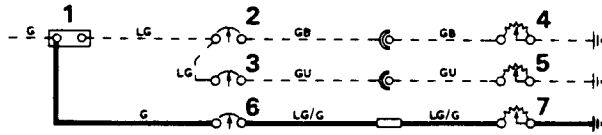
- 1. Tail lamp, R.H.
- 2. Tail lamp, L.H.
- 3. Flasher lamp, L.H.
- 4. Flasher lamp, R.H.
- 5. Stop lamp, R.H.
- 6. Stop lamp, L.H.
- 7. To fuse box
- 8. Socket on vehicle

Trailer

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

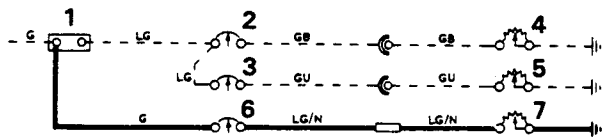
KEY TO CABLE COLOURS

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



Oil Temperature Gauge

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



Oil Pressure Gauge

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

KEY TO CABLE COLOURS

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

SECTION CONTENTS LIST

SECTION P

WHEELS AND TYRES

SUB-SECTION	DESCRIPTION	PAGE
P1	DESCRIPTION AND SPECIFICATIONS	P1.1
P2	MAINTENANCE	P2.1