



PART 3

ELECTRICAL
SYSTEM

24V

C3-series (Etiopien)

SERVICE MANUAL

CONTENTS

Group 30 General

Data	1
Service Procedures	4

Group 31 Battery

Construction and Function ...	1
Service Procedures	2
Batteries	2
Battery heater	2
Auxiliary start connection ...	2

Group 32 Alternator

Construction and Function ...	1
Service Procedures	3
Alternator	3
Charging regulator	9

Group 33 Starter Motor

Construction and Function ...	1
Service Procedures	3
Starter motor	3

Group 34 Ignition System

Construction and Function ...	1
Service Procedures	3
Ignition coil	3
Advance engaging resistor ...	3
Ignition switch	3
Suppressors	3
Distributor	4
Breaker contacts	8

Group 35 Lighting

Construction and Function ...	1
Service Procedures	2
Headlamps	2
Side lights and direction indi- cator lights	3
Tail light and reversing light ..	4
Courtesy light	4
Instrument panel and switch light- ing	4
Twelve-pole socket	5

Group 36 Direction Indicators with Hazard

Warning Lights, Horn, Wind- screen and Headlamp Wipers and Washers, Switches and Relays

Construction and Function ...	2
Service Procedures	4
Direction indicators with hazard warning lights	4
Horn	5
Windscreen wiper motor ...	6
Headlamp wiper motor ...	10
Washer motor	10
Switches	10
Relays	12

Group 37 Cables and Fuses

Construction and Function ...	1
Service Procedures	3
Fuses	3
Connectors	4

Group 38 Instruments, Contacts, Indicator and Warning Lights

Construction and Function ...	2
Service Procedures	8
Instruments and Senders ...	9
Contacts	11
Indicator/warning lights ...	15

GROUP 30 GENERAL

Data

BATTERY

Type	Boliden 108 M 57 K op
Number	2
System voltage	24 V
Battery capacity	57 Ah
Electrolytic density at +20°C (68°F)	
Fully charged battery	1.28
When re-charging should be carried out	1.21
Recommended charging current	6 A

ALTERNATOR

Type	Alternator
Designation	S.E.V. Marchal 28/35
Output	960 W
Max. speed	250 r/s (15 000 r/min)
Direction of rotation	Optional
Reduction, crankshaft - alternator	1:1.72
Resistance in rotor (across slip rings)	13-14
Resistance in stator (between phases)	0.32
Minimum length, brushes	5 mm (0.2")
Minimum diameter, slip rings	37.5 mm (1.48")
Voltage drop across safety diode, at a current of 5-30 A	0.5-1.5 V
Output tests:	
Alternator speed	83.3 r/s (5000 r/min)
Engine speed	48.3 r/s (2900 r/min)
Amperage, min.	35 A
Voltage	28 V
Tightening torques:	
Inhex bolts	4 Nm (0.4 kpm = 2.8 lbfft)
Terminal B+	4 Nm (0.4 kpm = 2.8 lbfft)
Other connections	3 Nm (0.3 kpm = 2.1 lbfft)
Nut for pulley	40 Nm (4 kpm = 28 lbfft)

Charging Regulator

Designation	S.E.V. Marchal
Control voltage at B+ on alternator	27.1-28.1 V
Testing conditions:	
Alternator speed	83.3 r/s (5000 r/min)
Engine speed	43.3 r/s (2900 r/min)
Alternator load	approx. 10 A
Surrounding temperature	25°C (78°F)
Overvoltage protection cuts out at	36-38 V

STARTER MOTOR

Designation	Bosch EGE 1/24 R 303 0 001 308 006
System voltage	24 V
Earth connection	Minus pole
Direction of rotation	Clockwise
Output	736 W (1 hp)
Number of teeth	9

Mechanical Test Values

Rotor axial clearance	0.1-0.3 mm (0.0039-0.0118")
Maximum permissible radial clearance for rotor	0.12 mm (0.0047")
Maximum permissible radial throw for rotor	0.05 mm (0.0020")
Maximum permissible radial throw for commutator	0.05 mm (0.0020")
Minimum permissible diameter for commutator	33.5 mm (1.30")
Brush spring force	8-9 N (0.8-0.9 kp)
Rotor brake friction torque	0.3-0.5 Nm (3-5 kpcm = - lbf)
Drive gap to ring gear	2.5-3.0 mm (0.98-0.12")
Drive clearance torque (the torque required of an assembled starter motor in order to turn over the drive in the starter motor's direction of rotation when the rotor is held fixed)	0.10-0.15 Nm (1.0-1.5 kpcm = 0.35-0.60 mm lbf)
Tooth clearance	(0.0014-0.0024")

Electrical Test Values

Unloaded starter motor: 23 V and 25-45 A	83.3-116.6 r/s (5000-7000 r/min)
Loaded starter motor: 20 V and 135-165 A	16.7-21.7 r/s (1000-1300 r/min)
Braked drive: 16 V, 220-270 A	0 r/s (0 r/min)
Control magnet: Minimum cut-in voltage	15 V
Adjusting measurement a (Fig. 33-30)	32.1-32.3 mm (1.26-1.272")

IGNITION SYSTEM

Firing sequence	1-5-3-6-2-4
Firing setting, vacuum governor disconnected	10° 13.3 r/s (800 r/min)
Basic firing position, engine switched off	10°
Spark plug	W 200 T 35 or corresponding
Electrode gap	0.7-0.8 mm (0.028-0.032")
Tightening torque, spark plug	35-40 Nm (3.5-4.0 kpm = 25-28 lbf)
Pre-engaging resistance	4.1-4.5 Ω at 20°C (68°F)
Condensator, ignition coil	0.45 μF
Ignition coil, designation	Bosch 0 221 102 001
Damper resistance	1000 Ω at 20°C (68°F)

Distributor

Type	PFU 6
Direction of rotation	Anti-clockwise
Breaker contacts, gap	Min. 0.25 mm (0.0098")
dwell angle	39-45°
contact pressure	5.0-6.3 N (0.50-0.63 kp = 1.1-1.3 lbf/in ²)
Condensator	0.15-0.20 μF
Distributor arm, resistance	4500-6000

Centrifugal Governor

Advance, total	11.5-13.5 distr. degrees
Advance starts at	(610-725 distr. r/min)
Values, 5°	(860-1000 distr. r/min)
10°	(1575-1975 distr. r/min)
Advance, maximum	(2250 distr. r/min)

Vacuum Governor (positive control)

Advance, total		4-6 distr. degrees
Advance begins at	10.7 kPa - 16.0 kPa	(80-120 mm Hg = 3.15-4.72" Hg)
Values at 2.5 distr. degrees ..	15.3 kPa - 21.3 kPa	(115-160 mm Hg = 4.53-6.30" Hg)
Advance, maximum	23.3 kPa - 25.3 kPa	(175-190 mm Hg = 6.89-7.48" Hg)

LIGHTING DEVICES

Bulbs

Description	Qty.	Output	Socket
Headlamps	2	55/50 W	p 45 t
Direction indicators	4	21 W	Ba 15 s
Side lights	2	4 W	Ba 9 s
Black-out lights (front) ..	2	15 W	S 8.5
Stop lights	2	21 W	Ba 15 s
Stop lights, black-out ..	2	3 W	SV 5.5
Tail lamps	2	5 W	Ba 15 s
Tail lamps, black-out ..	2	3 W	SV 5.5
Reversing lights	1	25 W	
Courtesy light	2	10 W	S 8.5
<u>Warning/indicator lights:</u>			
Fullbeams	1	2 W	Ba 9 s
Battery charging	1	2 W	Ba 9 s
Oil pressure	1	2 W	Ba 9 s
Direction indicators	2	2 W	Ba 9 s
Differential lock	2	2 W	Ba 9 s
Front-wheel drive	1	2 W	Ba 9 s
Brakes	1	2 W	Ba 9 s
Choke	1	2 W	Ba 9 s
<u>Instruments:</u>			
Speedometer	1	2 W	Ba 9 s
Temperature gauge	1	2 W	Ba 9 s
Fuel gauge	1	2 W	Ba 9 s
<u>Switches:</u>			
Light switch	1	3 W	Ba 7 s
Headlamp wiper	1	3 W	Ba 7 s
Dipped headlights automa- tic mechanism	1	3 W	Ba 7 s
Battery heater	1	3 W	Ba 7 s
Windscreen wipers	2	3 W	Ba 7 s
Washer	1	3 W	Ba 7 s
Hazard warning lights ..	1	3 W	Ba 7 s

Fuses

Rated current	8 A
Number	18

Service Procedures

Before carrying out any work on the electrical system, disconnect the negative cables from the batteries.

All cables except the earth cables have a marked sleeve on each end. These sleeves have the same number, and this makes it easier to identify the cables.

The battery cables and all cables to the charging regulator must be disconnected before carrying out any electrical welding work on the vehicle. The welding unit should be connected as near as possible to the part to be welded and on the same main component. If, for example, the frame is to be welded, then the welding unit should be connected to the frame.

This manual contains wiring diagrams for the following functions:

FUNCTION	GROUP	FIG.
1. Battery heater	31	31-5
2. Starter relay with pre-engaging resistance	34	34-3
3. Lighting, instruments and switches	35	35-13
4. Dipped beams automatic mechanism	35	35-15
5. Black-out lighting	35	35-16
6. Windscreen and headlamps washers (hose routing)	36	36-4
7. Direction indicators with warning lights	36	36-9
8. Windscreen wipers with relay	36	36-11
9. Windscreen wipers parking	36	36-20
10. Headlamps wipers	36	36-23
11. Coolant gauge with sender	38	38-3
12. Fuel gauge with sender	38	38-4
13. Front wheel drive engagement	38	38-5
14. Wiring for vacuum contacts	38	38-8
15. Warning devices for "Brake" warning light	38	38-9

CONNECTION DESIGNATIONS FOR DIFFERENT COMPONENTS

The purpose of the list shown below is to make it easier to understand the relationship between the wiring of a cable and the connection designation of a component.

FROM	TO
<u>Group 31</u>	
30 Battery	30 Starter motor
30 Starter motor	30 Auxiliary start socket
30 Starter motor	B+ Alternator
30 Starter motor	30 Ignition switch
31 Auxiliary start socket	Earth connection
<u>Group 31</u>	
61 Ignition switch across battery charging warning light	61 Alternator
61 Ignition switch across battery charging warning light	1 Switch, battery heater and dipped beams automatic mechanism
<u>Group 33</u>	
50 Starter button across starter relay	50 Control magnet, starter motor

FROM	TO
<u>Group 34</u>	
15 Ignition switch across pre-engaging resistance	15 Ignition coil
15 Ignition switch across pre-engaging resistance	Fuses A2, A3, A4 and A5
<u>Group 35</u>	
56 Light switch across relay for main beams flasher	56 Step relay
56a Step relay	56a Main beams
56b Step relay	56b Dipped beams
58 Light switch across relay for parking lights	Fuses B2, B3, B4 and B5
58 Light switch across relay for parking lights	30 Relay, dipped beams automatic mechanism
<u>Group 36</u>	
54 Flasher unit (terminal 49a)	54 Direction indicator lever
L Direction indicator lever	Left-hand direction indicator
L Switch for hazard warning lights	Left-hand direction indicator
R Direction indicator lever	Right-hand direction indicator
R Switch for hazard warning lights	Right-hand direction indicator
C Flasher unit	Indicator light, direction indicator
C2 Flasher unit	Indicator light, direction indicator (trailer)
53 Switch for wipers	Headlamps wiper motor and windscreen wiper motor, low-speed
53a Switch for wipers	Wiper motor, parking position
53b Switch for wipers	Windscreen wipers, high-speed
53e Switch for wipers	Windscreen wipers, brake winding
31 Wiper motor	Earth connection
85 Relay winding (poss. via sender)	Earth connection
86 Battery + (directly or across switch)	Relay, winding
87 Relay (poss. via terminal 30)	Consumer
87a Relay	Consumer
30 Battery + (directly or across switch)	Relay
30 Relay	Consumer
<u>Group 38</u>	
G Instruments	Sender

GROUP 31 BATTERY

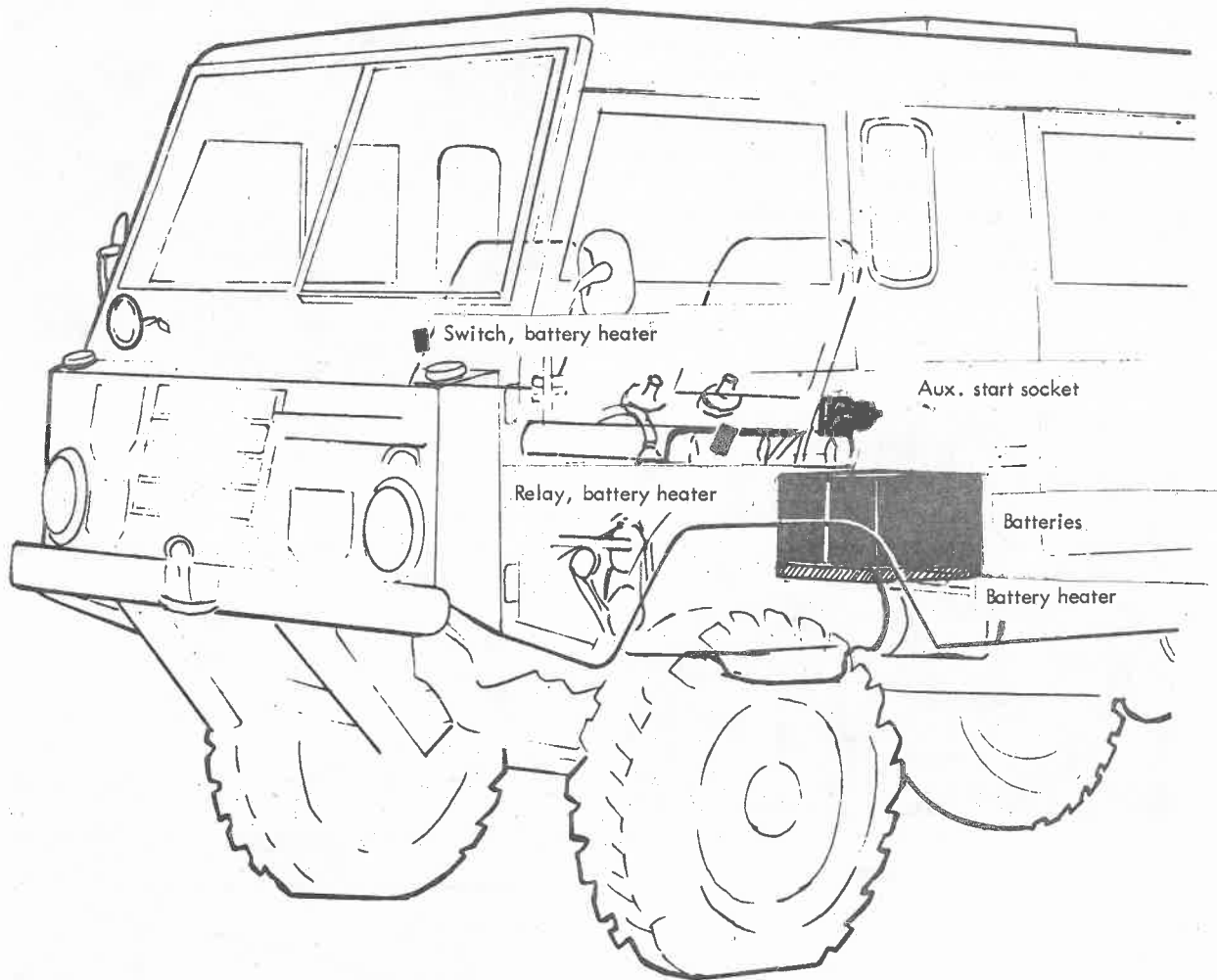


Fig. 31-1. Batteries

VOLVO
115 542

Construction and Function

The batteries are situated on the left-hand side behind the driver's seat, see Fig. 31-2, and consist of two series-coupled 12 volts lead-batteries with a capacity of 57 Ah. One of the battery's negative pole (-) is wired to the vehicle body.

The batteries have a heating device which prevents the acid temperature from going below $+15^{\circ}\text{C}$ (59°F).

The vehicle is equipped with an auxiliary start socket.

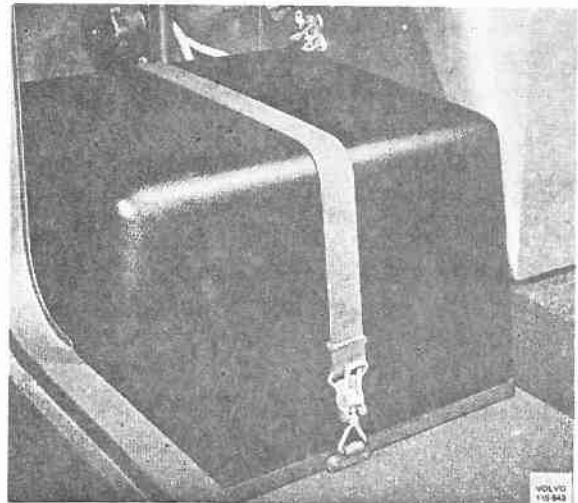


Fig. 31-2. Cover for batteries

Service Procedures

BATTERIES

When replacing batteries, the new batteries must be connected up with the correct polarity. When charging batteries in the vehicle, the charging unit must be connected up with the correct polarity. The battery cables must not be disconnected while the engine is running. If a rapid charger is used as an aid in starting, it must be disconnected when the engine has started.

Note! Do not run the engine at high speed when a rapid-charger is connected up. When using extra batteries as an aid in starting, these must always be connected in parallel to the vehicle's batteries.

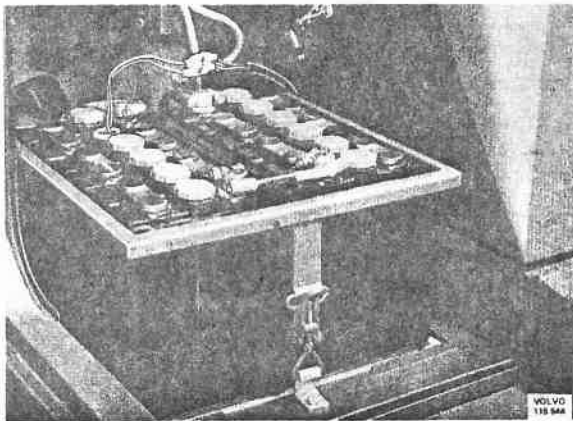


Fig. 31-3. Batteries

Replacing

1. Remove the cover over the batteries.
2. Disconnect the battery cables from the batteries and remove the cables for the temperature contact at the joint coupling, see Fig. 31-3.
3. Undo the two locks for the battery holder, Fig. 31-3, and remove the battery holder.
4. Remove the batteries from the vehicle.
5. Fit the new batteries and secure them in position with the battery holder.
6. Connect up the battery cables and cables to the temperature contact.
7. Fit and secure the cover over the batteries.

BATTERY HEATER

Replacing

1. Remove the batteries, see under "Replacement" above.
2. Disconnect the cables from the battery heater, see Fig. 31-4.
3. Fit the new battery heater and connect up the cables.

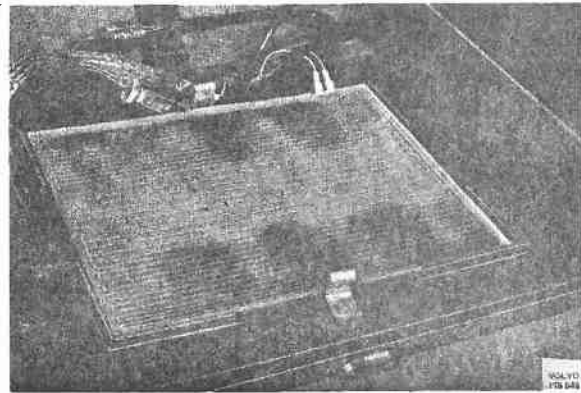


Fig. 31-4. Battery heater

4. Fit the batteries.

The wiring diagram, Fig. 31-5, shows how the battery heater is connected up.

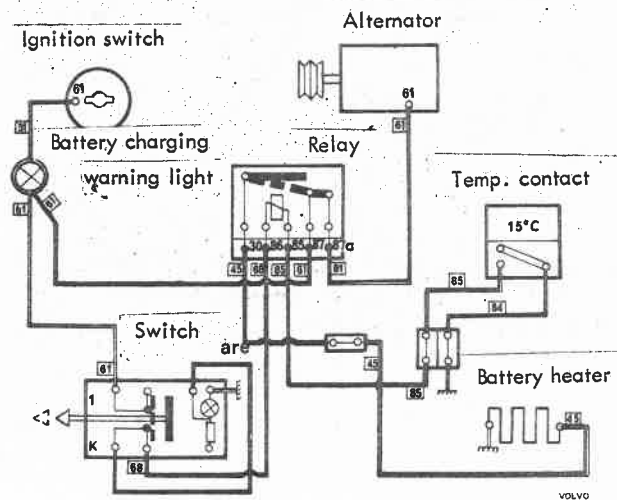


Fig. 31-5. Wiring diagram for battery heater

AUXILIARY START SOCKET

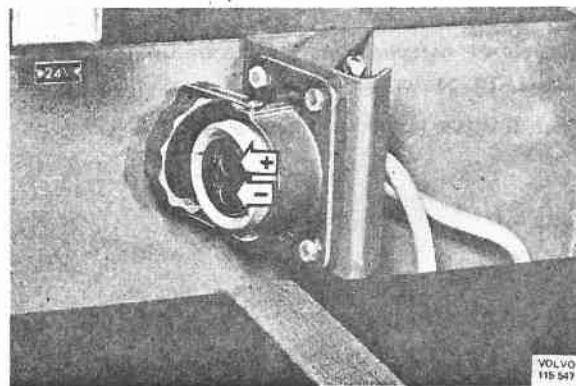
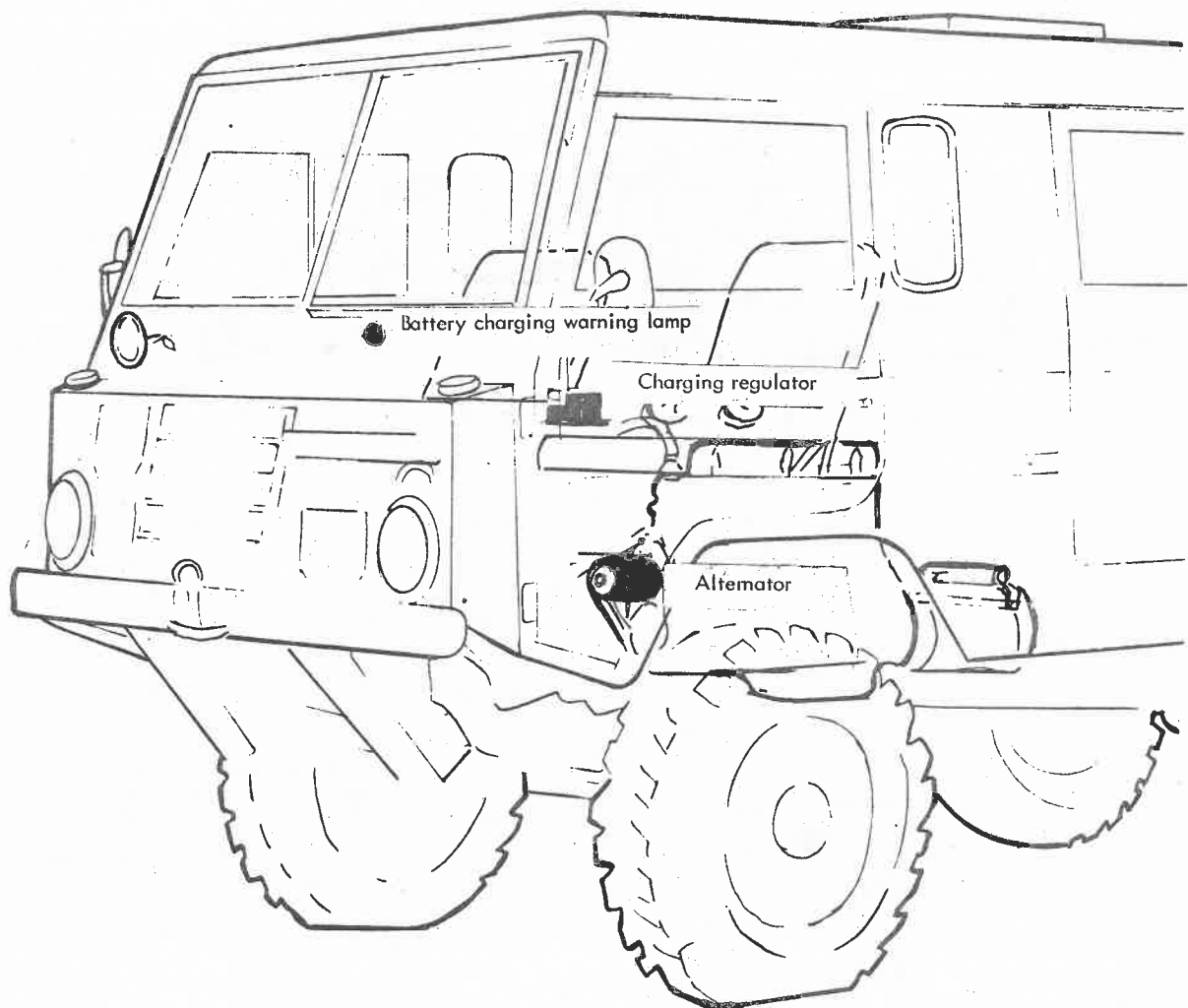


Fig. 31-6. Auxiliary start socket

GROUP 32 ALTERNATOR



VOLVO
115 548

Fig. 32-1. Alternator

Construction and Function

The alternator is placed on the right-hand side of the engine and is driven by two drive belts from the crankshaft pulley.

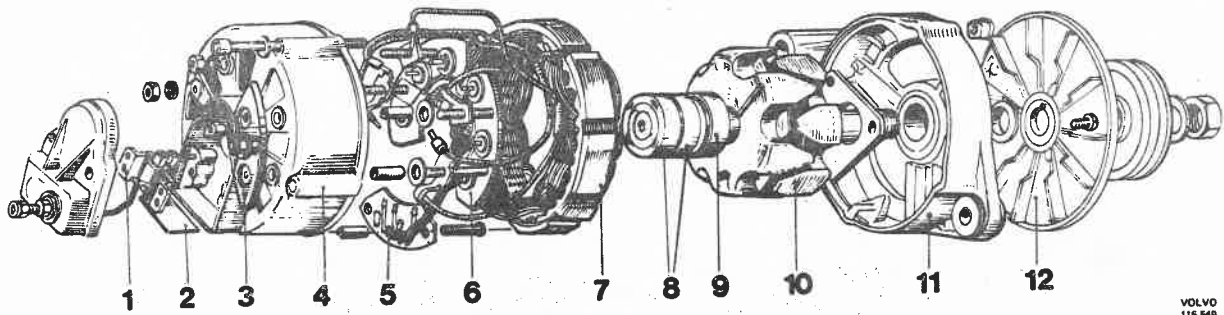
The charging regulator is behind the passenger seat and the battery charging warning lamp is on the fascia.

ALTERNATOR

The alternator is of the three-phase, star-wired type, with a rectifier built into the slip ring end shield, consisting of six silicon diodes.

The alternator is radio-suppressed by means of three RC-circuits, one for each phase. The alternator differs from a dynamo in that it has a rotating magnetic winding called a rotor and a stationary main winding called a stator. The rotor is of the claw-pole type with the magnetic winding fed across two slip rings. The safety diode placed on the outside of the alternator has two functions: it acts as an extra reverse-current protection for the al-

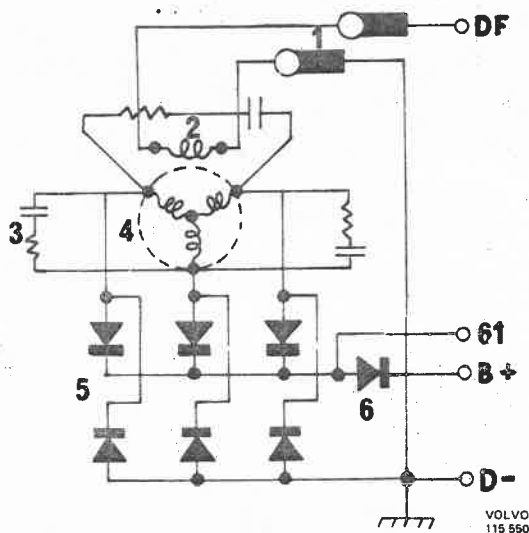
ternator should one of the six rectifier diodes stop functioning, and it also facilitates easy wiring of the battery charging warning light. The alternator is self-limiting (max. 35 A), which means that a simple charging regulator with only voltage regulation can be used.



VOLVO
115 549

- | | |
|-------------------------|----------------------|
| 1. Brush holder | 7. Stator |
| 2. Insulation plate | 8. Slip rings |
| 3. Safety diode | 9. Slip ring bearing |
| 4. Slip ring end shield | 10. Rotor |
| 5. RC-circuits | 11. Drive end shield |
| 6. Diode holder | 12. Fan |

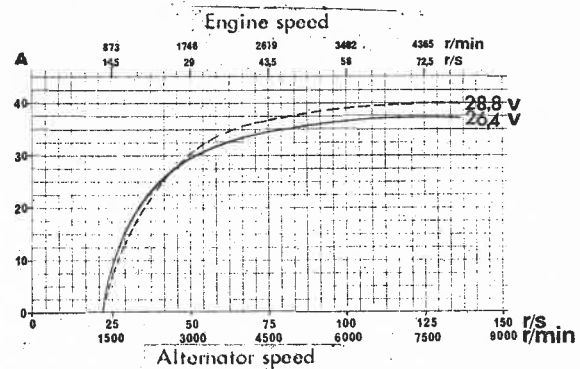
Fig. 32-2. Alternator, exploded view



VOLVO
115 550

- | | |
|---------------|-----------------|
| 1. Slip rings | 4. Stator |
| 2. Rotor | 5. Diodes |
| 3. RC-circuit | 6. Safety diode |

Fig. 32-3. Alternator internal wiring



VOLVO
115 553

Fig. 32-4. Output curve

CHARGING REGULATOR

The charging regulator is a transistor-type with built-in protection against excess voltage. Should excess voltage (36-38 V or more) arise in the alternator due to temporary failure or overloading of the electrical system, or if the control voltage becomes so high due to a faulty regulator, terminals 61 and D- in

the protection for excess voltage will short-circuit. When this happens, current is cut off to the alternator magnetic winding and the alternator stops charging. When the alternator voltage drops towards zero, this breaks the current in the cable between terminal 61 and D- on the protection for excess voltage so that the alternator starts charging again.

If this protection against excess voltage was not fitted, any temporary excess voltage would ruin both the regulator and other power consumers in the electrical system.

A faulty regulator must be replaced, it cannot be repaired or adjusted.

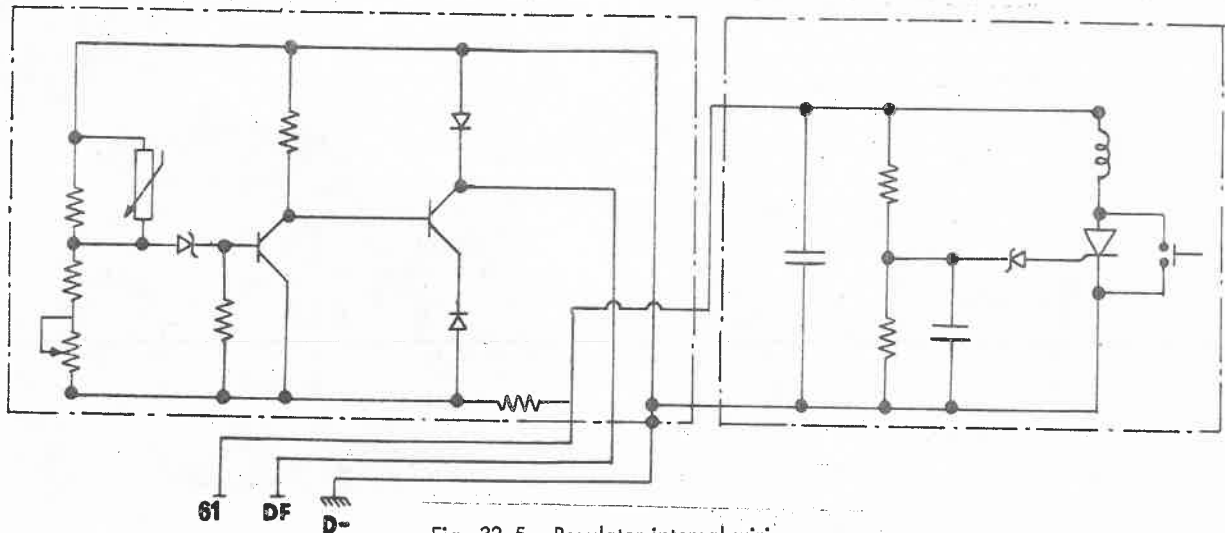


Fig. 32-5. Regulator internal wiring

VOLVO
115 551

Service Procedures

GENERAL

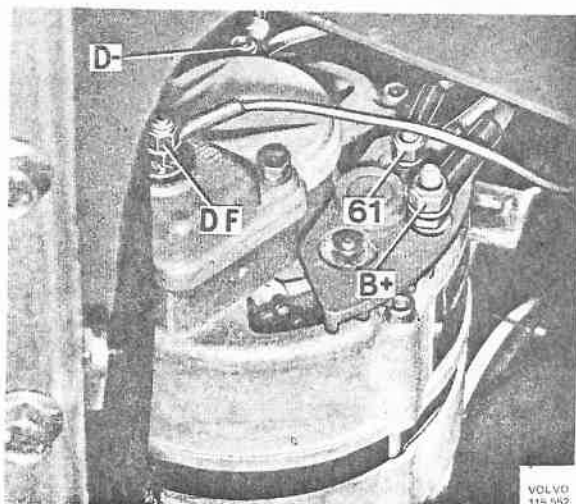
1. Never run the alternator with the main circuit broken. The cables to the batteries, alternator and regulator must never be disconnected while the engine is running.
2. Never try to polarize the alternator. All polarization is unnecessary.

ALTERNATOR

Removal

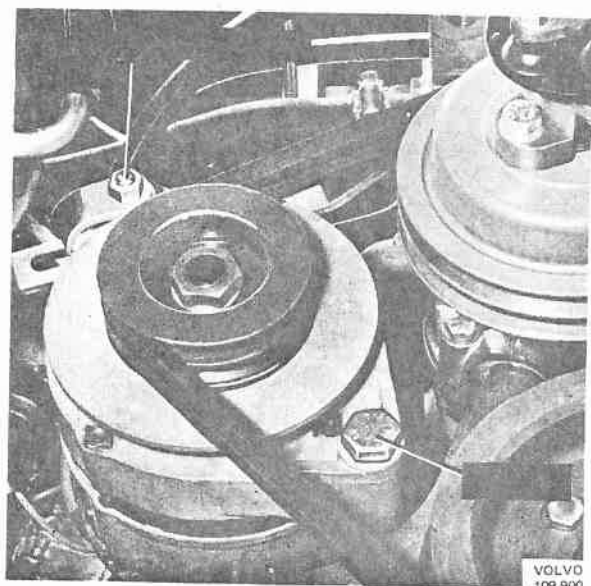
1. Remove the cover over the batteries and disconnect the negative cables.

2. Remove the front engine casing.
3. Note which cables are fixed to which terminals on the alternator and then remove them, see Fig. 32-6.
4. Remove the bolt, Fig. 32-7, securing the tensioning bar to the alternator and slacken the bolt securing the tensioning bar to the cylinder head several turns.
5. Remove the alternator retaining bolt and spacer washer, Fig. 32-7, and lift off the alternator drive belts.



VOLVO
115 552

Fig. 32-6. Alternator cable terminals

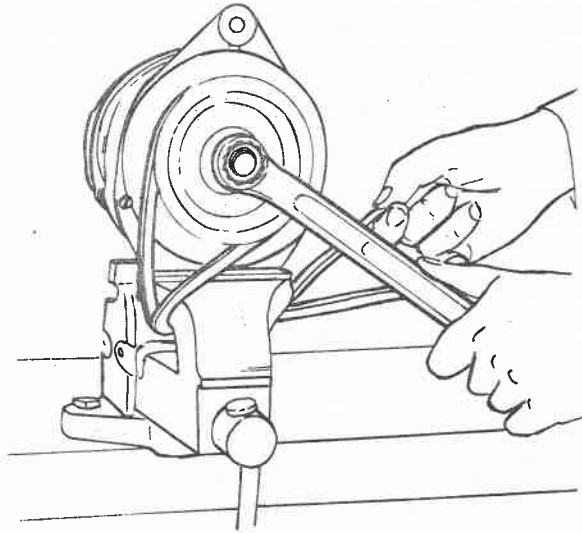


VOLVO
108 900

Fig. 32-7. Alternator fixed in position

Disassembling

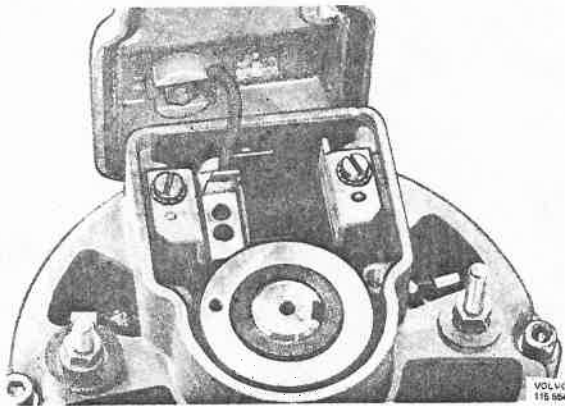
1. Fix the alternator pulley and drive belt as shown in Fig. 32-8 in a vice provided with soft jaws.



VOLVO
118 563

Fig. 32-8. Removing the pulley

2. Remove the nut and washer.
3. Pull off the pulley with a puller. Remove the fan, key and spacer washer.
4. Remove the cover and brush holder by removing the two bolts on the outside of the cover, also the two bolts securing the brush holder, Fig. 32-9.



VOLVO
118 564

Fig. 32-9. Removing the cover and brush holder

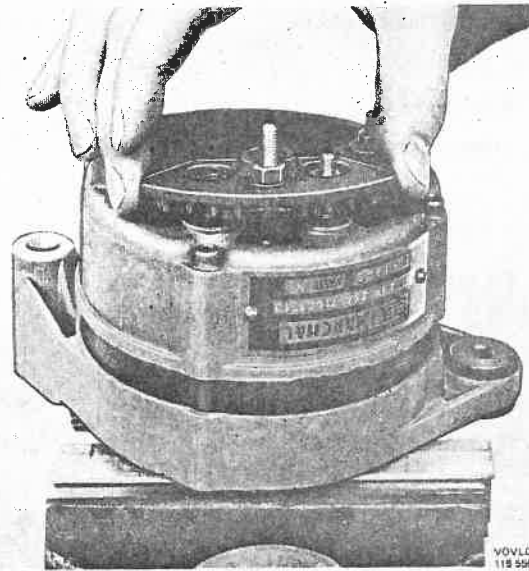
5. Remove the insulation plate, Fig. 32-10.



VOLVO
118 565

Fig. 32-10. Removing the insulation plate

6. Remove the nuts and spring washers retaining the safety diode, Fig. 32-11, and lift off the safety diode together with the two insulation washers from the alternator.



VOLVO
118 566

Fig. 32-11. Removing the safety diode

7. Mark up the bearing shields and stator to ensure that they are re-fitted in their original position.
8. Remove the four bolts holding the alternator together.

- Separate the drive bearing shield and the rotor from the slip ring end shield and stator by means of two screwdrivers, Fig. 32-12.

Note! Do not insert the screwdrivers so deep, otherwise they may damage the stator.

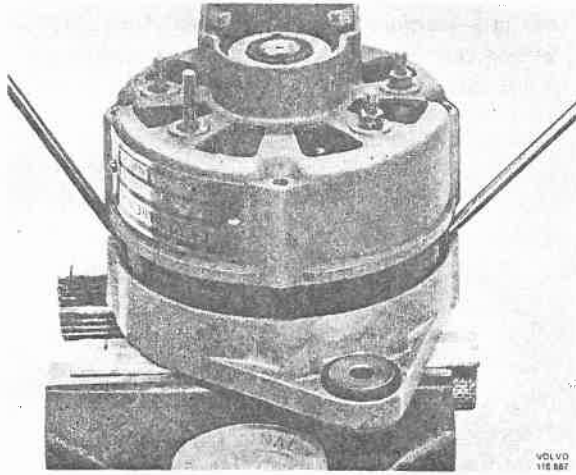


Fig. 32-12. Removing the stator and slip ring bearing shield from rotor and drive bearing shield

- Remove the nuts and washers securing the negative diode retainer. Lift up the stator so far that the two screws securing the RC-circuits can be removed, Fig. 32-13. Then remove the stator, diode holders (with two plastic bushings) and the RC-circuits from the slip ring bearing shield.

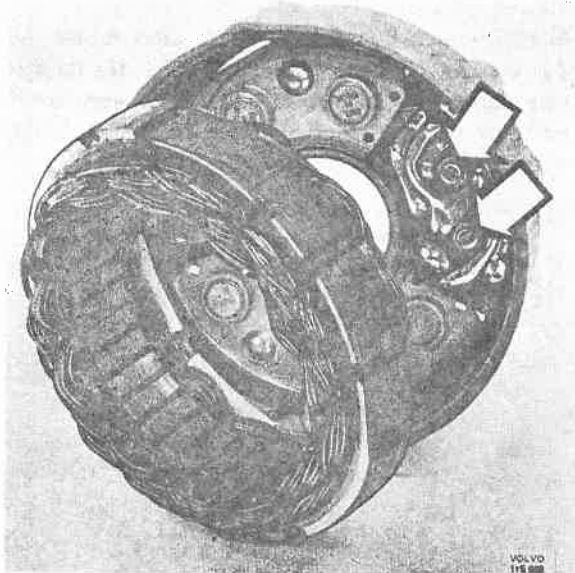


Fig. 32-13. Removing the screws for the RC-circuits

- Remove the three screws securing the drive side ball bearing and then remove the drive bearing shield from the rotor by holding the shield and tapping the rotor with a piece of wood or similar.

Checking and replacing parts

Equipment

Designation	Description	Included in tool kit			
		Volvo kit	Milo workshop kit	Standard and opt.	Extra Normal
M6290-141010	Puller ^{x)}		X		X
M3620-158110	Cable tester ^{xx)}				X
M3746-107010	Auto el. tester ^{xx)}		X		X
M6483-162010	El. sold. iron 250 W/220 ^{x)}				

x) Included in M8700-274510 Workshop trolley 1/S

xx) Included in M8740-214110 Equipment for auto electricians/S

Before checking the separated parts, clean them with white spirit. Since the alternator ball bearings are lubricated for life, they should only be wiped with a damp cloth.

Stator

Connect up a 24-V test lamp between the stator body and one of the phase windings, Fig. 32-14. If the lamp lights, then the insulation between the stator winding and the stator body is damaged.

Note! During the testing, only one test lamp with a voltage of 24 V should be used. A voltage of 110 V or 220 V, direct or alternating current, must not be used. This applies to all the alternator components.

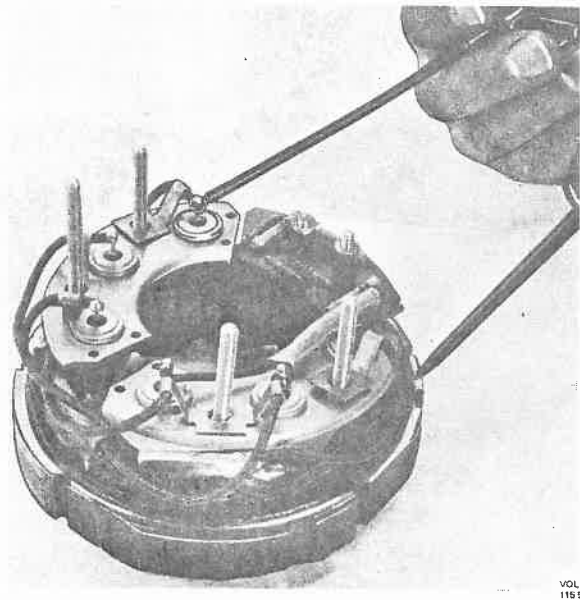


Fig. 32-14. Short-circuit testing the stator

Check the diodes with a diode tester, Fig. 32-15. If any of the rectifier diodes is faulty, the entire diode holder (with three diodes) must be replaced. See under "Rectifier diodes".

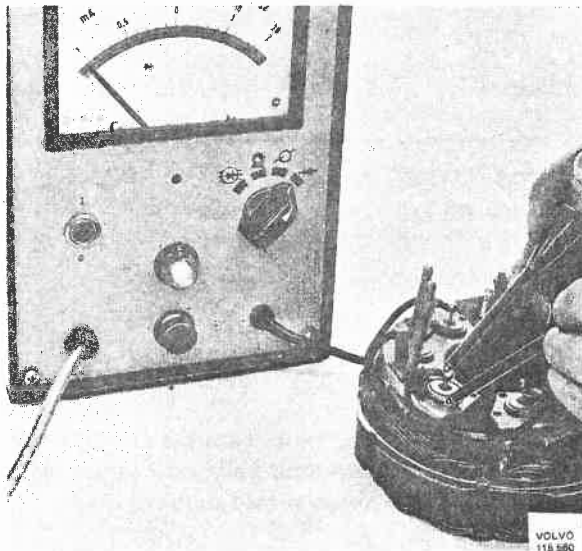


Fig. 32-15. Checking the diodes

Measure the resistance between the phase windings, Fig. 32-16, and check that it is approx. 0.32 . . . The measuring should be carried out at both the diode holder plates, in other words, three measurements at each plate, and the measurements should be as similar as possible. If they differ, then it is quite probable that there is short-circuiting between some of the coils in one of the windings.

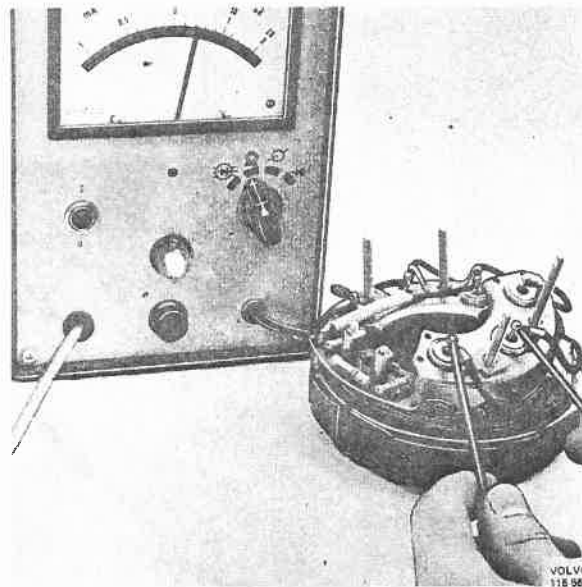


Fig. 32-16. Measuring the stator resistance

Rectifier diodes

For the soldering described below, use a soldering iron of at least 100 W. Mark up the cables connecting the diodes to the stator and solder loose the cables from the diodes. Place the new diode holder in exactly the same position as the old one. The positive diode holder is insulated from the body by means of insulation washers and sleeves, and its diodes are marked red. The negative diode holder is not insulated, and its diodes are marked black.

Solder the cables to the diodes. Note! During the soldering, hold the diode terminal with flat-end pliers to prevent heat from ruining the diode, Fig. 32-17.

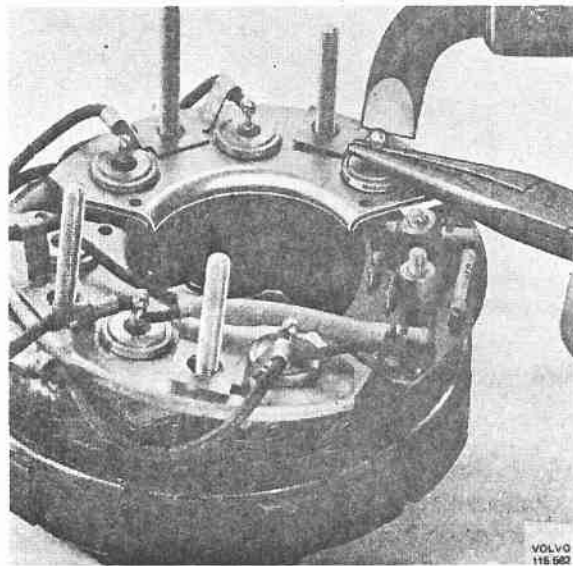


Fig. 32-17. Soldering the cables to the diodes

Safety diode

Check the safety diode with a diode tester, Fig. 32-18. If an ohmmeter is used instead of a diode tester, it must show a high resistance in the counter-current flow direction and low resistance in the current flow direction. If the safety diode is faulty, replace the entire holder and diode.

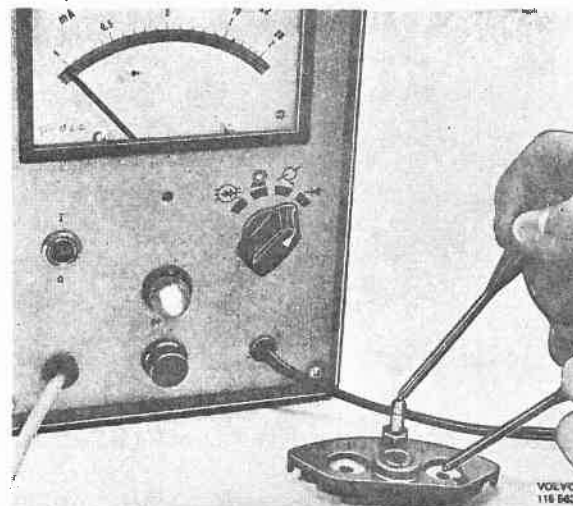
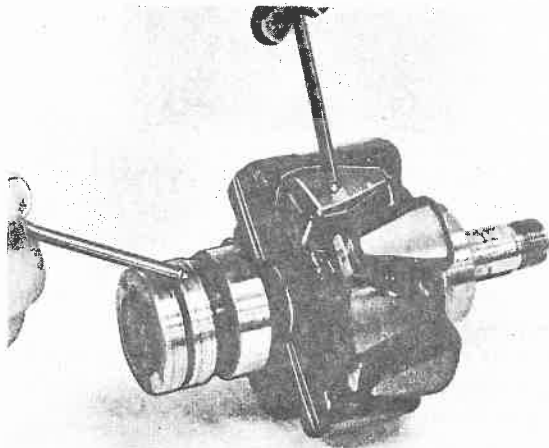


Fig. 32-18. Checking the safety diode

Rotor

Lathe the slip rings if they are burnt or damaged in any other way. Then sandpaper them. Centre the rotor accurately when lathing. The diameter of the slip rings must not be less than 37.5 mm (1.5"). After the lathing, check the roundness of the slip rings by means of a dial indicator. The radial throw must not exceed 0.05 mm (0.002"). Check the insulation between the slip rings and the rotor body, Fig. 32-19.

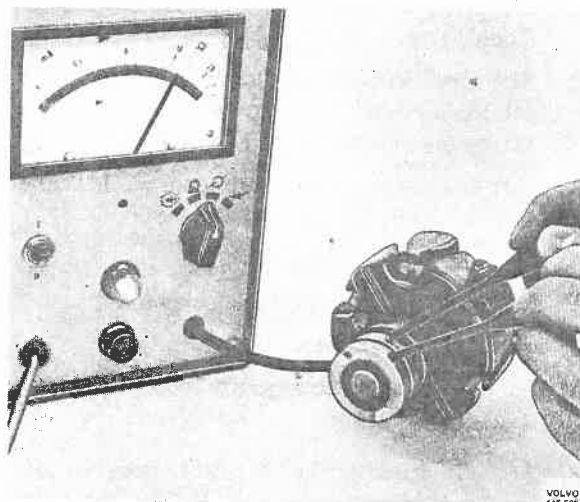


VOLVO
115 564

Fig. 32-19. Checking the rotor insulation

Measure the resistance between the slip rings (rotor winding) and check that it is 13-14 Ω , Fig. 32-20.

If the above requirements regarding minimal measurements and resistances are not met, the rotor must be replaced. Concerning the rotor ball bearings, see under "Bearings".

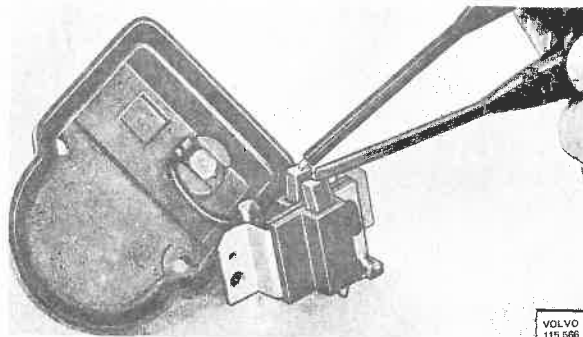


VOLVO
115 566

Fig. 32-20. Measuring the rotor resistance

Brush holders and brushes

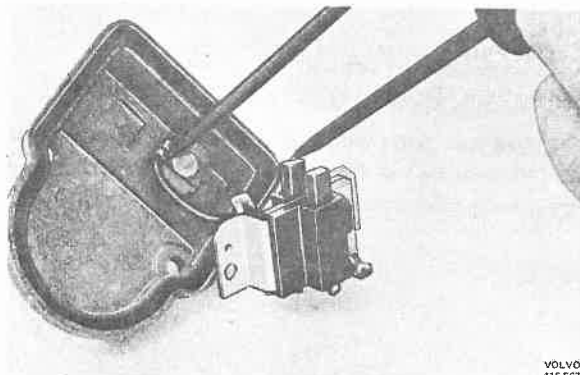
Connect a test lamp between the brushes. It should not light. See Fig. 32-21.



VOLVO
115 566

Fig. 32-21. Testing brushes for short-circuiting

Connect a test lamp between the DF-terminal and the plus brush, Fig. 32-22. The lamp should give a steady light even if the brush or the brush terminal cable alters position.



VOLVO
115 567

Fig. 32-22. Testing the terminal between DF and plus brush

Connect the test lamp between the brush holder body and the negative brush. The lamp should give a steady light even if the brush or the brush terminal cable alters position, Fig. 32-23.

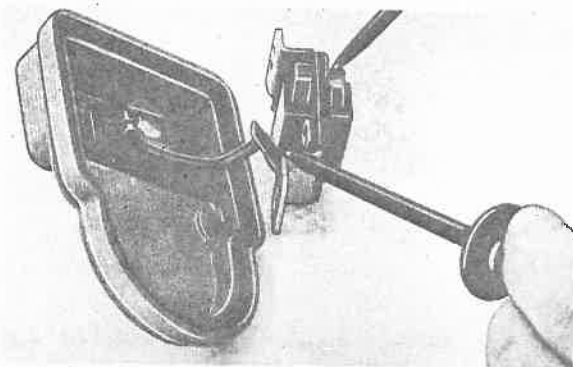


Fig. 32-23. Testing the terminal between brush retainer body and negative brush

Measure the brush length between the brush contact surface and the brush holder, with the brush resting against the spring, and check that it is not less than 5 mm (0.20"), Fig. 32-24.

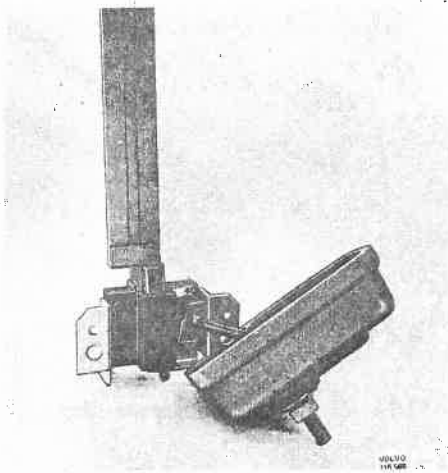


Fig. 32-24. Measuring the brush length (min. 5 mm = 0.20")

Bearings

The alternator ball bearings are lubricated for life.

Check that the bearings are not damaged or worn.

To replace the bearing on the drive side, fix the rotor in a vice with soft jaws. Pull off the bearing with an extractor, Fig. 32-25.

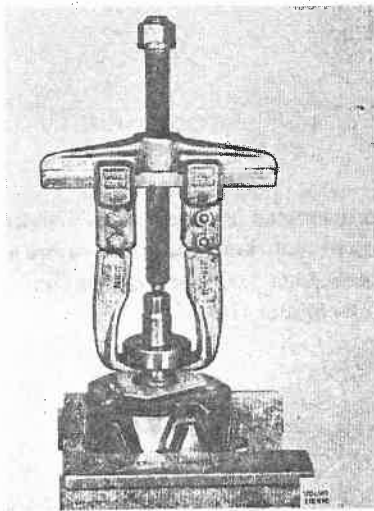


Fig. 32-25. Removing the drive bearing

Fit the new bearing in the drive bearing shield. Place a cover washer over the bearing and screw tight the washer. Press the bearing and shield on the rotor with a tubular sleeve which presses against the bearing inner ring, Fig. 32-26.

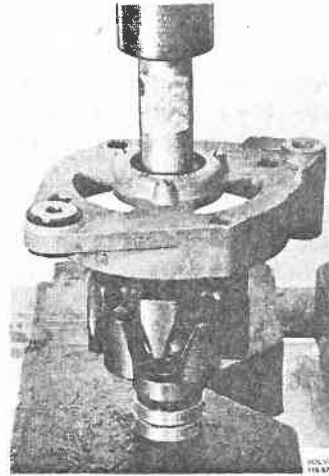


Fig. 32-26. Fitting the drive bearing

When replacing the drive end bearing shield bearing, replace the rotor if the bearing is faulty.

Each time any overhaul work is carried out here, the bearing ring on the bearing shield should be replaced.

RC-circuits

Use a soldering iron of at least 100 W when soldering off and on the cables in the RC-circuits. Hold the terminals at the diodes with flat-nosed pliers to prevent heat from ruining the diodes, see Fig. 32-17.

Assembling

1. Connect up the RC-circuits to the slip ring bearing shield. Then fit the stator (check with the line-up marks to make sure that it is fitted in its original position) and the positive diode holder. Do not forget the insulation washers for the positive diode holder. Fit the negative diode holder.
2. Assemble the drive bearing shield and rotor to the stator and slip ring bearing shield. Tighten up the four retaining bolts, to a tightening torque of 3.0 Nm (0.30 kpm = 2.2 lbftf).
3. Fit the plastic tube and insulation washers on the bolts on which the safety diode is fitted.
4. Fit the safety diode.
5. Fit the insulation plate for the brush holder.
6. Fit the brush holder.
Check that the cover gasket is in good condition.
7. Fit the cover.
8. Fit the spacer washer, key, fan, pulley and nut. Tightening torque 40 Nm (4.0 kpm = 29 lbftf).

After carrying out the above work, the alternator should be test-run on a test bench, see under "Checking the alternator (in test bench or in vehicle)".

Installing

1. Place the alternator in position and fit the retaining bolt and spacer washer.
2. Fit the drive belts.
3. Fit the bolt securing the tensioning bar.
4. Tension the drive belts by applying a suitable tensioning bar to the alternator drive bearing shield and then tighten up the bolt securing the tensioning bar.
5. Tighten up the alternator retaining bolts.
6. Tighten the bolt on the top cover and connect up the cables to their terminals, Fig. 32-27.

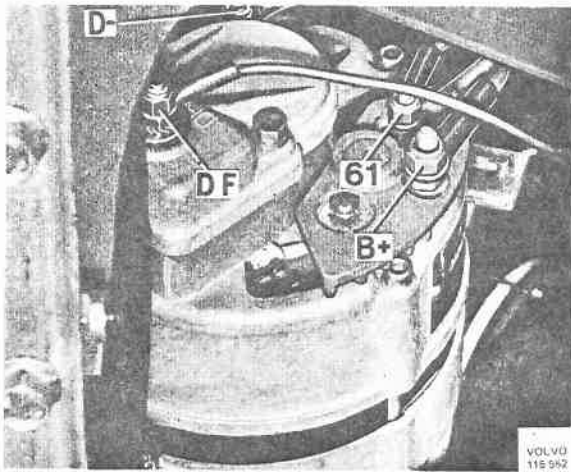


Fig. 32-27. Alternator cable terminals

7. Fit the front engine casing in position. Connect up the negative cable to the battery and fit the cover over the batteries.

CHARGING REGULATOR

Removal

Remove the regulator cables at the terminal box, and also remove the regulator, see Fig. 32-28.

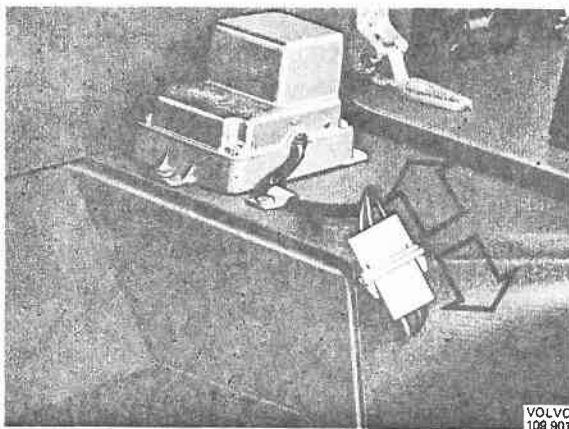


Fig. 32-28. Charging regulator

Installing

Check that the number on the new regulator is the same number as the one on the old regulator. Install the regulator with the three bolts and connect up the cables.

Checking the alternator
(on test bench or in vehicle)

M3746-707010 auto electric tester is included in M8740-214110 equipment for auto electricians/S.

Connect the alternator according to Fig. 32-29. Use a 0-40 V voltmeter and a 0-10 A ammeter.

50

Run the alternator on a test bench at a speed of 83.3 rev/sec (5000 rev/min). If the alternator is already in the vehicle, run the engine at a speed of 48.3 rev/sec (2900 rev/min). If the alternator is warm, it should generate at least 35 A at 28 V.

With continued testing of the alternator, compare the values given on the wiring diagram, Fig. 32-29, and the output curve for the alternator, Fig. 32-30.

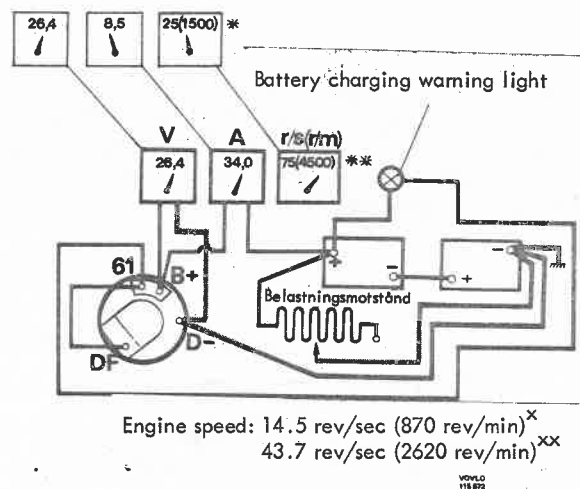


Fig. 32-29. Wiring diagram for checking alternator

Checking the RC-circuits

If there is interference in the radio and other consumer components, the reason may be that the RC-circuits in the alternator are not functioning. To check this, remove the drive belts from the alternator and start the engine. If there is no interference then, the fault is probably in the RC-circuits.

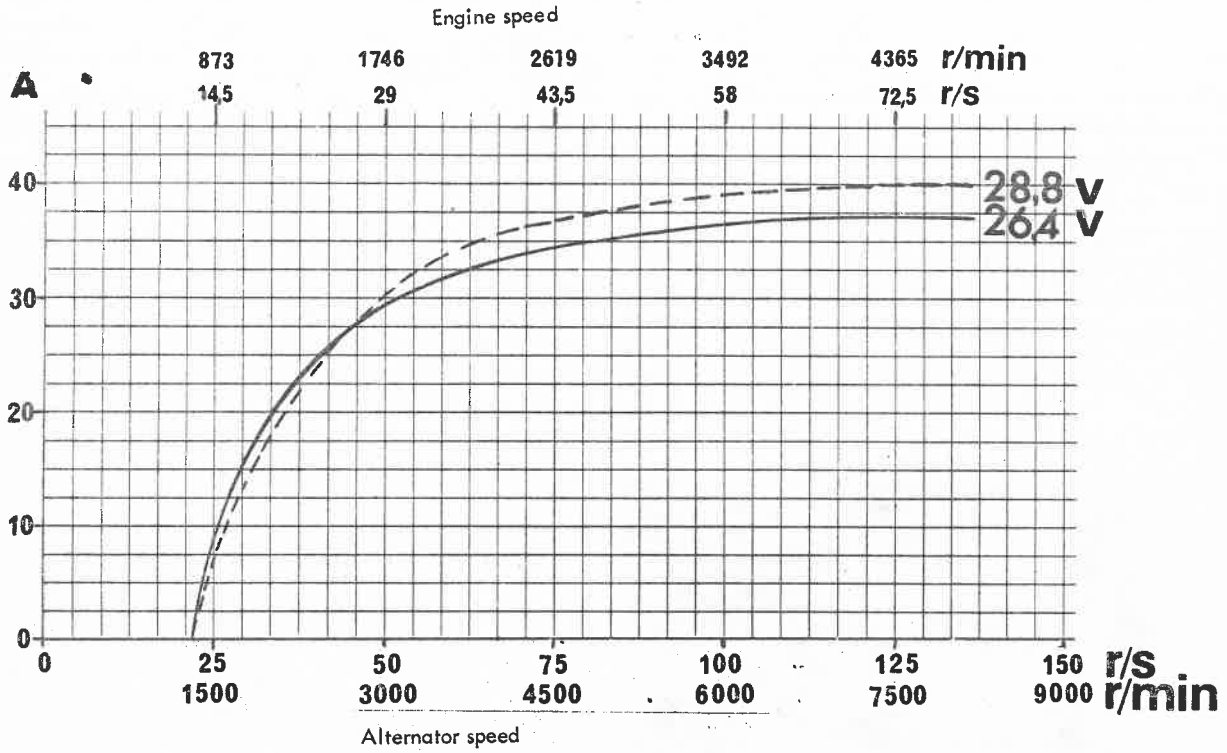


Fig. 32-30. Output curve

VOLVO
115 573

Checking the charging regulator (on test bench or in vehicle).

Connect the alternator and regulator according to Fig. 32-31. On test bench: run the alternator at a speed of 83.3 rev/sec (5000 rev/min). In vehicle: run the engine at 48.3 rev/sec (2900 rev/min). Load the alternator to approx. 10 A.

Check that the voltage is 27.1-28.1 V when the regulator surrounding temperature is 25°C (77°F). If the temperature is otherwise, compare the diagram in Fig. 32-32. Replace a faulty regulator since it cannot be adjusted.

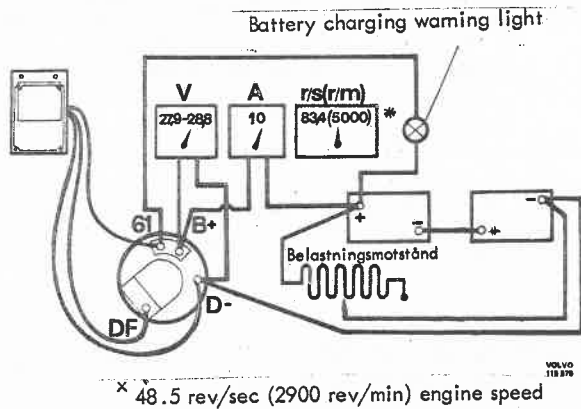


Fig. 32-31. Wiring diagram for checking alternator/regulator

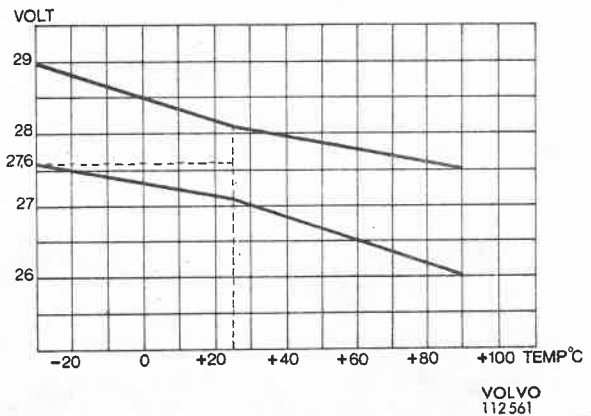
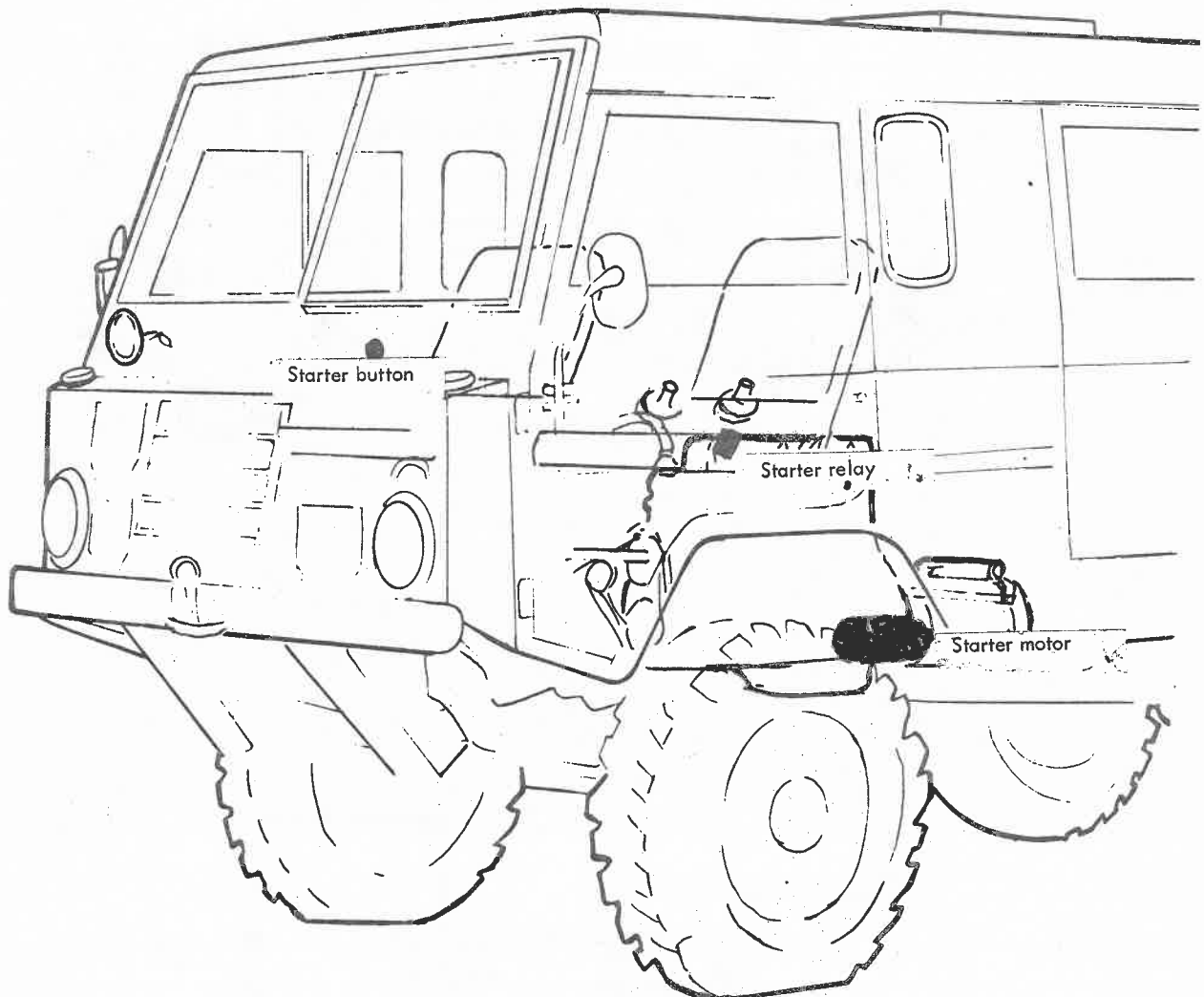


Fig. 32-32. Voltage-temperature diagram

VOLVO
112 561

GROUP 33 STARTER MOTOR

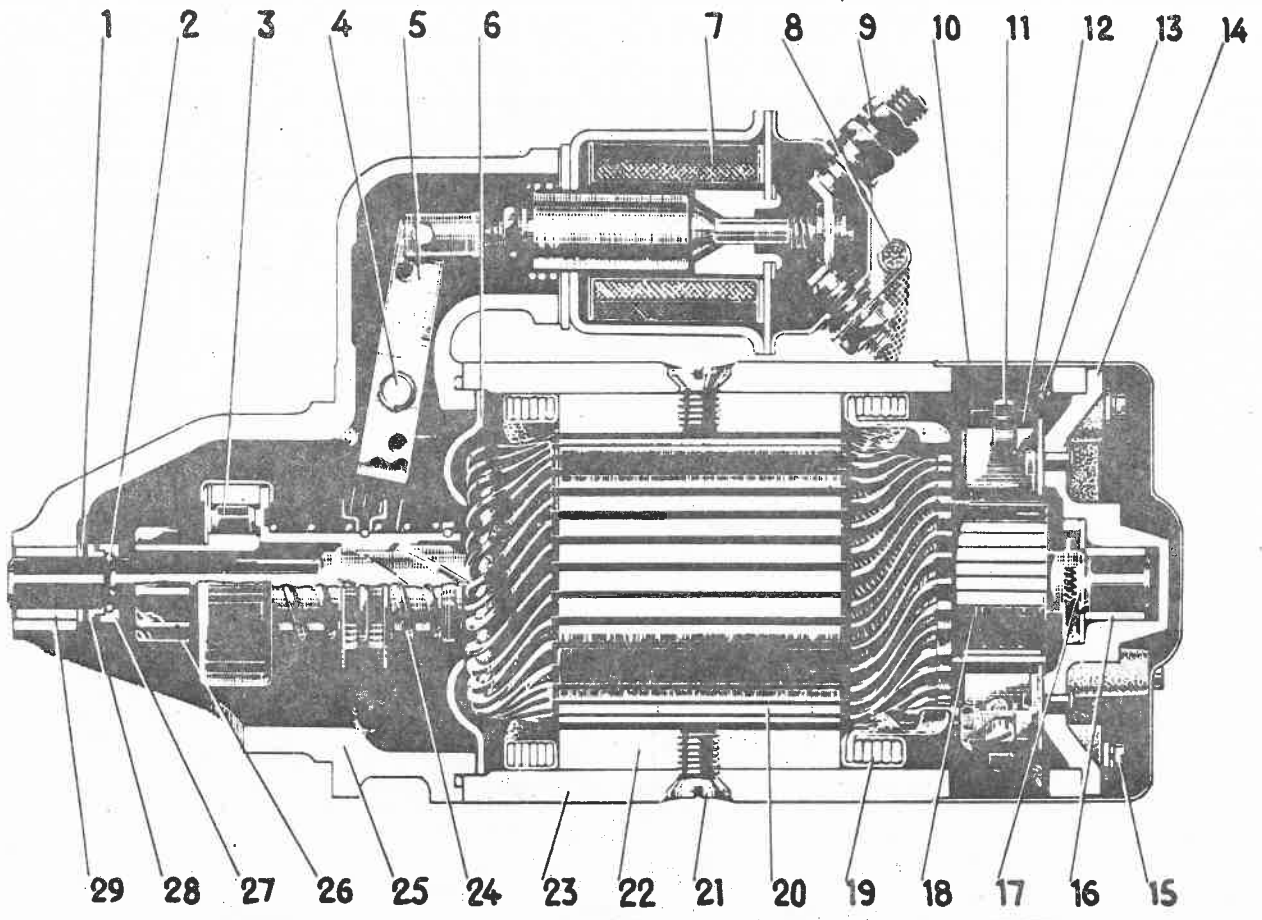


VOLVO
115 576

Fig. 33-1. Starter motor

Construction and Function

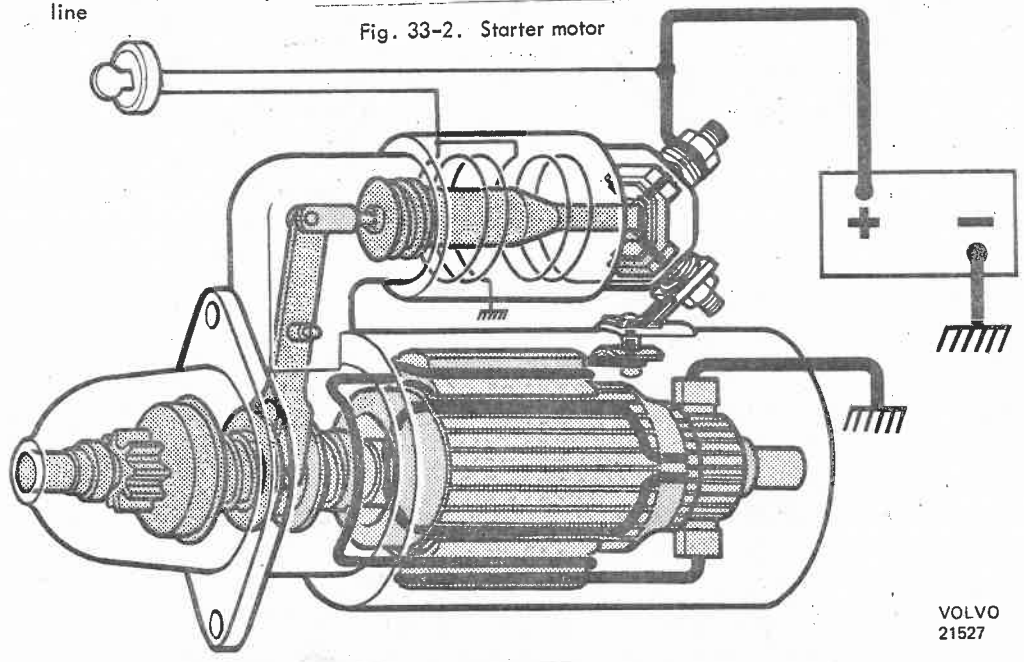
The starter motor at the flywheel casing on the left-hand side of the engine is a four-pole series motor. The pinion on the starter motor armature shaft engages the flywheel ring gear when displaced. The axial movement of the pinion is controlled by a magnet.



- | | | | |
|-------------------------|-----------------------------------|---------------------------|------------------------------|
| 1. Spacer washer | 9. Terminal screw | 17. Armature brake | 25. Drive bearing end shield |
| 2. Circlip | 10. Cover | 18. Commutator | 26. Drive |
| 3. Roller drive | 11. Brush spring | 19. Field winding | 27. Stop ring |
| 4. Pivot bolt | 12. Brush | 20. Armature | 28. Stop ring |
| 5. Shift lever | 13. Brush holder | 21. Pole screw | 29. Drive bearing bushing |
| 6. Intermediate bearing | 14. Commutator end bearing shield | 22. Pole shoe | |
| 7. Solenoid | 15. Screw | 23. Starter motor housing | |
| 8. Connection line | 16. Bushing | 24. Spring | |

VOLVO
115 600

Fig. 33-2. Starter motor



VOLVO
21527

Fig. 33-3. Starter motor internal wiring

Service Procedures

STARTER MOTOR

Testing in vehicle

M3746-107010 Auto Electric Tester is included in the M8740-214110 equipment for auto electricians/S.

Before starting the test, check to make sure that the batteries are fully charged and that battery cable terminals, earth cables and cables to the starter motor are in good condition.

Braked pinion

Connect up the measuring instruments as shown in Fig. 33-4. Engage top gear and brake the vehicle with the handbrake and footbrake. Push in the starter button for maximum 5 seconds and read off the instruments. The voltmeter should indicate 16V and the ammeter 220-270 A. If other values are obtained, then the starter motor is faulty and should be removed from the vehicle for close inspection and necessary overhaul.

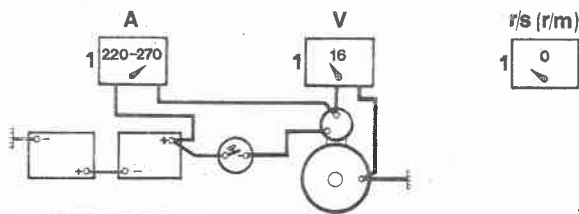


Fig. 33-4. Wiring diagram for starter-motor testing

Removal

1. Remove the cover over the batteries and disconnect the negative cables.
2. Remove the plate over the engine and gearbox.
3. Remove the gear lever control ball joints from the gearbox and lift up the control tube, Fig. 33-5.

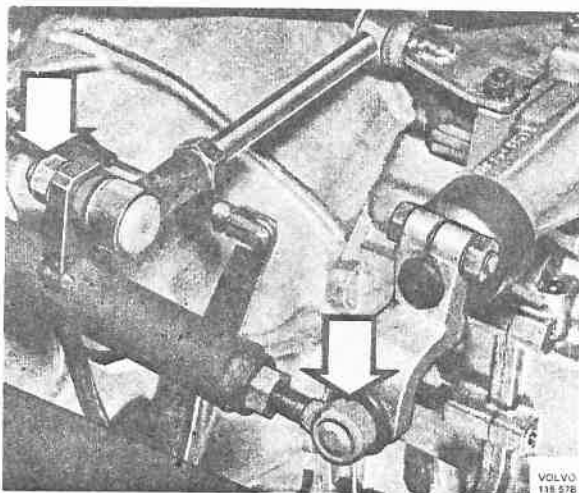


Fig. 33-5. Removing the gear lever control ball joints

4. Remove the cables from the starter motor and the screw on the engine block securing the earth cable, see Fig. 33-6.
5. Remove bolts, washers and nuts securing the starter motor to the flywheel casing and lift off the starter motor.

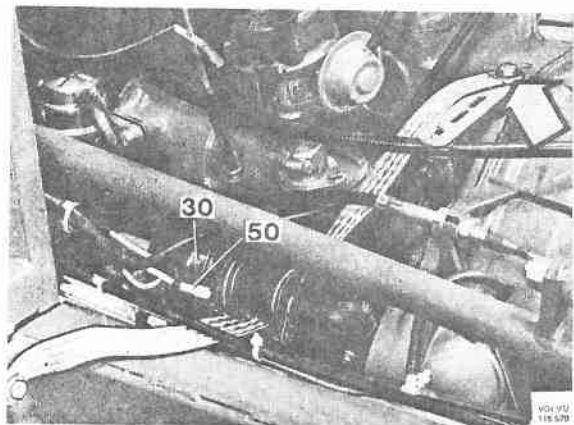


Fig. 33-6. Cable wiring for starter motor

Testing after removal

M3746-107010 Auto Electric Tester is included in the M8740-214110 equipment for auto electricians.

M3620-158220 cable tester.

Checking the solenoid

Wire up the solenoid according to Fig. 33-7. The test voltage at terminal 50 should be minimum 15 V and maximum 28 V. When the power is switched on, the solenoid should be able to push out the pinion to the engaging position and keep it there as long as the power is switched on. When current is broken, the solenoid immediately disengages and the pinion goes back to the rest position.

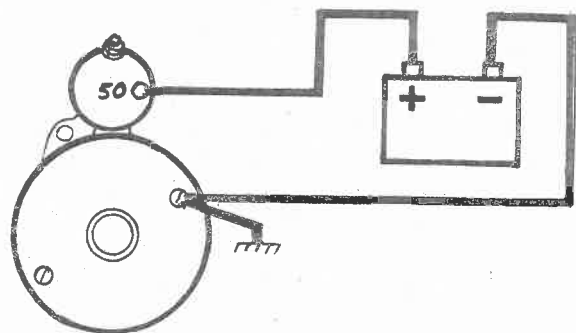


Fig. 33-7. Testing the solenoid

VOLVO
118 580

Clean the outside of the starter motor with white spirit. Remove the protective cover for the brushes.

Secure the starter motor on a test bench and connect up the instruments as shown in Fig. 33-8.

Note! The test bench ammeter should be provided with a shunt for minimum 500 A.

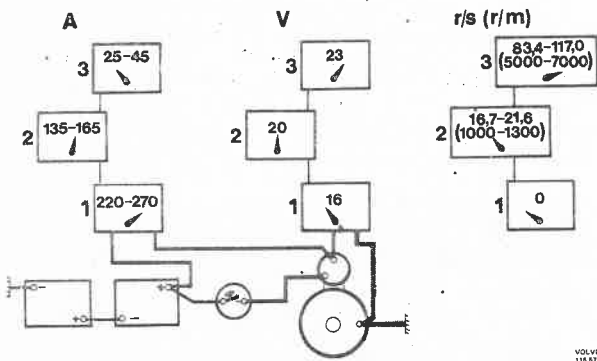


Fig. 33-8. Wiring diagram for starter motor testing

Disassembling

1. Remove the protective cover at the commutator end bearing shield.
2. Remove the screws securing the brushes and pull the brushes up out of their holders, Fig. 33-9.

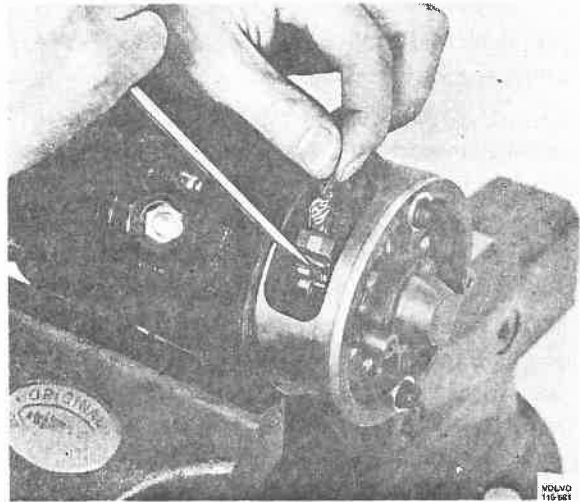


Fig. 33-9. Removing the electric brushes

Fault

Reason

- | | |
|---|--|
| 1. Low speed and low current. | Considerable resistance due to dirty commutator, worn brushes or too low brush spring pressure. |
| 2. Low speed and high current. | Short-circuiting in magnetic windings. The armature scrapes against the pole shoes due to worn bearings or distorted armature shaft. |
| 3. Powerful sparking, low rotation. | Low spring pressure due to worn brushes or defective brush springs. Short-circuiting or partial breakage in armature winding. |
| 4. Pinion does not go back to the rest position when the power is broken. | Poor contact at terminal 50 or fault in solenoid. |
| 5. Pinion goes back to rest position when voltage cuts-out. | Pinion scuffs against the armature shaft. |
| 6. Solenoid operates, but starter motor does not. | Faulty solenoid, poor contact with brushes. Breakage in magnetic winding. Armature scuffs against the journaling. |

3. Ta bort skruvarna som håller samman lager-sköldar och hus. Ta bort muttern som håller förbindelseledningen vid manövermagneten, bild 33-10.

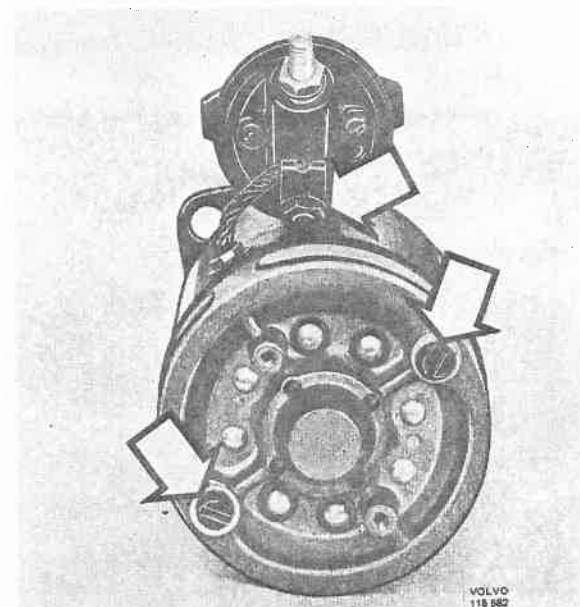


Fig. 33-10. Removing the nut and screws

4. Remove the commutator end bearing shield from the starter motor housing, Fig. 33-11.

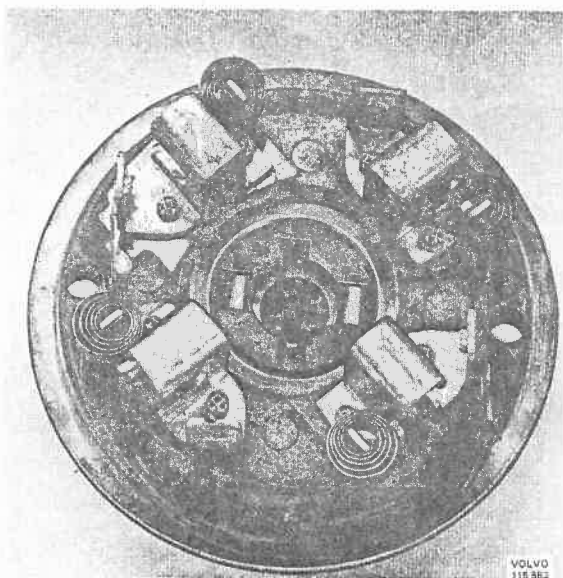


Fig. 33-11. Commutator end bearing shield

6. Remove the three bolts and lock washers securing the intermediate bearing, Fig. 33-13.

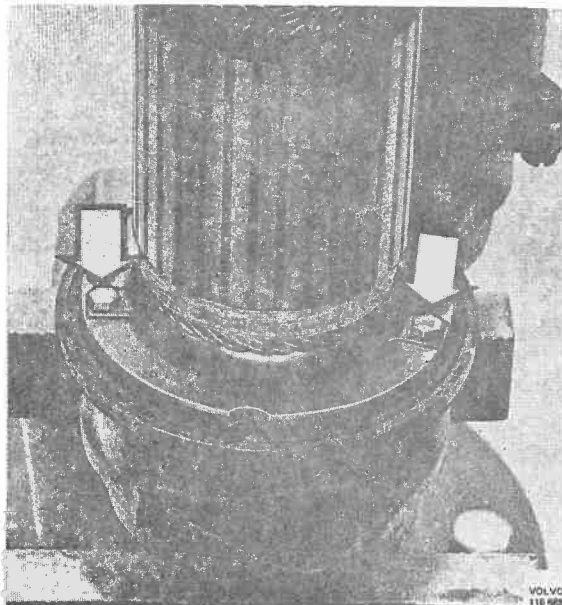


Fig. 33-13. Removing the bolts for the intermediate bearing

5. Separate the armature and the drive end bearing shield from the starter motor housing, Fig. 33-12.

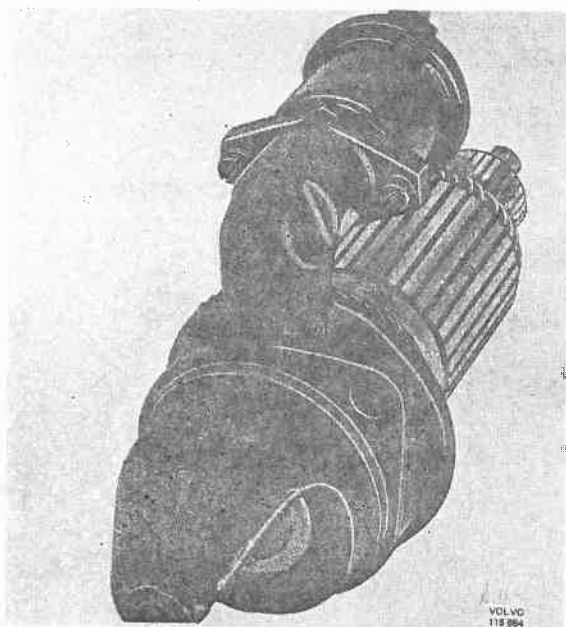


Fig. 33-12. Drive end bearing shield and armature

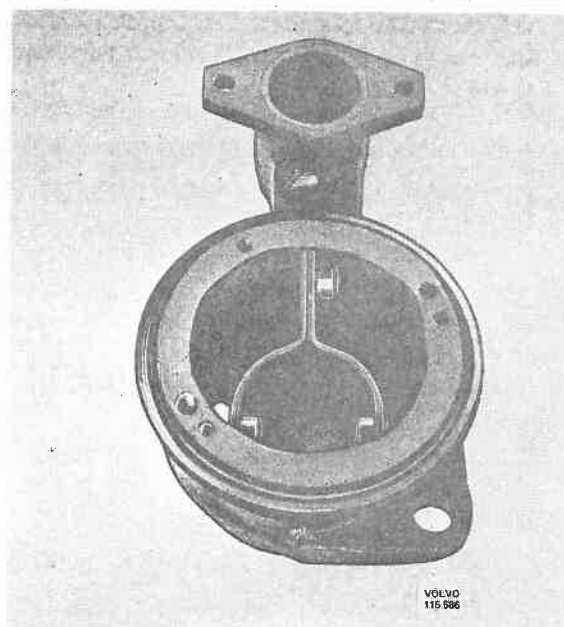


Fig. 33-14. Front end with engaging lever

9. Remove the washers for adjusting the axial clearance and then remove the outer stop ring from the armature.
10. Remove the starter motor pinion and intermediate bearing.

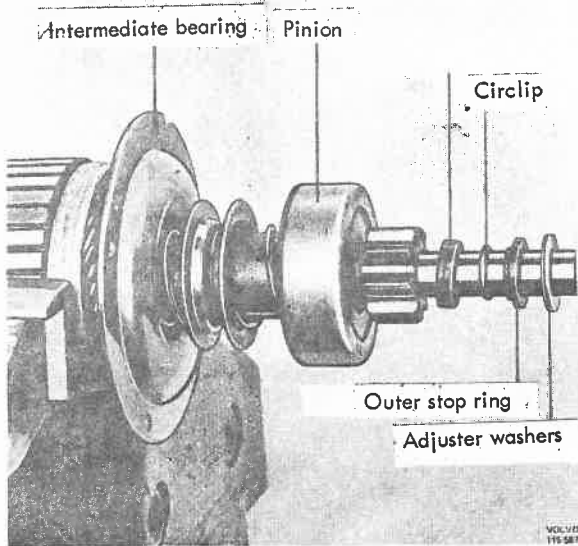


Fig. 33-15. Pinion end of armature

11. Remove the armature brake and flat washer from the commutator end bearing shield.
12. The starter motor pinion and brushes can be wiped with a damp cloth, and the other parts can be cleaned in white spirit.

Checking and replacing parts

Armature

1. Check the armature for mechanical damage.
2. Re-lathe the commutator if it is scored or unevenly worn. When lathing, use a precision machine with a special support chuck. Take small cuts at a time so as not to remove more than is necessary, see Fig. 33-16.

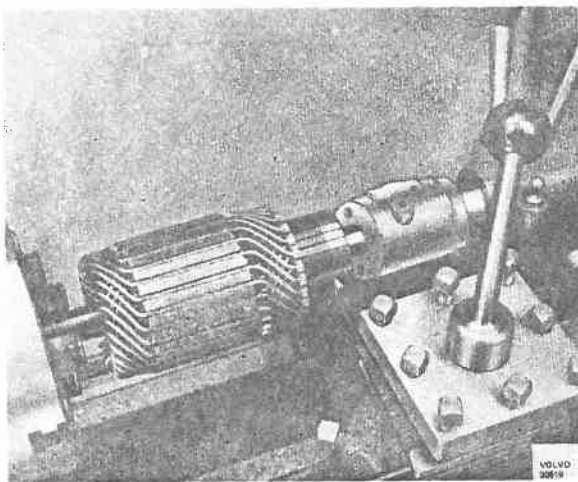


Fig. 33-16. Lathing the commutator

The diameter of the commutator may not be less than 33.5 mm (1.30") and the radial throw at the commutator may not exceed 0.05 mm (0.002"), Fig. 33-17.

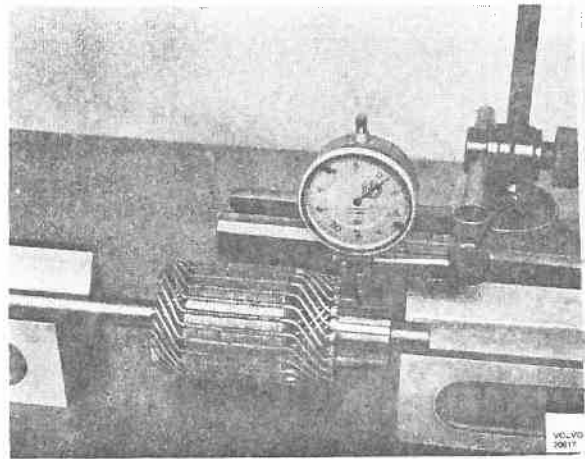
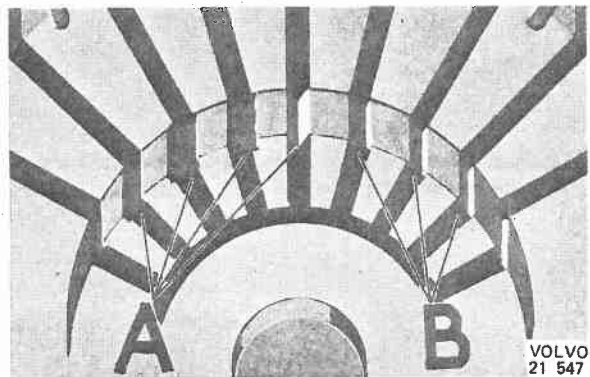


Fig. 33-17. Checking the radial throw

3. Insert the insulation between the discs to a groove depth of 0.5-0.8 mm (0.020-0.032") beneath the surface of the disc, see Fig. 33-18. Milling is done with a groove milling machine, see Fig. 33-19, or with a



- A Incorrectly milled
- B Correctly milled

Fig. 33-18. Groove depth on commutator

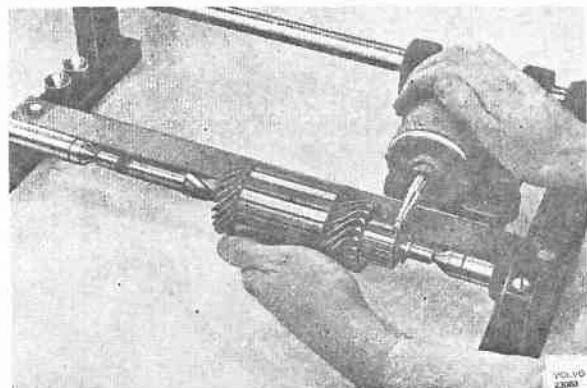


Fig. 33-19. Grooving machine, grooving down insulation

- Sandpaper the commutator with a fine sandpaper cloth, and blow clean the grooves with compressed air.
- Check the armature with an armature tester.

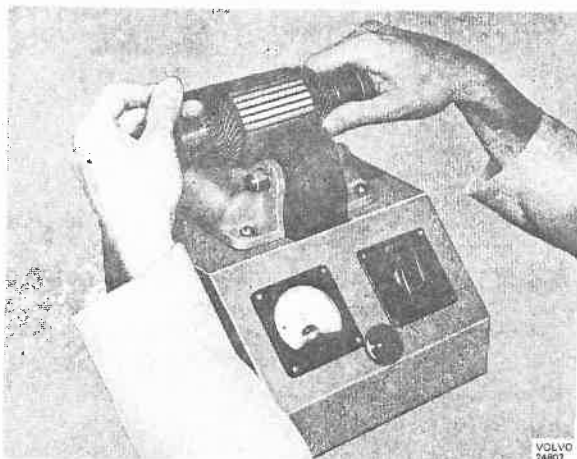


Fig. 33-20. Testing the armature

Magnetic windings

- Check the windings for mechanical damage.
- Connect a test lamp between the starter motor housing and field windings. If the lamp lights, then the windings or grommet in the housing is damaged, Fig. 33-21. Concerning replacement of the magnetic windings, see points 3 and 4.

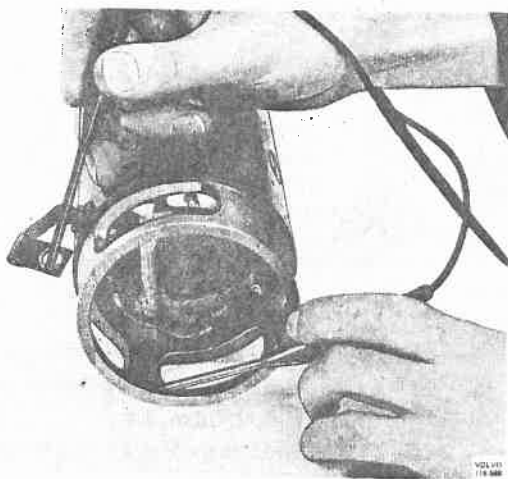


Fig. 33-21. Short-circuit testing, housing - field windings

- Make line-up marks for the pole shoes and starter motor housing so that the shoes are fitted in their original position when re-fitted.

Place the starter motor housing in a clamping block as shown in Fig. 33-22 and remove the bolts for the pole shoes.

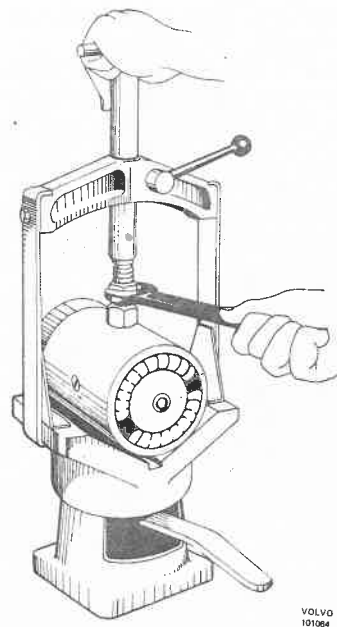
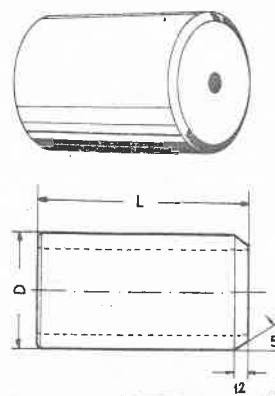


Fig. 33-22. Removing the pole shoe bolts

- Remove the pole shoes and the magnetic windings from the starter motor housing.

Fix the new windings loose in the housing together with the pole shoes, and press the assembly into the housing with a press drift, see Fig. 33-23, and tighten up the pole shoe bolts. Remove the housing from the clamping block and also remove the press drift.



$D = 66.04-66.09 \text{ mm (2.599-2.602")}$
 $L = 85 \text{ mm (3.346")}$

Fig. 33-23. Press drift

- Solder the grommet in position and check with a test lamp that there is no short-circuiting in the starter motor housing, Fig. 33-21.

Commutator/drive end bearing shields

Check the positive brush holder on the commutator bearing end shield for short-circuiting between the holder and shield. Use a test lamp, see Fig. 33-24.

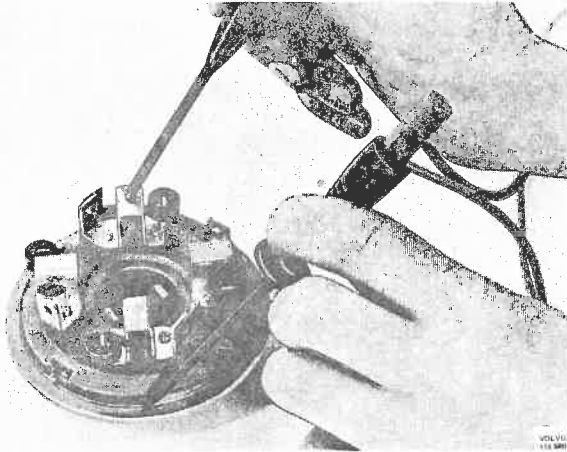


Fig. 33-24. Short-circuit testing the commutator end bearing shield

Place the commutator end bearing shield with brushes on the armature and measure the brush spring force by hooking a spring balance onto the brush spring where the spring goes against the brush. The spring force should be 8-9 N (0.8-0.9 kp = 1.7-1.9 lbf) and should be read off when the spring is lifted from the brush. If another force is obtained, the spring must be replaced. Check the joughalling for the intermediate bearing and the armature. If the gap is excessive, replace the intermediate bearing.

Each time any overhauling is carried out, the bushings in the drive end and commutator end bearing shields should be replaced. The bushings are of the self-lubricating type, and it is therefore important that they lie in light oil for at least 30 minutes before being fitted.

Bushings

1. Press or pull out the bushings with a suitable drift or extractor, see Figs. 33-25 and 33-26.

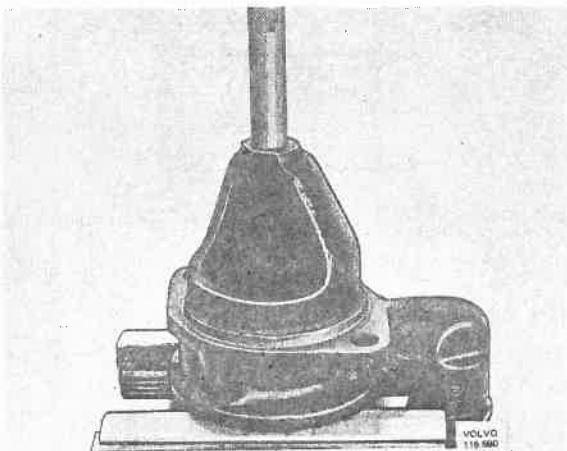


Fig. 33-25. Replacing the bushings

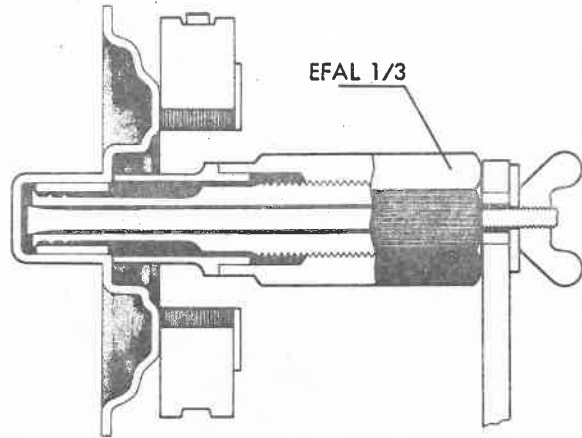


Fig. 33-26. Bushing extractor, make Bosch, mounted on bearing shield

2. Clean the hole for the bushing.
3. Press in the new bushing with a drift, e.g., a snap-on drift kit A-157 A or similar. If necessary, a smooth drift can be pressed through the bushing.

Lubrication

Use Bosch lubricant (or corresponding) according to the designations below, see Fig. 32-27.

Ft = grease
Ol = oil

1. Ft 2 v 3. Grease lightly the armature brake springs
2. Ol 1 v 13. Place the bushing in oil for 30 minutes before fitting.
3. Ft 2 v 3. Grease lightly the washers and shaft end.
4. Ft 2 v 3. Apply plenty of grease to the armature brake.
5. Ft 2 v 3. Apply plenty of grease to the groove.
6. Ft 2 v 3. Lightly grease the flange sleeve and coil spring.
7. Ft 2 v 3. Lightly grease the shaft end and lands.
8. Ft 2 v 3. Lightly grease the adjuster washers.
9. Ol 1 v 13. Place the bushing in oil for 30 minutes before fitting..
10. Ft 2 v 3. Lightly grease the pins and their bearing points.
11. Ol 1 v 13. Place the bushing in oil for 30 minutes before fitting.

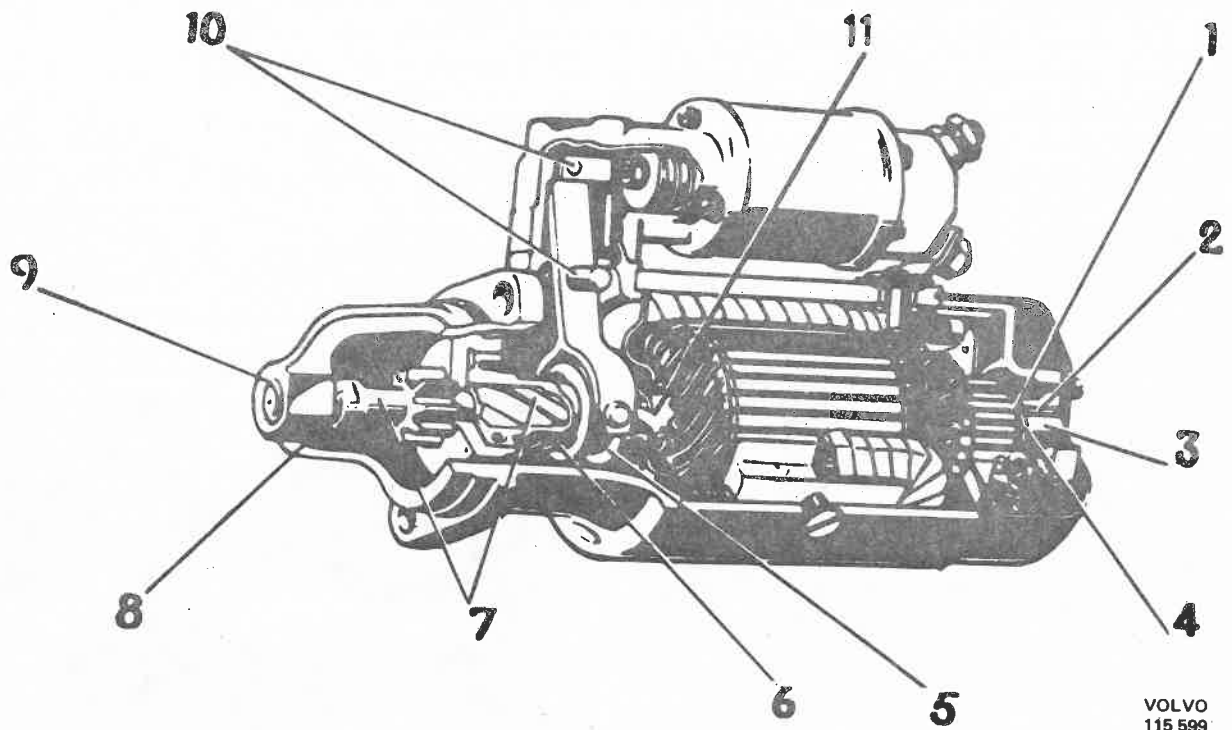


Fig. 33-27. Lubricating points

Assembling

1. Fit the armature brake on the commutator end bearing shield and the cable between the positive brushes, Fig. 33-28.

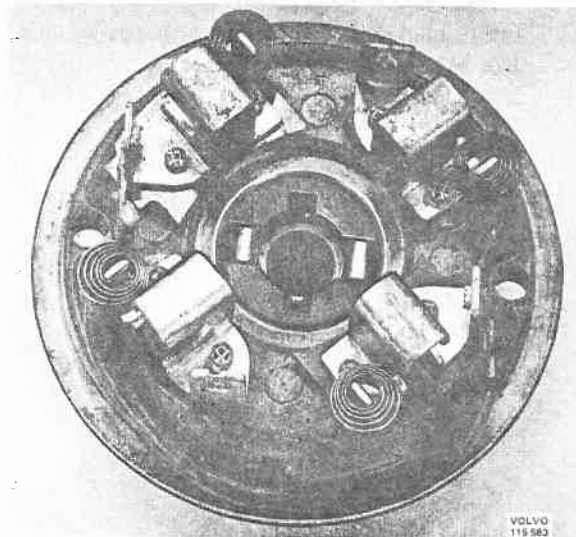


Fig. 33-28. Armature brake

2. Fit the intermediate brake with holder on the shaft and place the starter motor pinion on the armature shaft. Fit the washers and lock ring as shown in Fig. 33-29.
3. Place the engaging lever in its groove on the starter motor pinion and assemble the drive bearing end shield and the armature. The stop on the engaging lever must face towards the pivot bolt nut.

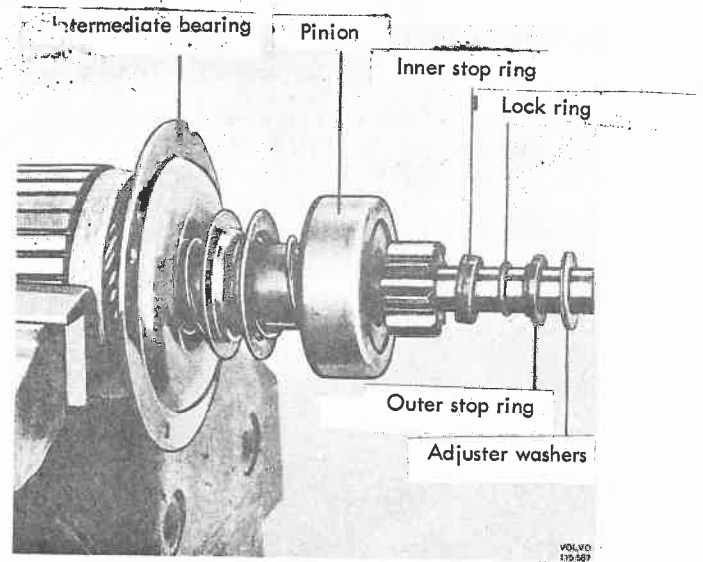
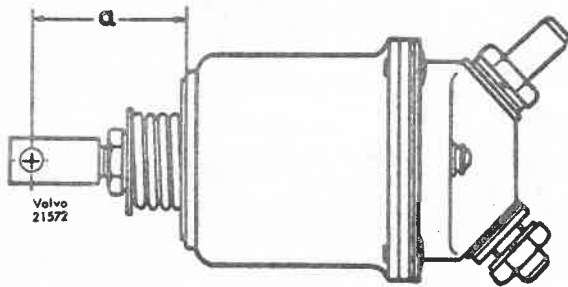


Fig. 33-29. Armature pinion end.

4. Screw tight the intermediate bearing holder in the pinion housing.
5. Fit the starter motor housing.
6. Fit the commutator end bearing shield on the end of the armature shaft, also fit the armature brake and screw tight the bearing shield in its correct position with the through bolts.
7. Fit the brushes in their holders and screw tight the cable from the magnetic windings in the brush holder.

8. Check the adjustment on the solenoid. Adjust if necessary, see Fig. 33-30.

Place the solenoid on the pinion housing and fit the pivot bolt.



$$a = 32.1-32.3 \text{ mm (1.30-1.31")}$$

Fig. 33-30. Solenoid adjustment measurement

9. Screw on the protective cover over the commutator end bearing shield.
10. Rotate the armature and check that it does not stick. Measure the axial clearance and check that it is 0.1-0.3 mm (0.004-0.012").
11. Test-run the starter motor on a test bench before installing it in the vehicle.

Installing the starter motor in vehicle

1. Mount the starter motor on the flywheel casing with the bolts, washers and nuts.
2. Connect up the cables to the starter motor. Route the earth cable through the starter motor housing and the solenoid and screw it tight to the engine block, see Fig. 33-31. Make sure that the earth cable does not come in contact with any current carrying part of the starter motor.

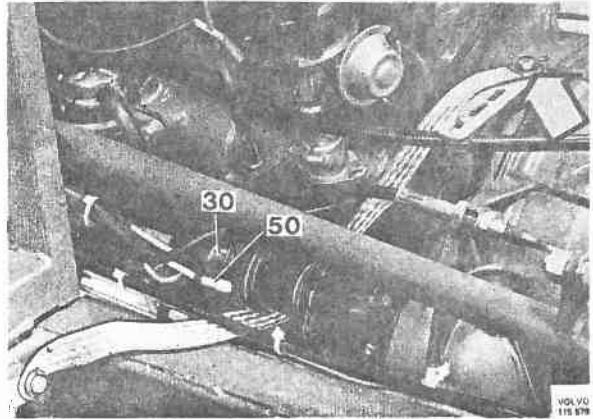
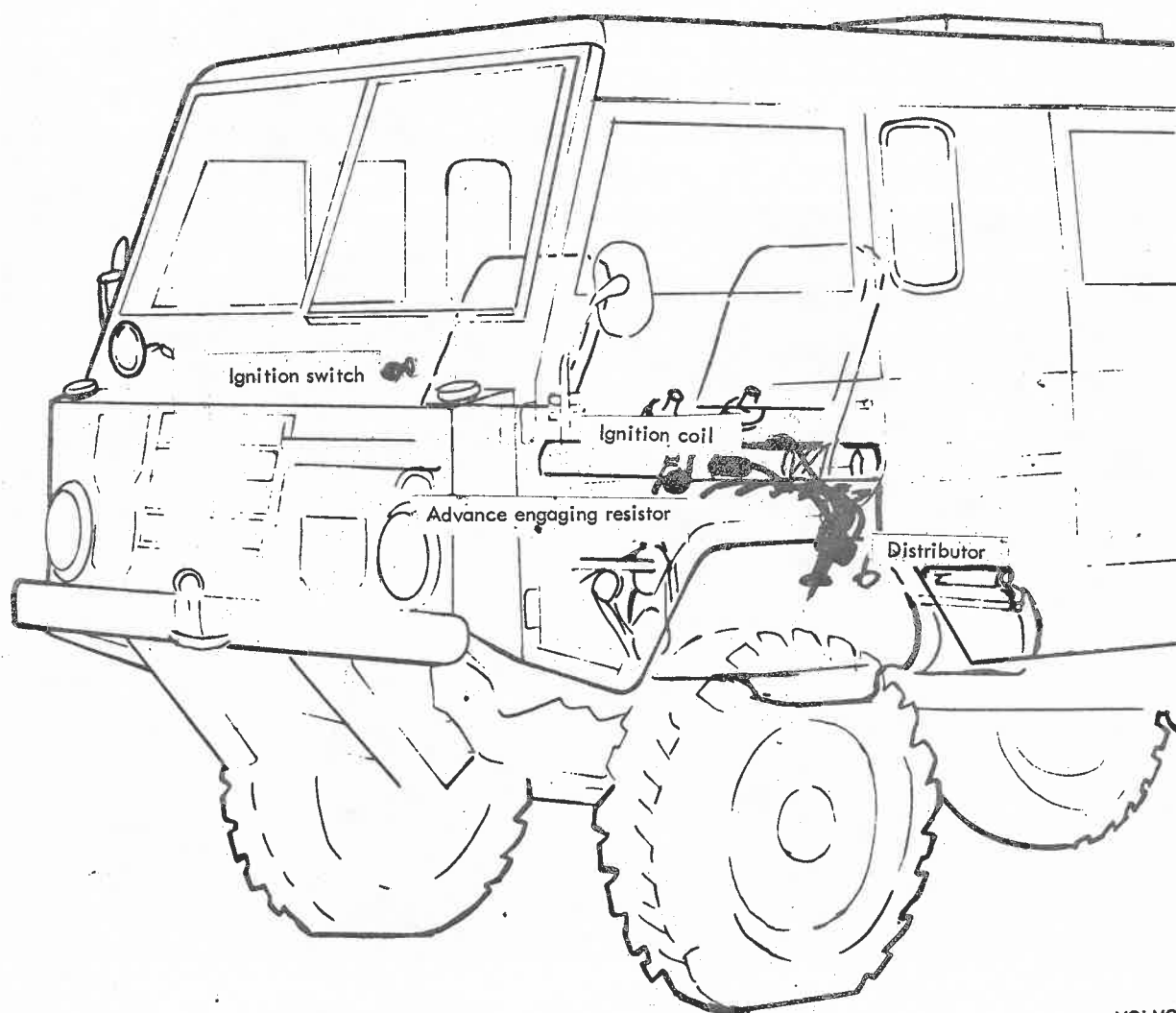


Fig. 33-31. Starter motor cable connections

3. Fit and tighten up the gear lever control ball joints in the gearbox.
4. Place the plate over the engine and gearbox.
5. Connect up the negative cable to the battery and fit the cover over the batteries.

GROUP 34 IGNITION SYSTEM



VOLVO
115 591

Fig. 34-1. Ignition system

Construction and Function

The ignition system is of the battery ignition type. It consists of the following main components: ignition coil with advance engaging resistor, ignition switch, distributor, spark plug cables and spark plugs.

IGNITION COIL WITH ADVANCE ENGAGING RESISTOR

The function of the advance engaging resistor, Fig. 32-2, is to protect the ignition coil, Fig. 34-2, against serious overheating, if the ignition switch is on and the engine has not started. In order that the ignition voltage is sufficiently high at the moment of starting, the advance engaging resistor is bypassed via a relay when the starter button is pushed in.

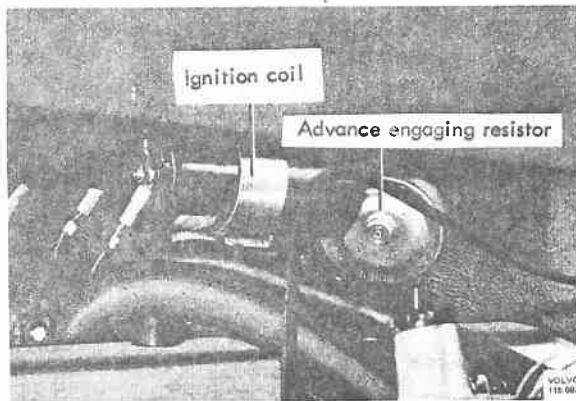


Fig. 34-2. Ignition coil and advance engaging resistor

The ignition coil will then be fed directly by battery voltage, see wiring diagram in Fig. 34-3.

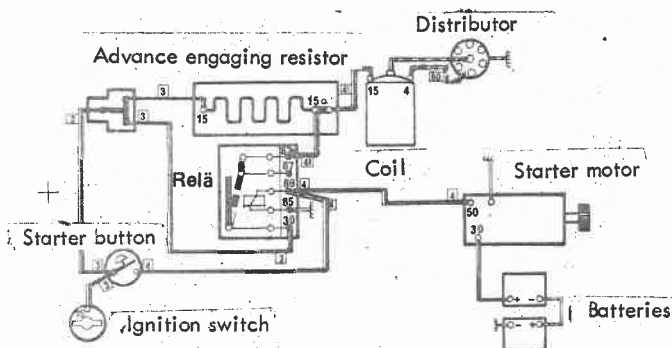


Fig. 34-3. Starter relay with advance engaging resistor, wiring diagram

IGNITION SWITCH

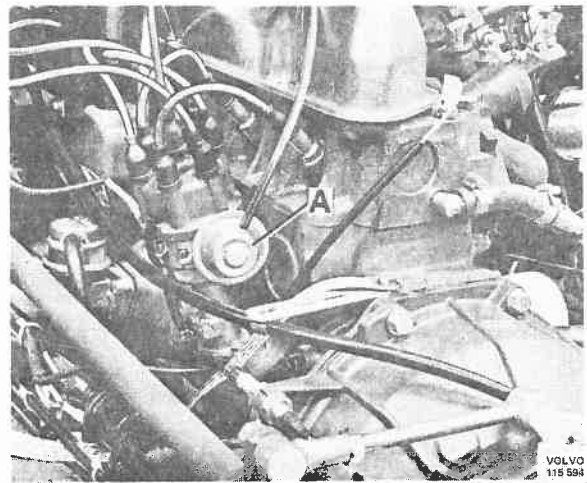
The ignition switch has two positions.

1. Switched-off position (key can be removed), voltage on terminal 30, Fig. 34-7.
2. Ignition position (starting and driving position), voltage on terminals 30, 15 and 61.

DISTRIBUTOR

The distributor is placed on the left-hand side of the engine, Fig. 34-4, and is driven from the camshaft. Its setting in relation to engine speed is regulated by the lower breaker plate (8, Fig. 34-5), which sits on the centrifugal governor.

Its setting in relation to engine load is regulated by the vacuum regulator which is mounted on the distributor (A, Fig. 34-4).



Firing sequence 1-5-3-6-2-4

Fig. 34-4. Distributor with spark plug cables

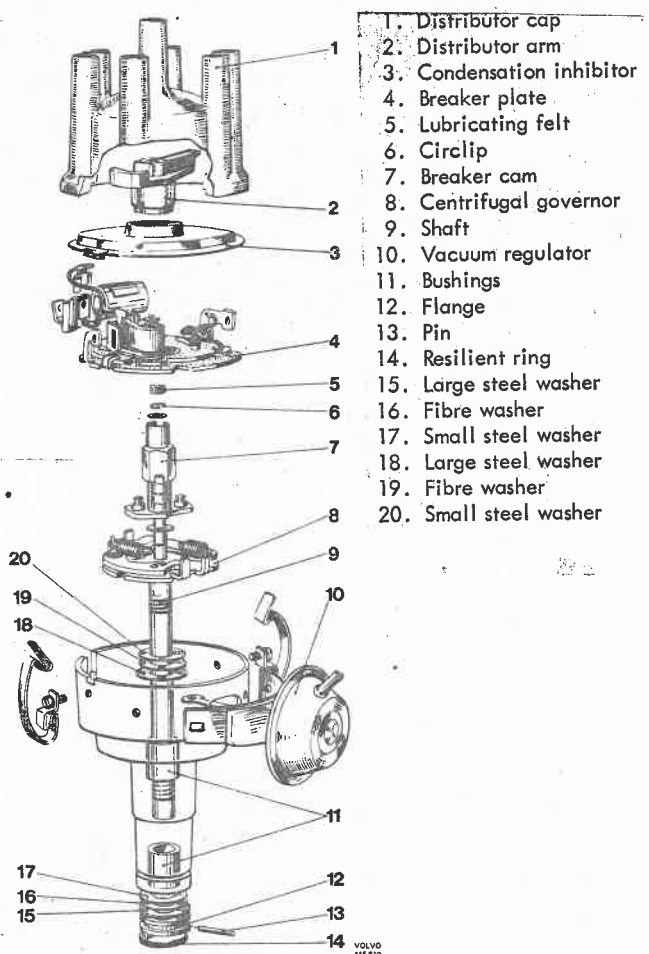


Fig. 34-5. Distributor, exploded view

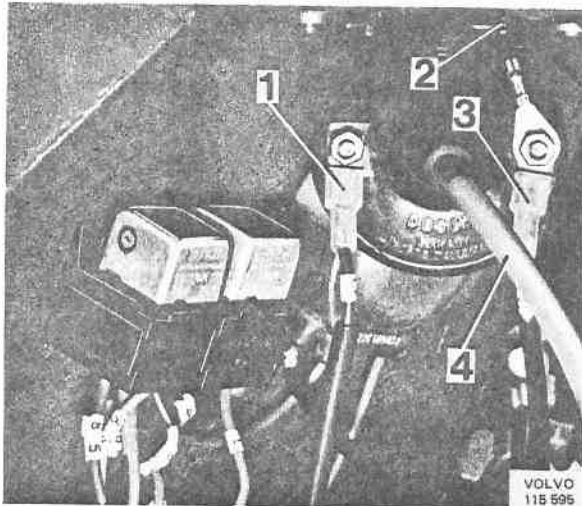
Service Procedures

IGNITION COIL

Removal

Disconnect cables 1, 3 and 4, Fig. 34-6.

Slacken the screw (2, Fig. 34-6) until the ignition coil can be removed.



1. Outgoing low-voltage cable (primary cable)
2. Screw
3. Ingoing low-voltage cable (primary cable)
4. High-voltage cable (secondary cable)

Fig. 34-6. Replacing the ignition coil

Installing

Install the coil and tighten up the clamping screw. Connect up the cables. The cable from the distributor must be connected to the negative terminal on the coil.

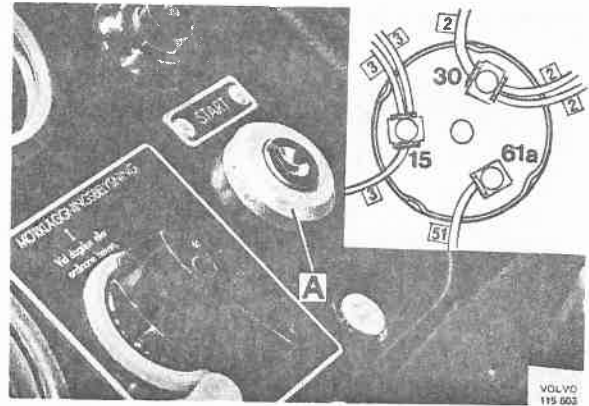
ADVANCE ENGAGING RESISTOR

Removal for testing

1. Remove the cover over the advance engaging resistor.
2. Mark and disconnect the cables from the resistor.
3. Remove the two screws securing the advance engaging resistor.

Testing

1. Connect an ohmmeter between the advance engaging resistor's two terminals, see Fig. 34-3. The resistance must be 4.1-4.5 Ω at 20°C (68°F).
2. If these values are not obtained, then the advance engaging resistor must be replaced.



A Retaining cap

Fig. 34-7. Ignition switch

Installing

1. Screw tight the advance engaging resistor.
2. Connect up the cables according to the marking.
3. Fit the cover.

IGNITION SWITCH

Replacing

1. Remove the cover over the batteries and disconnect the negative cable from the battery.
2. Remove the cap (A, Fig. 34-7).
3. Pull out the ignition switch.
4. Transfer the cables to the new switch. The cables with sleeves marked No. 3 must be connected to terminal 15, No. 2 to terminal 30 and No. 51 to terminal 61.
5. Install the new ignition switch and screw it tight with the cap.
6. Connect the negative cable to the battery and fit the cover over the batteries.

SUPPRESSORS

Checking and replacing

A damper resistance is fitted on each spark plug. Its resistance should be 1000 Ω at 20°C (68°F). The distributor lever should have a resistance of 4500-6000 Ω . If these values are not obtained, the resistor or the distributor lever should be replaced.

DISTRIBUTOR

Removal

1. Unclasp the lock clasps on the distributor cap and lift off the cap, Fig. 34-8.

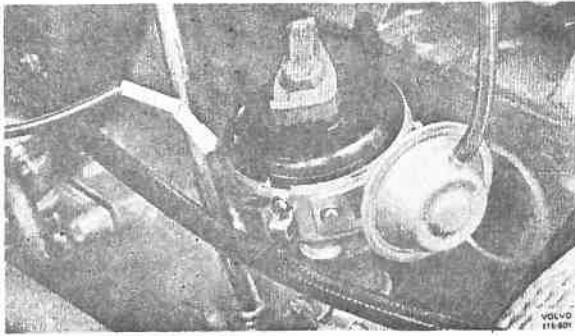


Fig. 34-8. Distributor cap removed

2. Disconnect the low-voltage cable from the distributor. Remove the vacuum hose from the vacuum regulator. Lift off the distributor arm and remove the condensation inhibitor. Slacken the retaining screw and pull up the distributor, Fig. 34-9.

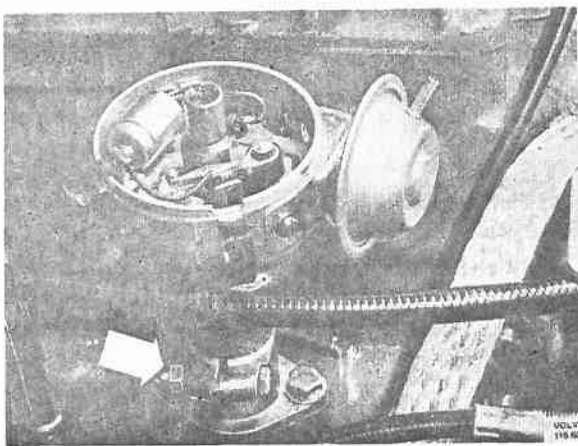


Fig. 34-9. Removing the distributor.

Disassembling

1. Remove the vacuum regulator, Fig. 34-10.

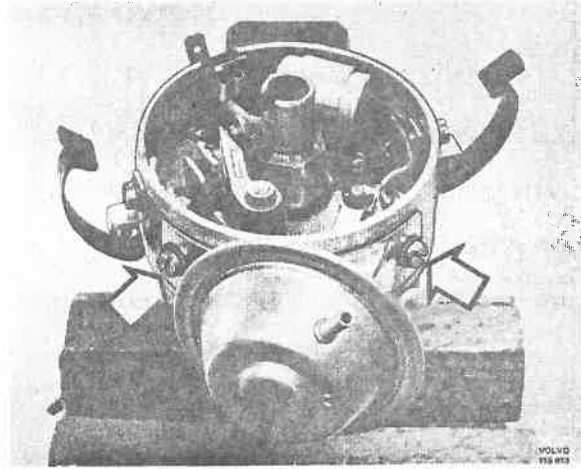


Fig. 34-10. Removing the vacuum regulator

2. Remove the lock clasps for the cap. Disconnect the cable from the breaker contacts and remove the condenser with its low-voltage terminal; Fig. 34-11.

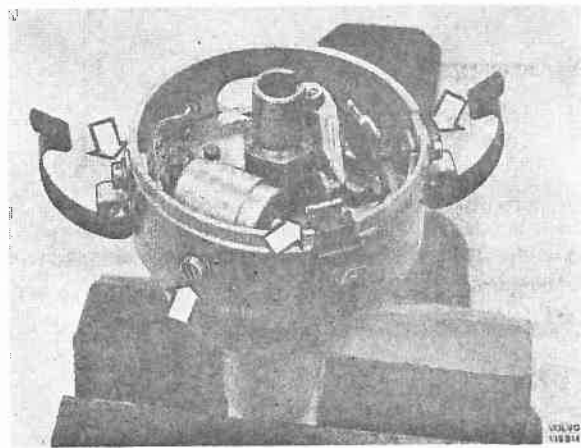


Fig. 34-11. Removing the low-voltage terminal.

3. Mark the position of the breaker plate in relation to the distributor housing and lift up the breaker plate.
4. Disconnect the springs for the centrifugal governor. Remove the lubricating felt and mark how the breaker cam is located in relation to the distributor shaft, Fig. 34-12.

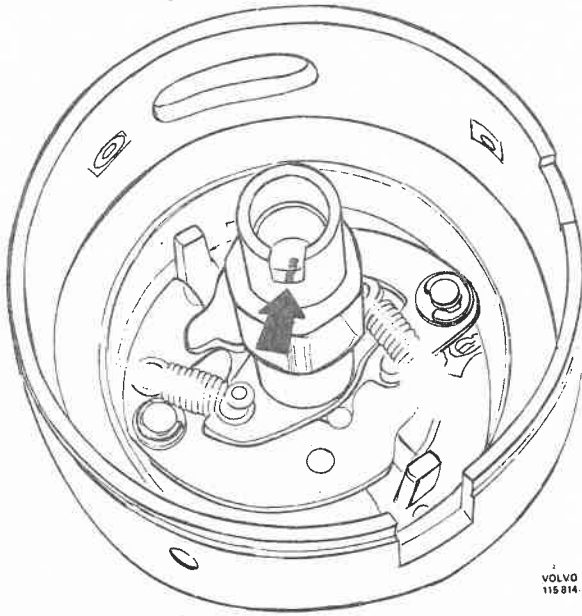


Fig. 34-12. Line-up marking the breaker cam and distributor shaft

- Fix the breaker cam in a vice with soft jaws. Carefully knock on the distributor housing with a plastic mallet until the lock ring loosens, Fig. 34-13. Take care of the lock ring and washers.

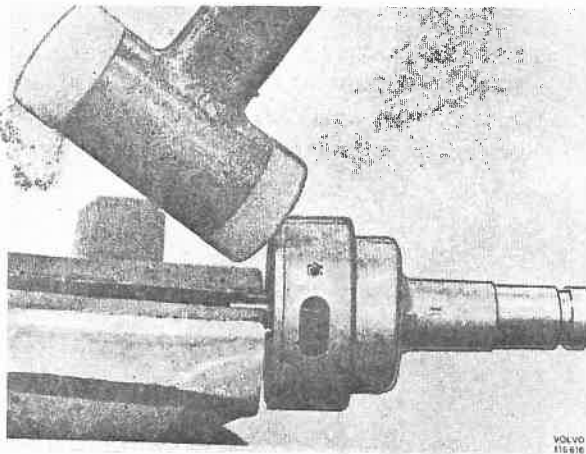


Fig. 34-13. Removing the breaker cam

- Remove the resilient ring and mark how the flange is located in relation to the distributor shaft.

Knock out the pin, Fig. 34-14. Lift off the flange and pull up the distributor shaft. Take care of the washers.

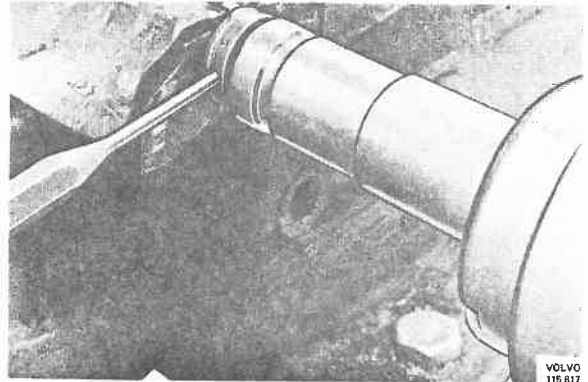


Fig. 34-14. Removing the flange pin

- Remove the retainers for the centrifugal weights and lift off the weights.

Checking and replacing parts

Breaker plate

The contacts must have smooth and even contact surfaces. The colour on the contacts must be grey.

Oxidized or burnt contacts must be replaced. After being in use for some time, the breaker lug can be worn and the spring fatigued, and for this reason the contact should be replaced if the distributor is disassembled for some reason or other.

Distributor shaft

The clearance between the distributor shaft and the breaker cam should not exceed 0.1 mm (0.004").

The cams on the breaker cam must not be scored or worn down as this would alter the dwell angle.

The holes in the centrifugal governor weights must not be oval or deformed in any other way.

The weight springs must not be deformed or damaged in any other way, see Fig. 34-15.

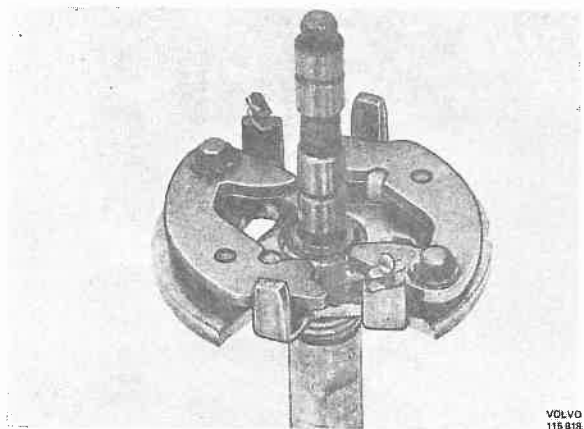


Fig. 34-15. Shaft with weights

Distributor housing

Check that the clearance between the distributor housing and the shaft does not exceed 0.2 mm (0.008"). If the clearance is excessive, replace the bushings, and if this is insufficient, also the shaft.

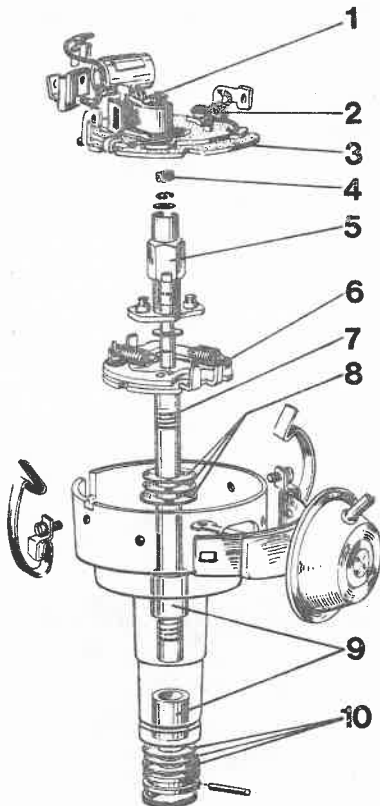
Assembling

Lubricate the parts according to the instructions given in Fig. 34-16.

Use Bosch lubricant or corresponding according to the designations given below.

Ft = grease
Ol = Oil

1. Cover the fibre lug with a light layer of grease Ft 1 v 4
2. Grease the top and ball for the vacuum regulator
Ft 1 v 26
3. Oil the breaker plate Ol 1 v 2
4. Douse the lubricating felt Ol 1 v 13
5. Cover the breaker cam with a light layer of grease
Ft 1 v 4
6. Lubricate the weights sparingly Ft 1 v 4
7. Oil the shaft before fitting it Ol 1 v 13
8. Grease the washers Ft 2 v 3
9. When fitting new bushings they must lie in oil for at least half an hour before being installed
Ol 1 v 13
10. Grease the washers Ft 2 v 3



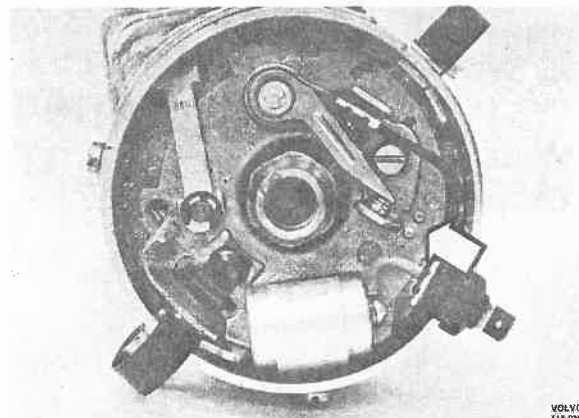
VOLVO
115 621

Fig. 34-16. Lubricating scheme

1. Fit the centrifugal weights and lock them tight with the lock rings.
2. Place the washers on the distributor shaft and insert the shaft in the housing.
3. Fit the washers and flange. Fit the pin and the resilient ring following the line-up marks.
4. Following the line-up marks fit the breaker cam with washers, circlip and lubricating felt, and secure the springs to the breaker cam.
5. Check the line-up marking and fit the breaker plate together with the two lock clasps. Fit the condenser and the low-voltage terminal in the housing.
6. Fit the vacuum regulator with screws and lock ring. Connect the cable from the breaker contacts.
7. Test-run the distributor, see under the heading "Test-running the distributor on a test bench".
8. Place the condensation inhibitor tab so that it fits in the recess in the distributor housing. Fit the distributor lever.

Test-running the distributor on a test bench

1. Run the distributor at approx. 8.3 rev/sec (500 rev/min) in its own direction of rotation (anti-clockwise) and adjust the dwell angle in the breaker contacts to 39-45° according to below.
2. Slacken slightly the screw for the breaker contacts. Then insert a screwdriver in the recess, Fig. 34-17. Turn until the dwell angle is correct. Tighten up the screw for the breaker contacts.



VOLVO
115 619

Fig. 34-17. Recess for dwell angle

- Run the distributor and adjust the graduating disc on the test bench so that a marking comes opposite 0° at so low a speed that the centrifugal governor cannot function, below 3.3 distr. rev/sec (200 distr. rev/min). Slowly increase the speed and read off the values at these prescribed graduations. A newly lubricated distributor should first be run up to max. speed several times. Permitted tolerance for the centrifugal governor is $\pm 1^\circ$.
- Run the distributor at low speed and adjust the graduating disc so that the marking is obtained at 0°. Connect the vacuum hose from the test bench to the vacuum regulator.

Gradually increase the vacuum and read off the values at the prescribed graduations. Compare the ignition advance curve, Fig. 34-18.

Öka vakuomet successivt och läs av värdena vid föreskrivna gradtal. Jämför tändförställningskurva, bild 34-18.

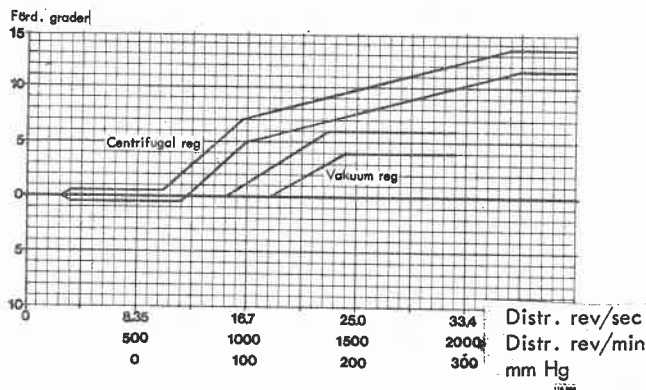


Fig. 34-18. Advance ignition curve

Ignition setting

The ignition setting should be adjusted while the engine is running with the help of a stroboscope. This is done as follows:

- Clean the flywheel damper in order to see the graduation marks.
- Disconnect the hose from the vacuum regulator.
- Connect the stroboscope to No. 1 spark plug and the battery.
- Start the engine and run it at approx. 13.3 rev/sec (800 rev/min). Point the stroboscope to the graduation on the flywheel damper. See Fig. 34-19. Slacken the distributor retaining screw and turn it until the firing position is 10°. Screw tight the distributor and check that the firing position and speed have not altered.

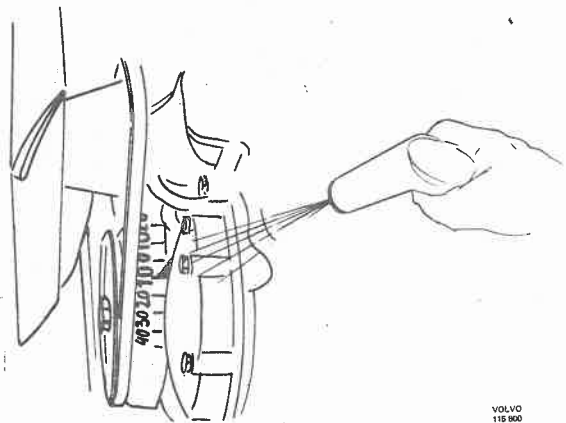


Fig. 34-19. Flywheel damper and graduations

Installing

- Install the distributor.
- Press the distributor downwards while turning the distributor lever at the same time. When the distributor has gone down about 5 mm (0.2") and it is not possible to turn the distributor lever, then the distributor flange is in the groove on the distributor pinion.
- Turn the distributor housing so that it takes up the same position it had when removed.
- Connect the low-voltage cable and the vacuum hose. Fit the distributor cap.
- Start the engine and adjust the firing. (If the engine does not start, turn the distributor housing until it does.)

- Remove the stroboscope and connect up the vacuum regulator hose.

The ignition setting can be adjusted as follows with the engine switched off:

- Clean the flywheel damper in order to see the graduation marks. Remove the cap and the condensation inhibitor.
- Connect up a 24 V lamp between the engine block and the low-voltage terminal on the distributor.
- Turn the ignition key to the firing position.
- Slowly turn over the crankshaft (by hand) in the engine's direction of rotation until the 10° marking on the flywheel damper is opposite the firing mark. The distributor lever should then point to the scribed mark on the edge of the distributor housing. The test lamp should light, Fig. 34-20.

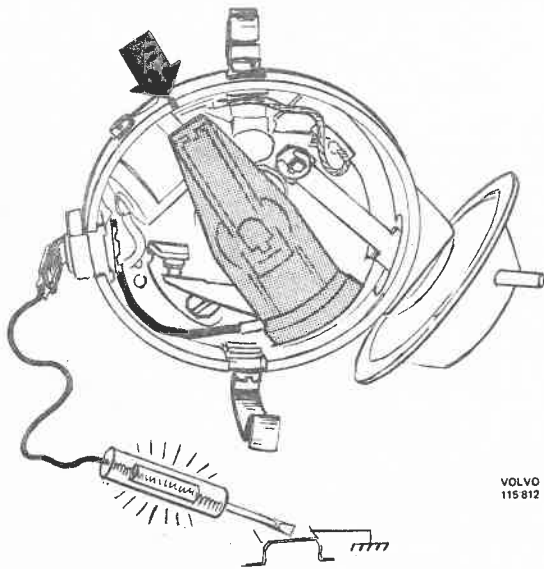


Fig. 34-20. Basic setting.

5. If the lamp does not light, slacken the distributor and slowly turn it in the engine's direction of rotation until the lamp lights. Then screw tight the distributor.
6. If the lamp lights earlier than according to point 4, slacken the distributor and turn it slowly in the engine's direction of rotation until it goes out. Then screw tight the distributor.

Breaker contacts

Replacing

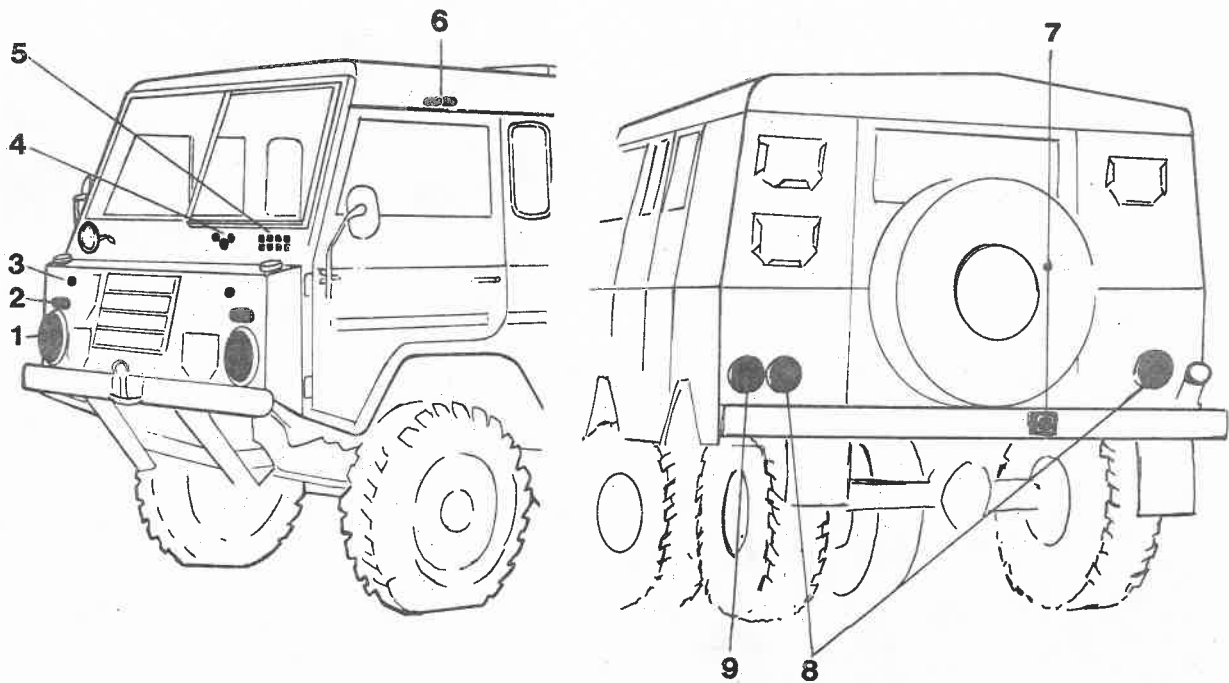
The breaker contacts can be replaced in the vehicle, but the distributor should be removed. The contacts are replaced as follows:

1. Lift off the distributor lever and the condensation inhibitor.
2. Disconnect the cable at the low-voltage terminal.
3. Remove the old contacts.
4. Fit the new contacts and connect up the cable to the low-voltage terminal.
5. Check to make sure that the breaker contacts are fitted properly horizontally and that they lie flat. This adjustment can be made with a tool such as the Bosch EFAW 57 A. Only the fixed contact may be bent.

Apply a light layer of grease to the breaker cam and the fibre lug (1, Fig. 34-16).

6. Wash the breaker contacts with trichloroethylene or chemically straight petrol.
7. Run the distributor in a test bench and adjust it according to the data given under "Test-running the distributor on a test bench".
8. Fit the condensation inhibitor and the distributor lever.

GROUP 35 LIGHTING



VOLVO
115 604

Fig. 35-1. Lighting

Construction and Function

The figures given below for the various lighting components, etc., refer to the figures shown in Fig. 35-1.

1. headlamps, 2. parking and indicator lights, 3. black-out lights, 4. instrument panel light, 5. switch light, 6. courtesy light, 7. twelve-pole power socket, 8. tail lamps and 9. reverse light.

Changing between main beams and dipped beams is carried out by moving the direction indicator lever towards the steering wheel in conjunction with a step relay, see Fig. 36-30.

The tail lamps are provided with separate bulbs for the following: rear lights, black-out rear lights, stop lights, black-out stop lights and direction indicators.

The vehicle is equipped with a dipped-beam mechanism and a switch for the black-out lighting.

The dipped-beam automatic mechanism switches on the dipped beams and parking lights when the engine starts and if the switch for the dipped-beam automatic mechanism is switched on.

The black-out switch makes it possible to either switch off all lighting or reduce lighting to a minimum.

Service Procedures

HEADLAMPS

Checking and adjusting

Check the headlamps with a view to the condition of the lens, reflector and bulb. If the lens is damaged by flying gravel, cracked or defective in any other way, replace the insert. A cracked lens will cause a deterioration in lighting power in addition to producing irritatingly irregular beams.

If the reflector is dull, buckled or damaged in any other way, replace the insert. The bulb must not be black or oxidized on the globe. Normally the lighting power of a bulb deteriorates after being in use for 200 hours.

The headlamps must be adjusted according to current provisions. An approved headlamp aligner should be used for the adjustment.

Adjustment is carried out by means of the screws for vertical and lateral adjustment, see Fig. 35-2.



Fig. 35-2. Headlamp

Replacing the headlamp insert

Replacing the bulb (carry out points 1-4 and 7-9)

1. Remove the retaining screw in the headlamp rim, Fig. 35-2.
2. Lift forward the rim together with insert, Fig. 35-3.

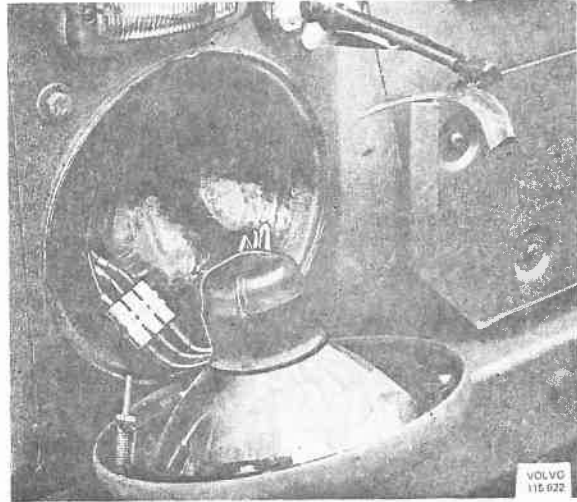


Fig. 35-3. Rim with insert

3. Release the bulb holder by turning the rubbered holder anti-clockwise.
4. Remove the bulb from the bulb holder.
5. Remove the screws and washers retaining the insert, Fig. 35-4.

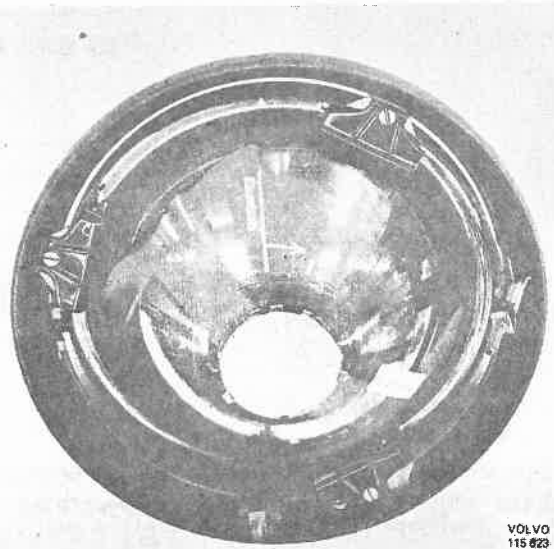


Fig. 35-4. Insert screws and washers

6. Fit the new insert together with the screws and washers.

7. Fit the new bulb in the bulb holder. Do not touch the bulb with your fingers. The reason for this is that any grease and dirt on the bulb glass can be vapourized due to heat from the bulb and this could damage the reflector.
8. Place the bulb holder properly in position in relation to the insert, Fig. 35-4. The marking on the holder should be opposite the marking "Einsetzen".

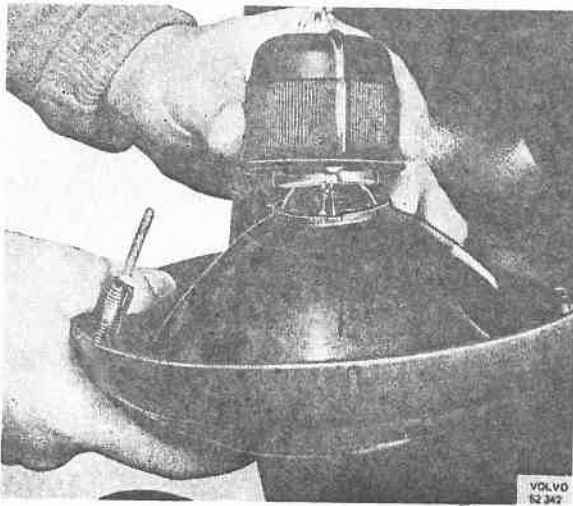


Fig. 35-5. Bulb holder position

9. Secure the holder by turning it to the marking "Fest", Fig. 35-6.

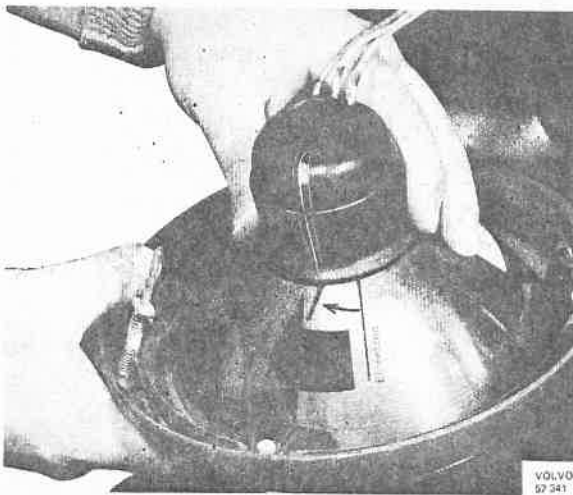


Fig. 35-6. Securing the bulb holder

PARKING AND DIRECTION INDICATOR LIGHTS

Replacing the bulbs

1. Remove the screws holding the lens, Fig. 35-7.

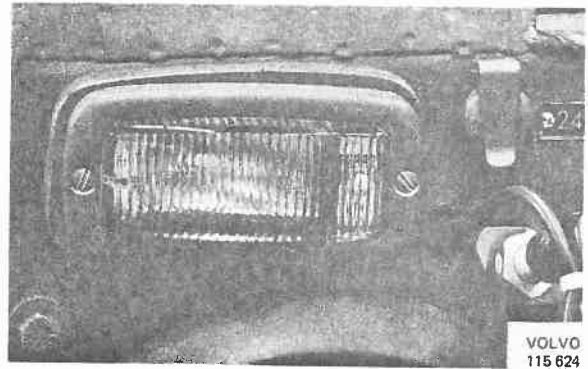


Fig. 35-7. Removing the lens and rim

2. Remove the defective bulb by pushing it inwards and turning it (bayonet fitting), Fig. 35-8.

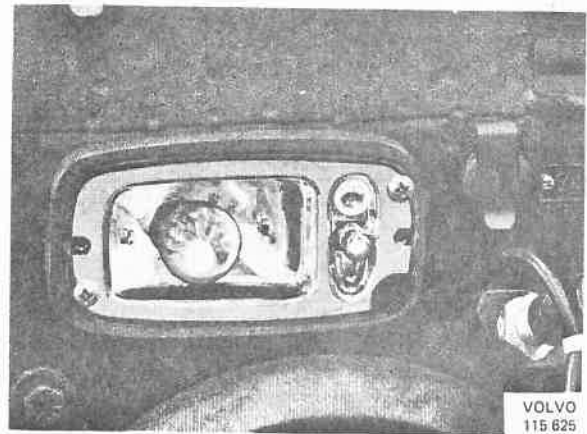


Fig. 35-8. Bulbs

3. Fit the new bulb.
(Do not touch the globe with your fingers.)
4. Wipe the light lens with a damp cloth and fit the lens and tighten up with the two screws.

TAIL LIGHT AND REVERSE LIGHT

Changing the bulb

1. Remove the screws on the light lens of the bulb to be replaced, see Fig. 35-9.

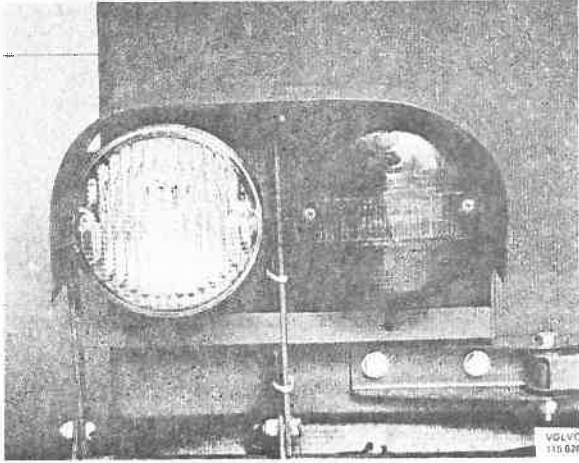


Fig. 35-9. Reverse light and tail light

2. Remove the defective bulb by pushing it in and turning it, or, if it is of the coil-shaped type, by pulling it straight out, Fig. 35-10.

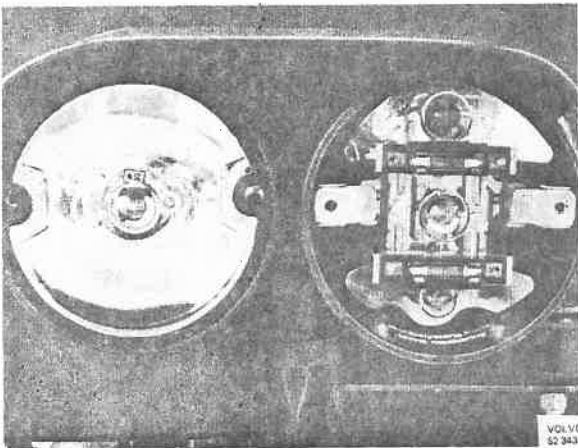


Fig. 35-10. Bulbs

3. Fit the new bulb without touching the globe with your fingers. Wipe the light lens with a damp cloth and re-fit it.

COURTESY LIGHT

Changing the bulb

1. Remove the lens by pulling it backwards, see Fig. 35-11.

35-11.

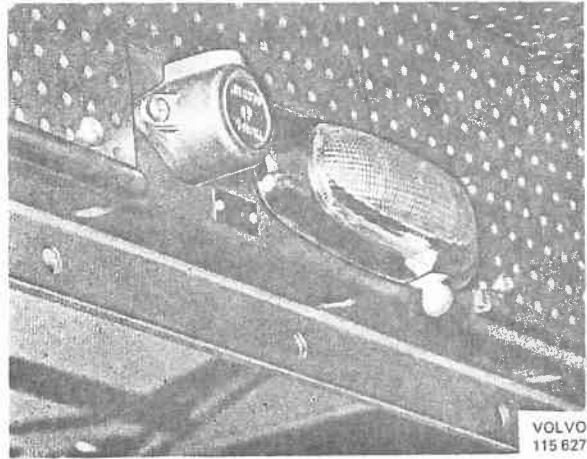


Fig. 35-11. Courtesy light

2. Remove the bulb and fit the new one, Fig. 35-12.

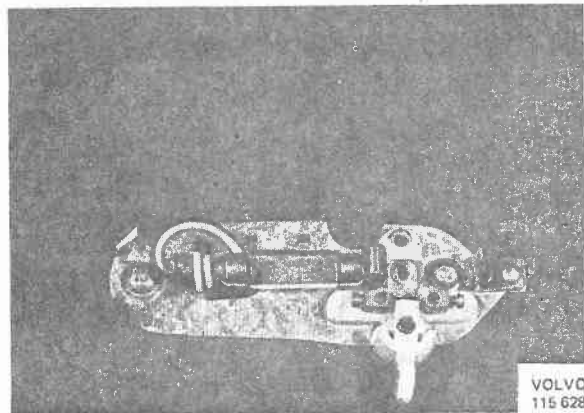


Fig. 35-12. Bulb

3. Re-fit the lens by pushing it straight in.

INSTRUMENT PANEL LIGHT AND SWITCH LIGHT

Fig. 35-13 shows the wiring for the instruments and switches. The switches and instruments used for black-out go across a rheostat.

Replacing the bulbs in switches and instruments

Note! The cables to the bulb holders in the switches are earth cables, see Fig. 36-24.

The cables to the bulb holders for the instruments are feed cables, which run directly from the rheostat, see Fig. 35-13.

1. Remove the cover over the batteries and disconnect the negative cable from the battery.
2. Separate the bulb holder from the switch or instrument by pulling it straight out.
3. Remove the faulty bulb by pushing it inwards and then turning it. Fit the new bulb.
4. Fit the bulb holder in the switch or instrument by pushing it straight in.
5. Re-connect the negative cable to the battery.
5. Sätt fast minuskabeln på batteriet.

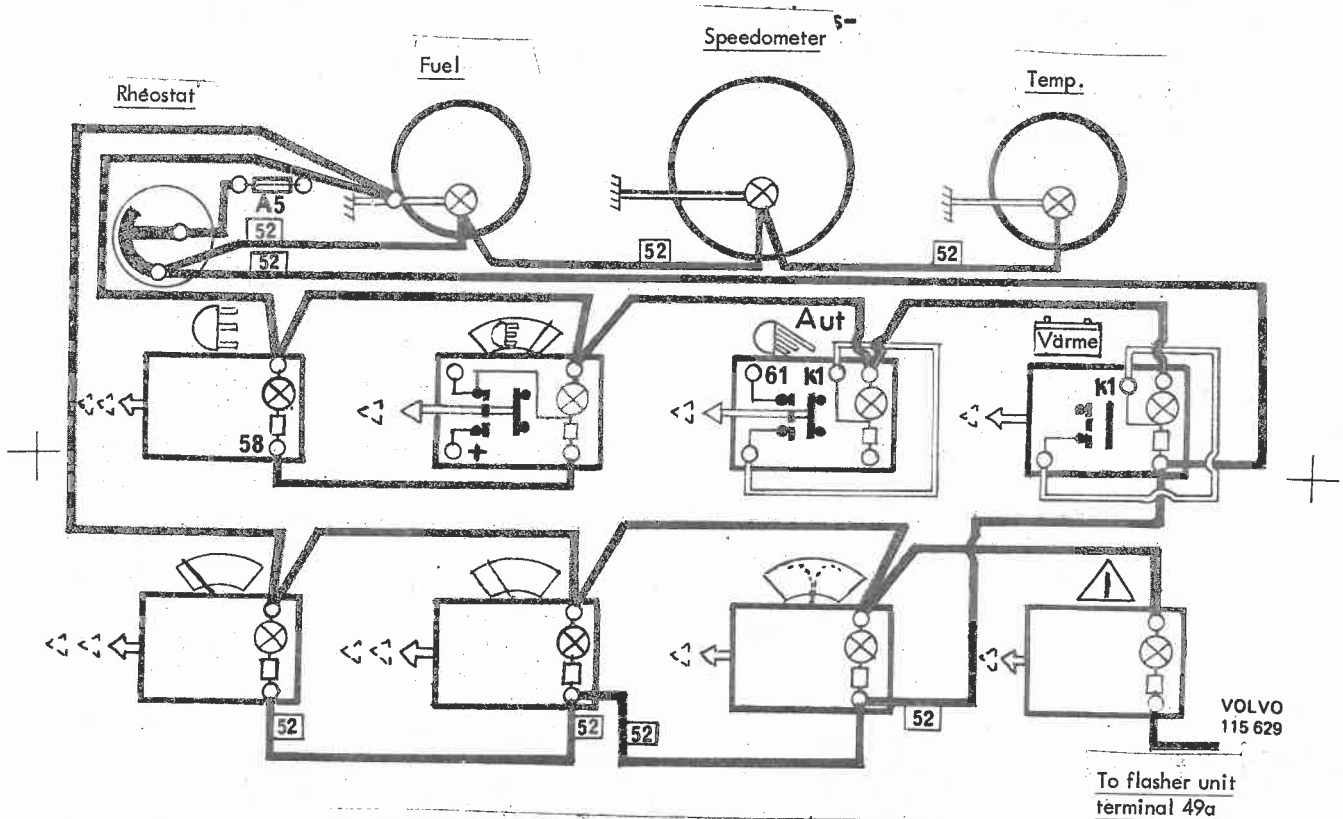


Fig. 35-13. Wiring diagram for lights in switches and instruments

TWELVE-POLE SOCKET, TRAILER CONTACT

The twelve-pole socket, Fig. 35-14, has the following output terminals:

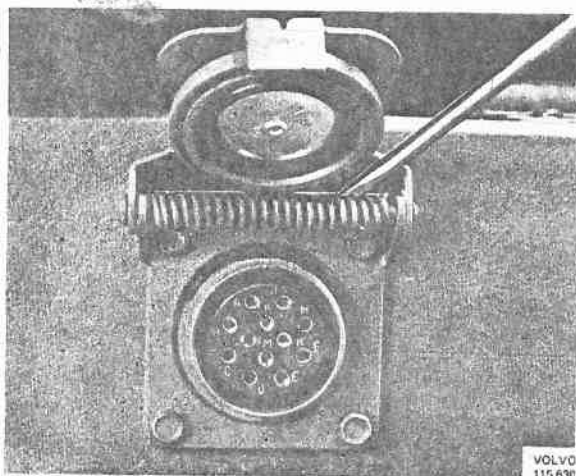
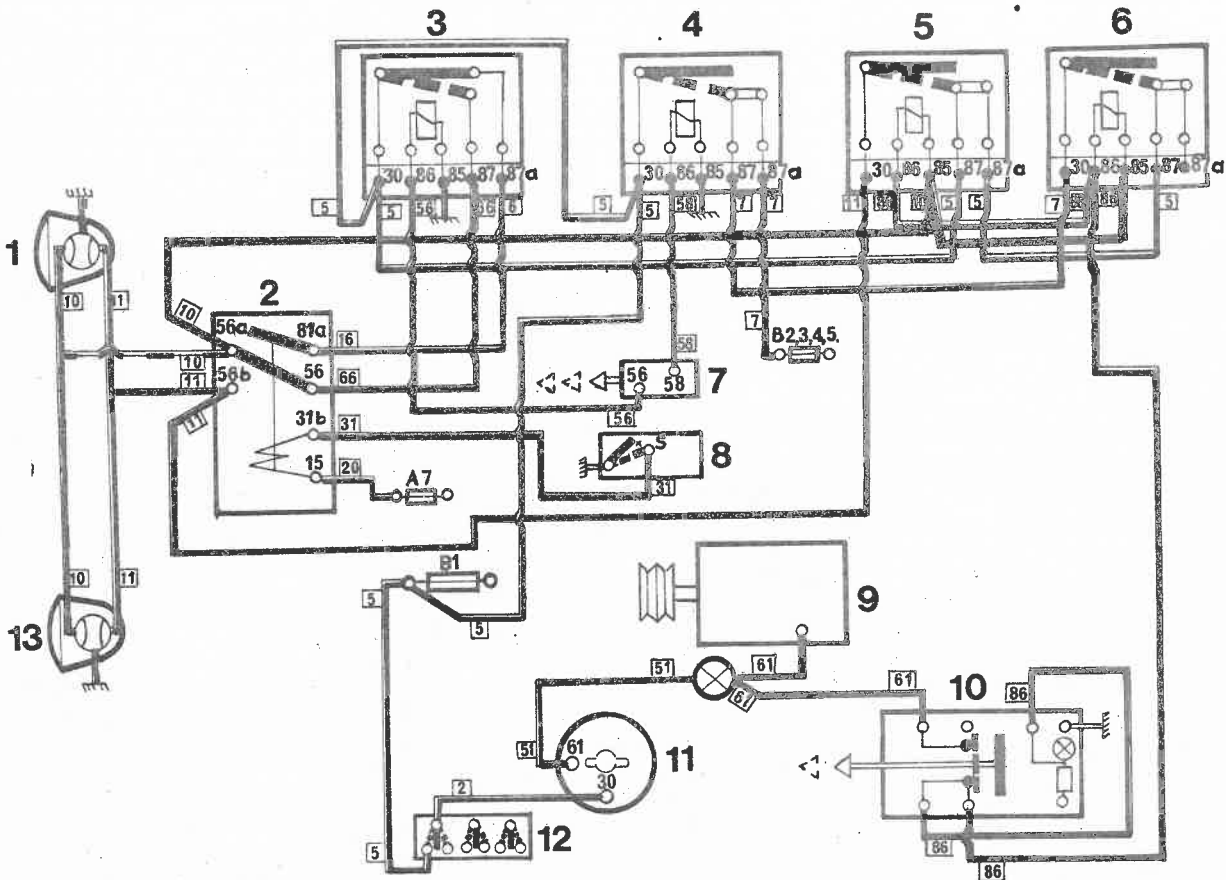


Fig. 35-14. Twelve-pole socket

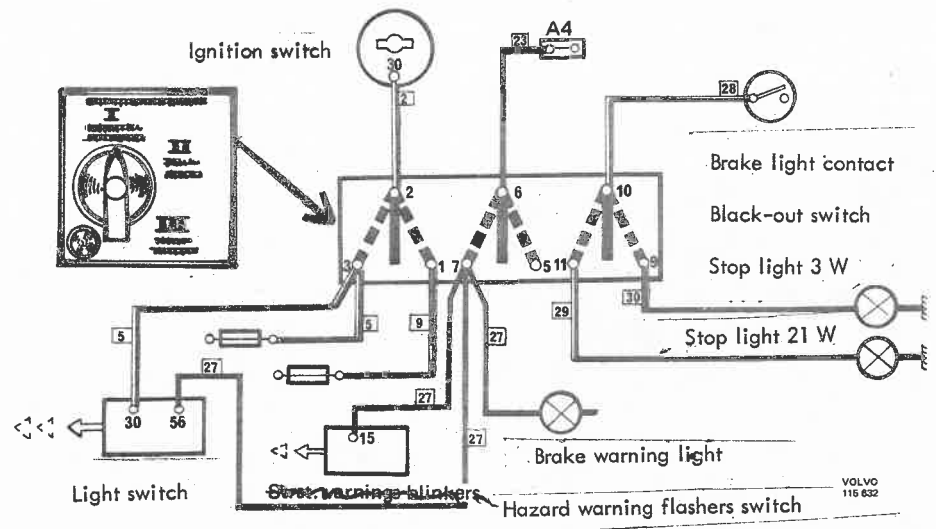
The number in brackets corresponds to the number on the cable sleeve:

A, (13)	Tail light, left
B, (12)	Tail light, right
C, (29)	Stop light 21 W
D, (32)	Direction indicator light, left
E, (33)	Direction indicator light, right
F, (19)	Tail light, black-out, 3 W
H, (30)	Stop light, black-out, 3 W
I, (20)	24 V output
K,	Earth (-)
L, (60)	Reverse light
M,	Reserve
N,	Reserve



- | | | |
|---|---|------------------|
| 1. Right headlamp | 8. Direction indicator lever | VOLVO
115 631 |
| 2. Step relay | 9. Alternator | |
| 3. Main beamflasher relay | 10. Dipped beams automatic mechanism switch | automatik |
| 4. Parking lights relay | 11. Ignition switch | |
| 5. Dipped beams automatic mechanism relay | 12. Black-out switch | |
| 6. Dipped beams automatic mechanism relay | 13. Left headlamp | |
| 7. Light switch | | |

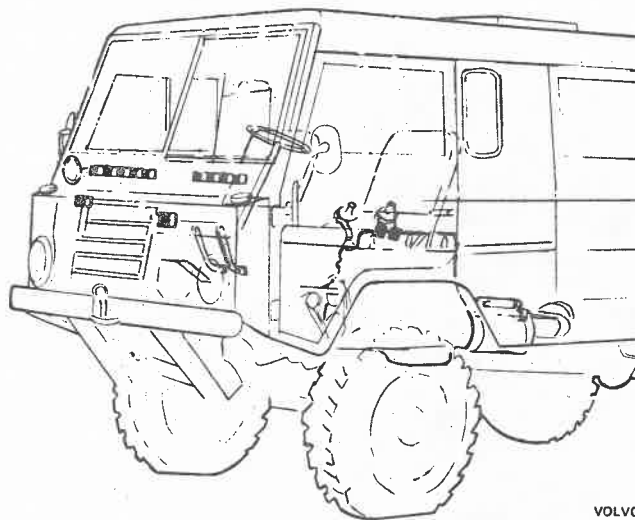
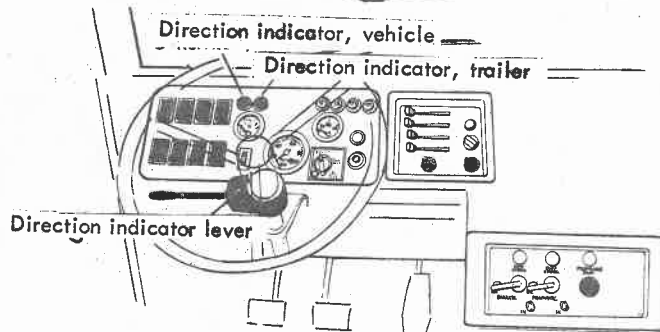
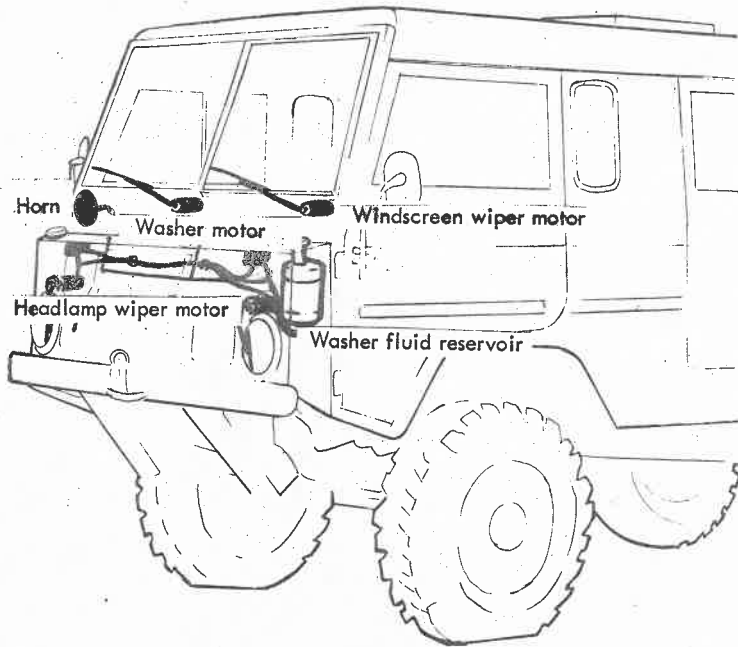
Fig. 35-15. Wiring diagram for dipped beams automatic mechanism



- Switch positions for black-out switch
- | | | |
|-----------------------------|--------|------------------------------|
| I = 2 + 3.6 + 7 and 10 + 11 | II = 0 | III = 2 + 1.6 + 5 and 10 + 9 |
|-----------------------------|--------|------------------------------|

Fig. 35-16. Wiring diagram for black-out lights

GROUP 36 DIRECTION INDICATORS WITH WARNING FLASHERS, HORN, WINDSCREEN WIPERS WITH WASHERS, SWITCHES AND RELAYS



VOLVO
115 642

Fig. 36-1. Wipers, direction indicators and relays

Construction and Function

DIRECTION INDICATORS AND HAZARD WARNING LIGHTS

The direction indicators comprise an electric flasher unit, lever, lights on instrument panel (for vehicle and trailer), indicators front and rear.

The hazard warning lights are switched on by a switch with built-in warning light and comprise the same flasher units and bulbs (front and rear) as for the direction indicators.

The direction indicators and hazard warning lights must have a blinking frequency of 75-105 blinks per minute when the bulbs have a wattage of 21 W.

HORN

The horn system comprises a horn button and a horn. The horn operates when the ignition switch is on and the button in the centre of the steering wheel is depressed.

WINDSCREEN AND HEADLAMP WIPERS AND WASHERS

Each of the windscreen wipers are driven by an electric motor and operated by means of two switches, one for each motor. The wiper motors have two different speeds.

Each of the headlamp wipers are driven by an electric motor and operated by means of a switch, which has automatic return to the shut-off position.

The headlamp wiper motors can be switched on when at least the parking lights are on.

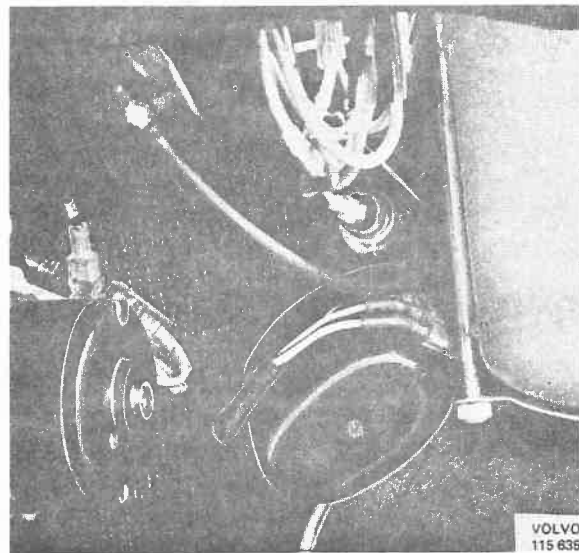


Fig. 36-3. Headlamp wiper, right-hand side

The windscreen and headlamp wiper motors have automatic return to the parking position as long as the ignition switch is on.

The windscreen and headlamp wiper motors are radio-suppressed.

The vehicle is equipped with two similar washer motors. The one on the left-hand side takes care of the windcreens and the one on the right-hand side the headlamps and washer fluid. The windscreen and headlamp washer consists of a pump (gear-type), electric motor, hoses, valves and nozzles. See layout on Fig. 36-4.

The washer motors are radio-suppressed.

The pump and electric motor are integrally built as a single unit. The washer reservoir is common to both washer motors and holds about 3 litres (5 Imp. pints). The windscreen washer motor is operated by means of a switch which has automatic return to the shut-off position.

The headlamp washer motor functions only when the headlamp wipers are switched on.

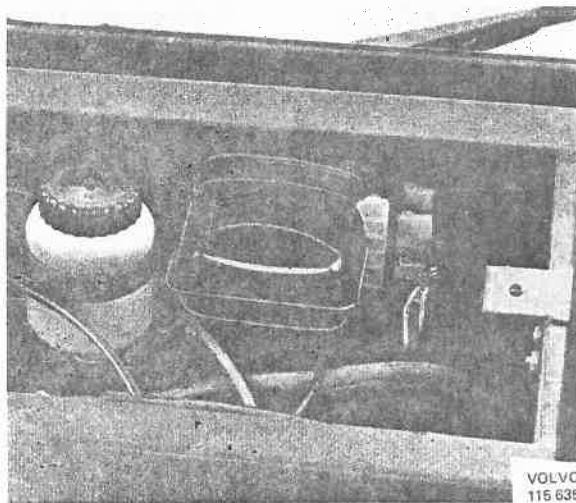


Fig. 36-2. Windscreen wiper, right-hand side

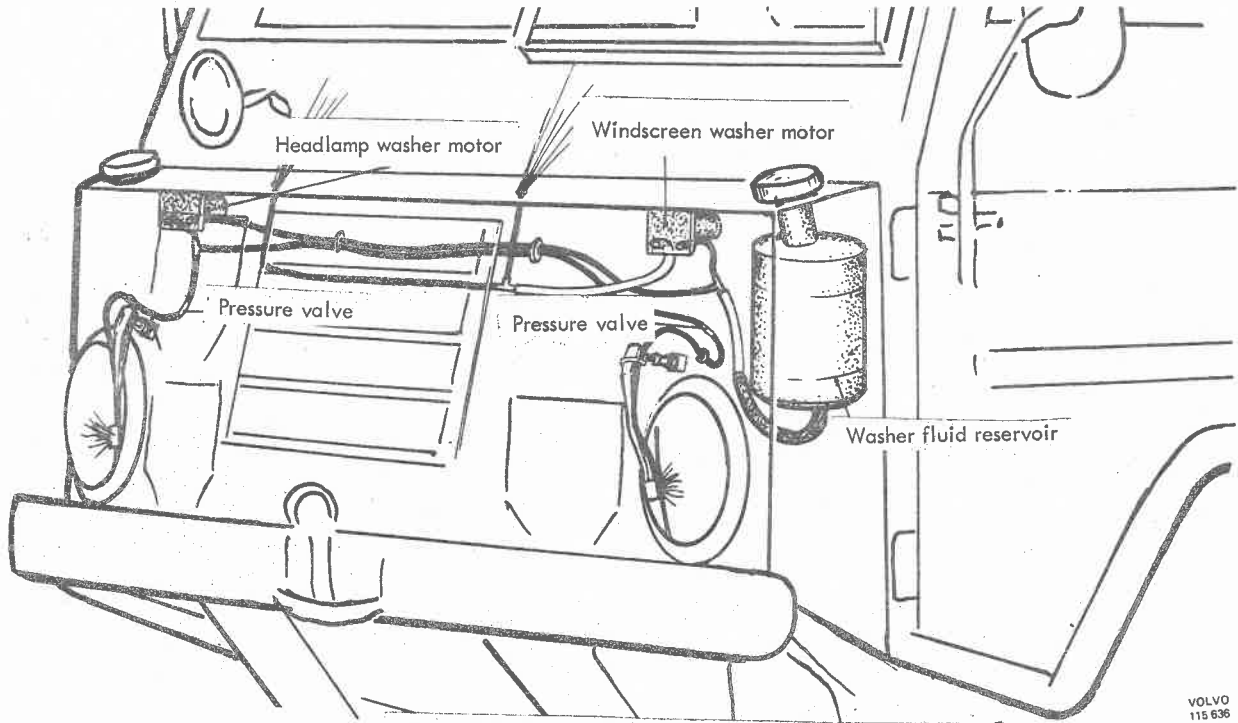


Fig. 36-4. Layout diagram, washers

SWITCHES

The vehicle is equipped with three types of switches: rocker, turn and push types.

The rocker switches are used for the following functions:

lights, headlamp wipers, dipped beams automatic mechanism, battery heater, windscreen wipers (two), washers and hazard warning lights.

The switch for the headlamp wiper and washer has automatic return to the shut-off position.

The switches for the dipped beams automatic mechanism and the battery heater are provided with an inhibitor button.

The switches operate the front and rear heater motors and the black-out lighting. The switches for the heater motors have three positions: 0=shut off, 1=full output, 2=half output. The switch for the black-out lighting also has three positions:

- I, Ordinary lighting can be switched on
- II, No lighting can be switched on
- III, Some lighting can be switched on

The rheostat is wired in such a way that when the ignition switch is on, it regulates the lighting power to the following components: fuel gauge, speedometer, coolant temperature gauge and the switches for the battery heater, washers and wipers.

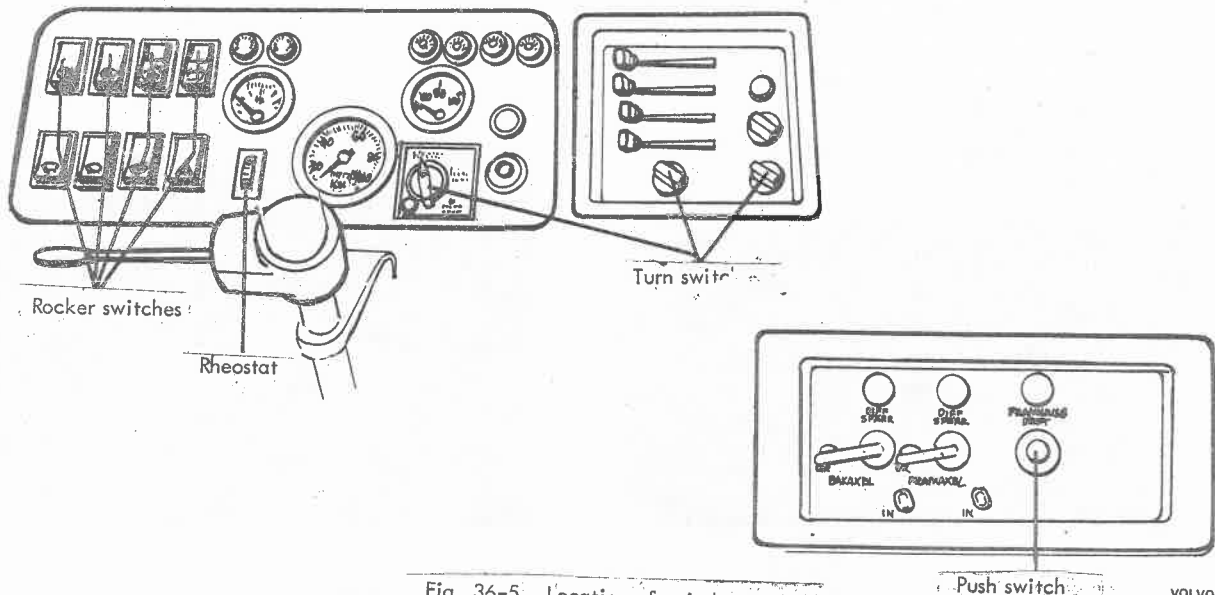


Fig. 36-5. Location of switches

VOLVO
115 636

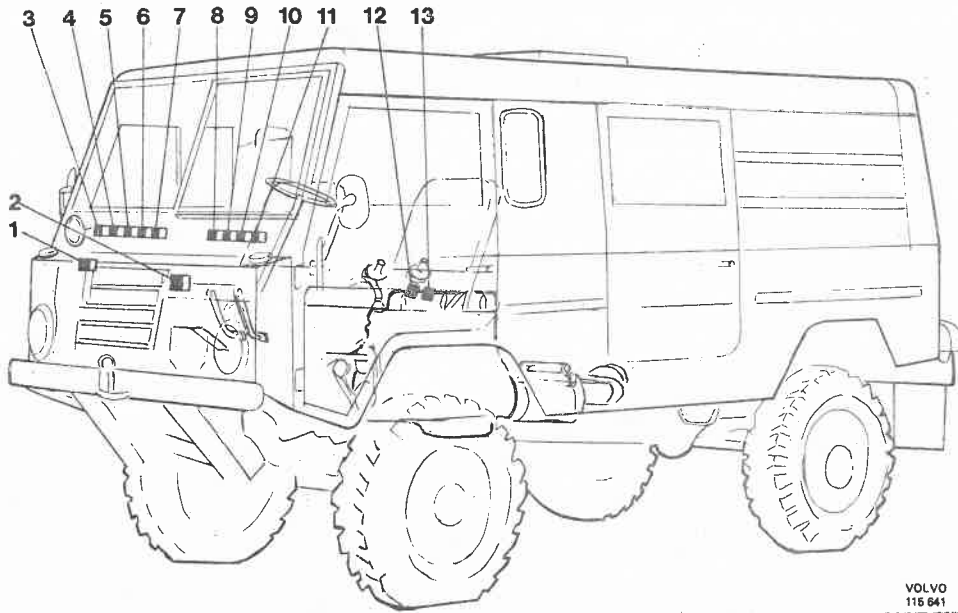
VOLVO
53 739

RELAYS

The vehicle is equipped with 13 relays, see Fig. 36-6. Eleven of these are activating relays, either of the shift type or of the make/break type. The other two are step relays for the main beams and dipped beams and an electronically operated flasher unit.

The make/break relays are used for the following purposes: high speed on windscreen wiper bypassing-or the advance engaging resistor, battery heater, reverse lights, parking lights and dipped beams automatic mechanism.

The shift relays are used for the following purposes: low speed on windscreen wipers and main beam flashers.



VOLVO
115 641

- | | |
|---|---------------------------------------|
| 1. Main beams and dipped beams | 8. Right windscreen wiper, high speed |
| 2. Flasher unit | 9. Right windscreen wiper, low speed |
| 3. Dipped beams automatic mechanism, parking lights | 10. Left windscreen wiper, high speed |
| 4. Dipped beams automatic mechanism, dipped beams | 11. Left windscreen wiper, low speed |
| 5. Main beam flashers | 12. Battery heater |
| 6. Parking lights | 13. Start |
| 7. Reverse lights | |

Fig. 36-6. Relays

Service Procedures

DIRECTION INDICATORS AND HAZARD WARNING LIGHTS

Replacing direction indicator lever

1. Remove the screws securing the lever to the steering column, see Fig. 36-7.
2. Remove the U-shaped washer and the two screws securing the lever, Fig. 36-8, to the attachment.



Fig. 36-7. Removing the lever screws. are

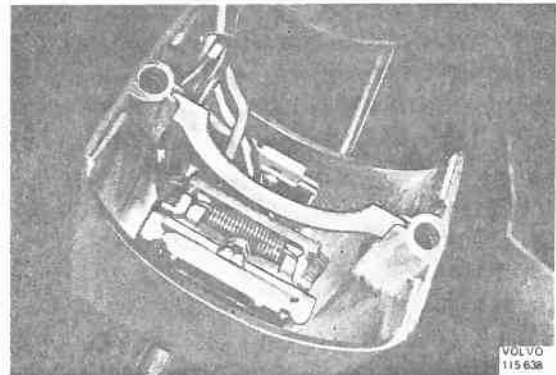
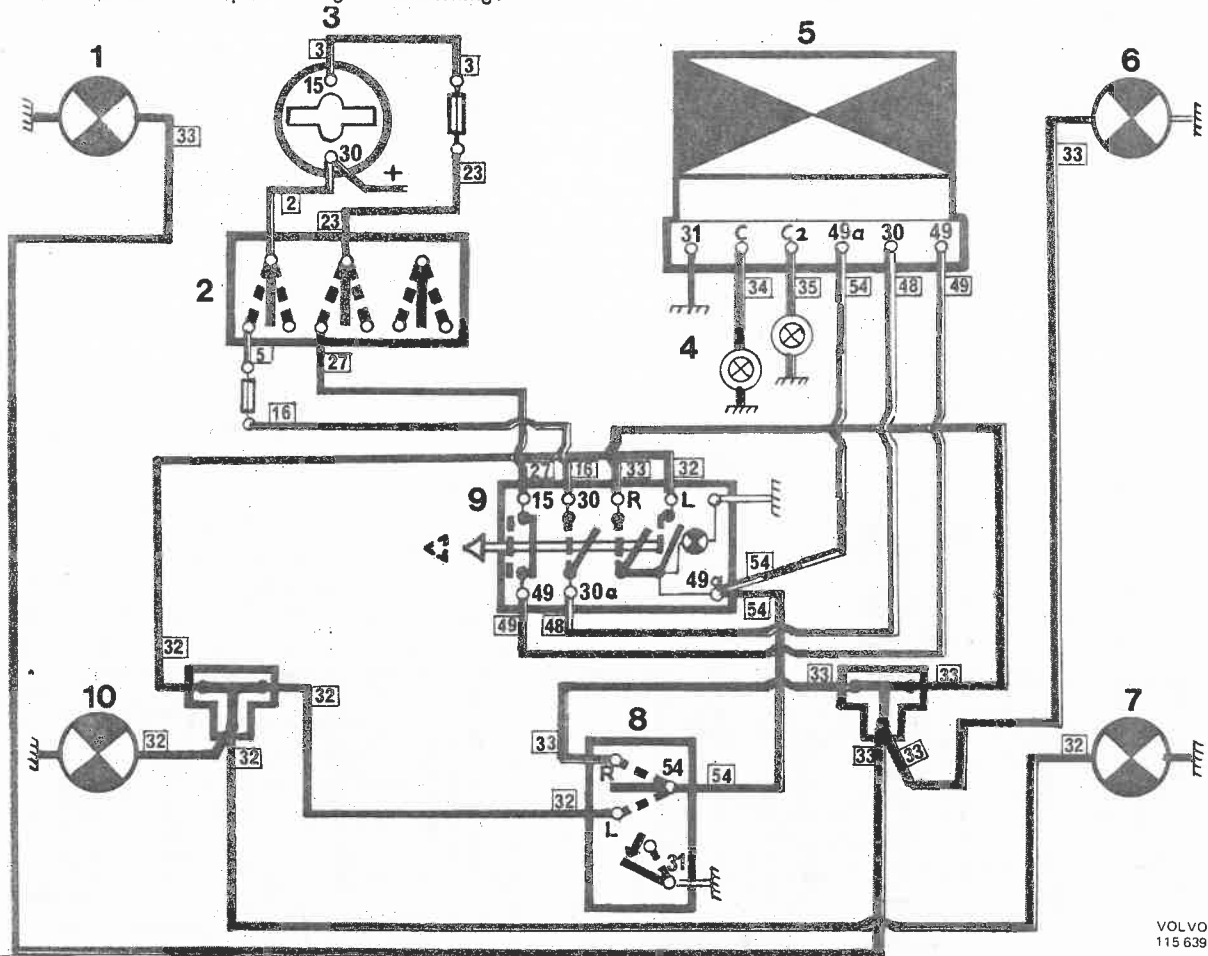


Fig. 36-8. Removing lever from attachment

3. Mark and remove the cables which run to the direction indicator lever from under the facia.
4. Remove the lever and cables by pulling the levers out through the hole in the facia.
5. Insert the new lever cables through the hole in the facia and connect them up according to the marking.
6. Fit the lever on the attachment and then the U-shaped washer.
7. Fix the lever attachment to the steering column.



VOLVO
115 639

- | | | |
|-------------------------------------|------------------------------------|-------------------------------------|
| 1. Right direction indicator, front | 4. Indicator/warning lights | 8. Switches |
| 2. Black-out switches | 5. Flasher unit | 9. Switches, hazard warning lights |
| 3. Ignition switch | 6. Right direction indicator, rear | 10. Left direction indicator, front |
| | 7. Left direction indicator, rear | |

Fig. 36-9. Wiring diagram, direction indicators - hazard warning lights

HORN

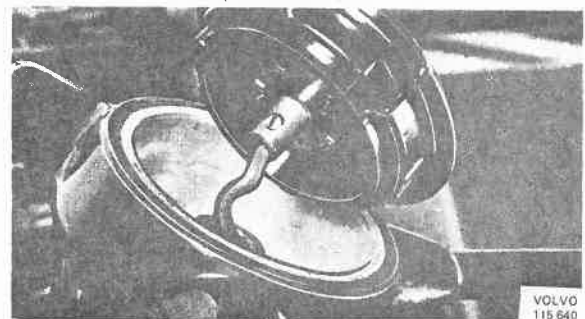
Replacing

1. Remove the cables and nut securing the horn. Remove the horn.
2. Fit the new horn and connect up the cables.

Replacing the horn button

This is carried out as follows:

1. Release the horn button from the steering wheel simply by inserting a small screwdriver or similar tool and levering the button out as shown in Fig. 36-10.
2. Release the screw securing the cable to the button.
3. Connect the new button to the cables and push the button into the button holder on the steering wheel.



VOLVO
115 640

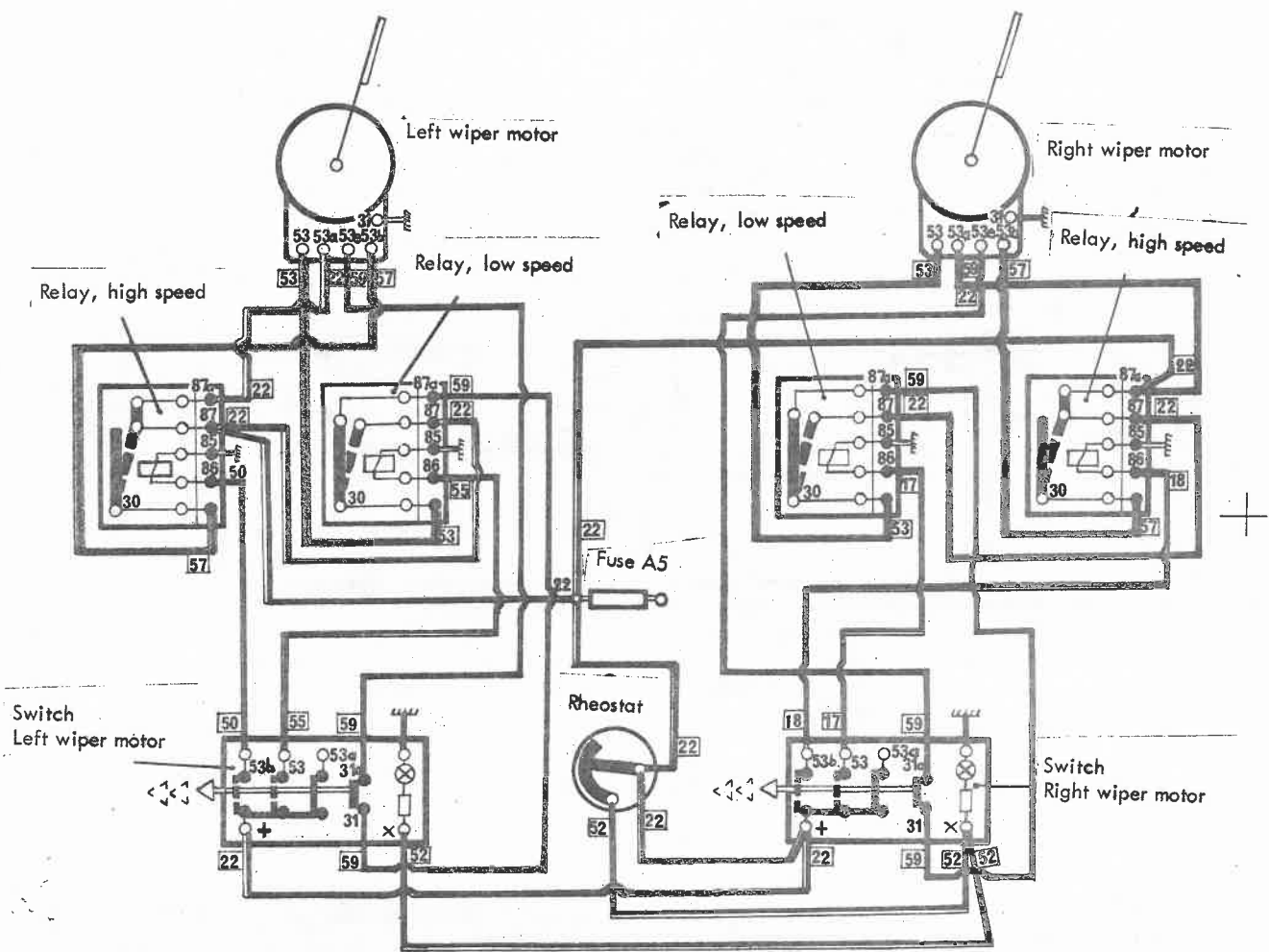
Fig. 36-10. Horn button

WINDSCREEN AND HEADLAMP WIPERS AND WASHERS

Windscreen wipers

Checking

If the windscreen wipers do not function (the ignition is on) either at high speed or at low speed, check fuse A5. If this fuse has blown, probably there is a short-circuit to the vehicle body at the wiper motors, switches, relays, rheostat or in the cables to one of these components. Use the wiring diagram, Fig. 36-11, to assist in fault-tracing and for the wiring up of replaced parts. As far as the headlamp wipers are concerned, use the wiring diagram in Fig. 36-23.



VOLVO
115 643

Fig. 36-11. Wiring diagram for windscreen wipers

Removal

1. Remove the cover over the batteries and disconnect the negative cable from the battery.
2. Remove the protective cap and wiper arm.
3. Remove the bracket, dust cover, nut, washers and seal.
4. Lift forwards the wiper motor, mark up and disconnect the cables.

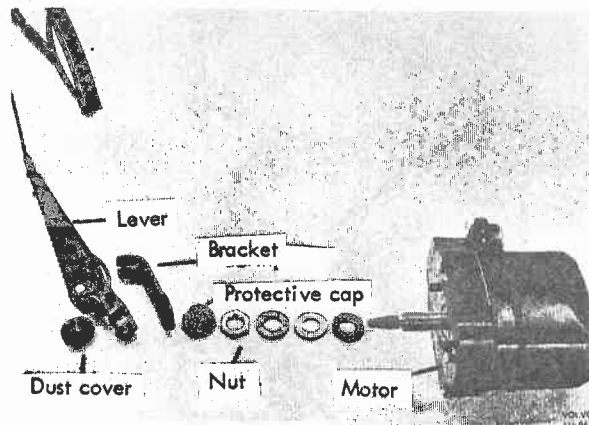


Fig. 36-12. Windscreen wiper, complete

Installing

1. Connect the cables according to the marking and install the wiper motor together with the seal, washers and nut.
2. Put on the dust cover. Position and screw tight the bracket so that the wiper arm takes up the correct position.
3. Lock tight the wiper arm on the wiper shaft together with the protective cap.
4. Connect up the negative cable to the battery and place the cover over the batteries.

Windscreen wiper motor

Disassembling

1. Take off the casing from the wiper motor and the two screws securing the brush holder bridge. Pull the rotor straight up and remove the two screws securing the stator, see Fig. 36-13.

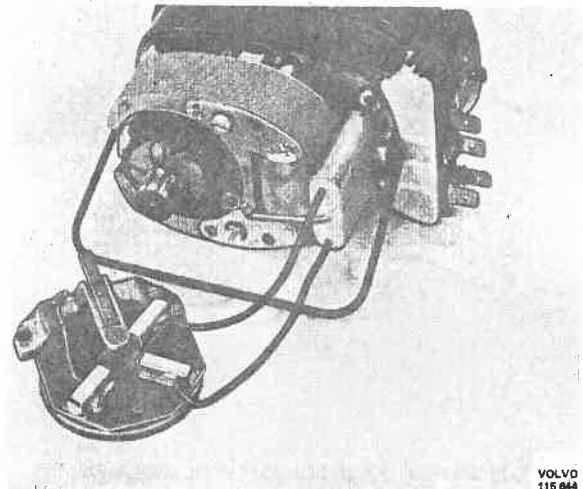


Fig. 36-13. Wiper motor with removed brush holder bridge

2. Remove the plastic plate over the parking switch. Remove the switch, brush holder bridge and suppressor from the housing, Fig. 36-14.

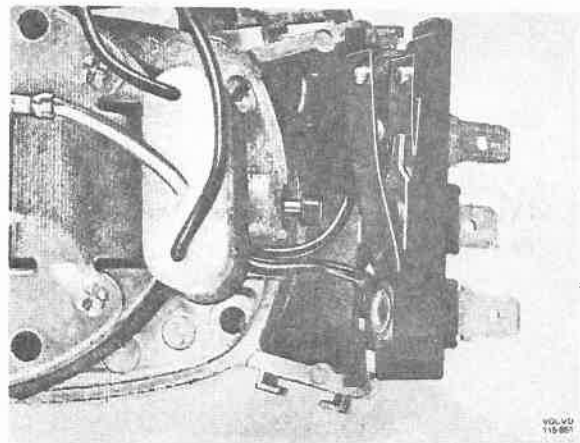


Fig. 36-14. Removing the parking switch

3. Remove the end and gasket from the output shaft. Remove the output shaft and toothsegment. Remove the four screws securing the lower housing half, Fig. 36-15.

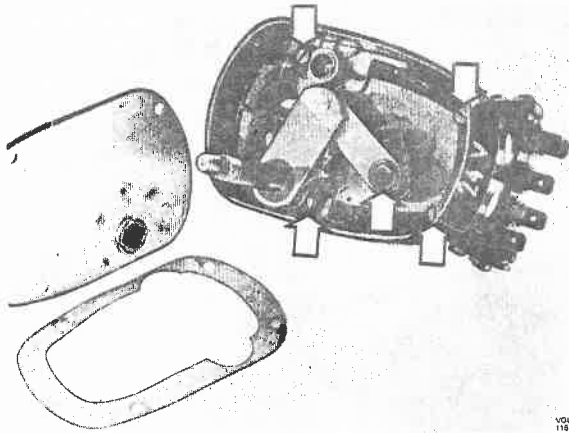


Fig. 36-15. Output shaft with tooth segment

4. Remove the lower housing half and gasket, see Fig. 36-16.

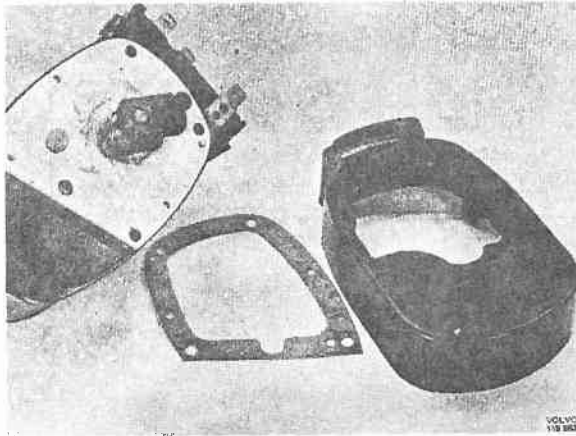


Fig. 36-16. Removing the housing and gasket

5. Remove the plate, gasket, gear wheel and drive from the drive housing, Fig. 36-17.

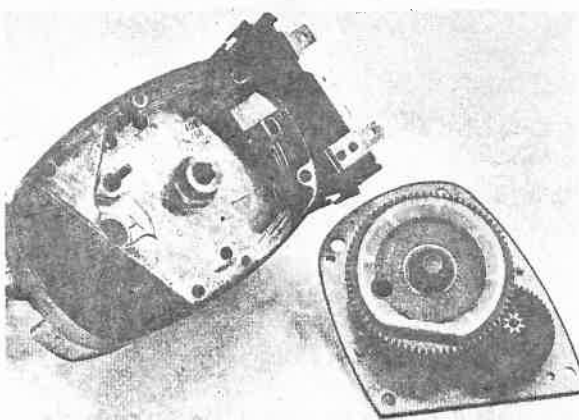


Fig. 36-17. Drive housing with drive and gear wheel

Checking and replacing parts

Clean all the parts and check for wear or any other defects. Also check the rotor for shorting between commutator and rotor body, also shorting between and breakage in the coils.

Shorting between the commutator and rotor body can be tested with a test lamp (40 V A.C.), which is connected between them, see Fig. 36-18. The lamp must not light.

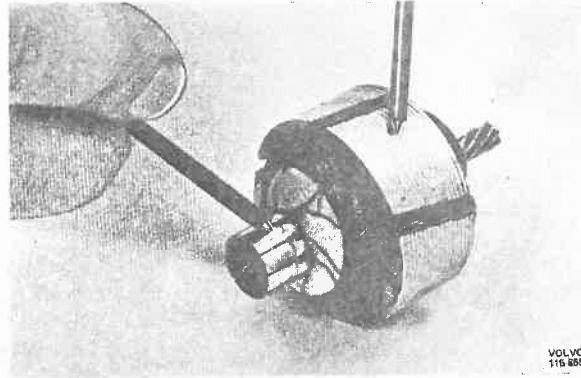


Fig. 36-18. Insulation test, rotor

Test for shorting between the coils with a smaller type of growler or with the Bosch coil tester EFAW 90 or 95 with probe EFAW 96, or corresponding. A total failure in any of the commutator plates can be checked by means of a test lamp (24 V D.C.). Move one of the test lamp's measuring pointers round the commutator and place the other on one of the plates. The lamp should light, Fig. 36-19.

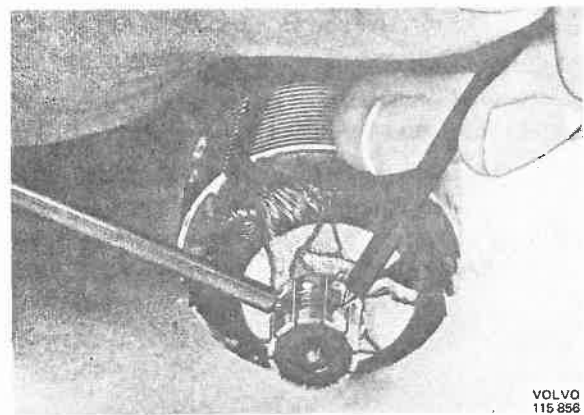


Fig. 36-19. Breakage test, rotor

If there is failure in one of the wires to any of the commutator plates, this can be noticed by considerable burn damage on one or several of the plates diametrically situated to each other.

Assembling

1. Apply plenty of grease to the drive housing, use Bosch Ft 1 V 35, or corresponding, and oil the pin for the parking switch.
2. Grease the gear wheel and drive. Fit the gear wheel and drive, also the gasket and housing.
3. Fit the lower housing half and gasket.
4. Grease the tooth segment and oil the output shaft. Fit the tooth segment and shaft. Lock tight the tooth segment with the lock pin. Fit the gasket and end on the output shaft.
5. Fit the parking switch and plastic plate.
6. Fit the stator and the two screws. Oil the rotor shaft. Fit the rotor and the suppressor.
7. Fit the brush holder bridge on the stator.
8. Fit the protective cover and test-run the windscreen wiper motor. Check the parking function, see wiring diagram in Fig. 36-20.

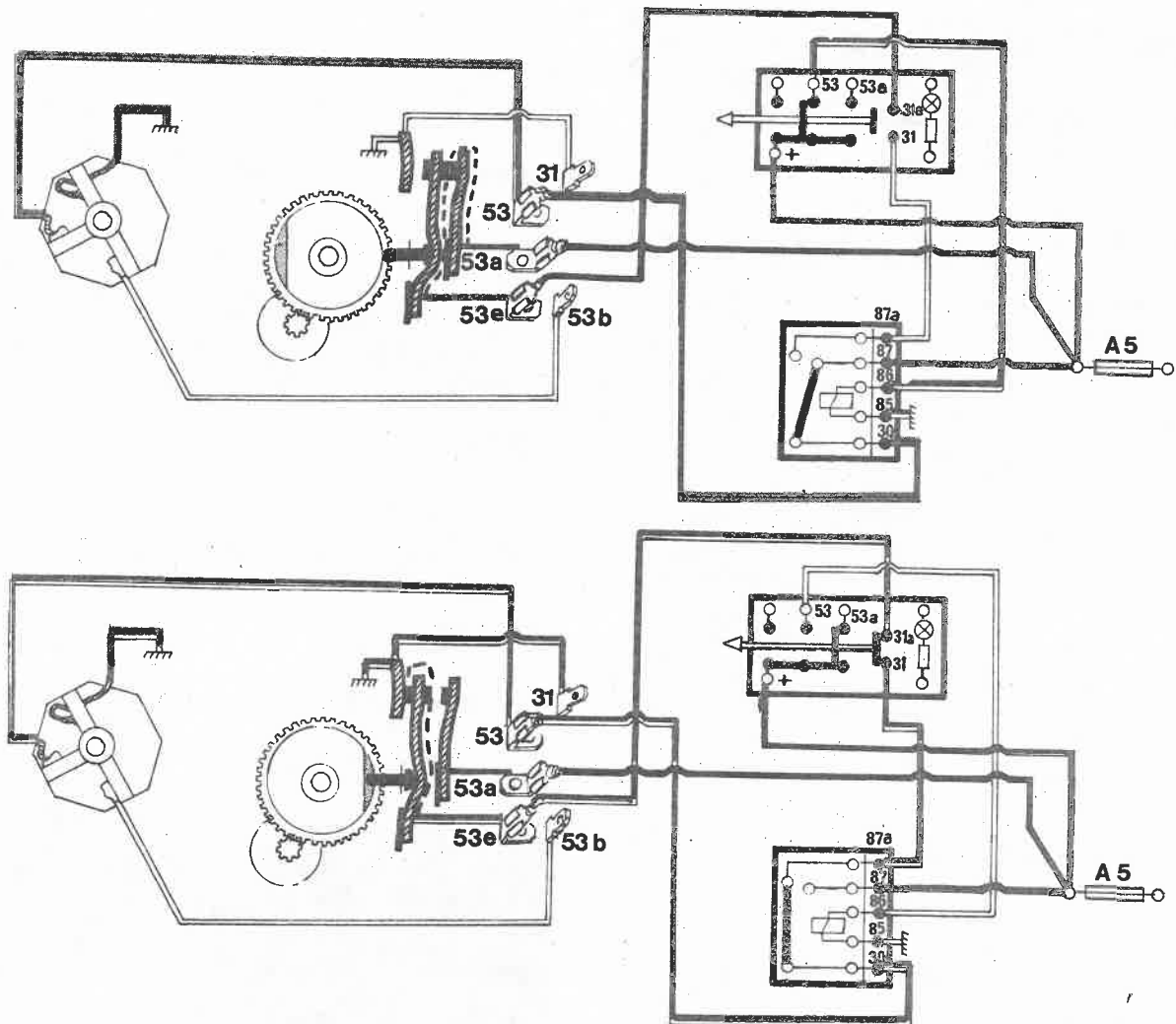


Fig. 36-20. Wiring diagram for parking function, windscreen wiper motor

VOLVO
115 904

Headlamp wiper motor

Removal

1. Remove the band clamp and the washer hose from the wiper arm.
2. Bend up the protection and remove the nut as well as the wiper arm from the shaft, Fig. 36-21.

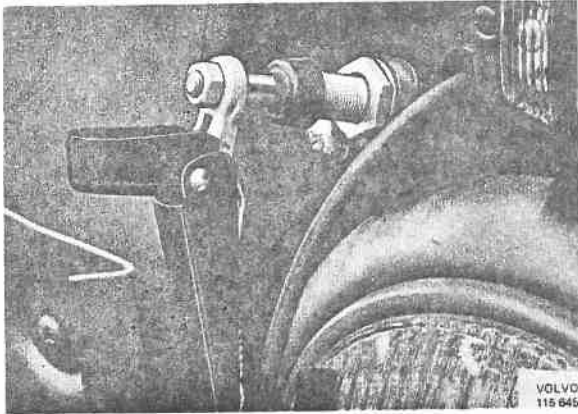


Fig. 36-21. Removing the wiper arm

3. Remove the dust cover, nut, washer and spacer, also lift forwards the wiper motor, see Fig. 36-22.
4. Mark up the cables to ensure correct re-installation and remove them.

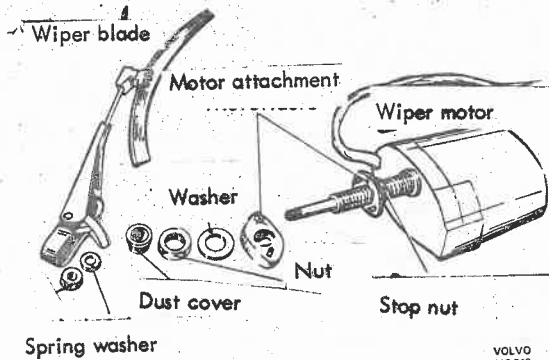


Fig. 36-22. Headlamp wiper, complete

Installing

1. Connect up the cables according to the marking.
2. Fit the wiper motor and motor attachments (make sure that the guide pins fit in the guide holes), the washer, nut and dust cover.
3. Switch on the ignition and the parking lights. Start the wiper motor and allow it to take up the parking position by releasing the button. It takes up the parking position automatically.

4. Fit the wiper blade and nut and connect the washer hose to the nozzle.
5. Fit the hose and band clamps on the wiper arm.

Left headlamp wiper motor

Right headlamp wiper motor

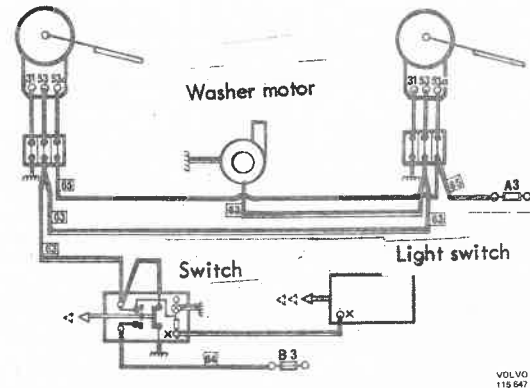


Fig. 36-23. Wiring diagram for headlamp wiper

Washer motor

Removal

1. Remove the screws securing the motor.
2. Mark up and remove the hoses and cables from the washer motor.

Installing

1. Fit the hoses and cables according to the marking.
2. Screw tight the motor to the body.

SWITCHES

Rocker-type

Removal

1. Remove the cover over the batteries and disconnect the negative cable from the battery.
2. Push out the entire switch assembly with contact and bulb holder, see Fig. 36-24, from the rear side of the facia.

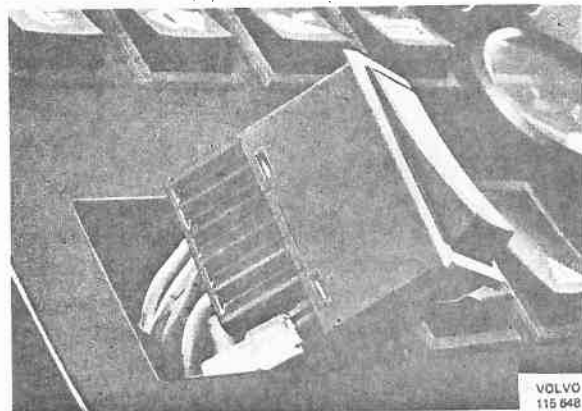


Fig. 36-24. Rocker-type switch

3. Separate the contact and the bulb holder from the switch.

Installing

1. Fit the bulb holder and contact on the new switch.
2. Push the switch back into the facia.
3. Connect up the negative cable to the battery and fit the cover.

Turn-type switches (for inside heater)

Removal

1. Remove the cover over the batteries and disconnect the negative cable from the battery.
2. Remove the cover to the right of the switches.
3. Remove the knob from the switch by pulling it straight out. Unscrew the nut.
4. Lift forward the switch, see Fig. 36-25. Mark the cables to ensure correct re-installation and remove them.

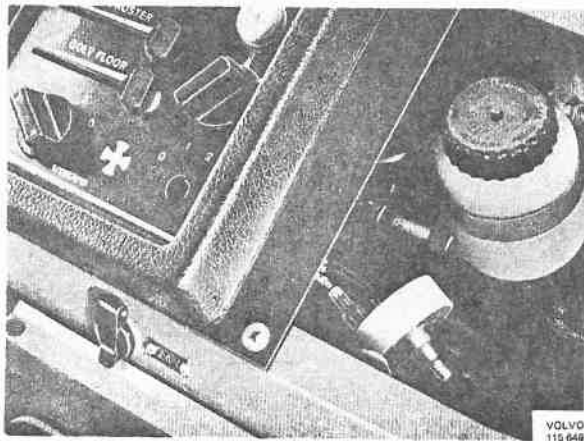


Fig. 36-25. Turn-type switches

Installing

1. Connect up the cables according to the marking and fit the switch.
2. Fit the nut, knob and cover.
3. Fit the negative cable to the battery and the cover over the batteries.

Push-type switches

Removal

1. Lever forwards the panel holding the push-type switch, see Fig. 36-26.

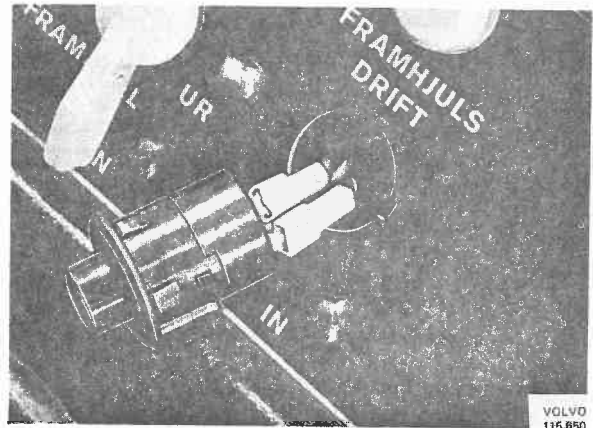


Fig. 36-26. Push-type switch

2. Disconnect the cables and push out the switch from the rear side of the panel.

Installing

1. Fit the new switch in the panel and connect up the cables.
2. Fit the panel.

Rheostat

Removal

1. Make sure that the ignition is switched off. Mark up and remove the cables for the rheostat.
2. Press out the rheostat from the rear side of the facia, see Fig. 36-27.

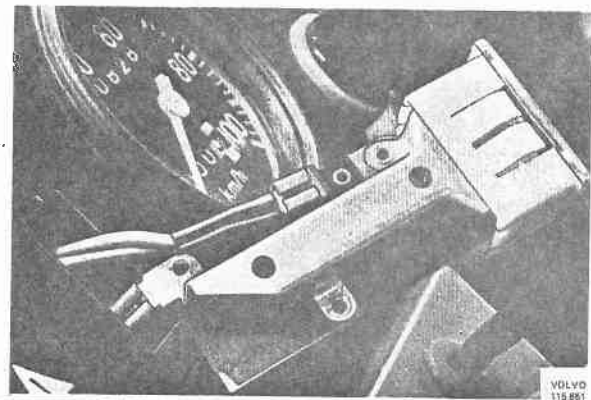


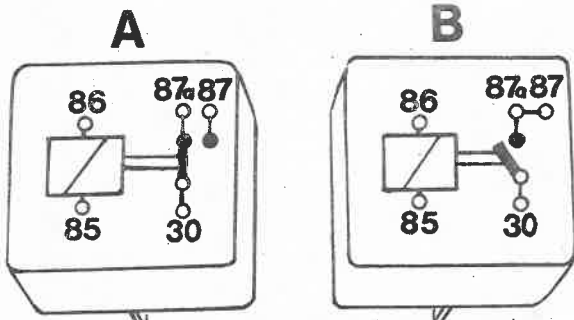
Fig. 36-27. Rheostat

Installing

1. Push the rheostat back into the facia and connect up the cables according to the marking.

RELAYS

When changing a make/break relay, do not confuse it with the shift relay, see Fig. 36-28. The cover of each relay has a small wiring diagram showing the type of relay fitted. The shift relays do not have any fixed connection between terminals 87 and 87a, while the make/break relays do have such a connection.



A = shift relay
B = make/break relay

Fig. 36-28. Activating relays

It is not possible to repair a relay, it must be replaced if it does not function. This applies to all the relays in the vehicle.

Activating relays

Replacing

1. Pull the relay straight up out of the relay socket.
2. Check that the new relay is of the correct type before fitting it. Push the relay securely into the socket.

Flasher unit

Removal

1. Remove the screws securing the clamp for the flasher unit, see Fig. 36-29.



Fig. 36-29. Flasher unit

2. Lift off the flasher unit from the clamp and separate the contact from the flasher unit.

Installing

1. Connect the contact to the new flasher unit.
2. Place the flasher unit in position behind the clamp and tighten up the screws.

Step relay for fullbeams and dipped beams

Removal

1. Remove the cover from the batteries and disconnect the negative cable from the battery.
2. Mark up and disconnect the cables from the step relay, see Fig. 36-30.

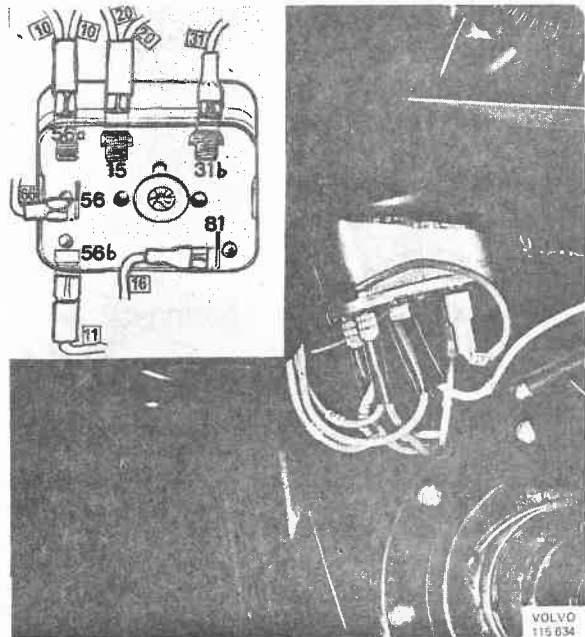
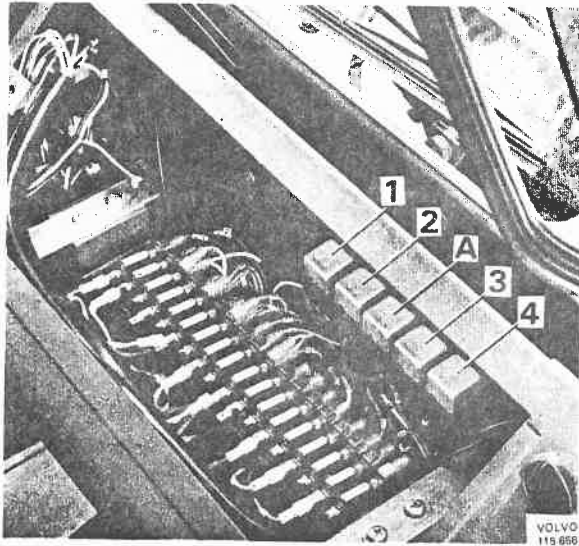


Fig. 36-30. Step relay, fullbeams and dipped beams

3. Remove the screws securing the relay

Installing

1. Install the relay.
2. Connect up the cables according to the marking.
3. Connect the negative cable to the battery and fit the cover over the batteries.



1. Reverse lights
2. Parking lights
- A. Flasher lights (shift relay)
3. Dipped beams automatic mechanism, dipped beams
4. Dipped beams automatic mechanism, parking lights

Fig. 36-31. Relays at fuses

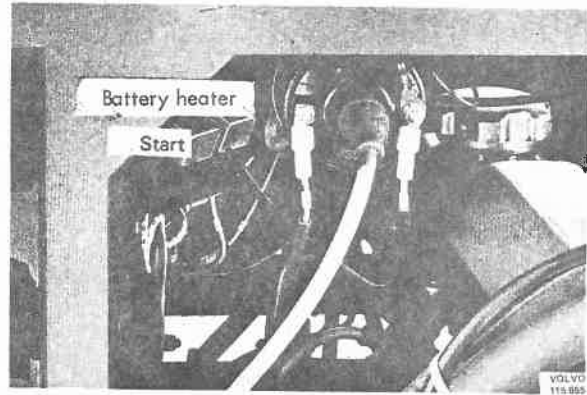
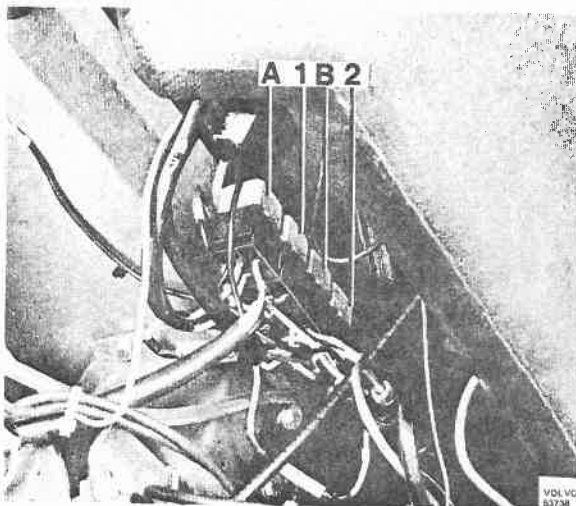


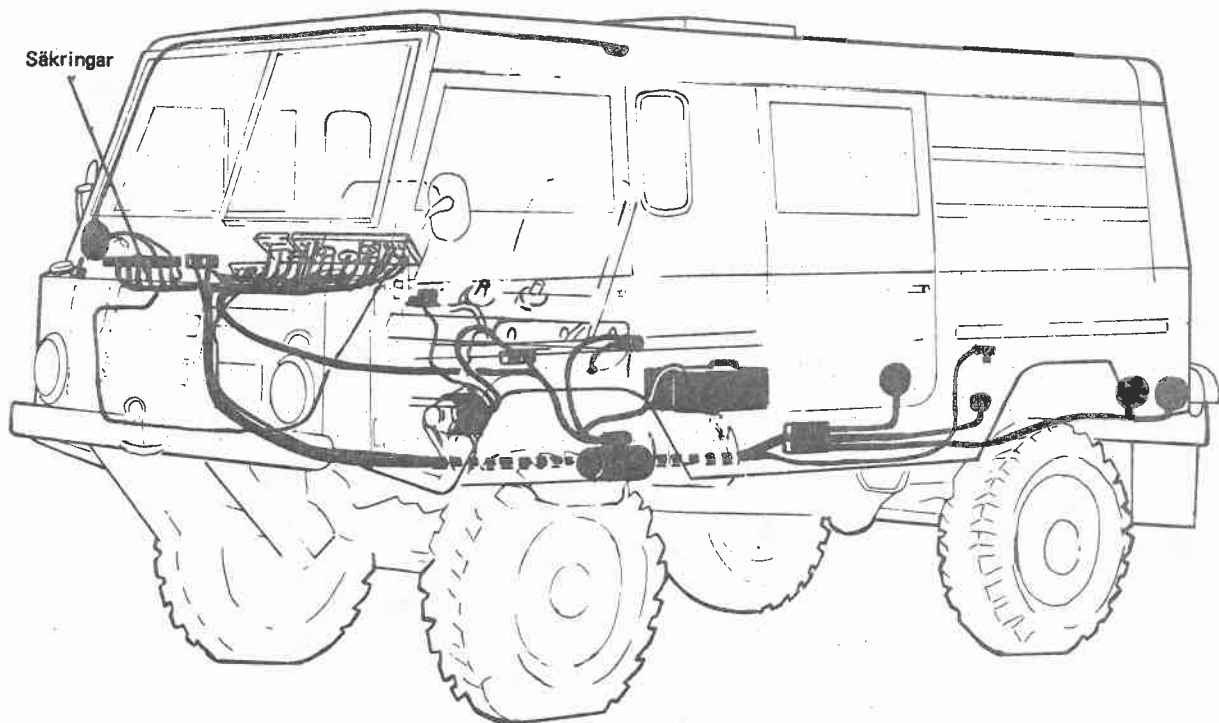
Fig. 36-33. Relays, engine compartment



- A. Left windscreen wiper, low-speed (shift relay)
1. Left windscreen wiper, high-speed
- B. Right windscreen wiper, low-speed (shift relay)
2. Right windscreen wiper, high-speed

Fig. 36-32. Relays, engine compartment

GROUP 37 CABLES AND FUSES



VOLVO
115 657

Fig. 37-1. Cables and fuses

Construction and Function

Construction and Function

CABLES

The cables have marked sleeves at each end. The sleeves at both ends have the same number in order to facilitate fault-tracing.

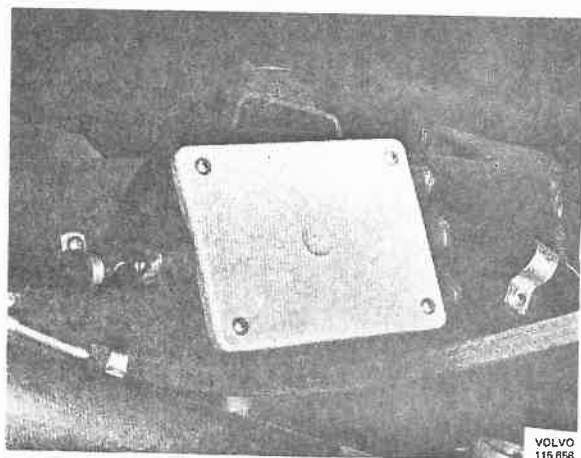
In the event of replacing a cable, the new cable must have the same area and insulation as the old one and must have RK-type multi wiring.

FUSES

The vehicle has two fuse boxes, marked A and B in the wiring diagram. Each box has nine fuses. Each of the fuses are dimensioned for a current of 8 A.

CONNECTORS

The vehicle is equipped with a connection box, Fig. 37-2. This is placed on the right-hand side on the frame, immediately in front of the rear axle gear.



VOLVO
115 658

Fig. 37-2. Connection box on frame

The box contains two, six-pole connection assemblies, see Fig. 37-3.

The earth connections inside the box are for the twelve-pole socket and for the tail lamps.

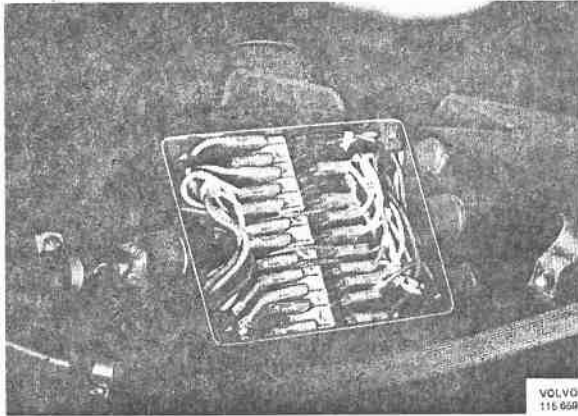


Fig. 37-3. Connection box without cover

The cables which go to the box come from the two connectors which are located on the left-hand side of the fuses at the fascia, Fig. 37-4.

The connectors, Fig. 37-5, are marked with black spots on the wiring diagram at the end of this manual, and have component number 35 (B2).

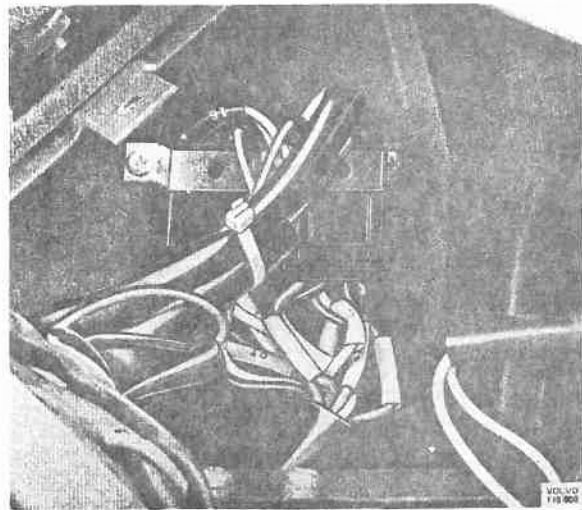


Fig. 37-4. Connectors at fuse holder

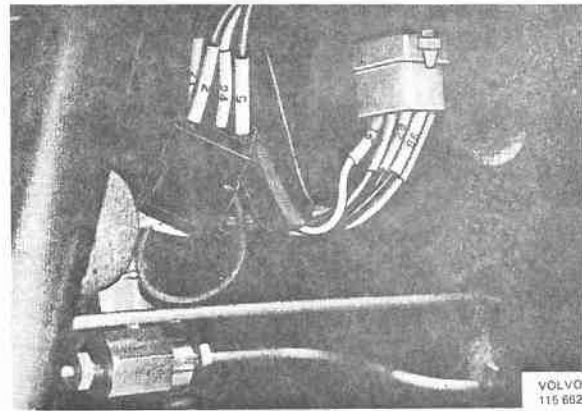
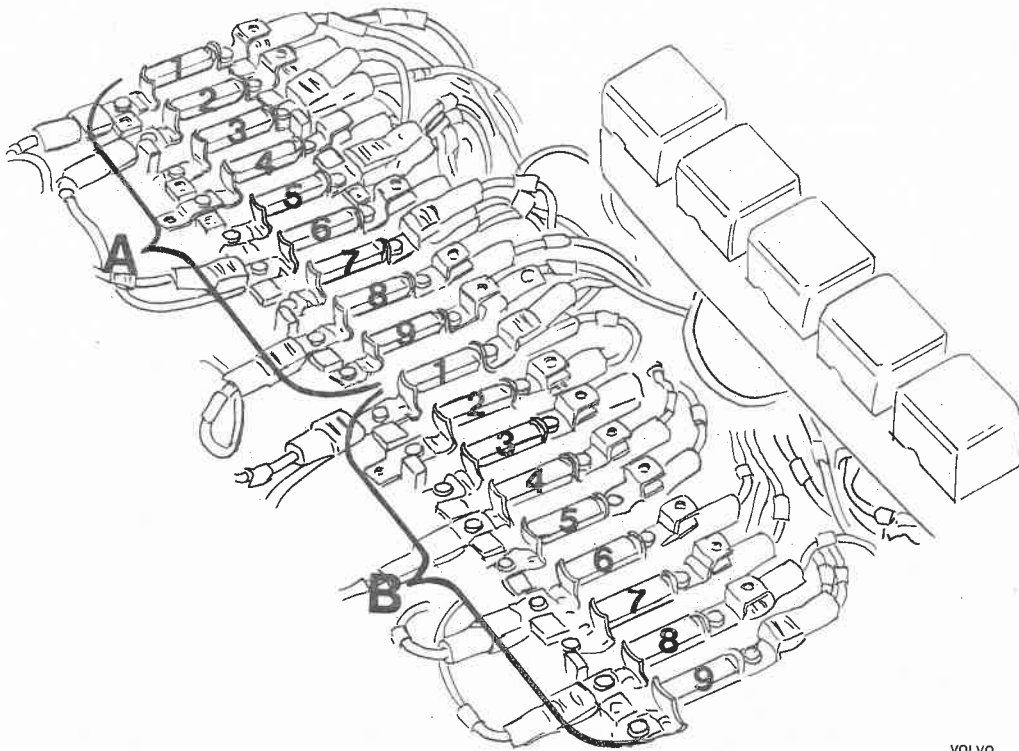


Fig. 37-5. Connectors underneath fascia

Service Procedures

In the fuse list given below, the number given in brackets is the number marked on the sleeves fitted on the ends of the cables.



VOLVO
115 661

- | | | | |
|----|--|----|--|
| B9 | Mainbeam, right (10) | A6 | Stop lights (21) |
| B8 | Mainbeam, left (10, main beam indicator light (10)) | A5 | Rheostat for instrument panel light (22)
windscreen wiper motor, right (22)
windscreen wiper motor, left (22) |
| B7 | Dipped light, right (11) | A4 | Direction indicators, light switch, warning light for brakes and brake circuit (23), relay, reverse spotlight (23) |
| B6 | Dipped light, left (11) | A3 | Fuel gauge, temperature gauge, warning light for oil pressure, windscreen washers (24), horn (24), spotlight wiper (for automatic parking) (65) |
| B5 | Tail light, right (12) | A2 | Compartment heater, indicator light choke (25), solenoid for front-wheel drive (73), indicator lights for differential lock and front-wheel drive (25) |
| B4 | Tail light, left (13) | A1 | Spare, Lufor receiver (72) |
| B4 | Parking light, right (14) and headlamps wipers and washers (64) | | |
| B2 | Parking light, left (15) | | |
| B1 | Courtesy light (16), reverse spotlight (16), hazard warning lights (16), connection box (16) | | |
| A9 | Black-out light, right (19), black-out bulbs, rear 3 W (19) | | |
| A8 | Black-out light, left (19) | | |
| A7 | Step relay, main beams and dipped beams (20), socket on fascia (20), socket at combined tail lamp (20) | | |

Fig. 37-6. Fuse assembly

CONNECTION BOX

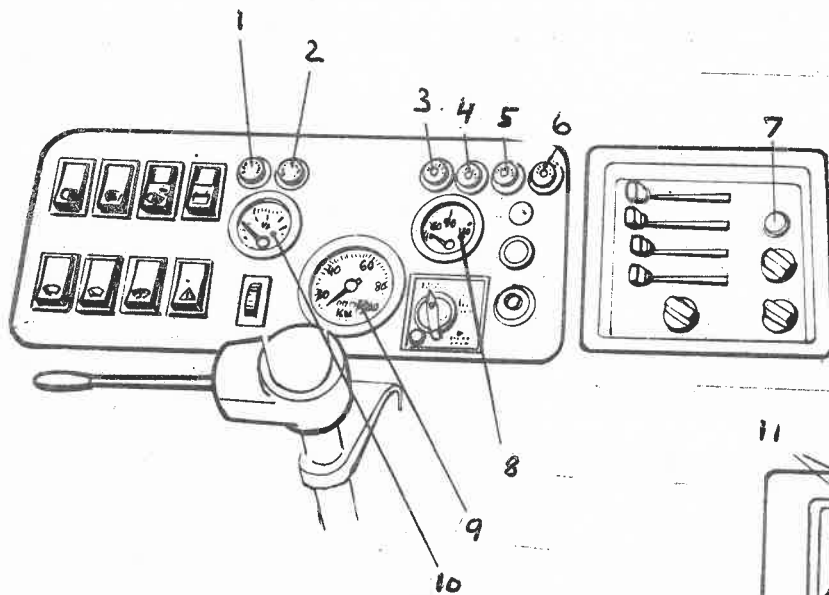
Removal

1. Remove the cover from the batteries and disconnect the negative cable from the battery.
2. Remove the cover from the connection box and the two clamps securing the cable harnesses on each side of the box.
3. Remove the connection box and the earth cables from the frame.
4. Separate the connector from the box.
5. Mark the cables and remove them from the connector. Remove the cables from the box.

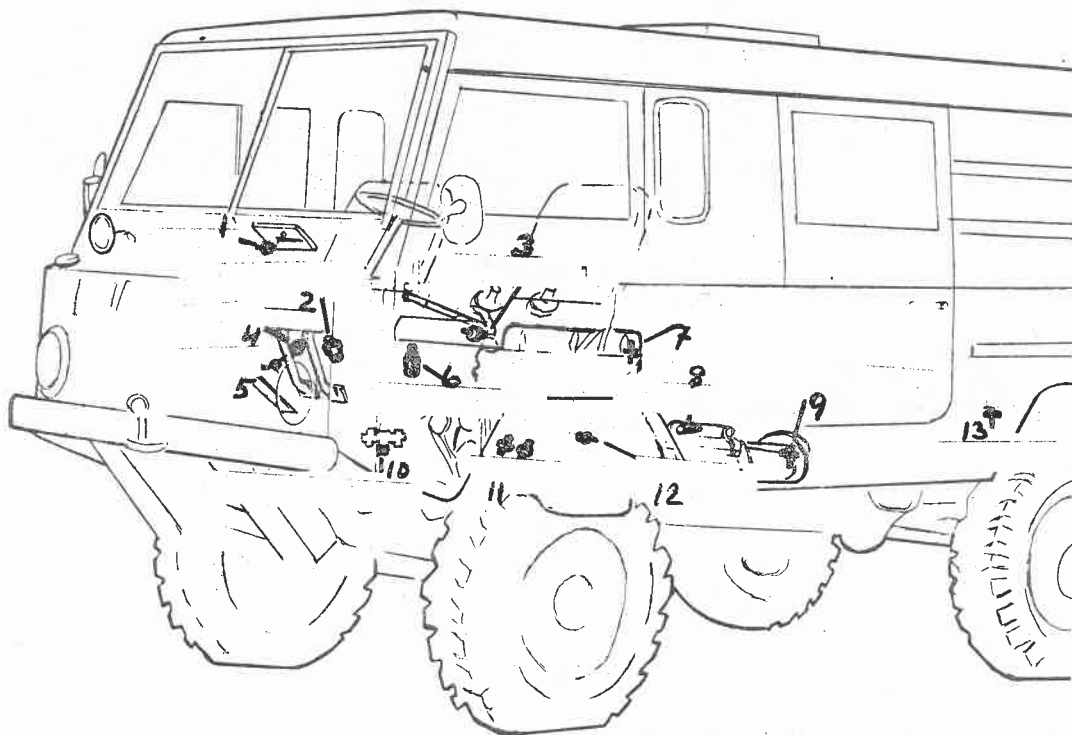
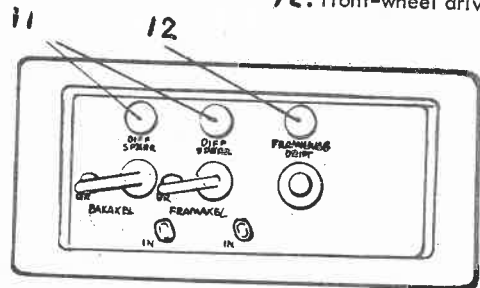
Installing

1. If necessary, remove the old rubber seals and fit new ones as well as new cable harness.
2. Run the cables into the box and connect them to the connector according to the marking.
3. Fit the connector panel securely in the box.
4. Fit the box on the frame. Fit the earth cables to one of the retaining screws. Make sure that there is good contact with the vehicle frame.
5. Fit the rubber seals in the box and clamp tight the cable harnesses on each side of the box.
6. Spray with Tectyl 151 A or corresponding.
7. Fit the cover on the connection box. Connect up the negative cable to the battery and fit the cover over the batteries.

GROUP 38 INSTRUMENTS, CONTACTS AND INDICATOR/WARNING LIGHTS



1. Direction indicator, vehicle
2. Direction indicator, trailer
3. Main beams
4. Battery charging
5. Brakes
6. Oil
7. Choke
8. Coolant temperature
9. Speedometer
10. Fuel gauge
11. Diff. locks
12. Front-wheel drive



1. Choke
2. Front-wheel drive
3. Parking brake
4. Stop light
5. Pedal travel
6. Solenoid
7. Coolant
8. Reverse lights
9. Front-wheel drive
10. Brake circuit difference
11. Diff. locks
12. Oil pressure
13. Fuel level

Fig. 38-1. Instruments, contacts and indicator/warning lights

Construction and Function

SPEEDOMETER

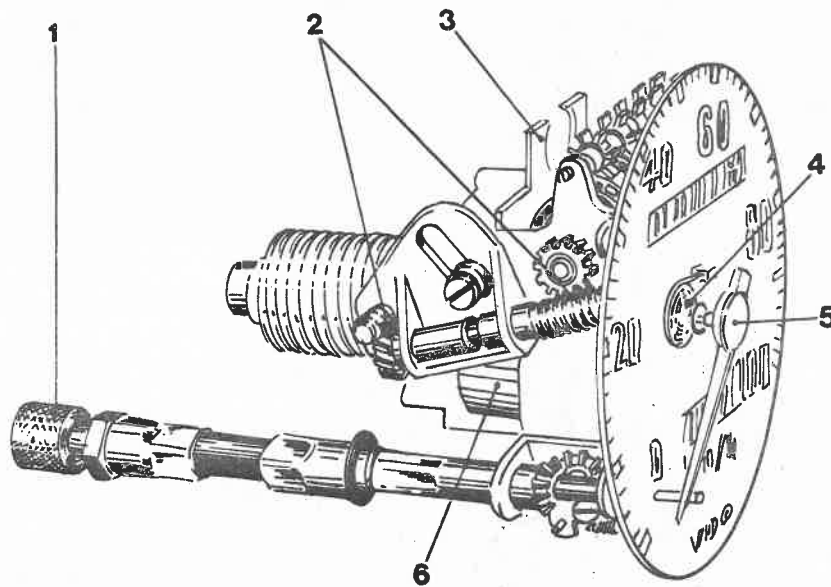
The speedometer is of the eddy-current type, and it is driven by a cable (speedometer cable) from a worm on the gearbox output shaft. The gauge consists of a permanent magnet, a mounting disc and an aluminium rotor drum. The rotor drum is on one end of the instrument indicator shaft. The shaft is also linked with a balance spring, the function of which is to brake the movement of the rotor drum and at the same time move the pointer towards the zero position when the vehicle has stopped.

The mileage recorder is driven by a number of gears directly from the speedometer cable. Reductions of these gears are selected so that the wire must make 617.5 revs in order for the instrument to register one km. The gauge is also equipped with a tripmeter, which indicates maximum driving distance of 999 kilometers. The fourth figure indicates metres driven in hundreds.

The tripmeter is re-set by turning the small knob.

The speedometer works on a principle of magnetic activation. When the vehicle is set in motion, a drive line rotates and this causes the permanent magnet to rotate. The rotating magnet generates a magnetic field which gives rise to eddy currents in the rotor drum. The magnetic lines flow across the instrument disc. The rotating effect which the magnetic field, as well as the induced eddy currents, have on the rotor drum will depend partly on the speed (increasing vehicle speed will give greater speedometer reading) and partly by the counteracting force from the balance spring.

The construction of the speedometer can be seen from Fig. 38-2.



VOLVO
115 664

- | | |
|--------------------------|-------------------------------------|
| 1. Tripmeter re-set knob | 4. Balance spring |
| 2. Worm | 5. Pointer |
| 3. Disc | 6. Rotor drum with permanent magnet |

Fig. 38-2. Speedometer layout

COOLANT TEMPERATURE GAUGE

The temperature gauge has two main parts: the gauge mounted in the facia and the temperature sender located in the engine block.

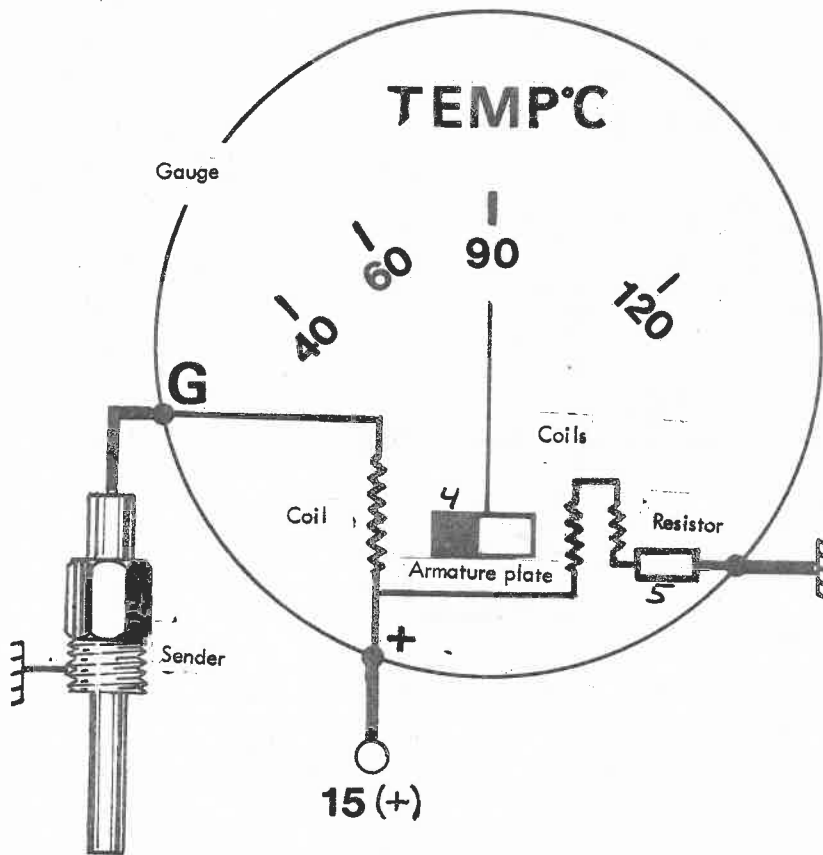
The temperature sender consists of a temperature-sensitive semiconductor. Sender resistance reduces as the temperature of the coolant rises.

The temperature gauge has three coils, which function as electro-magnets. One is connected in series with the sender, and the other two are connected to the vehicle chassis via a fixed resistor, Fig. 38-3.

When the engine coolant is cold (high resistance in the sender), most of the current flows through the two coils connected in series and through the fixed resistor to the body chassis.

The magnetic force which develops at these coils attracts the gauge armature plate and causes the pointer to point to 40°C (104°F) or less.

When the engine coolant temperature starts to rise (the resistance in the sender reduces), more and more current passes through the coil which is connected in series to the sender. The magnetic force which then arises attracts the pointer armature plate so that the pointer swings in the opposite direction to before. The temperature indicated by the pointer on the gauge will depend on the amount of coolant flowing through the coils, which in turn is determined by the coolant temperature.



VOLVO
115 665

Fig. 38-3. Layout of temperature gauge and sender

FUEL GAUGE

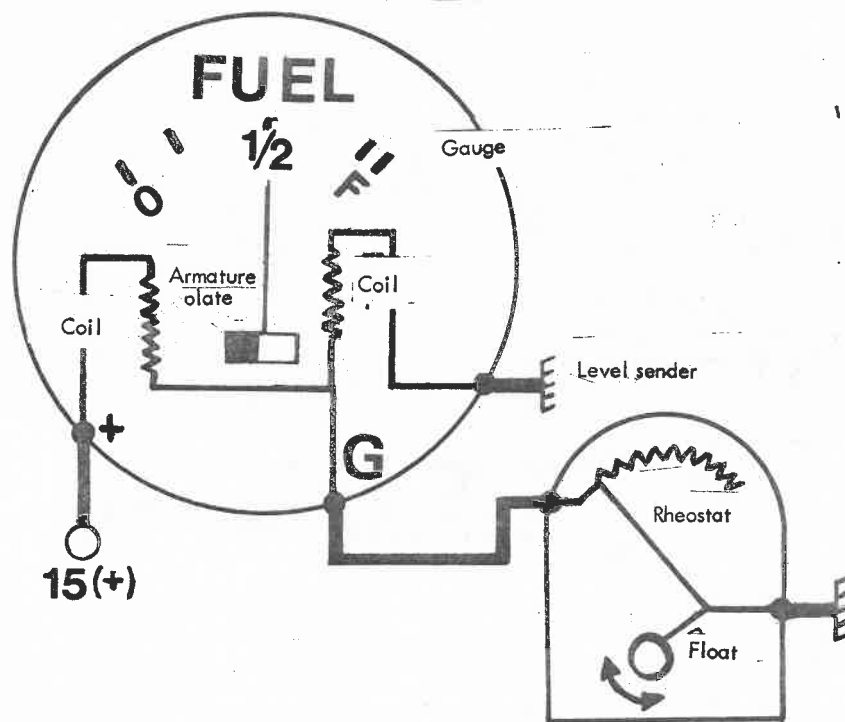
The fuel gauge, Fig. 38-4, has two main parts: the gauge mounted in the fascia and the level sender unit in the tank.

The level sender unit consists of a float which is in contact with a washer via a lever. This contact washer glides over a rheostat. The fuel level in the tank determines the position of the contact washer on the rheostat so that, at a higher fuel level, more coils of the rheostat are in circuit (the fuel gauge gives a higher reading) or less coils are in circuit (the fuel gauge gives a lower reading).

The fuel gauge has two coils, which function as electro-magnets. The coil which has the greatest magnetic force, see Fig. 38-4, will attract the armature plate of the gauge needle, which points to the amount of fuel in the tank. For example, when the magnetic force is equal in both coils, then the needle will point to 1/2 on the gauge (the tank is half-full). The level sender unit determines the amount of current that will flow through the coil.

Ex. When the float in the tank level unit is at its bottom position (the tank is empty), then there is little resistance in the rheostat. Most of the current then flows through the coil which is connected in series with the rheostat, and only a small amount of current flows through the coil which is connected to the vehicle chassis.

When the float is at its top position (the tank is full), there is great resistance in the rheostat. Most of the current then flows through the coil which is connected to the vehicle chassis.



VOLVO
115 666

Fig. 38-4. Layout of fuel gauge and level sender unit

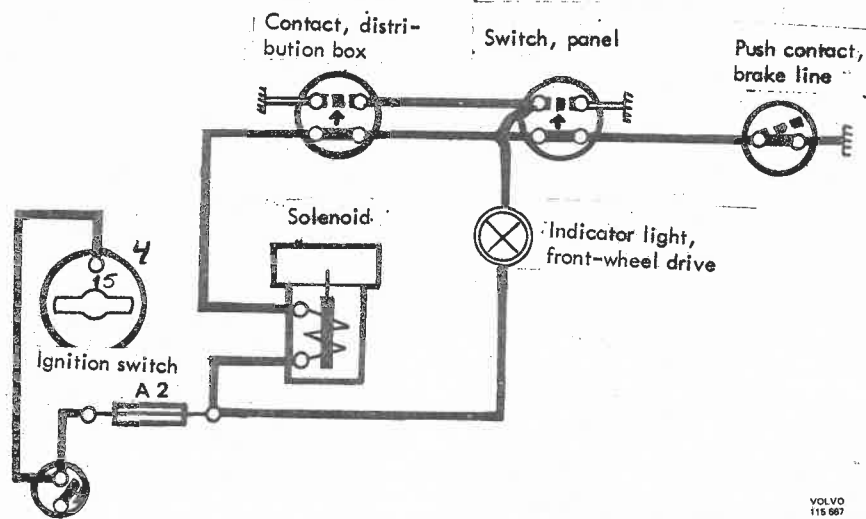
SOLENOID, FRONT-WHEEL DRIVE

The electrical components that operate the mechanical engagement of the front-wheel drive are the following: solenoid, switch, contacts and indicator light; see layout in Fig. 38-5.

When the ignition is switched on, current flows through the solenoid coil, the push contact in the distribution box, the switch on the instrument panel and through the push contact on the brake line to the vehicle chassis. The current is in circuit and the armature in the solenoid has been pulled over to its top position. When the circuit is broken for any reason or other, the armature in the solenoid goes to its bottom position and this engages the front-wheel drive.

As the above shows, disengaging and engaging the front-wheel drive will depend on whether the solenoid coil is in circuit or not. The front-wheel drive can thus be operated as follows:

- A. Ignition switch. With the ignition key in the neutral position, the current circuit is broken and the front-wheel drive is engaged. When the key is turned, the front-wheel drive disengages providing that contacts and switch are in the position shown in Fig. 38-5.
- B. Gear lever. When a low gear is engaged, the current circuit is broken by the contact at the distribution box and the front-wheel drive engages.
- C. Switch on instrument panel. Pushing in this switch breaks the current circuit and the front-wheel drive engages.
- D. Brake pedal. When the pedal is depressed and the hydraulic pressure in the push switch exceeds 0.8-1.0 MPa (8-10 $\text{kp/cm}^2 = 114-142 \text{ lbf/in}^2$), this breaks the current circuit and the front-wheel drive engages.



VOLVO
115 667

Fig. 38-5. Layout for engaging the front-wheel drive

SENDER

Oil pressure

When the ignition is switched on, current flows through the bulb in the warning light and through the oil pressure sender to the vehicle chassis. When the engine starts and oil pressure exceeds 40-70 kPa (0.4-0.7 kp/cm² = 5.6-10.0 lbf/in²), this actuates a diaphragm which breaks the sender electrical connection with the chassis frame.

The indicator light goes out.

Stop light contact

The contact is mechanical and is actuated by the brake pedal. When the pedal is in the rest position, the current circuit is broken. When the pedal is depressed, the current circuit is closed across the stop lights. This switches on the stop lights.

Contact for pressure difference in brake circuits

The contact is attached to the warning valve and operates mechanically via a guide pin when the pressure difference in the brake circuits exceeds 1 MPa (10 kp/cm² = 142 lbf/in²), see Fig. 38-6. If the pressure difference exceeds the above value, the contact is in circuit to the chassis frame and this causes the warning light marked "Brake", to go on, see Fig. 38-7. The light will remain on (providing that the ignition is switched on) until the contact has been removed and restored, whereby the guide pin is lifted up by the warning valve pistons.

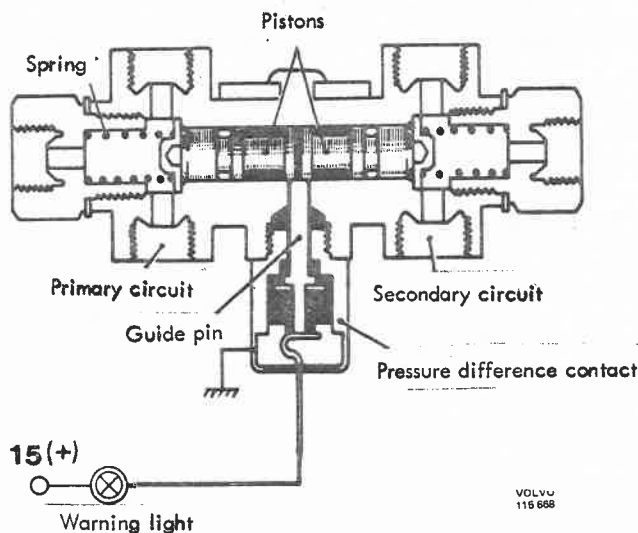


Fig. 38-6. Warning valve, normal position

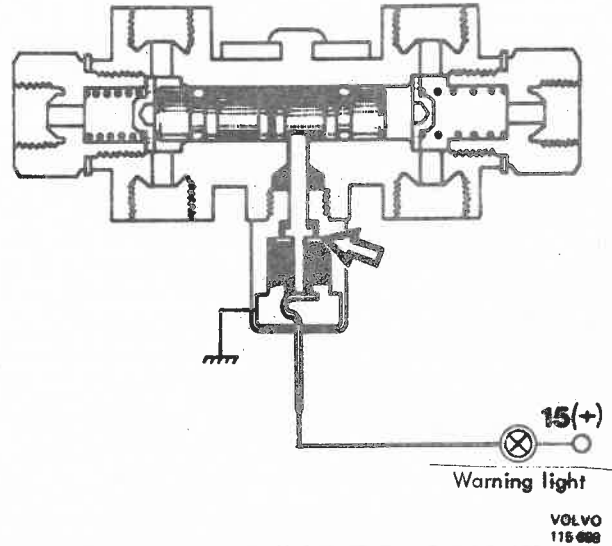


Fig. 38-7. Warning position

Contact for brake pedal travel

This contact is actuated by the brake pedal. The more the brake linings become worn, the further the brake pedal will have to travel. To ensure that the brakes will function, even if one of the circuits fail, the pedal must not travel too far. When the pedal goes down to 90-100 mm from the floor, that is, the pedal reserve has reduced to this measurement, the warning light goes on. The brakes must then be adjusted as soon as possible. Since the contact has indicated brake lining wear and excessive brake pedal travel, the contact pin must be re-set by hand.

Contact for parking brake

The contact causes the "Brake" warning light to go on when the parking brake is applied. The contact is actuated mechanically by a lever in the parking brake control.

Contact for reverse lights

The contact is mechanical and is actuated by the reverse gear. When reverse is engaged, the contact is connected electrically to the chassis and this causes the activating relay for the reverse light also to be connected to the chassis. The relay cuts in and causes the reverse lights to go on.

Contact for choke

This contact is actuated mechanically by the choke control. The contact is connected to the chassis electrically when the lever for the choke control is moved to the one side. This causes the "Choke" light to go on.

Vacuum contacts for differential locks

The contacts are connected to the vacuum lines which run to the front and rear control cylinders, see Fig. 38-8.

The function of the contacts is to switch on the warning lights marked "Diff. carrier" when the vacuum exceeds 39.5-40.5 kPa (0.395-0.405 kp/cm² = 5.6-5.8 lbf/in²).

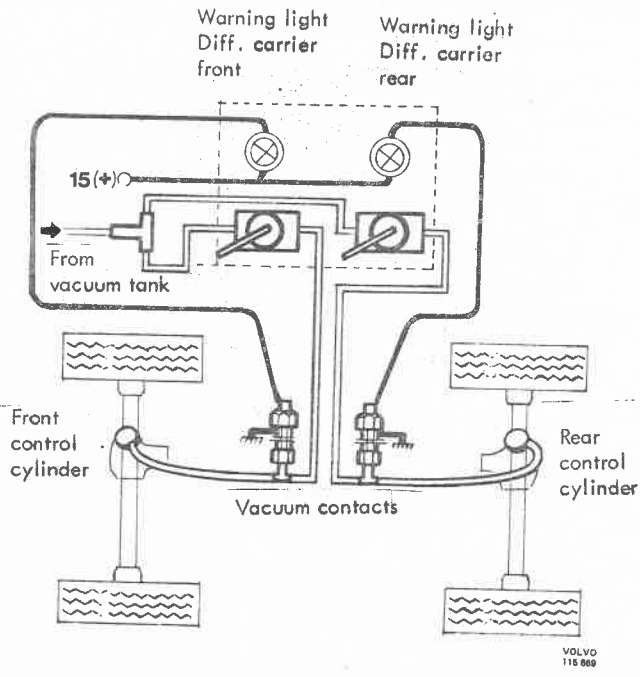


Fig. 38-8. Layout for vacuum contacts

WARNING LIGHTS

Battery charging

The light marked "Battery charging" is connected between terminal 61 on the ignition switch and terminal 61 on the alternator. When alternator voltage is lower than battery voltage, the light goes on. When the voltage rises and the alternator starts charging the battery, the light goes out, this showing that the alternator is charging.

Oil pressure

The light marked "Oil pressure" will light if the oil pressure in the engine goes below 40-70 kPa (0.4-0.7 kp/cm² = 5.6-10 lbf/in²).

Brake

The light marked "Brake" will light: when the parking brake is on, when there is an unacceptable pressure difference in the brake system, when the brake pedal travel exceeds a certain distance, see Fig. 38-9.

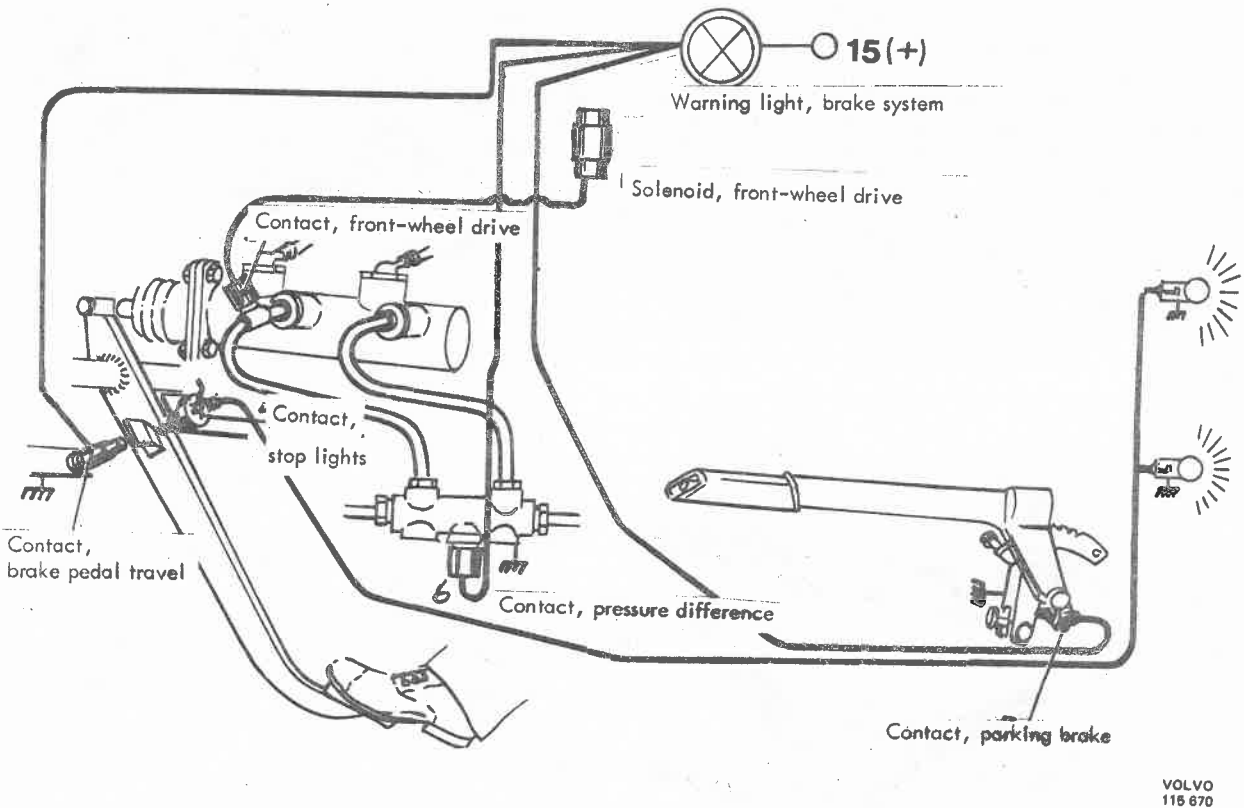


Bild 38-9.

Fig. 38-9. Layout for wiring for "Brake" warning light

Differential carriers

The lights marked "Diff. carrier" will light when the vacuum in the lines to the control cylinders for the front and rear differential carriers exceeds 39.5-40.5 kPa (0.395-0.405 kg/cm² = 5.6-5.8 lbf/in²).

Choke

The light marked "Choke" will light when the lever for the choke control is moved to the one side.

Main beams

The light marked "Main beam" will light when the main beams are switched on.

The light is connected in parallel with the main beam for the left-hand side at fuse (B 8).

Direction indicators

The lights marked "Dir. ind. vehicle" and "Dir. ind. trailer" blink simultaneously with the indicators. The direction indicator or panel light for the trailer will only blink when a trailer is connected to the vehicle. The blinking frequency should be 75-105 blinks per minute.

Service Procedures

SPEEDOMETER

If the speedometer, Fig. 38-11, does not function while the mileage recorder does, or if the speedometer is functioning but not the mileage recorder, then the fault is in the speedometer. If neither the speedometer nor mileage recorder is working, and the speedometer needle swings, probably the drive cable is broken or is jamming in its sleeve. The entire speedometer cable must then be replaced.

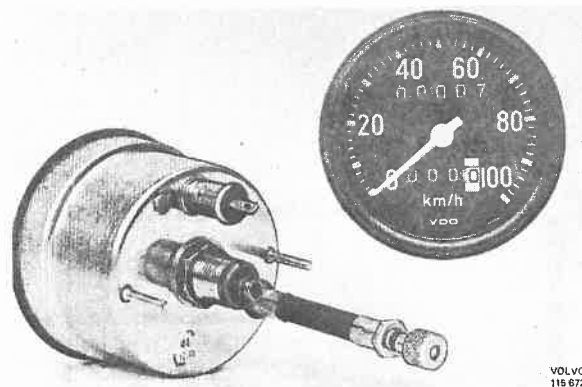


Fig. 38-11. Speedometer

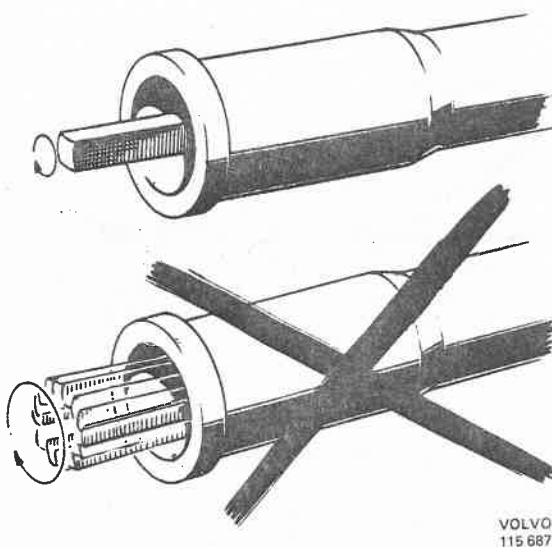


Fig. 38-10. Drive wire rotation

Replacing the speedometer

Removal

1. Take off the cover over the batteries and disconnect the negative cable from the battery.
2. Disconnect the speedometer cable connection from the speedometer and the bulb holder for the speedometer light.
3. Remove the nuts holding the bracket and remove the speedometer.

Installing

1. Install the speedometer. Make sure that it is properly installed in relation to the other instruments.
2. Fit the bulb holder for the speedometer light and screw on the nuts for the speedometer cable.
3. Connect the negative cable to the battery and fit the cover over the batteries.

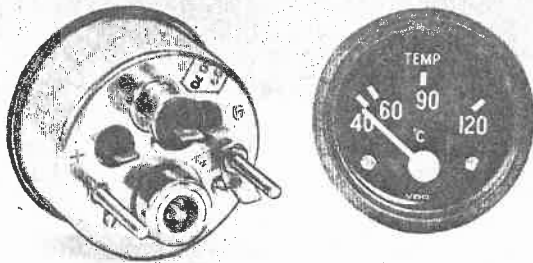
COOLANT TEMPERATURE GAUGE

Testing

If the temperature gauge, Fig. 38-12, is faulty or does not work at all, the fault may be in the actual instrument, the sender, see Fig. 38-13, or in the cables. The first thing to check is to make sure that the connections for the gauge and sender are good and that the gauge is earthed to the vehicle chassis.

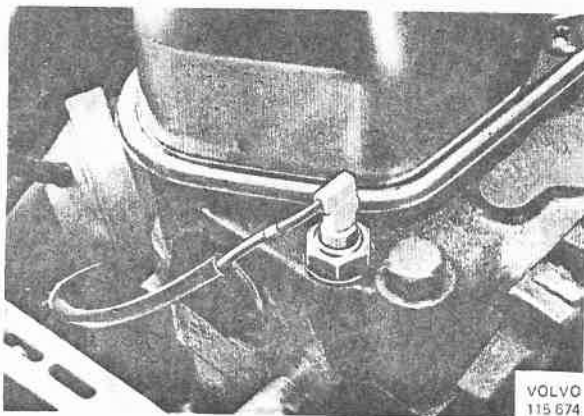
Check with a voltmeter or test lamp to make sure there is voltage on the input side of the gauge. If the cables and contacts are in good condition, continue with the test as follows:

3. Hold the cable at a cleaned spot on the engine in order to get earthing. If the gauge needle swings to 120, then the cable and gauge are in good condition, so the fault must be in the sender. If this is the case, follow the instructions given under "Checking the sender".
4. If the gauge needle does not swing to 120, disconnect the cable also at the instrument. Earth contact pin G. If the gauge is in good condition, then the needle should swing over to 120. If it does, then the fault must be in the sender cable. Repair or replace the cable.



VOLVO
115 673

Fig. 38-12. Temperature gauge



VOLVO
115 674

Fig. 38-13. Sender for temperature gauge

Temperature gauge indicates 120°C (248°F)

1. Disconnect the gauge cable running to the sender, marked (43).
2. Turn the ignition key to switch on the circuit. If the needle swings to 40, then the gauge is in good condition.
3. Switch off the circuit and re-connect the cable to the gauge.
4. Disconnect the cable at the sender and keep it insulated from the vehicle chassis.
5. Switch on the circuit. If the needle also swings now to 40, then the cable is in good condition. The fault must then be in the sender. If this is the case, follow the instructions given under "Checking the sender".

Checking the sender

Check the sender with an ohmmeter, which is wired between the terminal pin and the chassis. The following values apply (the sender body must be lowered into coolant up to where the threads begin):

Temperature	Resistance in sender
60°C (140°F)	120.5-147.5
90°C (194°F)	46.9- 55.5
100°C (212°F)	35.5- 41.5

Replace the sender if faulty.

Replacing the sender

1. Remove the rear engine casing and disconnect the cable from the temperature gauge sender.
2. If necessary, drain a little coolant from the cooling system.
3. Remove the sender, see Fig. 38-13, together with its washer.
4. Fit a new sender and washer and connect up the cable.
5. If necessary add coolant to the cooling system and re-fit the engine casing.

Temperature gauge indicates 40°C (104°F)

1. Disconnect the cable marked 43 at the sender.
2. Turn the ignition key to switch on the circuit.

Checking the coolant temperature gauge

The temperature gauge must be checked with a faultless sender connected up. The sender capillary is lowered into the coolant up to where the threads begin. Heat up the water in a suitable way and check the water temperature with the help of a thermometer.

Removing the temperature gauge

1. Take the cover off the batteries and disconnect the negative cable from the battery.
2. Remove the bulb holder for the instrument panel light and disconnect the cables from the gauge.
3. Remove the nuts holding the bracket and the earth cable. Remove the bracket and lift forwards the temperature gauge.

Installing the temperature gauge

1. Install the temperature gauge and make sure that it is fitted properly in relation to the other instruments.
2. Fit the bracket and the earth cable and tighten up the gauge with the two nuts.
3. Fit the bulb holder for the instrument panel light and connect up the flat pin sleeves as follows: cable marked 43 is wired to terminal marked G. Cables marked with a 24 are wired to a terminal marked +.
4. Connect the negative cable to the battery and place the cover over the batteries.

FUEL GAUGE

Testing

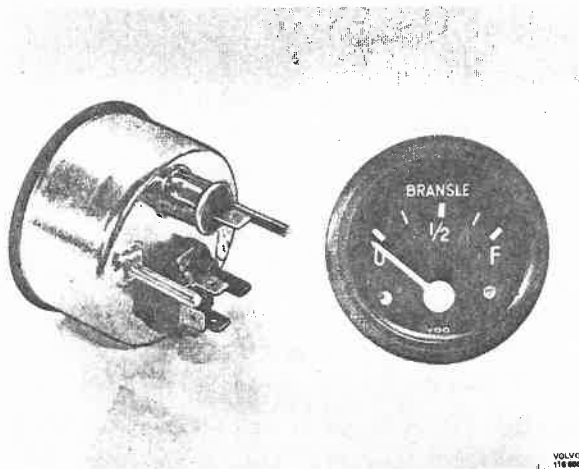


Fig. 38-14. Fuel gauge

If the fuel gauge, Fig. 38-14, gives a faulty reading or no reading at all, then the fault may be in the actual gauge, or in the tank level sending unit, see Fig. 38-15, or in the cables. Before testing, check that the connections at the gauge and the tank level sending unit are in good condition. Also check the earth cable, see Fig. 38-16, to the tank level sending unit. Test with a voltmeter or a test lamp that there is voltage at the input side of the gauge (when the ignition key is turned to switch on the electrical circuit). If the cables and contacts are in good condition, continue testing as follows:

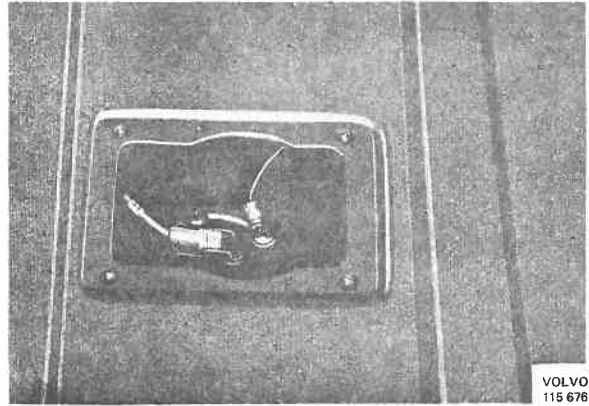


Fig. 38-15. Fuel tank level sending unit

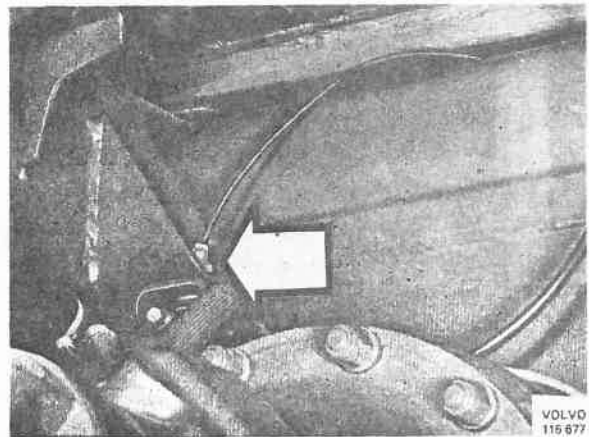


Fig. 38-16. Earth cable for fuel tank level sending unit

Fuel gauge indicates 0

1. Disconnect at the fuel gauge the cable marked 44 which goes to the fuel tank level sending unit.
2. Turn the ignition key to the firing position; if the needle swings over to F, then the instrument is in good condition.
3. Turn the key to the neutral position and re-connect the cable to the fuel gauge.

4. Disconnect the cable at the fuel tank level sending unit and keep it insulated from the vehicle's chassis. Turn the ignition key to the firing position: if the needle swings over to F, then the cable is also without fault. The fault then must be in the fuel tank level sending unit, which must be removed and tested with an ohmmeter.
5. The resistance with an empty tank (the float is at its bottom position) should be 0-6
With a full tank (the float is in its top position), the resistance should be 178-192
Move the float on the fuel tank level sending unit up and down and this should have a corresponding effect on the ohmmeter, the needle of which should follow the movement of the float without jerking or stopping.

Fuel gauge indicates F

1. Disconnect the cable marked 44 at the fuel tank level sending unit.
2. Turn the ignition key to the firing position.
3. Hold the cable against the earth cable. If the needle on the fuel gauge swings over to 0, then the cable and gauge are without fault, so the fault must be in the fuel tank level sending unit. Compare the previous test, Point 5.
4. If, according to the test above, the needle does not swing over to 0, disconnect the cable marked 44 also at the fuel gauge. Connect the contact washer to the chassis by means of a cable. If the gauge is in good condition, the needle will swing over to 0. If the instrument is in good condition, then the connections at the gauge must have poor contact or the contact between the cables and the fuel tank level sending unit.

Removing the fuel gauge

1. Take off the cover over the batteries and disconnect the negative cable from the battery.
2. Remove the bulb holder for the instrument panel light and disconnect the cable connections to the gauge.
3. Remove the nuts securing the bracket and remove the earth cables. Remove the bracket and lift forwards the gauge.

Installing the fuel gauge

1. Install the gauge. Make sure that it is fitted properly in relation to the other instruments.
2. Fit the bracket and earth cables. Tighten up the gauge with the two nuts.
3. Fit the bulb holder for the instrument panel light and connect up the flat pin sleeves as follows: cable marked 44 is wired to terminal marked G. Cables marked 24 are wired to terminal marked +.
4. Connect the negative cable to the battery and fit the cover over the batteries.

Removing the fuel tank level sending unit

1. Remove the four screws securing the cover over the sending unit, see Fig. 38-15.
2. Disconnect the cables from the sending unit. Make a line-up mark (e.g. with a screwdriver) on the sending unit and the tank.
3. Remove the screws securing the sending unit and then remove the unit. Remove the sender washer.

Installing the fuel tank level sending unit

1. Fit a new washer and re-fit the sending unit in position.
2. If necessary, replace the rubber seals for the screws. Screw tight the sending unit and connect up the cables.
3. Fit the cover over the sending unit.

REPLACING THE CONTACT FOR OIL PRESSURE

1. Remove the rear engine casing.
2. Disconnect the cable from the oil pressure contact, see Fig. 38-17.

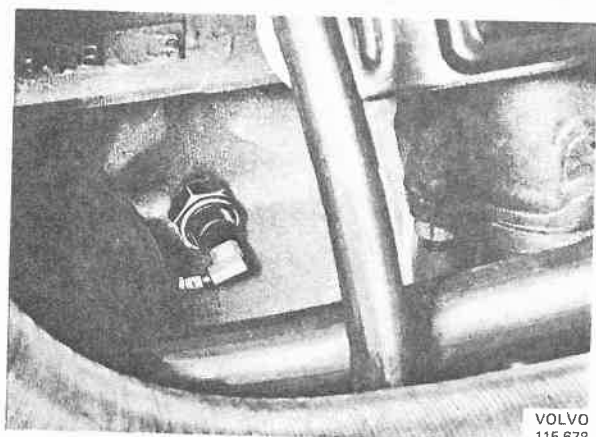


Fig. 38-17. Oil pressure contact

3. Hold the new sender prepared and fit it as soon as the old one has been removed.
4. Connect up the cable and restore the engine casing.

SOLENOID FOR FRONT-WHEEL DRIVE

Removal

1. Make sure that the ignition has been switched off. Disconnect the cables at the terminal board.
2. Slacken the pipe and hose connection several turns at the solenoid, see Fig. 38-18.

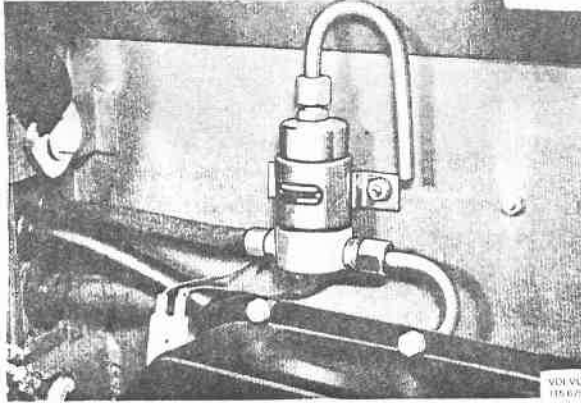


Fig. 38-18. Solenoid for front-wheel drive

3. Remove the screws securing the solenoid and the pipe and hose connections.

Installing

1. Install the pipe and hose connection at the solenoid without tightening it up.
2. Fit the solenoid.
3. Screw tight the pipe and hose connection and connect the cables to the terminal board.

CONTACT FOR STOP LIGHTS

Replacing

1. Disconnect the cables and remove the nut securing the contact, see Fig. 38-19, to the bracket.

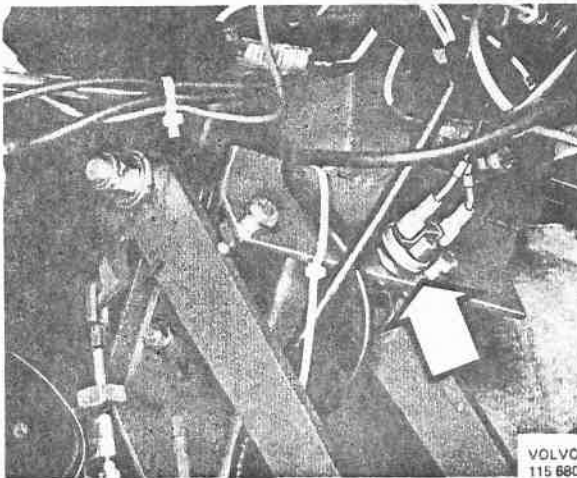


Fig. 38-19. Contact for stop lights

2. Fix the contact to the bracket and connect up the cables.

Adjusting

In order for the contact to function properly and not be damaged, it must have a certain position in relation to the brake pedal. The distance between the pedal in the rest position and the brass sleeve on the contact should be 2-6 mm, see Fig. 38-20. With any other value, remove the nuts and move the contact until the correct distance is obtained. Then tighten up the nuts.

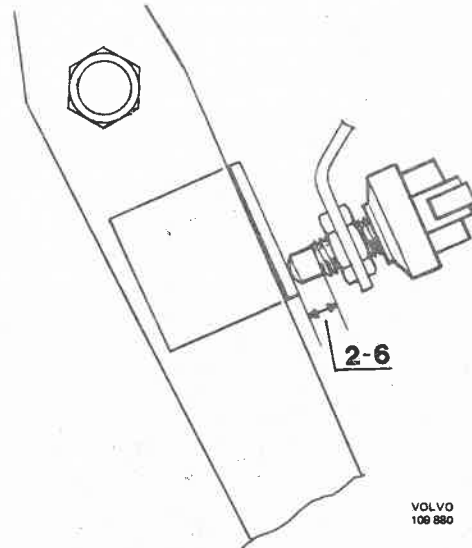


Fig. 38-20. Contact for stop lights, adjustment measurement

CONTACT FOR PRESSURE DIFFERENCE IN BRAKE CIRCUITS

Replacing

1. Disconnect the cable and screw off the old contact.
2. Screw on a new contact carefully in the warning valve. The tightening torque is approx. 15 Nm (1.5 kpm = 11 lbf·ft). Connect up the cable, see Fig. 38-21.

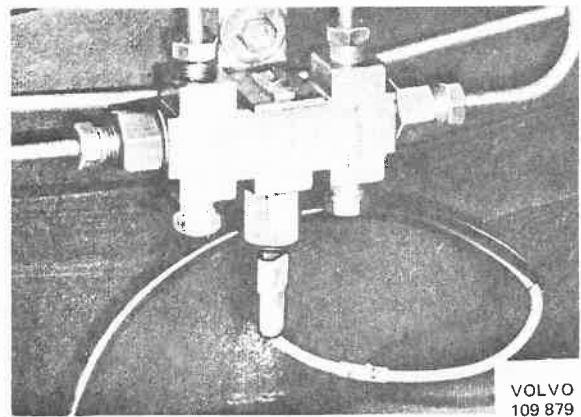


Fig. 38-21. Contact for pressure difference in brake circuits

CONTACT FOR BRAKE PEDAL TRAVEL

Replacing

1. Disconnect the cable and remove the nut securing the contact to the bracket.
2. Fit the new contact on the bracket and connect up the cable.

Adjusting

The contact should produce a warning when there is about 90-100 mm (3.5-4.0 ") left of the pedal travel, measured at the centre of the footplate. Since this normally can only be checked when bleeding the system, the position of the contact can be checked instead by measuring the distance between the pedal bracket and the contact pin with the contact in the rest position, see Fig. 38-22. This distance should be 15-17 mm (0.6-0.7 "). If the actual distance differs from this, slacken the nut and move the contact until the correct distance is obtained. Thereafter tighten up the nut.

The contact is re-set from the warning position by pushing back the contact pin to the rest position.

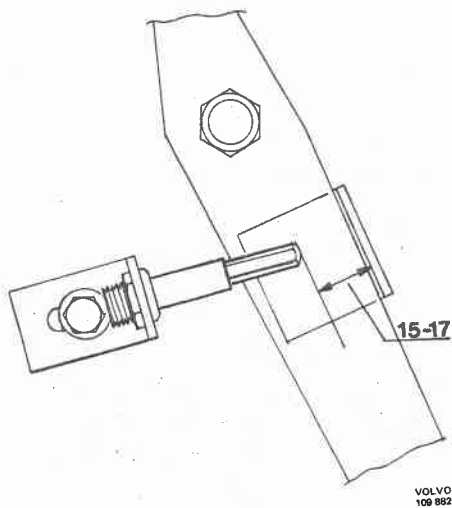


Fig. 38-22. Contact for brake pedal travel, adjustment measurement

CONTACT FOR PARKING BRAKE

Replacing

1. Remove the inspection cover.

2. Disconnect the cable and remove the nut holding the contact, see Fig. 38-23, to the bracket.

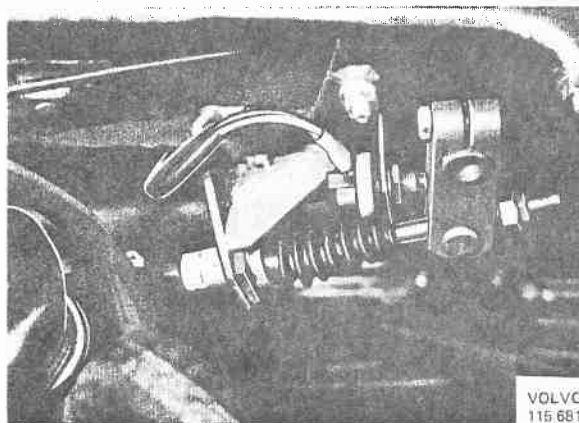


Fig. 38-23. Contact for parking brake

3. Fit the new contact and connect up the cable. The contact should cut in the circuit to the warning lamp marked "Brake" on the instrument panel at the second or third ratchet. Re-fit the inspection cover.

CONTACT FOR REVERSE LIGHTS

Replacing

1. Remove the plate over the gearbox.
2. Disconnect the cable and remove the contact, see Fig. 38-24.

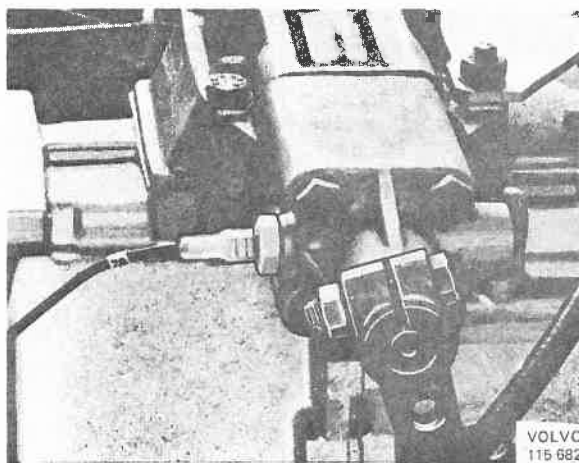


Fig. 38-24. Contact for reverse lights

3. Fit the new contact and connect up the cable.
4. Re-fit the plate over the gearbox.

CONTACT FOR CHOKE

Removal

1. Remove the cover over the batteries and disconnect the negative cable from the battery.
2. Release the two right screws holding the instrument panel so much that the panel for the choke control, etc., can be lifted forwards.
3. Disconnect the cable and remove the contact.

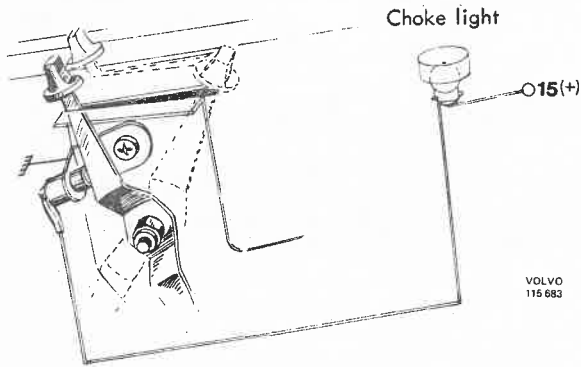


Fig. 38-25. Contact for choke

Installing

1. Fit the contact and connect up the cable.
2. Re-fit the panels. Before screwing the panels tight, connect the negative cable to the battery and check that the light marked "Choke" goes on when the lever for the choke control is moved to the one side (the ignition must be in circuit).
If necessary disconnect the negative cable from the battery and adjust the position of the contact.
3. Screw tight the panels (connect up the negative cable from the battery if disconnected) and fit the cover over the batteries.

VACUUM CONTACT FOR DIFF. CARRIERS

Replacing

1. Disconnect the cable from the contact, see Fig. 38-26.
2. Remove the contact.
3. Fit the new contact and connect up the cable.

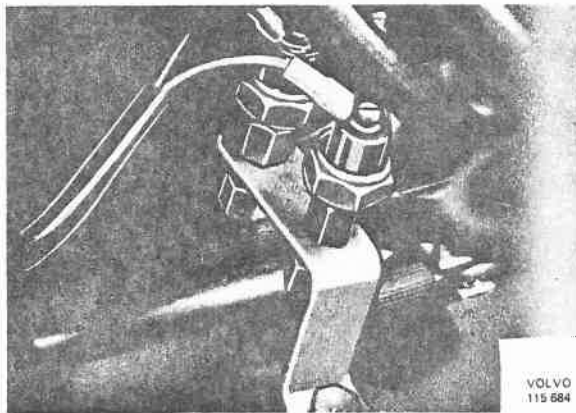


Fig. 38-26. Vacuum contact for diff. carriers

CONTACT FOR FRONT-WHEEL DRIVE (below instrument panel)

Replacing

Have a new contact and washer ready. Disconnect the cable and screw out the contact, see Fig. 38-27. Rapidly fit the new contact and washer. Connect up the cable. Check the level in the brake fluid reservoirs and test the brakes.

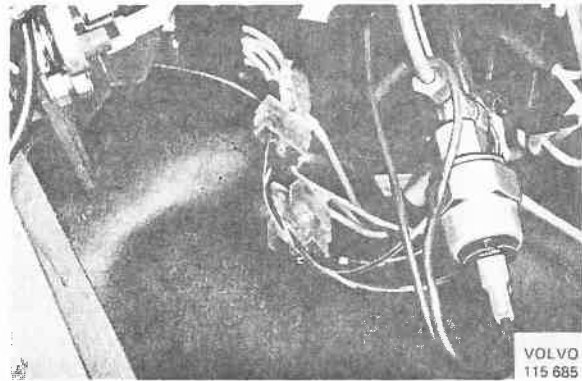


Fig. 38-27. Contact for front-wheel drive

CONTACT FOR FRONT-WHEEL DRIVE (at distributing gearbox)

Removal

1. Remove the plate over the gearbox.
2. Mark and disconnect the cables from the contact, see Fig. 38-28.
3. Remove the contact and the copper washer.

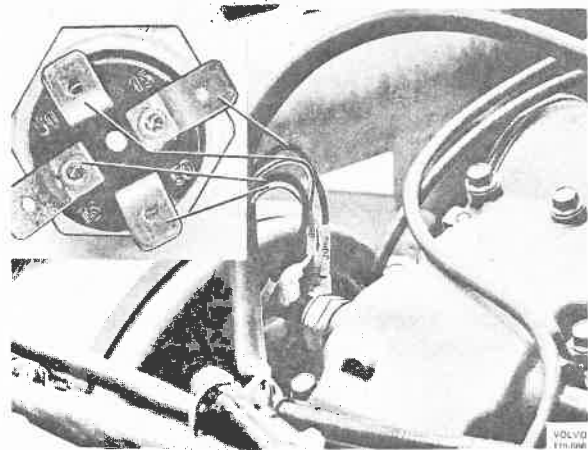


Fig. 38-28. Contact for front-wheel drive at distributing gearbox

Installing

1. Fit and screw tight the contact together with a new copper washer.
2. Connect up the cables according to the marking.
3. Re-fit the plate over the gearbox.

INDICATOR/WARNING LIGHTS

Changing the bulbs

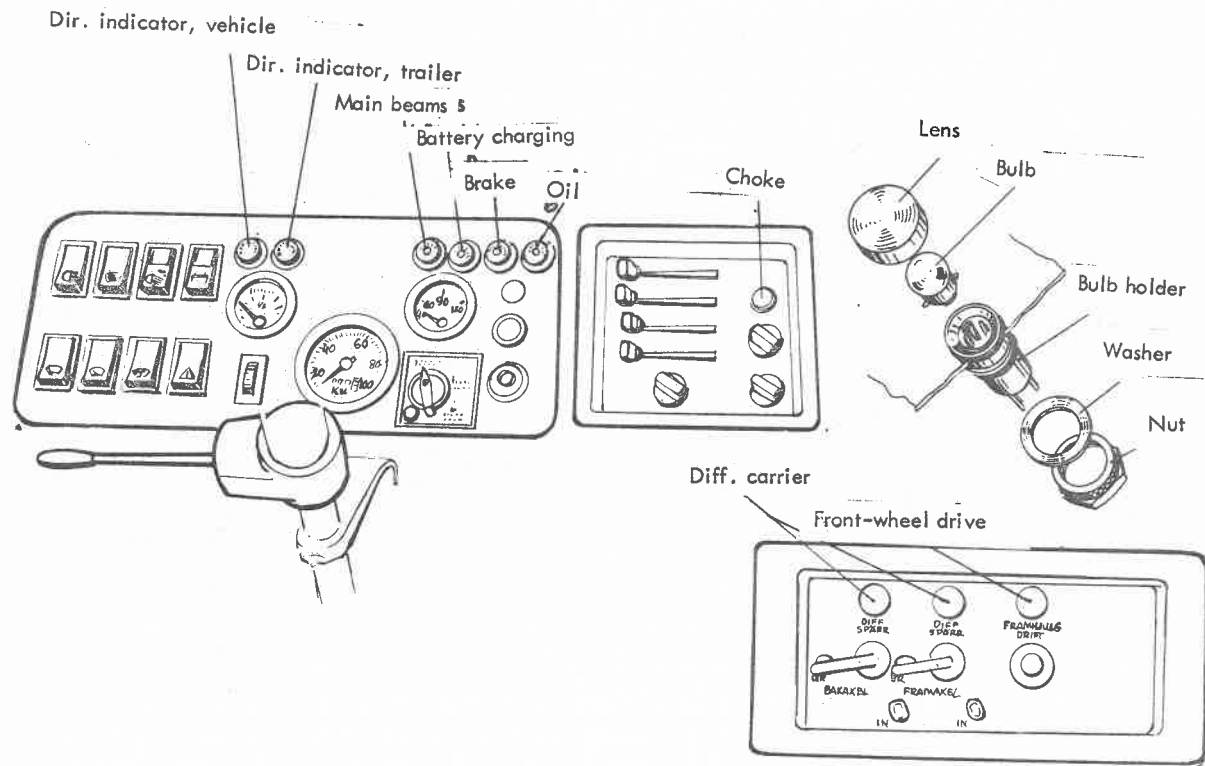
1. Unscrew the indicator/warning light lens and remove the bulb.
2. Fit a new bulb and screw on the lens.

Removing indicator/warning light

1. Remove the cover over the batteries and disconnect the negative cable from the battery.
2. Unscrew the indicator/warning light lens.
3. Mark the cables and disconnect them from the indicator/warning light.
4. Unscrew the nut securing the indicator/warning light and pull out the light from the panel.

Installing indicator/warning light

1. Fit the new indicator/warning light and tighten it up on the instrument panel with the nut.
2. Connect up the cables according to the marking.
3. Fit a new bulb if necessary and screw on the lens.
4. Connect up the negative cable to the battery and fit the cover over the batteries.



VOLVO
115 671

Fig. 38-29. Indicator/warning lights

LIST OF COMPONENTS

The letter and digit given in brackets indicates the square where the component is located.

1. Black-out light, right	(A 1)	43. Fuel gauge	(B 3)
2. Two-pole socket with cap	(A 1)	44. Rheostat	(B 3)
3. Parking and direction indicator light, right	(A 1)	45. Switch, battery heater	(B 4)
4. Step relay	(A 1)	46. Switch, dipped beams automatic mechanism	(B 4)
5. Two-pole socket with cap	(A 1)	47. Switch, headlamp wipers and washers	(B 4)
6. Main beams lamp, right	(A 1)	48. Light switch	(B 4)
7. Windscreen wiper motor, right	(A 2)	49. Hazard warning light switch	(B 4)
8. Horn	(A 2)	50. Switch, windscreen washer	(B 4)
9. Contact, choke	(A 2)	51. Switch, windscreen wiper, right-hand side	(B 4)
10. Oil pressure warning light	(A 2)	52. Switch, windscreen wiper, left-hand side	(B 4)
11. Battery charging warning light	(A 3)	53. 6-pole pin insulator	(C 1)
12. Windscreen washer motor	(A 3)	54. 6-pole socket insulator	(C 1)
13. Headlamp wiper motor, right	(A 3)	55. Courtesy light	(C 2)
14. Brake warning light	(A 3)	56. Fuse box, B	(C 2)
15. Direction indicator light, trailer	(A 3)	57. Fuse box, A	(C 2)
16. Direction indicator light, vehicle	(A 3)	58. Oil pressure contact	(C 2)
17. Flasher unit	(A 3)	59. Front-wheel drive contact at distr. gearbox	(C 2)
18. Brake pedal travel contact	(A 3)	60. Two-pole socket with cap	(C 2)
19. Headlamp wiper motor, left	(A 4)	61. Stop lights contact	(C 2)
20. Windscreen wiper motor, left	(A 4)	62. Coolant temperature sender	(C 3)
21. Relay, windscreen wiper motor	(A 4)	63. Contact for front wheel drive (on brake line)	(C 3)
22. Headlamp, left	(A 4)	64. Contact for parking brake	(C 3)
23. Parking and direction indicator light, left	(A 4)	65. Contact for pressure difference in brake circuits	(C 3)
24. Black-out light, right	(A 4)	66. Direction indicator lever	(C 4)
25. Two-pole socket, with cap	(A 4)	67. Terminal board, 6 units	(D 1)
26. Windscreen washer motor	(A 4)	68. Courtesy light	(D 1)
27. Relay, dipped beams automatic mechanism	(B 1)	69. Relay, reverse lights	(D 1)
28. Relay, main beams flasher	(B 1)	70. Contact, reverse lights	(D 1)
29. Relay, parking lights	(B 1)	71. Charging regulator	(D 2)
30. Relay, windscreen wiper motor, right-hand side	(B 2)	72. Alternator	(D 2)
31. Two-pole socket for Lufor receiver	(B 2)	73. Switch, front-wheel drive	(D 2)
32. Coupé heater motor	(B 2)	74. Indicator light, front-wheel drive	(D 2)
33. Choke light	(B 2)	75. Indicator light, diff. carrier	(D 2)
34. Switch, coupé heater	(B 2)	76. Vacuum contact, diff. carrier	(D 2)
35. Socket and pin insulator	(B 2)	77. Spark plug	(D 2)
36. Starter button	(B 2)	78. Damper resistance	(D 2)
37. Main beams indicator light	(B 2)	79. Distributor	(D 2)
38. Ignition switch	(B 3)	80. Connection socket, auxiliary aid in starting	(D 2)
39. Switch, black-out	(B 3)	81. Condenser	(D 2)
40. Coolant temperature gauge	(B 3)	82. Advance engaging resistor	(D 3)
41. Horn button	(B 3)	83. Ignition coil	(D 3)
42. Speedometer	(B 3)	84. Starter motor	(D 3)
		85. Relay, battery heater	(D 3)
		86. Relay, start	(D 3)
		87. Coupé heater motor	(D 3)
		88. Solenoid, front-wheel drive	(D 3)
		89. Temperature contact, battery heater	(D 3)
		90. Batteries	(D 3)
		91. Battery heater	(D 3)
		92. Combined tail lamp, right-hand side	(E 1)
		93. 12-pole socket	(E 1)
		94. Fuel tank level sending unit	(E 3)
		95. Combined tail lamp, without socket	(E 3)
		96. Reverse spotlight	(E 3)



