Service Manual

SECTION 3

Electrical system
and
instruments

164

Service school

VOLVO

Not for sale

INDEX

GROUP 30

GENERAL

The electrical system is designed for a voltage of 12 V. The equipment can be divided up into the following main parts: Battery, alternator and voltage regulator, starter motor, ignition system, lighting, remaining electrical standard equipment and instruments.

GROUP 31

BATTERY

GENERAL INFORMATION

The battery, Fig. 3-1, is placed on a shelf to the right of the radiator. The battery is a 12 V lead battery with a capacity of 60 Ah and with the negative pole stud-grounded.

SERVICE PROCEDURES

REMOVAL

1. Remove the cable terminals from the battery terminal studs. Use a puller if the cable terminals are stuck to the terminal studs.
2. Remove the securing bar and lift up the battery.
3. Clean the battery with a brush and rinse it with clean tepid water.
4. Clean the battery shelf and cable terminals. Use a special steel brush or pliers for the cable terminals.

INSTALLATION

1. Place the battery in position.
2. Install the securing bar and secure the battery.
3. Tighten the cable terminals on to the terminal studs. Coat the cable terminals and terminal studs with vaseline.

SERVICE

In order for the battery to function satisfactorily, the acid must be maintained at the prescribed level. Make sure that the level is about 5 mm ($^3/_{16}$") above the plates. If the level is too low, fill up with **distilled** water as necessary. Ensure also that the battery is thoroughly secure and the cable terminals firmly in position.

The cable terminal studs should be coated with a thin layer of vaseline to prevent oxidation.

VOLVO 105 433

Fig. 3-1. Battery

ALTERNATOR

GENERAL INFORMATION

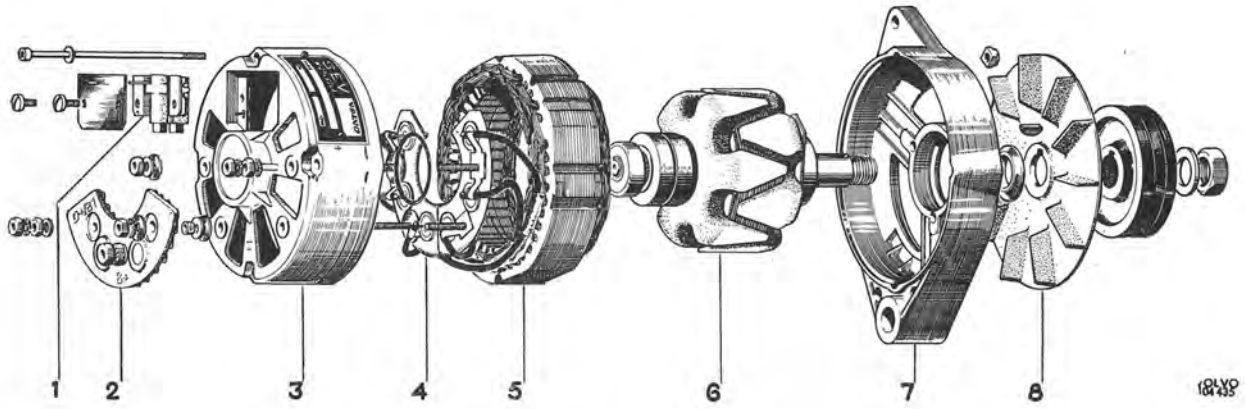


Fig. 3-2. Exploded view of alternator

1. Brush holder
2. Magnetizing diodes with holder
3. Slip ring and shield
4. Rectifier (silicon diodes)
5. Stator
6. Rotor
7. Drive end shield
8. Fan

The alternator is a three-phase, deltaconnected alternator unit which is located on the right-hand side of the engine and is driven by a V-belt from a pulley on the crankshaft. The alternator has a rectifier built into the slip ring end shield. This rectifier consists of six silicon diodes. The alternator has a rotating field (rotor) and stationary generating windings (stator).

The rotor is of the claw-pole type with the field windings fed over the slip rings. The construction of the rotor has made it possible for the alternator to have a max. speed of 250 r/s (15 000 r/m).

The magnetizing diodes (2, Fig. 3-2), which are placed on the outside of the alternator, have two functions: They prevent the battery from discharging through the regulator and alternator field, and they provide a simple means of operating the charging warning lamp.

The alternator is self-limiting (max. 55 amps.) and for this reason a simple voltage regulator can be used with only voltage control.

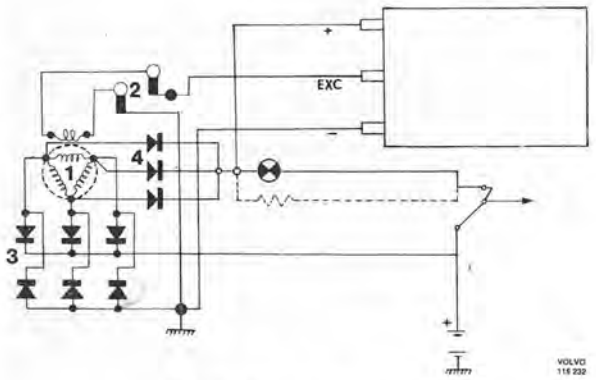


Fig. 3-3. Alternator inner circuit

1. Stator
2. Slip ring and brush holder
3. Rectifier diodes
4. Magnetizing diodes

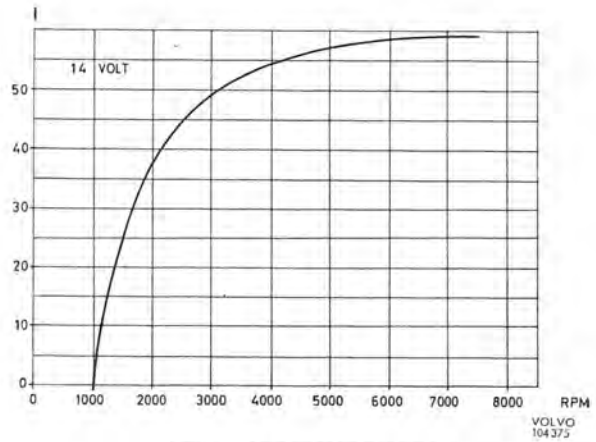


Fig. 3-4. Alternator output curve

SPECIAL INSTRUCTIONS FOR WORK ON ALTERNATOR EQUIPMENT

1. When replacing or fitting the battery, make sure that the new battery is connected with the correct polarity.
2. Never run the alterantor with the main circuit broken. The battery and/or alternator and regulator leads must never be disconnected while the engine is running.
3. No attempt should be made to polarize the alternator since this is not necessary.
4. When charging the battery while installed in the vehicle, the negative battery lead should be disconnected.
5. A rapid charger should not be used as a help in starting.
6. When using an extra battery as an aid in starting, always connect it in parallel.
7. When carrying out any electric welding on the vehicle disconnect the negative battery lead as well as all the alternator leads. The welding unit should always be connected as near as possible to where the welding is to be carried out.

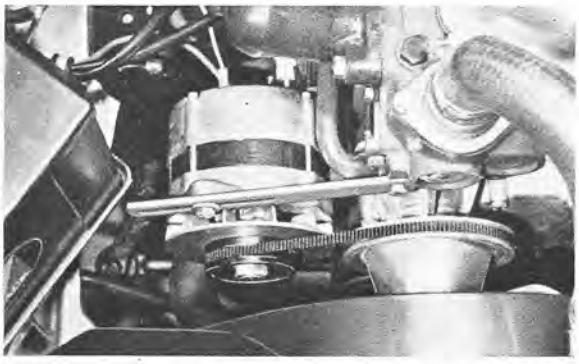
REMOVING ALTERNATOR

1. Disconnect the negative lead to the battery.
2. Disconnect the leads to the alternator.
3. Remove the bolt for the adjusting bar.
4. Remove the bolt holding the alternator to the engine block.
5. Remove the fan belt and lift the alternator forwards.

DISASSEMBLING ALTERNATOR

1. Release the two screws holding the brush holder. Pull out the brush holder.
2. Remove the nut and washer. Lift off the pulley, fan, key and spacer washer.
3. Remove the nuts and washers on terminal 61.
4. Mark the drive end shield, stator and slip ring end shield to avoid confusion when assembling. Remove the four attaching screws.
5. Remove the stator and slip ring end shield with the help of two screwdrivers, which are inserted in two of the sockets between the stator and drive end shield, see Fig. 3-7.

   NOTE. The screwdrivers may not be inserted deeper than 2 mm (just over $^1/_{16}$"), otherwise the stator may be damaged.
6. Release the three screws holding the support plate of the drive end bearing. Release the bearing by knocking the end of the shaft against a piece of wood, see Fig. 3-8.
7. Remove the nuts and washers for the diode-holders.
8. Remove the stator and diode holders for the slip ring end shield.

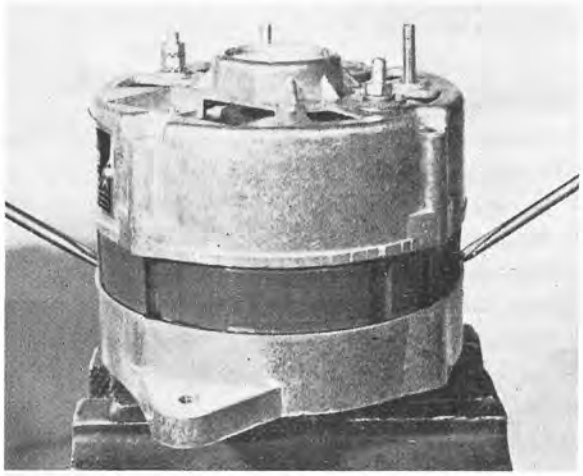


VOLVO 104469

Fig. 3-5. Alternator installed

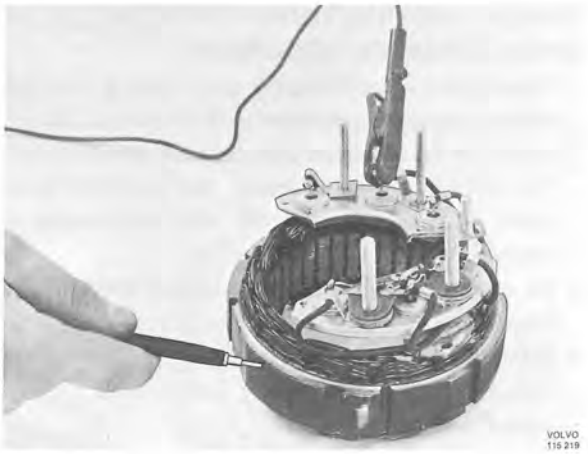
VOLVO 115 016

Fig. 3-6. Removing brush holder



VOLVO 104 471

Fig. 3-7. Disassembling alternator



VOLVO 115 219

Fig. 3-9. Checking stator

CHECKING DISASSEMBLED ALTERNATOR

STATOR

Check the stator for any short-circuiting. If one or several of the coils are burnt, there must be a shortcircuit in the stator. Connect a test lamp (12 V. 2—5 W) between the stator plates and a terminal on the stator, see Fig. 3-9.

If the lamp lights, the isolation between the stator winding and the stator plates must be burnt out, in which case the stator should be replaced.

NOTE. Only a 12 V. 2—5 W test lamp may be used; 110 or 220 V, D.C. or A.C. lamps may NOT be used. This applies to all the alternator components.

Check the diodes with a diode tester, see Fig. 3-10. If any of the rectifier diodes is faulty, the entire diode holder (with three diodes) must be replaced. If any of the magnetizing diodes is faulty, replace the holder, complete with magnetizing diodes.

If a diode tester is not available, the diodes should be soldered loose (see page 3 : 5) and tested with an ohmmeter. The diodes should have high resistance in reverse direction and low resistance in the flow direction.

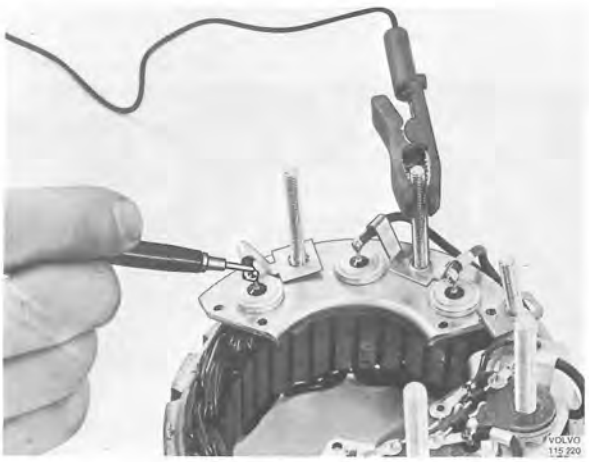
ROTOR

Check to make sure that the slip rings are not dirty or burnt.

Check the winding for breakage or damaged isolation. Measure the resistance between the slip rings, see Fig. 3-12. At 25°C (77°F) the resistance should be 3.7 ohms.

VOLVO 104 472

Fig. 3-8. Removing drive end shield



VOLVO 115 220

Fig. 3-10. Checking diodes

Fig. 3-11. Checking magnetizing diodes

If the slip rings are dirty, clean them carefully with a cloth moistened in trichloroethylene. The slip rings can also be polished with fine sand paper.

If the winding is faulty, the entire rotor must be replaced. Check the bearings. (The bearings should always be replaced when the alternator has been disassembled.)

BRUSH HOLDER

Connect a test lamp between the brushes. The lamp must not light.

Connect the test lamp between the DF-terminal and "+" brush. The lamp should give a steady light even if the brush or the terminal cable is moved see Fig. 3-13.

Connect the test lamp between the brush holder frame

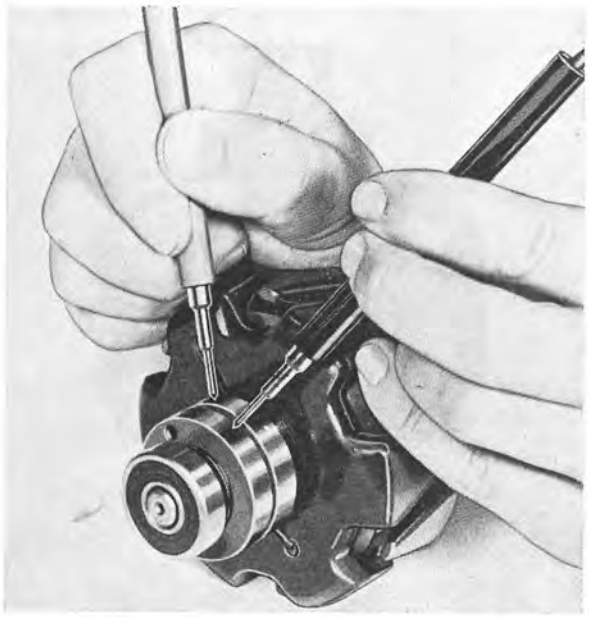


Fig. 3-12. Check-measuring rotor

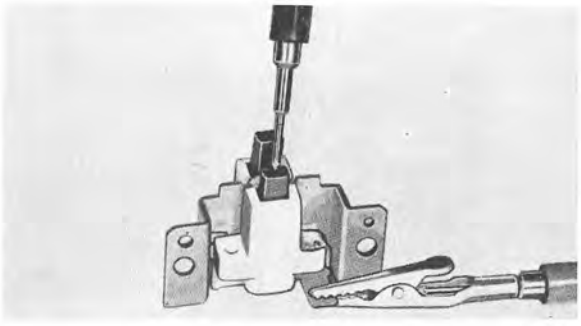


Fig. 3-13. Checking brush holder

"−" brush. The lamp should give a steady light even if the brush or the terminal lead is moved.

If the brush holder does not meet the above requirements or if the brush length is less than 5 mm (approx. $^3/_{16}$"), then replace the brush holder.

The brush length is measured between the brush contact surface and holder, with the brush resting against the spring, see Fig. 3-14.

REPLACING RECTIFIER DIODES

1. Mark the leads connecting the stator to the diodes. Solder loose the leads.
2. Place the new diode holder in exactly the same position occupied by the old one. Hold the outgoing diode lead with a pair of flat pliers. (This is to conduct the heat from the soldering point so as not to damage the new diode.)
3. Solder on the diodes, see Fig. 3-15.
   NOTE. The complete "+" or "−" diode holder must be replaced even if only one diode is faulty.

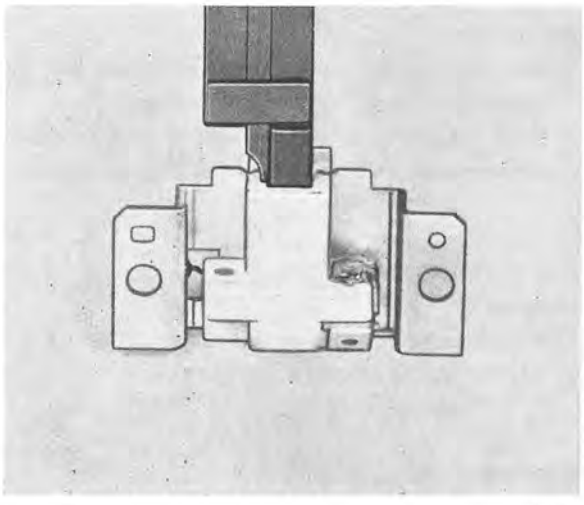


Fig. 3-14. Measuring brush length

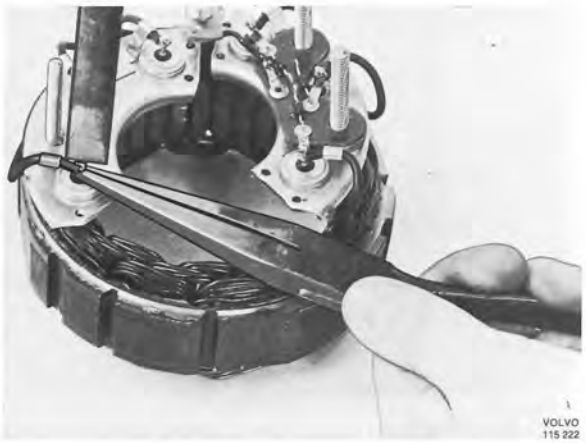


Fig. 3-15. Soldering on diodes

Use a well-heated soldering iron, minimum 100 W for the soldering.

Never change places for the two diode holders. The **positive diode holder** is isolated from the frame by means of isolation washers and sleeves and its diodes are marked in **red.**

The **negative diode holder** is not isolated and its diodes are marked in **black.**

REPLACING BEARINGS

DRIVE END SHIELD BEARING

Removal

1. Place the rotor in a vise with soft jaws.
2. Pull the bearing off with a claw puller, see Fig. 3-16.

Installation

1. Place the support plate on the rotor shaft with the three elevations facing the rotor winding.
2. Press the bearing in with the help of a tubular sleeve which presses on the bearing inner ring, see Fig. 3-17.

SLIP RING END BEARING

Removal

1. Place the rotor in a vise with soft jaws.
2. Pull the bearing off with a claw puller.

Installation

1. Press the bearing on with a tubular sleeve which presses on the bearing inner ring.

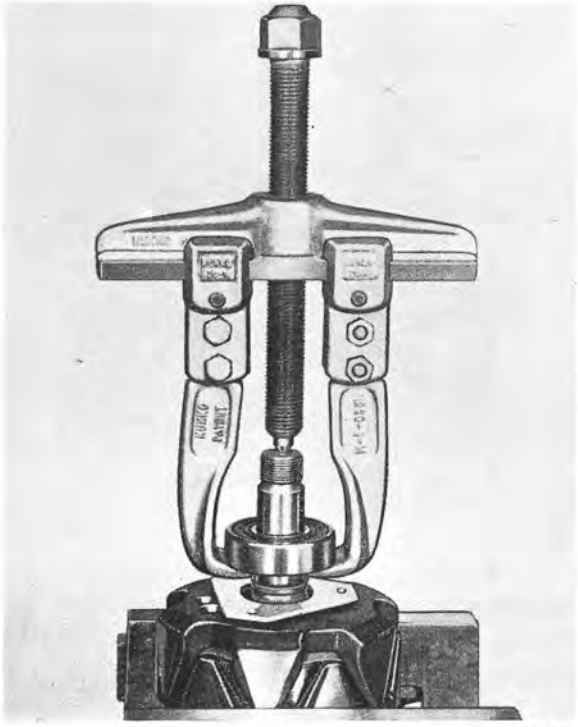


Fig. 3-16. Removing bearing

REPLACING SLIP RING END SHIELD O-RING

1. Remove the O-ring with a steel blade with rounded edges (for example, a feeler gauge), see Fig. 3-18.
2. Wash the groove clean.
   Check that the hole in the bearing shield is not blocked.
3. Fit a new O-ring.
   Lubricate the O-ring and the hole with mineral oil or similar.

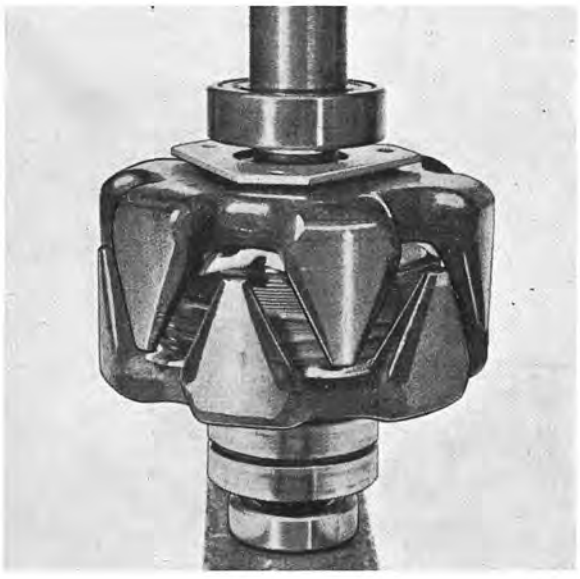
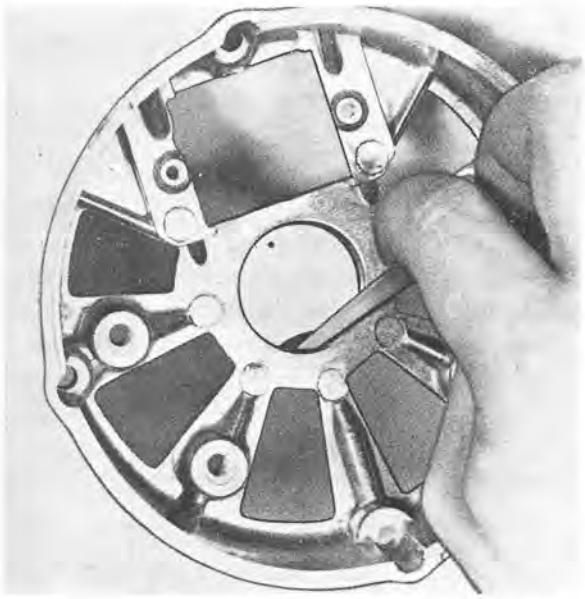


Fig. 3-17. Installing bearing



VOLVO
103019

Fig. 3-18. Removing O-ring

The O-ring should be replaced each time the alternator has been disassembled.

ASSEMBLING ALTERNATOR

1. Fit the stator and the diode holders in the slip ring end shield. (Do not forget the isolation washers for the positive diode holder). Fit the nuts and washers on the negative diode holder screws.
2. Press the rotor into the drive end shield. Fit the three screws for the drive bearing support plate.
3. Fit together the rotor and stator sections.
4. Fit the attaching screws. Tightening torque 2.8–3.0 Nm (0.28–0.30 kpm=2.0–2.2 lbft).
5. Fit the brush holder.

VOLVO
115 223

Fig. 3-19. Checking alternator

6. Fit the spacer washer, key, fan, pulley, washer and nut. Tightening torque 40 Nm (4 kpm=29.0 lbft).
7. Connect a test lamp between B+ and the alternator frame. Switch the terminals. The lamp should light only in one direction, see Fig. 3-19. After any repairs, the alternator should be test-run in a test bench.

INSTALLING ALTERNATOR

1. Place the alternator in position while fitting on the fan belt at the same time.
2. Fit the attaching bolts and tensioning iron without tightening up the bolts. Adjust the belt tension (see Section 2, Engine, Group 25) and secure the alternator. NOTE. Force may only be applied to the front end of the alternator when adjusting the belt tension. Fit the leads to the alternator.
4. Fit the battery lead.

VOLTAGE REGULATOR

GENERAL INFORMATION

Fig. 3-20. Voltage regulator fitted

The regulator, Fig. 3-20, is a twin contact regulator with a fixed upper contact, a movable contact and a fixed lower one. The movable contact is attached to an armature which is actuated by a voltage coil. The regulator also houses four resistors and one thermistor.

FUNCTION

When the ignition key is switched on, current flows through the charging warning lamp to +(61) on the regulator. It is then conducted via the regulator through the field winding to earth.

When the alternator starts rotating, alternating current is formed in the stator. This alternating current is rectified by the silicon diodes and the direct current produced is re-fed via the regulator to the field winding until the regulating voltage has been reached. When the regulating voltage has been reached the armature is attracted by the coil. This causes the contacts to open and the field current must pass the resistances R1, Fig. 3-21.

If in spite of this, the voltage rises, the armature is drawn further down and the movable contact meets the lower contact so that the field winding is earthed at both ends, this causing the voltage to drop rapidly. The cycle is repeated continuously so that the voltage is maintained constant.

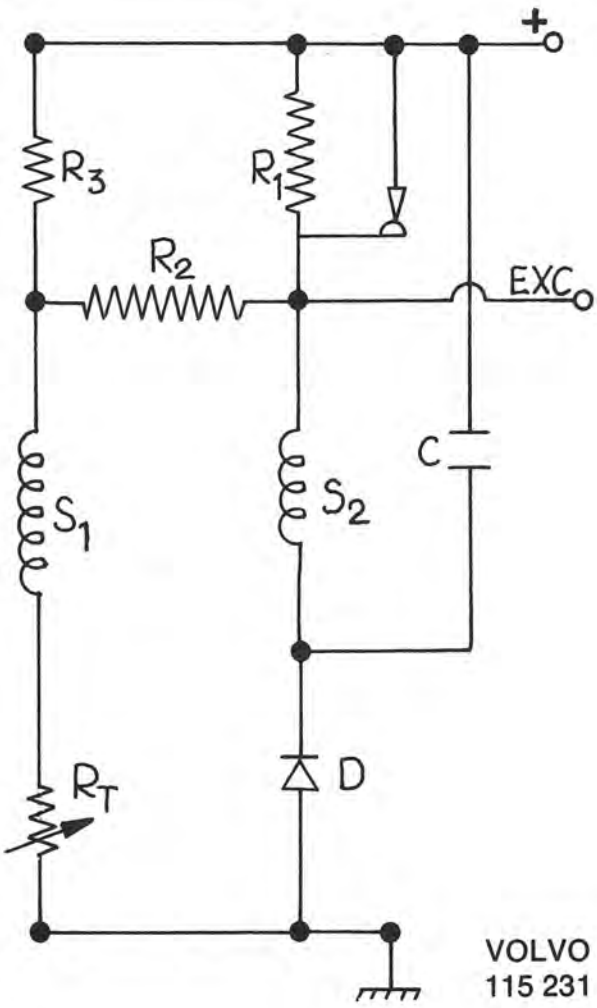


Fig. 3-21. Inner wiring of regulator
S1 Voltage winding
S2 Acceleration winding
R1 Regulator resistances (2) 10> ± 10 %
R2 Damping resistance 30> ± 10 %
R3 Compensation resistance (adapted to RT during manufacture)
RT Compensation thermistor approx. 4 > at 25°C (77°F)

TEST OF ALTERNATOR AND VOLTAGE REGULATOR

GENERAL

Fixed clamps should be used for all testing of the alternator equipment. So-called crocodile clamps should not be used as they have a certain tendency to loosen. A loose lead can result in the alternator and regulator being damaged. When about to connect up instruments, disconnect the battery first.

ALTERNATOR CIRCUIT TEST

Before carrying out any tests on the alternator or regulator in the vehicle check the battery and vehicle wiring system for damaged leads or insulation, loose or corroded lead terminals and poor earthing. **Check the fan belt** (see Section 2, Engine, Group 26). Any of the above faults must be remedied before the electrical checks can be started.

BATTERY TEST

Test the battery with a hydrometer and battery tester. If the battery is not fully charged, remove it from the car and charge it or replace it with a new one if necessary. A fully charged battery which is otherwise in good condition should always be used when testing.

VOLTAGE DROP TEST

This test is made to check the leads between the alternator and the battery and also the battery earth lead. The test should be carried out with a fully charged battery in good condition. The battery terminals should be well cleaned and tightened. Load the alternator with about 10 amps., meausre with a suitable voltmeter the voltage between the positive pole of the battery and B+ on the alternator. If the voltage at this test exceeds 0.3 volt, there is a fault in the lead or contact, which must be remedied immediately. After repairing the leads or contacts, measure the voltage drop between the negative pole of the battery and the alternator terminal D−. Here the voltage drop must not exceed 0.2 volt. If the voltage drop exceeds 0.2 volt, check the battery earth lead, the alternator contact with the engine and the engine contact with the chassis. After making the necessary repairs measure again.

ALTERNATOR TEST

(On a test bench or in the vehicle.)

Connect up the alternator as shown in Fig. 3-22. Check that the current through the field winding (ammeter C) is 3−3.5 amps. (If the current is not the correct one, then check the brush holder and field winding.) Run the alternator to a speed of 50 r/s (3000 r/m). Engine speed 25 r/s (1500 r/m).

The alternator should then produce at least 48 amps at 14 volts. (A further load may be connected up in order to maintain the voltage at 14 volts.) This applies to a warm alternator and an ambient temperature of 25°C (77°F).

Measure the voltage at B+ and 61 when the alternator charges.

The voltage should be 0.8−0.9 volt more than at terminal 61, otherwise the isolation diode is faulty and should be replaced.

VOLTAGE REGULATOR TEST

(On a test bench or in the vehicle.)

Connect up the alternator and regulator as shown in Fig. 3-23. Run the alternator at about a speed of 83 r/s (5000 r/m) engine speed 42 r/s (2500 r/m) for 15 seconds. Then read off the voltage on the voltmeter. With no load on the alternator, the voltmeter should read 13.1−14.4 volts with the regulator ambient temperature at 25°C (77°F).

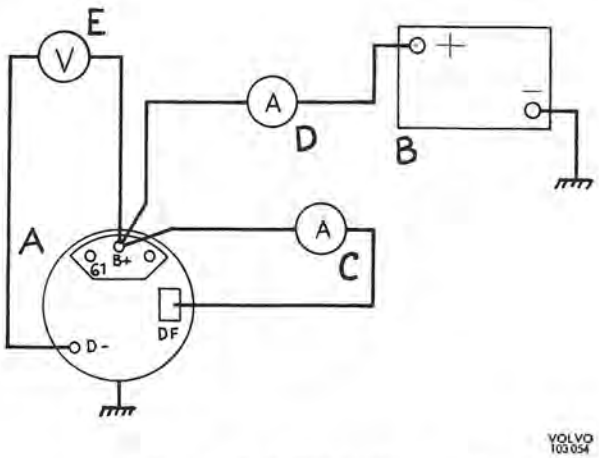


Fig. 3-22. Wiring diagram for testing alternator

A Alternator
B Battery 60 Ah
C Ammeter 0−10 amps.
D Ammeter 0−50 amps.
E Voltmeter 0−20 volts

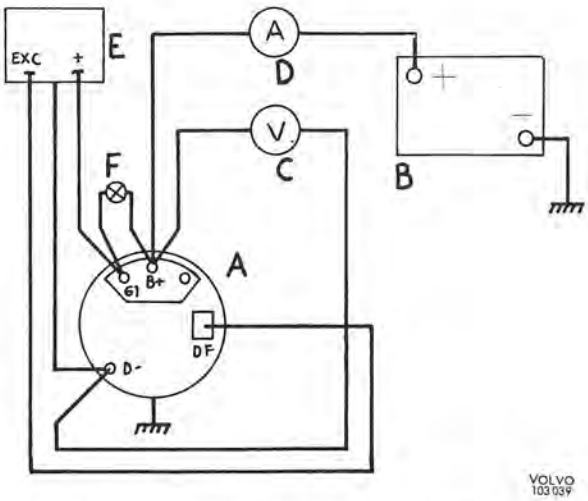


Fig. 3-23. Wiring diagram for testing voltage regulator

A Alternator
B Battery 60 Ah
Voltmeter 0–20 amps.
D Ammeter 0–50 amps.
E Voltage regulator
F Warning lamp 12 volts. 2 watts

Load the alternator with 10–15 amps, for example, full-beam headlights, and read off the voltage. The voltage should also lie on this occasion between 13.1–14.4 volts. For ambient temperatures other than 25°C (77°F), see the diagram in Fig. 3-24.

If the voltage is outside the tolerance limits, the regulator should be replaced.

If the voltage regulator is to be tested more accurately, install it in the vehicle which should then be driven for about 45 minutes at a speed above 50 kmph (30 mph).

The reason for the driving is to enable the regulator to obtain the correct working temperature.

NOTE. The vehicle must be driven. It is not sufficient just to have the engine idling.

Immediately after, or preferably during driving, measure the voltage between B+ and D– on the alternator. The engine should be turning over at about 25 r/s (1500 r/m),

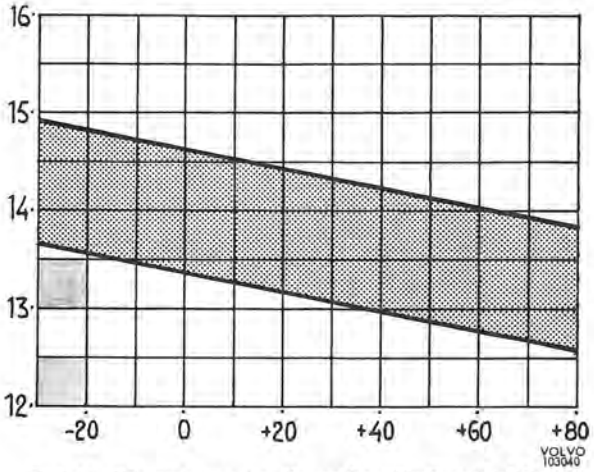


Fig. 3-24. Voltage-temperature diagram for cold voltage regulator

50 r/s (3000 alternator r/m) when the measuring is being carried out. When the regulator ambient temperature is about 25°C (77°F) the voltage should be 13.85–14.25 volts. For other ambient temperatures, see Fig. 3-25.

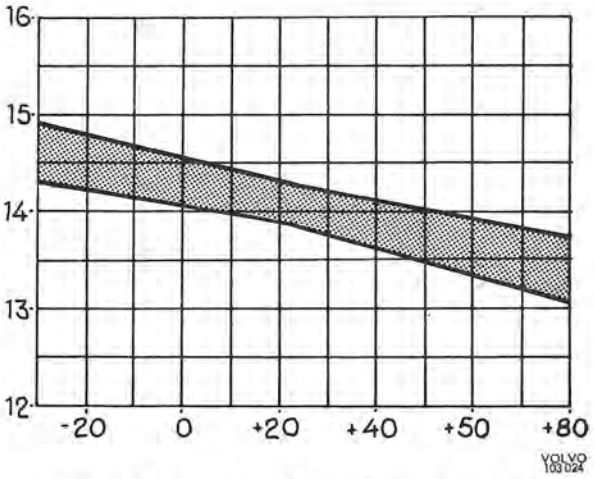


Fig. 3-25. Voltage-temperature diagram for warm voltage regulator

SERVICE DIAGNOSIS

CONDITION	POSSIBLE CAUSE
Alternator does not charge.	Worn or insufficiently tensioned fan belt. Breakage in charging circuit. Worn brushes. Breakage in rotor winding. Breakage in magnetizing diodes. Defective regulator.
Charging weak or irregular.	Worn or insufficnelty tensioned fan belt. Intermittent breakage in charging circuit. Worn brushes. Breakage or short-circuiting in one or several rectifier diodes. (Breakage in a diode reduces the charging current about 5 amps. Short-circuiting in a diode limits the alternator charging current to 7—8 amps and causes a rumbling sound in the alternator.) Rotor partly shorted. Stator broken or shorted. Defective regulator.
Too high charging.	Defective regulator. Defective terminals on regulator or alternator. Magnetizing diodes shorted.
Noise in alternator.	Worn fan belt. Loose pulley. Worn bearings. One or several rectifier diodes shorted. Alternator pulley incorrectly aligned in relation to the crankshaft pulley.
Charging warning lamp glows.	Voltage drop in fuse box.

STARTER MOTOR

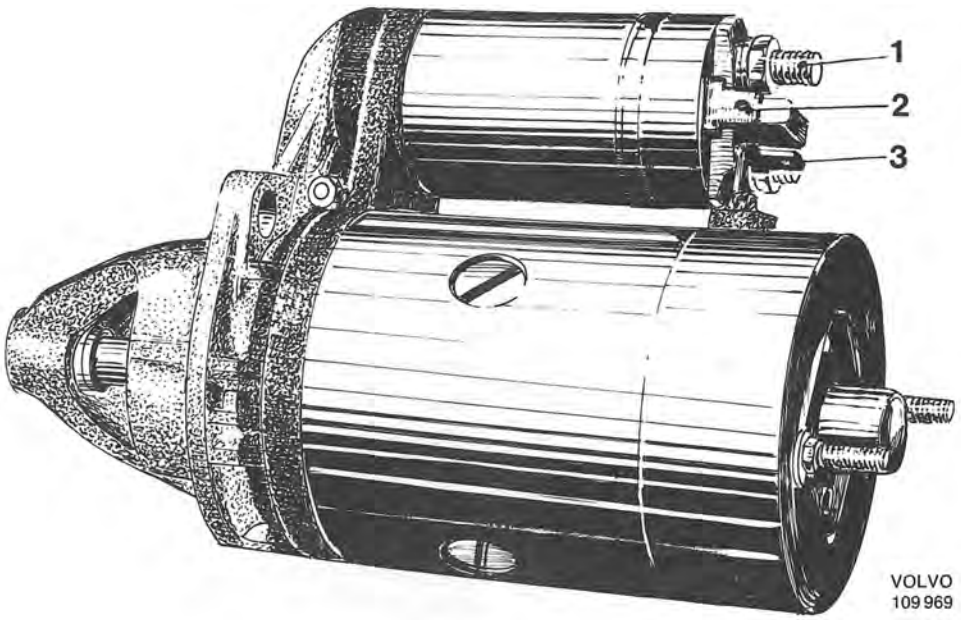


Fig. 3-26. Starter motor
1. + from battery
2. Terminal 16 (to ignition coil terminal 15)
3. Terminal 50 (to ignition switch)

GENERAL INFORMATION

The starter motor is mounted on the flywheel housing on the left-hand side of the engine. It consists of a four-pole series-wound motor. The starter motor rotor shaft pinion moves axially to engage with the flywheel ring gear. The pinion is controlled by a solenoid.

Turning the ignition key to the starting position cuts in the solenoid, causing the armature in the solenoid to be drawn in and the starter pinion to engage the ring gear on the engine flywheel.

When the armature has moved a certain distance, the contacts for the main current close and the starter motor starts running.

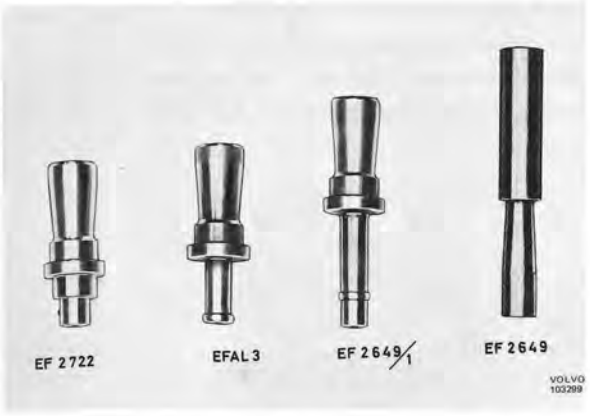


Fig. 3-27

SERVICE PROCEDURES

For those who so wish, Bosch supplies the following special tools:

EF 2722	Sleeve and drift for fitting circlip
EFAL 3	Smoothing drift
EF 2649/1	Smoothing drift
EF 2649	Drift for fitting bushing

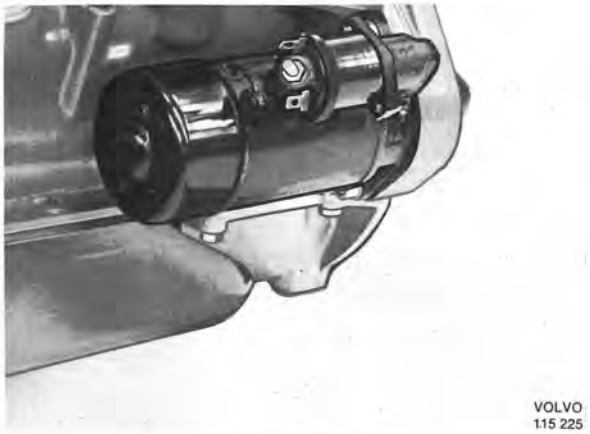


Fig. 3-28

REMOVING THE STARTER MOTOR

Disconnect the battery ground cable.

Disconnect the three leads from the starter motor.

Remove the bolts holding the starter motor to the timing gear housing and lift off the starter motor.

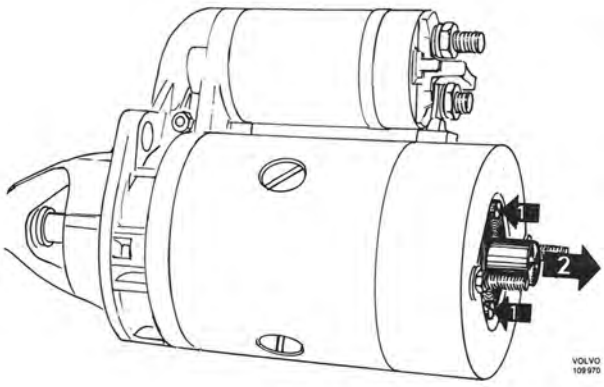


Fig. 3-29

STARTER MOTOR DISASSEMBLY

Unscrew both the screws securing the small cover on the front end of the shaft.

Remove the cover.

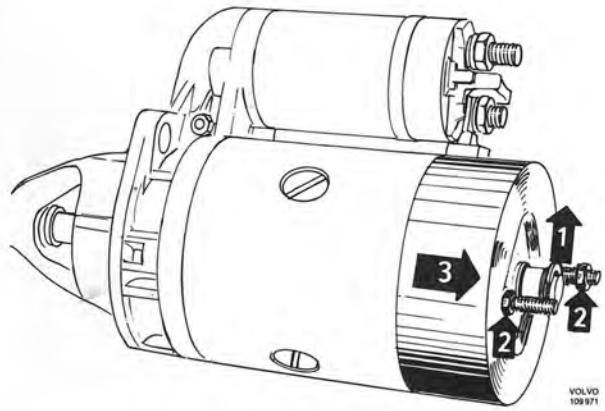


Fig. 3-30

Lift off the lock washer and adjusting washers.

Remove the two bolts holding the commutator end frame.

Remove the frame.

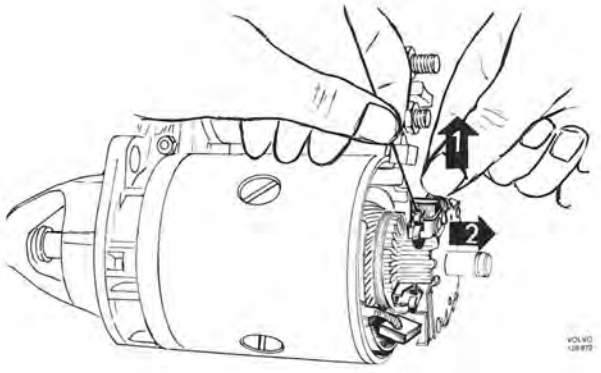


Fig. 3-31

Lift up the brushes and holders.
Remove the brush bridge from the rotor shaft.
When the bridge is removed, the negative brushes also follow, but the positive brushes will remain in the field winding.

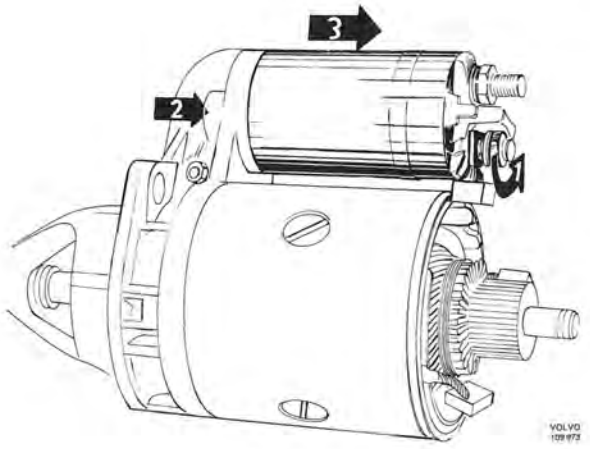


Fig. 3-32

Remove the nut holding the field terminal connection to the control solenoid.
Remove the screws securing the solenoid to the drive end frame.
Remove the solenoid.

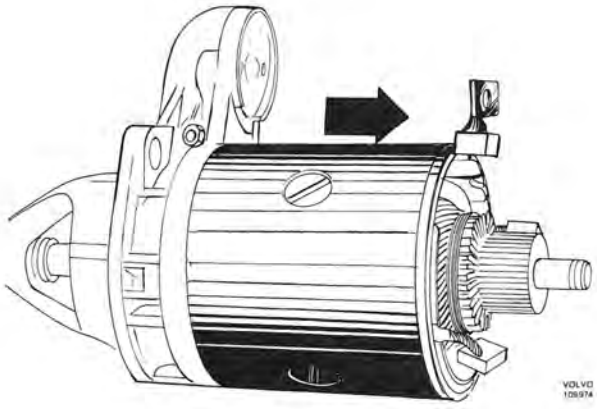


Fig. 3-33

Remove the stator from the drive end frame.

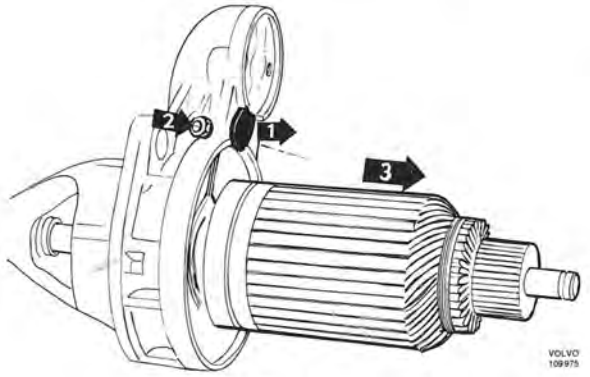


Fig. 3-34

Remove the rubber washer and metal washer.
Remove the screw on which the shift lever is carried.
Lift the armature with pinion and lever out of the drive end frame.

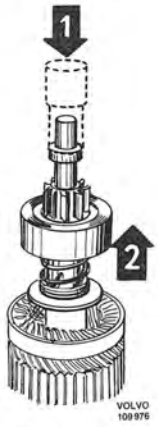


Fig. 3-35

Knock back the stop washer with the help of a suitable sleeve. Remove the snap ring, stop washer and armature shaft.

INSPECTION

Examine the armature for mechanical damage. If the armature shaft is bent or worn, the armature should be replaced.

If the commutator is scored or unevenly worn, it should be turned.

The commutator diameter must not be less than 33 mm (1.3″). After turning, the commutator should be checked with a micrometer. A radial throw of up to 0.08 mm (0.003″) is permitted.

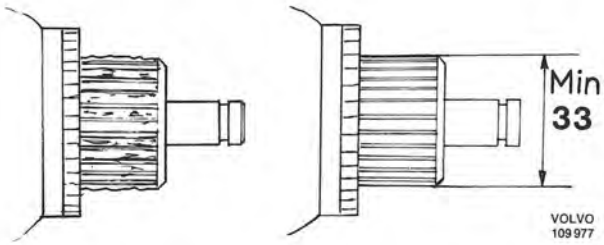


Fig. 3-36

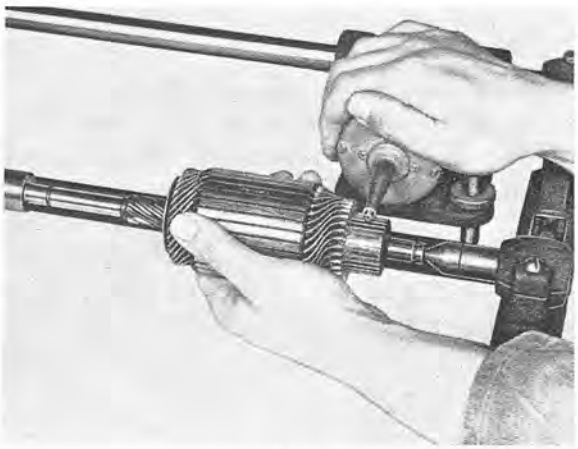


Fig. 3-37

The isolation between the laminations should be milled down to 0.4 mm (0.016″) below the surface of the laminations.

This work is carried out in a special apparatus, or if such is not available, with a ground-off hacksaw blade.

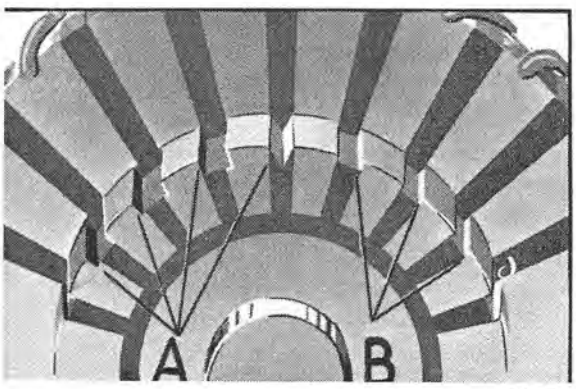


Fig. 3-38

A. Incorrectly milled.
B. Correctly milled.

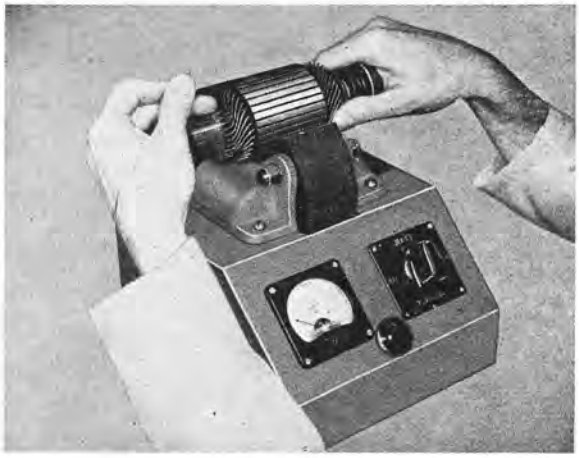


Fig. 3-39 VOLVO 24807

Examine the armature for shorts by placing it in a growler. Switch on and hold a hacksaw blade a few mm from the armature.

If the blade vibrates in any position when the armature is rotated, one of the following faults can be the reason: Shorting through the armature frame, shorting in the commutator or between the windings.

A shorted armature should be replaced by a new one.

Fig. 3-40 VOLVO 103306

Check the pole housing with 40 volts A.C.

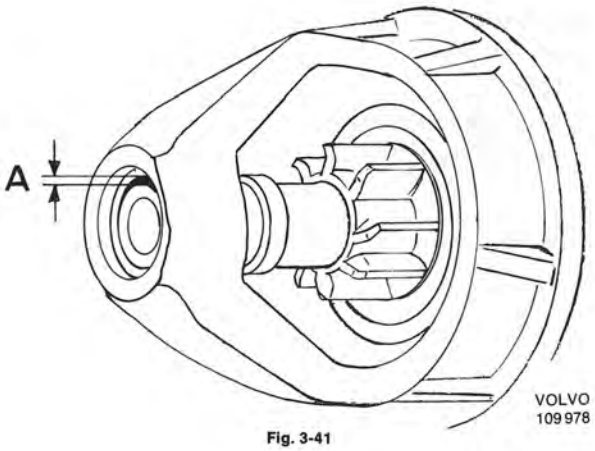


Fig. 3-41

Examine the drive end frame and brush holders.

If damaged of excessively worn, they must be replaced.

A bearing clearance "A" between the shaft and bushing of up to 0.12 mm (0.005") may be considered permissible.

Examine the other parts and replace any that are damaged or worn. The snap ring should always be replaced with a new one, since it may have been damaged or lost its tension when being removed.

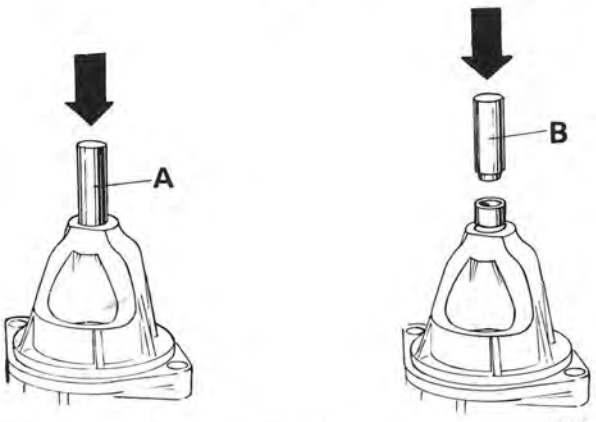


Fig. 3-42

REPLACEMENT OF SELF-LUBRICATING BUSHINGS

(Starter motor disassembled.)

Before the new bushings are installed, they should be immersed in oil (Bosch 01 1 V 13 or corresponding) for at least 1/2 hour. Otherwise they will wear rapidly and at worst seize.

The bushings are supplied with correct fit and should not be machined otherwise the pores may become blocked and deteriorate the self-lubrication.

Drive out the worn bushings with a suitable tool, A.

Clean the hole for the bushings and cut away any burr.

Press in the new bushings with a suitable drift, B.

REPLACEMENT OF FIELD COILS

(Starter motor disassembled.)

Mark the poles and pole housing in a suitable manner so that they are re-fitted in the same position.

Place the stator in the rotating clamping block (Bosch EFAW 9 or corresponding) and remove the pole screws. Remove the stator from the rotating clamping block and remove the pole shoes and field coils.

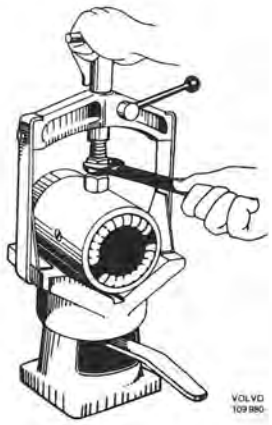


Fig. 3-43

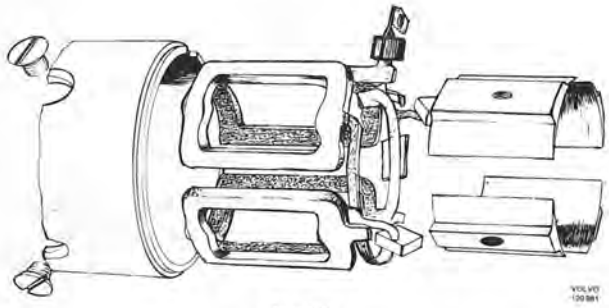


Fig. 3-44

Push in the new field coils and pole shoes into the stator. Before installing the field coils, warm them slightly. Make sure the pole shoes are located according to the marks.

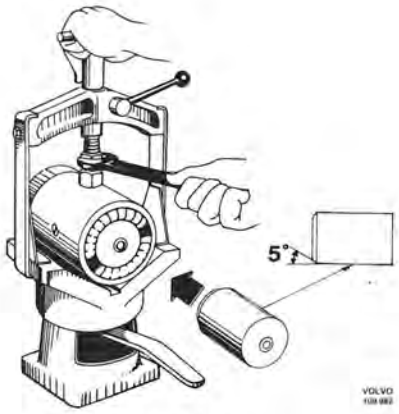


Fig. 3-45

Press in a suitable drift and place the stator in the rotating clamping block.

Tighten up the pole shoes.

Force out the press drift with a drift press.

Check the installed field coils for breakage and shorts.

REPLACEMENT OF BRUSHES

(Alternator removed.)

Brushes worn down less than 14 mm (approx. 1/2") should be replaced with new ones. Replacement is as follows:

1. Carry out steps 1 to 5 under "Disassembling alternator".
2. Heat the brushes loose from their respective attachments on the brush holder and field coils.
   This can be done rapidly with the help of a properly heated soldering iron.
3. Solder well the new brushes with a properly heated soldering iron.

The solder must not run down onto the brush wires, since this will impede the movement of the brushes in the brush holders.

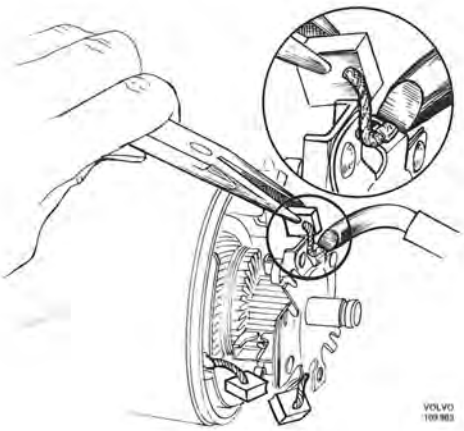


Fig. 3-46

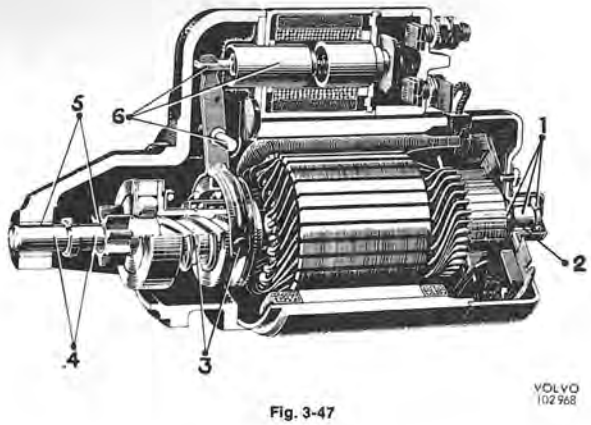


Fig. 3-47

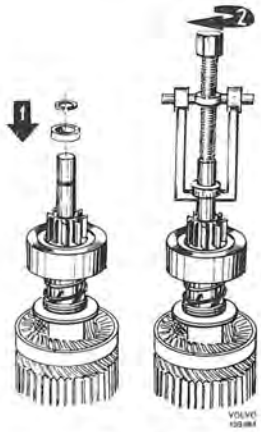


Fig. 3-48

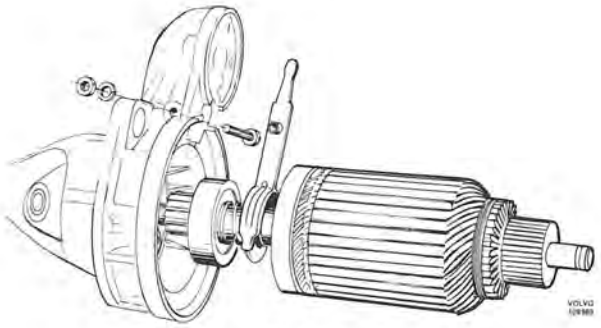


Fig. 3-49

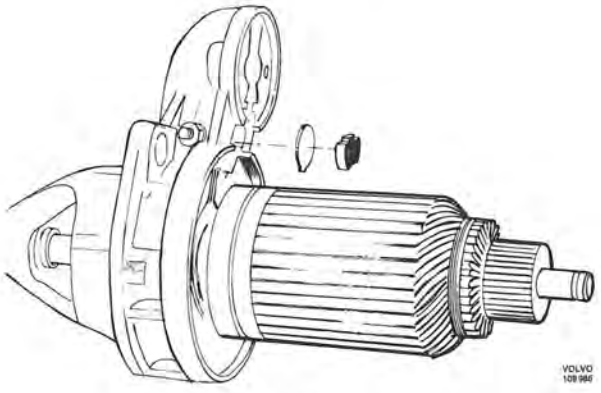


Fig. 3-50

STARTER MOTOR ASSEMBLY

Lubricate the parts of the starter motor according to the Fig. Use Bosch lubricant (or equivalent) in accordance with the following directions:

1. Ft 2 V 3 Place a thin layer of grease on the isolation washers, the shaft end, the adjusting washers and lock washer.
2. Ol 1 V 13 Place the bushing in oil for 1/2 hour before installation.
3. Ft 2 V 3 Apply plenty of grease to the armature thread and the engaging lever groove.
4. Ft 2 V 3 Place a thin layer of grease on the armature shaft.
5. Ol 1 V 13 Place the bushings in oil for 1/2 hour before installation.
6. Ft 2 V 3 Lubricate the engaging lever joints and the iron core of the solenoid with a thin layer of grease.

Install the starter pinion, the stop washer and snap ring. Pull the stop washer into position with a suitable puller.

Install the engaging arm on the starter pinion.
Install the armature in the drive end frame.
Install the screw for the engaging arm.

Install the metal washer and rubber washer on the drive end frame.

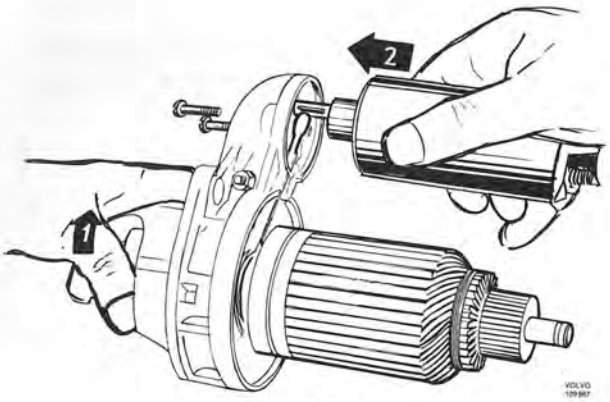


Fig. 3-51

Install the solenoid.

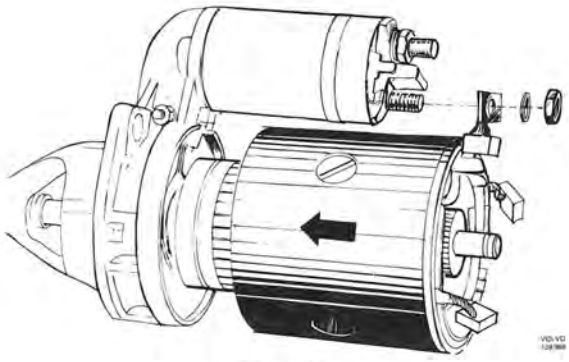


Fig. 3-52

Install the pole housing.

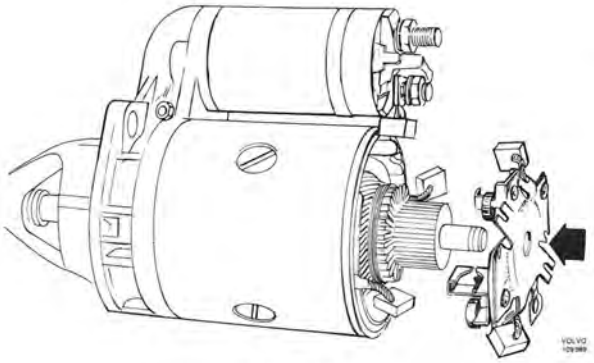


Fig. 3-53

Place the brush bridge in position.
Install the brushes.

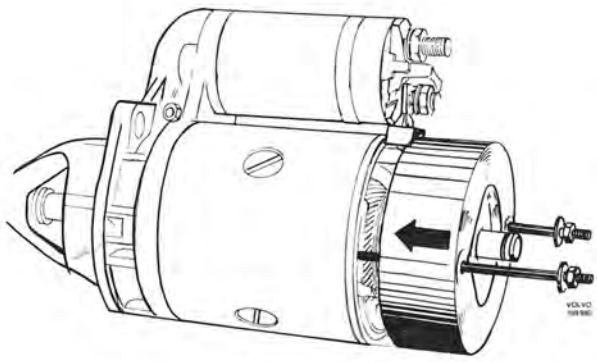


Fig. 3-54

Install the commutator bearing frame.
Screw the starter motor together with the two long bolts.

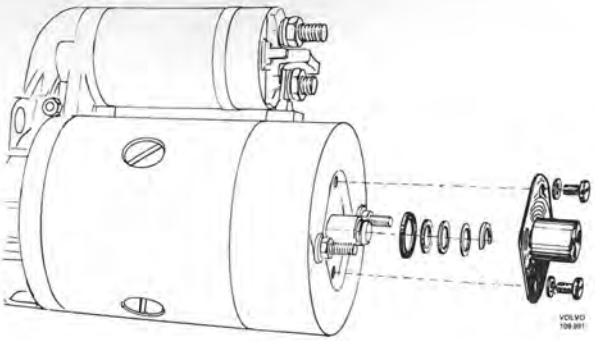
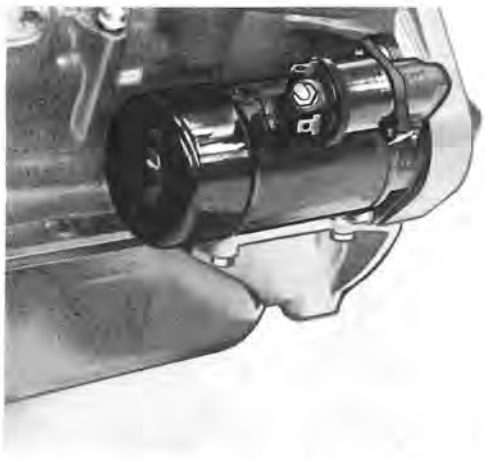


Fig. 3-55

Install the adjusting washers and the snap ring on the shaft end. Check that the armature axial clearance is 0.05–0.3 mm (0.002–0.012"). If necessary adjust with a suitable number of washers until the clearance is correct.
Screw tight the small casting over the shaft end.



VOLVO
115 225

Fig. 3-56

INSTALLATION OF STARTER MOTOR

Connect the electric cables to the starter motor.
Connect the ground cable to the battery.
Check the function by starting the motor.

GROUP 34

IGNITION SYSTEM

GENERAL INFORMATION

The ignition system is of the battery ignition type. It consists of the following main parts:
Ignition coil with advance engaging resistor, distributor, ignition leads and spark plugs.

IGNITION COIL

The ignition coil and advance engaging resistor are fitted on the bulkhead. In order to make sure that a completely satisfactory spark is obtained at high speeds, an ignition coil is fitted which is designed for a voltage lower than 12 volts. An advance engaging resistor is connected in series with the ignition coil for the purpose of lowering the voltage to the right value.
In order to raise the ingition voltage at the moment starting takes place, the advance engaging resistor is by-passed when the starter motor is engaged. The ignition coil is activated directly by the battery voltage via a contact on the starter motor (see wiring diagram). The advance engaging resistance has a resistance of 0.9 ohm.

DISTRIBUTOR

The distributor is mounted on the left-hand side of the engine, and is driven from the camshaft. The setting of the distributor in relation to engine speed is regulated by a centrifugal governor. Adjustment in relation to loading is controlled by a vacuum regulator mounted outside the distributor.

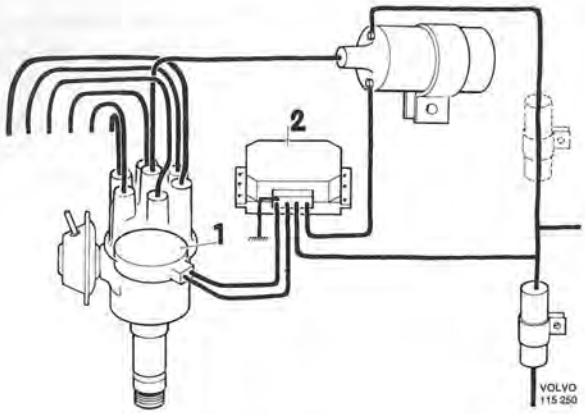


Fig. 3-57

BREAKERLESS SOLID STATE IGNITION SYSTEM

SUMMARY

The breakerless solid state ignition system differs from the conventional ignition system chiefly in two points:

1. The breaker points in the ignition distributor have been replaced by an induction type **impulse sender.**
2. An **electronic module** has been added. It is wired between the distributor and ignition coil. Its function is to amplify the impulses before sending them on to the ignition coil.

Otherwise the design and function are the same as for a conventional ignition system.

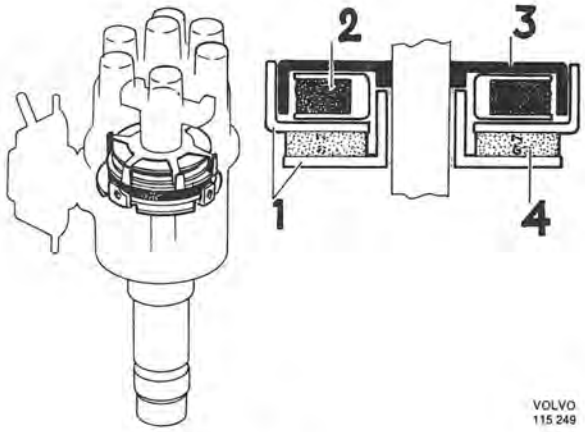


Fig. 3-58

SPECIFIC FUNCTION INFORMATION

(Contains only those differences compared with a conventional ignition system.)

IMPULSE SENDER

It is located in the distributor where the breaker points used to be.

Instead of closing and opening an electric circuit, the impulse sender functions as a small generator and consists of:

stator (1)

coil (magnetic pick-up) (2)

armature (rotor) (3)

permanent magnet (4)

The stator, coil and permanent magnet are connected to the ignition distributor housing while the armature is connected to the distributor shaft and rotates with it.

The stator and armature have as many pole teeth as the engine has cylinders.

The permanent magnet generates a magnetic field which goes through the stator. When the pole teeth are opposite each other, the magnetic circuit is closed, and opens when the pole teeth are separated. In other words, the armature closes and opens the magnetic field while it is rotating. This induces current pulses in the distributor coil (magnetic pick-up).

Vacuum and centrifugal control of the timing are similar to that in a conventional distributor.

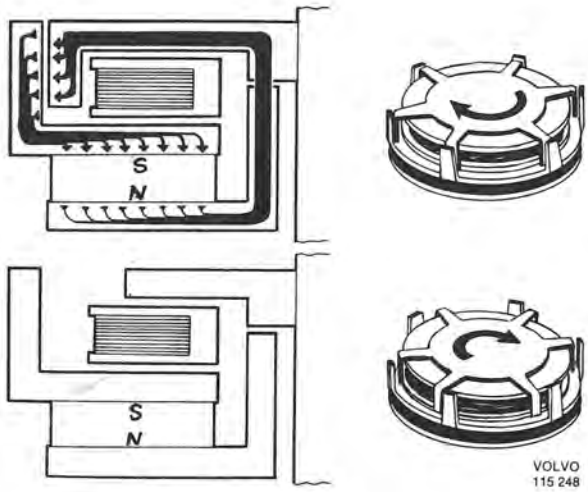


Fig. 3-59

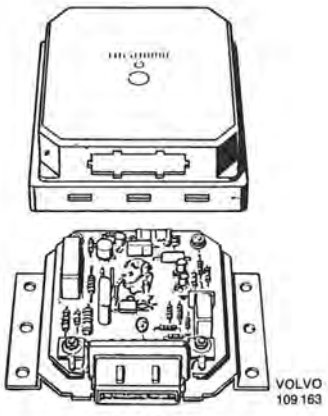


Fig. 3-60

The electronic module is a solid state design with transistors. It amplifies the impulses from the impulse sender and also controls the dwell angle.

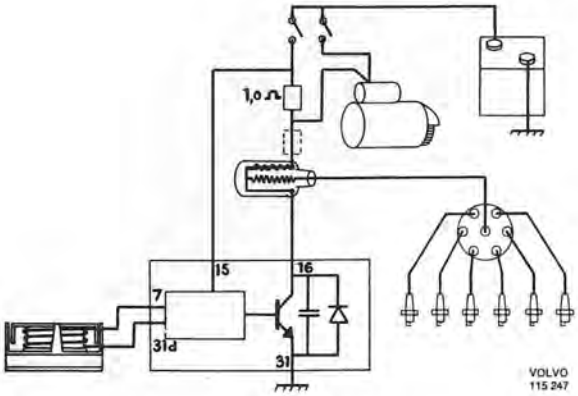


Fig. 3-61

Impulses received from the coil (magnetic pick-up) in the distributor are converted and reinforced in the electronic module and govern the output transistor which in turn controls the ignition coil primary circuit.
When the pole teeth are in front of each other, the module output transistor breaks the primary circuit and induces secondary voltage in the coil to fire the spark plugs.
In other words, the pole teeth have a function similar to that of the cam lobes in a conventional distributor.
The ignition coil has been specifically designed for the breakerless solid state ignition system.

SERVICE PROCEDURES DISTRIBUTOR

REPLACING IMPULSE SENDER (B 21 E)
Removal

Unclasp the lock clasps and remove cap, rotor and dust cover.

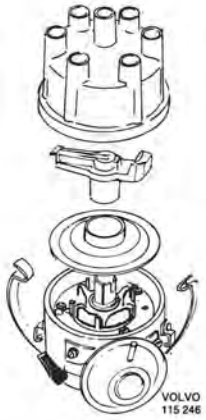


Fig. 3-62

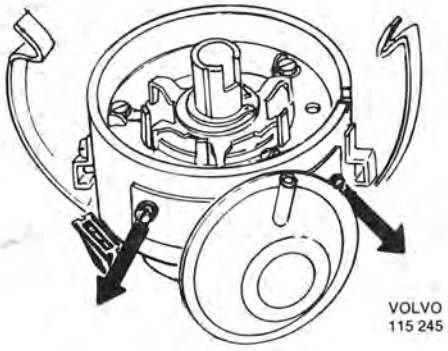


Fig. 3-63

Undo the screws for the vacuum unit and lock clasps and remove these.
The screws must always accompany the component they belong to since they are of different length and if improperly placed can project and damage moving parts.

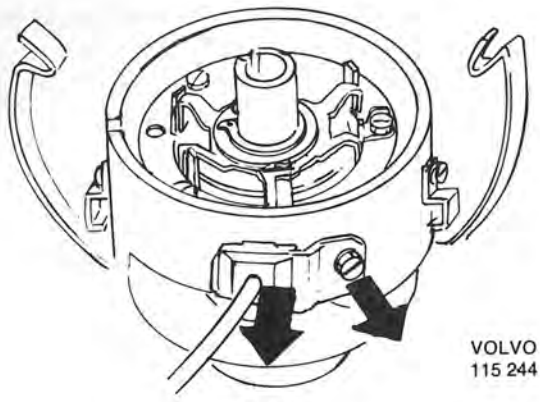


Fig. 3-64

Remove the screws securing the contact. Remove the contact by pulling it carefully straight out.

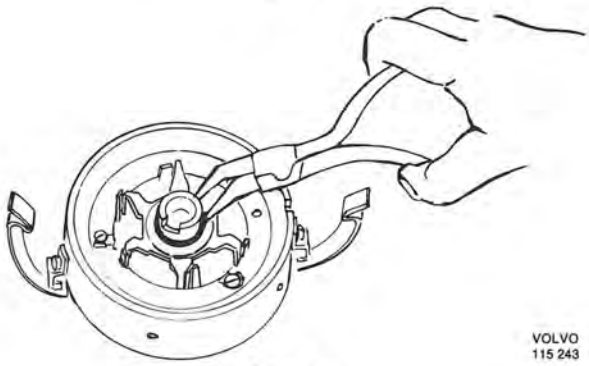


Fig. 3-65

Remove the snap ring with snap ring pliers. Then lift off the shims under the snap ring.

Fig. 3-66

Remove the screws retaining the impulse sender plate.

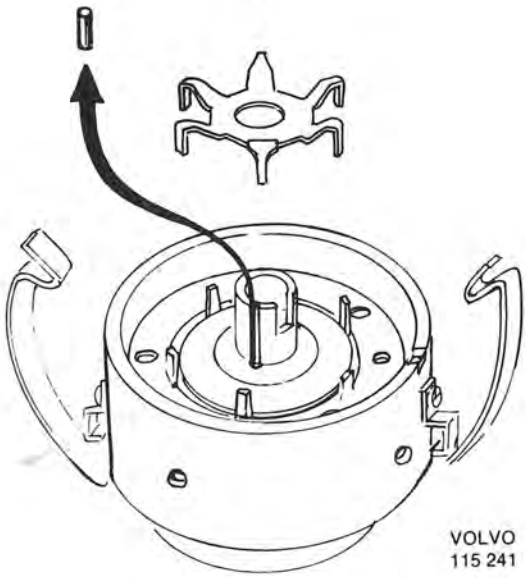


Fig. 3-67

Lift off the armature and the small lock pin.

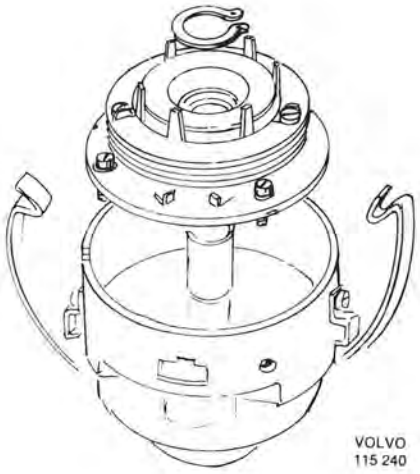


Fig. 3-68

Remove the snap ring with snap ring pliers. Lift up the impulse sender plate.

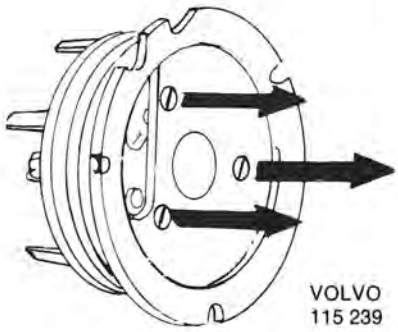


Fig. 3-69

Remove the three screws and replace the impulse sender.

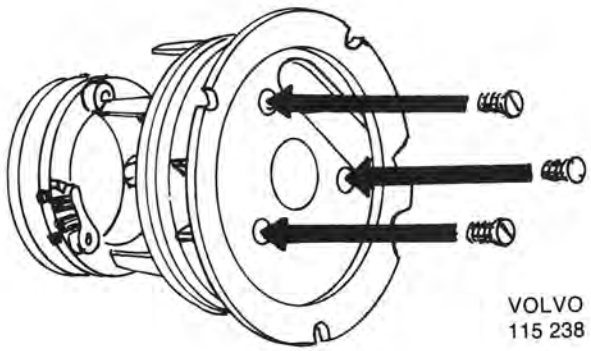


Fig. 3-70

Installation

Fit the impulse sender on the impulse sender plate by placing the connector pins opposite and above the attaching lug for the impulse sender plate.

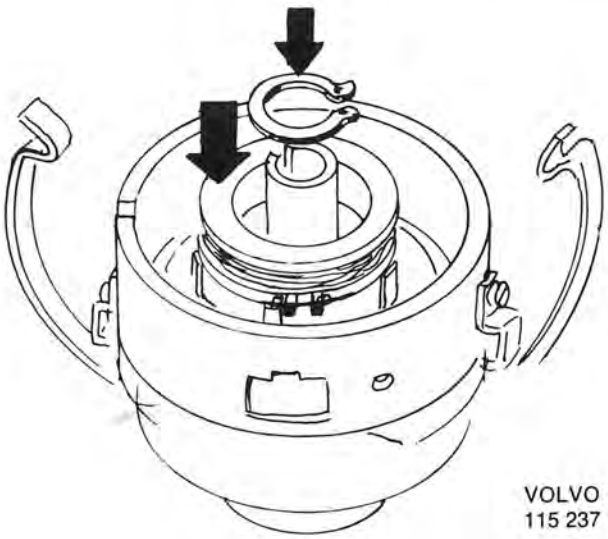


Fig. 3-71

Install the impulse sender plate and secure it with the two screws.
Install the snap ring.

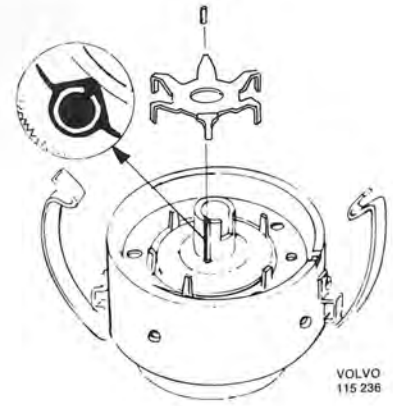


Fig. 3-72

Install the armature so that the slot comes opposite the ridge on the distributor shaft.
Fit the lock pin so that the slot faces the ridge on the distributor shaft.
Otherwise the lock pin may be sheared off.

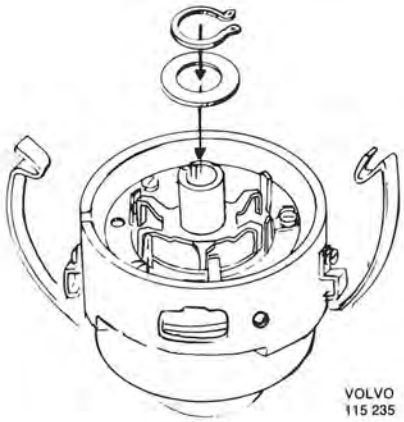


Fig. 3-73

Install the shims and snap ring.

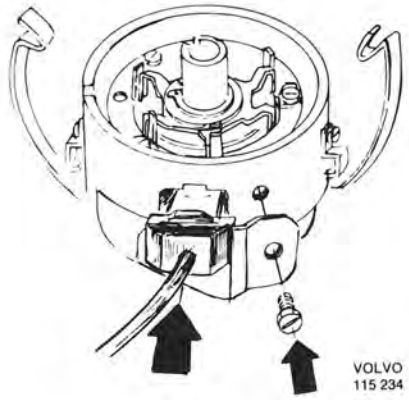


Fig. 3-74

Connect up the contact and secure it with the screw.

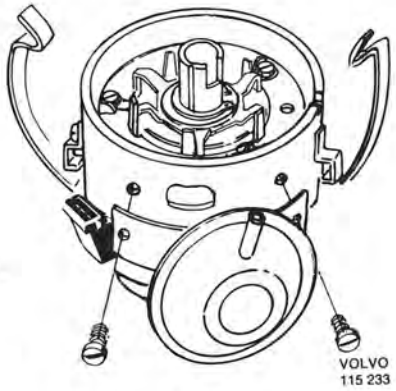


Fig. 3-75

Install the clasps and vacuum unit.

Install the dust cover, rotor and cap.

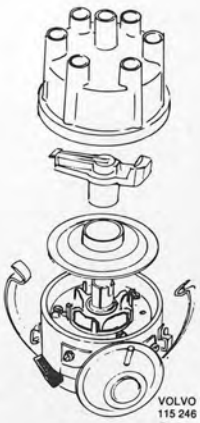


Fig. 3-76.

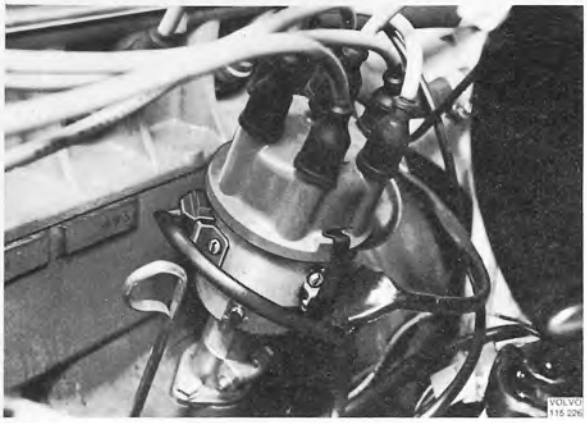


Fig. 3-77. Removing distributor

REMOVAL

1. Disconnect the ignition high tension leads from the distributor cap.
2. Disconnect the plug contact from the triggering contacts and the cable to the impulse sender at the contact.
3. Remove the vacuum hose from the vacuum regulator.
4. Release the attaching screw and pull up the distributor.

Fig. 3-78. Removing impulse sender

DISASSEMBLY

1. Remove impulse sender.
2. Disconnect the springs to the centrifugal governor and mark up where the drive shaft is located in relation to the distributor shaft. Secure the drive shaft in a vise with soft jaws, see Fig. 3-80.
   Carefully tap on the distributor housing with a plastic mallet until the circlip releases.

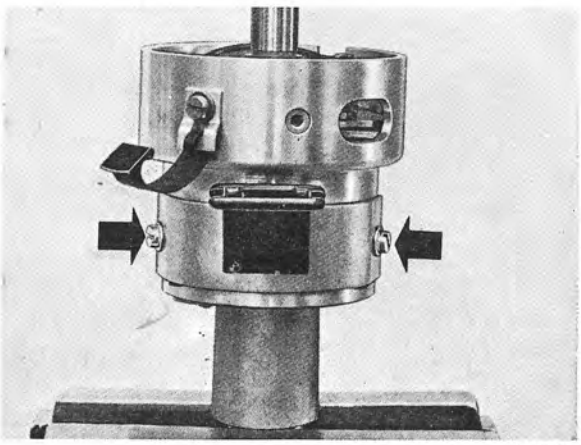


Fig. 3-79. Removing triggering contacts VOLVO 106 481

3. Remove the triggering contacts, see Fig. 3-79.

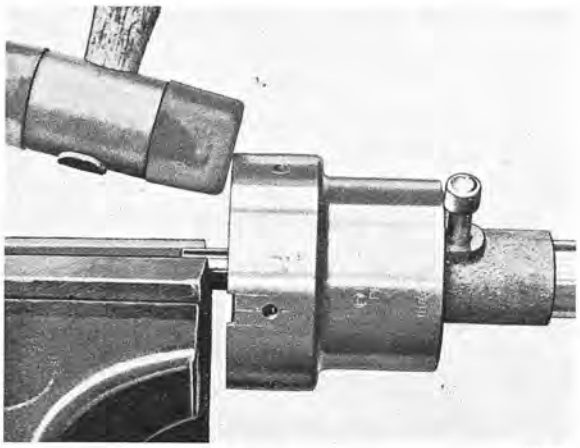


Fig. 3-80. Removing circlip

VOLVO 106480

4. Remove the resilient ring and mark up the location of the flange in relation to the distributor shaft. Knock out the pin. Take off the flange and pull up the distributor shaft. Check to make sure that no washers are lost.
5. Remove the lock springs for the centrifugal weights and take off the weights.

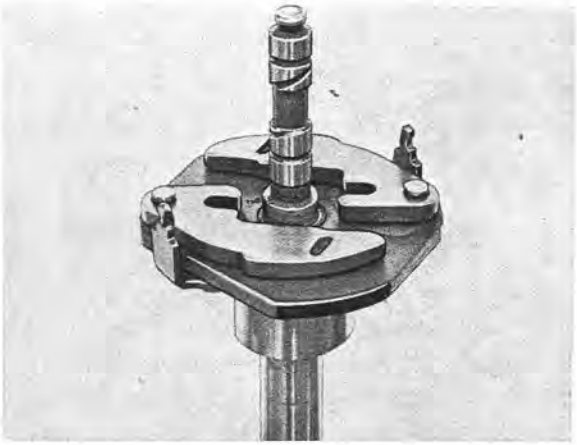


Fig. 3-81. Distributor shaft with centrifugal weights

VOLVO 103626

INSPECTING

Distributor shaft

The clearance between the distributor shaft and ignition breaker cam may not exceed 0.1 mm (0.004″).

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

The springs for the weights may not be deformed or damaged.

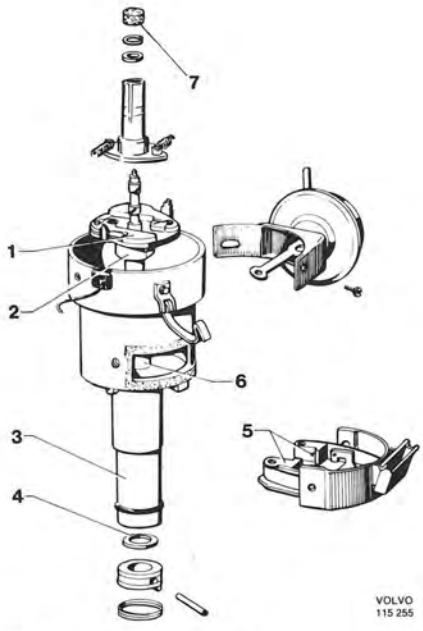


Fig. 3-82. Lubricating chart for distributor

1. Ft 2 v 3. Grease the weights.
2. Ft 1 v 4. Place a light layer on the breaker cam.
3. Ol 1 v 13. Place the brushes in oil for at least ½ hour before fitting. Soak the lubr. felt in oil.
4. Ft 2 v 3. Grease the washers.
5. Ft 1 v 4. Place a little grease on the fiber tabs.
6. Ol 1 v 13. Oil the shaft before fitting.
7. Ol 1 v 13. Soak the lubr. felt in oil.

Distributor housing

The clearance between the distributor housing and shaft may not exceed 0.2 mm (0.008″). If the clearance is excessive, replace the bushings and, if this is still not sufficient, the shaft.

1. Lubricate the parts of the distributor according to the instructions given in Fig. 3-82.
   Assembling is in reverse order to disassembling.

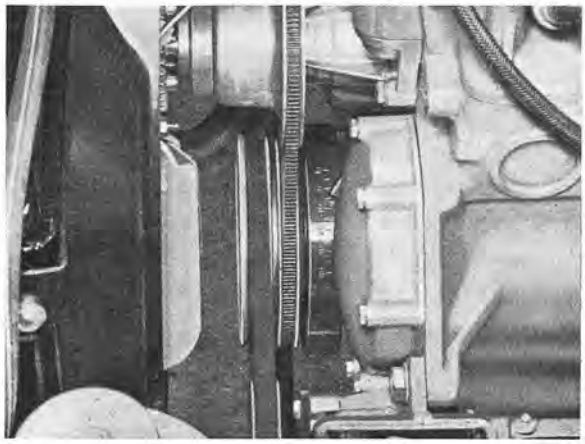


Fig. 3-83. Flywheel damper with graduation for ignition setting

INSTALLATION

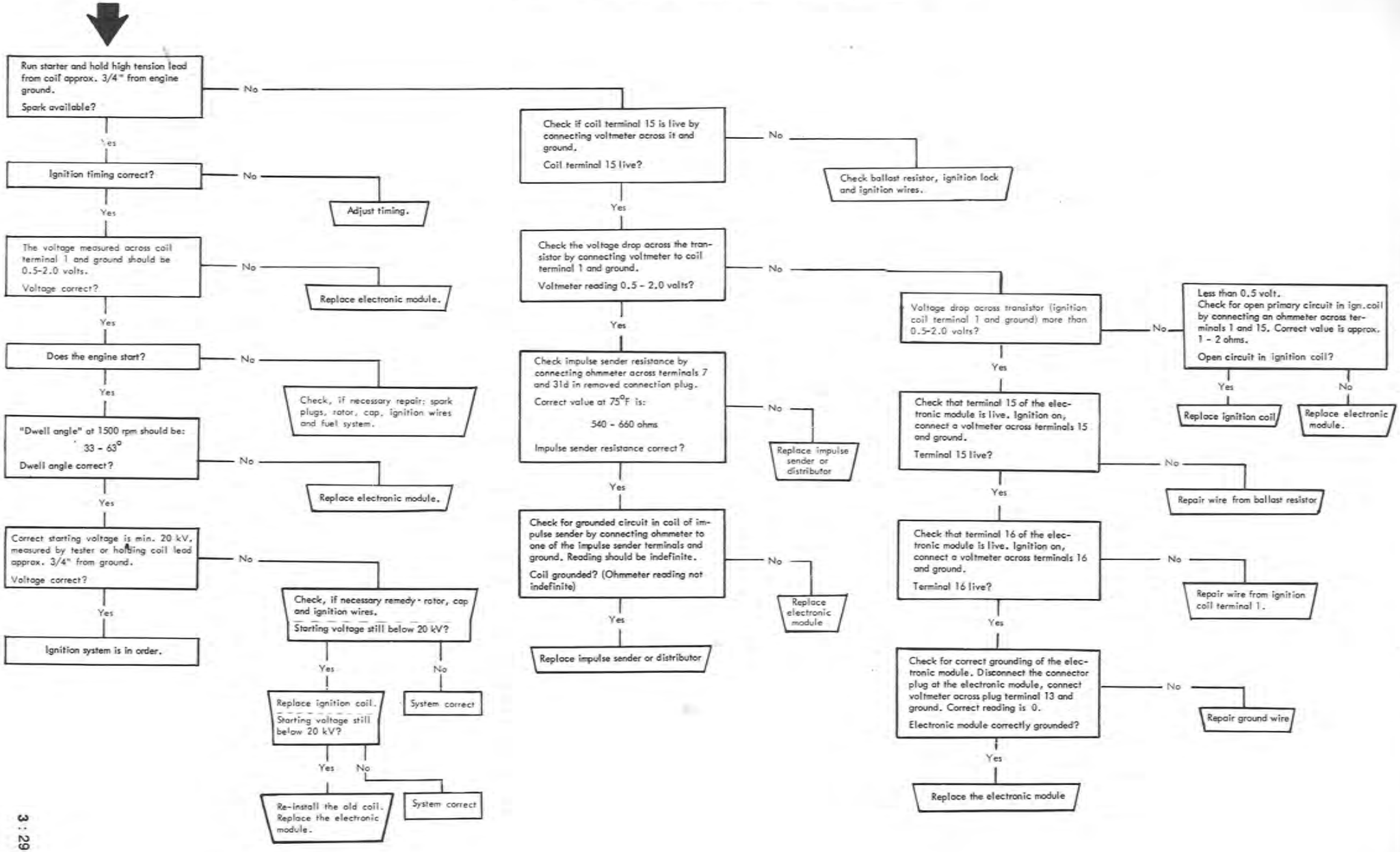
1. Place the distributor in position.
2. Press the distributor downwards while turning the distributor arm at the same time. When the distributor goes down about 5 mm ($^3/_{16}$") and it is no longer possible to turn the distributor arm, the driving collar of the distributor is then in the slot on the distributor drive.
3. Turn the distributor housing so that it takes up the same position it had before removal.
4. Connect the cable to the impulse sender contact. Connect the plug contact for the triggering contact. Connect the ignition high tension leads.
5. Start the engine and set the ignition. (If the engine does not start, turn the distributor housing until it does so.)

IGNITION SETTING

Ignition setting should always be carried out while the engine is running and with the help of a Stroboscope.

1. Clean the flywheel damper so that the graduation marks are visible, see Fig. 3-83.
2. Remove the hoses from the vacuum regulator. (The hose for the intake manifold should be shut off by, for example, bending it or by sealing it with a suitable plug, so that the engine does not draw in unwanted air.)
3. Connect the Stroboscope to No. 1 cylinder spark plug and to the battery.
4. Start the engine and run it at the r/m given in the "Specifications". Use a tachometer for this purpose. Point the ignition setting lamp at the graduation on the flywheel damper. Slacken the distributor attaching bolt and turn the distributor until the firing position agrees with that given in the "Specifications". Tighten securely the distributor and check that the firing position and speed have not been altered.
5. Remove the Stroboscope and re-fit the hoses on the vacuum regulator.

CHECK OF BREAKERLESS IGNITION SYSTEM



LIGHTING

GENERAL INFORMATION

Fig. 3-84. Headlights

Fig. 3-85. Rear light

The lighting consists of two upper and lower beam headlights with Sealed-Beam inserts, parking lights, tail lights, license plate lights and side marker lights.

The headlights are fitted in the mudguards, see Fig. 3-84. Extra lights can be installed in these recesses merely by removing these covers.

Switching between upper and lower beams is done by moving the turn signal lever towards the steering wheel. A relay makes the lighting. Up front the parking lights are integrally built with the turn signals and are mounted on the front bumper at the corners.

The tail lighs are provided with separate bulbs for rear lights, stop lights, back-up lights and turn signals, see Fig. 3-85.

SERVICE PROCEDURES

HEADLIGHTS

REPLACING HEADLIGHT INSERT

1. Remove the screw and take off the plastic cover over the space behind the headlight, see Fig. 3-88.
2. Remove the connecting contact by pulling it straight backwards.
3. Remove the outer rim by pulling it upwards-forwards, see Fig. 3-89.
4. Release the screws for the inner rim a couple of turns, see Fig. 3-90, turn the rim and lift it off together with the headlight insert.

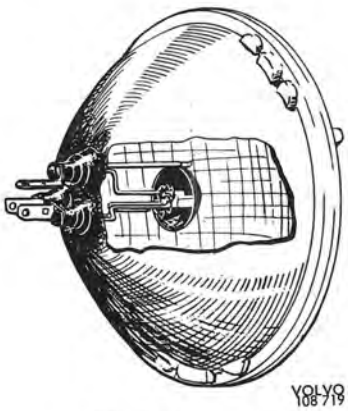


Fig. 3-86. Sealed-Beam Insert

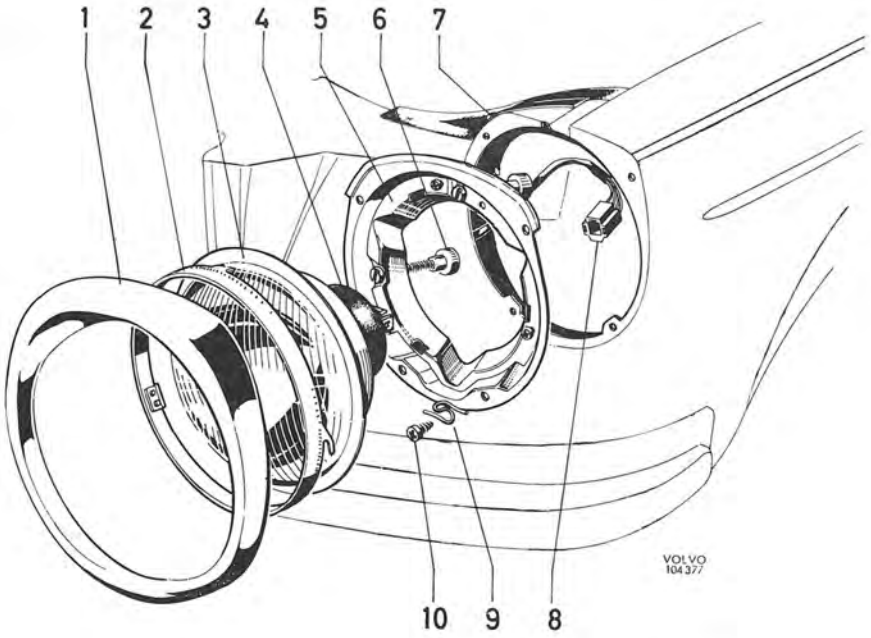


Fig. 3-87. Headlight
1. Outer rim
2. Inner rim
3. Headlight insert
4. Rubber cover
5. Holder unit
6. Adjusting knob
7. Plastic cover
8. Connector
9. Spring wire holder
10. Attaching screw

5. Remove the rubber cover from the old insert and fit it on the new one.
6. Fit the insert and inner rim. Fit the outer rim by hooking the lower section in the spring wire holders, then lift the rim straight up and hook it on securely.
7. Adjust the light according to current legislation. Adjustment is made by means of the two adjusting screws, see Fig. 3-87. Use approved light adjusting equipment.
8. Fit the plastic cover over the space behind the headlight.

CHECKING AND ADJUSTING HEADLIGHTS

The condition of the glass, reflector and bulb of the headlight should be checked. If the glass is damaged by flying gravel, cracked or in any other way defective, the insert

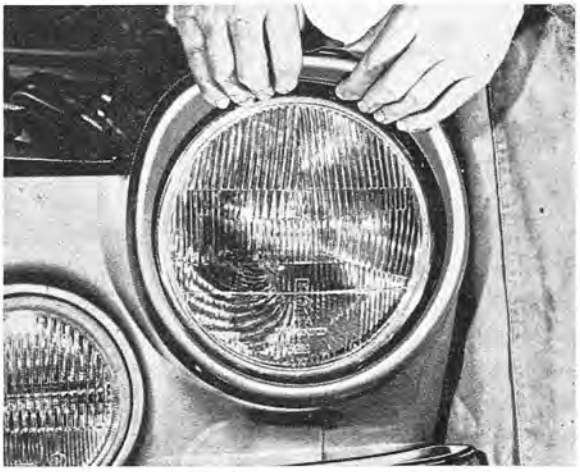

VOLVO
104478

Fig. 3-89. Removing outer rim

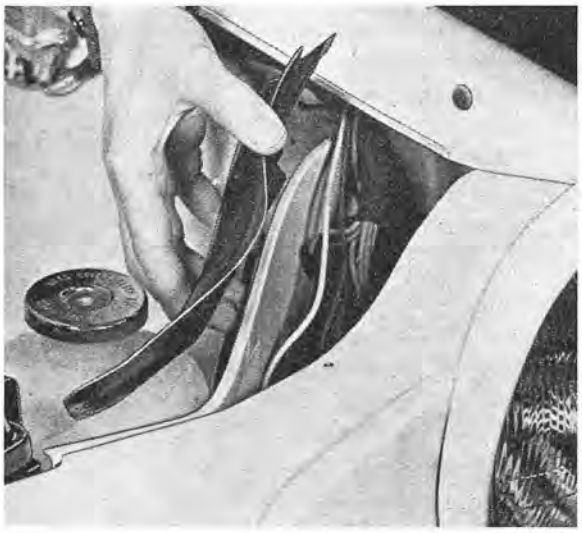

VOLVO
103325

Fig. 3-88. Removing plastic cover

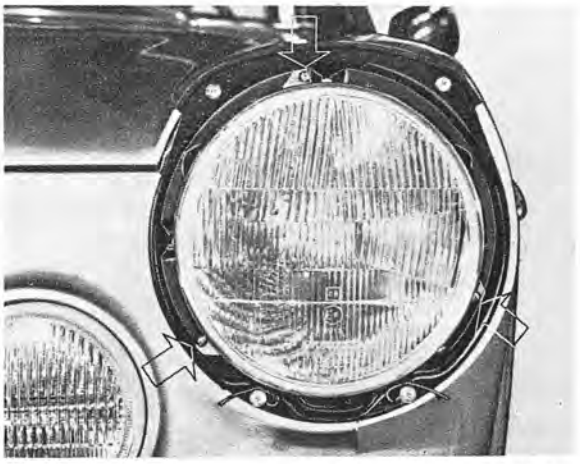
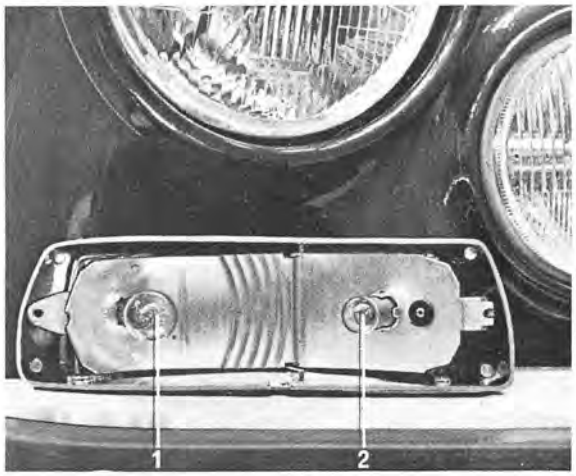

VOLVO
104479

Fig. 3-90. Screws for inner rim



VOLVO 108760

Fig. 3-91. Parking and turn signal light
1. Bulb for turn signal 2. Bulb for parking light

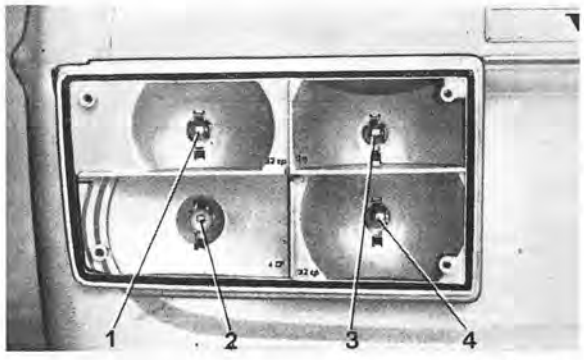
should be replaced. Glass which has become "sand-blasted" by flying stones, etc., will considerably reduce the lighting effect and can give rise to dazzling, irregular beams, etc.

If the reflector is dull, buckled or damaged in any other way, the insert should be replaced. The inside of the bulb must not be oxidized to a black or brown color. The lighting effect normally deteriorates to such an extent that the bulbs should be replaced after 100–200 hours of operation.

The voltage at the bulb with the headlights switched on and the engine running at charging speed should be at least 12.5 volts if sufficient lighting strength is to be produced.

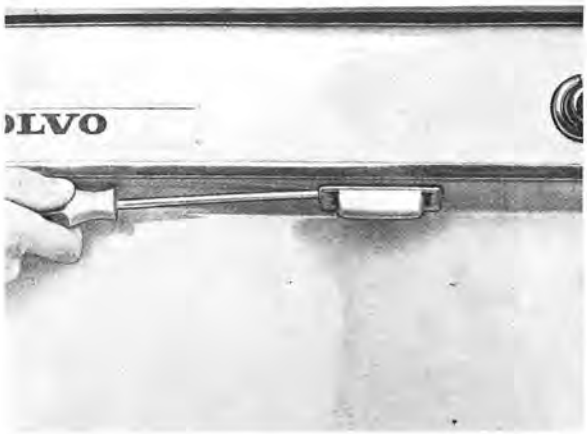
The headlights should be adjusted according to current legislation. Approved adjusting equipment should be used for this purpose.

Adjustment is made by varying the two adjusting knobs behind the headlight, see Fig. 3-87. The upper knob adjusts the headlight vertically and the knob at the side adjusts the headlight laterally.



VOLVO 108696

Fig. 3-92. Bulb location
1. Turn signal light 3. Reversing light
2. Tail light 4. Brake light



VOLVO 107325

Fig. 3-93. Removing license plate light

CHECKING

See "Checking and adjusting headlights".

PARKING LIGHTS AND TURN SIGNALS

REPLACING BULB

1. Remove the screws holding the glass and lift off the glass.
2. Replace the damaged bulb.
   NOTE. Do not touch the new bulb globe with your fingers.
3. Fit the glass and the screws. Check that the sealing is fitted correctly.

TAIL LIGHTS

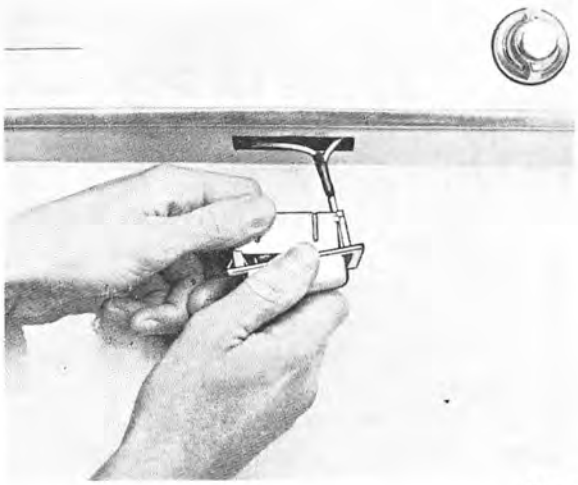
REPLACING BULBS

1. Unscrew the four attaching screws for the lamp glass and remove the glass.
2. Replace the bulb, see Fig. 3-92.
3. Re-fit the glass.

TAIL LIGHT

The tail light is replaced as a complete unit.

1. Remove the spare wheel (left-hand side).
2. Remove the protective cardboard.
3. Mark up the cables and disconnect them.
4. Remove the attaching screws. A suitable tool for this is an 8 mm ($^5/_{16}$") screwdriver.
5. Lift off the tail light.
6. Installing is in reverse order to removal.
7. Check to make sure that the tail light functions properly.



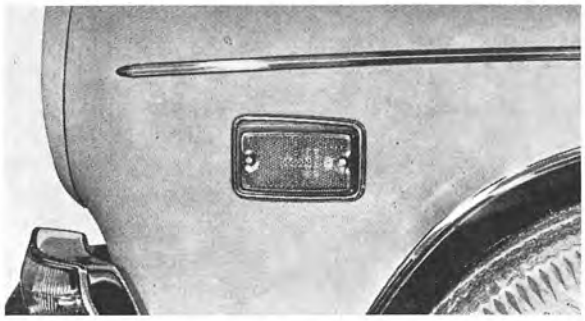
VOLVO 107326

Fig. 3-94. Disassembling license plate light

LICENSE PLATE LIGHT

REPLACING BULB

1. Remove the license plate light with the help of a cross-head screwdriver according to Fig. 3-93.
2. Disconnect the electric cable from the plate.
3. Disassemble the plate according to Fig. 3-94.
4. Replace the bulb.
5. Re-connect the electric cable to the plate.
6. Install the plate by pressing it firmly into its recess.



VOLVO 104484

Fig. 3-95. Side marker light

SIDE MARKER LIGHTS

Two side marker lights are placed on each side of the car, one in front and one in rear.

To replace the bulb, take off the glass. The glass is fitted on the body by two screws.

OTHER ELECTRICAL STANDARD EQUIPMENT

GENERAL INFORMATION

TURN INDICATORS

The turn indicator system consists of an electronic flasher relay, turn indicator switch, flash lamps on the front mudugards and bulbs in the tail lights. The turn signal lever is located under the plastic casing on the left-hand side of the steering column, see Fig. 3-97. It switches on the right or left in two stages. Stage one is used when changing a lane and stage two when changing direction. The switch has automatic return to neutral. The turn indicator panel light is wired in parallel across the switch. The turn indicators can also be used as emergency warning flashers, which are switched on by the emergency warning flasher switch on the control panel. The flasher function is governed by the flasher on the reverse side of the control panel, see Fig. 3-96. The steering wheel lock is equipped with a reminder buzzer which buzzes when the driver's door is open and the ignition key is in the ignition switch, in other words, if the steering wheel is not locked.

IGNITION SWITCH

The ignition switch is integrally built with the steering wheel lock. The switch has four positions:

0. Complete electrical system disocnnected and steering wheel locked.
1. Current to fuse box (Intermediate position).
2. Same as position 1 but also current to igniton coil (Driving position).
3. Same as position 2 but also current to starter motor solenoid (Starting position). When the ignition key is released in position 3, it returns automatically to position 2.

HORNS

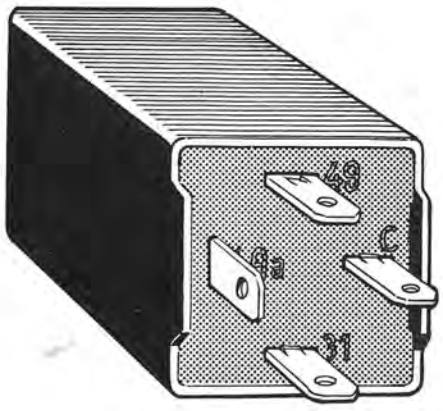
The horns are located to the left of the radiator behind the grille.

One of the horns has a low frequency and the other a high frequency.

The horn pad mounted in the steering wheel operates the horns.

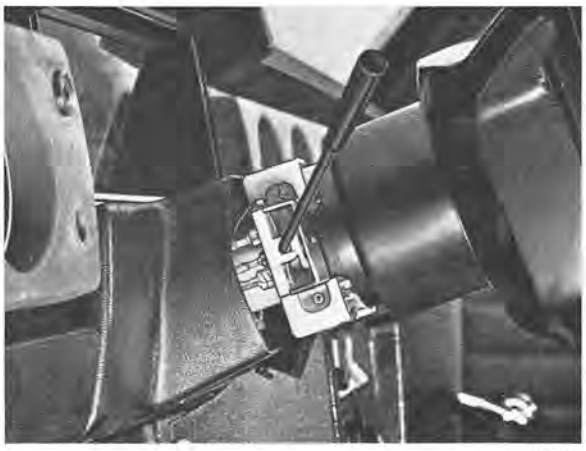
FUSES

The fuses are in a fuse box, which is located next to the left fresh-air vent. The fuses are accessible when the cover is removed.



VOLVO 108 628

Fig. 3-96. Flasher



VOLVO 107 327

Fig. 3-97. Turn signal lever

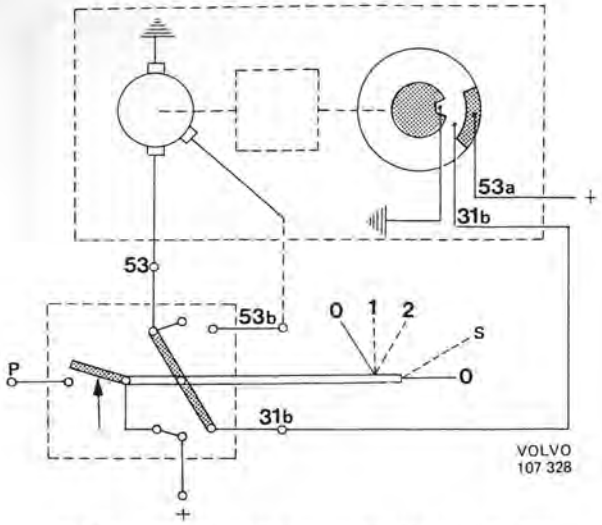


Fig. 3-98. Wiring diagram for windshield wiper motor, Electrolux

WINDSHIELD WIPERS

The windshield wipers are driven by an electric motor. The motor is connected to the wipers by a combined cable and linkage system. It has a permanently magnetized field and three brushes, one a minus brush and the other two plus bursches. The plus brushes are connected one at a time so that the engine has two different speeds, 0.57± 0.07 r/s (34±4 rpm) and 0.92±0.8 r/s (55±5 rpm). The function of the parking switch, which is built into the gear housing, is to return the wiper blades to a suitable, predetermined, parking position, see Figs. 3-98 and 3-99 irrespective of where the wiper is switched off.

WINDSHIELD WASHER

The windshield washer, see Fig. 3-100, which is located on the left wheel housing, is driven by an electric motor.

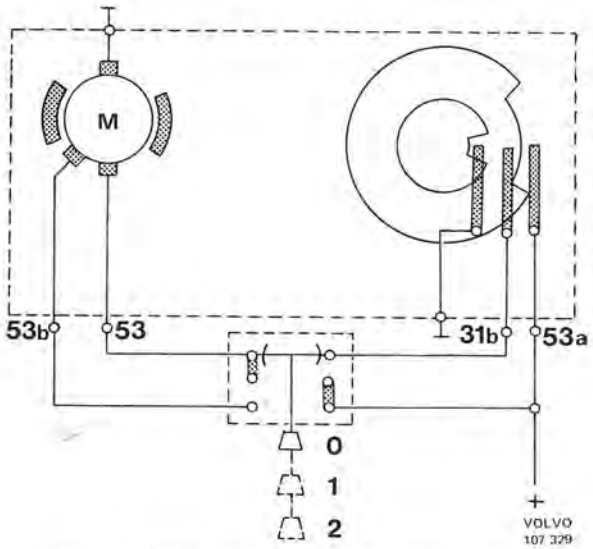


Fig. 3-99. Wiring diagram for windshield wiper motor, SWF

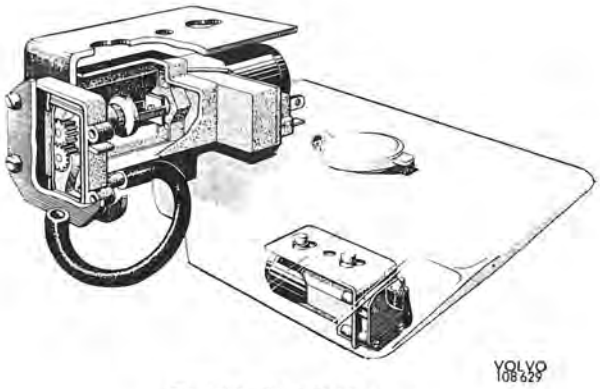


Fig. 3-100. Windshield washer

Motor and pump are placed on the underside of the washer container. The pump is of the gear type, see Fig. 3-100.

Wipers and washers are operated by the same switch lever, located on the steering column.

SWITCHES

The switches for the flashers, electrically heated rear window, are of the toggle type and are located on the control panel. Also located on the control panel is a rheostat for the instrument panel light.

INTERIOR LIGHT

The interior light consists of a lamp located in the middle of the roof. It is switched on by a switch built into the light. The switch has three positions. In its first position, the light is switched off completely, in the second position the light is on when any of the front doors is opened, and in the third position the light is on continuously.

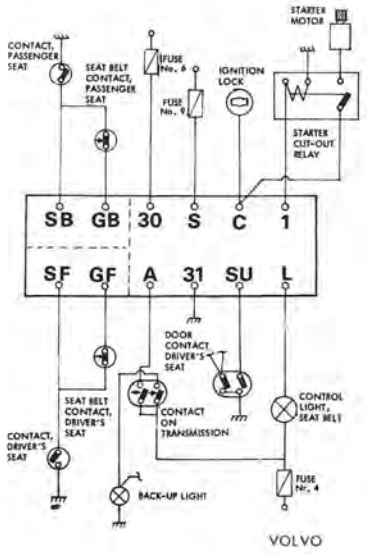


Fig. 3-101. Interlock Control System, wiring diagram

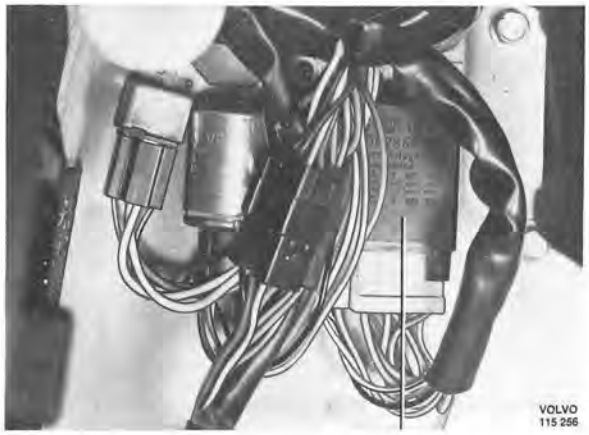


Fig. 3-102. Interlock Control Unit (1)

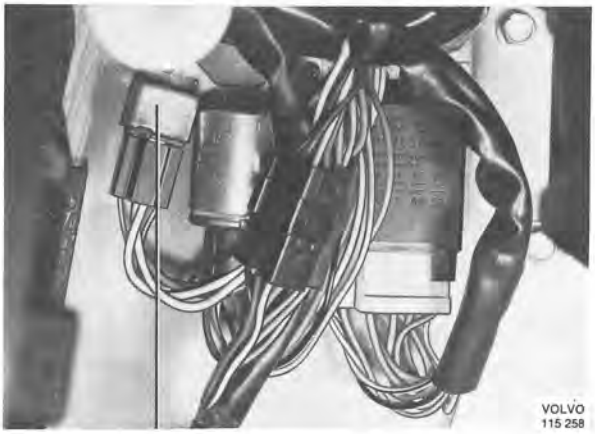


Fig. 3-104. Starter Cut-Out Relay (1)

SEAT/IGNITION INTERLOCK SYSTEM

GENERAL

The purpose of the Seat/Ignition Interlock System is to prevent starting the engine if the driver's seat or the passenger's seat is occupied but the appropriate seat belt is not fastened.

The Ignition Interlock Device consists of:

SEAT CONTACTS, one for each seat, which indicate if the seat is occupied. The circuit is closed when the seat is occupied.

BELT CONTACTS, which indicate if the belt is connected. The circuit is opened when the belt is fastened.

INTERLOCK CONTROL UNIT (Logic Unit), which switches on or off the Starter Cut-Out Relay, according to the indications of the above switches.

STARTER CUT-OUT RELAY, which is governed from the Interlock Control Unit and consequently opens or closes the circuit from the ignition switch to the starter. The Interlock Control Unit incorporates also:

buzzer and **"fasten seat belt" control light** and the warning fucntion "Ignition key left in the lock".

FUNCTION

The driver's seat and the passenger's seat each have one set of contacts and belt contacts. These sets are independent.

A relay in the Interlock Control Unit is governed by the indications from the driver's side and the passenger's side. When the seat belt is used correctly, the relay closes the circuit from "C" to "1" (relay rest position), and the engine can be started. See Fig. 3-101, pos. 1.

If the starter circuit has been cut out (seat and belt contacts incorrectly sequenced or misconnected) the driver is warned by the buzzer and the "Fasten Seat Belt" warning light when the ignition key is turned to the "Starting" position or the gear shift is in a forward position.

In order to prevent the cut-out and warning system to function if the seat intermittently is unoccupied (for instance at a road bump), there is a delay mechanism which cuts in the fucntion only when the seat has been occupied for more than 20 seconds.

If the relay has functioned, the seat belt has to be disconnected and re-fastened.

The engine can be started:

1. If the seat first is occupied (loaded).
2. If the seat first is occupied and the seat belt thereafter fastened.

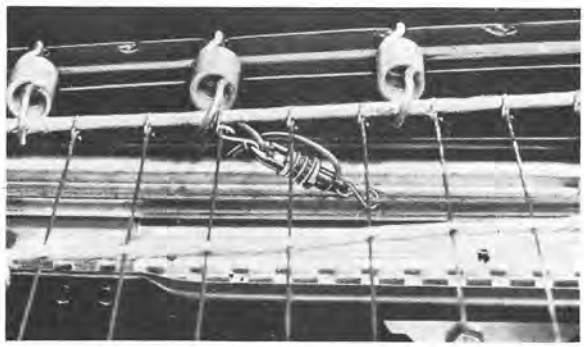


Fig. 3-103. Seat contact

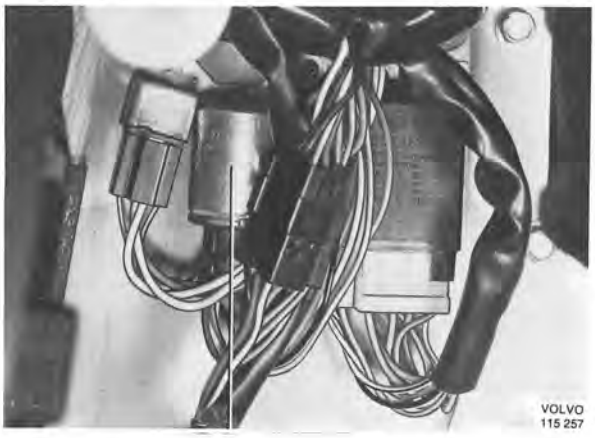


Fig. 3-105. Reed Relay

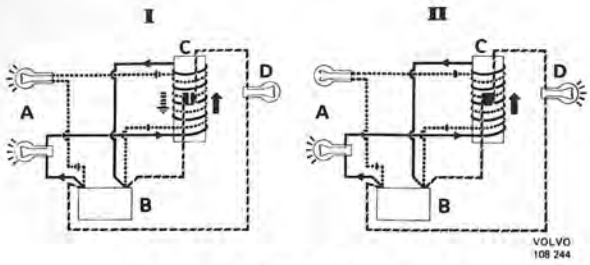


Fig. 3-106. Bulb Integrity Sensor, function

BRAKE LIGHT SWITCH

The brake light switch is located on the pedal carrier under the dashboard. It is operated mechanically by the brake pedal.

CONTROL RELAYS

The cars in the 164-series are as standard equipped with one control relay for switching between upper and lower beams.

Vehicles with automatic transmission are equipped with a control relay for the back-up lights.

BULB INTEGRITY SENSOR

The Bulb Integrity Sensor system consists of a Reed relay and a warning light. It indicates if any of the bulbs for lower beam, tail light or stop light are out of order.

The indication is that the warning light comes on. The Reed relay is located to the left under the dash board, see Fig. 3-105, and the warning light is located in the combination instrument.

The Reed relay consists of a contact set, surrounded by three coil sets (one for lower beams, one for tail lights, one for stop light).

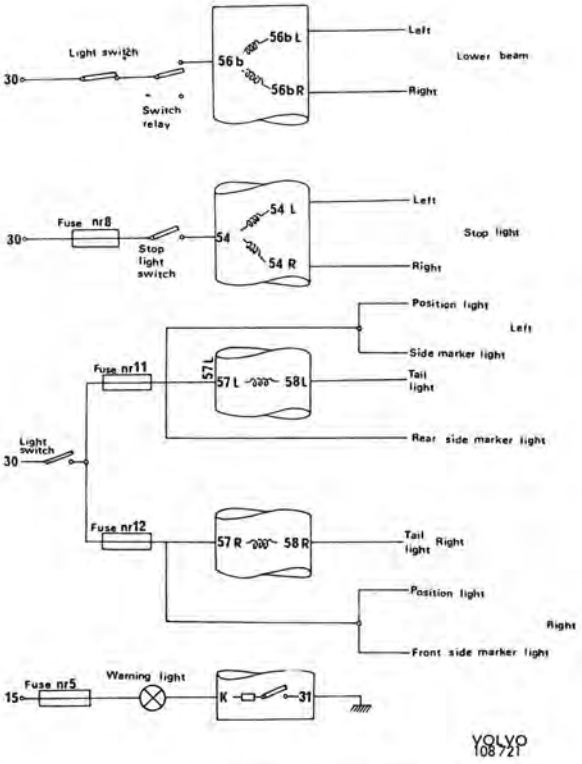
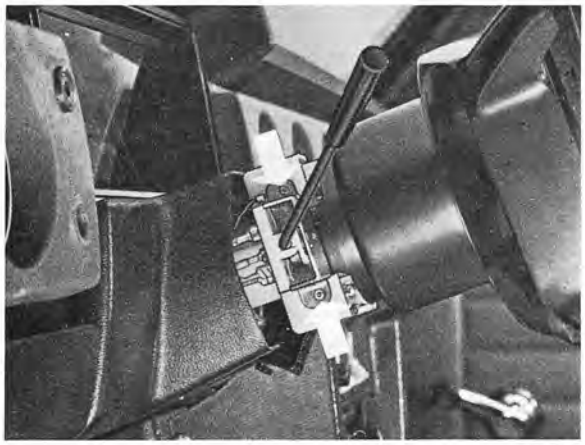


Fig. 3-107. Bulb Integrity Sensor, wiring diagram

Each coil set has two coils, one for the left bulb, one for the right bulb. The two coils develop counteracting magnetic fields.

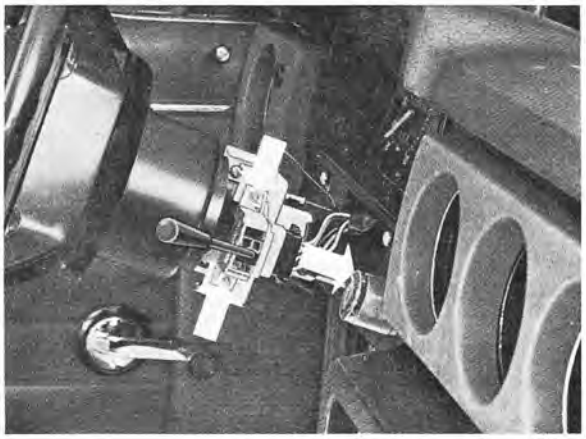
FUNCTION

When current flows through both coils in the coil set, which means that the bulbs on both sides are functioning, the two coils develop counteracting magnetic fields that cancel out each other and prevent the contacts from joining, see I Fig. 3-106. But if current flowing through one of the coils ceases (the bulb is not functioning), the contacts are actuated and the warning light comes on, see II in Fig. 3-106.



YOLVO 107331

Fig. 3-108. Lever for flashers



YOLVO 107332

Fig. 3-109. Lever for windshield wipers

REPLACING LEVERS FOR TURN INDICATORS AND WINDSHIELD WIPERS

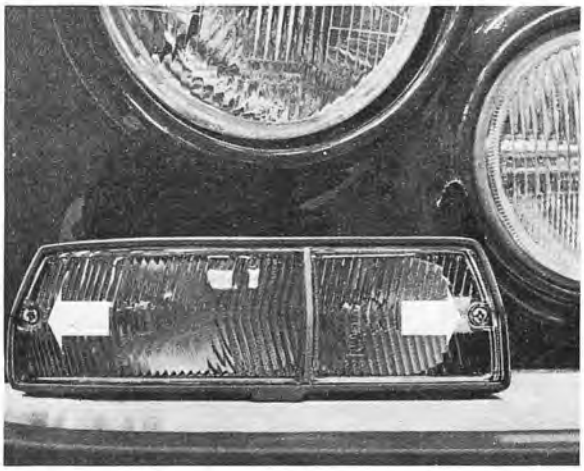
1. Remove the casings over the steering column.
2. Remove the screws for the lever.
3. Connect the electric wires to the new lever.
4. Install the new lever and check its function.
5. Restore.

REMOVING HORN CONTACT BAR

1. Remove the impact guard (1, Fig. 3-111). (Carefully lever it loose with the help of a screwdriver.)
2. Disconnect the electric cable (4, Fig. 3-111) from the contact bar (3, Fig. 3-111).
3. Remove the four attaching screws (2, Fig. 3-111) for the contact bar and lift off the bar. Installation of the contact bar is in reverse order to removal. After installation, check the flasher function.

REPLACING FLASHER LIGHTS

1. Remove the electric cable from the cable loom in engine compartment.
2. Remove the light glass, see Fig. 3-110.
3. Remove the housing from the fender. Pull out the electric cable with its grommet.
4. Install the new electric cable with grommet and install the housing.
5. Install the bulb connecting the electric cable to the harness.
6. Check the flasher function and install the lens.



YOLVO 108759

Fig. 3-110. Removing flasher light glass

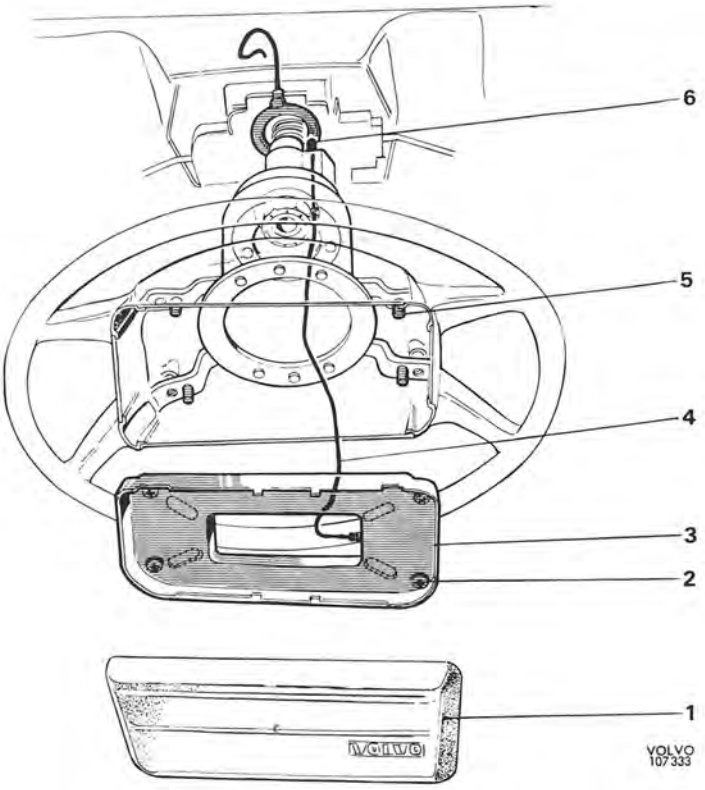


Fig. 3-111. Contact bar

1. Impact guard
2. Attaching screw
3. Contact bar
4. Electric cable
5. Contact pin
6. Slip contact

REMOVING WIPER MOTOR

1. Remove the drive link from the lever on the wiper motor after having first removed the lock device, see Fig. 3-113.
2. Remove the contact from the wiper motor.
3. Remove the three attaching screws (Fig. 3-114). Lift out the wiper motor.

When replacing a wiper motor, transfer the lever, rubber seal, damper rubber and spacer sleeves to the new wiper motor.

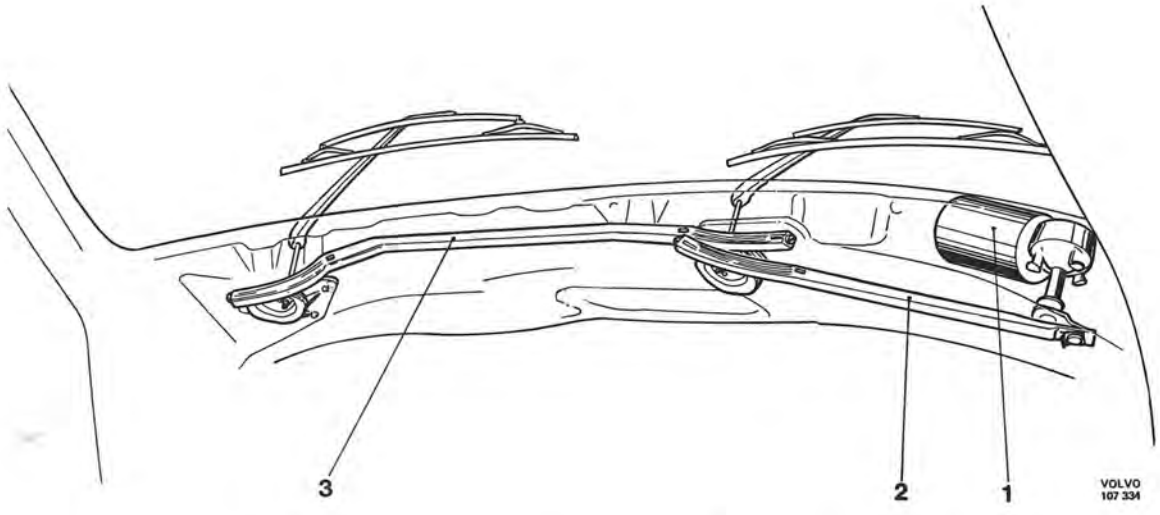


Fig. 3-112. Windshield wiper unit

1. Wiper motor
2. Drive link
3. Parallel drive link

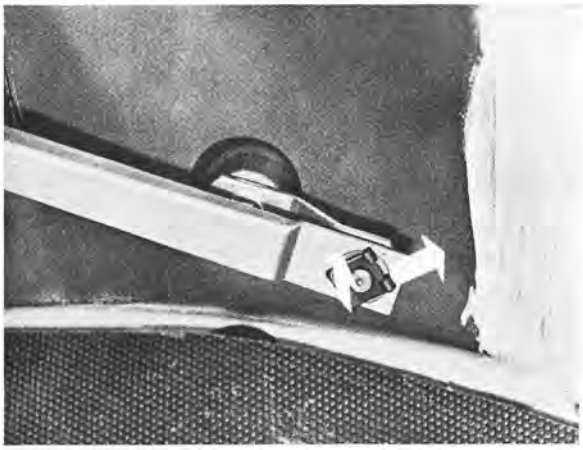


Fig. 3-113. Removing lock

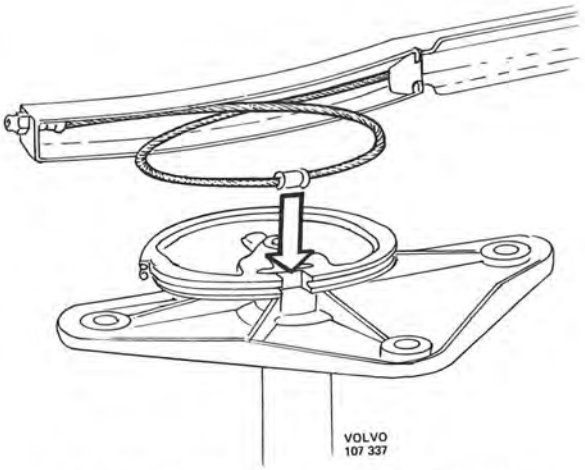


Fig. 3-115. Installing cable for drive link and parallel drive link, left-hand side

INSTALLING WIPER MOTOR

1. Place the wiper motor in position and install the attaching screws, see Fig. 3-114.
2. Connect up the contact to the wiper motor.
3. Install the drive link to the lever on the wiper motor.
4. Check the wiper function.

REMOVING DRIVE LINK

1. Remove the glove box.
2. Remove the right defroster nozzle.
3. Remove the drive link for the wiper motor lever and unscrew the nut for the cable stretcher.
   Lift off the drive link.

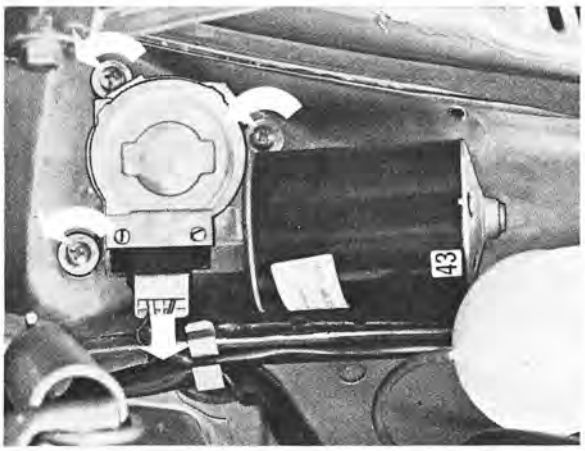


Fig. 3-114. Removing windshield wiper motor

INSTALLING DRIVE LINK

1. Place the cable's flange nipple in the segment recess and then lever the cable over the segment, see Fig. 3-115. This work should be done with the greatest care in order not to score the segment or damage it in any other way, as this would lead to disturbance in operation.
2. Install the connecting rod for the wiper motor lever. Thereafter tension the cable.
3. Check to make sure the wipers are functioning properly.
4. Install the defroster nozzle and glove box.

REPLACING CABLE

1. Remove the drive link and the parallel drive link.
2. Bend up the lock washer with the help of a screwdriver, and remove the washer. Remove the old cable.
3. Check to make sure the wipers are functioning properly.
4. Re-install the cable stretcher in the drive link. The nut should be screwed on only a couple of threads.
5. Install the drive link and parallel drive link.

REMOVING PARALLEL DRIVE LINK

Left-hand side

1. Remove the defroster hose.
2. Remove the air duct between the defroster nozzle and the air vent in the dashboard.
3. Remove the nut for the cable stretcher and disconnect the cable from the segment.

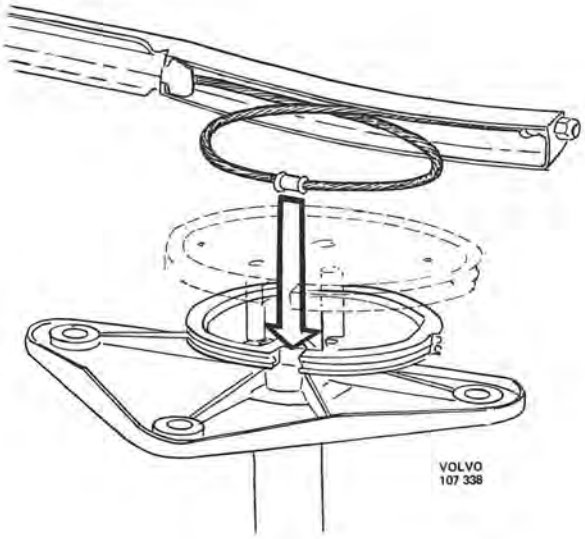


Fig. 3-116. Installing cable for parallel drive link, right-hand side

Right-hand side

1. Remove the side panel and defroster hose.
2. Remove glove box and right-hand defroster nozzle.
3. Disconnect the drive link and remove it.
4. Remove the nut for the cable stretcher and disconnect the cable from the segment.
5. Lift forward the parallel drive link.

INSTALLING PARALLEL DRIVE LINK

Left-hand side

1. Place the cable's flange nipple in the large segment recess and thereafter, prise the cable over the segment, see Fig. 3-115. Great care should be observed when doing this in order not to score the segment or damage it in any other way, otherwise this might lead to disturbances in operation.

Right-hand side

1. Place the cable's flange nipple in the small segment recess and thereafter prise the cable over the inner segment, see Fig. 3-116. Great care should be observed when doing this work so as not to score the segment or damage it in any other way, as this should lead to disturbance in operation. Tension the cable.
2. Place the drive link cable's flange nipple in the front segment recess and thereaefter prise the cable over the segment, see Fig. 3-115.
   Attach the drive link to the lever on the wiper motor. Tension the cable.
3. Check the wiper function.
4. Install the defroster hoses and the side panel.
5. Install the defroster nozzle and the glove box.

REPLACING WIPER ARM BEARING

1. Remove the wiper arm.
2. Remove the drive link and parallel drive link.
3. Remove the attaching screws and lift off the wiper arm bearing.
4. Transfer the seal to the new wiper arm bearing. A worn or deformed seal should be replaced by a new one.
5. Install the wiper arm.
6. Check the wiper function.

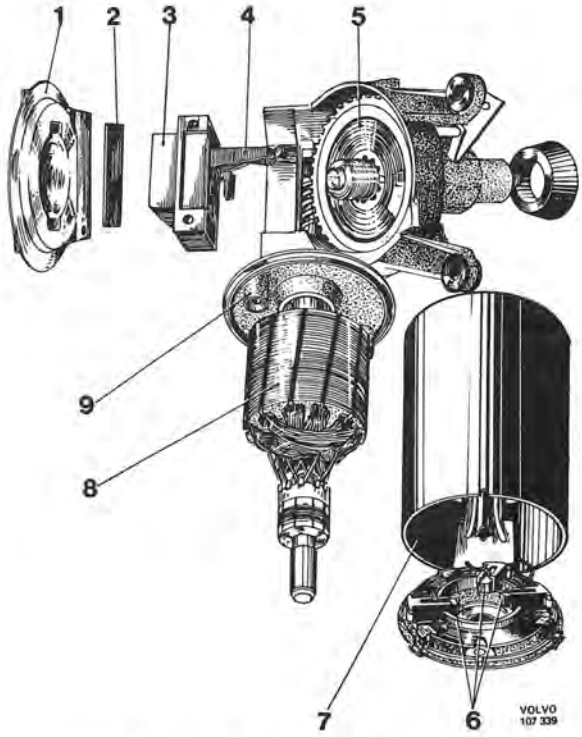


Fig. 3-117. Windshield wiper motor, Electrolux

1. Cover
2. Packing
3. Connection contact
4. Contacts
5. Gear with contact bar
6. Electric brushes
7. Stator
8. Rotor
9. End

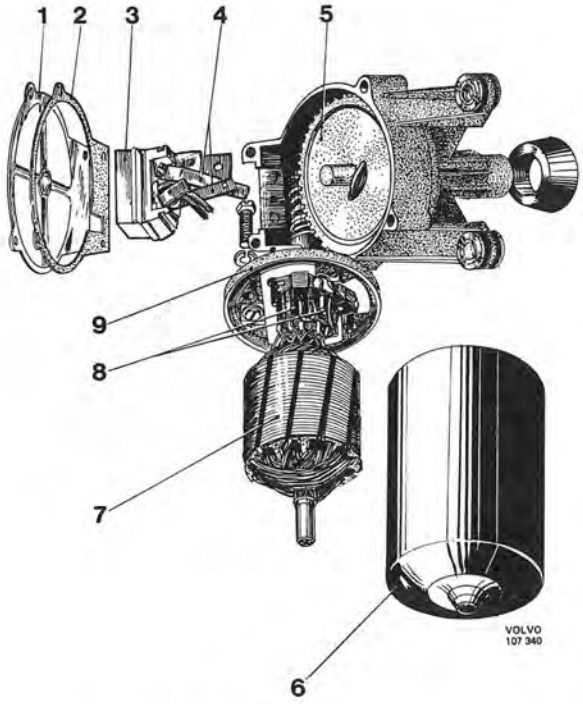


Fig. 3-118. Windshield wiper motor, SWF

1. Cover
2. Packing
3. Connection contact
4. Contacts
5. Gear with breakers
6. Stator
7. Rotor
8. Electric brushes
9. End

REPLACING INTERIOR LIGHT BULB

Pull down the glass at the short side opposite the switch. Pull out the bulb. The glass is re-fitted by hooking it securely at the side where the switch is situated and then pressing in the glass firmly.

REPLACING BRAKE LIGHT SWITCH

When replacing the brake light switch, make sure that the new switch is adjusted correctly so that it functions satisfactorily. The distance between the brake pedal released and the threaded bronze hub on the switch should be 4±2 mm (0.16±0.08") (A. Fig. 3-119). If the distance must be adjusted, release the attaching screw for the bracket and move the bracket until the correct distance is obtained.

REPLACING IGNITION SWITCH

1. Remove the contact by pulling it straight forwards.
2. Undo both the attaching screws with a screwdriver.
3. Lift out the ignition switch.

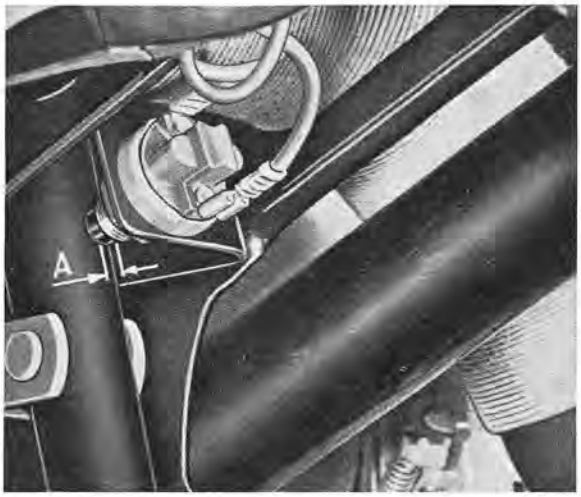


Fig. 3-119. Brake light switch

Installing of the ignition switch is in reverse order to removal.

REPLACING SWITCHES ON CONTROL PANEL

1. Disconnect the ground cable from the battery.
2. Unscrew the control panel and lift up from the bottom until the contacts are accessible.
3. Disconnect the contact harness from the switch.
4. Remove the switch by first pressing in the lock springs and then pressing the switch out of the panel, see Fig. 3-120.

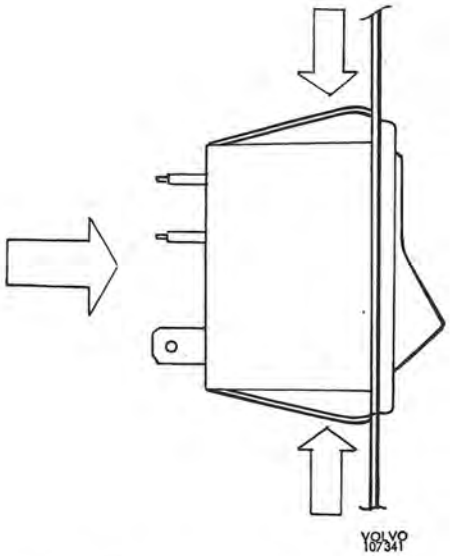


Fig. 3-120. Removing headlight switch

REPLACING HEADLIGHT SWITCH

1. Remove the switch knob.
2. Pull out the choke. (Does not apply to injection engines.)
3. Remove the impact guard by pulling it straight back.
4. Remove the nut for the switch with a suitable tool.
5. Remove the switch and transfer electric cables to the new switch.

Installation is in reverse order to removal.

BULB INTEGRITY SENSOR, CHECK

NOTE: The Bulb Integrity Sensor warning light may come on if current to the bulbs is distorted, e.g., a bulb is out of order. A short indication may sometimes occur, when the headlight is switched on, depending on variations in "starting" time for the bulbs.

1. Switch on the ignition.
   The warning light should come on.
   If the warning light does not come on, it is defective.
2. Start the engine.
   The warning light should go out.
   The Bulb Integrity warning light and the charging control light light simultaneously: the alternator does not function.
   The Bulb Integrity warning light is on after the charging control light has gone out: the Bulb Integrity Sensor is defective.
   NOTE: The light switch should be pushed in and the brake pedal not actuated during the test.
3. Switch on the headlight, lower beam.
   The warning light should be out.
   The Bulb Integrity warning light is on, but all bulbs for lower beam, parking light, tail light etc are functioning: the Bulb Integrity Sensor is defective.
4. Switch off the headlight lower beam.
5. Remove one of the fuses No. 11 or 12.
   The warning light should come on, if not, the Bulb Integrity Sensor is defective.
   Re-connect the fuse.
6. Switch off the light.
7. Depress the brake pedal.
   The warning light should be out. If it comes on and both brake lights function, it is defective.
8. Switch off the ignition.

BULB INTEGRITY SENSOR, REPLACEMENT

1. Disconnect the connector at the Sensor Unit.
2. Remove the sensor Unit.
3. Install the replacement Sensor Unit.
4. Re-connect the connector to the Sensor Unit.
5. Check the function of the replacement unit.

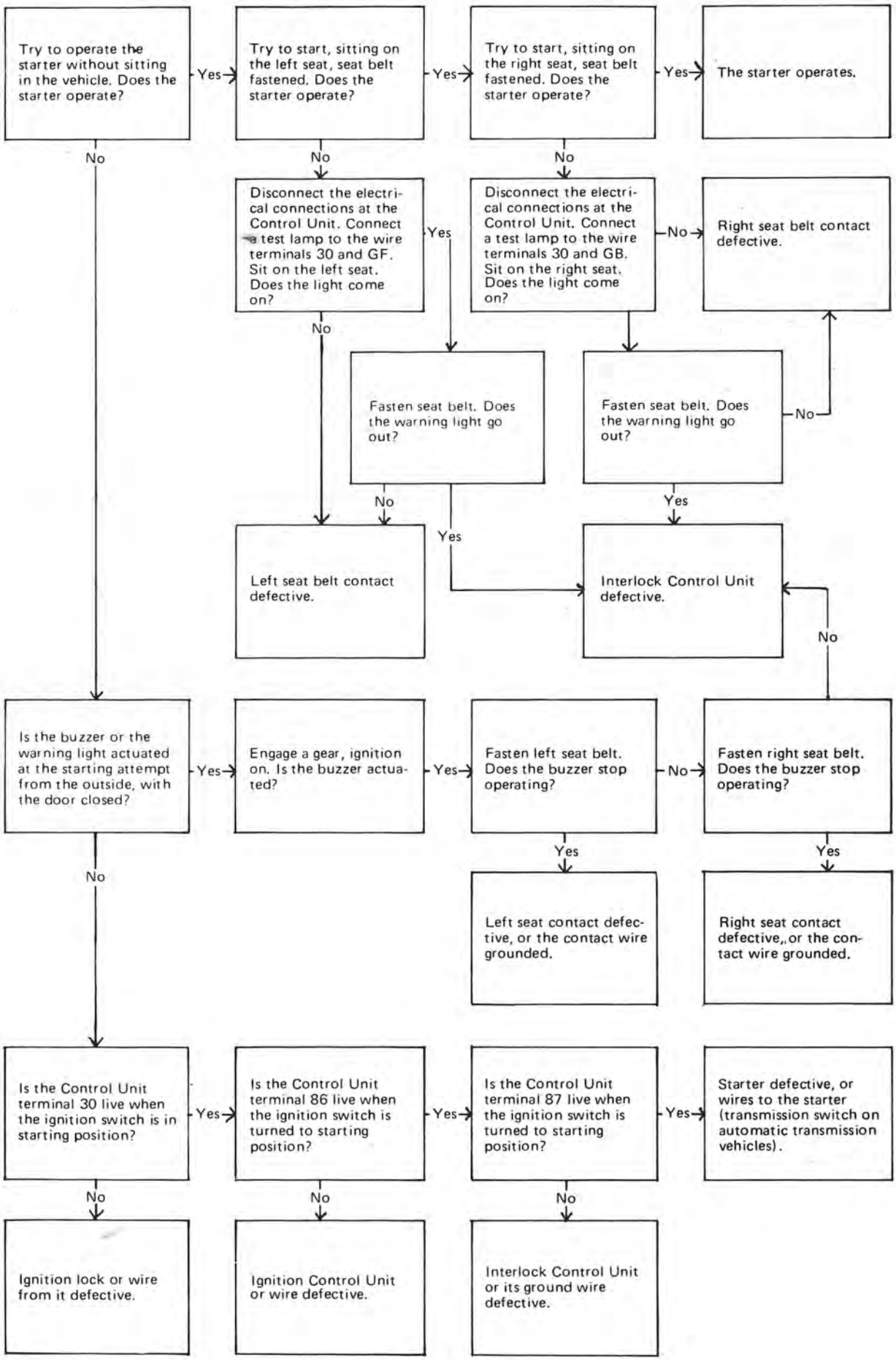
INTERLOCK CONTROL UNIT, REPLACEMENT

1. Disconnec the electrical connections at the unit.
2. Remove the control unit.
3. Install the replacement unit.
4. Test the unit, as follows:
   a. Get seated.
      Move the gear lever to "Neutral" position.
      Turn the ignition switch to starting positon.
      The starter should fail to operate.
   b. Fasten the seat belt.
      Turn the ignition switch to starting position.
      The starter should operate.
      Switch off the ignition.
      Disconnect the seat belt and leave the vehicle.

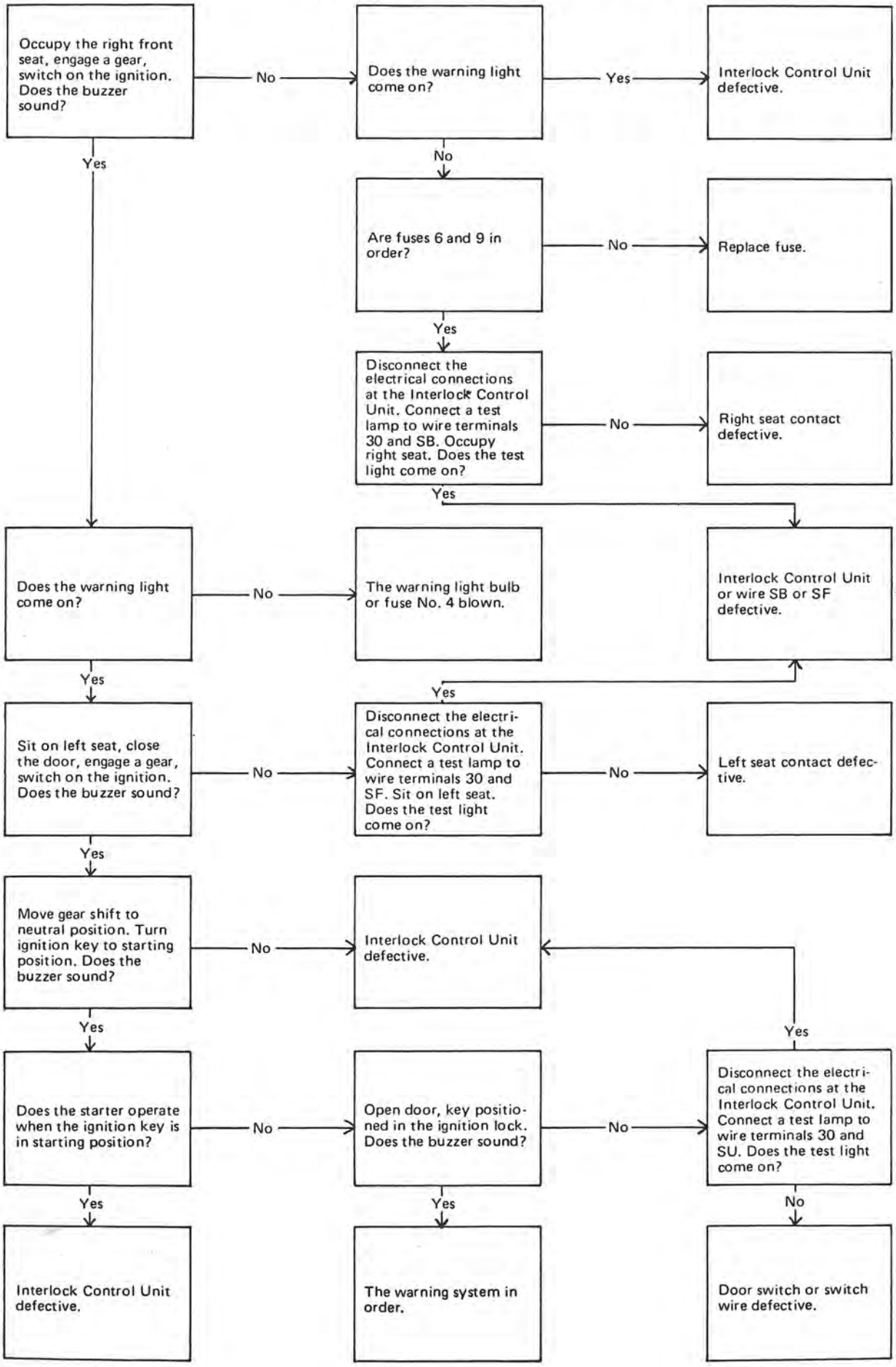
SERVICE DIAGNOSIS

Concerning Service Diagnosis on the Seat/Ignition Interlock System, see pages 3 : 44—3 : 46.

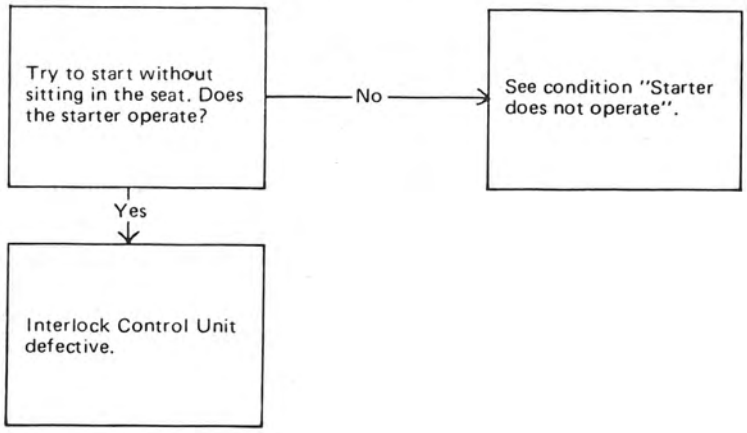
THE STARTER DOES NOT OPERATE



WARNING SYSTEM DOES NOT FUNCTION



WARNING SYSTEM OPERATES CONTINUOUSLY



INSTRUMENTS
TOOLS

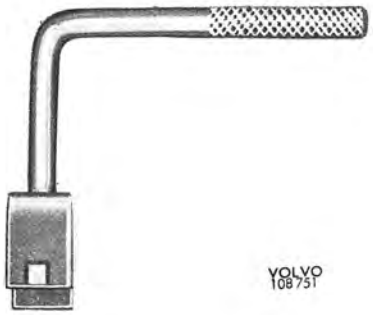


Fig. 3-121. Special tool for removing and installing tank fittings

The numbers for the special tools may now be preceded by SVO or 999, e.g., SVO 1801 or 999 1801

GENERAL INFORMATION

The instrumentation consists of a combined instrument, see Figs. 3-122 and 3-123. It comprises a speedometer, trip meter, tachometer (certain models), temperature gauge, fuel gauge, warning lamps for parking brake, brake circuit failure, oil pressure, battery charging, choke, bulb integrity sensor and overdrive.

Also connected to the combined instrument is a voltage regulator which maintains the feed voltage constant for the instrumentation.

Fig. 3-122. Combined instrument, front side

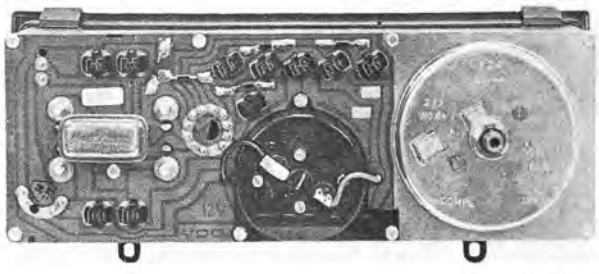


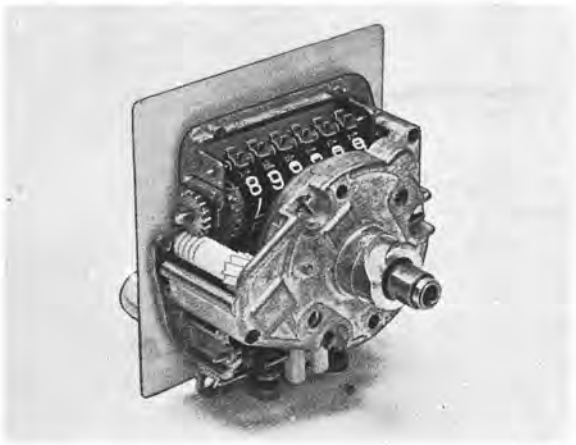
Fig. 3-123. Combined instrument, reverse side

SPEEDOMETER AND ODOMETER

The speedometer and odometer are integrally built and are driven by a drive line from a worm on the transmission output shaft.

The speedometer is of the eddy current type and mainly consists of a permanent magnet, a mounting disc and a rotor drum. The rotor drum is linked by a shaft to the gauge pointer. The shaft is also provided with a balance spring.

The odometer has a number of gears and registers up to 1 million km (600 000 miles). It is also provided with a trip meter. The ratio of the odometer is so chosen that the drive line should rotate 640 times in order for the gauge to register 1 km.



YOLVO 107389

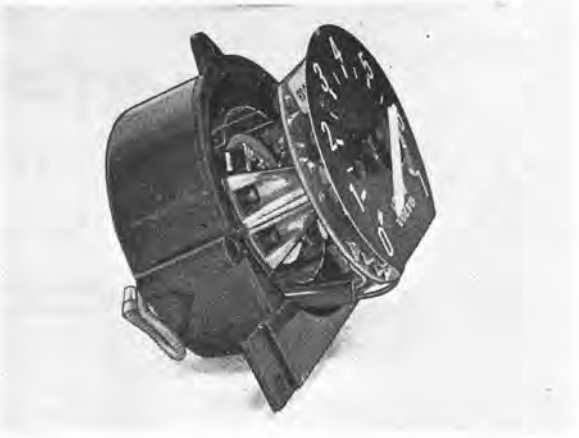
Fig. 3-124. Speedometer and mileometer

When the vehicle starts running, the drive line and the permanent magnet connected to the drive line rotate. This generates a rotating magnetic field, which gives rise to ecdy currents in the rotor drum. The rotating effect which the magnetic field as well as the induced eddy currents have on the rotor drum increases with increased speed on the permanent magnet. The rotation of the rotor drum is counteracted by the balance spring, this giving a proportional reading of the pointer to the magnetic rotation.

TACHOMETER

The tachometer consits partly of a transistorized registration and amplifier unit and partly of a rotational coil system.

The registration part senses, through a sender line, the pulse frequency of the ignition coil. The amplifier part amplifies and conducts the pulses to the rotational coil system.



YOLVO 107345

Fig. 3-125. Tachometer

The rotational coil system consists of an annular shaped permanent magnet round which a coil is fitted. The coil is movable the length of the magnet and is linked to a shaft to which the rev counter gauge pointer is fitted. When pulses from the amplifier are conducted through the coil, this forms a magnetic flow which coils the length of the permanent magnet. The rotational force is proportional to the current flow through the coil.

TEMPERATURE GAUGE, COOLANT

The temperature gauge is of the bi-metal type and consists of a sensor and registering instrument. The sensor is mounted on the engine and senses the coolant temperature. The registering instrument is included in the combined instrument.

YOLVO 108709

Fig. 3-126. Temperature gauge

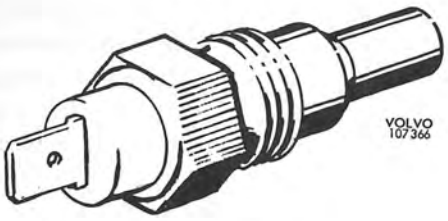


Fig. 3-127. Sensor for temperature gauge

The sensor, which is of the semi-conductive type, has a negative temperature coefficient, which means that its resistance drops in proportion to increased temperature. The registering instrument consists of a bi-metal spring connected to a pointer. A resistance wire, connected in series with the voltage stabilizer and sensor, is wound round the bi-metal spring.

When the ignition is switched on, current flows from the voltage stabilizer through the resistance wire and the sensor to ground. When current passes the resistance wire, it heats up the metal spring and this causes the pointer to indicate on the gauge. The volume of the current passing through the resistance wire in inverse proportion to the resistance of the sensor, and for this reason the gauge reading increases with increased engine temperature.

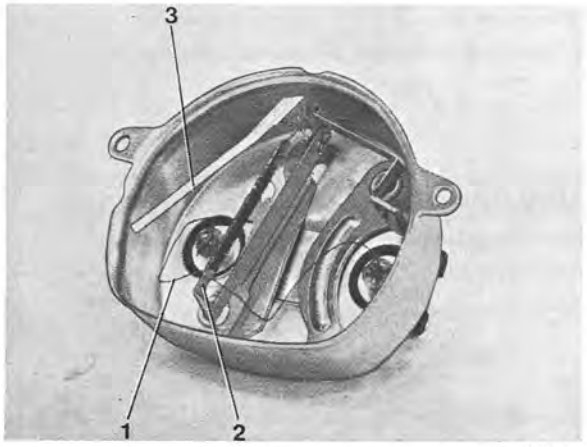


Fig. 3-128. Registering instrument, disassembled
1. Resistance wire 2. Bi-metal spring 3. Pointer

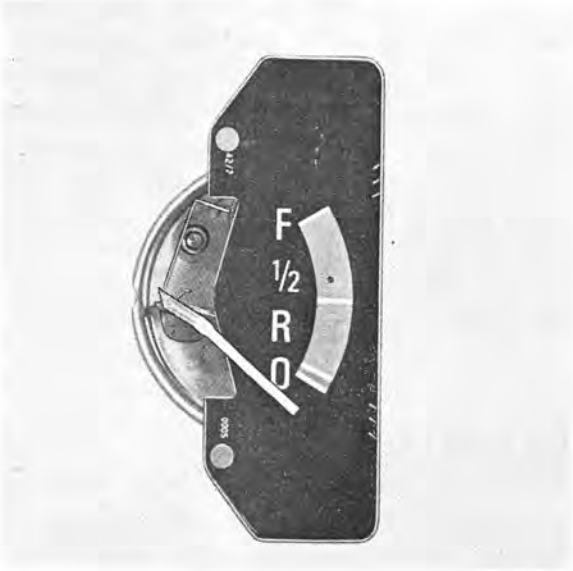


Fig. 3-129. Fuel gauge

FUEL GAUGE

The fuel gauge consists of a sender and indicating instrument. The sender in the fuel tank consists of a moving resistance, a lever and a float. The indicating instrument is of the same type as for the temperature gauge.

The function is exactly the same as for the temperature gauge, apart from the fact that the sender is mechanical. The amount of sender resistance engaged will depend on the amount of fuel in the tank and thereby the location of the float. In other words, an empty tank results in large sender resistance while a full tank produces minimum sender resistance. This has a corresponding effect on the indicating instrument.

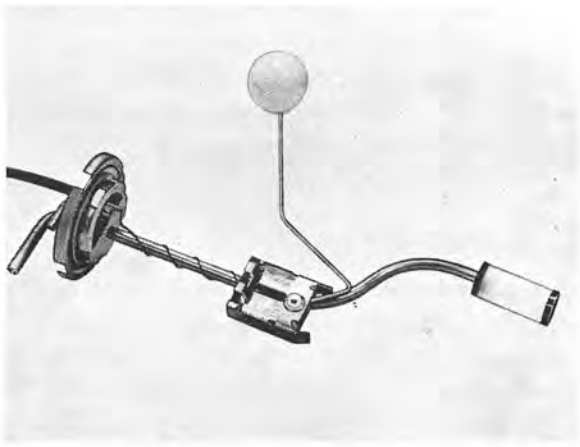


Fig. 3-130. Sender for fuel gauge

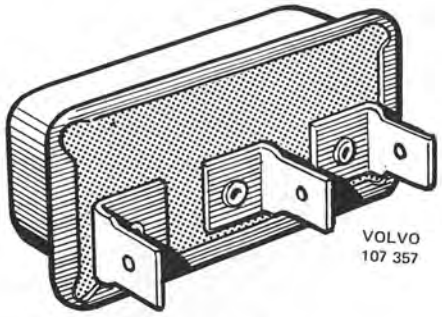


Fig. 3-131. Voltage stabilizer

VOLTAGE STABILIZER

The temperature and fuel gauges are powered by a voltage of 10 volts and are fed through a voltage stabilizer. This stabilizer contains a bi-metal spring and a contact breaker. When the ignition is switched on, current flows through the stabilizer and out to the instruments. This heats the stabilizer bi-metal spring which bends and thus breaks the circuit. As the spring cools down, it returns to its original position and the circuit is closed again. This cycle is repeated continuously. A regulated effect corresponding to a constant voltage of approx. 10 volts is thereby obtained. The breaking and making of the circuit is not visible on the instruments due to their inertia. The stabilizer is mounted on the reverse side of the combined instrument.

WARNING/CONTROL LAMPS

PARKING BRAKE

The parking brake warning lamp receives current via the ignition switch. When the parking brake is applied, the warning lamp is grounded by the switch, Fig. 3-132, and this switches on the warning lamp which remains lighted as long as the parking brake is on.

Fig. 3-132. Switch for parking brake control

BRAKE CIRCUIT FAILURE

Should a fault arise in any of the two circuits of the hydraulic brake system, so that there is a pressure difference between the circuits of more than 8 – 10 kp/cm² (114 – 142 psi) when the brakes are applied, this actuates the warning valve, Fig. 3-133 and the warning lamp goes on. The warning lamp remains lighted until the fault in the brake system has been corrected and the warning valve re-set. Re-setting the warning valve, see Section 5, Brakes, Group 52.

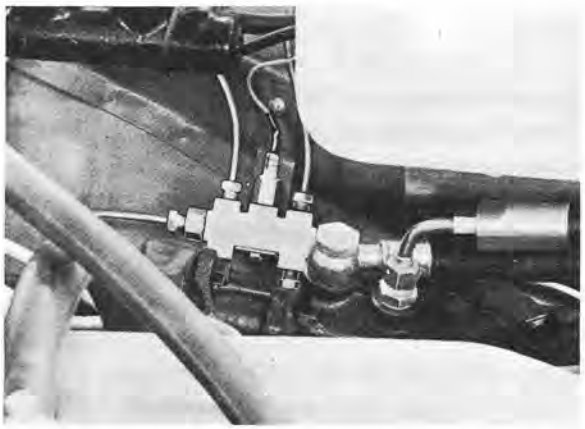


Fig. 3-133. Warning valve

BATTERY CHARGING

The battery charging warning lamp is connected to the alternator. It lights up when the alternator voltage is lower than the battery voltage. As the alternator voltage rises and commences to charge the battery, the warning lamp goes out, thus indicating that the alternator is charging.

TURN INDICATORS

The warning lamp for the turn indicators flashes when the signal is engaged. It is wired across the switch for the indicators.

FULL-BEAM HEALDIGHTS

The control light for the headlight upper beams comes on simultaneously with the full-beam headlights. It is wired parallel with the headlights at the relay.

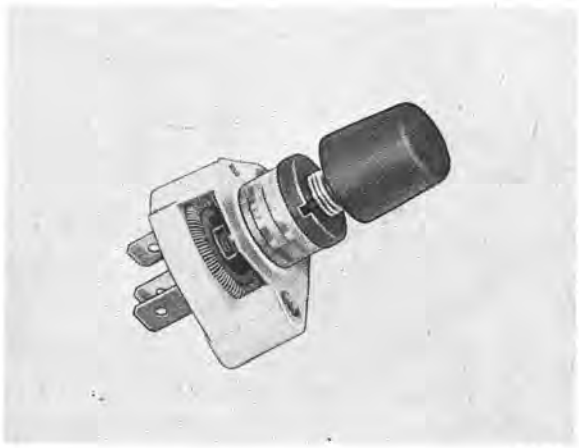
OIL PRESSURE

The warning lamp for the oil pressure receives current via the ignition switch and is grounded through a pressure sensitive valve on the engine. With the engine running and at normal pressure, the connection between this lamp and ground (through the engine) is open. When the oil pressure drops below a pre-determined value, the pressure sensitive valve closes the circuit and the warning lamp lights.

CONTROL PANEL

The control panel contains a rheostat for the instrument panel lighting, cigarette lighter and switch with built-in warning lamp for the electrically heated rear window and emergency warning flashers.

The control panel also contains the controls for the heating unit as well as a reminder lamp for the seat belts.



VOLVO 107390

Fig. 3-134. Rheostat for instrument light

OVERDRIVE

The control light for the overdrive is connected between the switch for the overdrive and ground, and thus lights when the overdrive is engaged.

CHOKE

When the engine is choked, a contact in the choke control cuts in the circuit and this grounds the warning lamp, which lights.

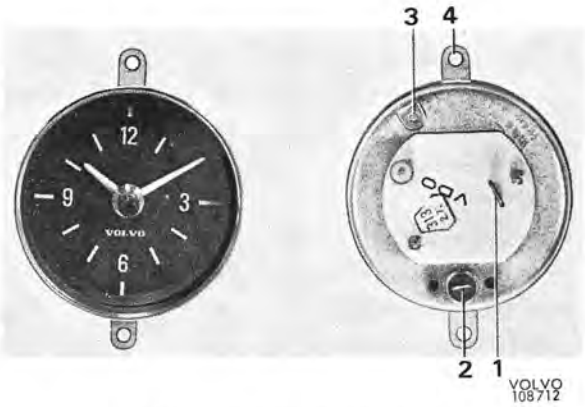


Fig. 3-135. Electric clock, front and reverse

1. Battery connection
2. Bulb
3. Battery connection
4. Attaching screws

CLOCK

The clock, Fig. 3-135, is electrically driven and is located above the control panel.

SERVICE PROCEDURES

For all work under the dashboard, the battery ground cable should be disconnected to avoid any short-circuiting.

REMOVING COMBINED INSTRUMENT

1. Remove the casings over the steering column.
2. Remove the attaching screws for the bracket and allow it to drop down towards the steering column. The combined instrument's attaching screws can now be removed.
3. Disconnect the speedometer cable from the instrument.
4. Take hold of the reverse side of the speedometer gauge with the hand and press the instrument upwards–inwards until the snap lock in the upper edge of the instrument releases.
5. Lift forward the instrument and disconnect the connection from its reverse side. (On vehicles with tachometer, the tachometer cable should also be disconnected.)

REMOVING WARNING LAMPS

1. The lamps are mounted in holders which are removed by pushing in their attaching hooks and then pulling the holder straight out.
2. The bulbs are released from their sockets by pulling them straight out.

REMOVING TACHOMETER OR GUARD COVER

1. Remove the combined instrument.
2. Remove the three screws.
3. Lift off the tachometer or the guard cover carefully in order not to damage the pole connections.

REMOVING SPEEDOMETER UNIT

1. Remove the combined instrument.
2. Remove the rev counter or guard cover.
3. Unscrew the three remaining screws.
4. Lift off the speedometer carefully in order not to damage it.

REMOVING VOLTAGE STABILIZER

The voltage stabilizer is removed by pulling it straight up so that the three connection pins release from their retainers.

REMOVING CABLE PLATE

1. Remove the combined instrument.
2. Remove the rev counter or guard cover.
3. Remove the speedometer.
4. Remove the three remaining screws.
5. Carefully lift up the cable plate so that the temperature gauge or fuel gauge is not damaged.

REMOVING TEMPERATURE GAUGE AND FUEL GAUGE

1. Remove the tachometer or guard cover.
2. Remove the speedometer.
3. Remove the contact device.
4. Remove both the nuts on the reverse side of the contact device.
5. Lift out the gauge.

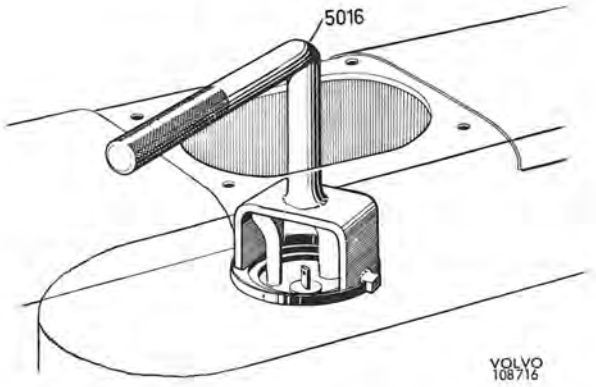


Fig. 3-136. Tool for removing sender for fuel gauge

The components in the combined instrument are installed in reverse order to removal.

REMOVING FUEL GAUGE SENDER

The sender, which is located in the fuel tank, is held in position with a bayonet fixture. When removing, use tool 5016 see Fig. 3-136.

REPLACING TEMPERATURE GAUGE SENSOR

1. Drain some of the coolant, about 2 dm^3 (2 qts).
2. Disconnect the electric cable from the sensor.
3. Remove the sensor and replace it with a new one.
4. Install the new sensor and connect the electric wire.
5. Fill coolant.

REMOVING CLOCK

1. Remove the impact pad.
2. Remove the control panel attaching screws.
3. Lift forward the panel sufficiently to get at the reverse side of the clock.
4. Disconnect the electric cable from the clock.
5. Remove the clock's two attaching screws and lift forward the clock.

Installation is in reverse order to removal.

TESTING SPEEDOMETER AND ODOMETER

If the speedometer or odometer is not functioning, the reason may be due to a fault in the instrument or speedometer cable or the worm gear, which is located on the transmission for driving the cable. In order to decide which component is faulty, check the following: If the speedometer functions while the odometer does not, or vice-versa, then the instrument is defective and should be replaced. No attempt should be made to repair the instrument.

When both the speedometer and odometer stop functioning, the fault is probably in the speedometer cable or the worm gear. Disconnect the speedometer cable from the instrument and see if it can be rotated. If it can, this means that it has broken from the worm gear. Check the cable and the drive at the transmission.

Check to see whether the drive couplings can rotate easily. If they jam, the instrument should also be replaced.

The speedometer can be checked by running it at different speeds. The following values should then apply:

Speed of drive couplings			
8.35	16.70	29.20	r/s
(500)	(1000)	(1750)	(rpm)

Speedometer reading			
33±2.5	63±2.5	108.5±2.5	mph

TESTING SPEEDOMETER CABLE

It is most important that the speedometer cable is correctly fitted if the speedometer is to function without trouble. It is vitally important that the cable is given a smooth bend. At no point must the radius of a bend be less than 100 mm (4"). If it is less than this, vibration and noise can occur in the instrument. The drive couplings must run true in the outer caisng of the cable. This is checked with the cable rotating.

TESTING TEMPERATURE GAUGE

If the temperature gauge is faulty, the faulty component (sensor, indicating instrument or voltage regulator) must first be traced and then the fault remedied. In order to trace the faulty component, two or possibly three resistors are required, one or two at 40 ohms and one at 282 ohms. Trouble-shoot as follows:

First disconnect the electric cable from the temperature sensor and then connect up the 282 ohm resistor between cable and ground.

First disconnect the electric cable from the temperature sensor and then connect up the 282 ohm resistor between cable and ground.

With the ignition switched on, the pointer on the indicating instrument should be at the beginning of the green field (50°C=122°F). Instead of the 282 ohm resistor, then connect the 40 ohm resistor. The pointer on the indicating instrument should be at the beginning of the red field (120°C=248°F). With correct indicating instrument function, the sensor is defective and should be replaced by a new one.

NOTE: The sensor cable must **never** be wired directly to ground since it would overheat and ruin the instrument.

If the instrument gives incorrect reading, the fault is either in the indicating instrument or the voltage regulator.

In order to decide where the fault lies, disconnect the fuel gauge sender wire from the sender and connect a resistance of 40 ohms between wire and ground.

If the fuel gauge now shows a full tank, the fault must be in the indicating instrument of the temperature gauge, which must be replaced. If, on the other hand, the temperature gauge and fuel gauge give the same, but incorrect, reading, then the voltage regulator must be defective and should be replaced.

TESTING REMOVED TEMPERATURE GAUGE SENSOR

The sensor is checked by heating it up and then reading resistance and temperature. The following values should be obtained if the sensor is without fault:

(NOTE: The resistances may deviate ±10 %.)

Temperature	50	100	120	°C
	(122)	(212)	(248)	°F
Resistance	282	60	40	ohms

TESTING FUEL GAUGE

The fuel gauge is checked in the same way as the temperature gauge.

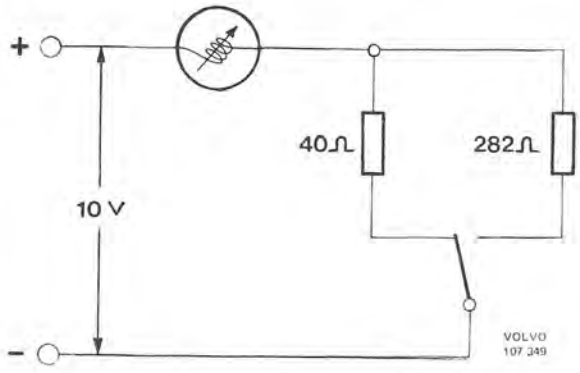


Fig. 3-137. Wiring diagram for checking temperature gauge or fuel gauge indicating instrument

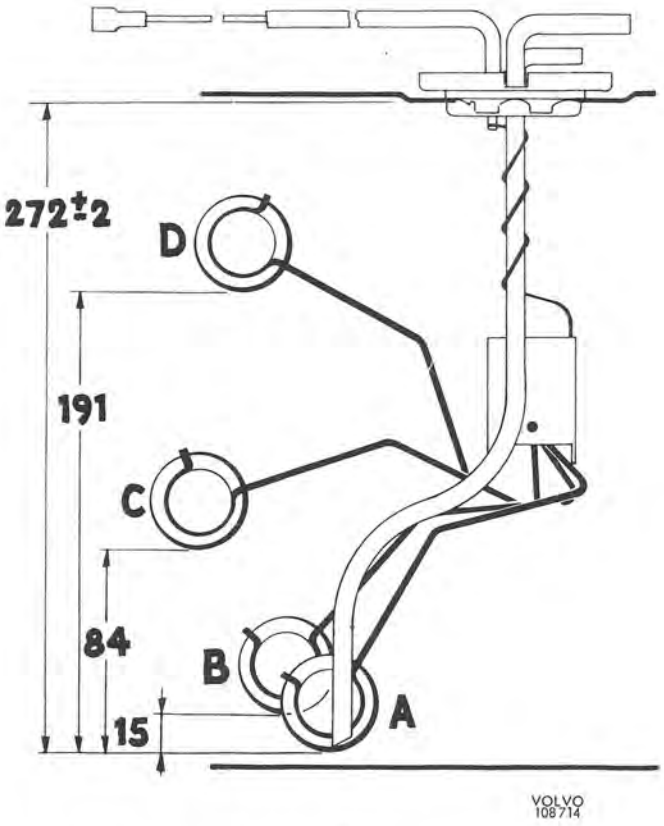
TESTING REMOVED FUEL GAUGE SENDER

The sender is checked with an ohmmeter which is wired between the contact unit for the electric cable and ground. The following resistance values should be obtained if the sender is functioning correctly:

Regarding various positions of the float, see Fig. 3-138. Its measurement indications indicate the number of mm the float should be lifted from its bottom position.

TESTING REMOVED VOLTAGE STABILIZER

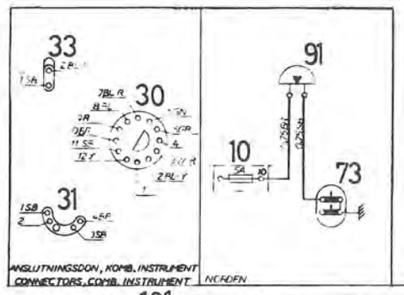
The function of the voltage stabilizer is checked with an adjustable bimetal instrument. The instrument is wired in series with a resistance of about 60 ohms and a constant D.C. voltage of 10 volts. The indicating instrument should be read off. The constant D.C. voltage is thereafter replaced by a 12 volt battery (check that the voltage is really 12 volts) and the voltage stabilizer. The indicating instrument should give a similar reading. During the test, the stabilizer should have the same position as it had in the vehicle. A damaged stabilizer is replaced by a new one, although it can of course be repaired, but this is pointless both from an economic and reliability point of view.

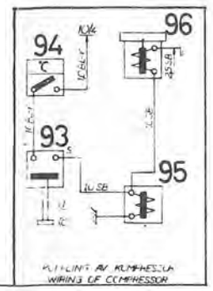


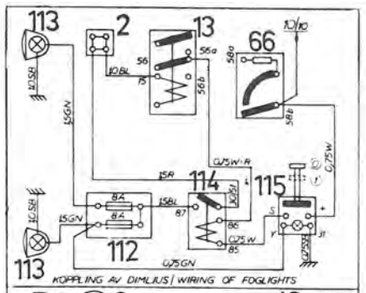
Position	Resistance in ohms		
A	282±48	C	98±14
B	223±26,5	D	40± 5

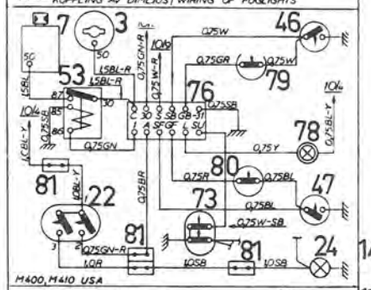
Fig. 3-138. Checking fuel gauge sender

Pos	Unit
1.	Battery, RV
2.	Connection plate
3.	Ignition switch
4.	Ignition coil
5.	Distributor, Firing order 1-5-3-6-2-4
6.	Spark plugs
7.	Starter motor, 800W
8.	Alternator, 760 W
9.	Voltage regulator
10.	Fuse box
11.	Light switch
12.	Bulb integrity sensor
13.	Step relay for upper and lower beams and headlight flasher, 1.25 A
14.	Upper beam, 45 W
15.	Lower beam, 40 W
16.	Position lamp, 5 W
17.	Tail lamp, 5 W
18.	Side marker lamp, 3 W
19.	License plate lamp, 5 W
20.	Stop light switch
21.	Stop lamp, 32 cp
22.	Conn at instrument
23.	Contact on transmission BW 35
24.	Back-up lamp, 32 cp
25.	Flasher unit
26.	Turn indicator lever
27.	Hazard warning signal switch
28.	Front turn signal lamp, 32 cp
29.	Rear turn signal lamp, 32 cp
30.	Conn at instrument
31.	Conn at instrument
32.	Brake failure pilot lamp, 1.2 W
33.	Conn at instrument
34.	Tachometer
35.	Thermometer
36.	Fuel meter
37.	Voltage stabilizer
38.	Turn signal light pilot lamp, 1.2 W
39.	Diode
40.	Upper beam pilot lamp, 1.2 W
41.	Bulb integrity sensor, 1.2 W
42.	Charging pilot lamp, 1.2 W
43.	Parking brake pilot lamp, 1.2 W
44.	Choke pilot lamp, 1.2 W
45.	Oil pressure pilot lamp, 1.2 W
46.	Contact, passenger's seat
47.	Contact, driver's seat
48.	Parking brake contact
49.	Luggage comp. light, 15 W
50.	Temperature gauge
51.	Oil pressure guard
52.	Brake failure contact
53.	Starter cut-out relay
54.	Fuel level gauge
55.	Horn, 7.5 A
56.	Horn ring
57.	Windshield wipe/wash switch
58.	Windshield wiper, 3.5 A
59.	Windshield washer, 2.6 A
60.	Fan switch
61.	Fan, 170 W
62.	El heated rear window switch
63.	El heated rear window, 200 W
64.	Clock
65.	Cigar lighter, 7 A
66.	Instrument lighting rheostat
67.	Instrument lighting, 2 W
68.	Control panel lighting, 1.2 W
69.	Gear selector lighting, 1.2 W
70.	Glove box contact
71.	Glove box lamp, 2 W
72.	Interior lamp, 10 W
73.	Door contact, driver's side
74.	Door contact, passenger's side
75.	EGR/CAT Warning lamp, 1.2 W
76.	Belt interlock unit
77.	EGR/CAT Warning contact
78.	Safety belt pilot lamp, 1.2 W
79.	Safety belt contact, pass.seat
80.	Safety belt contact, driver's seat
81.	Junction
82.	Overdrive lever M 410
83.	Overdrive contact on transmission M 410
84.	Overdrive solenoid on transmission M 410
85.	Over-drive pilot lamp, 1.2 W
86.	Buckle lighting, 1.2 W
87.	Relay for window lifts
88.	Supplementary air valve
89.	Heating element with thermostat, drivers' seat
90.	Heating element, driver's seat, 30 W
91.	Switch for window lift r.h.
92.	Switch for window lift l.h.
93.	Switch for compressor
94.	Thermostat
95.	Solenoid on compressor, 3.9 A
96.	Solenoid valve
97.	Relay for fuel pump
98.	Main relay, fuel injection
99.	Starting valve
100.	Temperatur-time contact
101.	Injection control unit
102.	Fuel pump, 6.5 A
103.	Flop valve contact
104.	Pressure sensor
105.	Temperature sensor I
106.	Temperature sensor II
107.	Injection valves
108.	Release contact
109.	Resistor, 0.9
110.	Rear ash tray lighting, 1.2 W
111.	Engine comp. lighting, 18 W
112.	Motor for window lift r.h., 5 A
113.	Motor for window lift l.h., 5 A
114.	Ignition control unit
115.	Relay for headlamp wiper
116.	Headlamp wiper
117.	Contact on transmission M 410
118.	Relay for back-up lamp
119.	Relay for AC









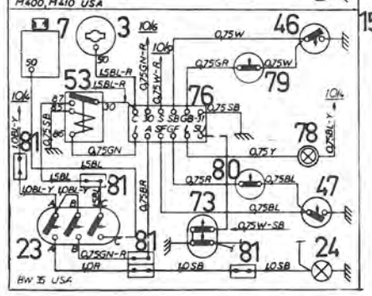


Illustration 3-A. Wiring diagram 164

VOLVO

TP 11089/1
USA
2200. 1.75

4931 Skandia-Tryckeriet, Göteborg