

Electrical System

(excl. Wiring Diagrams)

and

Instruments

242 / 244 / 245

Repairs and Maintenance

1976—

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VOLVO

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NOTE: All references to model 240 in this manual also apply to DL, GL and GT.

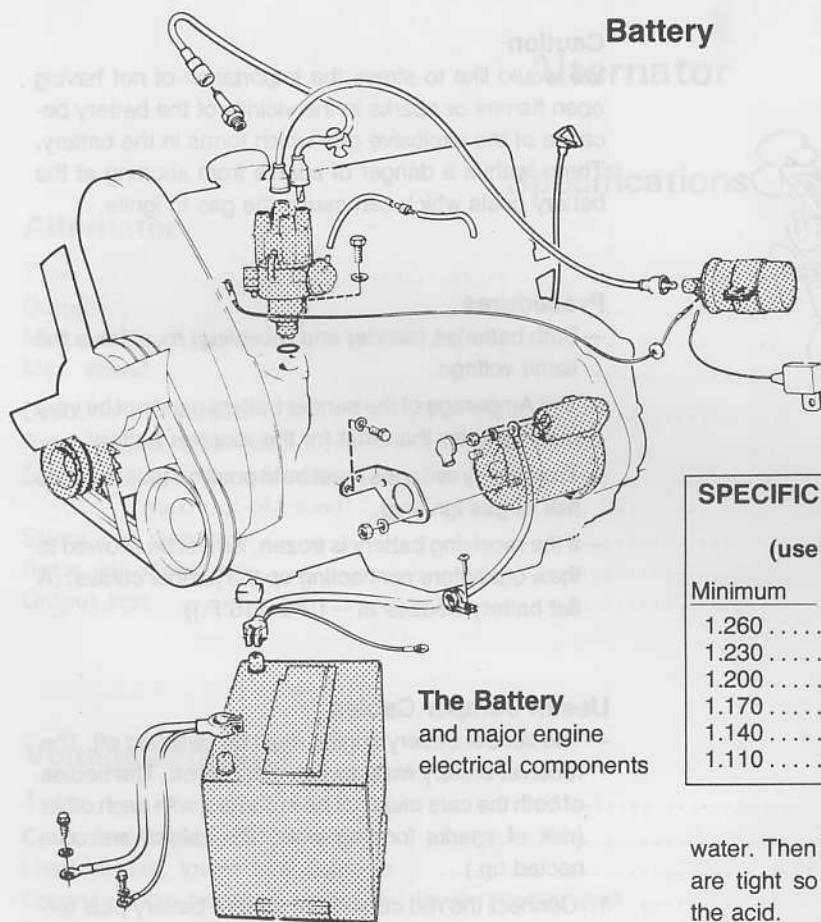
TP 11402/2

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Group 31

Battery



General Information

SPECIFIC GRAVITY (@20°C)* AND CHARGE
 Specific Gravity Reading
 (use the minimum figure for testing)

Minimum	Battery Charge
1.260	100% Charged
1.230	75% Charged
1.200	50% Charged
1.170	25% Charged
1.140	Very Little Power Left
1.110	Completely Discharged

*(80°F)

The Battery
 and major engine
 electrical components

General

Lack of electrolyte causes premature failure of batteries faster than anything else. Plates exposed to air deteriorate rapidly. Check electrolyte level frequently, especially in hot weather when evaporation is more likely.

Fill distilled water only to the battery, never acid. However, any water is better than no water. Battery life is extended by using the purest water available.

Checking Battery

The most common way to check battery charge is with a hydrometer. It measures specific gravity which is a direct measure of percentage sulphuric acid in the electrolyte. As battery drops from charged to discharged condition, acid leaves the solution and enters the plates. This causes a decrease in specific gravity.

Prolonging battery life is just a matter of developing good habits of testing and maintenance. A dirty battery discharges itself: acid corrosion and dirt act as conductors. Corrosion around battery posts eats away copper cable terminals.

A dirty battery should be removed and scrubbed with a solution of baking soda and water or ammonia and

water. Then flush with clean water. Be sure vent caps are tight so no solution gets into cells to neutralize the acid.

Also wash battery carrier and holddowns.

Do not overtighten holddown bolts. Tight bolts will strain the battery. Check battery case for cracks.

When charged, a battery gives off hydrogen and oxygen, a mixture which is highly explosive. Keep open flames away from battery and **never** disconnect a charger by removing the connection at the battery post.

Guard against sparks by disconnecting the ground cable **first** and connecting it **last**. Be careful not to let tools or other metal objects fall across the battery terminals.

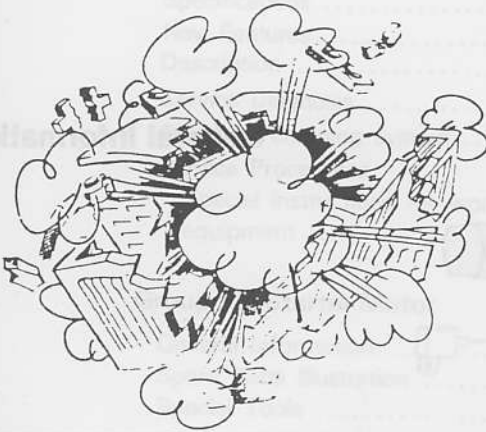
Never take readings right after adding water. Water must first be mixed with electrolyte. This is done by charging the battery or running it on the car for a couple of days.

Take electrolyte from each cell and compare readings. If one cell is 0.030 or more lower than other cells its plates are not holding charge and it might be necessary to replace the battery. (0.050 for dry charged)

If battery checks good by the specific gravity test, it might still be necessary to make a high rate discharge test, duplicating the starter motor demands. See Group 33, Starter Motor and Electrical test specifications.

Do not maintain load on battery longer than necessary.

WARNING!



Caution

We would like to stress the importance of not having open flames or sparks in the vicinity of the battery because of the explosive gas which forms in the battery. There is thus a danger of sparks from shorting at the battery posts which can cause the gas to ignite.

Procedures

- Both batteries (sender and receiving) must have the same voltage.
- The Amperage of the sender battery must not be very much greater than that for the receiver battery.
- The battery cell caps must be in position (this reduces risk of gas igniting).
- If the receiving battery is frozen, it must be allowed to thaw out before connecting up the jumper cables. (A flat battery freezes at -10°C . (15°F .)

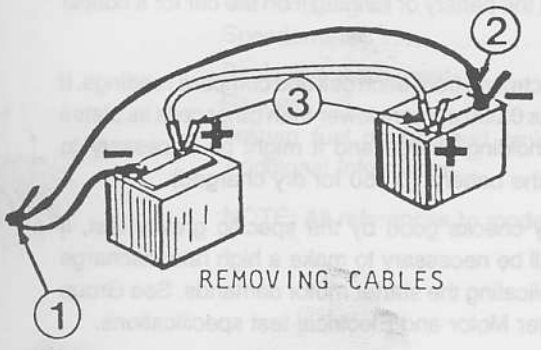
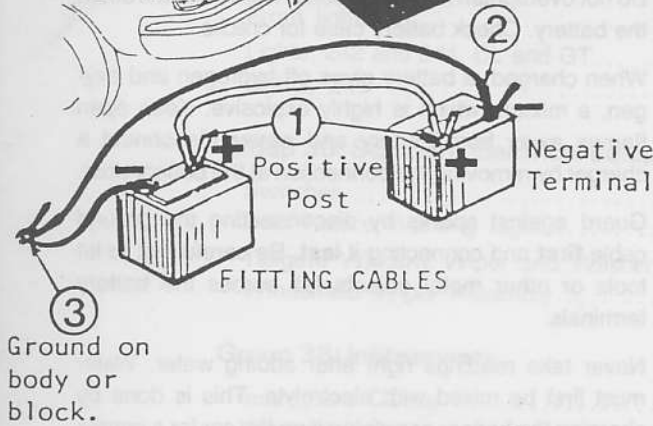
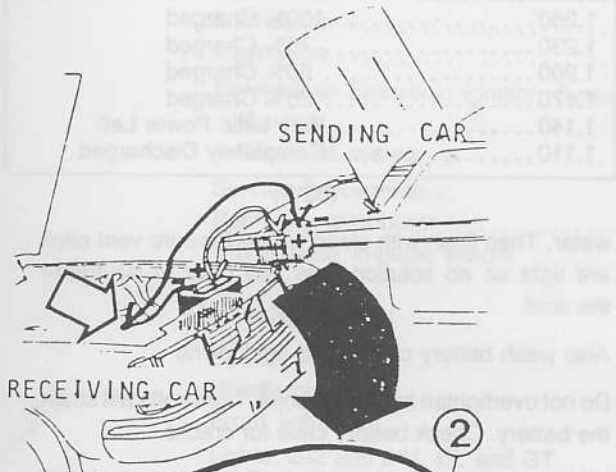
Use of Jumper Cables

— The sender battery engine must be switched off. The receiver battery main switch must be off. The bodies of both the cars must not be in contact with each other (risk of sparks forming when the cables are connected up.)

1. Connect the red cable from sender battery plus terminal to receiving battery plus post.
 2. Connect one end of the black cable to a ground point some distance from the receiving battery. Suitably the receiving battery's ground connection should also be on the body or on the engine.
- Start the car of the sender battery and idle it at about 1500 rpm for several minutes.
- Start the car of the receiver battery.

NOTE! Do not alter the position of the cable clamps during the starting attempt otherwise there is risk of sparks forming.
Do not bend over the battery!

— Remove the cables in precisely the reverse order to fitting them.



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Group 32

Alternator

Specifications

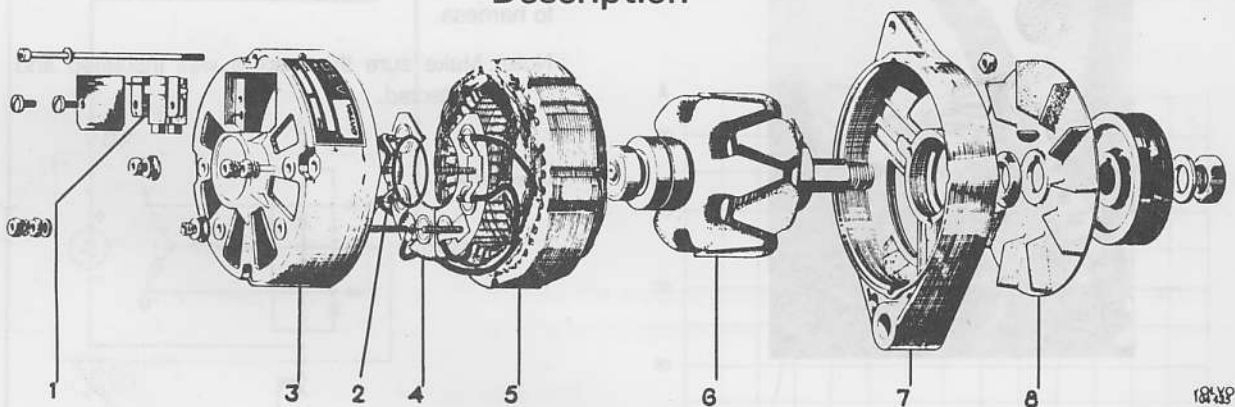
Alternator

Type	13.0-15.0V	
Output	770 W	
Max. amp.	55 Amps	
Max. speed	225 r/s	= 13500 rpm
Direction of rotation	Clockwise	
Ratio, engine/alternator	1:2	
Slip rings: minimum diameter	31.5 mm	= 1.3"
max. out-of-round	0.03 mm	= 0.0012"
Stator coil resistance	0.14 ohm + 10%	
Rotor coil resistance	4.0 ohms + 10%	
Output test	48 Amps at 3000 rpm, 13.2 Volts and 24°C ambient temperature	

Voltage Regulator

Type	Bosch 14V
Control voltage of 4000 rpm	13.9-14.8 Volts
Load current, lower two contacts	45 ± 1 Amp
Control range, between upper and lower contact sets	0-0.4 Volts
Load current, upper two contacts	3-8 Amps

Description



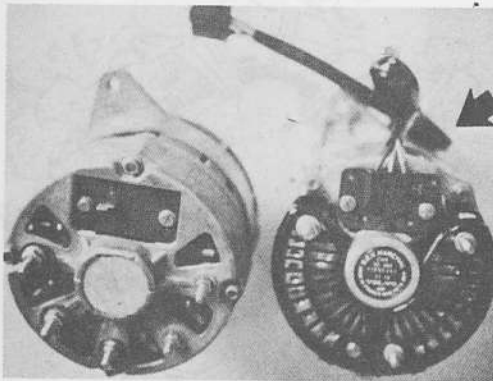
- | | |
|-------------------------------|---------------------|
| 1. Brush holder | 5. Stator |
| 2. Magnetizing Diodes | 6. Rotor |
| 3. Slip ring end shield | 7. Drive end shield |
| 4. Rectifier (silicon diodes) | 8. Fan |

The alternator is a three-phase, star connected alternating unit. The rectifier is built into the slip ring end shield and consists of six silicon diodes. Also housed in the slip ring end shield are three so-called magnetizing diodes, which feed the field via the voltage regulator.

An alternator has a rotating field coil (rotor) and a stationary main coil (stator). The rotor is a 12-pole claw-pole type with the field coil fed across two slip rings.

Since the alternator output is self-limited (max. 55 amps), a simple regulator is used. It controls the voltage only.

New Features

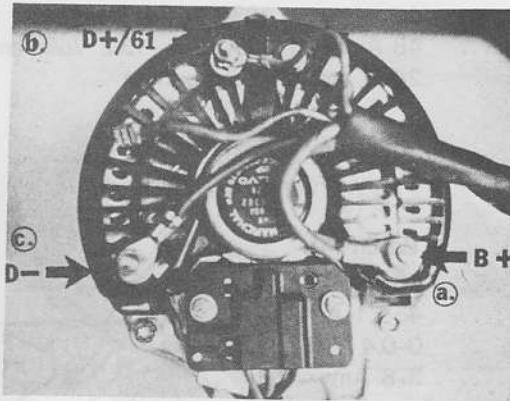


OLD

NEW

A new type SEV alternator (SEV P/N 71655302) is now being stocked under Volvo P/N 5462893-8. The new alternator can be identified by a black plastic diode guard and a molded wiring harness assembly. (See Picture Below). When replacing the older style SEV alternator with the new version, two minor changes to the old wiring harness are required. Refer to the instructions below.

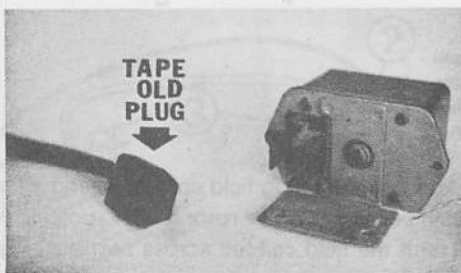
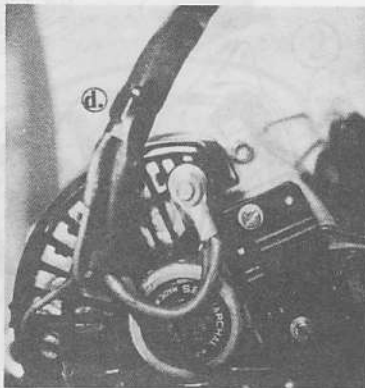
Wiring Harness With Molded Connection



After old style alternator is removed and in-car harness is disconnected, proceed with the operations shown during installation of the new alternator.

1. Connect in-car harness leads to terminals at back of new alternator as follows:
 - a. Heavy gauge, red twin lead to B+ terminal.
 - b. Single red lead to D+/61 terminal.
 - c. Black lead to D- terminal.
 - d. Use electrical tape to securely fasten green DF lead to harness.

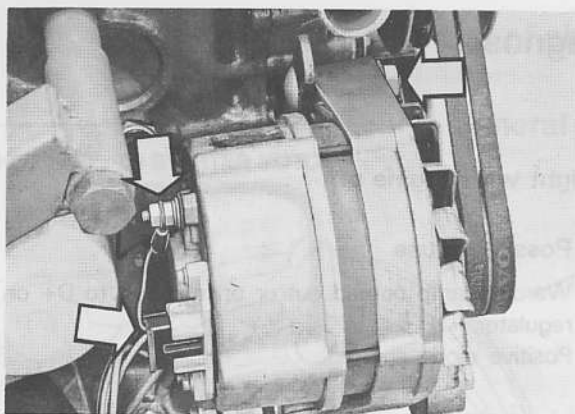
Note: Make sure the lead is well insulated and protected.



2. Carefully tape the old in-car wiring harness connector plug as shown.

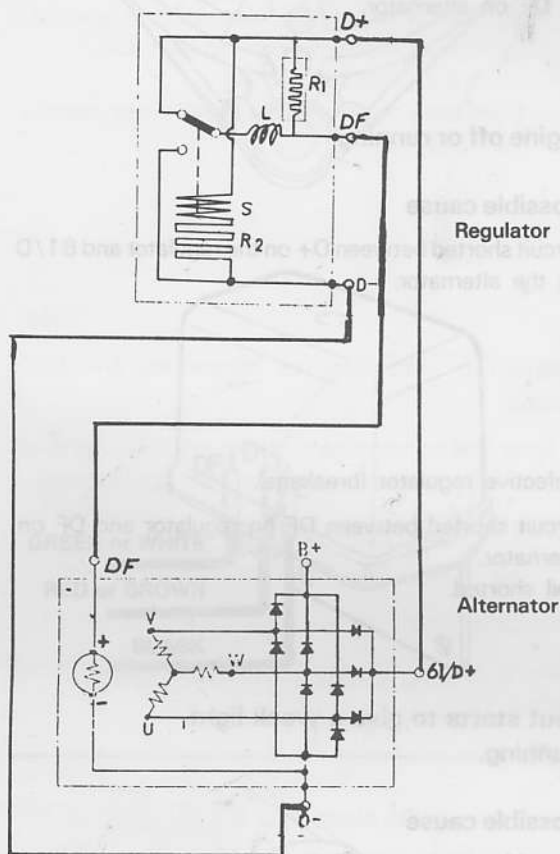
The connector plug from the new molded alternator harness should be plugged into the regulator.

Note: **Do not** under any circumstances cut any of the old leads since they may be needed for future alternator installations.



Alternator

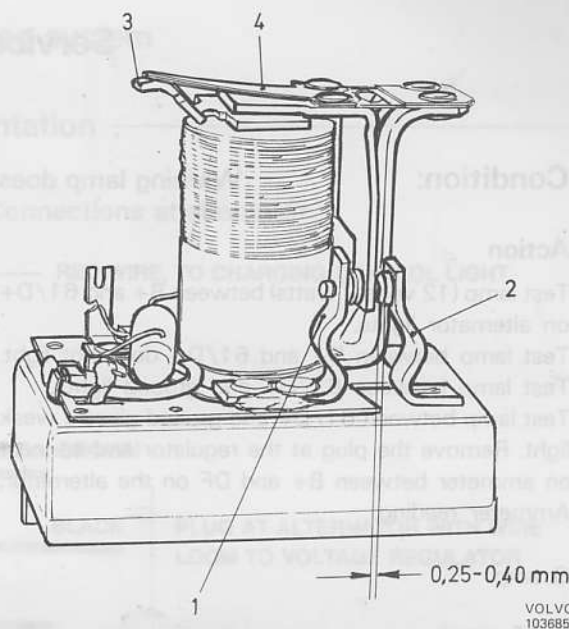
When the ignition is switched on, current flows through the charging warning lamp to terminal D+ on the voltage regulator. Via the regulator, the current is conducted through the rotor coil to ground.



Regulator

Alternator

When the rotor starts rotating, alternating current is formed in the stator. Most of the current is rectified by the positive and negative diodes and is conducted via B+ on the alternator to the battery. A small part of the current is rectified by the exciter diodes and is led via 61/D+ to the voltage regulator and then to the rotor coil. This cycle is repeated until the regulating voltage has been reached, at which point the lower control range contacts on the voltage regulator open and field current must pass a control resistance.

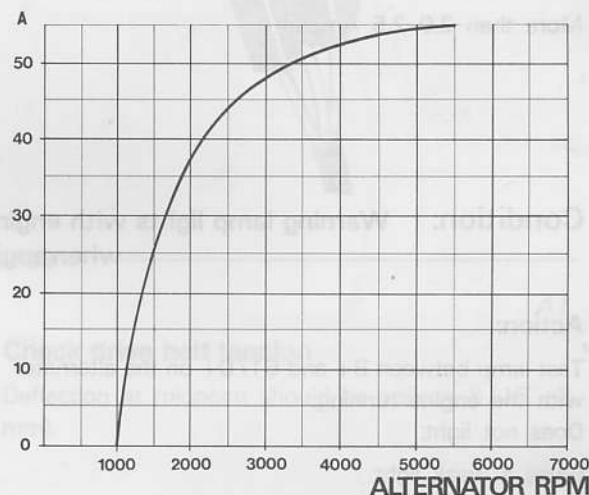


VOLVO
103685

Voltage regulator

- | | |
|--|---|
| 1. Regulator contact for lower control range | 3. Spring tensioner |
| 2. Regulator contact for upper control range | 4. Spring upper section: Steel spring
Lower section: Bi-metal spring |

If the voltage rises in spite of this, the armature on the voltage coil is pulled further down so that the upper control range contacts close. Thus the rotor coil is grounded at both ends which causes the voltage to drop rapidly. The cycle is repeated continuously so that the voltage is maintained constant.



VOLVO
106626

Alternator output curve

A = amps
RM = alternator speed/minute

The alternator maximum output is 55 amps. Top speed is 13500 rpm.

Service Diagnosis

Condition: Warning lamp does not light with engine off.

Action

Test lamp (12 volts 2 watts) between B+ and 61/D+ on alternator lights.

Test lamp between B+ and 61/D+ does not light.

Test lamp between 61/D+ and ground lights.

Test lamp between 61/D+ and ground gives a weak light. Remove the plug at the regulator and connect an ammeter between B+ and DF on the alternator.

Ammeter reading:

0 amp

2-2.5 amps

Possible cause

Warning lamp burned out or open circuit to D+ on regulator.

Positive diode shorted.

Worn brushes, oxidized slip rings on breakage in rotor coil.

Open circuit in regulator or in lead DF from regulator to DF on alternator.

Condition: Warning lamp lights with engine off or running.

Action

Disconnect the plug at the regulator:

Control lamp still lights.

Warning lamp goes out. Re-install the plug in the regulator and connect an ammeter between B+ and D+ on the alternator.

Ammeter reading:

Less than 2.0-2.5 Amps:

More than 2.0-2.5 Amps:

Possible cause

Circuit shorted between D+ on the regulator and 61/D+ on the alternator.

Defective regulator (breakage).

Circuit shorted between DF on regulator and DF on alternator.

Coil shorted.

Condition: Warning lamp lights with engine off but starts to give a weak light when engine is running.

Action:

Test lamp between B+ and 61/D+ on the alternator with the engine running:

Does not light.

Gives a weak light.

Install new regulator.

Test lamp between B+ and 61/D+:

Does not light.

Gives a weak light.

Possible cause

Transition resistance in the charging circuit or in the lead to the warning lamp.

Defective regulator (overcharging of the battery) or defective alternator (insufficient charging of the battery).

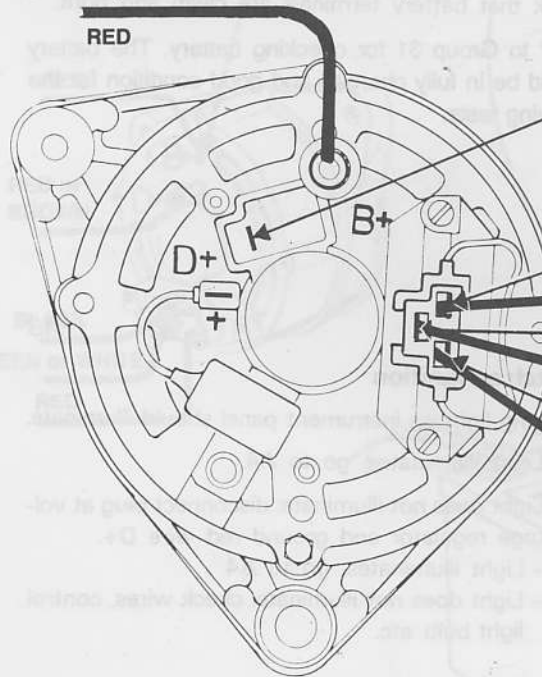
Removed regulator defective.

Defective alternator.

Check of charging system

General orientation

HOT WIRE, TO STARTER MOTOR



Connections at alternator

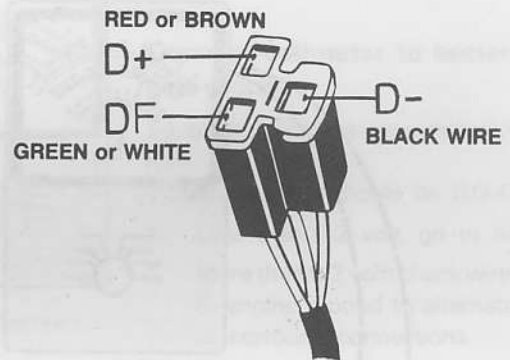
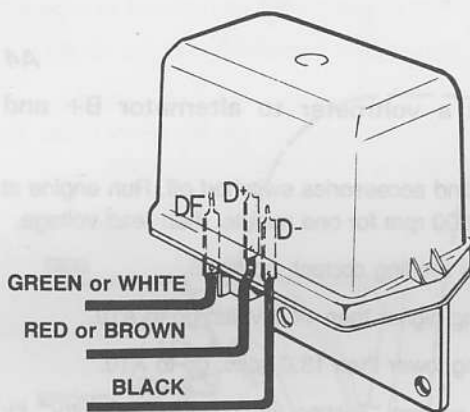
RED WIRE, TO CHARGING CONTROL LIGHT

D+ RED or BROWN
D- BLACK
DF GREEN or WHITE

PLUG AT ALTERNATOR WITH WIRE LOOM TO VOLTAGE REGULATOR

Connections at voltage regulator

identification of wires in plug

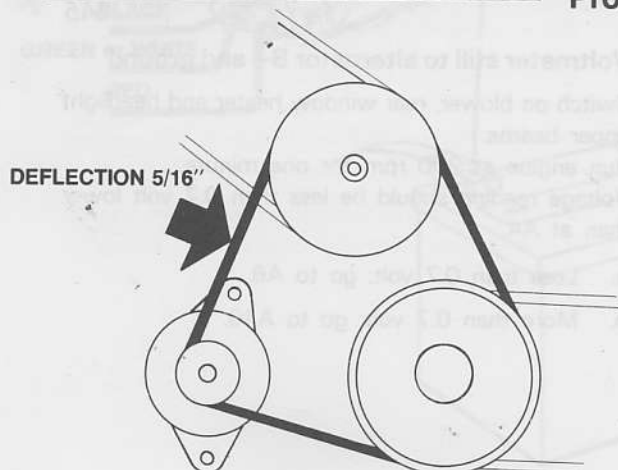


Procedures

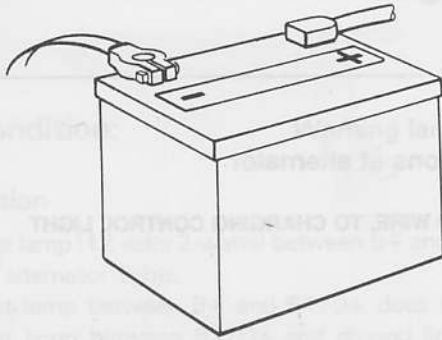
A1

Check drive belt tension

Deflection at midpoint should be approx. 5/16" (8 mm).



A2



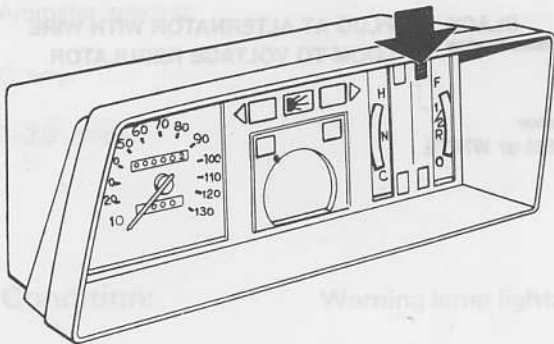
Check battery condition

A battery in good condition should be used for the following tests.

Check that battery terminals are clean and tight.

Refer to Group 31 for checking battery. The battery should be in fully charged and good condition for the following tests.

A3



Switch on ignition

Charging light on instrument panel should illuminate.

- a. Light illuminates, go to A4.
- b. Light does **not** illuminate: disconnect plug at voltage regulator and ground red wire D+.
 - Light illuminates: go to A4
 - Light does **not** illuminate: check wires, control light bulb etc.

A4

Connect a voltmeter to alternator B+ and ground

All lights and accessories switched off. Run engine at approx. 2000 rpm for one minute, then read voltage.

- a. Voltage reading correct: go to A5.
- b. Reading higher than 14.4 volts: go to A10.
- c. Reading lower than 13.0 volts: go to A10.

(Refer to section "Testing the Voltage Regulator" for charging rate).

A5

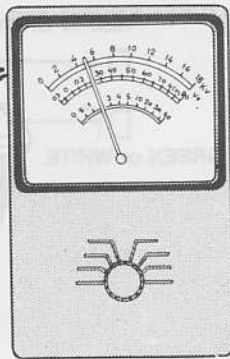
Voltmeter still to alternator B+ and ground

Switch on blower, rear window heater and headlight upper beams.

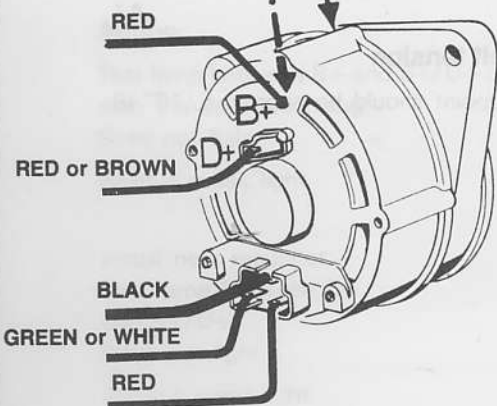
Run engine at 200 rpm for one minute.

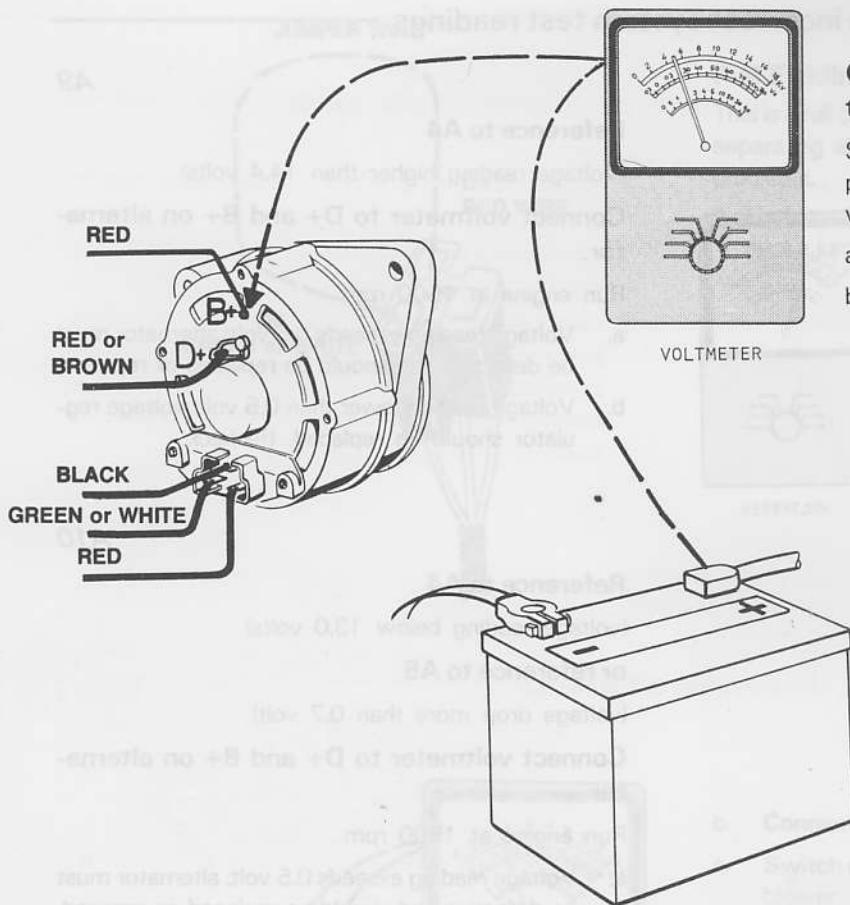
Voltage reading should be less than 0.7 volt lower than at A4.

- a. Less than 0.7 volt: go to A6.
- b. More than 0.7 volt: go to A10.



VOLT-METER

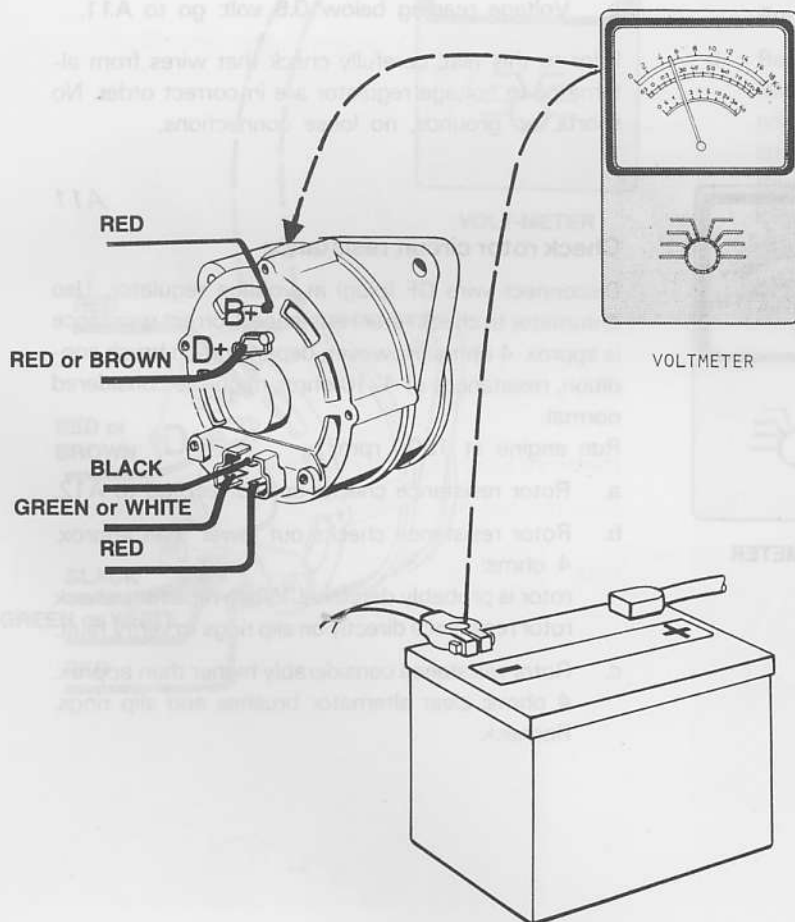




Connect voltmeter to alternator B+ and battery plus

Switch on headlight upper beams. Run engine at approx. 1500 rpm. Voltmeter reading should be 0.0–0.3 volt.

- a. Less than 0.3 volt: go to A7.
- b. More than 0.3 volt: Check wire from alternator B+ to starter motor to battery plus for loose or corroded connection.



Connect voltmeter to battery minus and engine ground

Switch on headlight upper beams. Run engine at 1500 rpm.

Voltage reading should be 0.0–0.2 volt.

- a. Less than 0.2 volt, go to A8.
- b. More than 0.2 volt: check wire from battery minus to engine ground to alternator ground for loose or corroded connections.

Charging system should be correct if all previous tests have proven satisfactory.

With incorrect system test readings

A9

Reference to A4

(Voltage reading higher than 14.4 volts)

Connect voltmeter to D+ and B+ on alternator.

Run engine at 1500 rpm.

- a. Voltage reading exceeds 0.5 volt: alternator must be defective and should be replaced or repaired.
- b. Voltage reading lower than 0.5 volt: voltage regulator should be replaced. Recheck.

A10

Reference to A4

(voltage reading below 13.0 volts)

or reference to A5

(voltage drop more than 0.7 volt)

Connect voltmeter to D+ and B+ on alternator

Run engine at 1500 rpm.

- a. Voltage reading exceeds 0.5 volt: alternator must be defective and should be replaced or repaired.
- b. Voltage reading below 0.5 volt: go to A11.

Prior to this test, carefully check that wires from alternator to voltage regulator are in correct order. No shorts, no grounds, no loose connections.

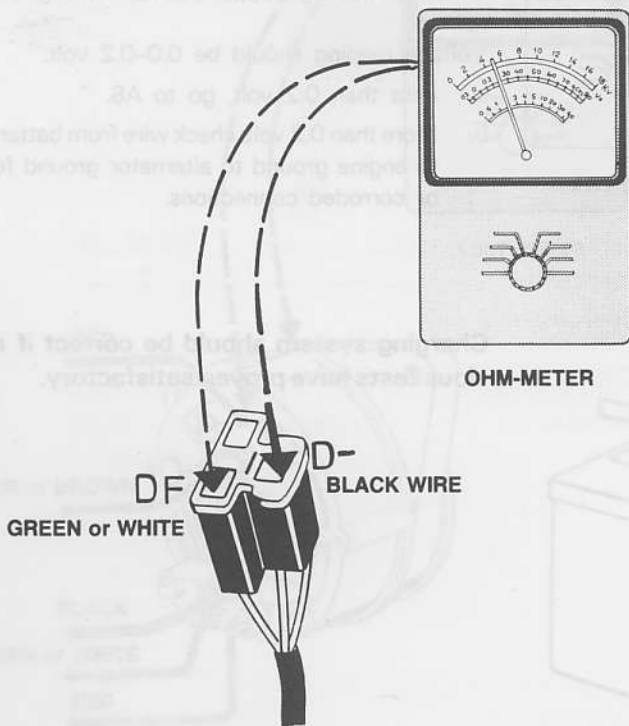
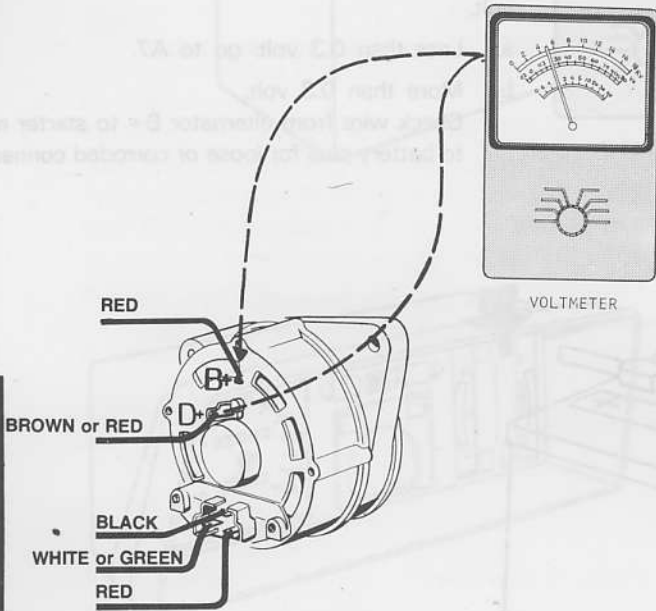
A11

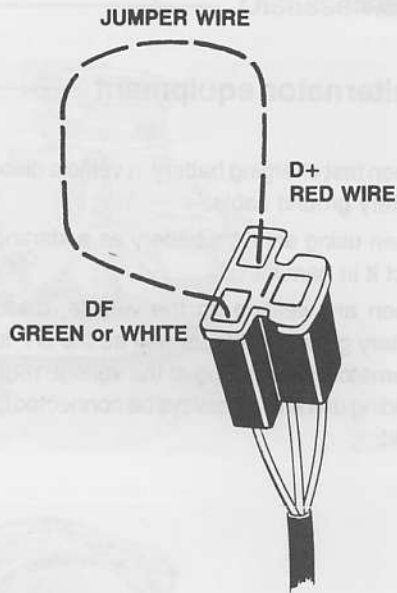
Check rotor circuit resistance

Disconnect wire DF (plug) at voltage regulator. Use ohmmeter to check rotor resistance. Correct resistance is approx. 4 ohms. However, depending on brush condition, resistances of 4–10 ohms might be considered normal.

Run engine at 1500 rpm.

- a. Rotor resistance checks out correct: go to A12.
- b. Rotor resistance checks out lower than approx. 4 ohms: rotor is probably defective. When repairing, check rotor resistance directly on slip rings to verify fault.
- c. Rotor resistance considerably higher than approx. 4 ohms: clear alternator brushes and slip rings. Recheck.

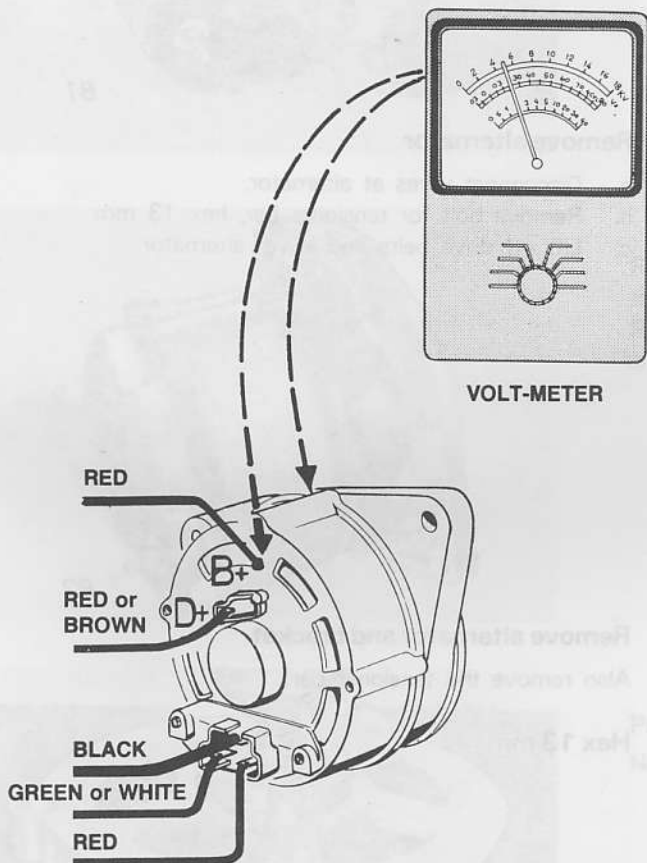




Full Fielding Test

This is a full charge test of alternator, aimed at definitely separating alternator problems from voltage regulator problems.

- a. Remove the plug at the voltage regulator and connect a jumper wire between D+ and DF as shown.



- b. Connect voltmeter to alternator B+ and ground
- c. Switch on:
blower, rear window heater, headlight upper beams.
Run engine at 2000 rpm.
- d. Read voltmeter
Readings higher than 14.0 volts: indicate alternator is correct and consequently voltage regulator should be replaced.
Readings below 14 volts, usually considerably lower: indicate the alternator should be replaced or repaired (rectifier diodes are most likely at fault).

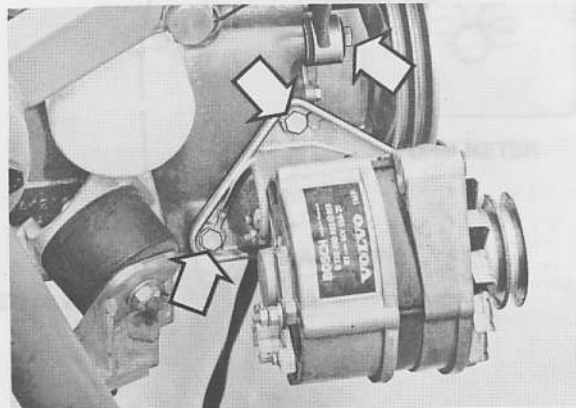
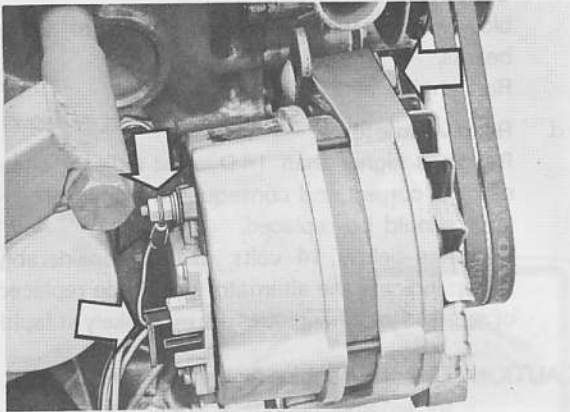
CAUTION: Do not run engine higher than 2000 RPM or for lengthy period—it could damage the battery and other electrical circuits due to High Voltage.

Service Procedures

Special instructions for work on alternator equipment

1. When replacing or installing battery, make sure that proper polarity is observed. A misconnected battery will immediately ruin the rectifiers.
2. Never run the alternator 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.
4. When fast charging battery in vehicle disconnect the battery ground cable.
5. When using an extra battery as a starting aid, connect it in parallel.
6. When arc welding on the vehicle, disconnect the battery ground cable as well as the B+ lead on the alternator and the plug at the voltage regulator. The welding unit should always be connected close to the weld.

Removing alternator



B1

Remove alternator

- a. Disconnect wires at alternator.
- b. Remove bolt for tensioner bar, hex 13 mm
- c. Lift off drive belts and lower alternator.

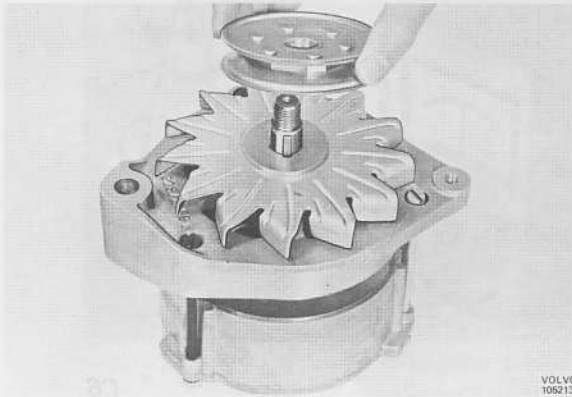
B2

Remove alternator and bracket

Also remove the tensioner bar.

Hex 13 mm

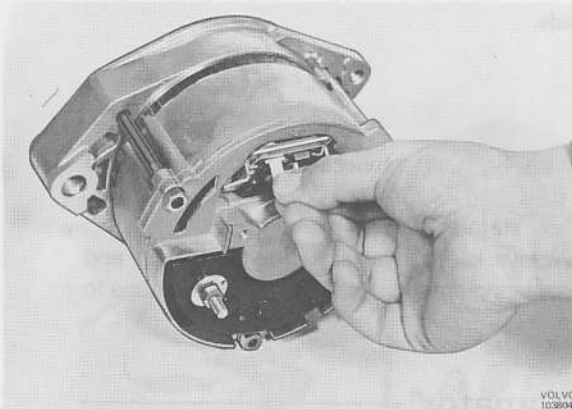
Disassembling alternator



VOLVC
105213

C1

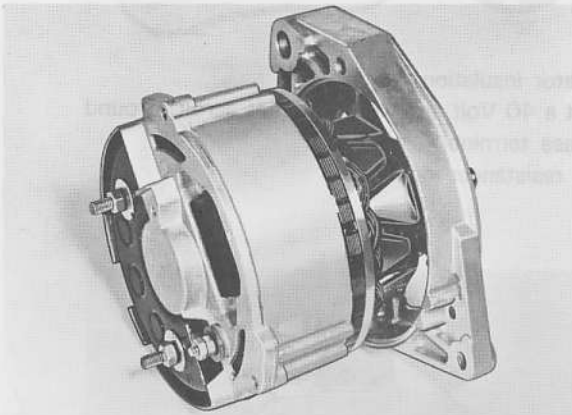
Remove nut and washer from pulley. Pull off pulley and fan. Remove key.



VOLVC
103804

C2

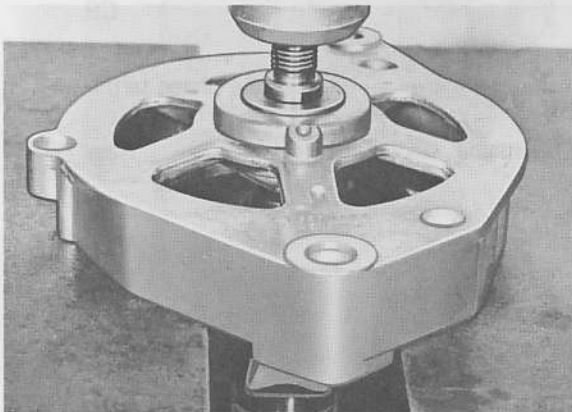
Remove brush holder retaining screws. Remove brush holder.



VOLVC
103804

C3

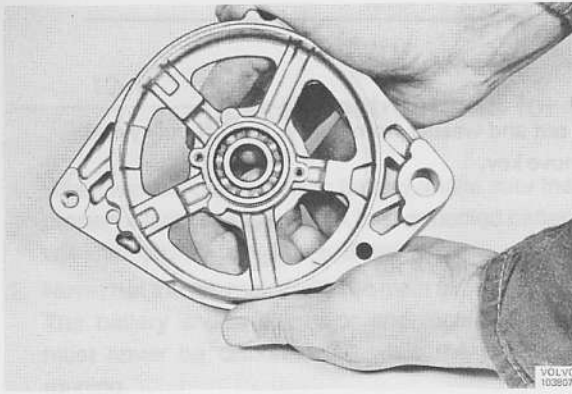
Remove nuts and bolts connecting alternator end shields. Remove front end shield from stator and rear end shield assembly.



VOLVC
103804

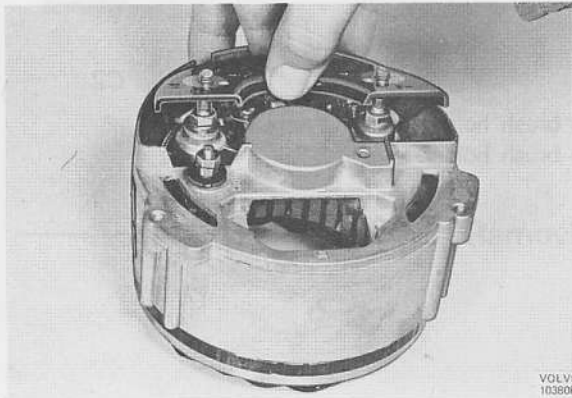
C4

Press out rotor from front end shield.
Note: old type shown.



C5

Remove the screws retaining the front ball bearing. Press out the bearing.



C6

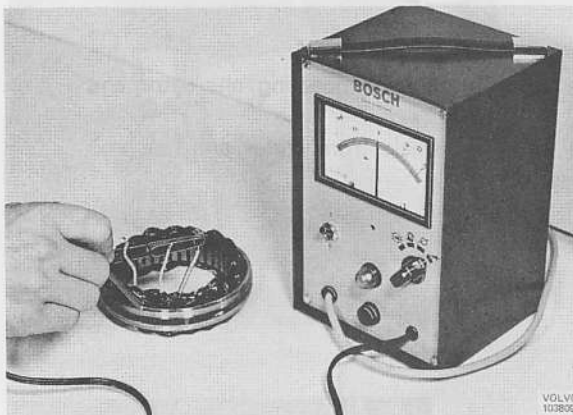
Remove nuts for plus diode plate. Lift up and bend plate aside.

C7

Solder loose the stator connections from the terminal points. Lift off the stator.

NOTE: Always use a heat sink when soldering and soldering around diodes to prevent damage to any diodes.

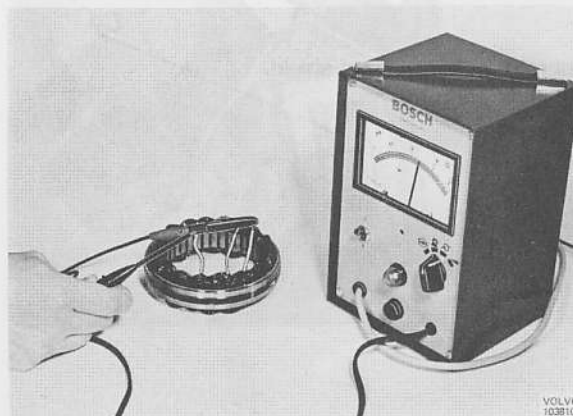
Test of disassembled alternator



C8

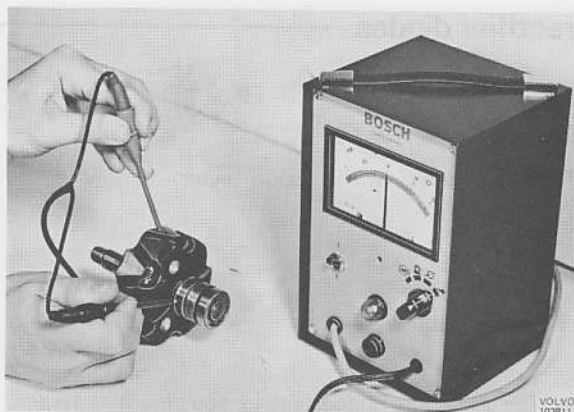
Stator

Test stator insulation. Connect a 40 Volt alternating current across ground and phase terminal. Correct resistance: indefinite.



C9

Test stator coil resistance. Connect the test instrument across the phase terminals. Correct resistance: 0.14 ohm + 10%.



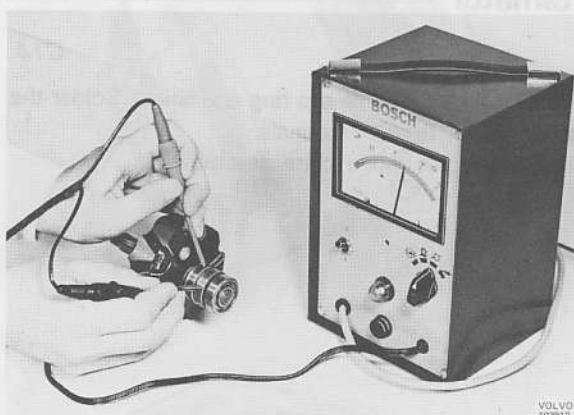
C10

Rotor

Test rotor insulation.

Connect a 40 Volt alternating current across rotor ground and a slip ring.

Correct resistance: indefinite.



C11

Test rotor coil resistance.

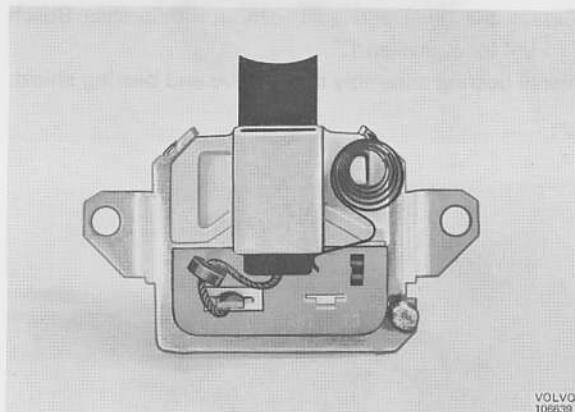
Connect the test instrument across the slip rings.

Correct resistance: 4.0 ohms + 10%.

Slip rings which are burned or damaged should be turned in a lathe. Use tail stock.

Slip ring minimum diameter is 31.5 mm = 1.3".

Use a dial indicator to check out-of-round, maximum 0.03 mm = 0.0012".



C12

Brush holder

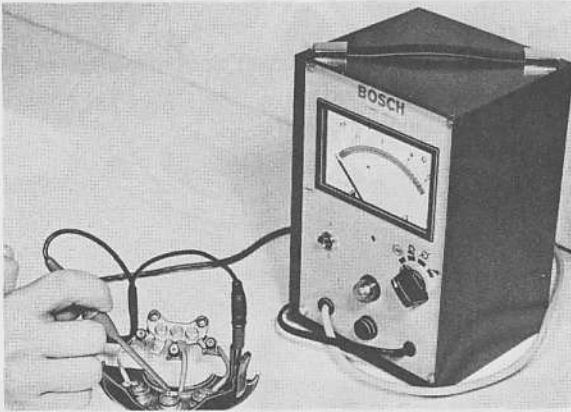
Test insulation.

Use 40 Volt alternating current.

Correct reading: indefinite

Check that minimum brush length is 14 mm = 0.55".

Replacing defective rectifier diodes



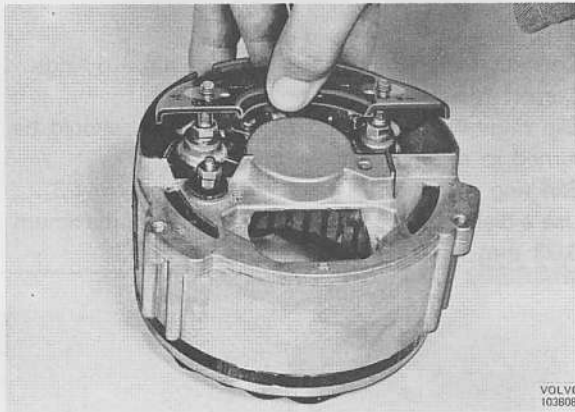
C13

Diodes

Test the diodes with a diode tester.

NOTE: Although Bosch testing equipment is shown, similar equipment is available from domestic manufacturers.

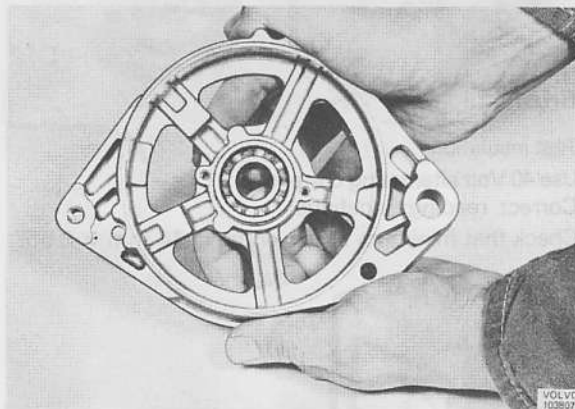
Assembling alternator



VOLVO
103808

C14

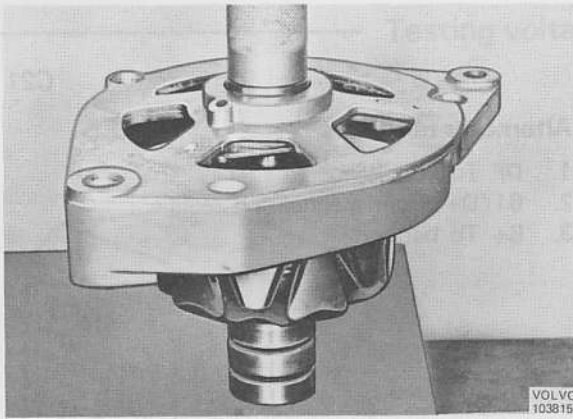
Install the stator in the slip ring end shield. Solder the stator wires to the terminals. Install the plus diode plate assembly.



VOLVO
103807

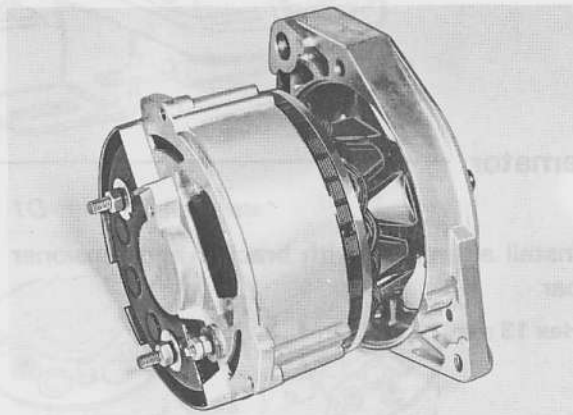
C15

Grease the drive end ball bearing with grease Bosch Ft 1 V 4 (or equivalent). Install bearing assembly in the drive end bearing shield.



C16

Press drive end bearing shield onto the rotor.
Install the spacer ring.

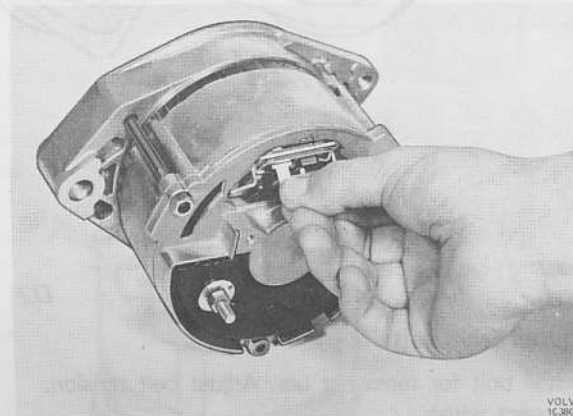


C17

Grease the slip ring end shield bearing with grease Bosch Ft 1 V 35 or corresponding. Coat the slip ring end shield bearing seat with Molykote. Assemble the alternator.

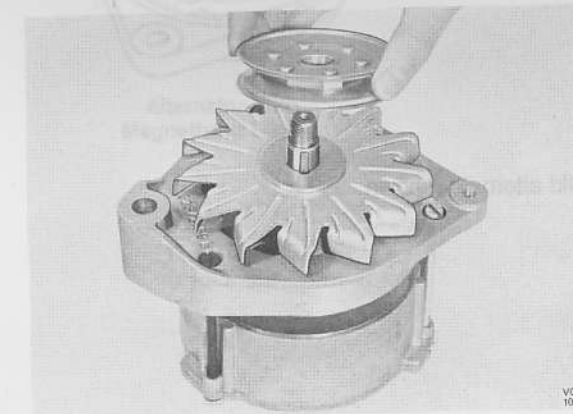
Do not forget to install the spring on the slip ring end shield bearing seat.

Assemble alternator components. Torque retaining screws to 3.6–4.3 lb.ft. = 5.0–6.9 Nm and nuts to 3.3–4.3 lb.ft. = 4.5–6.0 Nm.



C18

Install the brush holder.



C19

Install key, fan, spacer and pulley. Position the washer and torque the nut to 29 lb. ft. = 40 Nm.

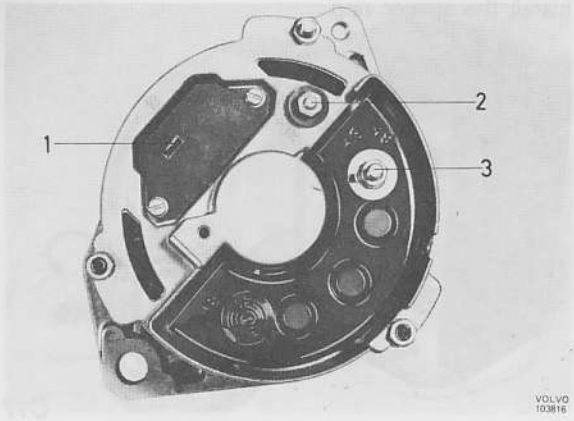
C20

Test on a test bench before installation.

D10

Replacing defective alternator

First drive belt onto the top.



C21

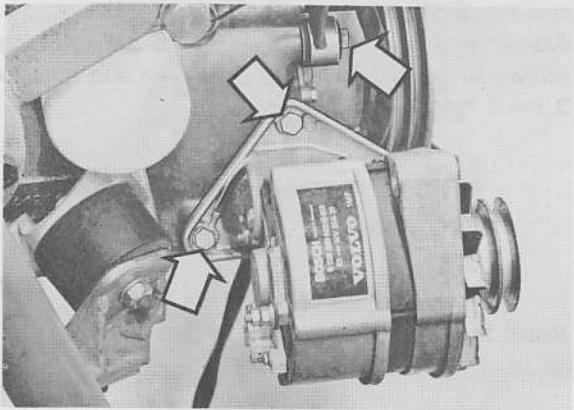
Alternator terminals

1. DF To field winding
2. 61/D+ From magnetizing rectifier
3. B+ To battery

similar equipment is available from domestic manufacturers.

Installing alternator

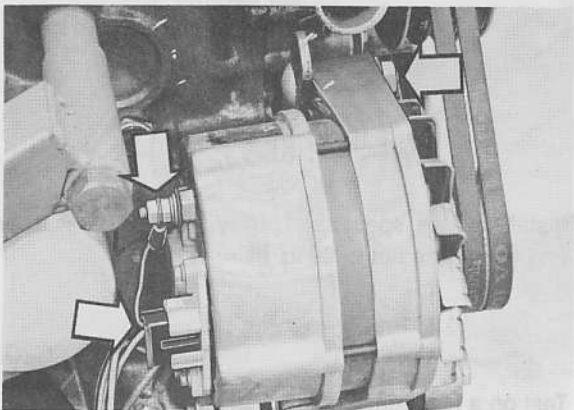
D1



Install alternator with bracket and tensioner bar

Hex 13 mm

D2

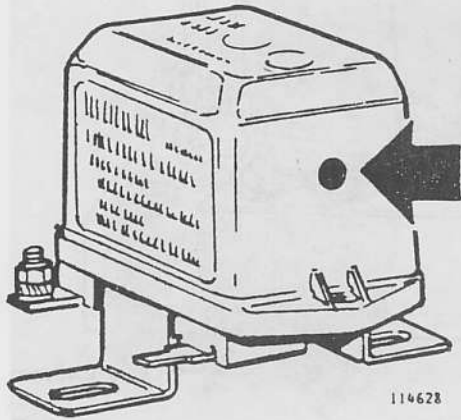


Install drive belts

Install bolt for tensioner bar. Adjust belt tension. Connect wires.

Old alternator shown.

Testing voltage regulator



Charging Regulator

Electronic charging regulators have now been introduced as spare parts for cars which do not have the three-terminal connection contact on the regulator.

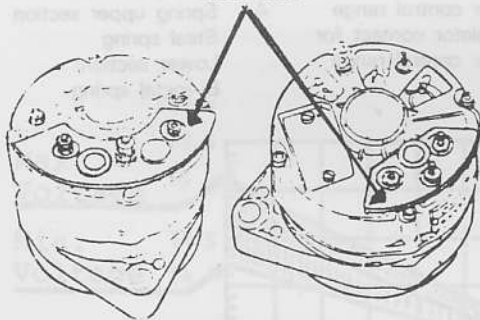
These new regulators can be easily identified by their **grey** cover. The old type regulators have **black** covers.

Identifying the regulator

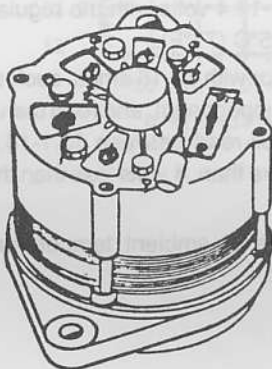
For alternator

	Marking	P/N
with Sev P/N 726-10102		
Protection diode (red plate)	Red Spot	1259303-4
Magnetizing diode	Blue or Black Spot	1259302-6
Sev P/N 726-10002		

Red Plate



Alternators With Protective Diodes



Alternator With Magnetizing Diodes

Identifying the alternator

Alternators with protective diodes have a red plate on the rear end.

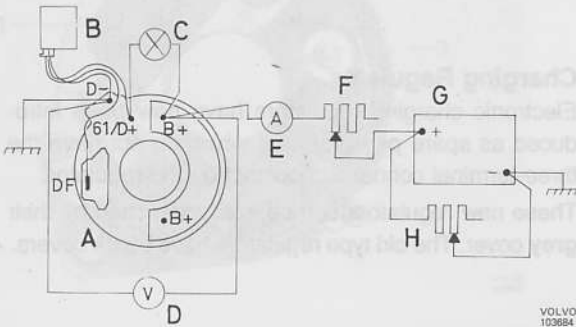
Those alternators which do not have a red plate on the rear end are fitted with magnetizing diodes.

Testing voltage regulator

(On test bench or in vehicle)

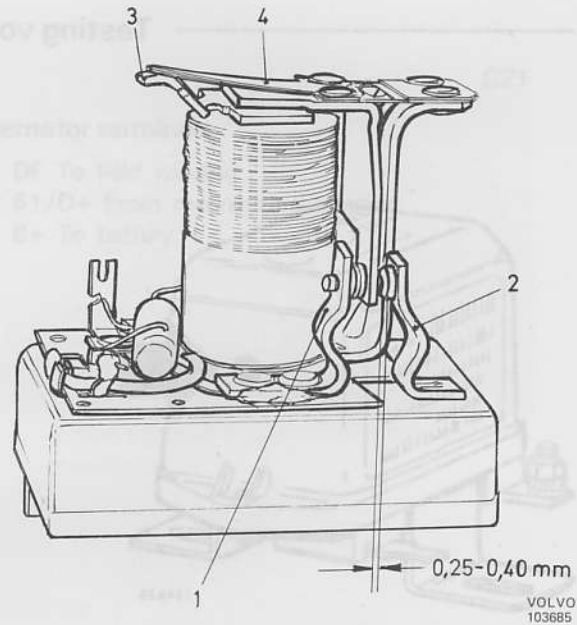
E1

Connect the regulator to an alternator in good condition.



Wiring diagram for testing voltage regulator

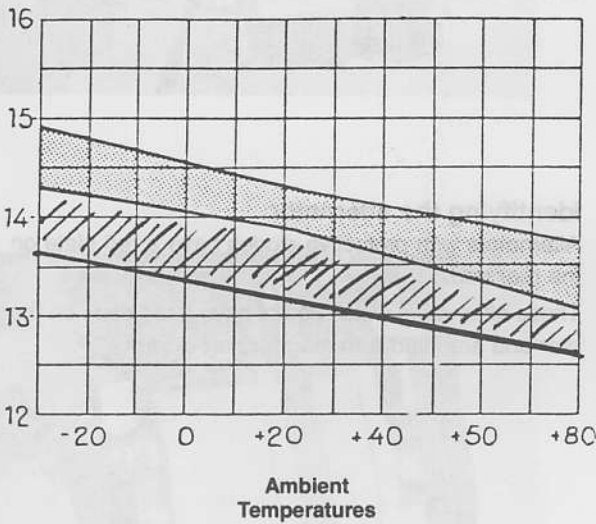
- | | |
|-----------------------------------|---------------------------|
| A. Alternator | E. Ammeter 0-50 amps. |
| B. Voltage lamp 12 volts | F. Regulator resistance |
| C. Control lamp 12 volts, 2 watts | G. Battery 60 amperehours |
| D. Voltmeter 0-20 volts | H. Load resistance |



Voltage regulator

- | | |
|--|--------------------------------|
| 1. Regulator contact for lower control range | 3. Spring tensioner |
| 2. Regulator contact for upper control range | 4. Spring upper section |
| | Steel spring |
| | Lower section: Bi-metal spring |

Old Type Regulators



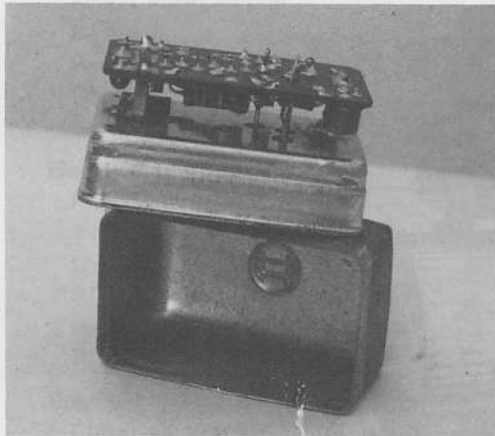
Run the alternator at 5000 rpm (alt. speed) or 2500 rpm (engine speed) for 15 seconds. Read the voltage on the voltmeter. With no load on the alternator, the voltmeter should read 13.1-14.4 volts with the regulator ambient temperature at 25°C (77°F).

Load the alternator with 10-15 amps, such as switching on headlights to upper beam, and read the voltage. The voltage should still read between 13.1-14.4 volts, but must not drop more than .4 volts less than the unloaded specification.

For exact voltage at ambient temperatures see diagrams opposite.

Testing voltage regulator

(On test bench or in vehicle)

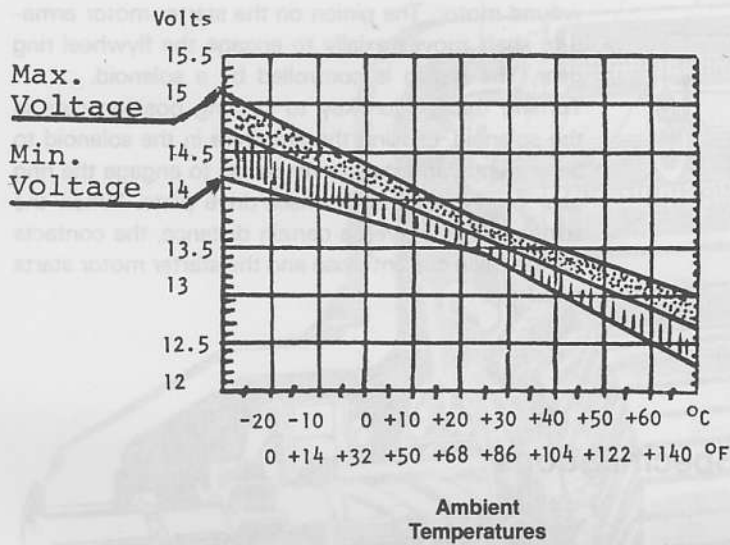


Electronic Regulators

If voltage is outside specification 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 approx. 45 minutes at speed above 30 mph. The reason for the driving is to let the regulator obtain correct working temperature.

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

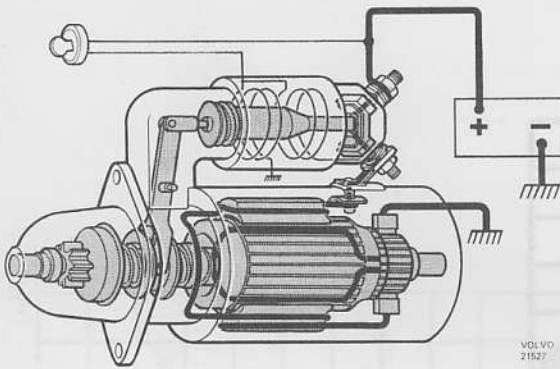
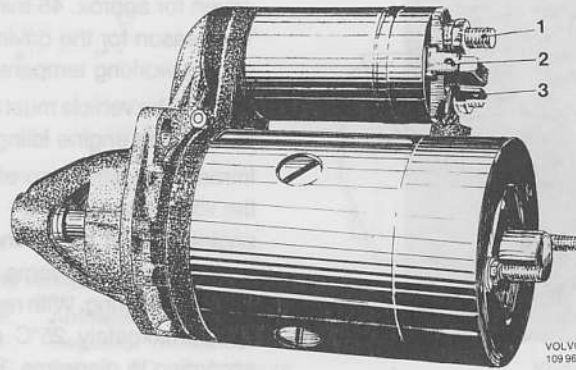
Immediately after, or preferably during driving, measure the voltage between B+ and D- on the alternator. The engine should be turning over at 1500 rpm, which is approximately the same as 3000 rpm alternator speed when measuring. With regulator at ambient temperature of approximately 25°C (77°F) the voltage should be according to diagrams. Please note voltage variations according to ambient temperatures.



Group 33

Starter Motor

General Information



The starter motor is mounted on the flywheel housing on the left side of the engine. It is a 4-pole series-wound motor. The pinion on the starter motor armature shaft moves axially to engage the flywheel ring gear. The pinion is controlled by a solenoid.

Turning the ignition key to 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/drive plate. When the armature has moved a certain distance, the contacts for the main current close and the starter motor starts running.

Specifications

Designation	Bosch	12V
Direction of rotation	Clockwise	
Output	810 W (1.1 hp)	
Pinion teeth	9	
No. of brushes	4	

Mechanical test specifications

Armature end float	0.01-0.03 mm	0.002-0.012"
Brush spring tension.....	14-16 N	3.1-3.5 lbs
Distance from pinion end to ring gear face	1.2-4.4 mm	0.047-0.173"
Frictional torque of rotor brake	25-40 Ncm	2.17-3.81 lb.in
Pinion idling torque	14-18 Ncm	1.20-1.56 lb.in
Backlash	0.3-0.5 mm	0.006-0.00
Pinion pitch	2.12	
Commutator min. diameter	33.5 mm	1.318"
Brush min. length	13 mm	0.52"

Electrical test specifications

Free-running:		
11.5 Volts and 30-50 Amps	97-130 r/s	5800-7800 rpm
Loaded:		
9.0 Volts and 185-220 Amps	17.5-22.5 r/s	1050-1350 rpm
Locked:		
7 Volts and 400-490 Amps	0 r/s	0 rpm

Solenoid

Cut-in voltage	Min 8 Volts
Release voltage	Less than 1 v.

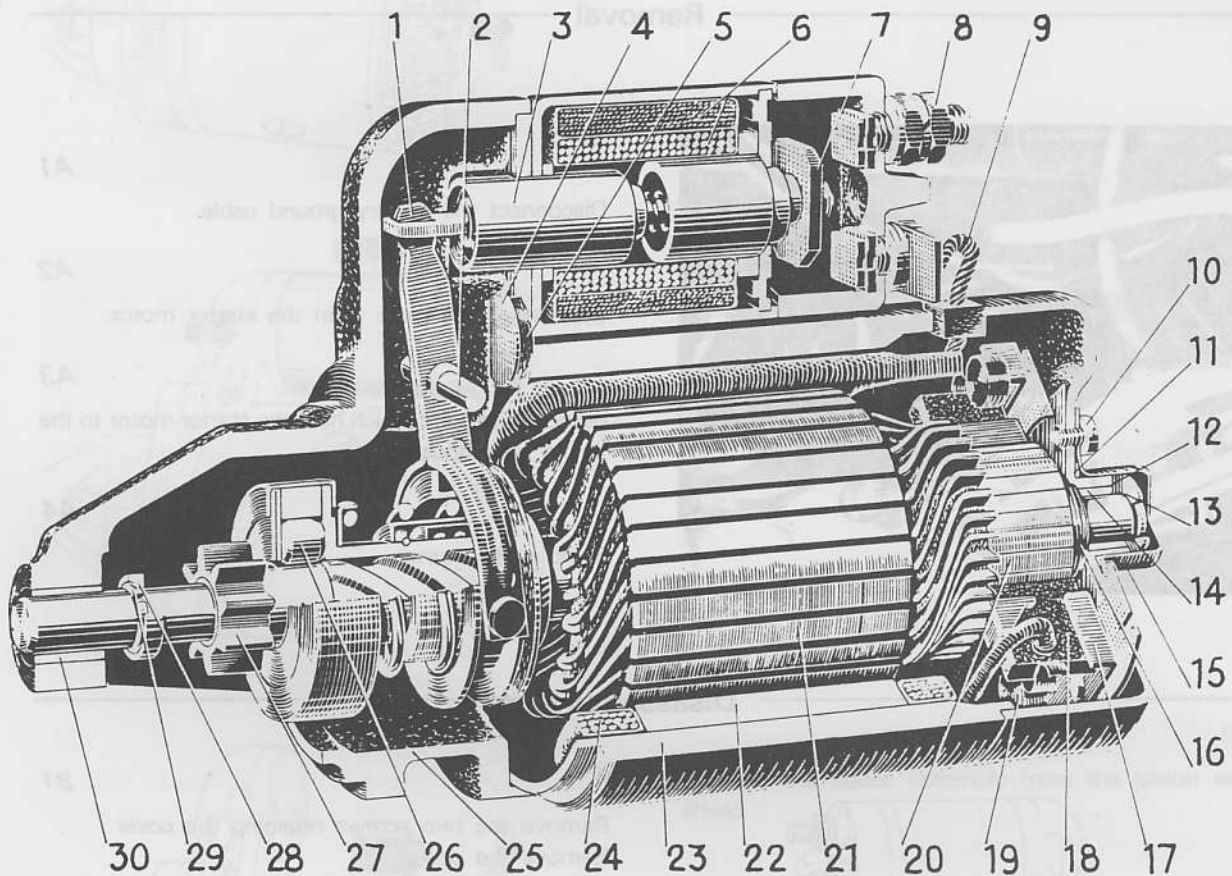
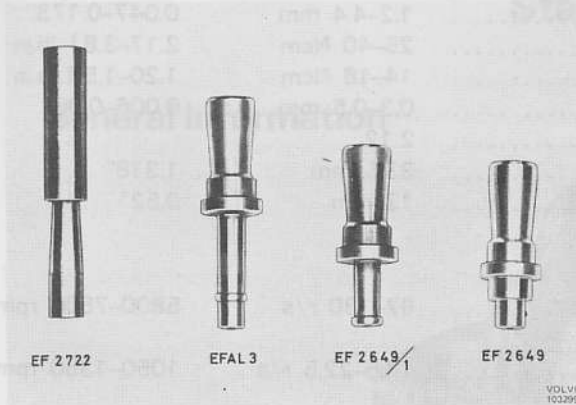


Fig. 3-27. Starter motor

- | | | |
|------------------------------|--------------------------|---------------------|
| 1. Shift lever | 11. Rubber gasket | 21. Armature |
| 2. Pivot pin | 12. Shims | 22. Pole shoe |
| 3. Plunger | 13. Lock washer | 23. Stator |
| 4. Steel washer | 14. Bush | 24. Field winding |
| 5. Rubber washer | 15. Commutator end frame | 25. Drive end frame |
| 6. Winding | 16. Adjusting washers | 26. One-way clutch |
| 7. Contact plate | 17. Brush holder | 27. Pinion |
| 8. Terminal for battery lead | 18. Brush | 28. Stop ring |
| 9. Connection lead to field | 19. Brush spring | 29. Snap ring |
| 10. Screw | 20. Commutator | 30. Bush |

VOLVO
101-139

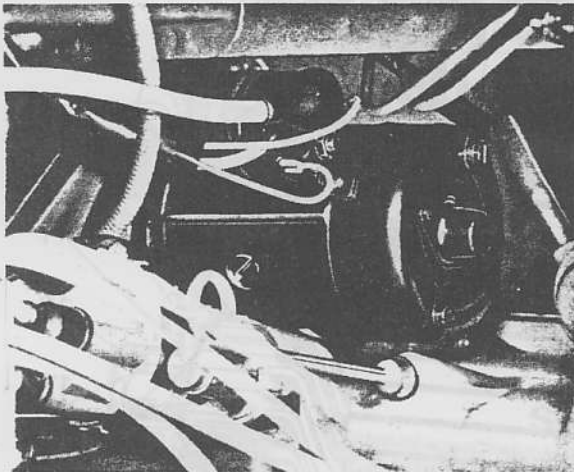
Special Tools



- EF 2722 Sleeve and drift for installing circlip
- EFAL 3 Smoothing drift
- FG 2649/1 Smoothing drift
- EF 2649 Drift for installing bushing

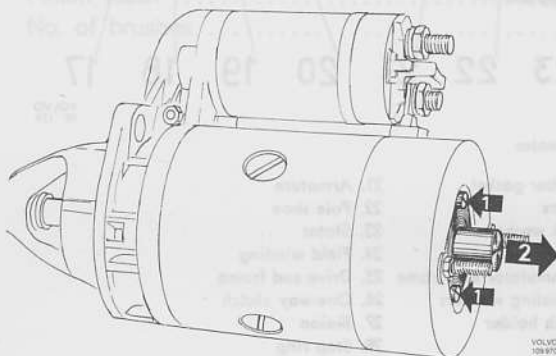
Service Procedures

Removal

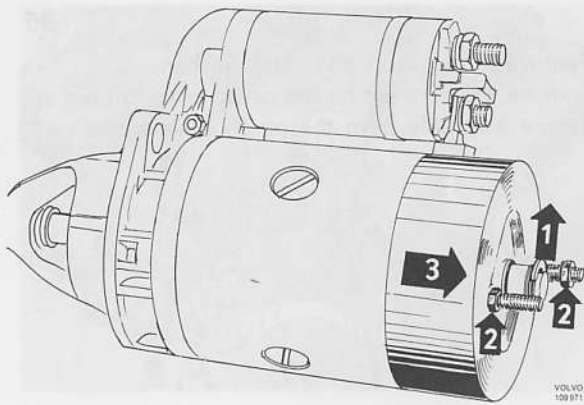


- A1 Disconnect the battery ground cable.
- A2 Disconnect the leads from the starter motor.
- A3 Remove the bolts which hold the starter motor to the timing gear housing.
- A4 Remove the starter.

Disassembly

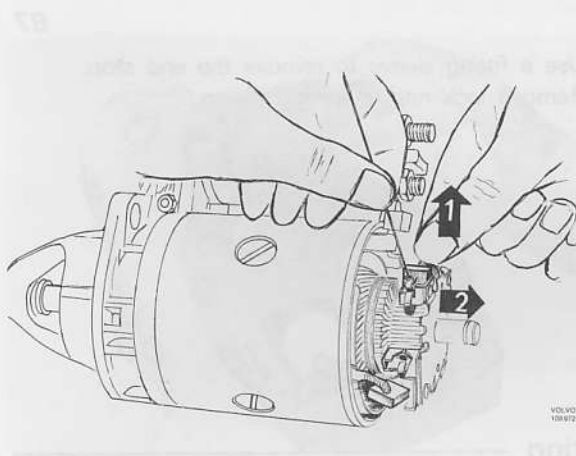


- B1 Remove the two screws retaining the cover.
Remove the cover.



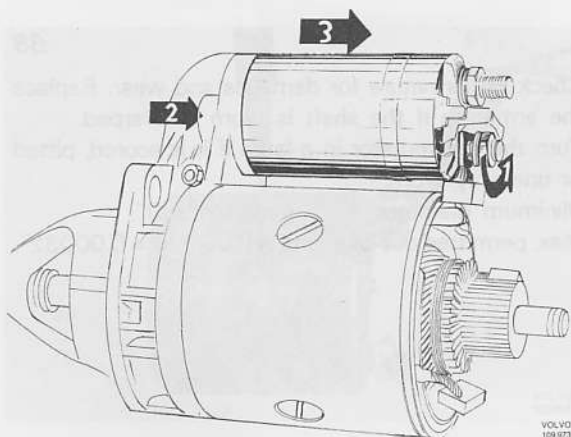
B2

Remove lock ring and spacer rings.
Remove the two screws retaining the commutator end shield.
Remove the shield.



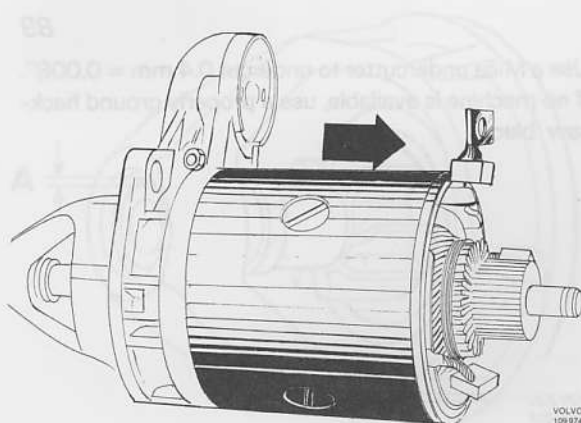
B3

Lift up the brushes.
Remove the brush holder bridge from the armature shaft.
The minus brushes are retained together with the brush holder bridge.
The plus brushes stay with the field coils.



B4

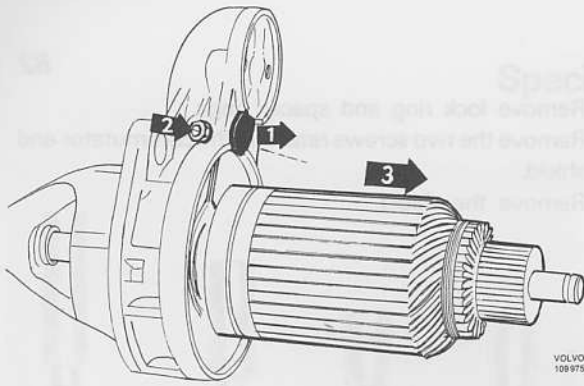
Remove the nut connecting the field coil to the solenoid.
Remove the screws retaining the solenoid to the pinion end shield.
Remove the solenoid.



B5

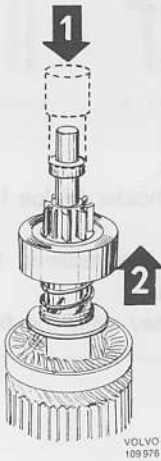
Remove the stator assembly from the pinion end shield.

Examination



B6

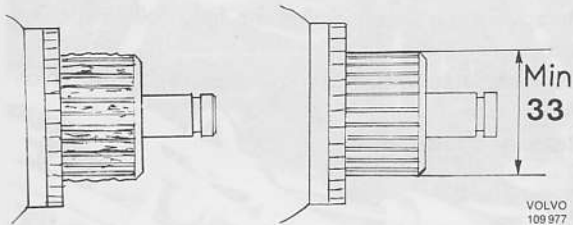
Remove rubber stop and steel washer.
Remove the pivot pin for the pinion lever. Lift out armature assembly from the pinion drive shield.



B7

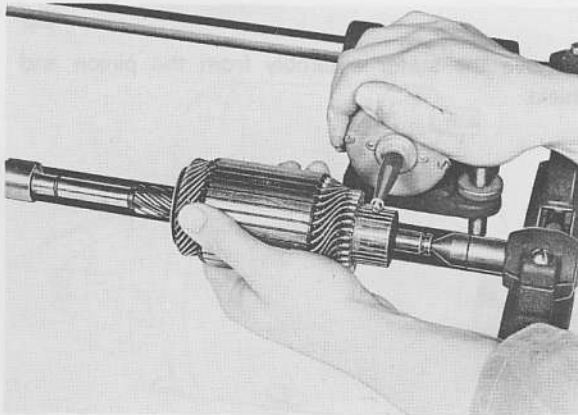
Use a fitting sleeve to remove the end stop.
Remove lock ring, stop and pinion.

Examination



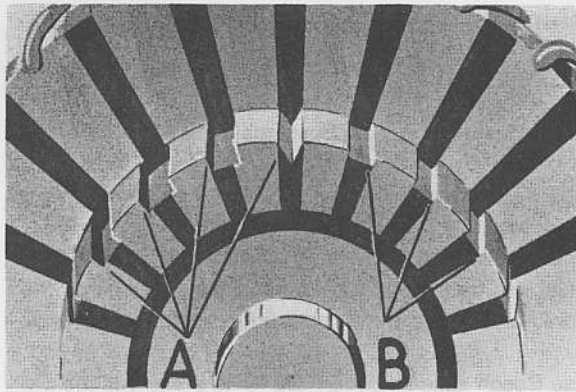
B8

Check the armature for damages and wear. Replace the armature if the shaft is worn or warped.
Turn the commutator in a lathe if it is scored, pitted or unevenly worn.
Minimum diameter is 33 mm = 1.300".
Max. permitted out-of-round is 0.08 mm = 0.00032".



B9

Use a Mica undercutter to undercut 0.4 mm = 0.008".
If no machine is available, use a properly ground hacksaw blade.



- A. Incorrect
- B. Correct

B10



B11

Use a "Growler" to check the armature for shorts. Switch on and hold a hacksaw blade close to the armature. If the blade vibrates in any position, one of the following faults can exist:

- short to ground
- commutator shorted
- windings shorted

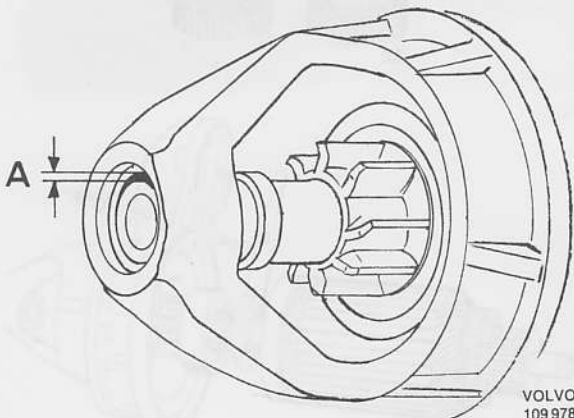
Replace the rotor if faulty.



VOLVO
103306

B12

Use 40 Volts AC current or available equipment to check the stator coil insulation.

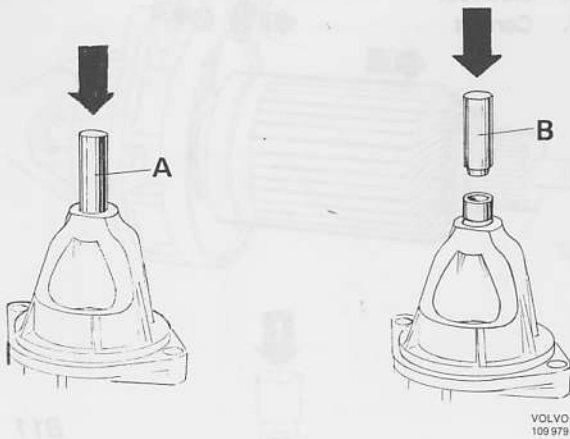


VOLVO
109978

B13

Check end shields and brush holder. Replace worn or damaged parts. No more than 0.005" (0.12 mm) bushing play is permitted. Check other parts and replace if worn or damaged. The lock ring should always be replaced as it might have been damaged or lost its tension when removed.

Installing bushings



B14

Before installation, new bushings should be immersed in oil, Bosch 01 1 V 13 or similar, for at least 1/2 hour. Otherwise their service time will be considerably reduced.

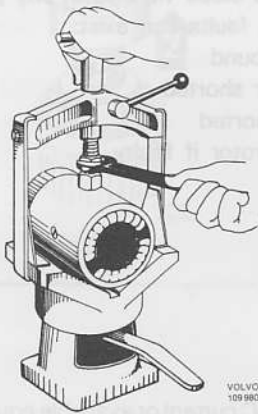
The bushings are made to correct dimensions and must not be machined. Any machining will block the pore holes which in turn obstructs the lubricating ability.

Use Bosch special tool EF 2649 to press out the old bushing.

Clean the hole and remove any burrs.

Use same Bosch tool to press in the new bushing.

Replacing field coil



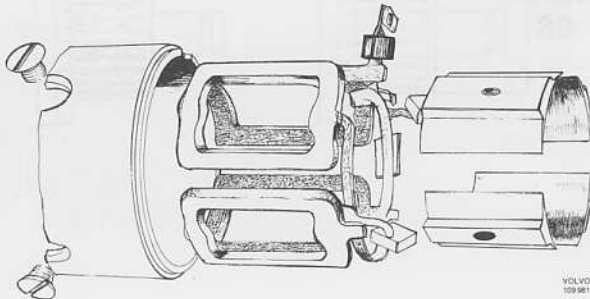
B15

Mark poles and housing. The poles should be reinstalled in exact positions.

Place the stator in a clamping device, Bosch EFAW9 or similar, and slacken the pole screws.

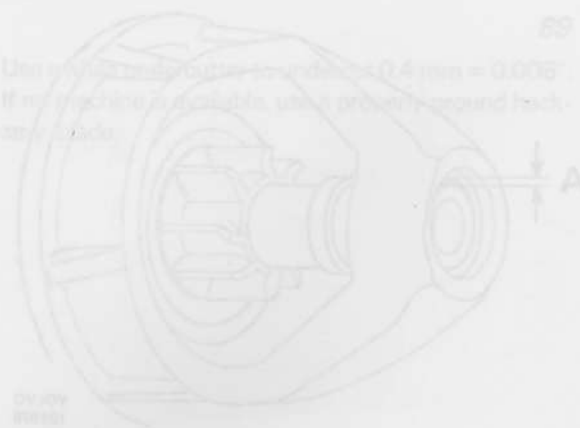
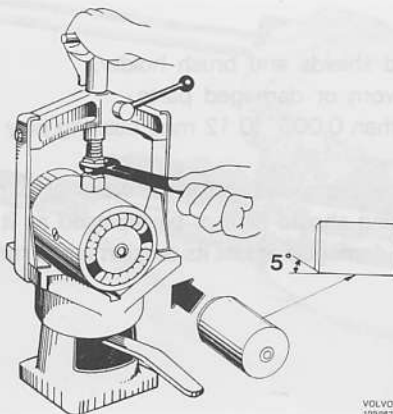
Remove the stator from the clamping device.

Remove poles and field coils.

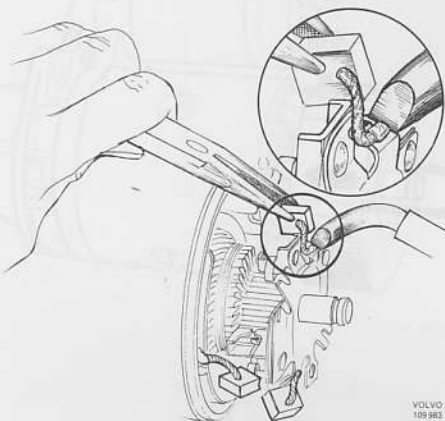


B16

Position the new field coils and the poles in the stator. Heat the field coils slightly before installation. Orientate the poles according to markings.



Replacing brushes



VOLVO
109 983

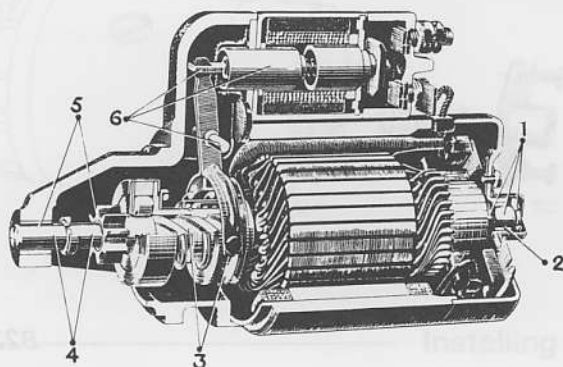
B17

Brushes shorter than $9/16'' = 14 \text{ mm}$ should be replaced.

1. Solder loose the brushes from their attachments.
2. Solder on the new brushes. Use a sufficiently hot soldering iron.

Do not allow any solder to run down in the brush leads. This would stiffen the leads and prohibit free movements.

Assembling starter motor



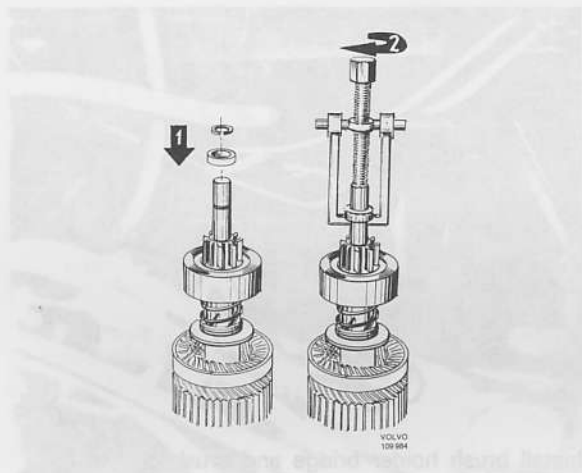
VOLVO
102 969

B18

Lubricate as shown. Use Bosch lubricants or similar:

1. Ft 2 V3 Apply a thin layer of grease on insulation washers, shaft bearing surfaces, spacer washers and lock ring.
2. O1 1 V13 Immerse the bushing in oil 1/2 hour before installation.
3. Ft 2 V3 Apply generously of grease in the armature gear guides and in the pinion lever groove.
4. Ft 2 V3 Apply a thin layer of grease on the shaft bearing surfaces.
5. O1 1 V13 Immerse the bushings in oil 1/2 hour before installation.
6. Ft 2 V3 Lubricate shift lever joints and solenoid iron core with a thin layer of grease.

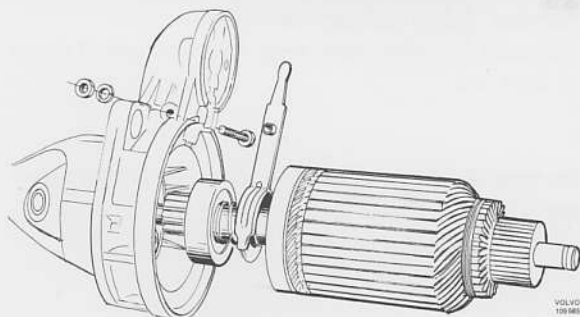
Install pinion, stop ring and lock ring. Tighten the stop ring into place with a fitting puller.



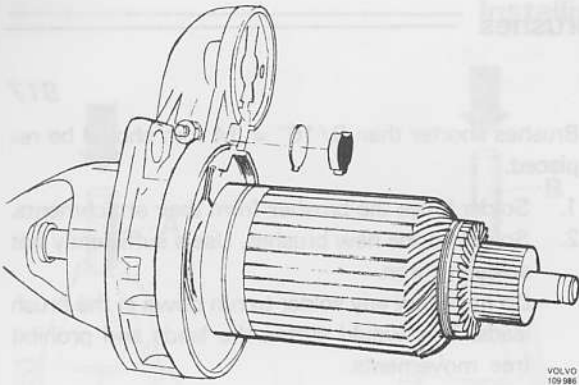
VOLVO
109 984

B19

Attach the shift lever to the pinion.
Install the armature in the drive end shield.
Install the shift lever pivot stud.

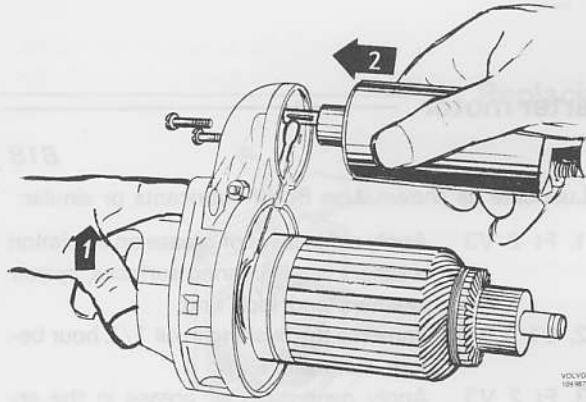


VOLVO
109 985



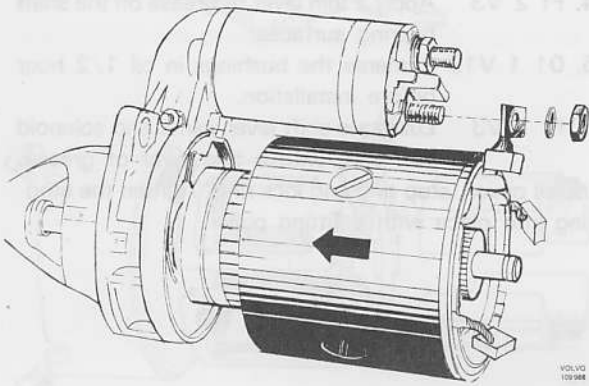
B20

Install steel washer and rubber stop.



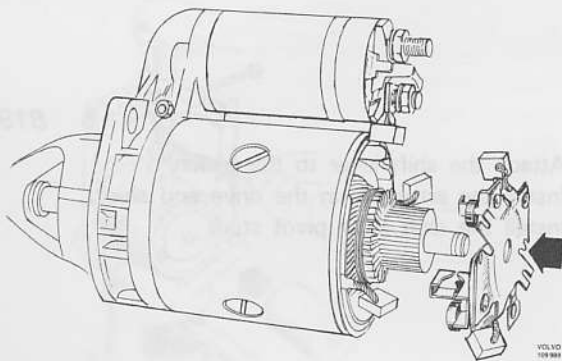
B21

Install solenoid.



B22

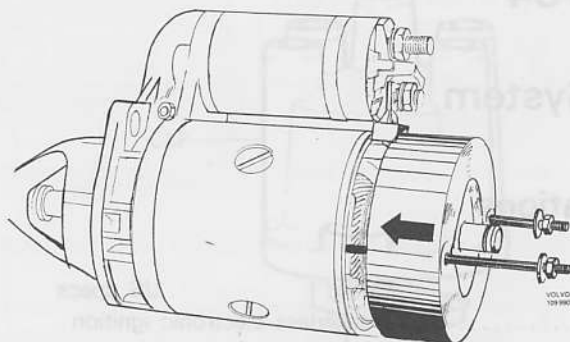
Install stator.



B23

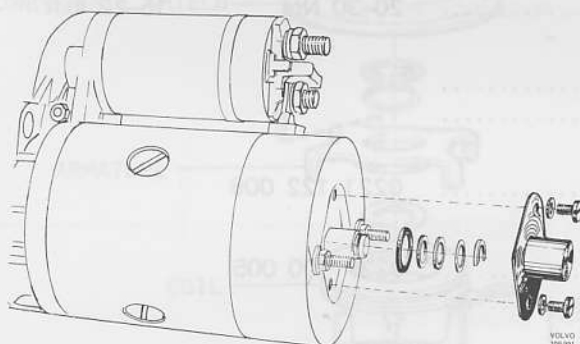
Install brush holder bridge and brushes.

B24



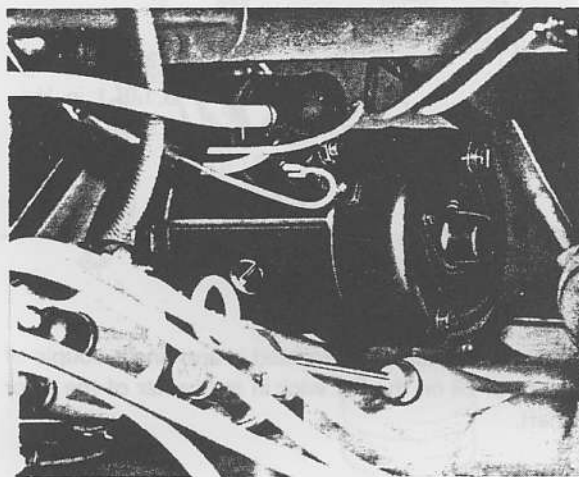
Install commutator end shield.
Install the two long screws that hold the starter motor together.

B25



Install spacer washers and lock ring. The armature end play should be 0.002–0.006" = 0.05–0.3 mm. Install sufficient amount of washers to keep the end play within these limits. Attach the small cover over the shaft end.

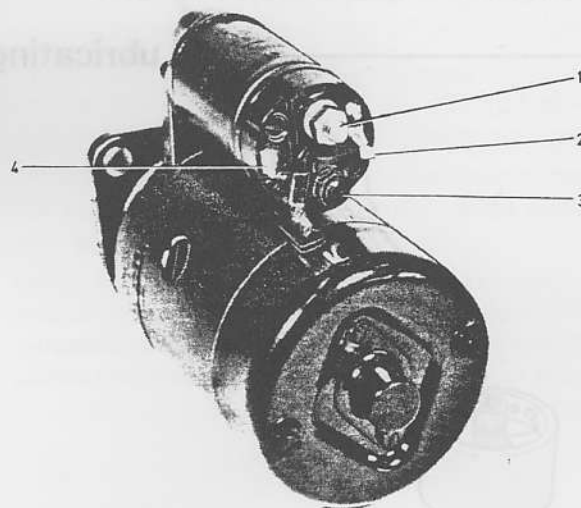
Installing starter motor



VOLVO
103 300

C1

Connect the starter motor leads.
Reconnect the battery ground cable.
Start the engine to check the starter motor function.



VOLVO
103 301

Fig. 3-30. Starter motor terminals

- 1. From battery
- 2. From ignition switch
- 3. To field winding
- 4. To ignition coil

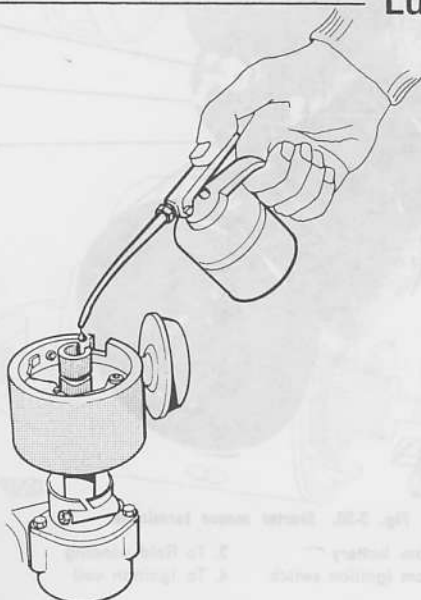
Group 34

Ignition System

Specifications

	Metric	US specs
Type	Breakerless electronic ignition	
Firing order	1-3-4-2	
Ignition timing, vacuum unit disconnected (check engine specifications) .		
Spark plugs (Check engine specifications)		
Gap	0.7-0.8 mm	0.028-0.0032"
Tightening torque	20-30 Nm	15-22 lb.ft
Distributor		
Bosch (Check engine specifications)		
Volvo P/N		
Ignition coil		
Bosch No.	0221 122 006	
Electronic module		
Bosch No.	0227 100 005	
Volvo P/N		
Centrifugal governor		
Total advance, distributor degrees	$11^{\circ} \pm 1^{\circ}$	
Advance begins at, distributor	7.2-10 r/s	430-600 rpm
Distributor rpm at 5° advance	15.2-18.3 r/s	910-1100 rpm
9° advance	23.3-34.5 r/s	1400-2070 rpm
full advance	40 r/s	2400 rpm
Vacuum unit		
Retard, distributor degrees (double for crankshaft degrees)	$5.0^{\circ} \pm 1^{\circ}$	
Retard begins at	61-107 mm Hg	2.4-4.3 in Hg
2° retard at	79-129 mm Hg	3.1-5.1 in Hg
Retard ends at	150 mm Hg	5.9 in Hg
Consult correct specifications for Model year.		

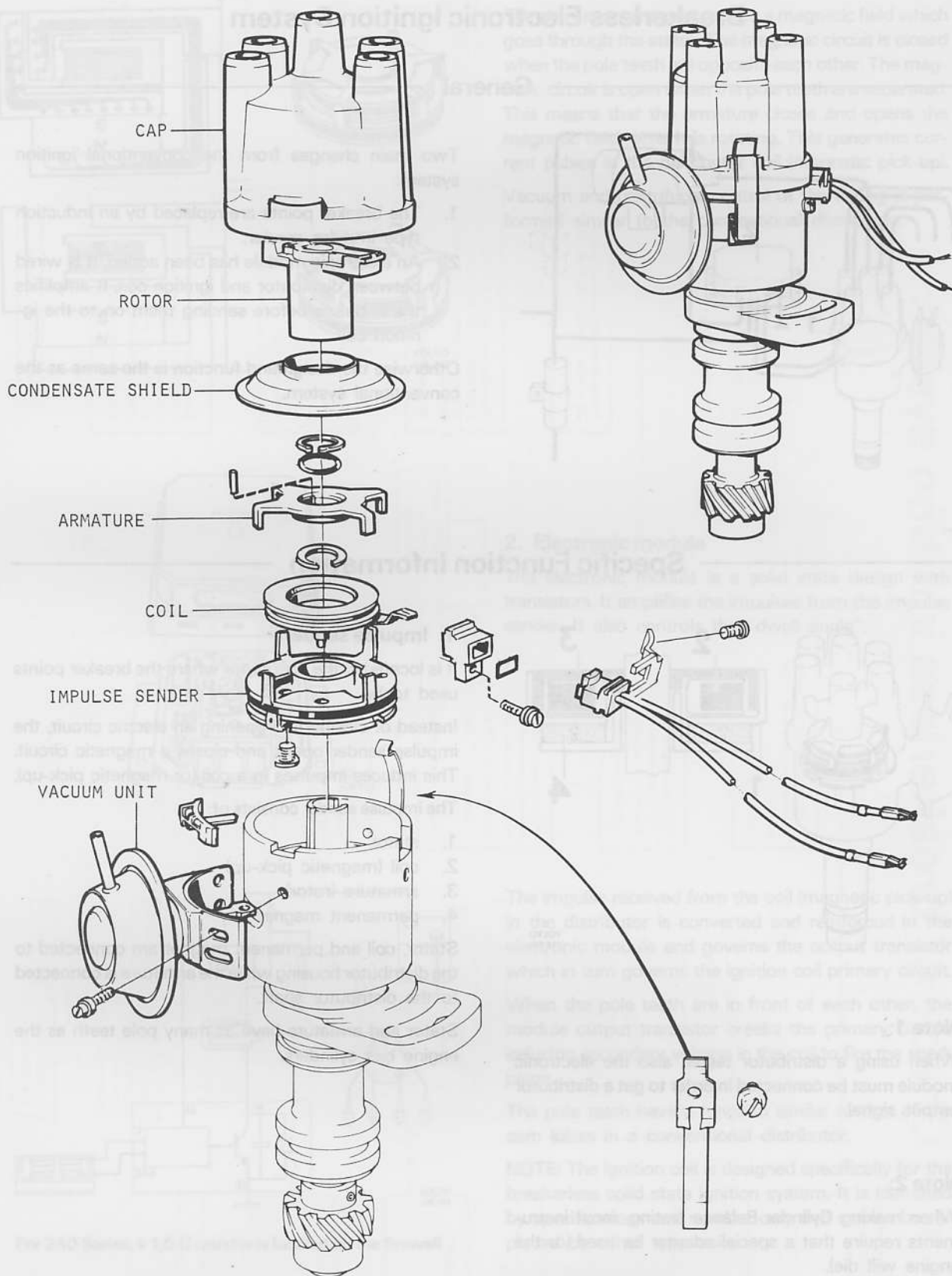
Lubricating distributor



The only lubrication permitted is applying a couple of drops of oil on the felt wick in the center of the rotor shaft.

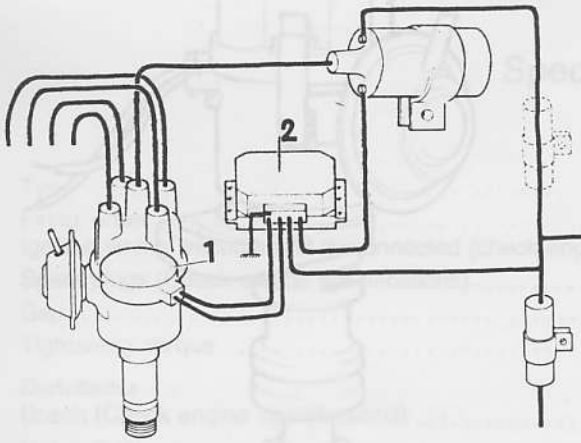
Remove distributor cap and rotor.
Lubricate felt wick under rotor with a couple of drops of light oil.

Be careful, do not splash any oil on the impulse sender.



Breakerless Electronic Ignition System

General

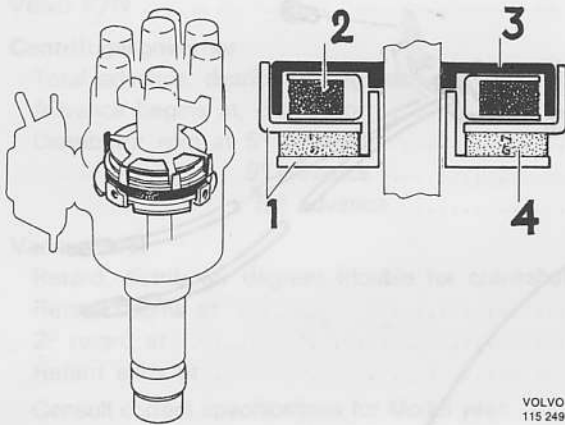


Two main changes from the conventional ignition system:

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

Otherwise the design and function is the same as the conventional system.

Specific Function Information



1. 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 opens and closes a magnetic circuit. This induces impulses in a coil (or magnetic pick-up).

The impulse sender consists of:

1. stator
2. coil (magnetic pick-up)
3. armature (rotor)
4. permanent magnet

Stator, coil and permanent magnet are connected to the distributor housing while the armature is connected to the distributor shaft.

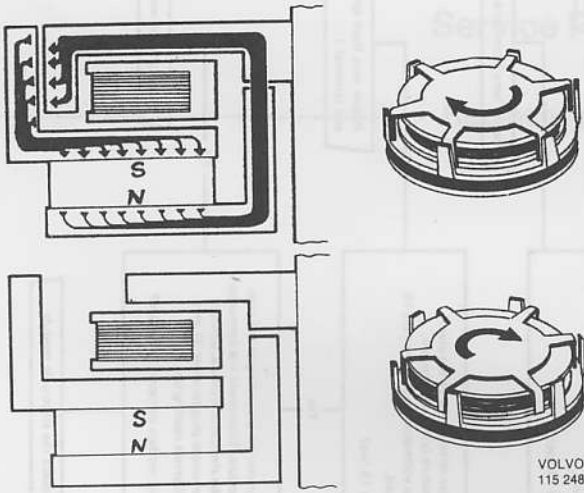
Stator and armature have as many pole teeth as the engine has cylinders.

Note 1:

When using a distributor tester, also the electronic module must be connected in order to get a distributor output signal.

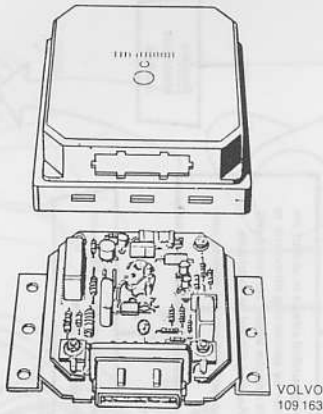
Note 2:

When making Cylinder Balance testing, most instruments require that a special adapter be used (or the engine will die).



The permanent magnet creates a magnetic field which goes through the stator. The magnetic circuit is closed when the pole teeth are opposite each other. The magnetic circuit is open when the pole teeth are separated. This means that the armature closes and opens the magnetic field while it is rotating. This generates current pulses in the distributor coil (magnetic pick-up). Vacuum and centrifugal control of the timing is performed similar to the conventional distributor.

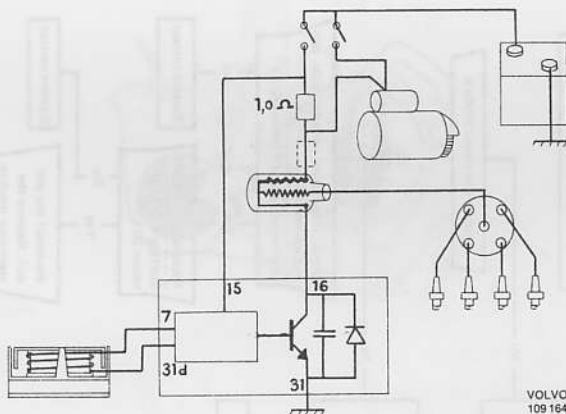
VOLVO
115 248



2. Electronic module

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

VOLVO
109 163



For 240 Series, a 1,0 Ω resistor is located on the firewall

The impulse received from the coil (magnetic pick-up) in the distributor is converted and reinforced in the electronic module and governs the output transistor which in turn governs the ignition coil primary circuit.

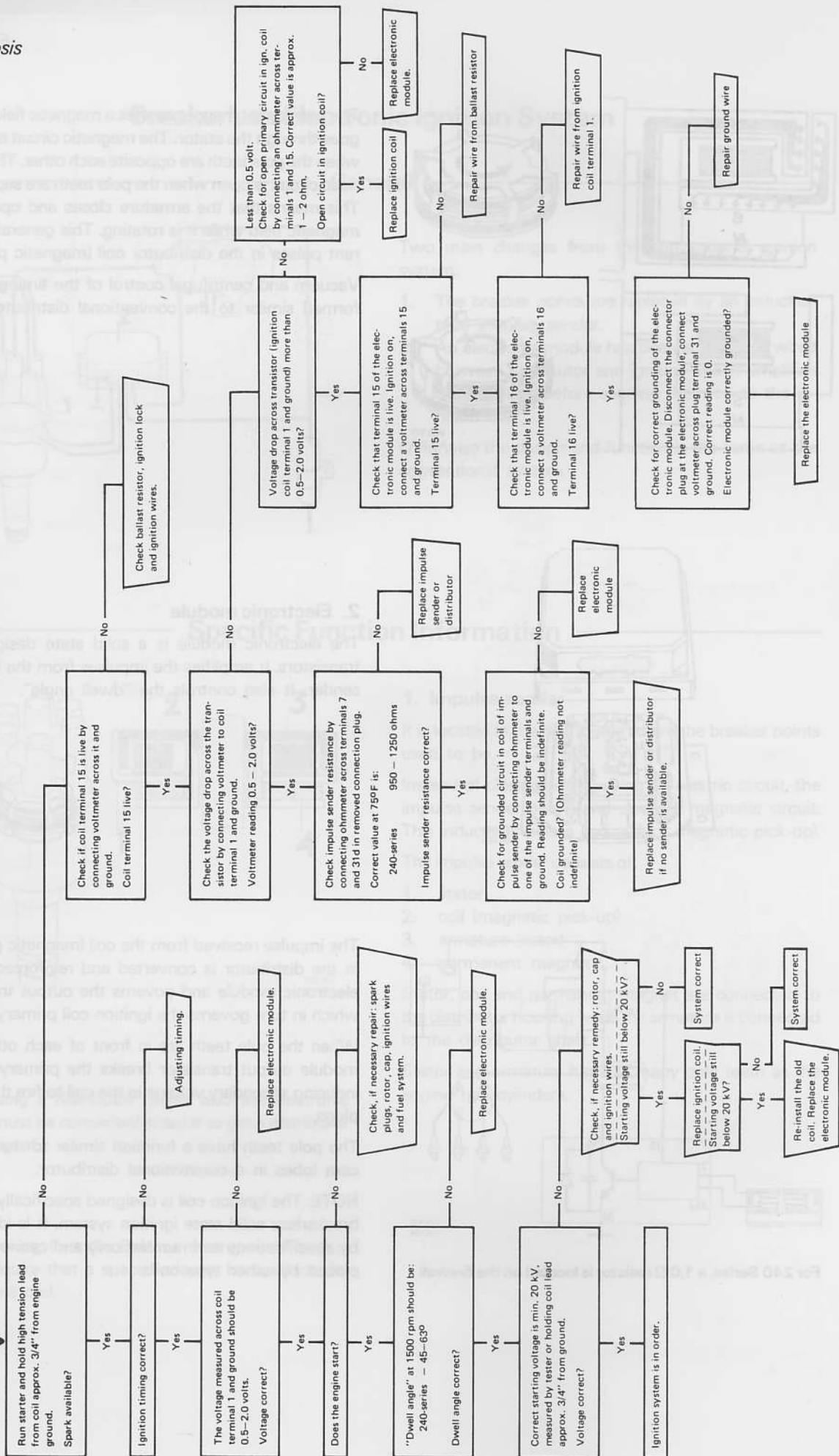
When the pole teeth are in front of each other, the module output transistor breaks the primary circuit, inducing secondary voltage in the coil to fire the spark plugs.

The pole teeth have a function similar to that of the cam lobes in a conventional distributor.

NOTE: The ignition coil is designed specifically for the breakerless solid state ignition system. It is identified by specifications and number only and cannot be replaced by other type coils.

Check of breakerless ignition system

start here ↓



Service Procedures

Replacing distributor

A1

Disconnect high tension leads (or cap), primary wire and vacuum hose at the distributor.

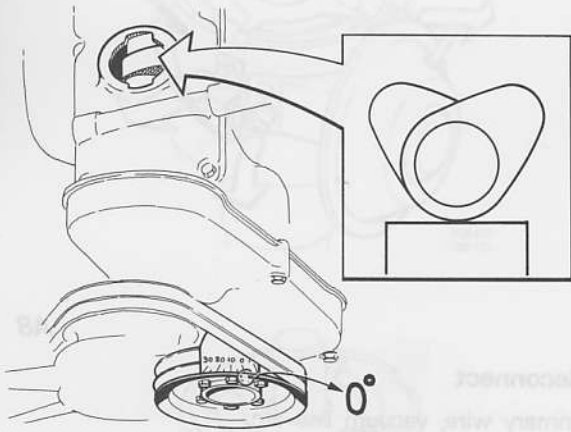
A2

Remove attaching bolt and lift off distributor.

A3

Rotate crankshaft until No. 1 piston is at top dead center (TDC).

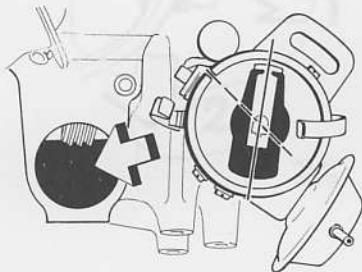
- The cams will then point obliquely up and pulley mark will be at 0°.



A4

Line up rotor

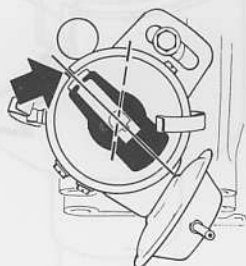
Turn rotor so mark is approx. 60° from mark on distributor housing.

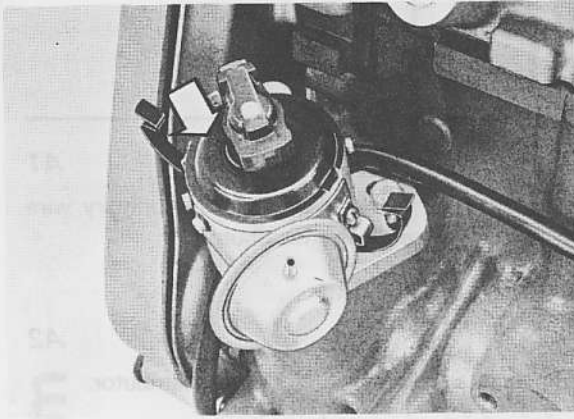


A5

Install distributor

Push distributor into position in engine block. Check that mark on rotor and mark on distributor housing line up. Install distributor retaining bolt, hex 13 mm.

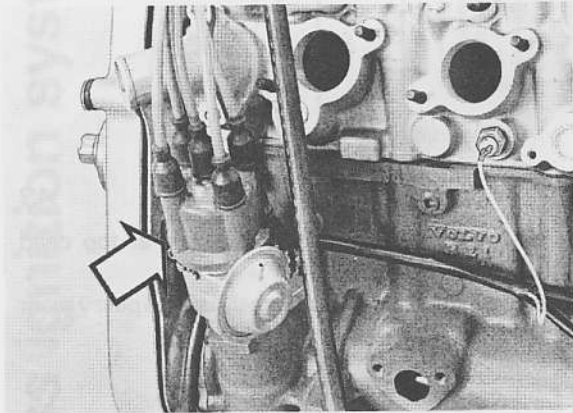




A6

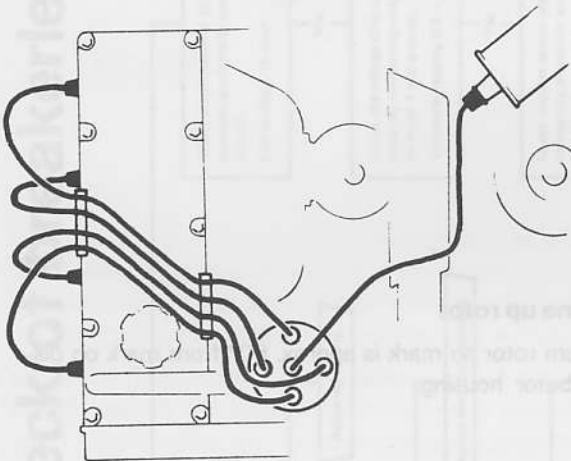
Install dust cover

Remove rotor, fit dust cover, and re-install rotor.



A7

Install distributor cap



A8

Reconnect

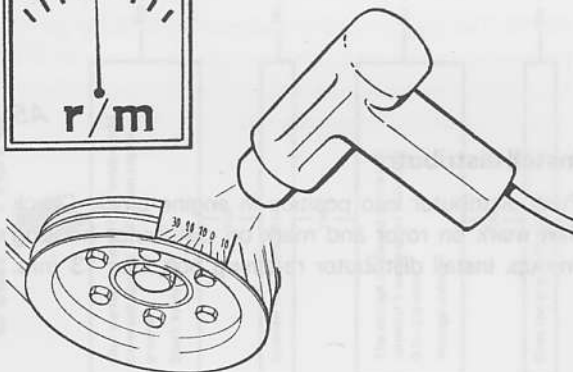
Primary wire, vacuum line etc.



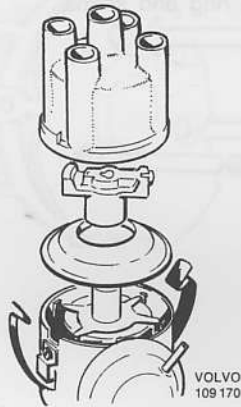
A9

Set timing

Refer to vehicle specifications.



Replacing impulse sender

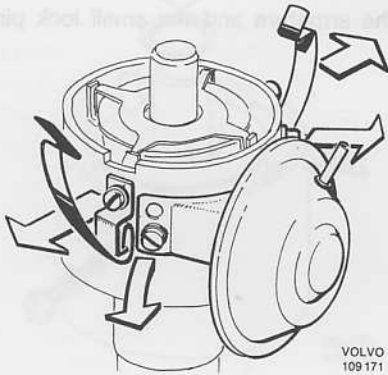


VOLVO
109 170

B1

Removal

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



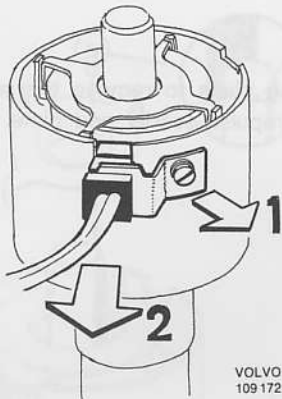
VOLVO
109 171

B2

Remove vacuum unit and clasps.

Caution:

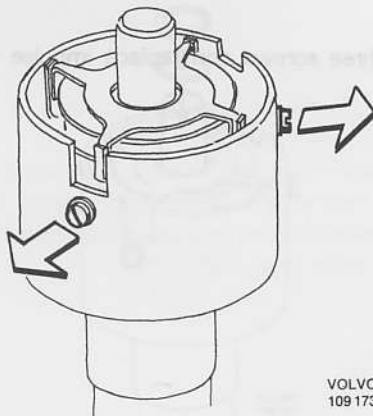
The retaining screws have different lengths and if improperly placed can project and damage moving parts. Therefore, always place the screws together with the component to which they belong.



VOLVO
109 172

B3

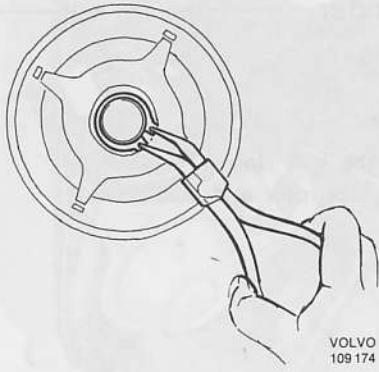
Remove the screws securing the contact.
Remove the contact by pulling it carefully straight out.



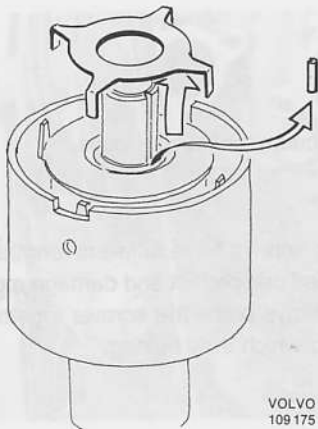
VOLVO
109 173

B4

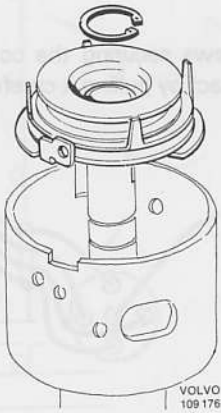
Remove the screws retaining the impulse sender plate.



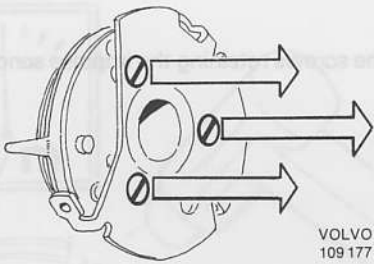
B5
Remove snap ring and shims.



B6
Lift off the armature and the small lock pin.



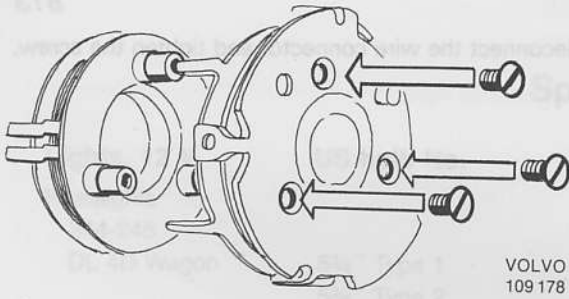
B7
Use snap ring pliers to remove the snap ring.
Lift up the impulse sender and plate.



B8
Remove three screws and replace impulse sender.

Group 35

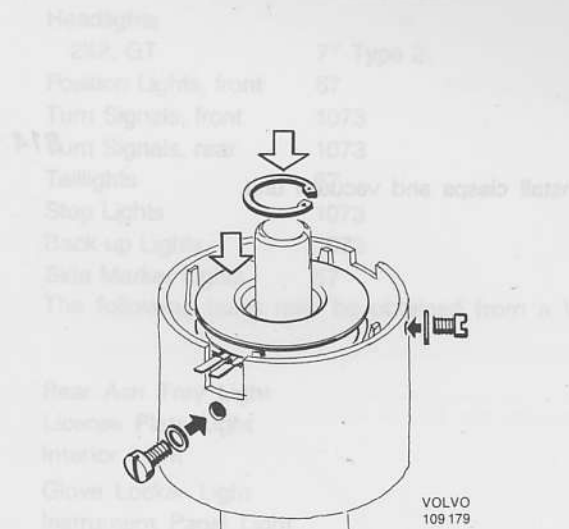
B9



VOLVO
109 178

Installation

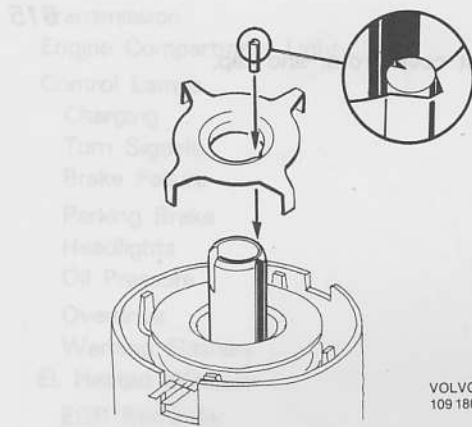
Attach the impulse sender to the plate.
The connector pins should be placed opposite above the attachment ear for the impulse sender plate.



VOLVO
109 179

B10

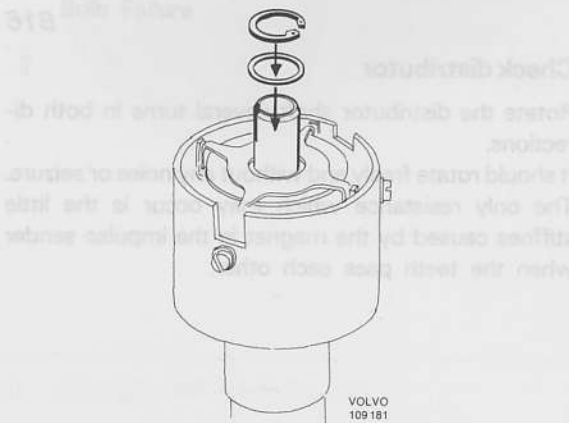
Install impulse sender.
Secure it with the two screws.
Install snap ring.



VOLVO
109 180

B11

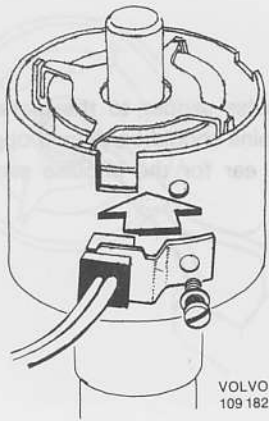
Install the armature.
The slot should be opposite the ridge on the distributor shaft.
Fit the lock pin so that the lift faces the ridge on the distributor shaft.
Otherwise the lock pin may be sheared off.



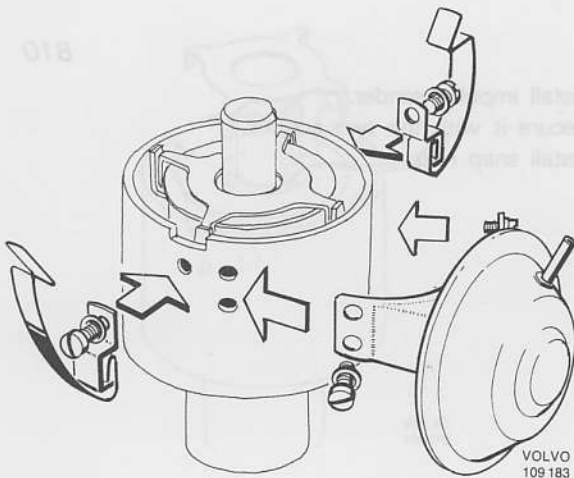
VOLVO
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B12

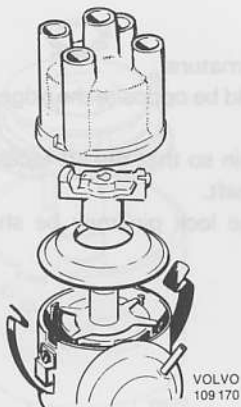
Install shims and snap ring.



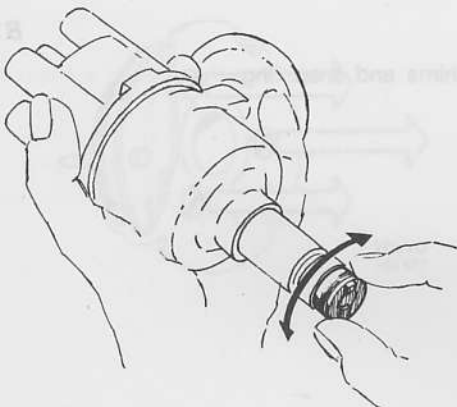
B13
Reconnect the wire connector and tighten the screw.



B14
Install clasps and vacuum unit.



B15
Install dust cover, rotor and cap.



B16
Check distributor
Rotate the distributor shaft several turns in both directions.
It should rotate freely and without any noise or seizure. The only resistance which may occur is the little stiffness caused by the magnet in the impulse sender when the teeth pass each other.

Group 35 Lights Specifications

Lights, 12 V	US bulb No.	Power	Socket	No. of bulbs
Headlights				
244-245				
DL 4D Wagon	5¾" Type 1			2
	5¾" Type 2			2
	Sealed Beam			
Headlights				
242, GT	7" Type 2			2
Position Lights, front	67	5W/4cp	Ba15s	2
Turn Signals, front	1073	21W/32cp	Ba15s	2
Turn Signals, rear	1073	21W/32cp	Ba15s	2
Taillights	67	5W/4cp	Ba15s	2
Stop Lights	1073	21W/32cp	Ba15s	2
Back-up Lights	1073	21W/32cp	Ba15s	2
Side Marker Lights	57	3W/2cp	S 8.5	2

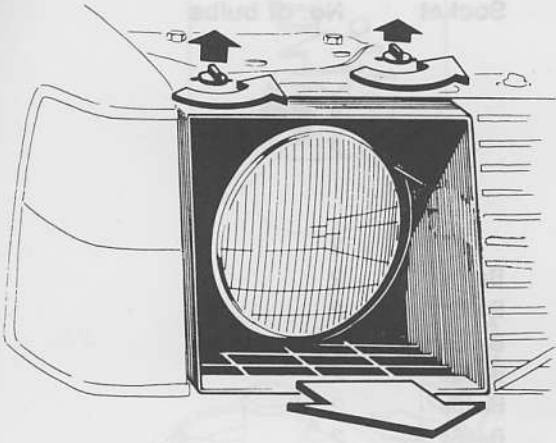
The following bulbs may be obtained from a Volvo dealer:

	Power	Socket	No of bulbs
Rear Ash Tray Light	1,2 W	W 1.8 d	1
License Plate Light	5W	S 8.5	2
Interior Light	10 W	S 8.5	1 (245:2)
Glove Locker Light	2 W	Ba 9 s	1
Instrument Panel Light	2 W	Ba 7 s	3
Control Panel Light	1,2 W	W 1.8 d	3
Shift Positions, Autom.			
Transmission	1,2 W	W 1.8 d	1
Engine Compartment Light	15 W	S 8.5	1
Control Lamps			
Charging	1,2 W	W 1.8 d	1
Turn Signals	1,2 W	W 1.8 d	2
Brake Failure	1,2 W	W 1.8 d	1
Parking Brake	1,2 W	W 1.8 d	1
Headlights	1,2 W	W 1.8 d	1
Oil Pressure	1,2 W	W 1.8 d	1
Overdrive	1,2 W	W 1.8 d	1
Warning Flashers	1,2 W	W 1.8 d	1
El. Heated Window	1,2 W	W 1.8 d	1
EGR Reminder	1,2 W	W 1.8 d	1
Seat Belts	2 W	Ba 9 s	1
Bulb Failure	1,2 W	W 1.8 d	1

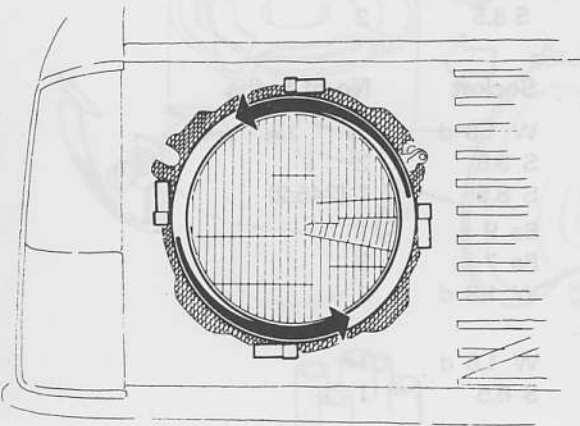
Models 240, DL 4d and DL 5d

Service Procedures

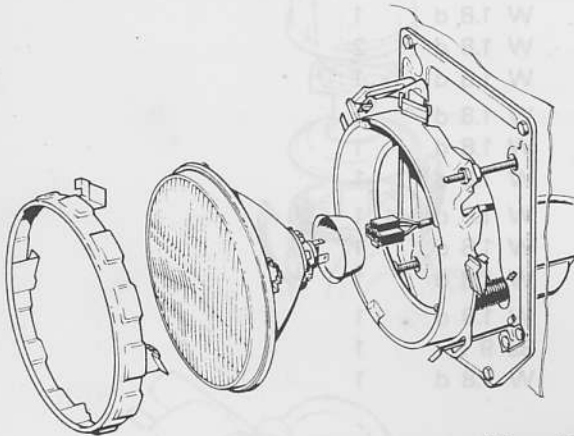
Replacing Sealed Beam headlamps



Turn 1/2 turn to remove the plastic screws.
Remove the headlight rim.

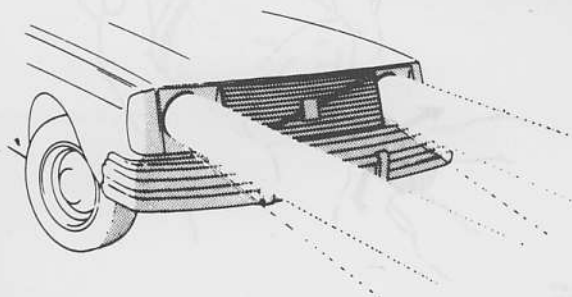


Turn the chromed ring slightly counter clockwise.
Remove the chromed ring and lift out the headlamp unit.
Disconnect the socket contact.

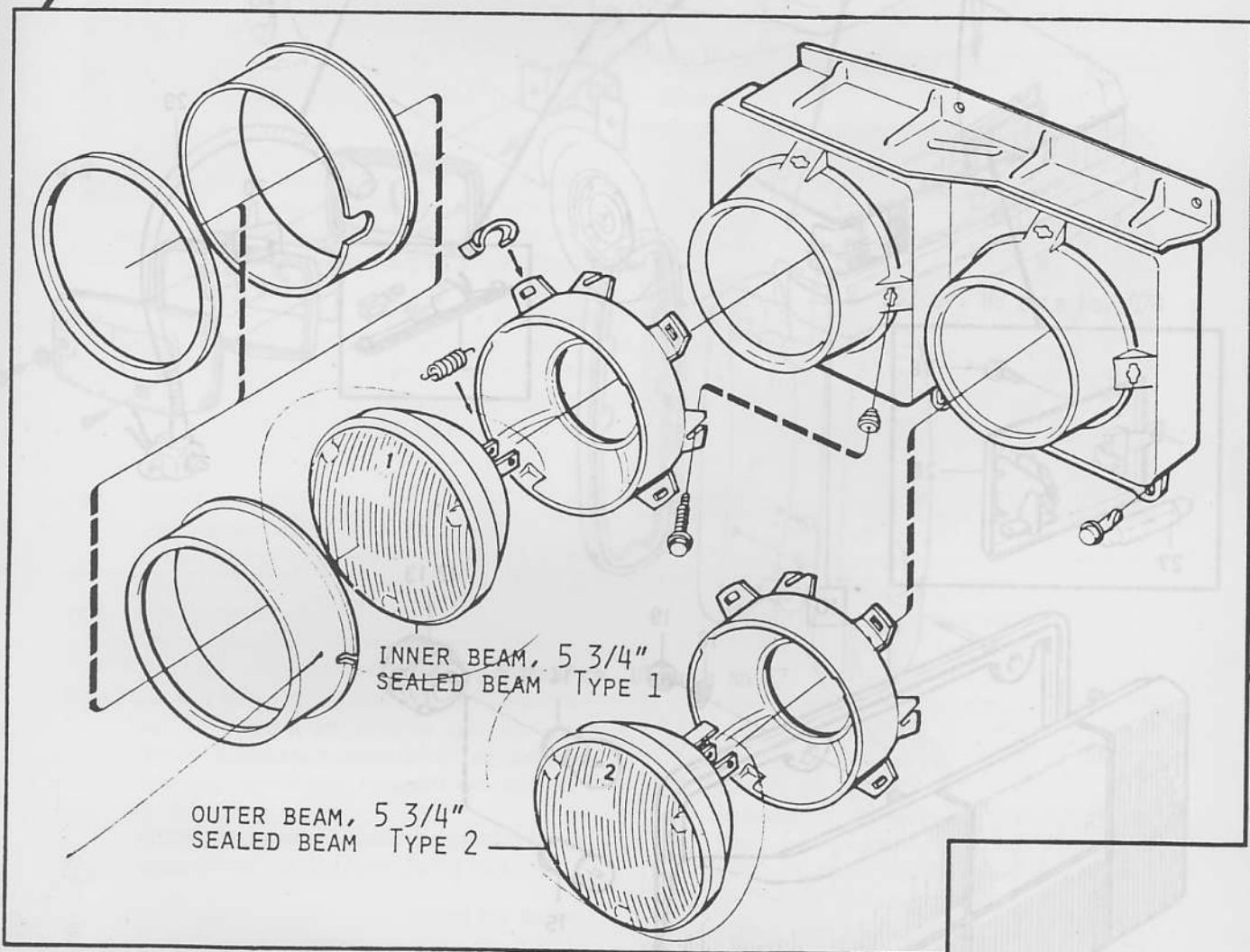
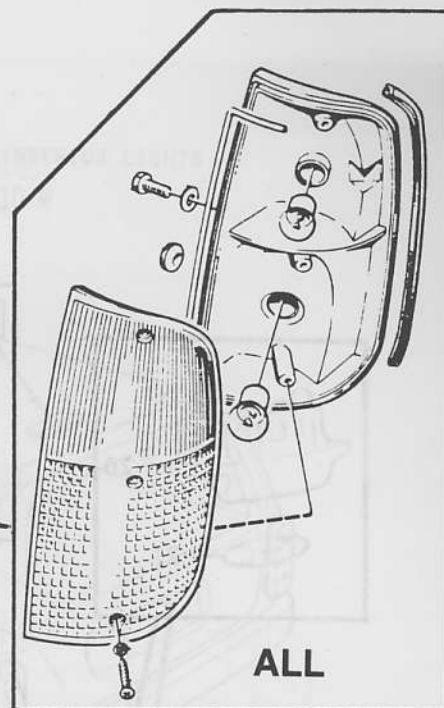
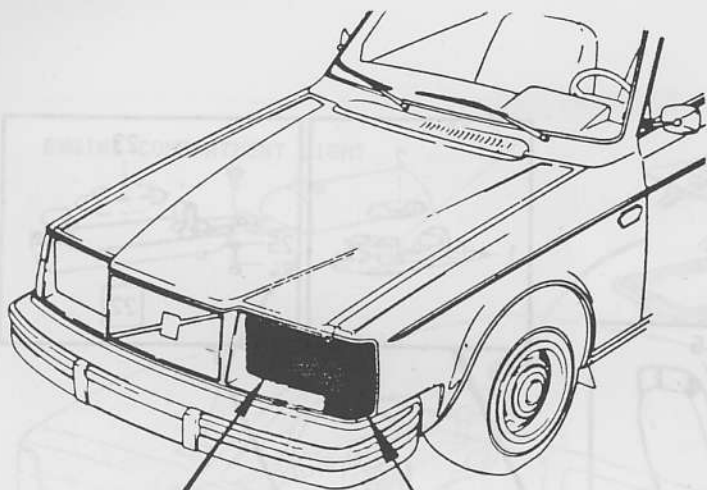


Reconnect socket contact, install headlamp unit,
chromed ring and rim.

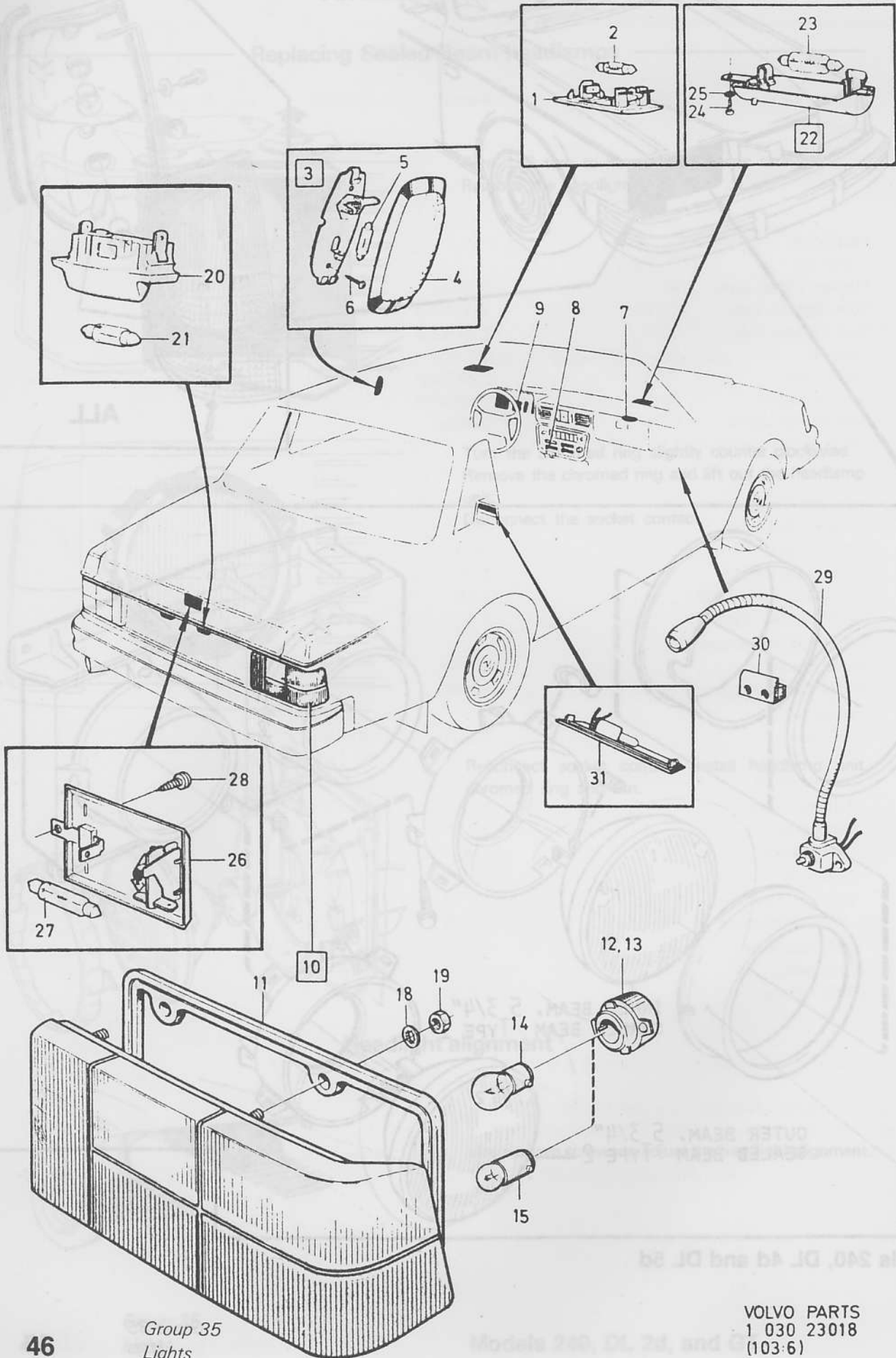
Headlight alignment

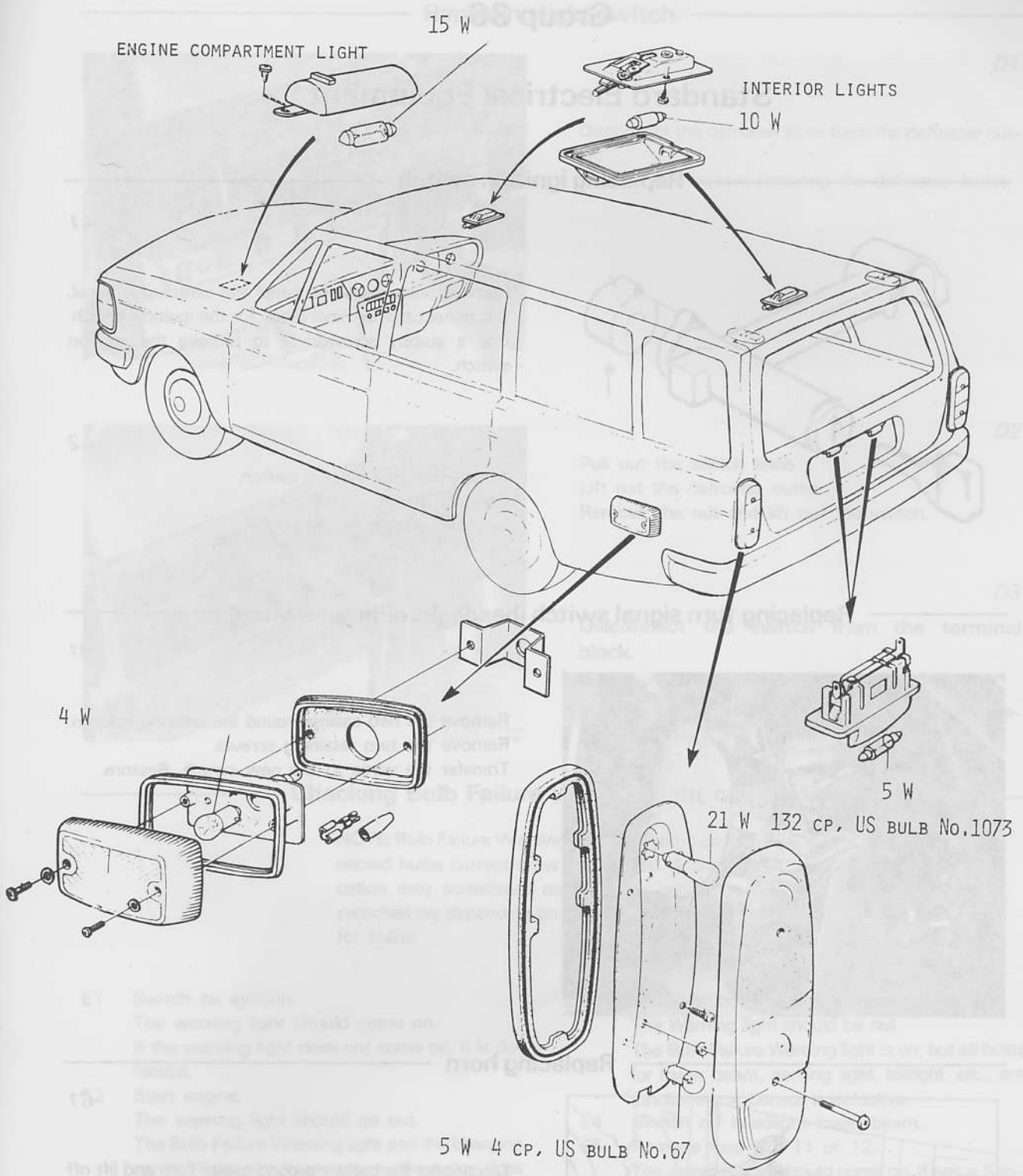


Use the two screws to adjust the headlight alignment.



Models 240, DL 4d and DL 5d





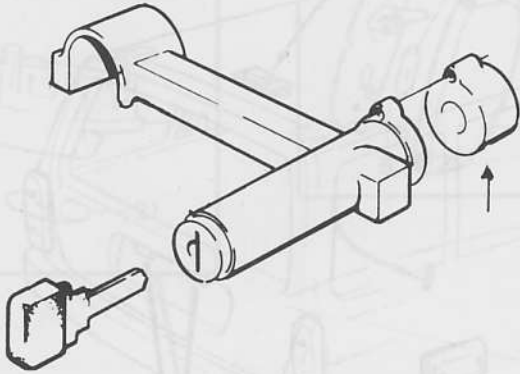
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Group 36

Standard Electrical Equipment

Replacing ignition switch

A1



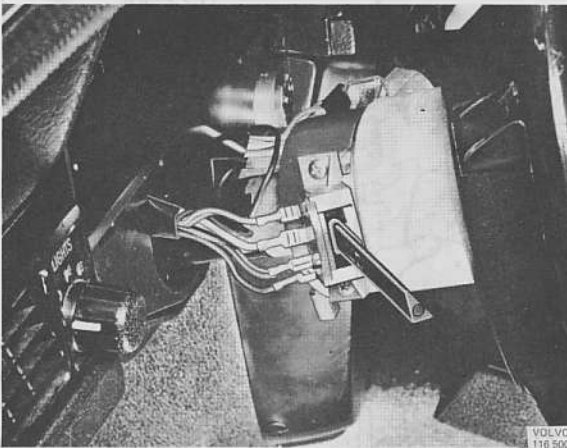
Remove noise insulation panel and center side panel. Disconnect the terminal block for the ignition switch. Use a stubby screwdriver to remove the ignition switch.

A2

Attach the new ignition switch. Connect the terminal block. Re-install panels.

Replacing turn signal switch (headlight dimmer switch)

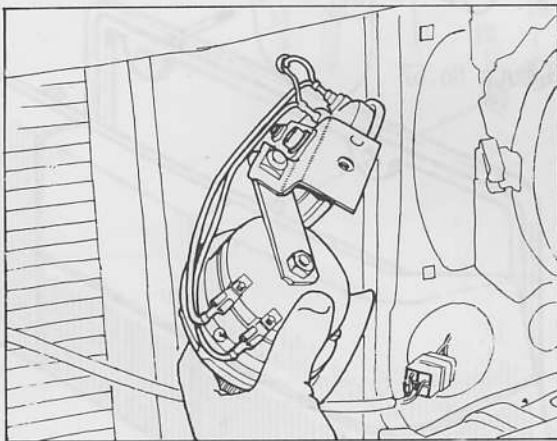
B1



Remove the two casings round the steering column. Remove the two retaining screws. Transfer the wires to the new switch. Restore.

Replacing horn

C1

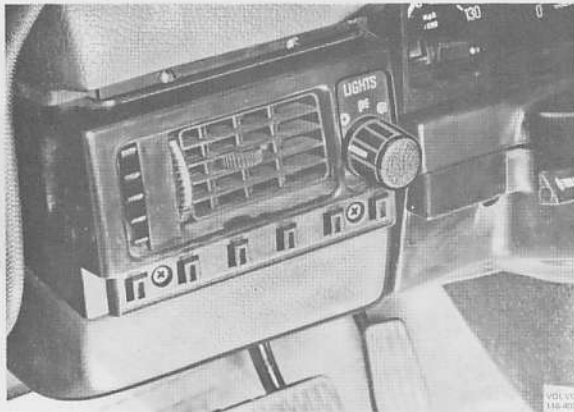


Disconnect the battery ground cable. Turn and lift off the lock pins. Remove the grille. Disconnect the wires at the horns. Remove the horns.

C2

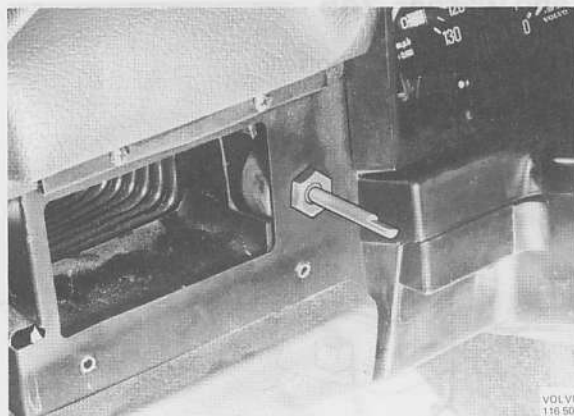
Install the horns. Attach the wires as shown. Install the grille and reconnect the battery ground cable.

Replacing light switch



D1

Disconnect the defroster hose from the defroster outlet.
Remove the screws retaining the defroster outlet.



D2

Pull out the switch knob.
Lift out the defroster outlet.
Remove the nut and lift out the switch.

D3

Disconnect the switch from the terminal block.

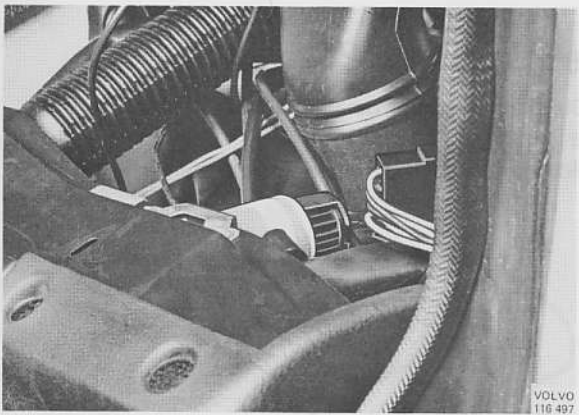
Connect the new switch.
Install switch, defroster outlet, switch handle and defroster hose.

Checking Bulb Failure warning light operation

NOTE: Bulb Failure Warning light may come on if connected bulbs current draw is distorted. A short indication may sometimes occur, when headlights are switched on, depending on variation in "starting" time for bulbs.

- | | |
|--|--|
| <p>E1 Switch on ignition.
The warning light should come on.
If the warning light does not come on, it is defective.</p> <p>E2 Start engine.
The warning light should go out.
The Bulb Failure Warning light and the charging control light simultaneously = alternator does not function.
The Bulb Failure Warning light is on after the charging control light has gone out = Sensor is defective.
NOTE: light switch should be pushed in and brake pedal not actuated during test.</p> | <p>E3 Switch on headlight lower beam.
The Warning light should be out.
The Bulb Failure Warning light is on, but all bulbs for lower beam, parking light, taillight, etc., are functioning = Sensor is defective.</p> <p>E4 Switch off headlight lower beam.</p> <p>E5 Remove fuse No. 11 or 12.
The warning light should come on. If not = Sensor is defective.
Re-connect fuse.</p> <p>E6 Switch off light.</p> <p>E7 Depress brake pedal.
The warning light should be out. If it comes on and both brake lights function, it is defective.</p> <p>E8 Switch off ignition.</p> |
|--|--|

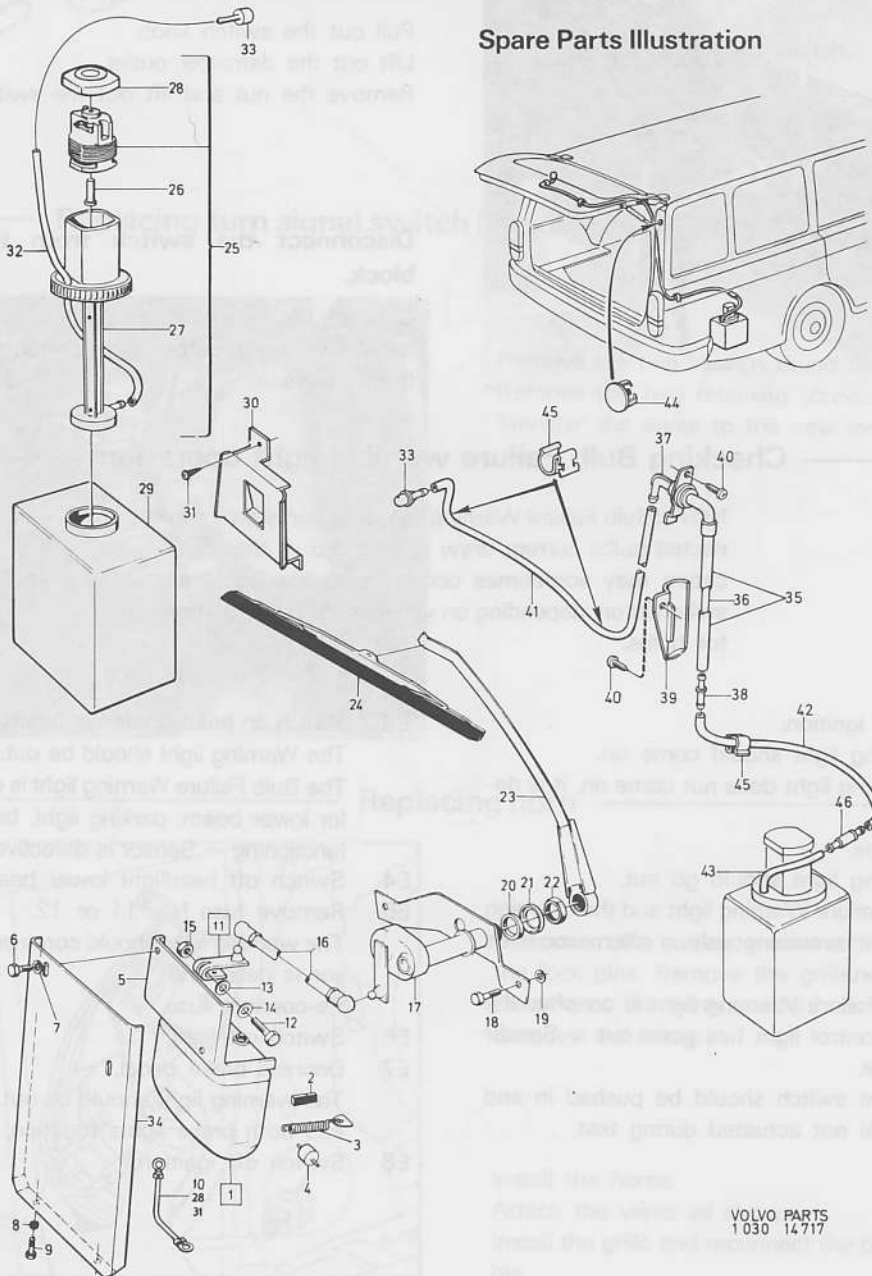
Replacing Bulb Failure Warning Light sensor



- F1 Disconnect the connector at the Sensor Unit.
- F2 Remove the Sensor Unit.
- F3 Install the replacement Sensor Unit.
- F4 Re-connect the connector to the Sensor Unit.
- F5 Check the function of the replacement unit.

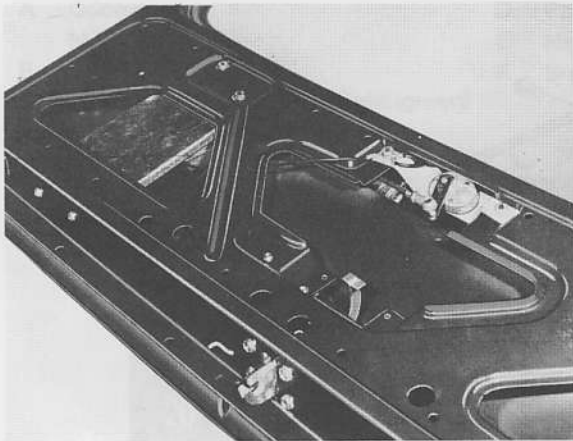
Tail gate window wiper and washer, 245

Spare Parts Illustration



VOLVO PARTS
1 030 14 717

Tail gate window wiper, 245



G1

Removing

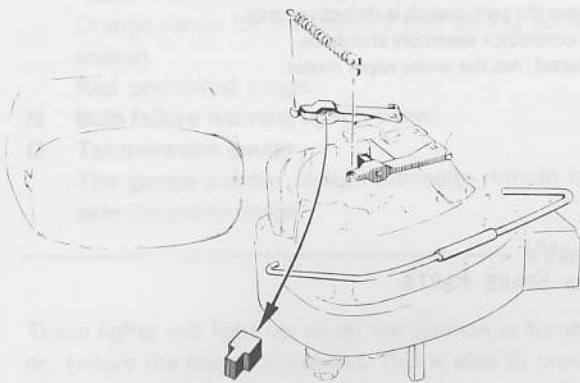
Disconnect the battery ground cable. Remove the panel on the inside of the tailgate. Remove the retaining screws for the wiper motor protection plate. Disconnect the link arm at the wiper motor. Fold the protection plate aside and lift out the wiper motor. Mark the wires, and disconnect them at the wiper motor.

G2

Installing

Reconnect the wires to the motor. Attach motor and protection plate. Reconnect the link arm to the wiper motor. Install the protection plate retaining screws. Install the panel on the inside of the tailgate. Reconnect the battery ground cable.

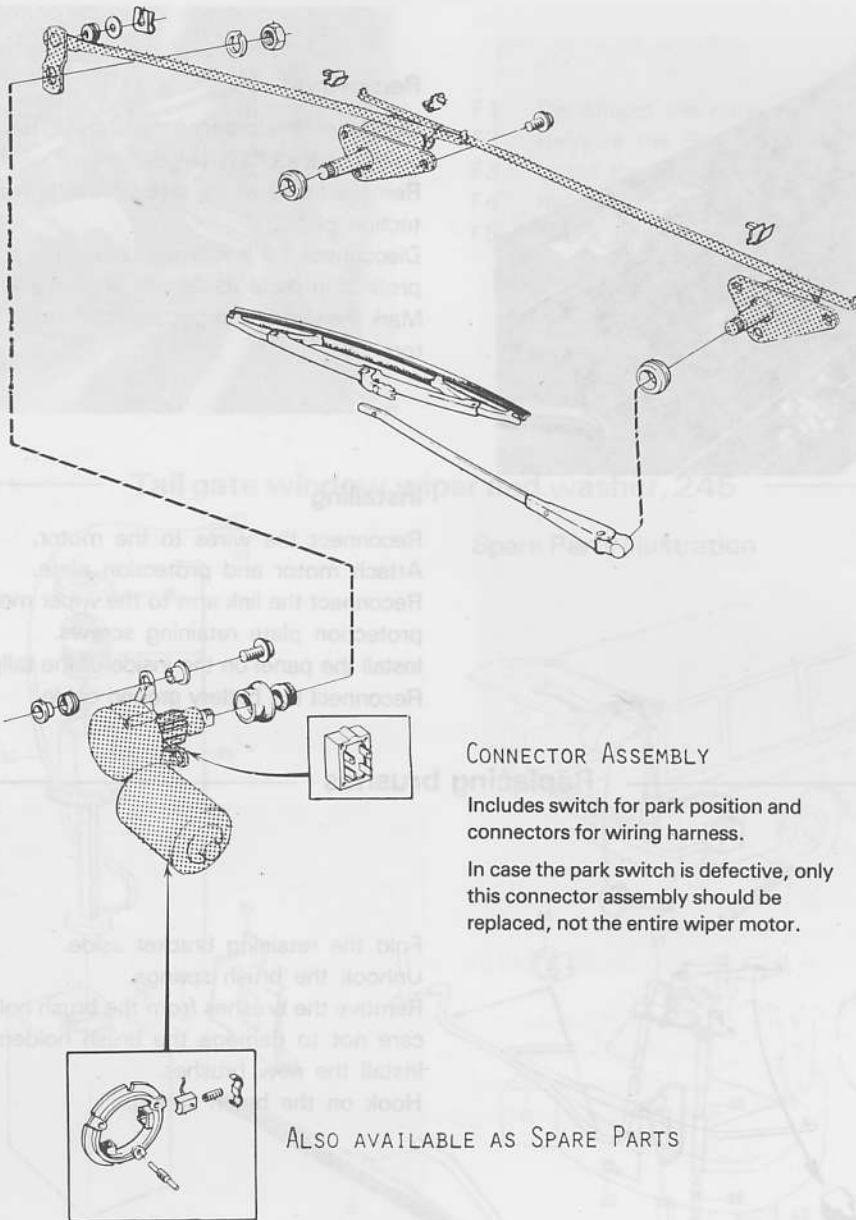
Replacing brushes



H1

Fold the retaining bracket aside. Unhook the brush springs. Remove the brushes from the brush holders. Observe care not to damage the brush holders. Install the new brushes. Hook on the brush spring.

Windshield wiper assembly



CONNECTOR ASSEMBLY

Includes switch for park position and connectors for wiring harness.

In case the park switch is defective, only this connector assembly should be replaced, not the entire wiper motor.

ALSO AVAILABLE AS SPARE PARTS

Replacing wiper unit

Removal

- J1 Disconnect battery ground cable.
Remove side panel.
Remove panel under dashboard.
- J2 Remove defroster hoses.
Remove glove box.
- J3 Remove wiper arms.
Disconnect wiper assembly and lift it out through glove box opening.

Installation

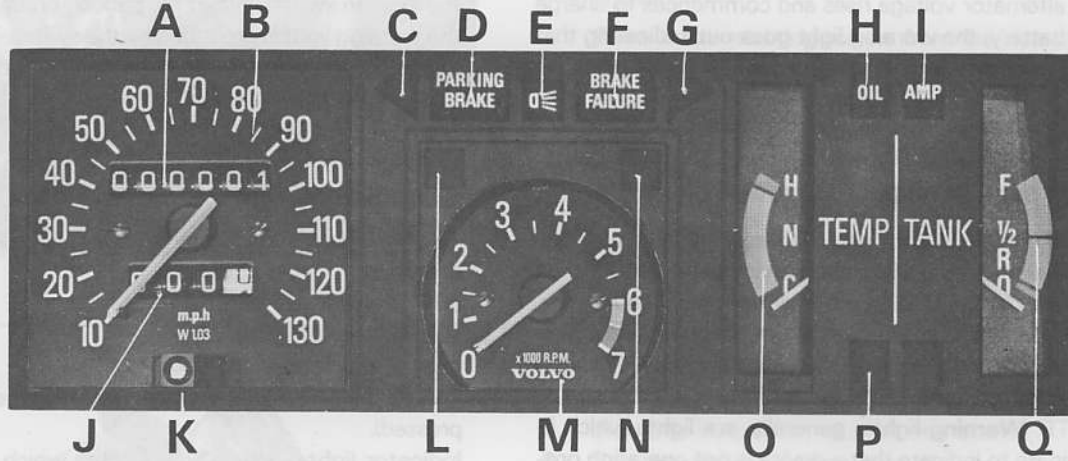
- K1 Install wiper assembly.
Remove device securing wiper assembly at transport and handling.
- K2 Install: glove box
defroster hoses
side panels
panel under dashboard
- K3 Install wiper arms.
Reconnect battery ground cable.
Check function.

Group 38 Instruments

Instrument Cluster

Instrument cluster

- | | | |
|--|--------------------------------------|---------------------------------------|
| A Odometer
Mile reading | D Parking brake reminder light (red) | G Right turn signal indicator (green) |
| B Speedometer | E High beam indicator (blue) | H Oil pressure warning light (red) |
| C Left turn signal indicator light (green) | F Brake failure warning light (red) | I Alternator warning light (red) |



- | | | | | |
|--|--|---|--|--|
| J Trip odometer
(last figures represents 1/10 mile) | M Tachometer (certain models)
Reads thousands of engine rpm.
Orange range for momentary use, during acceleration.
Red prohibited range. | O Temperature gauge
The gauge pointer should normally remain inside the green range. | P Overdrive indicator (green)
Lights when overdrive is engaged. | Q Fuel gauge
The fuel tank capacity is approx 60 liters = 15.8 US gals./13.2 Imp. gals.
F = Full
1/2
R = Reserve
O = Empty
The red range from R to O represents approx. 8 liters = 2.5 US gals./2 Imp. gals. |
| K Trip odometer reset knob
Push in to reset | N Bulb failure warning light (yellow) | | | |
| L Reminder light, EGR Service (except Lambda-Sond) | | | | |

Warning lights

These lights will light up when the ignition is turned on, before the engine is started. This is also to prove that the lights function. The light should go out after the engine has started. (However, the parking brake reminder light will not go out until the parking brake is released.)

Oil pressure warning light (red)

If the light comes on during driving, the oil pressure is too low. Stop the engine immediately and check the engine oil level, see page 46. After hard driving, the light will come on occasionally when the engine is idling. This is normal, provided it goes out when the engine speed is increased.

The warning light for the oil pressure receives current via the ignition switch. It is grounded through a pressure sensitive valve on the engine. With the engine running and at normal pressure, the circuit through

this light and ground is open. When the oil pressure drops below a pre-determined value, the pressure sensitive valve closes the circuit and the warning light is illuminated.

Brake failure warning light (red)

If the light comes on while driving and the brake pedal can be depressed further than normal, it is an indication that one of the brake circuits is out of function. 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/cm^2 (114–142 psi) when the brakes are applied, this actuates the valve and the warning light goes on. The warning lamp remains lighted until the fault in the brake system has been corrected and the warning valve re-set. Re, re-setting the warning valve, see Section 5, Brake, Group 52.

Alternator warning light (red)

If the light comes on when engine is running, check the alternator drive belt tension as soon as possible. The alternator warning light 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 light goes out, indicating that the alternator is charging.

Reminder light, EGR service (except Lambda-Sond)

If the vehicle is equipped with an EGR (Exhaust Gas Recirculation) 15 000 mile service reminder light, as required by the U.S. Environmental Protection Agency, the light will come on at 15 000 mile intervals. This is a reminder to get the EGR valve serviced. The light will stay on until reset by the dealer.

NOTE: **Warning lights**, generally, are lights which illuminate to indicate that a device is **not** operating properly.

Parking brake reminder light

This light will be on when the parking brake (hand brake) is set. The parking brake lever is situated between the front seats.

The parking brake reminder light receives current via the ignition switch. When the parking brake is applied, the warning light is grounded by the switch. The warning lamp remains lighted as long as the parking brake is on.

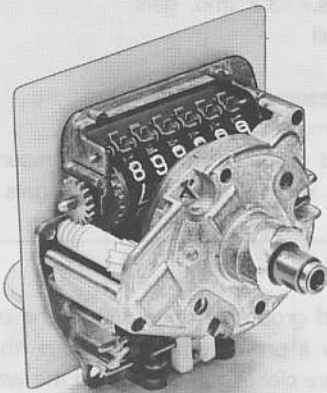
Bulb failure warning light

The light comes on if any of the following lights is defective:

- one of the lower beams
- One of the taillights
- one of the license plate lights
- one of the brake lights (when the brake pedal is depressed).

Indicator lights, generally, are lights which illuminate to indicate that a device is operating.

Testing speedometer and odometer assembly



If speedometer or odometer is not functioning, the reason may be a fault in instrument or speedometer cable or the worm gear in the transmission, or in the cable.

Check following:

If the speedometer functions while the odometer does not, or vice-versa, the instrument is defective and should be replaced. No attempt should be made to repair the instrument.

When both speedometer and odometer stop functioning, the fault is probably in speedometer cable or gear. Disconnect speedometer cable from instrument and see if it can be rotated.

Check the cable and the drive at the transmission. Check the drive couplings rotate easily. If it jams, the instrument should also be replaced.

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

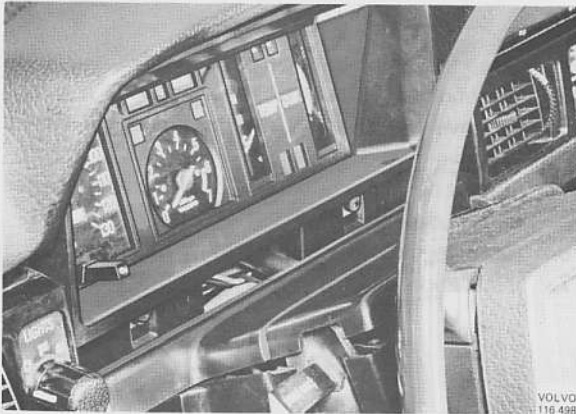
Drive speed	Speedometer reading
500 rpm	31.5 ± 2.5 mph
1000 rpm	60.5 ± 2.5 mph
1750 rpm	104.5 ± 2.5 mph

Speedometer drive 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 not bent too sharply. At no point must the radius of a

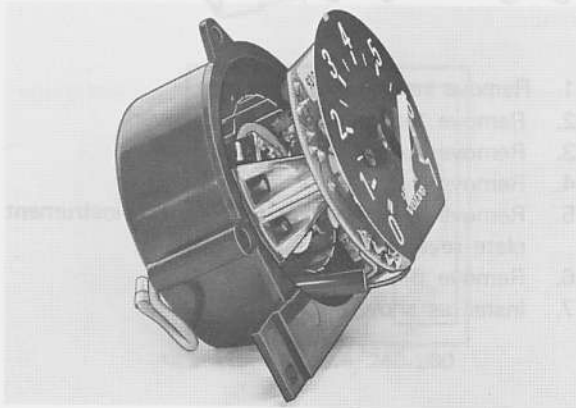
bend be less than 100 mm (4"). If it is less than this, vibration and noise can occur in the instrument. The drive couplings must run true in the outer casing of the cable. This is checked with the cable rotating.

Replacing instrument cluster



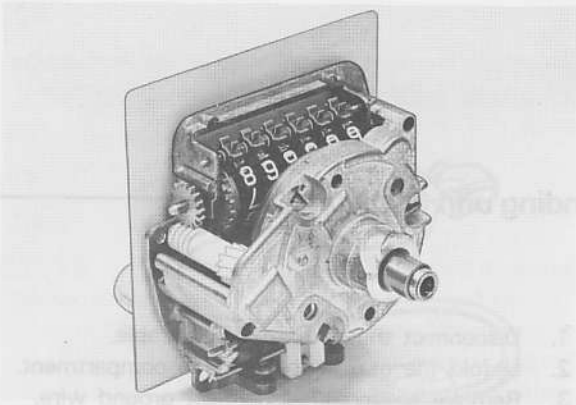
1. Remove the covers round the steering column.
2. Remove the bracket retaining screws. Allow the bracket to slip down on the steering column.
Remove the retaining screws from the instrument cluster.
3. Disconnect speedometer cable.
4. Grip the reverse side of the speedometer and press the instrument up-out until the snap lock at the instruments upper edge releases.
5. Lift out the instrument and disconnect the terminal block on the reverse side.

Replacing tachometer



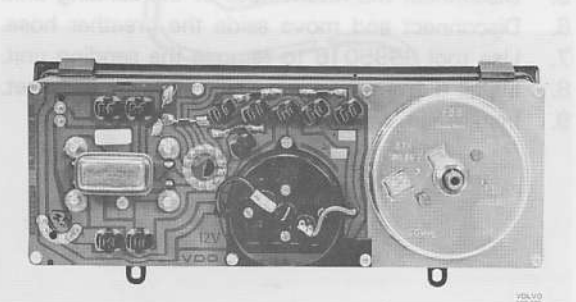
1. (Remove instrument cluster, see above).
2. Remove three retaining screws.
3. Carefully remove the instrument. The terminals can easily be damaged.
4. Install tachometer (or cover) as shown.

Replacing speedometer assembly



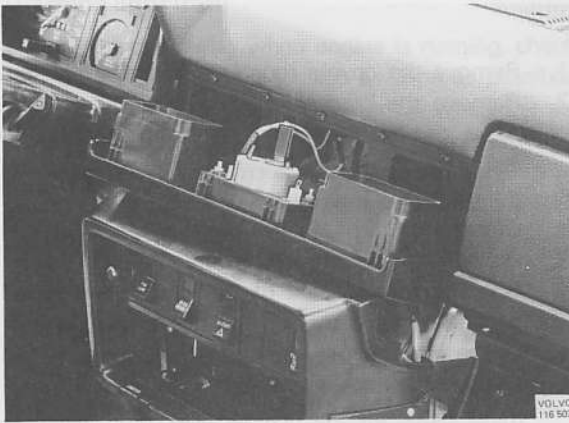
1. Remove instrument cluster, see above.
2. Remove tachometer (or blind cover.)
3. Remove three speedometer retaining screws.
4. Carefully remove the instrument.
Install as shown.

Replacing instrument plate ("printed circuit")



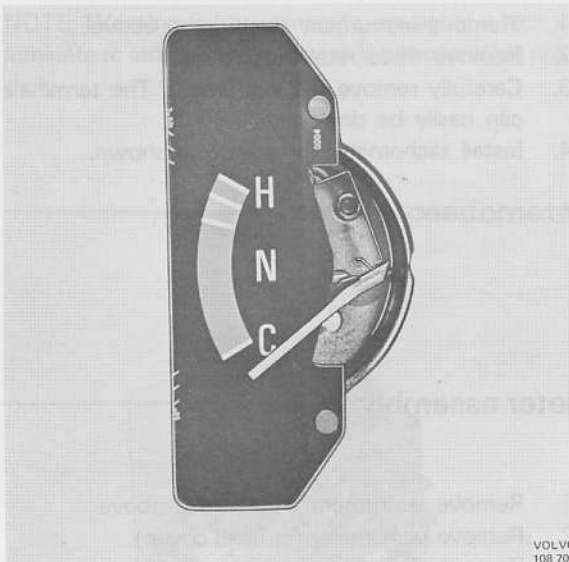
1. (Remove instrument cluster, see above).
2. Remove tachometer (or blind cover).
3. Remove speedometer.
4. Remove three plate retaining screws.
5. Carefully remove the plate, not damaging temperature of fuel gauge.

Replacing clock



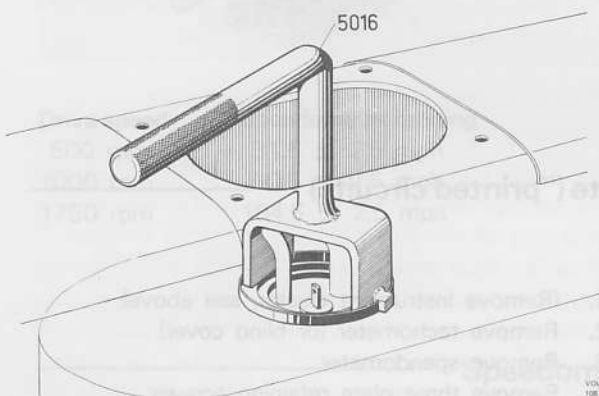
1. Disconnect the battery ground cable.
2. Disconnect the control panel and pull it out.
3. Remove the impact guard by pushing it down.
4. Remove two screws.
5. Lift out defroster outlet and clock. Mark the wires before disconnecting.
6. Remove two retaining screws. Replace clock.
7. Installation is opposite order.

Replacing temperature gauge / fuel gauge



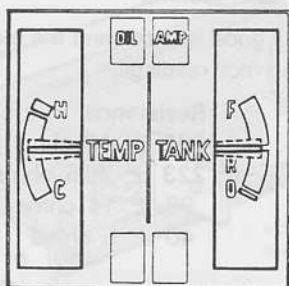
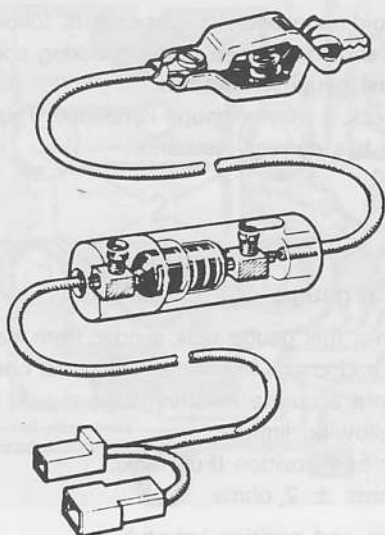
1. Remove instrument cluster.
2. Remove tachometer (or blind cover).
3. Remove speedometer.
4. Remove instrument.
5. Remove two retaining nuts on the instrument plate reverse side.
6. Remove the gauge.
7. Install as shown.

Replacing fuel gauge sending unit (tank unit)

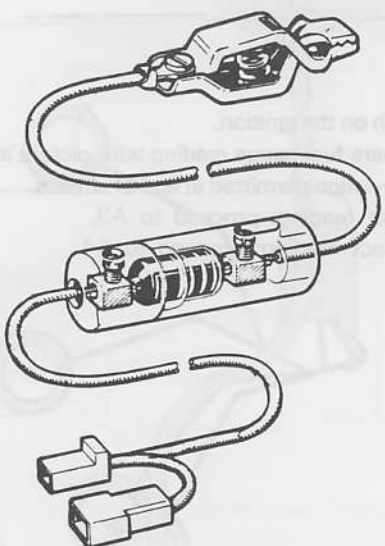


1. Disconnect the battery ground cable.
2. Unfold the mat in the luggage compartment.
3. Remove cover and disconnect ground wire.
4. Disconnect the wire at the sending unit terminal.
5. Disconnect the return hose at the sending unit.
6. Disconnect and move aside the breather hose.
7. Use tool 9995016 to remove the sending unit.
8. Install the new sending unit with a new gasket.
9. Installation is opposite order.

Testing temperature gauge or fuel gauge



140, 160-1974/240, 260



If a temperature or fuel gauge is not working properly, the gauge system can be tested as follows:

METHOD**A. Testing the voltage stabilizer.**

1. Connect the test resistor (part no. 999 5158-4) to the instrument which is functioning properly. In other words, if the fuel gauge is not functioning properly, disconnect the temperature gauge cable from the sensor and connect the test resistor between the sender cable and vehicle ground.

2. 140, 160—1974 240, 260

The pointer should now be horizontal (tolerance + pointer width).

If the instrument pointer points outside the tolerance range, then the voltage stabilizer is faulty. If the instrument pointer is within the tolerance range, continue with Step B.

B. Testing the gauge and sender.

1. Disconnect the cable to the **faulty** instrument sender and connect the test resistance between the sender cable and vehicle ground.
2. If the instrument pointer is **horizontal** or **inside** the mark, then the **sender** is faulty (tolerance + pointer width). Check the fuel gauge sender according to Service Manual, Sec. 3 240 or 260 series, Elec. System & Instruments (TP 11402 or 11413). If the pointer is outside the tolerance range, then the instrument is faulty.

Test resistor

P/N:

9995158-4 (blue cable) Volvo 140, 160-1976, 240, 260

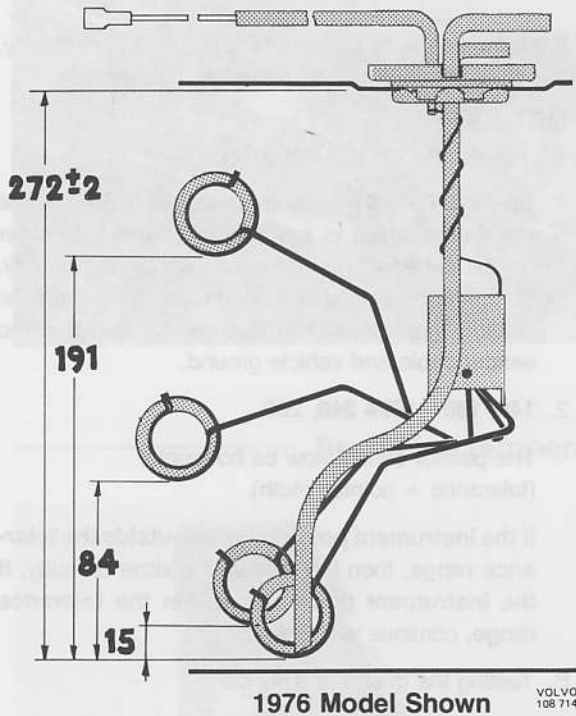
Spare Parts

P/N	Resistor
9999145-7	100 1W5% 140, 160—1974 240, 260

Replacing the resistor

Disconnect the cables and open the holder. Place the new resistor in the holder and allow the resistor connections to project from the holder. Insert the connection cables and tighten up. Cut the part of the resistor cable which projects.

Testing fuel gauges and tank level senders



To avoid unnecessary replacements, following procedures should be used when checking complaints on the fuel gauge indications.

To check, a master gauge is needed. This is a gauge which has correct resistance.

A1

Master gauge

Obtain a fuel gauge tank sender from Parts Department and check it with an accurate ohm-meter.

An extra accurate master gauge should stay within the following limits:

Upper end position (Full tank):
40 ohms ± 2 ohms

Bottom end position (empty):
282 ohms ± 14 ohms

It might be a good idea to bend the movement limiter to obtain correct readings.

Position	Resistance
0 mm	282 ± 48 ohms
15 mm	223 ± 26,5 ohms
84 mm	98 ± 14 ohms
191 mm	40 ± 5 ohms

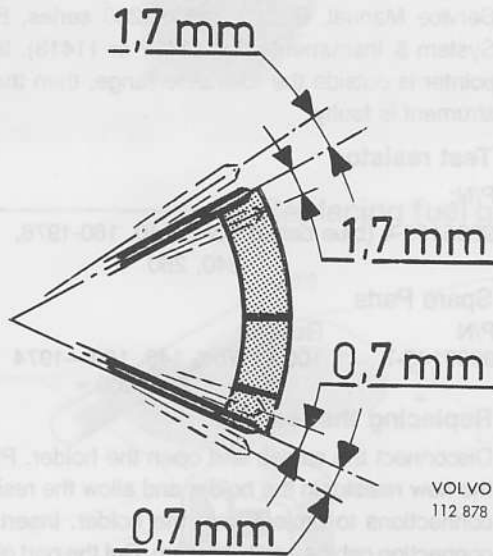
NOTE: Check vehicle specifications.

A2

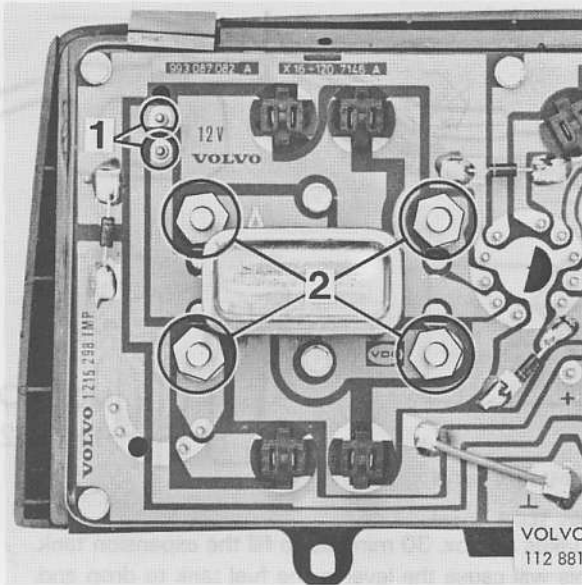
Disconnect the blue (brown) wire at the fuel gauge tank sender in the trunk. Instead, connect the master gauge and ground it.

A2

Switch on the ignition.
Compare fuel gauge reading with picture at left, showing deviation permitted at end of strokes.
Correct reading: proceed to A3.
Incorrect reading: proceed to A4.

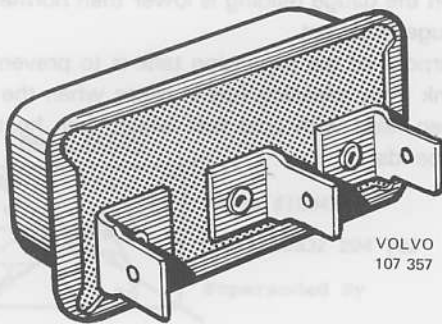


A3



Check connections

Check that the terminal pins (1) have correct contact and that the nuts (2) are tightened. Also check temperature gauge nuts.



Test operation of voltage stabilizer

To do this, use a new voltage stabilizer to test gauge readings.

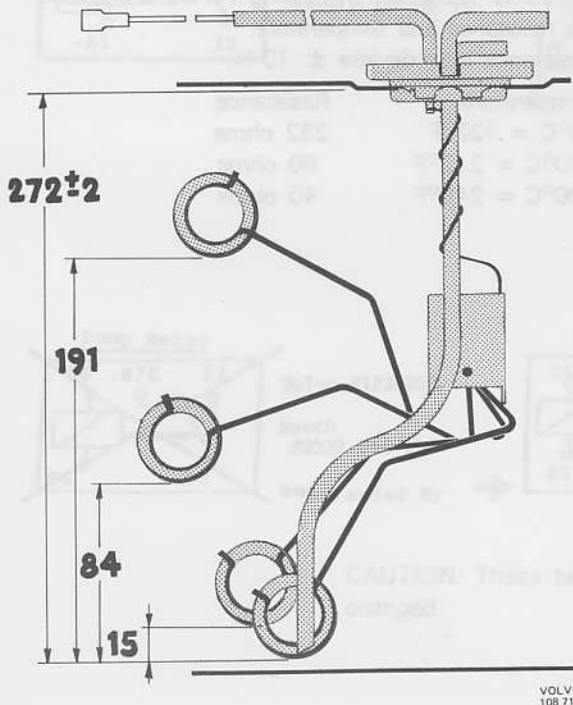
To replace voltage stabilizer, pull straight out so the three pins come loose from the retainers.

A4

A5

If mis-reading persists in spite of operations according to 1 and 2 above, re-install the ordinary voltage stabilizer and replace the fuel gauge.

The fuel gauge tank sender remains as possible trouble originator.



A6

Remove the tank sender.

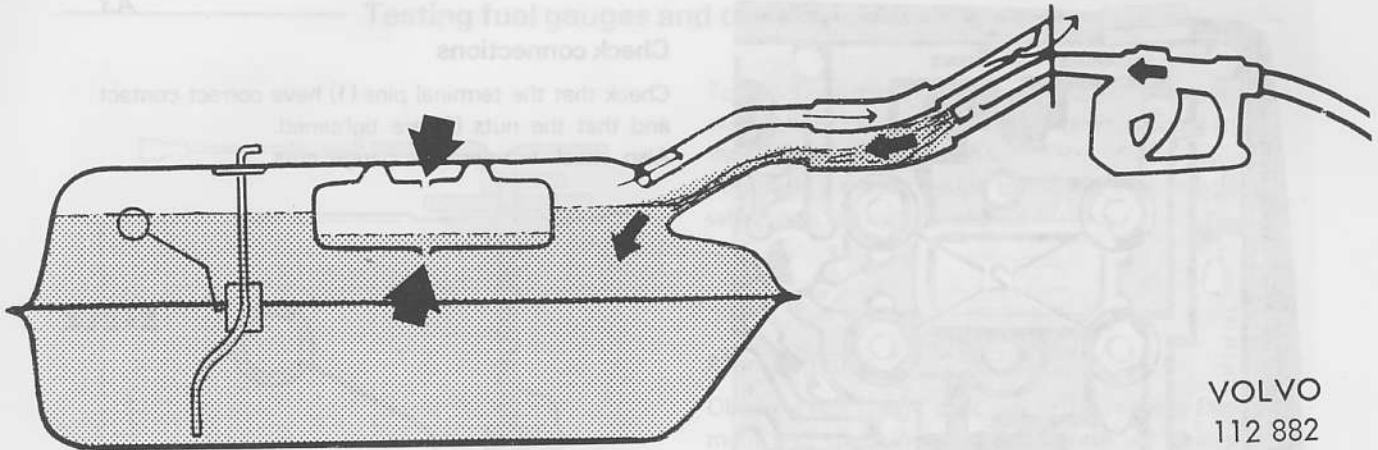
A7

Check that the tank sender lever operates without binding.

A8

Use an ohm meter to check resistance. Use measurements as shown in illustration at left. It might be convenient to make a fixture which facilitates a quick setting.

Position	Resistance
0 mm	282 ± 48 ohms
15 mm	223 ± 26.5 ohms
84 mm	98 ± 14 ohms
191 mm	40 ± 5 ohms



VOLVO
112 882

If a customer still complains in spite all specifications are within limits, it must be explained to him that the expansion tank inside the fuel tank causes the reading to drop faster at full tank.

The expansion tank capacity is approx. 6 liters (qts). It is slowly filled with fuel.

When filling fuel, the expansion tank is still almost empty when the fuel tank has been filled.

It takes approx. 30 minutes to fill the expansion tank. This will cause the level in the fuel tank to drop and, in addition to the fuel used, this might give the impression the gauge reading is lower than normal and the gauge incorrect.

The purpose of the expansion tank is to prevent the fuel tank from releasing fuel in cases when the tank has been filled with cold fuel which then heats up and expands.

NOTE: Early type illustrated—consult other publications for new design fuel tank specifications.

Testing temperature sensor



VOLVO
107 366

The sensor is checked by heating it in water and reading resistance and temperature.

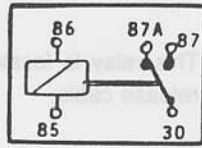
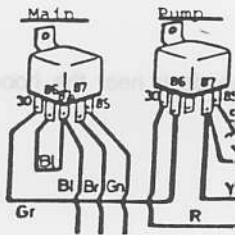
Resistance may deviate $\pm 10\%$.

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

Additional Information

Main and Pump Relay Application

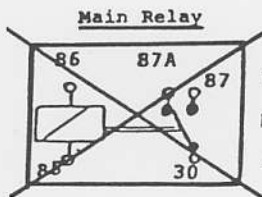
1974/1975 Models



Both pump and main relay are the same. They are located in the engine compartment. They are interchangeable.

Volvo #1214764-1
Bosch #0332 204 125

1976/1977 Models

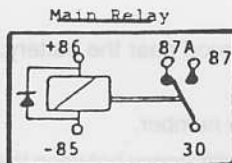


Volvo #1234750
Bosch #0332 204 102
Superseded By

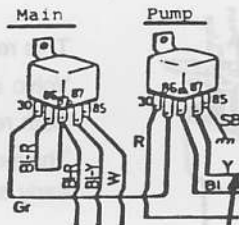
Both the main and pump relays are located under the dash near the hood release cable.

The pump relay is easily distinguished from the main relay by a heavy gauge yellow wire in its multiplug (#87), which goes to fuel pump.

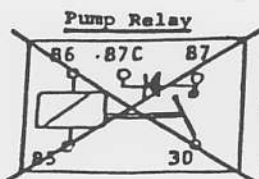
In most cases, the pump relay is fitted with a white plastic plug.



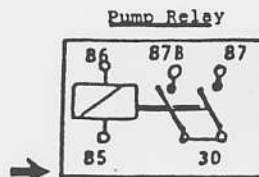
Volvo #1235134-2
Bosch #0332 204 110



To Fuel Pump



Volvo #1234751
Bosch #0332 014 114
Superseded By



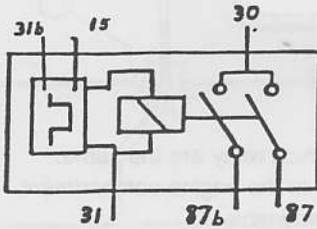
Volvo #1235020-1
Bosch #0332 015 009

CAUTION: These two relays must never be interchanged.

Main & Pump Relays

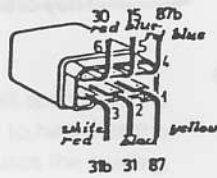
1978/1979 Models

Pump Relay



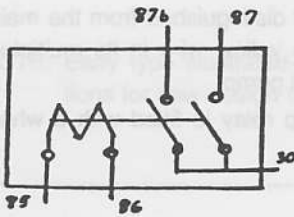
Volvo No.
1235337-1

This relay is located under the dash near the hood release cable.



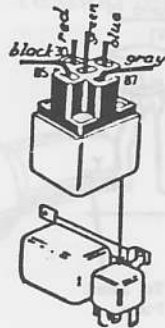
1977/1979 Models

Lambda-Sond Relay



Volvo # 1235013-8.

Bosch No. 0332015 001 **Early**
Bosch No. 0332015 012 **Late**



This relay is located under the hood near the battery.
Volvo #1235013-8.

Both relays use the same Volvo number.

The mounting bracket is the only difference between the early and late version.



**VOLVO SUPPORTS VOLUNTARY
MECHANIC CERTIFICATION
BY THE N.I.A.S.E.**

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