

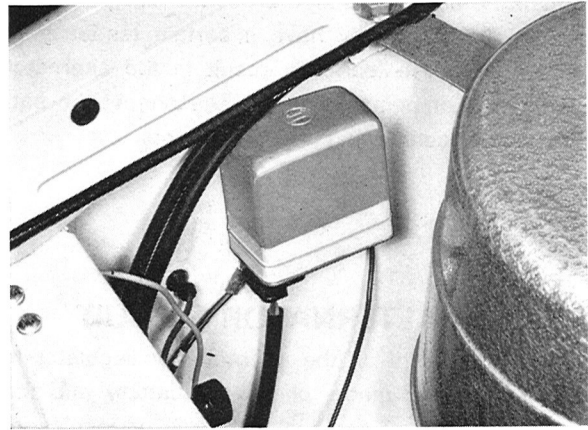
VOLTAGE REGULATOR

BOSCH

GENERAL INFORMATION

(Replace voltage regulator=Volvo Standard Times Op. No. 32205)

The voltage regulator is located on the wheel housing at a bracket behind the headlamp, see Fig. 3-68. It is a mechanical, single-pole voltage regulator with a lower contact, a movable contact and an upper contact, see Fig. 3-72. It is connected to the charging circuit by a three-pole plug. The regulator resistance is placed under a plate underneath the regulator. Temperature compensation is operated by a bimetallic spring which influences the spring tension so that the regulator receives lower regulating voltage at higher temperatures.



VOLVO
105 196

Fig. 3-68. Voltage regulator

SERVICE PROCEDURES

VOLTAGE REGULATOR REPLACEMENT

1. Disconnect the battery ground cable.
2. Pull the plug out of the voltage regulator.
3. Remove the screws and change the regulator.
4. Install the new regulator and insert the plug.
5. Reconnect the battery ground cable.

Concerning regulator adjustment, see under "Test the voltage regulator".

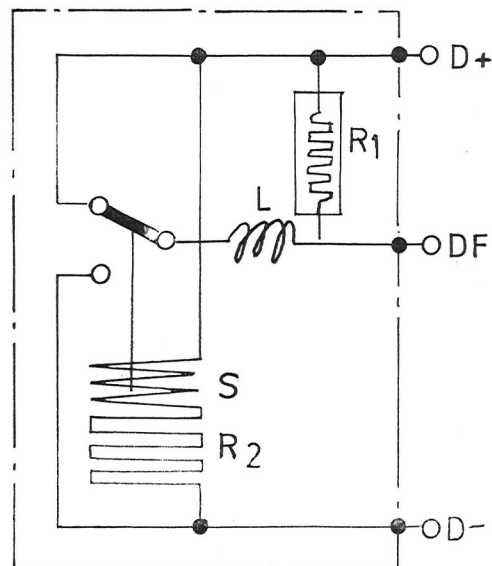


Fig. 3-69. Inner wiring of voltage regulator

- S Voltage coil 35 Ω
- R¹ Regulator resistance 2.45 Ω
- R² Compensation resistance 50 Ω
- L Contact impedance coil

VOLVO
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TEST OF ALTERNATOR AND VOLTAGE REGULATOR

For all tests of alternator equipment, fixed clamps should be used. So-called crocodile clamps should not be used as they have a certain tendency to loosen. A loose lead can result in the alternator and regulator being damaged. Disconnect the battery before connecting any instruments.

TEST OF ALTERNATOR CIRCUIT

Before any tests on the alternator or regulator in the vehicle are made, check the battery and the vehicle wiring for fault in the leads or insulation, loose or corroded lead terminals and poor ground. **Check the fan belt.** Any of the fault just mentioned must be repaired before the electrical checks are started.

BATTERY TEST

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

VOLTAGE DROP TEST

This test is made to check the leads between the alternator and the battery and also the battery ground cable. The test should be made with a fully charged battery in good condition. The battery connections should be well cleaned and tightened. Load the alternator with about 10 amps. Suitable load: headlights switched on. With the engine running and the alternator supplying 10 amps, measure with a suitable voltmeter the voltage between the positive pole of the battery and B+ on the alternator. If the voltage at this test exceeds .3 volt, there is a fault in the cable or contact, which must be remedied immediately. After repairing defective leads or contacts, measure again.

With the same load as above, measure the voltage drop between the negative pole of the battery and the alternator terminal D—. Here the voltage drop must not exceed .2 volt. If the voltage drop exceeds .2 volt, check the battery ground, the alternator contact with the engine and the engine contact with the chassis. After making the necessary repairs, measure again.

ALTERNATOR TEST

(In a test bench or in the vehicle)

Test of charging system in vehicle = Volvo Standard Times Op. No. 32174

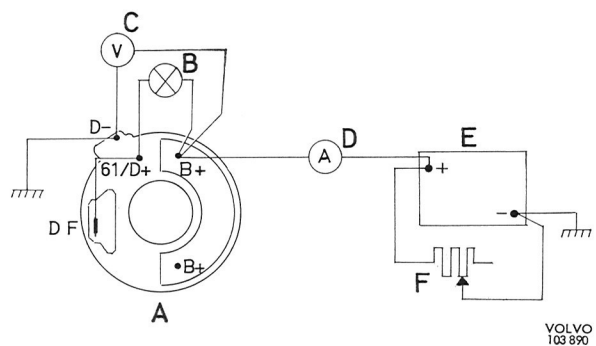


Fig. 3-70 Wiring diagram for testing alternator

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

Connect the alternator as shown in Fig. 3-70. Run it to a speed of 100 r/s (6000 r/m). Regulate the voltage to about 14 volts by means of the load resistance F. The alternator should produce 35 amps at 100 r/s (6000 r/m) and a voltage of 14 volts.

At the same time check to make sure that the charging warning lamp does not light or glow. If the alternator does not meet the above requirements, first check the brushes and diodes.

TEST AND ADJUSTMENT OF VOLTAGE REGULATOR

(In a test bench or in the vehicle)

Connect up the regulator to an alternator in good condition as shown in Fig. 3-71.

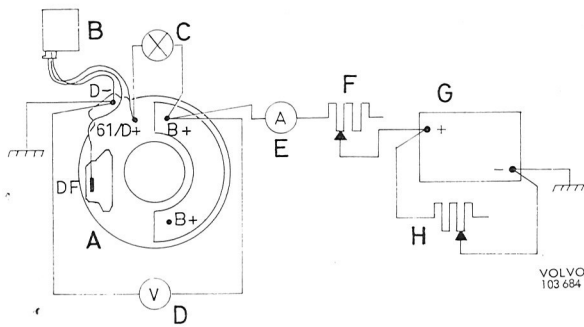


Fig. 3-71. Wiring diagram for testing voltage regulator

- | | |
|--------------------------------------|---------------------------|
| 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 |

Run the alternator to a speed of 67 r/s (4000 r/m) (engine speed 33.5 r/s (2000 r/m)). Load the alternator with approx. 28—30 amps.

Rapidly lower the alternator speed to about 16.9 r/s (1000 r/m) (in vehicle, idling speed), raise the speed again to 67 r/s (4000 r/m) engine speed 33.5 r/s (2000 r/m) and adjust the load to approx. 28—30 amps. Read the voltmeter. The voltage should be 14.0—15.0 volts and the regulator should be regulated on the left (lower) contact (1, Fig. 3-72).

The reading should be made within 30 seconds after the test has begun. Reduce the load on the alternator to 3—8 amps and read the regulating voltage. This voltage should now lie within the tolerance 0 volt to minus .3 volt in relation to the first reading. The regulator should now be regulated on the right (upper) contact (2, Fig. 3-72).

The regulating voltage in the lower regulating range is adjusted by bending the tensioner for the bi-metallic spring, see Fig. 3-73.

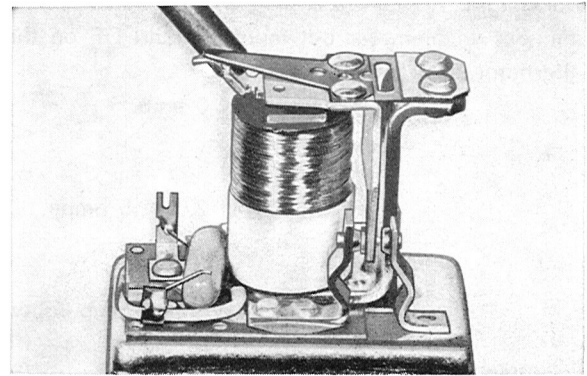


Fig. 3-73. Adjustment of voltage regulator

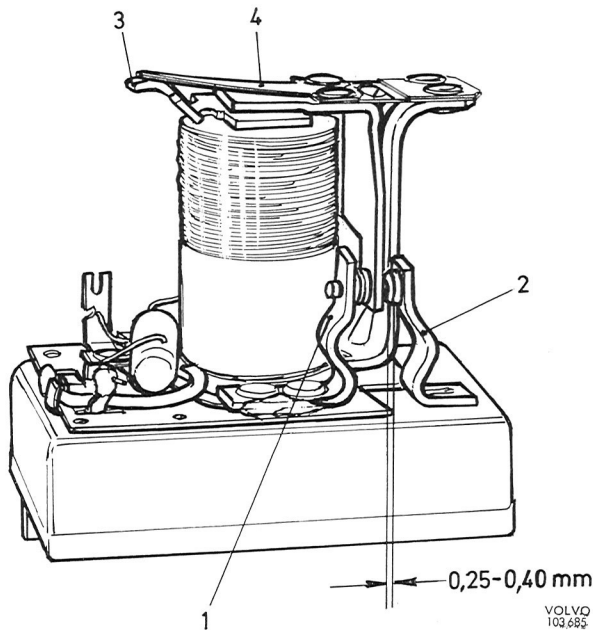


Fig. 3-72. Voltage regulator

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

If the tensioner is bent downwards, the regulating voltage should drop, if bent upwards the opposite should be the effect. If the regulating voltage in the upper regulating range is too high or too low in relation to the lower regulating range (0 volt to minus .3 volt) this is adjusted by bending the holder for the left (lower) contact and correcting at the same time the gap between the right (upper) contact and the movable contact according to Fig. 3-72.

If the holder is bent towards the right (upper) contact, the regulating voltage in the upper regulating range will drop. To avoid faulty adjustments due to residual magnetism in the regulator core, it is necessary to reduce the alternator speed down towards 0 after each adjustment and then increase the speed and make a new reading.

(If the adjusting is comprehensive and the regulator is warm, it can be suitably cooled to ambient temperature by means of compressed air before the final reading is made.)

SERVICE DIAGNOSIS

CONDITION

ACTION

POSSIBLE CAUSE

Warning lamp does not light with engine off.

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

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

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

A positive diode shorted.

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. The ammeter shows:

0 amp.

Worn brushes, oxide on slip rings or breakage in rotor winding.

2.0—2.5 amps.

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

Warning lamp lights with engine off or running.

Disconnect the plug at the regulator:
Control lamp still lights.

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

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

Read off the value on the ammeter:

Less than 2.0—2.5 amps.

Defective regulator (breakage).

Greater than 2.0—2.5 amps.

Circuit shorted between DF on the regulator and DF on the alternator.
Coil shorted.

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

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

Does not light.

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

Gives a weak light.

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

Install new regulator.

Test lamp between B+ and 61/D+ :

Does not light.

Removed regulator defective.

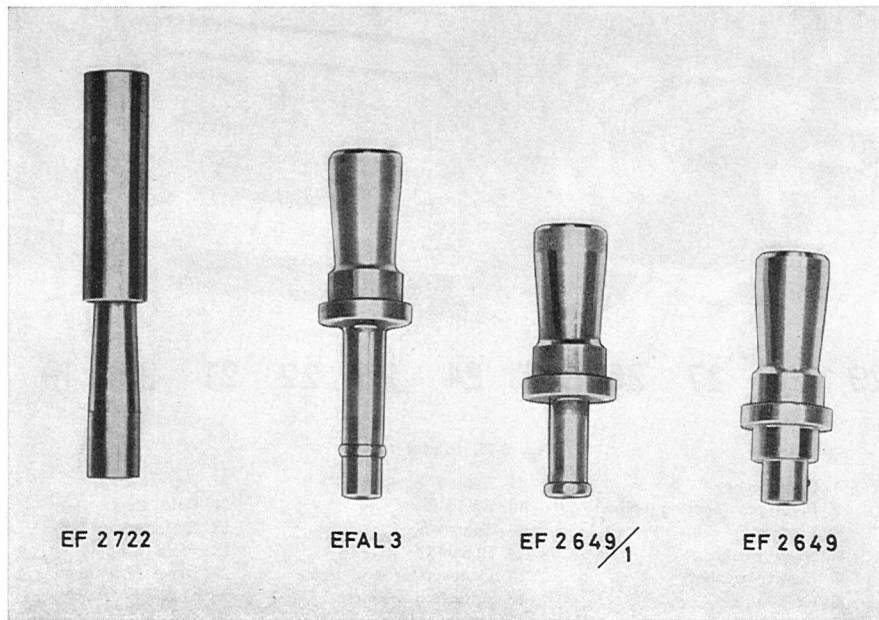
Gives a weak light.

Defective alternator.

GROUP 33

STARTER MOTOR

TOOLS



VOLVO
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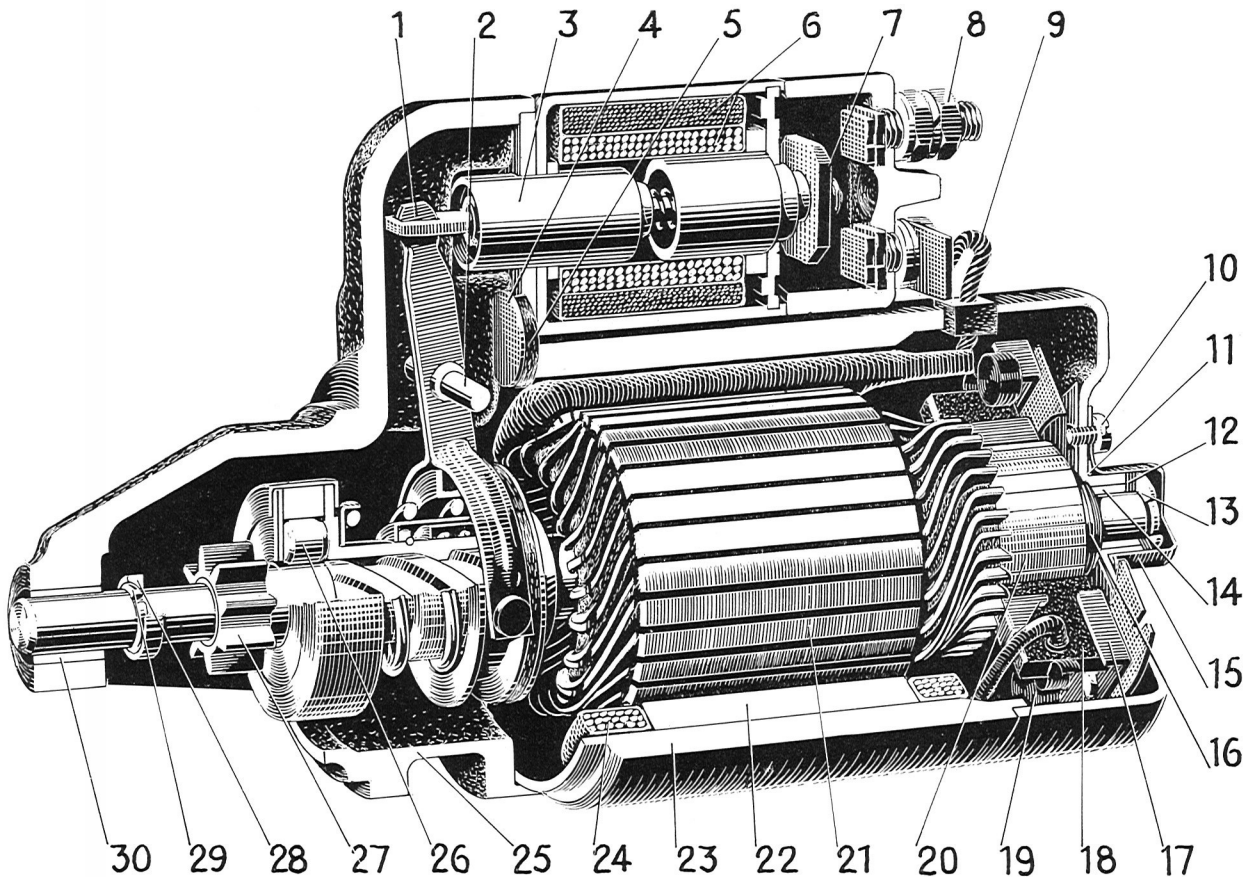
Fig. 3-74. Bosch special tools

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

GENERAL INFORMATION

The starter motor, Fig. 3-75, is mounted on the flywheel housing on the left-hand side of the engine. It consists of a 4-pole series-wound motor. The pinion on the starter motor rotor shaft moves axially to engage with the flywheel ring gear. The pinion is controlled by a solenoid. Turning the ignition key to the starting position cuts

in the solenoid, causing the armature in the solenoid to be drawn in and the starter pinion to engage the ring gear on the engine flywheel. When the armature has moved a certain distance, the contacts for the main current close and the starter motor starts running.



VOLVO
101139

Fig. 3-75. Starter motor

- | | | |
|------------------------------|--------------------------|---------------------|
| 1. Shift lever | 11. Rubber gasket | 21. Armature |
| 2. Pivot pin (bearing screw) | 12. Shims | 22. Pole shoe |
| 3. Plunger | 13. Snap ring | 23. Stator |
| 4. Steel washer | 14. Bushing | 24. Field winding |
| 5. Rubber washer | 15. Commutator end frame | 25. Drive end frame |
| 6. Coil | 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. Bushing |

SERVICE PROCEDURES

Replace starter=Volvo Standard Times Op No.
33118

Re-build starter=Volvo Standard Times Op. No.
33102

REMOVAL

1. Disconnect the battery ground cable.
2. Disconnect the leads from the starter motor.
3. Remove the bolts which hold the starter motor to the timing gear housing and remove the starter.

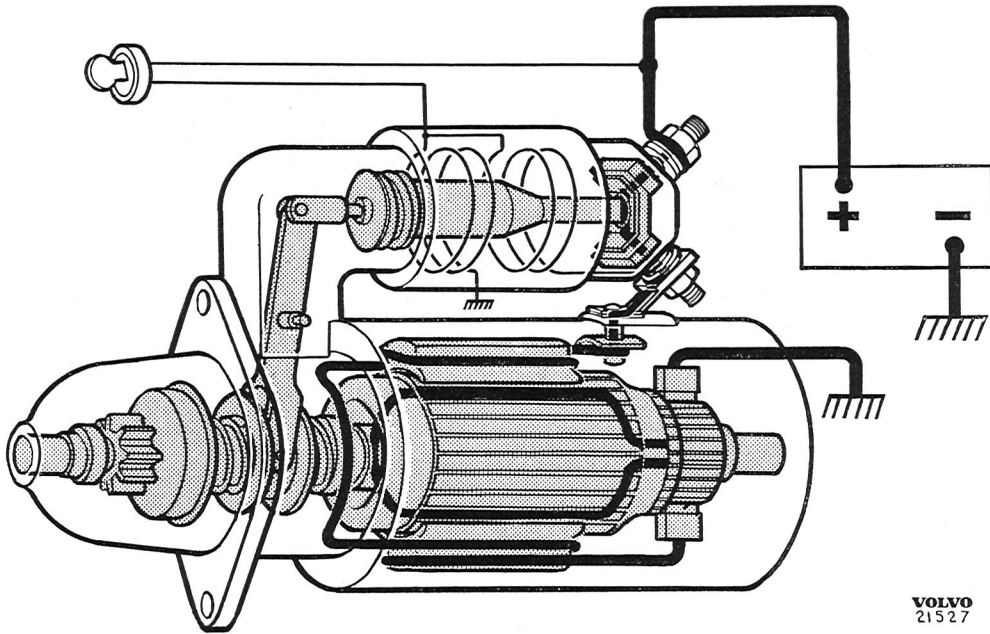


Fig. 3-76. Starter motor, general arrangement

STARTER MOTOR DISASSEMBLY

1. Remove the small cover on the front end of the shaft.
2. Lift off the lock washer and adjusting washers as shown in Figs. 3-79 and 3-80.
3. Remove the two bolts holding the commutator end frame and remove the frame.
4. Lift up the brushes and holders.
5. Remove the brush bridge from the rotor shaft. NOTE: The washers are as shown in Fig. 3-80. When the bridge is removed, the negative brushes also follow, but the positive brushes will remain in the field winding.
6. Remove the nut which holds the field terminal connection to the control solenoid.
7. Remove the attaching screws for the control solenoid. Remove the solenoid.

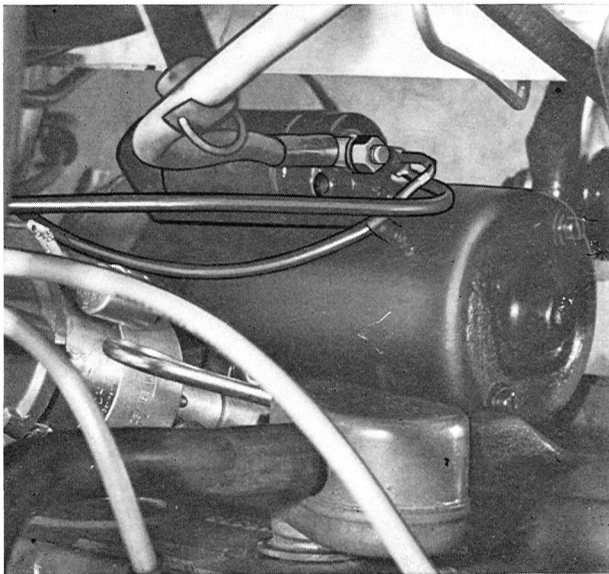


Fig. 3-77. Starter motor installed

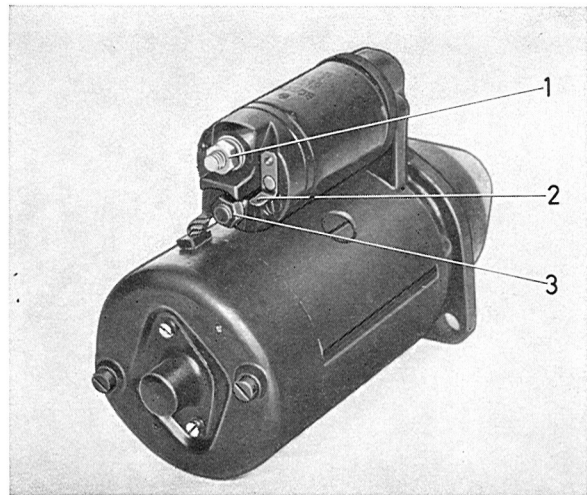
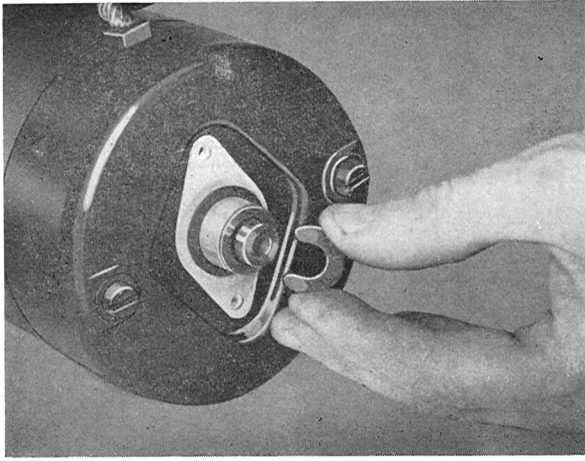


Fig. 3-78. Starter motor terminals

1. From battery
2. From ignition switch
3. To field winding

VOLVO
103 875



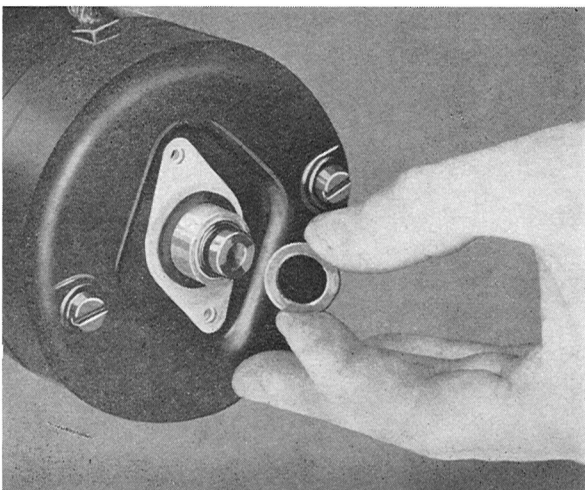
VOLVO
101 088

Fig. 3-79. Removing lock washer

8. Remove the drive end frame and armature from the stator.
9. Remove the rubber washer and metal washer, see Fig. 3-84.
10. Remove the screw on which the shift lever is carried.
11. Lift the armature with pinion and lever out of the drive end frame.
12. Knock back the stop washer and remove the snap ring on the armature shaft.
13. Remove the stop washer and pull off the starter pinion.

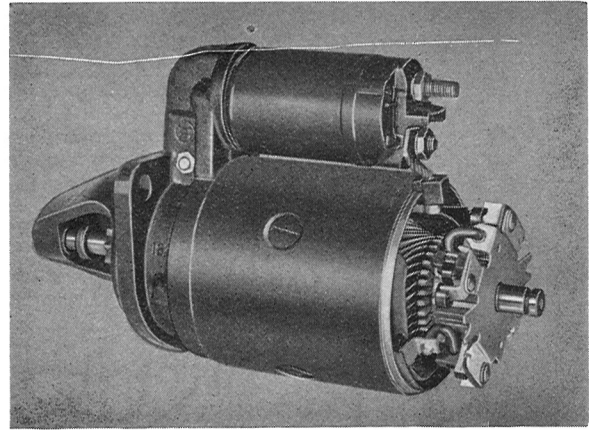
INSPECTION

Examine the armature for mechanical damage such as a bent or worn shaft, scored commutator and damaged windings.



VOLVO
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Fig. 3-80. Removing adjusting washers



VOLVO
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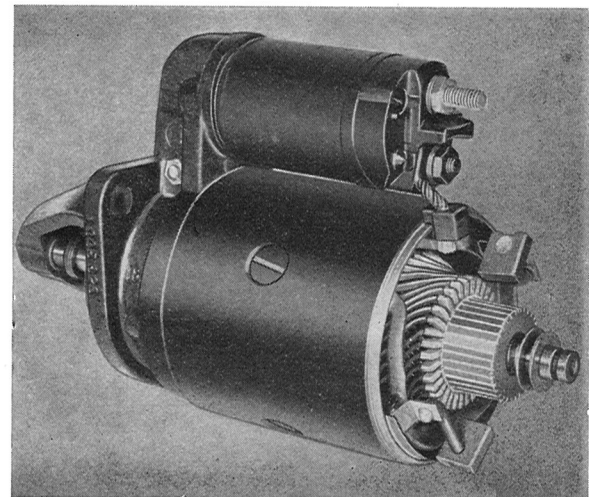
Fig. 3-81. Starter motor with bearing shield removed

If the armature shaft is bent or worn, the armature should be replaced.

If the commutator is scored or unevenly worn, it should be turned. The commutator diameter must not be less than 33 mm (1.3").

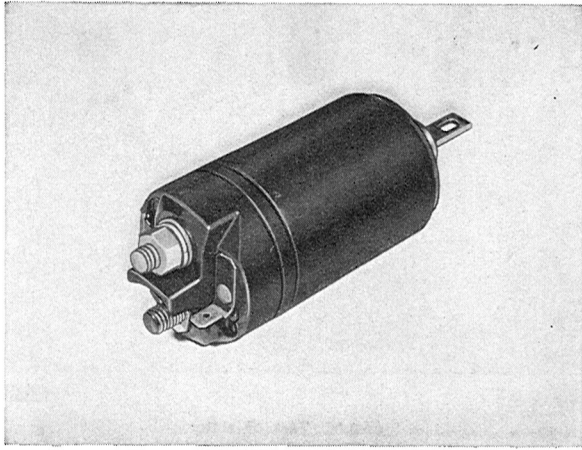
The commutator should be checked with a micrometer after turning. A radial throw of .08 mm (.003") may be considered permissible. The insulation between the laminations should be milled down to .4 mm (.016") below the surface of the laminations, see Fig. 3-86 and 3-87. This work is carried out in a special apparatus, or if such is not available, with a ground-off hacksaw blade.

Examine the armature for shorts by placing it in a growler. Switch on and hold a hacksaw blade a few mm from the armature, see Fig. 3-88. If the blade vibrates in any position when the armature is rotated, one of the following faults can be the reason: shorting through the armature frame, short-



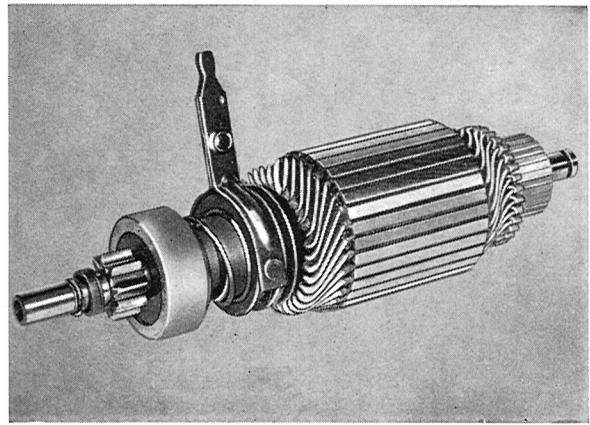
VOLVO
101 083

Fig. 3-82. Starter motor with brush bridge removed



VOLVO
103 676

Fig. 3-83. Control solenoid



VOLVO
101 080

Fig. 3-85. Armature with pinion

ing in the commutator or between the windings. Check the stator with 40 volts A.C., see Fig. 3-89. Examine the drive end frame with brush holders. If any of these parts are damaged or excessively worn, they must be replaced. A bearing clearance of up to .12 mm (.005") may be considered permissible.

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

SOLENOID TEST

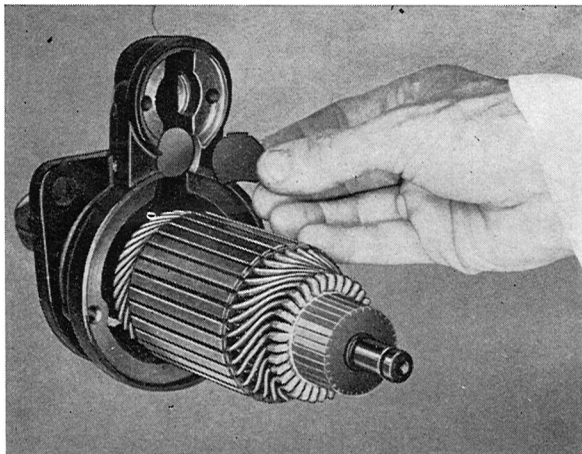
If the solenoid does not function, first check that the battery is in good condition.

Then connect a lead between the battery positive

terminal and the solenoid contact screw for the control lead. If the solenoid still does not engage the starter pinion and main current, it should be removed from the starter motor. If, on the other hand, it engages satisfactorily, examine the starter switch and leads. When the solenoid has been removed, it should be wiped clean. Then press the armature in several times and test again by connecting it to a battery. If the solenoid still does not function, replace it with a new one.

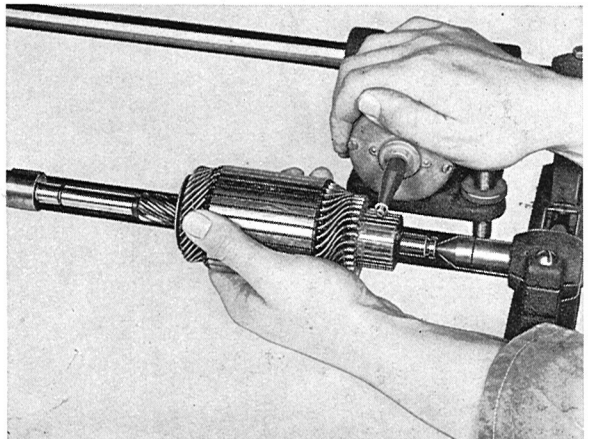
REPLACEMENT OF BRUSHES

When replacing the brushes, the starter motor is removed and disassembled. The brushes are soldered loose from their attachments in the brush



VOLVO
101 082

Fig. 3-84. Removing sealing washer



VOLVO
103 354

Fig. 3-86. Milling commutator

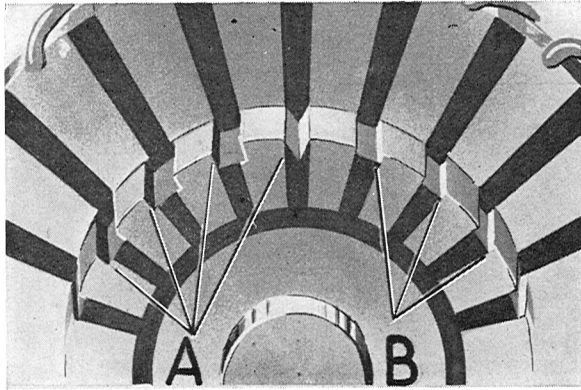


Fig. 3-87. Commutator milling
A. Incorrect milling B. Correct milling

holder and field respectively. The new brushes should be soldered on quickly and with sufficient heat. Solder must not be allowed to run down into the brush leads as this will prevent the movement of the brushes in the brush holders and may reduce the brush spring pressure. Brushes which have worn down less than 14 mm (approx 1/2") should be replaced with new ones.

INSTALLATION OF SELF-LUBRICATING BUSHINGS

The self-lubricating bushings are only worn insignificantly during operation if they are lubricated in the correct manner. If lubrication is neglected, the bushings dry out, with the result that they wear quickly. For replacement purposes bushings are supplied ready-machined to suitable dimensions. The bushings should not be machined internally or externally since the pores can then be partially blocked up, resulting in reduced lubricating capacity.

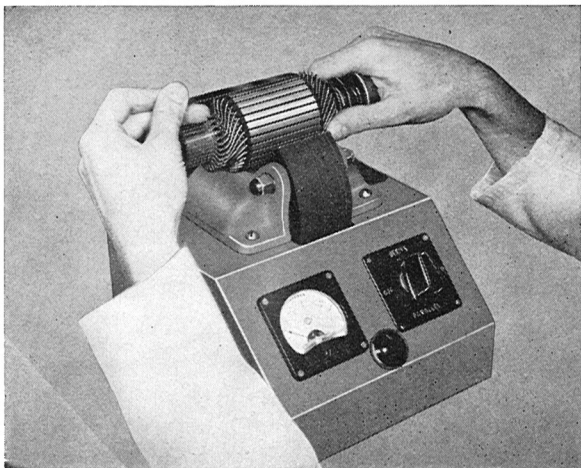


Fig. 3-88. Testing armature

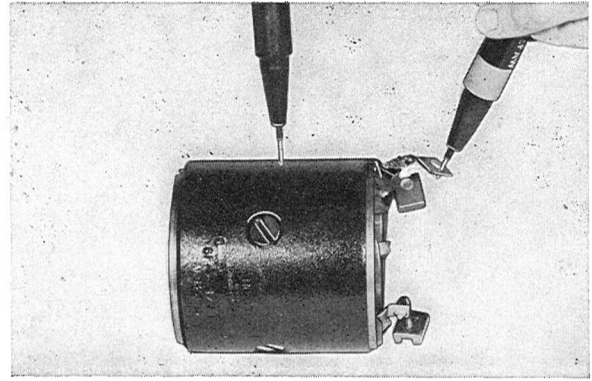


Fig. 3-89. Test of stator

Replace the bushings as follows:

1. Drive out the worn bushings with a suitable tool.
 2. Clean the hole for the bushings and cut away any burr.
 3. Press in the new bushings with a suitable drift.
- NOTE: Before a self-lubricating bushing is installed, it should lie in light oil for at least a 1/2 hour.

REPLACEMENT OF FIELD COILS

1. If the starter motor has not been disassembled, this must be done. Follow the instructions under the heading "Disassembly".

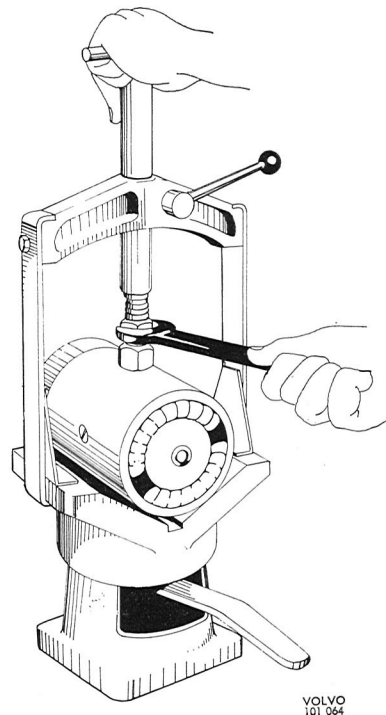


Fig. 3-90. Rotating clamping block for removal and installation of field coils

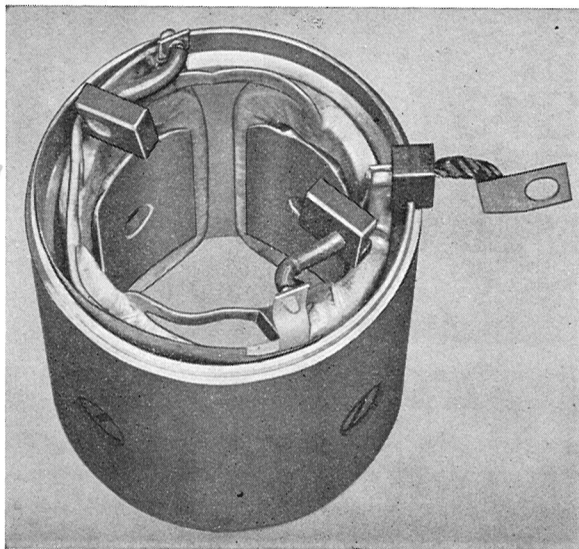


Fig. 3-91. Stator with soldered brushes

2. Mark poles and pole housing in a suitable manner so that they come in the same position when assembling.
3. Then place the stator in the rotating clamping block (Bosch EF AW 9 or similar) and remove the pole screws as shown in Fig. 3-90.
4. Before installing field coils, warm them slightly. Then place the poles in position in the field coils and slide them into the stator. Tighten the pole screws lightly. Press in a suitable drift. Set up the stator in the rotating clamping block and tighten the poles firmly.
5. Force out the press drift with a press tool. Check the installed field coils for breakage and shorts.

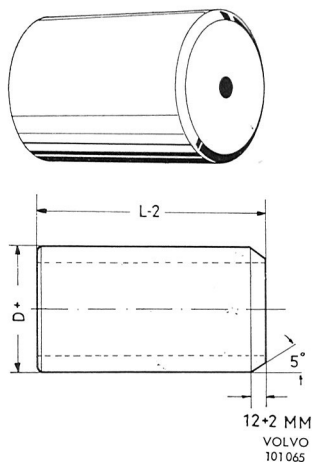


Fig. 3-92. Press drift for installation of field coils
 D=66.4—66.09 mm (2.599—2.602") L=85 mm (3.346")

STARTER MOTOR ASSEMBLY

1. Lubricate the parts of the starter motor according to Fig. 3-93.

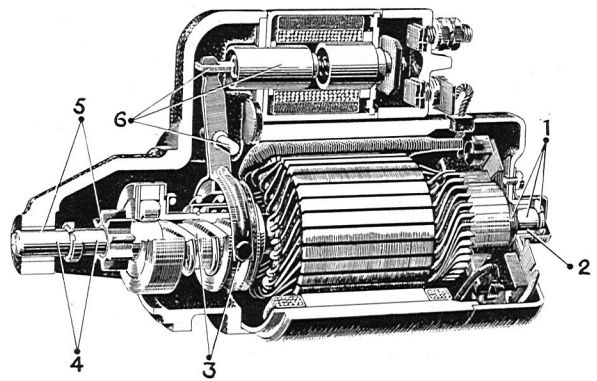


Fig. 3-93. Lubricating scheme for starter motor

Use Bosch lubricant (or equivalent) in accordance with the following directions:

1. Ft 2 V 3. Place a thin layer of grease on the insulation washers, the shaft end, the adjusting washers and lock washer.
 2. Ol 1 V 13. Place the bushing in oil for 1 hour before installation.
 3. Ft 2 V 3. Apply plenty of grease in the armature thread and the engaging lever groove.
 4. Ft 2 V 3. Place a thin layer of grease on the armature shaft.
 5. Ol 1 V 13. Place the bushings in oil for a 1/2 hour before installation.
 6. Ft 2 V 3. Lubricate the engaging lever joints and the iron core of the solenoid with a thin layer of grease.
2. Install the starter pinion on the armature shaft, and the wear washer as well as the snap ring. Secure the wear washer in position.
 3. Install the engaging arm on the pinion. Install the armature in the drive end frame.
 4. Install screw for the shift lever.
 5. Install the metal washer and rubber washer in the drive end frame.
 6. Install the stator on the armature and the drive end frame.
 7. Secure the solenoid in the shift lever. Screw tight the solenoid.
 8. Install the washers on the armature shaft as shown in Fig. 3-82.
 9. Place the brush bridge in position. Install the brushes.
 10. Install the commutator bearing frame. Screw the starter motor together with the two long bolts.
 11. Install the adjusting washers and the snap ring on the shaft end. Check the axial clearance of the armature. If necessary, adjust with the washers until the play agrees with the values in the "Specifications".
 12. Screw on securely the small casting over the shaft end.

INSTALLATION

1. Place the starter motor in position and secure it.
2. Connect the electric cables.
3. Install the lead terminal on the negative pole stud if the battery.

GROUP 34

IGNITION SYSTEM

GENERAL INFORMATION

The ignition system is of the battery ignition type. It consists of the following main parts: Ignition coil, distributor, ignition lead and spark plugs.

IGNITION COIL

The ignition coil is on the firewall, see Fig. 3-94. The function of the ignition coil is to transform the battery voltage to high tension voltage for the spark plugs. It consists of a core of laminated metal around which is a winding of heavy copper wire, the primary winding, and a winding of fine copper wire, the secondary winding. The primary winding operates at battery voltage from the distributor contact breakers. The other winding, the high-tension winding, is connected to the center terminal on the distributor cap, from where the high-tension current is distributed to the engine spark plugs.

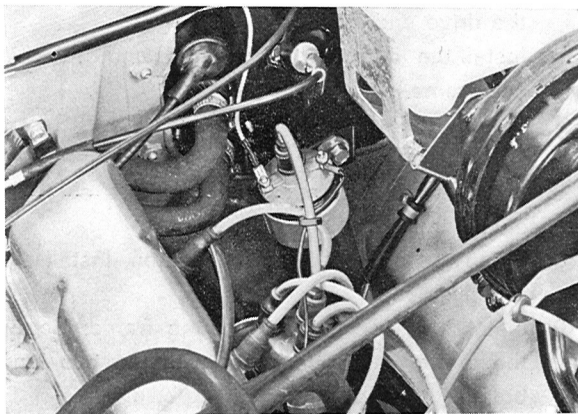


Fig. 3-94. Ignition coil installed

VOLVO
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DISTRIBUTOR

The distributor, Fig. 3-95 and 3-96, is located on the left side of the engine, and it is driven by the camshaft. The centrifugal governor located under the breaker plate regulates the spark timing according to the engine speed. The vacuum unit governs the spark timing according to the load. (B20F engines do not have a vacuum unit.)

The B20A and B20E engines vacuum units advance the timing when the load decreases.

The B20B engine vacuum unit retards the timing at idle and engine retard. This is part of the emission control and prevents the engine from emitting excessive amount of pollutants at idle and retard.

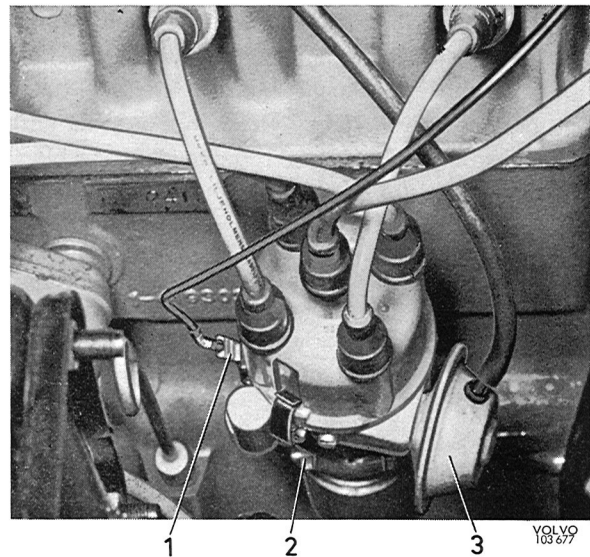
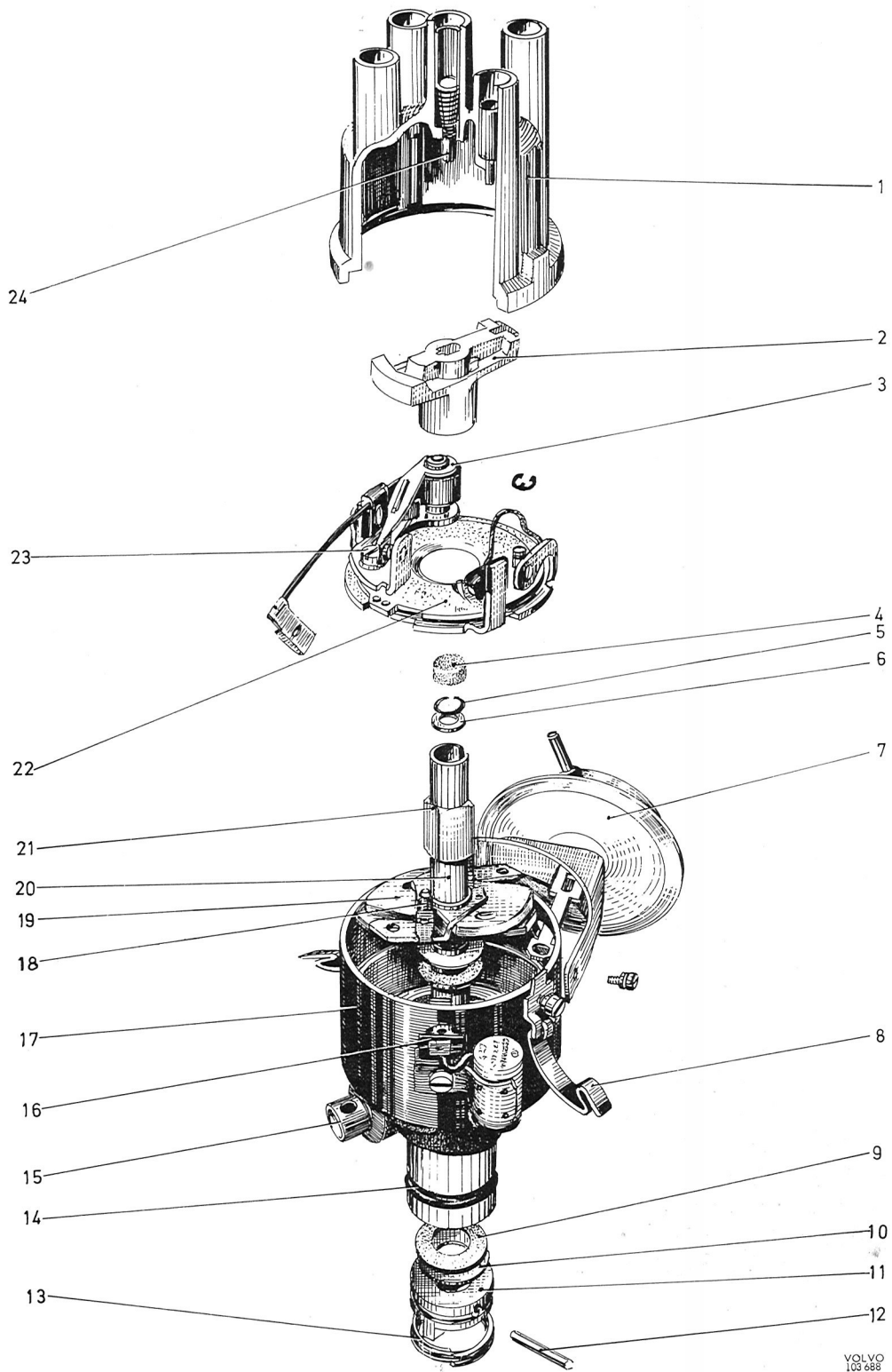


Fig. 3-95. Distributor B 20 B

1. Primary connection
2. Attaching screw
3. Vacuum regulator

VOLVO
103277



VOLVO
103 688

Fig. 3-96. Distributor, B 20 B

- | | | | |
|---------------------|--------------------|---------------------------------|-------------------------------------|
| 1. Distributor cap | 7. Vacuum unit | 13. Resilient ring | 19. Centrifugal weight |
| 2. Distributor arm | 8. Cap clasp | 14. Rubber seal | 20. Breaker camshaft |
| 3. Contact | 9. Fiber washer | 15. Lubricator | 21. Breaker cam |
| 4. Lubricating felt | 10. Steel washer | 16. Primary connection | 22. Breaker plate |
| 5. Circlip | 11. Driving collar | 17. Distributor housing | 23. Lock screw for breaker contacts |
| 6. Washer | 12. Lock pin | 18. Centrifugal governor spring | 24. Rod brush (carbon) |

SERVICE PROCEDURES

DISTRIBUTOR

Replace distributor=Volvo Standard Times Op. No. 34206

REMOVAL

1. Release the lock clasps for the distributor cap and lift off the cap.
2. Remove the primary lead from the primary connection (1, Fig. 3-95).
3. Remove the vacuum hose from the vacuum unit. (When removing the hose from the bakelite connection, observe great care not to break the connection.)
4. Slacken the screw (2, Fig. 3-95) and pull up the distributor.

Re-build removed distributor=Volvo Standard Times Op. No. 34271

Clean and adjust removed distributor=Volvo Standard Times Op. No. 34285

DISASSEMBLY

1. Pull off the distributor arm.
Remove the circlip for the pull rod from the vacuum regulator.
Remove the vacuum unit according to Fig. 3-97. (Not B20F distributor.)

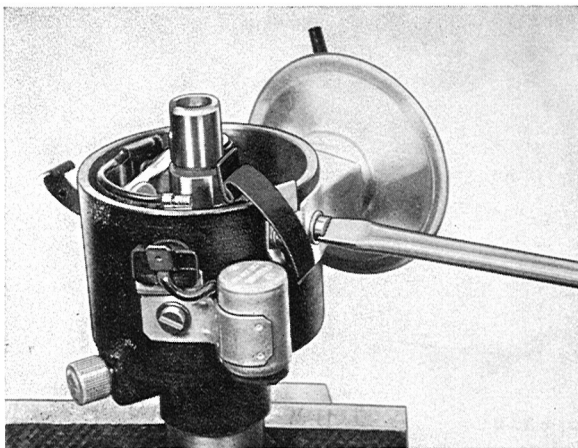


Fig. 3-97. Removing vacuum regulator

2. Mark how the lock clasps for the cap are located and remove them.
Disconnect the lead from the breaker contacts and remove the primary connection, Fig. 3-98. Lift up the breaker plate.

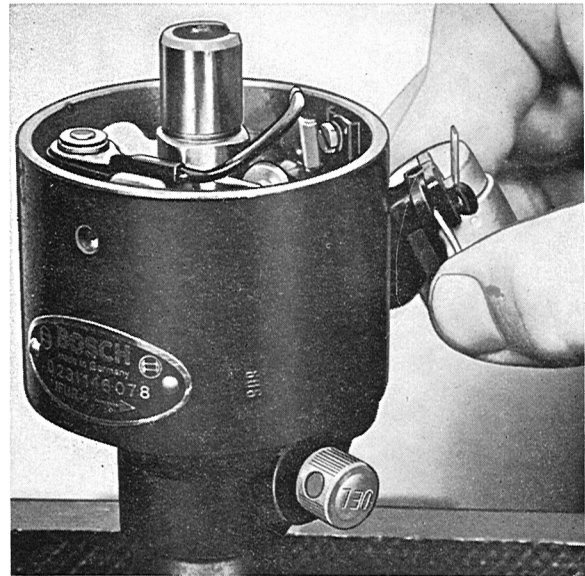


Fig. 3-98. Removing primary connection

3. Disconnect the springs for the centrifugal governor and mark how the breaker cam is located in relation to the distributor shaft. Secure the breaker cam in a vise with soft jaws. Carefully knock on the distributor housing with a plastic mallet (Fig. 3-99) until the circlip (5, Fig. 3-96) has released and lift off the breaker cam.

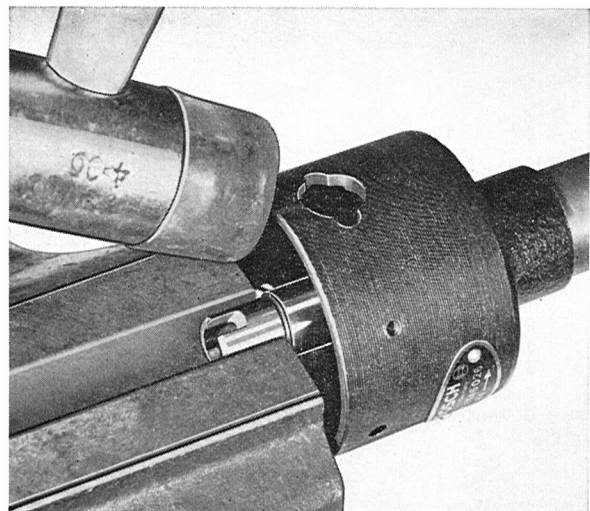


Fig. 3-99. Removing circlip

- Remove the resilient ring (13, Fig. 3-96) and mark how the driving collar (11, Fig. 3-96) is located in relation to the distributor shaft. Tap out the pin (Fig. 3-100), lift off the driving collar and pull up the distributor shaft. Check that no washers have been lost.

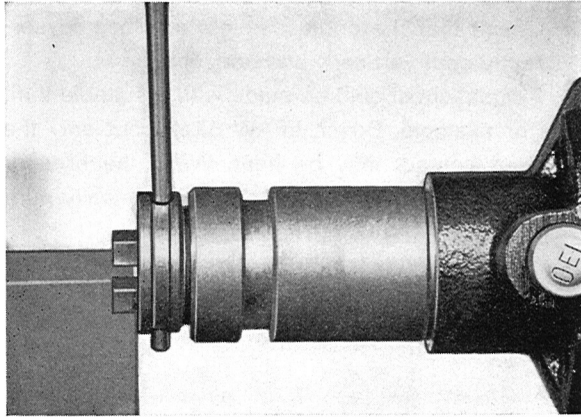


Fig. 3-100. Removing driving collar

- Remove the lock springs for the centrifugal weights and lift up the weights.

INSPECTION

Distributor plate

The surface of the contact points should be flat and smooth. The color of the contacts should be gray. Oxidized or burned contacts must be replaced. After a long period of use, the contact lip can be worn and the spring fatigued, so that the contacts should be replaced if the distributor for any reason is disassembled.

The contact plate must not be loose, worn or have burr.

Distributor shaft

The play between the distributor shaft and the breaker camshaft must not exceed .1 mm (.004"). The cams on the breaker camshaft must not be scored or worn so that the dwell angle is altered. The holes in the centrifugal weights must not be oval or deformed in any other way. The centrifugal weight springs must not be deformed or damaged.

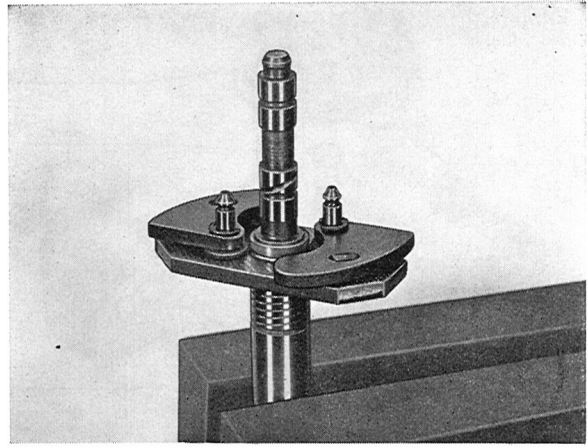


Fig. 3-101. Distributor shaft with centrifugal weights

Distributor housing

The play between the distributor housing and the shaft should not exceed .2 mm (.008"). If the play is excessive, replace the bushings and, if this is insufficient, also the shaft.

ASSEMBLY

- Lubricate the distributor parts according to the instructions in Fig. 3-102.
- Install the centrifugal weights and also the lock springs on to the weights. Install the breaker camshaft on to the distributor shaft. Hook on the springs for the centrifugal governor. Install the washer and circlip for the breaker camshaft. The circlip is placed into position by means of a suitable sleeve. Install the lubricating felt.
- Install the distributor shaft in the distributor housing and install the driving collar on the distributor shaft. Make sure that the fiber washers come against the distributor housing. Install the pin in the collar and check the axial clearance on the distributor shaft. The clearance should be .10—.25 mm (.004—.010"). Any adjustment can be done by altering the number of adjusting washers on the distributor shaft.
- Install the breaker plate. Fit the lock clasps for the cap. Fit the primary connection and connect the lead from the breaker contacts.
- Install the vacuum regulator.

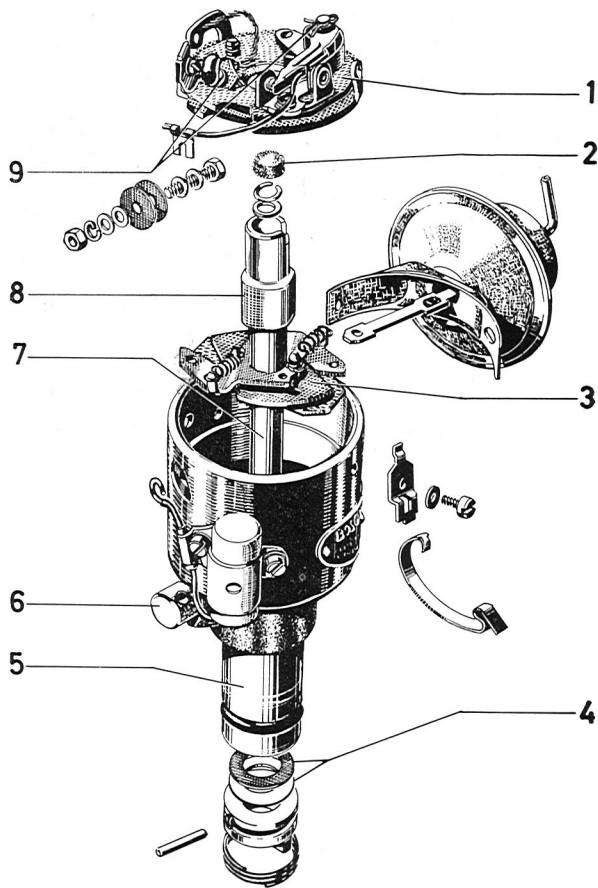


Fig. 3-102. Distributor lubrication

Use Bosch lubricants, or similar, see below:

- | | |
|--------------|--|
| 1. 01 1 V 2 | Rub the breaker plate with oil |
| 2. 01 1 V 13 | Drench the lubricating felt in oil |
| 3. Ft 2 V 3 | Lubricate the centrifugal weights sparingly |
| 4. Ft 2 V 3 | Grease the washers |
| 5. 01 1 V 13 | Immerse the bushings in oil at least 1/2 hour before installation. |
| 6. 01 1 V 13 | Fill the lubricator with oil |
| 7. 01 1 V 13 | Oil the cam before installation |
| 8. Ft 1 V 4 | Cover the cam with a thin layer |
| 9. Ft 1 V 26 | Grease the bushing for the moving contact |

6. Check that the contact points are mounted correctly both horizontally and vertically. Adjustment should be made with a suitable tool (for example, Bosch EFAW 57 A), but only the fixed contact may be bent. Wash the contacts with trichloroethylene or chemically pure gasoline.

Run the distributor on a test bench and check according to the "Specifications".

Install the distributor arm.

REPLACING CONTACT POINTS

Volvo Standard Times:

Replace Contact Points:

- | | |
|---------------------|---------------|
| In vehicle | Op. No. 34202 |
| Distributor removed | Op. No. 34281 |

The contact points can be replaced with the distributor fitted, but it **should** be done with the distributor disassembled.

1. Remove the distributor rotor arm.
2. Disconnect the electric lead at the primary connection.
3. Remove the screw for the contact points and lift up the old contacts.
4. Lubricate the distributor according to the instructions in Fig. 3-102.
5. Fit the new contact breaker.
6. Connect the electric cable at the primary connection.
7. Check that the contact points are located correctly both vertically and horizontally.

Adjustment should be made with a suitable tool, (for example, Bosch EFAW 57 A), but only the fixed contact may be bent. Wash the breaker points with trichloroethylene or chemically pure gasoline.

Run the distributor on a test bench and check according to the "Specifications".

TESTING DISTRIBUTOR IN TEST BENCH

1. Run the distributor at 8.4 r/s (500 rpm) in its ordinary direction of rotation (counter-clockwise) and adjust the dwell angle according to the "Specifications".
2. Adjustment is made by slackening the screw for the contact points and then inserting a screwdriver in the recess. Fig. 3-103, and turning the screwdriver until the dwell angle is the correct one. Then tighten the screw for the contact points.
3. Run the distributor and set the protractor on the test bench so that a marking comes opposite

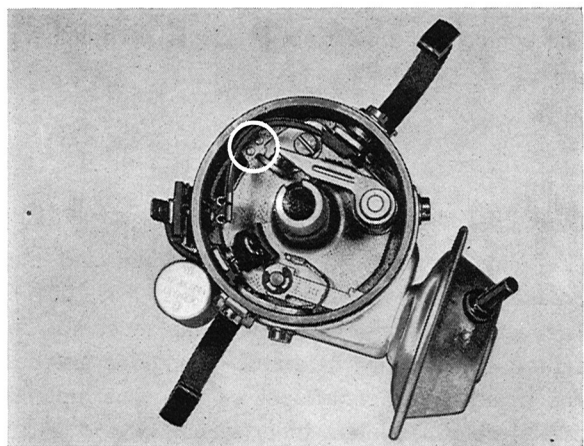


Fig. 3-103. Recess for adjusting the contact breaker

0° at such a low speed (below 5 distr. r/s=300 distributor r/m) that the centrifugal governor does not function. Increase the speed slowly and read the values at the prescribed graduations. A newly lubricated distributor should first be run up to maximum speed several times. Permissible tolerance for the centrifugal governor is $\pm 1^\circ$.

4. Run the distributor at low speed and adjust the protractor so that a marking is obtained at 0°. Connect the vacuum hose from the test bench to the vacuum regulator. Increase the vacuum gradually and read the values at the prescribed graduations. (Not B20F engines.)

INSTALLING

1. Position the distributor.
2. Press the distributor downwards while turning the distributor arm at the same time. When the distributor goes down about 5 mm (3/16") and it is no longer possible to turn the distributor arm, the driving collar of the distributor is then in the slot on the distributor drive.
3. Turn the distributor housing so that it takes up the same position it had before removal.
4. Connect the primary lead. Install the distributor cap.
5. Start the engine and set the ignition. (If the engine does not start, turn the distributor housing until it does so.)

IGNITION TIMING

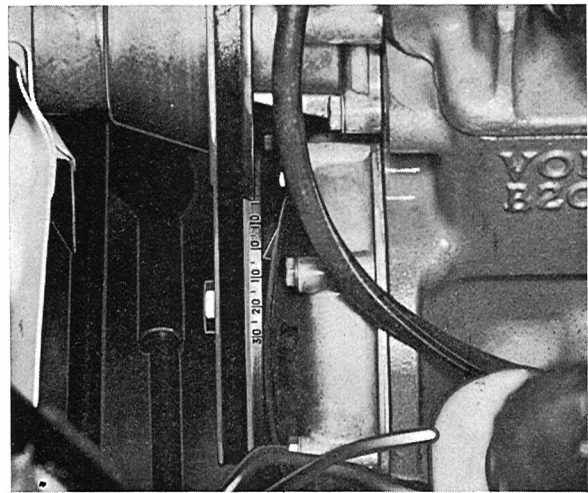
Set dwell angle and timing = Volvo Standard Times Op. No. 34276

Ignition setting should always be made with the engine running and with a timing light (Stroboscope) and a tachometer.

B 20 A AND B 20 B

1. Clean the pulley so that the graduation marks can be seen, see Fig. 3-104.
2. Disconnect the hose from the vacuum regulator. (On the B 20 B the hose should be pinched or plugged to prevent the engine taking in unwanted air.)

NOTE: On the B 20 F with exhaust gas recirculation, the vacuum hose to the EGR valve should be disconnected at the valve.



VOLVO
103721

Fig. 3-104. Graduation for ignition timing

3. Connect the timing light to the No. 1 cyl. spark plug and the battery. Connect a tachometer.
4. Start the engine and run it at the speed given in the "Specifications". Point the timing light at the graduations on the pulley. Slacken the attaching screw (2, Fig. 3-95) and turn it until the firing position agrees with the figure given in the "Specifications". Fix the distributor and check that the firing position and speed have not altered.
5. Remove timing light and tachometer and fit the hose to the vacuum regulator.

B 20 E, B 20 F

1. Clean the pulley so that the graduation marks can be seen, see Fig. 3-104.
2. Remove the hose connected to the distributor's vacuum regulator at the inlet duct.
3. Connect the timing light to the No. 1 cyl. spark plug and the battery. Connect a tachometer.
4. Start the engine. Adjust the engine speed to 11.6—13.4 r/s (600—800 rpm).
5. Point the timing light at the graduations on the pulley. Remove the distributor and turn it until the firing position agrees with the figure given in the "Specifications". Fix the distributor and check that the firing position and speed have not altered.
6. Remove timing light, and tachometer. Fit the hose the vacuum regulator.

GROUP 35

LIGHTING

GENERAL INFORMATION



VOLVO
108624

Fig. 3-105. Headlights



VOLVO
108625

Fig. 3-106. Rear and license plate lights

The lighting consists of two upper and lower beam headlights with quartz-iodine bulbs, H-4 bulbs (Sealed Beam inserts for the US market), parking lights, tail lights, license plate lights and, US market, side marker lights.

The headlights are installed in the grille. They are switched on and off by the light switch on the instru-

ment panel. Switching between upper and lower beams is done by moving the turn signal switch lever towards the steering wheel. A relay then makes the switching.

The tail lights have separate bulbs for rear lights, stop lights, back-up lights and turn signals.

SERVICE PROCEDURES

HEADLIGHTS

Sealed Beam, replace each, in addition to adjust headlights=Volvo Standard Times Op. No. 35121

REPLACING HEADLIGHT INSERT

1. Disconnect by pulling the connection contact backwards. (The battery must first be removed when replacing the insert for the left-hand headlights.) When replacing the insert for the right-hand headlight on vehicles with a B 20 A

or B 20 B engine, first lift the expansion tank for the radiator out of the way (for the B 20 E, F engine, remove the upper part of the air cleaner and the air filter.)

2. Remove the three plastic holders securing the insert in the case by releasing the screws. Press the insert backwards and lift it out.
3. Place the new insert in position. Re-fit the three plastic holders. Check to make sure that the holders fit in the lugs on the insert. Secure the insert.
4. Re-connect and check the light.

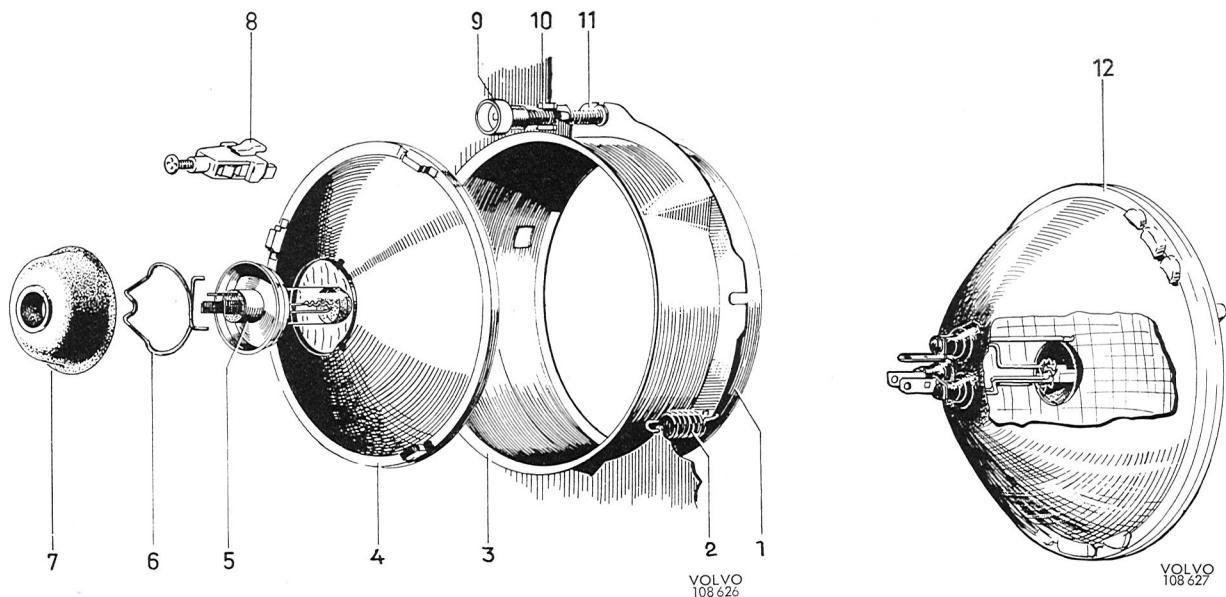


Fig. 3-107. Headlights

- | | | | |
|-------------|-----------------------|-------------------|------------------------|
| 1. Ring | 4. H4 insert | 7. Rubber cover | 10. Nut |
| 2. Spring | 5. Bulb | 8. Plastic holder | 11. Screw |
| 3. Retainer | 6. Bulb holder spring | 9. Adjusting knob | 12. Sealed Beam insert |

REPLACING HEADLIGHT BULB

1. Disconnect the cables by pulling out the connector (1, Fig. 3-108), and remove the rubber cover underneath.
2. Compress and remove the spring (1, Fig. 3-109) holding the bulb to the insert and take out the bulb.
3. Install a new bulb. (Do not touch the globe with your fingers.) Make sure it is fitted correctly. The small nibs on the bulb collar should fit in the insert recesses.
4. Install the spring and the rubber cover.
5. Connect the connection contact and check the lighting.

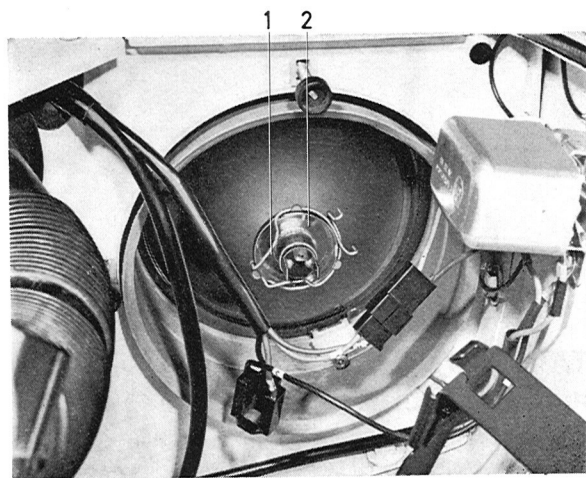


Fig. 3-109. Headlight, rear side

1. Spring 2. Bulb

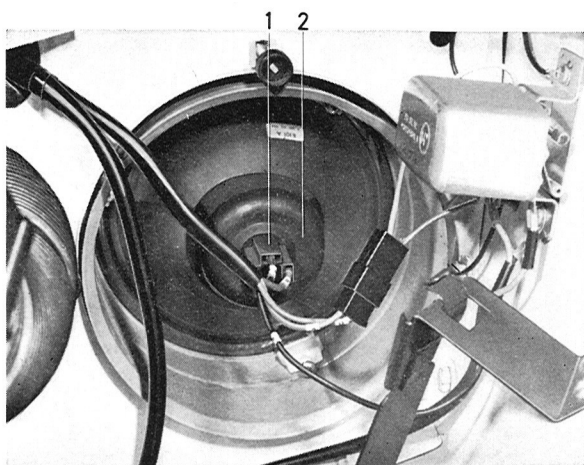


Fig. 3-108. Headlight, rear side

1. Connector 2. Rubber cover

CHECKING AND ADJUSTING

Adjust headlights=Volvo Standard Times Op. No. 35102

The headlights should be examined to check the condition of glass, reflector and bulb. If the glass is damaged by flying gravel or cracked or defective in any other way, the insert should be replaced. Glass which has become "sand-blasted" by flying gravel, etc, will considerably reduce the lighting effect and can give rise to dazzling, irregular beams, etc.

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

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

The headlights should be adjusted in accordance with current legislation. Approved equipment should be used.

Adjustment is made by varying the two adjusting screws behind the headlight, see Fig. 3-110. The upper screw adjusts the headlight vertically and the screw at the side adjusts the headlight laterally.

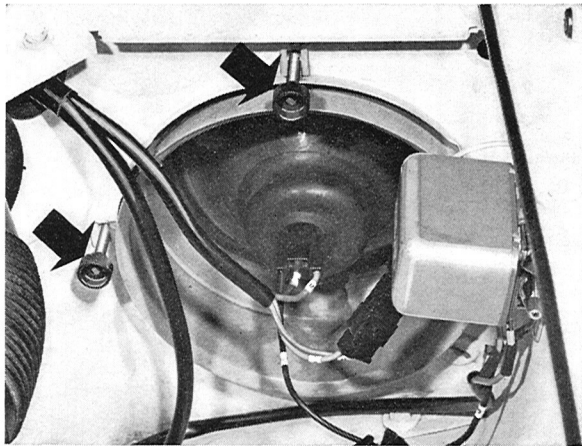


Fig. 3-110. Adjusting screws

TAIL LIGHTS

REPLACING BULBS

Replace rear light bulb or lens=Volvo Standard Times Op. No. 35118

1. Screw loose the four screws holding the glass, see Fig. 3-111 and lift off the glass.
2. Replace the bulb, see 3-112.
3. Re-install the glass.

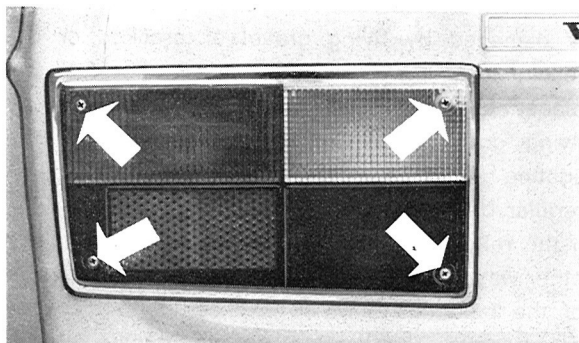


Fig. 3-111. Removing glass, rear tail light lens

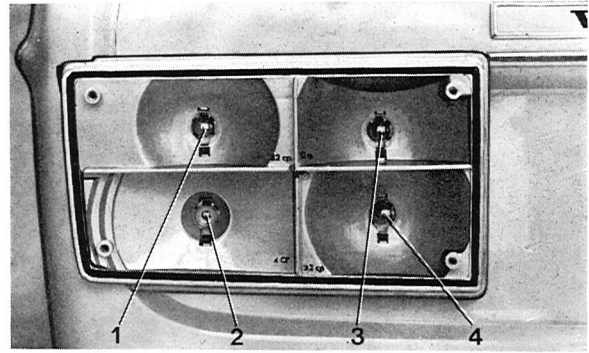


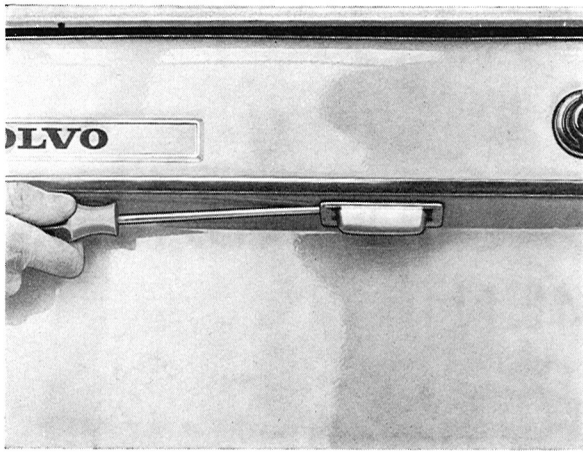
Fig. 3-112. Bulb location

- | | |
|----------------------|------------------|
| 1. Turn signal light | 3. Back-up light |
| 2. Rear light | 4. Brake light |

REPLACING TAIL LIGHT

The rear light is replaced as a complete unit.

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

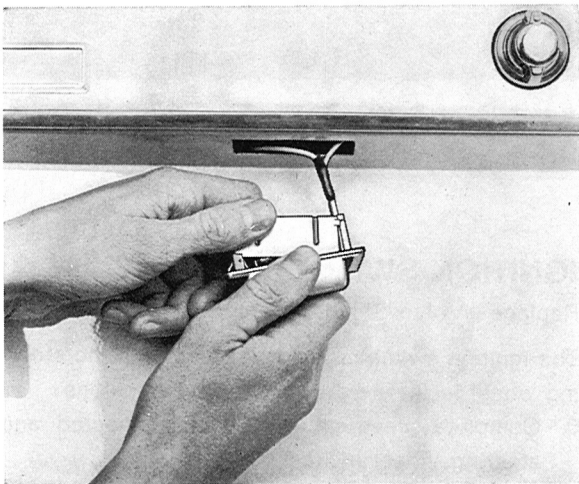


VOLVO
107325

Fig. 3-113. Removing license plate light

REPLACING LICENSE PLATE LIGHT

1. Remove the license plate light with a Phillips screwdriver according to Fig. 3-113.
2. Disconnect the electric wire from the plate.
3. Disassemble the plate according to Fig. 3-114.
4. Replace the bulb.
5. Re-connect the electric wire to the plate.
6. Install the plate by pressing it firmly into its recess.

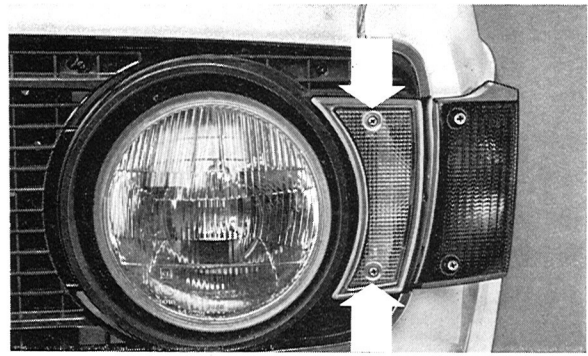


VOLVO
107326

Fig. 3-114. Disassembling license plate light

PARKING LIGHTS

The parking lights are located on the outside of the headlights. When removing the light to change the bulb etc., remove the two screws, Fig. 3-115, holding the lens to the grille and this will allow all the parts belonging to the light to be accessible for removal.



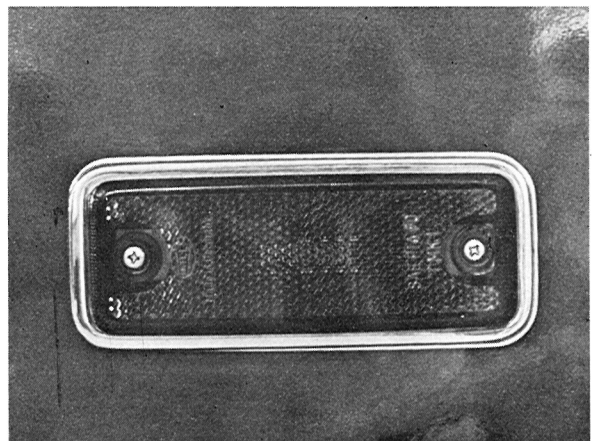
VOLVO
108697

Fig. 3-115. Parking light, screws holding the lens

SIDE MARKER LIGHTS

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

The front turn signal light also serves as side marker light. It has a bulb with two functions, one for turn signal and one for side marker. To replace the bulb, remove the lens, see Fig. 3-137. To replace the bulb in the rear side marker light, remove the lens which is attached to the body by two screws, see Fig. 3-116.



VOLVO
107441

Fig. 3-116. Rear side marker light

OTHER ELECTRICAL STANDARD EQUIPMENT

GENERAL INFORMATION

TURN SIGNALS

The turn signal system consists of an electronic flasher relay, turn signal switch, flash lamps on the front mudguards and bulbs in the rear lights. The turn signal switch is located under the plastic casing on the left-hand side of the steering column, see Fig. 3-118. It switches on right or left signal in two stages. Stage one is used when changing a lane and stage two when changing direction. The switch has automatic return to neutral. The control lamp is wired in parallel across the switch.

The turn signals can also be used as emergency warning flashers, which are switched on by the emergency warning flasher switch on the control panel. The flasher function is governed by the flasher on the reverse side of the control panel see Fig. 3-117.

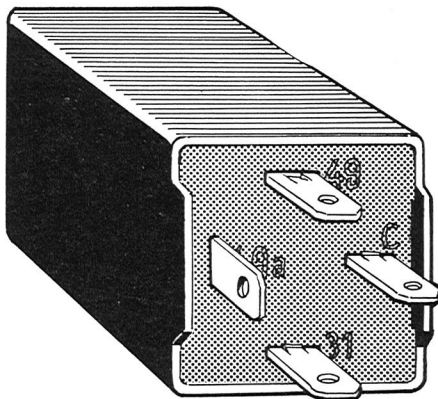
VOLVO
108 628

Fig. 3-117. Flasher

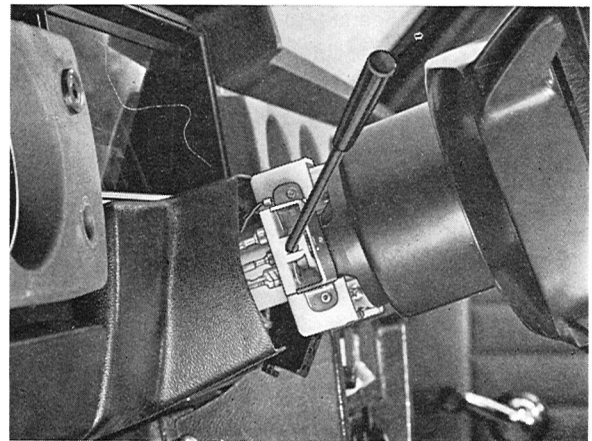
VOLVO
107 327

Fig. 3-118. Turn signal switch

IGNITION SWITCH

Replace=Volvo Standard Times Op. No. 34002

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

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

Vehicles intended for U.S.A. are equipped with a special steering wheel lock with a reminder buzzer which buzzes when the driver's door is open and the ignition key is in the ignition switch, in other words, if the steering wheel is not locked.

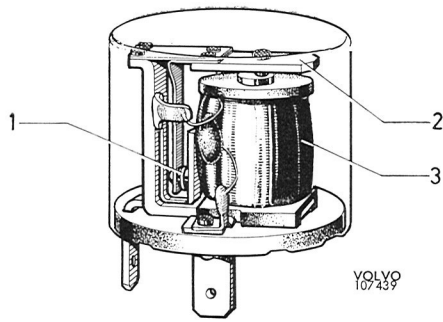


Fig. 3-119. Buzzer

1. Contacts
2. Armature
3. Coil

The buzzer is placed under the dashboard on the left-hand side and is connected to the fuse box (via the ignition) and the door switch on the driver's side. The buzzer consists of a pair of contacts and a coil. When current passes across the contacts and through the coil, the armature is drawn down towards the core of the coil. While the armature is being drawn down towards the core, the contacts cut out the current and the armature springs back, etc. This cycle is repeated continuously as long as current is switched on, that is, as long as the driver's door is open and the ignition key is in the ignition.

HORNS

Replace horn=Volvo Standard Times Op. No. 36202

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

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

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

FUSES

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

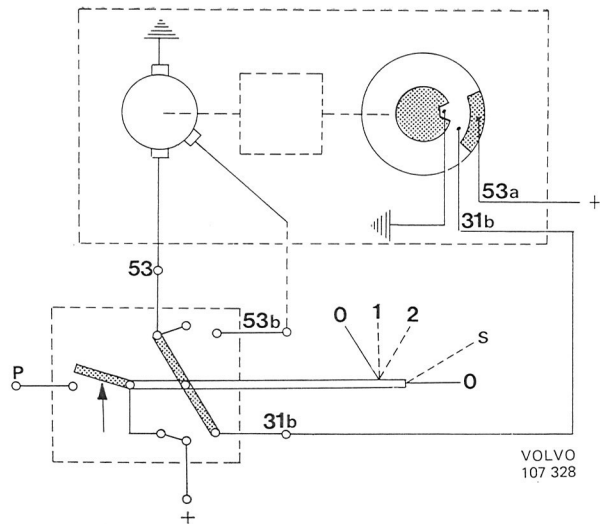


Fig. 3-120. Wiring diagram for windshield wiper motor, Electrolux

WINDSHIELD WIPERS

Volvo Standard Times	Op. No.
Replace wiper motor	36302
Replace wiper pivot assy	36318
Replace wiper motor drive wire	36356

The windshield wipers are driven by an electric motor. The motor is connected to the wipers by a combined cable and linkage system. It has a permanently magnetized field and three brushes, one a minus brush and the other two plus brushes. The plus brushes are connected one at a time so that the engine has two different speeds, $0,57 \pm 0,07$ r/s (34 ± 4 r/m) and $.92 \pm .8$ r/s (55 ± 5 r/m). The function of the parking switch, which is built into the gear housing, is to return the wiper blades to a suitable, predetermined, parking position, see Figs. 3-120 and 3-121, irrespective of where the wiper is switched off.

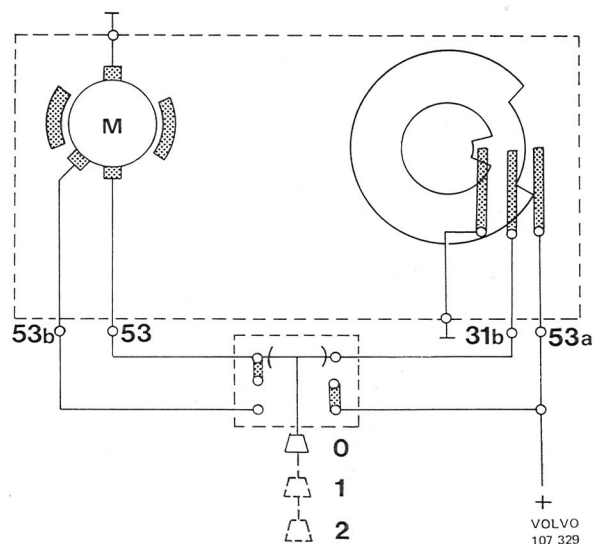


Fig. 3-121. Wiring diagram for windshield wiper motor, SWF

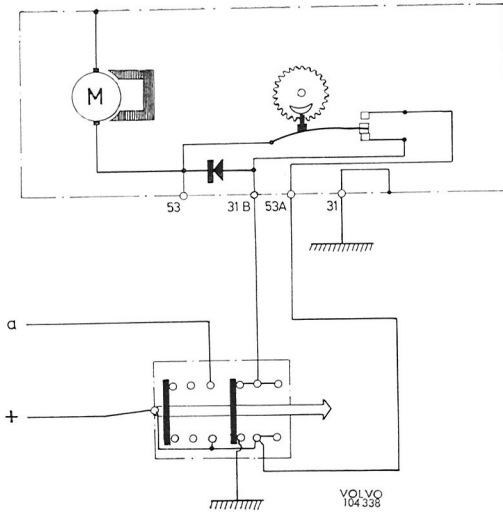


Fig. 3-122. Wiring diagram for tail gate window wiper
a. To tail gate window washer

TAIL GATE WINDOW WIPER, 145

The tail gate window wiper is operated by an electric, single-speed motor with a permanently magnetized field. It is connected to the wiper blade by a link arm. A parking switch, see Fig. 3-122, is built into the wiper motor. The function of this switch is to park the wiper blade irrespective of its position when switched off. The location of the tail gate window wiper can be seen in Fig. 3-123.

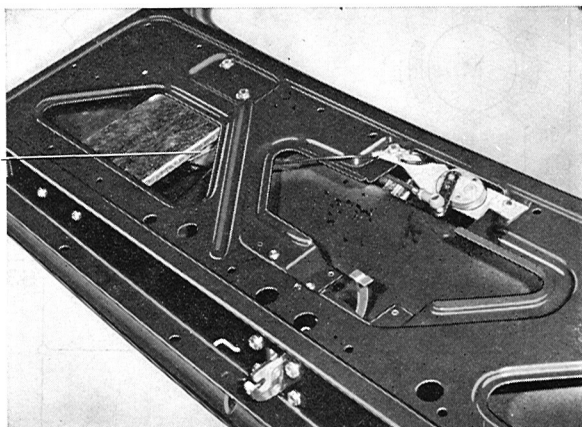


Fig. 3-123. Tail gate window wiper
1. Wiper motor

WINDSHIELD WASHER

Replace washer motor=Volvo Standard Times Op. No. 36324

The windshield washer is located on the left wheel housing. It is a gear type pump, driven by an electric motor. See Fig. 3-124.

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

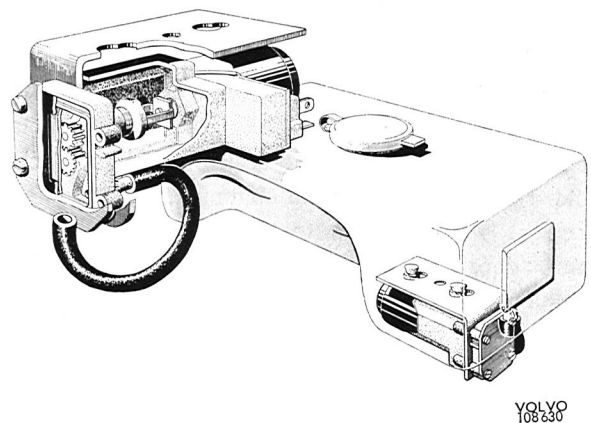


Fig. 3-124. Windshield washer

SWITCHES

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

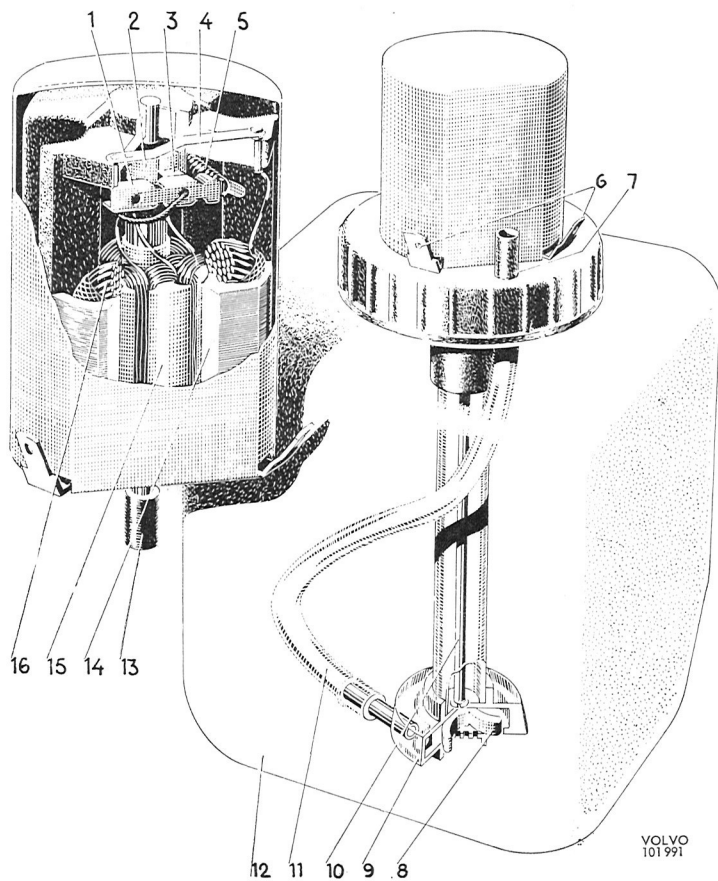


Fig. 3-125. Tail gate window washer, 145

1. Brush holder
2. Commutator
3. Brush
4. Thermal fusing
5. Spring
6. Terminal pins
7. Water outlet
8. Pump impeller
9. Pump housing
10. Shaft
11. Hose
12. Container
13. Flange
14. Stator
15. Rotor
16. Field coil

TAIL GATE WINDOW WASHER, 145

The tail gate window washer for the 145 model is driven by an electric motor, see Fig. 3-125. The pump is located at the bottom of the fluid container and is linked to the motor by a shaft. The pump is of the centrifugal type.

It is located in a cavity to the right under the floor of the cargo space, see Fig. 3-126.

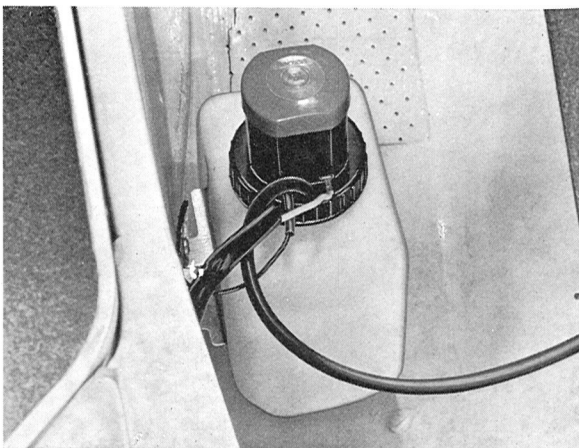


Fig. 3-126. Tail gate window washer

INTERIOR LIGHT

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

The 145 model has an extra light in the roof over the cargo space. Opening the tail gate switches on this light.

SEAT/IGNITION INTERLOCK SYSTEM

GENERAL

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

The Ignition Interlock Device consists of:

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

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

INTERLOCK CONTROL UNIT (Logic Unit. See 1 fig. 3-128), which switches on or off the Starter Cut-out Relay, according to the indications of the above switches.

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

The Interlock Control Unit incorporates also:

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

FUNCTION

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

A relay in the Interlock Control Unit is governed by the indications from the driver's side and the passenger's side. When the seat belt is used correctly, the relay closes the circuit from "C" to "1" (relay rest position), and the engine can be started. See Fig. 3-127, pos. 1.

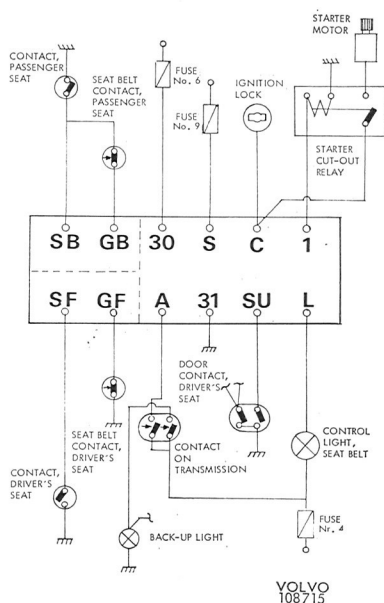


Fig. 3-127. Interlock Control System, wiring diagram

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

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

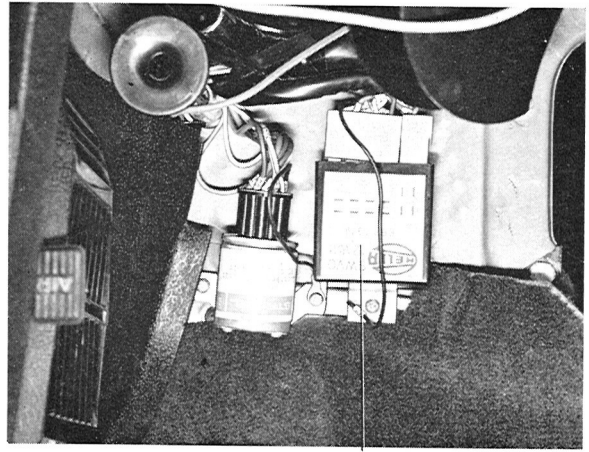


Fig. 3-128. Interlock Control Unit

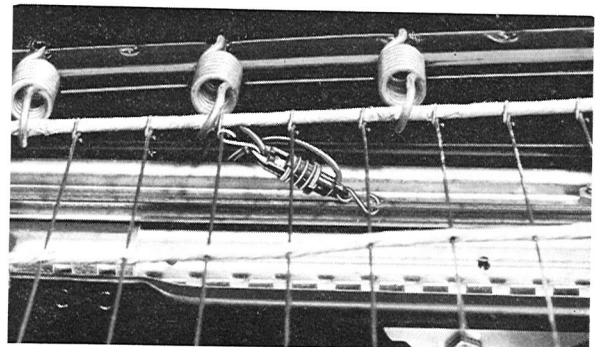


Fig. 3-129. Seat contact

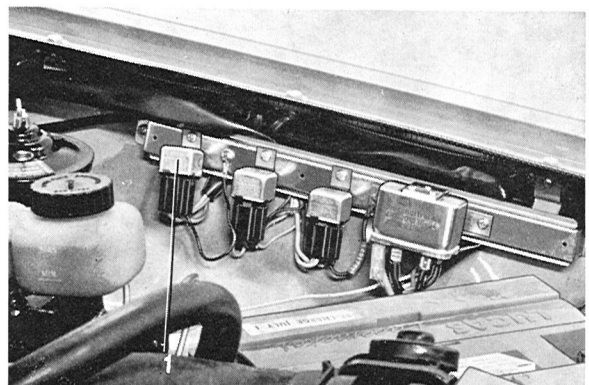


Fig. 3-130. Starter Cut-Out Relay

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

The engine can be started:

1. If the seat is not occupied (loaded)
2. If the seat first is occupied and the seat belt thereafter fastened.

BRAKE LIGHT SWITCH

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

CONTROL RELAYS

The cars in the 140-series are as standard equipped with three control relays:

- one for switching between upper and lower beams
- one for the back-up lights
- one for the rear window defroster.

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

BULB INTEGRITY SENSOR

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

The indication is that the warning light comes on. The Reed relay is located to the left under the dashboard, see 1, Fig. 3-131, and the warning light is located in the combination instrument.

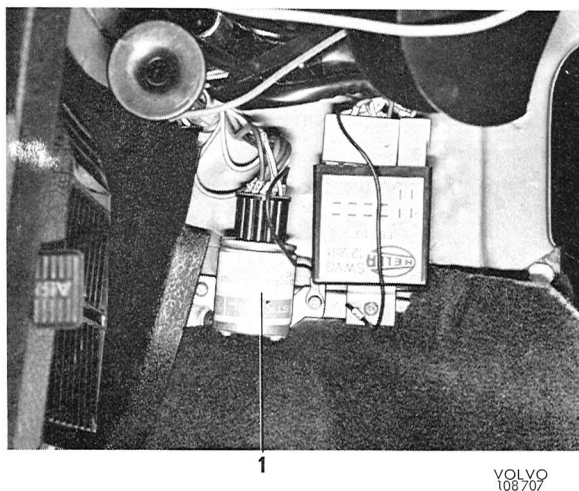


Fig. 3-131. Reed Relay

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

Each coil set has two coils, one for left bulb, one for right bulb. The two coils are counteracting each other.

FUNCTION

When current flows through both coils in the coil set, that means that the bulbs on both sides are functioning, the two coils are counteracting each other and there is no actuation of the contacts, see Fig. 3-132. But if the current flow through one of the coils ceases (the bulb is not functioning), the contacts are actuated and the warning light comes on, see II in Fig. 3-132.

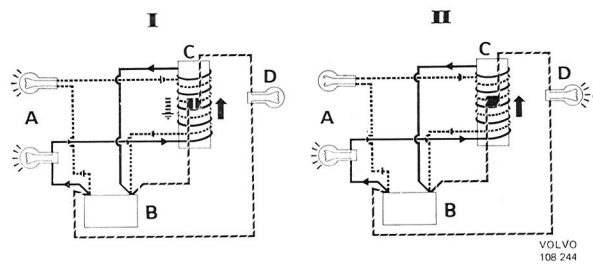


Fig. 3-132a. Bulb Integrity Sensor, function

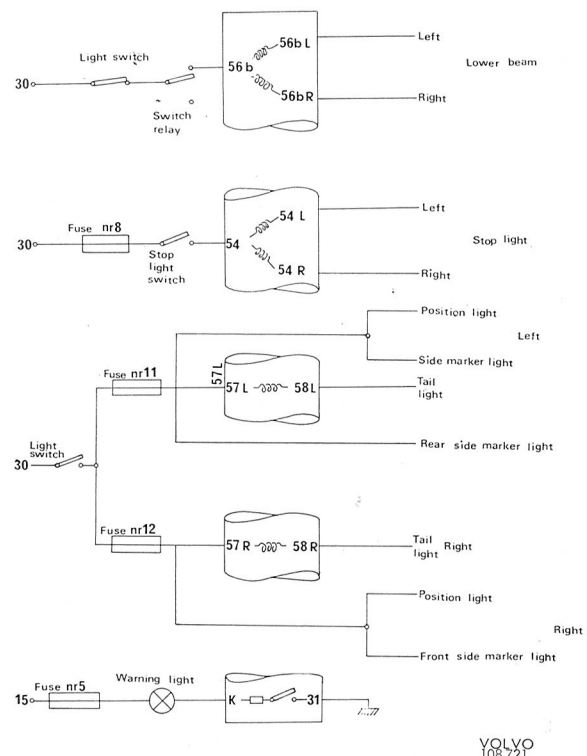


Fig. 3-132b. Bulb Integrity Sensor, wiring diagram