

SAAB



**SERVICE
MANUAL**

3 **Electrical system
Instruments**

M 1985—

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3 Electrical system Instruments

M 1985-

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Specifications

Battery



Voltage	12 V
Capacity	60 Ah
Earthing	Negative (-) earth
Specific gravity, when fully charged	1.28
Specific gravity when charging necessary	1.21

Alternator



S 34079

Bosch K1 - 14 V 70 A 20

Rated voltage	14 V
Rated speed	2000 r/min
Stator connection	Delta connection Δ
Slip ring diameter, new	27.8 mm
Minimum slip ring diameter	26.8 mm
Maximum permissible slip-ring throw	0.03 mm
Maximum permissible rotor throw	0.05 mm
Minimum brush length	5 mm (measured from edge of holder)
Ratio at pulley of engine/alternator	1:2.05

Test values:

Resistance,	rotor winding	2.8 ohm \pm 10 %
	stator between phases	0.09 ohm \pm 10 %

Output:	
at 1500 r/min	27 A
at 2000 r/min	46 A
at 6000 r/min	70 A

Starter motor

Type	Bosch DW 12 V 0 001 108 012
Number of teeth on pinion	9
Number of teeth on ring gear	142
Gear ratio	15.8:1
Output	1.4 kW (1.9 hp)

Test values

Mechanical:	
Backlash	0.35–0.60 mm
Clearance between pinion and ring gear	2.5–3.0 mm
Rotor end float	0.05–0.40 mm
Torque of freely rotating pinion	0.12–0.18 Nm (1.2 – 1.8 kgf cm)
Electrical:	
Idling speed, 12 V and 70 A	above 3000 r/min
On-load speed, 9 V and 315 A	above 1700 r/min
Locked stator	4 V 650–750 A
Lowest engagement voltage for stator solenoid at +20 °C	7 V

Ignition system

Type	Breakerless with Hall transmitter
Engine firing order	1–3–4–2
Ignition setting with vacuum control unit disconnected	

Engine	Specifica- tion	Model year	Degrees BTDC 2000 r/min
Carburetted (CM)	Europe Sweden	1985–	18° 20°

Distributor

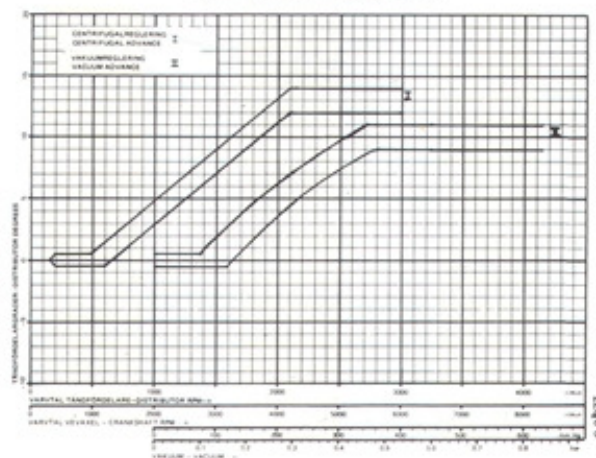


S 848 1

Order number
Direction of rotation
Rotor resistance

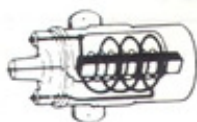
Bosch 0 237 021 024
Anti-clockwise
1 kOhm

Ignition timing graphs



Bosch 0 237 021 024

Ignition coil



Resistance of primary coil, measured
between terminals 1 and 15
Resistance of secondary coil measured between
terminal 1 and HT output terminal

1985 onwards

0.52–0.76 Ohm

2.4–3.5 kOhm

HT leads

Resistance of lead between distributor
and plug

2–4 kOhm

Resistance of lead between coil and distributor

0.5–1.5 kOhm

Spark plugs



Carburetted engine

NGK BP 6 ES
Bosch W 7DC
Champion N9Y alt N9YC

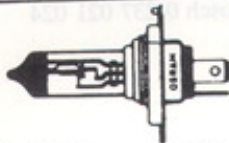





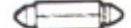









Electrode gap

0.6–0.7 mm

Tightening torque, non-lubricated plugs

25–29 Nm (2.5–3.0 kgf m)

Light bulb table

 Headlight	 H4 holder P43 t-38	 5 W  SV 8.5–8 Rear view mirror, luggage compartment
 21 W Rear direction indicators, brake light, reversing light, rear fog light	 BA 15s	 10 W  SV 8.5–8 Dome light
 21/5 W Front direction indicators/daylight driving light, parking light	 BAY 15d	 1.2 W  W2 x 4,6d Instrument illumination, heating and ventilation controls, warning/indicator lamps for brake system oil pressure, seat belts, choke, direction indicators, main beam headlights, electrically-heated rear window, fuel reserve, charging warning light.
 5 W Rear light, number plate illumination	 BA 15s	
		 2 W  BA 9s Ignition switch illumination

S 7989

Other electrical equipment

Windscreen wiper motor

Type	Lucas 54 104 297	
Speed (double-sweeps per minute) and power consumption: double-sweep/min	r/min	A
Motor warm, loaded with 1 Nm (10 kgf/cm) and voltage of 13.5 V		
half-speed	43	1.8
full speed	64	2.6
Motor locked (e.g. wiper blades frozen to glass)		approx. 15

Headlight wiper motor

Type	SWF 4E 3876/1	
	r/min	A
Speed (double-sweeps per min.) and current consumption at 0.25 Nm (2.5 kgf cm) and voltage of 13 V	46 ±5	1.5-2
Current consumption, motor locked (e.g. blades frozen to glass)		5-6

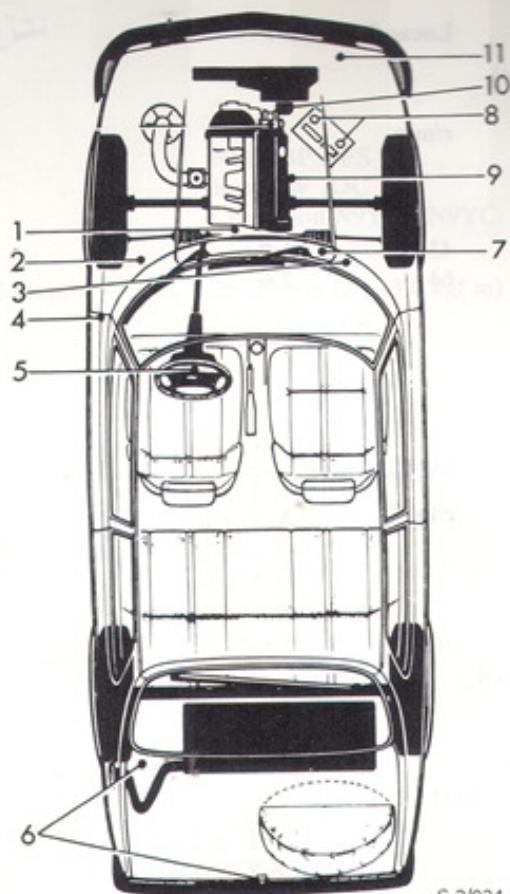
Electrically heated driver's seat

Thermostat cut-in temperature	12 °C ± 2.8 ±C
Thermostat cut-out temperature	28 °C ± 2.8 °C
Output of heating elements	approx. 80 W

Electrically heated rear window

Output at 13 V	160 W
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Lubrication



S 3/034

	Lubrication point	Lubricant
1	Alternator, ball bearing	Bosch grease Ft 1 v 34
2	Brake light switch	Vaseline or battery terminal grease (45) 30 06 665
3	Windshield wiper motor	Permanently lubricated (special grease)
4	Door switch, interior lighting	Vaseline or battery terminal grease (45) 30 06 665
5	Horn contact, slip ring and contact finger	Vaseline or battery terminal grease (45) 30 06 665
6	Door switch, luggage compartment lighting	Vaseline or battery terminal grease (45) 30 06 665
7	Ventilating fan motor	Permanently lubricated (special grease)
8	Battery terminals	Vaseline or battery terminal grease (45) 30 06 665
9	Starter motor, bushings	Bosch oil Ol 1 v 13
	Axial bearing, joints, springs	Bosch grease Ft 2 v 3
10	Radiator fan motor	Permanently lubricated (special grease)
11	Headlamp wiper motor	Permanently lubricated (special grease)

Special tools

Battery

The 12 volt
capacity is
100 amp
hours, the
battery is
sealed.



78 40 937 (A1) Pliers, splice crimping

Alternator

The pulley
instrument
is charged.



78 60 695 (A1) Pliers, uninsulated
cable terminals

The starter
is moved
the ignition



78 60 703 (A1) Pliers, uninsulated
Douglas plugs

Ignition

The spark
ignition
distribution
system
vacuum
The spark

Light

The light
ignition
but, and
with a
backing
wheel

Rear

The rear
light
flashed
light
light

Light

The light
ignition
light
light

Light

The light
ignition
light
light

General

Battery

The 12 volt battery is of lead-acid type with six cells. Its capacity is 60 ampere-hours (Ah). It is located in the front right-hand corner of the engine compartment with the negative pole grounded to the bodywork of the car.

Alternator

The generator is of the AC-type. A signal light on the instrument panel shows whether or not the alternator is charging.

Starter

The starter is rated at 1.4 kW (1.9 hp). Its drive pinion is moved into engagement by a solenoid operated by the ignition switch.

Ignition system

The engine has an electronic breakerless ignition system comprising a coil, distributor and output unit. The distributor incorporates a Hall transmitter with a slot rotor and a centrifugal advance mechanism and a vacuum advance mechanism.

The ignition switch is operated by the ignition key.

Lights

The outside lighting consists of headlights, front parking, direction indicators and side position lights, number plate light, and tail lights with rear direction indicators and side position lights, brake lights, and back-up lights which are automatically switched on when the gear shift lever is placed in reverse.

Rear fog lamps are provided for some markets.

The headlight mountings are arranged for vertical and lateral adjustment of the beam.

Headlights are controlled by the same lever that operates the direction indicators. To dim the lights, the lever is pulled towards the steering wheel. A blue light on the instrument panel indicates when the headlights are at high beam.

When the headlights are on, the parking and tail lights are also lit.

The town lights, together with the rear lights and license plate light, are switched on automatically when the engine is started.

The instrument illumination is regulated with a rheostat switch, placed on the instrument panel.

Other electrical equipment

Interior lighting consists of dome lights and ignition switch illumination, controlled by the dome light switch, a contact at each door, and a switch at the gear lever housing.

The trunk is illuminated by a lamp operated by a contact at the trunk lid hinge.

A self-cancelling lever under the steering wheel controls the current supply to the direction indicators. This lever also controls the headlights. A green light on the instrument panel indicates when direction indicators are operating. The warning flasher switch is located on the instrument panel. All four direction indicators flash together when this switch is actuated.

The windshield wipers are driven by a reciprocating spiral cable. The switch also actuates the windshield washer as well as the headlight wipers and washers fitted on cars on some markets. The windshield wipers have two speeds (five-speed cars are also equipped with an intermittent wiper operation function).

The horns are operated by a contact in the steering wheel safety padding.

The radiator fan is driven by an electric motor and is located behind the radiator. It is thermostat-controlled and operates only when the coolant temperature in the radiator exceeds the set cut-in temperature of the thermo-contact.

The backrest and cushion of the drivers seat have thermostat-controlled electric heating elements (see Group 8).

Wiring and fuses

The wires leading from the battery or alternator to the various current-consuming units are arranged in a wiring network divided into groups. The individual wires are color-coded for ease of identification. The terminals consists of solderless AMP connectors. Fuses are provided to protect the wiring, etc. against abnormally high current loads (e.g. short circuits) and to reduce the risk of fire in such an event. The fuses are grouped in a fuse box and the fuse box, relays and socket for ignition service instrument, "TSI", are mounted on the left wheel housing in the engine compartment. On cars not equipped with town lights, the panel has a place for a relay for extra equipment.

Brake light switch

The brake light switch is mechanical and is actuated by the brake pedal arm. On braking, current flows to the brake lights.

Brake warning system

Defects in the brake system, e.g. leakage from either of the two brake line circuits, are signaled by a brake warning light in the indicator light display instrument.

The switch is actuated by a float in the brake fluid container if the liquid level gets too low. The contact is incorporated in the filler cup of the brake fluid container.

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Battery

General

The battery is a 12 volt lead accumulator with six cells and a working voltage of about 2 volts per cell. The electrolyte used in the battery is dilute sulphuric acid with a spec. gravity of 1.28 at +68°F (+20°C) when the battery is fully charged. The capacity of the battery is 60 ampere-hours (Ah), i.e. it is rated to deliver a current of 3 amperes for 20 hours at +68°F (+20°C). The positive pole of the battery is connected to the starter and other current-consuming units and the negative pole is grounded to the bodywork of the car.

Removing and installing

To remove the battery from the car, first disconnect the negative (ground) cable to prevent shorting, then disconnect the positive cable. Note that the engine must be stopped before the terminals are disconnected, as the alternator may otherwise be damaged.

Next unscrew the two wing nuts from the hooks, after which the battery can be lifted out of the car.

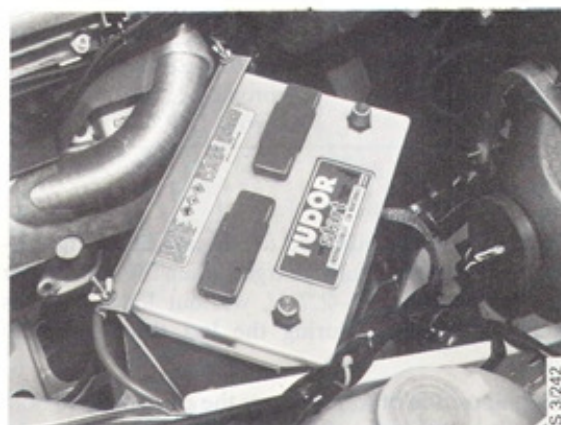
Before replacing the battery, make sure that the outside is clean and that the pole terminals and cable clamps are also clean so that they make proper contact. After connecting the cables, coat the pole terminals and clamps with acidfree vaseline.

Caution

Do not misconnect the battery. Reversing the pole connections, even momentarily, will damage the alternator rectifier. Connect the positive cable to the positive pole of the battery (both marked +) and the negative cable (ground lead) to the negative pole (both marked -). If an external battery is temporarily connected to the car battery, connect the poles positive-to-positive and negative-to-negative. The battery must not be connected to or disconnected from the electrical system of the car while the engine is running. When quick-charging the battery, first disconnect the positive cable.

Maintenance

As the ability of the battery to start the engine depends on its state of charge, regular checking and maintenance of the battery are important - especially in wintertime, when the load on the starter is heavier and the capacity of the battery is reduced by low temperature. Moreover, an undercharged battery is apt to freeze.



Electrolyte level

The level of electrolyte in the battery tends to fall due to evaporation and electrolytic decomposition of water. Use only distilled water to top up. The surface of the electrolyte should be about 0.4" (10 mm) above the top edge of the plates.

Sulphuric acid of the correct concentration should only be added if the spec. gravity of the electrolyte needs to be corrected as a result of drainage or leakage from the battery.

Electrolyte specific gravity

The spec. gravity of the electrolyte is measured with a hydrometer; the reading indicates the state of charge of the battery (see table).

State of charge	Spec. gravity
Full charge	approx. 1.28
Half charge	approx. 1.21
Discharged	approx. 1.12

Charging

Charging must be adjusted to the capacity of the battery. The battery is fully charged when the voltage per cell has reached 2.5–2.7 V, without load, and has remained constant during the last three hours of charging.

Decomposition of water causes the electrolyte to boil. The filter caps must therefore be removed from the cells while charging is in process.

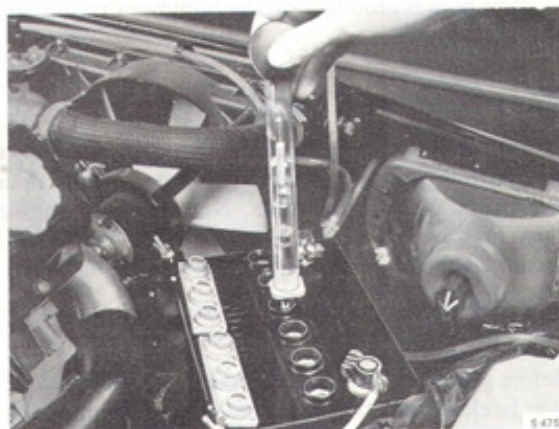
Temporary limited discharge

The battery can be charged by means of a conventional battery charger. In rapid charging, the charging current must not exceed 50 A.

Totally discharged battery

If the battery becomes totally discharged, i.e. as the result of an electricity-consuming device being left on, then trickle-charging will be necessary to initiate the chemical process in the battery once more.

Where applicable start re-charging with a current of 3 Amp approx. (max 5 Amp) for 24 hours or until the charging current drops to its lowest stable level. The charging voltage should never exceed 16 V in order to prevent a substantial loss of battery acid. If possible battery chargers supplying pulsating current should be used in such cases.



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Testing

By loading the battery (corresponding to the load during starting) for a period of 15 seconds; the capacity and charge of the battery can be determined by observation of the voltage. Use a battery tester with a rheostat.

Apply a load of about 200 A to the battery for 15 seconds, and check that the voltage does not drop below 9.6 V at a battery temperature of 27 °C (80 °F). The permissible voltages at lower temperatures are as follows.

Battery temperature	Minimum voltage
27 °C (80 °F)	9.6 V
16 °C (60 °F)	9.5 V
4 °C (40 °F)	9.3 V
- 7 °C (20 °F)	8.9 V
-18 °C (0 °F)	8.5 V

If the voltage reading during this test is too low, this indicates that the battery either has a temporarily low charge or inadequate capacity.

The following chart should be used to assess batteries. If it emerges that the battery is not defective, the temporary fault may be the result of an abnormally high load (e.g. electrical items left switched on) or of a fault in the electrical or charging system of the car.

Testing

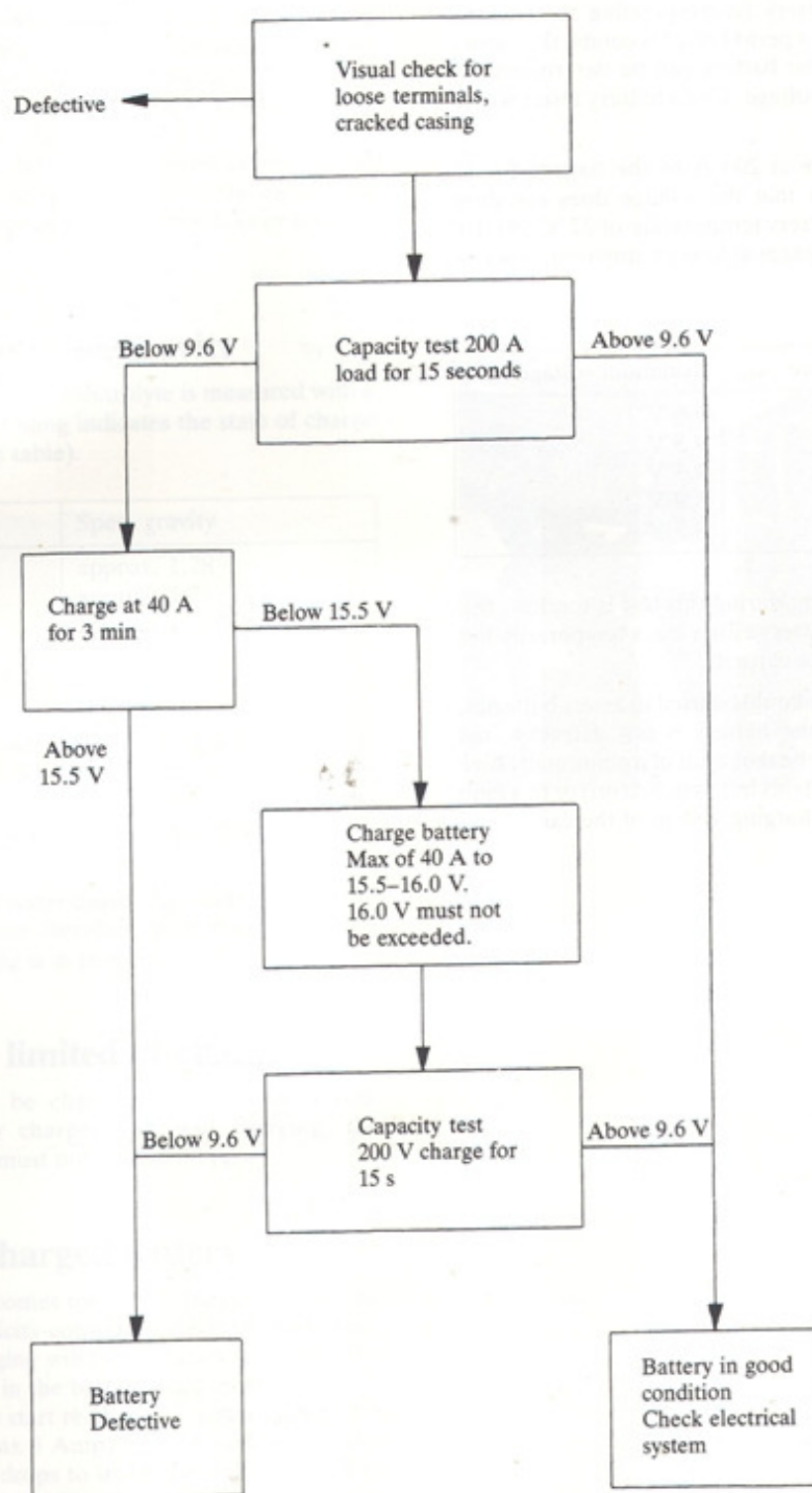
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Test chart

S 6888

Alternator

General

When the engine is running the alternator supplies the current required by the various electrical components and at the same time charges the battery.

The alternator drive pulley is equipped with fan vanes that draw air through the alternator when it is rotating in order to remove the heat generated.

The alternator is mounted on top of the engine in front of the heat exchanger and is driven by a V-belt from the crankshaft pulley.

Internal wiring

The alternator is internally ventilated. It has a 12-pole rotor with six silicon diode rectifiers. An exciter diode is connected to each of the three stator windings, with a common junction point at terminal D+. The stator windings are three-phase and are delta-connected (Δ). The six rectifier diodes are arranged and wired in an AC bridge, i.e. three diodes are wired for normal polarity (anode to the terminal) and the other three for reverse polarity (anode to the casing).

According to its polarity the diode holder is insulated from the body or directly connected to earth. The annular exciter winding is mounted on the rotor which has pole claws, one half of the claw acting as a north pole and the other as a south pole. The ends of the exciter winding are connected to slip rings which transmit the exciting current.

Operating principle

The circuit is completed when the ignition key is turned to the start position.

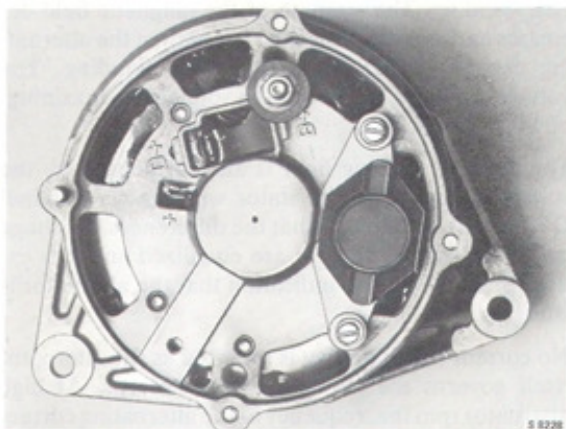
The circuit runs from the ignition switch via the ignition warning light to terminal D+ on the alternator.

The current is then carried through the exciter winding of the rotor and earthed via the voltage regulator.

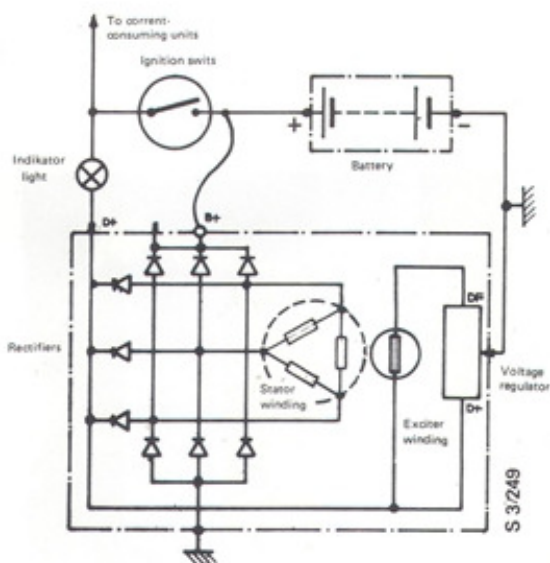
When current passes through the rotor, it causes a magnetic field to be formed round it.

When the engine starts and the rotor begins to turn the magnetic field also starts to rotate and this generates alternating current in the stator winding which is rectified as it passes the diodes and is fed into the battery via terminal B+.

The voltage obtained from the stator winding also passes via the exciter diodes to the voltage regulator so influencing its regulating function.



Alternator Bosch 70 A



Alternator wiring diagram

The alternator has an integral voltage regulator with an electronic breaker function.

When the voltage rises to 14 V approx. or above, the voltage regulator reduces the current through the exciter winding. The strength of the magnetic field decreases and as a result also the strength of the alternating current generated in the stator winding. The voltage regulator thus limits the voltage to a maximum of 14 V approx.

The ignition warning light is also influenced by the voltage output from the stator winding via terminal D+ on the regulator, so that the differences in voltage on both sides of the light are equalized and it is extinguished. This is an indication that the alternator is charging.

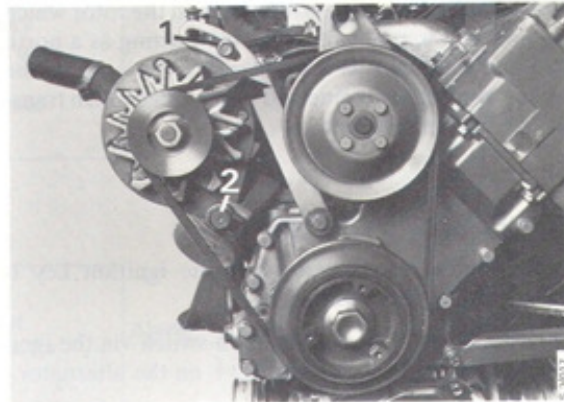
No current-limiting relay is required as the alternator itself governs the strength of the current. At high alternator rpm the frequency of the alternating current generated is also high and when the strength of the output current reaches a given value, the resulting resistance (impedance) is so great that no further increase of current is possible.

Maintenance

No lubrication is necessary as the bearings are sealed for life. Belt tension must be checked at regular intervals.

Adjust the belt tension by loosening bolts 1 and 2 and lifting the alternator outwards.

The alternator belt should be under sufficient tension to allow it to be depressed 5 mm under a load of 60 N (6 kg).



Checking the belt tension



Regulator

The regulator is integrated in the alternator and requires neither adjustment nor maintenance.

Important

NEVER earth the exciter terminals of the alternator or regulator or the connecting wire.

- NEVER reverse the regulator wires.
- NEVER disconnect the regulator or the battery while the alternator is rotating.
- NEVER dismantle the alternator with the battery connected.
- NEVER start the alternator unless the wire between the negative terminal on the alternator is connected to the negative terminal on the regulator.
- NEVER test the alternator-regulator assembly in the car or on the test bench without the battery being connected.
- NEVER reverse the battery connections as this can seriously damage the alternator.

Any necessary repairs should be performed by a specialist electrician; it is essential that disassembly and testing are properly performed as even minor errors can result in extensive damage.

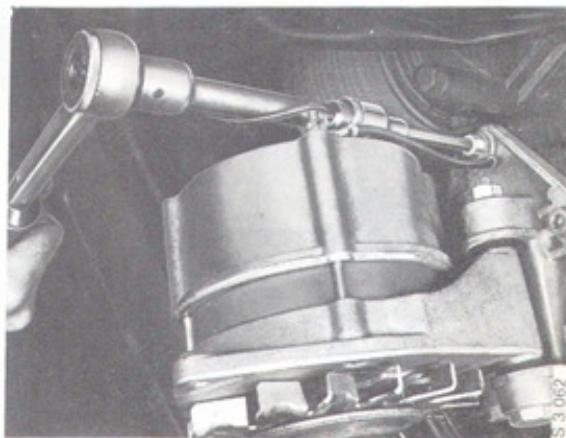
Caution

Before any electric welding is done on a car equipped with an AC alternator the battery earth cable and all wiring to the alternator must be disconnected to avoid damaging the rectifier diodes.

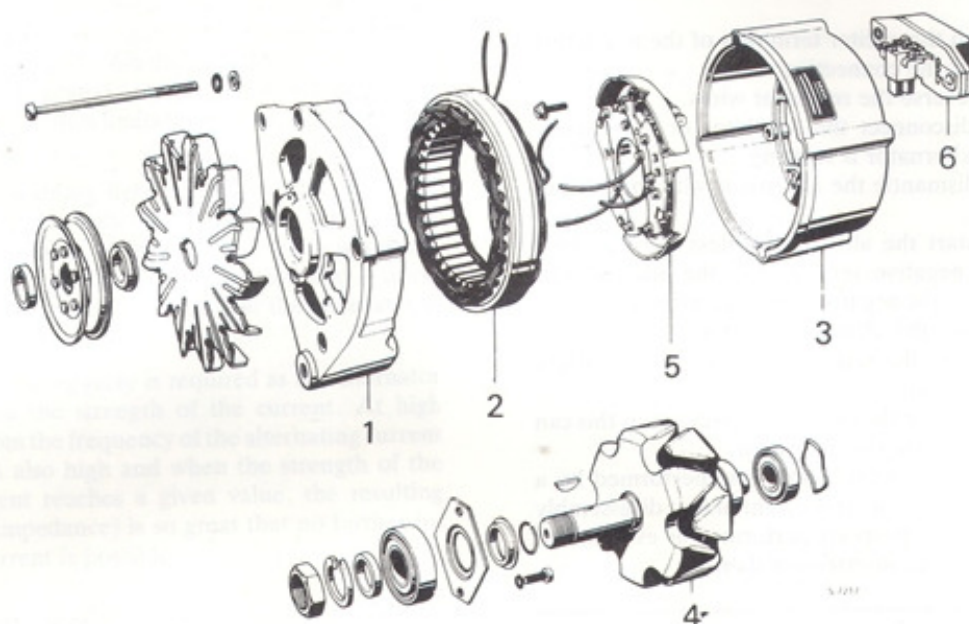
To remove and refit

1. Disconnect the negative battery lead. The engine must not be running.
2. Remove the alternator wires, mounting and adjusting bolts and remove the V-belt.
3. Remove the alternator.
4. Refitting is the reverse of the removal procedure.
5. Adjust the drive belt tension.

The through-bolt in the alternator mounting cannot be removed when the alternator is fitted in the car. The alternator mounting must therefore be unbolted from the engine before the alternator can be separated from the mounting.



The Bosch Alternator



The Bosch Alternator

1. Drive bearing bracket
2. Stator
3. Slip ring end bracket
4. Rotor
5. Rectifier unit
6. Voltage regulator and brush holder

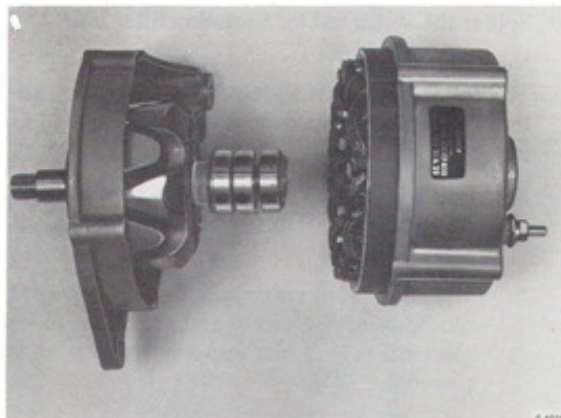
To dismantle

1. Clamp the pulley and remove the nut using a 22 mm spanner. Remove the pulley and fan.
2. Remove the voltage regulator from the alternator.



The voltage regulator removed from the alternator

3. Separate the stator and slip ring end bracket from the drive bearing assembly and rotor. Make a mark to indicate the position of the drive bearing assembly relative to the stator and slip ring end bracket.

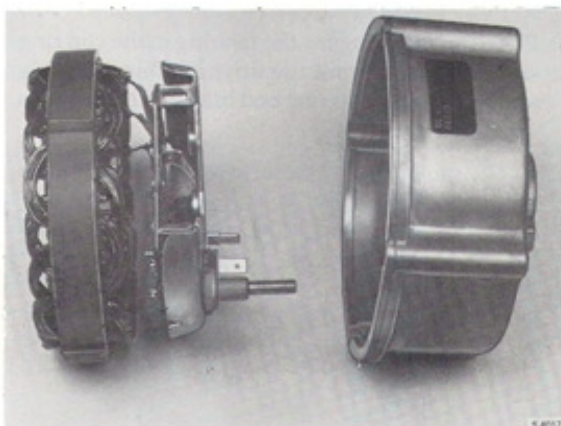


4. Remove the retaining screws and nut for the rectifier unit and separate the stator and the rectifier unit from the slip ring end bracket.
5. Unsolder the stator cables from the rectifier unit.

Note

The following points should be observed to protect the diodes from overheating during soldering:

- a. Use a well-heated soldering iron with a fine tip to enable soldering to be performed rapidly.
 - b. Use a pair of pliers to hold the wire between the body of the diode and the point to be soldered to conduct away as much heat as possible.
6. Support the drive bearing assembly on a suitable base and carefully press out the rotor. The bearing can now be dismantled. Take care to ensure that the rotor does not fall and become damaged as it is pressed free from the bearing assembly.
 7. Remove the ball bearing on the slip ring side using a suitable extractor.



Assembly

1. Pack the ball bearing with Bosch Ft 1 v 34 grease. Press the ball bearing into the bearing assembly with the capped side facing the drive.
2. Press the drive bearing assembly onto the rotor.
3. Press on the ball bearing on the slip ring side (see illustration). Ensure that the capped side faces the slip rings.

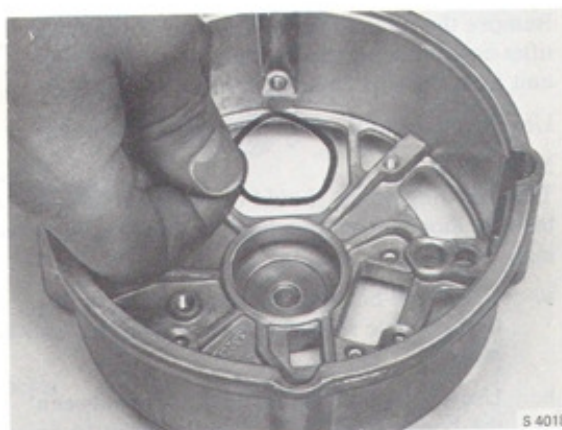


4. Solder the stator cables to the rectifier unit.

Note

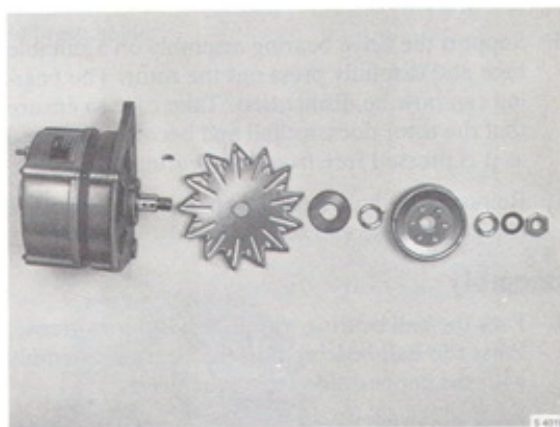
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- a. Use a well-heated soldering iron with a fine tip to enable soldering to be performed rapidly.
 - b. Use a pair of pliers to hold the wire between the body of the diode and the point to be soldered to conduct away as much heat as possible.
5. Reassemble the rectifier unit and the slip ring end bracket.
 6. Place the snap ring for the bearing in the clip ring end bracket and refit the drive bearing assembly and rotor to the slip ring end bracket and stator as described earlier.
 7. Check the length of the brushes (with the brush unit assembly removed, the brushes should protrude at least 0.20 in. (5 mm) through the opening) and reassemble the brush unit assembly.



8. Fit the fan and pulley. Make sure that the washers are installed in the correct order (see illustration). Tighten the nut to a torque of 34–39 Nm (23–29 lb.ft. 3,5–4,0 kgm).

(If, at the time of overhaul, the fan has done more than 100,000 km, the fan should be replaced).



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Changing the brushes

After the brush box has been removed, the brushes should protrude at least 5 mm from the housing; if not, change the brushes as follows.

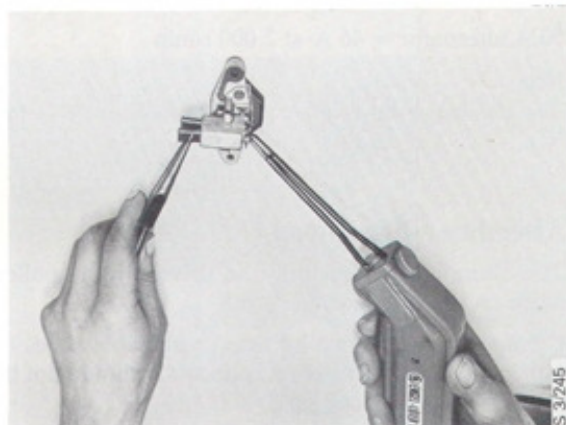
1. Use a soldering iron to melt the solder holding the lead to the brush-holder terminal, using pliers to withdraw the brushes at the same time.

N.B.

Work quickly to prevent the regulator becoming too hot; excessive heating will damage the regulator.

2. Carefully remove any traces of solder from inside the brush holder to enable the lead of the new brush to be inserted.

3. Insert the new brush and lead into the holder and solder the lead to the terminal.



Testing the alternator

General

Note the following before testing the alternator or its component parts:

Only direct current with a maximum voltage of 40 V may be used to test the rectifiers.

A 40V/40W AC glow lamp should be used for insulation and short circuit tests on stator windings and rotor windings. (Do not use a mains voltage of 110 or 220 V, since this might damage the rectifiers).

The battery cable must not be disconnected while the engine is running for the purpose of measuring the charging current.

If it is necessary to solder or unsolder diode connections, the diode connecting wire must be held in a pair of flat pliers to conduct away excess heat, on account of the heat sensitivity of the semiconductors. (Solder and unsolder the connections quickly with a hot soldering iron). Avoid mechanical strain at the point where the connecting wires issue from the heat sink assembly; the wire must not be bent or subjected to load at the point of attachment.

During repairs to the alternator, whether in the car or on a test bench, the battery must be disconnected.

Measuring the charging capacity

The charging voltage and charging current can be measured in the car or on the test bench.

- Measure the voltage using a voltmeter connected between terminal B+ and the alternator ground.

Measure the current using an ammeter connected in series with the wire from terminal B+ on the alternator.

Test values and wear limits

Engine belt pulley/alternator pulley ratio, see Group 0.

Testing at 2/3 maximum current

Connect the battery and put the alternator. Adjust the alternator speed to the prescribed rated rpm. The alternator should then deliver 2/3 of the maximum current:

70 A alternator = 46 A at 2,000 r/min

Note

The alternator should have a temperature of 140 °F (60 °C).

Alternator bench test

The alternator should only be driven by its pulley when on the test bench.

Connecting wires must be fitted with cable shoes or pin connectors. Improvised connectors should not be used on the battery either.

A 12 V battery must be connected in parallel to the alternator during testing. The battery acts as a buffer to attenuate peak voltages which occur when load is connected and disconnected. If these peaks exceed the permissible maximum voltage, the rectifier effect of the diodes will be destroyed. The voltage limit for silicon diodes is about 100 V.

Mounting the alternator

The alternator can be tested on most types of alternator test benches. In some cases it may be necessary to provide additional tensioning devices and drive arrangements.

Caution

The alternator must be mounted for testing using bolts in the normal manner and not clamped in place or secured by other means.

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Magnetization

Unlike a DC generator, the alternator does not demagnetize spontaneously after a long period of non-use. A 12 V test lamp of at least 1.2–2 W must therefore be connected across terminals D+ and B+ (see wiring diagram). Bias current is then supplied to the exciter winding through the test lamp, alternator terminal D+, and regulator terminal D+. It should be noted that the lamp wattage is at least as high as that stated above. Self-excitation begins as soon as the alternator voltage opens the exciter diodes, which occurs at 1–2 V. The voltage then rises rapidly and the potential difference across the test lamp gradually diminishes. The lamp remains lit until battery voltage has been reached.

Testing the components (removed from alternator)

A. Rotor

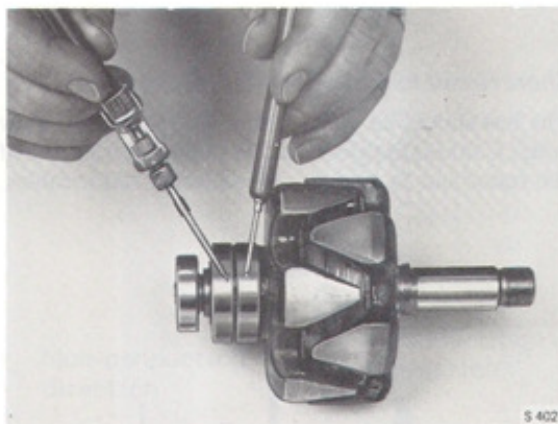
Short circuit in the winding

Measure the resistance in the winding from slip ring to slip ring using an ohmmeter.

The resistance should be:

Bosch 70 A 2.8 Ohm \pm 10 %

Maximum ovality on the rotor 0.0020 in (0.05 mm).



Measuring the resistance of the rotor winding

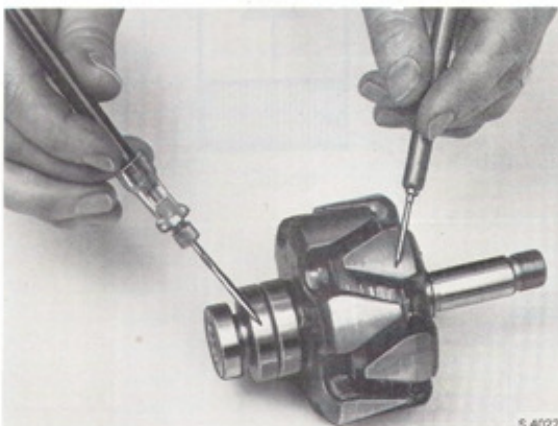
Short circuit to earth

Test the insulation of the exciter winding and the slip rings for a short circuit to earth.

Slip rings

Check that the surface of the slip rings is not greasy, dirty or scratched. Clean using trichloroethylene. Do not polishing the surface of the slip rings. A ring which is too highly polished may impair the electrical contact of the brushes.

Maximum ovality on the sliprings 0.0012 in (0.03 mm)



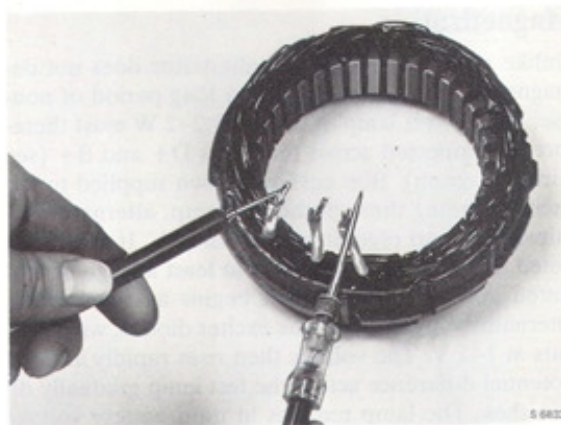
Checking the insulation of the exciter winding and the slip rings

B. Stator

Short circuit in the windings (rectifiers unsoldered)

The stator windings can be tested for short circuit by probing with a winding tester. This test should only be performed with the alternator dismantled. Another possibility is to measure the common resistance in two phases. Three measurements will reveal any deviation in the resistance of the stator winding. If the phases are marked U, V and W, measurements should be made across U-V, U-W and V-W. At 68 °F (20 °C) the reading in each case should be:

Bosch 70 A 0.09 ohm \pm 10 %

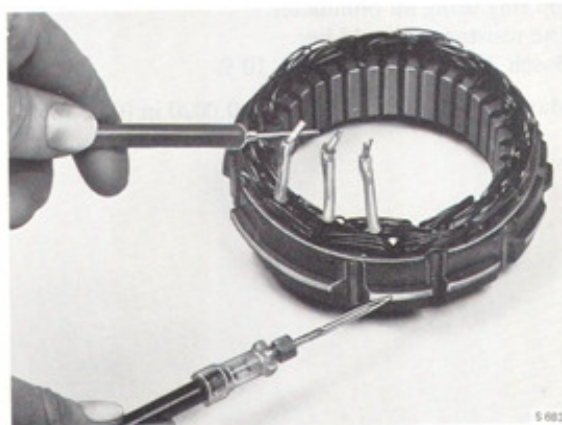


Resistance measurement across two phases



Short circuit to earth (rectifiers unsoldered)

The test should be made with a 40 V/40 W AC glow lamp. Connect the glow lamp between the iron core of the stator and each of the disconnected stator cables.



Test stator insulation

C. Rect

Testing t

Use only ohmmeter connected with the positive end of the test lamp. The test lamp should be of a diode type which has inverse connection direction that fails to produce an excessive current in the case of a short circuit.

Testing

Rectifier resistance should be correctly measured in each general kilohm range.

D. To

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1. Check the condition of the rotor and the stator.
2. Check the condition of the diodes and the rectifier.
3. Check the condition of the brushes and the brush holder.
4. Check the condition of the slip rings and the commutator.

C. Rectifiers

Testing the rectifiers

Use only a test lamp of not more than 40 V DC or an ohmmeter. The phase terminals must first be disconnected when testing the conducting and non-conducting directions of the silicon rectifiers as it is otherwise impossible to tell which diode is faulty. The positive diodes between terminal B+ and phase conduct from the terminal to the casing but not from the casing to the terminal. The negative diodes connected between phase and B- (inverse polarity) conduct from the casing to the terminal but not from the terminal to the casing (see illustration). To test this, connect the test lamp in series with the diode to be tested. The lamp should ignite when B+ is connected to the anode of a diode with normal polarity. The lamp should not ignite when B+ is connected to the casing. If the diode has inverse polarity, the lamp will ignite when B+ is connected to the terminal (cathode) but not when the direction of current flow is reversed. A faulty diode that fails to conduct current in the direction of conduction is defective because it has been overheated by an excessive strength of current. A diode that conduct current in both directions has probably been subjected to excessive voltage.

Testing rectifiers with an ohmmeter

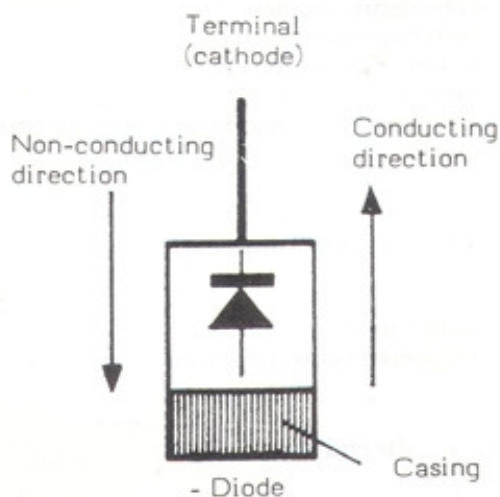
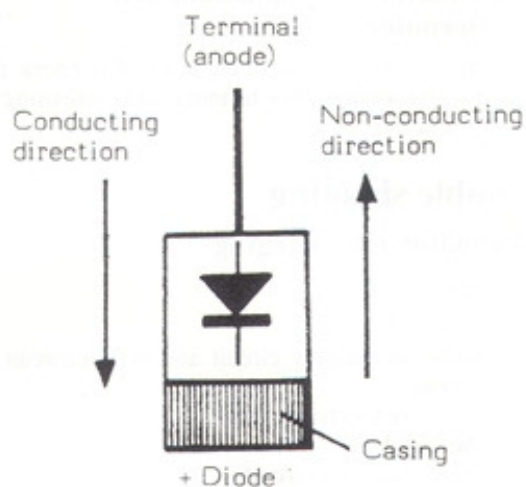
Rectifiers can also be tested using an ohmmeter. The resistance in the direction of conduction is low in correctly functioning diodes (e.g. a few ohms) but much greater in a non-conducting direction (e.g. several kilohms).

D. To check the brush unit assembly and connections (brush unit assembly or rotor removed)

1. Check that the brushes can move in the assembly.
2. Check the brushes for wear.

With the brush holder removed, the carbon brushes should protrude by at least 0.20 in. (5 mm) through the aperture in the brush holder.

3. Check that the brushes are completely insulated from each other. Connect the test instrument across two brushes.
4. Check that there is a good contact between each of the brushes and the "-" and "DF" terminals.



S 6392

E. Insulation test on assembled alternator

Once the alternator has been assembled check the insulation between the B+ terminal and earth using an insulation tester.

Trouble shooting

Alternator not charging

The cause may be:

- Slack drive belt
- Break in charging circuit and return circuit to ground.
- Defective electric brushes
- Shorted diodes
- Break in exciter circuit
- Faulty regulator
- Broken rotor winding
- Grounded stator
- Exciter diode unit ground connection broken or shorted.

Low or irregular amperage

The cause may be:

- Slack drive belt
- Irregular breaking in the charging circuit
- Worn electric brushes
- Faulty regulator
- Broken or shorted rectifier diode
- Partly shorted rotor
- Stator ground connection broken or partly shorted

Abnormally high amperage

The cause may be:

- Faulty regulator
- Bad contact between regulator and alternator

Noise in alternator

The cause may be:

- Badly worn drive belt
- Pulley loose or out of true
- Crankshaft and alternator pulleys out of alignment
- Worn or defective bearings
- A shorted rectifier diode
- Loose alternator retaining screws

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Starter

General

The starter spins the engine flywheel by a starter pinion and a gear ring. The pinion slides on the rotor shaft of the starter and is brought into engagement with the gear ring by a solenoid which thereupon trips the switch that supplies current to the starter. As soon as the engine fires, the gear ring on the flywheel starts to drive the pinion. When this happens, the pinion is released from the driver shaft by a freewheel arrangement but remains in engagement with the ring gear as long as the solenoid is energized by the ignition key. It is disengaged by a return spring when current to the solenoid is cut off.

The starter is of a new type incorporating a planetary gear. Compared with conventional starters, the new type operates at a higher speed, is lighter and of more compact design.

Removal

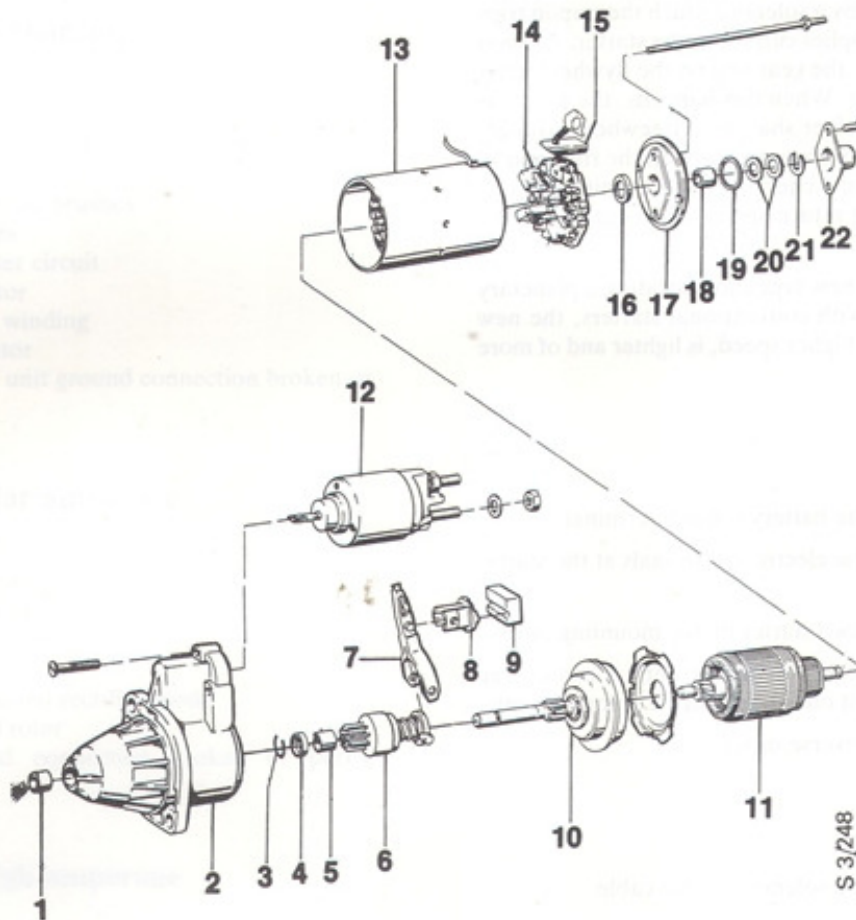
1. Disconnect the battery's minus terminal.
2. Disconnect the electrical terminals at the starter motor.
3. Remove the two starter motor mounting bolts.
4. Withdraw the starter motor until it comes free and then lift it out of the engine compartment.

Assemble in the reverse order.

Dismantling

1. Disconnect the solenoid feeder cable.
2. Remove the solenoid retaining screws.
3. Unhook and remove the solenoid.
4. Undo the two retaining screws from the end cap.
5. Remove the spring end cap, spring washer, shims and seal (pos. 18-21).
6. Remove the bolts from the commutator end bracket.
7. Separate the starter motor by lifting the motor body complete with armature and brush plate away from the drive end bracket and planetary gear.
8. Remove the commutator end bracket and seal (16, 17).
9. Withdraw the armature and brush plate from the motor body.

10. Disconnect the brush plate from the armature.
11. Remove the bearing bracket seal.
12. Withdraw the planetary gear, actuating fork and pinion from the drive end bracket. Remove the cover from the planetary gear.



1. Bush for bracket
2. Bracket for starter, drive end
3. Circlip
4. Stop ring
5. Bush, pinion end
6. Pinion
7. Actuator fork
8. Bearing bracket
9. Seal
10. Planetary gear
11. Armature

12. Solenoid
13. Starter boyd
14. Brush plate
15. Seal
16. Seal
17. Bracket, commutator end
18. Bush, commutator end
19. Seal
20. Shims
21. Spring washer
22. End cap

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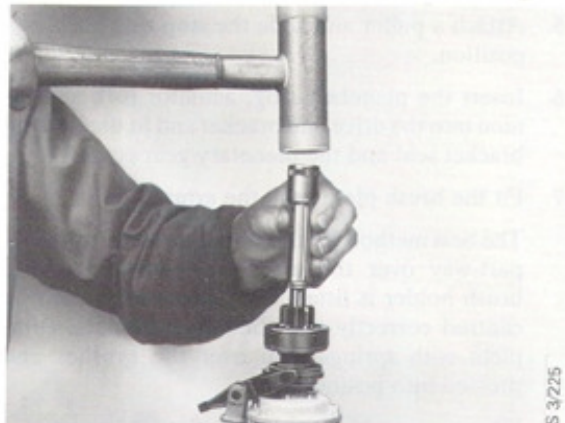
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13. Using a suitable sleeve, drive the thrust ring down towards the pinion.

N.B.

Take care not to apply any pressure to the plastic studs on the planetary gear assembly as this is likely to break them.



S 3/225

14. Remove the circlip (see illustration) and then the pinion.



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15. Remove the circlip and the washer from the planetary gear then withdraw the gear from the housing.
16. Inspect the spiral splines on the rotor shaft for burrs. If there are any, file them off.

Inspect the ring gear, pinion, planetary gear pinion and bushes.

Note

Check all components and exchange or repair any that are damaged. Soak the bearing bushings in hot oil before reassembling.

Assembly

1. Insert the planetary gear in the housing and fit the washer and circlip.
2. Lubricate the spiral splines and the pinion engaging ring with silicone grease.
3. Fit the pinion, stop ring and circlip on the armature shaft.
4. Fit the circlip in its groove on the armature.

5. Attach a puller and slide the stop ring back into position.
6. Insert the planetary ring, actuator fork and pinion into the drive end bracket and fit the bearing bracket seal and the planetary gear cover.
7. Fit the brush plate onto the armature.

The best method for this is to slide the brush plate part-way over the armature shaft before the brush holder is fitted. The brushes can then be centred correctly and the brush holders, complete with springs, slid over the brushes and pressed into position.

8. Fit the armature and brush plate in the starter body.
9. Fit together the starter body and drive end bracket, fit the commutator end bracket and tighten the throughbolts.

N.B.

Check that the seal between the commutator end bracket and the armature is correctly seated and in good condition before fitting the commutator end bracket.

10. Fit the seal, shims and spring washer, and then fit and secure the end cap.
11. Check the end float of the shaft, which should be 0.002–0.12" (0.05–0.30 mm), and correct with shims if necessary.
12. Hook the solenoid onto the actuator fork and secure them.
13. Connect the feeder cable.
14. Test the starter.

Solenoid (Starter removed from car)

Removing

1. Disconnect the feeder cable.
2. Remove the retaining bolts and remove the solenoid

Refitting

1. Hook the solenoid onto the actuator fork and secure the screws.
2. Connect the feeder cable.
3. Test the starter.



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Brush (Starter removed from car)

1. Remove the brush holder.
2. Remove the brush seal.
3. Remove the brush holder.
4. Remove the brush holder.
5. With the starter removed from the car.
6. Remove the brush holder.

To refit

1. Fit the brush holder.
2. Fit the brush holder.
3. Fit the brush holder.

N.B.

Check the brush holder is in good condition before fitting the brush holder.

4. Fit the brush holder.
5. Remove the brush holder.
6. Inspect the brush holder.
7. Check the brush holder.

Brush plate (Starter removed from car)

Removing

1. Remove the two bolts from the end cap.
2. Remove the end cap, spring washer, shims and seal.
3. Remove the screws from the commutator bearing housing
4. Remove the commutator end bracket.
5. Withdraw the armature and brush plate from the starter body.
6. Remove the brush plate from the armature.

To refit

1. Fit the brush plate onto the armature.

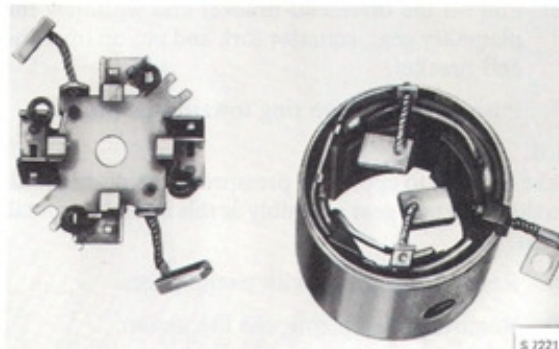
The best method for this is to slide the brush plate part-way over the armature shaft before the brush holder is fitted. The brushes can then be centred correctly and the brush holders, complete with springs, slid over the brushes and pressed into position.

2. Fit the armature and brush plate in the starter body.
3. Fit the commutator end bracket and tighten the throughbolts.

N.B.

Check that the seal between the commutator end bracket and the armature is correctly seated and in good condition before fitting the commutator end bracket.

4. Fit the seal, shims and spring washer.
5. Refit the end cap and secure the retaining bolts.
6. Insert and tighten the commutator end bracket bolts.
7. Check the operation of the starter.



Starter pinion (Starter removed from car)

Dismantling

1. Disconnect the feeder cable from the solenoid.
2. Undo the solenoid retaining screws.
3. Unhook the solenoid and remove it.
4. Remove the bearing bracket seal.
5. Remove the commutator end bracket bolts.
6. Pull off the drive end bracket and withdraw the planetary gear, actuator fork and pinion from the end bracket.
7. Push down the stop ring towards the pinion.

N.B.

Take care not to apply any pressure to the plastic studs on the planetary gear assembly as this is likely to break them.

8. Remove the circlip with circlip pliers.
9. Remove the stop ring and the pinion.
10. Check the spiral splines on the rotor shaft for burrs. If there are any, file them off.

Assembling

1. Lubricate the spiral splines on the rotor shaft and the pinion engaging ring with silicone grease.
2. Mount the pinion, stop ring and lock ring on the rotor shaft.
3. Use pliers to seat the lock ring in its groove in the rotor shaft.
4. Push up the stop ring using a claw puller.
5. Insert the planetary ring, actuator fork and pinion into the drive end bracket and fit the bearing bracket seal and the planetary gear cover.
6. Insert and tighten the throughbolts for the commutator end bracket.
7. Hook the solenoid to the actuator fork and secure it with the two screws.
8. Connect the feeder cable.
9. Check the operation of the starter.

Check

Inspection

The following motor inspection:

- Check the place of the ring and bracket.
- Check the braided and motor.
- Check the proper

Check shaft

To check the end of the clearance adjust the rotor end.

Tighten

Connect 7

Solenoid 4

Through 2

Checking the starter motor

Inspecting the motor externally

The following checks can be performed with the starter motor removed from the car but without dismantling:

- Check that the stop ring on the pinion is correctly in place and secure. The distance between the stop ring and the mounting flange of the drive end bracket should be between 31.3 and 32.6 mm.
- Check for possible short-circuiting between the braided lead from the solenoid to the brush plate and earth. Check that the lead is clear of the starter motor body and free from dirt.
- Check the condition of all seals and that they are properly seated.

Checking the end float of the armature shaft

To check the end float of the armature shaft, remove the end cap and measure the end float of the shaft. The clearance should be between 0.05 and 0.40 mm. To adjust the end float, change the shims at the commutator end.

Tightening torques

Connection of feed cable to solenoid:
7–9 Nm (70–90 kgf cm)

Solenoid securing bolts:
4.5–5.5 Nm (45–55 kgf cm)

Throughbolts in commutator end bracket:
2.7–3.5 Nm (27–35 kgf cm)

Ignition system

The car is fitted with an electronic, breakerless ignition system incorporating a Hall transmitter. Instead of contact breakers, the distributor has a slotted rotor and a semiconductor-type Hall transmitter. The signal from the Hall transmitter is converted and amplified by the system's output unit, which controls the coil.



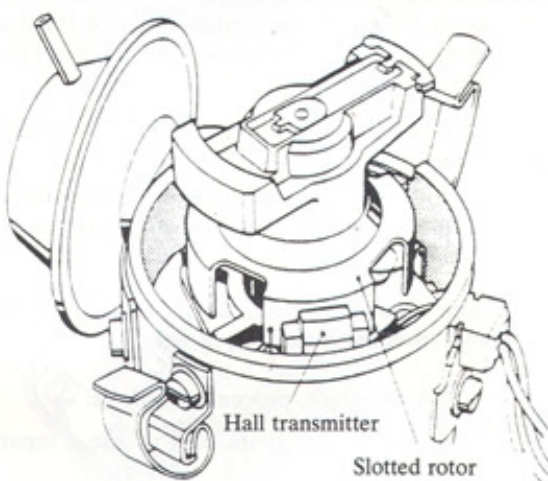
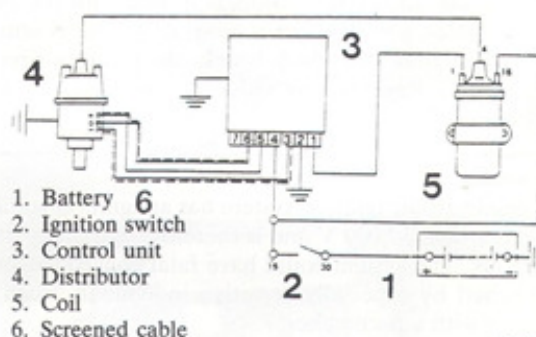
Distributor

The distributor comprises a slotted rotor, which rotates with the distributor shaft, and a Hall transmitter, mounted on a plate inside the distributor. The transmitter consists of a semiconductor and a magnet which energizes the semiconductor. The slotted rotor alternately screens the magnetic field and allows it to pass, thus determining the ignition timing.

Since the Hall transmitter and rotor are not subjected to mechanical wear, the timing is extremely stable.

N.B.

The Hall transmitter and slotted rotor cannot be dismantled. If the transmitter is defective, therefore, the entire distributor must be replaced.



Output unit

The output unit amplifies and converts the signal from the distributor. The amplified and converted signal is then used to control the ignition coil. The output unit also controls the dwell angle. Because of its hybrid design, the output unit is an extremely compact unit. The output unit also incorporates a current-limiting function, which eliminates the need for a compensating resistor.

Operating principle

The charging and discharging of the coil are determined by the position of the slotted rotor in relation to the Hall transmitter.

Charging of the coil

When the rotor cuts the magnetic field, no Hall effect is generated. The signal current to the output unit is high, the primary circuit is therefore closed and the primary winding is charging the coil.

Spark generation

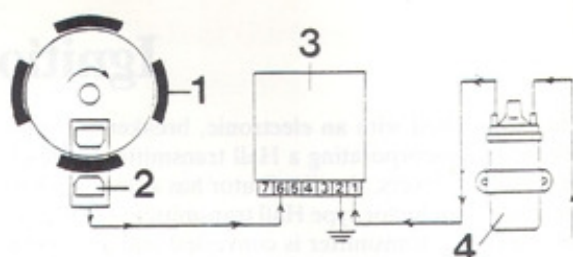
When one of the rotor slots is in line with the Hall transmitter, a Hall effect is generated. This is sensed by the output unit which breaks the primary circuit. Ignition voltage is now induced into the secondary circuit of the coil.

Caution

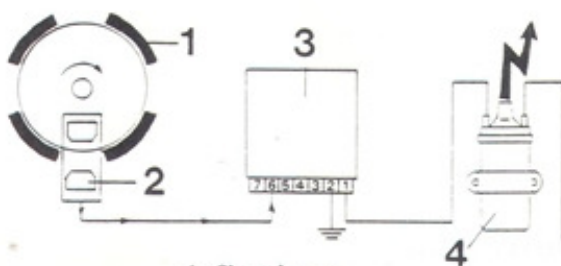
The electronic ignition system has an ignition voltage higher than 30,000 V and is therefore extremely dangerous. The system could have fatal consequences if touched by especially sensitive individuals, such as those with a pacemaker.

Owing to the damage that can be caused by flash-over in the vicinity of the ignition coil, the HT leads, the distributor and the output unit, the following items must be observed.

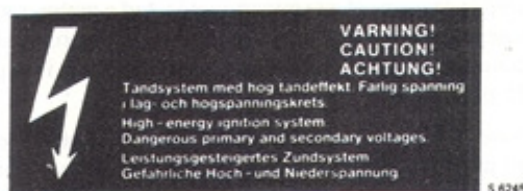
- Never disconnect an HT lead when the engine is running.
- If an HT lead has been disconnected or the distributor cap removed, no attempt must be made to start the engine.
- Before conducting compression tests or the like, always disconnect the output unit.
- To check the spark, proceed as follows:
 1. Unscrew the spark plug or use a separate plug.
 2. Attach the plug lead to the plug.
 3. Make sure that the plug is well earthed by holding it against a suitable component.
 4. Check the spark.



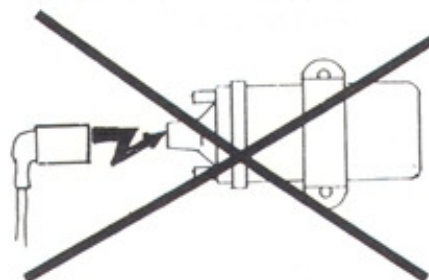
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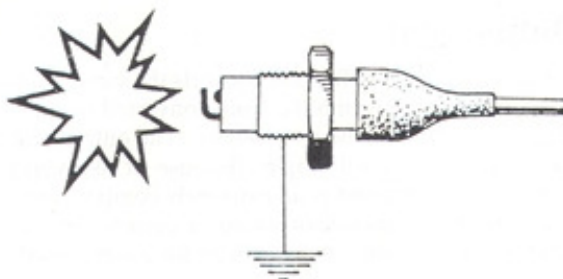
1. Slotted rotor
2. Hall transmitter
3. Output unit
4. Coil



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Checking the ignition timing using an indicator

The engine is equipped for checking of the timing by means of an indicator.

The equipment in the car comprises a pin in the engine flywheel and a service socket in the clutch cover. (Flywheel markings have been retained for measuring by means of a conventional stroboscope lamp.)

The indicator is connected to the clutch cover by means of a special connector and to the plug lead for No. 1 cylinder by means of a terminal.

Ignition service instrument

The ignition service instrument (TSI) is connected to the ignition service socket at the fuse box and by means of an impulse transmitter at the plug lead for No. 1 cylinder. The instrument consists of a tachometer, cam angle meter, stroboscope lamp and switch for operating the starter, and, in later versions, an ignition setting meter with graduated scale.

Caution

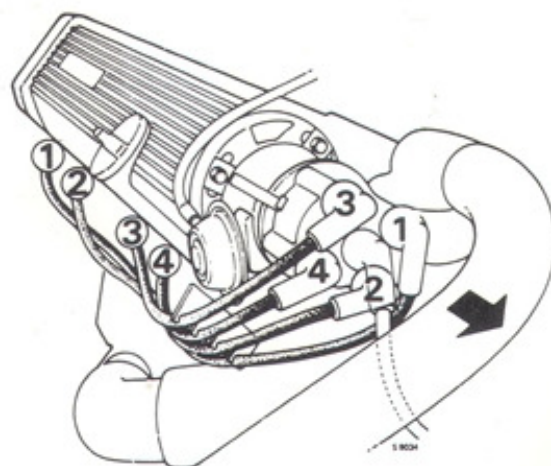
Check that the gear lever is in neutral before switching on the starter.

Since the ignition switch on the car is by-passed when the engine is run by means of the ignition service instrument, the fan is not actuated. If the engine is run for longer periods (more than 10 mins.) the ignition system should therefore be switched on by means of the ignition key. If the engine gets too hot, incorrect values will be obtained for the carbon monoxide content in the exhaust.

Note! The ignition switched on, all other electrical equipment in the ignition switch circuit, as well as the fan, will be on.



Ignition service socket

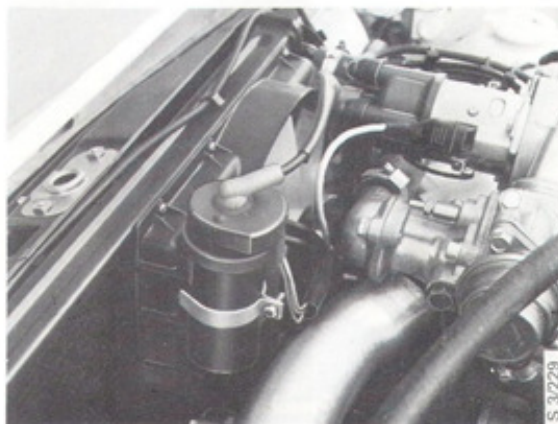


Location of HT leads

The coil

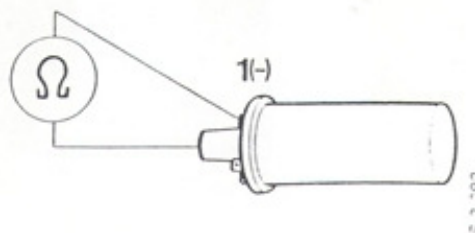
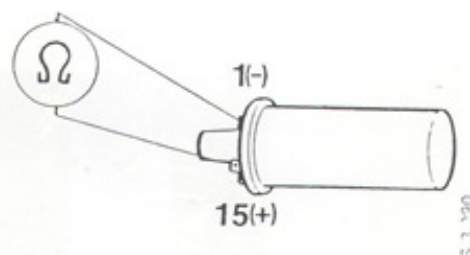
General

The coil is mounted on the radiator fan housing.



Checking the coil

1. Disconnect the electrical leads
2. Measure the resistance between terminals 1 (-) and 15 (+) of the primary winding.
Correct value: 0.52–0.76 ohm
3. Measure the resistance between terminal 1 (-) and the HT output of the secondary winding.
Correct value: 2.4–3.5 ohm
4. Check the performance of the coil by measuring the voltage or the length of the spark.

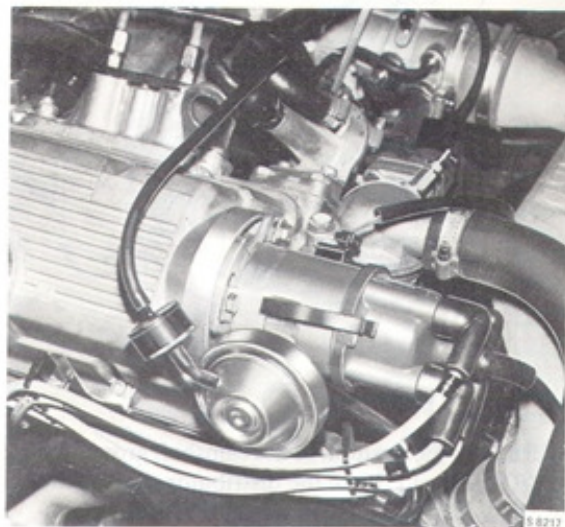


Note

Faults, if present, can often only be detected when the coil has warmed up. In case of doubt, leave the coil connected under load on the test bench for half an hour; it should still function perfectly at the end of this time.

Distributor

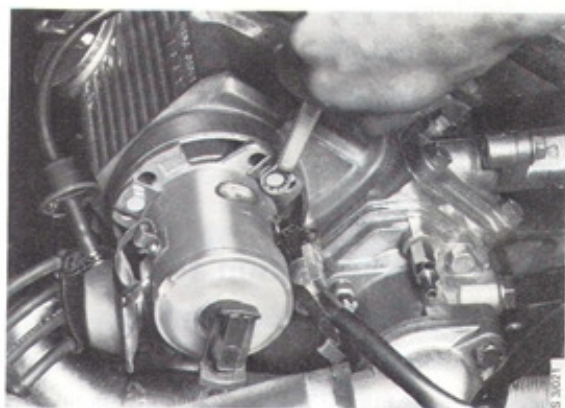
The distributor has both a centrifugal advance mechanism and a vacuum timing control. The centrifugal advance mechanism controls the timing in relation to the engine speed, and the vacuum control unit the timing in relation to the load on the engine. The distributor is mounted on the valve cover.



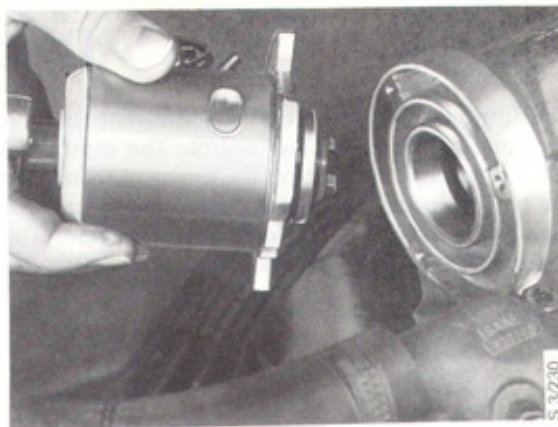
Changing the distributor

To remove

1. Remove the distributor cap.
2. Disconnect the lead to the Hall transmitter.
3. Detach the vacuum hose.
4. Remove the distributor securing bolts.



5. Lift the distributor away from the valve cover.



To refit

1. Check the position of the camshaft groove (Note, Offset) and rotate the distributor shaft so that its dog is in the corresponding position.
2. Push the distributor into position and refit the mounting bolts.
3. Refit the lead to the Hall transmitter and the distributor cap.
4. Set the ignition timing.
5. Tighten the mounting bolts. Re-connect the vacuum hose.
6. Set the idling speed.



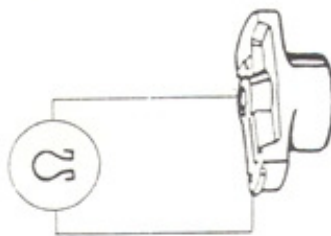
Checking the ignition system

Checking the rotor and HT leads

The resistance of the rotor should be 5 kohm.

The resistance of the HT leads, including connectors, should be as follows:

- Between the coil and the distributor: 0.5–1.5 kohm
- Between the distributor and spark plugs: 2–4 kohm.



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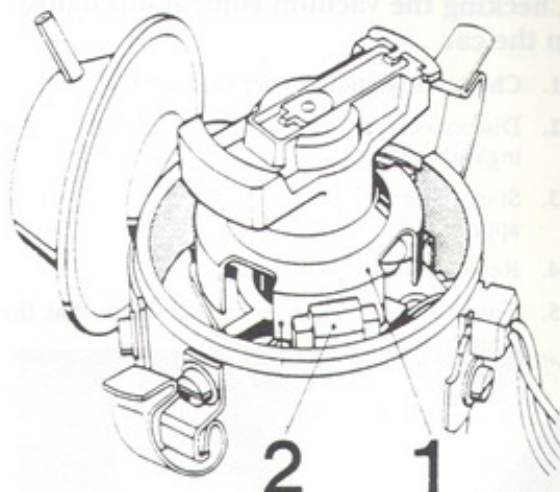
Check

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4. Ch

Model
1985-

Hall transmitter and slotted rotor

The Hall transmitter and rotor cannot be removed. In the event of a fault developing in the transmitter, the entire distributor must be replaced.



S 3 006

Distributor,

1. Slotted rotor
2. Hall transmitter

Checking and adjusting the timing

1. Connect the ignition service instrument (TSI) or equivalent equipment.
2. Disconnect the vacuum hose from the throttle housing/carburetor.
3. Start the engine and have it tick over at 2,000 r/min.
4. Check the timing and adjust as necessary.

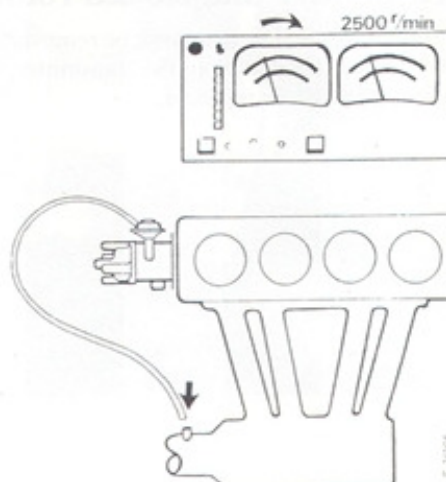
Model	Market	Degrees BTDC
1985-	Europe Sweden + Switzerland	20° 18°



Ignition service socket

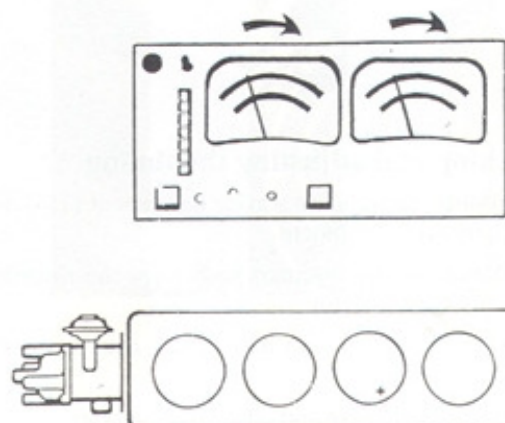
Checking the vacuum control mechanism in the car

1. Check the ignition service instrument.
2. Disconnect the vacuum hose at the throttle housing/carburetor.
3. Start the engine and have it run at a speed of approx. 2,500 r/min.
4. Read off the ignition advance.
5. Connect the vacuum hose and check that the ignition is advanced markedly.



Checking the centrifugal advance mechanism

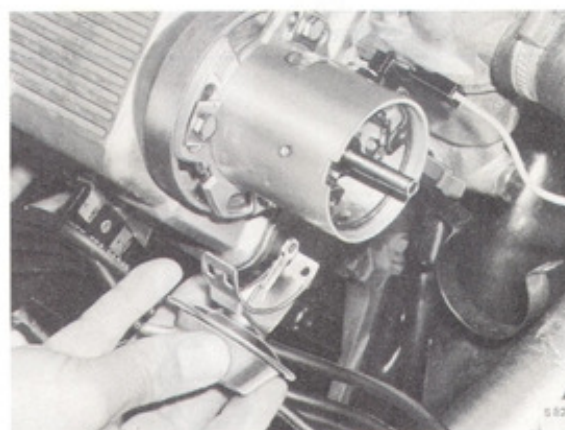
1. Connect the ignition service instrument.
2. Disconnect the vacuum hose.
3. Start the engine and have it run at idling speed.
4. Read off the ignition setting.
5. Increase the engine speed and check that the ignition setting changes.



Changing the vacuum control unit

To remove

1. Remove the distributor cap, rotor and dust shield.
2. Disconnect the vacuum hose and remove the securing screws for the control unit.
3. Lift off the vacuum control unit.



To refit

1. Rotate the pulse transmitter plate clockwise until it reaches the stop.
2. Hook the vacuum control unit onto the pin. This will be helped by rocking the transmitter in the distributor gently back and forth.
3. Fit the securing screws.
4. Fit the dust shield, rotor and distributor cap and reconnect the vacuum hose.

Changing the output unit

Individual components of the output unit cannot be replaced. If a fault should arise in the unit, the entire unit must be replaced. The output unit is mounted on the shelf close to the chassis number plate



Distributor with Hall transmitter

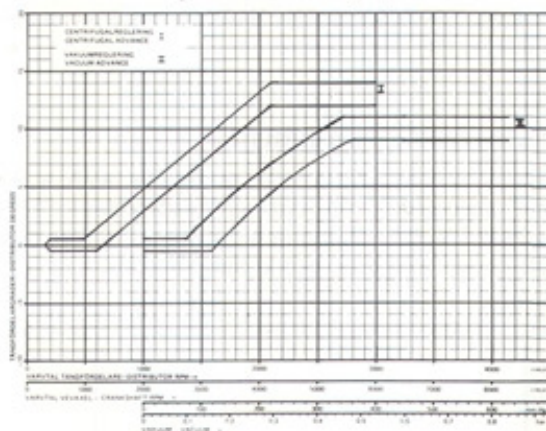
Checking the distributor on a test bench

Carry out the test in accordance with the instructions provided with the test equipment. Refer to the ignition advance graphs for the test values.

N.B.

The distributor rotates at half the speed of the engine.

Ignition advance graph



Bosch 0 237 021 024

Checking the vacuum control

Some considerations of vital importance to work on the electronic ignition system

1. When the engine is running, dangerously high voltage which, in some cases, may prove fatal may be present in the primary circuit of the coil and in all cables connected to terminal 1 (including the sockets for a tachometer, and TSI equipment, and the output unit). This is because the spark energy in the system is considerably higher than in conventional ignition systems.
2. When the ignition is switched on, full primary current will flow through the primary circuit of the coil. Consequently, always disconnect terminal 1(-) on the ignition coil before commencing work with the ignition on.

Fault-tracing

The recommended steps must be performed one at a time and in the stated order. If on inspection components are found to be defective, these must be renewed before any further fault-tracing is carried out. If a fault is known to occur, for example, under certain temperature conditions, always attempt as far as possible to trace faults under similar conditions. Thus, if trouble with starting the car is experienced during cold weather, fault-tracing should be carried out on a thoroughly cold engine. Such procedure is necessary because defective electronic components may operate perfectly under normal temperature conditions before breaking down completely. Bad connections can also be affected by temperature.

Fault-tracing equipment

Ignition setting instrument (preferably with a 90° dwell angle scale); volt-ohmmeter with scales for 15 V d.c. and 5 V a.c., minimum sensitivity of 10 000 ohm/V, 0-5 ohm midscale, 0-5 kOhm midscale.

Fault

Conditions

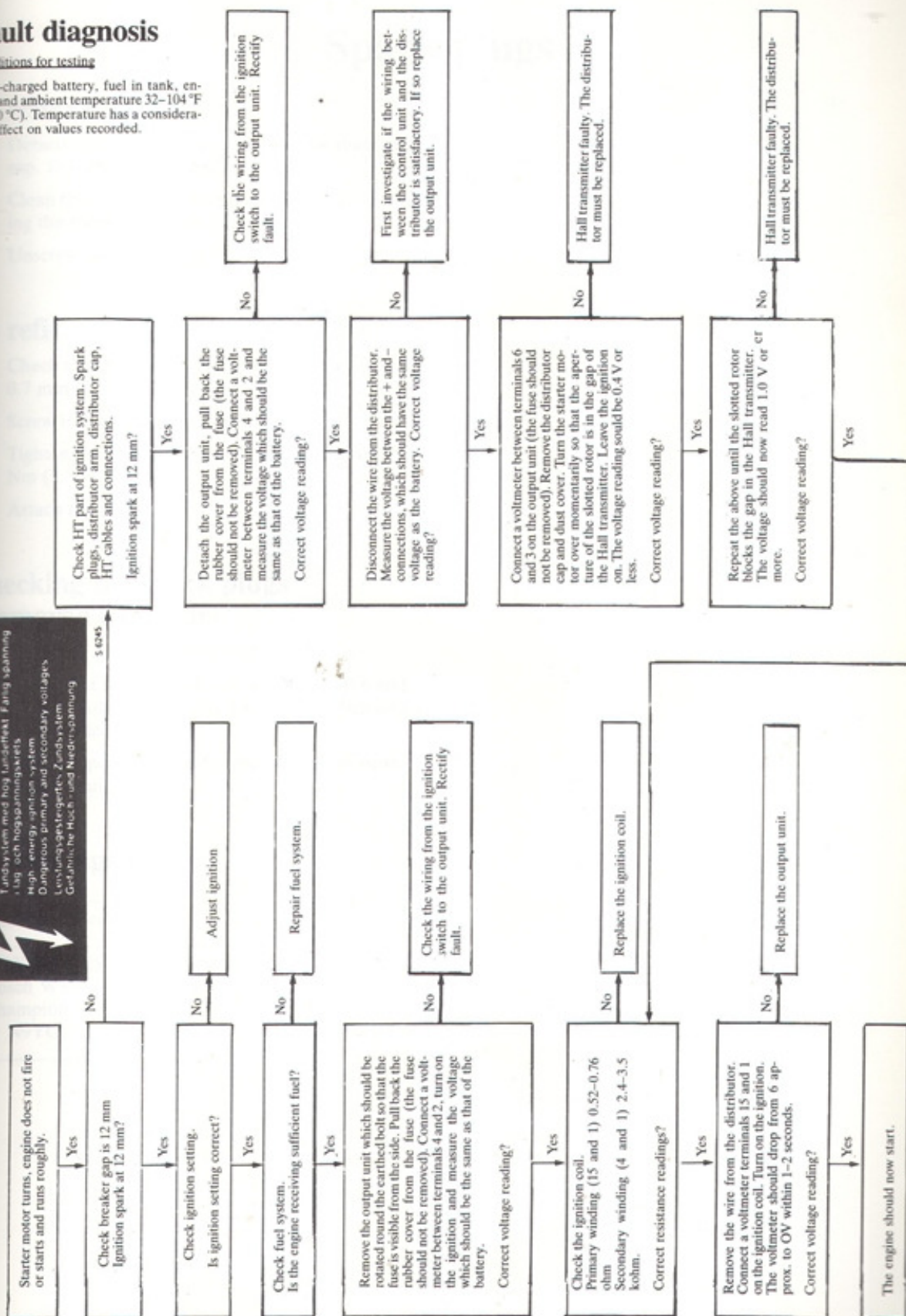
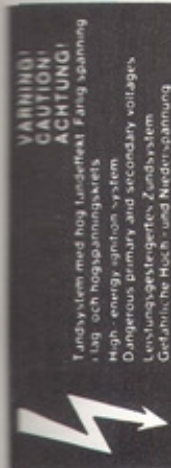
Fully-charged
engine and at
(0-40 °C).
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WARNING!
CAUTION!
ACHTUNG!
Undersystem need not be used! Fully charged
can not be used!

Fault diagnosis

Conditions for testing

Fully-charged battery, fuel in tank, engine and ambient temperature 32-104 °F (0-40 °C). Temperature has a considerable effect on values recorded.



Spark plugs

To remove

1. Detach the plug lead by carefully twisting the cap. Do not pull the lead itself.
2. Clean the surface of the cylinder head surrounding the spark plug using compressed air.
3. Unscrew the spark plug.

To refit

1. Check that the electrode gap is between 0.6 and 0.7 mm.
2. Screw in the plug until finger tight.
3. Tighten the plug to a torque of between 25 and 29 Nm (2.5–3.0 kgf m).
4. Attach the plug lead.

Checking the spark plugs (Removed from car)

1. Clean the spark plug by sandblasting.
2. Check that the electrode gap is between 0.6 and 0.7 mm. Adjust the gap as necessary, by bending the side electrode.
3. Test the spark plug under pressure in pressure-testing equipment.

Spark plugs

Recommended
NGK BP 6 ES
Bosch W7D
Champion N9Y
or N9YC

Interference suppressors

Installation kits are available for certain makes of car radio. These kits include all components for fitting the radio set as well as the necessary interference suppressing components.

The engines are delivered with suppressed ignition cables. Concerning resistance values, see Group 0.

Alternator interference

Permissible additions to alternator:

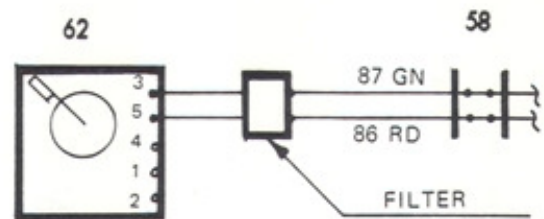
Capacitor 2.2 μ F, mounted on B+ and to earth.

Interference from the windshield wiper motor

Permissible additions to the windshield wiper motor:

Bosch No. 0 290 002 013 (normal interference suppression).

BERU FK 225 (when further suppression is needed).



S 5168

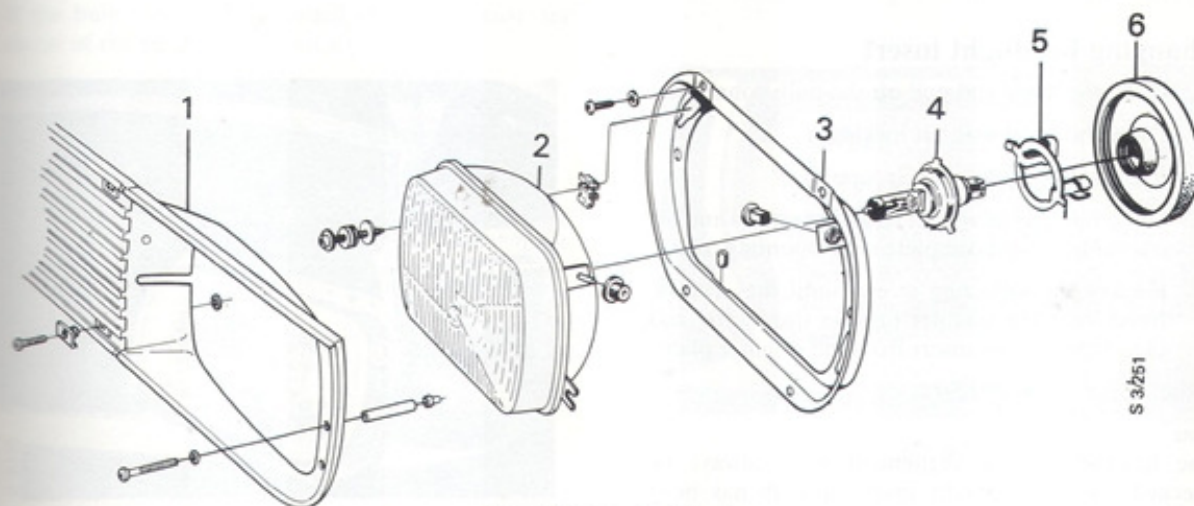
Interference suppressor mounted on windshield wiper motor

Lighting

Headlights

General

The headlights are built into the front sheet. The left and right headlight inserts are identical and freely interchangeable. The headlight bulbs have two filaments for high and low beam respectively; the beam elevation is controlled by the combined headlight dimmer/flasher and direction indicator control lever on the steering column. A light on the instrument panel glows blue when the headlights are on at high beam. The car is fitted with asymmetric headlights.



Headlight, exploded view

1. Headlight trim frame
2. Headlight insert
3. Mounting frame
4. Bulb
5. Bulb retainer
6. Sealing cap

S 3251

Daylight driving lights

A special connector is provided at the fuse box to enable the daylight driving lights to be disconnected. For daylight driving, the headlights come on at low beam and at reduced power. The necessary resistance for reducing the power is incorporated in the wiring loom.

The daylight driving lights are incorporated in the main headlight cluster or cornering lights.

The daylight driving lights are designed to make the car more readily visible during the day when visibility conditions are generally poor as in rain, fog, at twilight, when there are bright oncoming lights, in snow, etc. The daylight driving lights should not be used for driving at night when there is no adequate street lighting.

To safeguard against the driver forgetting to switch the headlights to full power, the headlights are connected in such a way that high beam can only be obtained with the headlight switch on.

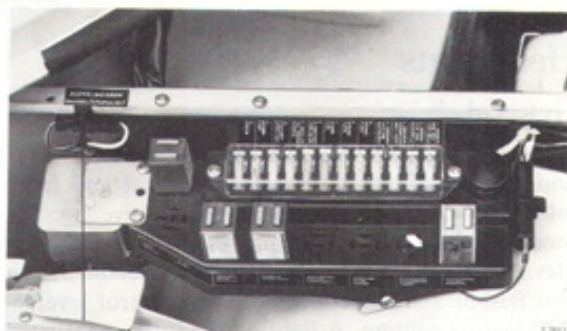
Changing headlight insert

1. Open the hood and pull off the bulb connector.
2. Close the hood without locking it.
3. Remove the grille (see Groupe 8).
4. Undo the four headlight retaining screws and lift out the headlight complete with mounting frame.
5. Slacken the adjusting screws until they can be freed from the retainer lugs on the insert, and then separate the insert from the retainer plate.

Install in the reverse order.

Note

The headlight beam alignment must always be checked after a headlight insert or bulb has been exchanged.



Connector, resistor for daylight driving lights



Removing the headlight

Changing headlight bulbs

The halogen bulbs have almost unchanged light output during the whole time of burning.

It is also essential that the reflectors are undamaged and that the wiring terminals make proper contact.

1. Open the hood and remove the contact housing and rubber sealing cap from the headlight.
2. Push in the bulb retainer and twist it counter-clockwise: the bulb can then be withdrawn.
3. Fit a new bulb, taking care not to touch the surface of the glass with your fingers. Note the position of the three guide shoes and ensure that the bulb is properly in position.
4. Fit the bulb retainer. Make sure that the spring locates the bulb securely in its correct position.
5. Push on the connector. Fold down the edge of the sealing cap making sure that it fits snugly round the bulb retainer and is the right way round.

Note

If the bulb is wrongly oriented in the reflector, the throw of the beam will be wrong.

Aligning right and left asymmetric beams

Headlight beams are normally adjusted with the help of special apparatus, but adjustment can also be made with the lights shining on a wall or screen.

Adjustment with beam aligning apparatus

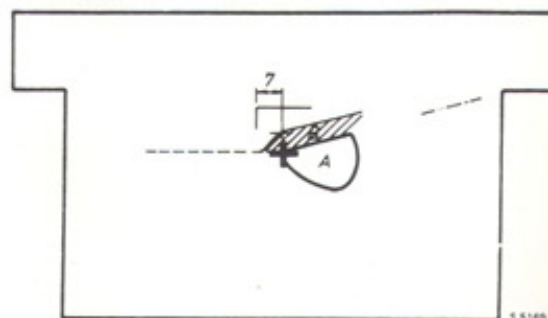
1. Check the tyre pressures and load the car as it would normally be loaded and place the car at right angles to the apparatus. Set the lens of the apparatus to the correct height relative to the headlight and to the correct lateral position relative to the asymmetrical part of the headlight glass.

Caution

If the lateral position is set incorrectly this can completely prejudice the alignment work.



Headlight adjusting screws

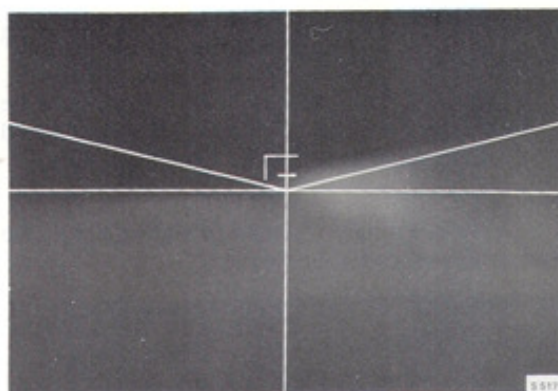


Alignment by means of beam aligning apparatus

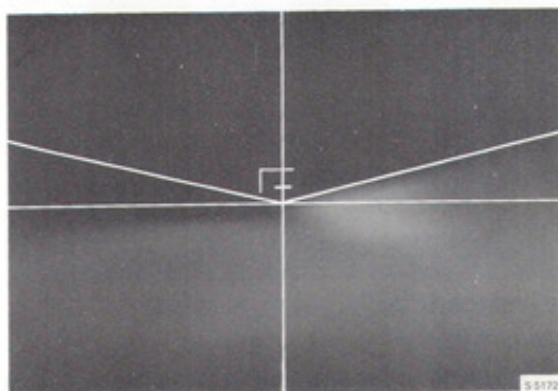
A. High intensity zone

B. Tolerance band, light-dark border

- a. When the apparatus is suspended from above:
Place the left-hand wheels of the car along the line. A maximum deviation of 1.2 in. (3 cm) in the distance of the front and rear wheels from the line is permitted.
 - b. When the beam aligning apparatus is equipped with an aperture:
Place the apparatus in front of one of the headlights, switch on the beam light and turn the apparatus until the beam strikes the same point on the front fenders (measured from the front edge).
2. Switch on the headlight at low beam.
 - a. Adjust the height relative to the left-hand (left asymmetric light: the right-hand) horizontal line. Adjust the vertical alignment using as reference the light-dark border which is between 0 and 1.18 in. (0 and 30 mm) to the left (to the right for left asymmetric light) of the centre line.
 - b. Adjust the lateral setting of the headlight in such a way that the zone with the highest intensity of light (A, see illustration) comes as near the centre as possible. The tolerance band (B) for the light-dark border can be used to obtain the optimum setting.
 3. Check the other headlights in a similar manner.
 4. If difficulty in making the necessary adjustments should be encountered, check the distribution of light from the headlight at full beam and check the seating of the bulbs.



Correct setting



Incorrect setting

Parking, brake and reversing lights, direction indicators and number plate lights

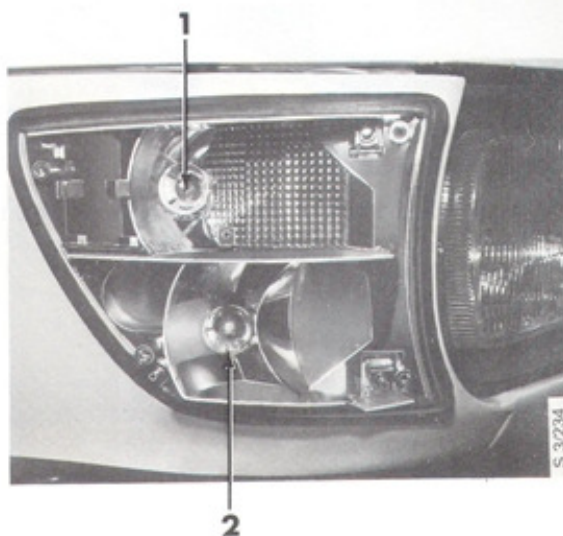
General

The front parking lights are recessed in the front fenders and are combined with the direction indicator lights. The upper part holds the direction indicators. The lower part of the front light contains parking light and daylight driving light in the same lampholder by means of a two-filament bulb. In the rear lights, lamps for rear light, number plate light, brake light, reversing light and direction indicators are mounted.

The brake light switch is mechanical and actuated by the twist rod between the brake pedal link and the servo unit.

Changing the bulbs (front lights)

1. Undo the retaining screws and lift off the glass.
2. Release the bulb from its bayonet fitting.
3. Clean any dirt off the bulb holder and glass.
4. Fit the bulb. Check that the bulb makes good contact, especially the ground contact.
5. Mount the glass.



Changing bulbs, front lights

1. Bulb, direction indicator
2. Bulb, parking light and daylight driving light

Changing the bulbs (rear lights)

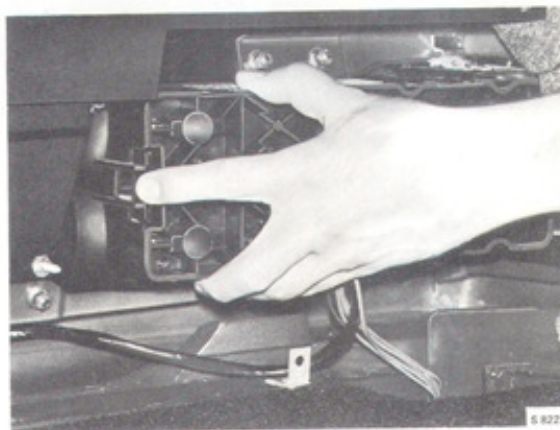
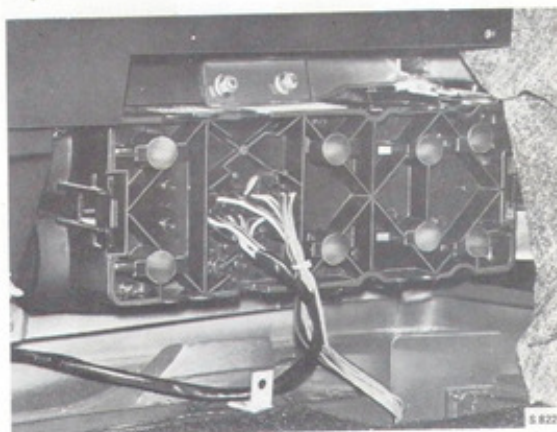
1. Remove the panel covering the rear light unit.
2. Fold back the trim to expose the back of the light unit.

3. Remove the back of the light unit by pressing the plastic catches (one on either side) in towards the centre of the light unit.

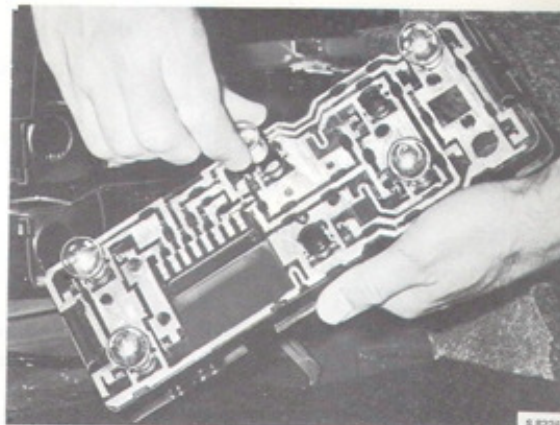


Rear light cluster

1. Direction indicator	21 W
2. Reversing light	21 W
3. Side marker light/reflector	
4. Brake light/trail light	5 W/21 W
5. Tail light/reflector	5 W
6. Rear fog light	21 W



4. Invert the back of the unit and replace the faulty bulb.



Number plate illumination

The two lights for the number plate illumination are fitted on the luggage compartment lid, on either side of the handle.

Remove the glass to gain access to the bulb.



Interior lighting

General

Interior lighting consists of a dome light mounted in the ceiling on the left-hand side and a light mounted on the rear-view mirror. The lights are switched on by either of the two door switches, the switch on the light fitting or by a switch on the gear lever housing.

Changing the dome light bulb

1. Undo the two screws; then the bulb and the glass can be removed.
2. Snap in the new bulb, making sure that it is properly seated in both grips and securely held.
3. Mount the glass and the two screws.

Changing the bulb, rear view mirror

1. Lift off the transparent plastic glass to expose the bulb.
2. Change the bulb and press the glass back into place.

Ignition switch illumination

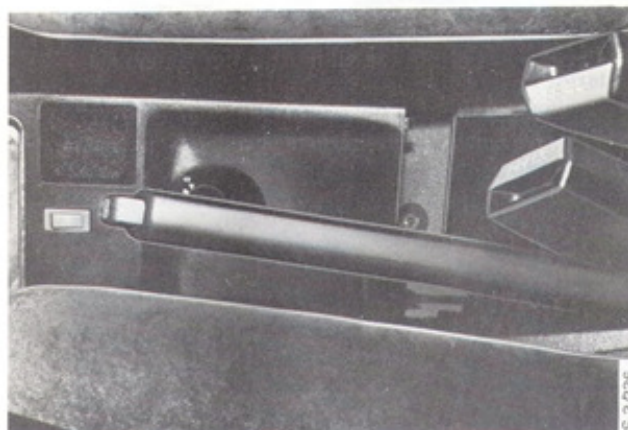
General

The light at the ignition switch is switched on by the two door contacts or by the switch on the gear lever cover.

The light is connected to terminal 15 of the ignition switch.

Changing the bulb

1. Remove the two screws in the front of the centre console.
2. Lift the upper section of the centre console and slide it forward to release the back, and then remove it.
3. To remove the bulb and bulb holder, press it down and guide it through the aperture in the centre console.
4. Replace the bulb with holder in the fitting in the cover
5. Refit the upper section of the centre console.



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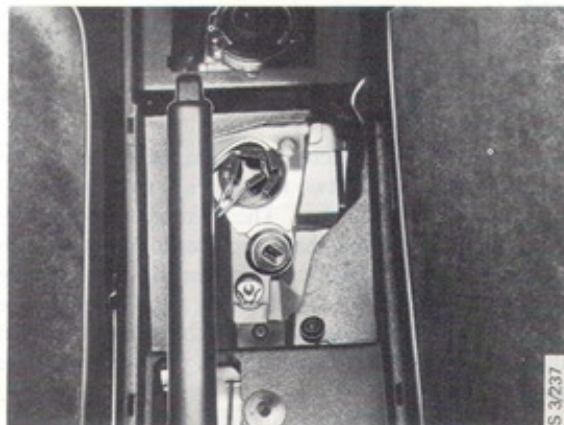
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Luggage compartment

The luggage compartment light, fitted on the left-hand side of the luggage compartment, is switched on and off by a switch located behind the left hinge for the luggage compartment lid. The switch is actuated by the hinge.

To change the bulb

1. Remove the two bulb holder retaining screws and pull the holder slightly forward.
2. Remove the faulty bulb and fit a new one.
3. Refit the bulb holder.



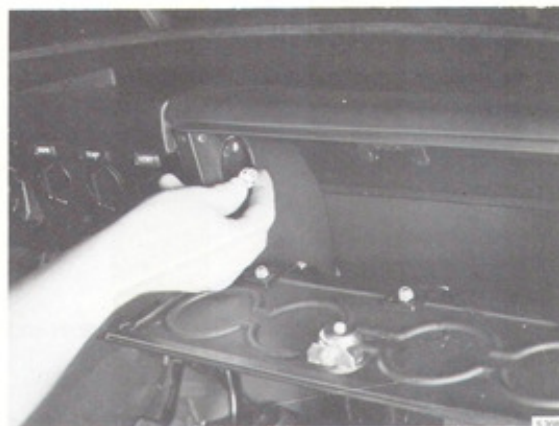
Illumination of controls and switches

General

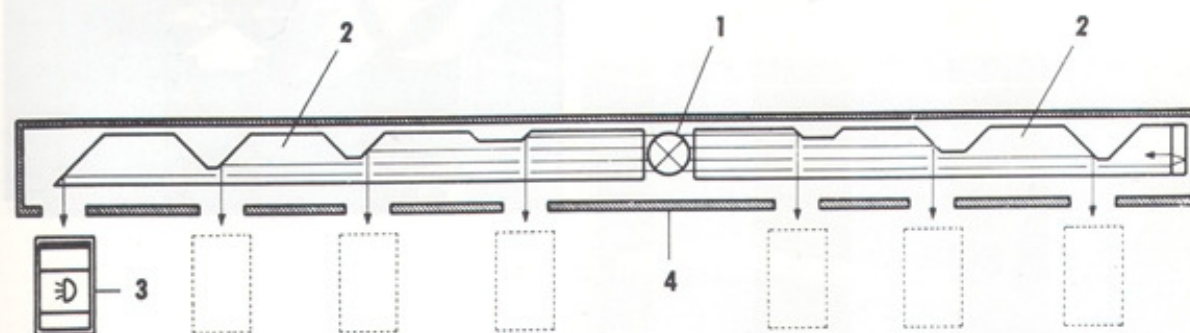
The controls and switches are illuminated by a light bulb located between two refractors in the instrument panel above the switches. The refractors, which are made of acrylic plastic, have recesses in line with each switch, the depth of the recess increasing with distance from the bulb. Light rays striking such a recess are refracted 90° to illuminate the switch through a hole in the panel. The heater controls are illuminated in the same way.

Changing the bulb

The light bulb for the controls and switches is located below the speedometer and can be reached after removal of the screen on the instrument side under the instrument panel. The heater control light bulb can be reached by removing the plastic cover inside the glove compartment.



Changing the heater control light bulb



Illumination of controls and switches (schematic)

S 3140

1. Bulb
2. Refractors
3. Control switch
4. Instrument panel

Direction indicators

General

The direction indicators consist of flashing lights at front and rear. The front ones are combined with the parking lights and flash with an orange light. The rear direction indicators have separate bulbs which also flash with an orange light.

The flasher unit is mounted under the instrument panel and is combined with a control relay which flashes a green light on the instrument to indicate that the direction indicators are on and that both front and rear lights are flashing.

If either light is not working, this can be detected by failure of the indicator lamp to flash and by a faster rate of flashing in the light that is still intact. The rate of flashing is 60–120 per minute when the flasher unit is in normal condition and bulbs of the right power are installed. The flasher unit cannot be adjusted. If other components (switch, wiring and bulbs) are normal, the cause of an abnormal flashing rate lies in the flasher unit, which should then be exchanged.

Note

The flasher will work at abnormal speed if bulbs of the wrong power are fitted.

Self-cancelling mechanism of direction indicator control lever

The play between the actuator and the "tooth" of the lever should be 0.008–0.024" (0.2–0.6 mm) when the lever is in neutral. Adjust the clearance by placing spacer washers between the lever and its mounting bracket.

Note

The actuator must be so placed that its centerline coincides with the centerline of the control lever housing when the front wheels are lined up fore-and-aft.

Horns and horn controls

General

The horns are of the loud-tone type and combine one high and one low note horn.

The horns are located in the front, left corner of the engine compartment: one below and to the left of the headlight and the other behind the spoiler.

Horn controls

The horn is operated by two horn pushes incorporated in the safety padding.



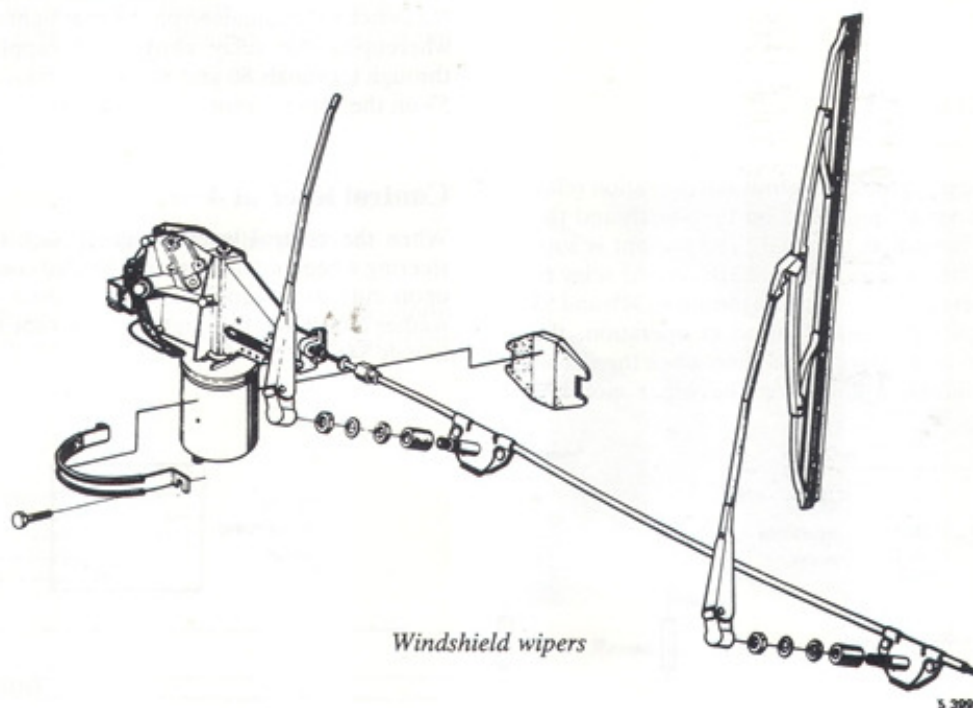
Horn pushes

Windshield wipers and washers, headlight wipers and washers

General

The windshield wiper motor is located on the right side of the dash panel. The movement is transmitted from the motor gear housing via a reciprocating flexible cable to gears attached to the wiper spindles. The cable runs in a steel tube between the wiper motor and the two spindles.

The motor is equipped with a self-parking device so that the wiper blades always come to rest at the bottom of the windshield no matter what position they are in when the motor is switched off.



Wiper/washer circuitry and functions

Control lever in neutral (0)

When the ignition is switched on, current is applied to terminal 53a of the headlight wiper motor and to terminal 4 of the windshield wiper motor. The motors go to the parking position when a spring-loaded contact device in each motor breaks the circuit between terminals 53a and 53 and 4 and 2, respectively. The contact device stops the motors very quickly by cutting in terminal 31b and thereby shorting out the rotor windings. This arrangement is necessary in order to stop the motors during the short time the contact is actuated by the cam; otherwise the motors would continue to run after being switched off, especially when blade resistance is low and the voltage across the motors high.

Control lever at 1

Five-speed cars

Current is supplied to the intermittent operation relay terminal 15b via terminal 53a on the switch and the intermittent operation terminal. The current is supplied intermittently from terminal 31b on the relay to terminal 5 on the wiper motor via terminals 31b and 53 on the switch. After each period in operation, the wipers return to the parking position when the circuit between terminals 4 and 2 on the wiper motor is broken.

Four-speed cars

Spring-loaded position. When the control lever is moved to this position, the wipers will make a single double-sweep.

Control lever at 2

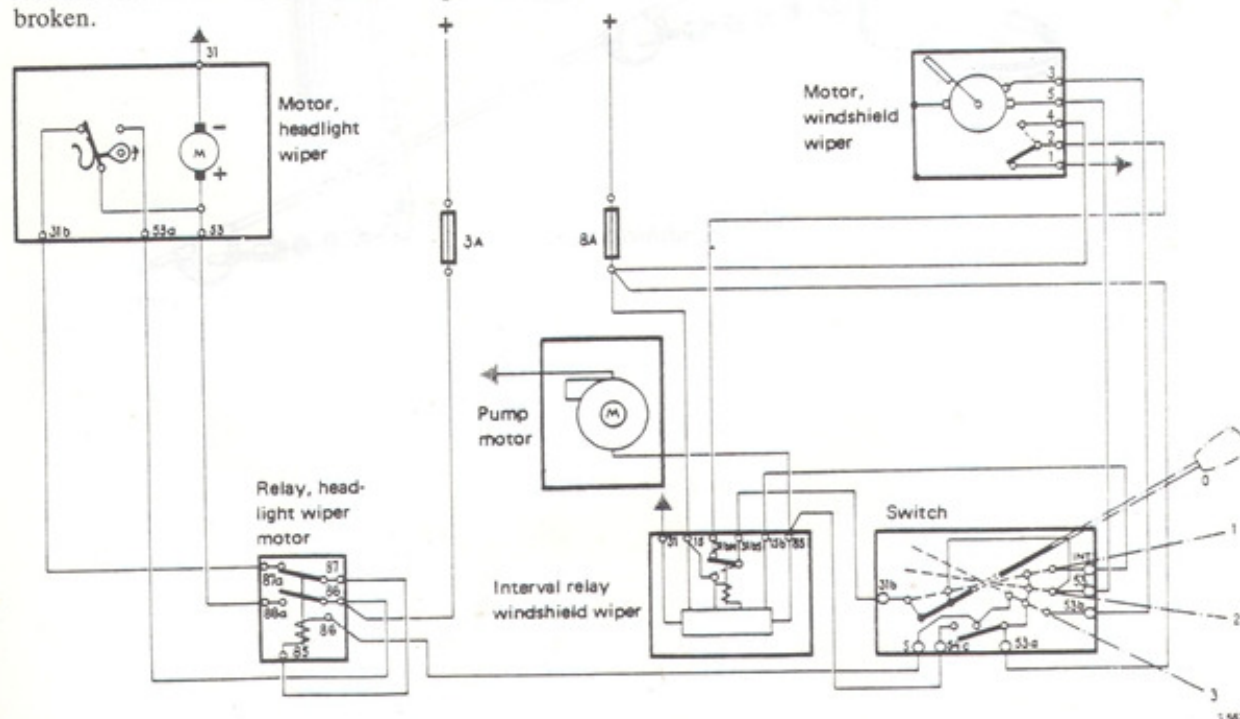
Current is supplied to the windshield wiper motor only (low speed) via terminals 53a and 53 on the switch, to 5 on the wiper motor.

Control lever at 3

Current is supplied to terminal 3 (high speed) on the windshield wiper motor via terminals 53a and 53b on the switch. At the same time, current flows across S on the switch to terminals 86 on the headlight wiper relay, whereupon the relay closes and supplies current through terminals 86 and 88a on the relay to terminal 53 on the wiper motor.

Control lever at 4

When the control lever is pulled back towards the steering wheel, it trips a spring-loaded contact whereupon current is supplied from terminal 53a to the washer motor and headlight wiper motor through terminals 54c and S.



Wiring diagram, headlight wiper and washer with intermittent operation

Windshield wiper motor

Function

In the wiper motor, the drive is transmitted to the flexible cable through a gear housing. The motor is fed from the battery through the ignition contact and via a fuse, the switch and a contact device in the gear housing. This last is in action throughout the greater part of the blade stroke, giving the motor two alternative grounding routes while the wiper switch is on. Each time the blades reach the limit of travel at which they are normally parked, the contact in the gear housing breaks. If the switch is off when this happens, the motor and blades come to rest in that position.

Lubrication

The rotor of the wiper motor is journaled in self-lubricating bearings, and the gear housing is packed with grease at the factory. Regular lubrication is not necessary.

Removal

1. Remove the wiper arms from the wiper spindles.
2. Remove the nut that holds the steel tube to the wiper motor.
3. Release the wiper motor and remove the motor and the flexible cable. (Pull the cable out of the tube).



Removal of wiper motor and flexible cable.

Installation

1. Guide the wiper motor's flexible cable into the tube while twisting the tube so that the gears on the spindles mesh with the cable.
2. Mount the wiper motor in the dash panel and connect it to the steel tube.
3. Test run the wipers and note on which side the spindles rest when the motor is switched off. (This test is made to prevent the wiper arm from moving the wrong direction when the wiper motor is switched on).
4. Fit the wiper arms.

Wiper mechanism

Removal

1. Remove the wiper arms and the wiper motor.
2. Undo the base plates on the spindle housings with a 3/8" wrench so the tubes can be detached from the spindle housings.
3. Undo the retaining nuts on the top of the dash panel and remove the spindle housings. Put the washer and rubber bushings in a safe place.

Installation

1. Mount the spindle housings on the dash panel plate with the rubber bushings, washers and nuts. Do not tighten the nuts.
2. Guide the tubes into their positions between the spindle housings and their base plates.
3. Insert the flexible cable while twisting to facilitate meshing and check that it runs smoothly.
4. Tighten the spindle nuts.
5. Mount the wiper motor on the dash panel and connect it to the steel tube.
6. Test run the wipers and note on which side the spindles rest when the motor is switched off. (This test is made to prevent the wiper arm from moving into the wrong direction when the wiper motor is switched on).
7. Fit the wiper arm.

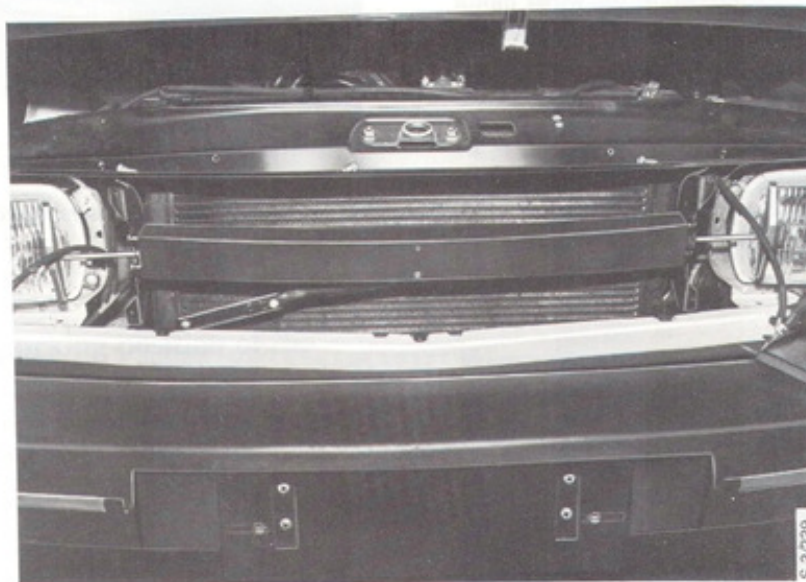
Windshield washer, headlight washer

The washer equipment consists of a liquid container mounted in front of the right-hand wheel housing and an electric pump, mounted in front of the container. The suction side of the pump is connected to the container by means of a hose. A hose runs from the outlet side of the pump and this divides to run to the nozzle in the hood for the windshield, and to the grille for the headlights. A non-return valve is fitted in the hose to the hood to prevent the hose from emptying when the pump is not operating.

Headlight wiper and washer

General

Cars destined for certain markets are equipped with a headlight cleaning system. This consists of a wiper and washer unit powered by separate electric motors which are operated by the same control lever as the windshield wipers and washer.



Headlight wiper mechanism

Wiper motor

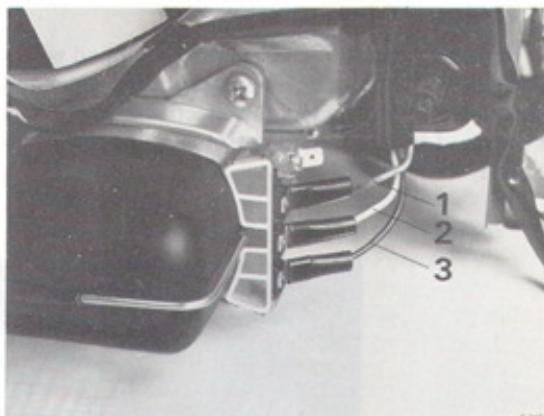
Removing and installing

1. Remove the grille. See group 8.
2. Remove the crank arm from the wiper motor and the nut from the shaft.
3. Remove the battery.
4. Disconnect the wires from the wiper motor.
5. Remove the screw which holds the wiper motor to the fan cover. The motor can then be removed. Take care of the spacers on the shaft.

Install in the reverse order.

Note

The screw in the wiper motor crank arm must be tightened to a torque of 10 Nm (7.2 ft.lb., 1.0 kpm) and locked with Loctite.



Wire connections and colors, headlight wiper motor

1. Red to "53a"
2. Yellow to "31b"
3. Brown to "53"

Note

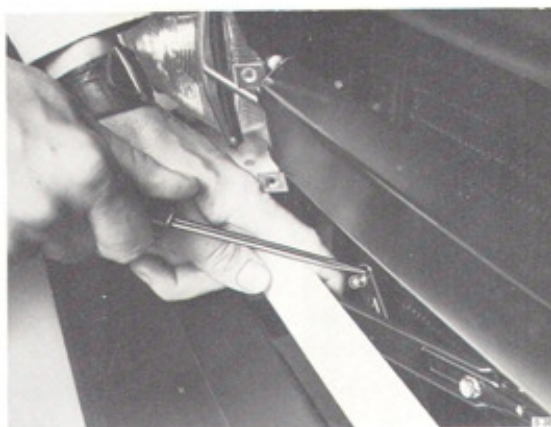
For normal use of the wipers, a fuse for a maximum current of 3 amp. is to be fitted in order to avoid damage to the wiper motor if the wipers freeze onto the glass.

While testing the assembly (dry headlight glass), an 8 amp. fuse may be temporarily fitted.

Wiper mechanism

Removing and installing

1. Remove the grille. See Groupe 8.
2. Prize apart the ball joint between the push rod and the crank arm of the motor.



3. Unhook the springs which hold the wiper shaft bushings to the front sheet.
4. Remove the four screws, holding the protecting cover and remove the cover together with the wiper mechanism.

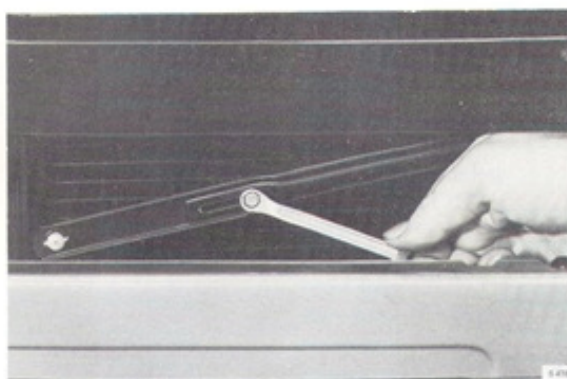
Install in the reverse order.

Before the springs and bushings are fitted, the recesses in the front sheet must be greased *on both sides*.



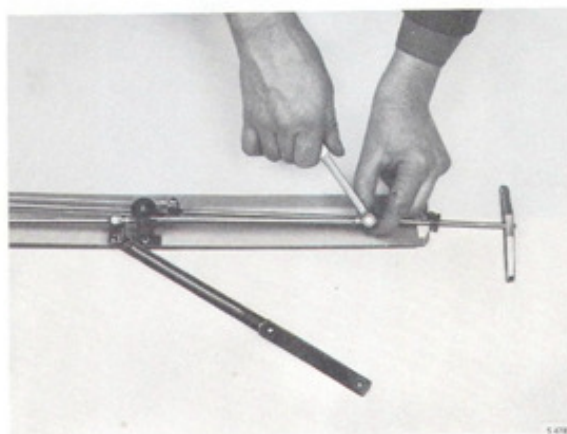
Adjusting the parking position of the wipers

Adjust the parking position of the wipers by altering the length of the push rod.



Adjusting the cord tension

1. Remove the protective cover and wiper mechanism.
2. Adjust cord tension by slackening the set screw in the cord attachment bushings and then moving the bushings to stretch the cords.



Checking the pressure of the wiper blades

Check the pressure of the wiper blades on the headlight glasses and make sure that the bushing does not stick in the recesses in the front sheet. The pressure of the wiper blades, measured in the parked position, must not exceed 3 N (11 oz, 300 p).

CRC 5.56 or similar is a suitable lubricant for the bushings.

Changing wiper blades

1. Release the catch on the wiper shaft and pull off the wiper blade.
2. Fit a new blade on the shaft and secure the catch.

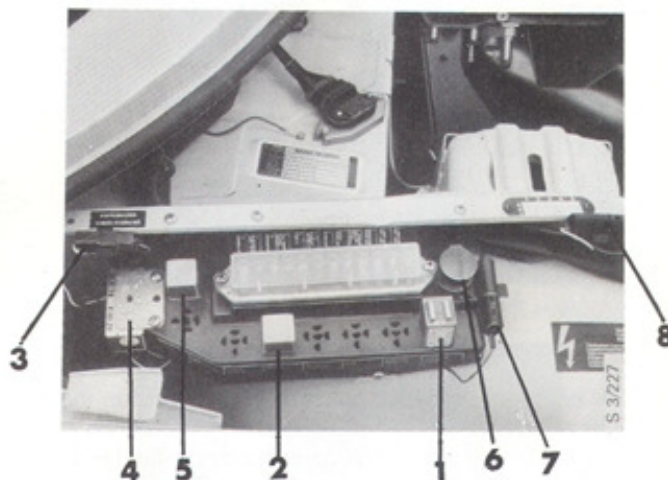


Electrical controls and switches

General

The ignition switch is located on the gear lever console and is combined with the starter switch and gear lever security lock.

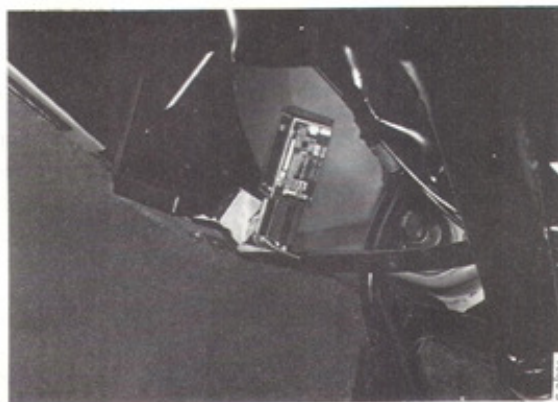
To protect the ignition switch contacts against excessively high currents, an extra relay is fitted. The windshield wipers and washer, the radiator fan relay, the ventilator fan and the reversing lights are supplied with current via this relay, which is located by the fuse box.



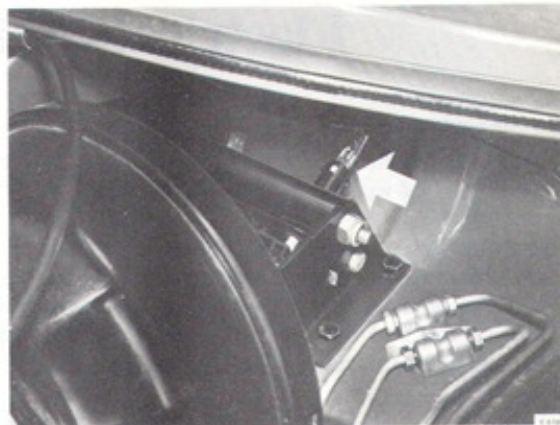
Retainer for fuse box and relays

1. Headlight wiper relay
2. Ignition switch relay
3. Intermittent relay, windshield wipers
4. Lighting relay
5. Relay, electrically heated rear window
6. Service outlet, ignition system (TSI)
7. Fuse for headlight wipers
8. Fuse for rear fog light

The flasher unit is situated on the left under the instrument panel.



The brake-light switch is mechanical and is actuated by the rod between the pedal pivot and the brake servo unit. When the brake pedal is depressed, current flows to the brake lights.



Brake-light switch

The brake warning light switch is incorporated in the filler cap of the brake fluid container. The switch is actuated by a float which is governed by the fluid level in the container. In the event of the fluid level falling below a preset limit, the switch closes and the warning light comes on.

To check the operation of the warning function, depress the centre of the filler cap to move the float mechanically.



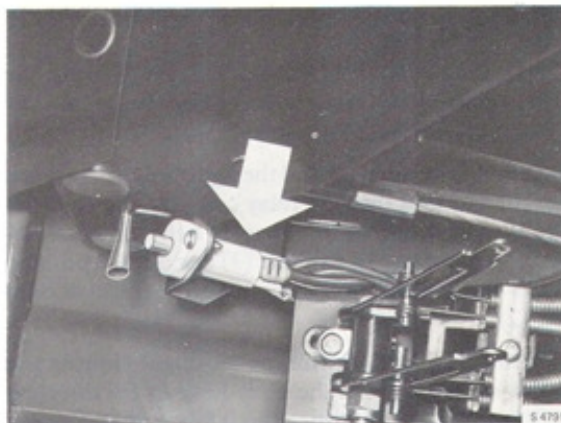
Brake warning light switch

The reversing light switch is located to the left of the gear lever under the console and is tripped by the gear lever when reverse gear is engaged, causing the reversing lights to come on.



Reversing light switch

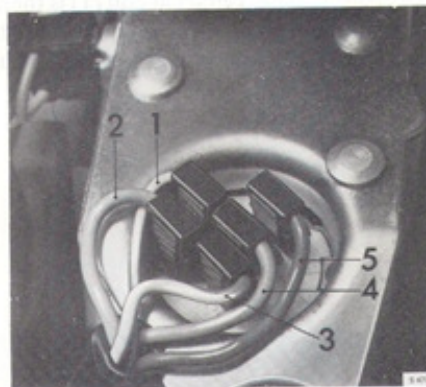
The switch that operates the handbrake warning light is located on the left of the handbrake lever under the console and is actuated by the movement of the handbrake lever.



Handbrake warning light switch

Ignition and starter switch

The ignition and starter switch is mounted in the gear lever housing. The switch has five terminals and the wires should be connected as shown in the picture.



Starter switch

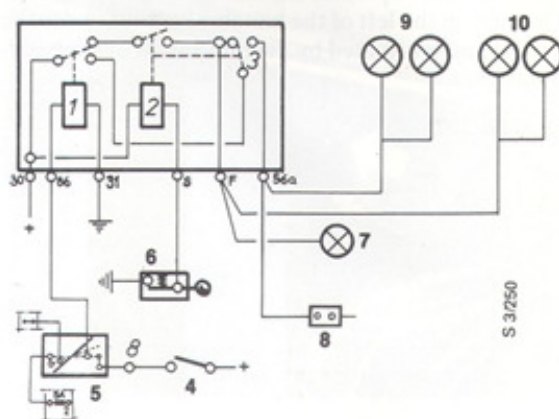
1. Brown/white to "54"
2. Yellow to "50"
3. Green/white to "15"
4. Grey to "30"
5. Red to "X"

Lighting relay

The lighting relay contains devices for flashing the high beam and switching between high beam and low beam. Function (see wiring diagram):

If the ignition switch (4) and the light switch (5) are on, current will pass through relay coil (1). The coil contact is pulled down and connects either high or low beam via contact (3). Contact (3) can change position as it is mechanically influenced by the contact at relay coil (2).

This coil is connected with the headlight dimmer and flasher switch (6) (i.e. the same lever as the direction indicator switch). If either the ignition switch or the light switch – or both – are switched off, the high beam signal can be used. The contact at coil (1) is then in the upper position and high beam is connected through the contact at coil (2), which is grounded through the light switch.

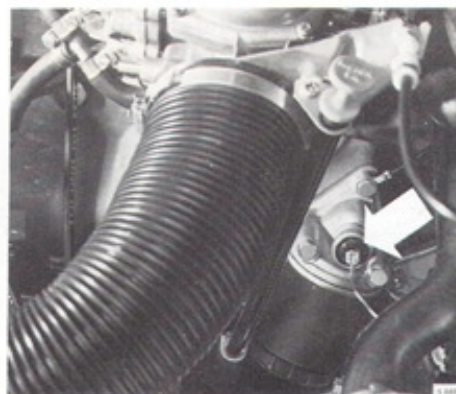


Wiring diagram, lighting relay and daylight driving light relay

1. Relay coil
2. Relay coil
3. Switching contacts
4. Ignition switch
5. Light switch
6. Low-beam/high-beam switch
7. High-beam warning light
8. Connector for daylight driving lights
9. Low beam
10. High beam

Oil pressure switch

The oil pressure switch is located on the oil pump adaptor casing.



Oil pressure switch

Removing

1. Pull off the lead.
2. Unscrew the oil pressure switch (width across flats 7/16").

Installing

1. Screw in the oil pressure switch and tighten to 12–15 Nm (9–11 lbf.ft. 1.2–1.5 kgf.m) torque.
2. Connect the wire.

Note

Coat the threads with sealant compound before installing.

Temperature gauge transmitter**To remove**

1. Drain the radiator and engine coolant system.
2. Pull off the lead.
3. Unscrew the transmitter (width across flats 1/2").

Installing

1. Screw in the transmitter.
2. Connect the lead.
3. Fill the system with coolant.
4. Warm up the engine and check the temperature transmitter deflection.
5. Check the coolant level and top up if necessary.

Warning system for unfastened seat belt

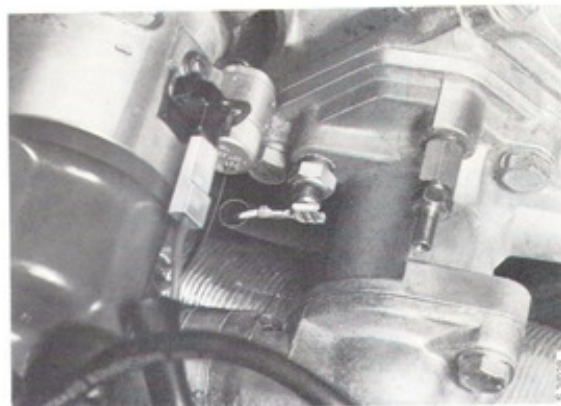
A warning lamp on the instrument panel lights up if the driver and/or the front seat passenger has not fastened his seat belt.

The following components are included in the warning system:

Warning lamp – in the middle of the panel
Switch in seat cushion.
Switch in buckle.

With the ignition on, the warning light will come on if:

- a. the driver has not fastened his seat belt.
- b. the switch in the passenger seat cushion has been activated but the seat belt not fastened.



Temperature gauge transmitter

Wiring and fuses

Wiring

The wiring conducts current from the battery or alternator to the various items of electrical equipment. To protect the wiring and reduce the risk of short circuits, the wires have been grouped wherever possible in cable looms, i.e. a number of independently insulated wires surrounded by an outer plastic sheath.

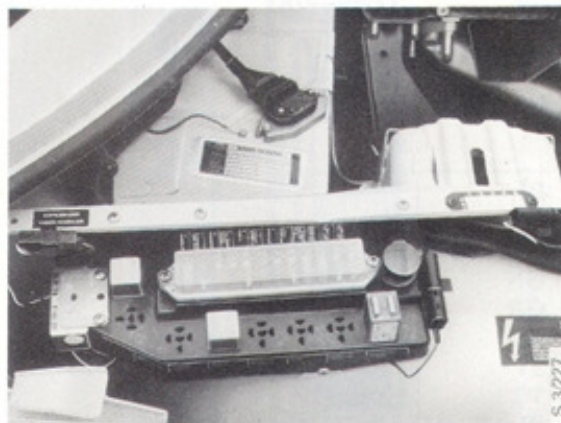
Wiring connections, sizes and colour codes are shown on the wiring diagram and the replacement of cables should not be difficult if this diagram is used as a guide. Always refer to the diagram before starting any work on the wiring. The leads in the wiring networks are colour-coded.

The wires terminate in solderless AMP connectors. Check that wiring is properly connected to avoid undue potential drop. The insulation of the cable looms should be tested if fuses blow frequently and damage to the insulation is suspected. Note that a fuse will not blow if a short occurs between it and the current. When installing new wiring, always take special care to make sure that the size of wire chosen can handle the current load for which it is intended, and that the wiring is well protected from wear and damage at points where it passes through partitions or is held by clamps.

Fuses

To protect wiring, etc. against abnormally heavy current loads, e.g. in the event of a short circuit, and to reduce the fire hazard if this should occur, the electrical system is provided with fuses grouped in a fuse box on the right wheel housing in the engine compartment. All parts of the system are fused except the headlights and the ignition system. A label by the fuse box shows which fuses protect which circuits.

Apart from these fuses there is a 3 A fuse for the headlight wiper system. This fuse is mounted in a special holder secured by a clip on the fuse box.



Position of fuses

Fuse No.	Circuit/component protected	Amperage
1.	LH rear and parking lights	5
2.	RH rear and daylight driving lights	5
3.	Horn, reversing lights	8
4.	Wipers, washers, instruments	8
5.	Electrically-heated seat, rear window heating, warning light	16
6.	Heater fan	16
7.	Radiator fan	16
8.	Electrically-heated rear window	16
9.	Cigarette lighter, clock, interior lighting	8
10.	—	—
11.	Direction indicators, hazard warning lights	8
12.	Brake lights	5
13.	Rear fog lights	5
14.	Headlight wiper	3

Important

The 5 A, 8 A, 16 A and 25 A fuses are the same length, and might easily be mistaken for each other. If a heavier fuse than the correct one should be fitted by mistake, there will be a risk of electrical components and wires being damaged.

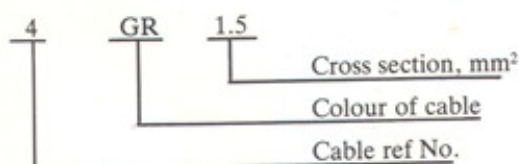
Note

Always check when putting in a new fuse that it makes proper contact. If a break in any circuit is suspected, check the fuse contacts first. If the test is made with a voltmeter, the maximum permitted potential drop is 0.1 V.

Wiring diagram

Colour code

BL	Blue
BR	Brown
GL	Yellow
GN	Green
GR	Grey
RD	Red
SV	Black
VT	White
BL/VT	Blue/white
BR/VT	Brown/white
GN/VT	Green/white
RD/VT	Red/white

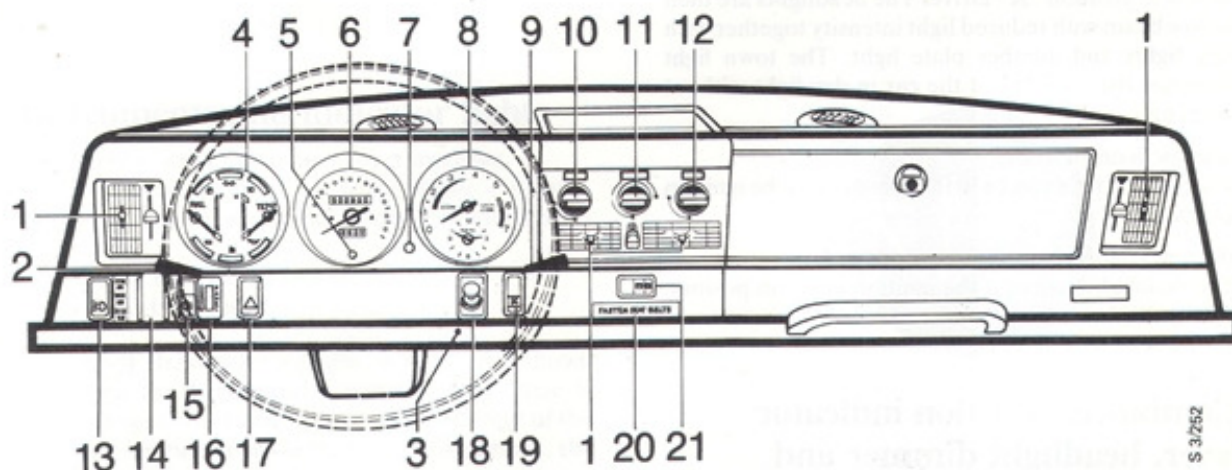


Note

The arrangement of components shown on the wiring diagram does not indicate their actual locations in the car.

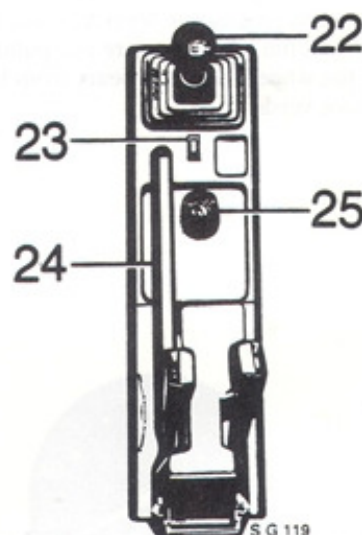
Instruments and controls

General



Controls and instruments

1. Fresh air vents.
2. Combined direction indicator lever, headlight dimmer and headlight flasher switch.
3. Horn control
4. Combination instrument.
5. Zero button for trip meter.
6. Speedometer.
7. Clock adjustment button.
8. 4-speed, clock. 5-speed, revolution counter and clock
9. Windshield wiper and headlight wiper and washer control.
10. Defroster control for windshield and front side windows.
11. Temperature control.
12. Ventilation control for front seat floor.
13. Headlight and parking light switch
14. Choke with warning light
15. Switch, rear fog light
16. Rheostat for instrument and control illumination
17. Hazard warning flasher switch
18. Cigarette lighter
19. Ventilator fan switch
20. Warning light, seat belts
21. Switch for electrically heated rear window.
22. Gear lever
23. Interior lighting switch
24. Handbrake lever
25. Ignition and gear (selector) lever lock



Manual
gear box

Headlight and parking light switch (13)

The tangent switch has three positions:

Top pushed in:

The town light (only Sweden, Norway and Denmark) is automatically turned on when the ignition key is turned to position "K" Drive. The headlights are then on low beam with reduced light intensity together with rear lights and number plate light. The town light increases the visibility of the car in day-light without dazzling.

Intermediate position:

The parking light can be lit independent of the ignition key position.

Bottom pushed in:

The headlights are lit if the ignition key is in position "K" or "G".

Combined direction indicator lever, headlight dimmer and flasher switch (2)

To signal a turn, move the lever down for left, up for right.

When the headlights are switched off, you can flash the high beam pulling the lever towards the steering wheel. When the headlights are on, pulling the lever towards the wheel shifts the beam from high to dimmed or vice versa.



Direction indicator, headlight flasher and dimmer switch

1. Left direction indicator
2. Right direction indicator
3. Headlight dimmer and flasher switch

Instrument lighting switch (16)

The instrument lighting can be regulated variably with a rheostat switch.

The instrument lighting cannot be turned on unless the parking lights or headlights are lit.

Hazard warning signal switch (17)

All direction indicator lights flash together when the button is pushed in. The hazard warning signal must only be used when the car is immobilized by accident, breakdown, etc. in a position where it is liable to endanger or obstruct traffic.


Instruments and indicator lights


- A. Combination instrument (4) comprising:
TEMP Temperature gauge for engine coolant.
The green zone indicates normal running temperature.
TANK Fuel gauge
FUEL Fuel gauge


(P) Brake warning light. A red light is shown when the handbrake is applied, or if there is leakage in the braking system. In the event of the light lighting up while the car is being driven, the cause should be investigated immediately and any faults or damage repaired as soon as possible by an authorized Saab dealer.

↔ Direction indicator repeater light. Flashes green in time with the direction indicators.

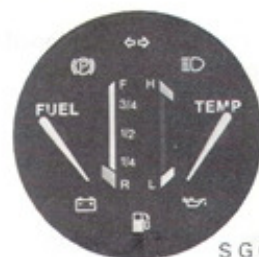
 High beam warning light. Shows a blue light when the headlights are on high beam.

 Charge indicator light. If this light glows yellow, the alternator is not charging.

 **Fuel reserve warning light.** Shows a steady orange glow when the quantity of fuel remaining in the tank is less than 2 imp. gal. (10 litres).

 Oil pressure warning light. Glows red to indicate dangerously low oil pressure or oil level. If it lights up while you are driving, switch off the engine at once and investigate the cause.

- B. Speedometer, odometer and trip meter (6).**
The trip meter resetting button is located at the bottom of the speedometer.



S G 052



S G 053

- C. Clock (8). The setting button is located to the left of the clock dial.

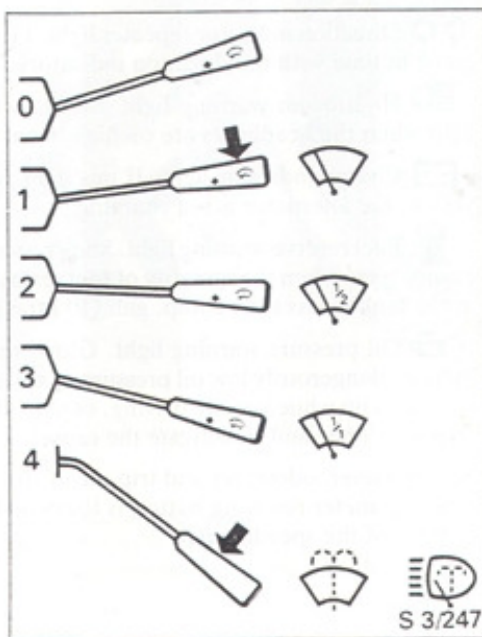


- D. 5-speed car models are equipped with a tachometer incorporating a clock.



Windshield and headlight wiper and washer control (9)

0. Neutral position
1. Windshield wiper 4-speed cars. Spring loaded position.
When the lever for a short instant is moved to this position the wipers make one double stroke.
5-speed cars, interval position.
2. Windshield wipers, low speed.
3. Windshield wipers, high speed.
4. Windshield and headlight washers, headlight wipers.
The washers will operate for as long as the lever is held in the springloaded position towards the steering wheel.



Ventilator fan switch (19)

The switch has two positions, first for half speed and second for full speed.

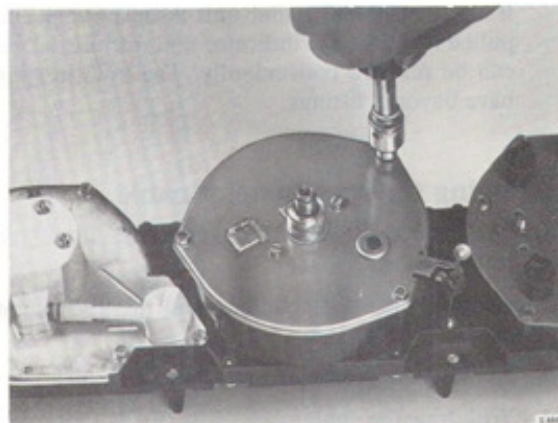
Instruments

Removing the instrument panel

1. Remove the safety padding (see description in Group 8).
2. Undo the four self-tapping screws that secure the panel.
3. Disconnect the speedometer wire and the electric wiring to the clock and combination instrument. Pull out the instrument illumination bulb holder. The instrument set can then be lifted out.

The instruments or the clock can then be separated from the panel by removal of the retaining screws.

Any repairs or adjustments to the instruments should be carried out by a specialist workshop.



Removing instruments from the unit

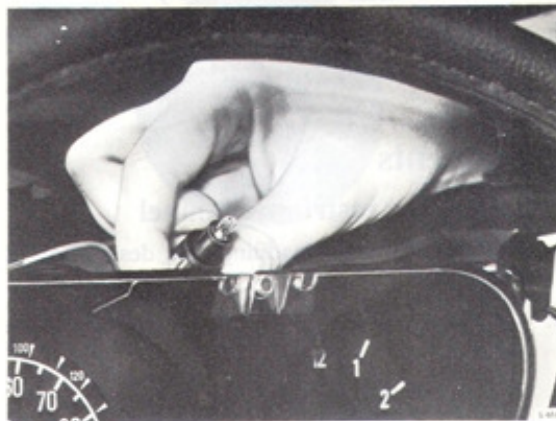
Install

Reassemble and reinstall the instrument unit in the reverse order.

Changing light bulbs

A. Instrument illumination.

The two bulbs can be reached after removal of the safety padding (see Group 8).



B. Warning and indicator lamps.

If the instrument panel unit is unscrewed and pulled forward, the indicator and warning lamps can be reached conveniently. The bulb holders have bayonet fittings.

Changing the speedometer cable

1. Disconnect the speedometer cable from the transmission.
2. Remove the safety padding and the instrument unit.
3. Remove the grommet from the dash panel.
4. Withdraw the cable.

Assembly is carried out in the reverse order.

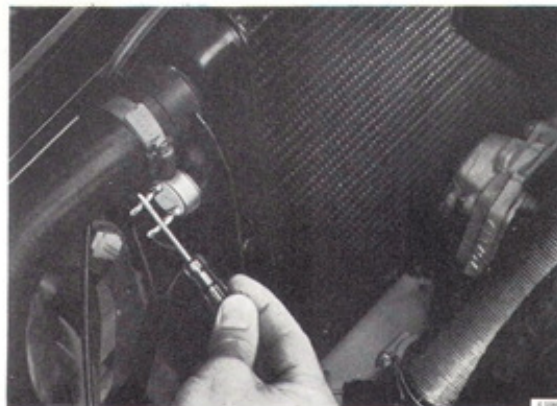
Radiator fan

General

The radiator fan is driven by an electric motor and is located behind the radiator. The fan is thermostatically controlled. The thermostat switch is located on the left of the radiator fan will be found in Group 2.

Checking operation of radiator fan

To check the operation of the radiator fan, switch on the ignition and hold a screwdriver across the two terminals. The fan should then start. Exchange the thermostatic switch if defective.



Checking radiator fan operation

Fuel level transmitter

The fuel level transmitter consists of a float which deflects the fuel gauge via a lever and a contact. When the volume of fuel in the tank falls below about 2 imp. gal. (10 liters) a warning light in the fuel gauge lights up.

The transmitter is located on top of the fuel tank and is accessible for adjustment or repair when the trunk floor covering and floor are removed.

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Saab Car Division
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