

Engine temperature gauge

The engine temperature gauge system has two main parts: a temperature gauge on the dashboard and a temperature sender in the engine block.

The temperature sender consists of a temperature-sensitive semi-conductor. The resistance through the sender reduces as the temperature of the engine rises.

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

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

The magnetic force which arises at these coils attracts the armature plate so that the pointer points to 40°C (104°F) or less.

When the engine coolant temperature starts rising (the resistance in the sender reduces), more and more current passes through the coil connected in series to the sender. The magnetic force which arises attracts the gauge pointer armature plate in the opposite direction to previously. The gauge pointer moves on the dial, and thus indicates the temperature, in relation to the amount of current flowing through the coils. The amount of current flowing through the coils is determined by the temperature of the coolant.

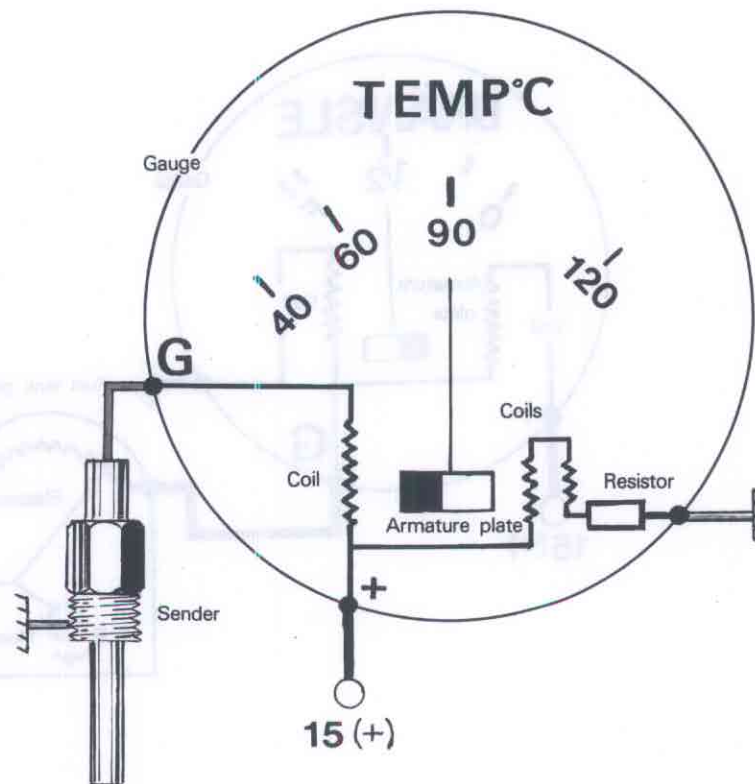


Fig. 38-3. Temperature gauge with sender, layout diagram

Fuel gauge

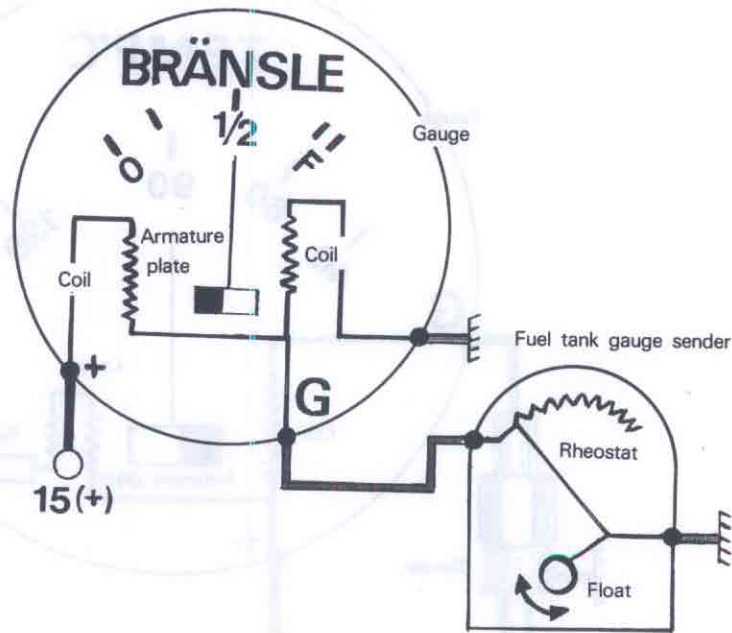
The fuel gauge system, see Fig. 38-4, has two main parts: fuel gauge on the dashboard and a tank gauge sending unit in the fuel tank.

The tank gauge sending unit consists of a float which is in contact with a contact plate via a lever. The contact plate slides over a rheostat. When there is more or less fuel in the tank (the fuel level rises or drops) more or less of the rheostat coils are in circuit.

The fuel gauge has two coils, which function as solenoids. The gauge needle armature plate is attracted to whichever of the two coils has the greatest magnetic force, and this in turn will depend on how much current is flowing through either of these coils, see Fig. 38-4. If, for example, the magnetic force is the same in each coil, then the gauge pointer indicates that the tank is 1/2 full. The fuel tank indicator unit determines how much current will flow through the coil.

Ex: When the float is at the bottom position (the tank is empty), then there is little resistance in the rheostat. Most of the current will then flow through the coil which is connected in series to the rheostat, and only a little part of the current flows through the coil which is connected to the vehicle chassis.

When the float is at its top position, then there is great resistance in the rheostat. Most of the current will then flow through the coil which is connected to the vehicle chassis.



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Fig. 38-4. Layout diagram of fuel gauge and fuel tank sending unit

- 1 Coil
- 2 Armature plate
- 3 Coil
- 4 Gauge
- 5 Fuel tank gauge sender

Solenoid, front-wheel drive

The electrical system which operates the mechanical engagement of the front-wheel drive comprises the following components: solenoid, switch, contacts and indicator light, see layout diagram, Fig. 38-5.

When the ignition is switched on, current flows through the solenoid winding, the pressure contact in the transfer box, the push-push switch on the instrument panel and then to the push contact on the brake line to the vehicle chassis. The current circuit is closed and the armature in the solenoid has been pulled to its top position. When the current circuit is opened, the armature in the solenoid goes to its lowest position and this engages the front-wheel drive.

As the above shows, this engaging and disengaging the front-wheel drive will depend on whether there is current through the solenoid winding or not. The front-wheel drive can thus be operated with:

- Ignition. With the ignition key in neutral, the current is broken and front-wheel drive is engaged. When the key is turned, the front-wheel drive is disengaged, providing that the contacts and switches are in the position shown in Fig. 38-5.
- Gear lever. When a low gear is engaged, the contact breaks the auxiliary gearbox current and the front-wheel drive engages.
- Panel switch. Pushing in the switch breaks the current circuit and engages the front-wheel drive.
- Brake pedal. When the brake pedal is depressed and the hydraulic pressure in the pressure switch exceeds 0.8–1.0 MPa (8–10 kgf/cm² = 11–14 lbf/in²), the current circuit is broken and the front-wheel drive is engaged.

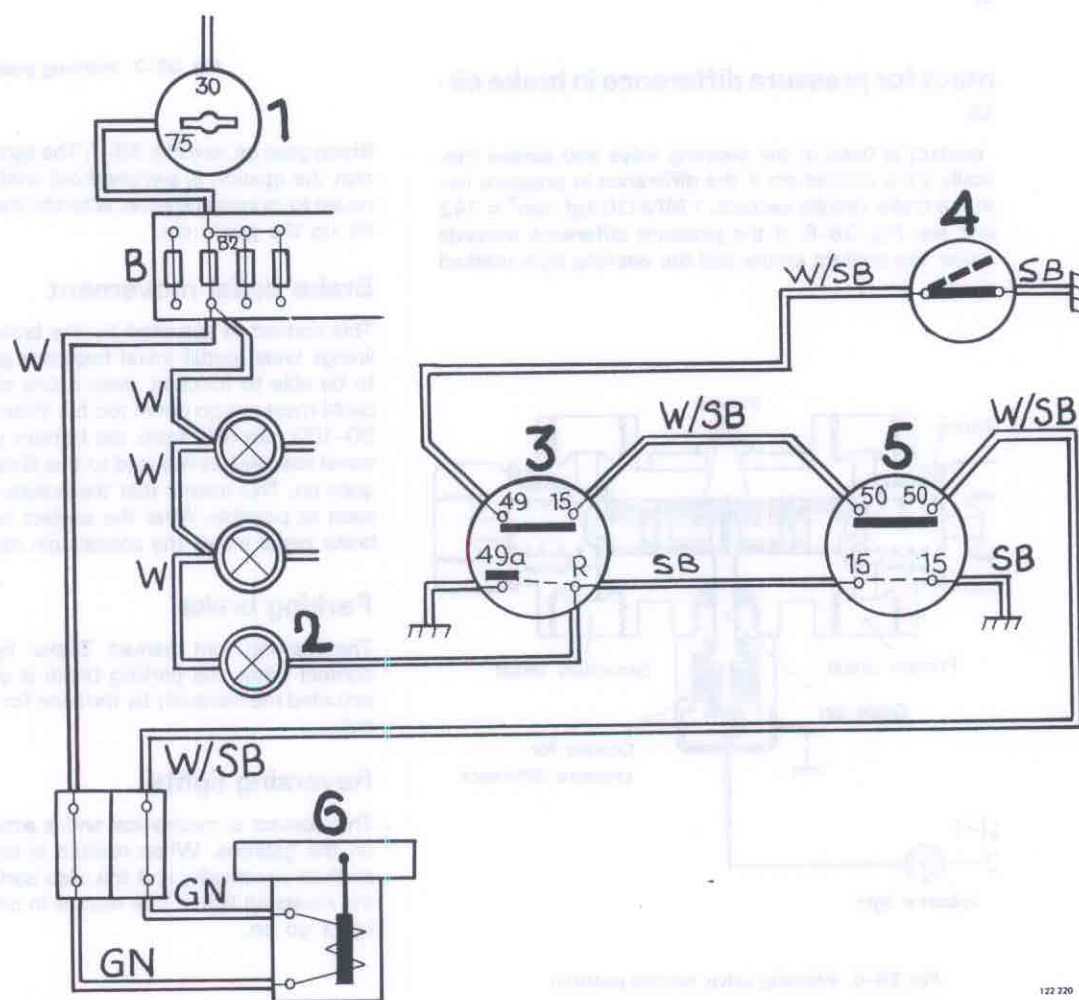


Fig. 38-5. Wiring diagram for front-wheel drive

- 1 Ignition
- 2 Fusebox (B)
- 2 Indicator light, front-wheel drive
- 3 Switch, instrument panel

- 4 Pressure contact, brake line
- 5 Contact, transfer box
- 6 Solenoid

Under contacts

Pressure

When the ignition is switched on, current flows through the pressure warning light and further through the oil pressure meter to the vehicle chassis. When the engine starts and oil pressure exceeds 40–70 kPa (0.4–0.7 kgf/cm² = 0.3 lbf/in²), this actuates a diaphragm which breaks the electrical circuit between the sender and chassis. Warning goes out.

Contacts

Stop lights

The contact for the stop lights is mechanical and is actuated by the brake pedal. When the pedal is not depressed, the contact is broken. When the pedal is depressed, the contact circuit to the stop lights is closed so that the lights go on.

Contact for pressure difference in brake circuits

This contact is fixed in the warning valve and senses mechanically via a control pin if the difference in pressure between the brake circuits exceeds 1 MPa (10 kgf/cm² = 142 in²), see Fig. 38-6. If the pressure difference exceeds this value, the contact earths and the warning light marked

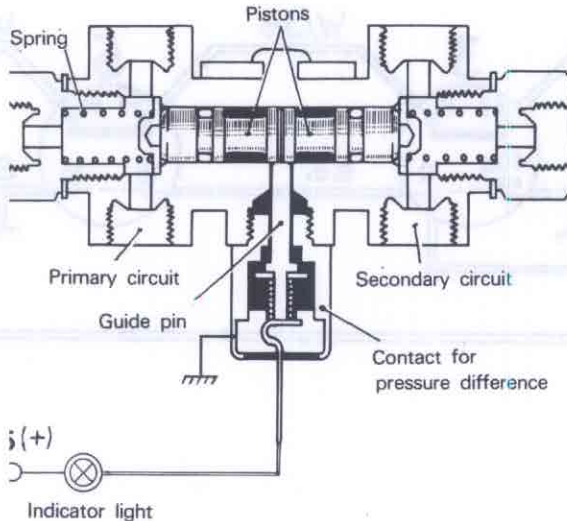


Fig. 38-6. Warning valve, normal position

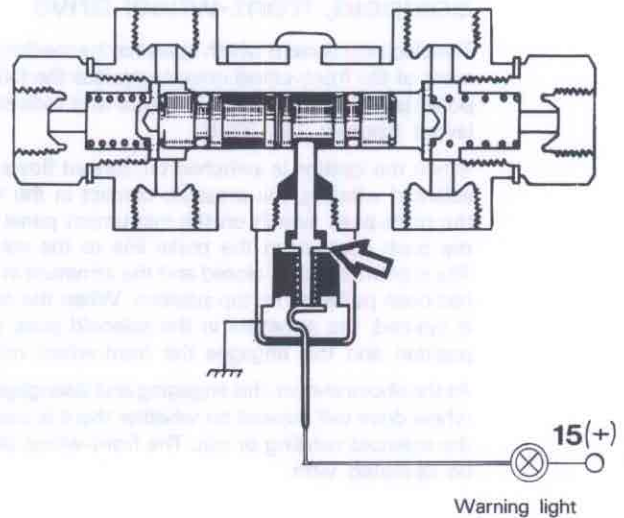


Fig. 38-7. Warning position

Brake goes on, see Fig. 38-7. The light remains on (providing that the ignition is switched on) until the contact has been re-set to its initial position, whereby the warning valve pistons lift up the guide pin.

Brake pedal movement

This contact is actuated by the brake pedal. As the brake linings wear, pedal travel becomes greater. For the brakes to be able to function, even if one of the circuits fails, the pedal must not go down too far. When the pedal goes down 90–100 mm (4"), from the bottom position, that is, pedal travel reserve has reduced to this distance, the warning light goes on. This means that the brakes should be adjusted as soon as possible. After the contact has indicated excessive brake pedal travel, the contact pin must be re-set by hand.

Parking brake

The warning light marked "Brake" lights by means of this contact when the parking brake is applied. The contact is actuated mechanically by the lever for the parking brake control.

Reversing lights

This contact is mechanical and is actuated by the shift gear on the gearbox. When reverse is engaged, the contact is earthed electrically, and this also earths the cut-in relay for the reversing lights. The relay is in circuit and the reversing lights go on.

Differential locks

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

The function of the contacts is to switch on the indicator lights marked "Diff.lock" when vacuum exceeds 39.5–40.5 kPa (0.395–0.405 kgf/cm² = 5–6 lbf/in²).

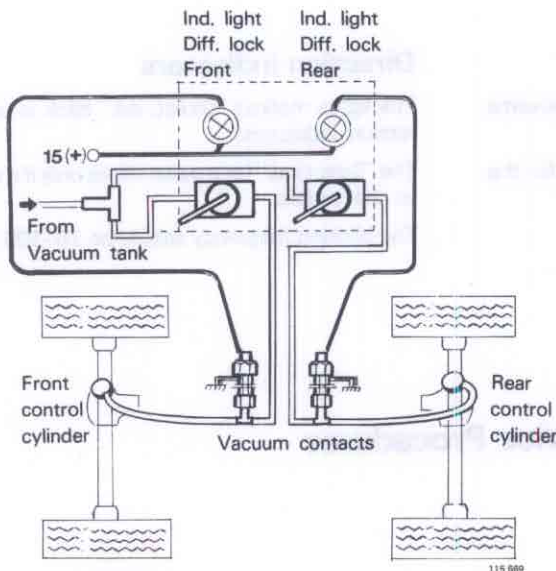


Fig. 38-8. Layout diagram for link-up of vacuum contacts

Warning/indicator lights

Battery charging

This light is marked "Charging". It is connected between the ignition terminal 61 and the alternator terminal 61. When the alternator voltage is lower than the battery voltage, the light goes on. When the voltage rises and the alternator starts charging the battery, the light goes out. This indicates that the alternator is charging.

Oil pressure

The light marked "Oil" should go on when the lubricating oil pressure in the engine goes below 40–70 kPa (0.4–0.7 kgf/cm² = 6–10 lbf/in²).

Brake

The light marked "Brake" should go on: when the parking brake is applied, or when the brake pedal travel exceeds a certain distance, see Fig. 38-9.

Diff. lock

The lights marked "Diff. lock" go on when the vacuum in the lines to the control cylinders for the front and rear differential locks exceeds 39.5–40.5 kPa (0.395–0.405 kgf/cm² = 5–6 lbf/in²).

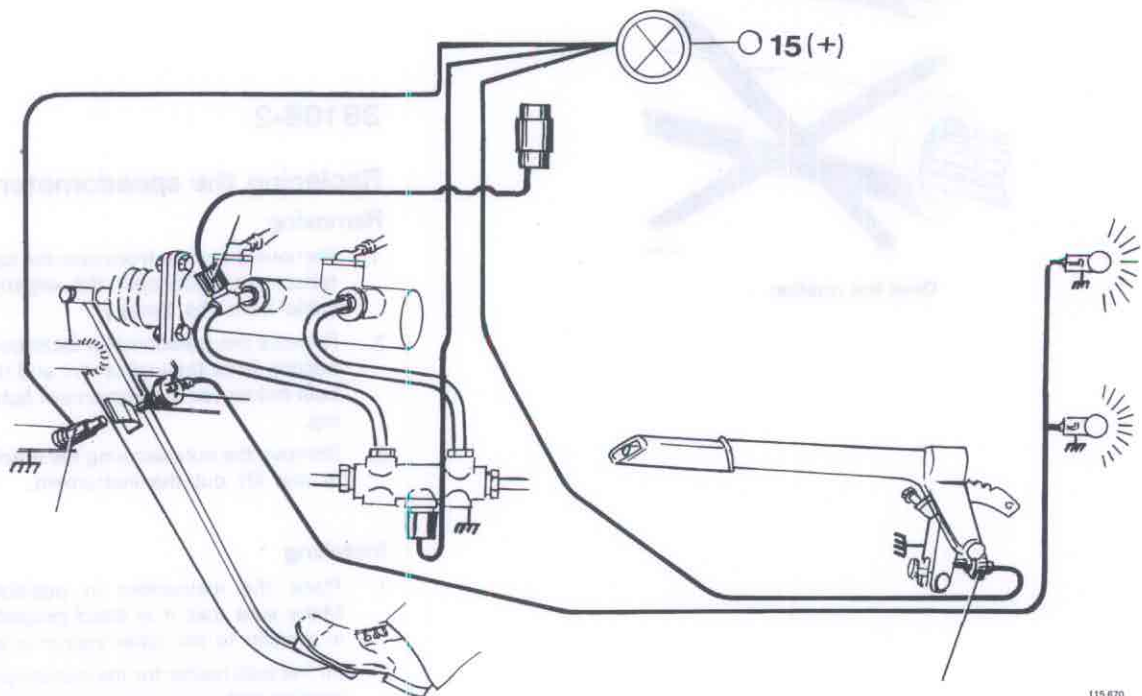


Fig. 38-9. Warning system for warning light marked "Brake"

Mainbeams

- light marked "Mainbeam" goes on when the mainbeams are on.
- light is connected in parallel with the mainbeam for the left-hand side at the fuse (A9).

Direction indicators

The lights marked "Direct. ind." blink in unison with the direction indicators.

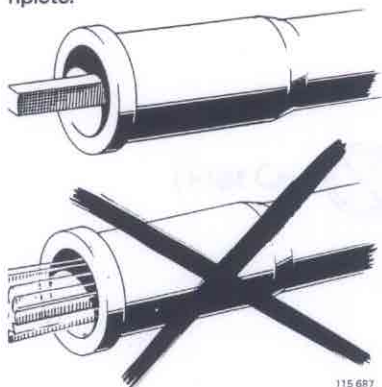
The "Direct ind." for a trailer blinks only if a trailer is connected to the vehicle.

The blinking frequency should be 75–105 blinks per minute.

Service Procedures

Speedometer

If the speedometer does not give a reading but the mileometer is functioning or if the speedometer is functioning but not the mileometer, then the fault is in the speedometer. If the instrument is not working at all, or if the speedometer needle swings, probably the drive line is broken or is jamming in its sleeve. If this is the case, replace the speedometer cable completely.



Drive line rotation



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Speedometer

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Replacing the speedometer

Removing

1. Remove the cover from over the batteries and disconnect the negative cable from the battery.
2. Remove the speedometer cable connection from the instrument and the bulb holder for the instrument lighting.
3. Remove the nuts securing the bracket and lift out the instrument.

Installing

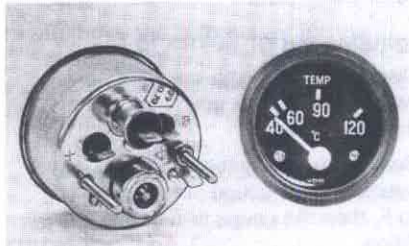
1. Place the instrument in position. Make sure that it is fitted properly in relation to the other instruments.
2. Fit the bulb holder for the instrument lighting and screw the speedometer cable nut on the instrument.
3. Connect up the negative cable to the battery and fit the battery cover.

Engine temperature gauge

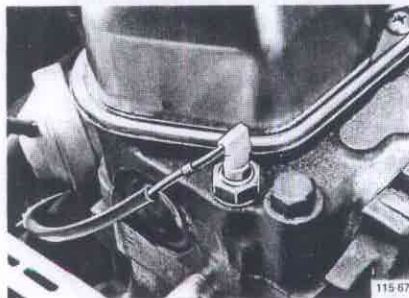
Testing

If the engine temperature gauge gives incorrect temperature or no temperature at all, then the fault may lie in the instrument, its sender or in the cables. The first thing to check is that there is good contact between the various instruments and sender connections and that the instrument is properly wired to the vehicle chassis.

Examine with a voltmeter or test lamp to make sure there is voltage on the instrument feed side. If the cables and contacts are without fault, carry out the following tests:



Engine temperature gauge



Sender for engine temperature gauge

Temperature gauge indicates 40°C (100°F)

1. Disconnect the cable at the sender.
2. Switch on the ignition.
3. Hold the cable end against a scraped clean part on the engine in order to get an earth connection. If the gauge pointer goes over to 120°C (250°F), then the cable and instrument are in good condition so that the fault must be looked for in the sender. See under "Checking the sender".

4. If the gauge pointer does not swing to 120°C (250°F), disconnect the cable also at the instrument. Connect contact pin "G" to the chassis. If the instrument is functioning properly, the indicator should swing over to 120°C (250°F). And if the instrument is without fault, there must be a breakage in the cable to the sender. If this is the case, repair or replace the cable.

Temperature gauge shows 120°C (250°F)

1. Disconnect the cable running from the instrument to the sender, the blue-coloured cable.
2. Switch on the ignition. If the gauge pointer swings to 40°C (100°F), then the gauge is in good condition.
3. Switch off the ignition and connect up the cable between instrument and sender.
4. Disconnect the cable at the sender and insulate it from the vehicle chassis.
5. Switch on the ignition. If the gauge pointer also swings to 40°C (100°F) now, then the cable is in good condition. The fault must be looked for in the sender. See under "Checking the sender".

Checking the sender

Check the sender with an ohmmeter, which is connected between the connection terminal and the vehicle chassis. The following temperatures apply (the sender body should be lowered into the coolant as far as to where the threads start):

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

Replace sender if faulty.

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Replacing the temperature sender

1. Remove the rear engine cover and disconnect the cable from the temperature sender.
2. If necessary, drain a little coolant from the cooling system.
3. Remove the sender and its gasket.
4. Fit a new sender and gasket and connect up the cable.
5. If necessary, top-up the cooling system with coolant and re-fit the engine cover.

Checking the temperature gauge

The temperature gauge is checked with the fuelless sender connected up. Lower the sender body into the coolant as far as where the threads start. Heat the coolant in a suitable way and check the temperature with the help of a mercury thermometer.

Moving the temperature gauge

Remove the cover from over the batteries and disconnect the negative cable from the battery.

Remove the bulb holder for the instrument lighting and disconnect the cables to the instrument.

Remove the nuts securing the bracket and the earth cable. Remove the bracket and lift out the temperature gauge.

Installing the temperature gauge

Place the temperature gauge in position and make sure that it is fitted properly in relation to the other instruments.

Fit the bracket and tighten up the gauge with the two nuts.

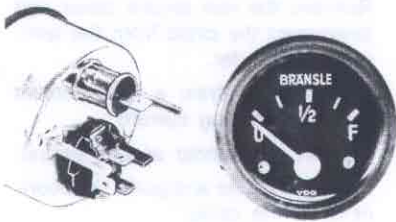
Fit the bulb holder for the instrument lighting and connect the cable connections to the gauge. The blue coloured cable is connected to "G", and the two yellow ones to "+".

Connect up the negative cable to the battery and fit the cover over the batteries.

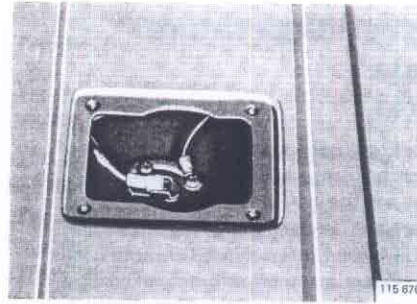
Fuel gauge

Testing

If the gauge gives a wrong reading or no reading at all, then the fault may be in the instrument, the fuel gauge sending unit or in the cables. Before starting the check that the connections at the instrument and sending unit are in good condition. Also check the earth to the fuel gauge sending unit. With a voltmeter or



Fuel gauge



Gauge sender unit

test lamp find out if there is voltage on the feed side of the instrument (when the ignition is switched on). If the cables and contacts are in good condition, continue testing as follows:

Fuel gauge pointer points to 0

1. Disconnect the green-coloured cable which runs to the gauge sender at the instrument.
2. Switch on the ignition to the firing position. If the gauge pointer swings to F, then the gauge is in good condition.
3. Switch off with the ignition key and re-connect the cable at the instrument.
4. Disconnect the cable at the gauge sending unit and keep it insulated from the vehicle chassis. Turn the ignition key to firing. If the gauge pointer swings to F, then the cable is also in good condition. The fault is probably in the gauge sending unit, which should be removed and tested with an ohmmeter.
5. The resistance with an empty tank (the float is at its lowest position) should be 0-6 Ω .

With a full tank (the float is at its top position) the resistance should be 178-192 Ω .

Move the gauge sending unit float up and down. The ohmmeter pointer should follow the movement of the float without jerking or without interruption.

Fuel gauge pointer points to F

1. Disconnect the green-coloured cable at the gauge level sending unit.
2. Switch on the ignition.
3. Hold the end of the disconnected cable against the chassis. If the pointer swings over to 0, then the cable and gauge are without fault, so the fault is probably in the gauge sending unit. See point 5 under the above previous test.

4. If, when doing the test described above, the gauge pointer does not swing to 0, disconnect the cable at the gauge. Connect the contact washer to the chassis with a piece of cable or corresponding. If the gauge is in good condition, the pointer will swing to 0. And if the instrument is without fault, then the fault is probably a poor contact at the connections to the instrument or in the cables to the gauge level sending unit.

Removing the fuel gauge

1. Remove the cover from over the batteries and disconnect the negative cable from the battery.
2. Remove the bulb holder for the instrument lighting and the cable connections at the instrument.
3. Remove the nuts securing the bracket and disconnect the earth cables. Remove the bracket and lift out the instrument.

Installing the fuel gauge

1. Place the fuel gauge in position. Make sure that it is located properly in relation to the other instruments.
2. Fit the bracket and connect up the earth cables. Tighten up the gauge with the two nuts.
3. Fit the bulb holder for the instrument lighting and connect the flat-pin sleeves as follows: the green-coloured cable is connected to the terminal marked "G". The yellow-coloured cables are connected to the terminal marked "+".
4. Connect up the negative cable to the battery and fit the cover over the batteries.

Removing the fuel gauge level sending unit

1. Remove the four screws securing the cover over the unit.
2. Disconnect the cables from the unit. Make a line-up mark (with, e.g., a screw-driver) on the unit and the tank.
3. Remove the screws securing the unit and then take out the unit. Remove the unit gasket.

Installing the fuel gauge level sending unit

1. Fit a new gasket and restore the sending unit back in position.
2. If necessary replace the rubber washer for the screws. Screw tight

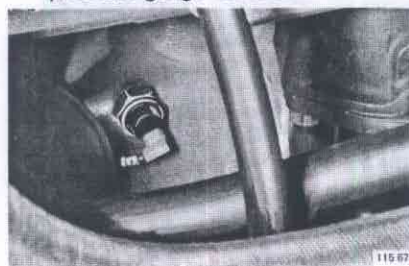
the sending unit and connect up the cables.

3. Fit and secure the cover over the sending unit.

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Replacing the contact for oil pressure gauge sender

1. Remove the rear engine cover.
2. Disconnect the cable from the oil pressure gauge contact.

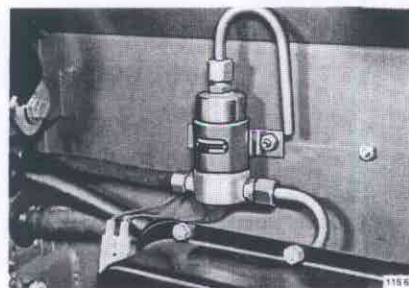


3. Have the new sender ready and fit it as soon as the old one has been removed.
4. Connect up the cable and re-fit the engine cover.

Solenoid for front-wheel drive

Removing

1. Make sure that the ignition is switched off. Then disconnect the cables at the connector.
2. Slacken pipe and hose connections at the solenoid several turns.



Solenoid for front-wheel drive

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

Installing

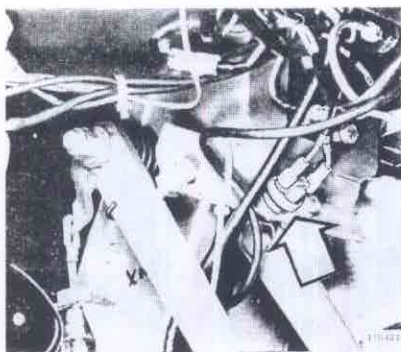
1. Fit the pipe and hose connections to the solenoid without tightening up.
2. Fit the solenoid.
3. Screw tight the pipe and hose connections and connect the cables to the connector.

Contact for stop lights

3408-2

Replacing

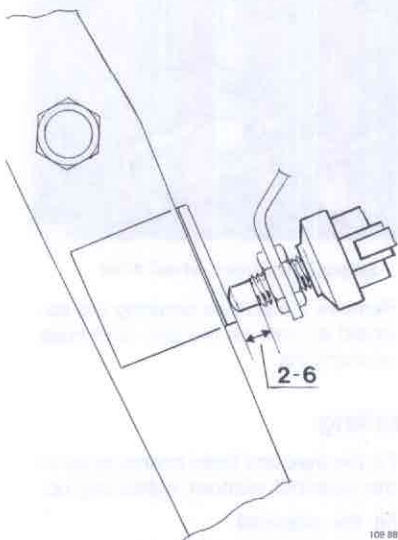
Disconnect the cables and remove the nut securing the contact to the bracket.



Fit the contact to the bracket and connect up the cables.

Adjusting

For the contact to function correctly and prevent it from being damaged, it must have a certain position in relation to the brake pedal. The distance between the pedal in the rest position and the brass sleeve on the contact should be 2–6 mm (1/16"). With a different distance, slacken the nuts and move the contact in order to obtain the correct distance. Thereafter tighten up the nuts.

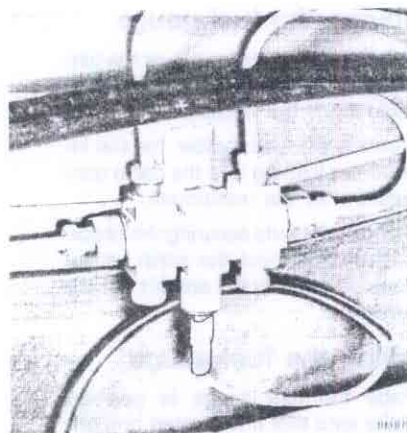


Contact for stop lights, adjustment measurement

Contact for pressure difference in brake circuits

Replacing

1. Disconnect the cable and unscrew the old contact.
2. Carefully screw the new contact into the warning valve. The tightening torque is approx. 15 Nm (1.5 kgf m = 22 lbf ft). Connect up the cable.



Contact for brake pedal travel

36424-2

Replacing

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

Adjusting

The contact should give warning when there is about 90–100 mm (4") left of pedal travel, measured at the centre of the footplate. Since normally this can only be checked by means of bleeding, check the position of the contact by measuring the distance between the brake pedal bracket and the contact pin, with the brake pedal in the rest position. This distance should be 15–17 mm (5/8"). If the distance is otherwise, slacken the nut and move the contact in order to obtain the correct distance. Thereafter tighten up the nut.

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