

Part 9 (91, 94)
INSTRUMENTS
HEATER SYSTEM
PV 544, P 210

CARS

SERVICE MANUAL

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GROUP 91

INSTRUMENTS

DESCRIPTION

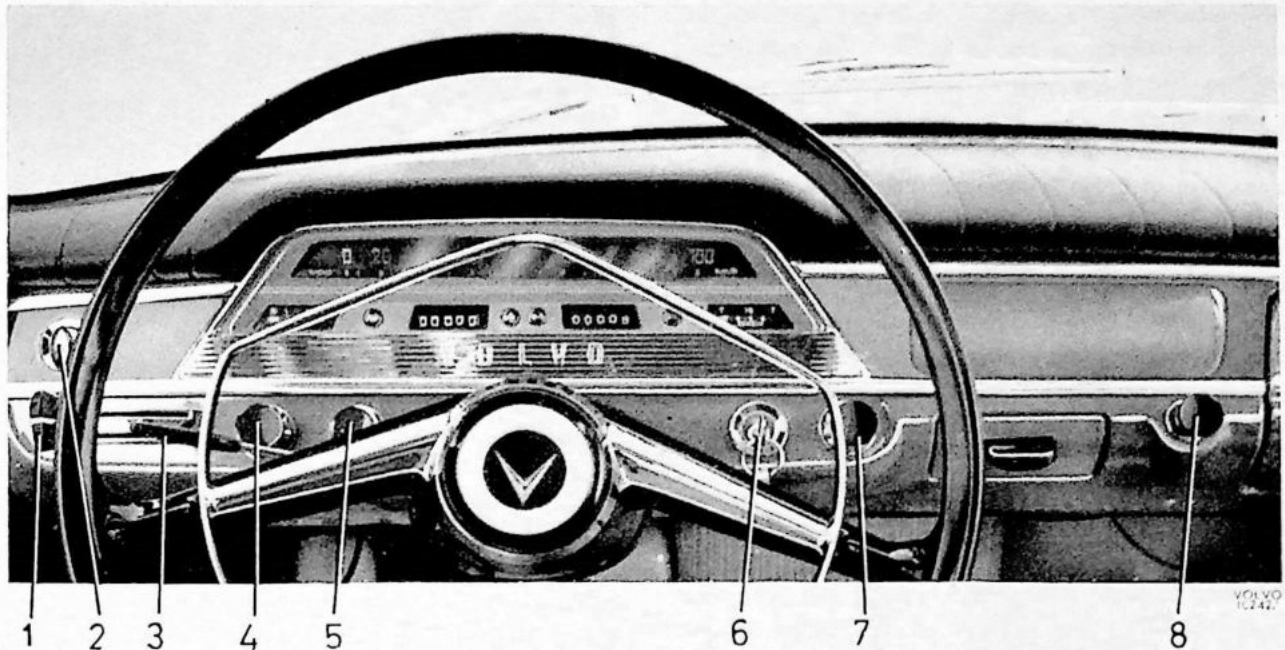


Fig. 1. Instruments and controls

1. Controls for heater and ventilation system
2. Choke control
3. Direction indicator switch with headlight flasher
4. Lighting switch
5. Heater fan control
6. Ignition switch with starter contact
7. Control for windscreen wiper and washer
8. Cigarette lighter

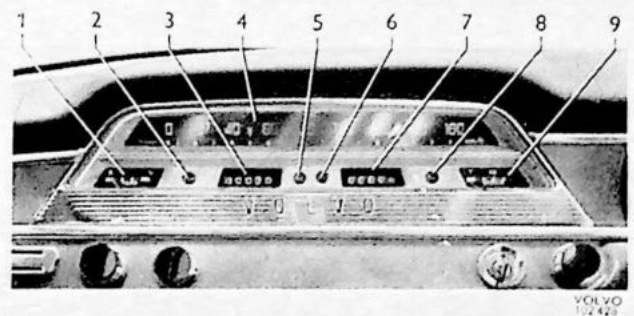


Fig. 2. Combined instrument

COMBINED INSTRUMENT

The combined instrument incorporates the speedometer, temperature gauge, fuel gauge, four warning lamps and two instrument panel lighting bulbs. The combined instrument is illustrated in Figs. 2 and 3.

1. Temperature gauge
2. Charging warning lamp
3. Trip meter
4. Speedometer
5. Control lamp for mainbeam headlights
6. Control lamp for direction indicators
7. Mileometer
8. Warning lamp for oil pressure
9. Fuel gauge
10. Instrument panel lighting

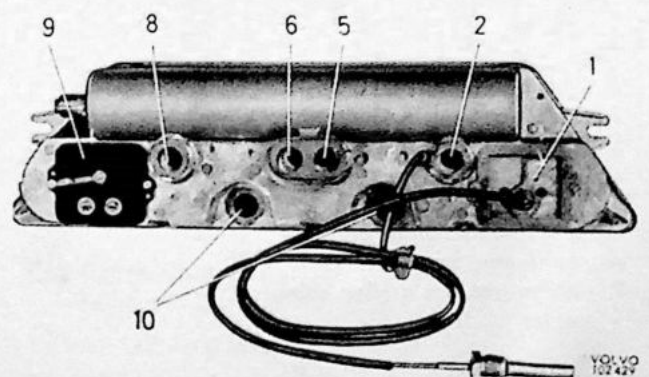


Fig. 3. Combined instrument, reverse side

FUEL GAUGE

The fuel gauge has two main parts. These consist of the tank fitting and the actual dial on the instrument panel. The tank fitting consists of a float which, through a lever, is connected with a contact arm which slides over an electrical resistor (rheostat). Any alteration of the fuel level in the tank will cause either a smaller or larger part of the resistor windings to be in circuit. The instrument dial has two coils, one in series with the rheostat in the tank fitting, and one connected directly to earth. When the fuel tank is empty, the current flows as described in alternative 1. When filling the tank, the current flowing in this way will be reduced due to an increasing part of the rheostat coming into circuit, so that a larger part of the current will flow through it directly to the coil connected to earth (alternative 2). The pointer on the dial will then move from the "Empty" position it had in alternative 1 and will give a reading on the scale proportional to the amount of fuel filled in the tank.

When the dial shows "Empty", the float of the tank fitting should be about 1.5 cm ($\frac{5}{8}$ ") from the bottom of the tank.

SPEEDOMETER

The speedometer is of the eddy current type. It is driven through the speedometer cable by a worm gear on the output shaft of the gearbox. When the speedometer driving cable begins to rotate, it carries with it a ring-shaped permanent magnet which is placed on the right side of the speedometer roller. The rotational speed of the magnet will thus be the same as that of the driving cable. On the left side of the speedometer roller there is a torsion spring, the purpose of which is to brake

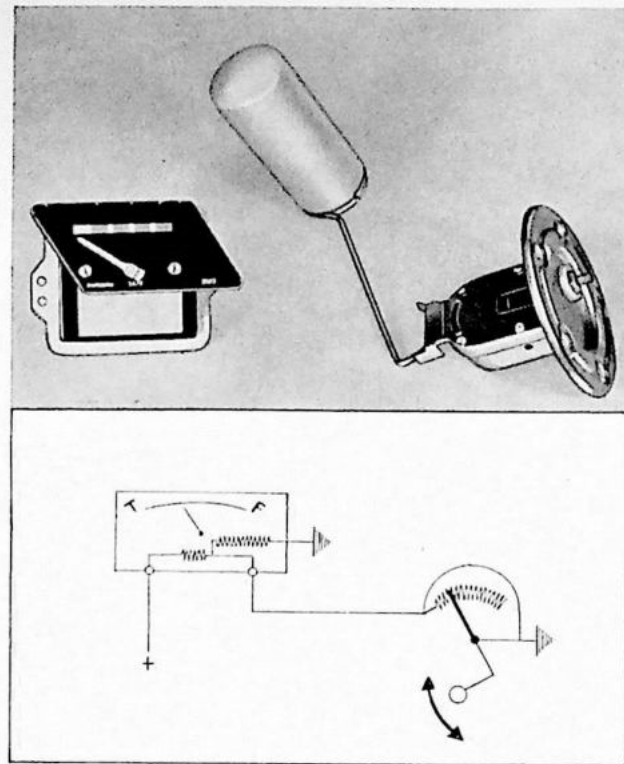


Fig. 4. Fuel gauge

the roller, at the same time tending to move the roller to the 0-position. A magnetic field exists between the permanent magnet and the right-hand end of the speedometer roller. There are also lines of magnetic force between the magnet and the ring which surrounds the permanent magnet at a certain distance.

This space is intended for the ring-shaped and projecting part of the speedometer roller, see Fig. 5. When driving, varying magnetic fields will arise which, when passing over the projecting part of the speedometer roller, will give rise to eddy currents. The torsional effect which both the magnetic field and the induced eddy currents will have on the speedometer roller depend partly on the speed and partly on the opposing force of the torsion spring.

1. Torsion spring
2. Stop arm for speedometer roller
3. Dial scale
4. Speedometer roller
5. Ring for magnetic lines of force and induced eddy currents
6. Permanent magnet
7. Worm gear for driving mileometer

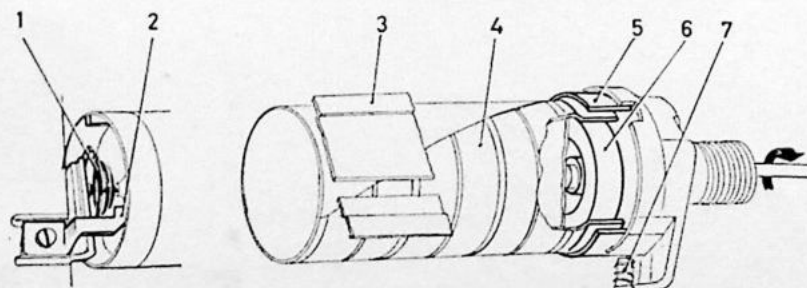


Fig. 5. Construction of the speedometer

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The mileometer and trip meter are driven from the speedometer shaft. Fig. 6 shows how the numeral rollers of these meters are driven.

The drive ratios from the speedometer to the mileometer and trip meter are worked out by the manufacturer so that the speedometer cable makes 0.63 of a revolution per metre driven. This value is also stamped on the reverse of the instrument.

Concerning percentage error with different tyre sizes, see the "Specifications" on page 12.

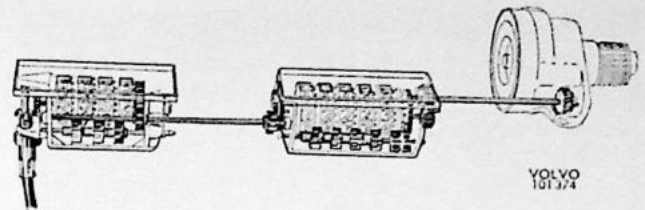


Fig. 6. Drive arrangement of mileometer and trip meter

TEMPERATURE GAUGE

The temperature gauge consists of a sensor unit and a dial. These are connected to each other by means of a copper pipe with a very small internal diameter. In order to protect it from external damage and to prevent sharp bends, the pipe is provided with a pleated protective covering and, on late production vehicles, an additional plastic covering. The sensor unit consists of a small container. It is partly filled with a mixture of volatile liquids, principally consisting of ether. As the coolant temperature rises, this liquid is progressively transformed into gas. This gives rise to an increase in pressure, which is transmitted through the above-mentioned copper pipe up to the flat tubular spring in the temperature gauge dial. The spring then tends to straighten itself out and at the same time transmits a movement to the lever which, through a suitable reduction, actuates the pointer of the instrument.

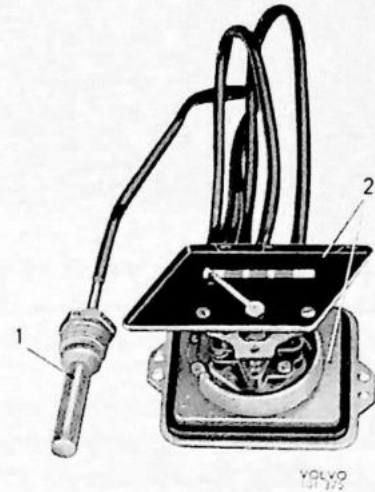


Fig. 7. Temperature gauge
1. Sensor unit 2. Dial unit

OIL PRESSURE CONTACT

The function of the oil pressure contact is shown in Fig. 8. The contact is adjusted to a predetermined breaking pressure. When the engine oil pressure is above this value, the oil pressure warning lamp is extinguished.

In the right-hand part of Fig. 8, the oil pressure is so low that the spring overcomes the force operating on the other side of the diaphragm. The contact rivet is then pressed down against the contact plate, with the result that the warning lamp lights. The adjusting screw of the contact, by means of which the breaking pressure can be varied, is accessible by removing the pipe on the oil pres-

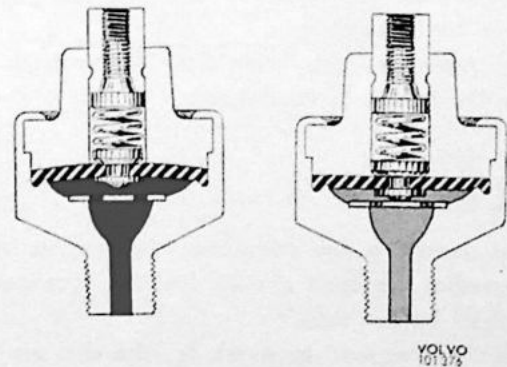


Fig. 8. Function of oil pressure contact

Engine	Breaking pressure
B 18	0.6—1.0 kg/cm ² (8.5—14 lb/sq.in.)
B 16	0.6—1.0 kg/cm ² (8.5—14 lb/sq.in.)

sure contact. Any adjustment of the breaking pressure must not, however, be done unless the engine oil pressure is measured at the same time with a separate pressure gauge.

WINDSCREEN WIPER

The windscreen wiper is driven by an electric motor. The motor is connected to the wiper blades through a drive gear housing and link arms. The windscreen is self-parking. Concerning removing, lubricating and adjusting the wiper motor, drive gears and linkage, see Part 3 (36).

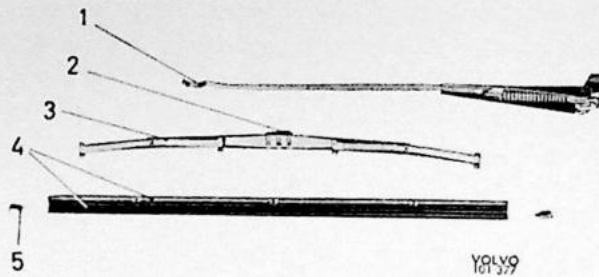


Fig. 9. Wiper arm and blade assembly

1. Wiper arm
2. Retaining spring
3. Scraper fitting
4. Rubber blade and retainer
5. Retaining piece

REPAIR INSTRUCTIONS

REPLACING THE COMBINED INSTRUMENT

Before removing or fitting the combined instrument, one of the battery connections must **always** be removed from the battery, preferably the pleated earth lead.

When removing the combined instrument, the bulb holders for the warning lamps and instrument lighting are removed first. Then disconnect the speedometer cable and leads to the fuel gauge. The temperature gauge should be removed from the instrument if it is not necessary to remove the combined instrument complete. It is simpler to do this than to drain the coolant and remove the sensor unit from the cylinder head, see under "Removing the temperature gauge". Remove the nuts which hold the combined instrument to the instrument panel. Lift out the instrument.

When replacing the individual instruments, see under the headings concerned.

FUEL GAUGE

Before removing any component belonging to the fuel gauge, the fault should first be localized as described below.

Check that the lead terminals for the dial are properly tight. Switch on the ignition. With a voltmeter or test lamp, check to see that there is voltage on the feed side of the instrument. When this has been done, continue testing as follows.

Instrument shows "Empty"

1. Disconnect the lead terminal on the tank fitting and hold the lead away from the vehicle frame.

Switch on the ignition. The fuel gauge should then show "Full".

2. If the instrument shows "Empty", disconnect the lead on the instrument (the lead which connects the dial to the tank fitting). If the dial now shows "Full", there is nothing wrong with the instrument and the fault will either be in the actual tank fitting or in the connecting lead to the instrument dial.

Instrument shows "Full"

1. Disconnect the lead terminal on the tank fitting. Switch on the ignition.
2. Earth the lead connected to the tank fitting with the help of a test lead. If the pointer goes over to "Empty", the lead and dial are undamaged. The fault is to be found in the tank fitting.
3. If, when carrying out these tests, the pointer does not go over to "Empty", also disconnect the lead at the terminal on the instrument. Earth the contact screw by means of a test lead. If the instrument is undamaged, the pointer should then go over to "Empty". Otherwise the fault is due either to poor contact on the

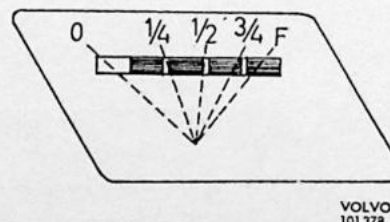


Fig. 10. Guide values for the instrument dial scale

terminals between the instrument and lead to the tank fitting or a breakage in the lead. A faulty instrument or tank fitting should be replaced with new parts.

Replacing the fuel gauge dial

1. Disconnect the pleated earth lead from the battery.
2. In order to facilitate removing the dial, first unscrew both the attaching screw of the ignition switch. Then bend the ignition switch out of the way.
3. Mark and disconnect the leads from the instrument. Remove the attaching screws and carefully lift out the instrument.

Fitting

1. Place the instrument dial in position and tighten the attaching screws.
2. Connect up the leads in accordance with the marking previously made. Do not confuse the leads!
3. Place the ignition switch in position and tighten the attaching screws.

Replacing the tank fitting

1. Make sure that the ignition key is in the switched-off position.
2. Turn back the mat in the luggage compartment (PV 544) or fold the rear seat cushion forwards (P 210) and lift off the tank fitting cover plate.
3. Blow well clean round the tank fitting with compressed air.
4. Disconnect the lead and remove the screws which hold the tank fitting and then lift it out. On the P 210 the fuel lead is also disconnected.

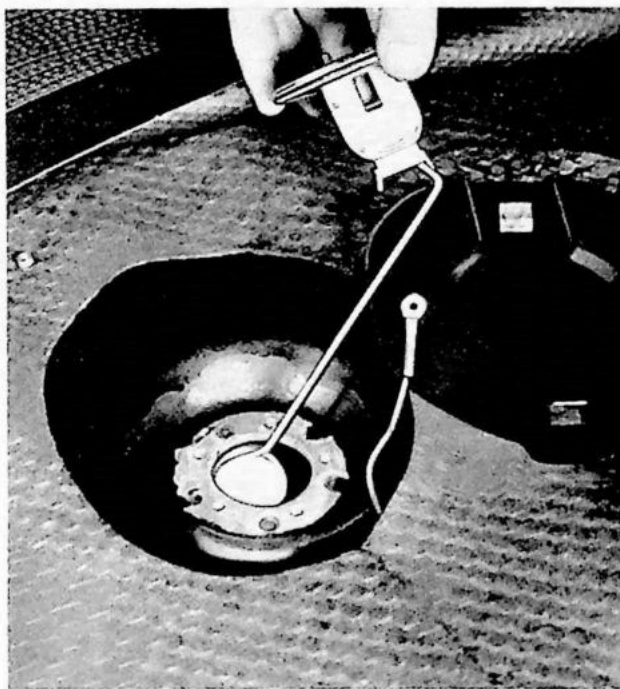
Fitting

Always use a new gasket in order to prevent leakage and petrol fumes inside the vehicle.

1. The gasket should be coated on both sides with a sealing adhesive which does not affect rubber and which is not dissolved by petrol.
2. Place the gasket in position on the tank. Place the tank fitting in position and tighten the screws well. Connect the lead.

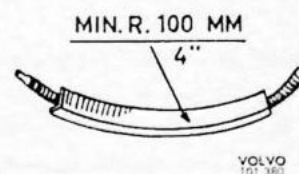
SPEEDOMETER

In order to correct any faults, the special tools and instructions used by a VDO authorized workshop should be available. If such special tools and instructions are not available, any adjustment and checking of the speedometer should be carried out by an authorized instrument workshop.



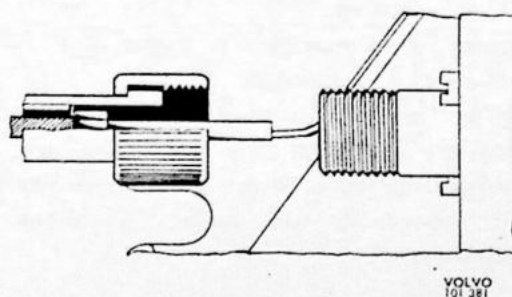
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Fig. 11. Removing the tank fitting



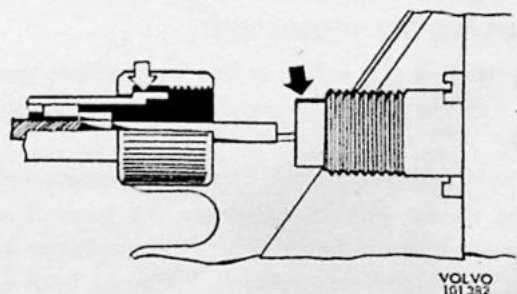
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Fig. 12. Template for fitting speedometer cable



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Fig. 13. Speedometer cable connection, early production



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Fig. 14. Speedometer cable connection, late production

Checking the speedometer cable

It is most important that the speedometer cable should be fitted correctly in order for the speedometer to function without trouble. The following should therefore be observed. At no point must the bending radius of the speedometer cable be less than 100 mm (4"). In order to facilitate checking this, it is advisable to manufacture a template with a bending radius of 100 mm (4") as shown in Fig. 12. Note also that late production speedometer cables and instruments are provided with a guide at the connecting points, see the arrows on Fig. 14.

Concerning replacement of speedometer gears, see Part 4 (43) and the specifications on page 12.

Replacing the speedometer cable

1. Screw off the cap nut on the instrument. Remove the rubber grommet from the cowl wall and pull the cable through.
2. Release the necessary retaining clips and unscrew the cap nut on the gearbox connection.
3. When fitting the new speedometer cable, handle it in such a way that there is no risk of damaging the driving cable or outer covering. When replacing a complete speedometer cable, no extra lubrication of the driving cable is normally necessary.
4. Thread the speedometer cable through the rubber grommet.
5. Connect the speedometer cable both to the instrument and gearbox.
6. Fit the rubber grommet in position. Fit the necessary retaining clips and make sure that the bending radius at any point is not less than that permitted, see under "Checking the speedometer".

TEMPERATURE GAUGE

Testing the temperature gauge and removing the sensor unit

If any fault is suspected in the temperature gauge, carry out the following check before removing the gauge.

1. Drain sufficient coolant from the system so that the sensor unit comes above the coolant level.
2. Remove the sensor unit from the cylinder head. If it is stubborn, carefully prise it backwards and forwards. Be careful with the gauge pipe.
3. Immerse the sensor unit in a container filled

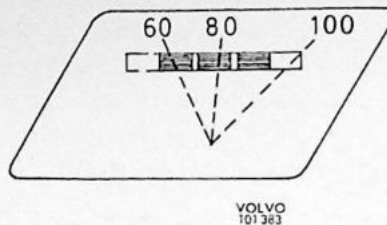


Fig. 15. Guiding values in °C for the temperature gauge scale.

with hot water. An ordinary and previously checked mercury thermometer is used for making comparative readings. In order to obtain good measuring results, both the sensor unit and thermometer should be prevented from coming into contact with the bottom of the container. It is not usually worthwhile to repair the temperature gauge.

TEMPERATURE GAUGE DIAL

Removing

1. Disconnect the pleated earth lead from the battery.
2. Remove the screws which hold the instrument dial and lift it out.
3. Remove the rubber grommet from the cowl and pull through the sensor unit. Be careful not to make sharp bends in the delicate measuring pipe.

Fitting

1. Push the sensor unit through the cowl wall.
2. Place the instrument dial in position in the combined instrument. Avoid sharp bends in the measuring pipe. Tighten the retaining screws.
3. Fit the sensor unit in the cylinder head. Fit the rubber grommet in the cowl wall.
4. Fill up with coolant. Check the level after starting the engine and top up if necessary.

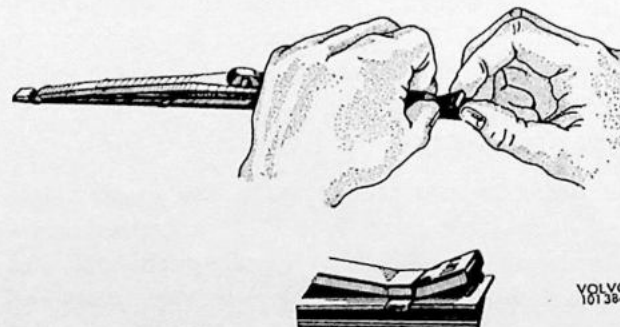


Fig. 16. Replacing wiper blade

WINDSCREEN WIPER

The ability of the windscreen wiper blades to keep the windscreen free from asphalt, gravel and insect splashes becomes gradually reduced in time. Additional factors are the severe operating conditions during winter and the natural ageing of the material. The wiper blades must therefore be regarded as replacement items. When replacing the wiper blades, the spring pressure of the scrapers should also be checked. In order to obtain good results, any silicon deposits or traffic film on the windscreen glass should be removed with a suitable window cleaning agent. Be careful when doing this, as most of such agents can damage the paintwork.

Replacing the wiper blades

1. Release the scraper by lightly moving the retaining spring.
2. Take out one of the retaining pieces and remove the rubber blade and its retainer from the scraper fitting.
3. Fit the new wiper blades. Use new retaining pieces.
4. Moisten the windscreen when testing the wiper blades. Check the contact of the blades with the glass. Also make sure that the blades are adjusted so that they do not strike against the windscreen frame. Check this with the wiper motor running at full speed.

GROUP 94

HEATER SYSTEM DESCRIPTION

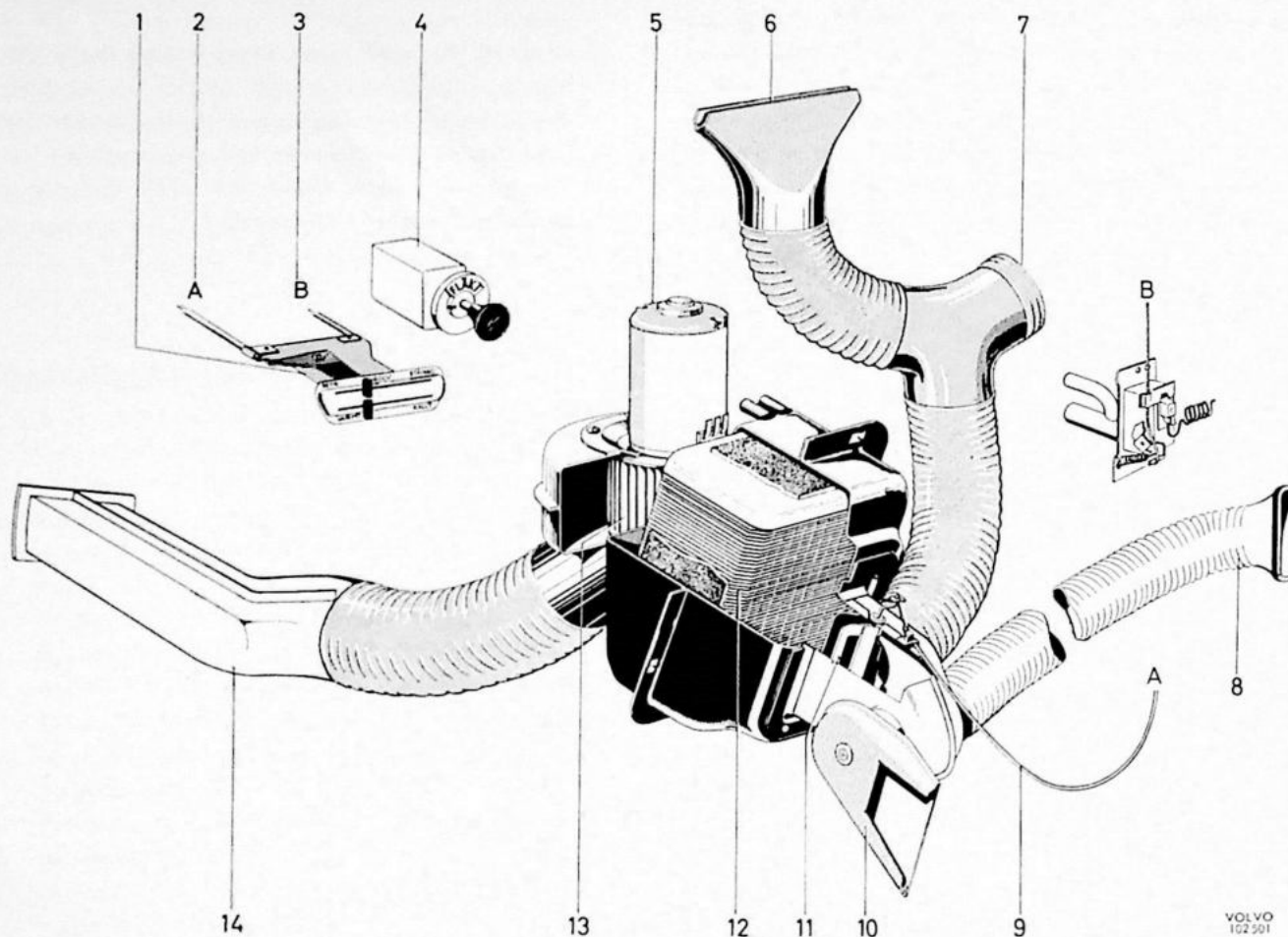


Fig. 17. Heater

- | | |
|----------------------------|-------------------------|
| 1. Heater controls panel | 8. Air nozzle, right |
| 2. Air flow control | 9. Control cable |
| 3. Heater control | 10. Air nozzle, left |
| 4. Fan switch | 11. Distributor shutter |
| 5. Fan motor | 12. Cell system |
| 6. Defroster nozzle, left | 13. Fan rotor |
| 7. Defroster nozzle, right | 14. Air intake |
- A. Control cable for shutter
B. Control cable for heater control valve

The heater, Fig. 17, consists of an air intake with fan and motor, cell system, distributor housing with shutter, heater control valve and controls. Figs. 18 and 19 show the flow of air when the controls are switched to "Floor" and "DEFR" resp.

HEATER CONTROL VALVE

The heater control valve is one of the main parts the heater. The purpose of the valve is to control the supply of heated coolant to the cell system of the heater. This supply is controlled by the valve in two ways; both manually by means of the heater control and automatically through a thermostat arrangement. The function of the heater control valve is shown in Fig. 21.

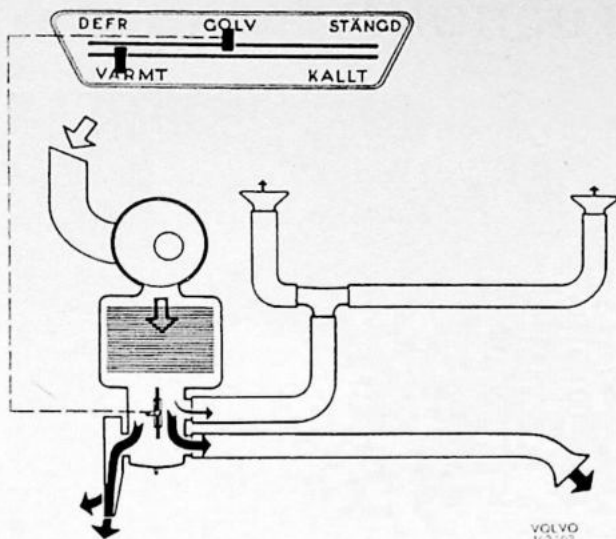


Fig. 18. Air flow, "Floor" position

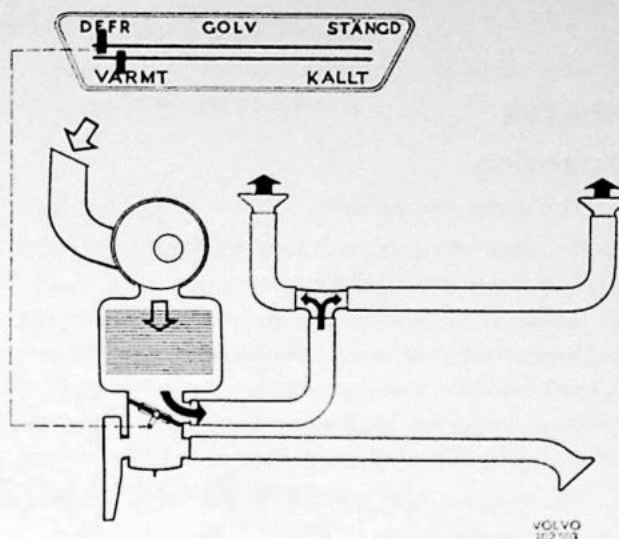


Fig. 19. Air flow, "DEFR" position

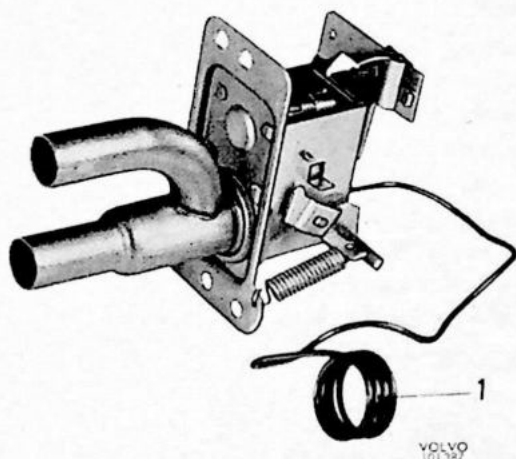


Fig. 20. Heater control valve
1. Sensitive coil for thermostat

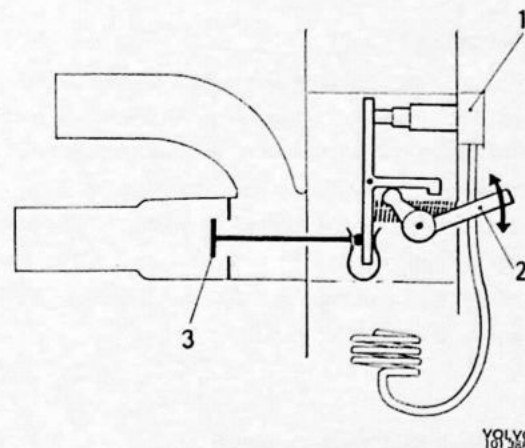


Fig. 21. Simplified sketch of heater control valve function
1. Thermostat 2. Lever for heater control 3. Valve

When the heater control is moved downwards (the lever on Fig. 21 is thereby pulled upwards), the valve is opened and coolant supply to the cell system begins. The air passing through the cell system is thereby heated up and then conveyed to the lower part of the heater in which the shutter arrangements and sensitive coil of the thermostat are placed. When the air flowing through has reached a particular temperature, the mixture of volatile liquids in the sensitive coil of the thermostat begins to vaporize. This gives rise to an

increase in pressure which causes the thermostat of the heater control valve to expand. This expansion results in the valve restricting the coolant supply to the cell system, thereby reducing the heat transmitted to the air flowing through. The thermostat then loses some of its expansion and the valve opens again. The continuous repetition of this process causes the temperature of the air flowing into the vehicle to be maintained constant at the desired level.

REPAIR INSTRUCTIONS

HEATER

Removing

1. Drain out the coolant.
2. Remove the rubber hoses on the heater control valve and cell system.
3. Unhook the control cables on the shutters and heater control valve. Disconnect the electric cables from the fan motor.
4. Disconnect the hose from the air intake and the hoses from the shutter housing.
5. Remove the nuts and lift off the shutter housing and heater.
6. Remove the screws and also the heater control valve.

Dismantling

1. Unscrew the six screws and lift off the fan motor and fan. The fan wheel is pulled by the engine shaft after the lock screw has been released.
2. Remove the drain cap. Unscrew the screws holding the heater halves together and separate the valves.
3. Lift up the cell system and remove the protective cardboard.

Checking the cell system

Clean the cell system externally and lower it under pressure (max. $1.2 \text{ kg/cm}^2 = 17 \text{ lb/sq.in.}$) into water heated to about $70\text{--}80^\circ \text{ C}$ ($160\text{--}180^\circ \text{ F}$). The joints in the cell system are soldered. The connecting points are brazed. If any leakage is discovered, the point concerned should be cleaned very thoroughly so that the new solder can flow in properly. After sealing has been completed, check the cell system again for leakage in accordance with the above instructions.

Assembling

1. Fit the rubber support buttons of the cell system and the protective cardboard. Fit the cell system, see Fig. 22.
2. If necessary, replace any missing rubber sealing strip with new. This is placed in the joint between the two halves before the heater is screwed together.
3. Fit the fan and fan motor.



Fig. 22. Fitting the cell system

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Fitting

Make sure that all damaged hoses and gaskets are replaced with new ones. Check that they come properly in position. Handle the heater control valve in the copper pipe with great care.

After fitting, check the shutter, the controls and the fan motor. Fill up with coolant. Start the engine and increase the speed sharply a sufficient number of times to expell the air in the system and then top up with coolant. Repeat this procedure until the cooling system is completely free from air.



Fig. 23. Assembling the heater

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HEATER CONTROLS

Removing

1. Remove the cables for the shutter and heater control valve.
2. Unscrew the nuts holding the control to the dashboard. Pull out the control.

Dismantling

1. Unscrew the screws for the cable clamp. Remove one of the lock washers for the lever shaft. Separate the parts.

Assembling and fitting

Assemble and fit the controls in reverse order to disassembling and removing.

Adjusting

Move up the controls to their closed position. Then check the position of the shutter and heater control valve. If they are not fully closed in this position, they should be adjusted, when the cable coverings at the respective attaching points on the heater or control valves are loosened. After final adjustment, move the controls backwards and forwards a few times to check the function.

SPECIFICATIONS

SPEEDOMETER GEARS

5.90—15" Tyres

Rear axle ratio	Speedometer gears			Theoretical percentage error of mileometer
	Number of teeth		Ratio	
	Large gear	Small gear		
4.10: 1 (10/41)	5	16	3.2/1	+1.56
4.56: 1 (9/41)	5	18	3.6/1	+0.7

The percentage error in the above table is calculated for a rolling radius of 318 mm (12 $\frac{1}{2}$ "), which is a standard value established by AB Volvo for this size of tyre at a vehicle speed of about 80 km.p.h. (50 m.p.h.).

6.00—15" Tyres

Rear axle ratio	Speedometer gears			Theoretical percentage error of mileometer
	Number of teeth		Ratio	
	Large gear	Small gear		
4.10: 1 (10/41)	5	16	3.2/1	+2.81
4.56: 1 (9/41)	5	18	3.6/1	+1.67

The percentage error in the above table is calculated for a rolling radius of 315 mm (12 $\frac{3}{32}$ "), which is a standard value established by AB Volvo for this size of tyre at a vehicle speed of about 80 km.p.h. (50 m.p.h.).

165 S 15 Tyres

Rear axle ratio	Speedometer gears			Theoretical percentage error of mileometer
	Number of teeth		Ratio	
	Large gear	Small gear		
4.10: 1 (10/41)	5	16	3.2/1	+3.8
4.56: 1 (9/41)	5	18	3.6/1	+3.7

The percentage error in the above table is calculated for a rolling radius of 308 mm (12 $\frac{1}{8}$ "), which is a standard value established by AB Volvo for this size of tyre at a vehicle speed of about 80 km.p.h. (50 m.p.h.).

6.40—15" Tyres

Rear axle ratio	Speedometer gears			Theoretical percentage error of mileometer
	Number of teeth		Ratio	
	Large gear	Small gear		
4.55: 1 (11/50)	5	17	3.4/1	+2.7

The percentage error in the above table is calculated for a rolling radius of 330 mm (13"), which is a standard value established by AB Volvo for this size of tyre at a vehicle speed of about 80 km.p.h. (50 m.p.h.).

REFERENCES TO WORKSHOP BULLETINS

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