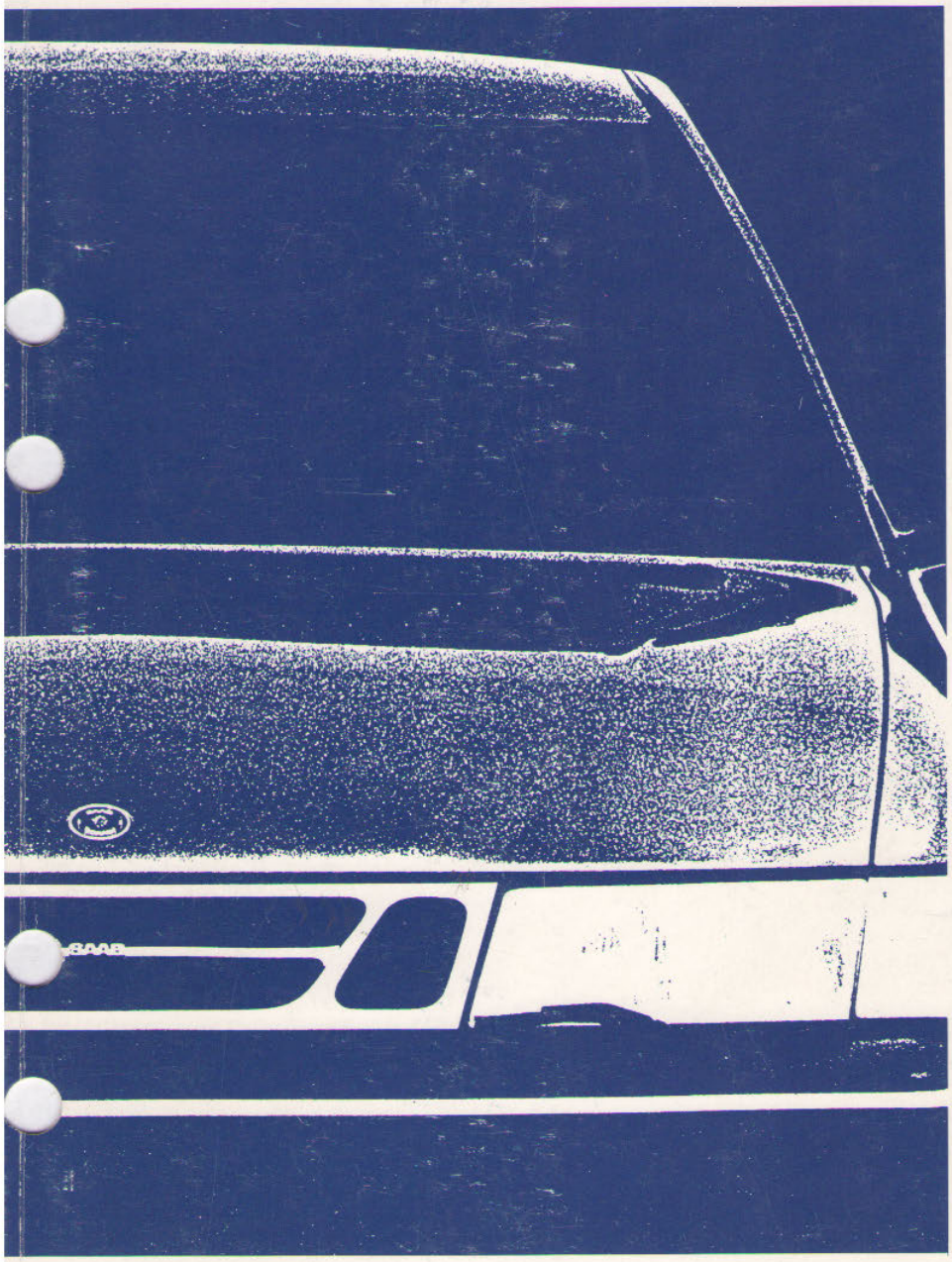
Saab 9000

Service Manual



M 1985-95

ENG

8:3 Air Conditioning

$24.3/ 11/98 (HP)

Saab 9000

SERVICE MANUAL

8:3 Air Conditioning

M 1985–1995

Foreword

This Service Manual is a compilation and update of Air Conditioning for the Saab 9000 M1985–95

This replaces previous Service Manuals:

- 8:3 Heating and Ventilation, Air Conditioning M1985–88
- 8:3 ACC II Automatic Climate Control M1991–
- 8:3 ACC II Automatic Climate Control M1995

In addition to these manuals, the following Service Informations have also been worked into the text:

108-1327	854-1288
108-1401	854-1294
854-084 (ST)	854-1301
854-1134	854-1395
854–1194	854–1408
854-1244	854-1420
854-1248	854-1422
854-1280	854-1427

All information and illustrations in this Service Manual are based on the design of the cars at the time of the final editing of the text. Model range, technical data and equipment vary between markets and may be changed without prior notice.

Saab Automobile AB

Warning, Important and Note

The headings "Warning", "Important" and "Note" occur from time to time in the Service Manual. They are used to draw the attention of the reader to information of special interest and seriousness. The importance of the information is indicated by the three different headings and the difference between them is explained below.

⚠ WARNING

Warns of the risk of material damage and grave injury to mechanics and the driver, as well as serious damage to the car.

Important

Points out the risk of minor damage to the car and also warns the mechanic of difficulties and time-wasting mistakes.

Note

Hints and tips on how the work can be done in a way that saves time and labour. This information is not supplied for reasons of safety.

Market codes

The codes refer to market specifications

AT	Austria	GB	Great Britain
AU	Australia	GR	Greece
BE	Belgium	IS	Iceland
CA	Canada	IT	Italy
CH	Switzerland	JP	Japan
DE	Germany	ME	Middle East
DK	Denmark	NL	Netherlands
ES	Spain	NO	Norway
EU	Europe	SE	Sweden
FE	Far East	US	USA
FI	Finland	UC	US California
FR	France		

Production: Service Support, Saab Automobile AB, Trollhättan, Sweden

Technical data

Compressor

Type designation		Sanden SD 510	Sanden SD 709	Seiko Seiki SS121 DN1
Number of cylinders		5	7	–
Cylinder volume	cm^3 (in^3)	161 (9.8)	154.9 (9.45)	121 (7.38)
Amount of oil, new compressor	dl	1,35	1,35	2.0
Clutch		Electro–magnetic	Electro–magnetic	Electro–magnetic
Engine speed range	rpm	500 – 6000	500 – 6000	500 – 6000
Weight with clutch	kg (lb)	7.7 (16.8)	6.95 (15.15)	6.8 (14.8)

Expansion valve

Year model		**M1985–1991**	**M1992–**
Type		Thermic expansion valve with external pressure equalization	Thermic expansion valve with internal pressure equalization
Capacity	ton	2	1.7
Overheating	C°(F°)	4.4 ± 0.8 (7.9 ± 2)	4.4 ± 0.8 (7.9 ± 2)

Anti–freeze thermostat

Year model		M1985–1991	M1992–
Make		Ranco	Ranco or General El.
Switch–off temperature	C°(F°)	+1.5 ± 1.1 (34.5 ± 2)	+2.0 ± 1.1 (35.6 ± 2)
Switch–on temperature	C°(F°)	5.0 (41.0) Switch–off temp+maximum difference=3.6	2 + 3.0± 1.1 (35.6 + 3.6± 2)

Pressure switch

M1985		**First stage**		
Switch–off pressure	bar (psi)	2.7 (39.5)		
Switch–on pressure	bar (psi)	3.1 (45)		
M1986–91			**Second stage**	**Third stage**
Switch–off pressure	bar (psi)	1.95 ± 0.24 (28 ± 3.5)	10.7 ± 0.97 (155 ± 14)	26.5 ± 1.95 (380 ± 28)
Switch–on pressure	bar (psi)	2.1 ± 0.34 (30.5 ± 4.95)	14.5 ± 0.97 (210 ± 14)	20.3 ± 1.95 (295 ± 28)
M1992–				
Switch–off pressure	bar (psi)	2.0 ± 0.25 (29 ± 3.6)	11.5 ± 1.5 (181 ± 28)	30 ± 2.0 (435 ± 29)
Switch–on pressure	bar (psi)	2.15 ± 0.35 (31 ± 5.1)	16.5 ± 1.2 (239 ± 17)	24.0 ± 2.0 (348 ± 29)

Safety valve

Refrigerant		R12	R134a
Type		Mechanical	Mechanical
Opening pressure	bar (psi)	31 ± 2 (445 ± 29)	37.0 ± 3.7 (537 ± 54)
Closing pressure	bar (psi)	28 (405)	30 (435)

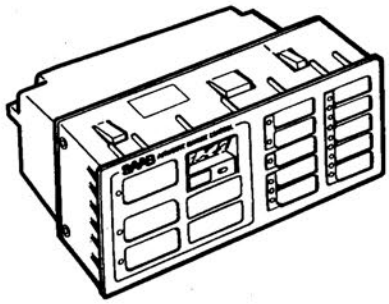
Refrigerant

Year model		M1985–1992	M1992–
Designation		R12	R134a
Quantity	kg (lb)	1.1 (2.43)	0.95 (2.1)
Quantity for system with rear A/C	kg (lb)	1.35 (2.98)	

Lubrication oil

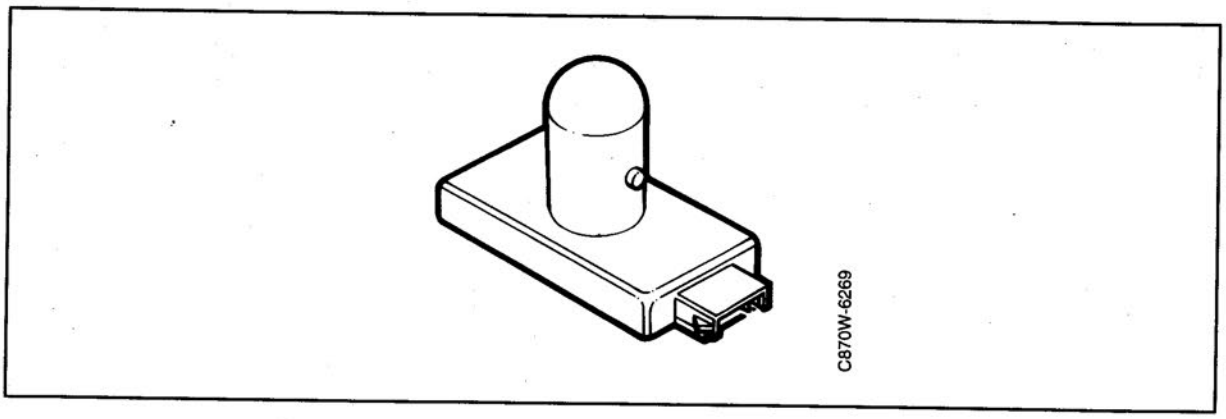
Refrigerant	R12	R134a
Type	Mineral oil 520 SUS 38° C	P.A.G. oil (Poly Alkylene Glycol)
Part number		40 74 787

ACC control module



Year model		M1985–89	M1990–94	M1995–
Number of connector pins		25	39+12	39
Voltage supply +30	pin No.	1	32 (in 39 pin) 1 (in 12 pin)	22
Voltage supply +54	pin No.	14	2 (in 12 pin)	7
Ground	pin No.	13	12 (in 12 pin)	1

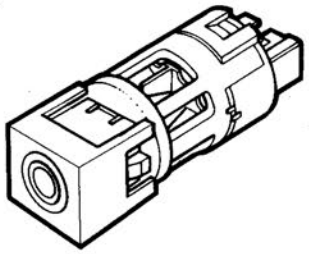
Solar sensor



Year model		M1990–94*	M1995–
Dark	W/m²	0**	0**
Lit with incandescent lamp (60W)	W/m²	600 – 1200 *	600 – 1200 *
Voltage supply approx. 10 V	pin No.	1 (+54)	1 (from ACC control module)
Ground	pin No.	4	4 (from ACC control module)
Sensor signal	pin No.	2	2 (to ACC control module)

* Earlier year models have no communication with the ISAT scan tool.
**Values given in W/m² are read with the ISAT scan tool.

Cabin temperature sensor



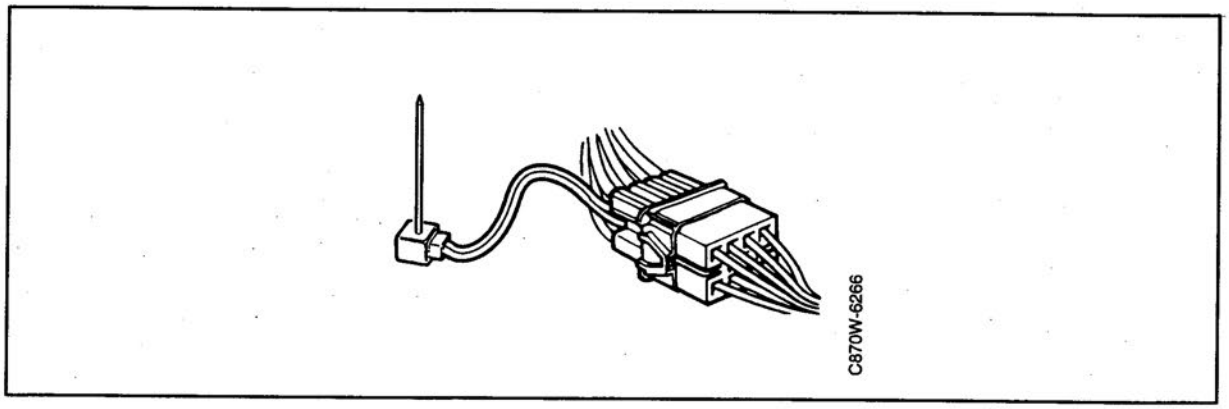
C870W-6267

Pin number applies to M95–.

Aspirating engine		12 V, approx. 50 mA
Voltage supply, aspirating engine	pin No.	4 (from ACC control module)
Ground, aspirating engine		grounding point G8
Signal voltage, temperature sensor (NTC)	pin No.	3 (from ACC control module)
Ground, temperature sensor (NTC)	pin No.	2 (from ACC control module)

°C	°F	k Ohm
0	32	30.0 – 34.9
10	50	18.5 – 21.1
20	68	11.8 – 13.2
25	77	9.5 – 10.5
30	86	7.6 – 8.5
40	104	5.0 – 5.7

Blended air temperature sensor



		M1990–94	M1995–
°C	°F	k Ohm	k Ohm
0	32	25.5 – 30.5	25.5 – 30.5
10	50	16.6 – 19.6	16.8 – 19.7
20	68	11.2 – 13.0	11.3 – 13.0
30	86	7.7 – 8.8	7.8 – 8.8
40	104	5.4 – 6.1	5.4 – 6.1
50	122		3.9 – 4.3
60	140		2.8 – 3.2
70	158		2.1 – 2.3
80	176		1.5 – 1.7
90	194		1.1 – 1.3

Tightening torques

Compressor

		Sanden
Centre nut, clutch	Nm (lbf ft)	38±4 (28±3)
Cylinder block bolts	Nm (lbf ft)	32±2 (23.5±1.5)
Oil filler plug	Nm (lbf ft)	10±2 (7.4±1.4)
Service valves	Nm (lbf ft)	14.5±2.5 (10.6±1.8)
Centre nut, clutch	Nm (lbf ft)	38±4 (28±3)

Other

		Sanden	Seiko Seiki
Compressor, pressure suction	Nm (lbf ft) Nm (lbf ft)	32.5±2.5 (24±2) 37.5±2.5 (28± 2)	10±2 (7.4± 1.4) 10±2 (7.4±1.4)
Condenser, inlet outlet	Nm(lbf ft) Nm (lbf ft)	24.5±3.5 (18± 2.5) 17±3 (12.6± 2.2)	24.5±3.5 (18±2.5) 17±3 (12.6±2.2)
Desiccant container, inlet outlet expansion valve	Nm (lbf ft) Nm (lbf ft) Nm (lbf ft)	17±3 (12.6±2.2) 17±3 (12.6±2.2)	17±3 (12.6±2.2) 18–25 (13.3–18.5)
Pressure switch	Nm (lbf ft)	17±3 (12.6± 2.2)	17±3 (12.6±2.2)
Expansion valve PAD connection valve to evaporator	Nm (lbf ft) Nm (lbf ft) Nm (lbf ft)	23.5±3.5 (17.3±2.6)	 17.5±2.5 (12.8±1.8) 6±2 (4.5±1.5)
Pressure equalization pipe connection on vacuum pipe	Nm (lbf ft)	8.5±1.5 (6.2±1)	
Evaporator outlet	Nm (lbf ft)	33.5±4.5 (24.5±3.5)	
Safety valve	Nm (lbf ft)	17±3 (12.6±2.2)	12±1 (8.8± 0.8)

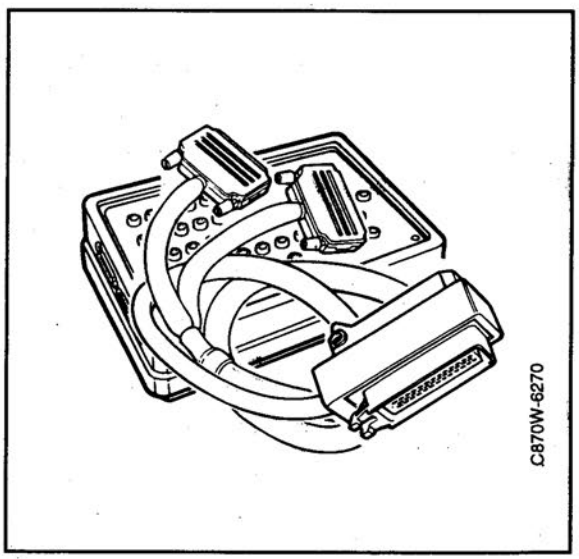
Belt tension

		Sanden*	Seiko Seiki	for V6 engine
For new, unused belt	N (lbf)	535 ± 45	Automatic	Automatic
Checking belt tension	N (lbf)	355 ± 22	Automatic	Automatic
Refitting used belt	N (lbf)	355 ± 22	Automatic	Automatic

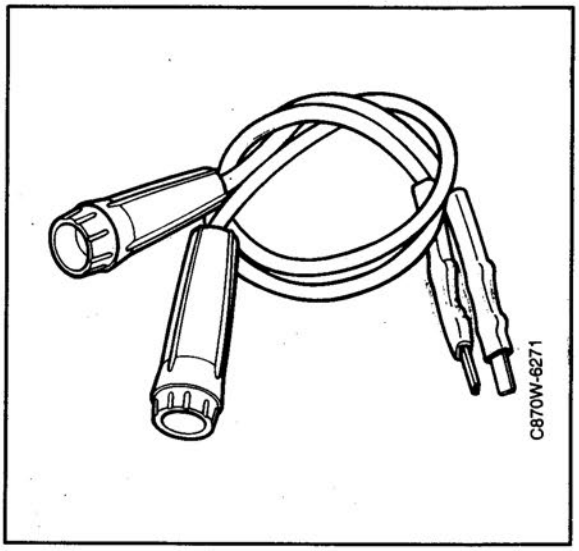
*With V–belt, otherwise automatic.

Special tools

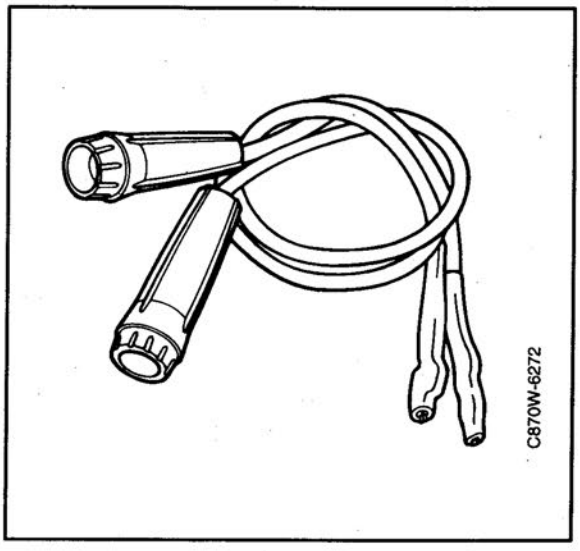
86 11 261 Breakout box and test cables



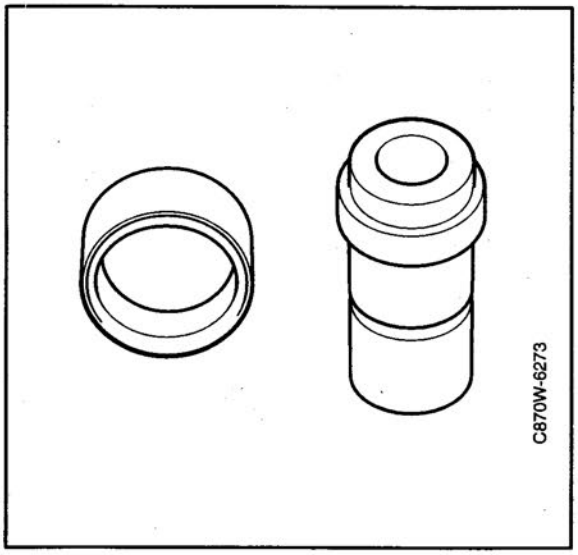
86 11 352 Test cables for pin connector (male pins)



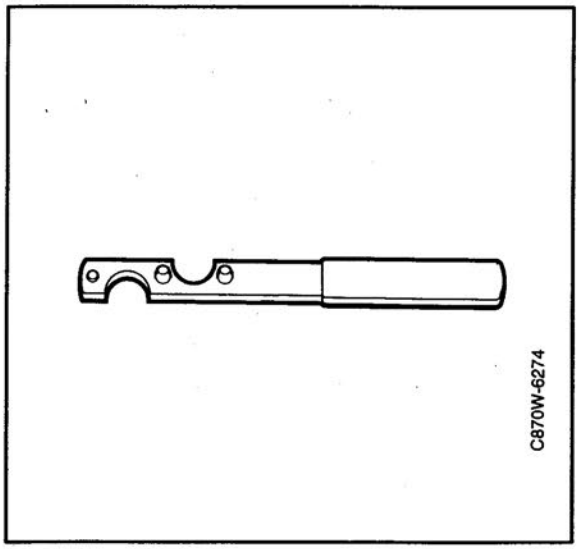
86 11 410 Test cables for pin connector (female pins)



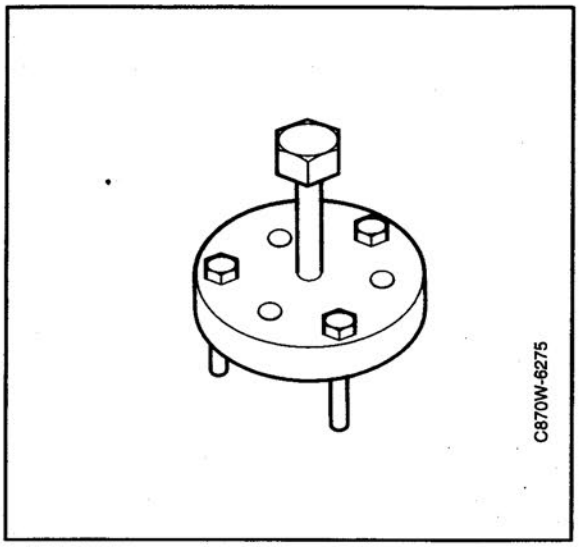
83 93 407 Spacer
82 92 559



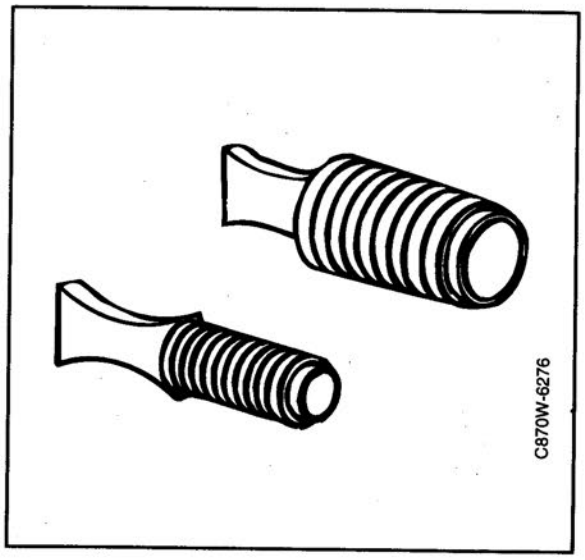
83 93 373 Key



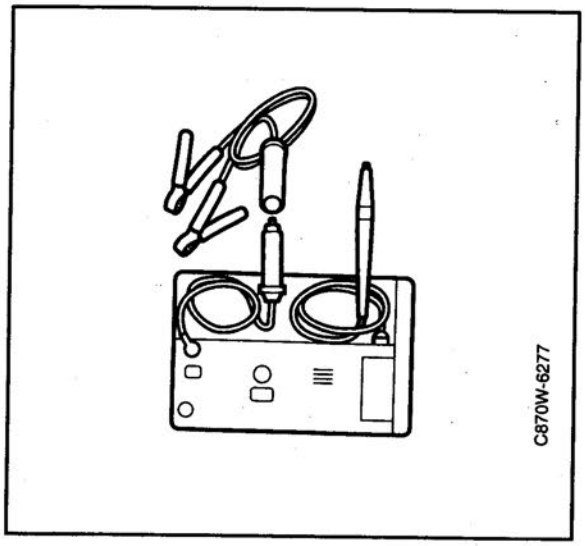
83 93 381 Puller



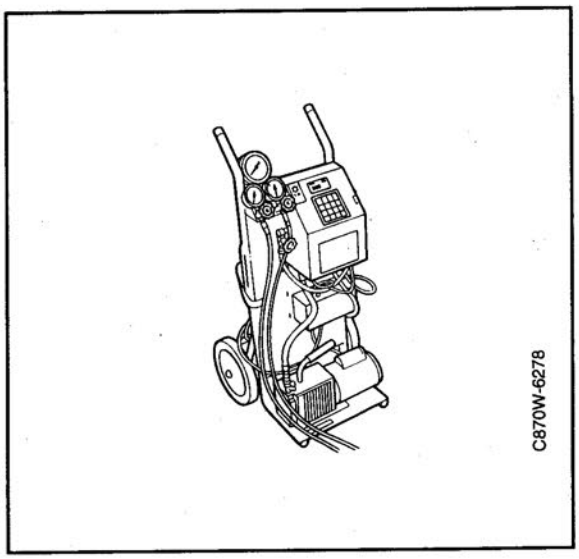
82 92 948 Plugs in basic kit with box
82 92 955 additional kit



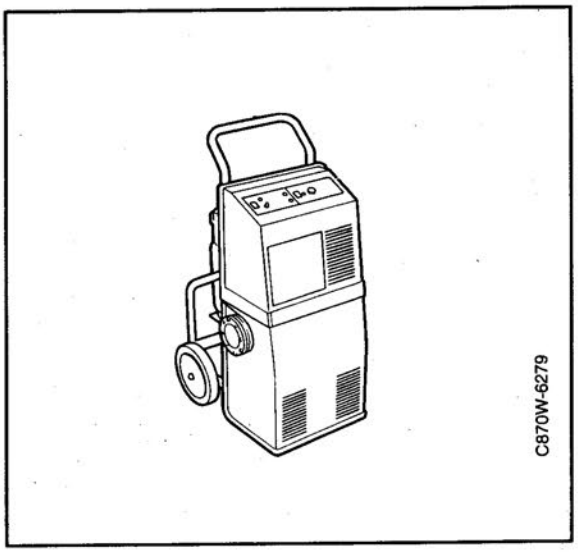
82 92 930 Leak detector



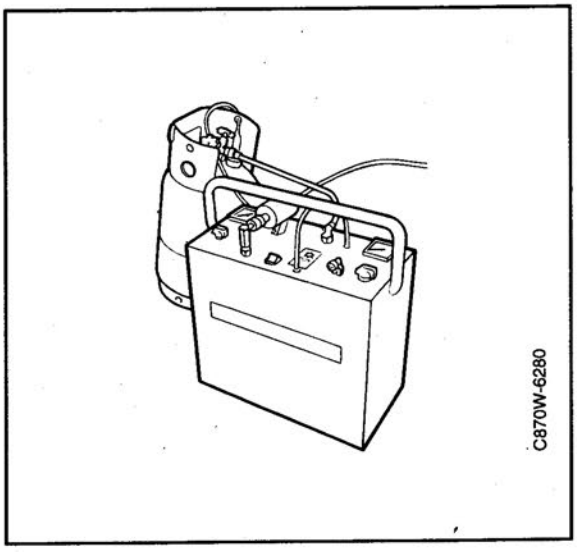
Robinair 10324 Smart Cart



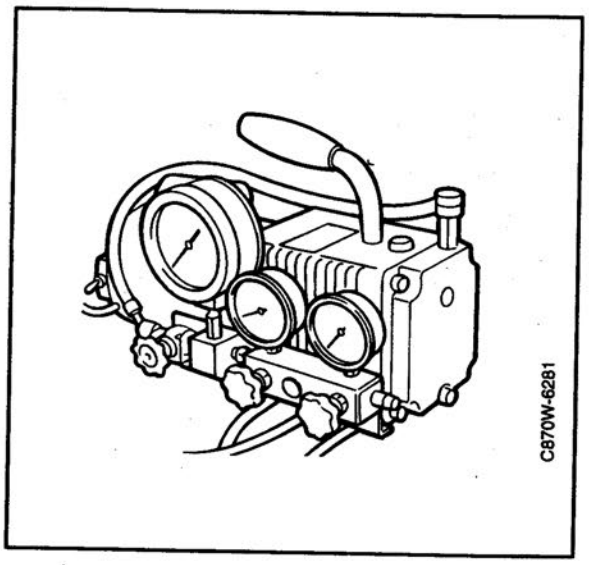
Robinair 17234



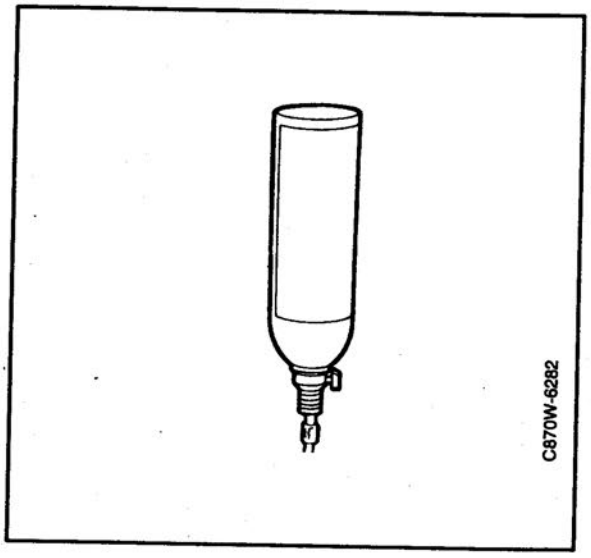
Robinair 17644



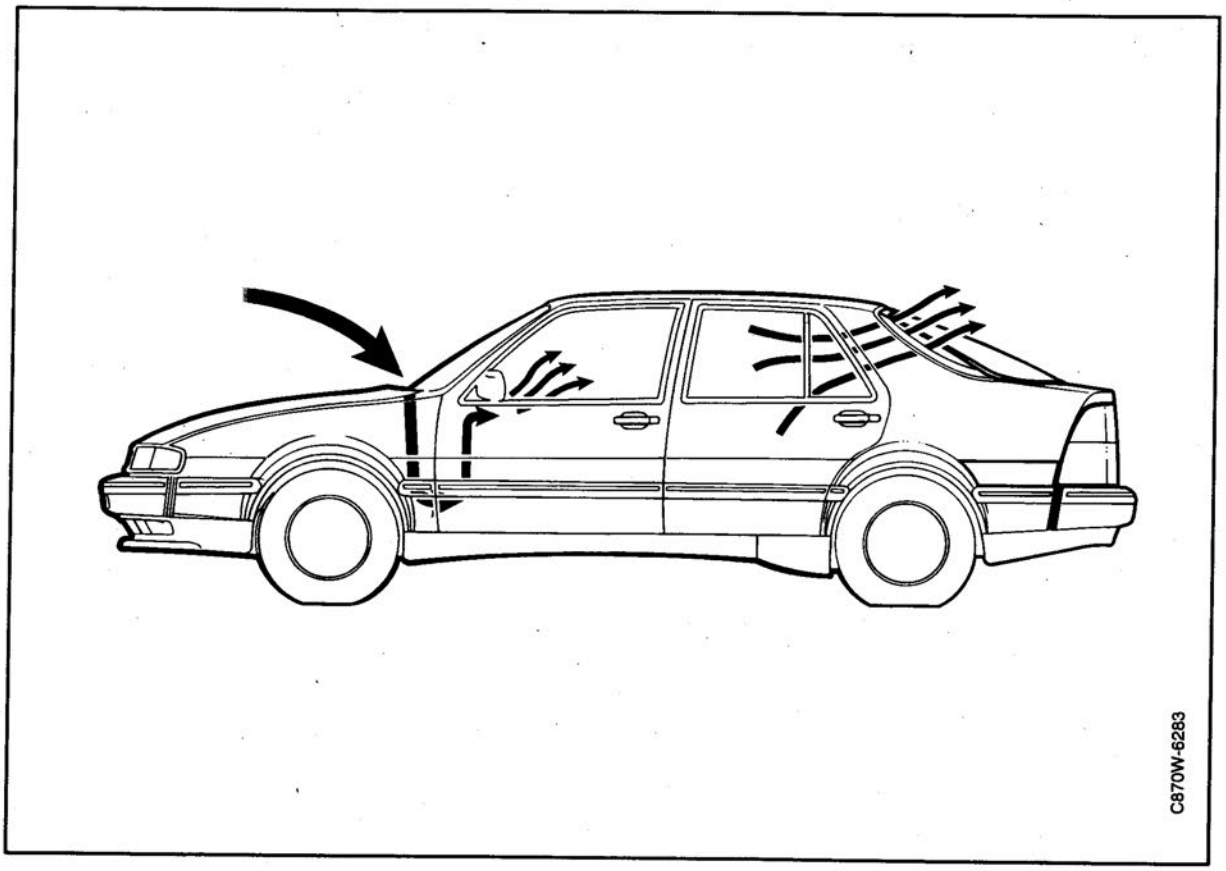
Robinair 10094



Robinair 1 litre bottle

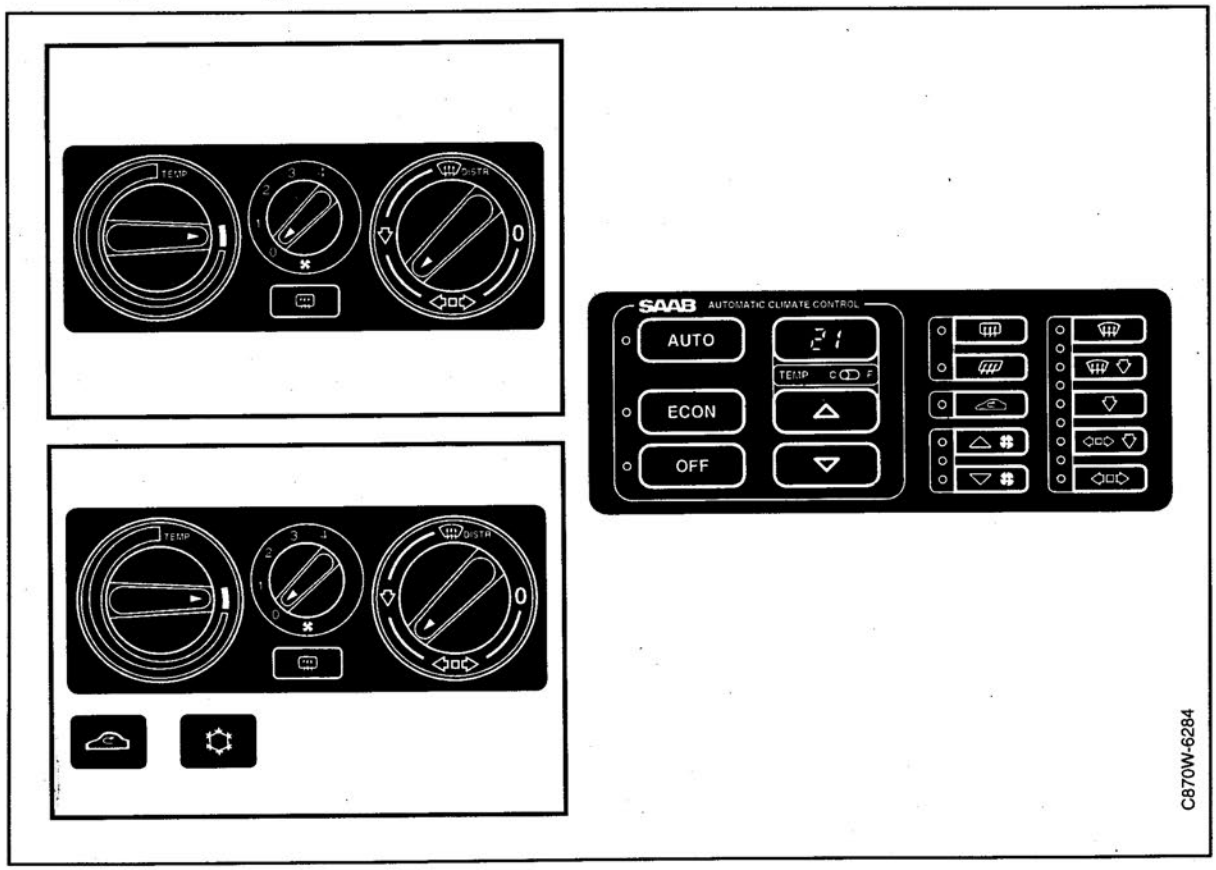


Technical description



The technical description can be said to consist of two parts. The first part covers heating and ventilation, with or without A/C. The second part covers the ACC unit.

Model, heating and ventilation unit



There are three designs of the heating and ventilation unit:

Heating and ventilation unit

Manually controlled heating and fresh air unit.

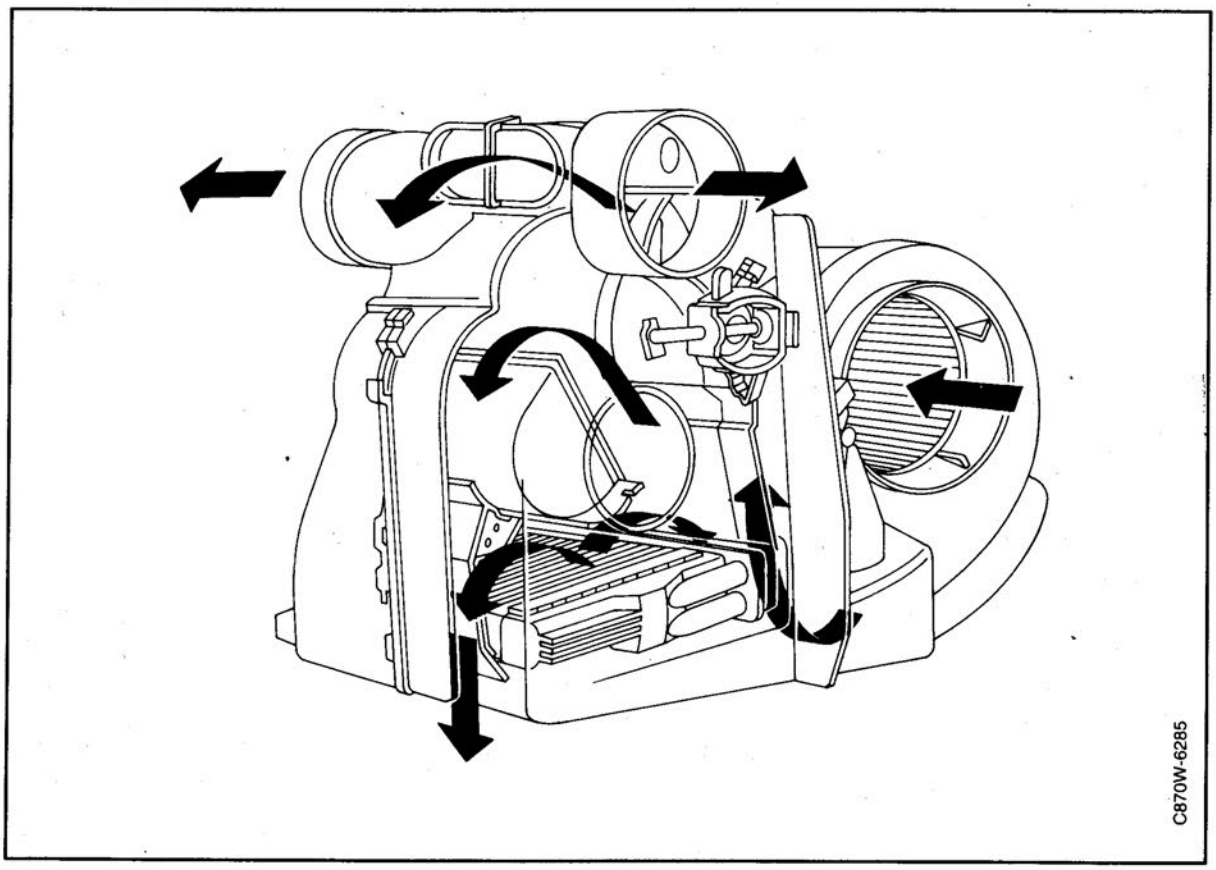
Heating and ventilation unit with A/C

Manually controlled heating and fresh air unit with additional A/C and recirculation.

Automatically controlled heating and ventilation unit, ACC

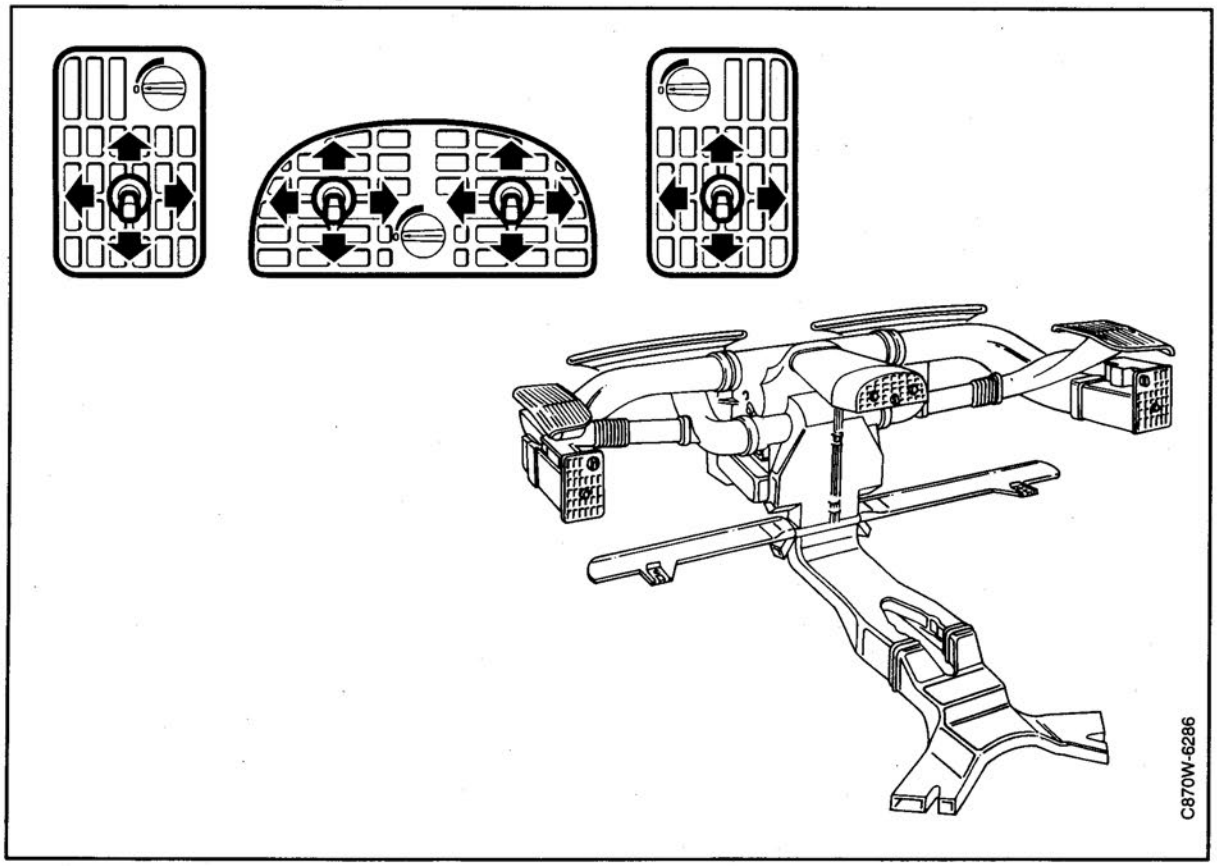
Heating and ventilation unit with automatic climate control, meaning that the unit automatically maintains the desired cabin temperature, irrespective of the temperature of the air outside. The design of the control panel varies slightly between year models.

Heating, ventilation part



The design of the heating and ventilation part is common to all three units. When the air has entered the unit through the air intake beside the lower edge of the windscreen, it passes through the fan housing and is directed by the air–mixing damper through or past the heat exchanger. Using air distributors, the air is then directed to the desired vent.
The system is an air–mixing system.

Air distribution system



From the heating and ventilation unit outlet, the air is directed via air ducts to the various vents, which distribute the air in the cabin.

Floor and defroster vents

There are four floor vents, of which two are for the rear floor. On year model 1988, front floor ducts were added with four separate air vents as well as rear door fans (not illustrated) for demisting the rear windows.

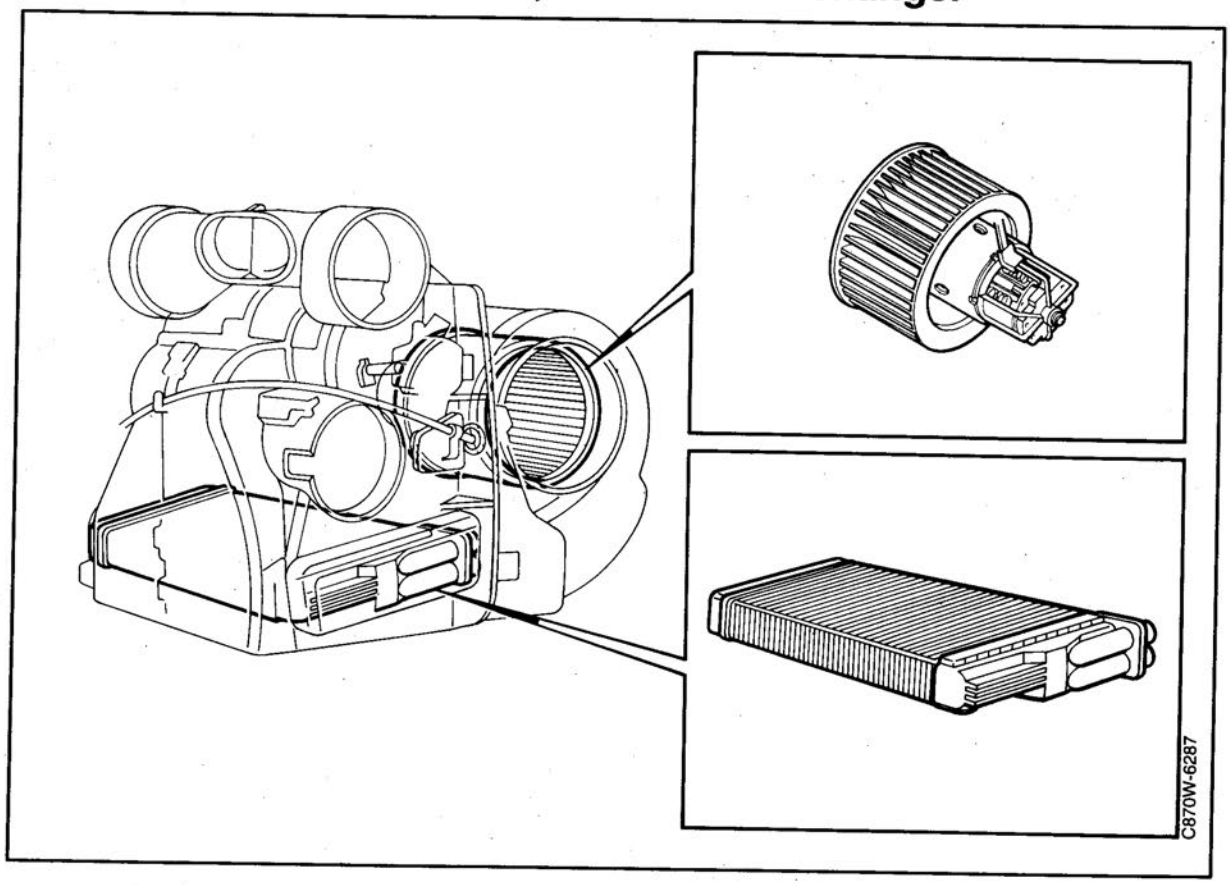
There are six defroster vents. Two of these control air to the windscreen and four small vents on the dashboard direct air to the front windows.

From year model 1987, chassis number CH1007949 for left–hand drive cars and chassis number CH1024270 for right–hand drive cars, all defroster air for the side windows is concentrated to the vents in the loudspeaker grills.

Air vents in the facia

There are four air vents in the facia. These can be individually controlled and the direction of air flow can be regulated both vertically and horizontally.
The vents in the facia have a control which allows air volume to be continuously controlled.

Fan impeller and fan motor, water heat exchanger



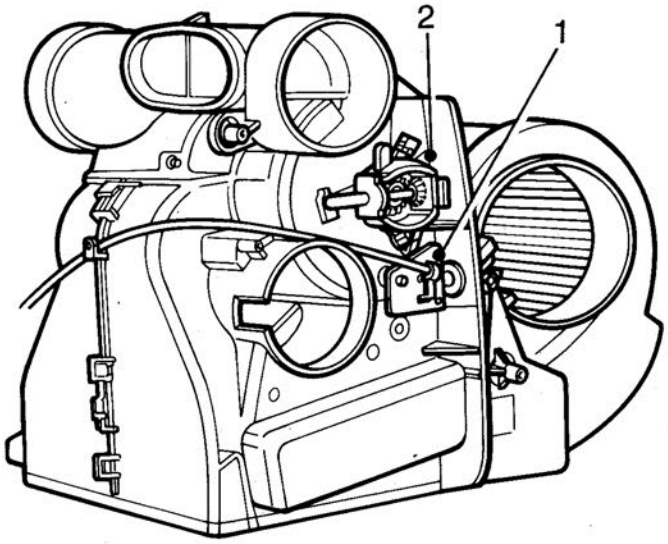
Fan impeller and fan motor

The fan impeller is of radial type with a guide collar on its outer edge. The fan impeller is balanced with steel clips. The fan motor is a DC motor, whose speed can be regulated by changing the voltage across it.

Heat exchanger

The heat exchanger is located horizontally in the bottom of the heating and ventilation housing. It has no water valve (water tap), and is therefore always warm.

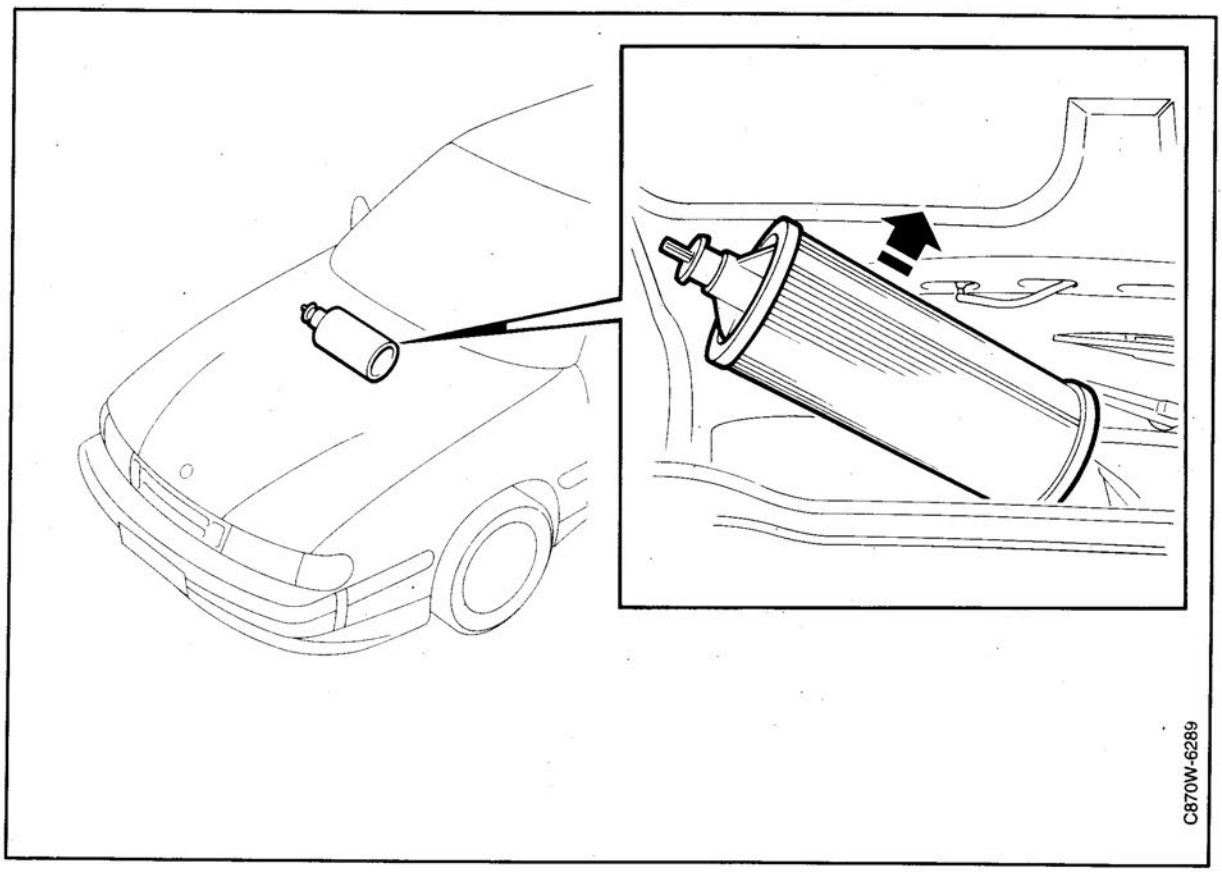
Air–mixing damper, without ACC



1. Cable attachment, air–mixing damper
2. Cable attachment, air distributor

The air–mixing damper is controlled by air temperature. The damper is continuously controlled via a cable from the heater controls.

Fresh–air filter for cars without A/C, –M1989



The filter is located in the engine compartment, easily accessible for replacement. It is made of paper and cleans the air of:

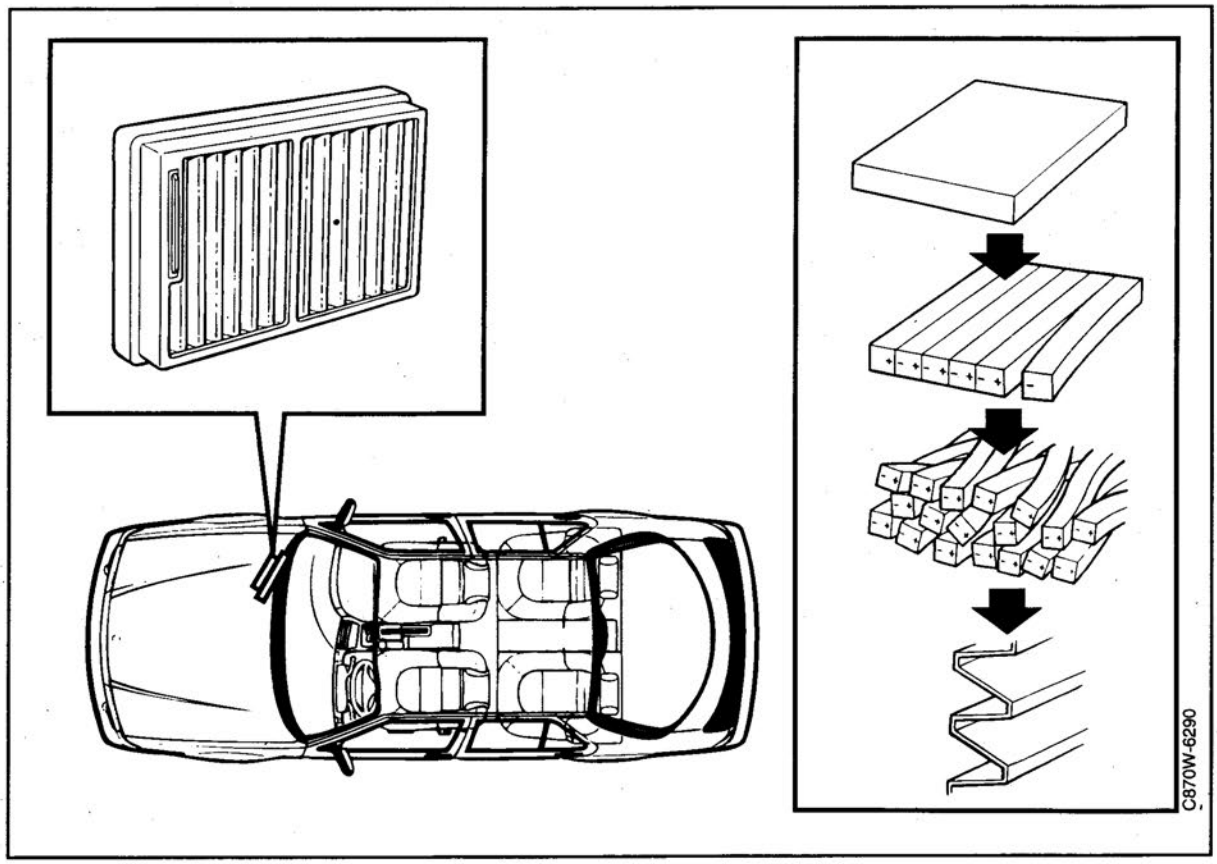
- all pollen to 100%
- All visible particles
- Oil and soot

The filter significantly reduces road dust on the windscreen and instruments.

A cover was introduced over the filter on M1987 from chassis numbers CH1021173, CH800853.

From M1990, a flat filter was introduced, similar to those for cars with A/C.

Fresh air filter for cars with A/C



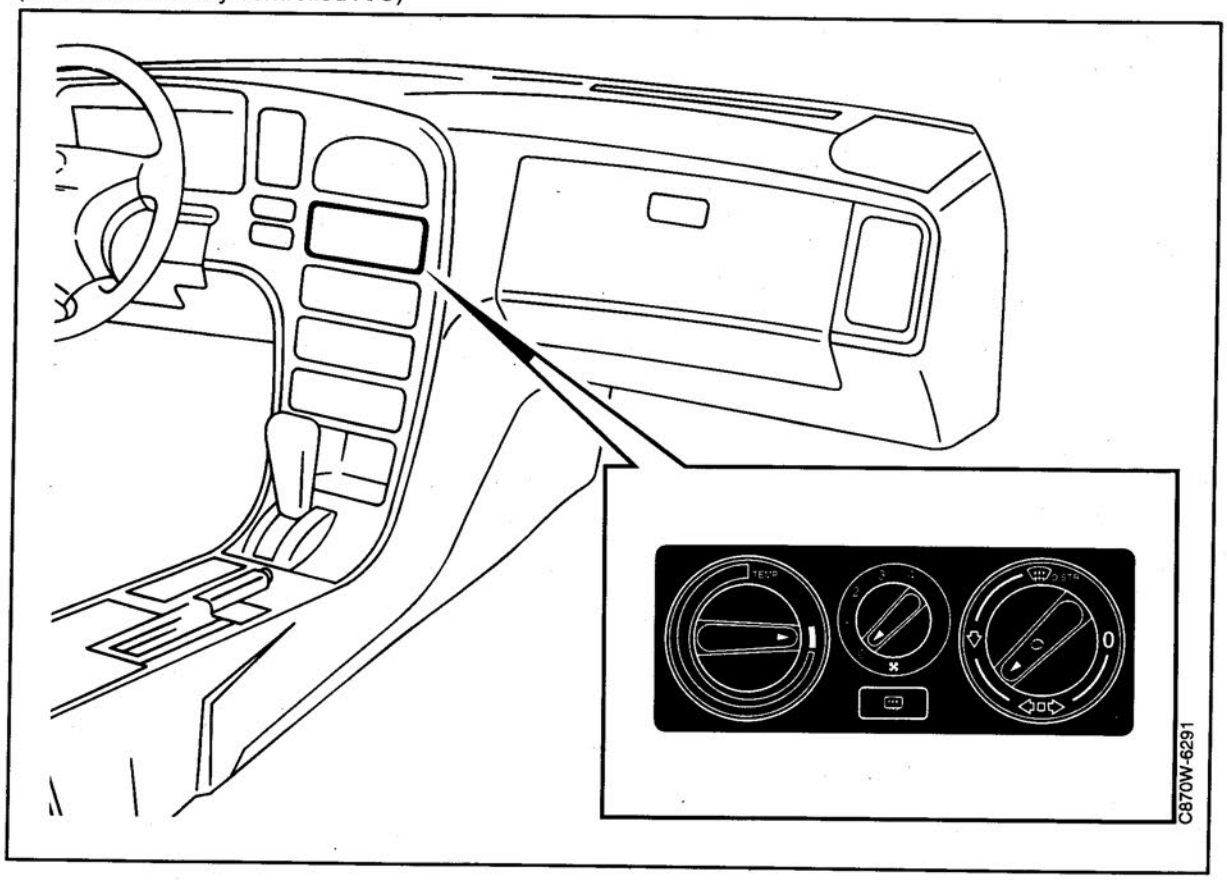
The filter is located beside the air intake, before the evaporator. The fibers stop the largest particles, but to trap the smallest ones, electrostatic charge is used. Using electrostatic charge, the filter attracts parts, more or less as a magnet attracts iron filings.

In addition to removing all visible particles, the filter also removes pollen, spores, other types of dust, asphalt fumes etc. from the cabin air.

In filters used up until M1991, oiled glass fibre was used as the filter material. This filter cleans the air as particles stick to the oil on the fibres.

Control panel for air distribution, manual

(also with manually controlled A/C)

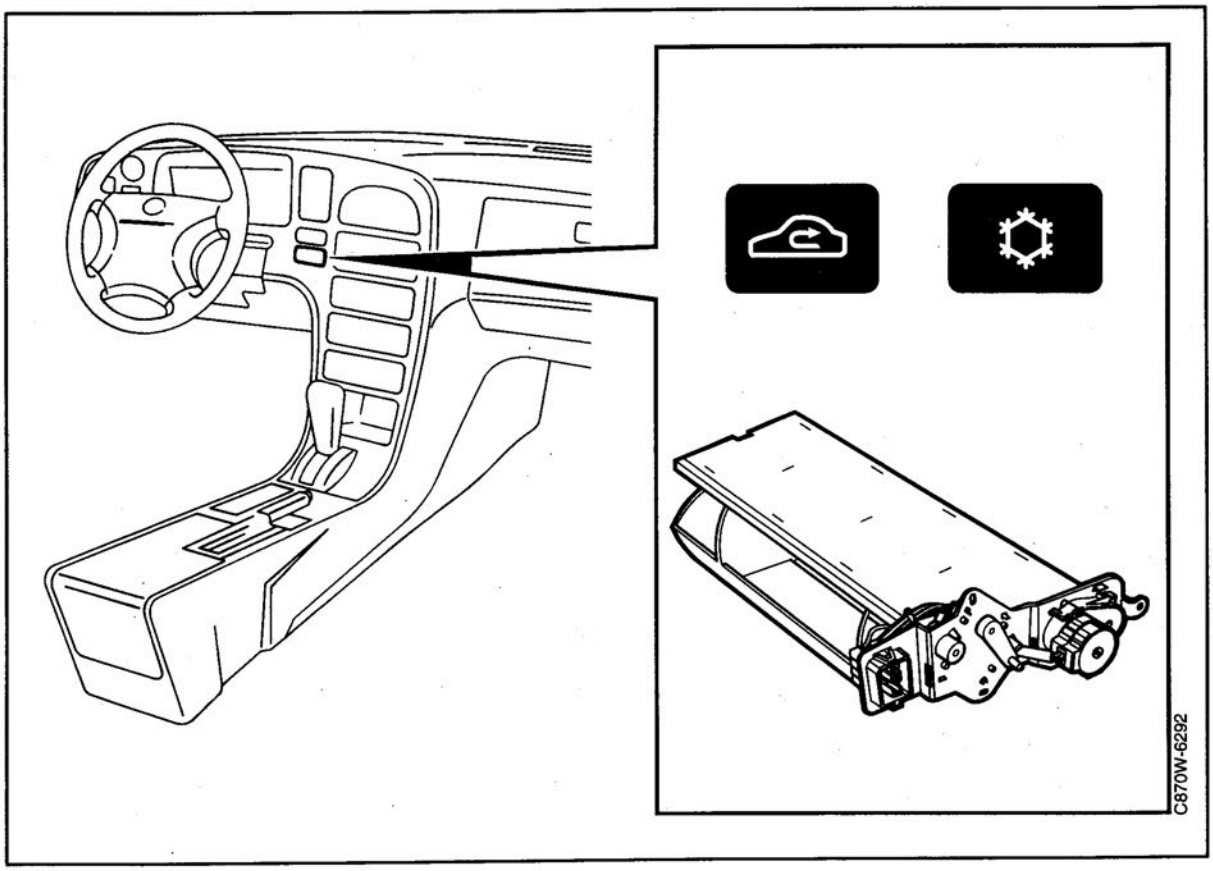


Temperature control is continuous. The fan control has five positions, zero and four speeds.

The switch for the electrically–heated rear window is located under the fan control.

The ventilation control has four ventilation choices and the continuous intermediate positions mix the two closest selections.

Control for cars with A/C



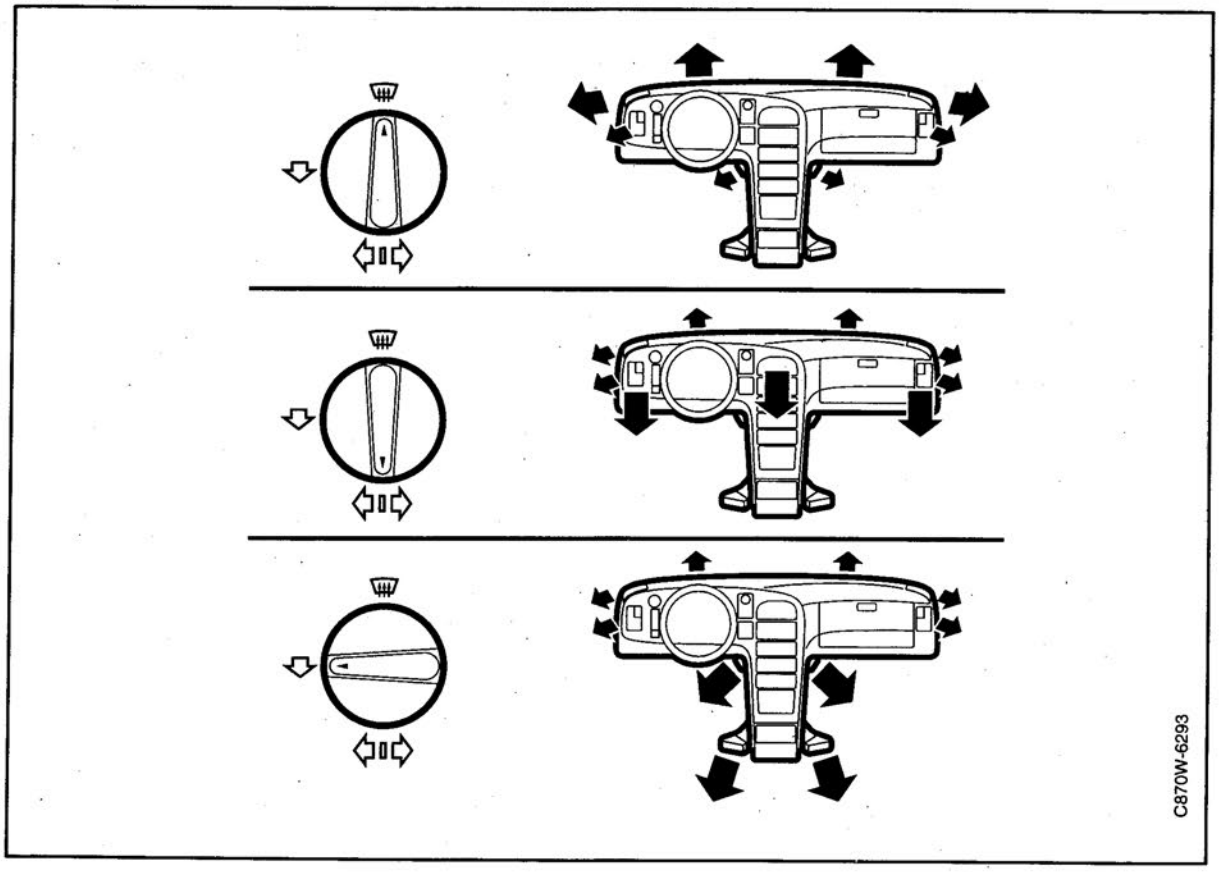
Cars with A/C have two push–buttons to the left of the control panel. One of these buttons is for A/C "on/off" and one is for recirculating cabin air.

Recirculation is 100% and used when outside temperature is high in order to raise cooling capacity and when driving in queues or tunnels.

If recirculation is used in damp weather, the air conditioning should also be switched on in order to prevent the build up of mist on the windscreen and windows. Demisting is achieved by the humidity condensing on the cooling unit (evaporator) in the air conditioning unit. However, temperature may affect the way in which the A/C compressor works, and demisting does not always work.
For this reason, during cold weather, recirculation may cause condensation on the windows despite A/C being on.

The air recirculation flap is powered by an electric motor.

Air distribution



The air distribution control can be regulated to a number of detent positions between the four main positions.

A certain amount of air is always directed to the defroster vents in order to keep the windscreen and windows free from mist.

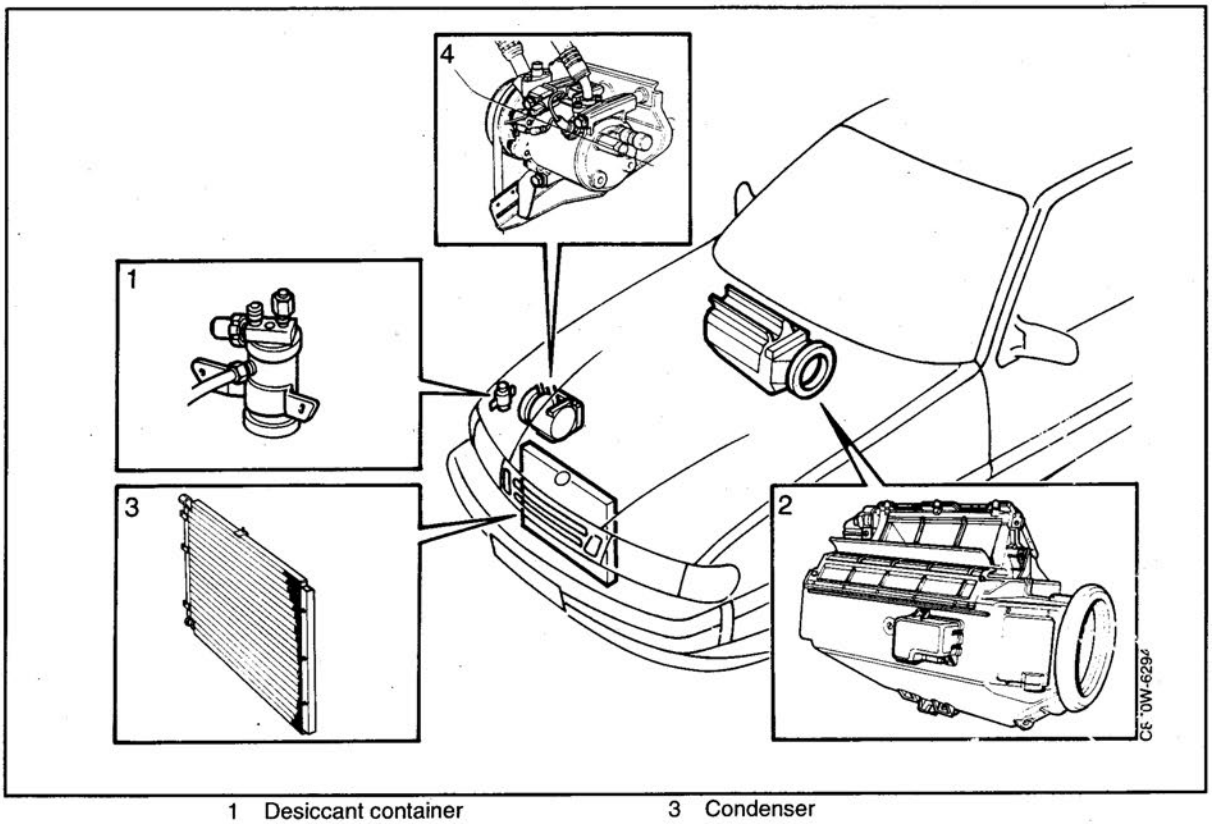
1 **Position 0**
All vents closed. No air distribution. No power to fan motor. Despite this, there may be a draught when the car is driven. The air is forced in through the system by wind pressure.

2 **Ventilation position.**
Air from vents in facia. Small amount of leakage to defroster vents (felt at high fan speed).
Selectable fan speed.

3 **Floor position.**
Air from floor vents. Small amount of leakage to defroster vents (felt at high fan speed).
Selectable fan speed.

4 **Defroster position.**
Air from defroster vents.
Small amount of leakage to floor vents (felt at high fan speed).
Selectable fan speed.

Air conditioning system (A/C)



1 Desiccant container
2 Evaporator
3 Condenser
4 Compressor

The function of air conditioning in a car is to lower air temperature in the cabin to a comfortable level when outside temperatures are high.

In humid weather, the system can also keep windscreen and windows free from mist at low fan speeds, even in difficult conditions.

The air conditioning does not produce cold, but removes heat from the car cabin.

In order to conduct heat away from the cabin, a refrigerant is used which has a lower temperature than the air as heat always moves from a warmer object to a colder one.

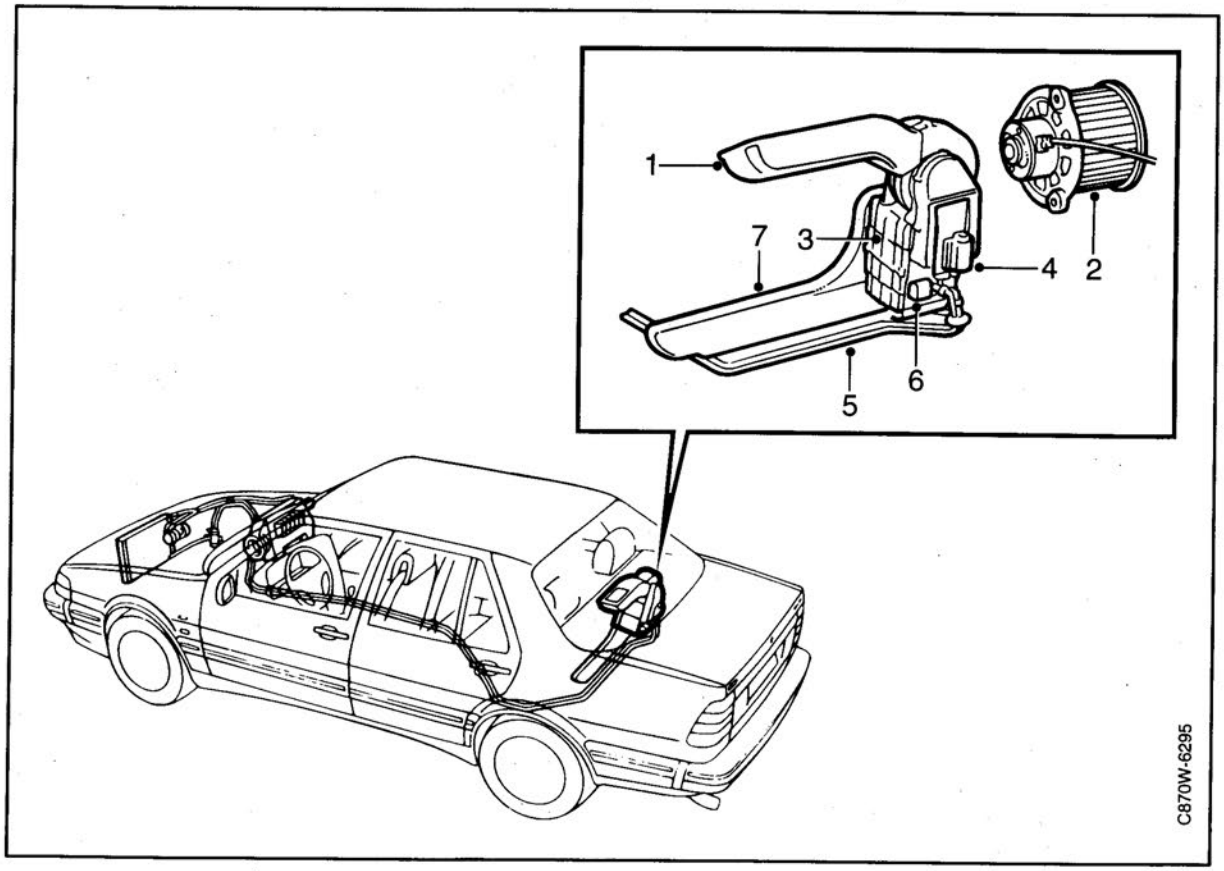
The refrigerant used is a fluid, R134a (R12 in older year models), which boils and evaporates at low temperature (about –30° C (–22° F) at normal atmospheric pressure).

The refrigerant has a constant ratio between pressure and temperature meaning that if, for example, pressure is changed, temperature also changes. This applies as long as volume is constant.

This relationship is used in the air conditioning by allowing the refrigerant to circulate in a closed system and changing its pressure so that temperature changes and it boils (evaporates). At system pressure, the refrigerant boils at about 0° – 4° C (32–39 °F).

In order for the medium to boil, heat must be available. This heat is taken from the air around the evaporator in which boiling takes place. When heat is absorbed by the refrigerant, the surrounding air becomes colder. It is this cold air which is blown into the cabin by the heating and ventilation unit fan. The heat which is absorbed by the refrigerant in the evaporator is transported to the engine compartment where it is transferred to the air by a condenser which is cooled by the air blowing through it and/or the electric radiator fan.

Rear air conditioning, M1992 only



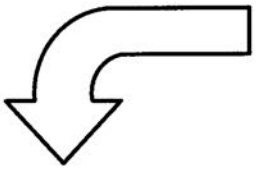
1 Vent
2 Fan
3 Evaporator
4 Fan control module
5 Refrigerant medium pipe
6 Solenoid valve
7 Air intake

Certain cars of year model 1992 were equipped with rear air conditioning (SAAB 9000 CD with ACC). This was to create a more even cooling of the cabin and in order to be able to reduce fan speed and maintain cooling.

An evaporator with fan is located in the luggage compartment and draws air via an air intake under the rear seat. The air is cooled and channeled to a vent in the parcel shelf. Coolant is lead to and from the rear evaporator in two insulated pipes under the car. A solenoid valve under the rear evaporator ensures that the oil returns to the compressor when the rear A/C unit is switched off. Otherwise, the oil may remain stationary in the pipes causing compressor breakdown. The solenoid valve also prevents circulation of refrigerant.

Other parts in the system are common to cars without rear A/C but the quantity of oil and quantity of refrigerant has been increased.
Note that it is not advisable to direct the center front vent diagonally upwards when rear A/C is used. If this is done, the air streams meet at the roof and cause cold air to drop on to the necks of the driver and passenger.

How the cooling unit works



1. Evaporator

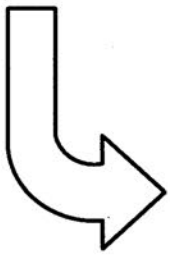
When the refrigerant comes from the expansion valve in to the evaporator, it expands. The pressure in the evaporator is much lower due to the suction effect of the compressor. As refrigerant expands, it becomes gaseous (boils). However, in order for evaporation to take place, heat must be supplied. This heat is taken from the air around the evaporator. The cold air is then blown into the cabin by the fan. Refrigerant is then directed on in gaseous form to the compressor.

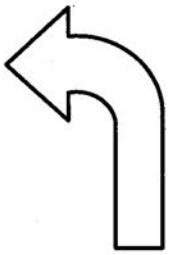
2. Anti–freeze thermostat

The anti–freeze thermostat prevents freezing and the build up of ice on the evaporator. A capillary tube is inserted between the evaporator cooling fins and senses temperature. When temperature drops below about +1.5° C (35° F), power to the compressor clutch is interrupted. When evaporator temperature then increases to about +4.5° C (40° F), the thermostat closes and the compressor is switched on again.

3. Compressor

Refrigerant arrives at the compressor under low pressure and in gaseous form. In the compressor, the refrigerant is compressed and its pressure and temperature increase. The warm gaseous refrigerant is then forced on into the condenser.





6. Expansion valve

The refrigerant which comes into the expansion valve is liquid, at high pressure and high temperature. The function of the expansion valve is to control the quantity of refrigerant which is sprayed into the evaporator. The valve does not let in more refrigerant than that quantity which can be evaporated at any particular time.
In order for the expansion valve to be able to let through the exact quantity of refrigerant, there is temperature sensor and a capillary tube.

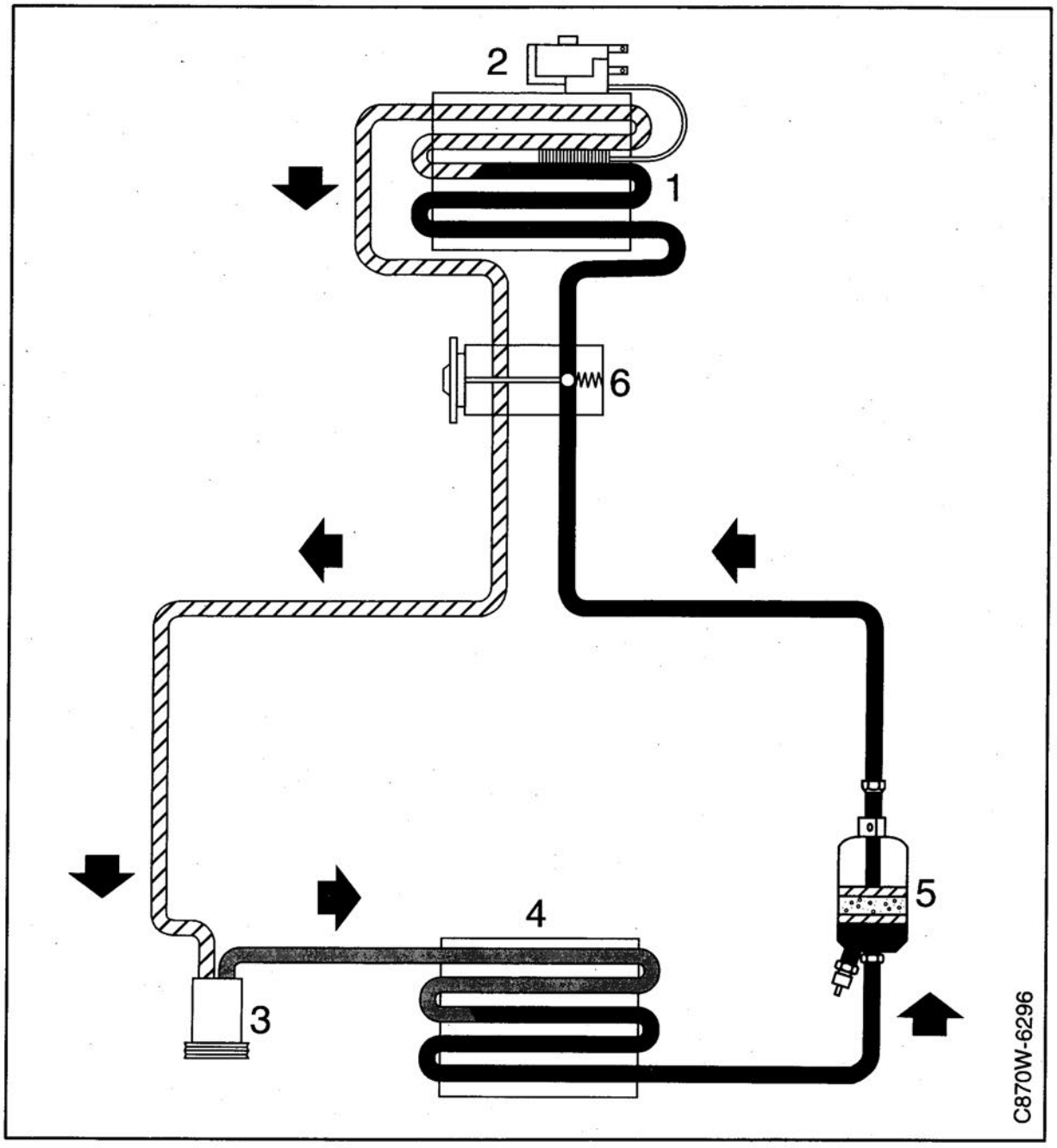
5. Desiccant container

The function of this is both to store and desiccate the refrigerant.
The refrigerant comes in to the desiccant container in liquid form under high pressure and at high temperature.
It passes through a filter where it is desiccated and where any particles are separated. The refrigerant is then led on in liquid form to the expansion valve.
There is a pressure switch on the desiccant container which disconnects the compressor if pressure becomes too low in the system.

4. Condenser

The hot refrigerant at high pressure is pumped by the compressor in to the condenser's cooling coil. The cooling coil has cooling fins, which are cooled by air from the car's radiator fan and the natural air circulation through the car. As heat always moves from a warmer to a cooler object, the hot refrigerant will transfer a part of its heat to the colder air. When the hot gaseous refrigerant looses some of its heat, it starts to condense and return to liquid.
On the gas side of the condenser is a mechanical safety valve which releases refrigerant if system pressure becomes too high.

Diagram, A/C



Diagram, A/C

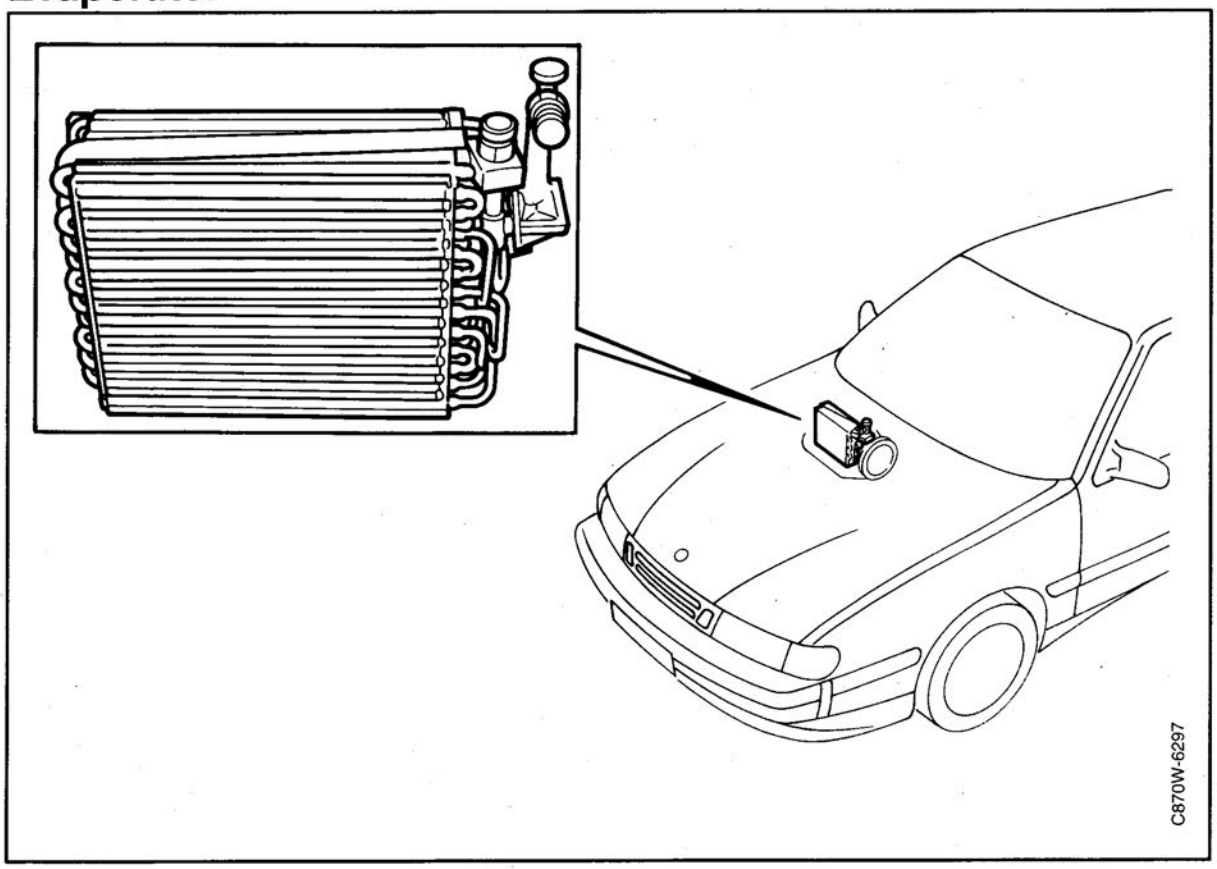
= gas, high pressure

= liquid, low pressure

= liquid, high pressure

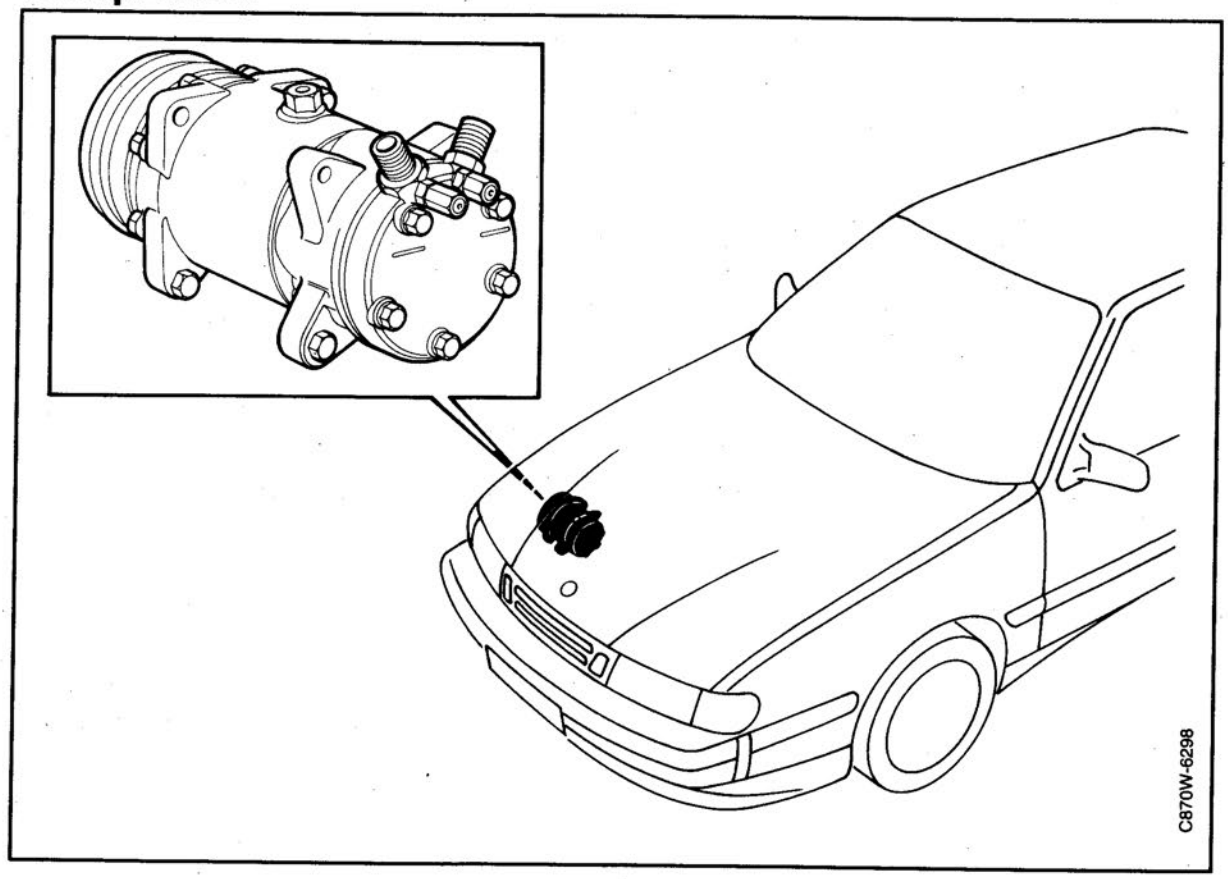
= gas, low pressure

Evaporator



In the evaporator, the incoming refrigerant expands and boils, taking up heat from the surrounding air. The cooled air is then led into the cabin.
The evaporator has fins and a refrigerant manifold. When heat is absorbed, condensation builds up on the outside of the evaporator. This condensation is drained out through a hose in the lower part of the evaporator casing and out into the engine compartment. The drain hose is required in order to protect against dirt and to prevent a higher noise level in the cab and to maintain cooling. In addition, odour may be generated if condensation is not satisfactorily removed.

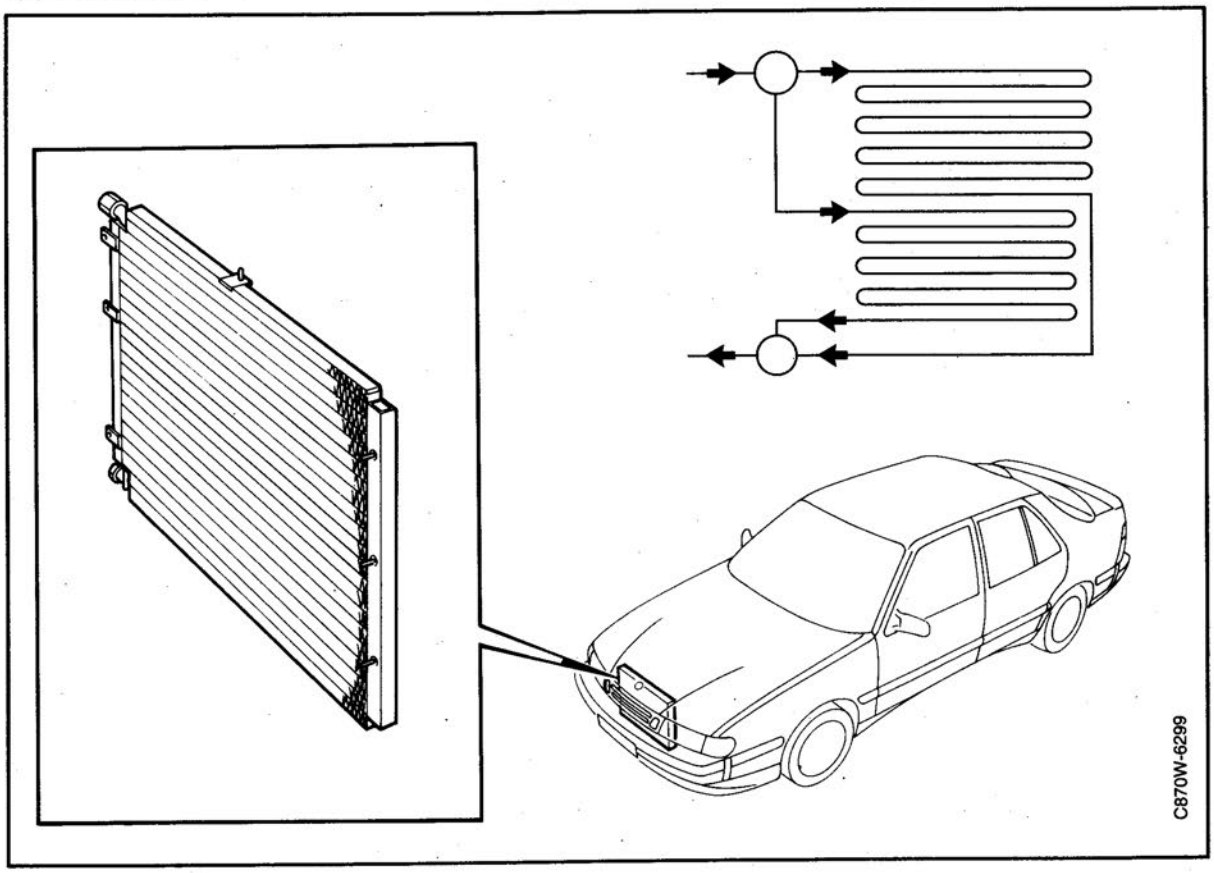
Compressor



The compressor has five cylinders and is of axial type up to year model 1987, and has seven cylinders from year model 1988. The pistons are fitted annularly around the input shaft.
The valves are of leaf type and are opened and closed by the differences in pressure which arise during piston movement.
The compressor and cylinder head are made of aluminium, while the cylinder bore is made of steel. The pistons are made from aluminium and have a piston ring.
The compressor clutch is electromagnetic.

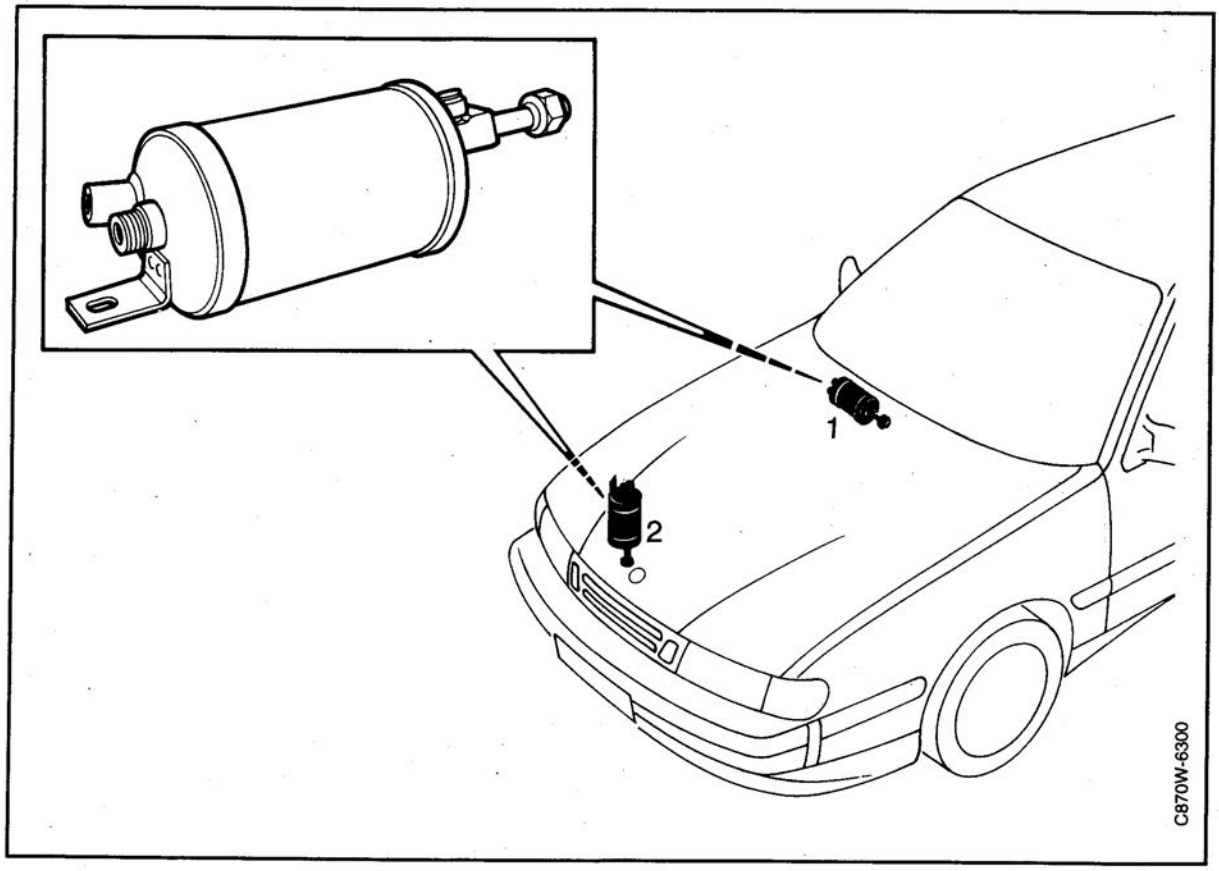
In M1992, a new vane type compressor was introduced which is specially adapted to R134a refrigerant. In addition, the compressor has overheating protection which switches it off at +140°C.

Condenser



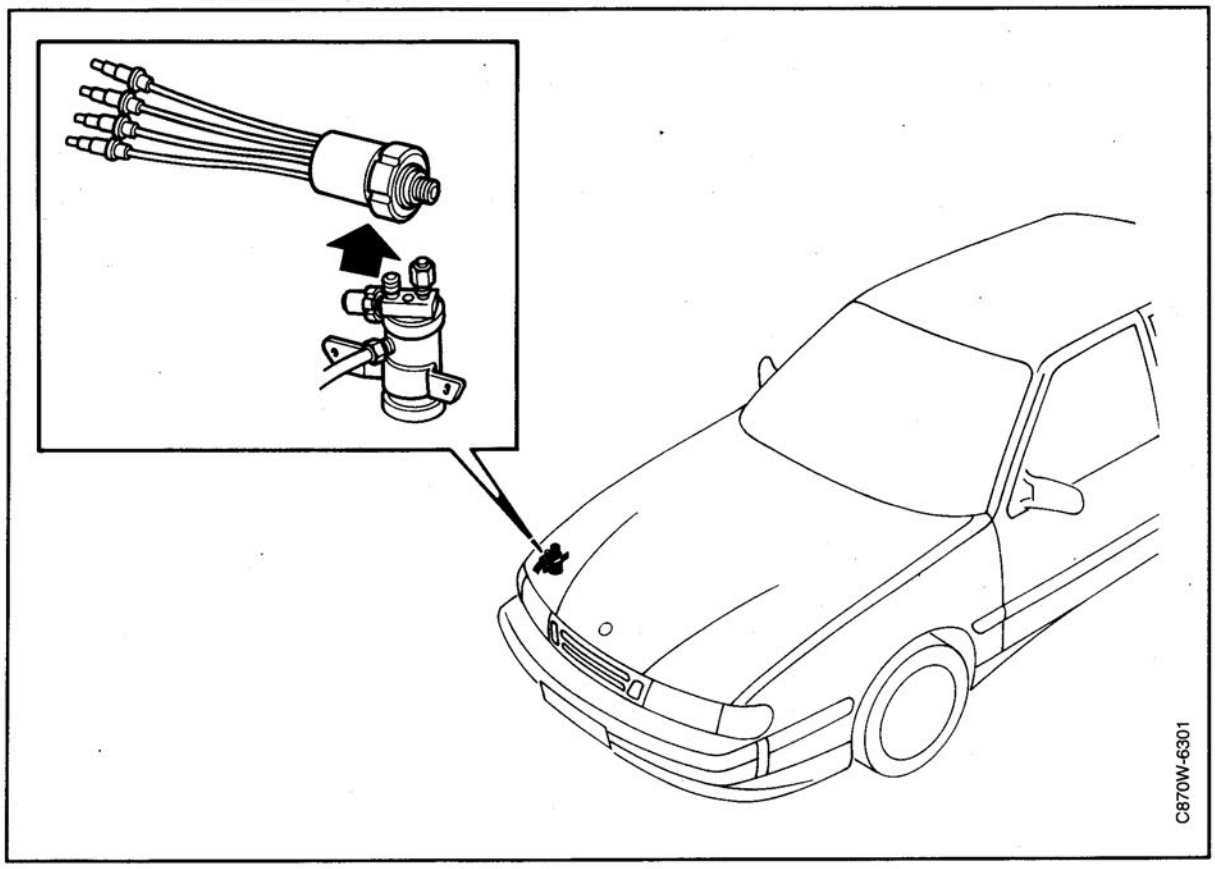
The condenser is made from aluminium and is of serpentine type, with cooling fins.
The refrigerant which passes through the condenser is cooled by natural air flow and gives off heat to the surroundings. A mechanical safety valve is fitted to the hose to the condenser intake. If system pressure becomes too high, the valve opens. When pressure again drops, the valve closes. This protects components and hoses from damage.

Desiccant container



The desiccant container is located above the evaporator casing up until year model 1991 (1) and beside the wheel housing on later year models (2). The function of this is both to store and desiccate refrigerant. The refrigerant which comes in to the desiccant container is in liquid form and under high pressure.
It passes through the filter unit where it is dehydrated and any particles are separated. The refrigerant then goes on to the expansion valve.
There is a sight glass on the desiccant container which indicates the amount of refrigerant in the system.
There is also a pressure switch on the desiccant container.

Pressure switch



Year model M1985:
The pressure switch disconnects the compressor if system pressure drops below 2.7 kPa (38 psi).
The compressor is then switched on again when pressure has risen to 3.1 kPa (44 psi). This protects the compressor from working at too low pressure (running dry).

If outside temperature drops below about + 5° C (41° F), the pressure is the system becomes so low (below 2.8 kPa, 39.4 psi), that the compressor is switched on.

Year model M1986–
The function of the pressure switch is extended and it becomes a three stage switch with the following functions:

Stage 1:

Allows the compressor to work at temperatures down to ± 0°C (32°F). Pressure in the system at this temperature is about 2 bar (29 psi).

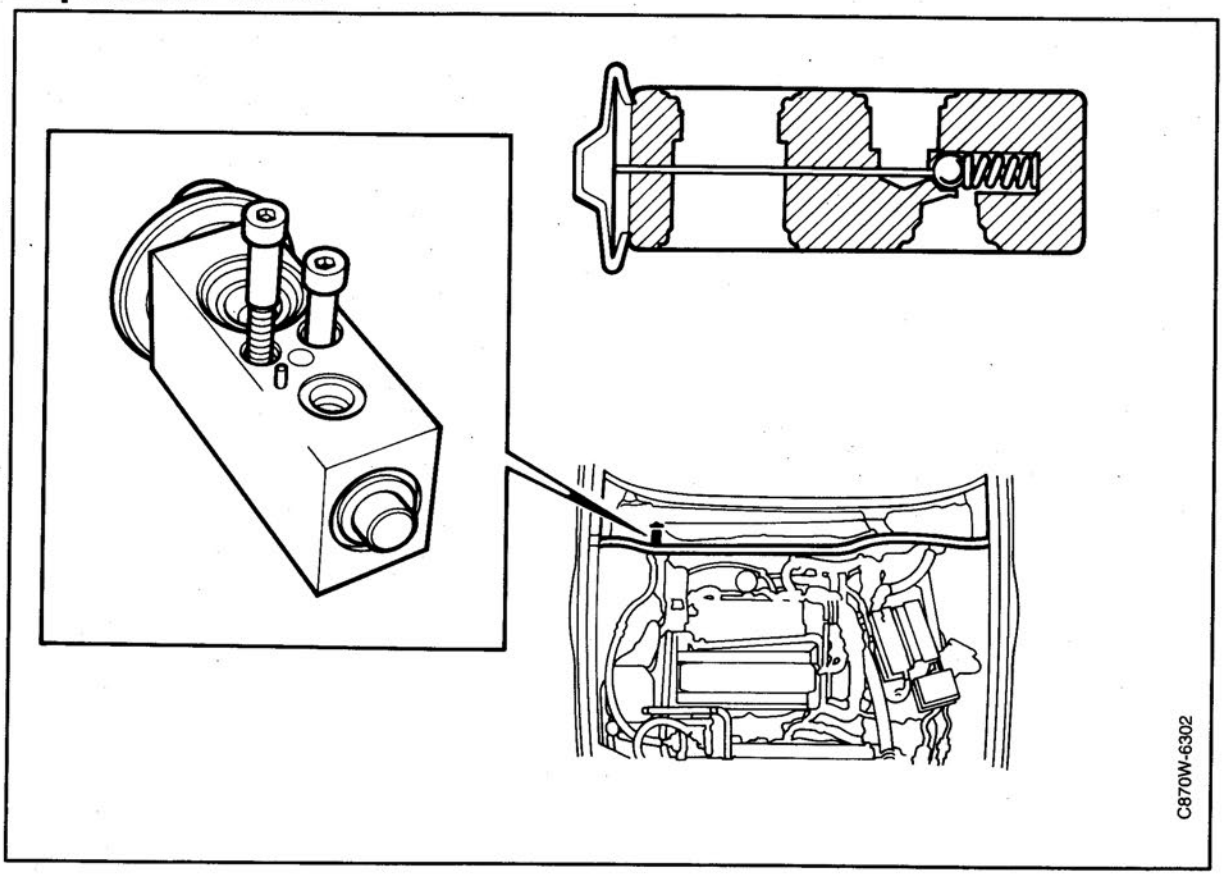
Stage 2:

Starts the engine's electric radiator fan at a pressure of about 15 bar (210 psi). When pressure has dropped to about 11 bar (155 psi), the fan is again disconnected. For R134a refrigerant, the fan is started at 16.5 bar (239 psi) and disconnected at about 12.5 bar (181 psi).

Stage 3:

This is a safety feature which breaks the electrical circuit to the compressor if pressure exceeds 27 bar (380 psi) for R12 refrigerant. When pressure has then dropped below 6 bar (90 psi), the compressor is reconnected. For R134a refrigerant the switch breaks at 30 bar (435 psi).

Expansion valve



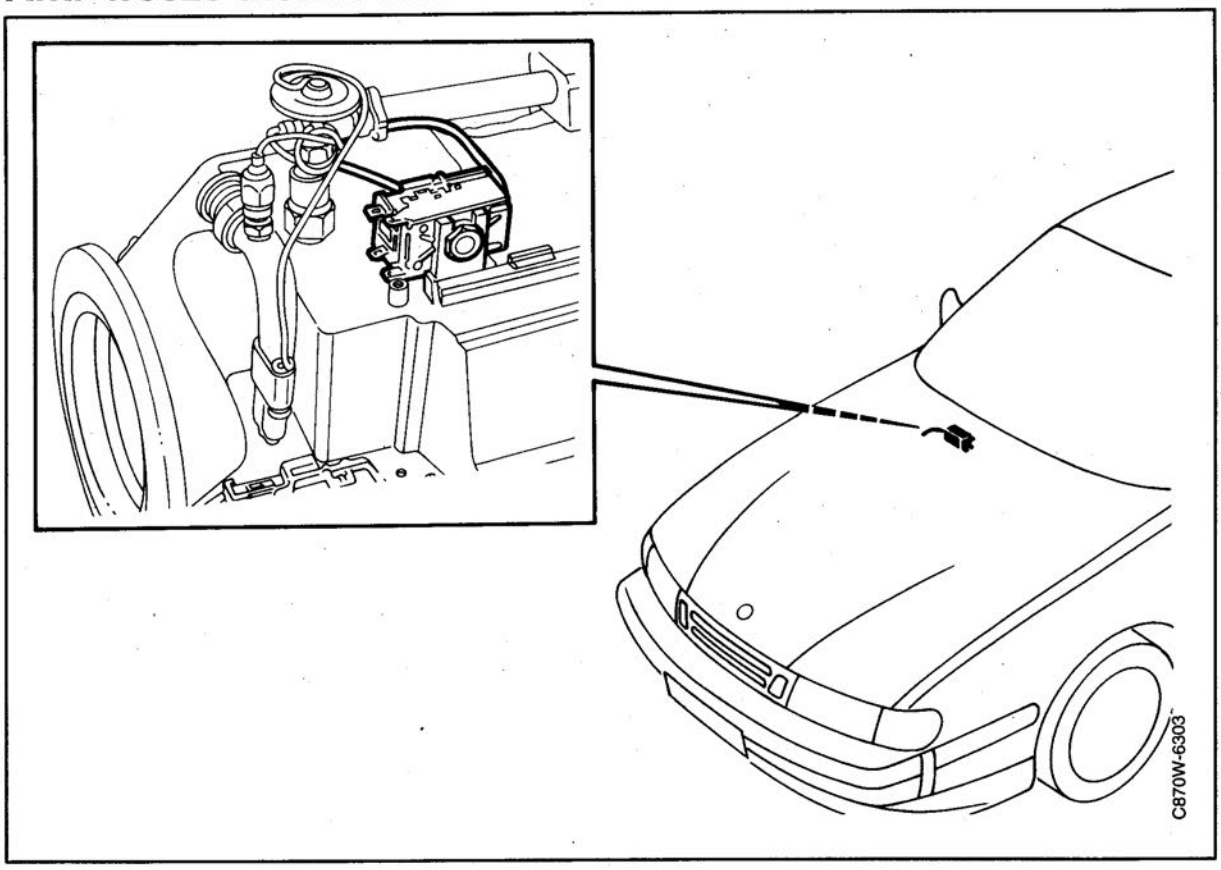
The expansion valve controls the quantity of refrigerant which is released into the evaporator.

Control is regulated by the temperature in the expansion valve temperature sensor.
For year models up to 1991, the temperature sensor is located against the evaporator outlet pipe.
From year model 1992–, the temperature sensor is built into the expansion valve. This applies to both R134a and R12 refrigerants.

Depending on temperature, and therefore pressure, in the evaporator outlet, a certain pressure is transferred to the upper side of the diaphragm. The pressure in the evaporator outlet pipe actuates the underside of the diaphragm (pressure transferred via capillary tube). The diaphragm then, via a washer and pushrod, actuates the valve which controls the quantity of refrigerant to the evaporator.

If too much refrigerant is released into the evaporator, it cannot all be evaporated, which may lead to poor cooling. In addition, the compressor may be damaged due to liquid refrigerant being sucked in (fluid stroke). If too little refrigerant comes in, the refrigerant is evaporated too early, which may also give poor cooling.

Anti–freeze thermostat

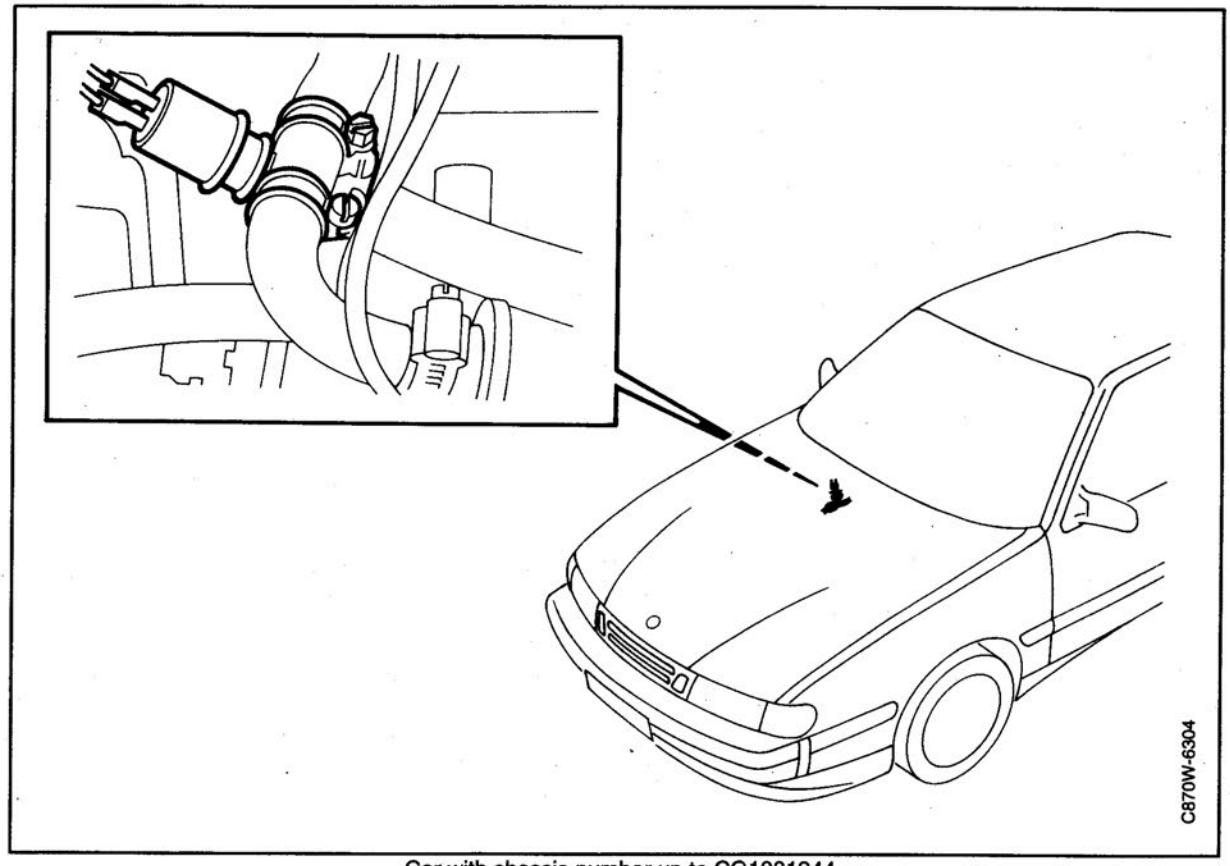


The anti–freeze thermostat is located above the evaporator casing. Its function is to prevent build up of ice between the evaporator cooling fins.

A capillary tube is inserted in the evaporator and senses temperature.

When temperature drops to about +1.5° C (34.7 °F) the thermostat switches off the compressor. When temperature in the evaporator has then risen to about +4.5° C (40.1°F), the compressor is again switched on.

Idling speed compensation



Car with chassis number up to CG1001944

Up to chassis number CG1001944 (M1986)
When the compressor is connected, load on the engine increases.

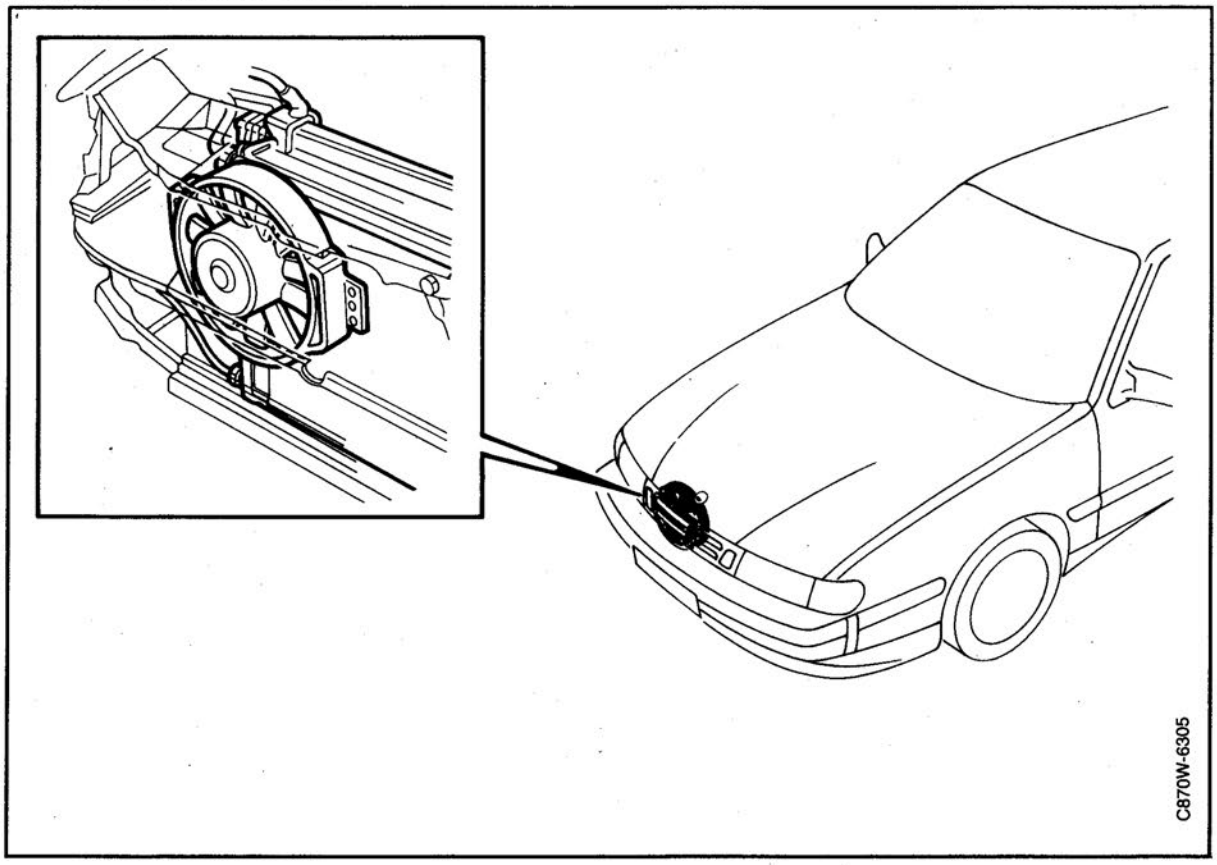
If the engine is running at idling speed, there is a danger that idling speed will become too low. In order to counteract this, there is a solenoid valve which opens an air duct in the intake manifold when the compressor is engaged. The quantity of air to the engine is then increased (and therefore quantity of fuel) and engine speed is maintained at a constant level.

From chassis number CG1001945 (M1986)
As all 16 valve engines after the above chassis number have automatic idle speed control, the solenoid valve for raising idling is discontinued.
The idle speed control system works as follows:

When the A/C compressor is switched on, a signal goes to the automatic idle speed control system, via the fuel injection control module, in order to compensate for increased load. An increased quantity of air is allowed to pass the throttle via the idle air control valve which is controlled by the ACC control module.
There is a delay for compressor switch–on, and this depends on which fuel system the car is equipped with.
In one case, delay is in the A/C relay and is about 0.6 seconds.
In the second case, the LH engine control module introduces the delay (LH 2.4.2).
Also see group 3 (Electrical system).

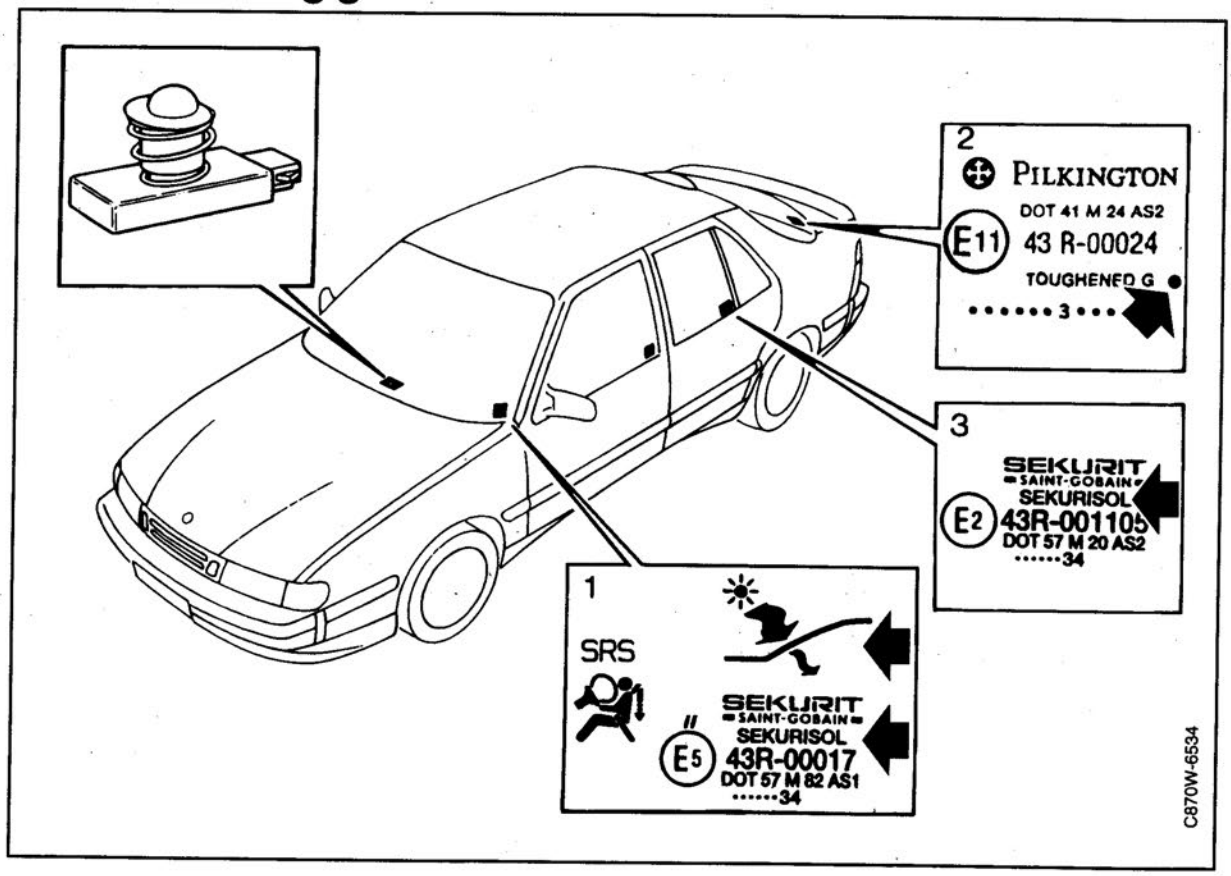
Delayed A/C start up when starting
From chassis number CG1001945, all cars with ACC have a 10 s delay (depending on year model) for A/C start up after starting. This is so that there is less load on the engine when starting if the A/C is switched on.
Also see group 3 (Electrical system).

Extra radiator fan



From year model 1986, cars for markets in hot climates have an extra radiator fan which is located in front of the radiator. The electric radiator fan is connected so that it works at the same time as the compressor.

Heat–absorbing glass

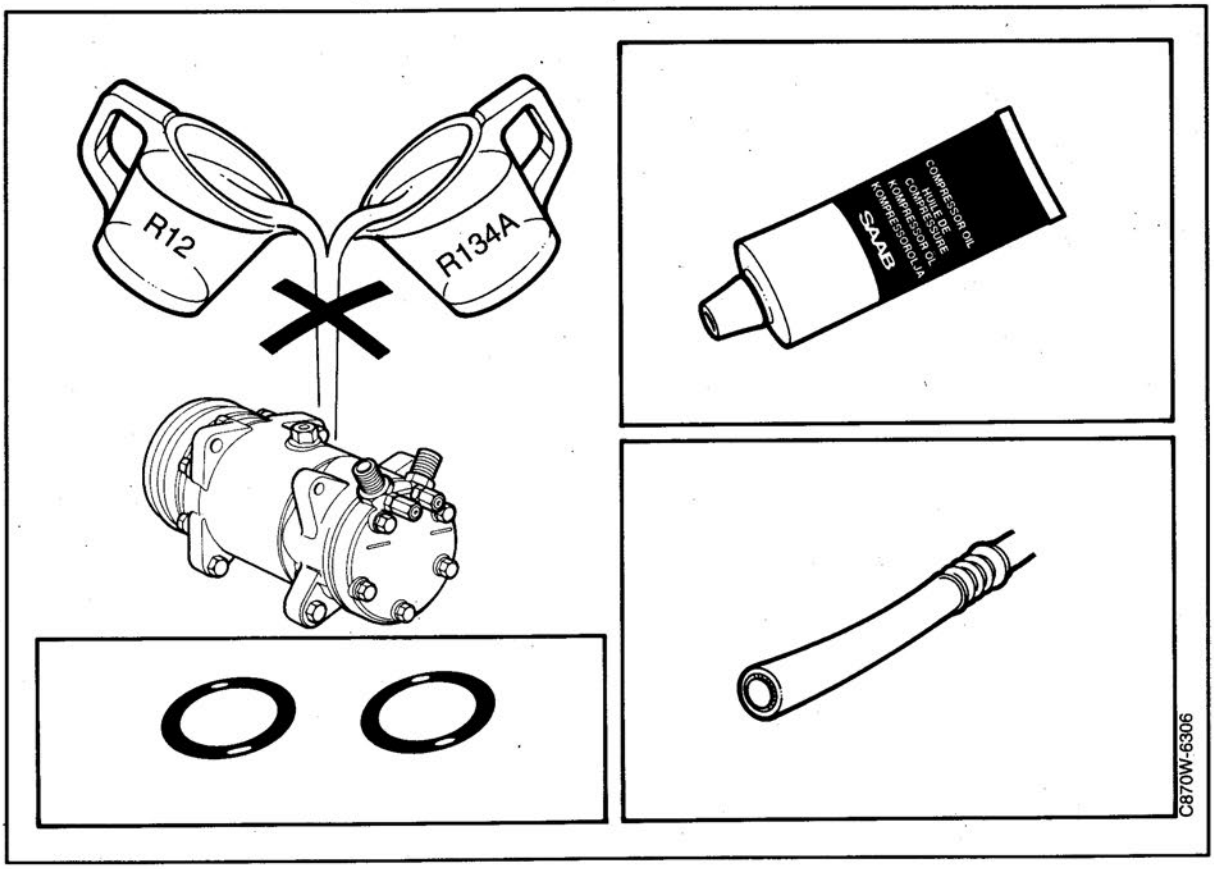


On year model 1994, heat absorbing glass is introduced to windscreen and windows. This facilitates cooling of the cabin.

The glass absorbs heat radiation from sunlight so that is does not get in to the cabin. If the car is stationary, it still becomes warm in the cabin as the windows become warm (e.g. when parking in sun). When the car is moving, the passing air removes heat from the windows.

The solar sensor is of course affected by the fact that the glass lets through less heat. A new solar sensor has been introduced for cars with the heat absorbing glass and the old sensor is still used in those markets which do not use this glass.

Two different refrigerants



R12 and R134a refrigerants

SAAB Automobile AB is among the first car companies in the world to develop an A/C system which uses the new, chlorine free R134a refrigerant. Unlike R12, the chlorine based freon which was previously used, R134a does not damage the ozone layer in the atmosphere.

From M1992, R134a refrigerant was introduced to certain markets and from M1993, R134a was introduced in all markets. R134a is now available for converting the old R12 system.

R134a must not be mixed with R12

The lack of chlorine in R134a means that the new refrigerant has completely different chemical properties than R12. Neither the compressor oil or the rubber material used in the R12 system can be used in the new R134a system.

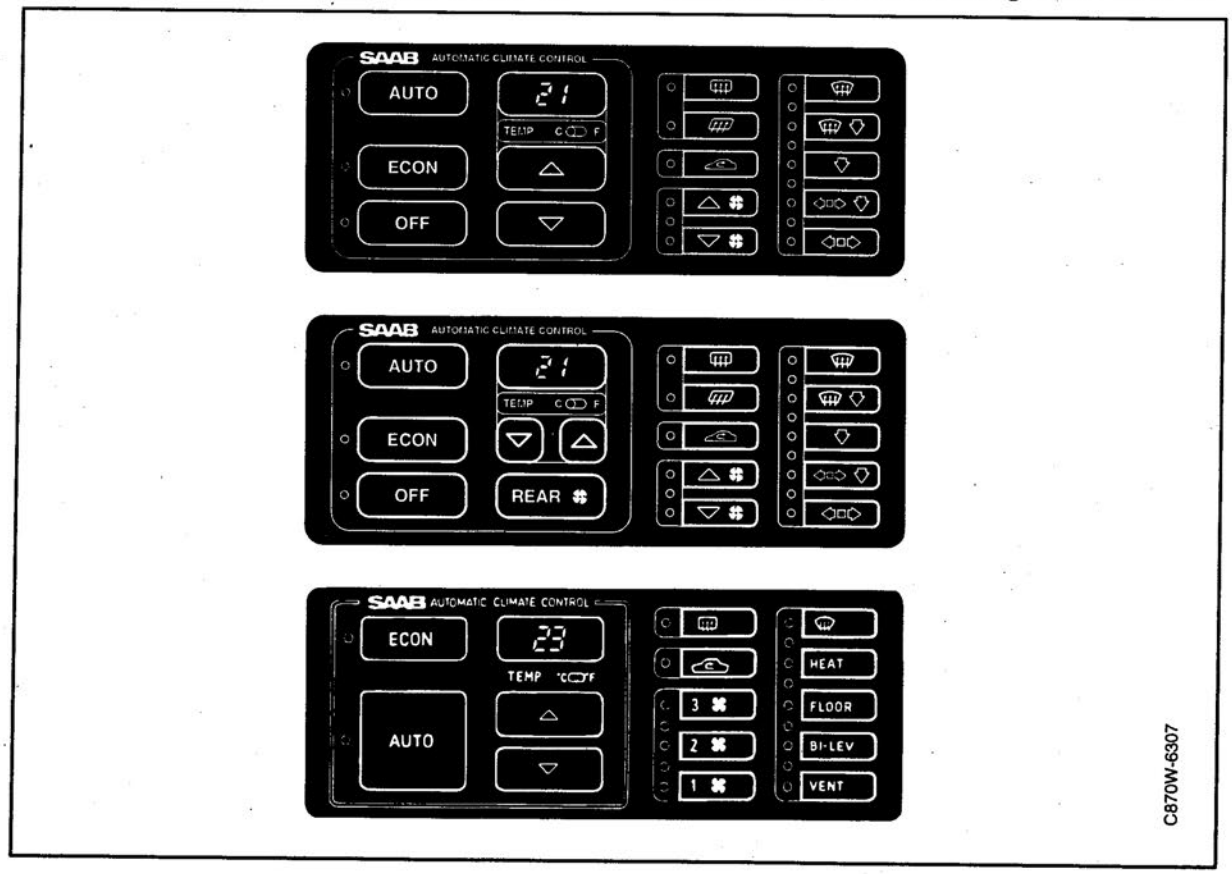
Even small quantities of the wrong refrigerant or the wrong compressor oil can cause chemical reactions which may eventually ruin the entire A/C system. As an example, pressure may become higher than the system is able to cope with.
This applies to both the actual A/C units, from compressors to O–rings, as well as stations for charging and draining refrigerant.

When switching from R12 refrigerant to R134a, the components in the A/C system have been adapted to R134a. In order to prevent components being switched between the different refrigerants, the following differences have been introduced:

- Compressor hose connections are different for the two refrigerants.
- The expansion valve has a different shape.

Otherwise, components are similar for the different refrigerants.

ACC, Technical description



ACC control module and connected components

Cars equipped with ACC are different from cars equipped with A/C in that a number of sensors and actuator motors and an electronic control module have been added to the heating and ventilation system.

With the AUTO feature engaged, it is sufficient for the driver to give the desired cabin temperature between +17°C – +27°C (62.5– 80.5 °F) and the allow the ACC system to achieve and maintain the desired temperature in the car.
The system can also be manually controlled.

The ACC unit monitors temperature signals and signals from the solar sensor and controls the positions of the various dampers and the speed of the system and rear door fans in order to maintain the desired temperature in the car.

All sensors and control mechanisms are used by the ACC control module in order to maintain a comfortable temperature by:

- Providing a reliable and comfortable temperature as soon as possible after the car is first started.
- Predicting changes due to varying conditions and carrying out the necessary adaptation as quickly and quietly as possible.

As electronics in general have developed quickly over the years, there have also been changes in the ACC control module. The software has been developed in order to achieve faster and more effective control of the temperature in the cabin.

The following has happened to ACC since 1985:

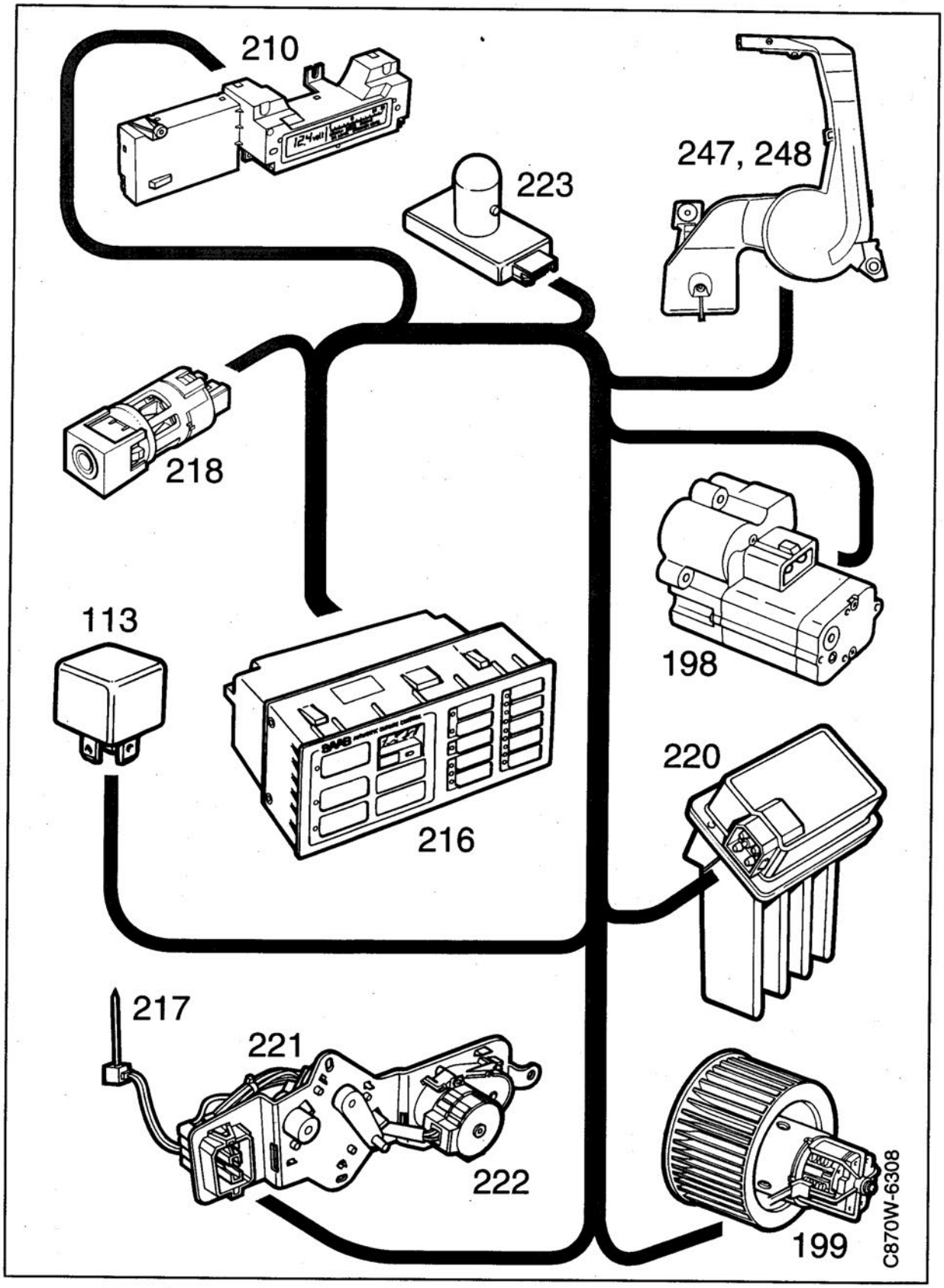
M1985
ACC generation 1. Registers solar intensity from the solar sensor and temperature readings from the outside air and cabin air as well as the mixed air (in heater housing). A number of diagnostic trouble codes can be read on the ACC panel display.

M1990
ACC generation 2. The control module now also receives information about the angle of the sun in relation to the car. Other sensors are more accurate. The ACC control module is available in two versions, 2.00 with ROM 1 and version 2.01 with ROM 3. A scan tool (ISAT) can be connected, with which diagnostic trouble codes can be read and command codes can be entered into the control module. The ACC system can now also be calibrated so that the various dampers are correct in relationship to the desired position.

During the 90's, ACC generation 2 has been equipped with further diagnostic trouble codes and command codes and the control software has been improved over time.

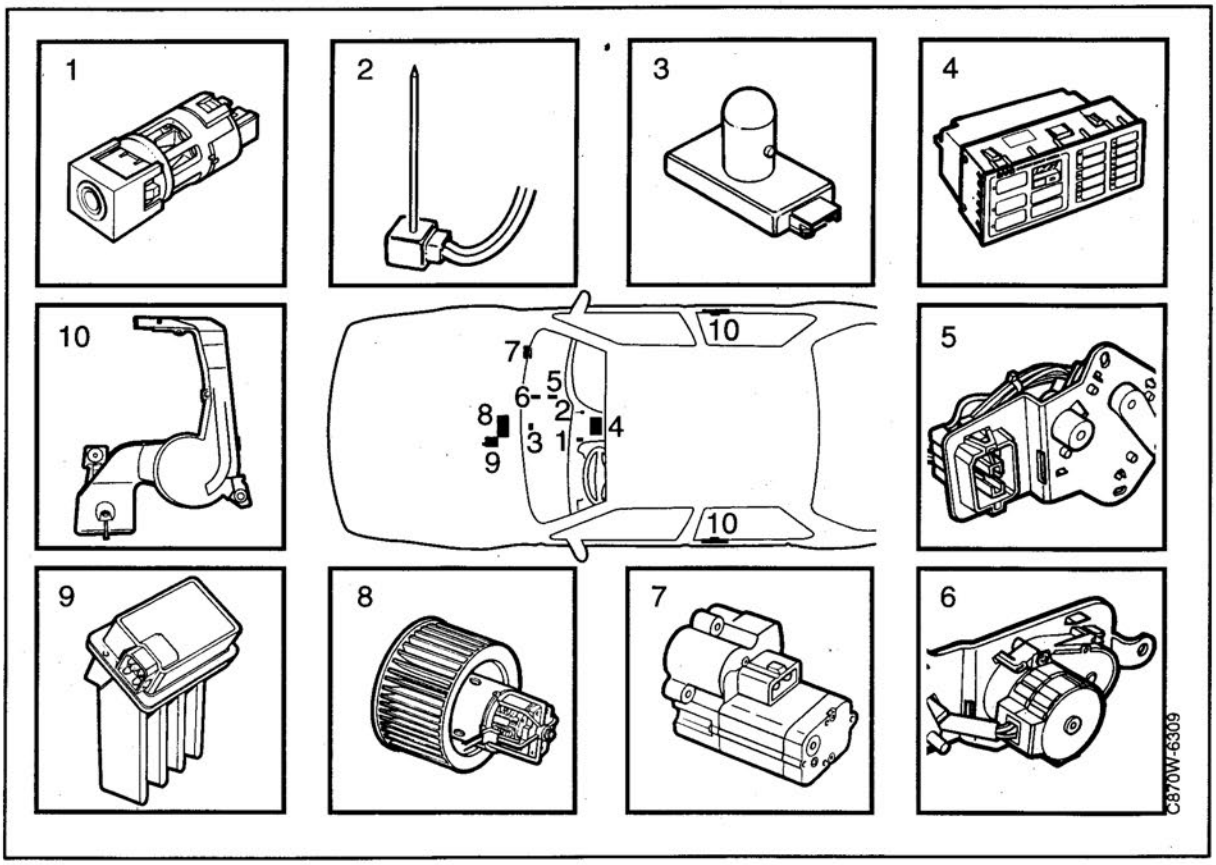
Using drawings and pin numbers, the ACC section primarily describes M1995– and where there are large differences, these are dealt with.

Diagram, ACC



Automatic Climate Control (ACC)

Components



The ACC system consists of the following components:

1 There is a **cabin temperature sensor** fitted in the facia. This continuously sends information to the ACC control module concerning cab temperature, which is the most important reading for the ACC system. Correct positioning is important for good operation.

2 A **blended air temperature sensor** is fitted in the defroster outlet on the heating and ventilation unit. This measures the temperature of the air that is blown out of the heating and ventilation unit.

3 There is a **solar sensor** located on the top of the facia. This provides the ACC control module with information about solar intensity on older models and even height and angle in relation to the car on later models. Location may vary between year models.

4 **The ACC control module** compares all measured values from the above components with the selected temperature on the display. The ACC control module controls the following components to adjust and maintain the desired temperature in the cabin:

5 There is a **stepping motor** which sets the air mixing damper in order to achieve the correct blended–air temperature.

6 A **stepping motor** adjusts the air distributor so that the required air distribution is achieved.

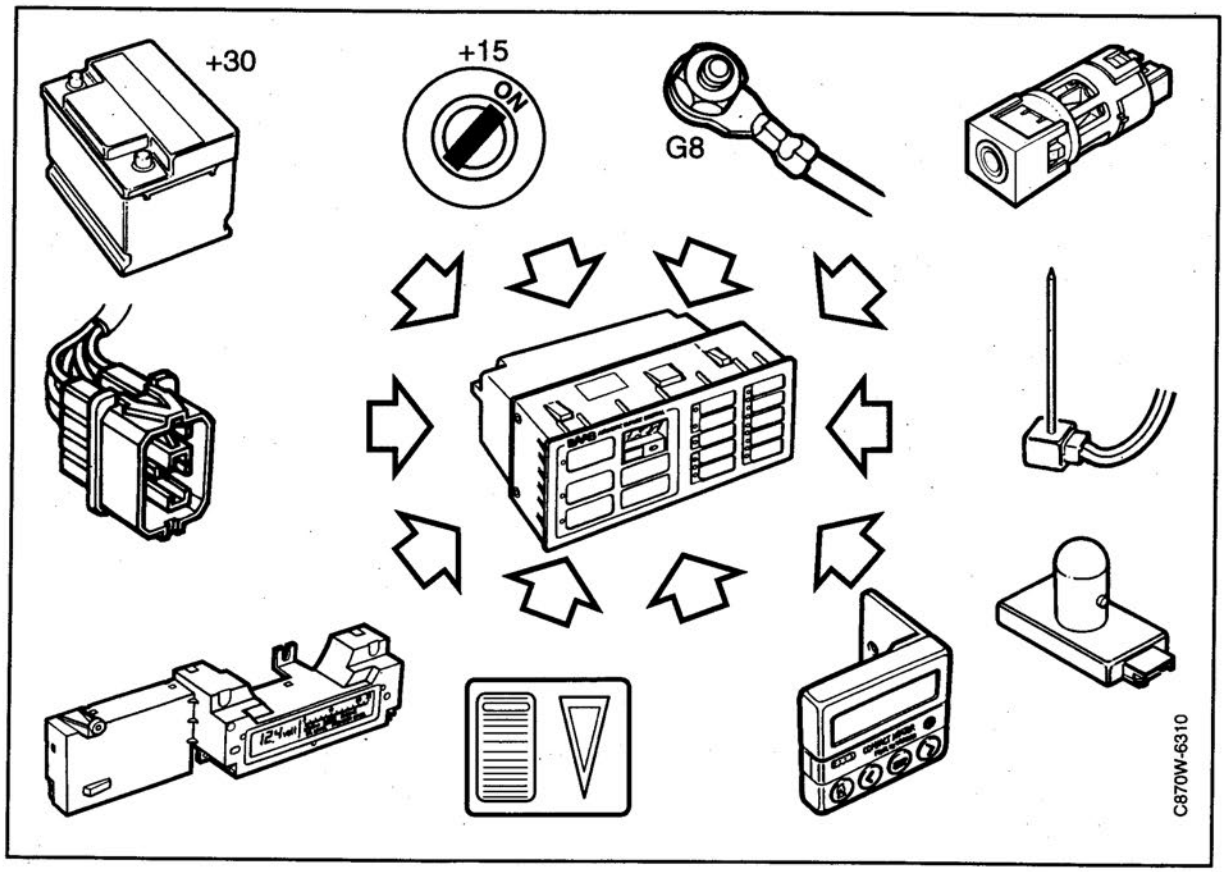
7 A **DC motor** sets the recirculation damper to either fresh air or recirculated air position.

8 A **variable speed DC motor** drives the ventilation fan. Fan speed can be manually or automatically controlled.

9 A **fan control unit** regulates the speed of the ventilation fan motor.

10 The **rear door fans** prevent misting on the rear door windows. The speed of these is controlled by the ACC control module.

ACC control module inputs



Description of year model 1995–

In order to make the description easy to understand this section primarily deals with year model 1995– (unless otherwise stated). In most cases, it is only pin numbers which vary between year models. All year models are of course described in detail in the chapter entitled Fault diagnosis and Adjusting / changing components.

The following pin numbers apply to year model 95.

1 Voltage from +30 (pin 22), see page 49.

2 Voltage from +15 (pin 7), see page 49.

3 Ground (pin 1), see page 49.

4 Cabin temperature sensor (pin 33), see page 50.

5 Blended–air temperature sensor (pin 32), see page 51.

6 Solar sensor (pin 6), see page 53.

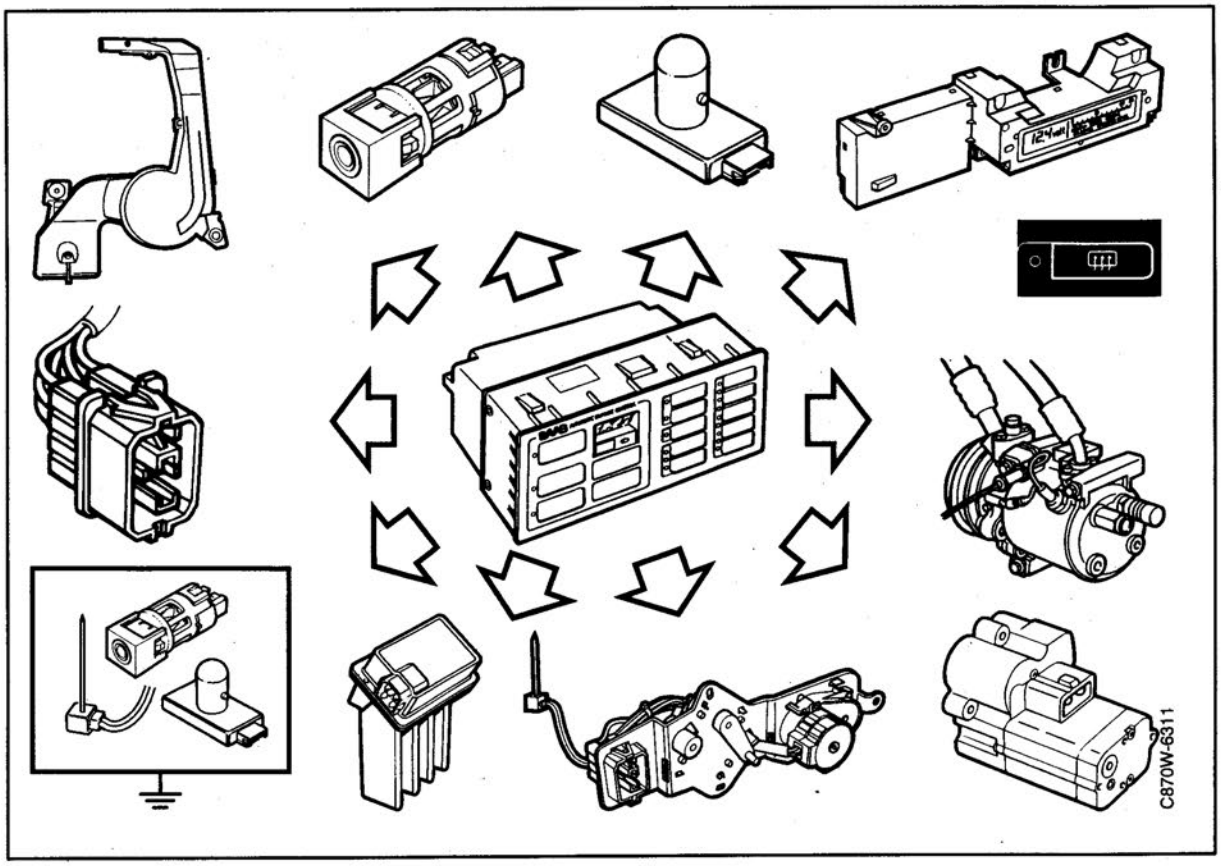
7 Parking heater (pin 3), see page 58.

8 Rheostat (pin 31), see page 59.

9 Outside temperature from EDU (pin 18), see page 52.

10 Diagnostics communication to the ISAT scan tool (pin 12).

ACC control module outputs



1 Cabin temperature sensor, ground (pin 15). See page 50.

2 Cabin temperature sensor, aspirating engine (+) (pin 16). See page 50.

3 Blended–air temperature sensor, ground (pin 14). See page 51.

4 Solar sensor, ground (pin 35). See page 53.

5 Fan control module, control voltage (pin 20). See page 54.

6 Fan control module, power supply (pin 17). See page 54.

7 Air–mixing damper, stepping motor winding 1 (pin 27). See page 60.

8 Air–mixing damper, stepping motor winding 1 (pin 28). See page 60.

9 Air–mixing damper, stepping motor winding 2 (pin 29). See page 60.

10 Air–mixing damper, stepping motor winding 2 (pin 30). See page 60.

11 Air distributor, stepping motor winding 1 (pin 23). See page 61.

12 Air distributor, stepping motor winding 1 (pin 24). See page 61.

13 Air distributor, stepping motor winding 2 (pin 25). See page 61.

14 Air distributor, stepping motor winding 2 (pin 26). See page 61.

15 Recirculation damper, DC motor (pin 2). See page 62.

16 Recirculation damper, DC motor (pin 21). See page 62.

17 A/C compressor (pin 38).

18 Electrically heated rear window (pin 39), see page 56.

19 Wake–up signal to EDU (pin 4), see page 58.

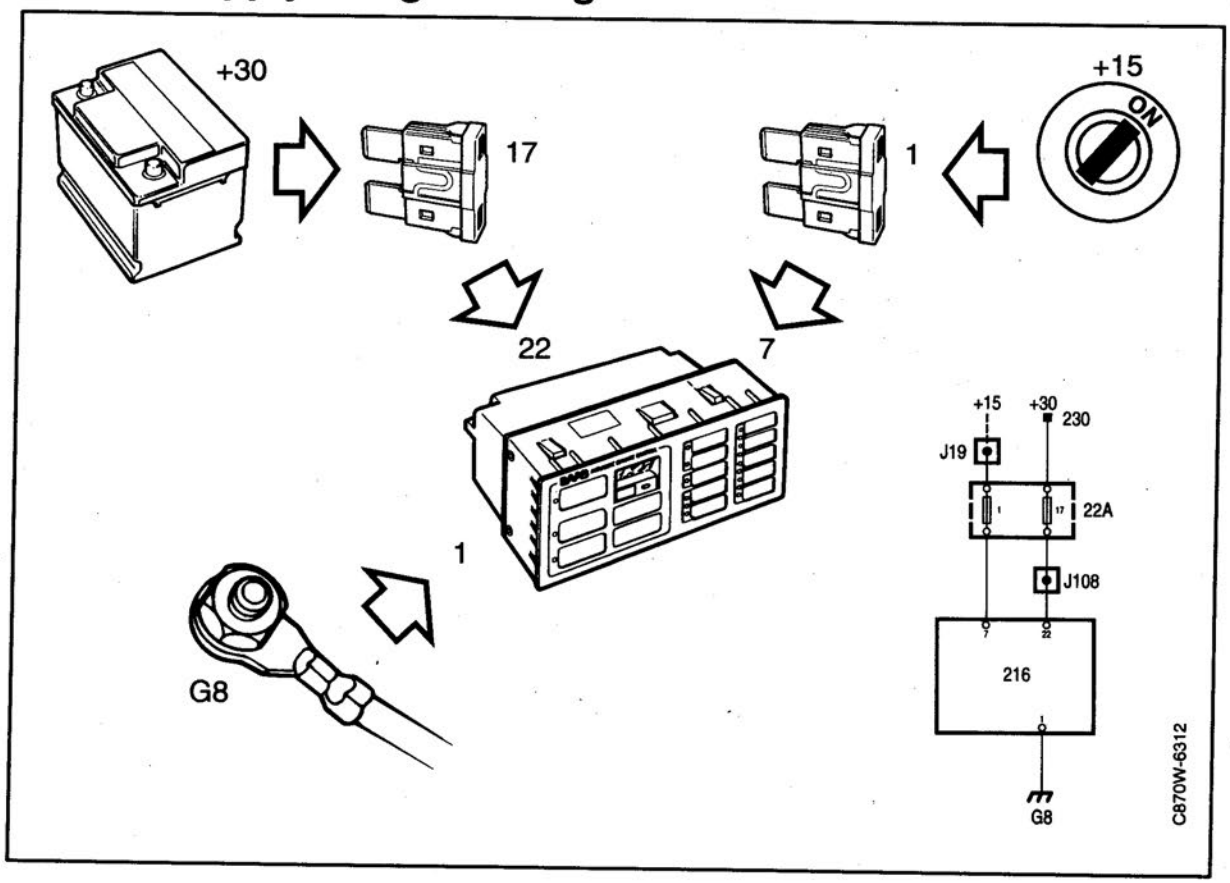
20 Solar sensor, supply voltage (pin 5). See page 53.

21 Rear door fan, left–hand side (pin 9). See page 55.

22 Rear door fan, right–hand side (pin 10). See page 55.

23 Diagnostics communication to the ISAT scan tool (pin 12).

Voltage supply and grounding



The following pin numbers apply to year model M1995.

The ACC control module is supplied with voltage from +30 and +15. +30 gives power voltage and +15 is used to start the ACC control module.

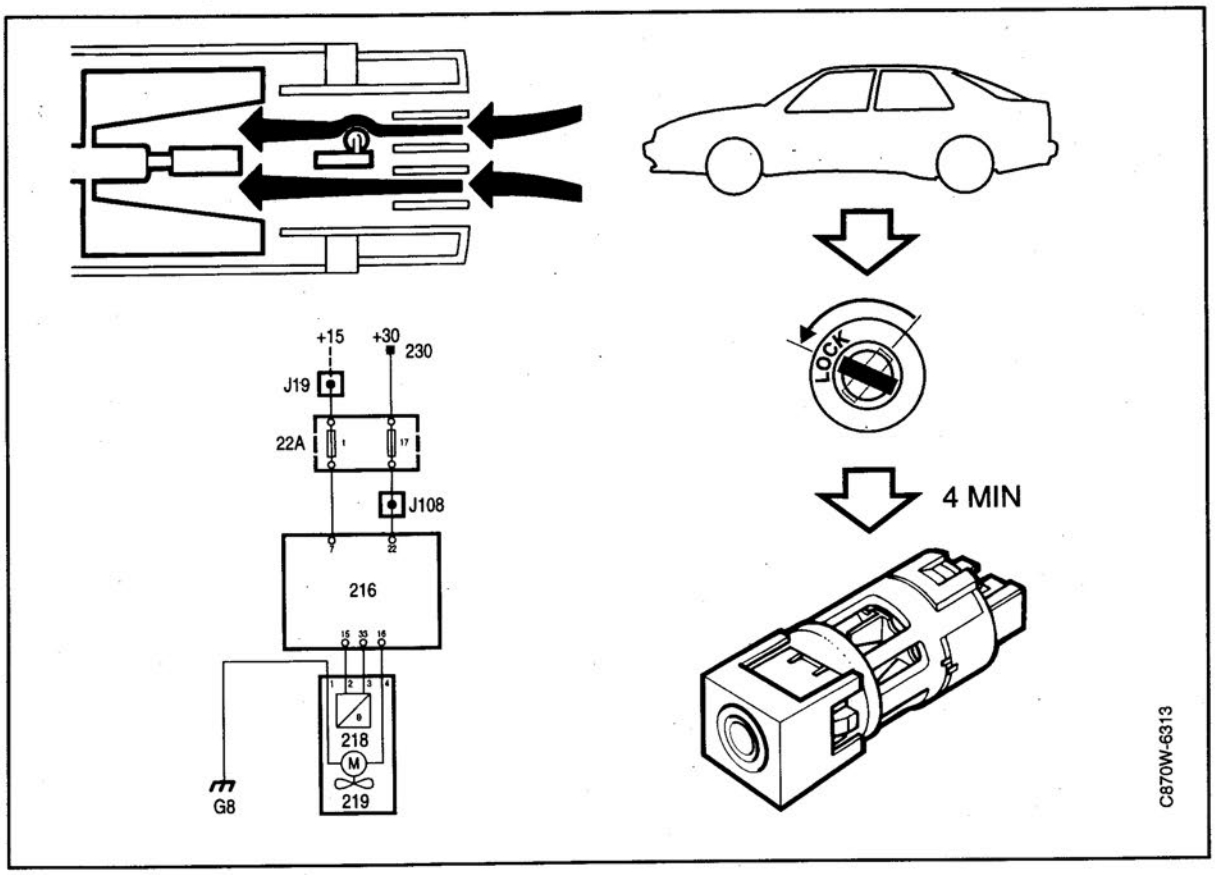
+30 is fed via fuse 17 in fuse holder 22A to pin 22 on the ACC control module.

+15 is fed via fuse 1 in fuse holder 22A to pin 7 on the ACC control module.

The ACC control module functions when supply voltage is 10 – 16 volts. Outside this range, the ACC control module goes into OFF mode.

The ACC control module (pin 1) is grounded to grounding point G8.

Cabin temperature sensor



The cabin temperature sensor is mounted in the facia next to the ACC control module. Correct positioning is important for operation.

In year model 1985, the cabin sensor has a hose going to a separate fan.
From year model 1986–, the sensor has a built–in suction fan which sucks cabin air past an NTC resistor. NTC stands for Negative Thermal Coefficient and means that resistance decreases as temperature rises.

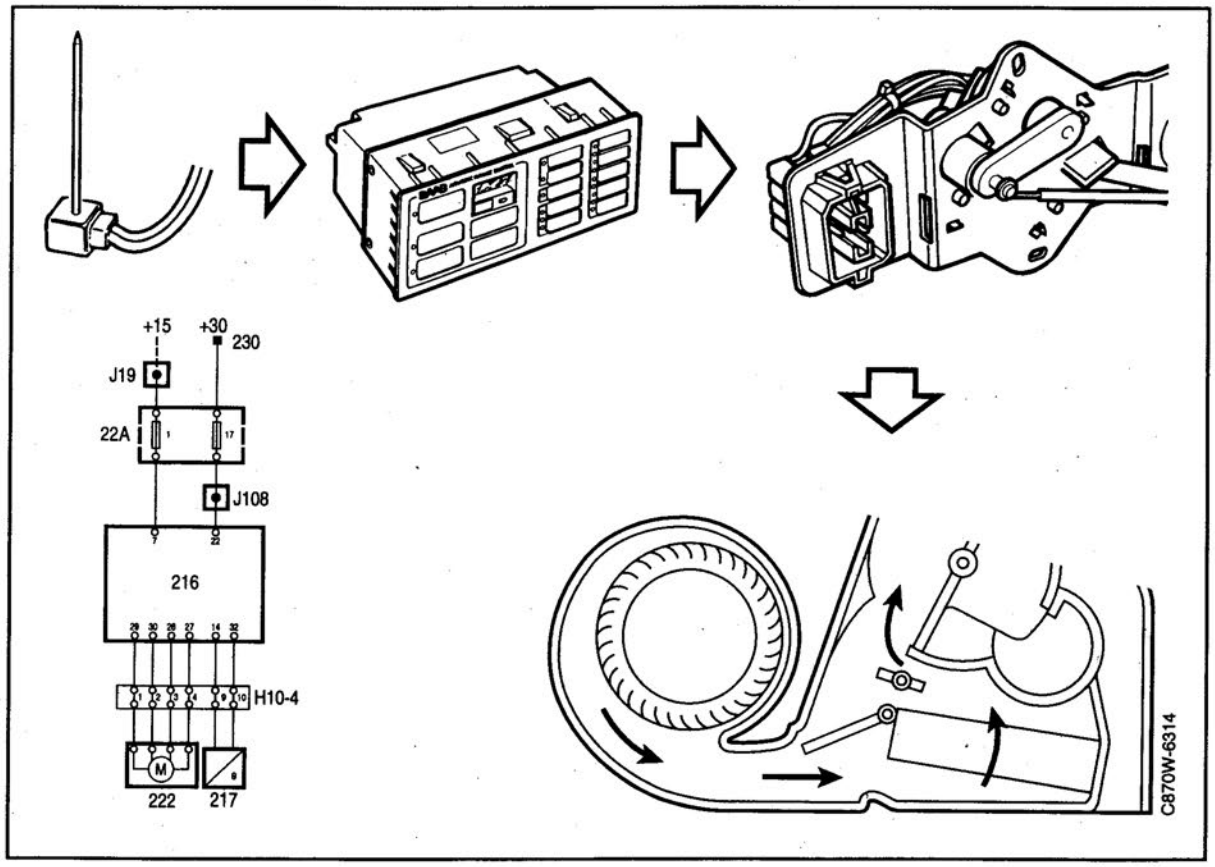
In year model 1995, the sensor is powered from pin 33 and grounded on pin 15 on the ACC control module.
The suction fan is supplied with voltage from pin 16 on the ACC control module and is grounded to grounding point G8.

The cabin temperature is the ACC control module's most important measured value and is compared with the selected cabin temperature to decide if the blended–air temperature should be raised or lowered.
Cabin temperature is adjusted with reference to the outside temperature to achieve the physical sensation of the selected temperature. If the difference between the selected temperature and the adjusted cabin temperature increases, the speed of the ventilation fan will also increase.

As heat behind the facia affects the reading from the cabin temperature sensor during short stops, the ACC control module re–checks the reading 45 seconds after the engine has been started for year model M1995.
For the same reason, the sensor suction fan continues to suck air through the sensor for 20 – 50 seconds after the ignition has been switched off for year models 1990–94 and for 4 minutes for year model 1995–.
Both these features reduce the risk of erroneous data.

If there is no reading from the cabin temperature sensor, temperature is set at +18°C (64.5°F).

Blended air temperature sensor

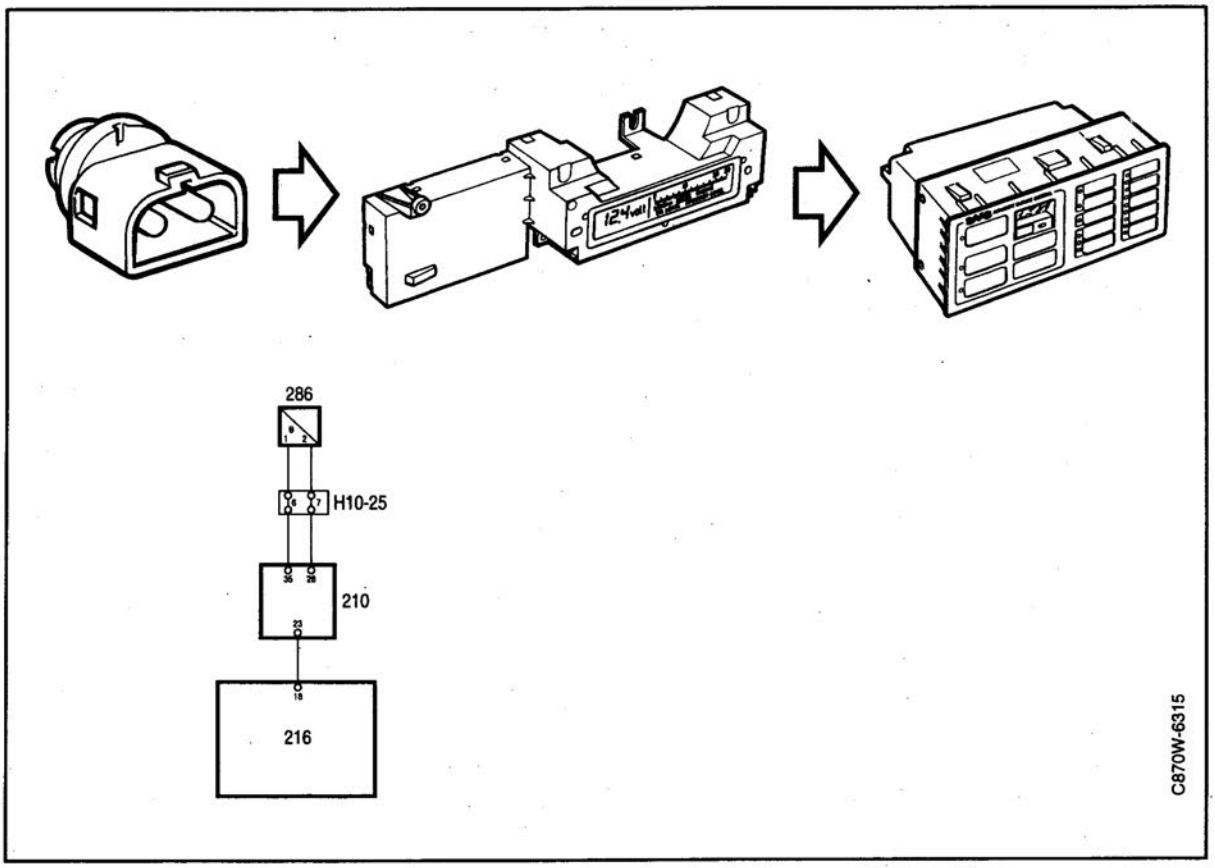


The blended air temperature sensor is of NTC type and has a pointed sensor body which is inserted into the defroster outlet on the right–hand side of the heating and ventilation unit.
For year model 1995, the sensor receives power from pin 32 and is grounded to pin 14 on the ACC control module.

When the ACC control module has decided what blended air temperature is required, the data from the blended air temperature sensor is used to adjust the position of the air mixing damper.
If selected temperature is "HI" (air–mixing damper fully open) or "LO" (air–mixing damper fully closed), the reading from the blended–air temperature sensor is not used.

If there is no data from the blended–air temperature, the ACC unit calculates a default value based on the other sensor data.

Outside temperature



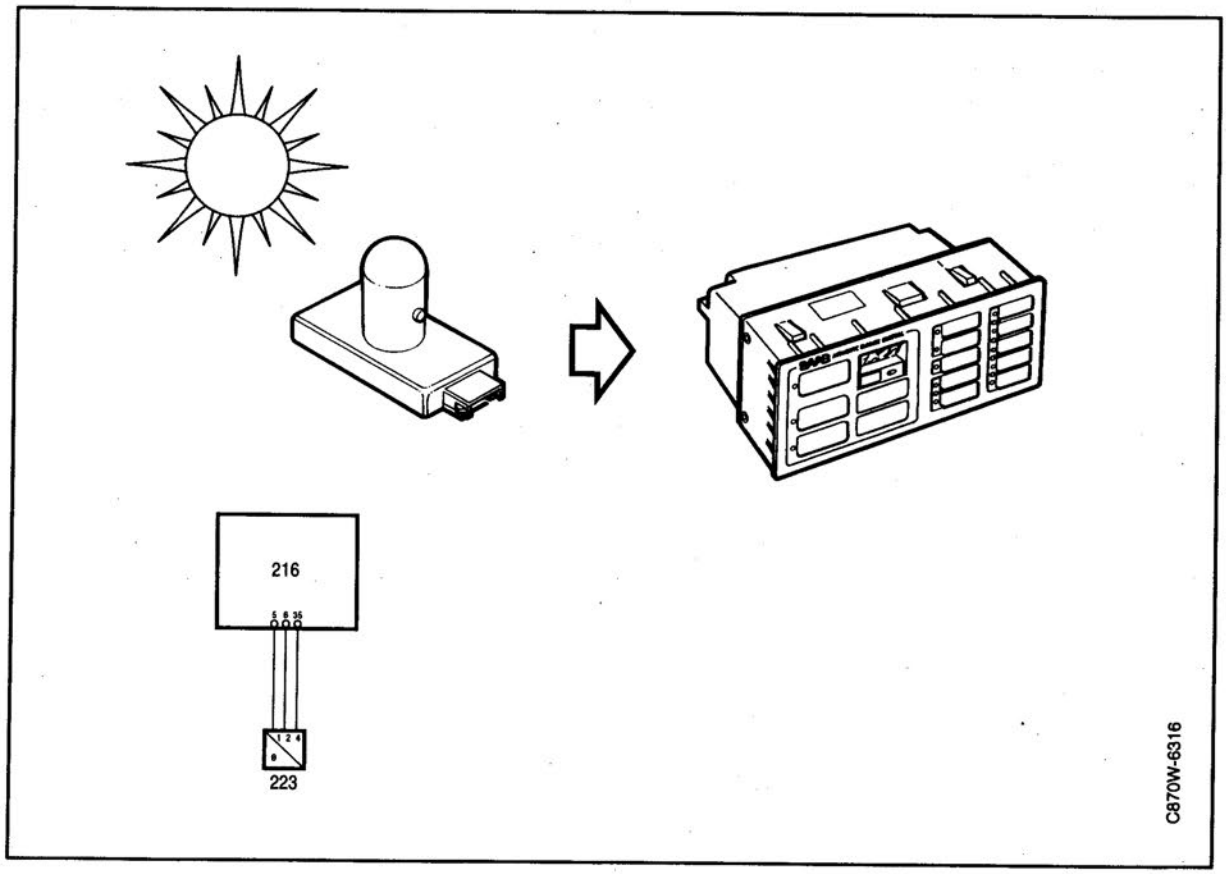
Outside temperature reading (M1990–) is received from the EDC which has a temperature sensor mounted under the car's front bumper.
The EDU control module sends a temperature signal to the ACC control module. This signal consists of a series of pulses where the number of pulses indicates temperature.
The pulse sequences are separated from each other by a pause of 400 ms so that the ACC control module has time to register each sequence.

Cabin temperature is adjusted so that the physical experience of the selected temperature is achieved. This means that the actual cabin temperature is higher than the selected temperature on the ACC display.

If there is no outside temperature reading when the ACC control module is switched on, a default reading of –44°C (–47°F) is set.
If a fault arises in the outside temperature data while the unit is switched on, the last valid data is used.

In cars of year model –1989, the outside temperature sensor is located in the heater unit intake.

Solar sensor



The solar sensor is located on the top of the facia. It registers solar intensity but also height and azimuth through the windscreen. In older year models (–1989), only solar intensity is measured.

Solar height is measured between 0° (horizontally) and 90° (vertically). The azimuth reading covers 360°, where 0° is directly forwards, 90° directly to the right etc.

In year model 1995, the solar sensor is powered from pin 5 and transmits a series of pulses back to pin 6 on the ACC control module.
These series of pulses are then processed in the control module's microprocessor.
The solar sensor is grounded to pin 35 on the ACC control module.

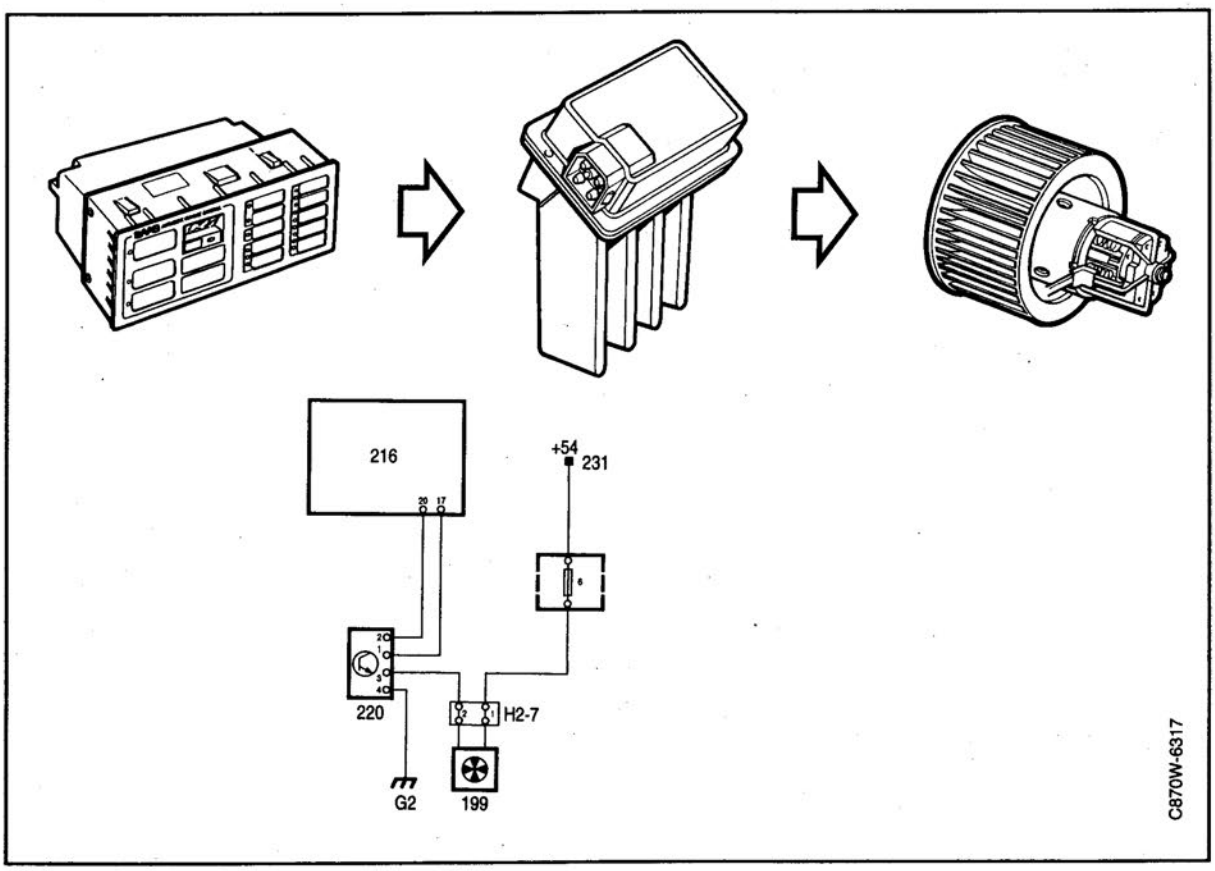
The solar sensor consists of five solar cells which are soldered to a circuit board which is in turn encased in a plastic box filled with silicone. In earlier year models, the microprocessor was also encased with the sensor. The electronics are now located in the ACC control module.
The sensor is enclosed in a cover of non–scratch plastic. The top side of this cover also functions as a filter and only transmits infrared radiation.

The signal which corresponds to the intensity of solar radiation ranges between 0 – 1390 W/m^2.

The fact that the solar sensor primarily measures heat radiation means that it cannot be tested using a fluorescent tube. Sunlight or an incandescent lamp must be used.

If there is no data from the solar sensor, a default value of 0 is used.

Ventilation fan



Pin numbers refer to M1995–.

The fan (pin 1) is direct fed with +54 from fuse 6 in fuse holder 22A. When the starter motor is operating, there is no voltage from +54.
On the ground side, the fan is connected to a fan control module which receives control voltage 0–5 volts from pin 20 on the ACC control module. Up to M1990, the fan also transmits a DC feedback signal, 1–12 Volts which is proportional to fan speed.
The fan control module is also supplied with voltage from pin 17 on the ACC control module.

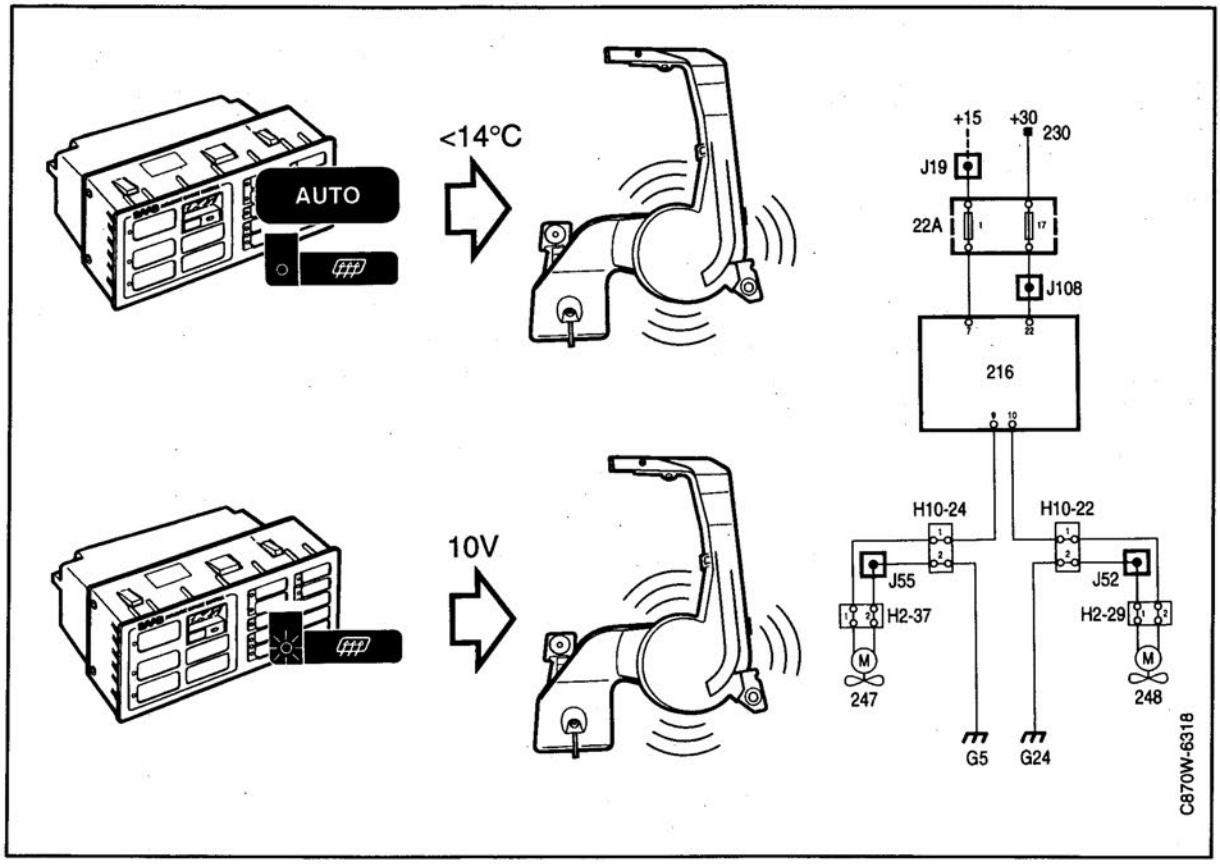
The ventilation fan motor is grounded via the fan control module to grounding point G2.

When the speed of the fan is manually adjusted, this is noted on the ACC control module display by the LED for "fan up" or "fan down" lighting.
When the "fan up" or "fan down" buttons are pressed, fan speed changes by 2 A/s. If the button is held depressed, fan speed changes by 3 A/s.
Max. fan current is approx. 20 A.

In the AUTO mode, fan speed is automatically controlled. In this case, the LED between the two used for manual control lights.
In AUTO mode, fan speed changes by 1 A/s.
If fan speed is manually controlled, AUTO mode is disengaged. Other features remain unchanged.

If "HI" or "LO" cabin temperature has been selected, the fan will run at maximum speed, but can also be manually adjusted.

Rear door fans



Pin numbers refer to M1995–.

The rear door fans are driven by a variable speed DC motor.

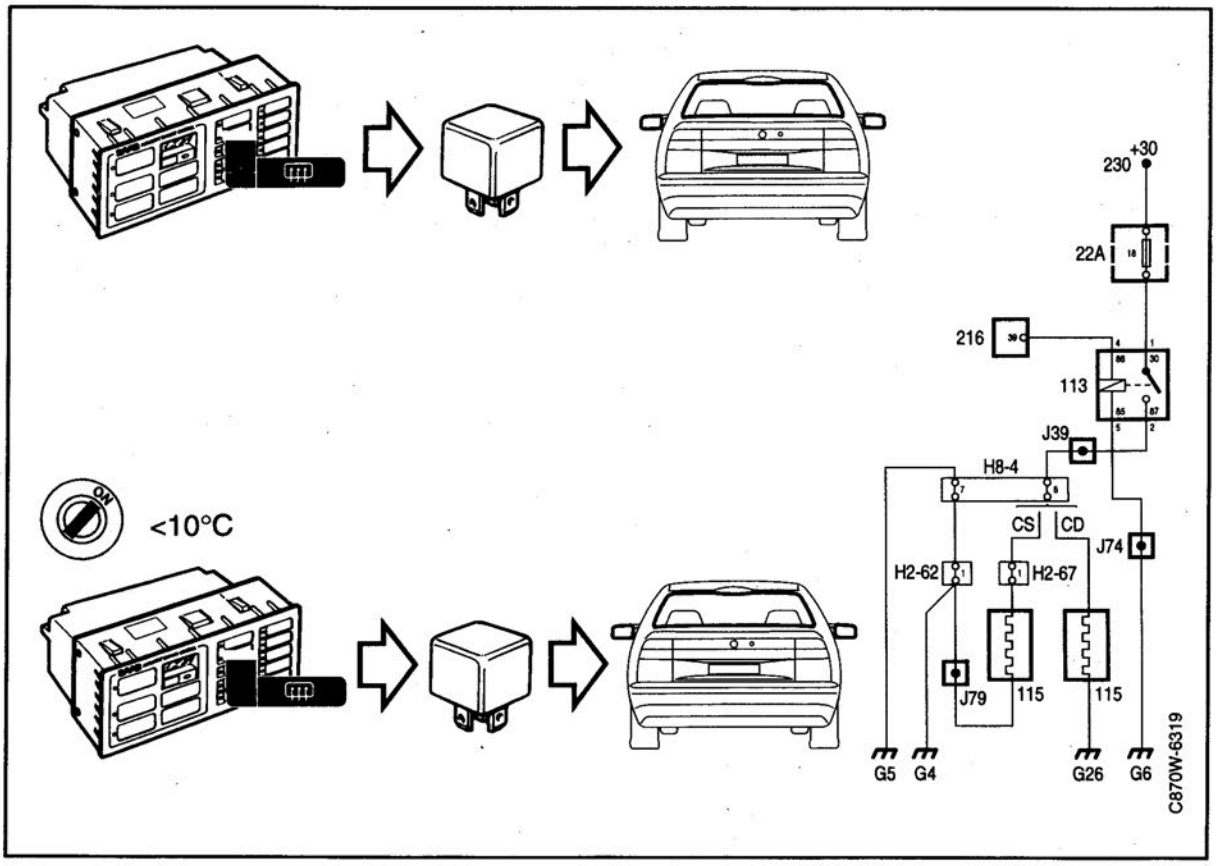
The fan in the left–hand rear door is supplied from pin 9 on the ACC control module with approx. 5–10 volts and is grounded to grounding point G5.

The fan in the right–hand rear door is supplied from pin 10 on the ACC control module with approx. 5–10 volts and is grounded to grounding point G24.

The rear–door fans are switched on in AUTO mode when outside temperature drops below +14°C (57°F).
They can also be manually controlled using a button on the ACC control module panel or using a button between the seats if there is no ACC.

The fan motors have a fixed minimum speed.
Fan speed is then controlled in stages, depending on ventilation fan speed.
When the electrically heated rear window is manually switched on, the rear door fans always work at maximum speed.

Electrically heated rear window and electrically heated door mirrors

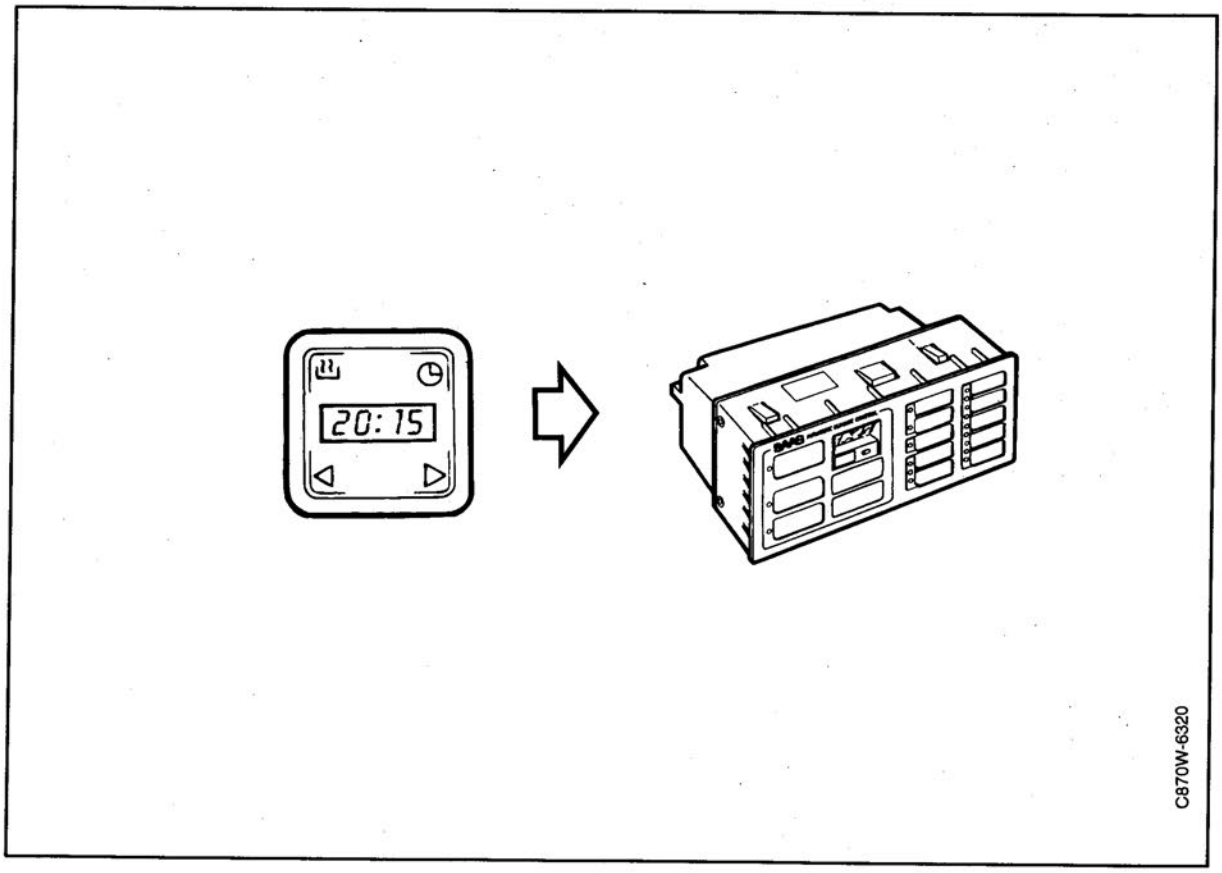


Pin numbers refer to M1995–.

The relay for the electrically heated rear window and the electrically heated door mirrors is supplied from pin 39 on the ACC control module.

When cabin temperature drops below +10°C (50°F) and the ignition is on, power supply to the relay is automatically engaged for 11 minutes. Switching off after 11 minutes is automatic, even when it has been connected manually using the button on the ACC control module panel.
When the electrically heated rear window is switched on, it can be switched off manually.

Parking heater M1990–94



A parking heater can be switched on using a timer or using the DCC trip computer and a signal is then sent to the ACC control module for the parking heater. Provided that the ignition is off, this results in the following selections:

Air–mixing damper – normal automatic control

Air–mixing damper – "defrost" and "heat" (damper angle 135° – 112.5°).

Air recirculation flap – "Recirculation" when outside temperature is below –10°C (14°F) or "Fresh air" when outside temperature is above –8°C (17.5°F).

Ventilation fan – motor current about 5.5 A.

Electrically heated rear window and electrically heated door mirrors – off

Rear door fans – off

Air conditioning – on (signal to A/C relay)

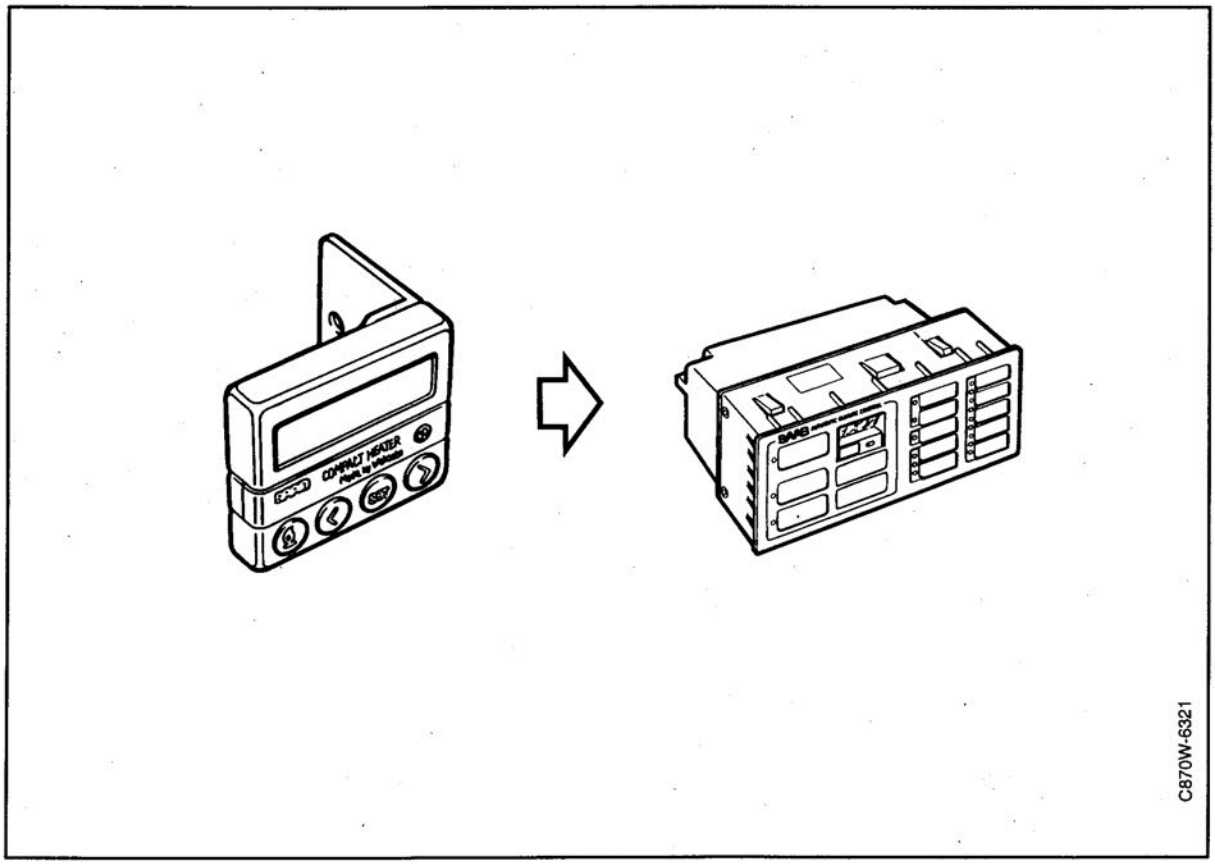
Temperature display – last temperature selected (LO= +16° C or 61°F).

LEDs – function normal

Manual selection – all selections except OFF are possible.

Note
OFF cannot be selected as long as the parking heater signal is active. This means that the selection can only be cancelled by either cancelling it in the DCC or the timer or by switching on the ignition.

Parking heater M1995–



Activation of the parking heater is selected with a time switch that supplies pin 3 on the ACC control module with 12 volts.
The ACC control module sends a 12 volt wake–up signal from pin 4 to the EDU control module, which sends information about outside temperature in the form of a sequence of impulses back to pin 18 on the ACC control module.

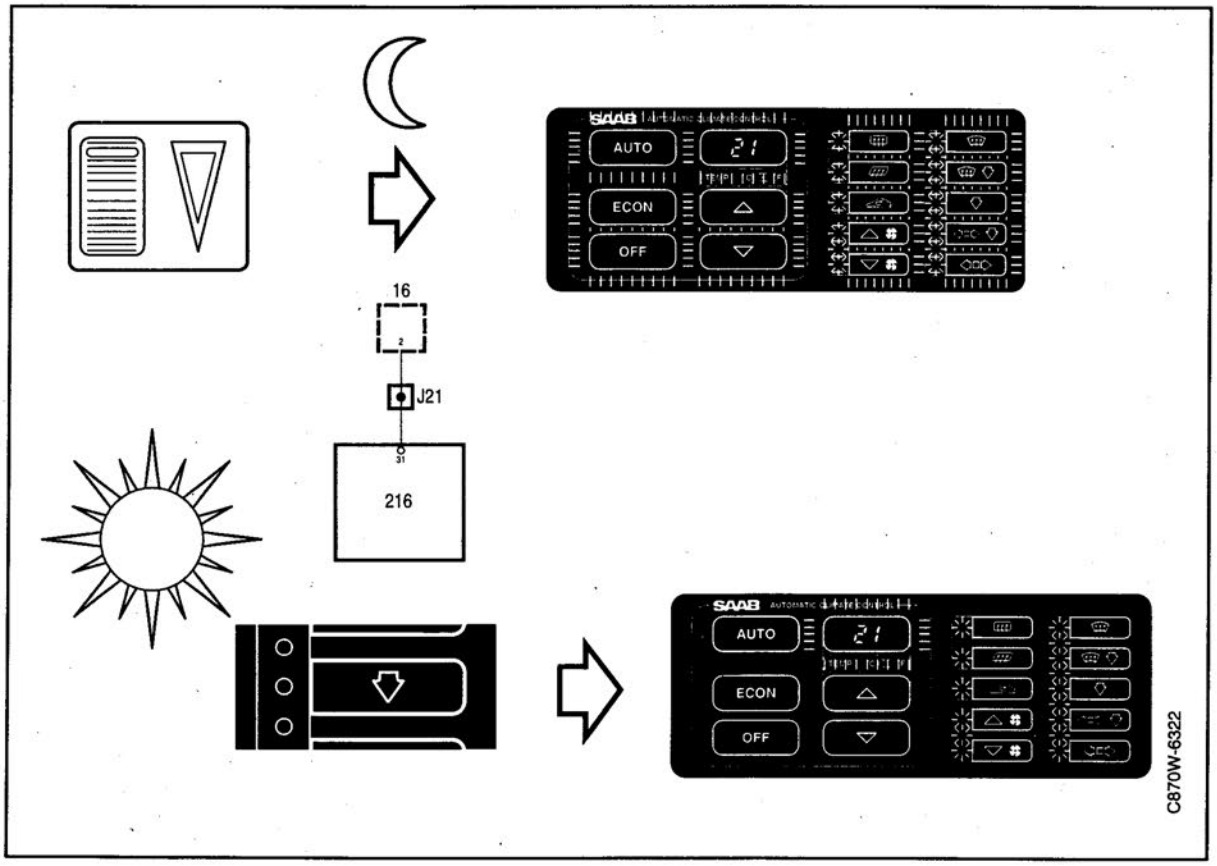
Provided the ignition is off, this results in the following selections:

Air mixing damper	Normal function
Air distributor	Normal function
Air recirculation flap	100% recirculation when outside temperature is < –10°C (14°F) 100% fresh air when outside temperature is > –10°C (14°F).
Ventilation fan	5.5 A motor current
Electrically heated rear window and electrically heated door mirrors	Off
Rear door fans	Off
Display	Normal function
LEDs	Normal function
Push–buttons	All manual selections except "OFF" and control of fan speed are possible.

Note

"OFF" cannot be selected while the parking heater is activated. This means that the selection can only be cancelled by cancelling the selection at the timer switch or by switching on the ignition.

Display and push–button illumination M1990–



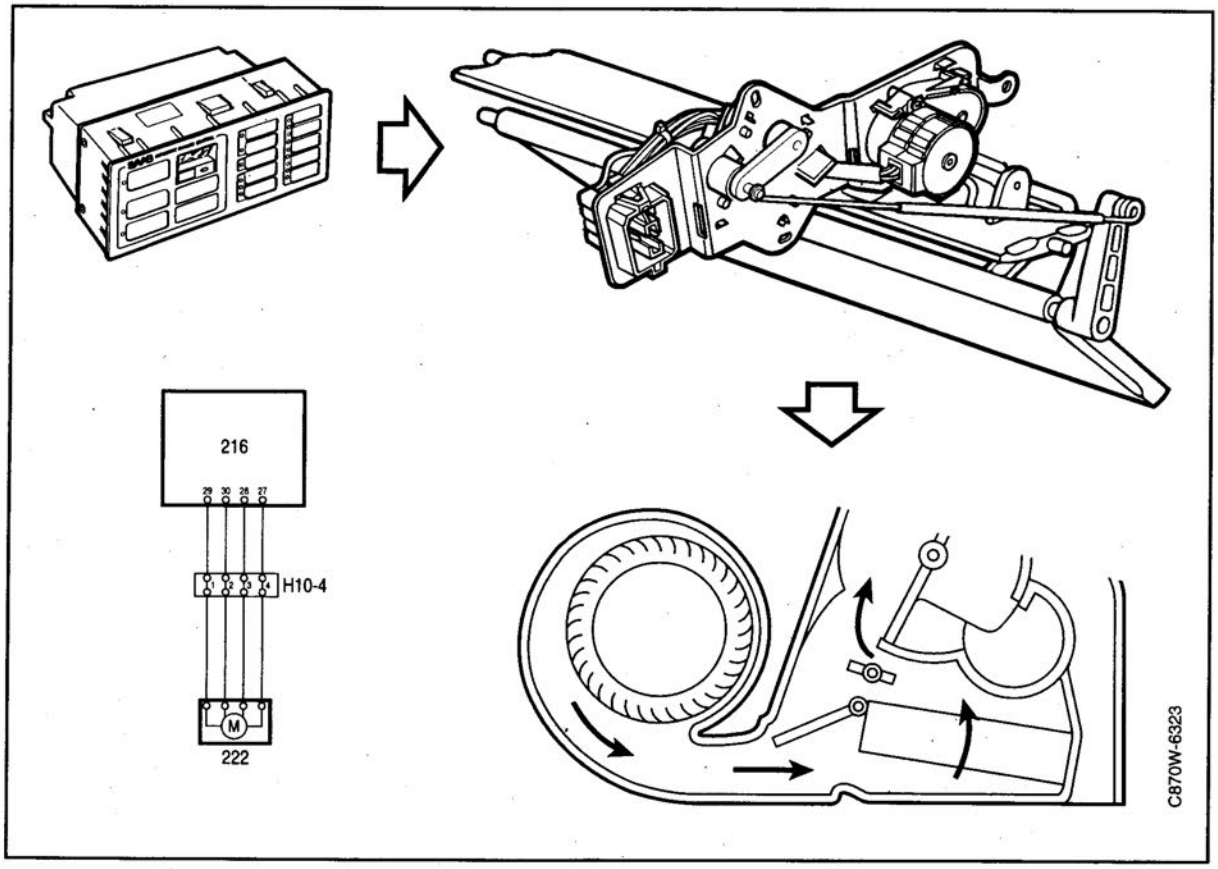
Pin numbers refer to M1995–.

The rheostat supplies PWM (pulse width modulated) voltage to pin 31 on the ACC control module. This voltage controls the strength of the display lighting, the push–button background lighting and the LEDs.

The fourth light strip from the top in the row with the buttons for adjusting the air distributor is a phototransistor. Data from this is used to adjust the lighting of the ACC control module display as well as the LEDs.

In darkness, the value is determined by the rheostat and in daylight by the brightness of the light in the cabin so that the panel can always be easily read.

Stepping motor, air mixing damper



Pin numbers refer to M1995–.

The stepping motor has two windings. A voltage is applied to the windings in a particular order by the output signal changing polarity at each pulse. This makes the motor move in short steps, hence the name stepping motor. The direction of rotation can be changed.
When the motor is stationary, both windings are continuously powered.
Winding 1 is connected to pins 27 and 28 on the ACC control module.
Winding 2 is connected to pins 29 and 30 on the ACC control module.

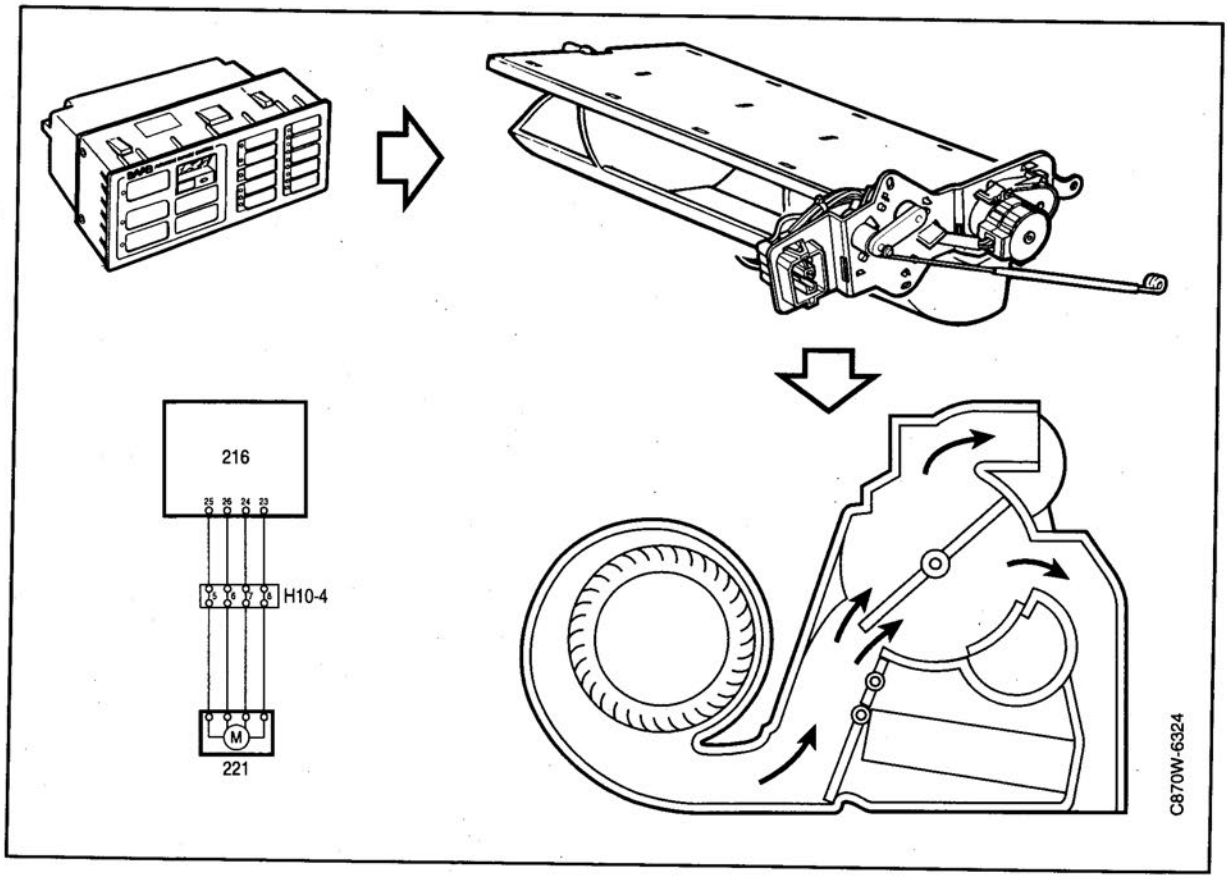
A stepping motor requires no feedback to the ACC control module. By sending a particular number of impulses, the ACC control module always knows how far the flap has moved.
For this, the control module must be calibrated.
During calibration, the damper is turned to 0 % heat.

Calibration is carried out using the ISAT scan tool or by simultaneously pressing the "AUTO" and "VENT" buttons. Calibration must be carried out if the battery has been disconnected or discharged or if the ACC control module or the stepping motor has been changed.

The air mixing damper is set by the ACC control module using information from the blended air temperature sensor in order to achieve a suitable blended air temperature.
The cabin temperature, outside temperature and selected temperature are decisive for the blended air temperature.

If the selected temperature is "HI" or "LO", the blended air flap will be set to the max. heat or max. cold position.

Stepping motor, air distributor



Pin numbers refer to M1995–.

The air distributor distributes the air flow to the various air vents in the cabin. For a description of the operation of the stepping motor, see previous page.
Winding 1 is connected to pins 23 and 24 on the ACC control module.
Winding 2 is connected to pins 25 and 26 on the ACC control module.

The angle of the air distributor is automatically adjusted when the ACC system is in AUTO or ECON modes, see table.
If the ACC control module's calculated nominal value for blended air temperature is high, air flow will be directed to defrost position.
If the ACC control module's calculated nominal value for blended air temperature is low, the air flow will be directed to panel position.

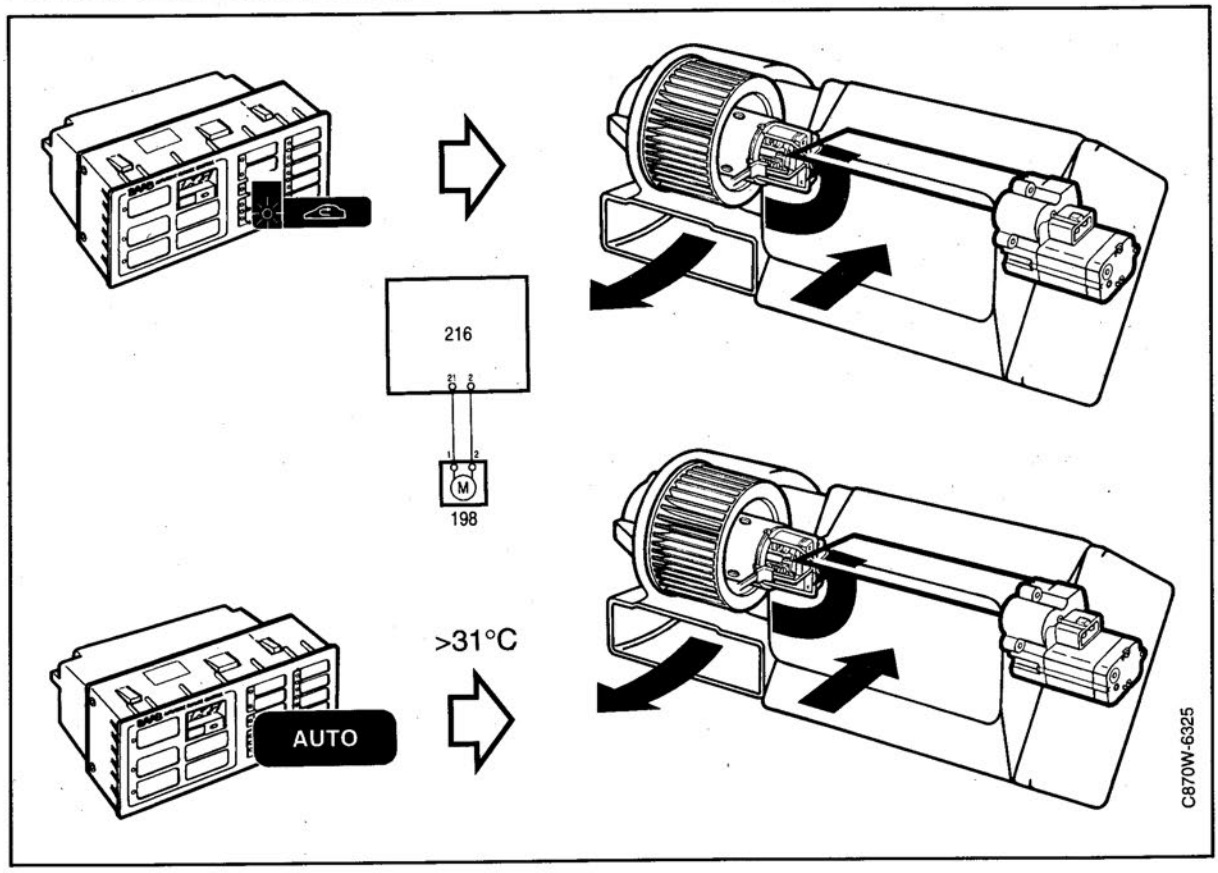
Required air distribution can also be selected manually. All other functions remain unchanged, see table.

If "HI" is selected, the flap goes to the defrost position and if "LO" is selected, the flap goes to the panel position.

Distribution	Angle when manually selected	Angle in AUTO mode
Defrost	135°	135° *
Defrost / floor	112.5°	112.5°
Floor	90°	–
Floor / panel	72°	72°
Panel	45°	45°

**Only in cold start mode.*

Direct current motor, air recirculation flap



Pin numbers refer to M1995–.

The air recirculation flap is controlled by a DC motor. The flap only has two positions; 100 % recirculated air or 100 % fresh air.

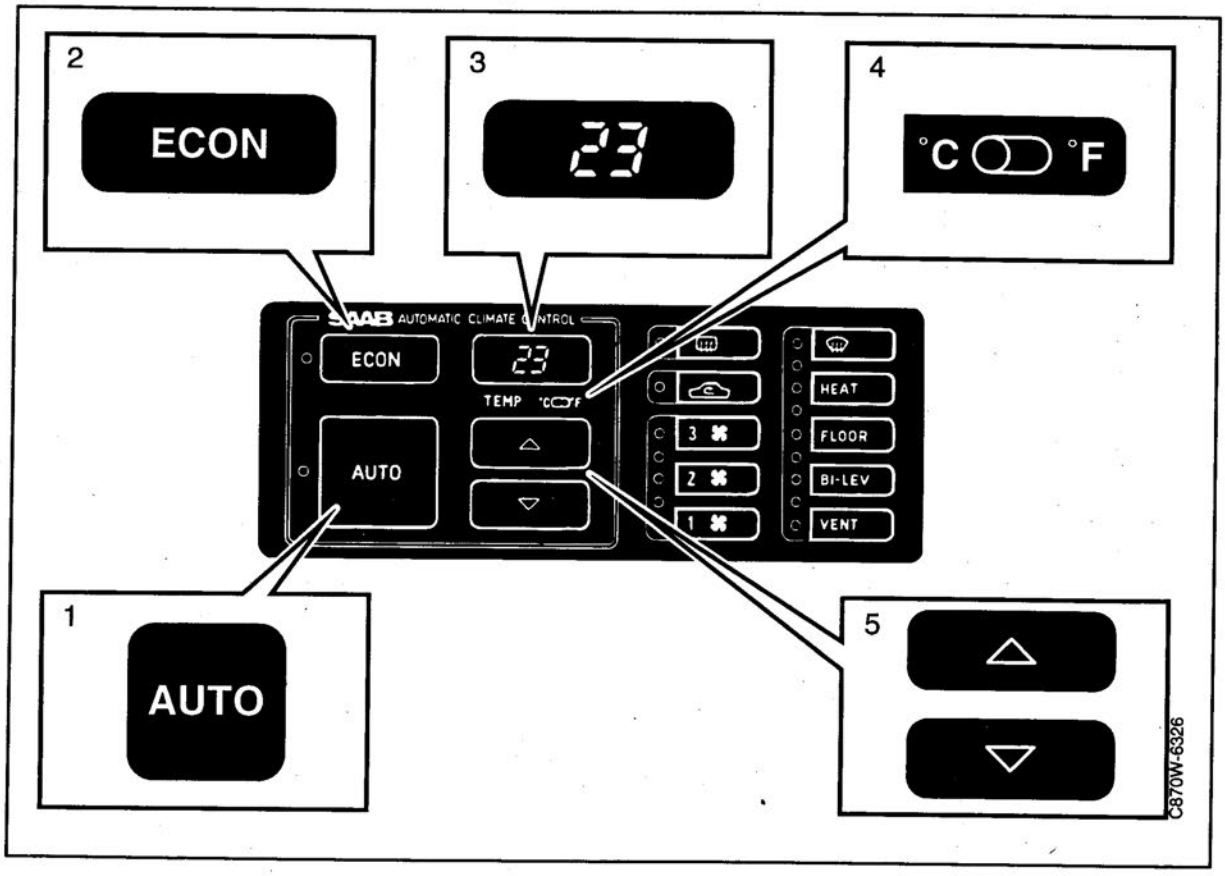
The air recirculation flap motor is connected to pins 2 and 21 on the ACC control module. The control module opens and closes the flap by changing the polarity on its pins.
To close the flap (recirculation position), pin 2 supplies approx. 12 volts for 23 seconds to ensure that the flap goes to its end position.
When the flap is to be opened, pin 21 supplies approx. 12 volts for 23 seconds.
When the flap has reached an end position, the current in the motor winding is limited by two PTC resistors incorporated in the motor. PTC stands for Positive Thermal Coefficient and means that the resistance increases with increased temperature (the opposite of NTC).

When the ignition is switched off, the air recirculation flap is always in the fresh air position, which is also the case during the first 60 seconds after the ignition is switched on.

Automatic recirculation is not available in ECON mode.
In AUTO mode, the ACC control module selects recirculation when the outside temperature is +27°C (80.5°F)and above for M1990–94 and +31°C (88°F) and above for M1995–.

If recirculation is manually selected, all other features remain unchanged.

Panel features, left–hand part M1985–89



1 **AUTO button**
Selects AUTO working mode, and the ACC control module maintains the apparent cabin temperature constant and at the desired level.
The LED lights in AUTO working mode and stays lit even when the electrically heated rear window, rear door fans and air recirculation flap are manually activated and deactivated. In the case of other manual selections, the LED goes out.
The ACC system always starts in the AUTO working mode, provided it has not been otherwise programmed.

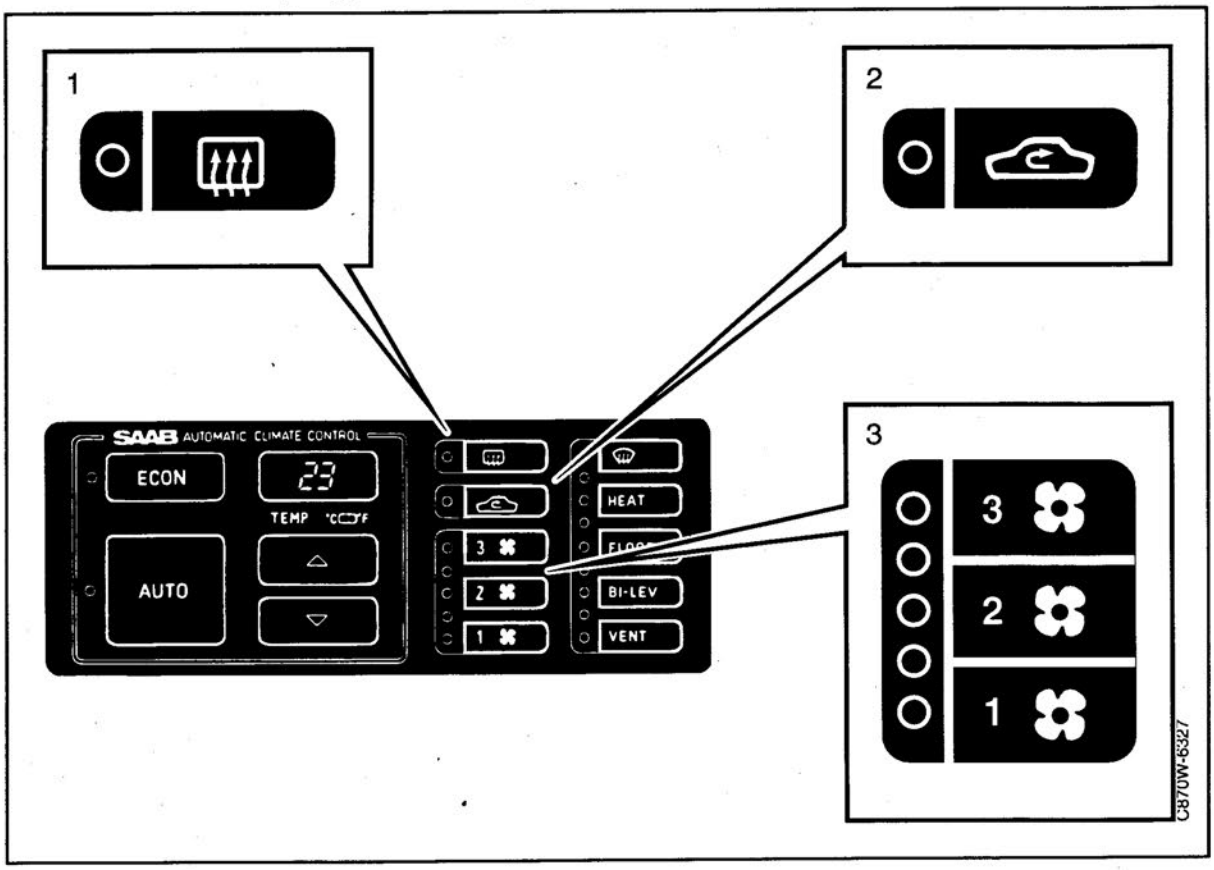
2 **ECON button**
Prevents the A/C system and recirculation being engaged. Other features are automatically controlled. The ECON LED lights.

3 **Display**
A display shows the set cabin temperature 17–27°C (62–81°F). The button under this allows either 0°C or 0°F to be selected.
The LO position (below 17° C or 63°F) provides air through the facia vents. The temperature valve is closed.
HI position (above 27° C or 80.5°F) gives reduced fan speed and heat to floor and defroster. Fully open temperature damper. Raising or lowering cabin temperature.
One press gives 1°C/2°F.

4 **°C/°F button**
Switches display temperature to °C or °F.

5 **Temperature buttons**
Increasing or decreasing desired cabin temperature.
Set temperature shown on display.

Panel features, right–hand part M1985–89

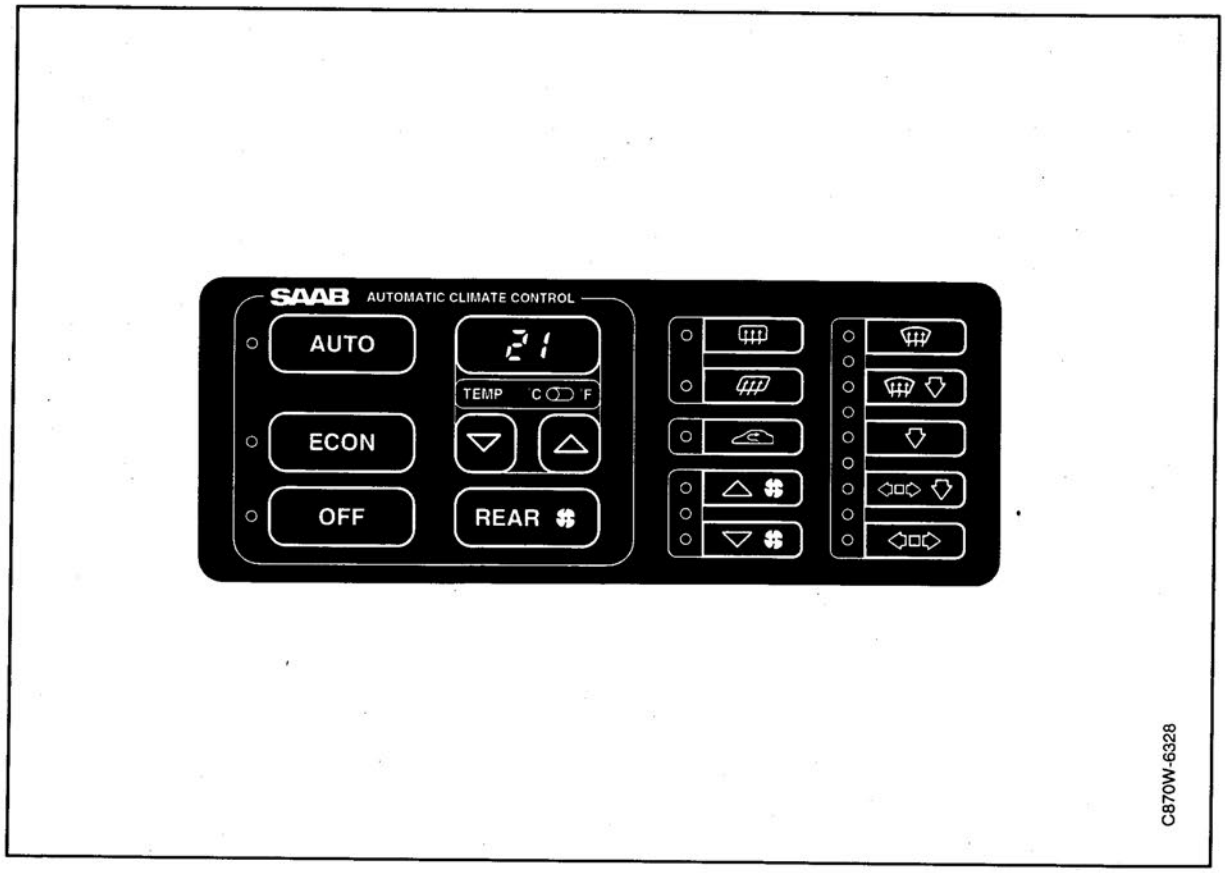


1 **Electrically heated rear window**
The electrically heated rear window and electrically heated door mirrors are automatically switched on if the system selects defroster position. These are automatically disconnected after about 13 minutes. They may be disconnected earlier by pressing the button. The electrically heated rear window can also be switched on manually but is then automatically switched off after about 13 minutes if it is not manually switched off earlier. Manual selection of defroster position does not switch on the electrically heated rear window.

2 **Recirculation**
Button is pressed when manually selecting recirculation and is indicated by the LED. Recirculation is recommended for use when driving in queues or similar.
If recirculation is automatically selected, this is indicated by the LED.

3 **Fan speed**
Three speeds for manual selection. Fan speed is continuous when automatically selected.

Panel features, rear A/C M1992



Operation

The rear A/C is controlled by the ACC control module. Depending on outside temperature and solar intensity, rear A/C is switched on and off.

When the ACC control module automatically selects rear A/C on, the LED beside the "REAR" button on the ACC panel lights.

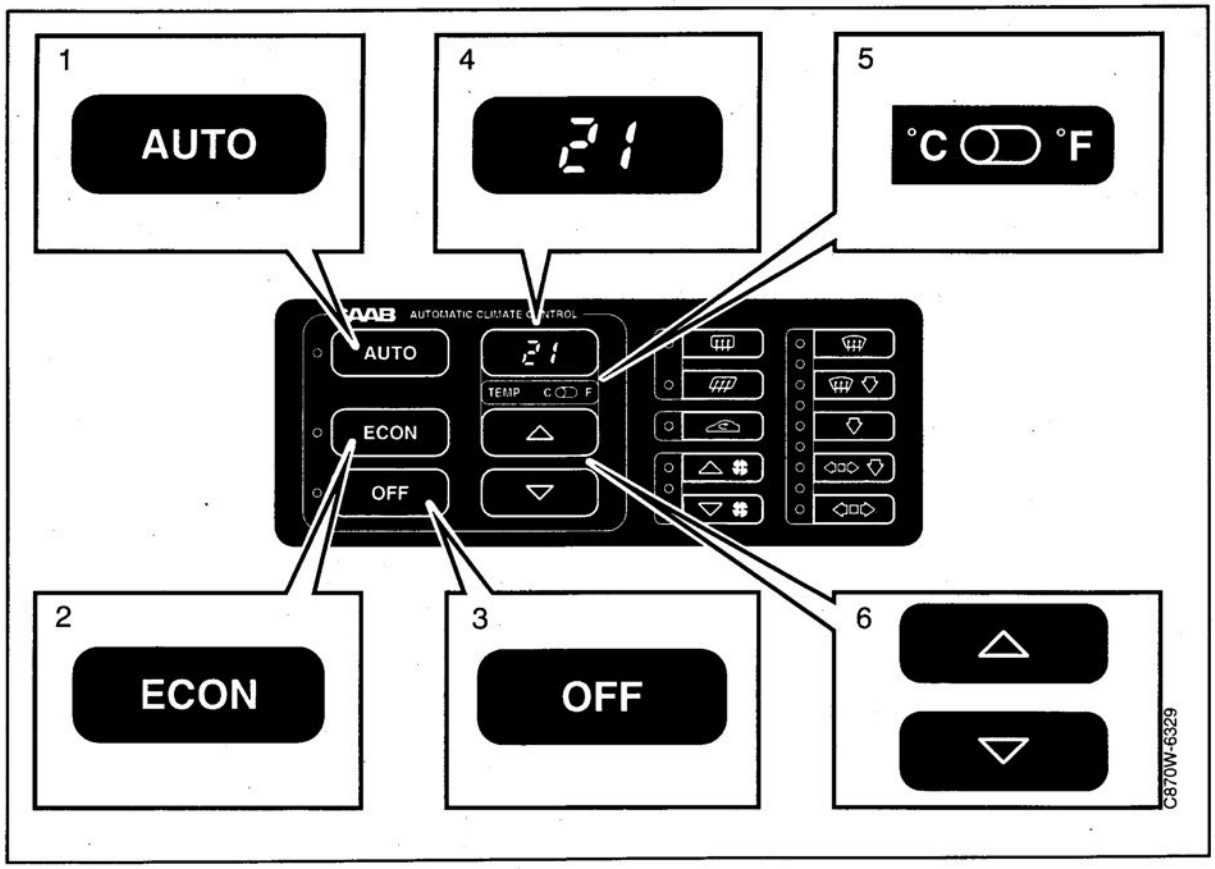
One press on "REAR" switches off the rear A/C unit. ACC still displays "AUTO" and functions as an ACC system with front A/C only. If "REAR" is pressed again, the rear A/C comes on again, provided the electronics consider it necessary to achieve the selected temperature.

Fan speed can, as previously, be increased or decreased as desired. If rear A/C is off, only front fan speed is changed.

If "REAR" is pressed at the same time as one of the buttons for increasing or decreasing fan speed, only rear fan speed increases or decreases. Speed is fixed at that speed at which the fan is running when the buttons are released. Only the front fan will be controlled automatically. Further manual raising or lowering of fan speed only affects the front fan. Returning to / from manual selection to automatic control is, as previously, achieved by pressing the "AUTO" button.

The rear A/C unit can even be started if the control module has chosen to leave it off. By simultaneously pressing "REAR" and the button for increasing fan speed, the rear fan starts. At the same time, the solenoid valve opens so that refrigerant is allowed to the rear evaporator. The anti–freeze thermostat then evaluates whether the compressor should start working and cooling start.

Panel features, left–hand part M1994–



1 **AUTO button**
Selects AUTO working mode, and the ACC control module maintains the apparent cabin temperature constantly at the desired level.
The LED lights in AUTO working mode and stays lit even when the electrically heated rear window, rear door fans and air recirculation flap are manually activated and deactivated. In the case of other manual selections, the LED goes out.
The ACC system always starts in the AUTO working mode, provided it has not been otherwise programmed.

2 **ECON button**
Prevents activation of the A/C system and recirculation. Other functions are controlled automatically. The ECON LED lights.

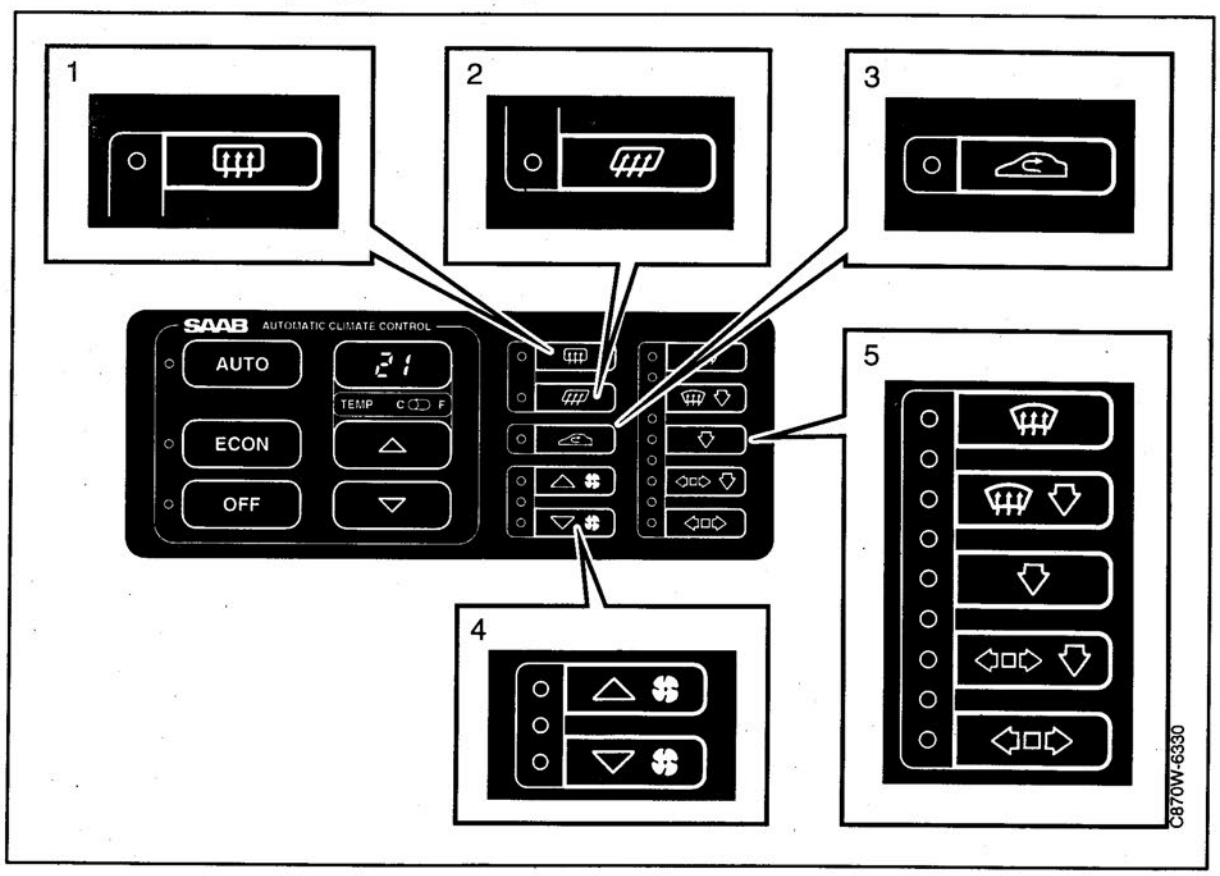
3 **OFF button**
Selects OFF working mode if the ACC system is running or if previous manual selections in the ACC system are already disconnected. When OFF working mode is selected, the ACC control module continues to monitor temperature.

4 **Display**
The display shows the selected temperature in the cabin. The display shows "HI" if the selected temperature is above +27°C (81°F) or "LO" if the selected temperature is below +17°C (63°F).
When the ignition is switched on, the ACC system starts at the temperature that was programmed when the ignition was last switched off.

5 **°C/°F button**
Switches display temperature to °C or °F.

6 **Temperature buttons**
Increasing or decreasing desired cabin temperature.
Set temperature shown on display.

Panel features, right–hand part M1994–



1 **Electrically heated rear window**
Connecting and disconnecting relay for electrically heated rear window or electrically heated door mirrors. Feature is activated for 11 minutes when it is manually selected or in AUTO working mode.
The LED lights when the feature is activated.

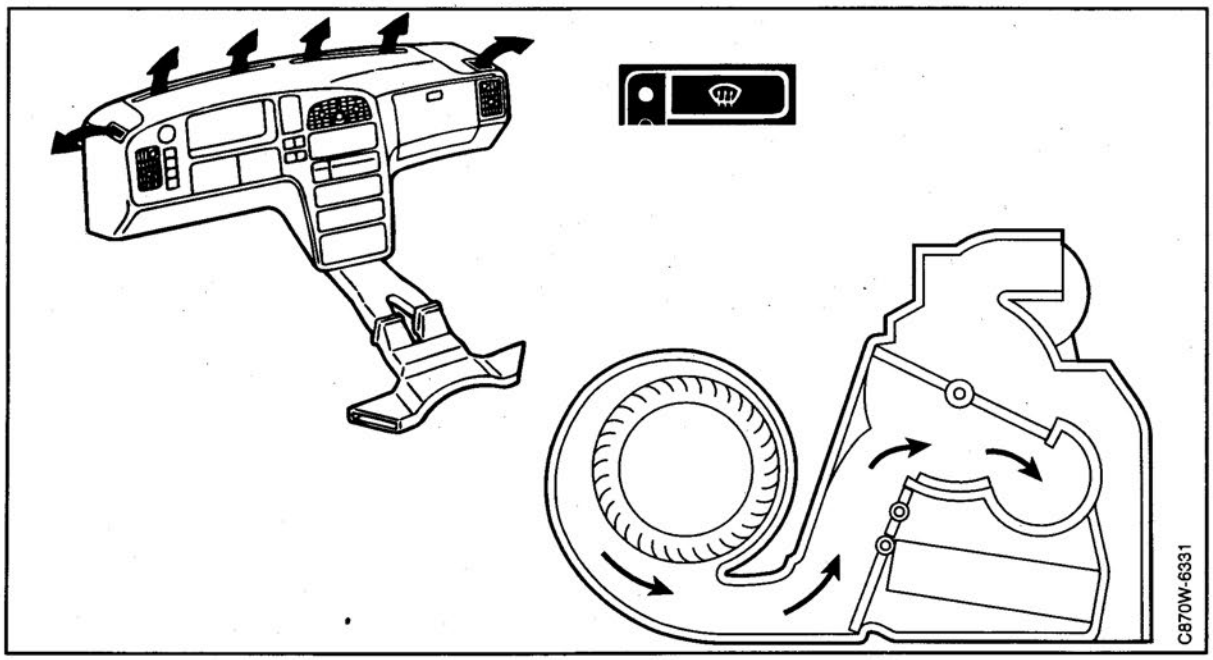
2 **Rear door fans**
Engaging and disengaging rear door fans. LED lights when fans are engaged.
Door fan speed is regulated in relation to ventilation fan speed, whether switched on manually or automatically.

3 **Recirculation**
Selects fresh air or recirculated air. LED lights when recirculation is selected.

4 **Fan speed**
Increasing or decreasing ventilation fan speed. When fan speed is automatically controlled, the LED between the two buttons lights.
When fan speed is increased manually, the upper LED lights and when fan speed is reduced the lower LED lights.

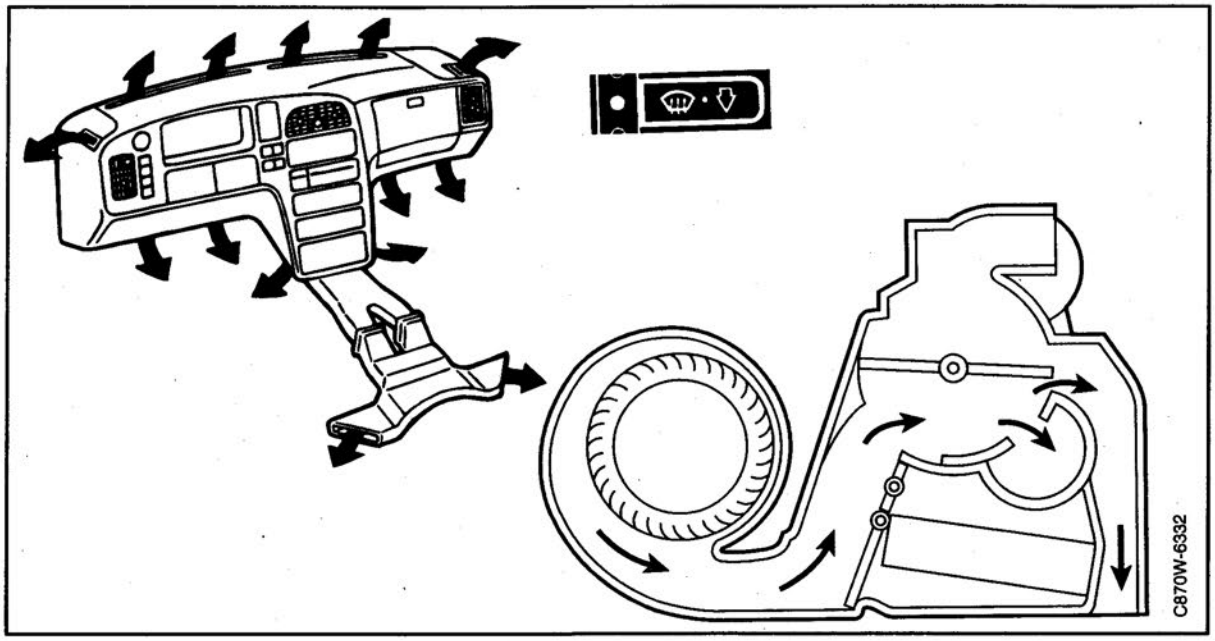
5 **Air distribution**
Selects air distribution as indicated.
In all flap positions an LED lights for the selected position. For flap positions between these angles in AUTO working mode, the centre LED lights.

Air distribution damper, "Defrost" position



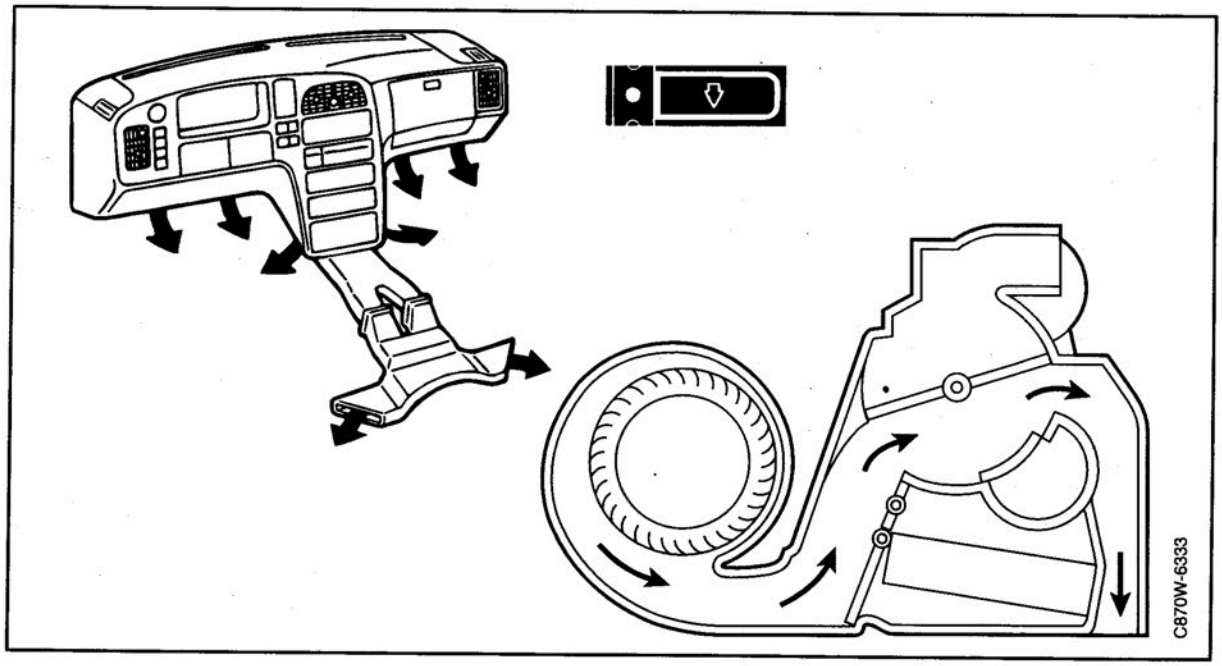
Damper angle 135° for both automatic and manual control.

Air distribution damper, "Defrost, floor" position



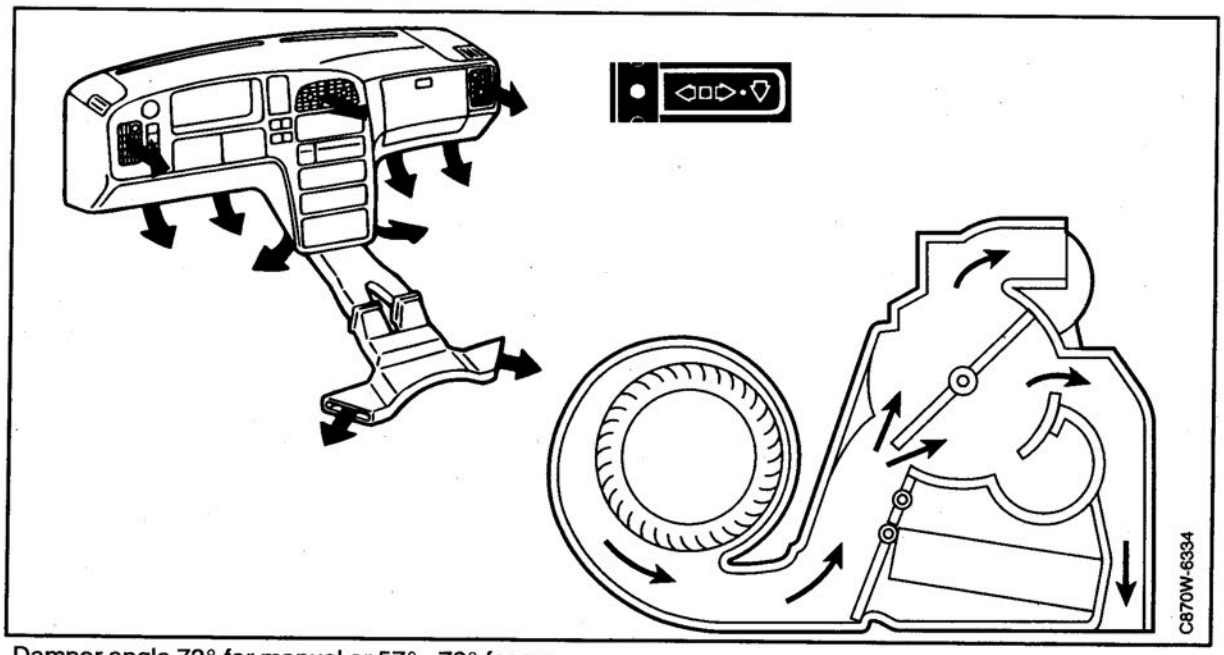
Damper angle 112.5° for manual or 112.5° –135° for automatic control. During both automatic and manual control.

Air distribution damper, "Floor" position



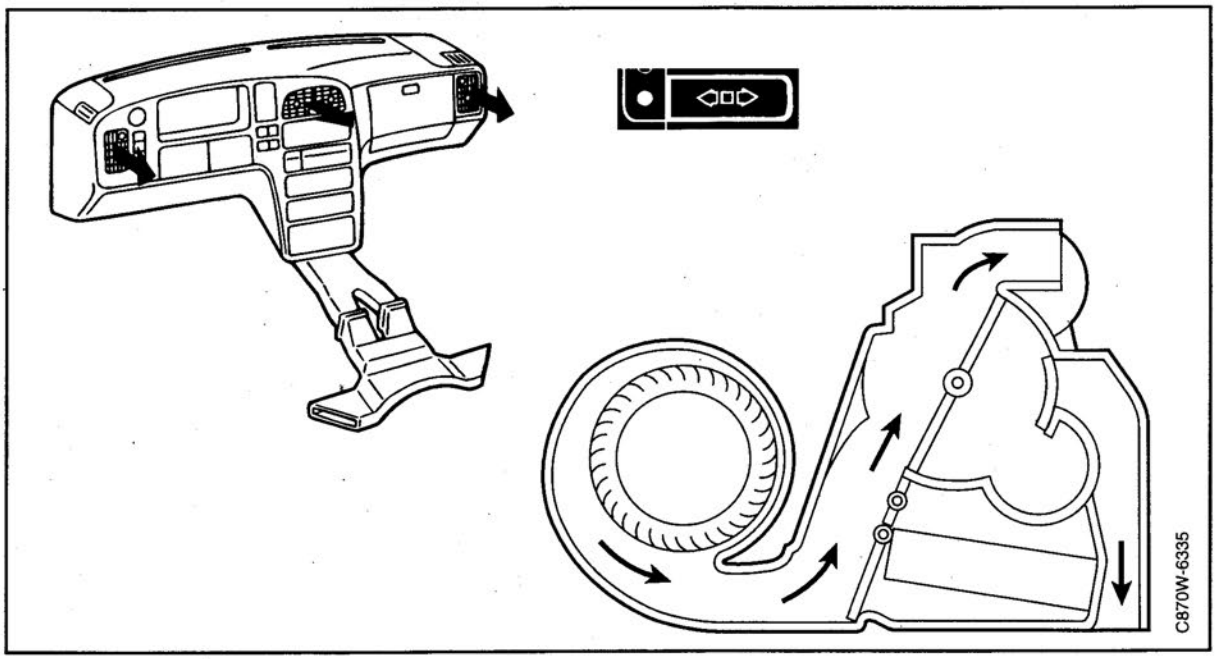
Damper angle 90° for manual control. This position is not used for automatic control.

Air distribution damper, "Panel, floor" position



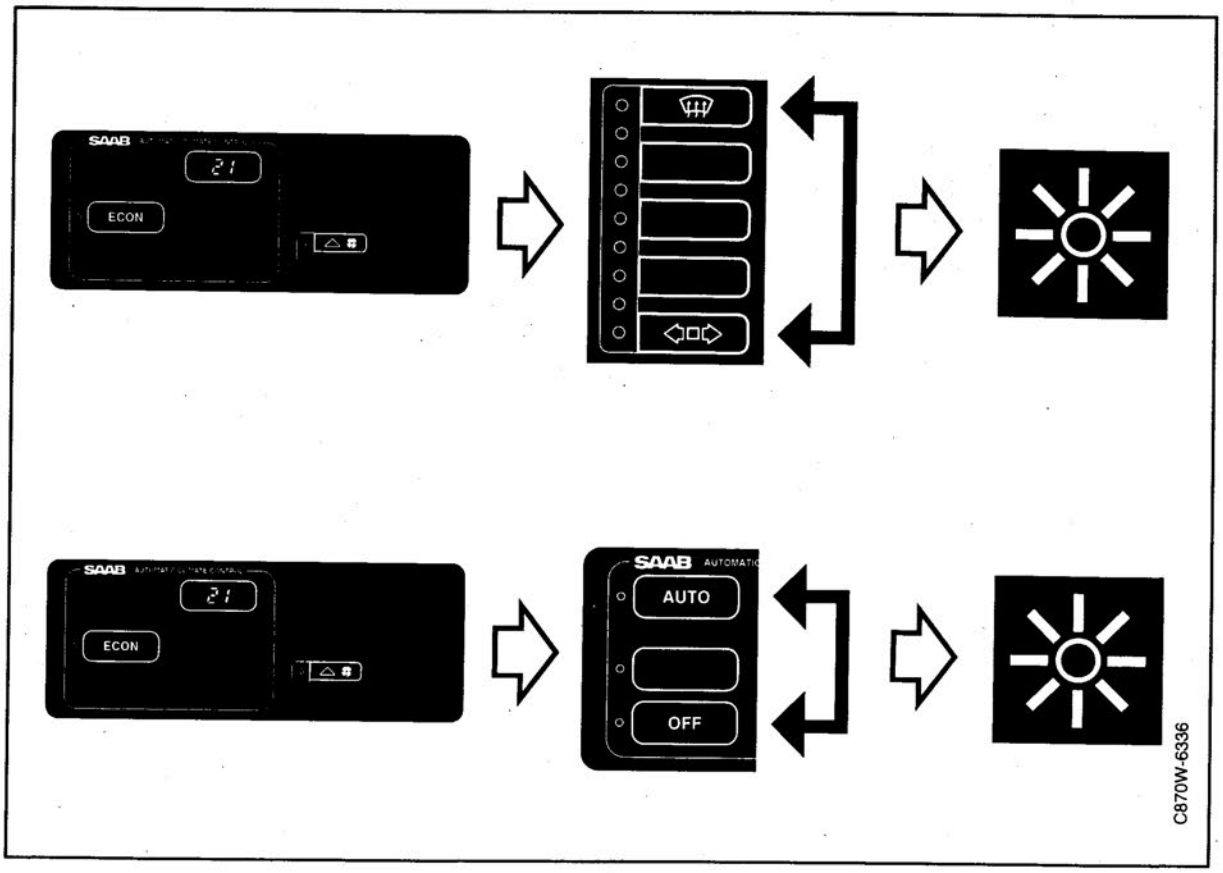
Damper angle 72° for manual or 57° –72° for automatic control. For both automatic and manual control.

Air distribution damper, "Panel" position



Damper angle 45° for both manual and automatic control.

User programming M1990–



The ACC control module can be user programmed. This means that manual selections can be programmed so that the ACC control module selects these after starting.
Other features, that have not been manually selected during programming, will be controlled automatically.
Note that the electrically heated rear window, rear door fans and recirculation can only be programmed to the opposite of that which the AUTO program has selected at the time of programming.

Program as follows:

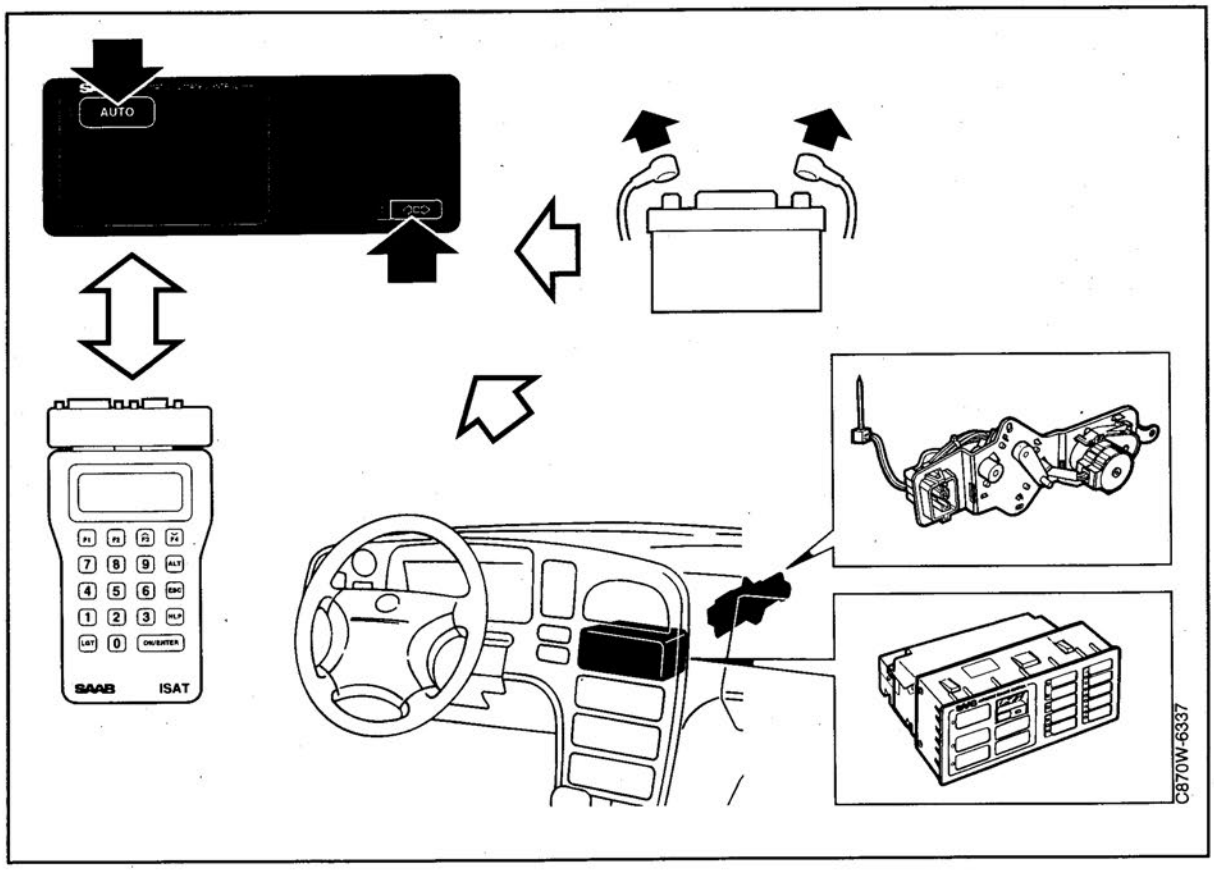
1 Compare the required manual selections with the buttons on the ACC control module panel.

2 Press the "DEF" and "VENT" buttons at the same time.

Cancel the program by pressing "AUTO" and "OFF" simultaneously.

The LEDs and display flash on to confirm the programming/cancellation.
User programming is stored even if power is lost to the ACC control module.

Calibration



The stepping motors in the ACC system have no feedback to the ACC control module for damper position. For this reason, these must be calibrated to their end positions before use. In M1990–, this can be done via the ACC panel. In older year models, this is done manually.
The air mixing damper is calibrated to 0 % heat and the air distributor is calibrated to defrost.

Calibration must be carried out in the following cases:

1 After changing the stepping motor.

2 If the battery has been disconnected or discharged.

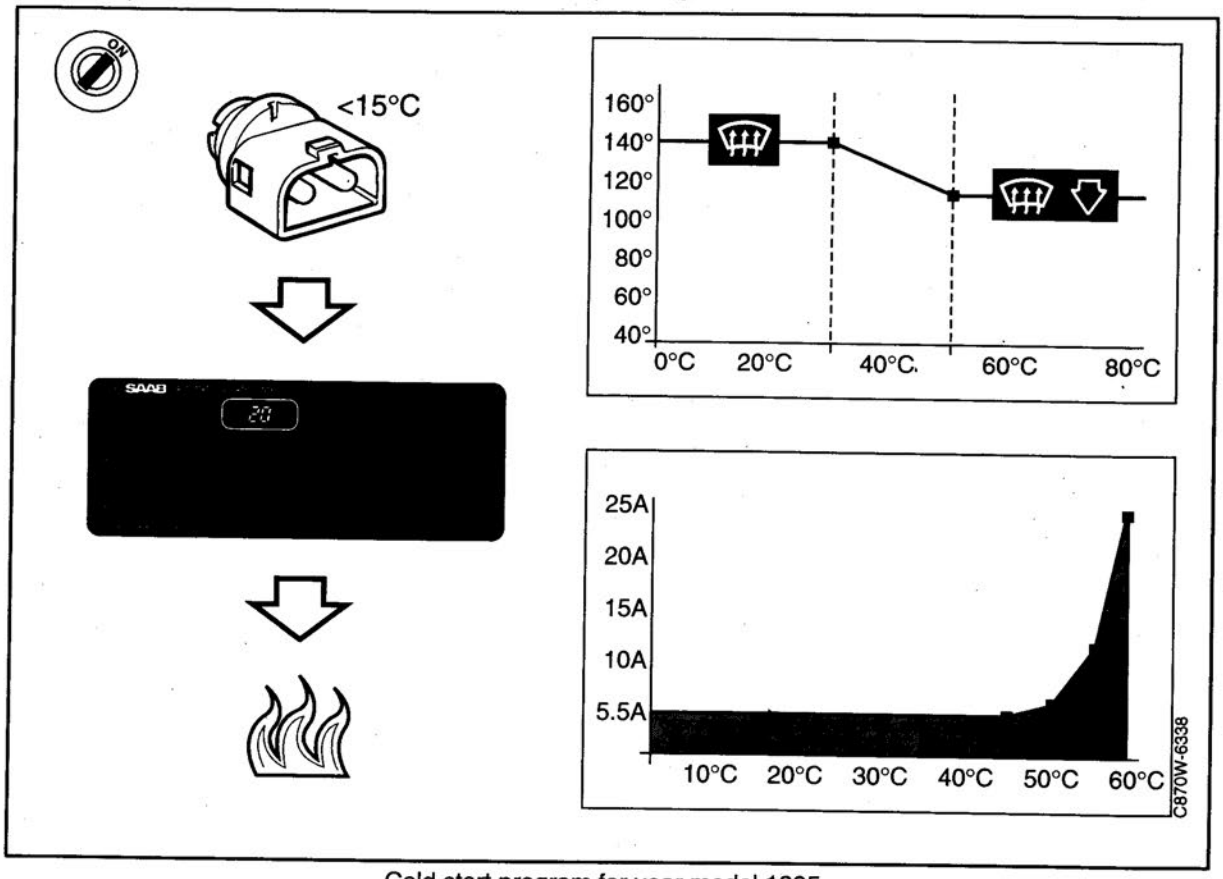
3 If the ACC control module connector has been disconnected.

The ACC system is calibrated using the ISAT scan tool or by pressing the "AUTO" and "VENT" buttons simultaneously.

A self test also starts during calibration. Calibration and self test are carried out in parallel and take about 30 seconds.
The number of detected faults is shown on the ACC display. A maximum of five faults can be stored at the same time.
All faults stored before calibration was carried out will be erased.
If no faults are discovered, the ACC display will show set temperature.
If the ignition is switched off during calibration, calibration continues when the ignition is switched back on again.

When calibration is completed, the ACC system returns to the previously selected functions.

Starting from cold in AUTO working mode



Cold start program for year model 1995

Conditions are appropriate for cold start when outside temperature is 5°C (9°F) or more below the preselected temperature and the ACC control module has calculated that a blended air temperature greater than +80°C (176°F) is required.

Air distribution starts in defrost position, and then goes to defrost/floor position as blended air temperature increases.
(See table)

When starting from cold, fan current is also dependent on blended air temperature.

Year models 1985–89

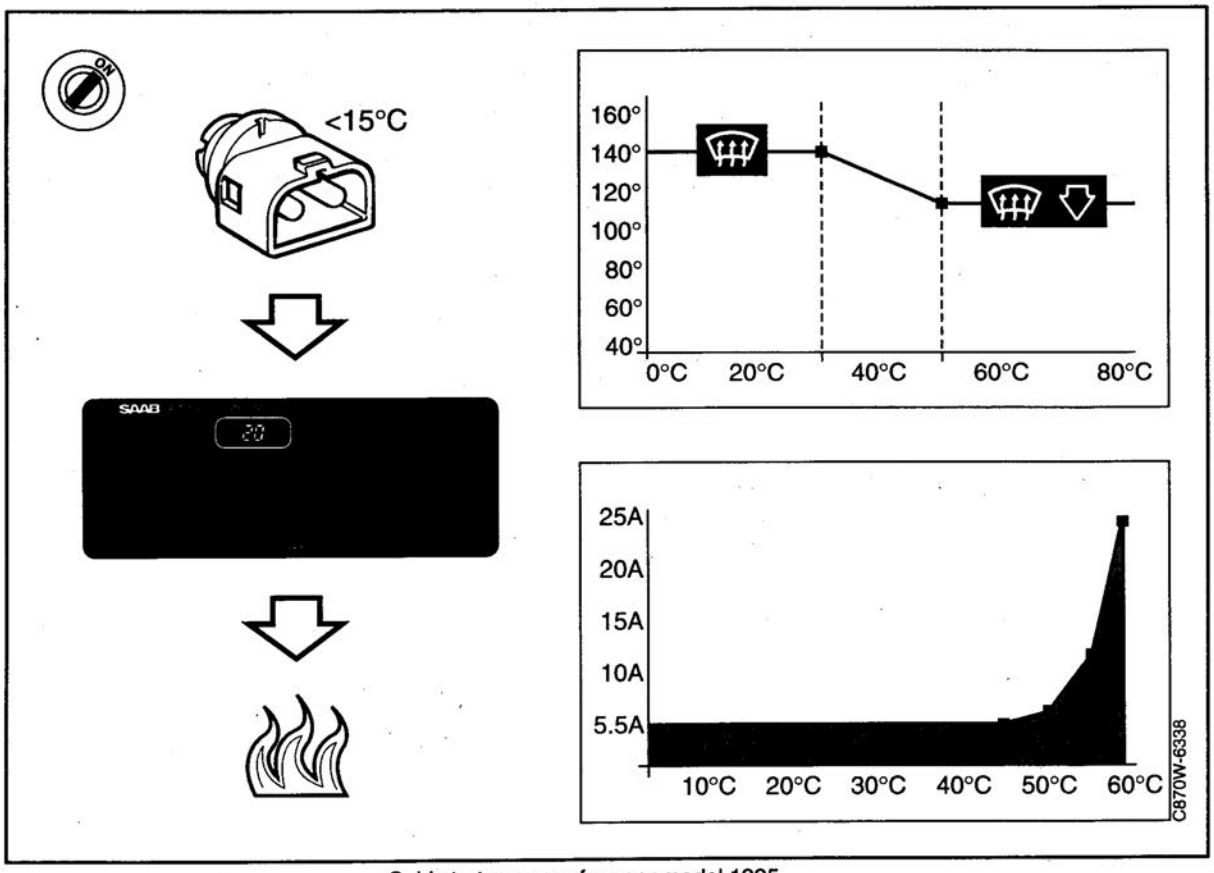
The system selects defroster position and fan speed 2 to begin with. The electrically heated rear window is switched on. When incoming air temperature reaches about 50°C (122°F), as measured by the blended air temperature sensor, air starts to be directed to the floor and fan speed is raised to 2.5 and then slows as selected temperature is achieved.

Year models 1990–94

Air distribution damper, cold start positions

Blended air temperature	damper
below +35°C (95°F)	"defrost" position
+35°C – +50°C (95–122°F)	Off "defrost" on "heat" position
above +50°C (122°F)	Normal operation

Starting from cold in AUTO working mode (contd.)



Cold start program for year model 1995

Year models 1990–94 (contd.)

Ventilation fan, speed when starting from cold

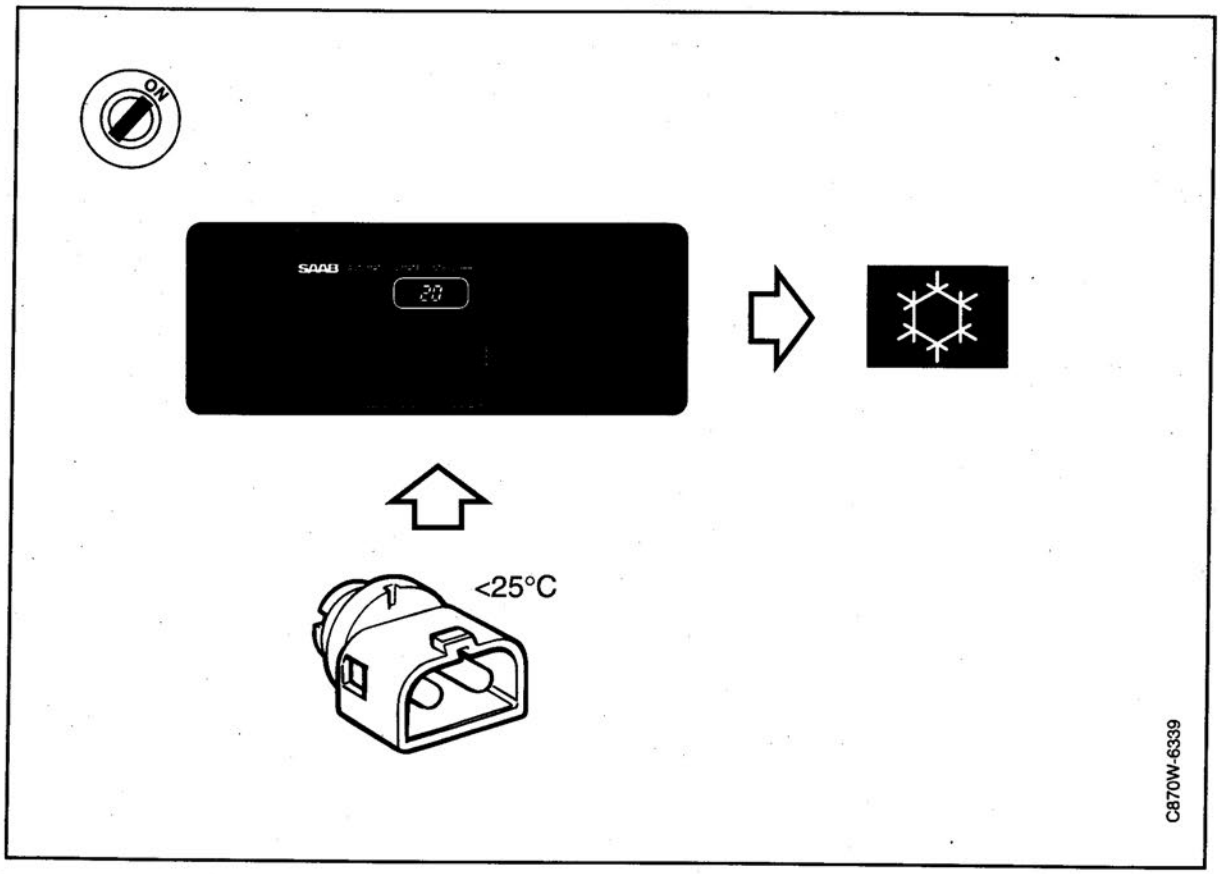
Blended air temperature below +35°C (95°F)	Current about 4.5 A
+35°C –+50°C (95–122°F)	Current about 4.5 – 6.4A
+50°C –+55°C (122–131°F)	Current about 6.4 – 12 A

As soon as the value calculated by the ACC unit for blended–air temperature drops below +80°C (176°F), but no less than 1 minute after starting, a switch over to normal operation takes place for both the air distribution damper and fan speed.

Year model 1995–

When starting from cold, there is a pre–programmed maximum fan speed.
Fan speed varies within the shaded area on the diagram above.
Even if the ACC control module has calculated that a higher fan speed is required, speed will never exceed the preprogrammed maximum speed, in graph.
This maximum speed can be adjusted using the ISAT scan tool

Starting from hot in AUTO working mode



Conditions are correct for starting from hot when the outside temperature exceeds the selected temperature by 5°C (9°F) or when the calculated value of blended air temperature is below +80°C (95°F).

Year models 1985–89

The automatic system selects ventilation position or intermediate level, depending on sunlight and high fan speed. Fan speed drops when cabin temperature approaches the selected temperature.
The compressor is not switched on if ECON has been selected. If ambient air temperature is above 27°C (81°F), recirculation is also selected. If the difference between cabin temperature and the selected temperature is greater than 5°C (9°F), ventilation position is selected

Year models 1990–94

There can be two levels of starting from hot, depending on the result of the temperature calculations carried out by the ACC unit in order to establish its control criteria. For simplicity, these levels are called hot and very hot. The following special selections apply:

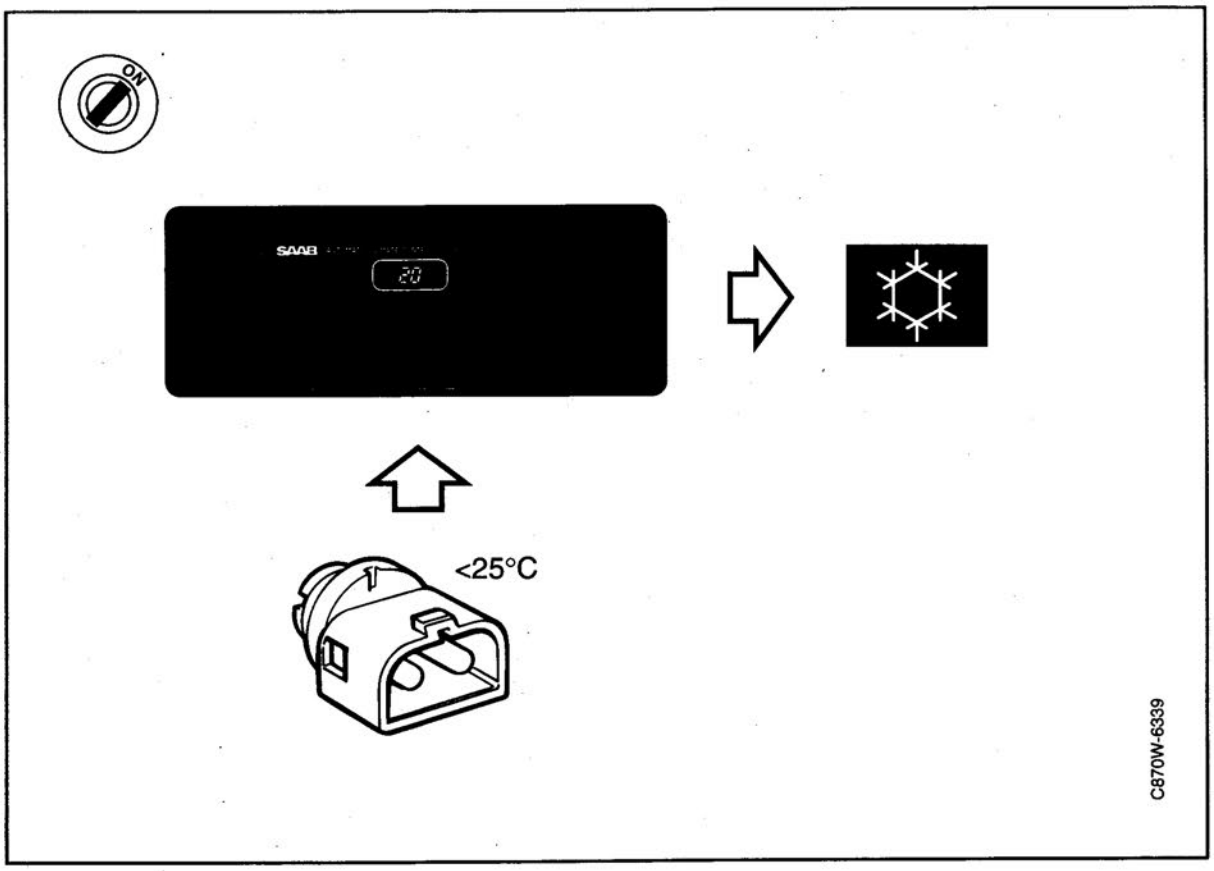
Hot conditions – current to the ventilation fan increases from 4.5 A during the start up period to the required speed at 1 A per second. The air distribution damper starts in normal position, and when the fan has achieved its operating speed, the program continues in normal operation.

Very hot conditions – ventilation fan motor current increases from 4.5 A during the start up period to 8 A, and then in steps of 1 A per second until the required speed is achieved. For 60 seconds, the air distribution damper is set to "ventilation" position.

After 1 minute, the ACC control module switches to normal operation.

(contd.)

Starting from hot in AUTO working mode (contd.)

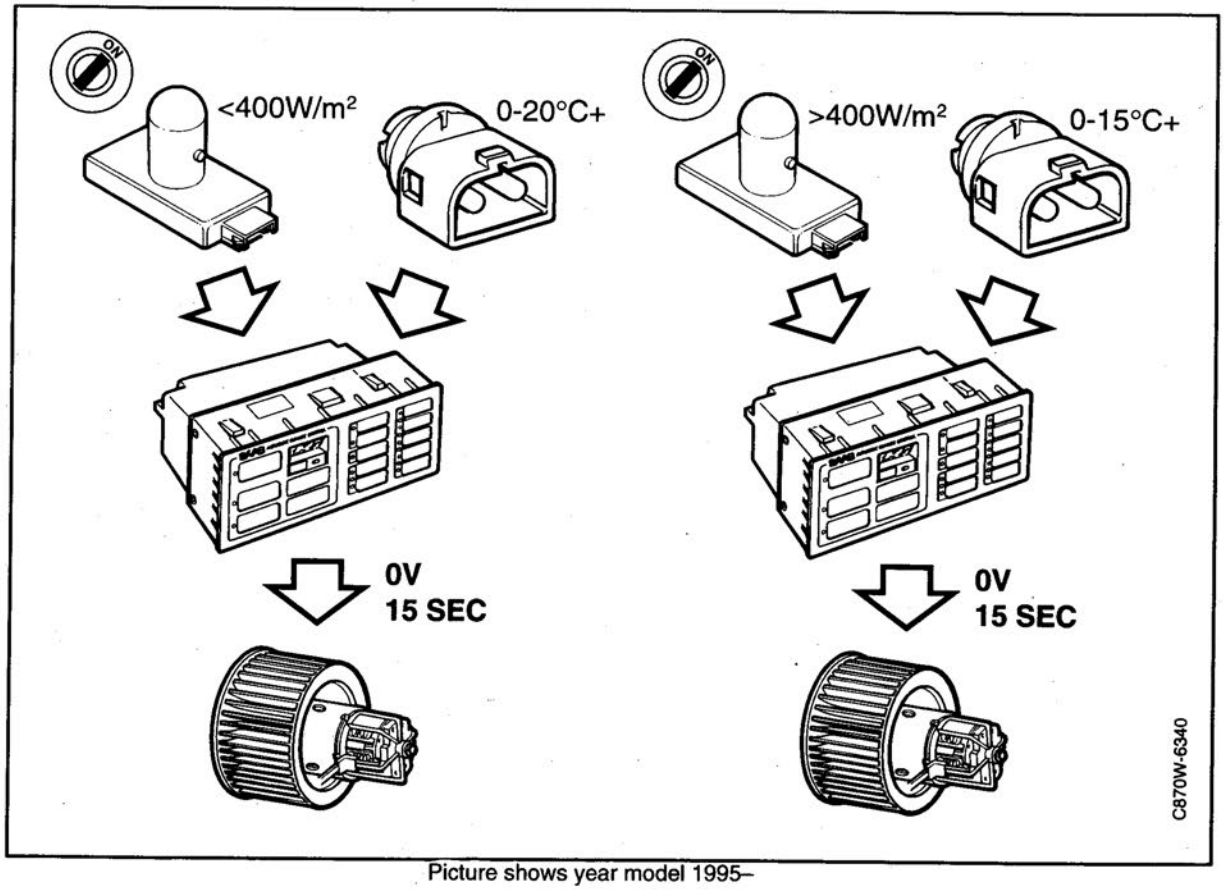


Year model 1995–

Fan speed is determined by the difference between the outside temperature and the selected temperature.
When starting, fan current increases by 1 A/s from 0 A to a value selected by the ACC control module.

If the actual temperature exceeds the ACC control module's calculated required temperature by more than 5°C (9°F) and selected temperature is so high that fan current calculated by the ACC control module exceeds 8 A, fan current will start at 8 A.
It will then change by 1 A/s until the calculated fan current is reached.
Under the above conditions, the air distributor will be in panel position and will, in stages, go towards normal AUTO mode.

Fan function when starting



Picture shows year model 1995–

It is likely that there will be a build–up of mist on the inside of the windscreen when the car is started after having been parked for up to three hours.

Various methods are used to minimize the risk of misting when starting in different conditions.

M1994
The principle of operation is always that any damp air is blown out through the floor vents before being blown onto windows.

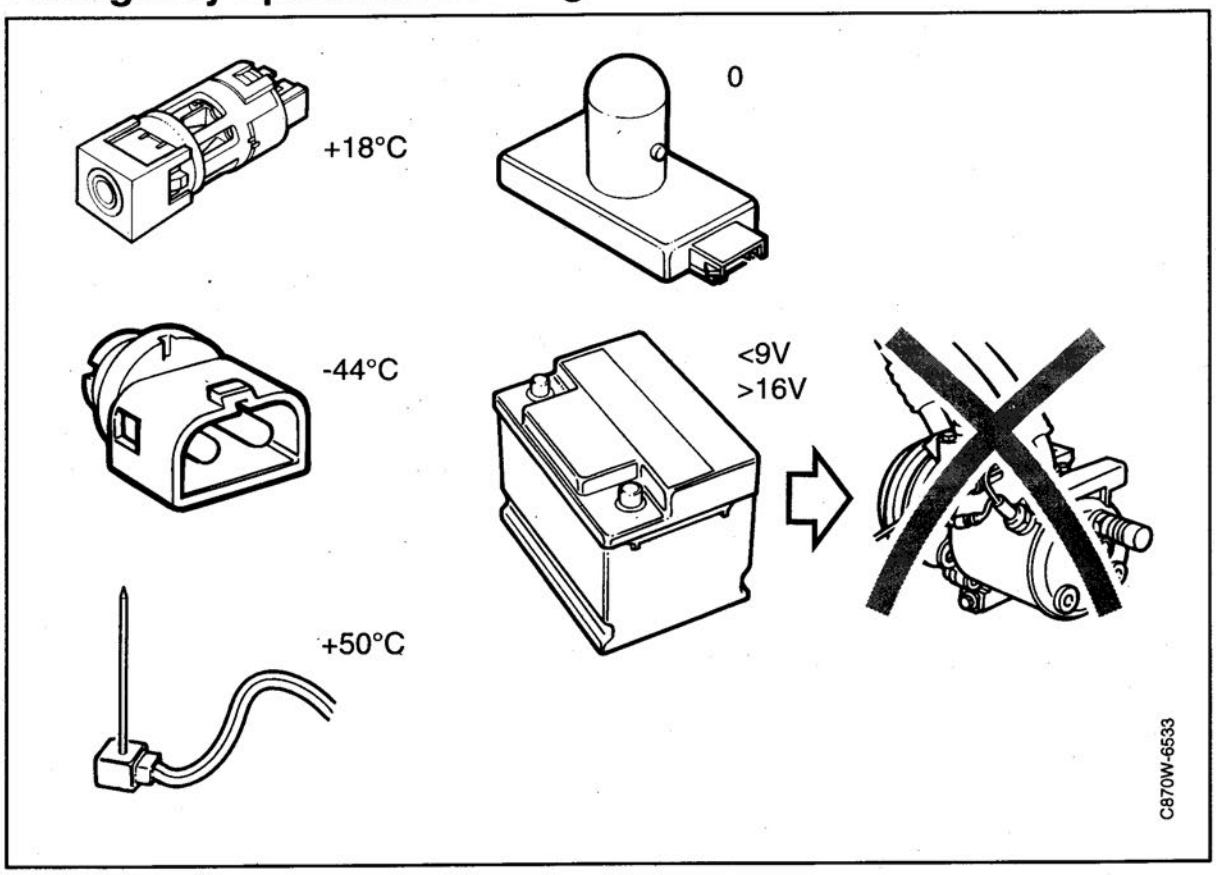
M1995–
Delayed start of ventilation fan for 15 seconds. During this time, the evaporator in the A/C system has time to cool down and dehumidify the air into the cabin.

Delay of ventilation fan start is selected when the outside temperature is 0 – 20°C (32–68°F) and solar intensity is below 400 W/m², or outside temperature is 0 – 15°C (59°F) and solar intensity is greater than 400 W/m².

There is always a certain chance of misting when outside temperature is between 0 and 2°C (32–35.6°F) as the A/C system anti–freeze thermostat disconnects the A/C compressor and the evaporator is not cooled.

During the 15 second delay on the ventilation fan, it is not possible to start the fan manually using the buttons on the ACC control module panel.
If required, it is possible to cancel this feature using the ISAT scan tool.

Emergency operation working mode



If the ACC control module's self diagnosis program discovers a fault, the emergency operation feature is engaged. If a shorted output is discovered, the corresponding control mechanism is disconnected. In the case of a sensor fault, the ACC control module works with the following default values:

- Interior temperature level is set to +18° C (65°F).
- Outside temperature–previous value or –44° C (–47°F) if the fault is present when starting.
- Blended air temperature level is set to +50° C (122°F) (version 2.00).
- Blended air temperature–set value calculated by ACC control module (version 2.01).
- Solar sensor–intensity, height of sun and azimuth angle all set to 0.
- If battery positive voltage drops below 9 V or exceeds 16 V, the ACC control module is switched off, but it is switched on again as soon as voltage returns to its normal value.
- If battery positive voltage in the ACC control module drops below 10.5 V, control of the stepping motors ceases, but the system continues to work with air mixing and air distributing dampers in the positions in which they were when the fault arose.
- If there is a fault in the EPROM, the ACC system is not disengaged when the ignition is switched off.

Important
The self test on blended air temperature sensor and cabin temperature sensor can only take place when outside temperature is above 0° C (32°F).

Year model changes M1985–95

The heating and ventilation system is continuously being modified. The various parts have been developed and better methods introduced. In addition to the fact that the various components have been modified physically, the ACC control module has also been improved.

New software has been developed which better controls the temperature in the cabin and more diagnostic trouble codes have been introduced. For this reason, it may be useful to go through the modifications which have taken place over the years and to look at both mechanical and electronic improvements which have been made.

M1986

- Compressor moved to the centre of the car in order to make it easier to repair and a new groove added to the pulley.
- Extra radiator fan at the front in order to increase cooling capacity in certain markets.
- The pressure switch in the A/C system has been increased to a three stage switch which sends a signal to the extra fan at 15 bar (210 psi) and breaks current at 27 bar (380 psi) in order to control the A/C system better.
- A/C start delay of about 10 seconds so that the engine has time to achieve idling speed, chassis No. CG1001945 and after.

M1987

- The electrically driven fan in the interior air sensor is integrated in the sensor for more accurate readings.
- All side defroster air is concentrated in the loudspeaker grilles from chassis No. CH1007949 LHD and CH1024270 RHD.
- The light intensity in the ACC panel is automatic, depending on the light level in the cabin, in order to make it easier to read.

M1988

- Defroster fans in rear doors have been introduced to cars with ACC for improved defrosting of rear side windows.
- Longer floor ducts for increased comfort.
- 7 cylinder A/C compressor which can be retrofitted.

M1990

- ACC generation 2 introduced with built–in fault diagnosis, ISAT scan tool communication and the possibility of user programming.
- New solar sensor which, in addition to intensity, also senses angle of incidence of solar radiation.

M1992

- Rear A/C unit introduced as an option for increased cooling.
- ACC unit has a "Rear" button for controlling rear A/C.
- R134a refrigerant introduced, in certain markets, in order to protect the ozone layer. Components in cooling system adapted for this.
- Due to the new refrigerant, the three stage pressure switch has new settings.

M1993

- All cars supplied with A/C have R134a refrigerant.
- Rear A/C discontinued, along with its control button on the ACC panel.

M1994

- Windows with lower heat transmission introduced in order to reduce the effect of solar radiation on interior temperature. Marked Sekurisol. The heat absorbed by the glass is transferred to the air when driving.
- New solar sensor introduced due to the new windows. Ordinary sensor still available for markets without the new glass.
- New software in ACC control module for improved control.
- Extra holes in heater housing for improved flow to floor.
- R134a refrigerant available for converting systems still operating with R12.

M1995

- New solar sensor without electronics (located in ACC instead).
- New software in ACC control module for improved control.

Fault diagnosis

Important notes for fault diagnosis

The electronics and software used to automatically control the temperature in the cabin have been developed and modified through the years. This means that fault diagnosis also varies between year models.

In cars of year model 1985–89, the electronics are somewhat simpler, meaning that fault diagnosis is also simpler.

Between 1990–94, the ISAT scan tool is used, making it possible to enter commands and read values during fault diagnosis.

When rear A/C was introduced as an option in 1992, diagnostic trouble codes and commands were introduced for this.

In year model 1995– fault diagnosis works in a similar way to previously but with different diagnostic trouble codes and wider options

Some important points to remember:

During fault diagnosis in the microprocessor system, memory sectors can become distorted and give unusual symptoms. In order to erase all unusual symptoms, the ignition should be switched off for at least 35 seconds.

Read and note all stored diagnostic trouble codes before disconnecting the battery or ACC control module.

Before fault diagnosis

Check the following before carrying out fault diagnosis:

- that the compressor drive belt is intact and correctly tensioned
- that air comes into the cabin through the air ducts
- that the flow of air through the condenser is not obstructed.
- that the compressor clutch engages and disengages when the A/C unit is switched on (outside temperature should be above +5°C). If the compressor is not engaged, the system can be emptied of refrigerant (pressure switch on desicant container prevents engaging) or there may be an electrical fault.
- applies only to year model 1985:
  that the electric radiator fan starts when the A/C unit is switched on.

Fault diagnosis, general

1 SDA MkII, which is an adapter, should always be connected to the ISAT scan tool.

2 The data link connector, which is green, is located under the right–hand front seat. The connector is covered by the trim which is slitted and is held in place with clips.

3 The ignition should always be on during fault diagnosis.

4 Read and note diagnostic trouble codes stored in all systems before the battery and the control module are disconnected.

5 If no communication can be achieved between the ISAT scan tool and the control module, first check that the fuses are intact and that there is supply voltage to the fuses.
Then check the leads between the control module and the data link connector.

6 Also check that voltage supply and ground are correct in the data link connector, and that the connector pins are undamaged and not loose.

7 To avoid damage to the control module/components, always check that the ignition in switched off before connector(s) are unplugged.

8 Check that control module grounding connections and supply voltages are correct.

9 It is sometimes useful to unplug connectors and check that connections and pins are undamaged and not loose.
Reconnect all connectors and erase all diagnostic trouble codes. If possible, start/drive the car and check if the fault(s) remain.

10 All voltages around the 12 volt level are proportional to battery positive voltage and, for this reason, the levels should only be used as a guide.

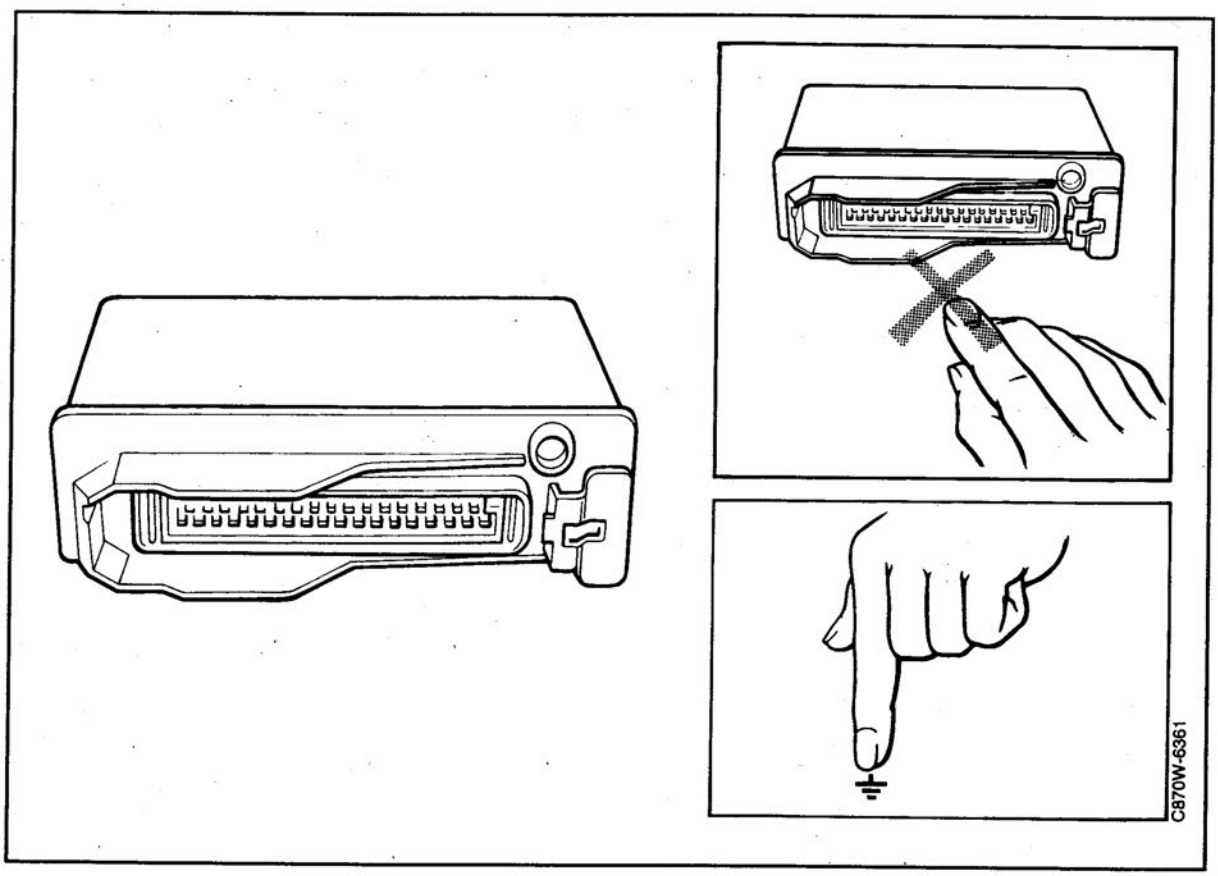
11 0 volt signals designate ground or 0 volt level. On a sensitive multimeter, a grounding point may give measurable voltage and a 0 volt level (output signal) can, without there being a fault, be around 1 volt. For this reason, voltage level should only be used as a guide.

12 Never switch from one unit to another (for example from volts, via amps to ohms) on the meter, without first having unplugged the instrument test leads.

Important

After conducting an operational test, always erase the fault memory with the command "CLEAR FAULT CODES".
All systems can be erased with the command "CLEAR".

Handling control modules



All control modules are more or less sensitive to static electricity and can, if they are handled incorrectly, be so seriously damaged as to render them unserviceable. For this reason, it is important that the following rules are followed in all situations where the control module must for some reason be dismantled or changed.

- Avoid unplugging or removing the control module unless it is absolutely necessary.
- Never touch the connector pins and never place the control module so that the pins can come into contact with anything.
- Before unpacking a new control module, ground the packaging to the car bodywork and open the packaging as short a time as possible before fitting the control module.
- When working with the control module, it is important to regularly ground yourself. This is especially important when you have been sitting in the car or when you have changed position or moved around the car. This is especially important in climatic conditions with very dry air (for example during the winter in cold markets).
- Avoid wearing clothing made of synthetic materials.
- Always handle control modules which are suspected of being faulty in the same manner. This increases the possibility of localizing the cause of the fault.

Basic mechanical fault diagnosis

Read fault diagnosis as follows:
Find the probable cause of fault by looking in the appropriate column in the list. Look up all possible fault causes and assess which is the most likely fault. Start with all "easy" tests. Note that faults are not in order of probability.

No cooling	Poor cooling	Uneven cooling	Noise in system	Probable cause	Action
				Electrical faults:	
X				Fuse blown	Check fuses
X				Loose electrical cable or ground connection (compressor not running)	Check all cables
X				Compressor clutch burnt out	Change clutch (see page 277)
X				Fan motor not running	Check electrical cable and fan motor
	X	X		Fan motor not working properly (poor connection or open circuit in motor)	Check and change if necessary
		X	X	Open circuit or poor connection in compressor clutch winding (clutch engaging and disengaging)	Change clutch
			X	Fan motor squeaking or rubbing against fan cowling	Check
			X	Noise when starting rear A/C	Fit adapter harness to rear A/C if not already done. See page 241.
				Mechanical faults:	
X	X		X	Drive belt poorly tensioned	Tension or change belt
	X			Air ducts blocked	Check and clean
	X			Air deflector behind front spoiler incorrectly cut out	Check and adjust cut out, see page 304.
			X	Clutch bearing worn or poorly centered	Change bearing
			X	Noise in recirculation position at speeds above 100 km/h	Air leakage at cable grommet. Take action described on page 236
			X	Clearance between pulley and electromagnetic clutch too great	Adjust clearance. If starting noise remains, change to rubber damped driver 43 83 642 see page 277
	X		X	Compressor worn or poorly attached	Change compressor and tighten properly

Continued on next page.

Basic mechanical fault diagnosis (contd.)

No cooling	Poor cooling	Uneven cooling	Noise in system	Probable cause	Action
				System faults:	
X				Anti–freeze thermostat not engaging compressor	Start by checking that the thermostat is properly inserted in the evaporator. If it was correctly fitted, change it.
X				Expansion valve stuck in open position	Change expansion valve
X				System leaking	Fill system, check for leaks and seal all leaks*
X				Blockage in hose or component	Check flow through each component
X				No refrigerant in system	Charge system*
	X			Air filter blocked on air side	Change filter
	X		X	Too little refrigerant in system (whistling sound in evaporator near expansion valve, bubbles in sight glass)	Drain system and recharge
	X			Expansion valve capillary tube damaged (no working medium)	Change expansion valve
	X			Receiver blocked	Change receiver
	X	X		Water in system. Cooling capacity good to begin with (several minutes) but becomes worse. Or poorer at high outside temperatures.	Drain system, change receiver and recharge
	X			Air in system (bubbles in sight glass). Applies to R12.	Drain system, change receiver and recharge
		X		Ice on air side of evaporator	Check that the anti–freeze thermostat tube is correctly inserted in the evaporator. If it was correct, change the thermostat.
		X		Gap in anti–freeze thermostat	Check thermostat and change if necessary
		X		The expansion valve capillary spiral is not well positioned against the evaporator outlet tube or is poorly insulated against air temperature	Check contact and insulation
		X		Difference between anti–freeze thermostat switch–on and switch–off temperatures too great	Change thermostat

*If there is a risk of leakage, the system must not be fully charged. Max 200 grams of refrigerant. See Draining/charging.

Basic mechanical fault diagnosis (contd.)

No cooling	Poor cooling	Uneven cooling	Noise in system	Probable cause	Action
				System overcharged:	
			X	Causes cracking noise or vibration in the high pressure line, gurgling sound in compressor, compressor pressure and suction pressure too high, hissing noise in expansion valve, bubbles or steam in sight glass. If the compressor valves are damaged by overcharging, compressor pressure becomes too low.	Drain system and recharge
			X	Too much water in the system can cause noise in the expansion valve	Drain system, change receiver and recharge

Fault diagnosis, M1985–89

Fault diagnosis, ACC

There is a fault diagnosis and monitoring program built in to the ACC system control module. Certain features are continuously monitored while driving, but others must be check manually.
The following features are monitored while driving:
Interior air sensor, outside temperature sensor and blended air sensor
If there is a fault in any of the sensors, an emergency program is engaged. The fault can then be searched for using a manual self test.
The following features are not monitored during driving:
Electric motors for temperature valve, air distribution, recirculation and fan motor and fan control.
The solar sensor is not monitored during driving either.

Manual fault diagnosis

During fault diagnosis, the ACC control module runs a program. The display then shows the number of faults and gives a diagnostic trouble code for each fault.
The following types of fault are indicated:

- Open circuit
- Short circuit
- Component fault
- Motor blockage
- Incorrect direction of rotation (electric motor)

However, there is no indication as to whether the fault is in the component or the wiring (for example in the case of faults which involve open circuit or short circuit).
For example: Diagnostic trouble code indicates open circuit in outside temperature sensor (2U). This means that connectors, wiring and the sensor must be checked to see if there is voltage to the outside temperature sensor. If there is voltage, try with a new sensor. If the fault remains, try using a new ACC control module.

Important
Before carrying out any work on the system, the 25 pin connector on the ACC control module must be unplugged. The control module may be damaged if it is exposed to certain voltages.

For more detailed fault diagnosis, see the Wiring Diagrams manual 3:2.

Manual fault diagnosis is conducted as follows

Press AUTO and VENT at the same time. Release the buttons.
The ACC control module then runs through a fault diagnosis program (about 40 seconds) which is indicated by 88 flashing on the display. After fault diagnosis, the number of faults can be read on the display. Press VENT once and the first diagnostic trouble code is displayed. Press once again for the next diagnostic trouble code etc.
Return to normal program by pressing AUTO.

Component	**Diagnostic trouble code displayed..**	
	Short circuit	Open circuit
Cabin temperature sensor	1 C	1 U
Outside temperature sensor	2 C	2 U
Blended air sensor	3 C	3 U
	Incorrect direction of rotation	Other fault
Air mixing damper motor	5 C	5 U
Air distribution damper motor	6 C	6 U
	Internal short circuit or blockage	Open circuit or short circuit to ground
Air recirculation flap motor	7 C	7 U
	Open circuit or short circuit to ground or battery positive voltage	
Control signal in cable 635	A C	
	Open circuit in main circuit, motor blocked or fault in speed control	
Ventilation fan motor / speed control	A U	
Climate control	E U	

Other fault diagnosis for year models M1985–86

Symptom	**Action**
Temperature in car varies. Car apparently cold despite high temperature being selected. Car apparently hot despite low temperature being selected.	Check that the hose between the interior air sensor and fan motor is intact and correctly fitted.

Fault diagnosis, M1990–94

Fault diagnosis, ACC generation 2

System No. 2 applies to ACC (start by using the ISAT scan tool to read any faults).

The ACC program has an integrated self test program which carries out a number of tests while the ACC control module is operating. The self test program is even run during initiation (when ignition is first switched on), either by simultaneously pressing in the AUTO and "ventilation" buttons or using the ISAT scan tool.
For a complete self test and calibration, the program must run for at least 35 seconds.

Each fault which is discovered by the self test program will be given a diagnostic trouble code which indicates what type of fault it is.
When the ignition is switched on for the first time, the number of faults discovered is shown on the display while the initiation program is running. In addition, the number of faults can also be read later by first pressing OFF and then AUTO.

The stored diagnostic trouble codes can be read from the memory using the ISAT scan tool. Stored diagnostic trouble codes are erased, either using the ISAT scan tool (command 900) or by pressing AUTO and "ventilation".

Important
At temperatures below 0° C (32°F), the cabin temperature sensor and blended air temperature sensor cannot be tested.

Always check connections to connectors before carrying out fault diagnosis in other areas.

Unplug connectors and check pins for damage. Refit connectors and erase all diagnostic trouble codes. Restart the system and check if the fault is still present.

When first detected, every fault is given a diagnostic trouble code which corresponds to a permanent fault. If the fault disappears again, the diagnostic trouble code is changed to intermittent. Fault codes can either be erased using the ISAT scan tool (command 900) or by pressing AUTO and "ventilation".

All voltage levels given in signal level tables have been measured by using a digital multimeter.

All signals around the 12 V level are proportional to battery positive voltage, and should therefore only be used as a guide.

0 V signals show ground voltage level but can, on a sensitive digital multimeter, give an indication slightly above 0 V.

Important
All measurements should be taken from the back of connectors.
Input or output voltages should only be measured with the ignition on or with the engine running.

Diagnostic trouble code table

The ISAT scan tool display shows which version of the ACC control module the vehicle is equipped with:

Version 2.00 Rom I
Version 2.01 Rom III

Version	Permanent faults	Intermittent faults	Faulty component	See page
2.00 2.01	42521	22521	**Blended air and cabin temperature sensors** Short circuit to +12 V or lower (pin 2 or 22) Short circuit +12 V or greater gives 42521 together with 46322 and 46323, or 22521 together with 26322 and 26323.	96
2.00 2.01	46322	26322	**Blended air sensors** Open circuit (pin 21 or 22) or short circuit to +12 V.(pin 21).	98
2.00 2.01	46323	26323	**Cabin temperature sensor** Open circuit (pin 1 or 2) or short circuit to + 12V (pin 1).	100
2.00 2.01	46391	26391**	**Outside temperature signal from EDU** Communications fault, no temperature pulses. Open circuit or short circuit to ground or +12 V.	102
2.01	53221	33221	**Electrically heated rear window, relay** Open circuit, short circuit to +12V, electrically heated rear window switched off.	104
2.01	53222	33222**	**A/C relay or injection system control module** Short circuit to +12V (in ECON position)	104
2.01	53271	33271	**Electrically heated rear window, relay** Short circuit to ground, electrically heated rear window on	104
2.01	53272	33272	**A/C relay or injection system control module** Short circuit to ground (in AUTO position)	104
	53421*	33421*	**Solenoid valve, rear A/C** Open circuit	
2.01	53621	33621	**Air recirculation flap, motor** Short circuit to +12V	106

*It is possible that this diagnostic trouble code has been generated erroneously. Start by erasing the diagnostic trouble code using the ISAT scan tool and start the car. If the diagnostic trouble code is generated again, proceed with fault diagnosis. If it has disappeared, no further action is required.

**It is possible that this fault code has been generated due to an incorrectly adapted wiring harness. See page 222 for correct action.

Diagnostic trouble code table (contd.)

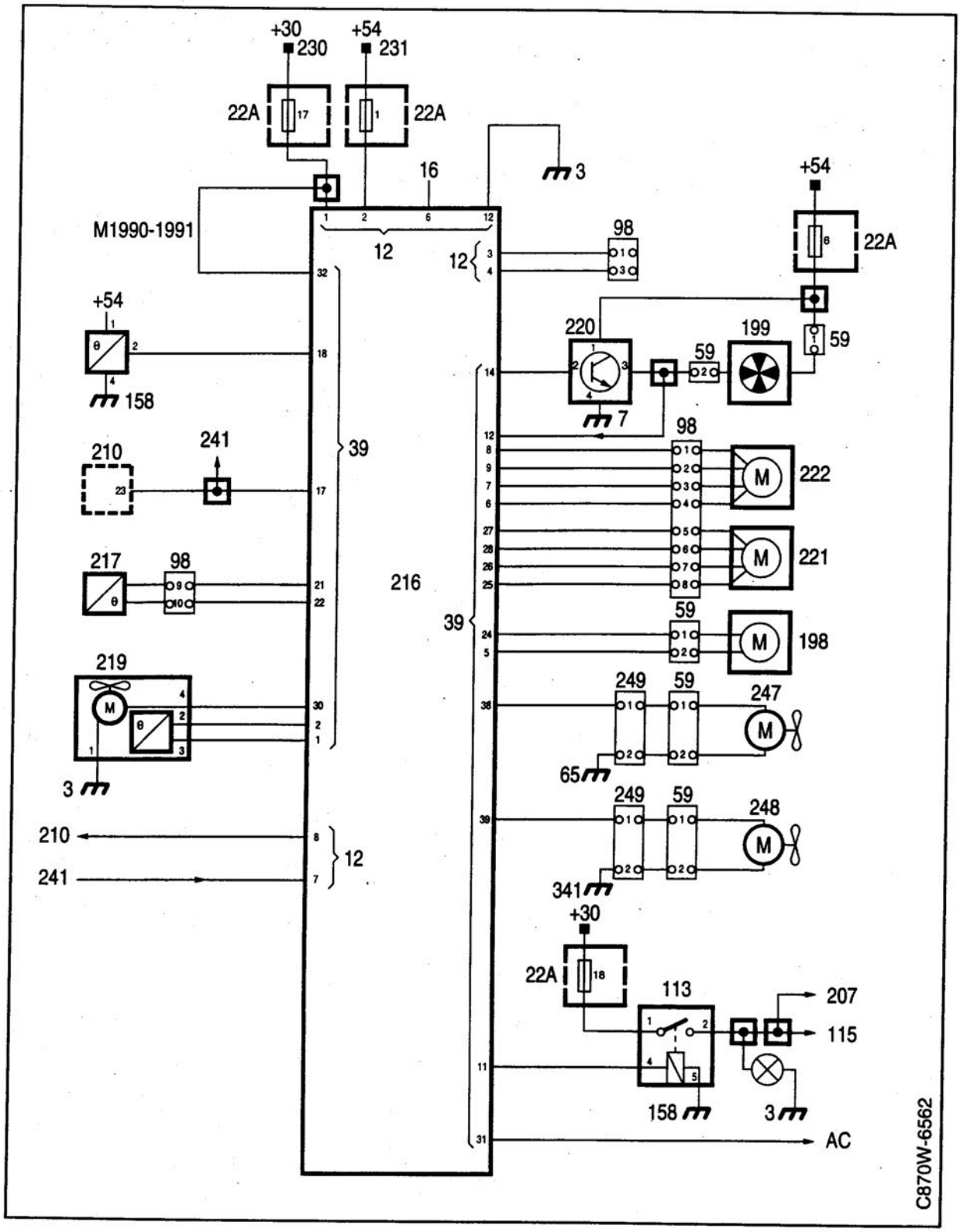
Version	Permanent faults	Intermittent faults	Faulty component	See page
2.00 2.01	53623	33623	**Air distribution damper, motor** Short circuit to +12V, open circuit, short or internal short circuit in ACC control module.	108
2.00	53623 53673	33623 33673	**Air distribution damper, motor** Short circuit to +12V, open circuit, short or internal short circuit in ACC control module.	108
2.00 2.01	53624	33624	**Air mixing damper, motor** Short circuit to +12V, break, short or internal short circuit in ACC control module.	110
2.01	53624 53674	33624 33674	**Air mixing damper, motor** Short circuit to +12V, break, short or internal short circuit in ACC control module.	110
2.01	53671	33671	**Air recirculation flap, motor** Short circuit to ground	106
2.01	53672	33672	**Cabin air temperature sensor, fan** Short circuit to ground	111
2.01	53673	33673	**Air distribution damper, motor** Short circuit to ground	108
2.01	53674	33674	**Air mixing damper, motor** Short circuit to ground	110
2.00 2.01	66891	–	**Solar sensor,** Component fault.	113
2.00 2.01	E6891	D6891**	**Solar sensor** Communications fault, no pulses. Break, short circuit to ground or +12V.	113

**It is possible that this fault code has been generated due to an incorrectly adapted wiring harness.
See page 222 for correct action.

ISAT scan tool commands

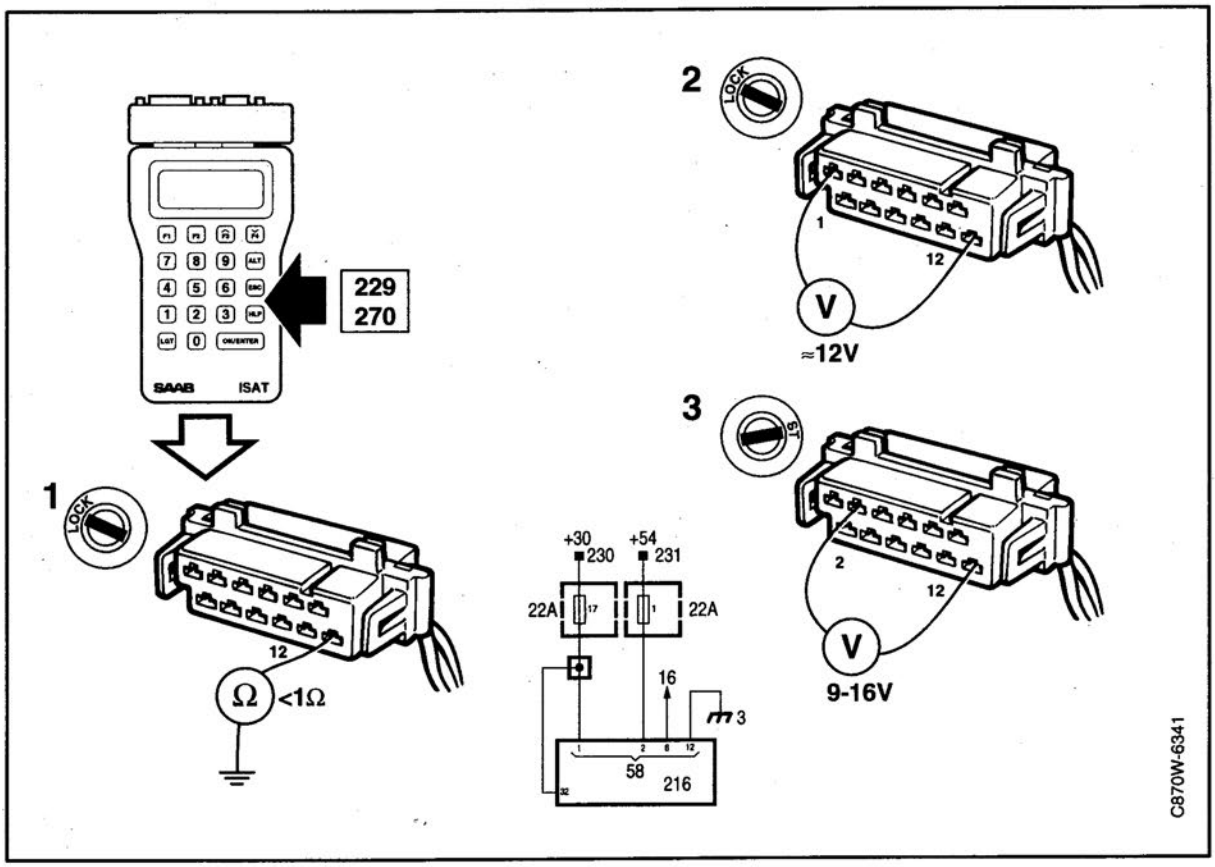
ISAT scan tool command	Description
22B Display shows	Control signal for rear A/C fan speed control 0 – 5V
27A Display shows	Desired position of air mixing damper motor, 0% (LO) – 100% (HI)
27B Display shows	Desired position of air distribution damper motor, 45° ("ventilation") – 135° ("defrost")
279 Display shows	Desired position of air recirculation flap motor, "fresh air" or "recirculation".
380 Display shows	Type of solar sensor: Standard or Australia
229 Display shows	Battery positive voltage to ACC control module. Voltage range 0 – 26.5 V.
22A Display shows	Fan speed control, signal, 0 – 5V.
270 Display shows	Control of LED intensity via photo transistor, 0% (dark) – 100% (light)
251 Display shows	Outside temperature, –44° C to +50° C
252 Display shows	Blended air temperature, 0° C to +80° C
250 Display shows	Cabin temperature, +10° C to +40° C
100	Transmit all stored diagnostic trouble codes.
800	End communication
900	Erase all stored diagnostic trouble codes. Start self test in ACC system and calibration of damper motors. All previously stored faults erased.
Important Commands 27A, 27B and 279 refer to the desired positions of the damper motors. This means that it is impossible to know whether the motor has in actual fact moved the damper to the prescribed position. This can only be checked visually.	

Wiring diagram



Wiring diagram, ACC

Testing power supply



ISAT scan tool command

229
Display shows battery positive voltage in ACC control module. Voltage range 0 – 26.5 V, voltage in ACC control module is always 1V lower than battery positive voltage.

270
Display shows control of LED intensity via photo transistor.
0% (dark) – 100% (light).

Place a finger over the photo transistor. Display shows percentage close to 0 % and LED is dark.

Shine a pocket torch on the photo transistor. Display shows a higher percentage reading and the LEDs shine more brightly.

1 Unplug the 12 pin connector (58) and check pin 12 for open circuit to ground.

2 Check +30 supply across pins 1 and 12 in the 12 pin connector (58).

3 Check +54 supply across pins 2 and 12 in the 12 pin connector (58).

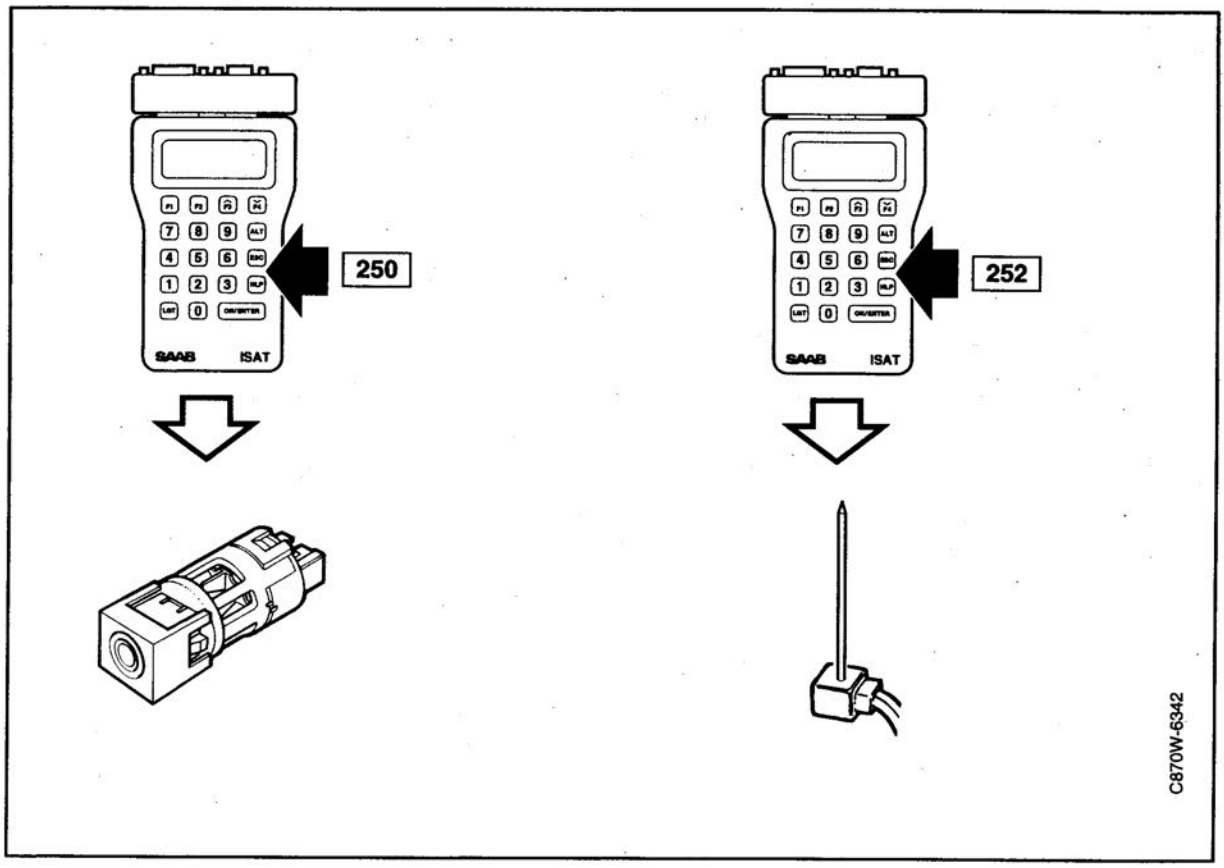
Signal levels

Signal measured	ACC pin	Status	Voltage
+30	1 & 12 (58)	Normal	BPV
+54	2 & 12 (58)	Normal battery positive voltage	(9 – 16 V)
Rheostat	6 & 12 (58)	Normal	0 – 12 V

Important
If supply voltage is outside the range 9 – 16 V, the OFF LED and display go out.

Diagnostic trouble code 4/22521

Sensors, general ground faults – testing



Fault symptom

Permanent: **42521**
Intermittent: **22521**

Conditions

This diagnostic trouble code is generated if the self test program detects 12 V on a general ground cable (0 V cable) for the blended air temperature sensor, pin 22 and cabin temperature sensor, pin 2 together with diagnostic trouble codes 46322 and 46323. Measurement gives less than 12 V. Only one diagnostic trouble code (42521 – 22521).

Testing

ISAT scan tool command: 250

Display shows:
Cabin temperature = +10° C to +40° C

If the display shows +18° C, the fault may be battery positive voltage on pin 2.

ISAT scan tool command:252

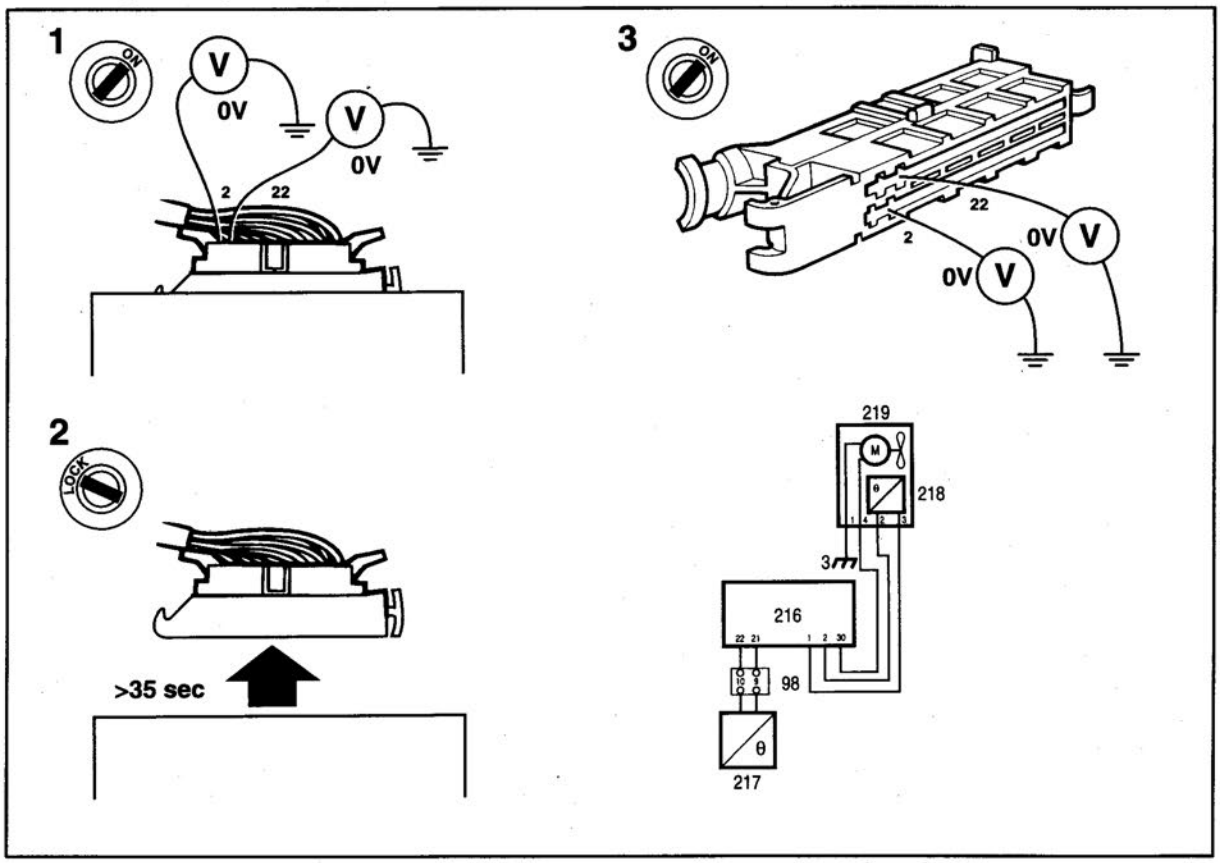
Display shows:
Blended air temperature = 0° C to +80° C

If the display shows +50° C (version 2.00) or a fixed value calculated by the ACC control module (version 2.01), the fault may be battery positive voltage on pin 22.

Important
At temperatures below 0° C, the cabin temperature sensor and blended air temperature sensor cannot be tested.

Diagnostic trouble code 4/22521 (contd.)

Sensors, general ground faults – testing



Action

1 Allow the ACC control module's 39 pin connector to be connected. Switch on the ignition and measure voltage between pin 2 and ground or pin 22 and ground from the rear of the connector.

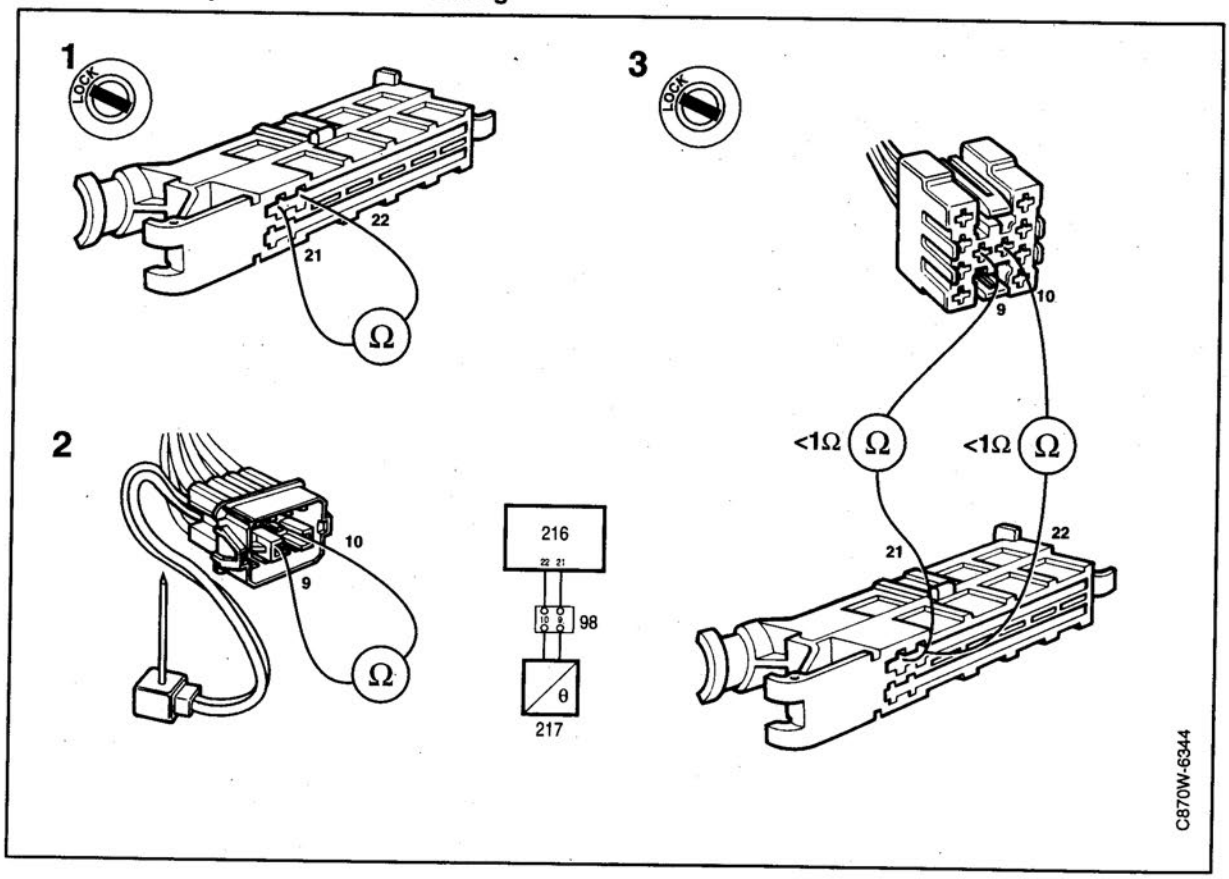
2 If there is voltage, switch off the ignition, wait for 35 seconds and unplug the 39 pin connector from the ACC control module.

3 Switch on the ignition. If there is still voltage, check the wiring harness to the sensor and the sensor itself.

4 If no voltage is indicated, refit connectors and erase diagnostic trouble codes. Restart the system to check if the fault is still present before trying a new ACC control module.

Diagnostic trouble code 4/26322

Blended air temperature sensor – testing



Fault symptom

Permanent: **46322**
Intermittent: **26322**

Conditions

Blended air temperature sensor: Open circuit on pin 21 or 22 or 12 V on pin 21 or fault in ACC control module monitoring circuit.

Testing

ISAT scan tool command: 252

Display shows:
Blended air temperature = 0° C to +80° C

Display shows fixed temperature +50° C (version 2.00) or a fixed value calculated by ACC control module (version 2.02), fault may be:
Open circuit on pin 21 or 22
Battery positive voltage on pin 22, see page 96

If the display shows +50° C (version 2.00) or a fixed value calculated by the ACC control module (version 2.01), the fault may be:
Battery positive voltage to pin 21.

If the display shows +80° C (version 2.00 and version 2.01), the fault may be:
Short between pins 21 and 22. (no diagnostic trouble code)
Pin 21 grounded (no diagnostic trouble code).

Important
At temperatures below 0° C, cabin temperature sensor and blended air temperature sensor cannot be tested.

Diagnostic trouble code 4/26322 (contd.)

Blended air temperature sensor – testing

Action

1 Unplug the 39 pin connector from the ACC control module and check resistance across pins 21 and 22. Reading varies between 1 and 240 kOhm within the range +90° – –40°C (194 – –40 °F). Some specific readings at various temperatures:

° C	°F	Min. (kOhm)	Max. (kOhm)
0	32	25.5	30.5
+10	50	16.6	19.6
+20	68	11.2	13.0
+30	86	7.7	8.8
+40	104	5.4	6.1

2 If values are incorrect, unplug the temperature sensor connector and repeat the measurement of resistance across pins 9 and 10 on the connector. If the reading is still incorrect, fit a new temperature sensor.

3 If the reading is correct across the temperature sensor connector, check if there is an open circuit between connector 98 and the ACC control module (pins 9 and 21, pins 10 and 22). If not, refit the connector, erase all diagnostic trouble codes, restart the system and check if the fault remains.

4 If the fault still remains, measure voltage at pin 21 on the ACC control module. This varies depending on the resistance of the sensor and battery positive voltage according to the following formula: (Measure on connected ACC control module with ignition on.)

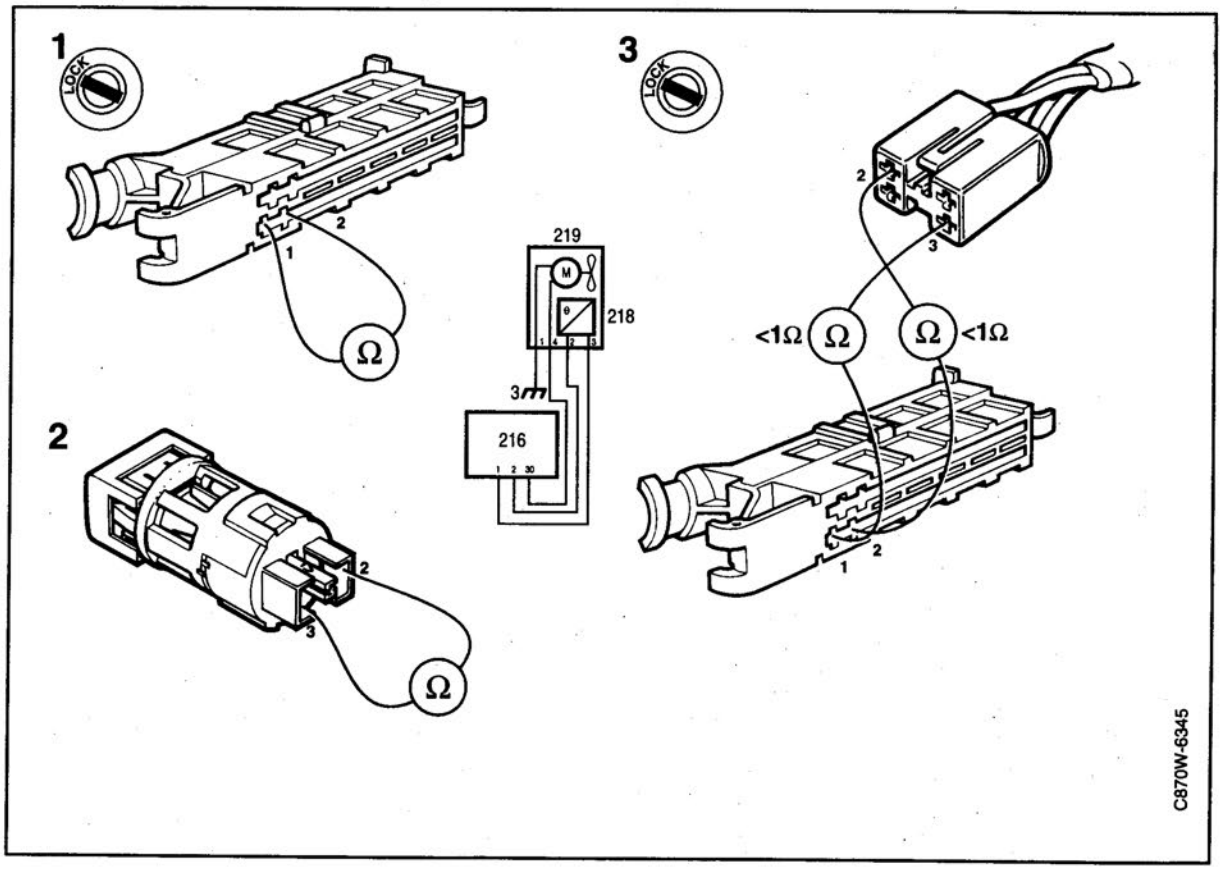
$$\frac{(\text{Battery positive voltage} - 1.5) \times R_{\text{sensor}}}{R_{\text{sensor}} + 10\ \text{kOhm}} = Z$$

Where Z is the voltage on pin 21.

5 If voltage is too high or too low, try with another ACC control module.

Diagnostic trouble code 4/26323

Cabin temperature sensor – testing



Fault symptom

Permanent: **46323**
Intermittent: **26323**

Conditions

Cabin temperature sensor: Open circuit on pin 1 or 2 or 12 V on pin 1 in ACC control module or fault in ACC control module monitoring circuit.

Testing

ISAT scan tool command: 250

Display shows:
Cabin temperature = +10° C to +40° C If the display shows +18° C, the fault may be:

Open circuit to pin 1 or 2.
Battery positive voltage on pin 1.
Battery positive voltage on pin 2, see page 96

If the display shows
+40° C (with cold air), the fault may be:
Short between pins 1 and 2 (no diagnostic trouble code).
Pin 1 is connected to ground (no diagnostic trouble code).

Important
At temperatures below 0° C, the cabin temperature sensor and blended air temperature sensor cannot be tested.

Diagnostic trouble code 4/26323 (contd.)

Cabin temperature sensor – testing

Action

1 Unplug the ACC control module's 39 pin connector and check the resistance across pins 1 and 2. Reading varies between 5 and 35 kOhm within the range 0° to +40°C (32–104°F). Some specific readings at various temperatures:

°C	°F	Minimum (kOhm)	Maximum (kOhm)
0° C	32	30.0	34.8
+10	50	18.5	21.1
+20° C	68	11.7	13.1
+25° C	77	9.5	10.5
+30° C	86	7.6	8.5
+40° C	104	4.9	5.6

2 If reading is incorrect, unplug the temperature sensor connector and repeat measurements of resistance across pins 2 and 3 in the connector. If reading is still incorrect:
Fit new temperature sensor.

3 If the reading is correct across the temperature sensor connector, check for open circuit between the sensor connector and the ACC control module's 39 pin connector (pins 2 and 2, pins 3 and 1). If there is no fault, refit the connector, erase all diagnostic trouble codes, restart the system and check if the fault remains.

4 If the fault is still present, measure voltage on pin 1 in the ACC control module's 39 pin connector. This varies depending on sensor resistance and battery positive voltage according to the following formula: (Measure with ACC control module connected and ignition on.)

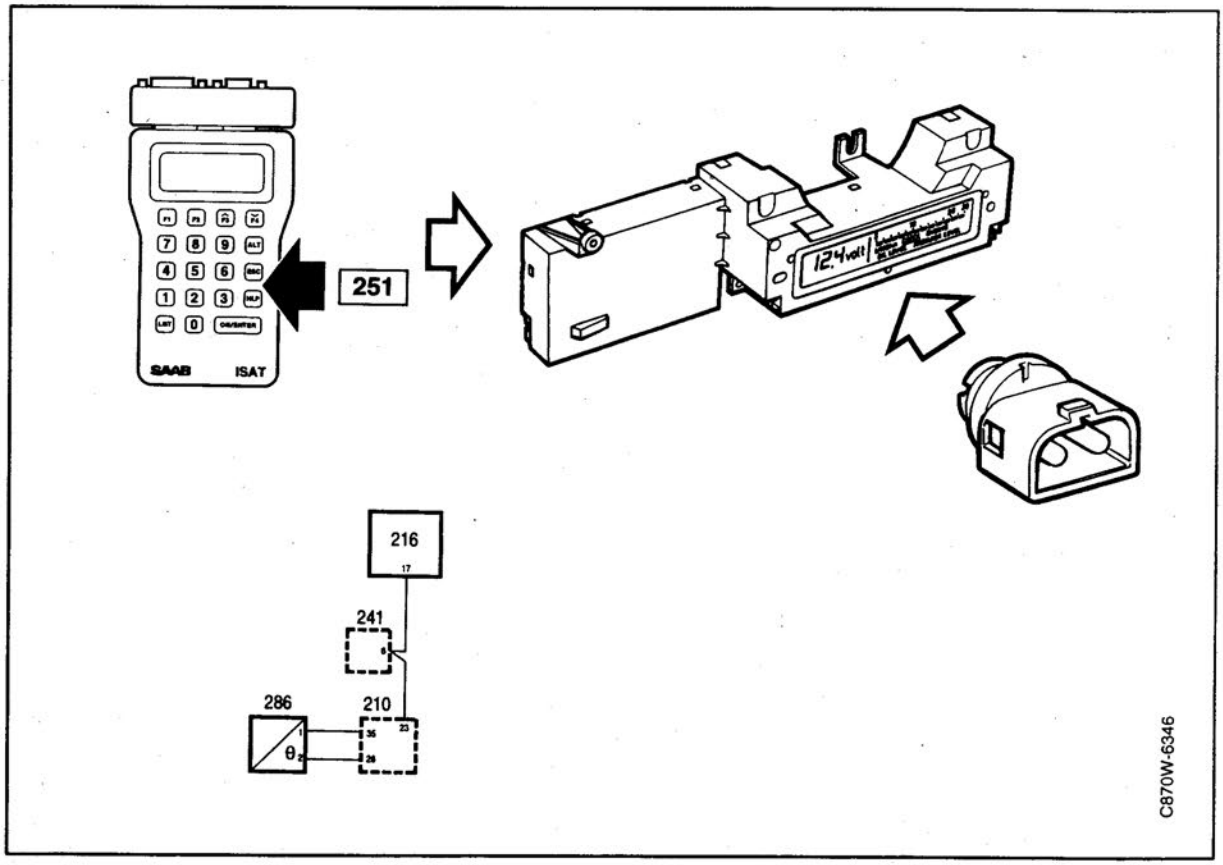
$$\frac{(\text{Battery positive voltage} - 1.5) \times R_{\text{sensor}}}{R_{\text{sensor}} + 10\ \text{kOhm}} = Z$$

Where Z is the voltage on pin 1.

5 If voltage is incorrect, try a new ACC control module.

Diagnostic trouble code 4/26391

Outside temperature sensor – testing



Fault symptom

Permanent: **46391**
Intermittent: **26391***

Conditions

No outside temperature pulses from EDU.

*In order to eliminate the risk of an erroneous diagnostic trouble code being generated, take action described on page 222 before testing.

Testing

ISAT scan tool command: 251

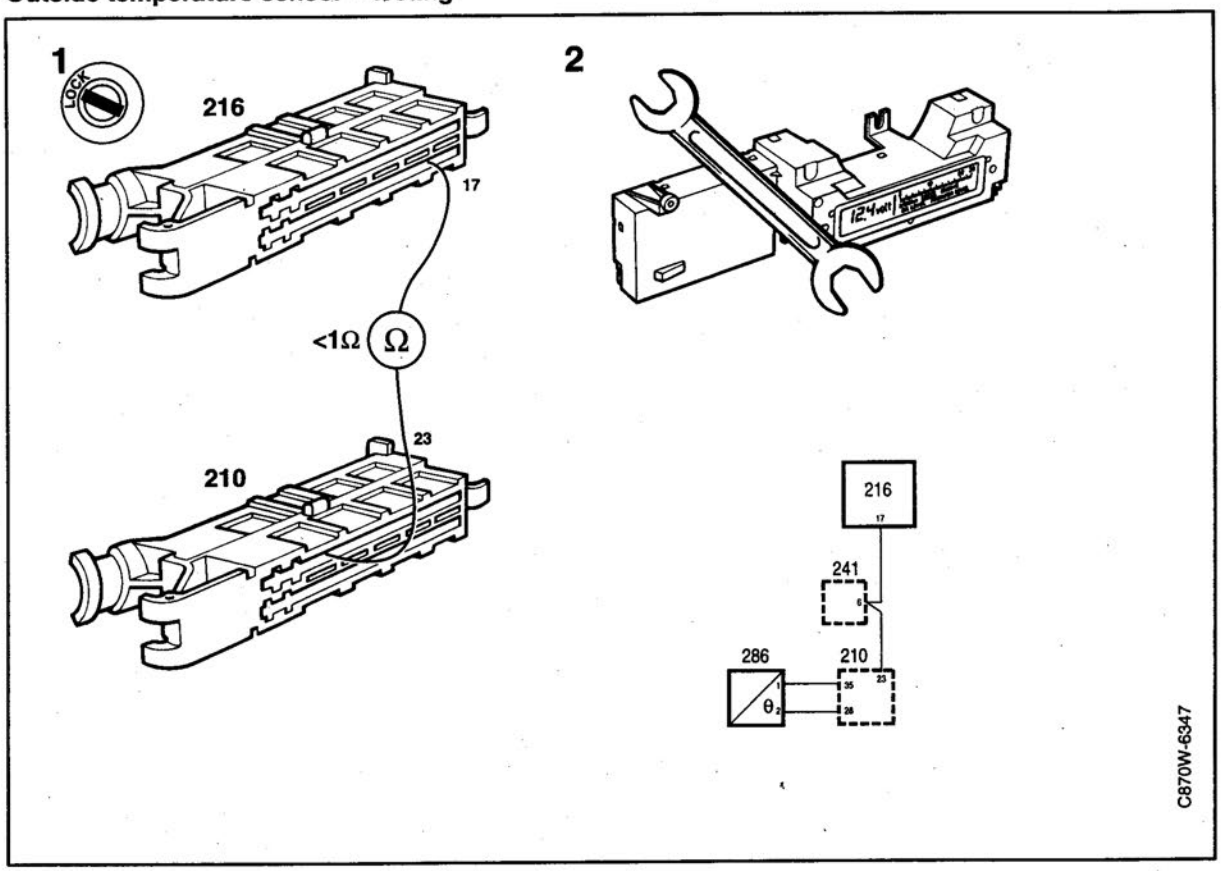
Display shows:
Outside temperature = –44° C to +50° C

If the display shows –44° C, the fault may be:
Open circuit or battery positive voltage on pin 17 when starting engine
Ground on pin 17.
EDU or ACC faulty

Set the last reading received while driving. Compare with EDU. If there is a difference the fault may be:
Open circuit or battery positive voltage on pin 17.

Diagnostic trouble code 4/26391 (contd.)

Outside temperature sensor – testing



Action

Important
Before conducting this test, check that the outside temperature reading via the EDU is functioning normally. Also check (if DCC is fitted) for diagnostic trouble code F2.

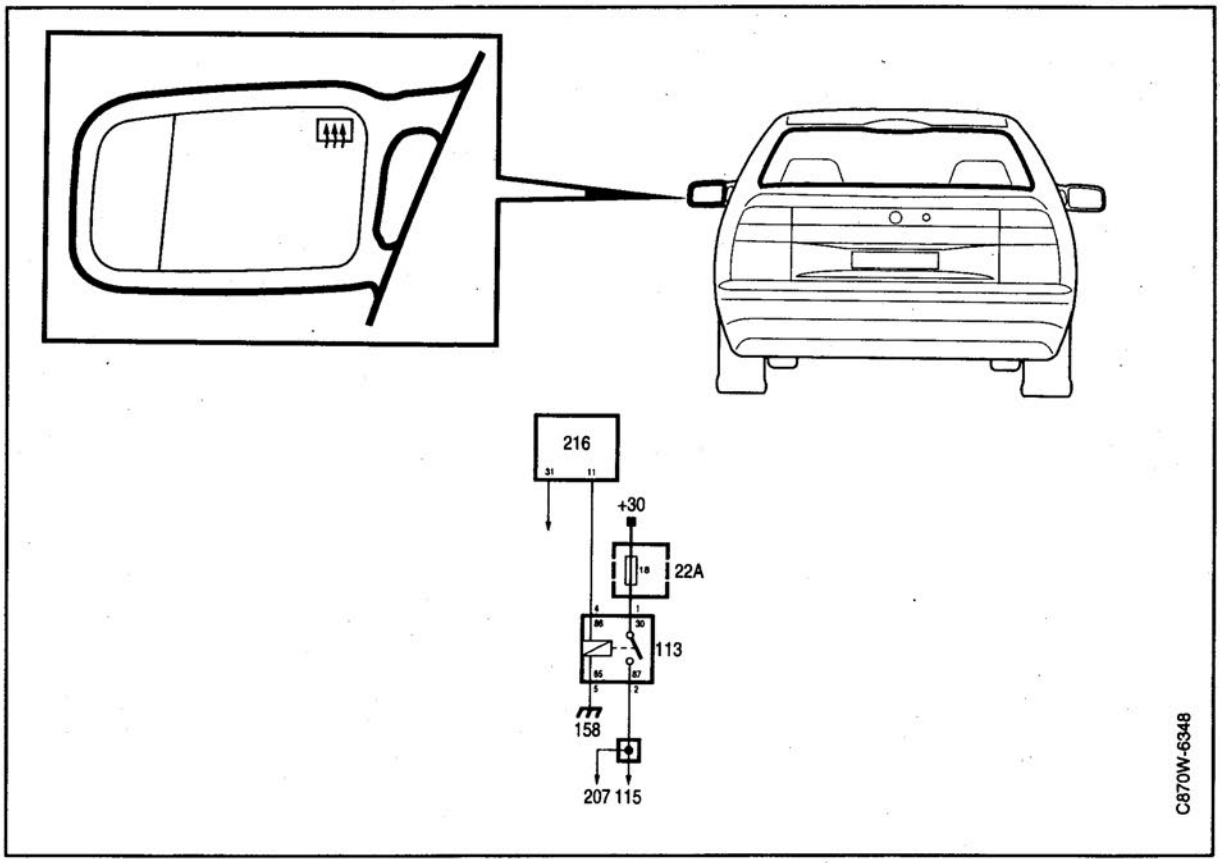
1 Unplug connectors from the EDU and ACC control module and check if there is an open circuit between pin 23 on the EDU connector and pin 17 on the ACC control module's 39 pin connector. If everything is normal, refit connectors, erase all diagnostic trouble codes and restart the system.

2 If the fault is still present, try with a new EDU.

3 If the fault still remains, refit the old EDU control module and try with a new ACC control module.

Diagnostic trouble codes 5/33221, 5/33271, 5/33222 and 5/33272

Electrically heated rear window and electrically heated door mirrors – testing



Fault symptom

Permanent: **53221**
Intermittent: **33221**

Conditions

Open circuit or short circuit to +12V (pin 11) when electrically heated rear window is off. (version 2.01)

Fault symptom

Permanent: **53271**
Intermittent: **33271**

Conditions

Short circuit to ground (pin 11) with electrically heated rear window on. (version 2.01)

Fault symptom

Permanent: **53222**
Intermittent: **33222**

Conditions

Short circuit to 12V (pin 31) only with ECON connected. (version 2.01)

Fault symptom

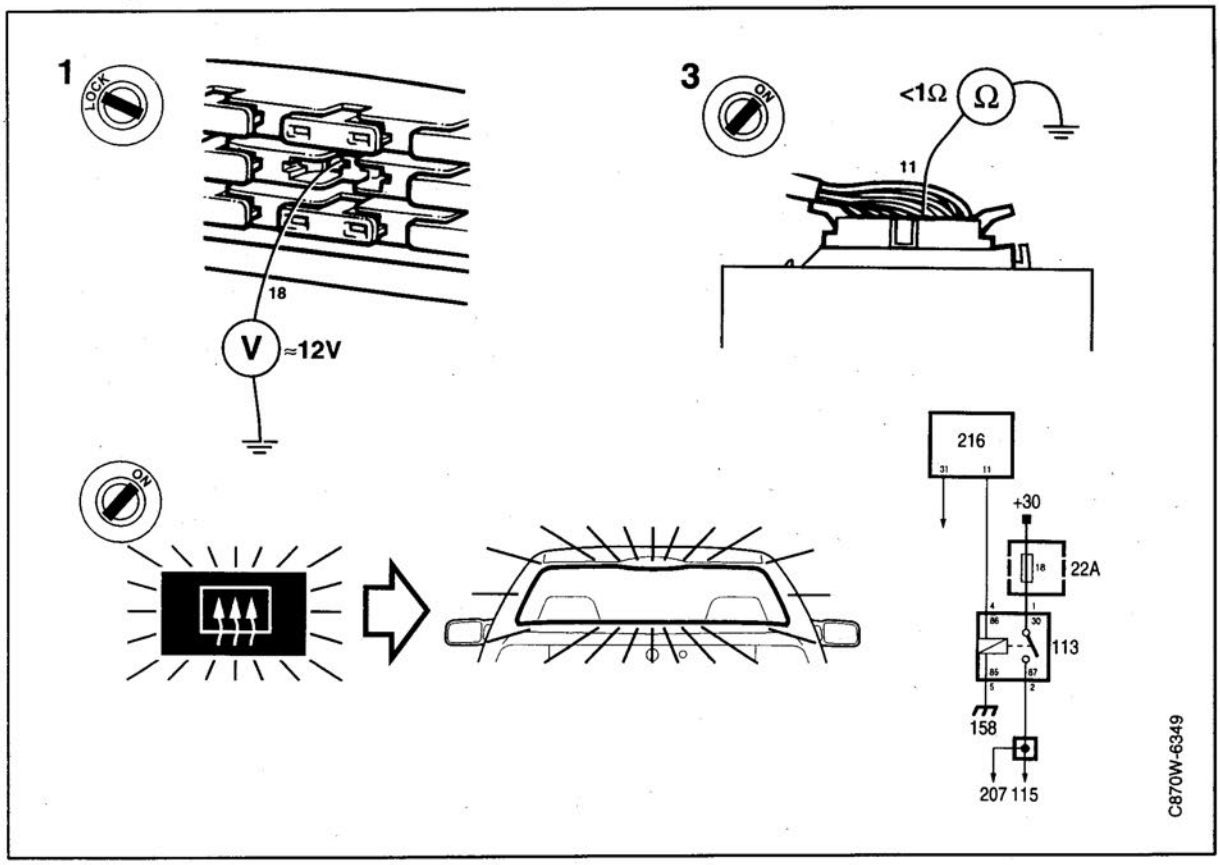
Permanent: **53272**
Intermittent: **33272**

Conditions

Short circuit to ground (pin 31) only with AUTO engaged. (version 2.01)

Fault codes 5/33221, 5/33271, 5/33222 and 5/33272 (contd.)

Electrically heated rear window and electrically heated door mirrors – testing



Action

1 Check the fuse in the power supply (to electrically heated rear window).

2 Check if supply is received at electrically heated rear window when it is manually switched on.

3 If no supply is received at the electrically heated rear window, check the signal to the window on the ACC control module.

4 If there is no fault with the signal, the fault is in the relay or its associated wiring harness.

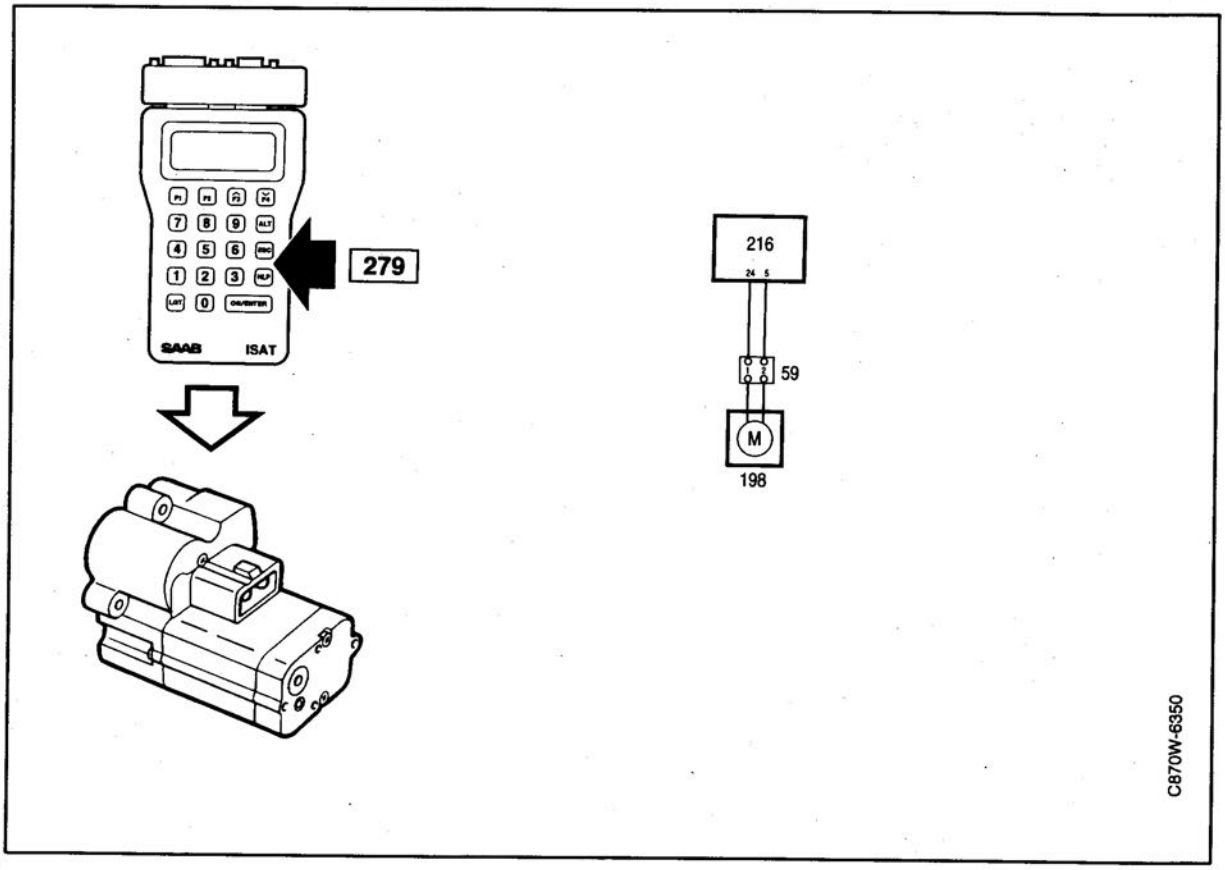
5 If the signal from the ACC control module is incorrect, carefully check connections in the ACC control module connector and then try a new ACC control module.

Signal levels

Signal measured	ACC pin	Status	Voltage
Electrically heated rear window etc	11 & ground	On Off	12V 0V
A/C	31 & ground	AUTO on	12V
A/C	31 & ground	ECON	0V

Diagnostic trouble codes 5/33621 and 5/33671

Air recirculation flap motor – testing



Fault symptom

Permanent: **53621**
Intermittent: **33621**

Conditions

Air recirculation flap motor, short circuit +12V. (version 2.01)

Fault symptom

Permanent: **53671**
Intermittent: **33671**

Conditions

Short circuit to ground (Version 2.01).

Testing

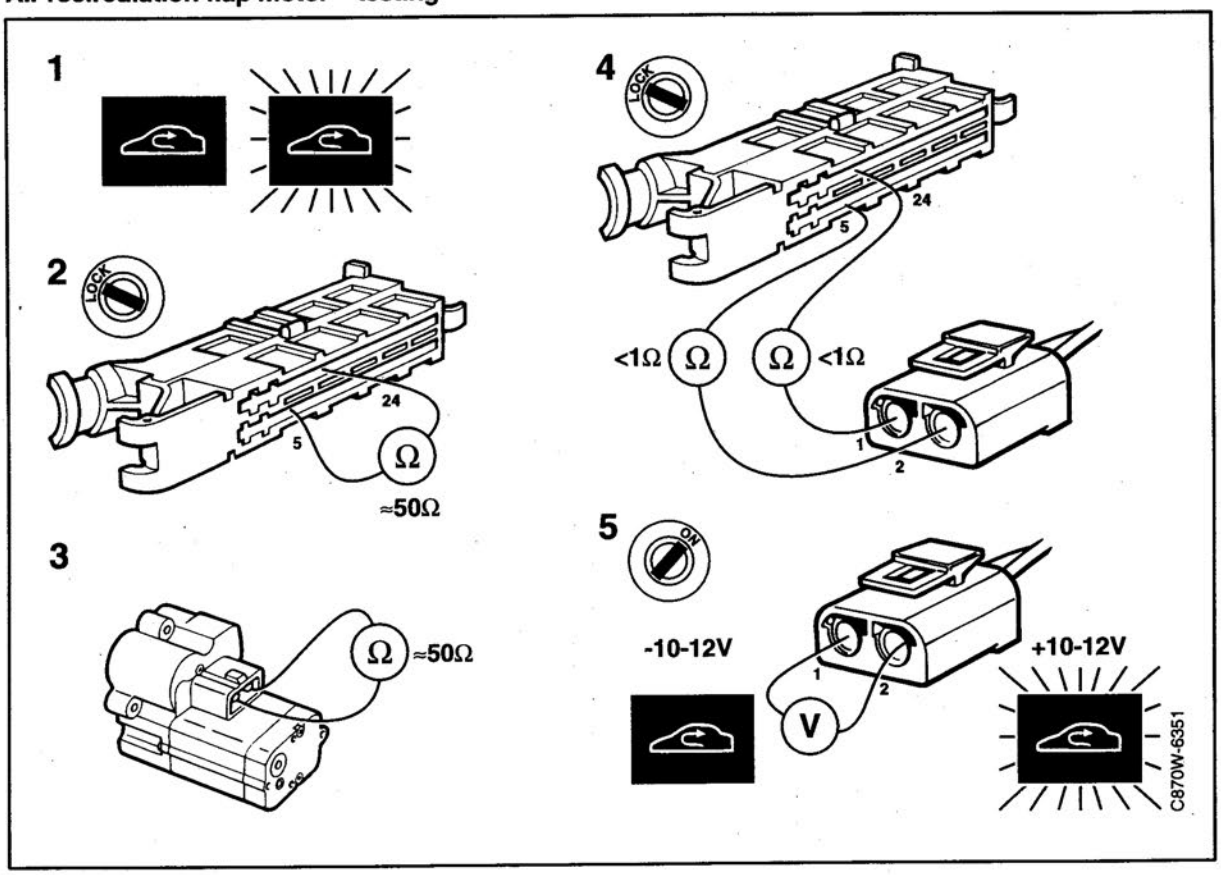
ISAT scan tool command: 279

Display shows:
Desired position of the air recirculation flap motor: "Fresh air" or "Recirculation".

Important
The desired position of the air recirculation flap motor does not mean that the motor moves the flap to different positions, buf only that it has been requested by the ACC control module. Visually check that the desired position corresponds to the actual position.

Diagnostic trouble codes 5/33621 and 5/33671 (contd.)

Air recirculation flap motor – testing



Action

1 Visually check that the flap moves between the "Recirculation" and "Fresh air" positions when the flap is manually controlled.

2 Unplug the ACC control module's 39 pin connector and check the resistance in the motor winding between connector pins 5 and 24. Resistance should be about 50 Ohm.

3 If resistance is incorrect, unplug the motor connector and measure the resistance directly on the motor winding. If faulty, try a new stepping motor.

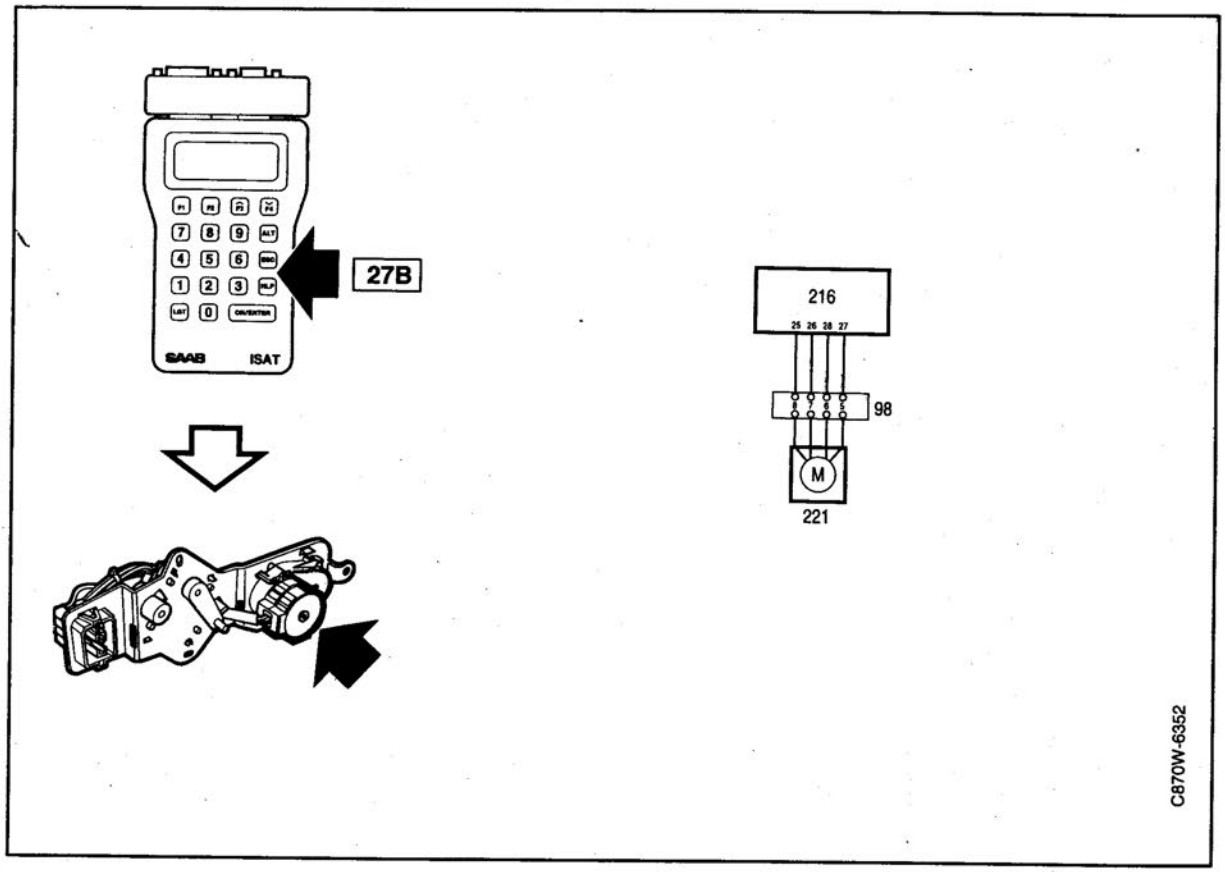
4 If resistance across the motor winding is correct, check for open circuit between the ACC control module connector and the motor connector. Also check for short circuit between the wiring harness and ground.

5 If all readings give normal values, connect the ACC control module's 39 pin connector and measure the voltage on the 2 pin connector 59. Connect the red multimeter cable to pin 1 and the black cable to pin 2. Measurement should be carried out when the flap is moved to "Recirculation" (+1 0/1 2V) and the LED lights or to "Fresh air" (–10/12V) and the LED is off. If measurements give correct readings, try with a new motor.

6 If not, try with a new ACC control module.

Diagnostic trouble codes 5/33623 and 5/33673

Air distribution flap motor – testing



Fault symptom

Permanent: **53623**
Intermittent: **33623**

Conditions

Air distribution flap motor: Short circuit +12V, open circuit, short or internal short circuit in ACC control module (diagnostic trouble code 53623 – 33623 on version 2.01 arises together with 53673 – 33673).

Fault symptom

Permanent: **53673**
Intermittent: **33673**

Conditions

Air distribution damper motor: Short circuit to ground.

Testing

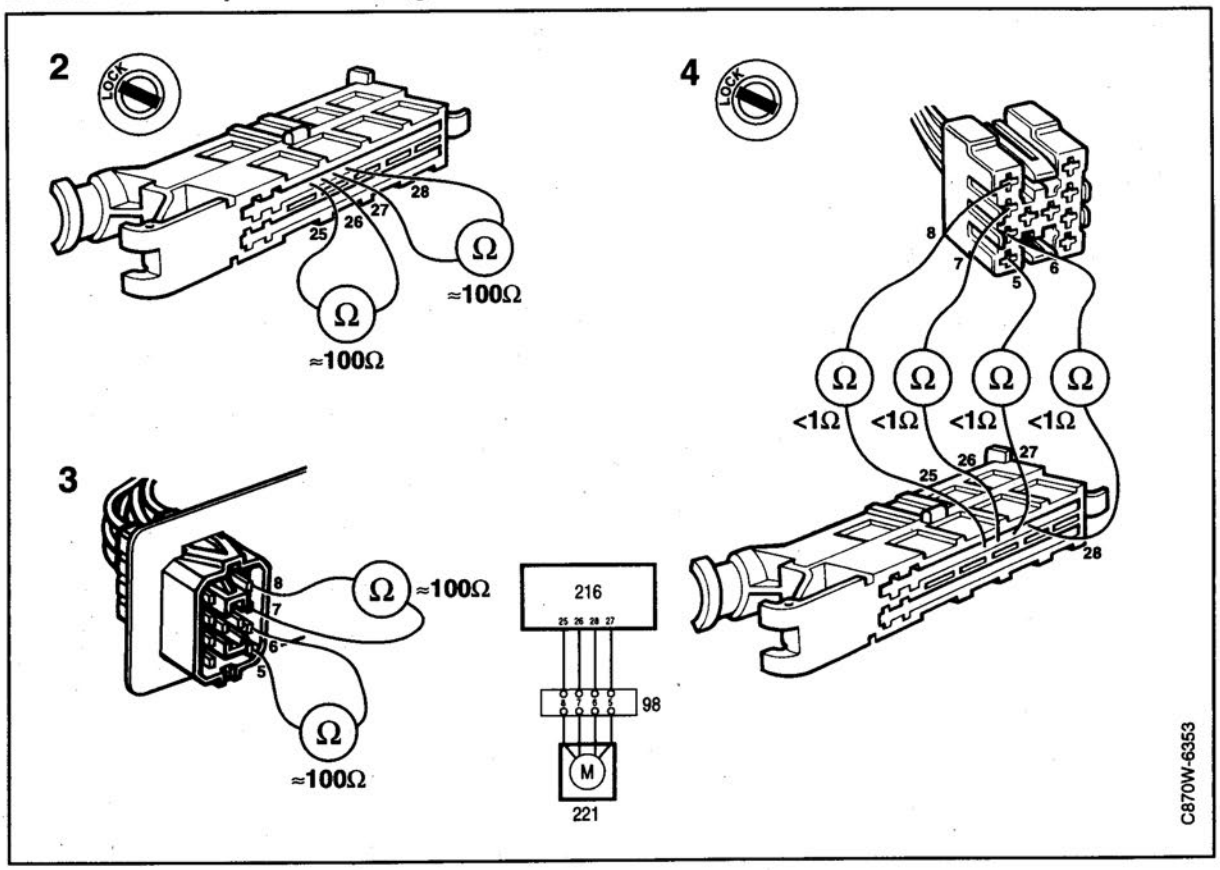
ISAT scan tool command: 27B

Display shows:
Desired position of the air distribution damper motor 45° ("ventilation") – 135° ("defrost").

Important
The desired position of the air distribution flap motor does not meant that the motor moves the flap to the desired position, but only that this is requested by the ACC control module. Visually check that the desired position corresponds to the actual position.

Diagnostic trouble codes 5/33623 and 5/33673 (contd.)

Air distribution flap motor – testing



Action

1 Visually check that the air distribution damper is moved by selecting "defrost" and "ventilation" in order to move the damper across the entire setting range.

2 If the damper is not moved, disconnect the ACC control module's 39 pin connector and check the resistance in the stepping motor winding across pins 25 and 26 and across pins 27 and 28. Resistance should be about 100 Ohm at 20°C (68°F).

3 If resistance measurement is incorrect, unplug the stepping motor's 10 pin connector 98 and measure resistance directly between the motor windings. If these are incorrect, try with a new stepping motor.

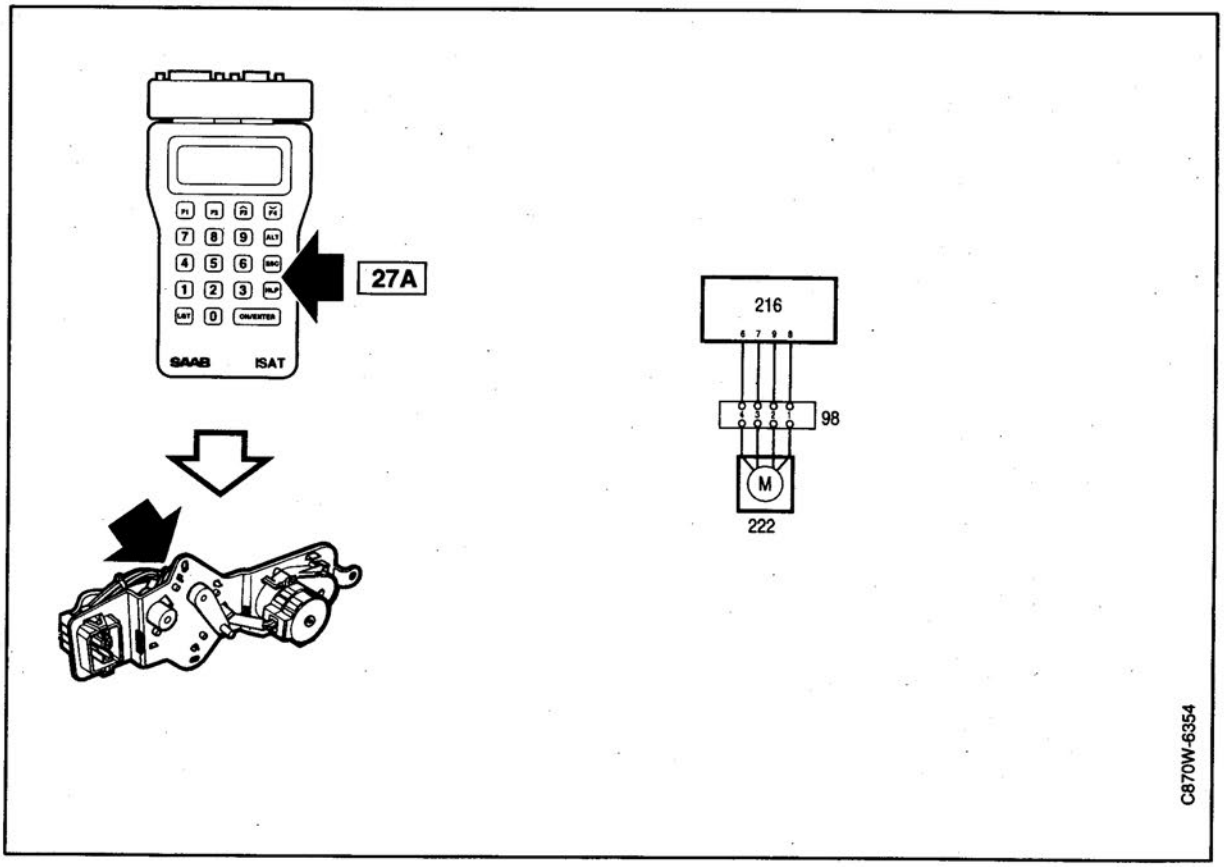
4 If resistance is correct across the stepping motor windings, check for open circuit between the ACC control module's connector and the stepping motor connector. Also check for short circuit between the wiring harness and ground.

5 If all electrical measurements indicate normal readings, refit the connectors. Erase all diagnostic trouble codes and restart the system. If the fault is still present, try with a new stepping motor.

6 If the fault is still present, even with a new stepping motor, refit the old stepping motor and try with a new ACC control module.

Diagnostic trouble codes 5/33624 and 5/33674

Air mixing damper motor – testing



Fault symptom

Permanent: **53624**
Intermittent: **33624**

Conditions

Air mixing damper motor: Short circuit +12V, open circuit, short or internal short circuit in ACC control module (diagnostic trouble code 53624–33624 on version 2.01 arises in combination with 53674 – 33674).

Fault symptom

Permanent: **53674**
Intermittent: **33674**

Conditions

Air mixing damper motor: Short circuit to ground (version 2.01).

Testing

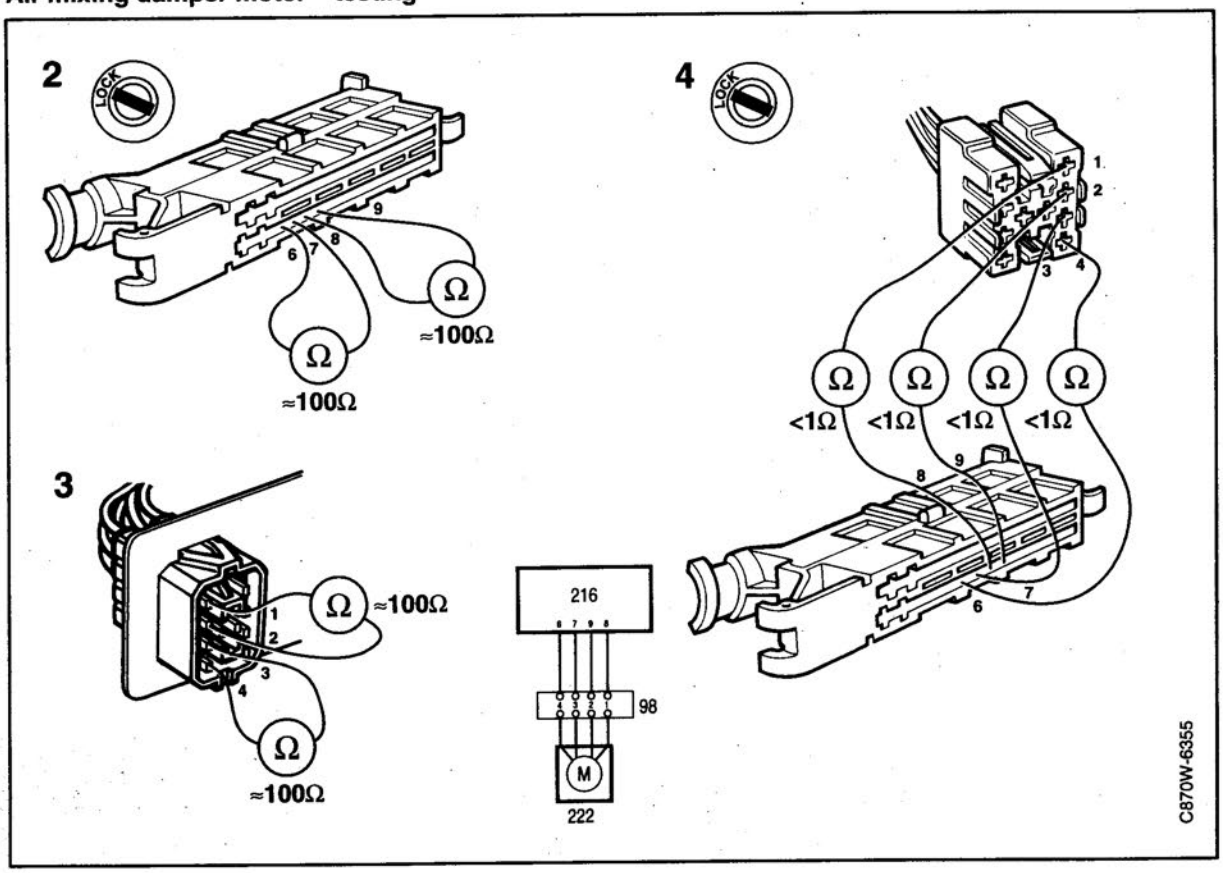
ISAT scan tool command: 27A

Display shows:
Desired position of air distribution damper motor 0% (LO) – 100% (HI).

Important
The desired position of the air distribution damper motor does not mean that the motor moves the damper to different positions, but only that this is being requested by the ACC control module. Visually check that the desired position corresponds to the actual position.

Diagnostic trouble codes 5/33624 and 5/33674 (contd.)

Air mixing damper motor – testing



Action

1 Visually check that the motor moves the temperature valve by using the buttons to alternately select HI and LO.

2 If the valve does not move, unplug the ACC control module's 39 pin connector and check the resistance in the stepping motor windings across pins 6 and 7 as well as 8 an 9. Resistance should be about 100 Ohm at 20° C (68°F).

3 If resistance reading is incorrect, unplug the stepping motor connector and measure the resistance directly between the motor windings. If this is incorrect, try with a new stepping motor.

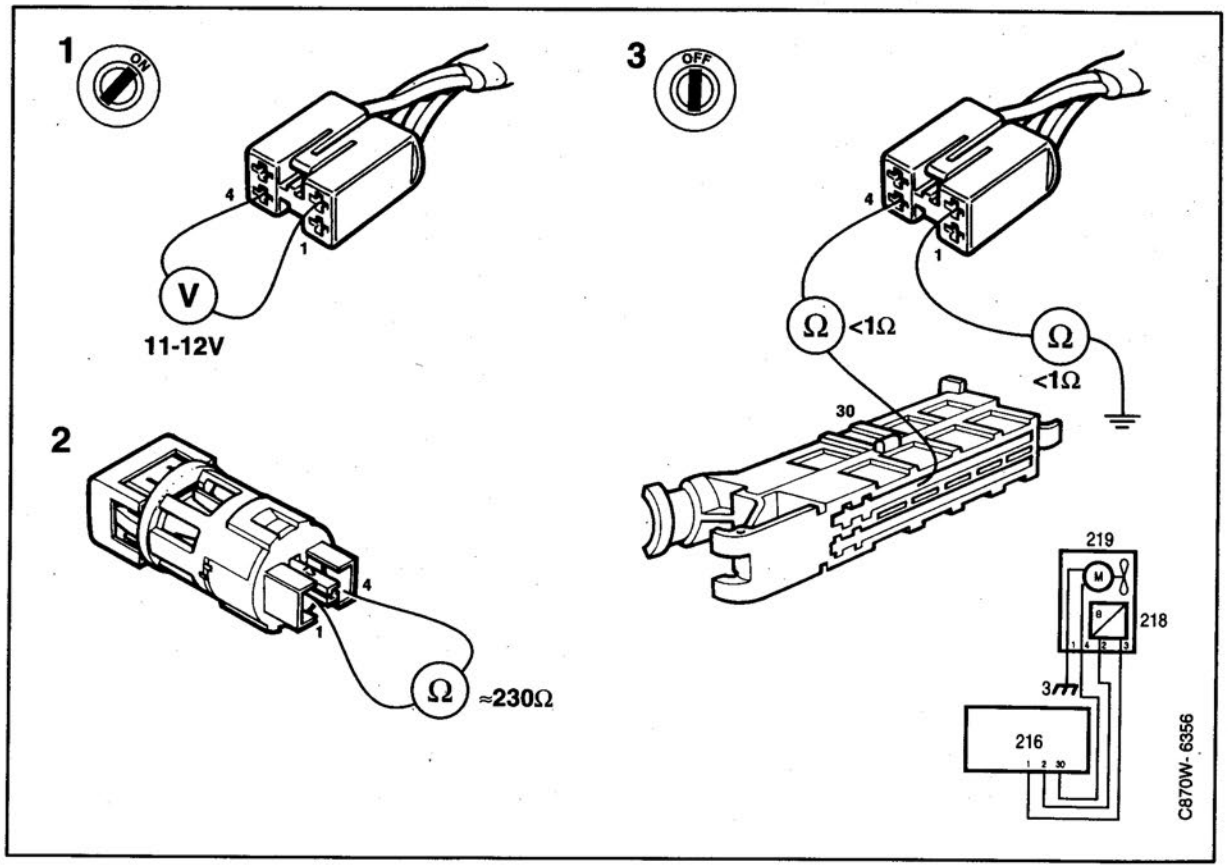
4 If resistance values across the stepping motor windings are correct, check for open circuit between the ACC control module's connector and the stepping motor 10 pin connector 98. Also check for short circuits between the wiring harness and ground.

5 If all electrical measurements indicate normal readings, refit the connectors. Erase all diagnostic trouble codes and restart the system. If the fault is still present, try with a new stepping motor.

6 If the fault is still present, even with a new stepping motor, refit the old stepping motor and try with a new ACC control module.

Diagnostic trouble code 5/33672

Cabin temperature sensor fan – testing



Fault symptom

Permanent: **53672***
Intermittent: **33672***

Conditions

Short circuit to ground (version 2.01)

*There is a chance that this diagnostic trouble code may have been generated erroneously. Start by erasing the diagnostic trouble code using the ISAT scan tool and start the car. If the diagnostic trouble code is again generated, proceed with fault diagnosis. If it is gone, no further action is required.

Action

1 Disconnect the sensor and check voltage between pins 4 and 1 in the connector. Reading should be 11 – 12 V.

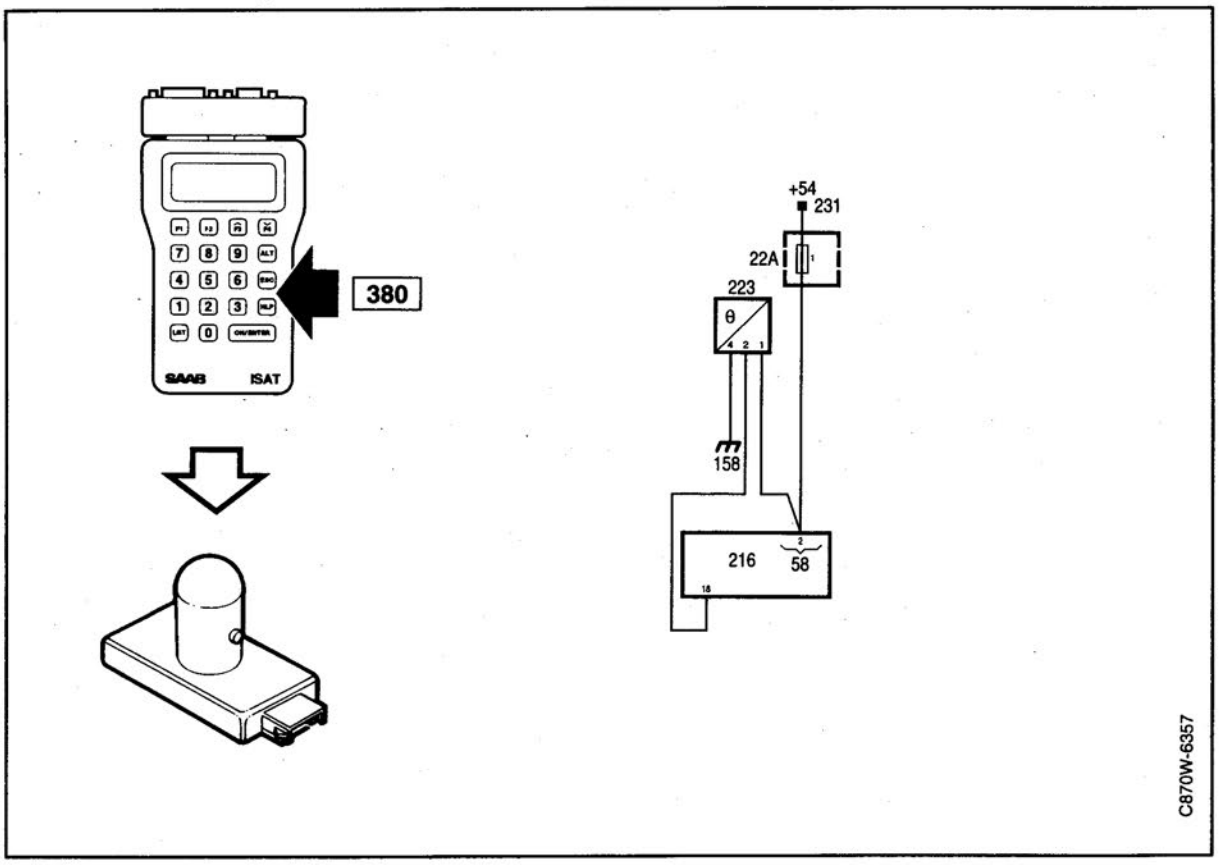
2 If voltage is correct, refit the connector and check if the motor is still not moving before fitting a new sensor. Note that the resistance in the suction fan motor between sensor pins 4 and 1 should be about 230 Ohm.

3 If no voltage is detected when carrying out measurements in stage 1, unplug the ACC control module's 39 pin connector and check if there is an open circuit between pin 4 on the sensor connector and pin 30 on the ACC control module's 39 pin connector. Also check that pin 1 on the sensor's connector has a good ground contact and that pin 4 on the sensor connector is NOT shorted to ground.

4 If there is no open circuit, refit connectors and check if the suction fan is still not moving before fitting a new ACC control module.

Diagnostic trouble codes 66891, E6891 and D6891

Solar sensor – testing



Fault symptom

Permanent: **66891**
Intermittent:

Conditions

Solar sensor, component fault.

Fault symptom

Permanent: **E6891***
Intermittent: **D6891***

Conditions

Solar sensor communications fault. This fault can be caused by open circuit, short circuit to ground or short circuit to 12 V (pin 18).

Testing

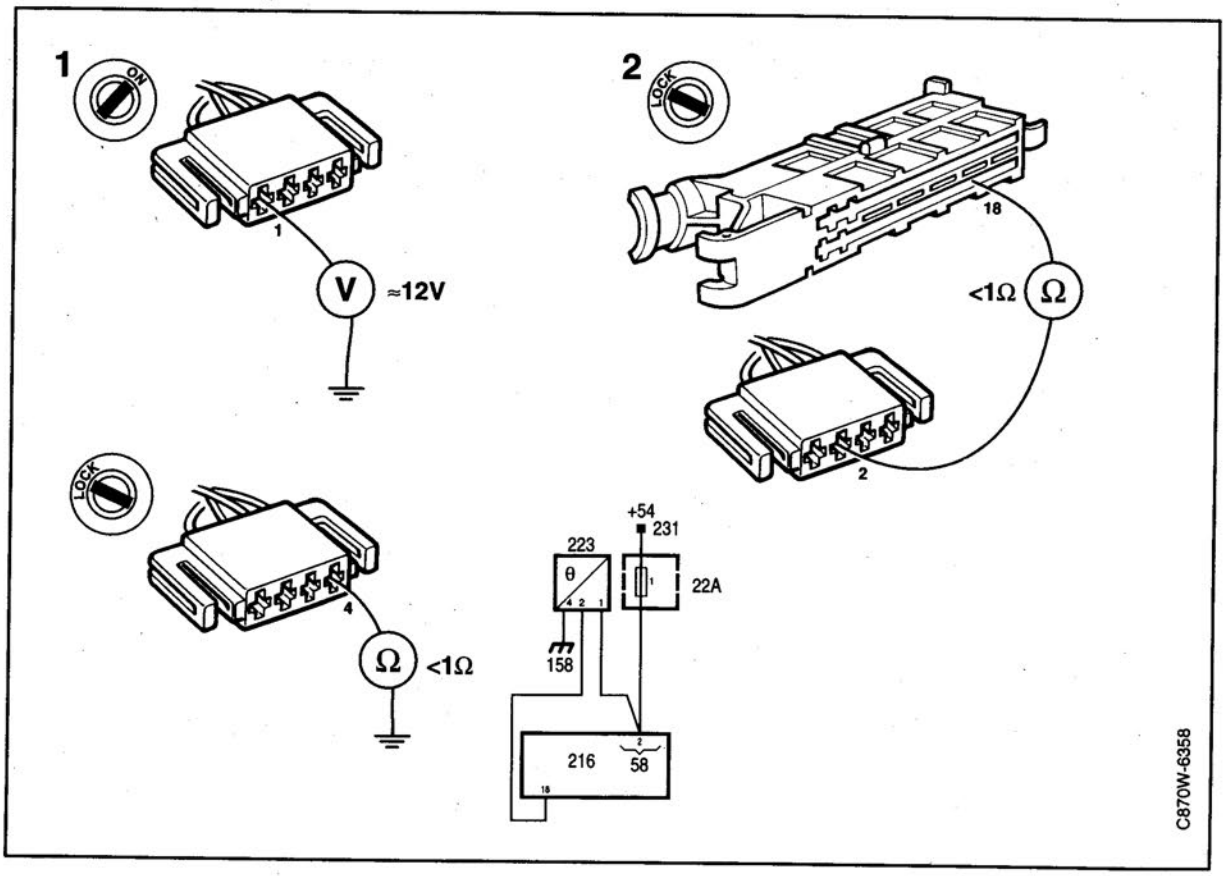
*There is a chance that this diagnostic trouble code may have been generated erroneously. Start by erasing the diagnostic trouble code using the ISAT scan tool and start the car. If the diagnostic trouble code is again generated, proceed with fault diagnosis. If it is gone, no further action is required.

ISAT scan tool command: 380

Display shows:
Type of solar sensor, standard or Australian.

Diagnostic trouble codes 66891, E6891 and D6891 (contd.)

Solar sensor – testing



Action

1 Unplug the solar sensor connector and check ground on pin 4 and +54 supply to pin 1. If readings are incorrect, check the circuit. If there is no fault, refit the connector, erase all diagnostic trouble codes and restart the system.

2 If the fault is still present: Unplug the solar sensor connector and the ACC control module's 39 pin connector. Check if there is an open circuit between pin 2 in the solar sensor connector and pin 18 in the ACC control module's connector. If there is no fault, refit connectors, erase all diagnostic trouble codes and restart the system.

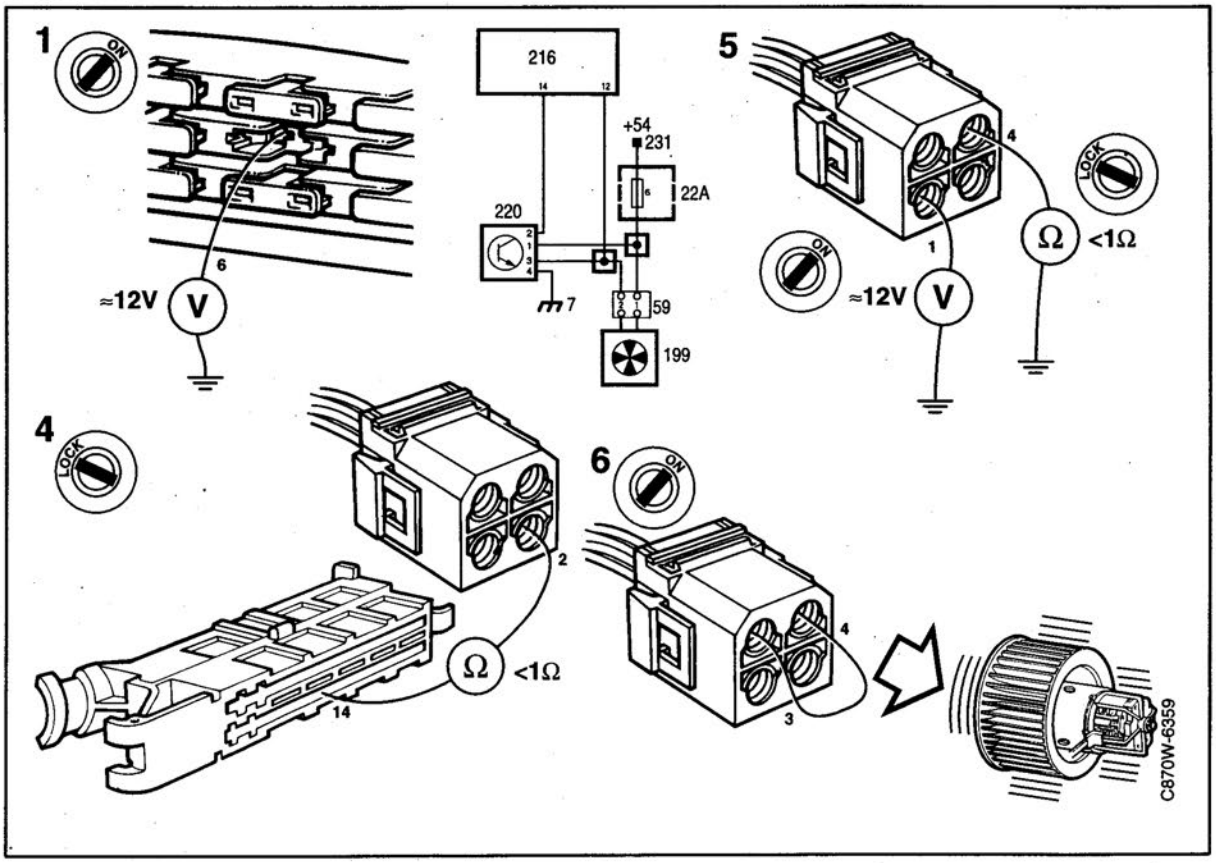
3 If the fault is still present, try with a new solar sensor and restart the system.

4 If the fault still remains, refit the old solar sensor and try with a new ACC control module.

Important
Selecting "INFO" on the DCC when the ignition is switched off starts the ACC. However, the solar sensor is not activated and fault code E6891/D6891 (communications fault in solar sensor) is therefore generated.

Command code 22A

Ventilation fan – testing



Testing

ISAT scan tool command: 22A

Display shows:
Ventilation fan – speed control, signal 0 – 5 V.

WARNING
The cooling unit for fan motor speed control is live (1.5–12V, depending on motor speed) and must never be connected to ground.

Signal measured	ACC pin	Connection	Voltage
Ventilation fan – speed control	14 & ground	Min. – max. speed	0 – 5V
Speed control (signal discontinued during year model 90)	12 & ground	Min. – max. speed	12 – 1V

Command code 22A (contd.)

Ventilation fan – testing

Action

If the ventilation fan is not working or the ACC control module cannot control its speed, take the following action:

1 Check the ventilation fan fuse.

2 Check the ventilation fan control signal from the ACC control module (pin 14 and ground). Vary speed using the fan speed buttons in order to change signal level.

3 If the value of control voltage is incorrect, try with a new ACC control module.

4 If the control signal for fan speed is normal, unplug the ACC control module's 39 pin connector and check for open circuit between pin 14 on the connector and pin 2 on the speed control.

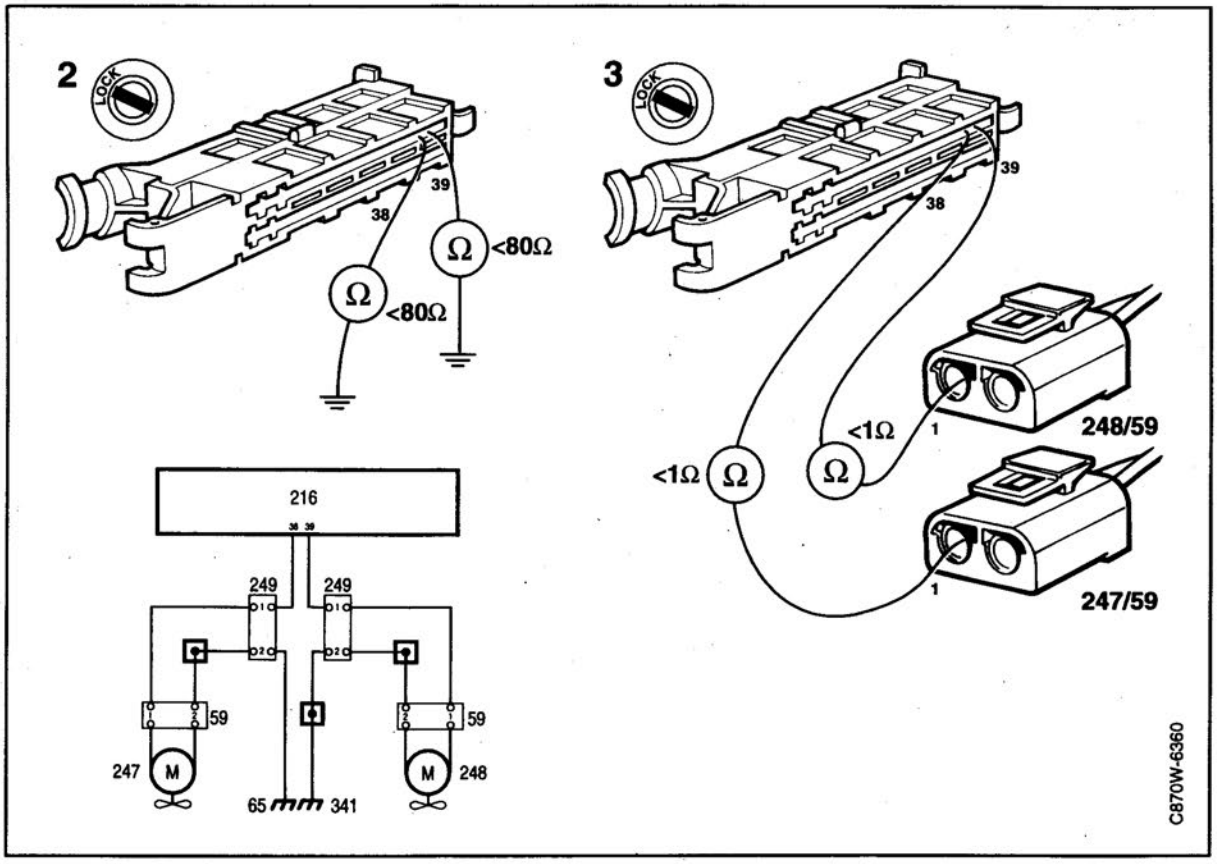
5 If there is no fault in the connection between the ACC control module and the fan's speed control, check supply voltage to pin 1 on the fan speed control and ground connection on pin 4.

6 If there are no faults in supply and ground connections: Disconnect speed control and short between pins 3 and 4. If the motor now works, the fault may be in the fan speed control. Refit all connectors and restart the system. If the fault remains, try with a new speed control.

7 If the motor does not work, even with the speed control shorted: Switch off the ignition and wait for 35 seconds. Unplug the ACC control module's 39 pin connector and the connector on the fan speed control. Disconnect the 2 pin connector 59 and interconnect pins 1 and 2. Check if there is an open circuit or short circuit to ground by measuring resistance on the cables to connector 59 between pins 1 and 2 on the ACC control module's connector and the fuse board with fuse 6 removed.

8 If the reading to connector 59 is correct, the fault may be in the motor. Refit all connectors and restart the system. If the fault is still present, try with a new motor.

Testing – rear door fans



Action

1 Check the fan's output signal on pin 38 or 39 on the ACC control module. Manually vary speed using the buttons for fan control.

2 If the output signal is correct, unplug the ACC control module's 39 pin connector and check the resistance in the rear door fan motor windings. Reading should be <80 Ohm. If resistance is correct, refit connectors and restart the system in order to check if the fault is still present.

3 If motor resistance is incorrect, check the cable between the motor connector and the ACC control module's 39 pin connector, and if the resistance is correct, try with a new motor.

4 If the output signal from the fan is incorrect, carefully check the 39 pin connector and then try with a new ACC control module.

Signal measured	ACC pin	Status	Voltage
Rear door fan, left	38 & ground	Min. – max. speed Stopped	7 – 11V 0V
Rear door fan, right	39 & ground	Min. – max. speed Stopped	7 – 11V 0V

Fault diagnosis M1995–

ISAT scan tool diagnostics mode

A number of the outputs from the ACC control module can be controlled using the ISAT scan tool "ACTIVATE", provided that the following two criteria are met:

- Battery positive voltage is between 10 and 16 volts.
- The speed of the car is 0 km/h.

If one of these criteria is not met, the ACC control module will not execute the commands from the ISAT scan tool.
This will also be shown on the ISAT scan tool.

Diagnostic trouble code detection

When reading diagnostic trouble codes from the ACC control module on the ISAT scan tool, the following procedure should be followed:

1 Cancel any manual selections and then test drive the car.

2 Read the diagnostic trouble codes and write them down on paper.

3 Calibrate

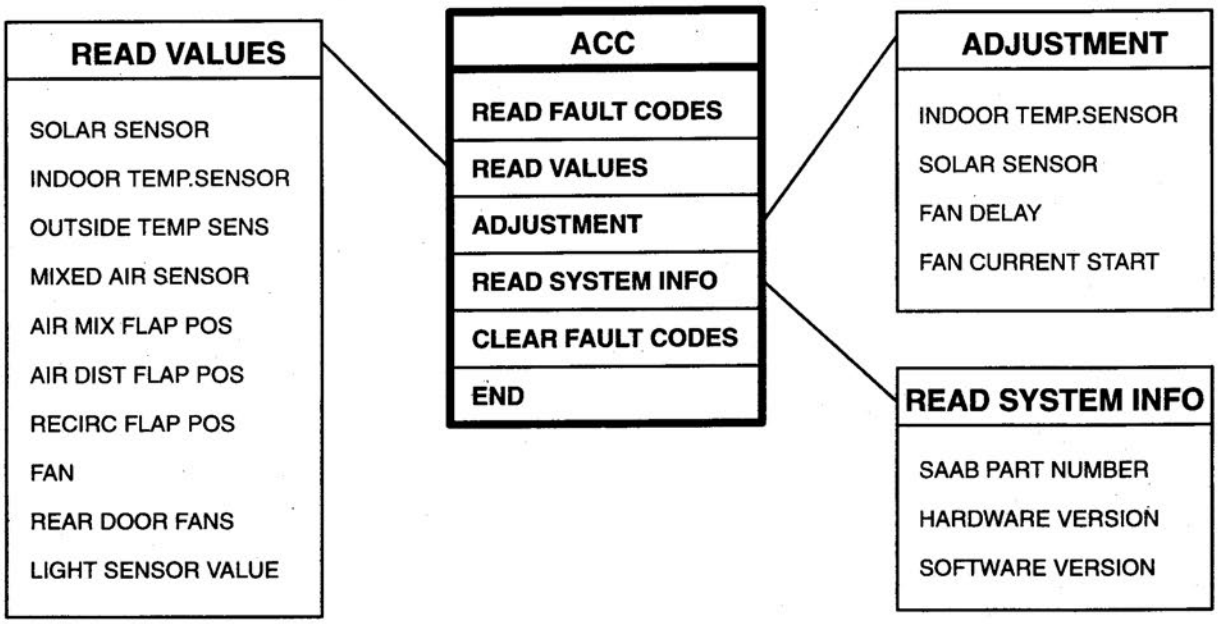
4 Read out the diagnostic trouble codes again and write down any further diagnostic trouble codes.

5 Remedy the diagnostic trouble codes.

6 Calibrate

This routine should be followed as diagnostic trouble codes B2403 and B2493 can only be detected through calibration.
Make a habit of always calibrating after working on the ACC system. Calibration is carried out so that the control module can set the stepping motor end positions.
These disappear if the +30 voltage is broken.

Menu structure for command codes



Command menu READ VALUES

ISAT scan tool text/commands	Function
SOLAR SENSOR XXXX W/m^2	Shows solar intensity (0–1390 W/m^2).
INDOOR TEMP. SENSOR XX °C XX °F	Shows the number of degrees in Celcius and Fahrenheit for the cabin temperature sensor.
OUTSIDE TEMP SENS XX °C XX °F	Shows the number of degrees in Celsius and Fahrenheit for the outside temperature sensor.
MIXED AIR SENSOR XX °C XX °F	Shows the number of degrees in Celsius and Fahrenheit for the blended air temperature sensor.
AIR MIX FLAP POS XXX %	Shows the position of the blended air flap (0–100 %, where 0 % is max. cold and 100 % is max. heat).
AIR DIST. FLAP XXX °	Shows the position of the air distributor (45–135°).
RECIRC. FLAP POS FRESH AIR MODE / RECIRC. MODE	Shows if the air recirculation flap is in the fresh air position or in the air recirculation position.
FAN CONTROL VOLTAGE X.X V	Shows the ACC control module control voltage to the fan.
REAR DOOR FANS XX.X V	Shows the voltage value of the rear door fans.
LIGHT SENSOR VALUE XXX %	Shows the current light intensity in the cabin (0–100 %).

Command menu ADJUSTMENT

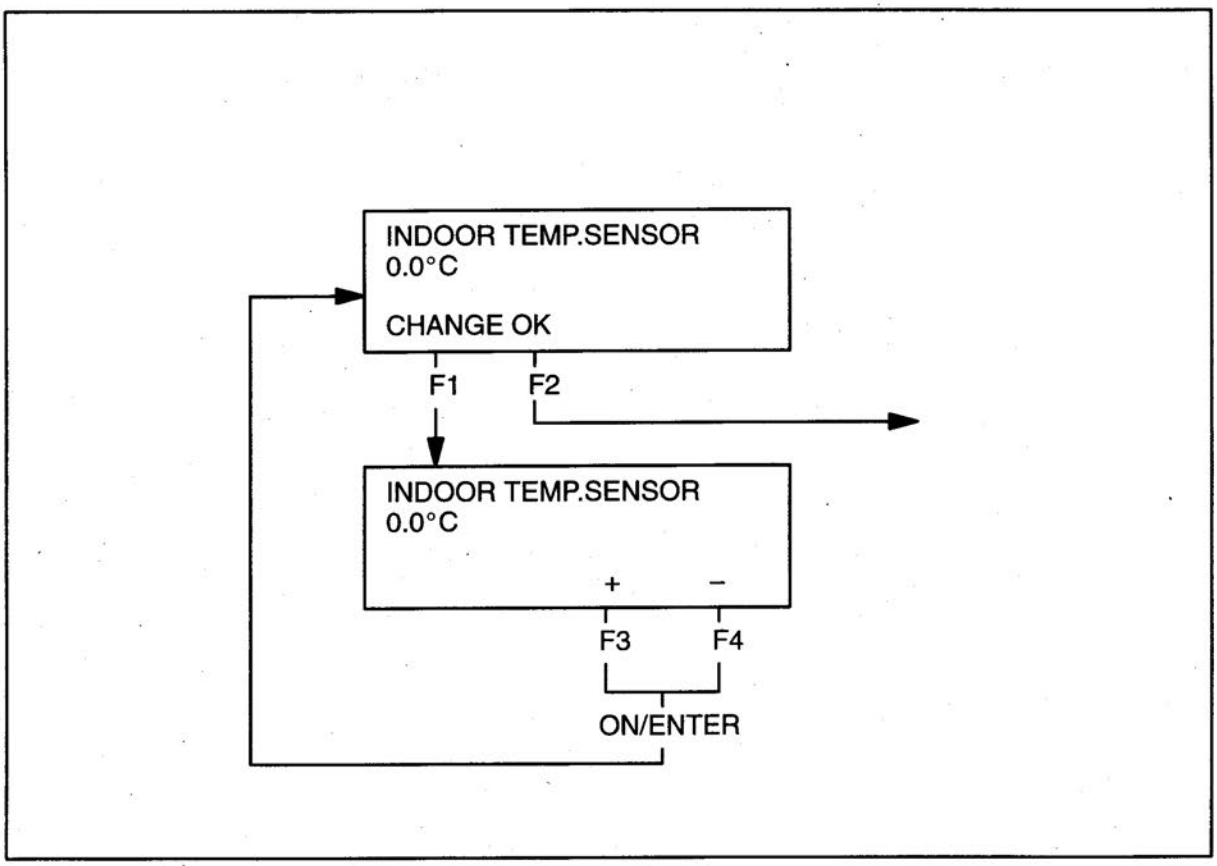
ISAT scan tool text/commands	Function
INDOOR TEMP.SENSOR	Adjusting (±2.5°C) the way in which the ACC control module interprets the reading from the cabin temperature sensor. See page 120.
SOLAR SENSOR	Adjusting the influence of the solar sensor on the ACC control module control program. See page 121.
FAN DELAY	Cancelling the programmed ventilation fan delay. See page 122.
FAN CURRENT START	Adjusting the ventilation fan start–up current. See page 123.

Command menu READ SYSTEM INFO

ISAT scan tool text/commands	Function
SAAB PART NUMBER	Shows Saab part number.
HARDWARE VERSION	Shows the hardware version.
SOFTWARE VERSION	Shows software version (e.g. 2.3 for M95)

Adjusting the ACC

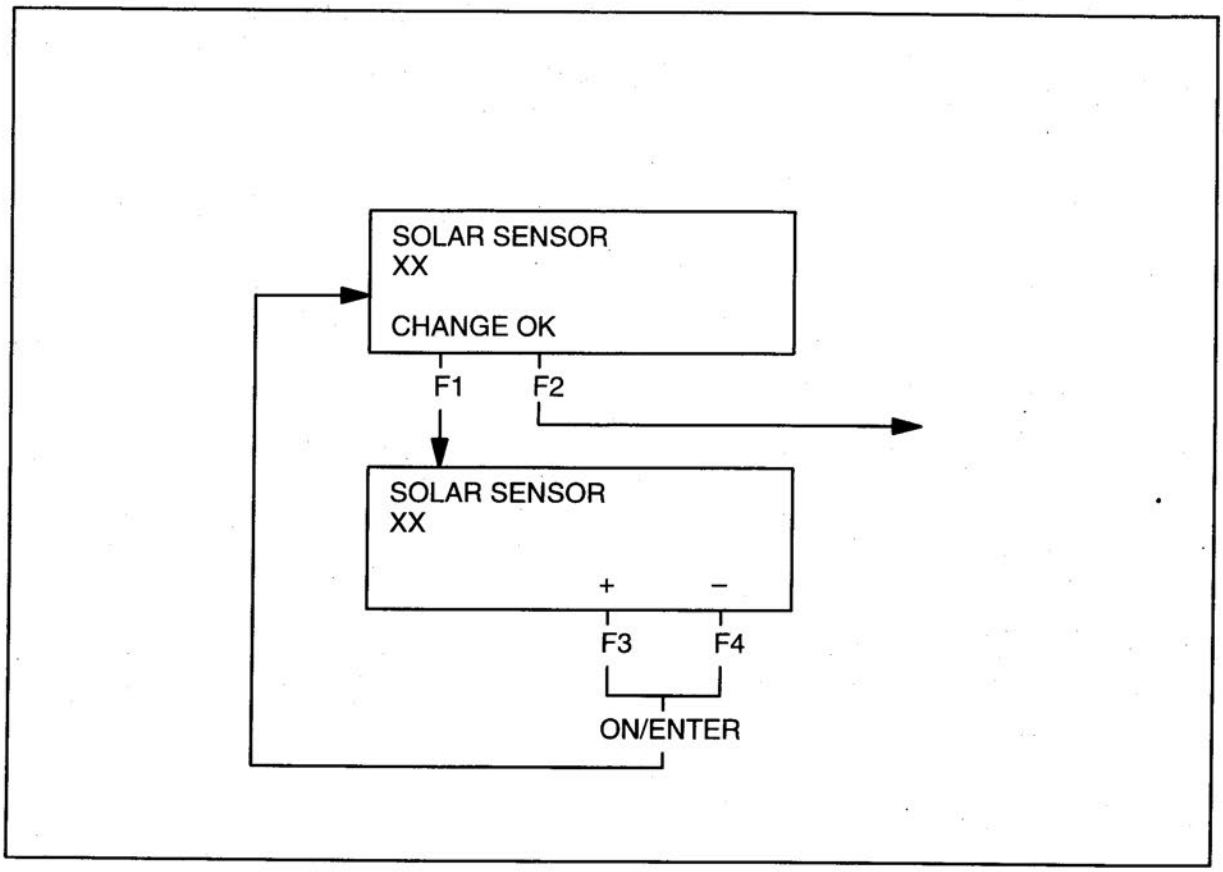
Adjusting the cabin temperature scale



Using ISAT scan tool command "INDOOR TEMP.SENSOR", it is possible to change the way the cabin temperature sensor interprets the cabin temperature. If the cabin temperature sensor's offset is increased, the temperature in the cabin will be increased by the corresponding number of degrees. Adjustment is in steps of 0.1°.

Important
This adjustment should only be made after careful consideration. Adjustment is possible up to ± 2.5°. If adjustment is too great, the ACC system may react completely differently when starting from cold. Significantly more cooling or heating and high fan speeds can be achieved. An appropriate adjustment range is ± 0.3 – 1.0°.

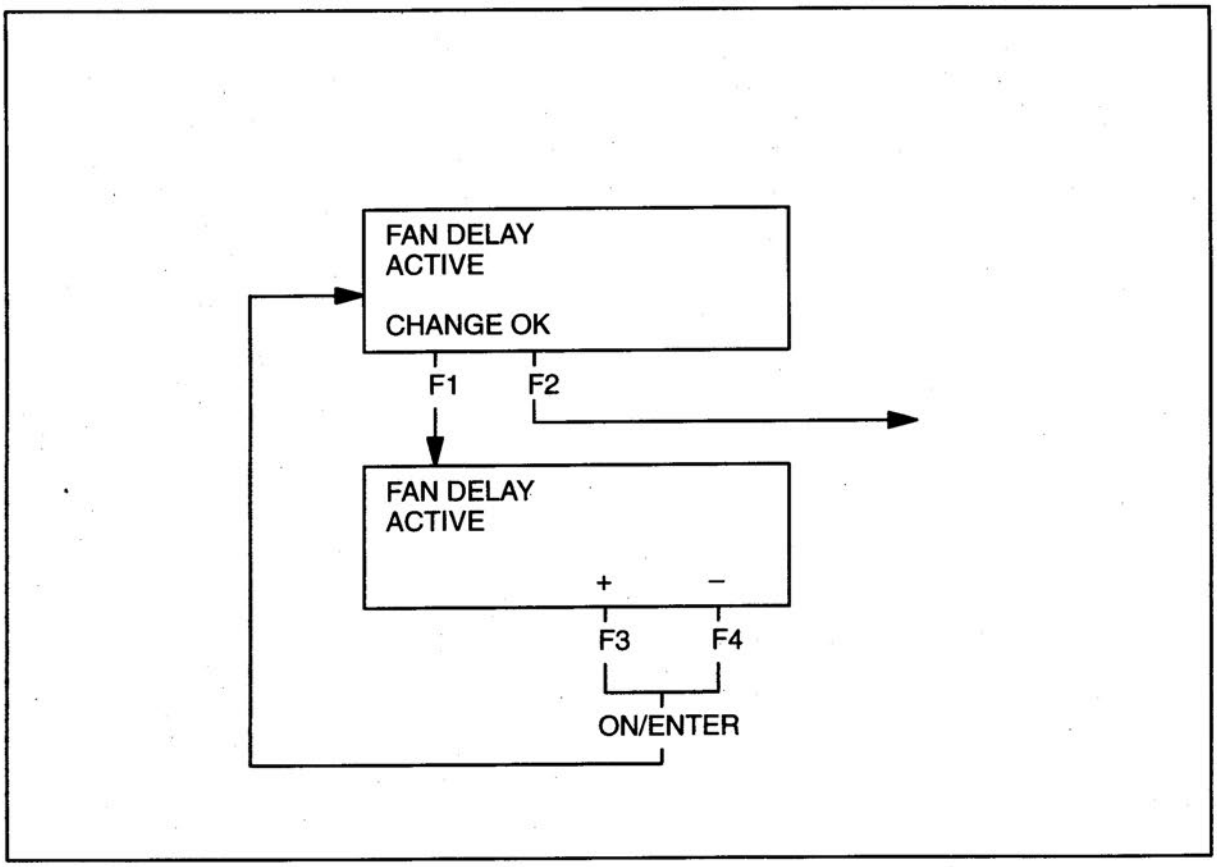
Changing the influence of the solar sensor



Using the adjusting command "SOLAR SENSOR", the influence of the solar sensor on the ACC control module control program can be changed.
Value from factory = 33.

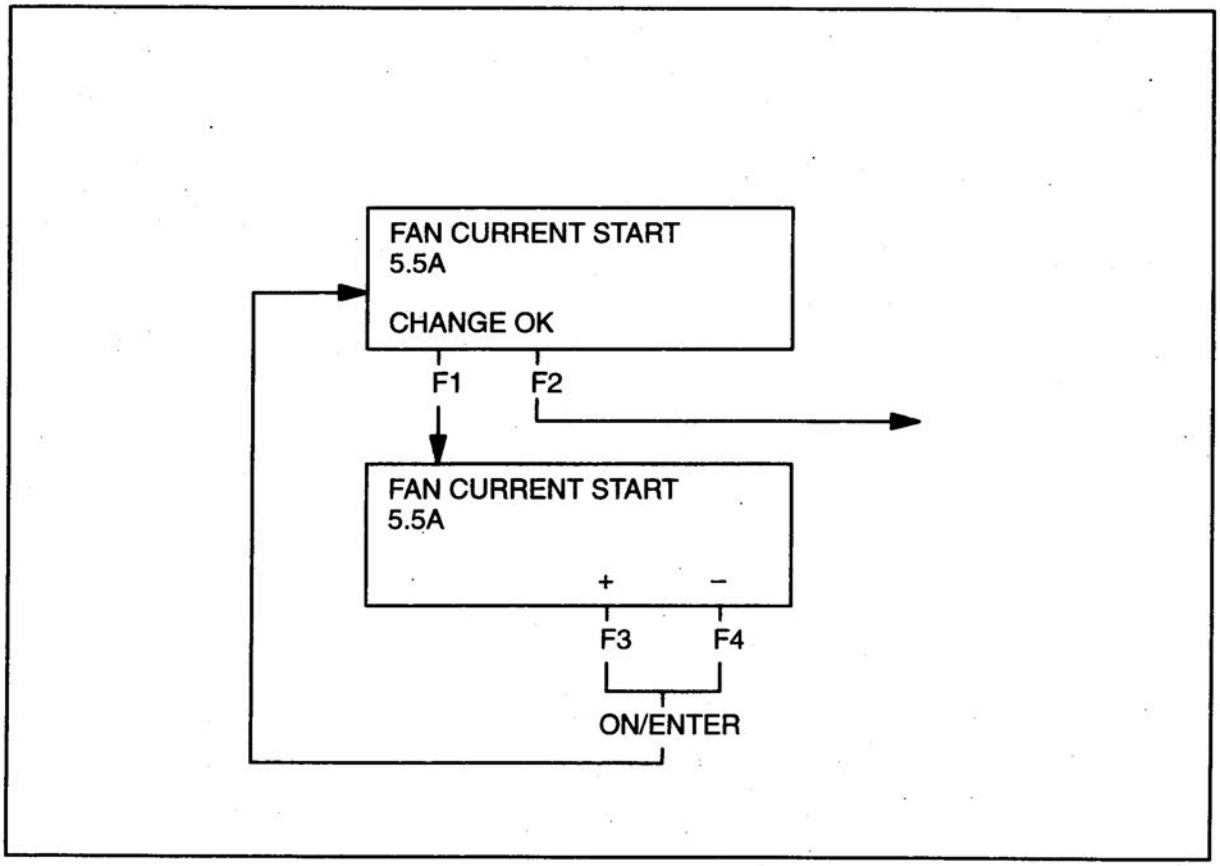
Important
The ISAT scan tool is prepared with this command. This command should not be used before information about it has been distributed, e.g. in a Service Information.

Fan delay when starting



Using the adjusting command "FAN DELAY", the cabin fan's pre–programmed start delay can be cancelled.
Under certain conditions, the start of the cabin fan is delayed for 15 seconds when the car is started to prevent misting on the windscreen.
If the delay is cancelled, fan speed is controlled by the ACC control module.

Fan current at start



Using the adjusting command "FAN CURRENT START", It is possible to change the maximum fan current limit (proportional to fan speed) that the ACC system starts with during cold start.
From factory, maximum fan current when starting is limited to 5.5 A. Starting current can also be below 5.5 A or it can be programmed.
Fan current is increased by the ACC control module as blended air temperature increases.
Maximum start current can be adjusted between 2.5 – 12.5 A according to the customer's requirements.
Recommended fan current when starting is 4 – 7 A.
This adjustment should be made after careful consideration, preferably in consultation with the customer.

Example of how adjustment can be carried out in consultation with the customer:
Connect the ISAT scan tool and read "FAN".
Ask the customer to set the fan speed he/she requires at start.
The control voltage fed to the fan corresponds to a certain current strength.
Using the ISAT scan tool, program the required fan speed according to the adjacent table. (Table shows approximate values).

Control voltage (V)	Start–up current (A)
0.4	1
0.6	2
0.8	3
1.0	4
1.2	5
1.4	6
1.6	7
1.8	8
2.0	9
2.2	10
2.4	11
2.6	12
2.8	13

Diagnostic trouble code table

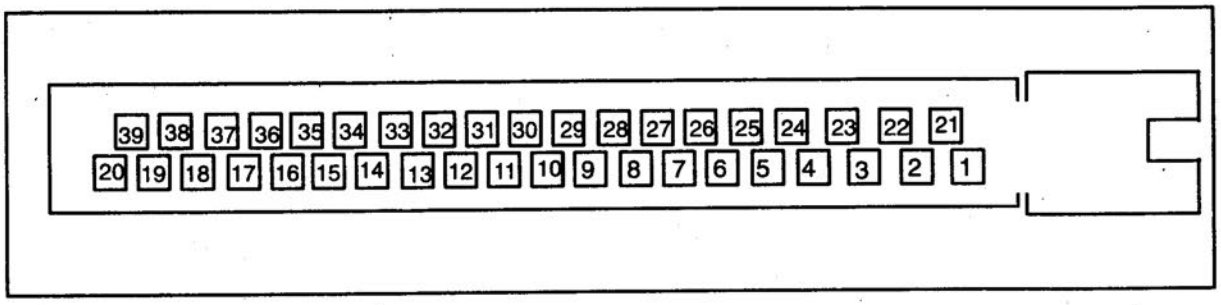
Diagnostic trouble code	Faulty function/component	Text on ISAT scan tool display	See page
B1341	Solar sensor, component fault.	FAULT X P/I B1341 SOLAR SENSOR COMPONENT FAULT	130
B1343	Solar sensor, open circuit/short circuit.	FAULT X P/I B1343 SOLAR SENSOR OPEN/SHORT CIRCUIT	131
B1348	Blended air temperature sensor, open circuit/short circuit to BPV.	FAULT X P/I B1348 MIXED AIR SENSOR BREAK/SHORT BATT+	132
B1353	Cabin temperature sensor, open circuit/short circuit to BPV.	FAULT X P/I B1353 INDOOR TEMP.SENSOR BREAK/SHORT BATT+	134
B1354	Suction fan for cabin temperature sensor, open circuit/short circuit to BPV.	FAULT X P/I B1354 INDOOR TEMP.SENSOR BREAK/SHORT BATT+	136
B1355	Suction fan for cabin temperature sensor, short circuit to ground.	FAULT X P/I B1355 INDOOR TEMP.SENSOR SHORT TO GROUND	137
B1492	A/C, short circuit to BPV.	FAULT X P/I B1492 A/C SHORT TO BATT+	138
B1493	A/C, short to ground.	FAULT X P/I B1493 A/C SHORT TO GROUND	138
B1497	Electrically heated rear window, open circuit.	FAULT X P/I B1497 HEATED REAR WINDOW OPEN CIRCUIT	139
B1498	Electrically heated rear window, short to ground.	FAULT X P/I B1498 HEATED REAR WINDOW SHORT TO GROUND	139
B1515	Common sensor ground, short circuit to BPV.	FAULT X P/I B1515 SENSOR GROUND FAULTY	140
B1605	Control module fault.	FAULT X P/I B1605 CONTROL MODULE FAULT	141

Diagnostic trouble code table (contd.)

Diagnostic trouble code	Faulty function/component	Text on ISAT scan tool display	See page
B1746	Outside temperature sensor, open circuit/short circuit.	FAULT X P/I B1746 OUTSIDE TEMP SENS OPEN/SHORT CIRCUIT	142
B2352	Voltage supply to ventilation fan, short circuit to ground.	FAULT X P/I B2352 FAN POWER SUPPLY SHORT TO GROUND	143
B2402	Air distributor stepping motor, short to ground.	FAULT X P/I B2402 AIR DIST. FLAP MOTOR SHORT TO GROUND	144
B2403	Air distributor stepping motor, open circuit (during calibration).	FAULT X P/I B2403 AIR DIST. FLAP MOTOR OPEN CIRCUIT	144
B2412	Air recirculation flap motor, short circuit to ground.	FAULT X P/I B2412 RECIRC.FLAP MOTOR SHORT TO GROUND	145
B2413	Air recirculation flap motor, short circuit to BPV.	FAULT X P/I B2413 RECIRC. FLAP MOTOR SHORT TO BATT+	145
B2437	Rear door fans, short circuit to ground.	FAULT X P/I B2437 REAR DOOR FAN SHORT TO GROUND	146
B2438	Rear door fans, open circuit.	FAULT X P/I B2438 REAR DOOR FAN OPEN CIRCUIT	146
B2492	Air mixing damper stepping motor, short circuit to ground.	FAULT X P/I B2492 AIR MIX FLAP MOTOR SHORT TO GROUND	149
B2493	Air mixing damper stepping motor, open circuit (during calibration).	FAULT X P/I B2493 AIR MIX FLAP MOTOR OPEN CIRCUIT	149
Fault with no diagnostic trouble code	Cabin fan motor, not functioning / faulty control.	–	125

Readings, control module connections

Unless otherwise stated, the ignition must be in the ON position. All values are approximate.



Pin	Component/Function	In/ Out	Measuring conditions	Measured value	Between X–Y	Signal, see page
1	Ground	In		<0.4 V	1 – B negative	**49**
2	Recirculation motor (F)	Out	Recirculation, ON OFF	 BPV – 1 V 0 V	2 – 1	**62**
3	No connection (intended for parking heater)	In				**58**
4	Parking heater	Out	Parking heater, deactivated activated	 0 V BPV	4 – 1	**58**
5	Supply voltage to solar sensor	Out		Approx. 12 V	5 – 1	**53**
6	Solar sensor	In				**53**
7	+15 voltage	In		<0.5V	BPV – 7	**49**
8	No connection					
9	Voltage supply to left–hand rear door fan	Out	Rear door fans, not activated low speed full speed	 0 V approx. 5 V approx. 10 V	9 – 1	**55**
10	Supply voltage to right–hand rear door fan	Out	Rear door fans, not activated low speed full speed	 0 V approx. 5 V approx. 10 V	10 – 1	**55**

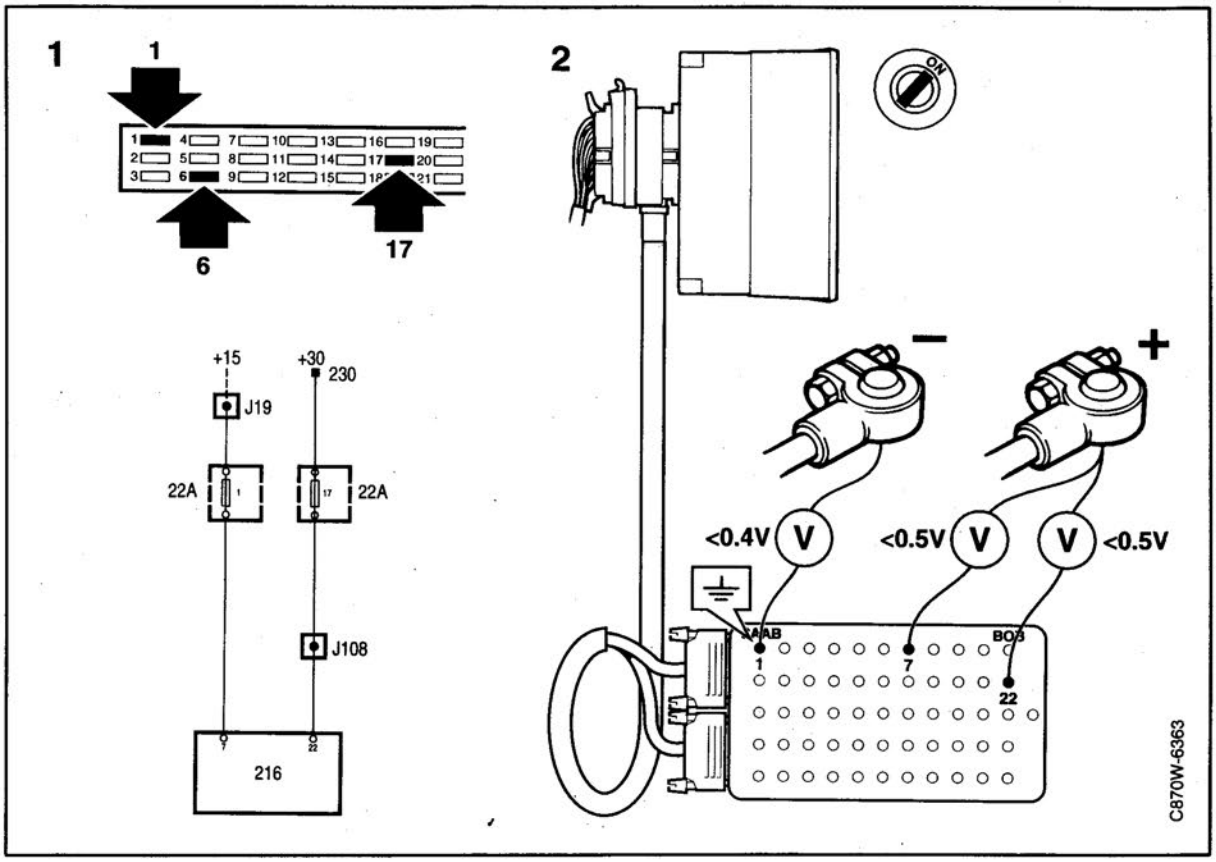
Readings, control module connections (contd.)

Pin	Component/Function	In/ Out	Measuring conditions	Measured value	Between X–Y	Signal, see page
11	No connection					
12	Diagnostics	In/ Out	ISAT scan tool connected ISAT scan tool not connected	approx. 12 V 4.5 – 5.0 V	12 – 1	
13	No connection					
14	Blended air temperature sensor, ground	Out		<0.1 V	14 – 1	51
15	Cabin temperature sensor, ground	Out		<0.1 V	15 – 1	50
16	Supply voltage for cabin temperature sensor fan	Out		BPV	16 – 1	50
17	Supply voltage for fan control module	Out		BPV	17 – 1	54
18	Outside temperature signal from EDU	In		7 – 13 V (fluctuating)	18 – 1	52
19	No connection					
20	Test voltage, cabin fan	Out	Fan, not activated full speed	 0 V 5 V	20 – 1	54
21	Recirculation motor (R)	Out	Recirculation, ON OFF	 0 V BPV – 1 V	21 – 1	62
22	+30 voltage	In		<0.5 V	BPV – 22	49
23	Motor, air distributor	Out	Motor not activated	BPV – 1 V	23 – 1	61
24	Motor, air distributor	Out	Motor not activated	approx. 1 V	24 – 1	61
25	Motor, air distributor	Out	Motor not activated	BPV – 1 V	25 – 1	61
26	Motor, air distributor	Out	Motor not activated	approx. 1 V	26 – 1	61
27	Motor, air mixing damper	Out	Motor not activated	BPV – 1 V	27 – 1	60
28	Motor, air mixing damper	Out	Motor not activated	approx. 1 V	28 – 1	60
29	Motor, air mixing damper	Out	Motor not activated	BPV – 1 V	29 – 1	60
30	Motor, air mixing damper	Out	Motor not activated	approx. 1 V	30 – 1	60

Readings, control module connections (contd.)

Pin	Component/Function	In/ Out	Measuring conditions	Measured value	Between X–Y	Signal, see page
31	Rheostat	In	Min. rheostat Max. rheostat	approx. 2 V approx. 12 V	31 – 1	59
32	Blended air temperature sensor	In	At approx. +20°C	approx. 6.6 V	32 – 1	51
33	Cabin temperature sensor	In	At approx. +20°C	approx. 6.4 V	33 – 1	50
34	No connection					
35	Solar sensor, ground	Out		<0.1 V	35 – 1	53
36	No connection					
37	No connection					
38	A/C (to EDU)	Out	AUTO MODE ECON MODE	BPV 0 V	38 – 1	
39	Electrically heated rear window	Out	Electrically heated rear window, ON OFF	 BPV 0 V	39 – 1	56

Testing voltage supply and ground connection



1 Check the following fuses:
- 17 for +30
- 1 for +15
- 6 for +54 ventilation fan motor.

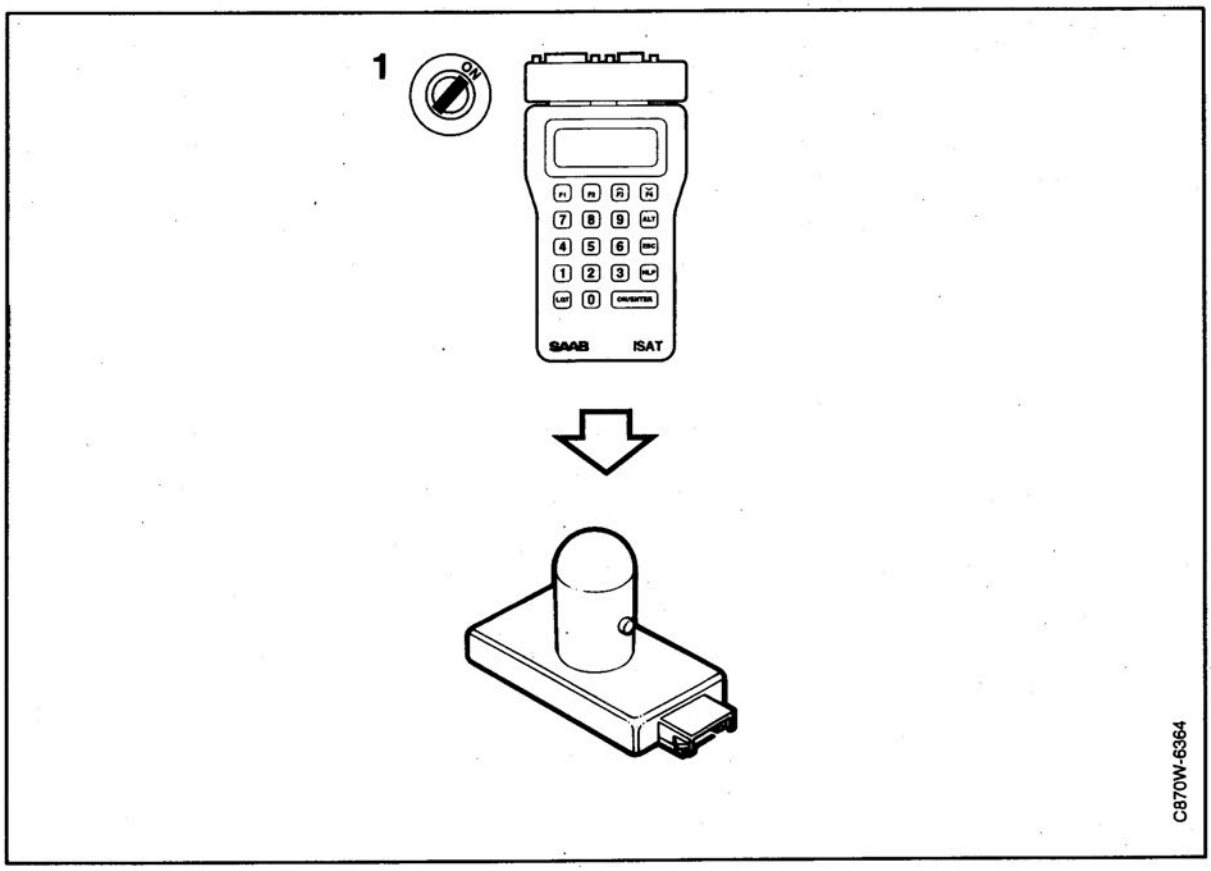
2 Connect a breakout box (BOB) to the ACC control module and take the following measurements with the ignition on:
   a) Between battery positive and pin 22. The voltage should be below 0.5 volts.
   b) Between battery positive and pin 7. The voltage should be below 0.5 volts.
   c) Between pin 1 and battery negative. The voltage should be less than 0.4 volts an full fan speed.

3 Check the leads between the control module and the fuses and between the control module and the grounding points for open or short circuits.

Fault diagnosis schedule

Diagnostic trouble code B1341

Solar sensor, component fault.



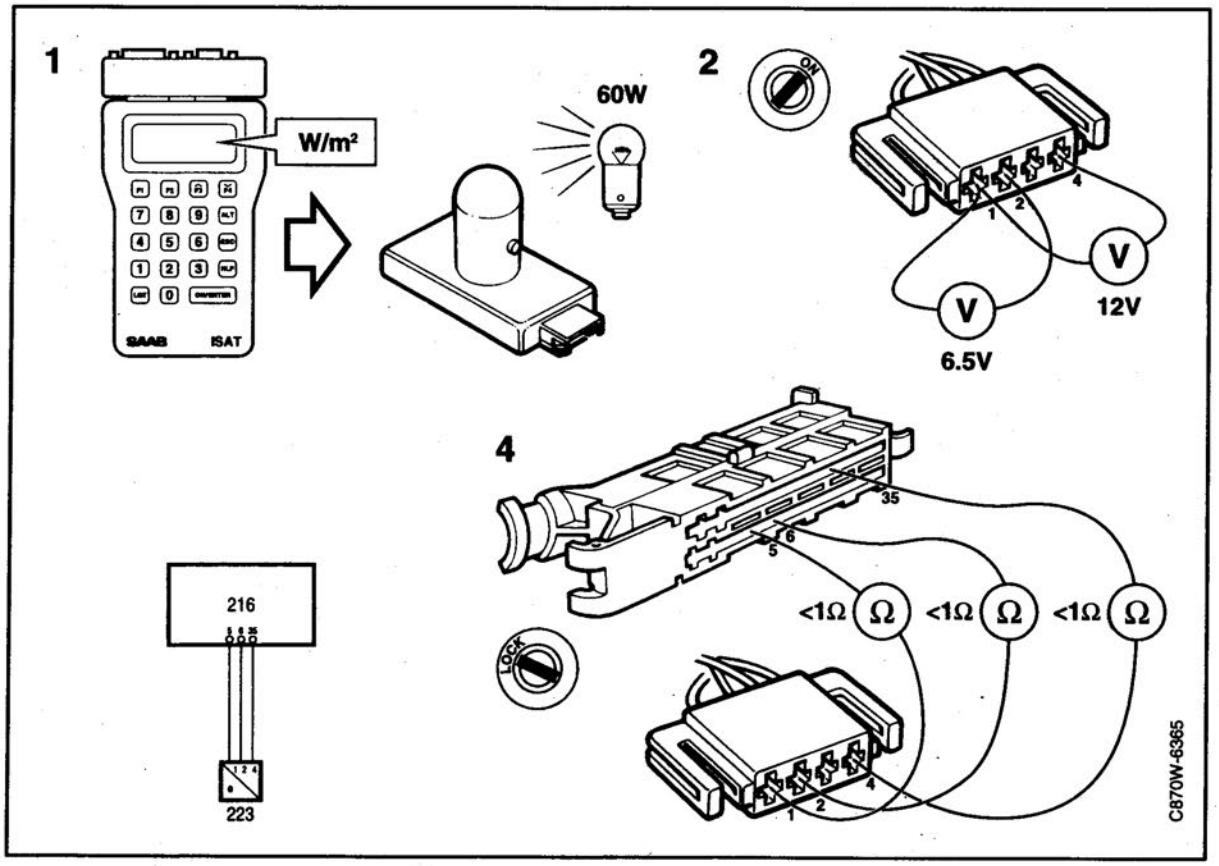
Action

1 Check that the correct design of solar sensor is fitted.

2 Change the solar sensor.

Diagnostic trouble code B1343

Solar sensor, open circuit/short circuit.



Action

1 Connect the ISAT and read the "SOLAR SENSOR VALUE".
The value can vary between 0 – 1390 W/m^2. Illuminate the solar sensor with a lamp and check that the value increases.
(A 60 W lamp gives approx. 600 – 1200 W/m^2.)
The solar sensor primarily measures infrared radiation which means that a fluorescent tube cannot be used.

2 Unplug the solar sensor connector and measure the voltage supply in the connector.
- The voltage between pins 1 and 4 should be about 12 volts.
- The voltage between pins 1 and 2 should be about 6.5 volts.
If the value is incorrect, proceed to point 4.

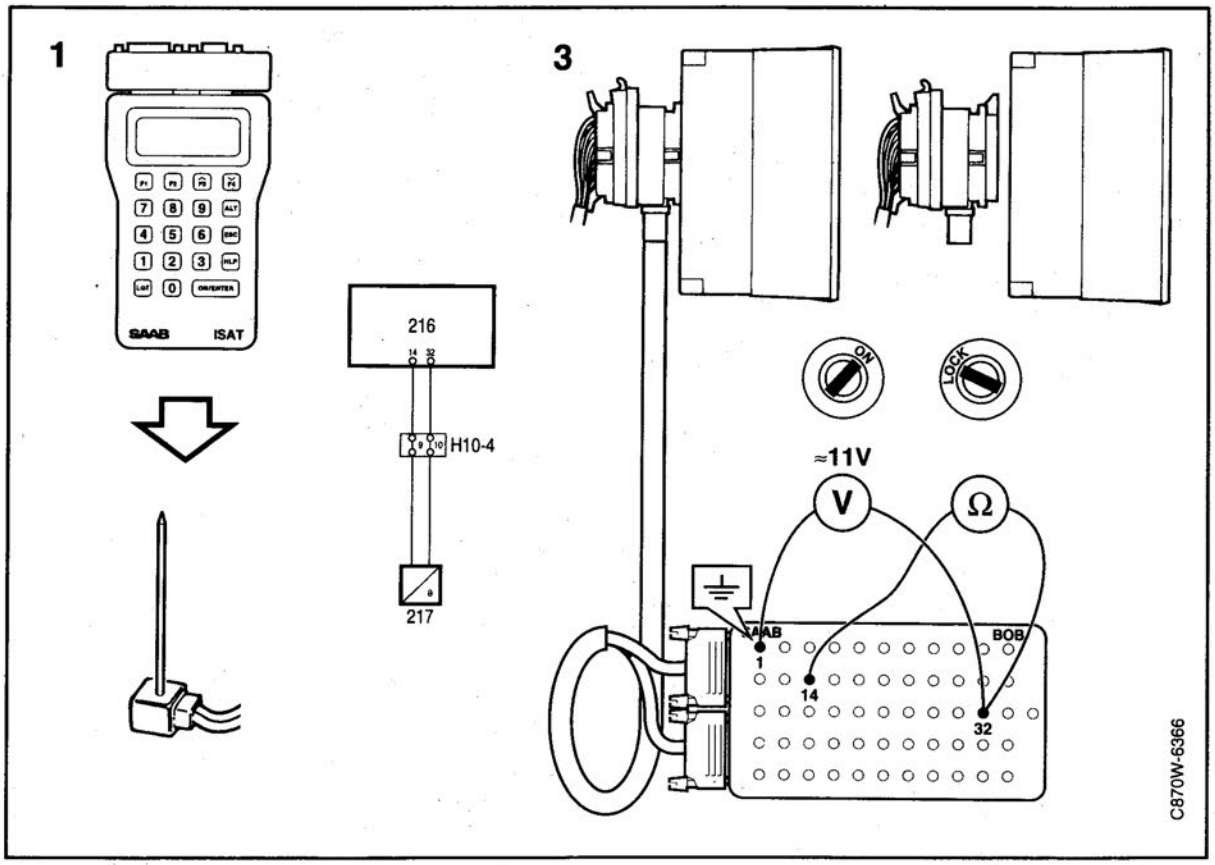
3 Change the solar sensor.

4 Unplug the ACC control module connector. Connect a BOB between the following pins and check the leads for open/short circuits to ground:
- The lead between pin 35 on the ACC control module connector and pin 4 on the solar sensor connector.
- The lead between pin 6 on the ACC control module connector and pin 2 on the solar sensor connector.
- The lead between pin 5 on the ACC control module connector and pin 1 on the solar sensor connector.

5 If the fault remains, proceed to page 152 for further action.

Diagnostic trouble code B1348

Blended air temperature sensor, open/short circuit to BPV.



Action

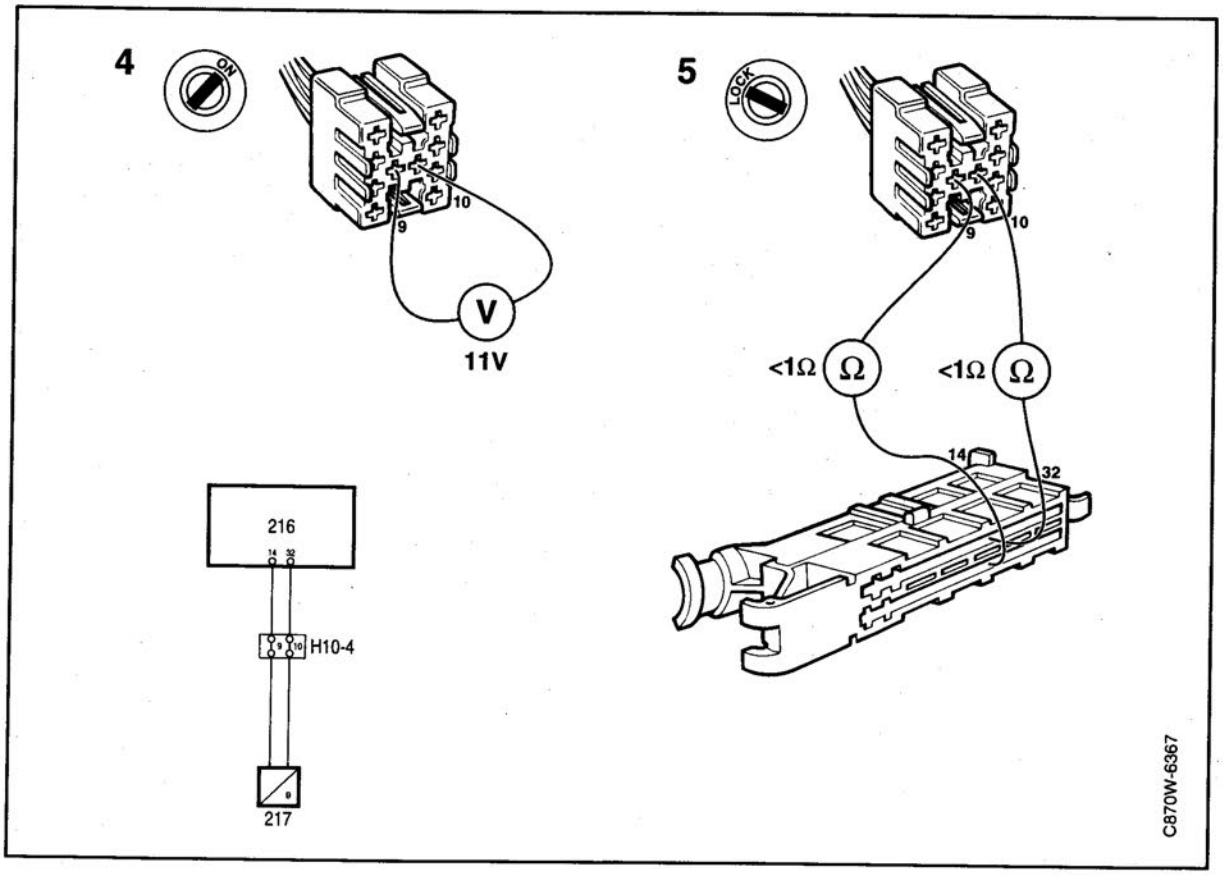
1 Connect the ISAT scan tool and read "MIXED AIR SENSOR".
When the engine is running and the selected cabin temperature is changed, the value on the ISAT scan tool display should also change. The car engine must be warm.

2 Remove the ACC control module and unplug the connector.

3 Connect a BOB and measure the resistance between pins 14 and 32 in the ACC control module connector.
The resistance should vary with the temperature of the surrounding air according to the following table.
If the value is incorrect, unplug blended air temperature sensor connector H10–4, connect a BOB to the ACC control module and measure the voltage between pin 32 and pin 1 on the ACC control module. The voltage should be about 11 V.
In the case of an incorrect value, proceed to page 152 for further action.

°C (°F)	Min. (kOhms)	Max. (kOhms)
0 (32)	25.5	30.5
+10 (50)	16.8	19.7
+20 (68)	11.3	13.0
+30 (86)	7.8	8.8
+40 (104)	5.4	6.1

Diagnostic trouble code B1348 (contd.)



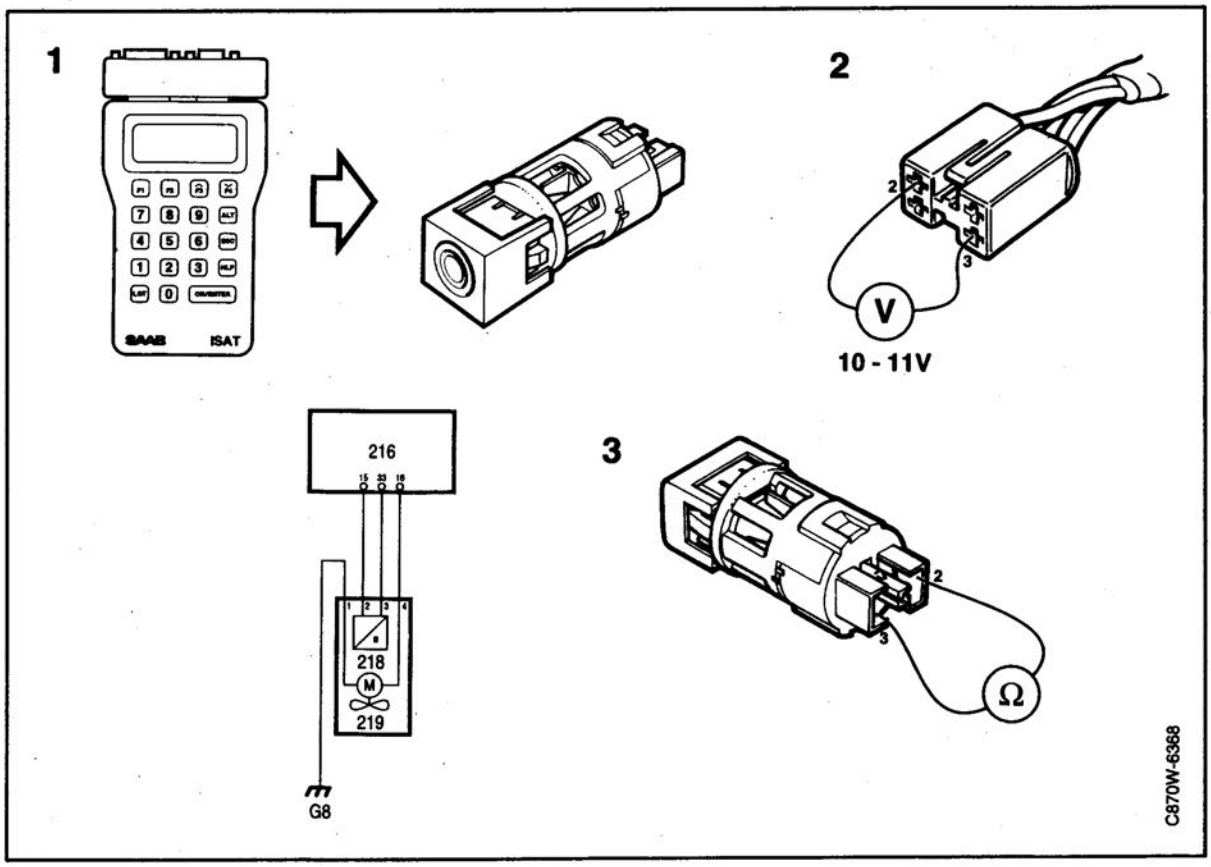
4 Measure the voltage between pins 9 and 10 in connector H10–4. The voltage should be about 11 V. If the value is correct, change the sensor.

5 Check the wiring harness for open/short circuits as follows:
- Pin 32 on the ACC control module to pin 10 in connector H10–4.
- Pin 14 on the ACC control module to pin 9 in connector H10–4.

6 If the fault remains, proceed to page 152 for further action.

Diagnostic trouble code B1353

Cabin temperature sensor, open/short circuit to BPV.



Conditions

Cabin temperature sensor, open/short circuit to BPV.

Action

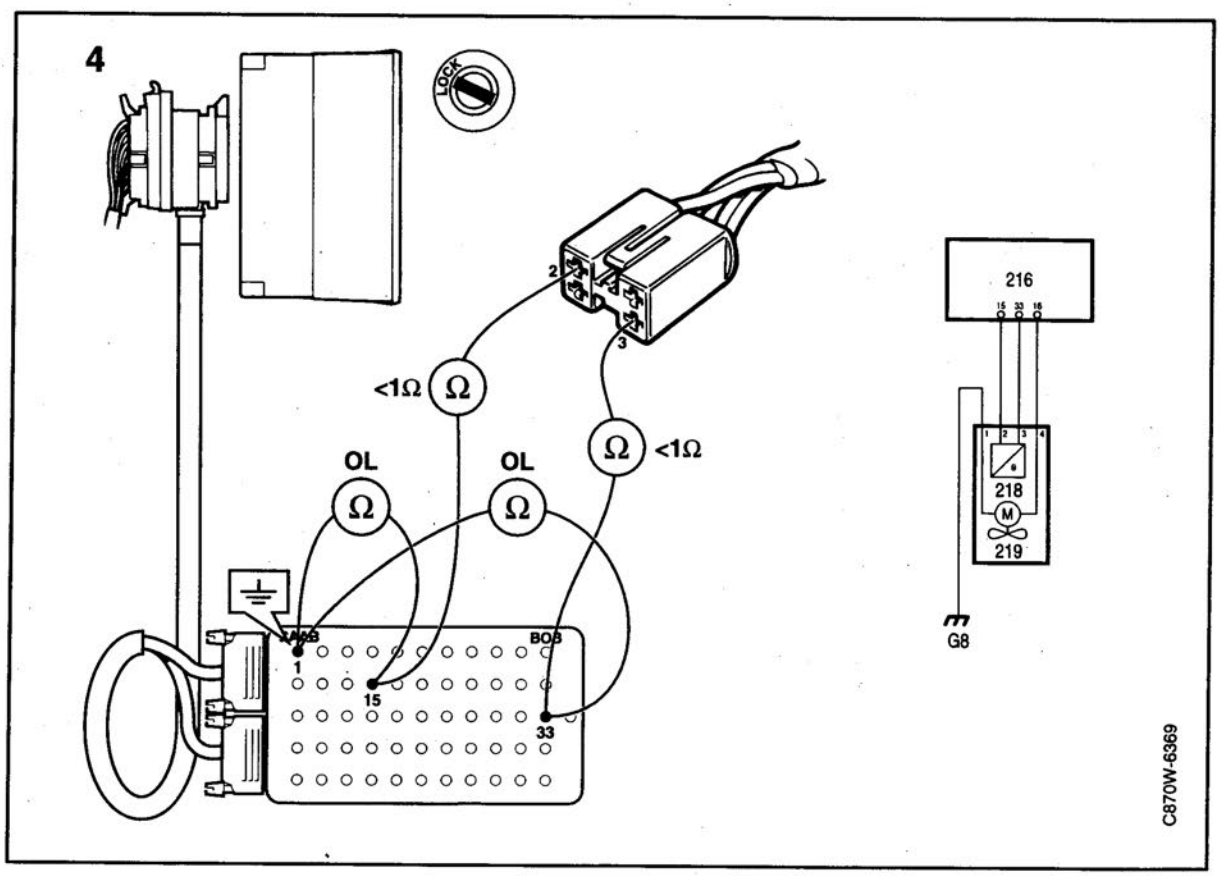
1 Connect the ISAT scan tool and read "INDOOR TEMP.SENSOR".
The values are displayed in Celsius and Fahrenheit.
The temperature readings should correspond to the ambient air temperature.

2 Unplug the cabin temperature sensor connector and check the voltage between pins 2 and 3 in the connector.
The voltage should be between about 10 and 11 volts.
If the value is incorrect, proceed to point 4.

3 Measure the resistance directly across the cabin temperature sensor. The resistance should vary with temperature according to the adjacent table.
Change the cabin temperature sensor if the data is incorrect. Erase the diagnostic trouble codes and check that the codes are not regenerated.

°C (°F)	Min. (kOhms)	Max. (kOhms)
0 (32)	30.0	34.9
+10 (50)	18.5	21.1
+20 (68)	11.8	13.2
+25 (77)	9.5	10.5
+30 (86)	7.6	8.5
+40 (104)	5.0	5.7

Diagnostic trouble code B1353 (contd.)

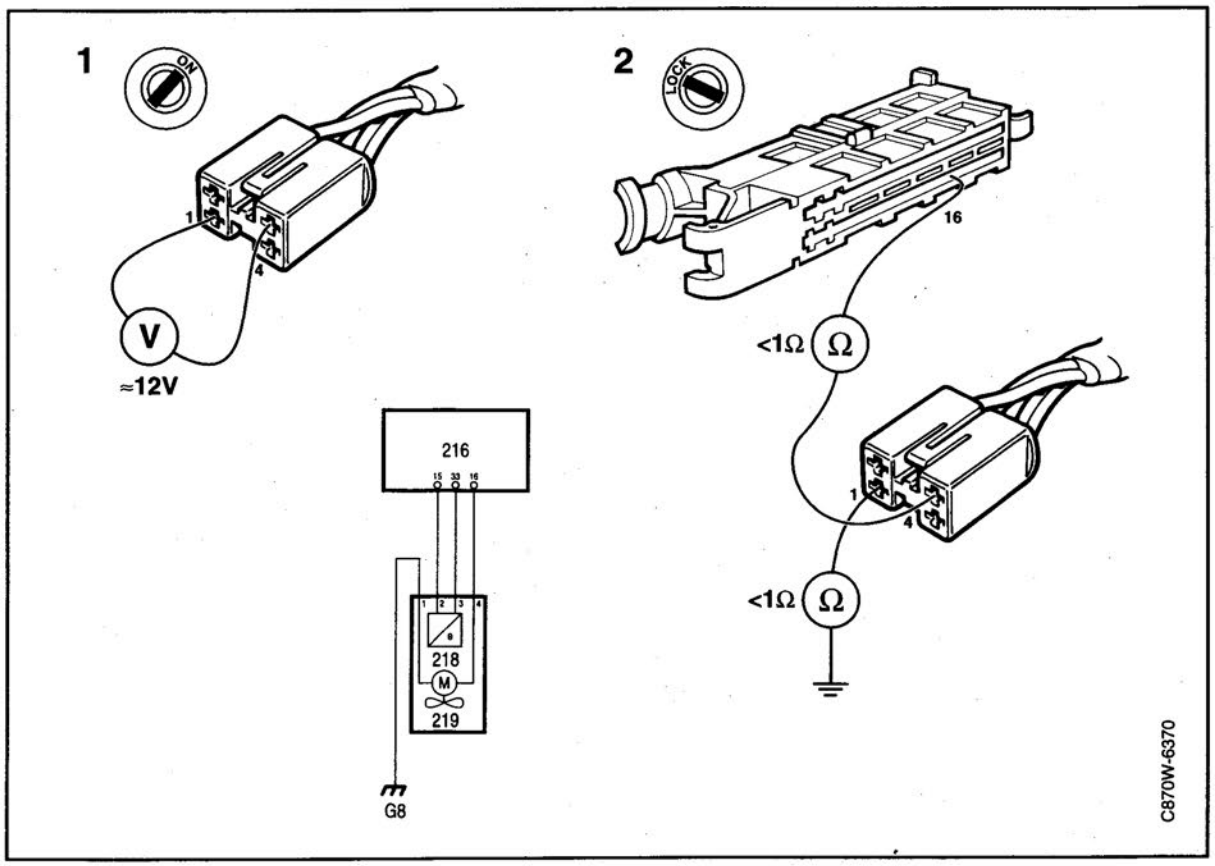


4 Unplug the ACC control module connector. Connect a BOB to the wiring harness and check the leads for open/short circuits as follows:
- Between pin 15 on the ACC control module connector and pin 2 on the sensor connector.
- Between pin 33 on the ACC control module connector and pin 3 on the sensor connector.

5 Proceed to page 152 for further action.

Diagnostic trouble code B1354

Cabin temperature sensor suction fan, open/short circuit to BPV.



Action

1 Unplug the cabin temperature sensor connector and check that voltage between pins 4 and 1 is about 12 V.
If the value is correct, proceed to point 3.

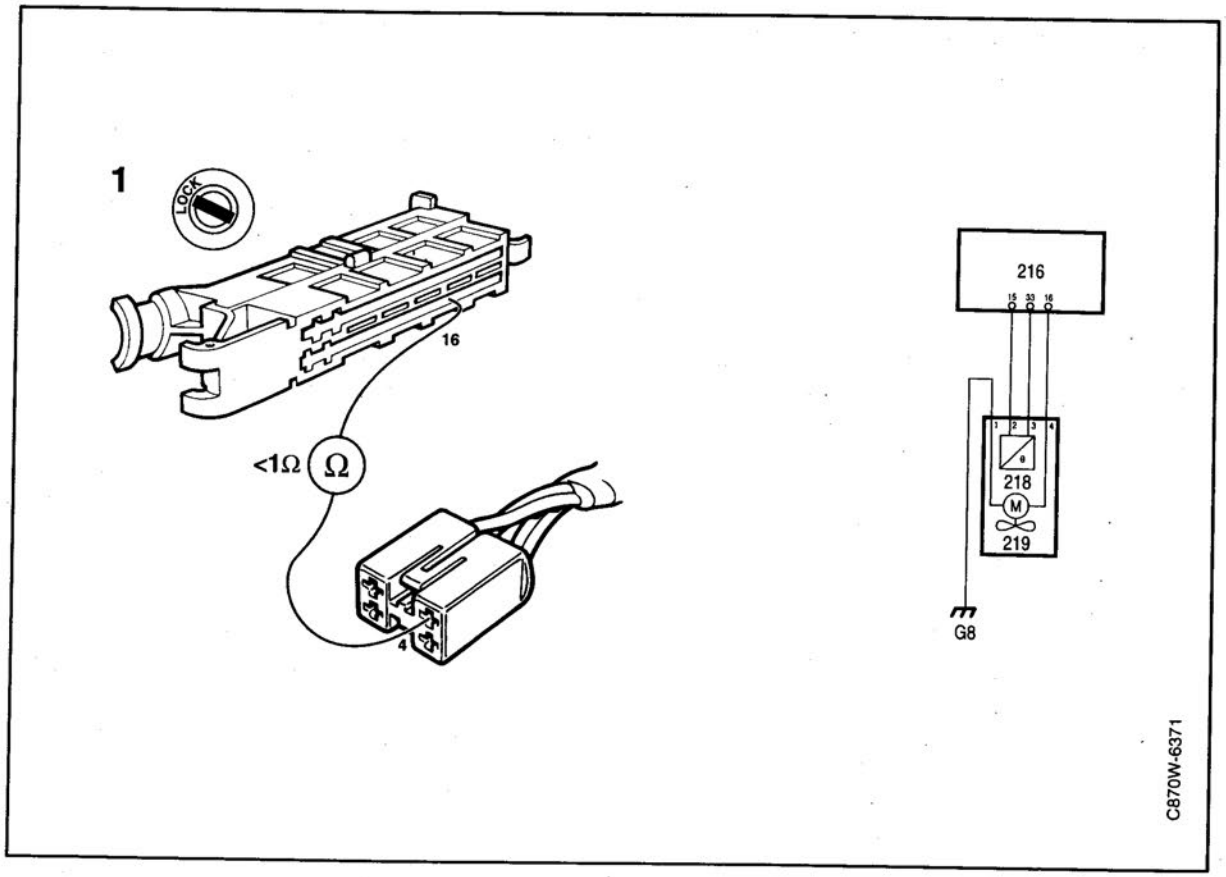
2 Check the cable assembly between pin 4 in the cabin temperature sensor connector and pin 16 in the ACC control module connector for open/short circuits to BPV.
Localize and remedy any faults.
Check the cable assembly between pin 1 in the cabin temperature sensor connector and ground for open/short circuits to BPV. Localize and remedy any faults.

3 Change the cabin temperature sensor and erase all diagnostic trouble codes. Check that they are not regenerated.

4 Proceed to page 152 for further action.

Diagnostic trouble code B1355

Cabin temperature sensor suction fan, short circuit to ground.

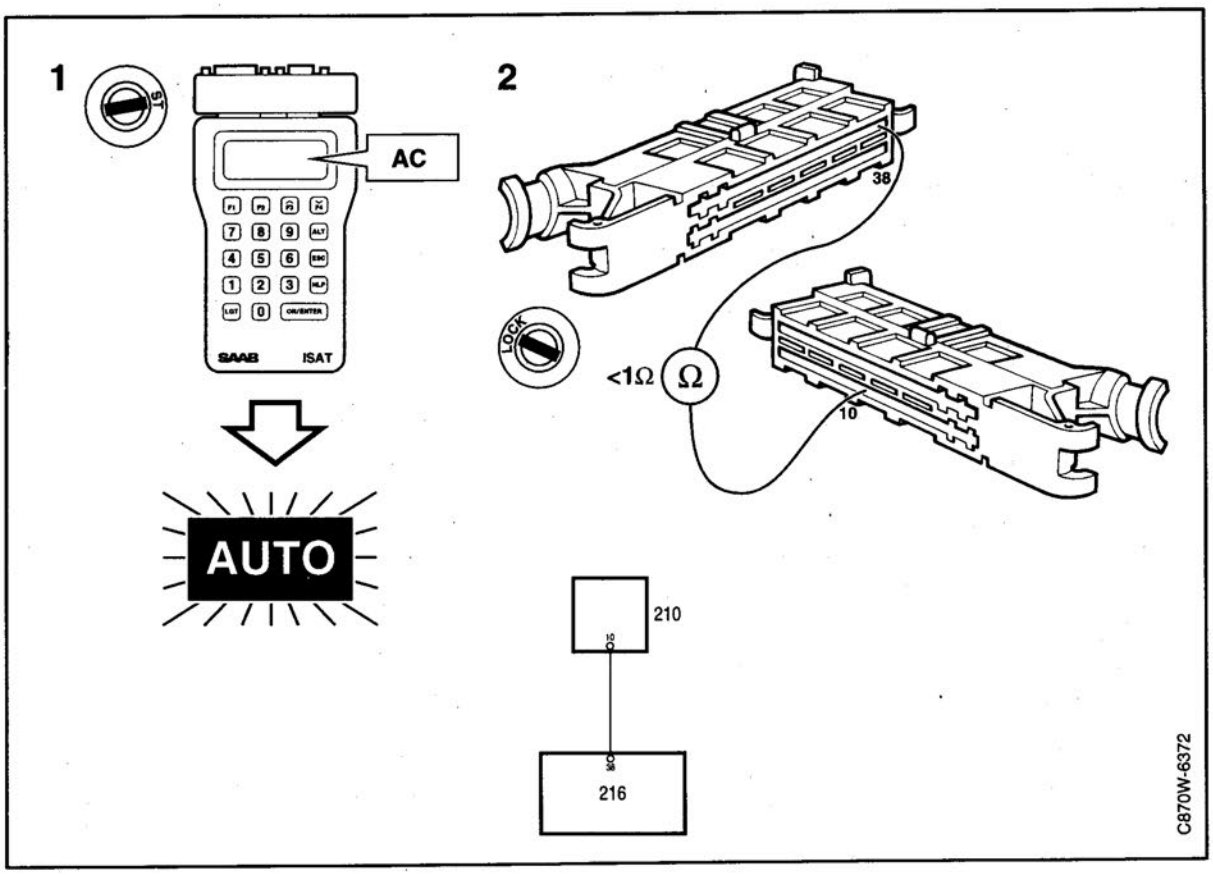


Action

1. Check the leads between pin 4 in the cabin temperature sensor connector and pin 16 in the ACC control module connector for short circuits to ground.
   Localize and remedy the fault.
2. Change the cabin temperature sensor.
3. If the fault remains, proceed to page 152 for further action.

Diagnostic trouble codes B1492 and B1493

A/C, shorting to BPV/ground.



Fault symptom

A/C, malfunctions.

Conditions

B1492: A/C, short circuit to BPV.

B1493: A/C, short circuit to ground.

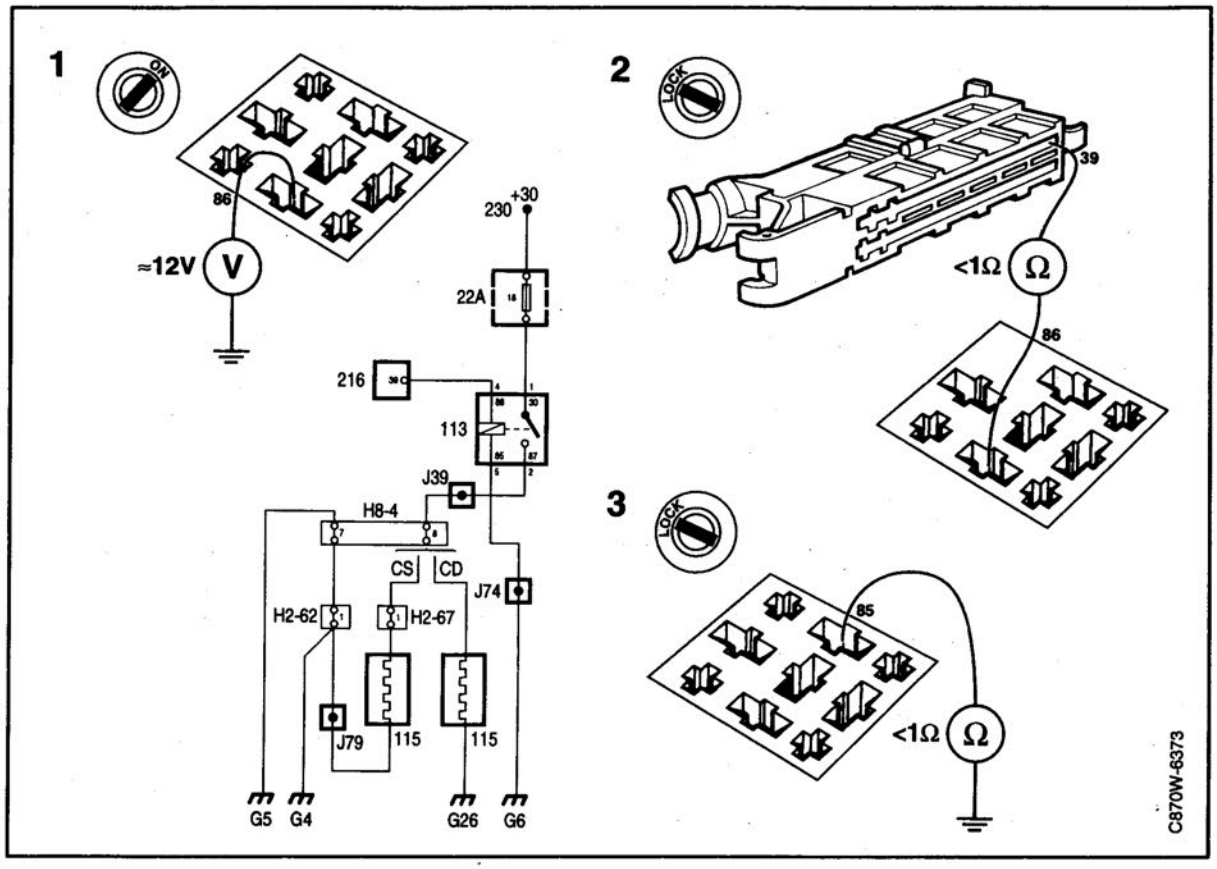
Action

1 Start the car engine. Press the AUTO button on the ACC control module panel. Connect the ISAT scan tool, contact the EDU and read "AC". The reading should be "ON". and change to "OFF" when the ECON button is pressed.

2 Check the wiring harness between pin 38 on the ACC control module and pin 10 on the EDU control module for short circuit to BPV/ground.

Diagnostic trouble codes B1497 and B1498

Electrically heated rear window, open or short circuit to ground.



Fault symptom

The electrically heated rear window cannot be switched on or off.

Conditions

B1497: Electrically heated rear window, open circuit.

B1498: Electrically heated rear window, short circuit to ground.

Action

1 Press the button for activating the electrically heated rear window on the ACC control module panel.
Remove the electrically heated rear window relay and measure the voltage between pin 4 (relay 86) and ground.
The voltage should be about 12 V.
If the value is correct, proceed to point 2.
If the value is incorrect, proceed to point 3.

2 Check the lead between contact 4 (relay 86) and pin 39 on the ACC control module for open/short circuit to ground.
Localize and remedy the fault.

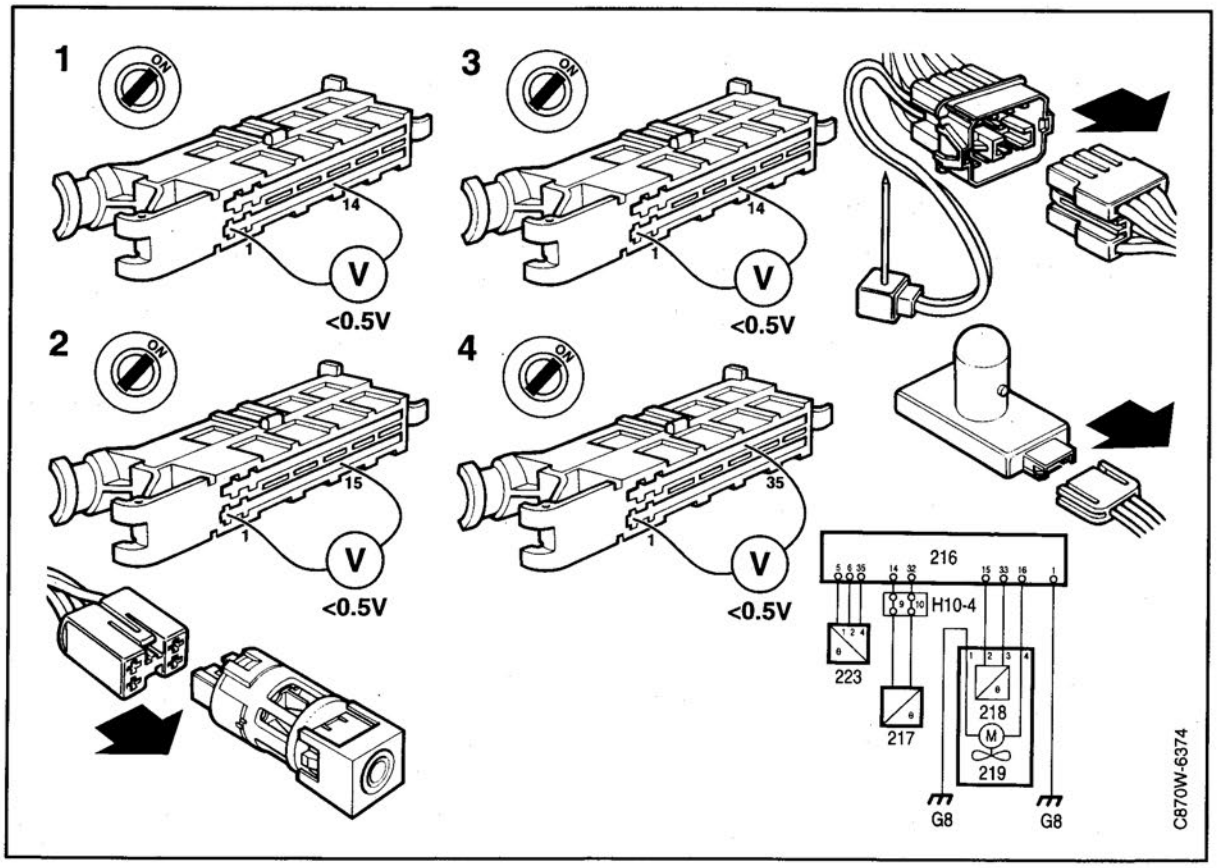
3 Check the lead between connector 5 (relay 85) and ground for open/short circuit to ground.
Localize and remedy the fault.

4 Change the relay.

5 If the fault remains, proceed to page 152 for further action.

Diagnostic trouble code B1515

Common sensor ground, short circuit to BPV.



Note

The cabin temperature sensor ground (pin 15), the blended air temperature sensor ground (pin 14) and the solar sensor ground (pin 35) have a common connection to the ACC control module.
For this reason, only one diagnostic trouble code can be detected.

Diagnostic trouble code B1515 can give the following consequential faults:
B1343, B1348 and B1353.

Conditions

Control module output pins 14, 15 or 35 are shorted to BPV.

Action

1 Connect a BOB and measure the voltage between pins 14 and 1 on the ACC control module.
Erase the diagnostic trouble code if the voltage is less than 0.5 volts.
Check that the diagnostic trouble code is not re–registered.

2 Unplug the cabin temperature sensor connector and measure the voltage between pins 15 and 1.
If the value is less than 0.5 volts, there is a fault in the cabin temperature sensor.
Change the cabin temperature sensor.

3 Unplug blended air temperature sensor connector H10–4 and measure the voltage between pins 14 and 1.

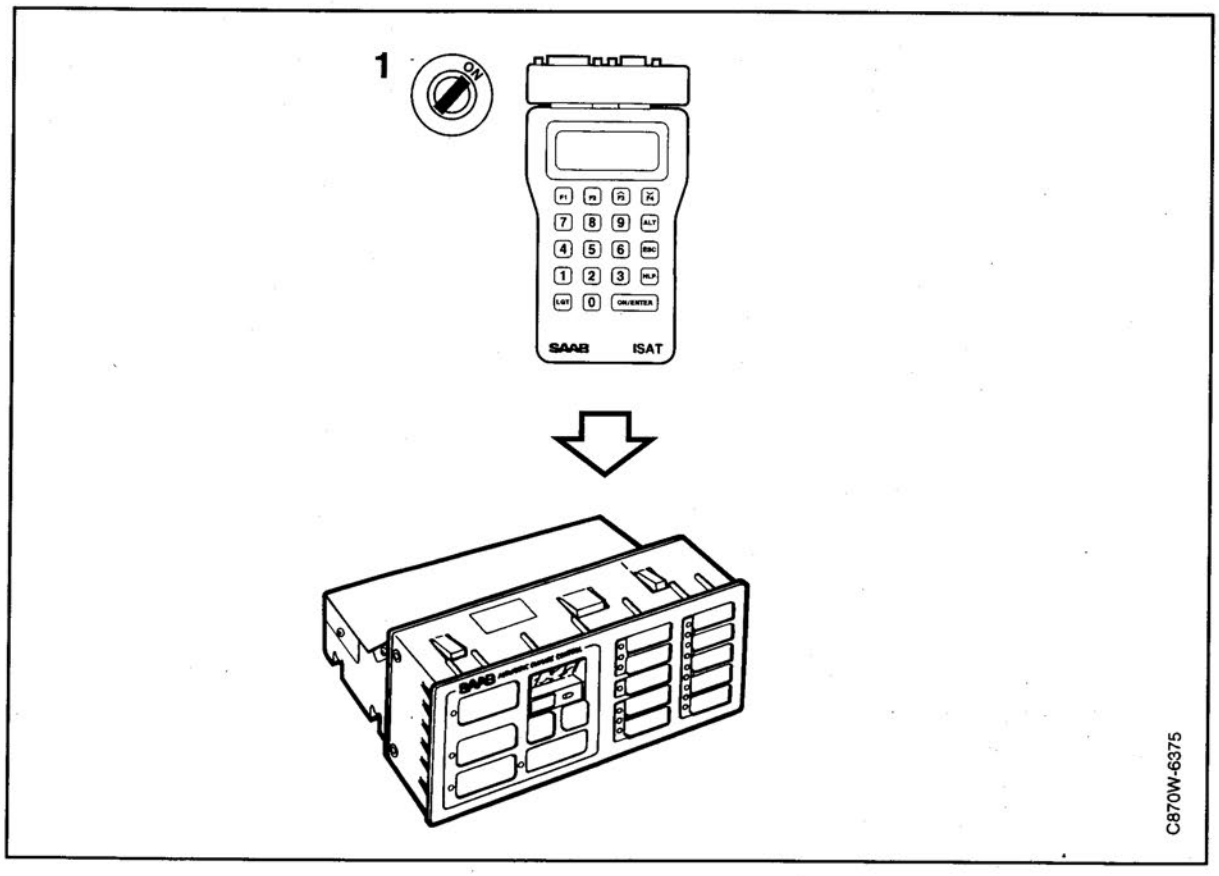
If the value is less than 0.5 volts, there is a fault in the blended air temperature sensor.
Change the blended air temperature sensor.

4 Unplug the solar sensor connector and measure the voltage between pins 35 and 1.
If the value is less than 0.5 volts, the fault is in the solar sensor.
Change the solar sensor.

5 The fault is in the wiring harness.
Localize and remedy the fault.

Diagnostic trouble code B1605

Control module fault.



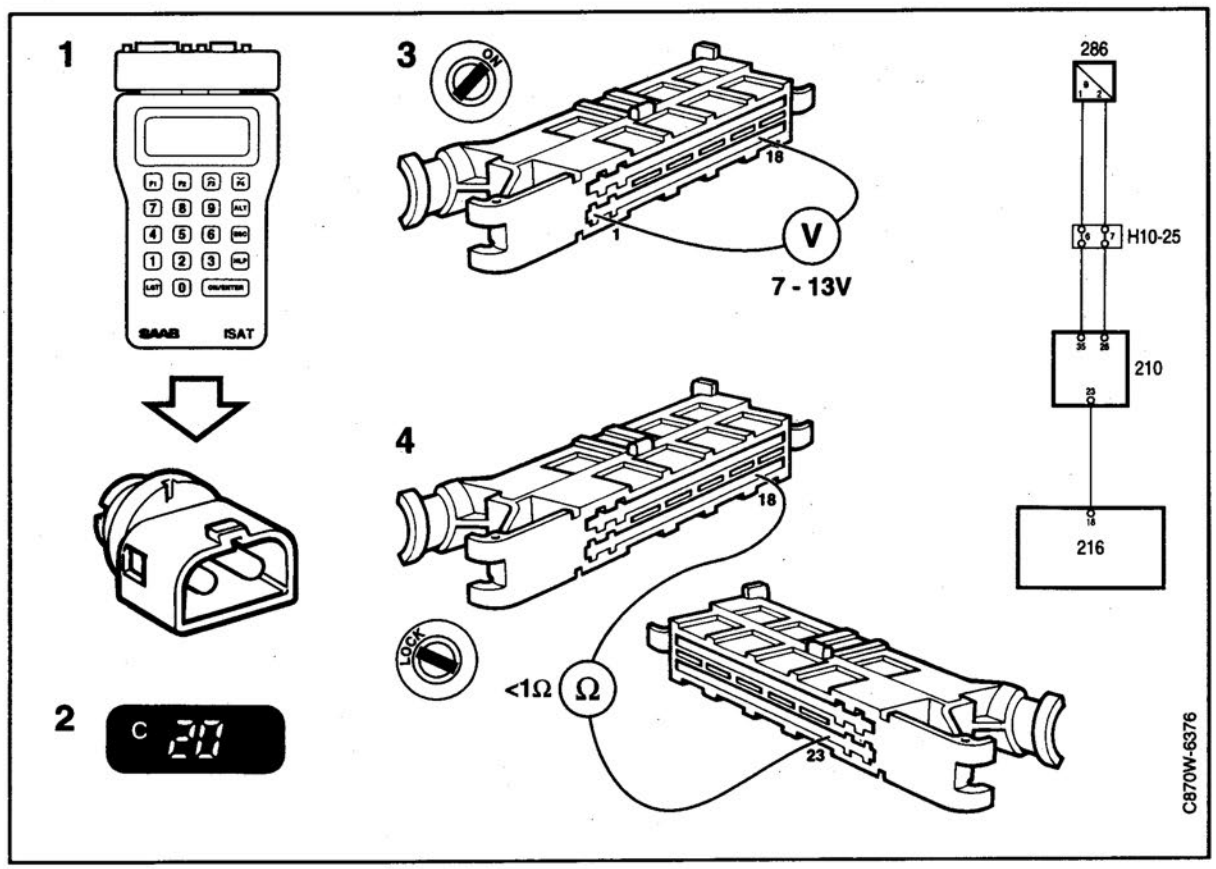
Action

1 Erase the diagnostic trouble code and check that is regenerated before starting with point 2.

2 Proceed to page 152 for further action.

Diagnostic trouble code B1746

Outsidé temperature sensor, open/short circuit.



Action

1 Connect the ISAT scan tool and read "OUTSIDE TEMP SENS".
Check that the temperature values correspond to ambiant air temperature.

2 Check that the temperature display on.the EDU is working. If not, carry out fault diagnosis on the EDU.

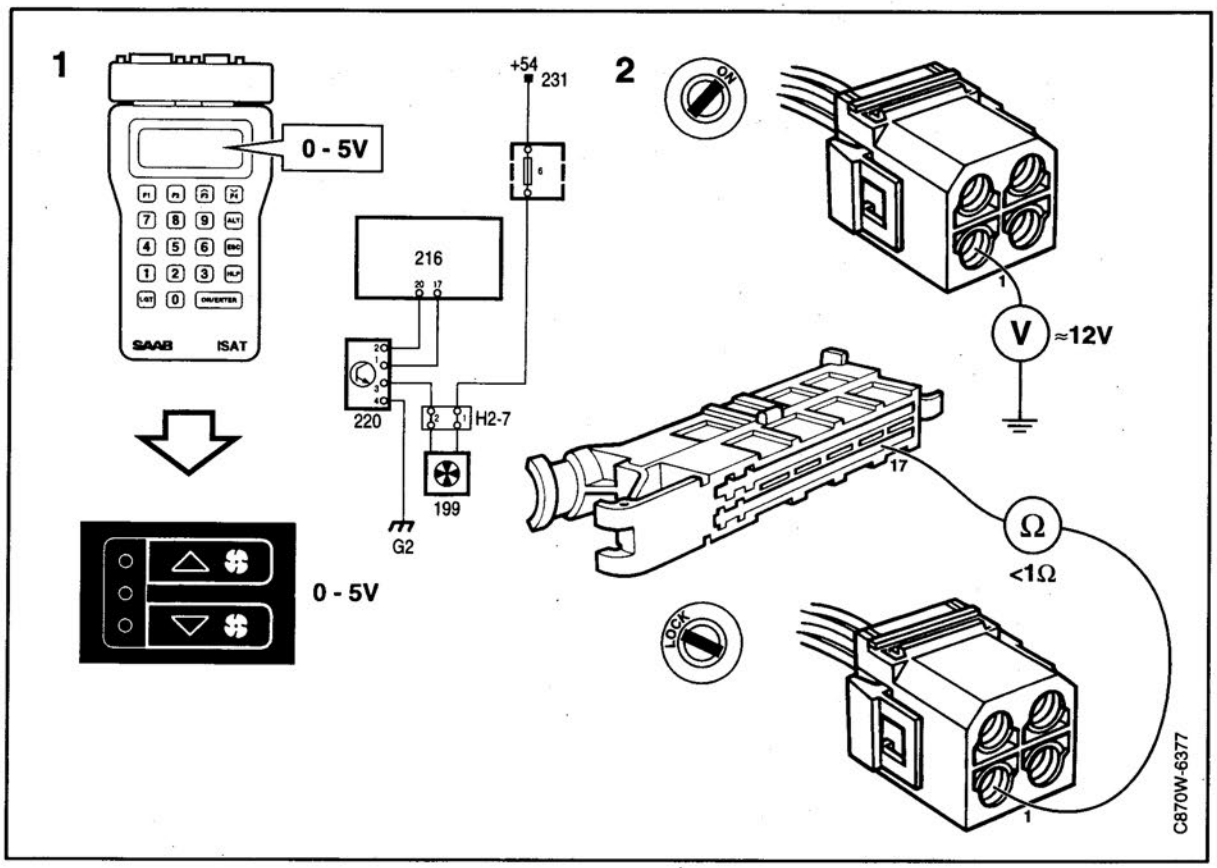
3 Remove the ACC control module. Connect a BOB and measure the voltage between pin 18 and pin 1 with the ignition on. The voltage should be about 7 – 13 volts (fluctuating). If the value is correct, proceed to page 152 for rurther action.

4 Check the lead between pin 18 on the ACC control module and pin 23 on the EDU control module for open/short circuits to ground.

5 Change the EDU control module.

Diagnostic trouble code B2352

Voltage supply to the cabin fan, short circuit to ground.



Fault symptom

Cabin fan, no or faulty function.

Action

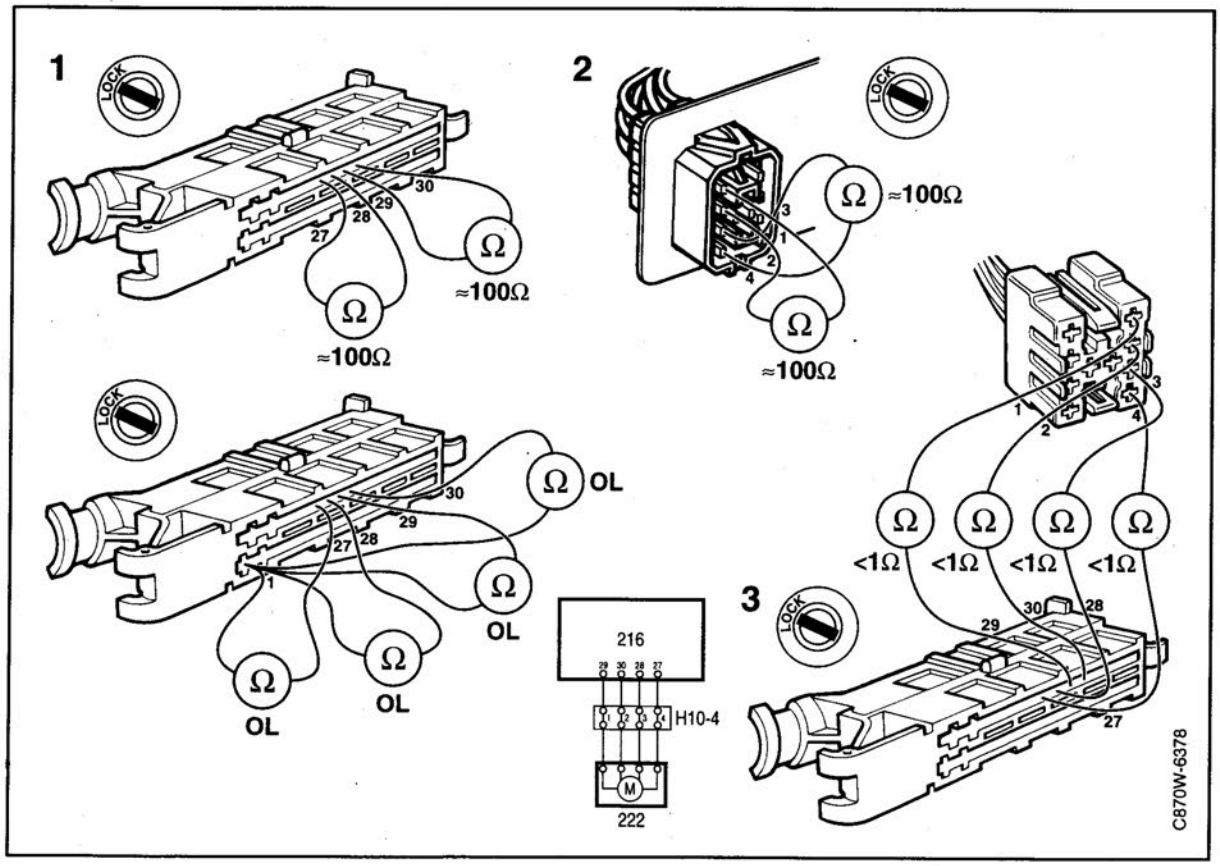
1 Connect the ISAT scan tool and read "FAN CONTROL VOLTAGE".
The ISAT scan tool gives the values in volts.
The correct value should be 0 – 5 V.
Non–activated fan gives 0 volts.
Maximum fan speed gives 5 volts.

2 Unplug the fan control module connector with the ignition on. Measure the voltage on pin 1.
The correct value should be about 12 V.
If the value is correct, change the fan control module.
If the value is incorrect, check the lead between pin 1 on the fan control module and pin 17 on the ACC control module for short circuit to ground.
Localize and remedy the fault.

3 If the fault remains, proceed to page 152 for further action.

Diagnostic trouble codes B2402 and B2403

Air distributor stepping motor, open/short circuit to ground.



Conditions

B2402: Short circuit to ground.

B2403: Open circuit, registered only when calibrating. Start fault diagnosis by reading any diagnostic trouble codes and noting them down.
Calibrate and read the diagnostic trouble codes again.

Action

1 Connect a breakout box (BOB) to the ACC control module wiring harness. The control module should not be connected.
Check winding resistance in both the stepping motor windings by measuring between connections 23 and 24 and between connections 25 and 26. Correct reading should be approx. 100 Ohm in both cases.
Also check that there is no short circuit to ground by measuring the resistance between ground connections 23, 24, 25 and 26. The correct value should be infinite (OL).
If all values are correct, proceed to point 4.

2 If the winding resistance is incorrect, repeat the measurement in connector H10–4 as follows:
- Measure between pins 5 and 6.
- Measure between pins 7 and 8.

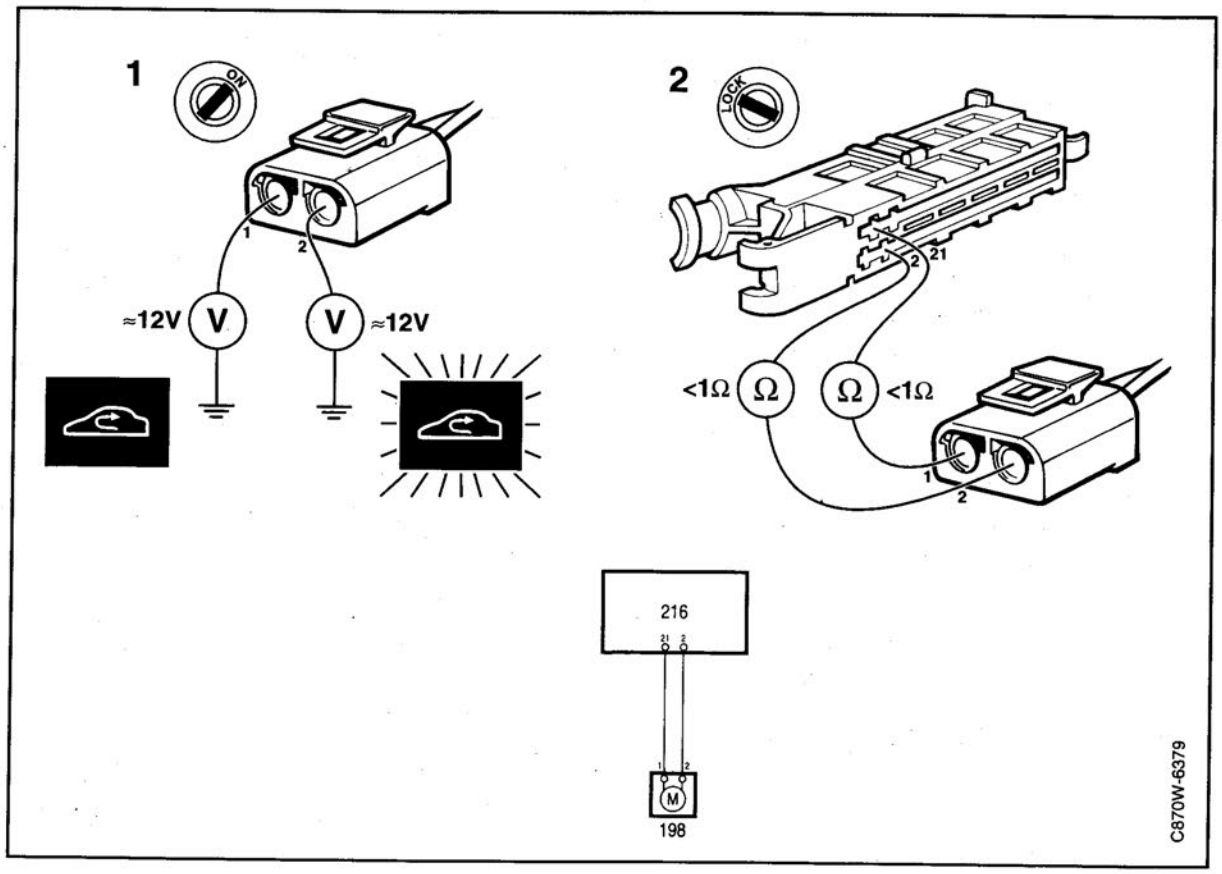
In both cases, the value should be about 100 ohms. If any of the values is incorrect, change the stepping motor.

3 Check the wiring harness between connector H10–4 and the ACC control module for short circuits to ground or short circuits between the connectors and/or open circuits.
Localize and remedy the short circuit.

4 Erase any diagnostic trouble codes.
Calibrate the ACC system.
If the diagnostic trouble code is reregistered.
Proceed to page 152 for further action.

Diagnostic trouble codes B2412 and B2413

Air recirculation flap motor, short circuit to ground/BPV.



Conditions

B2412: Control module output pin 2 or 21 shorting to ground.

B2413: Control module output pin 2 or 21 shorting to BPV.

Action

1 Unplug the recirculation motor's 2 pin connector. Measure voltage as follows:
Press the button on the ACC control module panel in order to activate the recirculation motor.
Measure the voltage between pin 2 in the connector and ground.
Then press the button again to switch off the air recirculation feature.
Measure the voltage between pin 1 in the connector and ground.
In both cases, the reading should be about 12 volts.
If the values are correct, change the air recirculation motor.

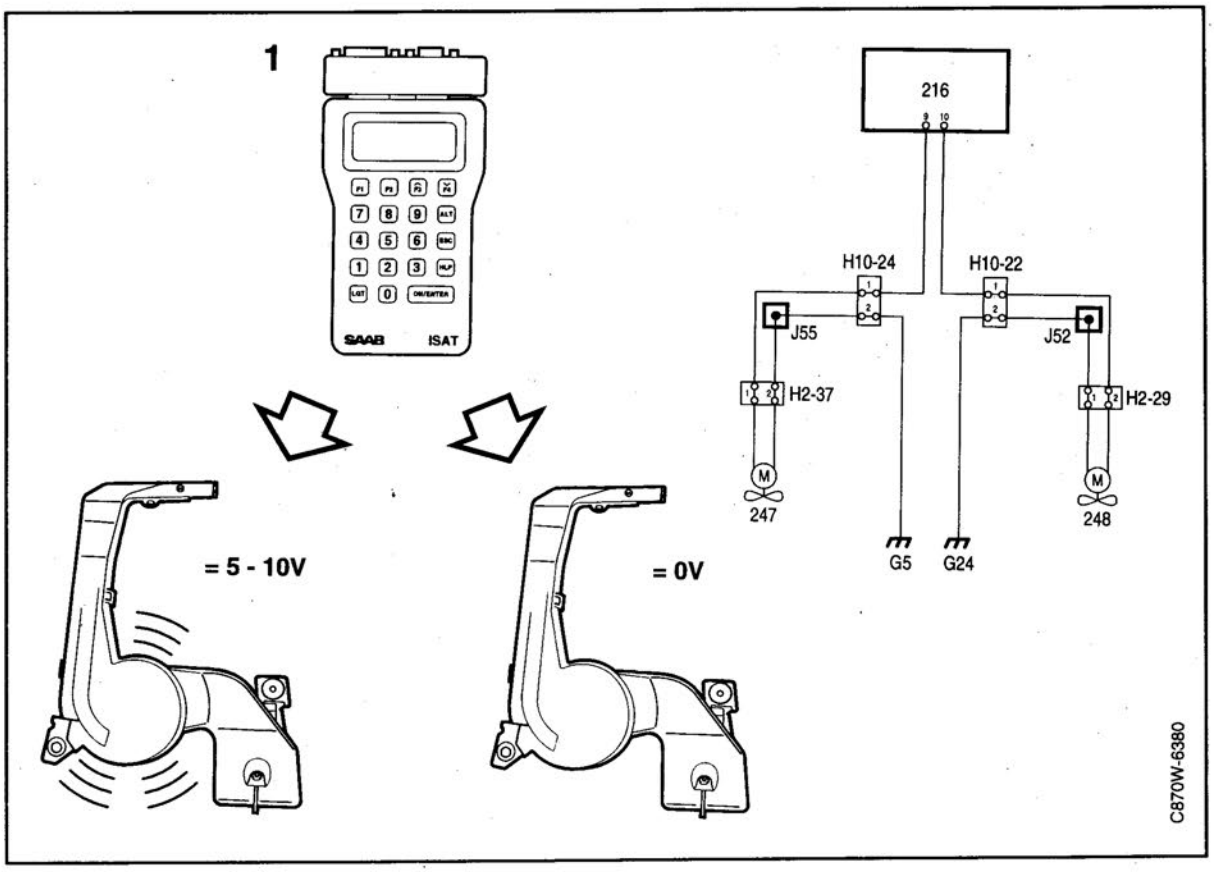
2 Check the wiring harness for open/short circuits as follows:
- Between pin 21 on the ACC control module and pin 1 in the air recirculation motor connector.
- Between pin 2 on the ACC control module and pin 2 in the air recirculation motor connector.

Localize and remedy the open/short circuit.

3 Proceed to page 152 for further action.

Diagnostic trouble codes B2437 and B2438

Rear door fans, open/short circuit to ground/BPV.



Conditions

B2437: Short circuit to ground.

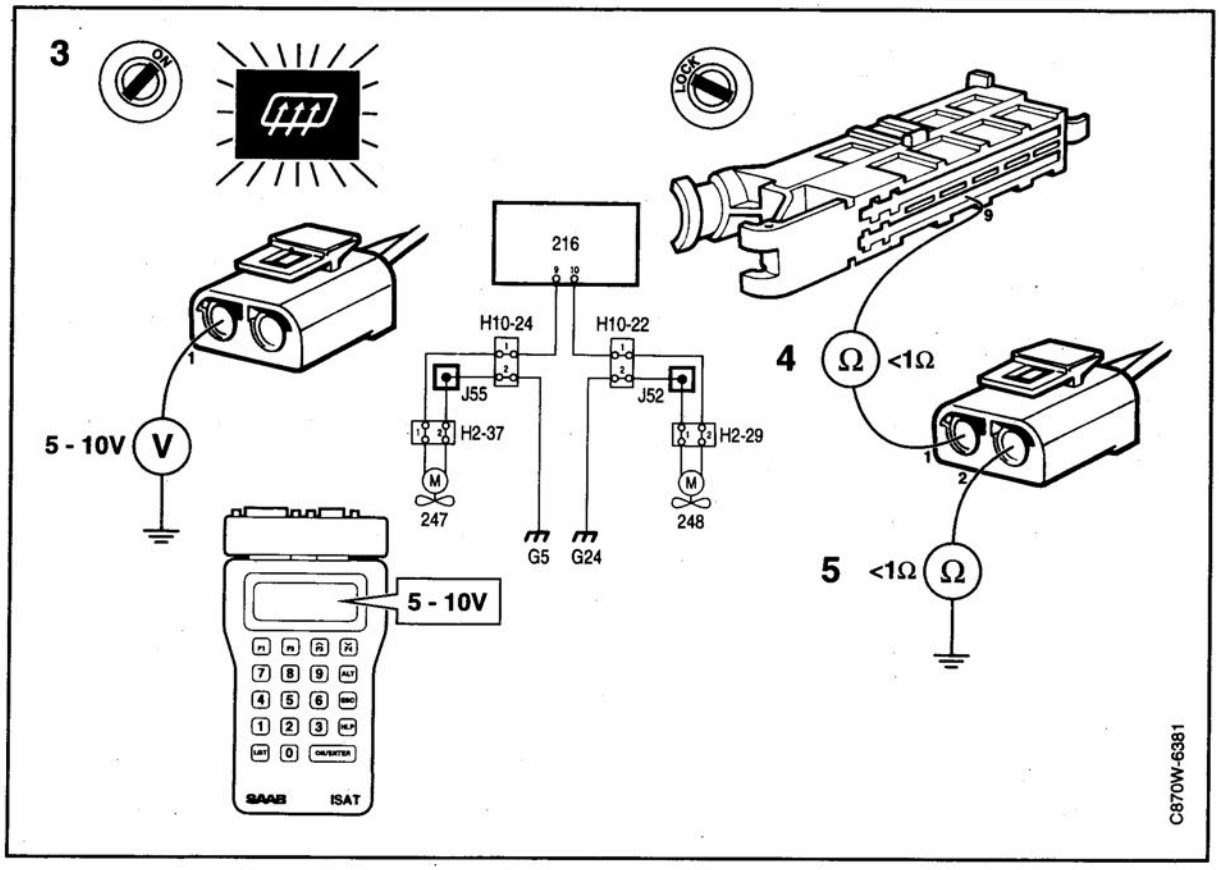
B2438: Open/short circuit to BPV.

Action

1 Connect the ISAT scan tool and read "REAR DOOR FANS".
The values are displayed in volts.
As the rear door fans are switched off, 0.0 Volt is displayed. When the rear door fans are activated, voltage varies between approx. 5 – 10 volts, depending on selected fan speed.

2 Check which rear door fan is not working.
If the left–hand rear door fan is not working, proceed to point 3 on page 147.
If the right–hand rear door fan is not working, proceed to point 7 on page 148.

Diagnostic trouble codes B2437 and B2438 (contd.)



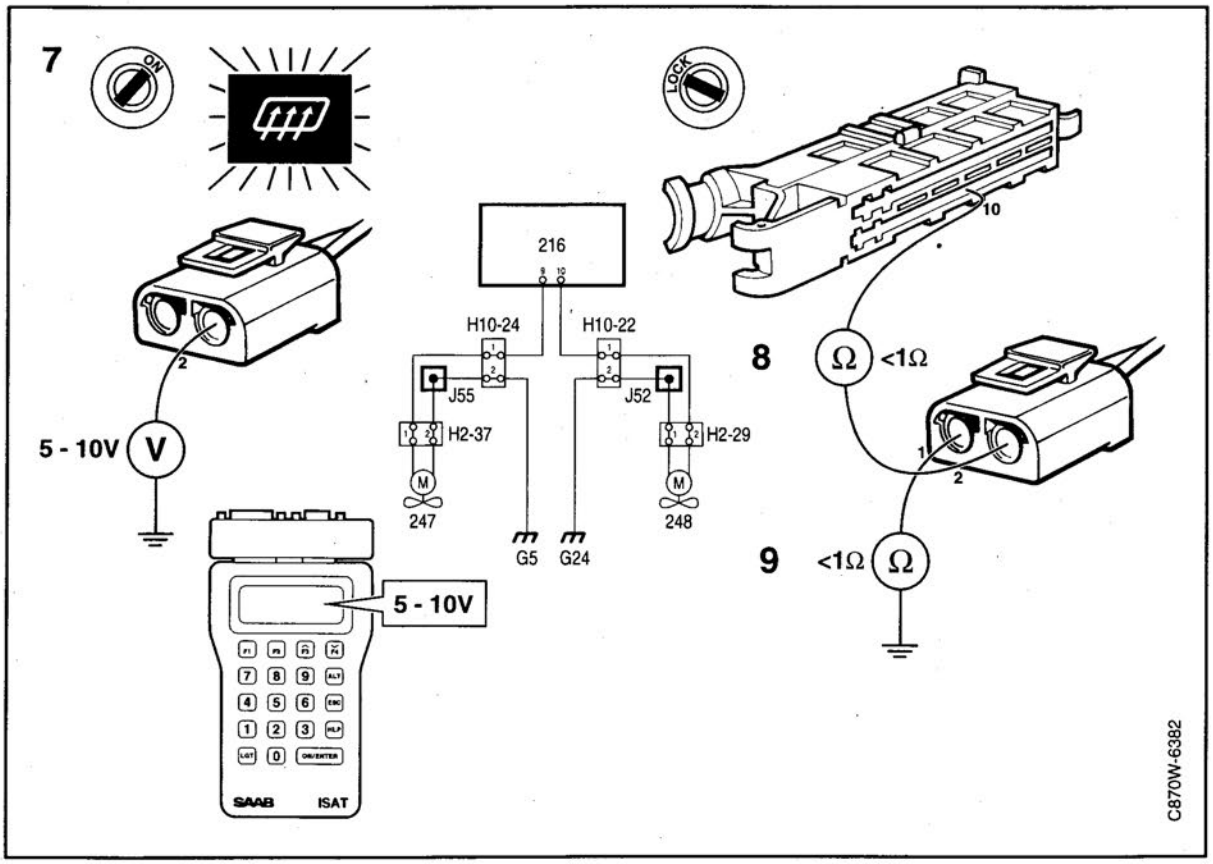
3 Unplug the connector (H2–37) beside the rear door fan and measure the voltage between pin 1 and ground.
Press the button on the ACC control module panel for activating the rear door fans and read the value.
The correct reading should be about 5 – 10 V.
Compare with point 1.
If the reading is incorrect, proceed to point 4. If the reading is correct, proceed to point 5.

4 Check the wiring harness between pin 9 on the ACC control module and pin 1 in connector H2–37 for open/short circuits.
Localize and remedy the fault.
If there is still no voltage, proceed to page 152 for further action.

5 Check the wiring harness between pin 2 in connector H2–37 and ground for open/short circuits.
Localize and remedy the fault.

6 Change the left–hand rear door fan.

Diagnostic trouble codes B2437 and B2438 (contd.)



7 Unplug the connector (H2–29) beside the right–hand rear door fan and measure the voltage between pin 2 in the connector and ground. Press the button on the ACC control module panel to activate the rear door fans and read the value. The correct reading should be about 5 – 10 volts. Compare with point 1.
If the value is incorrect , proceed to point 8. If the value is correct, proceed to point 9.

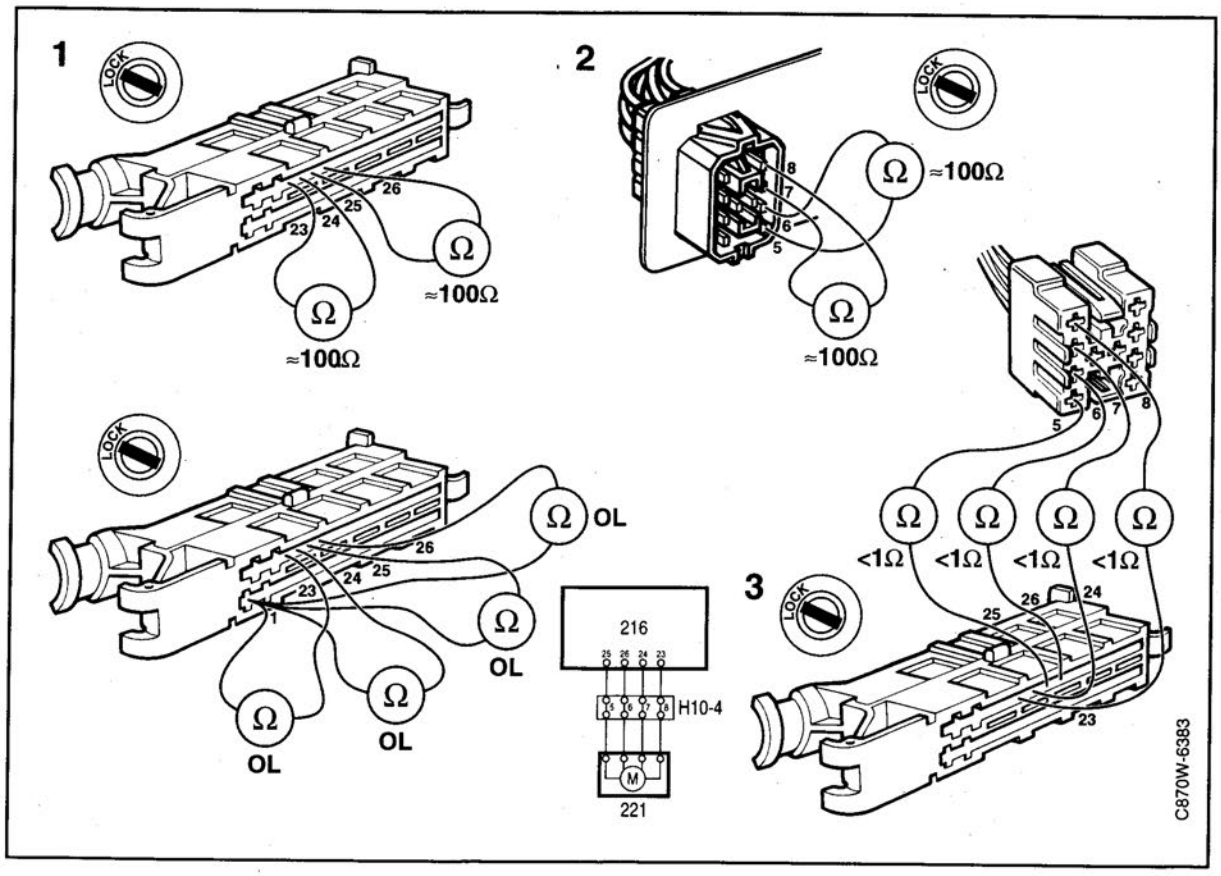
8 Check the wiring harness from pin 10 on the ACC control module to pin 1 in connector H2–29 for open/short circuits.
Localize and remedy the fault.
If there is still no voltage, proceed to page 152 for further action.

9 Check the wiring harness between pin 2 in connector H2–29 and ground for open/short circuits.
Localize and remedy the fault.

10 Change the right–hand rear door fan.

Diagnostic trouble codes B2492 and B2493

Air mixing damper stepping motor, open/short circuit to ground.



Conditions

B2492: Short circuit to ground.

B2493: Open circuit, registered only when calibrating. Start fault diagnosis by reading any diagnostic trouble codes and noting them down.
Calibrate and read the diagnostic trouble codes again.

Action

1 Connect a BOB to the ACC control module's wiring harness. Control module should not be connected.
Check the winding resistance in both the stepping motor windings by measuring between connections 27 and 28 as well as between connections 29 and 30.
In both cases, the correct value should be about 100 ohms.
Also check that there is no short circuit to ground by measuring the resistance between pin 1 and pins 27, 28, 29 and 30.
The correct value should be infinite (OL).
If all values are correct, proceed directly to point 4.

2 If the winding resistance is incorrect, repeat the measurement in connector H10–4 as follows:
- Measure between pins 1 and 2.
- Measure between pins 3 and 4.

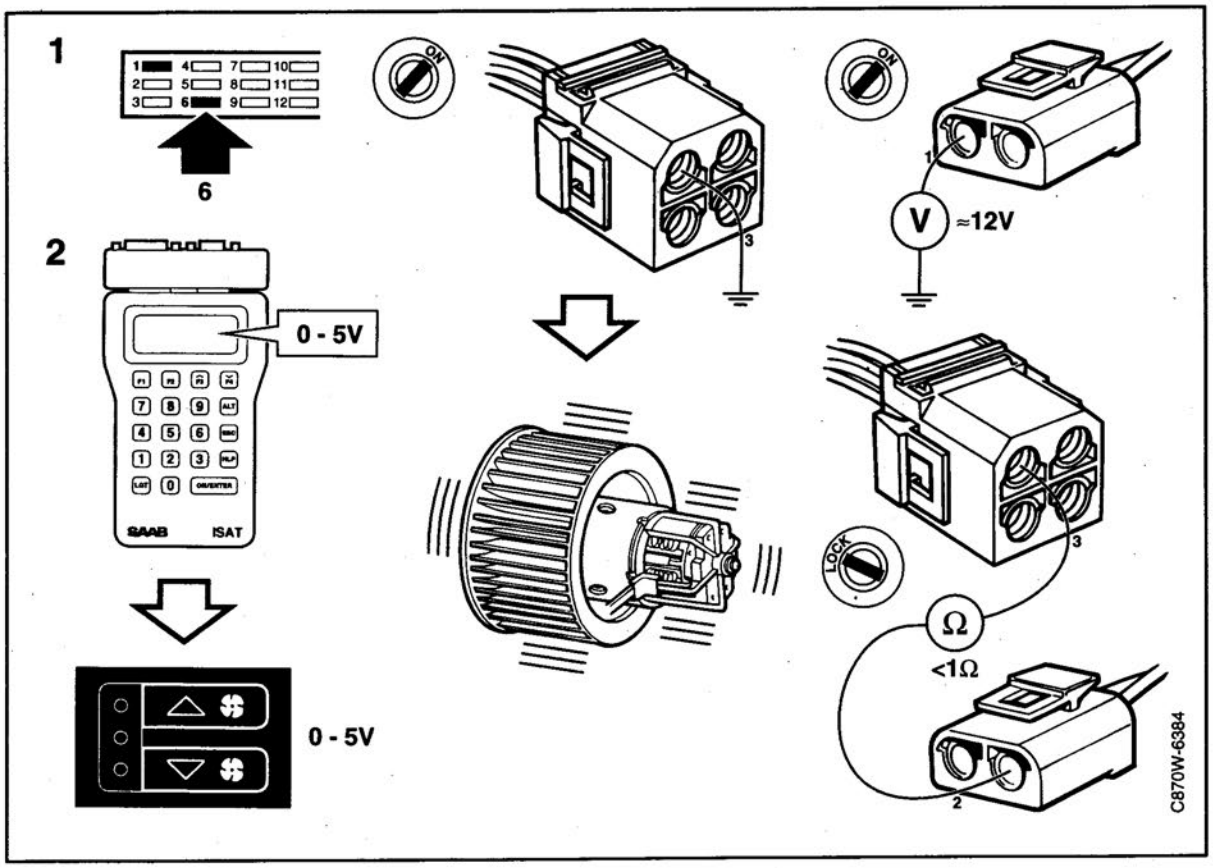
In both cases, readings should be approx. 100 Ohm.
If any of the values are incorrect, change the stepping motor.

3 Check the wiring harness between connector H10–4 and the ACC control module for short circuits to ground or short circuits between the connectors and/or open circuits.
Localize and remedy the short circuit.

4 Erase any diagnostic trouble codes.
Calibrate the ACC system.
Check to see if the diagnostic trouble code returns.
Proceed to page 152 for further action.

Faults with no diagnostic trouble code

Cabin fan motor, not working / faulty control.



Symptom

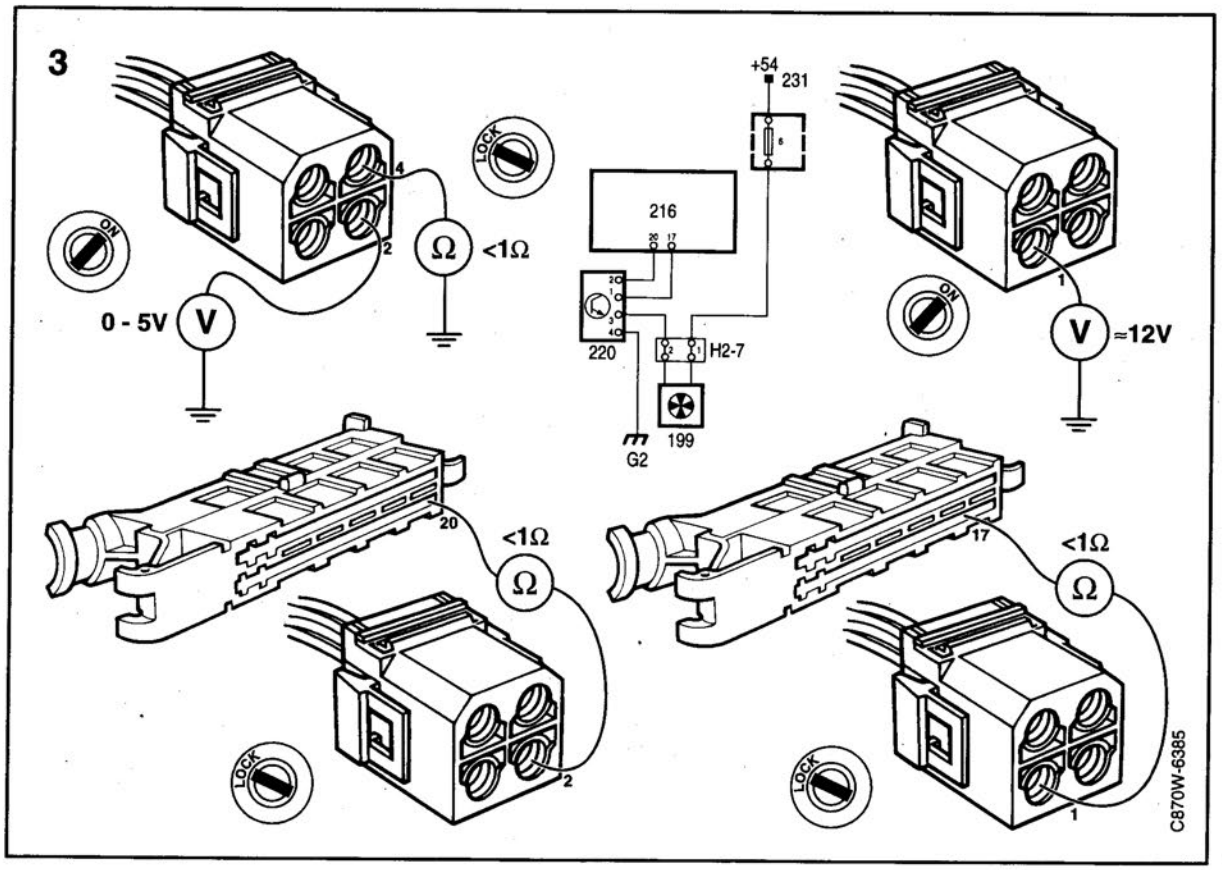
Ventilation fan motor not working
Faulty control of ventilation fan motor.

Action

1 Check that fuse 6 in fuse board 22A is intact.

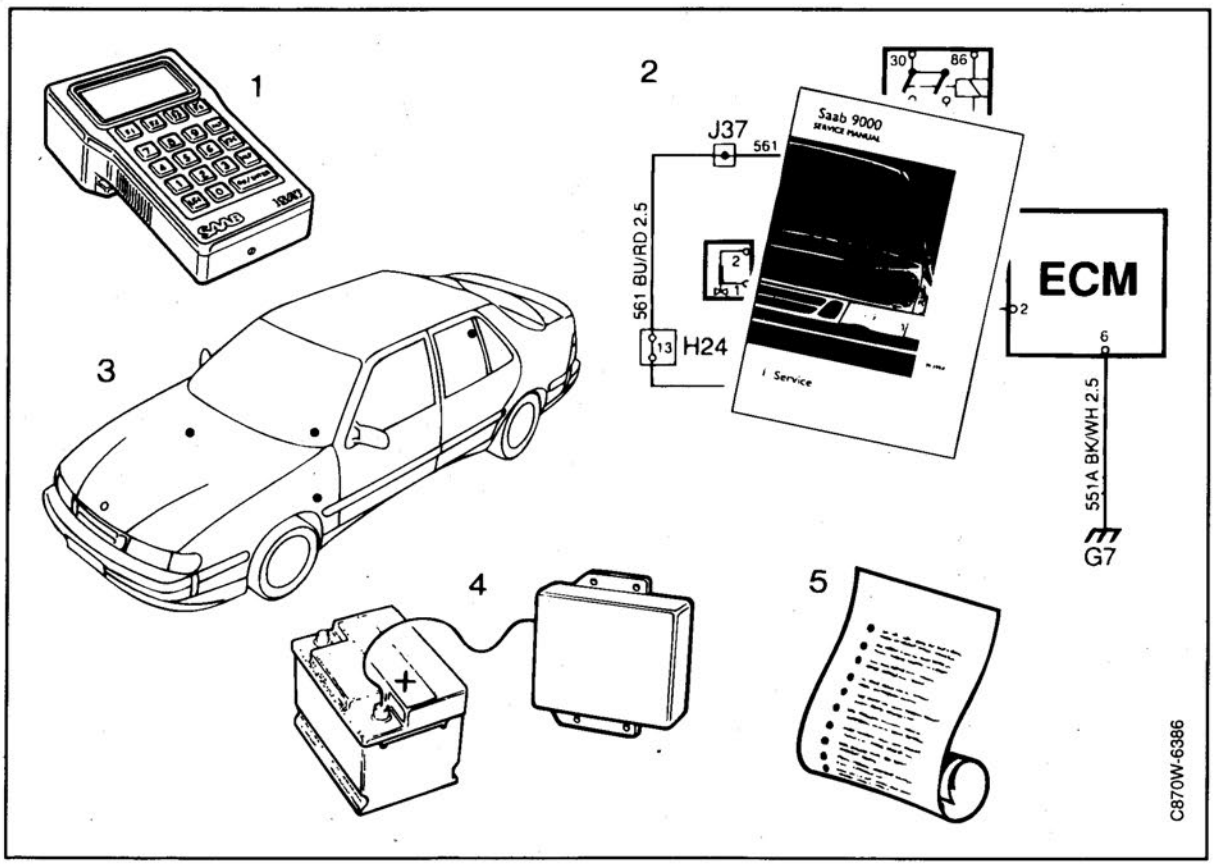
2 Connect the ISAT scan tool and read "FAN CONTROL VOLTAGE". The correct values should be 0 – 5 volts, where 0 V is a stationary fan and 5 V is full speed.
Manually step up fan speed on the ACC control module panel. At the same time, read the value for control voltage.
If there is no voltage, proceed to page 152 for further action.
If there is voltage, unplug the fan control module connector. Ground pin 3 with the ignition on.
The fan should now run at full speed.
If the fan runs at full speed, proceed to point 3.
If the fan does not run at full speed, check that there is battery positive voltage to pin 1 in connector H2–7 to the fan motor.
Check the lead between pin 2 in connector H2–7 and pin 3 in the fan control module connector for open circuit.
If the fault remains, change the fan motor.

Faults without diagnostic trouble code (contd.)



3 Unplug the fan control module connector and measure the resistance between pin 4 and ground. Check the wiring harness for open circuit.
Localize and remedy the fault.
Unplug the fan control module connector with the ignition on. Measure the voltage to pin 2. The correct value is 0 – 5 volts.
If there is no voltage, check the cable assembly between pin 2 in the fan control module connector and pin 20 in the ACC control module connector for open/short circuits to ground.
Measure the voltage on pin 1 in the fan control module connector. The correct voltage is about 12 V.
If there is 12 V, change the fan control module.
If there is no voltage, check the wiring harness between pin 1 in the fan control module connector and pin 17 in the ACC control module connector for open/short circuit to ground.
If the fault remains, proceed to page 152.

Action before changing a control module



When all checks have been made as described in the action schedule under the appropriate diagnostic trouble code or by manual fault diagnosis, and no fault has been detected, it is natural to assume that the control module is faulty.
Considering that the control module is both a high quality and an expensive component, it is important to be as sure as possible of the diagnosis.
For this reason, run through the following points before definitely deciding that the control module is the cause of the fault.

1 Check one more time that all the checks in the appropriate fault diagnosis schedule have been followed through.

2 Study the appropriate wiring diagram and make sure that you understand it. If necessary, consult the appropriate parts of the technical description and the electrical function description in Service Manual "3:2 Electrical system, wiring diagrams".

3 Check all grounding points. If you have done this before, do it again.

4 Check the voltage supply to the control module.

5 Go through the points under "General fault diagnosis" on page 82 one more time.

6 If, despite this, the original fault remains, the ACC control module must be changed.

Refrigerant

Draining / charging and converting refrigerant

Safety instructions

Remember the following when working with A/C installations:

Wear close–fitting eye protection, as there is a danger of release of refrigerant.

In addition, hands and skin should be protected as there is a danger of frost bite.

If refrigerant comes into contact with the skin, bathe with cold water and treat the injury as a frost injury.

If refrigerant gets into the eyes, rinse with plenty of ordinary water, preferably for at least 15 minutes.

If symptoms persist, seek medical attention.

⚠ WARNING

If a refrigerant container is heated, the pressure inside increases and there is a danger of explosion.

Gases generated when refrigerant is heated are toxic. These gases have a serious effect on the lungs.

Do not smoke or use naked flames when working with refrigerant as it can be broken down into poisonous gases at high temperatures. The gases generated from heating have an acrid smell at high concentrations.

Draining /charging, R12

Compressor oil – topping up and adjusting for R12

Too much oil gives poor cooling. Too little oil damages the compressor. When repairing leaks, or changing any components, the compressor oil must be topped up. The quantity of oil for each component depends on whether the leakage was slow or quick. Use mineral oil for the R12 system.

The A/C system is filled with 135 ml of compressor oil. A certain amount of compressor oil is always lost when draining refrigerant and replacing components. This amount must be recharged so that the operation of the system will not be adversely affected.

R12 systems use mineral oil.

Compressor oil should be topped up through the compressor oil plug.

The table below shows how much compressor oil is lost in connection with various types of work on the A/C system.

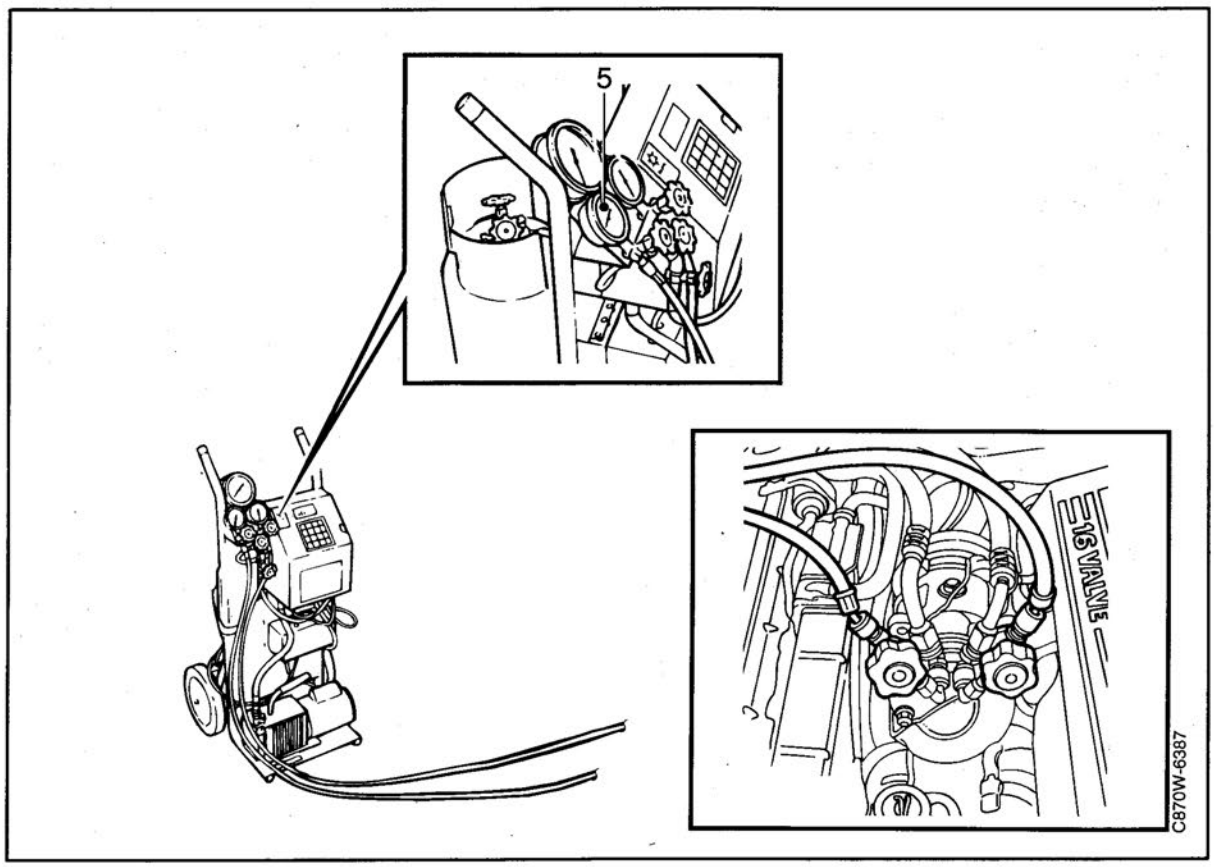
Reason for loss of oil	Amount of oil lost
Draining refrigerant	20 ml
Burst A/C hose	30 ml
Replacement of hose	15 ml
Replacement of condenser	30 ml
Replacement of evaporator	30 ml
Replacement of desiccant container	20 ml
Replacement of expansion valve	15 ml
Replacement of compressor*	60 ml*

*Note that the new compressor is filled with 135 ml of oil before delivery. In order not to have too much oil in the A/C system, and so impaired cooling, oil must be drained from the compressor before it is fitted. How much will depend on the amount of oil that has been lost in connection with the replacement of other components, if any. The A/C system should always contain 135 ml of compressor oil.

If only the compressor is being changed, 75 ml of oil should be dråined from the new compressor (135 – 60 = 75). If, for example, the desiccant container is also being changed, only 20 ml of oil should be drained from the compressor, as per the following example:

135 ml	(in a new compressor)
–20 ml	(lost during draining)
–20 ml	(lost when changing the desiccant container)
–60 ml	(lost when changing the compressor)
=35 ml	(to be drained from the new compressor)

Draining /charging, R12



Measuring pressure with the Robinair Smart Cart

Description of equipment, see page 162.

1 Check that the cock on the blue low–pressure hose and the cock on the red high–pressure hose on the pressure gauge stand are both closed.

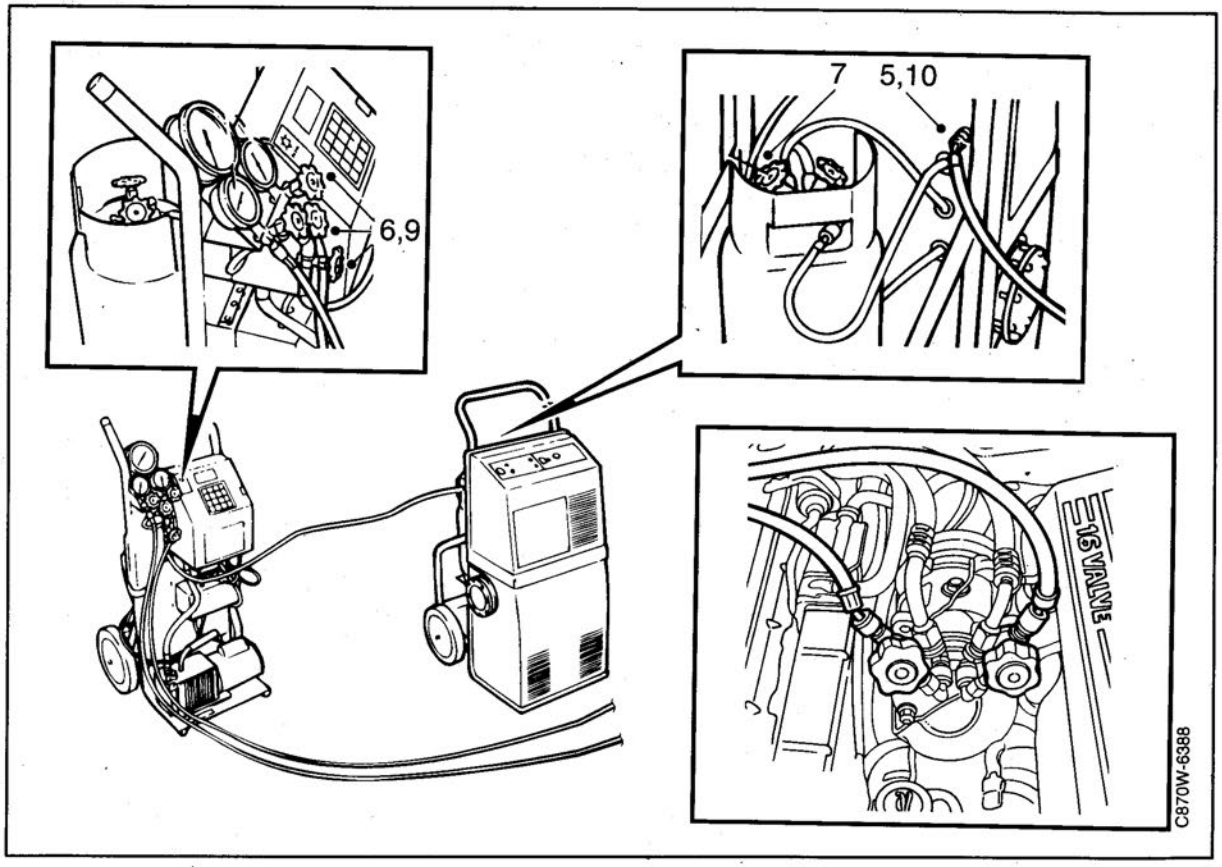
2 Connect the blue low–pressure hose to the low–pressure side of the compressor.

3 Connect the red high–pressure hose to the high–pressure side of the compressor.

4 Start the engine.

5 At engine speeds between 1500 and 2000 rpm and when air temperature is 20° C (68°F), it should be possible to read the following pressures on the pressure gauge when the compressor is working:
Low–pressure side: 1–3 bar
High–pressure side:10.5–14.5 bar

Draining /charging R12 (contd.)



Draining

Robinair Smart Cart and Robinair 17234 draining station

1 Connect the blue low–pressure hose to the low–pressure side of the compressor.

2 Connect the red high–pressure hose to the high–pressure side of the compressor.

3 Using the yellow hose, connect the pressure gauge stand's middle outlet to the draining station.

4 Open the cocks on the blue low–pressure hose and the red high–pressure hose and the cock on the yellow hose connected to the pressure gauge stand's middle outlet.

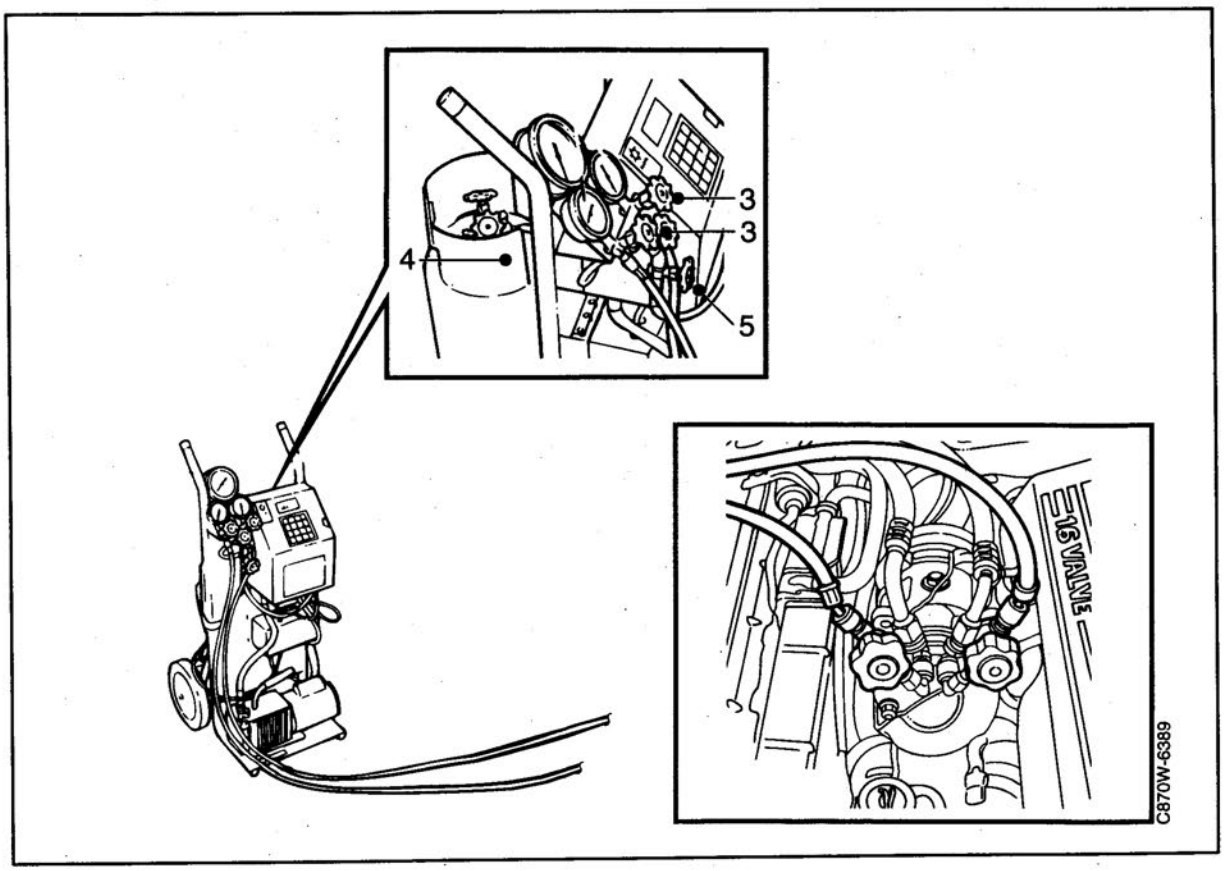
5 Open the blue cock ("Liquid") for liquid refrigerant and the red cock ("Gas") for gaseous refrigerant on the draining station's container.

6 Start the draining station. When draining is completed, the draining station automatically switches off or the pressure gauge shows 0.

7 Close the cocks on the blue low–pressure hose, the red high–pressure hose and the yellow hose connected to the pressure gauge stand's middle outlet.

8 Remove the yellow hose from the draining station. Draining is now completed and work on the A/C system can commence.

Draining /charging R12 (contd.)



Vacuum pumping and topping up

Make sure that the amount of compressor oil in the A/C system is correct before starting vacuum pumping and charging. See the table on page 155 in this section.

1 Connect the blue low–pressure hose to the low–pressure side of the compressor.

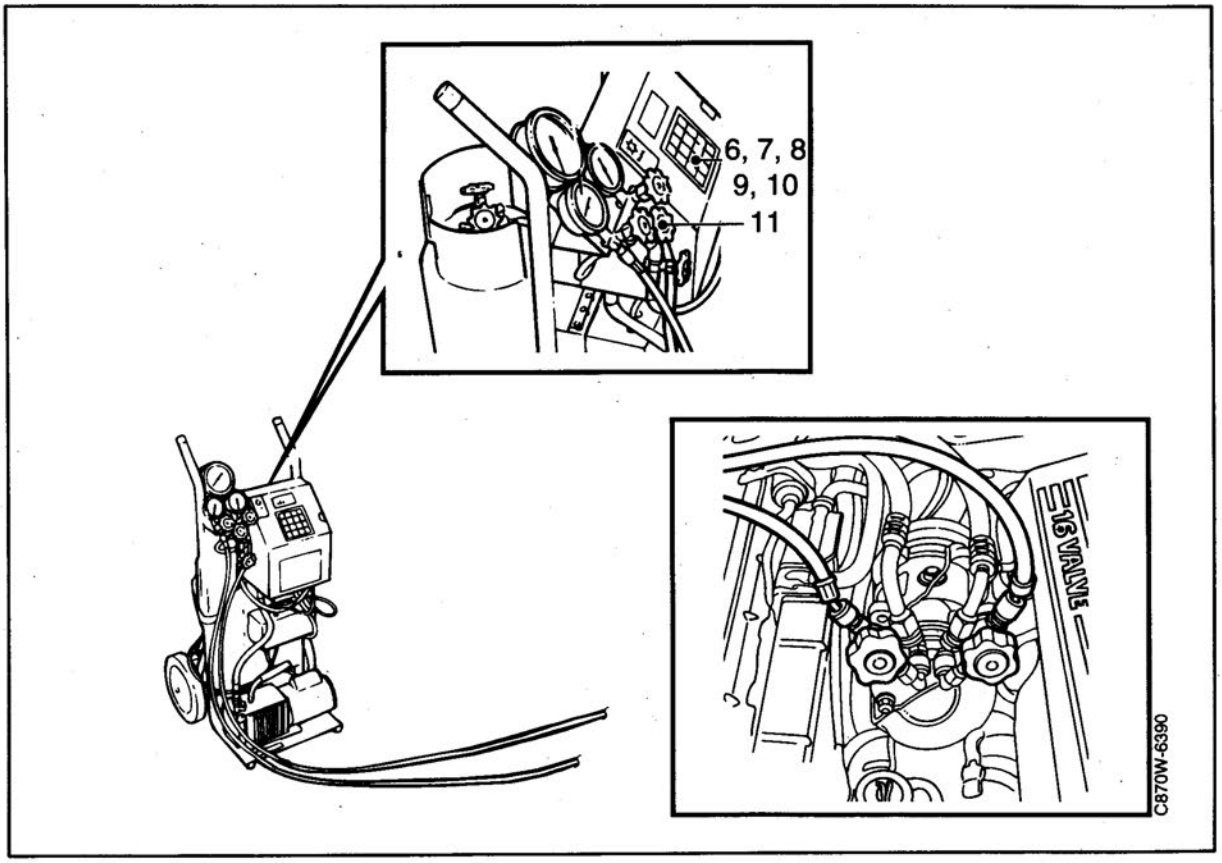
2 Connect the red high–pressure hose to the high–pressure side of the compressor.

3 Open the cocks on the blue low–pressure hose and red high–pressure hose on the pressure gauge stand.

4 Open the blue cock ("Liquid") for liquid refrigerant on the container on the Smart Cart.

5 Check that the cock on the yellow hose on the pressure gauge stand's middle outlet is closed.

Draining /charging R12 (contd.)



6 Program vacuum pumping for 30 minutes by pressing "30" on the control panel in the "Vacuum minutes" position. Acknowledge the selection by pressing "ENTER".

7 Press "REV. PROG".

8 Enter "1.10" to specify the number of kilogrammes of refrigerant to be charged. Acknowledge the selection by pressing "ENTER".

9 Press "REV. PROG".

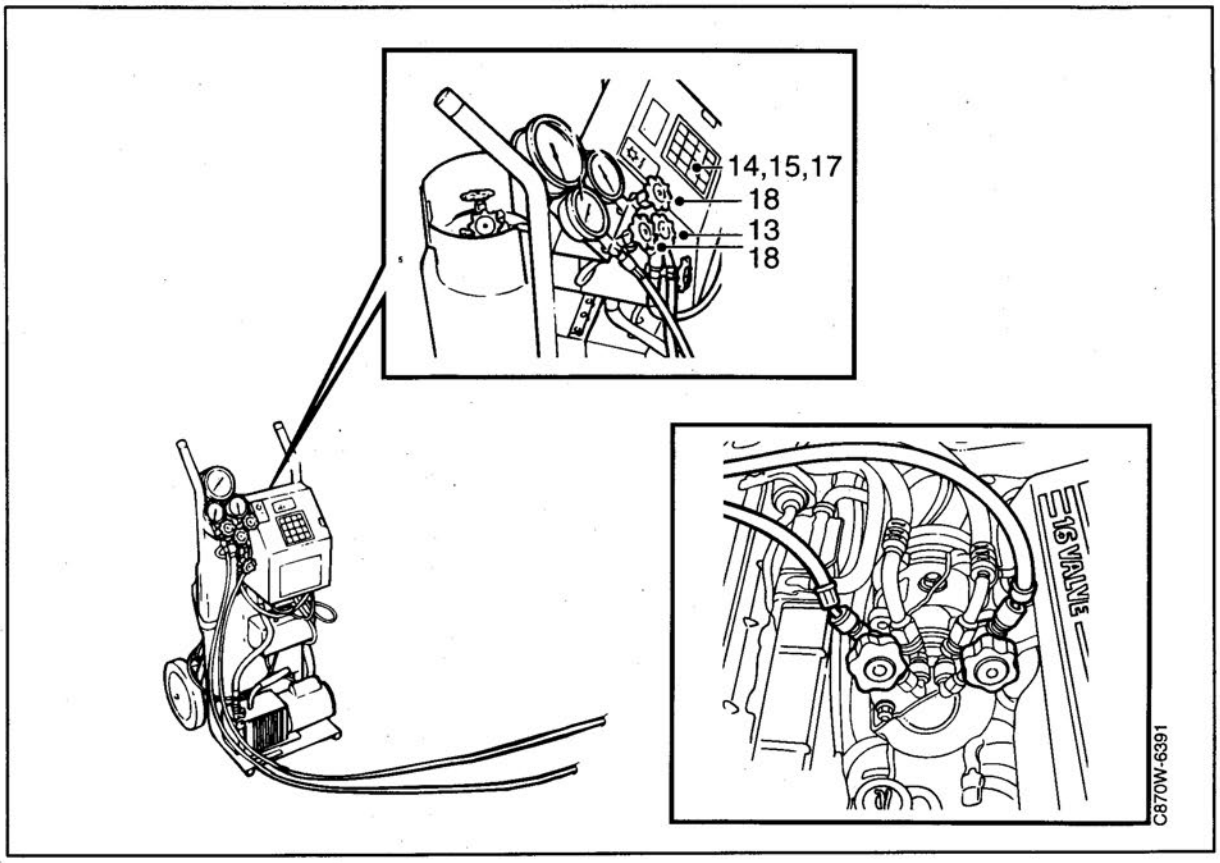
10 Press "START" to start vacuum pumping.

11 When vacuum pumping is completed, pressure should be below 10 m bar.

12 Move the A/C hoses slightly and make sure that there are no leaks in the system.

The pressure must not increase by more than 10 mbar in 5 minutes.

Draining /charging R12 (contd.)



13 close the cock to the blue low pressure hose on the pressure gauge

14 Press "START" to start charging of refrigerant.

15 Stop the charging process by pressing "HOLD" when about 200 grammes of refrigerant has been filled.

16 Move the A/C hoses slightly and check that the system is not leaking using a leakage detector for R12.

17 Continue the charging process by pressing "START". When charging is complete, the display on the control panel shows "CPL".

18 Close the cock to the red high–pressure hose to the pressure gauge.

19 Start the car and wait until the compressor starts working.
Pressure on the low–pressure side should be between 1.0–3.0 bar and check that the radiator fan switches on between 10.5 – 14.5 on high–pressure side.

20 Remove the connections on the compressor and refit the protective plugs over the service valves.

Draining /charging R134a

Refrigeration oil – topping up and adjusting for R134a

The A/C system is filled with 200 ml of compressor oil. A certain amount of compressor oil is always lost in connection when draining refrigerant and replacing components. This amount must be recharged so that the operation of the system will not be adversely affected.

Systems with R134a use P.A.G. oil, part number 40 74 787.

Charging compressor oil should be carried out on the compressor's high–pressure side. Compressor oil is supplied in tubes of 20 ml.

The table below shows how much compressor oil is lost in connection with various types of work on the A/C system.

Reason for loss of oil	Amount of oil lost
Draining of refrigerant	20 ml
Burst A/C hose	40 ml
Replacement of hose	20 ml
Replacement of condenser	40 ml
Replacement of evaporator	40 ml
Replacement of desiccant container	40 ml
Replacement of expansion valve	20 ml
Replacement of compressor*	70 ml*

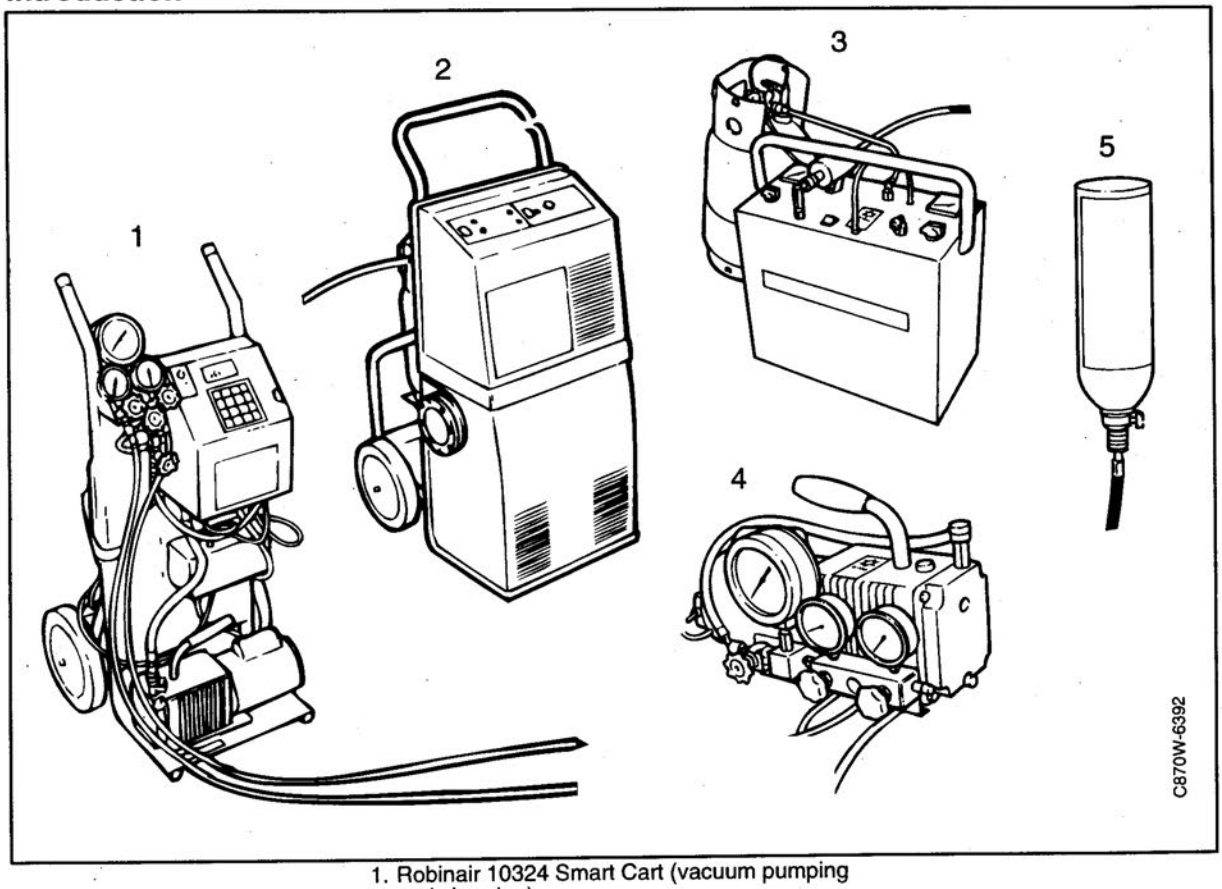
*Note that the new compressor is filled with 200 ml of oil before delivery. In order not to have too much oil in the A/C system, and so impaired cooling, oil must be drained from the compressor before it is fitted. How much will depend on the amount of oil that has been lost in connection with the replacement of other components, if any. The A/C system should always contain 200 ml of compressor oil.

If only the compressor is being changed, 130 ml of oil should be drained from the new compressor (200 – 70 = 130). If, for example, the desiccant container is also being changed, only 70 ml of oil should be drained from the compressor, as per the following example:

200 ml	(in a new compressor)
–20 ml	(lost during draining)
–40 ml	(lost when changing the desiccant container)
–70 ml	(lost when changing the compressor)
=70 ml	(to be drained from the new compressor)

Draining /charging, R134a

Introduction



1. Robinair 10324 Smart Cart (vacuum pumping and charging)
2. Robinair 17234 (draining)
3. Robinair 17644 (draining)
4. Robinair 10094 (vacuum pumping)
5. 1 litre refrigerant bottle (charging)

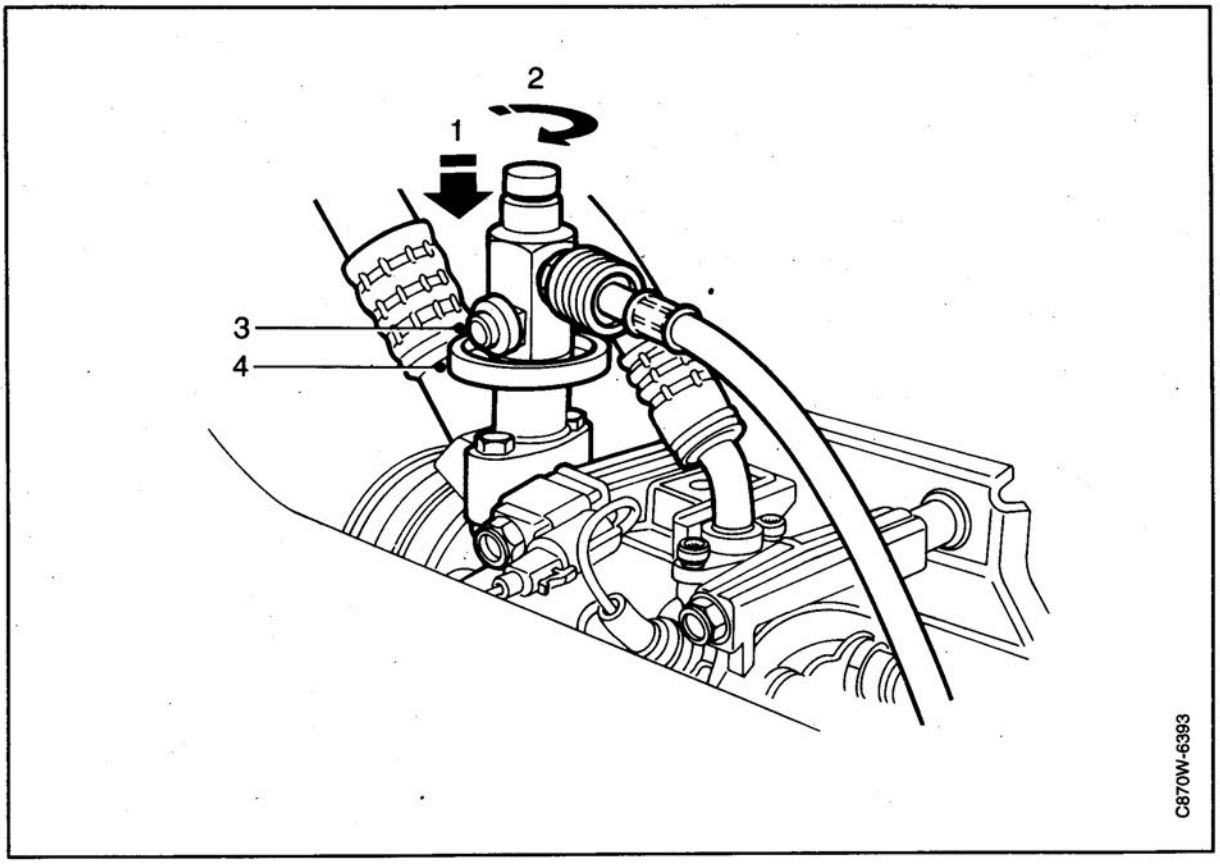
The use of special equipment for draining and charging is described in the following pages. This equipment has been developed for handling R134a refrigerant.

For information about the equipment, consult the manufacturer's manuals.

Remember to drain compressor oil from the draining stations at regular intervals (after every fourth draining is about right).

Important
Draining and charging equipment for R134a refrigerant must, under no circumstances, be used for R12 refrigerant or vice versa.

Draining /charging, R134a (contd.)



Snap–on couplings

Specially developed snap–on couplings are used to connect the draining and charging equipment hoses to the compressor's service connections. These snap–on connections are designed as so called Schrader valves and are therefore connected in two stages:

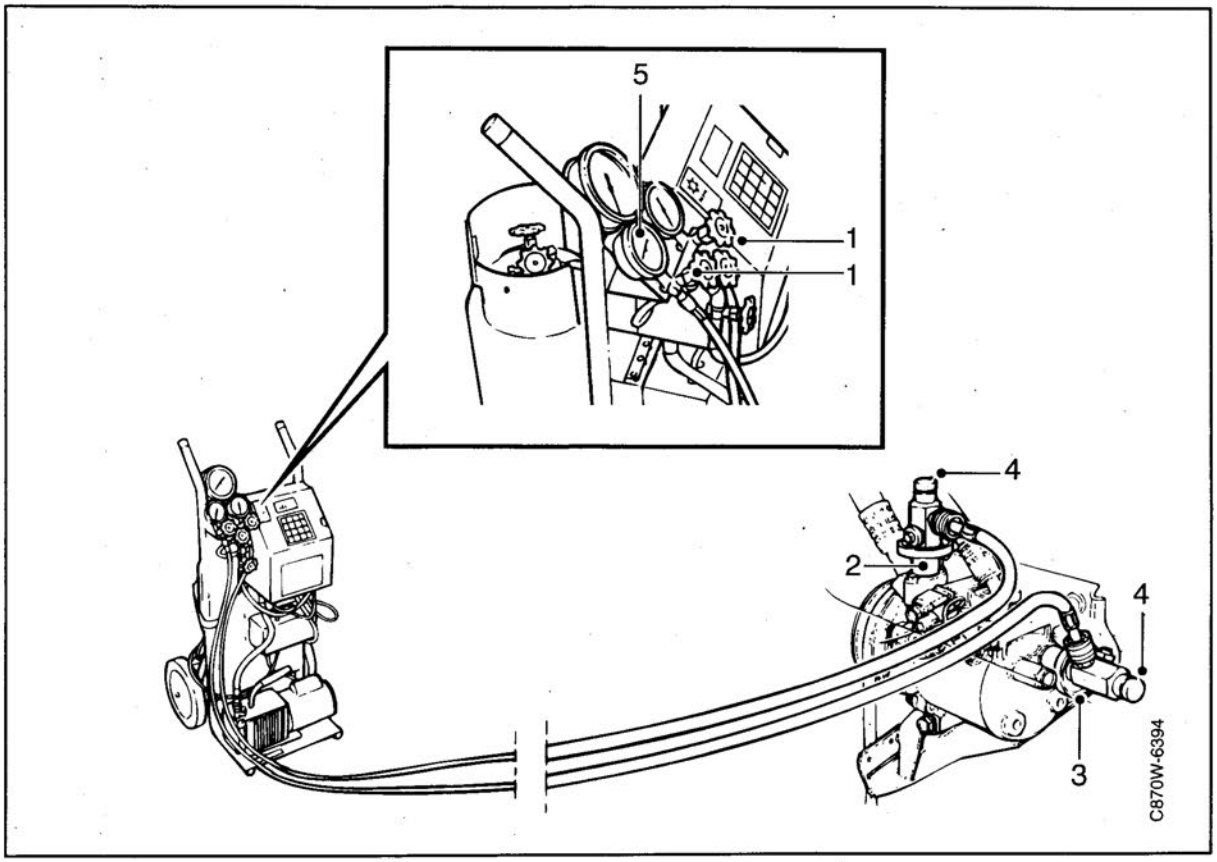
1 Press the snap–on coupling onto the compressor's service connection.

2 Turn the knob clockwise to open the valve and let the refrigerant pass through the connection.

To remove the snap–on coupling, first turn the knob (2) anti– clockwise to close the valve. Then remove the snap–on coupling by pressing the spring–loaded catch (3), so that the locking sleeve (4) can be pulled up.

When the valve is pressed in, a hissing sound is heard as the valve also evacuates the refrigerant inside the snap–on coupling.
The connections for the low–pressure side and high–pressure side are different sizes so that they cannot be mixed up.

Draining /charging, R134a (contd.)



Measuring pressure with the Robinair 10324 Smart Cart

1 Check that the cock on the blue low–pressure hose and the cock on the red high–pressure hose on the pressure gauge stand are both closed.

2 Connect the blue low–pressure hose, using a snap–on coupling to the low–pressure side of the compressor.

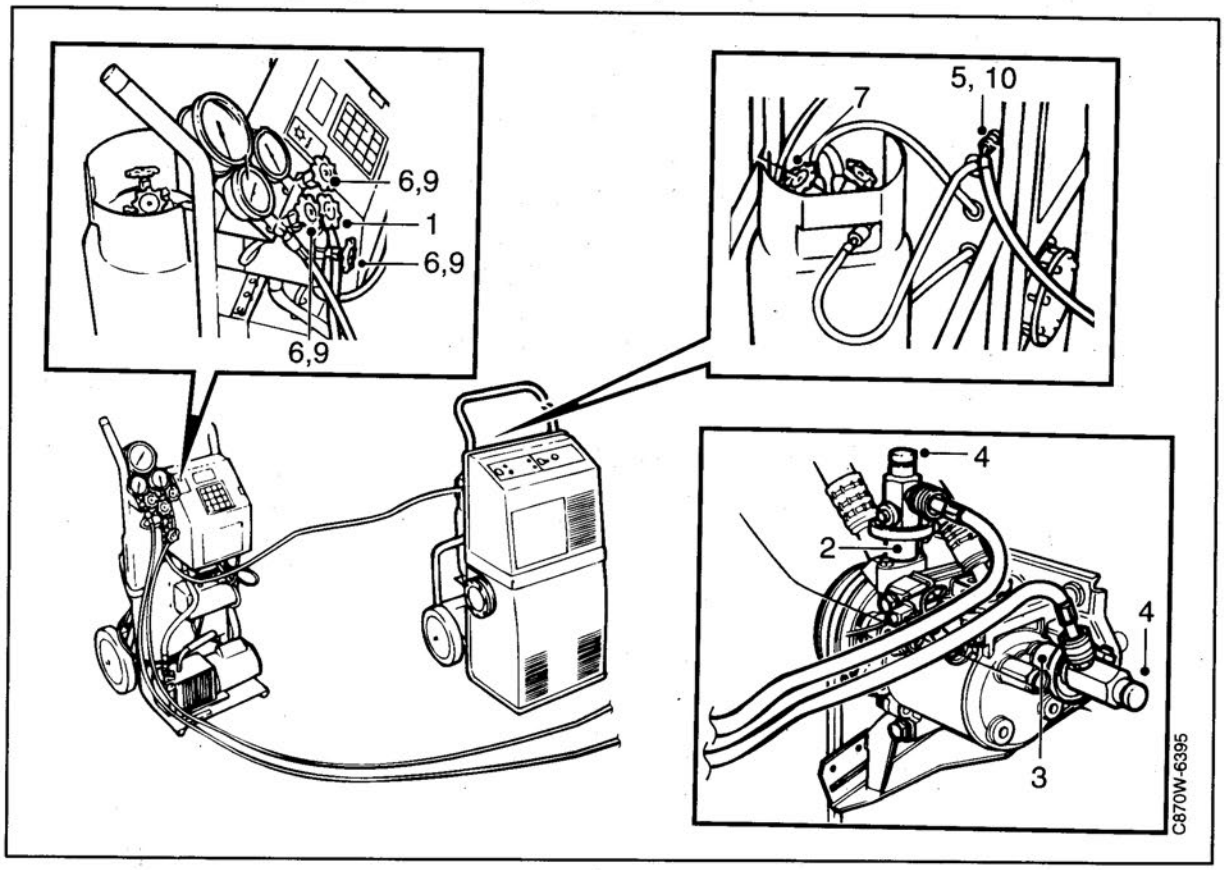
3 Connect the red high–pressure hose, using a snap–on coupling, to the high–pressure side of the compressor.

4 Open the valves on both snap–on couplings by screwing in the knobs.

5 Start the engine.

At an engine speed of 1500 – 2000 rpm and when air temperature is 20° C (68°F), it should be possible to read the following pressure on the pressure gauge when the compressor is working:
Low–pressure side: 1–3 bar
High–pressure side: 12–16.5 bar

Draining /charging, R134a (contd.)



Draining using Robinair 10324 Smart Cart and Robinair 17234 draining station

Important
The system should be drained on both the low–pressure and high–pressure sides at the same time. A non–return valve in the intake to the compressor's low–pressure side makes it impossible to empty one side only.

1 Check that only the black cock under the pressure gauge set is open. Other cocks should be closed.

2 Connect the blue low–pressure hose, using a snap–on coupling, to the low–pressure side of the compressor.

3 Connect the red high–pressure hose, using a snap–on coupling, to the high–pressure side of the compressor.

4 Open the valves on both snap–on couplings by screwing in the knobs.

5 Using the yellow hose, connect the pressure gauge stand's middle outlet to the draining station.

6 Open the cocks on the blue low–pressure hose and the red high–pressure hose and the cock on the yellow hose connected to the pressure gauge stand's middle outlet.

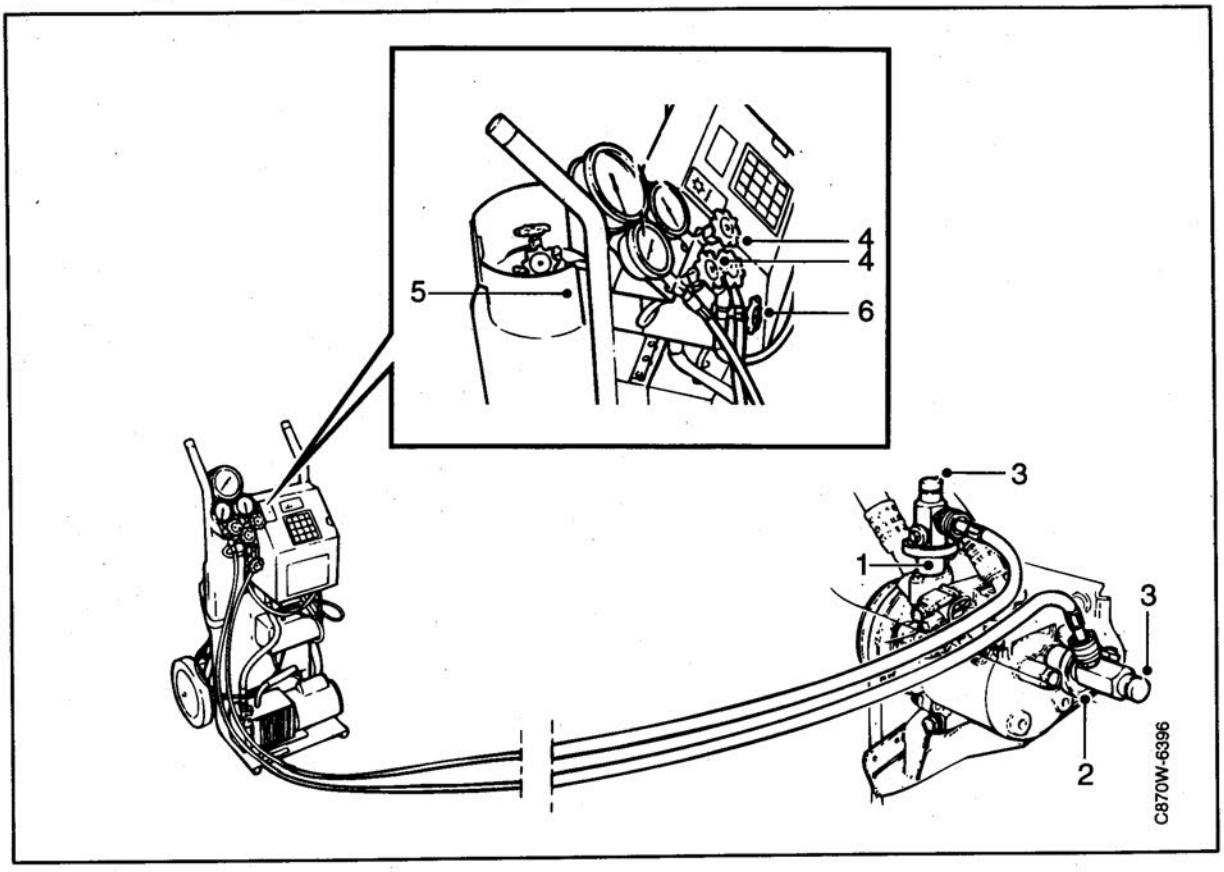
7 Open the blue cock ("Liquid") for liquid refrigerant and the red cock ("Gas") for gaseous refrigerant on the draining station's container.

8 Start the draining station. When draining is completed, the draining station automatically switches off or the pressure gauge shows 0 mbar.

9 Close the cocks on the blue low–pressure hose, the red high–pressure hose and the yellow hose connected to the pressure gauge stand's middle outlet.

10 Remove the yellow hose from the draining station. Draining is now completed and work on the A/C system can commence.

Draining /charging, R134a (contd.)



Vacuum pumping and topping up

Make sure that the quantity of refrigeration oil in the A/C system is correct before vacuum pumping or charging is started. See the table on the first page of this section.

Important
Vacuum pumping should be carried out on both the low–pressure and high–pressure sides at the same time. A non–return valve in the intake to the low–pressure side of the compressor makes it impossible to vacuum pump one side only.

1 Connect the blue low–pressure hose, using a snap–on coupling to the low–pressure side of the compressor.

2 Connect the red high–pressure hose, using a snap–on coupling, to the high–pressure side of the compressor.

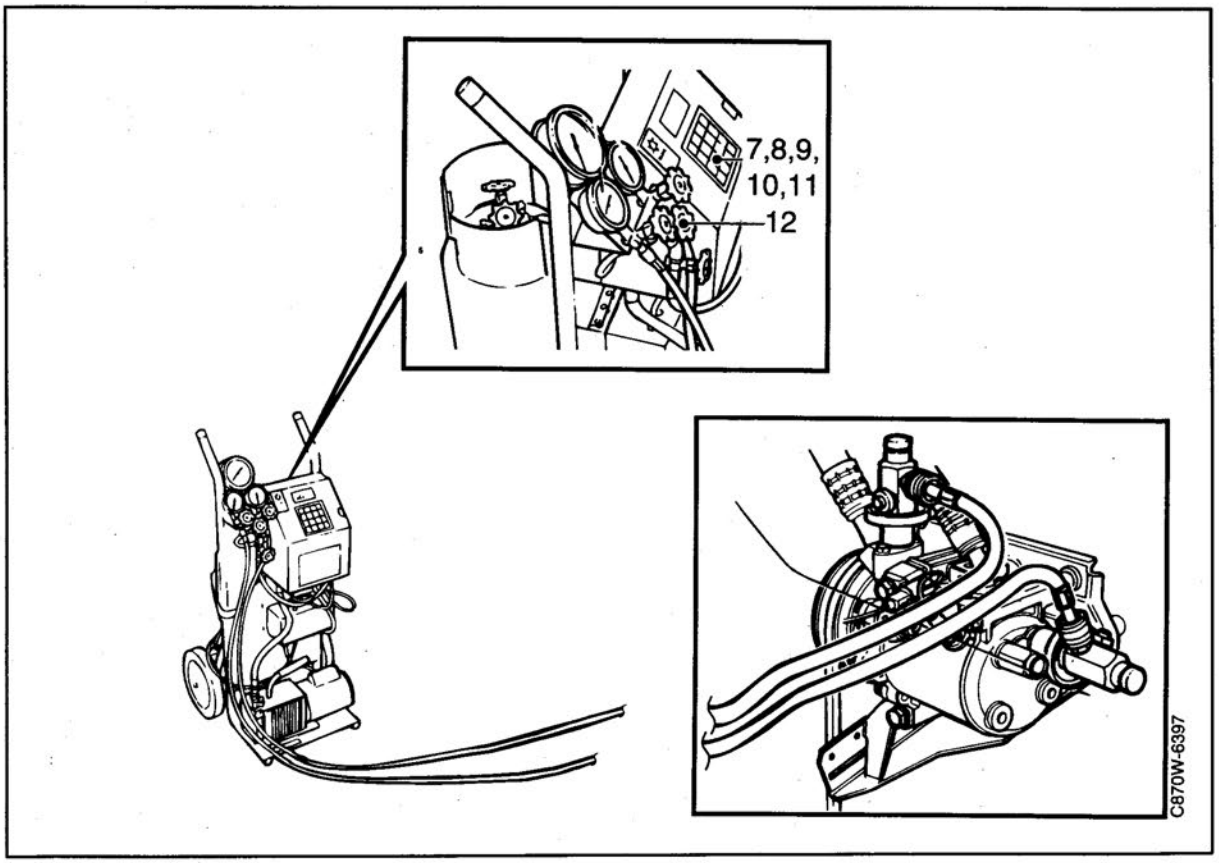
3 Open the valves on both snap–on couplings by screwing in the knobs.

4 Open the cocks on the blue low–pressure hose and red high–pressure hose on the pressure gauge stand.

5 Open the blue cock ("Liquid") for liquid refrigerant on the container on the Smart Cart.

6 Check that the cock on the yellow hose on the pressure gauge stand's middle outlet is closed.

Draining /charging, R134a (contd.)



7 Program vacuum pumping for 30 minutes by pressing "30" on the control panel in the "Vacuum minutes" position. Acknowledge the selection by pressing "ENTER".

8 Press "REV. PROG".

9 Press "0.95" to specify the number of kilogrammes of refrigerant to be charged. Acknowledge the selection by pressing "ENTER".

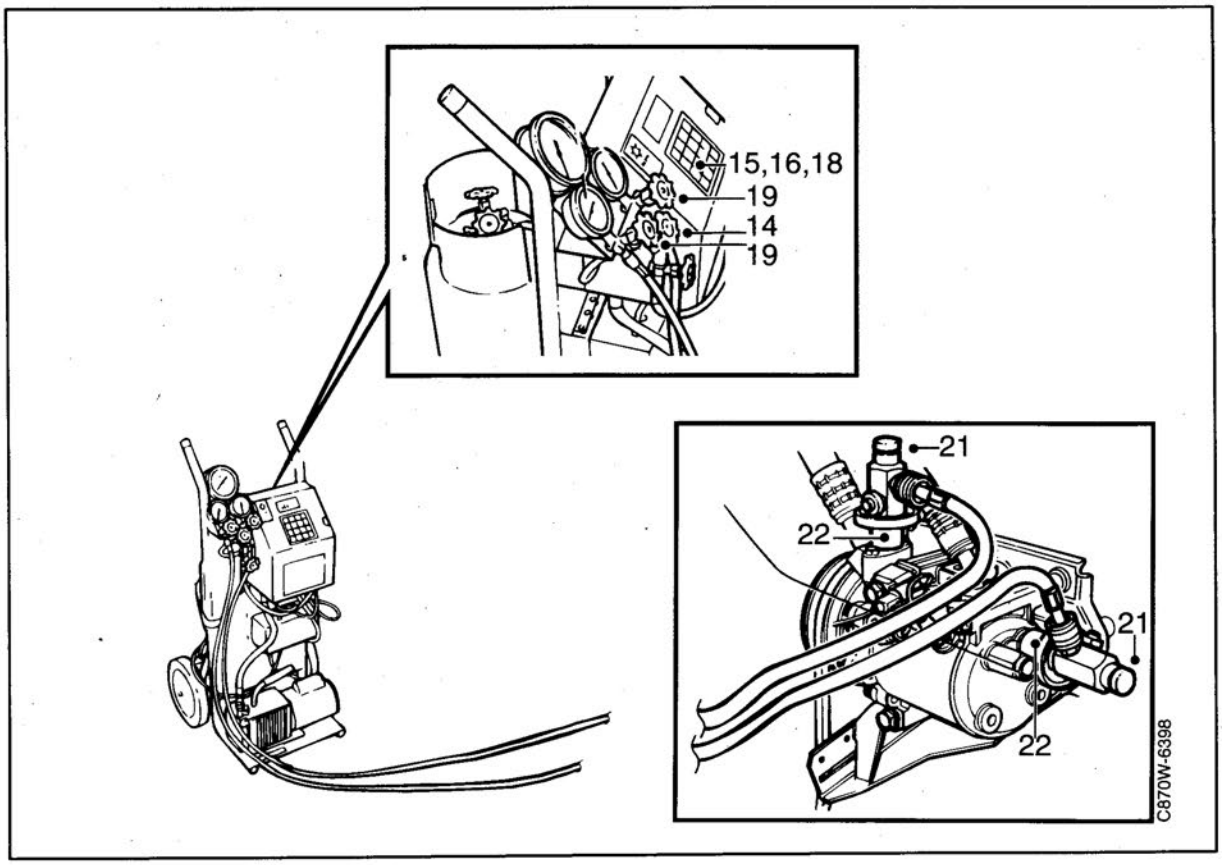
10 Press "REV. PROG".

11 Press "START" to start vacuum pumping.

12 Close the black cock under the pressure gauges as soon as vacuum pumping switches off after 30 minutes. Pressure must not exceed 10 mbar.

13 Move the A/C hoses slightly and make sure that there are no leaks in the system. The pressure must not increase by more than 10 mbar in 5 minutes.

Draining /charging, R134a (contd.)



> **⚠ WARNING**
>
> When using a 1 litre refrigerant bottle, refrigerant must only be filled on the low–pressure side of the compressor.

If the bottle is connected to the high–pressure side, there is a risk of it exploding when the car's engine is started.

14 Open the black cock under the pressure gauges and close the cock to the blue low–pressure hose on the pressure gauges.

15 Press "START" to start charging of refrigerant.

16 Stop the charging process by pressing "HOLD" when about 200 grammes of refrigerant has been filled.

17 Move the A/C hoses slightly and check with a leakage detector designed for R134a that the system is not leaking.

18 Continue the charging process by pressing "START". When charging is complete, the display on the control panel shows "CPL".

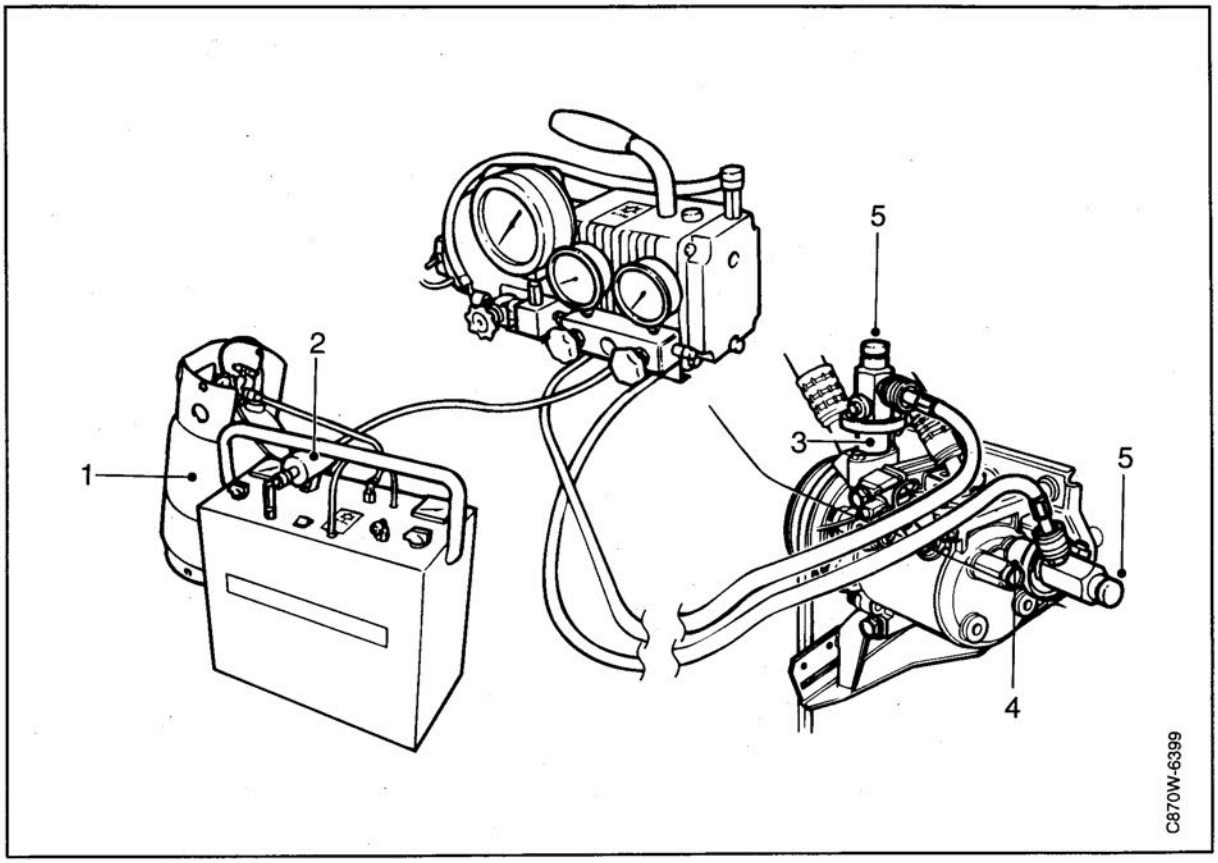
19 Close the cock to the red high–pressure hose to the pressure gauge.

20 Start the car and wait until the compressor starts working. Rev the engine so that the pump vanes in the compressor rotor are forced out.
Pressure on the low–pressure side should be between 1.0–3.0 bar. The radiator fan should switch on at 12.5–16.5 bar on the high–pressure side.

21 Close the snap–on coupling valves on the compressor by undoing the knobs.

22 Remove the connections on the compressor and refit the protective plugs over the service valves.

Draining /charging, R134a (contd.)



Robinair 17644 draining equipment and Robinair 10094 vacuum pump

Important
Draining and charging equipment for R134a refrigerant must, under no circumstances, be used for R12 refrigerant or vice versa.

Only small amounts of the wrong refrigerant or the wrong compressor oil will give rise to chemical reactions which will eventually ruin both the equipment and the car's A/C system.

Draining

Important
The system must be drained on both the low–pressure and high–pressure sides at the same time. A non–return valve in the intake to the low–pressure side of the compressor makes it impossible to drain one side only.

1 Open the red cock ("Gas") for gaseous refrigerant on the draining station's container.

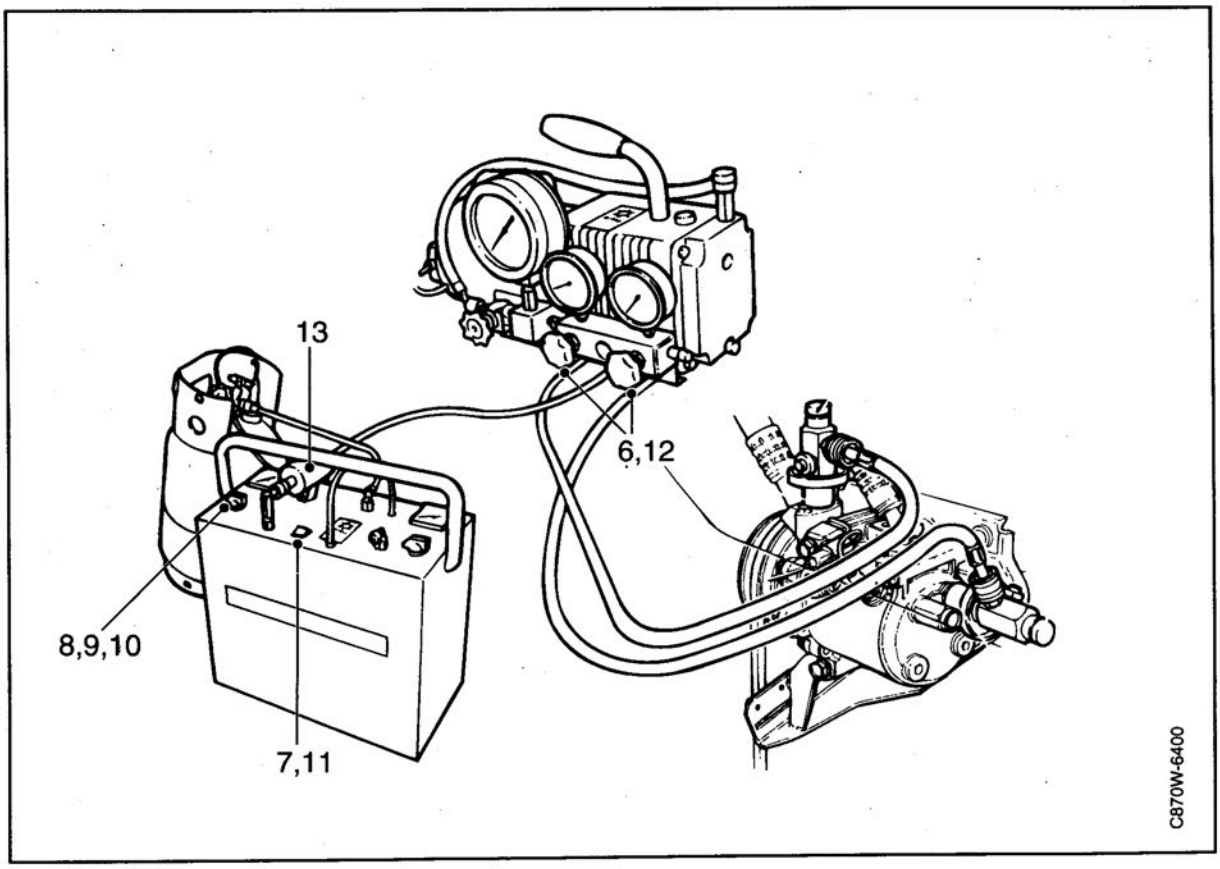
2 Connect the yellow hose on the pressure gauge stand's middle outlet to the inlet side of the draining station.

3 Connect the blue low–pressure hose, using a snap–on coupling, to the low–pressure side of the compressor.

4 Connect the red high–pressure hose, using a snap–on coupling, to the high–pressure side of the compressor.

5 Open the valves on both snap–on couplings by screwing in the knobs.

Draining /charging, R134a (contd.)



6 Open the cocks on the blue low–pressure hose and red high–pressure hose on the pressure–gauge stand.

7 Start the draining station.

8 If the draining station operates correctly, it should show negative pressure when the draining valve is closed.

9 Open the draining valve and drain the A/C system of refrigerant.

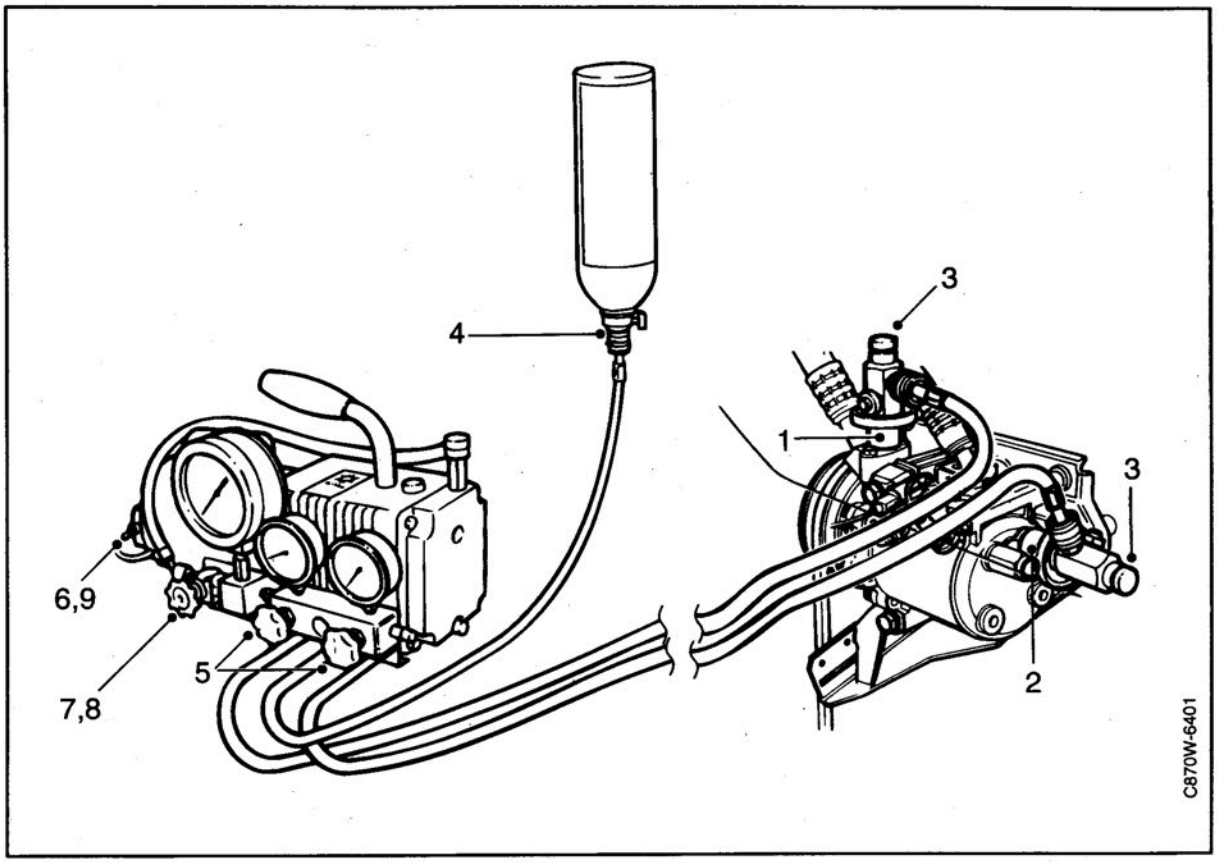
10 Close the draining valve when the gauge on the draining station shows a partial vacuum (approx. 10 mm Hg).

11 Turn off the draining station.

12 Close the cocks on the blue low–pressure hose and red high–pressure hose on the pressure gauge stand.

13 Remove the yellow hose from the draining station. Draining is now completed and work on the A/C system can commence.

Draining /charging, R134a (contd.)



Vacuum pumping

Make sure that the amount of compressor oil in the A/C system is correct before starting vacuum pumping and charging. See the table on page 161 in this section.

Important
The system should be vacuumed pumped on both the low–pressure and high–pressure sides at the same time. The non–return valve in the intake to the low–pressure side of the compressor makes it impossible to vacuum pump one side only.

1 Connect the blue low–pressure hose, using a snap–on coupling, to the low–pressure side of the compressor.

2 Connect the red high–pressure hose, using a snap–on coupling, to the high–pressure side of the compressor.

3 Open the valves on both snap–on couplings by screwing in the knobs.

4 Connect the yellow hose on the pressure–gauge stand's middle outlet to the refrigerant bottle.

5 Open the cocks on the blue low–pressure hose and red high–pressure hose on the pressure–gauge stand.

6 Start the vacuum pump

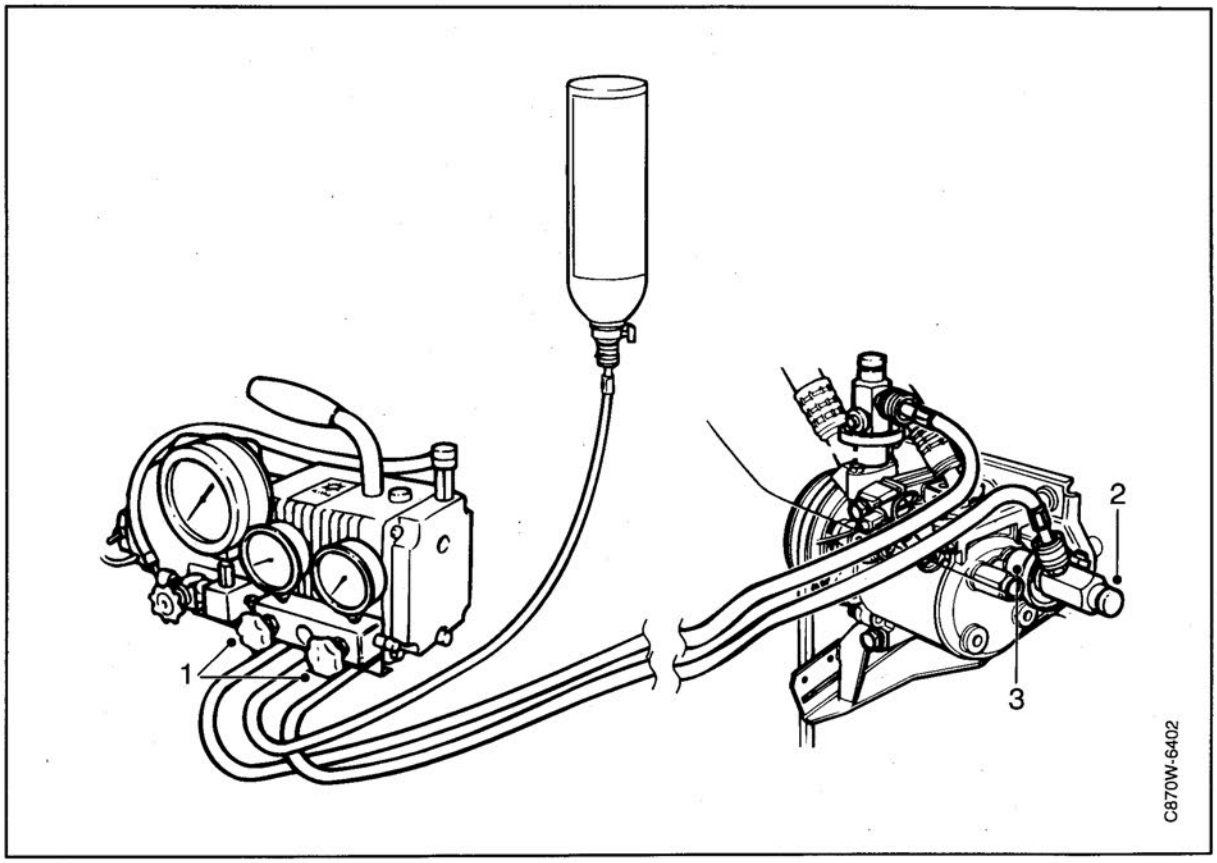
7 Open the vacuum valve and let the pump run for 30 minutes.

8 Close the vacuum valve when vacuum pumping is finished after about 30 minutes. The pressure should then be 0–10 mbar.

9 Switch off the pump.

10 Move the A/C hoses slightly and make sure that there are no leaks in the system. Pressure may not increase by more than 10 mbar during 5 minutes.

Draining /charging, R134a (contd.)



Filling from 1 litre refrigerant bottle

1 Close the cocks on the blue low–pressure hose and red high–pressure hose on the pressure gauge stand.

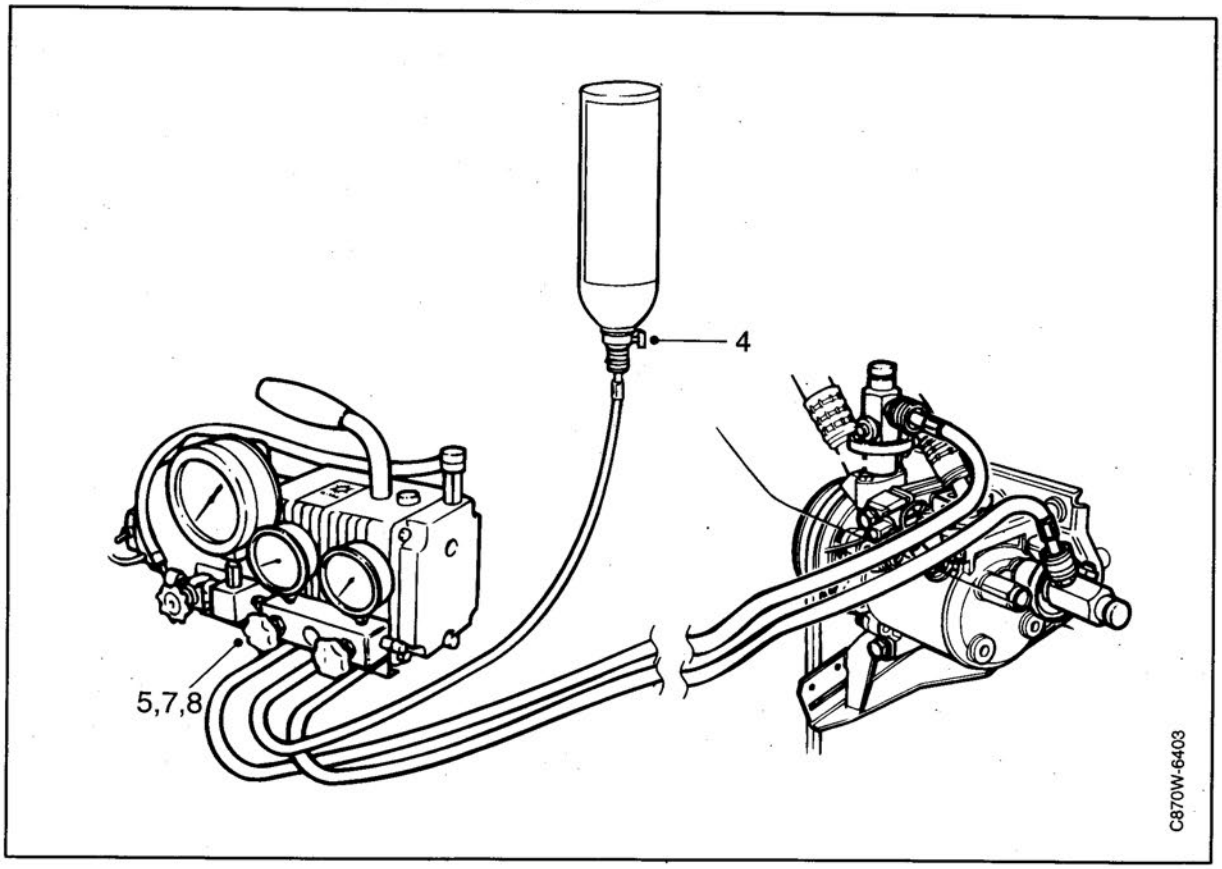
> **⚠ WARNING**
>
> Only the low–pressure side of the compressor may be filled with refrigerant from a 1 litre refrigerant bottle

If the bottle is connected to the high–pressure side, there is a danger of it exploding when the car's engine is started.

2 Close the valve in the red high–pressure hose snap–on coupling on the compressor by unscrewing the knob.

3 Then remove the red high–pressure hose snap–on coupling from the compressor and refit the protective plug over the connection.

Draining /charging, R134a (contd.)



4 Place the bottle with refrigerant upside–down and open the cock on the bottle.

Important
The refrigerant bottle must be inverted so that it may be fully emptied.

5 Charge with 200 grammes of refrigerant by carefully opening the cock on the blue low–pressure hose on the pressure gauge stand for about 5 seconds.

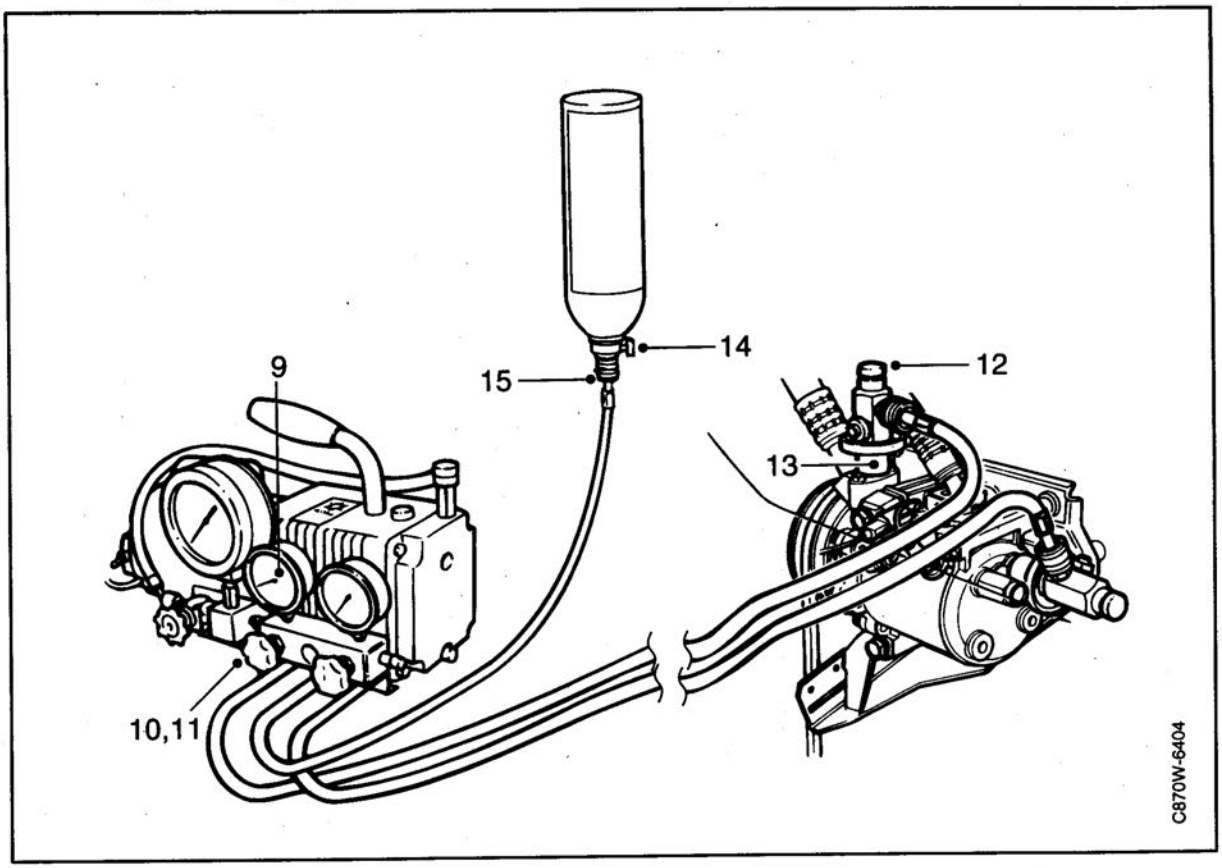
200 grammes of refrigerant corresponds to a pressure of 4–5 bar.

6 Move the A/C hoses slightly and check with a leakage detector designed for R134a that there are no leaks in the system.

7 Open the blue low–pressure hose cock on the pressure gauges and continue charging until pressure has stabilized.

8 Close the cock on the blue low–pressure hose on the pressure gauge stand.

Draining /charging, R134a (contd.)



9 Start the car and wait until the compressor starts to work. Rev the engine so that the pump vanes in the compressor rotor are forced out (this can be seen as the pressure drops below 3 bar on the gauge beside the blue low–pressure hose on the pressure gauges).

10 Open the cock on the blue low–pressure hose on the pressure gauge stand when the compressor starts working so that the remaining amount of refrigerant is sucked into the compressor.

11 Close the cock to the blue low–pressure hose on the pressure gauges when the bottle with refrigerant is emptied.

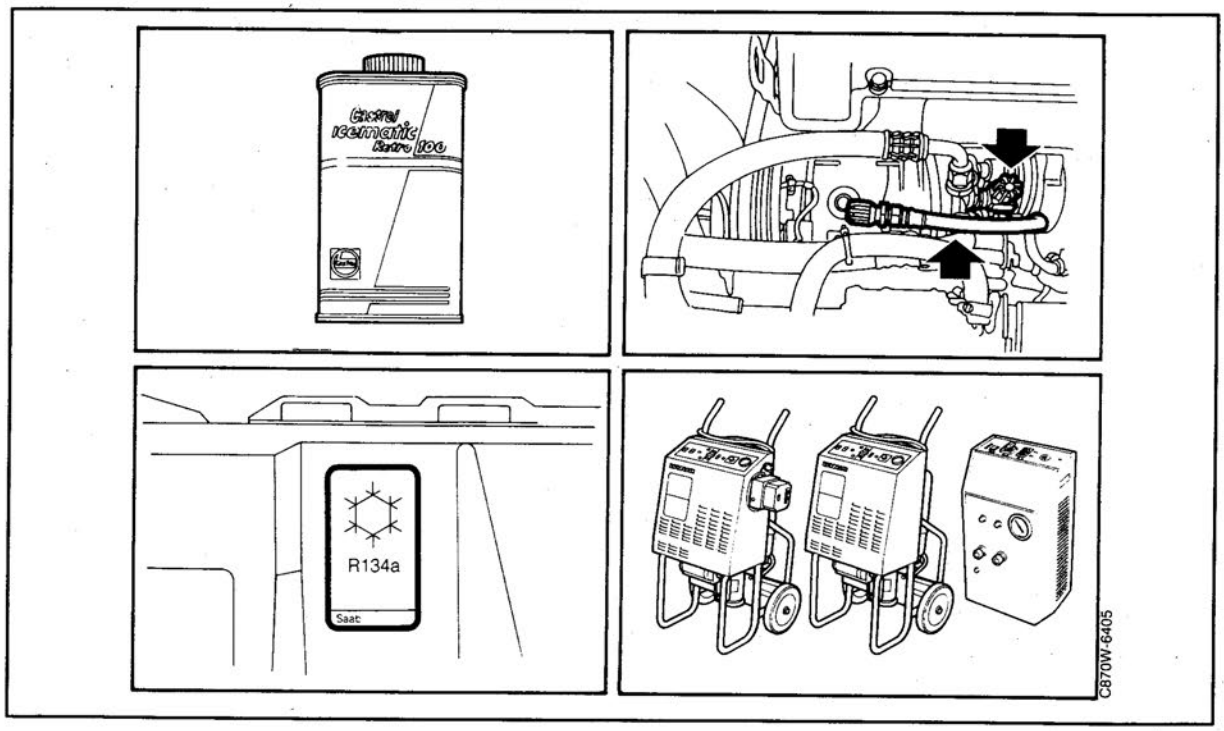
12 Close the valve on the blue low–pressure hose snap–on coupling on the compressor by unscrewing the knob.

13 Remove the blue low–pressure hose snap–on coupling from the compressor and refit the protective plug over the service valve.

14 Close the cock on the refrigerant bottle.

15 Remove the yellow hose from the refrigerant bottle.

Converting (retrofitting) the A/C system from R12 refrigerant to R134a



Cars affected

All Saab 9000 with A/C system containing R12 refrigerant.

Background

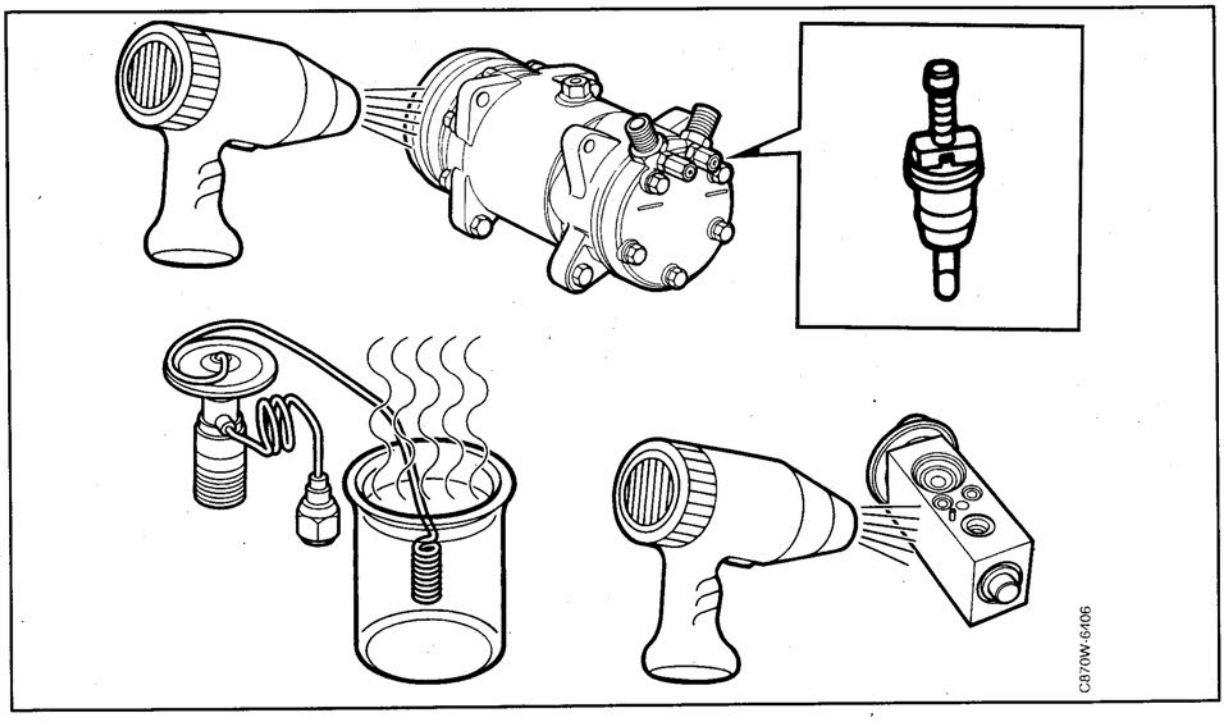
In year model 1992, R134a refrigerant was introduced. R134a is a chlorine–free refrigerant which does not damage the ozone layer in the atmosphere.

A method has now been developed which makes it possible to convert A/C systems from R12 refrigerant to R134a. This conversion basically consists of draining R12 from the system, and then flushing it with R12 repeatedly so that the old refrigeration oil is removed and then changing the desiccant container and charging with new compressor oil. Finally, R134a is charged.

Conversion can be carried out using various equipment. Three different alternatives are described in these instructions. Equippment common to all three alternatives is a refrigerant bottle with two cocks, charging equipment for R134a, about 10 kg of R12 refrigerant for flushing the system and R134a refrigerant for recharging it. In addition, special adapters must be used when connecting the A/C system.

Conversion of the A/C system has mainly been developed as an alternative for Saab owners who wish to have a refrigerant which does not damage the ozone layer. At the same time, it should be pointed out that the refrigerant industry is more and more switching from R12 to R134a, which may, in the long term, affect the availability and price of R12.

Converting, general



When converting from R12 to R134a, the compressor oil must also be changed. The properties of the R12 mineral oil in the system mean that it does not mix with R134a and does not therefore lubricate the compressor sufficiently. In its place, ester oil should be used in A/C systems which have been converted to R134a. Note that this only applies to converted A/C systems. In A/C systems which have been filled with R134a during factory production, PAG oil, and nothing else, should be used. However, it is not sufficient to simply fill the system with ester oil. The old mineral oil must first be removed. Otherwise, it will form an insulating layer in the evaporator and significantly decrease the performance of the A/C system.

In order to minimize the risk of chemical reactions and loss of cooling performance, at least 90 % of the mineral oil should be removed before the new refrigerant is charged.
Note that the total quantity of mineral oil in the A/C system can vary (as the system may have been repaired without the correct quantity of oil being added).

When refrigerant is emptied from the A/C system, mineral oil remains in the various parts of the system. In order to remove at least 90% of the mineral oil, the A/C system must be flushed with R12 using a special method.

During flushing, the A/C system is first emptied of R12. Liquid R12 is then charged on the high–pressure side of the compressor. The refrigerant circulates in the A/C system and is removed through an adapter in the compressor's oil filler connection. When flushing, it is important to remove all restrictions in the A/C system and equipment, such as Schrader valves, so that there is free flow. The expansion valve is held open by heating its sensor to max. 50°C.
As the system is working with refrigerant in liquid form at a pressure lower than normal operating pressure, the mineral oil will float on top of the refrigerant. The oil flows around the A/C system with the refrigerant and is removed through the oil filler connection at the top of the compressor.

In order to reach oil which is pressed up into pockets, the fluid level should be raised and lowered during rinsing. When level is lowered, the oil comes down from these pockets. Fluid level can be seen in the sight glass and can also be read as pressure changes on the pressure gauges connected to the suction side of the draining station. When converting to R134a in markets with a hot climate, an extra radiator fan can be fitted in front of the condenser on the Saab 9000 in order to increase cooling performance.

Equippment alternatives

Alternative 1 – AKA Mini Force

This equipment is a draining and cleaning station, especially developed for converting the A/C system from R12 to R134a. This equipment has larger capacity then normal service equipment for this work and work only takes about half the time it would normally take using the ordinary equipment for A/C work.

Alternative 2 – traditional Robinair service equipment with flushing unit and solenoid valve set

This equipment requires access to Robinair R12 draining and cleaning equipment. This equipment must be complemented with a flushing kit for flushing the car's A/C system. In order to reduce the time it takes for a mechanic to carry out this work, this equipment has been provided with an additional solenoid valve set which, using pulse relays automatically monitors the flushing of the A/C system.

Alternative 3 – traditional Robinair service equipment with flushing equipment.

This equipment requires access to Robinair draining and flushing equipment for R12. This equipment must be complemented with a flushing kit for flushing the car's A/C system. This alternative requires that the mechanic is in position beside the car during the entire work process in order to monitor and control the process.

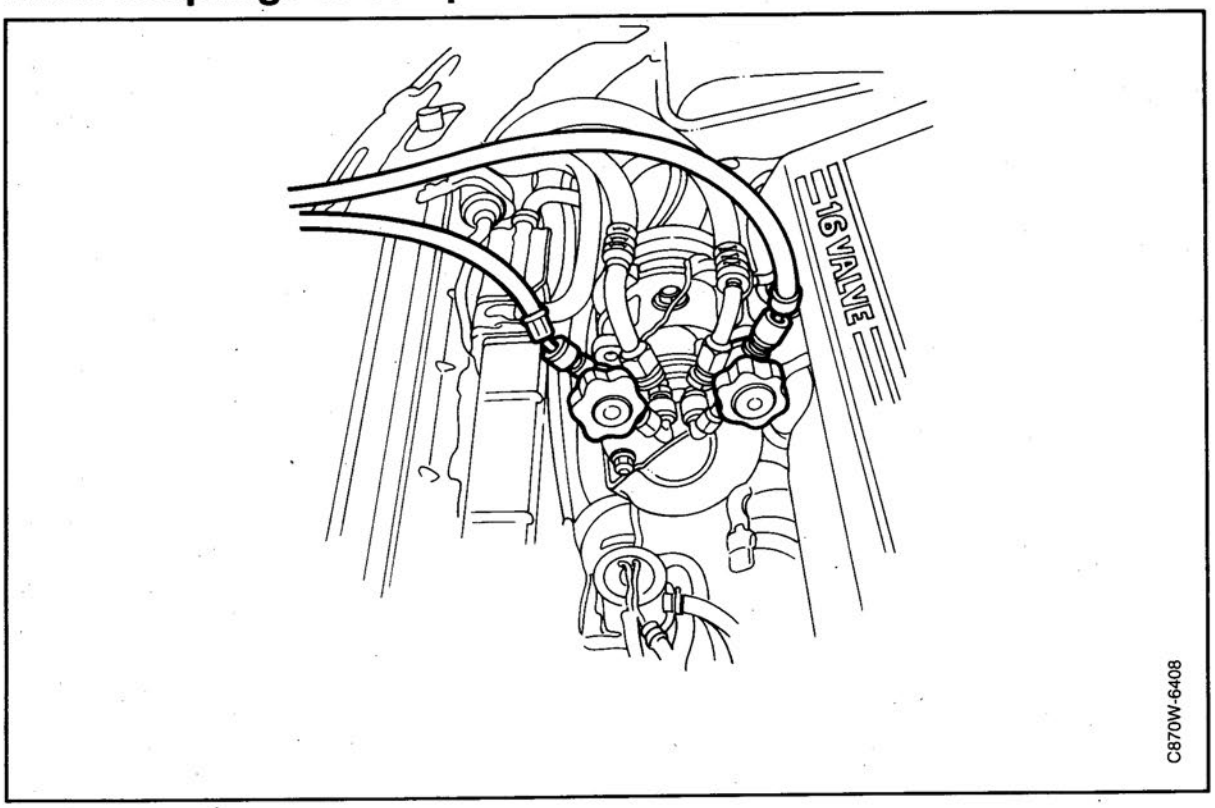
Tips when selecting equipment

When selecting equipment, it may be helpful to also assess the following factors.

If draining and flushing equipment for R12 is available in the workshop:
Assess the number of expected conversions and the necessity of the solenoid valve kit. The flushing unit must be procured in order to carry out conversions.

If there is no service equipment for A/C work in the workshop, or if the number of conversions if expected to be more than 3–5 per week:
AKA Mini Force equipment is the fastest equipment of the three alternatives and should be chosen if there is no equipment. If there is existing equipment, this equipment may still be the most cost–effective alternative, despite higher initial cost, as it can also be used as traditional service equipment for cars with R12 A/C systems. In addition, only half as much time is required by the mechanic for converting when compared with alternative 2.

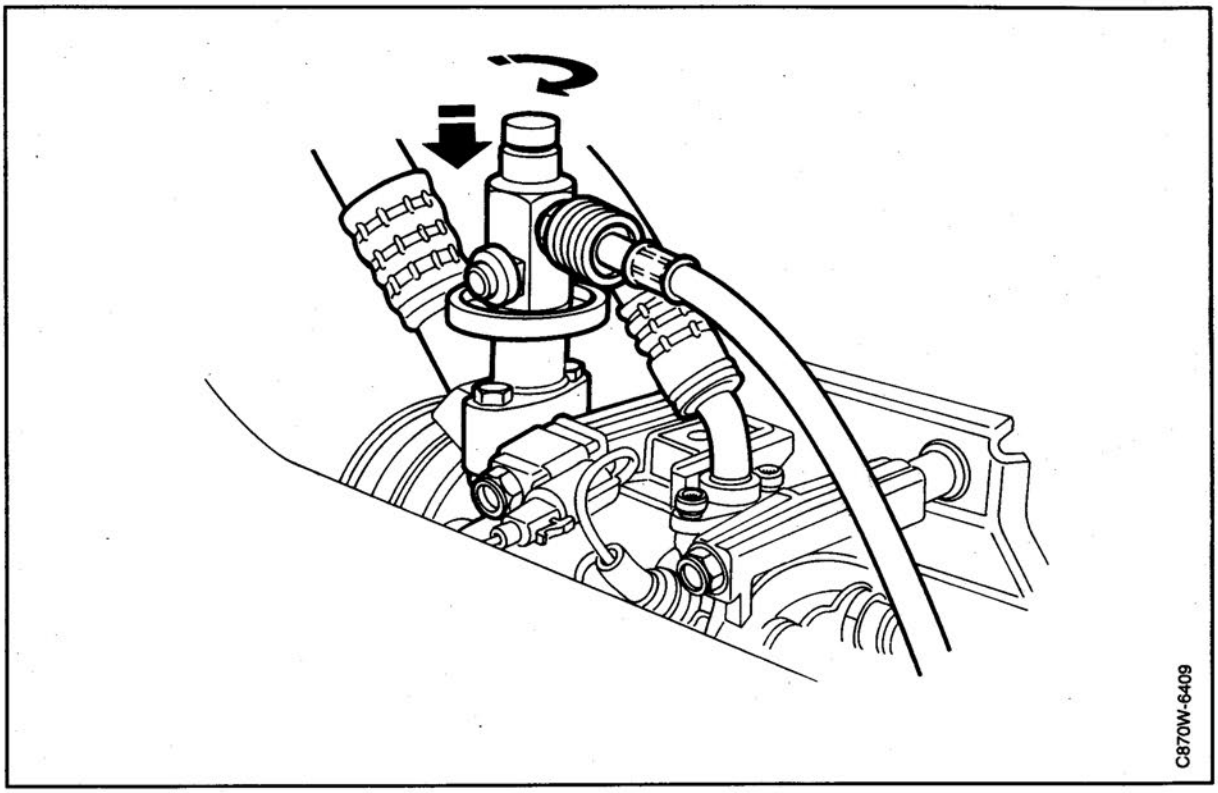
Hose couplings to compressor



Hose couplings to compressor **Sanden**.

Check that all cocks are closed on the equipment. The couplings to the compressor service connections are ordinary screw couplings and must only be tightened by hand.

Hose couplings to compressor (contd.)



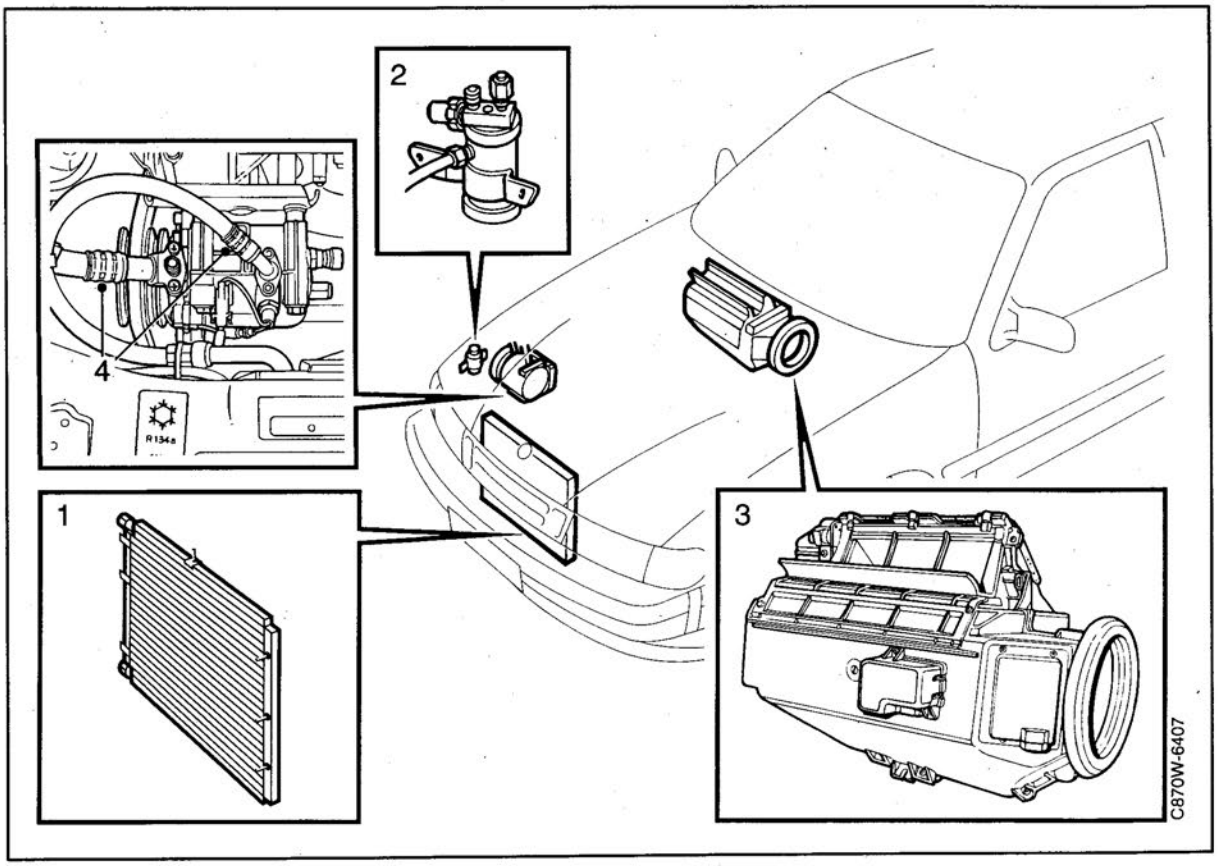
Hose couplings to compressor **Seiko Seiki SS121**.

Specially developed snap–on couplings are used to connect the draining and charging equipment hoses to the compressor's service connections. These snap–on connections are designed as so called Schrader valves and are therefore connected in two stages:

1 Press the snap–on coupling onto the compressor's service connection.

2 Turn the knob clockwise to open the valve and let the refrigerant pass through the connection.

Colour marking of components for R134a



Background

Components from A/C systems using R134a refrigerant must never, under any circumstances, be mixed with components from A/C systems using R12 refrigerant.

Even very small quantities of the wrong refrigerant or compressor oil give rice to chemical reactions which will eventually ruin the entire A/C system.

To prevent the wrong components from being fitted by mistake, the compressor and the expansion valve are unique to their particular A/C system and are designed so that they cannot be fitted to the wrong system.

The condenser, receiver, evaporator housing and hoses are the same in both systems. To prevent these components from being mixed with each other after they after they have been replaced, a special marking paint for R134a components has been introduced.

The part number of the marking paint is (40) 400 100 095.

Action

Mark replaced R134a components with marking paint as described below. Avoid marking the threads so that the components can be fitted temporarily with no danger of the paint rubbing off.

1 Condenser, mark with paint at the connections

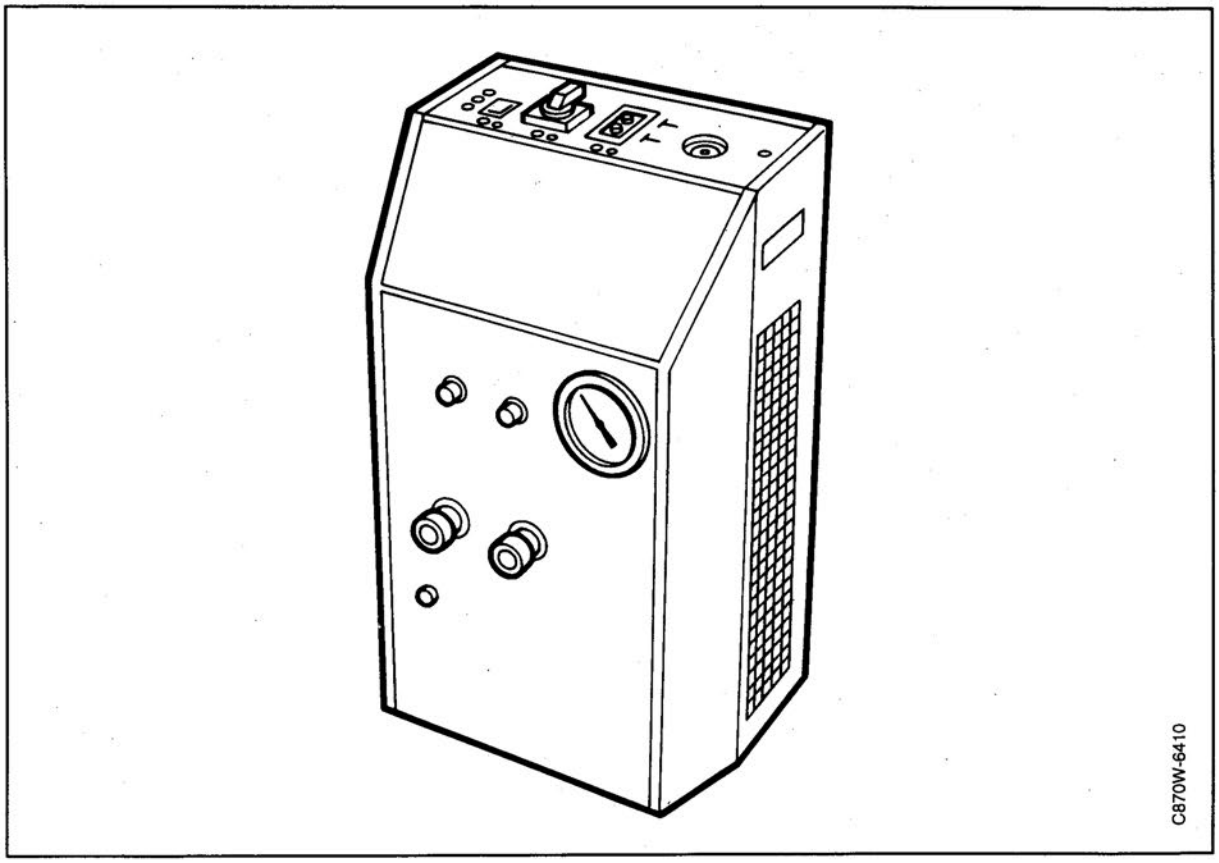
2 Dessicant container, mark at the connections

3 Evaporator housing, mark at the connections

4 Hoses, mark on the attachments

As mentioned earlier, the compressor and expansion valve are unique to the R134a system. They cannot be fitted to the wrong system and so need not be marked.

Alternative 1



Materials

- AKA Mini Force draining and cleaning station for R12
- Refrigerant bottle with two cocks, gas and liquid
- R12 refrigerant (approx. 10 kg) for flushing
- 1 red high–pressure hose
- 1 blue low–pressure hose
- Adapter 82 92 849, high–pressure side, Saab 9000 M1990–
- Adapter, oil plug (Sanden compressor) (16) 86 11 824
- Charging equipment for R134a
- R134a Refrigerant

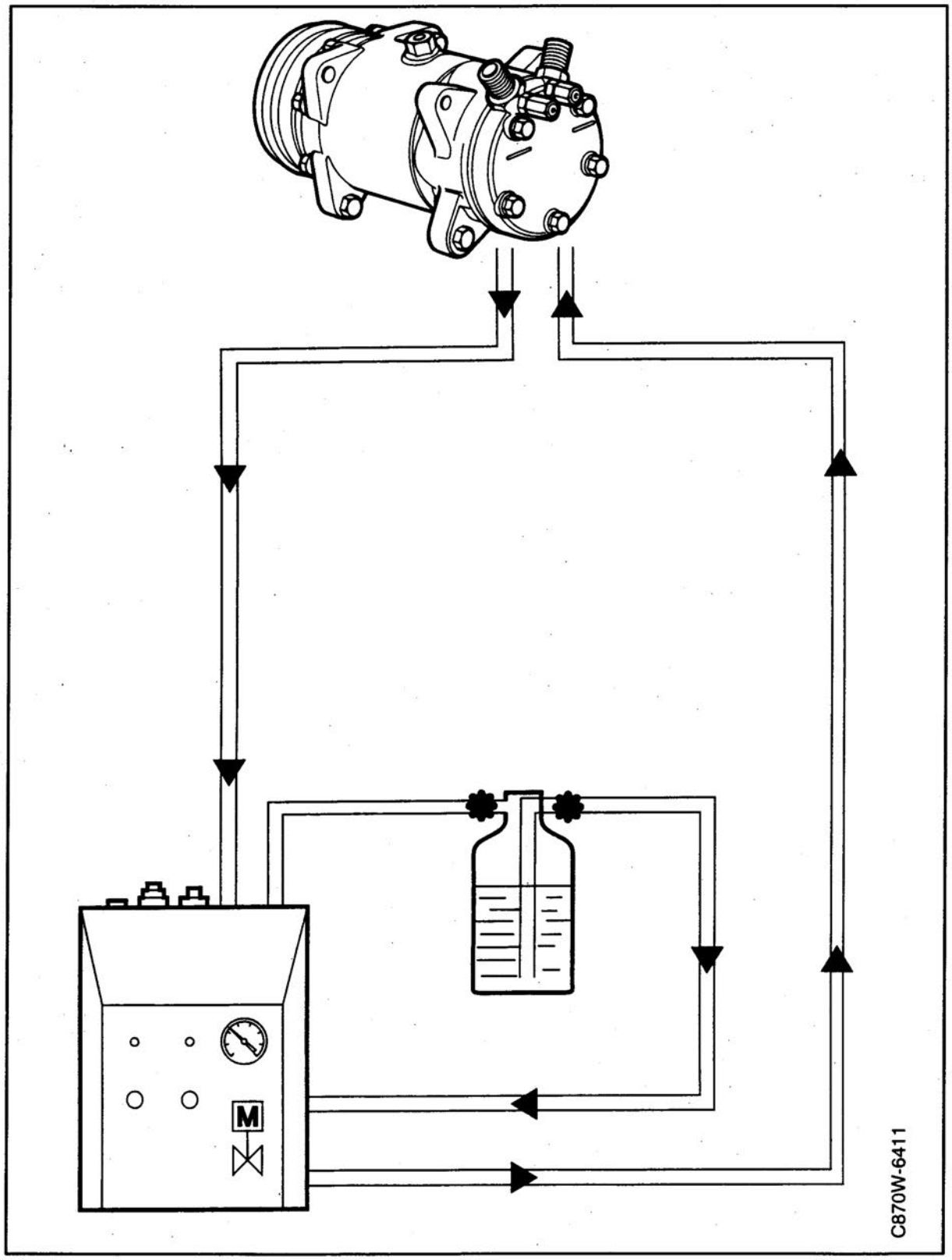
A set of spare parts for converting A/C systems from R12 to R134a has been prepared. This set contains the following items:

- Dessicant container
- Pressure switch, R134a (Saab 9000 only)
- Labels
- Service nipples, R134a
- Compressor oil (ester)

There are three different versions of the spare parts set, depending on car model.

74 96 383	Saab 9000 M1992
74 96 466	Saab 9000 M1990 – 1991
74 96 375	Saab 9000 M1985 – 1989

Converting, alternative 1



Schematic diagram for AKA Mini Force

Converting, alternative 1 (contd.)

⚠ Warning

Wear protective gloves and eye protection and use extraction equipment when working with refrigerant. Position the extraction equipment at the service connections on the A/C system and at the discharge outlet on the draining equipment vacuum pump. If refrigerant comes into contact with skin or eyes, it may cause frostbite. Under no circumstances should the engine be started while work on the A/C system is in progress.

Important
When converting the A/C system, the usual practice in regard to the high–pressure and low–pressure side when draining and charging refrigerant is disregarded. Carefully follow the colour directions in the method description and on the diagram.

1 Check the operation of the A/C system as follows:

- Carry out a performance test. See page 194.
- Carry out leak detection procedure

Repair any system faults or damage in conjunction with conversion when the A/C system has been drained of refrigerant.

2 Drain the A/C system of refrigerant. Note the amount of compressor oil that is drained.

3 Repair any damage to the A/C system.

4 Remove the cover over the bulkhead space.

5 Remove the expansion valve's sensitive element and heat it in hot water to max. 50° C (122°F).
M1992:
Heat the expansion valve's sensitive element using a hot air gun to max.50° C (122°F) or change to a through–drilled expansion valve.

6 Remove the Schrader valves and Schrader openers in the A/C system and on the equipment so that a free flow is obtained during the flushing process.

7 Connect one end of the blue low–pressure hose to the output on the draining station.

8 Connect the other end of the blue low–pressure hose to the high–pressure side of the compressor.

9 Remove the compressor oil filler plug and fit the adapter supplied in the kit.

10 Connect one end of the red high–pressure hose to the AKA Mini Force (suction).

11 Connect the other end of the red high–pressure hose to the compressor oil charging connection.

12 Open the cocks on the bottle, start the draining station and set the solenoid valve assembly to AUTO. Set the time as follows:

- The solenoid valve should be open a sufficiently long time for the sight glass to fill up at least to the half way mark.
- The solenoid valve should be closed until the sight glass is empty or the pressure has dropped by 1 bar.

13 When the oil is drained, foam and a film of oil will be visible in the flushing unit sight glass.

Converting, alternative 1 (contd.)

14 Continue flushing until no more bubbles are visible in the sight glass. Rotate the compressor swash plate a couple of turns during the flushing process.
Close the blue cock on the refrigerant bottle when the A/C system has been purged of oil after about 25 minutes.

15 Drain the A/C system completely of all refrigerant.

16 Drain off the compressor oil from the draining station, note the amount and check that at least 90% of the total volume of oil has been removed.

17 Refit the expansion valve's sensitive element.

18 Change the dessicant container for the one supplied in the set.

19 Fit the three–stage pressure switch supplied in the set to the new dessicant container.

20 Refit the Schrader valves that will be needed for the service valves that are to be fitted.

21 Refit other components that have been removed.

22 Fill the compressor crankcase with the specially developed retrofit compressor oil. This oil is supplied in the spare parts set.
135 ml

23 Refit the oil plug to the compressor.

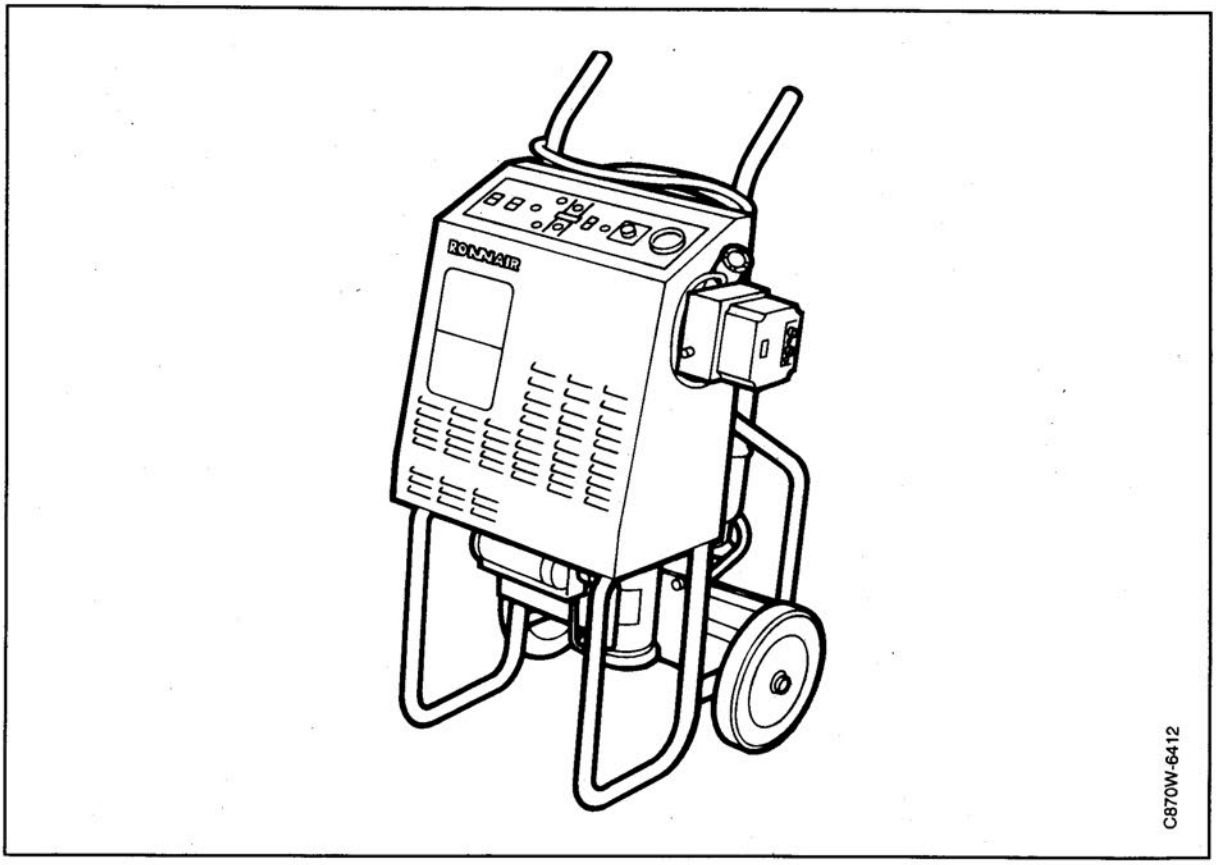
24 Screw the new service valves supplied in the set into place. The larger one is for the high–pressure side and the smaller one for the low–pressure side.

25 Connect up the equipment for R134a. Vacuum pump the A/C system and charge it with R134a refrigerant.
950 grams

26 Remove the existing A/C labels and stick the "Retrofit" labels in their place. The labels are supplied in the spare parts set.

27 Carry out leak detection and performance testing as described in the service manual.

Alternative 2



Materials

- Robinair draining and cleaning station for R12
- Robinair flushing kit 17560
- Solenoid valve set
- Refrigerant bottle with two cocks, gas and liquid
- R12 refrigerant (approx. 10 kg) for flushing
- 1 red high–pressure hose
- 1 blue low–pressure hose
- Adapter 82 92 849, high–pressure side M1990–
- Adapter, oil plug, (Sanden compressor), (16) 86 11 824
- Charging equipment for R134a
- R134a Refrigerant

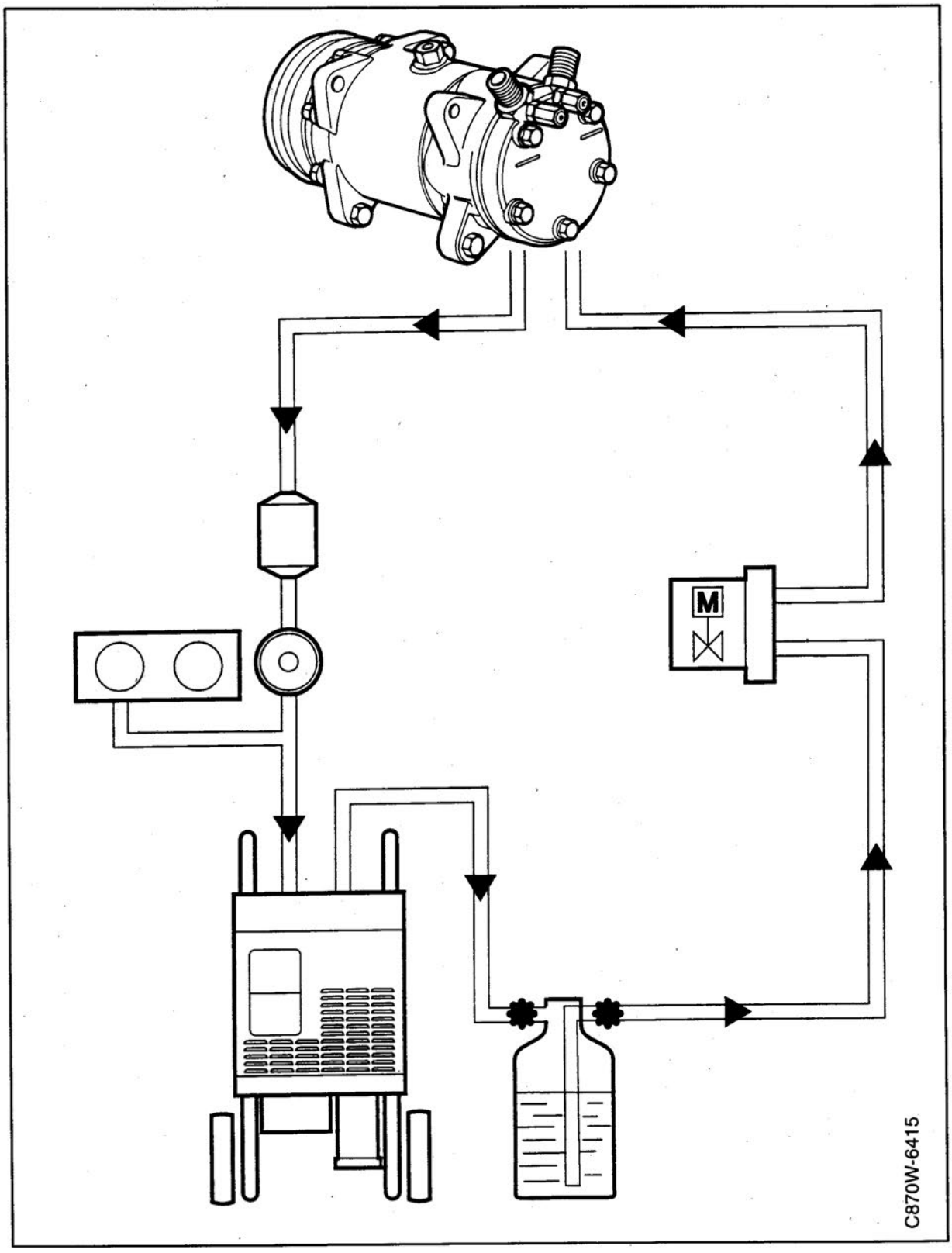
A spare parts set has been developed for converting A/C systems from R12 to R134a. This set contains the following items:

- Dessicant container
- Pressure switch, R134a
- Labels
- Service nipples, R134a
- Compressor oil (ester)

There are three different versions of the spare parts set, depending on car model.

74 96 383	Saab 9000 M1992
74 96 466	Saab 9000 M1990 – 1991
74 96 375	Saab 9000 M 1 985 – 1989

Converting, alternative 2



Schematic diagram for Robinair with automatic control

Converting, alternative 2 (contd.)

⚠ Warning

Wear protective gloves and eye protection and use extraction equipment when working with refrigerant. Position the extraction equipment at the service connectors on the A/C system and beside the outlet on the draining equipment's vacuum pump. If refrigerant comes into contact with skin or eyes, it may cause frostbite. Under no circumstances should the engine be started while work on the A/C system is in progress.

Important
When converting the A/C system, the usual practice in regard to the high–pressure and low–pressure side when draining and charging refrigerant is disregarded. Carefully follow the colour directions in the method description and on the diagram.

1 Check the operation of the A/C system as follows:

- Carry out a performance test. See page 194.
- Carry out leak detection procedure

Repair any system faults or damage in conjunction with conversion when the A/C system has been drained of refrigerant.

2 Drain the A/C system of refrigerant. Note the amount of compressor oil that is drained.

3 Repair any damage to the A/C system.

4 Remove the cover over the bulkhead space.

5 Remove the expansion valve's sensitive element and heat it in hot water to max. 50° C (122°F).
M92:
Using a hot air gun, heat the expansion valve's sensitive element to max. 50° C (122°F) or change to a through–drilled expansion valve.

6 Connect the blue hose from the pressure gauge set to the service nipple on the flushing station.

7 Remove the Schrader valves and Schrader openers in the A/C system and on the equipment so that a free flow is obtained when flushing.

8 Connect one end of the blue low–pressure hose to the high–pressure side of the compressor.

9 Connect the other end of the blue low–pressure hose to the high–pressure side of the compressor.

10 Remove the compressor oil filler plug and fit the adapter supplied in the kit.

11 Connect one end of the red high–pressure hose to the solenoid valve kit.

12 Connect the other end of the red high–pressure hose to the compressor's oil filler connection.

13 Open the cocks on the bottle, start the draining station and set the solenoid valve set to AUTO. Set time as follows:

- The solenoid valve should be open a sufficiently long time for the sight glass to fill to at least half way.
- The solenoid valve should be closed until the sight glass is empty or the pressure has dropped by 1 bar.

14 When the oil is drained, foam and a film of oil are visible in the sight glass. Continue flushing until no more bubbles are visible in the sight glass. Rotate the compressor swash plate a couple of times during the flushing process.

15 Close the blue cock on the refrigerant bottle when the A/C system has been drained of oil after about 45 minutes. Set the solenoid valve set to position M (manual = open).

16 Drain the A/C system completely of all refrigerant.

17 Drain off the compressor oil from the draining station, note the amount and check that at least 90% of the total volume of oil has been removed.

18 Refit the expansion valve's sensitive element.

Converting, alternative 2 (contd.)

19 Change the dessicant container for the one supplied in the set.

20 Fit the three–stage pressure switch supplied in the set to the new dessicant container.

21 Refit the Schrader valves that will be needed for the service valves that are to be fitted.

22 Refit other components that have been removed.

23 Fill the compressor crankcase with **135 ml** of the specially developed retrofit compressor oil. This oil is included in the spare parts set.

24 Refit the oil plug to the compressor.

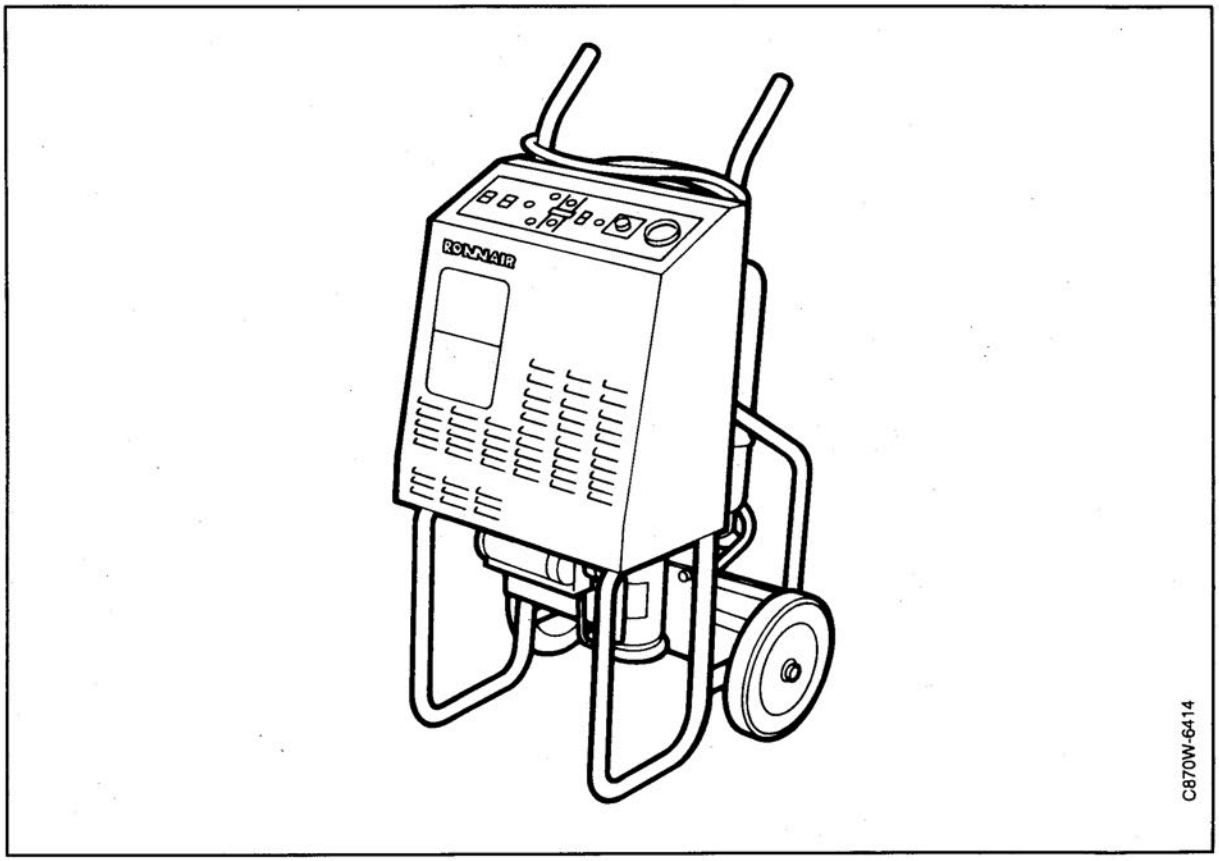
25 Screw on the new service valves which are included in the set. The larger one is for the high–pressure side, the smaller one for the low–pressure side.

26 Connect up the equipment for R134a. Vacuum pump the A/C system and fill it with **950 grams** of R134a refrigerant.

27 Remove the existing A/C labels and stick the "Retrofit" labels in their place. The labels are supplied in the spare parts set.

28 Carry out leak detection and performance testing as described in the service manual.

Alternative 3



Materials

- Robinair draining and cleaning station for R12
- Robinair flushing kit 17560
- Refrigerant bottle with two cocks, gas and liquid
- R12 refrigerant (approx. 10 kg) for flushing
- 1 red high–pressure hose with cock
- 1 blue low–pressure hose with cock
- Adapter 82 92 849, high–pressure side, Saab 9000 M1990–
- Adapter, oil plug (Sanden compressor), (16) 86 11 824
- Charging equipment for R134a
- R134a Refrigerant

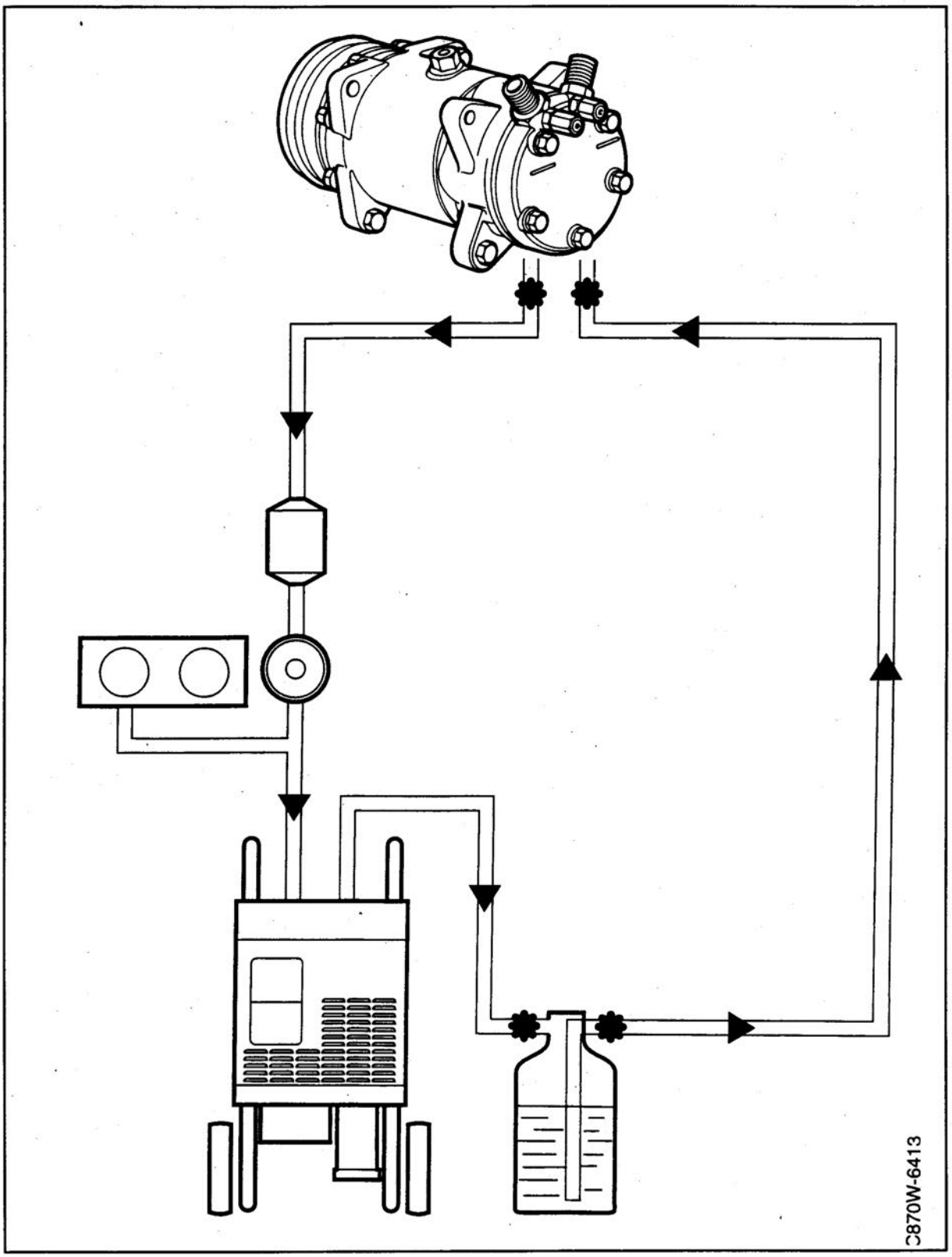
A set of spare parts for converting A/C systems from R12 to R134a has been developed. The set contains the following items:

- Dessicant container
- Pressure switch, R134a
- Labels
- Service nipples, R134a
- Compressor oil (ester)

There are three different versions of the spare parts set, depending on car model.

74 96 383	Saab 9000 M1992
74 96 466	Saab 9000 M1990 – 1991
74 96 375	Saab 9000 M1985 – 1989

Converting, alternative 3



Schematic diagram for Robinair

Converting, alternative 3 (contd.)

⚠ Warning

Wear protective gloves and eye protection and use extraction equipment when working with refrigerant. Position the extraction equipment at the service connections on the A/C system and at the outlet on the purging equipment's vacuum pump. If refrigerant comes into contact with skin or eyes, it may cause frostbite. Under no circumstances should the engine be started while work on the A/C system is in progress.

Important
When converting the A/C system, the usual practice in regard to the high–pressure and low–pressure side when draining and charging refrigerant is disregarded. Carefully follow the colour directions in the method description and on the diagram.

1 Check the operation of the A/C system as follows:

- Conduct performance test. See page 194
- Carry out leak detection procedure

Repair any system faults or damage in conjunction with conversion when the A/C system has been drained of refrigerant.

2 Drain the A/C system of refrigerant. Note the amount of compressor oil that is drained.

3 Repair any damage to the A/C system.

4 Remove the cover over the bulkhead space.

5 Remove the expansion valve's sensitive element and heat it in hot water to max. 50° C (122°F).
M1992:
Heat the expansion valve's sensitive element using a hot air gun to max. 50° C (122°F) or change to a through–drilled expansion valve.

6 Connect the blue hose from the pressure gauge set to the service nipple on the flushing station.

7 Remove the Schrader valves and Schrader openers in the A/C system and on the equipment so that a free flow is achieved during flushing.

8 Connect one end of the blue low–pressure hose to the blue low–pressure cock on the purging station's bottle.

9 Connect the other end of the blue low–pressure hose to the high–pressure side of the compressor.

10 Remove the compressor oil filler plug and fit the adapter supplied in the kit.

11 Connect one end of the red high–pressure hose to the suction side of the flushingstation.

12 Check that the cock on the red high–pressure hose is open.

13 Open both cocks on the bottle and start the draining station.

14 Open the blue low–pressure cock and charge with refrigerant (liquid).

15 When the oil is drained, foam and a film of oil will be visible in the flushing kit's sight glass. Close the blue cock on the low–pressure hose when the sight glass is at least half filled with liquid. Open the cock again when the sight glass is empty or when pressure has dropped by about **1 bar**.
Repeat this procedure until no bubbles are visible in the sight glass. Rotate the compressor swash plate a couple of times during the flushing.

16 Close the blue cock on the hose when the A/C system has been fully drained of oil after about 45 minutes.

17 Drain off the compressor oil from the draining station, note the amount and check that at least 90% of the total volume of oil has been removed.

Converting, alternative 3 (contd.)

18 Connect the other end of the red high–pressure hose to the compressor oil filler connection.

19 Refit the expansion valve's sensitive element.

20 Change the dessicant container for the one supplied in the set.

21 Fit the three–stage pressure switch supplied in the set to the new dessicant container.

22. Refit the Schrader valves that will be needed for the service valves that are to be fitted.

23 Refit other components that have been removed.

24 Fill the compressor crankcase with the specially developed retrofit compressor oil. This oil is supplied in the spare parts set.
135 ml

25 Refit the oil plug to the compressor.

26 Screw the new service valves supplied in the set into place. The larger one is for the high–pressure side and the smaller one for the low–pressure side.

27 Connect up the equipment for R134a. Vacuum pump the A/C system and charge it with R134a refrigerant.
950 grams

28 Remove the existing A/C labels and stick the "Retrofit" labels in their place. The labels are supplied in the spare parts set.

29 Carry out leak detection and performance testing as described in the service manual.

Adjusting / changing components

Cooling performance test, A/C system

A performance test shows whether the A/C system is actually working. There may still be faults in the control of the A/C system or the temperature in the cabin, which require more thorough investigation.

Conditions

Doors and windows	Closed
Panel vents	All open
Engine speed	1500 – 2000 rpm

Rear A/C

Doors and windows	Closed
Panel vents	All open
Engine speed	1500 – 2000 rpm

Control settings

	Manual A/C	ACC
Fan speed	4	Max. fan
Temperature	Cold	"LO"
Air distribution valve	VENT	"VENT" manual selection
Recirculation	Yes	Yes

Rear A/C

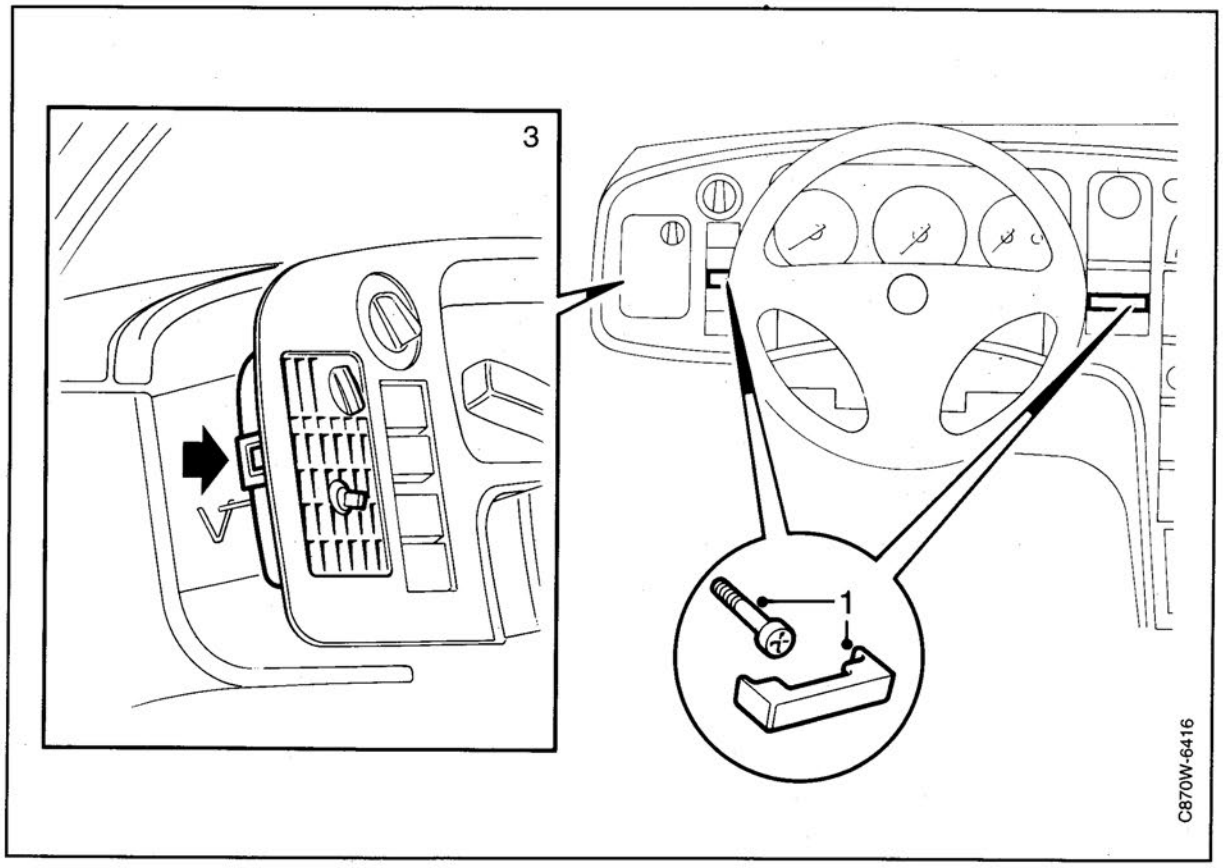
Fan speed		Max. fan front and rear
Temperature		"LO"
Air distribution valve		"VENT" manual selection
Recirculation		Yes

Cooling performance test, A/C system (contd.)

Readings after 5 minutes

Ambient temperature		20° C	30° C	40° C
R12 system until –91				
Air temperature measured approx. 100 mm inside the centre facia vents		6° – 10° C	6° – 10° C	10° – 12° C
Pressure measured on suction side of compressor, Compressor switched ON / OFF		1 – 3 bar	1 – 3 bar	1 – 3 bar
Pressure measured on pressure side of compressor, Radiator fan ON/OFF	R12	14.5/10.5 bar	14.5/10.5 bar	14.5/10.5 bar
	R134a	16.5/12.5 bar	16.5/12.5 bar	16.5/12.5 bar
Radiator fan second stage ON/OFF				22/18 bar
Rear A/C				
Air temperature measured approx. 50 mm inside the rear facia vent		6° – 12° C	6° – 12° C	10° – 12° C

Facia vent on driver's side, changing



To remove

1 Remove the covers over the screws to the right and left of the steering wheel.
Remove screws.

2 Extract the instrument illumination rheostat.

3 Carefully pull forward to the instrument panel. Detach the facia vent by pressing in the three fastening lugs. In certain cars, the panel vent is also attached with spring fasteners.
Remove vent

Fitting

4 Align the facia nozzle in the air ducts for the facia vent and defroster vent.

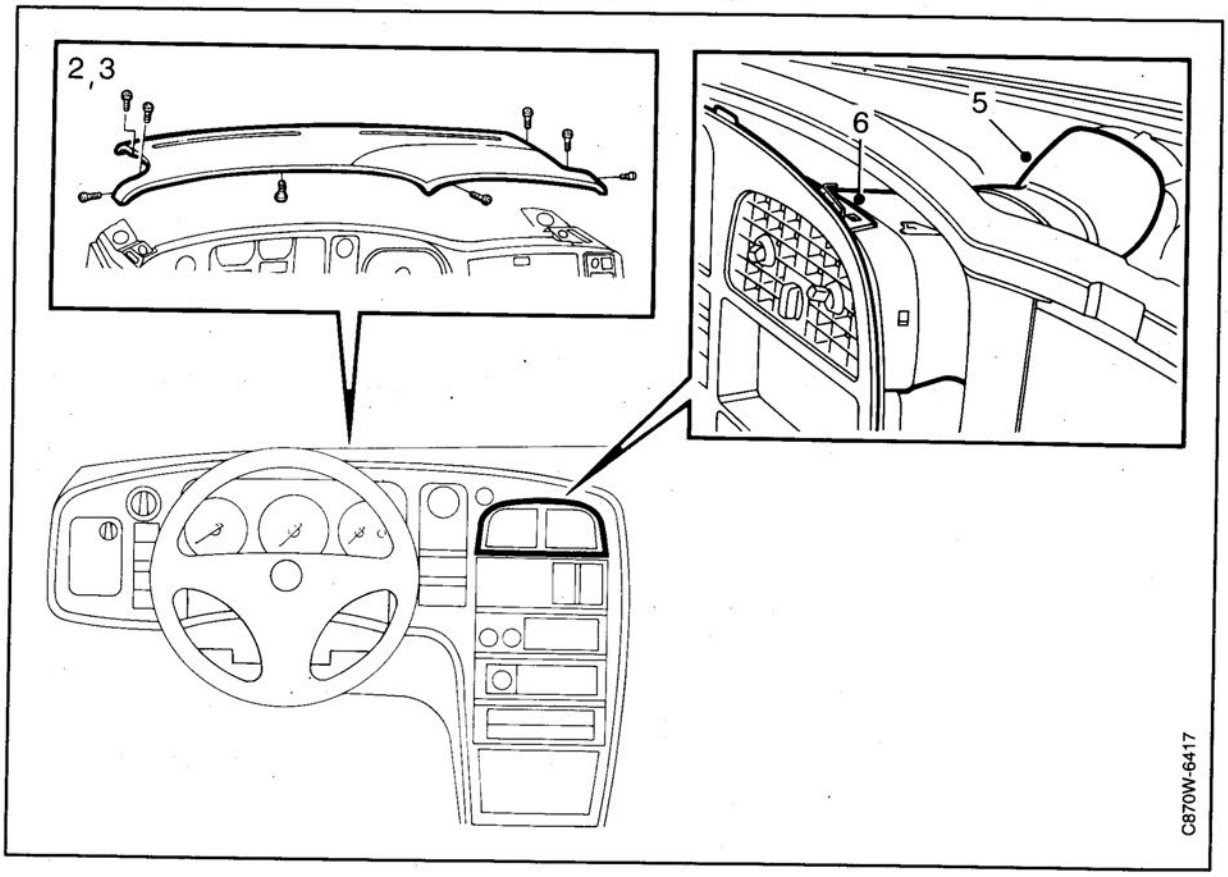
5 Refit the instrument panel over the facia vent. Make sure that the fastening lugs engage.

6 Fit the instrument illumination rheostat.

7 Refit screws and covers.

8 Pull the nozzle into position on the instrument panel using a bent welding rod.

Centre panel vent, changing/adjusting



To remove

1 Remove the door trim seals from the A pillars and remove the trim from the A pillars.

2 Remove the loudspeaker grilles.

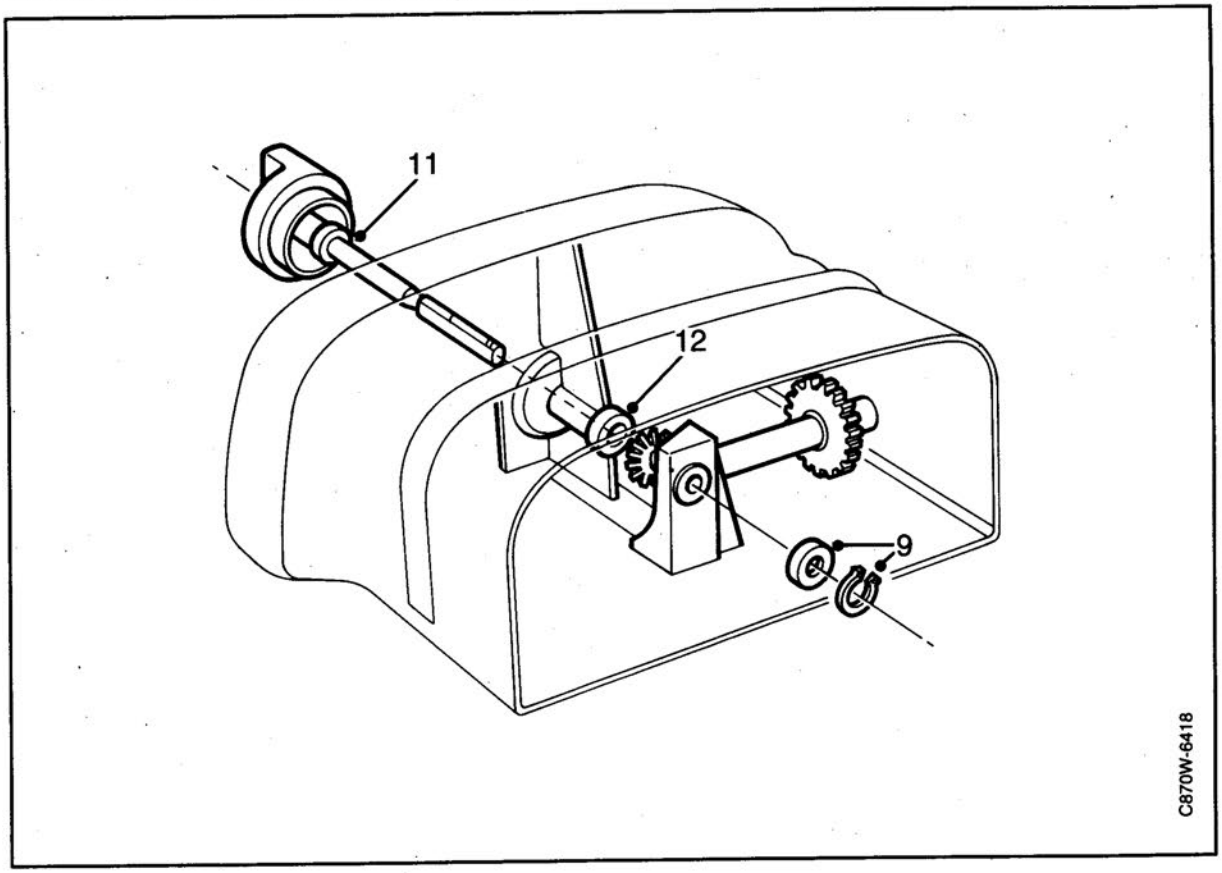
3 Remove the screws from the upper part of the facia. Lift up the front edge of the facia and pull it in toward the cabin so that the clips on the rear edge come loose.

4 Press the facia vent and air duct towards the cabin.

5 Detach the rear edge of the air duct by lifting it up. Remove air duct.

6 Detach the facia vent securing lugs and lift out the nozzle from behind.

Centre facia vent, changing / adjusting (contd.)



Adjusting

In certain cars with chassis number up to N1036712, the damper can be closed by the air flow. This is remedied using **Service kit part number 86 05 461.**

7 Remove the damper from the facia vent.

8 Remove the circlip and washer from the control shaft.

9 Press the control shaft out of the air vent and remove the crinkle washers from the gear. Use utility pliers if necessary.
These washers should not be refitted.

10 Fit the O–ring to the control shaft and place it behind the knob.

11 Insert the control shaft a short distance into the vent and fit the flat washer and gear.

12 Make sure that the damper's intermediate shaft is in position. Make sure that the knob is within the control range and press the control shaft into position.

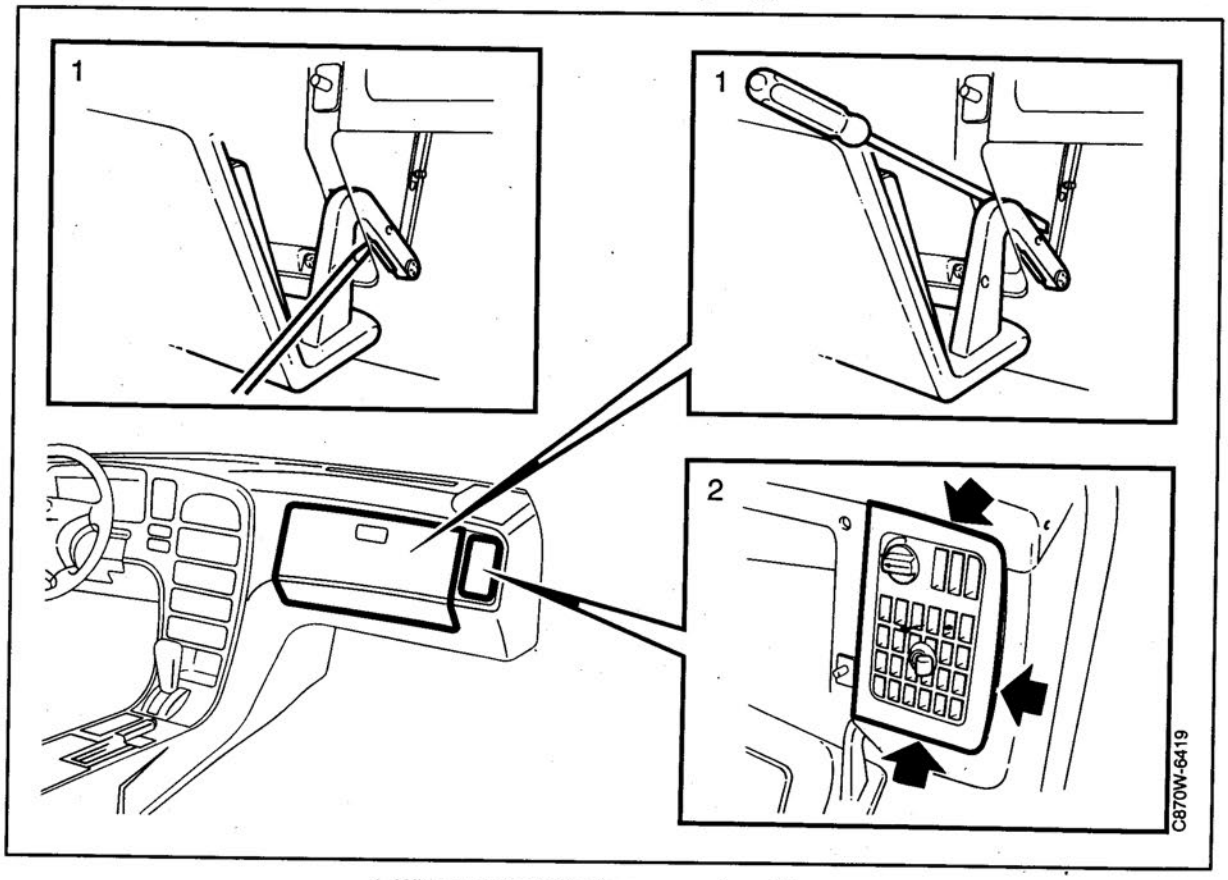
13 Place washer and retaining ring on control shaft.

14 Refit the damper and check that its position corresponds to the indication on the front of the vent.

Fitting

15 Make sure that the air duct lugs interlock when fitting.

Facia vent on passenger side, changing



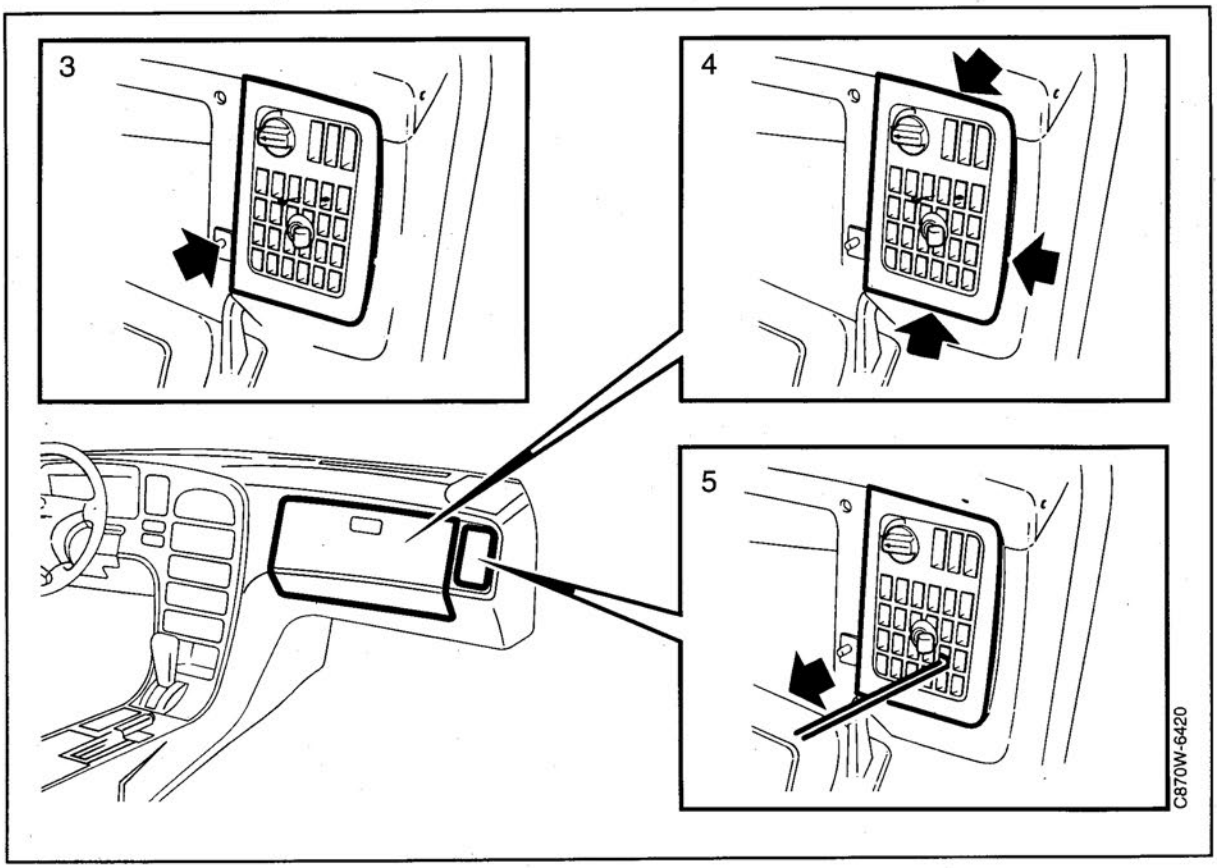
1. Without adjustable glove compartment flap
2. With adjustable glove compartment flap

To remove

1 Fully open the glove compartment flap by bending out the link arms in order to release the stops. Pull down the glove compartment lamp inside the glove compartment. If the car is equipped with a passenger airbag, the airbag module should be removed as described in manual 8:6.

2 Remove the glove compartment together with the facia vent by undoing the six screws. Using a screwdriver, carefully prise along the facia vent. Note the position of the clip.
Detach cables from glove compartment lamp and the lighting switch.

Facia vent on passenger side, changing (contd.)



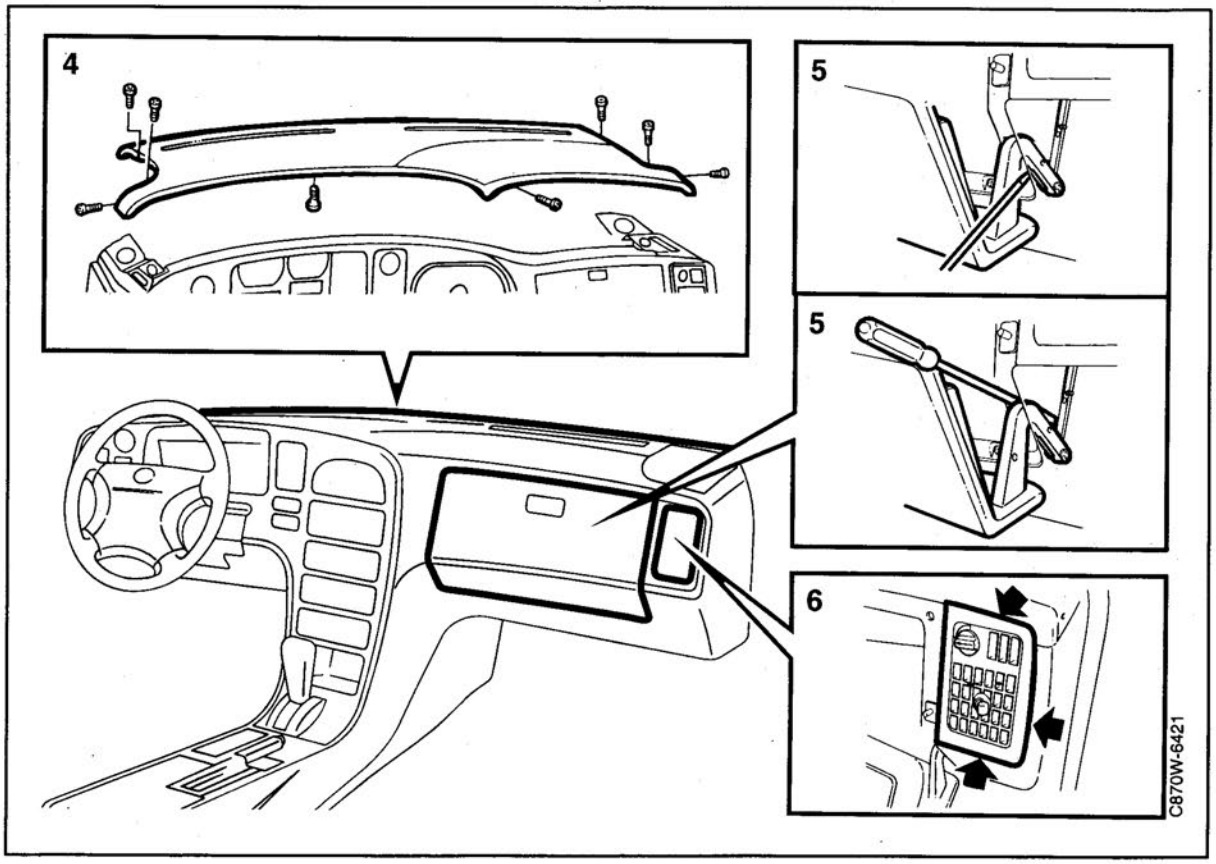
Fitting

3 Fit the fresh air nozzle to the defroster hose.

4 Check that the clip is engaged. Connect cables. Fit glove compartment.

5 Pull the fresh air vent into position using a bent wire.

Heater housing, removal



1 Detach the negative lead from the battery.

2 Undo the fan housing and remove the heat exchanger. See separate description.

3 Remove the door trim seals from the A pillars and remove A pillar trim.

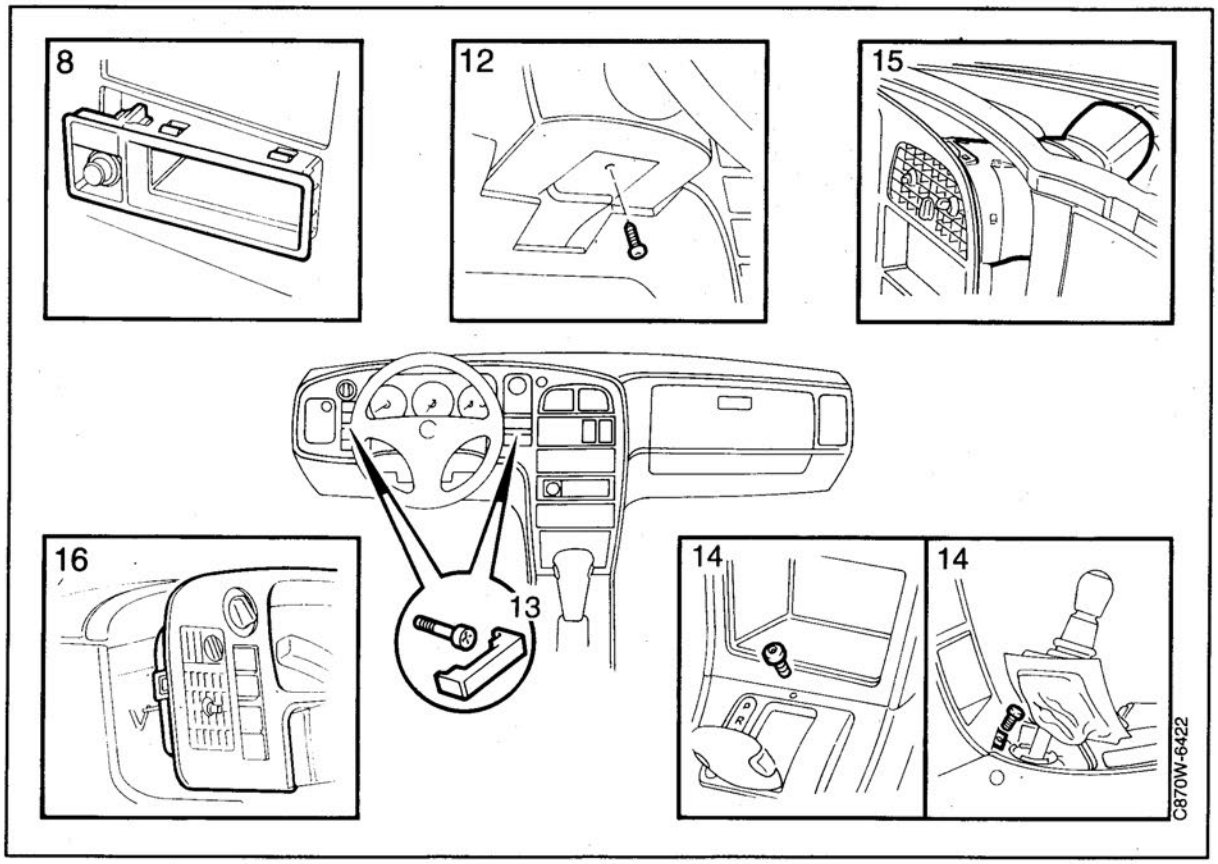
4 Remove loudspeaker grille and upper part of facia. Unplug solar sensor connector in cars with ACC.

5 Fully open the glove compartment flap by bending the link arms to release the stops. Pull down the glove compartment light inside the glove compartment.

Cars equipped with passenger airbag:
Remove the upper part of the facia, see Service Manual 8:2 Interior Equipment, section 853. On right–hand drive cars, the main instrument must also be lifted out.

6 Remove the glove compartment together with the facia vent by undoing the six screws. Using a screwdriver, carefully prise along the facia vent. Note the position of the clip.
Detach cables from glove compartment lamp and the lighting switch.

Heater housing, removal (contd.)



7 Detach the electrical distribution box and move it down.

8 Remove the ashtray.

9 Bend down the two upper retaining lugs and pull forward the ashtray holder. Unplug cables from cigarette lighter and ashtray light.

10 Pull the steering wheel as far forward as possible.

11 Remove steering wheel. See group 6, section 641.

12 Remove the protective covers from the steering column.

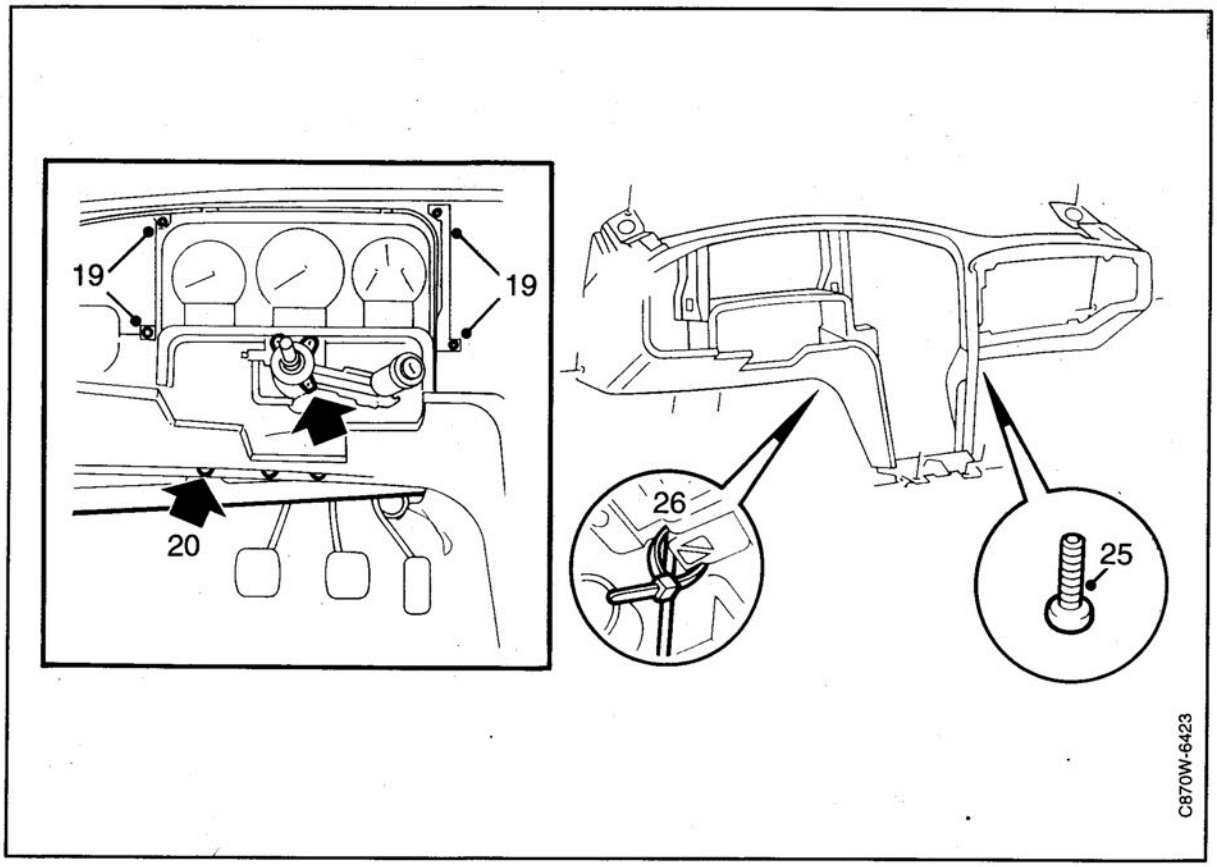
13 Remove covers and remove instrument panel screws.

14 Cars with manual gearbox:
Engage reverse.
Remove screw under gear lever gaiter.
Cars with automatic transmission:
Remove plug and screw securing gear selector cover.

15 Remove the centre facia vent and air duct.
Standard and standard with A/C:
Detach the control panel by pressing in the four securing lugs and pulling it into the cabin. Detach the air distributor rod, the temperature control damper gear and all connectors (make sure that the temperature control is in position 0).
ACC:
Pull forward the ACC control module. Unplug the connector and ground cable. Cut the cable tie securing the wiring.

16 Detach the outer facia vent from the instrument panel.

Heater housing, removal (contd.)



17 Unplug connectors from switches and clock. Mark connectors to make it easier to refit them. Lift off the instrument panel.

18 Dismantle the selector switch. Mark connectors to make it easier when refitting them.

19 Remove screws from combined instrument.

20 Remove acoustic insulation panels from under the facia. Remove panels from centre console.

21 From year model 1988
Remove left–hand and right–hand floor ducts.

22 Remove screws securing left–hand and right–hand side defroster ducts.

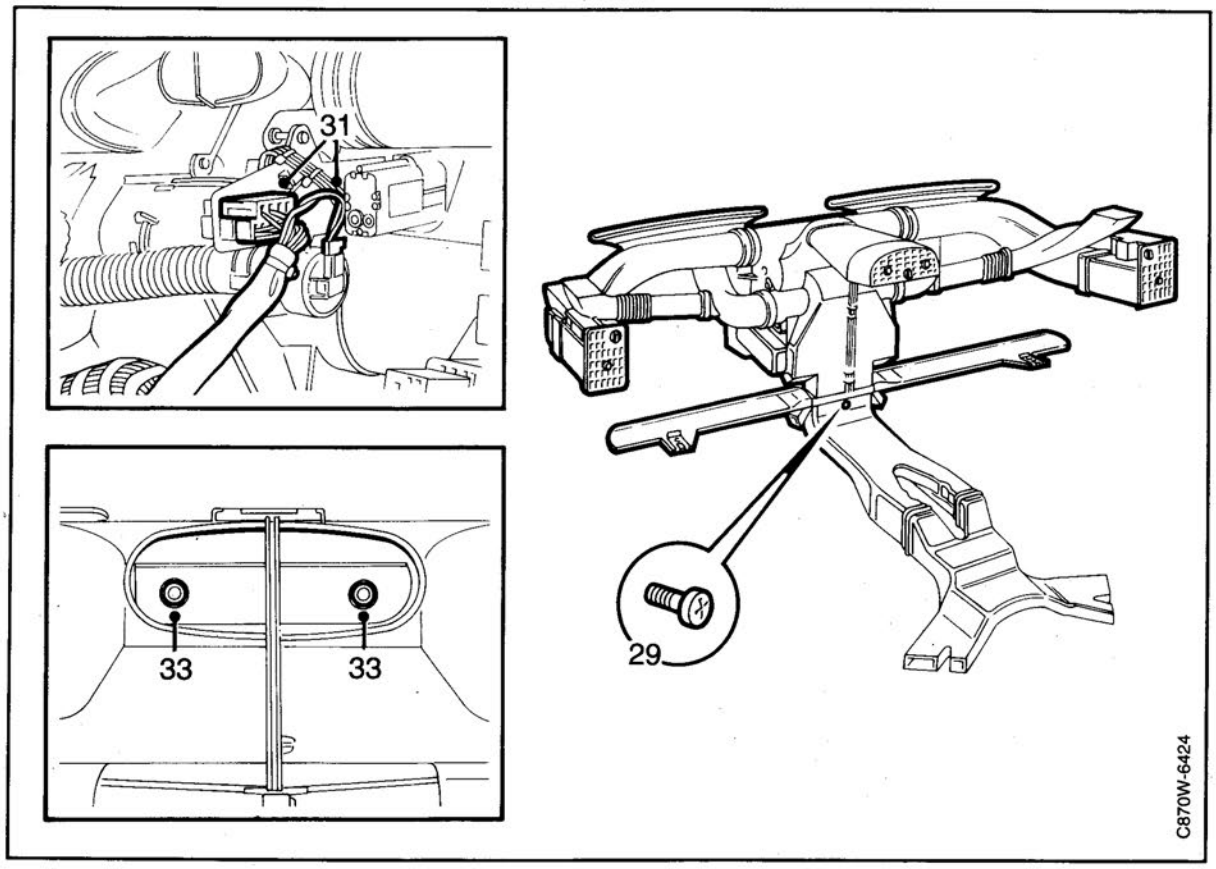
23 Cut the cable tie securing the wiring harness to the left–hand air duct (right–hand drive cars in right–hand air duct).

24 Unplug loudspeaker connections.

25 Remove screws securing the instrument panel and lift it out.

26 Detach cable tie from heater housing so that the electrical distribution box can be lifted down to the floor of the car.

Heater housing, removal (contd.)



27 Lift down the combined instrument.

Important
Protect the glass so that it is not scratched.

28 Remove the air duct and the left–hand and right–hand defroster vents.

29 Undo the screws and lift away the air duct which goes to the rear floor.

30 Unscrew the plastic holder securing the wiring loom under the heater housing.

31 Unplug connectors for servomotor, fan motor and blended air sensor (cars with ACC only).

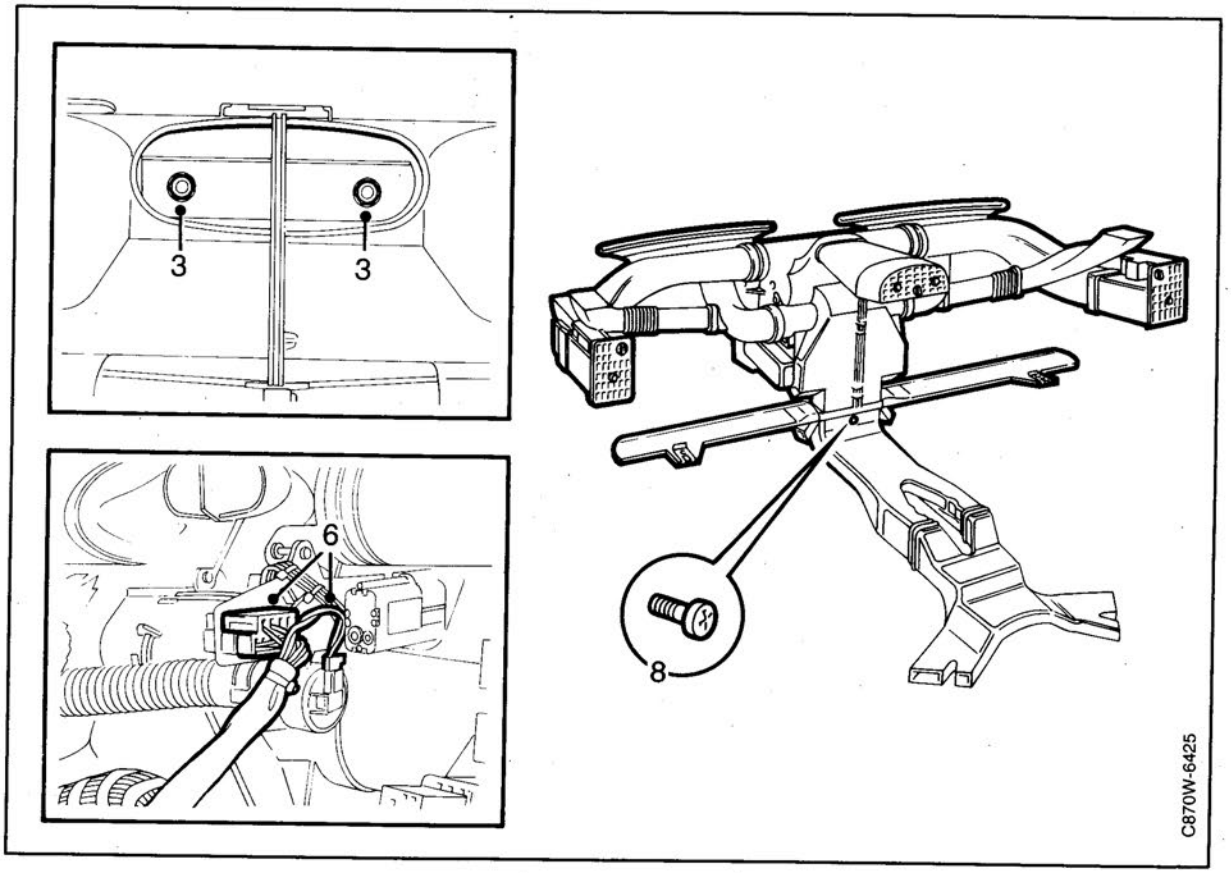
32 Remove the floor vents.

33 Remove screws in heater housing.

34 Detach clips from engine compartment and move cable entry to one side.

35 Lift the housing diagonally up. The underpart is located in a groove between the bulkhead and the facia subframe.
Picture shows year model 1985–1986

Heater housing, fitting (contd.)



Fitting

1 Fit a new seal between the heater housing and bulkhead.

2 Fit the heat exchanger in housing. Fit housing in position. Make sure that the lower edge of the housing is in its groove.

3 Fit screws to housing.

4 Fit cable entry in position.

5 Fit floor vents.

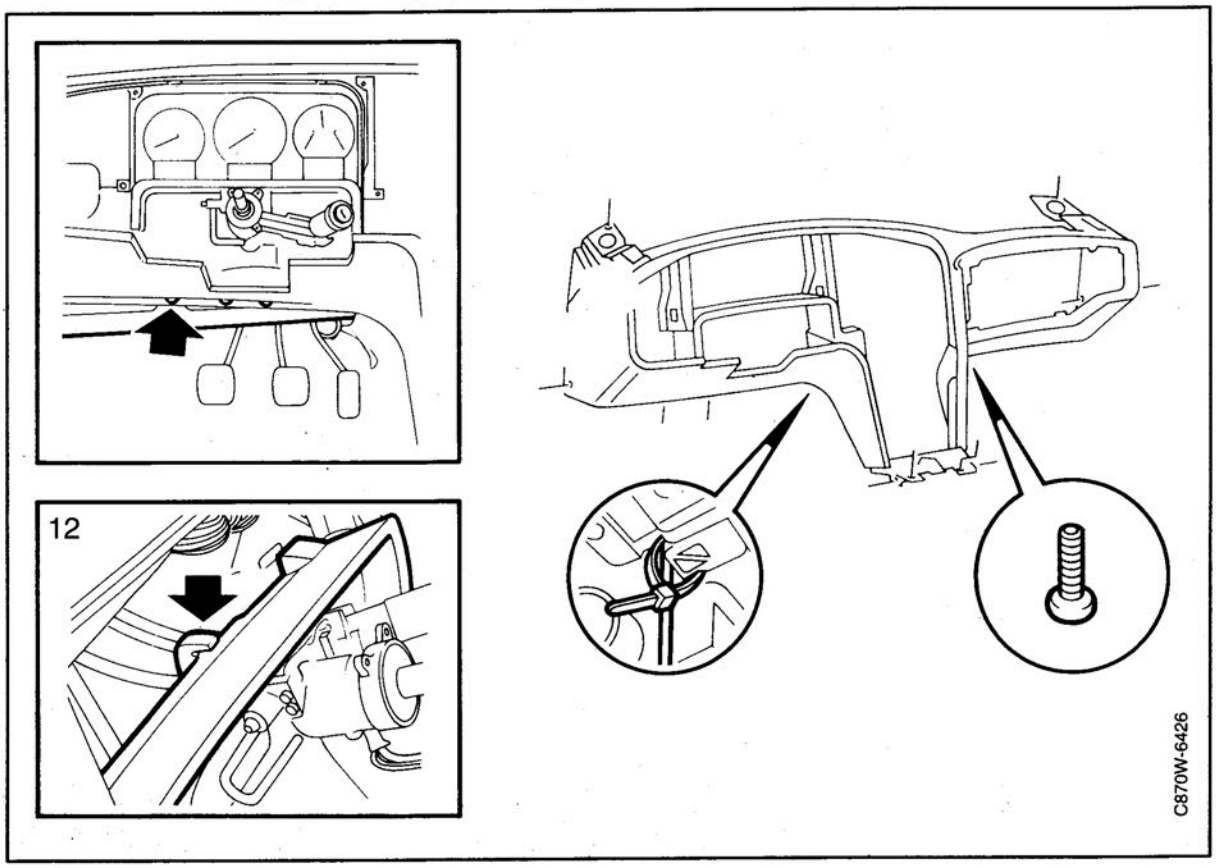
6 Plug in connectors for servomotor, fan motor and blended air sensor (cars with ACC only).

7 Fit the plastic holder securing the wiring harness under the heater housing.

8 Fit the air duct which goes to the rear floor.

9 Fit the defroster vent and defroster air ducts.

Heater housing, fitting (contd.)



10 Suspend the electrical distribution box in position and fit the wiring harness cable tie to the heater housing.

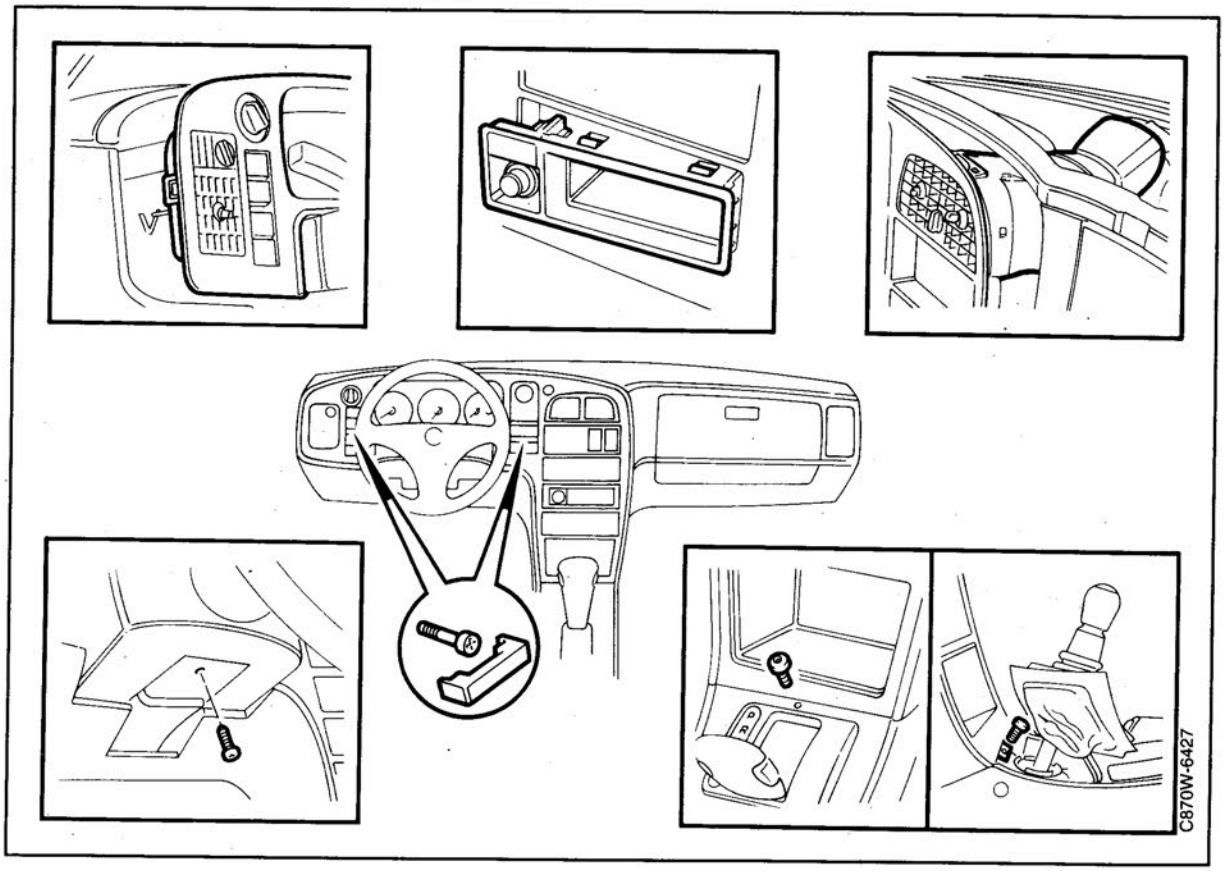
11 Place the combined instrument on the steering column bracket.

12 Place the facia in position and do up screws. Make sure that the facia is guided into the groove on the guide lug.

13 Screw the combined instrument into position.

14 Connect cables to loudspeakers.

Heater housing, fitting (contd.)



15 Fit air ducts to left–hand and right–hand facia vents.

16 Using a cable tie, secure the wiring harness to the left–hand air duct. (Right–hand drive cars – right–hand air duct).

17 Fit the screws securing the left–hand and right–hand side defroster ducts.

18 Fit the instrument panel facia vent to its hose.

19 Plug in electrical connectors to instrument panel.

20 Fit the centre facia vent and hose.

21 Fit the instrument panel to facia.

22 Plug in connectors and fit selector switch.

23 From year model M1988
Fit left–hand and right–hand floor duct.

24 Fit heater control panel or ACC control module.

25 Fit cover on steering column joint.

26 Fit steering wheel, see group 6, section 641.

27 Lift and fit electrical distribution box.

28 Fit facia vents and glove compartment. If an air-bag has been removed, see Service manual 8:2, Interior, section 853.

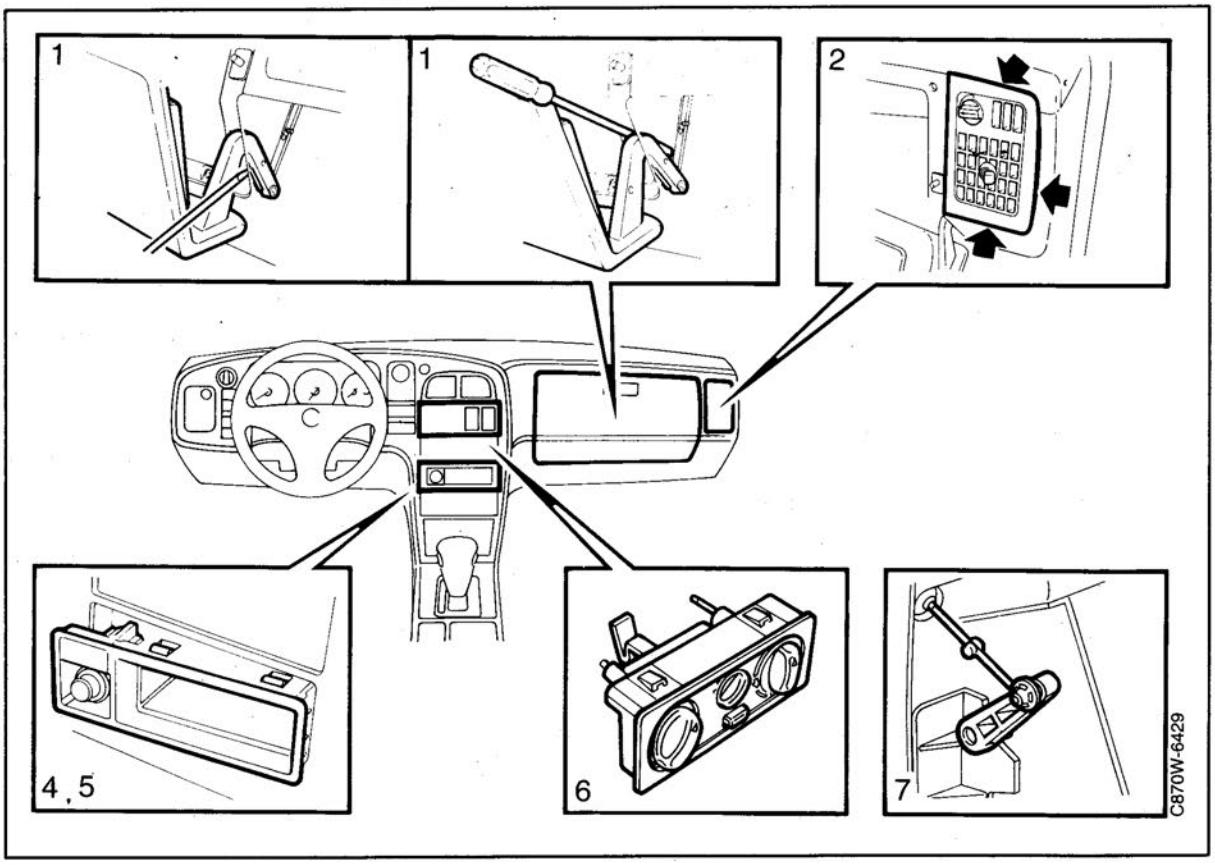
29 Fit the top of the facia, loudspeaker grilles and A pillar trim.

30 Fit ashtray holder and ashtray.

31 Fit the panel sections to the centre console and the acoustic insulation panels under the facia.

32 Fit fan housing.

Control panel, changing



1 Fully lower the glove compartment flap by bending out the link arms so that the stops are released. Pull down glove compartment light.

2 Remove the glove compartment together with the facia vent by undoing the six screws. Using a screwdriver, carefully prise along the edge of the facia vent. Note position of clip. Detach cables from glove compartment lamp and the lighting switch.

Cars equipped with passenger airbag:
Remove the upper part of the facia, see Service Manual 8:2 Interior Equipment, section 853. On right–hand drive cars, the main instrument must also be lifted out.

3 Undo electrical distribution box and lift down.

4 Remove the ashtray.

5 Pull the ashtray holder forward by bending down the two upper locking tabs.

6 Detach the control panel by pressing in the four retaining lugs and pulling it into the cabin.

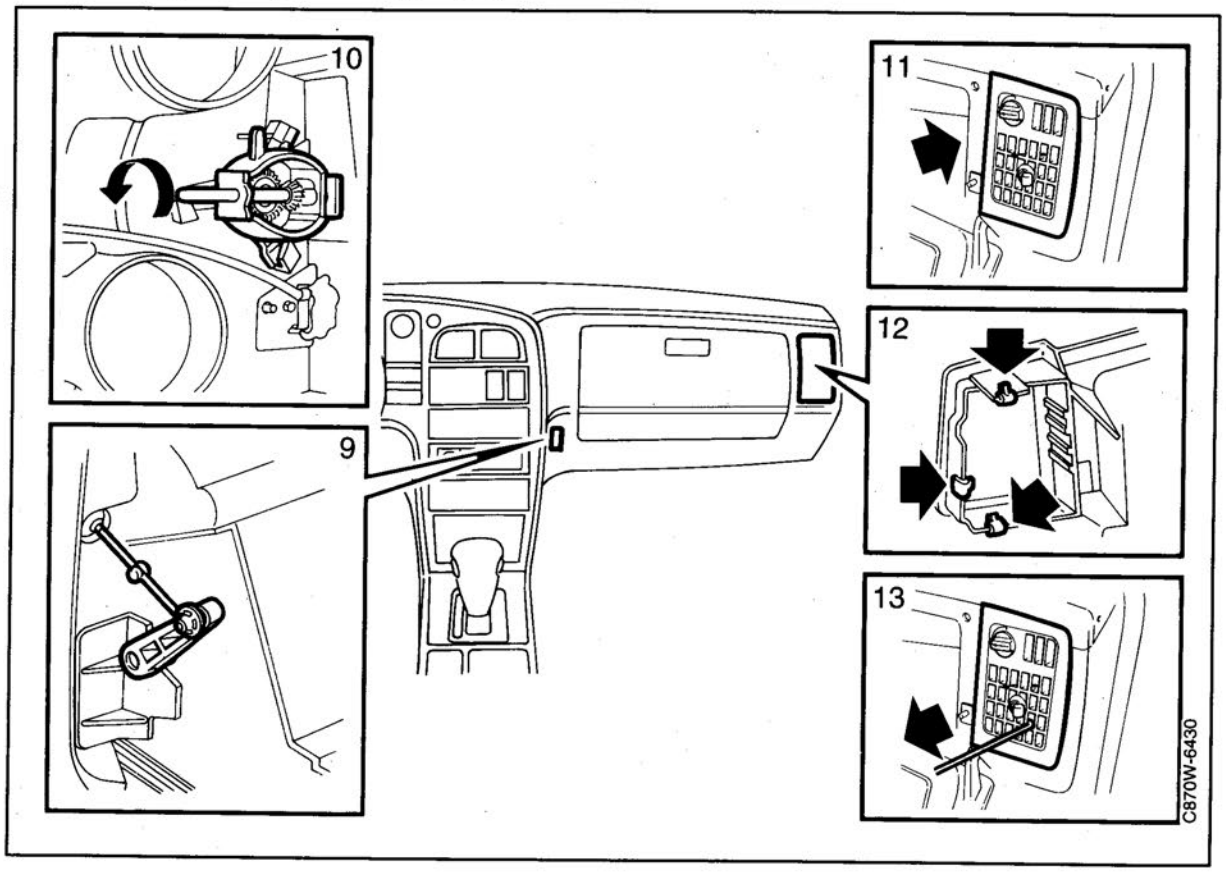
7 Detach
The air distributor rod

The temperature valve gear, making sure that the temperature control is set to position 0.

All connectors

8 Plug in all connectors to the new control panel.

Control panel, changing (contd.)



9 When fitting the temperature valve gear:
Make sure that the valve shaft in the engine compartment is set to cold, and that the valve shaft is "closest" to the engine compartment. Set heater control to cold.
Attach gear to control panel.

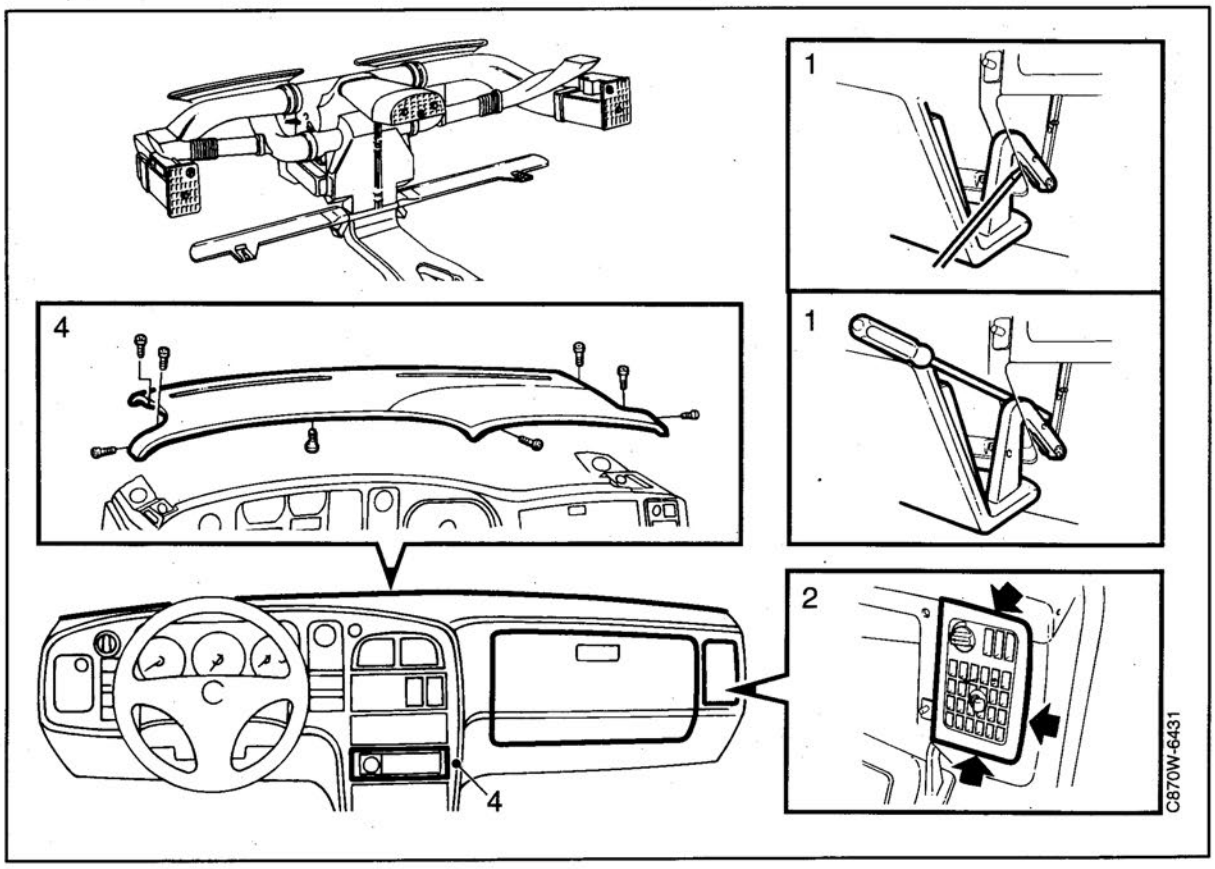
10 When fitting air distributor rod:
Turn the air distributor gear on the heating and ventilation unit to the far left. Set the air distributor control to position 0. Fit the rod with the orange part towards the shaft on the control panel.
Press the control panel into position. Check operation.

11 Fit the fresh air nozzle to the defroster hose.

12 Check that the clip is attached.
Connect leads.
Fit the glove compartment. If an airbag has been removed, see Service manual 8:2, Interior Equipment, section 853.

13 Pull the fresh air vent into position using a bent wire.

Temperature control cable, changing



1 Fully lower the glove compartment flap by bending out the link arms so that the stops are released. Pull down the glove compartment light.

2 Remove the glove compartment together with the facia vent by undoing the six screws. Using a screwdriver, carefully prise along the edge of the facia vent. Note position of clip. Unplug cables to glove compartment light and light switch.

Cars equipped with passenger airbag:
Remove the upper part of the facia, see Service Manual 8:2 Interior Equipment, section 853. On right–hand drive cars, the main instrument must also be lifted out.

3 Remove door trim seals from A pillars and remove A pillar trim.

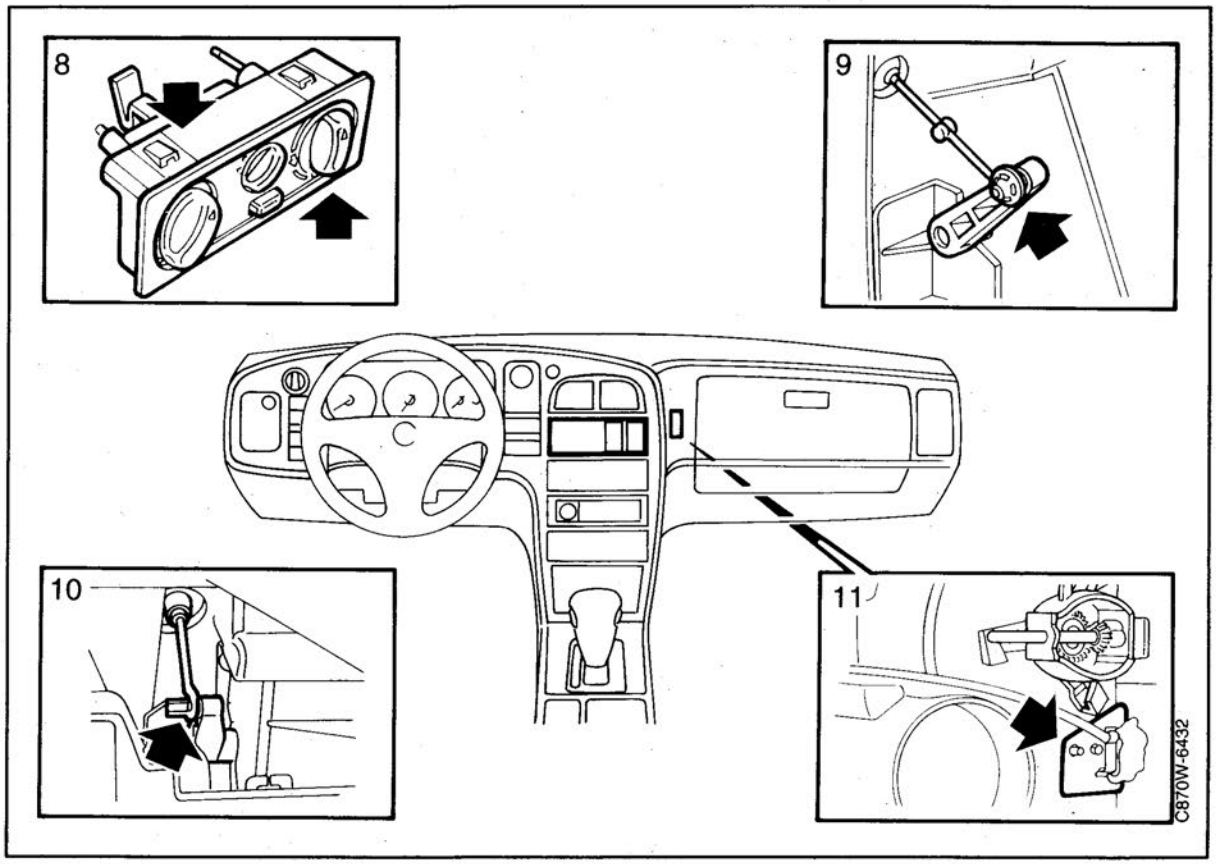
4 Remove loudspeaker grilles. Remove screws from the top of the facia. Remove the top of the facia by lifting up its front edge and pulling it into the cab so that the clips come loose.

5 Undo the screws and pull the electrical distribution box down.

6 Remove the air ducts to the outer facia vent and defroster. Unscrew the windscreen defroster.

7 Remove the ashtray. Pull the ashtray holder forward by bending down the two upper securing lugs.

Temperature control cable, changing (contd.)



8 Detach the control panel by pressing in the four securing lugs and pulling it into the cabin. Make sure that the temperature control is set to position 0.

9 Detach the air distributor rod. Detach the temperature control cable gear from the control panel.

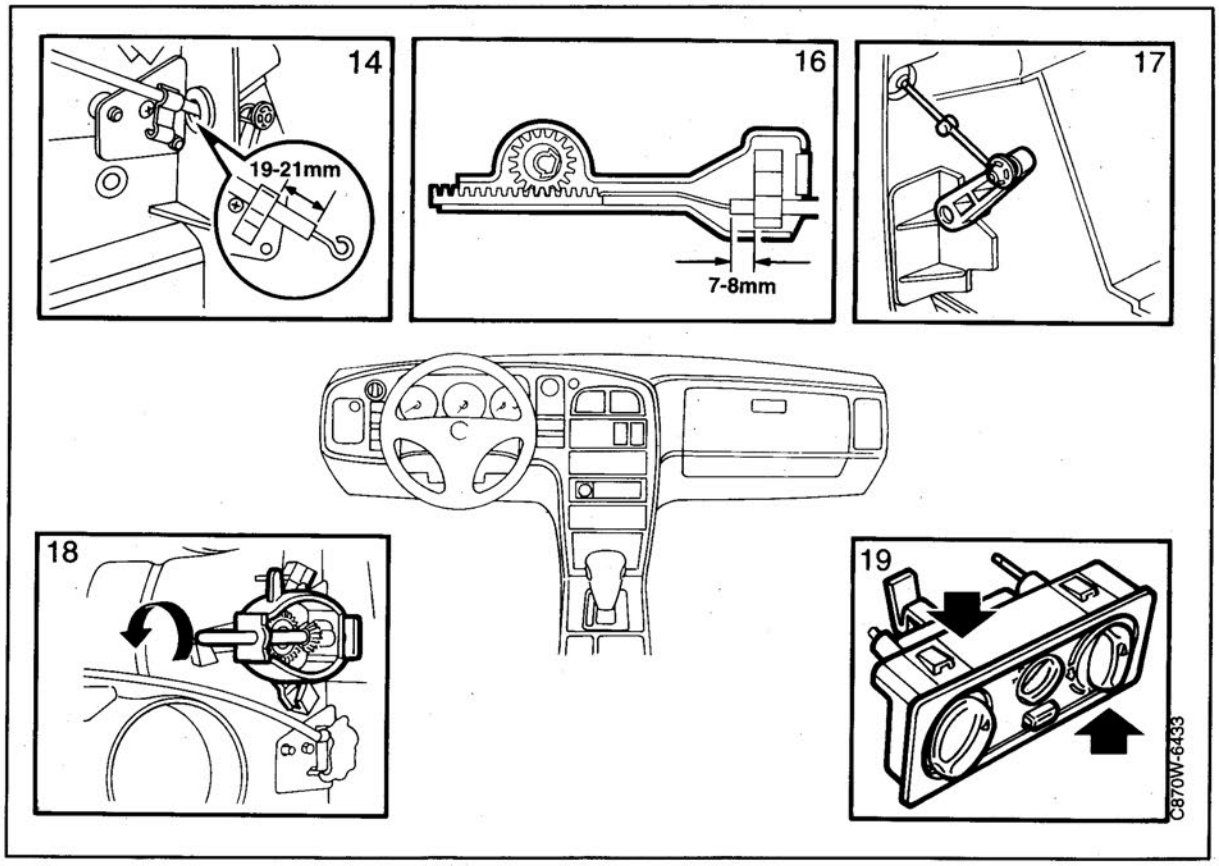
10 Remove the cover from the ventilation fan filter/ evaporator casing.
Remove the clip from the valve shaft in the engine compartment and detach the cable.

11 Remove the bracket complete with cable and clip from heating and ventilation unit. Detach cable from bracket.

12 Detach cable from temperature control gear.

13 Attach cable to valve shaft in engine compartment.

Temperature control cable, changing (contd.)



14 Fit a new cable to the bracket. Note dimension for cable sleeve, 19–21 mm.

15 Fit bracket complete with cable to heating and ventilation unit.

16 Fit cable to gear. Note dimension for cable sleeve, 7–8 mm.

17 When fitting gear to control panel:
Check that the valve shaft in the engine compartment is set to cold, and that the valve shaft is "closest" to the engine compartment.
Set the heater control to cold. Fit gear to control panel.

18 When fitting air distributor rod:
Turn the air distribution gear on the heating and ventilation unit fully to the left.
Set the air distribution control to position 0. Fit the rod with the orange coloured part towards the shaft on the control panel.

19 Fit control panel.

20 Check operation.

21 Fit
Air duct for defroster

Air duct for outer facia

Vent

Electrical distribution box

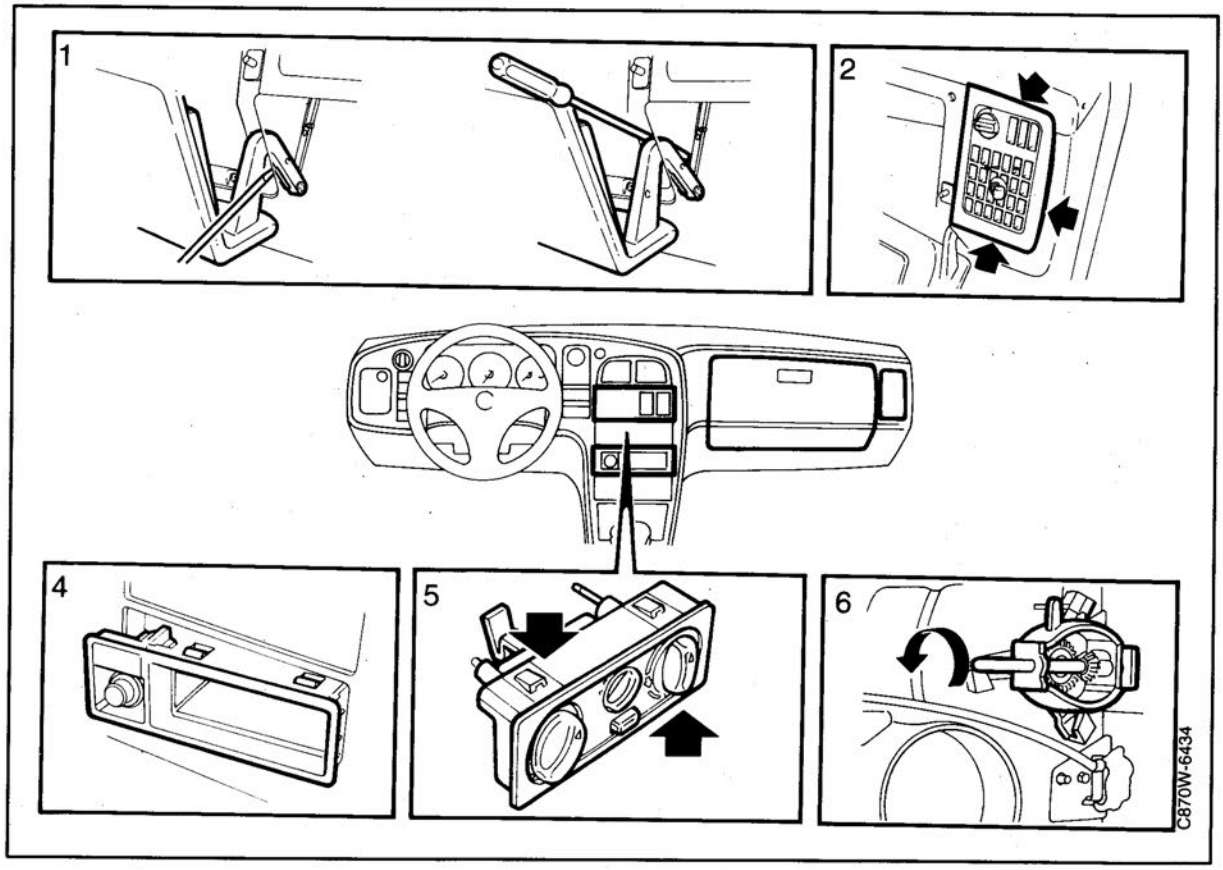
Upper part of facia

Loudspeaker grilles

Glove compartment (guide in air ducts) if an air-bag has been removed, see Service manual 8:2, Interior Equipment, section 853

A pillar trim and door seals

Gear and rod for air distributor, changing



To remove

1 Fully open the glove compartment by bending out the link arms so that the stops are released. Pull down glove compartment light.

2 Remove the glove compartment together with the facia vent by undoing the six screws. Using a screwdriver, carefully prise along the edge of the facia vent. Note position of clip. Detach cables from glove compartment lamp and the lighting switch.

Cars equipped with passenger airbag:
Remove the upper part of the facia, see Service Manual 8:2 Interior Equipment, section 853. On right–hand drive cars, the main instrument must also be lifted out.

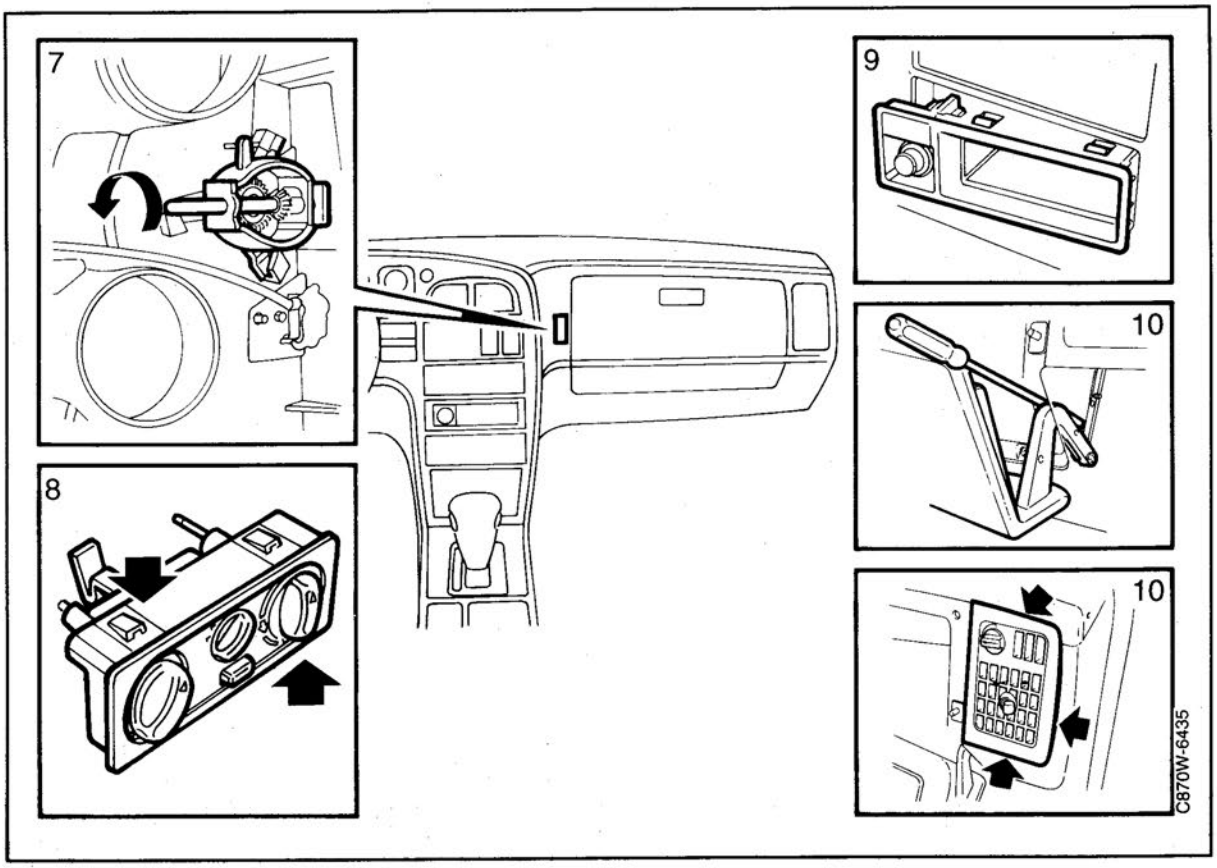
3 Undo electrical distribution box and lift down.

4 Remove the ashtray. Pull the ashtray holder forward by bending down the two upper securing lugs.

5 Detach the control panel by pressing in the four securing lugs and pulling it into the cabin. Make sure that the temperature control is set to position 0.
Detach air distributor rod.

6 Remove gear from heating and ventilation unit by pressing the clips on the top of the gear to the right. At the same time, turn the gear up so that the clips are released. Pull gear from valve.

Gear and rod for air distributor, changing (contd.)



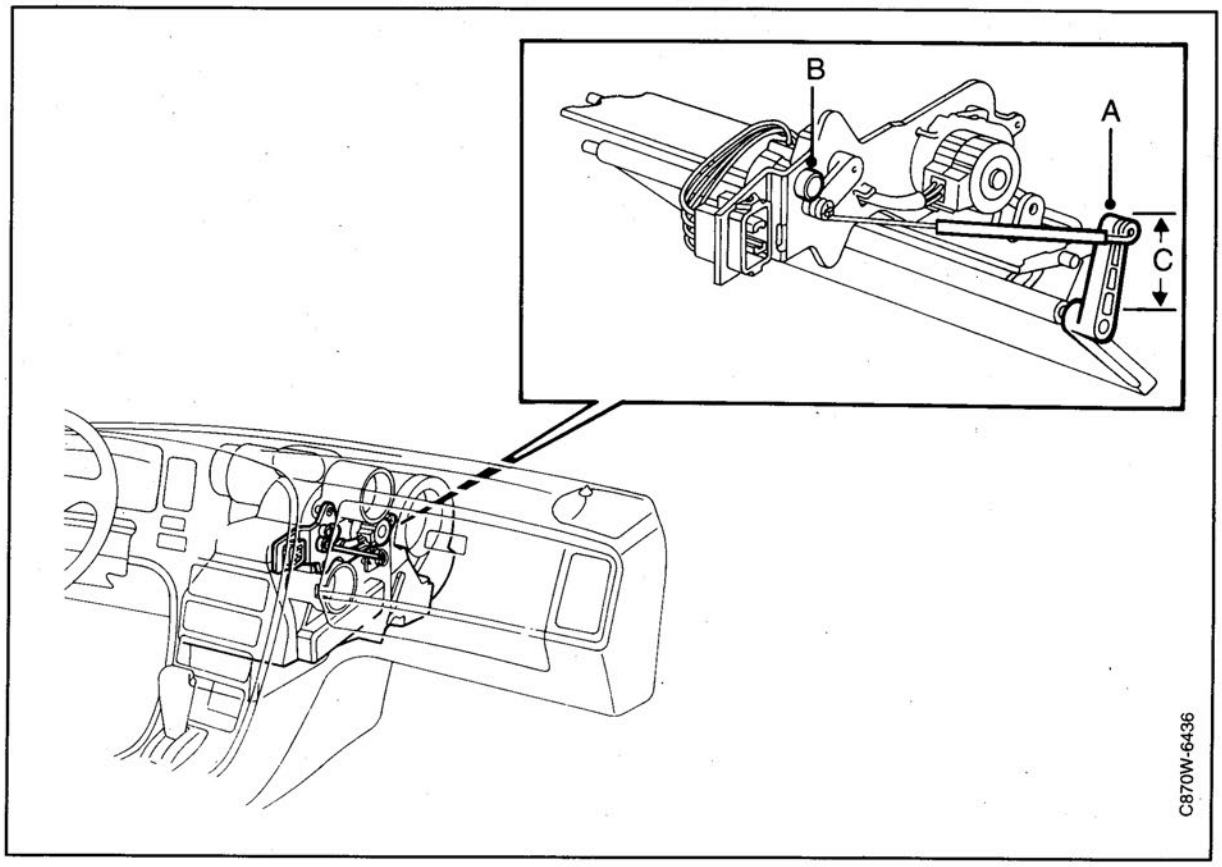
7 Fit a new gear.
Fit shaft to gear in air distributor. Turn the gear so that the clips lock into the lugs on the heating and ventilation unit.
When fitting rod:
Turn the shaft on the gear fully to the left. Set the air distribution control to position 0. Fit the rod with the orange coloured part towards the shaft on the control panel.

8 Press the control panel into position. Check operation.

9 Fit ashtray holder and ashtray.

10 Fit glove compartment and facia vent. If an airbag has been removed, see Service manual 8:2, Interior Equipment, section 853.

Air mixing damper arm, repairing



All cars from year model 1990, up to chassis number N1042558 are equipped with generation 2 automatic climate control (ACC2).

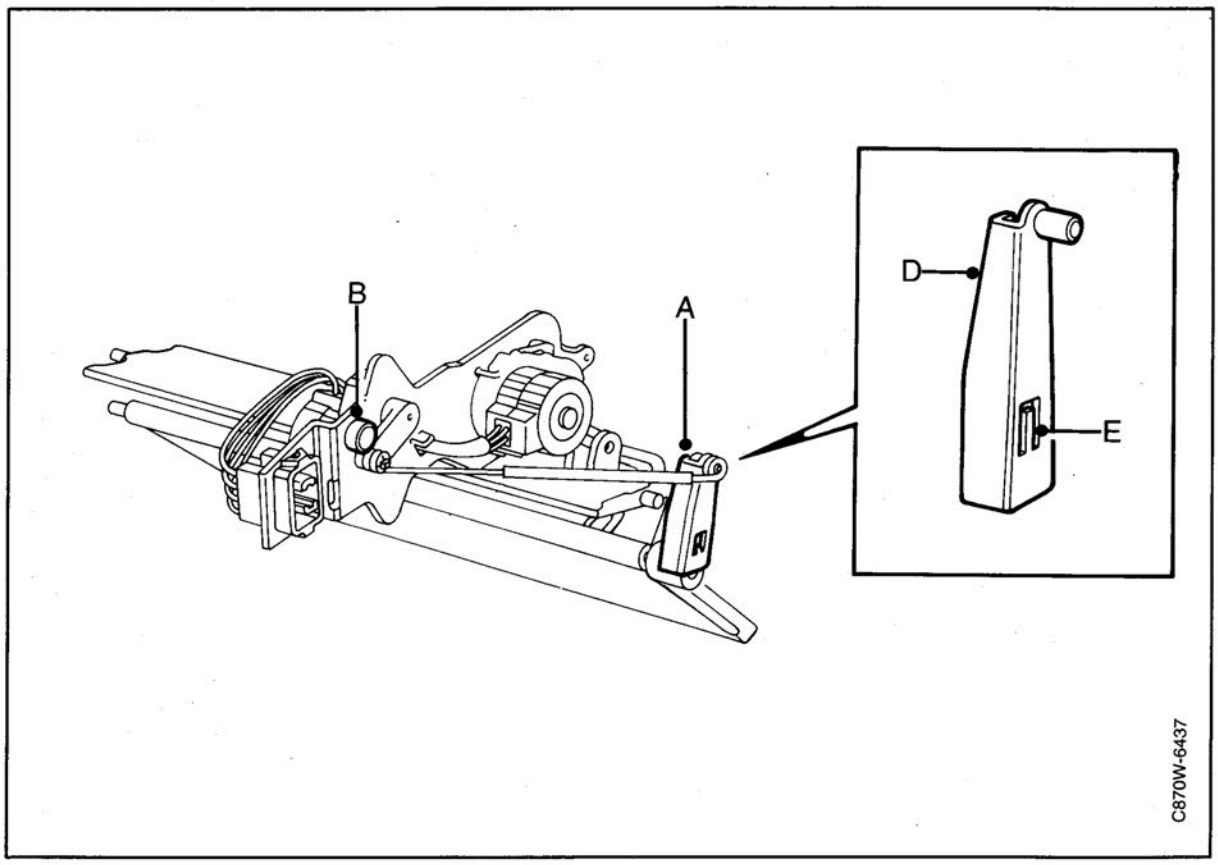
It has become apparent that the stepping motor which controls the air mixing damper has two wide a range. In certain cases, this can lead to the damper levers (A) breaking.
In order to make it possible to repair damaged dampers as simply as possible, a spare parts lever made of steel has been developed. The spare parts lever can be used if the air mixing damper lever is damaged in the area marked (C). If the damage is outside this area, the entire damper must be changed.
In production, from chassis number N1042529, a rubber bushing has been fitted to the end position stop closest to the connector (B), which limits the control range.

Materials

Spare parts kit 74 96 433
Kit contains the following items:

- Rubber bushing, 43 82 826
- Steel lever, 43 83 857

Air mixing damper arm, repairing (contd.)



Fitting steel lever

1 Switch on the ignition.
2 Select "LO" on the ACC control module.
3 Switch off the ignition.
4 Remove the cover over the bulkhead.
5 Detach the cable from the damaged part of the lever (A).
6 Fit the steel lever (D).
7 Secure the steel lever by pressing in locking lug E.
8 Refit the cable and press on the clip.
9 Refit the cover over the bulkhead.
10 Remove the ACC control module from the facia.
11 Fit rubber bushing part number 43 82 826 to the lever's rear end position stop (B).
12 Place the ACC control module in position in the facia.
13 Calibrate the ACC control module by switching on the ignition and then pressing "AUTO" and "VENT" at the same time.

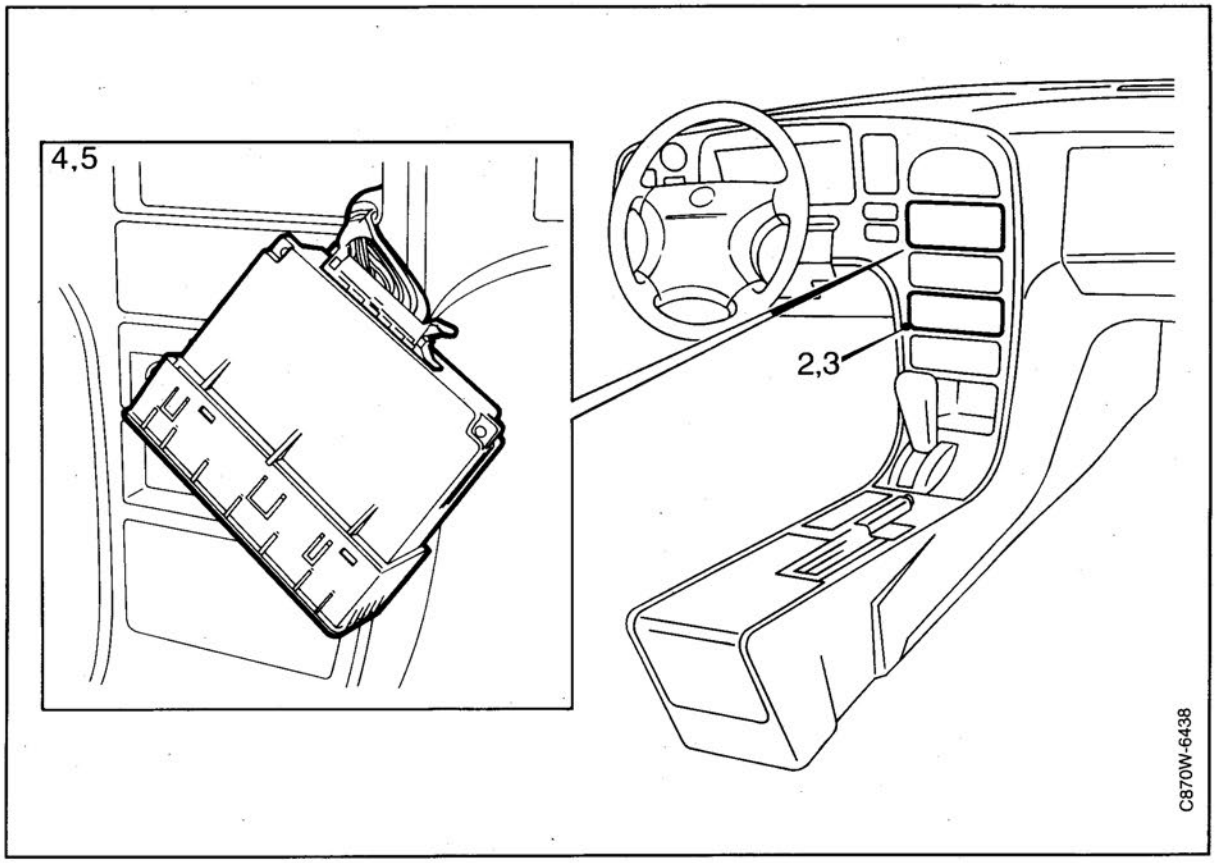
Cars with ACC

Things to remember when working with ACC

In order to avoid damage to the electronics in the ACC control module, proceed as follows:

- When arc welding, unplug the negative lead from the battery, the regulator connection and the 25 pin or 39 pin connector from the ACC control module.
- When taking measurements and conducting fault diagnosis, the 25 pin or 39 pin connector should be unplugged from the ACC control module.
- From year model M1988:
  The cooling fin on the ventilation fan speed control is live (+12 V) when the ignition is switched on. If the cooling fin is grounded, speed control is destroyed.

ACC control module, changing



To remove

1 Switch off the ignition.

2 Remove the ashtray.

3 Pull the ashtray holder forward by bending down the two upper locking tabs.

4 Press out the control module from behind.

5 Unplug the 25 pin connector, –1989 or the 39 pin connector, 1990–.

Fitting

6 If a M1994 ACC control module is to be fitted in a car of year model M1990–M1993, first carry out the procedures on page 219 so that the control module will operate as intended.

7 Plug in the connector.

8 Place the control module in position.

9 Clip in the ashtray holder and the ashtray.

Year model 1990–

10 Calibrate the ACC system by pressing the "AUTO" and "VENT" buttons at the same time.

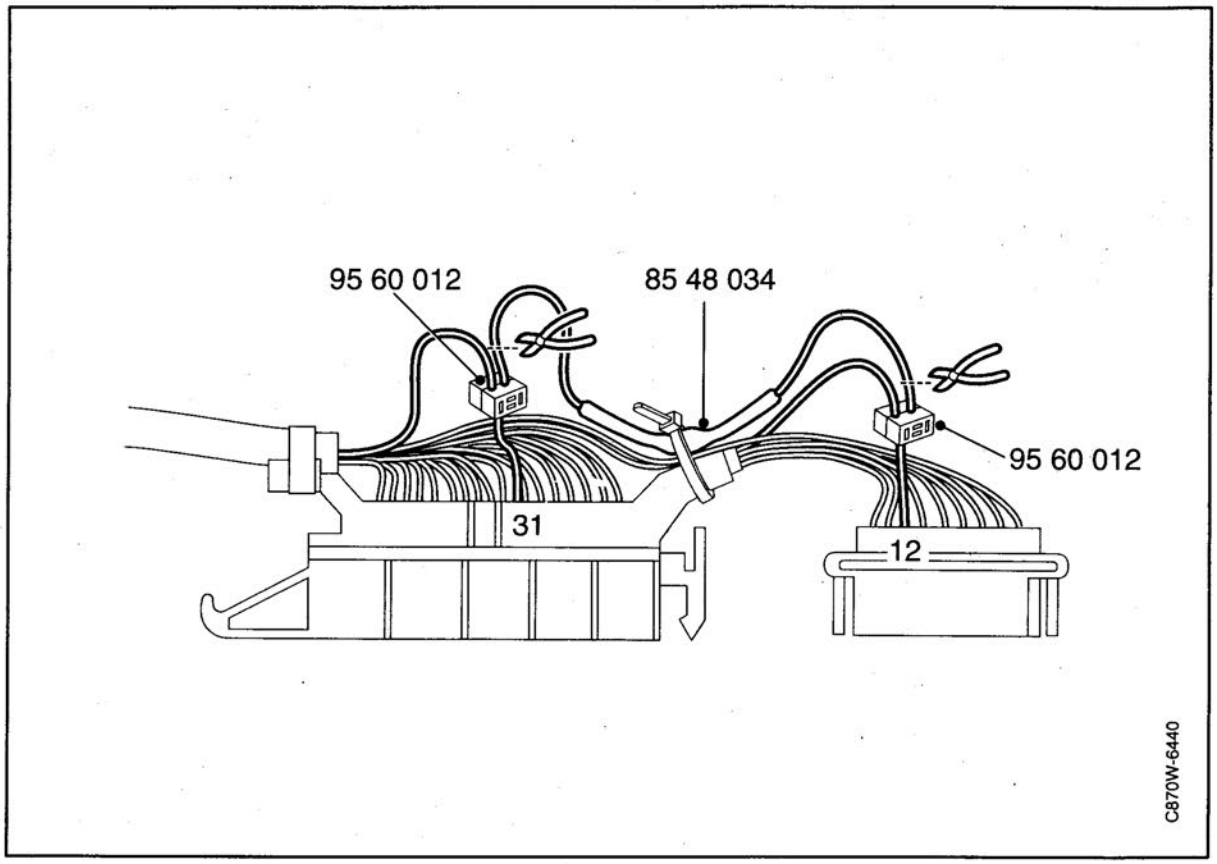
Year model M95

11 The ACC control module as a spare part should be adjusted using the ISAT scan tool set to "ADJUSTMENT" and "SOLAR SENSOR". Select the value 33 and press the ESC button in order to store this value in the control module.

Important
During calibration, all previous diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

12 Carry out user programming as required by the customer.

ACC control module, M1994, adapting



From 1993, a new ACC control module is introduced in order to eliminate erroneous diagnostic trouble codes being generated from the rear A/C. This applies to all cars of year models M1990–M1993 with ACC2. The new control module has the following designation:

ACC control module M1994, part number 43 82 933

or as a spare parts kit for rear A/C:

Part number 74 96 326 (contains ACC control module as above)

If this control module is to be fitted in cars from M1990–93, any jumper connections and resistors in the wiring harness must be removed.

Action

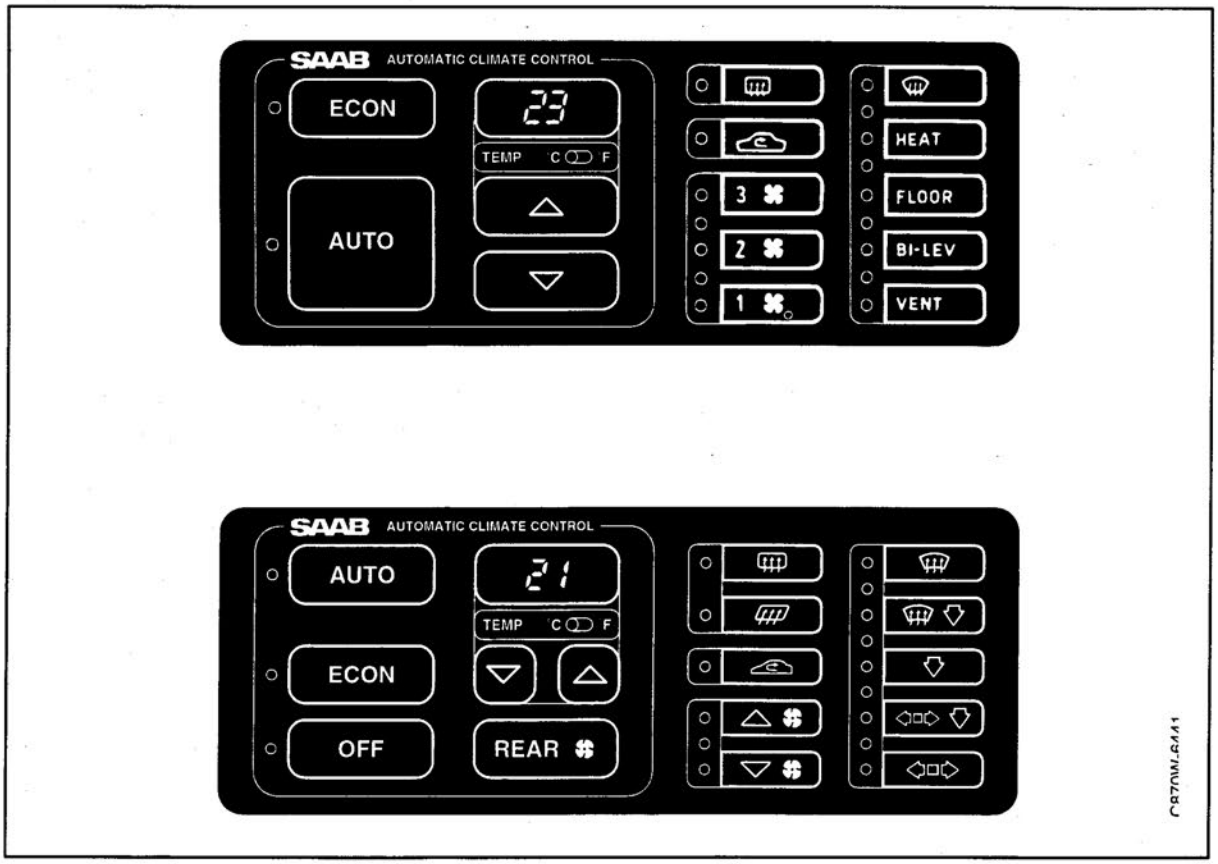
1 Unplug the 39 pin and the 12 pin connector on the rear side of the ACC control module.

2 Remove any jumper connections between pin 30 and pin 32 on the 39 pin connector. Insulate cable.

3 Remove any resistor between cables 623 (black) in the 12 pin connector and cable 407 (yellow/white) in the 39 pin connector. Insulate the cable.

4 Fit the new ACC control module and calibrate.

Symbols, ACC panel, changing



It has become apparent that the symbols on the ACC panel push–buttons can come loose. In order to avoid having to change the entire ACC panel if this happens, these symbols have been produced as a spare part.

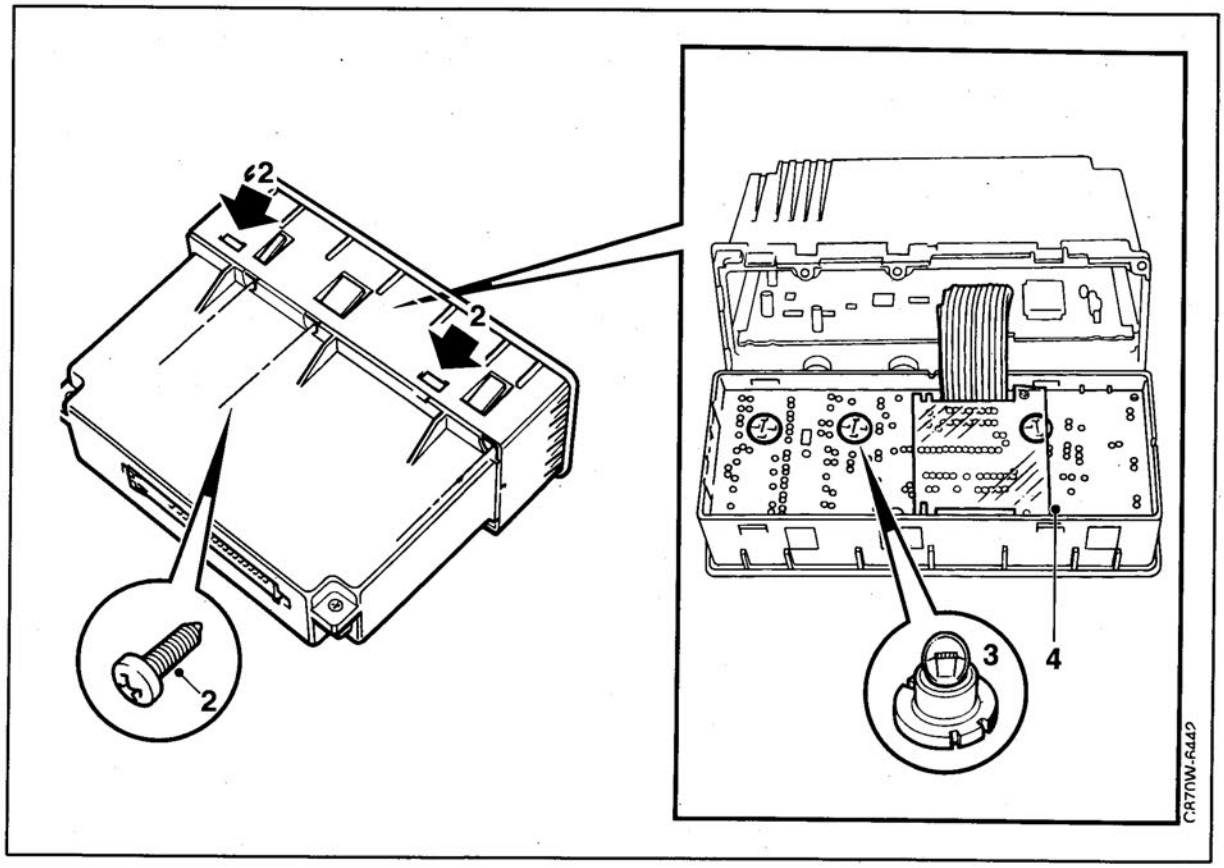
At delivery, the front side of the symbols is covered with a plastic film. This plastic film should be removed after the symbols have been placed in position.

Materials

Part No. 40 71 106,
symbols for ACC panel, generation 1,
up to year model 1989.

Part No. 40 74 316,
symbols for ACC panel, generation 2,
from year model 1990.

Backlighting in ACC control module 1990–.



To remove

1 Unplug the ACC control module.

2 Undo the six screws securing the rear part to the facia.
Undo the snap fasteners using a screwdriver.

3 Change the defective lamp.

Fitting

4 Fit the plastic cover so that the cable ribbon between the control module and the panel cannot be damaged.

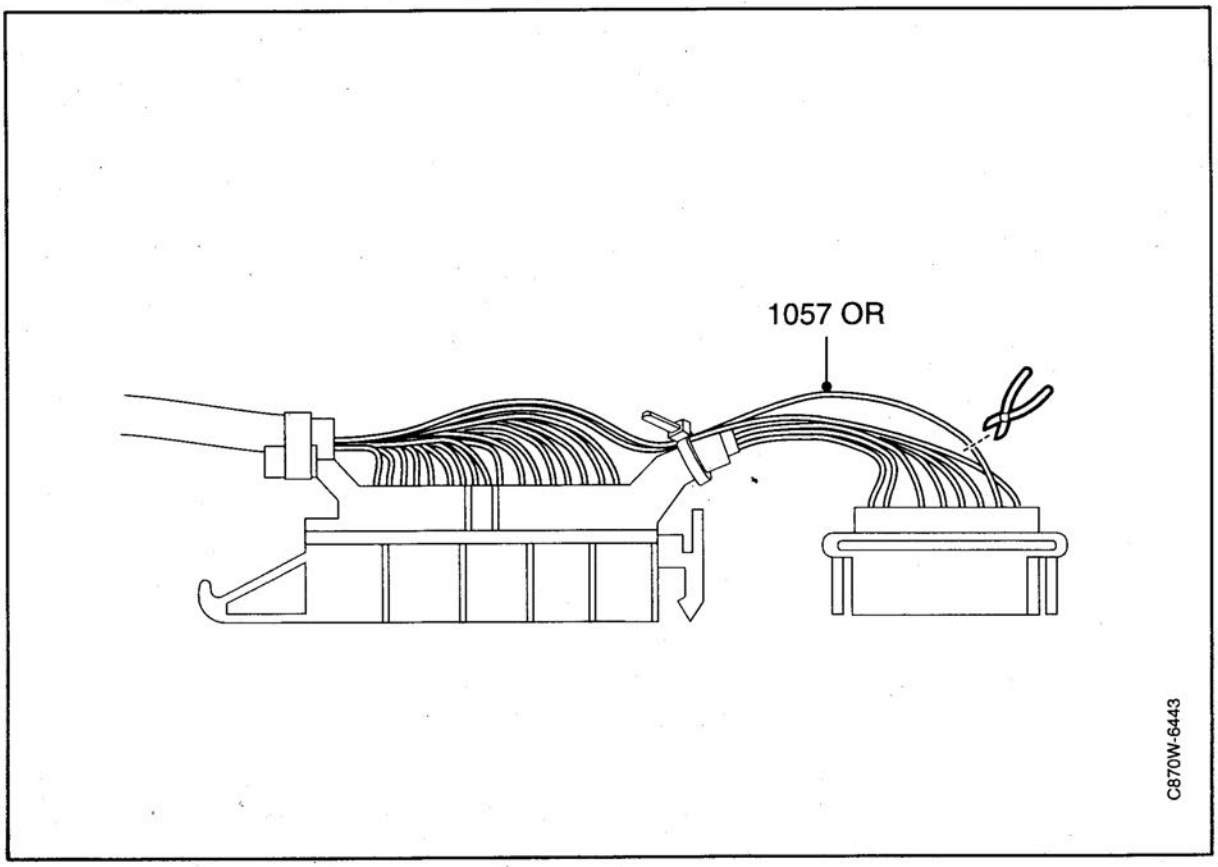
5 Screw the panel to the control module.

6 Secure the ACC control module in the car's facia.

7 Calibrate the ACC system by pressing the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all earlier diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Wiring harness, adapting M1990–92



Diagnostic trouble codes may be registered in ACC 2 without there actually being any fault.

Diagnostic trouble codes 26391 and D6891

Sporadic loss of outside temperature signal or sporadic loss of solar sensor signal.

Action

1 Detach the ACC panel.

2 Cut the orange cable (1057 OR) in the 12 pin connector on the rear of the ACC panel.

3 Insulate the cable and attach it under the cable tie on the 39 pin connector.

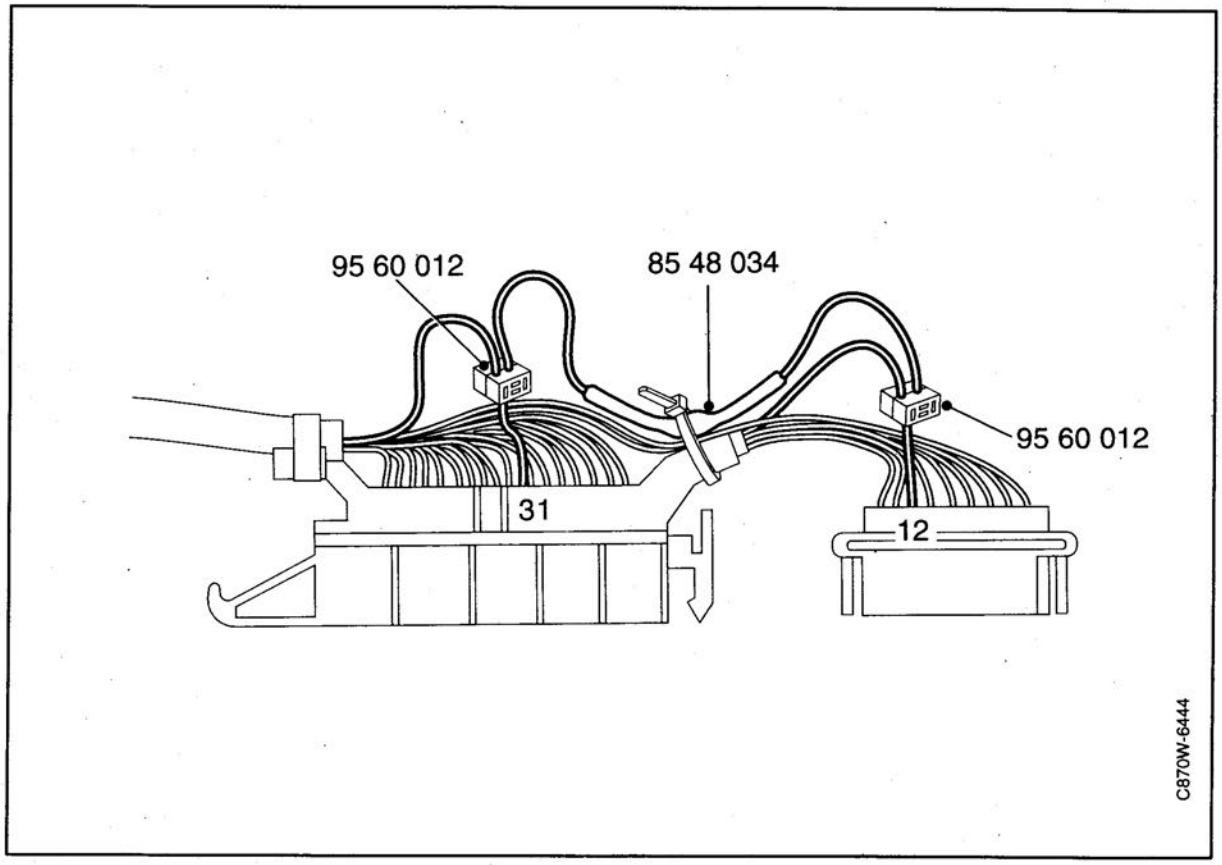
4 Refit the ACC panel.

Important
This action does not eliminate the diagnostic trouble codes but reduces the frequency of fault.

Do not change any components.

When these diagnostic trouble codes have been erased, they may return after a certain period. Explain to the customer that he/she does not need to bring the car in for repair if the diagnostic trouble codes return and there are no fault symptoms.

Wiring harness, adapting M1990–92 (contd.)



Diagnostic trouble code 33222

Pin 31, short circuit to I +12 V.

Car affected, chassis number ranges

L1004800 – L1008384
L2004500 – L2006313
L8000781 – L8000884
M1000001 – M1009246
M2000001 – M2006157

Action

1 Detach the ACC panel.

2 Fit a resistor, part number 85 48 034, between cable 623 (black) in the 12 pin connector and cable 407 (yellow/white) in the 39 pin connector at the ACC panel.

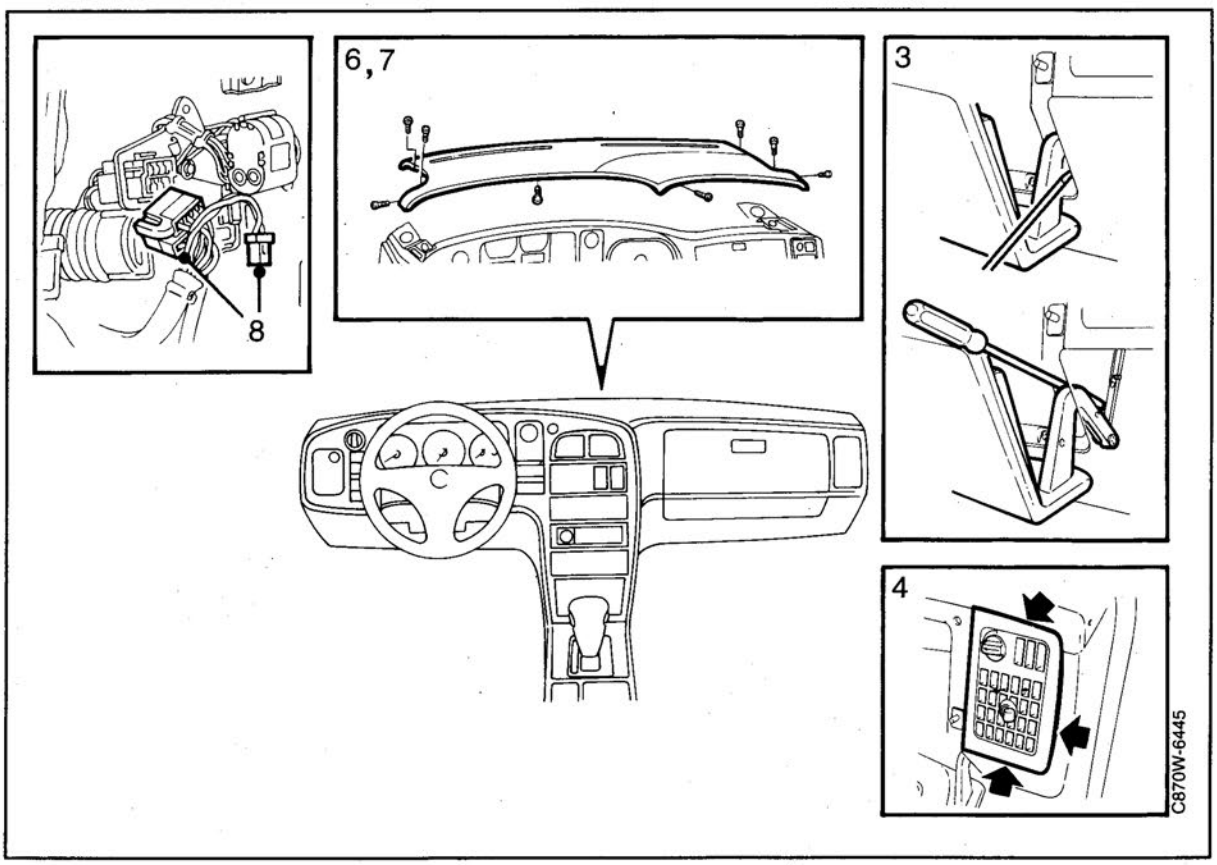
Use tap–on connectors, part number 95 60 012, to connect the resistor.

3 Attach the resistor with a cable tie.

4 Refit the ACC panel.

5 Erase diagnostic trouble codes.

Gear for air distributor, changing



To remove

Cars with ACC

1 Press in the temperature raising button so that "HI" is shown on the display.

2 Detach the negative lead from the battery.

3 Fully lower the glove compartment flap by bending out the link arms so that the stop is released. Pull down the glove compartment light.

4 Remove the glove compartment together with the facia vent by undoing the six screws. Using a screwdriver, carefully prise along the facia vent. Note the position of the clip.
Unplug cables to glove compartment light and light switch.

5 Undo electrical distribution box and lift down.

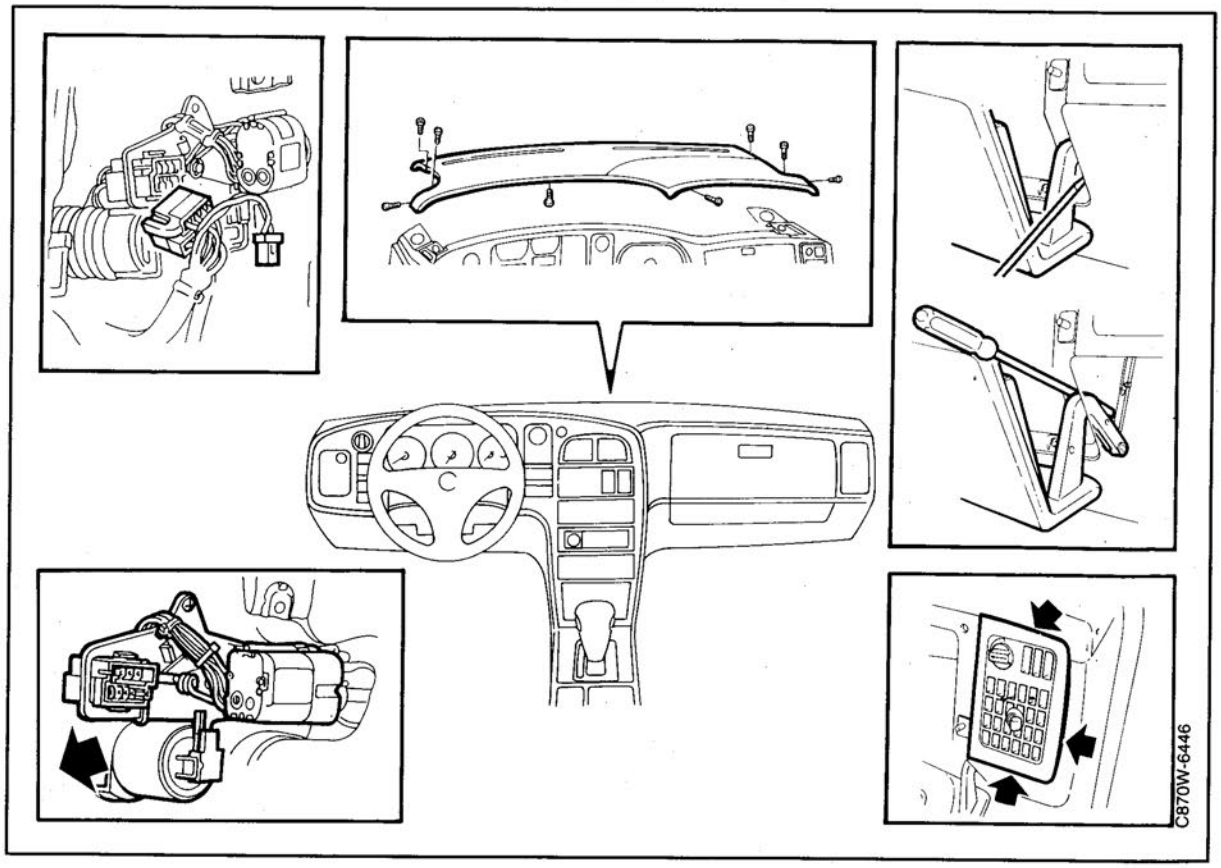
6 Remove the trim from the left–hand and right–hand A pillar.

7 Remove loudspeaker grilles.
Remove screws from the upper part of the facia.
Remove the upper part of the facia by lifting up its front edge and pulling it into the cabin so that the clips become detached.

8 Year models 1985–86
Unplug connectors to servomotors and interior air sensor electric motor.

From year model 1987:
Unplug connector to servo motor.

Gear for air distributor, changing (contd.)



9 Remove the clip and detach the cable from the servo motor.

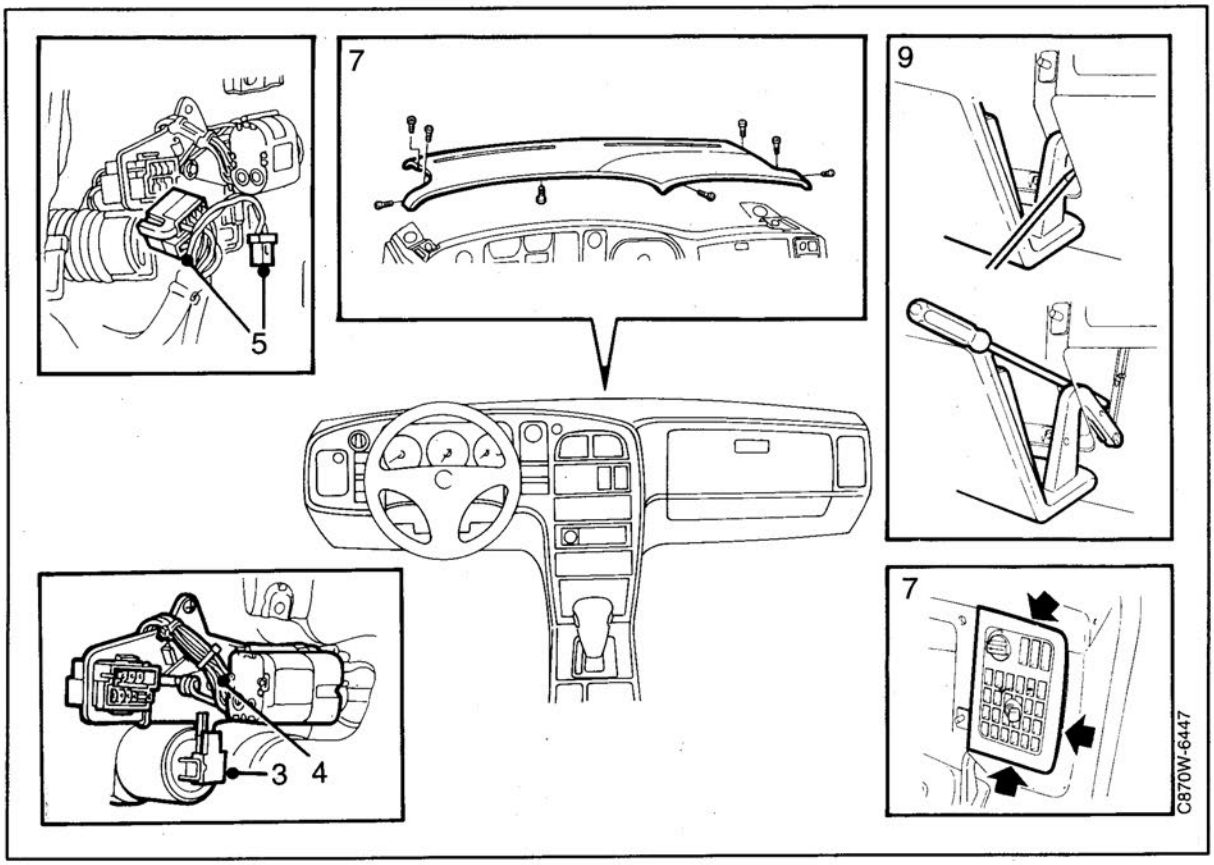
10 Remove bracket screws. Pull bracket and motor back.
Applies to year models 1985, 1986:
Detach hose from interior air sensor.

11 Lift out bracket with electric motors.

12 Remove the air ducts to the outer facia vent and defroster. Unscrew the windscreen defroster.

13 Remove gear from heating and ventilation unit by pressing the clips on the top of the gear to the right. At the same time, turn the gear up so that the clips are released. Pull gear from valve.

Gear for air distributor, changing (contd.)



Fitting

1 Fit a new gear.
Align shaft on air distributor gear. Turn the gear so that the lugs lock into the clips on the heating and ventilation unit.

2 Year models 1985–1986:
Detach the ACC panel. Leave it in its compartment.

3 Fit bracket with electric motors.
Check that the bevel gear spindle is in the correct position and that the cable for the heater control is on the correct side of the bracket.

4 Screw bracket into place. Attach the cable to the heater controls and fit clip.

5 Plug in connectors for servo and pump motors.

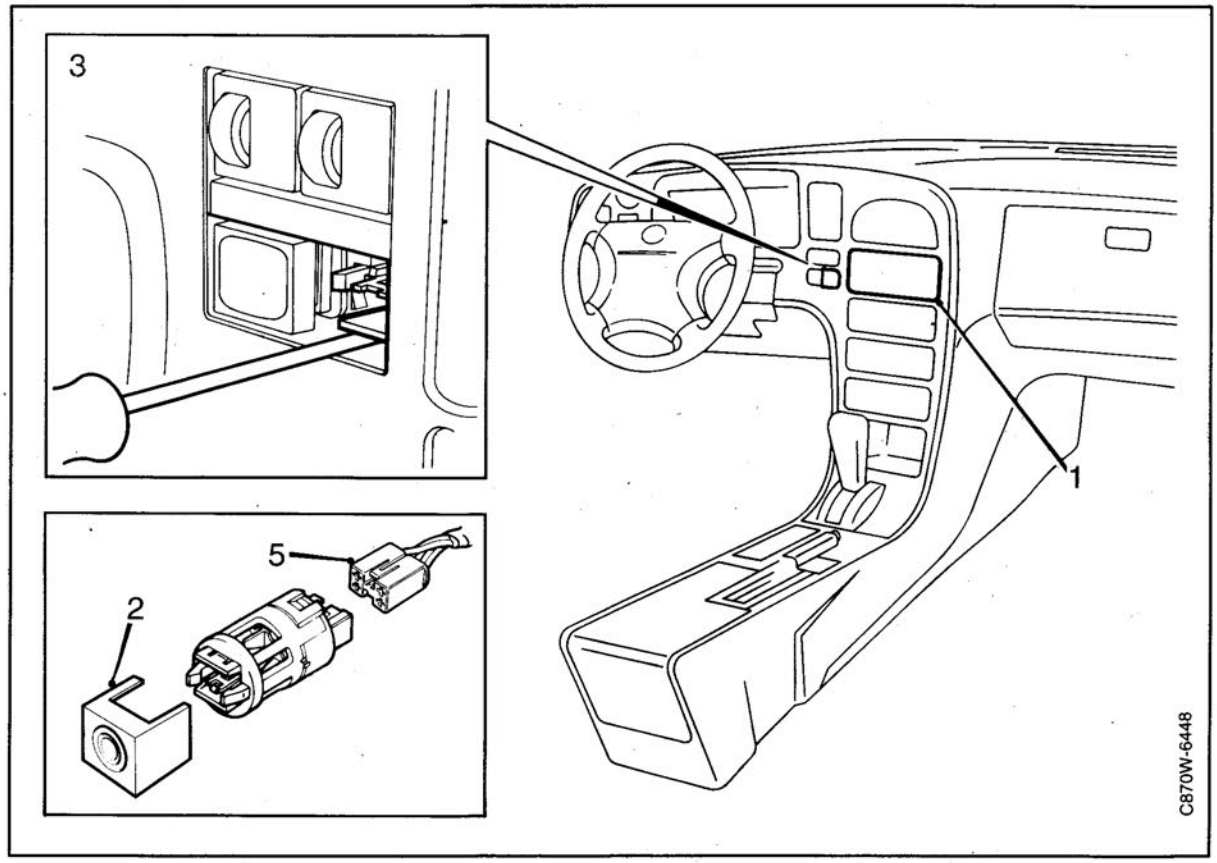
6 Year models 1985–1986.
Connect the hose to the interior air sensor. Fit the ACC panel.

7 Fit air duct and defroster vent.

8 Lift up the electrical distribution box.

9 Fit the glove compartment.

Interior air sensor, changing



To remove

1 Remove the ACC control module without unplugging the connector.

2 Remove the cover in front of the cabin temperature sensor.

3 Carefully release the locking tabs securing the sensor to the facia. Use a small screwdriver.

4 Release the sensor by pressing it in.

5 Unplug the connector on the back of the sensor.

Fitting

6 Plug in the connector.

7 Place the sensor in position. Correct position is important for good cabin temperature control.

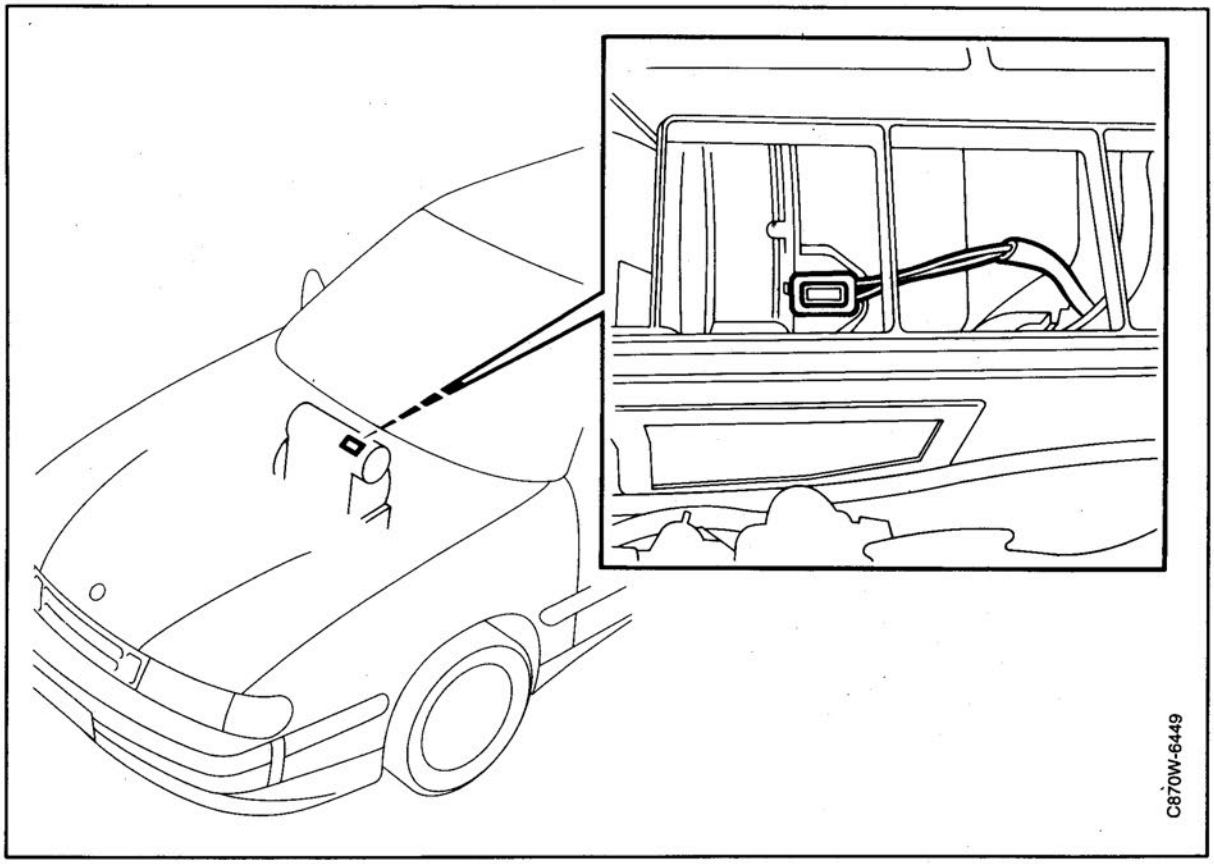
8 Press the cover into position in the panel in front of the sensor.

9 Fit the ACC control module in position.

10 M1990– Calibrate the ACC system by pressing in the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all previously stored diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Outside temperature sensor, changing –M1989



To remove

1 Unscrew the air intake grille when this is fitted.

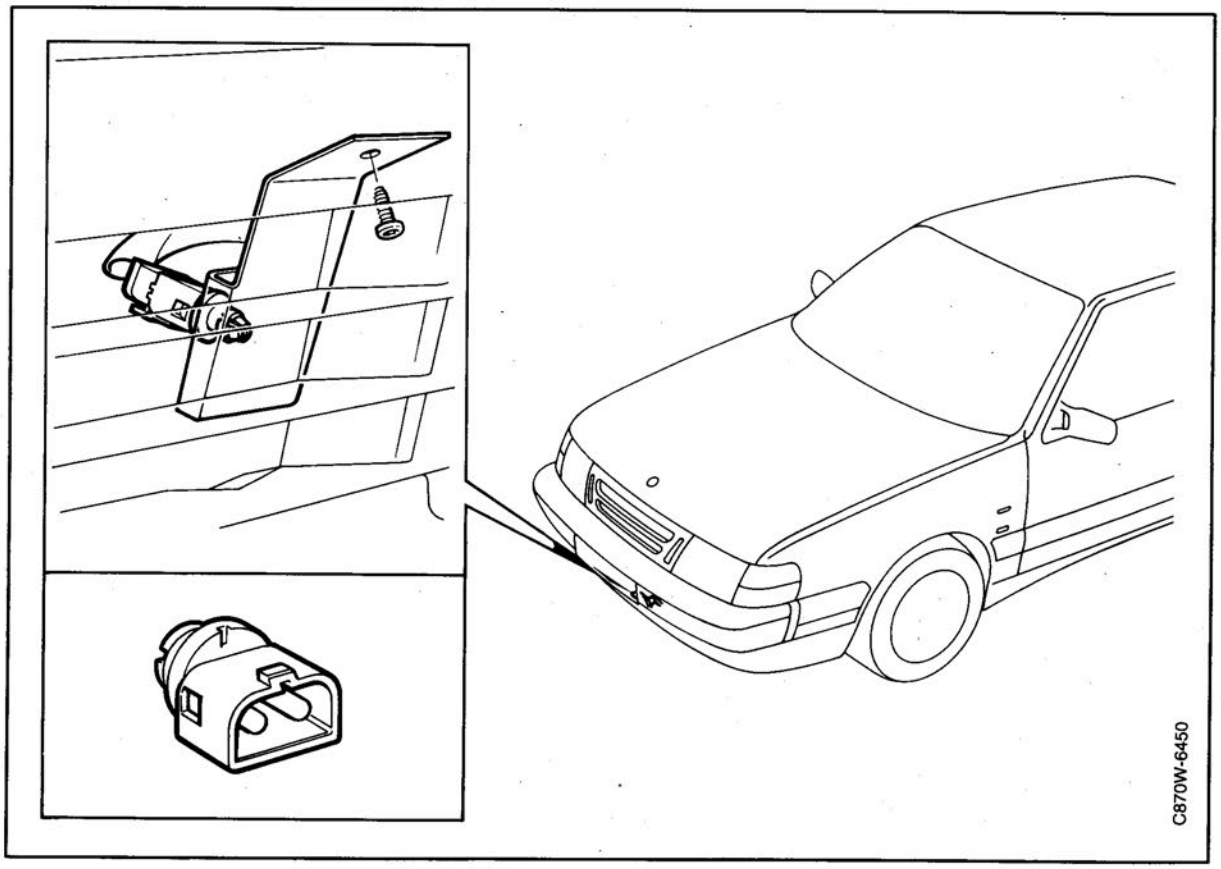
2 Unplug the sensor connector and change the sensor.

Fitting

3 When fitting, the bare metal surface (sensitive part) of the sensor should point up.

4 Fit all parts which have been removed.

Outside temperature sensor in bumper, changing



To remove

1 Undo screws securing the bracket in which the outside temperature sensor is fitted.

2 Pull the bracket back in order to remove it from its plastic grooves.

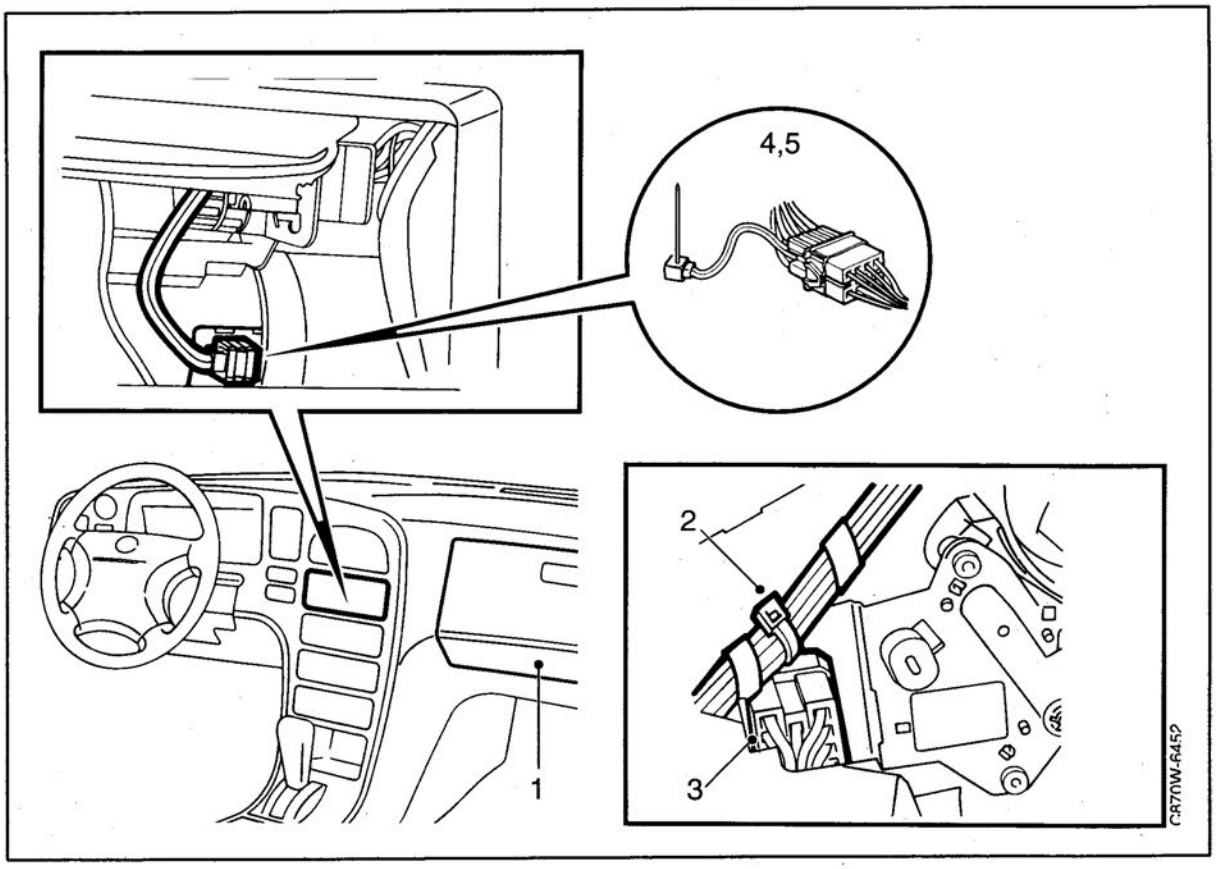
3 Carefully push the bracket through the air intake in the spoiler.

4 Remove the temperature sensor.

To fit

Fit in reverse order.

Blended–air temperature sensor, changing



To remove

1 **Left–hand drive cars without passenger air-bag:**
Remove the glove compartment and fold down the electrical distribution box, see Service manual 8:2, Interior Equipment, section 853.

Left–hand drive cars with a passenger air-bag and right–hand drive cars:
Remove the upper part of the facia, see Service Manual 8:2 Interior Equipment, section 853. On right–hand drive cars, the main instrument must also be lifted out.

2 Cut the cable tie around the lead to the connector.

3 Unplug the connector and press it out of the flap motor mounting.

4 Press both the blended air temperature sensor leads out of the connector. The leads do not need to be marked as their internal placing is not important.

5 Pull out the sensor.

Fitting

6 Place the blended air temperature sensor in position.

7 Connect both the sensor leads.

8 Press the one part of the connector into the actuator motor mounting.

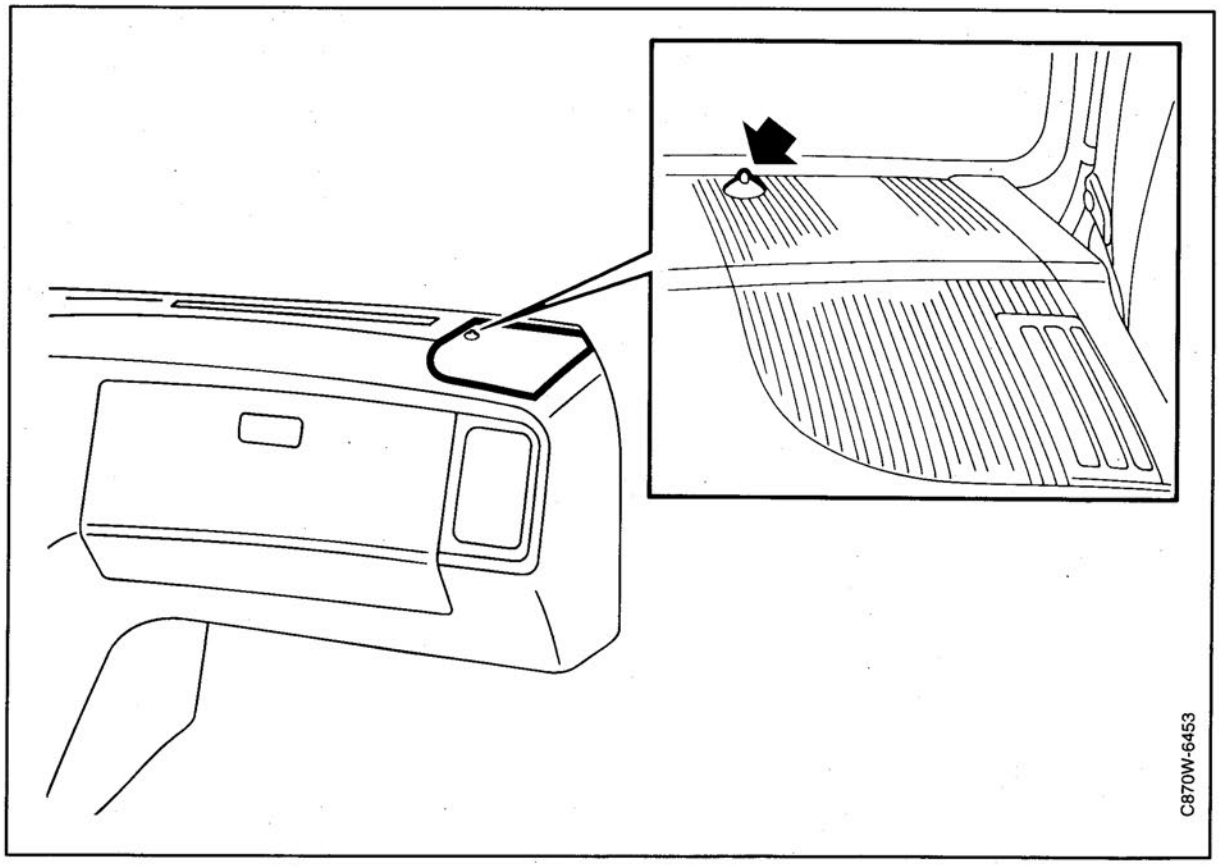
9 Plug in the connector and fit a cable tie around the lead and the actuator motor mounting.

10 Refit the electrical distribution box and the glove compartment (or the main instrument and the upper part of the facia).

11 Calibrate the ACC system by pressing the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all previously stored diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Solar sensor, changing –M1989



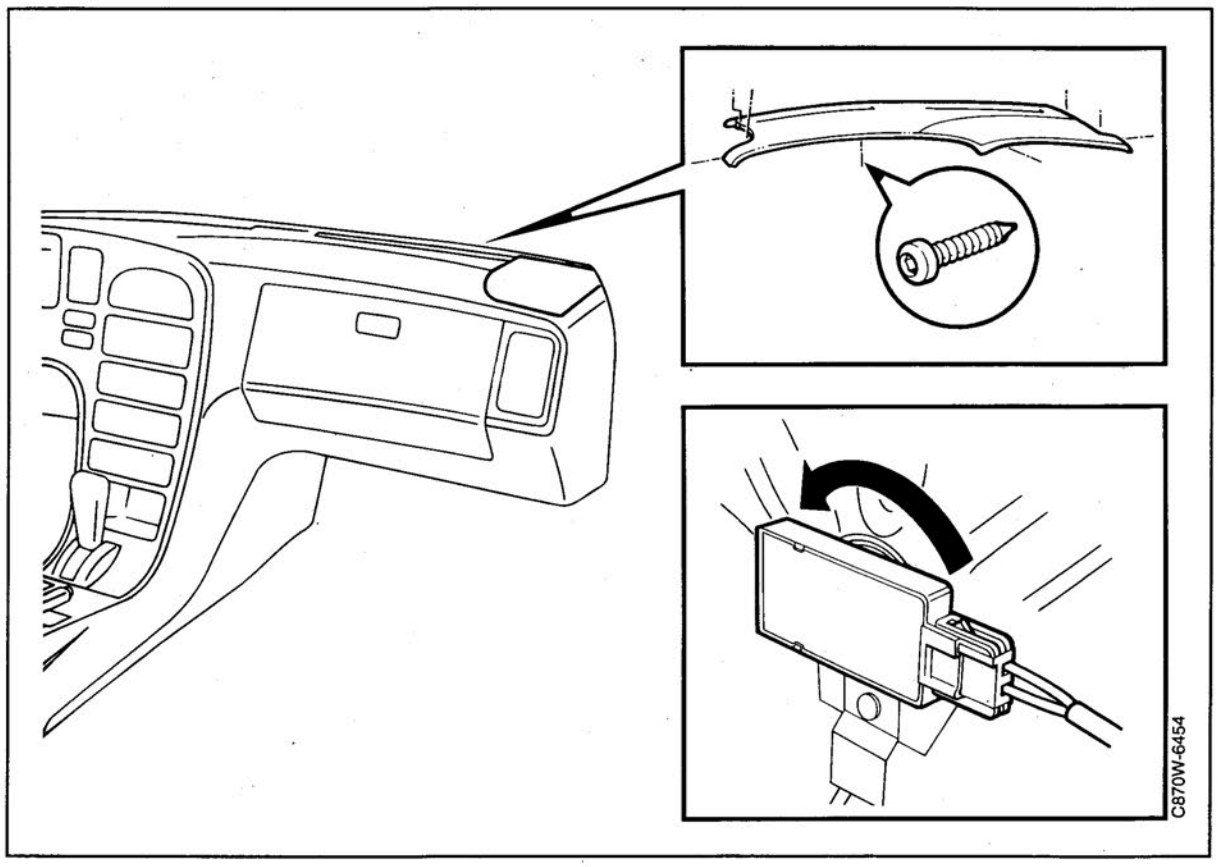
To remove

1 Remove the door trim seal from the A pillar and remove A pillar trim.

2 Remove the loudspeaker grille.

3 Unplug the connector. Change the solar sensor. The solar sensor is attached with double–sided adhesive tape. Clean the attaching surfaces before fitting the new solar sensor. If the car has loudspeakers, these must first be removed in order to gain access to the connector.
During year model 1986, the solar sensor was removed from the left–hand side to the right–hand side.

Solar sensor, changing M1990–



To remove

1 Remove the A pillar trims, see Service Manual 8:2 Interior Equipment, section 851.

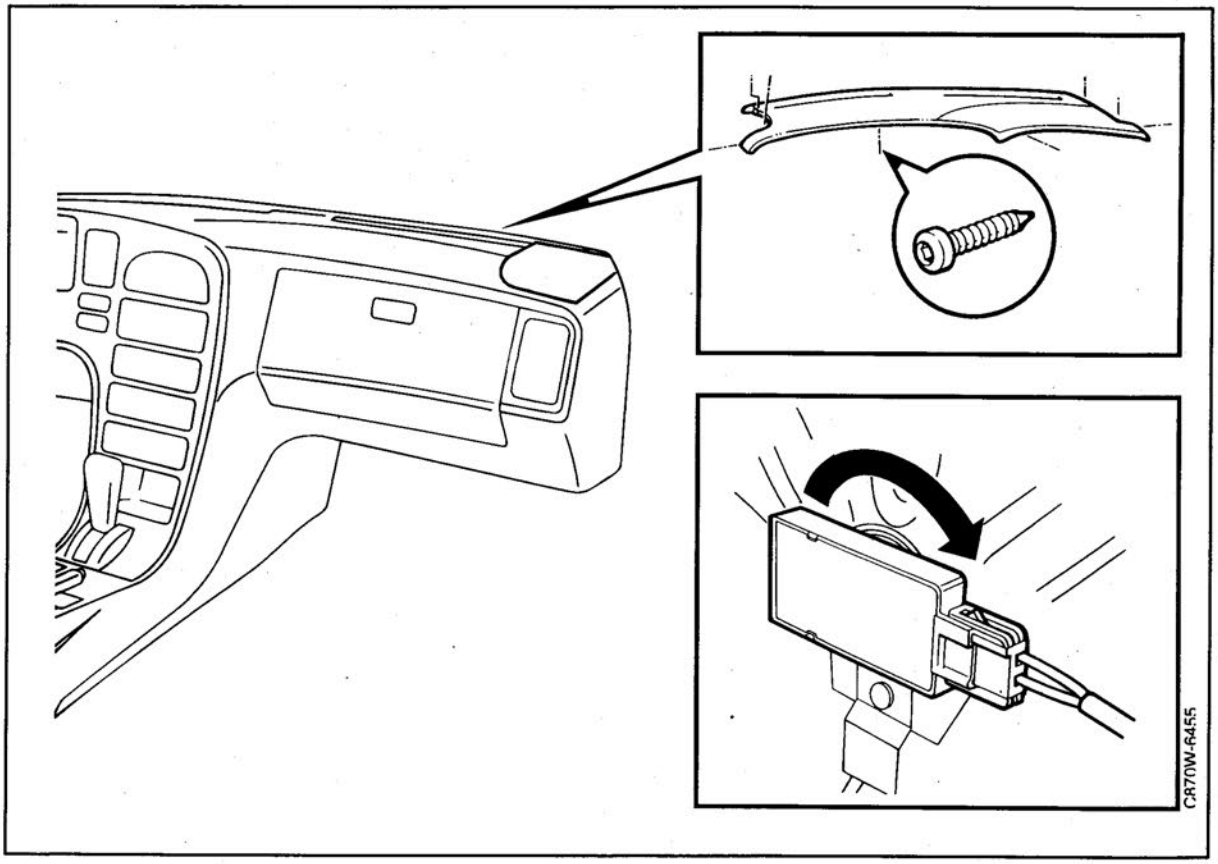
2 Remove the speaker grilles and the screws securing the upper section of the facia, see Service Manual 8:2 Interior Equipment, section 853.

3 Unhook the upper part of the facia from the cable between the A pillars.

4 Unplug the solar sensor connector and lift off the upper part of the facia.

5 Remove the solar sensor by pushing it against the facia and turning it counter clockwise, seen from the underside of the facia.

Solar sensor, changing, M1990– (contd.)



Fitting

1 Press the solar sensor into the holder. Note the position.

2 Fit the upper part of the facia in position and plug in the solar sensor connector.

3 Hook in the cable in the upper part of the facia.

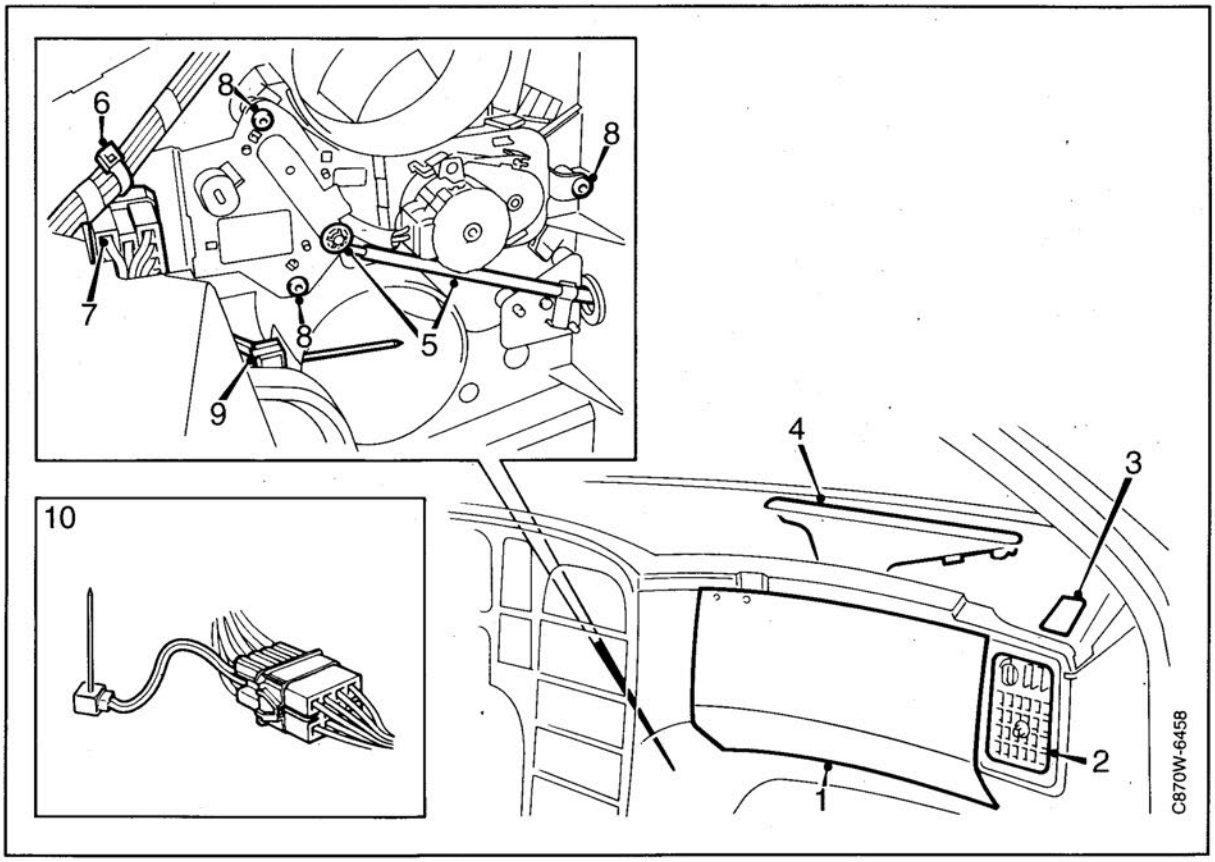
4 Tighten the screws securing the upper part of the facia, connect the speakers and screw down the speaker grilles, see Service Manual 8:2 Interior Equipment, section 853.

5 Fit the A pillar trims, see Service Manual 8:2 Interior Equipment, section 851.

6 Calibrate the ACC system by pressing the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all previously stored diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Damper motors, changing



To remove

Both the motors are changed as a unit.

1 **Left–hand drive cars with no passenger airbag:**
Remove the glove compartment and fold down the electrical distribution box, see Service Manual 8:2 Interior Equipment, section 853.

Left–hand drive cars with a passenger airbag and right–hand drive cars:
Remove the upper part of the facia, see Service Manual 8:2 Interior Equipment, section 853. On right–hand drive cars, the main instrument must also be lifted out.

2 Remove the right–hand air duct.

3 Remove the right–hand side defroster duct.

4 Remove the right–hand defroster duct.

5 Remove the clip and free the control cable.

6 Cut the cable tie around the lead to the connector.

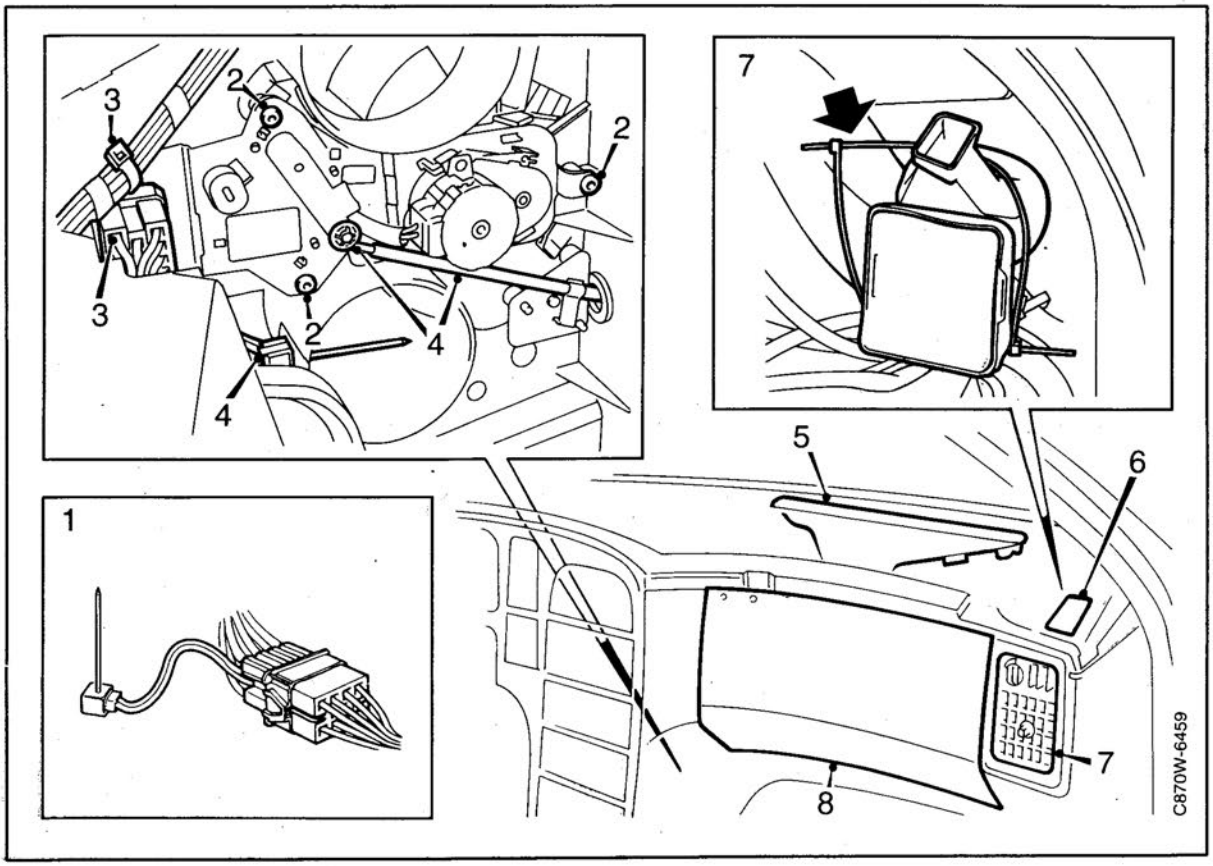
7 Unplug the connector and press it out of the flap motor mounting.

8 Remove the flap motor mounting.

9 Pull out the blended air temperature sensor. Lift away the flap motor mounting and the sensor.

10 Press both the sensor leads out of the connector. The leads do not need to be marked. Their internal placing is not important.

Damper motor, changing (contd.)



Fitting

1 Press the blended air temperature sensor leads into the connector.

2 Fit the damper motor mounting and the blended air temperature sensor in position. Tighten the three securing screws.

3 Plug in the connector in the damper motor mounting. Fit a cable tie around the lead and the mounting.

4 Press in the blended air temperature sensor. Fit the control cable and the clip.

5 Attach the right–hand defroster duct.

6 Attach the right–hand side defroster duct.

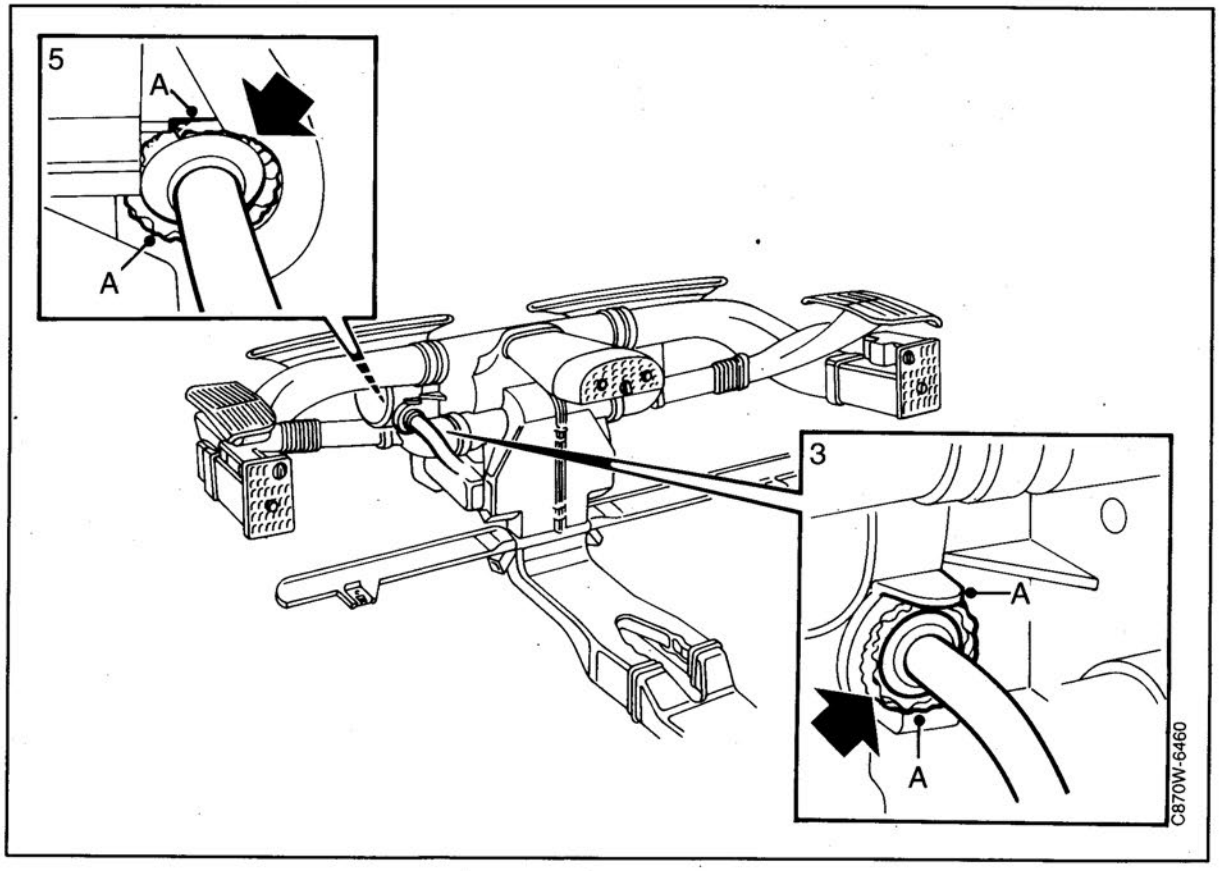
7 Fit the right–hand air duct and fix it using a cable tie.

8 Refit the electrical distribution box and the glove compartment (or the main instrument and the upper part of the facia).

9 Calibrate the ACC control module by pressing the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all previously stored diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Air leakage, sealing



When recirculation is selected, some air leakage may occur at the cable entry beside the heating and ventilation unit. This is due to excess pressure building up at the fresh air intake when the recirculation damper is closed. Air leakage can cause a high–frequency noise to develop at speeds above 100 km/h. This air leakage is corrected by sealing the cable entry with a suitable sealant. To ensure that this measure will be fully effective, the cable entry should be sealed on both sides, from the cabin and the engine compartment.

Materials

Sealant, part No. (16) 30 20 716

Action

First test drive the car to check that the noise occurs as described above.

1 Remove the top part of the facia.

2 Remove the defroster duct and air duct to the side vents.

3 Apply sealant around the cable entry beside the heating and ventilation unit. Also seal the air apertures (A) above and below the cable entry.

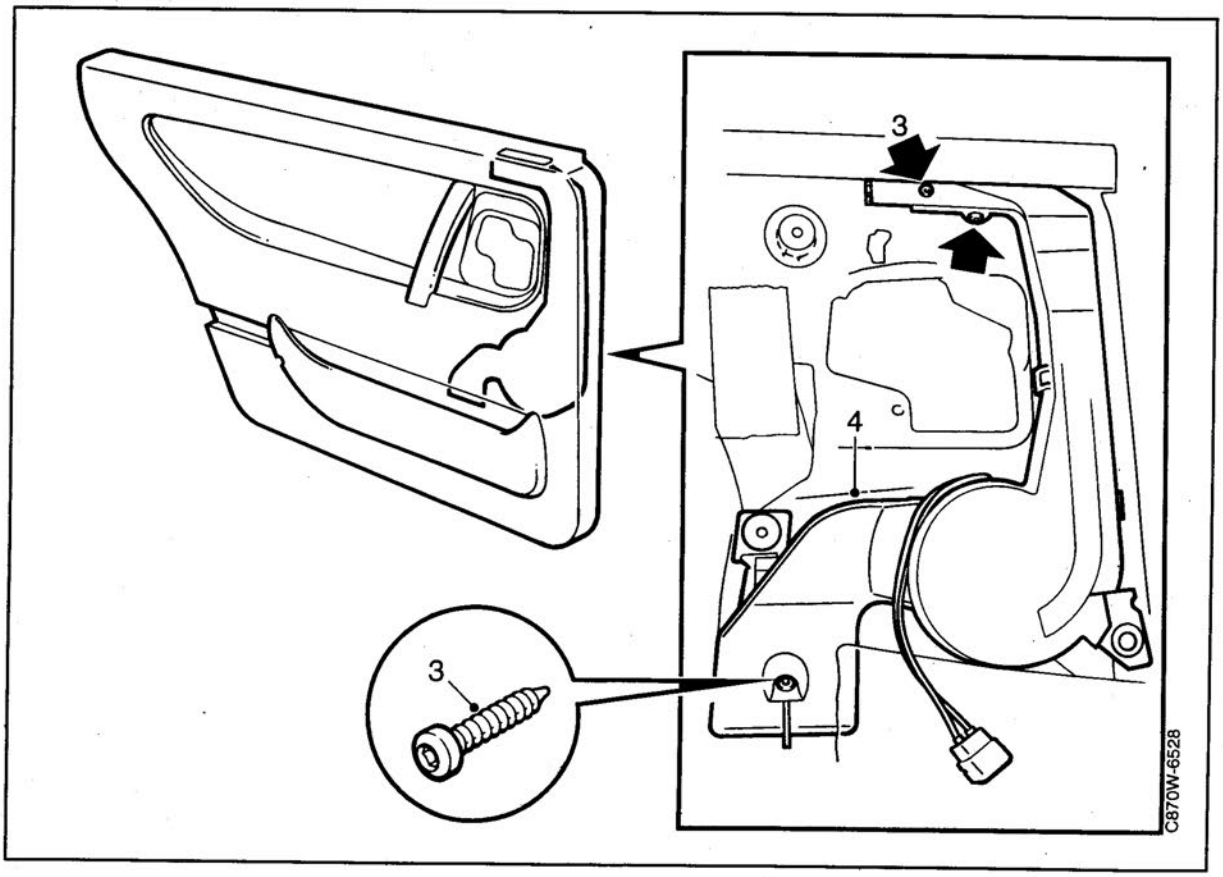
4 Open the bonnet and remove the cover over the bulkhead space.

5 Apply sealant around the cable entry beside the heating and ventilation unit. Also seal the air apertures (A) above and below the cable entry.

6 Refit the cover over the bulkhead.

7 Refit the air duct and top section of the facia.

Fans in rear doors, changing



To remove

1 Remove the rear door trim, see Service Manual 8:2 Interior Equipment, section 851.

2 Fold the sound insulation out of the way.

3 Remove the air intake grille and the air outlet grille.

4 Remove the rear door fan.

Fitting

5 Fit the rear door fan in the side of the door.

6 Fit the air intake grille and the air outlet grille.

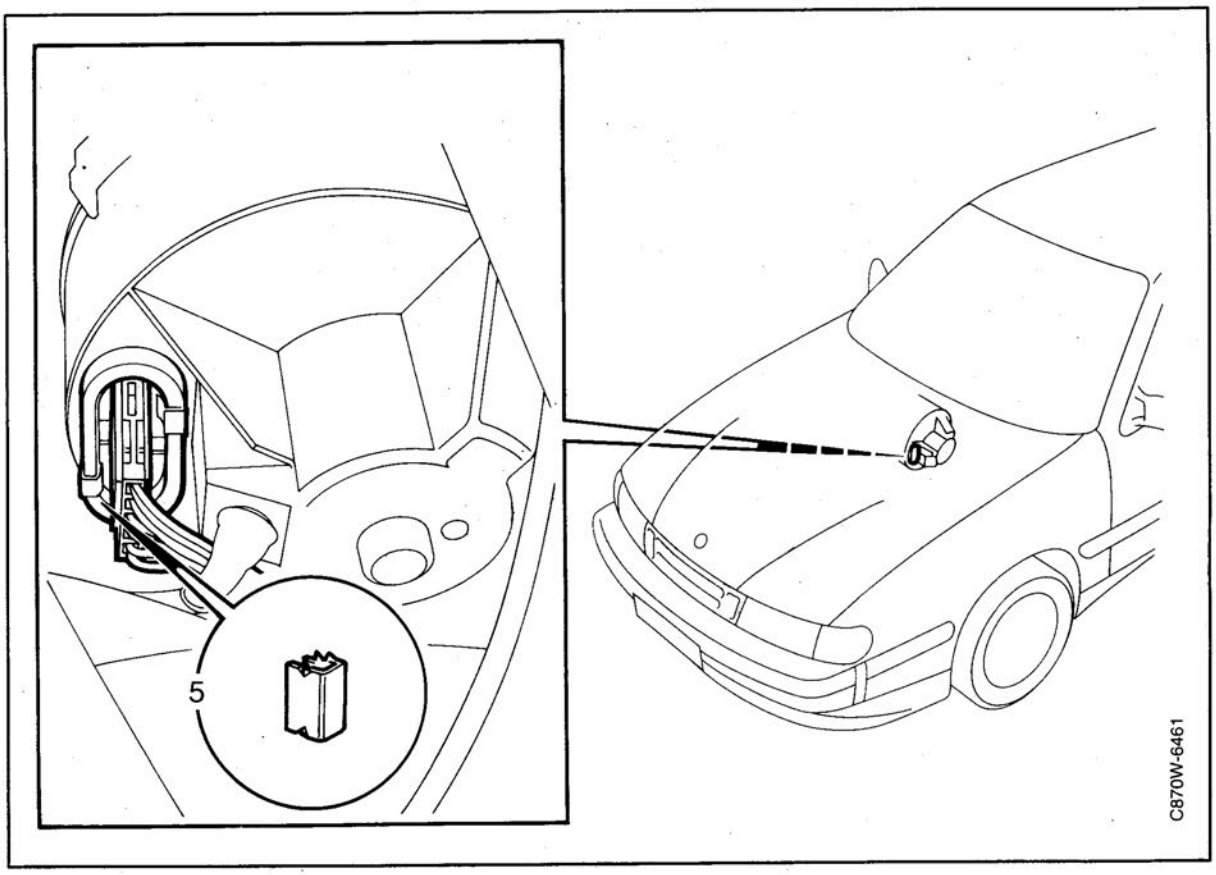
7 Fold back the sound insulation.

8 Plug in the connector and fit the rear door trim on the inside of the door.

9 90– Calibrate the ACC system by pressing the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all previously stored diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Fan resistor, changing (without ACC)



To remove

1 Remove the left–hand cover at the air intake as well as the air intake grille.

2 Unplug the fan resistor connector. Undo the clip and pull out the fan resistor.

Fitting

3 Fit a new fan resistor.

Miscellaneous during service

In cars before chassis number CG1020189, the fan resistor can come loose, causing the risk of short–circuit or melting the cables. In later cars, the resistor attachment has been improved by fitting two clips over the edge of the attachment.

When servicing the car, the fan resistor attachment should be checked and two clips fitted as below.

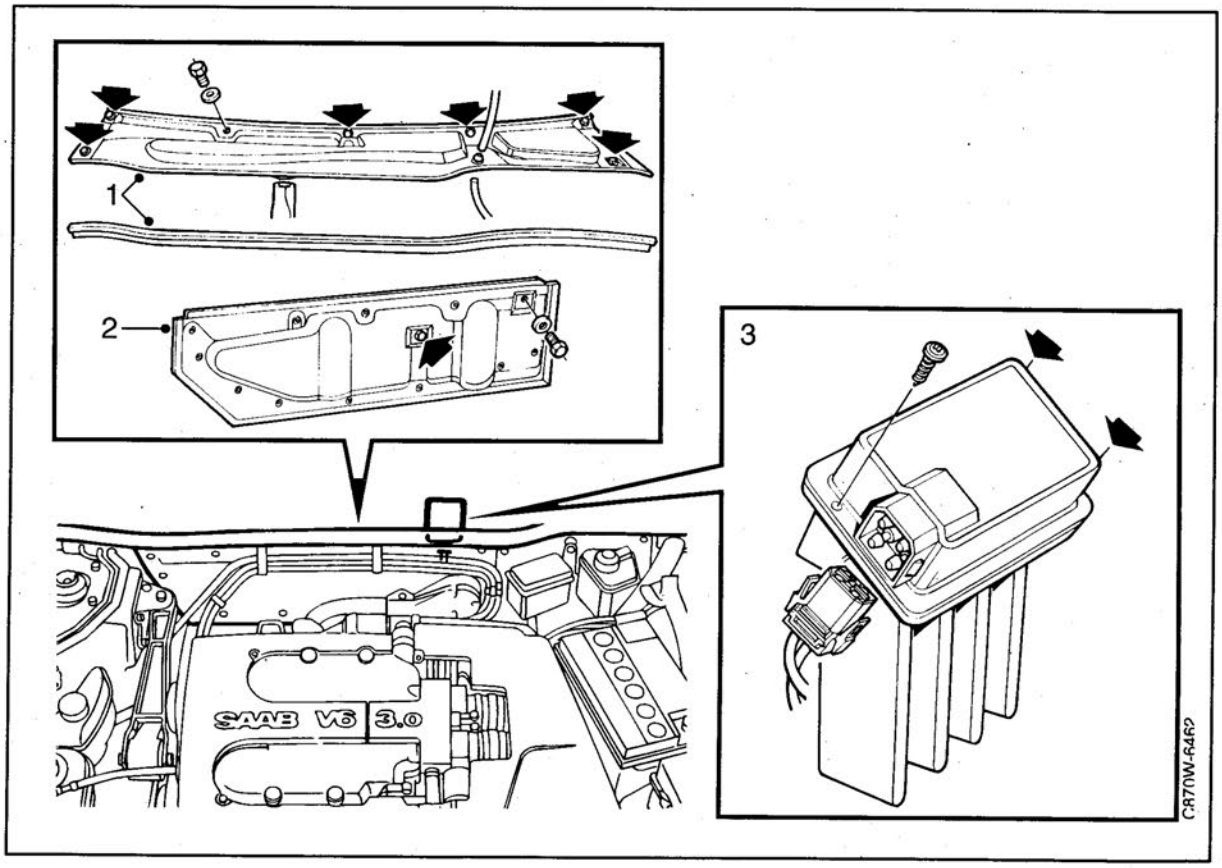
4 Remove the air intake cover.

5 Fit two clips to the fan resistor.

6 Refit the air intake cover.

Part number for clips 73 99 207.

ACC fan control module, changing



To remove

1 Remove the rubber strip and the cover over the bulkhead space.
Disconnect the washer hose.

2 Free the right–hand shield plates.

3 Unplug the connector and undo the three securing screws.
Lift away the fan control module.

Important
The fan control module cooling fin is live until the connector is unplugged.

Fitting

4 Fit the control module.

5 Plug in the connector.

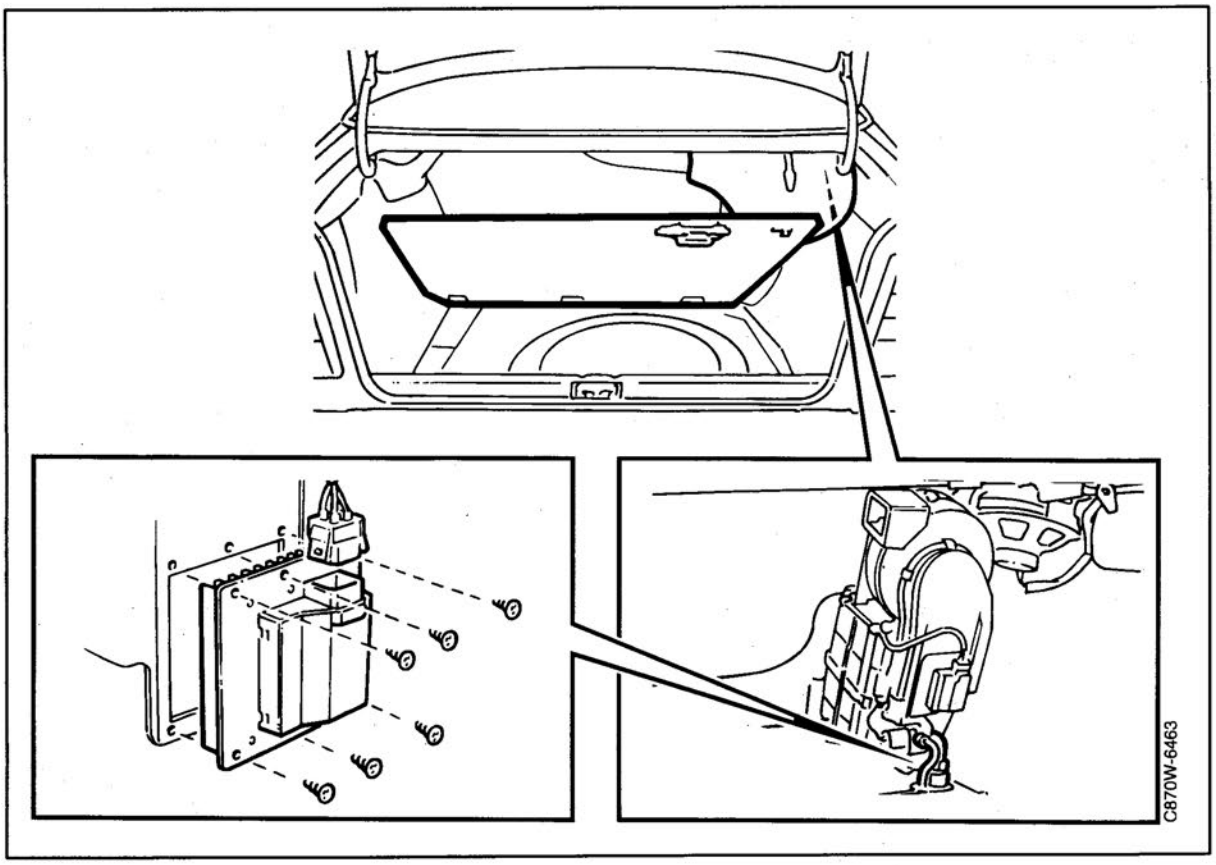
6 Fit the shield plates.

7 Connect the washer hose to the cover and secure the cover and the rubber strip over the bulkhead partition space.

8 Calibrate the ACC system by pressing the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all previously stored diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Rear ACC fan control module, changing



To remove

1 Remove the luggage compartment floor.

2 Remove the trim from around the evaporator casing.

3 Unplug connector.

4 Unscrew control module.

Fitting

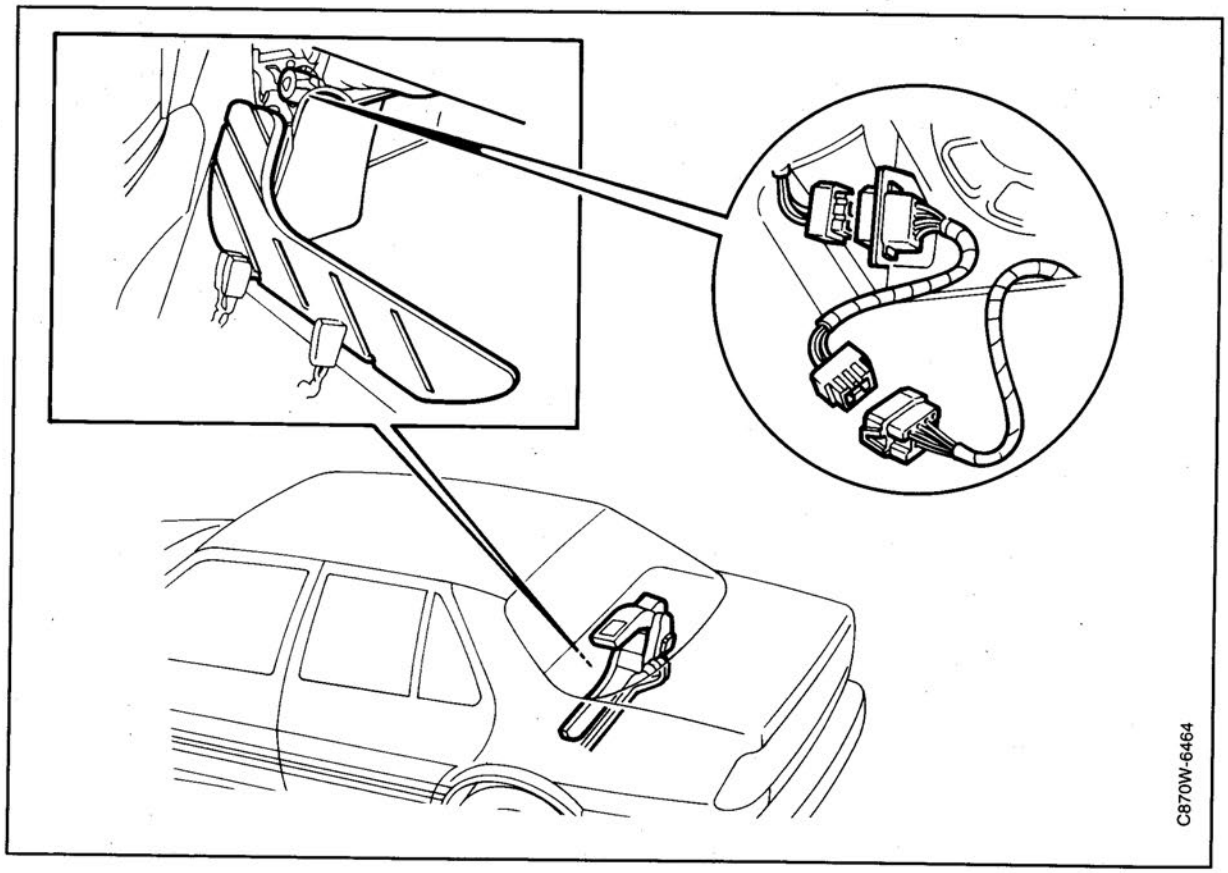
5 Screw control module onto evaporator housing.

6 Plug in the connector.

7 Refit the trim around the evaporator housing.

8 Refit the luggage compartment floor.

Rear A/C unit, adapter harness



In certain cars with rear A/C, within the chassis number ranges given below, noise can be heard from the air vent in the parcel shelf. This noise arises when pressure pulses from the compressor are transmitted to the A/C pipes under the car when the solenoid valve in the rear A/C unit is closed. This means that the noise is more noticeable when the rear A/C unit is not on.
In order to remedy this, an adapter harness, **part No. 44 18 372**, has been developed. The function of the adapter harness is to keep the solenoid valve open, even when the rear A/C unit is not on.
In a number of cars, the wrong adapter harness has been fitted. The resistor in this adapter harness is too small, which means that the rear A/C unit does not work.

This applies to all 9000 CD cars with rear A/C between the following chassis numbers:
N1000001 – N1020439

Action

Fit, or change, the adapter harness on all affected cars at the next service.

1 Remove the backrest.

2 Fit or change the adapter harness between the car's wiring harness and the rear A/C unit's internal wiring harness.

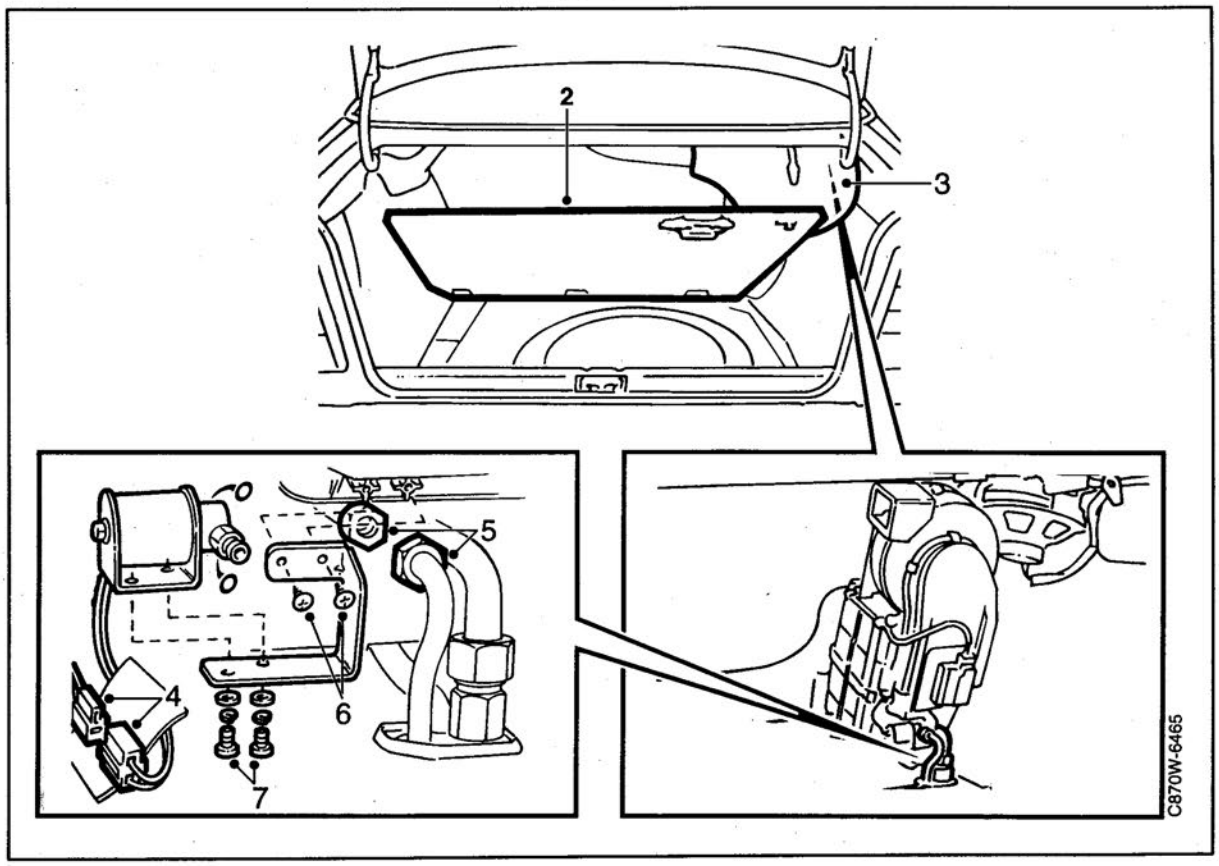
The adapter harness should be positioned so that it becomes a part of the rear A/C unit's internal wiring harness.

3 Refit the backrest.

Materials

Adapter harness part No. 44 18 372

Rear solenoid valve, changing



To remove

1 Drain the A/C system of refrigerant.

2 Remove the luggage compartment floor.

3 Remove the trim from around the evaporator casing.

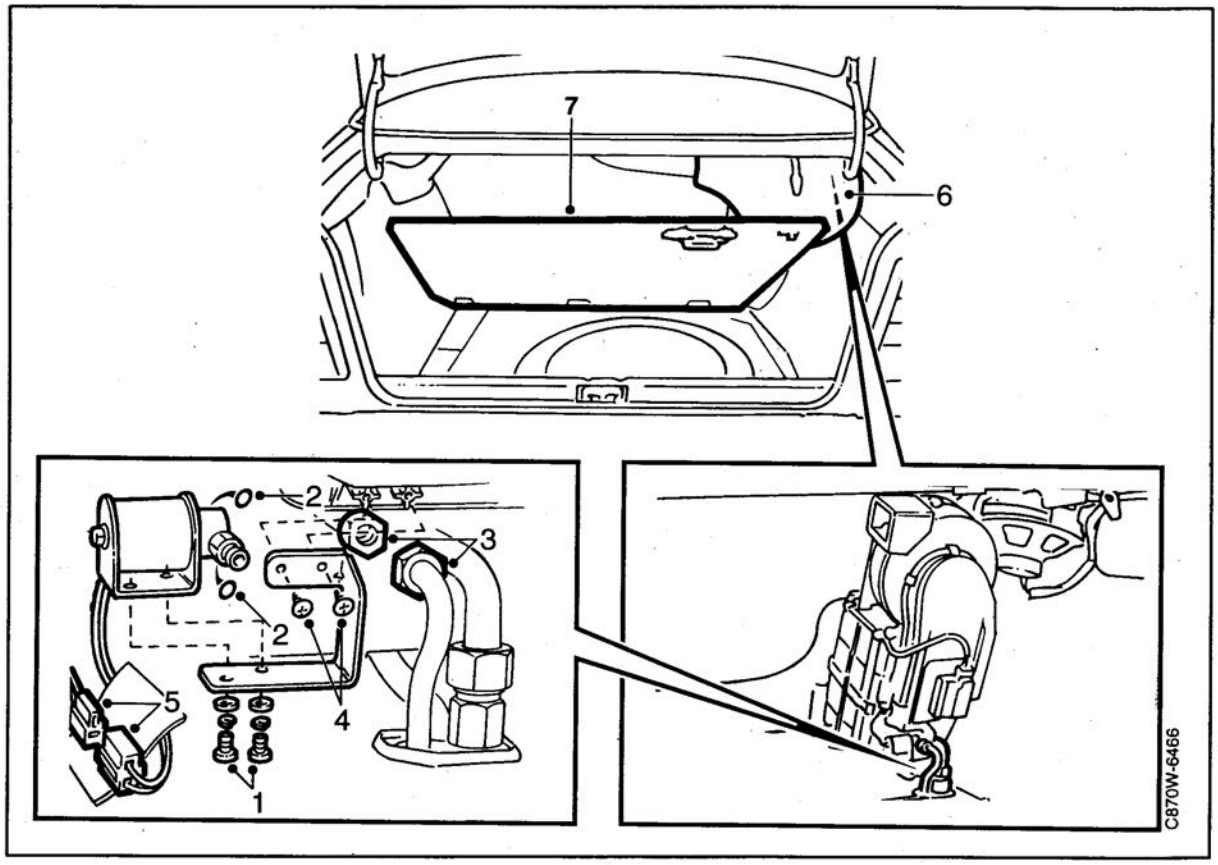
4 Remove the foam rubber and unplug the solenoid valve connector.

5 Undo the solenoid valve pipe connections. Use a holder.

6 Remove the two screws securing the solenoid valve bracket.

7 Remove the screws securing the solenoid valve to its bracket.

Rear solenoid valve, changing (contd.)



Fitting

1 Screw the solenoid valve onto its bracket.

2 Fit new O–rings to the pipe connections. Lubricate the O–rings with synthetic vaseline.

3 Do up the solenoid valve pipe connections. Use a holder.

Tightening torque: 14 Nm (10.4 lbf ft)

4 Screw on the solenoid valve bracket.

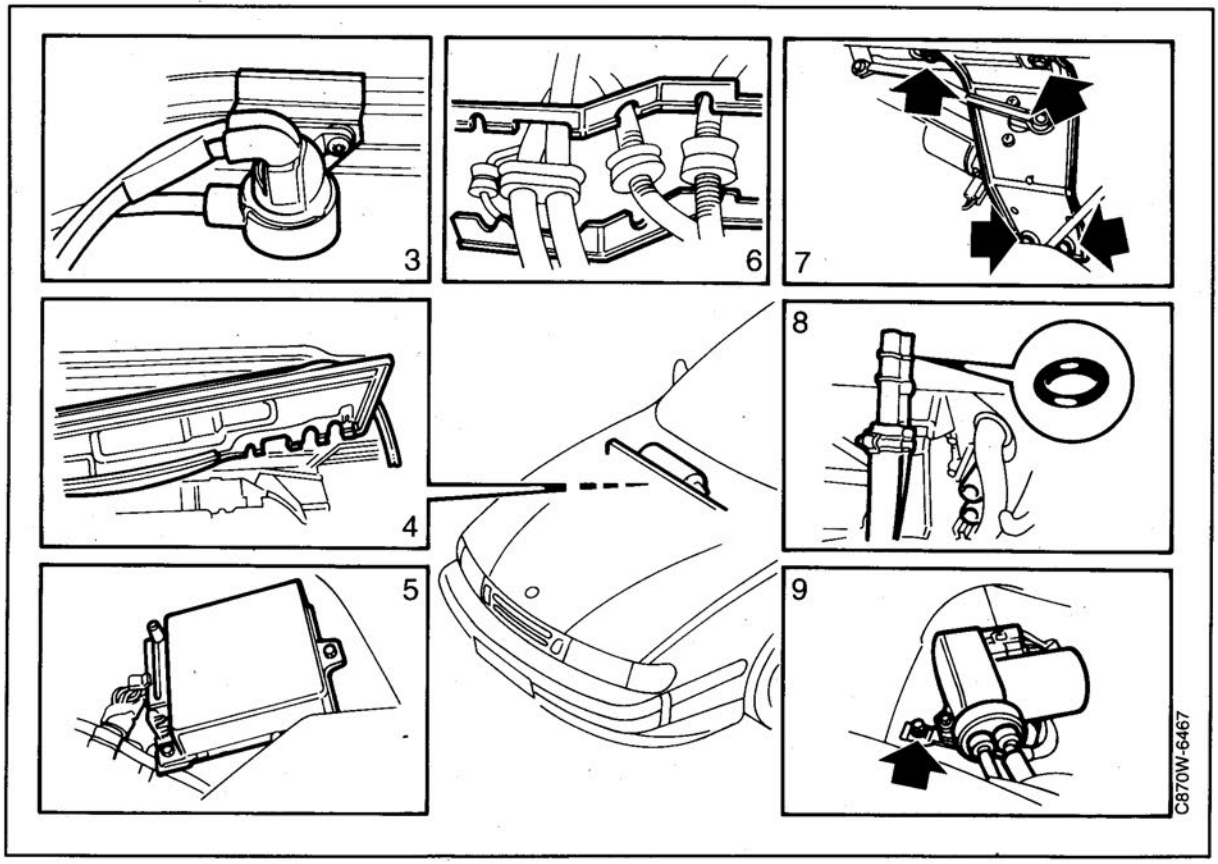
5 Plug in the solenoid valve connector and refit the foam rubber around it.

6 Refit the trim around the evaporator casing.

7 Refit the luggage compartment floor.

8 Fill the system with refrigerant.

Fan motor, changing



To remove

1 Detach the negative lead from the battery.

2 Remove

Bonnet if necessary

Wiper arms

Covers over evaporator casing and wiper motor

Plastic protector under windscreen moulding

3 Detach the seal strip from the bulkhead panel. Lift off the signal converter.

4 Remove the bulkhead panel.

5 Remove the screws and move the electronic control module to one side.

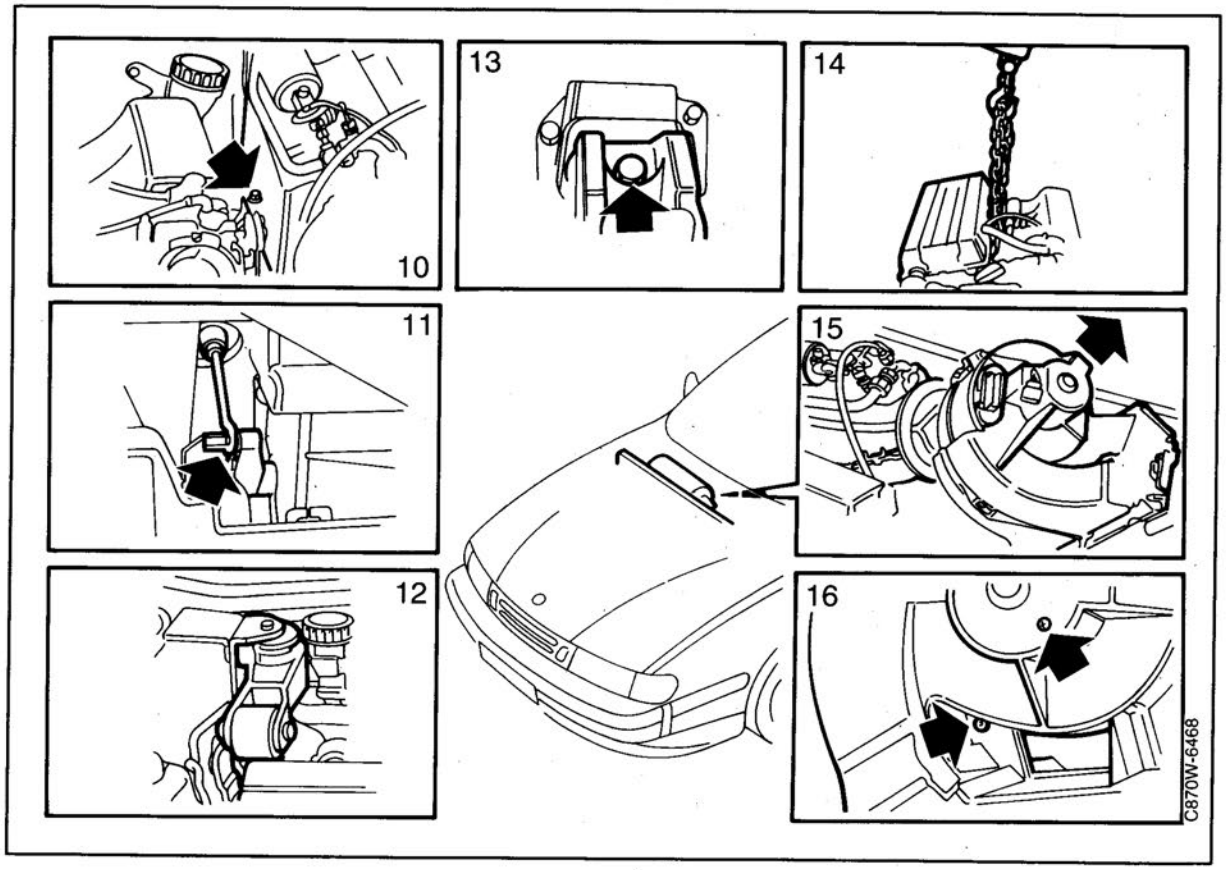
6 Remove the lead–through panel from the bulkhead panel. 4 screws.

7 Cut the cable tie. Unplug the connectors and remove the complete wiper mechanism.

8 Drain several litres of coolant from the cooling system. Remove the rubber cable gland around the coolant hoses. Remove the snap–on connector for the coolant hoses in the heat exchanger.

9 Remove the screws and move the vacuum pump for the cruise control to one side, if fitted.

Fan motor, changing (contd.)



10 Remove the screw securing the evaporator casing. Remove the clips securing the refrigerant hoses.

11 Remove the clip and detach the temperature valve cable.

12 Unscrew and remove the torque arm.

13 Remove the nut in the rear engine mounting.

14 Fit a lifting sling to the rear lifting eye and lift the engine slightly forward.

15 Carefully lift up the evaporator housing and remove the complete fan housing by undoing the securing lugs on both sides and turning it up at an angle.

16 Remove the four plastic clips and the screw holding the fan housing together.

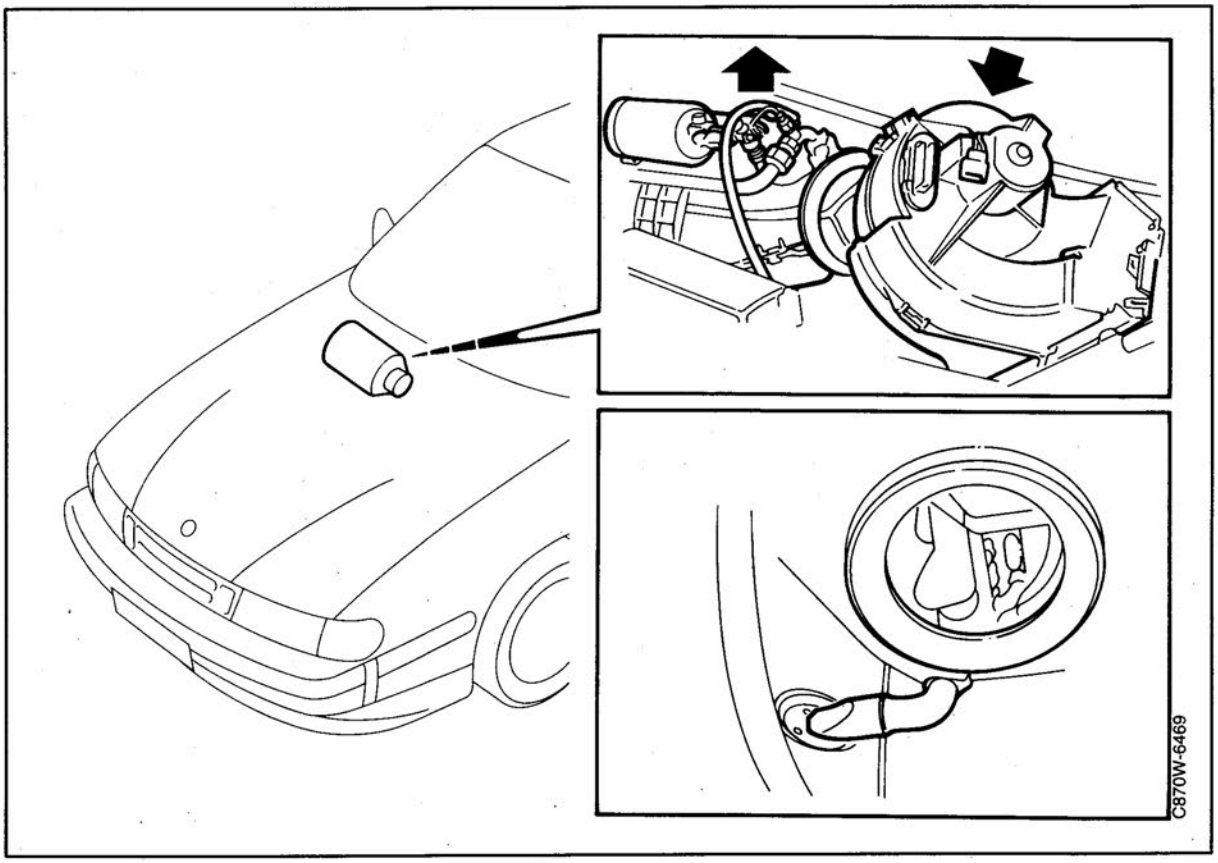
17 Remove the intermediate piece from the fan housing.
Split the fan housing.

18 Remove the screw securing the fan motor and press it out.

Fitting

19 Fitting is in reverse order.
See next page for hints.

Tips when fitting fan motor



Raise the evaporator casing.
Place the fan housing in position.
Hook the upper edge of the fan housing into the heating and ventilation unit.
Push the fan housing into position so that the securing lugs lock.

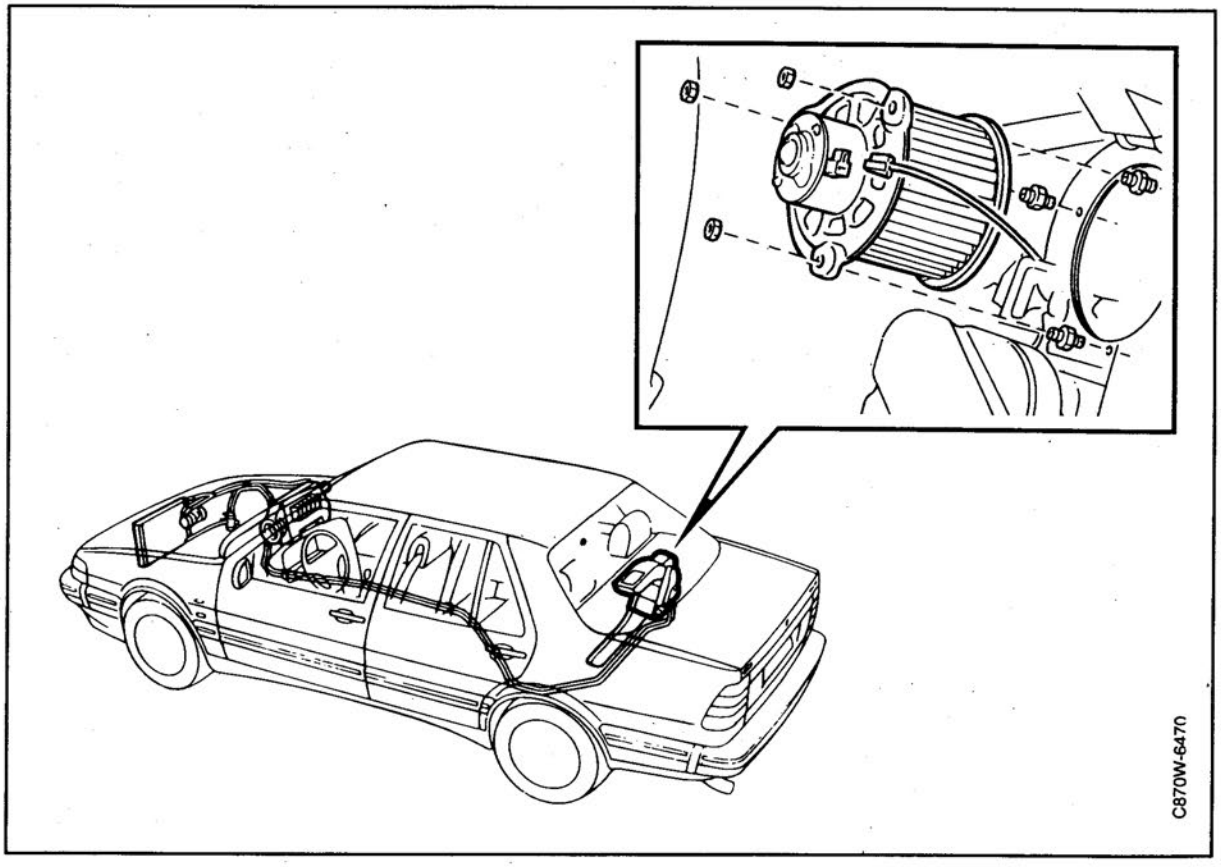
Check that the seal between the evaporator casing and fan housing is correctly positioned.
Check that the evaporator casing draining pipes are correctly positioned.

When fitting the heat exchanger hose coupling, make sure that the O–rings do not remain in the heat exchanger.
Fit new O–rings on the hose coupling and lubricate with synthetic vaseline.

Test pressurize the cooling system after the hose coupling has been fitted and the coolant has been topped up.

Important
The fan housing is not illustrated so that it is possible to see the draining pipe.

Rear fan motor, changing



To remove

1 Remove the backrest.

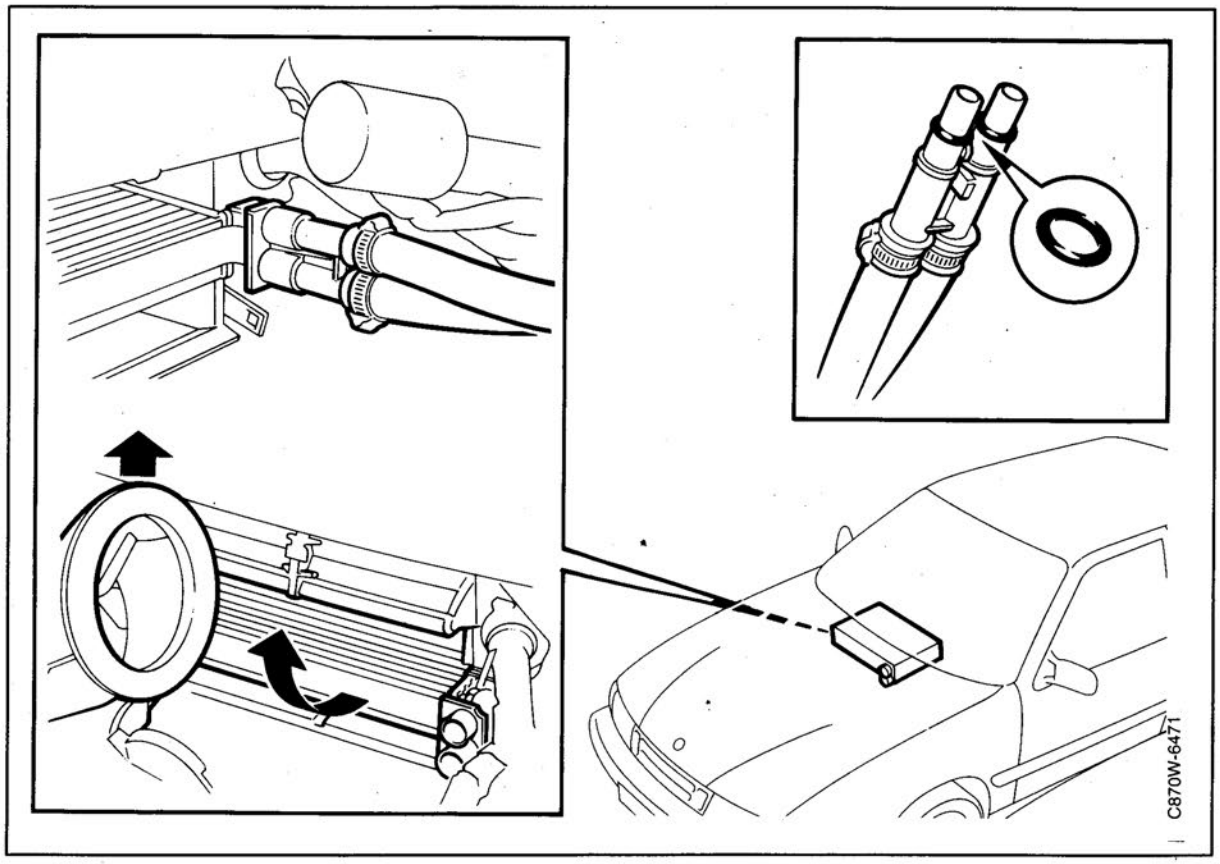
2 Remove the three retaining screws, unplug the connector and lift out the fan.

Fitting

3 Fit the fan in position, do up the three retaining screws and plug in the connector.

4 Refit the backrest.

Heat exchanger, changing



To remove

1 Remove fan housing. See "Changing fan motor".

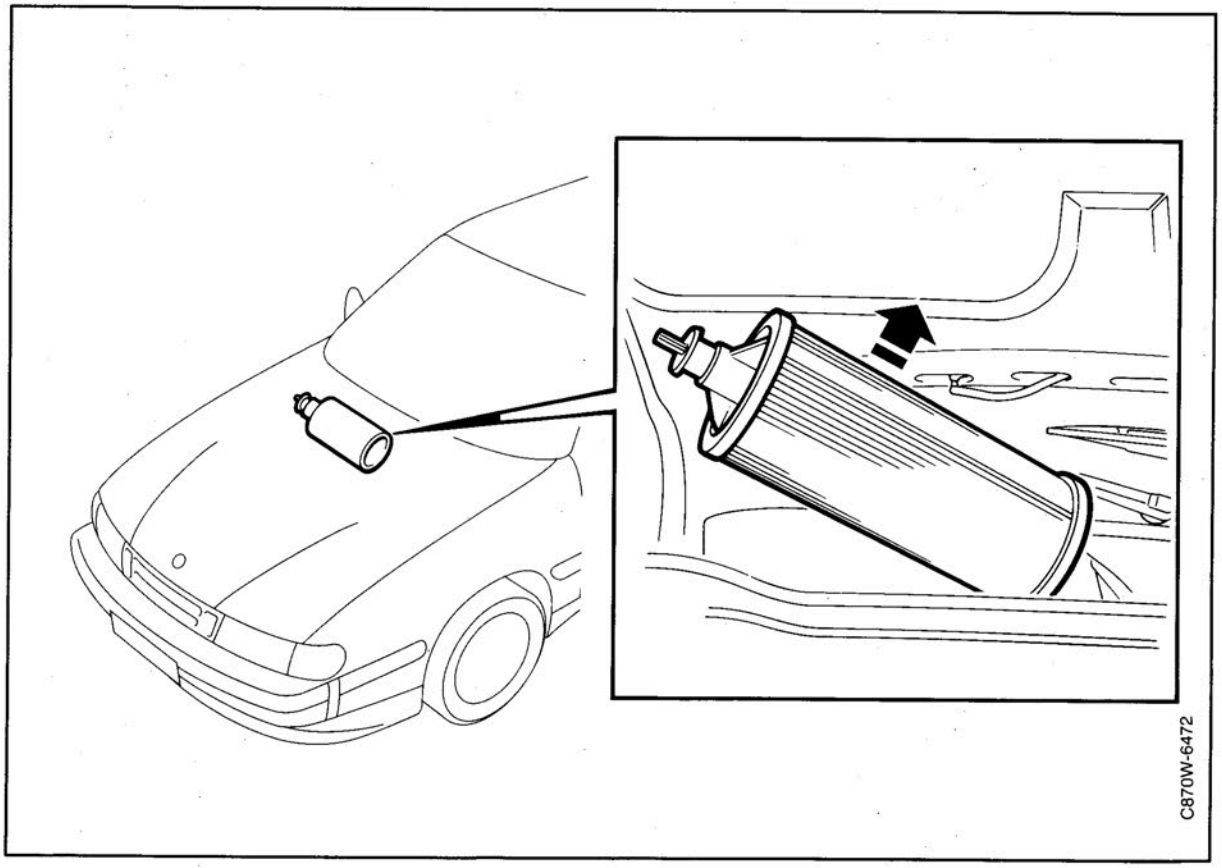
2 Cars without A/C/ACC:
Drain coolant from system.
Press in retaining lug and detach hoses from heat exchanger.
Lift out heat exchanger.

Cars with A/C/ACC:
Press in retaining lugs and detach hoses from heat exchanger.
Raise the evaporator casing.
Lift out heat exchanger.

Fitting

3 When fitting, hose coupling contact surfaces should be checked.
Change the O–rings and lubricate with vaseline.
Test pressurize the cooling system after the heat exchanger and hose couplings have been fitted and the coolant has been topped up.

Fresh air filter, changing (without A/C –M1989)



To remove

From chassis number CH1021173, CH8000853, the fresh air filter has a plastic cover.

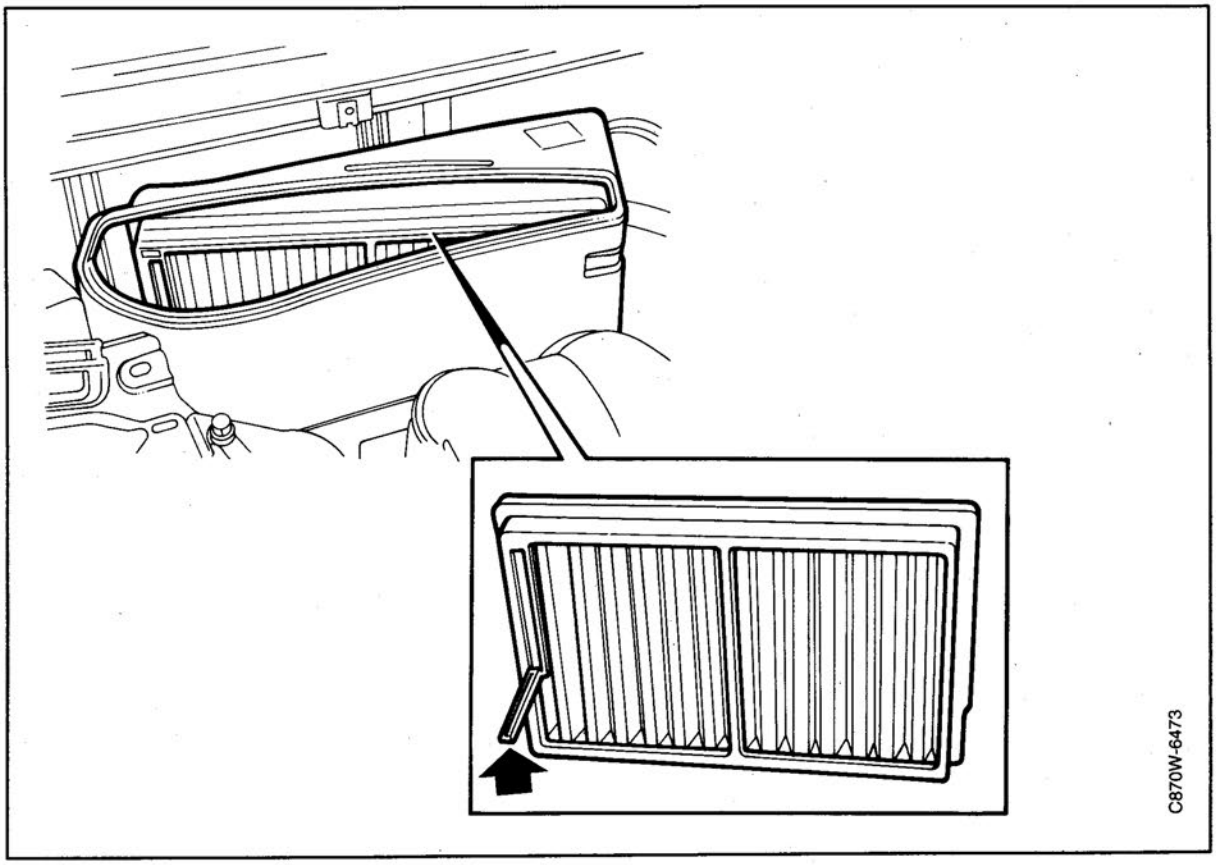
1 Press the filter towards the right–hand wheel housing and lift it out.

2 Remove the spring mechanism from the old filter and put it on the new filter.

Fitting

3 Guide in the pin. Press the filter towards the right–hand wheel housing and place it in position.

Fresh air filter, changing, (without A/C M1990–)



To remove

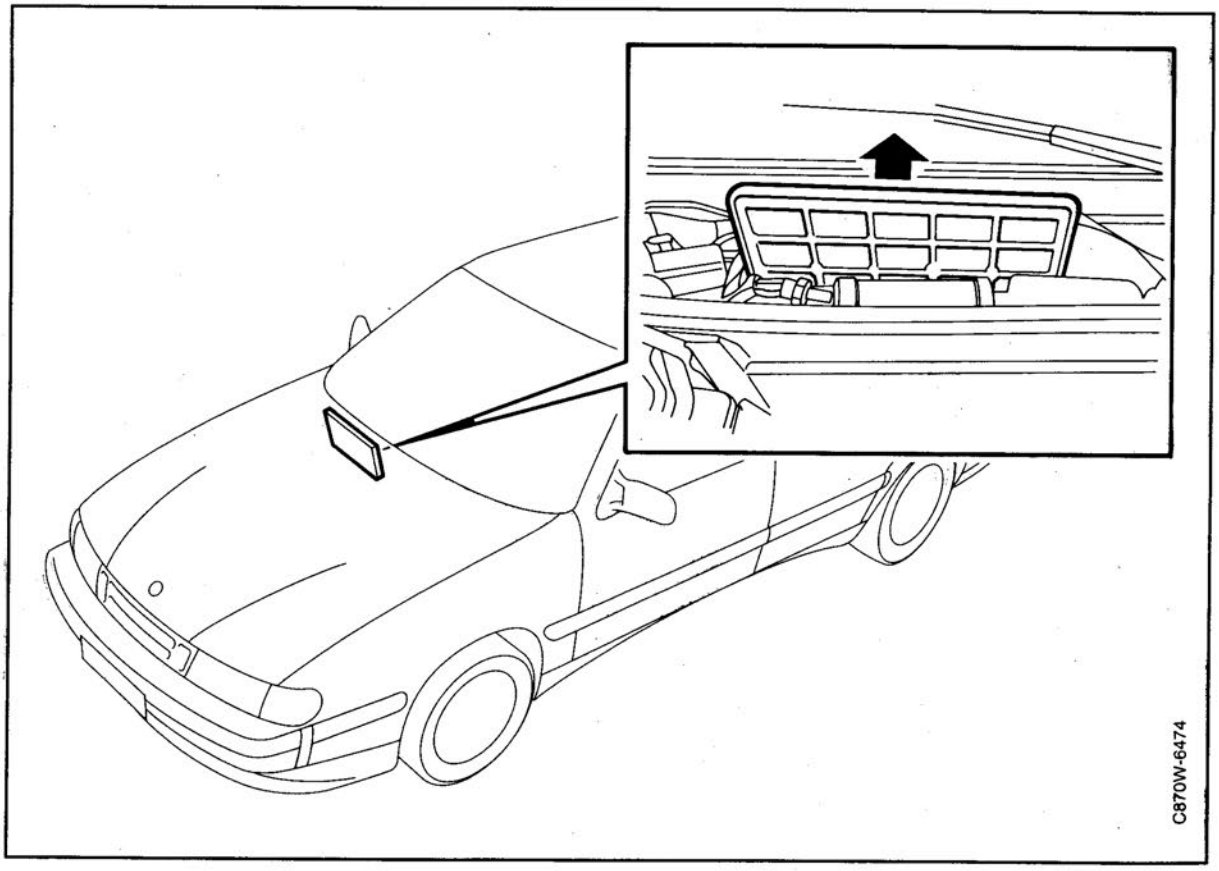
1 Remove the cover from over the evaporator casing. Remove the lid from over the filter.

2 Lift up the arm on the filter and pull out filter.

Fitting

3 Fit the new filter with the recess in the frame down/back.

Fresh air filter, changing, (with A/C)



To remove

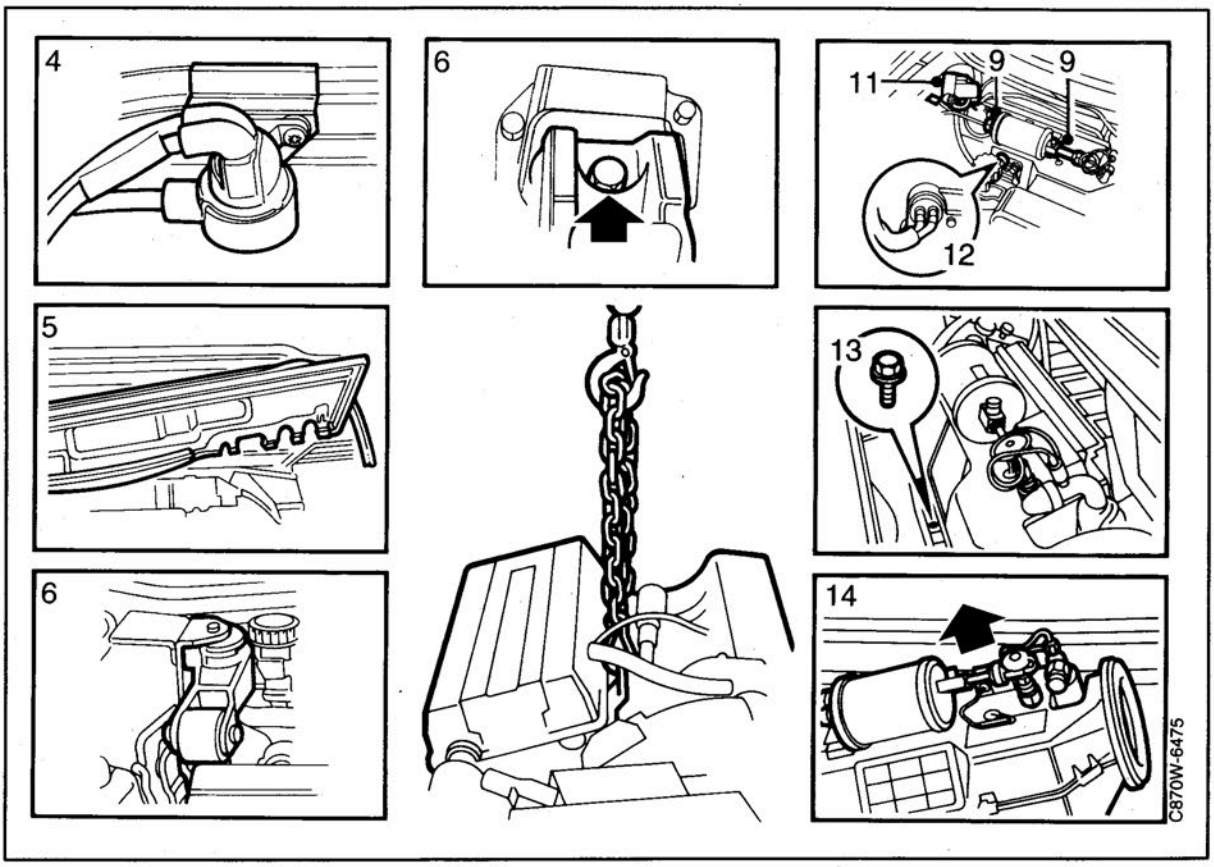
1 Remove the cover from over the evaporator casing. Lift the securing lugs. Raise the lid and pull out the filter.

Fitting

2 Fit the new filter with the recess in the frame down/back.

3 Lower the cover and secure with retaining lugs. Fit the cover panel over the evaporator casing.

Evaporator, changing –M1991



To remove

1 Detach the negative lead from the battery.

2 Empty refrigerant from system. See "Refrigerant".

3 Remove

Bonnet if necessary

Wiper arms

Covers over evaporator casing and wiper motor

Plastic protector under windscreen strip.

4 Remove the seal strip from the bulkhead panel and remove the signal converter.

5 Remove the bulkhead panel and the upper bracket for the oil filler pipe.

6 Remove the torque arm and the rear engine mounting.

7 Fit a lifting sling to the rear lifting eye on the engine.

8 Lift the engine slightly forward.

9 Detach the pipe connections to the desiccant container intake and the evaporator outlet. Use a holder.
Plug all open connections.

10 Remove the plastic pipe grommet from the panel and detach the steering servo bracket beside the oil container. Move the pipe to one side.

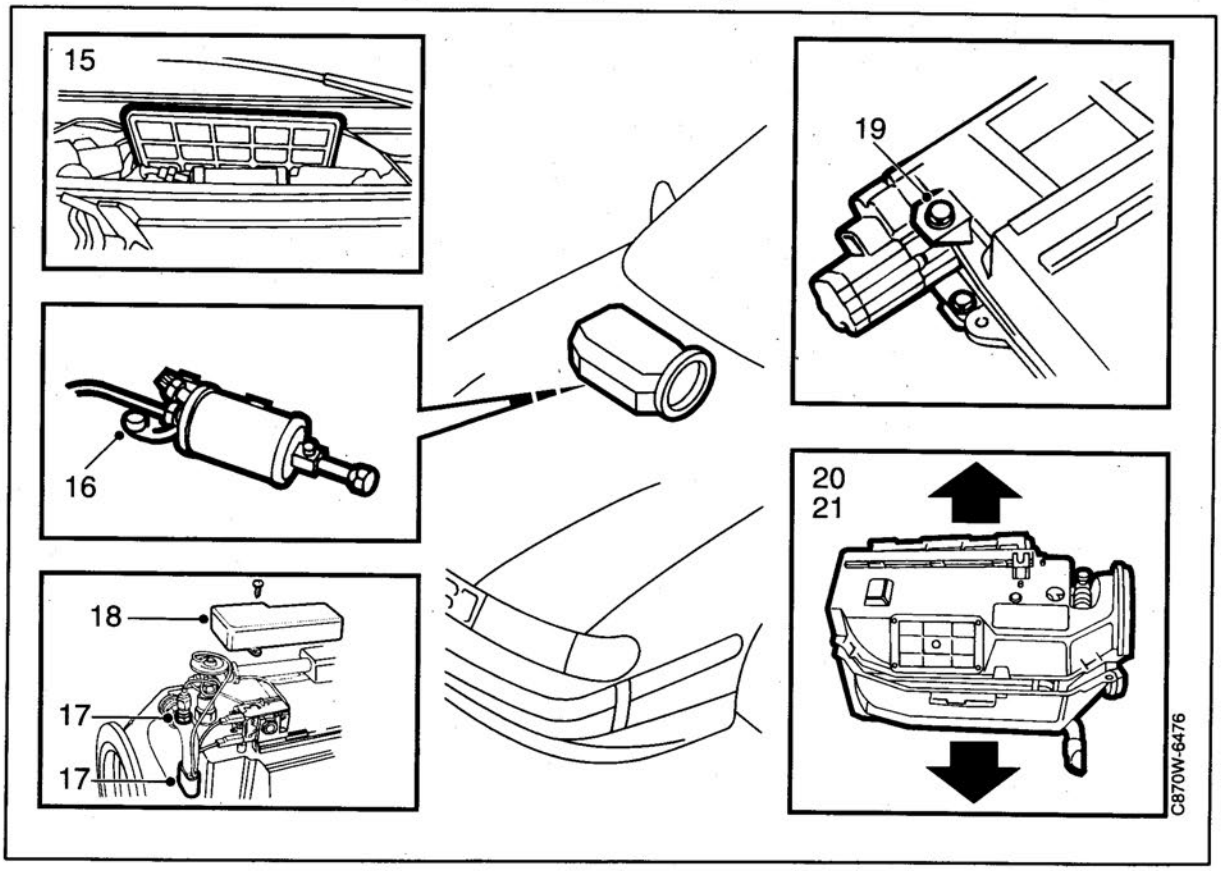
11 Detach the cruise control vacuum pump.

12 Unplug the fan control electrical connections (ACC only), the air recirculation flap motor, the anti–freeze thermostat and the desiccant container pressure switch.

13 Remove the evaporator casing screw.

14 Turn the evaporator casing up, move it to the centre and lift it out.

Evaporator, changing –M1991 (contd.)



To dismantle

15 Remove fresh air filter.

16 Remove the screw securing the desiccant container and unplug the desiccant container connection from the expansion valve.

17 Remove the insulation so that the clip securing the sensor can be undone. Detach the capillary tube and expansion valve connections from the evaporator.

Important
Plug all open connections immediately.

---

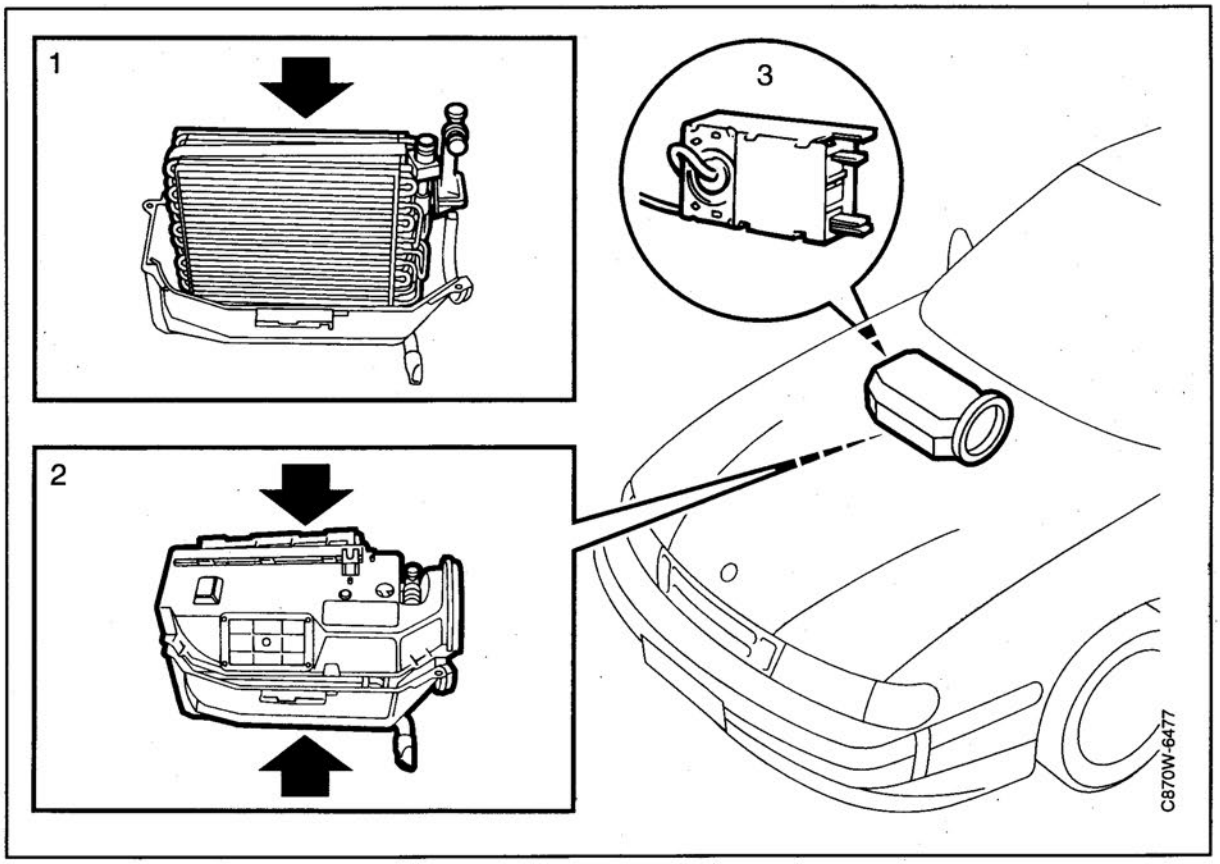
18 Remove the anti–freeze thermostat.

19 Remove the recirculation flap motor.

20 Cut the seal in the evaporator casing partition surface.

21 Remove the clip holding the evaporator casing together. Open the casing and lift out the evaporator.

Evaporator, changing –M1991 (contd.)



To assemble

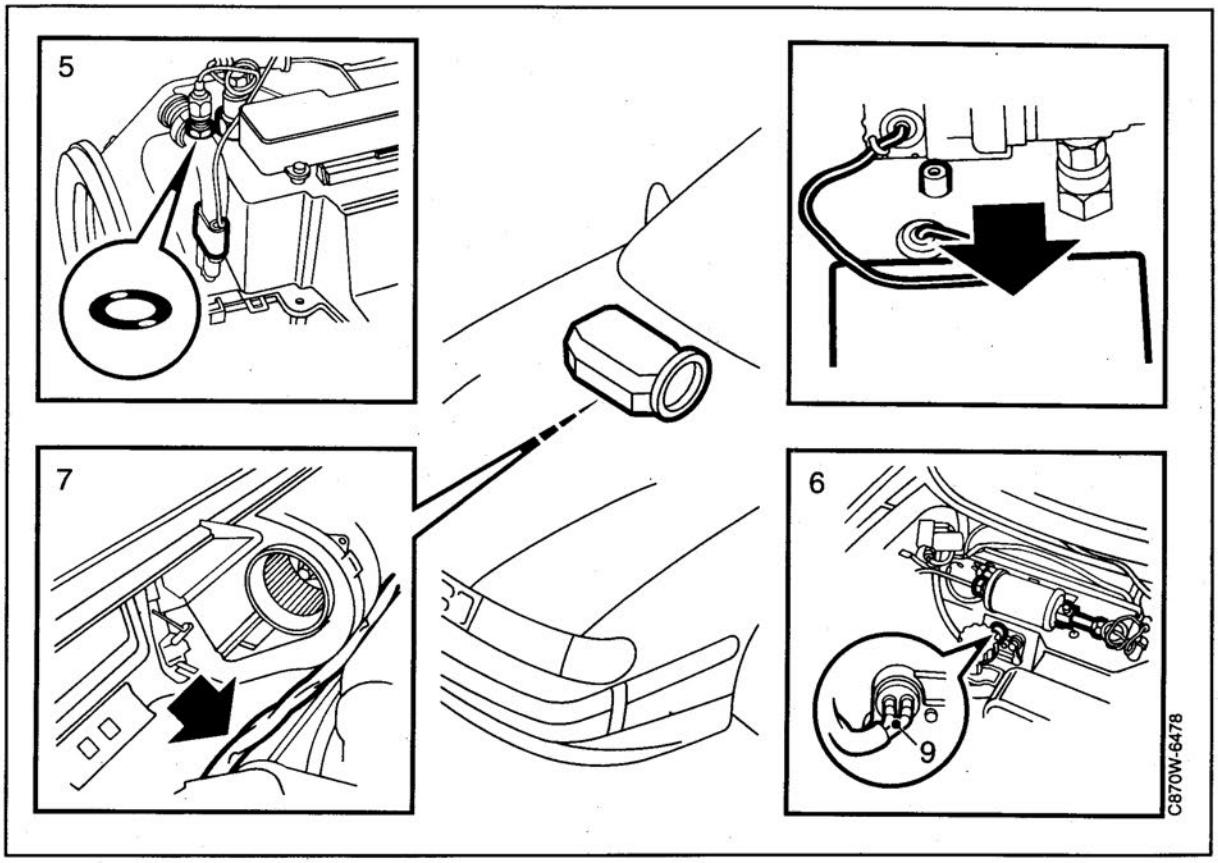
1 Place evaporator in casing. The inner grooves are for the evaporator, and the outer for the fresh air filter.

2 Place the recirculation flap and fresh air filter in position. Fit the upper part of the evaporator casing and the plastic clip. Check that the recirculation flap is in the correct position.
Change the seal if it is damaged.

3 Fit the anti–freeze thermostat. Check that the capillary tube is in the right position (bottom).

4 Fit the recirculation motor.

Evaporator, changing –M1991 (contd.)



5 Fit the expansion valve. Do not do up the connections.

Important
Fit new O–rings to the connections. Lubricate O–rings with synthetic vaseline.

Fit the sensitive body to the evaporator output. Make sure that contact is good. Carefully insulate the sensitive body

6 Fit the desiccant container. Do up all connections.

7 Check that electric cables are correctly positioned in the car.

Fitting

8 Lift the evaporator casing into position in the car. Centre it so that the seal is correctly positioned against the fan housing. Fit the evaporator casing screw. Make sure that the evaporator casing draining pipe is correctly positioned on the housing as illustrated.

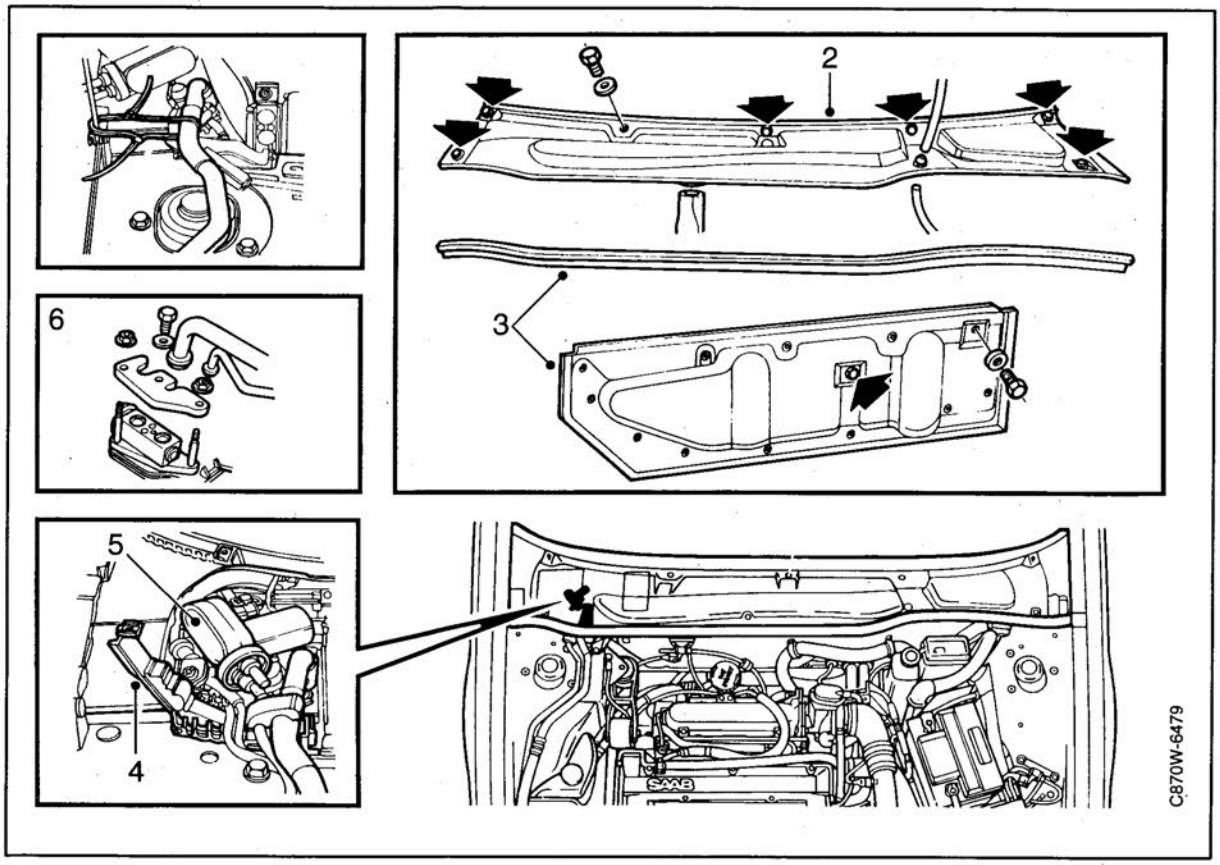
9 Plug in fan control connections, air recirculation flap motor, anti–freeze thermostat and the desiccant container pressure switch. Fit the cover over the anti–freeze thermostat.

10 Refit all parts which have been removed.

11 Fill the system with refrigerant. See chapter entitled "Refrigerant".

12 Carry out a performance test.

Evaporator, changing M1992–



Even small quantities of the wrong refrigerant or wrong compressor oil cause chemical reactions which will eventually destroy the entire A/C system. This applies to both A/C systems, from compressor to O–rings, and to stations for charging and draining refrigerant.

To remove

1 Drain the A/C system of refrigerant, see chapter "Refrigerant".

2 Remove the cover from over the bulkhead space. Remove the washer fluid hose and drain hose.

3 Remove the rubber strip and the right–hand partition plate.

4 Open the clamp over the A/C pipes.

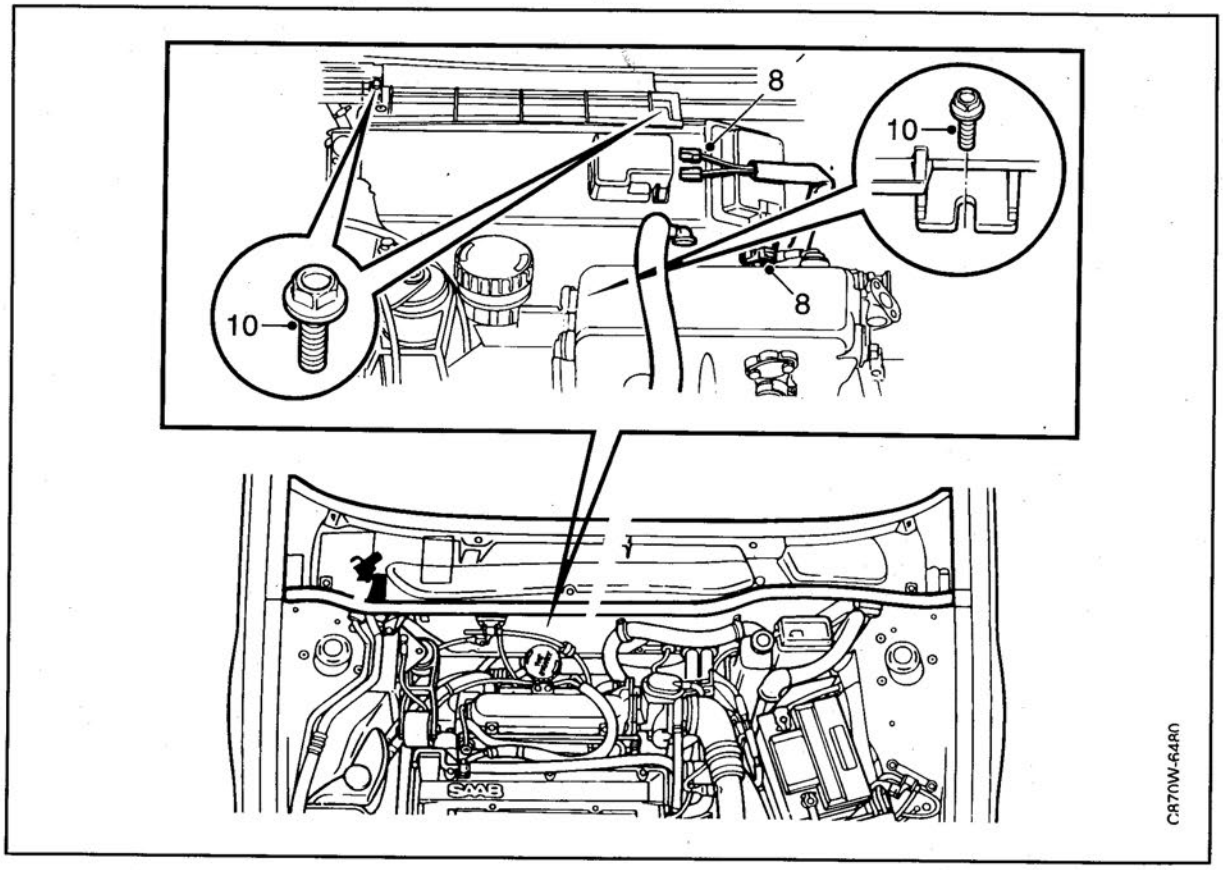
5 Where fitted, remove the cruise control system pump from its bracket and move to one side.

6 Unscrew the A/C pipes' PAD connection to the expansion valve. Plug openings in the pipes and the expansion valve.

Important
Both the desiccant container and compressor oil in the R134a system absorb water from the air, which cannot then be removed. For this reason, all connections which are opened must be immediately plugged.

7 Detach the A/C pipes from the holes beside the MacPherson strut, carefully move them to one side and attach them to the bonnet gas springs using cable ties.

Evaporator, changing M1992– (contd.)



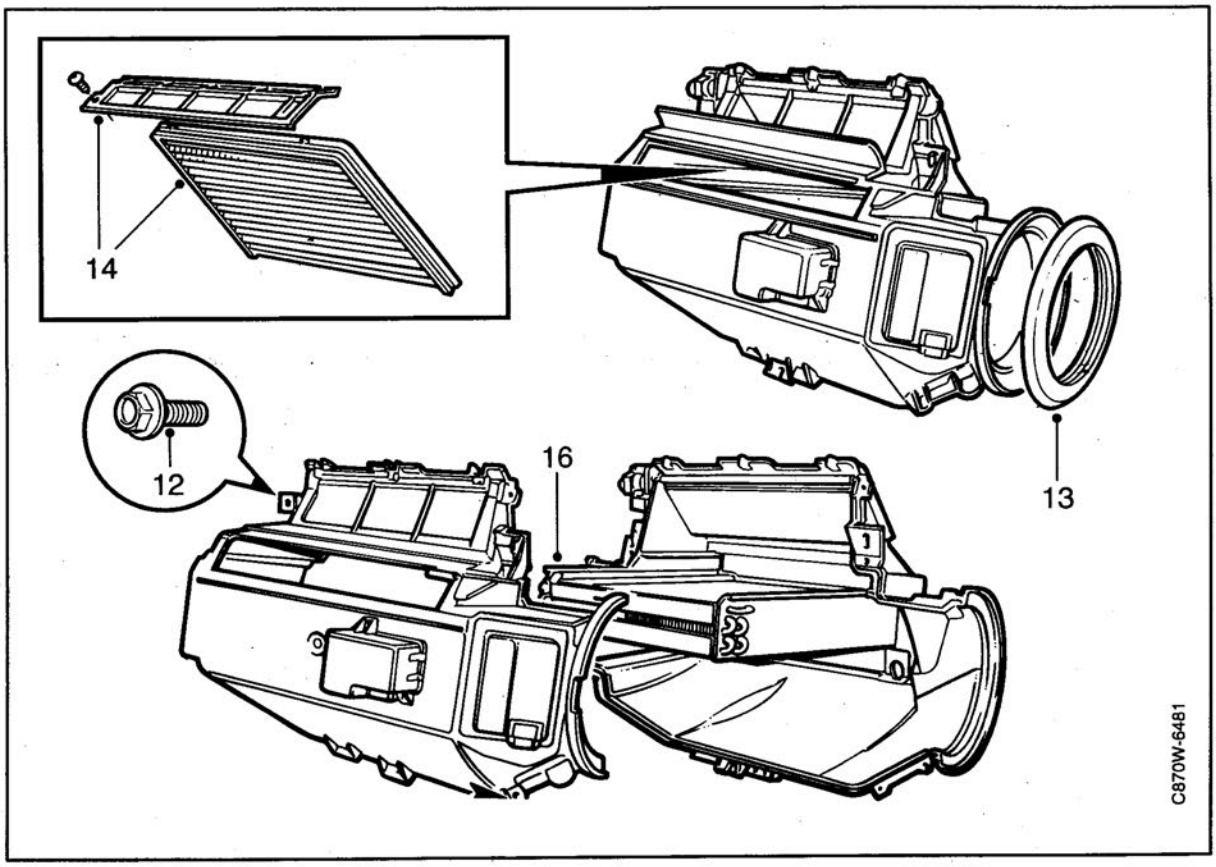
8 Unplug connectors to the air recirculation flap motor, thermostatic switch and fan control module.

9 Detach the vacuum connection to the rear of the intake manifold.

10 Remove the three retaining screws from the evaporator casing.

11 Detach the evaporator casing from the ventilation fan and lift it out of the car.

Evaporator, changing M1992– (contd.)



12 Remove the screw securing the air recirculation flap motor.

13 Remove the seal around the opening to the ventilation fan.

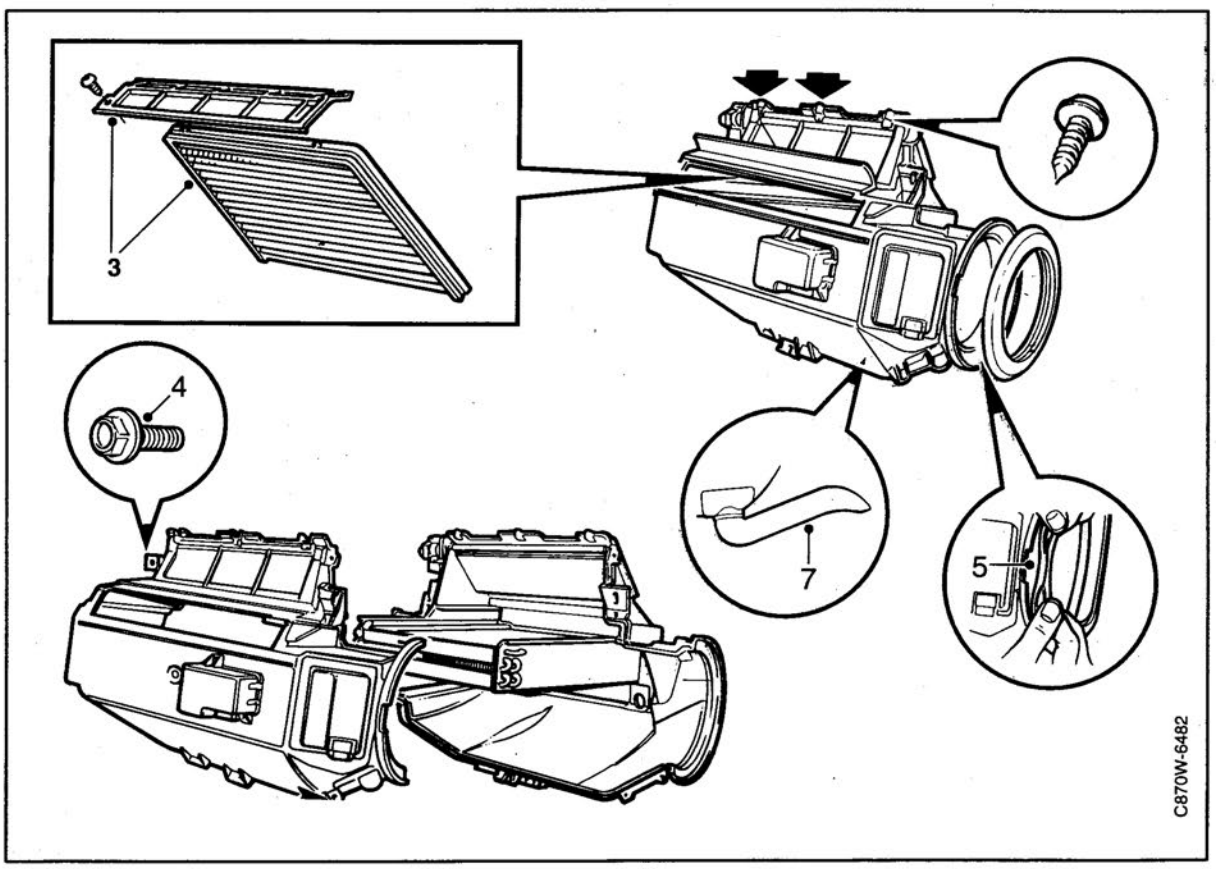
14 Remove the cover from over the fresh air filter and lift out the filter.

15 Remove the screws which hold together the two parts of the evaporator casing.

16 Lift the evaporator out of its casing.

Important
Lift carefully so that the anti–freeze thermostat capillary tube is not damaged.

Evaporator, changing M1992– (contd.)



Fitting

1 Place the evaporator in position in its casing.

2 Place the upper part of the evaporator casing in position. Fitting is facilitated by removing the anti–freeze thermostat from the evaporator casing and then fitting it separately. Do up the screws holding the housing together.

3 Place the fresh air filter in position and screw on the cover.

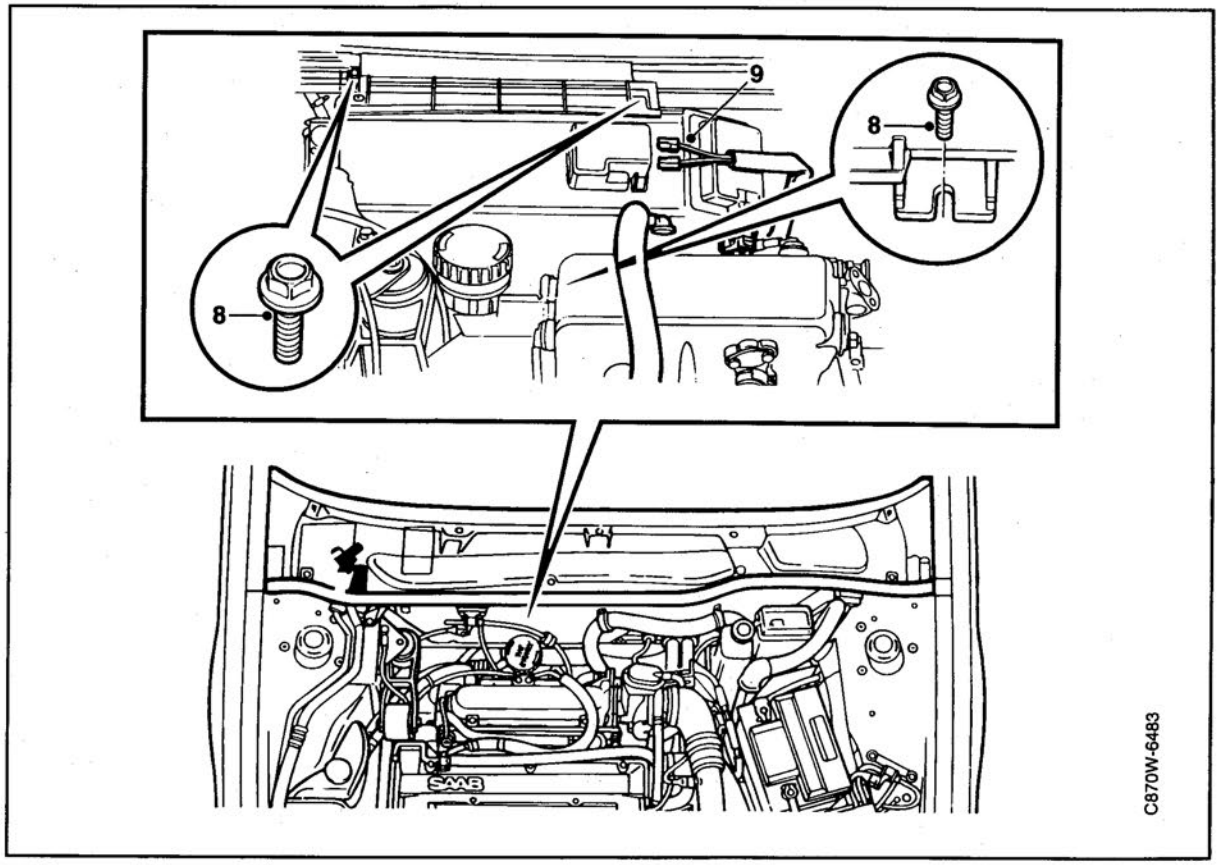
4 Do up the screws securing the air recirculation flap motor.

5 Push on the seal around the opening to the ventilation fan. Make sure that the lug on the seal flange is fitted into the recess on the edge of the evaporator casing.

6 Lubricate the inner edge of the seal using vaseline.

7 Place the evaporator casing in position. Check that the drain hose is not kinked, and that water can freely run out of the evaporator casing.

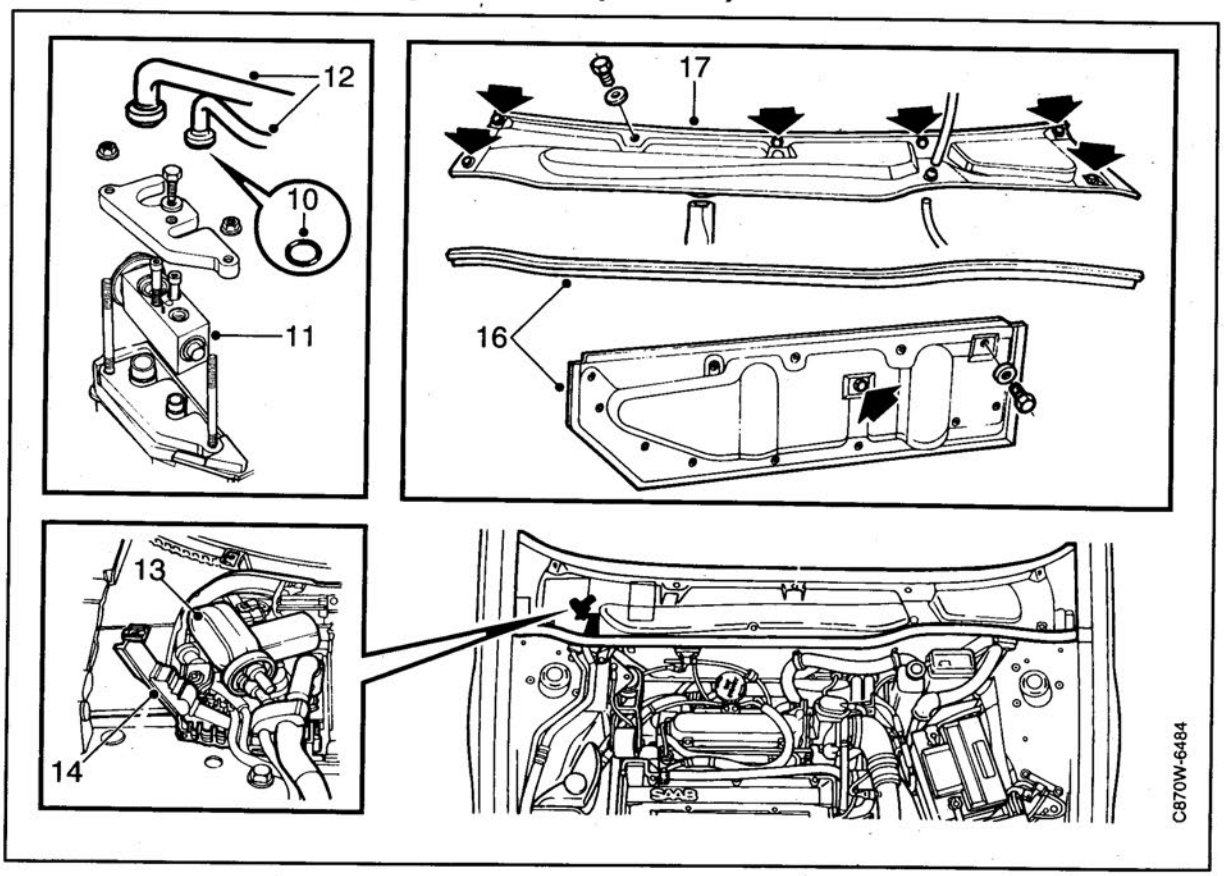
Evaporator, changing M1992– (contd.)



8 Do up the three screws securing the evaporator casing.

9 Plug in connectors to the air recirculation flap motor, thermostatic switch and fan control module.

Evaporator, changing M1992– (contd.)



10 Fit new O–rings to the A/C pipes and lubricate them using synthetic vaseline, part number (16) 30 15 286.

11 Place the A/C pipes in position on the expansion valve. Check that the pipes are correctly located in the holes and then tighten the PAD connector to the expansion valve.

Tightening torque: 17.5 Nm (12.8 lbf ft)

12 Refit the A/C pipes in the holder beside the MacPherson strut.

13 Where fitted, refit the cruise control system pump.

14 Lower the clamp over the A/C lines.

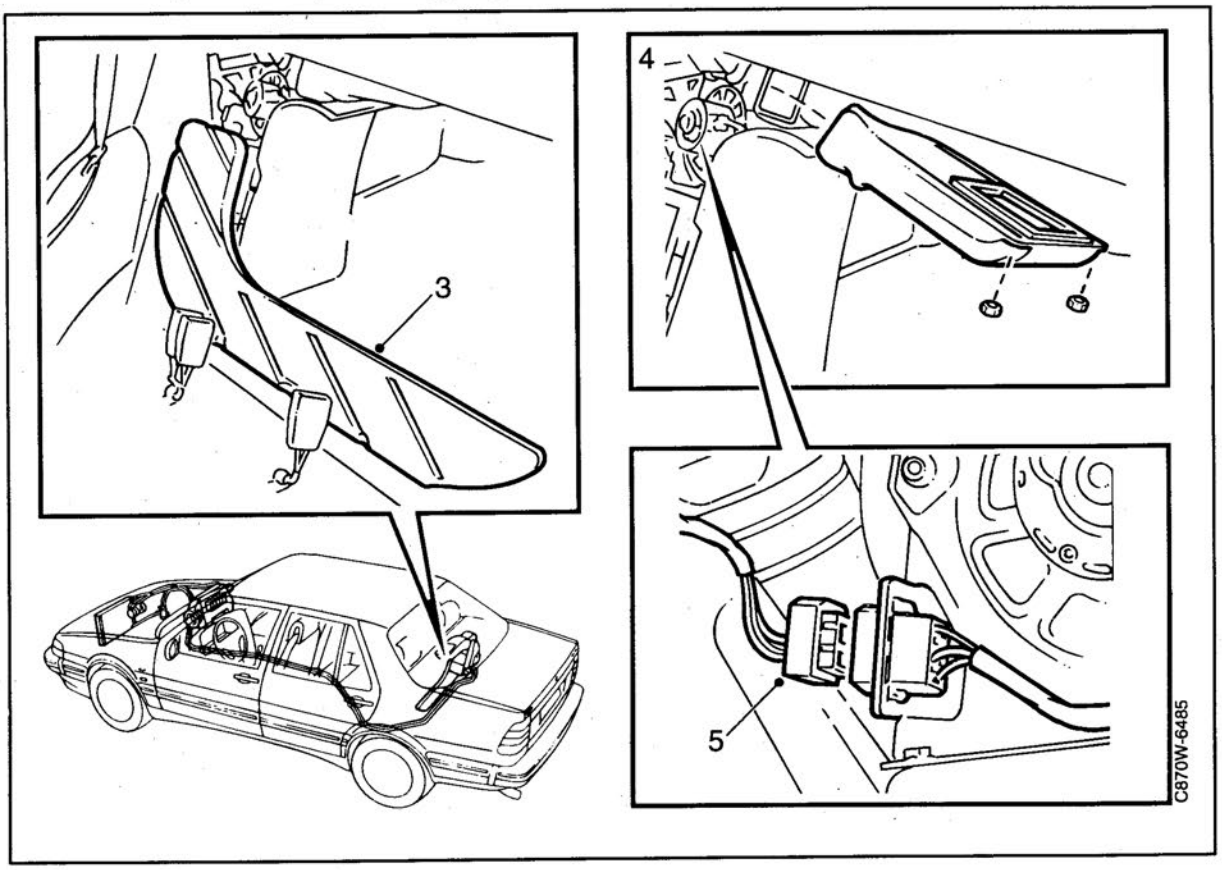
15 Refit the vacuum connection to the intake manifold.

16 Refit the partition plate and press on the rubber strip.

17 Connect the drain hose and washer fluid hose to the cover and screw the cover over the bulkhead space.

18 Fill with refrigerant, see chapter entitled "Refrigerant".

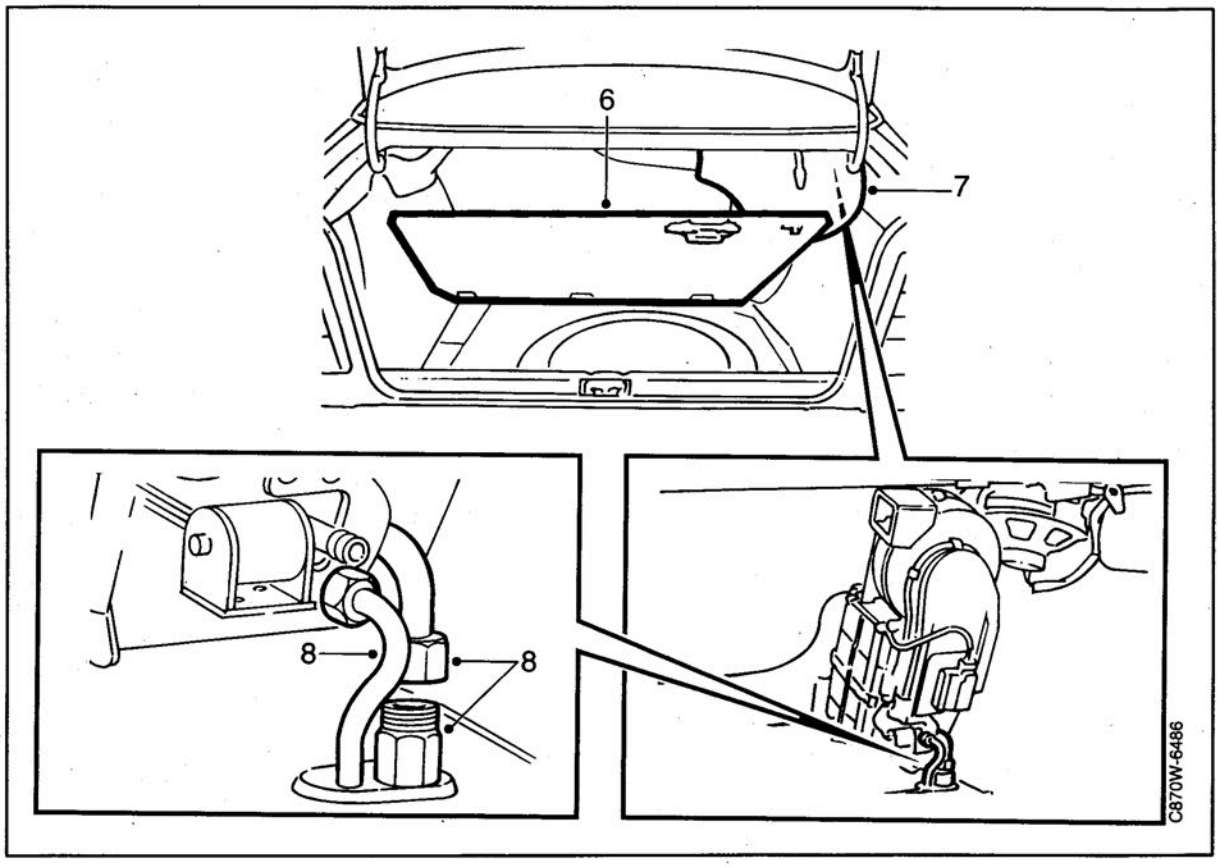
Rear evaporator, changing



To remove

1 Drain the A/C system of refrigerant.
2 Remove the backrest.
3 Remove the air intake.
4 Remove the air outlet duct.
5 Unplug connector.

Rear evaporator, changing (contd.)

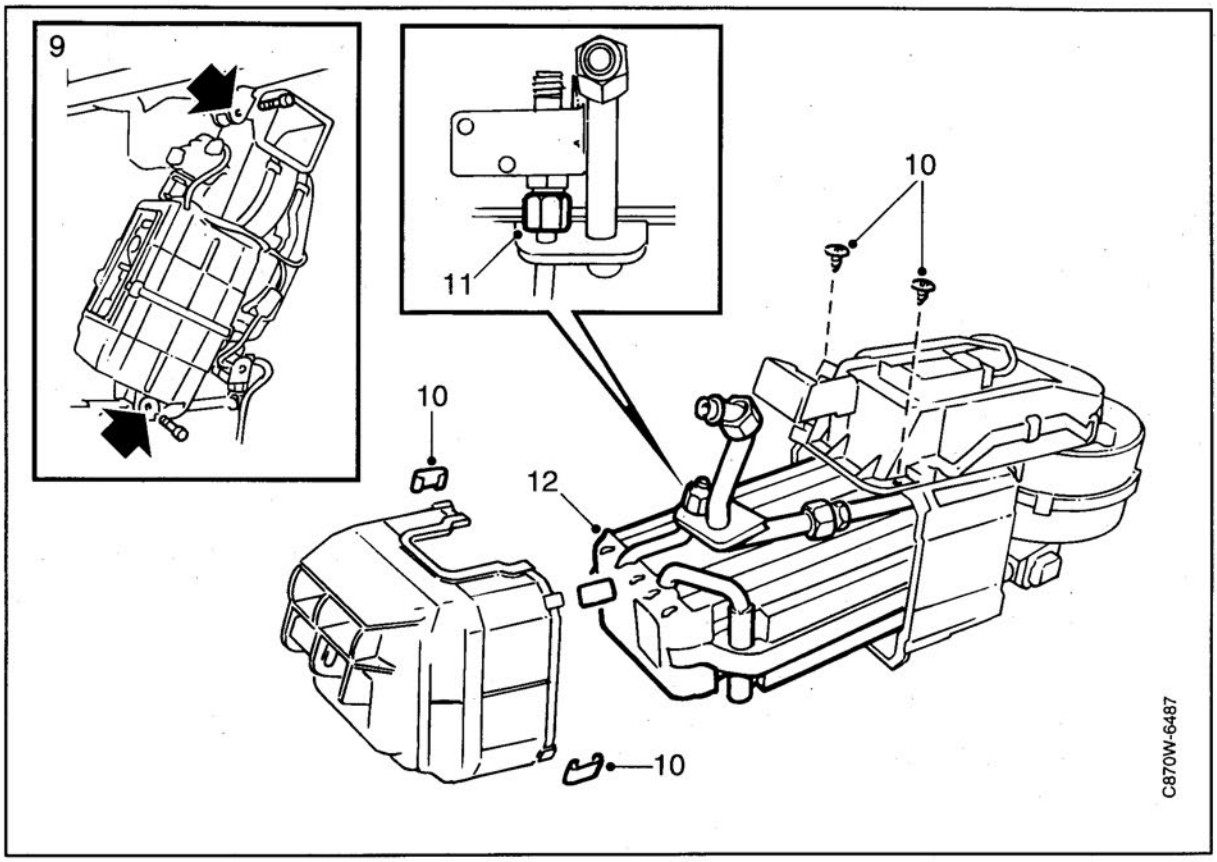


6 Remove the luggage compartment floor.

7 Remove the trim from around the evaporator casing.

8 Undo both the refrigerant pipe connectors. Use a holder.

Rear evaporator, changing (contd.)



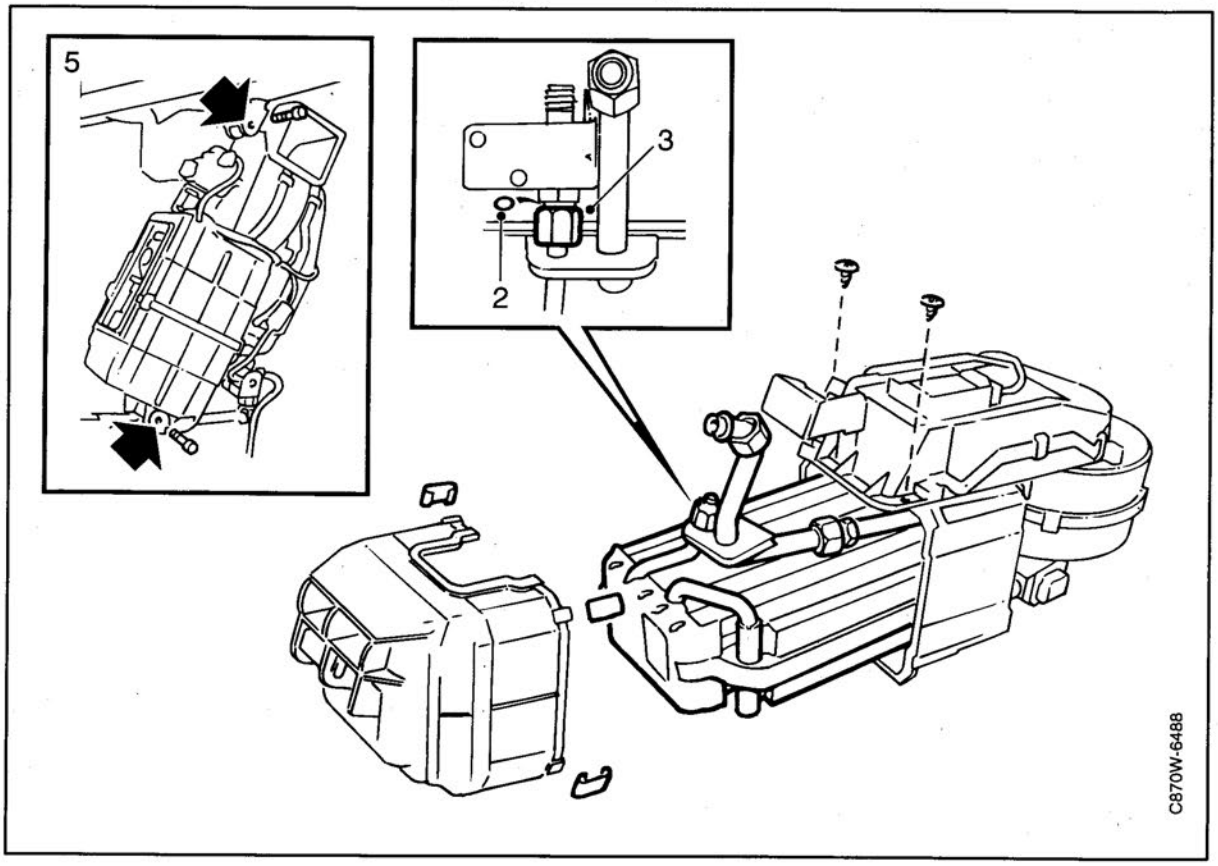
9 Remove both the evaporator casing retaining screws.

10 Remove the two screws and four clips securing the lower part of the evaporator casing.

11 Undo the connection to the solenoid valve. Use a holder.

12 Lift the evaporator out of its casing.

Rear evaporator, changing (contd.)



Fitting

1 Place the evaporator in position in its casing.

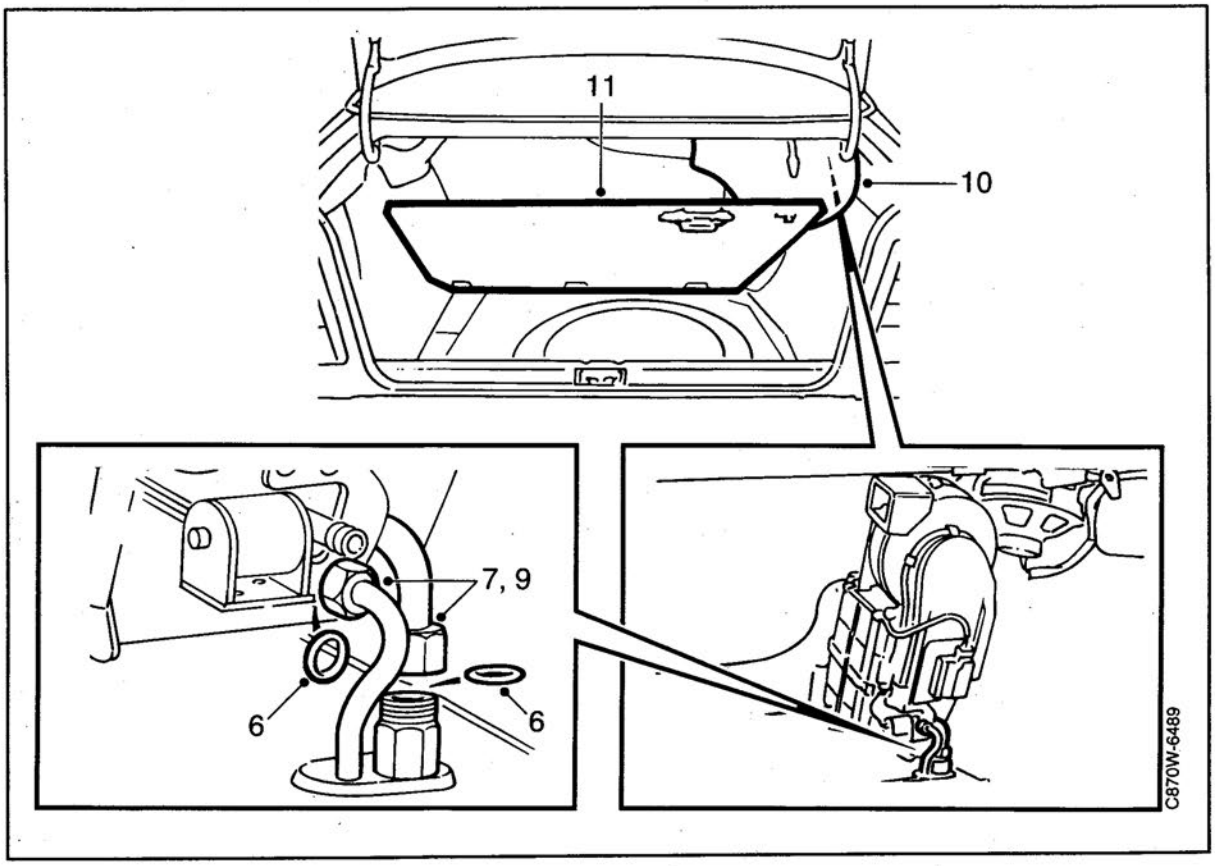
2 Fit a new O–ring to the connection at the solenoid valve. Lubricate the O–ring using synthetic vaseline.

3 Do up connection.
Tightening torque: 14 Nm (10.4 lbf ft)

4 Fit the lower part of the evaporator casing. Press on the four clips and do up both screws.

5 Fit the evaporator casing in position in the car, without doing up the retaining screws. Insert the end of the drain hose in the hole in the floor.

Rear evaporator, changing (contd.)



6 Fit new O–rings to the A/C pipes. Lubricate O–rings with synthetic vaseline.

7 Position the pipe connections.

8 Do up the evaporator casing retaining screws.

9 Do up the A/C pipe connectors. Use a holder.

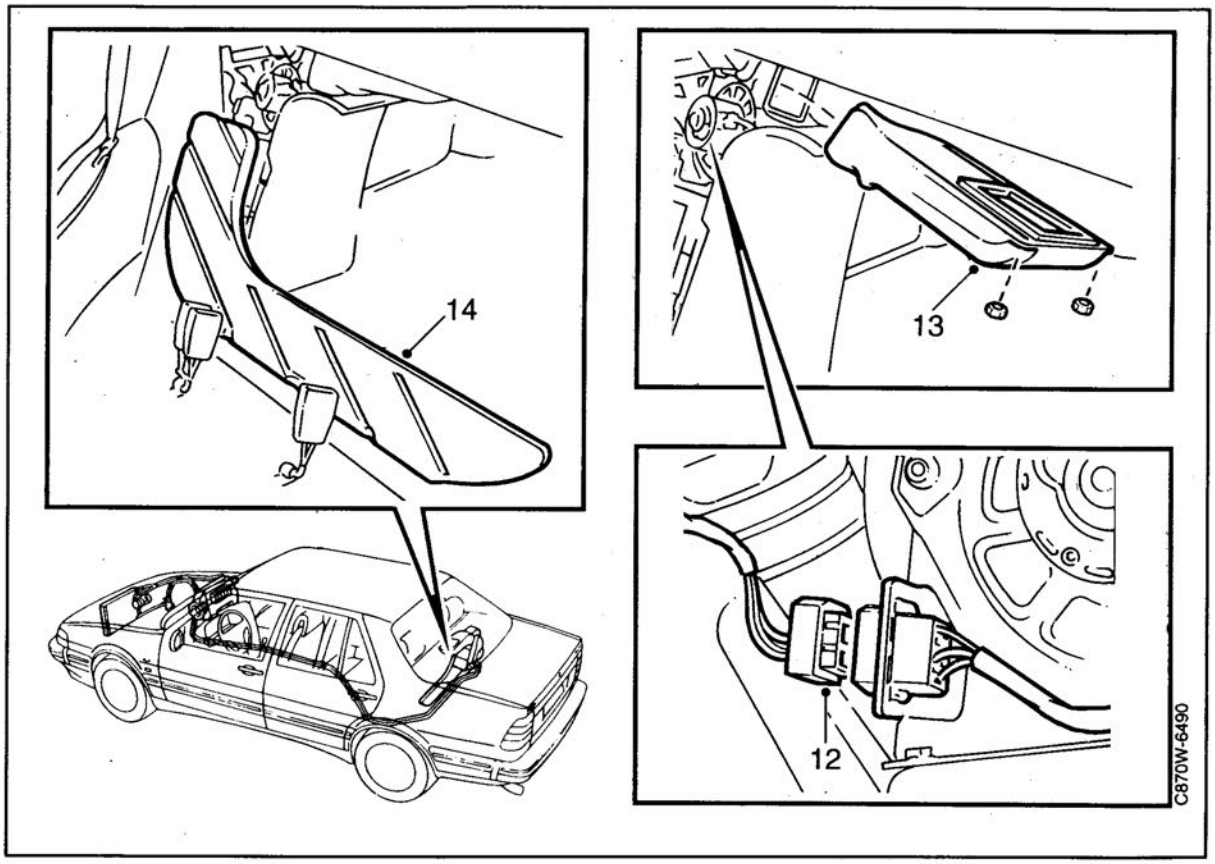
Tightening torque, pressure pipe: 13 Nm (9.6 lbf ft)

Tightening torque, vacuum pipe: 15 Nm (22.2 lbf ft)

10 Refit the trim around the evaporator housing.

11 Refit the luggage compartment floor.

Rear evaporator, changing (contd.)



12 Plug in the connector.

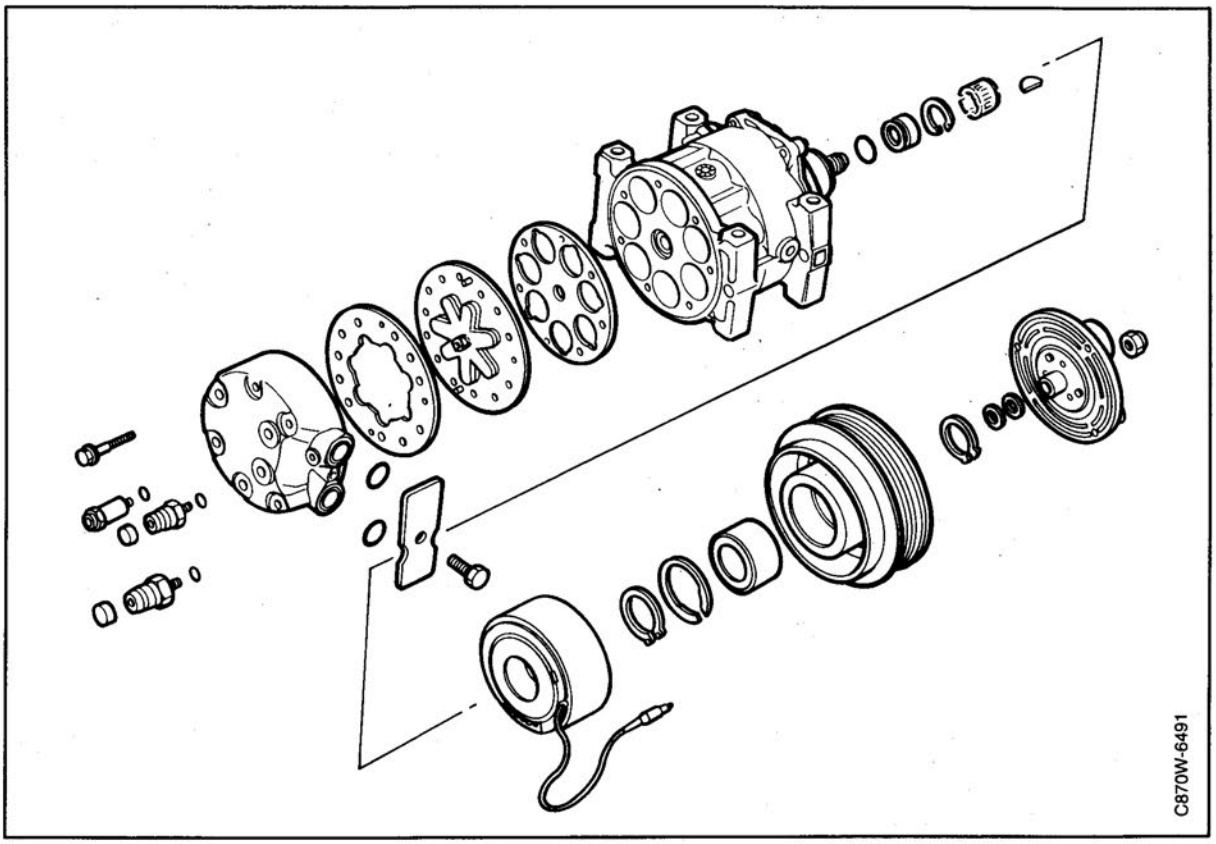
13 Refit the air outlet duct.

14 Refit the air intake.

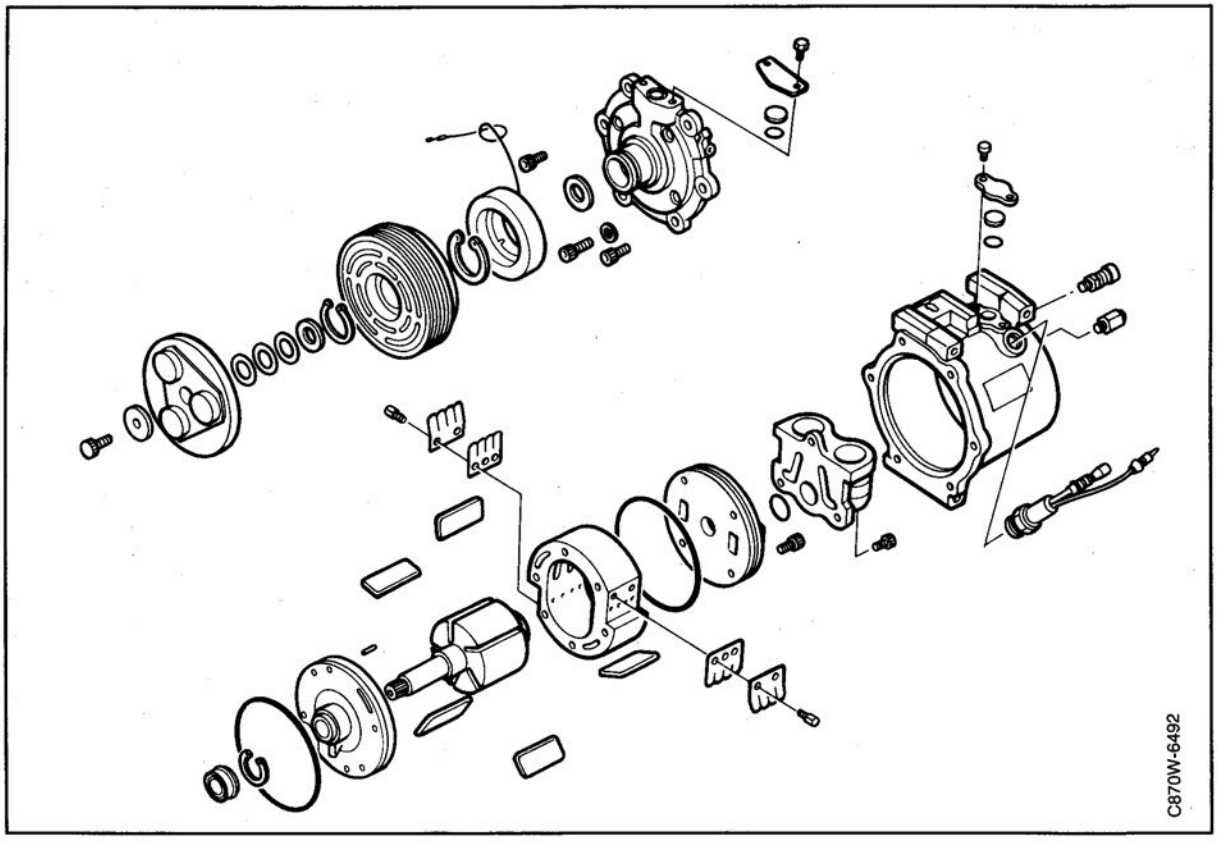
15 Refit the backrest.

16 Fill the system with refrigerant.

Exploded view drawings, compressor

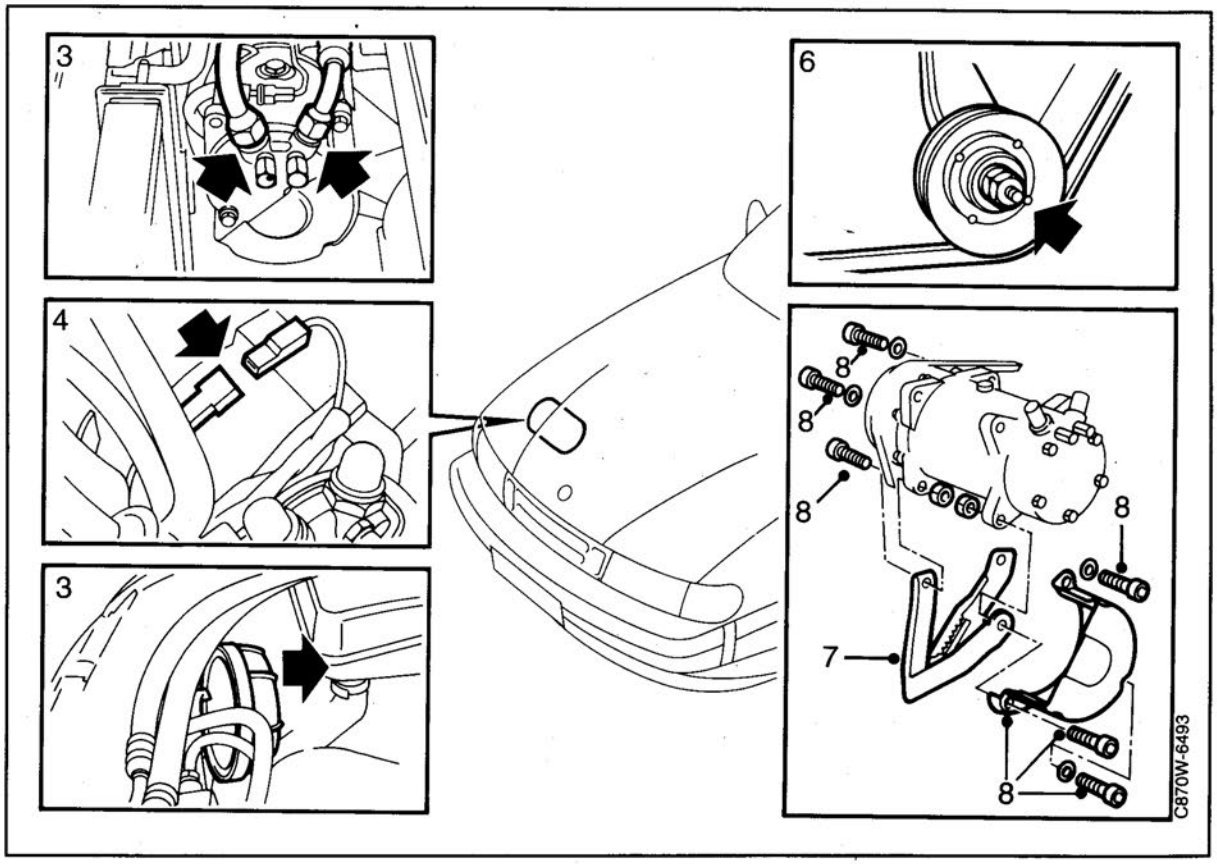


Sanden compressor



Seiko Seiki compressor

Compressor, changing R12 –M1991



To remove

1 Detach the negative lead from the battery.

2 Drain the system of refrigerant, see "Refrigerant".

3 Unscrew the compressor hose connections. Where appropriate, cover the oil cooler. Place plugs over compressor connections and hose connections.

Important
Both the desiccant container and compressor oil in the system absorb water from the air, which cannot then be removed. For this reason all connections which are opened must be immediately plugged.

4 Unplug connector.

5 Remove the plastic cover from over the right–hand headlamp.

6 Relieve the tension in the compressor belt.

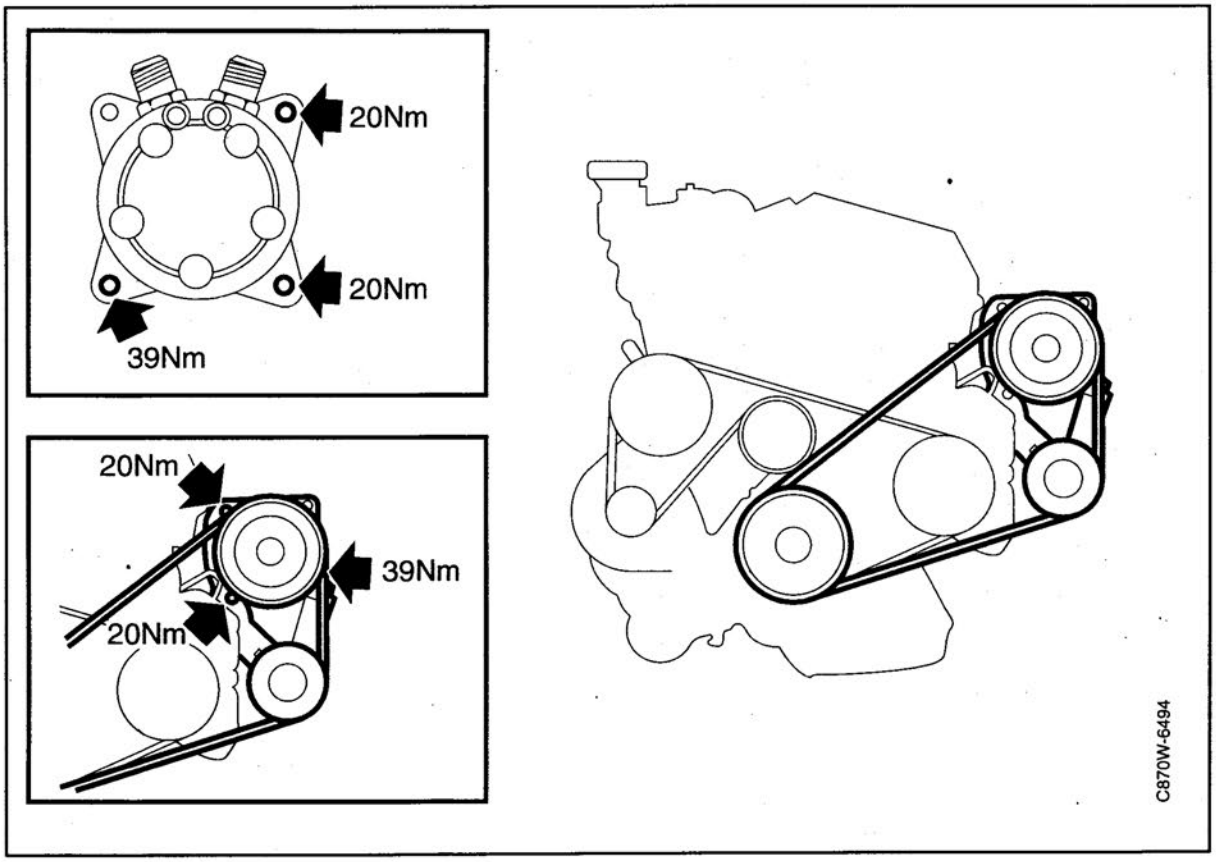
7 Undo the compressor belt tensioner. Leave it in position under the coolant expansion tank hose.

8 Remove the compressor retaining screws and heat shield. Lift the compressor towards the centre of the car and carefully lift it out.

When changing the compressor, see the chapter entitled "Refrigerant" for adjusting oil quantities.

Be sure to use the correct type of oil when refilling as the R12 and R134a systems use different types of oil, see chapter entitled "Refrigerant".

Compressor, changing R12 –M1991 (contd.)



Fitting

9 Check that the compressor belt tensioner is in position and that the belt is correctly positioned on the engine's pulley.

10 Fit the belt tensioner. Refit the rest of the retaining screws without tightening them.

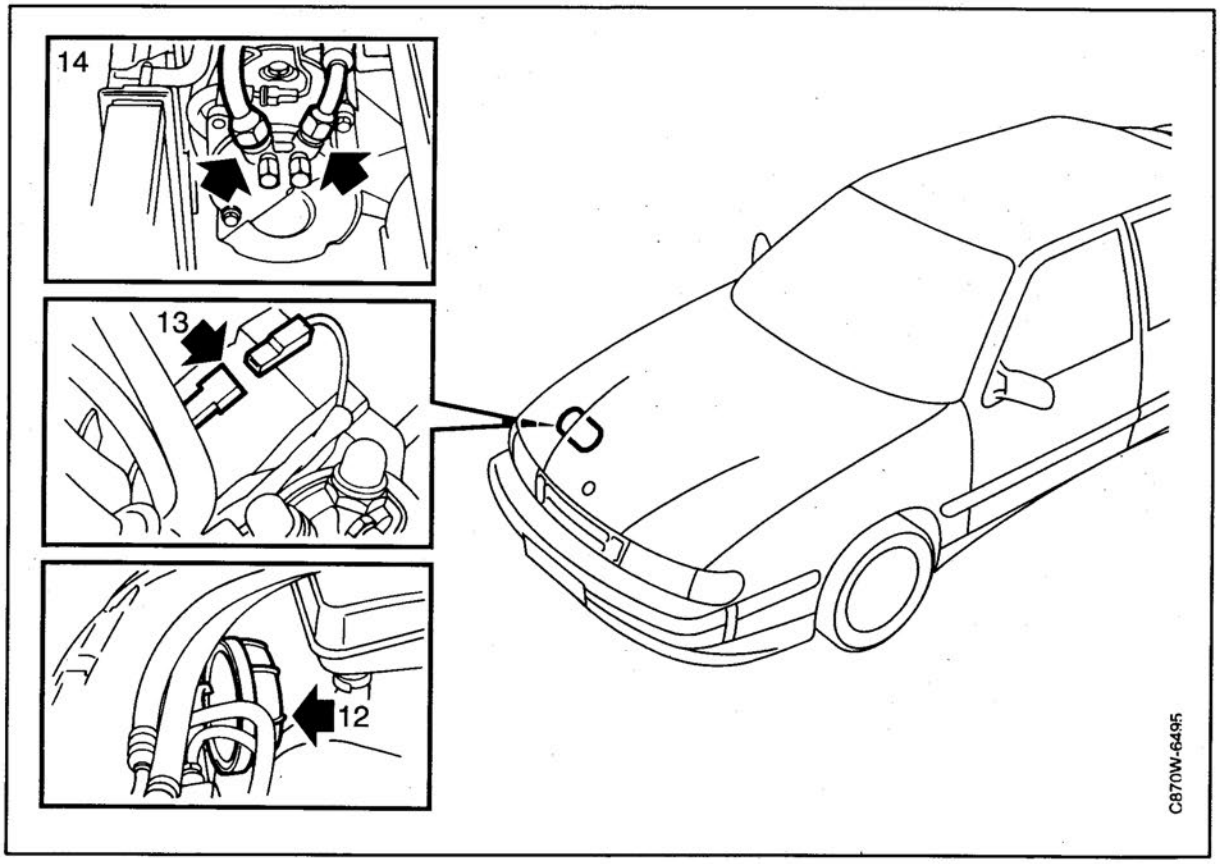
Important
Screws **must** be tightened in the following order to avoid damage to the compressor securing tabs and bracket.

Start by tightening the two screws on the front edge of the compressor to 20 Nm (14.8 lbf ft). See drawing. Then tighten the two screws in the rear edge of the compressor to 20 Nm (14.8 lbf ft).
Tighten the two remaining screws to 39 Nm. (28.8 lbf ft)

11 Fit the drive belt and tension as below. Use a tensiometer.
When refitting belt:
Tighten to 80 ± 5 lb (355 ± 22 N)
When fitting new belt:
Tighten to 120 ± 10 lb (535 ± 45 N)
When checking belt tension
If belt tension is below 60 lb (265 N), it is recommended that the belt be tensioned to 80 ± 5 lb (355 ± 22 N)

12 Fit the plastic cover over the right–hand headlamp.

Compressor, changing R12 –M1991 (contd.)



13 Plug in the connector. Check that the cables do not rub against the pulley.

14 Remove the plugs from the compressor and hoses. Check that there is no dirt in the connections.
Fit hoses to compressor.
Tightening torques:

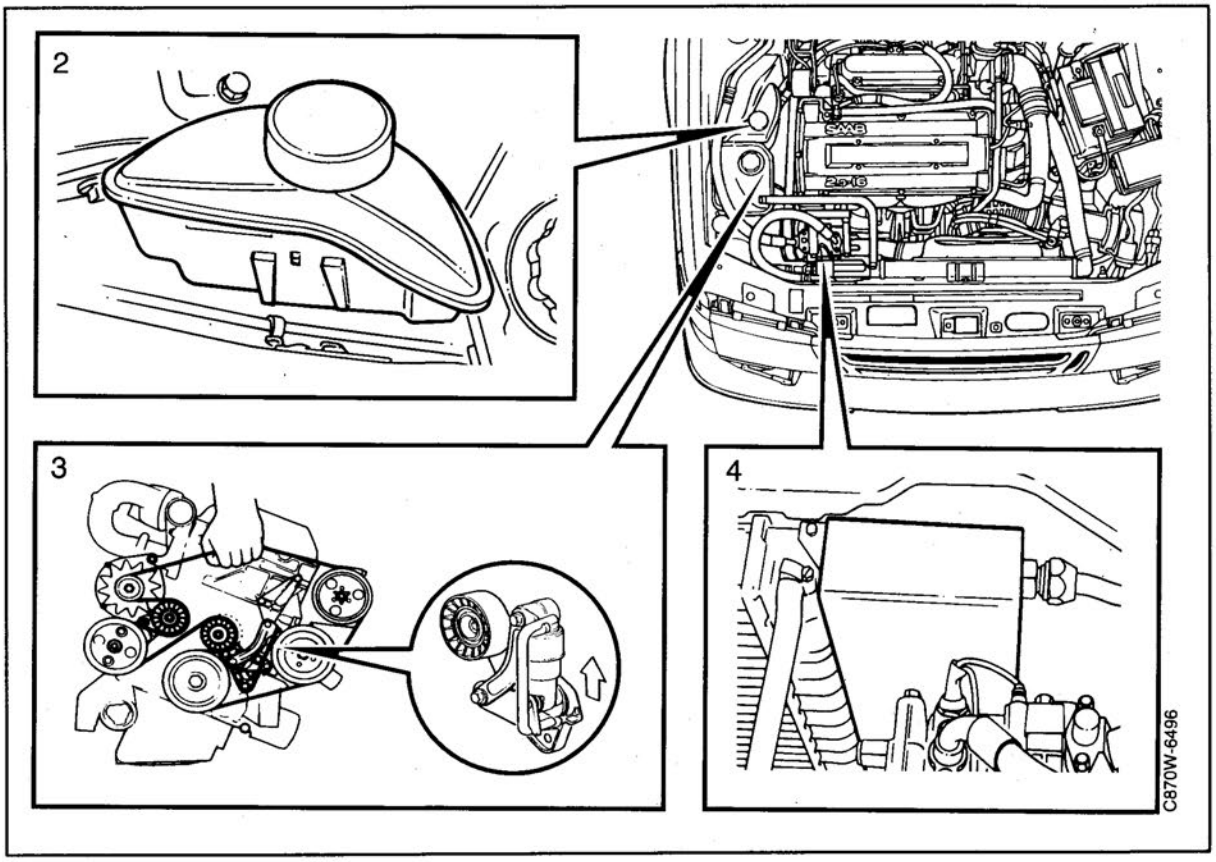
Pressure hose: 32.5 Nm (24 lbf ft)

Vacuum hose: 37.5 Nm (27.8 lbf ft)

15 Fill the system with refrigerant. See "Refrigerant".

16 Carry out a performance test.

Compressor, changing, R134a and R12 M1992–



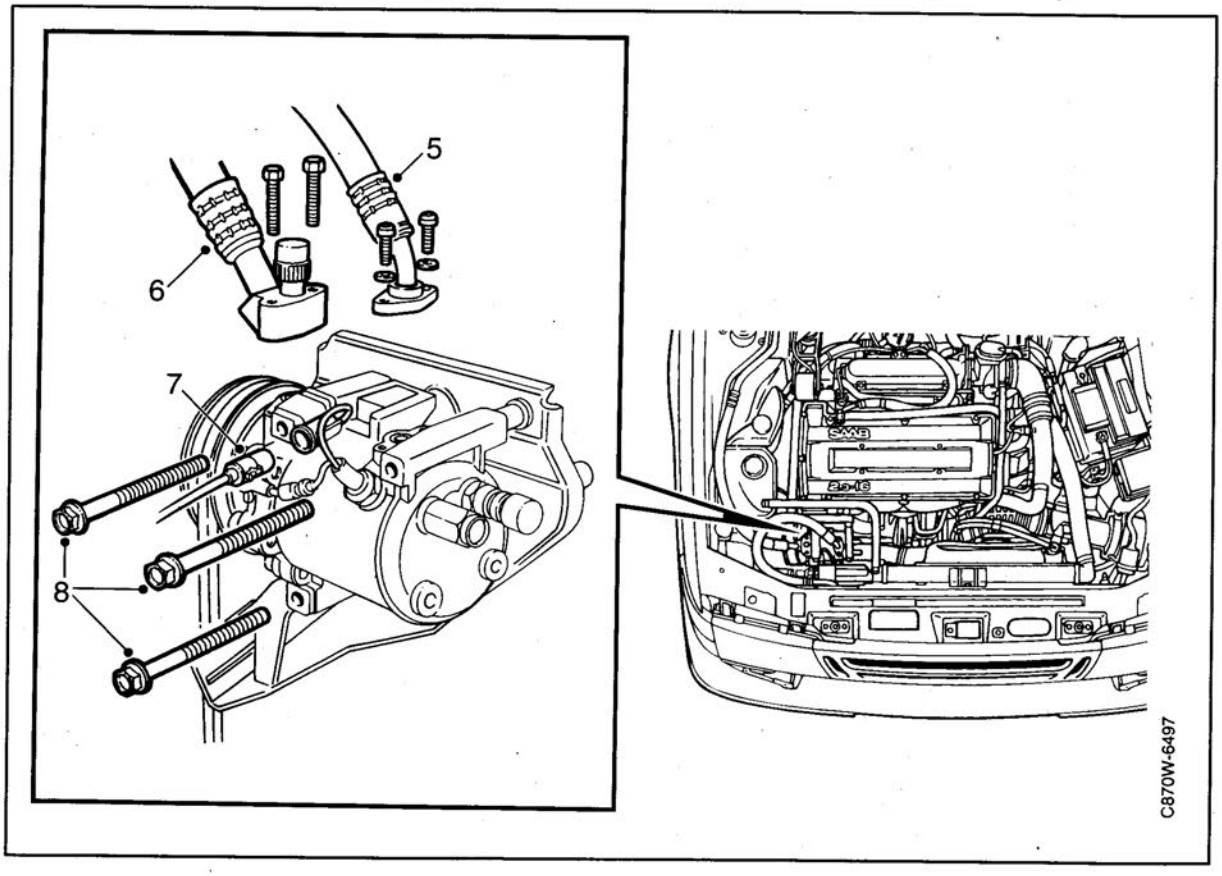
To remove

Important
Both the desiccant container and compressor oil in the R134a system absorb water from the air, which cannot then be removed. For this reason, all connections which are opened must be immediately plugged.

Important
Cars with 2.0 litre engines and R134a refrigerant up to chassis number N1034330 may have the less strong compressor bracket with part number 42 79 345, which should be changed for bracket part number 43 57 067 when working on the A/C. When doing this, it is only necessary to change bolt part number 79 82 119.

1 Empty the refrigerant from the A/C system, see "Refrigerant".
2 Move the servo oil container to one side.
3 Fit clamp 83 94 488 to the multi V belt.
4 Where appropriate, fit a protector over the oil cooler.

Compressor, changing, R134a and R12 M1992– (contd.)



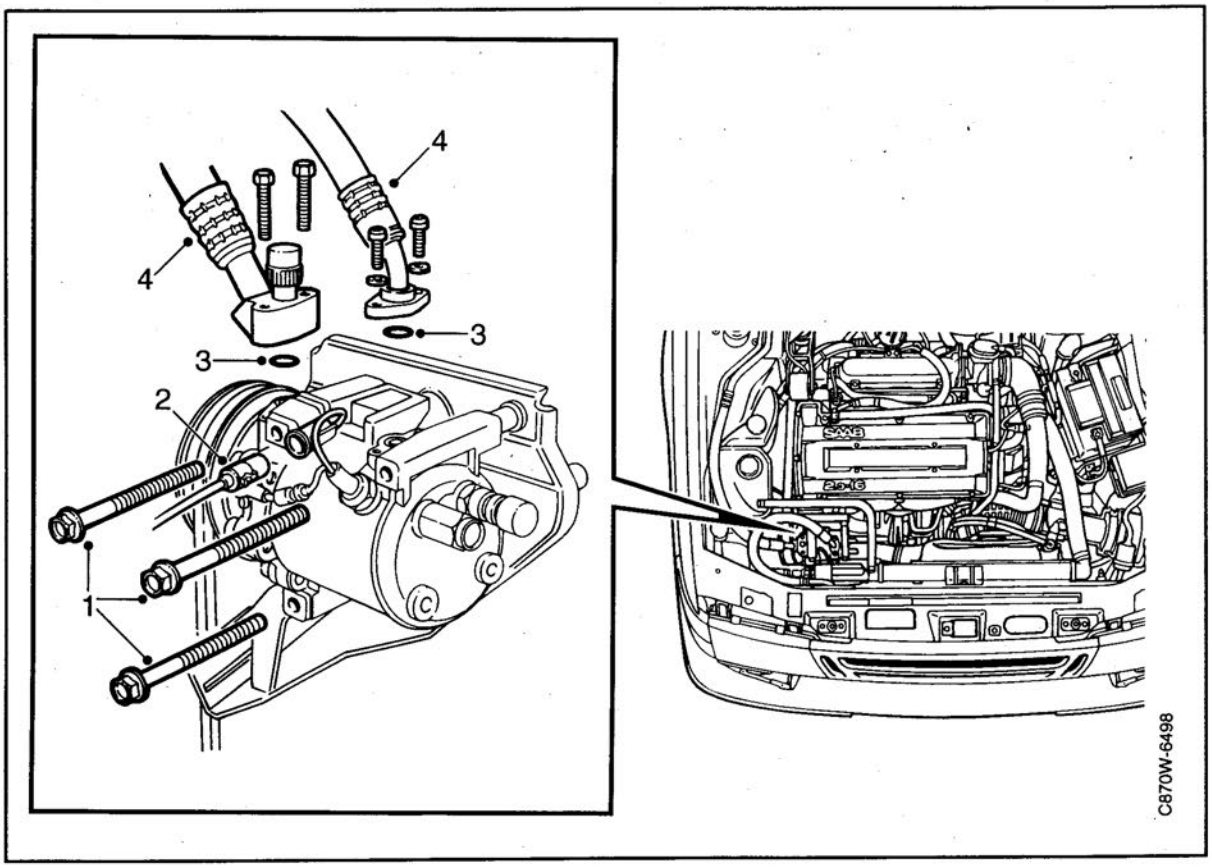
5 Undo the high–pressure hose connection on the compressor. Plug connections.

6 Undo the low–pressure hose connection on the compressor. Plug connections.

7 Unplug the compressor connector.

8 Remove the compressor retaining screws and lift the compressor away.

Compressor, changing, R134a and R12 M1992– (contd.)



Fitting

Important
Both the desiccant container and the compressor oil in the R134a system absorb water from the air, which cannot then be removed. For this reason, any connections which are open should be immediately plugged.

1 Check oil lever as per chapter "Refrigerant".

2 Place the compressor in position and do up the three retaining screws. Note that the bracket for the electrical connection is secured with the upper right–hand screw.
Tightening torque: 22.5 Nm (16.6 lbf ft)

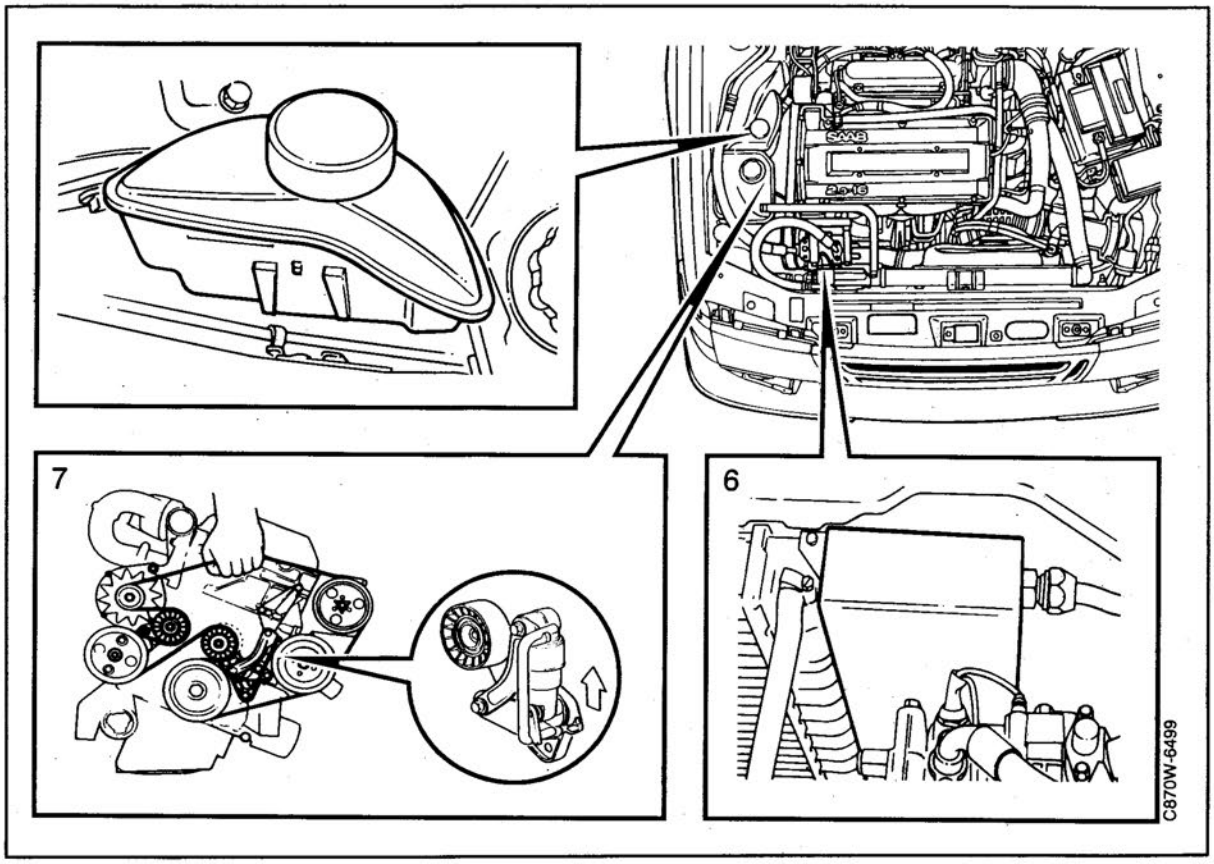
3 Connect the compressor's electrical connector and press it into the holder.

4 Lubricate two new O–rings using synthetic vaseline, part number (16) 30 15 286. Remove the plugs and place the new O–rings in position.

5 Screw the low–pressure and high–pressure hoses to the compressor.

Tightening torque: 10 Nm (7.4 lbf ft)

Compressor, changing, R134a and R12 M1992– (contd.)



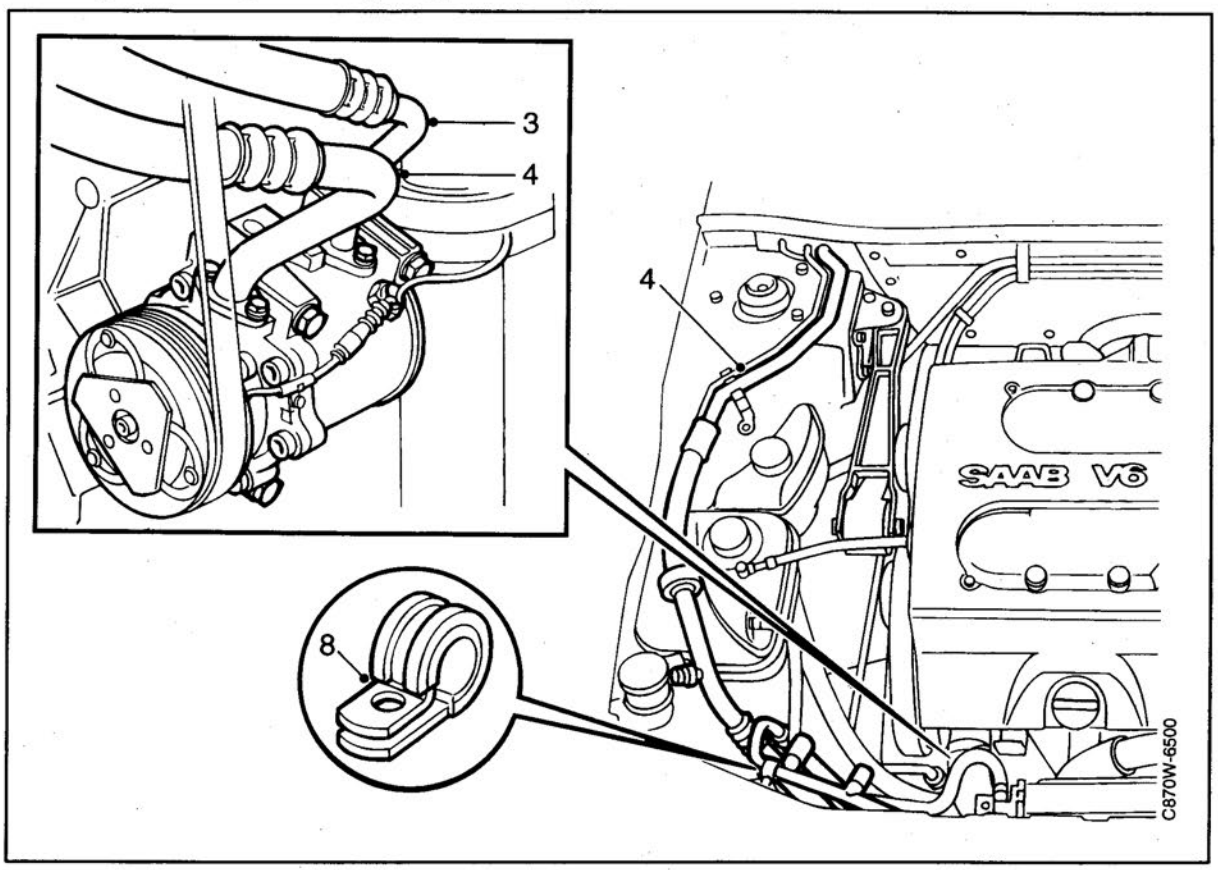
6 Remove the protector from the oil cooler.

7 Remove the clamp and refit the multi V belt.

8 Refit the servo oil container.

9 Fill the A/C system with refrigerant, see chapter entitled "Refrigerant".

Compressor, changing, V6 engine



Important
Both the desiccant container and the compressor oil in the R134a system absorb water from the air, which cannot then be removed. For this reason, any connections which are open should be immediately plugged.

To remove

1 Drain the refrigerant from the A/C system, see chapter entitled "Refrigerant"

2 Remove the cover from underneath, behind the front spoiler.

3 Remove pressure hose and lift out the compressor from underneath.

4 Remove vacuum hose.

Fitting

5 Adjust oil level as per table in chapter entitled "Refrigerant".

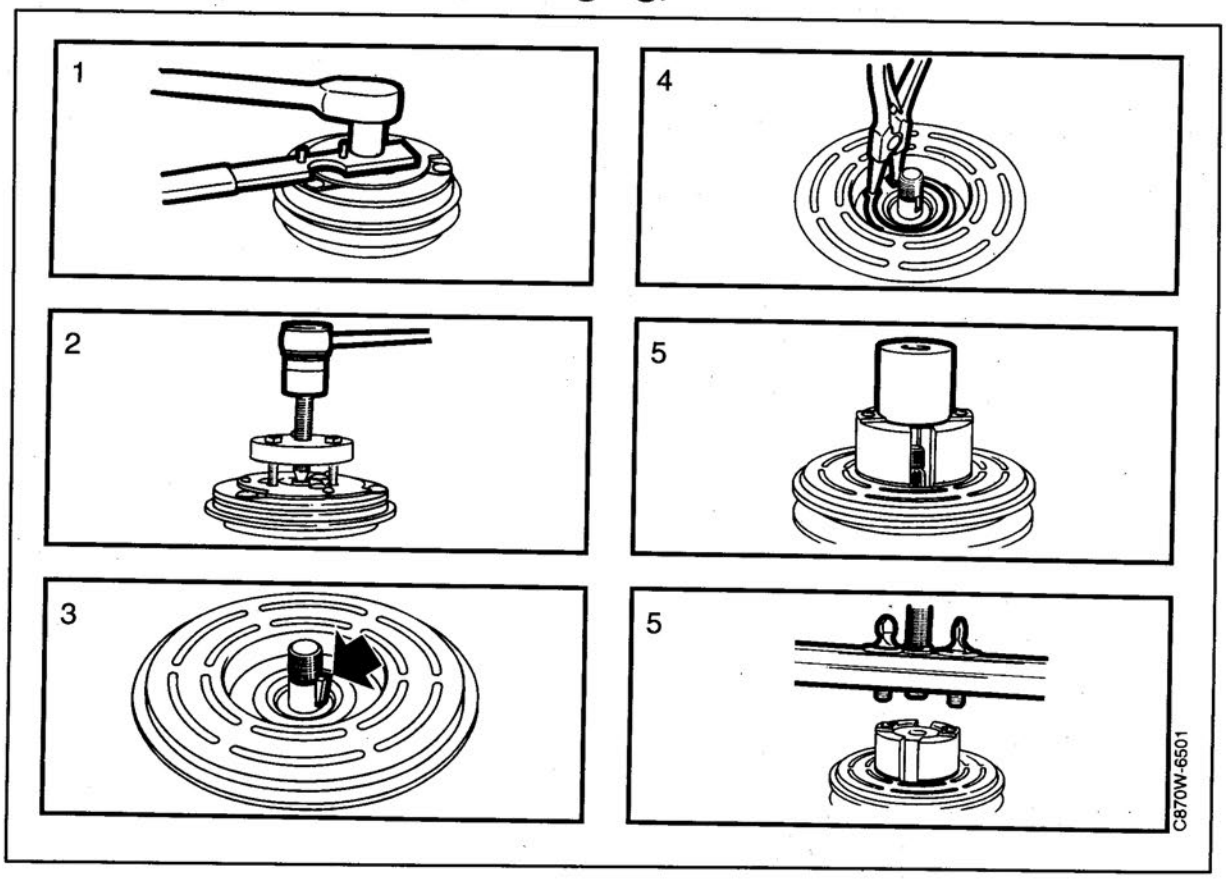
6 Lubricate two new O–rings using synthetic vaseline, part number (16) 30 15 286. Remove the plugs and place the new O–rings in position.

7 Fit the vacuum hose and lift the compressor into position from underneath.

8 Fit the pressure hose.

9 Fix the high–pressure hose with the clip.

Electromagnetic clutch, changing, Sanden



To remove

(compressor model Sanden SD 510 or SD 709, removed from car)

1 Mount the compressor in a vice.
Remove the centre nut from the compressor shaft.
Tools:
Socket Nv 3/4" (19 mm)
Key 83 93 373

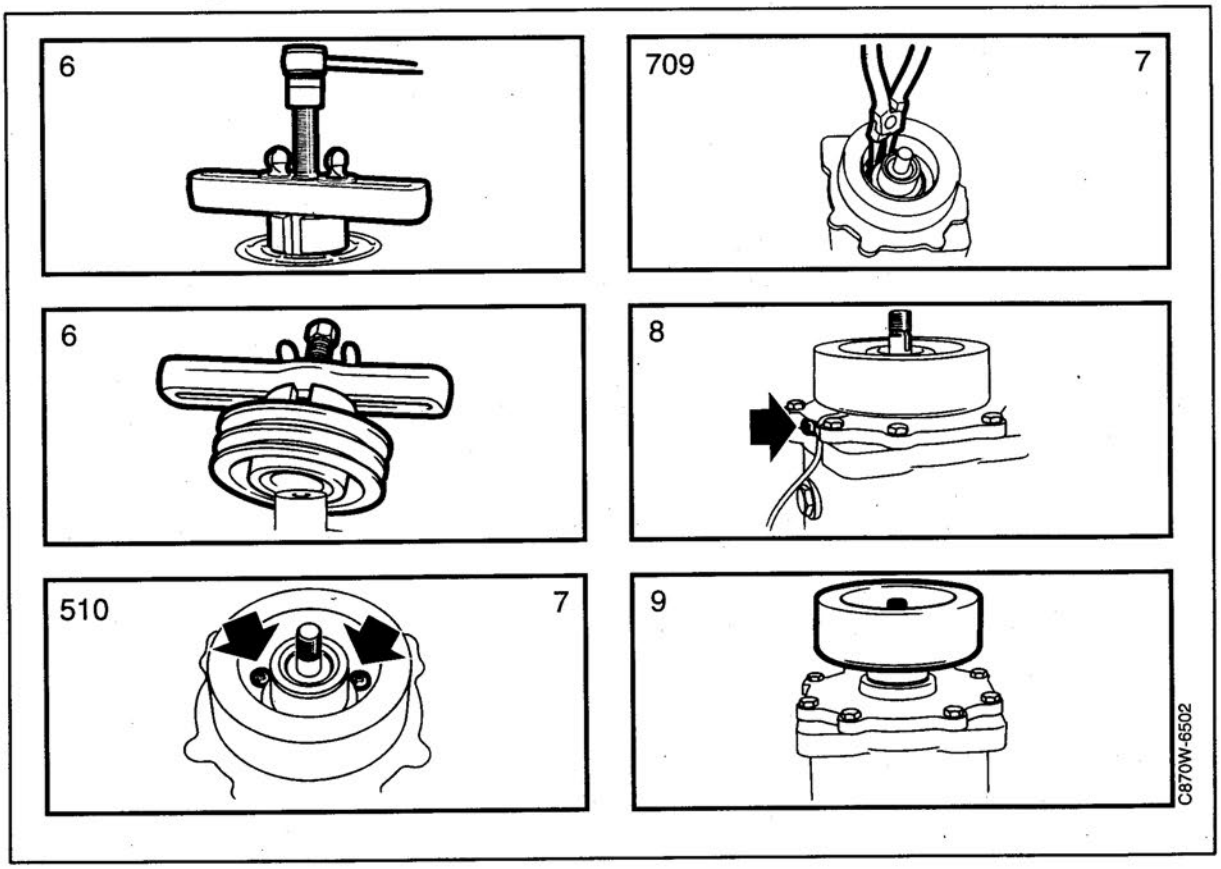
2 Remove the compressor clutch driver.
Tools:
Socket Nv 3/4" (19 mm)
Puller 83 93 381
In order to fit SD 709 as well, the three puller holes must be drilled out to Ø 9 mm.

3 Remove the key from the shaft.

4 Remove retaining rings from bearings and rotor.
Tool: Universal circlip pliers.

5 Compressor SD 510:
Fit puller 83 93 399.
Compressor SD 709
Fit puller 83 93 399 together with shanks and presser 82 92 567.

Electromagnetic clutch, changing, Sanden (contd.)



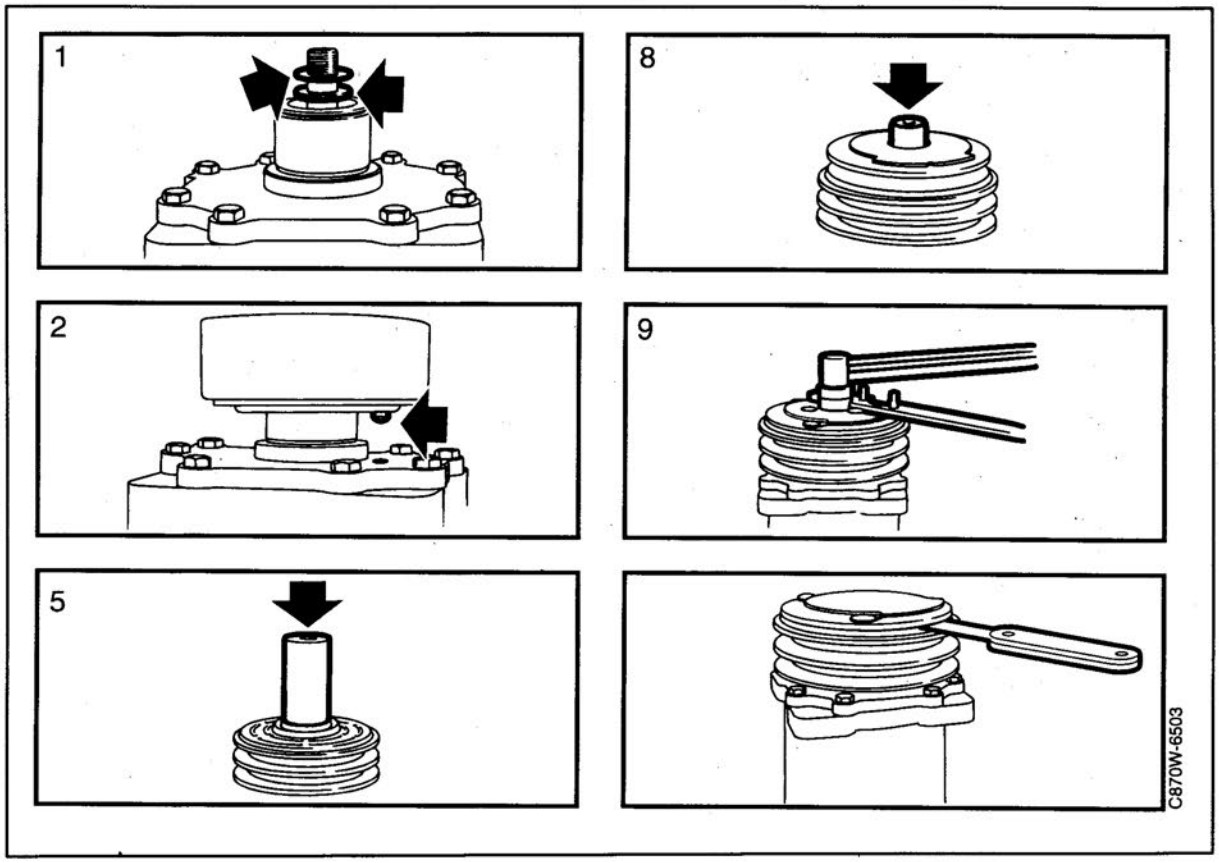
6 Remove the rotor section.

7 Compressor SD 510:
Remove the three screws securing the coil to the compressor.
Compressor SD 709:
Remove the circlip securing the coil to the compressor.

8 Remove the screw and clip holding the cable.

9 Lift off the coil.

Electromagnetic clutch, changing, Sanden (contd.)



Fitting

1 Fit shims to adjust clutch play.
The same number of shims should be refitted.

2 Fit the coil.

Important
The guide in the coil should be inserted in the hole in the compressor housing.

---

3 Compressor SD 510:
Tighten the three screws.
Compressor SD 709:
Fit the circlip.

4 Fit the clip and screw for the cable.

5 Place the rotor section on the compressor. Place the presser and intermediate ring 83 93 407 (set) for SD 510 or 82 92 559 for SD 709 in the rotor section. Note that the intermediate ring is oriented so that the compressive force is exerted on the inner ring bearing. Tap down the rotor section using a hammer until it stops against the compressor housing.

6 Fit circlips for bearing and rotor.

7 Fit key.

8 Place the compressor clutch driver on the shaft. Fit adapter 83 93 415. Tap down the driver using a hammer so that it stops against the shims on the shaft.

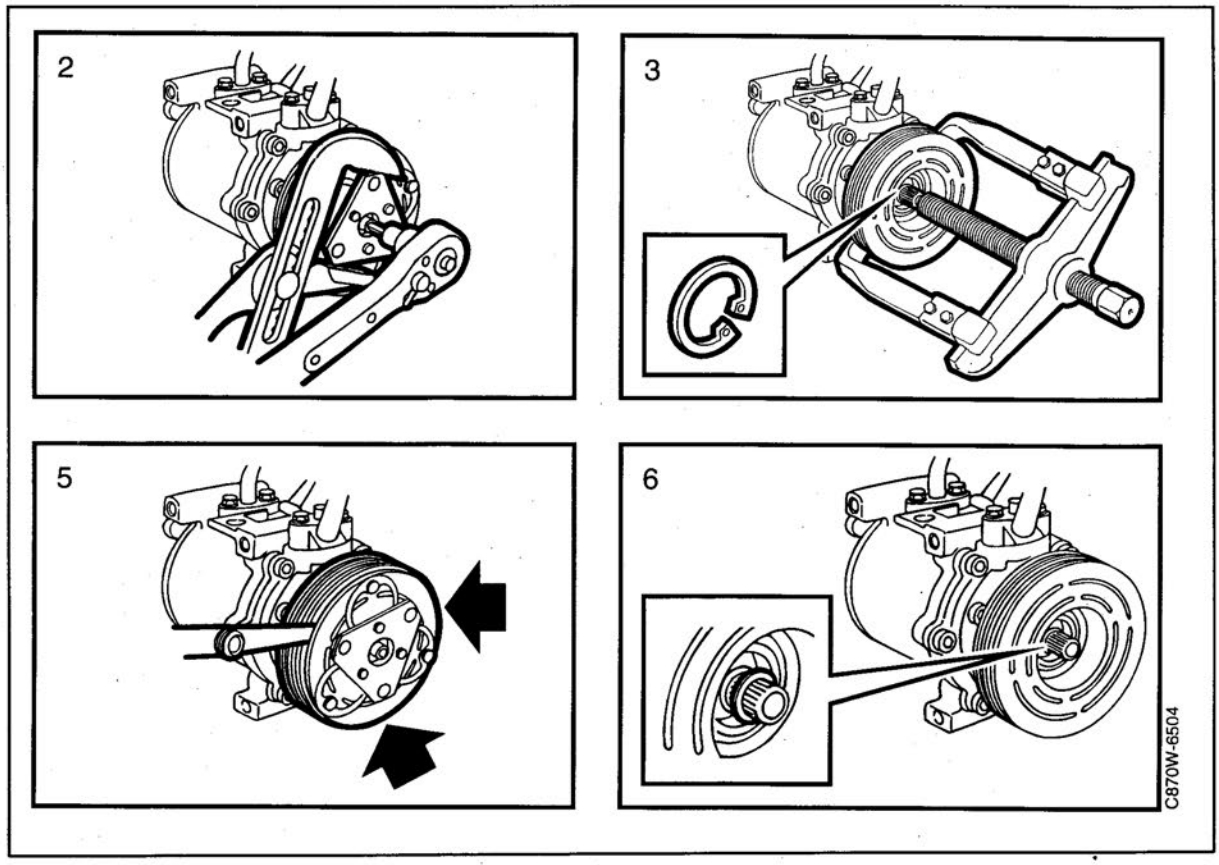
9 Fit the centre nut.

Tightening torque 38 Nm (28.2 lbf ft).

10 Check the play between the driver and rotor. Play should be between 0.40 – 0.80 mm. (0.16"–0.31").

If play is not correct, remove the driver and adjust the number of shims.

Electromagnetic clutch, changing, Seiko Seiki



To remove

1 Remove the compressor retaining screws and place the compressor on the radiator cross-member.
Protect the notch.

2 Undo the driver using a hexagonal key. Use utility pliers as a holder.

3 Remove the circlip from inside the pulley and remove the pulley from the shaft using puller 87 91 287 (A).

Fitting

4 Fit a pulley.

5 Fit the driver

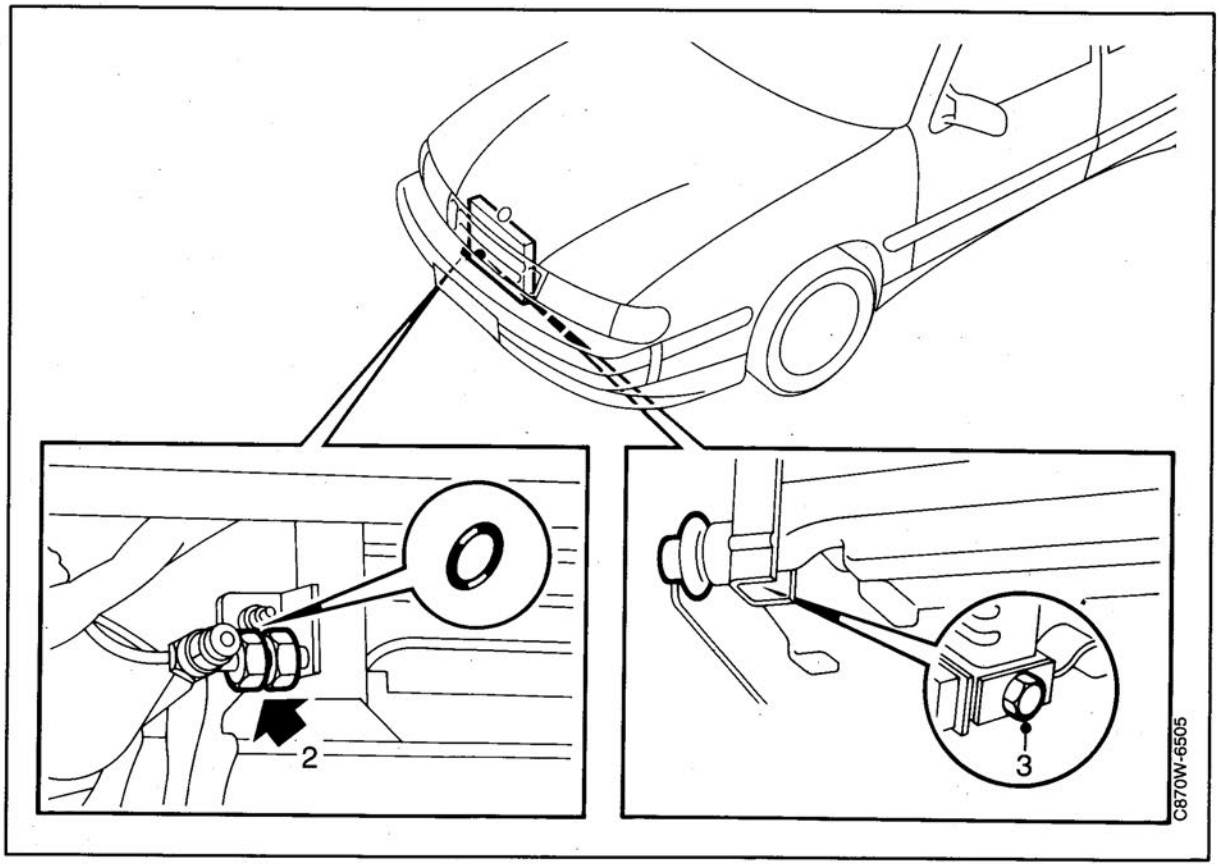
Tightening torque: 15 Nm (20.2 lbf ft)

and check the play between pulley and driver. Measure at three different points and calculate an average.
Average should be 0.3 – 0.6 mm.

6 Adjust the play between pulley and driver by changing shims on the compressor shaft.

7 Place the compressor in position and tighten the three retaining screws. Note that the bracket for the electrical connections is secured with the upper left–hand screw.

Condenser, changing



Drain the refrigerant from the A/C system, see chapter entitled "Refrigerant". Raise the front of the car and secure it using axle stands.

1 Remove spoiler and grille.

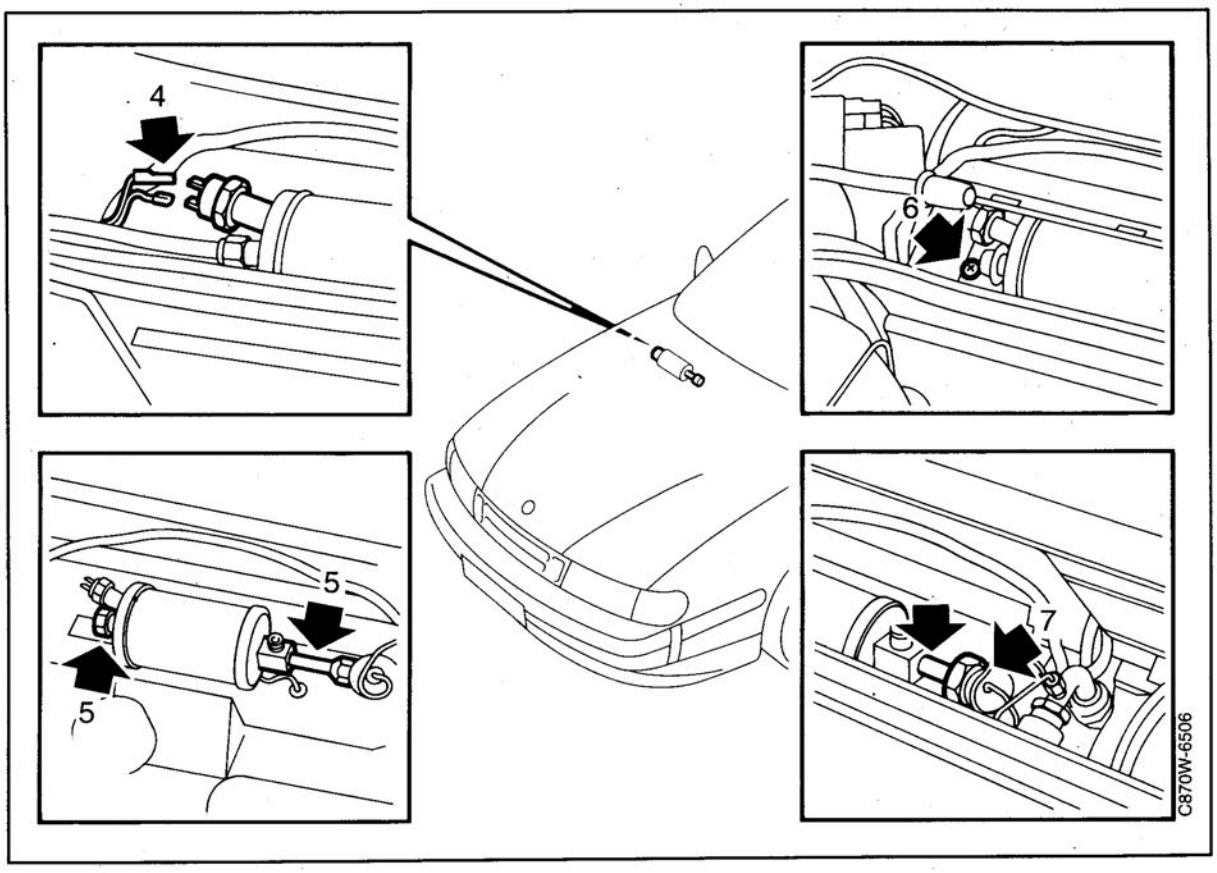
2 Unplug connections to condenser. Use holding tool. Plug all open connections.
Detach the extra electric radiator fan (if fitted) from the condenser.

3 Remove the lower screws from the condenser and carefully lower it.

To remember when fitting

Fill the condenser with 0.3 dl of compressor oil before fitting.
Make sure that the locating stud on the upper edge goes into the lead–through.
Change O–rings on hoses and lubricate them using synthetic vaseline before fitting.
Fill the system with refrigerant. See chapter entitled "Refrigerant".

Dessicant container, changing –M1991



1 Drain the refrigerant from the system, see chapter entitled "Refrigerant".

2 Remove the cover from over the evaporator casing.

3 Unplug electrical connections to pressure switch.

4 Slightly retract the rubber strip and raise the pipe from the plastic lead–through. Unscrew the pipe connection. Plug connections.

5 Remove the desiccant container screw.

6 Detach connections to expansion valve.

7 Lift out the desiccant container. Plug all connections.

8 Fit new O–rings in connections. Lubricate them with synthetic vaseline.

9 Fill the new desiccant container with 0.1 dl of clean compressor oil. Remember which oil to use.

10 Fit the desiccant container and tighten the connections.

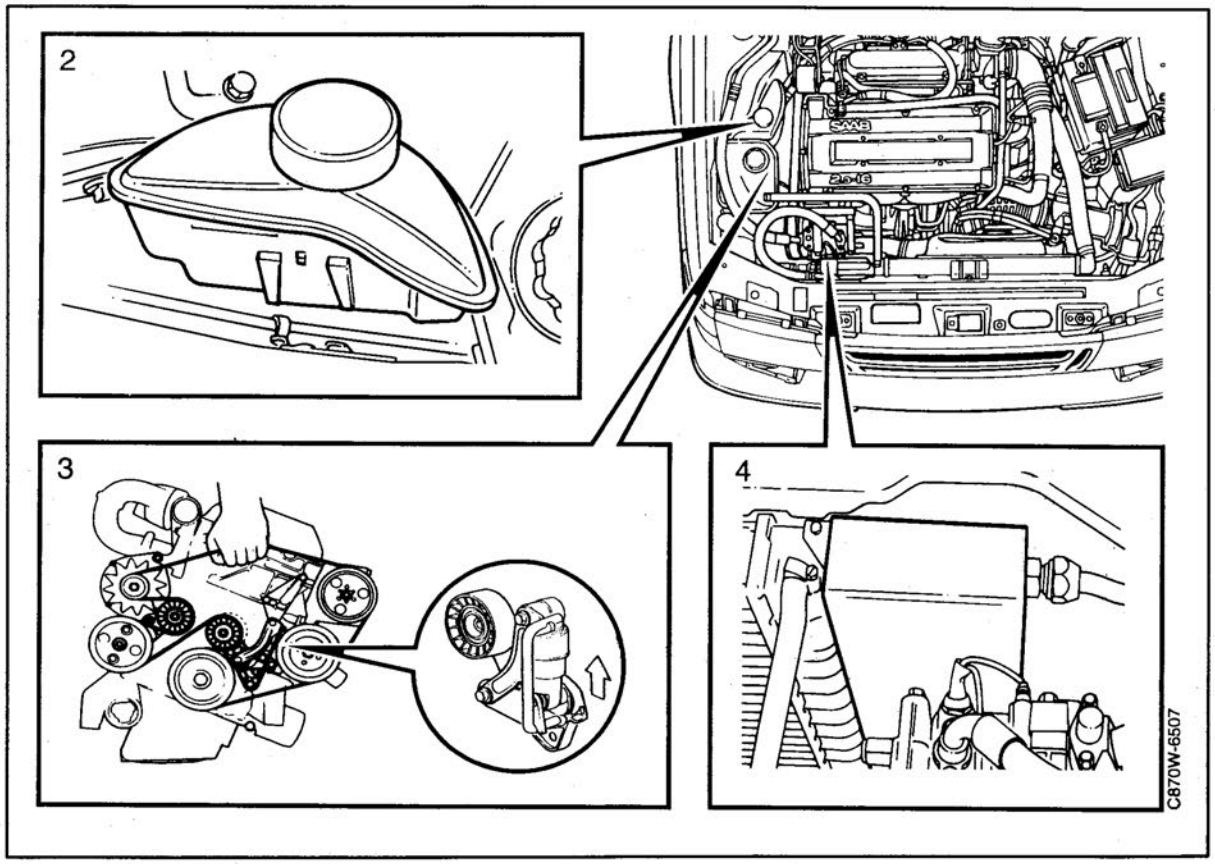
11 Plug in electrical connections to pressure switch.

12 Place pipe in rubber lead–through and press on the rubber strip.

13 Fill the system with refrigerant, see "Refrigerant".

14 Carry out a performance test.

Dessicant container, changing M1992–



To remove

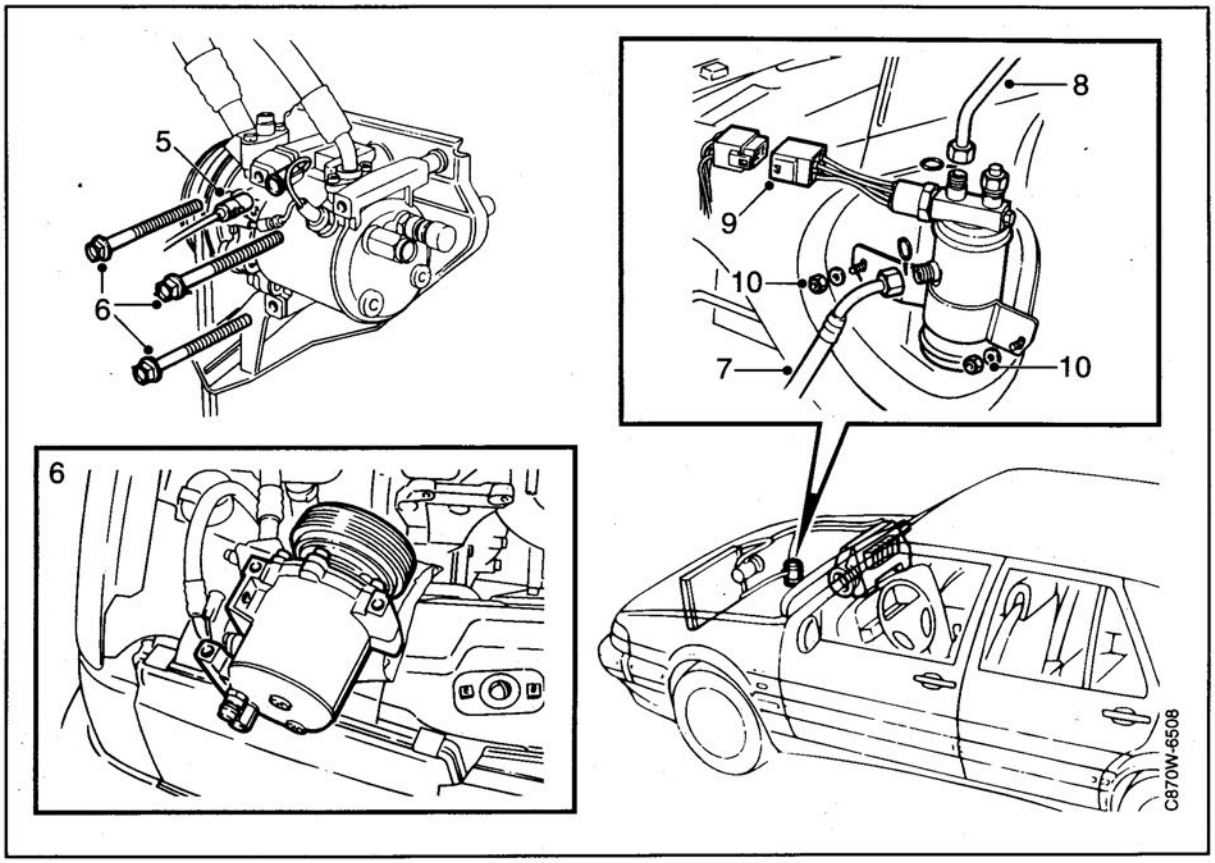
1 Drain the refrigerant from the A/C system, see chapter "Refrigerant".

2 Lift the servo oil container to one side.

3 Fit clamp 83 94 488 to the multi V belt.

4 Where appropriate, fit a protector over the oil cooler.

Dessicant container, changing M1992–



5 Unplug the compressor connector.

6 Remove the compressor retaining screws and place the compressor on the radiator cross-member, with a little paper underneath to protect against leaks.

Important
Both the desiccant container and the compressor oil in the R134a system absorb water from the air, which cannot then be removed. For this reason, any connections which are open should be immediately plugged.

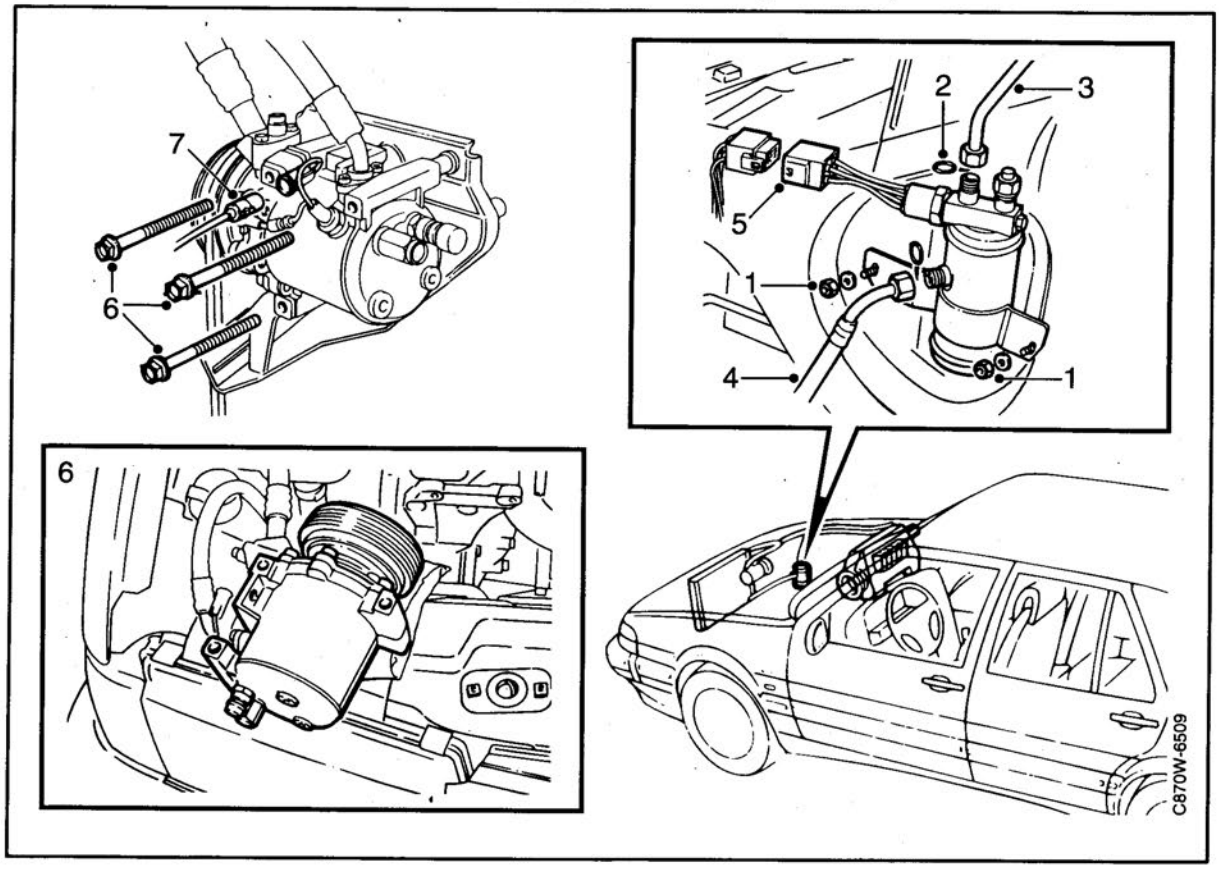
7 Detach the hose to the condenser using a holding tool. Plug openings.

8 Detach the pipe to the evaporator using a holding tool. Plug openings.

9 Unplug connector to pressure switch.

10 Remove the retaining screws and lift up the desiccant container.

Dessicant container, changing M1992– (contd.)



Fitting

1 Place the desiccant container in position and tighten screws.

2 Fit new O–rings to the desiccant container connections. Lubricate O–rings with synthetic vaseline, part number (16) 30 15 286.

3 Do up the pipe from the evaporator using a holding tool.

Tightening torque: 21.5 Nm (15.9 lbf ft)

4 Do up the hose from the condenser using a holding tool.

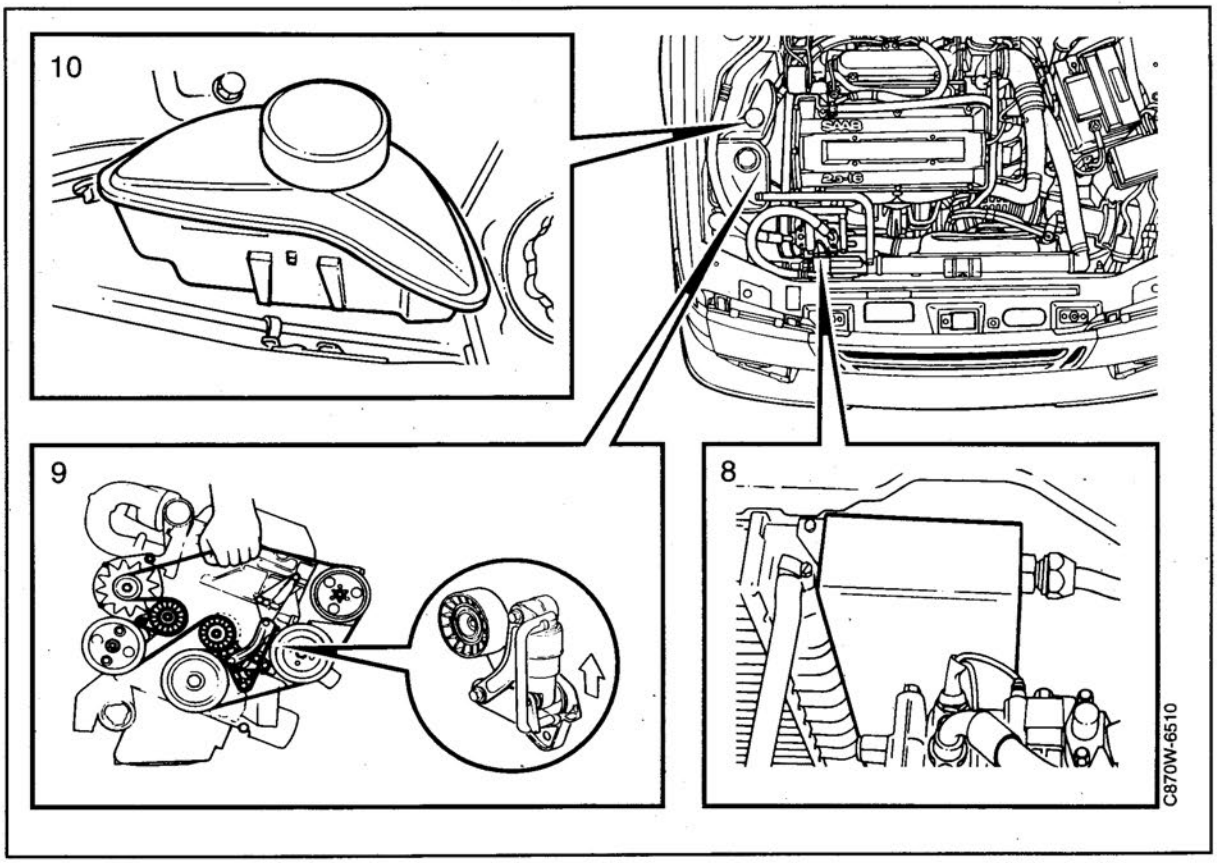
Tightening torque: 21.5 Nm (15.9 lbf ft)

5 Plug in connector to pressure switch.

6 Place the compressor in position and do up the three retaining screws. Note that the bracket for the electrical connection is secured by the upper left–hand screw.

7 Connect electrical wire to compressor.

Dessicant container, changing M1992– (contd.)



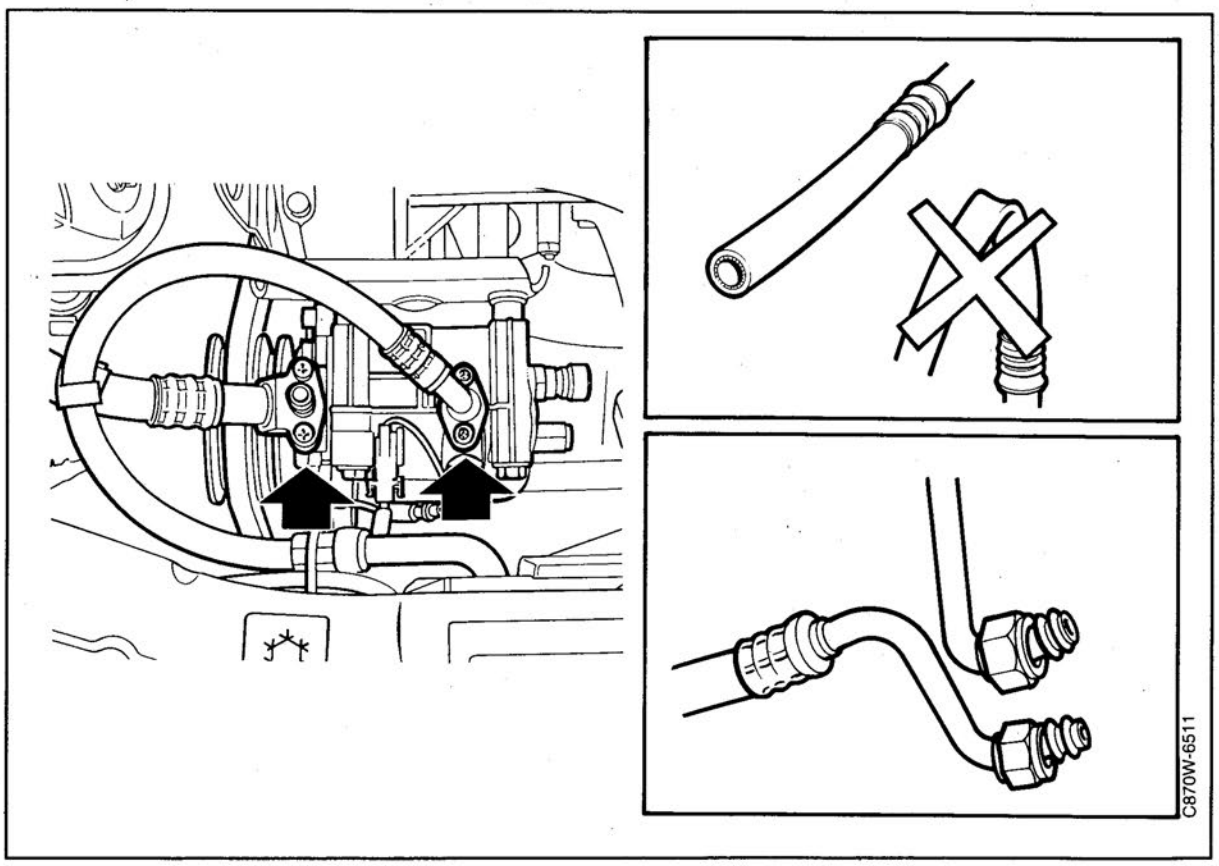
8 Remove the protector from the oil cooler.

9 Remove the clamp from the multi V belt.

10 Refit the steering servo container.

11 Fill with refrigerant, see chapter "Refrigerant".

Refrigerant hoses, changing



Important
In cars from M1992– which have R134a refrigerant, hoses with a thin polyamide film on the inside are used. This film protects the hoses against the P.A.G. oil which is used in this system.
These hoses are extremely sensitive to bending. Bending damages the polyamide film, which in turn damages the hose, causing the risk of leakage.

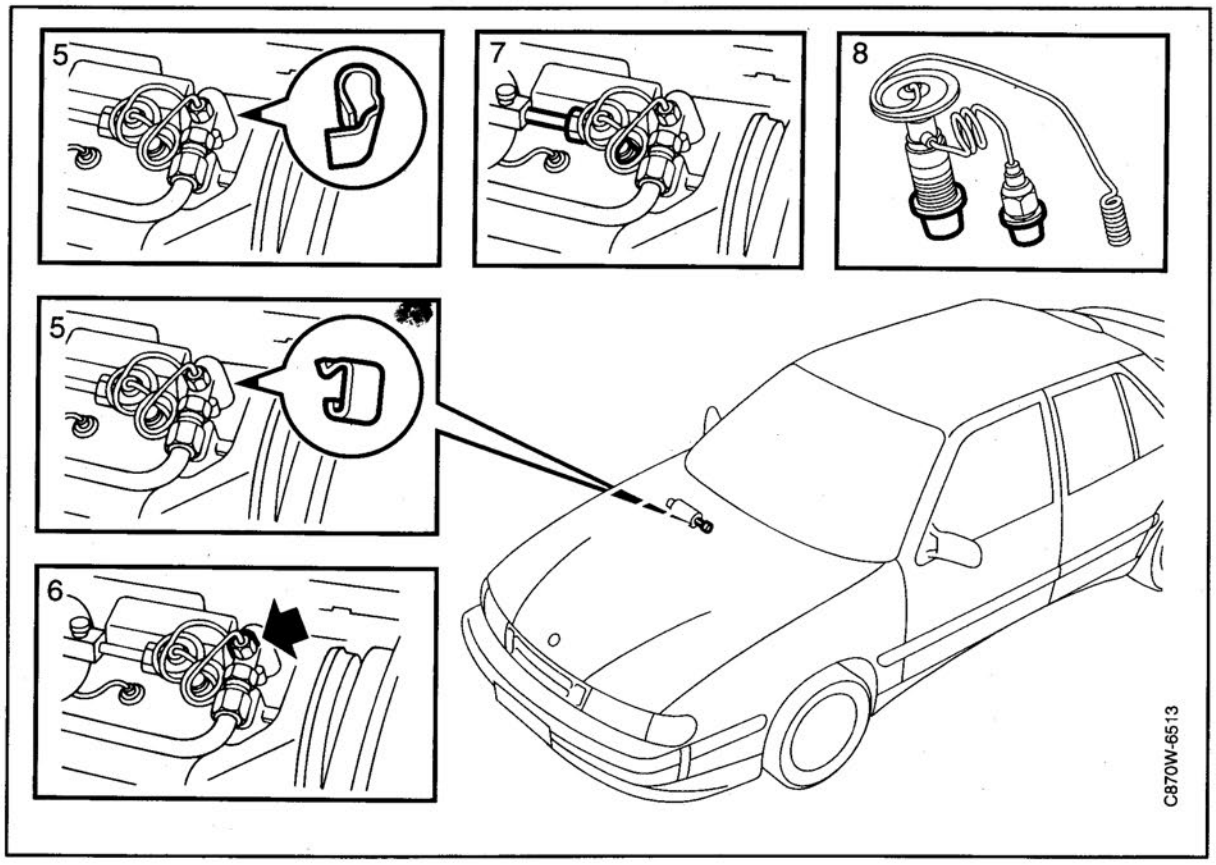
1 Drain the refrigerant from the system, see chapter entitled "Refrigerant".

2 Change the faulty hose.

3 If necessary, fill with new compressor oil. Use new O–rings which are lubricated with synthetic vaseline.
Torque tighten. See "Technical data".

4 Fill the system with refrigerant, see "Refrigerant".

Expansion valve, changing –M1991



1 Detach the negative lead from the battery.

2 Empty the refrigerant from the system. See chapter "Refrigerant".

3 Remove the cover from over the evaporator casing.

4 Remove the bulkhead panel in the engine compartment.

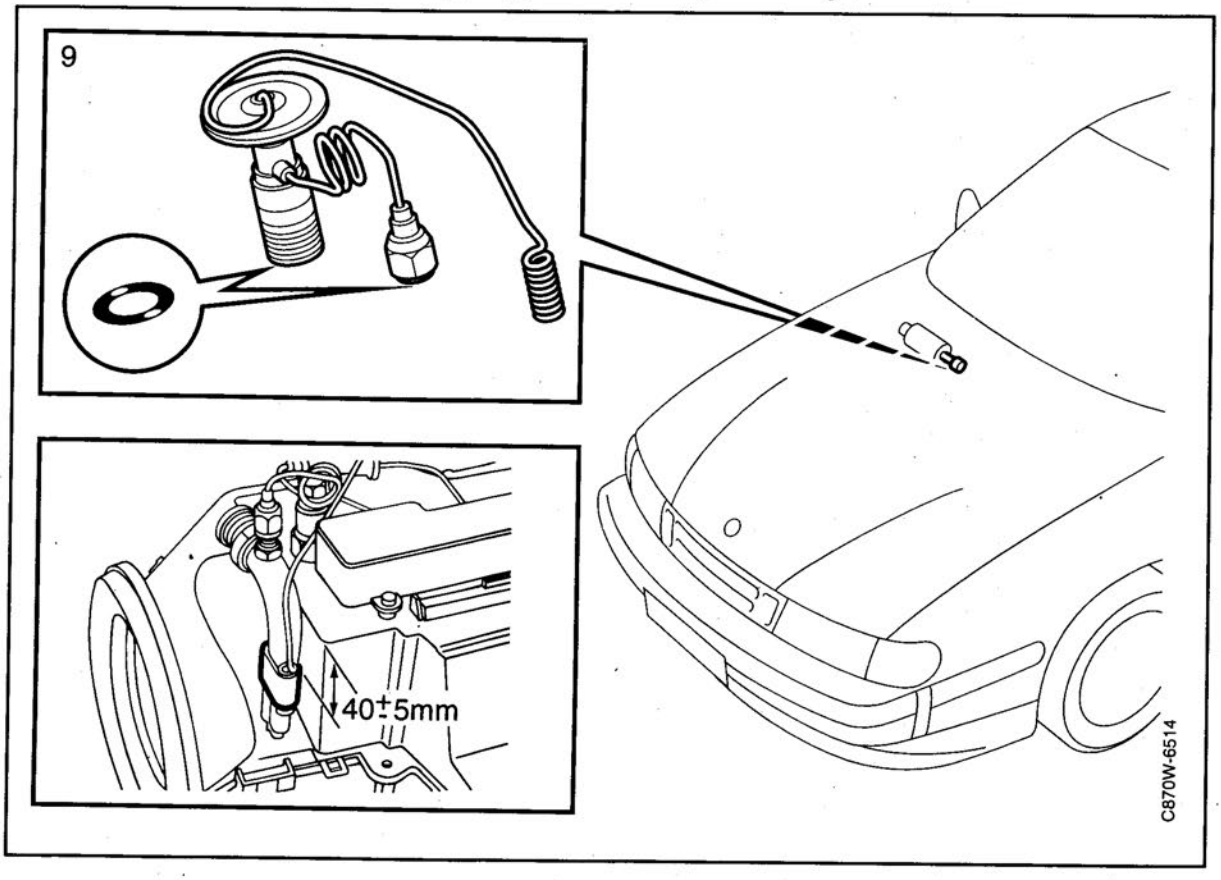
5 Remove insulation and clip.

6 Undo the capillary tube connections. Plug connections.

7 Undo expansion valve connections. Use a holding tool.

8 Remove the expansion valve. Plug connections.

Expansion valve, changing –M1991 (contd.)



9 Change the O–rings in the connections. Lubricate them with synthetic vaseline.

10 Fit the expansion valve. Use a holding tool.

11 Do up the capillary tube connection.

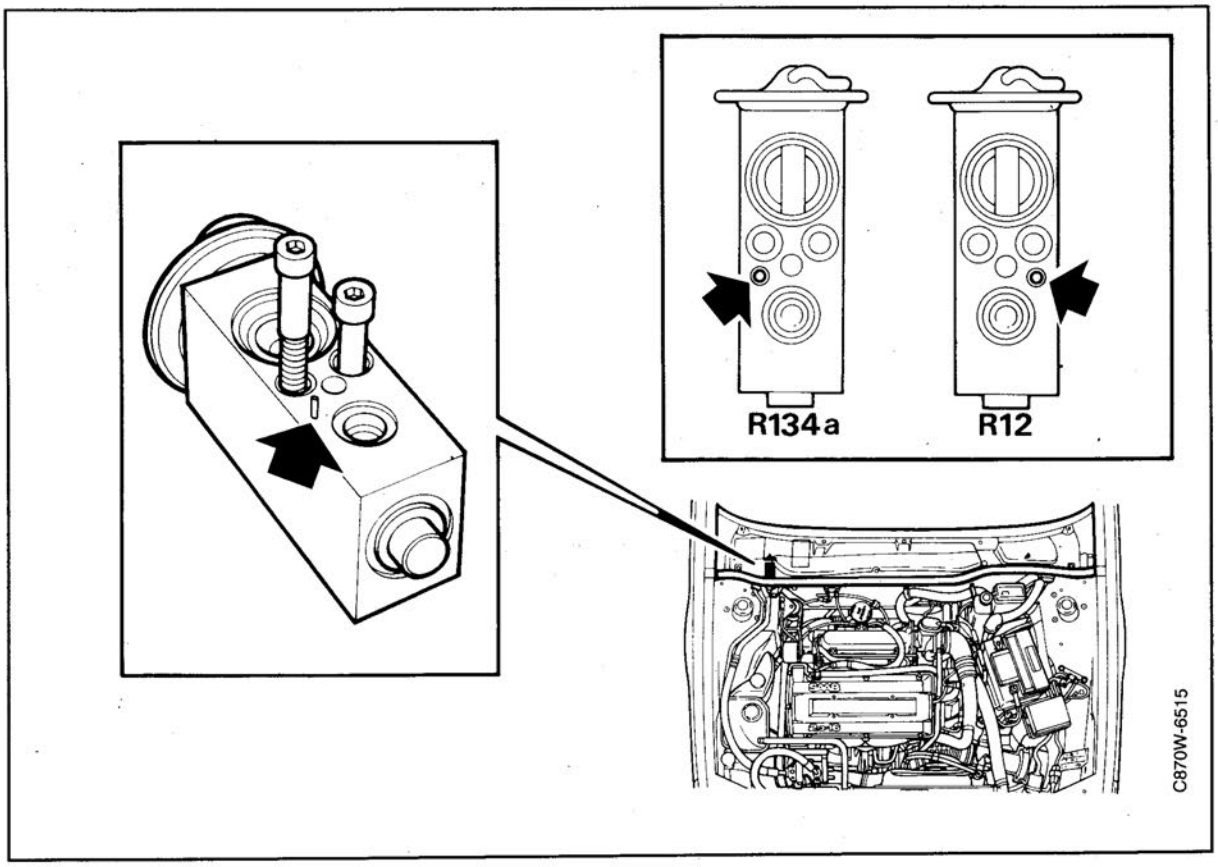
12 Fit clip and insulation to temperature sensor body. Make sure that it is clean under the sensitive body and that it is in contact with the evaporator pipe.

13 Fit the bulkhead panel and the cover over the evaporator.

14 Fill the system with refrigerant, see "Refrigerant".

15 Connect the battery lead and conduct a performance test.

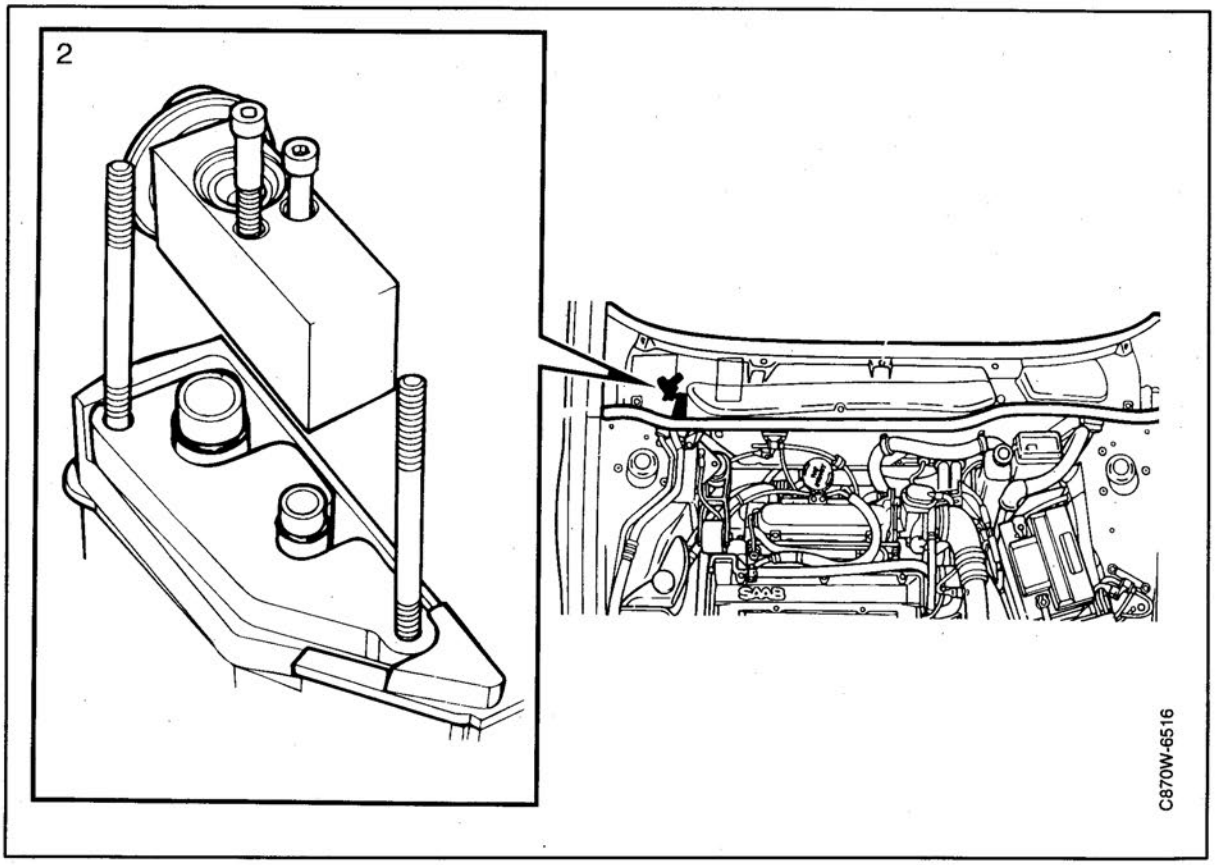
Expansion valve, changing M1992–



The expansion valve is a block type valve. The compressor vacuum hose is located in a pressure plate together with the pipe from the desiccant container. The pressure plate is connected with three screws to the expansion valve. The sensitive body is built into the expansion valve, which gives a more exact sensing of refrigerant temperature.

The new expansion valve is available in two versions, one for the R134a system and one for the R12 system. In order to eliminate the risk of these being confused, the two valves each have different guide pins. The guide pin should be aligned with a hole in the pressure plate in the connection to the A/C pipe. Seen from in front of the car, the guide pin is located on the left–hand side on the expansion valve in the R134a system, and on the right–hand side in the R12 system.

Expansion valve, changing M1992– (contd.)



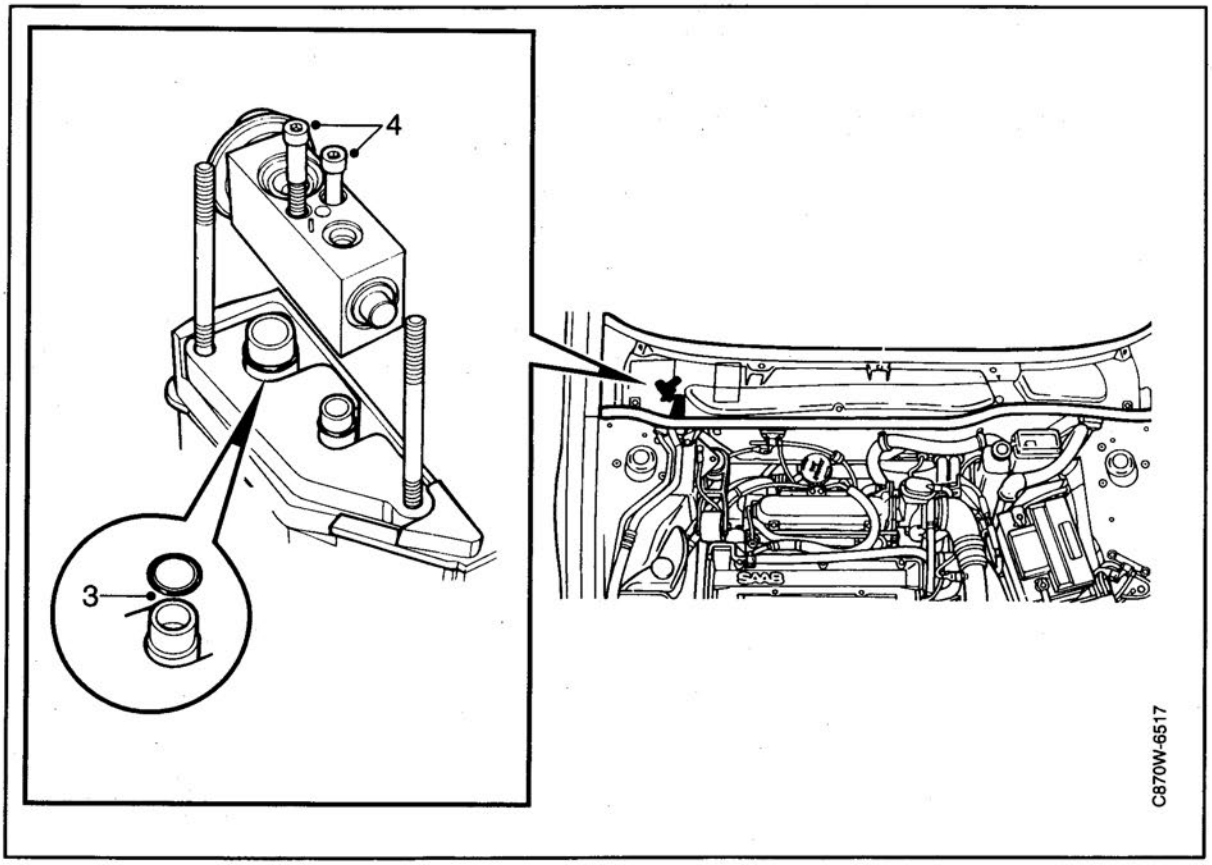
To remove

1 Release the expansion valve as described in points 1–2 in the description of removing the evaporator on page 256.

Important
Both the desiccant container and the compressor oil in the R134a system absorb water form the air, which cannot then be removed. The system must therefore never be left open.

2 Remove the expansion valve and plug the holes.

Expansion valve, changing M1992– (contd.)



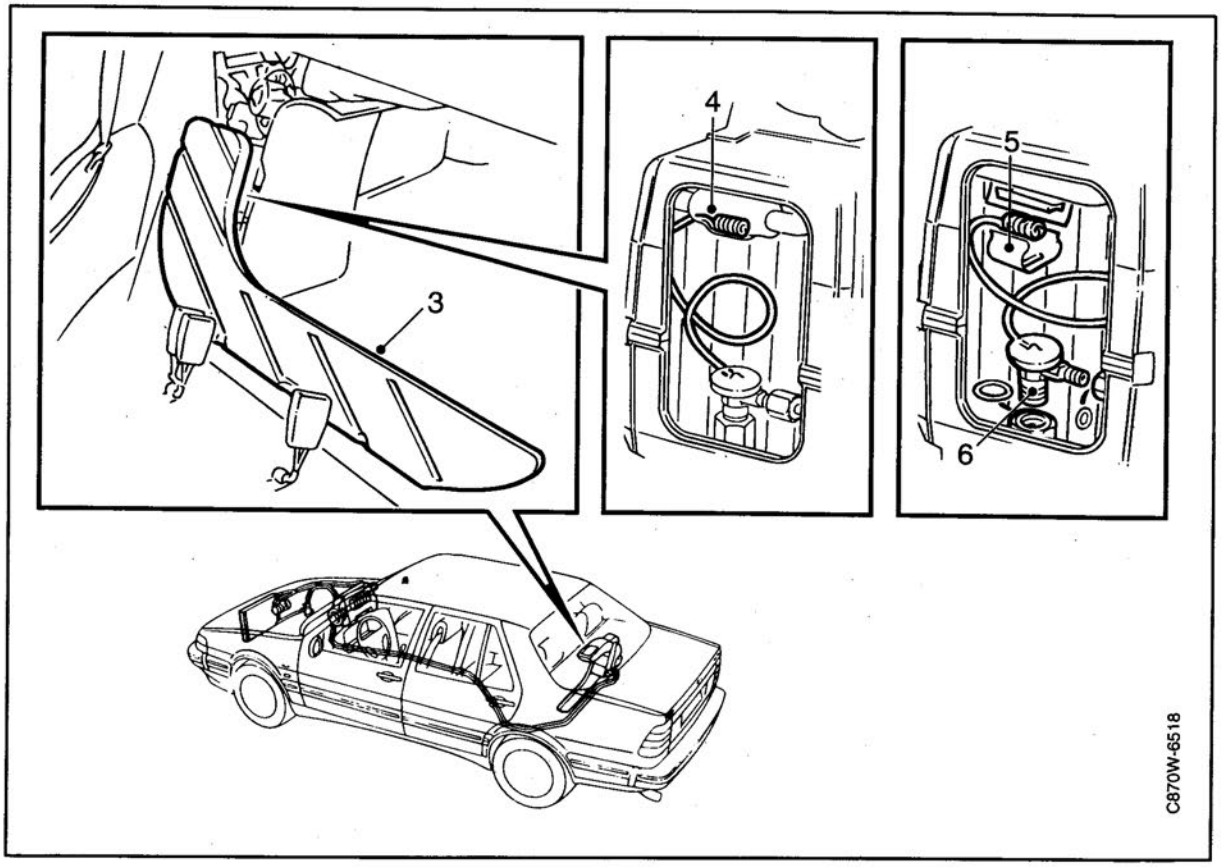
Fitting

3 Fit new O–rings to the pipe ends in the evaporator connection to the expansion valve. Lubricate the O–rings using synthetic vaseline, part number (16) 30 15 286.

4 Place the expansion valve in position and tighten the screws.
Tightening torque: 6 Nm (4.4 lbf ft)

5 Continue fitting as described in points 10–17 in the description of fitting the evaporator on page 261.

Rear expansion valve, changing



To remove

1 Drain the refrigerant from the system.

2 Remove the backrest.

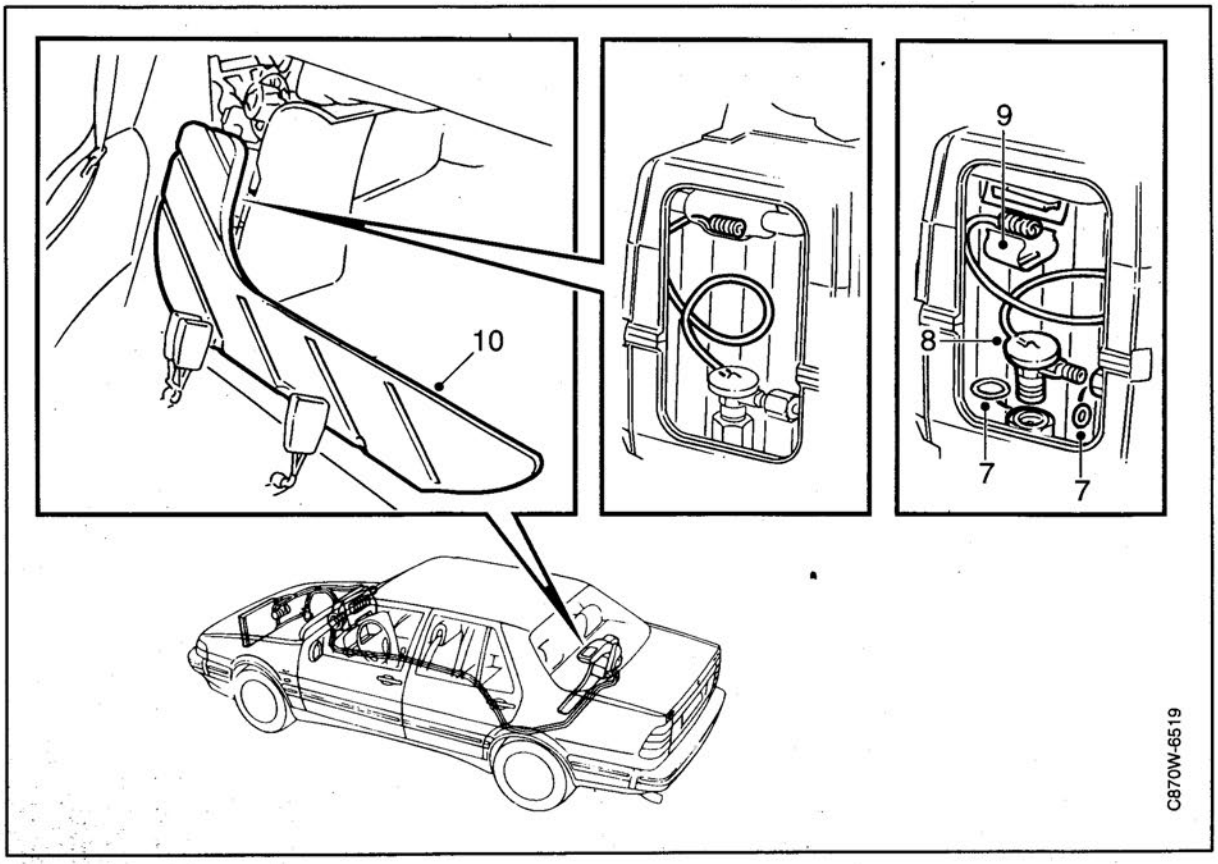
3 Remove the air intake.

4 Note the position of the capillary tube on the evaporator. It is extremely important to refit the tube in the same position.

5 Proceed to move the foam to one side and detach the capillary tube.

6 Open the expansion valve pipe connections using a holding tool and lift out the expansion valve.

Rear expansion valve, changing (contd.)



Fitting

7 Fit new O–rings to the expansion valve pipe connections. Lubricate the O–rings with synthetic vaseline.

8 Place the expansion valve in position and do up the pipe connections using a holding tool.

Tightening torque, pressure pipe: 14 Nm (10.4 lbf ft)

Tightening torque, vacuum pipe: 25 Nm (18.4 lbf ft)

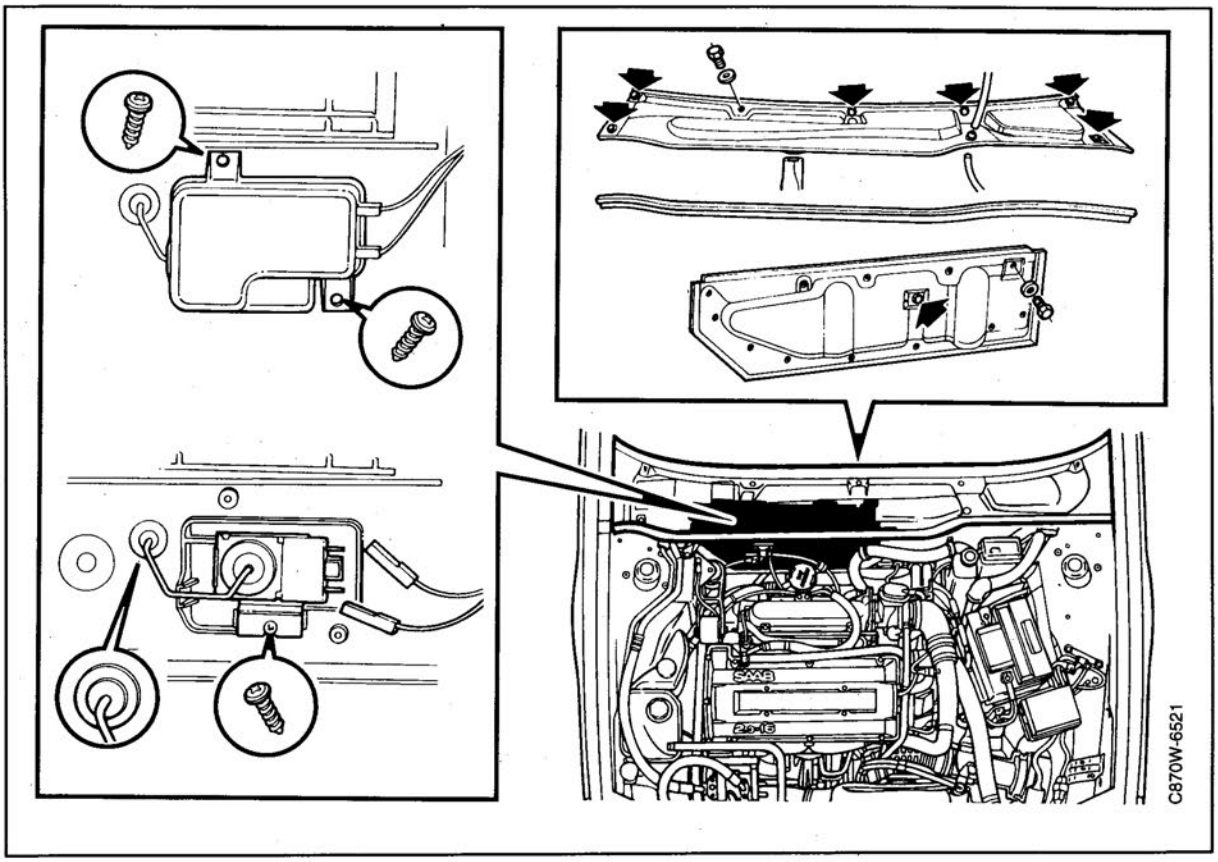
9 Refit the capillary tube to the evaporator casing in the position noted when removing it. It is extremely important to refit the tube in the same position.

10 Refit the air intake.

11 Refit the backrest.

12 Fill the system with refrigerant.

Anti–freeze thermostat, changing



To remove

1 Remove the cover from over the bulkhead space. Detach the drain hose and washer fluid hose.

2 Remove the rubber strip and the right–hand partition panel.

3 Unplug electrical connections.

4 Remove both screws securing the casing.

5 Remove the screws securing the actual anti–freeze thermostat.

Fitting

6 Carefully insert the capillary tube into the evaporator. Make sure that the tube goes all the way down. Do up the screw securing the anti–freeze thermostat.

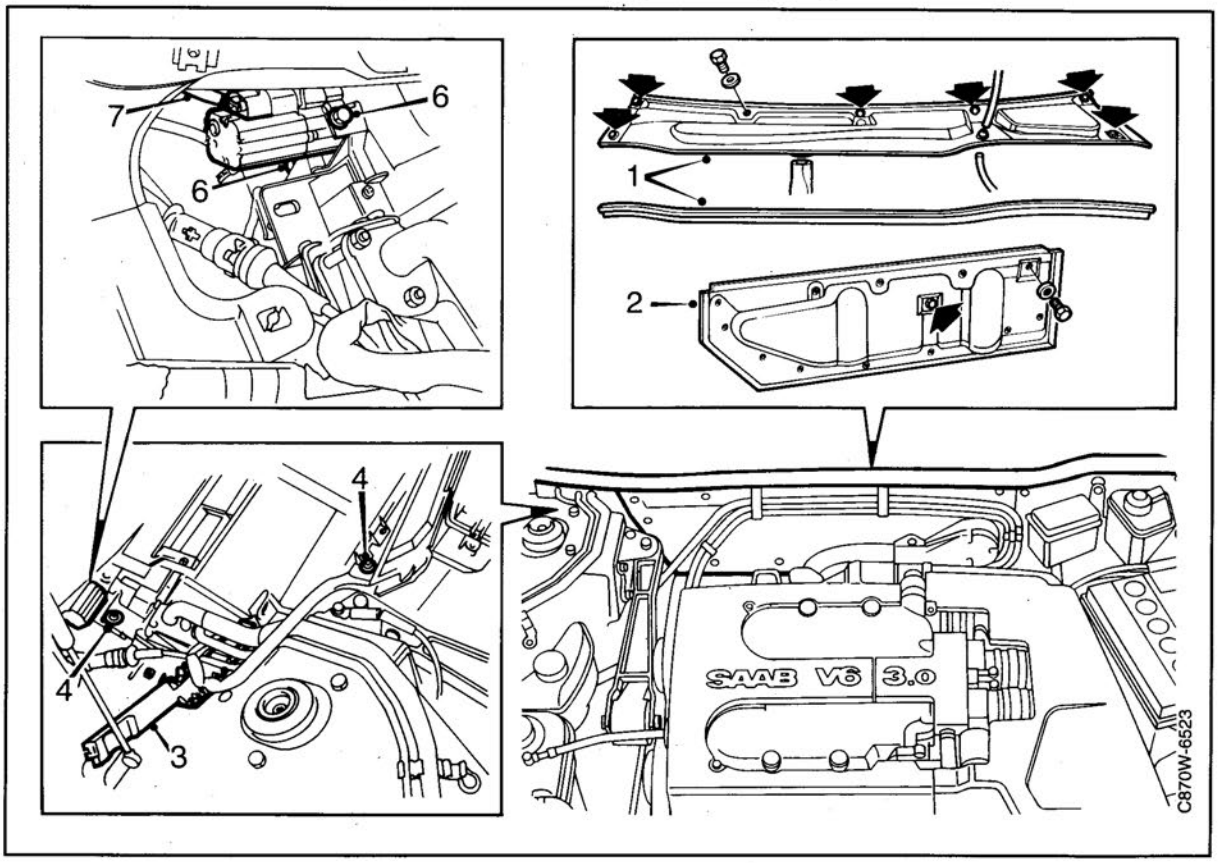
7 Screw on the casing.

8 Connect cables.

9 Screw on the partition panel and press on the rubber strip.

10 Connect the drain hose and the washer fluid hose to the cover and screw the cover over the bulkhead space.

Air recirculation flap, servomotor, changing



To remove

1 Remove the rubber strip and the cover over the bulkhead space.
Disconnect the washer hose.

2 Free the right–hand shield plates.

3 Open the clamp over the A/C lines.

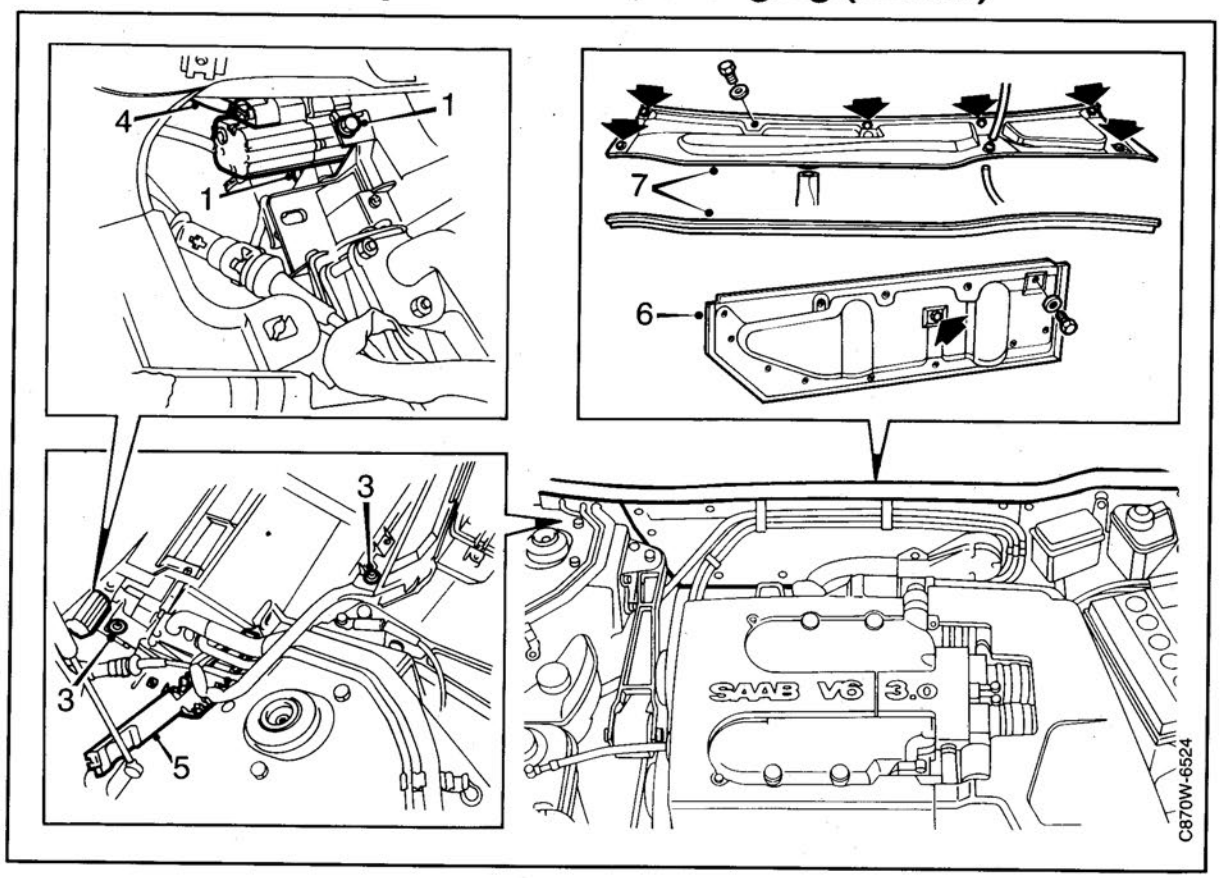
4 Remove the two evaporator casing securing screws.

5 Lift the evaporator casing a couple of centimeters forward to gain access to both the servo motor retaining screws.

6 Undo the servo motor retaining screws.

7 Unplug the connector and pull out the servo motor.

Air recirculation flap servomotor, changing (contd.)



Fitting

1 Attach the servomotor.

2 Place the evaporator casing in position. Check that the drainage hose is not kinked and that water can freely run out of the evaporator casing and down the drainage hose.

3 Secure the evaporator casing.

4 Plug in the servo motor connector.

5 Lower the clamp over the A/C lines.

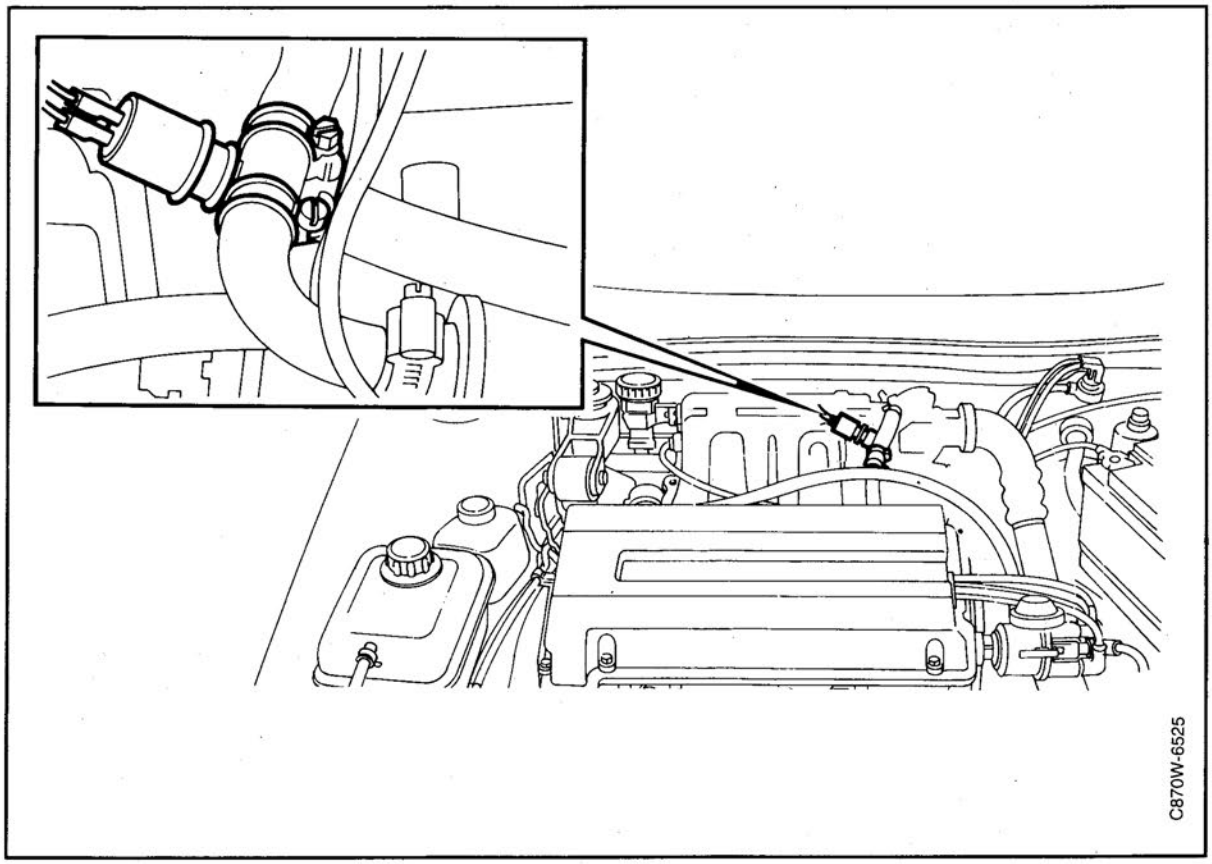
6 Fit the shield plates.

7 Connect the washer hose to the cover and secure the cover and the rubber strip over the bulkhead partition space.

8 Calibrate the ACC system by pressing the "AUTO" and "VENT" buttons at the same time.

Important
During calibration, all previously stored diagnostic trouble codes are erased. Before carrying out calibration, all stored diagnostic trouble codes should be read.

Idle speed control, changing



(up to 1986 chassis number CG1001944)

To remove

Unplug electrical connections and unscrew valve.

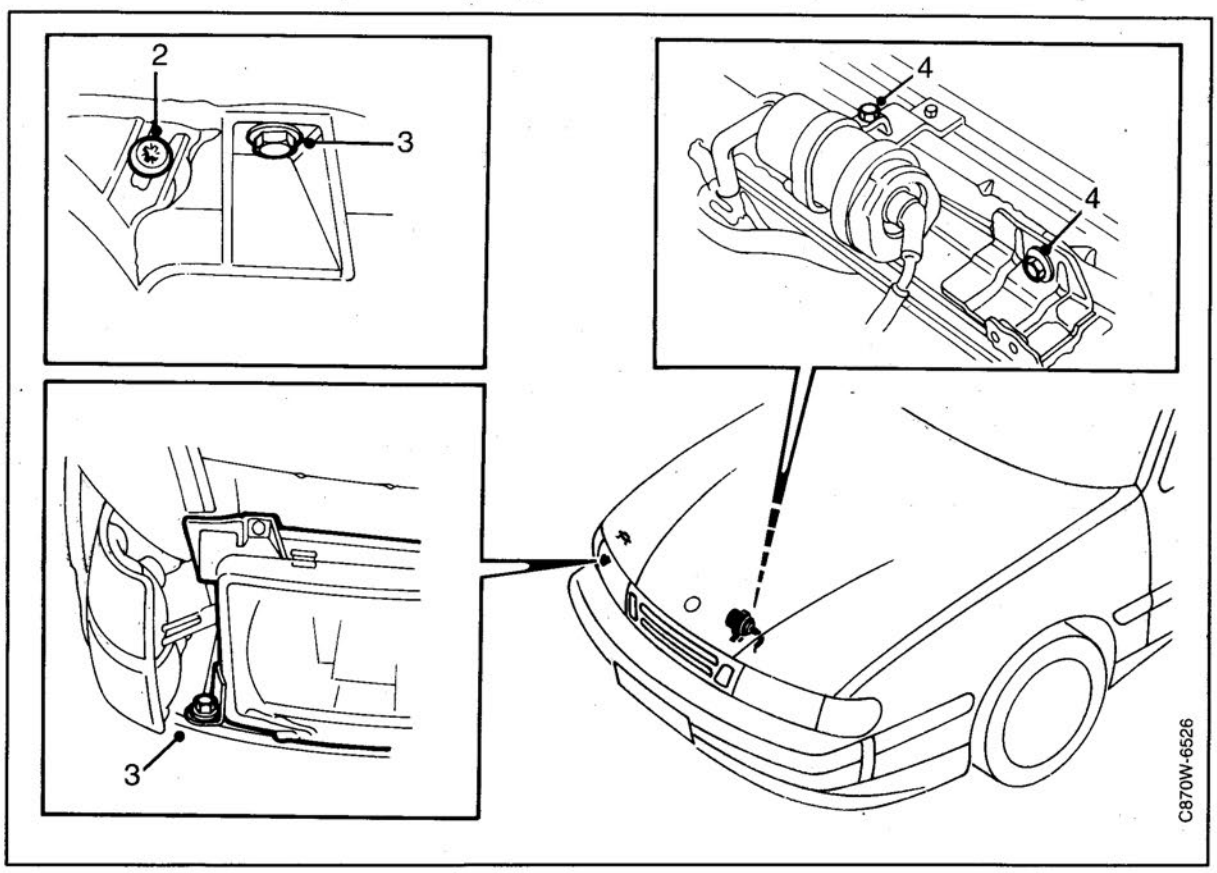
Checking

Let the engine run at idling speed and switch on the A/C. Remove one of the spade connectors on idle speed control. Engine speed should now drop. Connect the spade connector.

1986 from chassis number CG1001945.

As all 16 valve engines after the above chassis number have automatic idle speed control, the solenoid valve for raising the engine idling speed is removed.

Extra radiator fan, changing



(certain markets only)

To remove

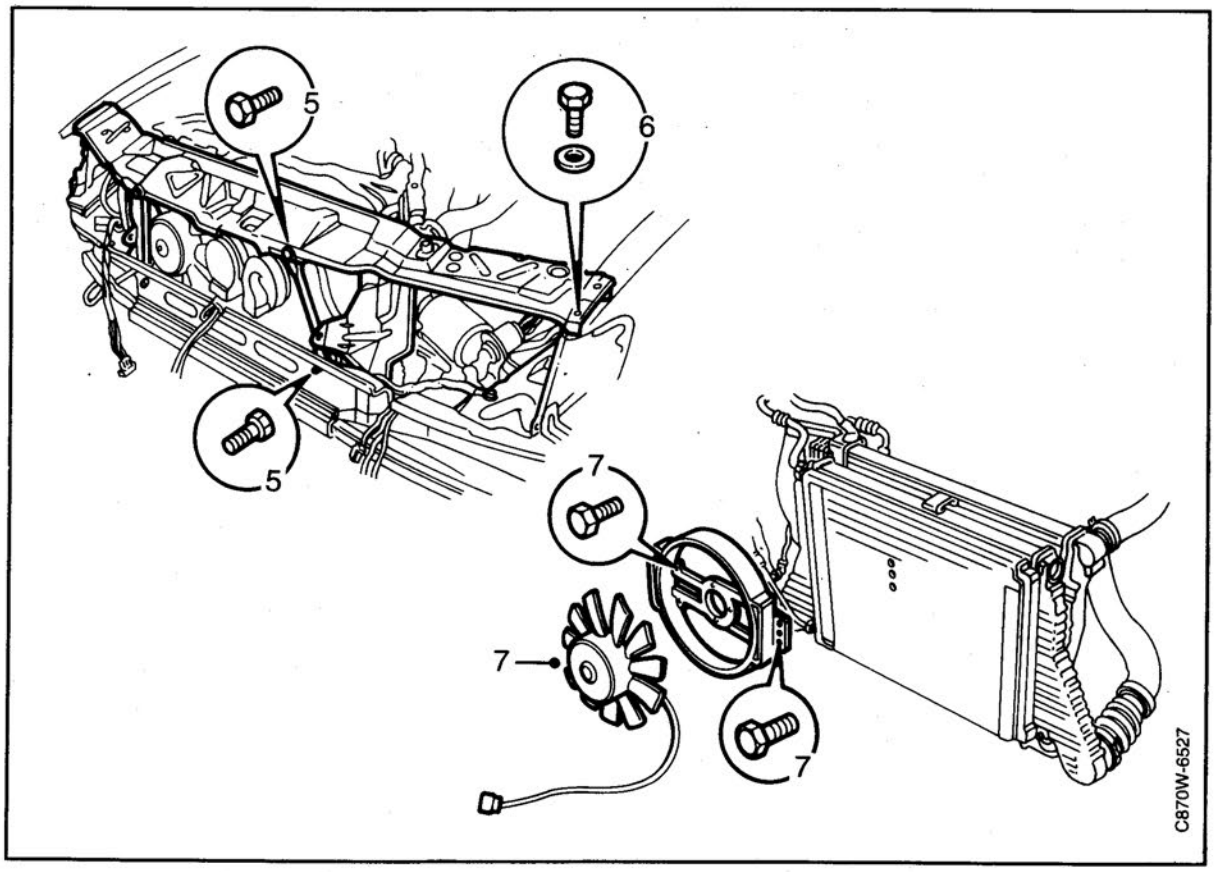
1 Remove the front spoiler and grille.

2 Undo the light cluster retaining screw and pull the cluster slightly forward.

3 Remove the headlamps.

4 Remove the screw from the ignition coil bracket.
Move the ignition coil to one side.
Remove the screw securing the radiator to the radiator crossmember.

Extra radiator fan, changing (contd.)



5 Detach the radiator crossmember from the front wings. Unplug electrical connector to the horn. Raise the radiator crossmember and move it to one side.

6 Remove the upper screws from the radiator crossmember stay.
Remove the lower radiator crossmember retaining screws.

Important
Be careful not to damage the paintwork.

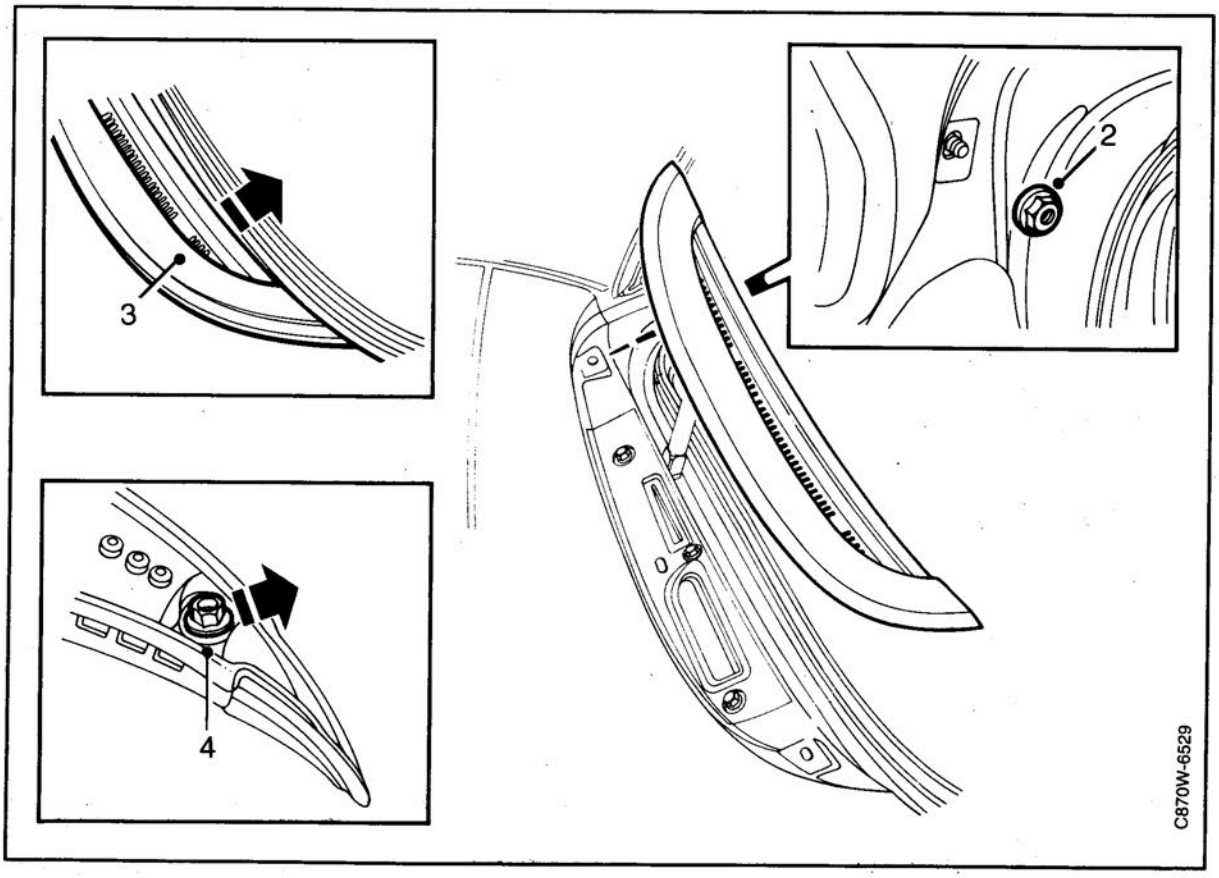
7 Remove the fan nut and two retaining screws. Unplug the electric radiator fan connector and lift out the fan.

Fitting

Apply sealant to the radiator crossmember's contact surface against the bodywork member.

Check headlamp settings after work is completed.

Air outlet grille, C pillar, changing (CS)



Background

A modified air outlet grille has been introduced in production. The new grille is more rigid, fits better and is easier to fit. The grille's rubber seal is vulcanized. The part number of the new air outlet grille is:
43 83 659 – right side
43 83 667 – left side

To remove

The air outlet grille and its studs are made from aluminium and can therefore be bent if they are not handled with care. For this reason, be extremely careful when removing the grille.

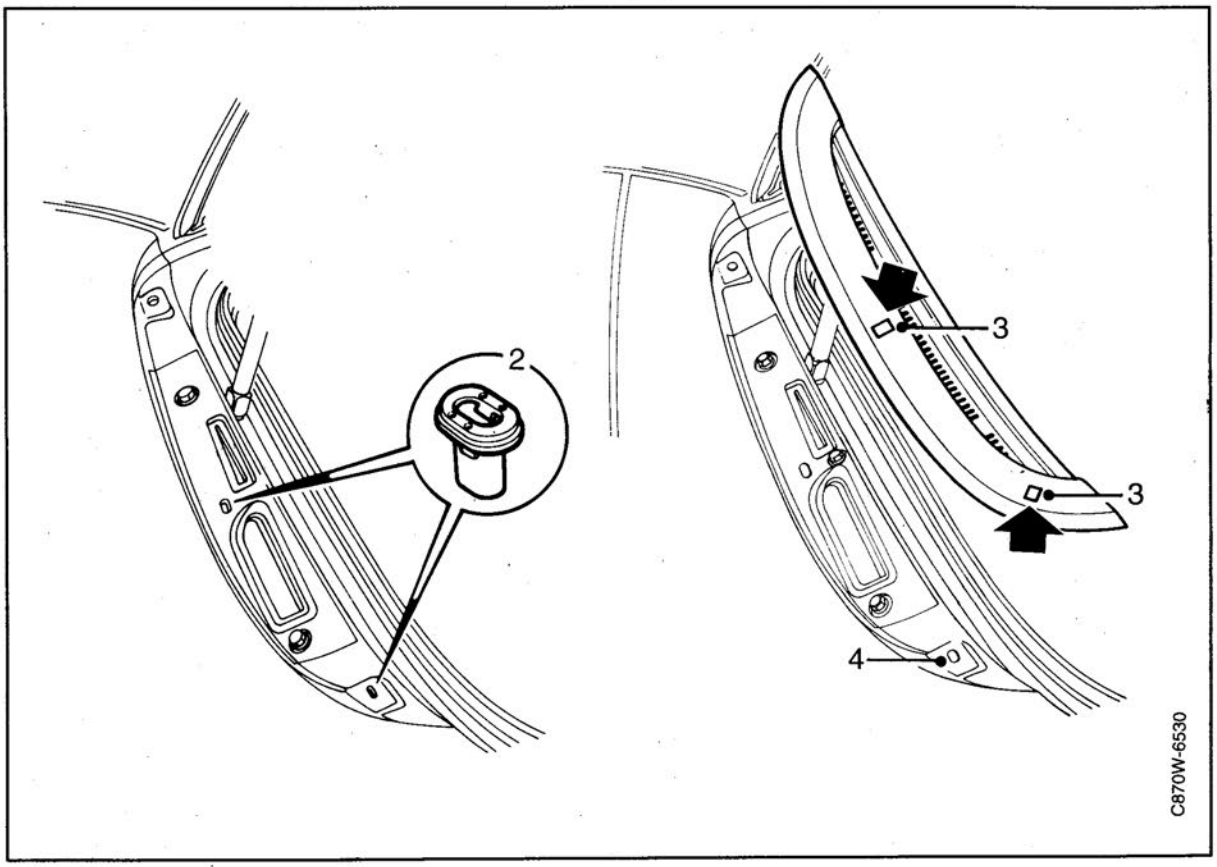
1 Remove the C pillar trim.

2 Remove the nut securing the upper end of the air outlet grille.

3 Using a wooden wedge or paste spreader, carefully prise out the air outlet grille. Start around the grille attachments.

4 Carefully cut away the clips from the air outlet grille. Do not bend the aluminium studs.

Air outlet grille, C pillar, changing (CS contd.)



Fitting

The air outlet grille and its studs are made from aluminium and can therefore be bent if they are not handled carefully. Take great care when fitting the grille.

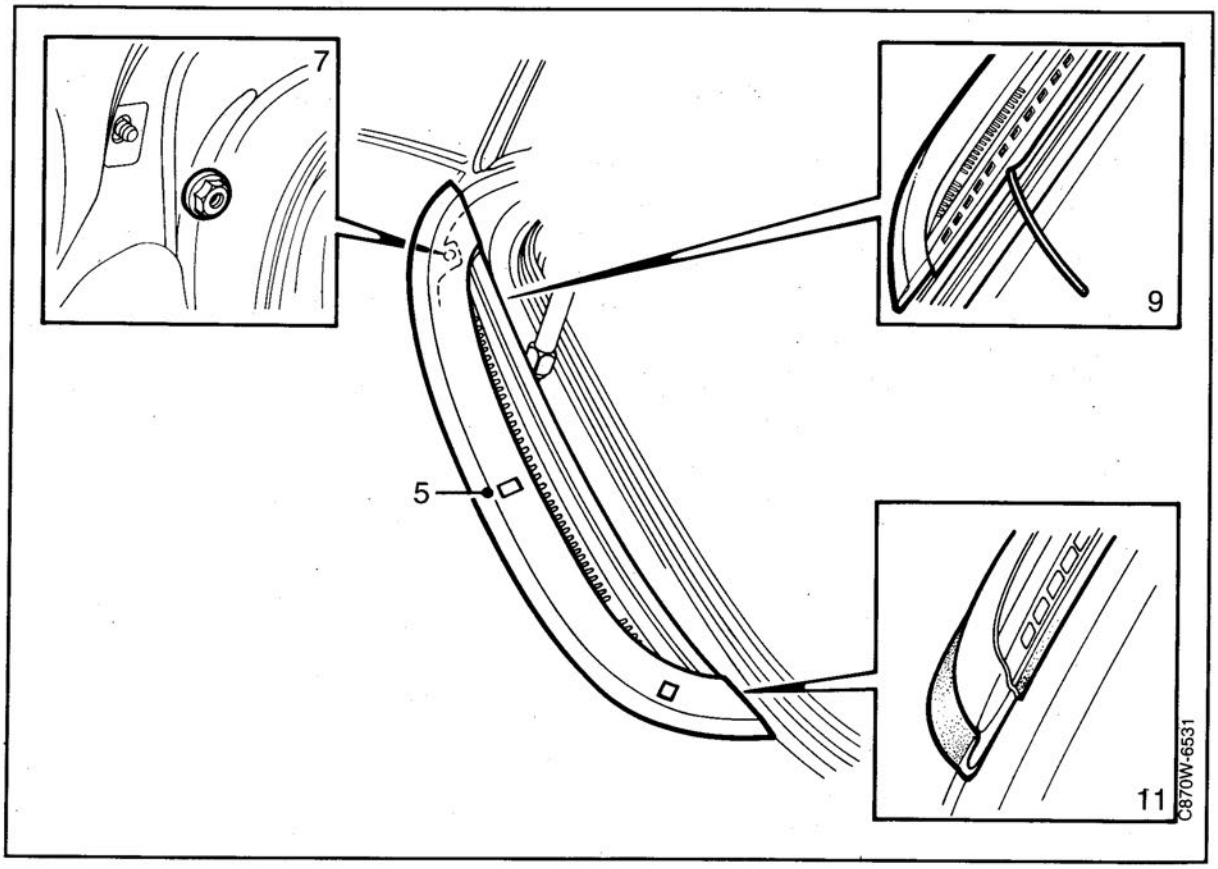
1 The air outlet grille is delivered with the rubber seal fixed using tape. Leave the tape in place while fitting.
If refitting a grille which has been removed, the rubber seal should be fixed in place with tape before starting work.

2 Press new clips into position using a suitable tool. Be careful not to damage them. Broken or incorrectly fitted clips can cause water leakage.

3 If a grille is being fitted after it has been removed, the position of the studs should be marked using tape on the top of the grille. The reason for this becomes evident in point 6 on the next page. New grilles are delivered with marks.

It is also useful to place string under the rubber seal along the inside of the grille, in order to make it easy to position the seal. See point 9 on the next page.

Air outlet grille, C pillar, changing (CS contd.)



4 Place the grille's lower stud in position on the lower clip, with the grille positioned as illustrated. Check that the lower corner of the rubber seal does not turn over.

5 Raise the grille and place the upper of the two studs in position in the upper clip.

6 Align the grille on the bodywork and press it down. Press on the marks which show the position of the studs. Use the entire palm of the hand in order to avoid bending the grille. Avoid pushing your fingers against the inside of the grille.

7 Remove a piece of the fixing tape and align the upper edge of the rubber seal. Then press the grille down and in and tighten a new lock nut onto the stud at the upper edge of the grille. Do not tighten too hard as the stud will break off.
Tightening torque: Max 2.5 Nm (1.8 lbf ft)

8 Remove the fixing tape.

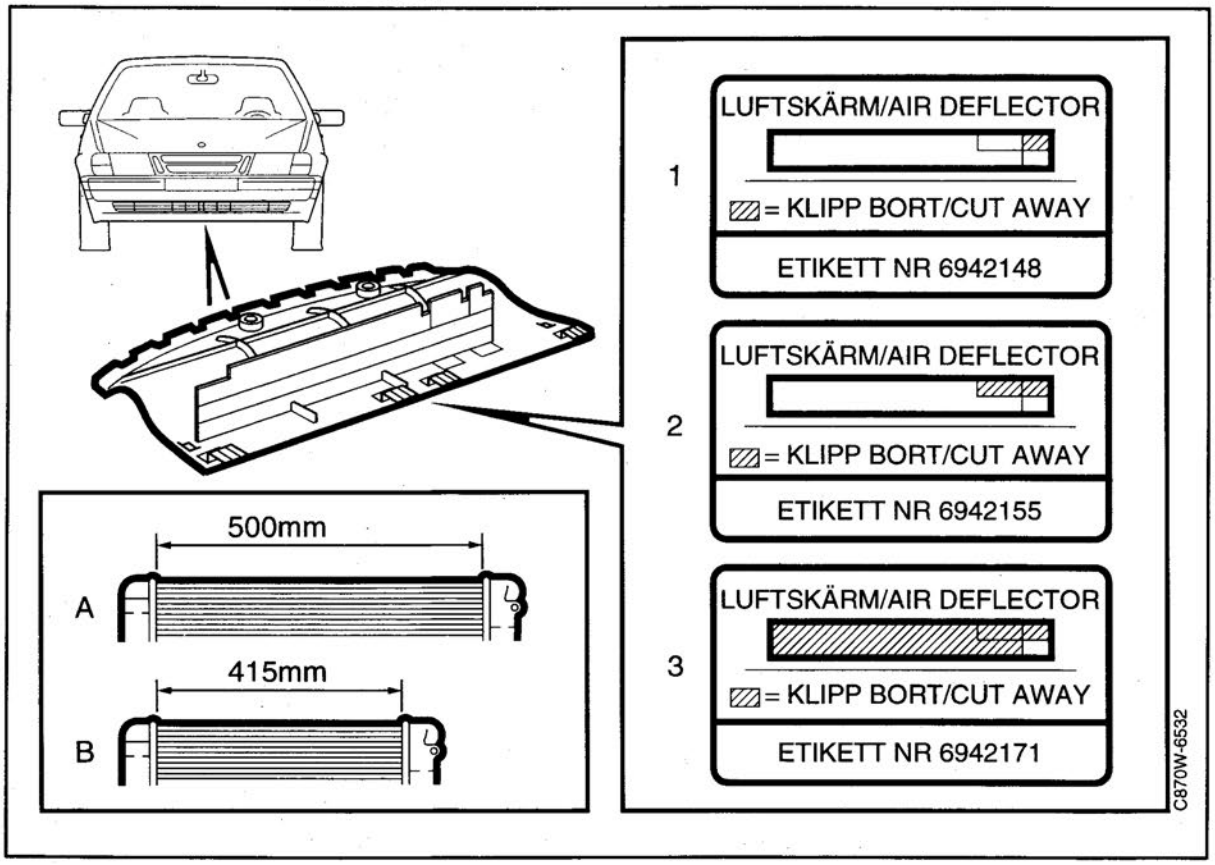
9 Pull away the string so that the rubber seal is in position.

10 Press the palm of the hands onto the grille one more time to finally align it with the bodywork.

11 Check the alignment of the lower edge of the grille. If necessary, carefully tap in the end using a rubber hammer.

12 Réfit the C pillar trim.

Air deflector, adjusting



Background

If cooling performance is poor, the air deflector behind the front spoiler may be incorrectly cut and should therefore be checked.

Action

Check that the correct cuts have been made on the lip at the top edge of the air deflector. If the cuts are wrong, a new air deflector should be fitted and be cut correctly. The drawing illustrates the three different versions of cutaway and on which cars each cutaway should be made.

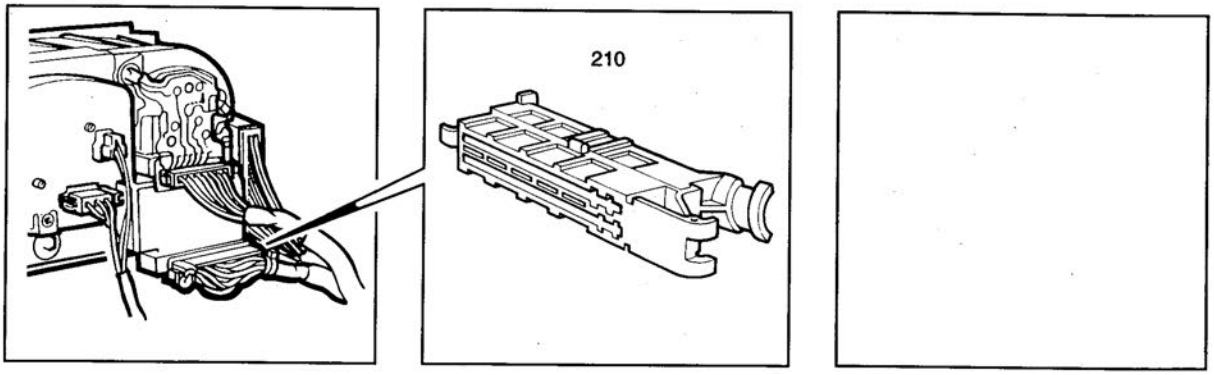
1 Cars with 20 dm^2 radiator (A) **without** air oil cooler for **automatic gearbox**.

2 Cars with 16.7 dm^2 radiator (B).

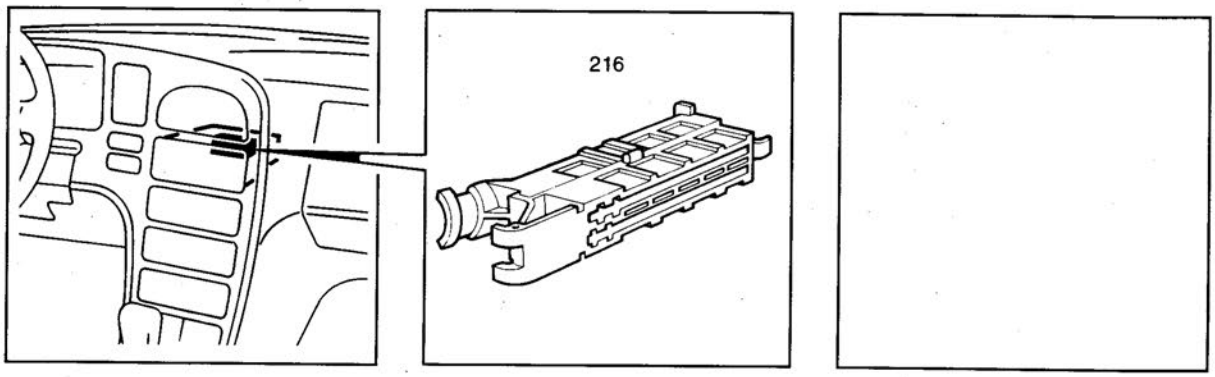
3 Cars with 20 dm^2 radiator (A) **with** air oil cooler for **automatic transmission**.

Connectors and grounding points

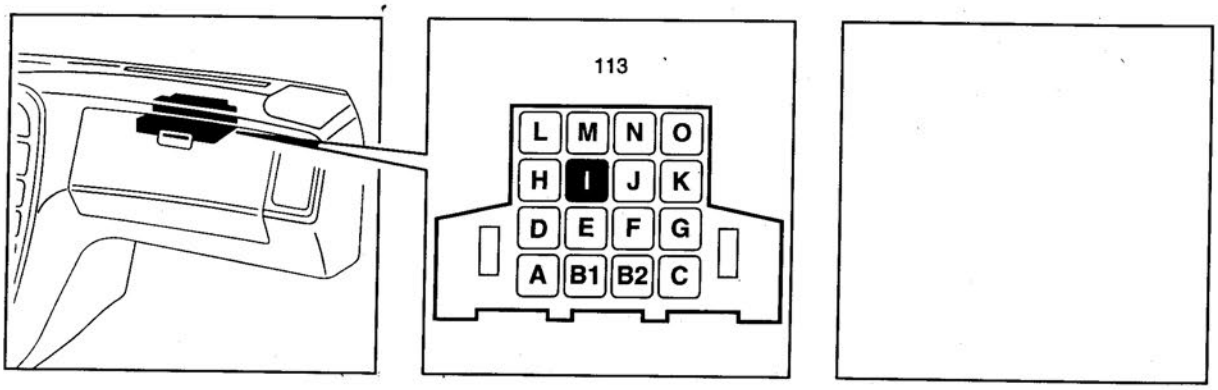
Mainly applies to year model 1994–



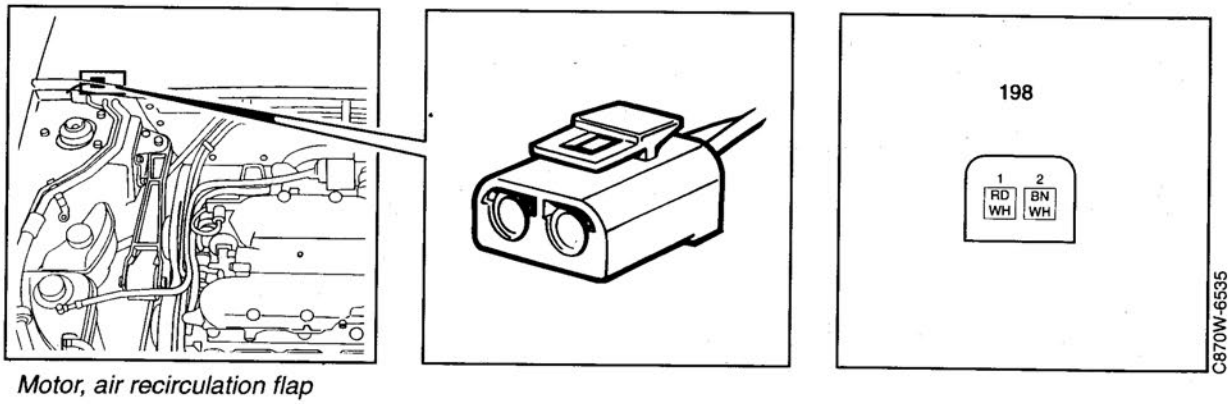
EDU trip computer



ACC control module

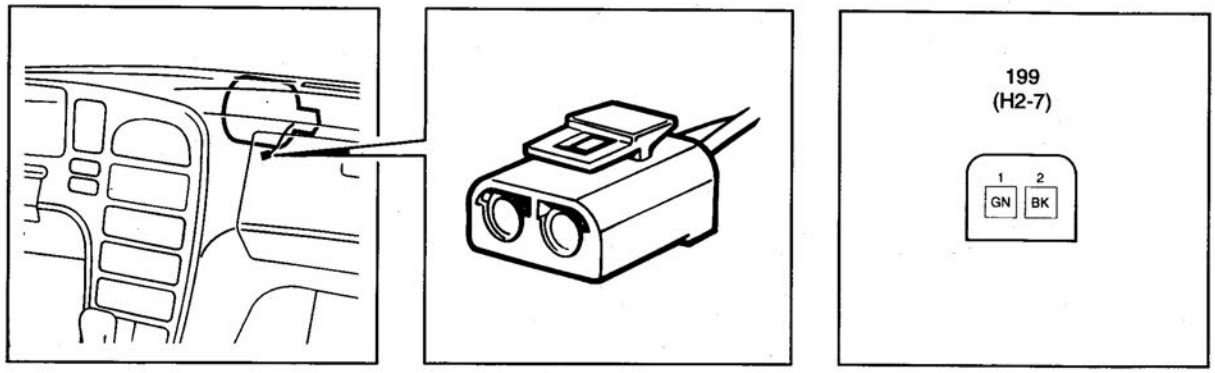


Relay, electrically heated rear window

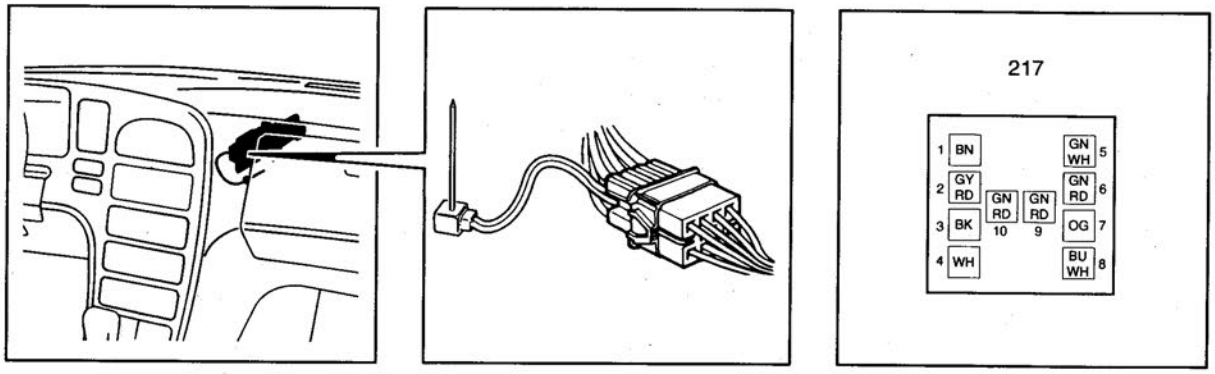


Motor, air recirculation flap

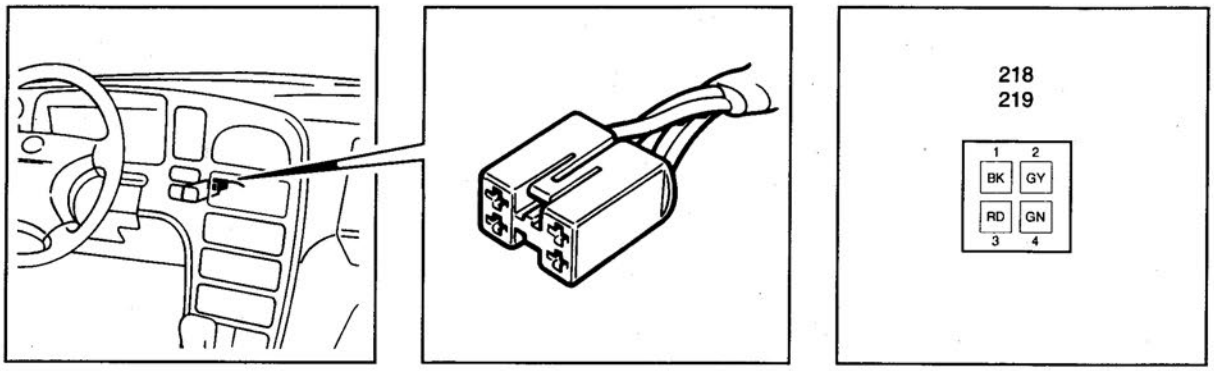
Primarily applies to year model M1994–



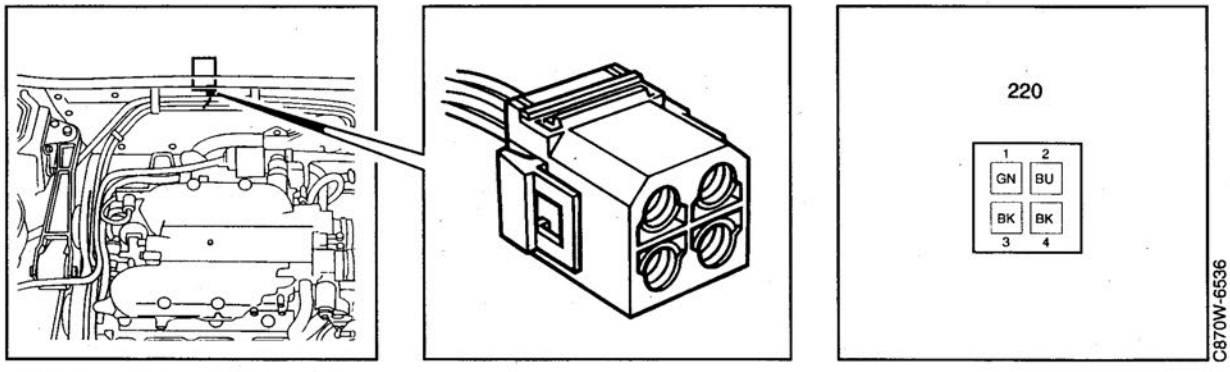
Motor, ACC ventilation fan



Blended air temperature sensor, ACC



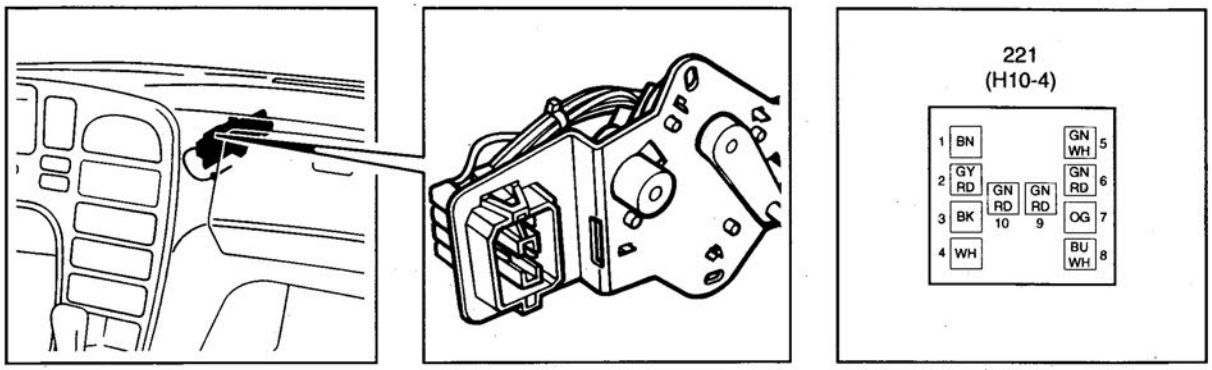
Cabin temperature sensor, ACC (218) with fan (219)



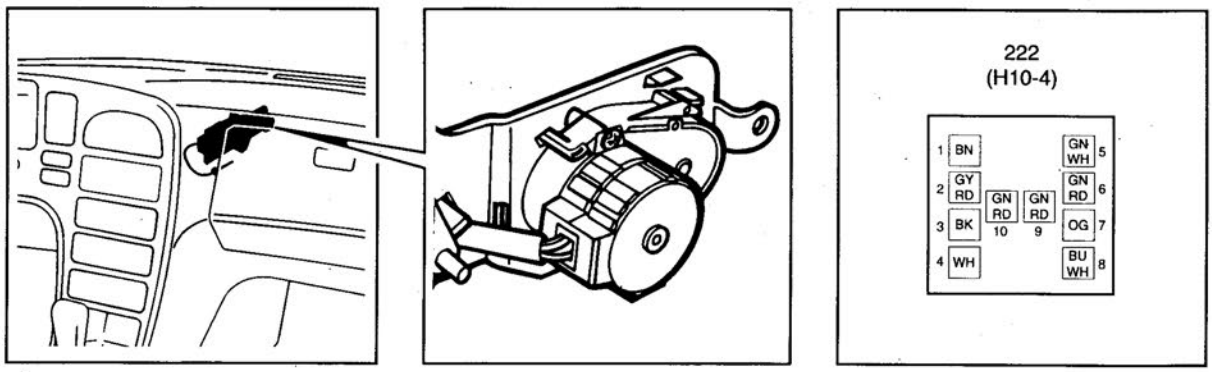
Speed control, ventilation fan

C870W-6536

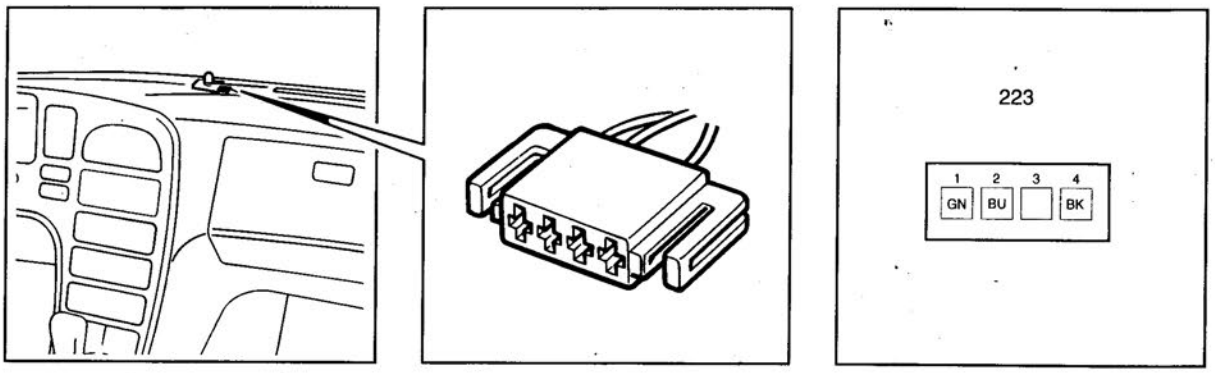
Primarily applies to year model M1994–



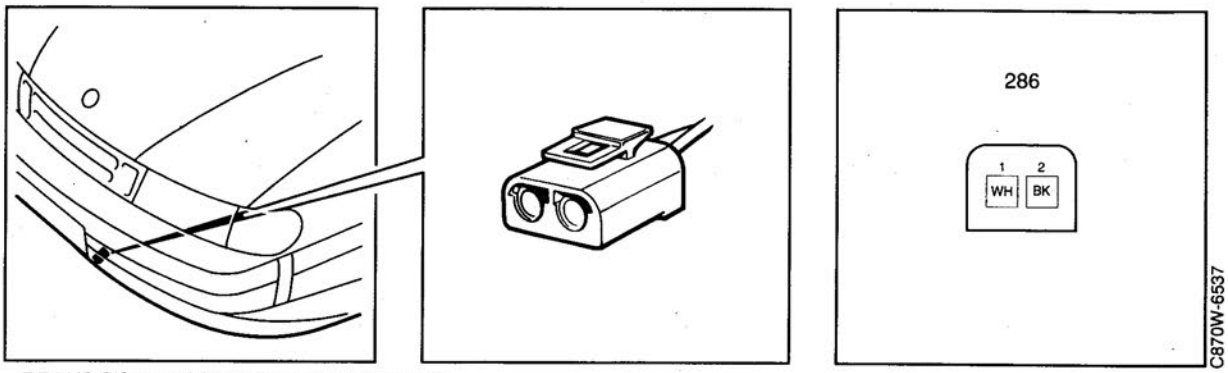
Motor, ACC air distributor



Motor, ACC, air mixing damper

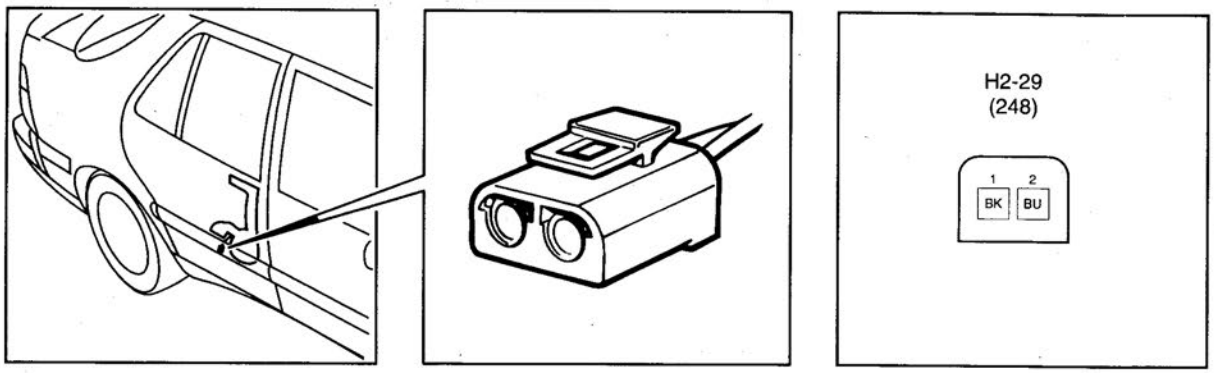


ACC solar sensor

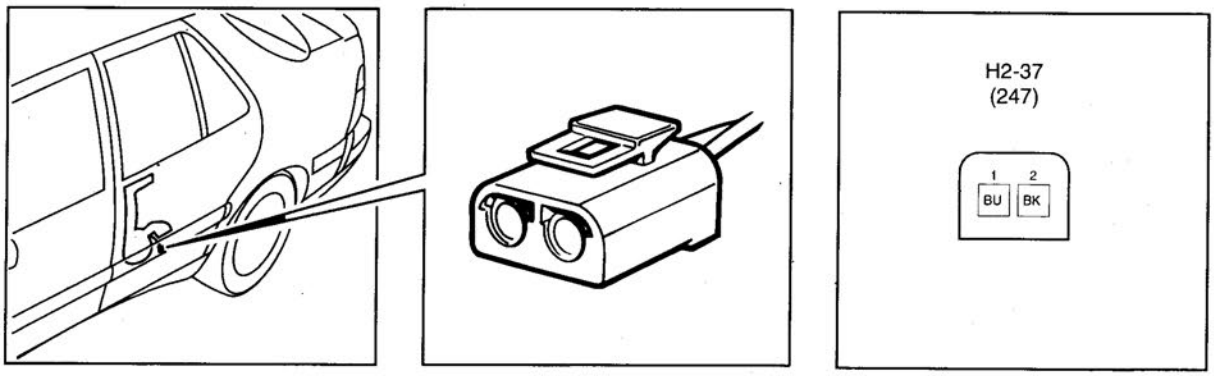


EDU/SCC outside temperature sensor

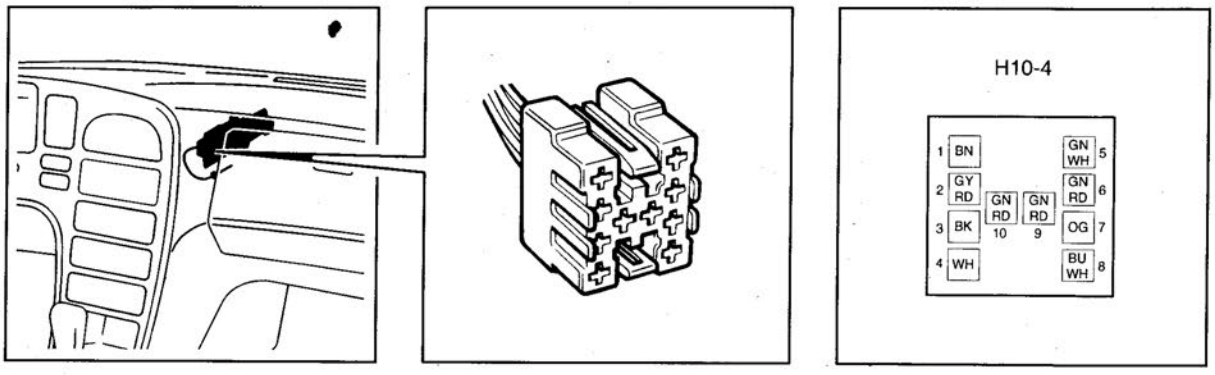
Applies primarily to year model M1994–



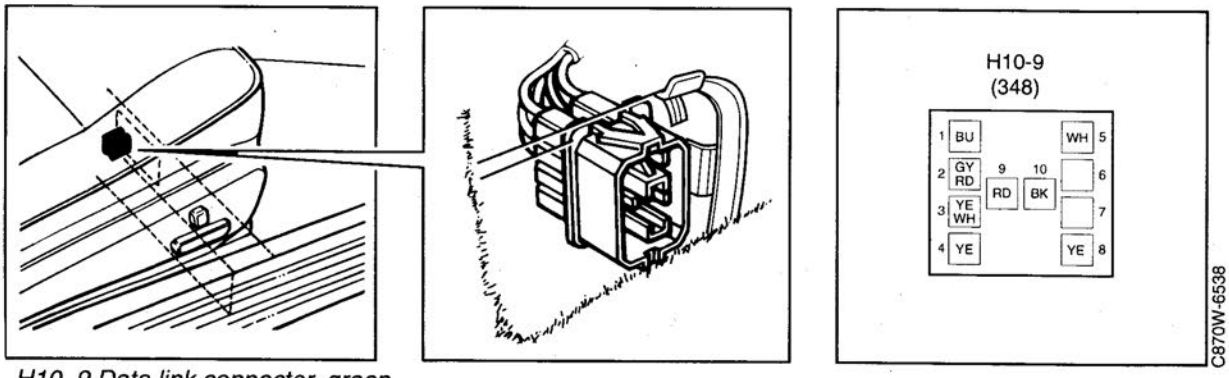
H2–29 2 pin connector (door fan motor, right–hand door)



H2–29 2 pin connector (door fan motor, left–hand door)

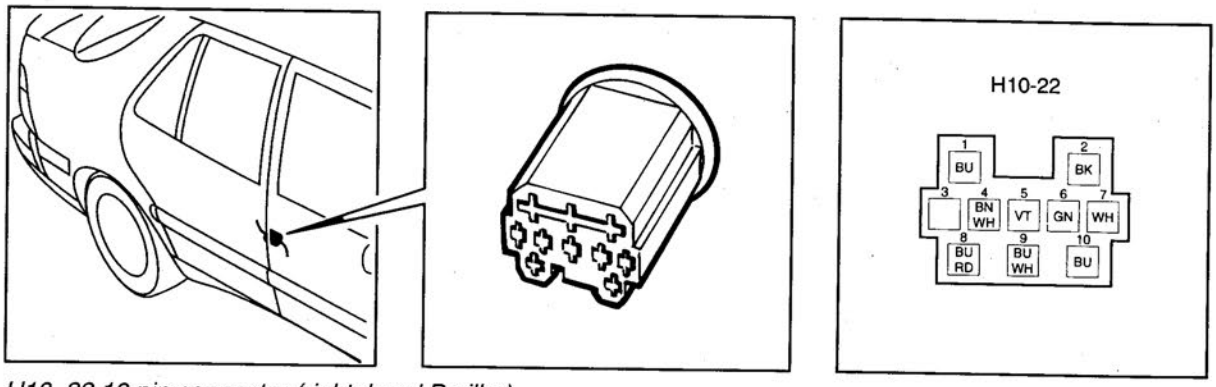


H10–4 10 pin connector on servomotor unit

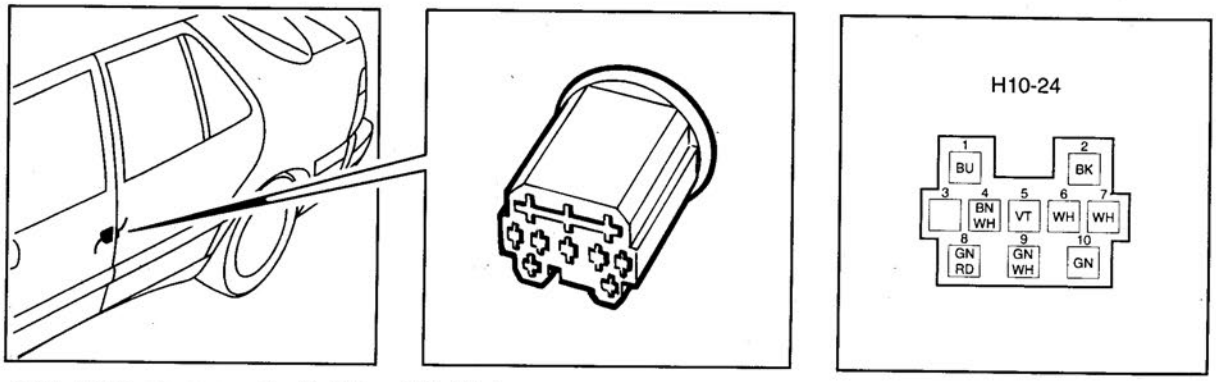


H10–9 Data link connector, green

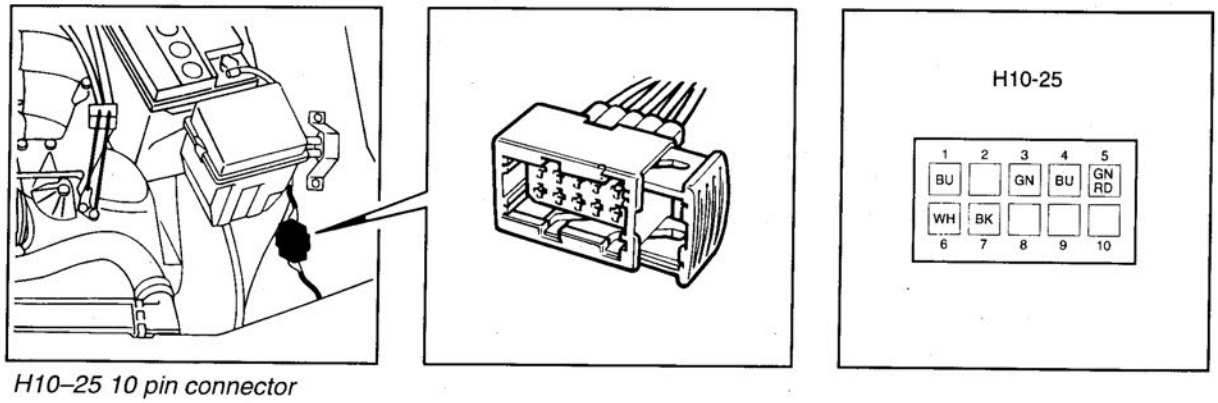
Applies primarily to year model M1994–



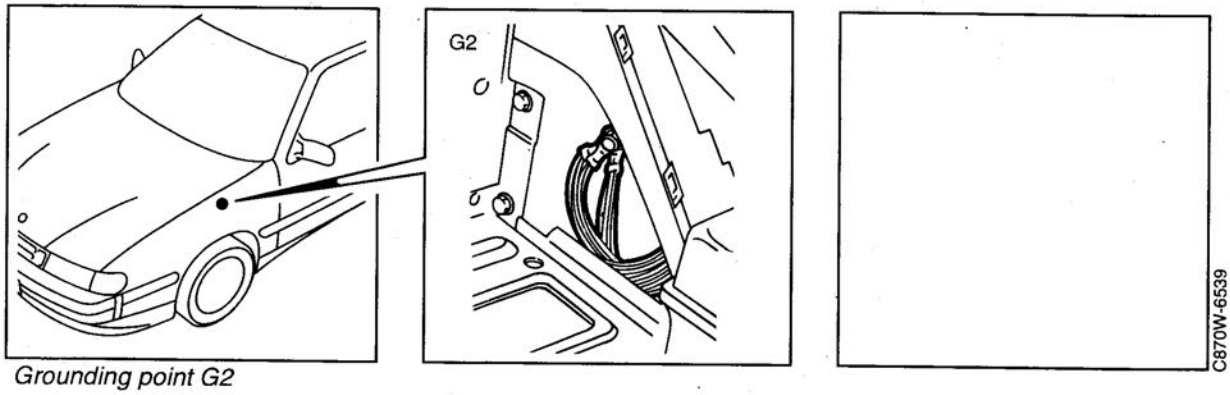
H10–22 10 pin connector (right–hand B pillar)



H10–24 10 pin connector (left–hand B pillar)

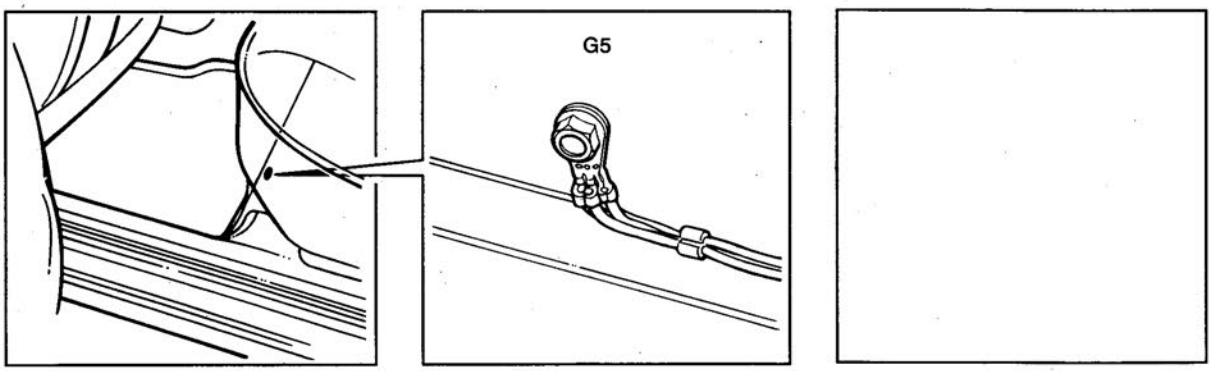


H10–25 10 pin connector

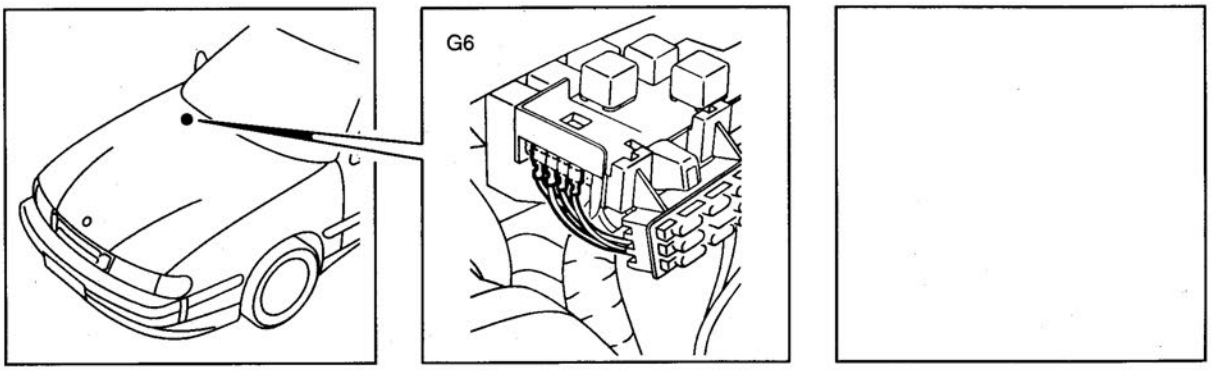


Grounding point G2

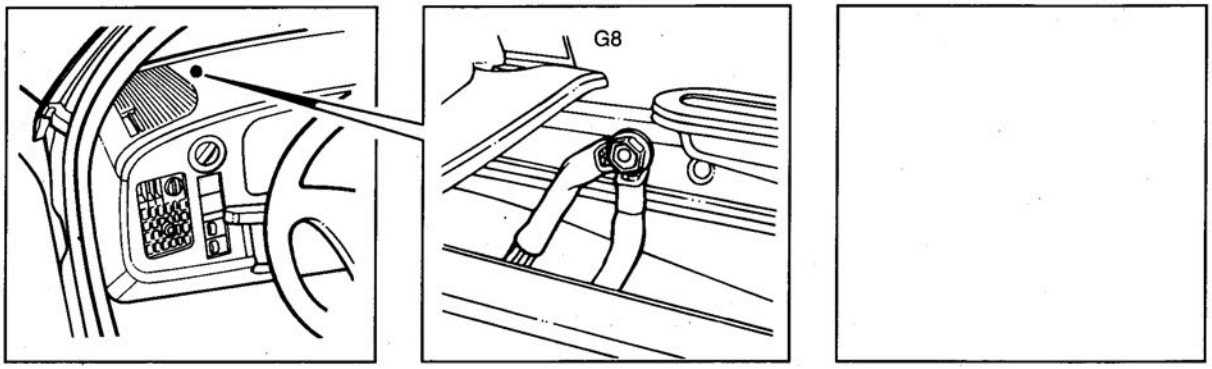
Applies primarily to year model M1994–



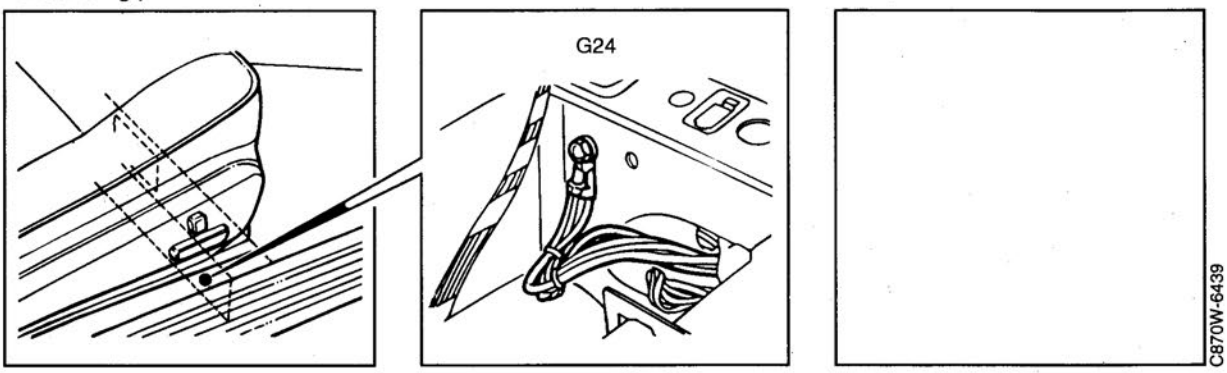
Grounding point G5



Grounding point G6



Grounding point G8



Grounding point G24

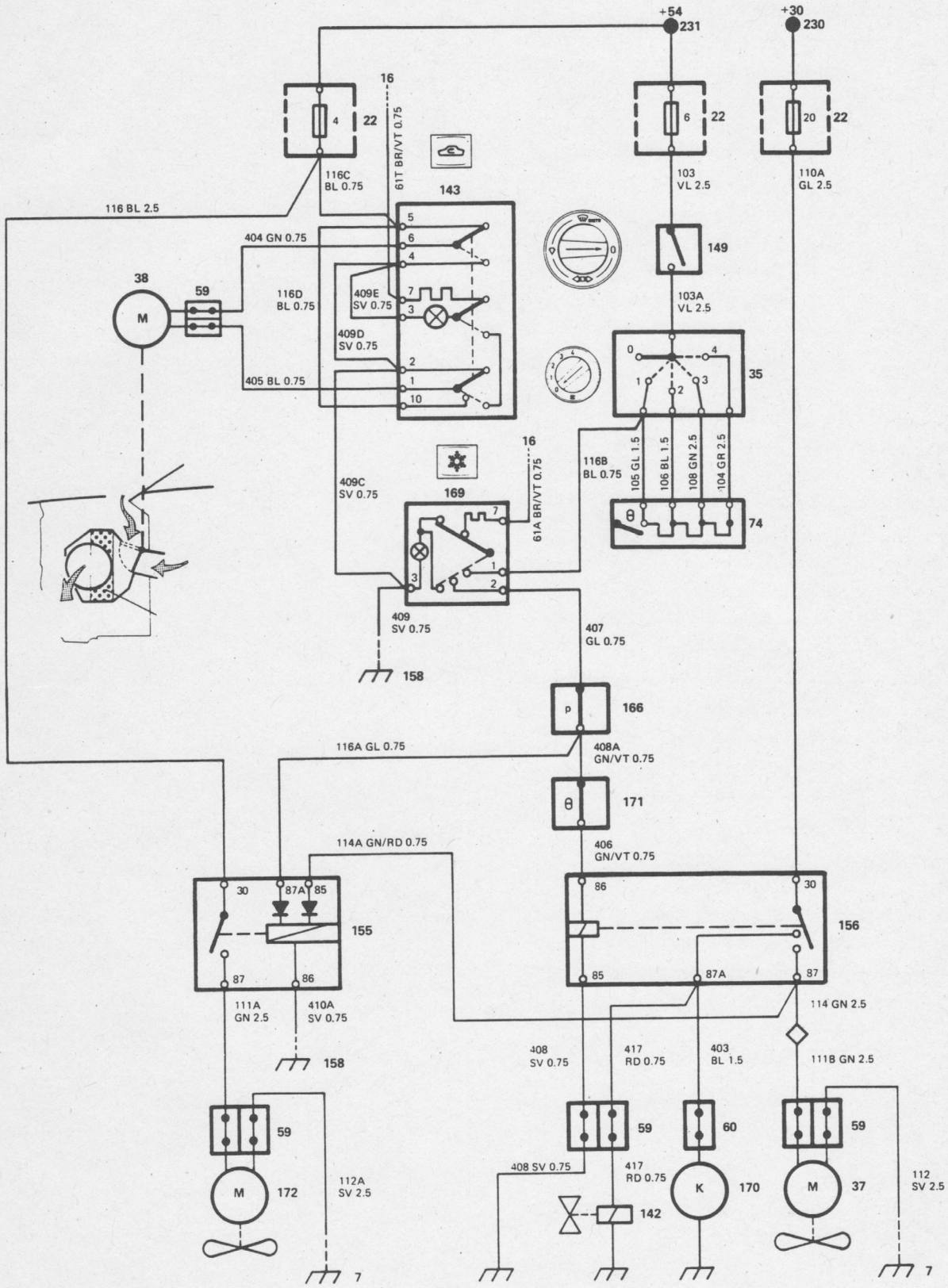
C870W-6439

Wiring diagrams

Air conditioning, A/C M1985

List of components

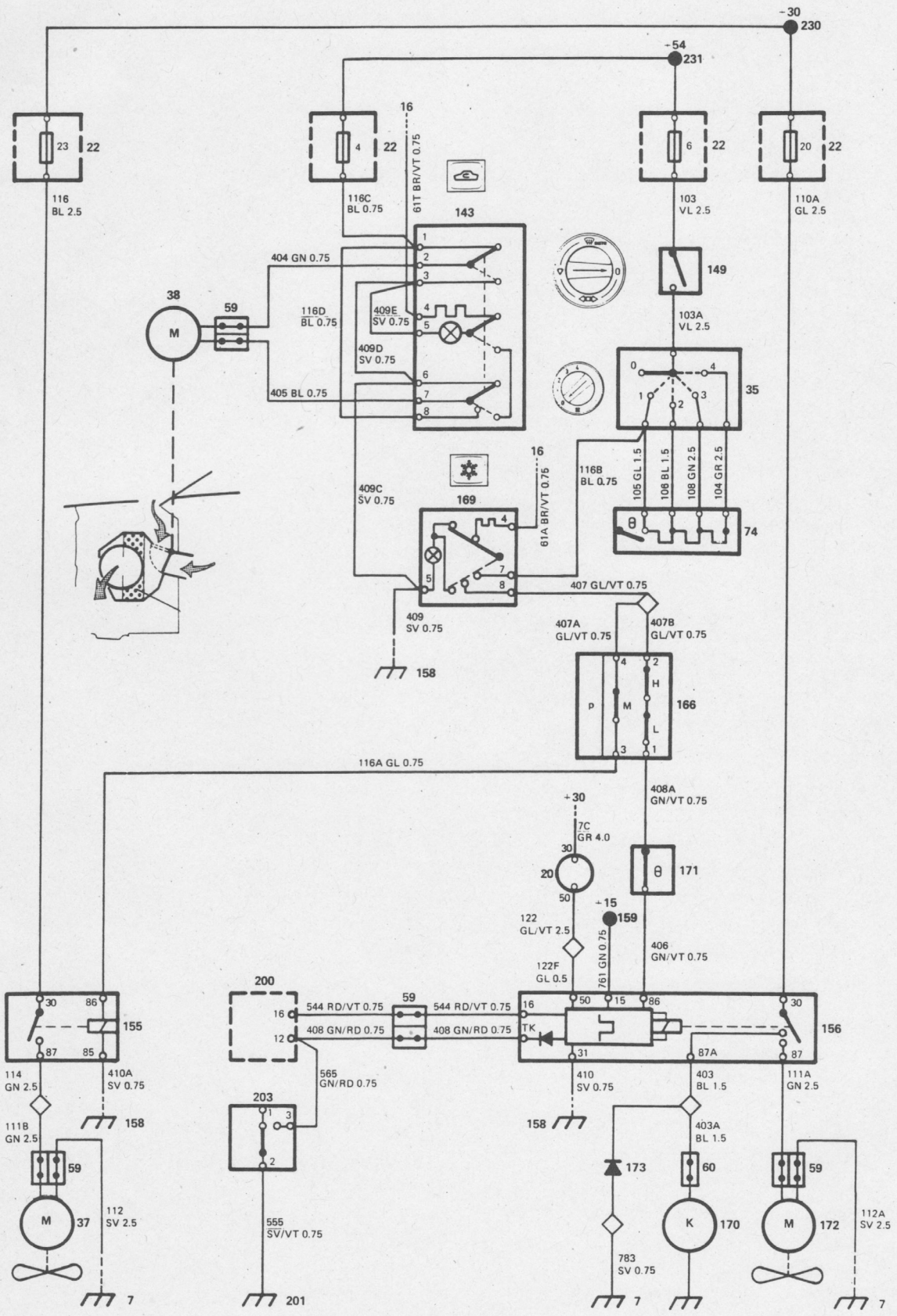
22	Fuse box in electrical distribution box
35	Switch, ventilation fan
37	Engine radiator fan
38	Motor, air recirculation flap
59	2 pin connector
60	1 pin connector
74	Resistor in ventilation fan
142	Solenoid valve
143	Switch, recirculation
149	Main switch, fan
155	Relay for A/C radiator fan
156	Relay for radiator fan
166	Pressure switch for radiator fan
169	Switch, A/C
170	A/C compressor
171	Anti–freeze thermostat
172	Radiator fan for A/C


+54
231
+30
230
22
16
61T BR/VT 0.75
116C
BL 0.75
116 BL 2.5
143
103
VL 2.5
110A
GL 2.5
404 GN 0.75
149
103A
VL 2.5
38
59
M
116D
BL 0.75
409E
SV 0.75
409D
SV 0.75
405 BL 0.75
35
105 GL 1.5
106 BL 1.5
108 GN 2.5
104 GR 2.5
116B
BL 0.75
74
409C
SV 0.75
169
61A BR/VT 0.75
409
SV 0.75
158
407
GL 0.75
166
116A GL 0.75
408A
GN/VT 0.75
171
114A GN/RD 0.75
406
GN/VT 0.75
155
156
111A
GN 2.5
410A
SV 0.75
114 GN 2.5
408
SV 0.75
417
RD 0.75
403
BL 1.5
111B GN 2.5
60
172
112A
SV 2.5
170
142
37
112
SV 2.5
7

Air conditioning, A/C M1986–89

List of components

20	Ignition switch
22	Fuse box in electrical distribution box
35	Switch, ventilation fan
37	Engine radiator fan
38	Motor, air recirculation flap
59	2 pin connector
60	1 pin connector
74	Resistor in ventilation fan
143	Switch, recirculation
149	Main switch, fan
155	Relay for A/C radiator fan
156	Relay for radiator fan
166	Pressure switch for radiator fan
169	Switch, A/C
170	A/C compressor
171	Anti–freeze thermostat
172	Radiator fan for A/C
173	Diode, A/C compressor
200	LH engine control module
203	Throttle position sensor

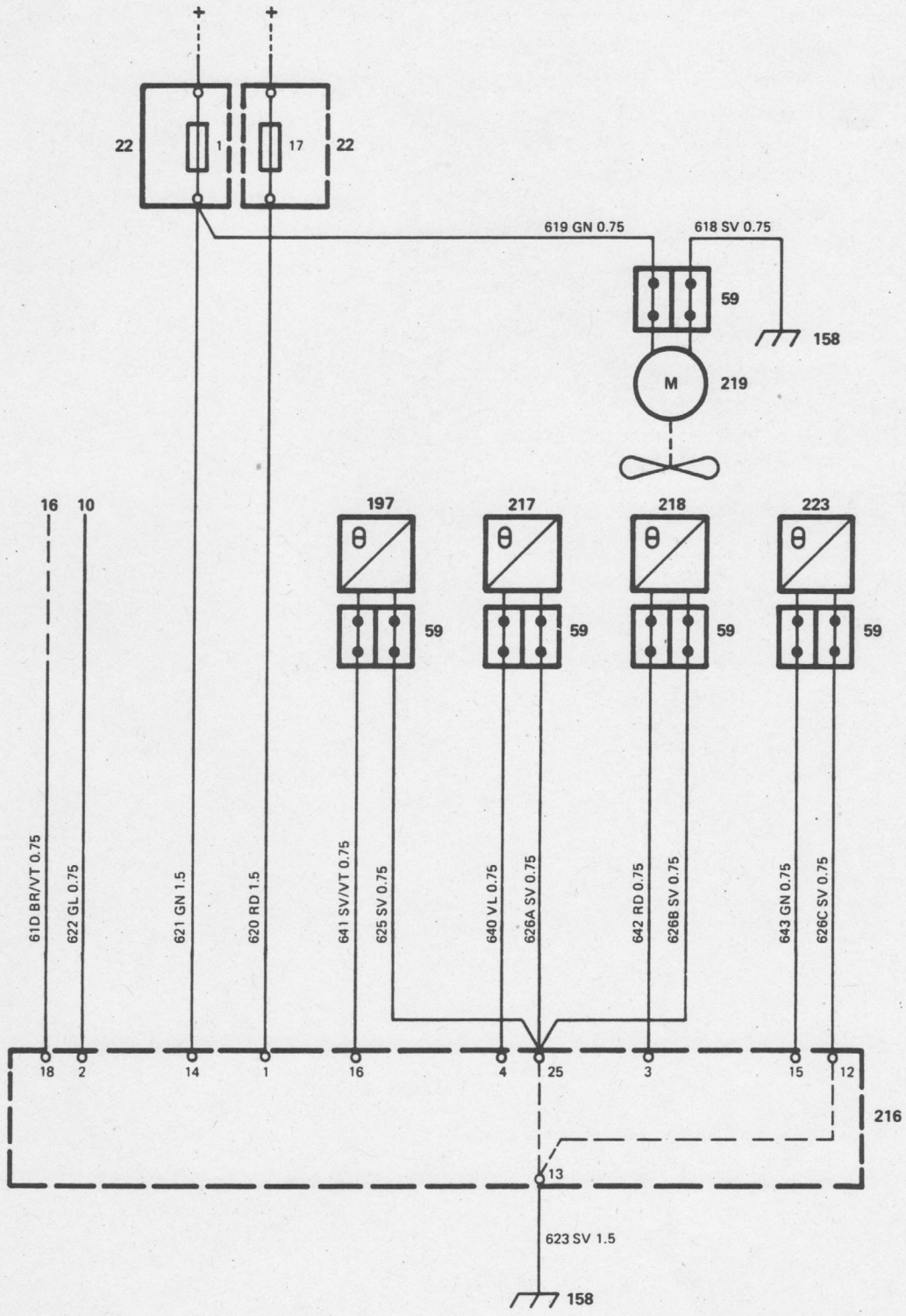

-30
230
-54
231
16
61T BR/VT 0.75
116
BL 2.5
116C
BL 0.75
103
VL 2.5
110A
GL 2.5
143
404 GN 0.75
116D
BL 0.75
409E
SV 0.75
409D
SV 0.75
405 BL 0.75
409C
SV 0.75
149
103A
VL 2.5
35
38
59
M
169
16
61A BR/VT 0.76
116B
BL 0.75
105 GL 1.5
106 BL 1.5
108 GN 2.5
104 GR 2.5
74
407 GL/VT 0.75
409
SV 0.75
158
407A
GL/VT 0.75
407B
GL/VT 0.75
166
116A GL 0.75
408A
GN/VT 0.75
+30
7C
GR 4.0
171
+15
159
122
GL/VT 2.5
122F
GL 0.5
761 GN 0.75
406
GN/VT 0.75
200
544 RD/VT 0.75
408 GN/RD 0.75
565
GN/RD 0.75
203
555
SV/VT 0.75
201
155
156
114
GN 2.5
410A
SV 0.75
111B
GN 2.5
112
SV 2.5
37
410
SV 0.75
403
BL 1.5
403A
BL 1.5
173
783
SV 0.75
60
K
170
111A
GN 2.5
112A
SV 2.5
172
7

ACC automatic climate control M1985–89

Sensor

List of components

22	Fuse box in electrical distribution box
59	2 pin connector
196	Outside temperature sensor
216	ACC control module
217	Blended air sensor
218	Cabin temperature sensor
219	Suction fan for cabin temperature sensor
223	Solar sensor

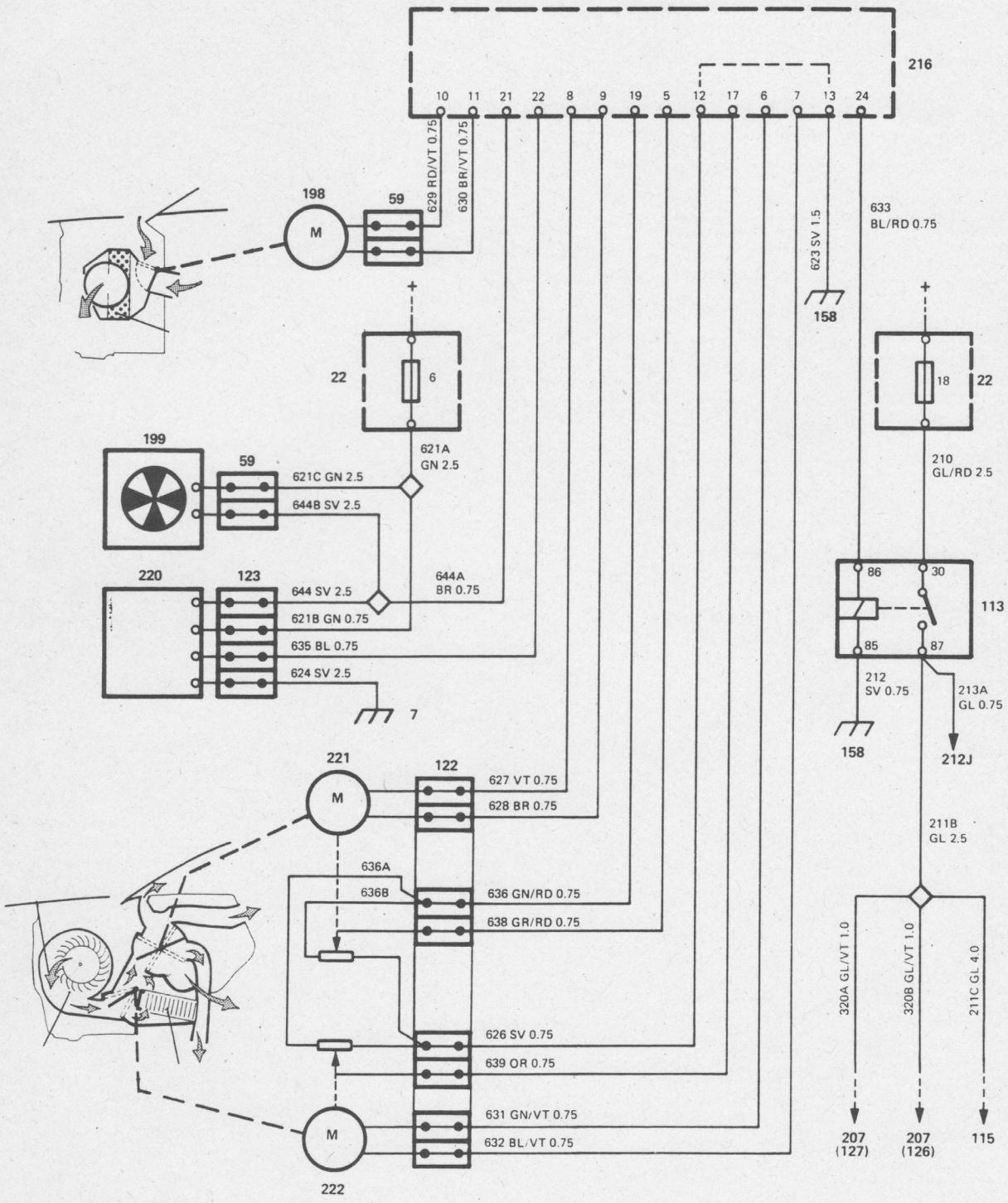

+
+
22
1
17
22
619 GN 0.75
618 SV 0.75
59
158
M
219
16
10
197
217
218
223
59
59
59
59
61D BR/VT 0.75
622 GL 0.75
621 GN 1.5
620 RD 1.5
641 SV/VT 0.75
625 SV 0.75
640 VL 0.75
626A SV 0.75
642 RD 0.75
626B SV 0.75
643 GN 0.75
626C SV 0.75
18
2
14
1
16
4
25
3
15
12
216
13
623 SV 1.5
158

ACC automatic climate control M1985–89

Actuator motors, electrically heated rear window

List of components

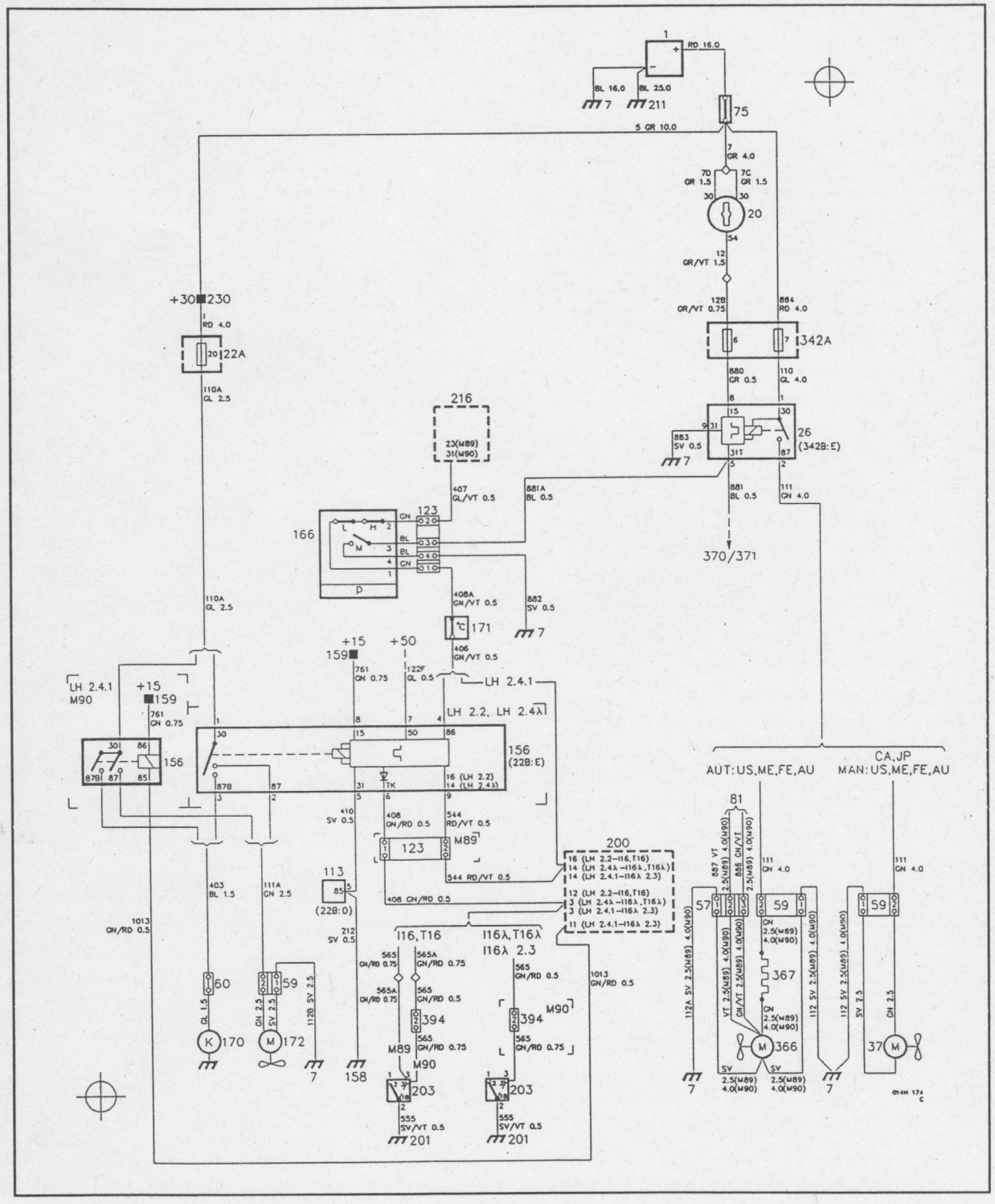
22	Fuse box in electrical distribution box
59	2 pin connector
113	Relay, electrically heated rear window
123	4 pin connector
198	Motor, air recirculation flap
199	Motor, cabin fan
216	ACC control module
220	Speed control, ventilation fan
221	Motor, air distributor
222	Air blending flap motor


216
10 11 21 22 8 9 19 5 12 17 6 7 13 24
629 RD/VT 0.75
630 BR/VT 0.75
198
59
M
623 SV 1.5
158
633
BL/RD 0.75
22
6
18
22
621A
GN 2.5
210
GL/RD 2.5
199
59
621C GN 2.5
644B SV 2.5
220
123
644 SV 2.5
621B GN 0.75
635 BL 0.75
624 SV 2.5
644A
BR 0.75
7
86
30
113
85
87
212
SV 0.75
213A
GL 0.75
158
212J
221
122
M
627 VT 0.75
628 BR 0.75
211B
GL 2.5
636A
636B
636 GN/RD 0.75
638 GR/RD 0.75
626 SV 0.75
639 OR 0.75
631 GN/VT 0.75
632 BL/VT 0.75
320A GL/VT 1.0
320B GL/VT 1.0
211C GL 4.0
207
(127)
207
(126)
115
222

Air conditioning, A/C M1990

List of components

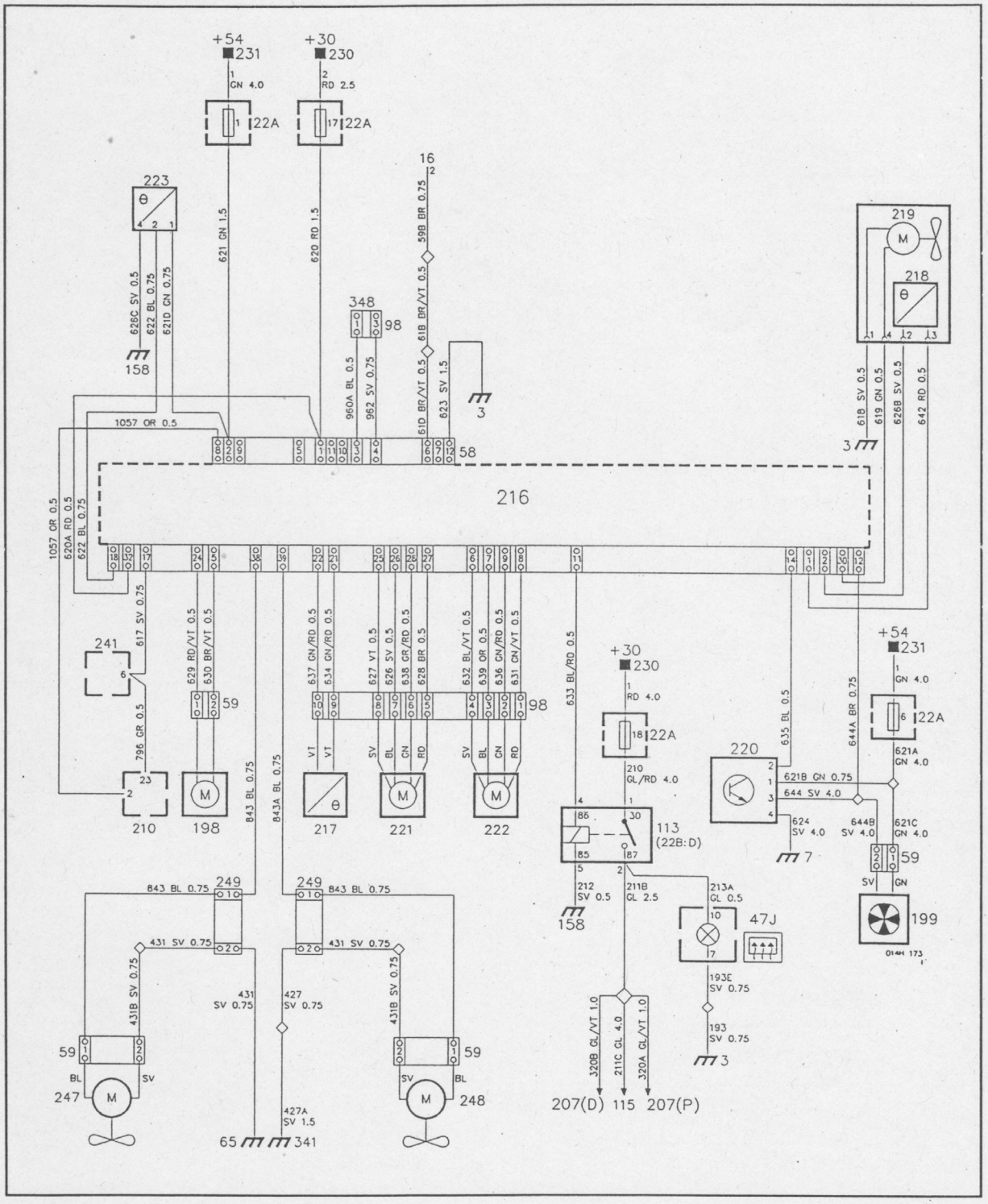
3	Grounding point
7	Grounding point
16	Rheostat
22A	Fuse board
26	Time delay relay, radiator fan
35	Switch, ventilation fan
37	Engine radiator fan
38	Motor, air recirculation flap
57	3 pin connector
59	2 pin connector
60	1 pin connector
74	Resistor, ventilation fan
113	Time delay relay, electrically heated rear window
123	4 pin connector
143	Switch, air recirculation flap
149	Main switch, fan
155	Relay, radiator fan
156	Relay, radiator fan
158	Distribution terminal, negative
159	Distribution terminal +15
166	Pressure switch, radiator fan
169	Switch, A/C
170	A/C compressor
171	Anti–freeze thermostat
172	Radiator fan for A/C
200	LH engine control module
201	Grounding point
203	Throttle position sensor
210	EDU
230	Distribution terminal +30
231	Distribution terminal +51
342A	Fuse board
366	Motor, fan
367	Resistor
370	Thermostatic switch
371	Thermostatic switch
394	24 pin connector


1
RD 16.0
BL 16.0
BL 25.0
7
211
75
5 GR 10.0
7
GR 4.0
7D
GR 1.5
7C
GR 1.5
30
30
20
54
12
GR/VT 1.5
12B
GR/VT 0.75
884
RD 4.0
6
7
342A
880
GR 0.5
110
GL 4.0
8
1
15
30
9
31
26
(342B:E)
883
SV 0.5
31T
87
7
5
2
881
BL 0.5
111
GN 4.0
370/371
+30
230
1
RD 4.0
20
22A
110A
GL 2.5
216
23(M89)
31(M90)
407
GL/VT 0.5
881A
BL 0.5
166
123
GN
BL
BL
GN
L
H
M
P
408A
GN/VT 0.5
882
SV 0.5
7
171
406
GN/VT 0.5
+15
159
761
GN 0.75
+50
122F
GL 0.5
LH 2.4.1
M90
LH 2.4.1
LH 2.2, LH 2.4λ
156
(22B:E)
30
15
50
86
87B
87
31
TK
16 (LH 2.2)
14 (LH 2.4λ)
410
SV 0.5
408
GN/RD 0.5
544
RD/VT 0.5
123
M89
200
16 (LH 2.2–I16,T16)
14 (LH 2.4λ –I16λ,T16λ)
14 (LH 2.4.1–I16λ 2.3)
12 (LH 2.2–I16,T16)
3 (LH 2.4λ –I16λ,T16λ)
3 (LH 2.4.1–I16λ 2.3)
11 (LH 2.4.1–I16λ 2.3)
113
85
(22B:D)
544 RD/VT 0.5
408 GN/RD 0.5
403
BL 1.5
1114
GN 2.5
101.3
GN/RD 0.5
212
SV 0.5
I16,T16
I16λ,T16λ
I16λ 2.3
565
GN/RD 0.75
565A
GN/RD 0.75
565A
GN/RD 0.75
565
GN/RD 0.5
394
M89
M90
565
GN/RD 0.75
203
555
SV/VT 0.5
201
101.3
GN/RD 0.5
60
GL 1.5
59
GN 2.5
SV 2.5
1128
SV 2.5
K
170
M
172
7
158
AUT:US,ME,FE,AU
CA,JP
MAN:US,ME,FE,AU
81
887 VT
2.5(M89) 4.0(M90)
888 GN/VT
2.5(M89) 4.0(M90)
111
GN 4.0
57
59
112A SV
2.5(M89) 4.0(M90)
VT
2.5(M89) 4.0(M90)
GN/VT
2.5(M89) 4.0(M90)
GN
2.5(M89) 4.0(M90)
367
M
366
SV
2.5(M89)
4.0(M90)
7
112 SV
2.5(M89) 4.0(M90)
SV 2.5
GN 2.5
37
M
01414 174
C

ACC automatic climate control M1990

List of components

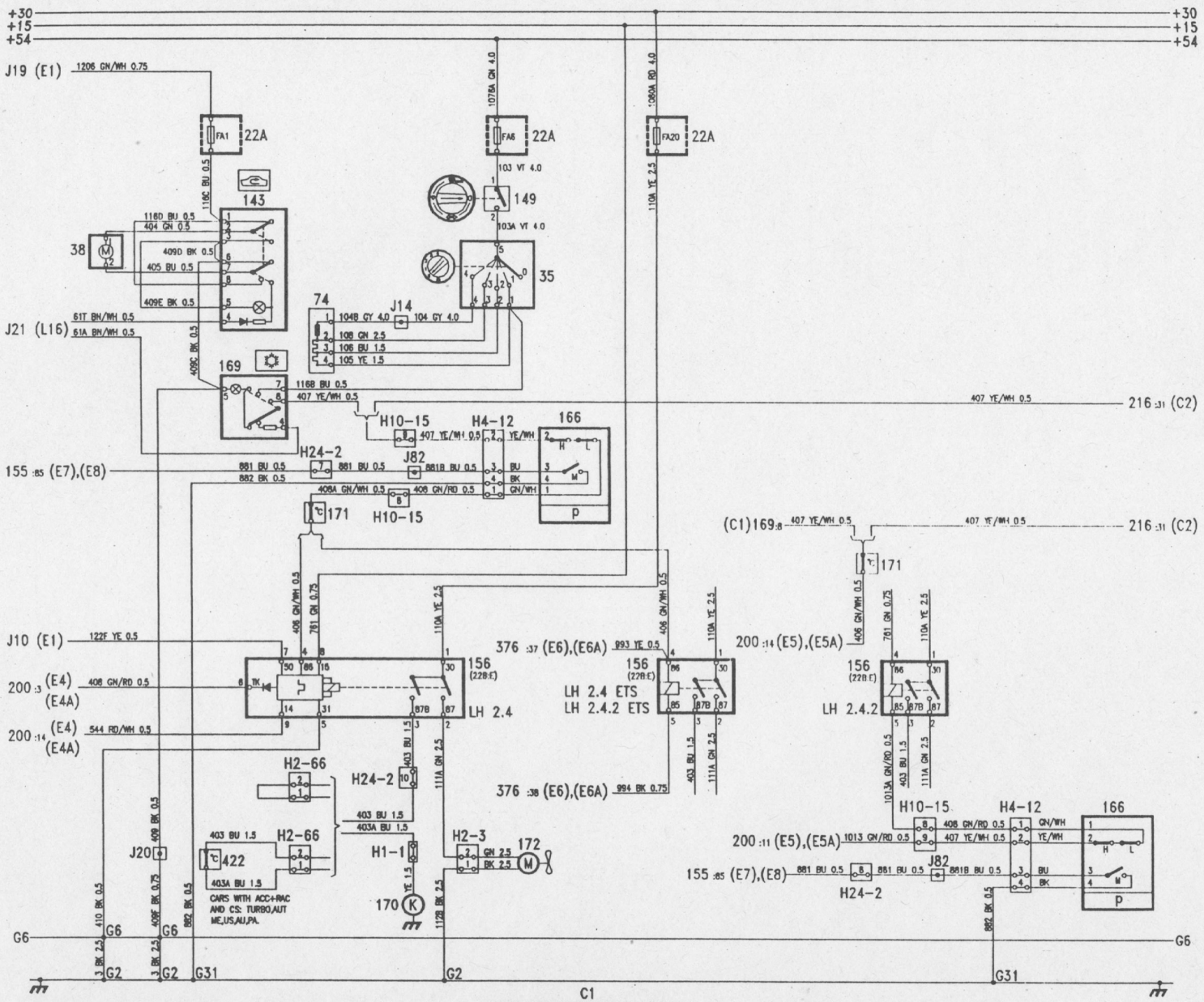
3	Grounding point
7	Grounding point
16	Rheostat
22A	Fuse board
47J	Indicator lamp
58	12 pin connector
59	2 pin connector
65	Grounding point
98	10 pin connector
113	Relay, electrically heated rear window
115	Electrically heated rear window
158	Distribution terminal, negative
198	Motor, air recirculation flap
199	Motor, cabin fan
207	Electric door mirrors
210	EDU
216	ACC control module
217	Blended air temperature sensor
218	Cabin temperature sensor
219	Suction fan for above
220	Speed control, ventilation fan
221	Motor, air distributor
222	Motor, air mixing damper
223	Solar sensor
230	Distribution terminal +30
231	Distribution terminal +54
241	DCC
248	Motor, door fan
249	7 pin connector
341	Grounding point
348	EDU data link connector


+54
231
+30
230
1 GN 4.0
2 RD 2.5
22A
22A
223
621 GN 1.5
620 RD 1.5
16
59B BR 0.75
61B BR/VT 0.5
348
98
960A BL 0.5
962 SV 0.75
61D BR/VT 0.5
623 SV 1.5
626C SV 0.5
622 BL 0.75
621D GN 0.75
158
3
1057 OR 0.5
58
216
219
218
618 SV 0.5
619 GN 0.5
626B SV 0.5
642 RD 0.5
620A RD 0.5
617 SV 0.75
241
629 RD/VT 0.5
630 BR/VT 0.5
59
796 GR 0.5
210
198
843 BL 0.75
843A BL 0.75
217
221
222
637 GN/RD 0.5
634 GN/RD 0.5
627 VT 0.5
626 SV 0.5
638 GR/RD 0.5
628 BR 0.5
632 BL/VT 0.5
639 OR 0.5
636 GN/RD 0.5
631 GN/VT 0.5
633 BL/RD 0.5
210 GL/RD 4.0
113 (22B:D)
212 SV 0.5
211B GL 2.5
213A GL 0.5
220
635 BL 0.5
621B GN 0.75
644 SV 4.0
624 SV 4.0
7
644A BR 0.75
621A GN 4.0
644B SV 4.0
621C GN 4.0
47J
193E SV 0.75
193 SV 0.75
199
014H 173
249
431 SV 0.75
431B SV 0.75
431 SV 0.75
427 SV 0.75
427A SV 1.5
65
341
247
248
320B GL/VT 1.0
211C GL 4.0
320A GL/VT 1.0
207(D)
115
207(P)

A/C air conditioning M1992

List of components

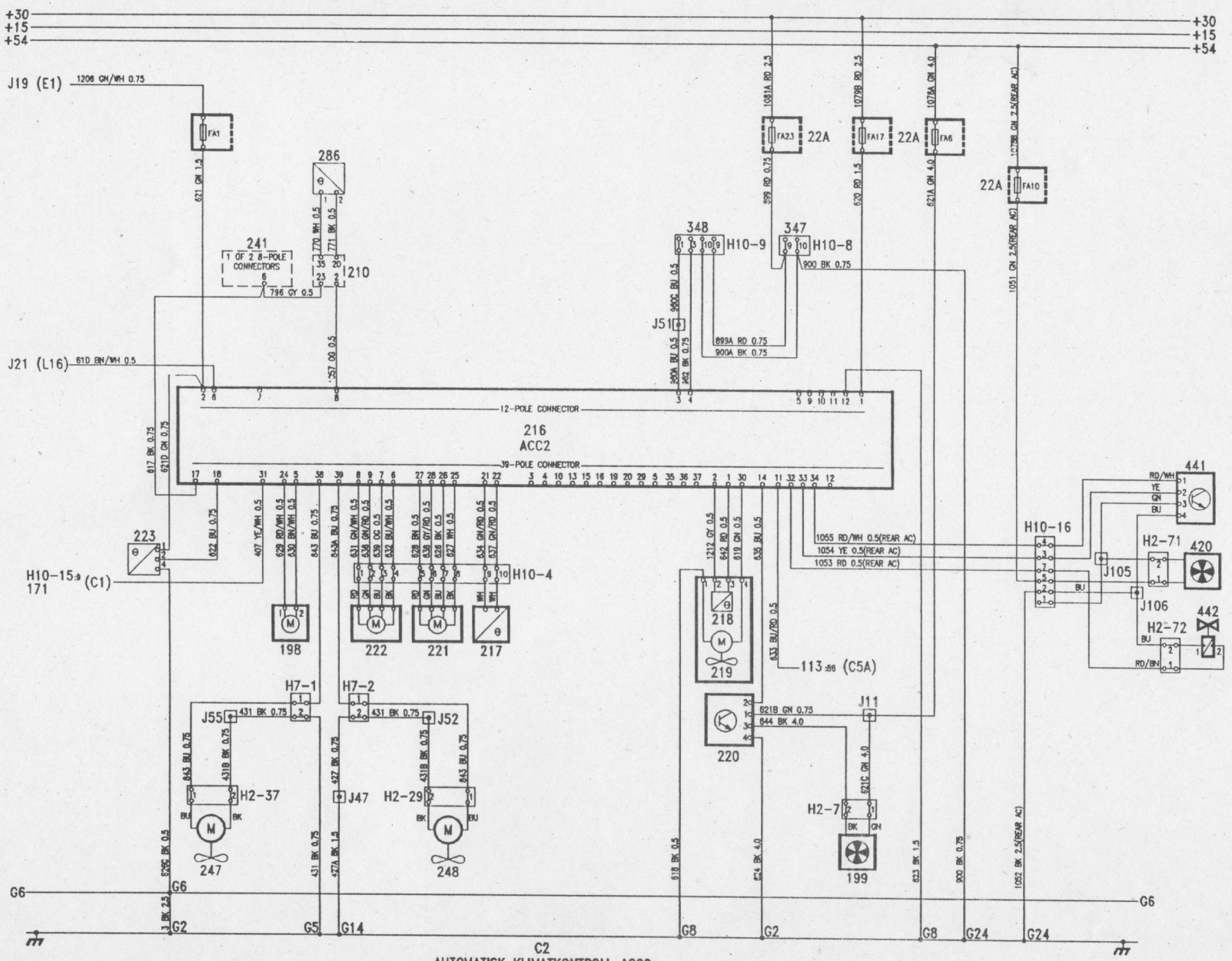
22A	Fuse box in electrical distribution box
35	Switch, ventilation fan
38	Motor, air recirculation flap
74	Resistor in ventilation fan
143	Switch, recirculation
149	Main switch, fan
155	Relay for A/C radiator fan
156	Relay for radiator fan
166	Pressure switch for radiator fan
169	Switch, A/C
170	A/C compressor
171	Anti–freeze thermostat
172	Radiator fan for A/C
200	LH engine control module
216	ACC control module
376	ETS
422	Thermostatic switch
H1–1	1 pin connector
H2–66	2 pin connector
H4–12	4 pin connector
H10–15	10 pin connector
H24–2	24 pin connector
G2	Grounding point
G6	Grounding point
G31	Grounding point


+30
+15
+54
J19 (E1)
1206 GN/WH 0.75
FA1 22A
FA6 22A
FA20 22A
1078A GN 4.0
1060A RD 4.0
1104 YE 2.5
116C BU 0.5
143
103 VT 4.0
149
103A VT 4.0
35
38
116D BU 0.5
404 GN 0.5
409D BK 0.5
405 BU 0.5
409E BK 0.5
74
J14
104B GY 4.0
104 GY 4.0
108 GN 2.5
106 BU 1.5
105 YE 1.5
J21 (L16)
61T BN/WH 0.5
61A BN/WH 0.5
409C BK 0.5
169
116B BU 0.5
407 YE/WH 0.5
407 YE/WH 0.5
216 :31 (C2)
H10-15
H4-12
166
H24-2
155 :85 (E7),(E8)
881 BU 0.5
882 BK 0.5
J82
881B BU 0.5
408A GN/WH 0.5
408 GN/RD 0.5
171
H10-15
(C1)169:8
407 YE/WH 0.5
407 YE/WH 0.5
216 :31 (C2)
171
406 GN/WH 0.5
781 GN 0.75
110A YE 2.5
J10 (E1)
122F YE 0.5
200 :3 (E4) (E4A)
408 GN/RD 0.5
200 :14 (E4) (E4A)
544 RD/WH 0.5
156 (22B:E)
LH 2.4
376 :37 (E6),(E6A)
993 YE 0.5
LH 2.4 ETS
LH 2.4.2 ETS
376 :38 (E6),(E6A)
994 BK 0.75
200 :14 (E5),(E5A)
LH 2.4.2
403 BU 1.5
111A GN 2.5
H2-66
H24-2
H1-1
H2-3
172
J20
422
403A BU 1.5
409 BK 0.5
409F BK 0.75
882 BK 0.5
CARS WITH ACC+PAC AND CS: TURBO,AUT ME,US,AU,PA.
170
112B BK 2.5
1013A GN/RD 0.5
200 :11 (E5),(E5A)
1013 GN/RD 0.5
407 YE/WH 0.5
155 :85 (E7),(E8)
881 BU 0.5
881B BU 0.5
H24-2
410 BK 0.5
3 BK 2.5
G6
G2
G31
C1
LUFTKONDITIONERING AC/ACC2
AIR CONDITIONER AC/ACC2

ACC automatic climate control M1992

List of components

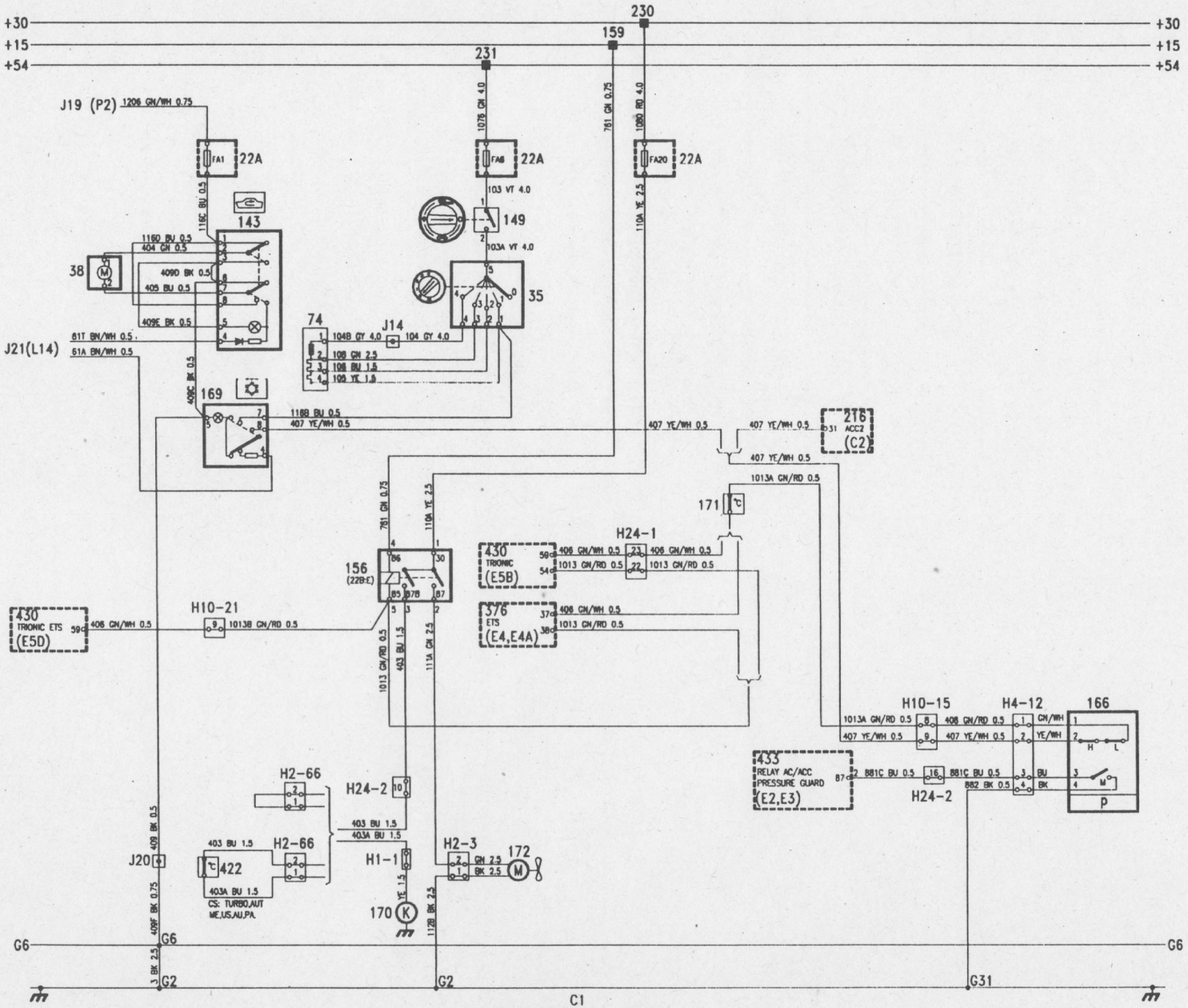
22A	Fuse box in electrical distribution box
113	Relay, electrically heated rear window
171	Anti–freeze thermostat
198	Motor, air recirculation flap
199	Motor, cabin fan
210	EDU
216	ACC control module
217	Blended air temperature sensor
218	Cabin temperature sensor
219	Suction fan, cabin temperature sensor
220	Speed control, ventilation fan
221	Motor, air distributor
222	Motor, air mixing damper
223	Solar sensor
241	SCC
247	Motor, door fan, left
248	Motor, door fan, right
286	Outside temperature sensor
347	Data link connector, motor
348	Data link connector
420	Fan motor, rear A/C
441	Speed control, rear A/C
442	Solenoid valve, rear A/C
H2–7	2 pin connector
H2–29	2 pin connector
H2–37	2 pin connector
H2–71	2 pin connector
H2–72	2 pin connector
H7–1	7 pin connector
H7–2	7 pin connector
H10–4	10 pin connector
H10–16	10 pin connector
G2	Grounding point
G5	Grounding point
G6	Grounding point
G8	Grounding point
G14, 24	Grounding point


+30
+15
+54
J19 (E1)
1206 GN/WH 0.75
FA1
621 GN 1.5
286
241
1 OF 2 8-POLE CONNECTORS
796 GY 0.5
J210
J21 (L16)
610 BN/WH 0.5
257 OG 0.5
1081A RD 2.5
FA23
22A
999 RD 0.75
10798 RD 2.5
FA17
620 RD 1.5
1078A GN 4.0
FA6
621A GN 4.0
1051 GN 2.5(REAR AC)
FA10
348
H10-9
347
H10-8
900 BK 0.75
J51
900A BU 0.5
899A RD 0.75
900A BK 0.75
12-POLE CONNECTOR
216
ACC2
39-POLE CONNECTOR
617 BK 0.75
6210 GN 0.75
223
H10-15:9
171
(C1)
622 BU 0.75
407 YE/WH 0.5
629 RD/WH 0.5
630 BN/WH 0.5
843 BU 0.75
843A BU 0.75
631 GN/WH 0.5
634 GN/RD 0.5
639 OG 0.5
632 BU/WH 0.5
628 BN 0.5
636 GY/RD 0.5
638 BK 0.5
627 WH 0.5
634 GN/RD 0.5
637 GN/RD 0.5
H10-4
198
222
221
217
1212 GY 0.5
642 RD 0.5
619 GN 0.5
635 BU 0.5
218
219
433 BU/RD 0.5
113:86
(C5A)
H10-16
1055 RD/WH 0.5(REAR AC)
1054 YE 0.5(REAR AC)
1053 RD 0.5(REAR AC)
441
RD/WH
YE
GN
BU
H2-71
420
J105
J106
442
H2-72
BU
RD/BN
H7-1
H7-2
J55
431 BK 0.75
J52
4318 BK 0.75
H2-37
H2-29
J47
427 BK 0.75
247
248
220
6218 GN 0.75
644 BK 4.0
J11
6210 GN 4.0
H2-7
199
5295 BK 0.5
431 BK 0.75
472A BK 1.5
618 BK 0.5
624 BK 4.0
623 BK 1.5
900 BK 0.75
1052 BK 2.5(REAR AC)
G6
G2
G5
G14
G8
G24
C2
AUTOMATISK KLIMATKONTROLL ACC2
AUTOMATIC CLIMATE CONTROL ACC2

A/C air conditioning M1994–

List of components

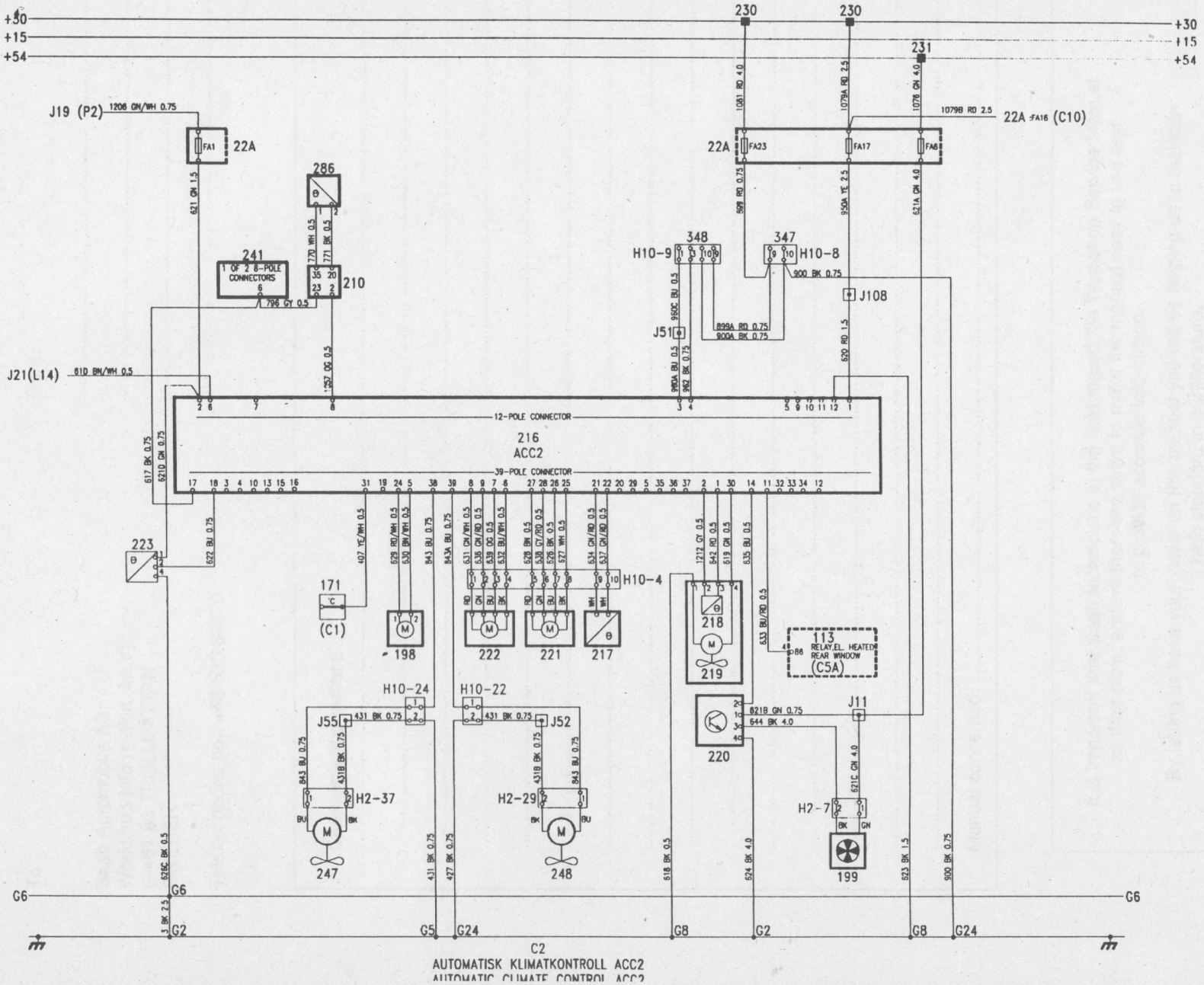
22A	Fuse box
35	Switch, ventilation fan
36	Motor, ventilation fan
37	Motor, radiator fan
38	Motor, air recirculation flap
74	Resistor in ventilation fan
75	Distribution terminal +
113	Relay, electrically heated rear window
116	Switch, electrically heated rear window
143	Switch, recirculation
149	Main switch, fan
155	Relay for A/C radiator fan
156	Relay for radiator fan
166	Pressure switch for radiator fan
170	A/C compressor
171	Anti–freeze thermostat
172	Radiator fan for A/C
179	Solenoid valve
210	EDU
230	Distribution terminal +30
231	Distribution terminal +54
370	Thermostatic switch
37	Thermostatic switch
H1–1	1 pin connector
H2–66	2 pin connector
H4–12	4 pin connector
G6	Grounding point
G7, 8	Grounding point


+30
+15
+54
230
159
231
J19 (P2)
1206 GN/WH 0.75
FA1
22A
FA8
FA20
1075 GN 4.0
761 GN 0.75
1060 RD 4.0
103 VT 4.0
149
103A VT 4.0
110A YE 2.5
143
1160 BU 0.5
404 GN 0.5
38
4090 BK 0.5
405 BU 0.5
409E BK 0.5
35
74
J14
104B GY 4.0
104 GY 4.0
108 GN 2.5
108 BU 1.5
109 YE 1.5
J21(L14)
61T BN/WH 0.5
61A BN/WH 0.5
409C BK 0.5
169
116B BU 0.5
407 YE/WH 0.5
216
ACC2
(C2)
171
1013A GN/RD 0.5
781 GN 0.75
110A YE 2.5
156
(228:E)
H24-1
430
TRIONIC
(E5B)
406 GN/WH 0.5
1013 GN/RD 0.5
376
ETS
(E4,E4A)
430
TRIONIC ETS
(E5D)
H10-21
1013B GN/RD 0.5
1013 GN/RD 0.5
403 BU 1.5
111A GN 2.5
H10-15
H4-12
166
CN/WH
YE/WH
BU
BK
H
L
M
P
433
RELAY AC/ACC
PRESSURE GUARD
(E2,E3)
881C BU 0.5
882 BK 0.5
H24-2
H2-66
403A BU 1.5
422
CS: TURBO,AUT
ME,US,AU,PA
H1-1
H2-3
GN 2.5
BK 2.5
172
170
J20
409 BK 0.5
409F BK 0.75
3 BK 2.5
112B BK 2.5
YE 1.5
G6
G2
G31
C1
LUFTKONDITIONERING AC/ACC2
AIR CONDITIONER AC/ACC2

ACC automatic climate control M1994–

List of components

16	Rheostat, lighting for controls
113	Relay, electrically heated rear window
198	Motor, air recirculation flap
199	Motor, cabin fan
210	EDU control module
216	ACC control module
217	Blended air temperature sensor
218	Cabin temperature sensor
219	Suction fan, cabin temperature sensor
220	Speed control for ventilation fan
221	Motor, air distributor
222	Motor, air mixing damper
223	Solar sensor
230	Distribution terminal +30
231	Distribution terminal +54
247	Fan, left–hand rear door
248	Fan, right–hand rear door
286	Outside temperature sensor, EDU
348	Data link connector, diagnostics
G2	Grounding point, battery shelf
G5	Grounding point on left–hand side under rear seat
G8	Grounding point on left–hand side under facia
G24	Grounding point under right–hand front seat
J19	**LHD:** Branching point approx. 180 mm from ignition switch and approx. 260 mm from windscreen wiper and rear windscreen wiper switch. **RHD:** Branching point approx. 260 mm from ignition switch.
J21	**LHD:** Branching point approx. 150 mm from preinstalled telephone connector towards the instrument. **RHD:** Branching point approx. 190 mm from the branch for radio switches towards right–hand side of car.
J51	Branching point approx. 275 mm from data link connector under right–hand front seat.
J108	Branching point approx. 180 mm from output on fuse 17 in electrical distribution box in facia.


+30
+15
+54
230
230
231
+30
+15
+54
J19 (P2)
1208 GN/WH 0.75
22A
FA1
22A
FA23
FA17
FA6
22A (C10)
10798 RD 2.5
286
241
1 OF 2 8-POLE CONNECTORS
210
796 GY 0.5
J21(L14)
611 BN/WH 0.5
348
347
H10-9
H10-8
900 BK 0.75
J108
J51
12-POLE CONNECTOR
216
ACC2
39-POLE CONNECTOR
223
171
(C1)
H10-4
198
222
221
217
218
219
113
RELAY,EL HEATED REAR WINDOW
(C5A)
H10-24
H10-22
J55
J52
J11
220
H2-37
H2-29
H2-7
247
248
199
G6
G2
G5
G24
G8
C2
AUTOMATISK KLIMATKONTROLL ACC2

Workshop Information

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From

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Comments/suggestions

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Manual concerned: .....

It is important that Saab technicians in the field regard the Workshop Service Manual as their bible, and we therefore strive to make the manual easy to use and to provide accurate information.

By letting us have your views on this manual you will be helping us to maintain a high standard in our literature.

Note down any comments or suggestions you may have on a sheet of paper or take a copy of this page and send us your views at the above address. For greater convenience, you are also welcome to send your comments by fax, using the telephone number shown.

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