SAAB

900

SERVICE MANUAL

2:4 Exhaust system, cooling system, turbo system

M 1981–86–

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Units

The basic units as well as the derived units used throughout the Service Manual are in accordance with the SI system.

As a supplement to these, a number of other units are specified within brackets.

The following symbols for the various units have been used in this issue:

SI unit	Supplementary unit	Also equivalent to
mm	in	-
kg	lbs	lb
N	lbs	lbf
Nm	ft.lbs	lbf•ft
bar	PSI	lbf/in^2
l	qts (US)	-
°C	°F	-

Conversion factors

1 in = 25,4 mm	1 mm = 0.039 in
1 lbs = 4,45 N	1 N = 0,23 lbs
1 ft.lbs = 1,36 Nm	1 Nm = 0,74 ft.lbs
1 PSI = 0,07 bar	1 bar = 14,5 PSI
1 qts = 0,95 l	1 l = 1,05 qts

Production: Technical Publications, Saab-Scania, Trollhättan, Sweden

Technical Data

Turbo system

			B201	B202
Maximum charging pressure	1981 (USA)	bar (PSI)	0.5 ± 0.05 (7.2 ± 0.7)	
	1982 (USA)	bar (PSI)	0.6 ± 0.05 (8.6 ± 0.7)	
	1983 (USA)	bar (PSI)	0.65 ± 0.05 (9.5 ± 0.7)	
	1984-	bar (PSI)	0.70 ± 0.05 (10.1 ± 0.7)	0.85 ± 0.05 (12.3 ± 0.7)
	1984- (USA)	bar (PSI)		0.75 ± 0.05 (10.8 ± 0.7)
Basic charging pressure, APC	-1985	bar (PSI)	0.30 ± 0.03 (4.4 ± 0.4)	0.40 ± 0.03 (5.8 ± 0.4)
	-1985 (USA)	bar (PSI)		0.35 ± 0.03 (5.0 ± 0.04)
	1985	bar (PSI)	0.32 ± 0.03 (4.6 ± 0.4)	
	1986	bar (PSI)	0.32 ± 0.03 (9.6 ± 0.4)	
Tripping pressure for pressure switch,	1981 (USA)	bar (PSI)		
	Non Turbo			0.7 ± 0.1 (10.1 ± 1.4)
	Others	bar (PSI)	0.95 ± 0.05 (13.8 ± 0.7)	1.10 ± 0.05 (16.0 ± 0.7)
	Others (USA)	bar (PSI)		0.95 ± 0.05 (13.7 ± 0.7)
Turbo shaft bearing	end float	mm (in)	0.025-0.10 mm (0.0010-0.0039)	
	radial clearance	mm (in)	0.075-0.18 mm (0.0030-0.0071)	

Exhaust emission control system

EGR system and delay valve, Sweden specification
(also specifications for Switzerland and Australia as from 1983 models)

Engine	Model year	Type	Flow through valve, kg/h (lb/h)	Diameter of restriction, mm (in)	Delay, s
CM	1981-83	-	-	-	2
	1984-	On/off	6 (13)	4.0 (0.1575)	2
CA	1984-	On/off	20 (44)	4.3 (0.1693)	2
TM	1981-83	-	-	-	2
TA	1981-83	On/off	20 (44)	4.0 (0.1575)	-
IM	1981-83	-	-	-	2
	1984-*	2-port	10 (22)	5.0 (0.1969)	2
IA	1981-83	2-port	10 (22)	10.0 (0.3937)	2
	1984-		20 (44)	5.0 (0.1969)	2
SM, SAM	1982-	On/off	6 (13)	4.0 (0.1575)	20
SA, SAA	1981-83	On/off	20 (44)	4.0 (0.1575)	6
	1984-		20 (44)	4.0 (0.1575)	2
SLM (B202)	1985-	Prop.	20 (44)	4.7 (0.850)	-

* This type of valve was introduced during the 1983 model year.

Thermostatic valve

Opening temperature of thermostatic valve	°C (°F)	43 (110) approx.

EGR

		On/off	Two-port
Engine speed (fast idling) at which the valve should open			
EGR valve fully open at	r/min	approx. 2500	approx. 3500
EGR valve opens at	r/min	approx. 1900	approx. 2600

Colour coding

EGR valve:	kg (lb/h)	Green=6 (13) Red=10 (22) Blue=20 (44)
Delay valve:	s	Brown=2 White=6 Green=20

Mechanical throttle damper (dash pot)

			Sweden	Europe
Delay time from 3000 r/min to idling speed		s	3-6	3-6
Setting speed:	single carburetor	r/min	2600 ± 100	
	twin carburetors	r/min	3000 ± 100	
	fuel injection	r/min	2000 ± 100	2500 ± 100
	Turbo 16	r/min	2600 ± 100	2600 ± 100

As from 1983 models, also applicable to Switzerland specifications

Cooling system

Coolant

Type		Saab Original Coolant
Capacity	litre (qts)	10 (10.5)

Thermostat

Opening temperature	°C (°F)	89 ± 2 (192 ± 4)	82 ± 2 (179 ± 4)*

* Certain market specs. only

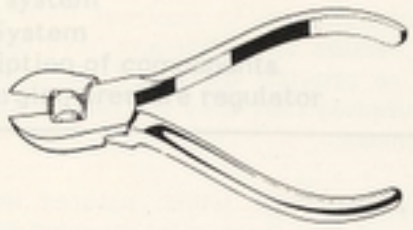
Expansion tank

Pressure valve opens at	bar (PSI)	0.9 - 1.2 (13-17)

Thermostatic switch

Makes circuit at	°C (°F)	90 - 95 (194-203)
Breaks circuit at	°C (°F)	85 - 90 (185-194)

Special tools



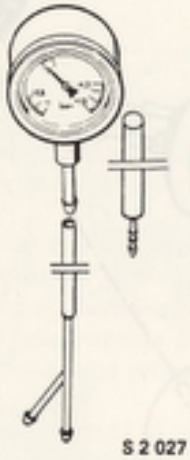
83 92 912 — Sealing pliers, charge pressure regulator, Turbo, control unit

S 2 025

83 93 472 — Bihex flare nut socket

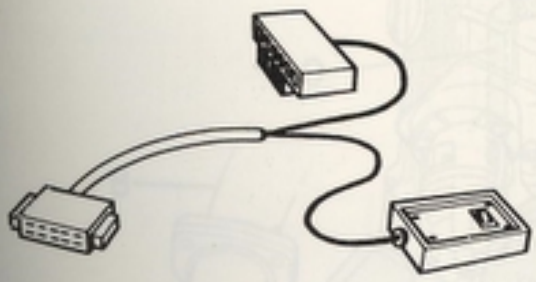
S 6 014

83 96 480 — Socket adaptor for Turbo oil return pipe



S 2 027

83 93 514 — Pressure gauge for Turbo APC boost and component check

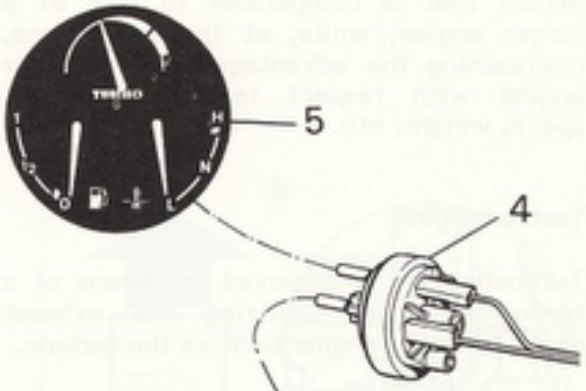


S 2 026

83 93 548 — Test wiring harness (up to 1985 models)

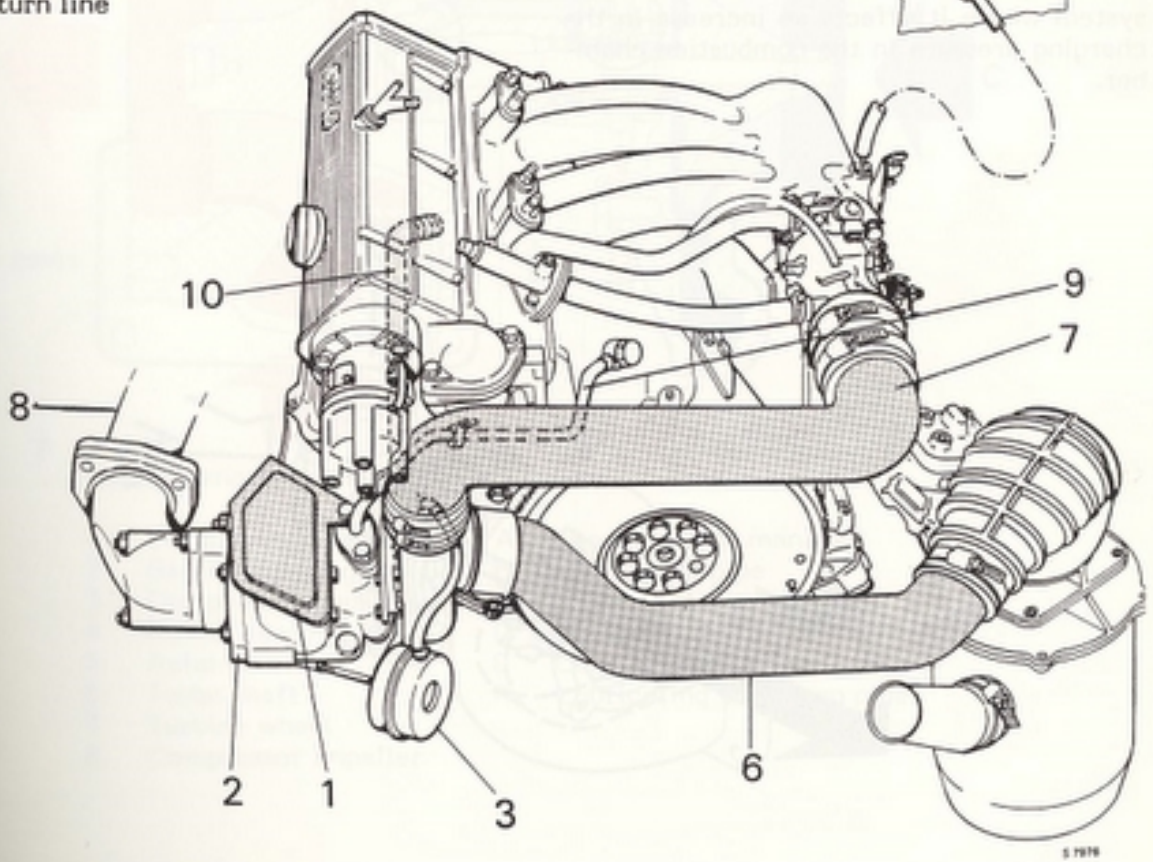
83 94 074 — Test wiring harness (as from 1986 models)

Technical Description



Turbo engine

1 Turbocharger
2 Waste-gate valve
3 Diaphragm unit
4 Pressure switch
5 Turbo gauge
6 Hose, air cleaner to turbocharger
7 Hose, turbocharger to inlet manifold
8 Exhaust pipe
9 Oil supply line
10 Oil return line



Turbo system

Supercharging, general

In contrast to conventional engines, a super-charged engine provides improved charging on the induction stroke, which produces more effective combustion of the mixture and an increase in power output and torque. With a supercharged engine, it is possible to achieve performance that is comparable to that of a larger engine, while, at the same time, maintaining the advantages of a smaller engine with respect to fuel economy, space, weight, etc.

Turbocharging

Turbocharging is achieved by means of a turbo-compressor, utilizing the exhaust gases from the engine to drive the turbine.

The exhaust gases are led to an exhaust gas turbine, causing the turbine wheel to rotate. The turbine wheel is mounted on the same shaft as a compressor impeller which rotates at the same speed.

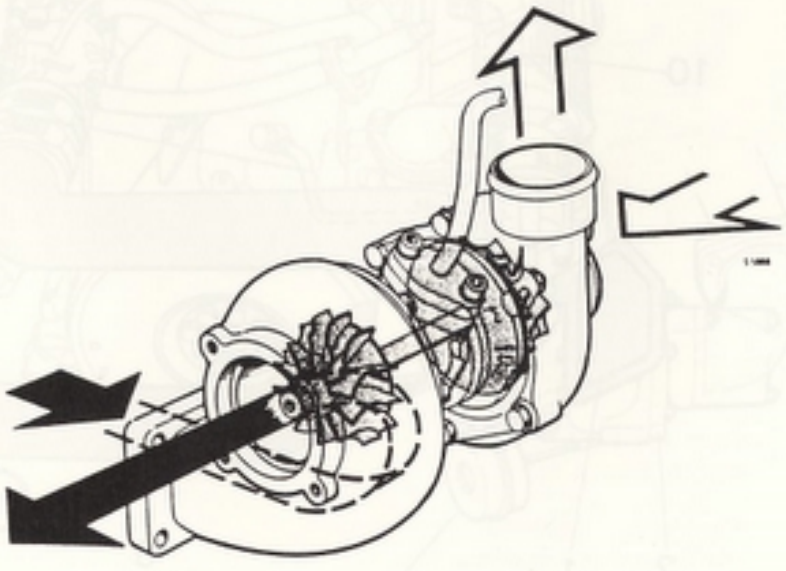
The compressor is located in the induction system where it effects an increase in the charging pressure in the combustion chamber.

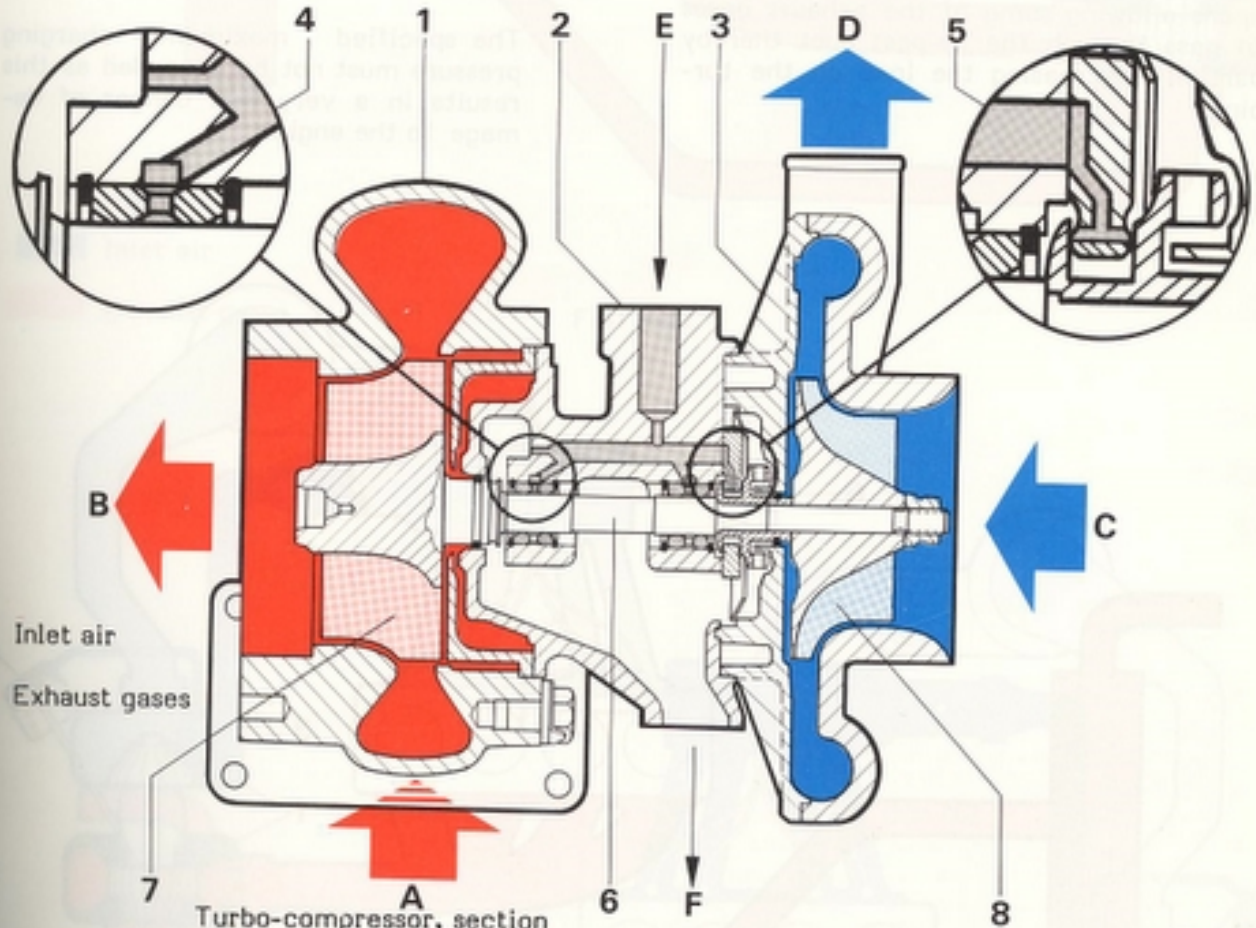
The Saab Turbo unit has been designed to start operating at relatively low engine speeds, in order to provide increased torque at engine speeds typical of normal driving conditions. In contrast to the Saab Turbo, earlier turbochargers have been designed to provide increased performance, which implies that they are only utilized at full throttle.

The turbine shaft which rotates at very high speed has been very accurately balanced. The shaft is mounted in a floating sliding-contact bearing through which there is a relatively high oil flow. Thus, during rotation, the shaft floats on a film of oil.

The lubricating oil is supplied by the engine lubricating system through a special line running from the oil pump. Return oil flows through a relatively large-bore pipe back to the sump.

Sealing between the shaft and the bearing housing consists of sealing rings (piston ring type) installed in grooves in the shaft.





Turbo-compressor, section

1	Turbine housing	A	From exhaust manifold
2	Bearing housing	B	To exhaust pipe
3	Compressor housing	C	From air cleaner
4	Radial bearing	D	To inlet manifold
5	Axial bearing	E	Lubricating oil line
6	Turbo shaft	F	Lubricating oil return pipe
7	Turbine wheel		
8	Compressor impeller		

Charging pressure control

The charging pressure in the inlet manifold is principally controlled by engine speed and load. The charging pressure is, however, limited under high loads by a charging pressure regulator. The charging pressure regulator is located on the exhaust side of the engine and controls the exhaust gas flow through a by-pass duct at the side of the turbine.

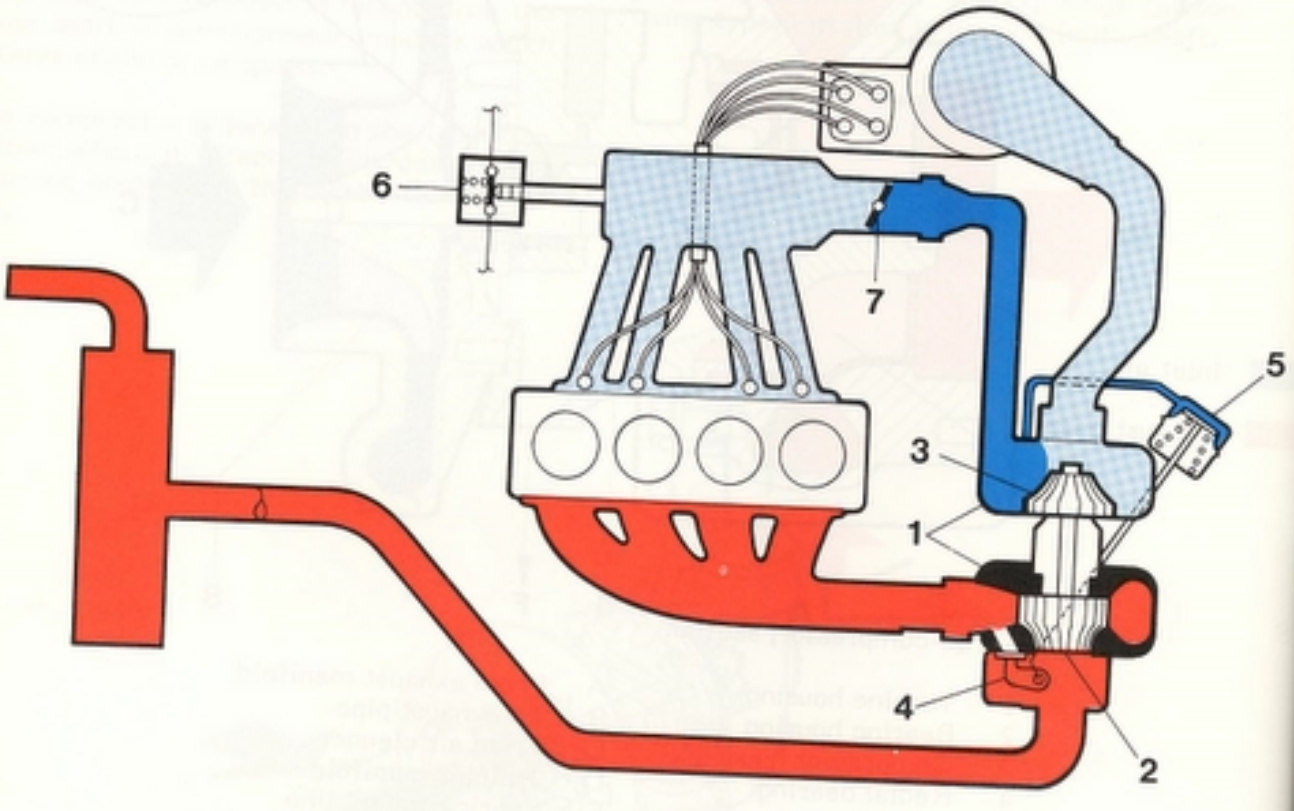
The charging pressure regulator (waste-gate) valve is closed when the load on the engine is normal or less. As the load increases and the charging pressure approaches the maximum permissible level the waste-gate opens allowing some of the exhaust gases to pass through the by-pass duct thereby partially decreasing the load on the turbine.

The charging pressure regulator is a flap valve which closes or opens the by-pass duct at the side of the turbine wheel. The flap valve is activated by a rod from a diaphragm capsule situated at the compressor housing. A spring in the diaphragm capsule closes the flap. The diaphragm is activated by pressure in the compressor.

When pressure in the compressor is greater than that of the spring the flap is opened thereby releasing some gases from the side of the turbine, so reducing the load it is subjected to. This, in turn, also reduces the compressor pressure.

Caution

The specified maximum charging pressure must not be exceeded as this results in a very real danger of damage to the engine.

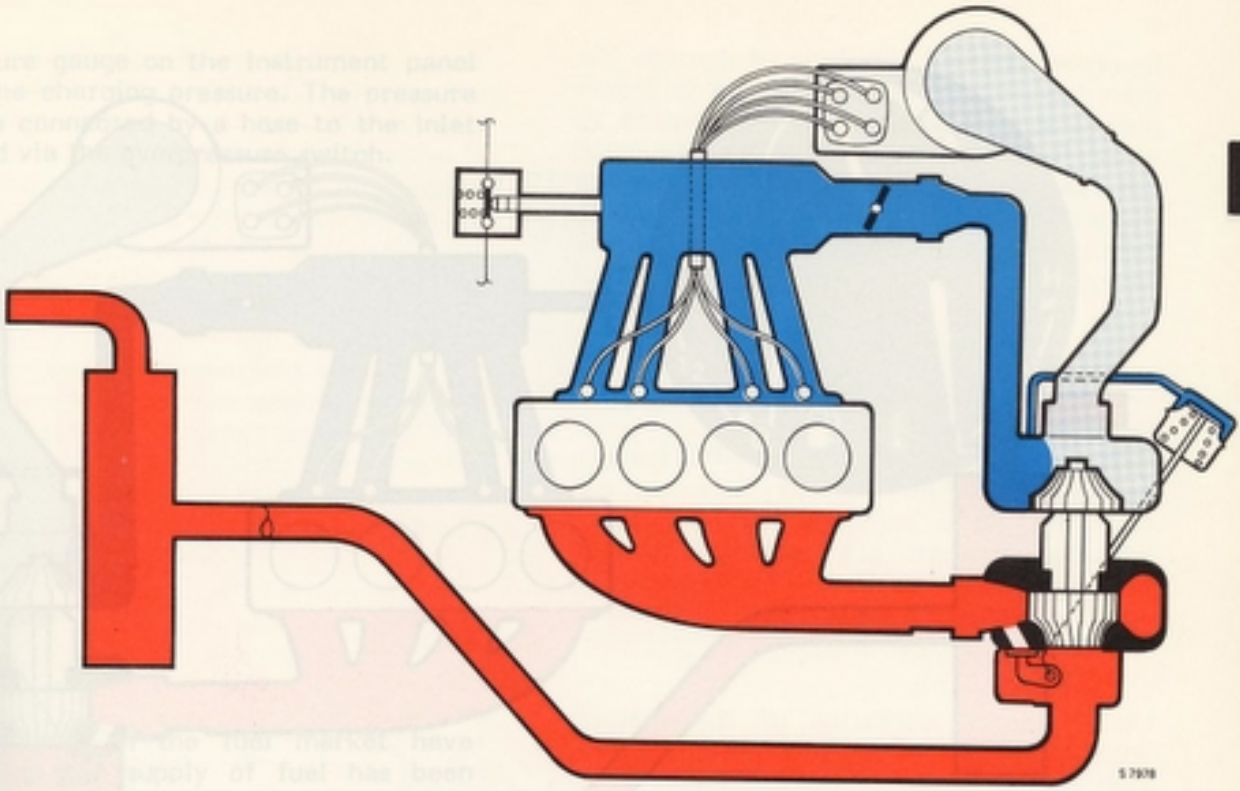


Engine idling

Inlet air

Exhaust gases

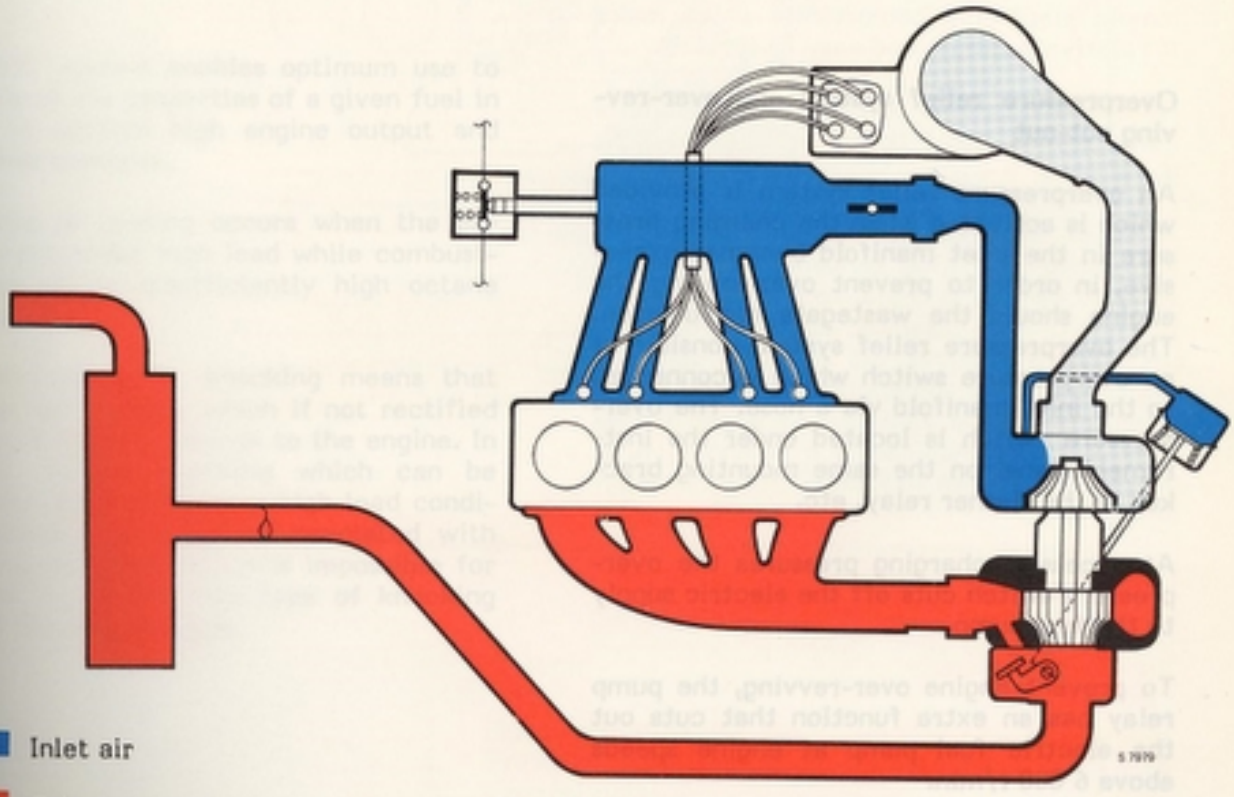
1 Turbo-compressor
2 Turbine wheel
3 Compressor impeller
4 Charge pressure regulator
5 Diaphragm unit
6 Pressure switch
7 Throttle bytterfly



Inlet air

Exhaust gases

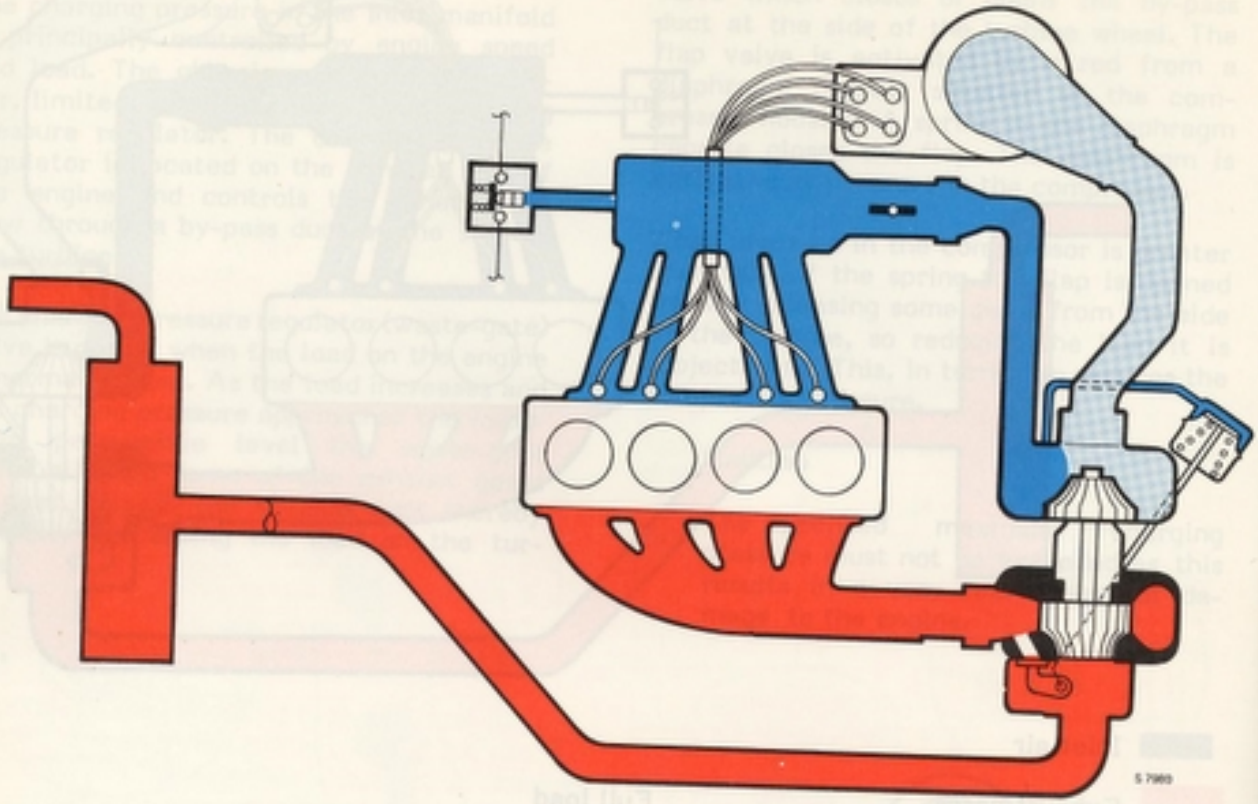
Full load



Inlet air

Exhaust gases

Partial load



Inlet air

Exhaust gases

Excessive pressure in the inlet manifold at full load (e.g. sticking charging pressure regulator)

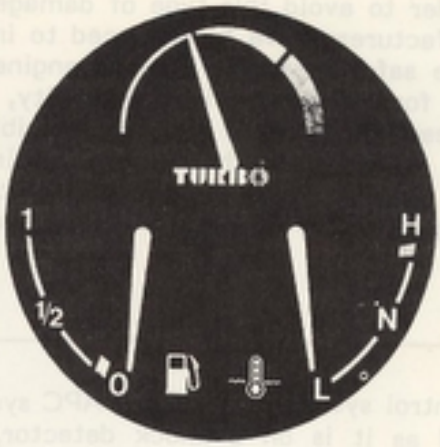
Overpressure relief system and over-revving cut-out

An overpressure relief system is provided which is activated when the charging pressure in the inlet manifold becomes excessive, in order to prevent over-loading the engine should the wastegate malfunction. The overpressure relief system consists of an overpressure switch which is connected to the inlet manifold via a hose. The overpressure switch is located under the instrument panel on the same mounting bracket as the flasher relay, etc.

At excessive charging pressures the overpressure switch cuts off the electric supply to the fuel pump.

To prevent engine over-revving, the pump relay has an extra function that cuts out the electric fuel pump at engine speeds above 6 000 r/min.

A pressure gauge on the instrument panel shows the charging pressure. The pressure gauge is connected by a hose to the inlet manifold via the overpressure switch.



APC System

General

Recent trends in the fuel market have meant that the supply of fuel has been irregular and this has resulted in varying quality.

The quality of automobile fuel also varies as a result of different standards and environmental requirements in various countries, which means that the octane rating can vary by several points from one country to another.

The APC system enables optimum use to be made of the properties of a given fuel in order to achieve high engine output and good fuel economy.

Knocking or pinking occurs when the engine is put under high load while combusting fuel of an insufficiently high octane rating.

In technical terms, knocking means that the fuel self-ignites, which if not rectified can cause serious damage to the engine. In addition to the knocking which can be detected under temporary high load conditions there is a knocking associated with high engine speeds which is impossible for the ear to detect. This type of knocking causes the most damage.

In order to avoid this type of damage the manufacturers have been forced to incorporate safety margins in their engines to allow for differences in fuel quality, with the result that it has not been possible to make full use of the energy obtainable from the fuel for propelling the car - energy has been lost in the form of wasted heat.

Note
A control system such as the APC system, based as it is on a knock detector, can never eliminate individual occurrences of knocking as these are necessary for the function of the system. This knocking is not detrimental to the engine.

Under normal operation of the system, with the engine under load, periodic knocking can be heard in the passenger compartment - one knock approx. every three seconds. This knocking is not detrimental to the egine.

Principle of operation

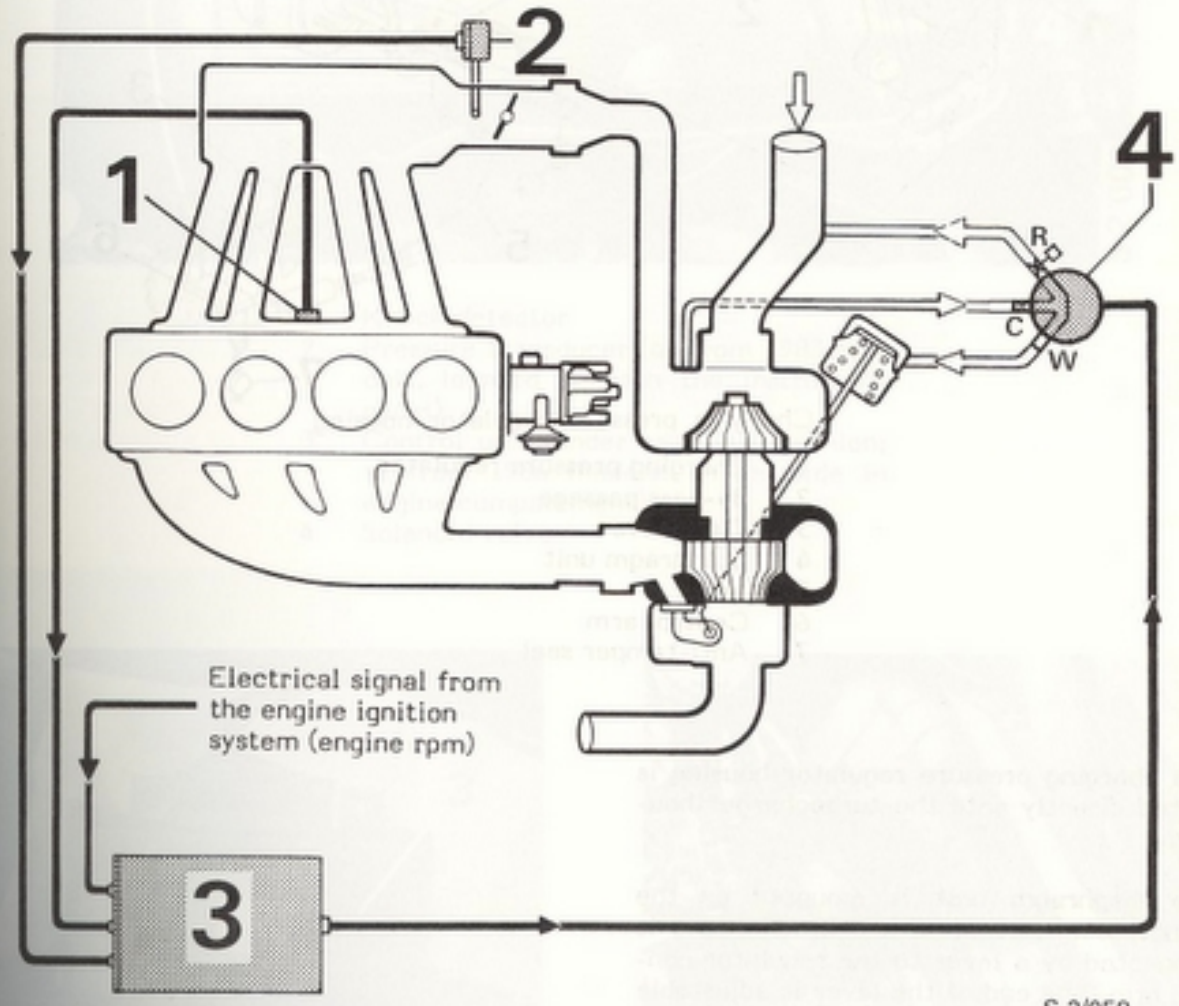
The APC system consists of few moving parts. The system is principally based on simple electronic components which make it relatively robust and easy to service.

An engine with the APC system automatically adapts itself to the quality of fuel being used.

A knock detector (1) senses the engine's load ratio (knocking tendency) and transmits an electrical signal to the control unit (3) which also receives signals from the pressure transducer (2) and the ignition system (engine speed). These signals are processed by the control unit which transmits electric impulses to a solenoid valve (4) which in turn regulates the diaphragm unit.

Through continual adjustment of the charging pressure to suit the octane rating and the engine working conditions, the margins which are normally built into the engine in order to avoid damage may be circumvented. This allows optimum utilization of the fuel being used, i.e. the max. possible engine output is always available for propulsion.

The APC system senses and controls the charging pressure of the engine by means of an electric pressure transducer. This pressure transducer also compensates for changes in the condition of the engine. The maximum charging-pressure setting should therefore not be altered.



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APC-system

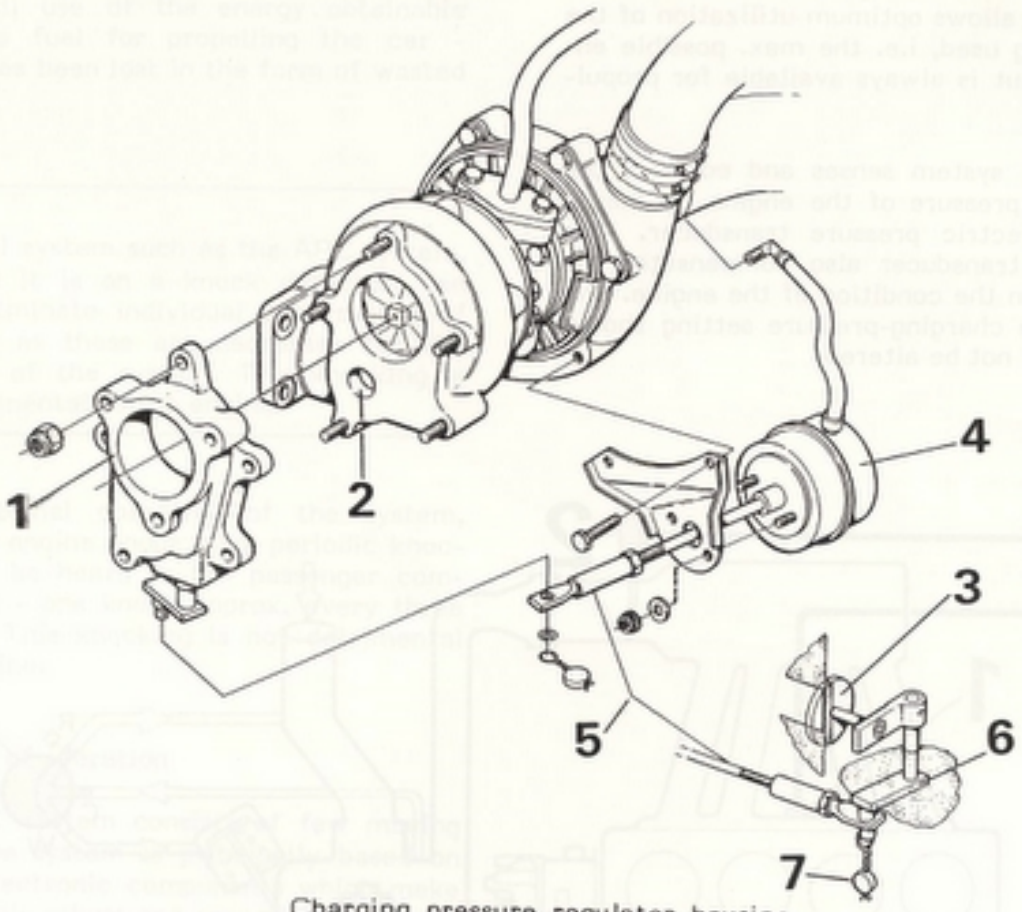
Electrical wiring

Air hose

1 Knock detector
2 Pressure transducer
3 Control unit
4 Solenoid valve

Description of components

Charging pressure regulator

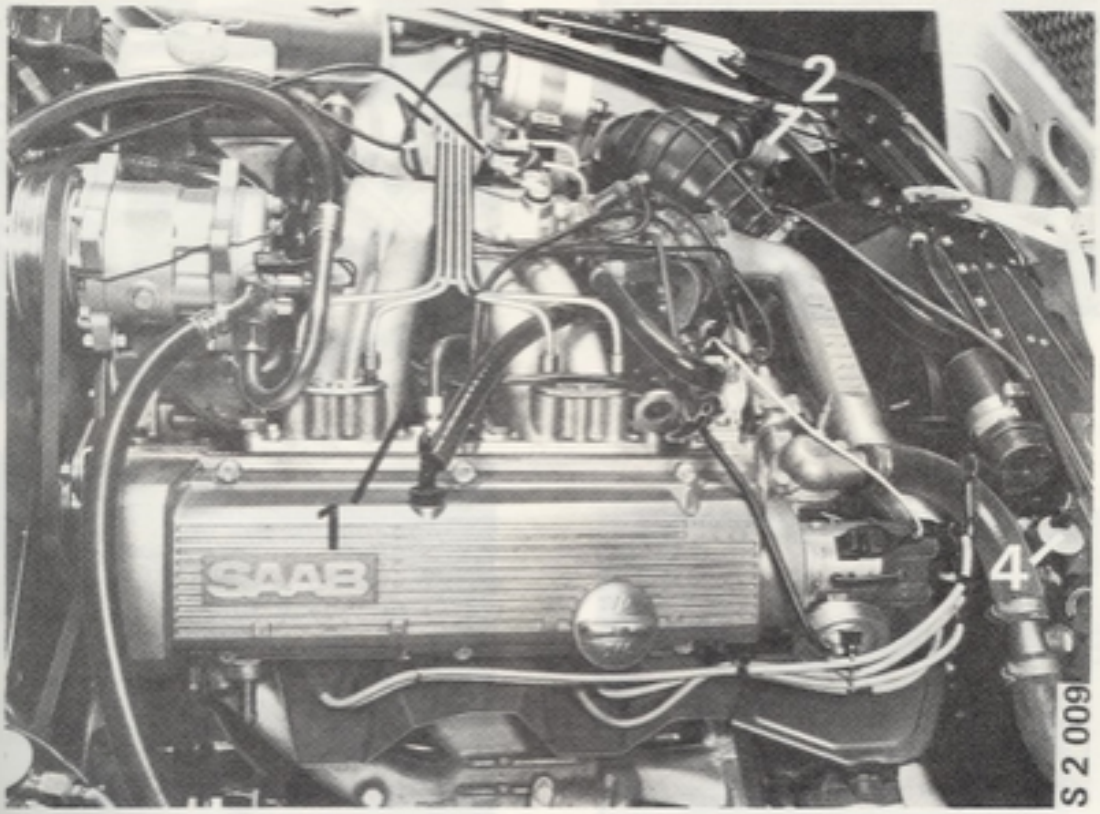


Charging pressure regulator housing

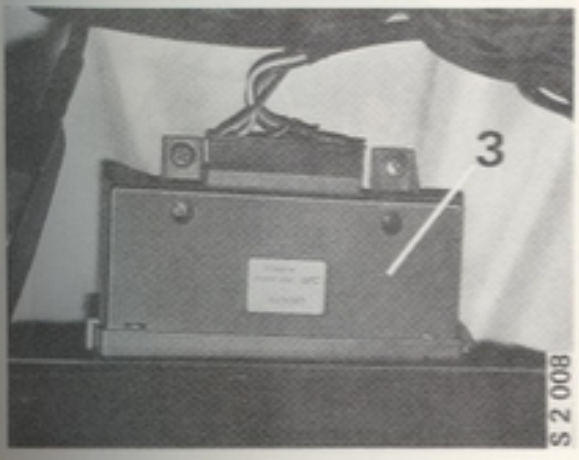
1 Charging pressure regulator
2 By-pass passage
3 Flap valve
4 Diaphragm unit
5 Lever
6 Control arm
7 Anti-tamper seal

The charging pressure regulator housing is bolted directly onto the turbocharger housing.

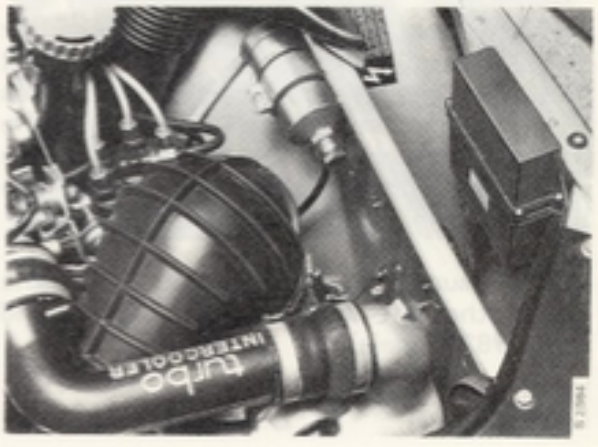
The diaphragm unit is mounted on the compressor housing with a bracket and is connected by a lever to the regulator control arm. The end of the lever is adjustable so enabling the tension on the diaphragm unit spring to be altered. The end of the lever is secured to a stud on the control arm by a circlip, and an anti-tamper seal is fitted to prevent unauthorized adjustment.



1 Knock detector
2 Pressure transducer (as from 1983 models, located beneath the instrument panel)
3 Control unit (under rear seat cushion; as from 1986 models: on LH side in engine compartment)
4 Solenoid valve



Location of control unit, -1985



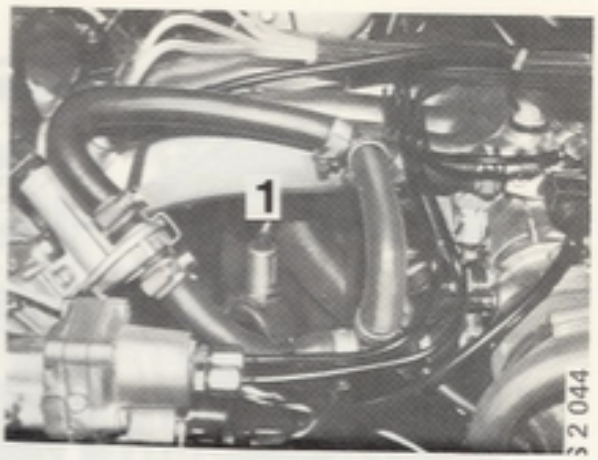
Location of control unit as from 1986 models

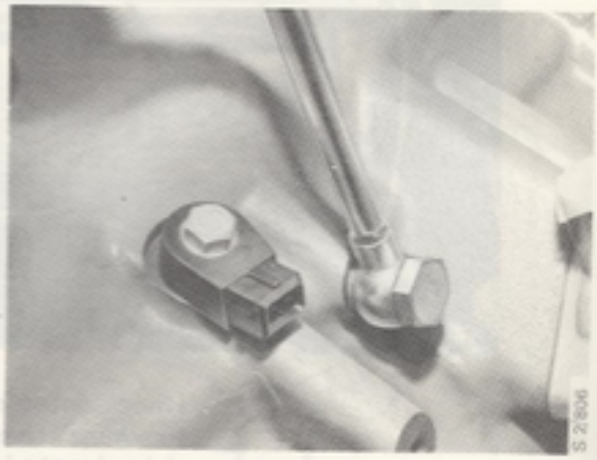
Knock detector

The knock detector (1) registers any knocking/pinking in the engine and converts it to electric signals that are transmitted to the control unit (3).

The knock detector also starts up the APC system when it registers the normal vibrations of the engine.

The knock detector is mounted on the left side of the engine block below the inlet manifold.



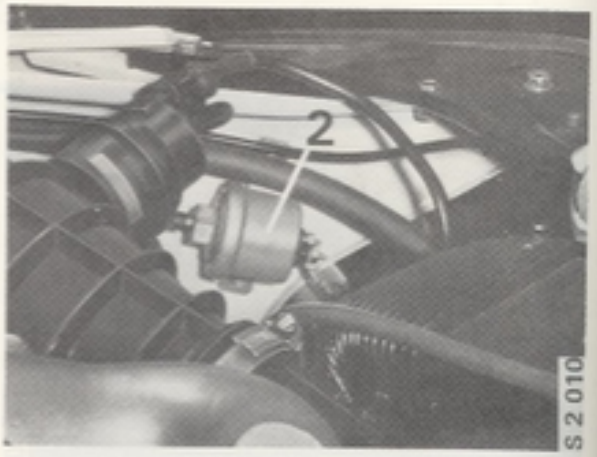


Pressure transducer

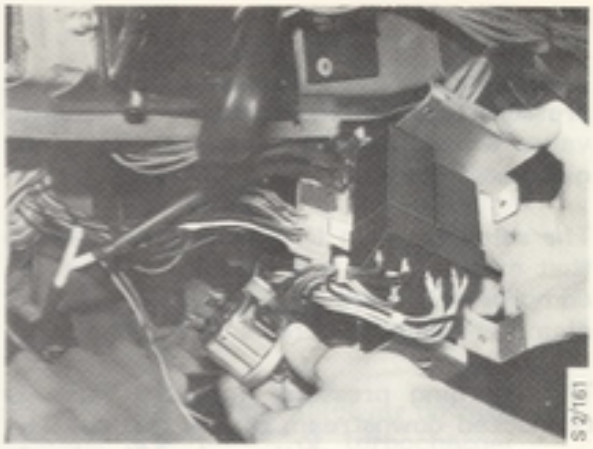
The pressure transducer (2) registers the pressure downstream of the throttle.

The pressure is converted to an electric signal which is transmitted to the control unit (3). The pressure transducer ensures that the maximum boost supplied to the engine is correct even if the performance of other engine parts changes during the life of the engine.

The pressure transducer is mounted at the top of the left wheel housing (up to and incl. 1982 models).



As from 1983 models, the pressure transducer is located under the instrument panel.

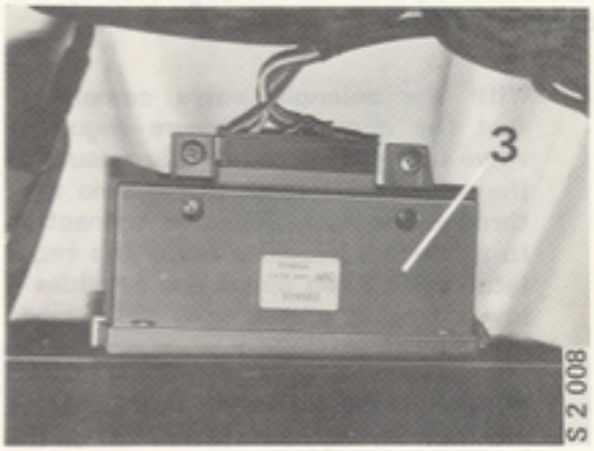


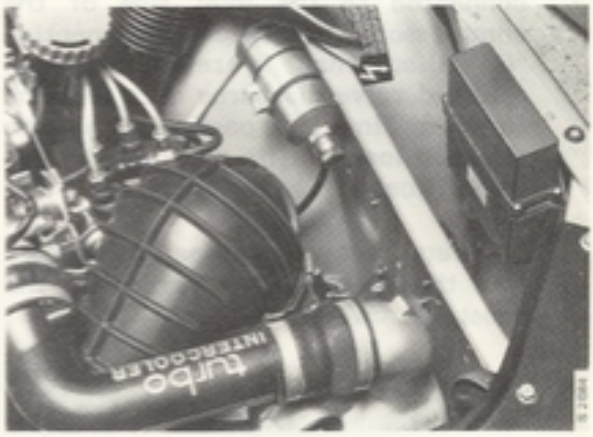
Control unit

The control unit (3) receives electric signals from the knock detector (1), the pressure transducer (2) and the ignition system (engine speed), analyses them and then activates the solenoid valve (4).

The control unit is mounted under the rear seat cushion (up to and incl. 1985 models).

As from 1986 models, the control unit is mounted on the LH wheel arch inside the engine compartment. The unit is hose-proof, has a new 25-pin connector and also incorporates a new function: on braking, the APC system automatically reduces the charging pressure to the basic setting.





Solenoid valve

The solenoid valve (4) regulates the control pressure to the charging pressure regulator valve which in turn determines the charging pressure.

The solenoid valve is fed with the pressure that exists in the inlet manifold after the compressor. There is an orifice of fixed diameter mounted in the solenoid inlet.

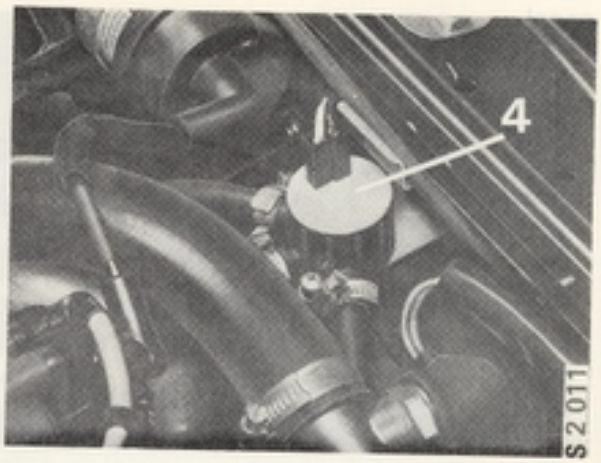
The charging pressure regulator valve is connected downstream of the orifice. The mean outlet area of the solenoid valve is determined by the pulse ratio of current fed to the solenoid, i.e. the pulse relationship between the open and closed valve.

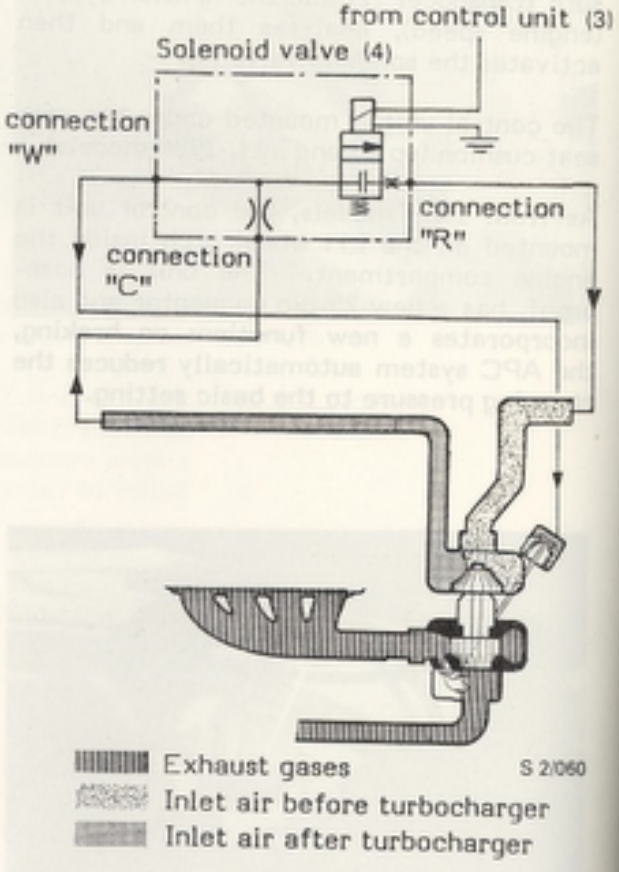
The current pulse ratio is regulated by the control unit (3).

- With the solenoid valve completely shut the charging pressure regulator valve is exposed to the full pressure of the inlet manifold as there is no flow through the solenoid valve connection to produce a pressure drop. The regulator valve then opens and provides a low charging pressure as determined by its basic setting.

- With the solenoid valve fully open the pressure through connection "R" of the solenoid valve is vented via a hose connected to the inlet side of the compressor. The orifice in connection "C" is so small in relation to the solenoid valve discharge area that the small air flow that passes through the solenoid loses all its pressure through the orifice.

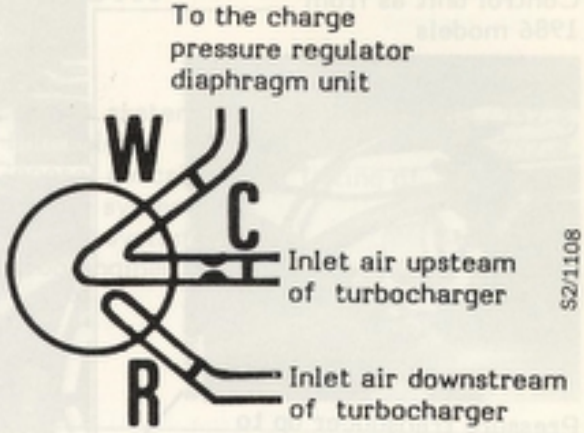
  The regulator valve loses its pressure and thus closes, so increasing the boost.





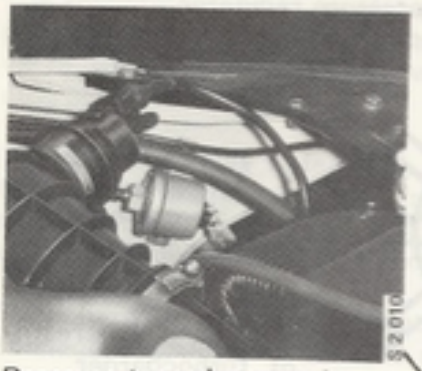
- When the car is running, the solenoid valve oscillates between the open and closed positions at a fixed frequency of 12 Hz. When the charging pressure exceeds 0.4 bar (6 lb/in^2), the pulse width changes. The pulse width is the ratio between the time the valve is open and the time it is closed during a cycle of 1/12 th of a second. The pulse width is determined by the control unit, on the basis of signals received by the control unit from the knock detector (1), the pressure transducer (2) and the ignition system (engine speed).

The solenoid valve is mounted on the right of the upper part of the radiator member.



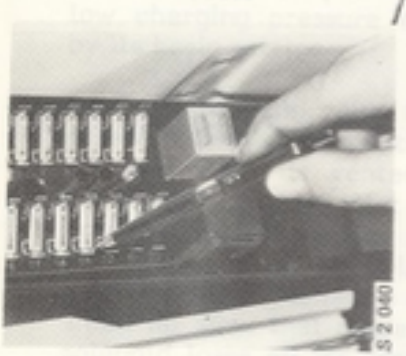
Wiring runs and location of components

Control unit as from 1986 models



Pressure transducer up to and incl. 1982 models

Pressure transducer, as from 1983 models



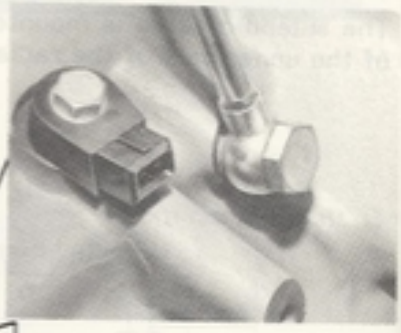
Fuse No. 19. (+) current to control unit

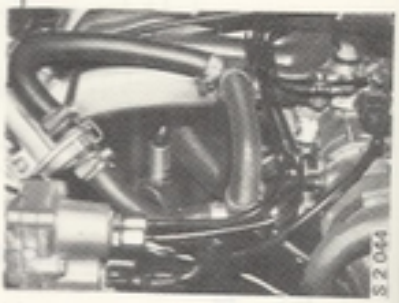
Ignition pulses from fuel pump relay to control unit, up to and incl. 1985 models

Cable harness, wheel housing

Solenoid valve

Common easting point for components in APC system





Knock detector

Knock detector connector up to and incl. 1982 models

Control unit

Exhaust system

Exhaust manifold - overview

General

Exhaust manifolds are either in the form of a casting or made from sheet, according to the engine variant to which they are fitted. The exhaust manifold is secured to the cylinder head by means of studs and nuts; distance pieces are interposed to prestress the flange joint to allow necessary movement of the manifold on thermal expansion.

To prevent tension arising from changes in length, the stud holes in the manifold flanges are oversized to provide clearance around the studs. The nuts must always be tightened to the specified torque on fitting.

The seal between the manifold flange and the cylinder-head flange face is provided by a gasket which also serves as a heat shield. Additional gaskets are used to offset any distortion in the mating surfaces of the manifold. These additional gaskets are fitted between the exhaust manifold and the heat-shield gasket.

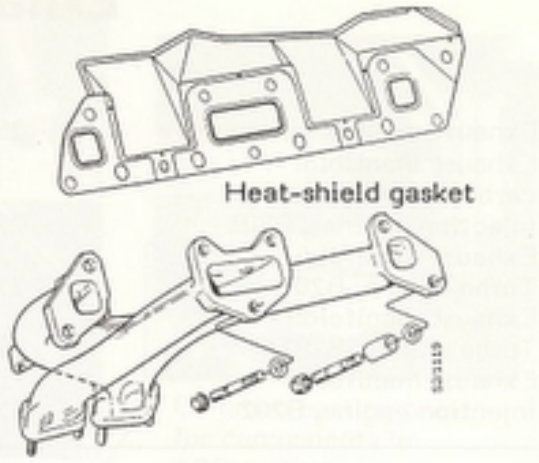
Exhaust manifold: B201 carburettor & injection engines

To remove

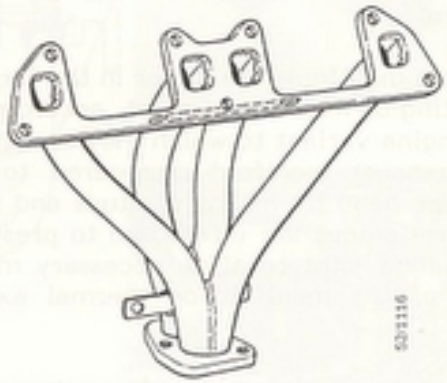
1. Disconnect the negative (-) battery lead.
2. Remove the gearbox-oil filler tube and plug the hole (manual gearbox only).
3. Push aside the preheater hose and remove the preheater cover.
4. Unbolt the exhaust pipe from the exhaust manifold.
5. Slightly raise the tail end of the engine.
6. Unbolt the engine bracket from the cylinder head and engine mounting.
7. Remove the intermediate manifold section (N/A to sheet-steel manifolds as these are of integral construction).
8. Remove the outer exhaust manifold and the gasket.

To fit

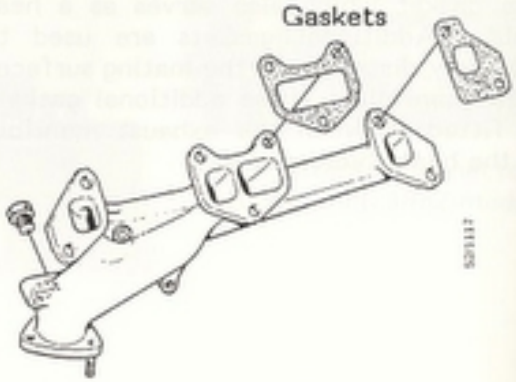
Fit in the reverse order.



Two-piece exhaust-manifold casting fitted to B201 carburettor and injection engines



Integral sheet-steel exhaust manifold fitted to B201 carburettor and injection engines as from 1986 models with S and EU specs

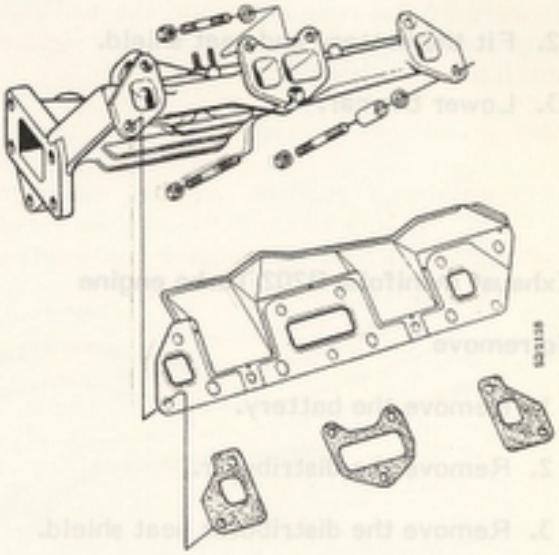


Exhaust-manifold casting fitted to B201 carburettor and injection engines with catalytic converter emission control

Exhaust manifold: B201 Turbo engines

To remove

1. Raise the car to a convenient working height.
2. Remove the battery and heat shield.
3. Remove the heat shield from the turbo unit.
4. Unbolt the exhaust pipe flange.
5. Unbolt the preheater plate.
6. Remove the turbo branch pipe.
7. Remove the turbo and steady bar securing bolts from the exhaust manifold.
8. Unbolt the steady bar from the gearbox casing.
9. Raise the tail end of the engine.
10. Unbolt the engine bracket from the cylinder head and engine mounting.
11. Remove the gearbox-oil dipstick tube.
12. Undo the manifold nuts and lift the exhaust manifold complete with gasket off the engine.



Exhaust-manifold casting, B201 turbo engine

To fit

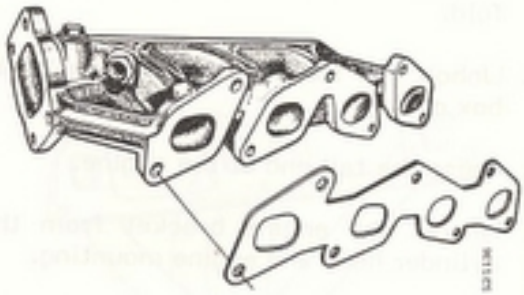
1. Lift the exhaust manifold complete with new gasket into position and fit the nuts.
2. Fit a new gasket between the turbo unit and exhaust manifold and fit the bolts.
3. Fit the steady bar.
4. Lower the engine.
5. Tighten the exhaust manifold.
6. Fit the dipstick tube.
7. Secure the steady bar to the gearbox casing.
8. Tighten the turbo unit to the exhaust manifold.

9. Fit the turbo branch pipe and exhaust pipe.
10. Fit the preheater plate.
11. Fit the heat shield over the turbo unit.
12. Fit the battery and heat shield.
13. Lower the car.

Exhaust manifold: B202 Turbo engine

To remove

1. Remove the battery.
2. Remove the distributor.
3. Remove the distributor heat shield.
4. Disconnect the turbo suction (inlet) pipe, pressure (discharge) pipe and oil supply pipe from the turbo unit and the oil supply pipe from the engine.
5. Disconnect the electrical leads to the solenoid valve from the turbo unit and waste-gate valve.
6. Disconnect the EGR pipe from the exhaust manifold and EGR valve.
7. Unbolt the turbo unit bracket from the gearbox casing.
8. Remove the dipstick tube.
9. Disconnect the oil return pipe from the turbo unit.
10. Unbolt the exhaust pipe from the turbo unit.
11. Remove the nuts, distance pieces and washers from the exhaust manifold.
12. Slide the exhaust manifold clear of the studs and then remove it complete with turbo unit.
13. Separate the exhaust manifold from the turbo unit.



Exhaust-manifold casting: B202 turbo engine

To fit

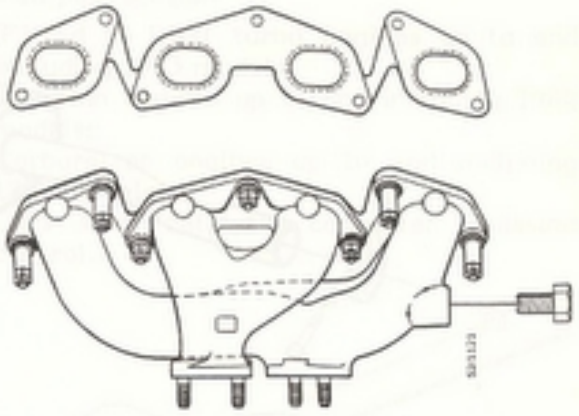
To fit the exhaust manifold, reverse the removal procedure.

Fit new gaskets to the joint faces and new securing nuts for the exhaust manifold.

Exhaust manifold: B202 injection engine

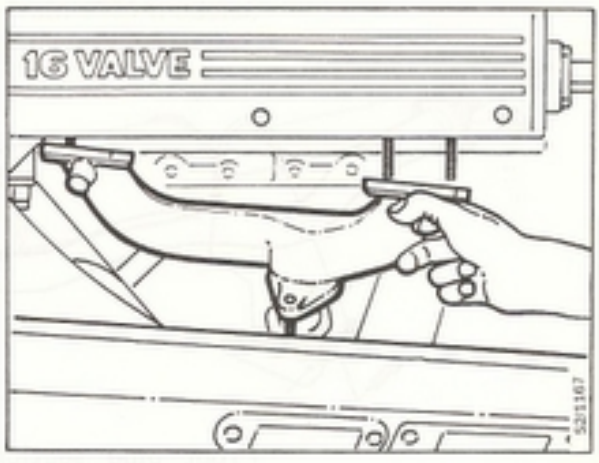
To remove

1. Remove the oil filler pipe from the gearbox and blank off the opening.
2. Separate the exhaust pipe from the silencer.
3. Remove the intermediate manifold section.
4. Remove the upper stud from the outboard flange of the outer exhaust-manifold section. Use a second nut to lock the securing nut when unscrewing the stud.



Two-piece exhaust-manifold casting fitted to B202 injection engine

5. Remove the remaining nuts and distance pieces and then free the exhaust manifold from the studs by raising the leading end to clear the engine mounting.

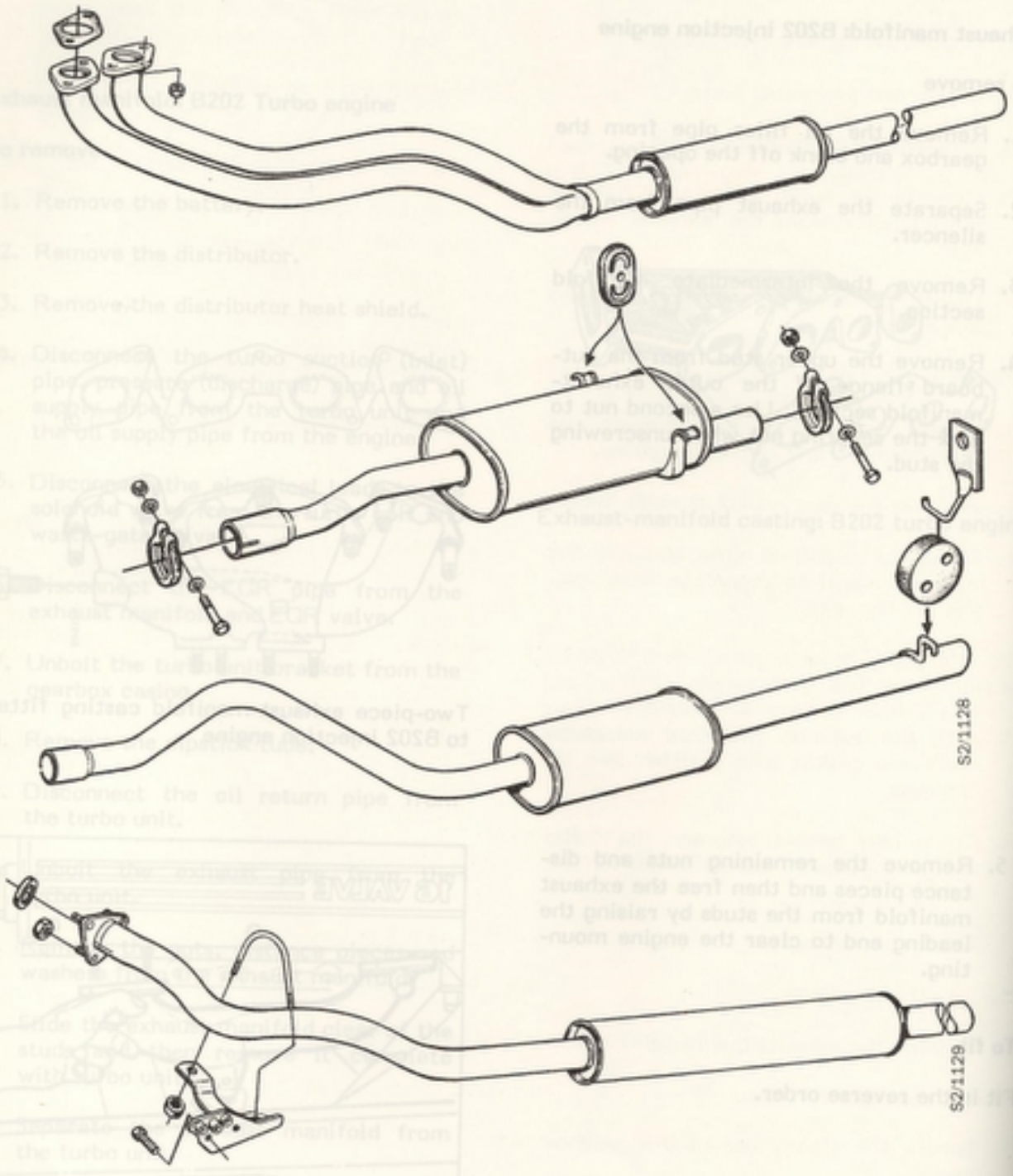


To fit

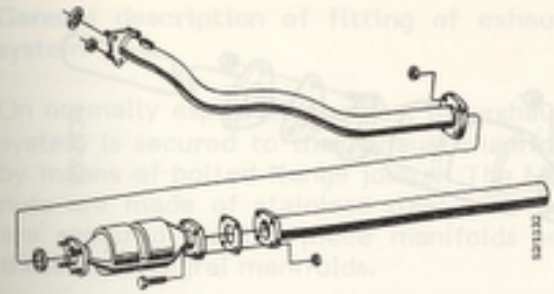
Fit in the reverse order.

Exhaust system - overview

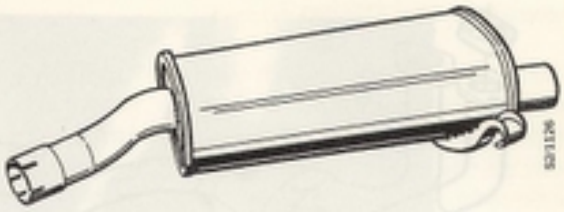
The exhaust system comprises three sections: the front pipe section incorporating the front silencer; the intermediate pipe section incorporating a silencer located forward of the rear axle; and the tail pipe which discharges on the LH side underneath the rear bumper.



Front pipe section and clamp fitted to B201 turbo engine

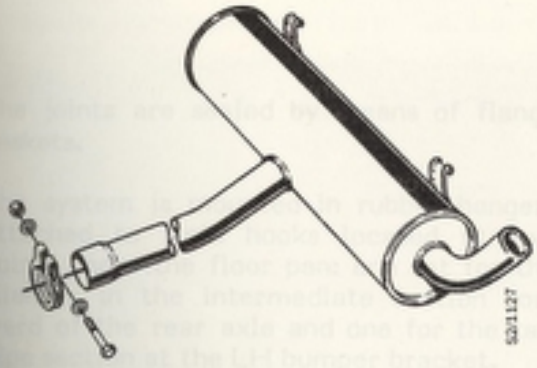


Front pipe section with catalytic converter



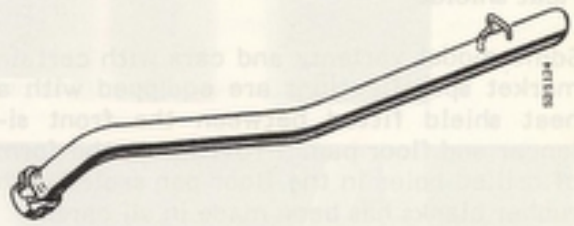
Longitudinally mounted silencer in intermediate section

(Fitted to turbo engines as from 1984 models;
Injection engines without catalytic converter as from 1985 models;
Carburettor engines as from 1986 models.)



Intermediate section with transverse silencer

(Fitted to B201 turbo engines up to and including 1983 models;
B201 injection engines up to and including 1984 models;
B201 car burettor engines up to and including 1985 models;
B201 engines equipped with catalytic converter emission control.)



Tail pipe section

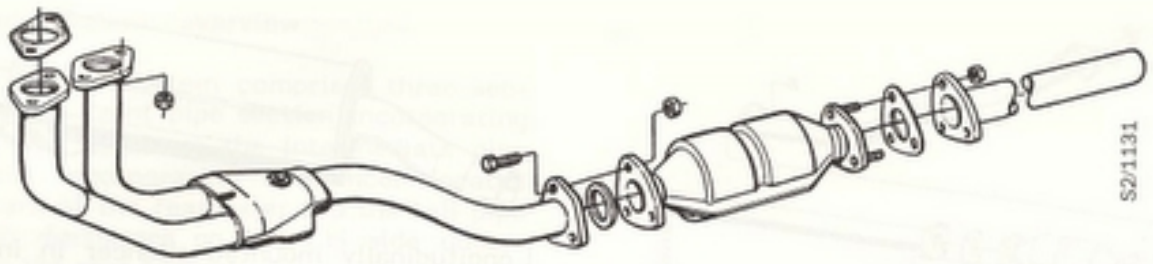
(Fitted to B201 turbo engines up to and including 1983 models;
Injection engines up to and including 1984 models;
Carburettor engines up to and including 1985 models;
Cars with catalytic converter emission control.)

Tail pipe

(Fitted to B201 and B202 turbo engines as from 1984 models.)

Rear pipe section

(Fitted to B201 injection engines as from 1985 models;
Carburettor engines as from 1986 models;
B202 injection engines;
Turbo engines with catalytic converter emission control.)



Front pipe section with catalytic converter

(Fitted to B202 injection engines.)

Heat shields

Some model variants and cars with certain market specifications are equipped with a heat shield fitted between the front silencer and floor pan. Provision in the form of drilled holes in the floor pan sealed with rubber blanks has been made in all cars.

Thus, a heat shield can quickly be fitted if problems attributable to excessive heat are experienced.

As from 1984 models, turbo-engine cars have both a front and a rear heat shield.

Turbo cars and cars with catalytic converter emission control (B201 and B202 engines)

Front heat shield

(Over catalytic converter and front pipe section)

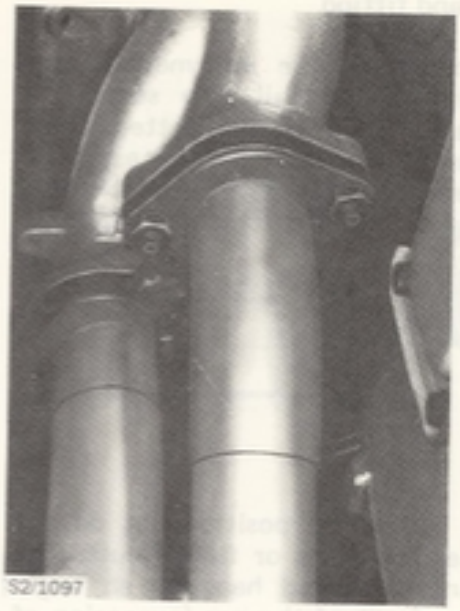
Rear heat shield

(Over silencer in intermediate section)

S2/1131

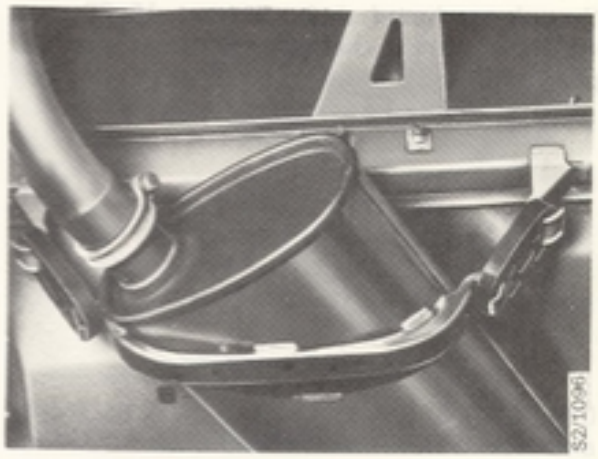
General description of fitting of exhaust system

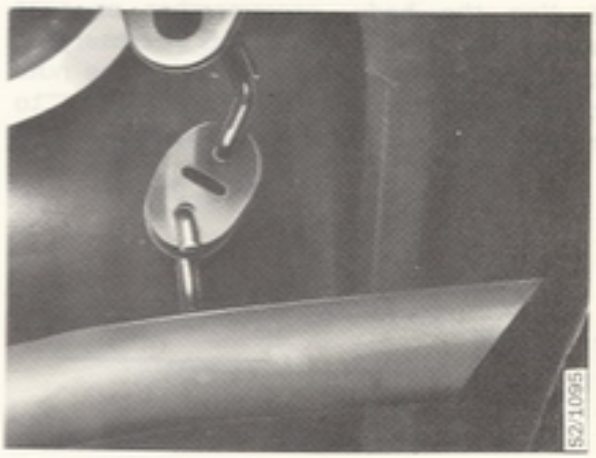
On normally aspirated engines, the exhaust system is secured to the exhaust manifold by means of bolted flange joints. The M10 nuts are made of stainless steel and four are required for two-piece manifolds and three for integral manifolds.


S2/1097

The joints are sealed by means of flange gaskets.

The system is mounted in rubber hangers attached to rigid hooks located at two points under the floor pan: one set for the silencer in the intermediate section forward of the rear axle and one for the tail pipe section at the LH bumper bracket.


S2/1096


S2/1095

S2/1122

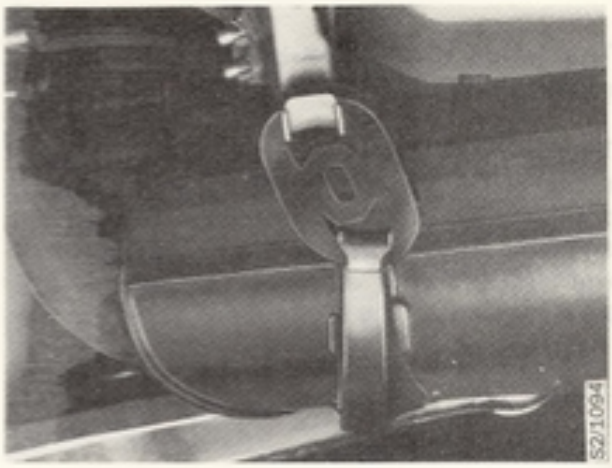
The turbo exhaust pipe is secured to the pipe flange by means of three M8 locknuts which are not stainless steel.

The flange joints seal by means of a taper fit. The front pipe section is secured to the gearbox casing by means of a U-bolt. In all other respects, the system is fitted in the same way as to normally aspirated engines.

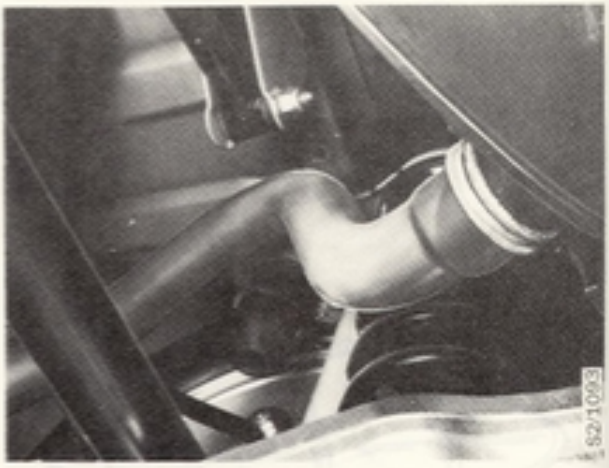
Assembly and fitting

Place a clamp on the intermediate pipe section and on the tail pipe section by sliding the clamps over the slotted, flared end of the respective pipe. To assemble, slide the end of the pipe as far as it will go inside the flared end of the adjoining pipe.

Hang the system in position but do not tighten the mountings or flange nuts. The rubber hangers should hang at an angle towards the front of the car (expansion of the pipe when hot is approx. 15-20 mm, which will bring the hangers into a vertical position).



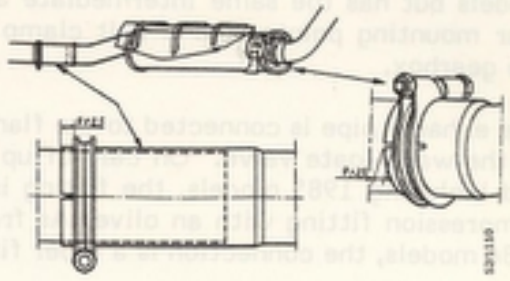
Check that the system is hanging freely and not under tension and that it is not fouling the body, crossmember or rear spring link. Adjust the run as necessary at the pipe joints and by slackening the nuts on the exhaust manifold. Remember to retighten all nuts after adjustment.



Tightening clamps and joints

Normally aspirated engines

Tighten the exhaust manifold flange. Before tightening each clamp, slide it over the slot in the flared end to a position approx. 9 mm (0.35 in) from the end. Make sure that the pinchbolt on the leading clamp is on top of the pipe and that for the trailing clamp underneath the pipe.



Turbo engines

Hang the system loosely in position. Locate the front pipe section in the U-bolt and secure the pipe to the flange, eliminating all clearance between pipe and flange (not so tight that the pipe cannot be rotated). Tighten the U-bolt, the leading and trailing clamps and finally the flange joint.

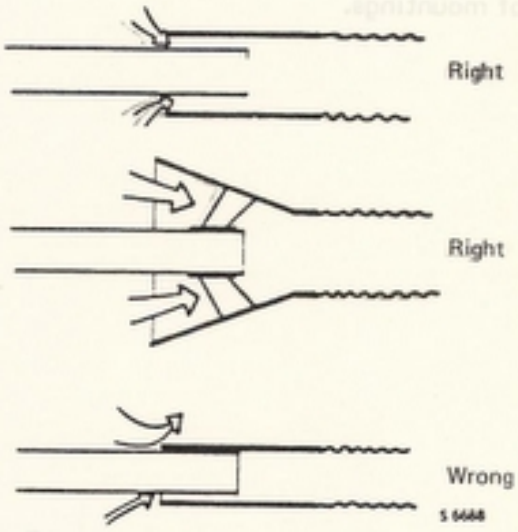
Connection to exhaust extraction equipment

When using exhaust extraction equipment when running the engine in the workshop, avoid excessive depressurization of the exhaust system which may affect readings, e.g. of the CO content.

If excessively powerful exhaust extraction equipment is connected to turbo cars, oil may escape through the seals in the turbo unit.

This will result in the wool in the exhaust system becoming saturated with oil, causing blue smoke to be emitted from the car for some considerable time afterwards.

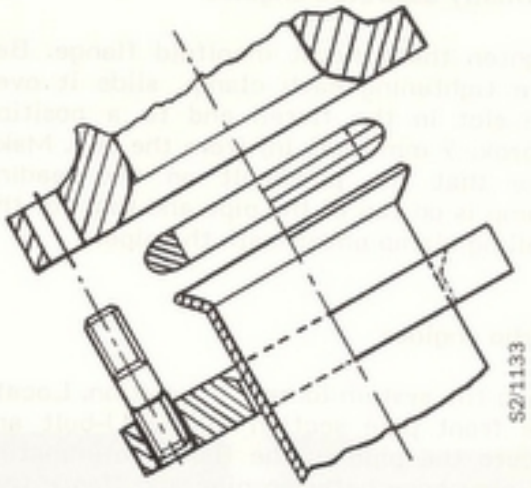
To avoid excessively powerful exhaust extraction, connect a hose with an open coupling.



Exhaust system on Turbo cars

The exhaust system fitted to turbo-engine cars is of a larger bore than that on other models but has the same intermediate and rear mounting points, and U-bolt clamp at the gearbox.

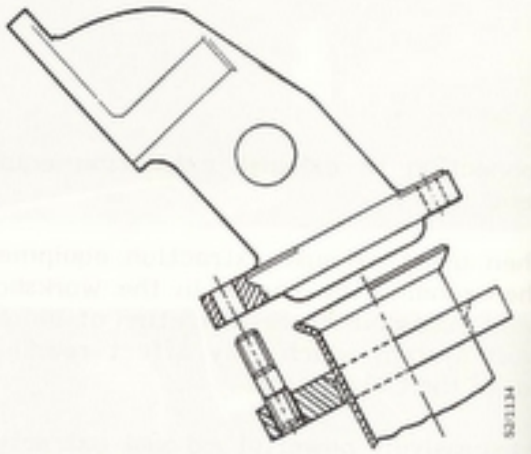
The exhaust pipe is connected to the flange on the waste-gate valve. On cars of up to and including 1985 models, the fitting is a compression fitting with an olive. As from 1986 models, the connection is a taper fit.



Up to and including 1985 models

As from 1984 Turbo models, the run of the exhaust system and the mountings for the intermediate silencer and tail pipe have been modified.

The intermediate silencer and tail pipe are of a new design but can be fitted to cars as from 1981 models with the use of a special set of mountings.



As from 1986 models

Removing the front muffler

1. Jack up the car.

2. Unscrew the bolts securing the front exhaust pipe to the exhaust manifold.

3. Undo the clamp holding the connecting ring at the joint with the middle exhaust pipe and separate the pipes.

4. Turbo models: Undo the clamp on the transmission casing.

To remove the rear muffler and the other sections of pipe, detach the rubber mountings and clamps from the part to be removed.

Removal of middle exhaust pipe and muffler

To remove the middle exhaust pipe or the rear muffler it is best to begin by unclamping the joint between these two units.
To remove the entire system, first undo the front pipe from the exhaust manifold, (Turbo models: Undo also the clamp on the transmission casing) and then unclamp the rear pipe joint. Withdraw the rear pipe from the rear.

Refit in the reverse order.

Note
After refitting, check the exhaust system for leaks and make sure that the pipe is not in contact with the body.

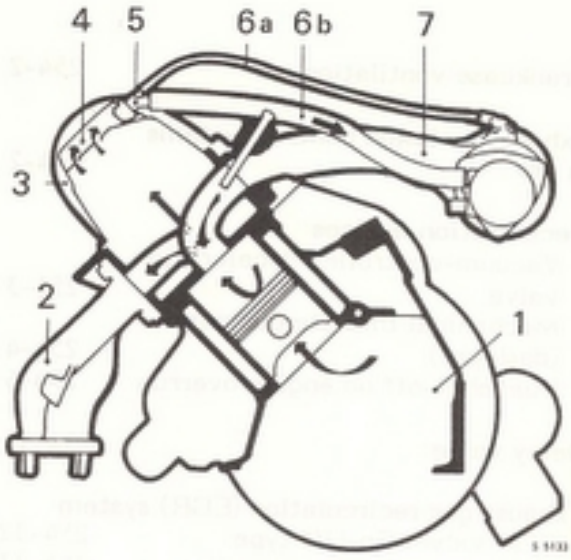
Exhaust emission control system

Crankcase ventilation

The crankcase ventilation is completely enclosed. The ventilation system comprises a three-way nipple in the valve cover, from which a thicker hose runs to the air cleaner, and a small-bore hose to the inlet manifold. Turbo engines are not fitted with the small-bore hose and the nipple is plugged.

The size of the various hoses and connections are designed to ensure efficient evacuation of the gases in the crankcase into the engine under all running conditions. The gases are evacuated through the small-bore hose directly into the inlet manifold under all running conditions with the exception of when the engine is at full load (and of Turbo cars), in which cases the gases are evacuated through the thicker hose to the air cleaner and thence to the engine.

Carbureted engines are equipped with a flame guard at the ventilation hose connection to air cleaner.



Crankcase ventilation

1 Crankcase
2 Exhaust manifold
3 Camshaft cover
4 Oil catcher and flame trap
5 Nipple and restriction
6a Small-bore hose (norm. asp. engines only)
6b Large-bore hose
7 Inlet manifold

Exhaust emission control systems in use

To meet the exhaust emission requirements in certain markets, special exhaust emission control systems are fitted to cars with specifications for these markets.

The following exhaust emission control systems are in use:

- Deceleration devices

  Vacuum-controlled deceleration valve
  Mechanical throttle damper (dash pot)
  Device for fuel shut-off on engine o verrun

- Delay valves (distributor vacuum control)

- Exhaust gas recirculation (EGR) systems

  EGR valve: proportional
  EGR valve: On-Off
  EGR valve: two-port

- Catalytic converters

- Oxygen-sensor-regulated injection systems (Lambda)

- Evaporative-loss control device (ELCD)

Deceleration devices

The deceleration devices are designed to maintain combustion during engine overrun to prevent the emission of unburned hydrocarbons.

The following types of deceleration device are used:

- Vacuum-controlled devices for carbureted engines (84 and earlier models)

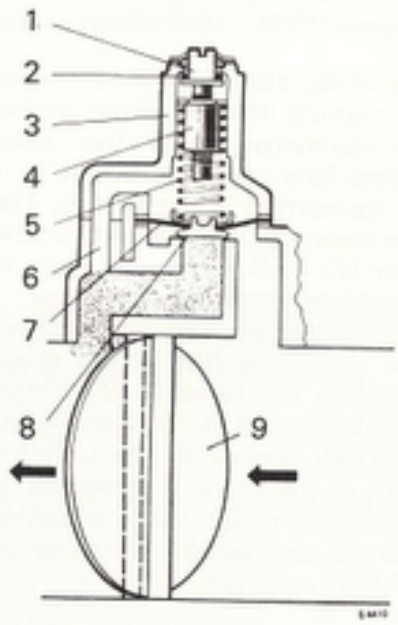
- Mechanical throttle damper device (dash pot) - 84 and earlier models (carburetor)

- Disc valve in throttle butterfly (85 models onwards)

Vacuum deceleration valve
(Carbureted engines)

This diaphragm valve is activated by depression on the engine side of the throttle and provides the correct fuel air mixture for proper combustion during engine overrun.

Excessive idling speed may be caused by a faulty or an incorrectly adjusted deceleration valve.

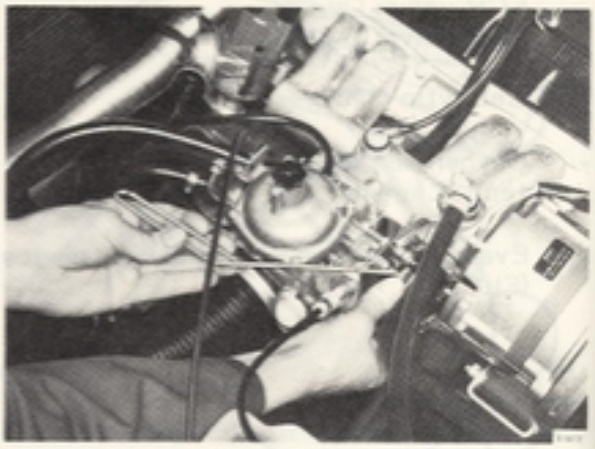


Deceleration valve

1 Adjusting screw
2 Rubber ring
3 Cover
4 Nut
5 Spring
6 Connecting passage to area above diaphragm
7 Diaphragm
8 Valve
9 Throttle

To adjust

1. Run the engine until it and the carburetor are at working temperature.
2. Run the engine at idling speed and check that the deceleration valve is closed. If in doubt, turn the deceleration valve adjusting screw a few turns counter-clockwise.
3. Adjust the quantity of fuel and engine speed to obtain the specified idling speed. (If in doubt, the ignition timing should also be checked).
4. Fully open the deceleration valve by turning the adjusting screw clockwise until the engine speed no longer increases (1500 - 1800 r/min approx).
5. Carefully close the deceleration valve by turning the adjusting screw counter-clockwise until the valve just closes (the engine will now be running at its normal idling speed). Then turn the deceleration adjusting screw a further 1/2 - 3/4 turn counterclockwise.
6. Check the adjustment by revving up the engine to 3000 r/min approx. and allowing the throttle to spring back to its stop position. Despite a slight delay, the engine should unfailingly return to the normal idling speed. If not, the deceleration valve adjusting screw should be turned counter-clockwise slightly more.



Deceleration valve adjustment
Tool 83 92 748 or 83 92 953

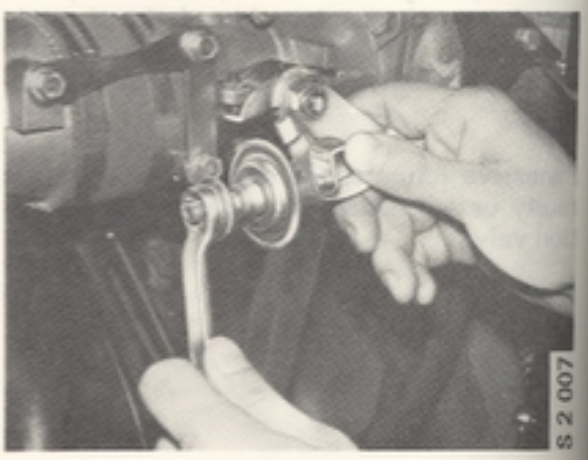
Mechanical dashpot

The dashpot mechanically delays the closing of the throttle.

To check

1. Run the engine until fully warm.
2. Connect a tachometer and set the idling to the prescribed speed.
3. Increase the engine speed to 3000 r/min release the throttle and use a stop watch to record the time taken for the engine to return to the idling speed set under point 2.

   The deceleration time should be 3-6 s.



Dashpot, injection engines

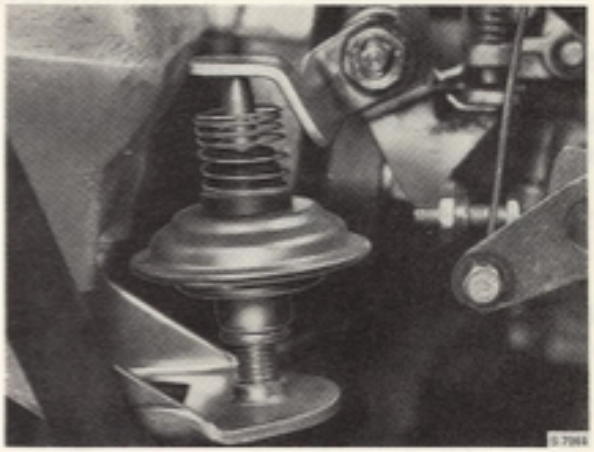
To adjust

To adjust the deceleration time, loosen the locknut on the dashpot and screw it away from the stop on the throttle lever (shorter deceleration time) or towards the stop (longer deceleration time).

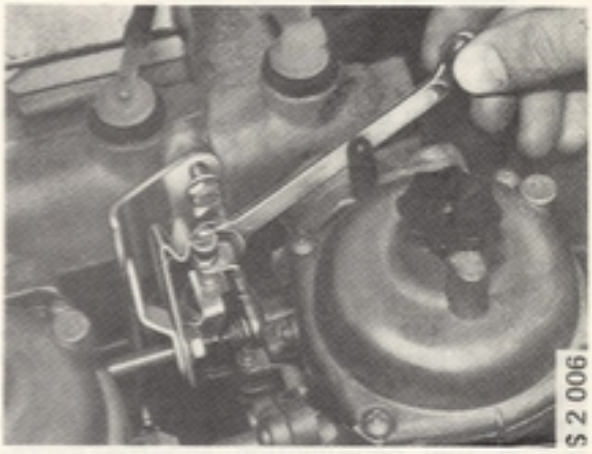
Twin carburetted engines, as from 1982 models

- Remove the dashpot locknut.
- Set the dashpot at approximately the correct position.
- Tighten the locknut.
- Finely adjust the dashpot position by loosening both the mounting bracket bolts on the inlet manifold and moving the bracket in its oval holes to the correct position.
- Tighten the bolts.

1. Run the engine until warm and check that the CO setting and ignition are correct.
2. Remove the suction advance pipe.
3. Rotate the throttle lever and check that the dashpot rod strikes the stop at the specified engine speed (check using tachometer).



Dashpot, single carburetor



Dashpot, twin carburetors

	Speed where dashpot strikes throttle lever stop (r/min)
Sweden singlecarburetor	2600 ± 100
Sweden and Switzerland twin-carburetors	3000 ± 100
Sweden and Switzerland injection and Turbo engines	2000 ± 100
Europe injection and Turbo engines	2500 ± 100
1981 models	
Norm. asp. USA only	2500 ± 100
Norm. asp. Canada spec.	2300 ± 100
Turbo Canada spec.	2200 ± 100
1982 models onwards:	
Norm. asp.	2500 ± 100
Turbo	2200 ± 100

4. Rev up the engine and check that the deceleration time is correct.

5. Refit the suction advance pipe.

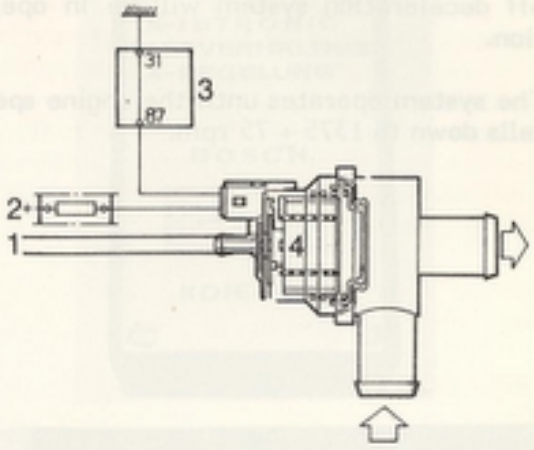
1985 models onwards:
The throttle butterfly incorporates a disc valve actuated by the depression raised on engine overrun. The valve is not adjustable.

Fuel shut-off during deceleration

As from 1982 models, cars with USA spec., manual gearboxes and CI fuel injection are equipped with a system which disconnects the injection of fuel during deceleration, to reduce fuel consumption and the hydrocarbon (HC) emissions.

Function of the vacuum valve

When current flows through the vacuum valve solenoid (4) (from fuse box (2) via the deceleration system relay (3) to ground), the pressure from the inlet manifold (1) engages a diaphragm and opens the by-pass channel.



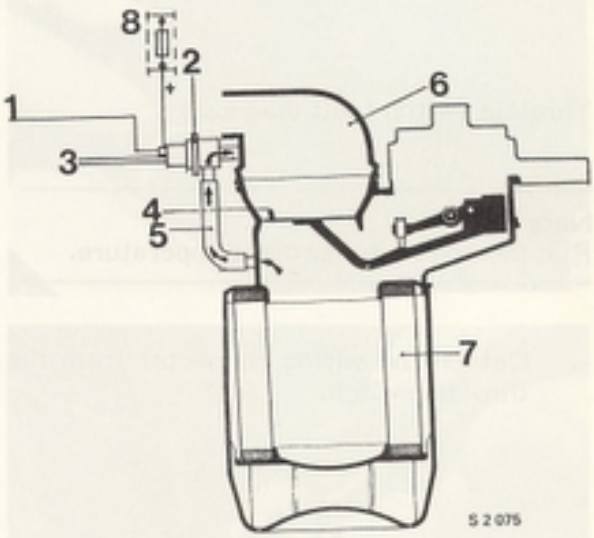
Operation

When the fuel shut-off deceleration system is in operation, the flow of air (which normally passes the air flow sensor plate) is led through a hose and a vacuum valve by-passing the mixture control unit (see fig.). This gives the result that the air flow sensor plate does not lift, but adopts its "0" position so cutting off the supply of fuel to the cylinders.

The vacuum valve by-passes the air when the deceleration system relay is activated. The activated relay also gives a signal to the lambda system, which will be set at a fix pulse relation (60 %).

The deceleration system relay is activated if the following conditions are obtained:

- The thermoswitch is closed (coolant temperature over 45°C (113°F).
- The time relay is not activated (relay switch in rest position).
- Engine speed exceeds 1575 ± 175 rpm.

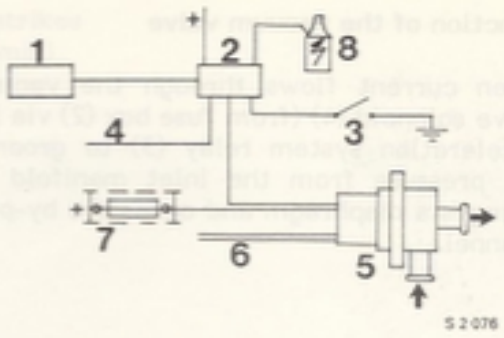


Air cleaner with mixture control unit

1 From deceleration system relay
2 Vacuum valve
3 From inlet manifold
4 Air flow sensor plate in rest position
5 By-pass hose
6 Rubber bellow
7 Filter
8 Fuse box

From the moment the throttle switch closes (accelerator released), the fuel shut-off deceleration system will be in operation.

The system operates until the engine speed falls down to 1375 ± 75 rpm.



Fuel shut-off, principle

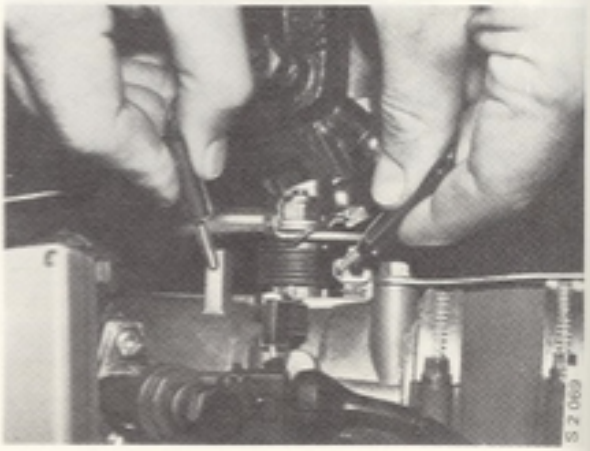
1 Acceleration enrichment time relay
2 Deceleration system relay (car with manual transmission)
3 Throttle switch
4 Control unit Lambda
5 Vacuum valve
6 Hose from inlet manifold
7 Fuse box
8 Ignition coil

Throttle switch fault diagnosis

Note
Run the engine to normal temperature.

- Detach the wiring connector from the throttle switch.

- Use a buzzer to check that an earth is made between the connector plug on the throttle switch and earth when the accelerator is released.

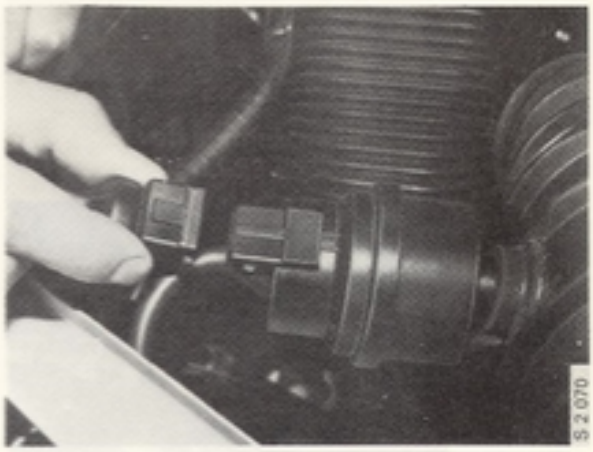


- Connect the wiring connector to the throttle switch.

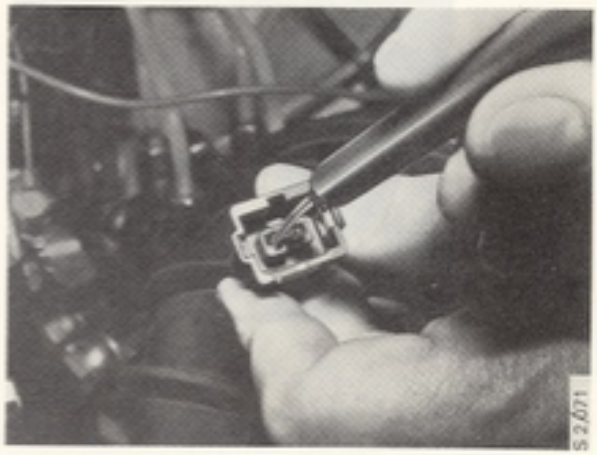
Vacuum valve - to check operation of fuel shut-off

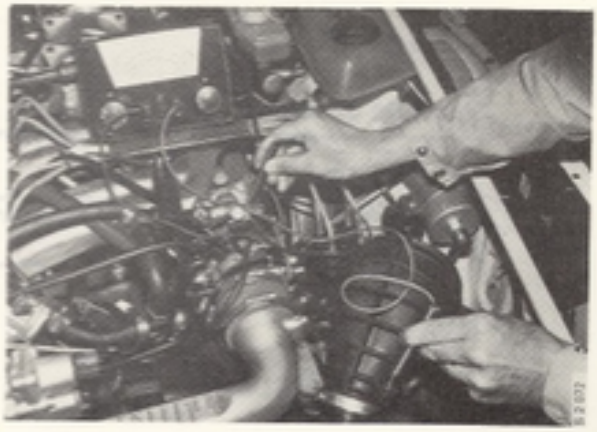
- Connect a Bosch KDJE 7453 meter alt. SAAB pulse relation meter 83 93 597 to check the pulse relation. See "Lambda system".

- Start the engine and let it run at 875 rpm approx.
- Detach the electrical connection from the vacuum valve.



- Measure the voltage (12 volts) between the connector and earth.

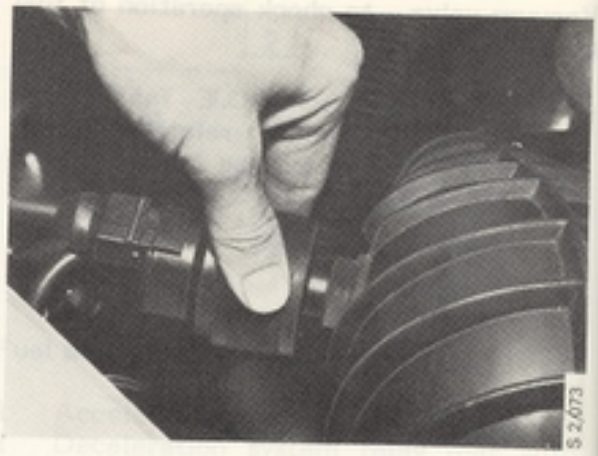


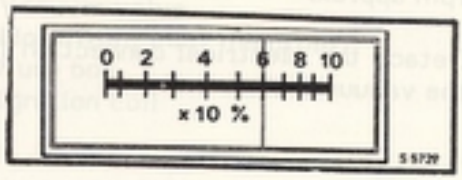


- Connect the electrical connector to the vacuum valve.

Have the engine idling.

Increase the engine speed to 2,000 rpm approx., release the accelerator and use your hand to feel if the vacuum valve is operating (will also be indicated by a sharp reduction in engine rpm) and that the Lambda system assumes a fixed pulse relation (60 %) until the system cuts out at 1375 ± 75 rpm.





Possible causes

	Deceleration system realy (cars with manual transmission)	Acceleration enrichment time relay	Throttle switch 0°	Valve, fuel shut-off	Pulse relation valve	Lambda control unit
	Possible defective component					
Fuel shut-off not operating	•	•	•	•		
Incorrect pulse ratio, when system operates	•	•	•		•	•

S 2,073

Delay valve

On some models, a delay valve is fitted in the vacuum line between the carburetor (throttle housing) and the vacuum advance control unit on the distributor. The valve retards depression formation for a given time, as shown in the table below. This results in a delay in the ignition advance and a consequent reduction in the emission of oxides of nitrogen (NO_x).

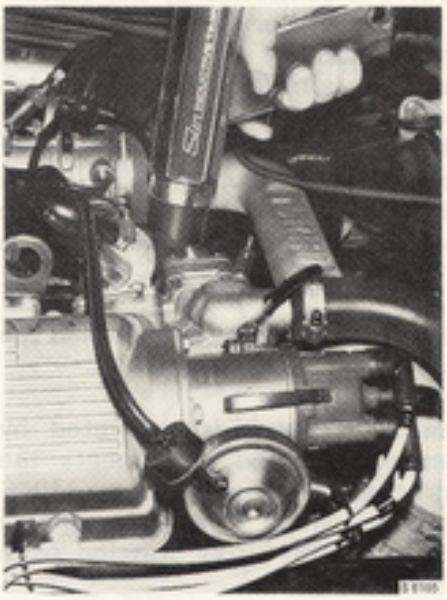
Delay valve, colour code marking	Delay time
Brown	2 ± 1 s
White	6 ± 2 s
Green	20 ± 4 s

To check

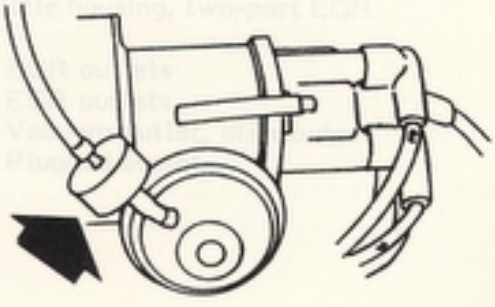
A stroboscopic timing light, tachometer and stop watch are required to carry out this test.

1. Connect the tachometer and the stroboscopic timing light.
2. Run the engine at normal idling speed.
3. Have an assistant rapidly open the throttle and run the engine at 3000 r/min approx. Start the stop watch when the throttle open.
4. Observe the ignition timing in the light given by the stroboscopic timing light. Vacuum advance should occur after the specified time (see table).

A faulty delay valve should be renewed.



Note
The coloured end of the delay valve should always face towards the vacuum advance control unit on the distributor. It is also important that the valve is fitted with the shorter hose running between the valve and the vacuum advance control unit.



Note
If it is necessary to remove the suction pipe, e.g. when checking the ignition timing, the hose should always be detached at the carburetor end (throttle housing) to prevent dirt entering the hose and blocking the delay valve.

Exhaust gas recirculation system (EGR)

Recirculating a small amount of the exhaust gases to the intake side of the engine reduces the combustion temperature, which helps to reduce the emission of nitrogen oxides (NO_x).

EGR gases are led from the exhaust port in No. 2 cylinder through a special passage in the cylinder head and thence a steel pipe on the intake side to a valve in the inlet manifold.

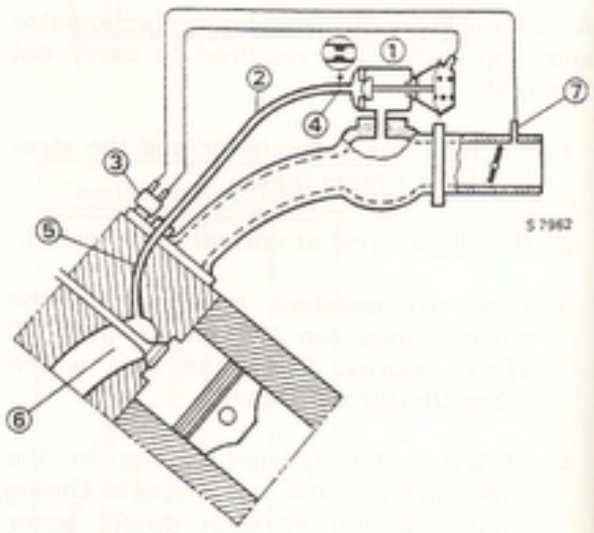
When the EGR valve opens a small quantity of exhaust gas flows through the passage and pipe into the inlet manifold.

EGR on-off system

The EGR valve is controlled by the depression from the carburetor (throttle housing). The relative position of the vacuum outlet to the throttle is such that the EGR valve will open at an engine speed of 1900 r/min approx. (fast idling) or at a slightly higher speed. The valve is fully open at low loads. At full throttle and slightly below the depression is so slight that the valve is closed.

The quantity of exhaust gas is governed the orifice (4).

The thermostatic valve is activated by coolant temperature and disconnects the depression at temperatures below 110°F (43°C) approx. which improves engine operation immediately after starting from cold.



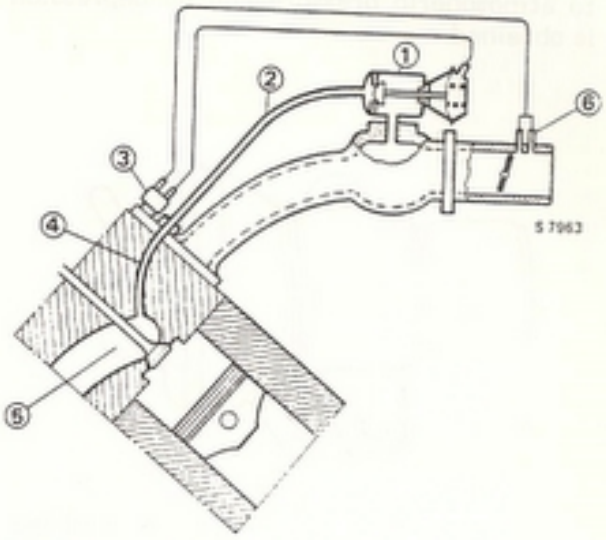
EGR on-off system

1 EGR valve
2 EGR pipe
3 Thermostat valve
4 Orifice (4 mm Ø)
5 EGR passage
6 Exhaust port (no. 2 cylinder)
7 Vacuum outlet

2-port EGR

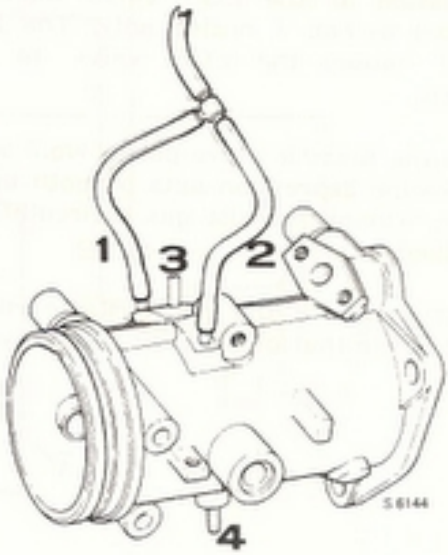
This device is only fitted on certain models.

Apart from EGR on-off, this system has no restriction in the exhaust manifold outlet. The amount of recirculated gases is regulated by means of a variable opening in the EGR-valve.



Two-port EGR

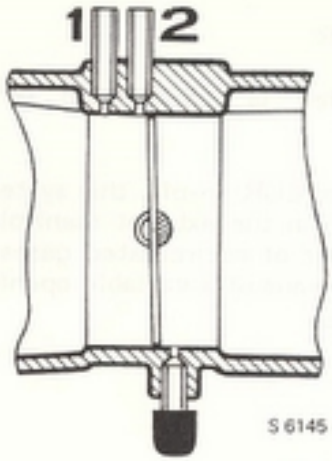
1 EGR-valve
2 EGR pipe
3 Thermostatic valve
4 EGR-passage
5 Exhaust passage (No.2 cylinder)
6 Vacuum outlet



Throttle housing, two-port EGR

1 EGR outlets
2 EGR outlets
3 Vacuum outlet, distributor
4 Plugged outlet

When the throttle is closed (idling or engine overrun) both outlets are subjected to atmospheric pressure and no depression is obtained.



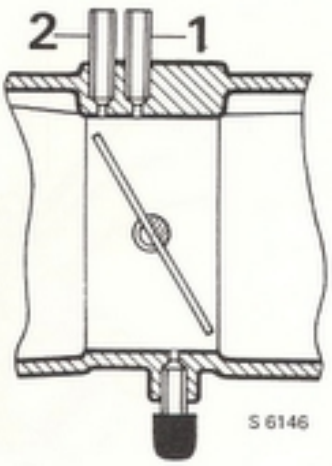
The outlets on the atmospheric side of the throttle valve

1 Outlet
2 Outlet

As the throttle valve passes No. 1 outlet (steady low speed, light acceleration or light engine overrun), a depression is created at the EGR valve through No. 1 outlet. This is then partially offset by the fact that No. 2 outlet is subject to atmospheric pressure, which creates a lower depression at the EGR valve than that created in No. 1 outlet only. The lower signal causes the EGR valve to open slightly.

When the throttle valve passes No.2 outlet, the engine depression acts on both outlets and maximum exhaust gas recirculation is obtained.

The function of the thermostatic valve is identical to that of the EGR on-off system.



Both outlets on the vacuum side of the throttle valve

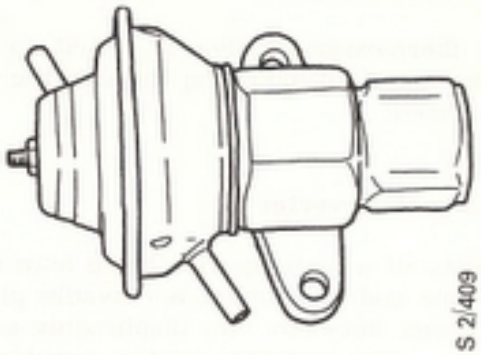
1 Outlet
2 Outlet

The proportional type EGR system

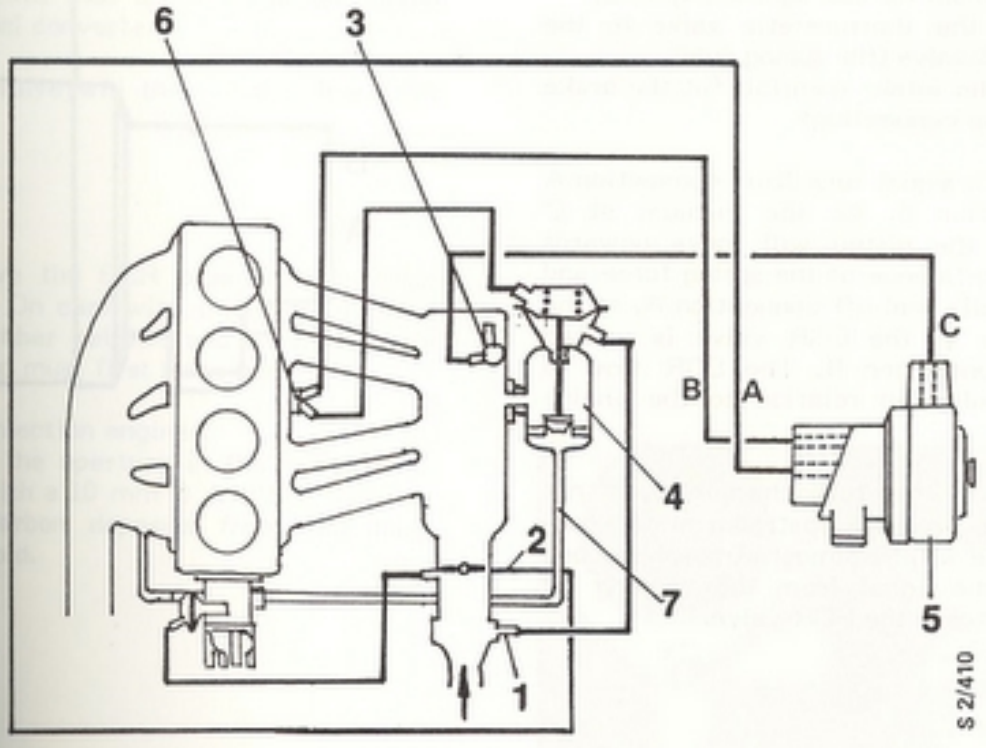
The EGR system consists of an EGR valve which is opened by vacuum as well as pressure, a signal converter whose function it is to control the opening of the EGR valve, and a thermostatic valve which disconnects the vacuum at engine temperatures below 20°C (68°F).

The EGR valve consists of a control valve, the opening and closing of which is controlled by a spring and a diaphragm located in the diaphragm housing mounted on the valve. The diaphragm housing is provided with two tappings for hoses. One of these hoses is connected to a tapping on the butterfly valve housing upstream of the butterfly valve and the other is connected to one of the tappings on the thermostatic valve (PVS valve).

In the event of vacuum or pressure, the control valve will open in proportion to the pressure in the intake manifold.



The EGR valve



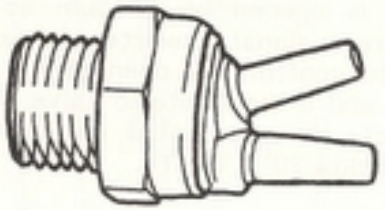
1 Signal tapping upstream of the butterfly valve
2 Signal tapping at the butterfly valve (same as the vacuum for the ignition system)
3 Signal tapping from the intake manifold
4 EGR valve
5 Signal converter
6 Thermostatic valve
7 EGR tube

Markings of hose connections
A = to butterfly valve housing (1) (vacuum for the ignition system)
B = via the thermostatic valve to the EGR valve (spring side)
C = to the intake manifold (at the brake servo connection)

The thermostatic valve (PVS valve)

is actuated by the coolant temperature and disconnects the vacuum from the EGR valve if the engine temperature is below approx. 20°C (68°F).

The thermostatic valve is fitted to the intake manifold mounting towards the cylinder head.



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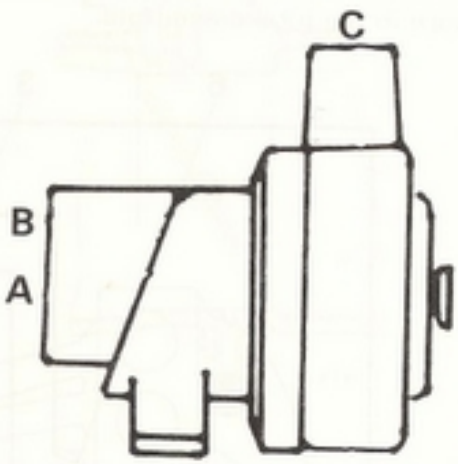
The signal converter

consists of a housing with three hose connections and containing a movable piston suspended between two diaphragms and a spring. The movable piston actuates a valve.

The three hose connections are connected as follows:

A = to the butterfly valve housing (1) (vacuum for the ignition system)
B = via the thermostatic valve to the EGR valve (the spring side)
C = to the intake manifold (at the brake servo connection)



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The vacuum signal runs from connection A to connection B. As the vacuum at C increases, the piston will move upwards under the influence of the spring force and will gradually seal off connection A, at the same time as the EGR valve is vented through connection B. The EGR flow is thus controlled in relation to the engine load.

As long as the turbocharger does not charge, the pressure upstream of the butterfly valve will be almost atmospheric and the pressure signal from the tapping (2) will not actuate the EGR valve.

Idling

Due to the location of the butterfly valve, both tappings will be on the upstream side of the butterfly valve and will thus be at the same pressure. The EGR valve will then remain closed.

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Part-load

When the butterfly valve is partially open and the turbocharger is charging, the pressure upstream of the butterfly valve will be higher than downstream of it.

This pressure differential will keep the EGR valve open, in spite of the vacuum signal now obtained from tapping (1).

Full load

When the butterfly valve is open, the pressure signal from both tappings will be approximately equal and the EGR valve will remain closed.

Low load

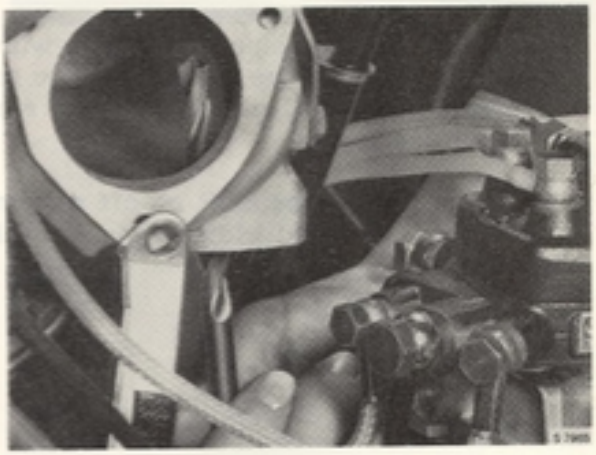
When the butterfly valve is slightly open, the tapping (1) on the butterfly valve housing will be on the rear side of the butterfly valve and will thus apply a vacuum signal to the signal converter.

The EGR valve will then pass a low EGR flow.

Cleaning

1. Remove the EGR pipe and the EGR valve. On cars with injection engines, the rubber bellows and throttle valve housing must first be removed.

2. Fuel injection engines:
   Clean the aperture in the inlet manifold with a 10 mm Ø drill bit. Remove any carbon deposits from the inlet manifold.



3. Carbureted engines:
   Clean the aperture in the inlet as follows:

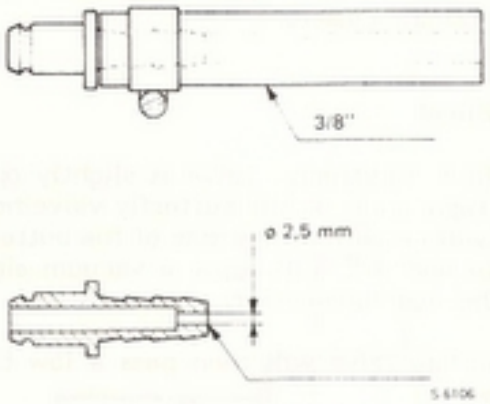
   a Remove the brake servo pipe from the connection on the inlet manifold.

   b Usa a specially-made adaptor to connect compressed air to the inlet manifold brake servo outlet.
   See box below:

Note
Compressed air should be connected to the inlet manifold through the brake servo connection when cleaning the EGR aperture in order to prevent particles of carbon entering the manifold.

A specially-made compressed air adaptor with an internal orifice (2.5 mm Ø) and a length of 3/8 in compressed air hose is used to limit the pressure of the air.

The compressed air adaptor is made as shown in the figure, e.g. by soldering up the end of the connector and then drilling out a 2.5 mm Ø hole.



   c Clean the EGR aperture in the inlet manifold with a 10 mm Ø drill bit which allows the carbon deposits to be blown out.

   d Remove the compressed air hose and refit the brake servo hose.

4. Wash the EGR pipe and clean with compressed air. Use a piece of wire to clear the pipe if carbon deposits are extensive.

   The orifice in the EGR on-off system should be cleaned with a 4 mm Ø drill bit.

5. Clean the inlet and outlet of the EGR valve using a rotary wire brush. Take care not to damage the valve spindle when cleaning the outlet side.

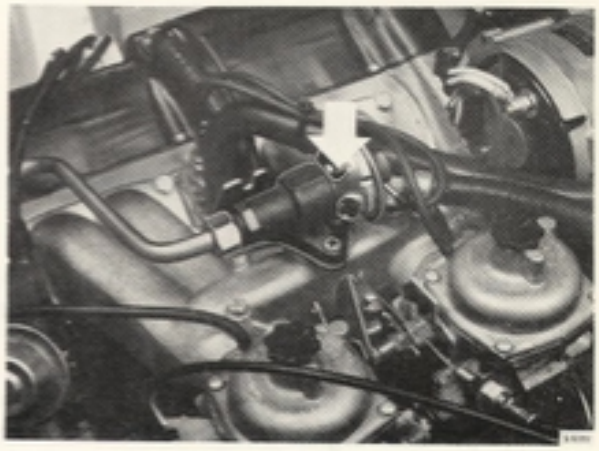
   Rinse the valve in trichloroethylene and blow the valve clean with compressed air, keeping it open by means of a vaccum. To create a vacuum in the EGR valve, use a vacuum pump or suck through a hose connected to the valve.

6. Install the EGR valve using a new gasket and mount the EGR pipe. Connect the vacuum hose. Cars with injection engines: Install the throttle valve housing and rubber bellows.

Checking the EGR system (On-off and two-port types)

1. Run the engine until warm and connect a tachometer.

2. Rev up the engine and check when the EGR valve opens. The valve should open at fast-idling speed (see below). The valve spindle is visible between the valve casing and the vacuum bellows.



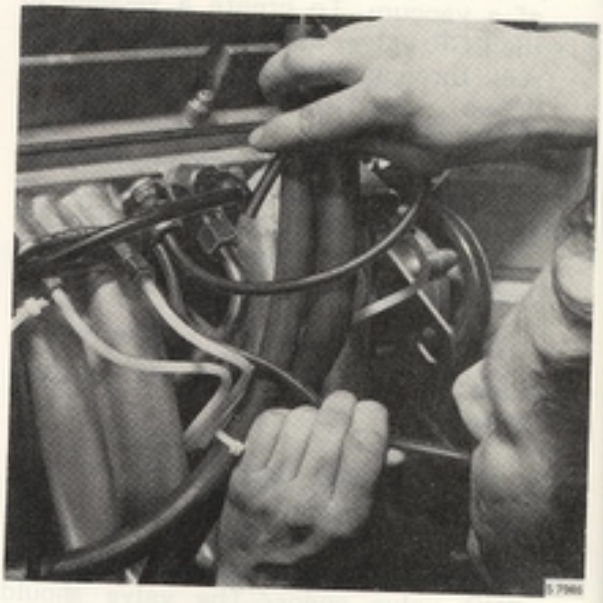
Type	Engine speed (fast idling) at which the valve should open
On-off	approx. 1 900 r/min
2-port	2 600 ± 300 r/min

Checking the EGR valve

1. Run the engine at idling speed.

2. Disconnect the vacuum hose from between the PVS valve and the EGR valve.

   Create a vacuum in the EGR valve using a vacuum pump or by sucking on the hose. The idling should become rough and the engine should eventually stop.



Checking the EGR system (proportional type in the car)

1. Start the engine, run it until it is warm and then let it run at idling speed.

2. Disconnect the hose from connection A of the signal converter at the branch point downstream of the butterfly valve housing (vacuum hose for the ignition system).

3. Disconnect the hose from connection C of the signal converter. (Hold your finger over the hole or seal the hose, so that air will not be drawn into the intake manifold.)

4. Raise a vacuum in the hose A disconnected earlier, using a vacuum pump or by sucking at the hose end. If the operation is correct, the idling speed should now drop, and the engine may even stall.

5. Reconnect the hose to connection C of the signal converter.

6. Raise a vacuum again in the hose disconnected earlier. If the operation is correct, the engine speed should not be affected.

Checking the performance of the EGR valve

1. Start the engine, run it warm and let it run at idling speed.

2. Disconnect the hose between the EGR valve and the thermostatic valve.

3. Raise a vacuum in the EGR valve by means of a vacuum pump or by sucking at the end of the hose.

   If the operation is correct, the idling speed should drop, and the engine may even stall.

   Reconnect the hose.

4. Disconnect the hose between the EGR valve and connection 2 on the butterfly valve housing. Pressurise the EGR valve by means of a radiator tester or by blowing into the end of the hose.

   If the operation is correct, the idling speed should drop, and the engine may even stall.

   Reconnect the hose.

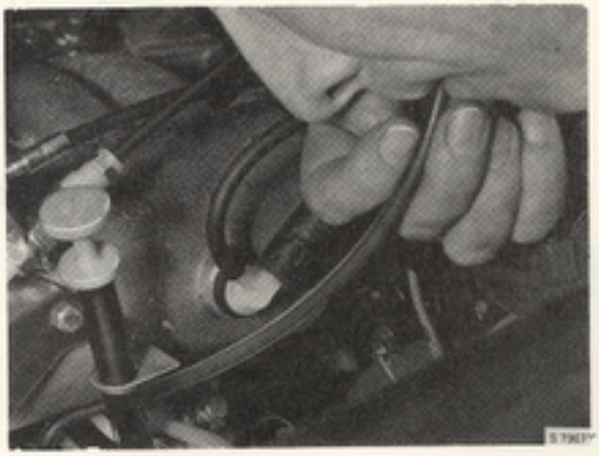
Note
A slight amount of leakage may occur due to imperfect tightness between the valve spindle and the valve housing.

Checking the thermostatic (PVS) valve

Check the performance of the thermostatic valve by disconnecting the hoses and blowing through the valve.

If the engine temperature is below 20°C (68°F), the valve should remain closed.

If the engine temperature is above 20°C (68°F), the valve should be open.



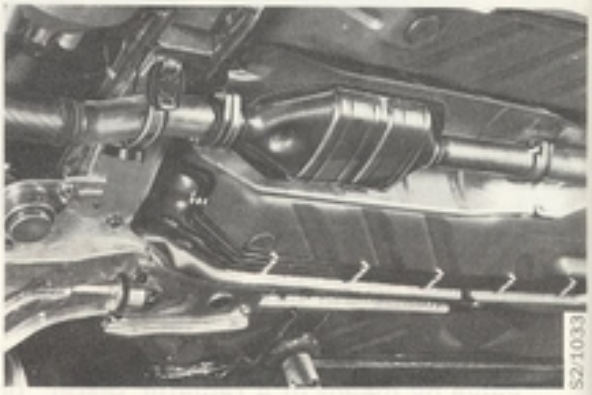
Catalytic converter (USA spec. only)

The final stage in the exhaust emission control system consists of a catalytic converter fitted in the exhaust pipe between the exhaust manifold and the front silencer.

Provided that the oxygen-sensor-regulated CI injection system maintains the optimum air/fuel mixture, with oxidation of the carbon monoxide (CO) content and hydrocarbons (HC), the catalytic converter reduces the emission of oxides of nitrogen (NO_x). The exhaust emitted by the car to the atmosphere will therefore consist largely of carbon dioxide (CO_2), hydrogen (H_2) and nitrogen (N_2).

The catalytic converter consists of a cellular ceramic insert, the walls of which are coated with catalytic material (platinum and rhodium).

Cars equipped with catalytic converters must never be run on anything other than lead-free fuel. This is because lead destroys the active constituents of the catalyst.

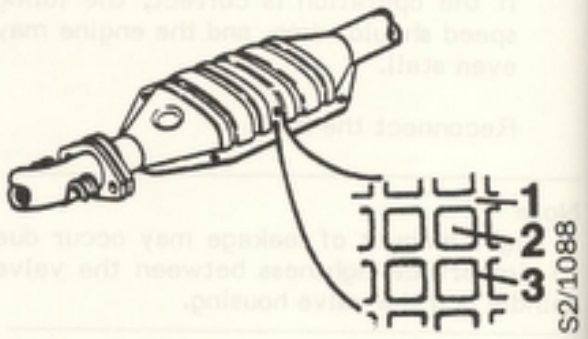


Checking the condition of the catalytic converter (1981-83 models)

A check of the condition of the catalytic converter can be made by comparing the CO content upstream and downstream of the converter.

The CO values with the engine idling at normal temperature must be within the following limits:

Upstream of converter:	0.5 - 1.2% CO
Downstream of converter:	<0.3% CO



Catalytic converter

1 Ceramic insert
2 Passages
3 Catalytic coating

To fit

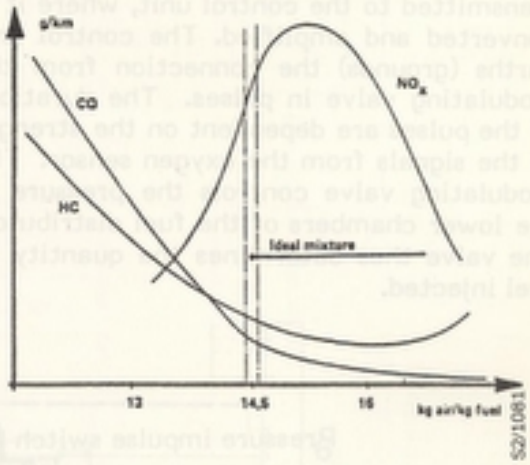
The catalytic converter is fitted to the exhaust pipe by means of flange couplings. The leading coupling has a conical seal (olive) and the trailing coupling a plain seal.

Oxygen-sensor regulated injection system (Lambda)

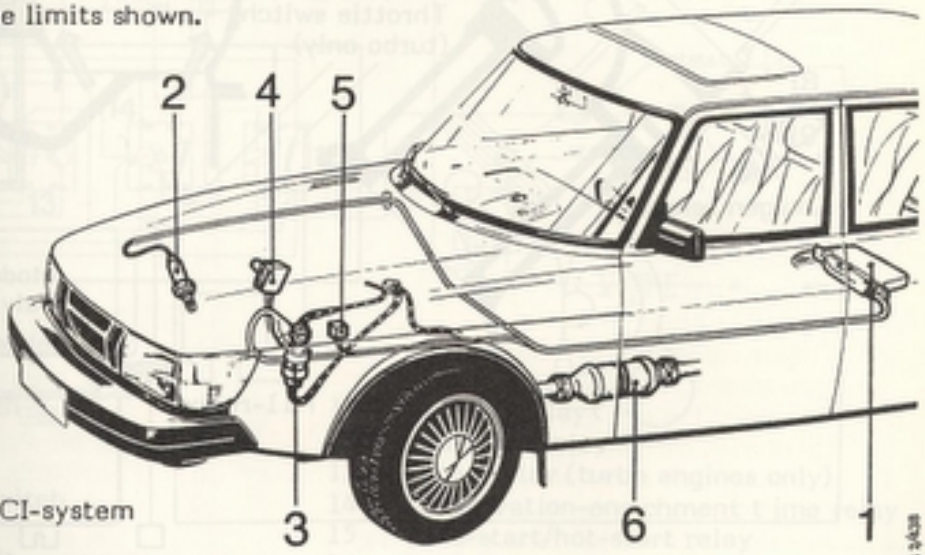
General

US-cars are equipped with the CI or LH Jetronic injection system combined with an electronic control system which is regulated by an oxygen sensor (also known as Lambda sensor) located in the exhaust manifold. The cars are also fitted with a three-component catalytic converter which is located between the exhaust manifold and muffler in the exhaust pipe.

The three-component catalytic converter is capable of reducing the content of CO, HC and NO_x in the exhaust gases down to the prescribed limits on the condition that accurate regulation of the air-to-fuel ratio can be maintained under all driving conditions. The chart below shows the extremely narrow range within which the converter can work. Should the air-to-fuel ratio move outside this field, then the limit governing one or more of the relevant gases will be exceeded. The sensor-regulated injection system ensures that the air/fuel mixture is continually kept within the limits shown.



Air/fuel ratio and exhaust gases



Oxygen-sensor regulated CI-system

1 Electronic control unit, Lambda
2 Oxygen sensor
3 Modulating valve
4 Throttle switch
5 Relay
6 Catalytic converter

Oxygen-sensor-regulated CI injection system (1984 models)

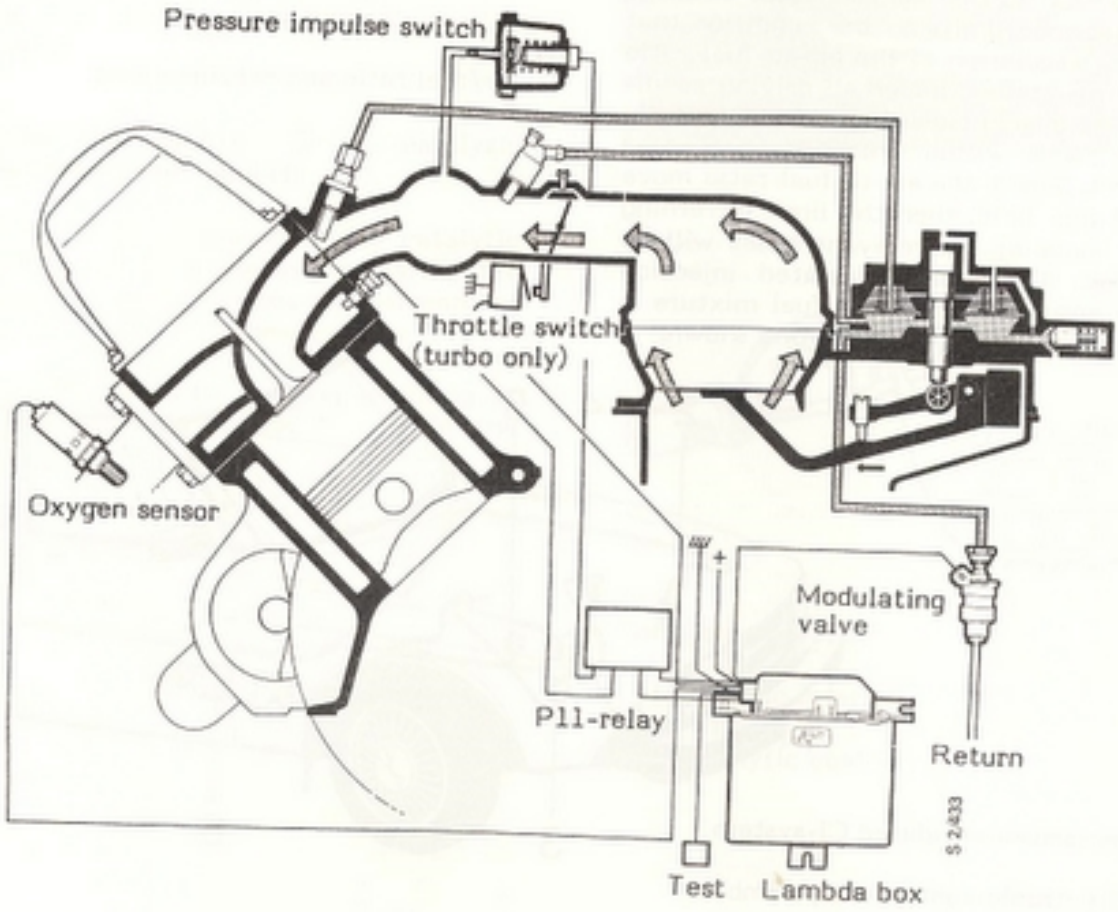
General description

Oxygen sensor regulation is a further development of the CI system and is designed to ensure more precise control of the air-to-fuel ratio. The system consists of an oxygen sensor, located in the exhaust manifold, which senses the amount of oxygen in the exhaust gases. The sensor delivers a voltage signal which is dependent on the amount of oxygen. The signal is transmitted to the control unit, where it is converted and amplified. The control unit earths (grounds) the connection from the modulating valve in pulses. The durations of the pulses are dependent on the strength of the signals from the oxygen sensor. The modulating valve controls the pressure in the lower chambers of the fuel distributor. The valve thus determines the quantity of fuel injected.

If the fuel sensor should maloperate, the control unit will apply a fixed pulse value to the modulating valve.

Under some conditions, a richer air-to-fuel ratio is necessary. The system is therefore supplemented with an enrichment system.

This enrichment system is operative, for instance, when the engine is started, when the car is accelerated within 2 min after starting and on full-throttle acceleration (only on the Turbo).

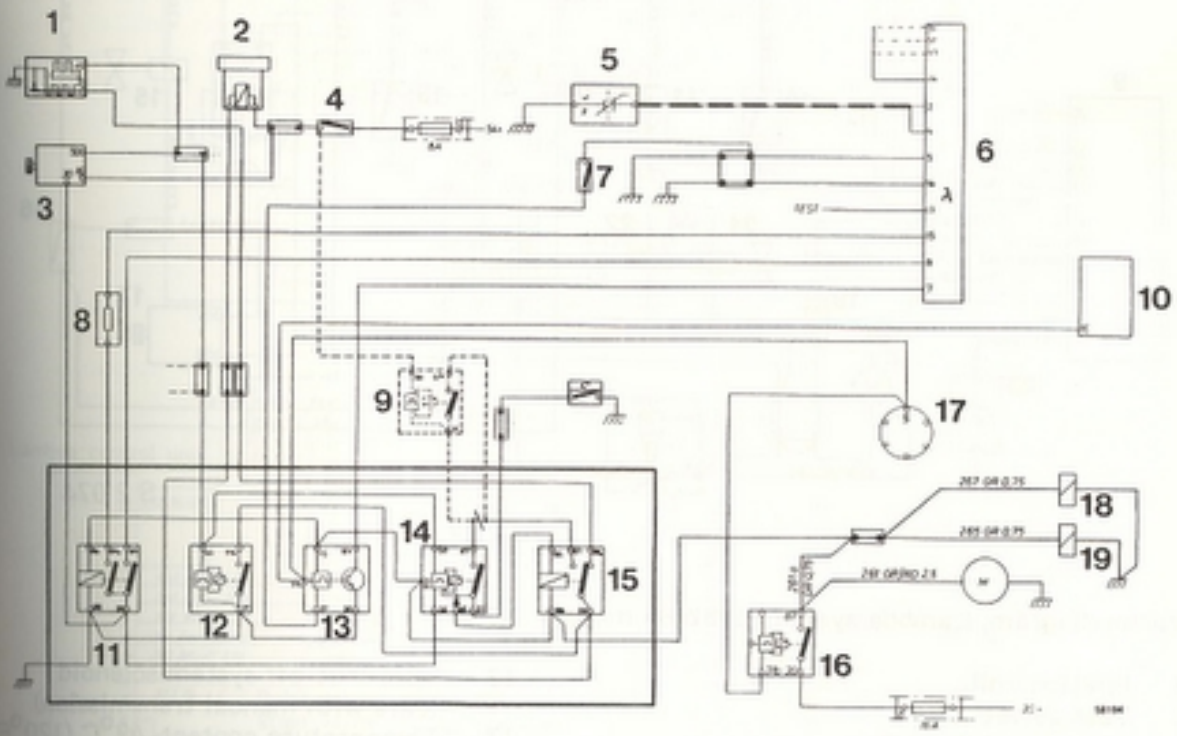


Electrical system and control of oxygen sensor (Lambda sensor)

In 1981 model cars, when the fuel pump is running the relay receives power from the pump relay and terminal 30 on the starter motor. Consequently, power flows to terminal 8 on the electronic control unit and to terminal 15 via the modulating valve.

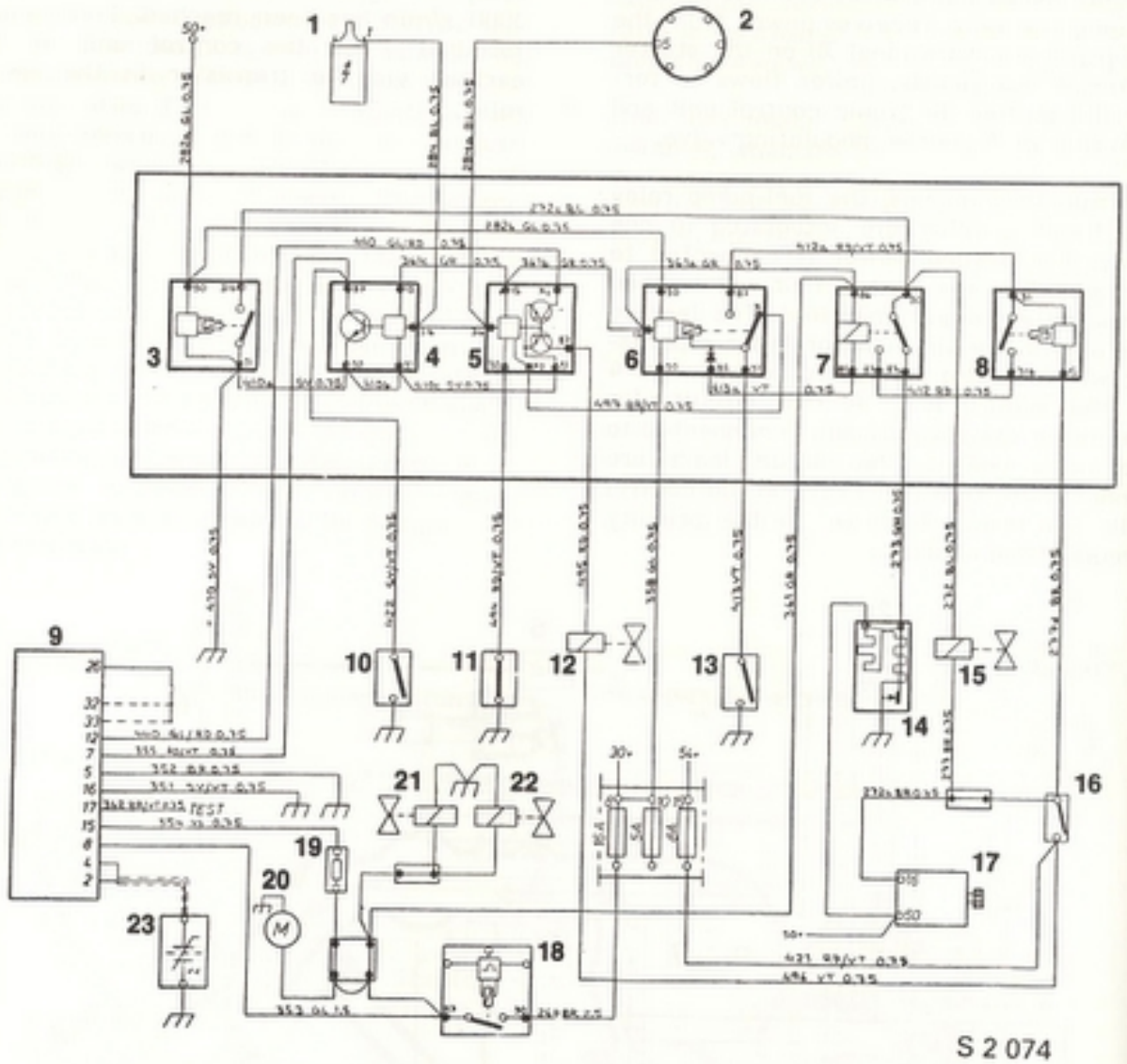
As from 1982 models, the fuel-pump relay and Lambda relay are integrsted in one relay. The oxygen sensor is connected to terminal 2 on the control unit and earthed through the exhaust manifold. The lead to the oxygen sensor incorporates a suppressor which is also connected to terminal 4 on the control unit. A test circuit, for measuring the pulse ration, is connected to the relay holder. The circuit leads are connected to terminal 17 (-) on the control unit and terminal 15 (+) in the primary circuit of the ignition.

In turbo engines, full-load enrichment takes place when the throttle switch is closed (butterfly wide open) and the speed relay has signalled that an engine speed of 3000 r/min has been reached. This causes terminal 7 on the control unit to be earthed via the transistor in the speed relay.



Lambda system (1981 models)

1 Thermostatic switch
2 Start valve
3 Starter motor
4 Pressure impulse switch
5 Oxygen sensor
6 Lambda control unit
7 Throttle switch
8 Modulating valve
9 Accel eration enrichmentpulse relay
10 Electronic control unit for ignition system
11 Lambda relay
12 Hot-start relay
13 Speed relay (turbo engines only)
14 Acceleration-enrichment t ime relay
15 Cold-start/hot-start relay
16 Fuel-pump relay
17 Test socket
18 Control pressur e regulator
19 Auxiliary air valve



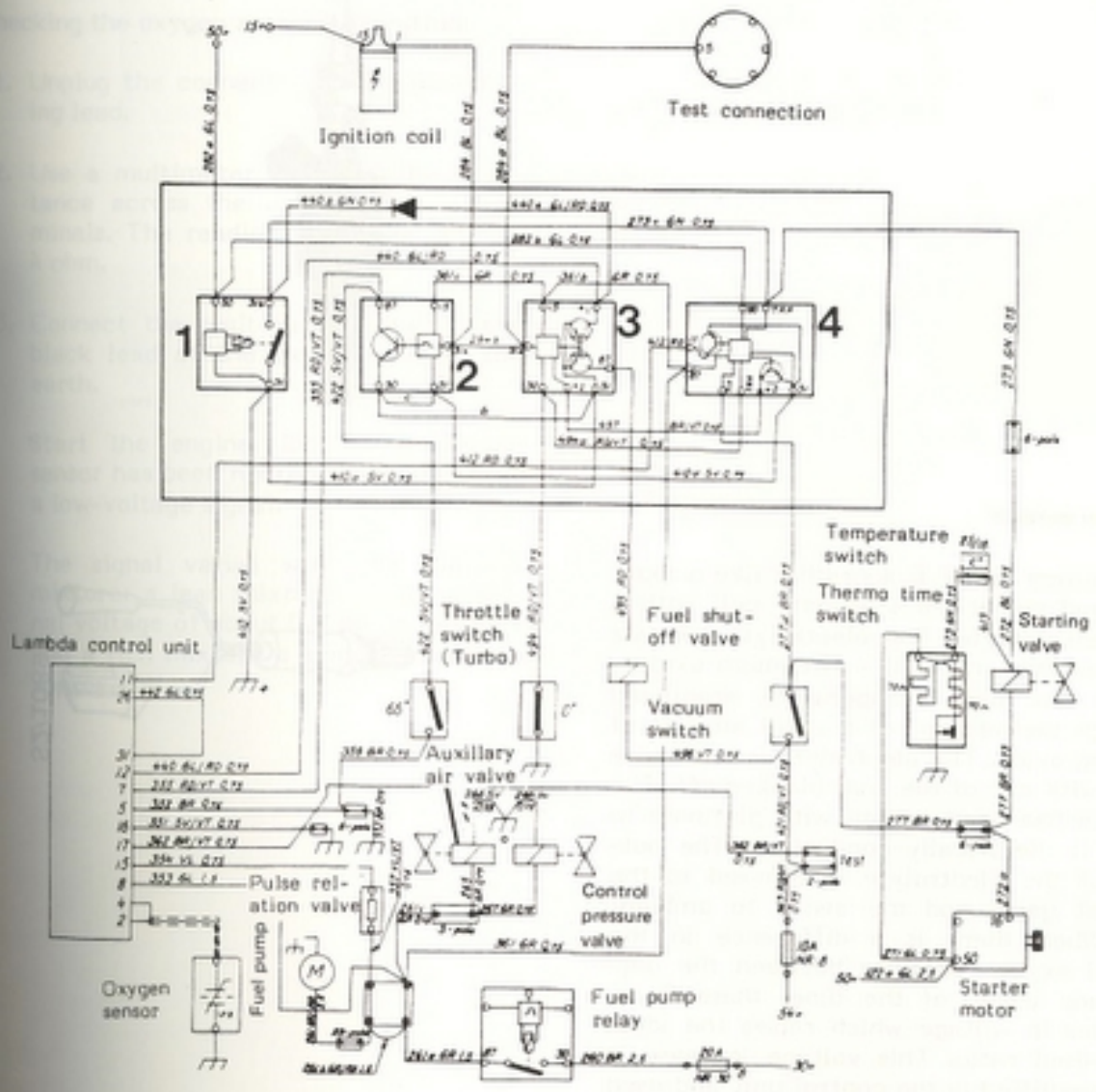
Wiring diagram, Lambda system, 1982-83 models

1 Ignition coil
2 Test outlet
3 Hot start pulse relay
4 Engine speed relay model 1981: 3000 rpm model 1982-: 3.800 rpm
5 Deceleration system relay (cars with manual transmission)
6 Acceleration enrichment time relay
7 Cold/Hot start ground relay
8 Acceleration enrichment pulse relay
9 Control unit, Lambda
10 Throttle switch 65° only turbo
11 Throttle switch 0°
12 Fuel shut-off system solenoid (cars with manual transmission)
13 Temperature contact, 49°C (120°F)
14 Thermo time switch
15 Start valve
16 Vacuum switch
17 Starter motor
18 Fuel pump relay
19 Modulating valve
20 Fuel pump
21 Auxiliary air valve
22 Pilot pressure valve
23 Lambda sensor

Location of relays in the Lambda box as from the 1984 model

B & C Time delay relay (relay P11)
E Engine speed relay, fuel shut-off (manual transmission only)
F Warm start relay
G Engine speed relay (Turbo only)

S 2/435



Wiring diagram for the Lambda system as from the 1984 model

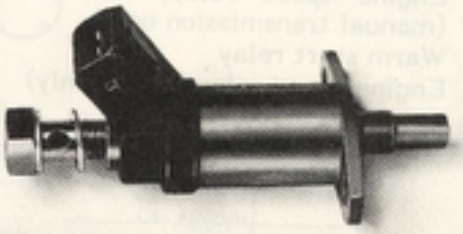
1 Pulse relay
2 Lamda engine speed relay
3 Deceleration relay
4 Transient enrichment relay (P11)

Enrichment system

The Lambda system has been supplemented with an enrichment system which comes into operation on different occasions. The purpose of the enrichment is to improve the drivability when starting the engine from cold or warm and when accelerating.

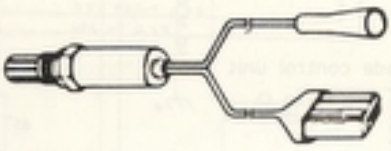
Enrichment is carried out via the starting valve and the modulating valve.

Two different versions of the enrichment system have been produced, one of these being for the 1981 - 83 models and the other as from the 1984 model.



Oxygen sensor

The oxygen sensor looks rather like a spark plug and comprises a primary cell with a solid electrolyte. The electrolyte consists of a ceramic material - zirconium oxide - which has been temperature stabilized through the addition of a small amount of yttrium oxide. The electrolyte is in tubular form with one of the ends blanked off. The surface has been coated with platinum to make it electrically conductive. The outside of the electrolyte is exposed to the exhaust gases and the inside to ambient air. When there is a difference in the partial oxygen pressure between the outside and inside of the tube, there is an increase in voltage which raises the ideal air-to-fuel ratio. This voltage increase is then amplified in the control unit and used to regulate the impulses transmitted to the modulating valve.



S2/1089

The oxygen sensor must be kept at a specified temperature (above 600°C, 1100°F) to work efficiently. The sensor must be replaced every 30.000 miles (B201 engines) as the strength of the output signal decreases with age. Accordingly, a mileage counter has been fitted which actuates a warning lamp (EXH) after 30.000 miles. The counter should be reset in conjunction with replacement of the sensor. No mileage counter (distance recorder) is fitted to B202 engines but the oxygen sensor must be replaced every 90,000 km (55,000 miles).

Checking the oxygen sensor preheating

1. Unplug the connector on the connecting lead.

2. Use a multimeter to check the resistance across the oxygen sensor terminals. The reading should be approx. 4 ohm.

3. Connect the multimeter between the black lead of the oxygen sensor and earth.

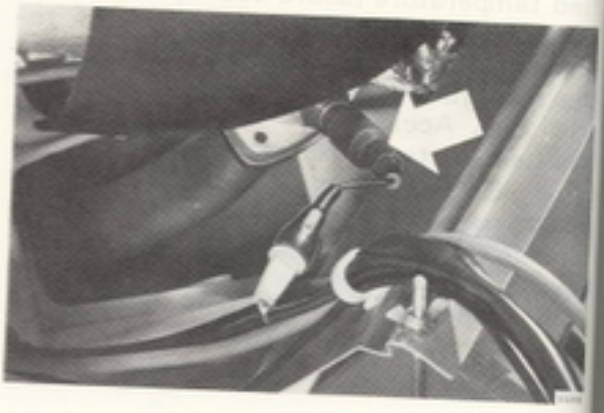
   Start the engine. Once the oxygen sensor has been heated, it should emit a low-voltage signal.

   The signal varies with the air/fuel mixture: a lean mixture causes a signal voltage of about 0 V to be emitted and a rich mixture a signal voltage of approx. 1 V.

S2/1089

Replacing the oxygen sensor

Before fitting the oxygen sensor, coat all threads and gaskets with an antiseize compound (e.g. Never Seize or Molycote 1000).

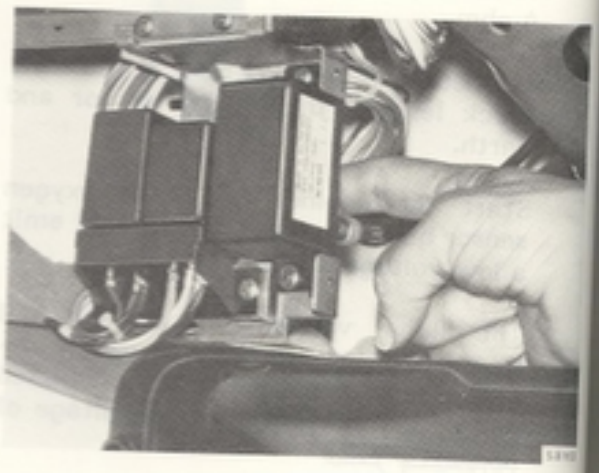


Note
The joint between the oxygen sensor and the exhaust manifold must be gas-tight. Check that the other joints between the cylinder head cover and the muffler are tight.

Note
The oxygen sensor is highly sensitive to knocks and must be handled carefully.

Reset the counter for the EXH service warning light as follows:

1. Remove the padding from below the instrument panel.
2. Depress the button on the counter.
3. Refit the padding.

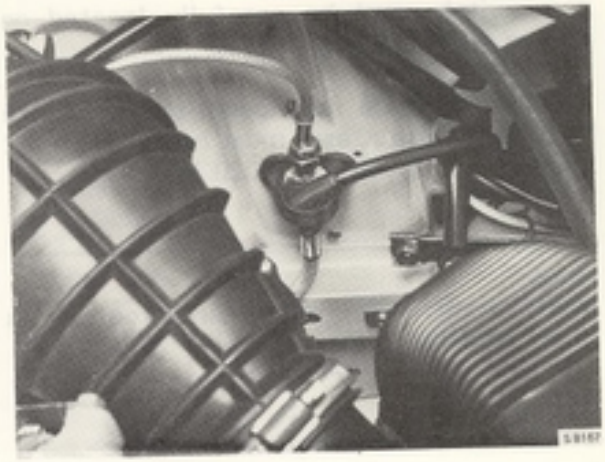


Replacing the modulating valve

Note
During removal and fitting of the modulating valve, prevent the rubber valve retainer from coming into contact with gasoline. The rubber is of a special grade to prevent vibrations from the valve being transmitted to the body. The rubber swells considerably if allowed to come into contact with gasoline.

Removal

1. Disconnect the electric cable.
2. Disconnect the small-bore line to the modulating valve. Grip the hexagonal nut closest to the hose (14 mm across flats) and undo the valve nut (17 mm across flats).
3. Remove and disconnect the valve and return lines.



Fitting

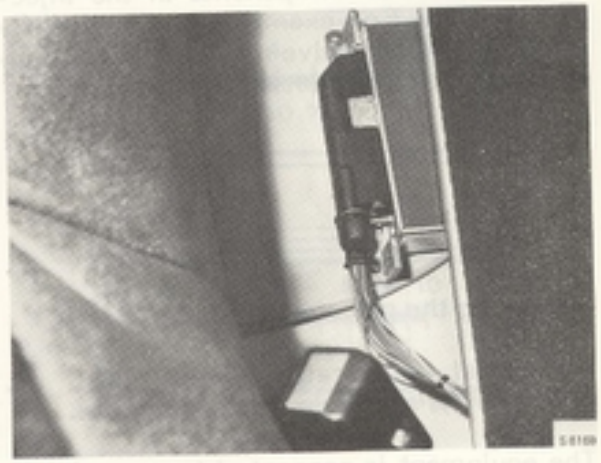
1. Fit the valve and return lines.
2. Connect the small-bore hose to the valve.
3. Connect the electric cable to the valve.

Replacing the Lambda control unit

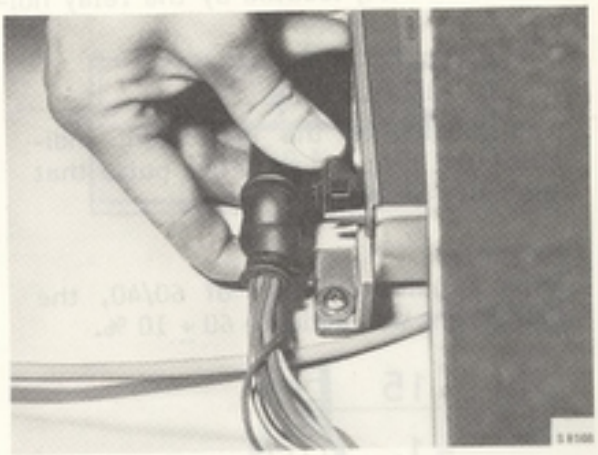
To remove

1. Tilt the rear seat cushion forward.

2. Squeeze the clips on the connector and pull the connector off the control unit.



3. Undo the three retaining screws and lift out the control unit.



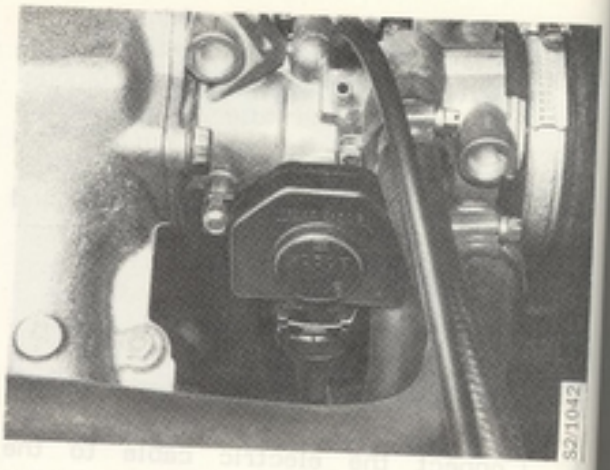
To fit, reverse the removal procedure.

Fitting the throttle switch

The switch must be carefully located on fitting, as follows:

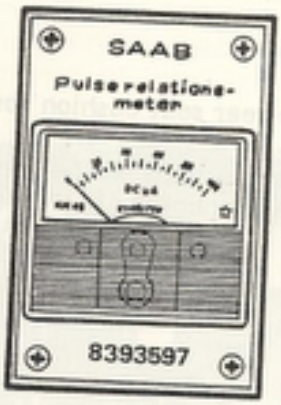
With the throttle fully open, the clearance from the contact arm must be between 0.2 and 0.5 mm (0.008 and 0.020 in).

Note
Insertion of the contact arm too far is likely to damage the switch.



Fault diagnosis of Lambda system (CI injection system)

Before tracing possible faults in the oxygen-sensor regulating system itself, make sure that the symptoms are not caused by mechanical faults in the engine, ignition system or other components in the injection system. For example, an incorrectly adjusted exhaust valve may have a considerable effect on regulation of the system.



S 2/458

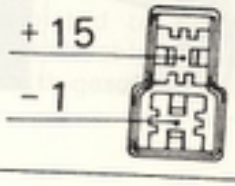
Measuring the pulse relation

A special pulse-ratio meter, part no. 83 93 597, is available for this purpose.

The equipment is connected to a special 2-pole test socket, located by the relay holder.

The reading on the instrument indicates the proportion of the pulse that the valve is open.

Example:
With a pulse relation of 60/40, the instrument will indicate 60 ± 10 %.



S 5728

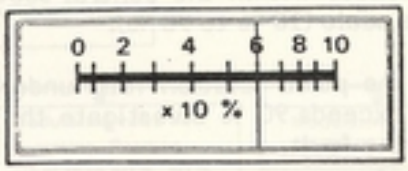
It is also possible to use certain types of dwell angle testers. The scale values must be corrected accordingly and possibly also marked on the scale itself.

Connect the tester to battery voltage. Connect the primary connections of the dwell angle tester as shown in figure.

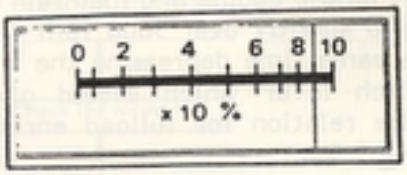
Measuring with engine switched off:

With the engine switched off, connect a jump lead across terminals 30 and 87 in the relay holder for pump relay and switch on the ignition. The modulating valve should then operate audibly and evidently.

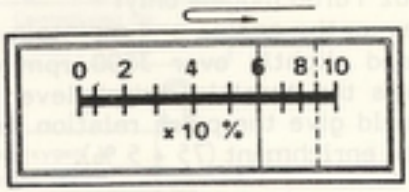
1. With the sensor connected, the reading should be 60 ± 5 % for model 1981 and 50 ± 5 % as from model 1982 cars. This is a fixed pulse relation which is maintained before the sensor has reached its working temperature and in the event of the sensor being defective.



2. By disconnecting the cable from the oxygen sensor and grounding it, it is possible to obtain a reading approximately 90 %. Greatest scope exists here for the regulating system to enrich the fuel/air mixture.

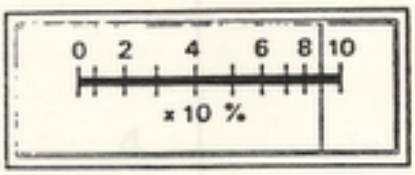


3. When the sensor cable is disconnected from ground, the system will "lock on" to 60 ± 5 % (1981) and 50 ± 5 % (as from 1982), directly with no lean mode as on earlier systems.



Measuring immediately after starting (1984 models)

1. Immediately after starting, the meter reading should be 92 %. The value should persist for 3 s after the engine has started.



2. Depress the accelerator pedal quickly. Every time the accelerator pedal is depressed, the meter reading should be more than 90 %.

Measuring with the engine running

With the engine running, it is possible to observe variations due to the regulation of the pulse relation.

1. A fixed pulse relation will be obtained when the oxygen sensor is cold, up to about 1 minute after starting from cold, on the 1984 model, up to a coolant temperature of 25°C (77°F).
   Observed value: 60 ± 10%.

2. Once the engine has reached operating temperature the pulse relation should oscillate within the central section of the scale (10 % to 90 %).

   If the pulse relation falls under 10 % or exceeds 90 % investigate the cause of the fault.

3. 1981 Turbo models only:
   Rev up the engine and maintain engine speed slightly over 3000 rpm while at the same time depressing the throttle switch lever which should give the pulse relation for fulload enrichment (85 ± 5 %).

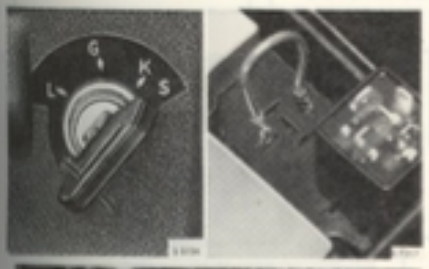
   1982 Turbo models only:
   Rev up the engine and maintain engine speed slightly over 3800 rpm or depress the throttle switch lever which should give the pulse relation for full-load enrichment (75 ± 5 %).

Fault Diagnosis chart (oxygen sensor regulated CI-system)

1

If the engine is warm, let it cool for about 3 minutes. Connect the pulse relation measuring instrument.

2



Switch on the ignition. Disconnect the fuel pump relay and connect a jump lead across terminals 30 and 87 in the relay holder.

Yes: Audible and apparent operation of modulating valve. Pulse relation 60±10% (-1981) or 50 ± 5% (from 1982). It will take a few seconds before the control unit regulates the pulse relation regulary.

No:

- Modulating valve operating but incorrect pulse relation.
  - Check that the measuring equipment is properly connected. Check the pulse relation. Is the pulse relation as specified?
    - Yes: Disconnect the oxygen sensor line. Pulse relation should approach 60 % - 1981 / 50 % - 1982
      - No: Control unit defective.
      - Yes: Oxygen sensor defective.
    - No: Check the wiring.
      - OK: Control unit defective.
- Modulating valve not operating. Reading other than 60 %, 50 % or 0.
  - Check the modulating valve. Coil resistance, 2 to 3 ohm.
    - OK: Check the wiring.
- Modulating valve operating, no reading.
  - Check that the measuring equipment is properly connected.

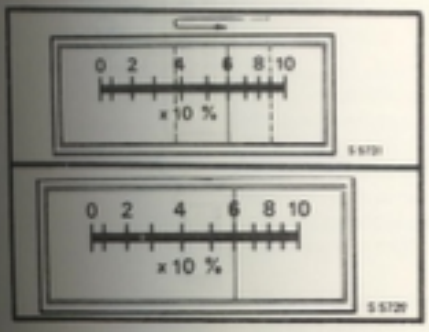
3

Disconnect the line from the oxygen sensor. No change in pulse relation. Ground the oxygen sensor wire. Pulse relation exceeds 75%. (Greater than 60% = rich mixture).

Yes

No

4



Disconnect the wire from ground. Pulse relation " locks on " 60 ± 5% (-1981) or 50 ± 5% (from 1982).

Yes

No: Test the circuit between terminal 2 on the control unit and the oxygen sensor.

- OK: Control unit defective.

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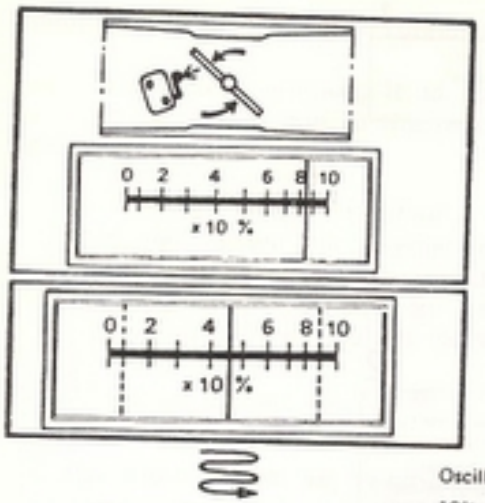


Non Turbo

Turbo

Turbo cars:

Start the engine and depress the throttle switch lever (full load enrichment). Steady pulse relation of 85 ± 5 % for 1981 and 75 ± 5 % for 1982–.

No

Check the throttle switch, r.p.m. relay and the wiring.

Yes

Connect the Sond wire and run the engine until warm. The pulse relation should oscillate within the central section of the schale.

Oscillates under 10%

Oscillates between 10 and 90%

Oscillates above 90%

Rev up engine to 4000 r.p.m.

System OK

Rev up engine to 4000 r.p.m.

Pulse relation remains low

Pulse relation increases

Pulse relation decreases

Pulse relation remains high

Check control pressure and line pressure

Check crankcase ventilation. (Fuel mixed with engine oil?)

Check for air leaks: From crankcase ventilation between airflow sensor and engine.

Check control pressure and line pressure.

Check CO reading before catalyser.

Check control pressure and line pressure.

Check CO reading before catalyser.

CO exceeds 1%

CO below 0,3%

Check fuel distributor

CO exceeds 1%

CO below 0,3%

Check fuel distributor

Check Sond, electronic unit (A) and wiring (A).

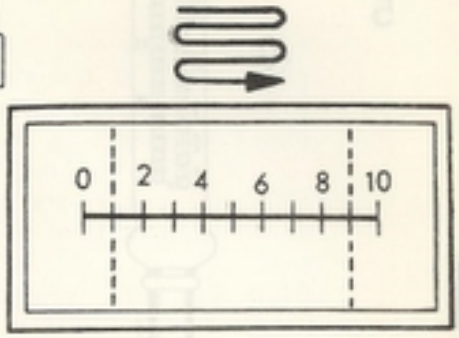
Check Sond, electronic unit (A) and wiring (A).

Check fuel distributor

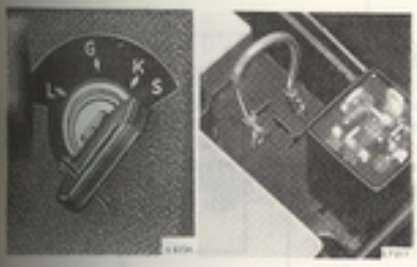
Fault Diagnosis chart (electrical system)

1

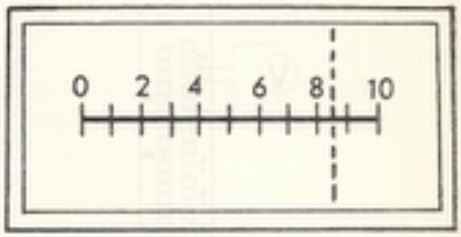
Disconnect the connector from the control unit.



2



Switch on the ignition. Disconnect the fuel pump relay and connect a jump lead across terminals 30 and 87 in the relay holder.



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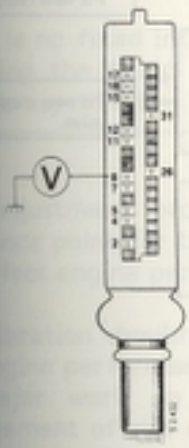


Check the voltage at the control unit connection: Connect a voltmeter across terminal 8 (+) and ground. The meter will indicate the battery voltage.

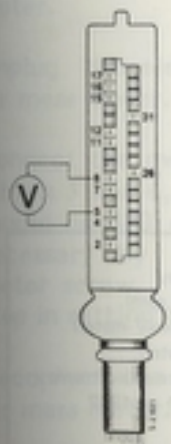
No → Disconnect the oxygen sensor relay and read off the voltage in the relay holder across:
1. 30 (+) and 87 (-)
2. 86 (+) and 85 (-)
Readings indicate battery voltage.

Yes → Fit new relay.

No →
1. Check the voltage at 30 in the relay holder and the circuit between 87 in the relay holder and 8 on the control unit.
2. Check the voltage at 86 in the relay holder and the circuit between 85 in the relay holder and ground.

Yes

4



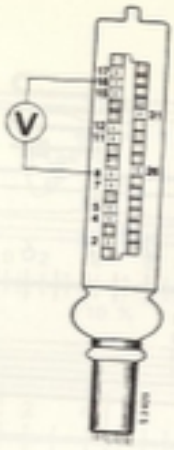
Measure the voltage across 8 (+) and 5 (-) at the control unit:
Meter indicates battery voltage.

No → Check the circuit between 5 on control unit and ground.

Yes

Continued on next page.

5



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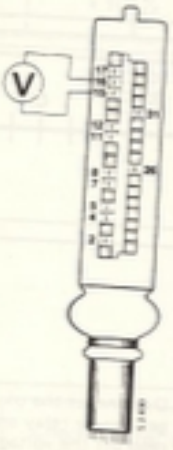

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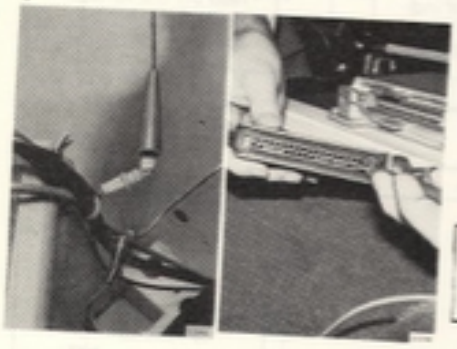

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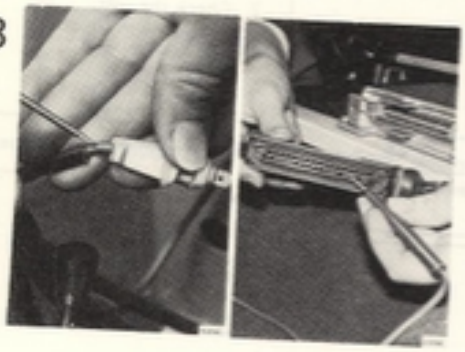

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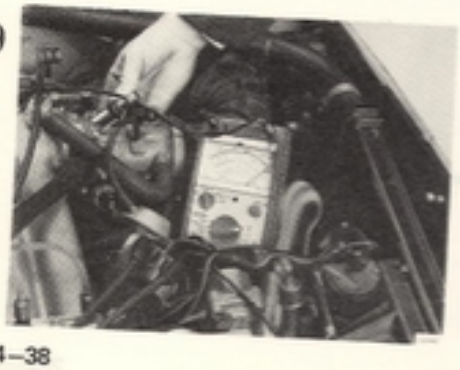


5

Measure the voltage across 8 (+) and 16 (-) on the control unit:
Meter indicates battery voltage.

No → Check the circuit between 16 on control unit and ground.

Yes ↓

6

Measure the voltage across 15 (+) and 16 (-) on the control unit:
Meter indicates battery voltage.

No → Disconnect the connector from the modulating valve and measure voltage at connector:
Battery voltage obtained across one terminal and ground.
0 reading obtained across other terminal and ground.

No → Check the circuit between the modulating valve and:
1981: terminal 87b on oxygen sensor relay.
1982: terminal 87 on fuel pump relay.

OK → Fit new relay.

Yes ↓

Using and ohmmeter, measure the resistance across the modulating valve:
2–3 ohm.

No → Fit new modulating valve.

Yes ↓

Check the circuit between terminal 15 on the control unit and the modulating valve.

Yes ↓

7

Disconnect the cable at the oxygen sensor and check the circuit between the oxygen sensor and terminal 2 on the control unit (ohmmeter).

Yes ↓

8

Check the circuit between the suppressor harness on the oxygen sensor and terminal 4 on the control unit (use an ohmmeter).

↓

9

Turbo: Check the acceleration enrichment circuit having removed the engine speed relay (1981 model: 3000 rpm, 1982 model: 3800 rpm)

- Terminal 15 connected to battery voltage(V-meter)
- Terminal 30 connected to earth (ohmmeter).
- Terminal 31 b corinected to ignition system, electronic unit, terminal 16 on 1981 and terminal 1 on 1982 (ohmmeter)
- Jump lead between terminals 31 and 87 on the relay holder and check that terminal 7 on the control unit is grounded when the throttle switch is depressed.

Lambda system on B202 engines with LH Jetronic fuel injection

Checking and adjusting the basic setting of the fuel system in conjunction with component replacement

1. Remove the blanking plug from the adjusting screw on the air mass meter.

2. Start the engine and run it until it reaches normal temperature.

3. Connect pulse meter 83 93 597 to the TSI socket complete with jumper leads 83 94 132 (02 80 701).

Checking the basic setting for fuel injection

Note
There is no fixed interval for checking and adjusting the basic setting for the fuel-injection system.

The adjustment procedure established a reference point for the LH system and does not affect engine performance.

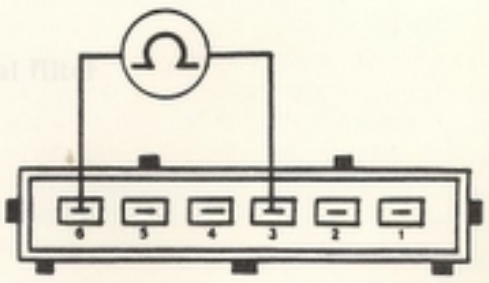
Recalibration should be carried out **only** if the engine performance has been disturbed by major work on the engine, such as replacement of the control unit, temperature sensor, air mass meter or the like, overhaul of the cylinder head or replacement of the timing chain.

1. Remove the blanking plug over the potentiometer screw on the air mass meter.

2. Unplug the electrical leads from the air mass meter.

3. Connect the multimeter between terminals 3 and 6, as shown; the reading should be 380 ohm. If not, adjust as necessary by turning the potentiometer screw. This is always the first step in setting the base value.

4. Reconnect the electrical leads to the air mass meter.

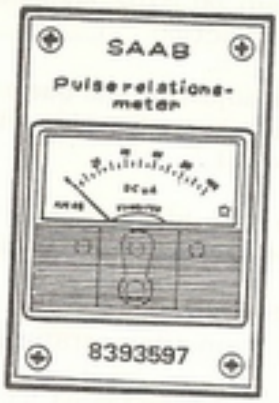


S2/1079

5. Connect pulse meter 83 93 597 to the test socket at the side of the evaporator housing using the leads provided with the LH service kit.

6. Start the engine and leave it running until the fan cuts in.

7. When the basic value is correct, the needle will oscillate between the ends of the scale.



S 2/458

Note
The needle will not oscillate or hunt rapidly across the scale and there may be a pause between needle movements. The needle moves very much more slowly than was the case with the CI system.

---

8. If adjustment is necessary, turn the potentiometer screw as follows:

   - If the needle locks at full scale or settles largely on the high side of the scale, turn the screw anticlockwise until the needle spends an equal amount of time at both ends.

   - If the needle settles largely on the low side of the scale, turn the screw clockwise until the needle spends an equal amount of time at both ends.

9. Refit the blanking plug over the screw in the air mass meter.

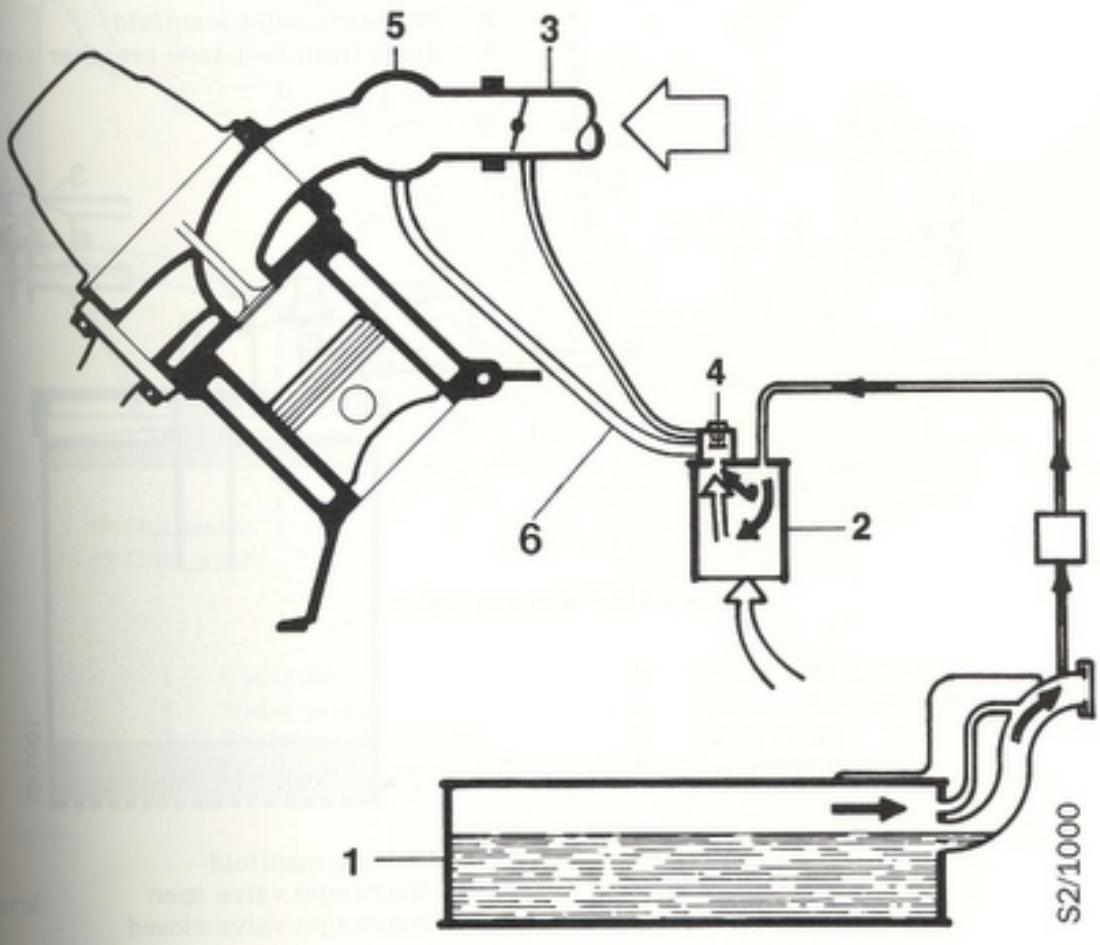
Evaporative-loss control device (ELCD)

Injection-engine cars with specifications for the USA, CA, JA, AU and ME are equipped with an ELCD.

Principle of operation

When the engine is switched off, hydrocarbons from the fuel tank breather system accumulate in the filter and are adsorbed by the activated charcoal.

When the engine is running, a control signal from the throttle housing acts on the diaphragm valve, opening the port to the inlet manifold and thereby purging the activated charcoal of the hydrocarbons. The depression in the inlet manifold and throttle housing provides the control signal and purging function.



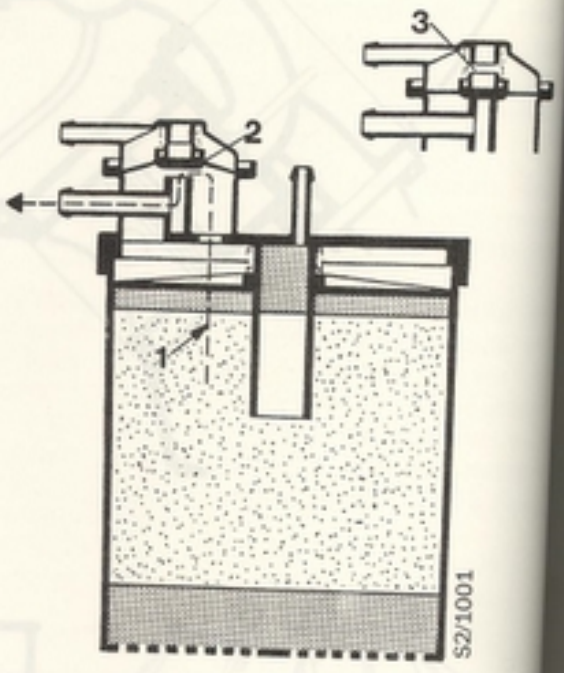
1 Fuel tank
2 Activated-charcoal filter
3 Throttle housing
4 Diaphragm valve
5 Inlet manifold
6 Hose

Activated-charcoal filter

At the top of the filter canister are the diaphragm shell and three connection spigots:

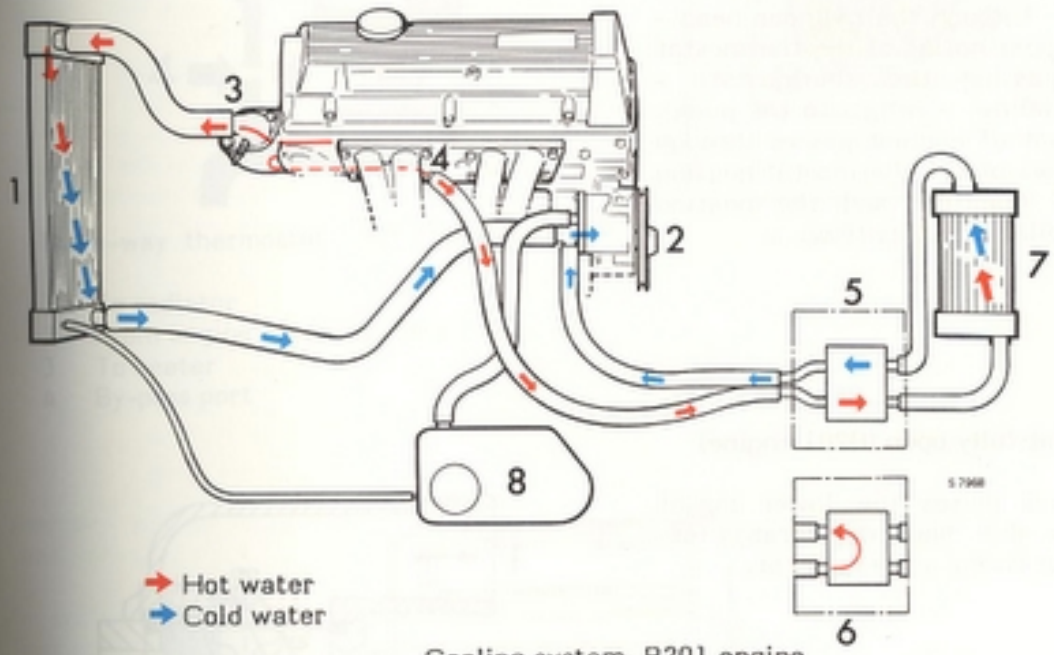
- Control signal from throttle housing
- Outlet to inlet manifold
- Inlet from fuel-tank breather system

1 Signal input
2 Outlet to inlet manifold
3 Inlet from fuel-tank breather system



1 To inlet manifold
2 Diaphragm valve open
3 Diaphragm valve closed

Radiator and cooling system



Cooling system, B201 engine

1 Radiator
2 Water pump
3 Thermostat housing
4 Outlet, inlet manifold
5 Water valve, open
6 Water valve, closed
7 Heater core
8 Expansion tank

General

The cooling system is a pressurized unit with a cross-flow radiator and expansion tank.

The water pump is mounted on the timing cover and is driven by a "V" belt from the crankshaft pulley. The thermostat is located in the housing bolted onto the front end of the cylinder head. The radiator fan is electrically driven and is connected over a thermostatic switch.

Coolant flow

A Thermostat shut

From the water pump - via a channel in the engine block - through the cylinder head and lower outlet of the thermostat housing - through the inlet manifold water jacket - through a hose to the passenger compartment heating system - through a hose from the heating system - return to pump.

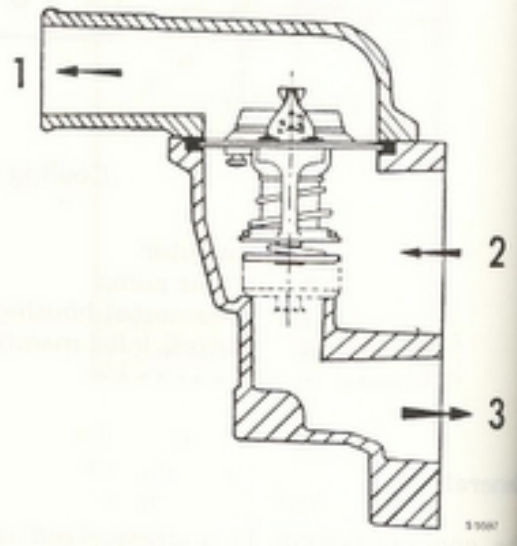
When the water valve for the passenger compartment heating system is open water circulates through the heater core. With the water valve shut a passage is opened in the valve connecting the inlet and exhaust sides of the engine, so completing the internal engine cooling circuit.

B Thermostat normally open (B201 engine)

From the water pump - via a channel in the engine block - through the cylinder head - through the upper outlet of the thermostat housing (by-passing the thermostat) - through the radiator - return to the pump. A small amount of coolant passes through the lower outlet of the thermostat housing via the inlet manifold and the heating system in parallel with this flow.

C Thermostat fully open (B201 engine)

The thermostat closes the lower outlet of the thermostat housing thereby forcing all coolant through the radiator.

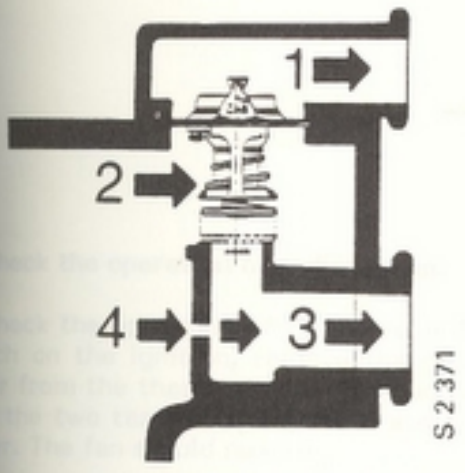


Three-way thermostat (B201 engine)

1 To radiator
2 From engine block/cylinder head
3 To water pump

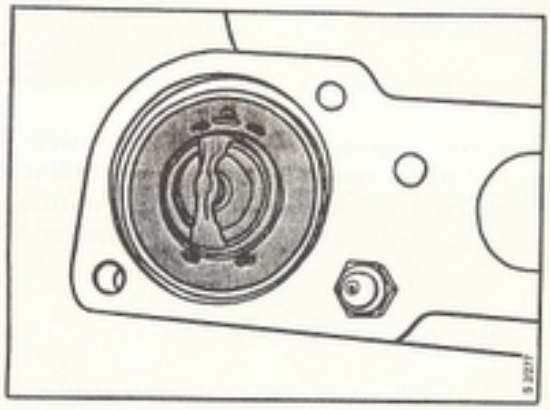
D Thermostat fully open (B202 engine)

The thermostat closes the lower outlet on the thermostat housing, forcing the coolant to circulate through the radiator and substantially reducing the flow through the heater.

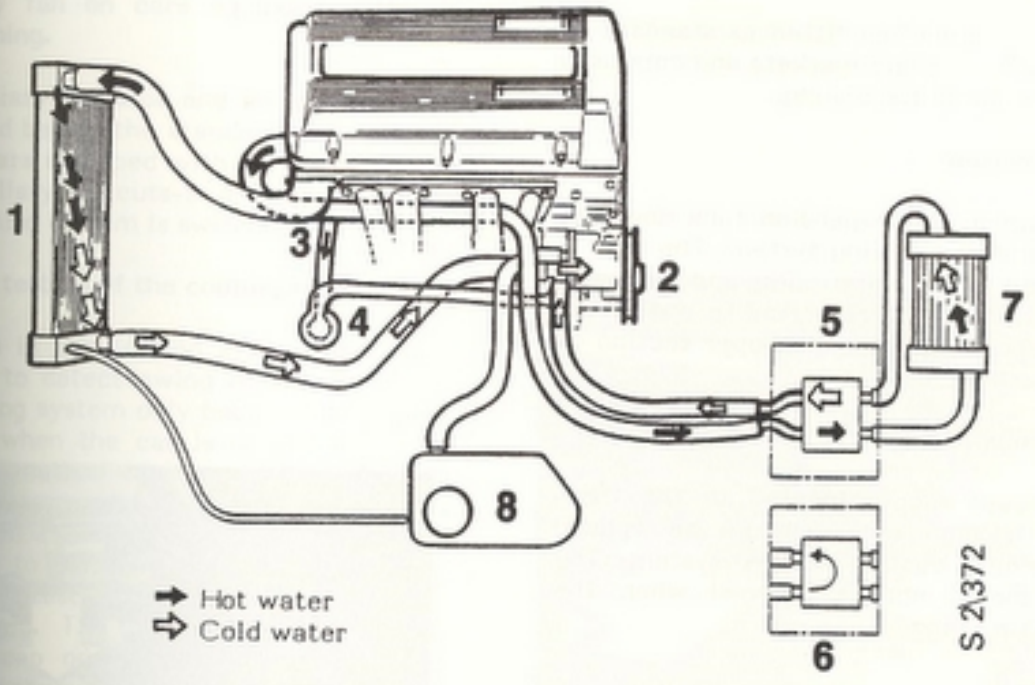


Three-way thermostat (B202 engine)

1 To radiator
2 From engine block/cylinder head
3 To heater
4 By-pass port



Thermostat



➡ Hot water
⇨ Cold water

1 Radiator
2 Water pump
3 Thermostat housing
4 Preheater, valve housing
5 Heater valve open
6 Heater valve closed
7 Heat exchanger
8 Expansion tank

Radiator

Normally aspirated engines

Radiators fitted in cars with specifications for Sweden and Finland are of the single-row type and those with other specifications of the dual-row type.

Cars with ME and FE specifications up to and including 1983 models are fitted with dual-row radiators.

Turbo engines

All turbo-engine cars are fitted with a special turbo-upgraded dual-row radiator, as are 1984 models onwards with normally aspirated engines and specifications for ME and FE.

Auxiliary cooling systems

A variety of auxiliary cooling systems are available to cope with difficult conditions. These are fitted in certain models and cars destined for certain markets where extremes of temperature are usual.

The auxiliary cooling systems include:

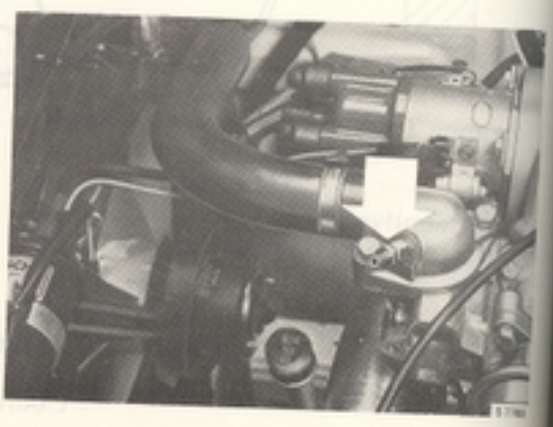
- Auxiliary cooling fan located to the left of the standard fan.
- Spoiler (ejector) fitted as standard to cars for certain markets and cars used extensively for towing.

Expansion tank

The liquid in the expansion tank does not circulate in the cooling system. The tank is connected to the water pump and the upper left section of the radia-tor to enable air to be evacuated from the upper section of the radiator.

Bleeder nipple

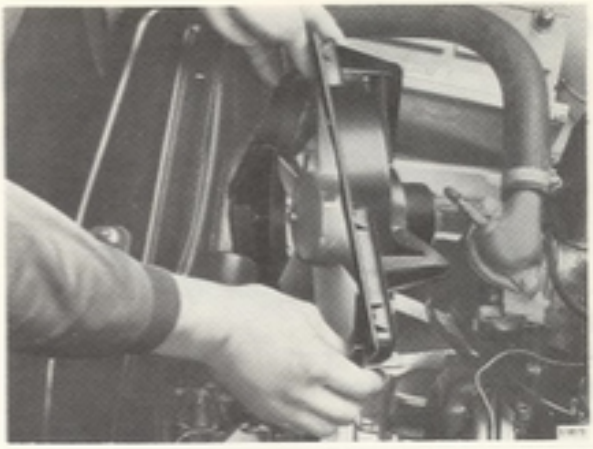
The bleeder nipple located in the thermostat housing cover should be opened when adding coolant to the system. The nipple should not be opened when the engine is running.



Radiator fan

General

The radiator fan is driven by an electric motor and is located behind the radiator. The fan is thermostatically controlled. The termostat switch is located on the left side of the radiator.



To check the operation of radiator fan

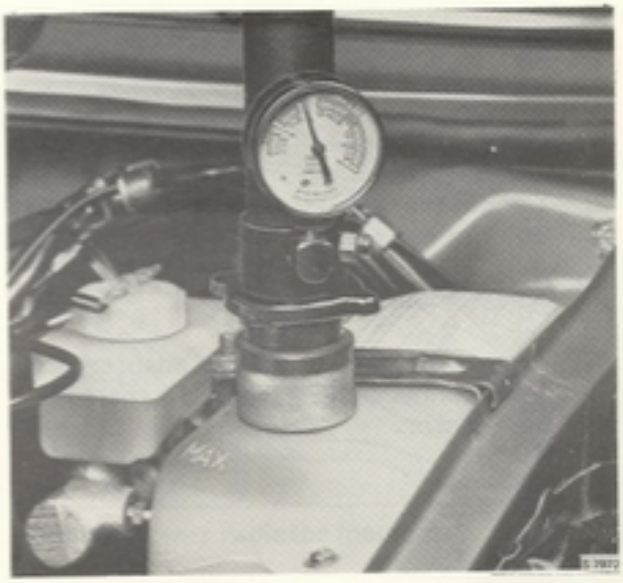
To check the operation of the radiator fan, switch on the ignition, remove the rubber cover from the thermostat switch and connect the two terminals, e.g. with a screwdriver. The fan should now run.

Auxiliary fan on cars equipped with air conditioning.

An auxiliary radiator and an auxiliary fan are fitted beside the standard radiator and fan on cars equipped with air conditioning. The auxiliary fan cuts-in as soon as the air conditioning system is switched on.

Pressure testing of the cooling system

Leakages in the cooling system are often difficult to detect owing to the fact that the cooling system only becomes fully pressurized when the car is on the road. An excellent method of testing the system is to use a pressure tester which pressurizes the system and enables the radiator hoses and seals to be checked. The highest permissible test pressure is 1.2 bar (17.5 lb/in^2). The pressure at which the radiator cap opens can also be checked using the pressure-testing equipment. The opening pressure should be between 0.9 and 1.2 bar (13.0 and 17.5 lb/in^2).



Cleaning the radiator

If the radiator has become clogged with dirt, insects, etc. it must be cleaned. Hose it clean holding the hose inside the engine compartment and directing the jet of water towards the front of the car. Blow the radiator dry using compressed air.

Note
Do not hose the radiator at too high a pressure as excessive pressure is likely to damage the fins.

Checking the radiator

To check whether the radiator is blocked, run the engine until the thermostat opens. Thereafter, check the temperature of the radiator using your hand. If distinct hot and cold zones are apparent, the radiator is blocked and must either be cleared or replaced.

Checking the expansion tank filler cap

If the car has been driven for some time with an incorrect concentration of anti-freeze in the coolant, deposits may form in the filler cap and have an adverse effect on its ability to function properly. To check the function of the filler cap, use pressure tester and adaptor 83 94 140.

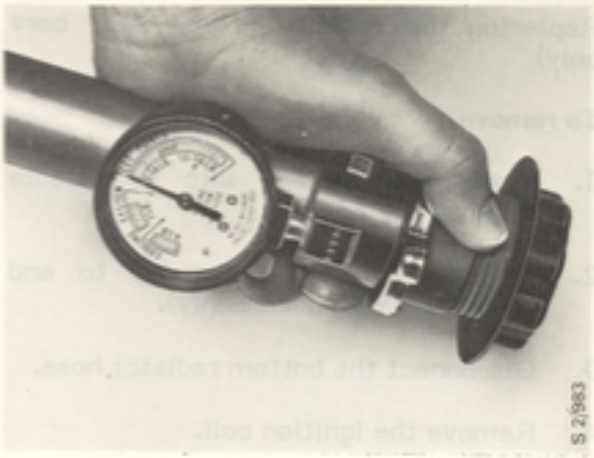
1. Remove the outer seal and clean the seal inside the cap.

2. Check that the vacuum valve in the cap has not seized.

3. Reassemble the cap.

4. Screw the cap onto the adaptor and then connect the adaptor to the pressure tester.

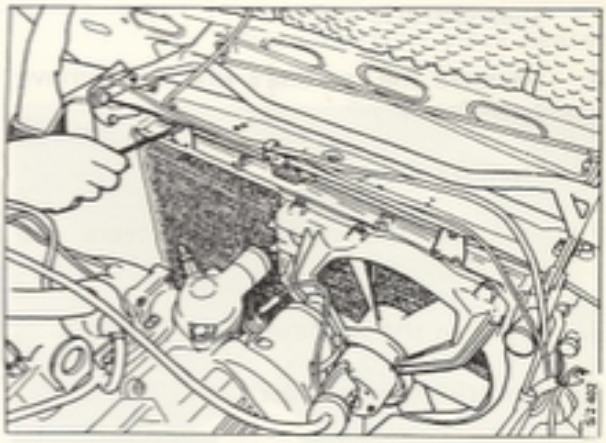
5. Raise the pressure and check that the valve opens at a pressure of 1.0 - 1.25 bar (14.5-18.2 lb/in^2).



Replacing the radiator

Removal

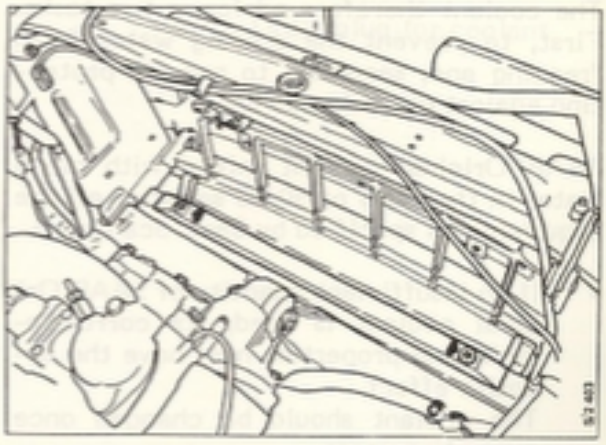
1. Drain the coolant. Remove the distributor cap.
2. Slacken the hose clips and remove the radiator hoses.
3. Disconnect the electrical leads to the fan and the thermostatic switch and remove the coil. Disconnect the hose to the expansion tank and the air intake to the air cleaner.
4. Remove the two bolts in the upper radiator member, and lift the radiator out of the car, pulling the top of the radiator slightly backwards.



Upper retaining bolts

To fit

1. Guide the radiator studs into the holes in the radiator member. Fit the retaining bolts.
2. Connect the radiator hoses and electrical leads. Refit the coil and distributor cap.
3. Fit the air cleaner intake.
4. Fill up with coolant and bleed the system.



Holes in lower radiator member

Replacing the radiator (Turbo APC cars only)

To remove

1. Drain the coolant into a suitable receptacle.
2. Remove the air intake (up to and including 1984 models only).
3. Disconnect the bottom radiator hose.
4. Remove the ignition coil.
5. Remove the APC valve and switch assembly.
6. Disconnect the top radiator hose.
7. Remove the turbo pressure (discharge) pipe.
8. Disconnect the expansion tank hose.
9. Disconnect the electrical leads at the thermostatic switch.
10. Remove the fan (cars with AC:remove both fans).
11. Remove the radiator.
12. Remove the rubber bush from the radiator.
13. Remove the fan lower securing bolt.

Refit in the reverse order.

Coolant

Aluminium engine components requires effective corrosion inhibitor in the coolant. The coolant therefore performs two tasks. First, to prevent the cooling water from freezing and, secondly, to provide protection against corrosion damage.

SAAB Original coolant mixed with clean water in the ratio of 50/50 satisfies all the requirements specified by Saab-Scania AB.

- If an insufficient quantity of SAAB Original coolant is used, its corrosion-inhibiting properties may have the opposite effect.
- The coolant should be changed once every two years.

Note
During the 1983 model year, a coolant was introduced which needs changing only once every three years. The colour of this coolant is green.

The reason for the coolant having to be changed is because the anti-corrosion additives are gradually consumed.

Changing the coolant

1. Remove the cap from the expansion tank.

Note
Great caution should be employed when the cap is to be removed. Carefully slacken the cap and release any vapour before removing it.

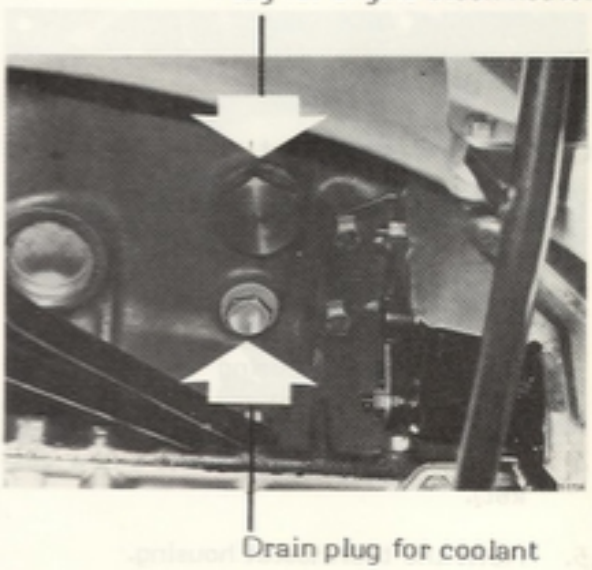
2. Drain the coolant through the valve on the radiator and the drain plug in the engine block.

Note
To drain the system completely, i.e. coolant in the bottom radiator hose and lower section of the radiator, the bottom hose must be disconnected from the radiator. It is not possible to drain the heating system completely.

3. Close the drain valve and tighten the drain plug and refill the system with coolant (50 % Saab Original Coolant and 50 % clean water). The system holds approximately 10 l. Open the bleeder nipple on the thermostat housing until coolant starts to flow through the nipple.

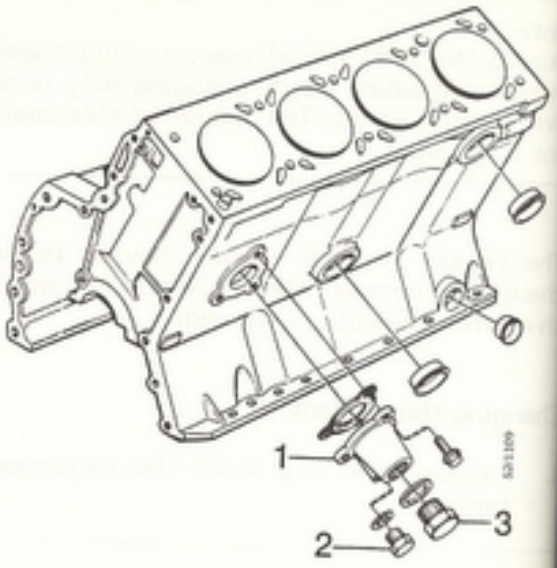
4. Start the engine and run it up to normal operating temperature. Let it run at a moderate speed and with the temperature control for the heating system set to maximum.

   Top up the system as the air is expelled.



Draining the coolant from the block (B201 engine as from 1985 models)

Drain the coolant through the lower plug (2) in the cap. The upper plug (3) can be removed for fitting of an immersion heater.



Cylinder block B201 engine (as from 1985 models)

1 Cap
2 Coolant drain plug
3 Immersion heater plug

Thermostat

Changing the thermostat

1. Undo the cap on the expansion tank to release the pressure.
2. Replace the cap securely.
3. Remove the securing bolts for the thermostat housing.
4. Change the thermostat (fit a new gasket).
5. Refit the thermostat housing.
6. Run the engine up to normal operating temperature and then top up the coolant as necessary.

Winter thermostat

A winter thermostat with an opening temperature of 92°C (197°F) is available as a spare part.

3

from 1985

This thermostat is only intended for winter use in markets with very severe climates, i.e. Nordic countries, Canada and the northern states of USA. It should be replaced by the standard 88°C (190°F) thermostat at the end of the winter.

Winter thermostats **must not be fitted to turbo cars.**

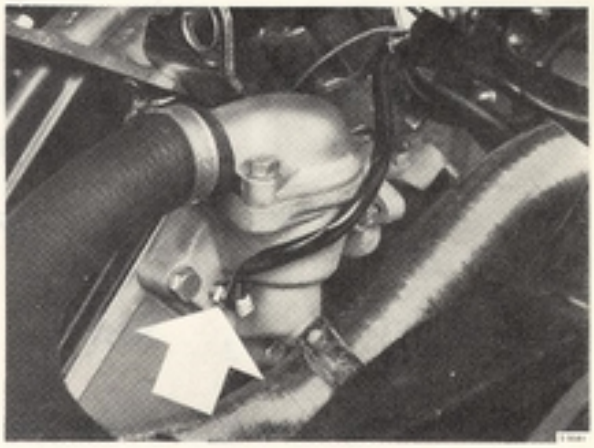
Temperature transmitter

To remove

1. Drain the coolant from the radiator and engine block.
2. Disconnect the electrical wire.
3. Remove the transmitter (1/2 in spanner).

To refit

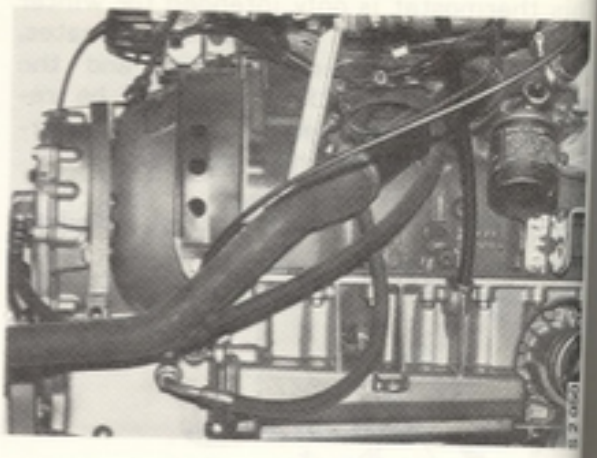
1. Screw in the transmitter.
2. Reconnect the wire.
3. Refill the coolant.
4. Run the engine until warm and check the temperature gauge reading.
5. Check the coolant level and top up if necessary.

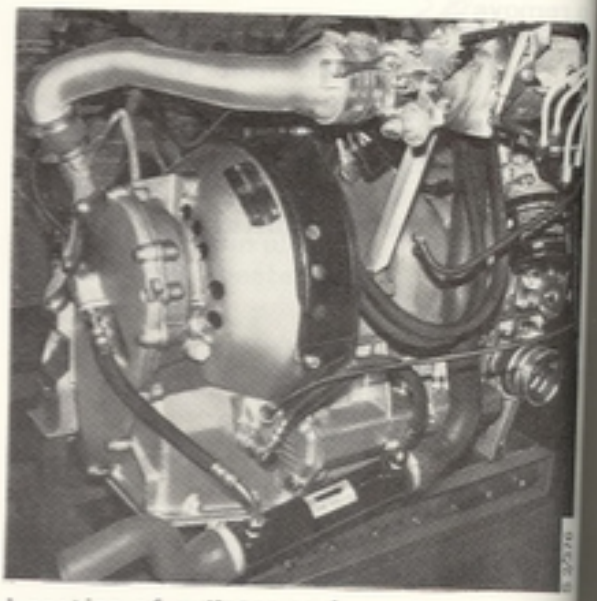


Oil cooler for cars with automatic transmission

General

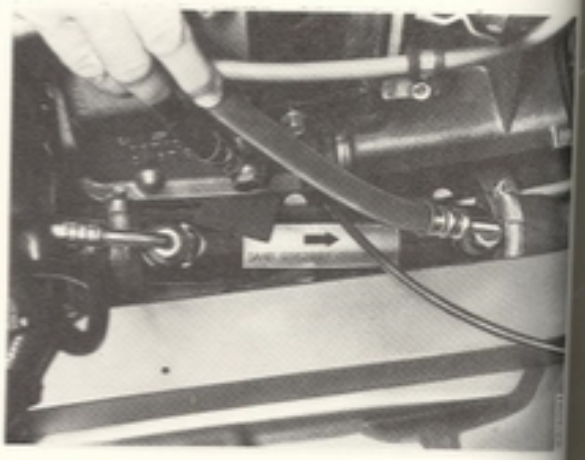
An oil cooler is fitted to cars with automatic transmission. The oil cooler is located in the hose between the radiator and the water pump. The capacity of the oil cooler is adequate even when the car is being used for towing.





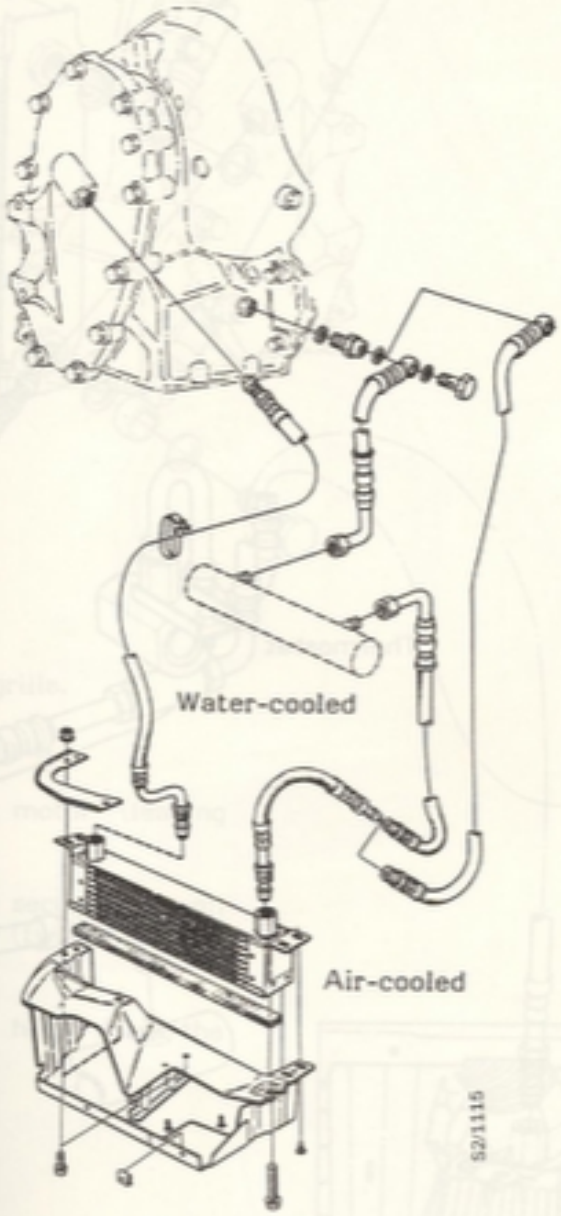
Location of radiator as from chassis

Nos. AD 1025779
2009779
3010025
6002579

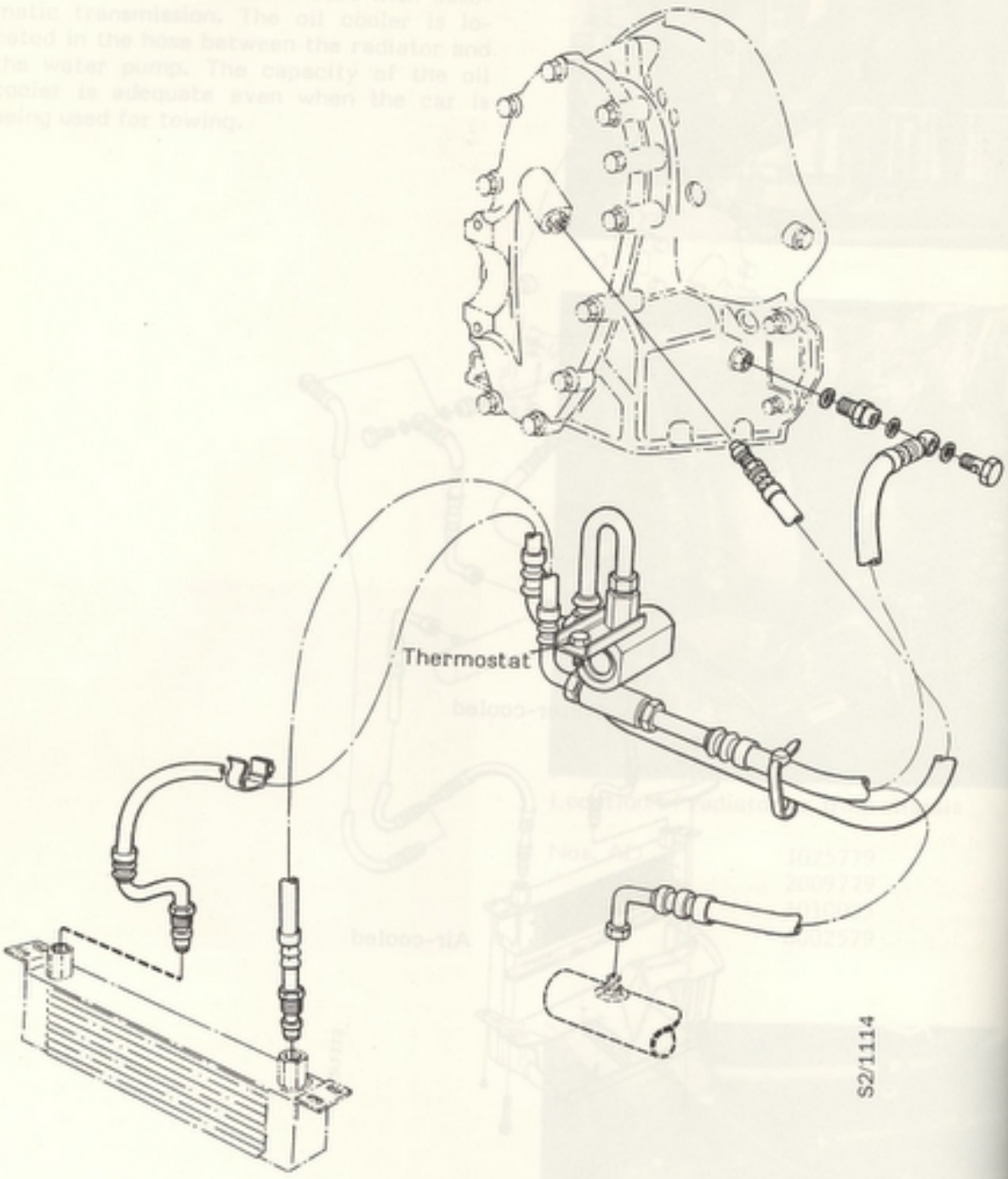


Air-cooled variant for cars with ME, FE and AU specs., and all B202 turbo engines as from 1984 models

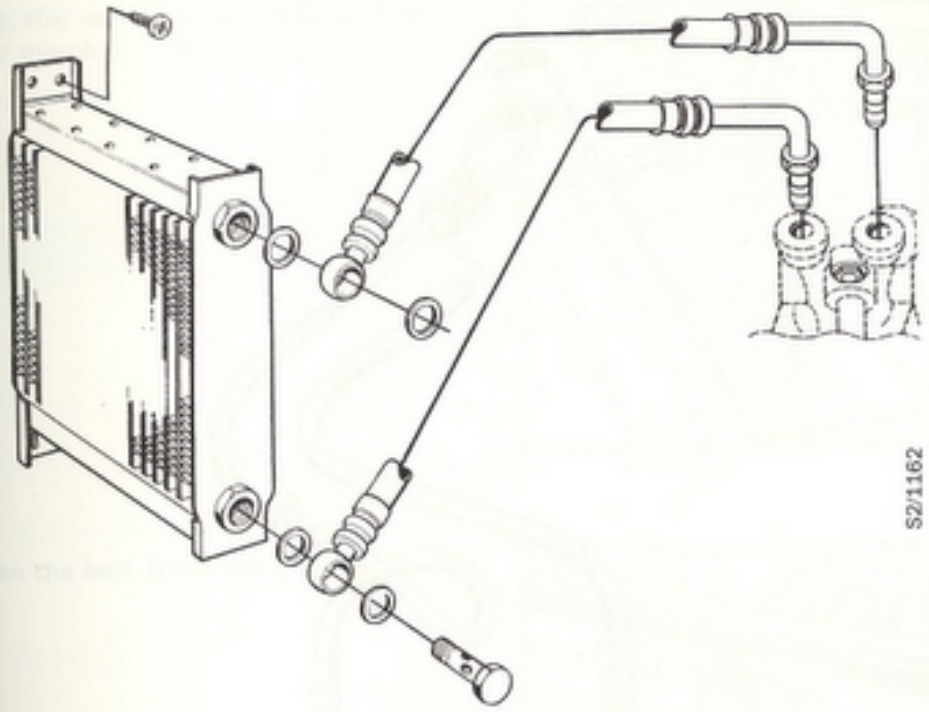
Water-cooled variant (all other models)



Air-cooled variant with thermostat for cars with B202 engine and USA, CA or JA specs., as from 1985 models

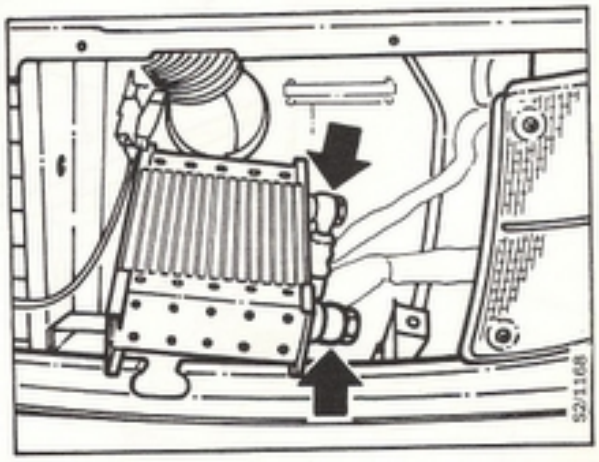


Air-cooled engine-oil cooler fitted to all B201 turbo engines up to and including 1985 models



To remove

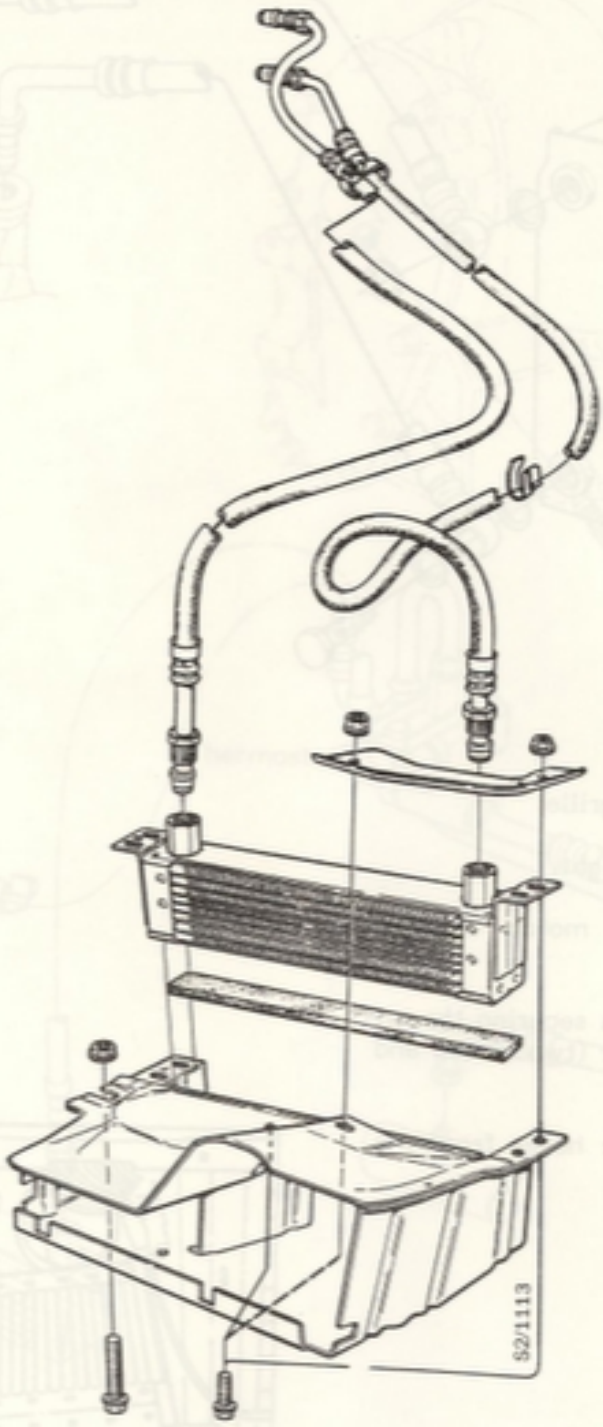
1. Remove the radiator grille.
2. Remove the LH headlight.
3. Remove the wiper motor (leaving leads attached).
4. Undo the four screws securing the oil cooler to the radiator (two at top and two at bottom).
5. Detach the hydraulic hoses from the cooler.



To fit

Refit in the reverse order.

Air-cooled engine-oil cooler for all B202 turbo-engine cars as from 1984 models, and B201 engines as from 1986 models



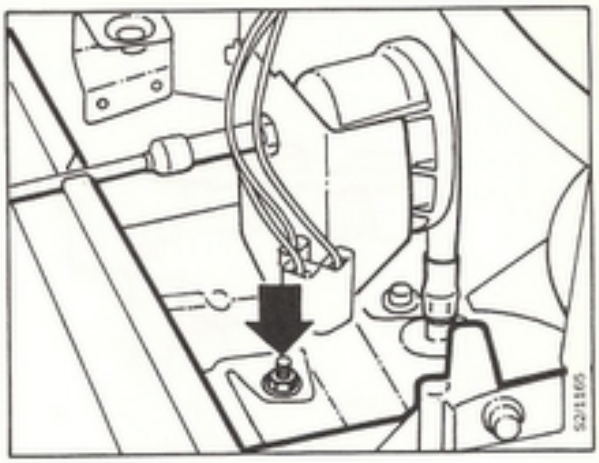
To remove

1. Remove the LH light cluster.
2. Remove the baffle plate.

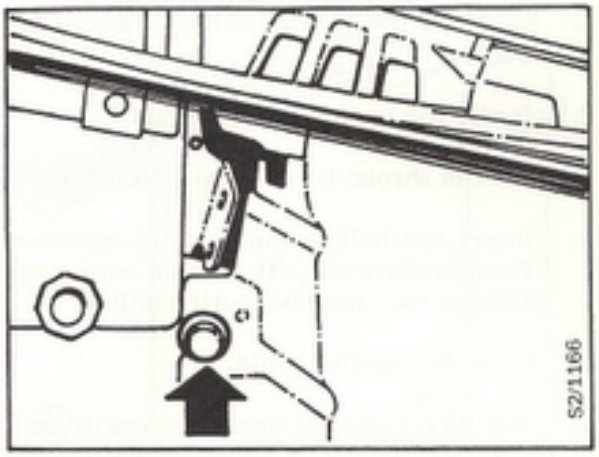
3. Remove the LH headlight.

4. Remove the spoiler grille for the oil cooler.

5. Remove the nut from the bolt in the radiator member

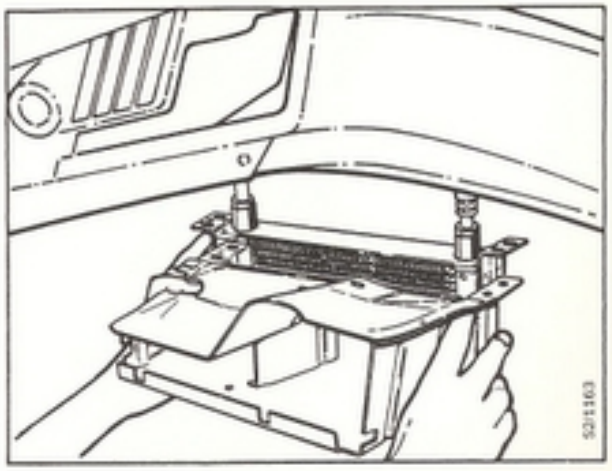


and then the bolt from underneath.

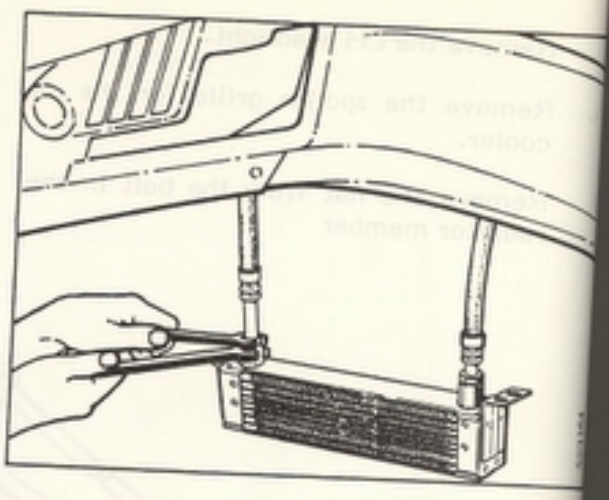


6. Remove the six bolts securing the shroud and cooler to the body.

7. Lower the shroud and remove it from the oil cooler.

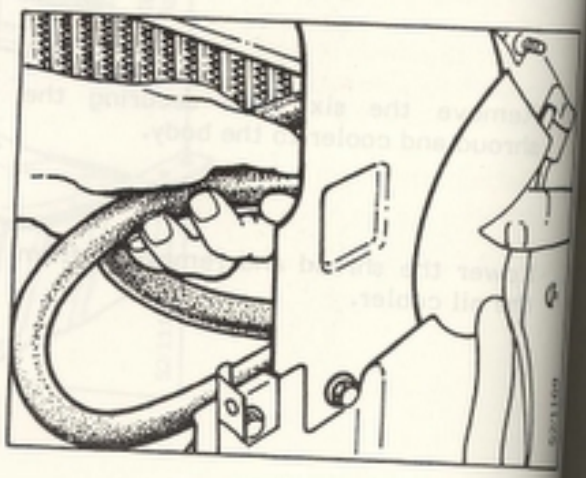


8. Disconnect the hydraulic hoses from the oil cooler.



To fit

1. Connect the hydraulic hoses to the oil cooler.
2. Insert the cooler in the shroud.
3. Fit the shroud leaving the bolts slack.
4. Insert the bolt in the radiator member from underneath, fit the nut and then tighten the shroud-securing bolts.
5. Refit the spoiler grille.
6. Pull the hydraulic hoses forward such that they run straight up from the oil cooler.
7. Fit the headlight.
8. Fit the baffle plate.
9. Fit the light cluster.



Intercooler

B202 turbo engines as from 1984 models and B201 turbo engines as from 1986 models

To remove

1. Remove the following:

   - The mounting plate between the radiator member and intercooler

   As from 1986 models:
   - The plastic shroud between the radiator member and intercooler

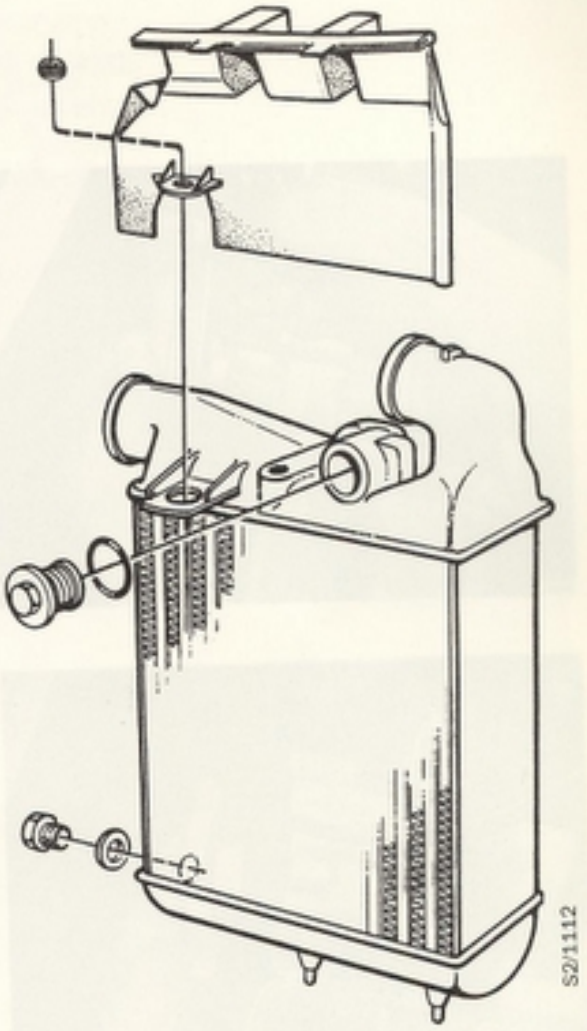
   - The bolt securing the intercooler to the radiator member.

2. Remove both turbo pressure pipes.

3. Lift out the intercooler.

To fit

Refit in the reverse order.



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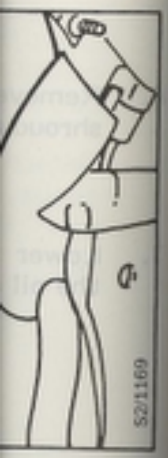
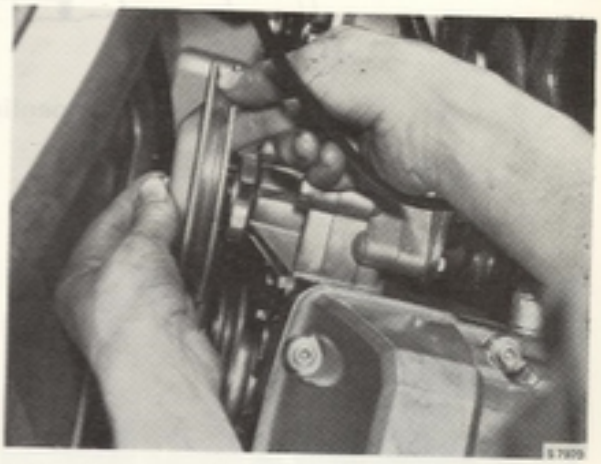


S2/1169

Water pump

To remove

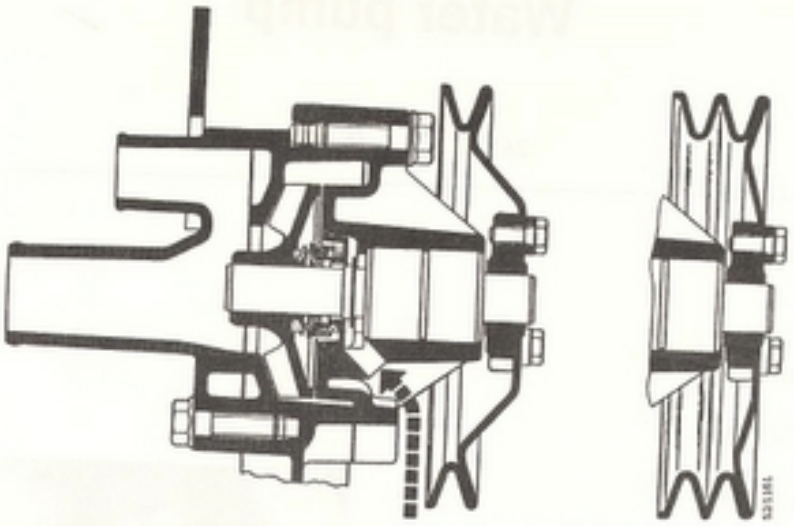
1. Drain the coolant.
2. Remove the "V" belt.
3. Remove the pulley.



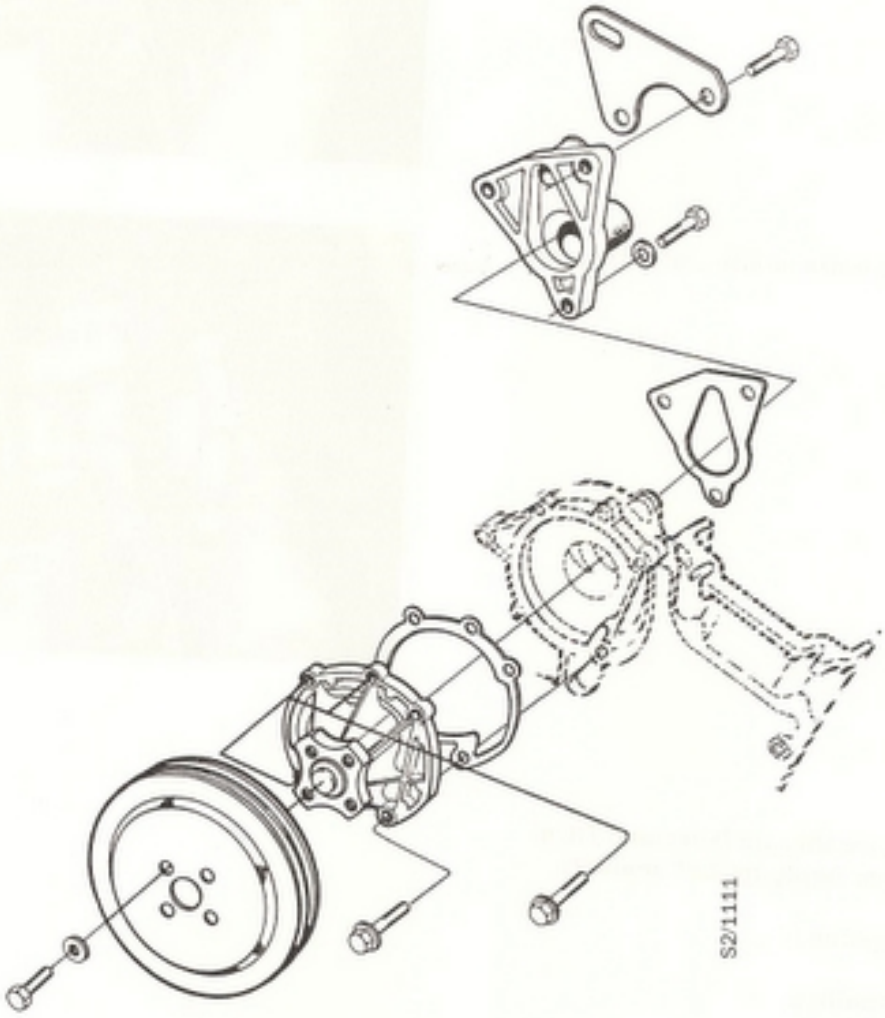
4. Remove the bolts and lift off the pump.

To refit

1. Clean the mating surfaces and fit a new gasket. Apply gasket sealant.
2. Refit the pump.
3. Refit the pulley.
4. Refit the "V" belt.
5. Fill the system with coolant.

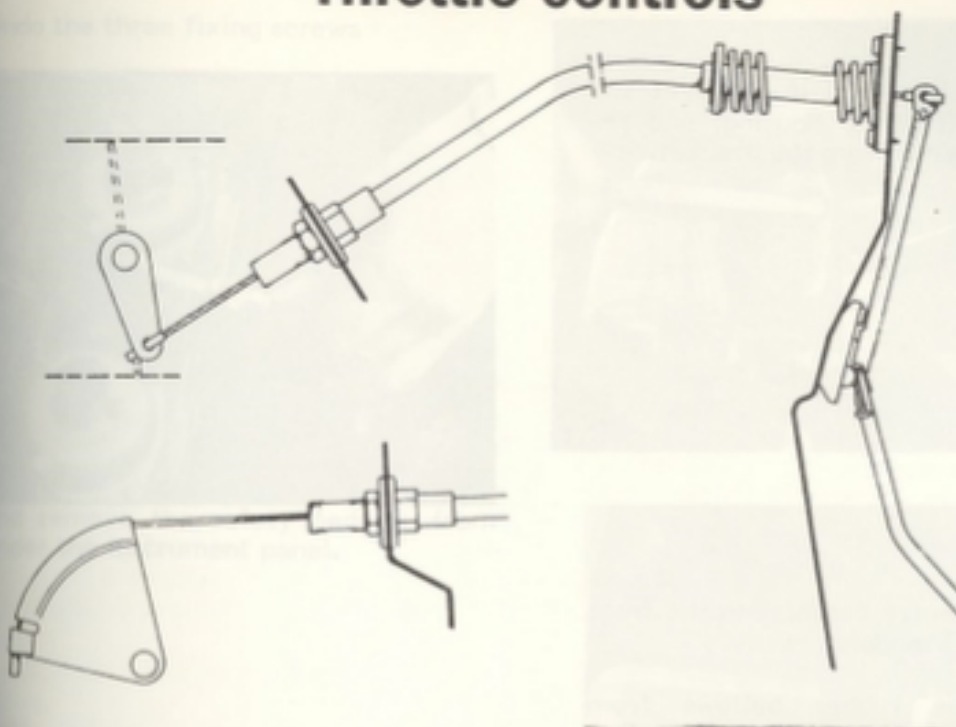


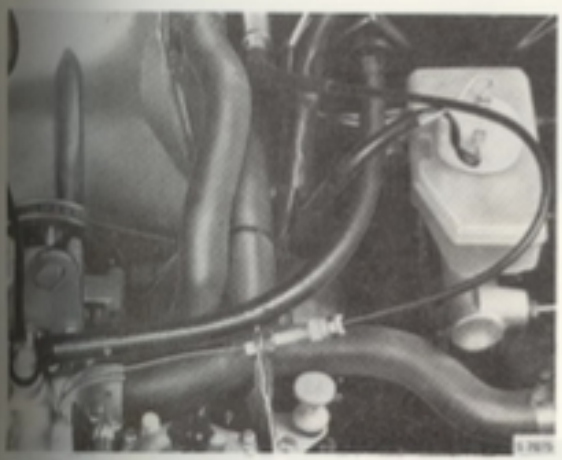
Drain hole for negligible leakage past pump seal



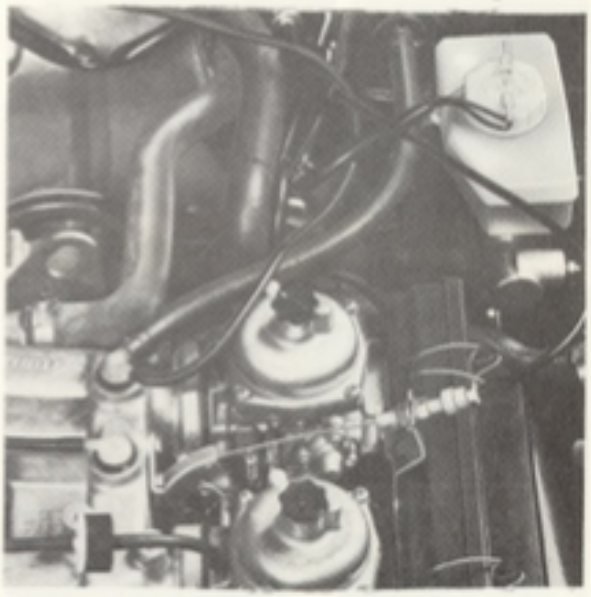
Permissible leakage from 8 hours' constant running is approx. 5 ml

Throttle controls

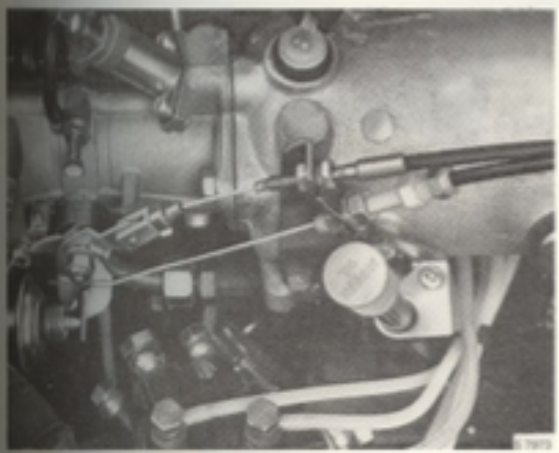




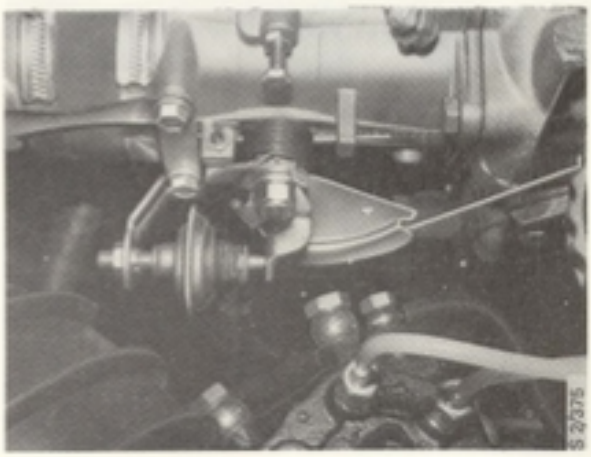
Throttle cable on single-carburettor engine



Throttle cable on twin-carburettor engine



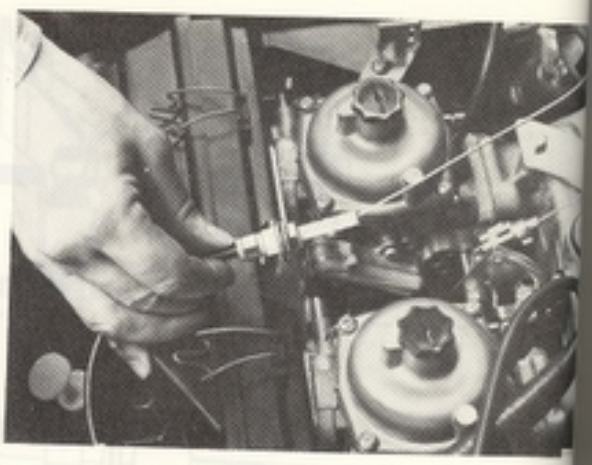
Throttle cable on fuel injection engine with automatic transmission



Throttle cable on Turbo engines

Removal

1. Disconnect the throttle cable at the carburetor (throttle housing) and remove the sheath from the bracket.



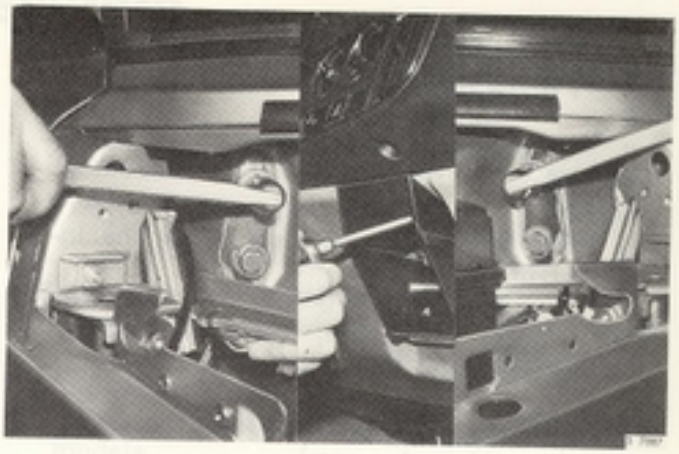
2. Cars with centre consoles in the front as from 1983 models:

   Remove the rubber bellows from between the front and rear consoles.

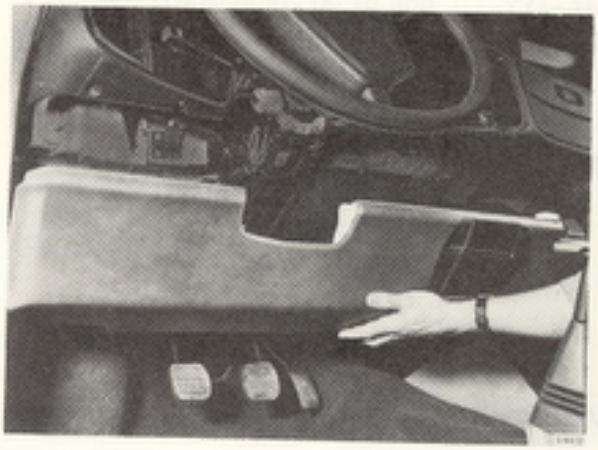
   Remove the two lower screws and the screw adjacent to the ashtray.

   Lift out the centre console.

3. Undo the three fixing screws



and remove the safety padding from under the instrument panel.



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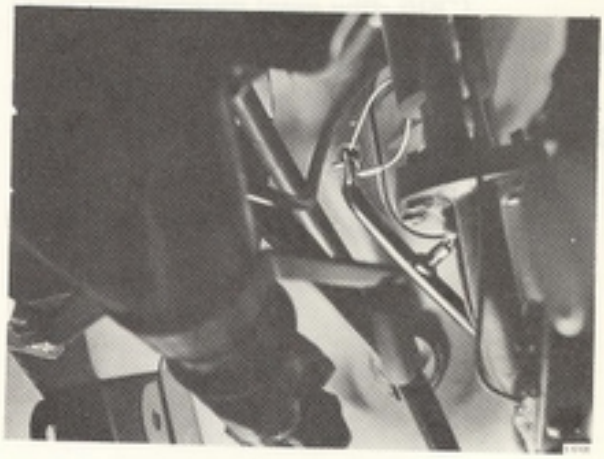
4. Unhook the cable from the accelerator arm.



5. Unscrew the grommet in the bulkhead and remove the cable.

Fitting

1. Fit the grommet in the bulkhead.
2. Connect the cable to the accelerator arm.
3. Fit the safety padding below the instrument panel.
4. Where applicable, refit the centre console and the rubber bellows.
5. Fit the throttle cable to the driver (throttle-valve arm).
6. Fit the cable sheath to the bracket and adjust the tension of the cable to eliminate play in the accelerator.
7. Press the accelerator down to the floor and check that the throttle valve is wide open.

Accelerator pedal

Removal

1. Remove the safety padding below the instrument panel.
2. Unhook the throttle cable and remove the pedal assembly.

Turbo system

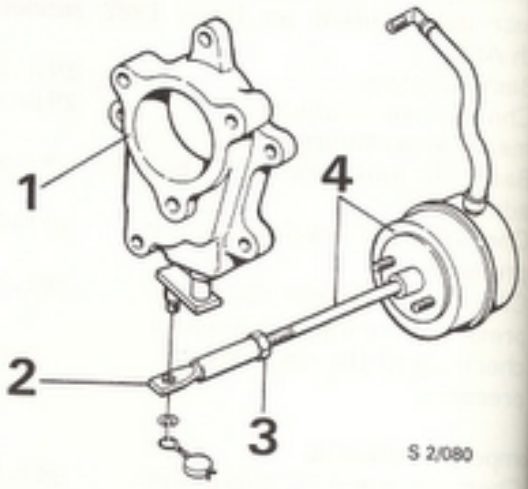
Basic setting of the charging-pressure regulator (waste-gate valve) up to and incl 1982 models (N/A to cars with APC)

A basic mechanical setting should be performed in conjunction with repair or replacement of charging pressure regulator components. Therefore the charging pressure should be recorded while the car is being driven, which acts as a basis for a more accurate adjustment of the charging pressure.

Charging pressure regulator - basic setting

(The diaphragm unit and charging pressure regulator mounted on the turbocharger.)

1. Hold the regulator control arm in the "closed position". Adjust the end of the diaphragm unit lever so that its hole lines up with the stud on the control arm.



1 Charging pressure regulator housing
2 End piece
3 Lock nut
4 Diaphragm unit with lever

2. Screw in the end onto the lever six turns.

   Tighten the locknut.

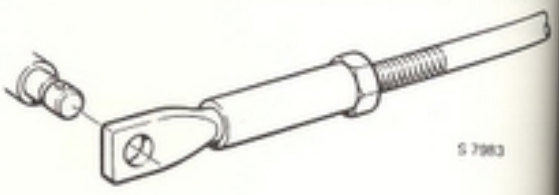
3. Pull out the lever and fit it onto the control arm stud.

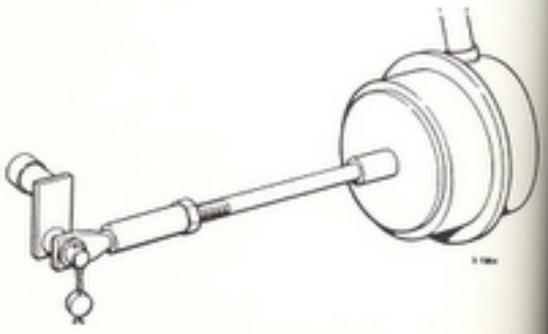
   Fit the circlip.

4. Check the charging pressure by taking the car out for a drive.

   Adjust as necessary, until the charging pressure is within the specified limits.

5. Fit an anti-tamper seal to the stud on the control arm.



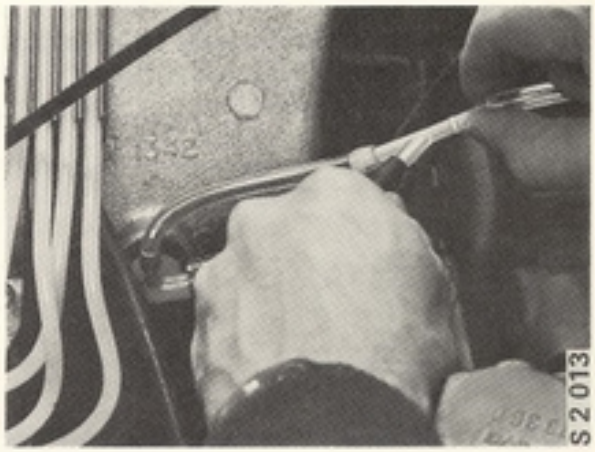


Charging pressure - to measure on the road

Note
Checking the maximum charging pressure on the road must be performed as rapidly as possible (3-5 s approx.) in order to avoid abnormally high brake temperatures.

The car must be driven at least 0.6 miles (1 km) after the test has been completed in order to allow the brakes time to cool.

The charging pressure should be recorded on a road test with a special pressure gauge connected to the inlet manifold.

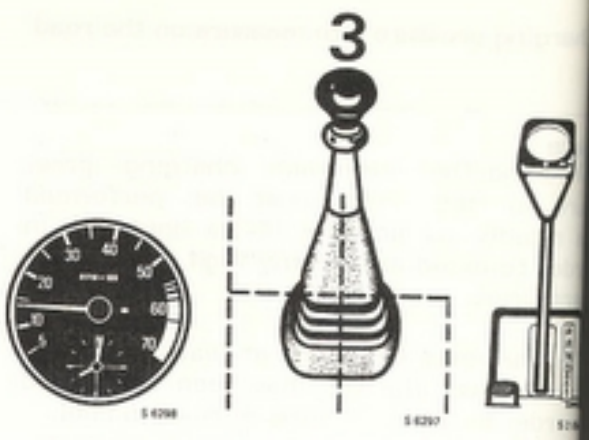


1. Connect gauge 83 93 514 between the outlet on the inlet manifold and the overpressure switch hose. Run the hose into the engine compartment and hang the gauge vertically to avoid faulty readings.

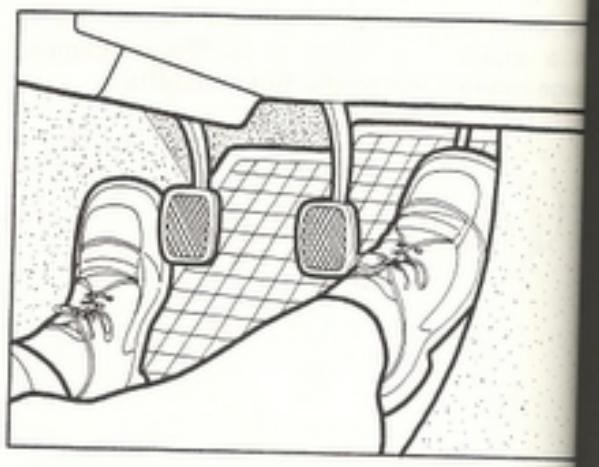
2. The engine must be properly warmed up before starting the road test.

3. a **Manual transmission:** The test should be performed with the car in 3rd gear and at an engine speed lower than 1 500 r/min.

b **Automatic transmission:** The test should be performed with the gear selector in position 1 and at an engine speed lower than 1 500 rpm.



4. Accelerate at full throttle by pressing the accelerator down to the floor.



5. As the engine speed approaches 3 000 r/min apply the brakes, but hold the accelerator down to put the car under full load at 3 000 r/min and note the maximum pressure shown on the gauge.

S 2 054

S6299

S 6300

S 6302

Charging pressure - to adjust
(After road test)

Based on the charging pressure recorded during the road test, adjustment should be performed as follows:

1. Remove the circlip and security seal.
2. Loosen the locknut on the end adjustment.
3. Detach the diaphragm unit lever.

Note
Damage can be caused to the diaphragm if the diaphragm unit push rod is not prevented from rotating when adjusting the end piece. When clamping the push rod the tool should be positioned as close to the thread as possible in order to avoid burring the inner part of the rod. Burrs on the inner part of the rod can damage the bushing in the diapragm unit and disrupt the charging pressure control.

- **Insufficient charging pressure:** rotate the end clockwise (shorten the lever).
- **Excessive charging pressure:** rotate the end counter-clockwise) lengthen the lever).

4. Refit the lever.
5. Refit the circlip and re-seal the charging regulator control arm.

Charging pressure adjustment table (USA spec. only)

Pressure reading Bar (PSI)	Pushrod adjustment required bar (number of turns)
0.38 (5.5)	3 clockwise
0.40 (5.8)	2.5 clockwise
0.42 (6.1)	2 clockwise
0.44 (6.3)	1.5 clockwise
0.46 (6.6)	
0.48 (6.9)	
0.50 (7.2)	Correct setting
0.52 (7.5)	
0.54 (7.8)	
0.56 (8.1)	1.5 counter-clockwise
0.58 (8.4)	2 counter-clockwise
0.60 (8.6)	2.5 counter-clockwise
0.62 (8.9)	3 counter-clockwise

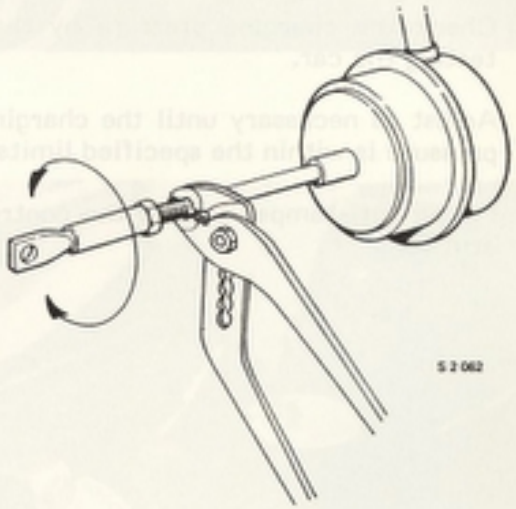
Charging pressure adjustment table

Charging pressure recorded Bar (PSI)	Rotate lever end (number of turns)
0.58 (8.4)	- 3
0.60 (8.6)	- 2.5
0.62 (8.9)	- 2
0.64 (9.2)	- 1.5
0.66 (9.5)	
0.68 (9.8)	
0.70 (10.1)	Correct setting
0.72 (10.4)	
0.74 (10.7)	
0.76 (11.0)	+ 1.5
0.78 (11.3)	+ 2
0.80 (11.6)	+ 2.5
0.82 (11.8)	+ 3

Adjusting the charging pressure regulator (waste-gate valve) as from 1982 models with APC

The charging pressure regulator valve and diaphragm unit assembly is factory-set and should only be adjusted in conjunction with repairs, component replacement or fault tracing.
For adjustment/repair purpose the basic setting is performed mechanically and the basic charging pressure is then recorded on the road.

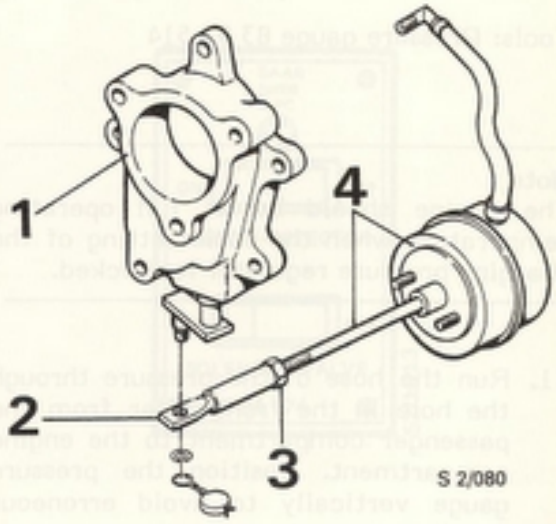
Note
Damage can be caused to the diaphragm if the diaphragm unit push rod is not prevented from rotating when adjusting the end piece. When clamping the push rod the tool should be positioned as close to the thread as possible in order to avoid burring the inner part of the rod. Burrs on the inner part of the rod can damage the bushing in the diapragm unit and disrupt the charging pressure control.



Charging pressure regulator - basic setting

The charging pressure regulator valve and diaphragm unit assembly should be connected to the turbocharger.

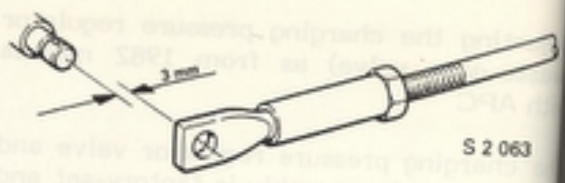
1. Press the control arm of the regulator to the "shut" position. Adjust the end piece on the diaphragm unit push rod so that it can easily be fitted to the control arm stud, without forcing the diaphragm return spring.



1 Flap valve with adjusting rod
2 End piece
3 Lock nut
4 Diaphragm unit

2. Screw the end piece 3.5 turns inwards onto the diaphragm unit push rod (= 3 mm pre-load).

   Tighten the locknut.



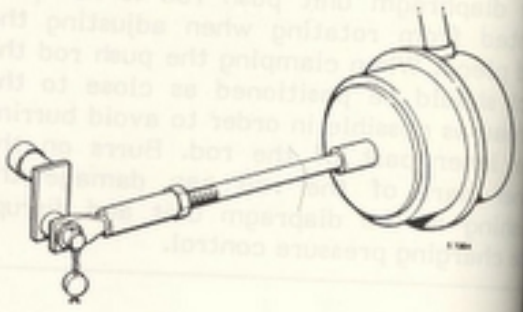
3. Pull out the push rod and hook the end piece onto the control arm stud.

   Fit the circlip.

4. Check the charging pressure by road testing the car.

   Adjust as necessary until the charging pressure is within the specified limits.

5. Fit an anti-tamper seal to the control arm stud.



Checking the basic setting of the charging pressure regulator on the road (basic charging pressure setting)

Tools: Pressure gauge 83 93 514

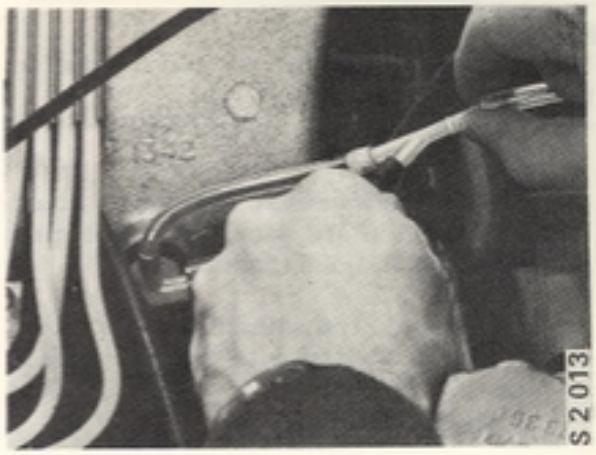
Note
The engine should be at full operating temperature when the basic setting of the charging pressure regulator is checked.

---

1. Run the hose of the pressure through the hole in the front pillar from the passenger compartment to the engine compartment. Position the pressure gauge vertically to avoid erroneous readings.

S 2 063

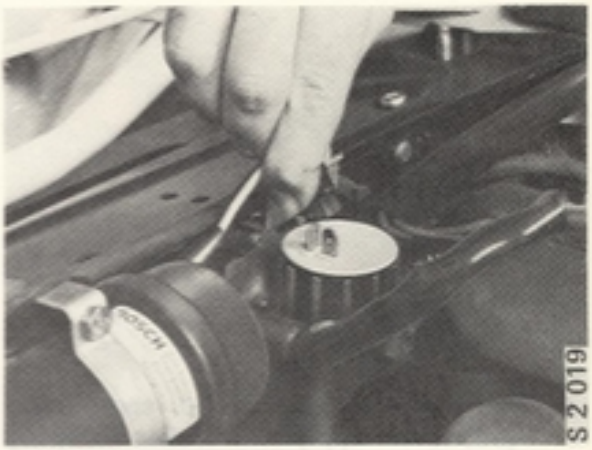
2. Connect the hose of the pressure gauge between the connection on the inlet manifold and the hose to the pressure switch.



S 2 013

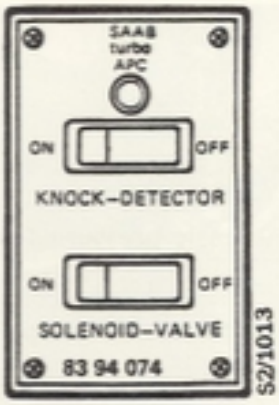
3. a Isolate the APC system, by disconnecting the cables to the APC solenoid valve.

b Alternatively if test loom 83 94 074 is connected (1986 models onwards):



S 2 019

- set knock-detector switch to OFF
- set solenoid-valve switch to OFF.

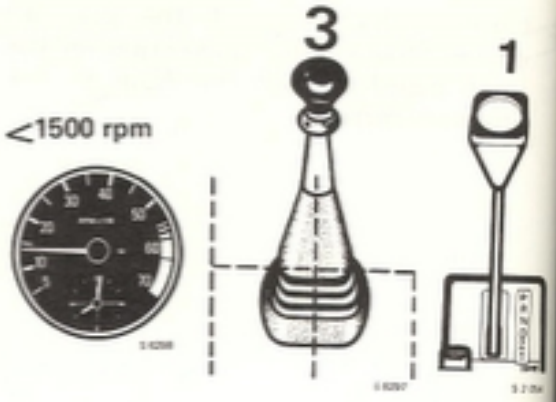


S2/1013

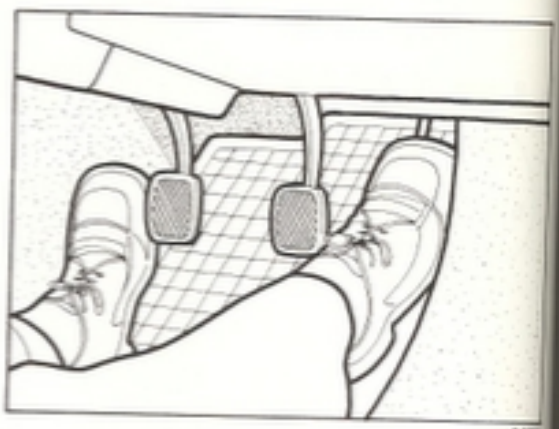
Note
The engine should be at full operating temperature.

4. **Manual transmission.** The test should be started in 3rd gear with the engine speed under 1,500 r/min.

   Automatic transmission. The test should be started with the gear selector in "1" and engine speed below 1,500 r/min.



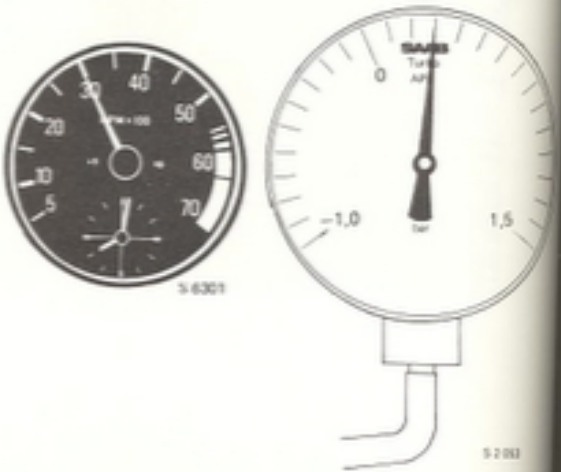
5. Depress the accelerator to the floor.



6. When the engine speed approaches 3,000 r/min apply the brakes (keeping the accelerator pressed to the floor) so that the engine is put under full load at 3,000 r/min.

Read off the basic pressure from the pressure gauge.

Refer to 'Technical data' for the correct reading.



The basic pressure setting is only the initial setting for the function of the APC system and has no direct effect on the maximum charging pressure level, i.e. engine performance, achieved when the APC system is connected. **Engine output is not increased by raising the basic charging pressure above (the value specified in 'Technical data').**

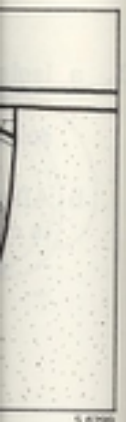
Maximum charging pressure, which produces the correct maximum output from the engine, is controlled by the function of the APC system.

7. If the basic pressure setting falls outside the specified tolerances adjust as described under 'adjusting the basic pressure of the charging pressure regulator'.

8. If the basic pressure setting falls within the specified tolerances, fit an anti-tamper seal to the control lever stud.

9. Reconnect the cables to the solenoid.

10. Remove the pressure gauge and the APC test loom (where applicable).



Adjusting the basic pressure of the charging pressure regulator

Working on the basis of the basic pressure reading obtained, adjust as follows:

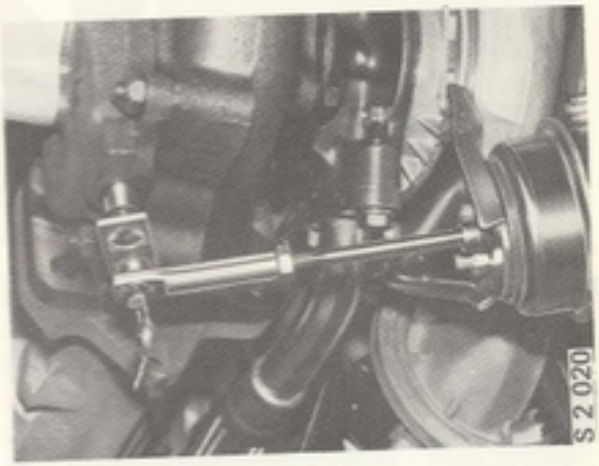
1. Remove the anti-tamper seal and circlip.

2. Loosen the end piece locknut.

3. Unhook the lever from the control arm stud.

- **Insufficient charging pressure:** rotate the end clockwise (shorten the lever).
- **Excessive charging pressure:** rotate the end counter-clockwise) lengthen the lever).

The nominal figure is given in 'Technical data'.



4. Refit the lever onto the control arm stud, and tighten the locknut.

5. Refit the circlip.

6. Check the basic pressure setting on the road. See 'Checking of the basic setting of the charging pressure regulator on the road'. (If the basic pressure setting does not respond to adjustment, see the Fault-tracing chart).

7. If the basic pressure setting is correct, fit an anti-tamper seal to the control arm stud.

8. Reconnect the cables to the solenoid or remove the APC test loom.

9. Remove the pressure gauge.

Checking the maximum charging pressure

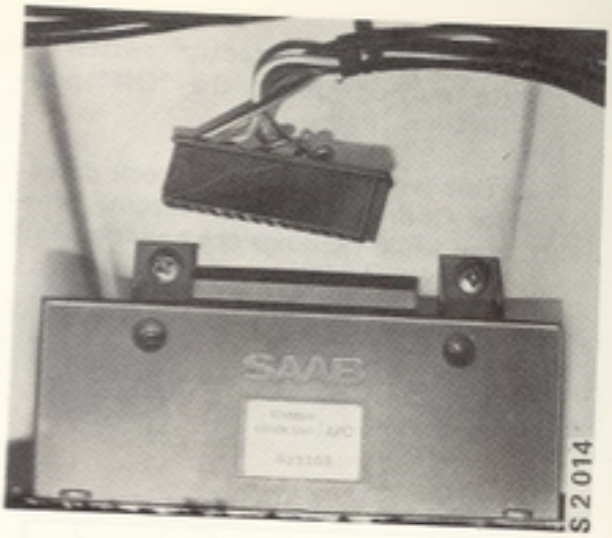
Tools: Pressure gauge 83 93 514

Test wiring harness with service box 83 93 548 (up to and incl. 1985 models) or
83 94 074 (1986 models onwards)

1. Run the hose of the pressure gauge from the passenger compartment to the engine compartment. **Position the pressure gauge vertically to avoid erroneous readings.**

2. Connect the hose of the pressure gauge between the connection on the inlet manifold and the hose to the pressure switch.

3. a Tilt the rear seat cushion forward and disconnect the control unit cables.

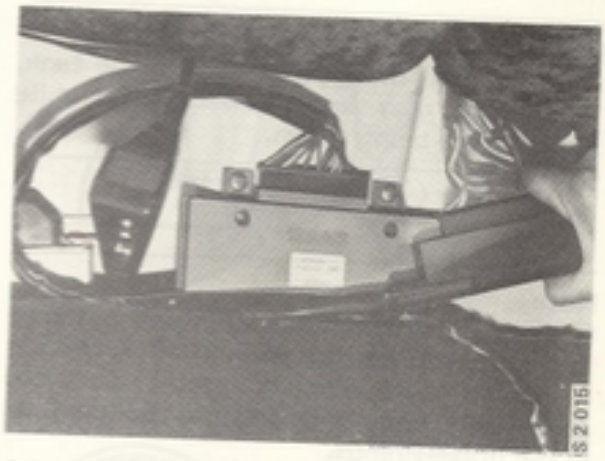


S 2014

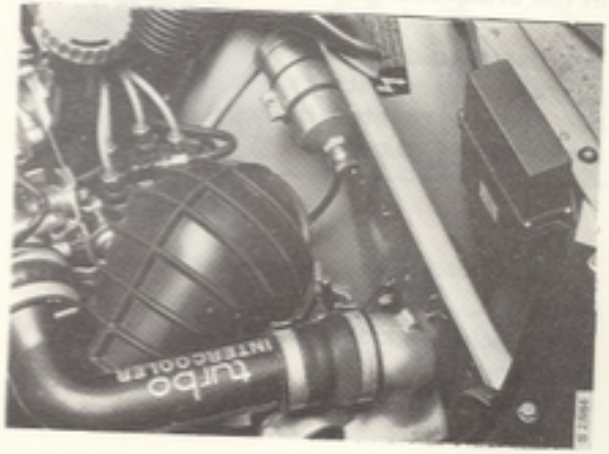
b As from 1986 models:
Lift the catch and detach the wiring loom connector from the control unit, and lift up the control unit.


S 2965

4. a Connect the test wiring harness with the service box between the normal harness connector for the control unit and the control unit itself.


S 2015

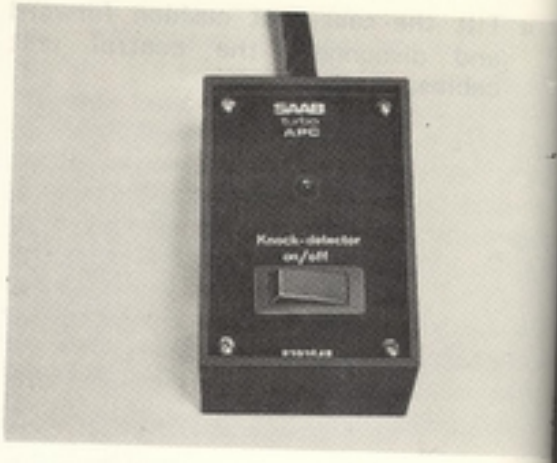
b As from 1986 models:
Run the test loom with control box into the cabin.



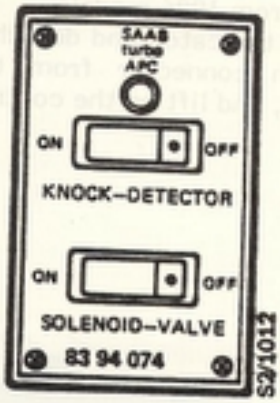

S 2013

5. a Set the 'knock-detector' switch on the service box to the "Off" position.

(This is to prevent the knock detector from varying the charging pressure while readings are being taken.)



b As from 1986 models:
Set the knock-detector switch on the control box to ON and the solenoid-valve switch to ON.



Note
Depending on the type of fuel in the tank, the engine may knock continually while readings are being taken.

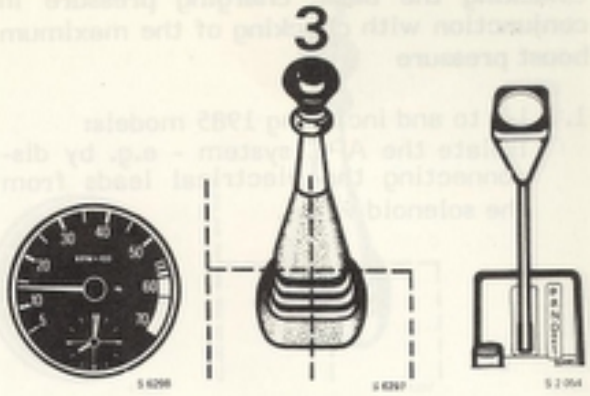
Note
Checking the maximum charging pressure in a road test must be performed as quickly as possible (3-5 seconds approx.) to avoid abnormally high temperatures building up in the brake linings.

The car should be driven at least 0.6 miles (1 km) between each test and after testing has been completed in order to allow the brake linings to cool.

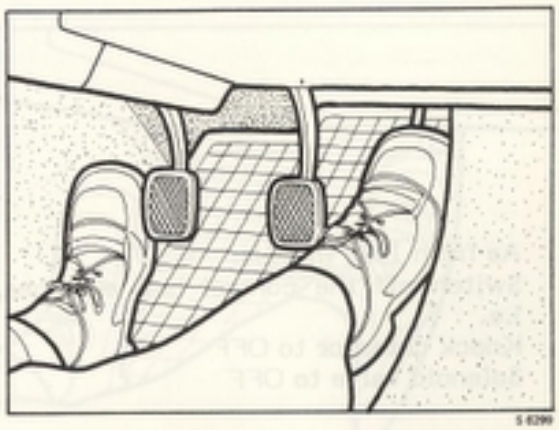
Note
The engine should be at full operating temperature.

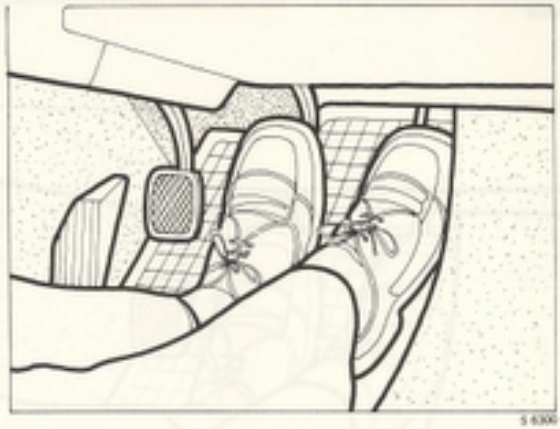
A. **Manual transmission.** The test should be started in 3rd gear with engine speed below 1,500 r/min.

B. **Automatic transmission.** The test should be started with the gear selector in "1" and engine speed below 1,500 r/min.



6. Depress the accelerator to the floor. When the engine speed approaches 3,000 r/min charging apply the brakes (while keeping the accelerator pressed to the floor) so that the engine is held under full load at 3,000 r/min.
Read the charging pressure off the pressure gauge. The gauge must be vertical in order to obtain a true reading.



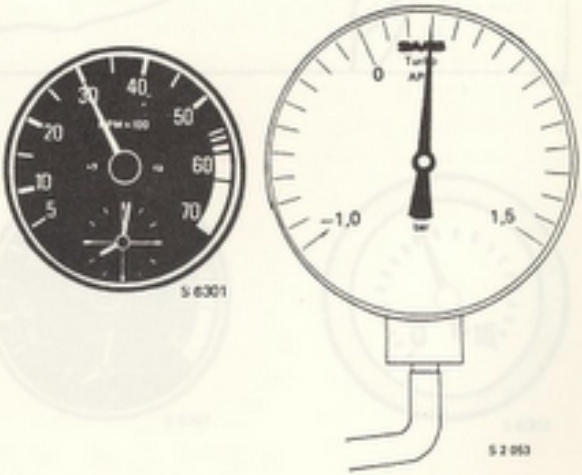


Note
A charging pressure surge may be noted when the engine is accelerated to maximum, i.e. the charging pressure will momentarily exceed the pre-set maximum figure when the accelerator is floored.

7. Once stabilized the charging pressure reading should be the same as that specified in 'Technical data'.

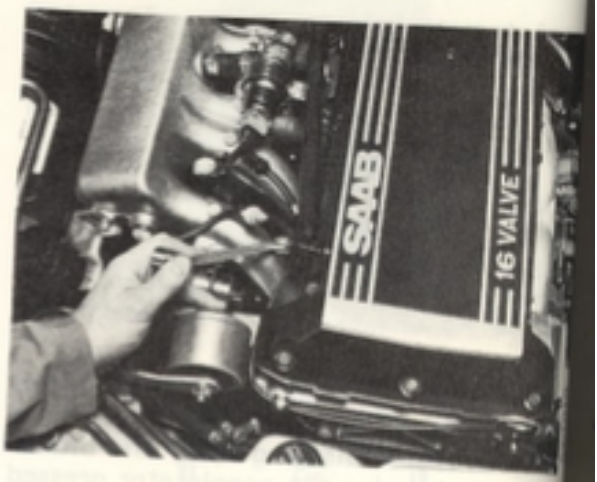
If the charging pressure reading is within the tolerances specified, remove the testing equipment.

If the charging pressure reading is not within the tolerances specified, first check the basic setting on the road and then refer to the fault-diagnosis table.

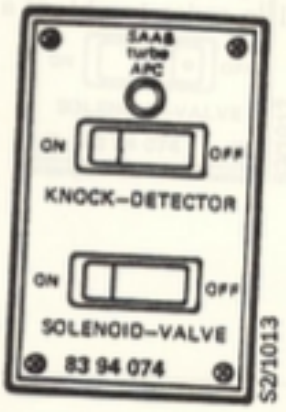


Checking the basic charging pressure in conjunction with checking of the maximum boost pressure

1. Up to and including 1985 models:
   Isolate the APC system - e.g. by disconnecting the electrical leads from the solenoid valve.

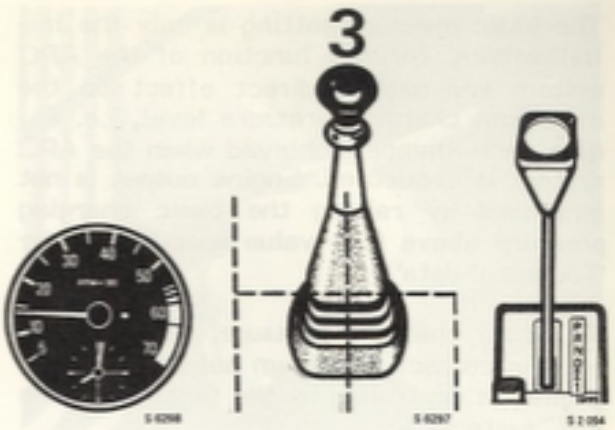


2. As from 1986 models:
   Switch off the control box switches, i.e.
   Knock detector to OFF
   Solenoid valve to OFF

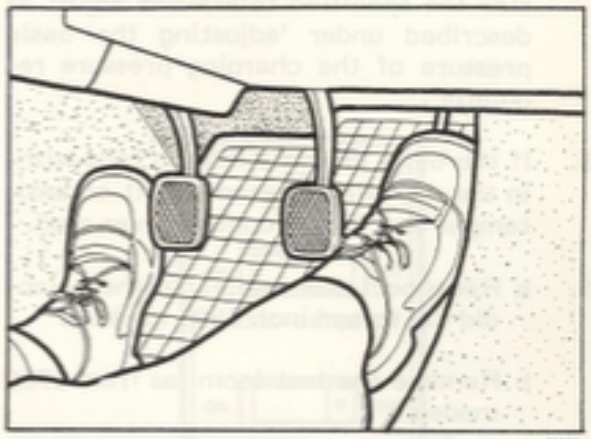


3. a **Manual transmission.** The test should be started in 3rd gear with the engine speed under 1,500 r/min.

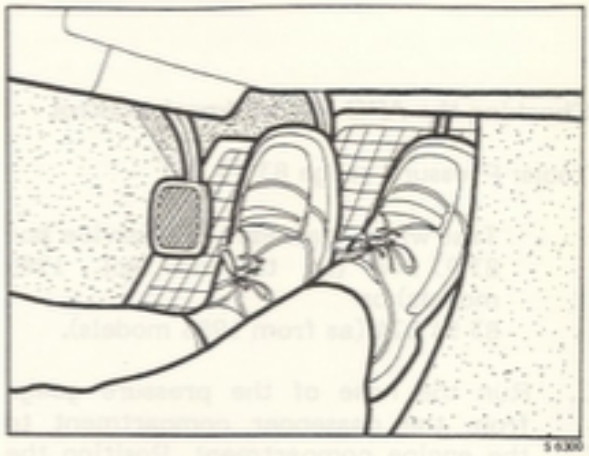
   b **Automatic transmission.** The test should be started with the gear selector in '1' and engine speed below 1,500 r/min.



4. Depress the accelerator to the floor.



5. When the engine speed approaches 3,000 r/min apply the brakes (keeping the accelerator pressed to the floor) so that the engine is put under full load at 3,000 r/min.
   Read off the maximum pressure from the pressure gauge.



6. After the pressure has stabilized, note the reading on the gauge (the correct value is given under 'Technical data'.

The basic pressure setting is only the initial setting for the function of the APC system and has no direct effect on the maximum charging pressure level, i.e. engine performance, achieved when the APC system is connected. **Engine output is not increased by raising the basic charging pressure above (the value specified under 'Technical data').**

Maximum charging pressure, which produces the correct maximum output from the engine, is controlled by the function of the APC system.

7. If the basic pressure setting falls outside the specified tolerances adjust as described under 'adjusting the basic pressure of the charging pressure regulator'.

8. If the basic pressure setting falls within the specified tolerances, fit an anti-tamper seal to the control lever stud.

9. a Reconnect the cables to the solenoid (up to and incl. 1985 models).

   b Remove the test loom (as from 1986 models).

10. Remove the pressure gauge.

Checking the APC system knock control

Tools: Pressure gauge 83 93 514

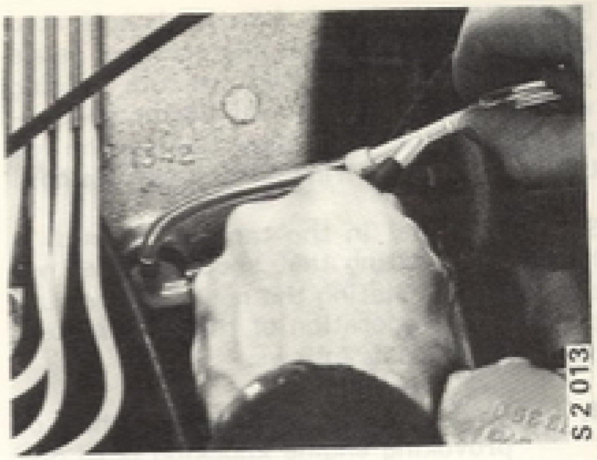
Test wiring harness with service box 83 93 548 (up to and incl. 1985 models) or
83 94 074 (as from 1986 models).

1. Run the hose of the pressure guage from the passenger compartment to the engine compartment. Position the pressure gauge vertically to avoid erroneous readings.

2. a Connect the test wiring harness with service box (see 'Checking of maximum charging pressure').

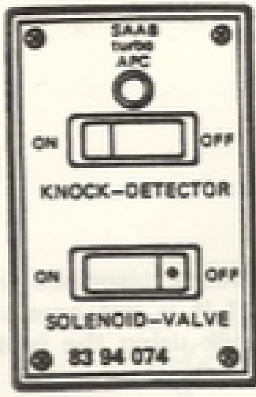
Connect the test equipment between the wiring loom connector and the control unit.

b As from 1986 models:
Run the test loom and box inside the cabin.



3. a Up to and incl. 1985 models:
Set the 'knock detector' switch on the service box to ON.

b As from 1986 models:
Set the switches on the control box as follows:
Knock detector to OFF
Solenoid valve to ON.



4. Road test at 3,000 r/min approx.

If the system is working correctly the engine charging pressure should drop by about 0.1 bar (1.5 PSI) when knocking occurs as a result of the engine being put under load at full throttle. If knocking persists the pressure will be further reduced by the system in several steps, until the engine runs without knocking.

If the engine is now maintained under full load then the charging pressure will try to increase again in steps (0.1 bar 1.5 PSI approx. in 3 seconds) towards the nominal figure until the knocking occurs again, whereupon the charging pressure will once again drop, etc.

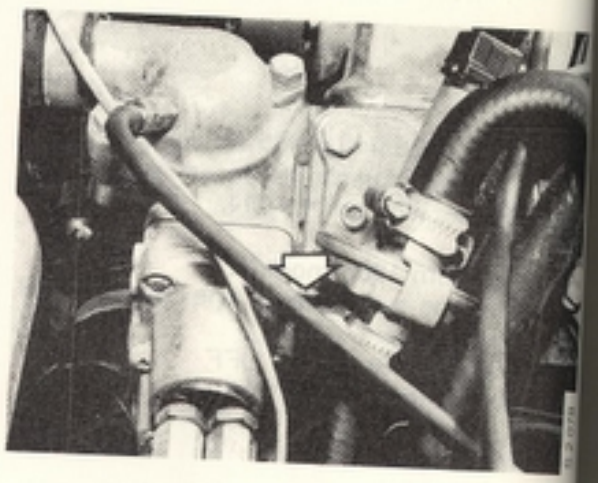
The lower the octane rating of the fuel used in the engine, the lower will be the mean charging pressure of the engine when operating at full throttle.

Every time the knock detector is activated the reading on the charging pressure gauge will alter - the charging pressure reading will drop below the pre-set maximum figure while at the same time flashing the red LED on the test wiring harness service box.

Should the fuel in the tank be of such a high octane rating that knocking does not occur, thus obviating the need for pressure control, the operation of the APC system can be checked as follows:

4. a If necessary, a further method of provoking engine knocking is to disconnect the full-load enrichment hose, (EU-spec. cars only).

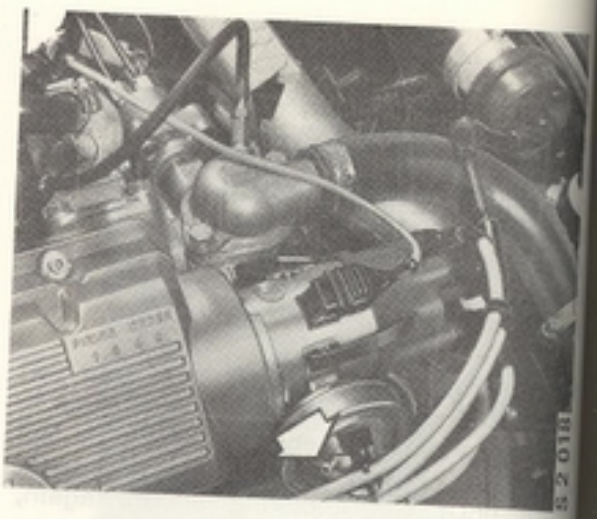
   b Cars with USA spec:
   Disconnect the electrical leads from the full-load-enrichment switch on the throttle housing.



The test procedure described below should only be used if it is not possible to make the engine knock using the fuel already in the tank.

5. Remove the vacuum hose from the vacuum control unit on the distributor. Seal the hose.

   This disconnects the distributor's advance and retard mechanism with the result that the engine runs 5° advanced under full load conditions.



6. Depressing the accelerator to the floor during the road test should now cause the engine to knock and the function of the APC system can be observed.

   If knocking still does not occur then fuel of a lower octane rating must be used to carry out the test.

7. Remove the test equipment.

Note
Do not forget to reconnect the vacuum hose to the distributor and the hose to the full-load enrichment device (if disconnected) on completion of the test.


S 2 078

Checking components

Checking the APC system in the car

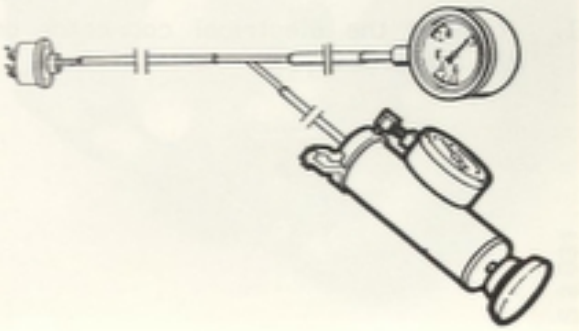
Tools: Pressure gauge 83 93 514
Hose with connector (included with the pressure gauge)

Air pump (radiator tester)

1. Remove the pressure transducer hose from the inlet manifold connection.

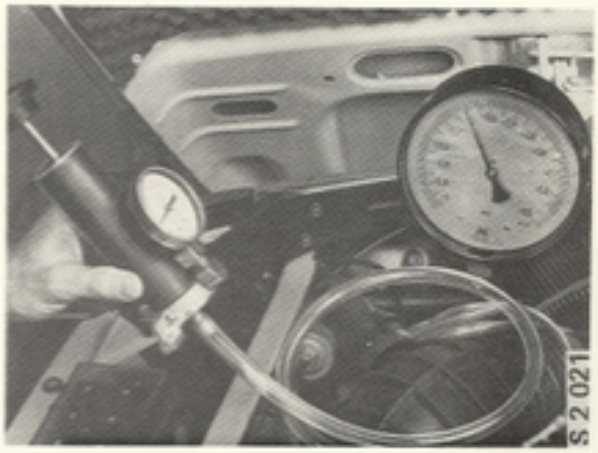
   Seal the inlet manifold connection.

2. Connect the pressure gauge to the hose from the pressure transducer (as from 1983 models, the hose from the pressure switch). Position the pressure gauge vertically to avoid erroneous readings.

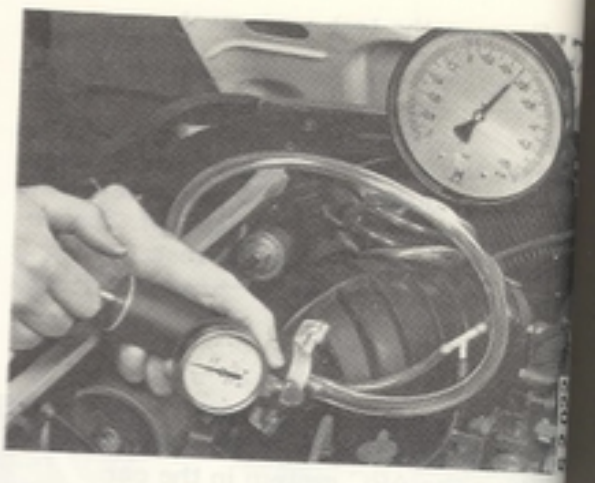

S 2 067


S 2 018

3. Connect the air pump via the hose and connector to the hose from the pressure transducer.


S 2 021

4. Start the engine and increase the speed to at least 2,100 r/min (in order to make sure that the APC system is in operation.



5. Increase the pressure to 0.50 bar (6.6 PSI)

6. Check that the solenoid valve starts to operate (chattering sound).

   The fact that the solenoid valve starts to operate is an indication that the components in the APC system -knock detector, pressure switch, control unit and solenoid - are working.

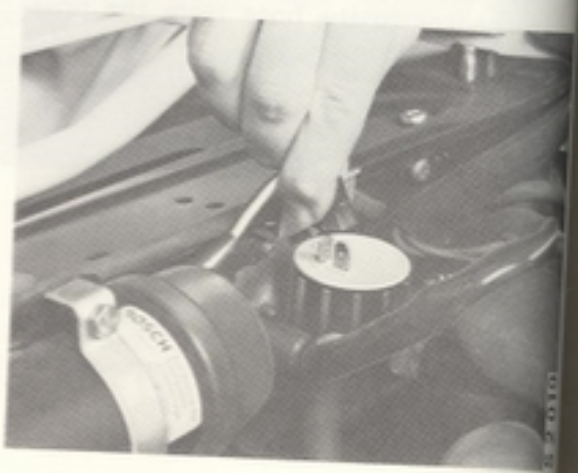
   If the solenoid valve does not start to operate, see the Fault-tracing chart.

Checking the solenoid valve

Tools: Jump leads for connecting the solenoid valve to the car battery.

1. Remove the electrical connector on the solenoid valve.

2. Disconnect the hose running between the turbo compressor inlet and the "R" connection on the solenoid valve.




S 2 022

3. Connect the jump leads between the battery (12 V) and the electrical terminals of the solenoid valve.

4. The solenoid valve should be open when the current is on and closed when the current is off. This can be checked by blowing down the disconnected hose.

If the solenoid valve does not function as described above, it should be replaced.

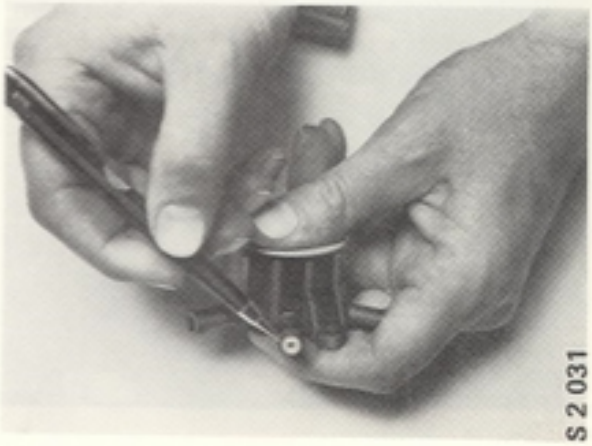

S 2 030

Checking the solenoid valve restriction

The solenoid connection (marked 'C') leading to the hose from the turbocharger outlet incorporates a restriction.

Check that the restriction is free from dirt, etc.

If the restriction is blocked and the dirt cannot be removed, replace the solenoid valve.


S 2 031


S2/1055

Checking the pressure transducer

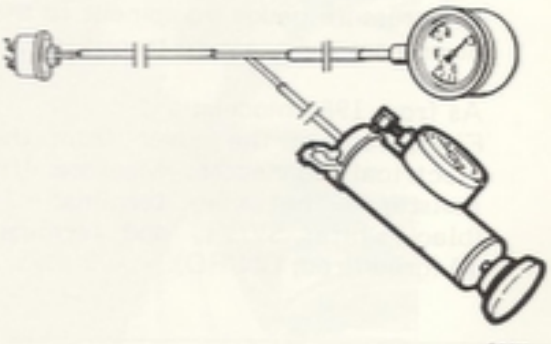
Tools: Pressure gauge 83 93 514

Hose with connector (included with the pressure gauge)

Air pump (radiator tester)

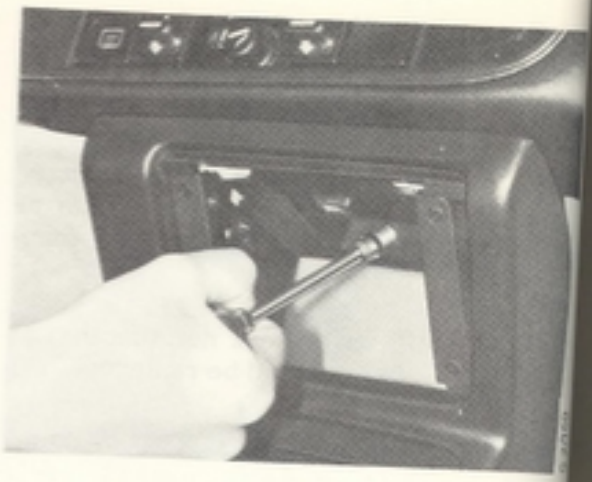
Vacuum pump

Ohmmeter


S 2 057


S 2 019

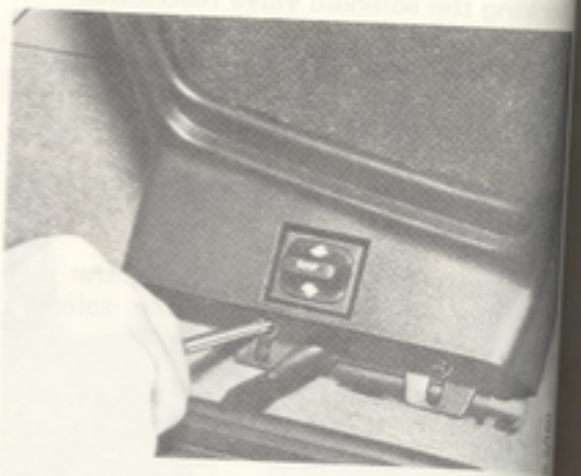
1. a Up to and including 1982 models:
Disconnect the pressure transducer hose at the inlet manifold. Connect the pressure gauge to the pressure transducer hose.



b Alternative method as from 1983 models:
Check the transducer by unplugging the connector from the APC control unit and measuring the resistance between terminal 9 (green/red; GN/RD) and terminal 8 (black; SV).

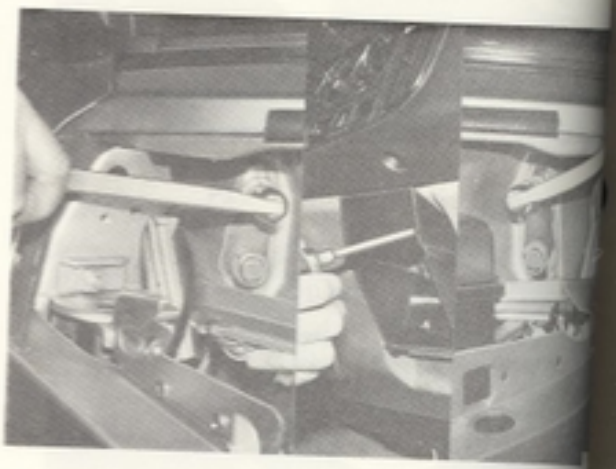
Note
To preclude damage to the connector, apply the rest prods to the same side as that on which the cables enter the connector.

As from 1983 models:
Remove the gaiter from between the front and rear centre sonsoles.
Remove the centre console.



c Remove the lower section of the safety padding.

d Disconnect the pressure transmitter hose at the Y connector. Connect the pressure gauge equipment to the hose from the pressure transducer.



As from 1986 models:
First, remove the cover from the electrical connector. Measure the resistance between terminal 23 (black/white; SV/VT) and terminal 10 (green/red; GN/RD).

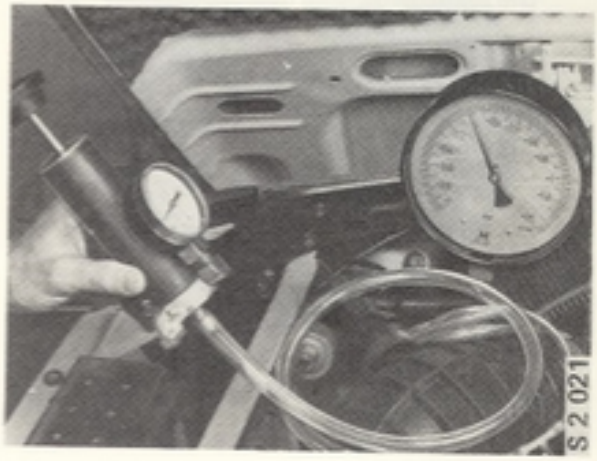
Note
To preclude damage to the connectory, apply the rest prods to the same side as that on which the cables enter the connector.

S 2/159

S 2/160

Note
Keep the pressure gauge vertical to avoid erroneous readings.

2. Connect the air pump via the hose and connector to the hose from the pressure transducer.



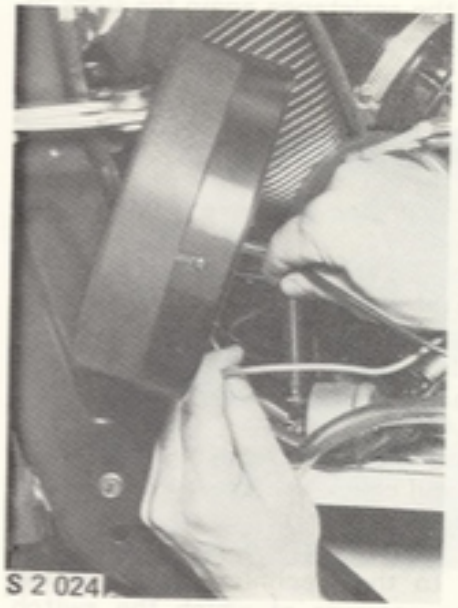
S 2 021

3. Disconnect the cables from the pressure transducer.

S 2 023

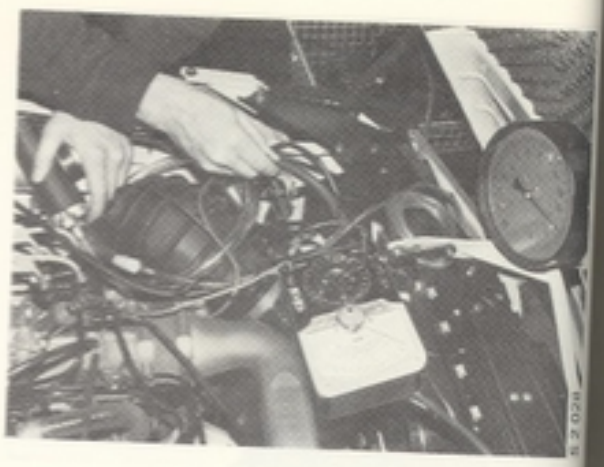
4. Connect an ohmmeter to the electrical terminals of the pressure switch.

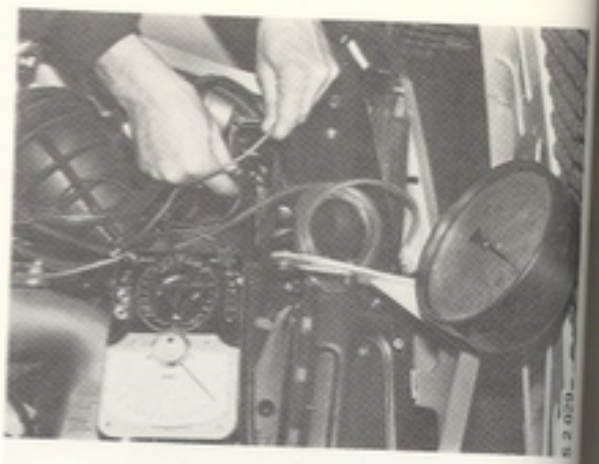
   Measure the resistance which should be 10 ohm (tolerance: - 5 ohm; + 3 ohm) at atmospheric pressure.



S 2 024

5. Using the air pump, raise the pressure to 1 bar (14.5 PSI) approx, then reduce it to 0.60 bar (8.3 PSI) while tapping the pressure transducer lightly with the handle of a screwdriver. Measure the resistance which should be 88 ± 5 ohm at 0.60 bar (8.3 PSI)





If the above readings are not obtained, or a short circuit or break in the circuit is indicated, replace the pressure transducer.

6. Replace the air pump with the vacuum pump and raise a vacuum of approx. 0.5 bar (6.6 PSI)

   Check the resistance again for signs of a short circuit or break in the circuit.

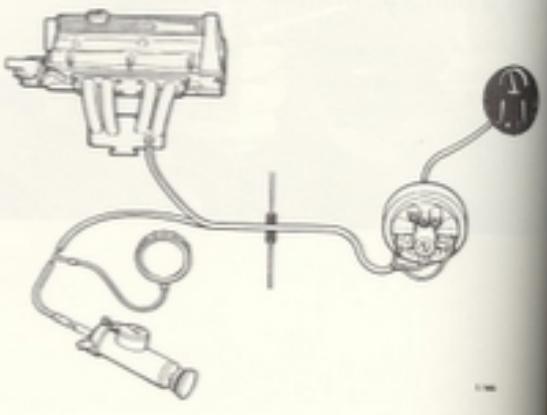
Checking the pressure switch

1. Start the engine and have it idle.

2. Disconnect the hose to the pressure switch at the inlet manifold and connect gauge 83 94 074, together with a suitable pump (e.g. cooling system tester) to the pressure switch hose.

3. Increase the pressure by means of the pump and check the pressure at which the engine cuts out.

   Refer to the 'Technical data' section for the pressure at which the switch should break the circuit.




S 2 028

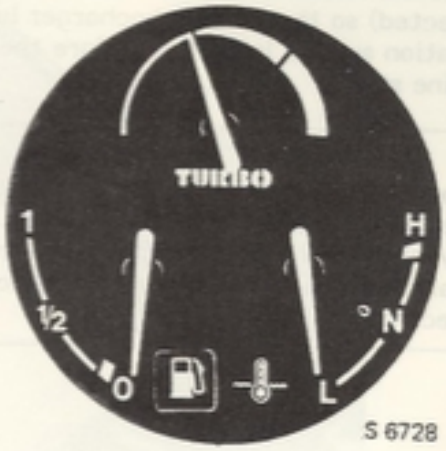

S 2 029

Checking the turbo pressure gauge

Check the turbo pressure gauge following the same procedure as that for checking the pressure switch.

At maximum charging pressure, the needle should be within the wide orange zone.

At the pressure switch actuating pressure, the needle should be in front of the limit between the orange and the red zones.



S 6728

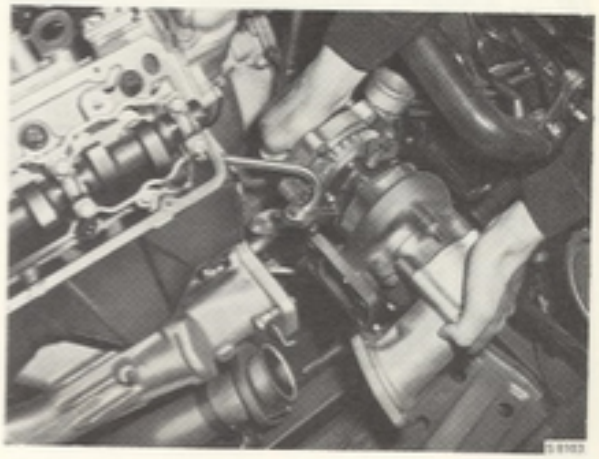
Turbocharger

To remove

1. Remove the battery.
2. Remove the suction and pressure connections from the compressor and loosen the pre-heating hose.
3. Remove the exhaust elbow between the exhaust manifold and compressor.
4. Remove the oil pressure pipe and oil return pipe from the turbocharger.
5. Remove the retaining bolts from the turbo flange on the exhaust manifold and remove the turbocharger.

To refit

1. Refit the turbocharger to the inlet manifold with a new gasket.
2. Refit the oil return pipe to the turbocharger with a new gasket.
3. Fill the oil feed channel with engine oil and refit the oil pressure pipe with a new gasket.
4. Refit the exhaust elbow and exhaust manifold.
5. Refit the suction and pressure connections to the compressor.



6. Run the engine for 30 s approx. on the starter motor (with distributor disconnected) so that the turbocharger lubrication system is primed before the engine starts.

Note
Ignition systems with Hall transmitters: Before running the starter when the secondary circuit is open, the primary circuit must also be isolated, e.g. by disconnecting the electronic control unit.

Removal and refitting of APC components

Note
Ensure that dirt does not enter the APC system hoses and regulating equipment.

Knock detector, (up to and incl. 1982 models)

To remove

Tools: Open twelve point socket, 24 mm, no. 83 93 472

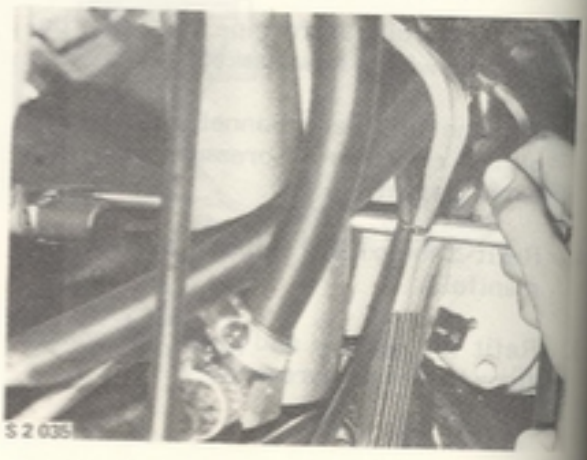
Long extension

Jointed handle or ratchet

Caution

Do not apply force to the knock detector casing when removing or refitting it.

1. Detach the knock detector wiring from the car wiring harness at the knock detector plug about 350 mm from the knock detector.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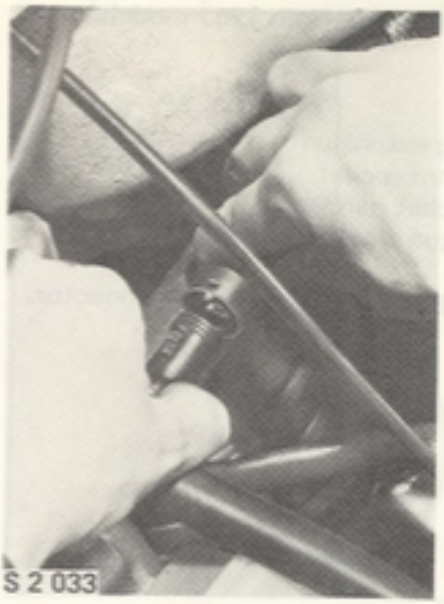
2. Remove the knock detector from the engine block.

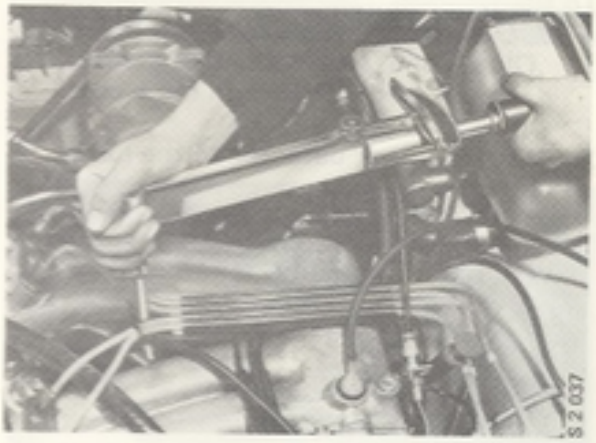


To refit

1. Clean the threads and the mating surfaces and oil the threads and mating surfaces.

2. Screw the knock detector into the engine block.

   Tightening torque: 8 Nm (6 lbf ft)



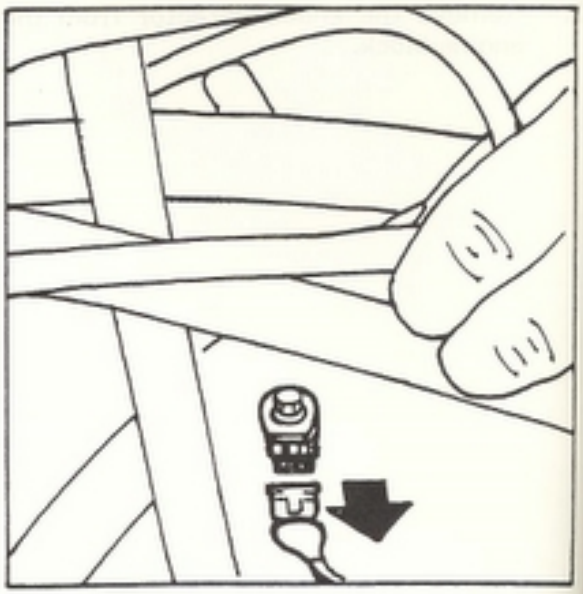
3. Connect the knock detector electrical wiring to the car wiring harness.

Knock detector (as from 1983 models)

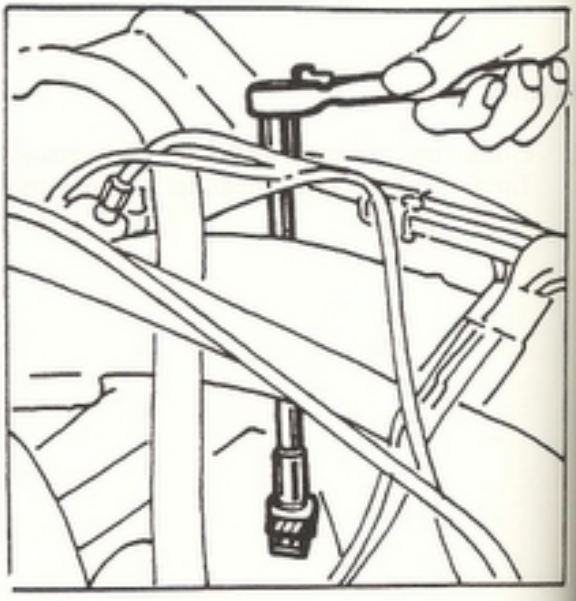
To remove

Tools: Long extension
13 mm socket
Ratchet handle
Torque wrench

1. Unplug the knock detector connector.



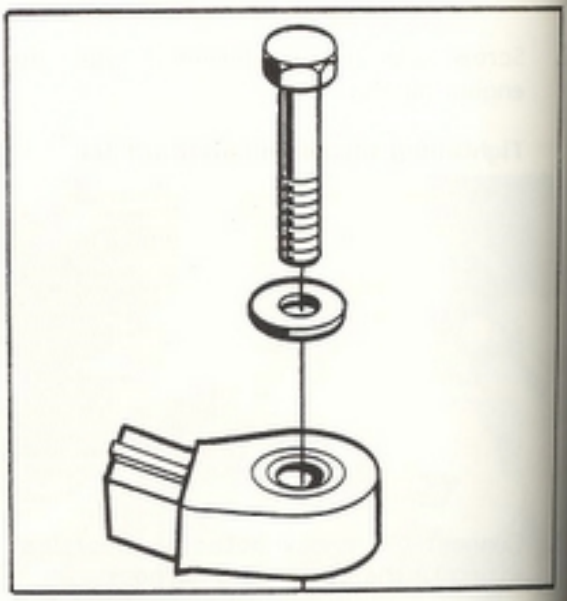
2. Remove the centre-bolt from the knock detector and lift the detector off the block.



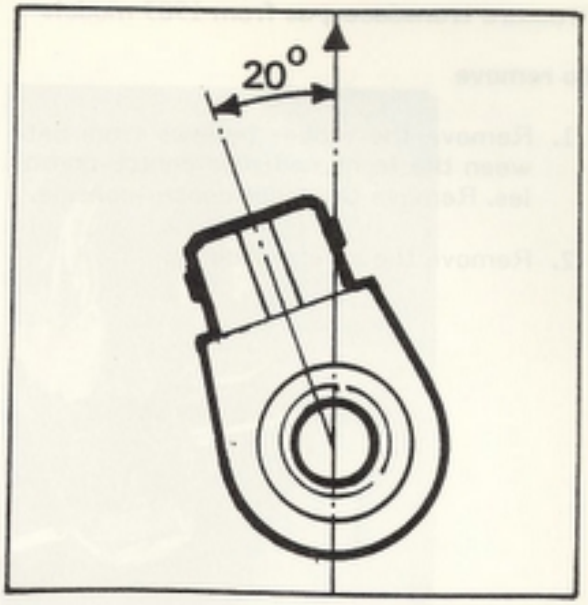
To fit

1. Clean and lubricate the centre-bolt and the threaded hole in the block.

2. Fit the knock detector to the block.



Note
Fit the knock detector with the electrical detector to the front but offset at angle of 20 degrees.



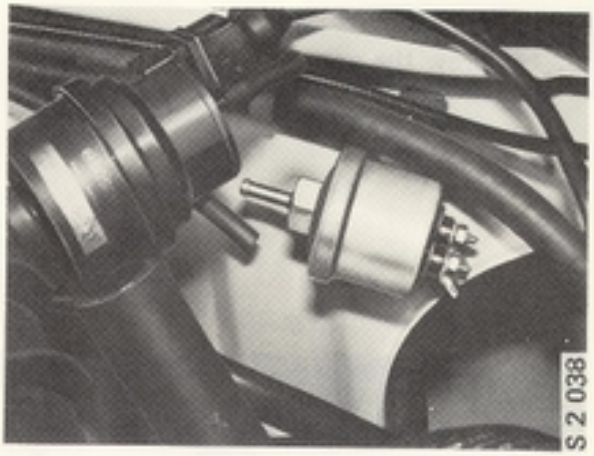
Tightening torque: 14 Nm (10.4 lbf ft)

3. Push on the connector.

Pressure transducer up to and incl. 1982 models

To remove

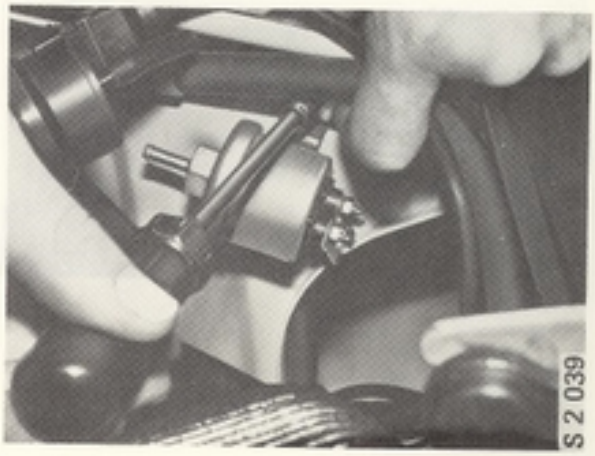
1. Detach the wiring from the pressure transducer.
2. Remove the hose from the pressure transducer.



3. Remove the screws holding the pressure transducer on the wheel housing.

To refit

1. Position the pressure switch on the wheel housing.
2. Mount it using the two screws.
3. Reconnect the hose.
4. Reconnect the wiring.

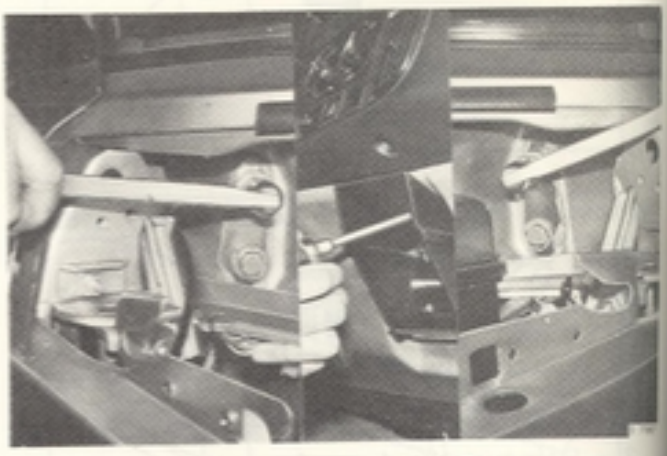


Pressure transducer, as from 1983 models

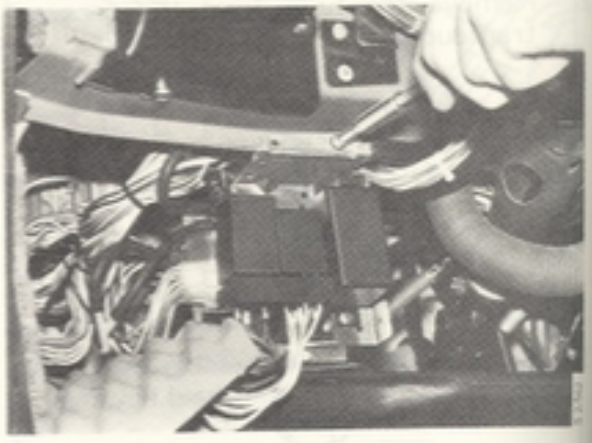
To remove

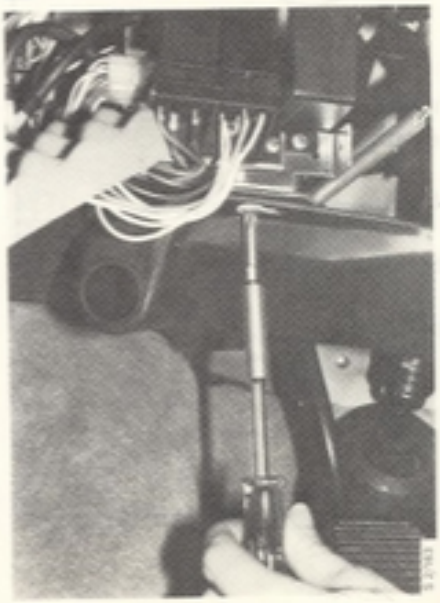
1. Remove the rubber bellows from between the front and rear centre-consoles. Remove the front centre-console.

2. Remove the safety padding.



3. Unscrew the pressure transducer bracket from the panel member (3 screws).





4. Disconnect the cables from the pressure transducer.

5. Disconnect the air hose from the pressure transducer.

6. Undo the 2 bolts securing the transducer to the bracket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To refit

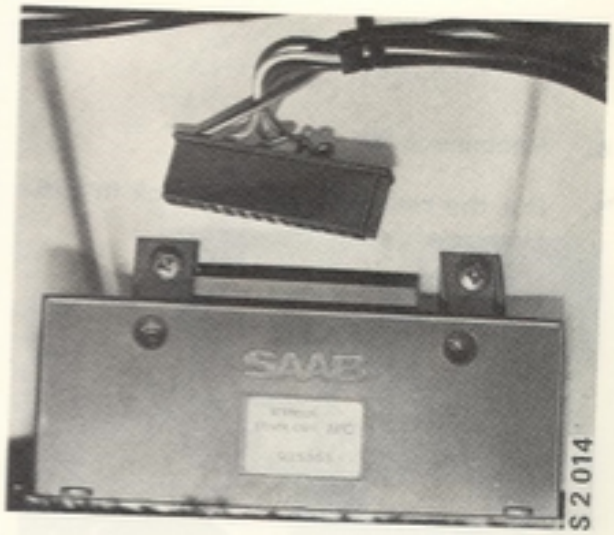
Refit in the reverse order.

Control unit (up to and incl. 1985 models)

To remove

1. Fold the rear seat cushion forward.

2. Detach the wiring harness connection from the control unit.



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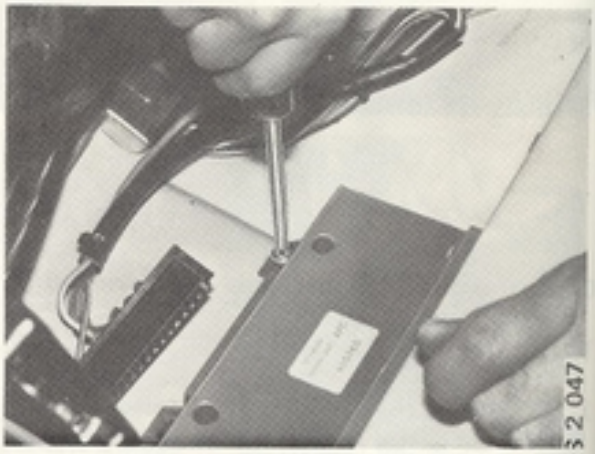
3. Remove the screws holding the control unit to the floor.

To refit

1. Check that the control unit has an anti-tamper seal fitted.

2. Position the control unit on the floor under the rear seat cushion.

3. Screw the unit into position.



4. Reconnect the wiring.

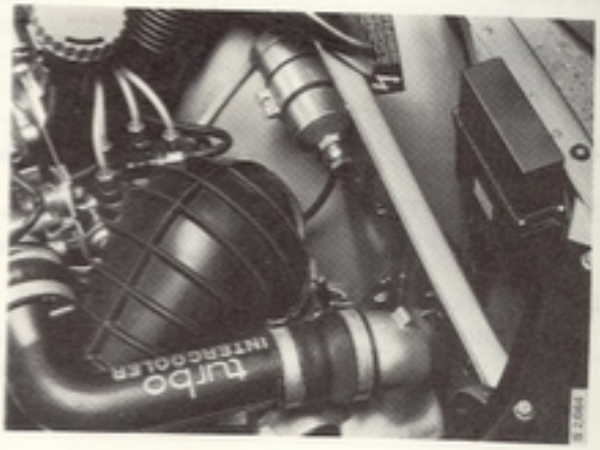
5. Put the rear seat cushion back in position.

Control unit (as from 1986 models)

To remove

1. Open the bonnet.
2. Unplug the connector from the control unit.

3. Undo the screws securing the control unit to the edge of the wing.
4. Undo the brackets.



To fit

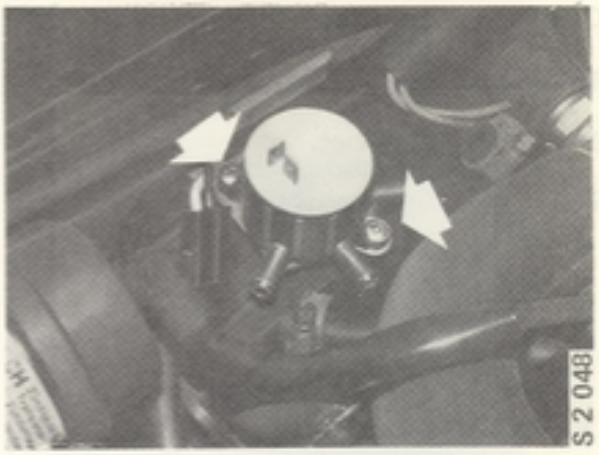
Fit in the reverse order.

Solenoid valve

To remove

1. Remove the electrical connector from the solenoid.
2. Loosen the hose clips and remove the rubber hoses from the valve connections.

3. Remove the screws holding the solenoid valve on the bracket.



To refit

1. Position the solenoid valve on the bracket.
2. Refit the screws.
3. Connect the hoses to their respective valve connections, refit the hose clips.
4. Reconnect the wiring to the solenoid terminals.

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Fault-diagnosis table for the turbo unit

Fault	Cause	Remedy
Noise or vibration from the turbo compressor	Poor lubrication of the turbo shaft bearing	Check the oil pressure and flow to the turbo. If the fault should persist after remedial action (permanent bearing damage) exchange the turbo compressor.
	Leakage in the induction or exhaust system	Tighten leaking connections and replace defective seals and gaskets
	Unbalanced turbo shaft owing to damage	Exchange the turbo compressor
Insufficient charging pressure	Leakage between the compressor and cylinder head or between the cylinder head and turbine	Tighten leaking connections and replace defective seals and gaskets
	Incorrect setting of charging pressure	Adjust the charge pressure regulator
	Valve in charge pressure regulator sticks in open position	Overhaul the charge pressure regulator
	Partially clogged exhaust system	Clean or replace exhaust system
	Clogged air cleaner	Change cartridge
	Binding turbo shaft	Exchange turbo compressor
Excessive charging	Incorrect setting of charging pressure	Adjust charge pressure regulator
	Leakage at exhaust pressure line connections	Tighten; if necessary, replace nipples
	Clogged exhaust pressure line	Remove and clean
	Damaged diaphragm unit in charge pressure regulator	Replace diaphragm unit
	Flap valve in charge pressure regulator binds in closed position	Replace the charge pressure regulator housing
	Ice formation in exhaust pressure line. (Excessive pressure occurs 1-2 min after cold start when ambient temperature below freezing)	Avoid heavy loading of engine immediately after cold starting

Fault	Cause	Remedy
Engine knocking	Excessive charging pressure	Adjust charging pressure
	Unsuitable fuel (octane too low)	Change fuel
	Ignition setting too far advanced	Adjust timing
Oil leakage at turbo shaft seals (oil fumes in exhaust)	Poor return flow from turbo: - Clogged return line - Excessive crankcase pressure - Air cleaner clogged, oil coating on compressor seals	 Check return line Check crankcase ventilation Change air cleaner
	Turbo unit seals damaged	Exchange turbo compressor

Fault-diagnosis table for basic charging pressure (APC)

Symptom	Possible cause	Remedy
Not possible to adjust basic pressure as detailed.	Faulty charging pressure regulator valve.	Remove the exhaust elbow. Visually check that the valve flap is in contact with the turbocharger body. Remove the seal and circlip. Unhook the diaphragm unit push rod from the charging pressure regulator valve. Check that the valve shaft rotates freely. Replace faulty charging pressure regulator valve.
	Sticking diaphragm unit push-rod bushing	Check that the diaphragm unit push rod moves freely. Replace faulty diaphragm unit.
	Blocked orifice in the solenoid valve hose connection to the turbocompressor (connection "C").	**Note** Can be temperature-sensitive. Clean orifice.

Fault-diagnosis table for APC components

Symptom	Possible cause	Remedy (refers to APC system)
Solenoid valve not functioning when APC system tested in car as per"Checking of components"	The control unit has no voltage between terminal 14 (+) and 6 ground (-). **Note.** The wiring harness connector should be left connected to the control unit during the measurement.	Check that fuse 19 has not blown. Remove any oxidation present. Check the wiring in the connectors at distributor panel (fuse box) and control unit. Check that the (+) and ground (-)cables are undamaged. Rectify as required.
	Loose connector on knock detector. Broken cable between knock detector and control unit.	Check electrical connection at the connectors (in the engine compartment and on the control unit). Rectify as required.
	Knock detector not properly tightened.	Check tightness. See under 'Removing and refitting of com-ponents, knock detector'.
	Faulty knock detector.	Test system with known good knock detector. If symptoms disappear, replace defective knock detector.
	Solenoid valve not functioning despite supply greater than 5 volts. **Note.** The solenoid electrical connector is to remain connected.	Check the solenoid valve. See under 'Checking components, checking the solenoid valve'.
	Faulty pressure transducer.	Check the pressure switch. See under 'Checking components, checking the pressure transducer'.
	Faulty control unit.	Test system with known good control unit. If symptoms disappear, replace defective control unit.

Fault-diagnosis table for APC system

Symptom	Possible cause	Remedy
Maximum charging pressure too low (low engine output)	Incorrectly adjusted basic pressure.	Check the basic setting of the charging pressure regulator valve. See 'Adjusting the basic pressure of the charging pressure regulator'.
	Loose or oxidized electrical connections in the APC-System.	Check electrical connections of control unit, bulkhead connector, pressure transducer (2 connections) fuel pump relay, knock detector plug and common ground in the engine compartment.
		Also check for broken cables in the knock detector-to-control unit, pressure switch-to-control unit, or fuel pump relay to control unit, wiring. Rectify if required.
	Defective (short circuit) stop light switch.	Replace.
	Faulty or wrongly adjusted cruise control vacuum switch (T-16).	Adjust switch or replace replace if defective.
	Faulty knock detector.	Test system with known good knock detector. If symptoms disappear, knock detector was at fault. Replace.
	Faulty pressure transducer.	Check the pressure transducer. See 'Checking the pressure transducer'. Replace the pressure transducer if required.
	Solenoid valve does not open.	Check the solenoid valve. See 'Checking the solenoid valve' under 'Checking components'. Replace faulty solenoid valve.
	Faulty control unit.	Test system with known good knock control unit. If symptoms disappear, control unit was at fault. Replace.

Fault-diagnosis table for APC system

Symptom	Possible cause	Remedy
	The knock detector registers abnormal engine vibrations.	Connect the test wiring harness with service box (83 93 548 or 83 94 074 as appropriate), (see 'Checking the APC system knock control'). If the LED flashes when driving under light load listen for abnormal engine noise. If the engine sounds normal try a new knock detector.
	Faulty spring or sticking rod in the diaphragm unit.	Try a new diaphragm unit.
	Faulty turbocompressor.	Remove the exhaust elbow and the inlet to the compressor. Check visually that the turbine wheel and the compressor are not damaged. Replace faulty turbocompressor.
Charging pressure too high (also covers violent changes in charging pressure during acceleration). Pressure switch cuts out.	Leak in turbocompressor - solenoid hose.	Check for leaks. Replace faulty hose.
	Leak in solenoid valve - diaphragm unit hose.	Check for leaks. Replace faulty hose.
	Leak in diaphragm unit.	Check for leaks. Replace faulty diaphragm unit.
	Ruptured diaphragm unit.	Check for leaks. Replace faulty diaphragm unit. Check the mounting of the diaphragm unit housing on the bracket. Replace faulty diaphragm unit.
	Leak in hose to pressure transducer.	Check for leaks. Replace hose.
	Faulty pressure transducer.	Check pressure transducer. See 'Checking pressure transducer'. Replace faulty pressure transducer.
	Solenoid valve does not shut due to sticking valve spool.	Check the APC system in the car. Replace faulty solenoid valve.
	Blocked orifice in the solenoid hose connection to the turbocompressor (connection 'C').	**Note.** Can be temperature-sensitive. Check and clean orifice as necessary.

Symptom	Possible cause	Remedy
	Incorrect basic charging pressure setting.	Check the basic setting of the charging pressure regulator valve with the car on the road. See 'Checking the basic setting of the charging pressure regulator on the road'. Adjust as necessary.
	Short circuit in the pressure transducer signal circuit.	Check the wiring between pressure transducer and the control unit. Rectify short circuit.
	Faulty control unit.	Test system with known good control unit. Replace control unit if defective.
	Shaft sticking in the pressure regulator valve.	Remove the seal an circlip. Unhook the diaphragm unit push rod from the regulator valve control arm stud. Check that the valve shaft rotates easily. Replace faulty charging pressure regulator valve.
	Sticking diaphragm unit push rod bush.	Replace diaphragm unit.
Normal charging pressure but no pressure reduction despite intensive knocking/pinking.	APC system not functioning.	See 'Checking the APC system knock control'.
	Bad contact in the knock detector wiring.	Check the connector between the knock detector and the car wiring harness.
	Knock detector not properly tightened.	Check tightness. See 'Removand refitting of components, knock detector'.
	Faulty knock detector.	Test system with known good knock detector. If symptoms disappear, knock detector was at fault. Replace.
	Faulty control unit.	Test system with known good control unit. If symptoms disappear, control unit was at fault. Replace.
	Bearing sticking in the charging pressure regulator valve.	Remove the seal and circlip. Unhook the diaphragm unit push rod from the regulator valve control arm stud. Check that the valve shaft rotates easily. Replace faulty charging pressure regulator valve.

Symptom	Possible cause	Remedy
	Diaphragm unit rod bush sticking.	Replace diaphragm unit.
Solenoid valve active at idling speed. (Irregular chattering sound.)	Idling speed too low.	Increase idling speed to 875 ± 50 r/min approx.
	Broken cable between pressure transducer and control unit.	Check the wiring. Rectify as required.
	Faulty pressure transducer.	Check the pressure transducer. See 'Checking the pressure transducer'. Replace faulty pressure transducer.
	Bad contact/broken cable between knock detector and control unit wiring.	Check the electrical connections at the connector in the engine compartment and at the control unit. Check that the wiring between the knock detector and the control unit is unbroken. Rectify as required.
	Knock detector not properly tightened.	Check tightness. See 'Removal and refitting of components knock detector'.
	Faulty knock detector.	Test system with known good knock detector. If symptoms disappear, knock detector was at fault. Replace.
	Faulty control unit.	Test system with known good control unit. If symptoms disappear, control unit was at fault. Replace.

Alphabetical section guide

Saab-Scania AB
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