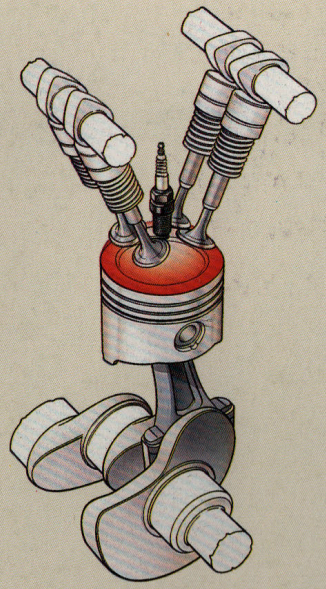
SAAB

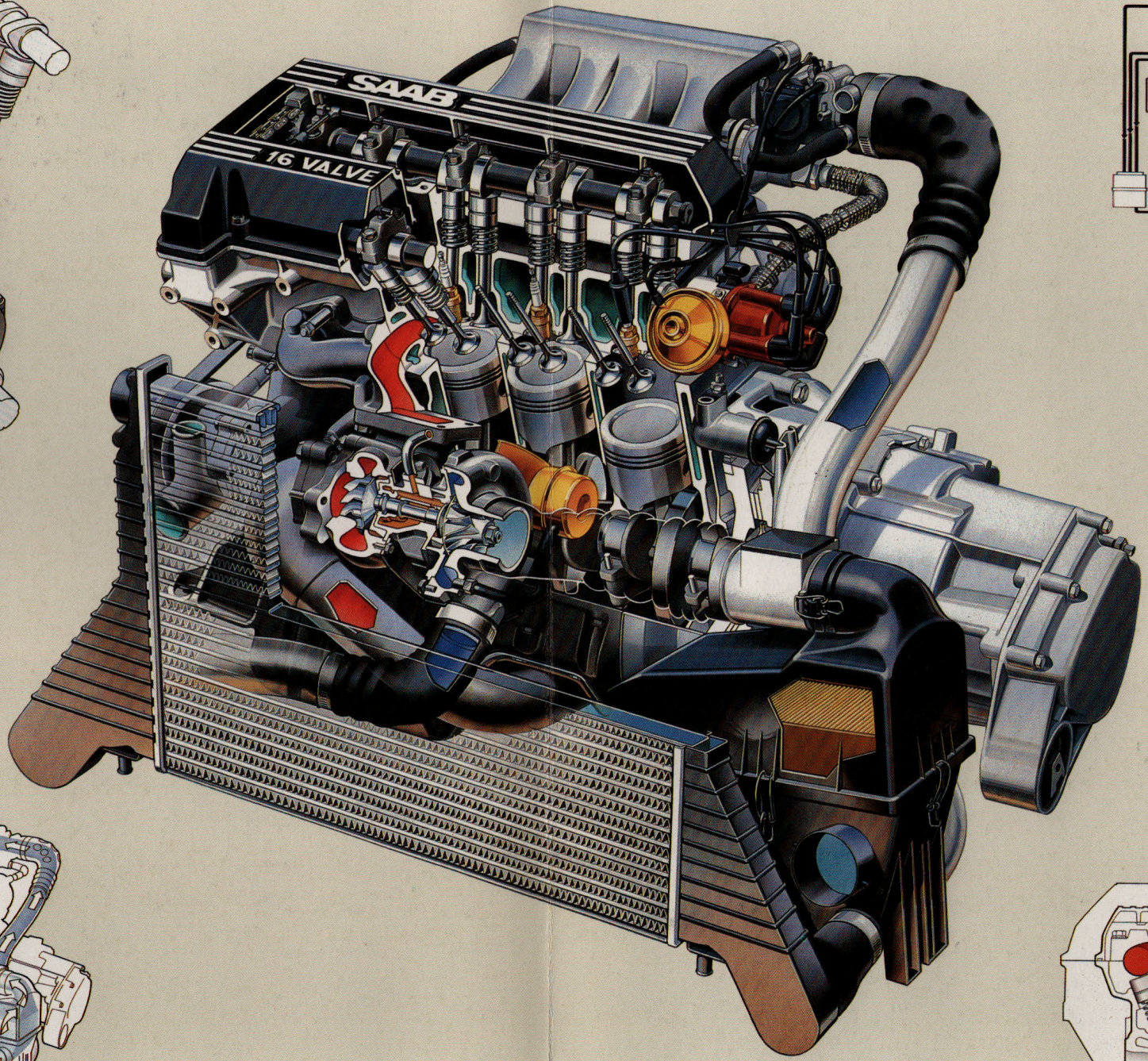
9000

SERVICE MANUAL

2:4 Exhaust system, cooling system, turbo system

M 1986–87–

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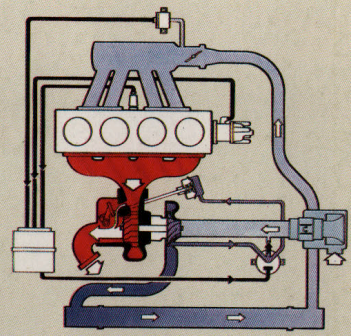
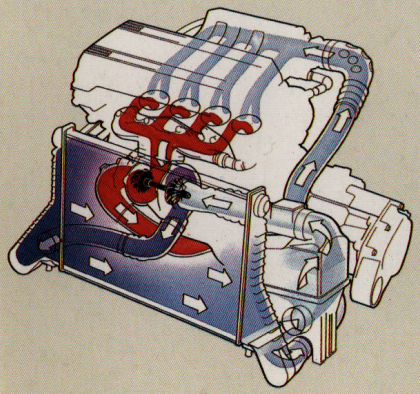
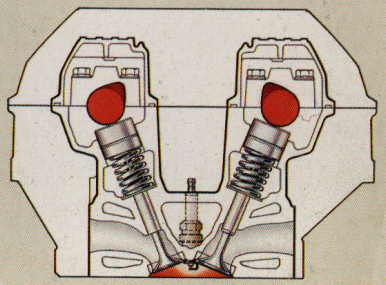
16 VALVE







SAAB 9000

SERVICE MANUAL

2:4 Exhaust, cooling and turbo systems

M 1985–1987–

Units

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

For users not familiar with the SI units, some non-Continental units are given in brackets after the respective SI unit.

The following symbols and abbreviations are used:

SI unit	Equivalent unit and symbol
mm	inch (in)
kg	pound (lb)
N	pound-force (lbf)
Nm	pound-force foot (lbf ft)
bar	pound-force per square inch (lbf/in^2) (Also abbreviated: psi)
l (litre)	US liquid quart (liq qt) (Also abbreviated: qts) US gallon (USgal)
°C	°F

Conversion factors

1 in = 25.4 mm	1 mm = 0.039 in
1 lbf = 4.45 N	1 N = 0.23 lbf
1 lbf ft = 1.36 Nm	1 Nm = 0.74 lbf ft
1 psi = 0.07 bar	1 bar = 14.5 lbf/in^2
1 liq qt = 0.95 l	1 l = 1.05 liq qt
1 US liq qt = 0.83 UKqt	1 USgal = 0.83 UKgal

Market codes

The codes refer to market specifications

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

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

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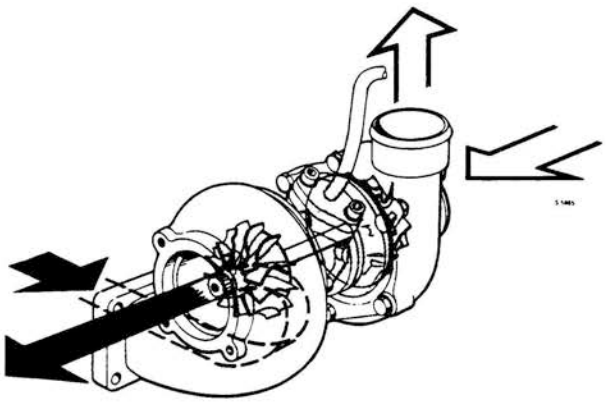
Technical data

Induction and exhaust systems



Turbo compressor

Maximum charging pressure, EU	bar (psi)	0,85 ± 0.05 (12,3 ± 0,7)
USA	bar (psi)	0,75 ± 0,05 (10,8 ± 0,7)
Basic charging pressure, EU	bar (psi)	0.40 ± 0.03 (5,8 ± 0,4
USA	bar (psi)	0,35 ± 0,03 (5,0 ± 0,4)
Tripping pressure for pressure switch, EU	bar (psi)	1.10 ± 0.05 (16,0 ± 0,4)
USA	bar (psi)	0,95 ± 0,03 (13.8 ± 0,4)
Turbo shaft bearings:		
End float	mm (in)	0.025 - 0.10 (0,0010-0,0039)
Radial clearance	mm (in)	0.075 - 0.18 (0,0030-0,0071)

Exhaust emission control system

EGR valve, type		Proportional
Maximum flow	kg/h (lb/h)	20 (44)
Colour code		Blue
Diameter of restriction 1985	mm (in)	4.3 (0.0169)
1986	mm (in)	4,7 (0.0185)
Opening temperature of thermostatic valve	°C (°F)	30 (86)
Closing temperatur of thermostatic valve	°C (°F)	20 (68)

Mechanical throttle damper (dashpot)

Time taken for engine to slow from 3000 r/min to idling speed	s	3-6
Setting speed	r/min	2600 ± 100

Cooling system

Coolant

Type		Saab Original Coolant
Capacity	litre (US gal)	8,65 (2.29)

Thermostat

Opening temperature	°C (°F)	89 ± 2 (192 ± 4)*
*) Alternative spec. for certain markets:		82 ± 2 (180 ± 4°F)

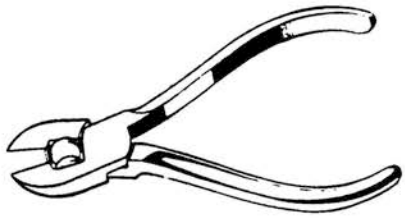
Expansion tank

Pressure valve opens at	bar (lb/in²)	0.9 - 1.2 (13.0 - 17.4)

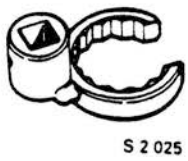
Thermostatic switch

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

Special tools

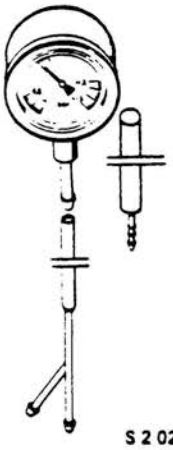


83 92 912 Pliers for anti-tamper seal on waste-gate valve, Turbo unit and APC control unit

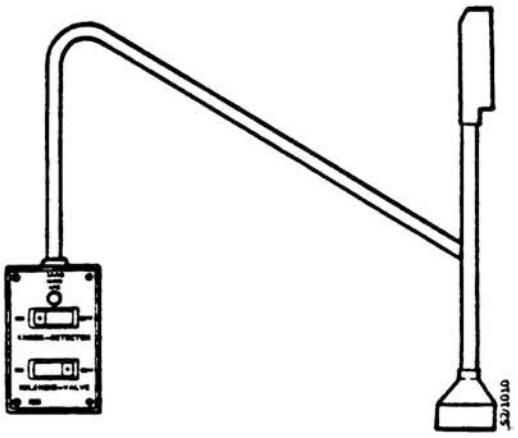


83 93 472 Bihex flare nut socket

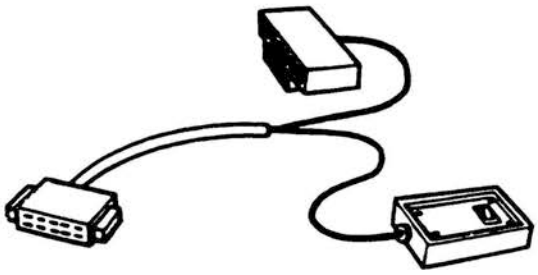
83 96 480 Socket adaptor for Turbo oil return pipe



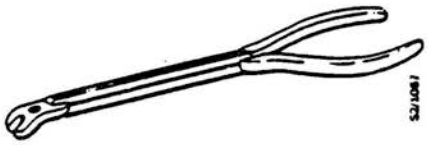
83 93 514 Pressure gauge for Turbo APC boost and component check



83 94 074 APC test loom, as from 1986 models

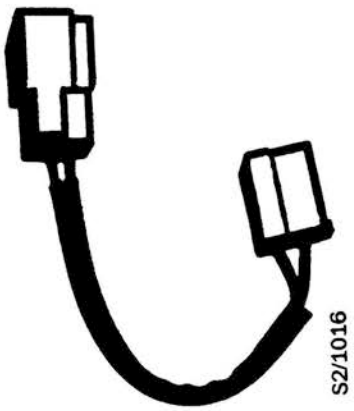


83 93 548 Test loom (1985 models only)



83 94 066 Waste-gate valve adjusting tool (charging pressure)

83 93 597 Pulse meter



83 94 132 Test loom

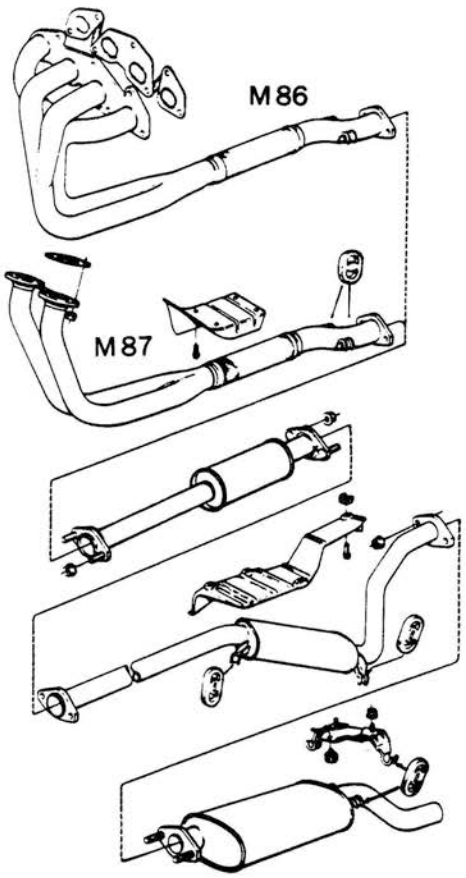
Technical description

Exhaust system

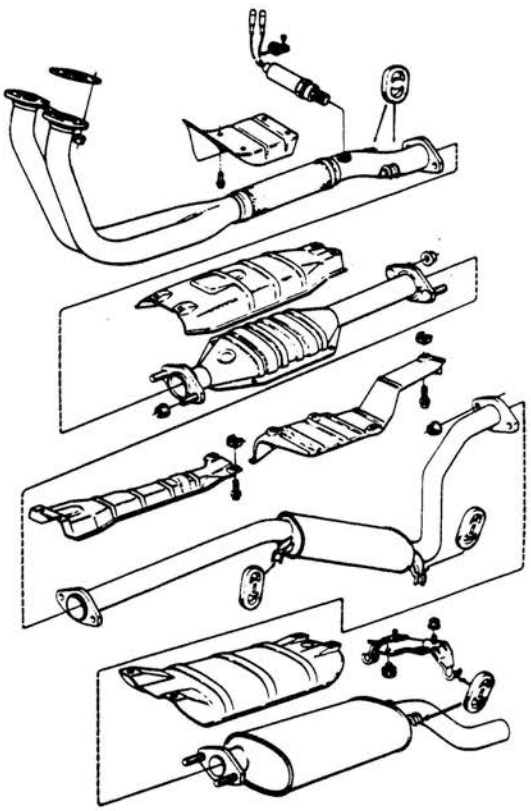
The exhaust system is designed to carry the exhaust gases from the engine and provides low resistance to flow, low noise level and has a long useful life.

The system comprises four sections: the front pipe section and three silencer sections.

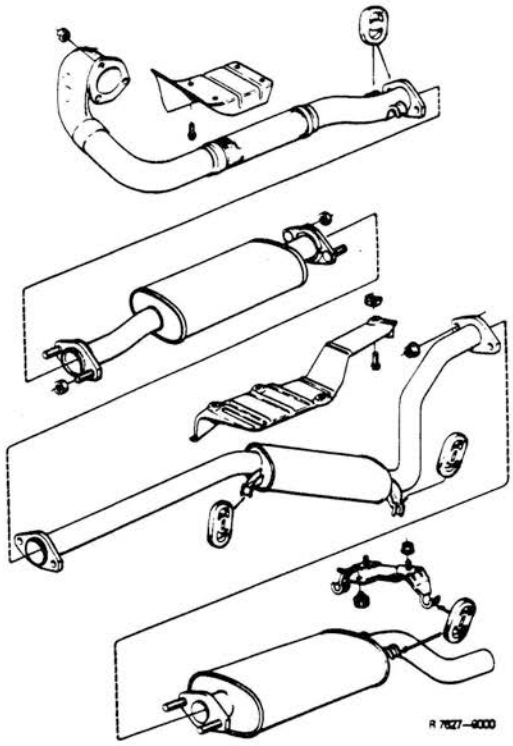
Exhaust system, injection engines



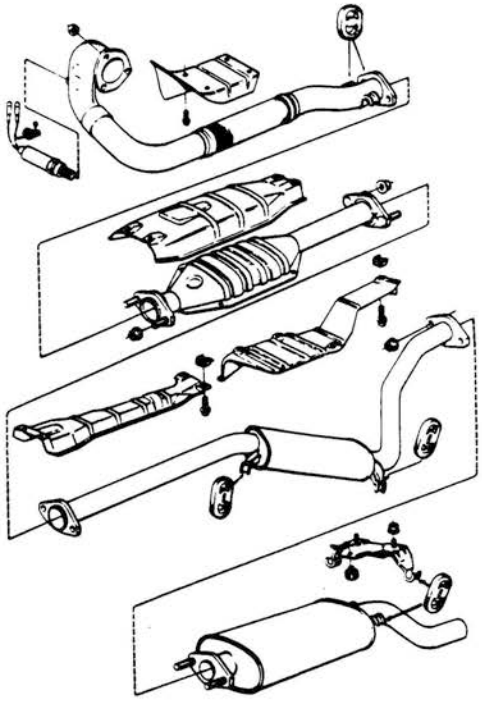
Exhaust system, injection engines with catalytic converter



Exhaust system, turbo

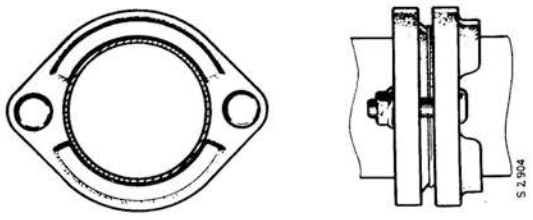


Exhaust system, turbo with catalytic converter



Anti-corrosion protection for the exhaust system includes aluminium plating of the front pipe section and intermediate pipe section between the silencers. The inlet and tail pipes of the rear silencer are made of chromium steel. The insides of the silencers are made of corrosion-resistant 12% chromium steel and the outer skin is aluminized.

All joints are of the flared flange type without gaskets, which facilitates replacement and makes for a good fit. The system is suspended at six points in rubber hangers and, to increase its clearance from the ground, is semi- enclosed in a channel in the floor pan. Galvanized heat shields are fitted around the hottest parts of the exhaust system, the number of which varies with the engine variant to which the system is connected.

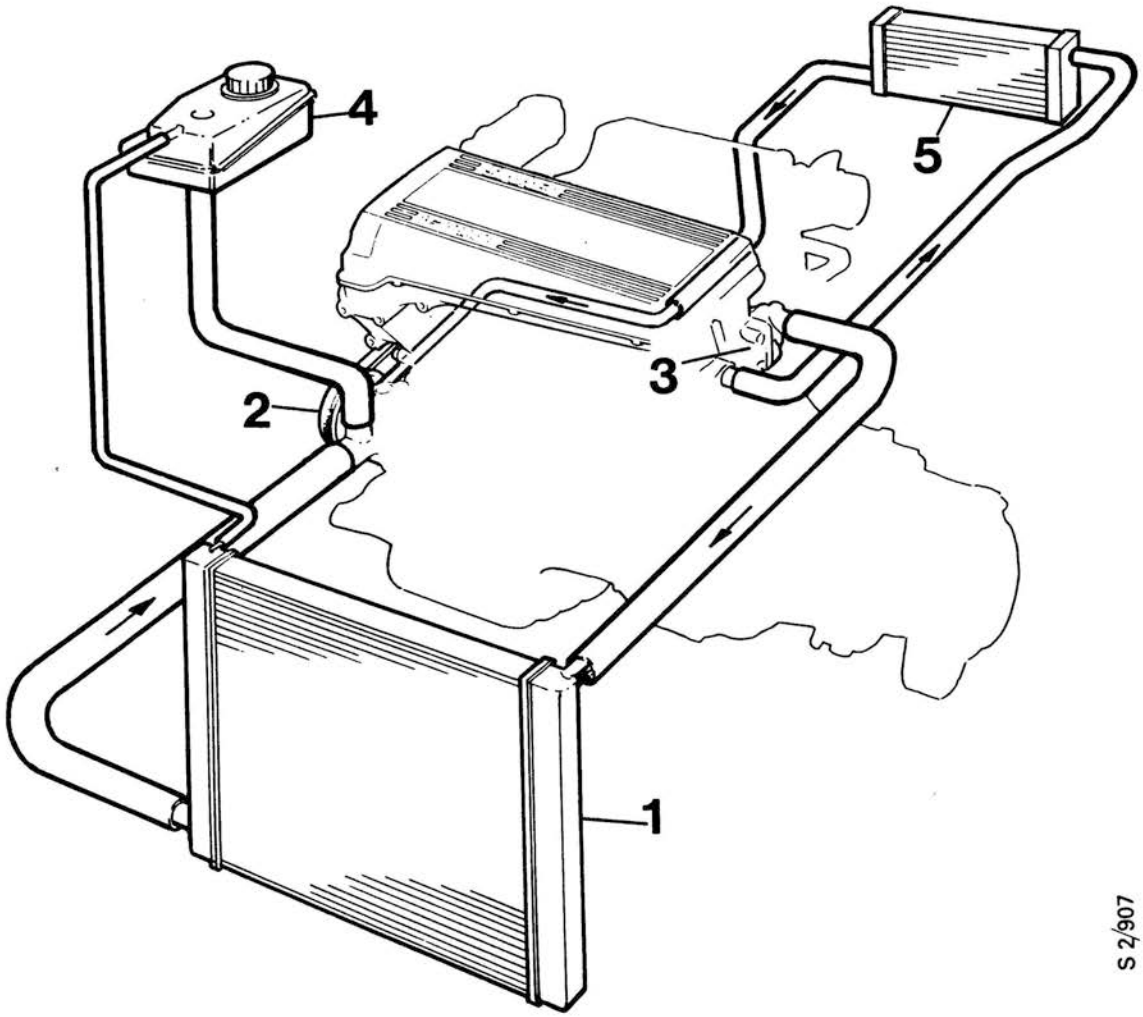


Exhaust emission control

All Saab cars are fitted with exhaust emission control equipment to satisfy the requirements of the respective market. The following exhaust emission control systems are in use:

- Closed-circuit crankcase ventilation
- Deceleration device
  Mechanical throttle damper (dashpot)
- Delay valve (distributor vacuum advance)
- Exhaust gas recirculation (EGR) system
  EGR valve of the on/off type
- Catalytic converter
- Oxygen-sensor-regulated fuel injection system
- Evaporative-loss control device (ELCD)
- Automatic idling control (AIC) system
- Pulse-air system

Cooling system



1 Radiator
2 Water pump
3 Thermostat housing
4 Expansion tank
5 Heat exchanger

The cooling system is pressurized and incorporates a cross-flow radiator and an expansion tank. The water pump is located inside the timing cover and is driven by a belt from the crankshaft. The thermostat is located in a housing at the left-hand end of the cylinder head. The electric radiator fan is controlled by a thermostat.

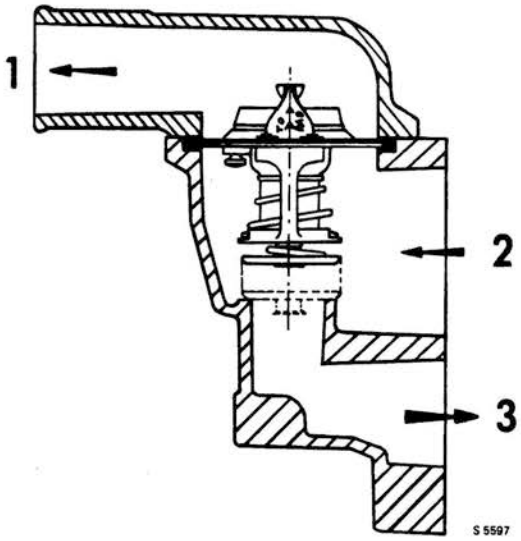
Coolant flow

A Thermostat closed:
From the water pump, through a passage into the engine block, out through the lower outlet on the thermostat housing and through a hose to the heater-box inlet and, thence, from the heater box, back to the pump.

B Thermostat in normally open position:
From the water pump, through a passage into the engine block and out through the upper outlet on the thermostat housing (by-passing the thermostat), through the radiator and back to the pump.

A small quantity of coolant also flows from the lower outlet on the thermostat, through the heat exchanger inlet hose and back to the pump.

C Thermostat fully open:
The thermostat closes the lower outlet on the thermostat housing, forcing all coolant to circulate through the radiator.



Three-way thermostat

1 To the radiator
2 From the cylinder block
3 To the heater

Expansion tank

The coolant in the expansion tank does not circulate through the cooling system. The tank is connected to the water pump and to the top right-hand section of the radiator. The latter connection is for the purpose of evacuating air from the top of the radiator.

Radiator fan

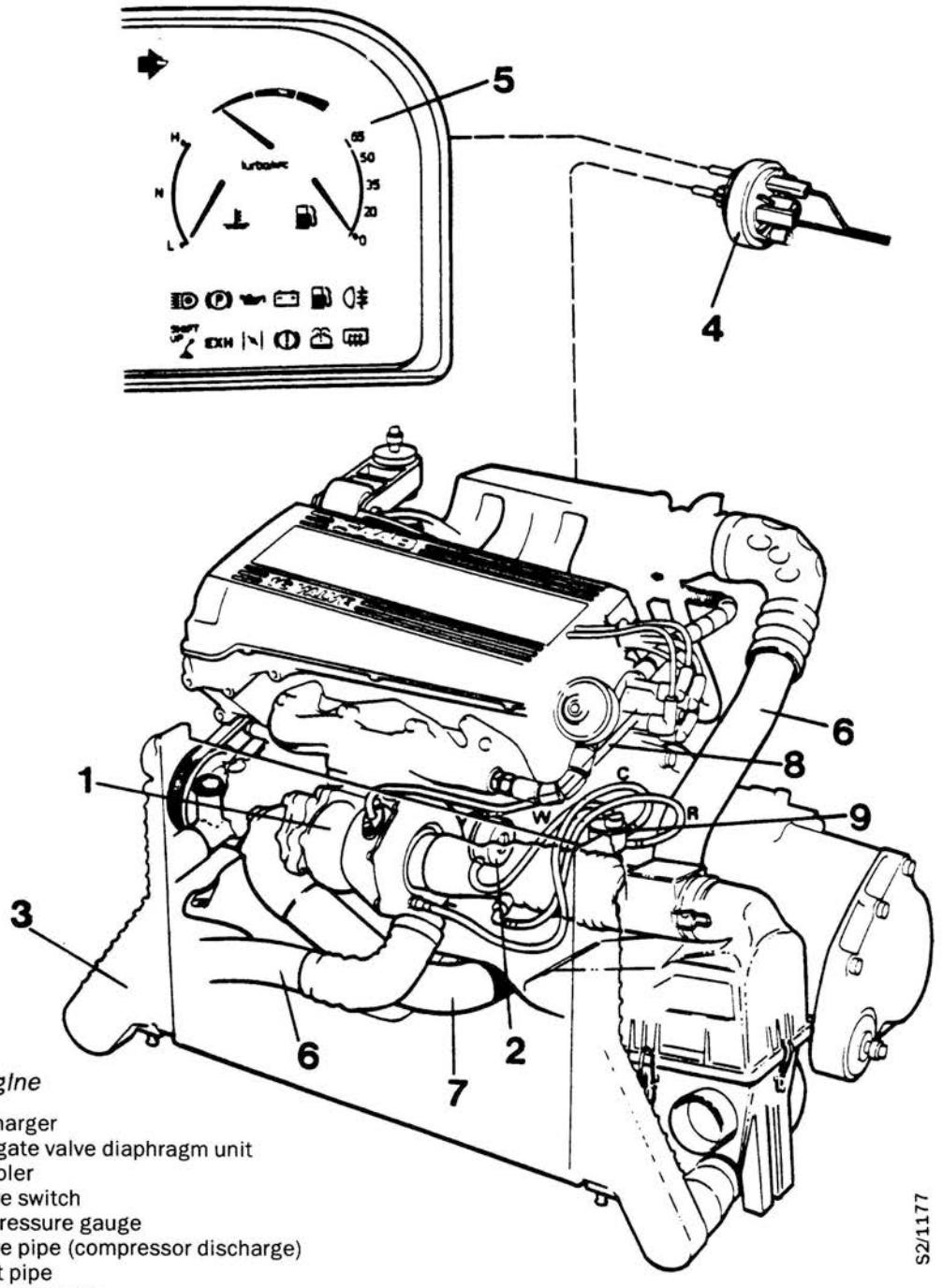
The radiator fan is driven by an electric motor and is located behind the radiator. Operation of the fan is controlled by a thermostatic switch on the right-hand side of the radiator.

Turbo system

Supercharging

In contrast to a normally aspirated engine, the supercharged engine induces a greater mass of air on the induction stroke, which increases the efficiency of the combustion and enables the engine to develop greater power and torque.

Supercharged engines can achieve a level of performance comparable to that developed by larger engines, yet still retain the intrinsic advantages of better fuel economy, smaller size, lighter weight, etc., that smaller engines enjoy.



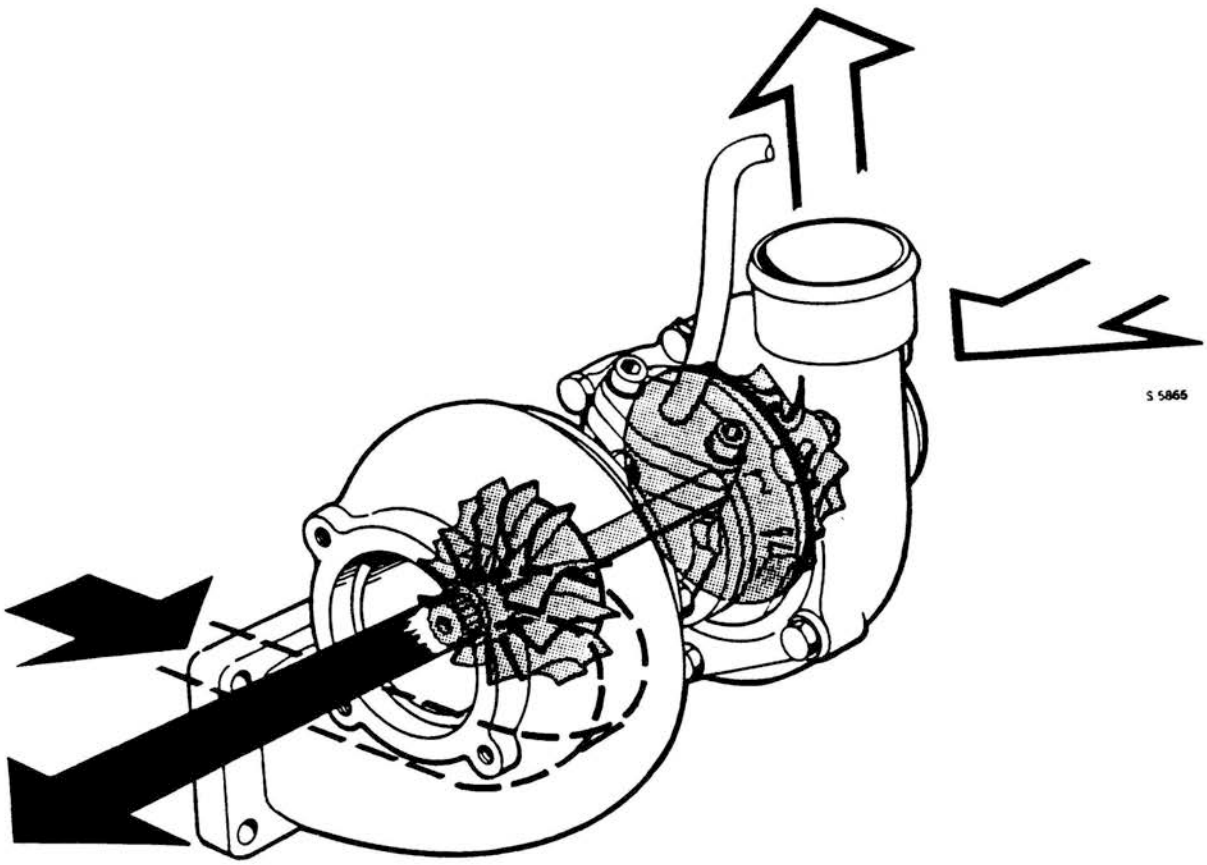
Turbo engine

1 Turbocharger
2 Waste-gate valve diaphragm unit
3 Intercooler
4 Pressure switch
5 Turbo pressure gauge
6 Pressure pipe (compressor discharge)
7 Exhaust pipe
8 Lubricating oil line
9 Solenoid valve

Turbocharging

In a turbocharged engine, the engine is supercharged by a turbo compressor in which a turbine driven by the exhaust gas is used to drive the compressor.

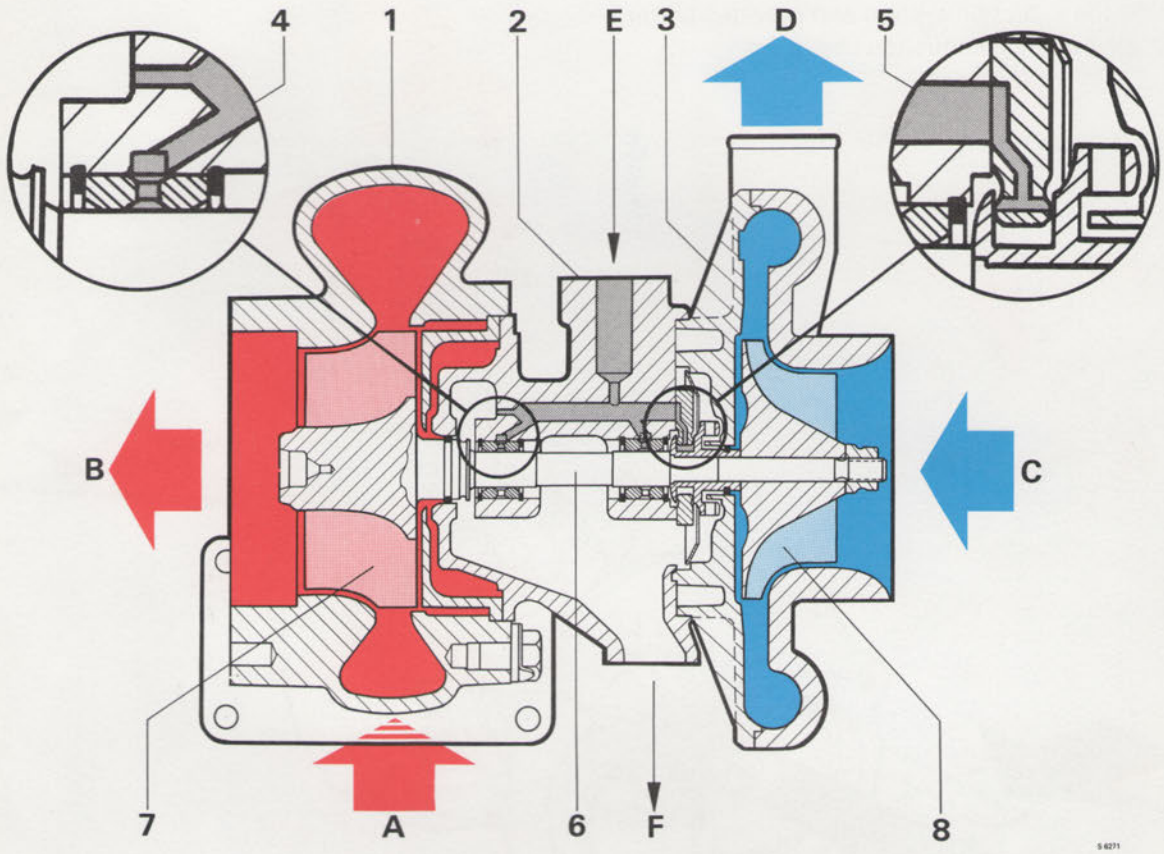
The exhaust gas flows through the vanes on the turbine wheel causing it to rotate. The turbine wheel and the impeller of the compressor are mounted on a common shaft and therefore rotate at the same speed. The impeller is mounted inside the induction system and provides better charging of the combustion chambers.



The Saab turbo is designed to come into operation at fairly low engine speeds and thus provide a higher torque within the speed range existing under normal driving conditions. In contrast to the Saab system, previous turbochargers were designed to provide greater power, as a result of which the boost effect of the turbo came into play at the top end of the speed range, at full throttle.

The turbine shaft rotates at very high speed and has therefore been very precisely balanced. The shaft is mounted in floating sliding bearings, which means that because of a fairly high flow of oil through the bearings, the shaft rotates, floating on a film of oil.

The oil for the bearings is supplied from the engine lubricating system by means of a special oil line from an adaptor on the oil pump. The oil is returned to the sump through a fairly large-bore pipe. Sealing rings (of the piston-ring type), located in grooves in the shaft, provide a seal between the shaft and the bearing housing.



Induction air

Exhaust gases

Cross-section of the turbocharger

1 Turbine housing
2 Bearing housing
3 Compressor housing
4 Radial bearing
5 Axial bearing
6 Turbine shaft
7 Turbine wheel
8 Compressor impeller

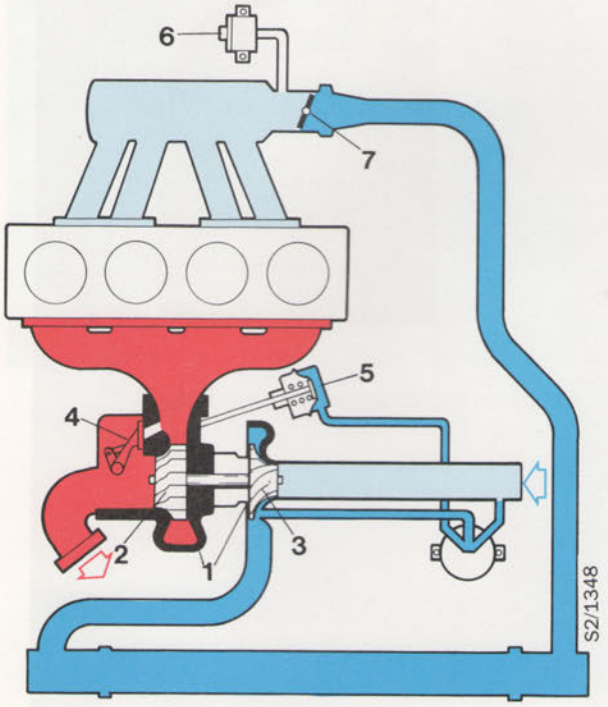
A From exhaust manifold
B To exhaust pipe
C From air cleaner
D To inlet manifold
E Lubricant feed
F Lubricant return

Charging-pressure regulation

The charging pressure in the inlet manifold is determined largely by the speed of the engine and the load being applied. However, when the engine is being subjected to a heavy load, the charging pressure is limited by a charging pressure regulator.

The charging pressure regulator is fitted to the exhaust side of the engine and it regulates the flow of exhaust gas by means of a bypass passage adjacent to the turbine.

The valve in the charging pressure regulator (known as a waste-gate) remains closed when the load on the engine is equivalent to, or less than, that encountered under normal driving conditions. However, as the load increases and the charging pressure approaches its preset limit, the waste-gate opens, allowing some of the exhaust gas to flow through the bypass passage, thus reducing the flow through the turbine.



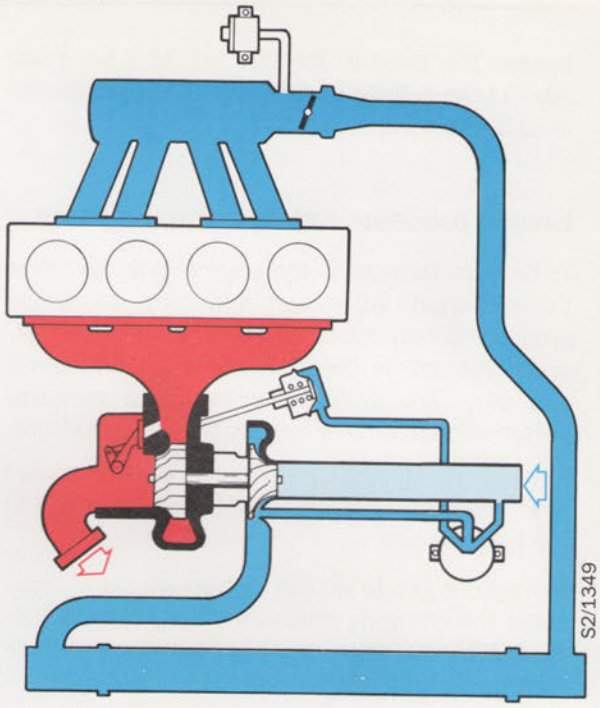
Induction air

Exhaust gases

Engine at idling speed

1 Turbocharger
2 Turbine wheel
3 Compressor impeller
4 Charging pressure regulator (Wastegate)
5 Diaphragm unit
6 Pressure switch
7 Throttle butterfly

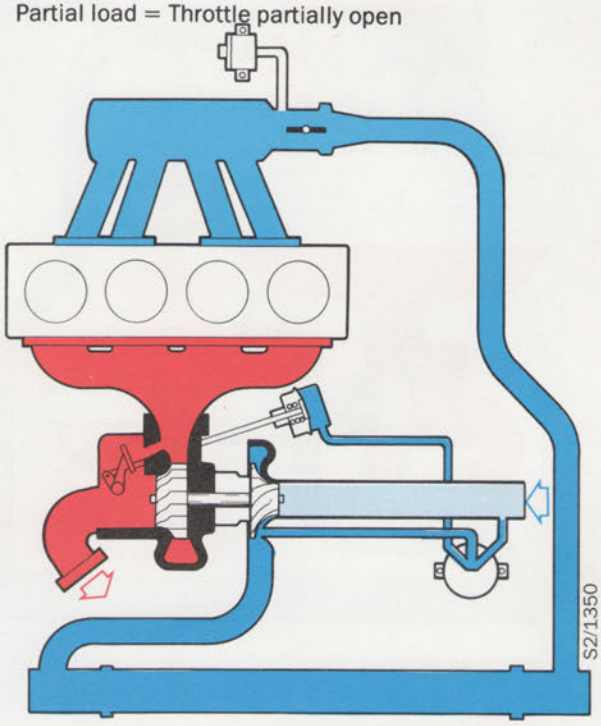
The waste-gate is a flap valve, which closes or opens the bypass passage adjacent to the turbine wheel. The valve is actuated by a pushrod from a diaphragm unit at the compressor housing. The diaphragm is connected to the compressor pressure and a diaphragm return spring holds the valve closed when the pressure is below the actuating limit. As the pressure acting on the diaphragm rises, it overcomes the pressure exerted by the diaphragm return spring, opening the valve and allowing exhaust gas to



Induction air

Exhaust gases

Partial load = Throttle partially open



Induction air

Exhaust gases

Maximum load = Throttle fully open

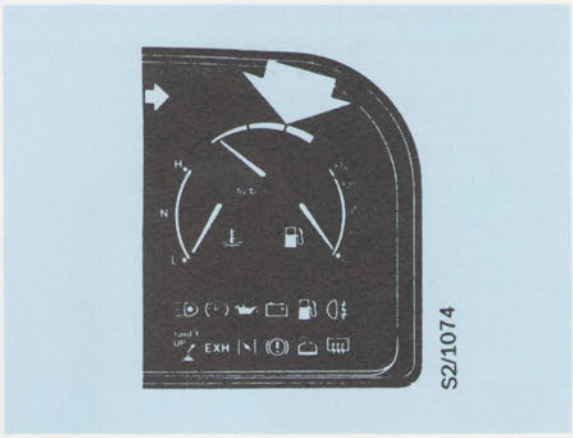
bypass the turbine, thereby reducing the pressure on the turbine and thus the pressure generated by the compressor.

Excess pressure safety cut-out system

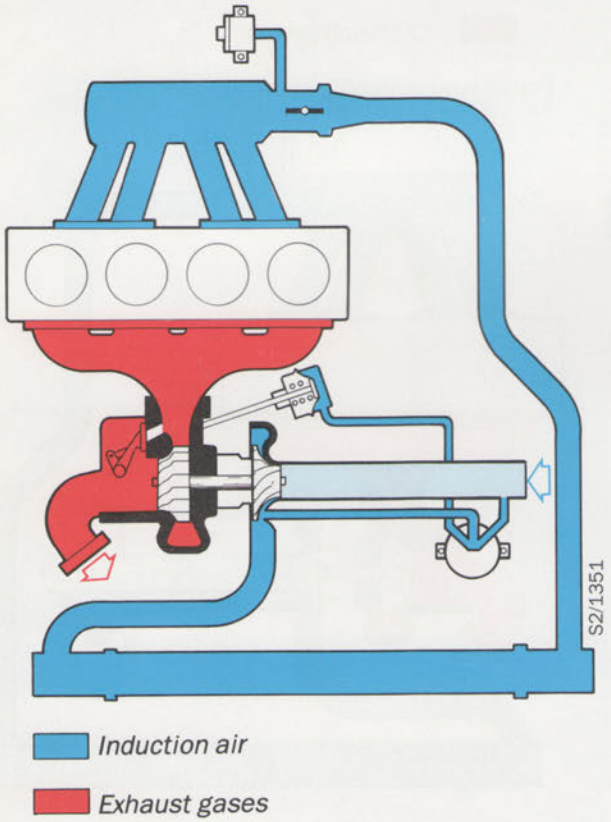
To prevent damage to the engine in the event of the waste-gate valve malfunctioning, an excess pressure safety cut-out system, triggered by excess pressure in the inlet manifold, will come into play. The system consists of a pressure switch connected by a hose to the inlet manifold.

If the charging pressure should exceed a preset limit, the pressure switch will break the circuit to the fuel pump.

A pressure gauge on the instrument panel indicates the charging pressure. The gauge is connected to the inlet manifold via the pressure transducer and switch unit.



Maximum permissible boost pressure



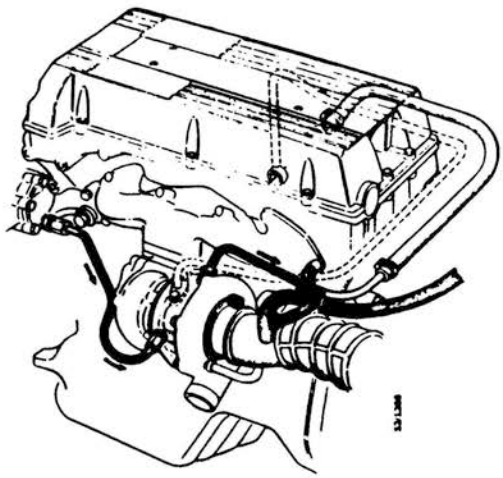
Excessive pressure in the inlet manifold at full throttle (e.g. because of malfunctioning waste-gate)

Water-cooled turbo unit

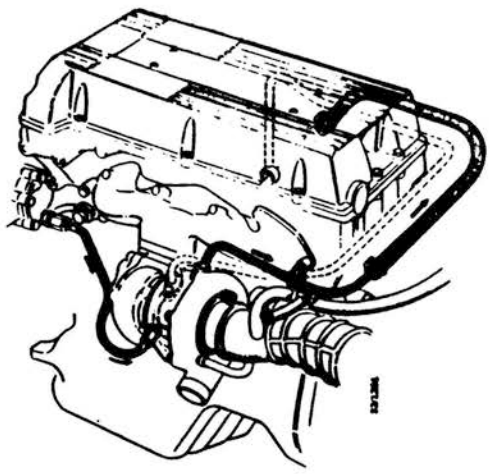
As from 1987 models, the turbo unit is water cooled, reducing the temperature in the bearing housing by some 100 °C (212 °F). The lower operating temperature obviates any coking tendencies and the damage that can be caused by coking.

Description of operation

Coolant for the bearing housing is supplied by a pipe connected to the coolant circuit between the water pump and the cylinder block. From the bearing housing, the coolant flows into the preheater circuit for the crankcase ventilation.



After the engine has been switched off and the water pump has stopped running, the coolant will continue to circulate through the system and into the cylinder head through natural convection.



Automatic performance control (APC)

In recent years, fuel supplies in many countries have been irregular, which has resulted in variations in the quality of the fuel.

The quality of the fuel available at the pump is also influenced by national standards and environmental regulations, with the result that the octane rating may vary by several points between one country and another.

The APC system enables the engine to achieve optimum performance and good fuel economy, regardless of the grade of fuel being used at any given time.

Knocking or pinking occurs in an engine when it is being put under a heavy load (e.g. full throttle) while running on an inferior grade of fuel (i.e. octane number too low).

Knocking is caused by the fuel pre-igniting and this may seriously damage the engine if allowed to continue. Apart from the knocking that can be heard when the engine is temporarily overloaded, another type of knocking occurs at high engine speeds, which is inaudible to the human ear; it is this type of knocking that is most detrimental to the engine.

To avoid the risk of engines being damaged under such conditions, the manufacturers incorporate tolerances in the design of engines to allow for variations in the quality of the fuel. Consequently, the full energy value of the fuel cannot be utilized for propulsion, and energy is lost in the form of heat.

Note
APC and similar systems, based on the use of a knock detector, can never completely eliminate isolated knocking tendencies that are necessary to the operation of the system. However, these knocks are not detrimental to the engine.

With the system working normally and the engine under load, these knocks can be heard inside the car, at a frequency of about one every three seconds.

How the APC system works

The APC system contains few moving parts; the system consists almost entirely of simple electronic components, and it is therefore unlikely to become damaged and is also easy to service.

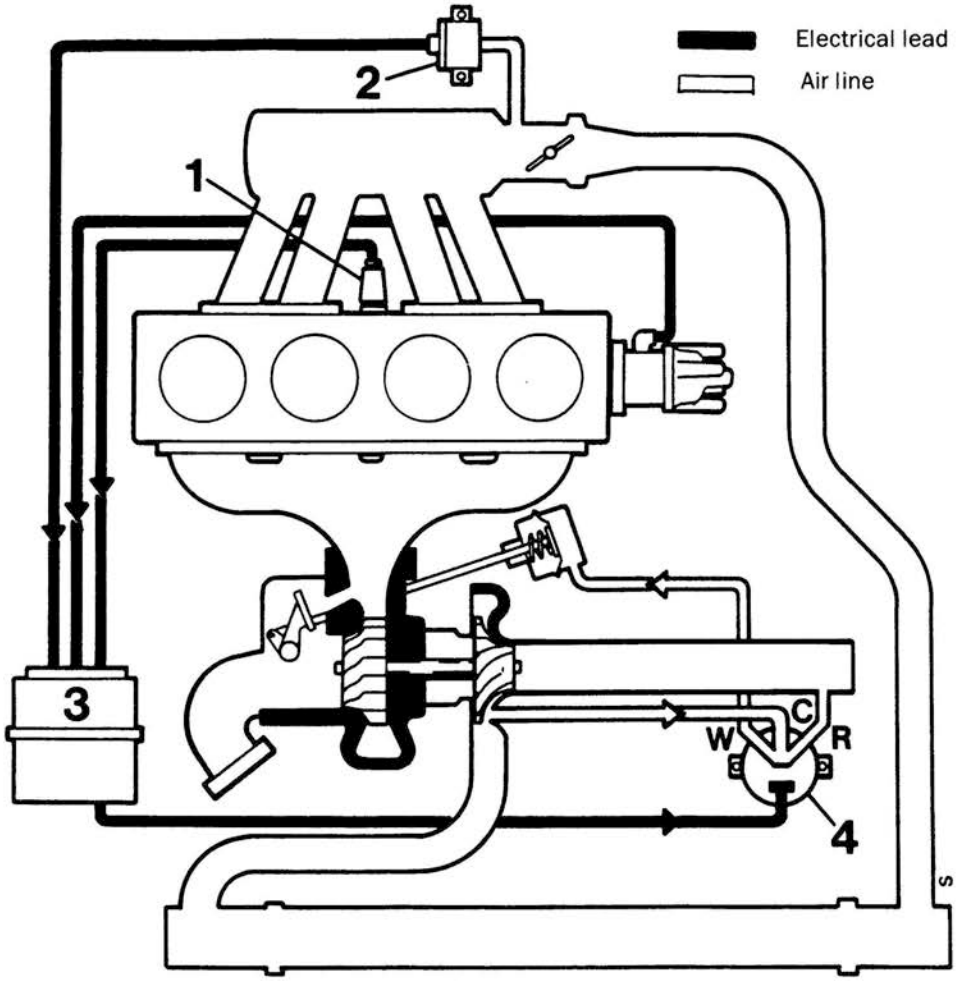
Engines equipped with the APC system adjust automatically to the grade of fuel in the tank.

A knock detector (1) senses the knocking tendencies in the engine and sends an electric signal to a microprocessor, the electronic control unit (3), which also receives electric signals from the pressure transducer (2) and the ignition system (engine-speed information). These signals are processed by the control unit (3), which then sends electric pulses to a solenoid valve (4) which controls the charging pressure.

Since the charging pressure is continuously being matched to the grade of the fuel and the working conditions of the engine, there is no need for the design of the engine to incorporate the tolerances normally required to obviate damage to the engine. Consequently, maximum engine performance is always achieved from the grade of fuel being used at a given time.

The APC system controls the charging pressure of the engine by means of an electric pressure transducer to produce maximum engine power.

The pressure transducer also compensates for changes in the condition of the engine and the maximum charging-pressure setting should therefore not be altered.



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

The knock detector (1) records the engine's knocking and pinking tendencies and converts these into an electric signal to the electronic control unit (3).

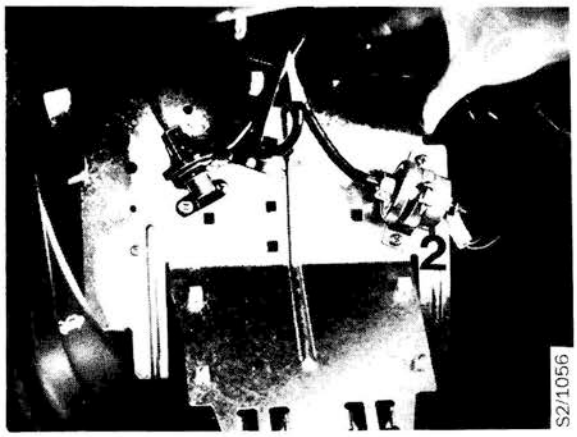
The knock detector also initiates the APC system when sensing normal engine vibration.

The knock detector is located below the inlet manifold, on the cylinder block.

S 2805

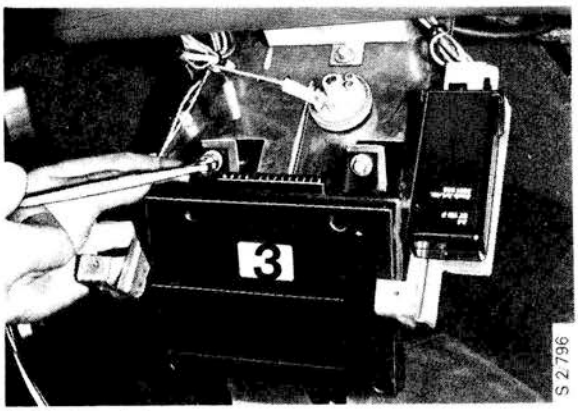
The pressure transducer (2) senses the pressure downstream of the throttle butterfly.
The pressure has a linear effect on a resistor which, in turn, controls the signal to the ECU (3). The pressure transducer will maintain the maximum charging pressure at the correct value, despite the changes occurring due to normal wear and tear on the engine components during the life of the car.

The pressure transducer is mounted on a bracket underneath the instrument panel, on the left-hand side of the car.



The control unit (3) receives electric signals from the knock detector (1), the pressure transducer (2) and the ignition system (revs), which it then analyses for control of the solenoid valve (4).

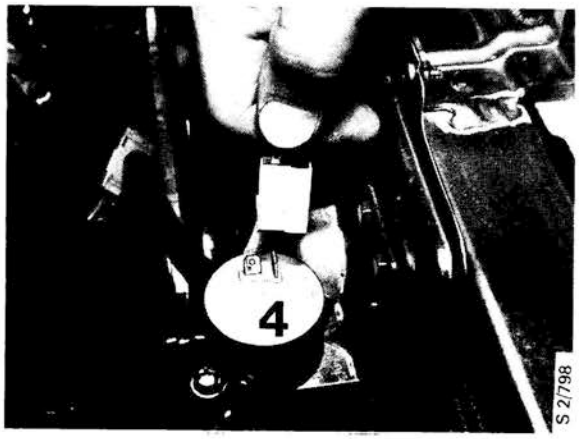
The electronic control unit is fitted underneath the instrument panel, on the LH side of the car.



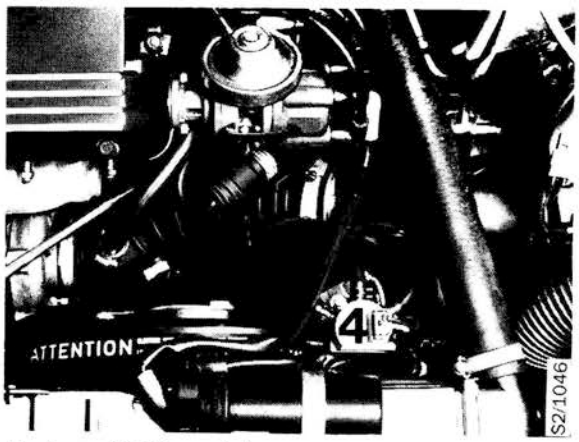
1985 models

As from 1986 models

The solenoid valve (4) regulates the control pressure for the charging pressure regulator and is connected to the pressure present in the inlet manifold downstream of the compressor. A fixed-diameter restriction is incorporated in the inlet port to the solenoid valve.
The charging pressure regulator is connect ed downstream of the restriction. The diameter of the outlet port of the solenoid valve is determined by the oscillating frequency at which the valve is operating, i.e. the oscillating frequency between the open and closed positions of the valve, governed by signals from the electronic control unit (3).



1985 models



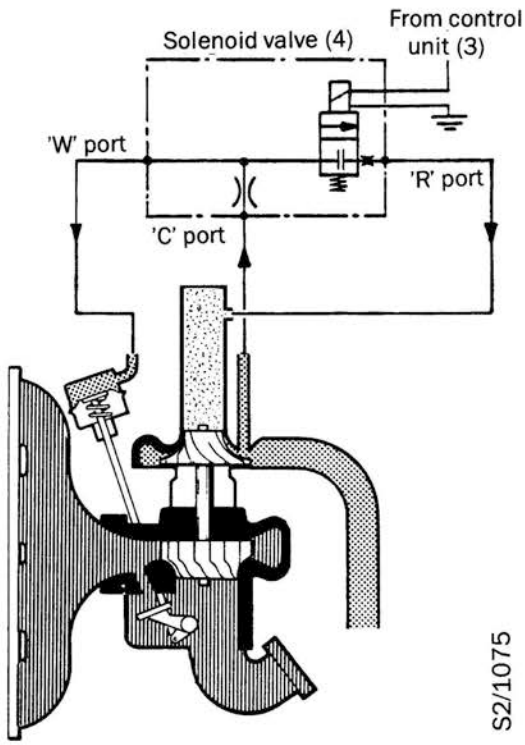
As from 1986 models

- When the solenoid valve is **fully closed,** the charging pressure regulator is connected to the full pressure present in the inlet manifold, since no air is flowing through the 'R' port of the solenoid to effect a fall-off in pressure. Thus, the waste-gate valve opens, and a low charging pressure is obtained from this basic setting.
- When the solenoid valve is **fully open,** pressure is evacuated through the 'R' port of the solenoid valve, through a hose to the inlet side of the compressor. The restriction in port 'C' is so narrow in comparison with the valve opening that there is a total pressure drop in the small quantity of air flowing through the restriction.

  Thus, no pressure will be acting on the charging pressure regulator, the waste- gate valve will be closed and the turbo unit will provide **a boost to the charging pressure.**

- When energized, the solenoid valve oscillates between the open and closed positions at a fixed frequency of 12 Hz. If the charging pressure rises above 0.4 bar, the pulse width of the valve will change. The pulse width is the relationship between the time that the solenoid valve is open and the time that it is closed during a cycle of 1/12th of a second. The pulse width is governed by the control unit (3), which responds to the signals received from the knock detector (1), the pressure transducer (2) and the ignition system (engine revs).

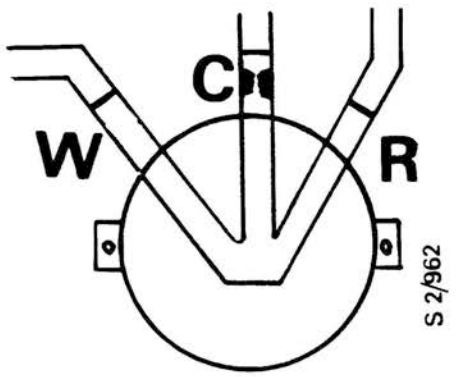
  The solenoid valve is mounted on a bracket by the fan shroud behind the radiator.



Exhaust gas

Induction air upstream of turbo compressor

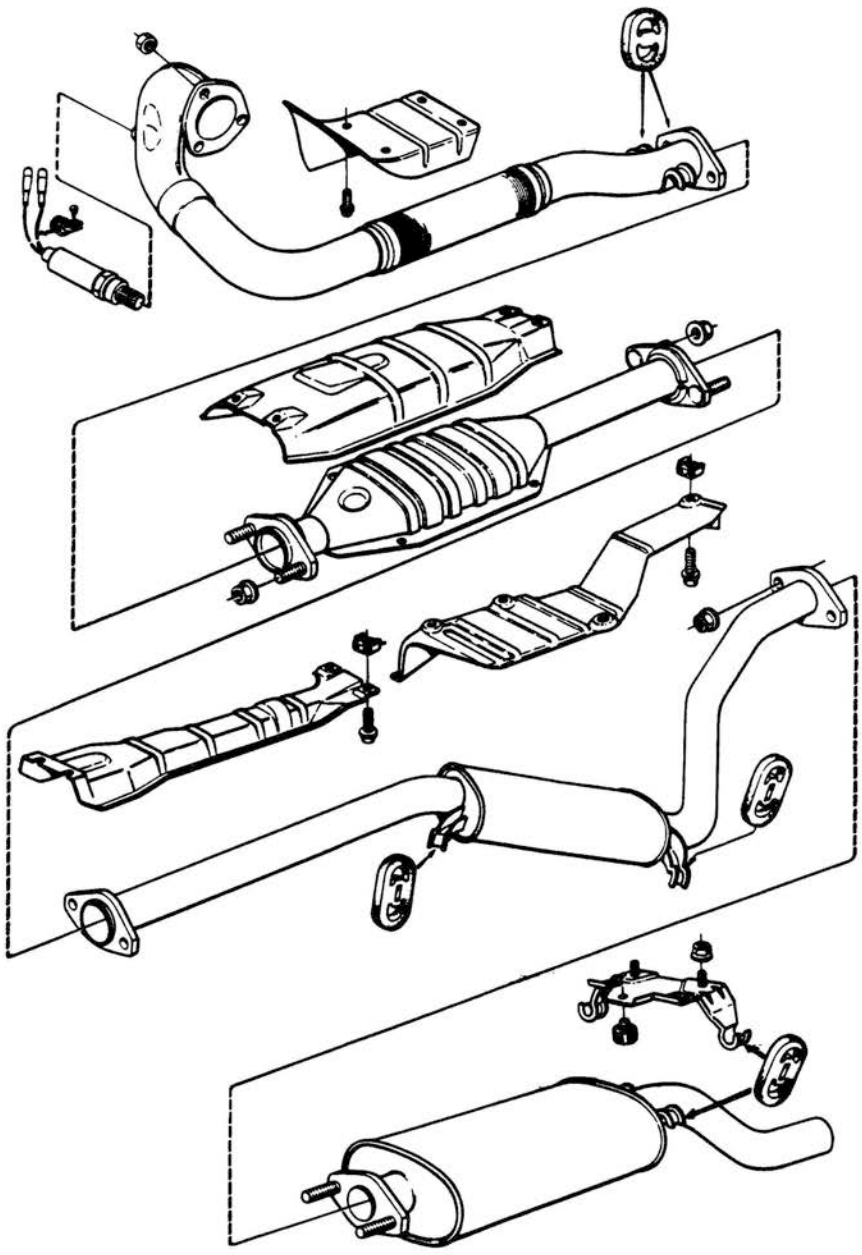
Induction air downstream of turbo compressor



W = To diaphragm unit of charging pressure regulator
R = To inlet manifold via port upstream of turbo unit
C = To inlet manifold via port downstream of turbo unit

Exhaust system

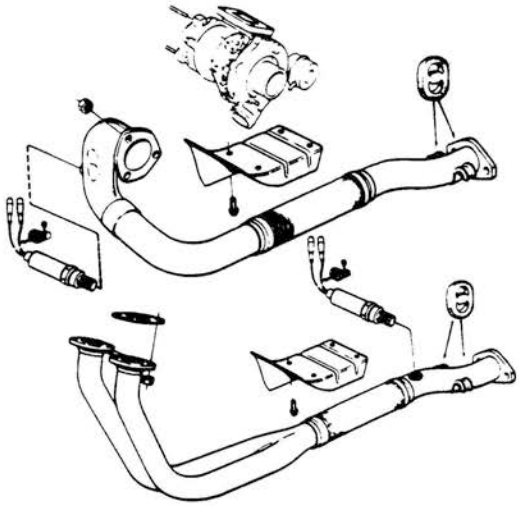
General



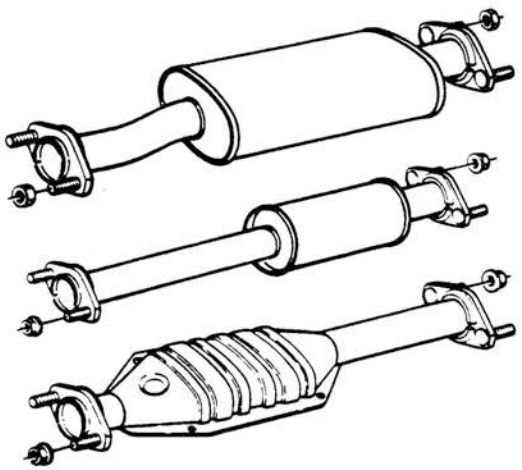
The four sections of the exhaust system

The front section of pipe incorporates flexible elements to prevent engine movement and vibration being transferred to the exhaust system. The pipe is connected by means of flange joints to the turbo unit (9000 T16), the exhaust manifold (9000i) and the front silencer section.

On all cars with catalytic converters, the pipe is specially designed, with provision for the oxygen sensor.

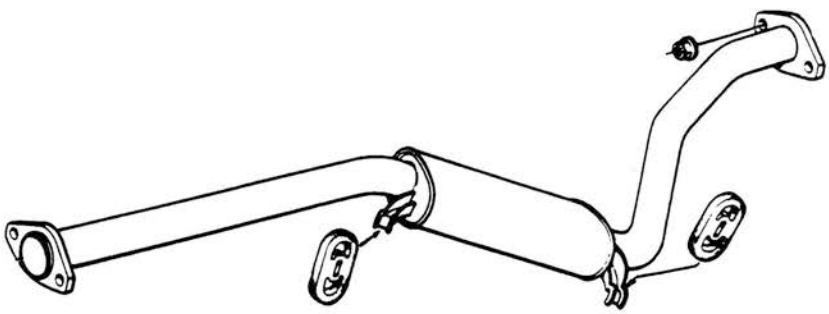


The front silencer section with flange joints. The silencer on both injection and turbo models is of the baffle type, which absorbs sound in a narrow frequency range. Alternatively, this section incorporates the catalytic converter, which is of the same design on all models.



1 Turbo
2 9000i
3 Catalytic converter

The intermediate silencer section is equipped with flange joints and is of the same straight-through type on both turbo and 9000i cars.



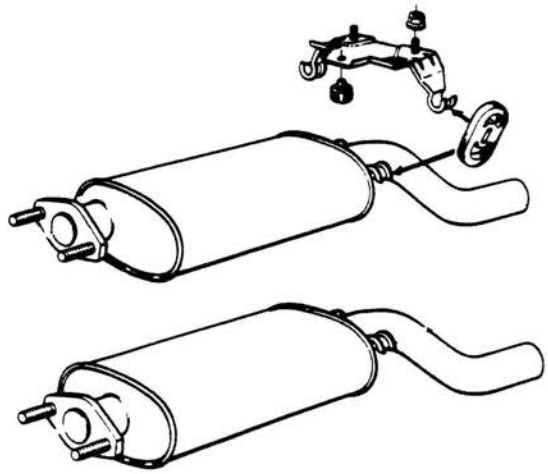
Turbo: pipe diameter 60 mm

9000i: pipe diameter 48 mm

The rear silencer section is equipped with flange joints.

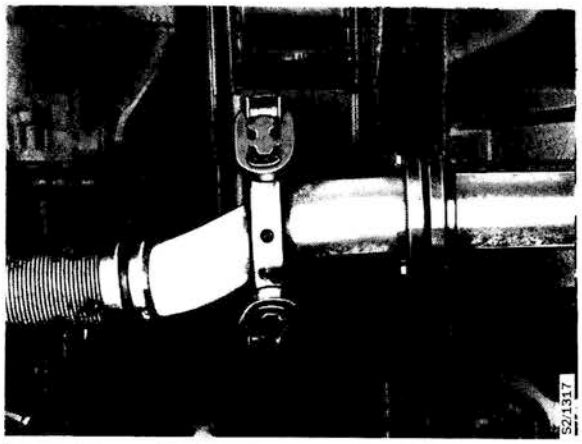
The silencer on turbo models is of the straight-through type and that on 9000i models of a design combining the properties of baffle-type and straight- through type silencers.

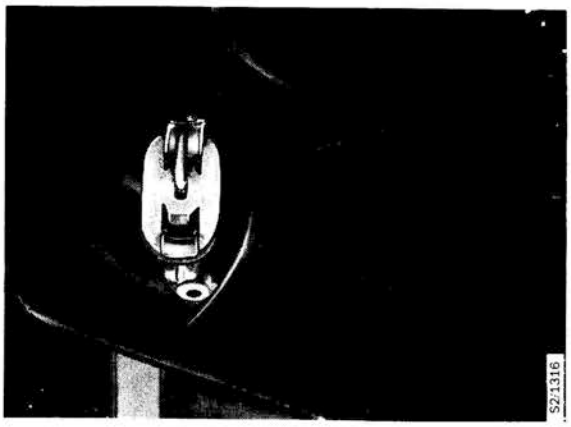
The seal between the sections is achieved by a taper fit. It is important that the joints be tightened evenly, keeping the flanges parallel.

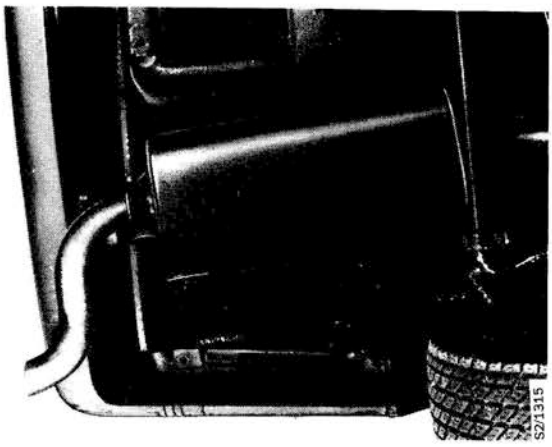


Mountings

The exhaust system is held to the underside of the car by means of three pairs of rubber hangers: one for the front section of pipe, one for the intermediate silencer section and one for the rear silencer.





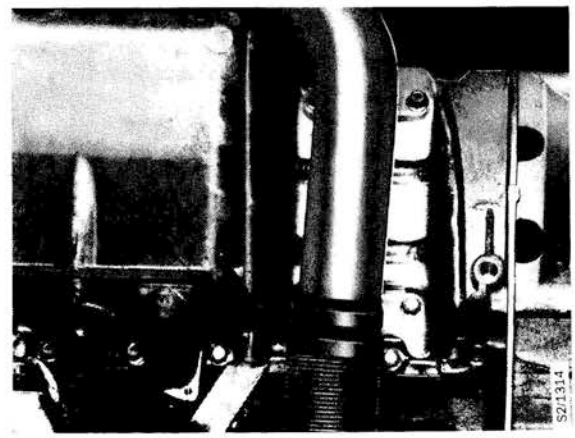


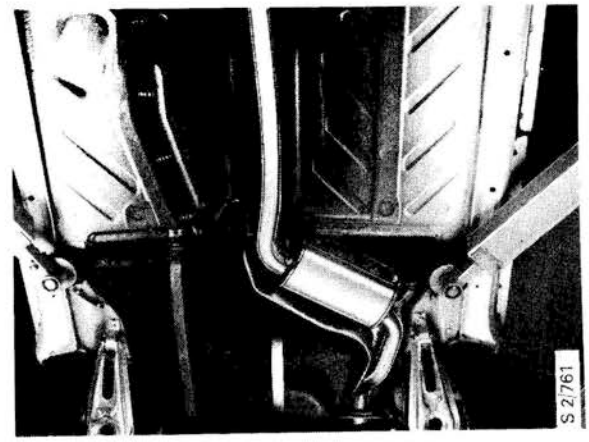
Heat shields

Two heat shields are incorporated in the exhaust system: one at the front under the sump; and one at the rear, adjacent to the intermediate silencer.

On cars with catalytic converters, heat shields are also fitted over the catalyst canister and the pipe to the intermediate silencer section.

9000i cars also have a heat shield over the rear silencer.





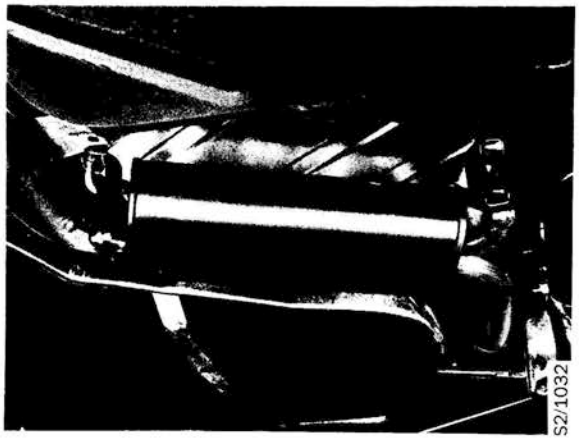
Rear silencer

To replace the rear silencer

1 Unbolt the flange joint in the exhaust pipe.

2 Unhook the rear exhaust hangers.

3 Unhook the hangers for the intermediate silencer and lower the pipe.



4 Lower and remove the silencer.

To fit

1 Lift the new silencer into position and attach the hangers to the hooks.

2 Attach the hangers for the intermediate silencer.

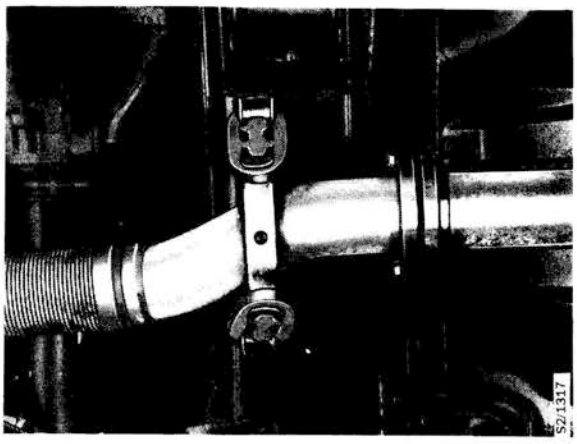
3 Tighten the bolts in the flange joint. Make sure that the exhaust system is well clear of adjacent parts.

Exhaust manifold

For details of exhaust manifold removal and fitting refer to the section on the turbo unit.

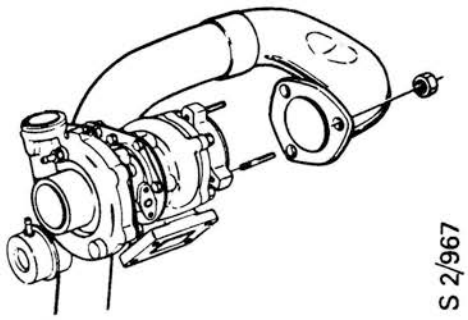
To replace the front section of exhaust pipe

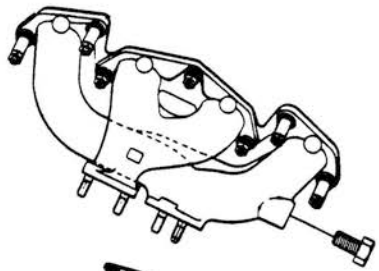
1 Undo the flange joint between the front pipe and front silencer sections. Unhook the hangers from the underside of the car.

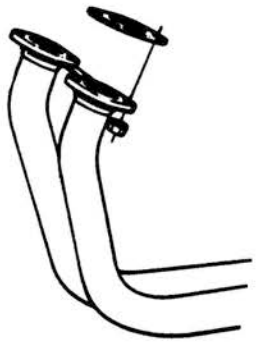


2 Unbolt the front exhaust pipe from the turbo unit (9000i - exhaust manifold) and lower the pipe between the engine and the front subframe cross-member.

3 Insert the new section of pipe and bolt it to the turbo unit, (9000i - exhaust manifold).

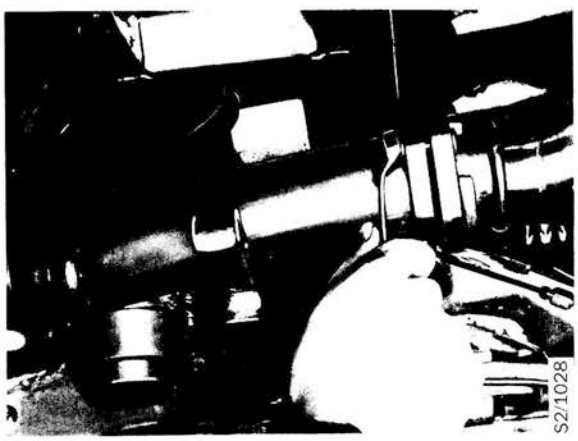






N.B.
Fit new nuts, making sure that the locking tab is outermost.

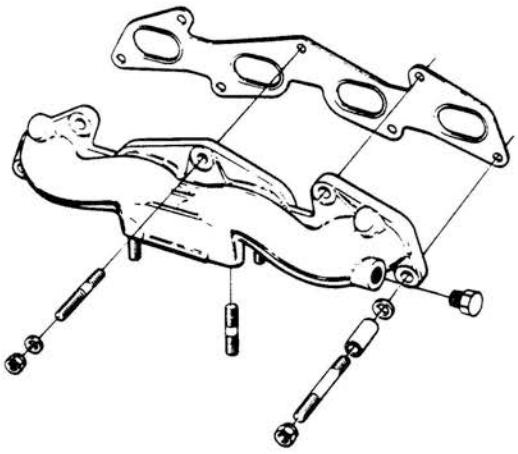
4 Secure the flange joint under the car and attach the rubber hangers. Before tightening the bolts in the flanges between the front pipe section and front silencer section, insert a block of wood, 30-mm thick, between the engine subframe and the front pipe section to prevent the exhaust system from being forced upwards as the bolts are tightened.



Exhaust manifold

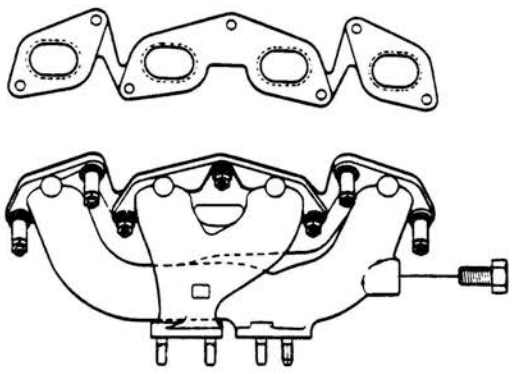
Turbo cars

The exhaust manifold comprises a casting attached to the cylinder head by means of studs, spacers and locknuts.



9000i cars

The exhaust manifold comprises a two-piece casting attached to the cylinder head by studs, spacers and locknuts.



Exhaust emission control systems

Exhaust emission control systems in use

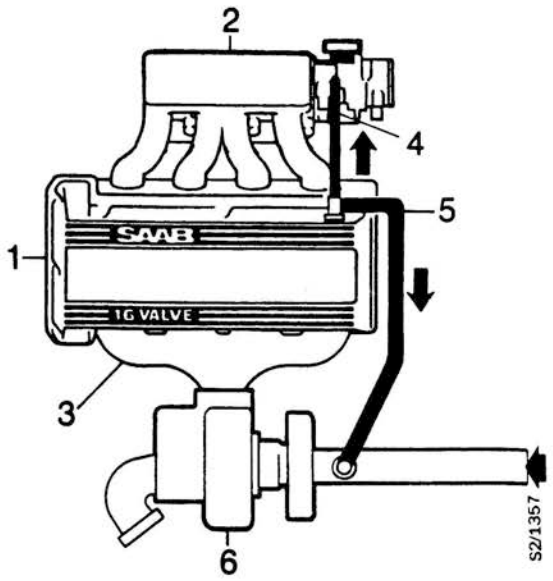
- Closed-circuit crankcase ventilation
- Deceleration device
  Mechanical throttle damper (dashpot)
- Delay valve (distributor vacuum advance)
- Exhaust gas recirculation (EGR) system
  EGR valve of the on/off type
- Catalytic converter
- Oxygen-sensor-regulated fuel injection system
- Evaporative-loss control device (ELCD)
- Automatic idling control (AIC) system
- Pulse-air system

Crankcase ventilation

The engine has a fully enclosed crankcase ventilation system consisting of a double-spigot outlet on the camshaft cover, from which a large-bore hose runs to a connection upstream of the turbo compressor and a small-bore hose to the throttle housing.

The crankcase gases are evacuated through the small-bore hose direct to the throttle housing in all conditions except at full throttle (full load), when the gases are evacuated through the large-bore hose and returned to the inlet manifold via the turbo unit.

To avoid icing the system is heated by water and there is also a check valve in the small hose to avoid damage under conditions of turbo boost.

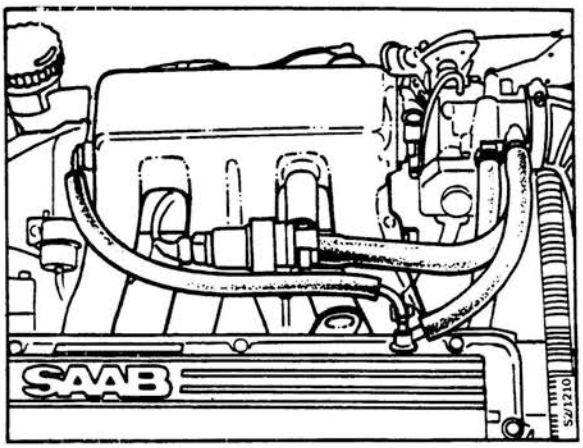


Crankcase ventilation

1 Camshaft cover
2 Inlet manifold
3 Exhaust manifold
4 Small-bore hose
5 Large-bore hose
6 Turbo compressor

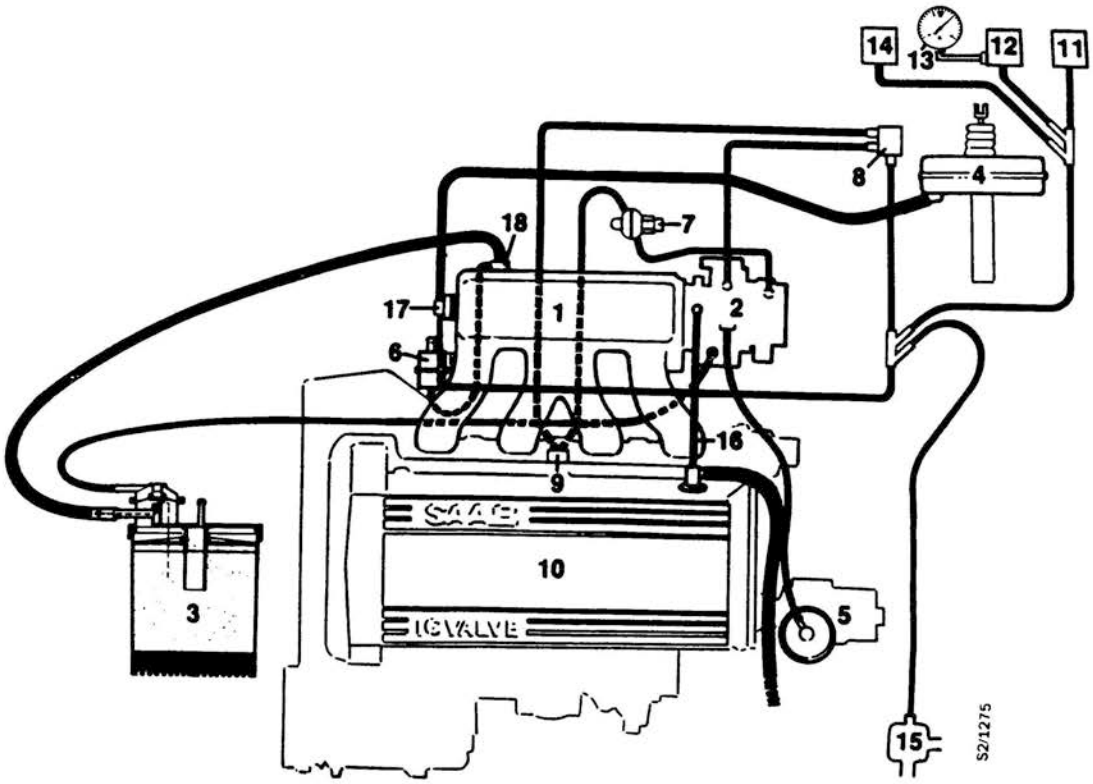
9000i

The crankcase gases are evacuated via the twin-spigot outlet on the camshaft cover through either a small-bore hose to the inlet manifold or a large-bore hose to a point upstream of the butterfly in the throttle housing, for mixing with the induction air prior to combustion in the engine. Evacuation takes place through the small-bore hose when the engine is at idling speed and through the large-bore hose when load is applied to the engine (throttle open).



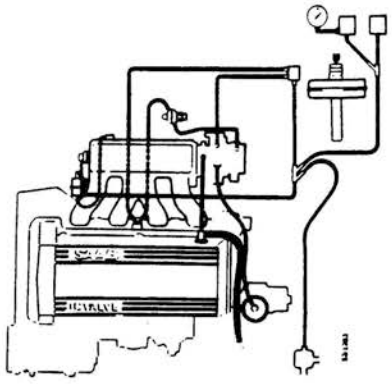
Inlet manifold vacuum outlets

The various vacuum outlets on the inlet manifold and throttle housing and the vacuum-line runs for different engine variants (S & US specs. only) are shown in the following diagrams.

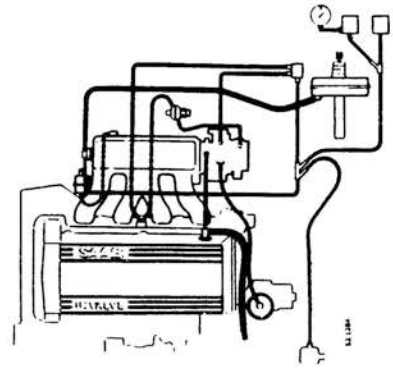


Inlet manifold vacuum outlets on 1987 models

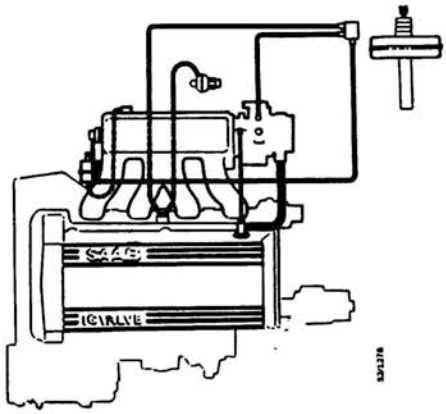
1 Inlet manifold
2 Throttle housing
3 Activated-charcoal filter
4 Brake servo
5 Distributor
6 Fuel pressure regulator
7 EGR valve (proportional)
8 Signal converter
9 Thermostatic valve
10 Camshaft cover
11 Pressure sensor (transducer)
12 Pressure switch
13 Pressure gauge
14 Change-up indicator
15 Relief valve
16 Crankcase ventilation
17 Vacuum outlet to brake servo and other functions
18 Vacuum outlet to fuel pressure regulator and activated-charcoal filter



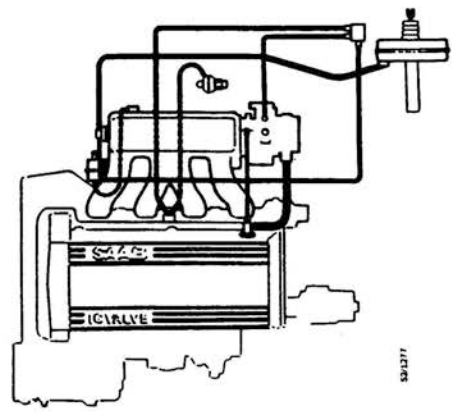
Turbo (S spec.), manual and automatic, with ABS brakes



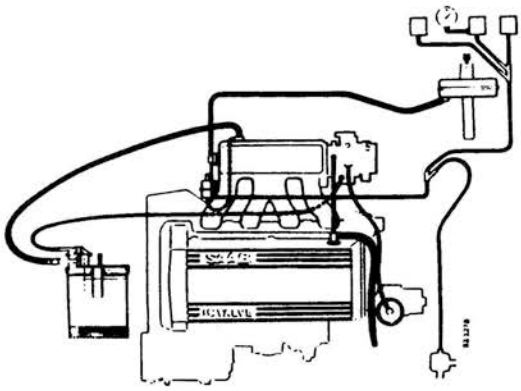
Turbo (S spec.), manual and automatic



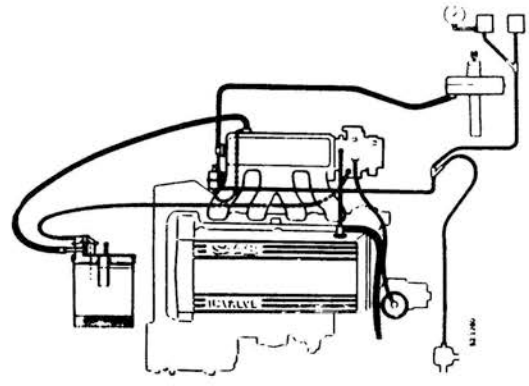
9000i (S spec.), manual and automatic, with ABS brakes



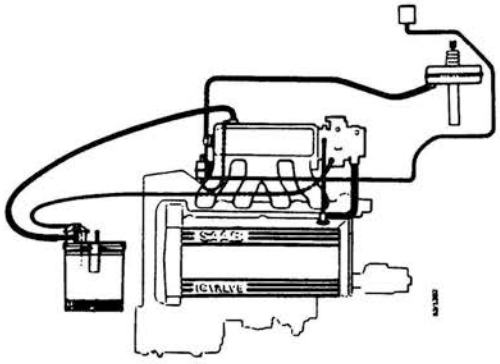
9000i (S spec.), manual and automatic



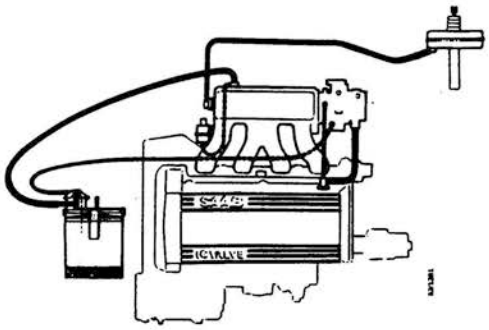
Turbo (US spec.), manual



Turbo (US spec.), automatic



9000i (US spec.), manual



9000i (US spec.), automatic

Deceleration device

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

Dashpot

The dashpot mechanically delays the closing of the throttle butterfly.

To check

1 Start the engine and run it up to normal temperature.

2 Connect a tachometer and adjust the speed to 875 r/min.

3 Increase the engine speed to 3000 r/min and use a stopwatch to measure the time it takes for the engine to return to 875 r/min after the throttle has been released.
The time should be 4 ± 1 s.

Setting

To adjust the delay time, back off the locknut on the dashpot and move the dashpot away from the throttle stop (to reduce the delay time) or towards the stop (to increase the delay time).

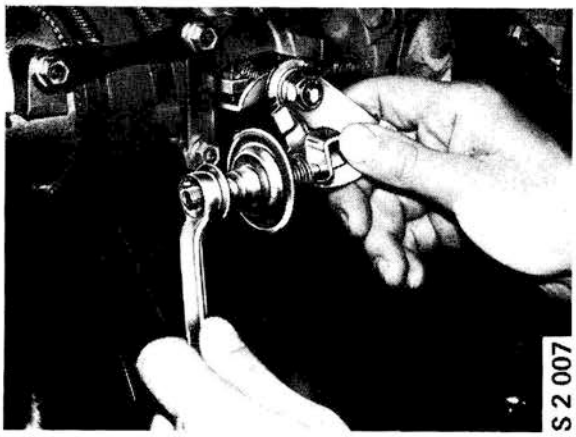
1 Run the engine up to normal temperature and check that the CO reading and the ignition timing are correct.

2 Disconnect and plug the vacuum line at the ignition advance unit on the distributor. Where applicable, disconnect and plug the ends of the EGR hoses.

3 Turn the throttle lever and check that the dashpot rod strikes the stop at the specified engine speed (use a tachometer).

4 Rev up the engine and check that the engine speed drops to idling speed with the specified delay.

5 Reconnect the vacuum line to the ignition advance unit and, where applicable, reconnect the EGR hoses.

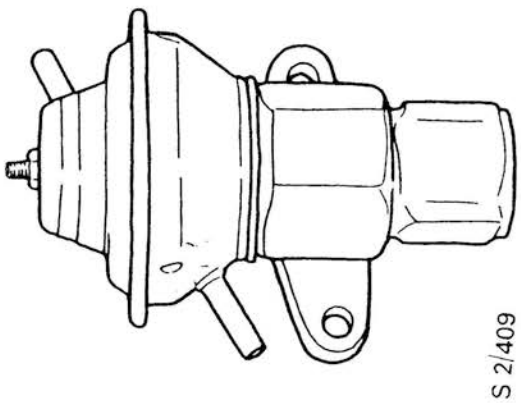


Throttle dashpot

Exhaust gas recirculation (EGR)

The EGR system consists of an EGR valve, opened either by vacuum or pressure, a signal converter, which controls operation of the valve, and a thermostatic valve which closes communication to the depression in the inlet manifold at engine temperatures below 20°C (68°F).

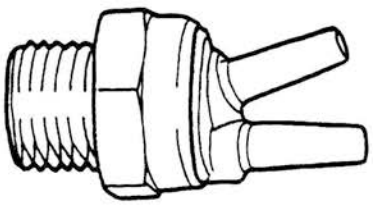
The EGR valve consists of a control valve, which is opened and closed by a spring and diaphragm inside the diaphragm shell fitted to the valve body. The diaphragm shell incorporates two hose-connection spigots: one for a hose connected to an outlet on the throttle housing upstream of the butterfly and the other for a hose connected to an outlet on the thermostatic (PVS) valve. The action of vacuum or pressure causes the valve to open in proportion to the depression present in the inlet manifold.



EGR valve

The thermostatic valve (PVS valve)

The valve, fitted in the inlet manifold flange, is actuated by the coolant temperature and disconnects the vacuum from the EGR valve if the engine temperature is below approx 30°C (86°F).



The signal converter

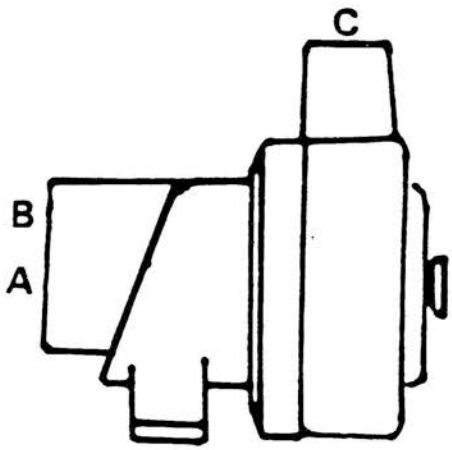
The signal converter houses a plunger suspended between two diaphragms and a spring and has three outlets. The plunger actuates a valve.

The three outlets (spigot connections for hoses) are as follows:

A From ignition advance outlet (1) at throttle housing.

B To the EGR valve (spring-loaded side) via the thermostatic valve.

C From inlet manifold (brake servo outlet).



The vacuum signal goes from outlet A to outlet B. As the vacuum at outlet C rises, the plunger moves up the bore and, assisted by the spring, gradually closes port A. At the samt time, the EGR valve is evacuated through outlet B. Thus, the quantity of exhaust gas recirculated to the inlet manifold is proportional to the load on the engine.

When there is no boost from the turbocharger, pressure approximately equivalent to atmospheric pressure will be acting ustream of the throttle butterfly, and the signal from outlet (2) will not cause the EGR valve to open.

Engine at idling speed (throttle closed)

With the butterfly in the idling position, both signal outlets will be upstream of the butterfly and connected to the same pressure. The EGR valve will therefore remain closed.

Partial load on engine (throttle partially open)

When the butterfly valve is partially open and the turbo is charging, the pressure upstream of the butterfly will be higher than that downstream of it. This difference in pressure will keep the EGR valve open, in spite of the vacuum signal communicated from outlet (1) on the throttle housing.

Full load (throttle fully open)

At full throttle, the pressure at both signal outlets will be the same and the EGR valve will be closed.

Throttle slightly open

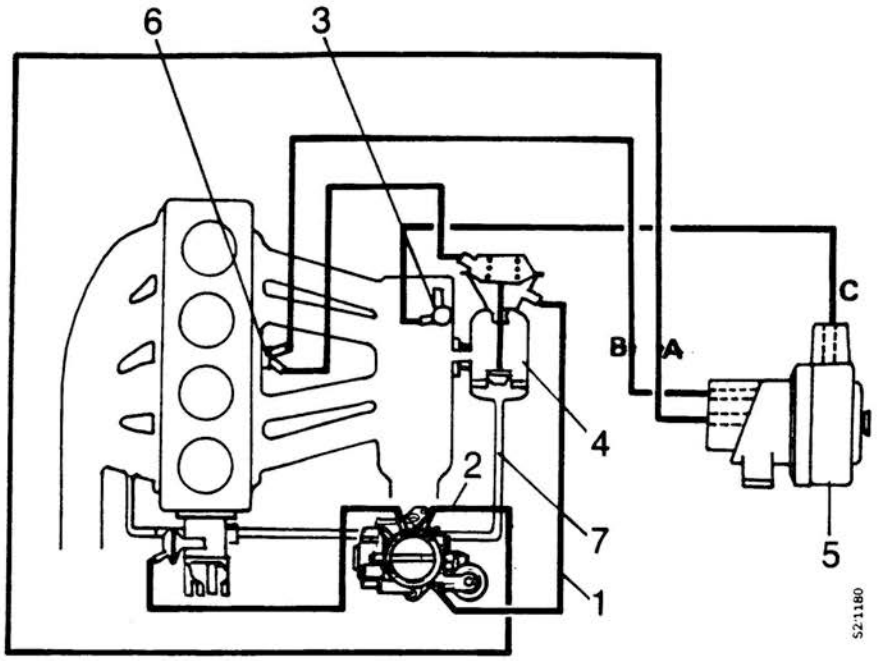
When the throttle is only slightly open, signal outlet (1) will be in communication with the vacuum downstream of the butterfly, signalling a vacuum to the signal converter. The EGR valve will therefore admit a small quantity of the exhaust gases.

Checking the EGR system in the car

1 Start the engine, run it up to normal temperature and then let it run at idling speed.

2 Disconnect the hose from the signal converter at outlet 2 on the throttle housing (vacuum hose for the ignition system).

3 Disconnect the hose from outlet C of the signal converter. (Hold a finger over the hole or seal the hose, to prevent air being drawn into the inlet manifold.)



1 Signal outlet upstream of throttle butterfly
2 Signal outlet at throttle butterfly
3 Signal outlet at inlet manifold
4 EGR valve
5 Signal converter
6 Thermostatic valve
7 EGR pipe

Hose identification

A = From ignition advance outlet (1) at throttle housing
B = From EGR valve (spring-loaded side) via the thermostatic valve
C = From inlet manifold (brake servo outlet)

4 Raise a vacuum in hose A (now disconnected), using a vacuum pump or by sucking the hose end. If the system is functioning properly, the idling speed should now drop, and the engine may even stall.

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

6 Raise a vacuum again in hose A. If the system is functioning properly, the engine speed should not be affected.

Checking the performance of the EGR valve

1 Start the engine, run it up to normal temperature 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 the end of the hose.

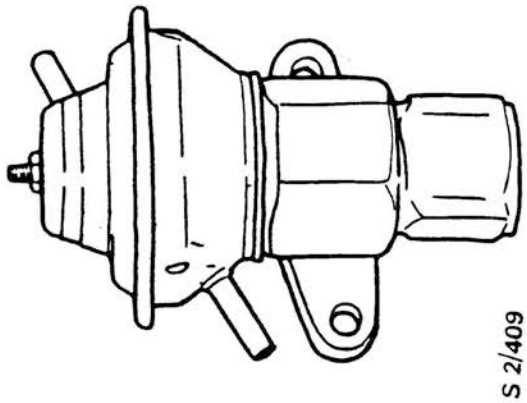
If the valve is operating properly, the idling speed should drop, and the engine may even stall.

Reconnect the hose.

4 Disconnect the hose between the EGR valve and connection 2 on the throttle housing. Pressurize the EGR valve by means of a cooling system pressure tester or by blowing into the end of the hose.

If the valve is operating properly, the idling speed should drop, and the engine may even stall.

Reconnect the hose.



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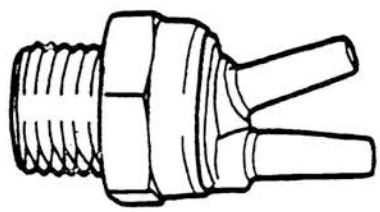
N.B.
A slight amount of leakage may occur due to imperfect tightness between the valve spindle and the valve housing.

Checking the thermostatic valve

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

If the engine temperature is below 30°C (86°F), the valve should remain closed.

If the engine temperature is at or above 30°C (86°F), the valve should be open.

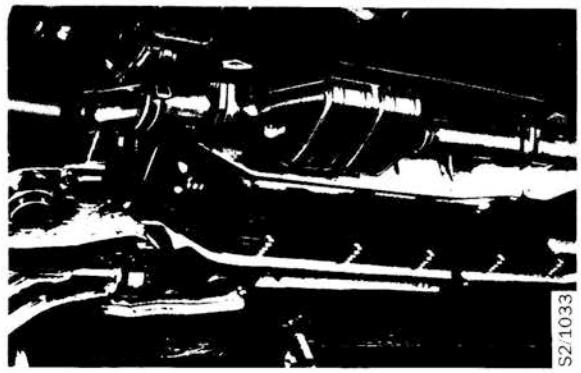


Oxygen-sensor-regulated injection system (Lambda)

General

N.B.
Because lead destroys the active constituents of the catalyst, cars with catalytic converters must never be run on anything other than lead-free fuel.

Cars with specifications meeting strict exhaust emission requirements are equipped with the LH Jetronic fuel-injection system, and an electronic control system incorporating an oxygen sensor fitted in the exhaust system. These cars are also equipped with a catalytic converter fitted in the exhaust system behind the front pipe section.

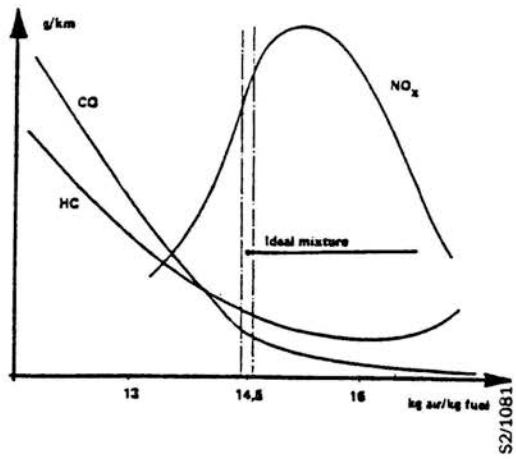


Provided that the oxygen-sensor-regulated LH injection system maintains the optimum fuel-air mixture, with oxidation of the carbon monoxide (CO) content and hydrocarbons (HC), the catalytic converter reduces the emission of oxides of nitrogen (NOx). The exhaust gases emitted to the atmosphere thus consist largely of carbon dioxide (CO_2), Hydrogen (H_2) and nitrogen (N_2).

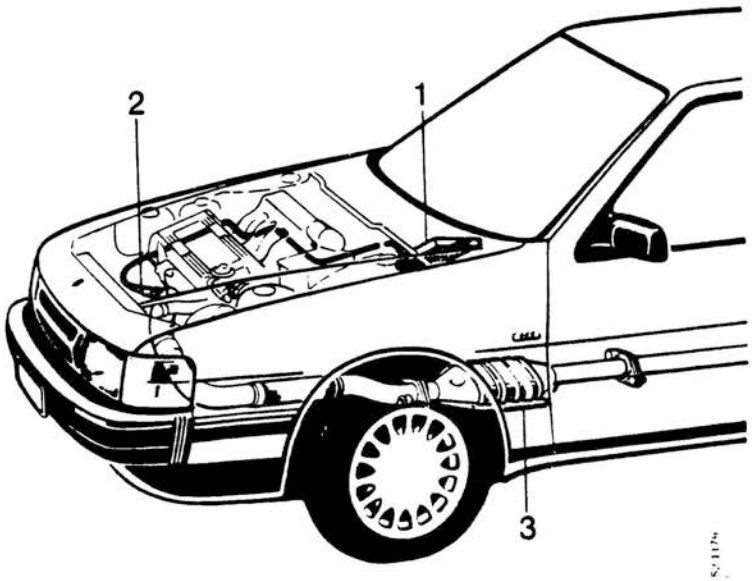
As shown in the diagram, the catalytic converter works within very narrow limits; if the air/fuel ratio should depart from this range, one or more of the emitted gases will inevitably exceed the permitted emission level. However, the oxygen-sensor-regulated injection system ensures that the mixture is kept within the correct limits.

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

The catalytic converter is fitted in the exhaust system by means of flange joints, the front one being sealed by an olive and the rear one by a gasket.



Air/fuel ratio and exhaust gases

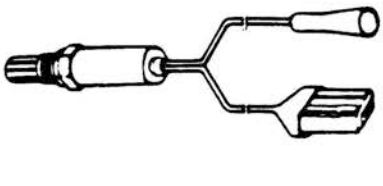


Oxygen-sensor-regulated injection system

1 ECU (Lambia)
2 Oxygen sensor
3 Catalytic converter

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.



The oxygen sensor does not become operative until the working temperature exceeds 600 °C (1112 °F). As the oxygen sensor ages, the output signal decays; the sensor must therefore be replaced after 90,000 km (60,000 miles).

Checking the oxygen sensor preheating

1 Unplug the electrical lead connector.

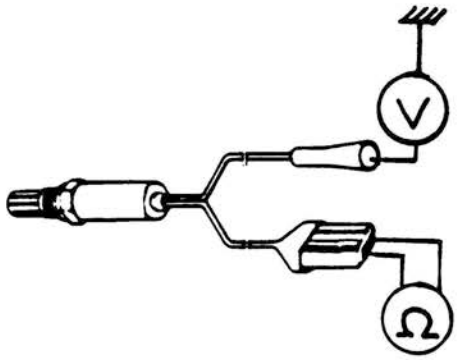
2 Use a multimeter to check the resistance across the oxygen sensor terminals. The reading should be approx. 4 ohm.

3 Reconnect the electrical lead and start the engine.

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

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

The signal varies with the mixture: when the mixture is lean, the signal will be just above zero volt, and when the mixture is rich, the signal will be close to 1 V.



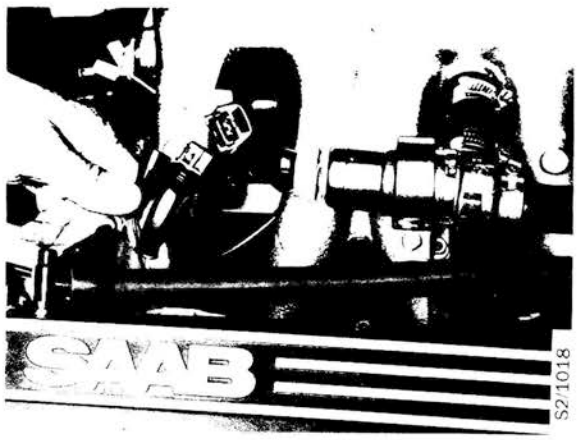
Replacing the oxygen sensor

1 Unplug the connector for the oxygen sensor.

2 Unscrew and remove the sensor.

Before fitting the oxygen sensor, coat all threads and gaskets with an antiseize compound (e.g. Never Seize or Molycote 1000 - Part No. 30 20 971).

N.B.
It is essential that the joint between the oxygen sensor and the exhaust pipe is gastight.



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

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 using test loom 83 94 132 (02 80 701).

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

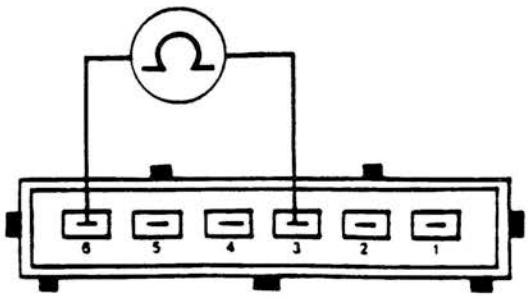
The adjustment procedure establishes a reference point for the LH system and does not affect engine performance, or drivability.

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 pins 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.

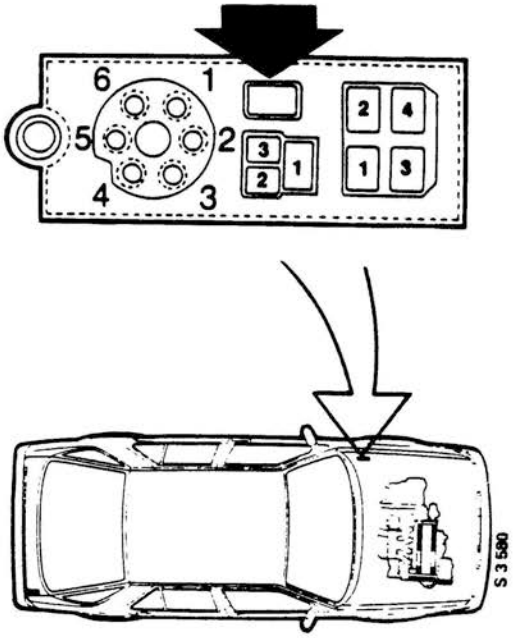


4 Reconnect the electrical leads to the air mass meter.

5 Connect the pulse meter (83 97 597) to the TSI socket (as shown), located on the left-hand side in the engine compartment, behind the false bulkhead, using test loom 83 94 132 (02 80 701) contained in 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.



N.B.
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.

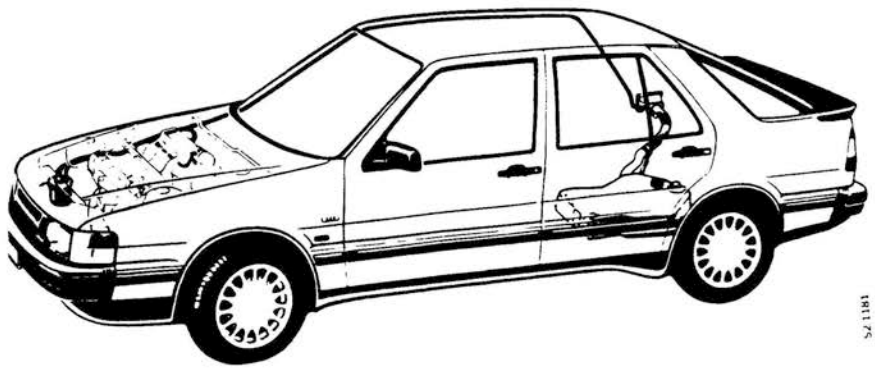
8 If adjustment is necessary, turn the potentiometer screw as follows:

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

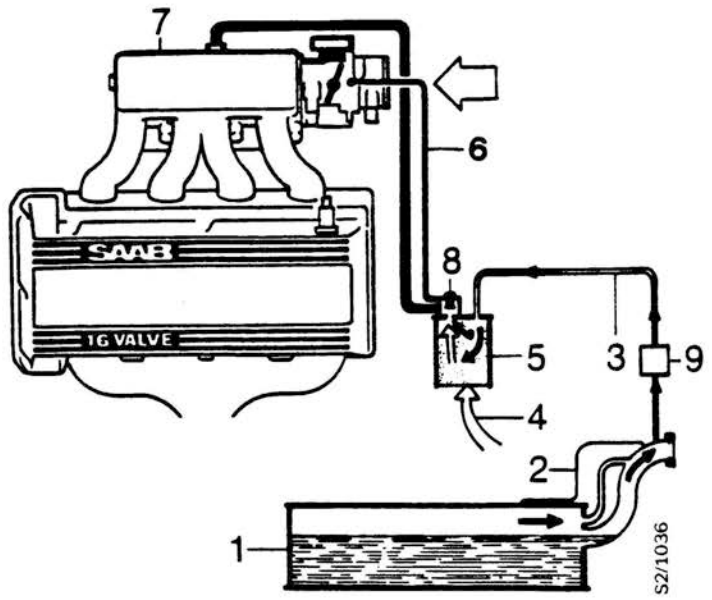
Cars with US, CA, JP, AU or ME specifications are equipped with an ELCD.



Principle of operation

When the engine is switched off, hydrocarbons from the fuel tank breather system flow into the filter and accumulate in 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.



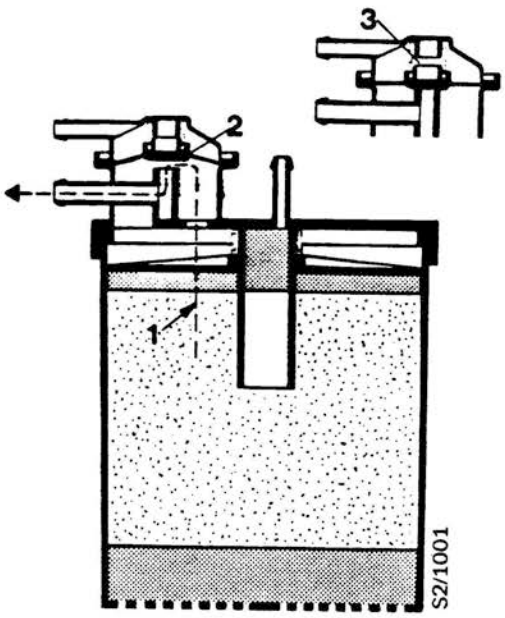
1 Fuel tank
2 Breather hose
3 Evaporation hose
4 Fresh air
5 Activated-charcoal filter
6 Signal hose
7 Inlet manifold
8 Diaphragm valve
9 Rollover valve

Activated-charcoal filter

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

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

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



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

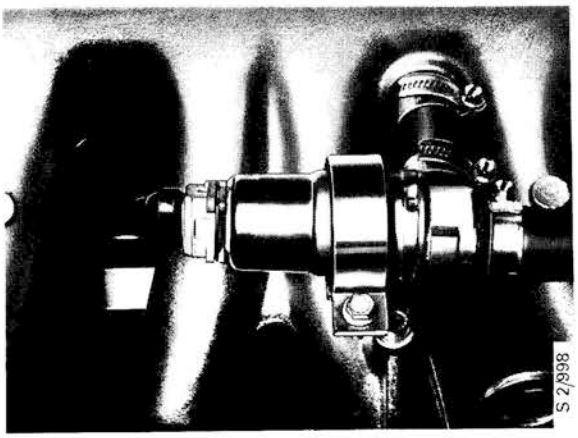
Automatic Idling Control (AIC)

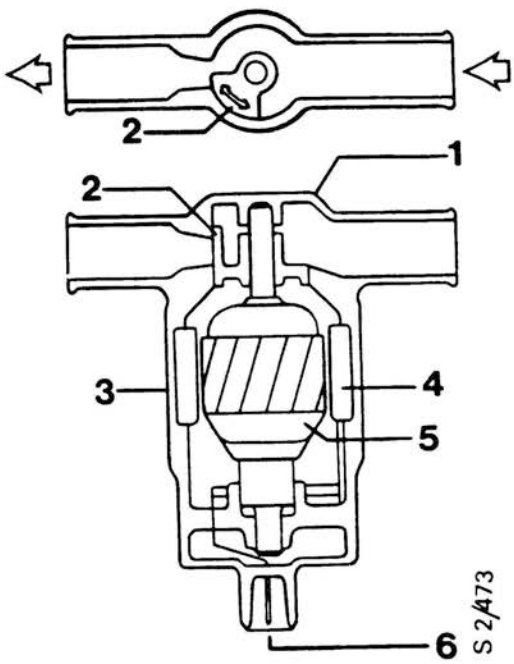
The automatic idling control system was introduced with the air-mass measuring system to provide:

- Smoother idling.
- Improved cold starting and better running of the engine during the warm-up period.
- Increase in idling speed when the AC compressor cuts in.
- Compensation for reductions in engine speed caused by loads from the steering servo pump and alternator and when the car is being driven at high altitudes.
- A deceleration function.

The AIC valve controls the flow of air by-passing the throttle butterfly. The volume of the air flow is determined by the size of the opening in the valve which, in turn, is controlled by signals from the electronic control unit.

The AIC valve is a rotary slide valve, with a built-in two-stage motor, which maintains a continuous reciprocating action, rotating through a maximum angle of 90°.

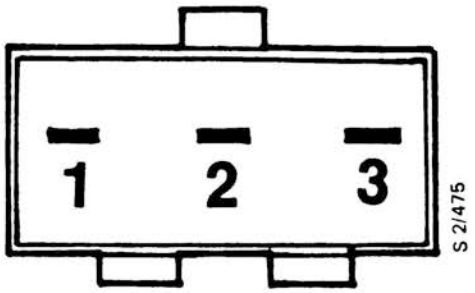




AIC valve
1 Valve housing
2 Valve slide
3 Housing
4 Solenoid
5 Electric motor casing
6 3-pin connector (from ECU)

The two-stage motor receives control signals from the electronic control unit in the form of electric pulses.

Because of the continuous, limited-travel reciprocating action of the motor (apparent only by its vibrating), the opening of the valve can be varied within extremely short periods (opens/closes within 150-200 ms), which enables it to allow the required amount of air to flow through it at a given moment and thereby maintain a constant and/or increased idling speed.



Setting the idling speed (cars with AIC system and idling adjusting screw)

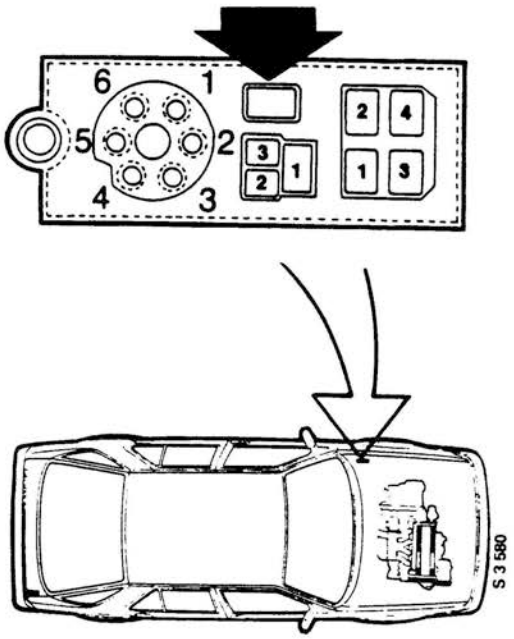
1 Start the engine and run it up to normal temperature.

2 Connect a tachometer and let the engine idle.

3 Use a jumper lead to earth the single-pin socket on the TSI box located in the engine compartment on the left-hand side behind the false bulkhead panel. The AIC valve will now be closed.

4 Set the idling speed to 800 ± 25 r/min.

5 Disconnect the jumper lead from the test socket and check that the engine speed changes and then stabilizes at 875 ± 75 r/min.



Adjusting the idling speed (Cars with AIC system without idling adjusting screw)

1 Start the engine and run to normal temperature. The transmission oil must be hot.

2 Connect a tachometer and leave the engine to idle. Make sure that no additional load is put on the engine (AC compressor, fan, etc., all switched off).

3 Unplug the connector from the throttle-position sensor and connect a jumper lead between pin 2 (green; GR) and pin 18 (black/white; SV/VT), thereby simulating closure of the sensor contacts.

4 To close the AIC valve, use a jumper lead to connect the single-pole outlet on the test socket to earth. (The test socket is located between the fresh-air vent and the RH wheel-arch panel inside the car. The lead from the socket is the green/red one.)

5 Check that the speed is 700 25 r/min.

Before adjusting the speed (as necessary), undo the securing screws for the throttle-position sensor to enable the throttle-adjusting screw to be used.

6 Switch off the engine and adjust the throttle-position sensor such that a click is audible as the butterfly leaves the idling position.

7 Tighten the securing screws for the throttle-position sensor, and plug on the connector.

8 Start the engine.

9 Disconnect the jumper lead from the test socket and check that the speed of the engine first increases and then stabilizes at 850 r/min.

Fault diagnosis

Tools:
Voltmeter or test lamp
Ohmmeter

Make all measurements at the back of the wiring-loom connector to the control unit.

N.B.
Do not confuse the connectors for the throttle-position sensor and the AIC valve.

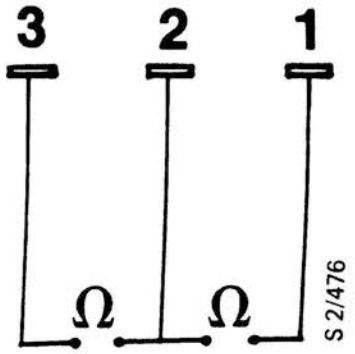
If the control function fails to operate and there is no increase in the idling speed when the AC compressor cuts in, check that power is reaching the blue/red lead at pin 16 of the AIC valve connector.

If not, check for power in the blue/red lead between pin 16 on the LH control unit and the AC relay.

If power is present, check the continuity of the yellow/red lead from pin 3 of the AIC valve to pin 23 of the ECU connector, and of the blue/white lead between pin 9 on the AIC valve and pin 10 on the ECU connector.

If the leads are good, measure the resistance across pin 3 and pin 2 (the centre pin) on the AIC valve and pin 2 and pin 1. The reading should be 20 ± 2 ohm. If this reading is not obtained, fit a new AIC valve and check again.

If a correct reading is obtained, fit a new ECU.



To remove/refit the AIC valve

1 Unplug the electrical connector.

2 Undo the hose clips and disconnect the hoses.

3 Undo the securing screws for the valve and slice it down out of the clip.

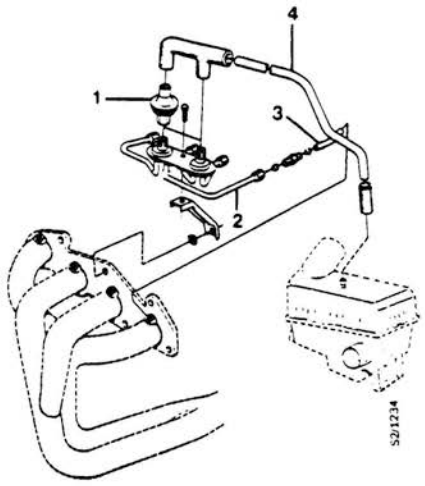
Refit in the reverse order.

Pulse-air system

Technical description

The system consists of two pulse-air (check) valves, two air-injection manifolds, four nozzles (discharging adjacent to the exhaust valves) and an air hose from the air cleaner to the pulse-air valves.

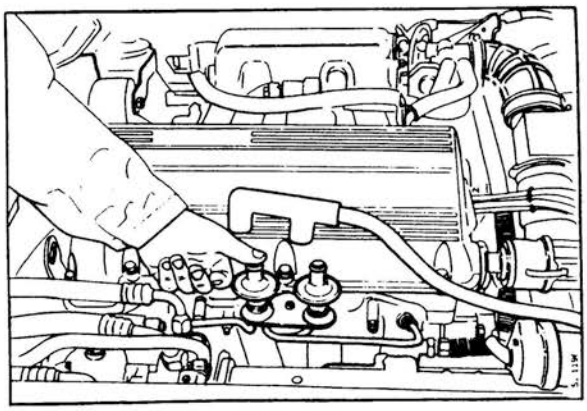
The pulse-air system uses the pressure variations in the exhaust manifold to supply air for oxidation of the exhaust gases, thereby reducing the emission of hydrocarbons and carbon monoxide.



Pulse-air system
1 Pulse-air valve
2 Air-injection manifold
3 Nozzle
4 Air hose

Function check

With the engine idling, disconnect the rubber hose from the pulse-air valves and place a thumb over the inlet of each valve to check that they are drawing in air. If exhaust gas is escaping through the valve on pulsation, fit a new valve.

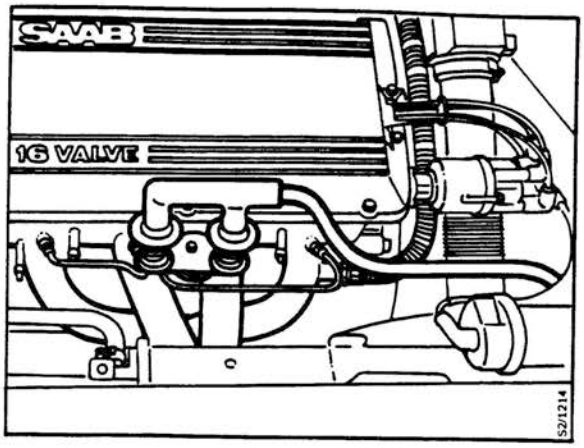


To change the exhaust manifold

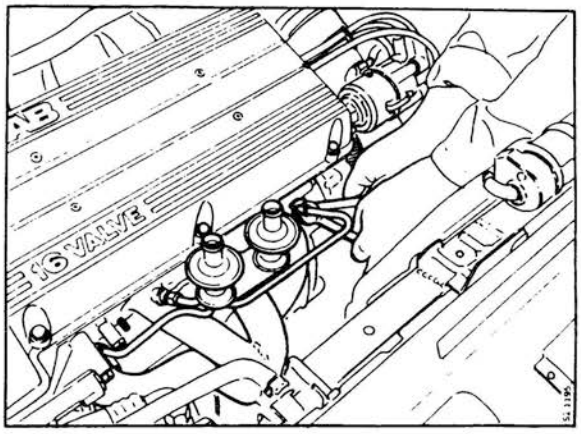
For cars with AC, start with step 1. For cars without AC, go straight to step 2.
Carry out the work with the car on a lift.

1 Remove the AC compressor from its bracket as follows:
   a) Release the tensioner for the AC belt and lift the belt off the compressor pulley.
   b) Unbolt the compressor from the bracket.
   c) Remove the compressor by sliding it forwards.
2 Remove the pulse-air unit as follows:
   a) Disconnect the air hose from the valves.

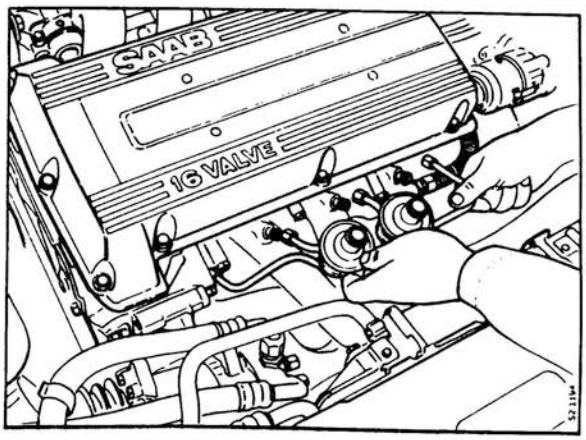
b) Unscrew the bracket from the exhaust manifold and valve mounting plate.



c) Undo the air-injection manifold connections at the nozzle fittings on the exhaust manifold. Use a spanner to stop the fittings turning.



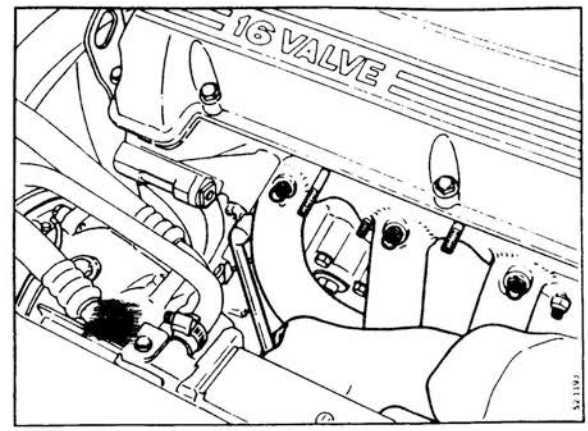
d) Remove the valve assembly complete with air-distribution manifolds.



3 Disconnect both ends of the EGR pipe and lift it off.

4 Remove the exhaust manifold as follows:

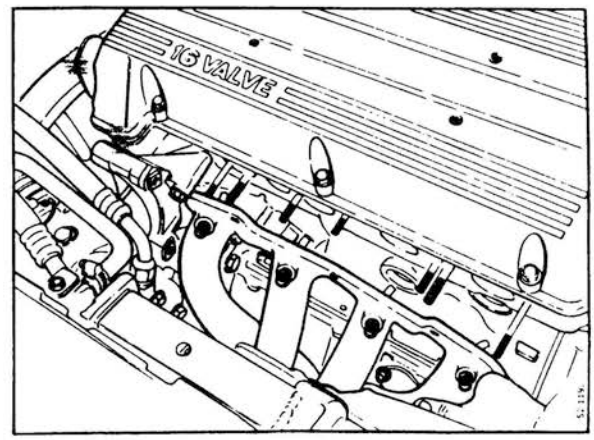
a) Unbolt the exhaust manifold from the cylinder head.



b) From underneath the car:
Undo the flange joint between the exhaust manifold and the exhaust pipe, and unhook the rubber hangers.

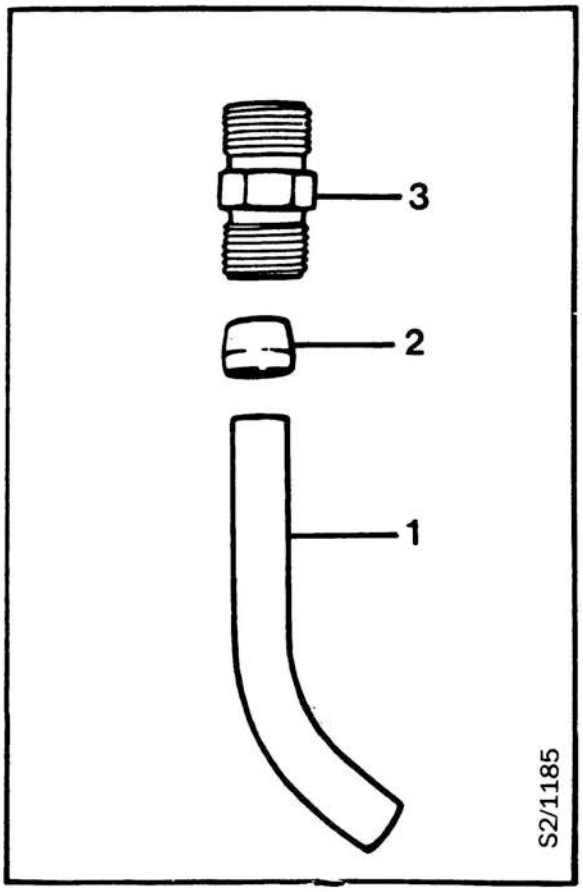
c) Lift the exhaust manifold off the studs in the cylinder head and lower it out of the car.

Refit in the reverse order.
When lifting the exhaust manifold into position, guide it onto the stud nearest the AC compressor first.

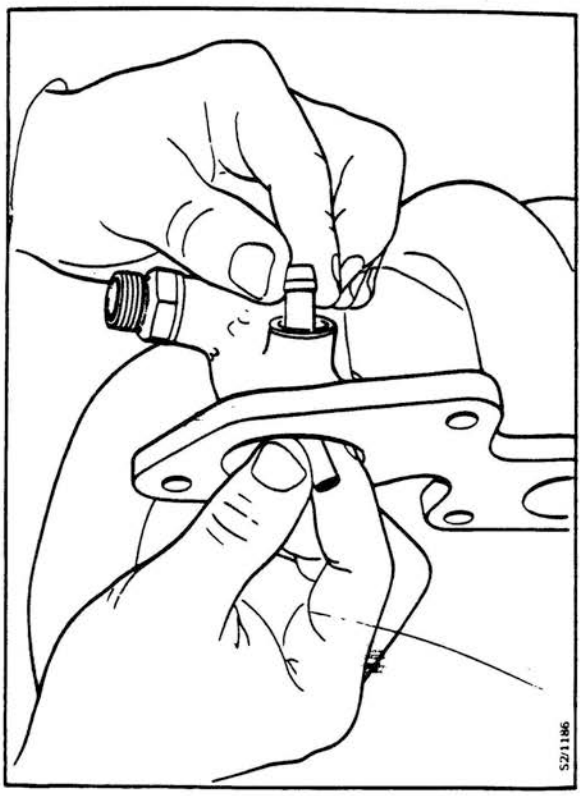


New nozzles and olives must be used when a new exhaust manifold is to be fitted.

Transfer the nipple for the EGR pipe to the new exhaust manifold.

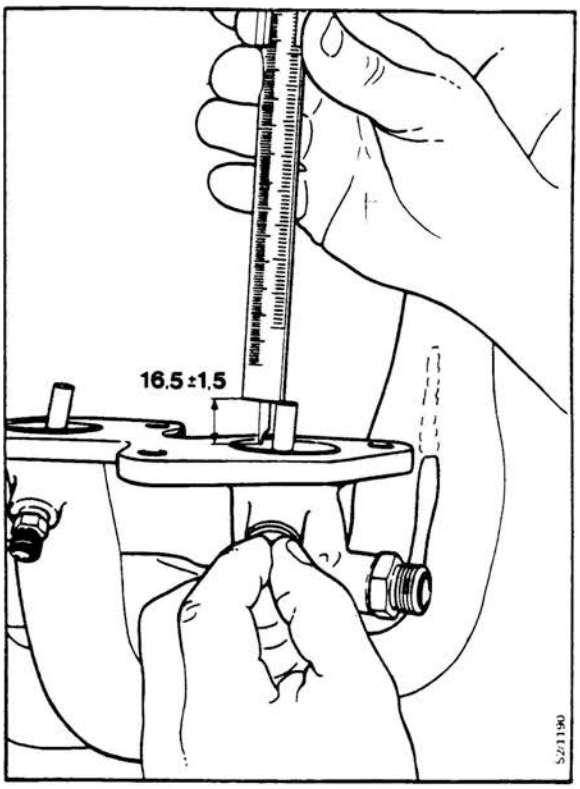


1 Nozzle
2 Olive
3 Manifold fittin

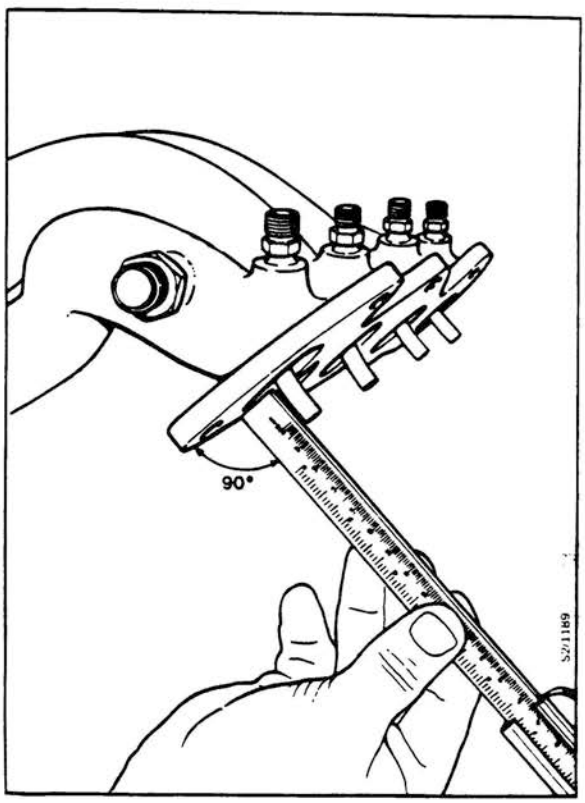


To fit new nozzles

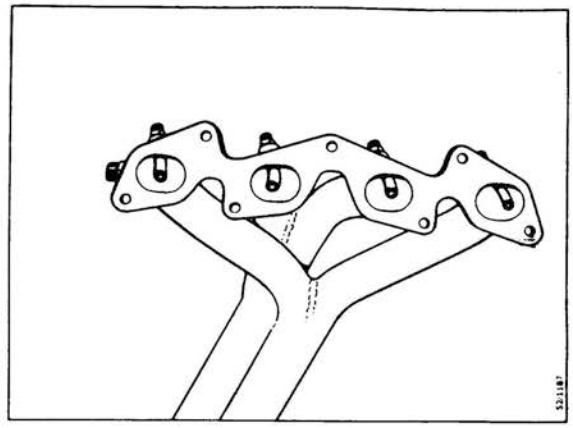
- Check the position of each nozzle and adjust as necessary. The nozzle shall protrude 16.5 ± 1.5 mm (0.65 ± 0.6 in) beyond the face of the exhaust manifold flange.



- Make sure that the nozzle is perpendicular (at 90°) to the face of the flange.



- Make sure that the nozzles are properly centred in the exhaust ports.



Cooling system

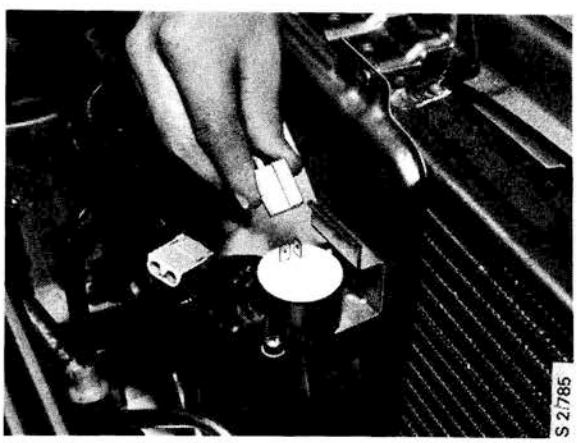
Radiator

To remove

1 Drain the coolant (see section 261-5) and remove the radiator grille.

2 Disconnect the top radiator hose. Remove the air intake to the air cleaner.

3 Unplug the electrical leads from the fan and the solenoid valve. Remove the solenoid valve from the bracket on the fan shroud.

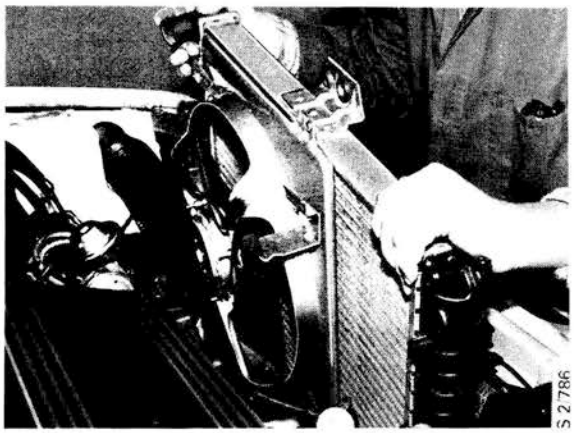


4 Undo the securing bolts for the air-cooled oil cooler and move the cooler to one side. The two bottom securing bolts need only be slackened. Remove the overflow hose from the radiator and disconnect the bottom radiator hose.

5 Unplug the connectors for the leads to the radiator fan and the thermostatic switch.

6 Undo the clamp and remove the ignition coil.

7 Remove the bolts securing the radiator to the radiator member. Withdraw the radiator from its rubber mountings and lift it out.


S 2 786

Refit in the reverse order.

Intercooler and condenser

To remove

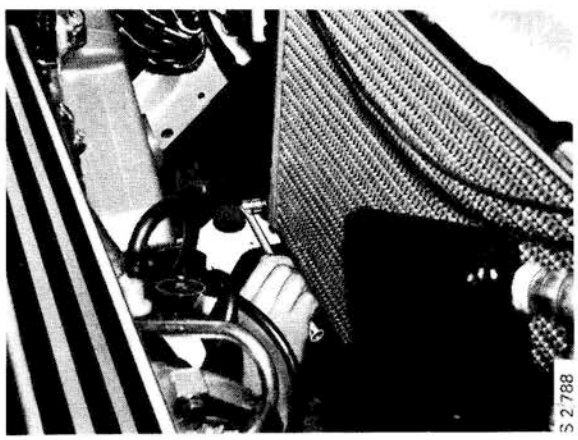
Follow the procedure for removing the radiator and then proceed as follows.

1 Remove the plastic guard from the bottom of the intercooler.

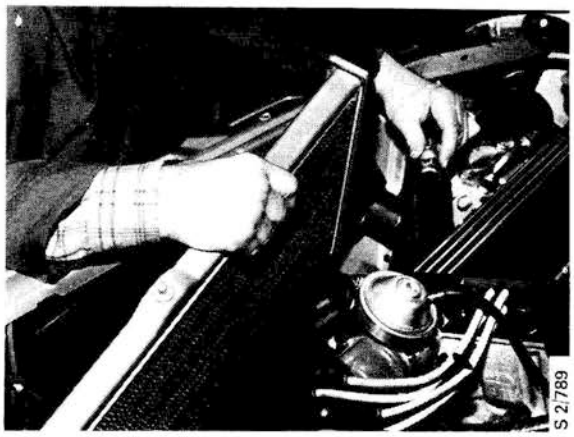

S 2 787

2 Detach the hoses from the connections at either end of the intercooler and remove both socket connectors.

3 Undo and remove the two bolts securing the intercooler to the AC condenser.


S 2 788

4 Pull the intercooler away from the front panel, withdraw it from its mountings and lift it out. Stand the oil cooler on the compressor and secure it.


S 2789

To remove the condenser (when applicable)

5 Disconnect the hoses from the condenser and lift it upwards and to the left.

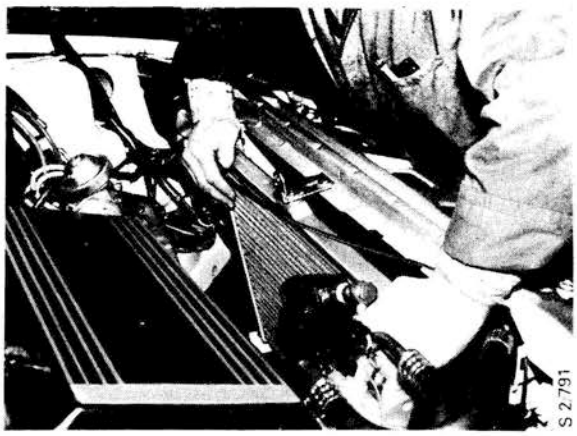
Refitting

Condenser

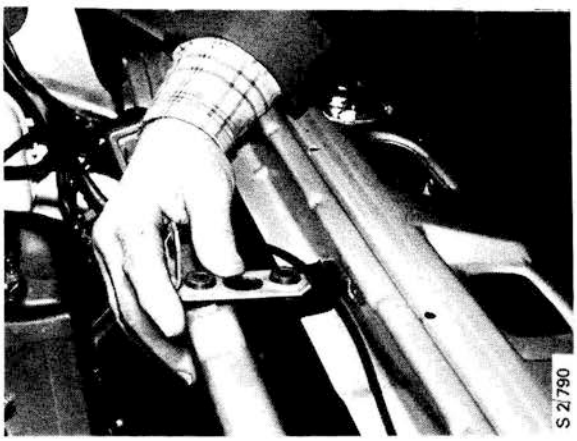
1 Connect the hoses and lower the condenser into position. Do not fit the securing bolts until the intercooler has been fitted.

Intercooler

1 Guide the intercooler into position and press it into its mountings.

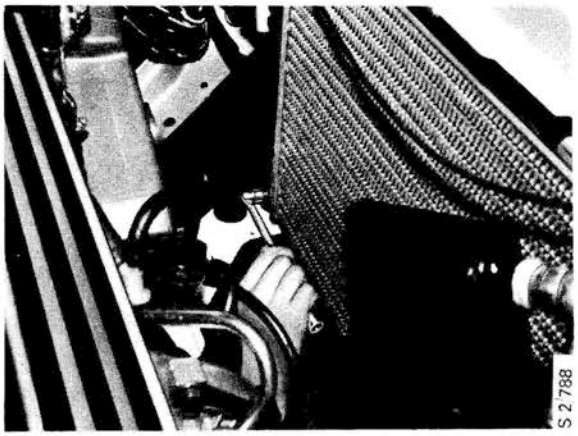

S 2791

2 Engage the stud on the top of the intercooler in the fixing plate and pull the intercooler forwards.


S 2790

3 Fit the two bolts securing the intercooler to the condenser, taking care not to overtighten them.

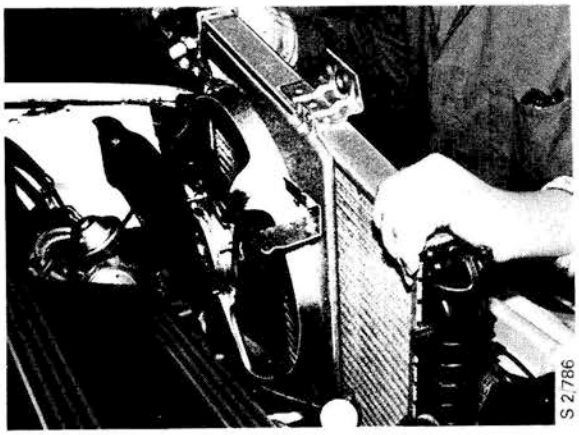
4 Reconnect the intercooler hoses.



To refit the radiator

1 Lower the oil cooler in front of the compressor. Make sure that the pipe is correctly positioned before dropping the radiator into position, as the pipe cannot be fitted later.

2 Lower the radiator into its rubber mountings and press it home.

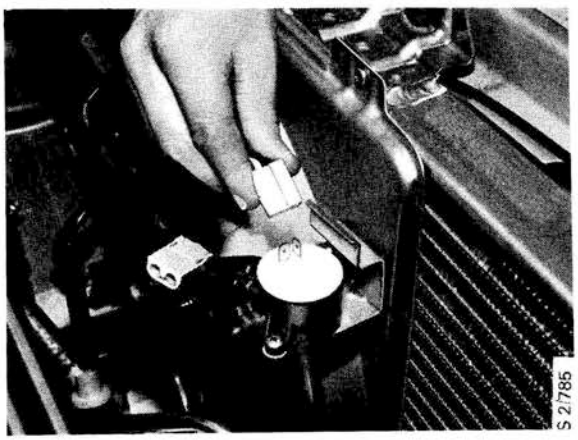


3 Fit the two securing bolts in the middle fixing on the radiator member.

4 Fit the oil cooler and overflow hose to the radiator. Fit the bottom radiator hose.

5 Fit the solenoid valve. Refit the clamp for the ignition coil on the radiator member.

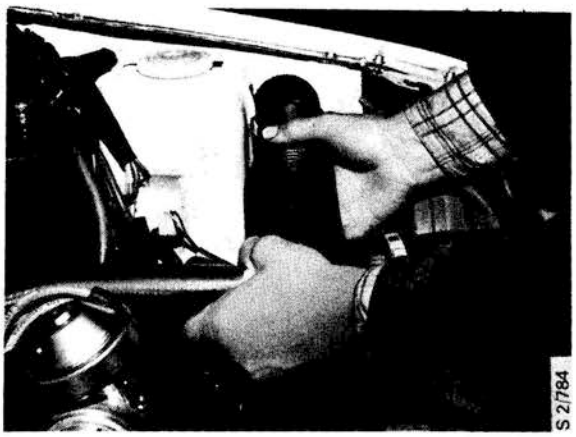
6 Connect the electrical leads to the radiator fan and solenoid valve. Secure the leads in their clips. Connect the lead to the thermostatic switch.



7 Connect the top radiator hose.

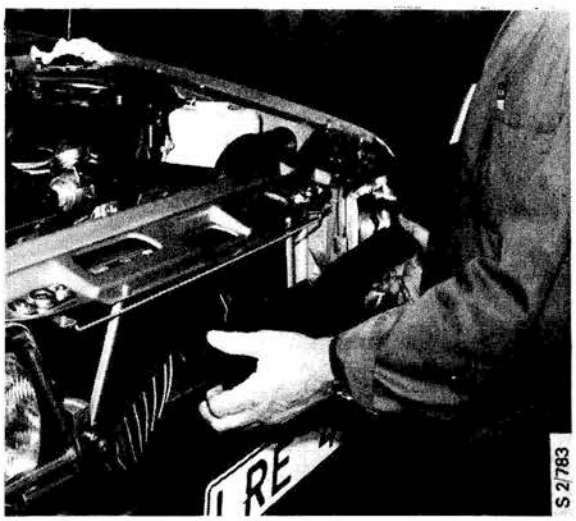
8 Fit the plastic guard under the intercooler.

9 Fit the air intake.



10 Fill up the coolant and pressure-test the cooling system.

11 Fit the radiator grille.



Changing the coolant

To drain the coolant

1 If the coolant is hot, start by releasing the pressure in the system by carefully slackening the expansion tank filler cap.

Place a suitable receptacle under the radiator to collect the coolant.

2 Remove the drain plug from the radiator and remove the filler cap from the expansion tank.

N.B.
The cooling system holds 8.65 litres (9.1 liq qt) of coolant. After the system has been drained (after about 70 seconds), approximately 1.25 litres (1.3 liq qt) of coolant will remain in the system (0.3 litre (0.3 liq qt) in the heat exchanger and 0.95 litre (1.0 liq qt) litre in the block).

Refilling

1 Replace the drain plug and tighten it finger-tight only.

2 Mix approximately 6.5 litres (6.9 liq qt) of equal parts antifreeze and water in a container.

3 Pour the coolant into the expansion tank. Depending on the time it takes for air to be expelled from the system, it will take approximately 70 seconds to refill the system.

4 Replace the filler cap, run the engine up to normal temperature and then add approximately one litre (1 liq qt) more of coolant.

5 Check the coolant level again after a few days and top up as necessary.

Water pump

To remove

(engine in car)

1 Raise the front of the car, support it on axle stands and remove the wheel on the right-hand side.

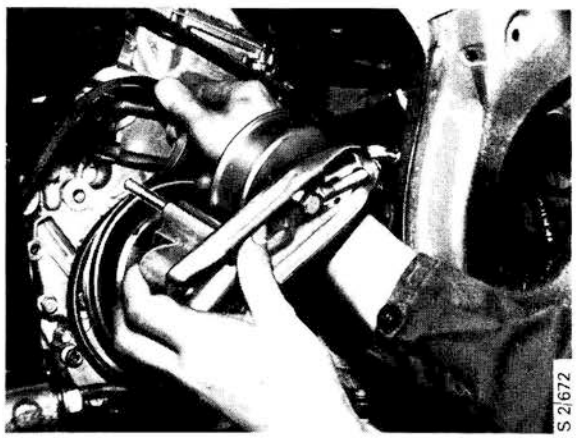
2 Remove the front section of the wing liner.

3 Drain off the coolant.

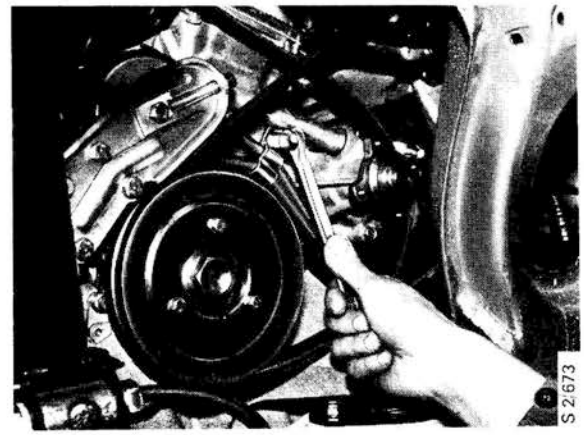
4 Slacken the drive belt.

5 Undo the nuts and remove the water-pump pulley.

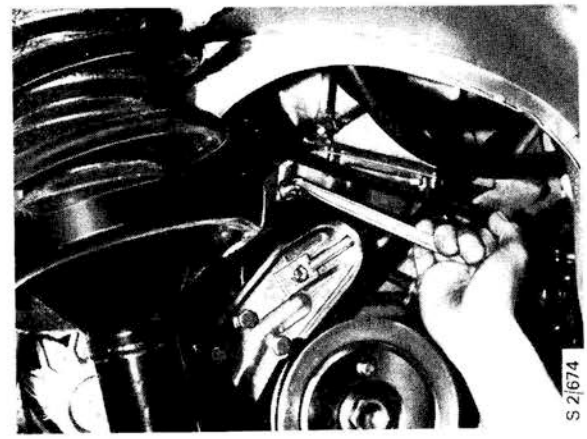
6 Remove the belt-tensioning pulley.



7 Undo the clip holding the oil lines to the oil cooler.

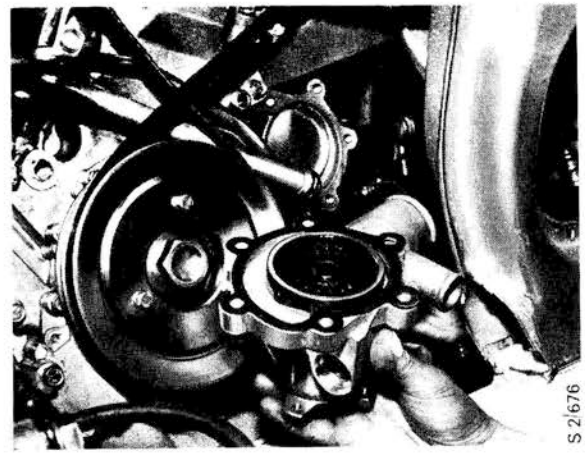


8 Undo the clip securing the water pipe to the block.



9 Disconnect the coolant hoses from the pump.

10 Undo the bolts securing the pump to the bracket and remove the pump.



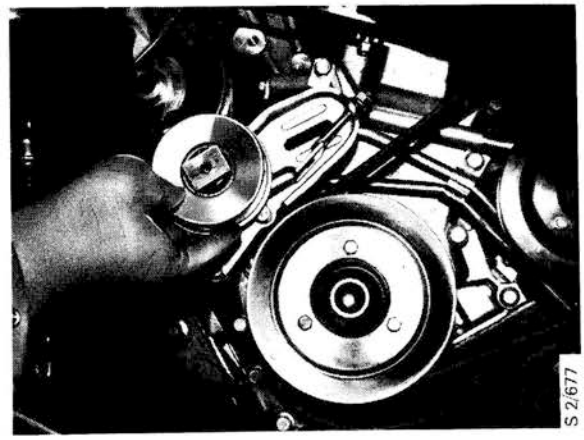
To refit

1 Fit the new pump with a new gasket and tighten the securing bolts to a torque of 20 Nm (15 lbf ft).

2 Refit the clip for the oil lines.

3 Connect the coolant pipe to the pump, using a new 'O'-ring. Tighten the clip securing the pipe to the block.

4 Fit the belt-tensioning pulley. Make sure that the arbor plate on the pulley is correctly located in the slot in the bracket.



5 Fit the belt and the pulley. Tighten the bolts to a torque of 8 Nm (15 lbf ft).

6 Tighten the belt, measure the tension and adjust as necessary.

7 Connect the coolant hoses to the water pump.

8 Replenish the coolant and pressure test the cooling system.

9 Fit the wing liner.

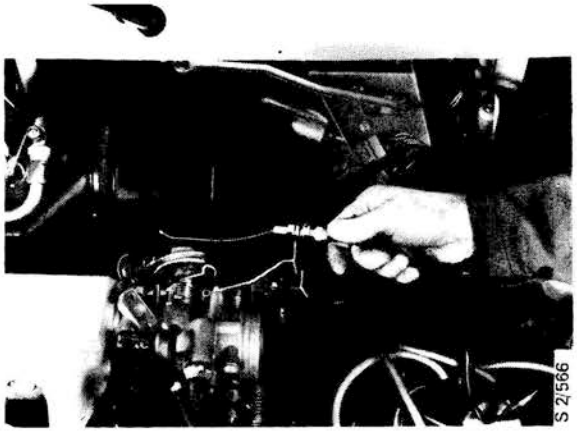
10 Replace the wheel and lower the car.

Throttle cable

Changing the throttle cable (US and CA specs. and all 1986 and earlier models)

To remove

1 Remove the rubber socket connector between the throttle housing and the turbo pressure (delivery) pipe.



3 Pull out the sheathing collar from the grommet in the bulkhead.

4 Remove the trim panel from over the pedal assembly and the carpet trim to the left of the radio console.

5 Disconnect the ball chain for the cruise control system from the cable stop. Note the position of the chain for refitting.

6 Disconnect the cable bush and the cable from the accelerator pedal.

7 Pull the cable through the bulkhead and save the seal for the collar.

To refit

Refit in the reverse order.

Adjust the cable so that there is no free play in the accelerator.

Make sure that the ball chain for the cruise control system is fitted in exactly the same position as before.

Throttle cable, cars with ABS (N/A US & CA)

To accommodate the ABS system, the throttle-cable brackets and levers are of a modified design and both the throttle and kick-down cables have been rerouted as from 1987 models.

The fitting for the throttle-cable lead-through at the bulkhead has also been modified.

The cable assembly comprises an outer casing (1), an adjusting screw (2), a flanged collar (3) and an inner cable (4) with nipple (5).

The outer casing is fixed to the bracket on the throttle housing and in the rubber grommet in the bulkhead, and the cable is connected to the accelerator at one end and the lever on the throttle housing at the other.

Changing the throttle cable

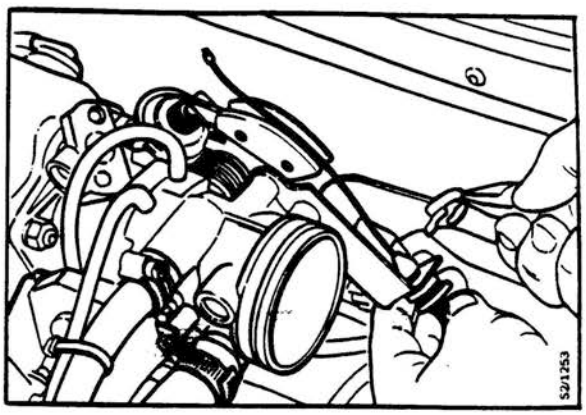
To remove

1 Remove the rubber socket connector from between the throttle housing and the turbo delivery pipe.

2 Remove the EGR pipe.

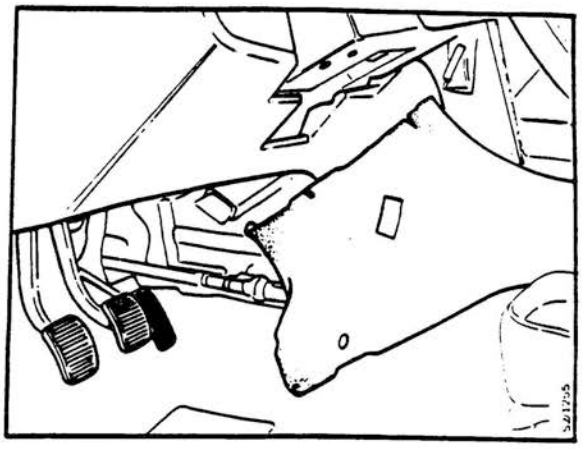
3 Unhook the cable from the throttle lever.

4 Remove the retaining clip for the adjusting screw from the bracket on the throttle housing.



5 Lift the coolant hose and tuck it behind the turbo delivery pipe.

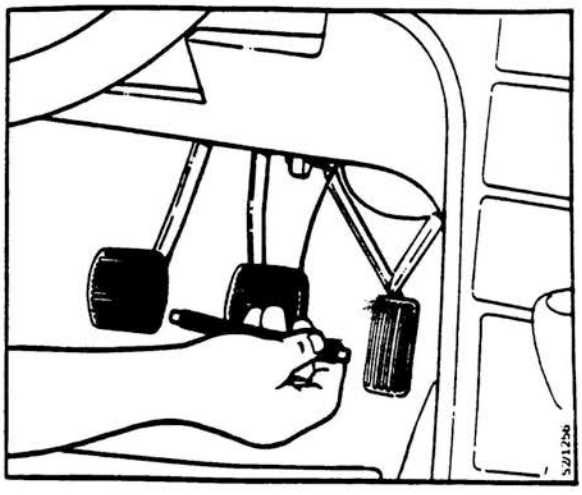
6 Remove the lower dash panel and the centre console trim panel.



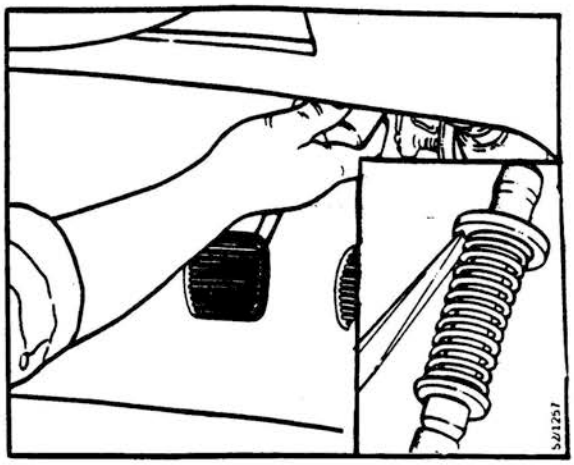
7 Cars with cruise control:
Unhook the ball chain from the retaining link, noting carefully the position of the chain for refitting.

8 Disconnect the retaining link from the cable and detach the cable and bush from the accelerator pedal. Depress the accelerator and use a screwdriver or the like to hold the pedal down.

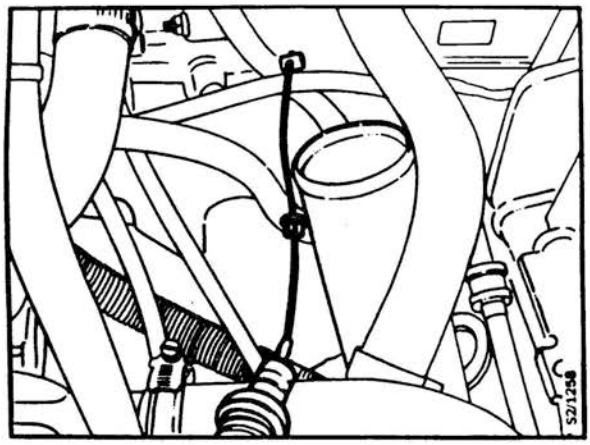
9 Fasten a pull-through wire to the end of the cable and use a screwdriver (as shown) to press the flanged collar on the cable out of the rubber grommet in the bulkhead.



N.B.
Considerable force may be required to press out the collar.



10 Pull the cable through into the engine compartment and disconnect the pull-through.

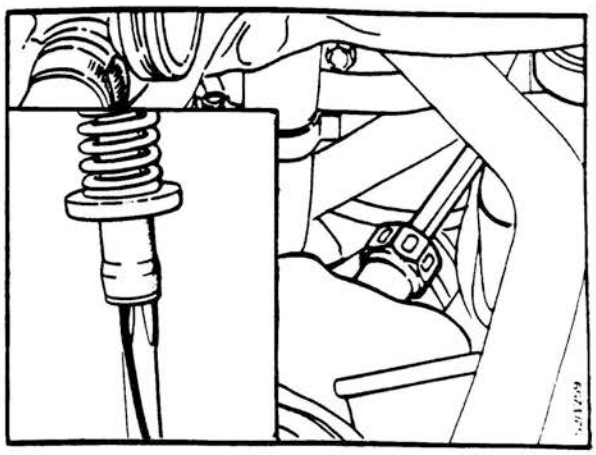


To refit

Before fitting the new cable, lubricate the flanged collar with a little acid- free grease or petroleum jelly.

1 Attach the wire pull-through to the end of the cable and pull the cable through until the flanged collar reaches the grommet in the bulkhead.

2 Using a large screwdriver as shown, press the flanged collar into the grommet.



3 Pull the cable into position and press the cable bush onto the pedal.

4 Remove the wire pull-through and hook the nipple on the end of the cable onto the retaining link.

Cars with cruise control:
Attach the ball chain to the retaining link.

Secure the retaining link using a piece of butyl tape and return the accelerator to the home position.

5 Slot the adjusting screw into the bracket on the throttle housing and fit the retaining clip.

6 Secure the cable nipple by crimping it in the throttle lever.

7 Adjust the throttle cable to the correct tension by means of the adjusting screw.

8 Replace the centre-console trim panel and the lower dash panel.

9 Refit the EGR pipe (when applicable).

10 Fit the rubber socket connector between the throttle housing and the turbo delivery pipe.

Accelerator pedal

To remove/fit

1 Insert a bolt or the like under the stop on the inlet manifold to relieve the tension in the cable to facilitate prising open of the clip.

2 Undo the two socket screws in the bearing bracket and lift the pedal clear of the pedal assembly.

Refit in the reverse order.

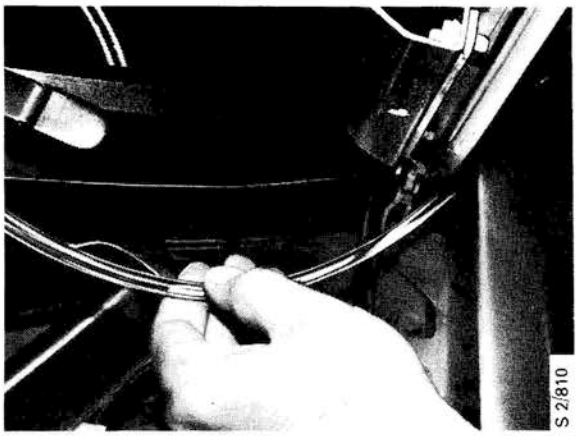
Turbo system

To check the maximum charging pressure

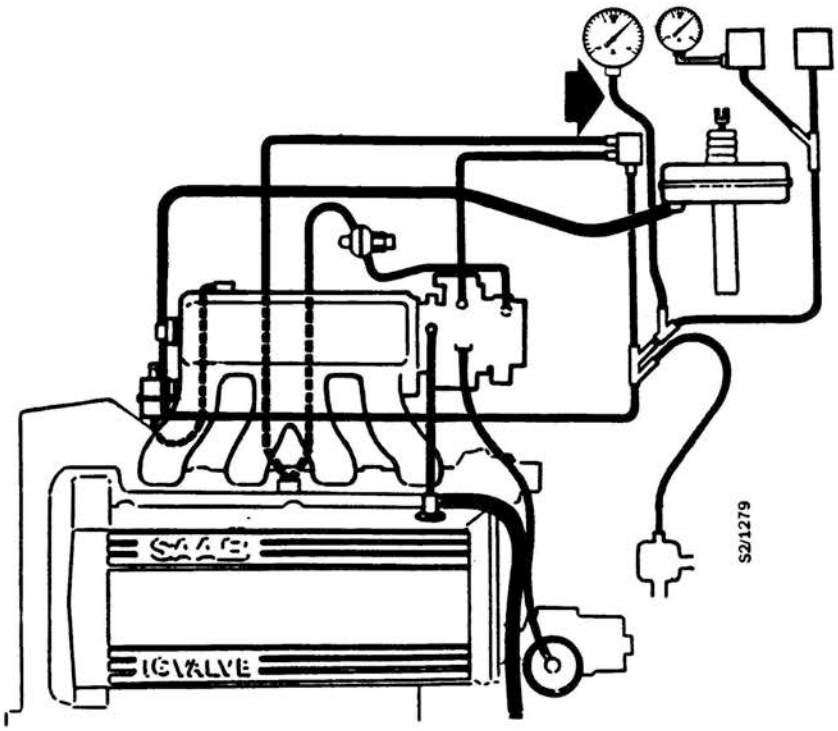
Tools: Pressure gauge 83 93 514
Test loom with switch box 83 93 548 (1985 models only) or 83 94 074 (1986 models onwards).

1 Run the pressure gauge hose from inside the car, through the hole in the front door pillar and thence to the engine compartment.

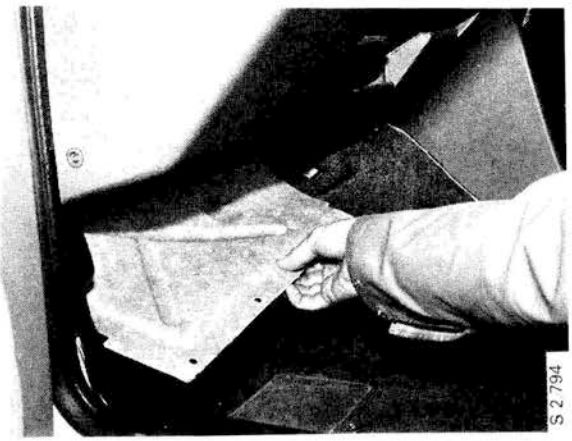
N.B.
Position the gauge vertically to avoid faulty readings, (hang it on the rear-view mirror.


S 2/810

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



3 Remove the lower dash panel by the pedals and unplug the wiring loom from the electronic control unit.



4 Connect the test loom with switch box to the back of the loom connector for the electronic contol unit.

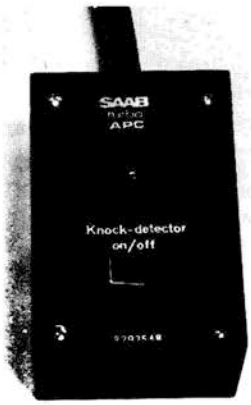
5 a (1985 models only)
Make sure that the knock-detector switch is in the OFF position.

b (As from 1986 models)
Make sure that the knock-detector switch is in the OFF position and that for the solenoid valve in the ON position.

(This is done to isolate the knock detector so that it cannot cut in and vary the charging pressure while the pressure is being measured.)


S2/1048

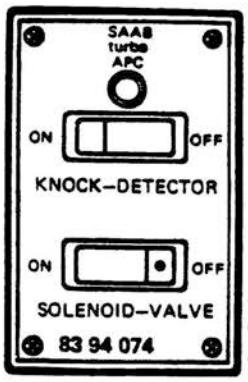
N.B.
The engine may knock continuously during the measuring procedure, depending on the octane of the fuel in the tank.



S 2/016

Caution

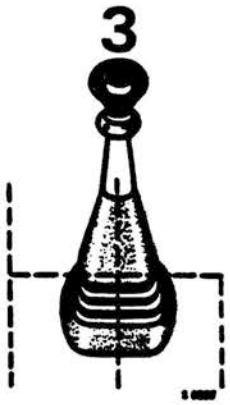
- If the car is being driven on the road, the checking procedure for the maximum charging pressure must be carried out as quickly as possible (in three to five seconds) to avoid the brake linings becoming excessively hot.
- Drive the car at least one kilometre (six-tenths of a mile) between checks and again after the final check to give the linings time to cool down.



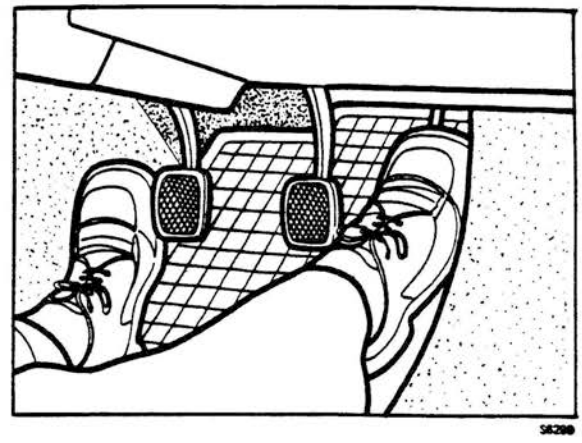
S2/1011

N.B.
The engine must be at normal running temperature.

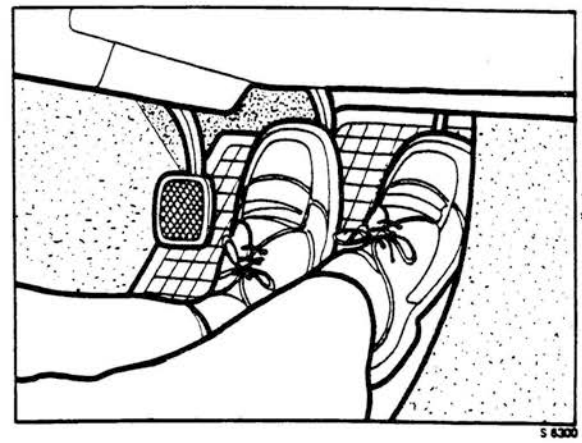
The check must be performed with third-speed gear engaged and at an engine speed below 1500 r/min.



6 Press the accelerator hard down to accelerate at full throttle.



When the engine speed approaches 3000 r/min, brake hard, keeping the accelerator fully depressed, so that full load will be put on the engine at 3000 r/min. Read off the pressure from the gauge.

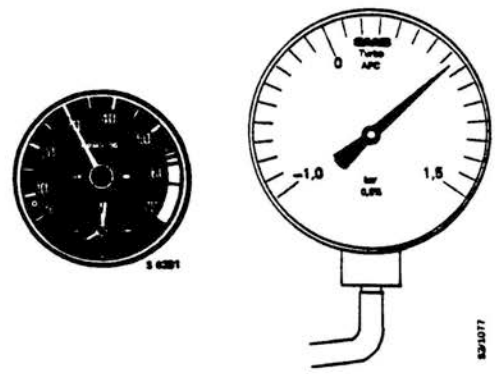


N.B.
A surge in the charging pressure may occur when the accelerator is pressed hard down. This is because the charging pressure briefly attains a higher value than the preset maximum.

7 After it settles down, the charging pressure should be at the value specified in the "Technical data" section.

If a reading within the limits is obtained, disconnect the test equipment.

If not, refer to the fault-diagnosis chart.



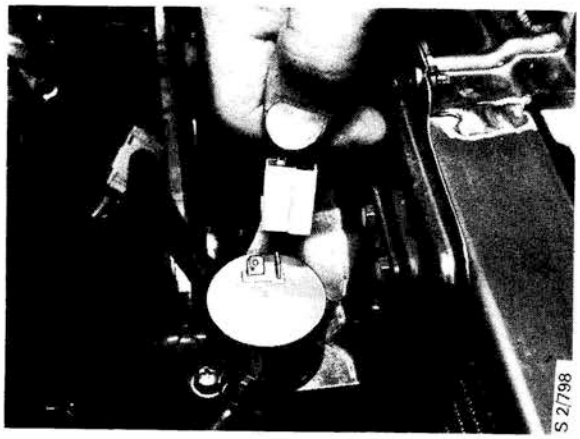
Checking the basic charging pressure in conjunction with checking of the maximum boost pressure.

1985 models only:

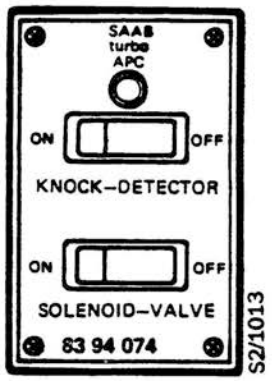
Isolate the APC system: for instance, by unplugging the wiring loom from the solenoid valve.

As from 1986 models:

Ideally this check should be performed immediately after the maximum boost pressure has been tested, when the engine has been thoroughly warmed up.

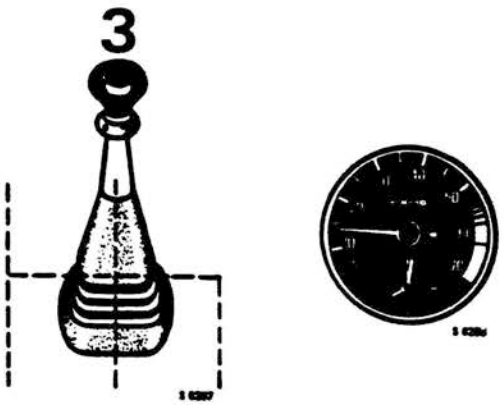


Switches on switch box in positions:
Knock-detector - OFF
Solenoid valve - OFF

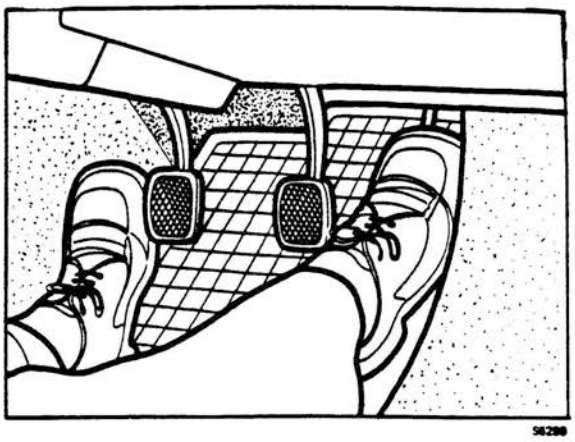


N.B.
Make sure the engine is at normal running temperature.

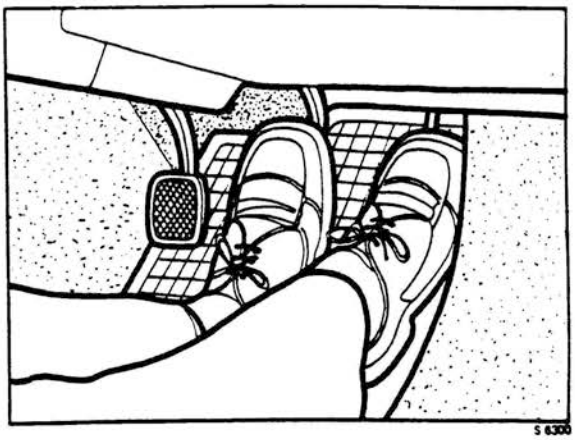
The check must be performed with third-speed gear engaged and at an engine speed below 1500 r/min.



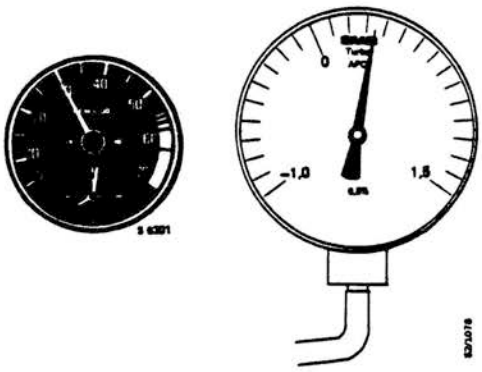
1 Press the accelerator hard down to accelerate at full throttle.



2 When the engine speed approaches 3000 r/min, brake hard, keeping the accelerator fully depressed, so that full load will be put on the engine at 3000 r/min.



3 Read off the basic charging pressure from the pressure gauge.
See the "Technical data" section for the correct value.



The basic charging pressure is no more than a basic setting for the APC system and thus has no direct effect on the actual charging pressure or the performance of the engine when the APC system is operating. To increase the basic setting of the charging pressure above the specified value will not increase the performance of the engine. The maximum charging pressure for optimum engine power is controlled by the APC system.

4 If the basic charging pressure is outside the specified limits, adjust the basic setting as detailed in the section headed "To adjust the basic setting for the charging pressure".

5 Disconnect the test loom.

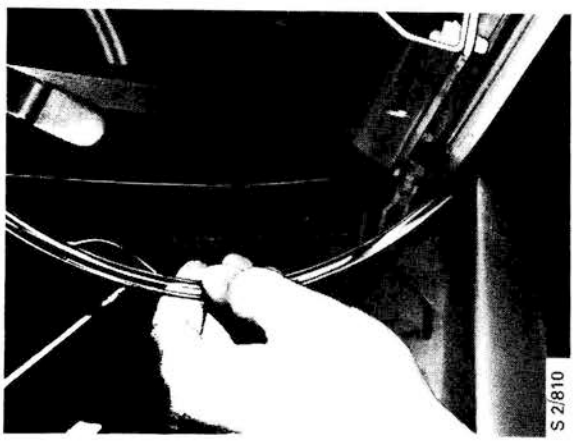
6 Disconnect the pressure gauge.

To check the basic setting of the charging pressure regulator on the road

Tool: Pressure gauge 83 93 514
Test loom with switch box 83 94 074 (if necessary)

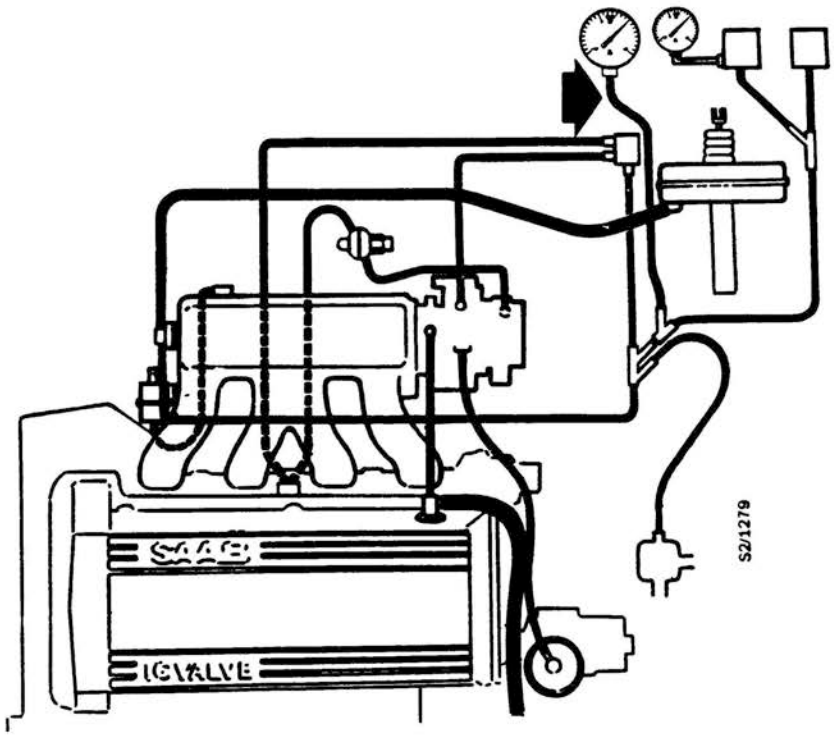
N.B.
The engine must be at normal running temperature before the basic setting of the charging pressure is checked or adjusted.

1 Run the pressure gauge hose from inside the car, through the hole in the front door pillar and thence to the engine compartment.

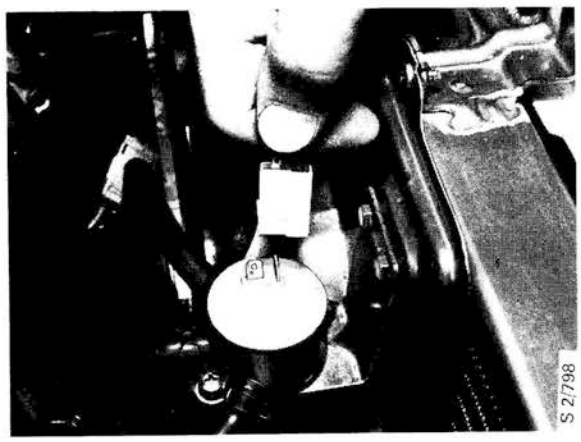


N.B.
Position the gauge vertically to avoid faulty readings (hang it on the rear-view mirror).

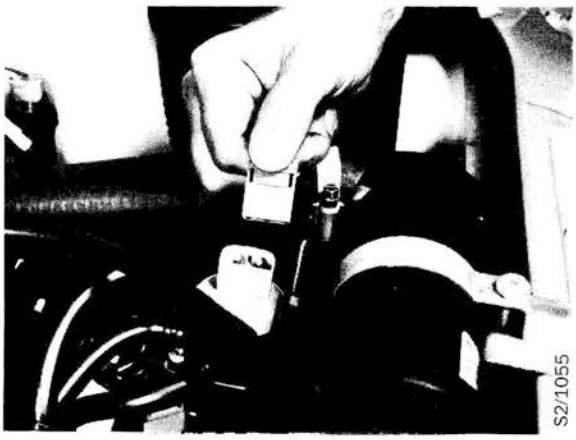
2 Connect the pressure gauge hose between the spigot on the inlet manifold and the hose to the pressure switch (see diagram below).



3 Isolate the APC system as follows:
1985 models only:
Unplug the wiring loom from the solenoid valve.



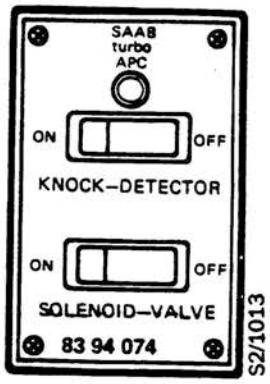
1985 models



As from 1986 models

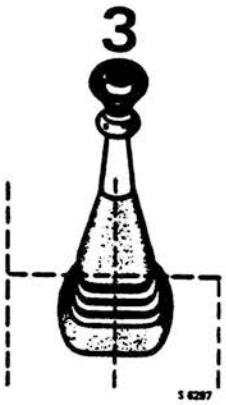
1986 models onwards:
Connect test loom and switch box 83 94 074 between the loom connector and the APC control unit (refer to "Checking the maximum boost pressure", on page 291-12).

Knock-detector switch: set to OFF
Solenoid-valve switch: set to OFF

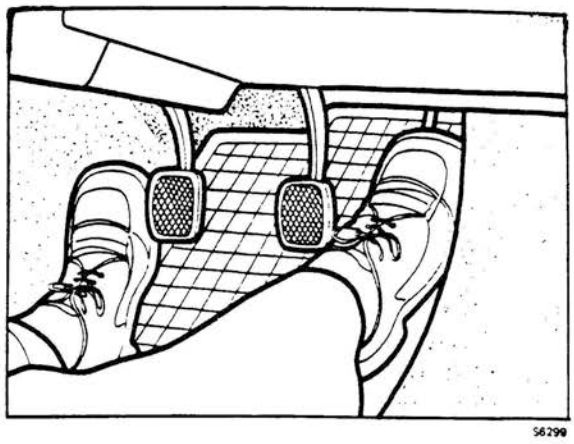


N.B.
Make sure the engine is at normal running temperature.

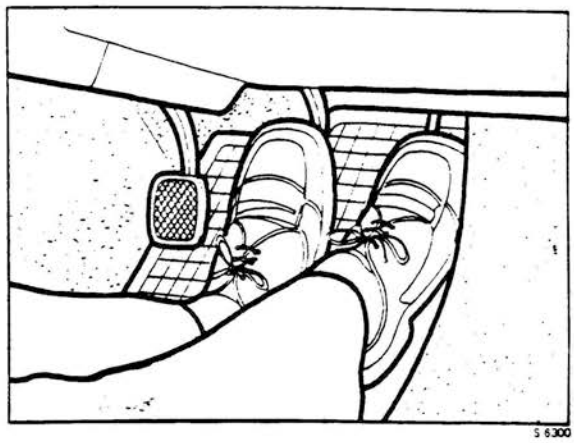
The check must be performed with third-speed gear engaged and at an engine speed below 1500 r/min.



4 Press the accelerator hard down to accelerate at full throttle.

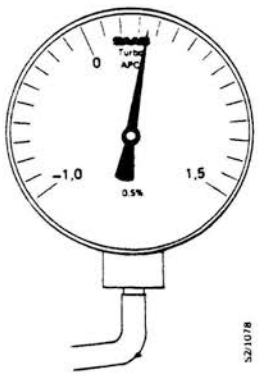


5 When the engine speed approaches 3000 r/min, brake hard, keeping the accelerator fully depressed, so that full load will be put on the engine at 3000 r/min.



Read off the basic charging pressure from the pressure gauge.

See the "Technical data" section for the correct valve.



N.B.
The basic charging pressure is no more than a basic setting for the APC system and thus has no direct effect on the actual charging pressure or the performance of the engine when the APC system is operating. To increase the basic setting of the charging pressure above the specified valve will not increase the performance of the engine. The maximum charging pressure for optimum engine power is controlled by the APC system.

6 If the basic charging pressure is outside the specified limits, adjust the basic setting as detailed in the section headed, "To adjust the basic setting for the charging pressure".

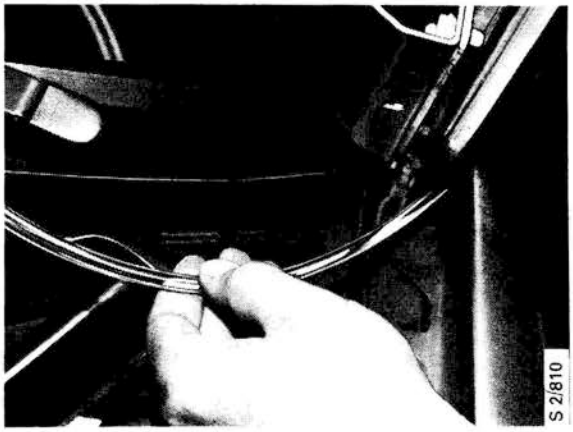
7 Plug on the connector for the solenoid valve (or disconnect the test loom).

8 Disconnect the pressure gauge.

To check the anti-knock function of the APC system

Tools: Pressure gauge 83 93 514.
Test loom with switch box 83 93 548 (1985 models only) or 83 94 074 (1986 models onwards).

1 Run the pressure gauge hose from inside the car, through the hole in the front door pillar and thence to the engine compartment.



N.B.
Position the gauge vertically to avoid faulty readings, (hang it on the rear-view mirror).

N.B.
The engine may knock continuously during the test, depending on the octane of the fuel in the tank.

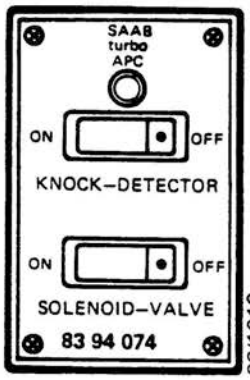
2 Connect the pressure gauge hose between the spigot on the inlet manifold and the hose to the pressure switch.

3 Connect test loom and switch box 83 93 548 (1985 models only) or 83 94 074 (as from 1986 models) between the wiring loom connector to the ECU and the ECU.

S 2/017

4 a 1985 models only:
Set the knock-detector switch on the switch box to ON.

b As from 1986 models:
Make sure the switches are set as follows:
Knock-detector: ON
Solenoid valve: ON



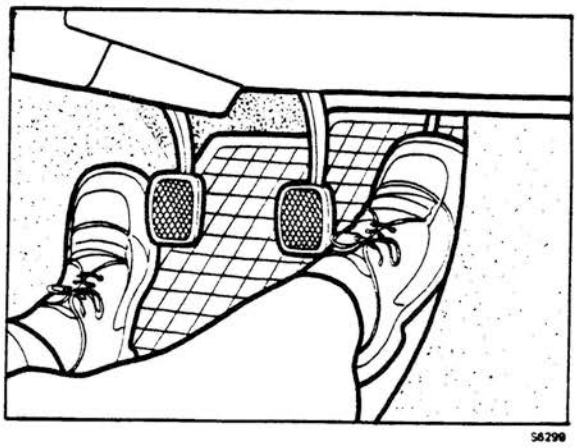
S2/1012

5 Perform the check at about 3000 r/min.

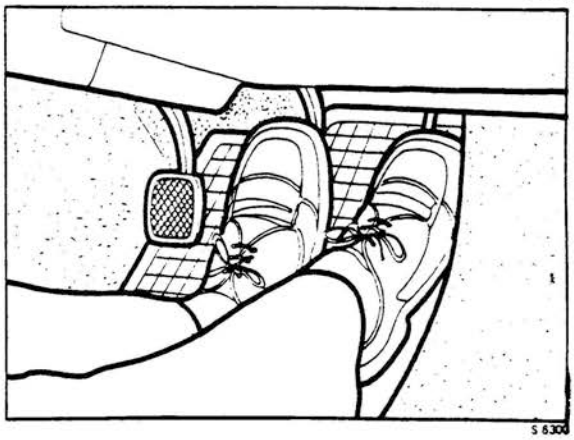
Caution

To prevent the brake linings from overheating, the test on the APC system at maximum boost pressure must be performed as quickly as possible (within 3-5 seconds). After performing the test, drive the car for at least a mile to enable the brake linings to cool.

Press the accelerator hard down to accelerate at full throttle.



When the engine speed approaches 3000 r/min, brake hard, keeping the accelerator fully depressed, so that full load will be put on the engine at 3000 r/min.



If the system is working properly, the charging pressure should fall by approx. 0,1 bar (1,45 psi) when knocking occurs when the engine is running at full throttle. This fall in pressure may occur several times until the knocking has been eliminated.

If the engine is held at full throttle, the charging pressure will rise (by approx. 0.1 bar/1.45 psi every three seconds) towards the nominal value until knocking recurs, whereupon the charging pressure will be decreased again.

The lower the octane rating of the fuel, the lower will be the mean value of the charging pressure when the engine is running at full throttle.

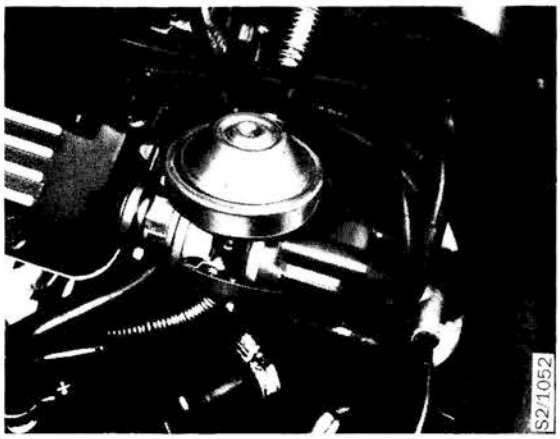
Each time the knock detector is activated, this will be indicated by the pressure gauge for the charging pressure. The charging pressure will fall below the preset maximum value, and the red indicator light on the test loom switch box will flash.

If the fuel in the tank has a high octane rating, with the result that no knocking occurs (and thus no pressure regulation), check the APC system by means of the procedure detailed in steps 6-8 below.

N.B.
Follow the procedure below only if the engine cannot be made to knock with the fuel being used.

6 Disconnect the vacuum hose from the vacuum control unit on the distributor. Blank off the end of the hose.
7 The engine should now knock when the car is accelerating hard at full throttle, enabling the operation of the APC system to be observed.

If knocking in the engine cannot be generated, fuel of a lower octane must be used to enable the check to be carried out.
8 Disconnect the test equipment.



N.B.
Remember to reconnect the vacuum hose to the distributor.

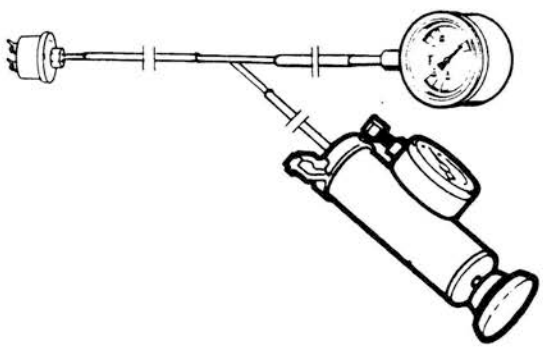
Checking the system components

To check the APC system in the car

Tools: Pressure gauge 83 93 514
Connector and hose (included in pressure gauge set)
Air pump (cooling system tester)

1 Disconnect the pressure transducer hose from the inlet manifold. Blank off the end of the spigot on the manifold.
2 Connect the pressure gauge set to the hose from the pressure transducer.

N.B.
Position the gauge vertically to avoid faulty readings.



3 Connect the air pump complete with connector, hose and pressure gauge to the hose from the pressure transducer.

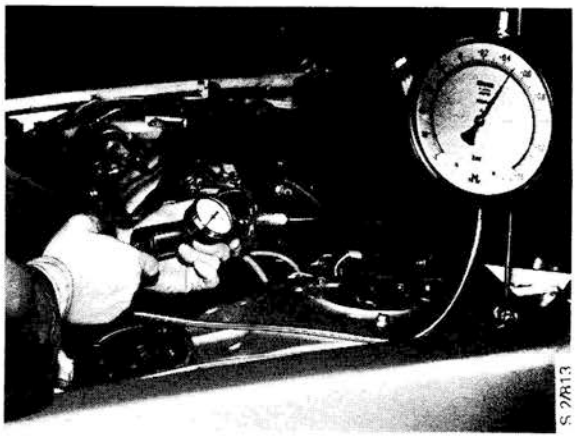
4 Start the engine and increase the speed to at least 2100 r/min (to ensure that the APC system is operative).

5 Raise the pressure to 0.50 bar (7.3 lb/in²).

6 Check that the solenoid valve is working (chattering noise).

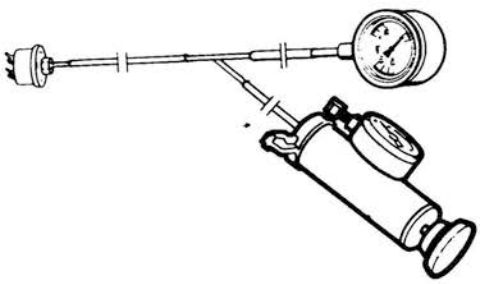
Operation of the solenoid valve indicates that all APC components are working, namely, the knock detector, pressure sensor and ECU.

If the solenoid valve is not working, refer to the fault-diagnosis chart for system components.



To check the pressure transducer

Tools: Pressure gauge 83 93 514
Connector and hose (included in pressure gauge set)
Air pump (cooling system tester)
Ohmmeter



1 Remove the panel from under the instrument panel (LH side).

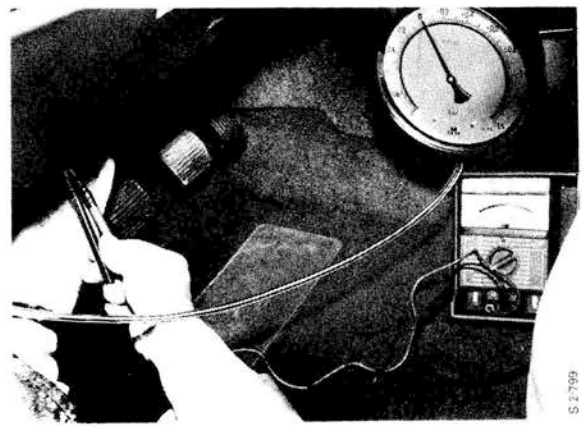
2 Unplug the connector from the APC control unit.

3 Connect the air pump complete with connector, hose and pressure gauge to the hose from the pressure transducer.

N.B.
Position the gauge vertically to avoid faulty readings.

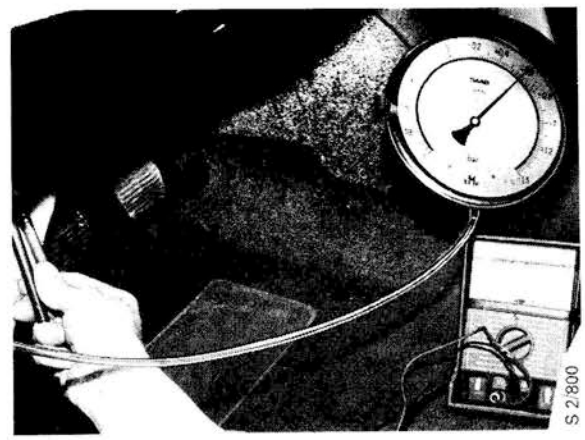
4 From the back of the wiring loom connector to the APC unit, connect the ohmmeter across the terminals for the black/white lead and green/red lead (leads to pressure transducer).

5 Measure the resistance. At atmospheric pressure the reading should be: 10 (+3 -5) ohm.



6 Raise the pressure to approximately 1 bar (15 psi) and then let it drop to 0.60 bar (8.7 psi) and at the samt time tap lightly with the handle of a screwdriver on the APC bracket. Measure the resistance which, at 0.60 bar (8.7 psi), should be 88 ± 5 ohm.

If correct readings cannot be obtained, fit a new pressure transducer.

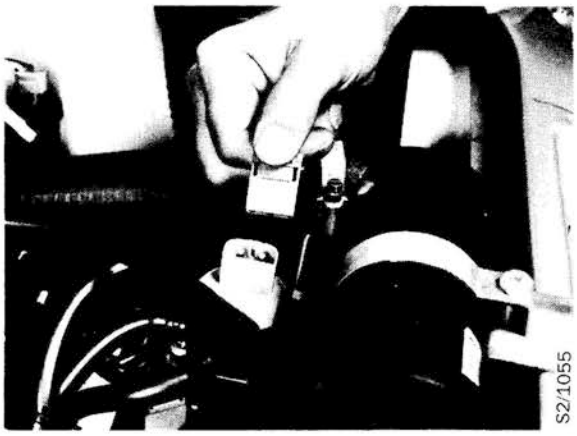


To check the solenoid valve

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

1 Unplug the connector from the solenoid valve.

1985 models only



As from 1986 models

2 Disconnect the inlet hose from the turbo compressor and from outlet 'R' on the solenoid valve at the inlet manifold.

3 Use the jumper leads to connect battery voltage (12 V) to the terminals on the solenoid valve.

4 When the battery voltage is connected, the valve should be open. When the power supply is broken, the valve should be closed. Check by blowing through the open end of the hose.

If the solenoid valve is not working as described, fit a new one.

To check the restriction in the solenoid valve

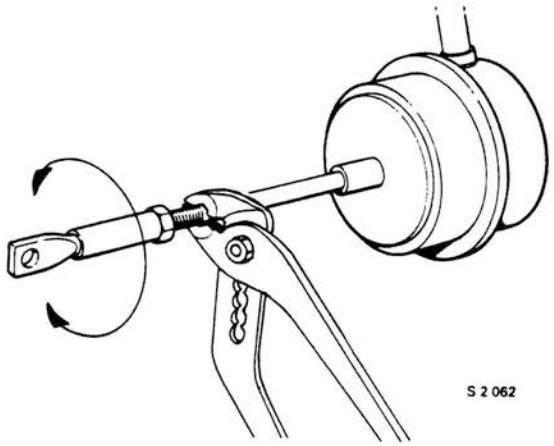
A restriction marked "C" is incorporated in the port on the solenoid valve for the hose from the turbo compressor.

- Check that the restriction is not blocked by dirt, etc.

If the restriction is too small or dirt cannot be removed fit a new solenoid valve.

Charging pressure regulator (waste-gate valve)

The diaphragm unit of the waste-gate valve is set at the factory and should only be adjusted after repair, component replacement or in conjunction with fault diagnosis. The basic adjustment for the valve should be set in the workshop but the basic charging pressure must be measured with the car on the road.



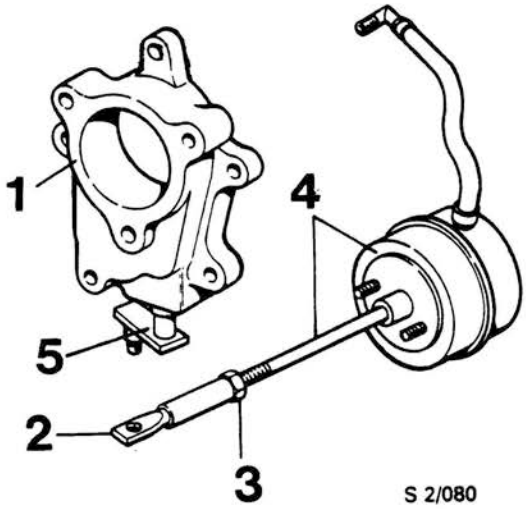
Caution

When adjusting the length of the pushrod, make sure that the tool is applied as close to the thread as possible. Turn the pushrod carefully to avoid scoring it. Scoring may cause the diaphragm unit bearing to bind and disrupt control of the charging pressure.

Basic setting of the waste-gate valve

Diaphragm unit and waste-gate valve assembled on turbo unit.

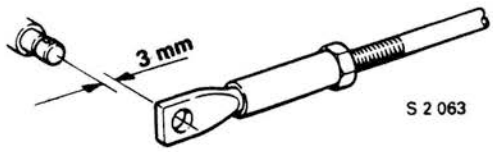
1 Hold the actuator on the waste-gate valve in the closed position. Turn the threaded sleeve on the end of the pushrod to line up the hole with the pin on the actuator.



1 Waste-gate housing
2 Threaded sleeve
3 Locknut
4 Diaphragm unit and pushrod assembly
5 Waste-gate valve actuator

2 Screw the threaded sleeve clockwise 3.5 turns on the pushrod, to offset the hole by 3 mm (0.118 in) relative to the pin.

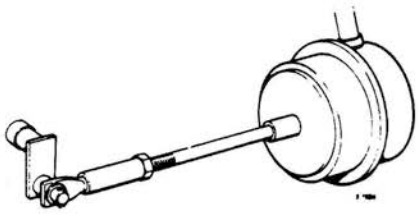
Tighten the locknut.



3 Pull out the pushrod and fit the end onto the pin. Fit the circlip.

4 Take the car out for a test drive and measure the charging pressure (see page 291-7).

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



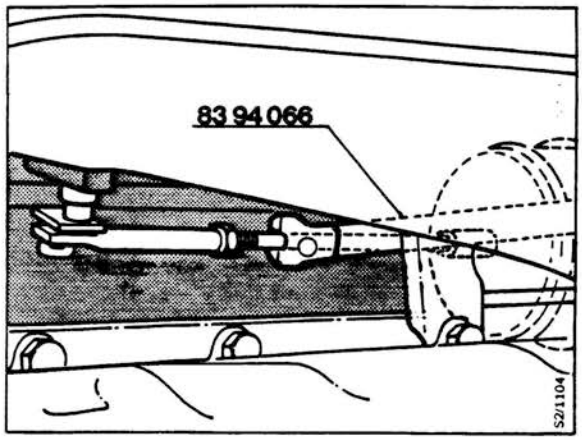
To adjust the basic setting for the charging pressure

Having noted the reading on the pressure gauge during the road test, adjust the pressure as follows:

1 Drive the car onto a car lift.

2 Undo the locknut on the diaphragm unit.

3 Rotate the pushrod using tool 83 94 066.



Caution

When adjusting the length of the pushrod, make sure that the tool is applied as close to the thread as possible. Turn the pushrod carefully to avoid scoring it. Scoring may cause the diaphragm unit bearing to bind and disrupt control of the charging pressure.

- To increase the charging pressure, rotate the pushrod clockwise.
- To reduce the charging pressure, rotate the pushrod anticlockwise.
- Nominal value: see the "Technical data" section.

4 Take the car out onto the road and check the pressure again, following the same procedure as before. If the charging pressure cannot be adjusted correctly, refer to the fault diagnosis table.

Fault diagnosis

Fault-diagnosis chart for incorrect basic setting for the charging pressure

Symptom	Possible cause	Check/remedy
Basic setting cannot be adjusted as directed	Defective waste-gate valve	Remove the exhaust pipe bend. Make a visual check of abutment surfaces between valve and turbine housing. Remove the anti-tamper seal and circlip and unhook the diaphragm push-rod from the waste-gate actuator. Check that the valve spindle moves freely. If valve defective, fit a new one.
	Bearing between diaphragm unit and pushrod binding	Check that the pushrod moves freely Replace defective diaphragm unit.
	Locked restriction in solenoid valve connection for hose to turbo compressor (connection "C").	**Note** Can be affected by temperature. Clean the restriction.

Fault-diagnosis chart, charging pressure

Symptom	Possible cause	Check/remedy
Maximum charging pressure too low (engine performance down)	Incorrectly adjusted basic setting for charging pressure	Check the basic setting of the waste-gate valve and adjust as necessary, as directed on page 291-7.
	Poor contact in wiring circuits between pressure transducer and ECU, pressure transducer and earth or in knock detector connector. Break in leads between knock detector and ECU, or pressure transducer and ECU.	Check connection of electrical leads to ECU. connector on bulkhead, pressure transducer (two connectors) and earth, and check the knock detector connector (in engine compartment).
		Check that leads are sound between knock detector and ECU and between pressure transducer and ECU. Rectify as necessary.
	Defective knock detector.	Fit a new knock detector.
	Defective pressure transducer	Check the pressure transducer (see subsection, "To check the pressure transducer"). Replace if defective.
	Solenoid valve fails to open	Check the solenoid valve (see subsection, "Checking the system components").
		If defective, replace the valve.
	Defective ECU.	Fit a new ECU.
	Knock detector senses abnormal engine vibration	Connect the test wiring loom with junction box (83 93 548) as detailed in section 291. Set the switch to "ON". If the indicator light flashes when the engine is under partial load, listen for abnormal noise from the engine. If no abnormal noise is detected, try fitting a new knock detector.
	Defective spring or binding pushrod in diaphragm unit	Try fitting a new diaphragm unit.
	Defective turbo compressor	Remove the exhaust pipe bend and the turbo compressor inlet.
		Make a visual check for damage to the compressor and turbine wheel. Replace a defective turbo compressor.

Symptom	Possible cause	Check/remedy
Charging pressure too high (also applies to marked excess surge of charging pressure on acceleration)-pressure switch triggered.	Leak in hose between turbo compressor and solenoid valve.	Check for leak. Replace leaking hose.
	Leak in hose between solenoid valve and diaphragm unit	Check for leaks. Replace a defective hose.
	Leak in diaphragm unit	Check for leaks. Replace a defective diaphragm unit.
	Cracked diaphragm unit	Check for leaks.
	Cracked diaphragm unit.	Check the fixing of the diaphragm unit to the bracket. Fit a new diaphragm unit.
	Leak in hose to pressure transducer.	Check for leaks. Replace defective hose.
Defective pressure	Check the pressure transducer transducer	transducer as detailed in section 291. Replace if defective.
	Solenoid valve fails to close because of binding plunger.	Check the APC system in the car. Replace a defective solenoid valve.
	Blocked restriction in solenoid valve outlet for hose to turbo compressor (connection "C").	N.B. Can be affected by temperature. Clean the restriction.
	Incorrect basic setting for charging pressure	Check the basic setting of the waste-gate valve in road test. (as detailed in section 291). Adjust as necessary.
	Short circuit in signal line from pressure transducer.	Check the lead between the pressure transducer and ECU. Rectify the short circuit.
	Defective ECU.	Check the APC system with a known good ECU fitted. If the symptom disappears, the ECU was defective. Discard the defective ECU.
	Binding bearing between waste-gate housing and valve.	Remove the anti-tamper seal and circlip, and unhook the diaphragm unit pushrod from the waste-gate actuator. Check that the spindle moves freely. Replace a defective waste-gate valve.
	Binding bearing between pushrod and diaphragm unit.	Fit a new diaphragm unit.

Symptom	Possible cause	Check/remedy
Charging pressure normal but no drop in pressure despite knocking/pinking	APC system not working.	Refer to the section on checking the APC system.
	Poor contact in knock-detector lead.	Check connector between knock detector and main wiring loom.
	Knock detector not tightly fitted.	Check that knock detector fitted properly. Refer to the section on removal of system components.
	Defective knock detector	Try fitting a new knock detector.
	Defective ECU.	Try fitting a new ECU.
	Binding bearing between waste-gate housing and flap valve.	Remove the anti-tamper seal and circlip, and unhook the diaphragm unit pushrod from the waste-gate actuator. Check that the spindle moves freely. Replace a defective waste-gate valve.
	Binding bearing between pushrod and diaphragm unit.	Fit a new diaphragm unit.
Solenoid valve working at idling speed. (Irregular chattering noise)	Idling speed too low. Break in circuit between pressure transducer and ECU.	Increase the idling speed to approx. 875 ± 75 r/min. Check the electrical leads. Rectify any breaks.
	Defective pressure transducer	Check the pressure transducer (as detailed in section 291. Replace if defective.
	Poor contact/break in circuit between knock detector and ECU.	Check connection of electrical leads at connector in engine compartment and at ECU.
		Check for a break in the circuit between the knock detector and the ECU. Rectify any breaks.
	Knock detector not tightly fitted.	Check that knock detector fitted properly. (See component-replacement section)
	Defective knock detector	Fit a new knock detector.
	Defective ECU.	Fit a new ECU.

Fault-diagnosis chart for system components

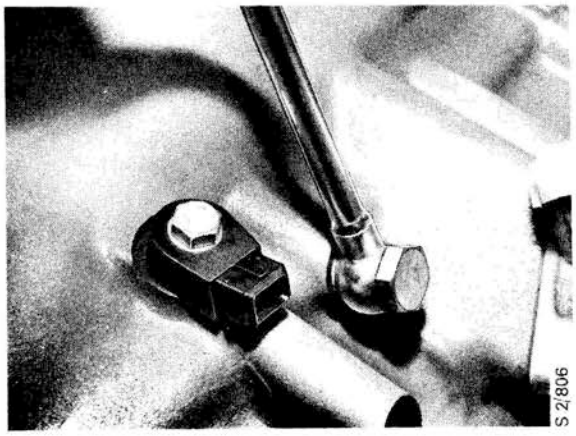
Symptom	Possible cause	Check/remedy
Solenoid valve not working in APC system test.	No power between ECU pin 14 (+) and ECU earth pin 6 (-). **N.B.** Check with loom connector plugged in to ECU.	Check that fuse 5 is sound and, if necessary, clean the contacts. Check the lead connections at the power distribution panel and control unit.
		Rectify as necessary.
	Poor contact in connector for knock detector.	Check lead connections at wiring loom connector in engine compartment and at ECU.
	Check for break in lead between knock detector and ECU.	Rectify as necessary.
	Knock detector not properly tightened	Check that knock detector is properly tightened (as detailed in section 291).
	Defective knock detector.	Test the APC system with a new knock detector fitted. If the fault disappears, the knock detector was defective. Discard the defective knock detector.
	Solenoid valve not working despite power supply in excess of 5 V. **N.B.** Make sure that the connector for the valve is plugged in.	Check the solenoid valve, as directed under "To check the solenoid valve".
	Defective pressure transducer	Check the pressure transducer (as detailed in section on component checks).
	Defective ECU	Check the APC system with a new ECU fitted. If the fault disappears, the ECU was defective. Discard the defective ECU.

Component replacement

To remove the knock detector

Tools: Long extension bar (3/8-in drive)
13 mm socket (or 12 mm if bolt blue)
Ratchet handle
Torque wrench

1 Unplug the knock-detector connector.



2 Remove the knock detector from the block.

To fit

1 Thoroughly clean the abutment surfaces.

2 Bolt the knock detector to the block.

N.B.
It is vital that the knock detector be tightened to the correct torque, as the torque loading affects the strength of the signal to the ECU.

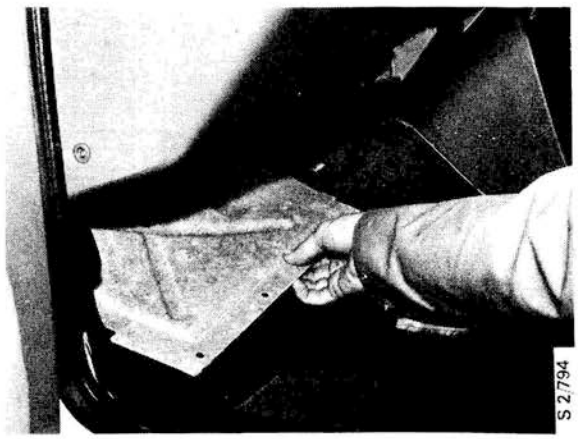
3 Tighten to a torque of 14 ± 5 Nm (10.5 ± 3.7 lbf ft).
If securing bolt blue: 8 Nm (5.9 lbf ft).

4 Plug in the knock-detector connector.

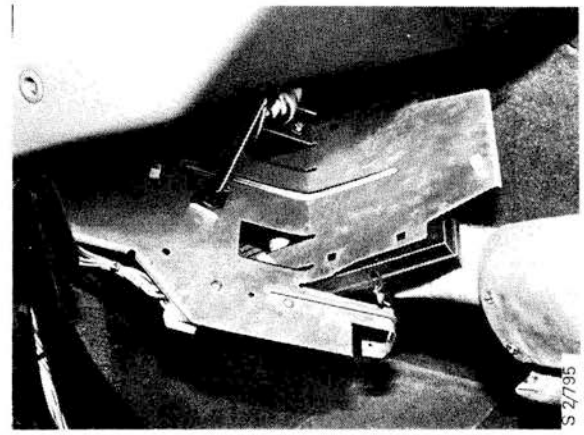
To remove the APC bracket (1985 models only)

1 Remove the cover from underneath the instrument panel (LH side -5 screws).

2 Unplug the connector from the APC control unit.



3 Undo the three screws and remove the APC bracket by pulling it forward and down.

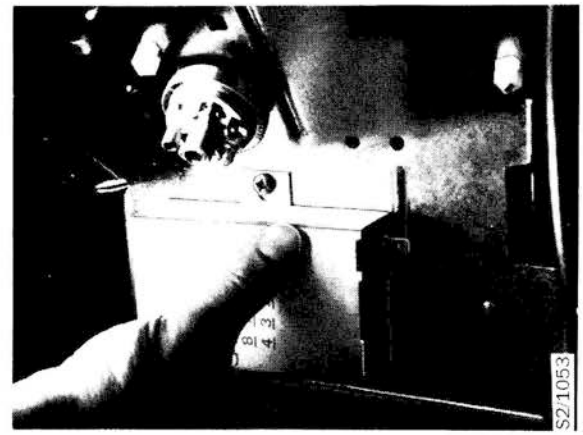


Refit in the reverse order.

To remove the APC bracket (As from 1986 models)

1 Remove the panel underneath the instrument panel (LH side - 5 screws).

2 Unplug all connectors from the electronic control unit, cruise control unit, pressure switch and windscreen-wiper delay relay and push the clip for the wiring loom out of the bracket.



3 Pull the bracket forwards and upwards as far as it will go and bend the panel so that the bracket will clear the edge of the carpeting.

4 Remove the bracket.

To fit the APC bracket

1 Press the clip for the wiring loom into the bracket and remove the cover from the steering column bearing to make for better access.

2 Slide the bracket into position and bend back the panel.

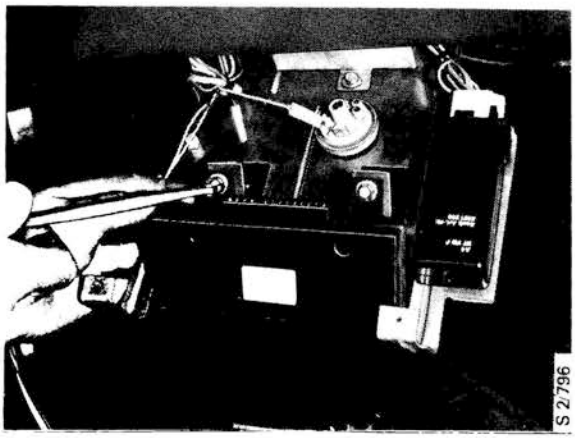
3 Plug on the connectors for the APC control unit, pressure switch, cruise control unit and windscreen-wiper delay relay.

4 Refit the panel.

To remove the electronic control unit

1 Remove the APC bracket (see "To remove the APC bracket").

2 Undo the three self-tapping screws securing the control unit to the bracket and remove the control unit.



1985 models

As from 1986 models

To fit

1 Check that the anti-tamper seal is fitted (1985 models only).

2 Position the control unit on the bracket.

3 Fit the self-tapping screws to secure the control unit to the bracket.

4 Fit the APC bracket (see "To fit the APC bracket").

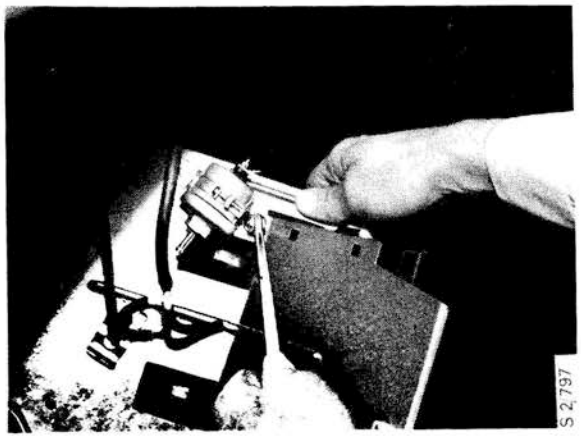
To remove the pressure transducer

1 Remove the APC bracket (see the section, "To remove the APC bracket").

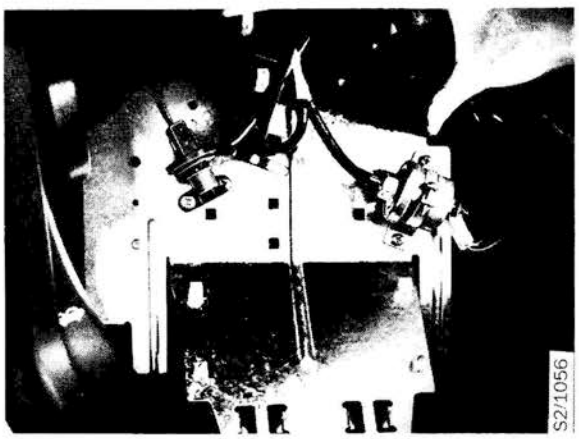
2 Disconnect the electrical leads to the pressure transducer.

3 Disconnect the air hose from the pressure transducer.

4 Remove the pressure transducer from the bracket.



1985 models



As from 1986 models

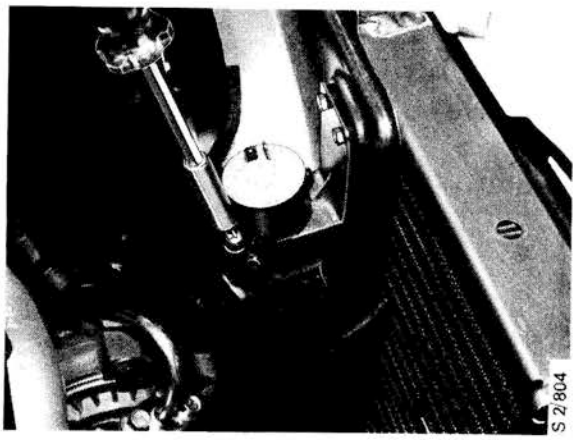
Refit in the reverse order.

To remove the solenoid valve

1 Unplug the electrical connector from the solenoid.

2 Loosen the hose clips and disconnect the hoses from the valve.

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



1985 models

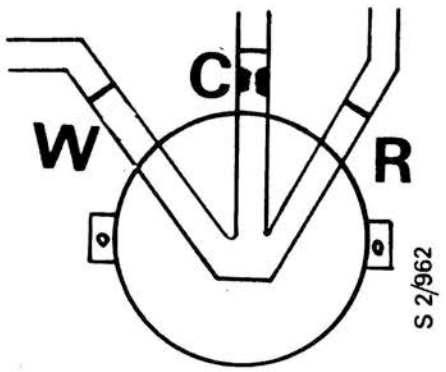
As from 1986 models

To fit

1 Positon the solenoid valve on the bracket.

2 Refit the screws.

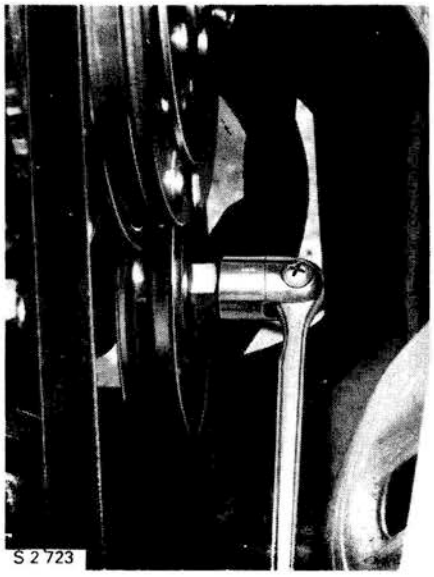
3 Reconnect the hoses to the valve.



4 Reconnect the solenoid connector.

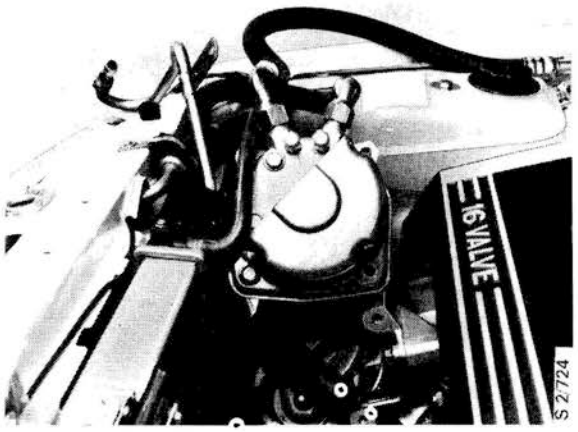
To remove the turbo unit

1 Release the tension on the AC compressor belt by slackening the belt tensioner.



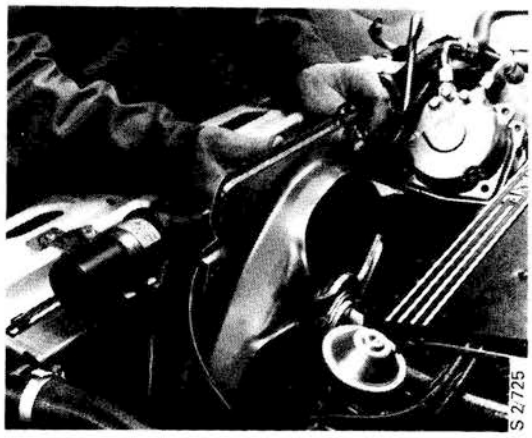
2 Undo the top pipe coupling on the air-cooled oil cooler and undo the clips securing the pipe to the radiator.

3 Remove the AC compressor mounting bolts. Insert a sheet of metal to protect the oil cooler and lift the compressor towards the expansion tank.



4 Remove the solenoid valve from its mounting on the radiator and disconnect the electrical leads.

5 Unplug the electrical leads at the radiator fan. Unbolt and remove the fan.



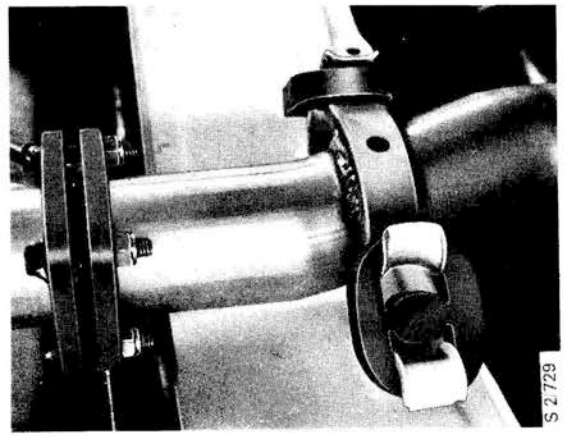
6 Unplug the electrical connectors for the air mass meter, undo the toggle fasteners securing the air mass meter to the air cleaner and pull the rubber socket connector off the turbo unit.

7 Disconnect the turbo pressure pipe from the compressor.

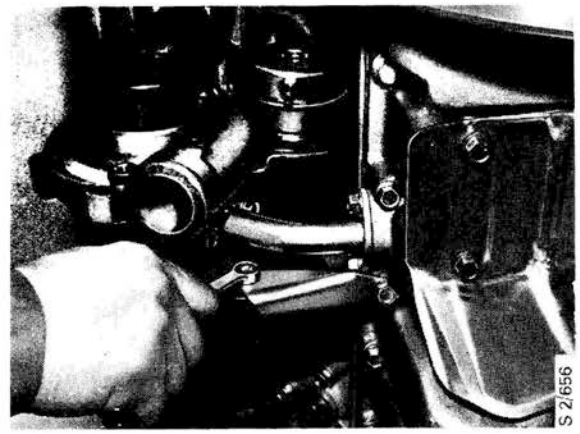
8 Remove the bolts securing the oil pipe to the turbo unit. Undo the clip securing the oil pipe to the cylinder head, disconnect the oil pipe banjo coupling from the block and undo the clip on the inlet manifold.

9 Unbolt the exhaust pipe from the turbo compressor.

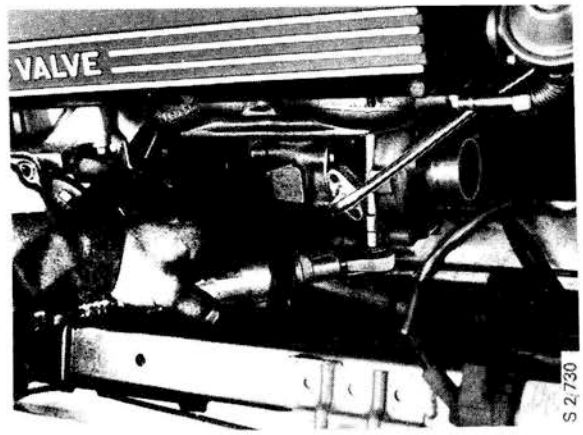
10 Unhook the front rubber hangers for the exhaust pipe.



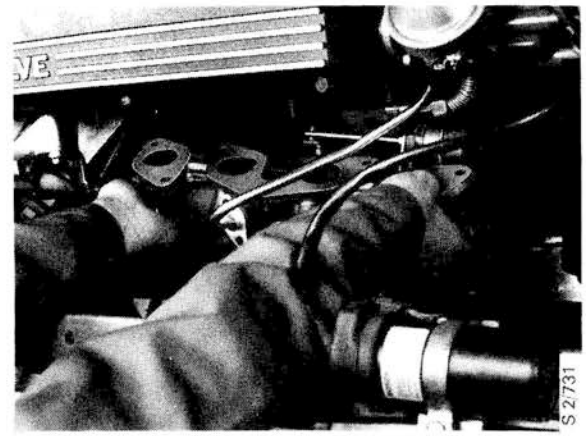
11 Remove the steady bar between the sump and the compressor. Remove the securing bolts for the oil return pipe. Blank off the aperture to prevent washers or nuts from the exhaust manifold dropping inside during removal.



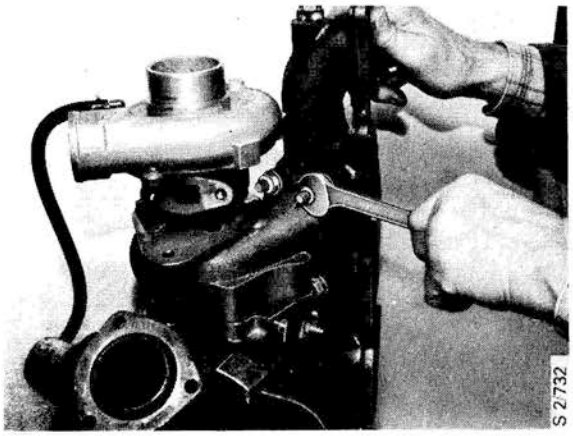
12 Remove the nuts securing the exhaust manifold to the cylinder head.



13 Lift off the exhaust manifold with the turbo unit assembly.



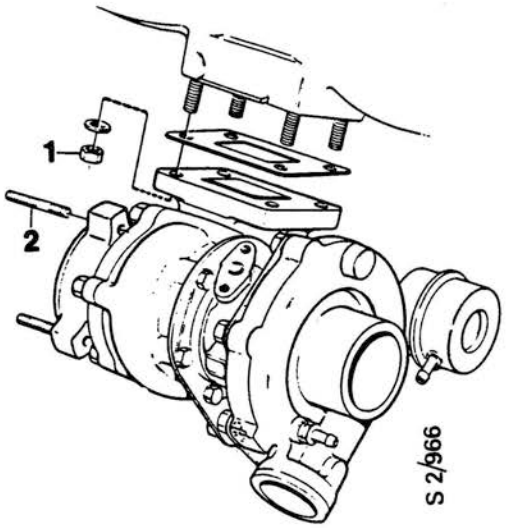
14 Mount the assembly in a vice and remove the nuts holding the units together.



To fit

1 Fit the nuts securing the turbo unit to the exhaust manifold.

N.B.
Fit new locknuts with the tab turned inwards.



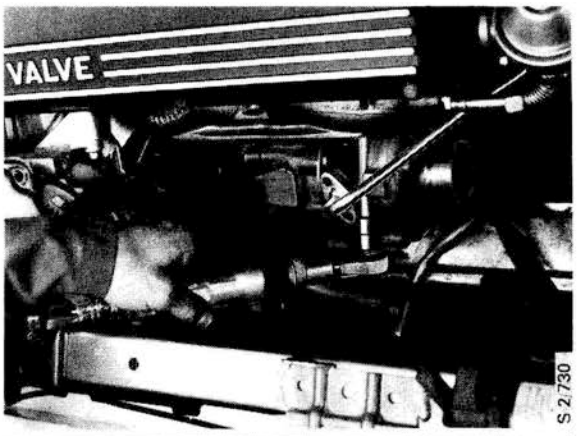
2 Fit a new gasket over the studs for the exhaust manifold and fit the exhaust manifold and turbo unit assembly.

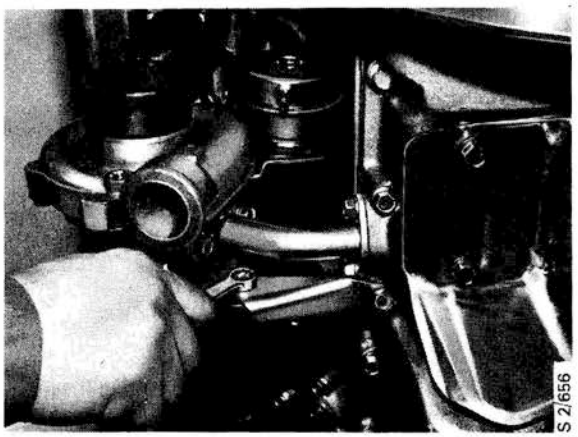
When refitting the unit, always use new locknuts on the studs (see 1 and 2 as shown). New locknuts are precoated with lubricant.

Tightening torque: 40 Nm (29.5 lbf ft)

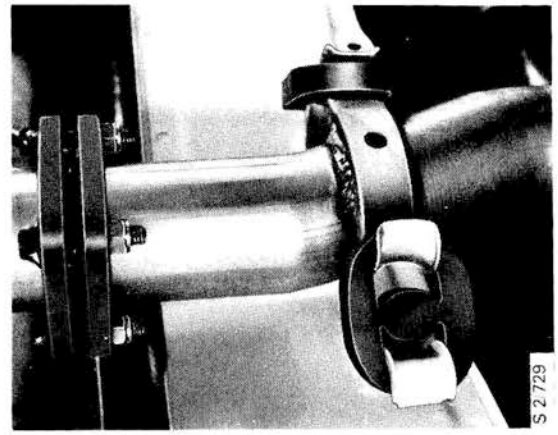
3 Fit the clip holding the turbo oil supply pipe to the inlet manifold. Connect and tighten the banjo coupling to the engine block. Make sure that the copper washers are sound. Secure the pipe to the turbo unit.

4 Fit the return oil pipe and the steady bar between the turbo unit and the crankcase (sump).





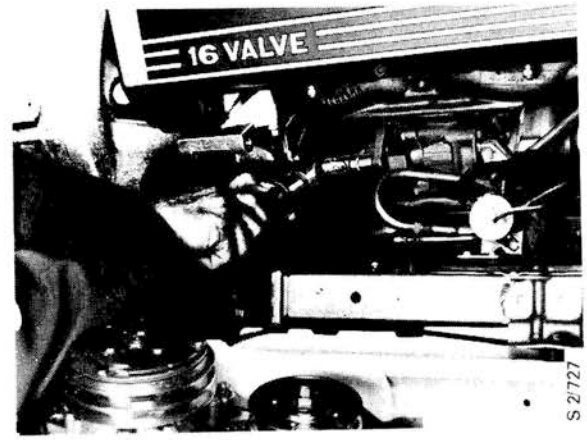
5 Hook up the rubbers for the front exhaust hanger.



6 Bolt the exhaust pipe to the turbo compressor.

N.B.
Always fit new locknuts with the tab turned outwards.

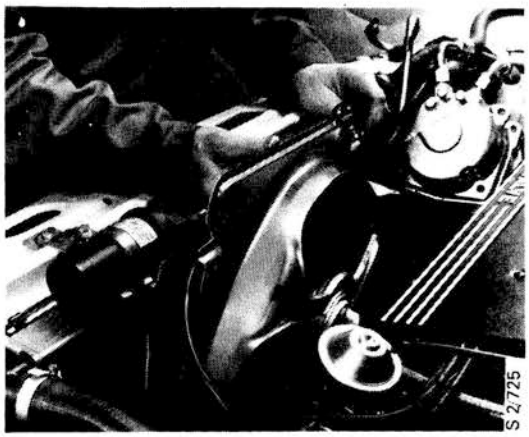
Tightening torque: 25 Nm (18.5 lbf ft).



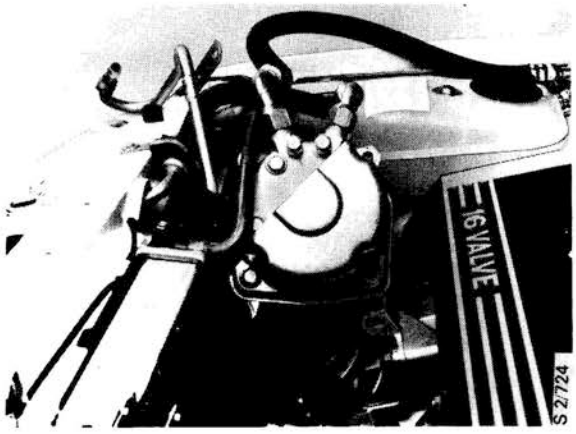
7 Fit the turbo pressure pipe to the compressor.

8 Fit the air mass meter and rubber socket connector between the air cleaner body and the inlet side of the turbo compressor.

9 Fit the fan and the solenoid valve, plug in the connectors and secure the electrical leads in their clips. Connect the return hose to the solenoid valve.

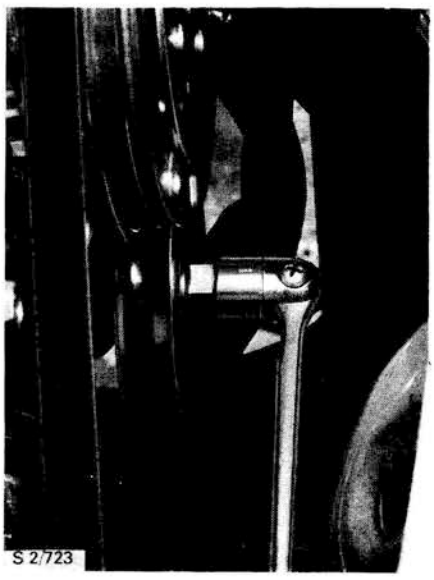


10 Insert a sheet of metal to protect the oil cooler and fit the AC compressor.



11 Reconnect the oil pipe to the oil cooler and secure the pipe clip to the radiator.

12 Fit the compressor belt and tighten it to the correct tension (see section 216).



Alphabetical Section Guide

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