

**GROUP 07****ENGINE COOLING SYSTEM****INDEX**

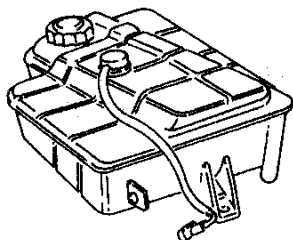
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ILLUSTRATED INDEX

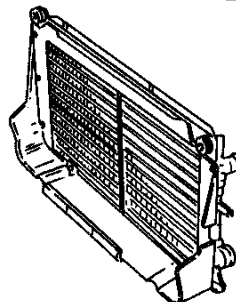
EXPANSION TANK

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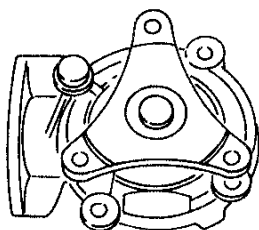
RADIATOR

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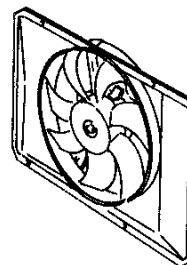
WATER PUMP

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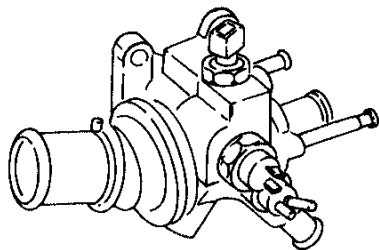
ENGINE COOLING FAN

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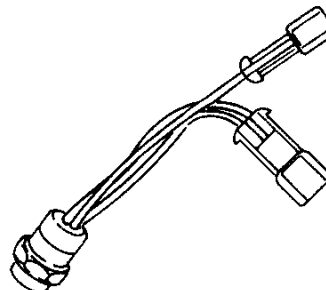
THERMOSTAT UNIT

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ELECTRIC FAN THERMAL CONTACT

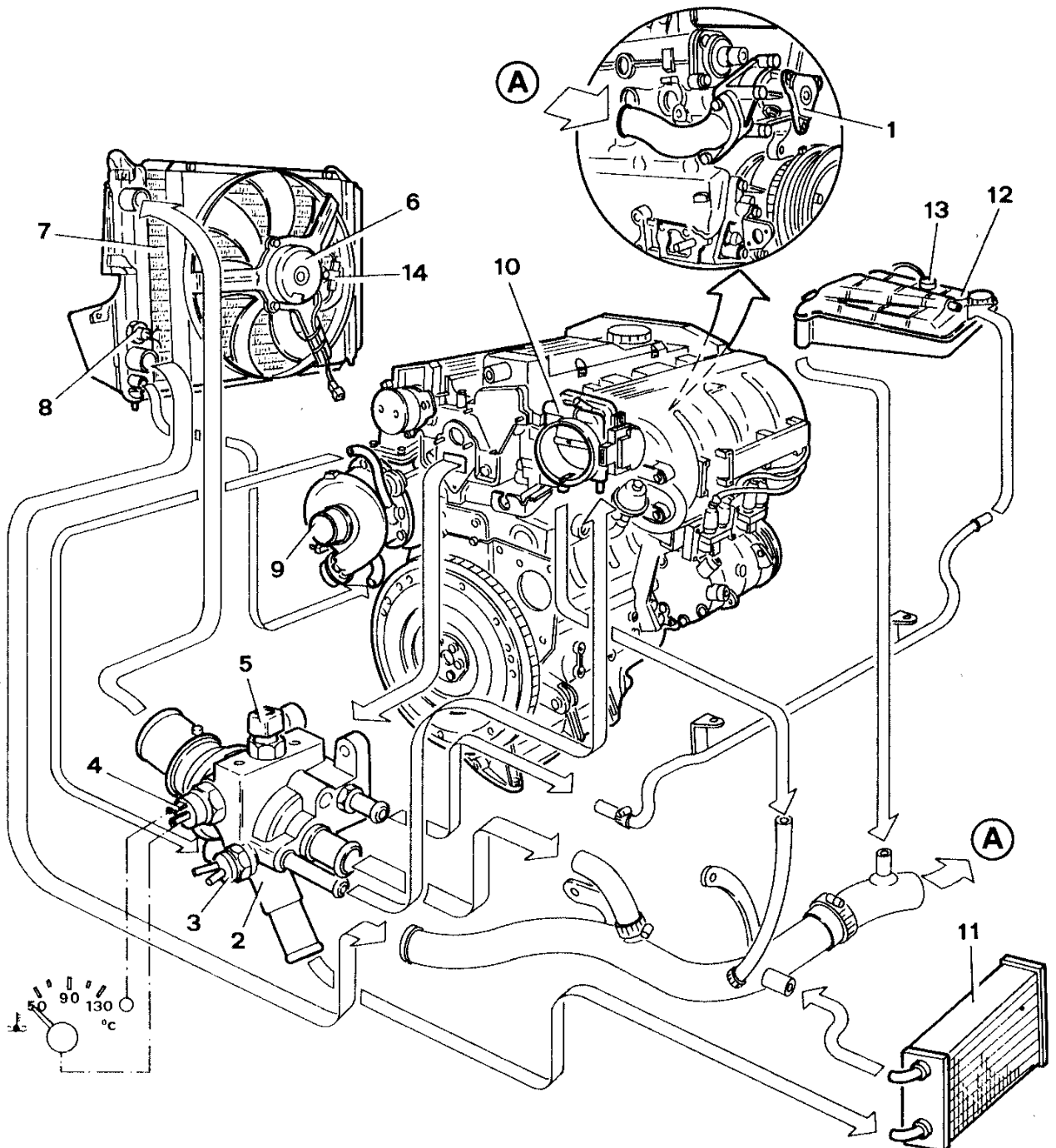
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COOLING SYSTEM

- 1. Water pump
- 2. Thermostatic cup
- 3. E.G.R. Thermovalve
- 4. Engine cooling temperature gauge sender and maximum temperature warning light contact
- 5. Engine coolant temperature sensor (NTC)
- 6. Cooling fan
- 7. Radiator
- 8. Fan control thermal contact
- 9. Turbocompressor
- 10. Throttle body
- 11. Heater
- 12. Expansion tank
- 13. Engine coolant minimum level sensor
- 14. Supplementary resistance





DESCRIPTION

The cooling system is of the sealed type with forced circulation obtained by a centrifugal pump activated by the crankshaft via a Poly- V belt.

A thermostatic valve located on the rear side of the cylinder head keeps the engine at the optimum temperature: it opens when the coolant reaches a temperature of $\sim 83\text{ }^{\circ}\text{C}$.

The radiator cools the liquid by dynamic air flow and by a two-speed electric fan which is controlled by a two-stage thermal contact located on the radiator. A supplementary resistance and a relay activate the second speed of the fan if the temperature reaches $97\text{ }^{\circ}\text{C}$.

In the versions with an automatic heater and air conditioner, the second speed is engaged both when the temperature reaches the second level and when the first speed has been engaged for 10 seconds.

The expansion tank supplies the circuit if the level begins to fall and acts like a lung, absorbing the variations in volume of the liquid due to the variations in temperature. It also ensures that air is bled from the system.

The circuit is fitted with a sensor which carries out the following functions: engine coolant temperature sender for the gauge and maximum temperature warning light contact for the instrument panel. This warning light will come on when the temperature exceeds $120\text{ }^{\circ}\text{C}$.

OPERATION OF THE CIRCUIT

The liquid, after cooling the engine, reaches the thermostat unit via the cylinder head. From here, if the temperature is below $83\text{ }^{\circ}\text{C}$ it is sucked up by the pump through a return manifold.

If the temperature is above this value the liquid is sent via an aperture in the thermostat, towards the radiator. After being cooled in the radiator the liquid returns thorough a manifold, to the pump which channels it again to the engine.

A hose leads from the radiator through which the liquid

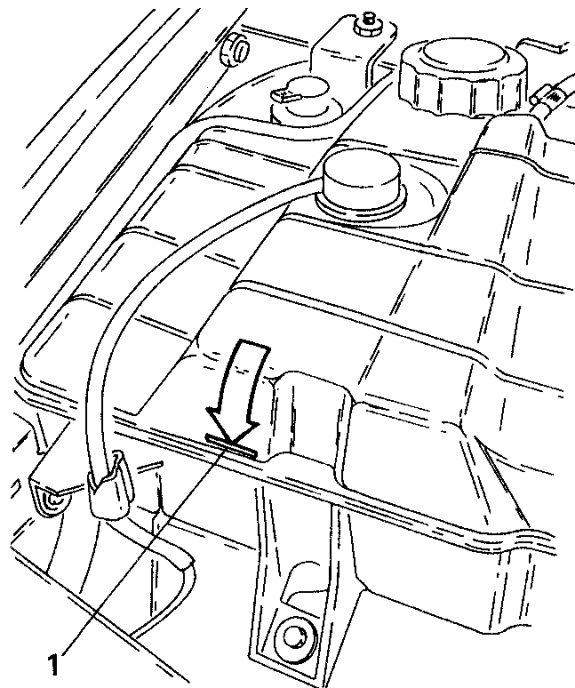
is sent to cool the turbocompressor. It then returns to the thermostatic cup. Two hoses lead from the thermostatic cup: one heats the throttle valve and one the passenger compartment. The liquid is returned through the intake manifold to the pump.

Another hose leaves the thermostatic cup and this serves to deaerate the system and return the liquid to the expansion tank. The expansion tank supplies the circuit by way of a hose which is connected to the manifold returning the liquid to the pump.

CHECKING LEVEL AND REPLACING ENGINE COOLANT

Check

1. Visually check that the level of the liquid when cool reaches the mark on the expansion tank. If not top-up the system with the specified fluid.

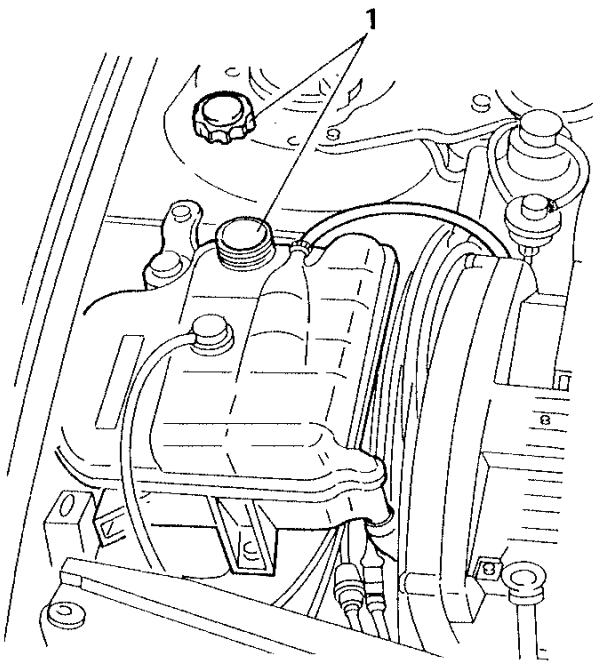


**Substitution**

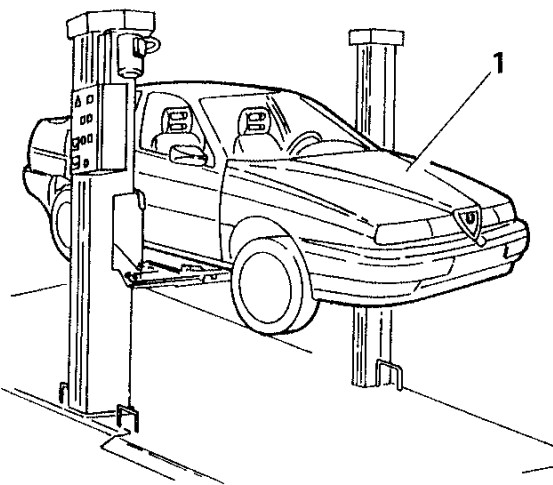
- Place the vehicle on a lift.
- 1. Unscrew and remove the cap from the expansion tank.



WARNING:
Never remove the cap from the expansion tank when the engine is hot!



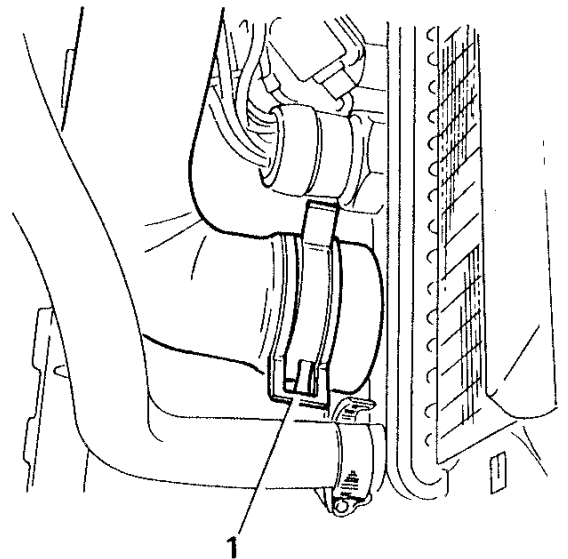
- 1. Raise the vehicle on the lift.



- 1. Loosen the clamp securing the the engine coolant outlet sleeve from the radiator and disconnect the sleeve. Drain off the engine coolant into a suitable container placed under the vehicle.



WARNING:
The antifreeze mixture used as an engine coolant will damage painted surfaces.



- Re-connect the sleeve to the radiator along with all the other hoses which were previously disconnected, checking that all the clamps have been tightened.
- Fill up the system until the liquid reaches the MAX mark on the expansion tank.
The recommended quality and quantity of the engine coolant liquid is given in the following table.

Minimum temperature: - 40 °C		
Concentrated antifreeze	Alfa Romeo Antifreeze	5.0 litres (55%)
Distilled water		4.1 litres (45%)
Ready-for-use antifreeze	Alfa Romeo Climafluid Permanent - 40 °C	9.1 litres



- Start the engine and run it to normal operating temperature until the thermostat opens and frees the residual air contained in the system.
- When the engine is cold, top-up the system until the liquid reached the mark on the expansion tank.
- Screw the pressurized cap back on to the expansion tank.

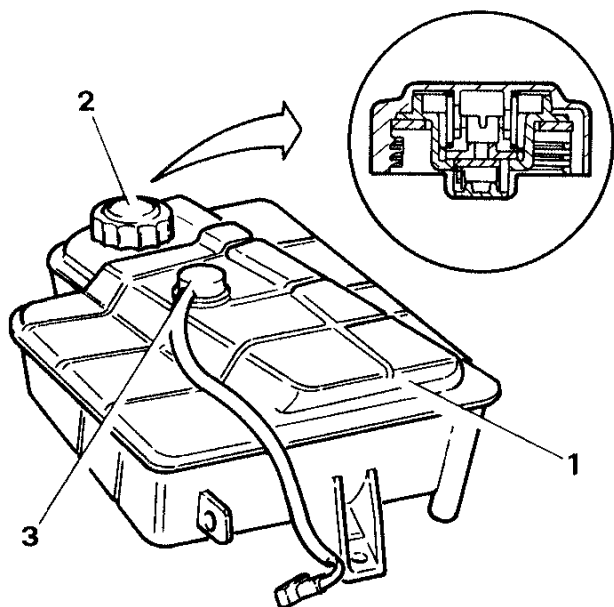
**WARNING:**

It is not advisable to mix different types or makes of antifreeze!

Do not use rust-proofing additives as these may not be compatible with the antifreeze mixture!

EXPANSION TANK

The expansion tank supplies the cooling system and absorbs the variations in volume of the liquid caused by the variations in engine temperature.



1. Expansion tank
2. Pressurized cap
3. Engine coolant minimum level sensor

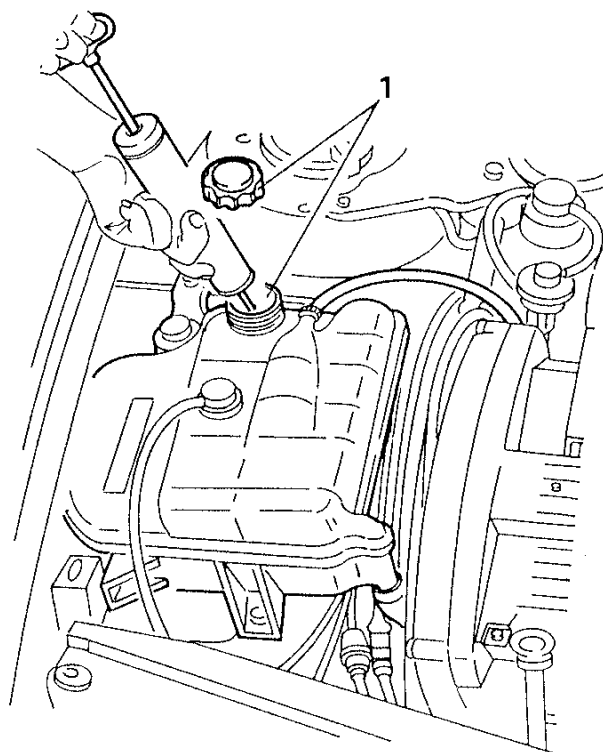
The expansion tank also allows air to leave the circuit, through a hose leaving the thermostatic cup, by means of a calibrated valve on the pressurized cap.

This valve also has a "washing" function, permitting external air to enter when there is a vacuum in the circuit caused by the cooling of the engine.

The engine coolant minimum level sensor is located on the expansion tank.

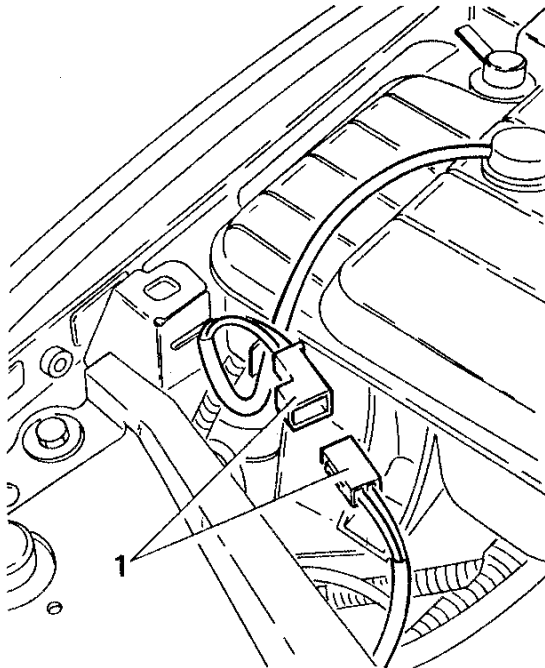
REMOVAL/REFITTING

- Disconnect the negative (-) cable from the battery.
- 1. Using a suitable syringe, empty the expansion tank.

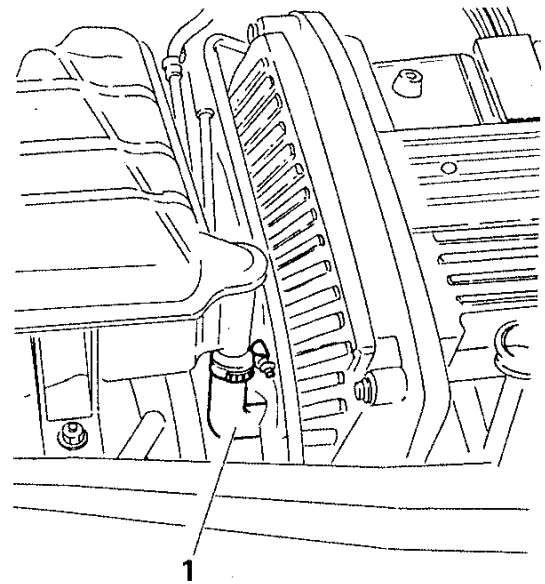




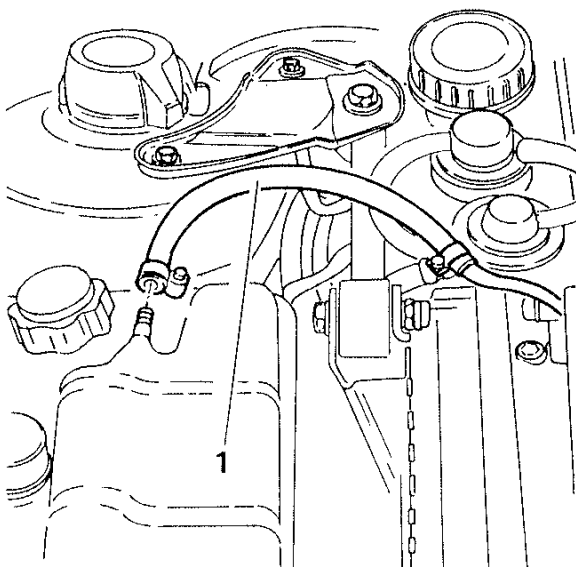
1. Disconnect the electrical connection from the engine coolant minimum level sensor.



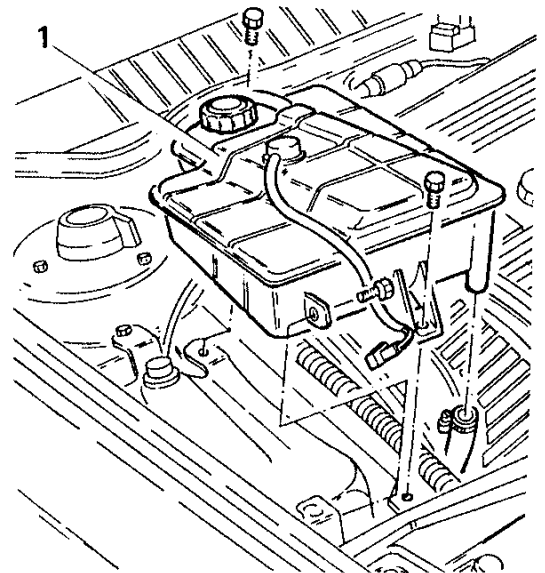
1. Disconnect the engine coolant delivery hose from the expansion tank.



1. Disconnect the deaeration and engine coolant return hose from the expansion tank.



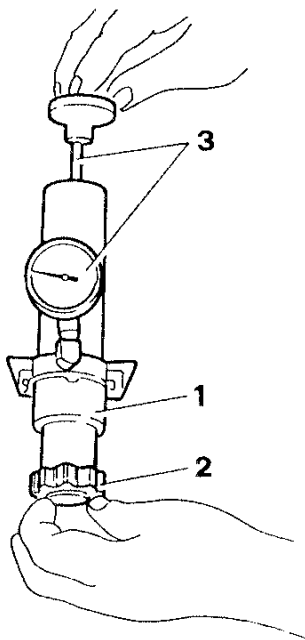
1. Loosen the screws and remove the expansion tank.





PRESSURIZED CAP SEAL TEST

1. Tighten the connection onto the lower end of the test instrument.
2. Fit the pressurized cap of the expansion tank onto the connection.
3. Manually pressurize the piston and check that the valve opens at the specified value.

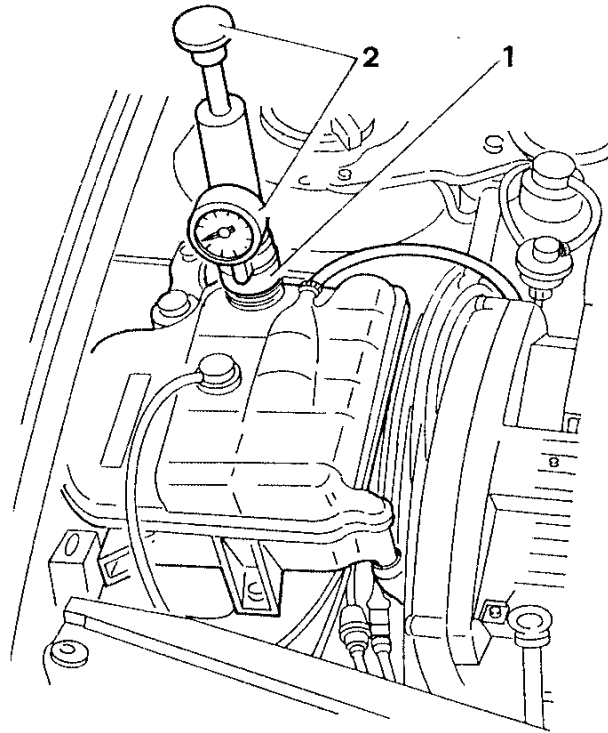


Pressure setting of pressurized cap

$0.98 \pm 0.1 \text{ bar (} 1 \pm 0.1 \text{ kg/cm}^2\text{)}$

ENGINE COOLANT SYSTEM SEAL TEST

- Unscrew and remove the pressurized cap from the expansion tank.
1. Screw the test instrument and connection onto the neck of the expansion tank.
 2. Manually pressurize the circuit and check that the pressure is maintained at the correct level. If not check that there are no leaks from the sleeves or the radiator.



Pressure of hydraulic control circuit

$1.08 \text{ bar (} 1.1 \text{ kg/cm}^2\text{)}$



WARNING:

For safety reasons when carrying out these tests with the test instrument the pressure must not exceed $1.38 \text{ bar (} 1.4 \text{ kg/cm}^2\text{)}$.



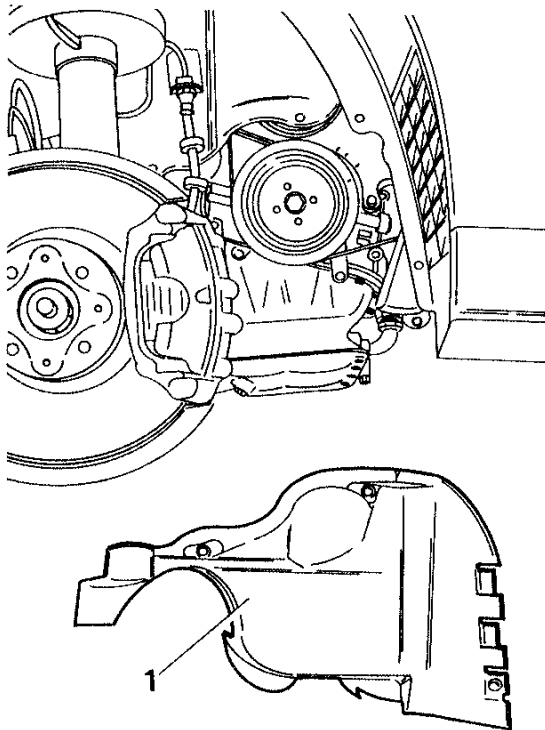
WATER PUMP

The water pump is of the centrifugal type with paddles. The body of the pump is made of aluminium alloy and the rotor of phenolic resin.

Fixed to the engine block it is operated by a Poly V drive belt driven by the crankshaft. A gasket ensures that the seal is made between the engine block and the pump. The water pump is constantly in use and can therefore guarantee that the cooling liquid is constantly circulated.

REMOVAL/REFITTING

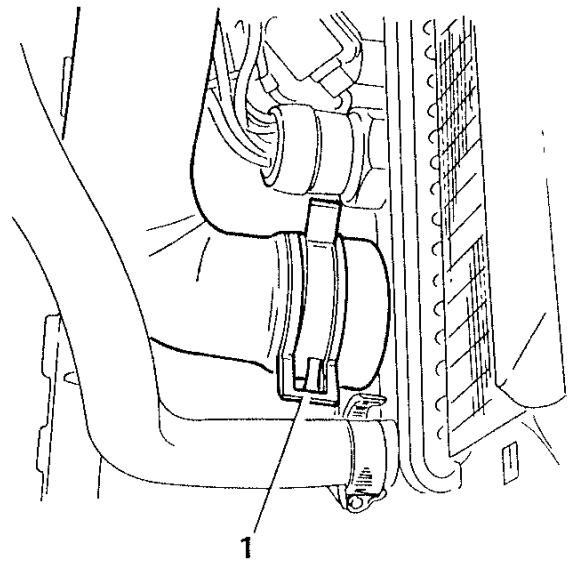
- Place the vehicle on a lift.
 - Disconnect the negative (-) cable from the battery.
 - Remove the front right-hand wheel.
1. Remove the dustguard from the front right-hand wheel arch.



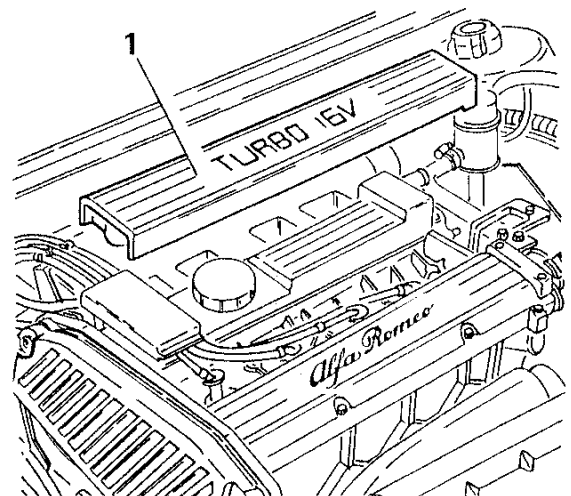
1. Loosen the clamp securing the engine coolant outlet sleeve to the radiator and disconnect the sleeve. Drain off the engine coolant into a suitable container placed under the vehicle.

**WARNING:**

The antifreeze mixture used as an engine coolant will damage paintwork.

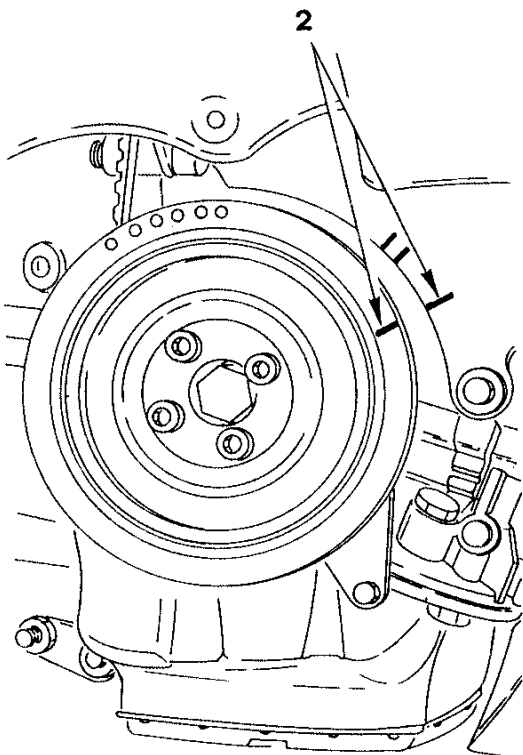
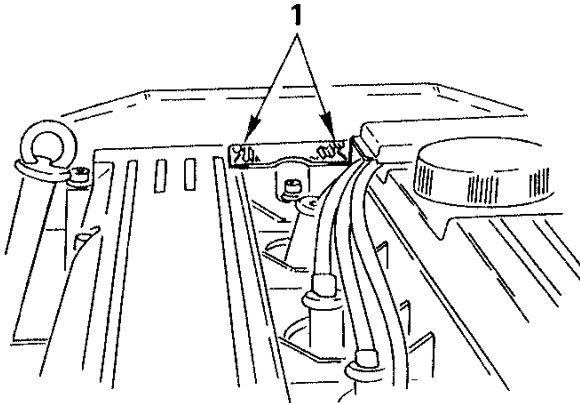


1. Remove the spark plug cover.

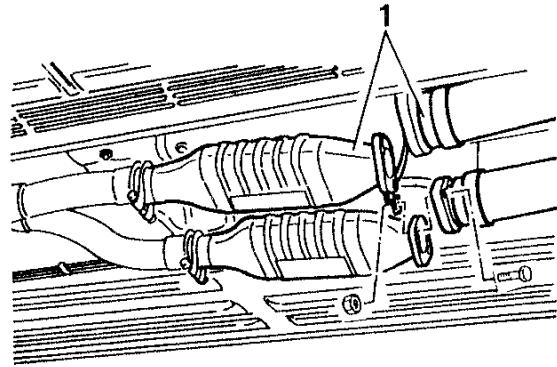




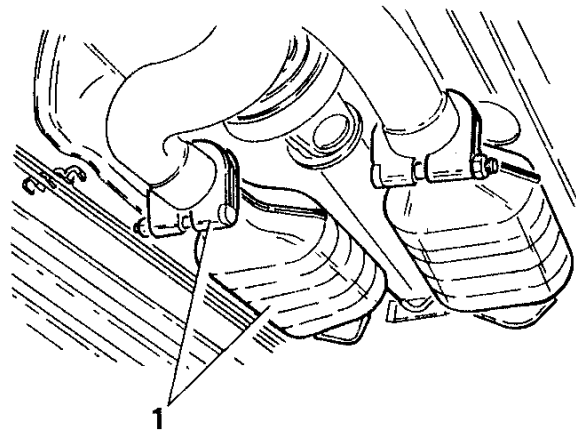
- Check that the piston of cylinder n° 4 is at T.D.C. in the firing phase operating as follows:
 1. Check that the notch on the side of the timing pulley coincides with the reference marks on the timing cover.
 2. Check that the notch on the crankshaft pulley coincides with the one on the timing belt cover.



- Raise the vehicle on a lift.
- 1. Disconnect the two flanges of the front section of the exhaust pipe from the catalytic converters.

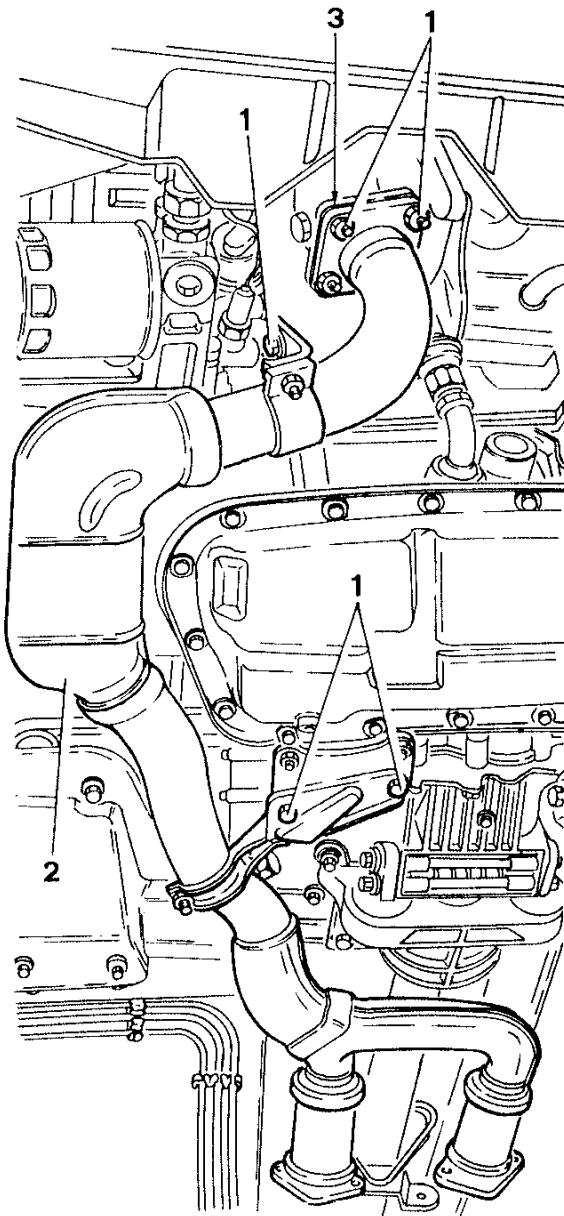


1. Loosen the collars and remove the two catalytic converters.

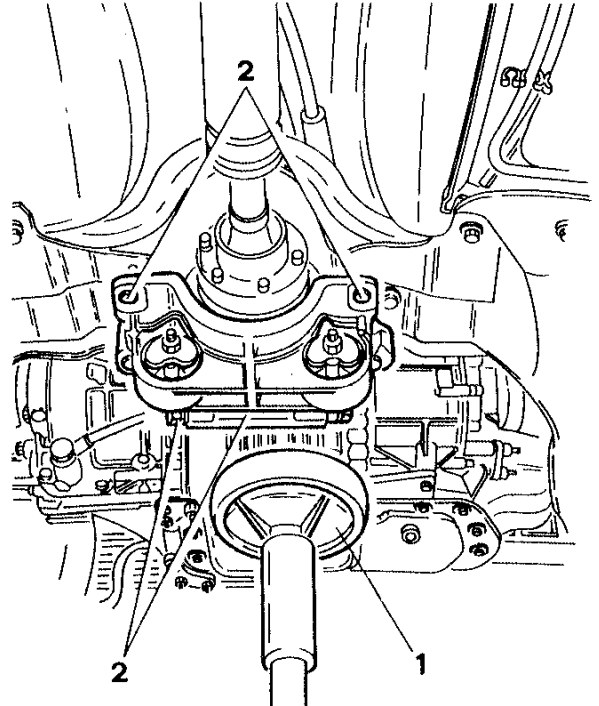




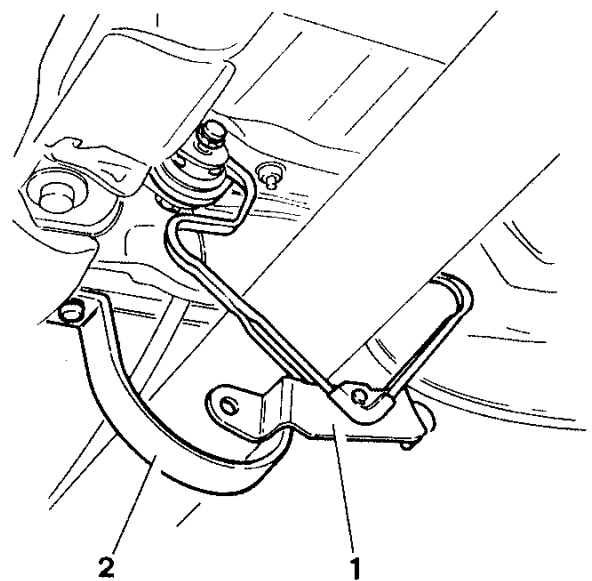
1. Loosen the screws and nuts securing the front section of the exhaust pipe to the turbocompressor and to the support brackets.
2. Remove the front section of the exhaust pipe.
3. Remove the gasket.



1. Place a suitable column lift under the central differential.
2. Loosen the screws and bolts and remove the rear engine support.

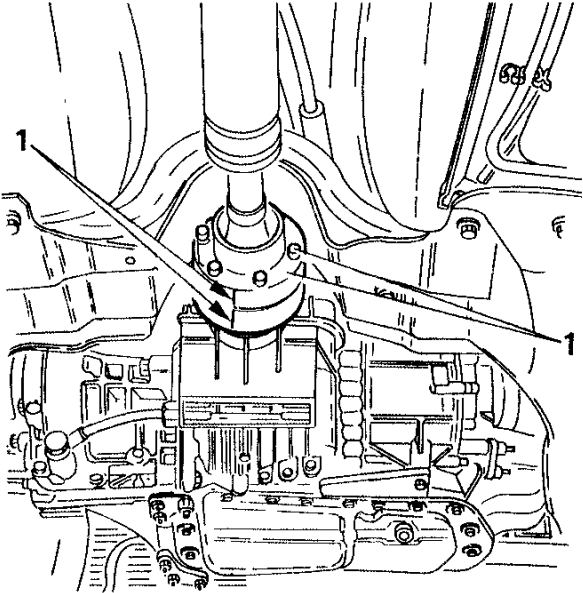


- Remove the column lift.
1. Remove the flexible support securing the exhaust pipe.
 2. Remove the drive shaft safety bracket.

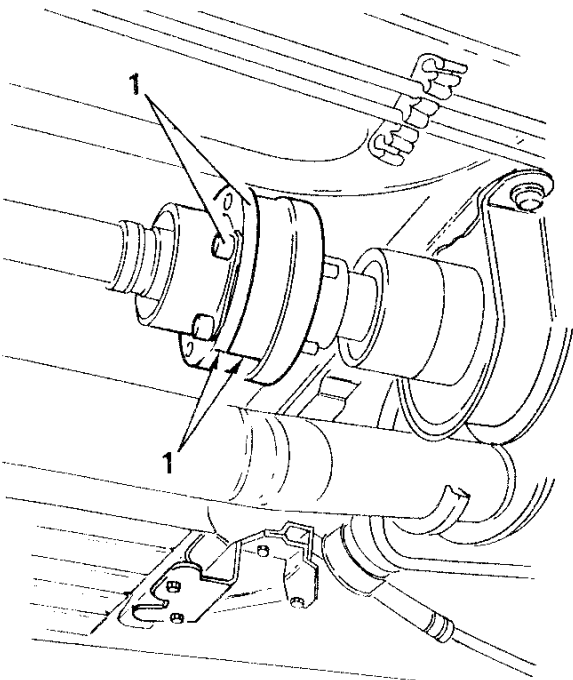




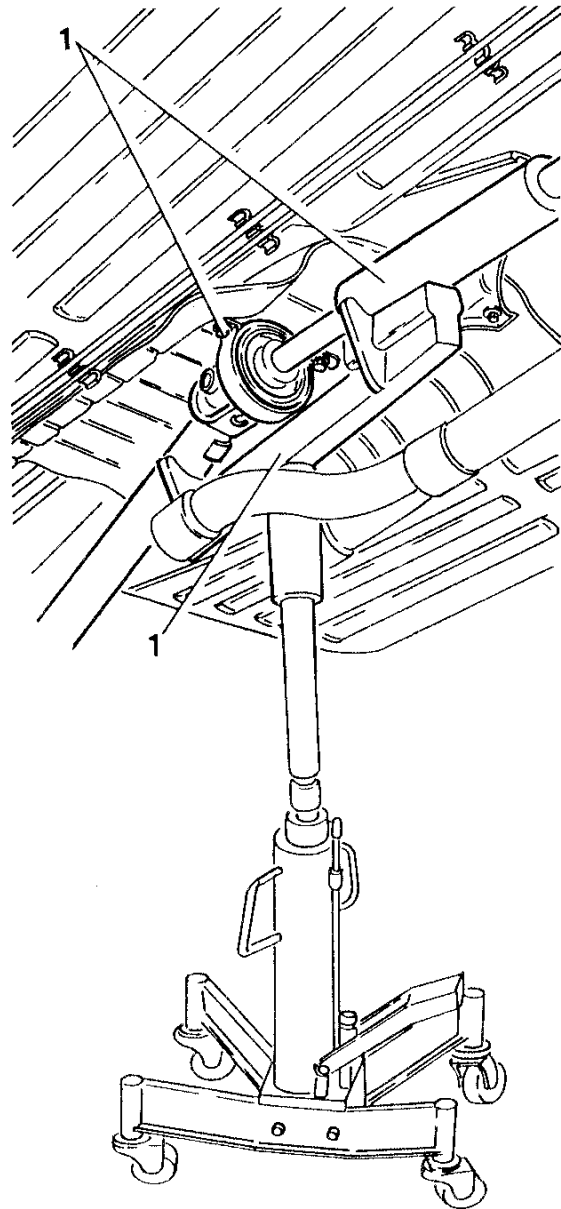
1. Make reference marks on the flange forming the connection between the front section of the drive shaft and the central differential and separate them after removing the relative screws.



1. Make reference marks on the flange forming the connection between the front and rear sections of the drive shaft and separate them after removing the relative screws.

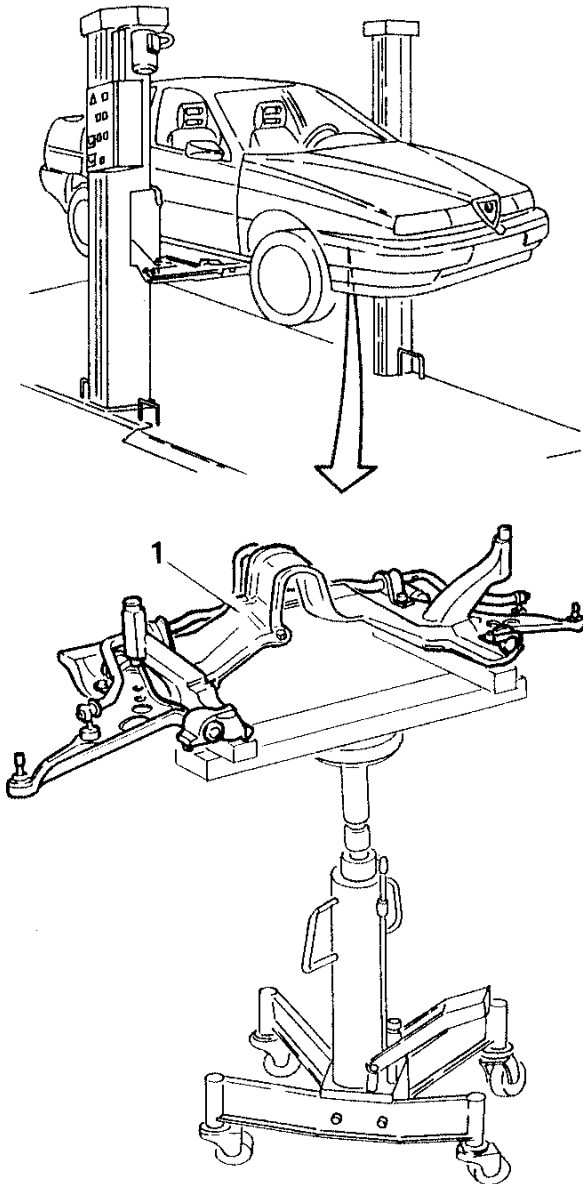


1. Support the front and central sections of the drive shaft with a suitable tool and remove them after loosening the screws of the central flexible support.

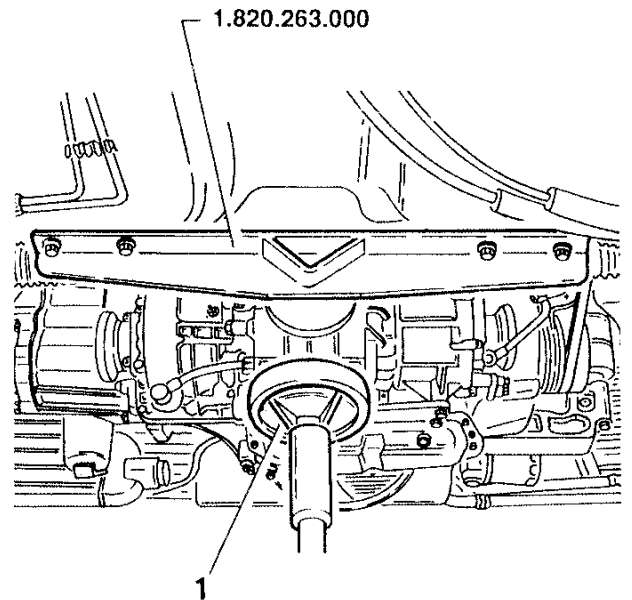




1. Loosen the screws and remove the complete cross-member together with the swinging arms (see GROUP 21).

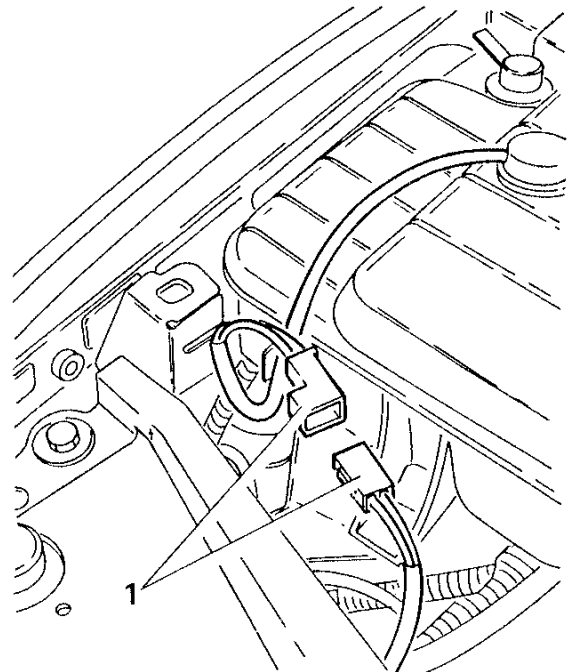


1. Place a suitable column lift under the central differential and raise just enough for the engine rear support tool N° 1.820.263.000 to be fitted.



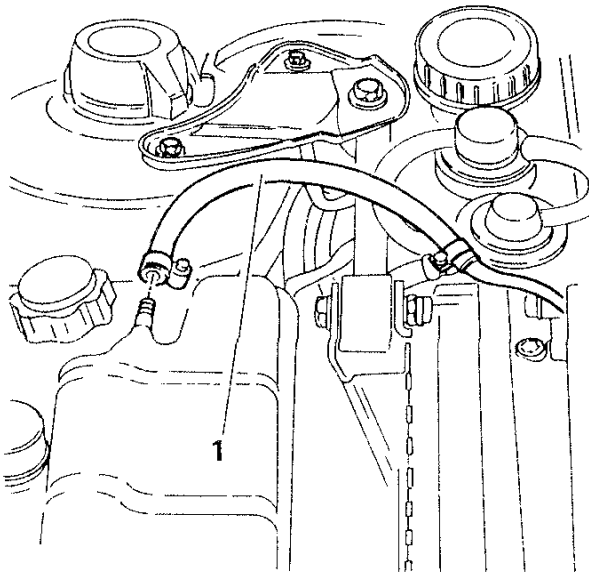
– Lower the vehicle.

1. Disconnect the electrical connection of the engine coolant minimum level sensor.

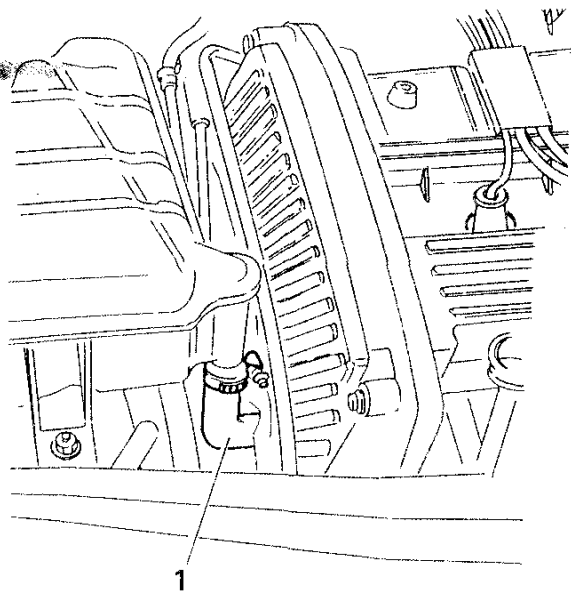




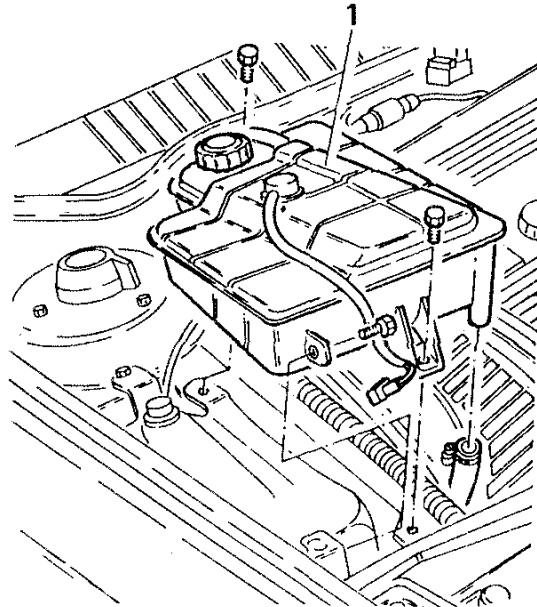
1. Disconnect the engine coolant return and deaeration hose from the expansion tank.



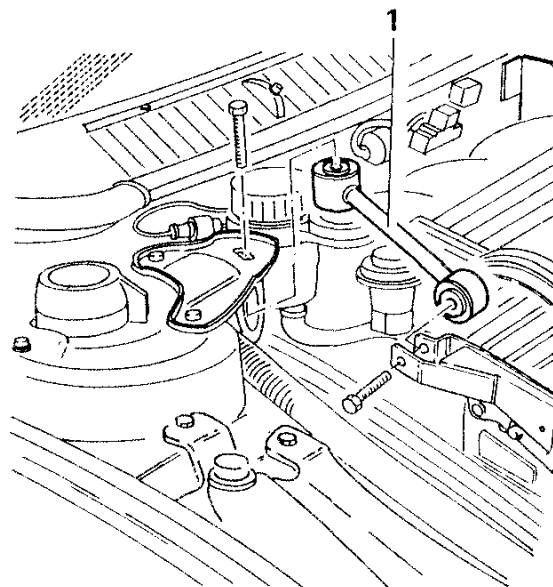
1. Disconnect the engine cooling circuit delivery hose from the expansion tank.



1. Loosen the screws and remove the expansion tank.

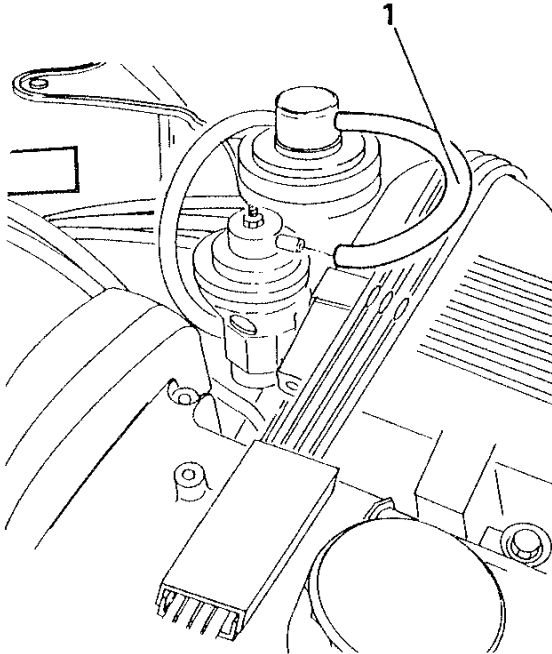


1. Remove the engine damping rod.

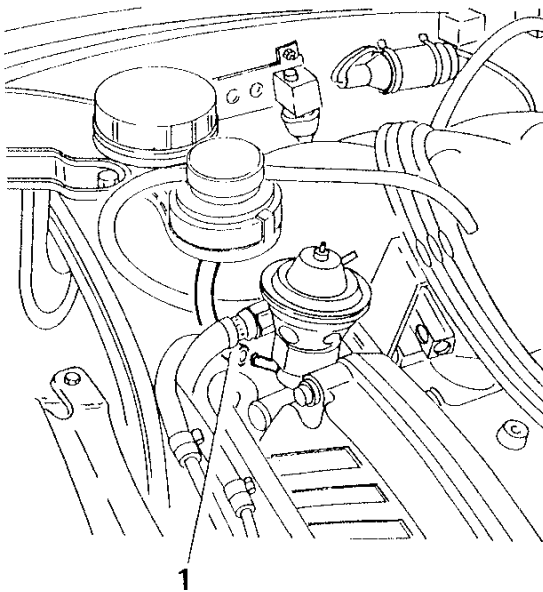




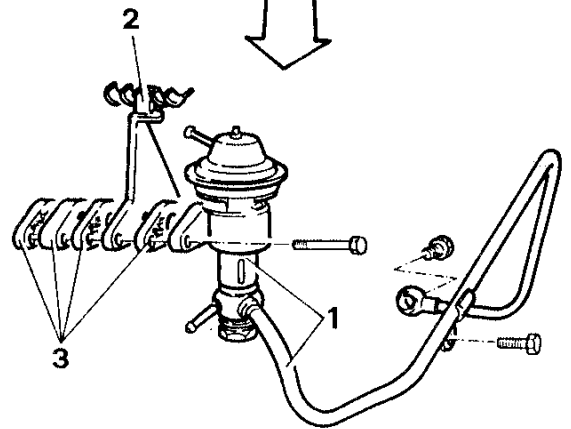
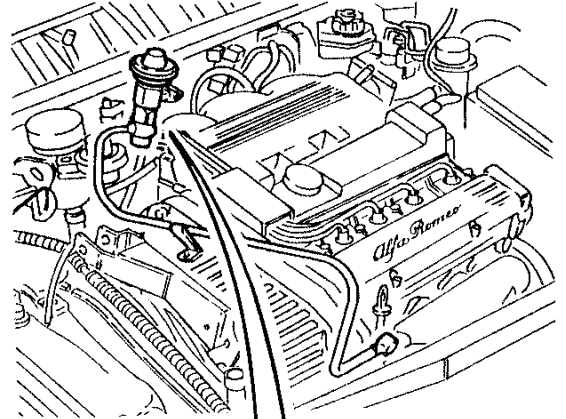
1. Disconnect the pneumatic signal modulation valve vacuum signal delivery hose from the E.G.R. valve.



1. Disconnect the exhaust gas to pneumatic signal modulation valve from the E.G.R. valve.

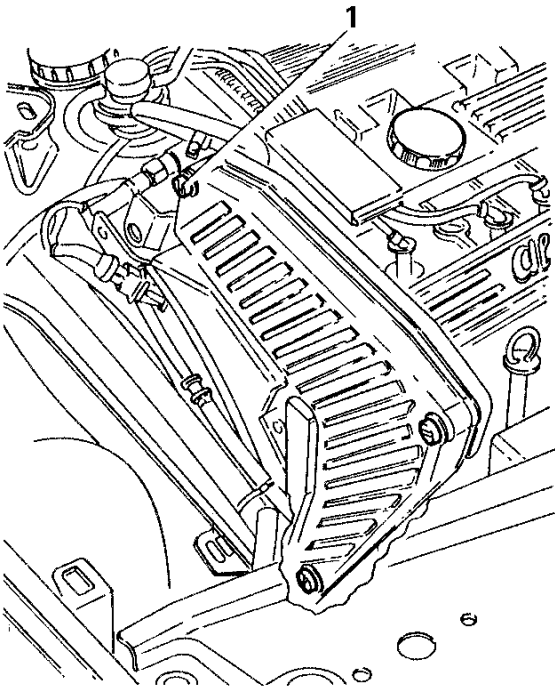


1. Remove the E.G.R. valve together with the exhaust gas intake hose.
2. Remove the spark plug cable support bracket.
3. Recover the spacer and gaskets.

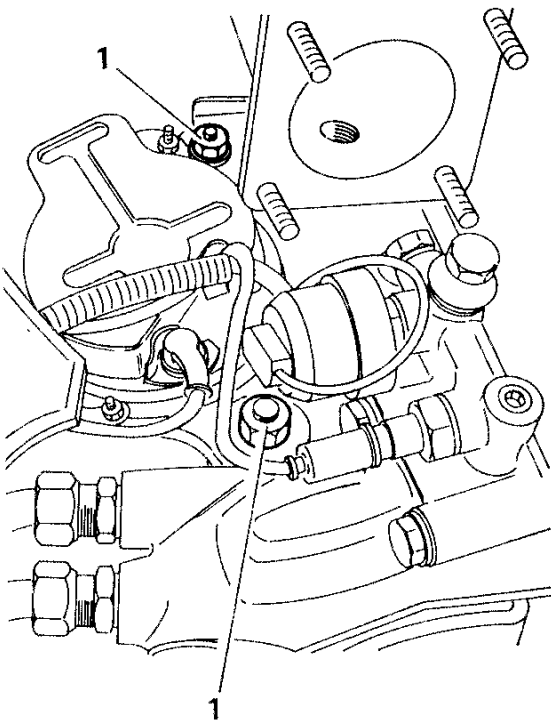




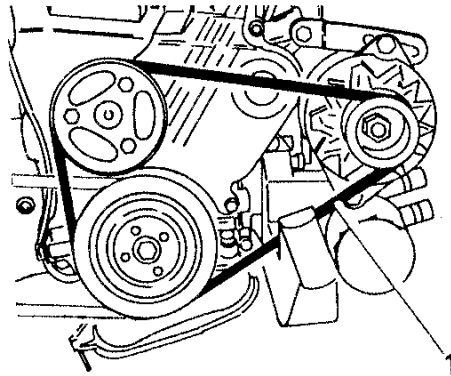
1. Remove the upper screws securing the timing belt cover.



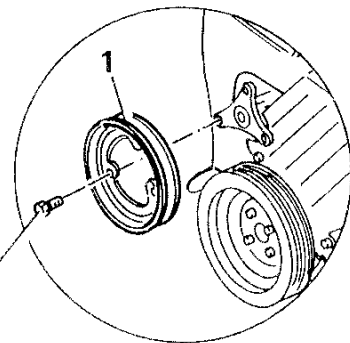
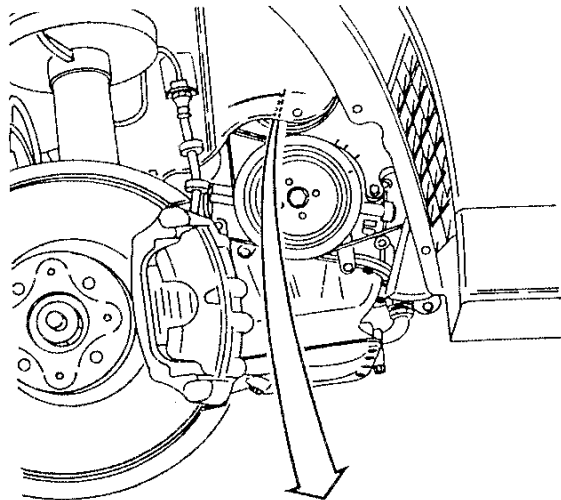
- Raise the vehicle.
1. Loosen the two bolts securing the alternator.




1. Remove the water pump alternator drive belt.



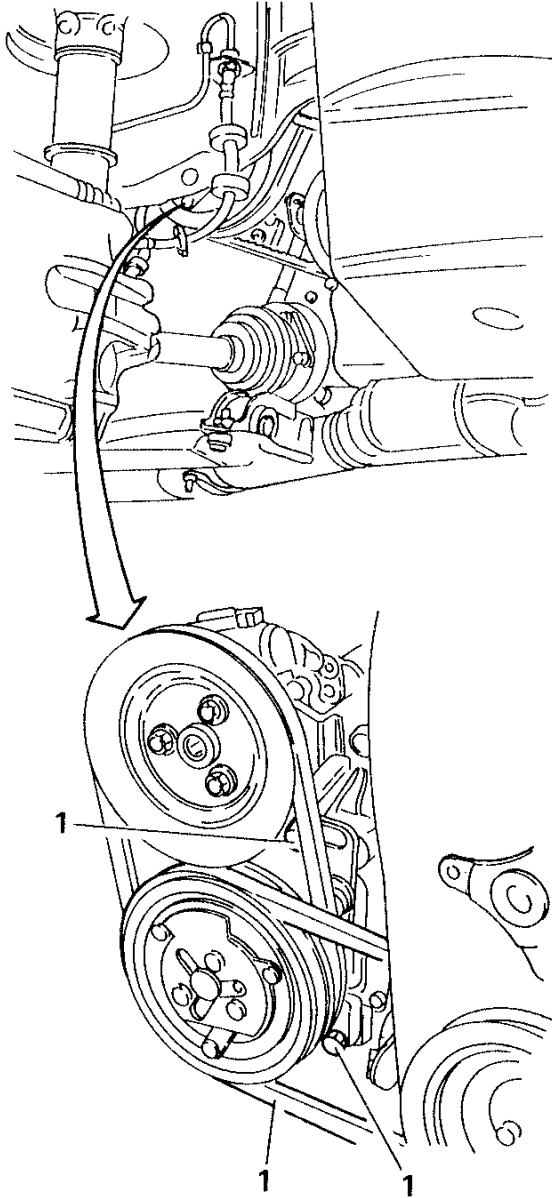
1. Loosen the screws and remove the water pump drive pulley.



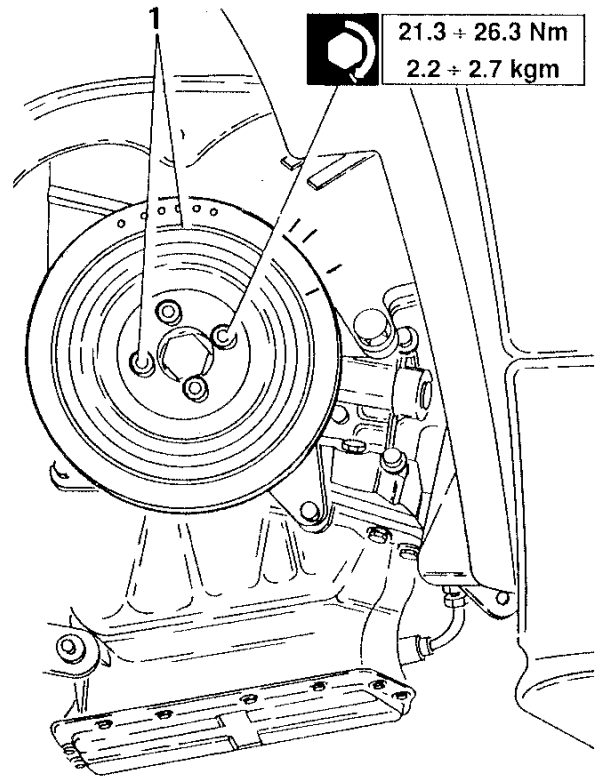
 21.3 + 26.3 Nm
2.2 + 2.7 kgm



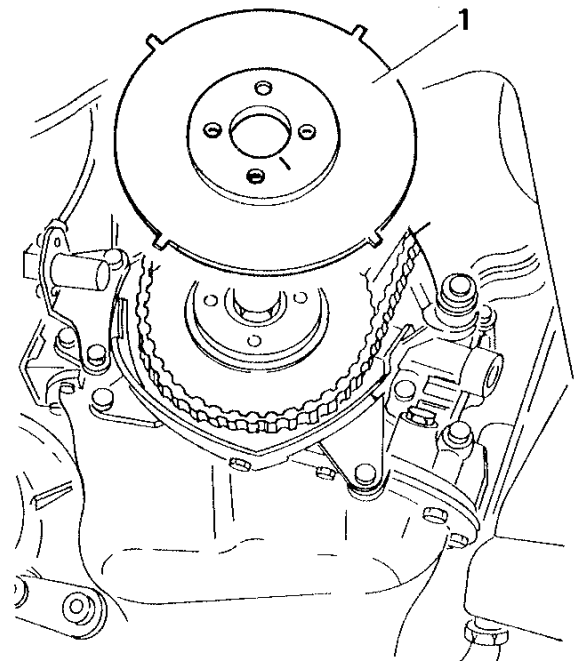
1. Loosen the two upper screws and the two lower bolts securing the air conditioning compressor and remove the drive belt.



1. Loosen the screws and remove the auxiliary services drive pulley.

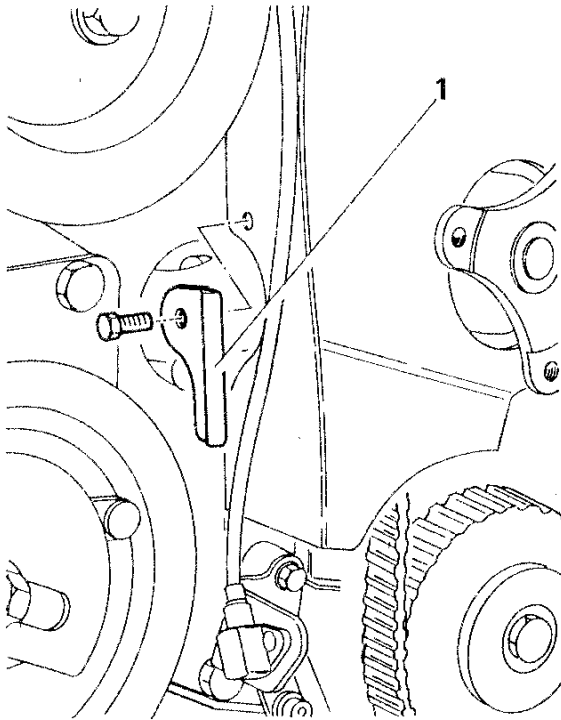


1. Recover the phonic wheel of the r.p.m. and T.D.C. sensor.

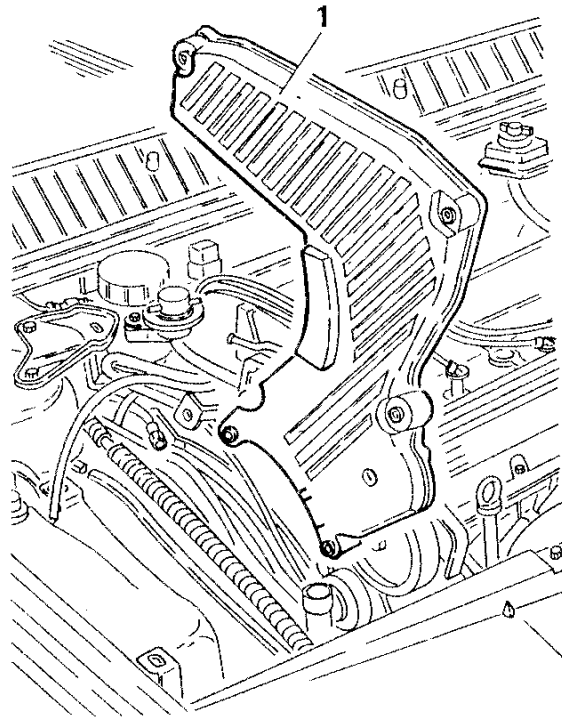




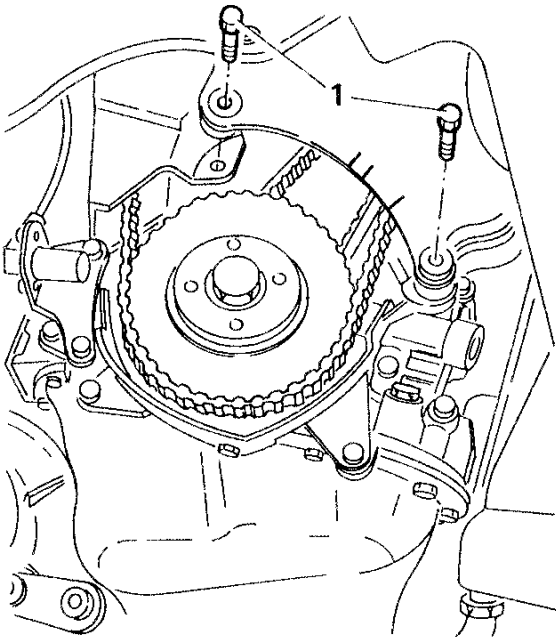
1. Loosen the screws and remove the plate securing the r.p.m and T.D.C. sensor cables.



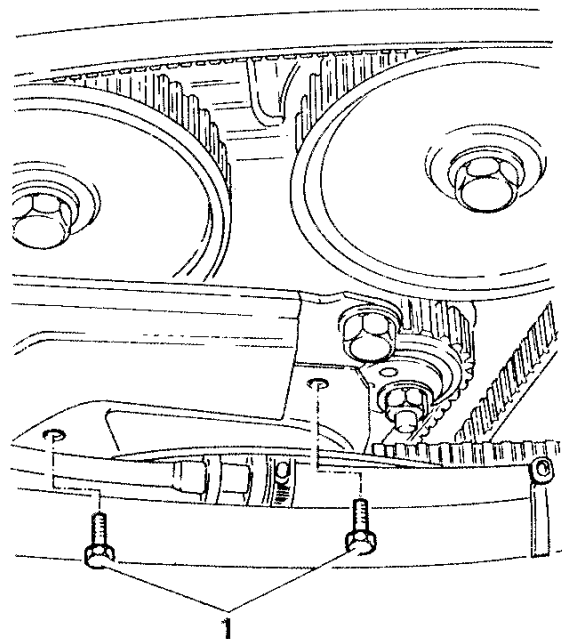
- Lower the vehicle.
1. Recover the timing belt cover.



1. Loosen the lower screws securing the timing belt cover.

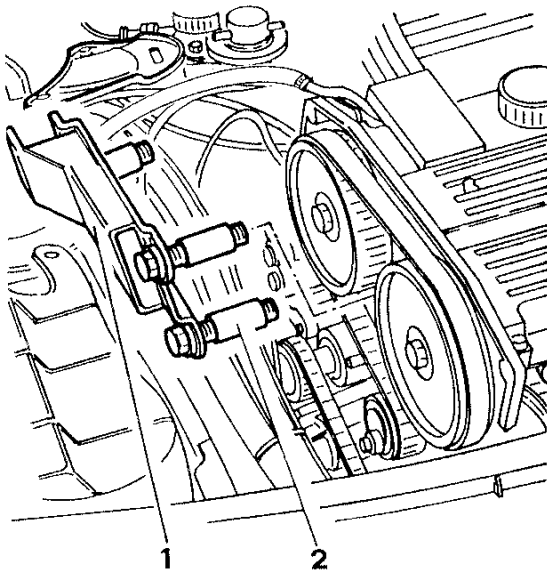


1. Loosen the two screws securing the timing belt metal cover to the engine damping rod support bracket and remove from engine.

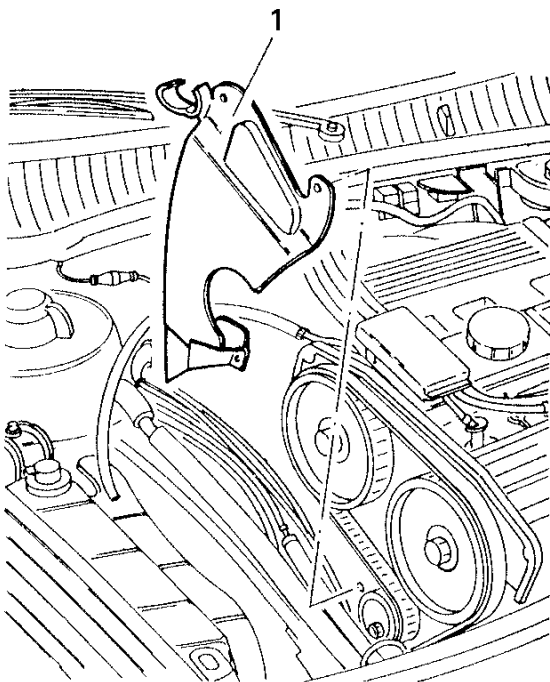





1. Loosen the three screws and remove the engine damping rod support bracket.
2. Remove the spacers.

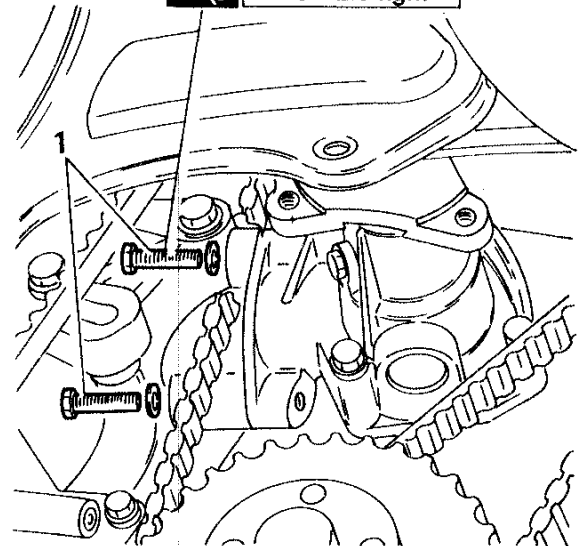


1. Remove the timing belt metal cover which was loosened previously.




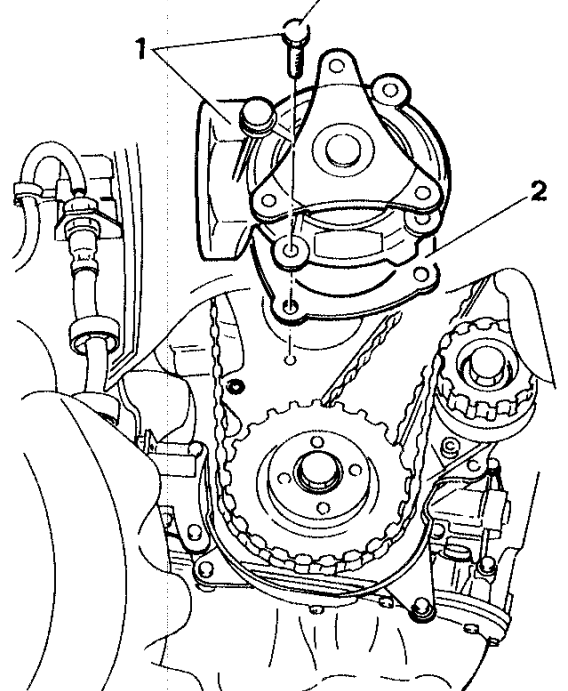
- Raise the vehicle.
1. Loosen the screws securing the water pump to the intake manifold.

 19.6 + 24.2 Nm
2.0 + 2.5 kgm



1. Loosen the three screws and remove the water pump from the engine block.
2. Remove the gasket.

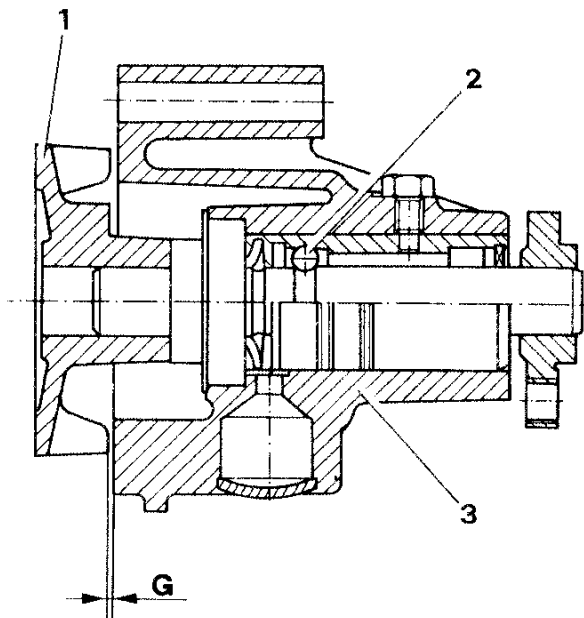
 21.3 + 26.3 Nm
2.2 + 2.7 kgm



**CHECKS AND INSPECTIONS**

- Check that the pump body and the rotor are in good condition and that there are no signs of oxidation or corrosion.
- Check that the clearance between the rotor and the pump body are within the specified limits.
- Check that the front gasket on the pump is in good condition and that it does not leak.
- Check that the bearing is not worn in any way.

If any of these anomalies is detected the entire water pump should be replaced.



Clearance between rotor and pump body

$G = 0.6 - 1.0 \text{ mm}$

1. Rotor
2. Bearing
3. Pump body

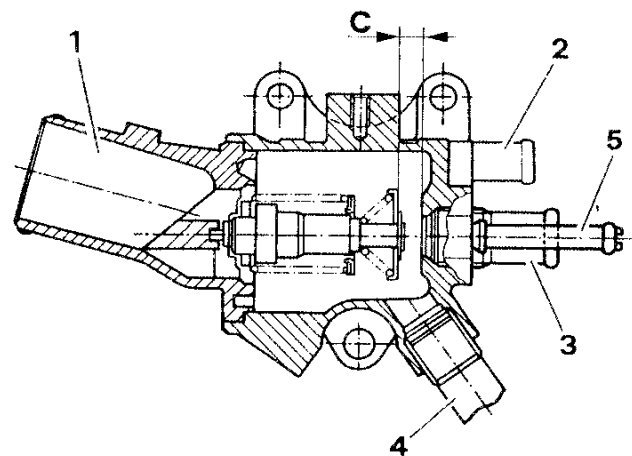
THERMOSTAT UNIT

The thermostat unit is located on the rear side of the cylinder head.

It ensures that the engine does not exceed the optimal temperature. As long as the the temperature of the engine coolant is below $83 \pm 2 \text{ }^\circ\text{C}$, the thermostat valve directs the coolant to the pump. When the temperature exceeds this value the valve opens permitting the coolant to flow to the radiator.

The following are fixed to the thermostat cup:

- A sensor (NTC) to measure the temperature of the engine coolant. This value is sent to the injection/ignition control unit.
- An engine coolant temperature sender and maximum temperature warning light contact for the instrument panel.
- A thermovalve for the exhaust gas recirculation system.



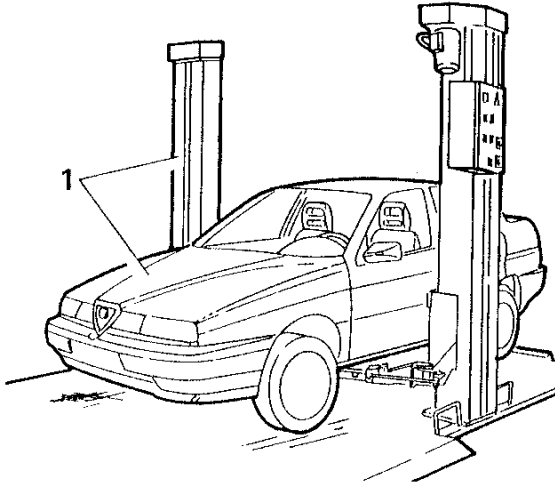
Total bulb travel (at $91 \pm 2 \text{ }^\circ\text{C}$)

$C = 7 \pm 0.5 \text{ mm}$

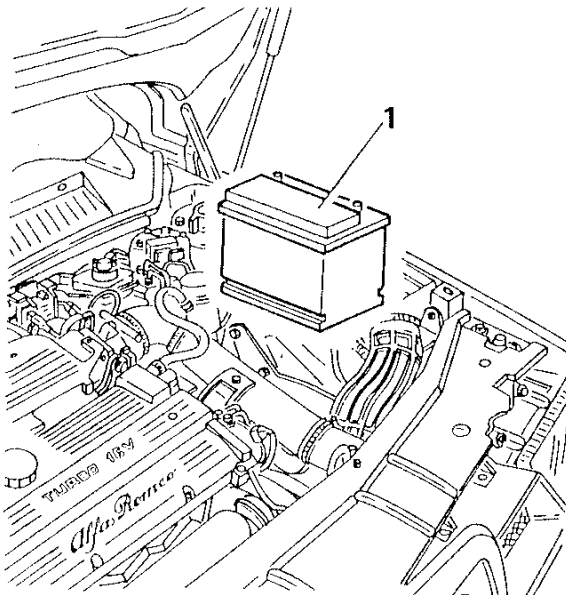
1. Delivery to radiator
2. Delivery to expansion tank
3. Delivery to pump intake manifold
4. Delivery to heater
5. Delivery to throttle body

**REMOVAL/REFITTING**

1. Place the vehicle on a lift.



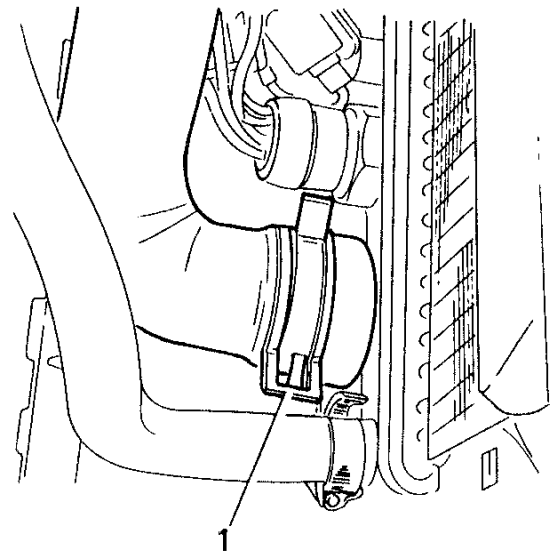
1. Remove the battery after disconnecting first the negative (-) and then the positive (+) cables.



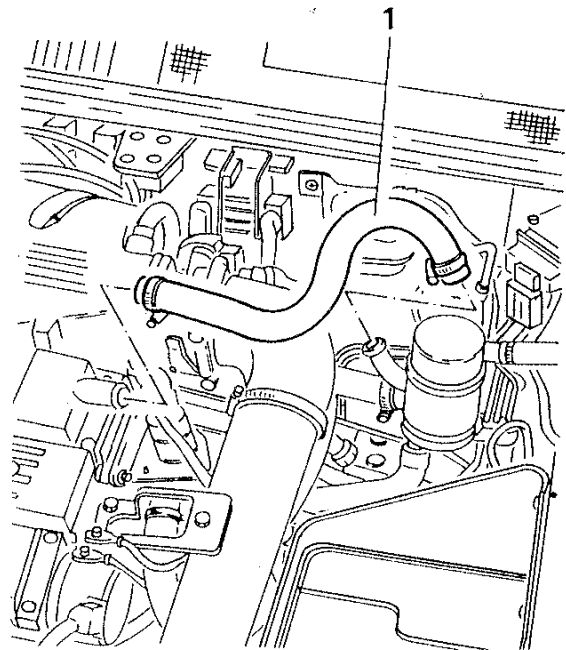
1. Loosen the clamp securing the engine coolant outlet sleeve to the radiator and disconnect the sleeve. Drain off the engine coolant into a suitable container placed under the vehicle.

**WARNING:**

The antifreeze mixture used as an engine coolant will damage paintwork.

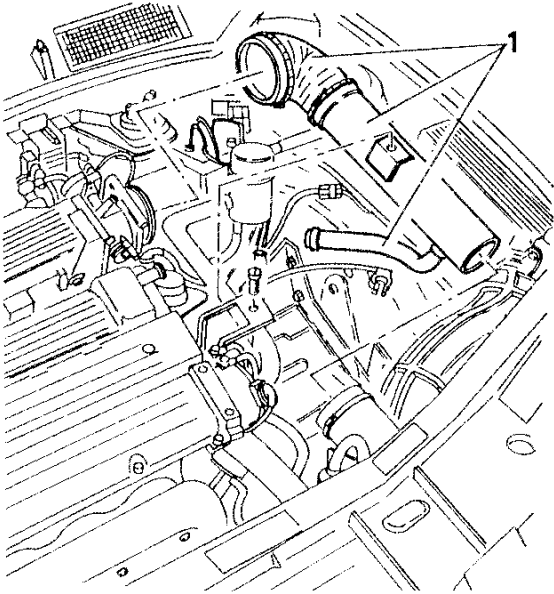


1. Remove the oil vapour recovery hose from the cylinder head.

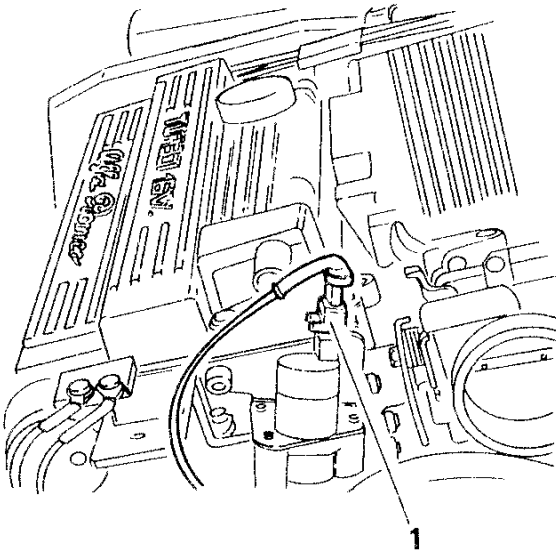




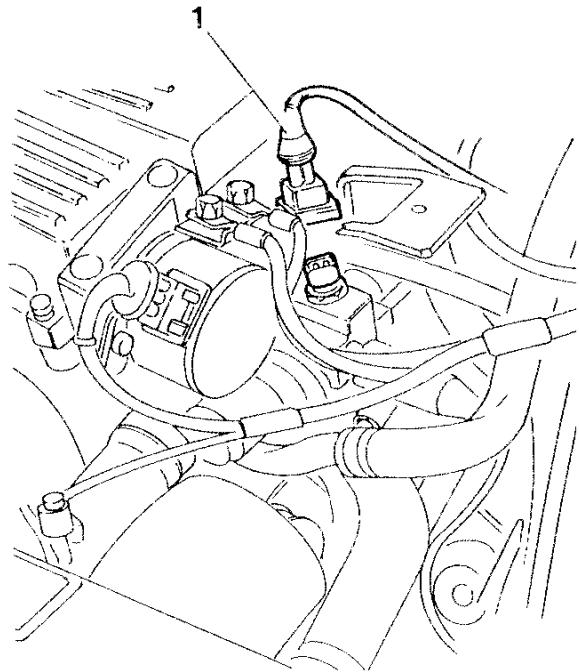
1. Remove the rigid intake manifold together with the elbow connection to the throttle body and air intake for the constant idle speed actuator.



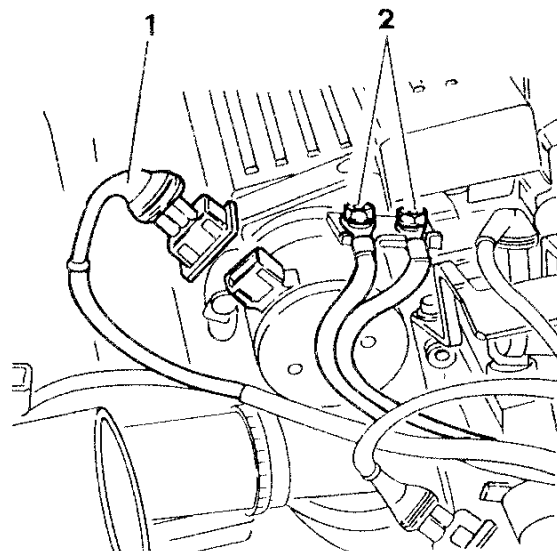
1. Disconnect the electrical connection from the constant idle speed actuator.



1. Disconnect the electrical connection from the engine coolant temperature sensor (NTC).

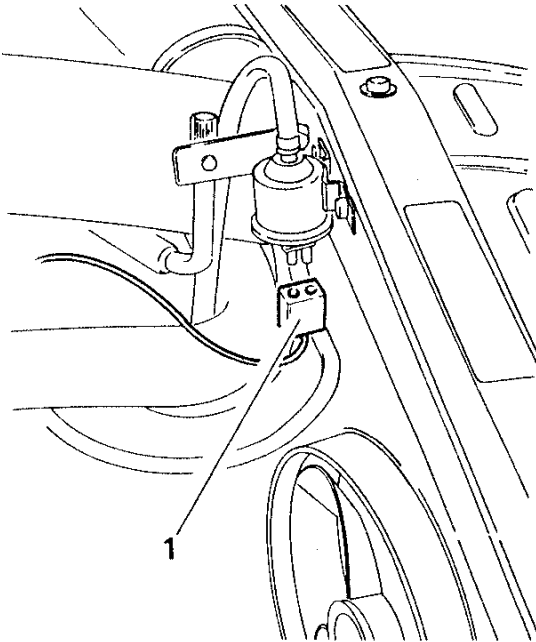


1. Disconnect the electrical connection from the timing sensor.
2. Disconnect the earth cables.

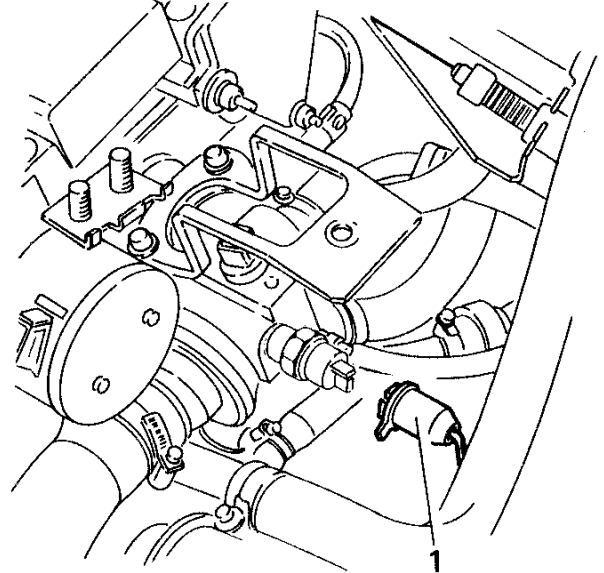




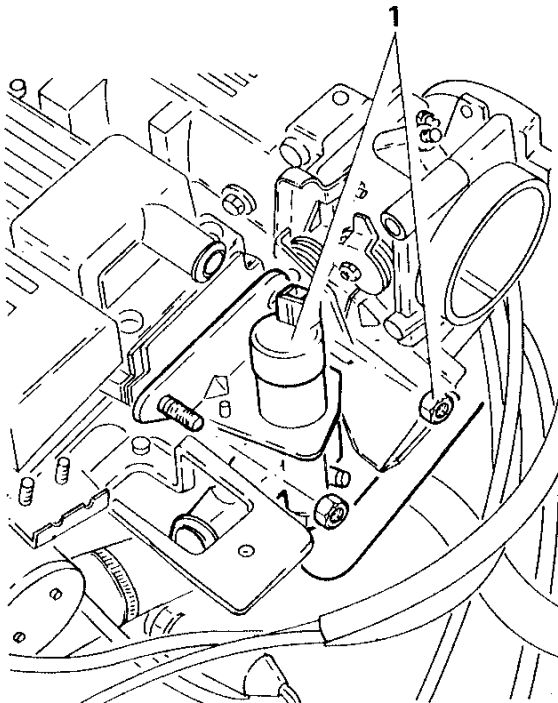
1. Disconnect the electrical connection from the over-boost device Pierburg solenoid valve.



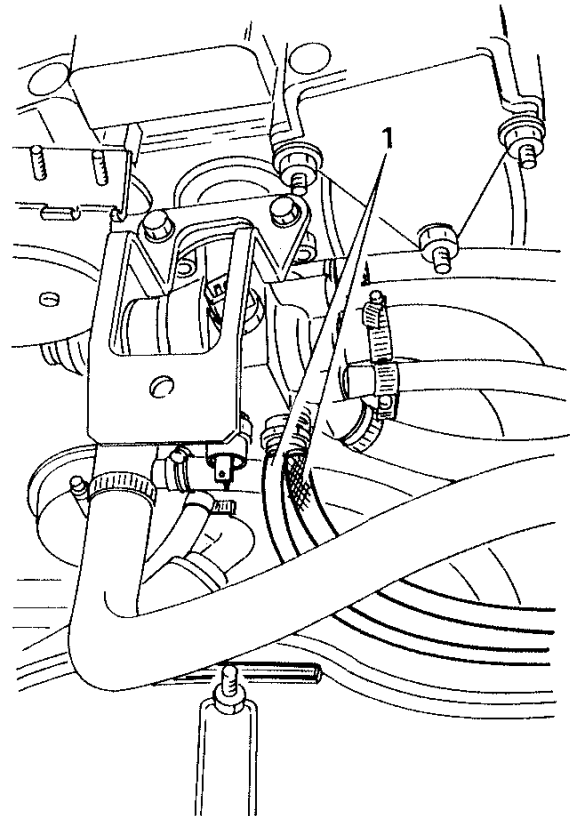
1. Disconnect the electrical connection from the engine coolant temperature sender and maximum temperature warning light.



1. Loosen the nuts securing the constant idle speed actuator and move it to one side.



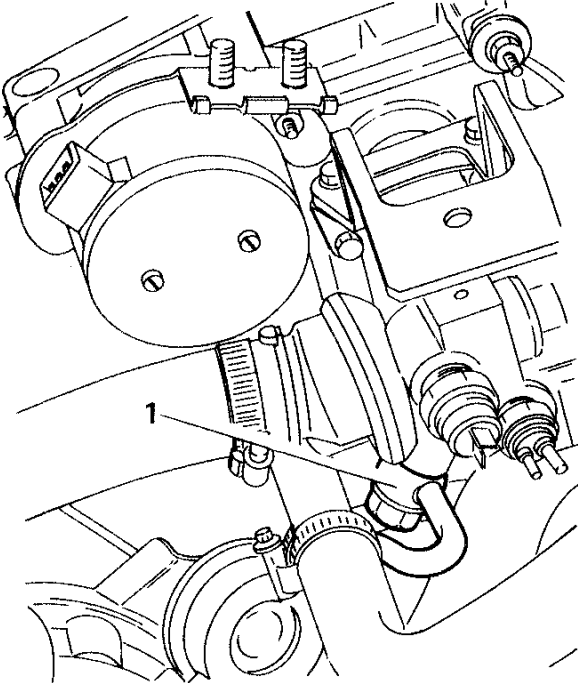
1. Disconnect the vacuum intake and the vacuum delivery hose for the pneumatic signal modulation valve from the E.G.R. system solenoid valve.



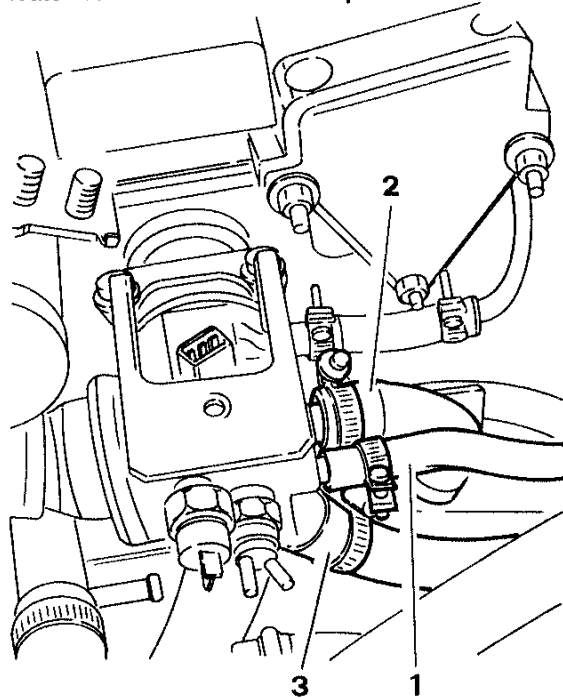


– Raise the vehicle.

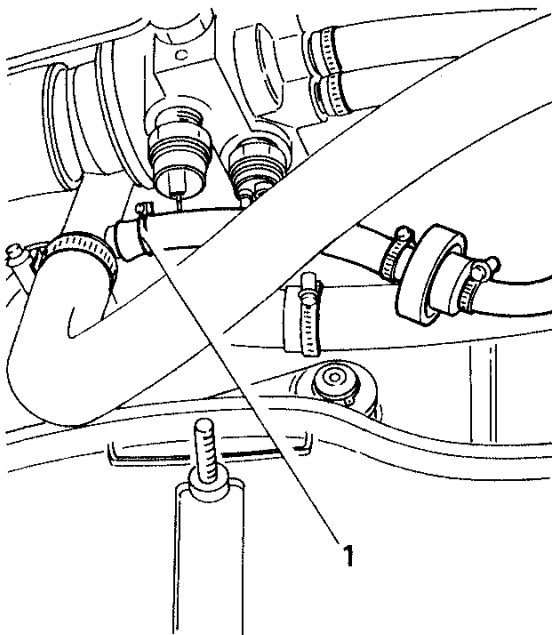
1. Disconnect the connection of the engine coolant return hose (from the turbocharger) from the thermostatic cup.



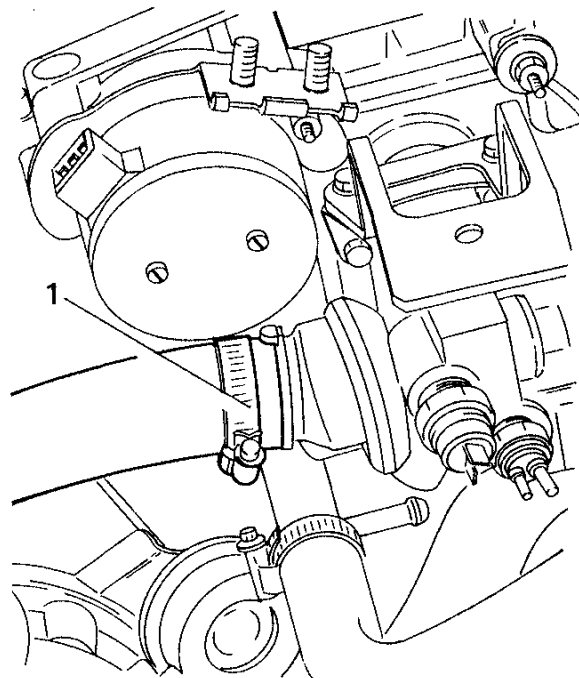
1. Disconnect the hose carrying engine coolant to the throttle body from the thermostatic cup.
2. Disconnect the hose returning engine coolant to the pump from the thermostatic cup.
3. Disconnect the hose carrying engine coolant to the heater from the thermostatic cup.



1. Disconnect the hose carrying the oil vapours to the intake box from the point where it branches off.

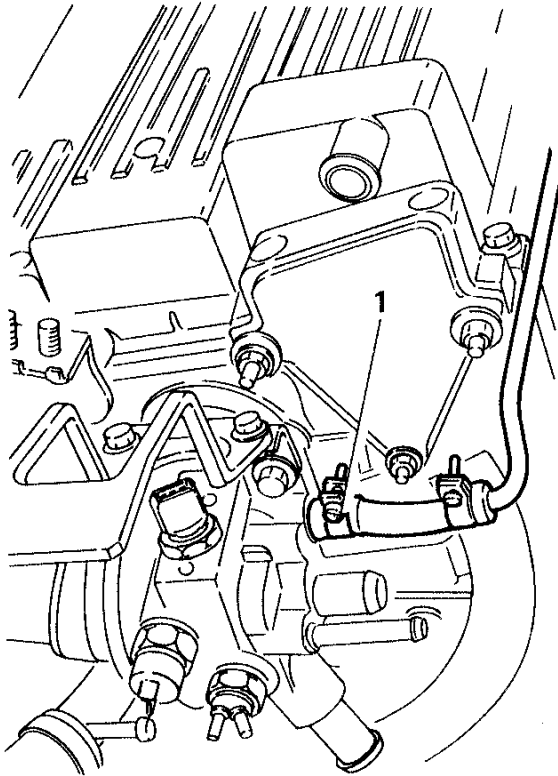


1. Disconnect the hose carrying engine coolant to the radiator from the thermostatic cup.

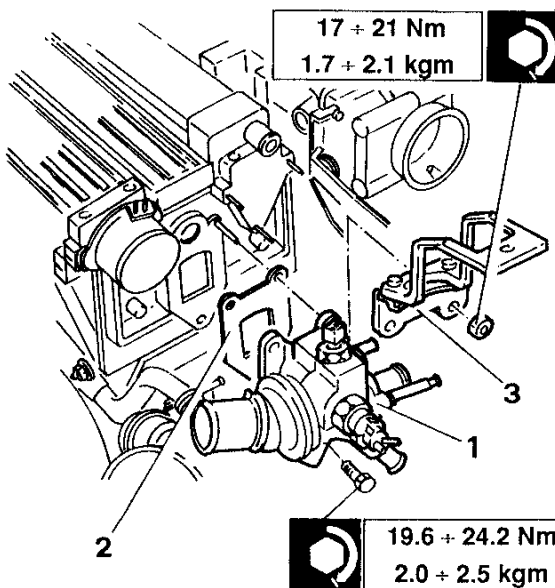




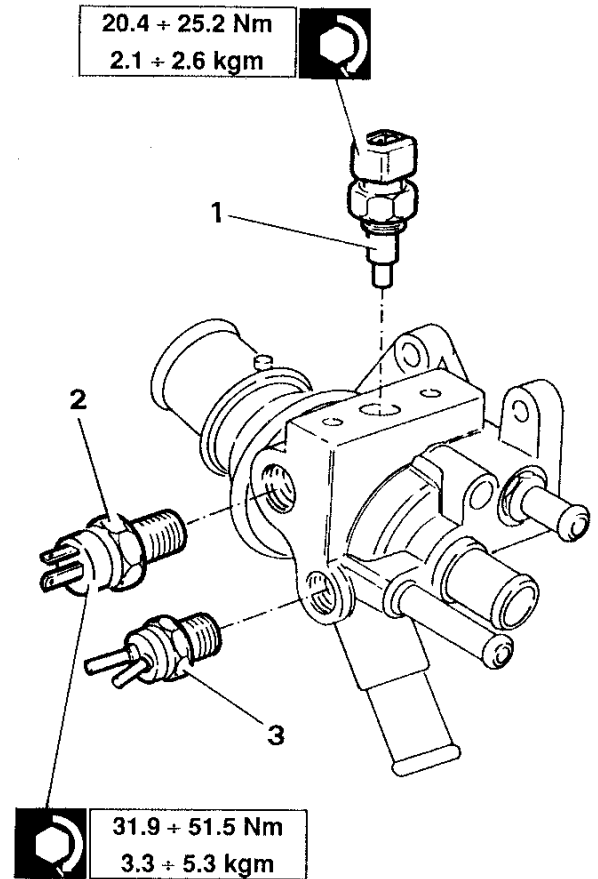
1. Loosen the clamp securing the hose carrying the engine coolant from the thermostatic cup to the expansion tank.



1. Loosen the three nuts and remove the thermostatic cup after disconnecting it from the previously loosened hose.
2. Remove the gasket.
3. Remove the bracket.



1. Remove the engine coolant temperature sensor (NTC) from the thermostatic cup.
2. Remove the engine coolant temperature gauge sender and maximum temperature warning light contact from the thermostatic cup.
3. Remove the E.G.R. system thermovalve.



**CHECKS AND INSPECTIONS**

Check the calibration of the thermostat as follows:

1. Hang the thermostat in a container of water and heat the water.
2. Using a thermometer check that the thermostat begins to open and opens fully at the temperatures indicated in the table.

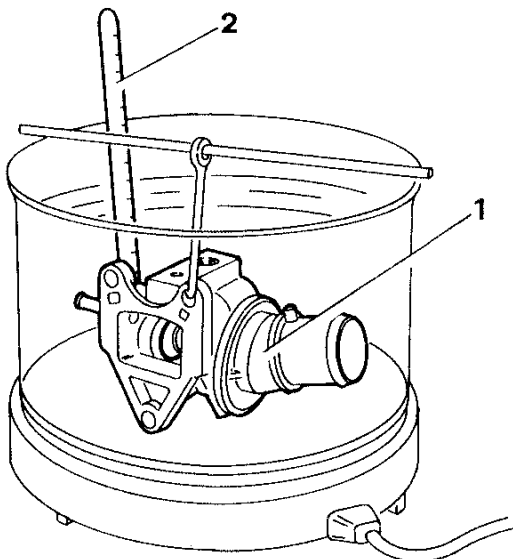
**WARNING:**

Do not allow the thermostat or the thermometer to touch the bottom of the container.

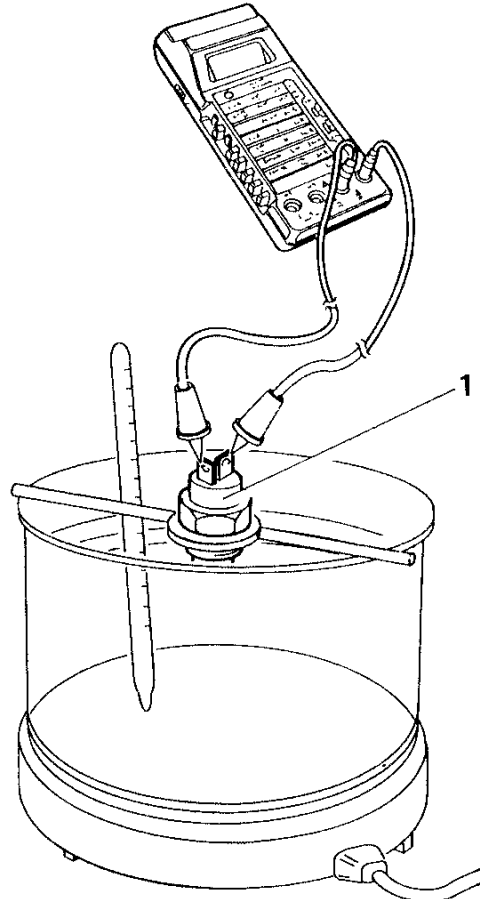
- Also check that the total bulb travel is as indicated in the table.

Thermostat setting	
Begins to open	$83 \pm 2 \text{ } ^\circ\text{C}$
Fully open	$91 \pm 2 \text{ } ^\circ\text{C}$
Total bulb travel	$7 \pm 0.5 \text{ mm}$

- If the correct values are not obtained, replace the thermostat.



1. Check the calibration of the engine coolant temperature gauge sender and maximum temperature warning light contact. If the correct values are not obtained, replace the sender.



Closing temperature	$120 \pm 2 \text{ } ^\circ\text{C}$
Opening temperature	$108 \pm 3 \text{ } ^\circ\text{C}$



RADIATOR

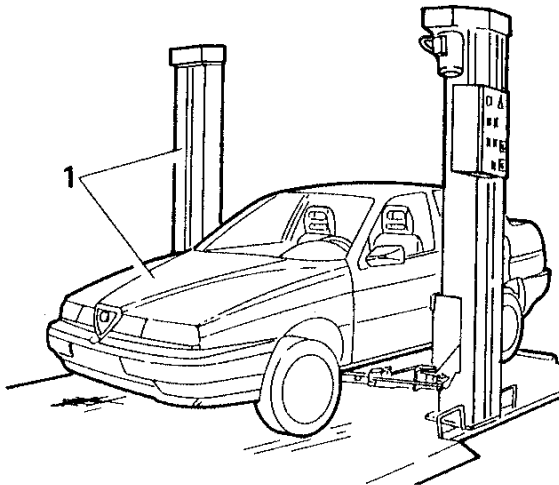
The radiator has been structured so that the heat can be dispersed when the engine is running.

It is composed of a radiator core (frontal radiator surface 20.3 dm^2) and by two side tanks fitted with necks for the inlet and outlet of the engine coolant.

The hoses and wings of the radiator core are made of aluminium and tanks are in plastic.

REMOVAL/REFITTING

1. Place the vehicle on a lift.
- Disconnect the negative (-) cable from the battery.

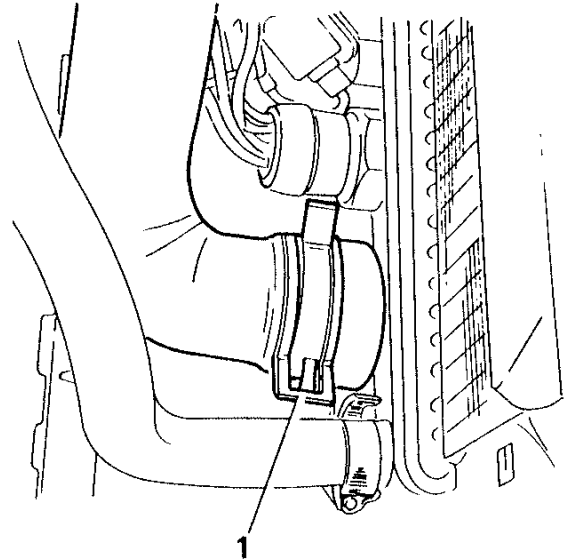


- Raise the vehicle.
1. Loosen the clamp securing the engine coolant outlet sleeve to the radiator and disconnect the sleeve. Drain off the engine coolant into a suitable container placed under the vehicle.

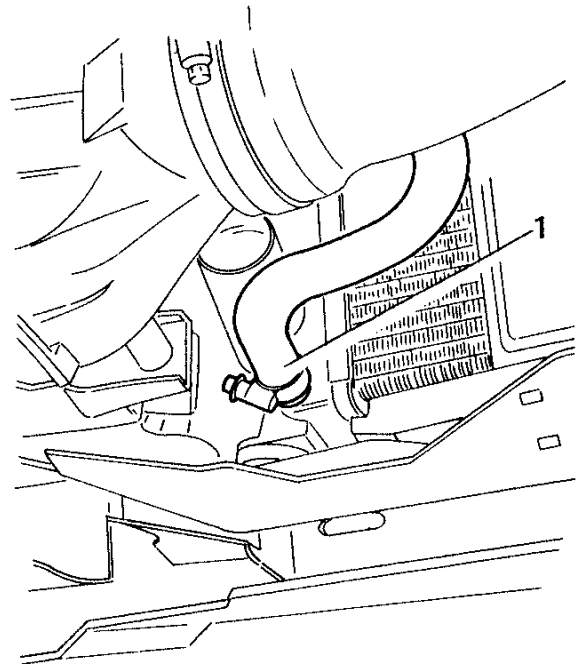


WARNING:

The antifreeze mixture used as an engine coolant will damage paintwork.

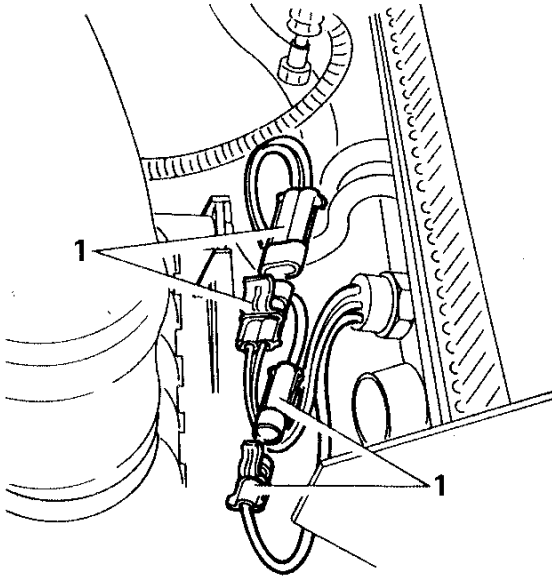


1. Disconnect the hose carrying the engine coolant to the turbo compressor from the radiator.

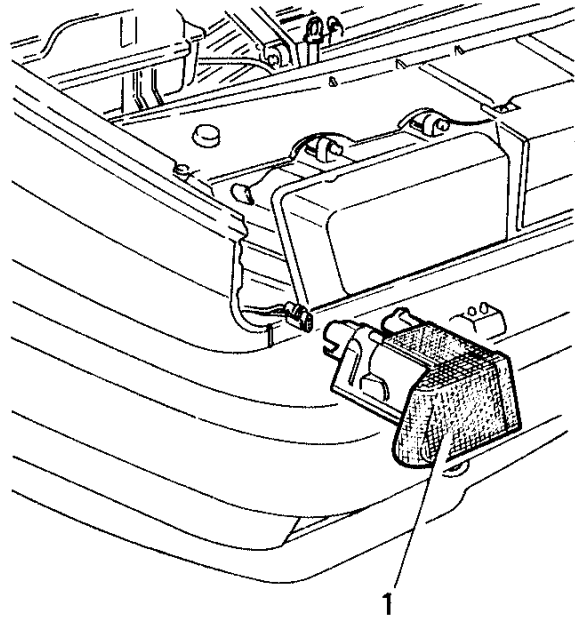




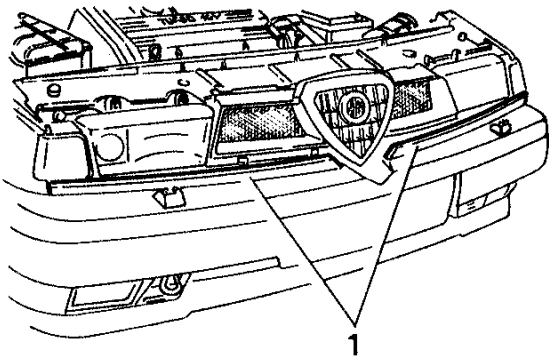
1. Disconnect the electrical connections from the engine cooling fan thermal contact.



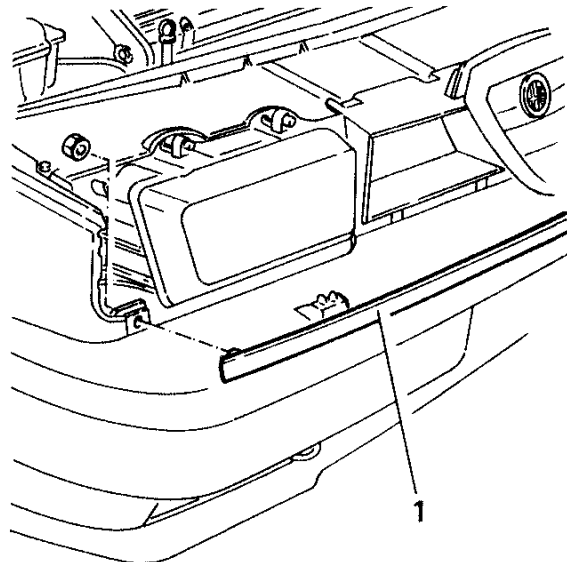
1. Remove the front direction indicators (see GROUP 40).



1. Centrally detach the two strips of trim from the front grille.

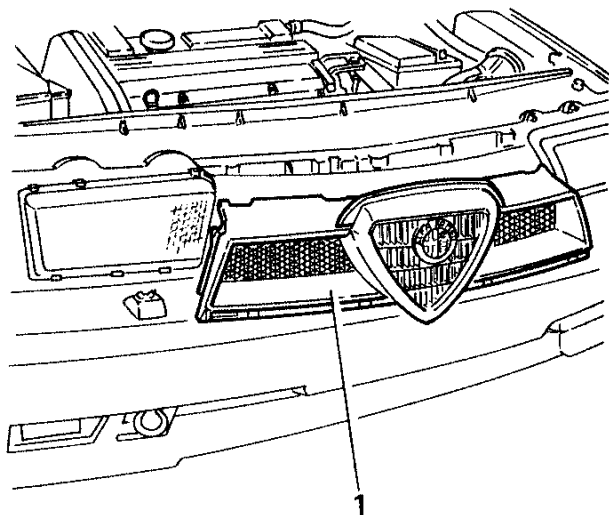


1. Loosen the side nut securing the two strips of trim to the body and remove the strips.

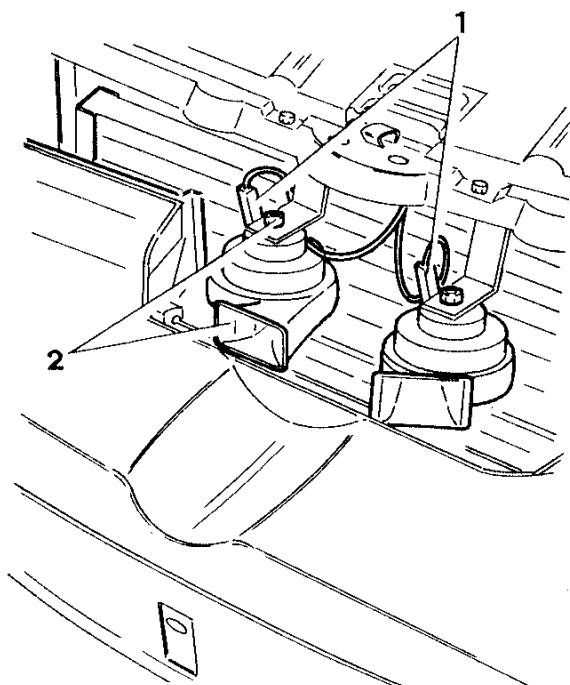




1. Remove the front grille (see GROUP 75).

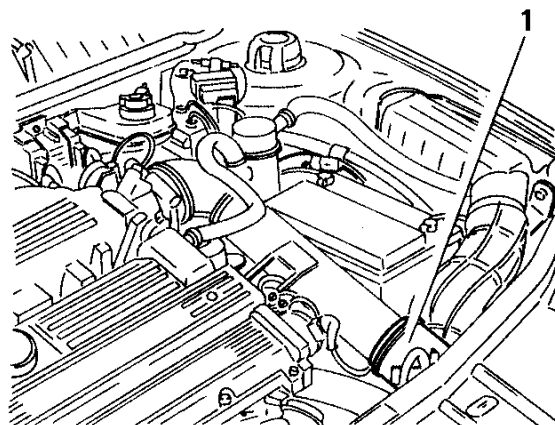


1. Disconnect the electrical connections from the horns.
2. Loosen the nuts and remove the horns.

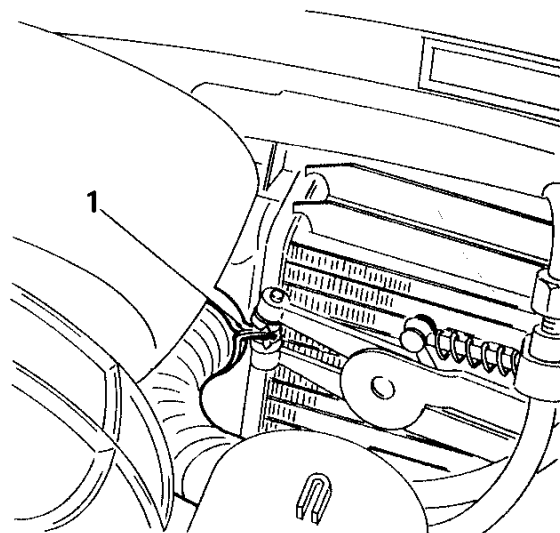


- Remove the front bumper (see GROUP 75).

1. Disconnect the sleeve carrying air from the inter-cooler from the rigid intake manifold, and move it to one side.

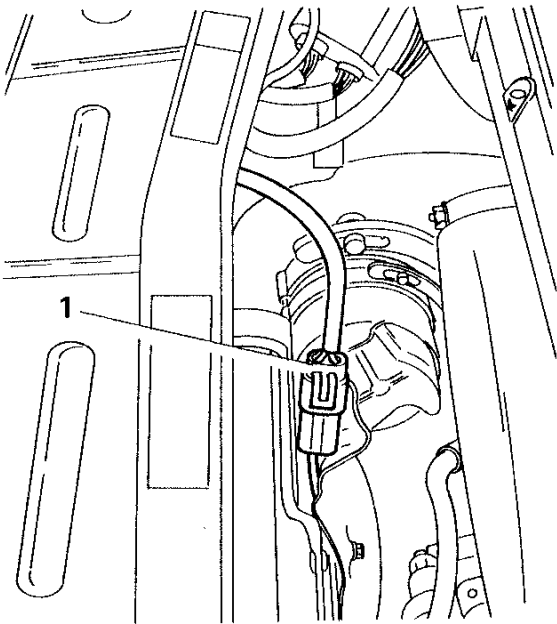


1. Disconnect the engine coolant inlet hose from the radiator.

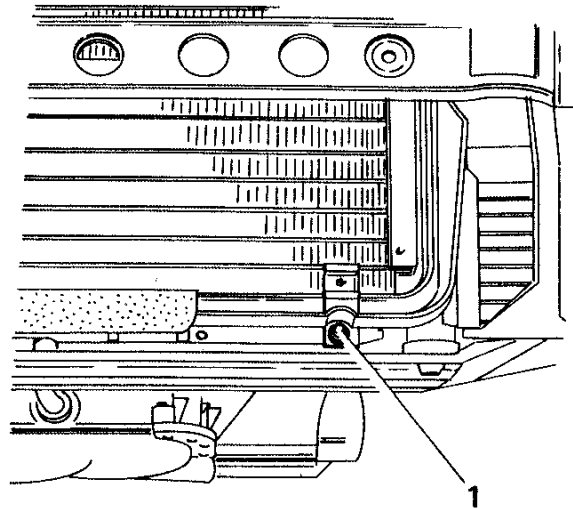




1. Disconnect the electrical connection from the engine coolant fan.

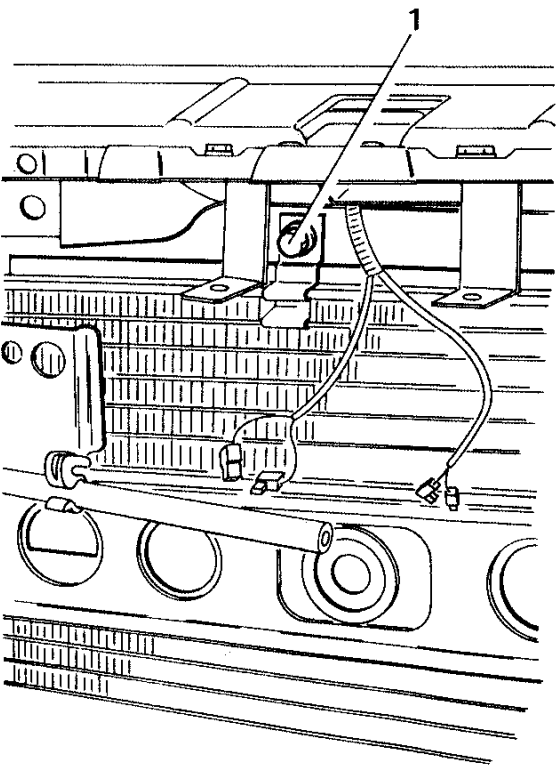


1. Loosen the two lower screws securing the air conditioning condenser to the radiator.

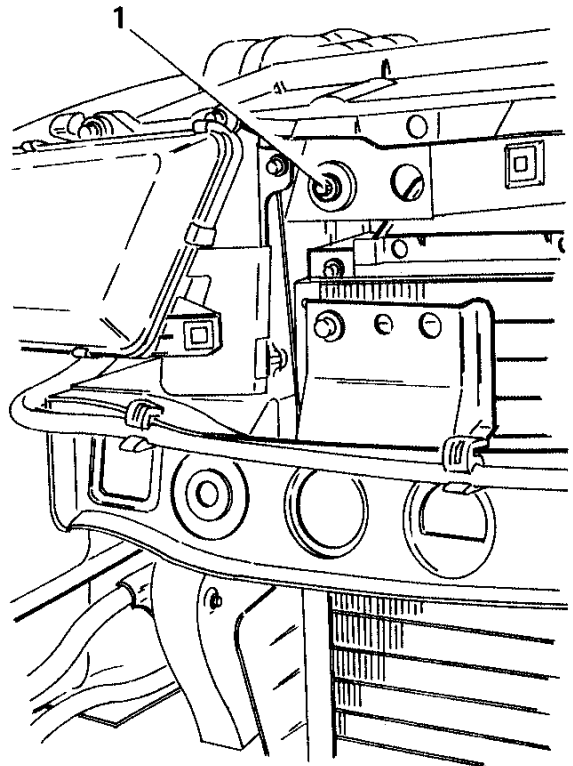


- Raise the vehicle.

 1. Loosen the two upper screws securing the air conditioning condenser to the radiator.

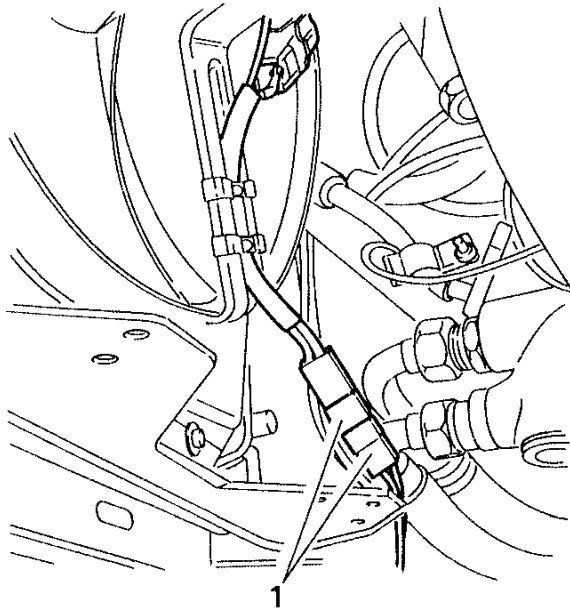


1. Loosen the two upper screws securing the radiator to the crossmember.

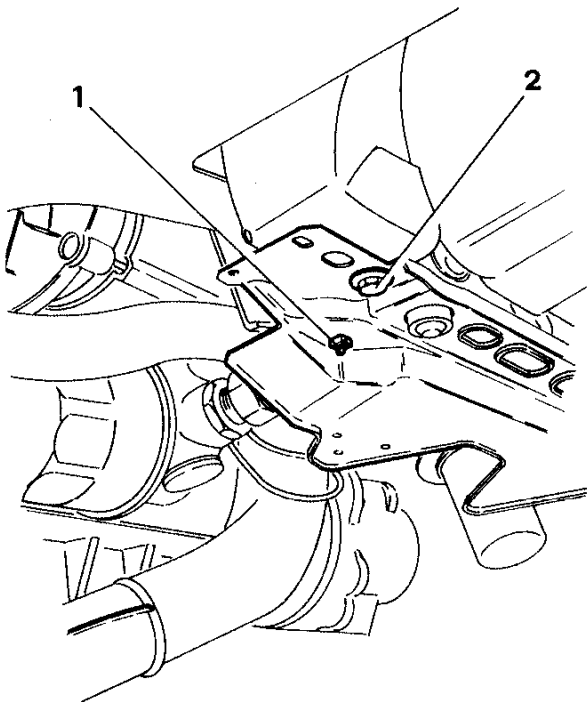




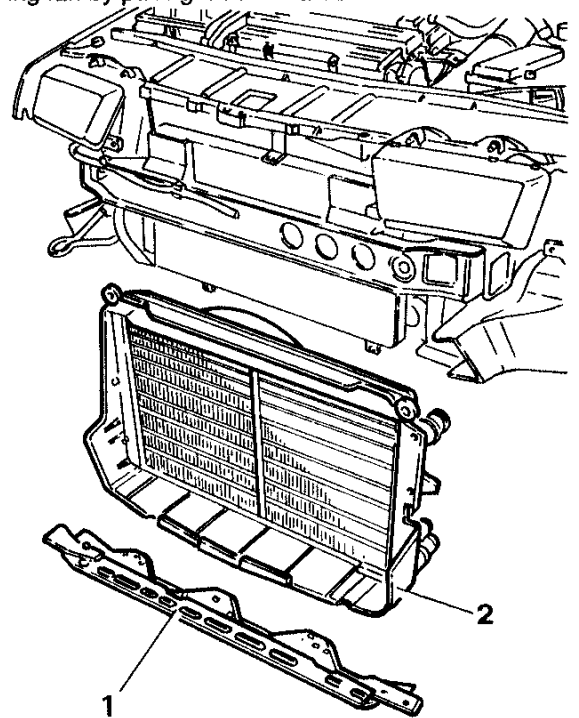
1. Disconnect the electrical connection from the engine cooling fan resistance.



1. Loosen the screw securing the engine oil radiator air conveyor to the crossmember.
2. Loosen the screws securing the lower crossmember to the body.

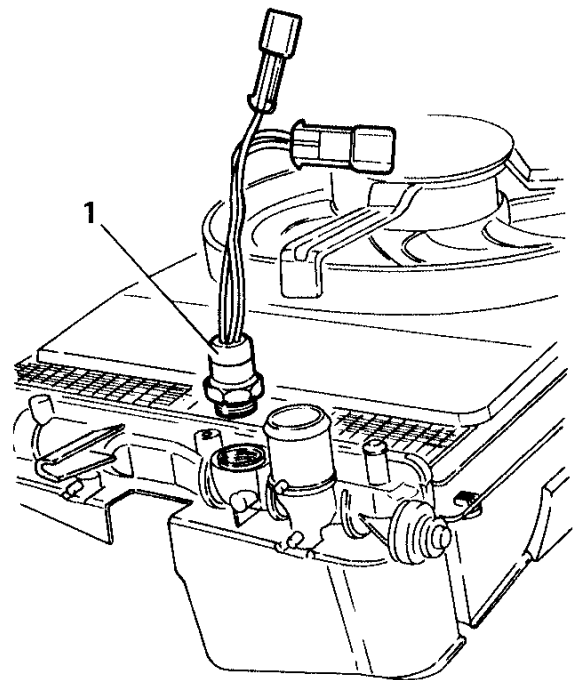


1. Remove the lower crossmember.
2. Remove the radiator together with the engine cooling fan by pulling it downwards.



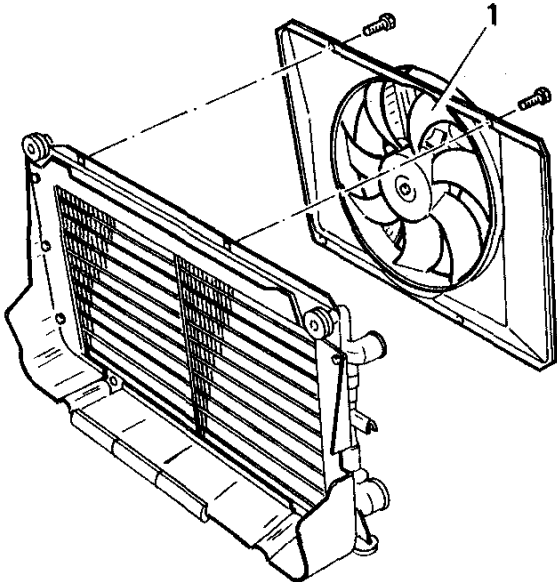
DISASSEMBLY AND REASSEMBLY

1. Remove the engine cooling fan thermal contact from the radiator.

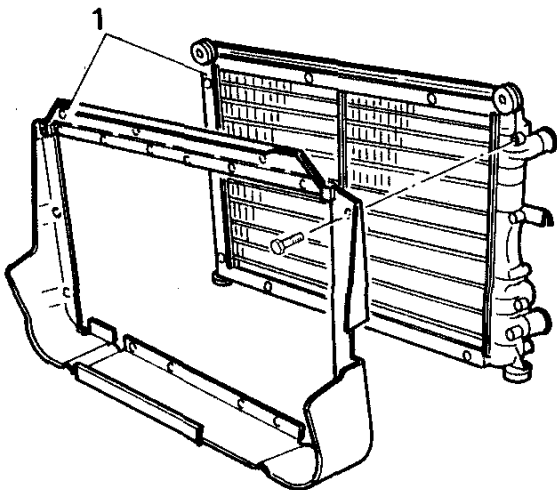




1. Loosen the four screws and remove the engine cooling fan from the radiator.



1. Loosen the six screws and separate the air conveyer from the radiator.



ENGINE COOLING FAN

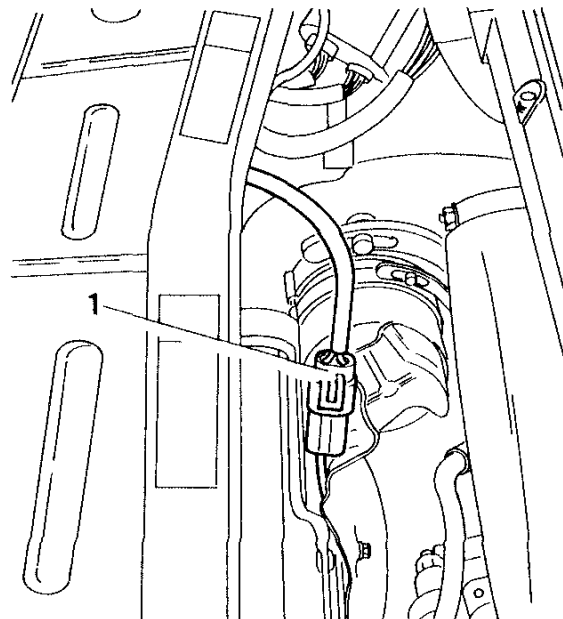
The two-speed engine cooling fan makes it possible to increase heat dissipation by the radiator.

A two stage thermal contact detects excessive temperatures and activates the engine cooling fan as a consequence. The contact of the first level closes at $92 \pm 2 \text{ }^\circ\text{C}$ and opens at $87 \pm 2 \text{ }^\circ\text{C}$ (first speed), and that of the second level closes at $97 \pm 2 \text{ }^\circ\text{C}$ and opens at $92 \pm 2 \text{ }^\circ\text{C}$ (second speed).

In the versions with an automatic heating-ventilation system with air conditioner the second speed is engaged after the first level has been on for about ten seconds in addition to coming on when a second level temperature is reached.

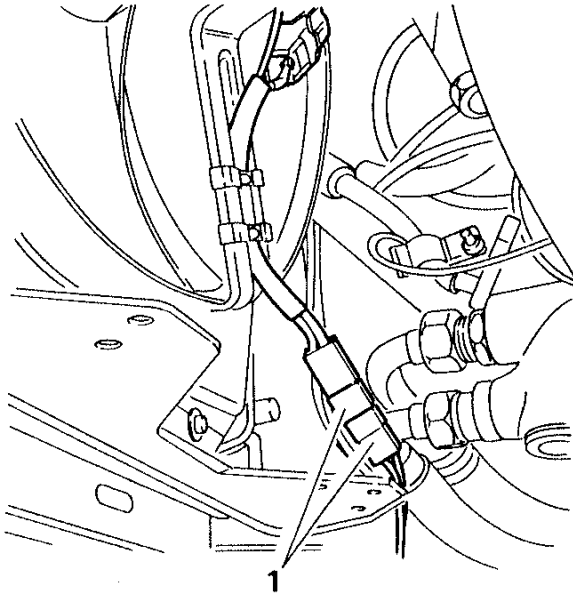
REMOVAL/REFITTING

- Place the vehicle on a lift.
 - Disconnect the negative (-) cable from the battery
1. Disconnect the electrical connection of the engine cooling fan power supply.

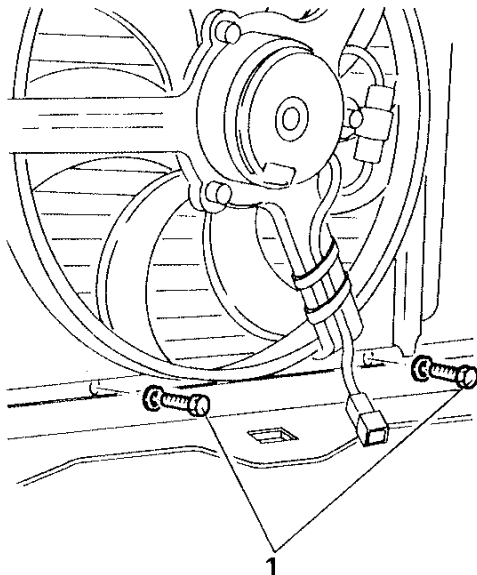




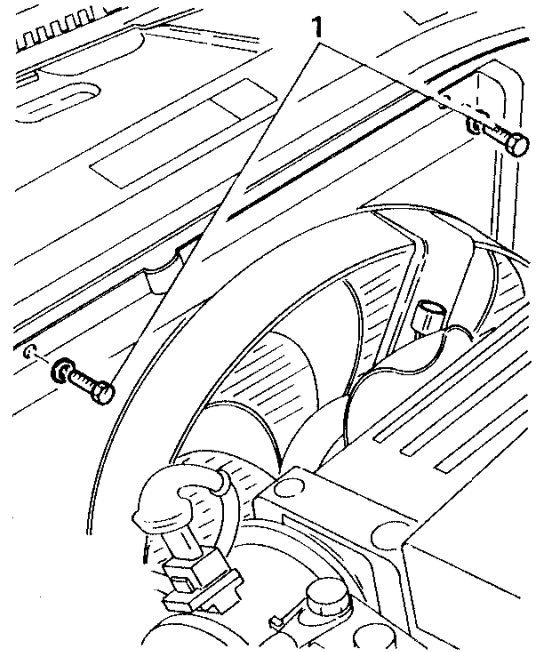
- Raise the vehicle.
- 1. Disconnect the electrical connection of the engine cooling fan resistance.



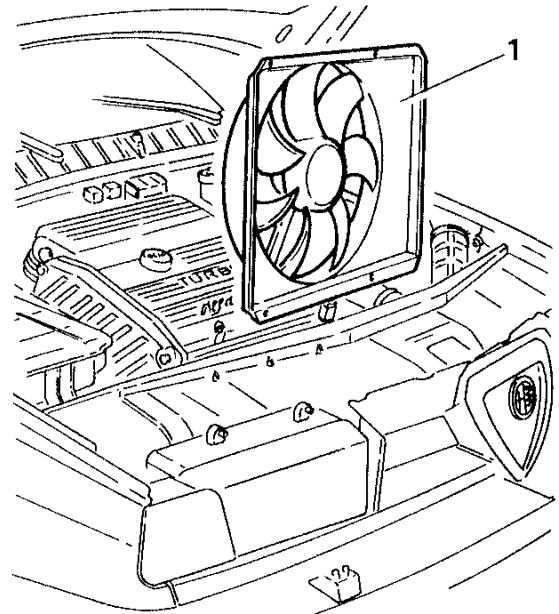
- 1. Remove the two lower screws securing the engine cooling fan.



- Lower the vehicle.
- 1. Loosen the two upper screws securing the engine cooling fan.



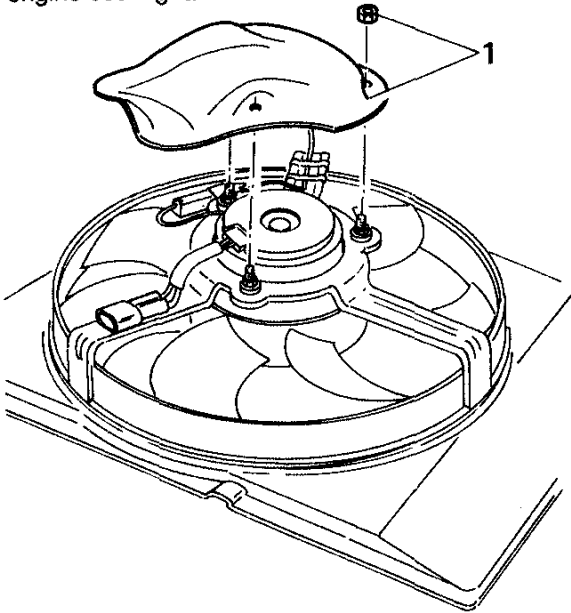
- 1. Remove the engine cooling fan.



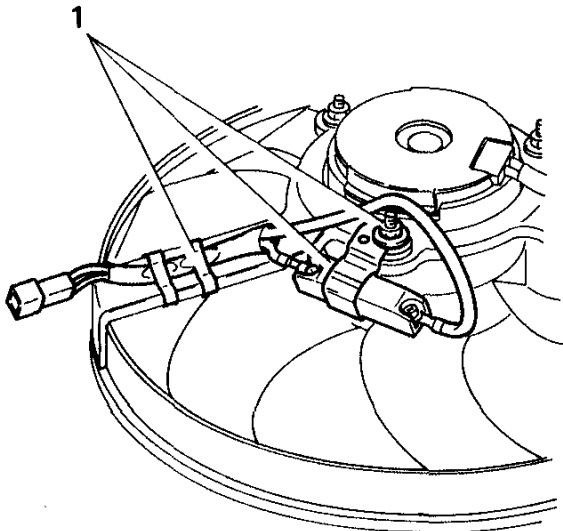


DISASSEMBLY AND REASSEMBLY

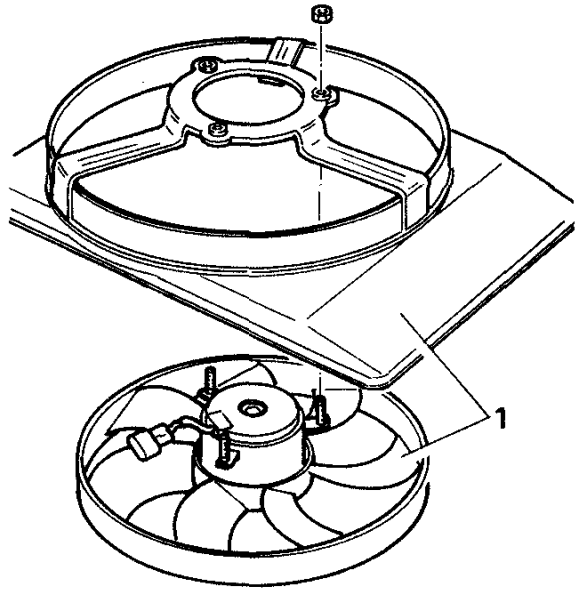
1. Loosen the nuts and remove the heat shield from the engine cooling fan motor.



1. Remove the fan resistance after freeing the cables from the clips and loosening the retaining nut.



1. Loosen the three nuts and separate the fan from the conveyor.

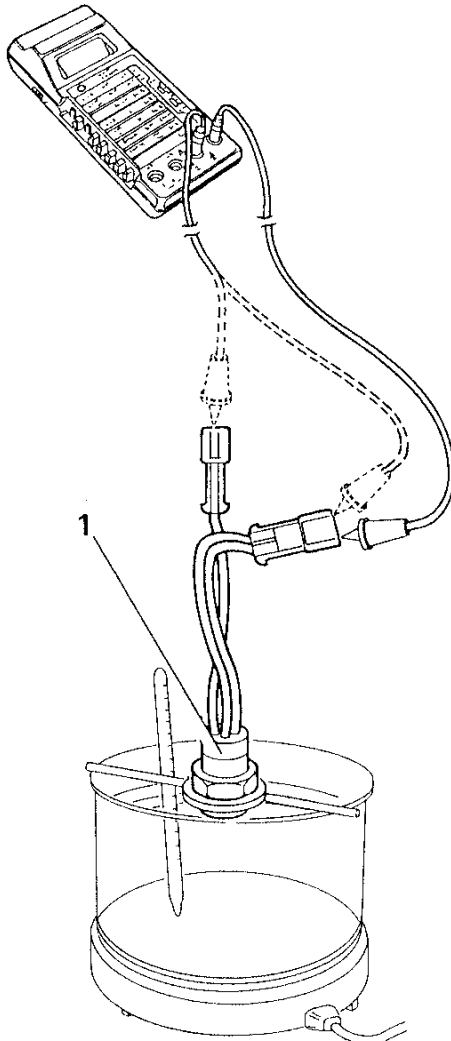




ELECTRIC FAN THERMAL CONTACT

Check the calibration of the thermal contact as follows:

- Remove the thermal contact from the radiator.
- 1. Hang the thermal contact in a container full of water and heat the water.
- Using a thermometer and a multimeter, check that the thermal contact opens/closes at the correct temperatures at the first speed (the two pins on connector A open and close).
- Similarly, check that the thermal contact opens/closes (the contact closes/opens between the pin of connector A and that of connector B) at the correct second speed temperature.

**WARNING:**

Do not allow the thermometer or the thermal contact to touch the bottom of the container.

Cut in/cut off temperatures of the cooling fan

1 st speed	Cut in (contacts close)	92 ± 2 °C
	Cut off (contacts open)	87 ± 2 °C
2 nd speed	Cut in (contacts close)	97 ± 2 °C
	Cut off (contacts open)	92 ± 2 °C

- If the correct values are not obtained, replace the thermal contact.

**TECHNICAL CHARACTERISTICS AND SPECIFICATIONS****ENGINE COOLANT**

Minimum temperature: - 40 °C		
Concentrated Antifreeze	Alfa Romeo Antifreeze	5.0 litres (55%)
Distilled water		4.1 litres (45%)
Antifreeze ready for use	Alfa Romeo Climafluid Permanent - 40 °C	9.1 litres

COOLING SYSTEM

Hydraulic circuit control pressure	1.08 bar (1.1 kg/cm ²)
Pressure setting of pressurized cap	0.98 ± 0.1 bar (1 ± 0.1 kg/cm ²)

THERMOSTAT

Temperature at start of opening	83 ± 2 °C
Temperature when fully open	91 ± 2 °C
Total bulb travel	7 ± 0.5 mm

WATER PUMP

Clearance between rotor and pump body	0.6 - 1.0 mm
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**ENGINE COOLANT TEMPERATURE GAUGE SENDER AND MAXIMUM TEMPERATURE WARNING LIGHT CONTACT**

Temperature at which contacts close	120 ± 2 °C
Temperature at which contacts open	108 ± 3 °C

COOLING FAN THERMOCONTACT

Temperature at which fan cuts in/out

1 st speed	Cuts in (contacts close)	92 ± 2 °C
	Cuts off (contacts open)	87 ± 2 °C
2 nd speed	Cuts in (contacts close)	97 ± 2 °C
	Cuts off (contacts open)	92 ± 2 °C

TIGHTENING TORQUES

Part	Nm	kgm
Screws securing water pump pulley	21.3 - 26.3	2.2 - 2.7
Screws securing water pump to engine block	19.6 - 24.2	2.0 - 2.5
Screws securing suction manifold to water pump	19.6 - 24.2	2.0 - 2.5
Screw securing auxiliary units drive belt pulley	21.3 - 26.3	2.2 - 2.7
Engine coolant temperature sensor (NTC)	20.4 - 25.2	2.1 - 2.6
Engine coolant temperature gauge sender and maximum temperature warning light contact	31.9 - 51.5	3.3 - 5.3
Screw securing thermostat cup to head	19.6 - 24.2	2.0 - 2.5
Nut securing thermostat cup to head	17 - 21	1.7 - 2.1

SPECIFIC TOOLS

1.820.263.000	Engine support rear support
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**FAULT DIAGNOSIS AND CORRECTIVE INTERVENTIONS**

FAULTS AND SYMPTOMS	FAULT ISOLATION	TEST REFERENCE
LOSS OF ENGINE COOLANT - (if this shows up by low coolant level and white-green sediments around the area of the leak)	- If the leaks are not copious, perform the procedure given in the section "SEALING TEST ON HYDRAULIC CIRCUIT".	A
ENGINE OVERHEATING	- Start the engine and run it to normal operating temperature. - If the temperature is extremely high the indicator on the instrument panel will light up. NOTE: If the warning light and temperature gauge becomes damaged a pressurized cap on the expansion tank will allow the high pressure in the system to be released through a valve on the pressurized cap. WARNING: If the vehicle is often driven on dusty or muddy roads or when the pollen or insect levels are high, the front part of the radiator may get blocked resulting in a reduction in the cooling action and consequent overheating of the engine.	B



LOSS OF ENGINE COOLANT






TEST A

TEST STEPS		RESULTS	REMEDY
A1	CHECK CLAMPS		
– Check that the clamps are not loose, damaged, incorrectly fitted or of the wrong size.		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	Proceed to phase A2
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	Tighten or replace the faulty clamps
A2	CHECK GASKETS, SLEEVES AND CAPS		
– Check that there are no leaks from the gaskets, sleeves and caps.		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	Proceed to phase A3
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	Replace the faulty parts.
A3	CHECK RADIATOR		
– Check that the radiator is not leaking.		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	Proceed to phase A4
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	Replace the radiator.
A4	CHECK EXPANSION TANK		
– Check that the expansion tank is not leaking from around the cap or through the release valve.		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	Proceed to phase A5
		<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	If damaged replace the tank

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LOSS OF ENGINE COOLANT	TEST A
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TEST STEPS		RESULTS	REMEDY
A5	CHECK GASKET		
- Check that there are no leaks from the coolant pump gaskets or from the thermostat unit.		 ►	Proceed to phase A6
		 ►	Replace the gasket between the pump and the motor or the gasket between the motor and the thermostat unit.
A6	CHECKING WATER PUMP AND THERMOSTAT UNIT		
- Check that there are no cracks or other defects on the water pump or thermostat unit.		 ►	Proceed to phase A7
		 ►	Replace the faulty parts
A7	CHECK CYLINDER HEAD		
- Check that the screws of the cylinder heads have been tightened to the correct torque. If the torque is correct, check the condition of the cylinder head gaskets.		 ►	Tighten the screws to the correct torque or replace the cylinder head gaskets. (In this case check that the engine oil has not been contaminated by engine coolant).

End of test A











ENGINE OVERHEATING	TEST B
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TEST STEPS		RESULTS	REMEDY
B1	CHECK WARNING LIGHT AND GAUGE		
	– Check that the engine coolant temperature warning light and gauge, and the engine senders work correctly - see ELECTRICAL AND ELECTRONIC DIAGNOSIS.	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B2</p> <p>Replace or repair the faulty parts.</p>
B2	CHECK LEVEL OF ENGINE COOLANT		
	– Check the level of engine coolant.	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B3</p> <p>Top up the liquid to the correct level. Check the sealing of the circuit.</p>
B3	CHECK LEVEL OF ENGINE OIL		
	– Check the level of the engine oil	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B4</p> <p>Top up the engine oil to the correct level.</p>
B4	CHECK BELT		
	– Check the tension and condition of the water pump drive belt.	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">(OK)</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B5</p> <p>Tighten the belt to the correct tension or replace it if damaged or excessively worn.</p>

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ENGINE OVERHEATING	TEST B
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TEST STEPS		RESULTS	REMEDY
B5	CHECK ENGINE COOLING FAN		
– Check the operation of the engine cooling fan - see ELECTRICAL AND ELECTRONIC DIAGNOSIS		 ►	Proceed to phase B6
		 ►	Replace the electric fan or the elements of the electrical system which cannot be used.
B6	CHECK THERMAL CONTACT		
– Check the setting of the engine cooling fan thermal contact.		 ►	Proceed to phase B7
		 ►	Replace the thermal contact.
B7	CHECK DUCTS		
– Check that there are no obstructions in the engine coolant ducts. Visually check that the sleeves are not squashed or bent.		 ►	Proceed to phase B8
		 ►	Restore the operation of the ducts to normal.
B8	CHECK FLOW OF ENGINE COOLANT		
– Check that the engine coolant flows freely in the ducts by manually pumping it through the hoses and checking the agitation of the liquid in the expansion tank.		 ►	Proceed to phase B9
		 ►	Clean the blocked ducts with the specific detergent. Ensure that the engine coolant is of the specified type.

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ENGINE OVERHEATING	TEST B
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TEST STEPS		RESULTS	REMEDY
B9	CHECK RADIATOR		
	– Check that the radiator is not encrusted and that it contains no foreign materials.	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B10</p> <p>Wash the radiator with the specific detergents Ensure that the engine coolant is of the specified type.</p>
B10	CHECK WATER PUMP		
	– Check the state and operation of the water pump.	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B11</p> <p>Replace the pump and relative gasket.</p>
B11	CHECK THERMOSTAT		
	– Run the engine to normal operating temperature and touch the duct between the thermostat and the radiator. Ensure that it heats up slowly.	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B12</p> <p>Replace the thermostat unit and relative gasket.</p>
B12	CHECK THERMOSTAT		
	– Check that the thermostat is set correctly.	<div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="text-align: center;">OK</div> <div style="font-size: 2em;">▶</div> </div>	<p>Proceed to phase B13</p> <p>Replace the thermostat unit and relative gasket.</p>

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ENGINE OVERHEATING

TEST B

TEST STEPS		RESULTS	REMEDY
B13	CHECK TIMING PHASE		Restore the correct timing phase.
- Check that the timing phase is correct - see GROUP 00 - CHECKING TIMING PHASE.			

End of test B