

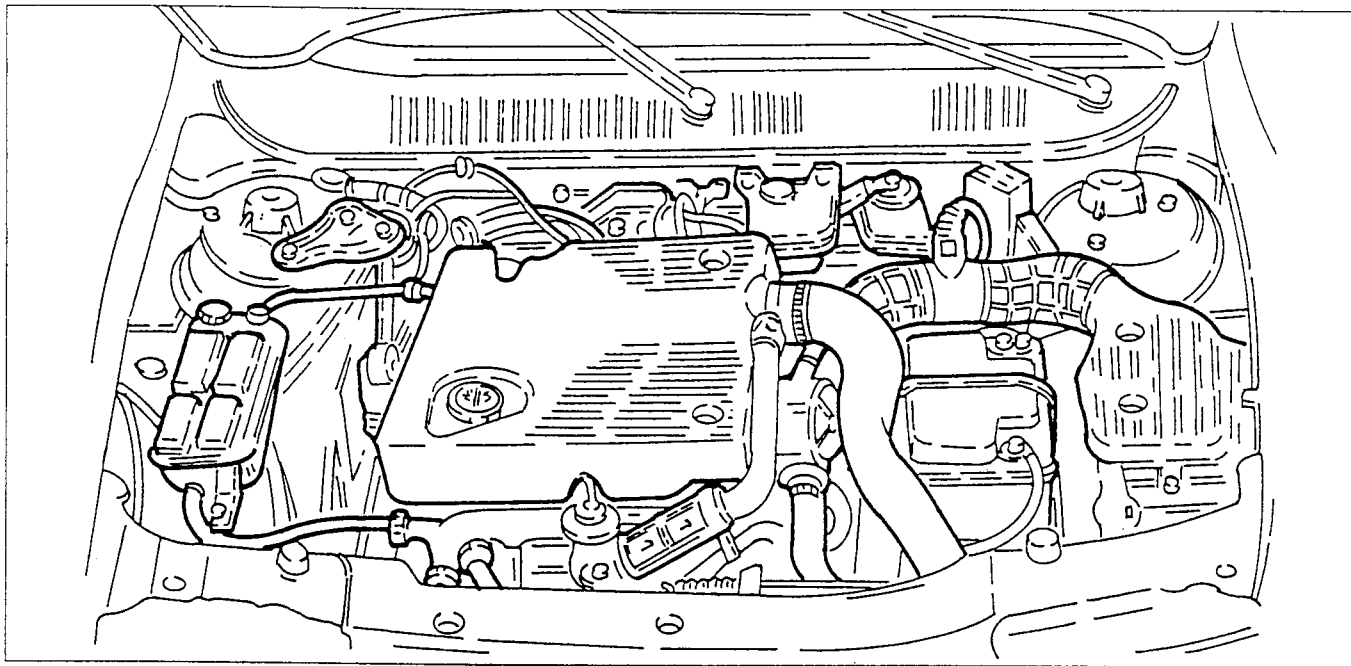
DESCRIPTION

The information and illustrations given below make it possible to quickly remove the power unit from its housing and then refit it.

Disassembly of the single components on the bench is described in the "ENGINE OVERHAULING" volume.

The following procedure may be used only in part depending on necessity.

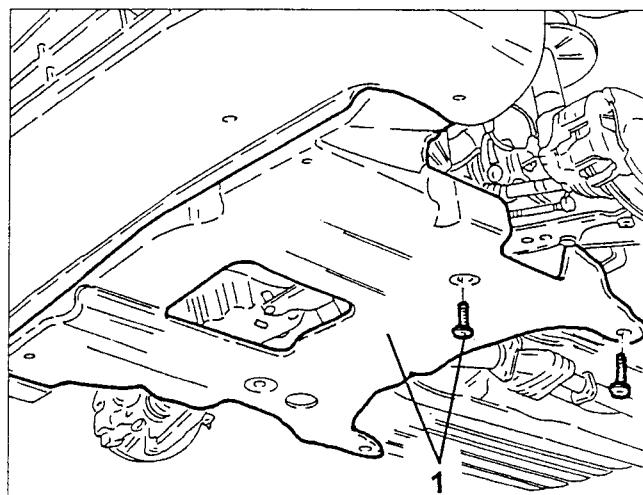
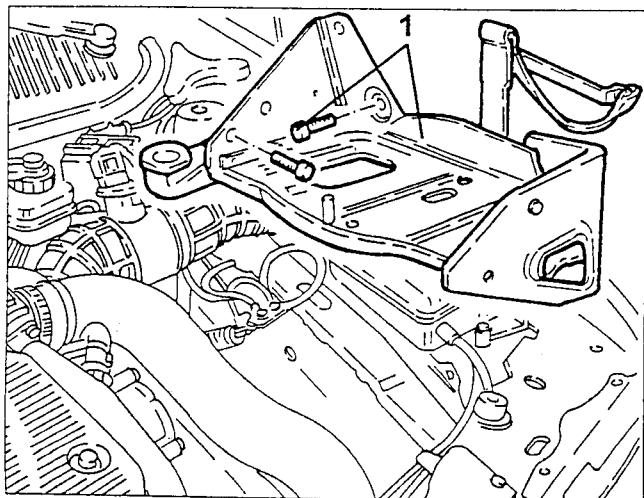
For further information and details, refer to the chapters concerning the components or specific groups.



REMOVAL

- Set the car on a lift.
- Remove the battery (see GROUP 55).
- Remove the battery acid drain duct.
- 1. Slacken the fastening screws and remove the battery holder.

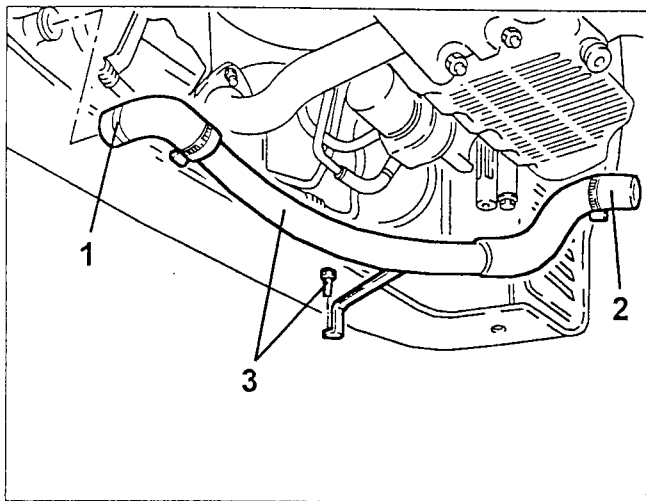
- Remove the front wheels and dust guards.
- 1. Slacken the fasteners and remove the under engine guard.



1. Drain the engine coolant fluid, disconnecting the coolant outlet sleeve from the radiator.

NOTE: Collect the coolant in a suitable container.

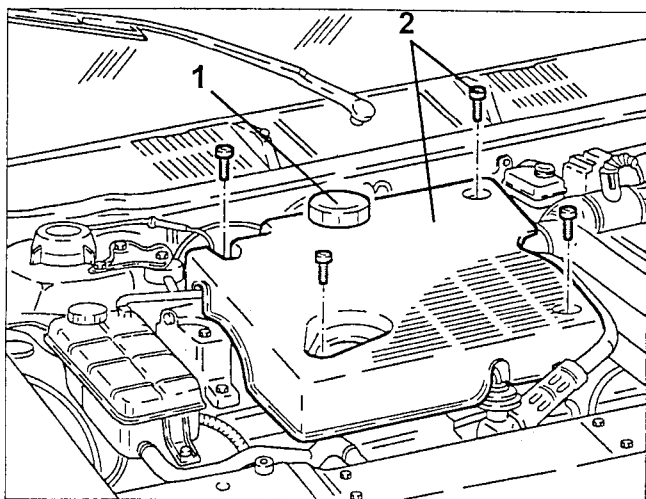
2. Disconnect the coolant outlet sleeve from the stiff coolant return pipe to the pump.
3. Slacken the fastening screw and remove the coolant outlet pipe from the radiator.



- Using a suitable syringe, siphon the oil from the power steering tank.

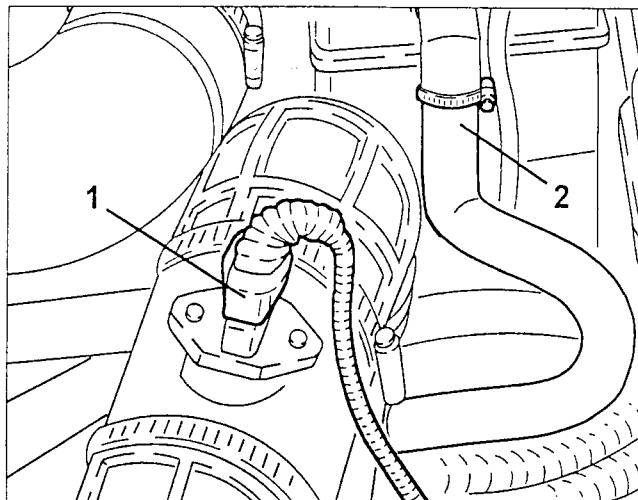
1. Remove the engine oil filler cap.
2. Slacken the fastening screws and remove the engine cover.

- Refit the engine oil filler cap.

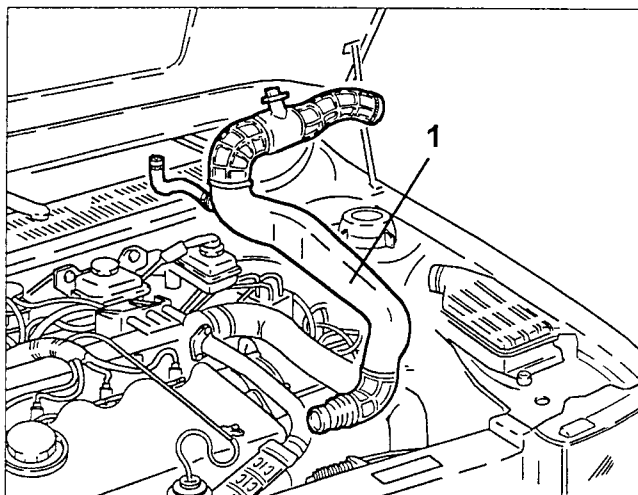


1. Disconnect the electrical connection from the air flow meter.

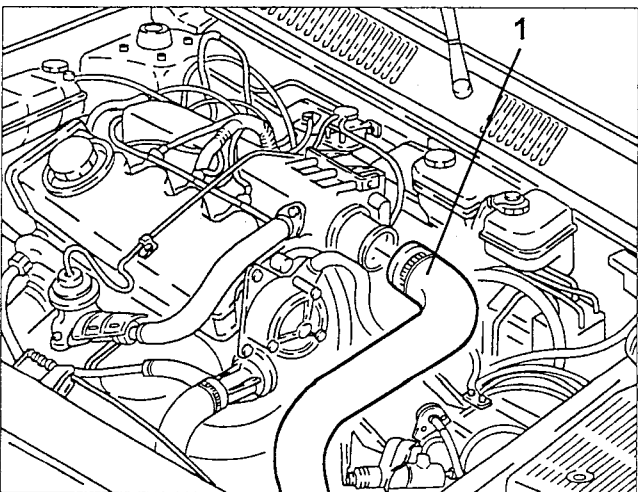
2. Disconnect the oil vapour re-circulation pipe from the oil vapour separator.



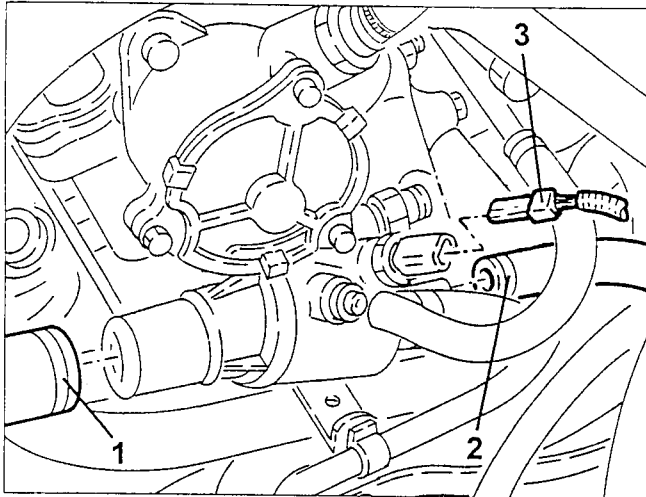
1. Slacken the clamps and remove the complete air delivery pipe from the filter to the turbocharger.



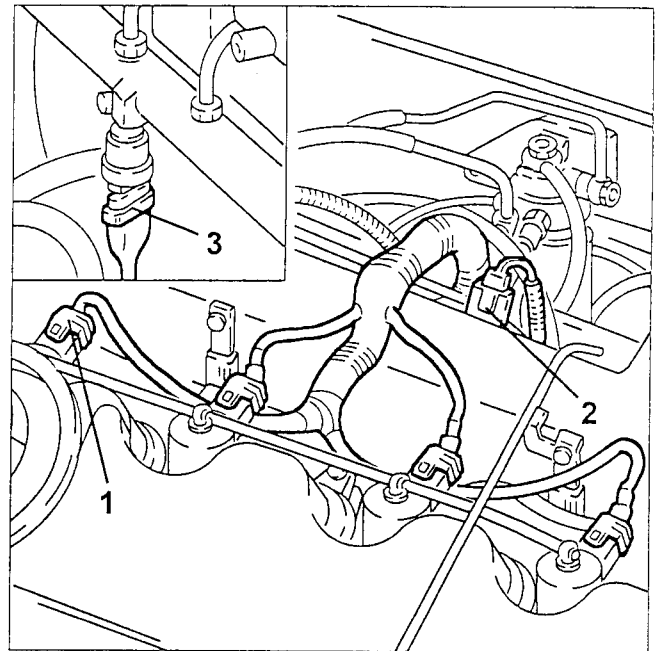
1. Disconnect the air delivery pipe from the inter-cooler from the intake box.



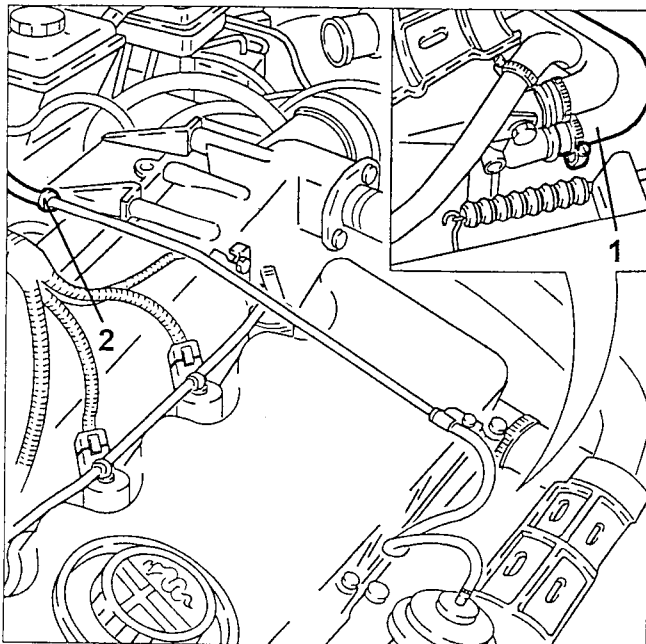
1. Disconnect the coolant delivery sleeve to the radiator from the thermostatic cup.
2. Disconnect the coolant delivery pipe to the climate control system heater from the thermostatic cup.
3. Disconnect the electrical connection from the engine coolant temperature sensor.



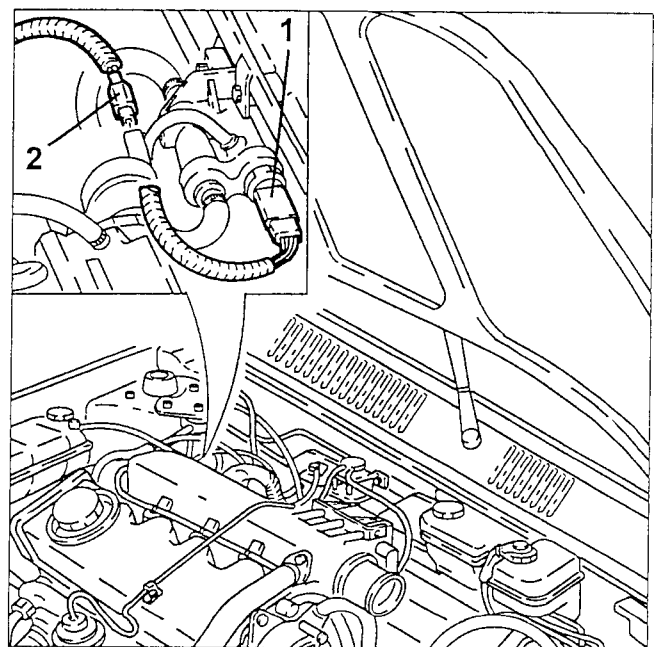
1. Disconnect the electrical connection of the injectors.
2. Disconnect the electrical connection from the overpressure sensor.
3. Disconnect the electrical connection from the fuel temperature sensor.



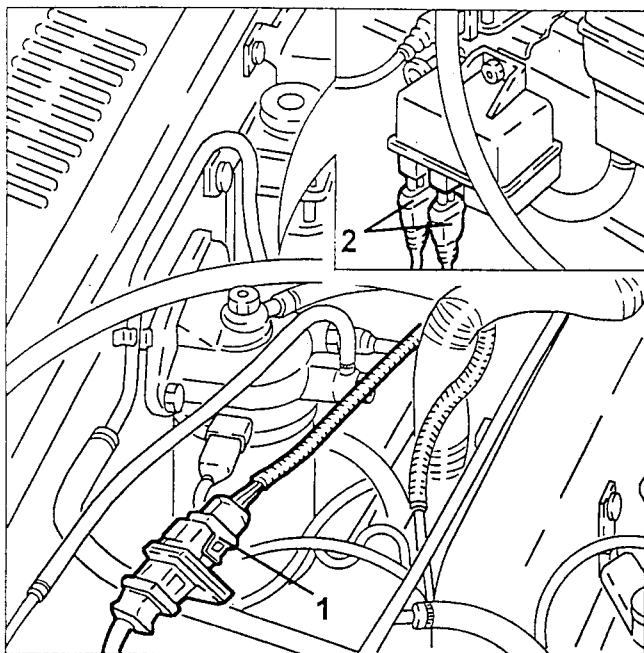
1. Disconnect the return pipe from the climate control system heater from the stiff water pump coolant return pipe.
2. Disconnect the connection of the E.G.R. valve modulated control pipe.



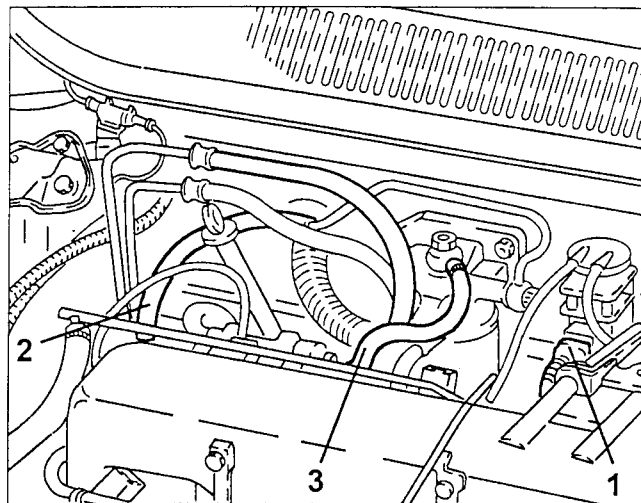
1. Disconnect the electrical connection from the fuel pressure sensor.
2. Disconnect the electrical connection from the fuel pressure regulator.



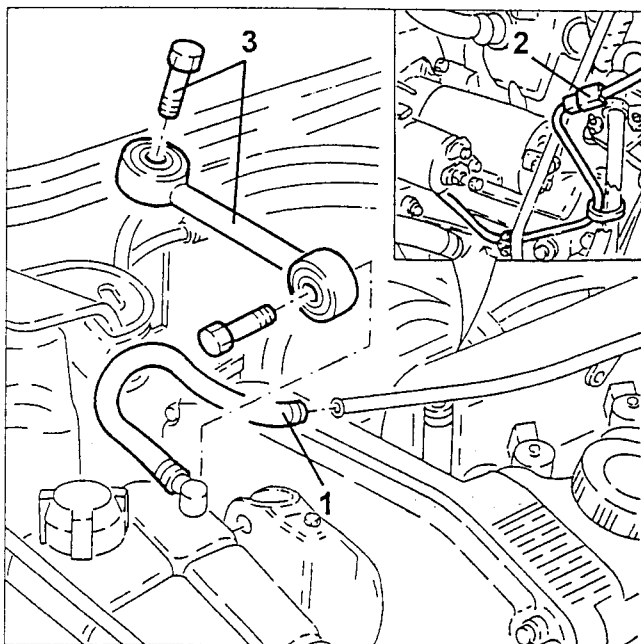
1. Disconnect the electrical connection of the cam angle sensor.
2. Disconnect the electrical connections from the glow plug warming control unit.



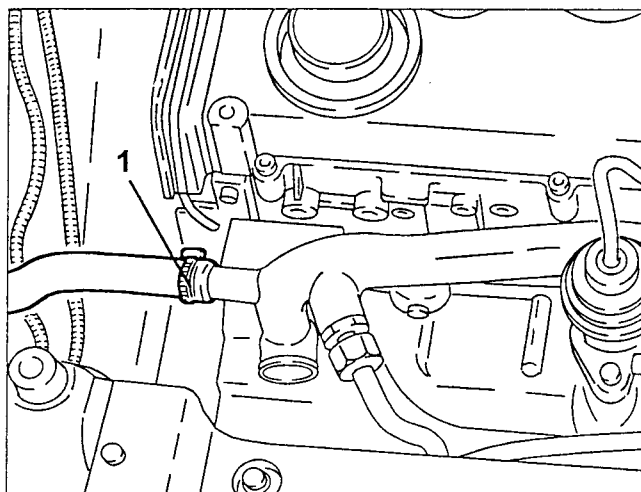
1. Disconnect the electrical connection E.G.R. modulation solenoid valve.
2. Disconnect the fuel delivery pipe from the pressure pump.
3. Disconnect the fuel return pipe from the fuel return manifold pipe.



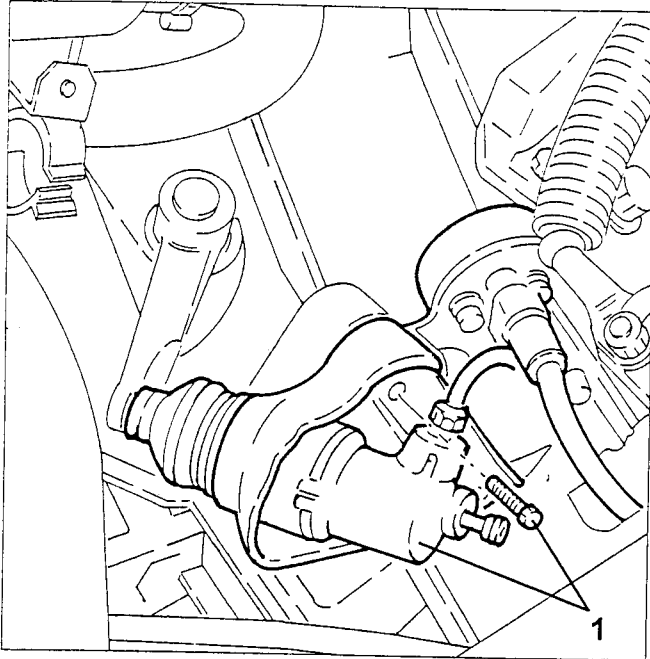
1. Disconnect the connection of the coolant return pipe to the header tank.
2. Disconnect the electrical connection of the rpm sensor.
3. Slacken the fastening screws and remove the power unit reaction rod.



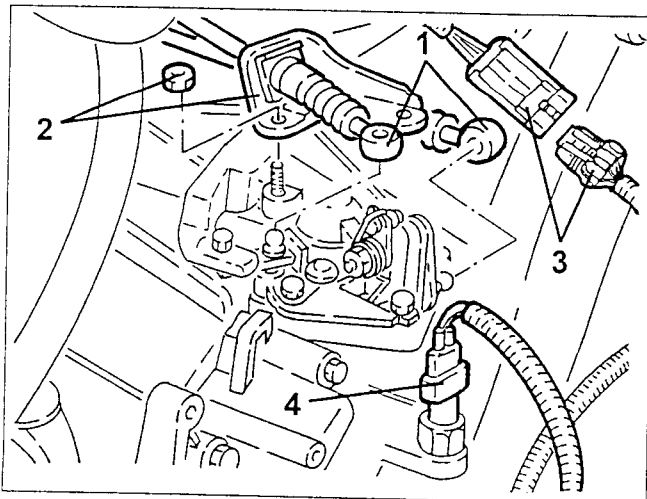
1. Disconnect the system supply pipe leading from the header tank from the stiff coolant return pipe to the water pump.



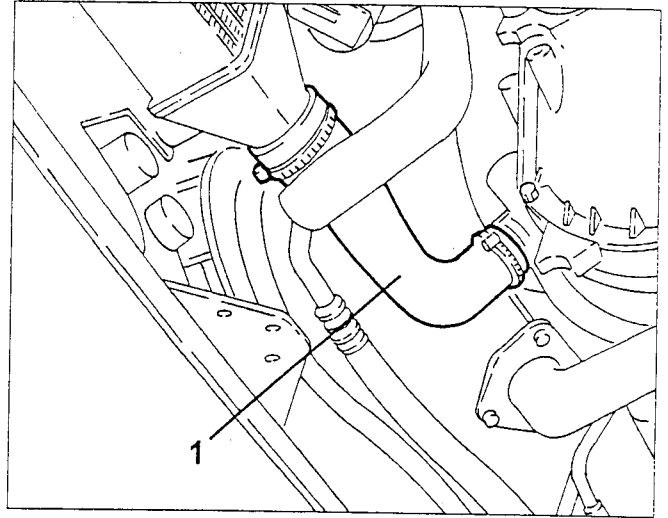
1. Slacken the fastening screws and move aside the operating cylinder complete with pipes and pulse damper.



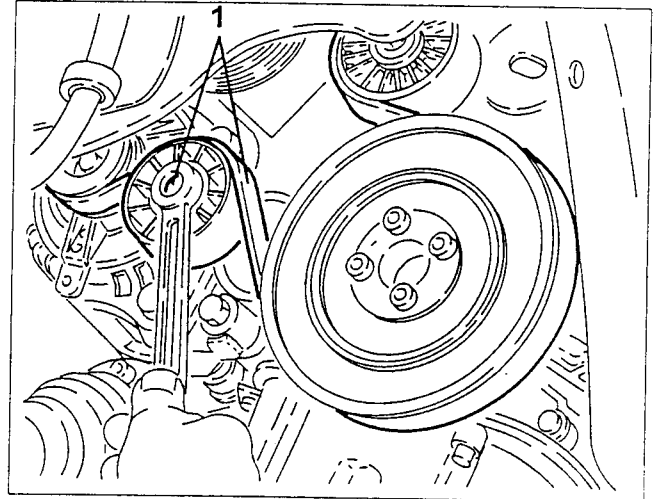
1. Disconnect the gear selection and engagement cables.
2. Slacken the nuts and move aside the support brackets complete with gear selection and engagement cables.
3. Disconnect the electrical connection of the speedometer sensor.
4. Disconnect the electrical connection from the reversing lights sensor.



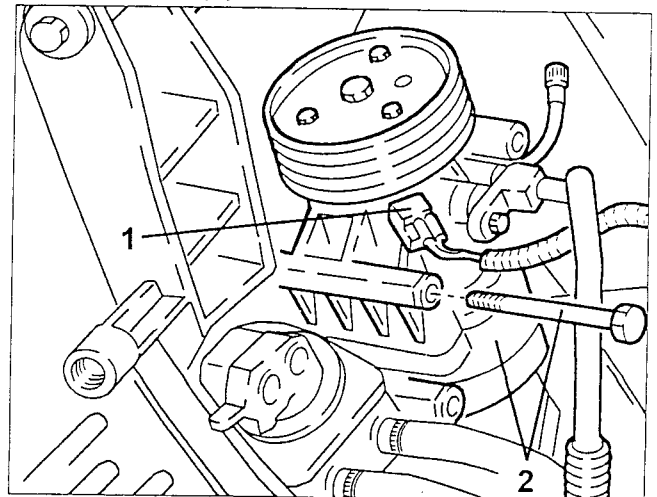
1. Remove the air delivery pipe from the turbo-charger to the heat exchanger.



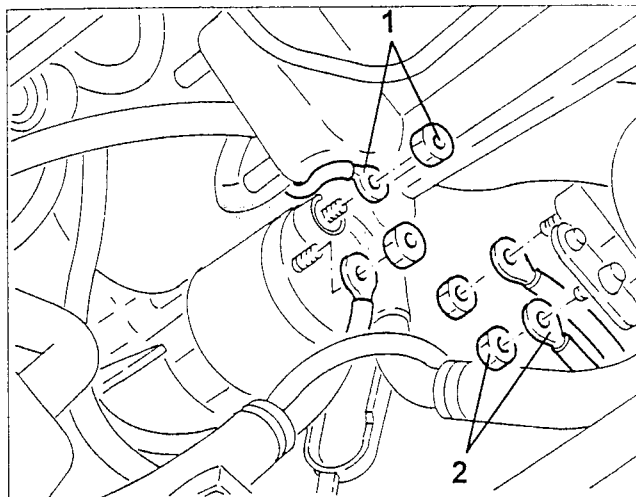
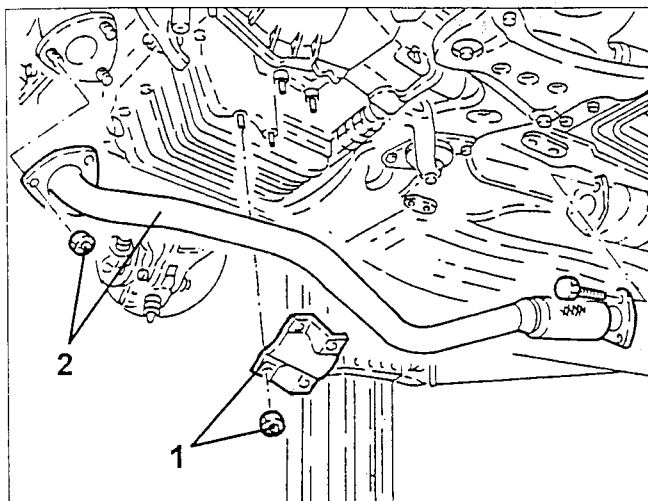
1. Working as illustrated on the tensioner, slacken the tension of the engine components belt and remove it.



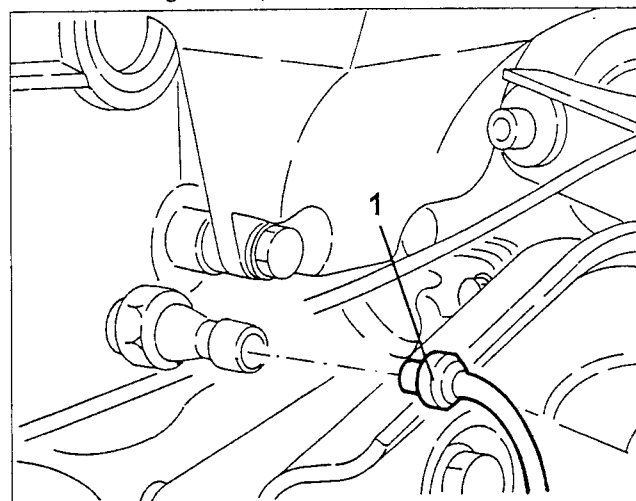
1. Disconnect the electrical connection from the conditioner compressor.
2. Slacken the fastening screws and move aside the conditioner compressor without disconnecting the associated pipes.



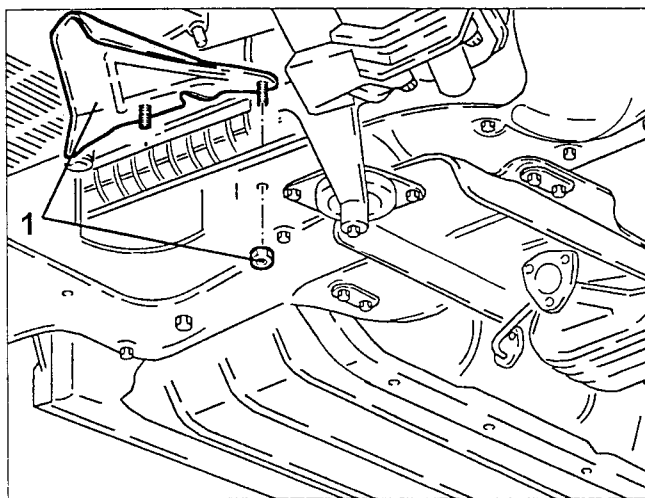
1. Slacken the fastening nuts and remove the reinforcement bracket.
 2. Slacken the nuts and screws and remove the front section of the exhaust pipe.
- Remove the associated seals.



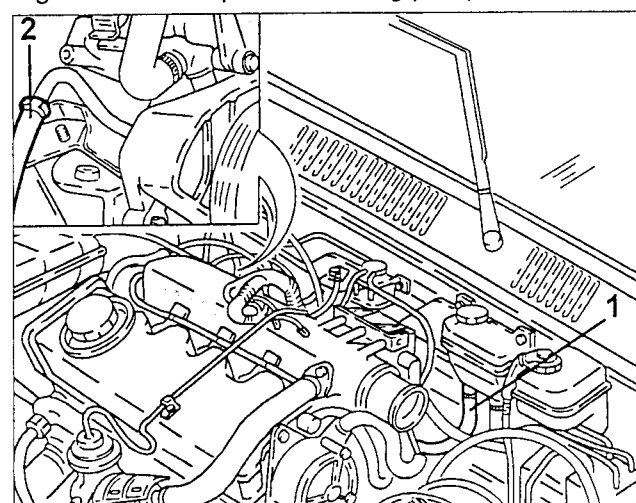
1. Disconnect the electrical connection from the minimum engine oil pressure sensor.



1. Slacken the nuts and remove the power steering box heat shield.

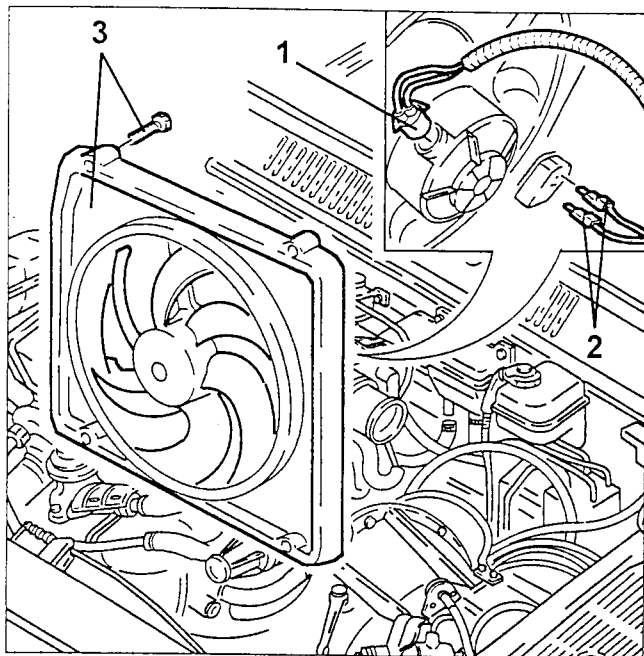


1. Disconnect the delivery pipe to the pump from the power steering fluid tank.
2. Disconnect the delivery pipe to the power steering box from the power steering pump.

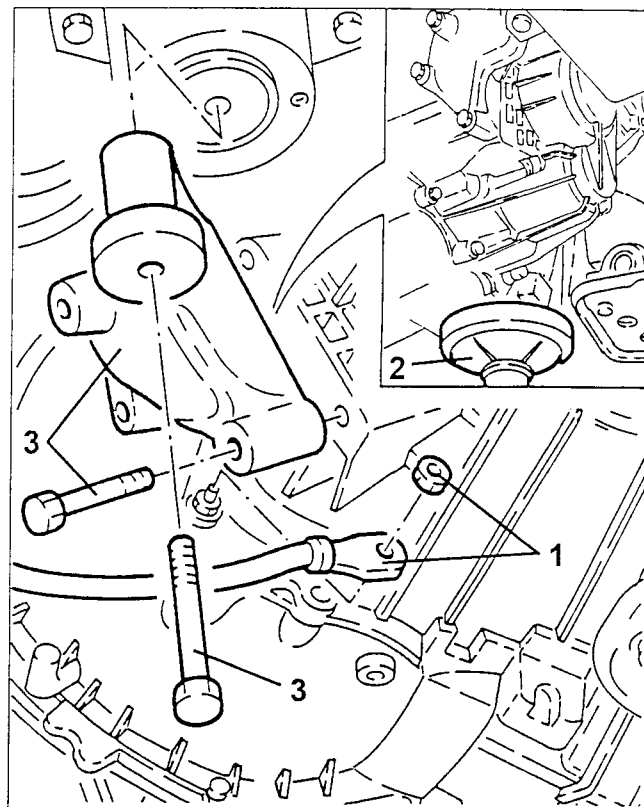


1. Disconnect the electrical connections from the starter motor.
2. Disconnect the electrical connections from the alternator.

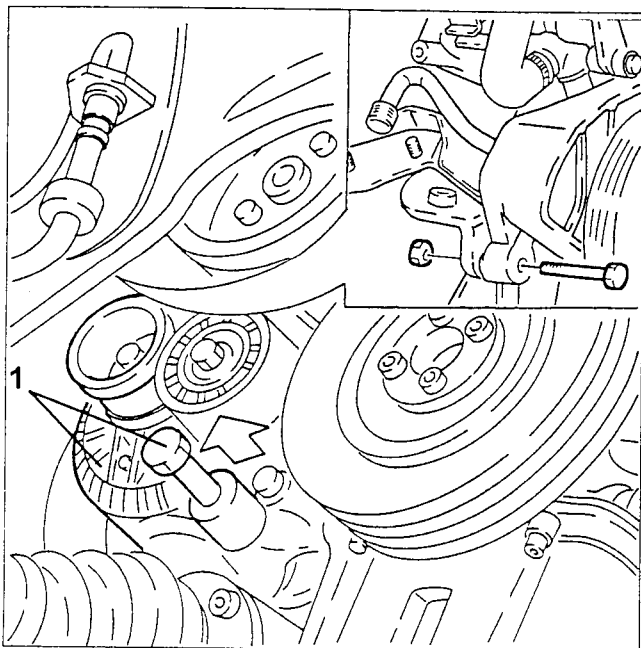
1. Disconnect the electrical connection from the engine cooling fan.
2. Disconnect the electrical connections from the engine cooling fan resistor.
3. Slacken the fastening screws and remove the engine cooling fan.



3. Slacken the fastening screws and remove the power unit gearbox side support.



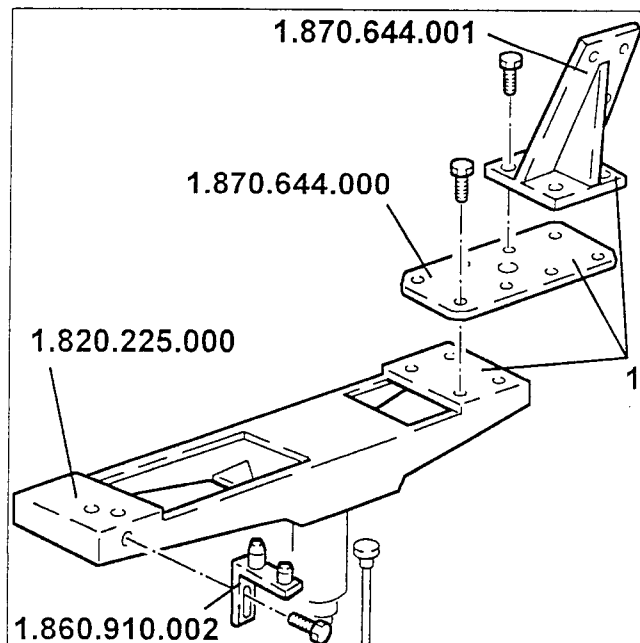
1. Slacken the fastening bolts and remove the alternator.



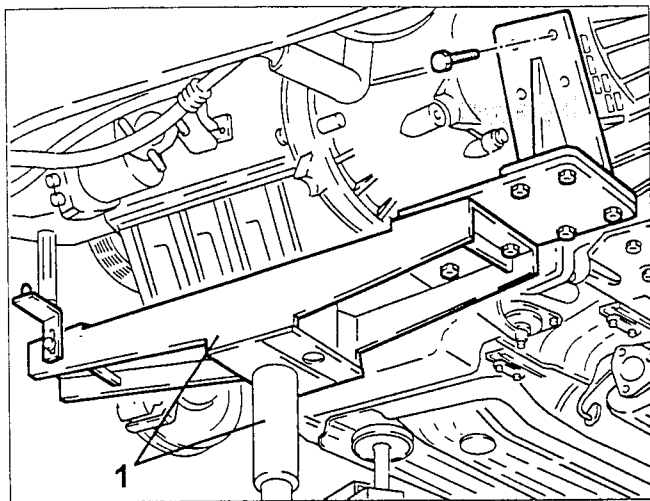
1. Disconnect the earth cable from the gearbox.
2. Place a hydraulic jack under the differential.

- Lower the hydraulic jack until the joint of the left axle shaft to the suspension crossmember rests on it.

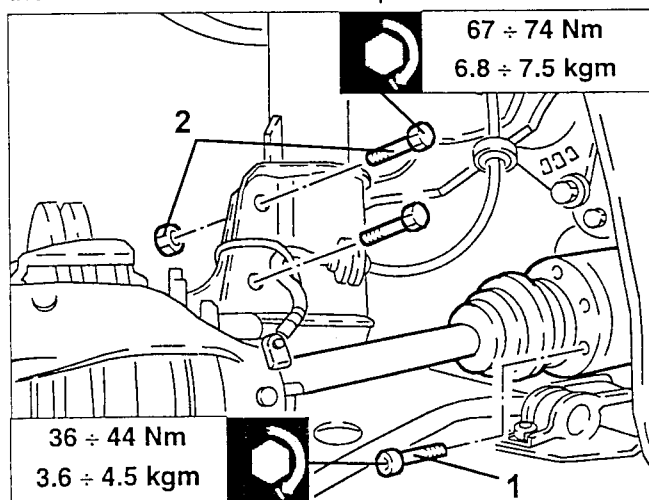
1. Assemble base no. 1.820.225.000, the gearbox side supports no. 1.870.644.000 and 1.870.644.001 and the timing gear side support no. 1.860.910.002 on a hydraulic jack.



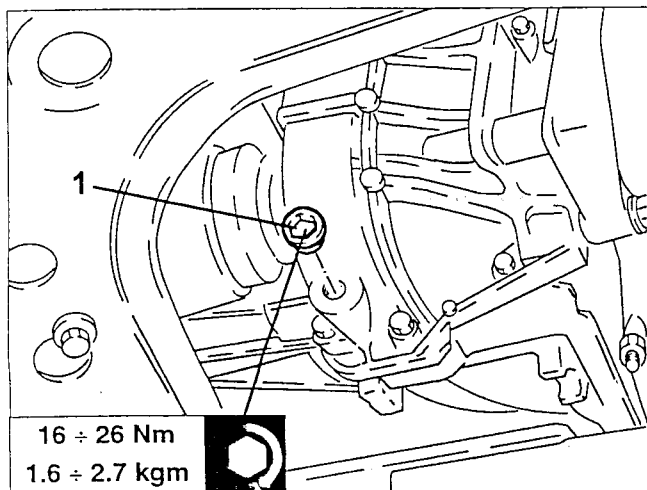
1. Place the hydraulic jack complete with tools under the engine and fasten the gearbox side support with the corresponding screws.



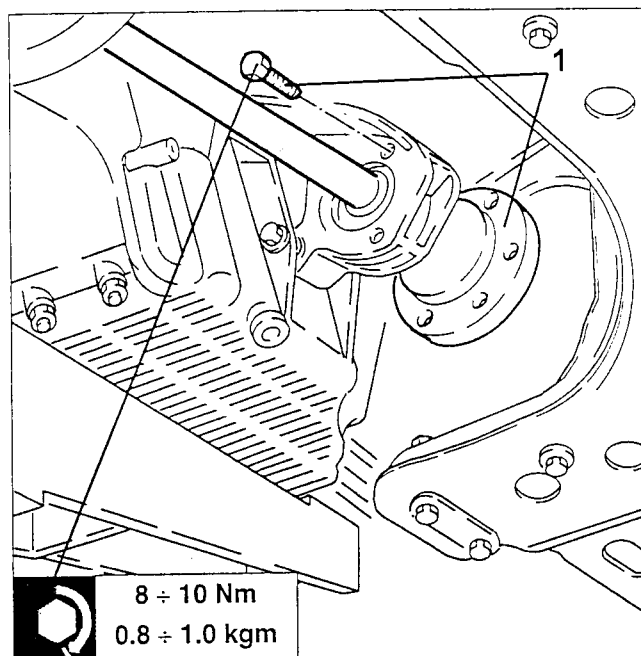
1. Slacken the axle shaft fastening bolts.
2. Slacken the two bolts fastening the right shock absorber to the upright to prevent interference of the axle shaft with the oil sump.



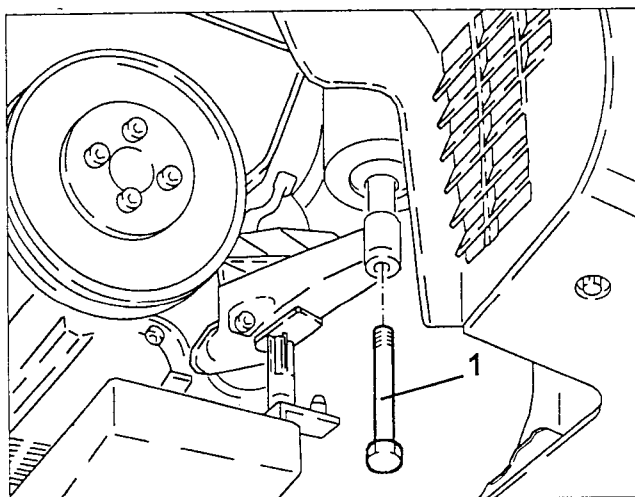
1. Slacken the drain cap and drain the gearbox/differential oil.



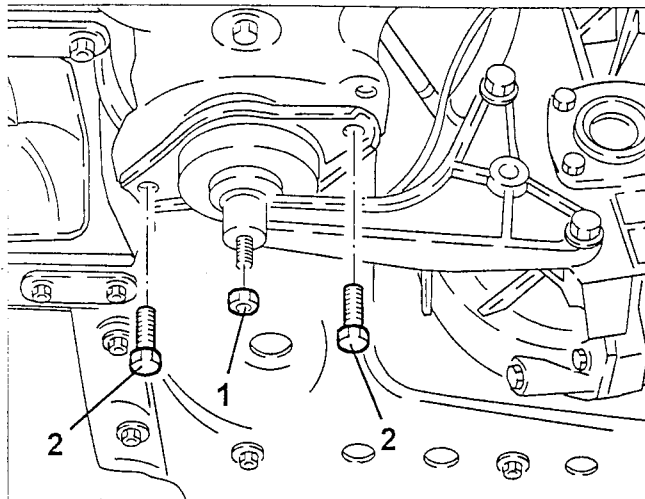
1. Slacken the fastening screws and remove the intermediate axle shaft.



1. Slacken the screw fastening the timing gear side rigid engine support to its flexible pad.

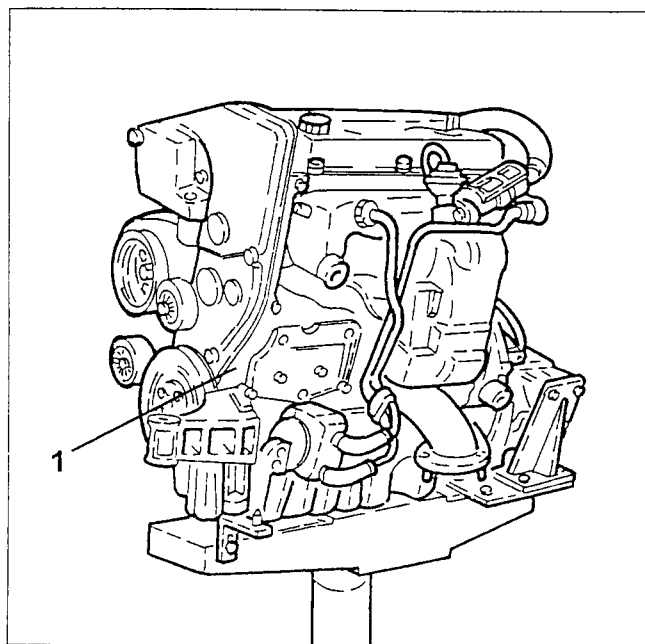


1. Slacken the nut fastening the power unit rear stiff support to its flexible pad.
2. Slacken the screws fastening the power unit rear support flexible pad to the suspension crossmember.



1. Lower the hydraulic jack and remove the power unit from the engine compartment.

WARNING: The hydraulic jack used for removing the power unit must have a capacity of at least 1000 kg.

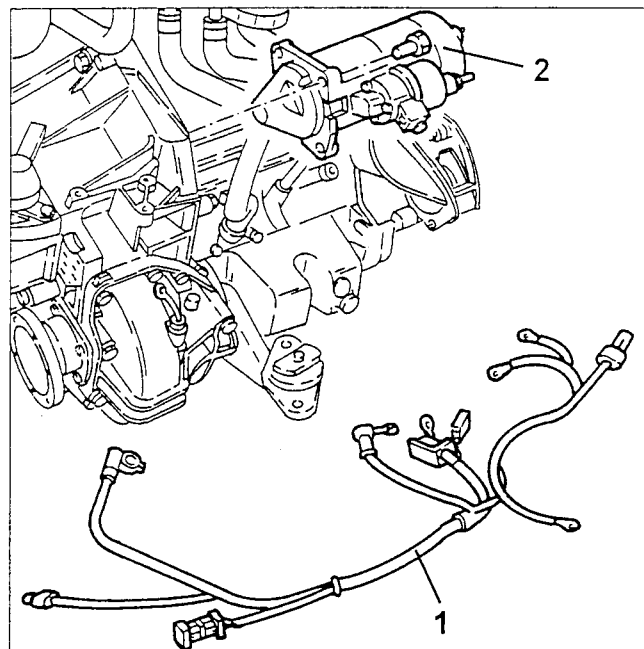


- Support the power unit with a hydraulic hoist as well as with the hydraulic jack used for removal.

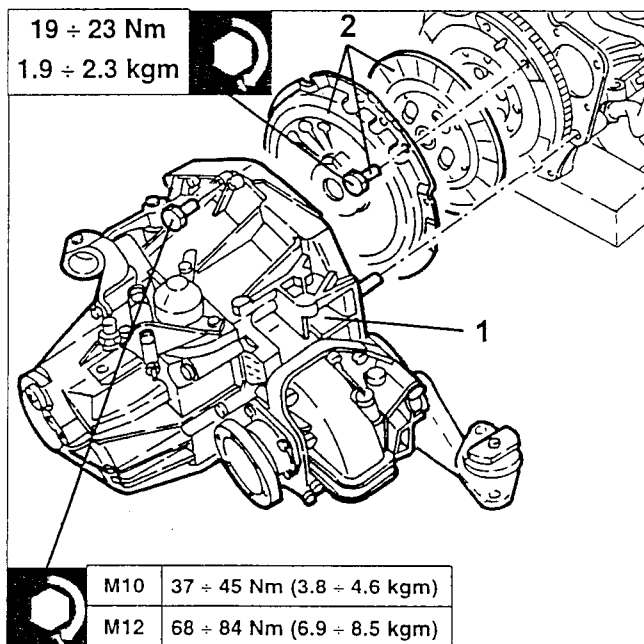
WARNING: For moving the power unit use a hydraulic hoist after freeing it from the hydraulic jack.

- Release the power unit from the support tools, then place it on a special work bench.

1. Scollegare e rimuovere il cablaggio elettrico dal gruppo motopropulsore.
2. Slacken the fastening screws and remove the starter motor.



1. Slacken the fasteners and remove the gear-box/differential unit from the engine.
2. Slacken the fastening screws, then remove the clutch box complete with thrust bearing and clutch plate.



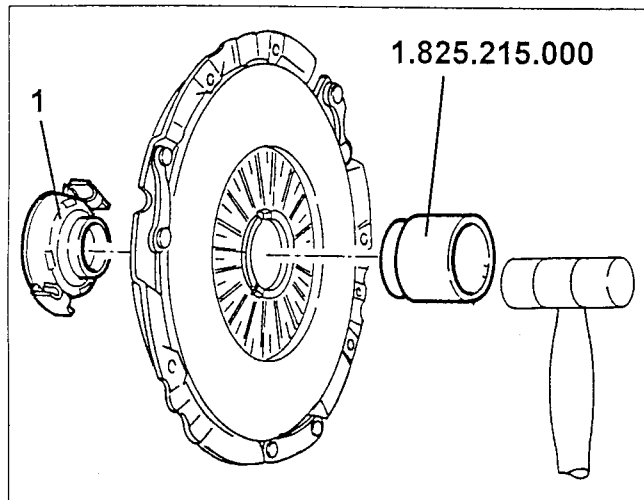
19 ÷ 23 Nm
1.9 ÷ 2.3 kgm

M10	37 ÷ 45 Nm (3.8 ÷ 4.6 kgm)
M12	68 ÷ 84 Nm (6.9 ÷ 8.5 kgm)

REFITTING

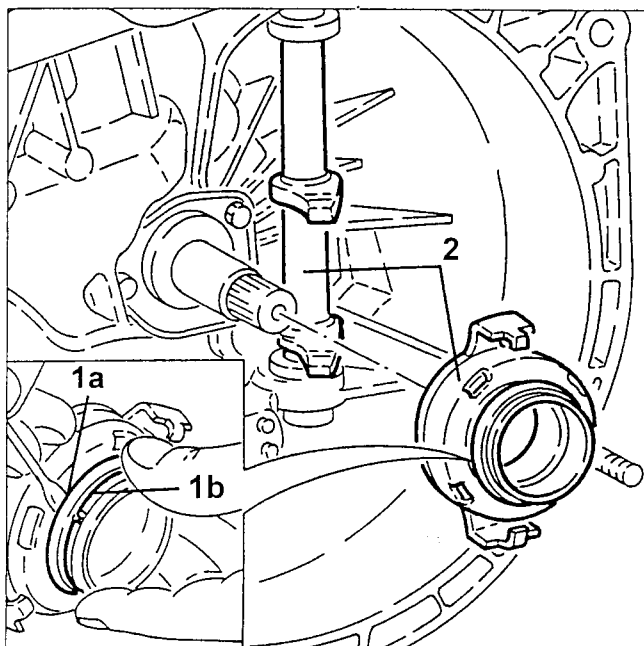
Reverse the sequence followed for removal, following the instructions given below.

1. Remove the thrust bearing from the clutch box using tool no. 1.825.215.000.



- Install the clutch plate and clutch box centring them with tool no. 1.820.124.000.
- Tighten the clutch box fastening screws to the specified torque.

1. Raise the plastic taper ring (1a) of the thrust bearing until covering the spring (1b).
2. Install the thrust bearing on the main shaft and hook it to the fork pin.



- Assemble the gearbox - differential unit and fasten it with its nuts and screws tightening to the specified torque.
- Work on the clutch control lever to engage the thrust bearing on the clutch box.

- Prepare the engine compartment for inserting the power unit, placing all the electric cables, pipes, etc. so that they do not interfere with refitting.
- Take due care when installing the power unit to avoid damaging the single components.

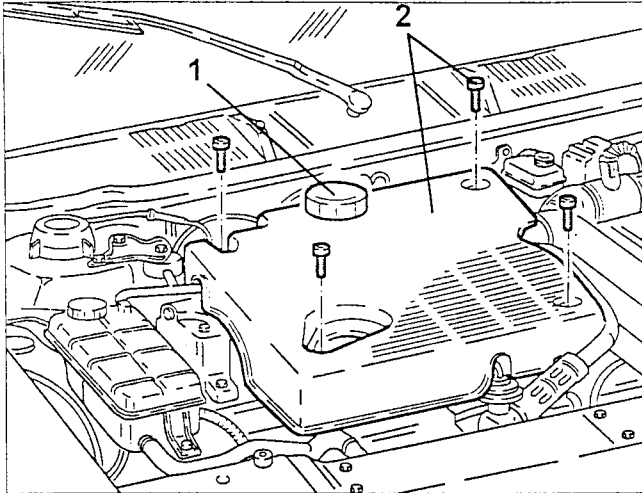
WARNING: Make sure that the power unit support points have been fastened correctly.

- After assembly, fill the various systems following the specified procedures (see Group 00).
- Carry out all the necessary checks and operations (see Group 00).

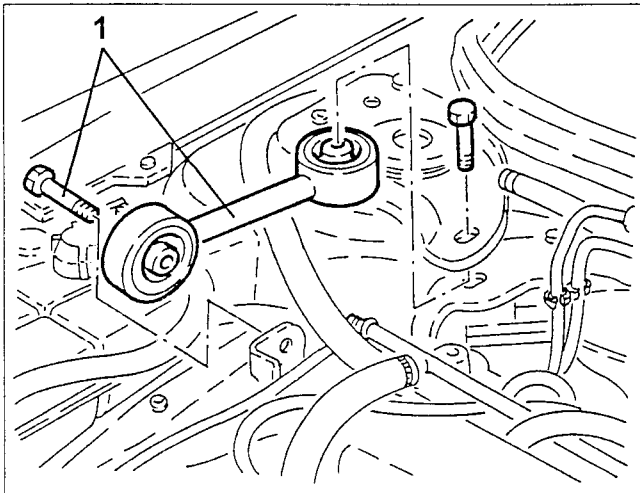
CYLINDER HEAD

REMOVAL/REFITTING

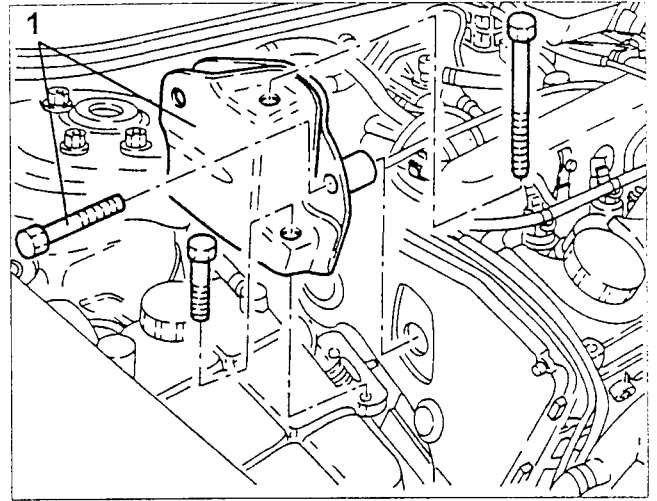
- Set the car on a lift.
- Remove the battery (see GROUP 55).
- 1. Remove the engine oil filler cap.
- 2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.



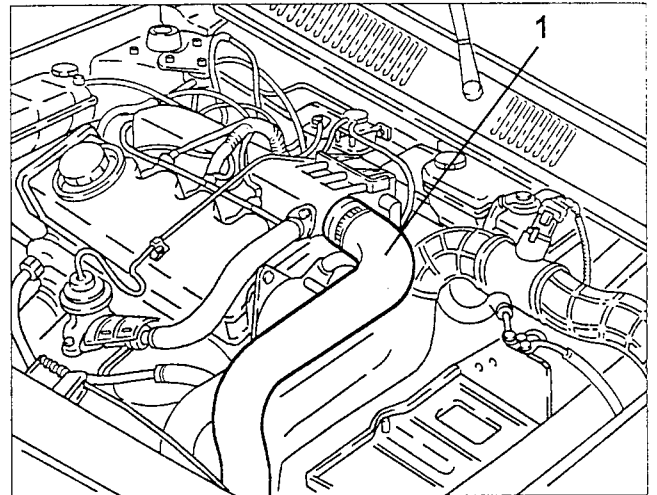
1. Slacken the fastening screws and remove the power unit reaction rod.



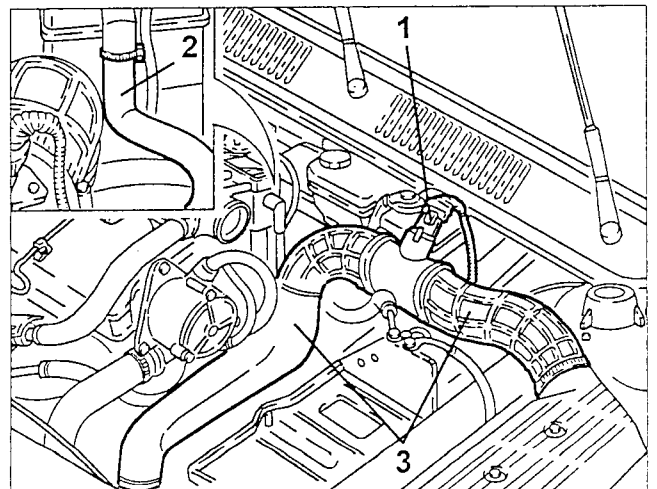
1. Slacken the fastening screws and remove the engine side reaction rod support bracket.



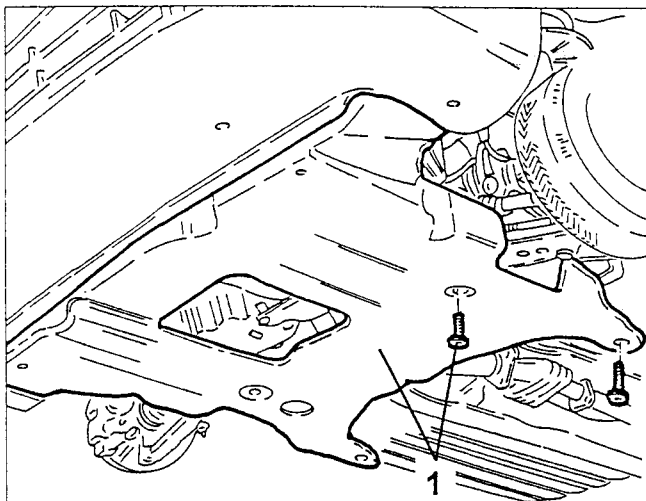
1. Disconnect and remove the air delivery pipe from the intercooler to the intake box.



1. Disconnect the electrical connection from the air flow meter.
2. Disconnect the oil vapour re-circulation pipe from the oil vapour separator.
3. Loosen the clamps and remove the complete air delivery pipe from the cleaner to the turbocharger.

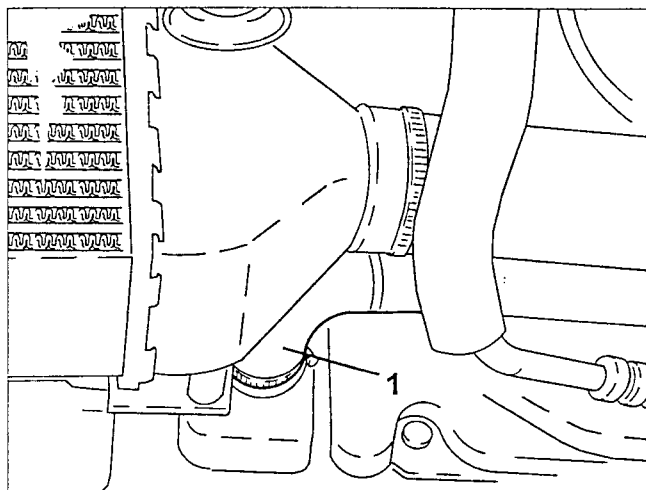


- Remove the right front wheel and dust guard.
 - Remove the right front wheel arch.
1. Slacken the fastenings and remove the under engine guard.

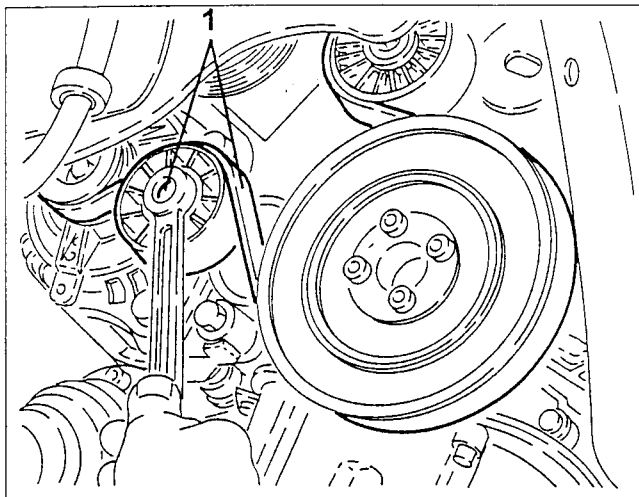


1. Drain the engine coolant fluid, disconnecting the coolant fluid outlet sleeve from the engine cooling radiator.

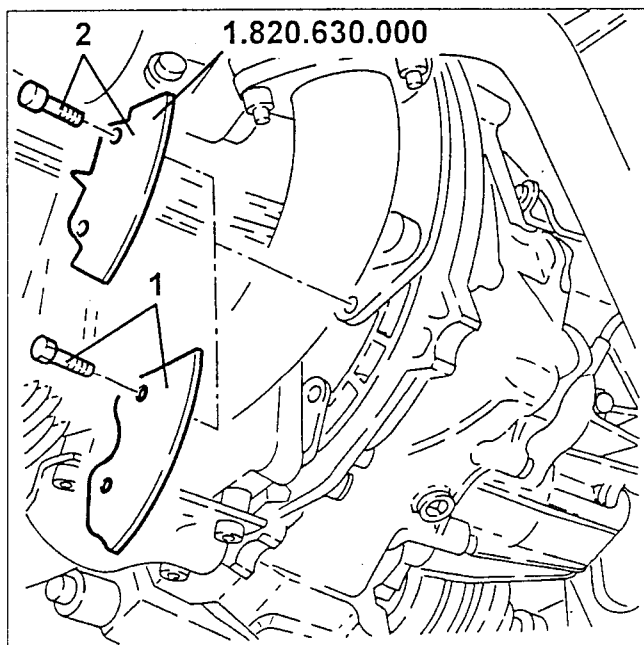
NOTE: Collect the engine coolant fluid in a suitable container.



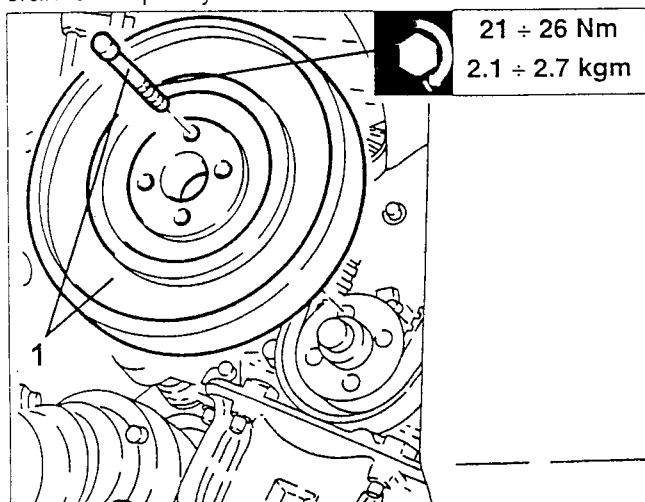
1. Working as illustrated on the tensioner, slacken the tension of the engine components belt and remove it.



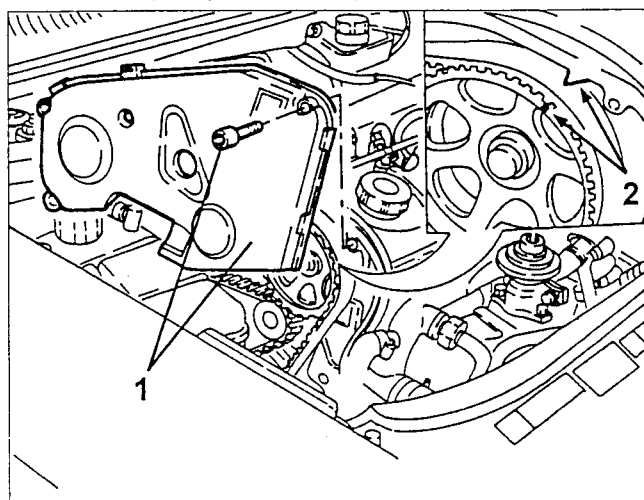
1. Slacken the screws and remove the flywheel lower guard.
2. Install flywheel stopper tool no. 1.820.630.000.



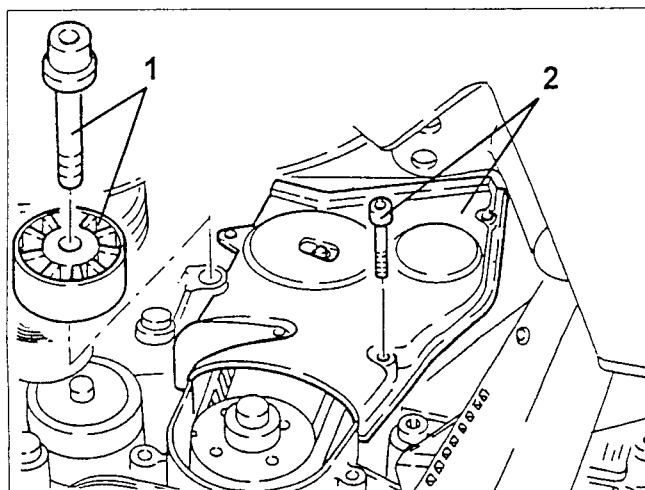
1. Slacken the fastening screws and remove the crankshaft pulley.



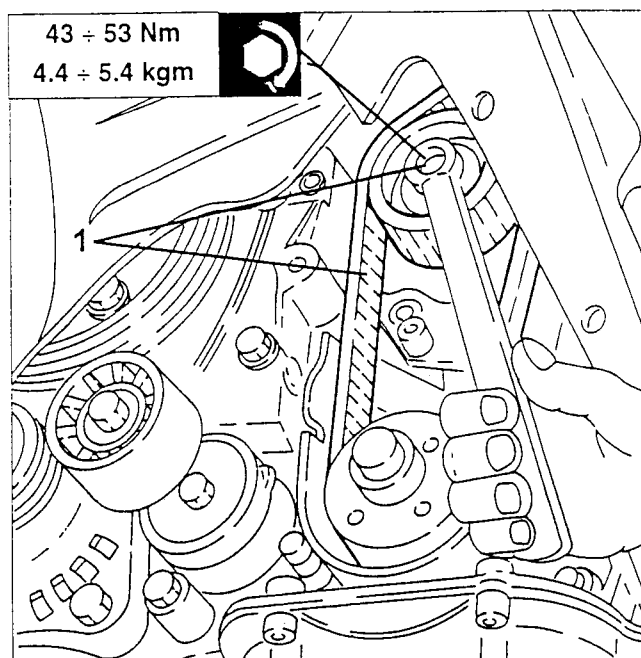
1. Slacken the fastening screws and remove the upper timing gear belt guard.
2. Working on the screw of the camshaft driving pulley, turn the crankshaft until aligning the timing references (1st cyl. at T.D.C.).



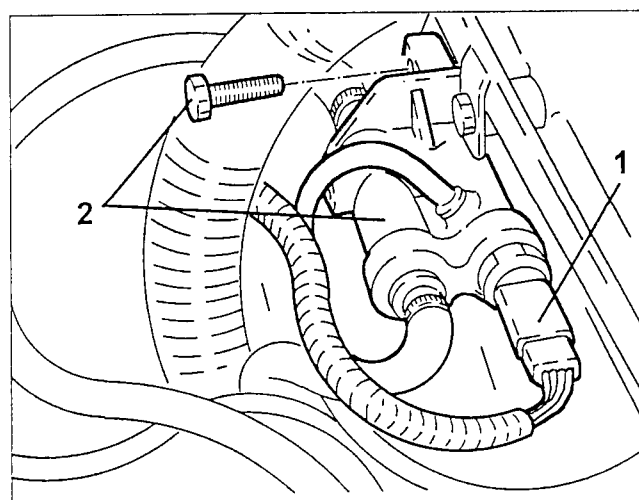
1. Slacken the fastening screw and remove the engine components belt fixed tensioner.
2. Slacken the fastening screws and remove the camshaft belt lower guard.



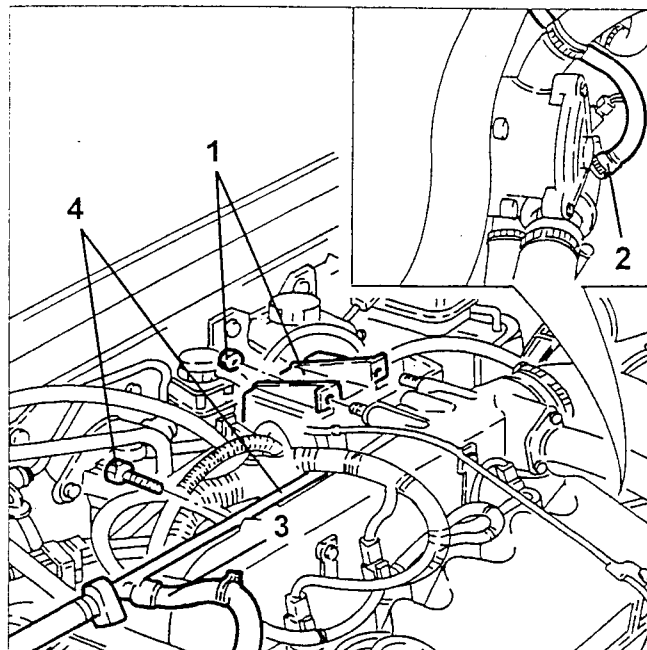
1. Loosen the nut fastening the camshaft belt tensioner, then remove the camshaft belt.



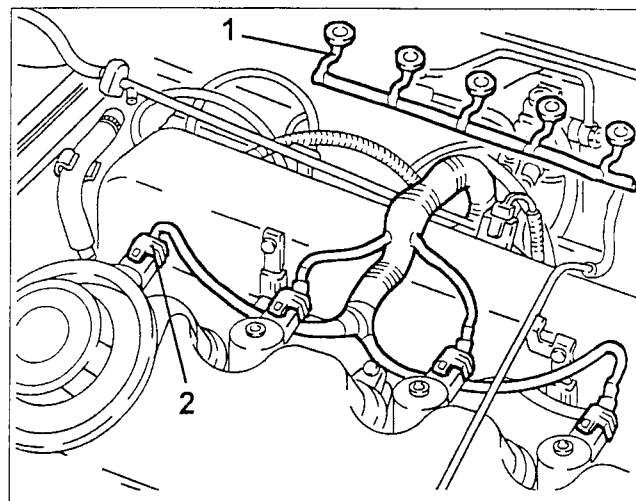
1. Disconnect the electrical connection from the fuel temperature sensor.
2. Slacken the screws and remove the fuel return manifold pipe.



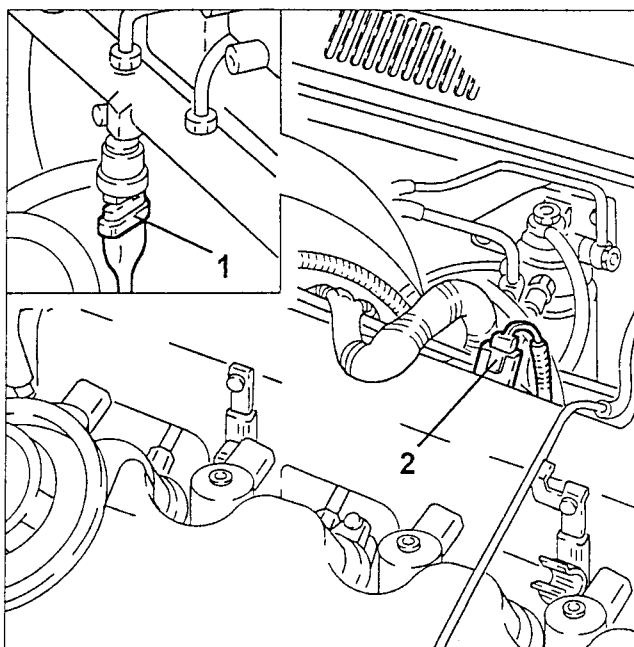
1. Slacken the fastening nuts and move aside the oil vapour separator.
2. Disconnect the coolant fluid return pipe to the header tank from the thermostat.
3. Disconnect the cylinder head coolant outlet pipe from the header tank coolant return pipe.
4. Slacken the fastening screws and move aside the coolant return pipe to the expansion tank.



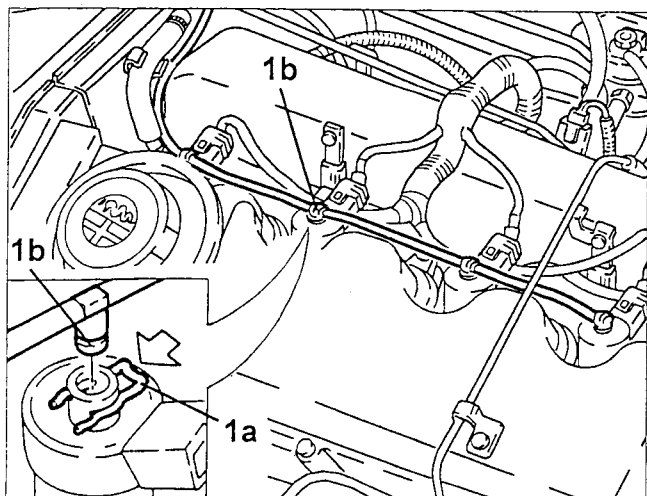
1. Disconnect the electrical connections from the glow plugs.
2. Disconnect the electrical connections from the injectors, then move the wiring aside.



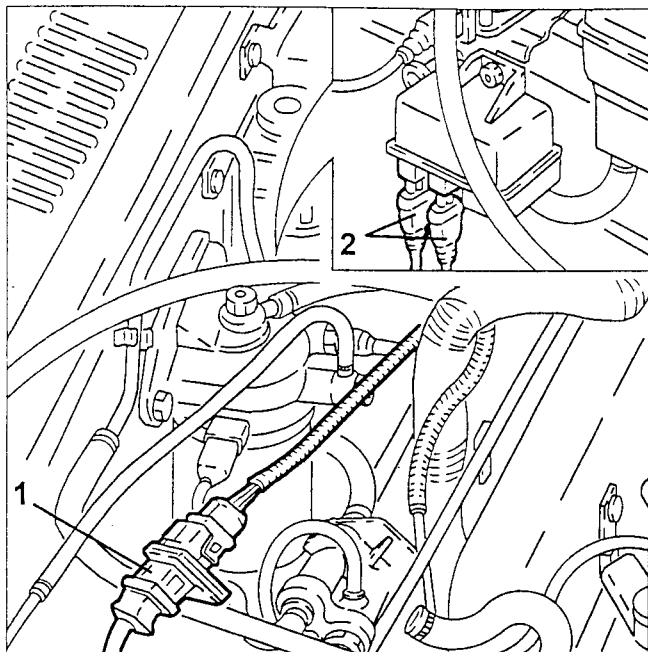
1. Disconnect the electrical connection from the fuel pressure sensor.
2. Disconnect the electrical connection from the supercharging sensor.



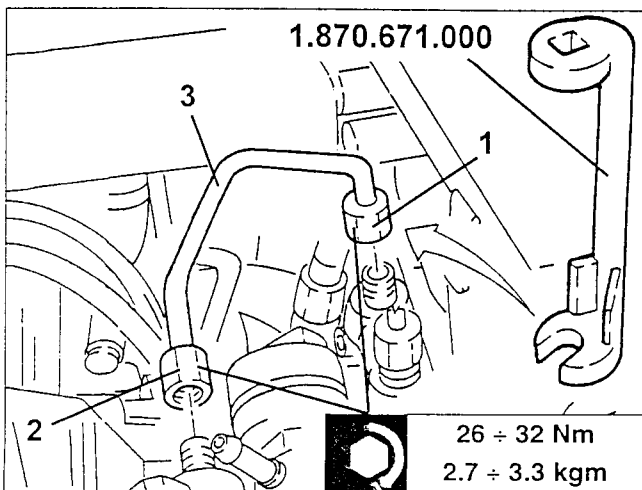
1. Push the catches (1a) by hand and disconnect the fuel return pipe for lubricating the injectors (1b) from the injectors.



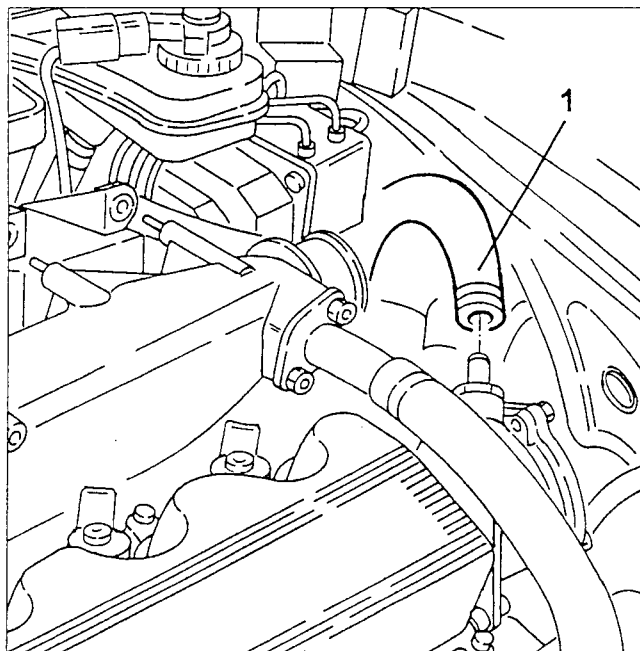
1. Disconnect the electrical connection of the cam angle sensor.
2. Disconnect the electrical connections from the glow plug control unit.



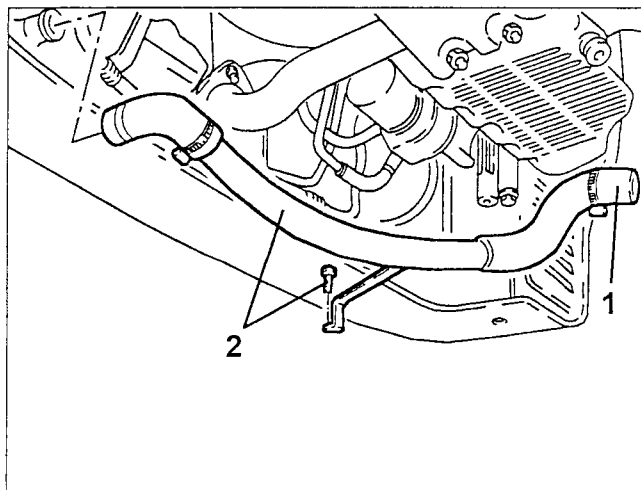
1. Slacken the manifold side coupling of the pipe from the pressure pump to the fuel manifold using tool no. 1.870.671.000.
2. Slacken the pressure pump side coupling of the delivery pipe from the pressure pump to the manifold using a suitable wrench.
3. Remove the fuel delivery pipe from the pressure pump to the single fuel manifold pipe.



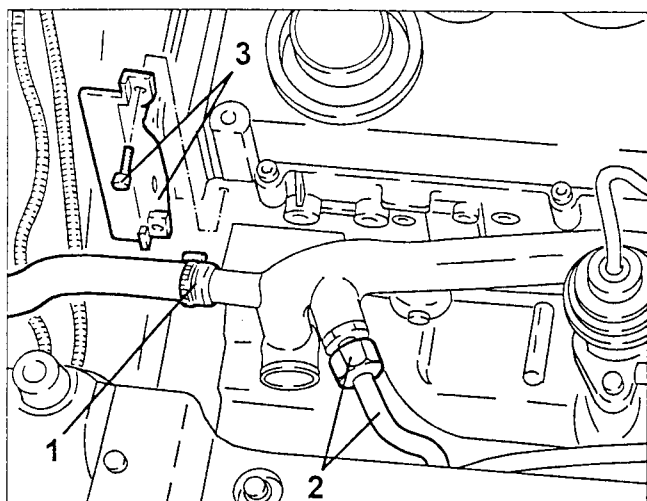
1. Disconnect the vacuum takeoff pipe from the vacuum pump.



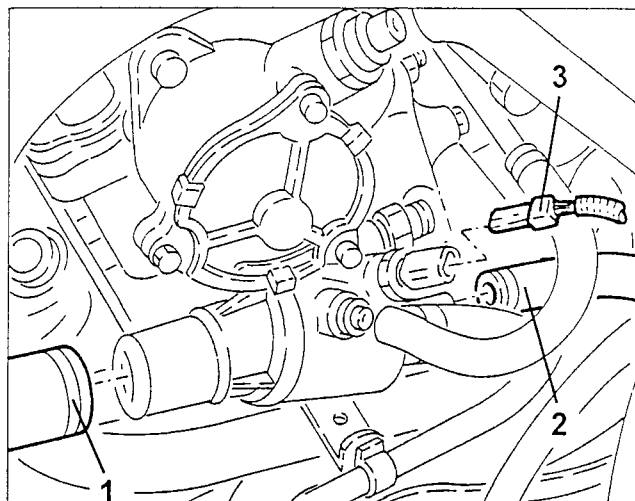
1. Disconnect the coolant fluid outlet sleeve from the stiff coolant return pipe to the pump.
2. Slacken the fastening screw and remove the radiator coolant fluid outlet pipe.



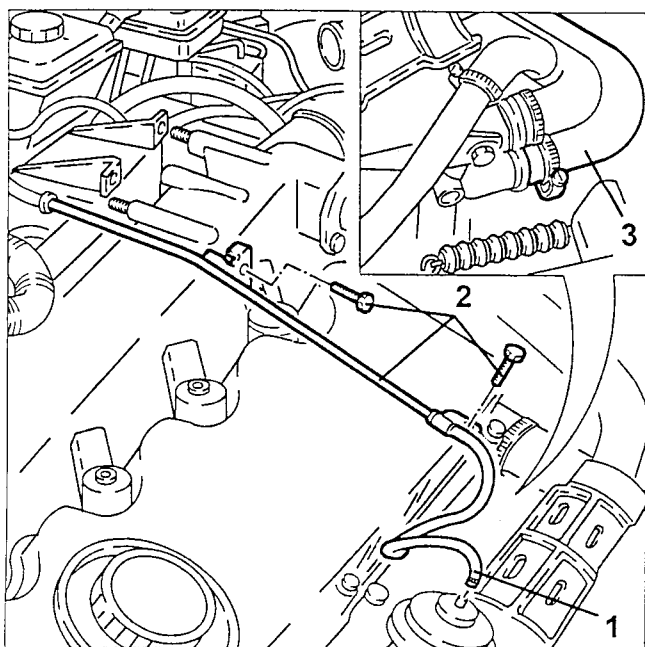
1. Disconnect the system supply pipe from the stiff coolant fluid return pipe to the pump.
2. Slacken the coupling and disconnect the engine oil heat exchanger outlet pipe from the stiff coolant fluid return pipe to the pump.
3. Slacken the fastening screws and remove the camshaft belt left side guard.



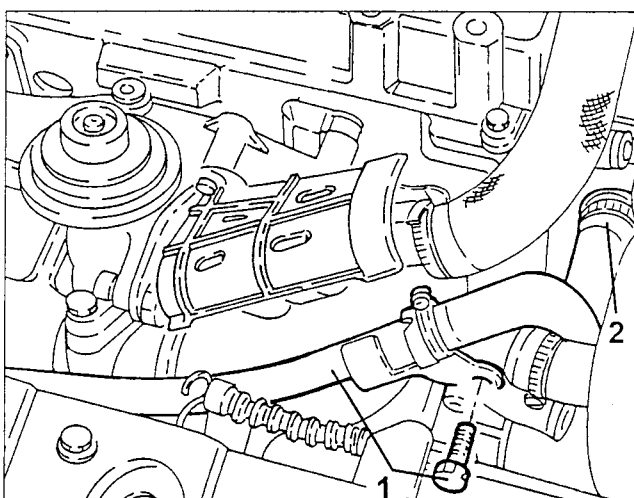
1. Disconnect the coolant fluid delivery sleeve to the radiator from the thermostat.
2. Disconnect the coolant fluid delivery pipe to the climate control system heater from the thermostat.
3. Disconnect the electrical connection from the coolant fluid temperature sensor.



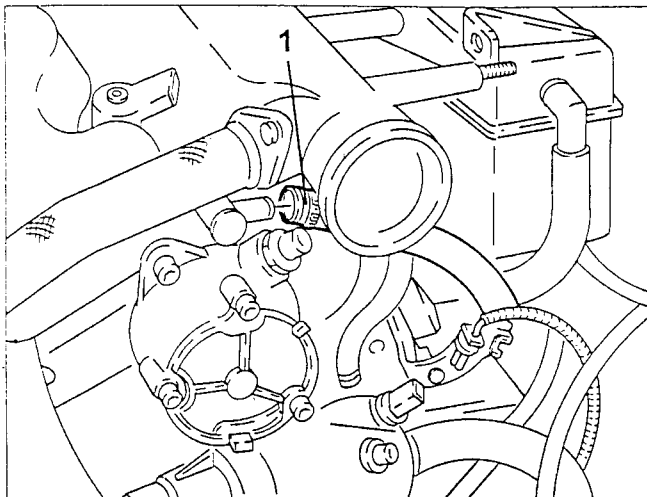
1. Disconnect the vacuum pipe from the E.G.R. valve.
2. Slacken the fastening screws move aside the vacuum pipe for the E.G.R. valve.
3. Disconnect the the return pipe from the climate control system heater from the stiff coolant fluid return pipe to the pump.



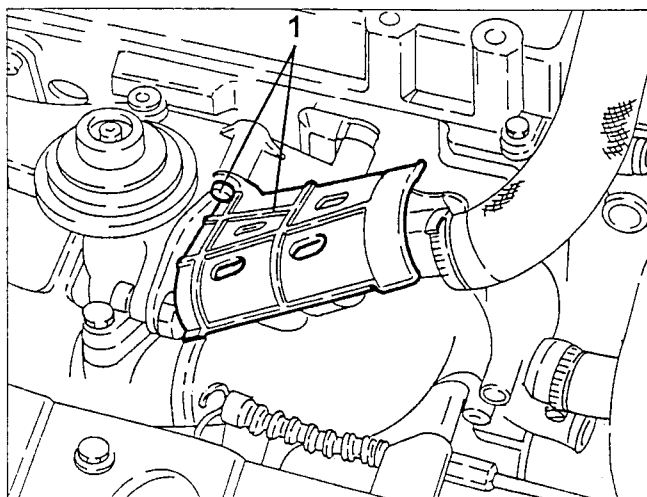
1. Slacken the screw fastening the coolant fluid delivery pipe to the engine oil heat exchanger.
2. Disconnect the coolant fluid delivery sleeve to the engine oil heat exchanger from the thermostat.



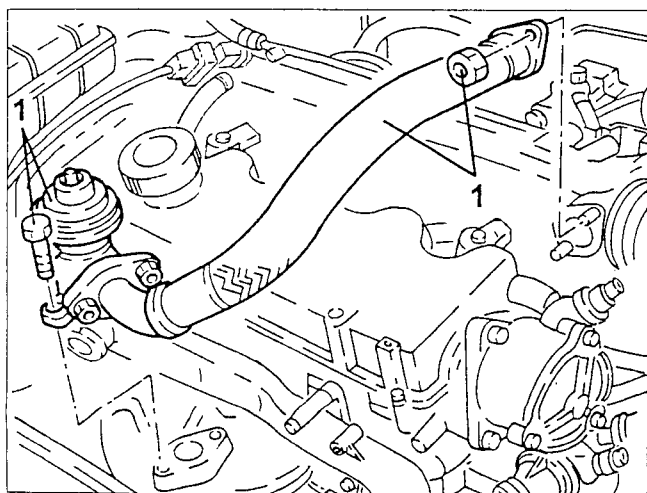
1. Disconnect the oil vapour recovery pipe from the coupling on the tappet cover.



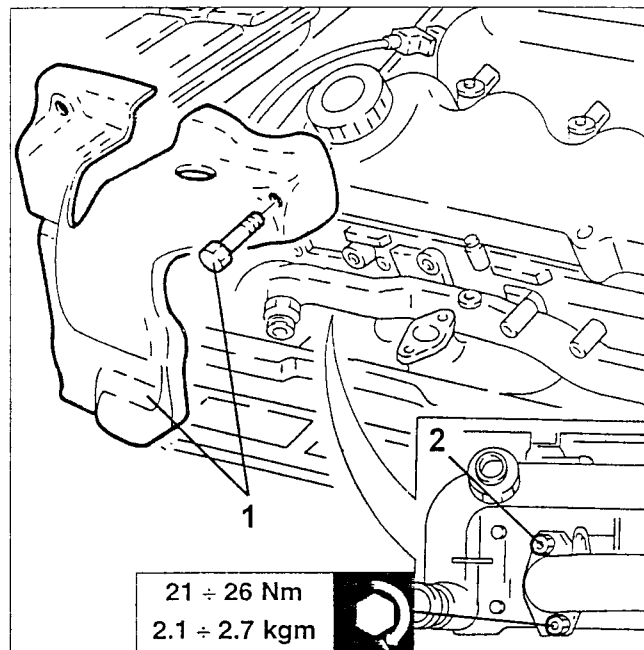
1. Slacken the fastening screws and remove the E.G.R. valve cover.



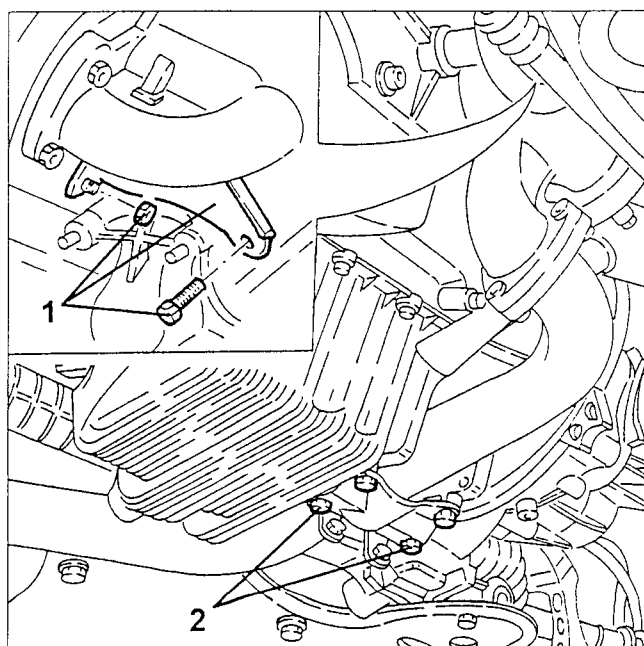
1. Slacken the nuts and screws, then remove the E.G.R. valve complete with gas re-circulation pipe.
- Remove the seals.



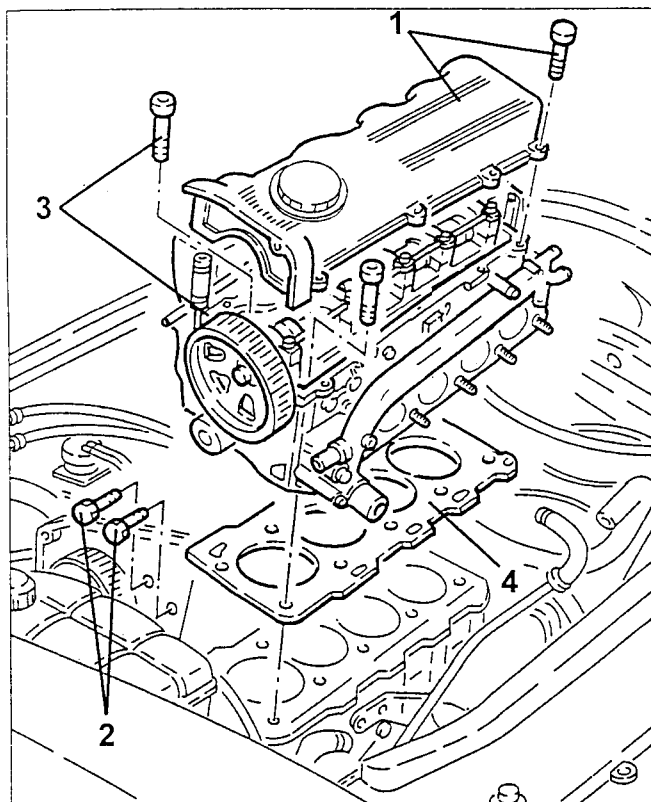
1. Slacken the fastening screws and remove the heat shield from the exhaust manifold.
2. Slacken the nuts fastening the exhaust manifold to the cylinder head.



1. Slacken the fastening screws and nut, then remove the turbocharger support bracket.
2. Loosen the nuts fastening the reinforcement bracket.



1. Slacken the fastening screws and remove the tappet cover complete with seals.
2. Slacken the screws fastening the pressure pump support to the air intake box.
3. Slacken the fastening screws and remove the cylinder head.
4. Remove the cylinder head seal.



- Strip down and overhaul the cylinder head proceeding as described in the "ENGINE OVERHAULING" volume.

Refit the cylinder head reversing the sequence followed for removal and following the instructions given below.

- Fit a new cylinder head seal on the crankcase making sure that it is of the same thickness as the one removed.

NOTE: The cylinder head seal is of the ASTADUR type.

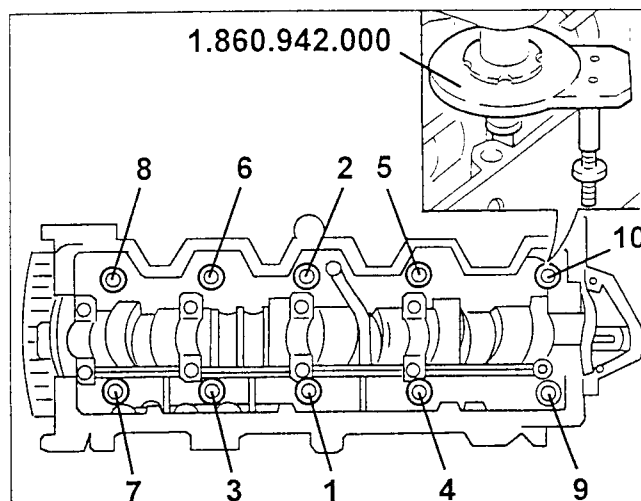
Because of the special compound with which the seal is made it undergoes a polymerising process when the engine is running so that it hardens considerably during use..

To ensure that the seal polymerises it is necessary to:

- keep the seal closed in its nylon bag;
- take the seal out of the bag only shortly before assembly;
- do not lubricate or dirty the seal with oil.

- Place the cylinder head on the crankcase.
- Tighten the cylinder head fastening screws, proceeding as described below and bearing in mind that the tightening sequence for each step is the one illustrated.

NOTE: For angle tightening use goniometer no. 1.860.942.000 as illustrated.



Tightening procedure

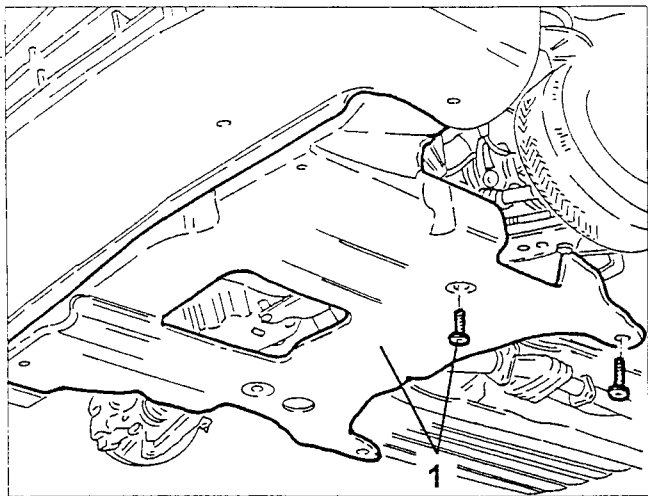
Tighten screws to a torque of:	65 Nm (6.6 kgm)
Turn the screws by an angle of:	90° + 90° + 90°

For refitting the camshaft drive belt and its timing and for fitting the engine components belt see GROUP 00.

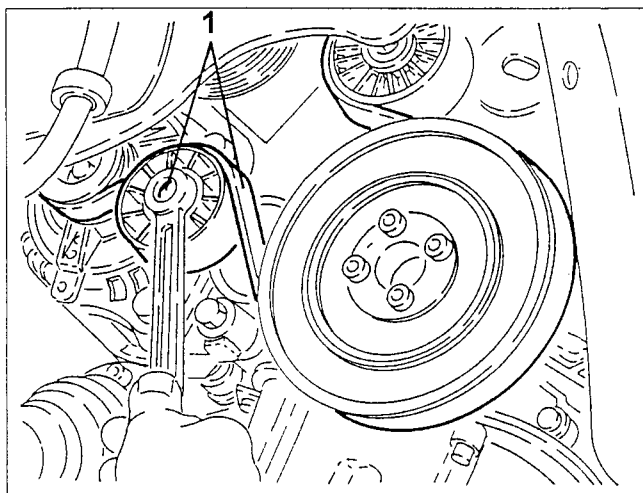
OIL SUMP

REMOVAL/REFITTING

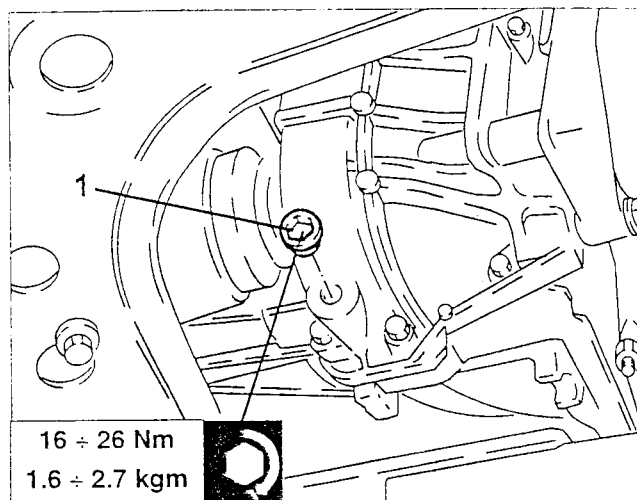
- Set the car on a lift.
- Make sure the ignition key is in the "STOP" position, then disconnect the battery (-) terminal.
- Remove the right front wheel and dust guard.
- 1. Slacken the fasteners and remove the under engine guard.



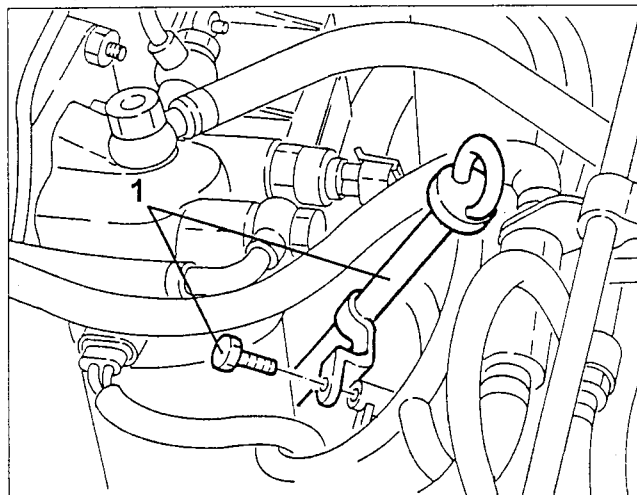
1. Working as illustrated on the tensioner, loosen the tension of the auxiliary components belt and remove it.



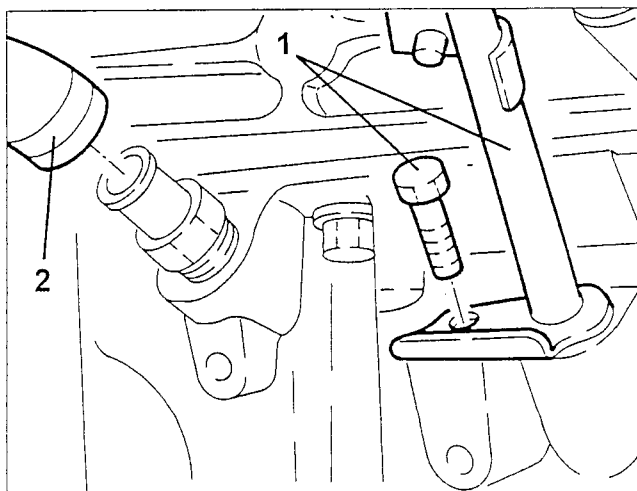
- Remove the front section of the exhaust pipe.
- 1. Slacken the drain cap and drain the gearbox - differential oil.



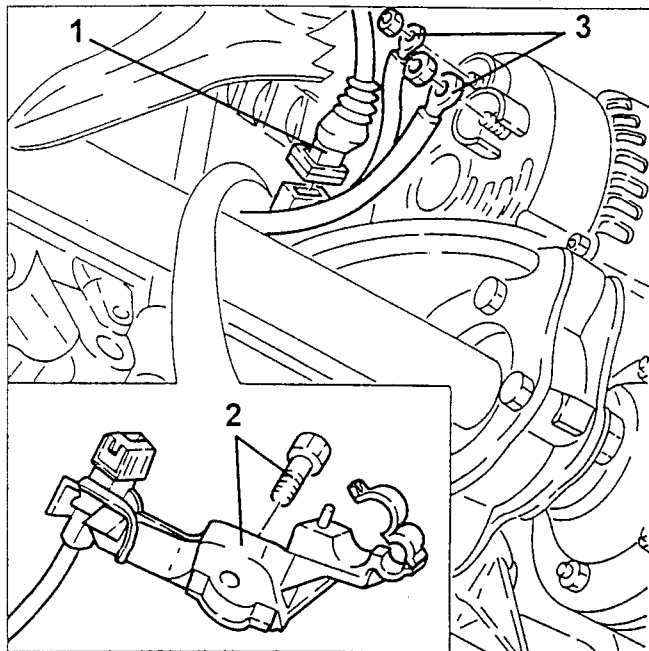
1. Slacken the upper screw of the engine oil dipstick guide pipe.



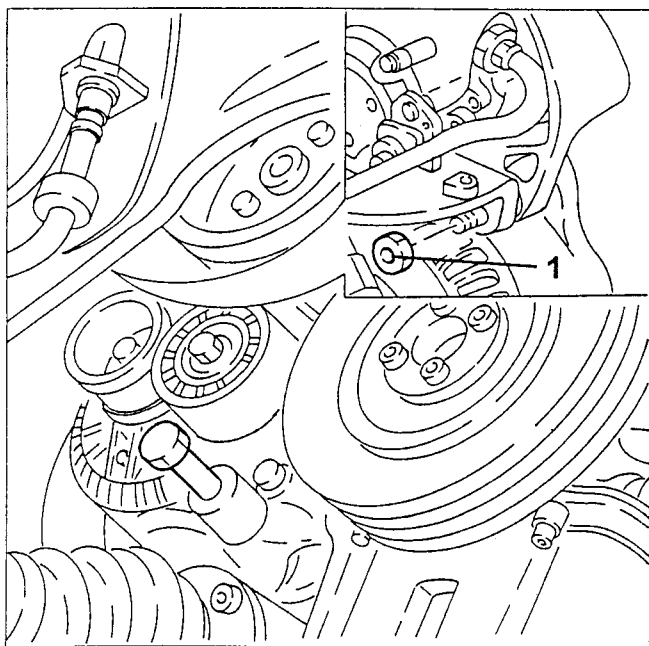
1. Slacken the lower screw of the engine oil dipstick guide pipe.
2. Disconnect the condensed oil recovery pipe from the oil sump.



1. Disconnect the electrical connection of the rpm sensor.
2. Slacken the screw and move aside the electric wiring fastening bracket.
3. Disconnect the electrical connections from the alternator.

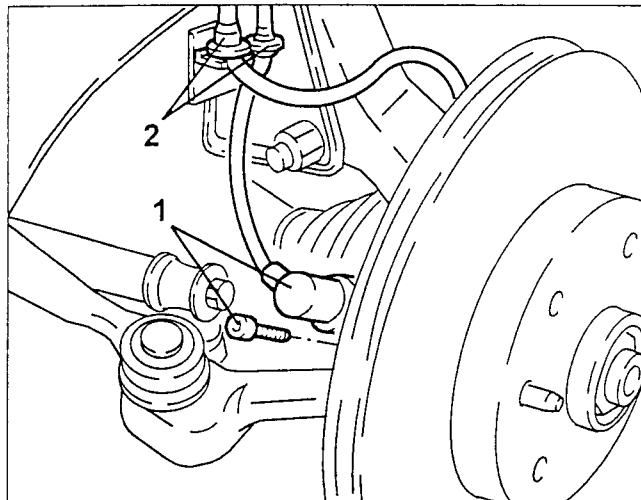


1. Slacken the nuts of the alternator fastening bolts.

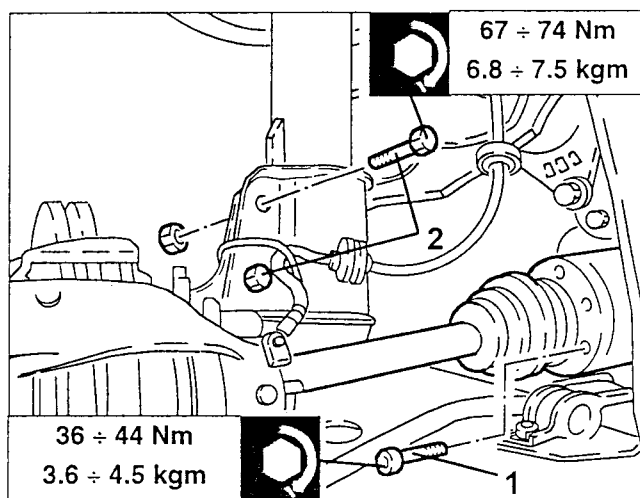


- Remove the guide pipe complete with engine oil dipstick.

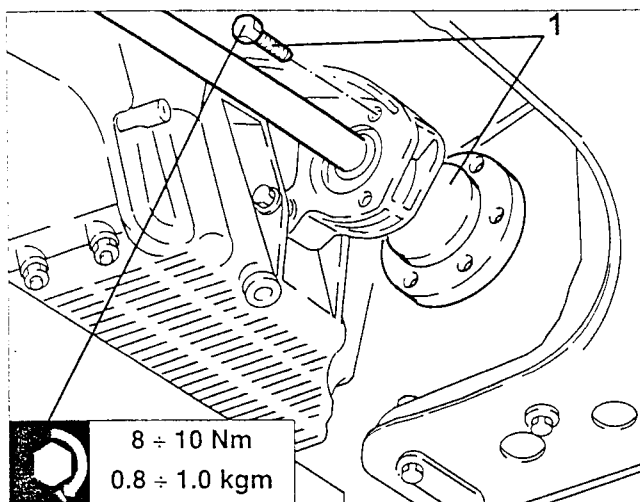
1. Slacken the fastening screw and remove the right A.B.S. sensor from the upright.
2. Release the A.B.S. sensor cable and the right brake caliper hose from the support brackets.



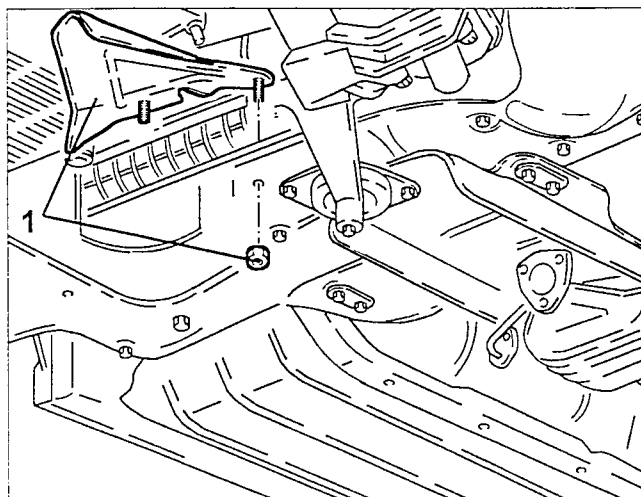
1. Slacken the bolts fastening the right axle shaft to the intermediate axle shaft.
 2. Slacken the bolts fastening the shock absorber to the right front wheel upright, then withdraw only the upper bolt.
- Move the right axle shaft away from the intermediate axle shaft as necessary.



1. Slacken the screws fastening the intermediate axle shaft to its support and remove it from the differential.

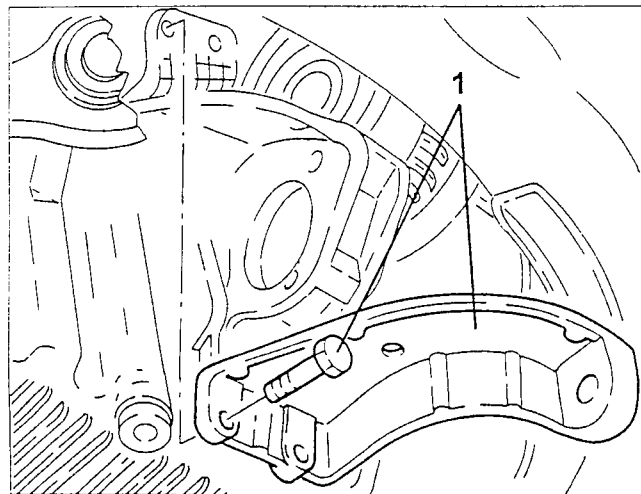


1. Slacken the fastening nuts and remove the front suspension crossmember guard.

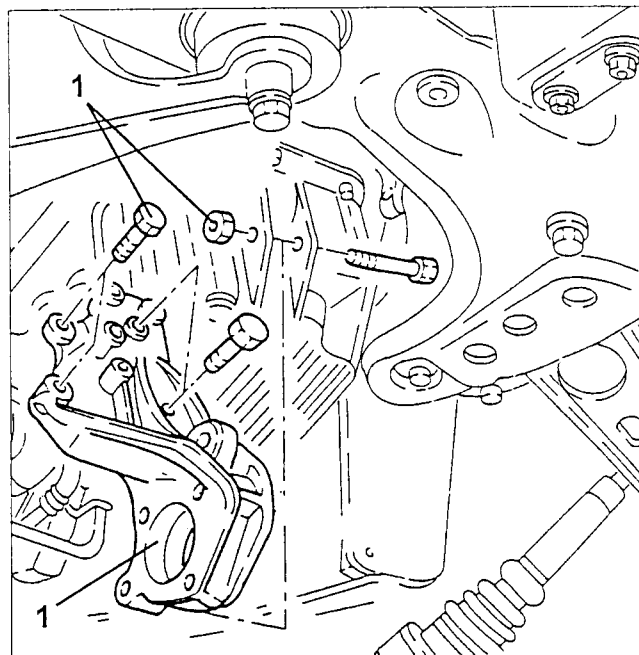


- Withdraw the screws from the alternator fastening bolts and move it aside.

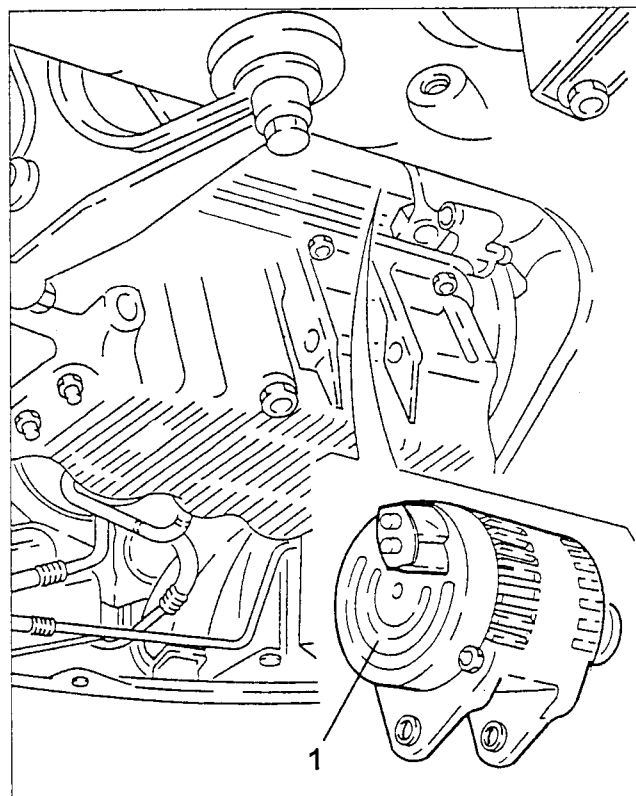
1. Slacken the fastening screws and remove the rear alternator support bracket.



1. Slacken the screws and bolt, then remove the intermediate axle shaft bearing support.



1. Retrieve the alternator.

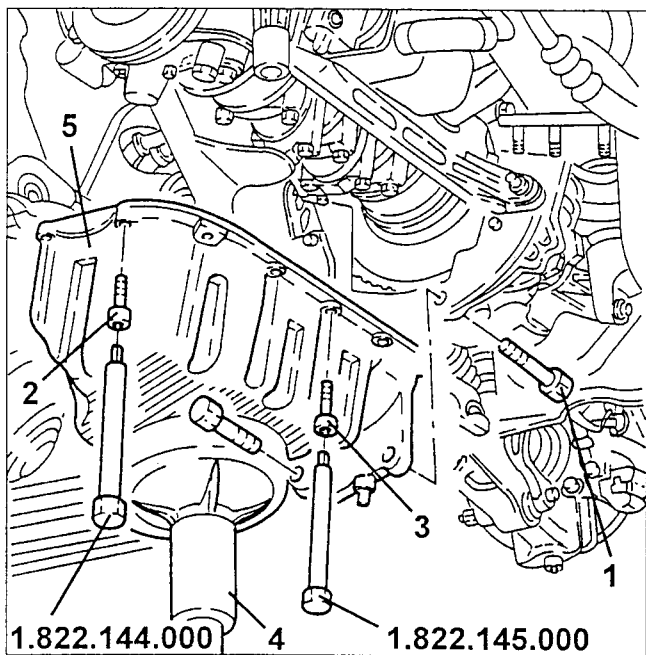


- Slacken the drain cap and drain the engine oil.

NOTE: Collect the engine oil in a suitable container.

1. Slacken the screws fastening the oil sump to the gearbox.
2. Slacken the front and rear screws fastening the sump to the crankcase using wrench no. 1.822.144.000.
3. Slacken the side screws fastening the sump to the crankcase using wrench no. 1.822.145.000.
4. Place a hydraulic jack under the oil sump.
5. Remove the oil sump.

NOTE: Before removing the sump heat it with a drier to facilitate detachment of the sealant.



- Remove all traces of sealant from the oil sump and crankcase contact surfaces.

GENERAL DESCRIPTION

The EDC-15C Common Rail is a high pressure electronic injection system for fast diesel engines with direct injection.

The main features are:

- availability of high injection pressures (1350 bar)
- possibility of modulating these pressures between 150 bar up to the maximum operating pressure of 1350 bar, regardless of the engine speed and load
- capability of operating at high engine speeds (up to 6000 rpm).
- injection control precision (advance and length of injection)
- reduction of consumption levels
- reduction of emissions.

The main functions of the system are mainly the following:

- fuel temperature control
- engine coolant temperature control
- injected fuel quantity control
- idle speed control
- fuel cut-off during deceleration
- cylinder balancing at idle speed control
- "anti-sawing" control
- exhaust smoke control during acceleration
- exhaust gas re-circulation control (E.G.R.)
- maximum torque limiting control
- maximum engine speed limiting control
- glow plug control
- climate control system engagement control (where fitted)
- auxiliary fuel pump control
- cylinder position control
- main and pilot injection advance control
- injection pressure closed loop control
- electric balance control
- supercharging pressure control
- self-diagnostics
- connection with Alfa Romeo CODE control unit (Immobiliser).

SYSTEM FUNCTIONS

The Common Rail system makes pre-injection (pilot injection) possible before the T.D.C. with the advantage of reducing the derivative of the pressure in the combustion chamber, reducing the combustion noise typical of direct injection engines.

The control unit controls the amount of fuel injected, adjusting the line pressure and injection times.

The information the control unit processes to control the amount of fuel to be injected is the following:

- engine rpm
- coolant fluid temperature
- supercharging pressure
- air temperature
- quantity of intake air
- battery voltage
- fuel oil pressure
- accelerator pedal position.

SYSTEM OPERATING LOGIC

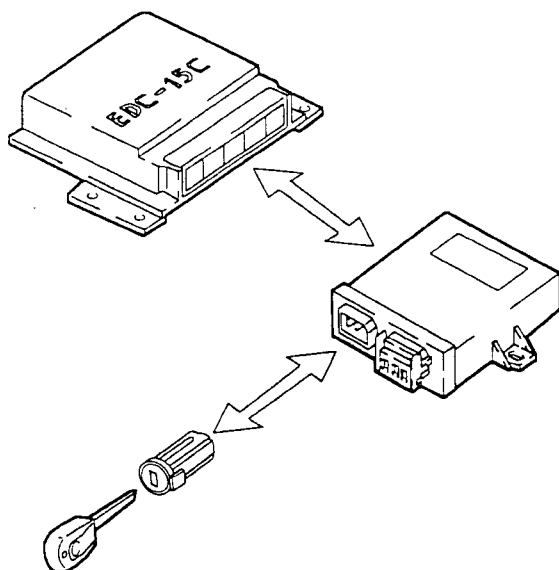
Self-diagnostics

The control unit self-diagnostic system checks the signals leading from the sensors comparing them with the permissible limit data:

- fault signalling at starting
 - warning light on for 4 seconds indicates the test phase
 - warning light off after 4 seconds indicates no fault to components that may change the values set down by anti-pollution regulations
 - warning light on after 4 seconds indicates a fault.
- fault signalling during operation
 - warning light on indicates a fault
 - warning light off indicates no fault to components that may change the values set down by anti-pollution regulations.
- recovery
 - the control unit defines the type of recovery depending on the faulty components
 - the recovery parameters are managed by normally operating components.

Recognition of the Alfa Romeo CODE

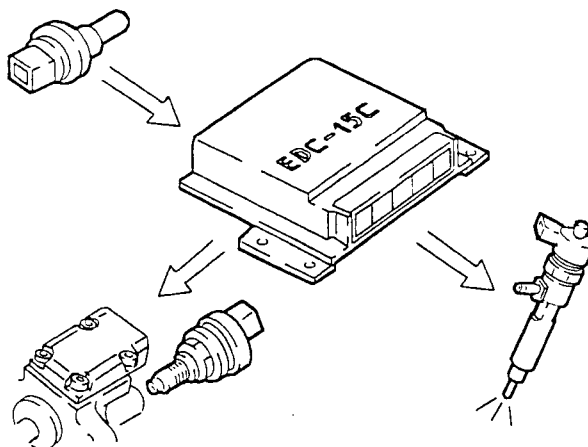
The moment the control unit receives the signal of the ignition key at "MAR" it converses with the Alfa Romeo CODE control unit to obtain consent to start the engine.



Engine coolant temperature control

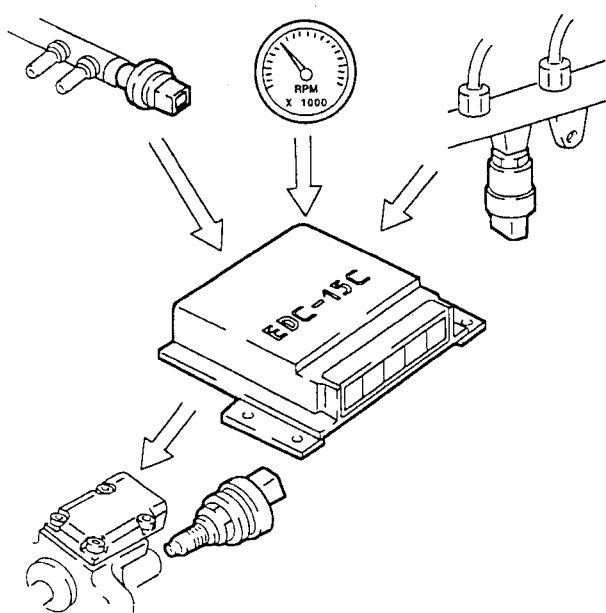
With an engine coolant fluid temperature above 105°C the control unit:

- reduces the amount of fuel injected (reduces engine power)
- commands the cooling fans
- turns on the coolant fluid temperature warning light.



Fuel temperature control

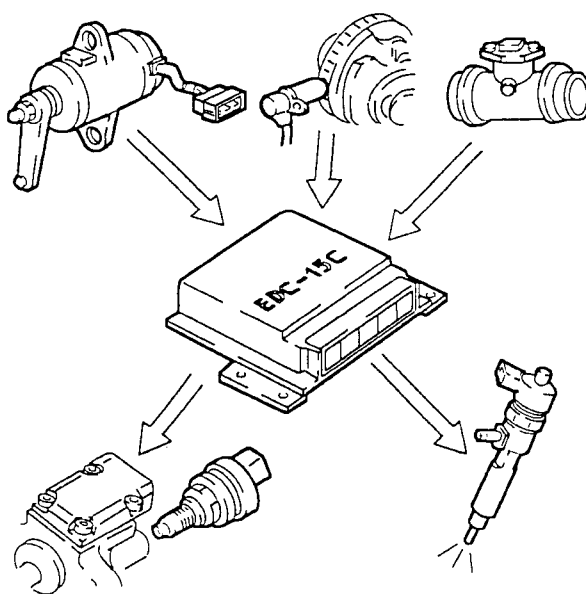
With a fuel temperature at 110°C, detected by the sensor on the re-circulation manifold, the control unit commands the pressure regulator to reduce the line pressure (it does not change the injection times).



Injected fuel quantity control

On the basis of the signals coming from the different sensors and the mapped values, the control unit:

- commands the pressure regulator
- changes the "pilot" injection time up to 3000 rpm
- changes the "main" injection time.

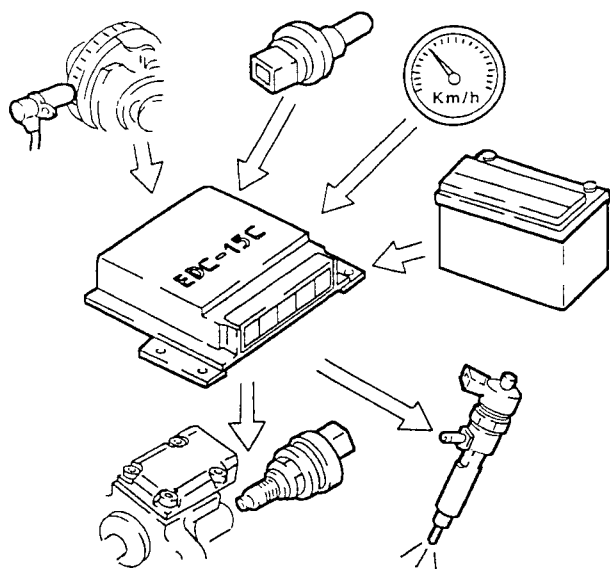


Idle speed control

The control unit processes the signals coming from the different sensors and adjusts the quantity of injected fuel:

- commands the pressure regulator
- changes the injection times of the injectors.

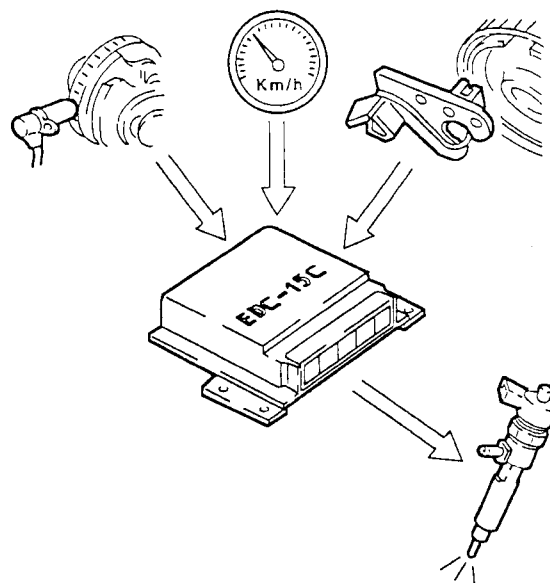
Within certain thresholds the engine speed takes account of the battery voltage.



Cylinder balance control at idle speed

On the basis of the signals received from the sensors the control unit controls the regularity of the torque at idle speed:

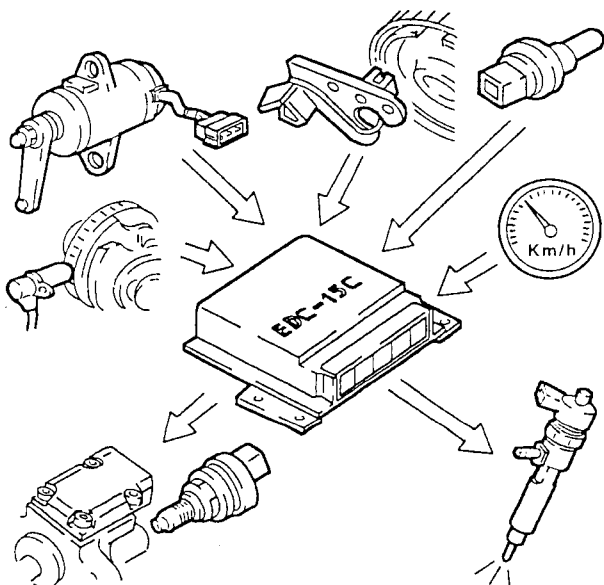
- it changes the quantity of fuel injected to the single injectors (injection time).



Fuel cut-off during deceleration

When the accelerator pedal is released, the control unit brings about the following logics:

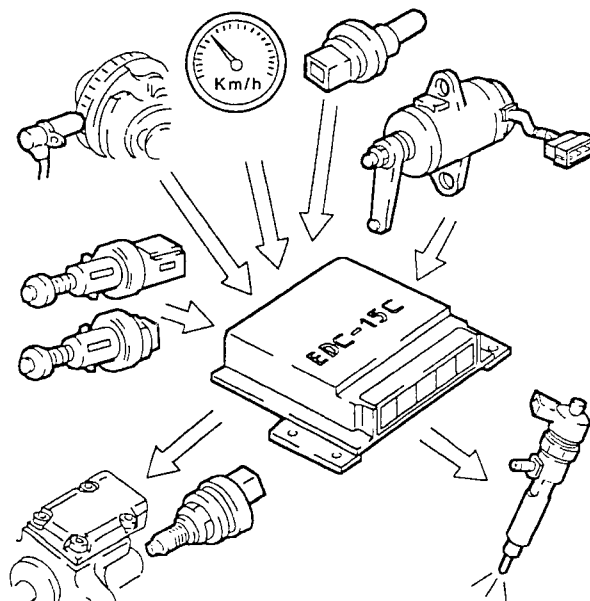
- it cuts off the supply to the injectors
- it partially reactivates the supply to the injectors before reaching idle speed
- and commands the fuel pressure regulator.



"Anti-sawing" control

The control unit processes the signals received from the different sensors and determines the quantity of fuel to be injected through:

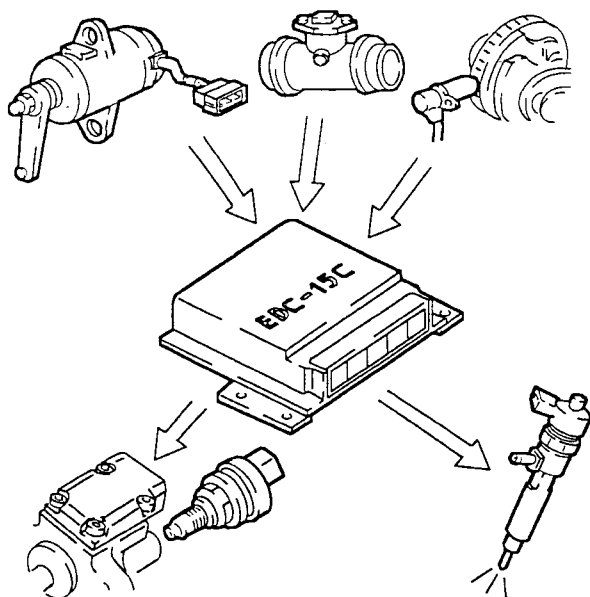
- the fuel pressure regulator
- the injector opening time.



Exhaust smoke control during acceleration

With heavy acceleration, on the basis of the signals received from the air flow meter and rpm sensors, the control unit determines the optimum quantity of fuel to be injected:

- it commands the pressure regulator
- and changes the injection time of the injectors.

**Maximum torque limiting control**

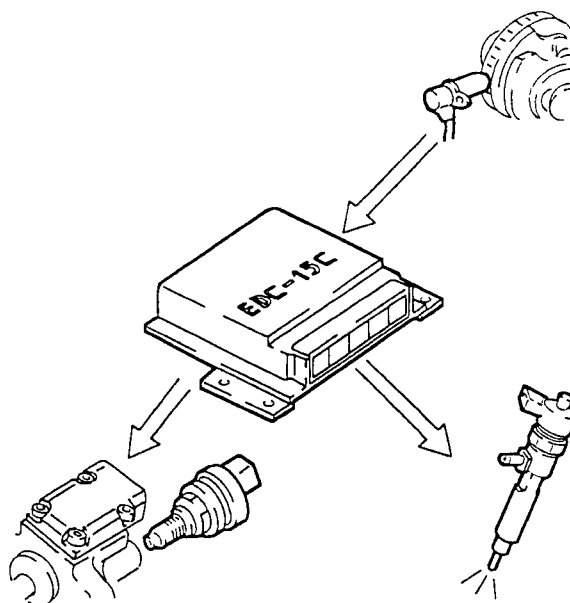
In relation to the rpm, the control unit calculates the following on pre-defined maps:

- limit torque
- allowed smoke (limit)

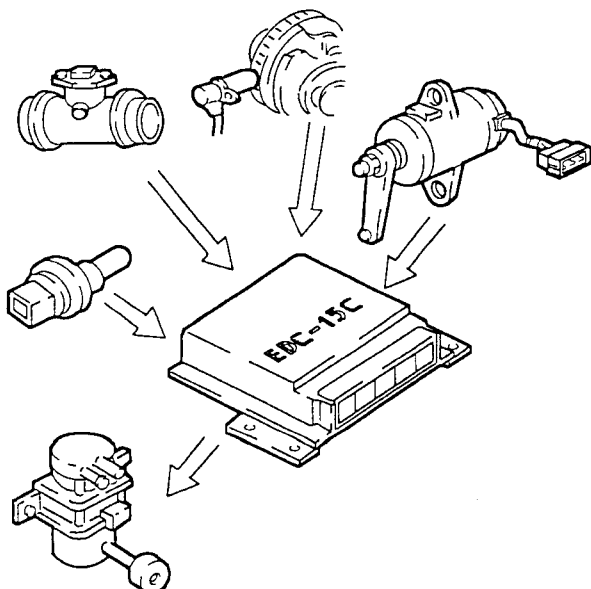
It compares these minimum values and corrects them with other parameters:

- coolant fluid temperature
- engine rpm
- car speed

and commands the amount of fuel to be injected (pressure regulator - injectors).

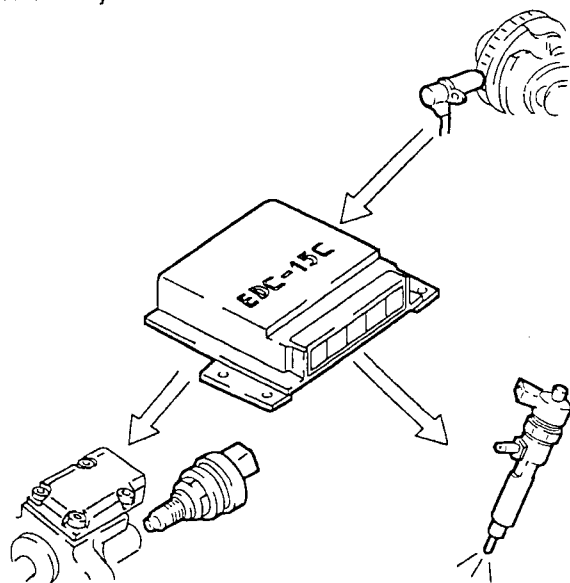
**Exhaust gas re-circulation control (E.G.R.)**

On the basis of the engine load and of the signal coming from the accelerator pedal potentiometer, the control unit limits the amount of intake air, activating the partial intake of exhaust gas.

**Maximum speed limiting control**

Depending on the rpm the control unit activates two operating strategies:

- at 5000 rpm it cuts off the fuel reducing the line pressure
- over 5400 rpm it deactivates the auxiliary pump and the injectors.

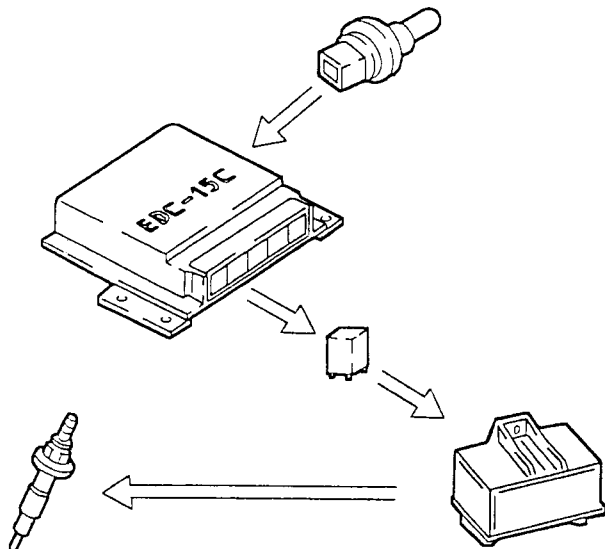


Glow plug control

During:

- starting
- after-starting

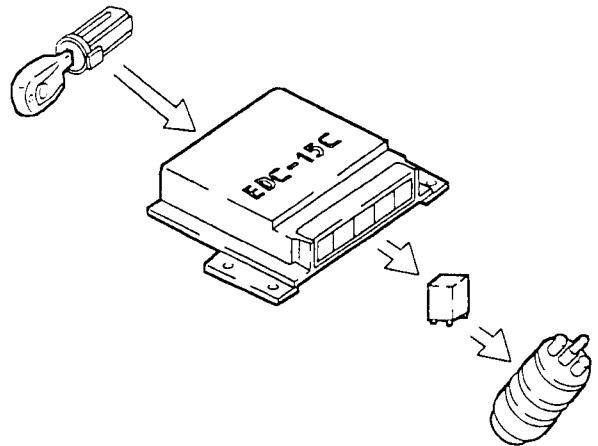
the injection control unit times the operation of the glow plug control unit in relation to the temperature of the engine.



Auxiliary fuel pump control

Regardless of the engine speed, the control unit:

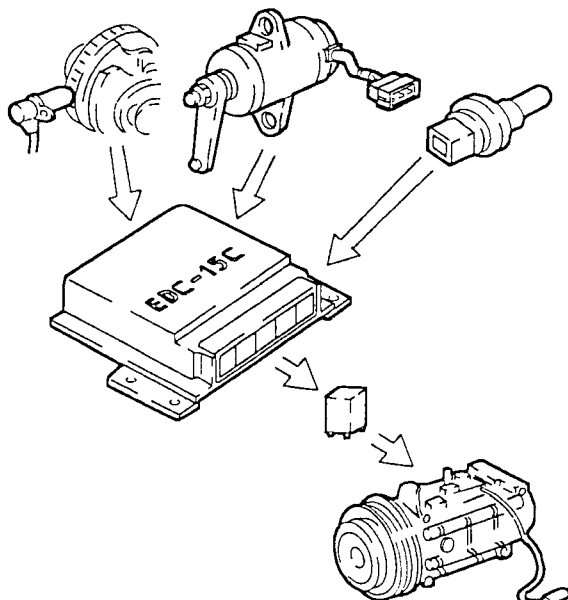
- supplies the auxiliary fuel pump with the ignition key at MAR
- cuts off the supply to the auxiliary pump if the engine is not started within a few seconds.



Air conditioning system engagement control

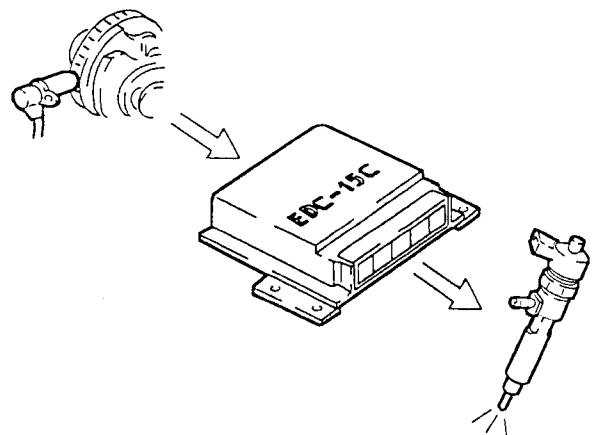
The control unit commands the air conditioner compressor:

- turning it on/off when the corresponding switch is pressed
- turning it off momentarily (about 6 sec.) in the event of heavy acceleration or the need for full power.



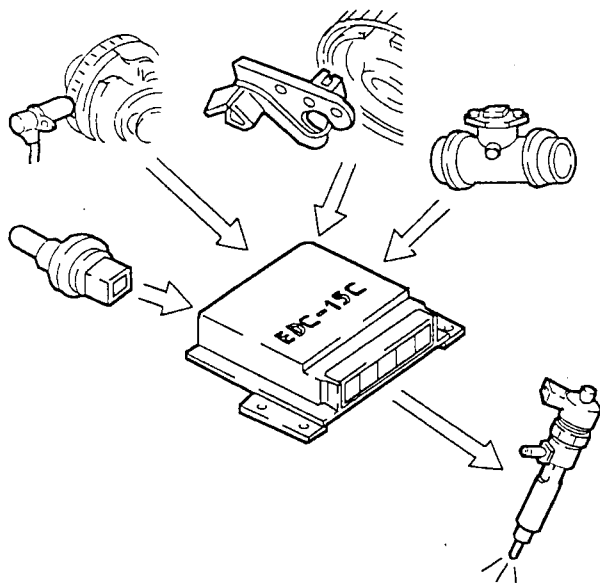
Cylinder position control

During each revolution of the engine, the control unit detects which cylinder is in the bursting stroke and commands the injection sequence at the suitable cylinder.



Main and pilot injection advance control

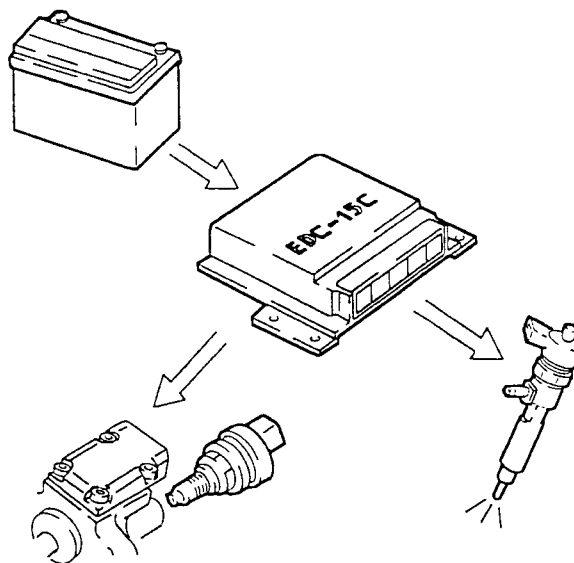
On the basis of the signals coming from the different sensors, including the absolute pressure sensor integrated in the control unit itself, the control unit defines the optimum injection point according to an internal map.



Electric balance control

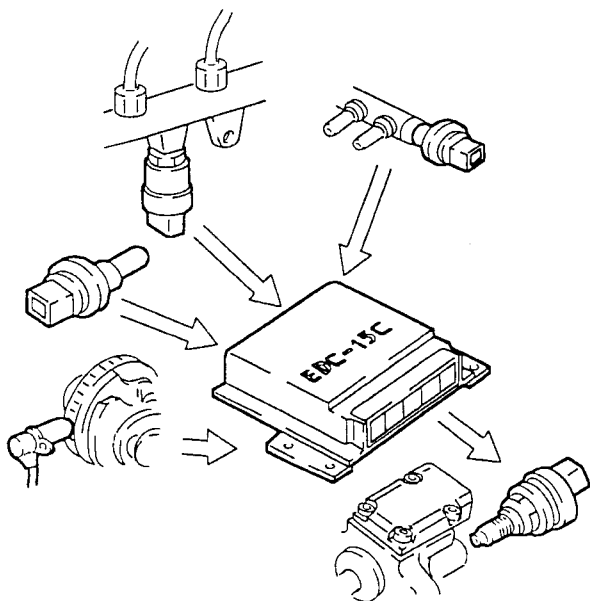
The control unit changes the idle speed in relation to the battery voltage:

- it increases the injection time of the injectors
- and adjusts the line pressure.



Closed loop injection pressure control

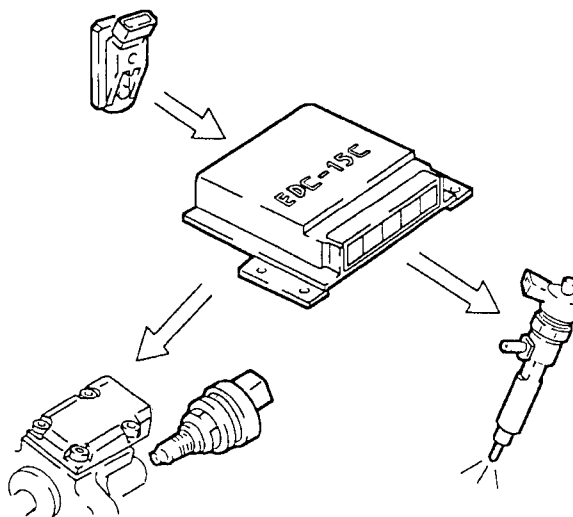
On the basis of the engine load, determined by processing the signals coming from the different sensors, the control unit commands the regulator to obtain an optimum line pressure.



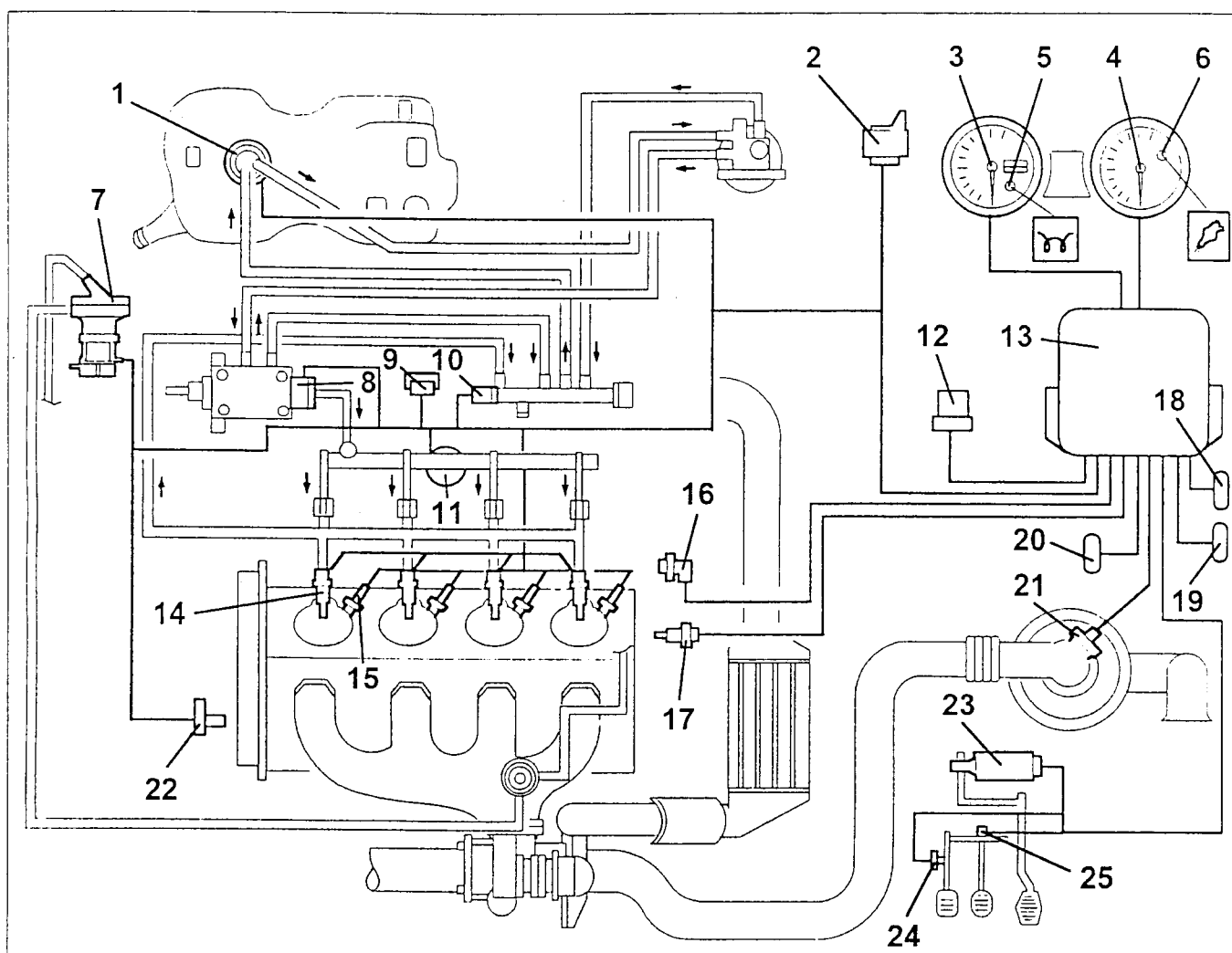
Supercharging pressure control

At the different engine speeds the control unit processes the signal leading from the supercharging sensor and defines the amount of fuel to be injected:

- it commands the pressure regulator
- and changes the injection time.



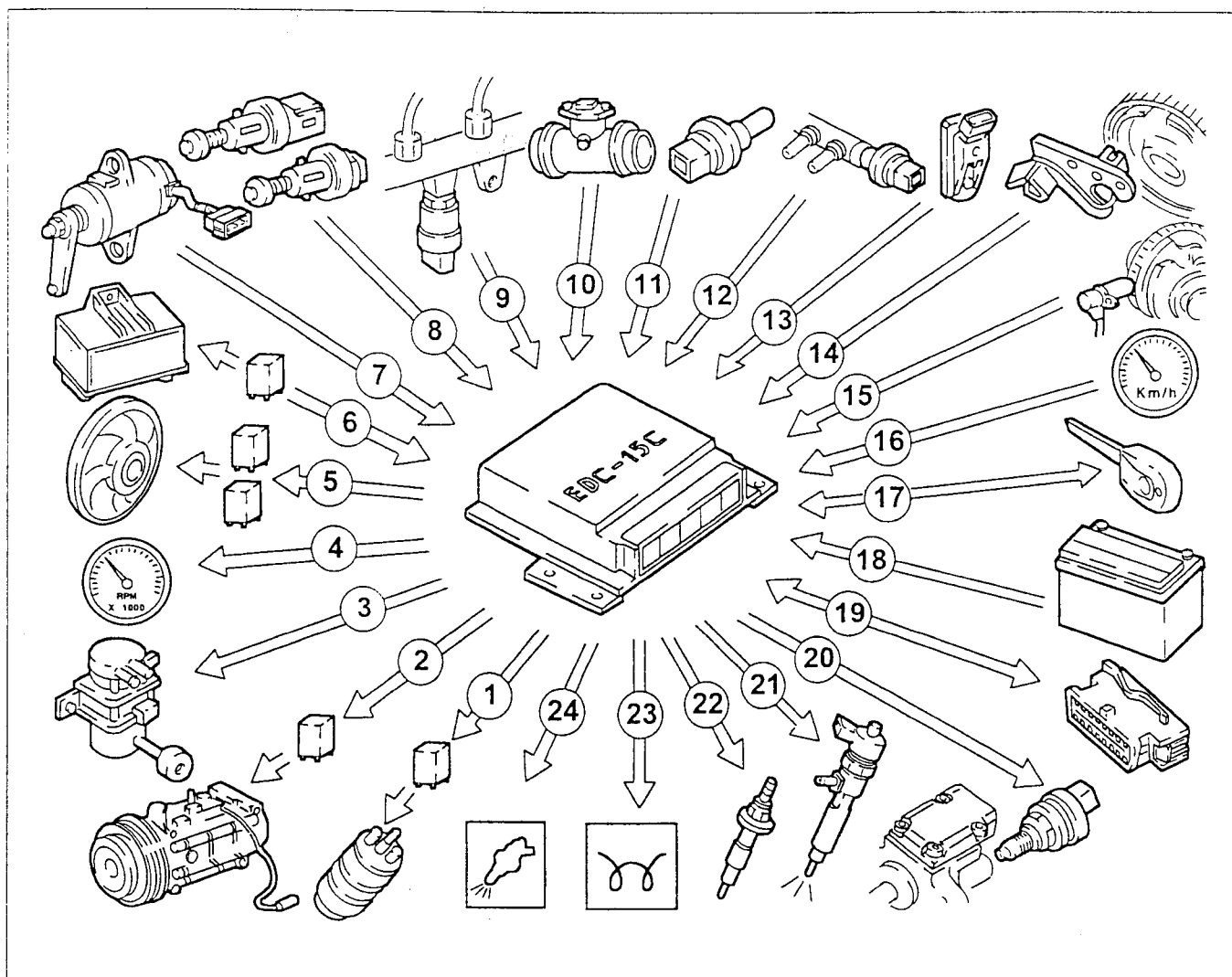
EDC-15C COMMON RAIL INJECTION SYSTEM COMPONENTS



1. Auxiliary electric fuel pump
2. Glow plug control unit
3. Speedometer
4. Rev counter
5. Glow plug warning light
6. Check Engine warning light
7. E.G.R. valve modulator
8. Pressure regulator
9. Overpressure sensor
10. Fuel temperature sensor
11. Fuel pressure sensor
12. Relay
13. Injection control unit

14. Injectors
15. Glow plugs
16. Rpm sensor
17. Water temperature sensor
18. Climate control connector
19. Diagnostic connector
20. Alfa Romeo CODE connector
21. Air flow meter
22. Timing sensor
23. Accelerator pedal potentiometer
24. Clutch pedal switch
25. Brake pedal switch

FUNCTIONAL LAYOUT OF EDC-15 COMMON RAIL INJECTION SYSTEM

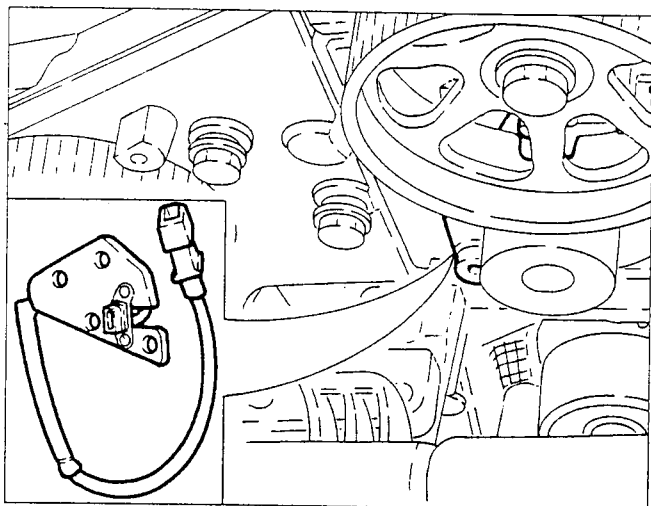


1. Electric fuel pump
2. Air conditioner compressor
3. Modulator for E.G.R. valve
4. Rev counter
5. Fans
6. Glow plug control unit
7. Accelerator pedal potentiometer
8. Brake - clutch switch
9. Fuel pressure sensor
10. Air flow meter
11. Coolant fluid temperature sensor
12. Fuel temperature sensor

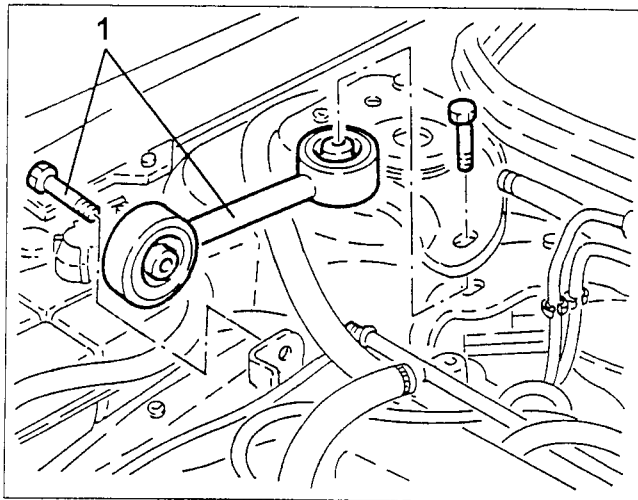
13. Overpressure sensor
14. Timing sensor
15. Rpm sensor
16. Speedometer
17. Alfa Romeo CODE
18. Battery
19. Socket for diagnostics
20. Pressure regulator
21. Injectors
22. Glow plugs
23. Glow plug warning light
24. Check Engine warning light

CAM ANGLE SENSOR

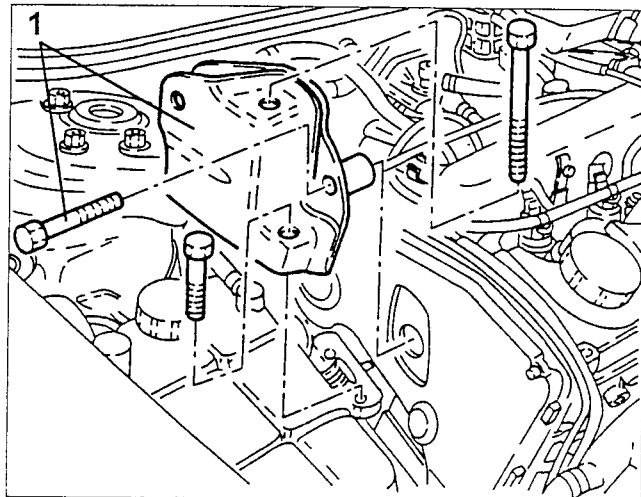
This hall effect sensor is fitted on the cylinder head and faces the camshaft drive pulley (exhaust). On the latter there is an aperture which allows the timing sensor to signal the engine timing position. The injection control unit uses the timing sensor signal to detect the T.D.C. at the end of compression.



1. Slacken the fastening screws and remove the power unit reaction rod.

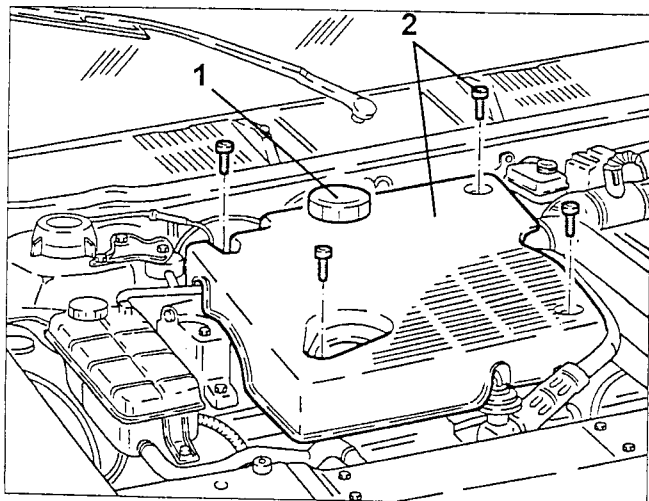


1. Slacken the fastening screws and remove the engine side reaction rod support bracket.

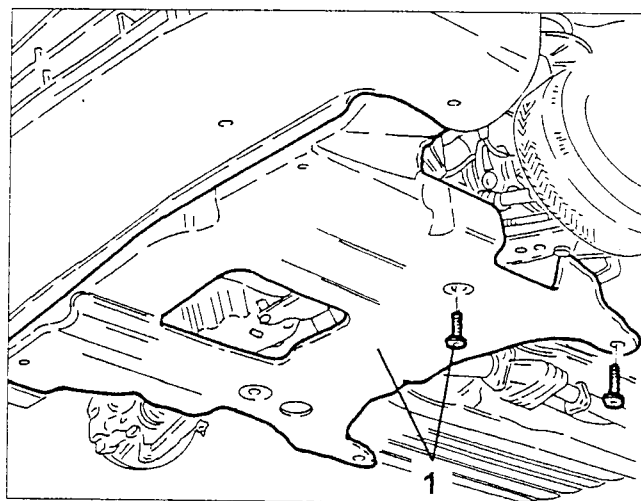


REMOVAL/REFITTING

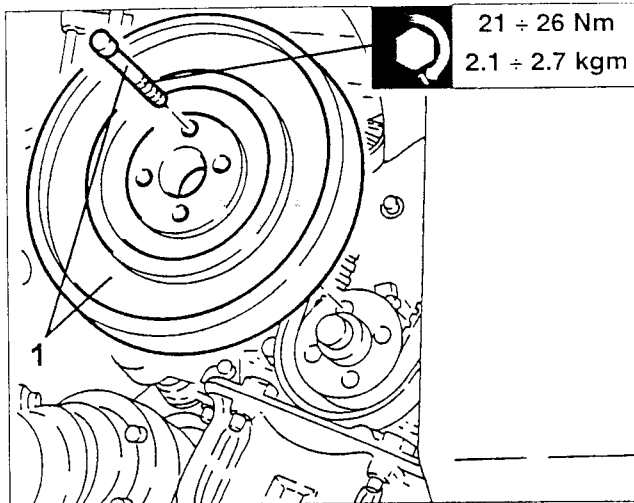
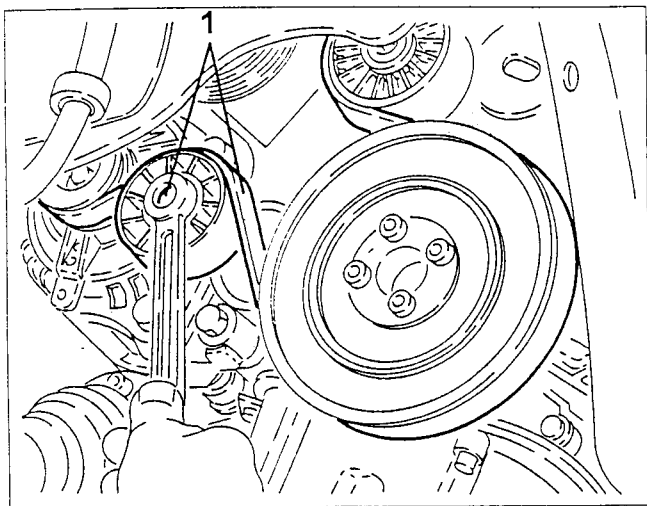
- Set the car on a lift.
- Make sure the ignition key is in the «STOP» position, then disconnect the battery (-) cable.
- 1. Remove the engine oil filler cap.
- 2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.



- Remove the right front wheel and dust guard.
- Remove the right front wheel arch.
- 1. Slacken the fastenings and remove the under engine guard.

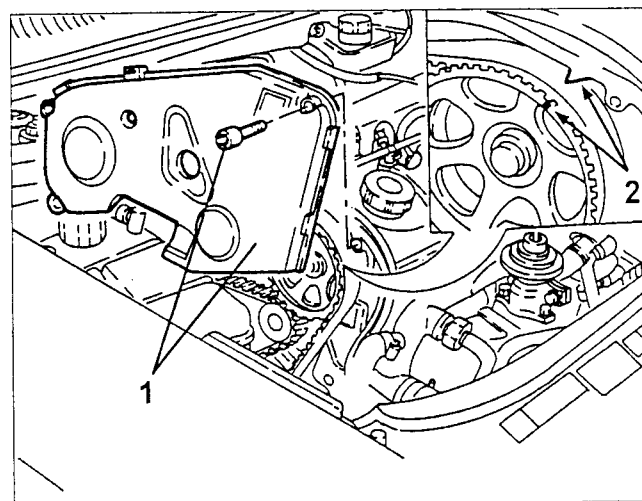
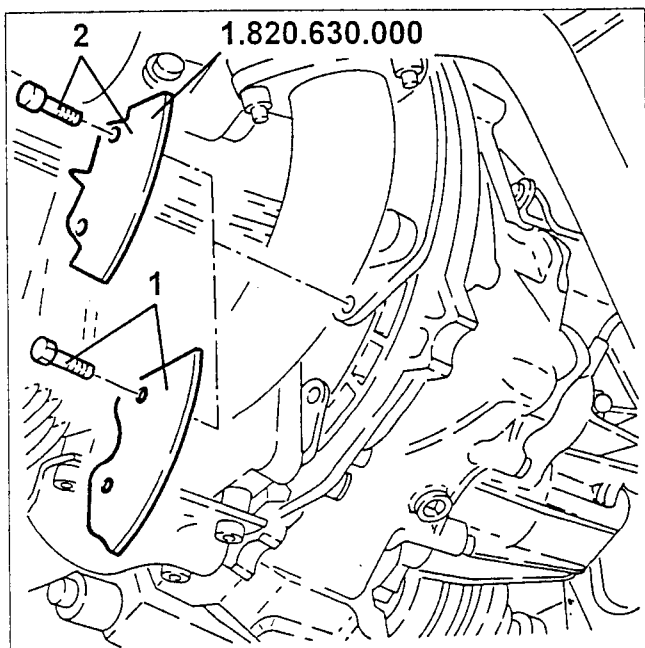


1. Working as illustrated, loosen the tension of the engine components belt and remove it.

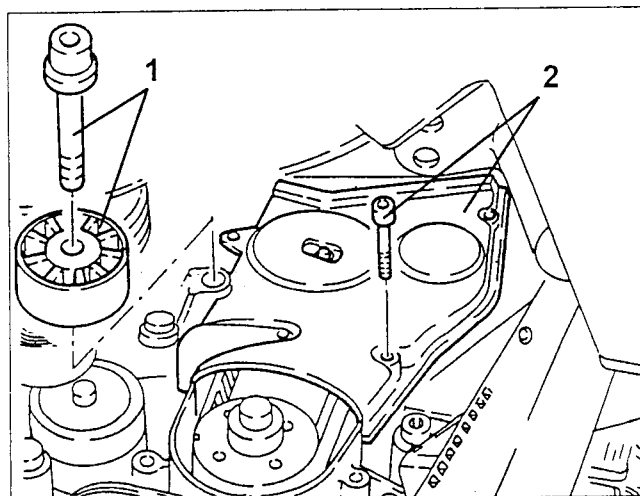


1. Slacken the fastening screws and remove the camshaft belt upper guard.
2. Working on the screw of the camshaft driving pulley, turn the crankshaft until aligning the timing references (1st cylinder at T.D.C.).

1. Slacken the screws and remove the lower flywheel guard.
2. Install flywheel stopper tool no. 1.820.630.000.

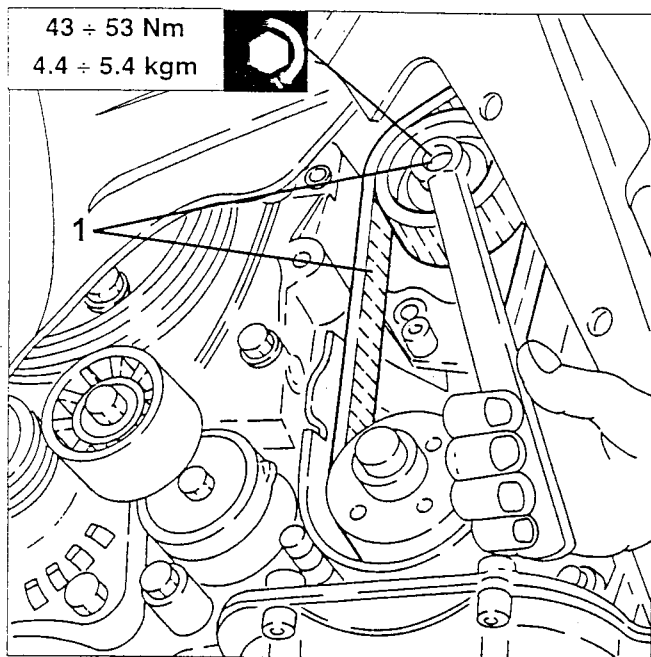


1. Slacken the fastening screw and remove the engine components belt fixed tensioner.
2. Slacken the fastening screws and remove the camshaft belt lower guard.

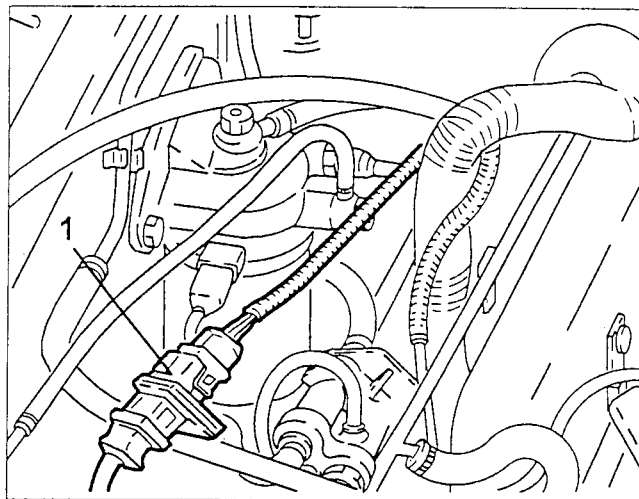


1. Slacken the fastening screws and remove the crankshaft pulley.

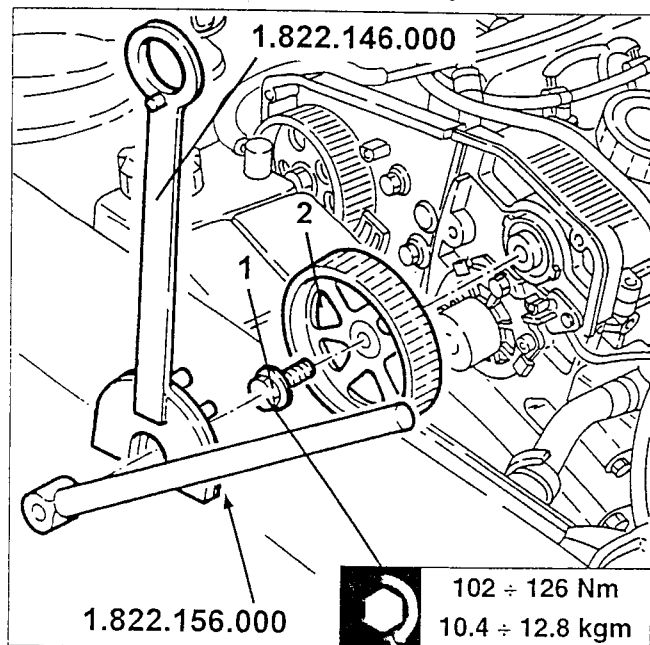
1. Loosen the nut fastening the camshaft belt tensioner, then remove the camshaft belt.



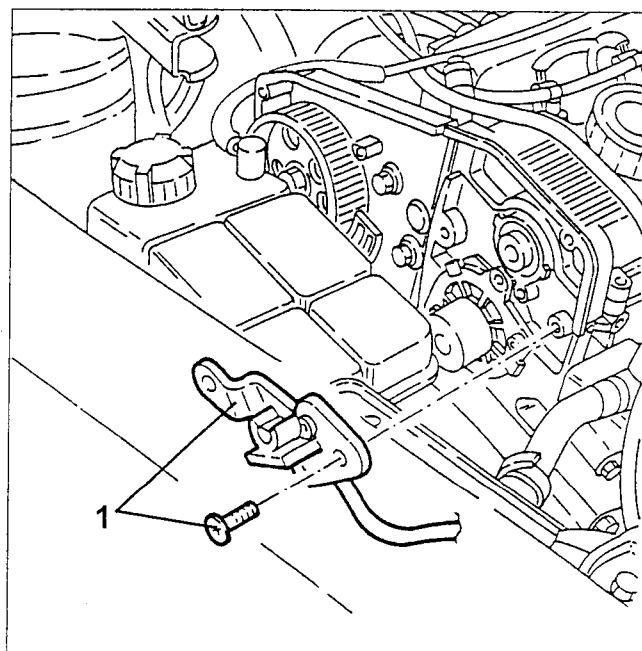
1. Disconnect the electrical connection of the cam angle sensor.



1. Slacken the fastening screw of the driven toothed pulley using tools no. 1.822.146.000 and no. 1.822.156.000 as counter torque.
2. Remove the toothed driven pulley.



1. Slacken the fastening screws and remove the cam angle sensor.



Refit reversing the sequence followed for removal and refer to GROUP 00 for refitting the timing gear drive belt and timing and for refitting the engine components drive belt.

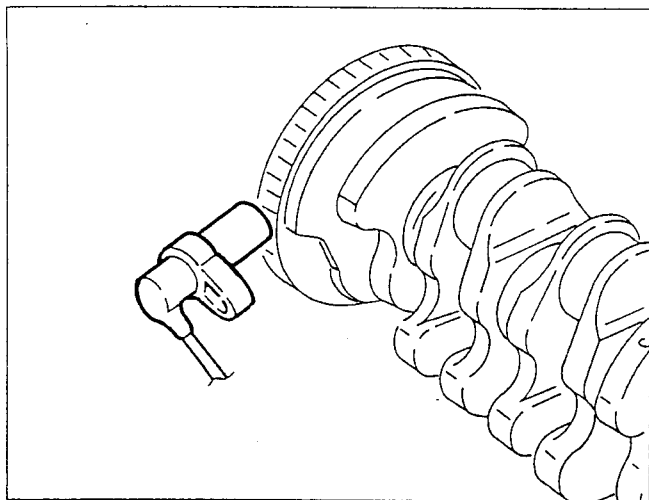
RPM SENSOR

This is fitted on the crankcase and “faces” the phonic wheel on the crankshaft.

It is of the inductive type, i.e. it works through the change of the magnetic field generated by the passage of the teeth of the phonic wheel (60-2 teeth).

The injection control unit uses the rpm sensor signal to:

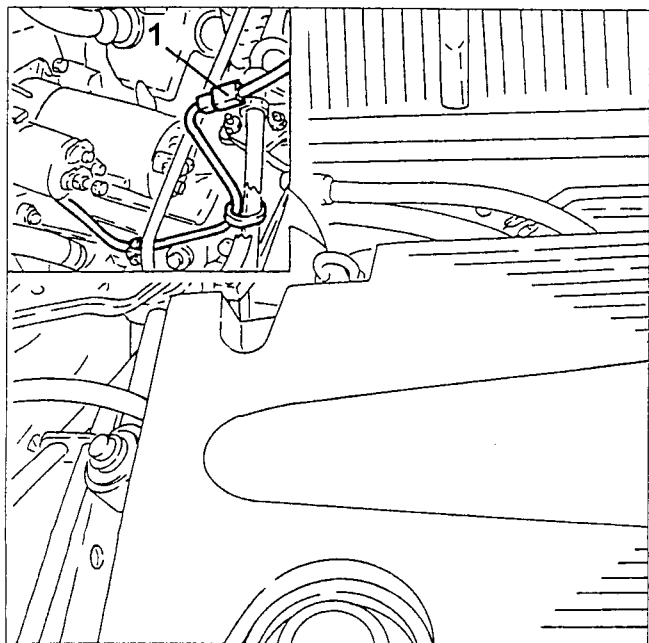
- determine the speed of rotation
- determine the crankshaft angular position.



REMOVAL/REFITTING

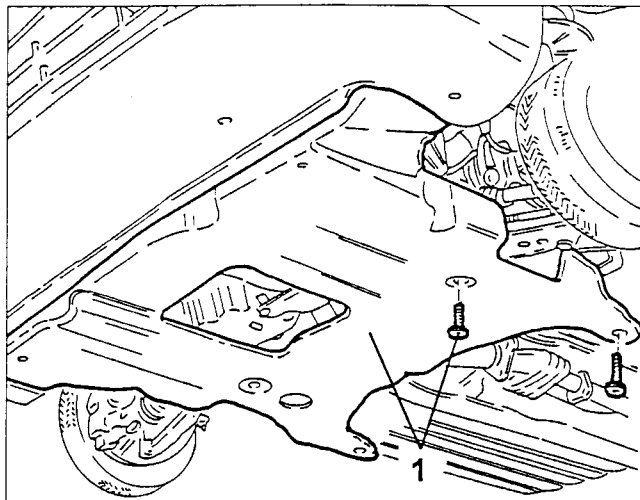
- Set the car on a lift.
- Make sure the ignition key is in the «STOP» position, then disconnect the battery (-) cable.

1. Disconnect the electrical connection of the rpm sensor and release it from the support bracket.

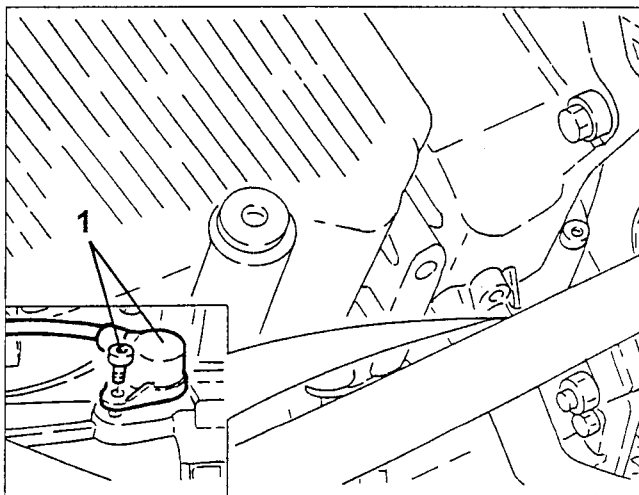


- Raise the car.

1. Slacken the fastenings and remove the under engine guard.

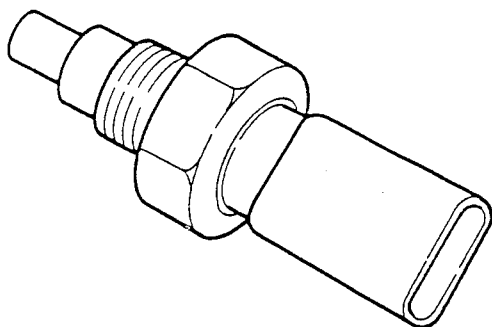


1. Slacken the fastening screw and remove the rpm sensor after releasing its wiring from the fasteners.



COOLANT FLUID TEMPERATURE SENSOR

This is fitted on the thermostatic cup and detects the temperature of the water through a double NTC thermistor with a negative resistance coefficient. One NTC thermistor sends the signal to the injection control unit while the other sends the signal to the instrument cluster for the temperature gauge and warning light.



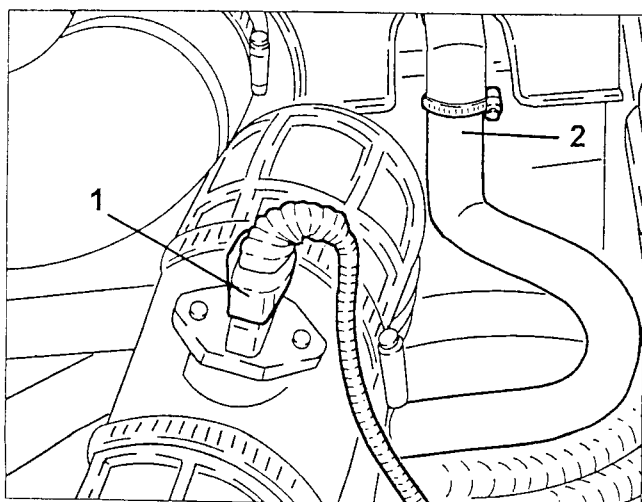
The sensor is made with semi-conductor technology, therefore, if the temperature of the sensor increases with the temperature of the water, the resistance value is reduced.

As the change in the resistance is not linear, at the same temperature increase it is higher for low temperatures than for high temperatures.

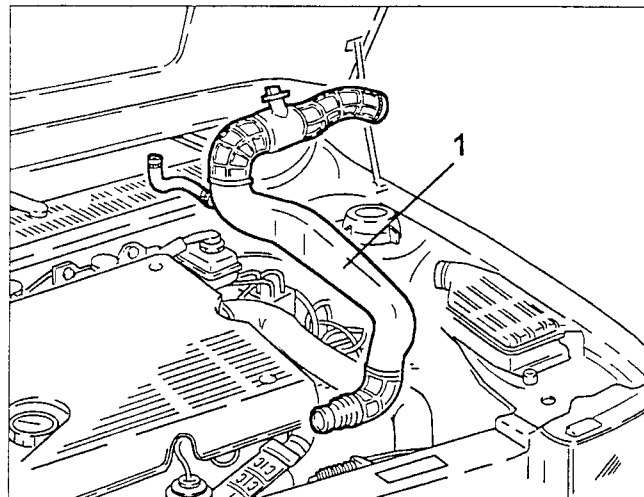
REMOVAL/REFITTING

- Remove the battery (see Group 55).

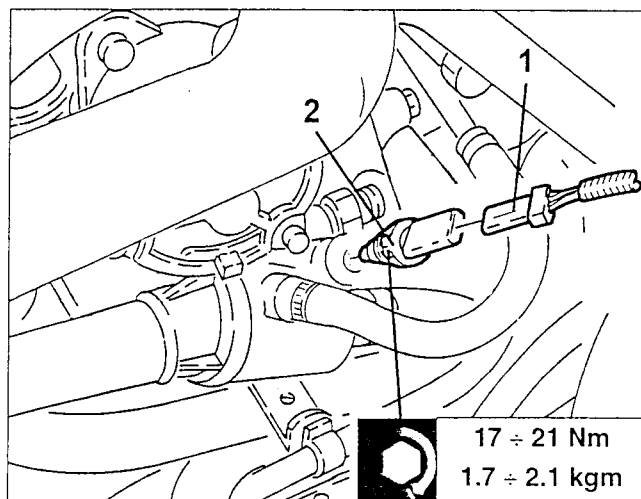
1. Disconnect the electrical connection from the air flow meter.
2. Disconnect the oil vapour re-circulation pipe from the oil vapour separator.



1. Loosen the clamps and remove the complete air delivery pipe from the cleaner to the turbocharger.



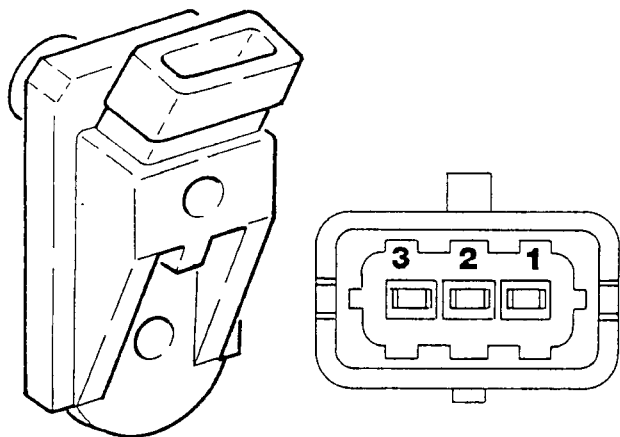
1. Disconnect the electrical connection from the engine coolant fluid temperature sensor.
2. Slacken and remove the engine coolant fluid temperature sensor.



OVERPRESSURE SENSOR

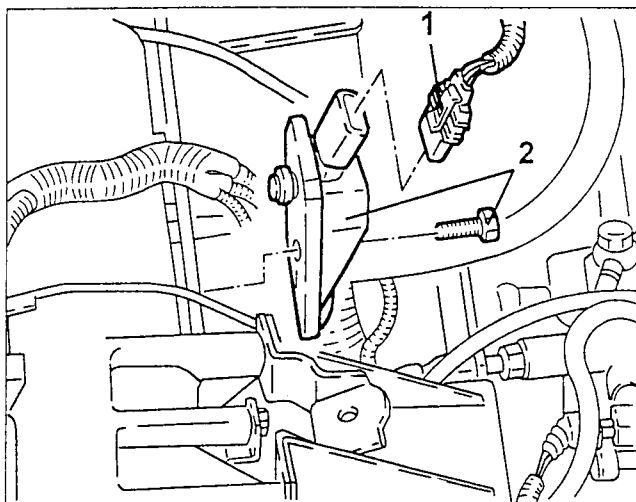
This is installed at the centre of the intake box and its purpose is to inform the injection control unit for:

- injection pressure adjustment
- injection length adjustment.



- 1. 5 V (from ECU)
- 2. Earth
- 3. Output signal

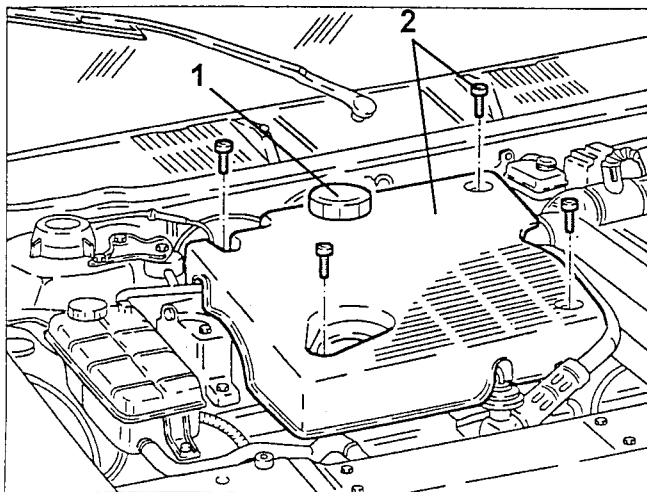
1. Disconnect the electrical connection from the overpressure sensor.
2. Slacken the screw and remove the overpressure sensor.



REMOVAL/REFITTING

- Make sure the ignition key is in the «STOP» position, then disconnect the battery (-) cable.

1. Remove the engine oil filler cap.
 2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.



ACCELERATOR PEDAL POTENTIOMETER

The accelerator pedal is fitted with two integrated potentiometers:

- a main one
- and a safety one.

The control unit activates the following recovery strategies:

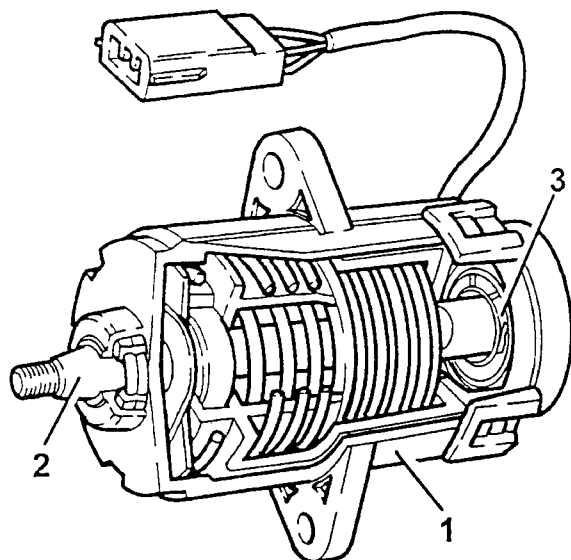
- in the event of a fault on one of the two potentiometers, it allows throttle opening up to a maximum of 40° in a very long time
- in the event of a complete failure of the two potentiometers, it shuts off throttle opening.

OPERATION

The sensor consists of a body (1), secured to the pedal assembly with a flange, which houses an axially positioned shaft (2) connected to two potentiometers (3).

There are two springs on the shaft; one (coil spring) ensures correct pressure resistance and the other ensures pedal return when released.

Operating range 0° to 70°; mechanical stop at 88°.

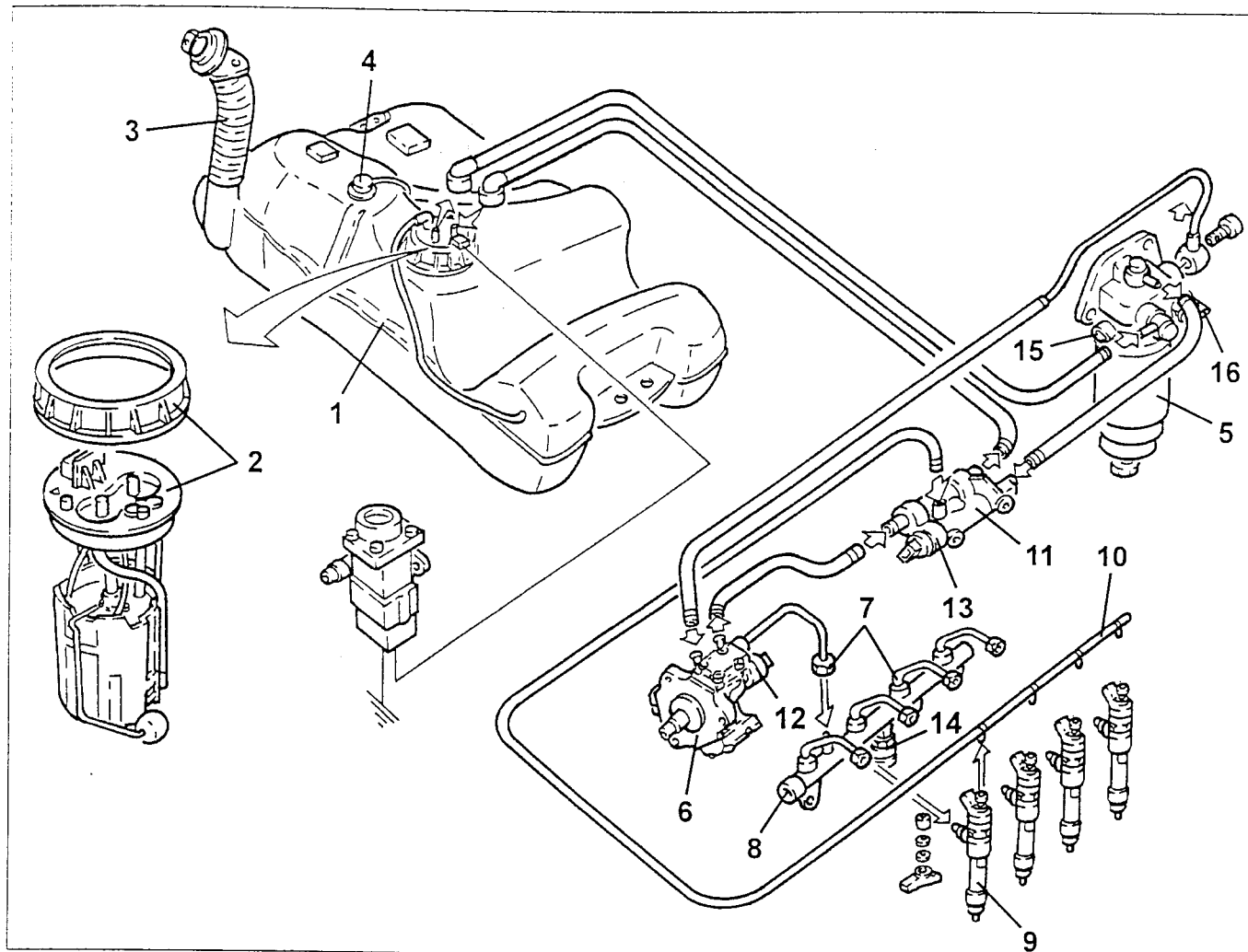


- 1. Body
- 2. Shaft
- 3. Potentiometers

REMOVAL/REFITTING

TO BE PUBLISHED SOON

DESCRIPTION OF FUEL SUPPLY SYSTEM



1. Fuel tank
2. Submerged pump assembly complete with level gauge control
3. Fuel filler pipe
4. Multi-function valve
5. Fuel filter cartridge
6. Pressure pump
7. High pressure pipes
8. Delivery manifold

9. Injectors
10. Injector re-circulation pipe
11. Return manifold
12. Pressure regulator
13. Fuel temperature sensor
14. Fuel pressure sensor
15. Fuel heater
16. Thermal switch

The fuel supply system is subdivided into a low pressure circuit and a high pressure circuit.

The low pressure circuit comprises:

- submerged auxiliary electric pump
- fuel oil filter

- return manifold.

The high pressure circuit comprises:

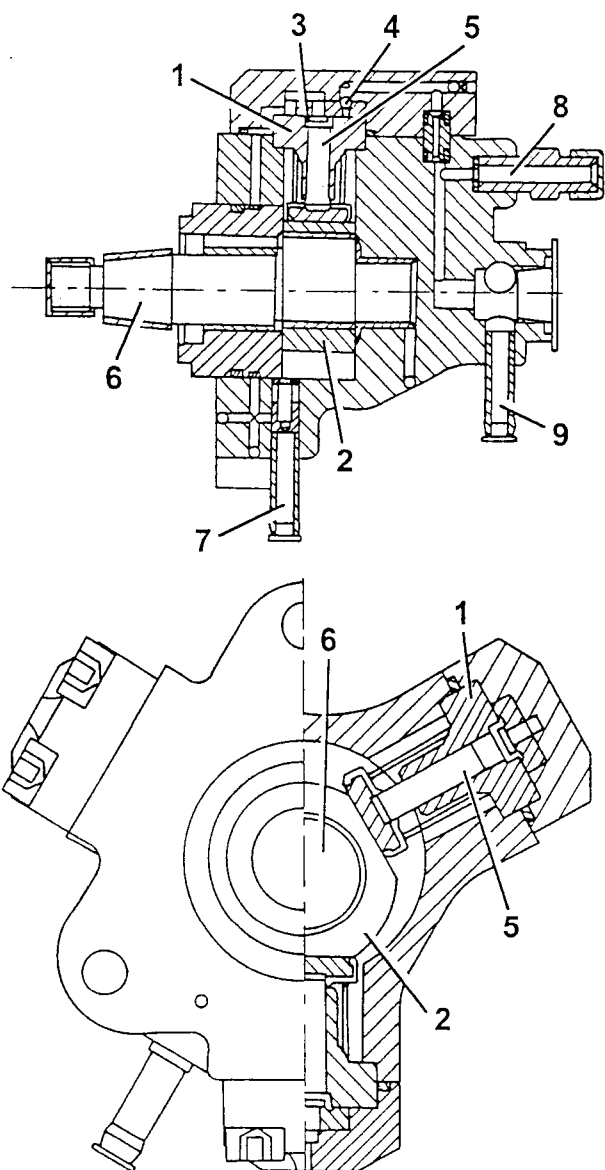
- fuel pump
- delivery manifold.

PRESSURE PUMP

This is of the "radial jet" with three radial pistons (total displacement 0.657 c.c.) and it is controlled by the timing gear belt with no need for timing.

Each pumping unit comprises:

- a piston (5) operated by a cam (2) integral with the spindle of the pump (6)
- a plate inlet valve (3)
- a ball delivery valve (4).



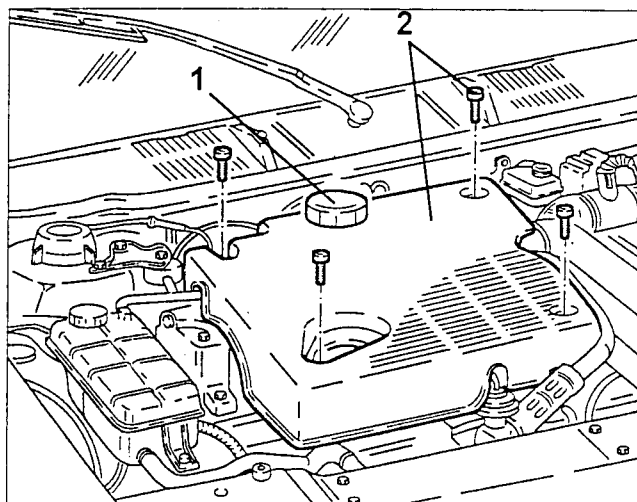
1. Cylinder
2. Cam
3. Plate inlet valve
4. Ball delivery valve
5. Piston
6. Pump spindle
7. Inlet - low pressure
8. Delivery - high pressure
9. Delivery - low pressure (re-circulation)

The pressure pump must be supplied with a pressure of at least 0.5 bar; therefore the fuel system is fitted with an auxiliary electric pump submerged in the fuel tank.

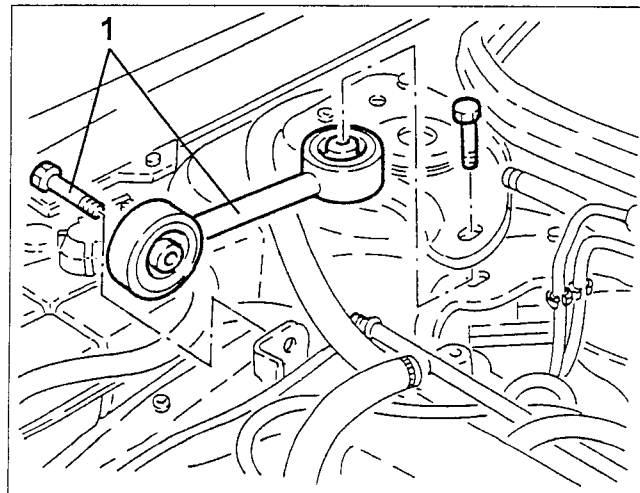
The maximum delivery pressure reaches 1350 bar. The pressure pump is lubricated and cooled by the actual fuel oil through suitable grooves.

REMOVAL/REFITTING

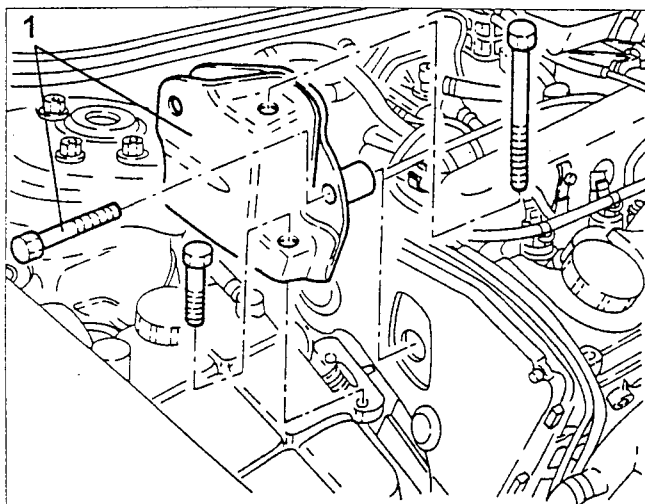
- Set the car on a lift.
- Make sure that the ignition key is at the "STOP" position, then disconnect the battery terminal (-).
- 1. Remove the engine oil filler cap.
- 2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.



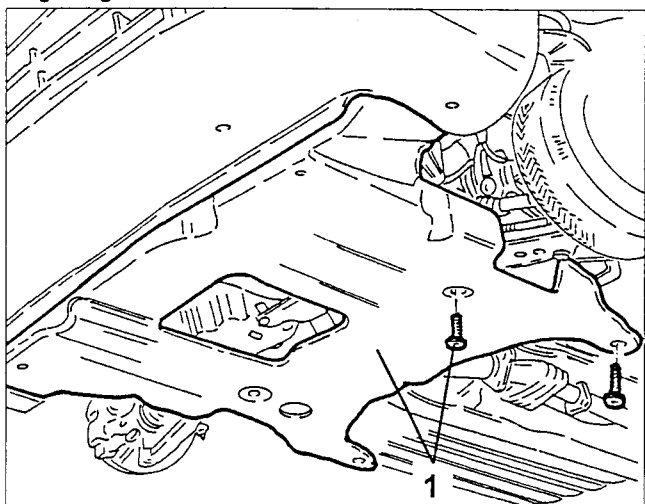
1. Slacken the fastening screws and remove the power unit reaction rod.



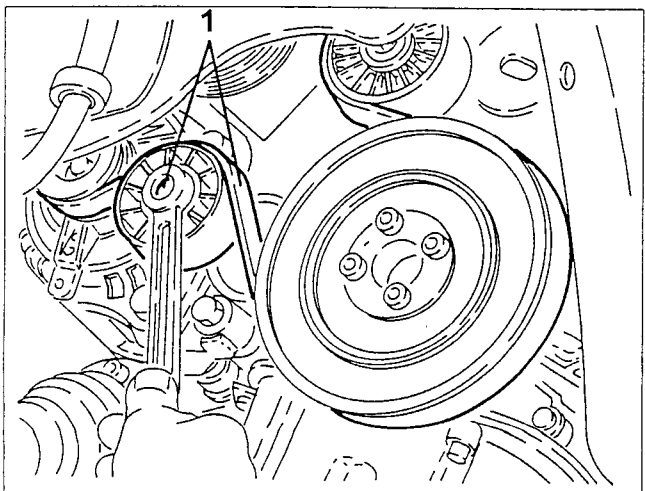
1. Slacken the fastening screws and remove the reaction rod engine side support bracket.



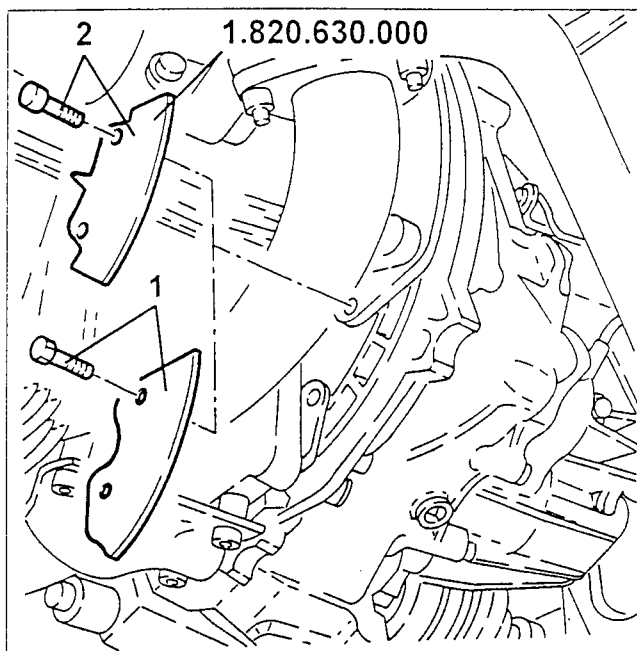
- Remove the right front wheel and its dust guard.
 - Remove the right front wheel arch.
1. Slacken the fastenings and remove the under engine guard.



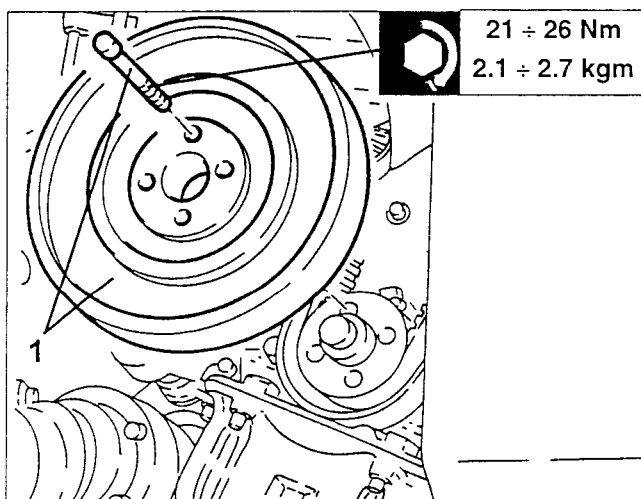
1. Proceeding as illustrated on the tensioner, slacken the tension of the engine components belt and remove it.



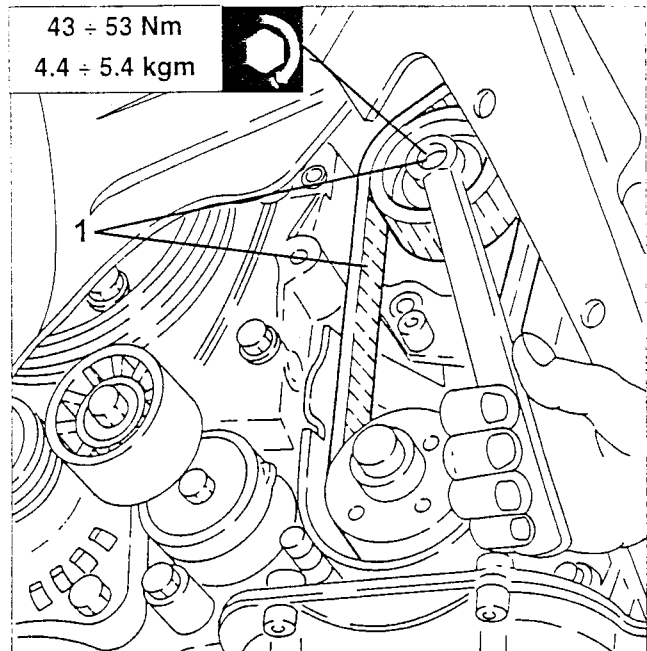
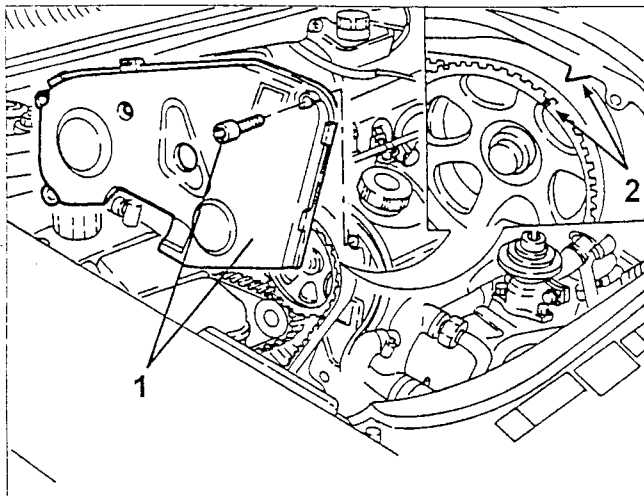
1. Slacken the screws and remove the lower flywheel guard.
2. Install flywheel stopper tool no. 1.820.630.000.



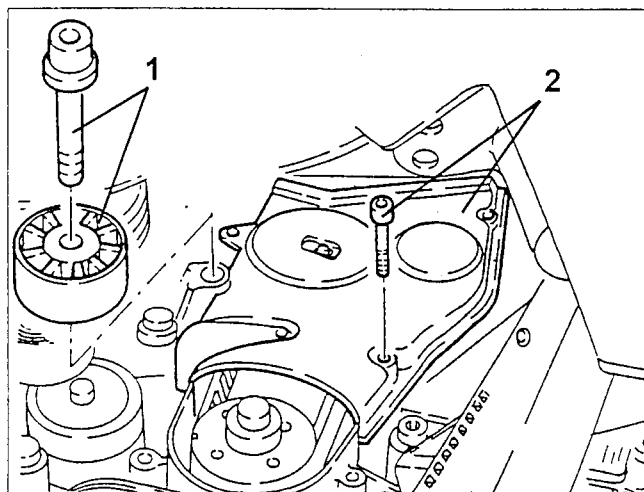
1. Slacken the fastening screws and remove the crankshaft pulley.



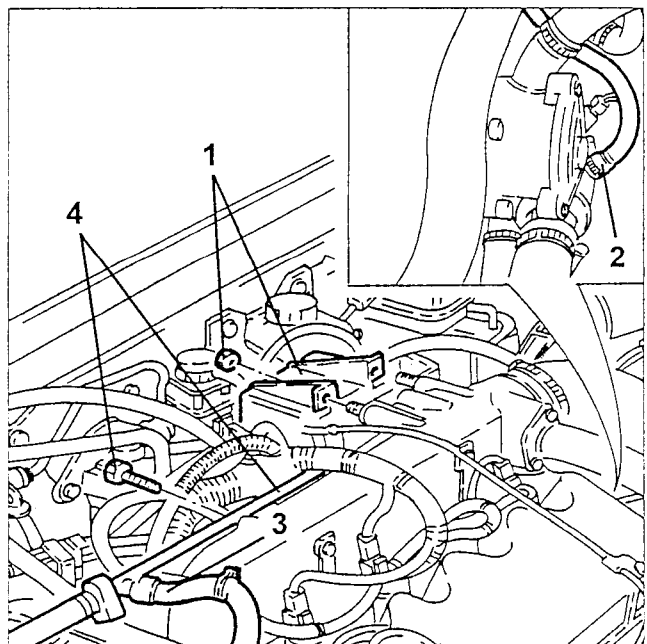
1. Slacken the fastening screws and remove the timing gear belt upper guard.
2. Working on the driving pulley screw, turn the crankshaft until the timing references are aligned (1st cyl. at T.D.C.).



1. Slacken the fastening screw and remove the fixed tensioner of the engine components belt.
2. Slacken the fastening screws and remove the timing gear belt lower guard.

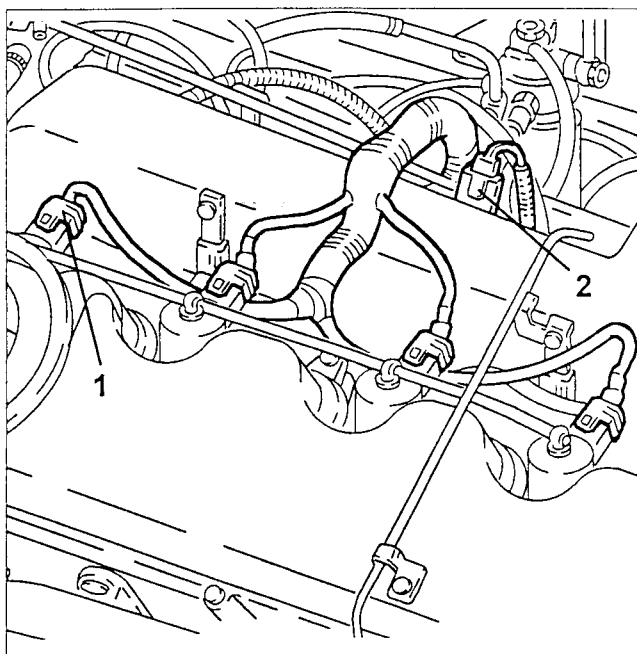
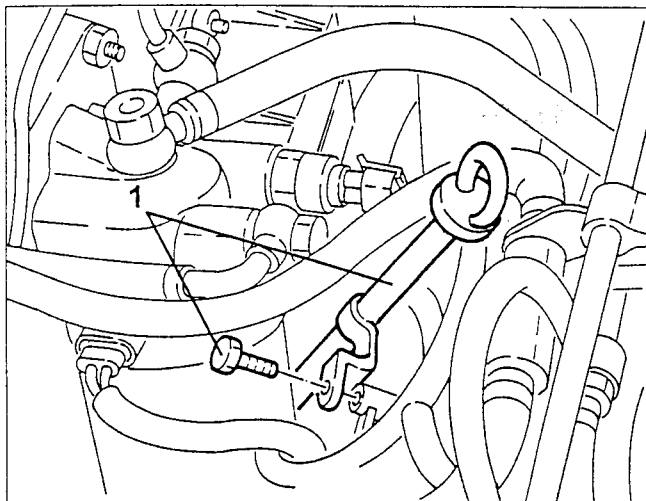


1. Slacken the fastening nuts and move the oil vapour separator.
2. Disconnect the coolant fluid return pipe to the header tank from the thermostat.
3. Disconnect the cylinder head coolant outlet pipe from the header tank coolant return pipe.
4. Slacken the fastening screws and move aside the header tank coolant return pipe.

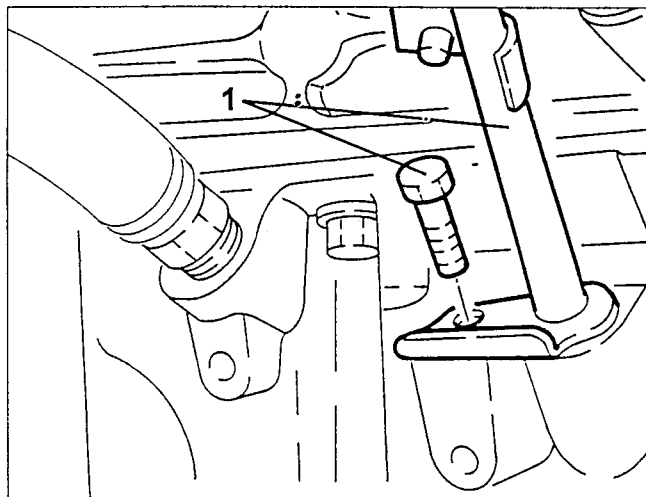


1. Slacken the nut fastening timing gear belt tensioner, then remove the timing gear belt.

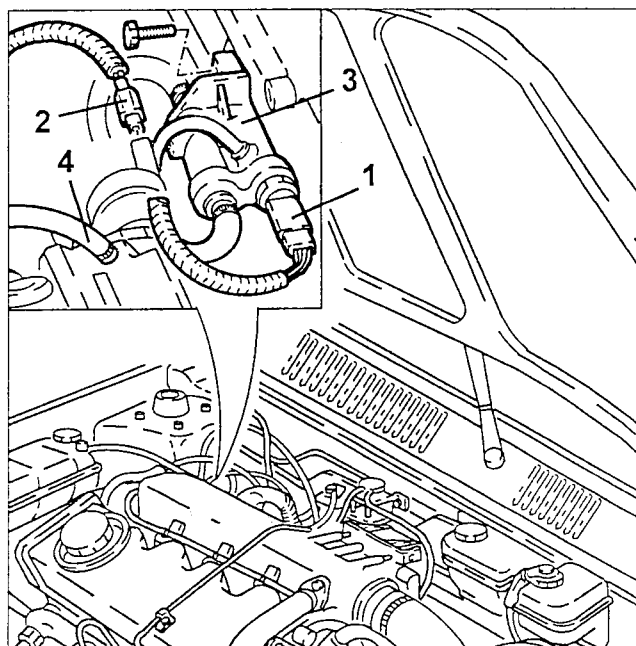
1. Slacken the upper screw of the engine oil dipstick guide pipe.



1. Slacken the lower screw of the engine oil dipstick guide pipe.



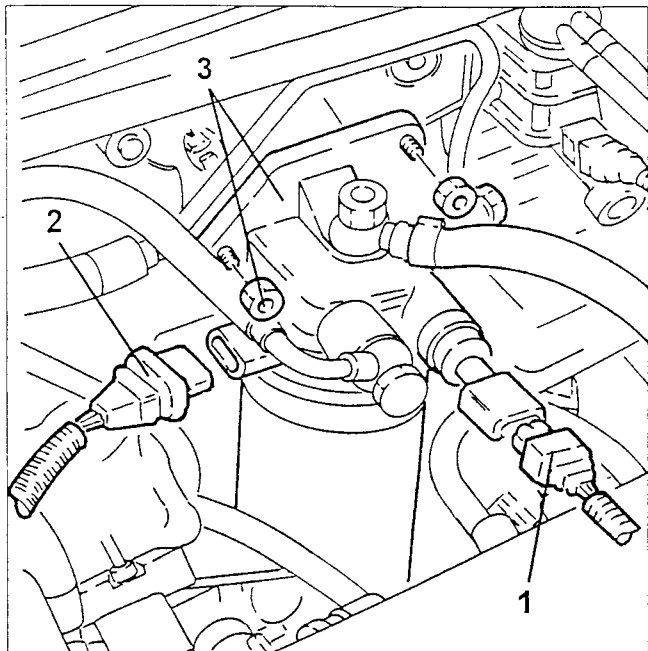
1. Disconnect the electrical connection from the fuel temperature sensor.
2. Disconnect the electrical connection from the fuel pressure regulator.
3. Slacken the screws and move the fuel return manifold pipe.
4. Disconnect the fuel inlet pipe from the pressure pump.



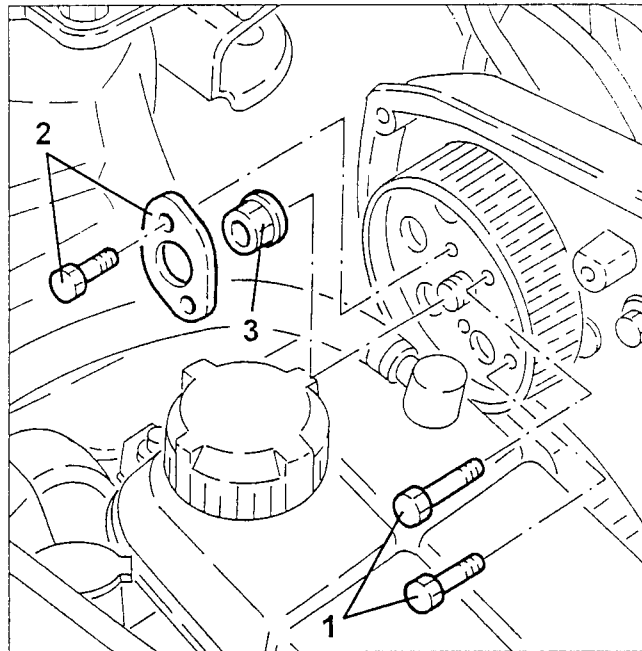
- Remove the guide pipe complete with engine oil dipstick.

1. Disconnect the electrical connections from the injectors.
2. Disconnect the electrical connection from the over-pressure sensor and move aside the wiring.

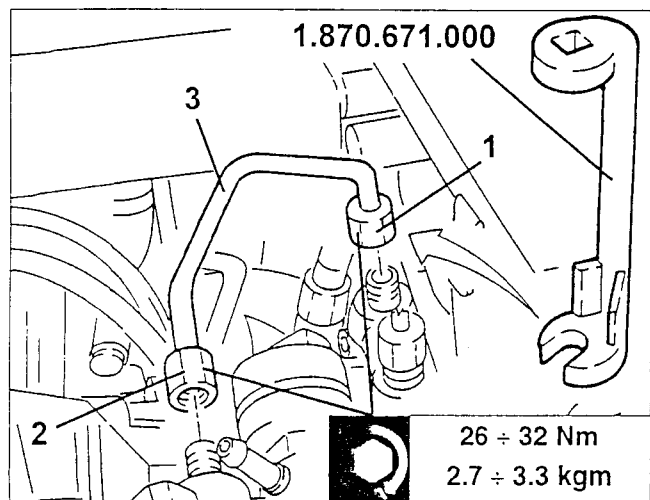
1. Disconnect the electrical connection from the fuel heater thermal switch.
2. Disconnect the electrical connection from the fuel heater.
3. Slacken the fastening nuts and move the fuel filter complete.



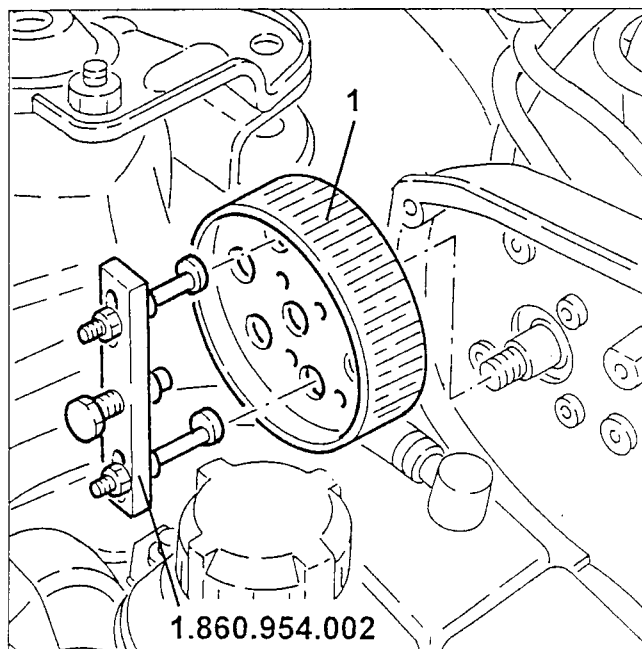
1. Tighten two screws in the special seats to lock the pressure pump drive pulley.
2. Slacken the screws and remove the safety flange.
3. Slacken nut fastening the pressure pump control pulley.



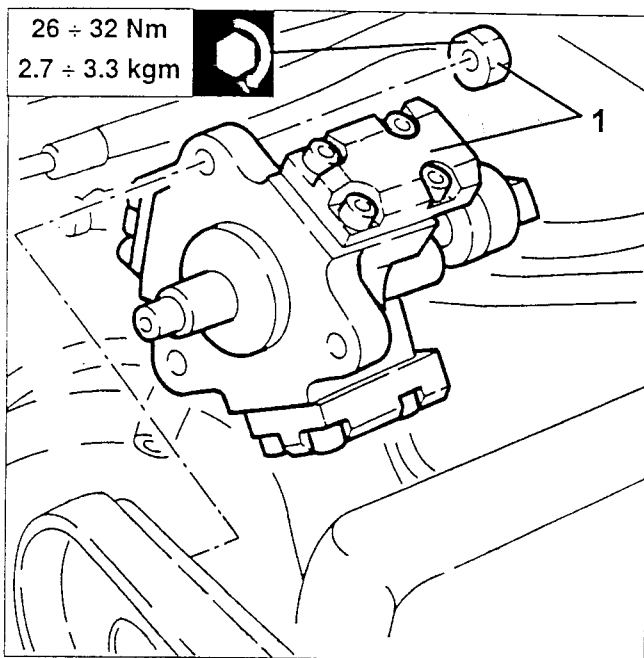
1. Slacken the manifold side coupling of the pipe between the pressure pump and fuel manifold using tool no. 1.870.671.000.
2. Slacken the pressure pump side coupling of the pressure pump delivery pipe to the manifold using a suitable wrench.
3. Remove the fuel delivery pipe from the pressure pump to the single fuel manifold pipe.



1. Remove the pressure pump control pulley using tool no. 1.860.954.002.



1. Slacken the fastening nuts and remove the pressure pump.

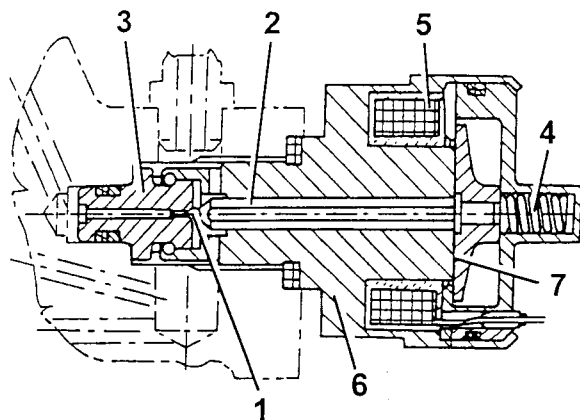


FUEL PRESSURE REGULATOR

This is fitted on the pressure pump and controlled by the injection control unit. It adjusts the pressure of the fuel supply to the injectors.

The pressure regulator mainly comprises:

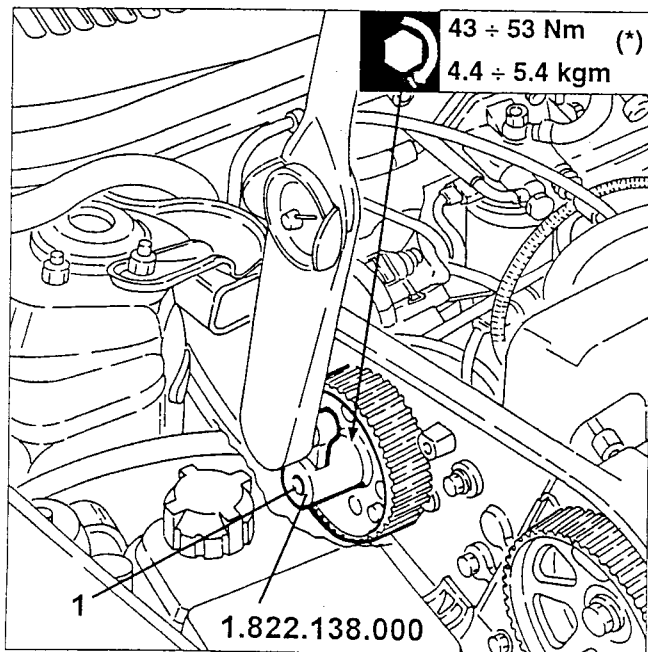
- a ball shutter (1)
- a pin (2) for controlling valve (3)
- a pre-loading spring (4)
- a coil (5).



1. Ball shutter
2. Pin
3. Valve
4. Pre-loading spring
5. Coil
6. Body
7. Anchor

Reassemble, reversing the sequence followed for removal and following the instructions given below.

1. Tighten the nut fastening the pressure pump control pulley to the specified torque using wrench no. 1.822.138.000.



(*): Nominal value

INJECTORS

These are fitted on the cylinder head and controlled by the injection control unit.

The injector can be subdivided into two parts:

- actuator/atomiser composed of a pressure rod (1), pin (2) and nozzle (3)
- solenoid control valve composed of a coil (4) and drive valve (5).

OPERATION

The injector works in three steps:

- "rest position"

The coil (4) is de-energised and the shutter (6) is in the closed position and does not allow the delivery of fuel into the cylinder $F_c > F_a$ (F_c : due to the line pressure which acts directly on the control area 7 of the rod 1; F_a : due to the line pressure which acts in the supply volume 8).

- "start of injection"

The coil (4) is energised and causes the shutter (6) to rise.

The fuel of the control volume (9) flows towards the return manifold (10) causing a pressure drop on the control area (7).

Simultaneously, the line pressure through the supply duct (12) exerts a force $F_a > F_c$ in the supply volume (8) causing the pin (2) to rise, thereby sending fuel into the cylinders.

- "end of injection"

The coil (4) is de-energised and makes the shutter (6) return to the closed position which again creates a balance of force which returns the pin (2) to the closed position, resulting in the end of injection.

1. Pressure rod
2. Pin
3. Nozzle
4. Coil
5. Drive valve
6. Ball shutter
7. Control area
8. Supply volume
9. Control volume
10. Fuel return - low pressure
11. Control duct
12. Supply duct
13. Electrical connection
14. Fuel inlet - high pressure coupling
15. Spring

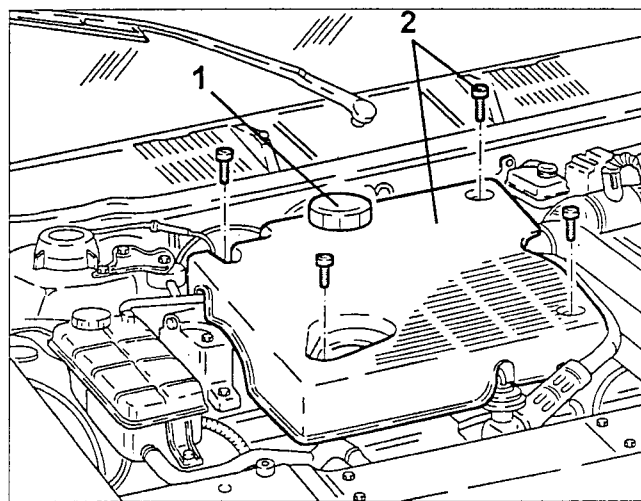
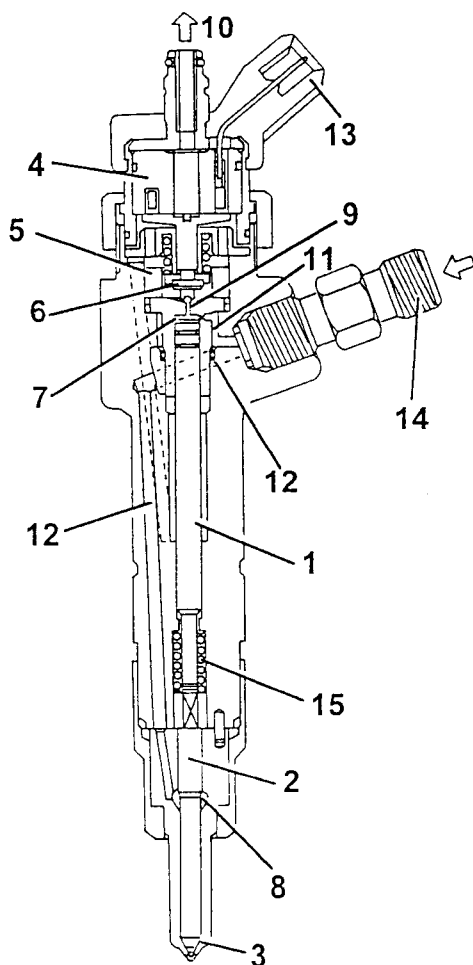
REMOVAL/REFITTING

- Make sure that the ignition key is at "STOP", then disconnect the battery terminal (-).

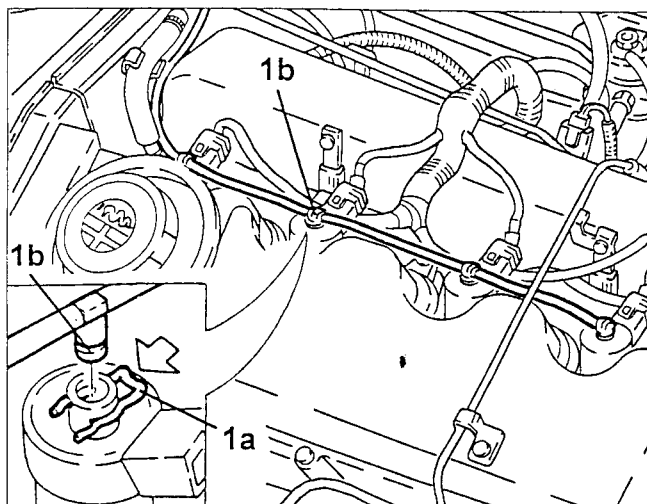
1. Remove the engine oil filler cap.

2. Slacken the fastening screws and remove the engine cover.

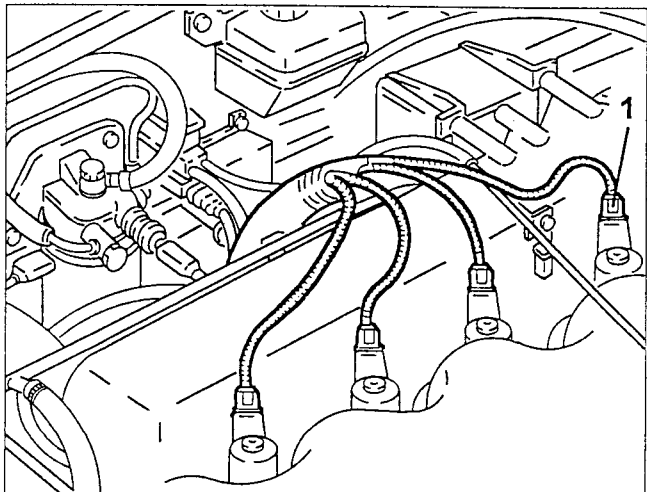
- Refit the engine oil filler cap.



1. Push the catches (1a) and disconnect the fuel return pipe for lubricating the injectors (1b) from the injectors.

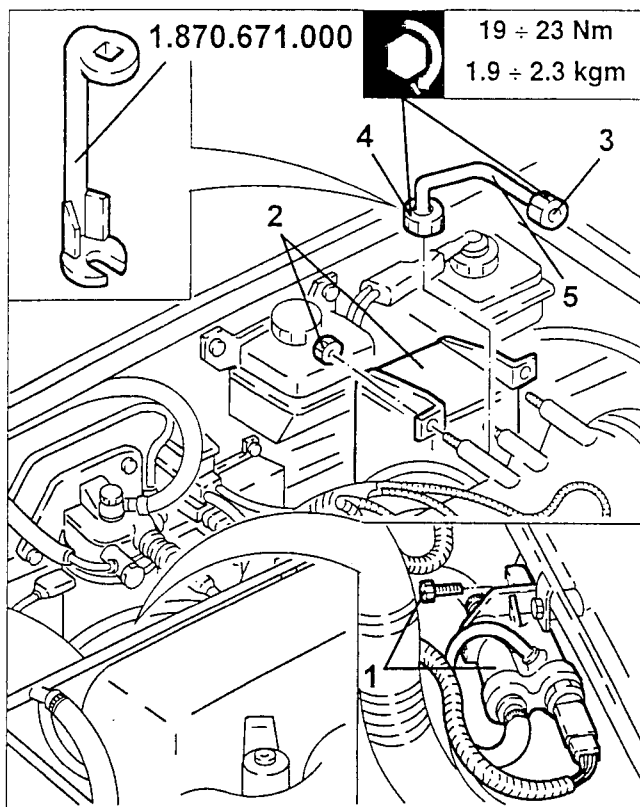


1. Disconnect the electrical connections from the injectors, then move aside the wiring after releasing it from the fastening clamps.

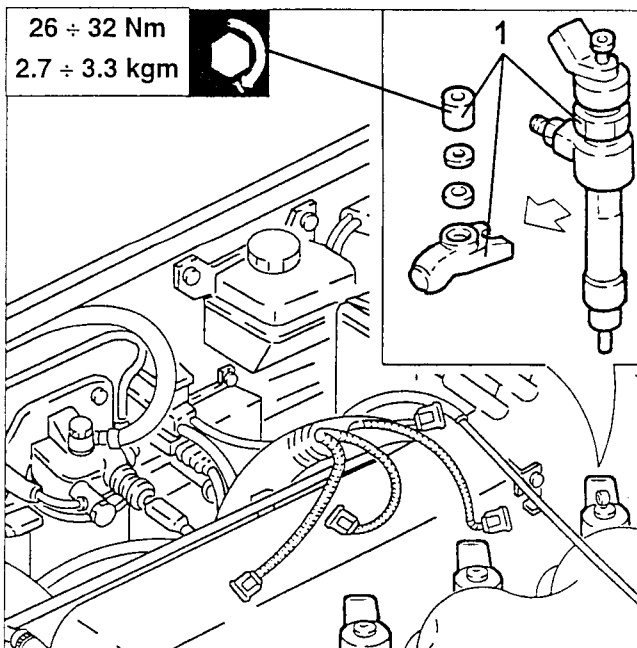


1. Slacken the screws and move aside the complete fuel return manifold pipe.
2. Slacken the nuts and move the oil vapour separator.
3. Slacken the injector side coupling of the pipes from the fuel manifold to the injectors using a suitable wrench.
4. Slacken the manifold side coupling of the pipes from the fuel manifold to the injectors using tool no. 1.870.671.000.

5. Remove the fuel delivery pipes from the single fuel manifold to the injectors.



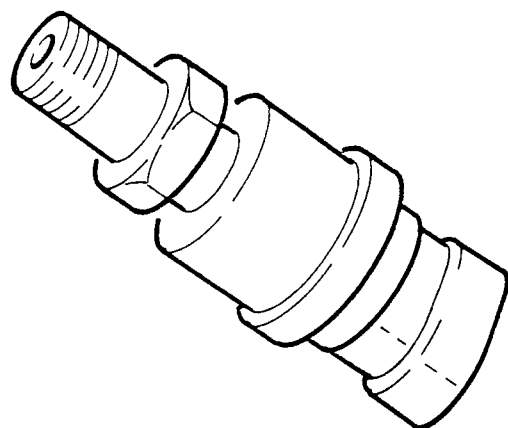
1. Slacken the fastening nuts, then remove the brackets and injectors.



FUEL PRESSURE SENSOR

This is fitted at the centre of the "rail" fuel distributor manifold and its task is to supply the injection control unit a feedback signal to:

- adjust the injection pressure
- adjust the injection time.



DELIVERY MANIFOLD

The delivery manifold is fitted on the intake side of the cylinder head.

With its volume of approx. 33 c.c. It dampens fuel pressure oscillations due to:

- operation of the pressure pump,
- opening of the injectors.

The fuel pressure sensor is fitted at the centre of the delivery manifold.

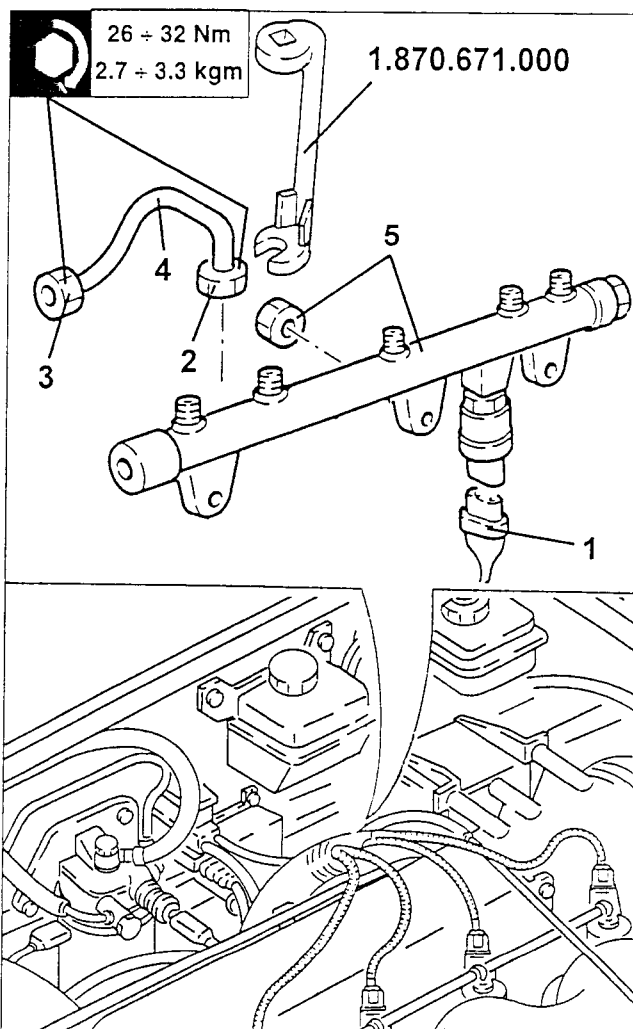
The high-pressure hydraulic connections (between manifold - pump and manifold - injectors) are made through steel pipes with an inside diameter of 2 mm and an outside diameter of 6 mm.

2. Slacken the manifold side coupling of the pipe from pressure pump to fuel manifold using tool no. 1.870.671.000.

3. Slacken the pressure pump side coupling of the delivery pipe from the pressure pump to the manifold using a suitable wrench.

4. Remove the fuel delivery pipe from the pressure pump to the single fuel manifold pipe.

5. Slacken the nuts and remove the fuel delivery manifold.



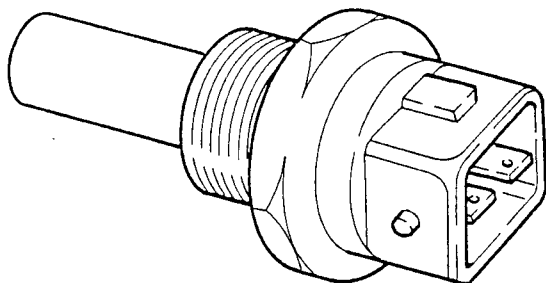
REMOVAL/REFITTING

- Make sure that the ignition key is in the «STOP» position, then disconnect the battery (-) terminal.
- Remove the pipes from the fuel manifold to the injectors (see specific procedure).

1. Disconnect the electrical connection from the fuel temperature sensor.

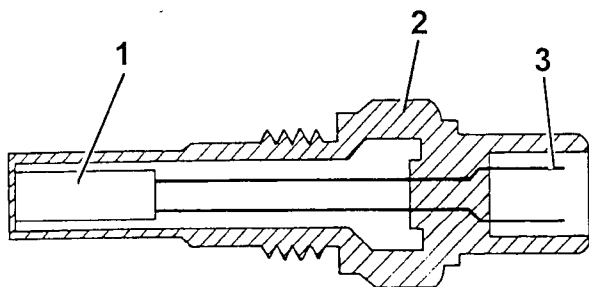
FUEL TEMPERATURE SENSOR

This is fitted on the return manifold and detects the temperature of the fuel through an NTC thermistor with a negative resistance coefficient.



The sensor is made with semi-conductor technology; therefore, if the temperature of the sensor increases as the fuel temperature increases, the resistance rating lowers.

As the change in resistance is not linear, with the same increase in temperature, it is higher for low temperatures than for higher ones.

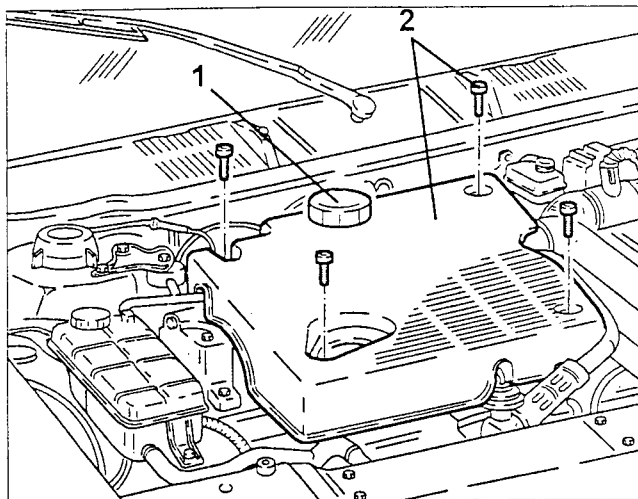


- 1. Resistance
- 2. Sensor body
- 3. Supply connector

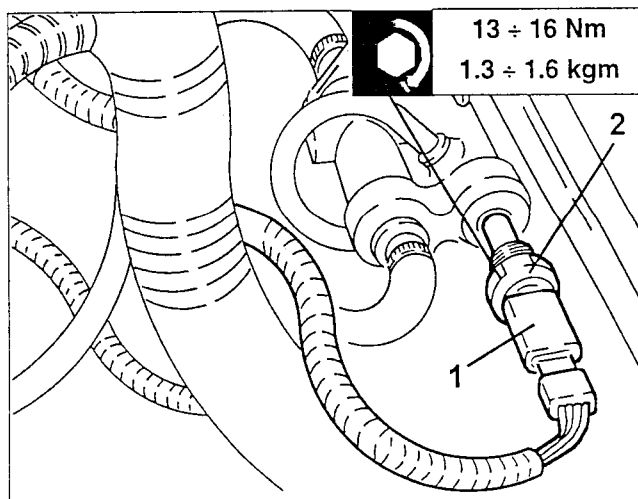
REMOVAL/REFITTING

- Make sure that the ignition key is in the «STOP» position, then disconnect the battery (-) terminal.

1. Remove the engine oil filler cap.
 2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.



1. Disconnect the electrical connection from the fuel temperature sensor.
2. Slacken and remove the fuel temperature sensor from the fuel return manifold pipe.



FUEL FILTER

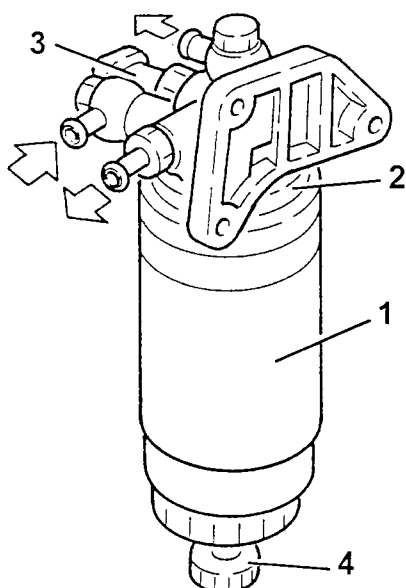
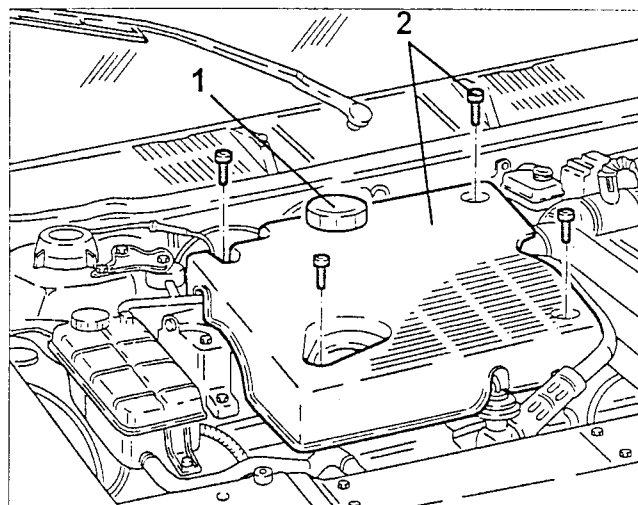
The fuel filter is installed in the engine compartment on the bulkhead.

It is of the cartridge type with a filtering element (1) formed of a pack of paper disks with a filtering surface of 5300 cm² and a filtering power of 4 ÷ 5 µm.

The filter is fitted with a fuel pre-heating device (2) controlled by a thermal switch (3) fitted on the filter itself.

When the fuel temperature is below 6 °C an electrical resistance heats it up to a maximum of 15 °C before sending it to the pressure pump.

At the base of the fuel filter cartridge there is a cap (4) for draining the water in the filter.



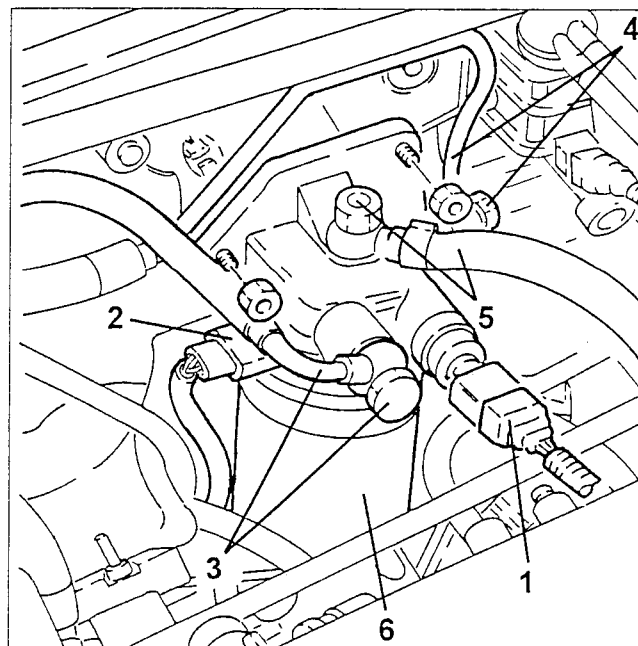
- 1. Filtering element
- 2. Fuel pre-heating device
- 3. Thermal switch
- 4. Water drain cap

REMOVAL/REFITTING

- Make sure that the ignition key is in the «STOP» position, then disconnect the battery (-) terminal.

1. Remove the engine oil filler cap.
2. Slacken the fastening screws and remove the engine cover.

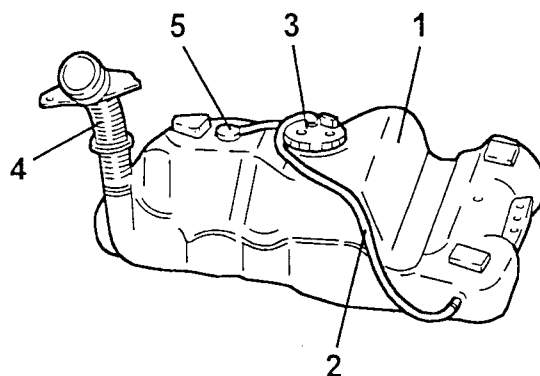
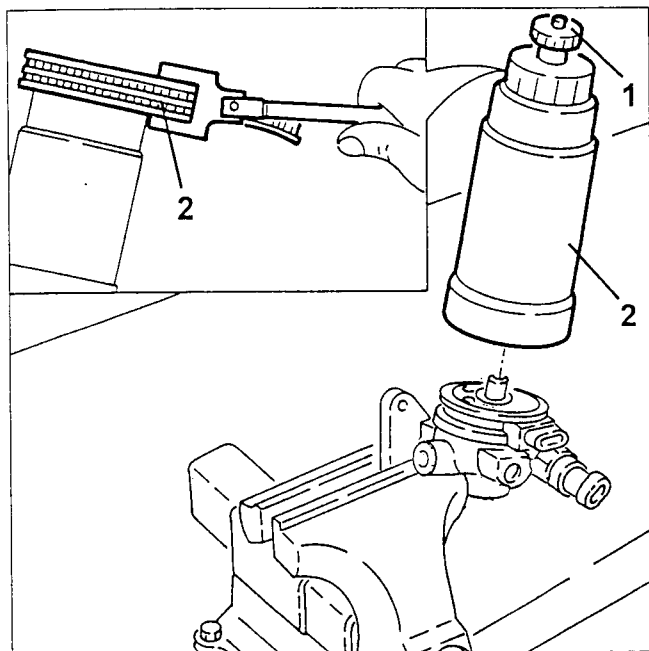
1. Disconnect the electrical connection from the fuel heater thermal switch.
2. Disconnect the electrical connection from the fuel pre-heating device.
3. Slacken the coupling and disconnect the fuel delivery pipe from the fuel filter.
4. Slacken the coupling and disconnect the delivery pipe to the pressure pump from the fuel filter.
5. Slacken the coupling and disconnect the delivery pipe to the return manifold from the fuel filter.
6. Slacken the fastening nuts and remove the fuel filter complete.



- Put the fuel filter in a vice clamp with protective jaws.

1. Remove the water drain cap from the fuel filter.
2. Slacken and remove the fuel filter filtering element using a suitable tool.

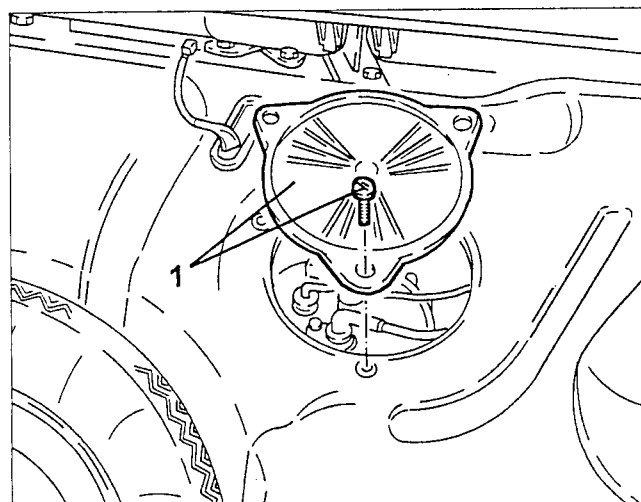
WARNING: When refitting tighten the filtering element completely by hand.



1. Fuel tank
2. Breather pipe between the lower and upper part of the tank
3. Submerged pump assembly complete with level gauge control
4. Fuel filter
5. Multi-function valve

REMOVAL/REFITTING

- Set the car on a lift.
- Make sure that the ignition key is in the «STOP» position, then disconnect the battery (-) terminal.
- Siphon the fuel from the tank using suitable equipment.
- Remove the right rear wheel.
- Working from the boot, tilt the rear seat back and move aside the trim.
- 1. Slacken the fastening screws and remove the lid for access to the submerged pump assembly complete with level gauge control.



FUEL TANK

The fuel tank is made of plastic and has a capacity of about 61 litres, including a reserve of approx. 5 ÷ 8 litres.

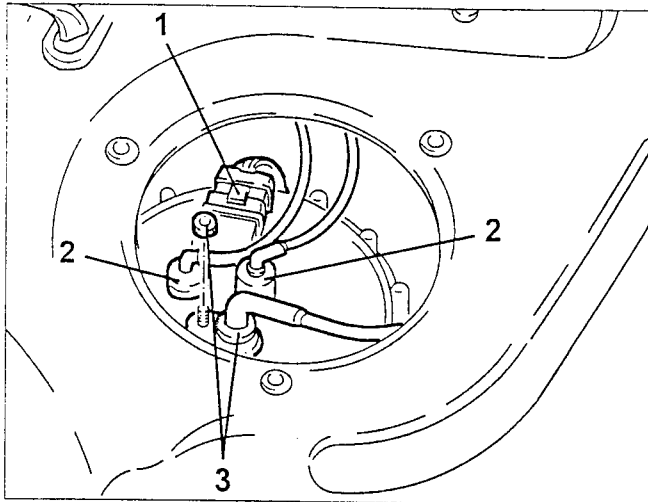
The fuel filler is on the main body and the fuel cap has a special closing system which prevents it from being closed above the specified torque (locking above the foreseen value is prevented by a snap device).

The fuel tank is fastened under the body in correspondence with the boot surface and the rear seat, its shape is designed so as not to interfere with the rear suspension axle.

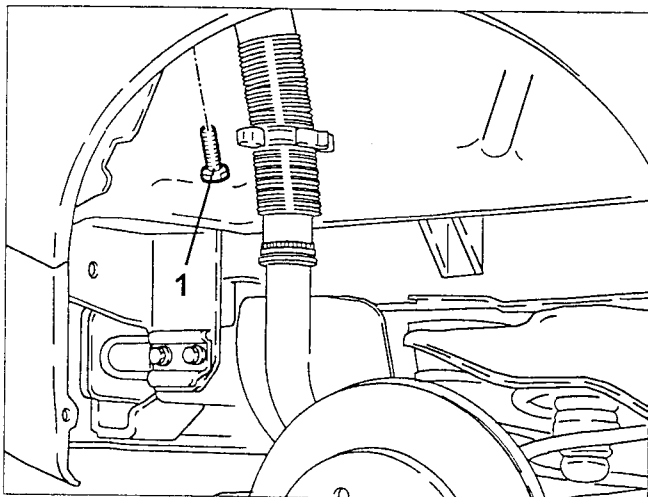
The particular shape of the fuel tank requires the presence of a pipe to vent the air in the upper part when refuelling.

In the upper part the tank has apertures for housing the submerged pump assembly complete with level gauge control and multi-function valve.

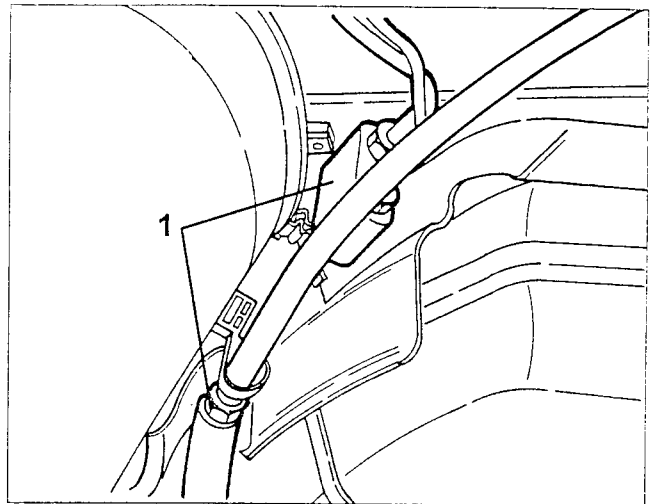
1. Disconnect the electrical connection from the submerged pump assembly complete with level gauge control.
2. Disconnect the quick couplings of the fuel delivery and return pipes from the submerged pump assembly complete with level gauge control.
3. Slacken the nut and disconnect the breather pipe between the lower and upper part of the tank.



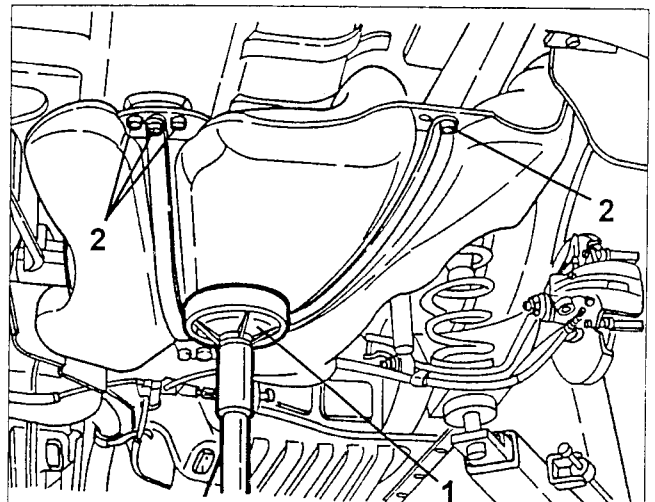
1. Working from the wheel arch, slacken the screw fastening the fuel filler to the body.



1. Release the handbrake cables and brake pipes from the fasteners on the tank.

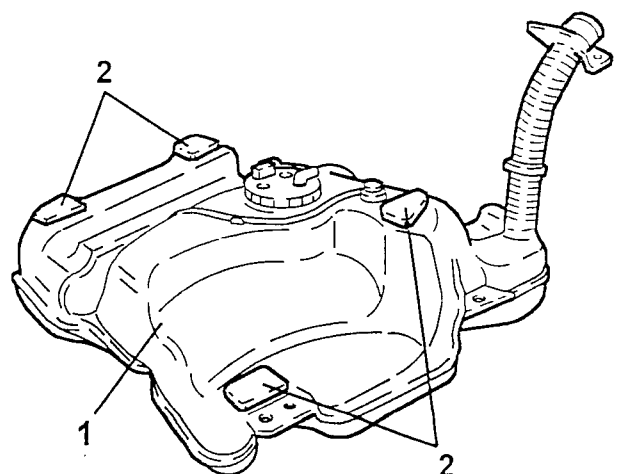


1. Set a hydraulic jack under the fuel tank.
2. Remove the plastic nails and slacken the fuel tank fastening screws.



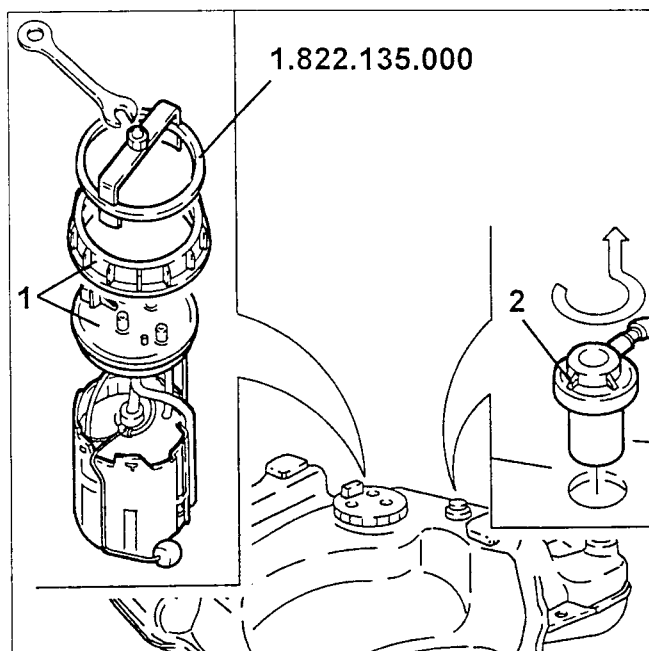
1. Lower the hydraulic jack and remove the fuel tank.

WARNING: When refitting the tank check for the presence on it of the rubber pads (2).



DISASSEMBLY/REASSEMBLY

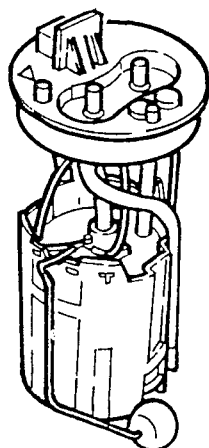
1. Using tool no. 1.822.135.000, remove the lock ring, then withdraw the submerged pump assembly complete with level gauge control from the tank.
2. Remove the multi-function valve complete with pipe from the fuel tank.



SUBMERGED PUMP ASSEMBLY COMPLETE WITH LEVEL GAUGE CONTROL

This mainly comprises:

- an electric pump of the type with pins
- a fuel level gauge
- a fuel filter.



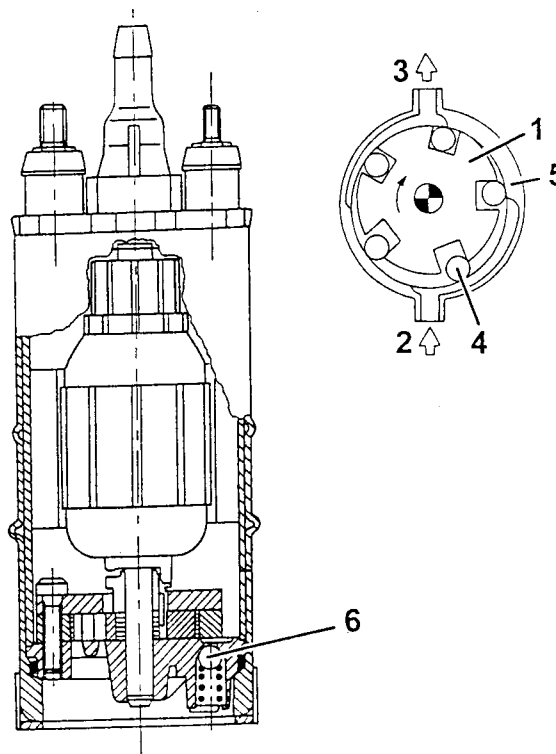
ELECTRIC FUEL PUMP

The electric pump submerged in the fuel is of the volumetric type with pins, with motor with brushes and with permanent magnet energising.

The impeller (1) turns, drawn by the motor, creating volumes which move from the inlet port (2) to the delivery port (3).

These volumes are delineated by the pins (4) which adhere to the outer ring (5) while the motor turns.

The pump is fitted with two valves, a non-return one to prevent the fuel circuit from emptying (with pump stopped) and the second one is an overpressure valve (6), which re-circulates delivery with the intake when the pressure exceeds 5 bar.

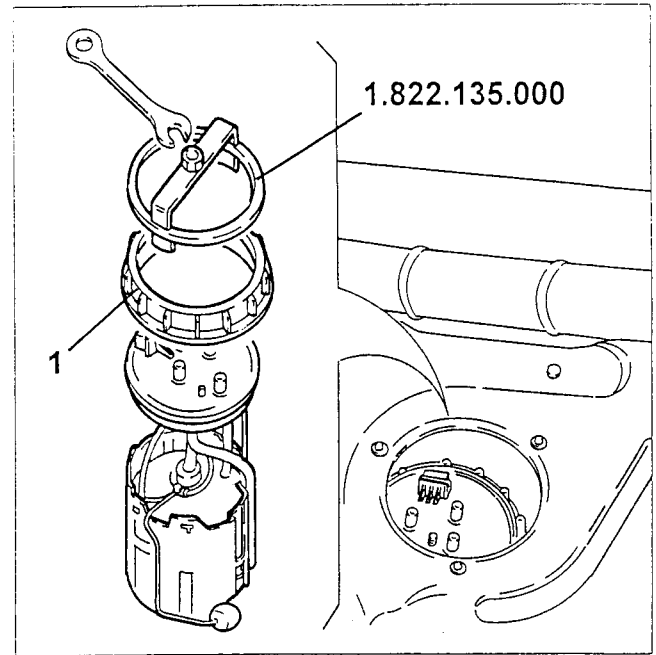
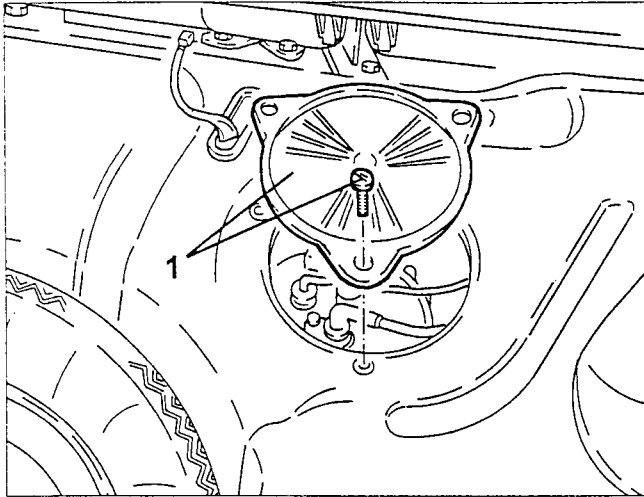


1. Impeller
2. Intake port
3. Delivery port
4. Pins
5. Outer ring
6. Overpressure valve

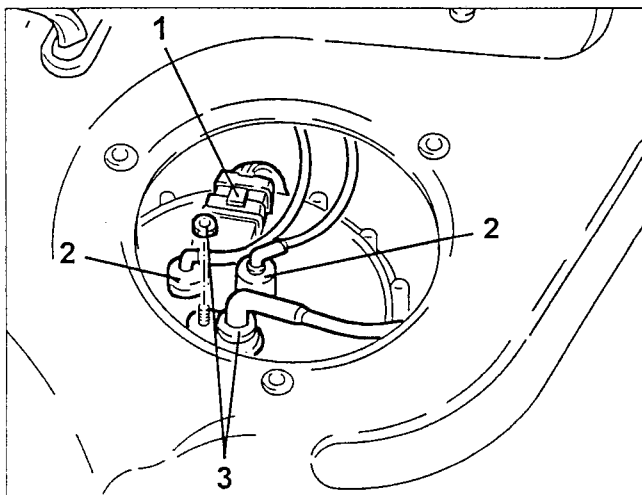
REMOVAL/REFITTING

- Make sure that the ignition key is in the «STOP» position, then disconnect the battery (-) terminal.
- Working from the boot, tilt the rear seat back and move aside the trim.

1. Slacken the fastening screws e remove the lid for access to the submerged pump assembly complete with level gauge control.



1. Disconnect the electrical connection from the submerged pump assembly complete with level gauge control.
2. Disconnect the quick couplings of the fuel delivery and return pipes from the submerged pump assembly complete with level gauge control.
3. Slacken the nut and disconnect the breather pipe between the lower and upper part of the tank.

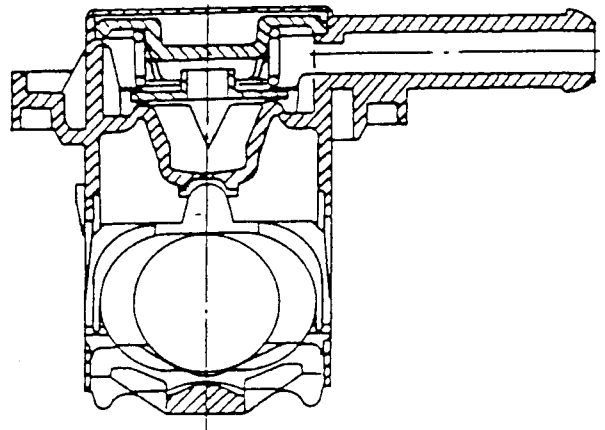


1. Using tool no. 1.822.135.000, remove the lock ring, then withdraw the submerged pump assembly complete with level gauge control from the fuel tank.

MULTI-FUNCTION VALVE

The functions of this valve are the following:

- pressurising the fuel tank
- retaining
- tightness in the event of overturning.



FUEL TANK PRESSURISING

The fuel tank is kept under pressure between 55 ÷ 75 mbar using a fluoro-silicone rubber valve resting on a sealing edge.

The valve is supported with a stainless steel plate countered by a spring.

When the pressure in the tank exceeds the specified limit, it overcomes the resistance of the spring and allows the valve to rise, thereby allowing the vapours through to the atmosphere.

The valve closes again when the pressure returns within limits.

RETAINING

In particular vehicle operating conditions, a vacuum can be created inside the fuel tank due to the effect of:

- changes in temperature
- fuel consumption.

In this case, the function of the valve is to restore the pressure in the tank by admitting air.

A possible fault of this function may cause "sawing" or vehicle stoppage, because of the difficulty in supplying the electric pump.

This function is carried out directly by the goose-necked valve made directly on the fluorine-silicone rubber.

SEALING IN THE CASE OF OVERTURNING (ROLL-OVER)

This function is to prevent fuel from spilling from the tank if the vehicle is overturned or sloped heavily.

During normal operation of the vehicle (bends, acceleration, braking, etc.) the fuel is shaken and could spill to the canister.

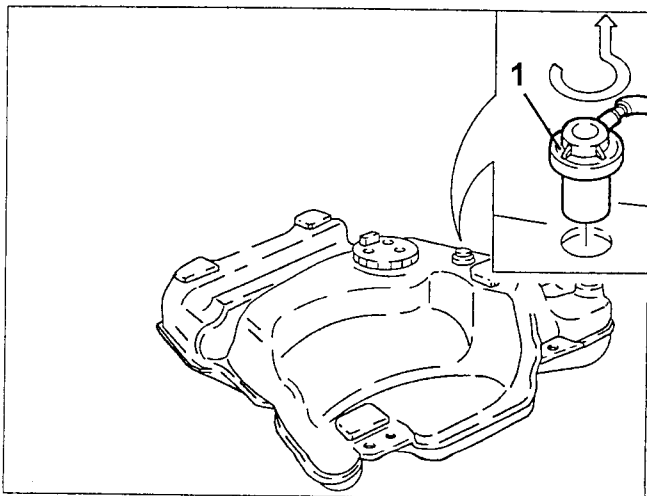
The high degree of sensitivity of the roll-over prevents this from occurring.

The roll-over closing angle is below 33°.

REMOVAL/REFITTING

- Remove the fuel tank (see specific procedure).

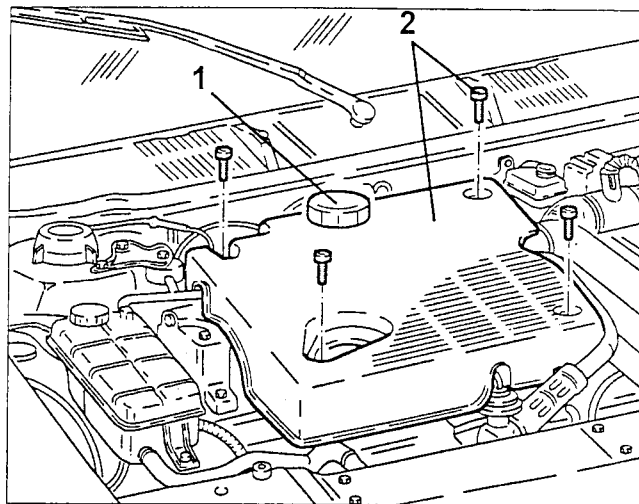
1. Remove the multi-function valve complete with pipe from the fuel tank.



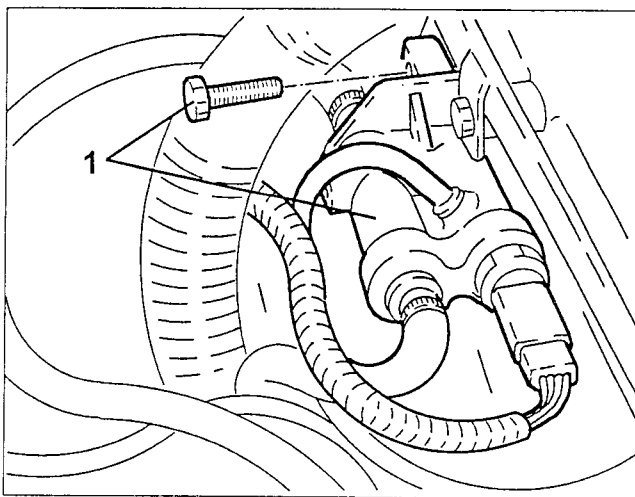
PIPE FROM PRESSURE PUMP TO FUEL MANIFOLD

REMOVAL/REFITTING

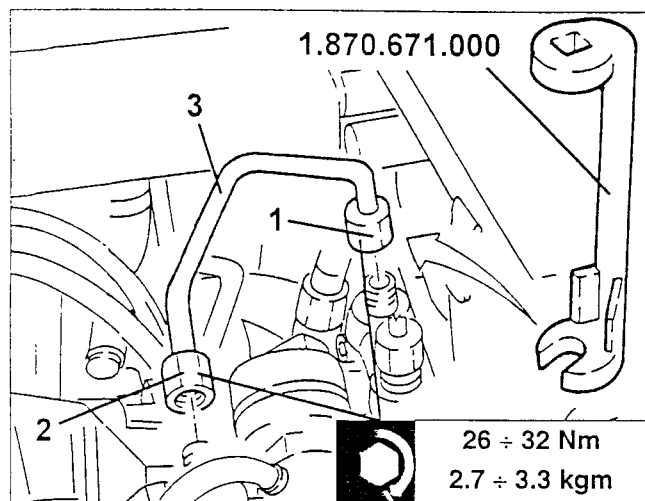
1. Remove the engine oil filler cap.
2. Slacken the fastening screws and remove the engine cover.
3. Refit the engine oil filler cap.



1. Slacken the screws and move aside the fuel return manifold pipe.



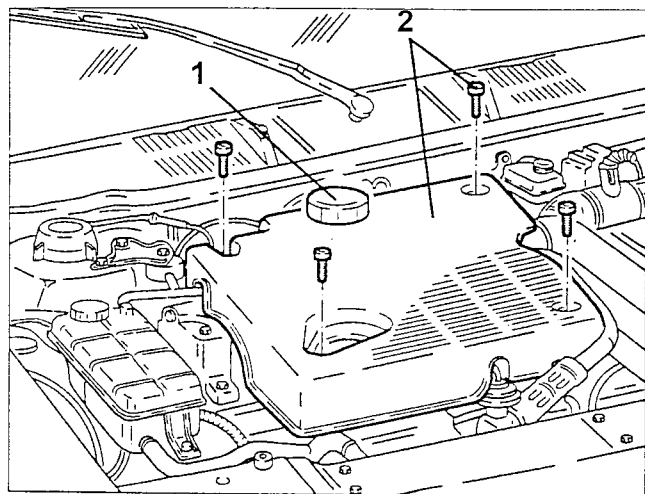
1. Slacken the manifold side coupling of the pipe from the pressure pump to the fuel manifold using tool no. 1.870.671.000.
2. Slacken the pressure pump side coupling of the delivery pipe from the pressure pump to the manifold using a suitable wrench.
3. Remove the fuel delivery pipe from the pressure pump to the single fuel manifold pipe.



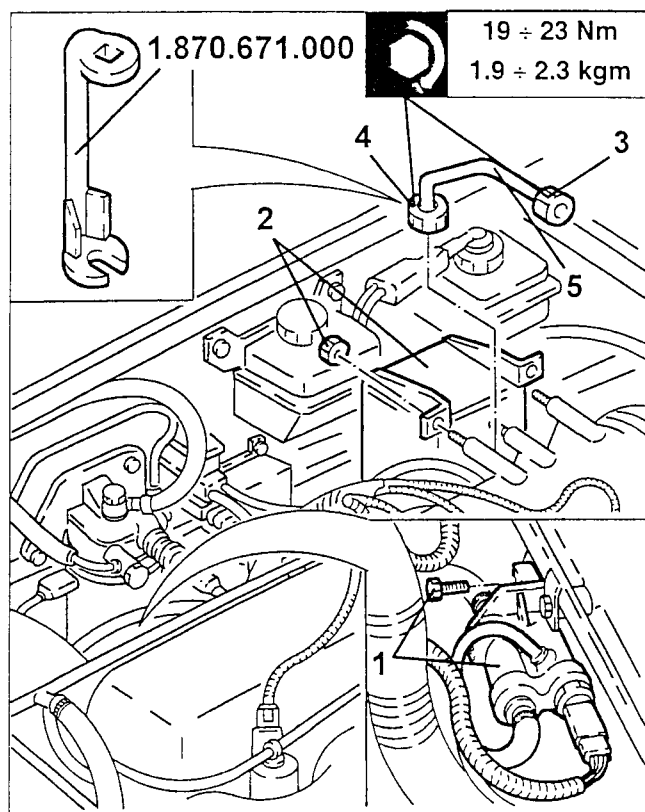
PIPES FROM FUEL MANIFOLD TO INJECTORS

REMOVAL/REFITTING

1. Remove the engine oil filler cap.
 2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.



1. Slacken the screws and move aside the complete fuel return manifold pipe.
2. Slacken the nuts and move the oil vapour separator.
3. Slacken the injector side coupling of the pipes from the pipes for the fuel manifold to the injectors using a suitable wrench.
4. Slacken the manifold side coupling of the pipes from the pipes for the fuel manifold to the injectors of the pipes from the pipes for the fuel manifold to the injectors using tool no. 1.870.671.000.
5. Remove the fuel delivery pipes from the single fuel manifold to the injectors.

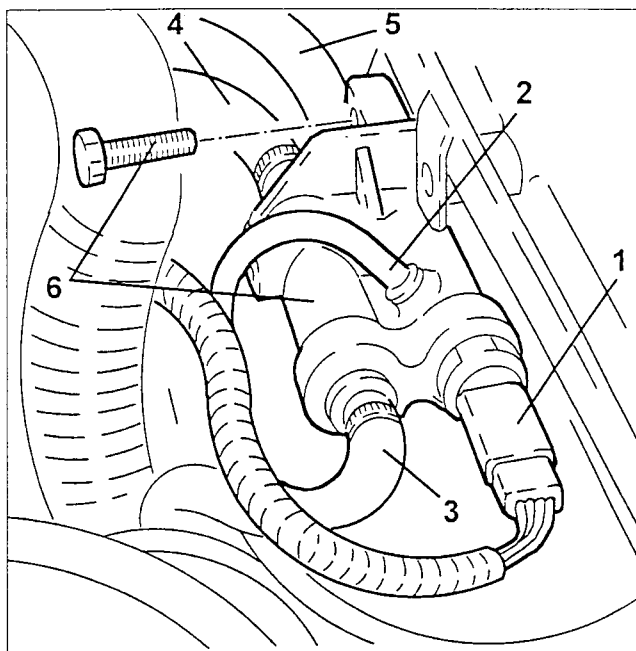


FUEL RETURN MANIFOLD

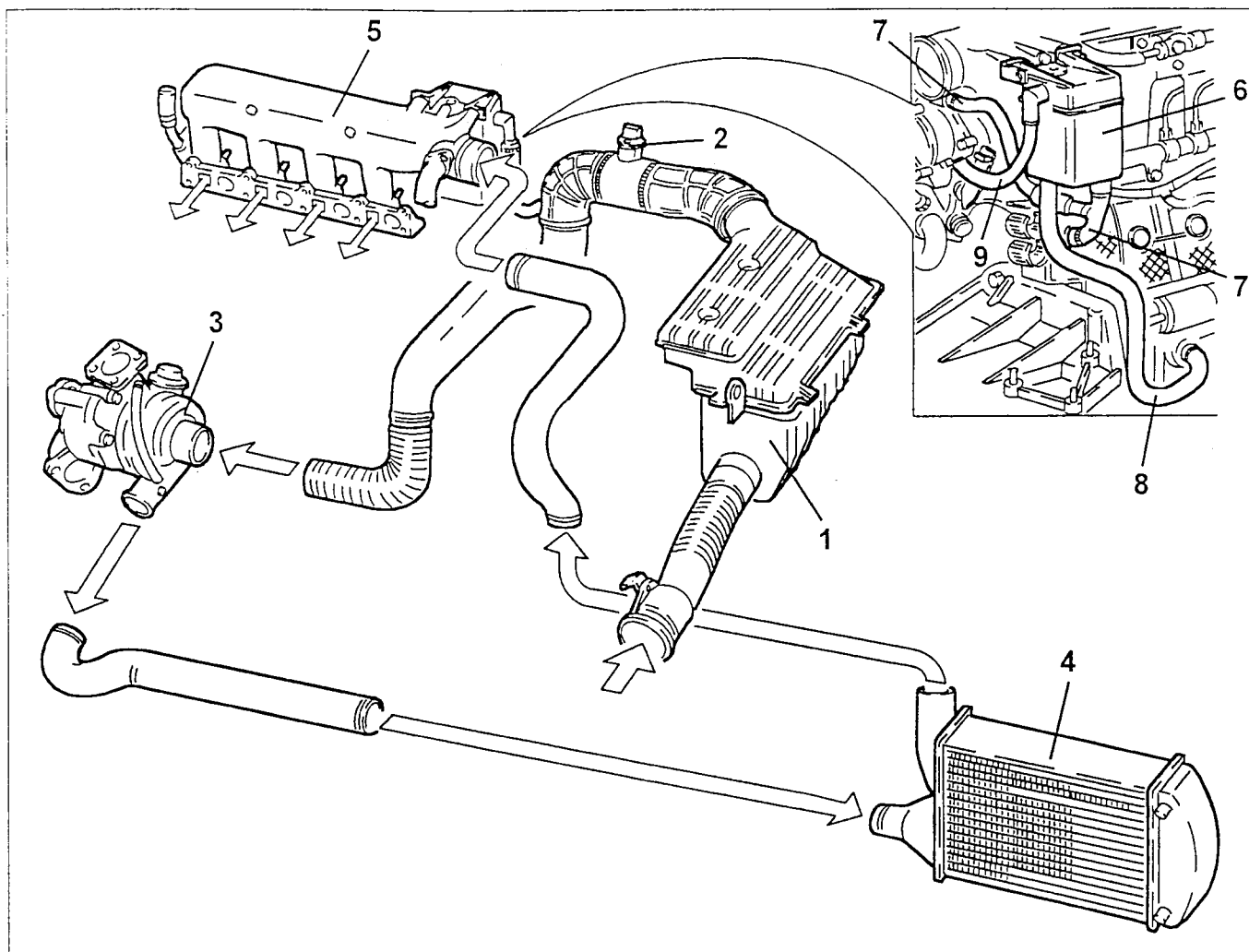
REMOVAL/REFITTING

- Remove the engine oil filler cap.
- Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.

1. Disconnect the electrical connection from the fuel temperature sensor.
2. Disconnect the fuel return pipe from the injectors from the fuel return manifold pipe.
3. Disconnect the fuel return pipe from the pressure pump from the fuel return manifold pipe.
4. Disconnect the fuel return pipe to the tank from the fuel return manifold pipe.
5. Disconnect the fuel return pipe from the fuel filter from the fuel return manifold pipe.
6. Slacken the screws and remove the fuel return manifold pipe.



DESCRIPTION OF AIR SUPERCHARGING AND OIL VAPOUR RE-CIRCULATION SYSTEM



- 1. Air cleaner complete
- 2. Air flow meter
- 3. Turbocharger
- 4. Air-air heat exchanger
- 5. Intake box

- 6. Oil vapour separator
- 7. Oil vapour recovery pipes
- 8. Condensed oil recovery pipe
- 9. Oil vapour re-circulation pipes

The air taken in through a dynamic inlet and filtered through a cartridge element reaches the turbocharger (3) from which it is sent under pressure to the intercooler (4).

Here, the air is cooled by an air - air heat exchanger and sent to the intake box from which it is sent to the cylinders.

Oil vapour emissions are controlled by a separator (6) which collects the vapours released from the crankcase cylinder head with pipes (7).

The difference in temperature between the separator and the oil vapours causes partial condensation.

The condensed vapours are sent to the crankcase through pipe (8).

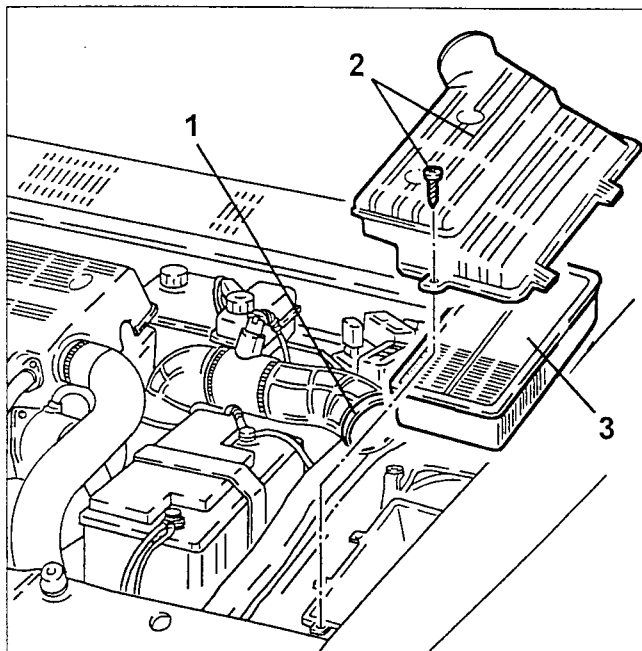
The remaining vapours are sent to the turbocharger air intake sleeve through pipe (9).

For details of the single components, see the following paragraphs.

AIR CLEANER

CHANGING THE AIR CLEANER CARTRIDGE

1. Slacken the clamp fastening the corrugated sleeve to the air cleaner cover.
2. Slacken the fastening screws and remove the air cleaner cover.
3. Remove the air cleaner cartridge.

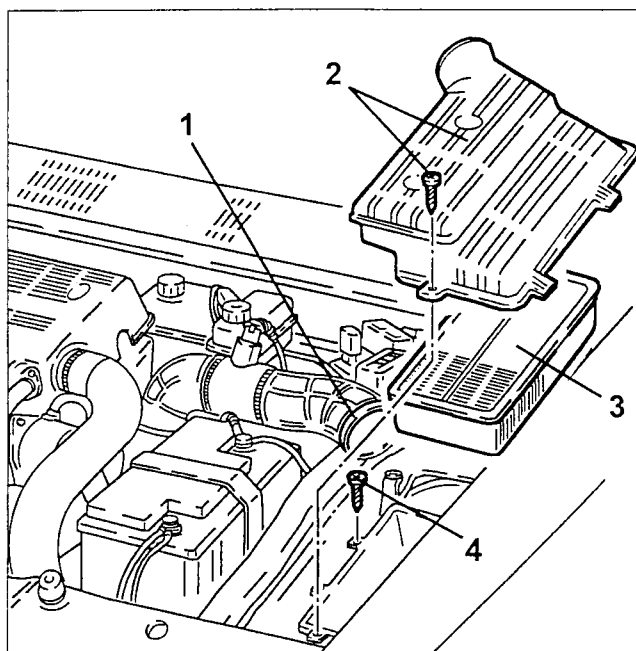


WARNING: Any attempt to clean the cleaner may damage it, risking compromising correct operation of the supply system.

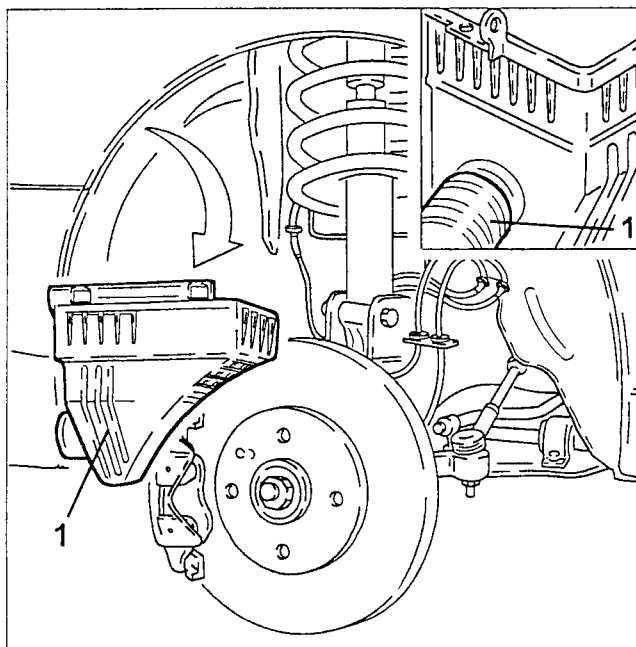
- Carefully clean the air cleaner cartridge container.
- Check the conditions of the cartridge and, if necessary, replace it.
- Assemble the air cleaner cover and fasten it with its screws.
- Tighten the clamp fastening the corrugated sleeve to the air cleaner cover.

REMOVAL/REFITTING

- Set the car on a lift.
 - Remove the left front wheel, dust guard and wheel arch.
1. Slacken the clamp fastening the corrugated sleeve to the air cleaner cover.
 2. Slacken the fastening screws and remove the air cleaner cover.
 3. Remove the air cleaner cartridge.
 4. Slacken the fastening screws of the air cleaner box.



1. Remove the air cleaner box withdrawing it from the wheel arch after disconnecting it from the air inlet sleeve.

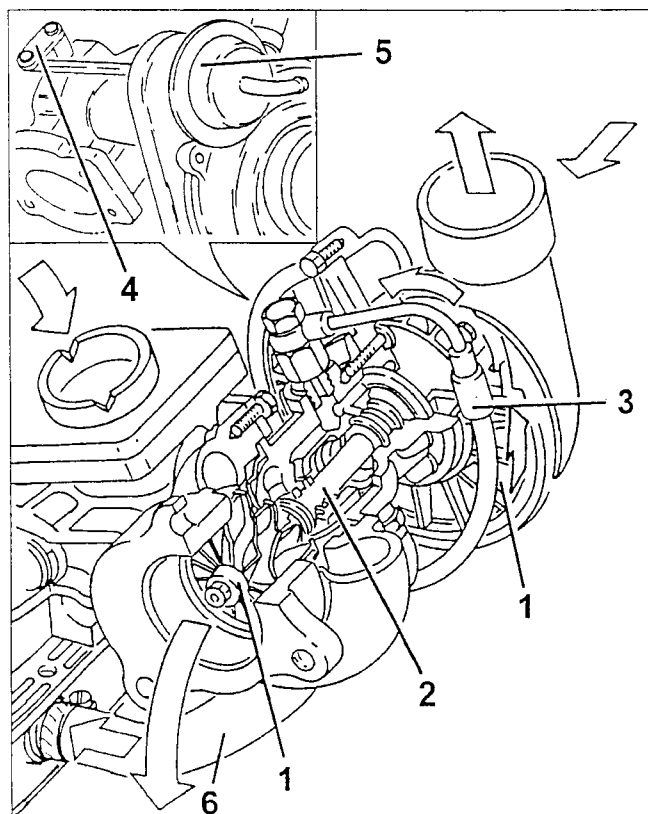


TURBOCHARGER

This mainly comprises two impellers (1) keyed onto the same shaft (2), which turns on floating bearings lubricated through a branch (3) of the engine lubricating circuit.

The oil used disperses part of the great amount of heat released to the turbine by the exhaust gas.

On the turbocharger a WASTE-GATE valve (4) is fitted which is controlled by a pneumatic actuator (5) which makes it possible to shutter the passage of exhaust gas to the turbine depending on the engine's need of power/torque.

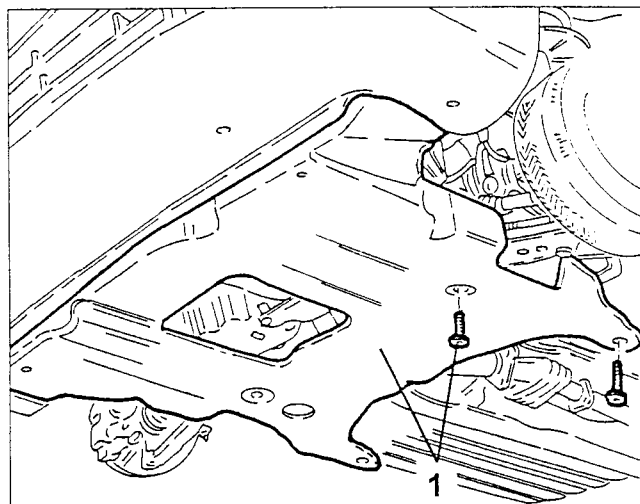


1. Impellers
2. Shaft
3. Oil delivery pipe to turbocharger
4. WASTE-GATE valve
5. Pneumatic actuator
6. Oil outlet pipe from turbocharger

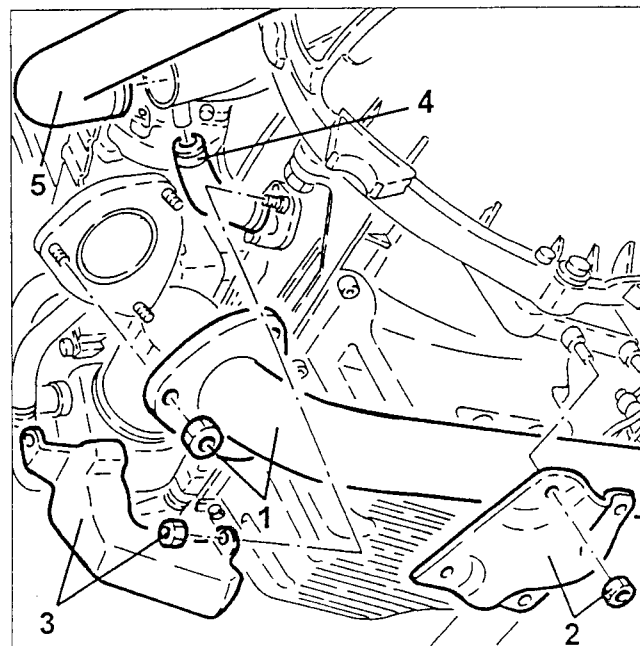
REMOVAL/REFITTING

- Set the car on a lift.
- Make sure that the ignition switch is at the "STOP", then disconnect the battery (-) terminal.

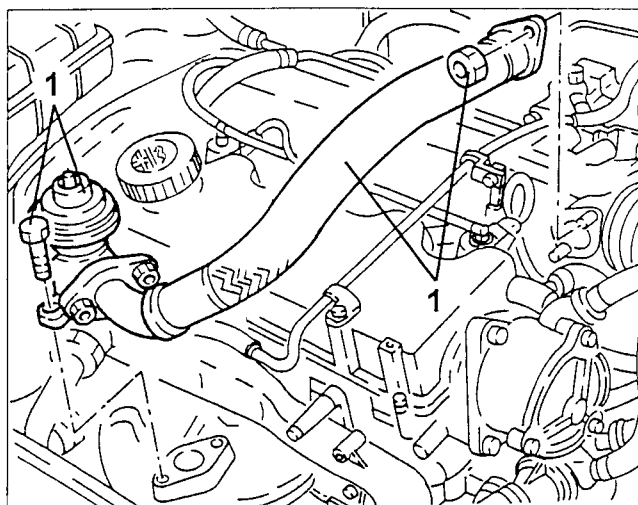
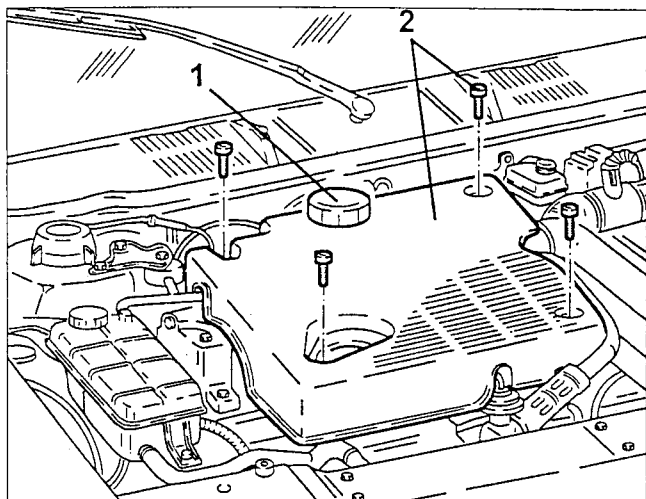
1. Slacken the fasteners and remove the under engine guard.



1. Slacken the nuts fastening the front section of the exhaust pipe to the exhaust manifold.
2. Slacken the fastening nuts and remove the reinforcement plate.
3. Slacken the fastening nuts and remove the guard of the oil outlet pipe from the turbocharger.
4. Disconnect the oil outlet pipe from the turbocharger.
5. Disconnect the air delivery sleeve to the heat exchanger at the turbocharger.

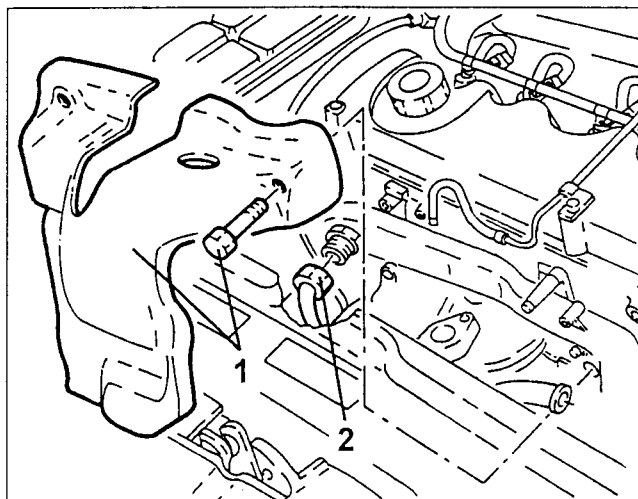
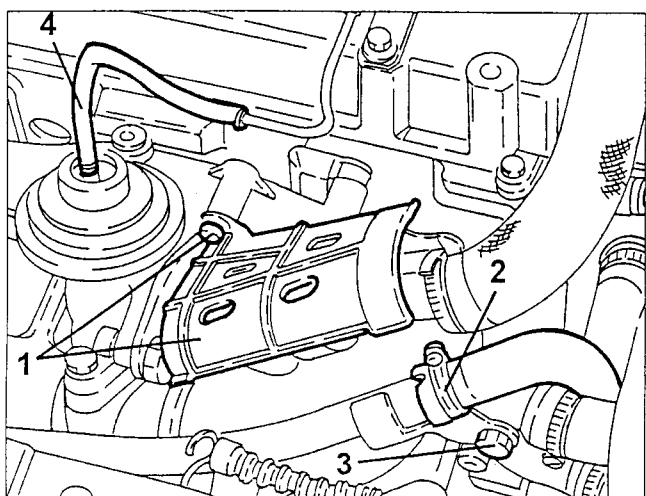


1. Remove the engine oil filler cap.
 2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.

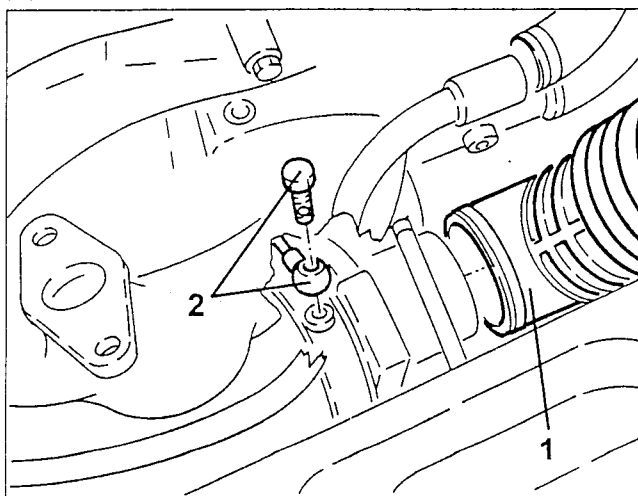


1. Slacken the fastening screws and remove the heat shield from the exhaust manifold.
2. Disconnect the engine oil heat exchanger outlet pipe from the stiff water pump inlet pipe.

1. Slacken the fastening screws and remove the E.G.R. valve cover.
2. Disconnect the fluid delivery sleeve to the engine oil heat exchanger from the stiff pipe.
3. Slacken the fastening screw of the stiff coolant fluid delivery pipe to the engine oil heat exchanger.
4. Disconnect the vacuum pipe from the E.G.R. valve.

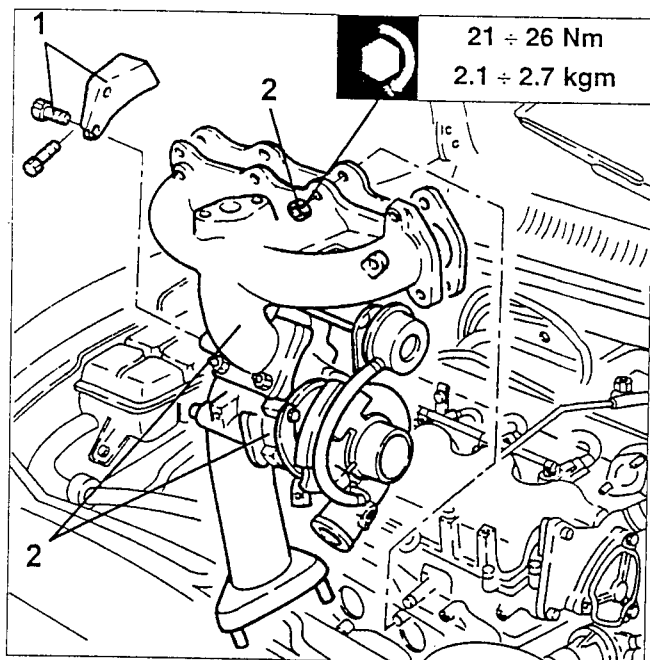


1. Disconnect the air inlet sleeve from the turbocharger.
2. Slacken the coupling and disconnect the oil inlet pipe from the turbocharger.

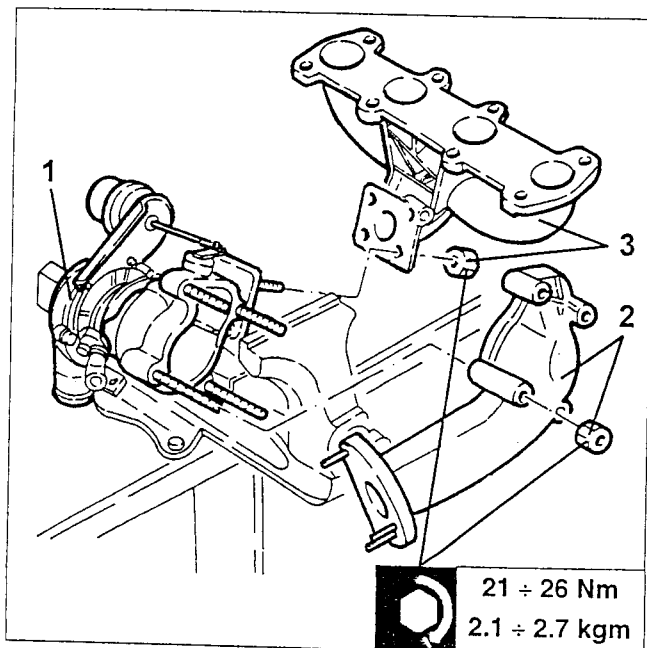


1. Slacken the nuts and screws and remove the E.G.R. valve complete with exhaust gas re-circulation pipe.
- Remove the seals.

1. Slacken the fastening screws and remove the bracket connecting the turbocharger to the crank-case.
2. Slacken the nuts and remove the turbocharger complete with exhaust manifold and exhaust pipe connection sleeve.

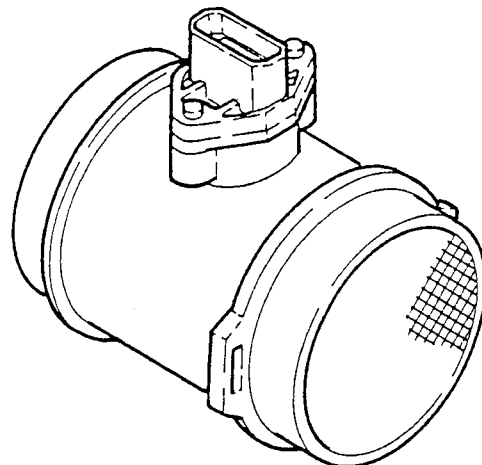


1. Put the turbocharger in a vice clamp on the bench.
2. Slacken the fastening nuts and remove the exhaust pipe connection sleeve.
3. Slacken the fastening nuts and separate the exhaust manifold from the turbocharger.

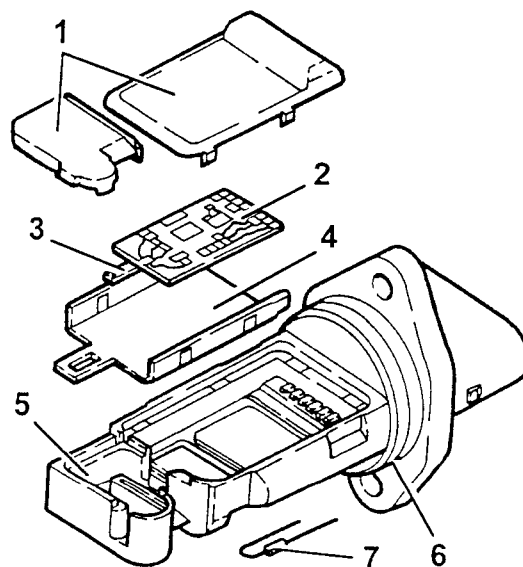


AIR FLOW METER

The air flow meter is located on the air intake sleeve and it is of the "heated film" type.



The intake air temperature sensor is incorporated in the air flow meter.



1. Covers
2. Electronic board
3. Sensor
4. Support plate
5. Support
6. O-Ring
7. Temperature sensor

WARNING: The air flow meter cannot be disassembled.

The operating principle is based on a heated diaphragm interposed in a measurement channel through which the intake air that goes to the engine flows.

The hot film diaphragm is kept at a constant temperature (about 120 °C above the temperature of the incoming air) by the heating resistance.

The mass of air that crosses the measurement channel tends to withdraw heat from the diaphragm, therefore, to keep it at a constant temperature, a certain current must flow through the resistance.

This current is measured by a suitable Wheatstone bridge.

Therefore, the current is proportionate with the mass of flowing air.

The air flow meter directly measures the mass of air (not the volume) thereby eliminating problems of temperature, altitude, pressure, etc.

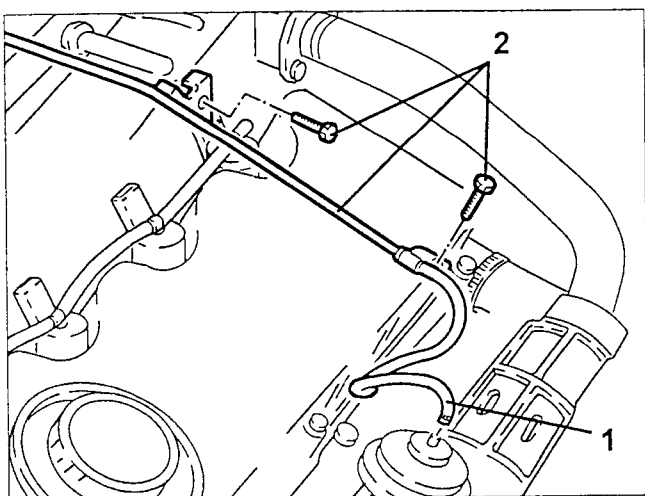
AIR BOX

REMOVAL/REFITTING

- Remove the pressure pump (see specific paragraph).

1. Disconnect the vacuum pipe from the E.G.R. valve.

2. Slacken the fastening screws and move aside the E.G.R. valve vacuum pipe.

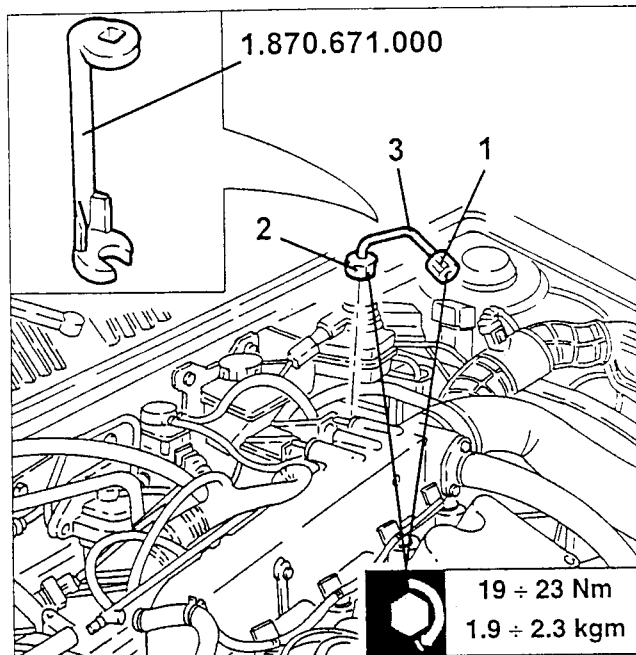


- Disconnect the electrical connections from the glow plugs.

1. Slacken the injector side coupling of the pipes from the fuel manifold to the injectors using a suitable wrench.

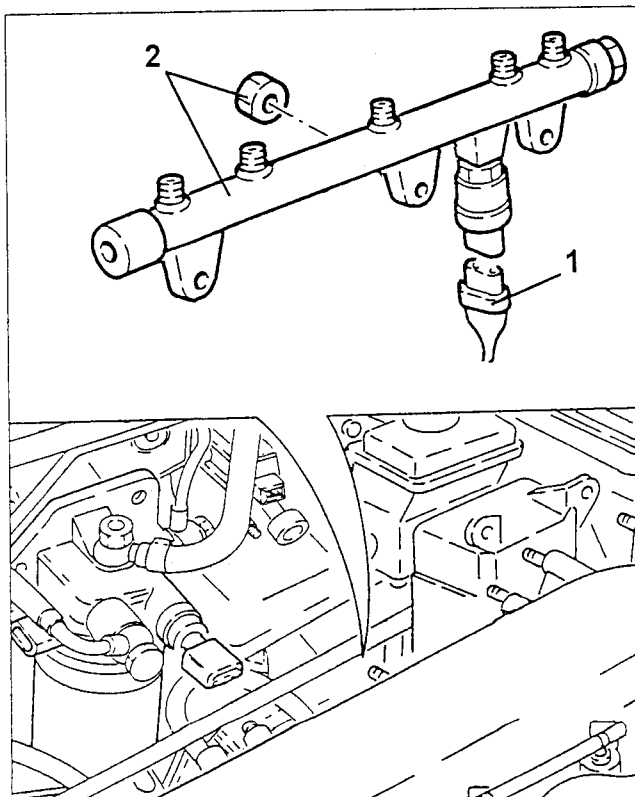
2. Slacken the manifold side coupling of the pipes from the fuel manifold to the injectors using tool no. 1.870.671.000.

3. Remove the fuel delivery pipes from the single fuel manifold to the injectors.

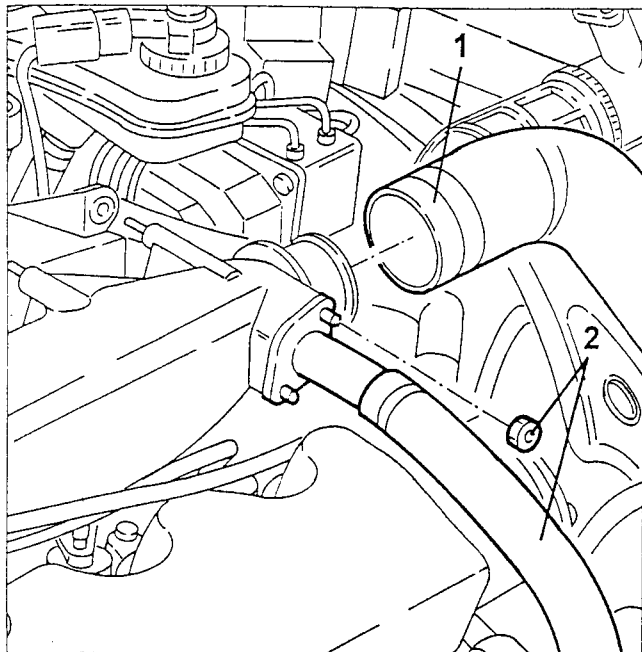


1. Disconnect the electrical connection from the fuel pressure sensor.

2. Slacken the fastening nuts and remove the fuel delivery manifold.



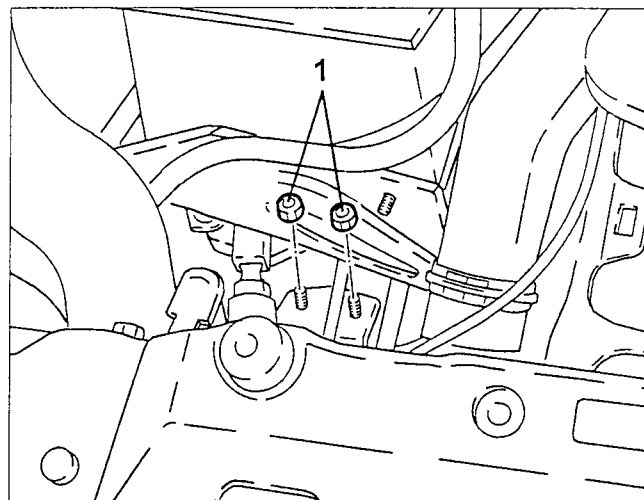
1. Disconnect the air inlet sleeve from the air box.
2. Slacken the nuts and disconnect the exhaust gas recovery pipe from the air box.



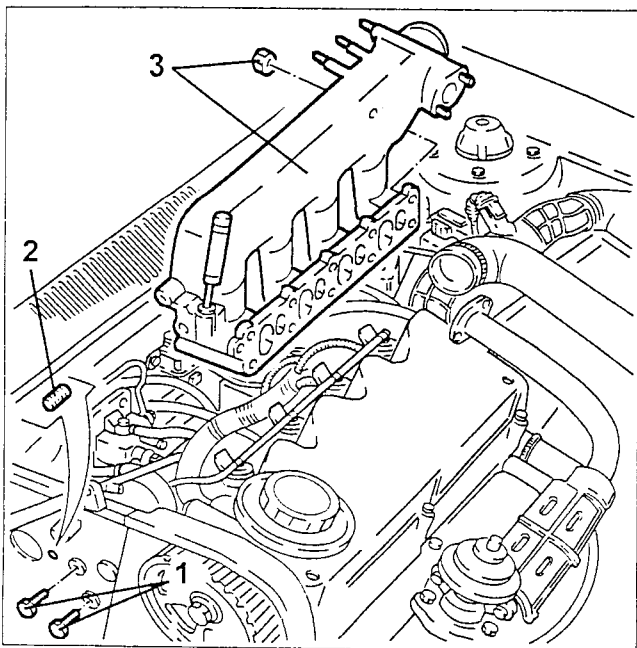
INTERCOOLER

REMOVAL/REFITTING

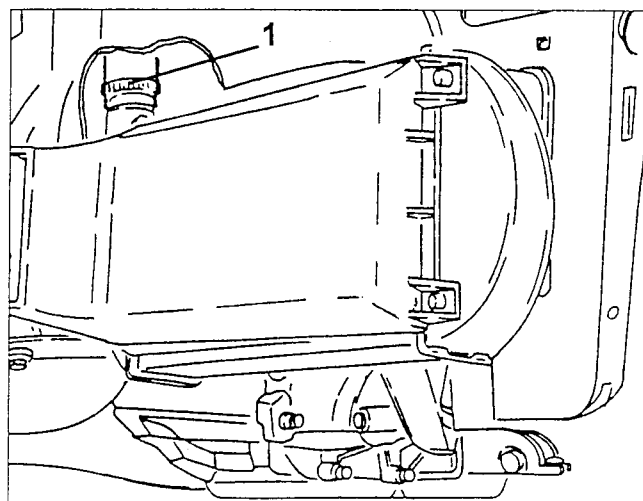
- Set the car on a lift.
- Make sure that the ignition switch is in the "STOP" position, then disconnect the battery (-) terminal.
- 1. Slacken the nuts fastening the air conditioning system drier filter support.



1. Slacken the screws fastening the pressure pump support to the air box.
2. Slacken the stud illustrated of the pressure pump support to aid removal of the air box.
3. Slacken the fastening nuts and remove the air box complete with seal.

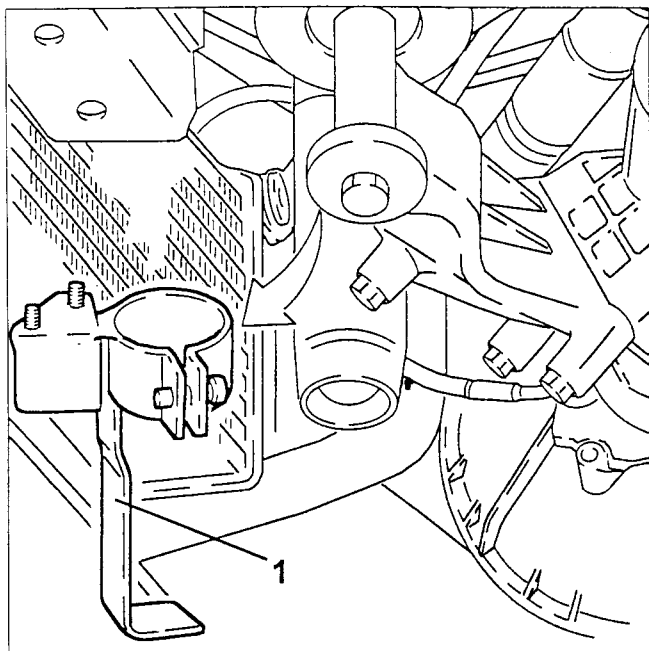


1. Loosen the clamp fastening the intercooler air outlet sleeve.

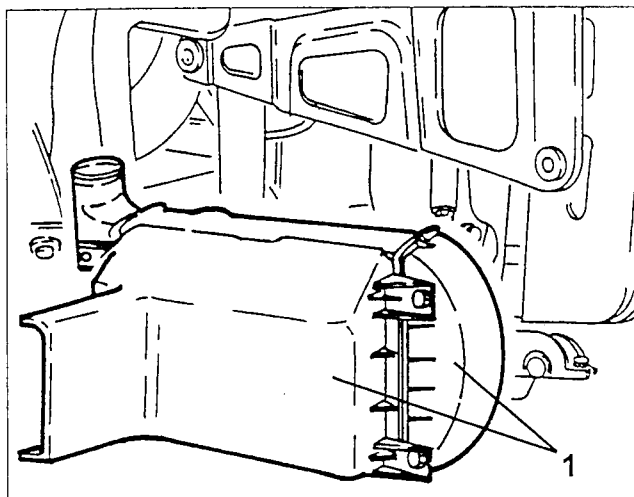


- Remove the front bumper (see specific paragraph).

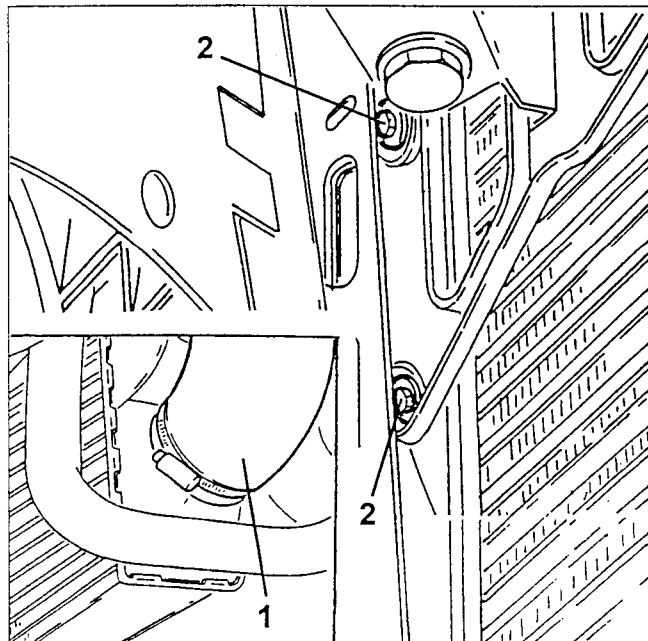
1. Loosen the screw and remove the air conditioning system drier filter support.



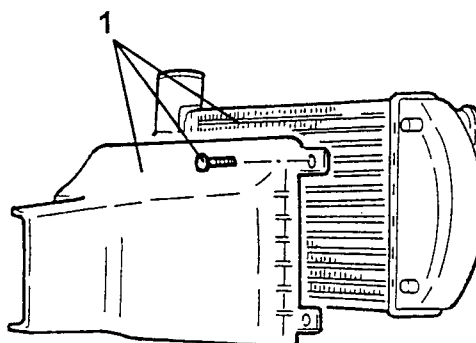
1. Remove the intercooler complete with air duct.



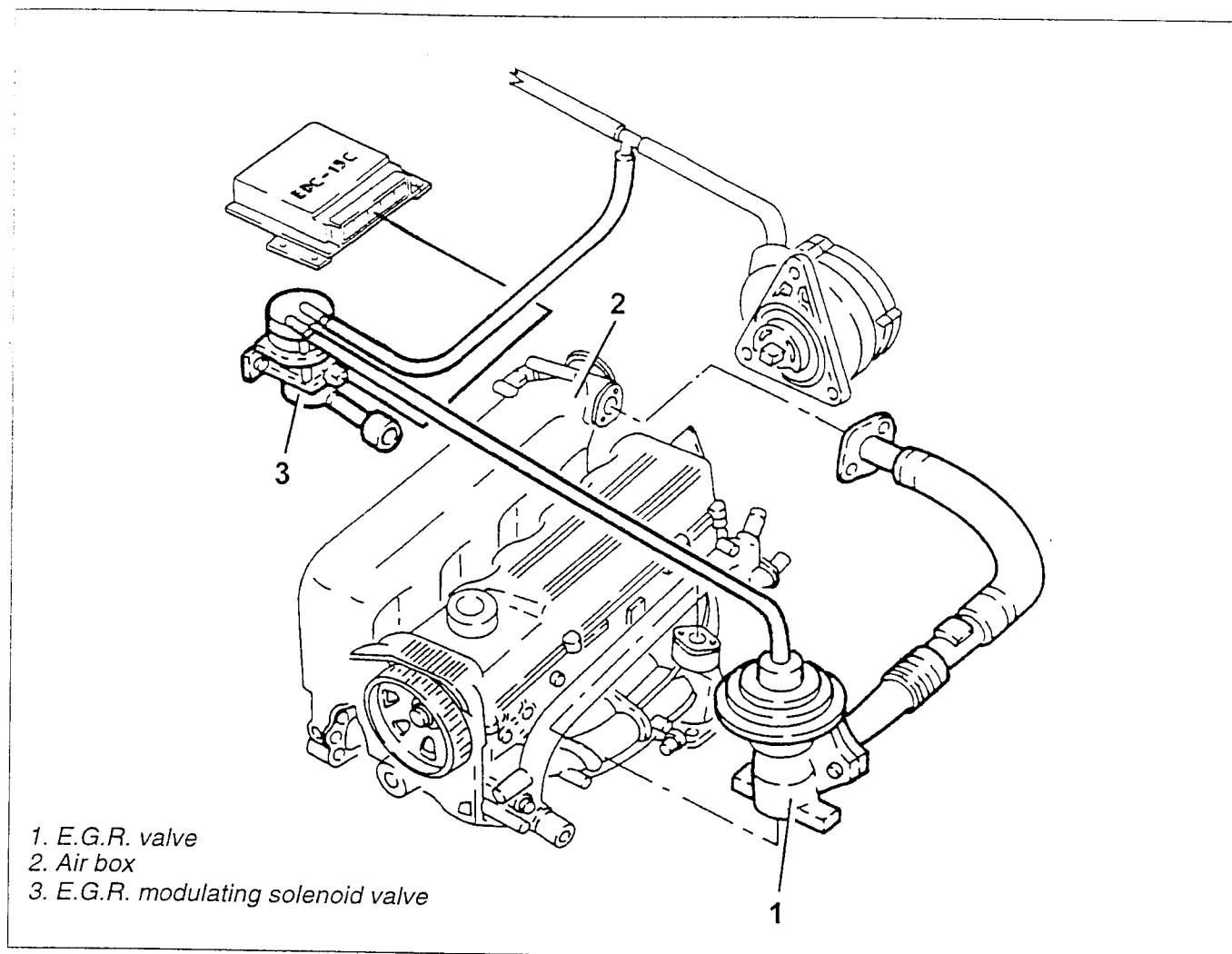
1. Loosen the clamp and disconnect the air inlet sleeve from the intercooler.
2. Slacken the screws fastening the intercooler to the support bracket.



1. On the bench, slacken the fastening screws and separate the intercooler from the air duct.



DESCRIPTION OF EXHAUST GAS RE-CIRCULATION SYSTEM (E.G.R.)



In order to further reduce emissions of NO_x (nitric oxide) the supply system is fitted with an E.G.R. valve (1).

The E.G.R. valve (Exhaust Gas Re-circulation) withdraws part of the exhaust gases and re-admits them to the intake box (2).

The E.G.R. valve is operated by the vacuum modulated by the electromagnetic valve (3) controlled by the injection control unit.

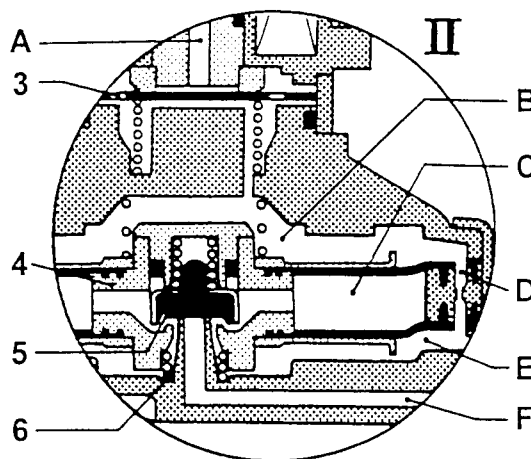
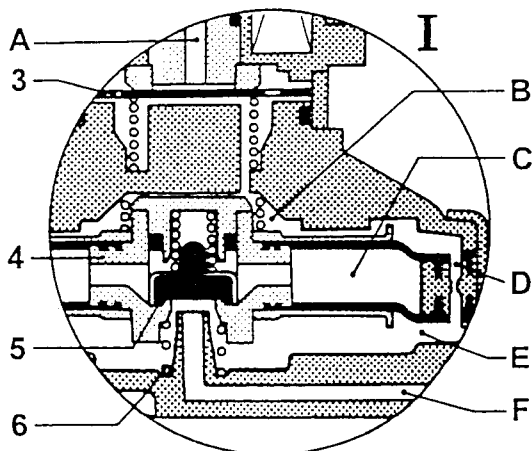
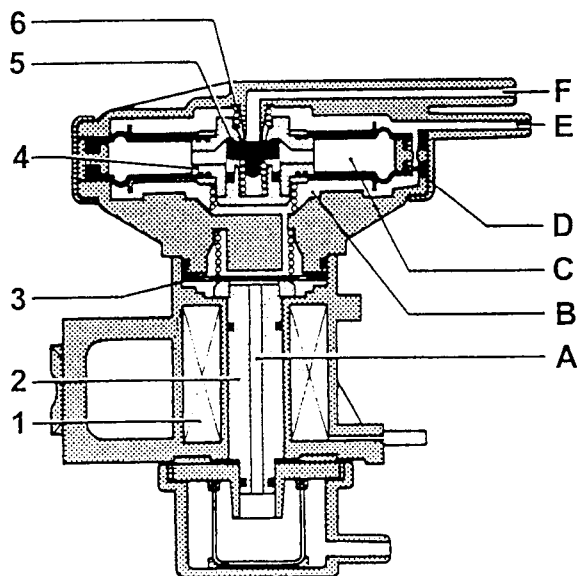
E.G.R. MODULATING SOLENOID VALVE

The vacuum reaches chamber E of duct F (case I), because the force of the spring (6) acts on the mobile equipment (4) and the diversion valve (5) lets it through.

Through the compensation hole D, the vacuum then involves chamber B and the surface of the plate shutter (3).

When the forces acting on the plate (3) are balanced, the atmospheric pressure in duct A enters chamber B, moving the mobile equipment downwards (case II), this way the shutter of the valve (5) closes duct F and puts chamber E in communication with chamber C at atmospheric pressure, lowering the vacuum of duct E.

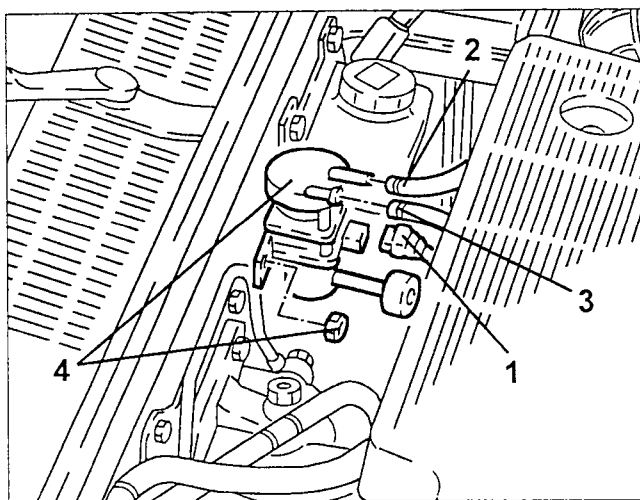
The lowered vacuum or the higher absolute pressure in chamber E makes the mobile equipment (4) rise again (4) (case I), closing passage C and taking the valve (5) to the ideal condition (E in communication with F), to repeat the cycle.



REMOVAL/REFITTING

- Make sure that the ignition key is at the "STOP" position, then disconnect the battery (-) terminal.

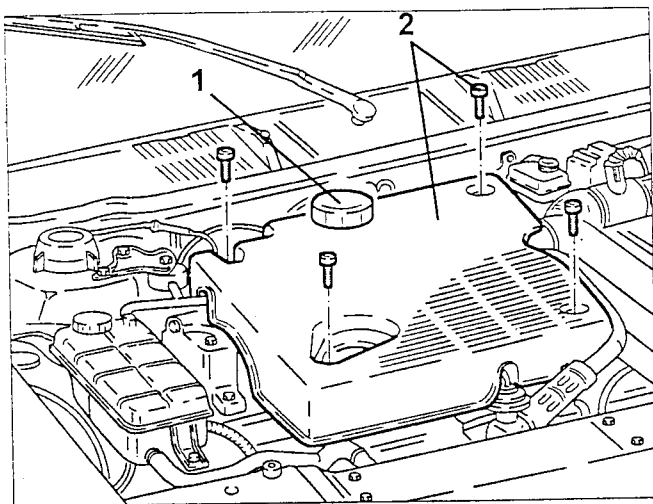
1. Disconnect the electrical connection from the E.G.R. modulating solenoid valve.
2. Disconnect the vacuum pipe from the E.G.R. modulating solenoid valve.
3. Disconnect the E.G.R. valve control pipe from the E.G.R. modulating solenoid valve.
4. Slacken the fastening nuts and remove the E.G.R. modulating solenoid valve.



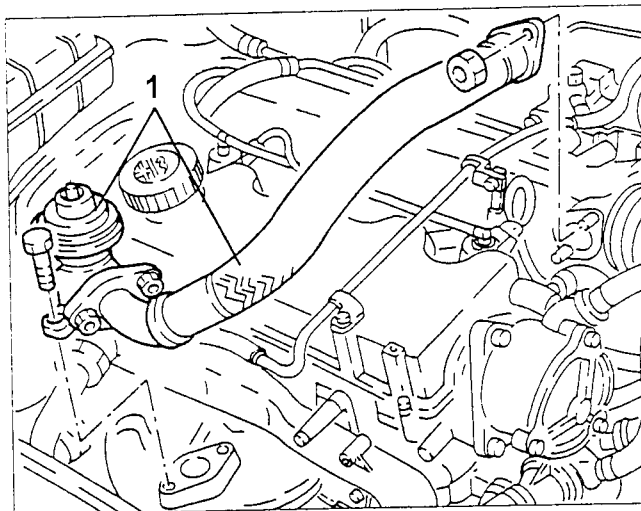
E.G.R. VALVE

REMOVAL/REFITTING

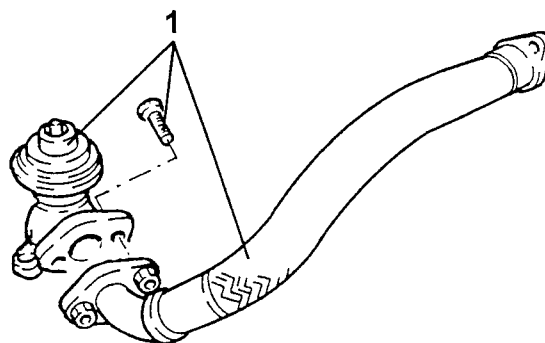
1. Remove the engine oil filler cap.
 2. Slacken the fastening screws and remove the engine cover.
- Remove the engine oil filler cap.



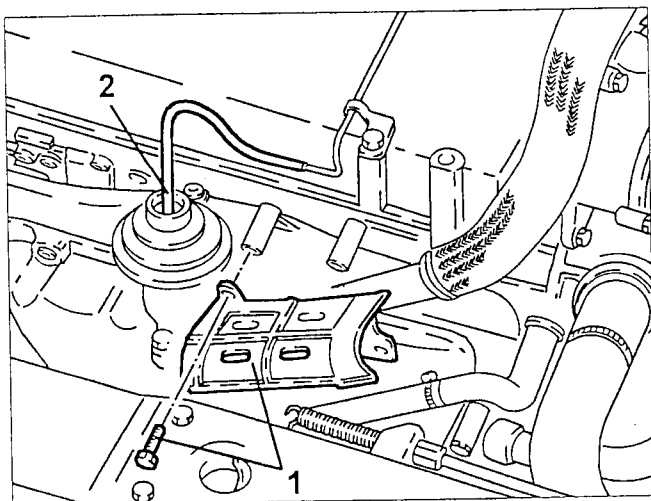
1. Slacken the nuts and screws and remove the E.G.R. valve complete with exhaust gas re-circulation pipe.
- Remove the seals.



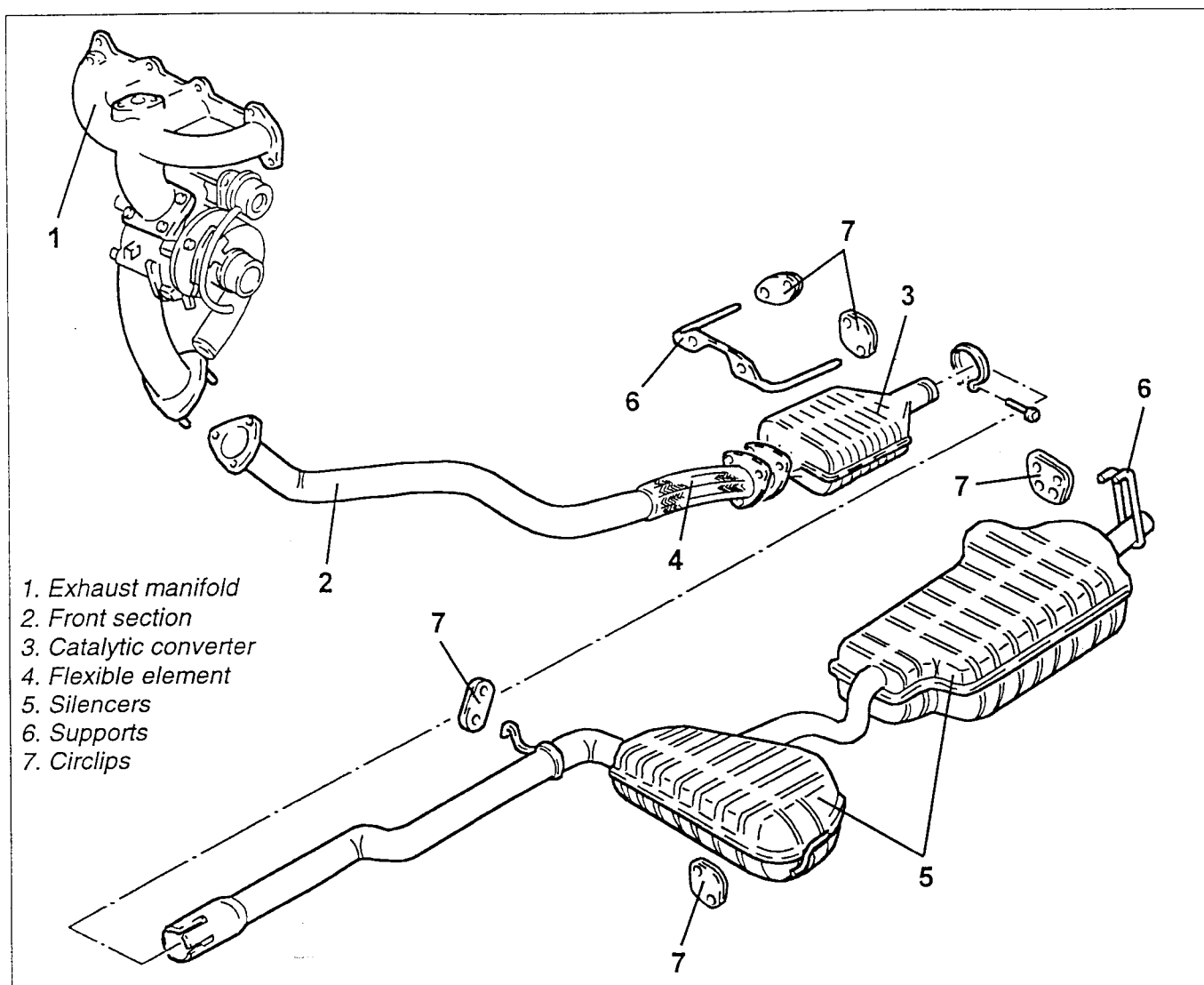
1. Working on the bench, slacken the fastening screws and separate the E.G.R. valve from the exhaust gas re-circulation pipe.



1. Slacken the fastening screws and remove the E.G.R. valve cover.
2. Disconnect the vacuum pipe from the E.G.R. valve.



DESCRIPTION OF EXHAUST SYSTEM



The engine exhaust gases flow through the manifold (1) to the turbocharger and then through a pipe (2) to the oxidising catalytic converter (3).

In the front section of the exhaust pipe there is a flexible element (4) to limit the transmission of vibrations.

The rear section of the exhaust pipe comprises a single silencer (5).

Special shields limit the radiation of heat towards the body.

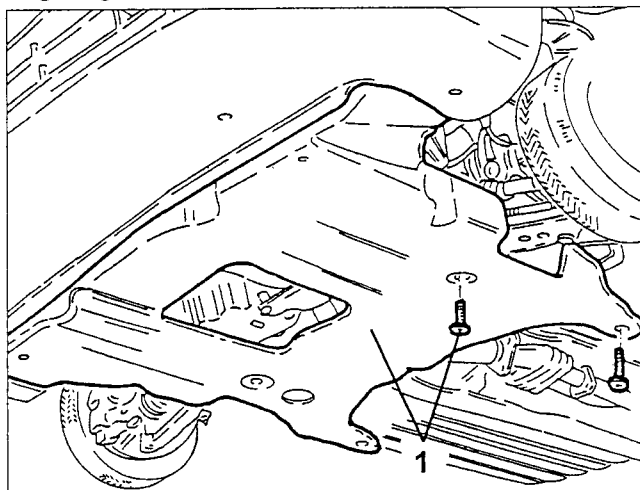
The different components are supported by supports (6) and circlips (7) fastened under the body.

EXHAUST, FRONT SECTION

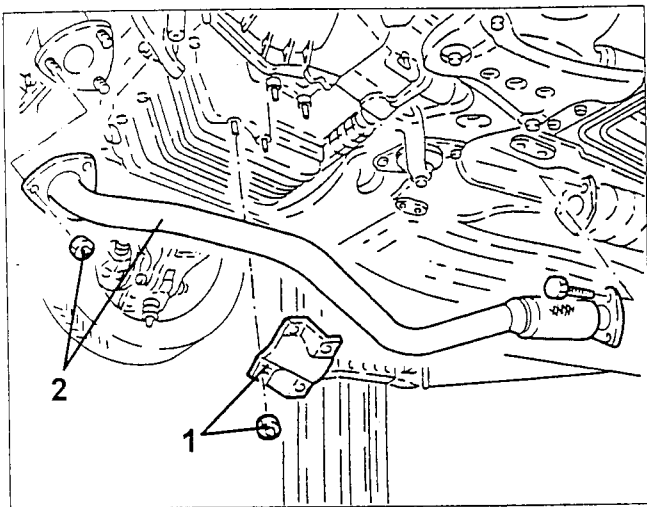
REMOVAL/REFITTING

- Set the car on a lift.

1. Slacken the fastenings and remove the under engine guard.



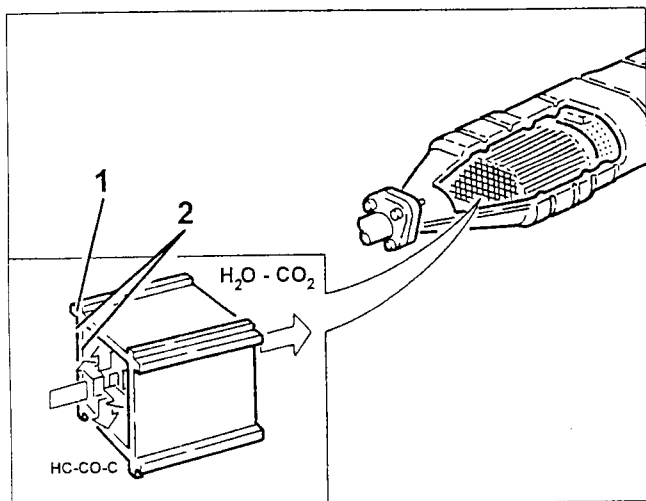
1. Slacken the fastening nuts and remove the re-inforcement bracket.
 2. Slacken the nuts and screws and remove the front section of the exhaust pipe.
- Remove the seals.



CATALYTIC CONVERTER

The oxidising catalyst is a post-treatment device for oxidising the CO, HC's and particulate, turning them into carbon dioxide (CO_2) and water vapour (H_2O).

The catalytic converter consists of a one-piece ceramic honeycomb (1), the cells of which are impregnated with platinum (2), a substance which catalyses the reactions of oxidation.



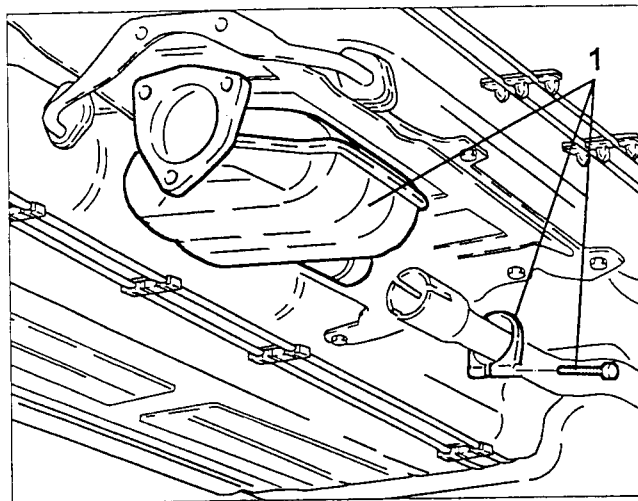
The exhaust gases that cross the cells heat the catalyst, triggering conversion of the pollutants into inert compounds.

The chemical oxidation reaction of CO, HC and particulate is effective with temperatures between 200 and 350°C.

In fact beyond 350°C the sulphur contained in the fuel oil begins to oxidise, giving rise sulphur and sulphuric dioxide.

REMOVAL/REFITTING

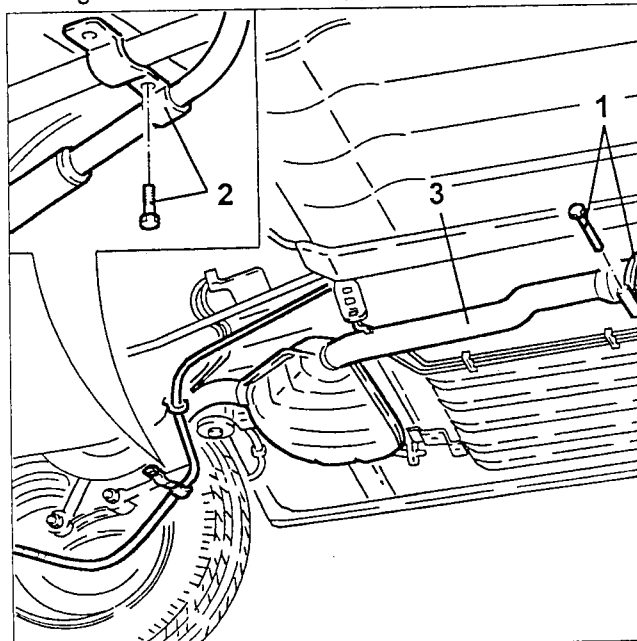
- Set the car on a lift.
 - Remove the front section of the exhaust pipe (see specific paragraph).
1. Loosen the fastening clamp and remove the catalytic converter.



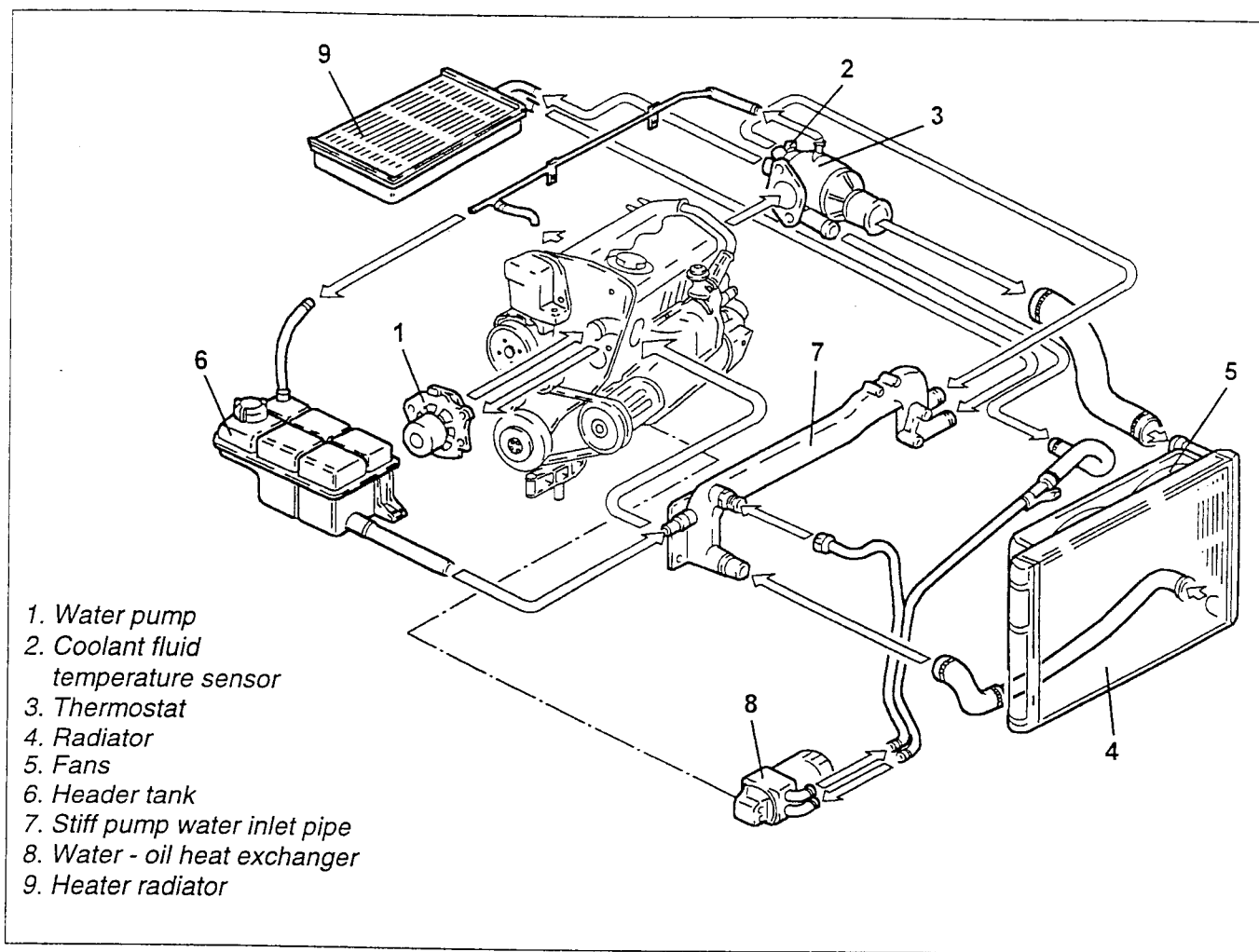
EXHAUST, REAR SECTION

REMOVAL/REFITTING

- Set the car on a lift.
1. Loosen the clamp fastening the rear section of the exhaust pipe to the catalytic converter.
 2. Release the handbrake cable from the fastenings.
 3. Remove the exhaust pipe rear section after freeing it from its flexible supports.

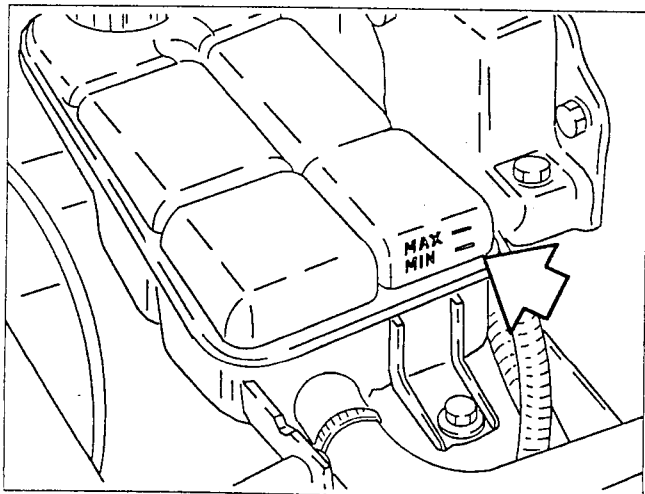


DESCRIPTION OF ENGINE COOLING SYSTEM

CHECKING THE LEVEL
AND CHANGING ENGINE
COOLANT FLUID

Checking

- Check that the level (cold) of the coolant fluid in the header tank is between the MIN and MAX marks.

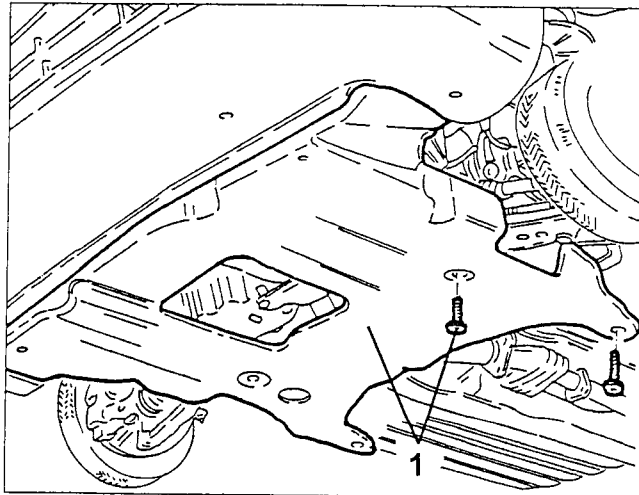


Changing

- Set the car on a lift.
- Slacken and remove the header tank cap.

WARNING: Absolutely never remove the header tank cap when the engine is hot.

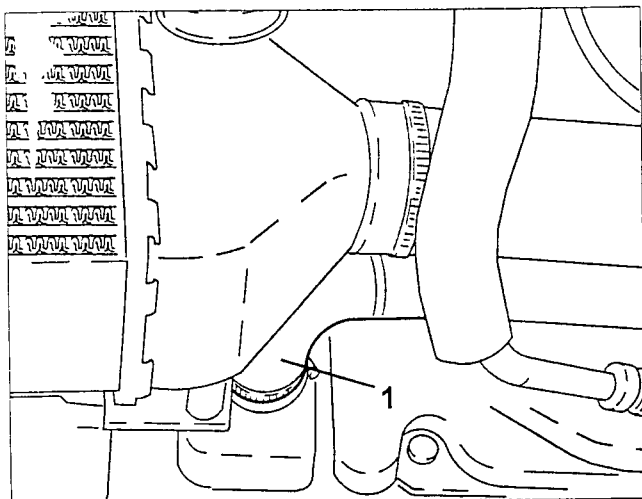
1. Slacken the fasteners and remove the under engine guard.



1. Drain the engine coolant fluid, disconnecting the radiator outlet sleeve.

NOTE: Collect the engine coolant fluid in a suitable container.

WARNING: The antifreeze fluid used as engine coolant is harmful to paint. Therefore, avoid any contact with painted parts.



- Re-connect the sleeve to the radiator and any disconnected pipes, checking that all the clamps are tightened.
- Fill with fluid of the type and quantity specified until reaching the MAX mark on the header tank.
- Start the engine and bring it to normal operating temperature so that the thermostat opens to release the air left in the circuit.
- When the engine is cold, top up to the MAX mark on the header tank.
- Screw the pressurised cap back on the header tank.

WARNING: Antifreeze fluids of different types or brands should not be mixed.

Do not use antirust additives: they might be incompatible with the antifreeze used.

HEADER TANK

The header tank supplies the circuit and absorbs the changes in volume of the coolant fluid with the changing temperature of the engine.

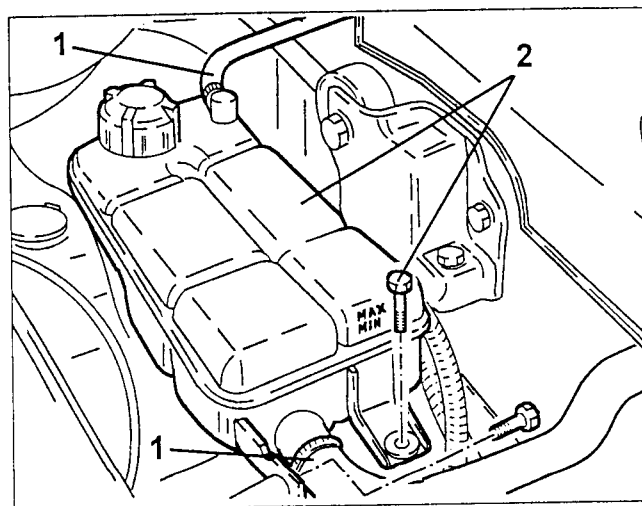
The tank also allows air out of the circuit, through a special calibrated valve in the pressurised cap and a pipe connected to it.

This valve also carries out a washing action admitting air from outside when there is a vacuum - in the circuit caused by cooling of the engine.

REMOVAL/REFITTING

- Drain the engine coolant fluid (see specific paragraph).

1. Loosen the clamps and disconnect the coolant fluid inlet and outlet pipes from the header tank.
2. Slacken the fastening screws and remove the header tank.



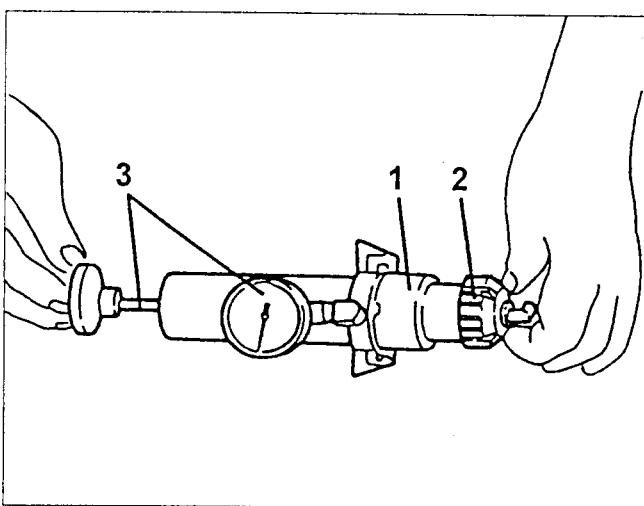
PRESSURISED CAP TIGHTNESS TEST

1. Slacken the coupling on the lower end of the testing tool.
2. Install the header tank pressurised cap on the coupling.
3. Pressurise working manually on the piston and check on the pressure gauge that the cap relief valve opens at the specified setting rate.

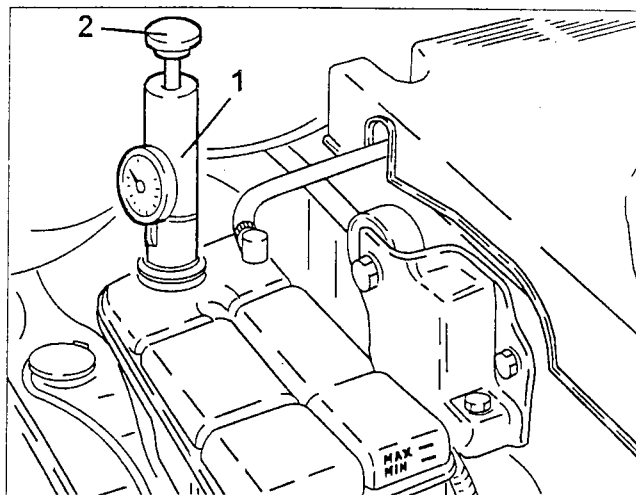


Pressurised cap setting pressure

0.98 ± 0.1 bar



WARNING: For safety reasons, during these checks with the test tool, never allow the pressure to exceed 1.38 bar.



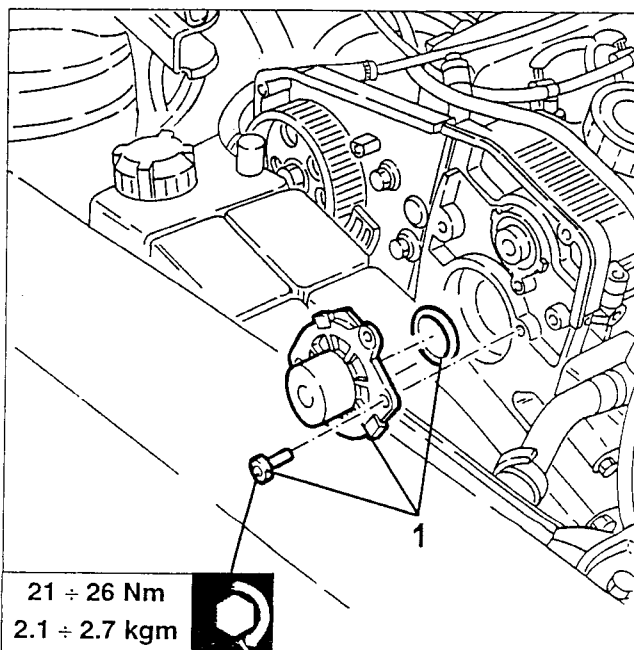
WATER PUMP

This is of the centrifugal type with vanes with aluminium alloy pump casing and phenolic resin impeller. It is fastened to the crankcase and operated directly through the camshaft belt.

REMOVAL/REFITTING

- Remove the cam angle sensor (see specific paragraph).

1. Slacken the fastening screws and remove the water pump complete with O-Ring.



21 ÷ 26 Nm
2.1 ÷ 2.7 kgm



ENGINE COOLING SYSTEM TIGHTNESS TEST

- Slacken and remove the pressurised cap from the header tank.

WARNING: Absolutely never remove the cap from the header tank when the engine is hot.

1. Screw the hydraulic circuit tightness test tool, fitted with the special coupling, on the header tank filler.
2. Manually pressurise the circuit and check on the tool that the pressure stays at the specified rating. If not, check that there are no leaks from the sleeves or radiator.



Hydraulic circuit control pressure

0.98 ± 0.1 bar

Refit reversing the sequence followed for removal and refer to GROUP 00 for installing the valve gear drive belt and timing and for installing the engine components belt.

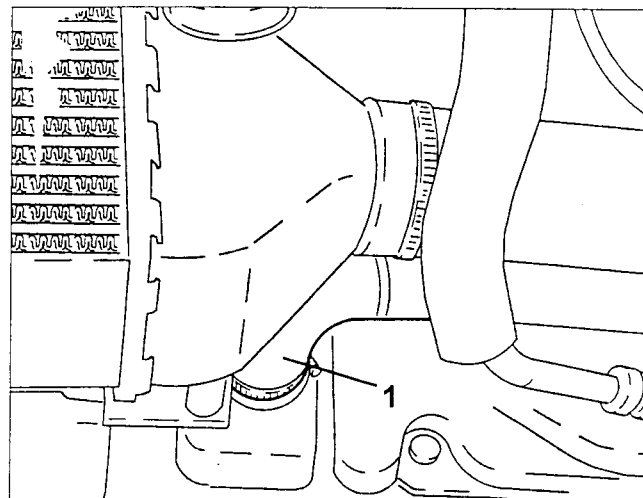
THERMOSTAT

This is fitted on the rear of the cylinder head and it keeps the engine at the optimum temperature:

- With the temperature $< 80 \pm 2^{\circ}\text{C}$ the thermostatic valve (closed) diverts the fluid directly towards the pump

- with the temperature $> 80 \pm 2^{\circ}\text{C}$ the thermostatic valve (open) ducts the coolant fluid towards the radiator.

The engine water temperature sensor connected to the injection control unit and instrument cluster is fitted on the thermostat.

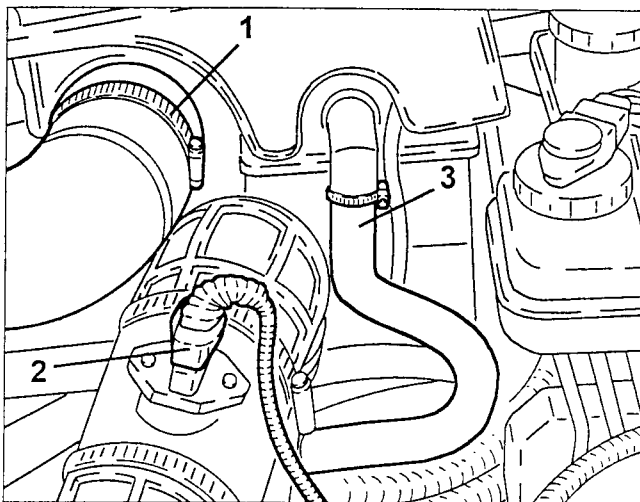


- Remove the battery (see GROUP 55).

1. Disconnect the air inlet sleeve from the air box.

2. Disconnect the electrical connection from the air flow meter.

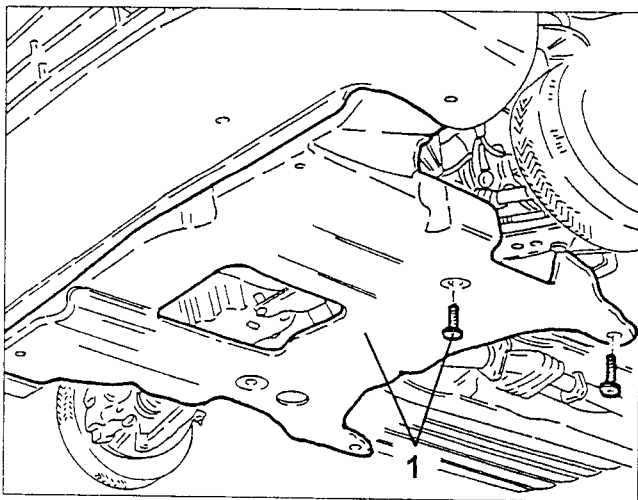
3. Disconnect the oil vapour re-circulation pipe from the oil vapour separator.



REMOVAL/REFITTING

- Set the car on a lift.

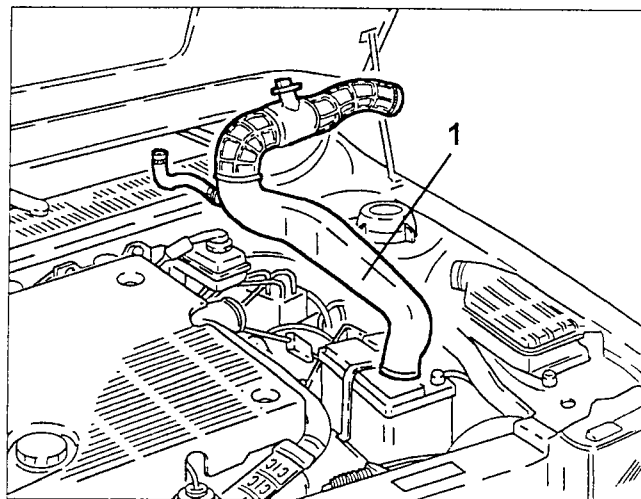
1. Slacken the fastenings and remove the under engine guard.



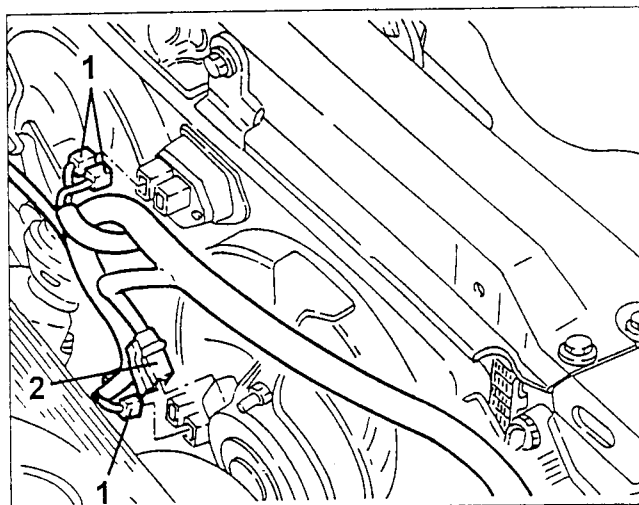
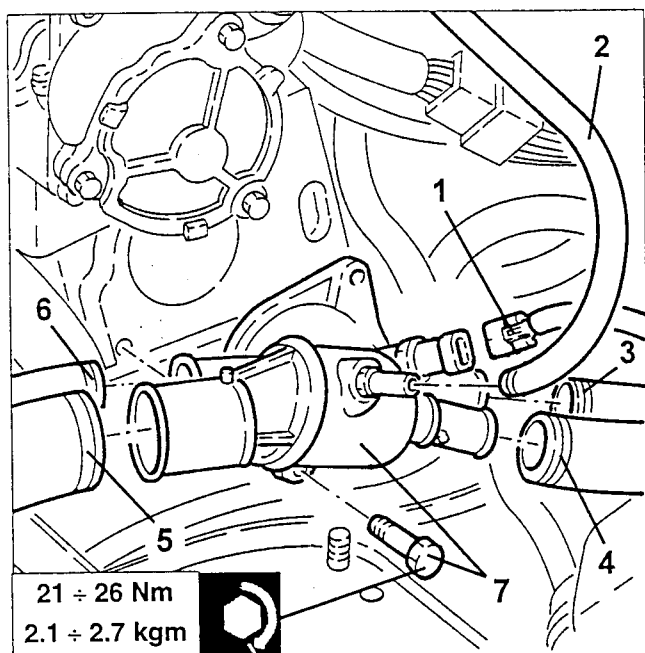
1. Drain the engine coolant fluid, disconnecting the radiator outlet sleeve.

NOTE: Collect the engine coolant fluid in a suitable container.

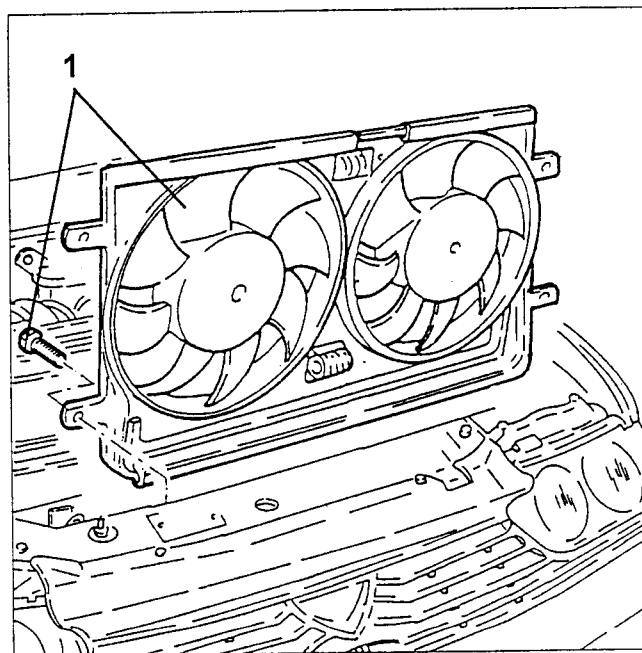
1. Loosen the clamps and remove the complete air delivery pipe from the cleaner to the turbocharger.



1. Disconnect the electrical connection from the engine coolant temperature sensor.
2. Disconnect the return pipe to the header tank from the thermostat.
3. Disconnect the delivery pipe to the climate control system heater from the thermostat.
4. Disconnect the delivery pipe to the stiff pump fluid inlet pipe from the thermostat.
5. Disconnect the coolant fluid delivery sleeve to the radiator from the thermostat.
6. Disconnect the delivery pipe to the engine oil heat exchanger from the thermostat.
7. Slacken the fastening screws and remove the thermostat complete with seal.



1. Slacken the fastening screws and remove the cooling fans.



FANS

The two-speed cooling fans disperse the heat of the radiator and/or of the air conditioning system condenser.

They are controlled directly by the injection control unit according to a specific operating logic.

REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connections from the additional resistances of the fans.
- 2. Disconnect the electrical connections of the supply to the cooling fans.