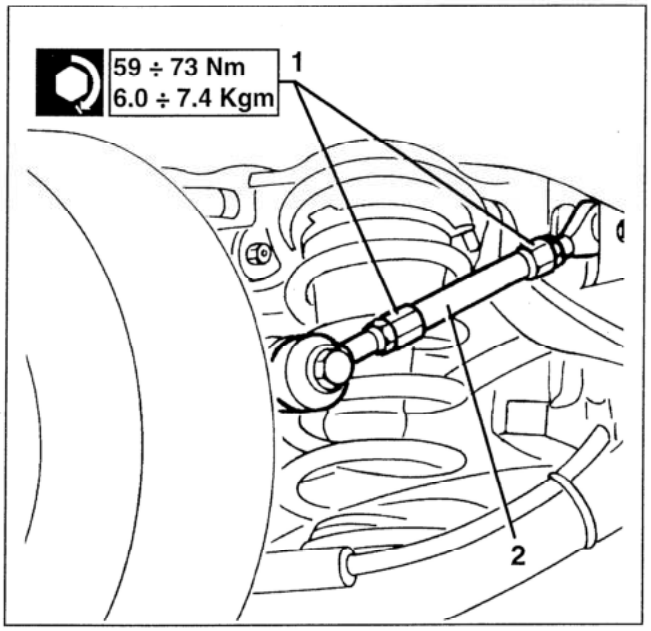
If the toe-in is other than specified proceed as follows:

1. Slacken the fastenings of the adjustment rods.
2. Turn the rods, until reaching the specified value

**NOTE: Adjustment should be carried out working on the rods of both wheels.**

– Tighten the rod fastenings to the specified torque.

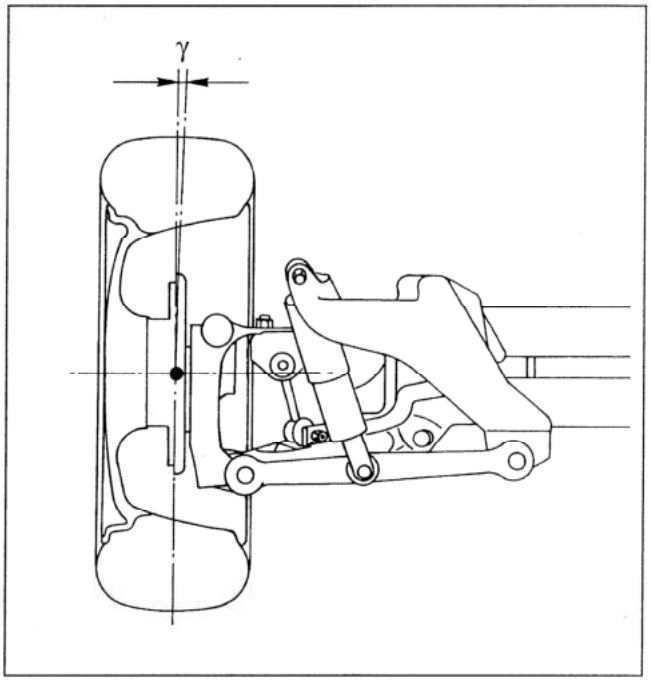



## CHECKING THE REAR WHEEL CAMBER

– Check that the camber angle (not adjustable) is within the specified limit.

| Rear wheel camber "γ" |
|---|
| GTV 3.0 24V |
| -2°3' ± 20'*<br>-1°47' ± 20'** |

* to '97 versions
** '98 versions

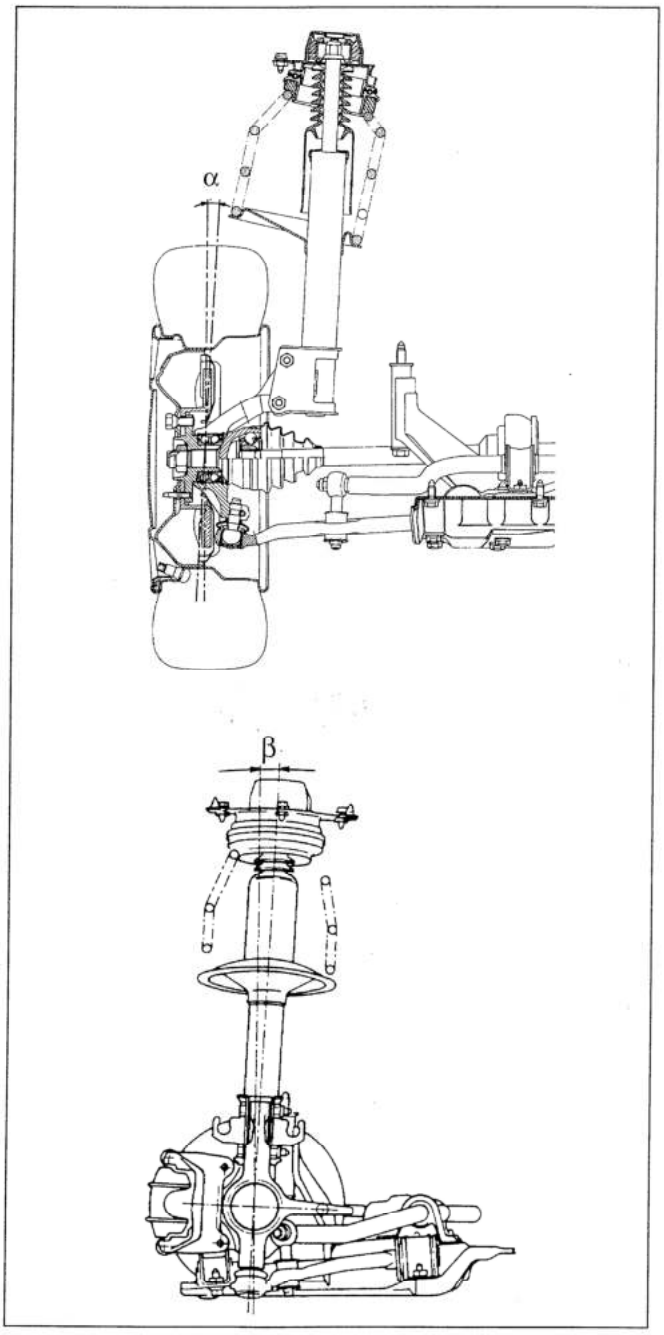



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| Caster "β" |
|---|
| **GTV 3.0 24V** |
| 3°5' ± 30'*<br>2°42' ± 30'** |

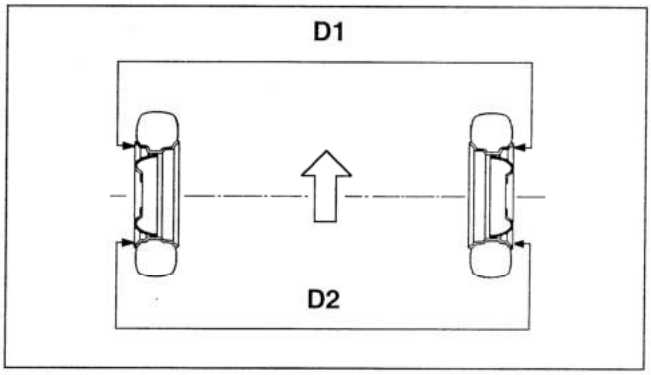
* to '97 versions
** '98 versions

**NOTE: If the values are not within the specified limits, body squaring should be checked (see GROUP 70).**




## CHECKING THE REAR WHEEL TOE-IN

– Using suitable tools, check that the toe-in is within the specified limits.




| Rear wheel toe-in D2 - D1 |
|---|
| **GTV 3.0 24V** |
| 2.5 ± 0.5 mm*<br>3.0 ± 1 mm** |

* to '97 versions
** '98 versions

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# CHECKING THE CHARACTERISTIC ANGLES

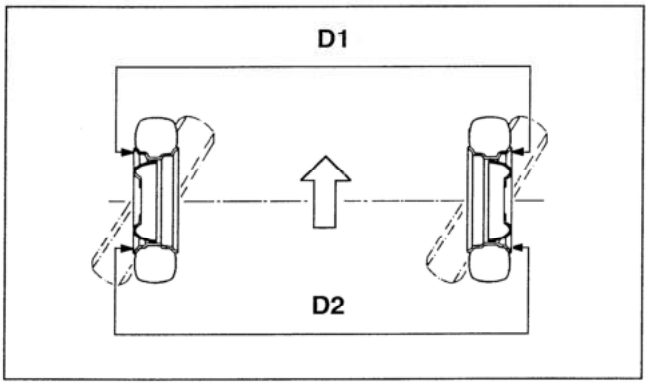
## Preliminary operations

– Inflate the tyres to the specified pressure.
– Fill with fuel and the specified oils and fluids.
– Check that the eccentricity and orthogonality of the wheel rims does not exceed:

- 1 mm for steel rims
- 0.3 mm for alloy rims

## CHECKING THE FRONT WHEEL TOE-IN

– Using suitable tools, check that the toe-in is within the specified limits.




| Front wheel toe-in D2 - D1 |
|---|
| GTV 3.0 24V |
| -1.5 ± 0.5 mm*<br>-2.0 ± 1 mm** |

* to '97 versions
** '98 versions

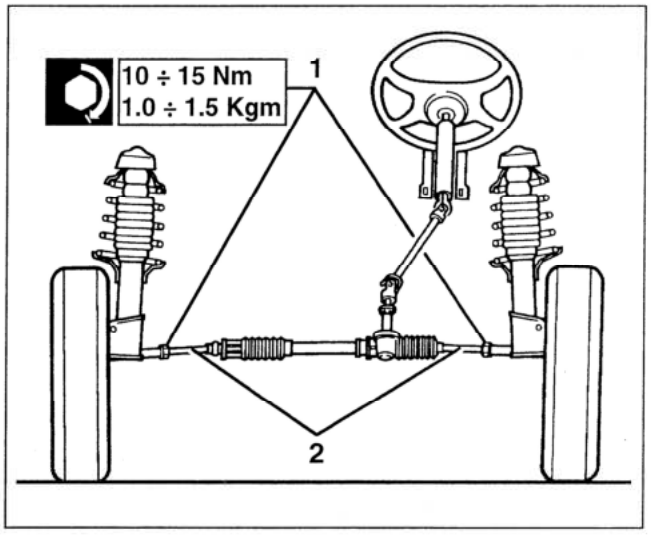
If the toe-in is other than specified, proceed as follows:
1. Slacken the fastenings for adjusting the track rods.

**WARNING:**
**Each time the front wheel toe-in is adjusted, it is necessary to check that the boots turn freely on the rod and if necessary remove them and lubricate with the specified grease.**

2. Turn the rods, until reaching the specified value without changing the position of the steering wheel spokes

**NOTE: Adjustment should be carried out on the rods of both wheels.**

– Tighten the track rod adjustment fastenings to the specified torque.




## CHECKING THE FRONT WHEEL CAMBER AND CASTER

– Check that the camber and caster angles (not adjustable) are within the specified limits.

| Front wheel camber "α" |
|---|
| GTV 3.0 24V |
| -0°1' ± 20'*<br>-0°56' ± 20'** |

* to '97 versions
** '98 versions

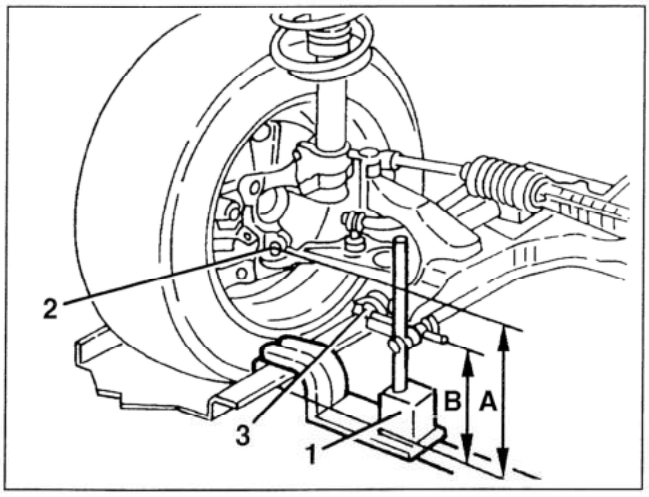
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# WHEEL ALIGNMENT

## CHECKING THE FRONT WHEEL ALIGNMENT

- Inflate the tyres to the specified pressure.
- Fill with fuel and the specified oils and fluids.
- Set the car on a lift.
- Sway the car a few times to settle the suspensions.

1. Position the reference tool on the on the car resting surface.
2. Using a surface gauge measure the distance "**A**" between the car resting surface and the centre of the steering knuckle fastening screw.
- With the help of a millimetred rule measure the distance found.
3. Using the surface gauge measure the distance "**B**" between the car resting surface and the centre of the wishbone pin.
- With the help of the millimetred rule measure the distance found.




- Calculate the difference between dimension "**B**"and dimension "**A**" and check that it is with the specified limits.

| Front alignment B-A |
|---|
| GTV 3.0 24V |
| -36 ± 5 mm*<br>-45 ± 5 mm** |

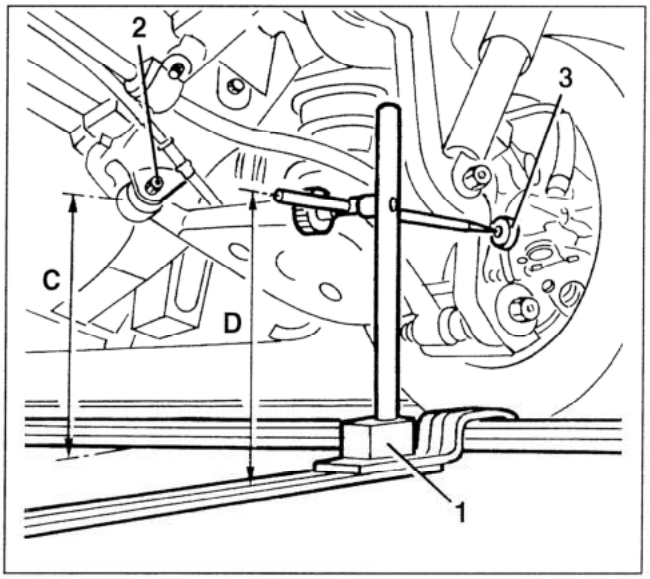
* to '97 versions
** '98 versions

**NOTE: If the alignment values are not within the specified values change both suspension springs.**

## CHECKING THE REAR WHEEL ALIGNMENT

- Inflate the tyres to the specified pressure.
- Fill with fuel and the specified oils and fluids
- Set the car on a lift.
- Sway the car a few times to settle the suspensions.

1. Position the reference tool on the car resting surface.
2. Using a surface gauge measure the distance "**C**" between the car resting surface and the fulcrum of the spring carrier arm.
- With the help of a millimetred rule measure the distance found.
3. Using the surface gauge measure the distance "**D**" between the car resting surface and the rear wheel centre.
- With the help of the millimetred rule measure the distance found.




- Calculate the difference between dimension "**C**"and dimension "**D**" and check that it is with the specified limits.

| Rear alignment C - D |
|---|
| GTV 3.0 24V |
| -74 ± 5 mm*<br>-69 ± 3 mm** |

* to '97 versions
** '98 versions

**NOTE: If the alignment values are not within the specified values change both suspension springs.**

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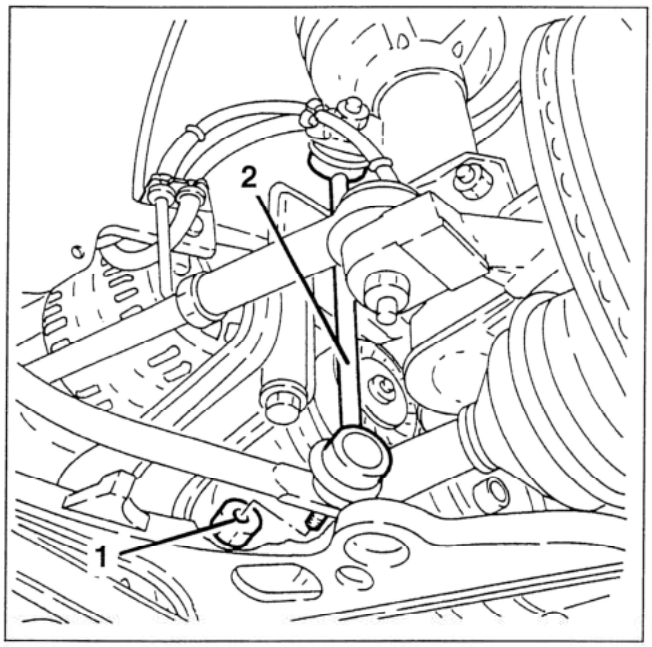
# FRONT SUSPENSION

## STABILISER BAR CONNECTING ROD

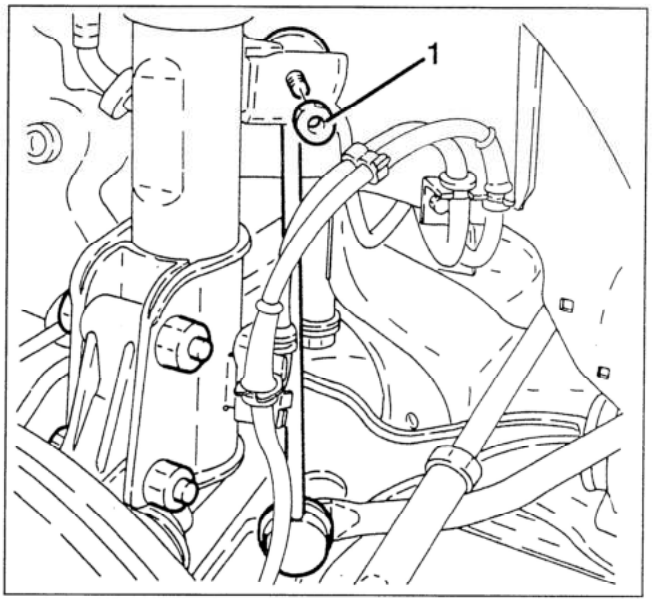
### REMOVAL/REFITTING

– Position the vehicle on a shop jack.
– Remove the front right-hand wheel.

1. Loosen the shock-absorber connecting rod fastening nut.



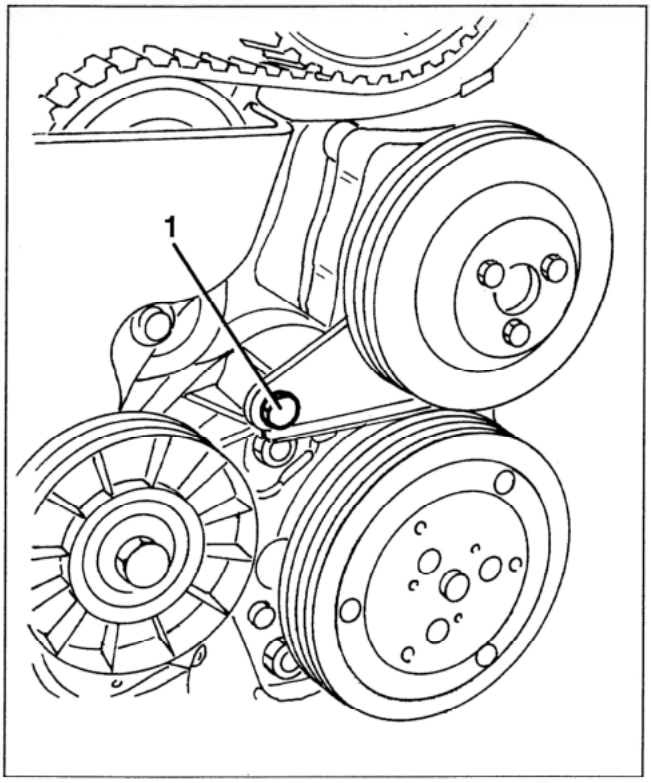

1. Loosen the nut fastening the connecting rod to the stabiliser bar.
2. Remove the connecting rod.



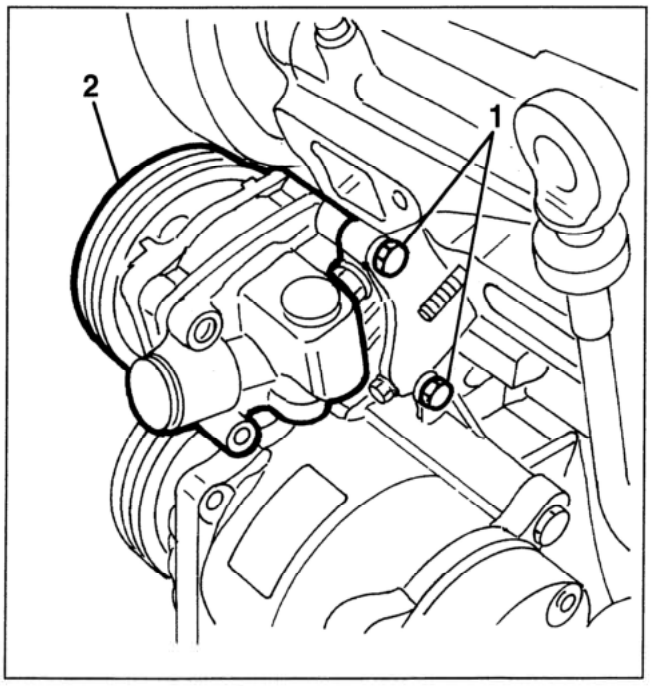

Refit the connecting rod by reversing the removal sequence.

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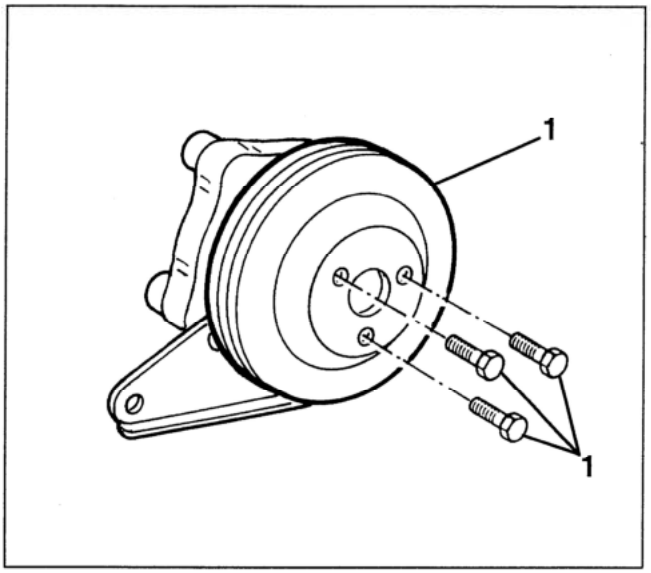
1. Slacken the screw fastening the power steering pump plate.




1. Slacken the two screws fastening the rear power steering pump.
2. Remove the power steering pump.




1. If necessary, slacken the three screws and separate the pulley.




## CHECKS AND INSPECTIONS

**CAUTION:**
**The power steering pump, like the steering box must not be disassembled for any reason whatsoever. They are to be sent to the Manufacturer for overhauling.**

Check the steering wheel rolling torque with the car stationary and the engine running. The torque must be between 0.6 daN with the engine at idle speed and 0.75 daN with the engine at top rpm: if these values are exceeded check the pressure of the system with the wheels steered completely. To do this insert a pressure gauge using an appropriate Tee union on the pressurised oil delivery pipe to the power steering leading from the pump, and steer completely to one side. Forcing the steering wheel to turn further, the pressure reading should rise to appr. 85 bar. If this fails to occur there is an operating fault in the pump or in the distributor valve of the power steering box.

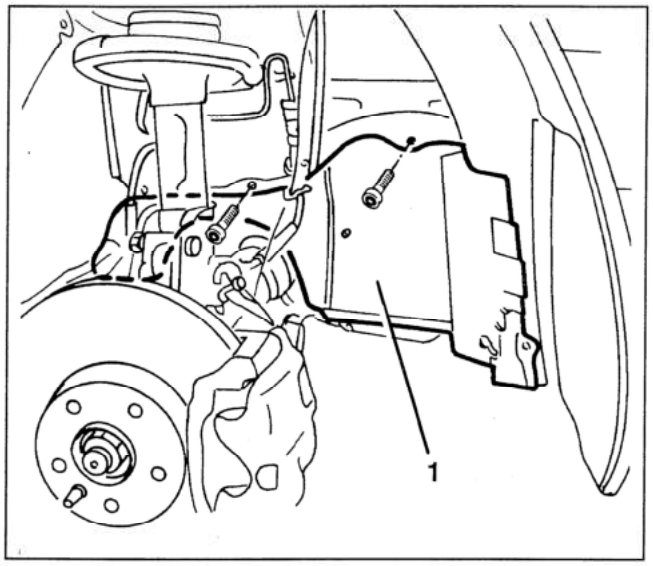
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# POWER STEERING

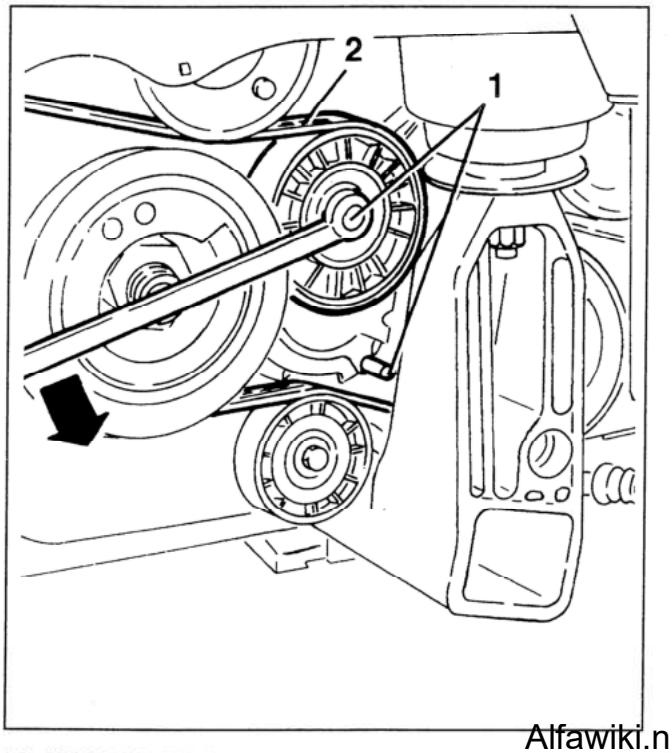
## POWER STEERING PUMP

### REMOVING/REFITTING

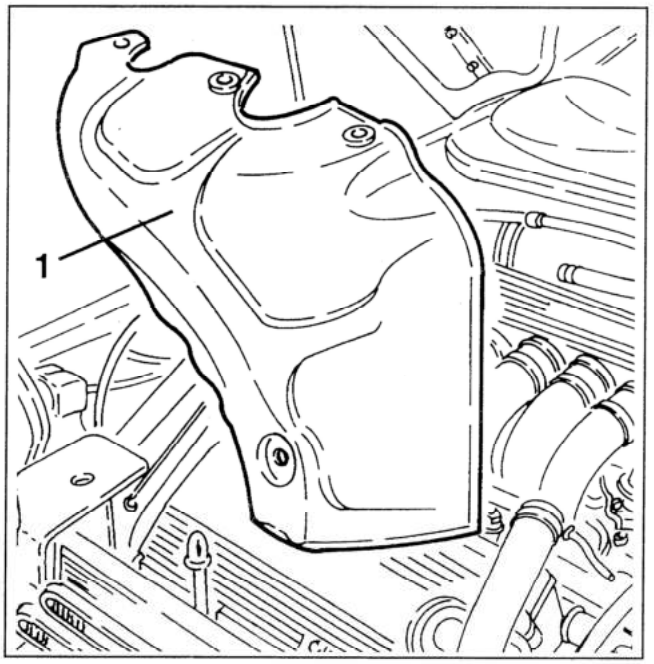
– Set the car on a lift.
– Remove the right front wheel and gravel guard (see GROUP 70).
1. Remove the engine compartment bulkhead.



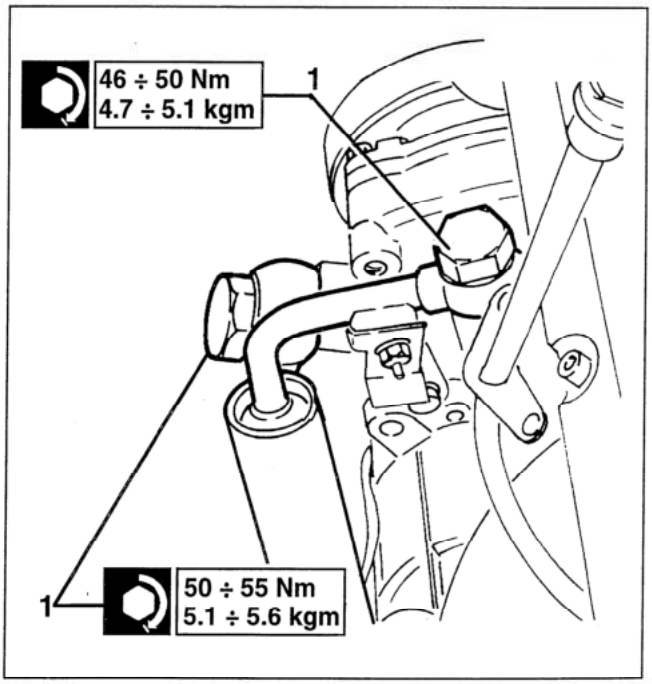

1. Using a wrench on the belt tensioner pulley fastening screw, del tendicinghia, overcome the force of the automatic tensioner and lock it in this position (belt slack) inserting the special pin as illustrated.
2. Prise and remove the auxiliary components drive belt.




– Remove the right hand engine compartment cover.
– Using a syringe, siphon the oil from the power steering system reservoir.
– Remove the upper radiator crossmember and the engine cooling fans (see GROUP 10).
1. Slacken the fastenings and remove the heat shield from the exhaust manifold of the left cylinder head.

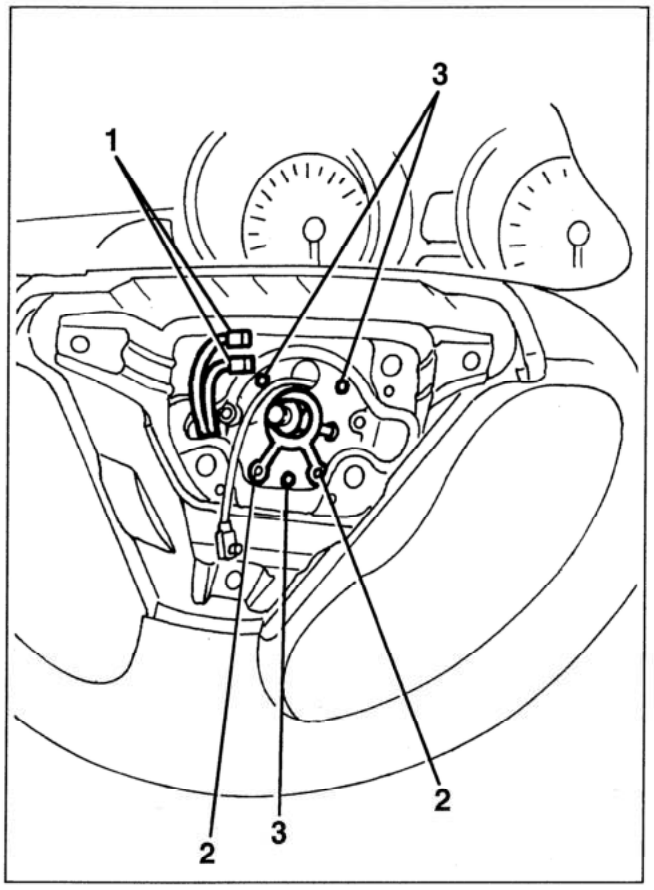



1. Disconnect the oil inlet and delivery pipe fittings from the power steering pump.

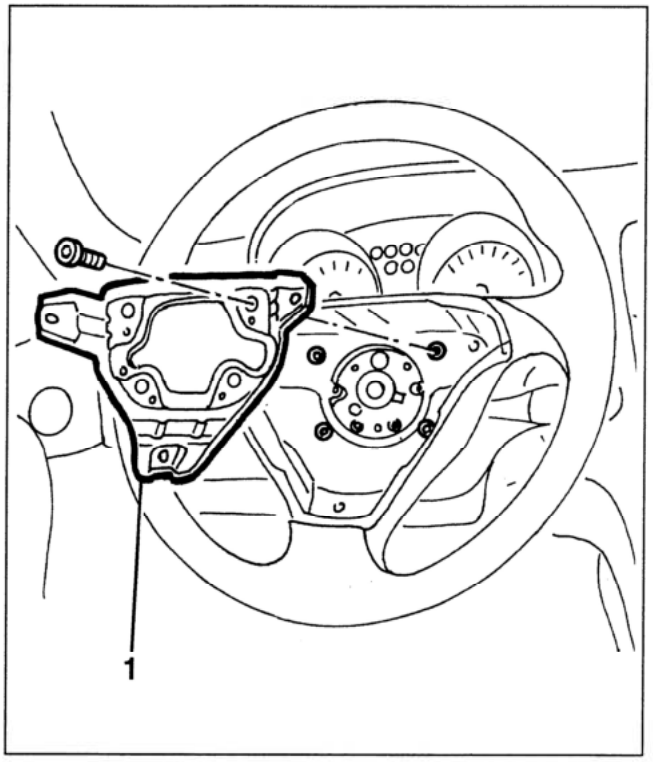



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1. Disconnect the connections of the horns.
2. Slacken the two screws and remove the safety clip.
3. Slacken the three screws and separate the clock spring from the steering wheel.




1. Slacken the four screws and separate the horn control from the steering wheel.




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# STEERING CONTROL

## STEERING WHEEL

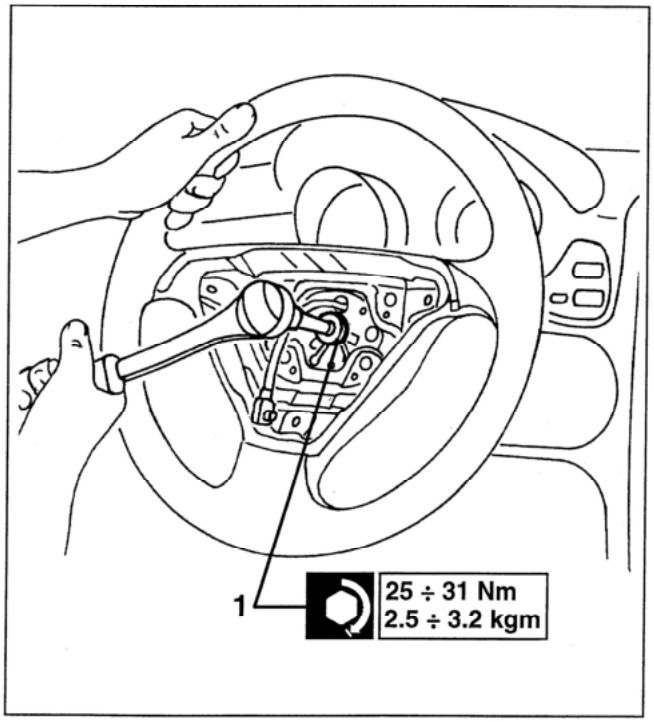
### REMOVING / REFITTING

– Remove the Air Bag module (see GROUP 55).

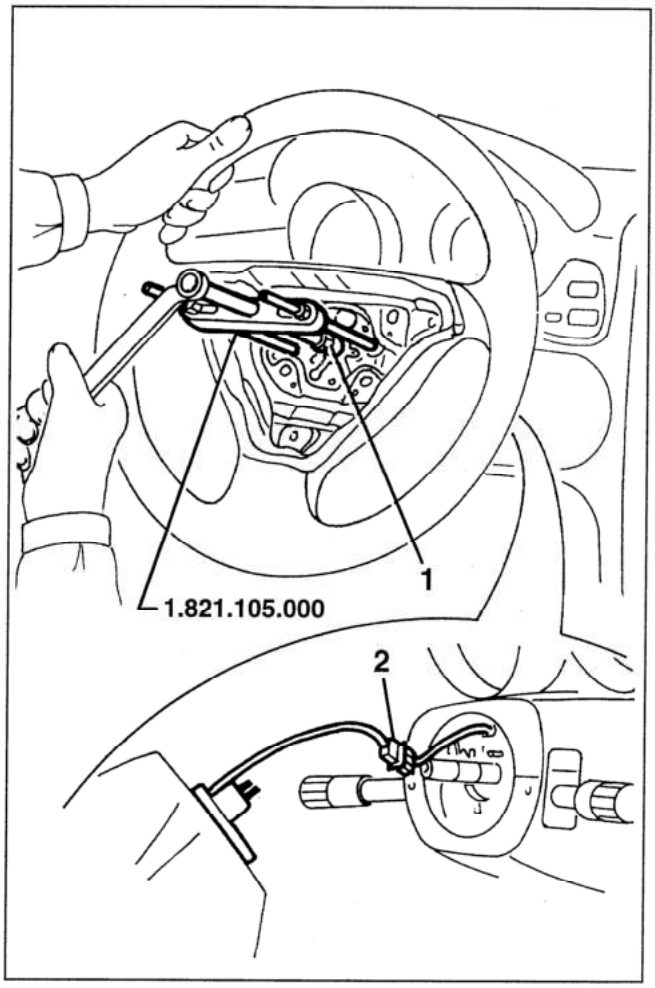
**WARNING:**
**Before doing any work on the system carefully follow the SAFETY RULES concerning the Air Bag system given in Group "55 - ELECTRIC SYSTEM DIAGNOSIS", Section "Air Bag and Pretensioners".**
**Disconnect both battery terminals, isolate them accurately and wait for 10 minutes before proceeding.**

1. Remove the steering wheel fastening nut.

**CAUTION:**
**Before doing this check that the wheels are perfectly straight.**



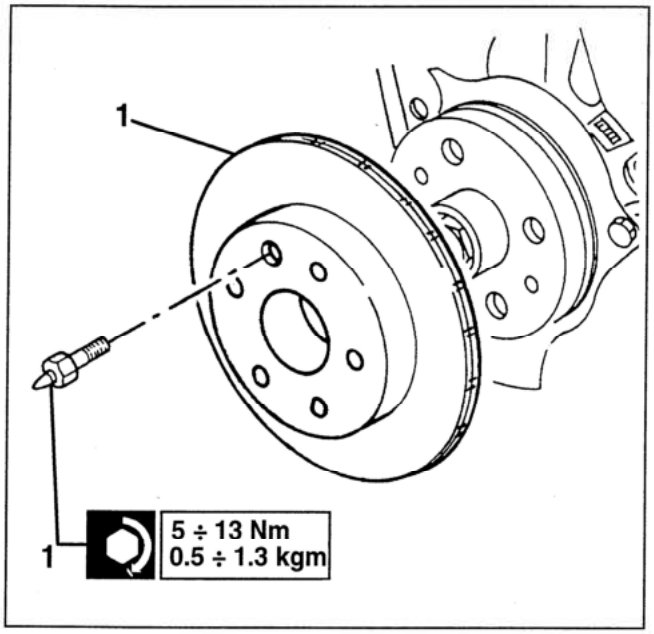

1. Using tool no. 1.821.105.000 remove the steering wheel from the steering column.
2. Disconnect the connection of the clock spring




**CAUTION:**
**Take <u>the utmost care</u> not to turn the clock spring in relation to the steering wheel, as the device is locked only when it is separated from the steering wheel (see next step). Therefore, it is advisable to restrain it to the steering wheel with adhesive tape for example.**

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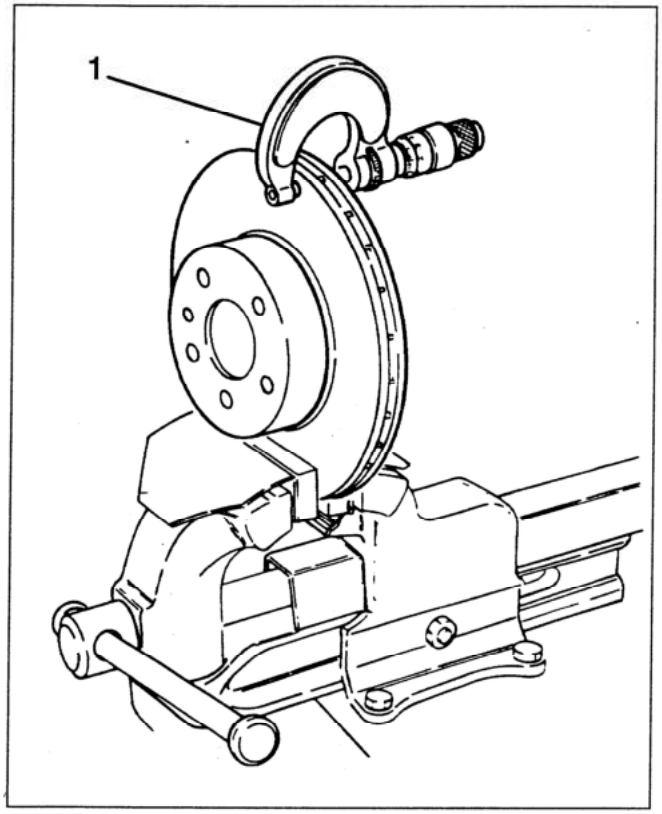
1. Slacken the fastening pin and remove the brake disk.




## CHECKS AND INSPECTIONS

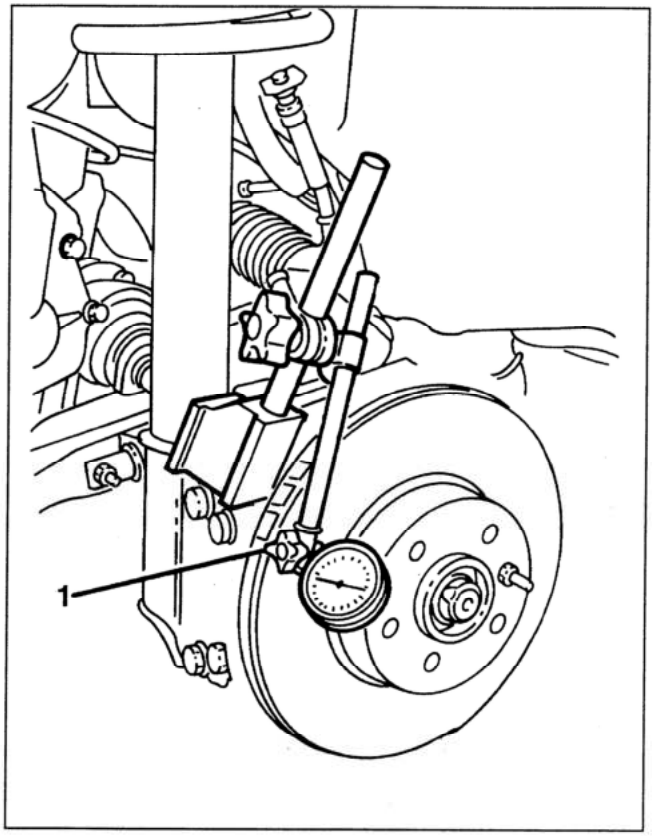
1. Check the thickness of the disks and that the working surfaces have no deep scores or porosity.

| Thickness of disk | At wear limit |
|---|---|
| | 26.4 mm |




1. When replacing only the brake pads, check that disk oscillation in relation to the axis of rotation is within the specified limits (0.15 mm max).

**NOTE: the value must be measured 2 mm from the disk outside diameter.**



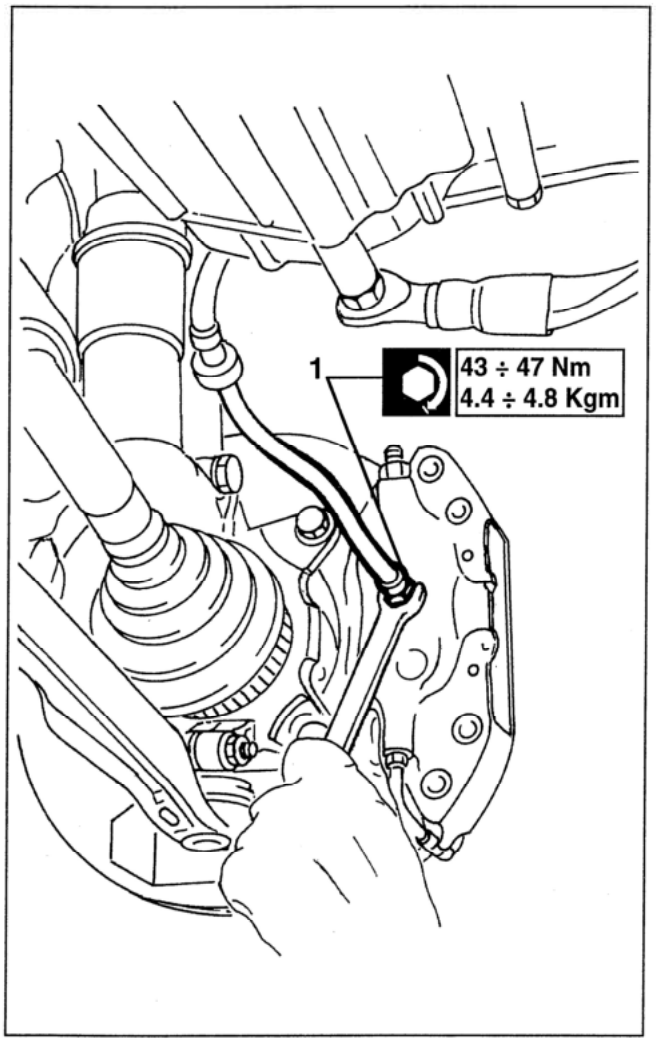

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## BRAKE CALIPER

### REMOVING/REFITTING

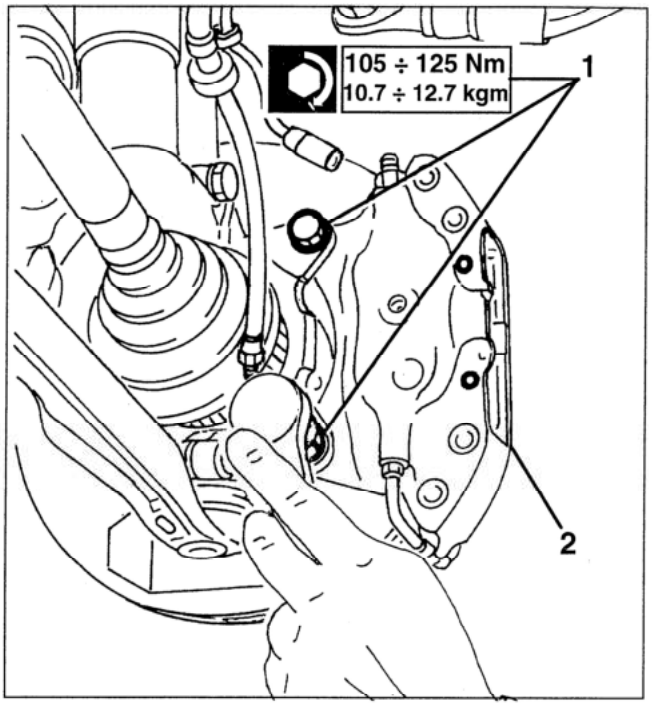
– Set the car on a lift.
– Remove the wheel on the side concerned.
– Remove the brake pads (see specific paragraph).
1. Slacken the fitting and disconnect the brake fluid pipe from the caliper.

**Suitably plug the pipe to avoid spilling the brake fluid.**




1. Remove the two brake caliper fastening screws.
2. Remove the brake caliper complete.

**The brake caliper cannot be disassembled.**
**Avoid disassembling the brake caliper, it must be changed entirely.**

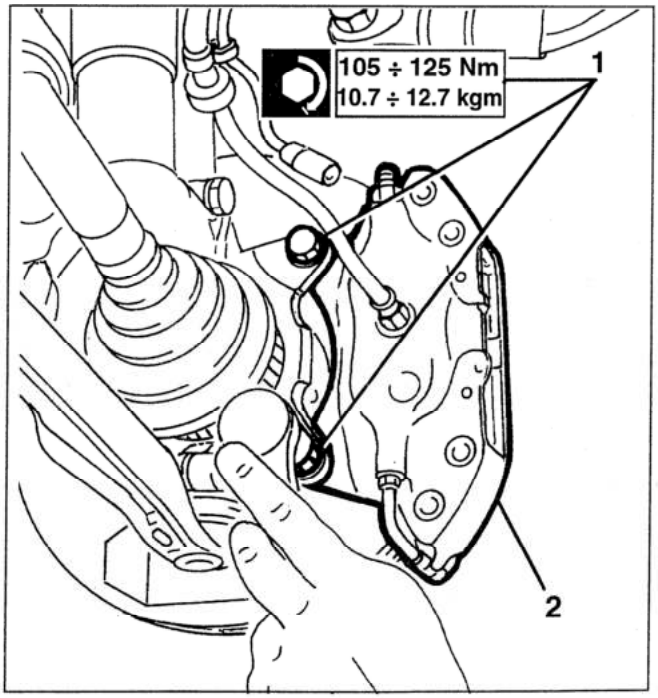



After refitting. relieve the air from the braking system (see specific paragraph).

## BRAKE DISK

### REMOVING/REFITTING

– Set the car on a lift.
– Remove the wheel on the side concerned.
– Remove the brake pads (see specific paragraph).
1. Remove the two brake caliper fastening screws.
2. Remove and move aside the brake caliper complete, without disconnecting the piping.



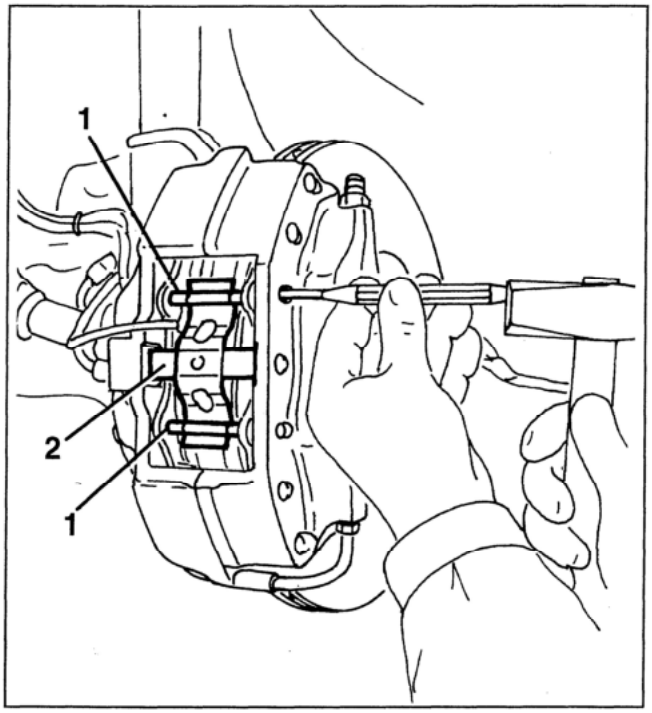

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# FRONT BRAKE UNIT

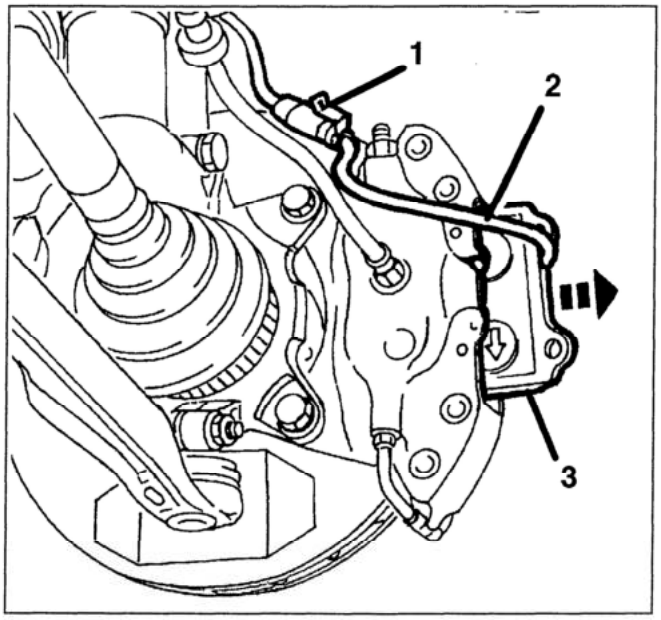
## BRAKE PADS

### REPLACEMENT

– Set the car on a lift.
– Remove the wheel on the side concerned.
1. Using a punch, withdraw the two brake pad fastening pins.
2. Remove the cross spring.

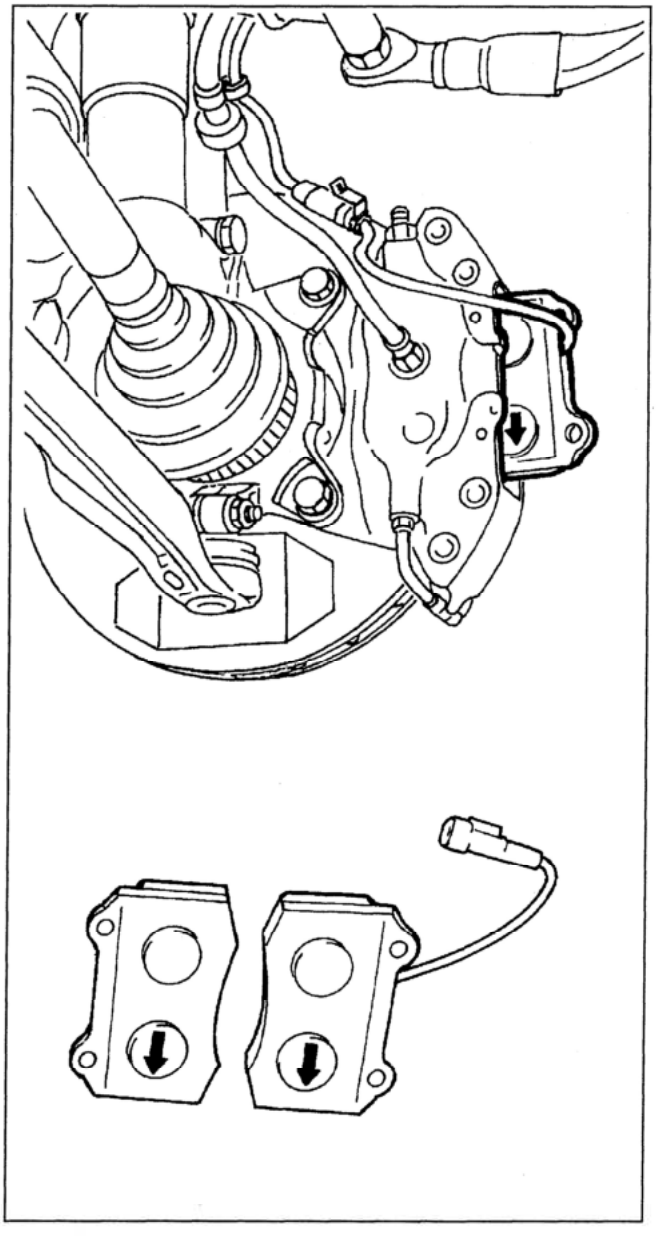



1. Disconnect the brake pad wear sensor electrical connection.
2. Release the cable from the retainer on the caliper.
3. Remove the brake pads.




**WARNING**
**Take the utmost care not to damage the control piston boots. Push the pistons into their housings using a stick as lever, make sure that the brake fluid does not spill out of the reservoir during this operation.**

**WARNING**
**When refitting, the brake linings are to be assembled with the arrows downwards, as illustrated.**
**The wear sensor should be installed on the inner side of the disk with the cable on the upper side.**



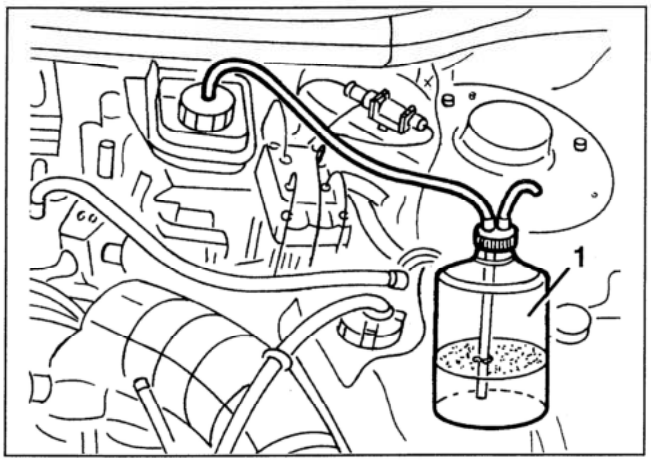
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# BRAKE HYDRAULIC SYSTEM

## RELIEVING THE AIR FROM THE SYSTEM

When filling the hydraulic system or doing any work on it, it is necessary to proceed as described below.

1. Using the special device applied to the brake fluid reservoir, releieve the air in the following sequence:
1. LH front wheel
2. RH front wheel
3. LH rear wheel
4. RH rear wheel




**For each wheel proceed as follows:**

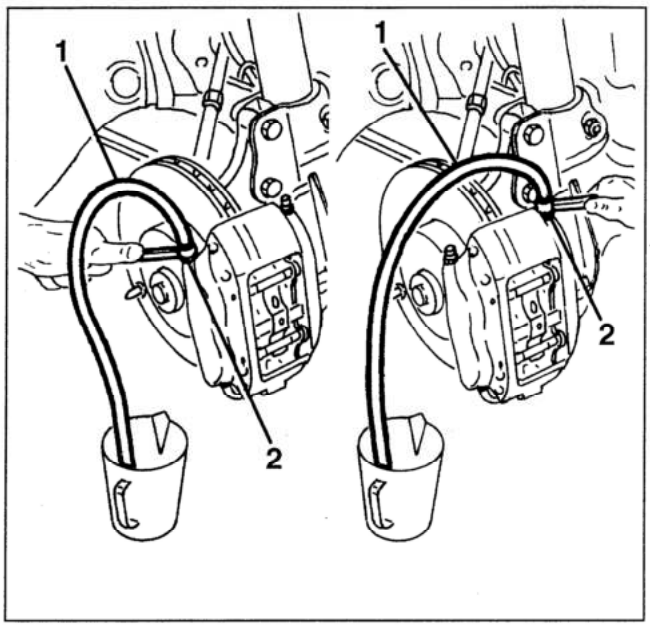
– Fill the brake-clutch fluid reservoir to the"max" level with the specified fluid.

– If necessary, remove the wheel on which you are working.

1. Fit a tube on the relief screw. Put the other end of the tube in a container of the specified fluid.

2. Slacken the relief screw and pump the brake pedal (wait for a few seconds between one press and the next). When the fluid comes out with no bubbles, fully depress the brake pedal and lock the relief screw to the specified torque.

**WARNING**
**The front brake calipers have a relief screw for heaf caliper half body.**
**Relieve the air on both half bodies.**




**NOTE: The above operation is carried out on each wheel separately.**

**WARNING:**
**When relieving the air make sure that the fluid level never falls below the minimum level.**
**Do not re-use the fluid drained off during this operation.**
**Prevent the fluid from contacting painted parts and damaging them.**

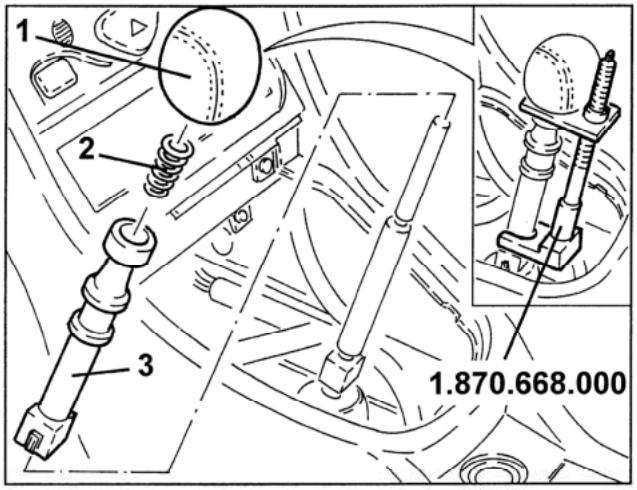
**NOTE: If the above procedure is not carried out correctly, air is likely to get into the piston resulting in longer brake pedal travel, in which case proceed as described.**
**Air could also get into the ABS hydraulic unit resulting in the impossibility of carrying out any type of air relieving operation.**

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# REVERSE INHIBITOR ON THE GEAR LEVER BRACKET

## REMOVAL/REFITTING

- Lift and remove the gear lever cap.
1. Remove the gear lever knob with tool no. 1.870.668.000.
2. Remove the spring.
3. Remove the reverse inhibitor.





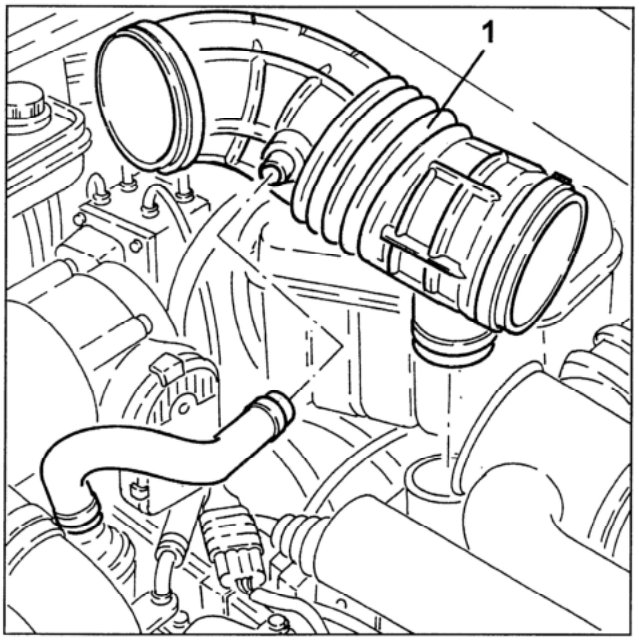

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- Complete refitting by reversing the removal sequence.

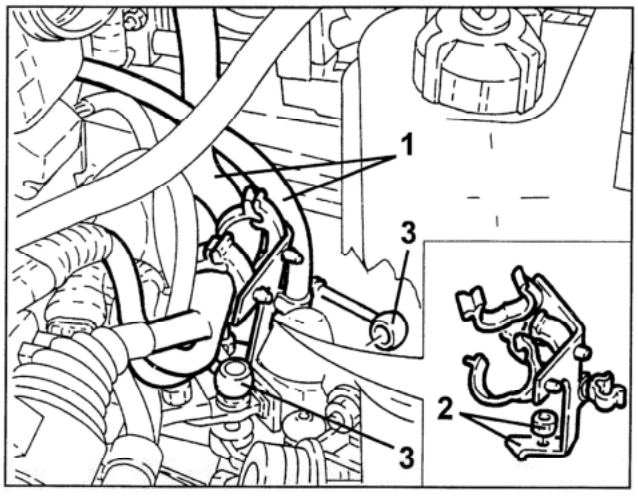
## GEAR SELECTION AND ENGAGEMENT ASSEMBLY

### REMOVAL/REFITTING

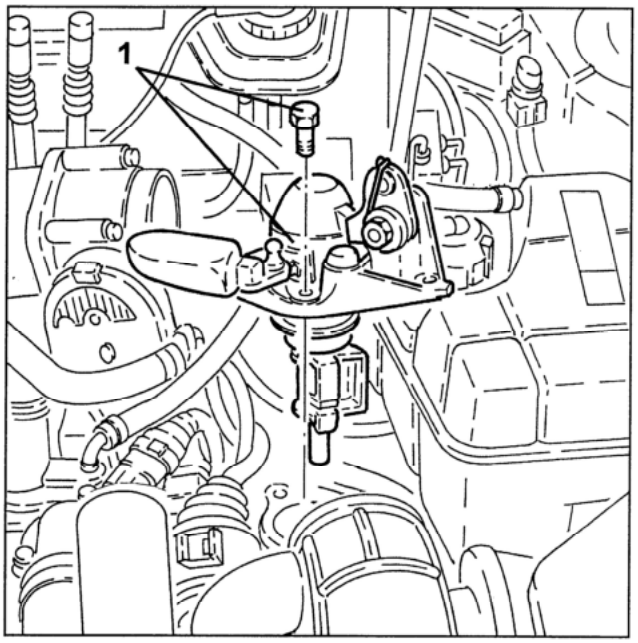
1. Loosen the fastening clips and remove the corrugate sleeve.



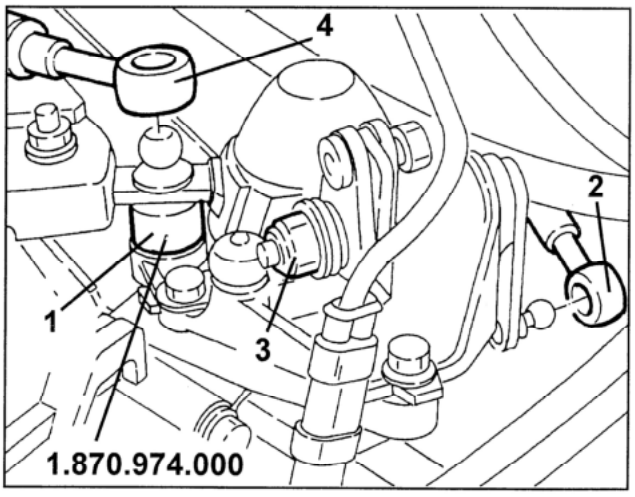

1. Release the electrical wiring from the bracket fastening clips.
2. Loosen the nut and remove the electrical wiring bracket.
3. Disconnect the gear selection and engagement wires.




1. Loosen the screws and remove the gear selection and engagement assembly.

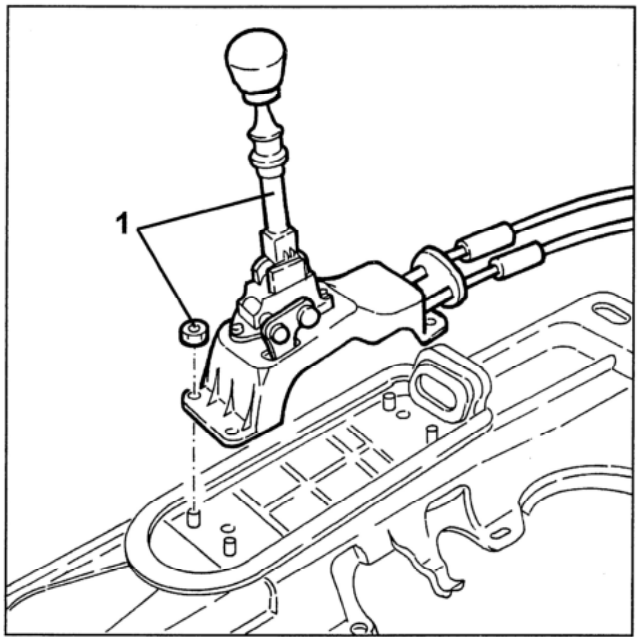


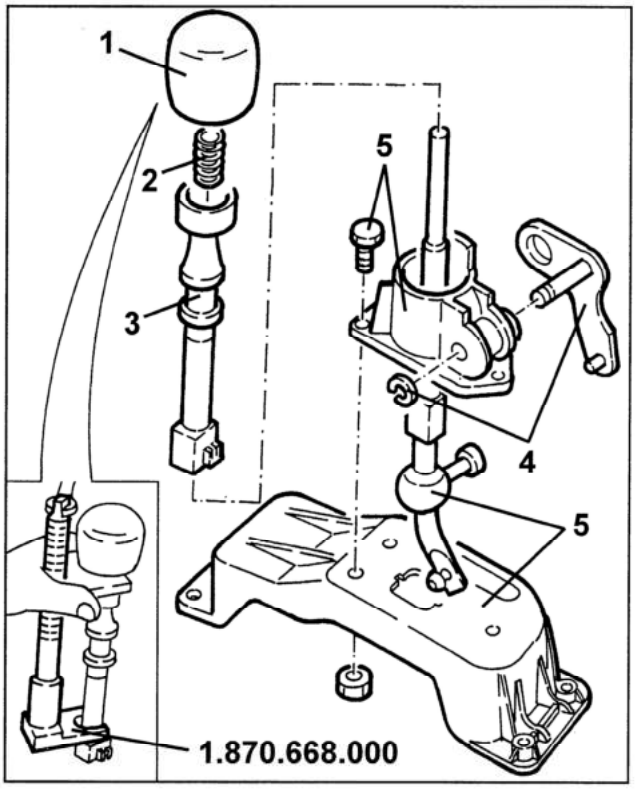

- Refit by reversing the removal sequence to the gear selection and engagement assembly fitting in its seat step.
1. Fit tool no. 1.870.974.000 under the gear engagement wire ball coupling.
2. Connect the gear selection wire.
3. Loosen the gear selection/engagement assembly adjustment nut.
- Torque the gear selection/engagement assembly adjustment nut after positioning the gear lever in neutral and shifting it all to the right.
4. Connect the gear engagement wire.
- Position the gear lever in reverse and remove tool no. 1.870.974.000.



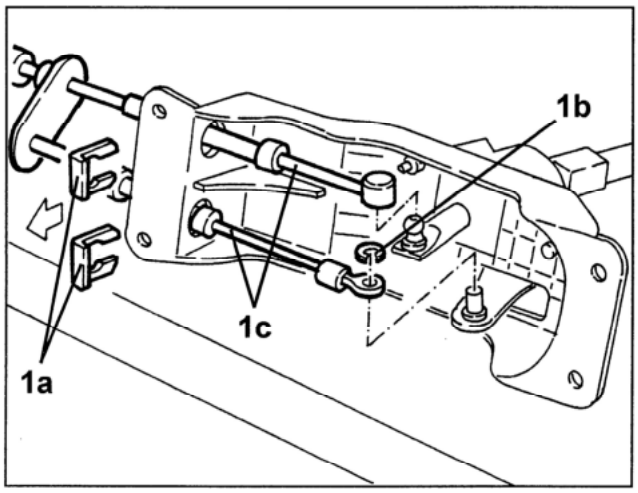

- Complete refitting by reversing the removal sequence.

1. Loosen the fastening nuts and remove the gearbox lever bracket with gear selection/engagement wires.



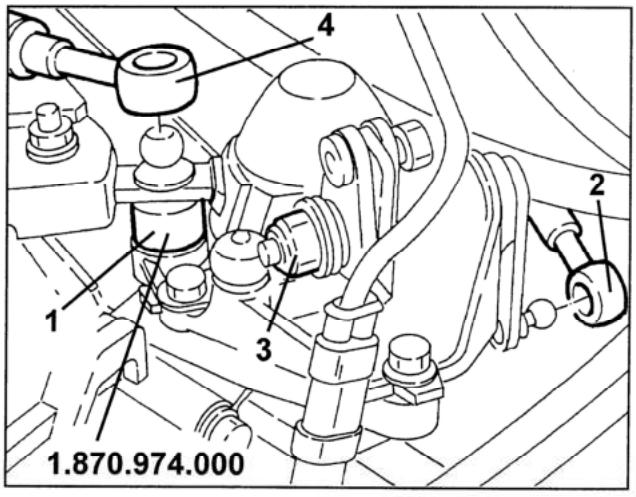

1. Remove the retainer plates (1a), washer (1b). Then disconnect and remove the gear selection/engagement wires (1c).




1. Remove the gear lever knob with tool no. 1.870.668.000.
2. Remove the spring.
3. Remove the reverse inhibitor.
4. Remove the washer and remove the lever.
5. Loosen the bolts and disassemble the gear rod from the respective brackets.

## REFITTING

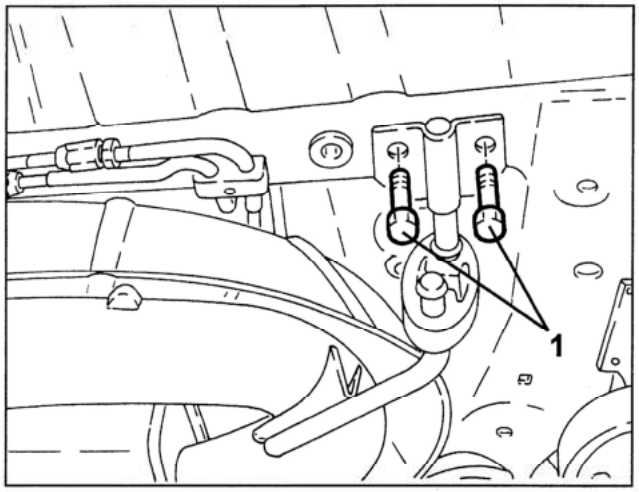
- Refit by reversing the removal sequence to the brackets and gear selection/engagement wires and fasten with the respective nuts refitting step.
1. Fit tool no. 1.870.974.000 under the gear engagement wire ball coupling.
2. Connect the gear selection wire.
3. Loosen the gear selection/engagement assembly adjustment nut.
- Torque the gear selection/engagement assembly adjustment nut after positioning the gear lever in neutral and shifting it all to the right.
4. Connect the gear engagement wire.
- Position the gear lever in reverse and remove tool no. 1.870.974.000.



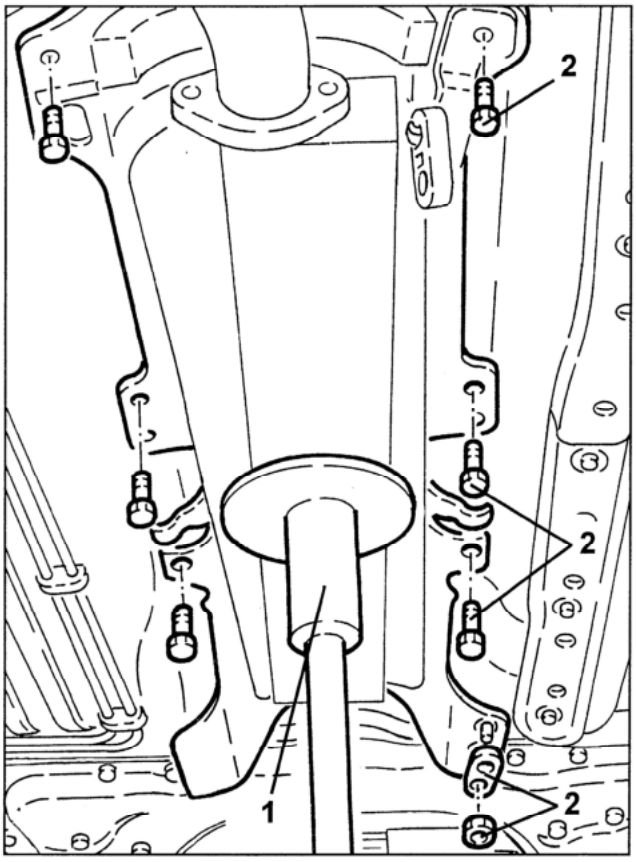



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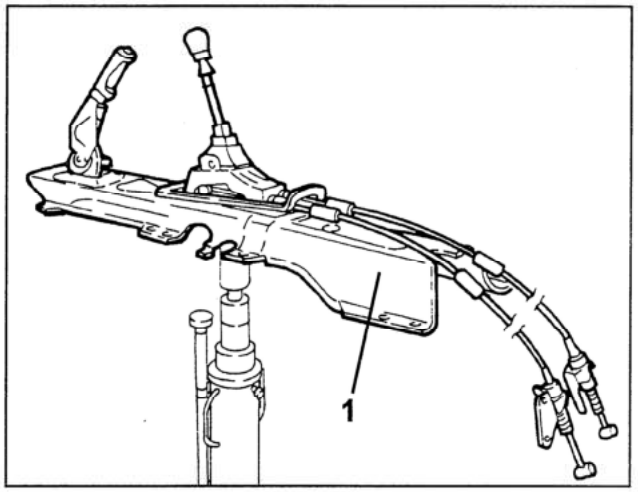
1. Loosen the intermediate exhaust bracket fastening screws.




1. Position a hydraulic jack under the handbrake lever bracket.
2. Loosen the gearbox and handbrake levers fastening screws and nuts from the underbody.

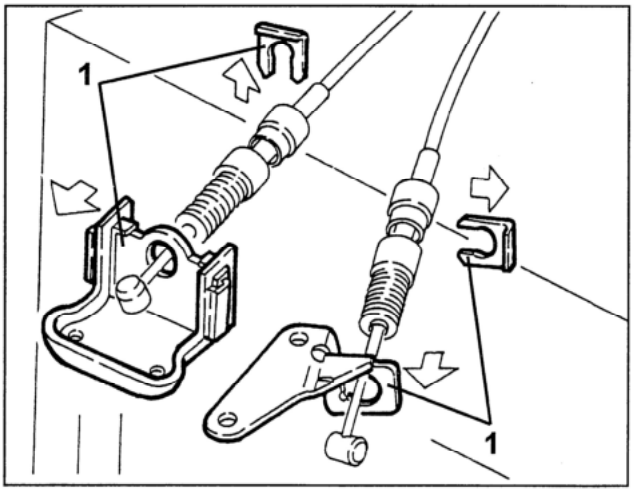



1. Lower the hydraulic jack and remove the gearbox and handbrake lever assembly.

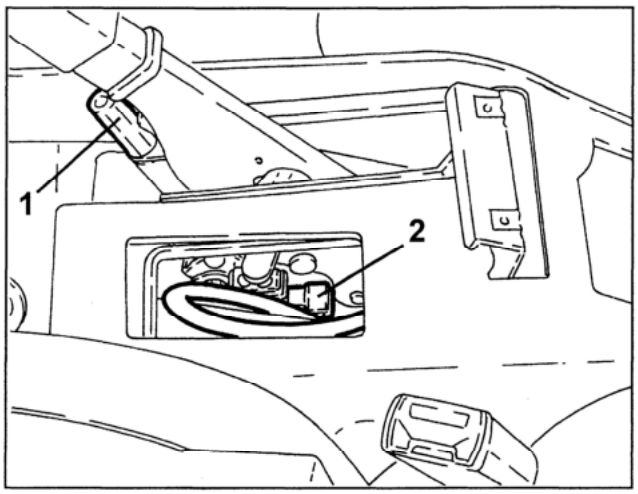



## DISASSEMBLY/RE-ASSEMBLY

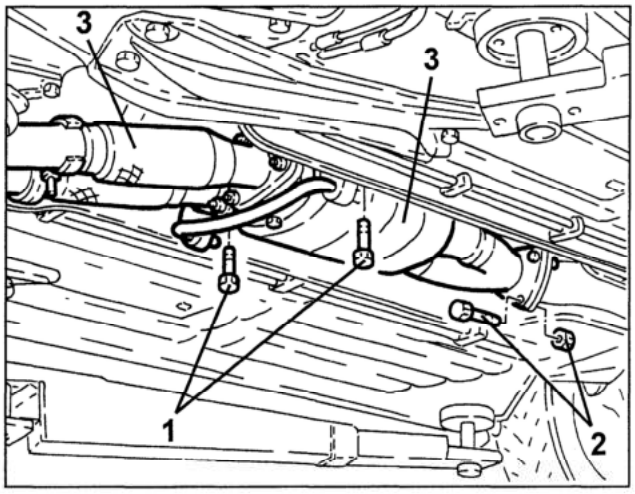
1. Loosen the retainer plates and remove the gear selection/engagement brackets.



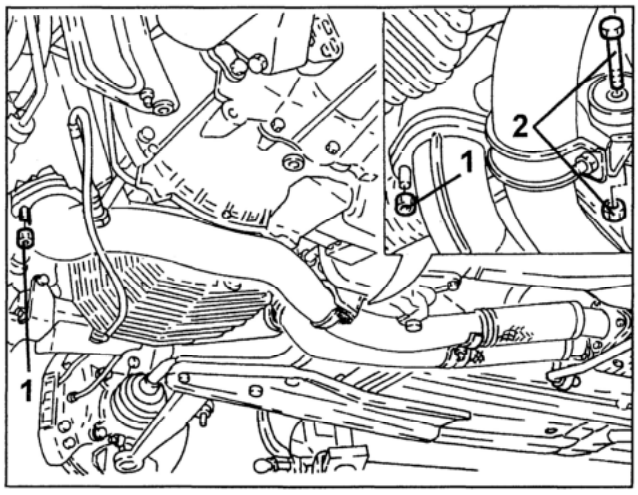
- Remove the tunnel unit (see Assembly 70).
1. Lift the handbrake lever and loosen the handbrake wire tension nut.
2. Disconnect the handbrake warning light switch electrical connection.



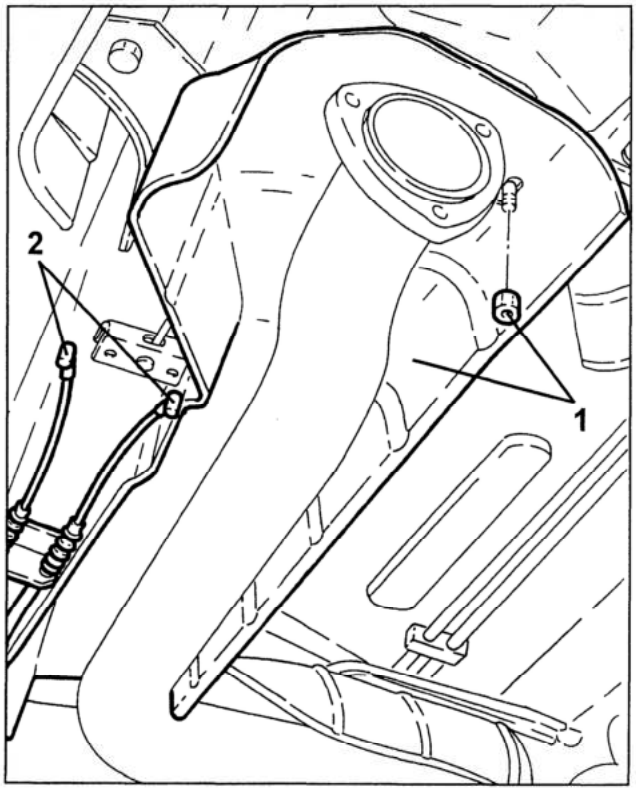

1. Loosen the catalytic converter bracket fastening screws.
2. Loosen the bolts fastening the catalytic converter to the mufflers.
3. Remove the exhaust pipe front section and catalytic converter with the hydraulic jack.
- Remove the respective seals.




- Position a hydraulic jack to support the exhaust pipe.
1. Loosen the exhaust manifold exhaust pipe front section fastening nuts.
2. Loosen the bolt fastening the exhaust pipe front section to the respective rubber mount.




1. Loosen the fastening nuts and remove the exhaust pipe firewall.
2. Disconnect the handbrake wires.





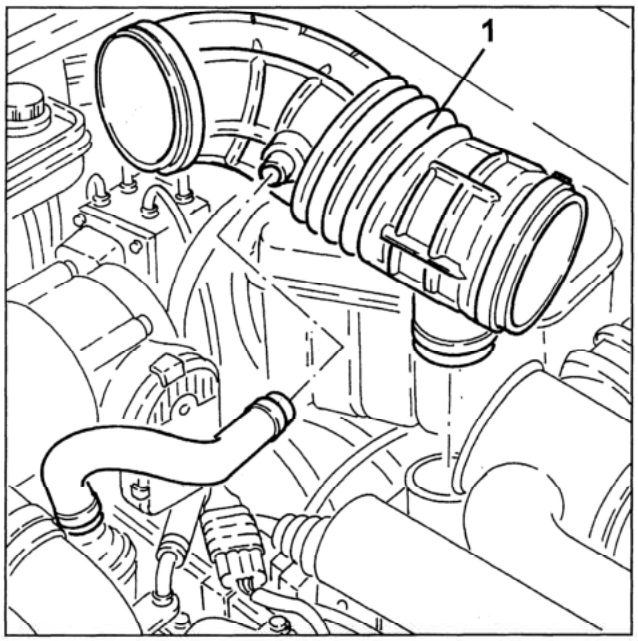
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## GEARBOX LEVER AND HANDBRAKE BRACKET

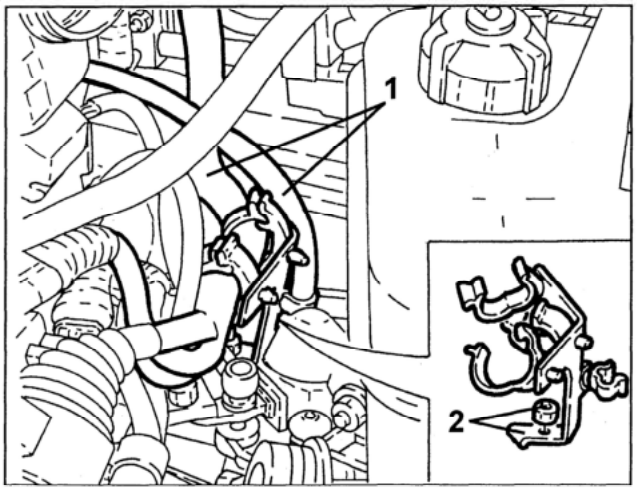
### REMOVAL

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.

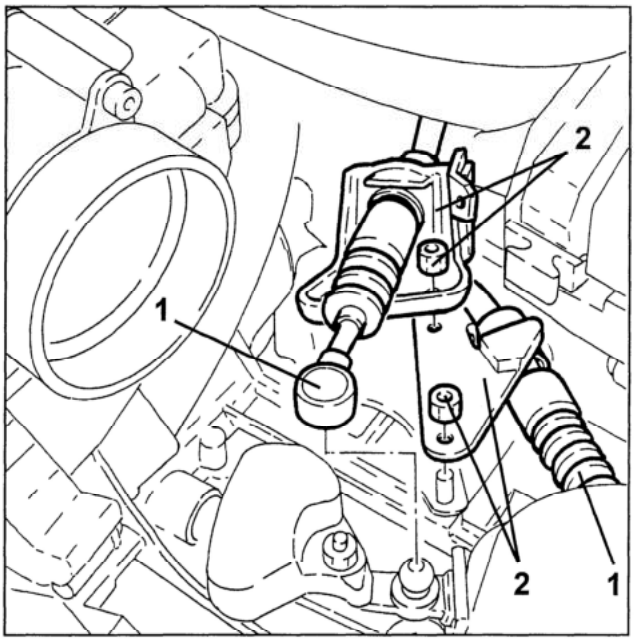
1. Loosen the fastening clips and remove the corrugated sleeve.



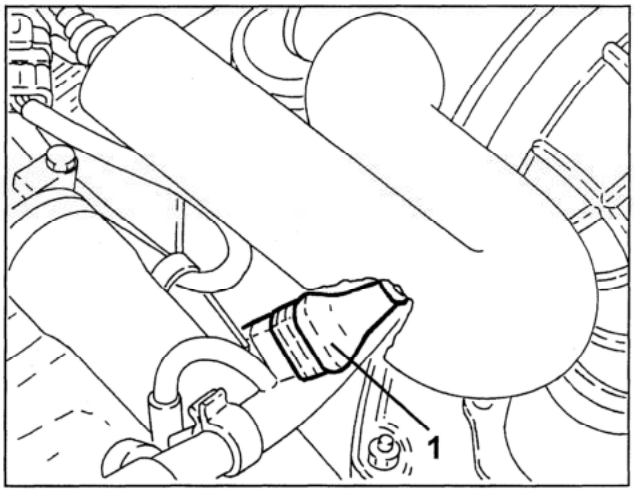

1. Release the electrical wiring from the bracket fastening clips.
2. Loosen the nut and remove the electrical wiring bracket.




1. Disconnect the gear selection and engagement wires.
2. Loosen the nuts and release the bracket and gear selection and engagement wires.




1. Disconnect the left-hand lambda sensor electrical connection.





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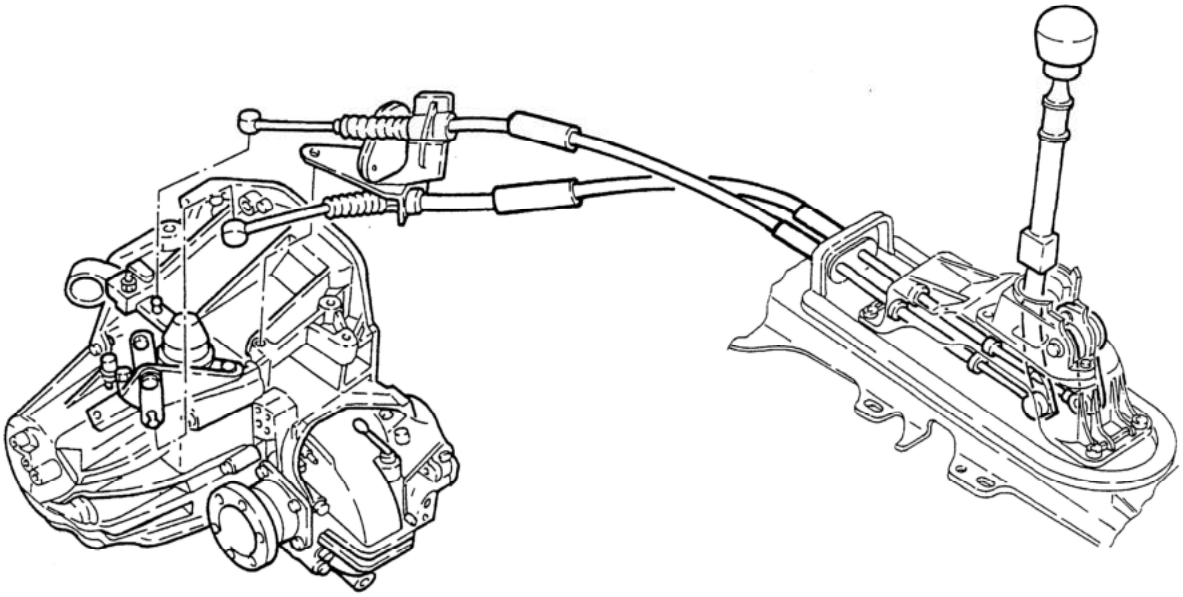
# GEARBOX EXTERNAL CONTROLS

## DESCRIPTION

The double wire external control is made with high-feature plastic material (fatigue resistant, self-lubricating, low-weight). This type of control, combined with inertia distribution towards the gearbox, ensures:

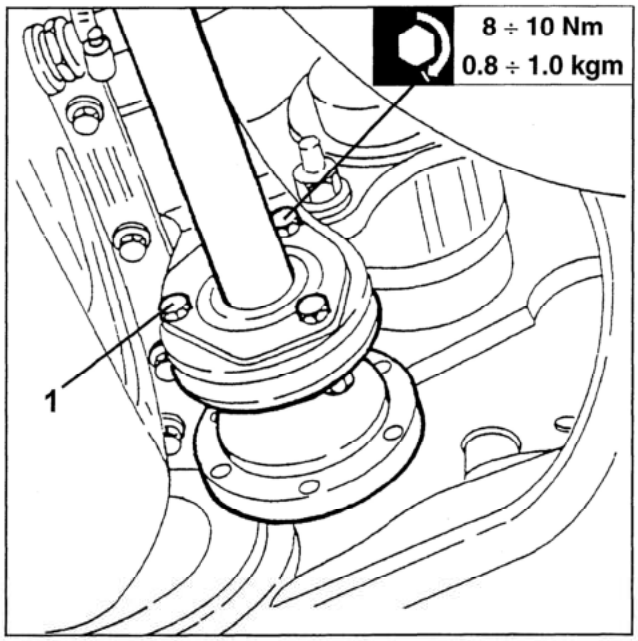
- high comfort, thanks to the vibration filtering action and light-weight external components
- accurate manoeuvres and reduced coupling play.

The external control is equipped with a reverse engagement stroke inhibiting device which ensures additional safety in preventing involuntary manoeuvres.

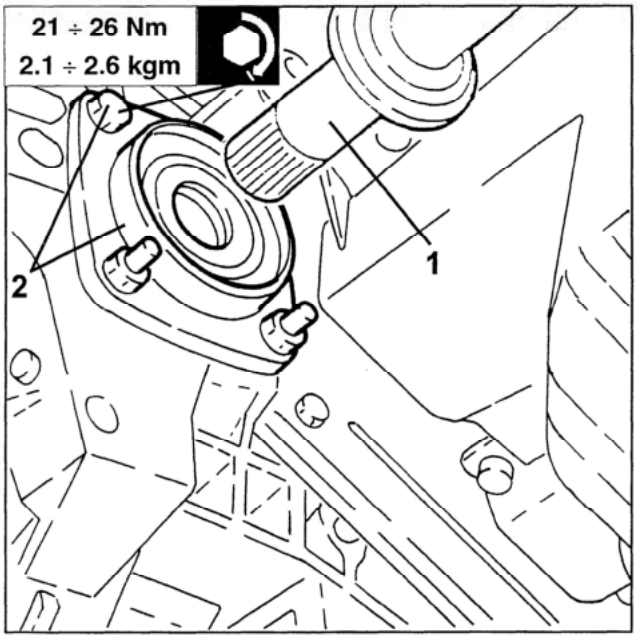



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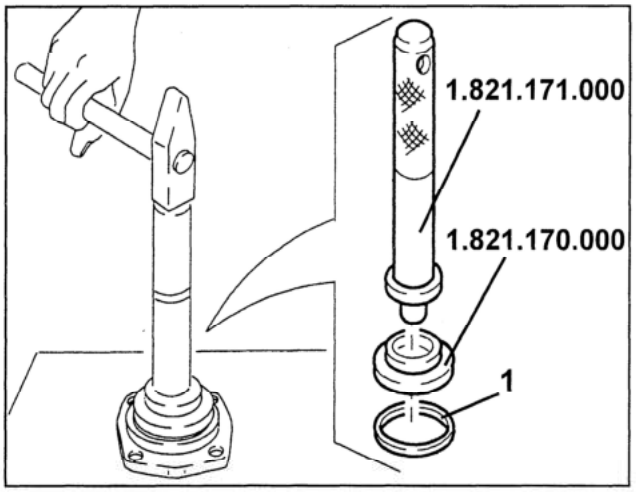
1. Loosen the intermediate shaft fastening screws.




1. Remove the intermediate shaft from the differential.
2. Loosen the fastening screws and remove the differential right-hand flange and oil seal.



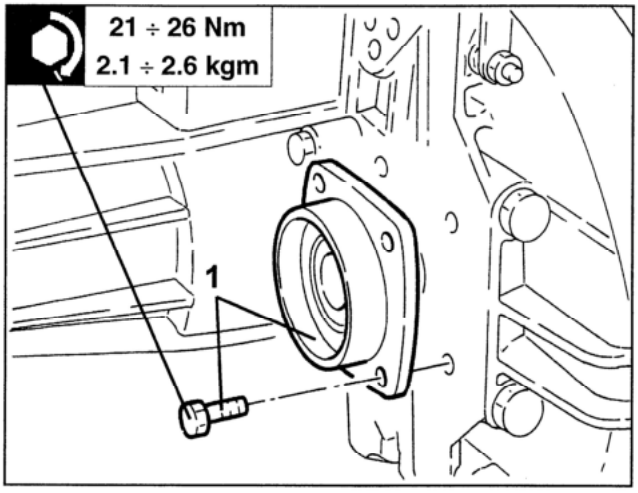

- At the bench, remove the oil seal from the differential right-hand flange.
1. Fit a new oil seal on the right-hand differential flange with tools no. 1.821.170.000 and no. 1.821.171.000.



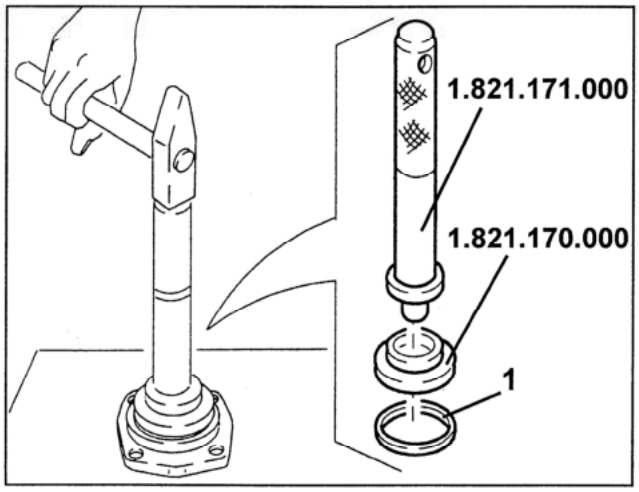

- Complete refitting by reversing the removal sequence.


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1. Loosen the fastening screws and remove the differential left-hand flange and oil seal.



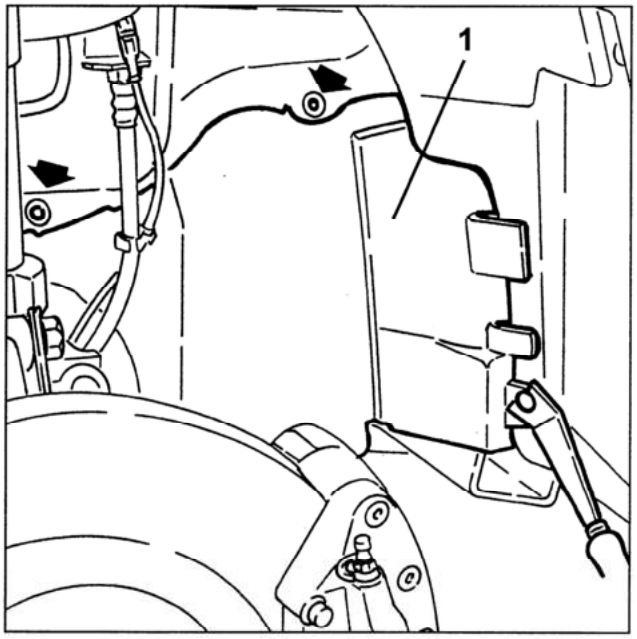

- At the bench, remove the oil seal from the differential left-hand flange.
1. Fit a new oil seal on the left-hand differential flange with tools no. 1.821.170.000 and no. 1.821.171.000.



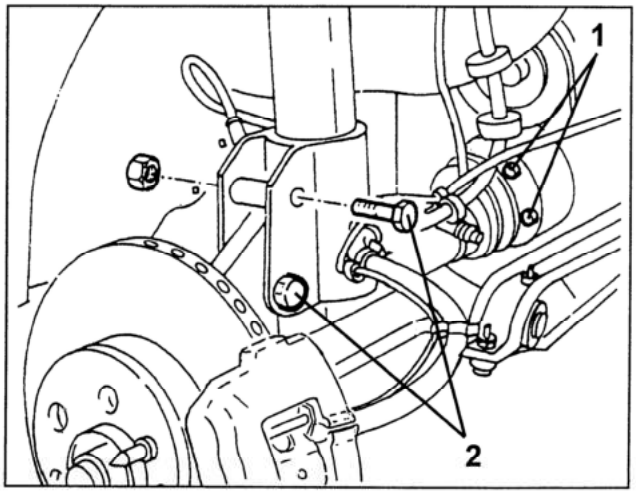

- Complete refitting by reversing the removal sequence.

## DIFFERENTIAL CASING OIL SEAL, ENGINE SIDE

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Remove the front right-hand wheel.
1. Remove the button, loosen the screws and remove the front right-hand wheel compartment dust guard.




- From the right-hand wheelhouse, disconnect the brake pad wear sensor electrical connection.
- Release the ABS inductive sensor wire from the bracket.
1. Loosen the two bolts fastening the right-hand drive shaft to the intermediate drive shaft.
2. Loosen the two bolts fastening the right-hand riser to the shock absorber, and remove only the upper bolt.
- Push the right-hand drive shaft just enough to disconnect it from the intermediate drive shaft.



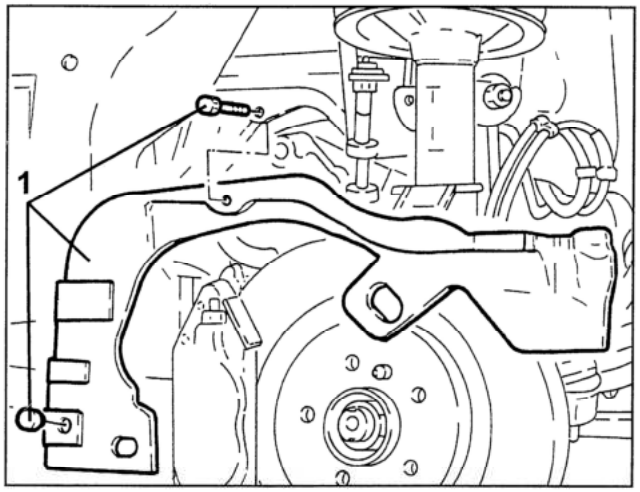

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## VEHICLE OPERATIONS

### DIFFERENTIAL CASING OIL SEAL, GEARBOX SIDE

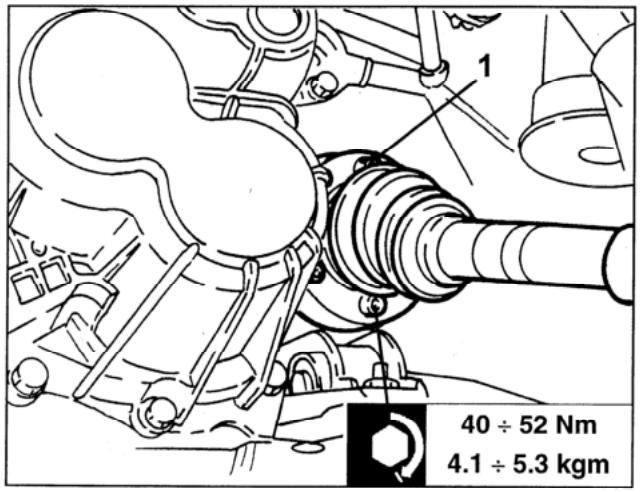
- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Remove the front left-hand wheel.

1. Remove the button, loosen the screws and remove the front left-hand wheel compartment dust guard.

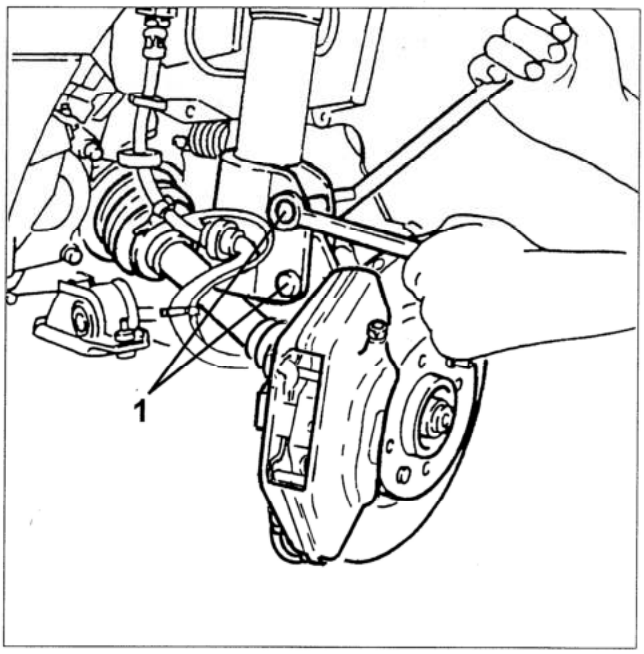



- From the left-hand wheelhouse, disconnect the brake pad wear sensor electrical connection.
- Release the ABS inductive sensor wire from the bracket.

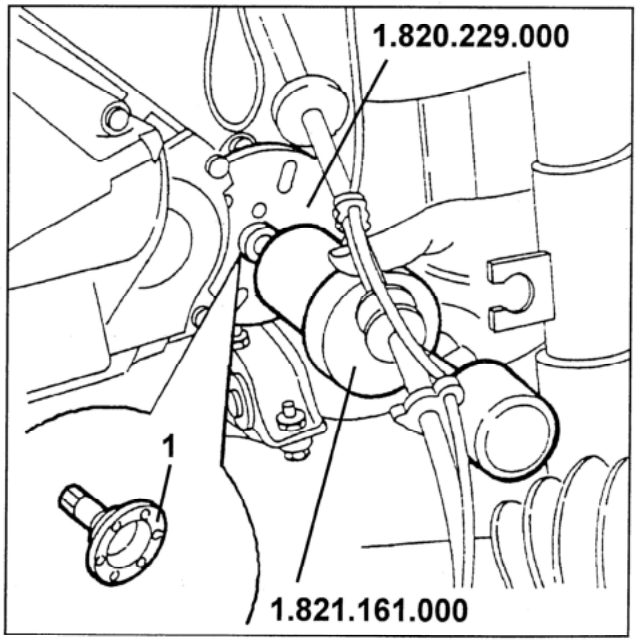
1. Loosen the bolts fastening the left-hand drive shaft to the internal differential shaft.



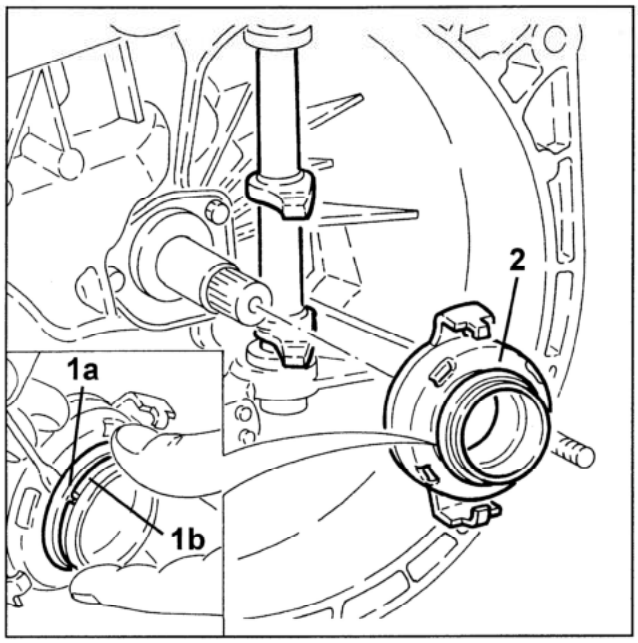

1. Loosen the two bolts fastening the left-hand riser to the shock absorber, and remove only the upper bolt.



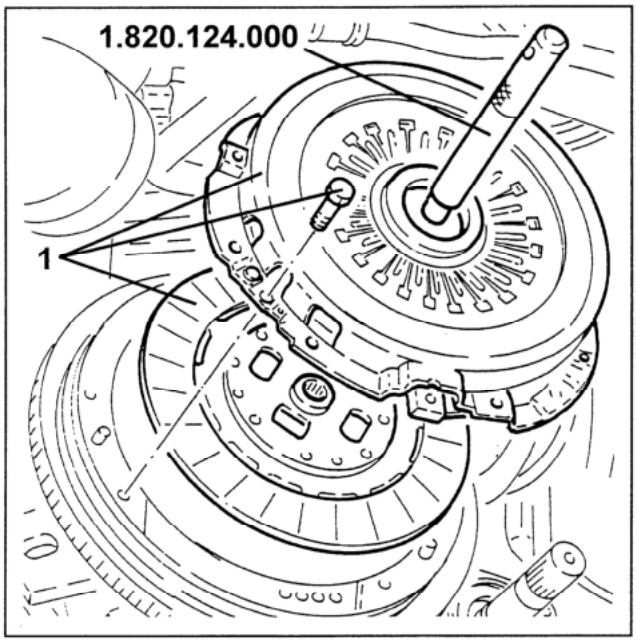

1. Use tools no. 1.820.229.000 and no. 1.821.161.000 to remove the differential internal drive shaft.



1. Lift the thrust bearing taper ring (1a) to cover spring (1b).
2. Fit the thrust bearing on the primary shaft and couple it with the fork pin.

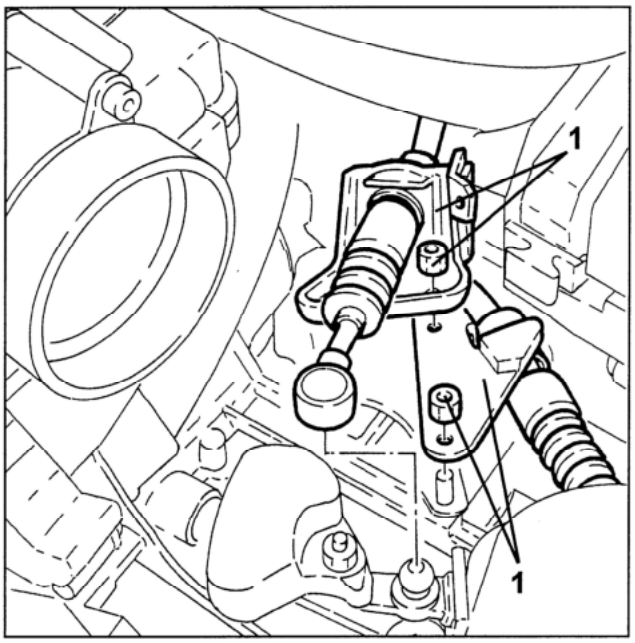



1. Fit the clutch plate and clutch frame centring them with tool no. 1.820.124.000.

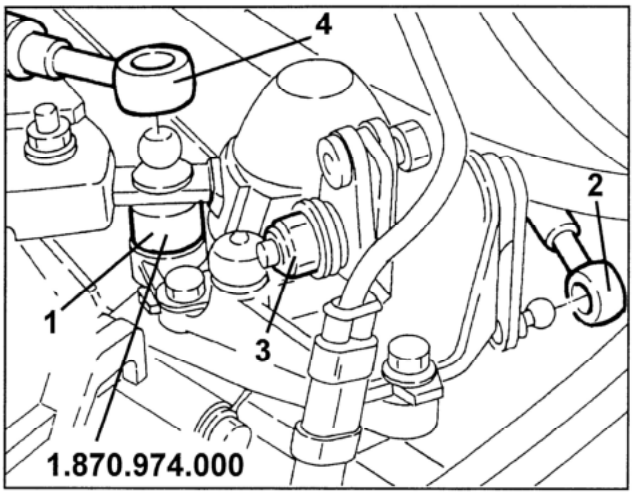



- After fitting the gearbox and fastening it with the respective screws, operate the clutch lever to engage the thrust bearing on the clutch.

- Complete refitting by reversing the removal sequence until the gear selection/engagement assembly step. Then adjust the gear selection/engagement wires as follows.
1. Position the bracket and gear selection/engagement wires. Fasten the respective nuts.



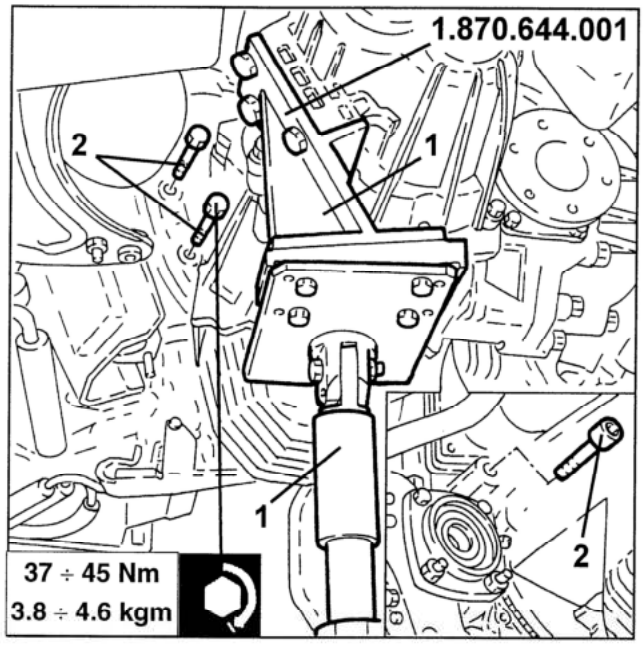

1. Fit tool no. 1.870.974.000 under the gear engagement wire ball coupling.
2. Connect the gear selection wire.
3. Loosen the gear selection/engagement assembly adjustment nut.
- Torque the gear selection/engagement assembly adjustment nut after positioning the gear lever in neutral and shifting it all to the right.
4. Connect the gear engagement wire.
- Position the gear lever in reverse and remove tool no. 1.870.974.000.



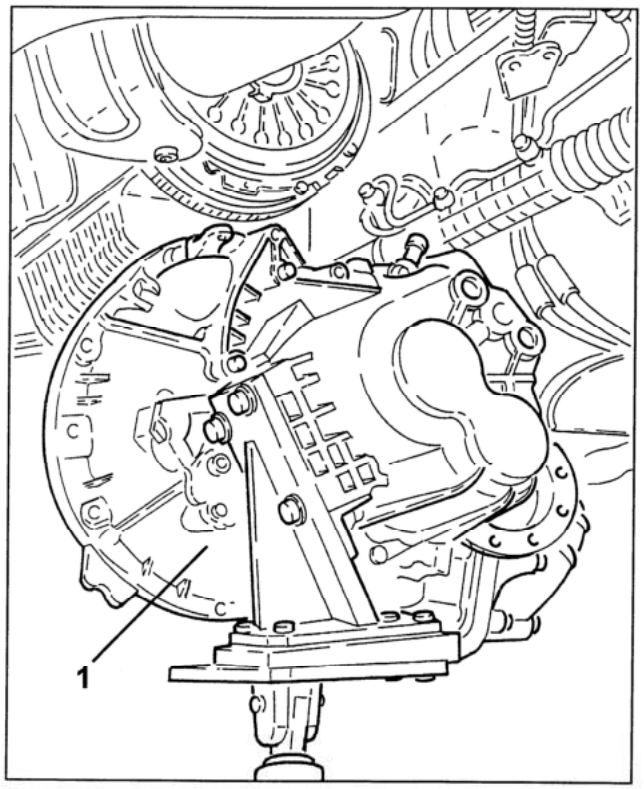

- Complete refitting by reversing the removal sequence.

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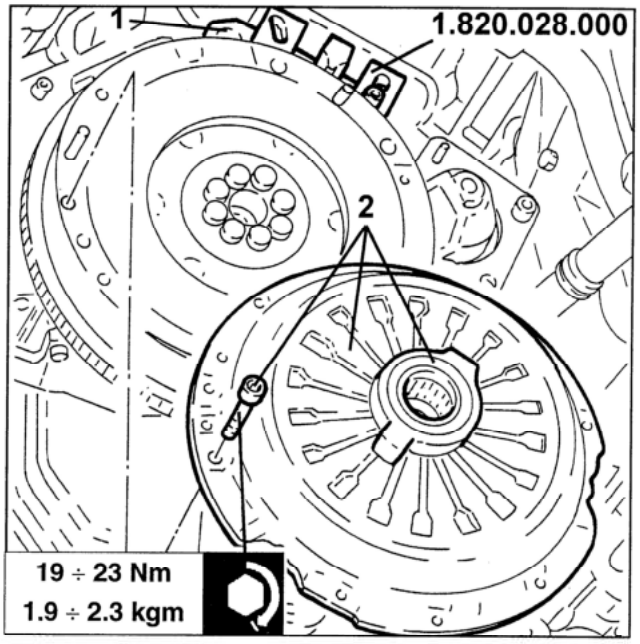
1. Support the gearbox-differential with a hydraulic jack and tool no. 1.870.644.001.
2. Loosen the remaining lower gearbox-differential fastening screws.



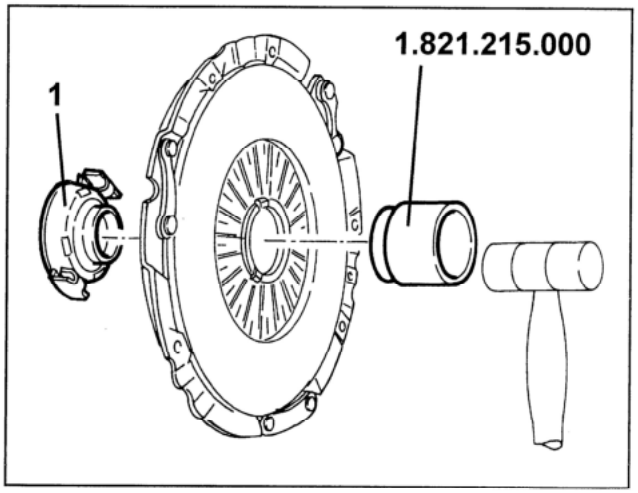

1. Lower the hydraulic jack and remove the gearbox-differential assembly.



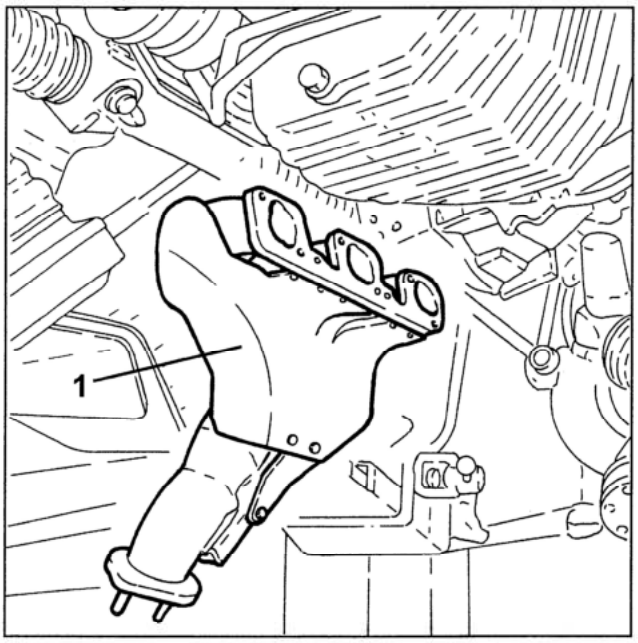

1. Fit flywheel retainer tool no. 1.820.028.000.
2. Loosen the screws and remove the clutch frame with thrust bearing and clutch plate.



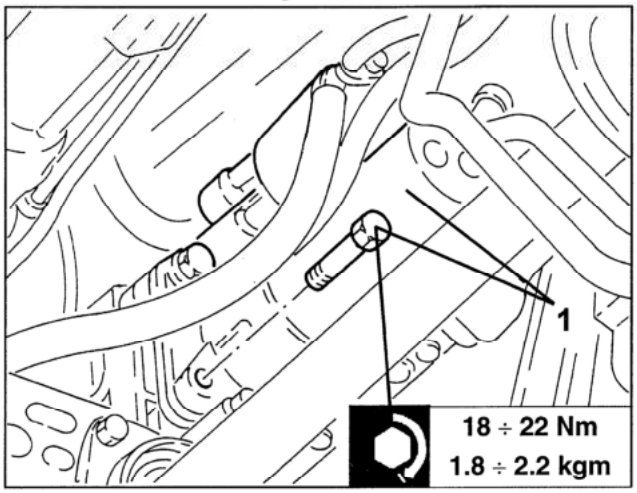

Attain to the following precautions when refitting.
1. Remove the thrust bearing from the clutch frame with tool no. 1.821.215.000.



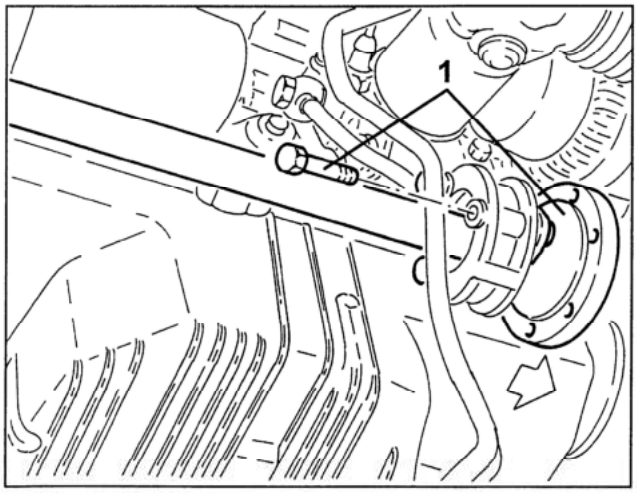
1. Remove the right-hand exhaust manifold.



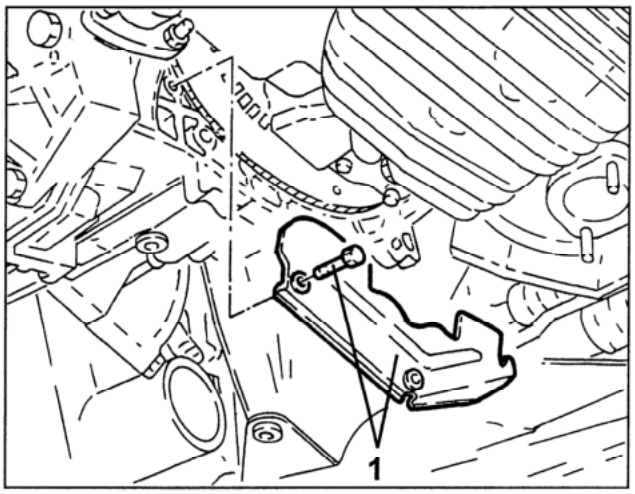

1. Loosen the fastening screws and release the starter motor from the gearbox.



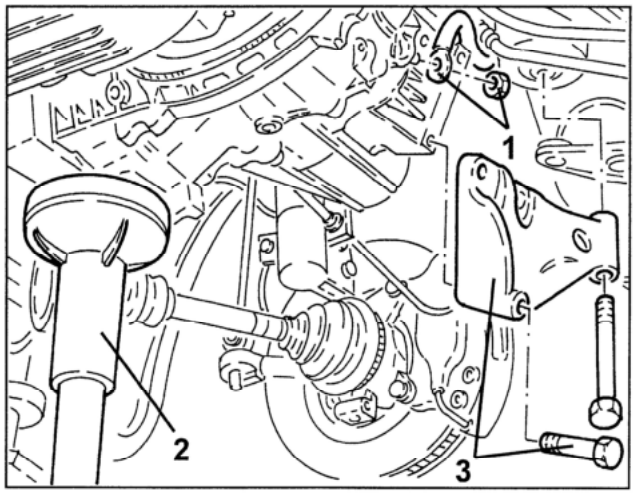

1. Loosen the fastening screws and remove the intermediate drive shaft.




1. Loosen the fastening screws and remove the flywheel guard.

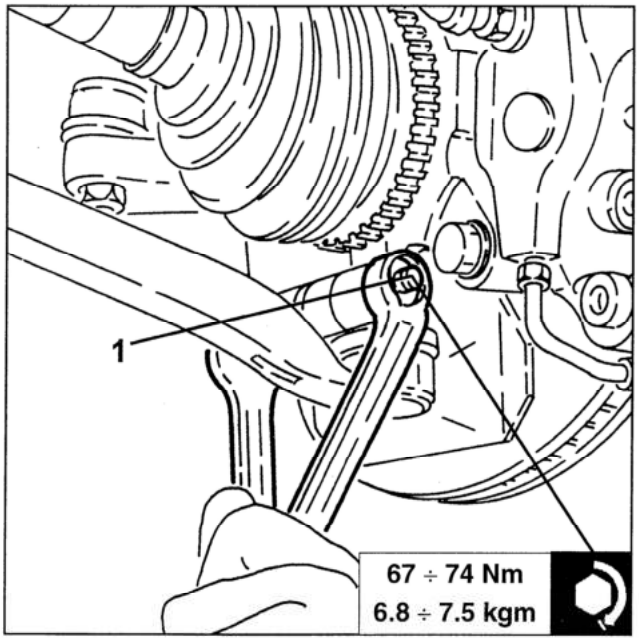



1. Disconnect the gearbox earth braid.
2. Position a hydraulic jack under the differential.
3. Loosen the screws and remove the gearbox bracket, engine side.
- Remove the hydraulic jack from under the differential.

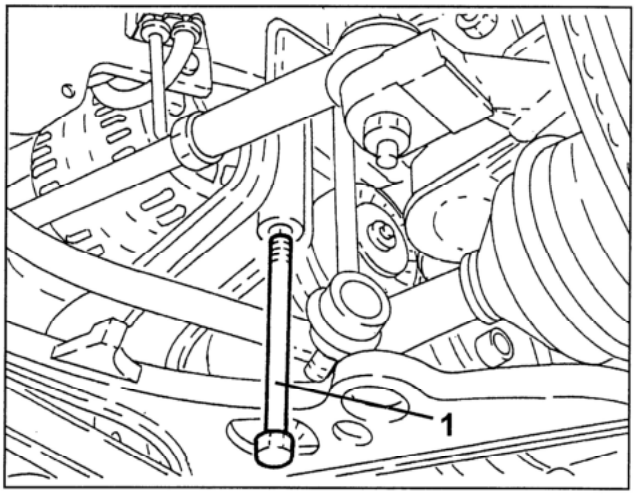



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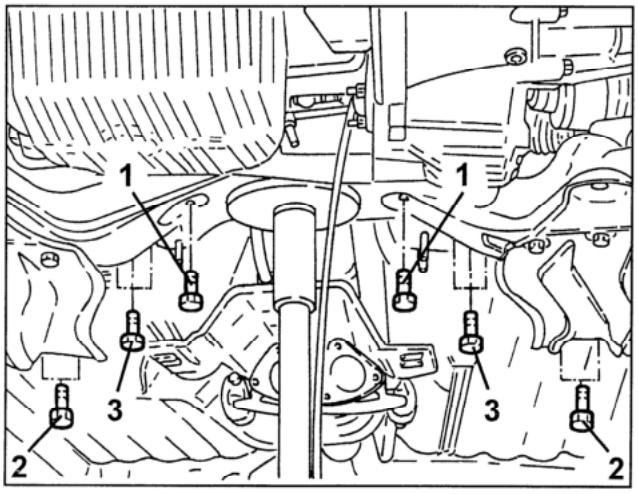
1. Loosen the bolts fastening the wishbones to the wheel risers.



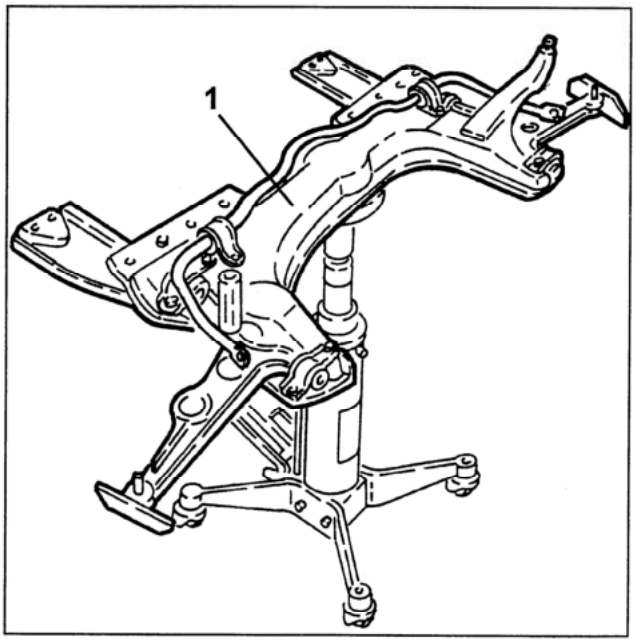

1. Loosen the side screws fastening the crossmember to the underbody.



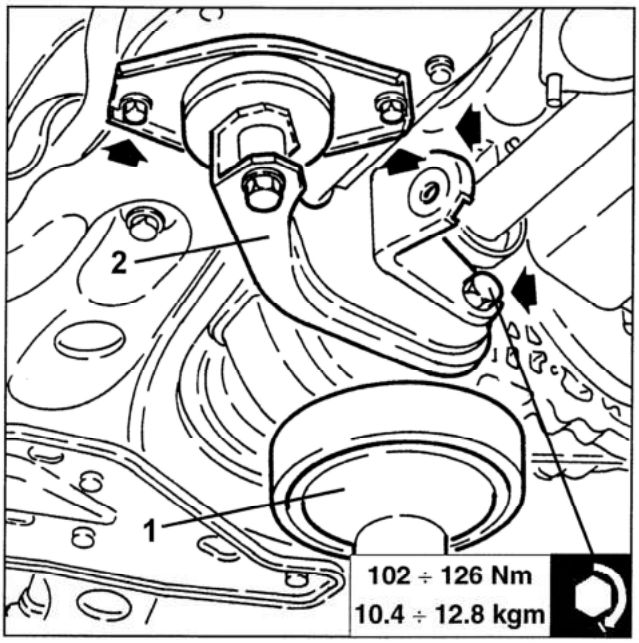

1. Loosen the screws fastening the power steering unit to the crossmember.
2. Loosen the rear screws fastening the crossmember to the underbody.
3. Loosen the central screws fastening the crossmember to the underbody.



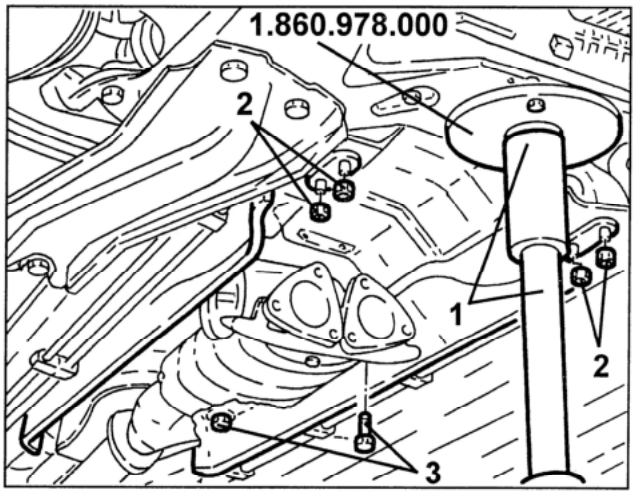

1. Lower the hydraulic jack and remove the crossmember with wishbone, stabiliser bar and reinforcements.



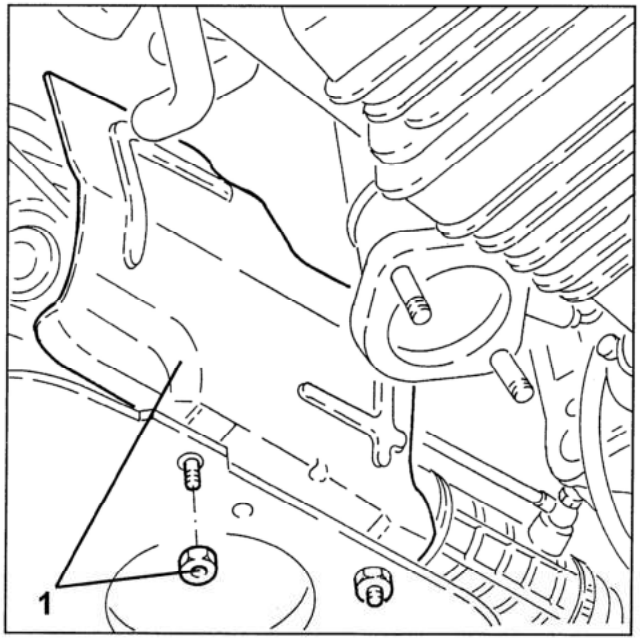
1. Position a hydraulic jack under the differential.
2. Loosen the fastening screws and remove the complete engine rear mount.
- Remove the hydraulic jack from under the differential.



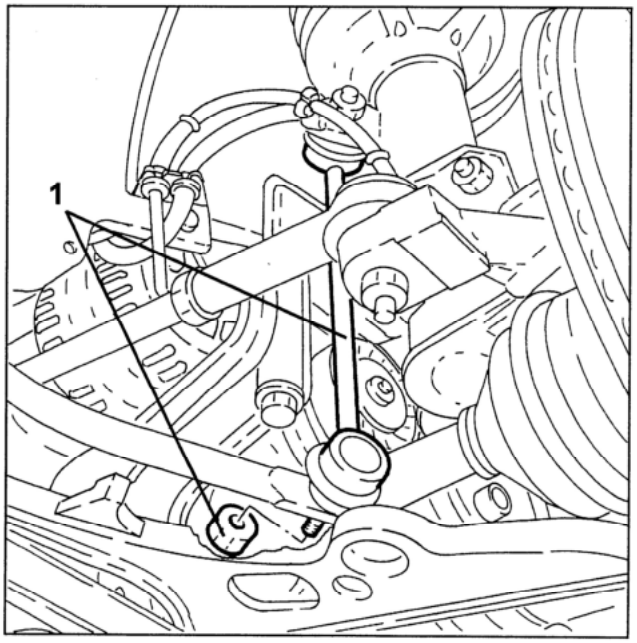

1. Use a hydraulic jack to support the crossmember by means of tool no. 1.860.978.000.
2. Loosen the gear lever bracket front fastening nuts.
3. Loosen the rear screws and loosen the remaining gear lever screws.



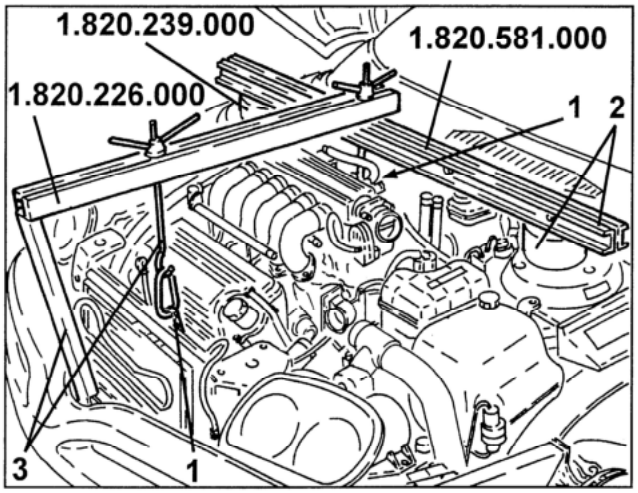

1. Loosen the fastening nuts and remove the power steering unit firewall.



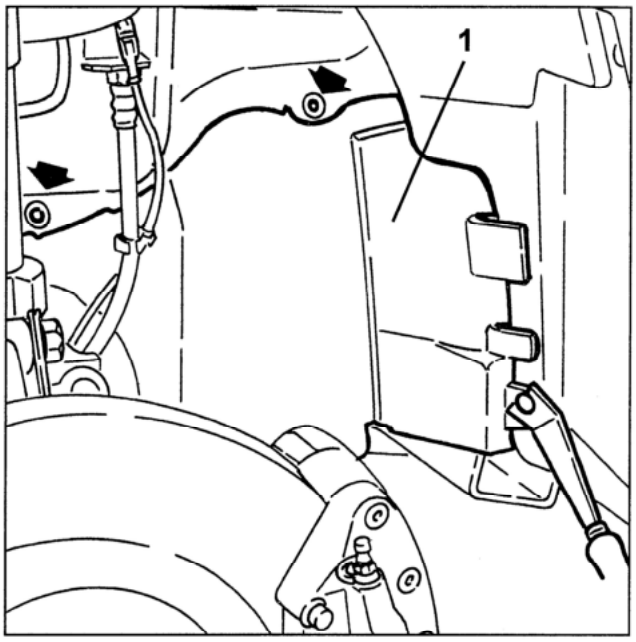

1. Loosen the nuts and disconnect the stabiliser bar tie-rods.



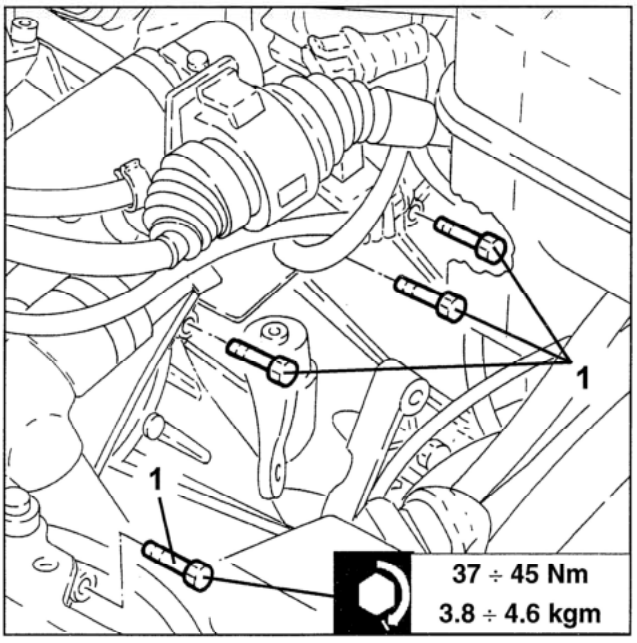
1. Fit the two specific engine brackets on the cylinder heads.
2. Fit crossmember no. 1.820.581.000 with brackets no. 1.820.239.000.
3. Fit bracket no. 1.820.226.000 and connect the respective tie-rods to the brackets previously fitted on the cylinder heads.



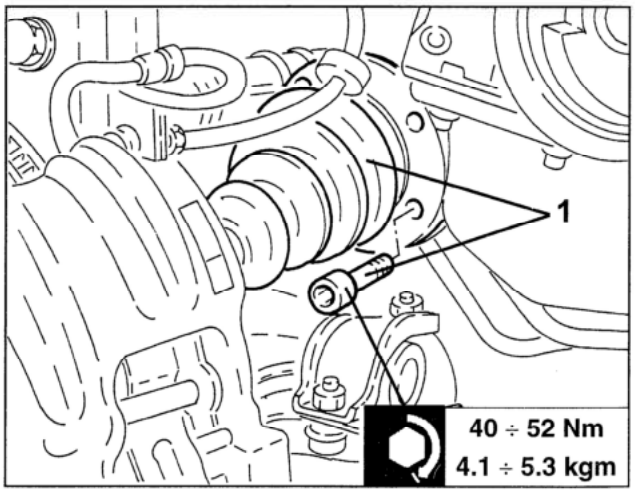

1. Remove the button, loosen the screws and remove the dust guard from the right-hand front wheel compartment.



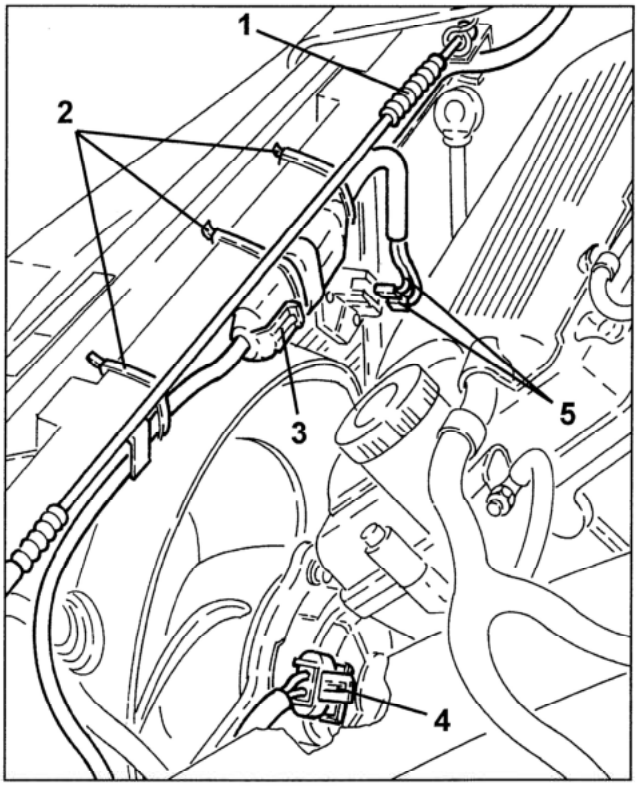

1. Loosen the upper screws fastening the gearbox-differential to the engine.



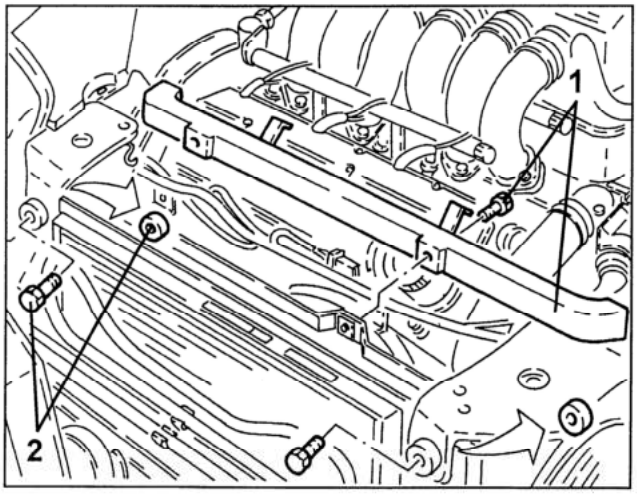

1. Loosen the fastening bolts and disconnect the drive shafts.



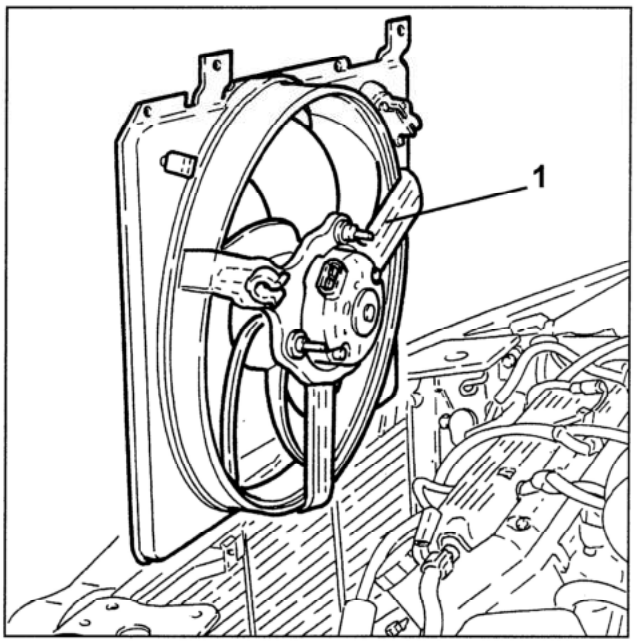
1. Disconnect the bonnet lock wire and move it aside.
2. Release the electrical wiring from the fastening clips and the duct.
3. Disconnect the electrical connection.
4. Disconnect the engine cooling fan electrical connection.
5. Disconnect the engine cooling fan resistor electrical connection and move the electrical wiring aside.



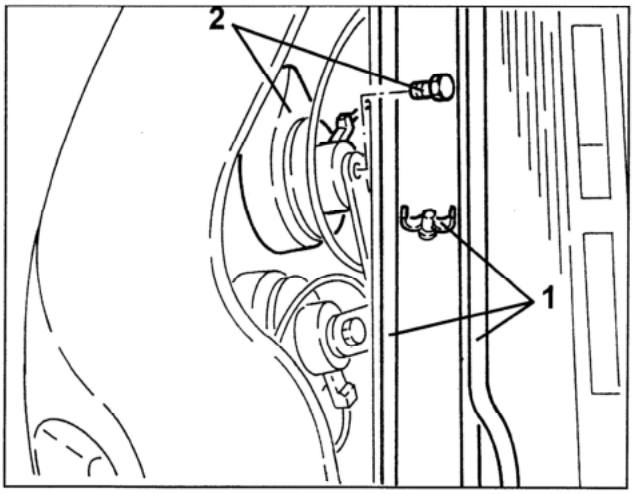

1. Loosen the screws and remove the electrical wiring duct.
2. Loosen the two upper engine cooling radiator fastening screws and take the respective shims.




1. Move the radiator from the engine just enough to remove the engine cooling fan.



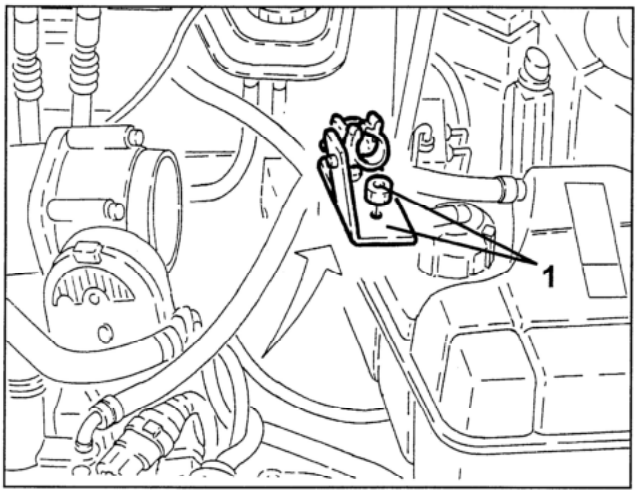

1. Release the power steering cooling serpentine from the fasteners on the underbody front crossmember.
2. Loosen the fastening screw and move the right-hand horn aside.



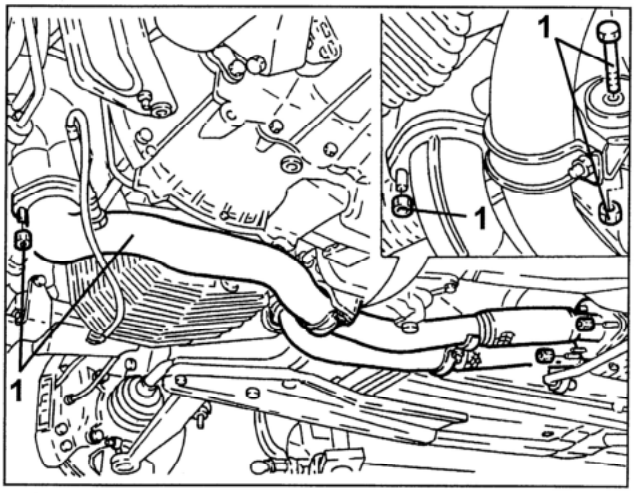



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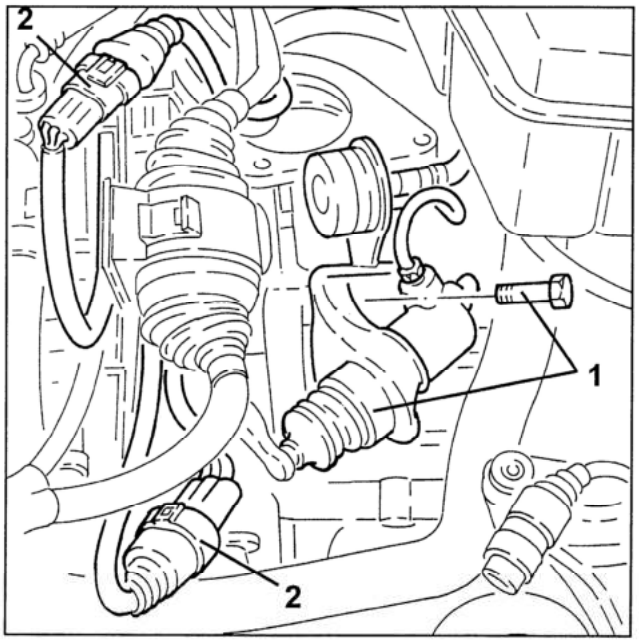
- Release the starter motor power wiring from the fastening clips and move it aside.
1. Loosen the fastening nut and remove the starter motor wiring bracket.




1. Loosen the fasteners and remove the exhaust pipe front section.

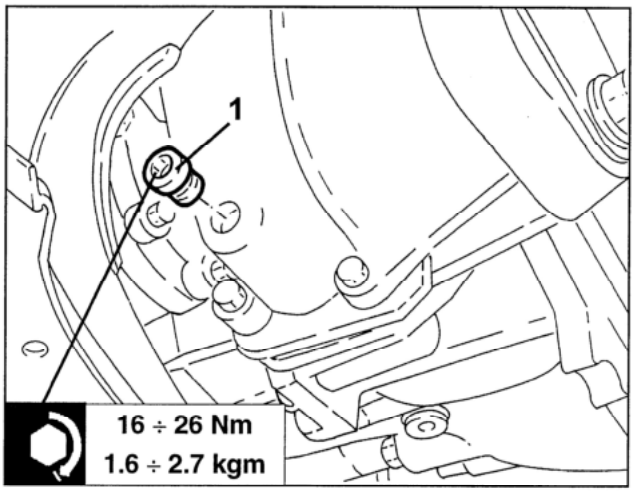



1. Loosen the fastening screws and move the bracket with clutch cylinder and vibration damper aside without disconnecting the respective pipes.
2. Disconnect the lambda sensor electrical connections and release the electrical wiring from the fastening clips.



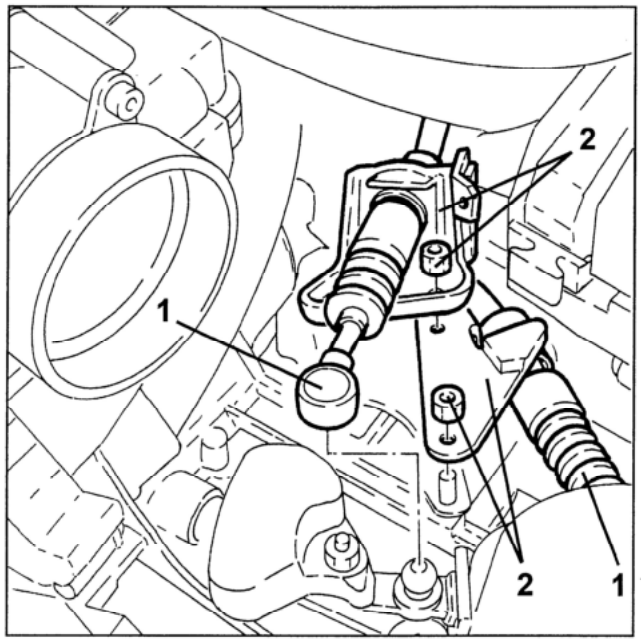

1. Loosen the cap and drain the gearbox-differential oil.

**NOTE: Collect the oil in a suitable container.**

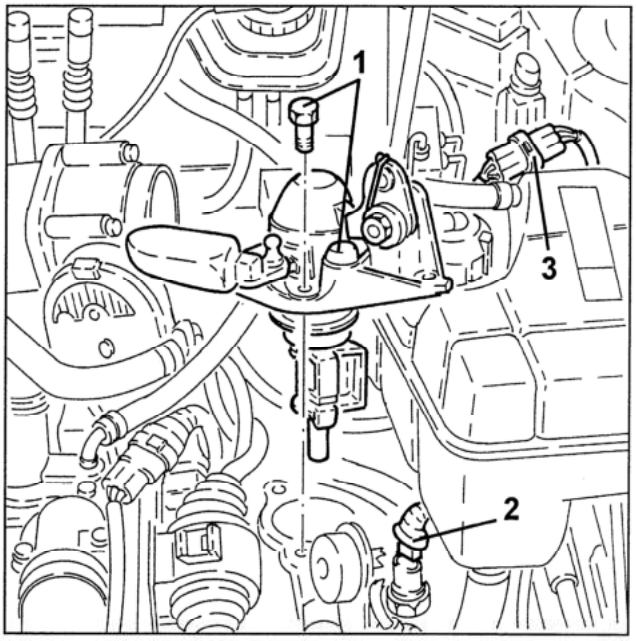



- Loosen the nuts fastening the right-hand exhaust manifold to the cylinder heads.

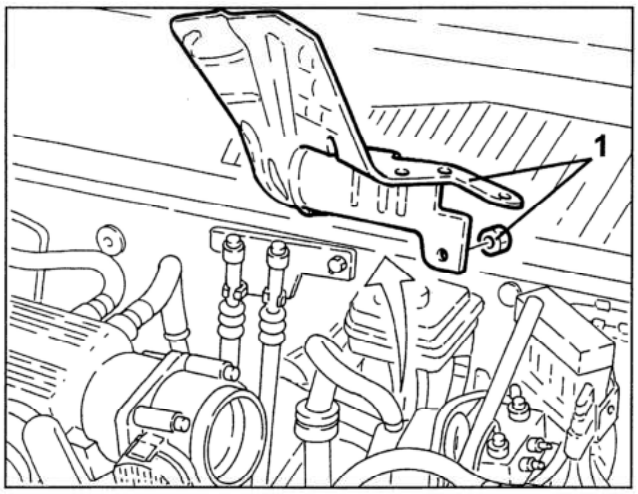
1. Disconnect the gear selection and engagement wires.
2. Loosen the nuts and move the brackets and selection/engagement wires aside.



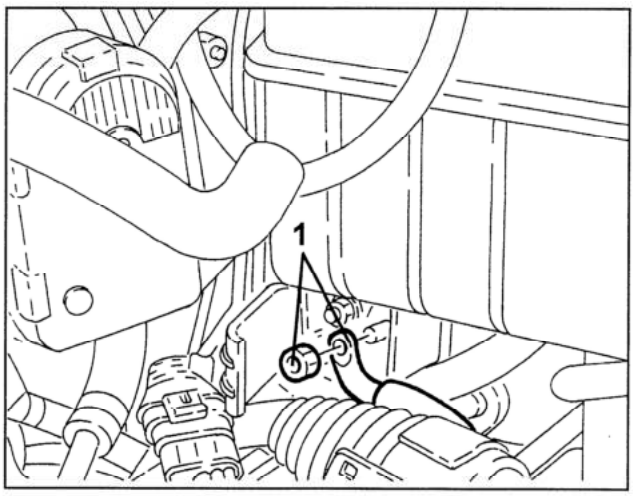

1. Loosen the screws and remove the gear selection and engagement assembly.
2. Disconnect the reversing light switch electrical connection.
3. Disconnect the starter motor power electrical connection.




1. Loosen the nut and remove the upper firewall from the right-hand exhaust manifold.



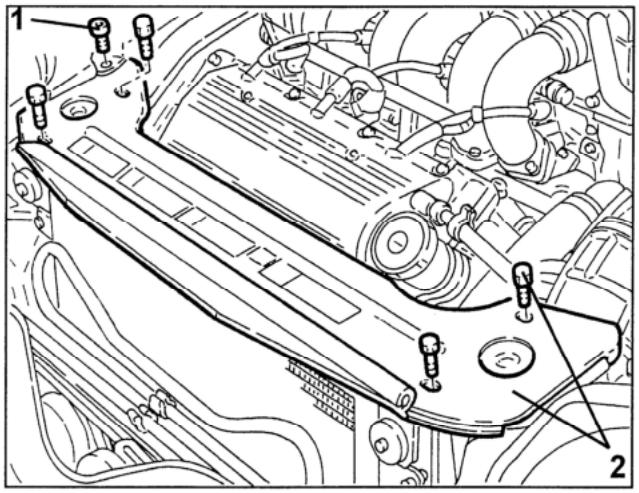

1. Open the junction unit and disconnect the starter motor power wire.



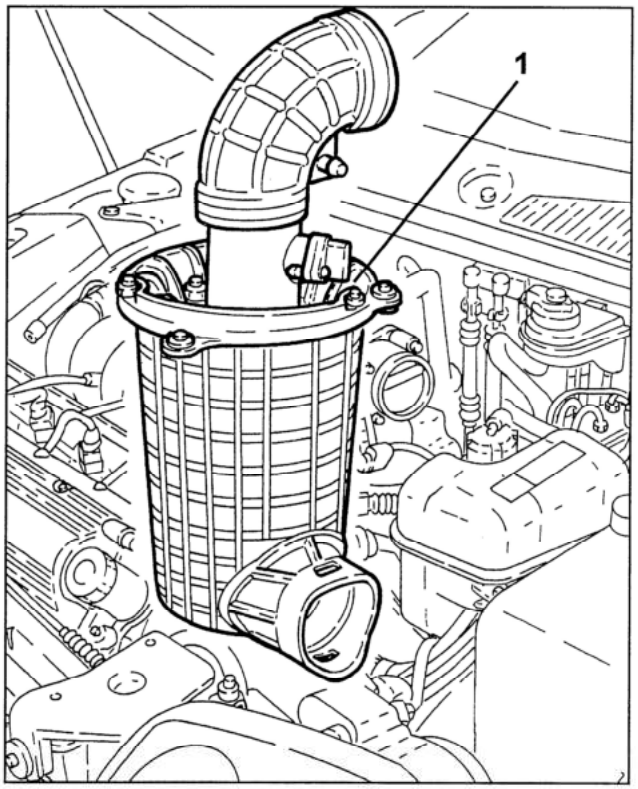



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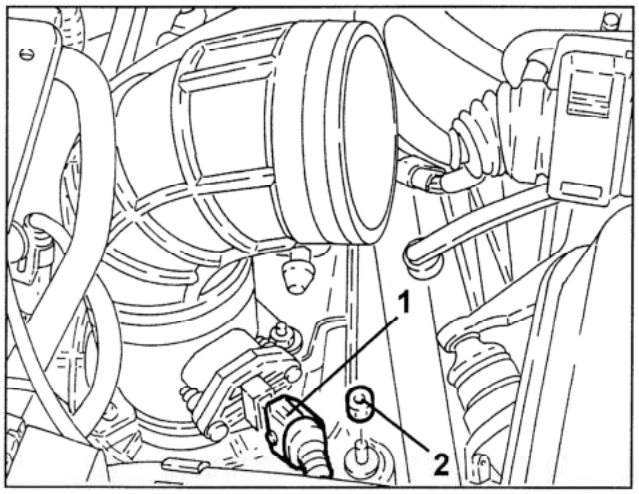
- Release the engine cooling fan from the fastenings on the upper radiator crossmember.
1. Loosen the screw fastening the right-hand side engine compartment guard to the upper radiator crossmember.
2. Loosen the fastening screws and remove the upper radiator crossmember.



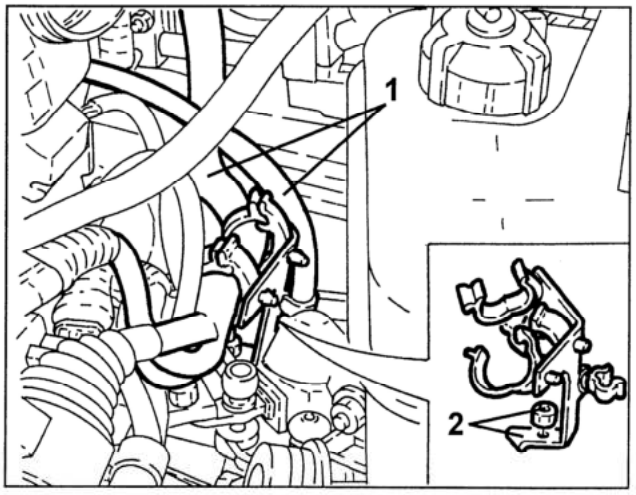

- Release the air cleaner from the lower resonator sleeve.
1. Remove the complete air cleaner.




1. Disconnect the air flow meter electrical connection.
2. Loosen the air cleaner fastening nuts.




1. Release the electrical wiring from the fastening clips on the bracket.
2. Loosen the fastening nut and remove the electrical wiring bracket.

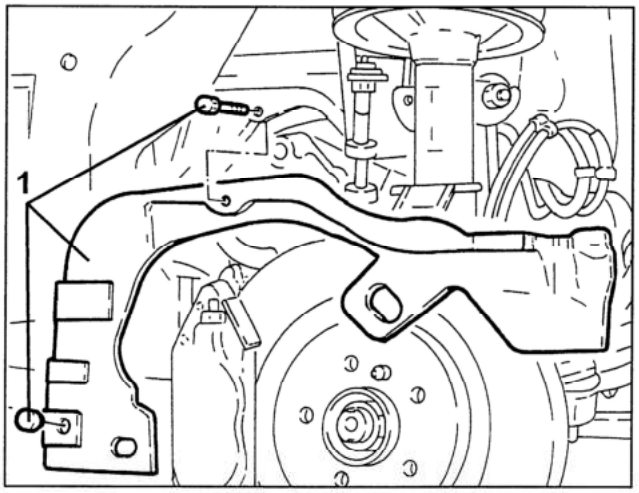


# GEARBOX ASSEMBLY

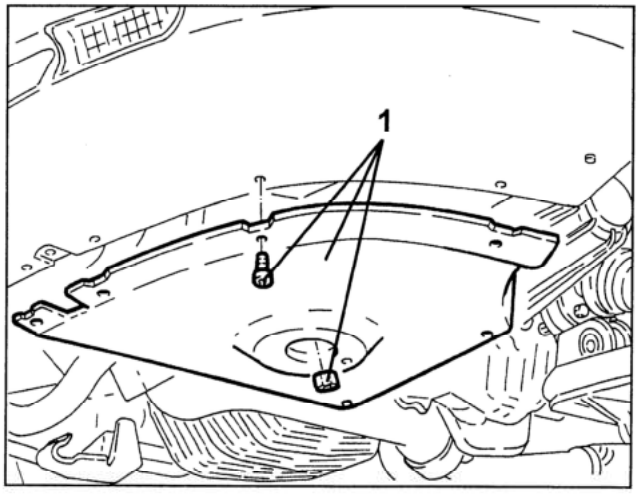
## REMOVAL/REFITTING

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Remove the front wheels.

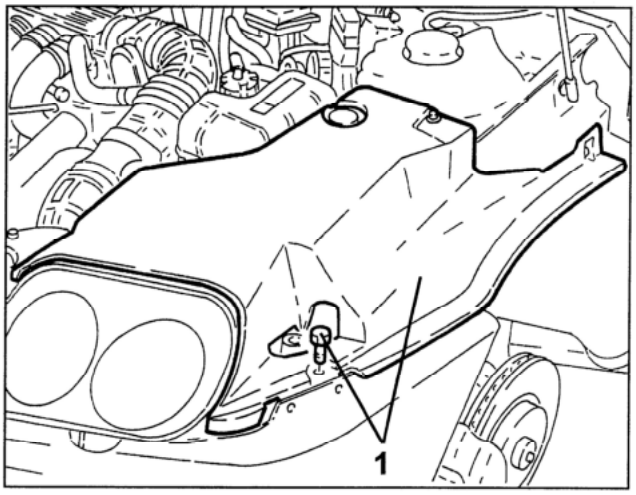
1. Remove the button, loosen the screws and remove the front left-hand wheel compartment dust guard.



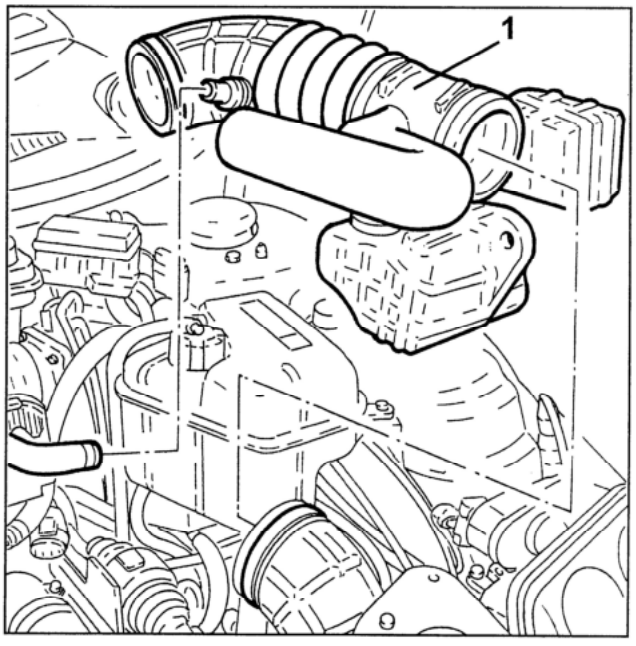

1. Loosen the screws and the nut and remove the lower air cleaner guard.




1. Loosen the screws and remove the left-hand side engine compartment guard.

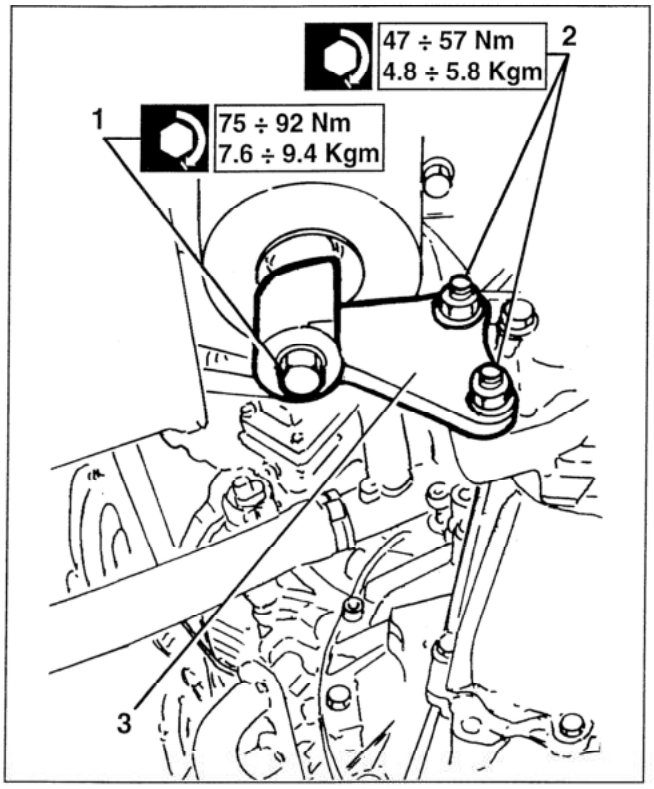



1. Loosen the clips and remove the corrugated sleeve and resonators after releasing the intermediate resonator from the fastening pin.

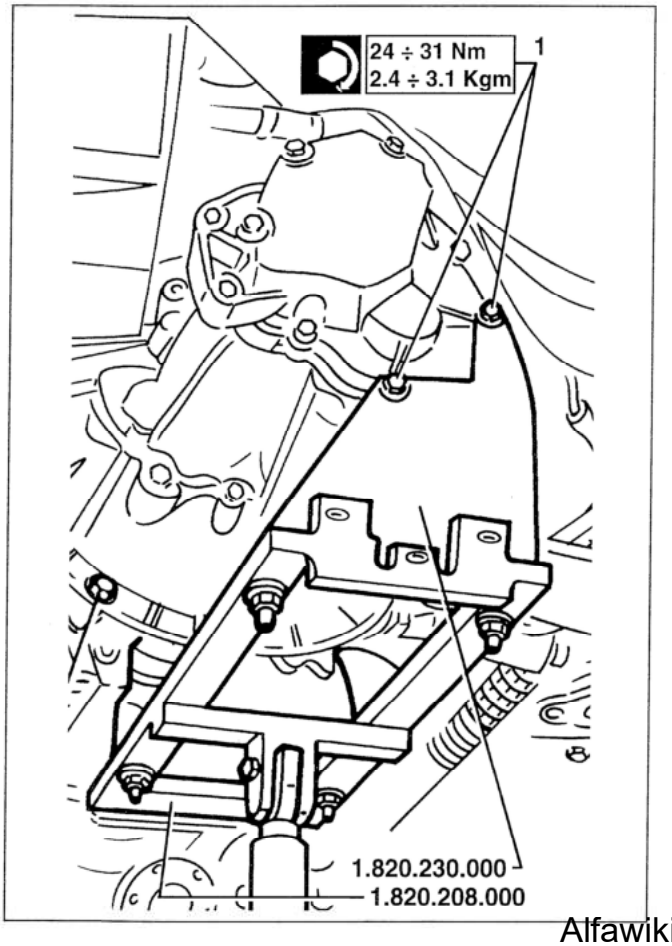




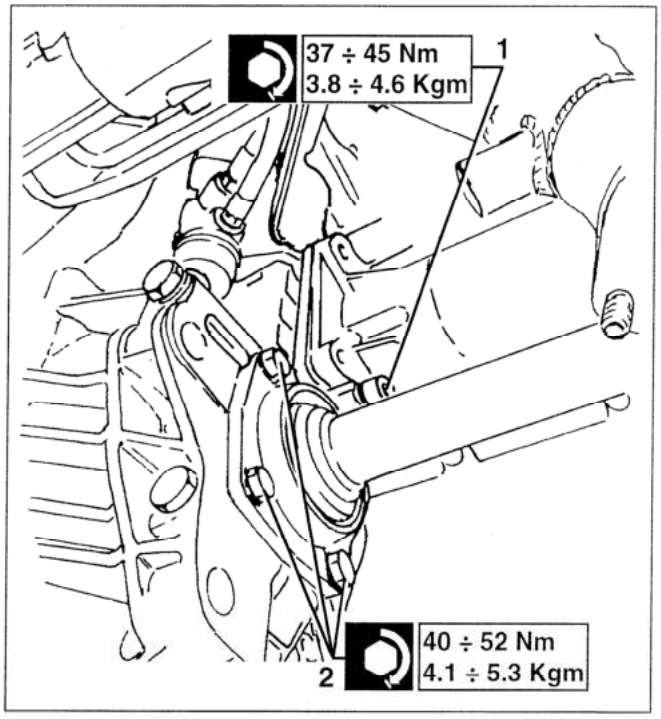
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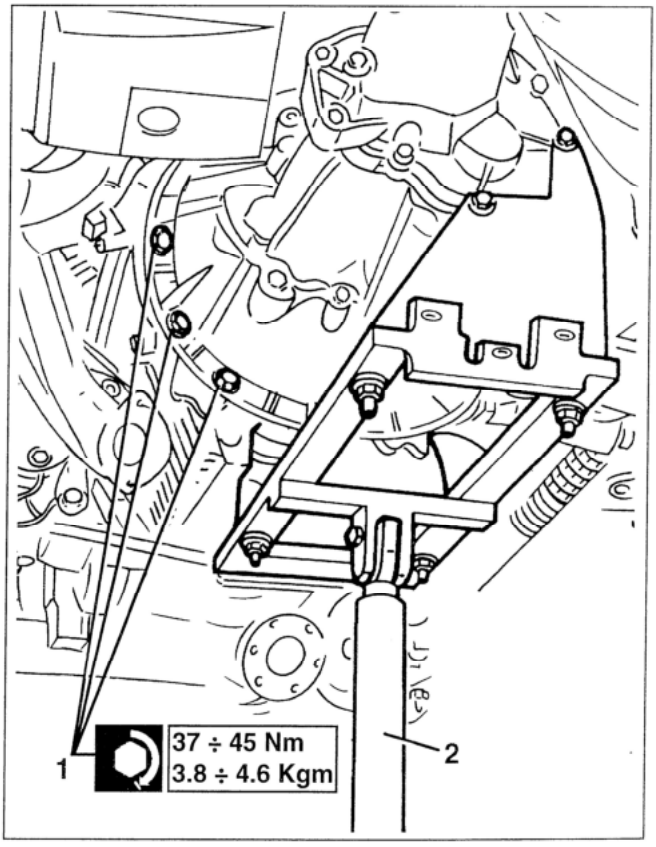

1. Slacken two of the gearbox cover fastening screws and fasten brackets no. 1.820.230.000 and no. 1.820.208.000.
2. Use a hydraulic lift to support the gearbox unit.




1. Slacken the rear Allen screw fastening the engine-gearbox.
2. Slacken the four screws fastening the layshaft support to the differential.

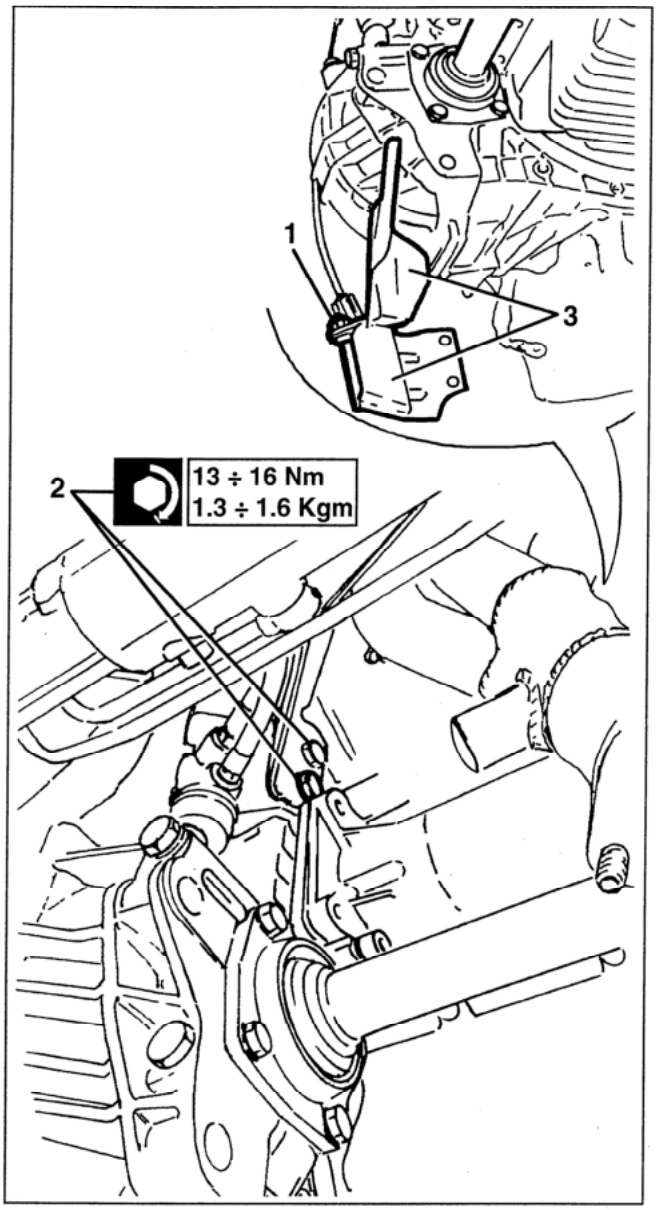



1. Slacken the three remaining screws fastening the gearbox to the engine.
2. Move away the gearbox from the engine and lower it using the hydraulic jack.

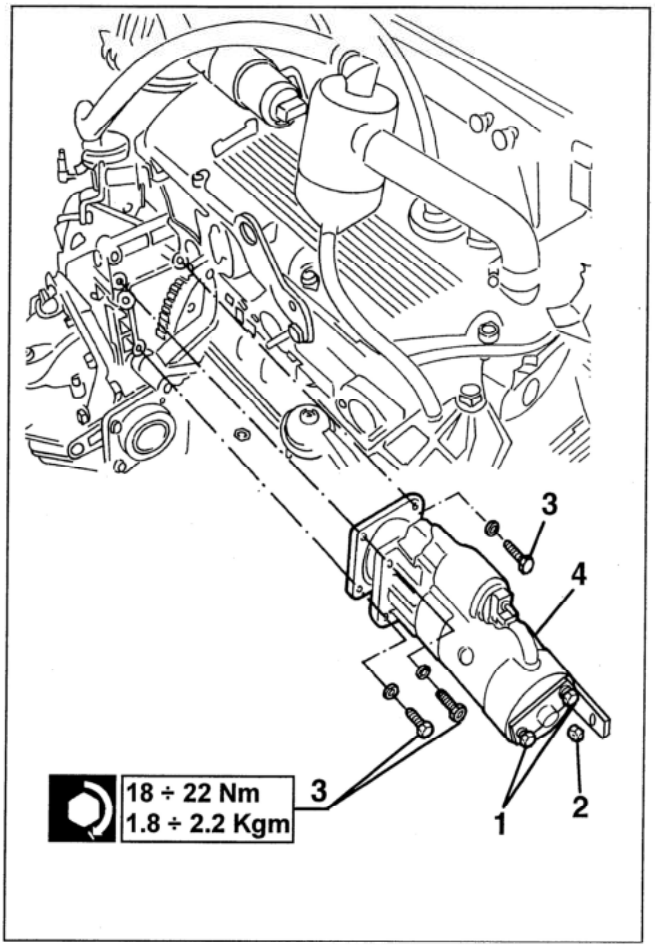



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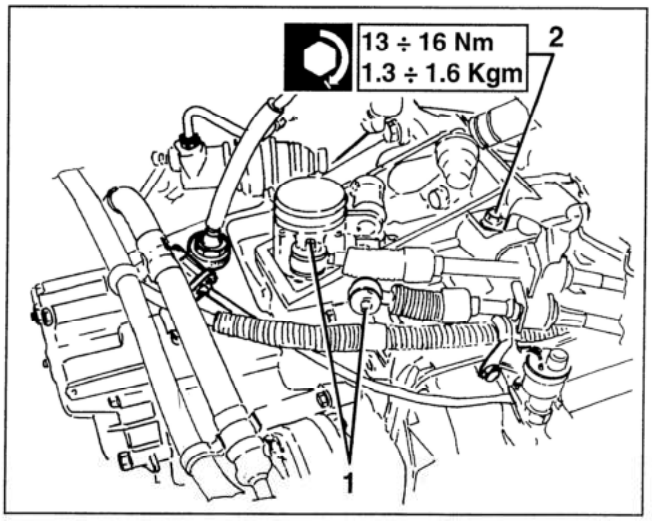
1. Slacken the two nuts fastening the upper gearbox control cable cover.
2. Slacken the two screws fastening the lower gearbox control cable cover.
3. Retrieve the two covers.




1. Slacken the two nuts fastening the rear starter motor.
2. Slacken the nut fastening the square.
3. Slacken the starter motor fastening screws.
4. Retrieve the starter motor complete with square.

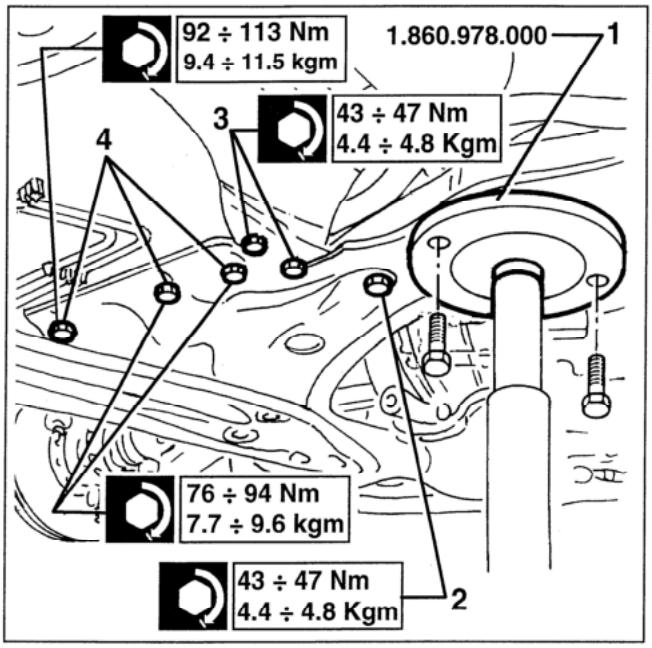



– Work from above.
1. Remove the retainer clips and withdraw the gear control cables from the pin.
2. Slacken the upper screw of the gearbox control cable support bracket.

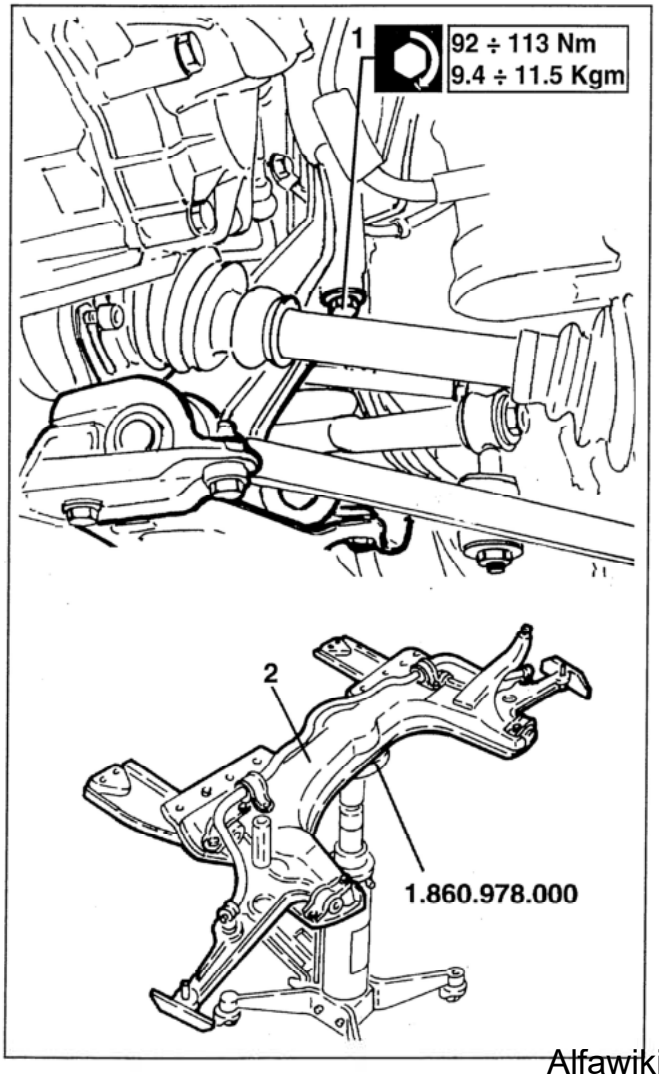



1. Slacken the screw fastening the gearbox rear support.
2. Slacken the nuts fastening the support to the gearbox.
3. Remove the support.

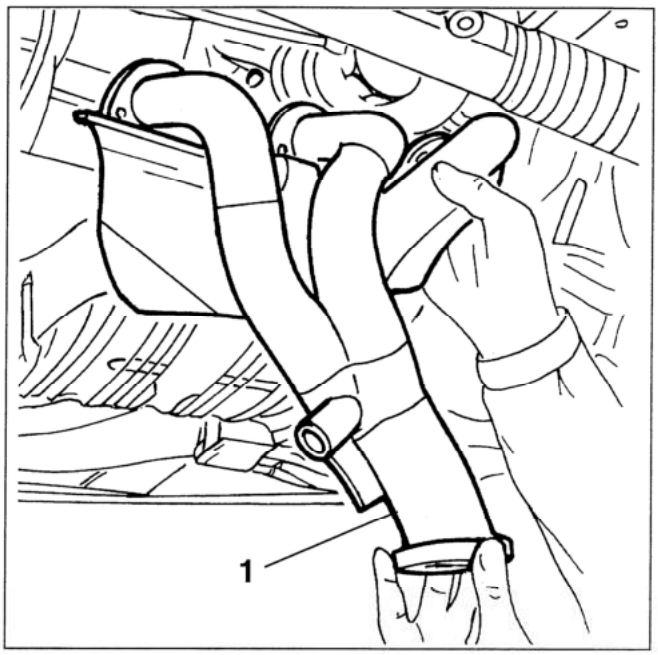
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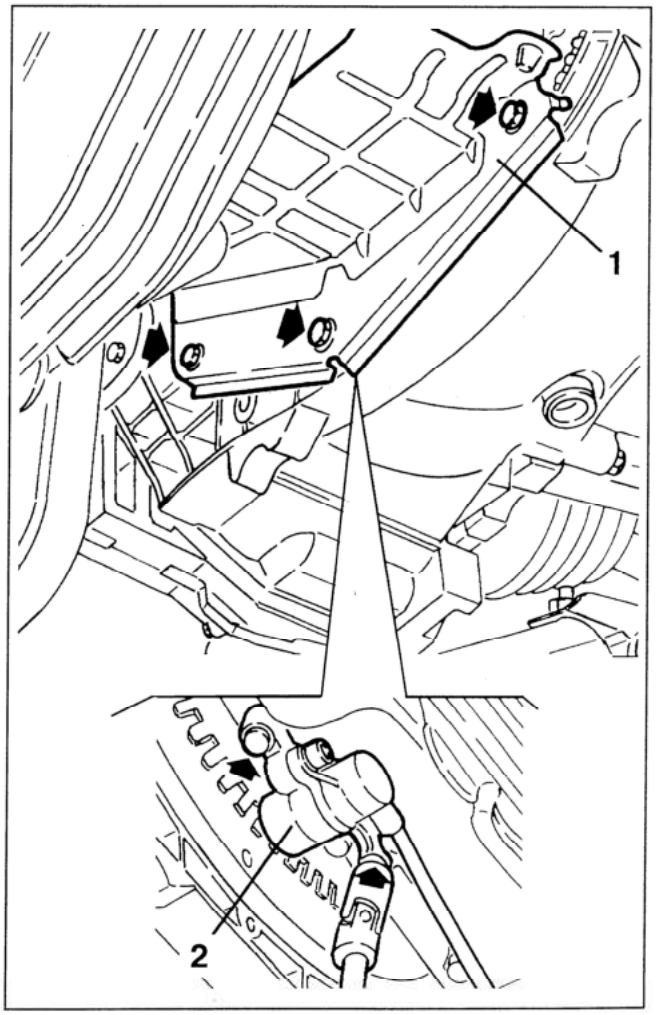

1. Slacken the upper crossmember fastening screw on each side.
2. Slowly lower the hydraulic jack and remove the crossmember complete with wishbones and stabiliser bar.




1. Retrieve the exhaust manifold complete with heat shield.

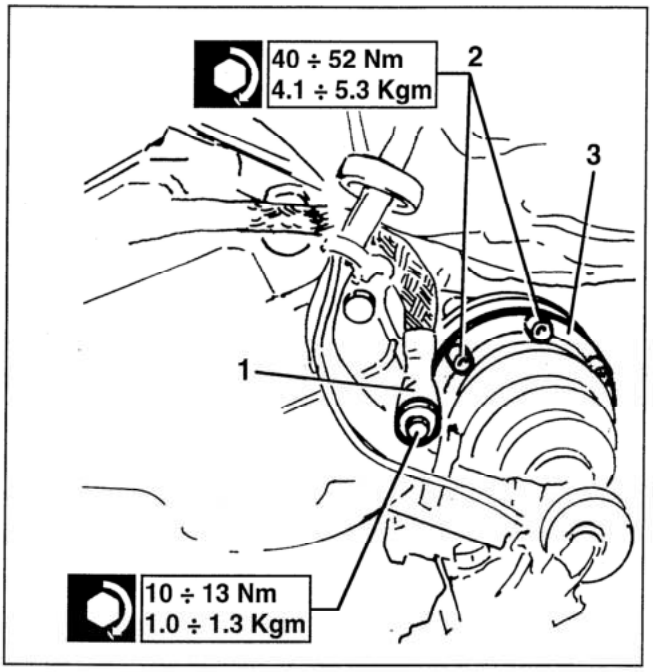



1. Slacken the fastening screws and remove the fly-wheel cover.
2. Slacken the fastening screws and remove the rpm and timing sensor.

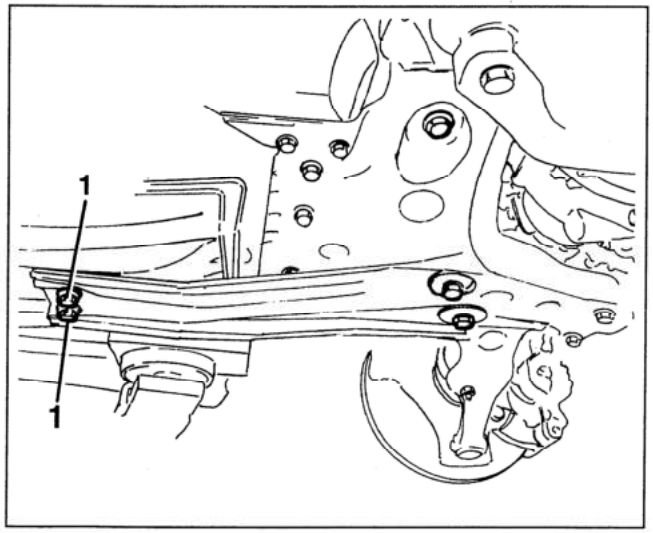



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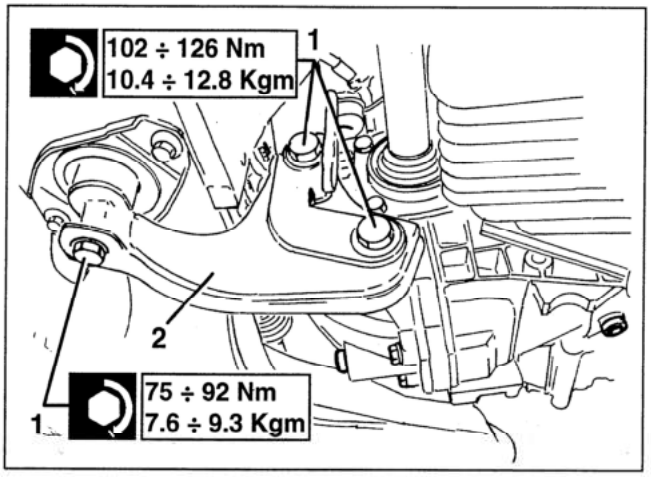
1. Working on the left side of the car, slacken the nut and disconnect the earth braid from the gearbox.
2. Slacken the six bolts and disconnect the axle shaft from the differential.
3. Retrieve the safety plates.



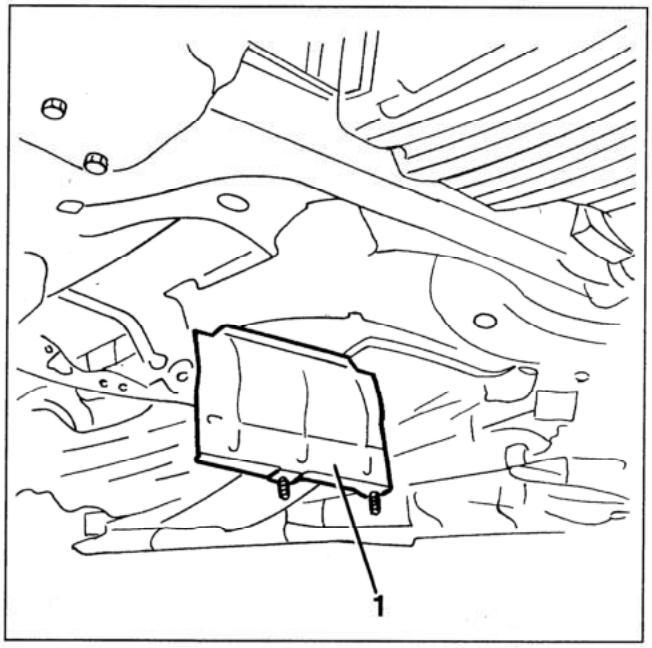

1. Working from under the car, slacken the two screws fastening the rear of each of the two front crossmember reinforcement struts.




1. Slacken the three fastening screws.
2. Remove the rear engine support.

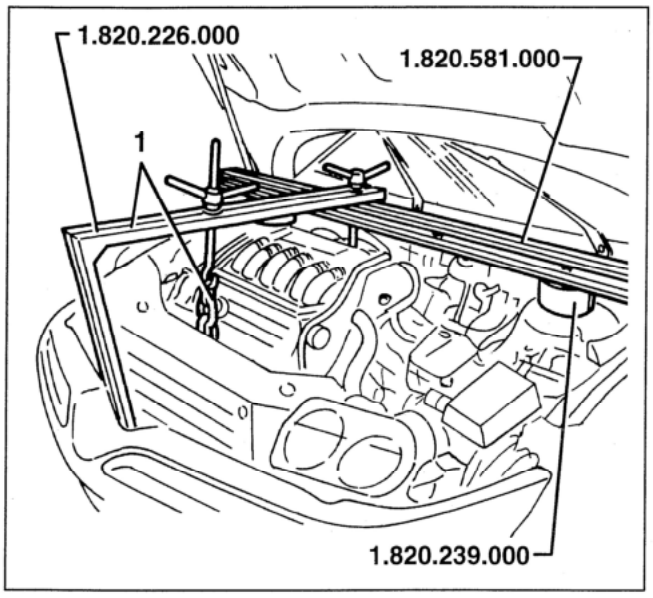



1. Remove the heat shield from the crossmember.

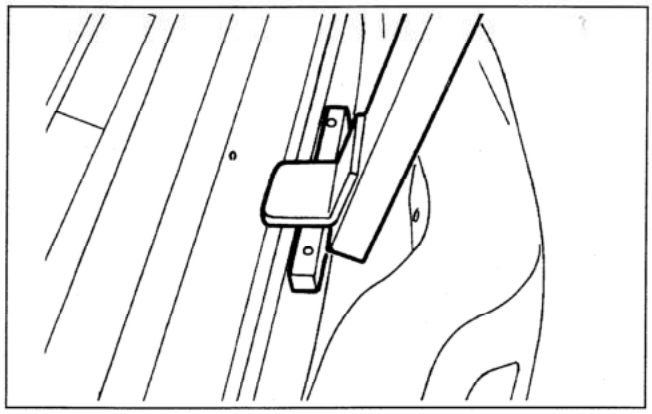



– Install tool no. 1.860.978.000 on a hydraulic jack.
1. Fasten the tool to the centre of the crossmember.
2. Slacken the screws fastening the steering box to the crossmember.
3. Slacken the nuts fastening the crossmember to the gearbox controls support.
4. Slacken the screws fastening the crossmember to the body.

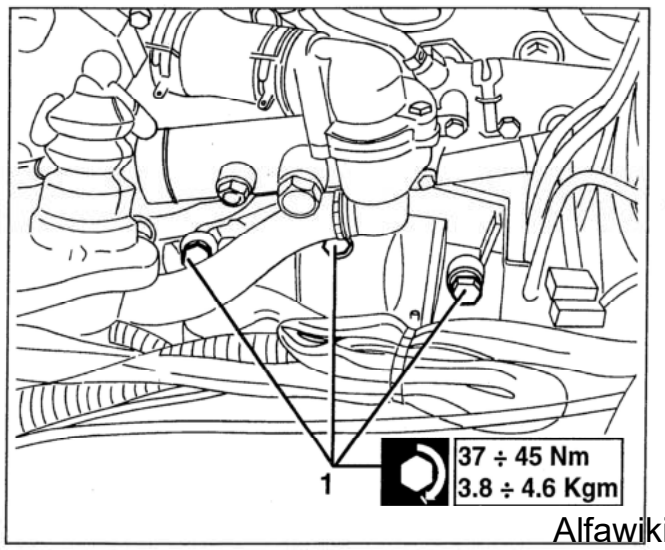
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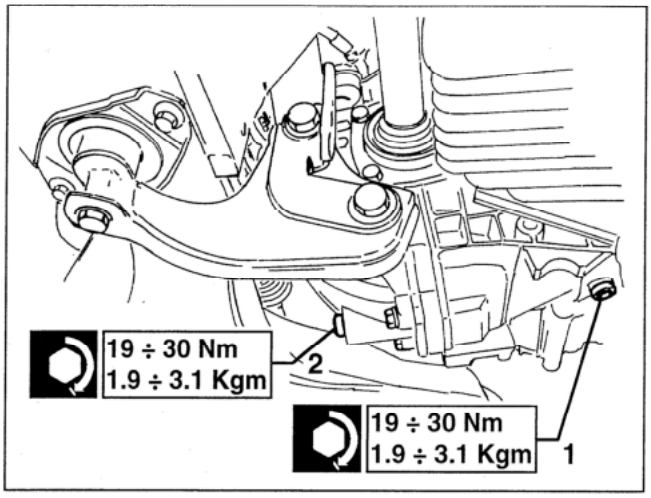

**WARNING:**
**To avoid damaging the power steering piping housed at the front of the radiator, place a suitable thickness between the front connection of the tool and its resting surface.**



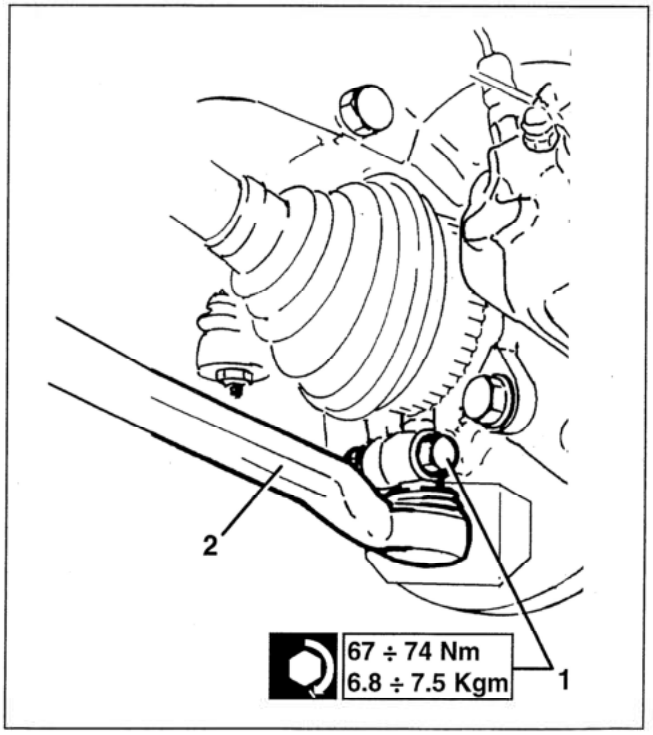
1. Slacken the three upper screws fastening the gearbox cover to the crankcase.
– Raise the gearbox oil dipstick.




– Raise the car.
– Place a suitable container under the engine compartment.
1. Slacken the plug and drain the gearbox oil.
2. Slacken the plug and drain the differential oil.

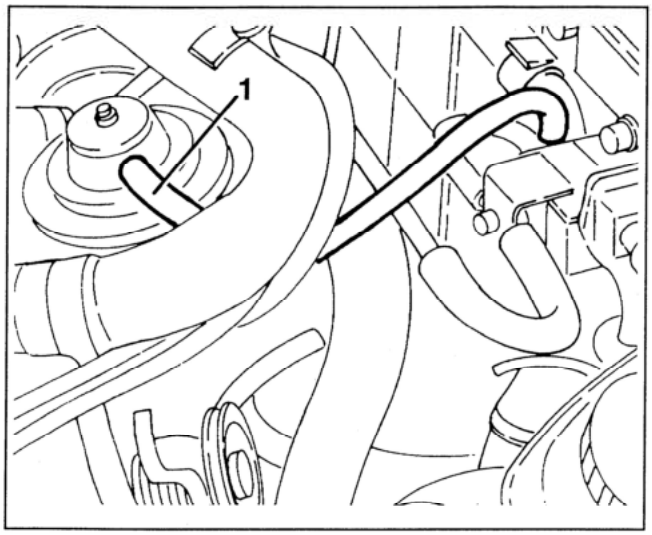



1. Working from both sides of the car, slacken the bolt fastening the wishbone to the wheel hub.
2. Withdraw the wishbone ball pin.

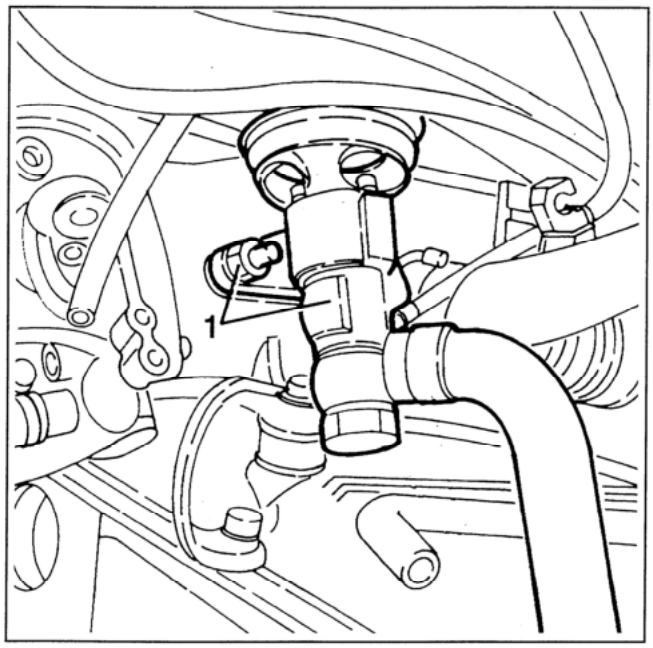



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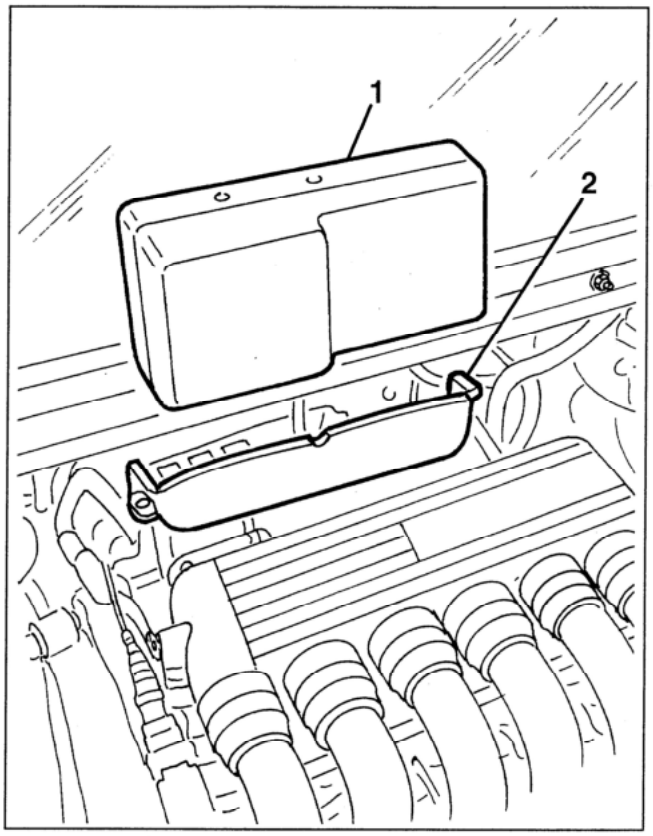
1. Disconnect the modulated vacuum pipe leading from the solenoid valve from the E.G.R. valve.



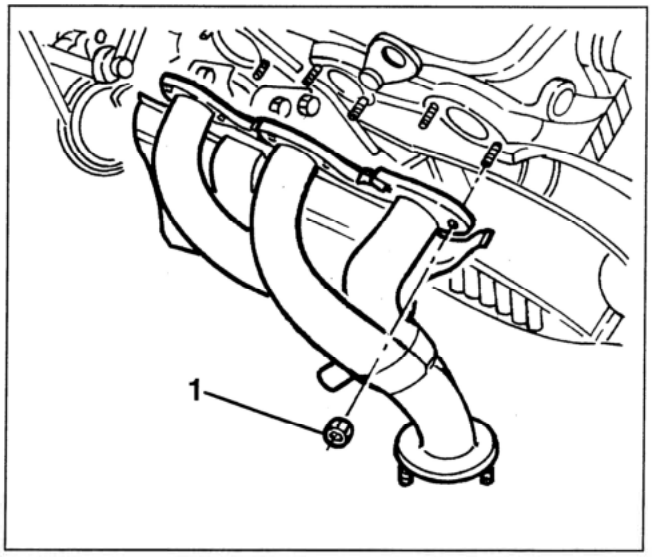

1. Slacken the two fastening nuts and remove the E.G.R. valve complete with exhaust gas takeoff pipe from the intake box.
– Retrieve the seal.




1. Slacken the screws and remove the relay unit cover.
2. Retrieve the cover.



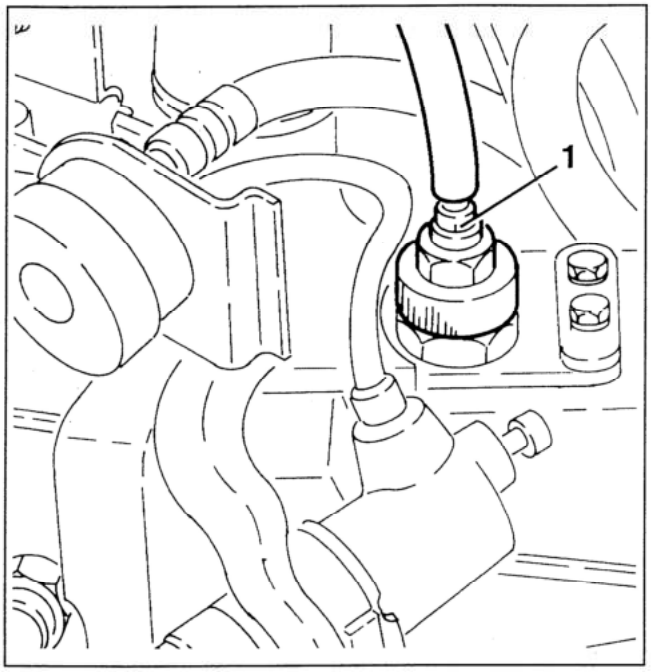

1. Slacken the six nuts fastening the rear exhaust manifold, complete with heat shield, to the cylinder head.



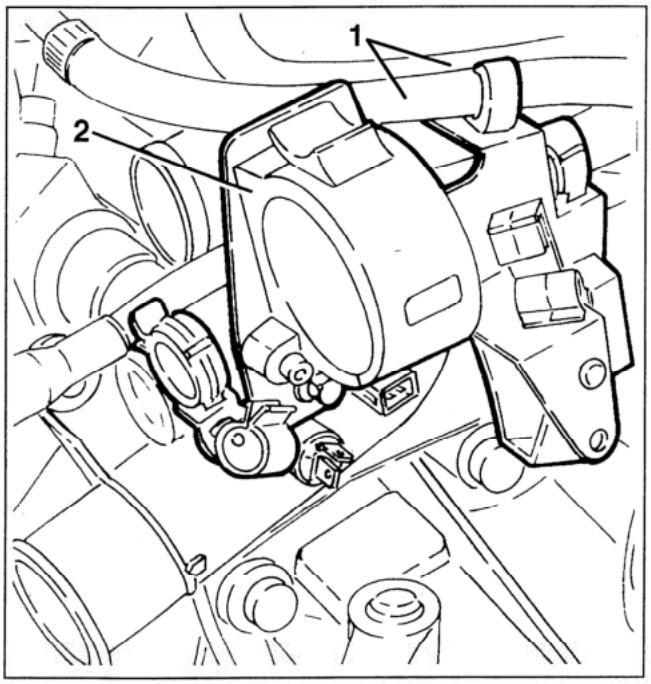

1. Using tools 1.820.239.000, 1.850.581.000 and 1.820.226.000 support the engine appropriately with a chain.

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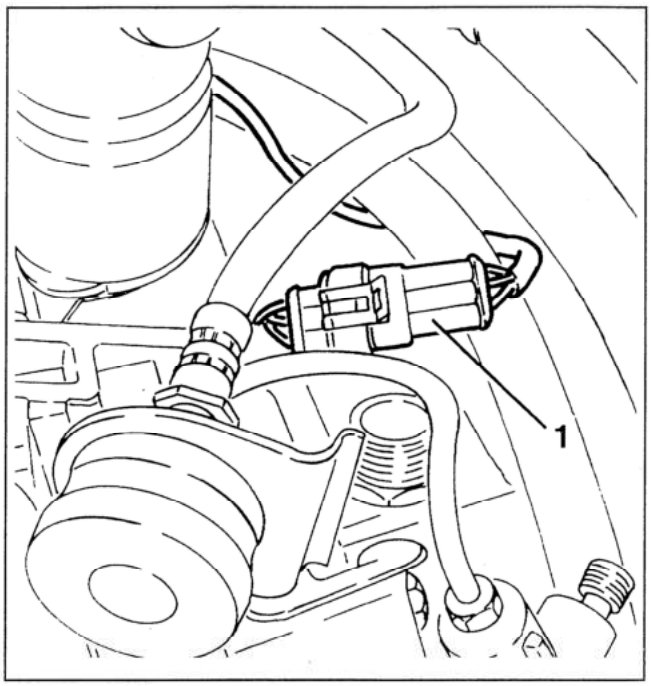
1. Disconnect the cable for synchronised reverse gear engagement.



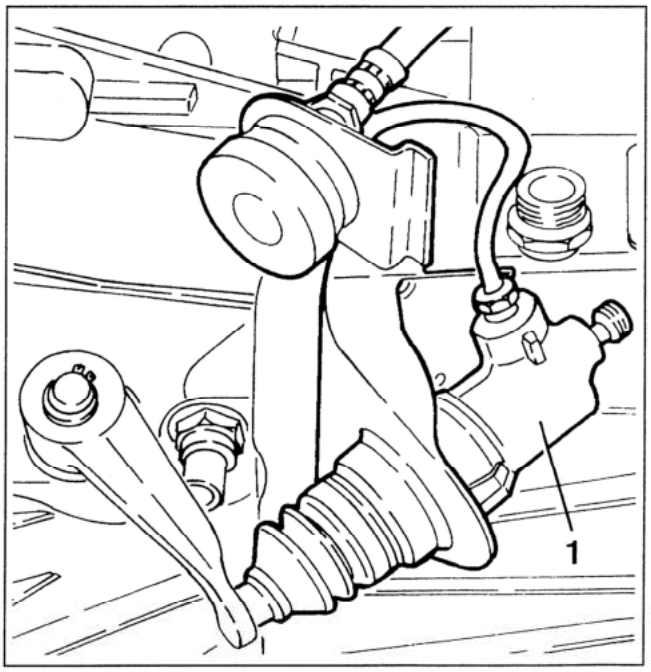

1. Release the fuel pipes.
2. Slacken the fastenings and remove the injection wiring support bracket and pipe fasteners.




1. Disconnect the electrical connection of the tachometric sensor.

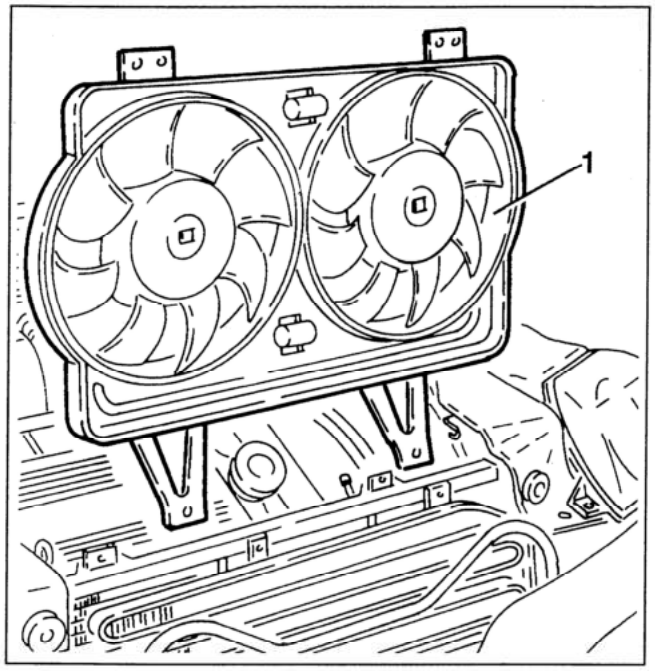



1. Slacken the fastening screws of the clutch control cylinder support bracket, then move the pipe aside without disconnecting the pipes.

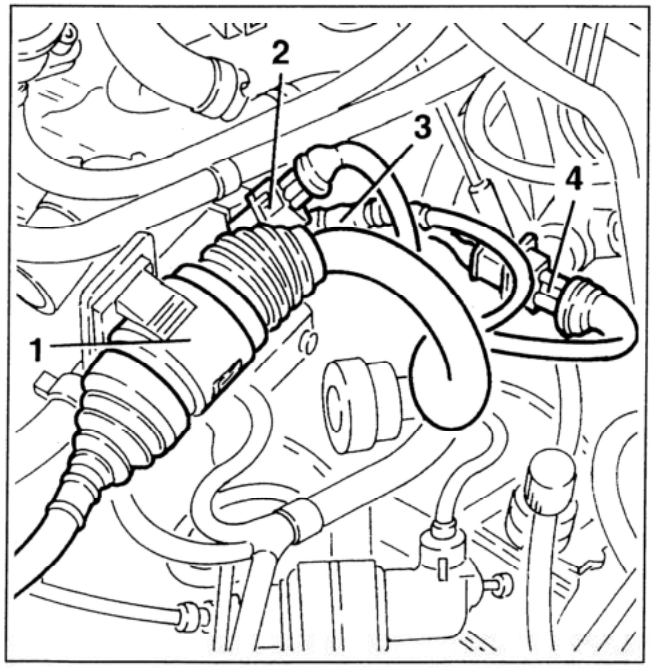



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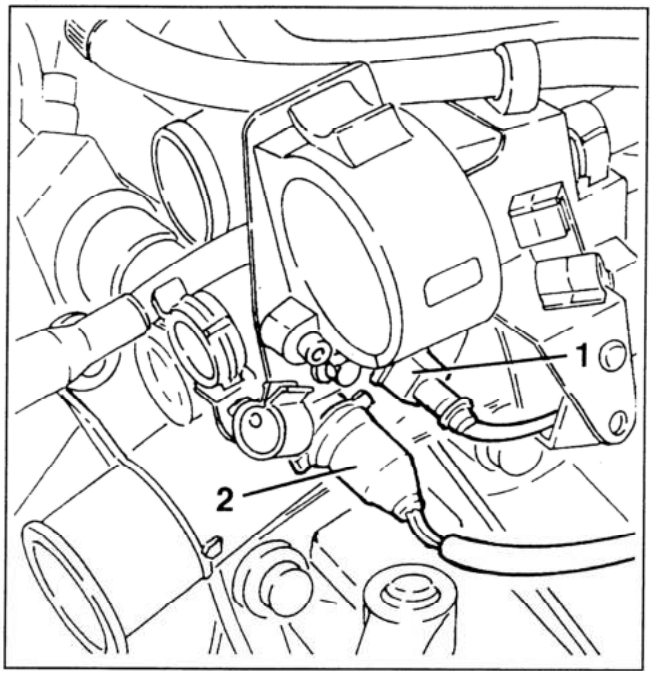
1. Slacken the fastening screws and remove the cooling fans withdrawing them upwards.



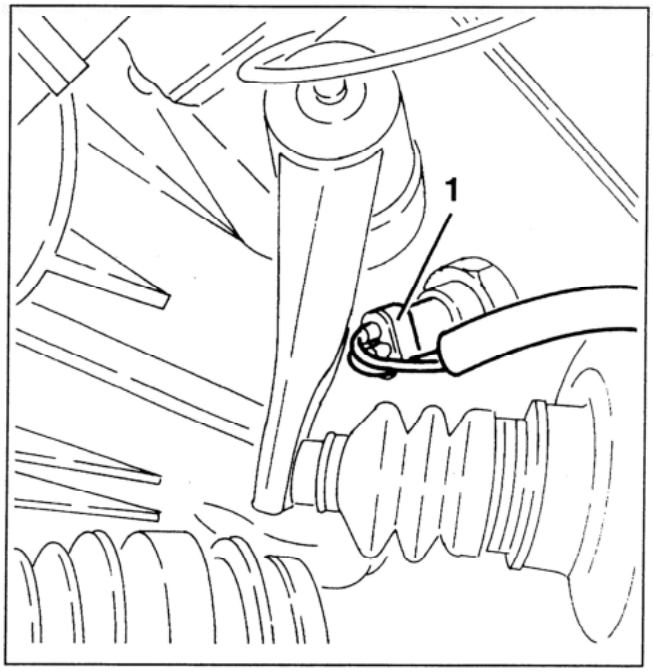

1. Release the injection wiring connector.
2. Disconnect the electrical connection of the rear pinging sensor.
3. Disconnect the electrical connection of the rpm and timing sensor.
4. Disconnect the electrical connection of the cam angle sensor.




1. Disconnect the electrical connection from the engine coolant temperature sensor (NTC).
2. Disconnect the electrical connection from the coolant temperature transmitter and maximum temperature thermal contact.

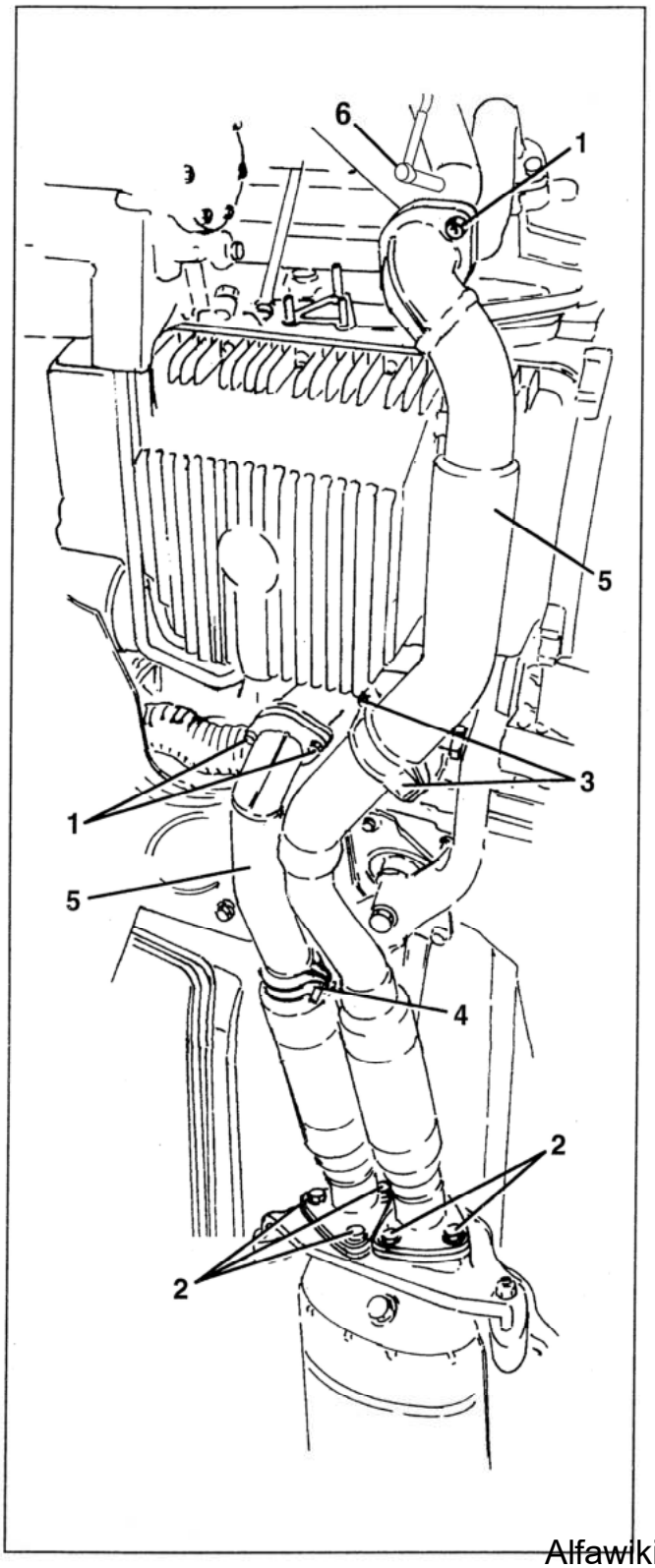



1. Disconnect the electrical connection from the reverse gear sensor.

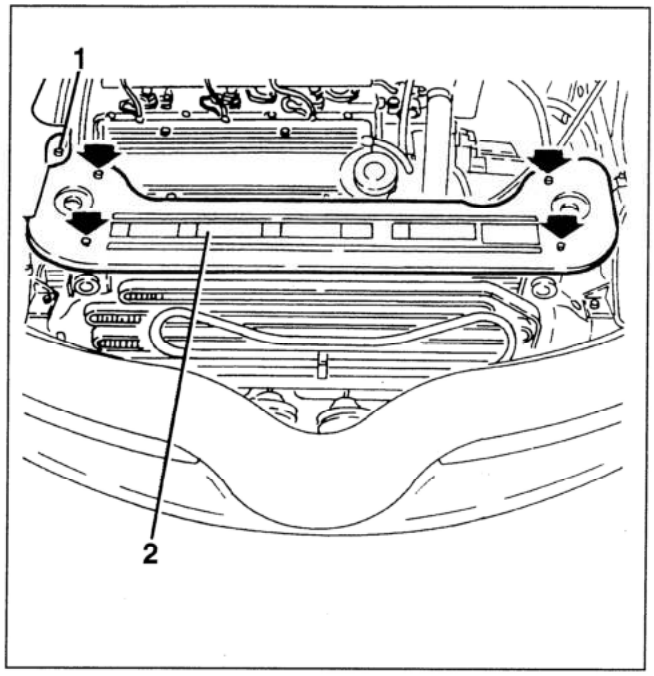



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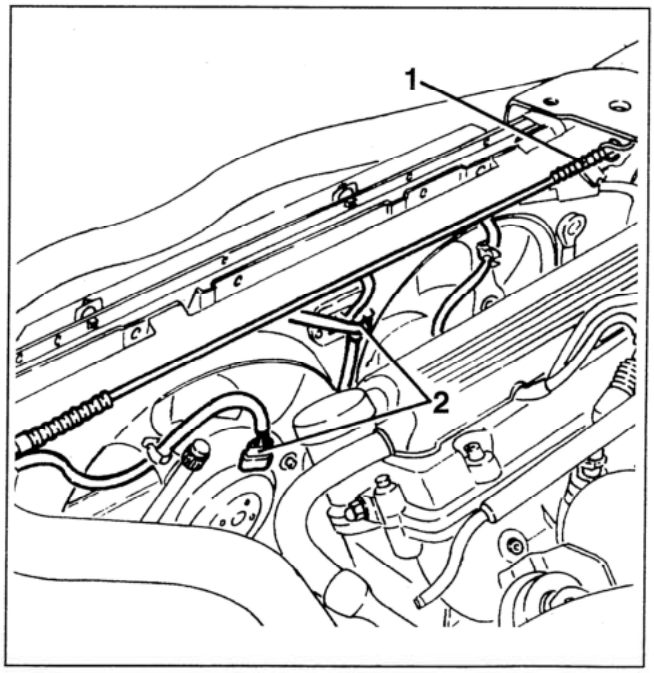
1. Slacken the nuts fastening the front exhaust pipes to the exhaust manifolds.
2. Slacken the bolts fastening the pipes to the catalytic converter.
3. Slacken the bolt and disconnect the collar.
4. Slacken the nut and remove the collar.
5. Retrieve the front exhaust pipes.
6. Disconnect the EGR valve pipe fitting from the exhaust manifold.




– Lower the car.
1. Slacken the screw fastening the right engine compartment guard.
2. Slacken the fastening screws and remove the upper radiator crossmember.

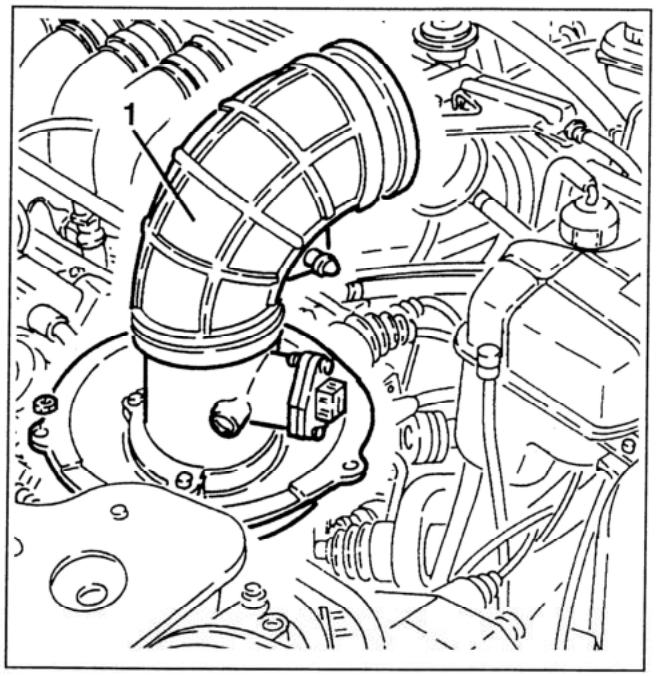



1. Disconnect the bonnet opening cable and move it aside so that it does not hinder the following operations.
2. Disconnect the electrical connections from the fans and additional resistances, then release the cables from the fastening clamps and groove.

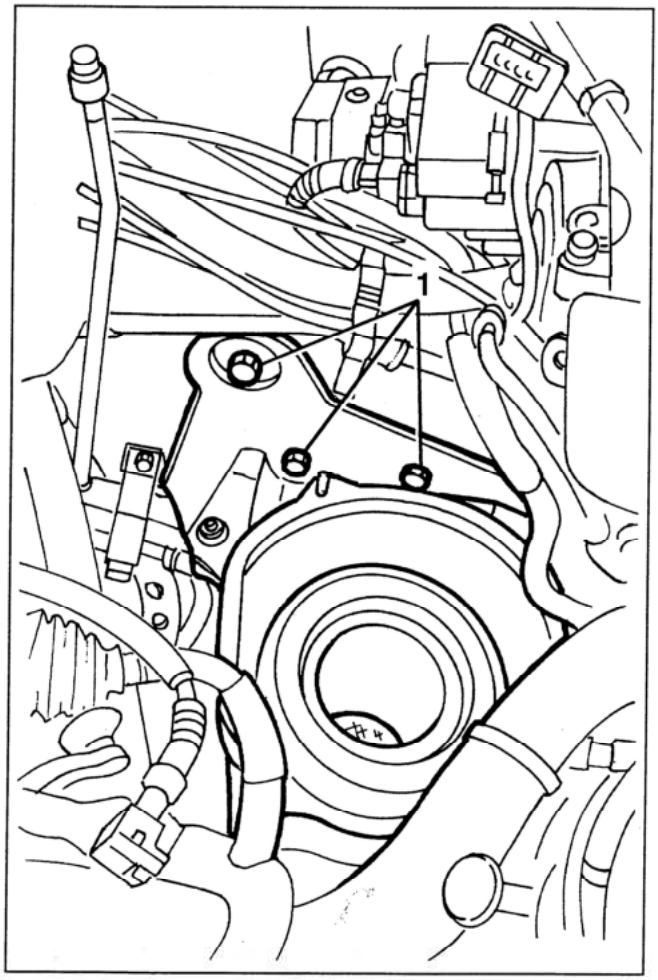



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1. Slacken the three fastening nuts and remove the air cleaner cover complete with hot film air flow meter and the first section of corrugated sleeve.

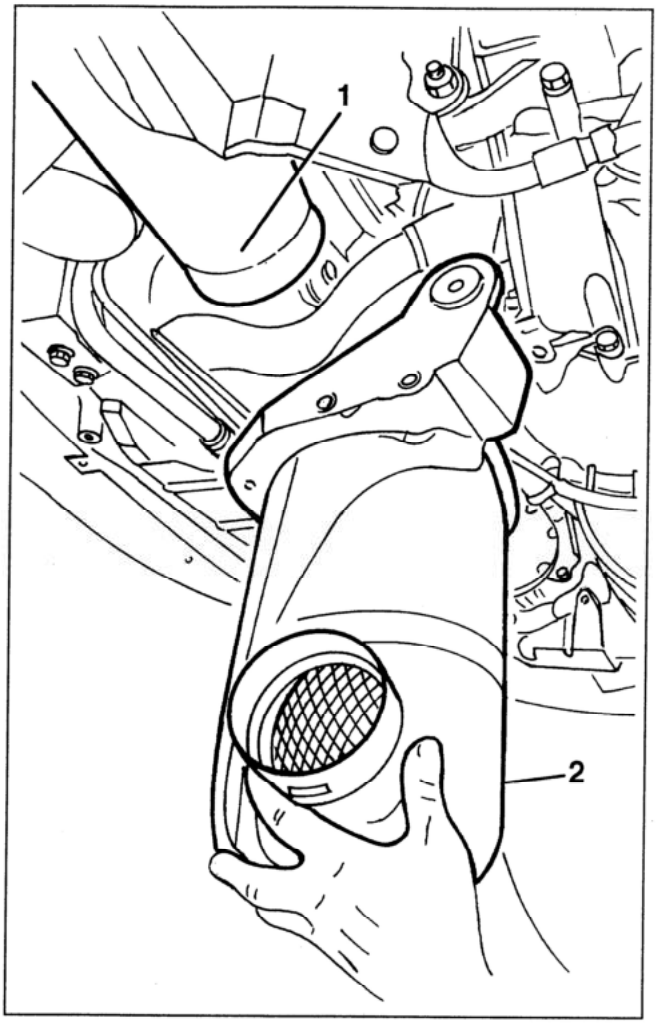



1. Slacken the three fastening screws and release the air cleaner container support bracket.




– Raise the car.

1. Release the air takeoff pipe from the cleaner container.
2. Retrieve the container complete with bracket from below.

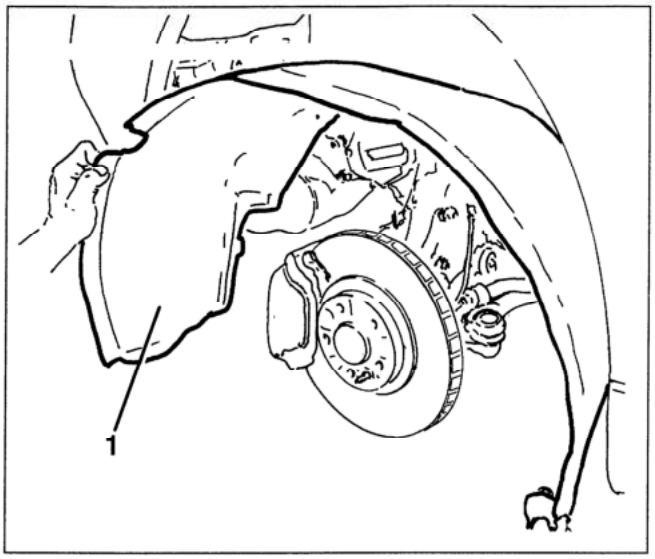



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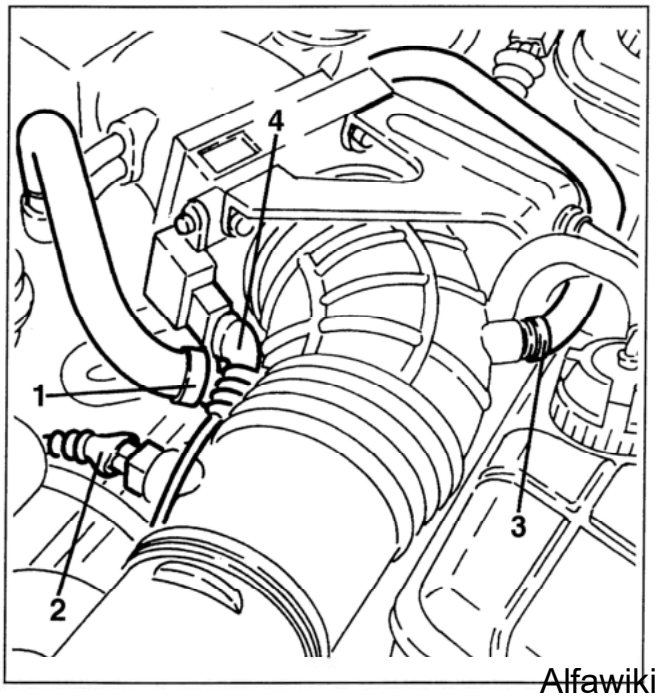
# GEARBOX UNIT

## REMOVING/REFITTING

– Set the car on a lift.
– Disconnect the battery.
– Remove the front wheels.
1. Remove the left front gravel guard.



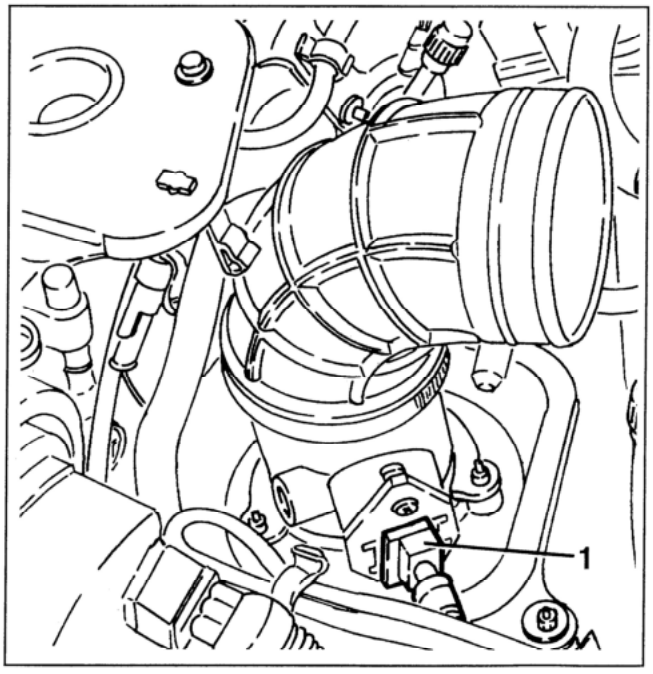

– Remove the engine compartment guard on the lefthand side (see GROUP 70).
1. Disconnect the oil vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.
2. Disconnect the electrical connection from the intake air temperature sensor.
3. Disconnect the air takeoff pipe for the constant idle device from the corrugated sleeve.
4. Disconnect the electrical connection from the throttle potentiometer.




1. Prise off the button fastening the first section of corrugated sleeve to the resounder.
2. Slacken the two fastening clamps.
3. Remove the second section of corrugated sleeve complete with resounders.




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




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# CLUTCH CONTROL

## CLUTCH CONTROL CYLINDER

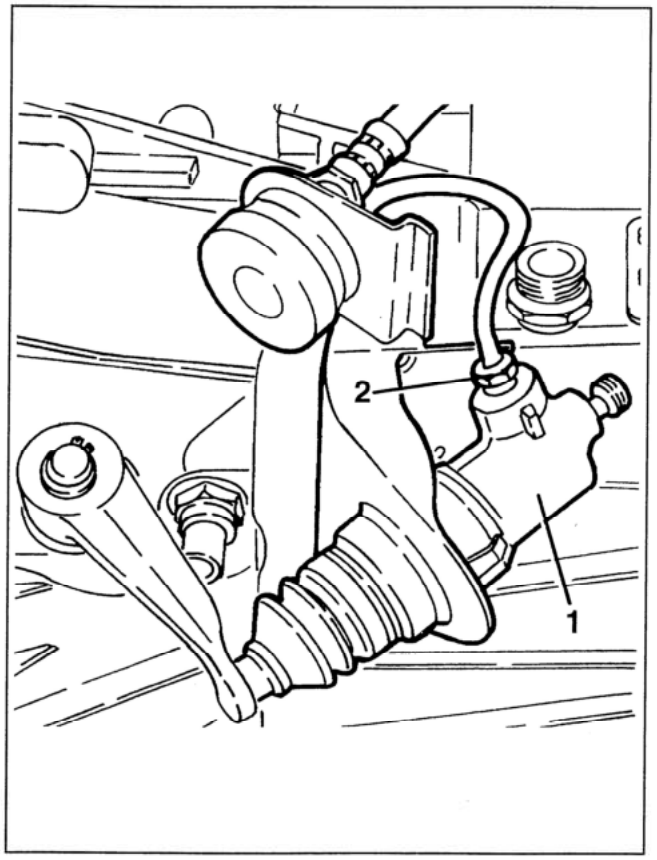
### REMOVING/REFITTING

– Disconnect the battery

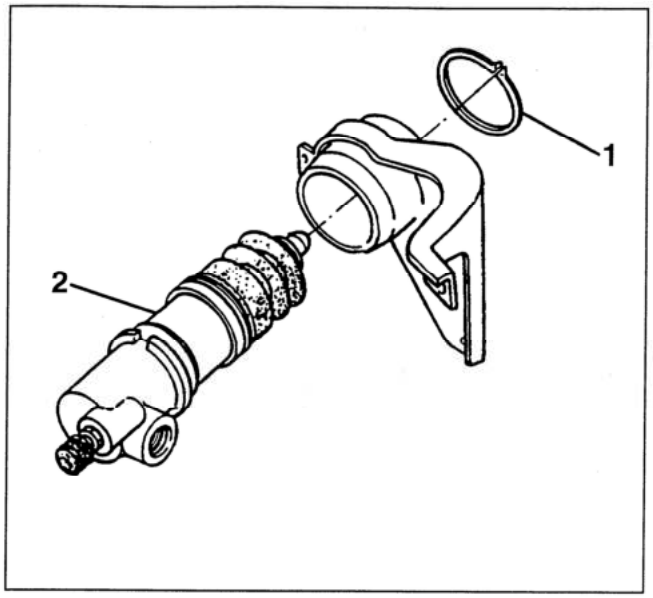
– Working from the engine compartment, remove the air cleaner cover and intake manifold (see Group 10).

– Drain the clutch-brake fluid reservoir using a suitable syringe.

1. Slacken the screws fastening the cylinder support bracket to the gearbox.
2. Slacken the hydraulic union of the stiff pipe from the control cylinder.




1. Remove the retainer ring.
2. Withdraw the clutch cylinder.

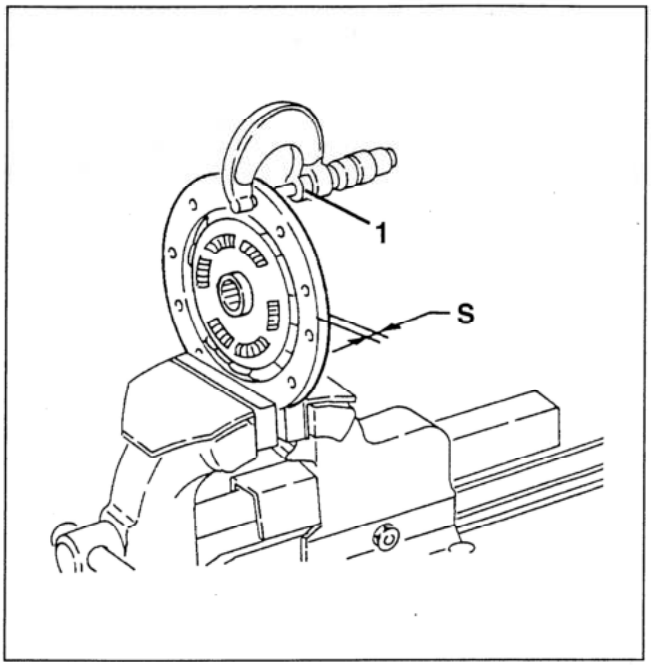



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## CHECKS AND INSPECTIONS

1. Check the gaskets for even wear and that the thickness of the clutch plate is no lower than the minimum specified.

| Thickness "S" of clutch plate (mm) | |
|---|---|
| New | At wear limit |
| 7.1 ÷ 7.7 | 6.3 |




– Check that there are no signs of burning or vitrification, that fastening is correct and that the springs are intact.
– Check that the clutch plate hub is intact, runs smoothly and that there is no excessive play on the drive shaft.
– Check the working surfaces of the flywheel and pressure plate for signs of overheating, uneven wear, nicks or missing parts.
– Check the thrust bearing for noise, excessive play and that it runs smoothly on the sleeve.
– Check the fork for cracks, distortion, freedom of movement and excessive wear of the working surfaces.

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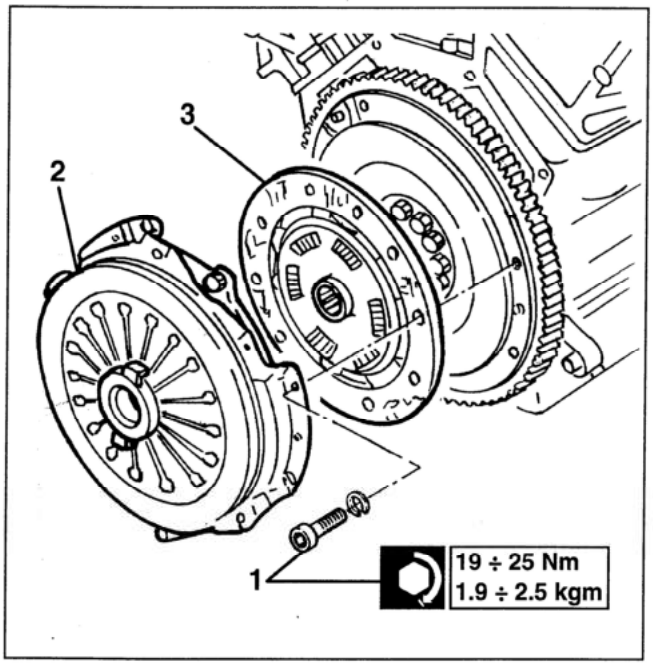
# CLUTCH PLATE AND PRESSURE PLATE

## REMOVING/REFITTING

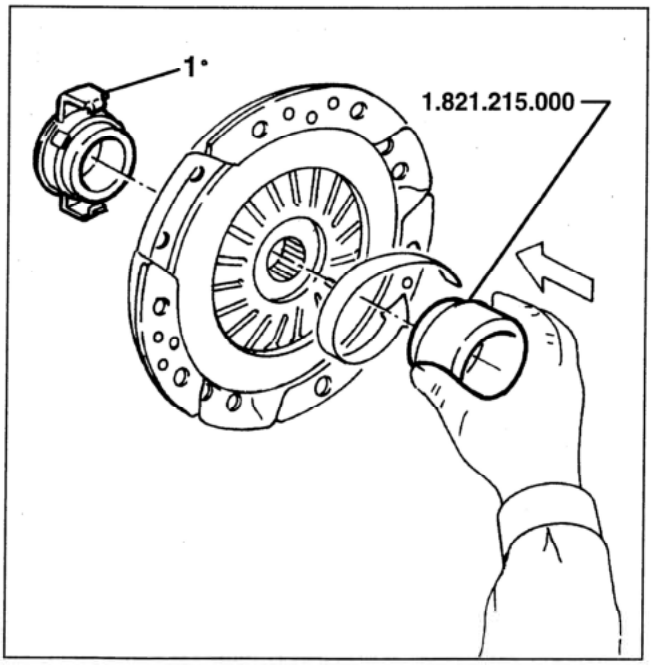
– Remove the gearbox-differential unit (see GROUP 21).

– When changing only the clutch plate, mark the position between the pressure plate and flywheel to facilitate refitting operations.

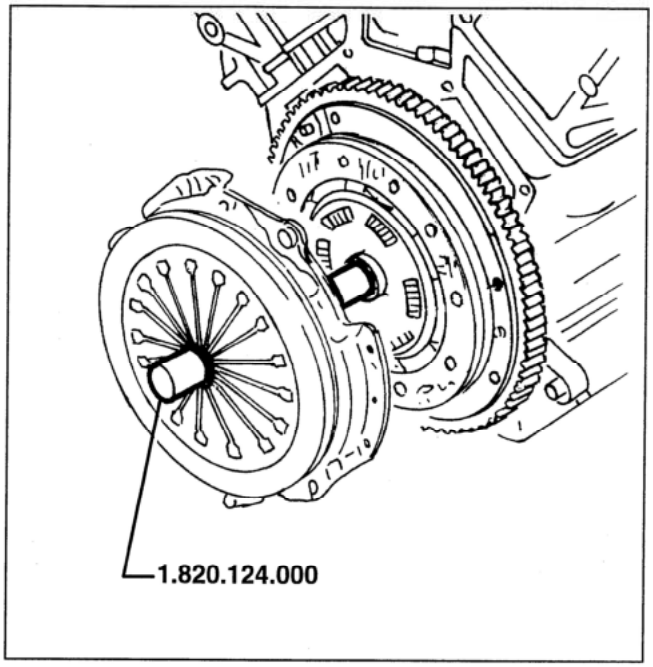
1. Slacken the screws fastening the pressure plate to the flywheel.
2. Remove the pressure plate.
3. Remove the clutch plate.



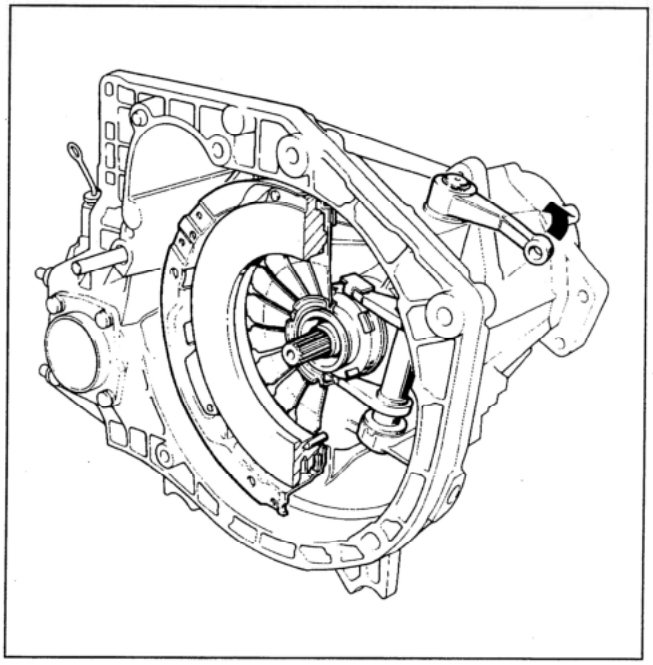

1. Using tool 1.821.215.000 rremove the thrust bearing from the diaphragm spring.




When refitting use tool 1.820.124.000 to centre the clutch plate correctly.




After refitting the gearbox to the crankcase, move the control lever in the direction of the arrow to position the thrust bearing in its housing.



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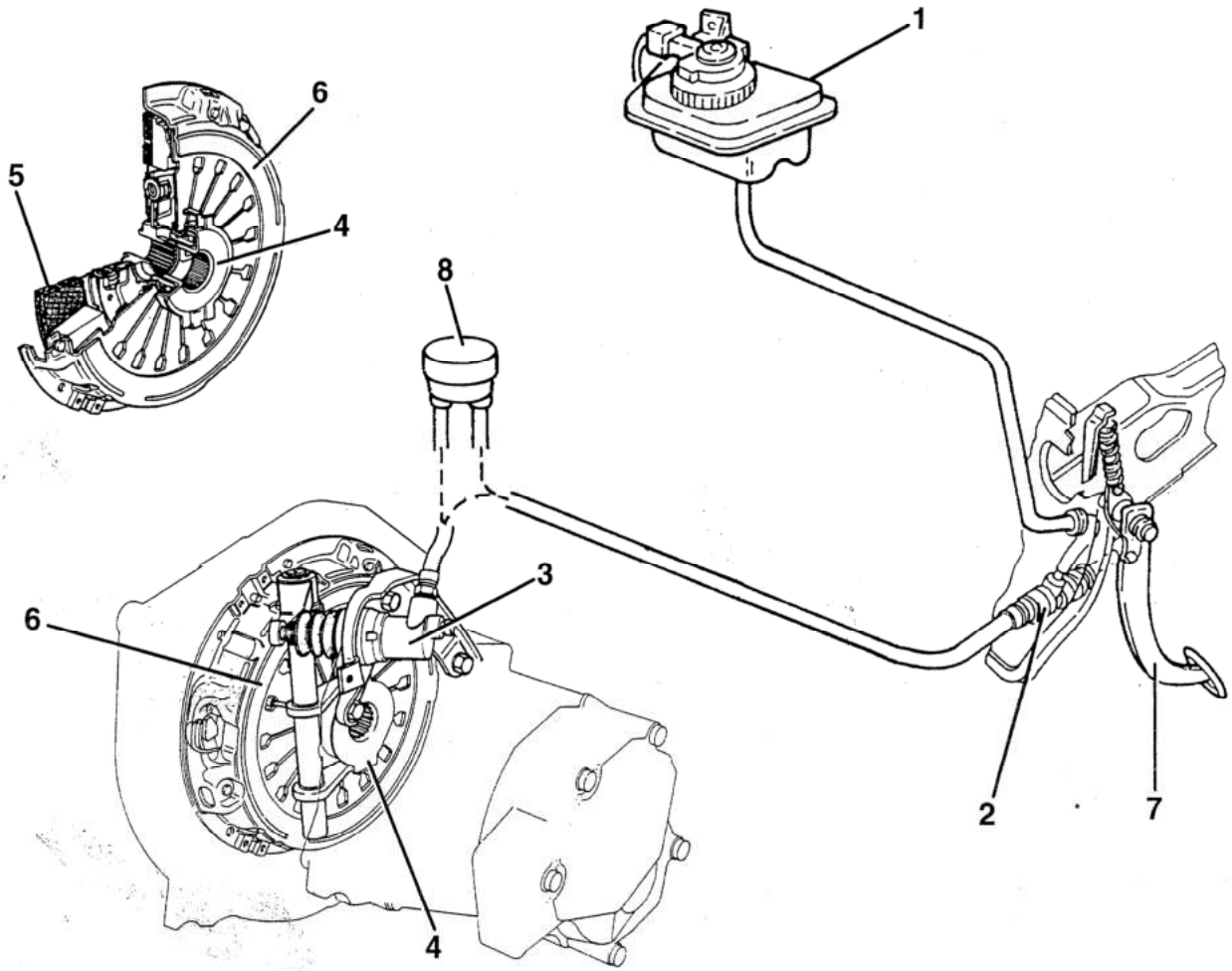
# CLUTCH SYSTEM

## DESCRIPTION

The clutch adopted is a dry single-plate type with diaphragm pressure plate springs and operated by hydraulic control.

The conventional single-plate dry solution is fitted with hydraulic control with pul disengagement in order to reduce the effort exerted on the clutch pedal to operate it.

This type of control is characterised by the fact that pressing the pedal the clutch is pulled by the coupled thrust bearing rather than pushed in the conventional manner. This solution has been adopted because, owing to the need to transmit a high torque, it would be necessary to increase the dimensions of the clutch assembly to leave the effort on the pedal unchanged during disengagement.




1. *Brake-clutch system reservoir*
2. *Clutch pump*
3. *Clutch control cylinder*
4. *Thrust bearing*
5. *Clutch plate*
6. *Pressure plate*
7. Clutch control pedal
8. *Damper*

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## DESCRIPTION

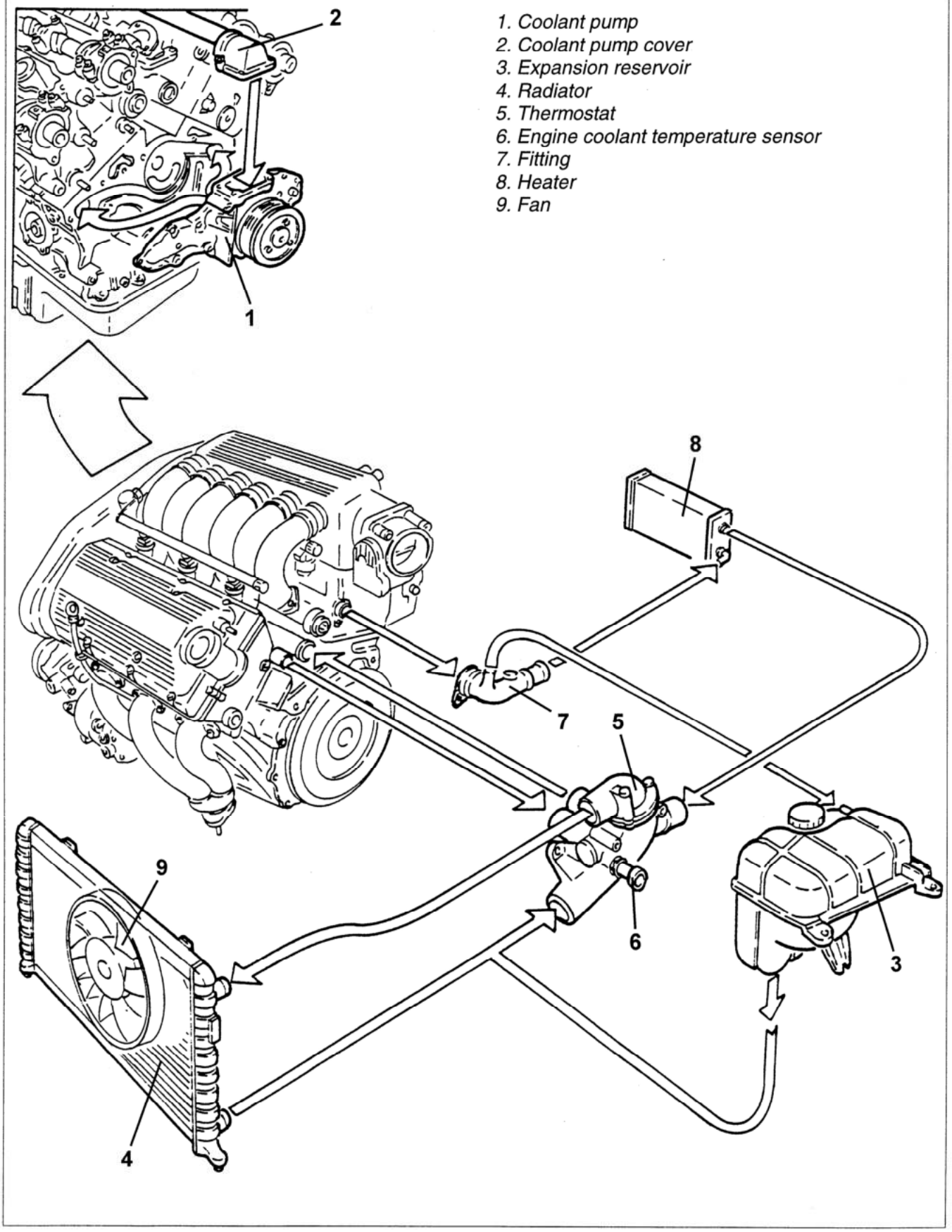
The cooling system is sealed and of the forced circulation type. It features a centrifuge pump (1) operated by the crankshaft by means of a Poly-V belt.
A thermostat valve (5) located on the rear of the engine ensures optimal engine temperature. It opens when the coolant reaches a temperature of 87 ± 2 °C.
The radiator (4) cools the fluid by means of dynamic air and a two speed fan. The fan is controlled by the injection-ignition ECU according to a specific logic.
The expansion reservoir (3) feeds the circuit if the level decreases and absorbs the fluid variations in volume according to the temperature. Furthermore, it acts as a circuit air bleeder.
The circuit is equipped with a single engine coolant temperature sensor which measures coolant temperature by means of a double NTC thermistor with negative resistance value. One NTC thermistor sends a signal to the injection ECU while the other sends a signal to the instrument panel temperature gauge and warning light.

## CIRCUIT OPERATION

The fluid cools the engine and reaches the thermostat (5) via the cylinder head. If its temperature is lower than 87 °C, the coolant is sucked by the pump (1) via a longitudinal return manifold located between the two cylinder heads. If the temperature is higher than this value, the coolant is conveyed to the radiator via the thermostat opening. After being cooled in the radiator, the coolant returned to the thermostat from where it is conveyed to the pump via the longitudinal manifold. A specific fitting (7) on the right-hand cylinder head receives the coolant from a supplementary duct on the head and sends it via two specific pipes to the climate control system heater (8) and to the expansion reservoir (3).


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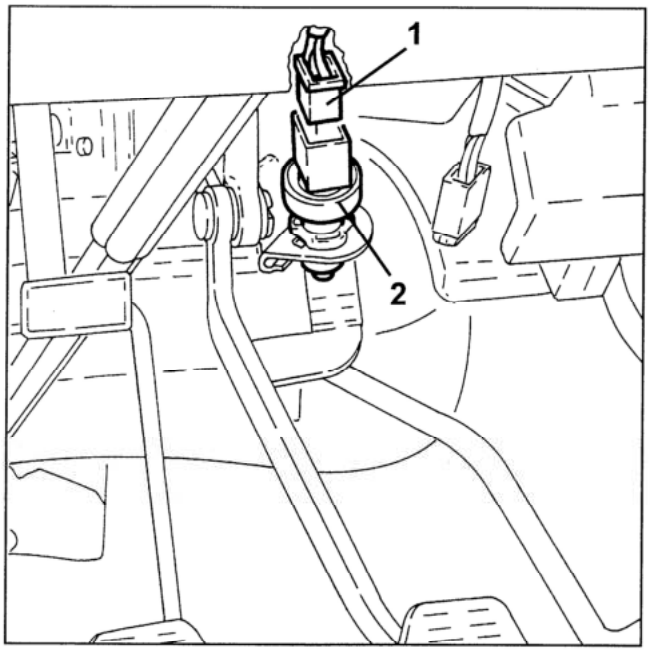
## ENGINE COOLING SYSTEM



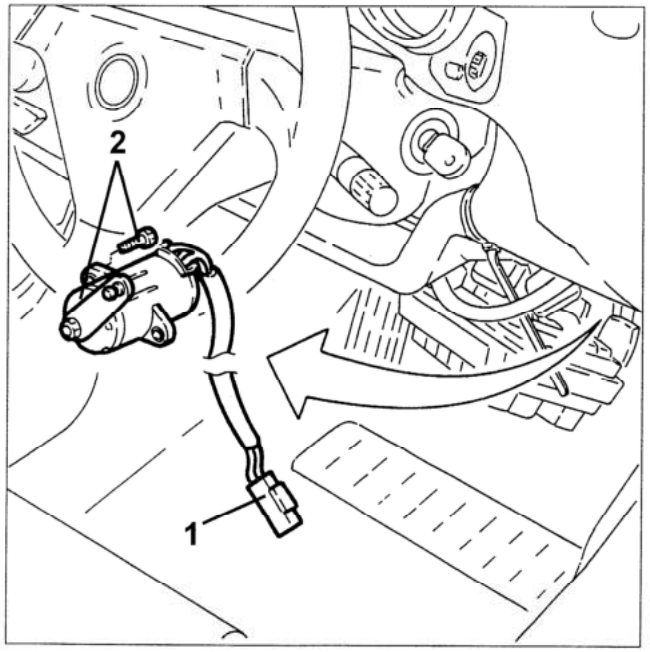


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1. Disconnect the brake pedal switch electrical connection.
2. Remove the brake pedal switch.



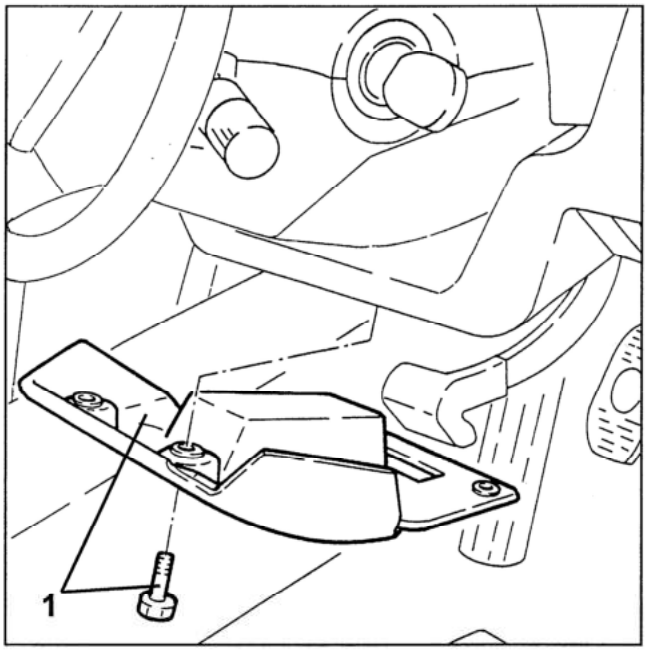

1. Disconnect the accelerator pedal potentiometer electrical connection.
- Fasten the valves suitably to the side.
- Disconnect the accelerator pedal potentiometer from the tie-rod.
2. Loosen the fastening screws and remove the accelerator pedal.



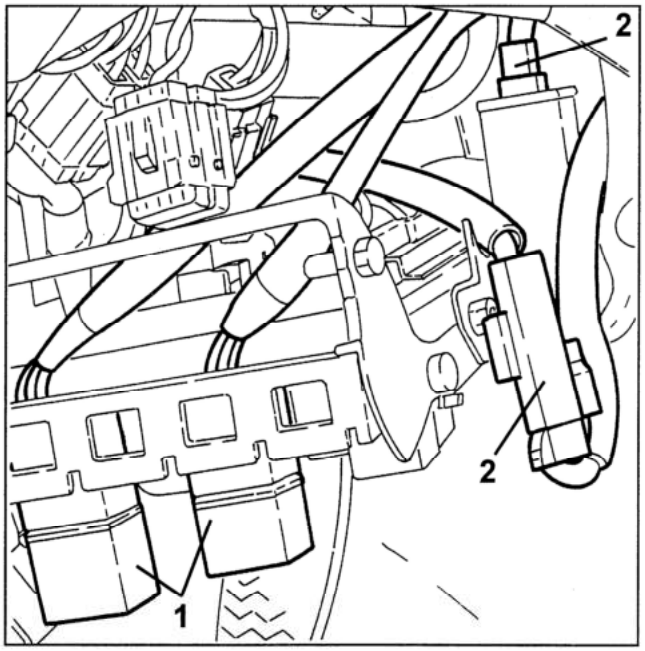

**NOTE: After refitting the accelerator pedal potentiometer, calibrate as shown below.**

- Make sure the ignition key is at STOP.
- Connect tool no. 1.806.365.000 to the diagnostic socket and turn the knob to 3.
- Connect Examiner.
- Turn the ignition key to MAR.
- With Examiner, go to "Parameters".
- Press "Select" and select the parameter "Accelerator position track 1".
- Check whether the potentiometer calibration values correspond to prescriptions:
idling (accelerator pedal released), 8% ± 1%
- maximum opening (accelerator pedal fully pressed), 64,3% ± 1%.
- Remove the diagnostic tool.

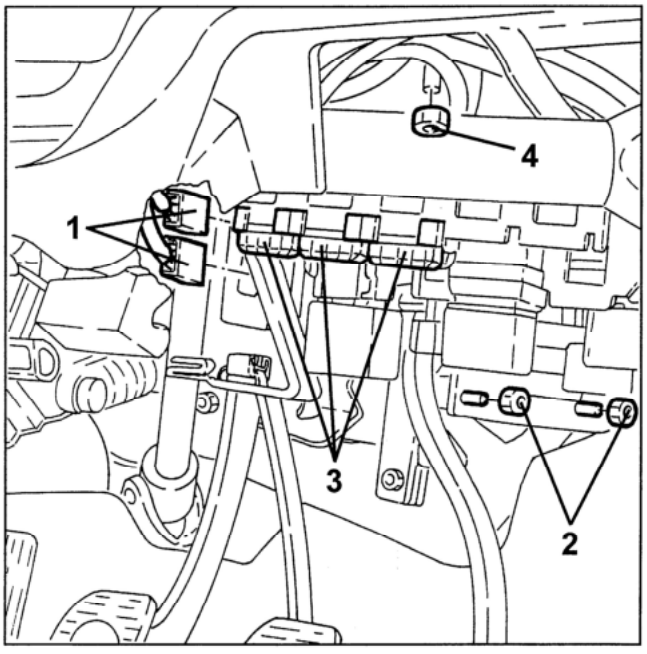
1. Remove the fastening screws and remove the guard under the dashboard.



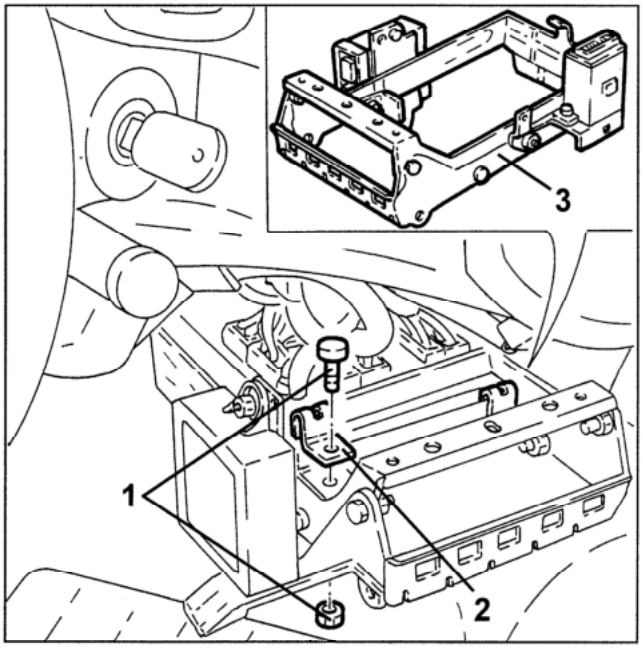

1. Disconnect the two relays.
2. Disconnect the valve electrical connections.




1. Disconnect the Alfa Romeo CODE ECU electrical connections.
2. Loosen the bolts fastening the valve bracket to the brake booster bracket.
3. Remove the indicated relays to reach the nut fastening the valve bracket to the dashboard.
4. Loosen the nut fastening the valve bracket to the dashboard.

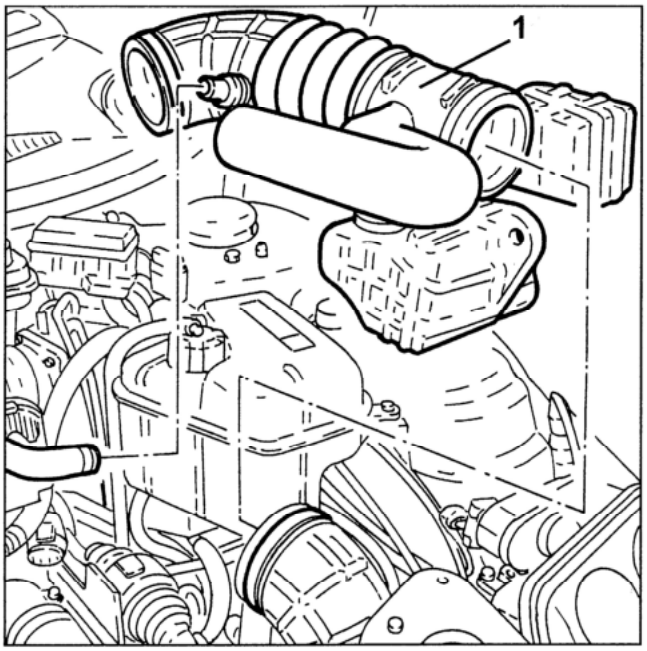



1. Loosen the bolts fastening the valves to the bracket.
2. Remove the clips.
3. Remove the valve bracket.

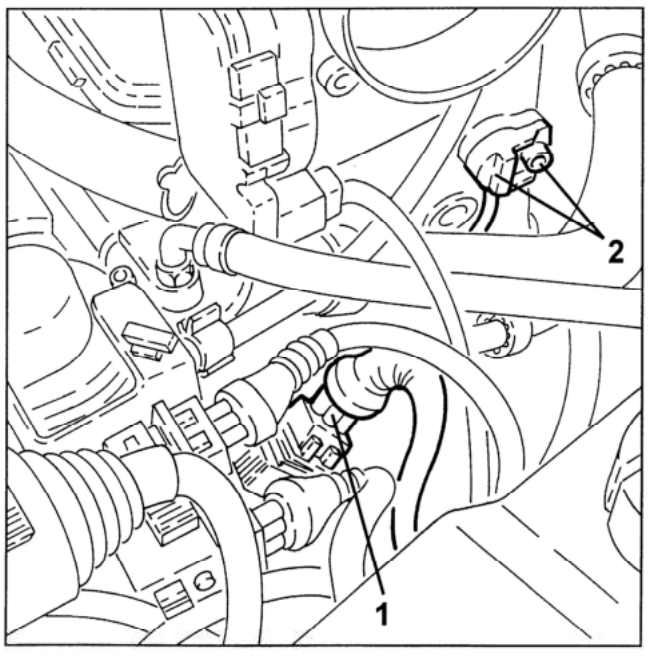


## REMOVAL/REFITTING

- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Loosen the screws and remove the left engine compartment guard.
1. Loosen the clips and remove the corrugated sleeve with resonators after releasing the intermediate resonator from the fastening pin.



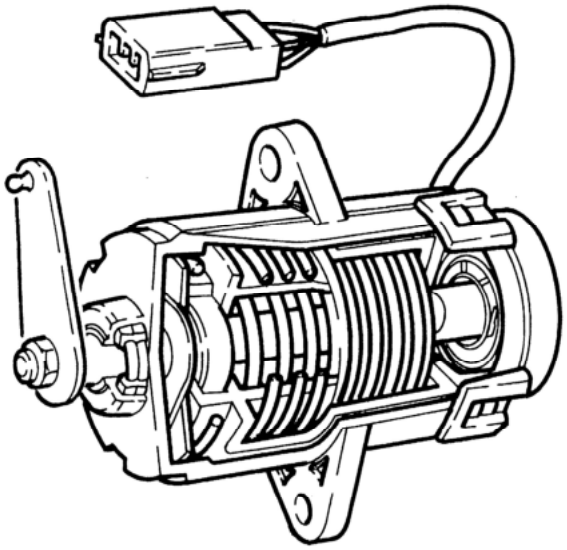

1. Disconnect the cam angle sensor electrical connection.
2. Loosen the fastening screw and remove the cam angle sensor with electrical wiring.




## ACCELERATOR PEDAL POTENTIOMETER

The accelerator pedal is fitted with two built-in potentiometers:
- one main potentiometer
- one back up potentiometer.
The injection ECU performs the following recovery strategies:
- if one of the two potentiometers fails, the throttle is opened to a maximum of 40° over a long time
- if both potentiometers fail completely the throttle is closed.
The accelerator pedal is adjusted by excluding the respective stop (which should not exceed the notch).

**Operation**
The sensor consists of a casing (1) fastened to the pedal board by means of a flange inside which a shaft (2) is axially connected to the double track potentiometer (3). A helicoid spring on the shaft ensures the correct pressure resistance while a second spring ensures return when released. Operative field from 0° to 70°; mechanical stop at 88°.

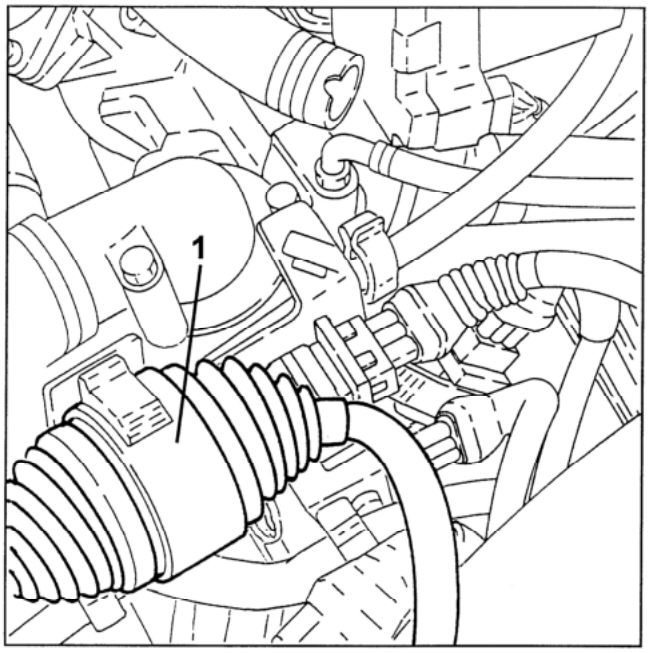


## REMOVAL/REFITTING

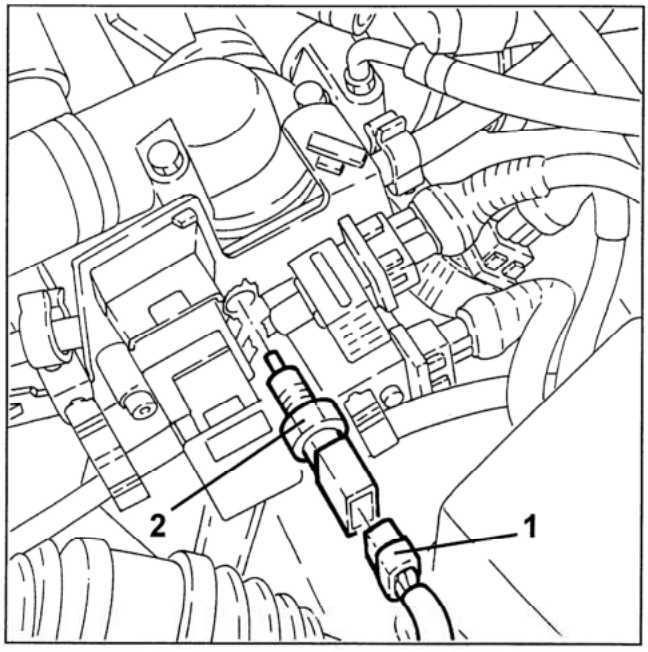
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Remove the valve guard (see Assembly 70).

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1. Disconnect the injection wiring and move it aside.



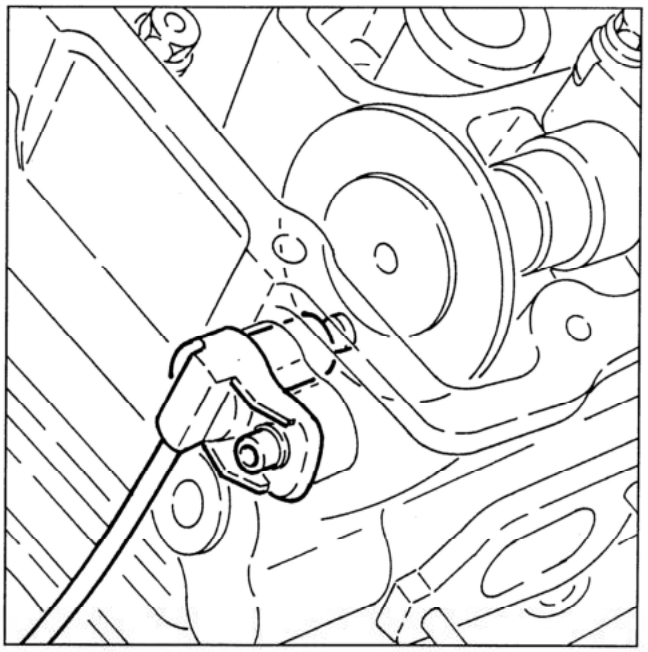

1. Disconnect the engine coolant sensor electrical connection.
2. Loosen and remove the engine coolant sensor from the thermostat cup.



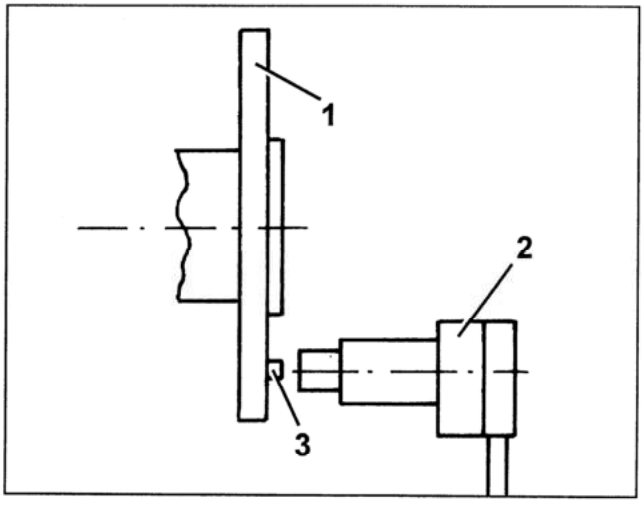

## CAM ANGLE SENSOR

This Hall effect sensor is fitted on the right-hand cylinder head and faces the disc on the right-hand cylinder head rear exhaust side.

The disc is fitted with a pin which allows the sensor to signal the engine stroke position.
The injection ECU uses the signal to acknowledge TDCs at the end of compression stroke.



**Operation**
A semiconductor layer is crossed by current and submerged in a normal magnetic field (perpendicular force lines with respect to the current) generates a potential difference at the poles called "Hall" voltage.
When disc (1) revolves, pin (3) crosses sensor (2) and blocks the magnetic field.
This generates a low output signal. On the other hand, when sensor (2) reads the pin (3), the output signal is up.
Consequently, the up signal alternates with the down signal once every two engine revolutions, precisely when cylinder 1 is 58° before TDC.



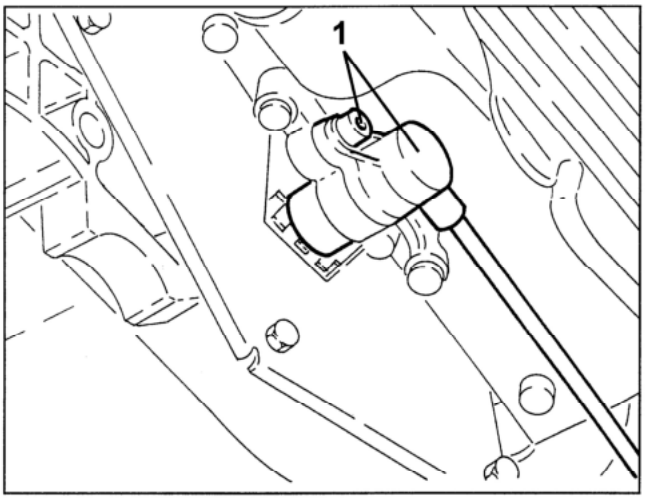


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1. Loosen the fastening screws and remove the rpm and phase sensor guard.

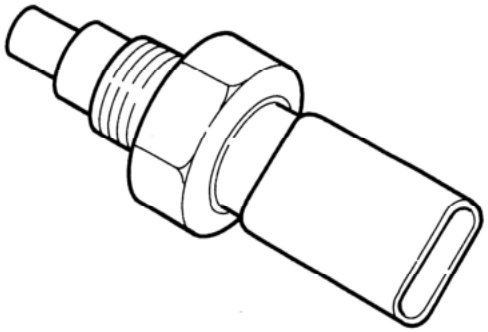



1. Loosen the fastening screw and remove the rpm and phase sensor.
- If required, loosen the fastening screws and remove the rpm and phase sensor from its bracket.




## ENGINE COOLANT TEMPERATURE SENSOR

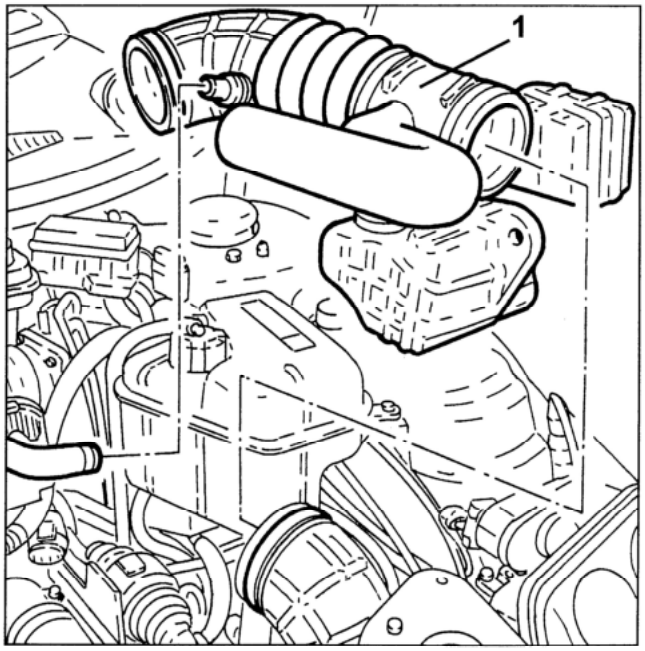
This sensor is fitted on the thermostat cap and measures the coolant temperature by means of a double NTC thermistor with negative resistance coefficient. One NTC thermistor sends a signal to the injection ECU while the other sends a signal to the instrument panel temperature gauge and warning light.



The sensor applies semiconductor technology. Consequently, the resistive value decreases as the sensor temperature increases with the coolant temperature.
The resistance variation is not linear: consequently, it is higher at low temperatures with respect to higher temperatures.

### REMOVAL/REFITTING

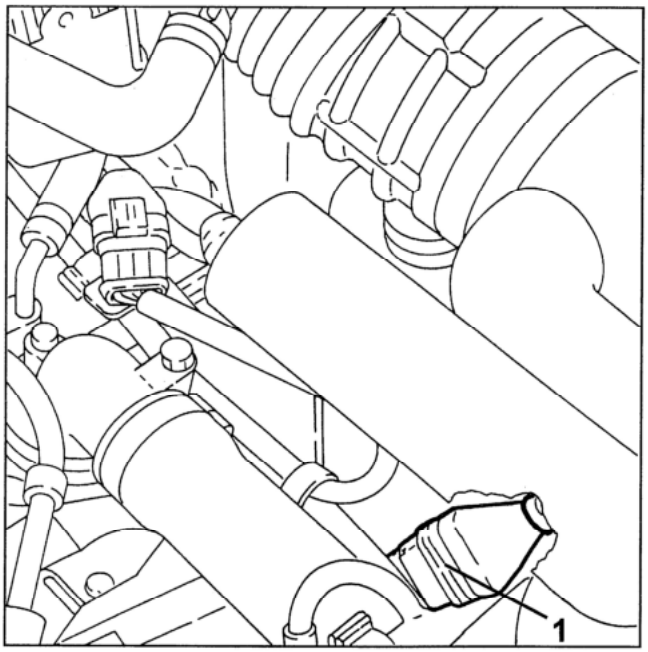
- Make sure the ignition key is at "STOP" and remove the (-) battery terminal.
- Loosen the screws and remove the left engine compartment guard.
1. Loosen the clips and remove the corrugated sleeve with resonators after releasing the intermediate resonator from the fastening pin.



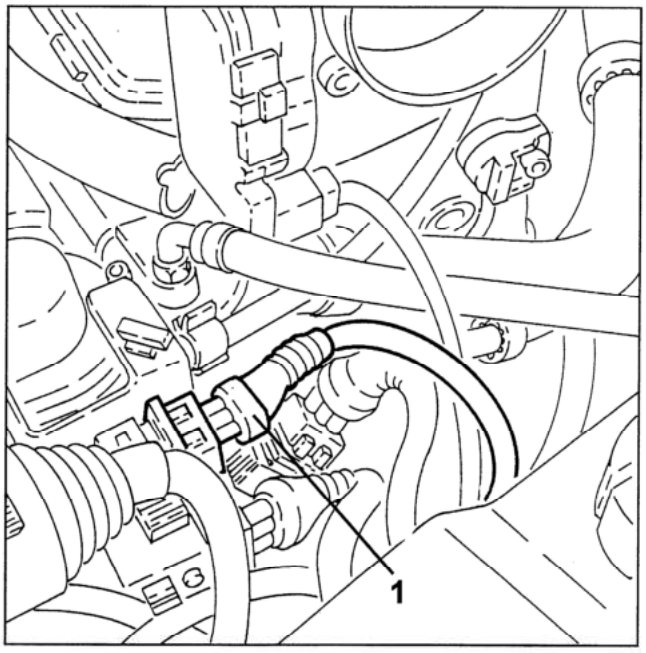


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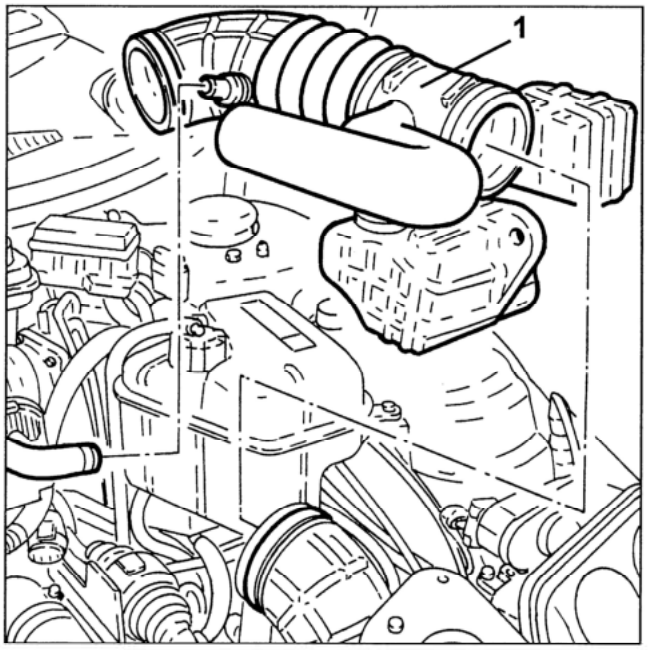
1. Disconnect the left-hand lambda sensor electrical connection.



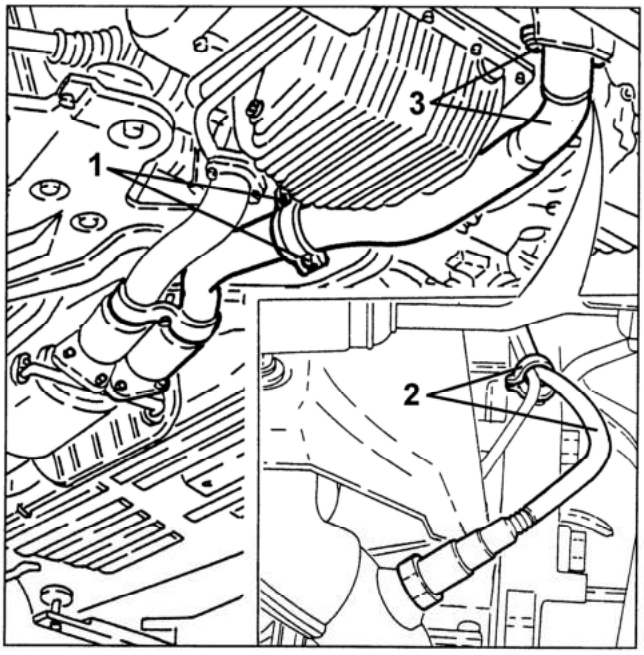

1. Disconnect the rpm and phase sensor electrical connection and release the respective electrical wiring from the fastening clips (where relevant).




1. Loosen the clips and remove the corrugated sleeve with resonators after releasing the intermediate resonator from the fastening pin.

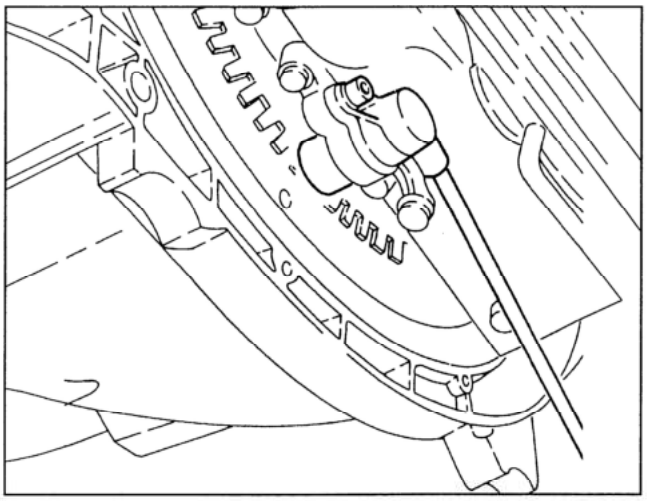



- Lift the vehicle.
1. Loosen the exhaust pipe fastening collar from the rubber mount.
2. Release the left-hand lambda sensor electrical wiring from the fastening clip.
3. Loosen the exhaust manifold fastening nuts and lower the front exhaust pipe section as required.

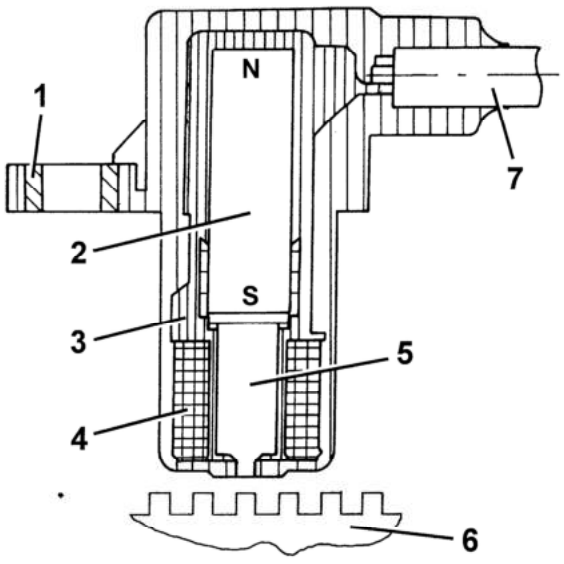


## RPM AND PHASE SENSOR

This sensor is fitted on the crankcase and faces the phonic wheel on the flywheel.
It is inductive, i.e. it works by means of the variations in the magnetic field generated by the passage of the phonic wheel teeth (60 - 2 teeth).
The injection ECU uses the rpm sensor signal to:
- define revolution speed
- define crankshaft angular position.

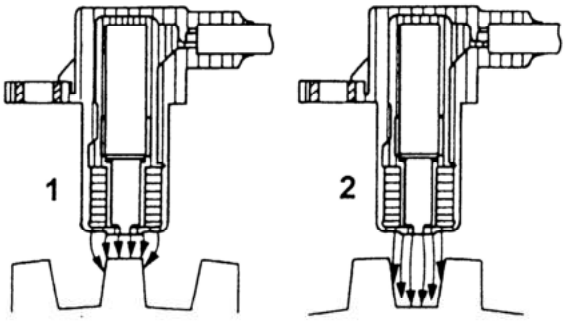


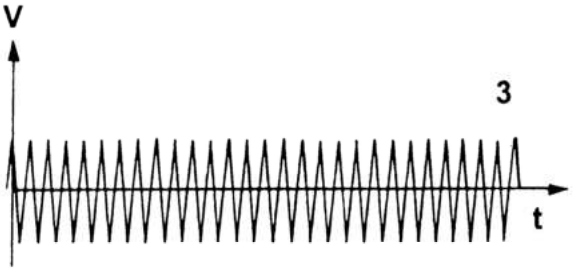
**Operation**
The switchover from full to none, due to the presence or the absence of a tooth, causes magnetic flow variations which generate an induced alternated voltage by counting the teeth on the phonic wheel.
The frequency and the width of the voltage sent to the ECU provides the engine angular speed measurement.




*1. Brass bushing*
*2. Permanent magnet*
*3. Plastic sensor casing*
*4. Coil winding*
*5. Pole core*
*6. Crown or phonic wheel*
*7. Co-axial double wire or electrical connection*

The prescribed gap between the sensor tip and the phonic wheel for correct signals must be between **0.8** and **1.5 mm**.
The gap cannot be adjusted. If the gap is out of tolerance, check intactness of sensor and phonic wheel.




*1. Maximum magnetic flow*
*2. Minimum magnetic flow*
*3. Induced alternating voltage trend.*

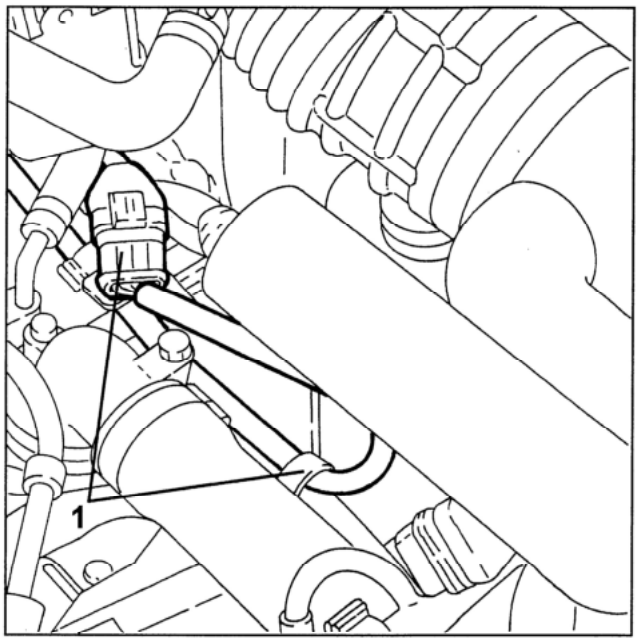
### REMOVAL/REFITTING

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.

## RIGHT-HAND LAMBDA SENSOR REMOVAL/REFITTING

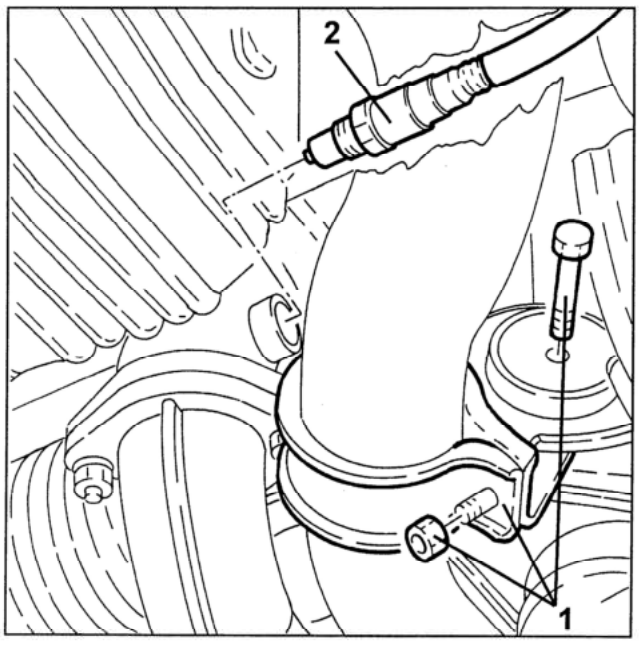
- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.

1. Disconnect the right-hand lambda sensor electrical connection and release the respective wiring from the fastening clips.




- Lift the vehicle.

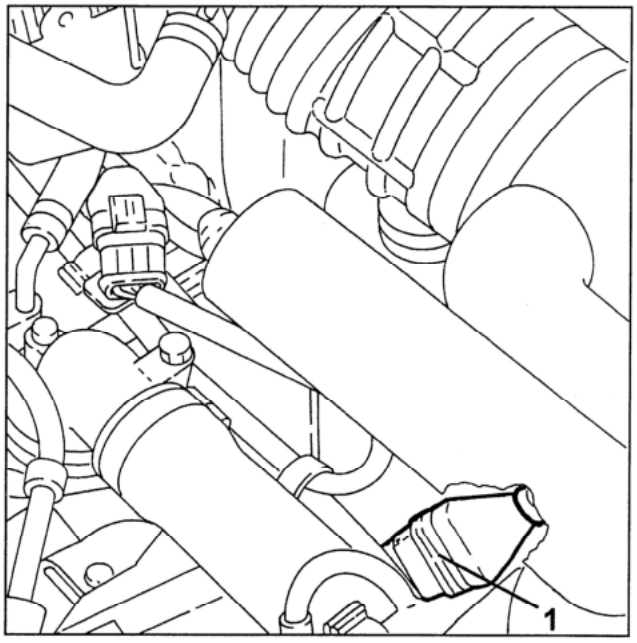
1. Loosen the nuts and the screw. Then remove the exhaust pipe fastening collar from the rubber mount.
2. Loosen and remove the right-hand lambda sensor with electrical wiring.



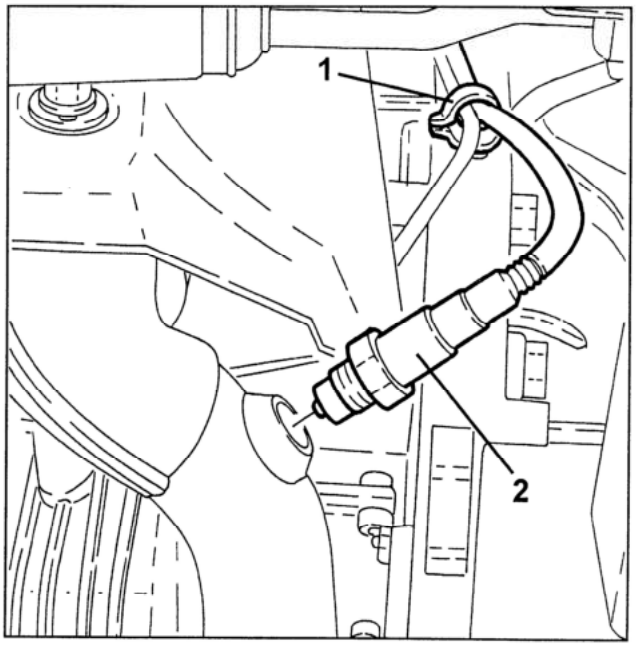

## LEFT-HAND LAMBDA SENSOR REMOVAL/REFITTING

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.

1. Disconnect the left-hand lambda sensor electrical connection.

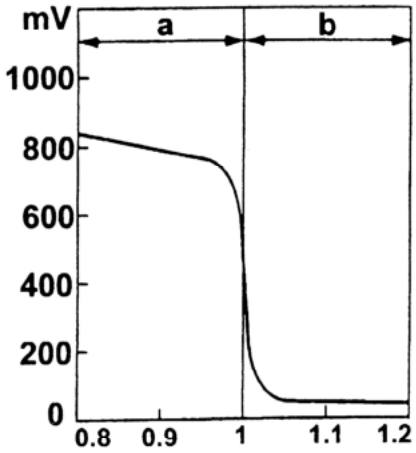



1. Release the left-hand lambda sensor wiring from the fastening clips.
2. Loosen and remove the left-hand lambda sensor with electrical wiring.



## LAMBDA SENSOR

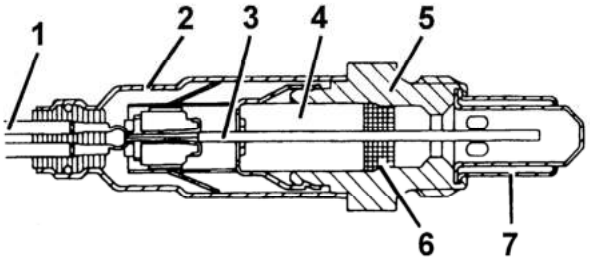
The exhaust system is equipped with two "planar" lambda sensors fitted on the front section of the exhaust pipe.
One lambda sensors controls the right-hand combustion (cylinders 1 - 2 - 3) while the other controls the left-hand side combustion (cylinders 4 - 5 - 6).
The injection ECU identifies the mixture compositions (lean or rich) according to the lambda sensor output voltage.
The ECU adjusts the amount of injected fuel to ensure optimal composition of the mixture ($\lambda = 1$), to create ideal conditions for the treatment of exhaust fumes in the catalytic converter.
If the mixture is too rich ($\lambda < 1$) the amount of fuel is reduced and if the mixture is too lean ($\lambda > 1$) the amount of fuel is increased.




a. Rich mixture (no air)
b. Lean mixture (excessive air)

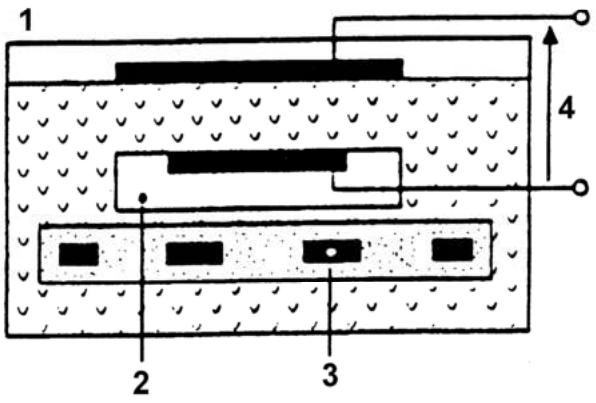
The lambda sensor, in contact with the exhaust fumes, generates an electrical signal with a voltage which varies according to the concentration of oxygen in the fumes.
The voltage is characterised by a sudden variation with the composition of the mixture differs from $\lambda = 1$.
The lambda sensor heating is governed by the injection ECU proportionally according to exhaust fume temperature.
This avoids thermal shocks to the ceramic casing due to the contact with condensed water in the exhaust fumes when the engine is cold.

The measuring cell and the heater and built-into the "planar" ceramic element (layered) with the advantage of rapid cell heating to allow a "closed loop" control ($\lambda = 1$) within 10 seconds from when the engine is started.



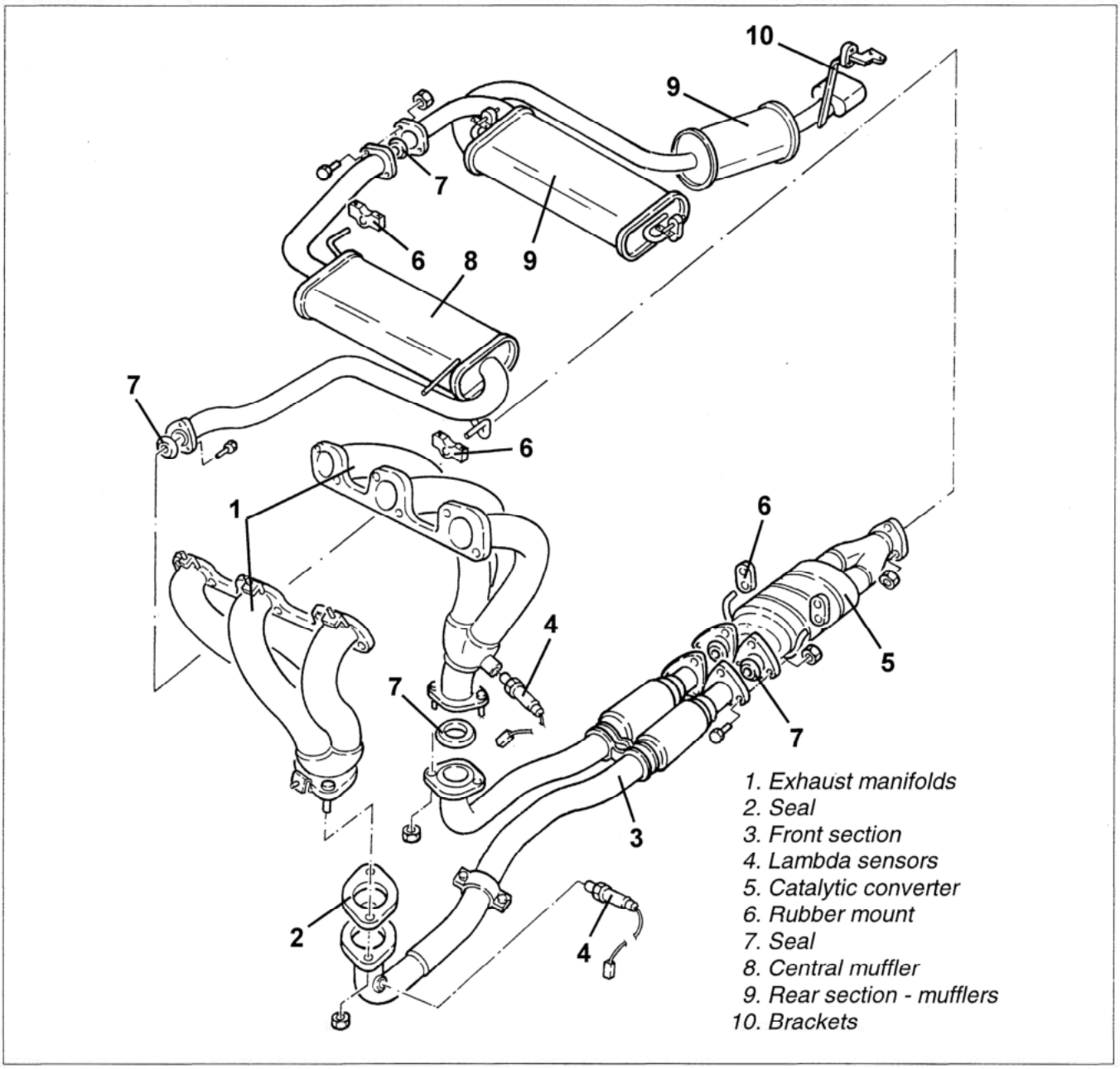

*1. Connection wire*
*2. Protective sleeve*
*3. Planar sensor element*
*4. Ceramic supporting tube*
*5. Sensor seat*
*6. Ceramic seal*
*7. Protection pipe*

The lambda sensor operation is based on the principle of a oxygen concentration cell and solid electrolyte. The surfaces of the measuring cells are covered with noble material micro-pore layers.




*1. Exhaust fumes*
*2. Reference air passage*
*3. Heater*
*4. Lambda sensor voltage*

## DESCRIPTION



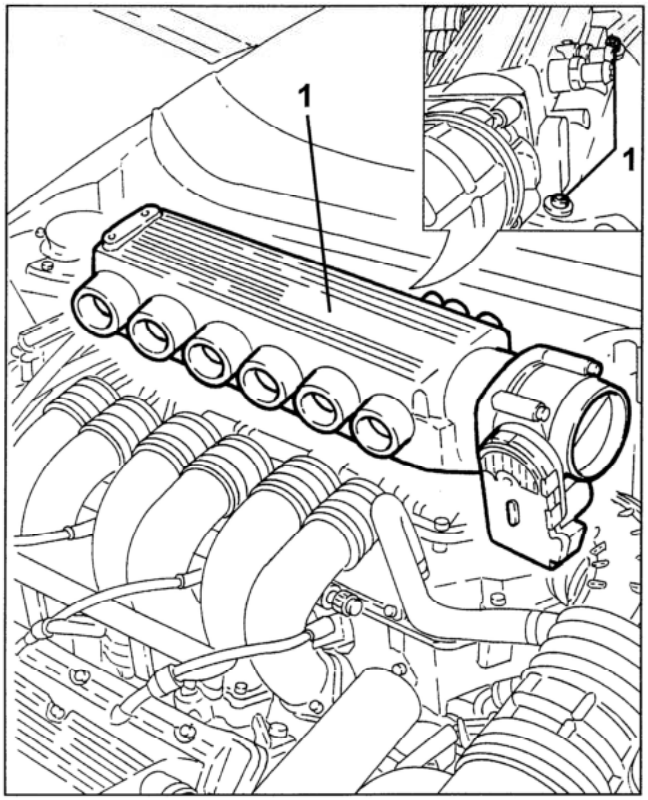

1. Exhaust manifolds
2. Seal
3. Front section
4. Lambda sensors
5. Catalytic converter
6. Rubber mount
7. Seal
8. Central muffler
9. Rear section - mufflers
10. Brackets

The gas from the cylinder heads are conveyed via the manifolds (1) to the front exhaust pipe section (3) where to rubber parts limiting the transmission of vibrations.
From the front section the exhaust gases are sent to the three way catalytic converter (5) where most of the polluting substances are transformed.
The exhaust gasses go from the catalytic converter and cross three specific mufflers (8) and (9).

The connections between the various sections of the pipe are ensured by flanges and seals. The system is linked to the underbody by means of rubber mounts. Heat radiation towards the underbody - which is considerable due to the catalytic converter - is limited by a set of firewalls located between the exhaust pipe and the underbody. The system is equipped with two lambda sensors (see "Lambda sensor" description).


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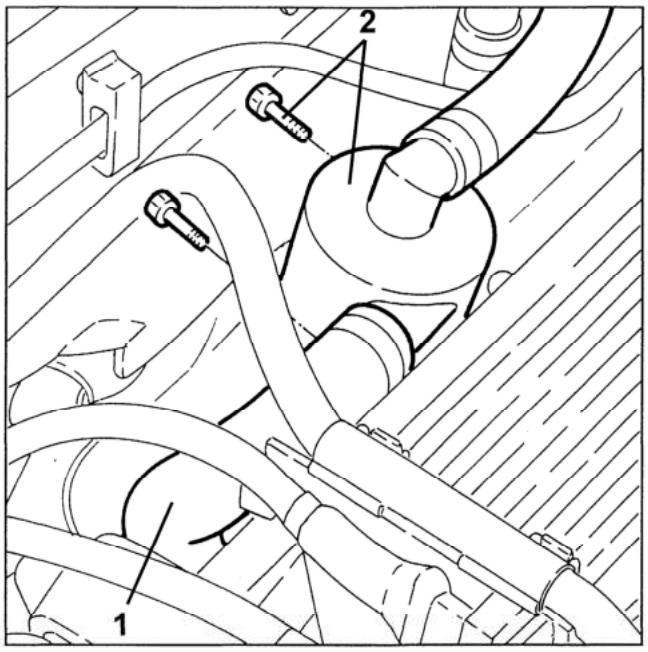
1. Loosen the fastening screws and remove the intake manifold.



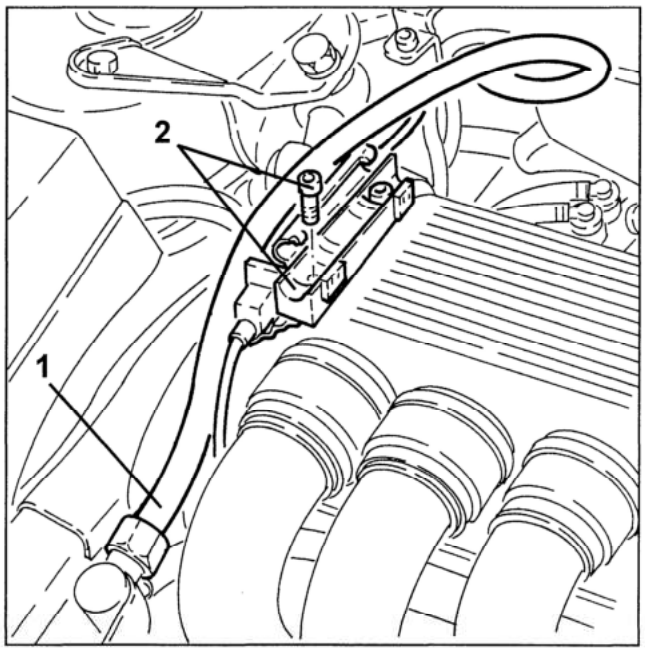


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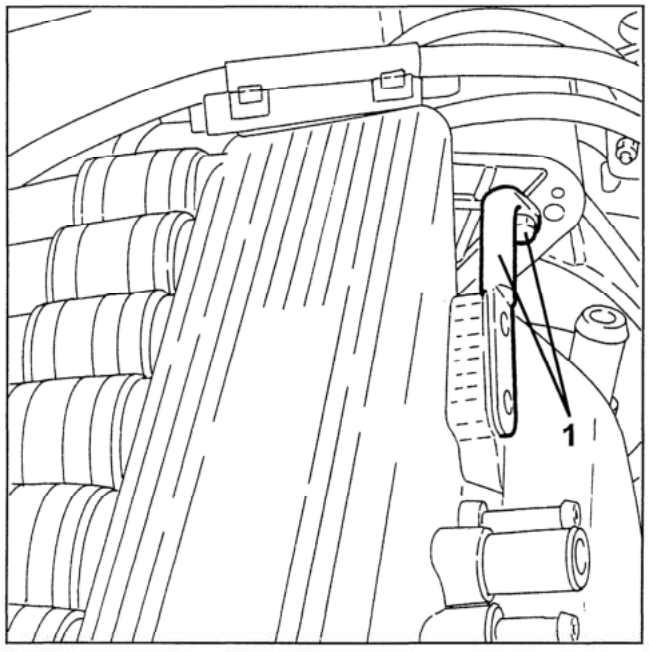
1. Disconnect the oil vapour recovery pipe from the right-hand cylinder head tappet cover.
2. Loosen the fastening screws and move the oil vapour separator from the intake manifold.



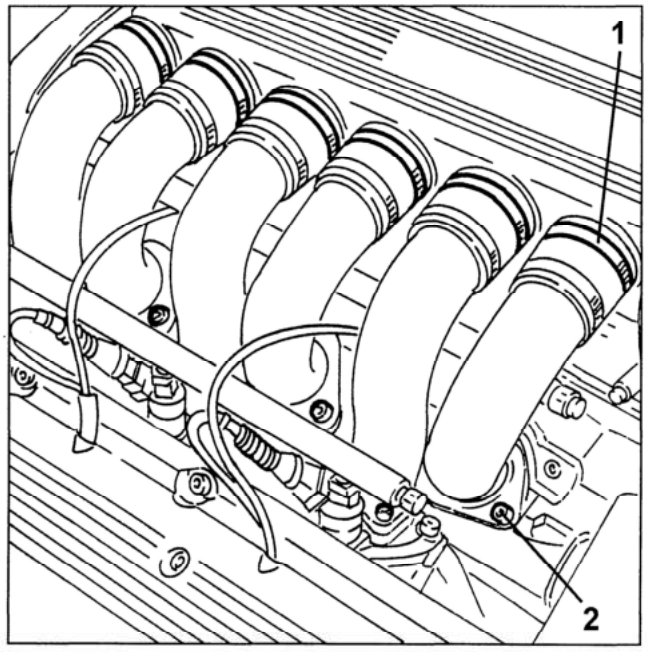

1. Release the fuel delivery pipe from the bracket.
2. Loosen the fastening screws and move the fuel feed delivery pipe bracket with front knock sensor electrical connection aside.




1. Loosen the screw and remove the intake manifold connection from the engine tie-rod bracket.



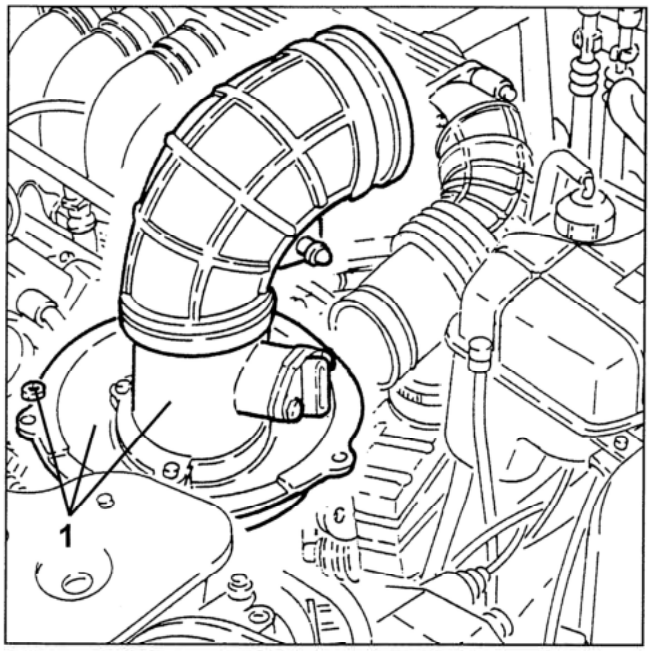

1. Loosen the intake manifold duct clips.
2. Loosen the intake manifold duct fastening screws.
- Release the ducts from the intake manifold.





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1. Loosen the fasten nuts and remove the air cleaner cover with hot film flow meter and corrugated sleeve.

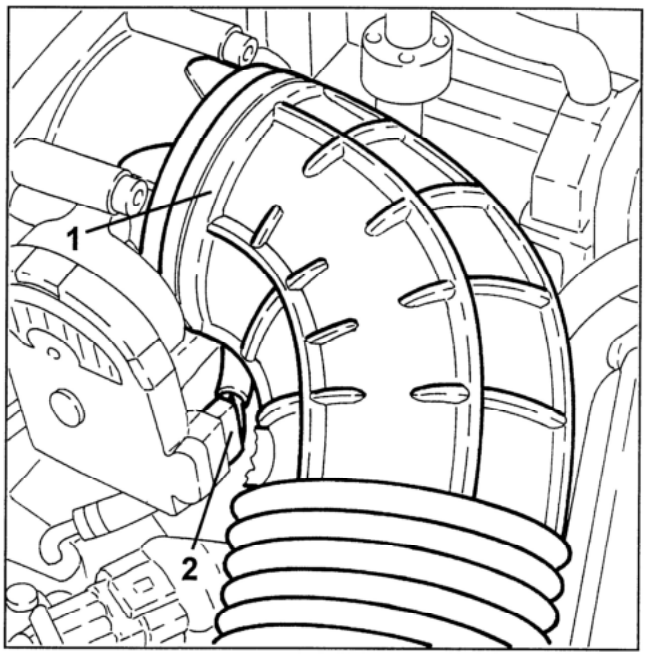



- At the bench, separate the hot film flow meter from the air filter cover and from the corrugated sleeve elbow.

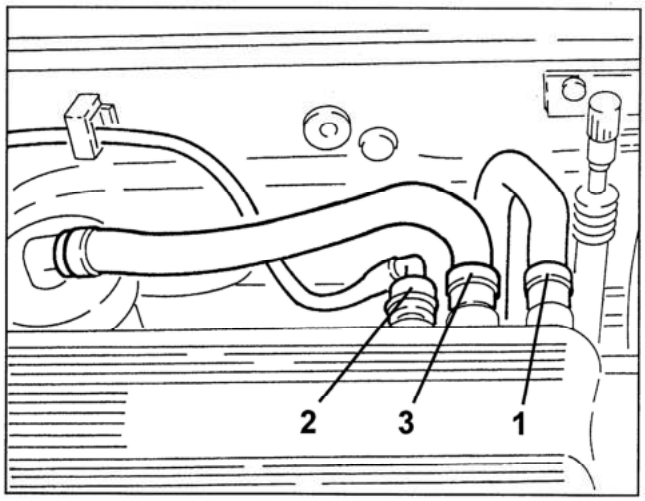
## INTAKE MANIFOLD

### REMOVAL/REFITTING

- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
1. Disconnect the corrugated sleeve from the throttle casing with built-in DVL.
2. Disconnect the electrical connection from the throttle casing with built-in DVL.




1. Disconnect the brake booster vacuum pipe from the intake manifold.
2. Disconnect the fuel vapour recovery pipe from the intake manifold.
3. Disconnect the oil vapour recirculation pipe from the intake manifold.





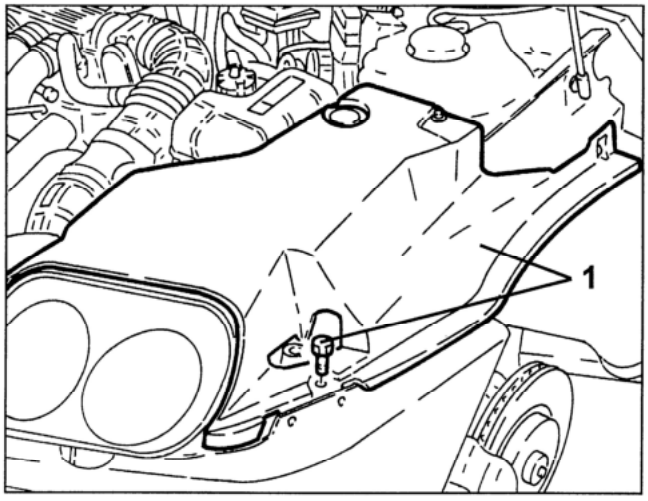
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**IMPORTANT: The air flow meter cannot be disassembled.**

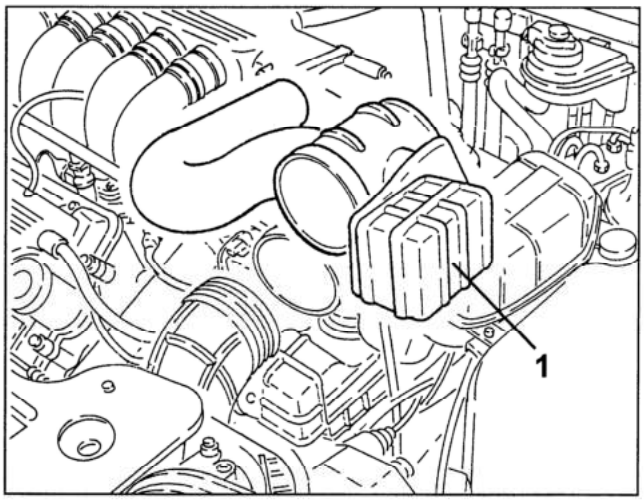
The operating principle consists of a heated membrane film in a measuring duct through which the engine intake air flows.
The film is maintained at constant temperature (approximately 120°C warmer than the intake air temperature) by a resistance.
The air flow in the duct tends to take heat from the film.
Consequently, a certain current is required by the resistance to keep the temperature.
This current is measured by means of a Wheatstone jumper and is proportional to the air flow.
This air flow meter directly measures the air mass (and not volume) thus eliminating problems related to temperature, altitude, pressure, etc.

## REMOVAL/REFITTING

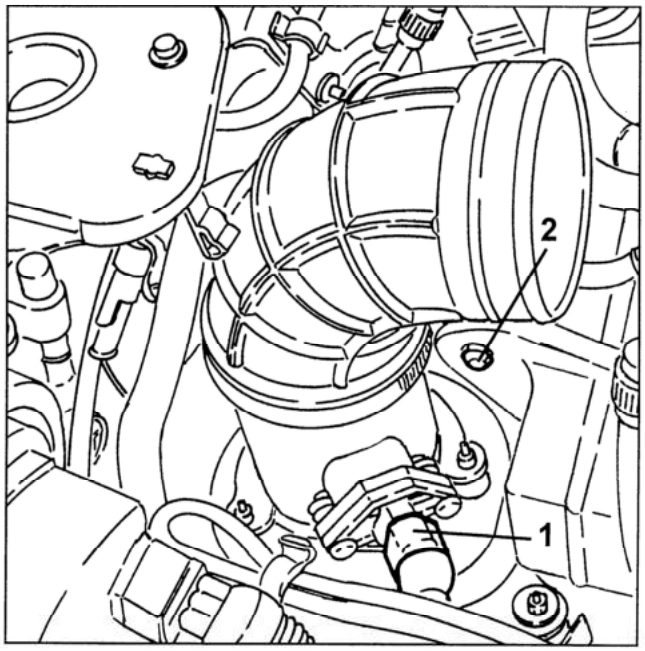
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
1. Loosen the screws and remove the engine compartment side guard.




1. Loosen the fastening clips and remove the upper resonator.



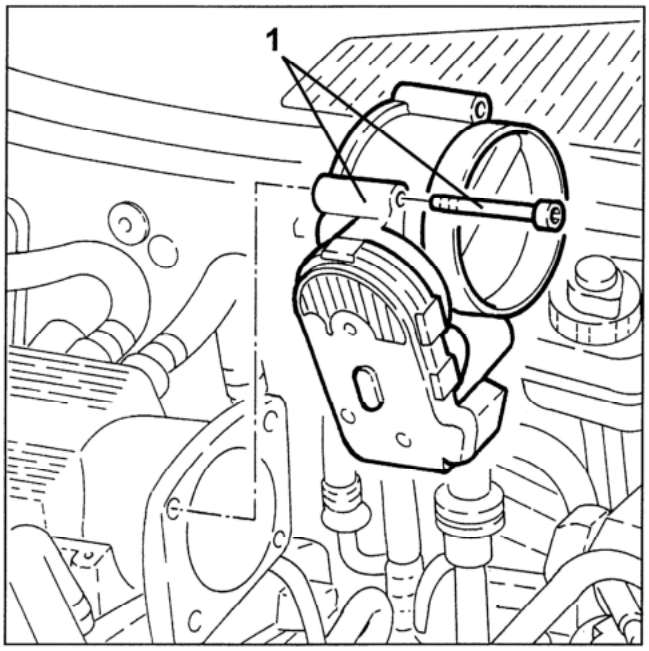

1. Disconnect the hot film flow meter electrical connection.
2. Release the corrugated sleeve elbow fastening button from the resonator.





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1. Loosen the fastening screws and remove the throttle casing with built-in DVL and seal.




**IMPORTANT: After refitting, repeat the throttle casing with built-in DVL self-learning procedure described below.**

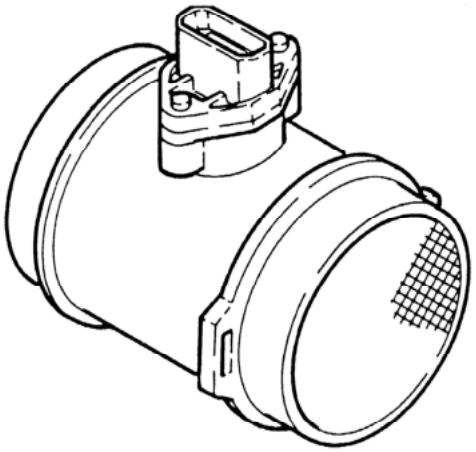
**IMPORTANT: During this procedure (from when the instrument panel is powered to the end of the self-learning procedure), do not press either the accelerator pedal, the brake pedal or the clutch pedal.**

- Make sure the ignition key is at STOP.
- Connect tool no. 1.806.365.000 to the diagnostic socket and turn the knob to 3.
- Connect Examiner.
- Turn the ignition key to MAR.
- Wait for 60 seconds for the ECU to check the throttle internal spring and the maximum/minimum angular positions.
- Turn the ignition key to STOP.
- Wait for 15 seconds for the ECU to record the learnt values in the EPROM.
- With Examiner, check whether the idling self-learning procedure was ended correctly (SELF-LEARNING OUTCOME - OK; SELF-LEARNING STORAGE - Done).

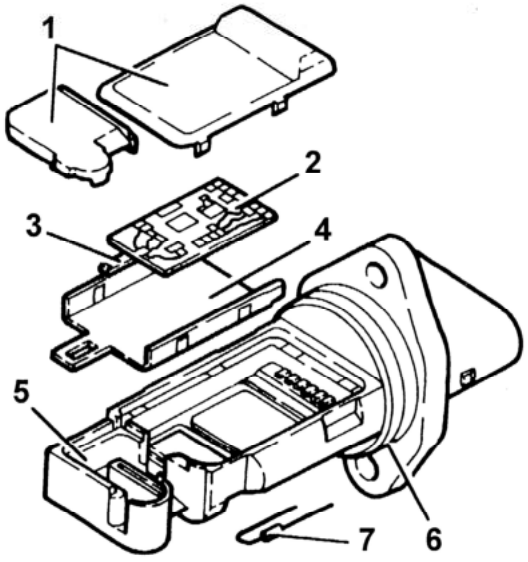
**NOTE: If the self-learning procedure is not correct, take the key to STOP and repeat the procedure. If the incorrect outcome persists, check the connection to the diagnostic socket and tool operation.**

## AIR FLOW METER

The "hot film" flow meter is located on the intake air sleeve.



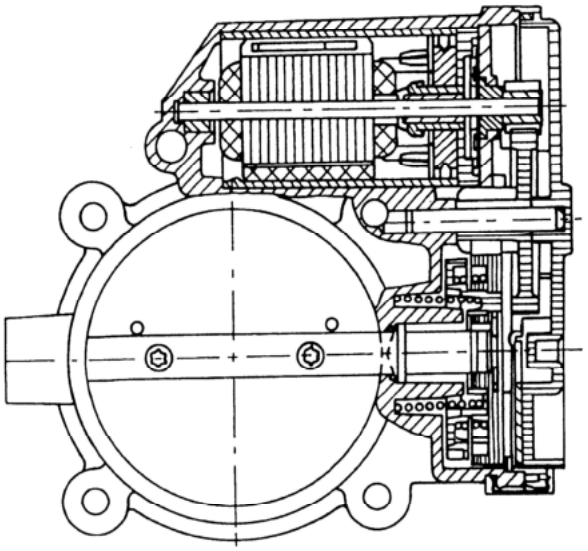
An intake air temperature sensor is built into the flow meter.




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

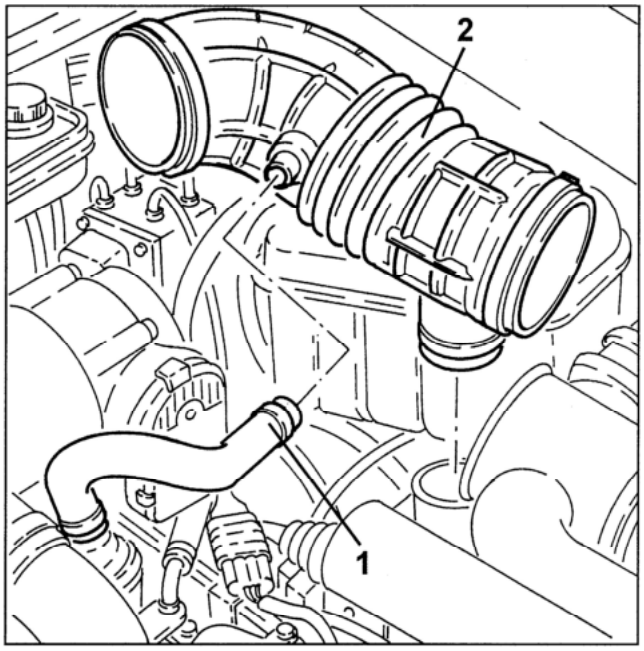
## THROTTLE CASING WITH BUILT-IN DVL

The device is fitted on the intake manifold and controls the amount of engine intake air. The ECU controls the throttle opening by means of a direct current motor built into the throttle casing according to the signal from the accelerator potentiometer. The throttle can be opened from 0° to 80°, including idling ratio.
The throttle casing with built in DVL is equipped with two potentiometers which back each other up. If the potentiometers fail or if power is cut, the ECU reduces engine torque as follows:
- if the accelerator pedal is fully depressed, the ECU cuts off feed to one or more cylinders to reach a maximum engine ratio of 2500 rpm
- if the accelerator pedal is in an intermediate position, the ECU cuts feed to one or more cylinders to reach an engine ratio lower than 2500 rpm.
After replacing either the throttle casing with built-in DVL or the injection ECU, a self-learning procedure is required (see specific paragraph).

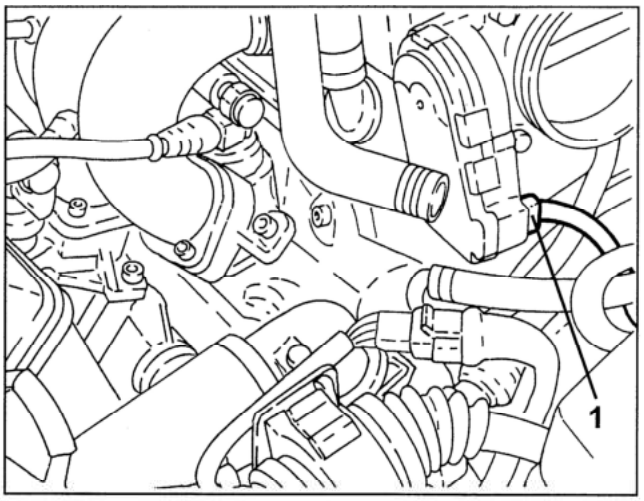


### REMOVAL/REFITTING

- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
1. Disconnect the oil vapour recirculation pipe from the corrugated sleeve.
2. Loosen the clips and remove the corrugated sleeve.



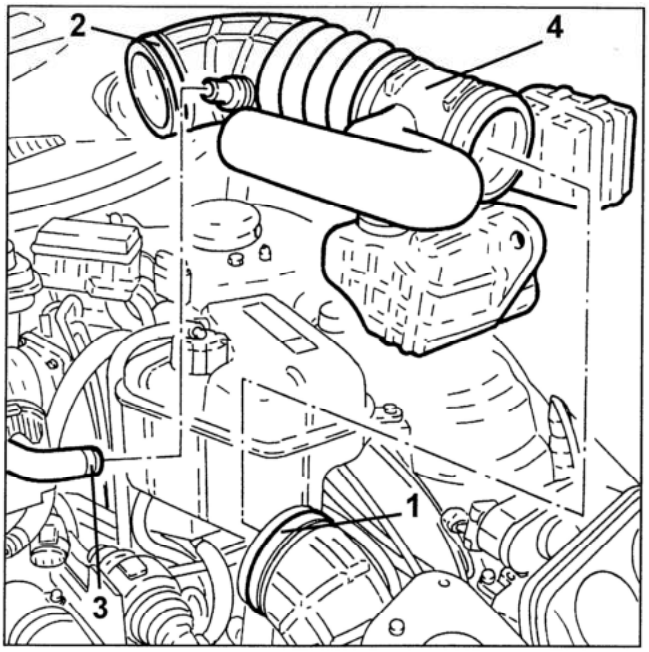

1. Disconnect the electrical connection from the throttle casing with built-in DVL.





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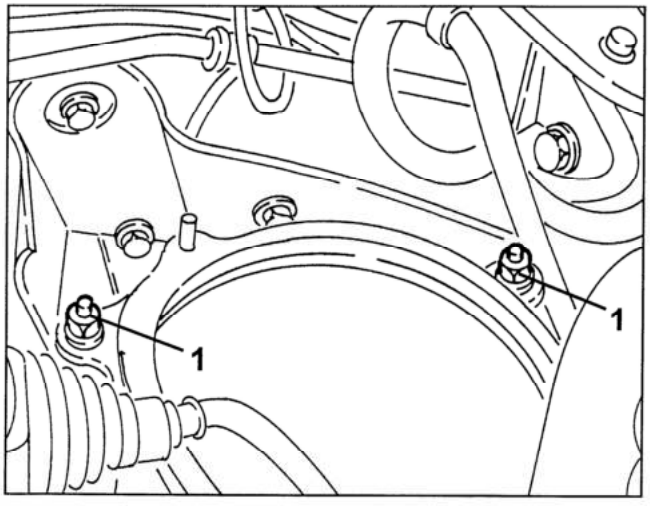
1. Loosen the clip fastening the upper resonator to the corrugated sleeve elbow.
2. Loosen the clip fastening the corrugated sleeve to the throttle casing with built-in DVL.
3. Loosen the clip and disconnect the oil vapour recirculation pipe from the corrugated sleeve.
- Release the button fastening the corrugated sleeve elbow to the resonator.
4. Remove the intermediate resonator with upper resonator and corrugated sleeve. Separate at the bench, if required.



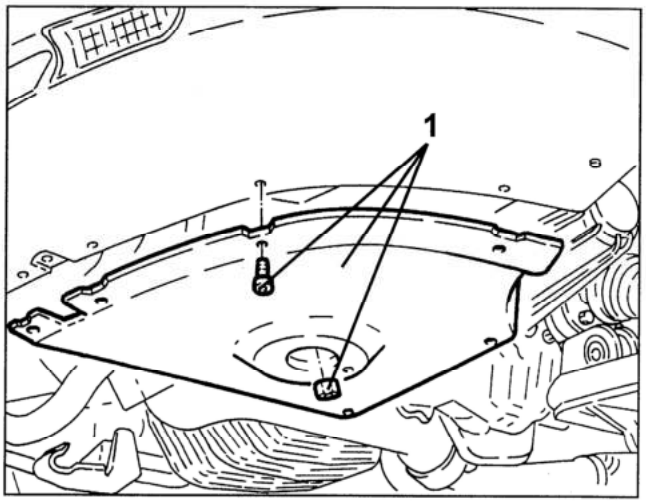

## AIR CLEANER CASING

### REMOVAL/REFITTING

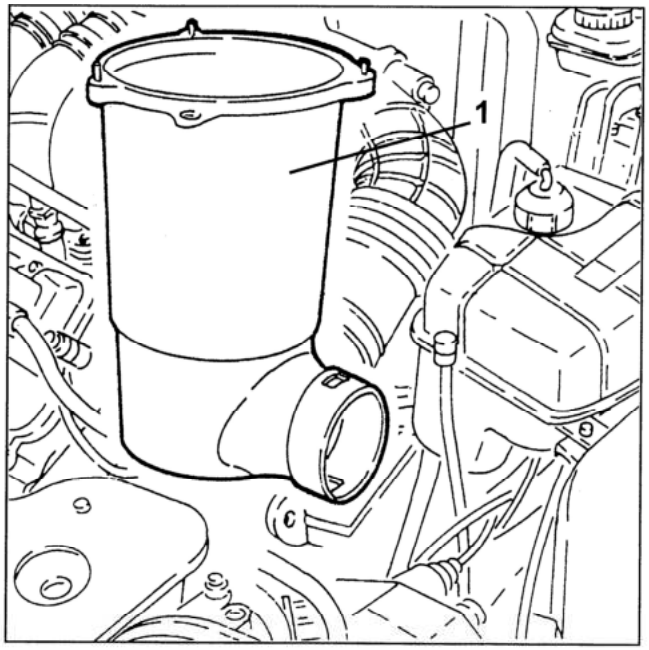
- Position the vehicle on a shop jack.
- Remove the air cleaner cartridge (see specific paragraph).
1. Loosen the air cleaner fastening nuts.




- Lift the vehicle.
1. Loosen the screws and nut and then remove the air filter lower guard.



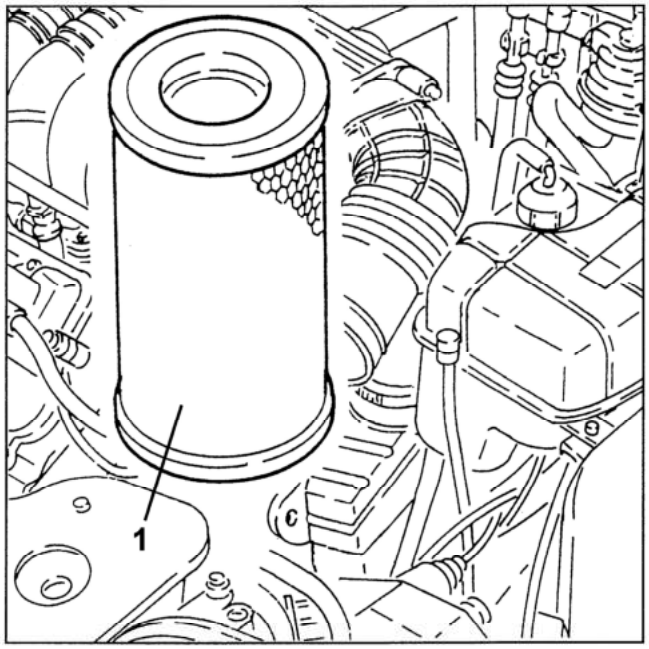

- Release the air cleaner casing from the lower resonator sleeve.
1. Lower the vehicle and remove the air cleaner casing.





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1. Remove the filtering element and manifold.



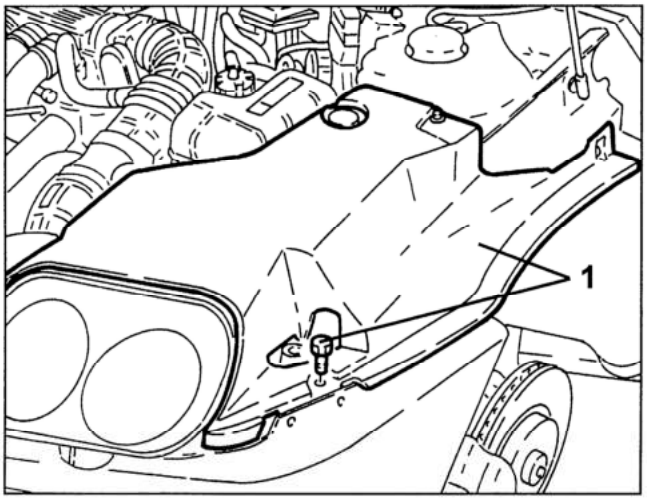

**IMPORTANT: Cleaning operations can damage the filter and compromise correct engine operation.**

- Refit a new air cleaner by reversing the removal sequence.

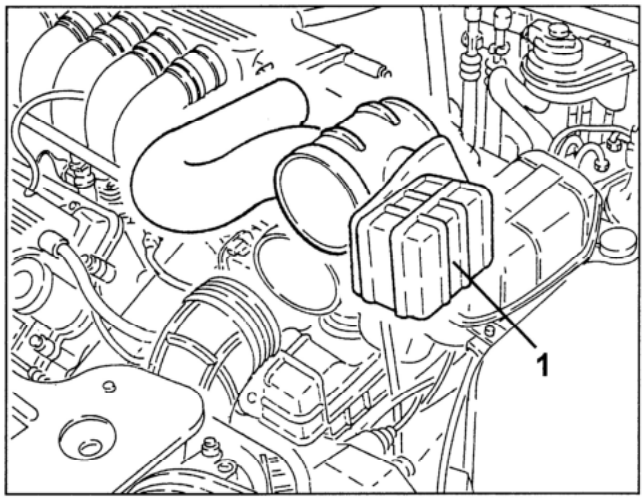
## UPPER RESONATOR

### REMOVAL/REFITTING

1. Loosen the screws and remove the engine compartment side guard.



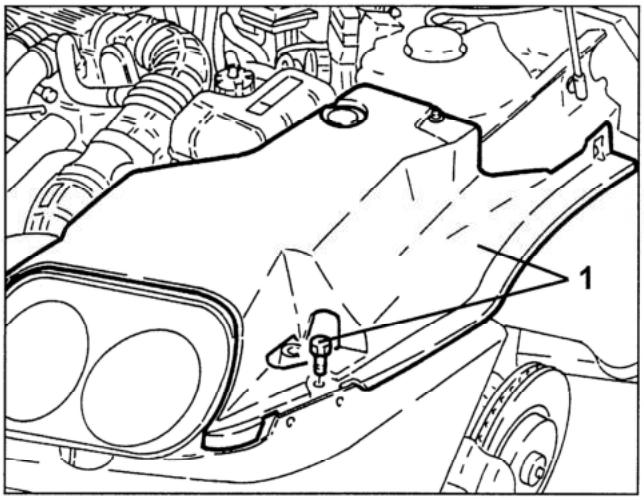

1. Loosen the fastening clips and remove the upper resonator.




## INTERMEDIATE RESONATOR

### REMOVAL/REFITTING

1. Loosen the screws and remove the engine compartment side guard.

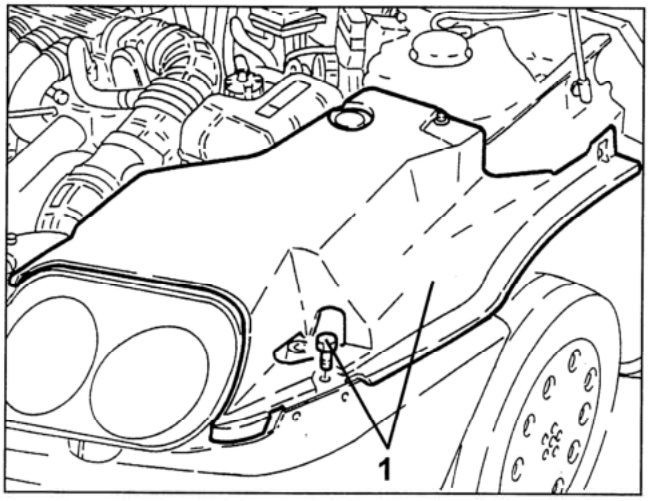




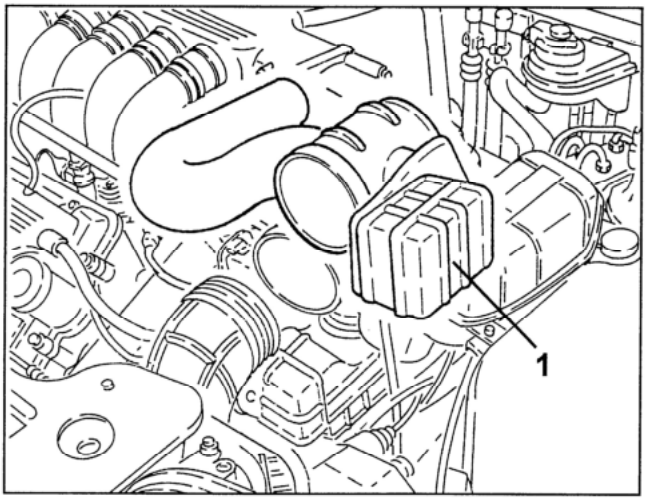
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## AIR CLEANER CARTRIDGE REPLACEMENT

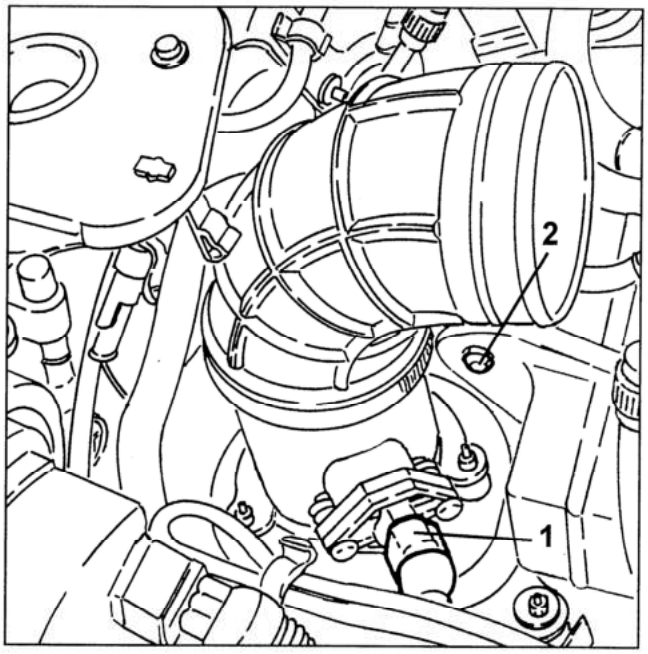
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
1. Loosen the screws and remove the engine compartment side guard.



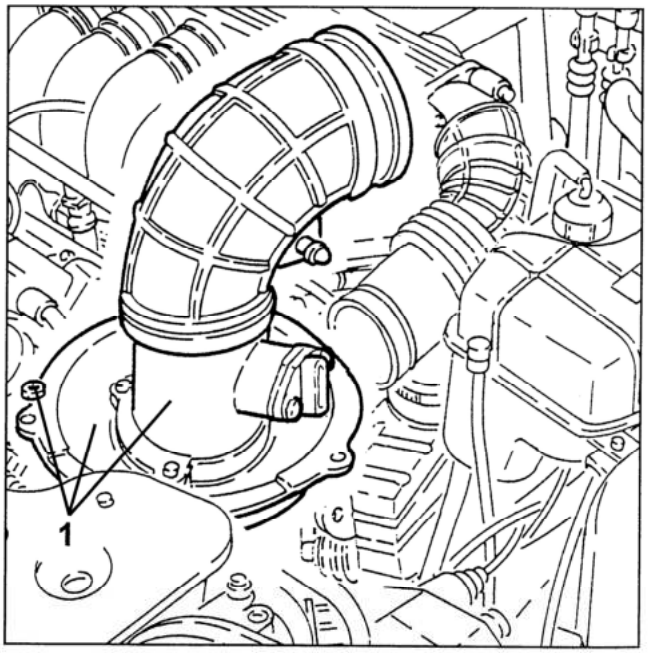

1. Loosen the fastening clips and remove the upper resonator.



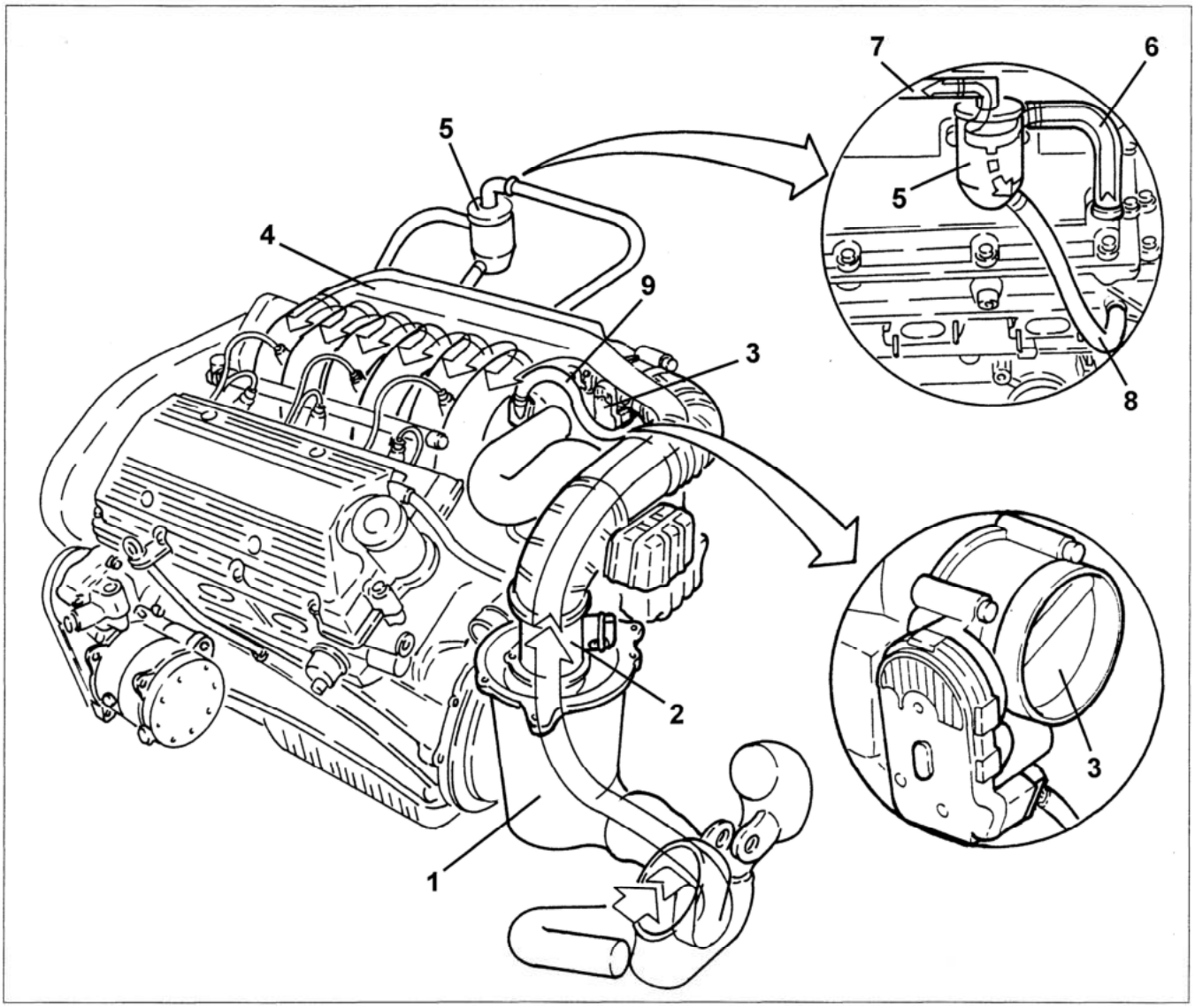

1. Disconnect the hot film flow meter electrical connection.
2. Release the corrugated sleeve elbow fastening button from the resonator.




1. Loosen the fasten nuts and remove the air cleaner cover with hot film flow meter and corrugated sleeve.



# AIR FEED AND OIL VAPOUR RECOVERY SYSTEM DESCRIPTION




*1. Air cleaner*
*2. Hot film flow meter*
*3. Throttle casing with built-in DVL.*
*4. Intake manifold*
*5. Oil vapour separator*
*6. Oil vapour recovery pipe*
*7. Oil vapour recirculation pipe*
*8. Condensed oil recovery pipe*
*9. Oil vapour recovery pipe*

The air is taken in via a dynamic inlet and filtered by a cartridge element (1).
It crosses the hot film flow meter (2) and reaches the throttle casing with built-in DVL (3) via the corrugated sleeve.
"Resonators" are fitted along the intake duct.
The throttle casing with built-in DVL is controlled by the injection ECU according to the accelerator pedal potentiometer and regulates the amount of air taken in by the engine.

The fuel vapours (see specific paragraph) and the oil vapours reach the feed system. Oil vapour emission is controlled by means of a separator (5) which collects the vapours in the cylinder head via pipe (6). The temperature difference between the separator and oil vapours causes partial condensation. The condensed vapours are conveyed to the cylinder head via pipe (8). When idling, the oil vapours are conveyed via pipe (7) and at high loads, via pipe (9).

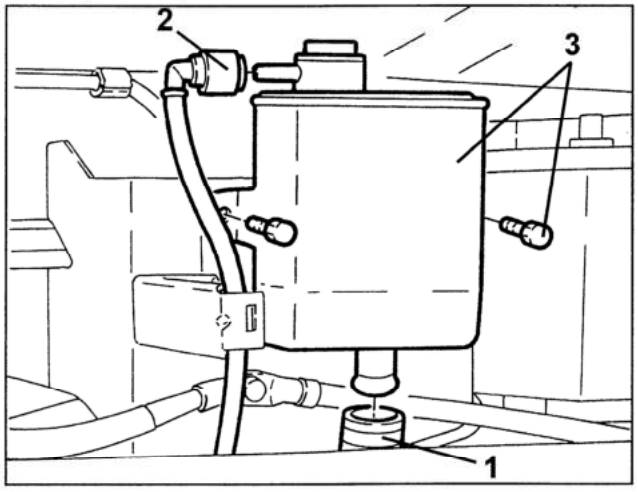

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## FUEL VAPOUR SEPARATOR

Located in the boot, the separator has the purpose of limiting the amount of fuel vapours which reach the canister by condensing a part of them, thanks to its shape.
It consists of a plastic container with two connections: one lower vapour inlet and condensed fuel outlet and one upper outlet to the canister.

### REMOVAL/REFITTING

- Remove the space saver spare wheel.
- Remove the boot upholstery.
1. Disconnect the tank fuel vapour inlet pipe from the separator.
2. Disconnect the canister fuel outlet pipe from the separator.
3. Loosen the fastening screws and remove the fuel vapour separator.

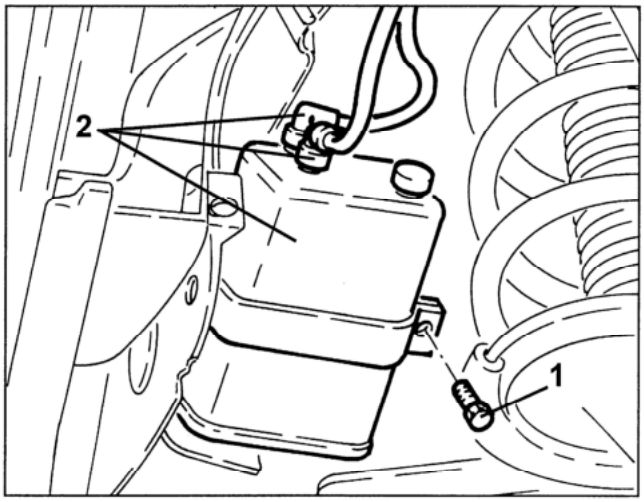



## FUEL VAPOUR CANISTER

This device consists of an active carbon filtering element in a plastic casing which absorbs the fuel vapours from the separator. A one-way valve, to which it is connected via a specific pipe, allows to take in external air during vapour intake to wash the active carbon filter.

### REMOVAL/REFITTING

- Position the vehicle on a shop jack.
- Remove the right-hand front wheel.
- Loosen the screws and remove the right side engine compartment guard.
- Remove the right front wheelhouse.
1. Loosen the canister fastening screw.
2. Disconnect the two canister pipes and remove the canister.

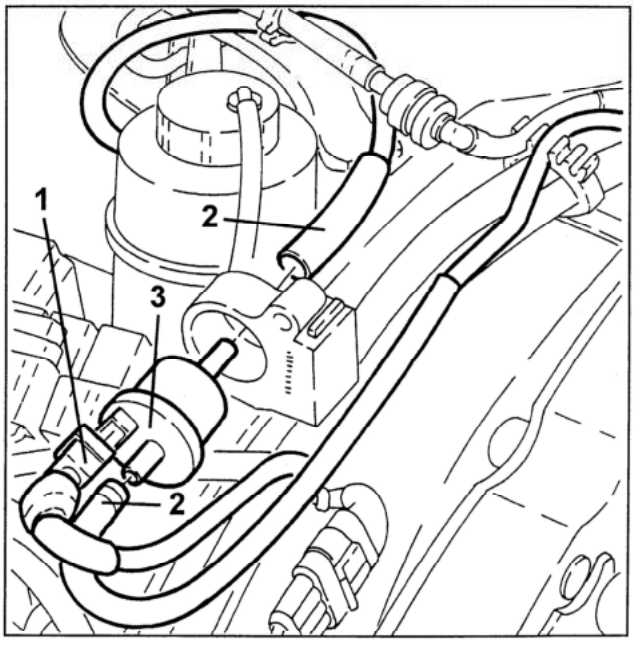



## FUEL VAPOUR SOLENOID VALVE

This valve is controlled by the injection ECU and lets the fuel vapours stored in the canister into the intake manifold.

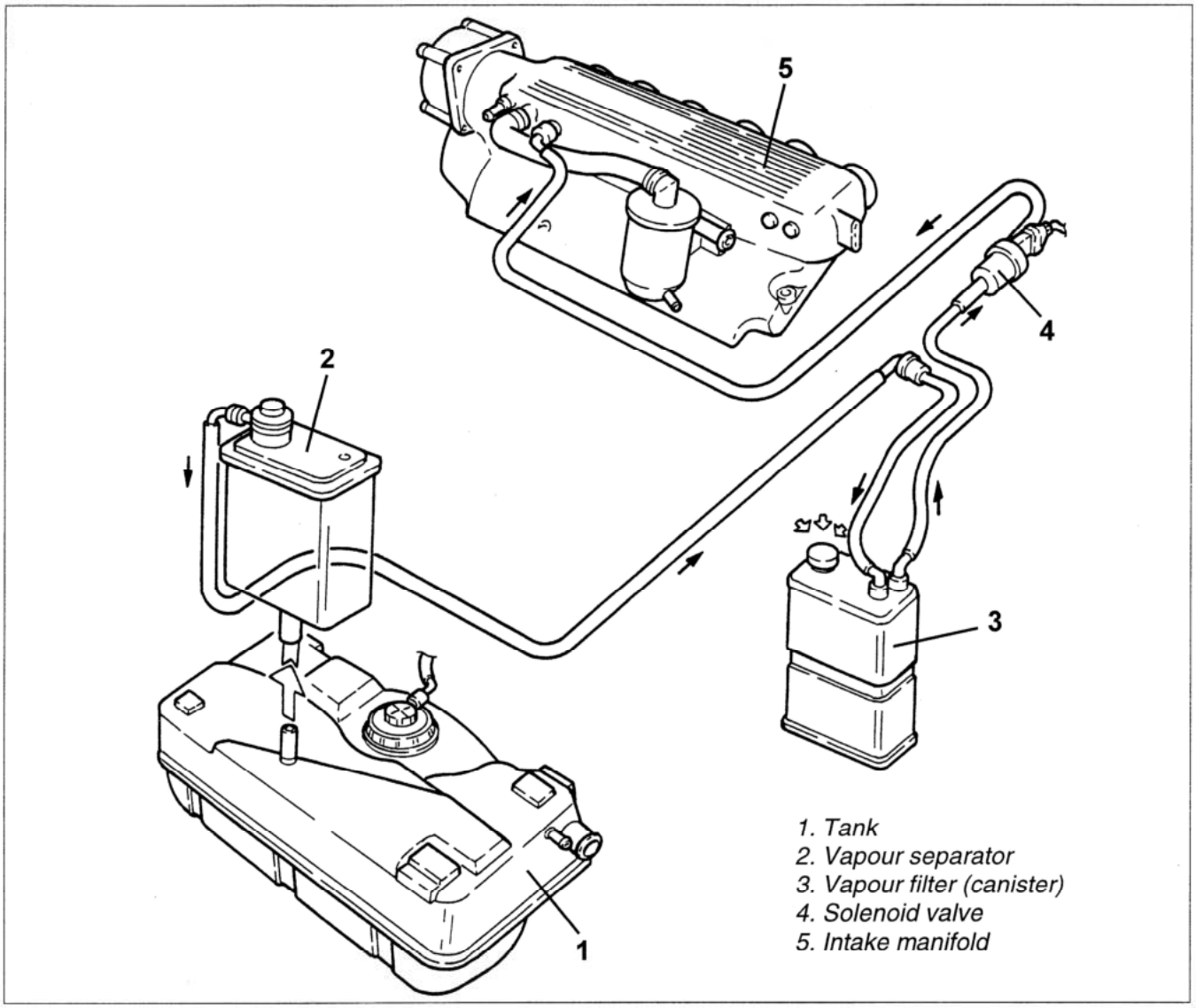
### REMOVAL/REFITTING

- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Loosen the screws and remove the right engine compartment guard.
1. Disconnect the fuel vapour solenoid valve electrical connection.
2. Disconnect the fuel vapour solenoid valve inlet and outlet pipes.
3. Remove the fuel vapour solenoid valve by removing it from its bracket.




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## FUEL VAPOUR RECOVERY SYSTEM DESCRIPTION

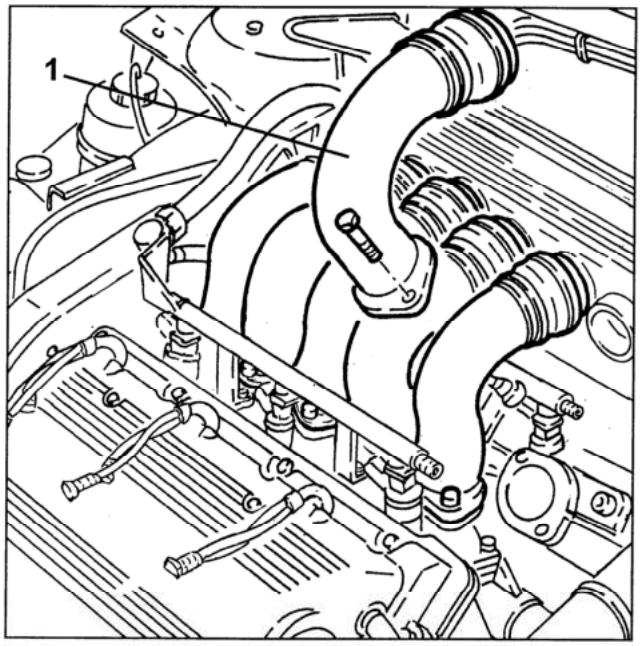



The fuel in the tank produces a considerable amount of potentially polluting vapours if released into the atmosphere.
The purpose of the vapour control and recovery system is to recover the vapours and burn them in the engine.
The vapours from the tank (1) reach the separator (2) via a specific pipe which is shaped as to allow the condensed fuel to drip back into the tank.
The remaining fuel vapours are sent to the canister (3) where they are absorbed and stored by the active carbon filter.
A solenoid valve (4) is located between the canister and the engine intake.
When the solenoid is not activated, the connection is closed and the fuel vapours remain inside the canister thanks to the active carbon filter.

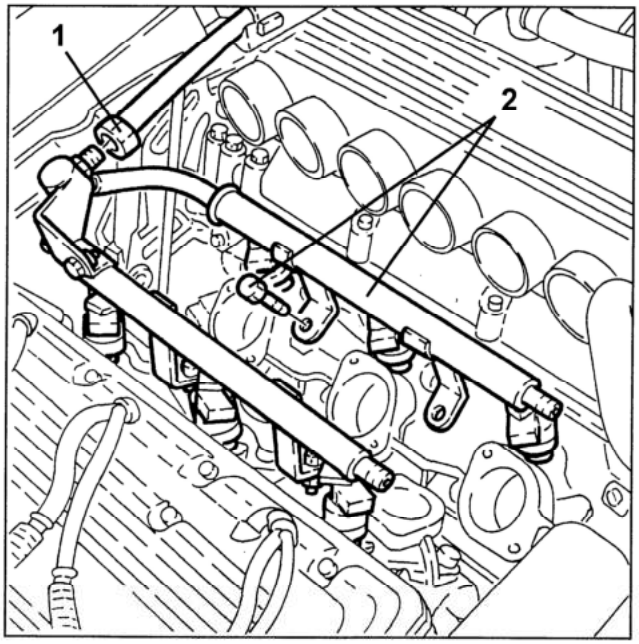
In certain conditions of load, the ECU opens the solenoid valve allowing any vapours in the canister to be taken in.
This condition persists even when the lambda sensors detect decreased oxygen in exhaust due to excessive presence of fuel in the firing chamber.
If there are no fuel vapours in the canister, and consequently only air is taken in, the lambda sensors detect and inform the ECU of an increase in oxygen. In this case, the ECU closes the solenoid valve and the connection with the canister thus eliminating the excessive air intake.


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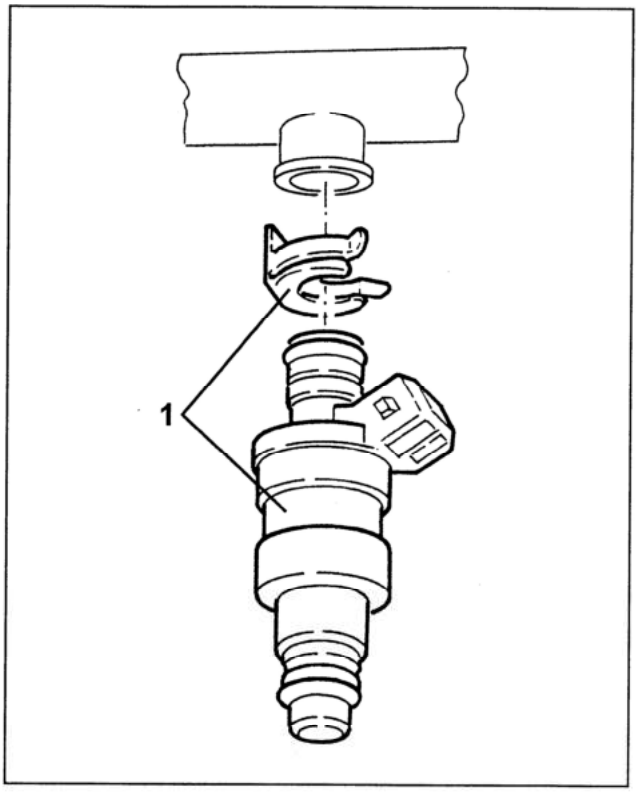
1. Loosen the clips and the screws. Then remove the intake air ducts.




1. Disconnect the fuel delivery pipe from the distribution manifold.
2. Loosen the screws and remove the distribution manifold and injectors.



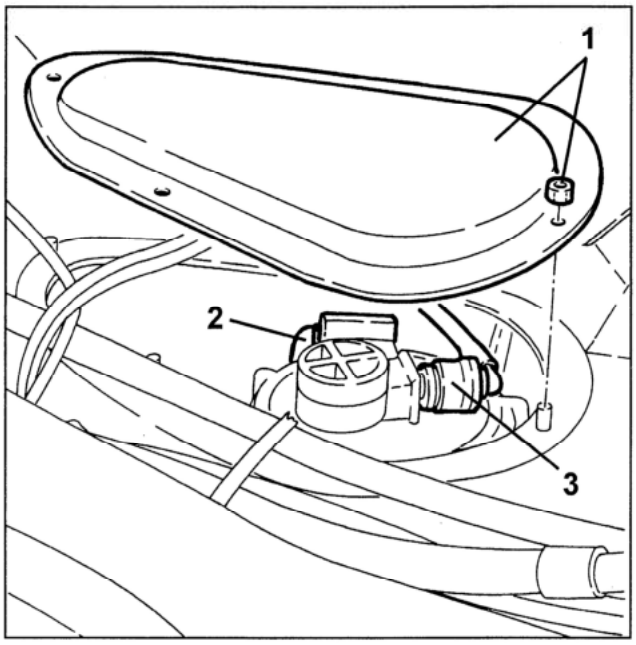

1. At the bench, remove the retainers and remove the injectors from the distribution manifold.



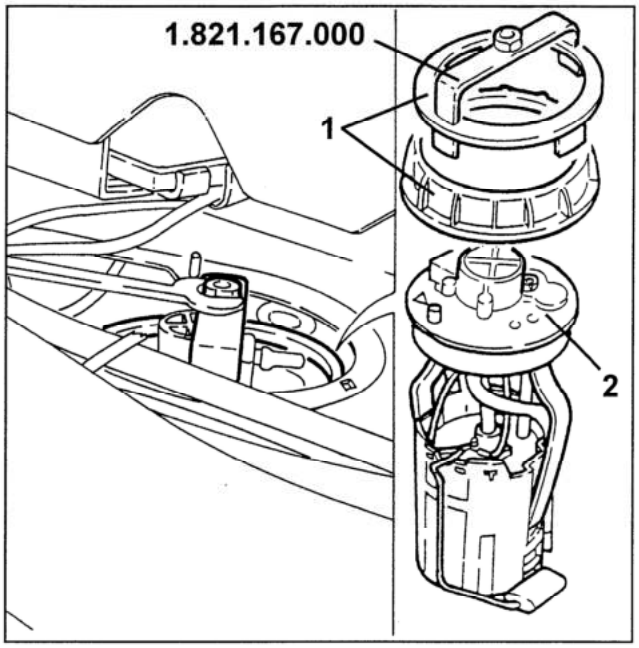
The pump is a single stage, peripheral flow device which ensures high performance at low voltage and temperature. The advantages with respect to volumetric pumps are:
- lower weight
- smaller size.

## REMOVAL/REFITTING

- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Remove the rear seat cushion and back (see specific paragraph).
1. Loosen the fastening nuts and remove the fuel pump and gauge guard.
2. Disconnect the fuel pump and gauge electrical connection.
3. Disconnect the fuel delivery pipe from the fuel pump and gauge.




1. Use tool no. 1.821.167.000 to remove the fuel pump and gauge fastening nut screw.
2. Remove the fuel pump and gauge.



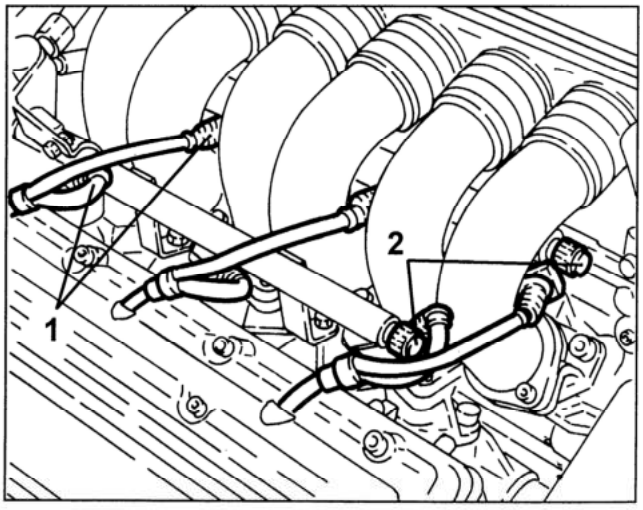

- Refit the fuel pump so that the arrow printed on the fuel pump guard is aligned with the reference mark on the tank.

## INJECTORS

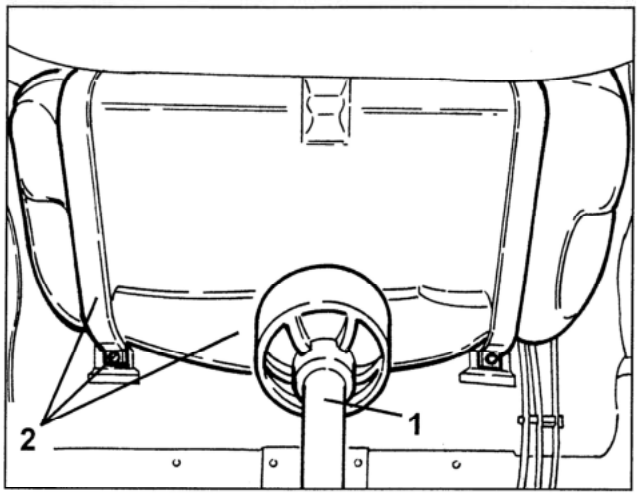
### REMOVAL/REFITTING

- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
1. Disconnect the injector electrical connections.
2. Drain fuel pressure by loosening the caps on the distribution manifold and operating the underlying valves.

**NOTE: Collect the fuel which is let out in a suitable container.**

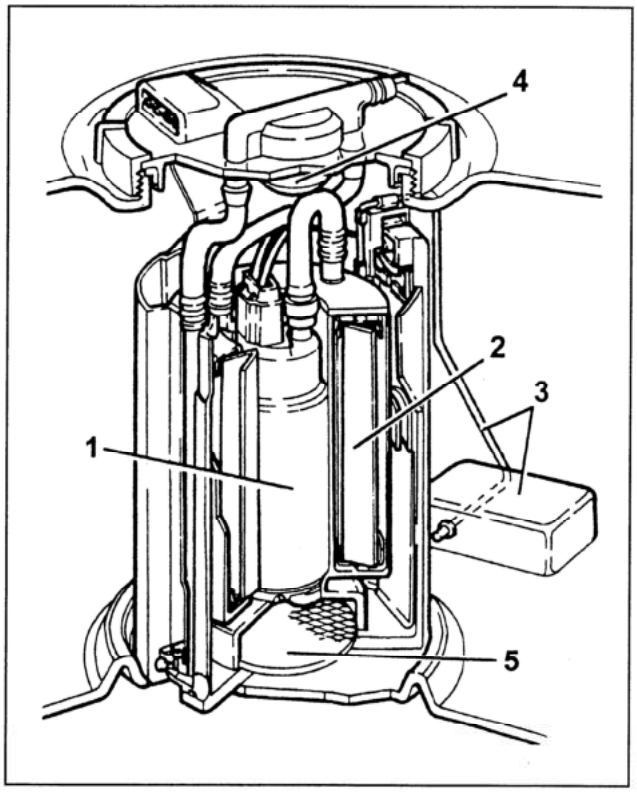


1. Position a hydraulic jack under the fuel tank.
2. Loosen the fuel tank metal belts and remove the tank by lowering the hydraulic jack.

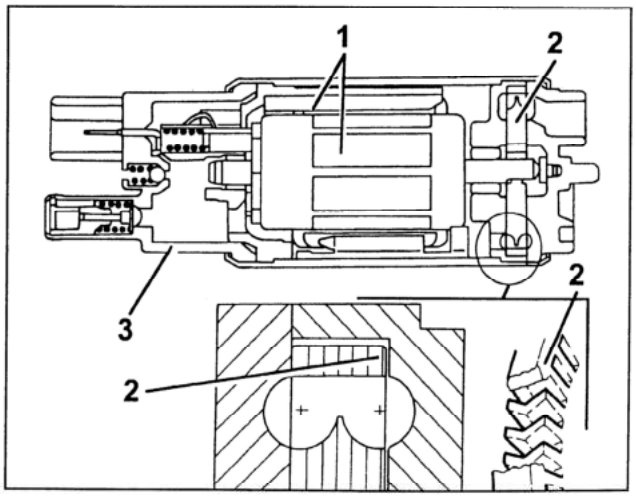



## FUEL PUMP AND GAUGE

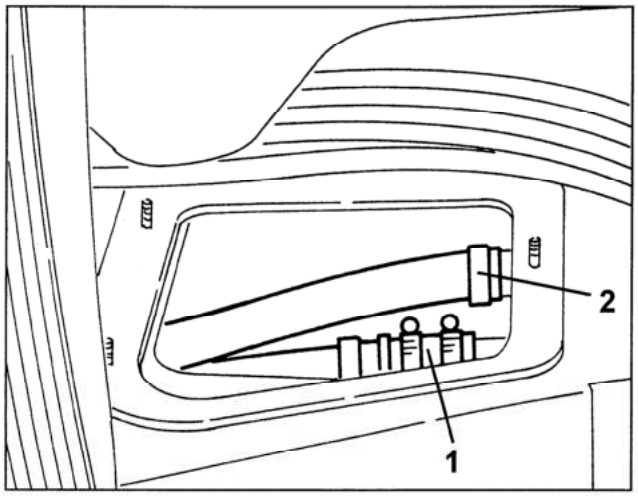
The main parts are:
- electrical fuel pump (1)
- fuel filter (2)
- float gauge (3)
- membrane pressure regulator (4)
- mesh pre-filter (5).



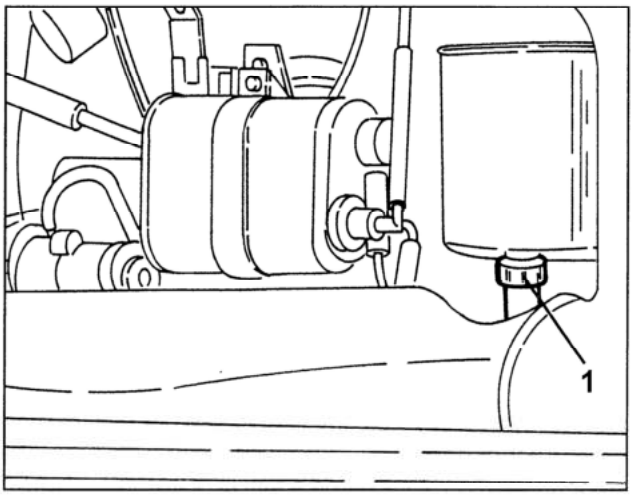

The fuel pump features a permanent magnet electrical motor (1) which controls the pump impeller (2) and a terminal guard (3) which contains the electrical and hydraulic connections.



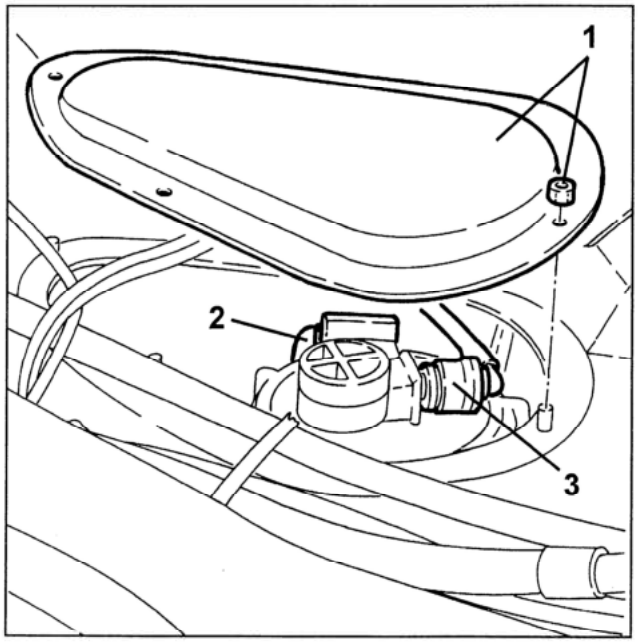
1. Loosen the fastening clip and disconnect the fuel filler from the tank.
2. Loosen the fastening clip and disconnect the breather pipe from the fuel tank.



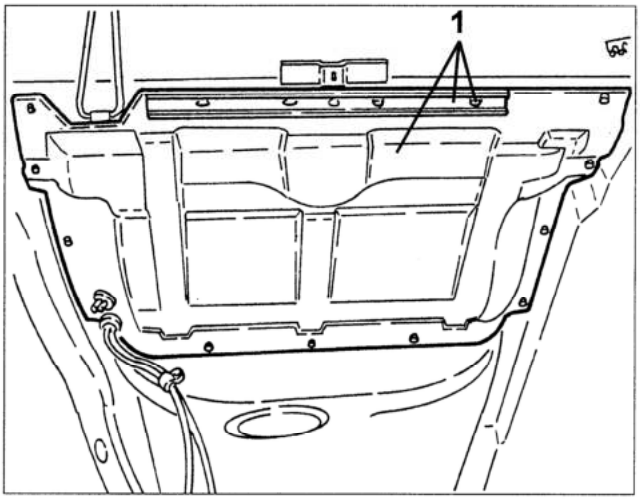

1. From inside the boot, lift the upholstery and disconnect the tank vapour inlet pipe from the fuel vapour separator.




1. Loosen the fastening nuts and remove the fuel pump and gauge guard.
2. Disconnect the fuel pump and gauge electrical connection.
3. Disconnect the fuel delivery pipe from the fuel pump and gauge.

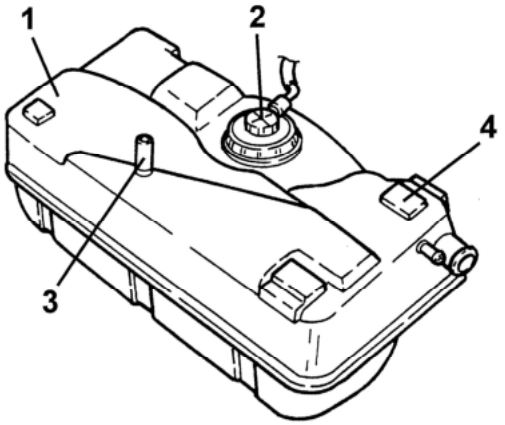



- Lift the vehicle and remove the rear suspension (see specific paragraph).
1. Loosen the fastening screws and remove the tank protection sheet and reinforcement bar.



## FUEL TANK

The tank is made of steel and has a capacity of 70 litres, including a reserve of approximately 9 litres. The filler is on the main casing and a specific compartment so that it can be removed from the tank. This allows removing the tank.



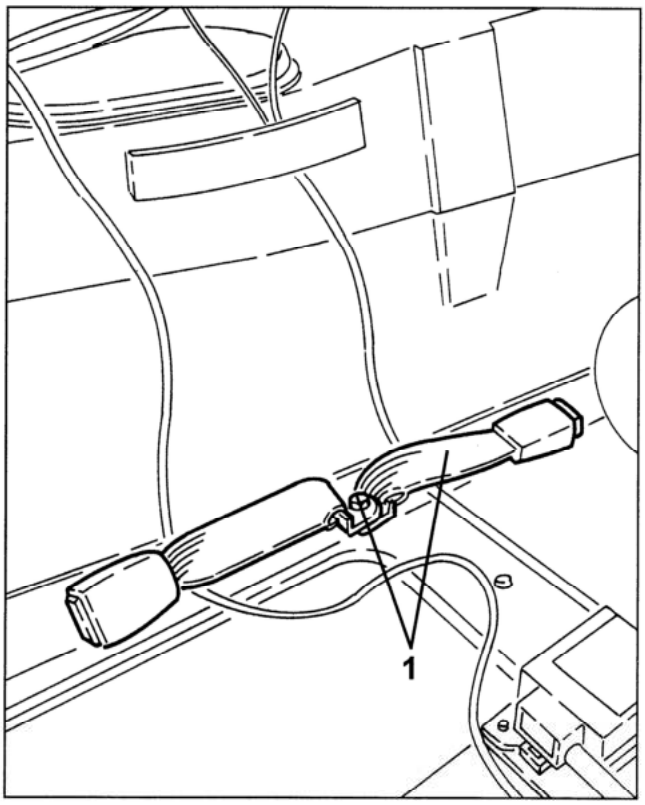

*1. Tank*
*2. Fuel pump and gauge*
*3. Vapour recovery pipe*
*4. Dampers*

The filler cap presents a system which ensures it can only be closed at the prescribed torque. Excessive torque (exceeding prescriptions) will cause the notches to turn without locking.
The tank is fitted under the rear seat and is fastened by means of two belts to the underbody. it is protected by a specific steel partition.
The fuel filler pipe doubles as a breather.
The fuel pump and gauge is housed above the tank.
A specific pipe allows the fuel vapours to reach the separator from the tank.

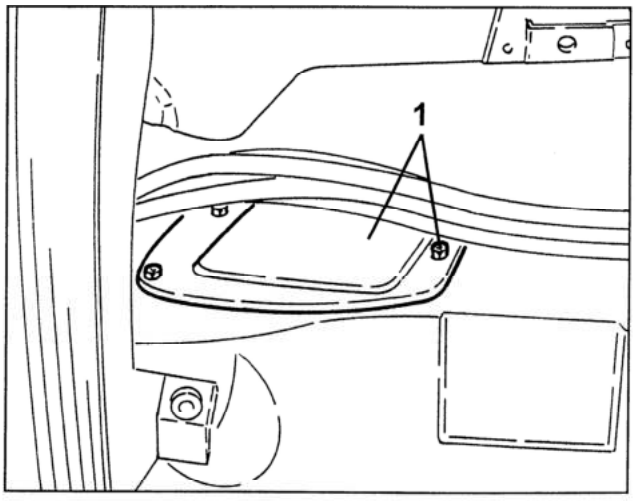
### REMOVAL/REFITTING

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Empty the tank by sucking fuel from the filler with a suitable tool.
- Remove the rear seat cushion and back (see specific paragraph).

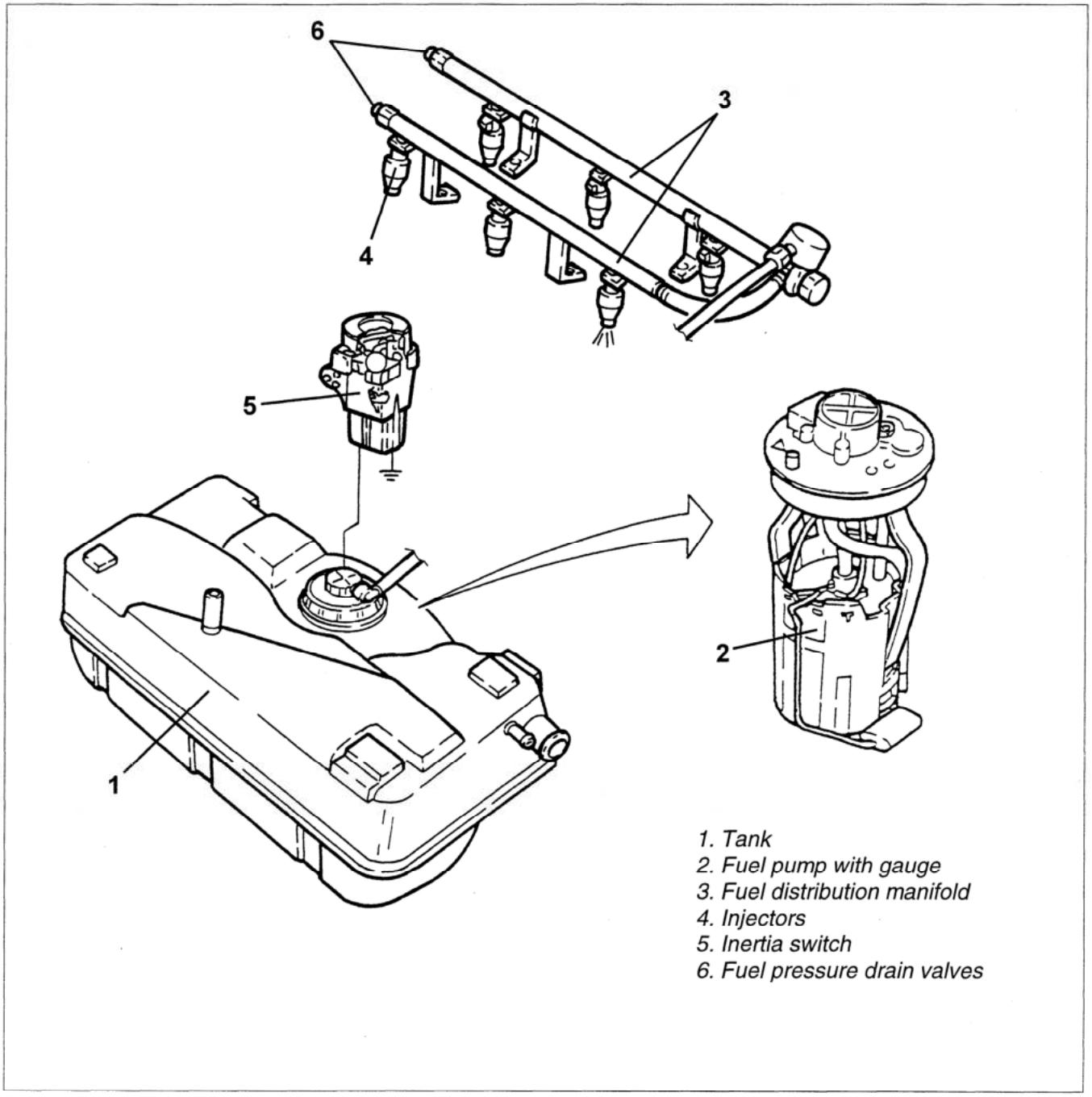
1. Loosen the fastening screw and remove the rear seat belt retainers.




1. Loosen the fastening nuts and remove the fuel tank filler cover.



## FUEL FEED SYSTEM DESCRIPTION




*1. Tank*
*2. Fuel pump with gauge*
*3. Fuel distribution manifold*
*4. Injectors*
*5. Inertia switch*
*6. Fuel pressure drain valves*

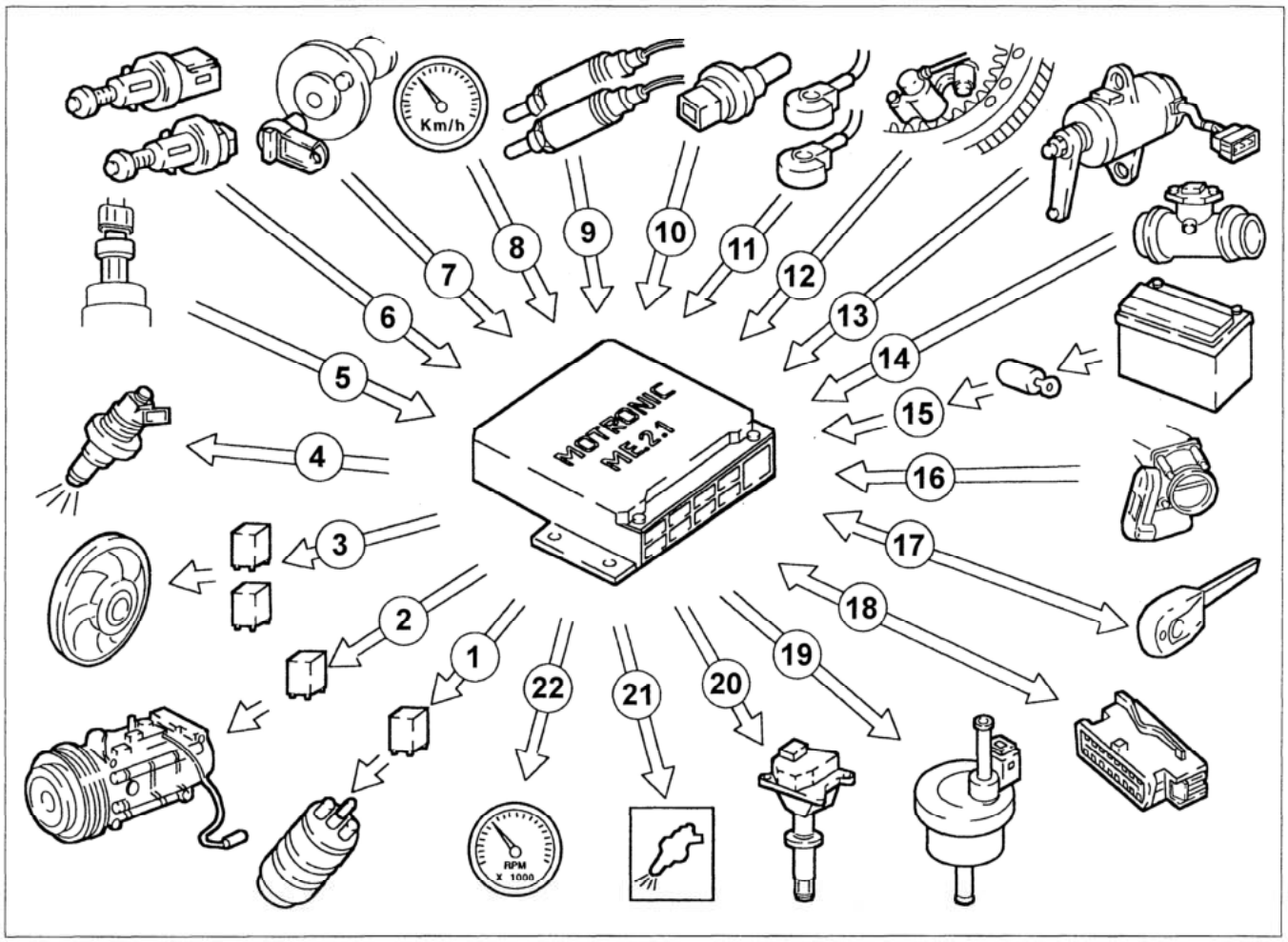
The fuel feed system is returnless, i.e. a single pipe connects the fuel pump and the engine. Advantages are:
- reduced possibility of the car catching fire after an accident
- reduced fuel vapour emission in the atmosphere.

The filler cap is fitted on the steel fuel tank main casing.

The electrical fuel pump is contained in a frame which also houses the following components:
- fuel pressure regulator
- fuel gauge
- fuel filter.

The system is equipped with an inertia switch which cuts fuel pump power in the event of an impact.

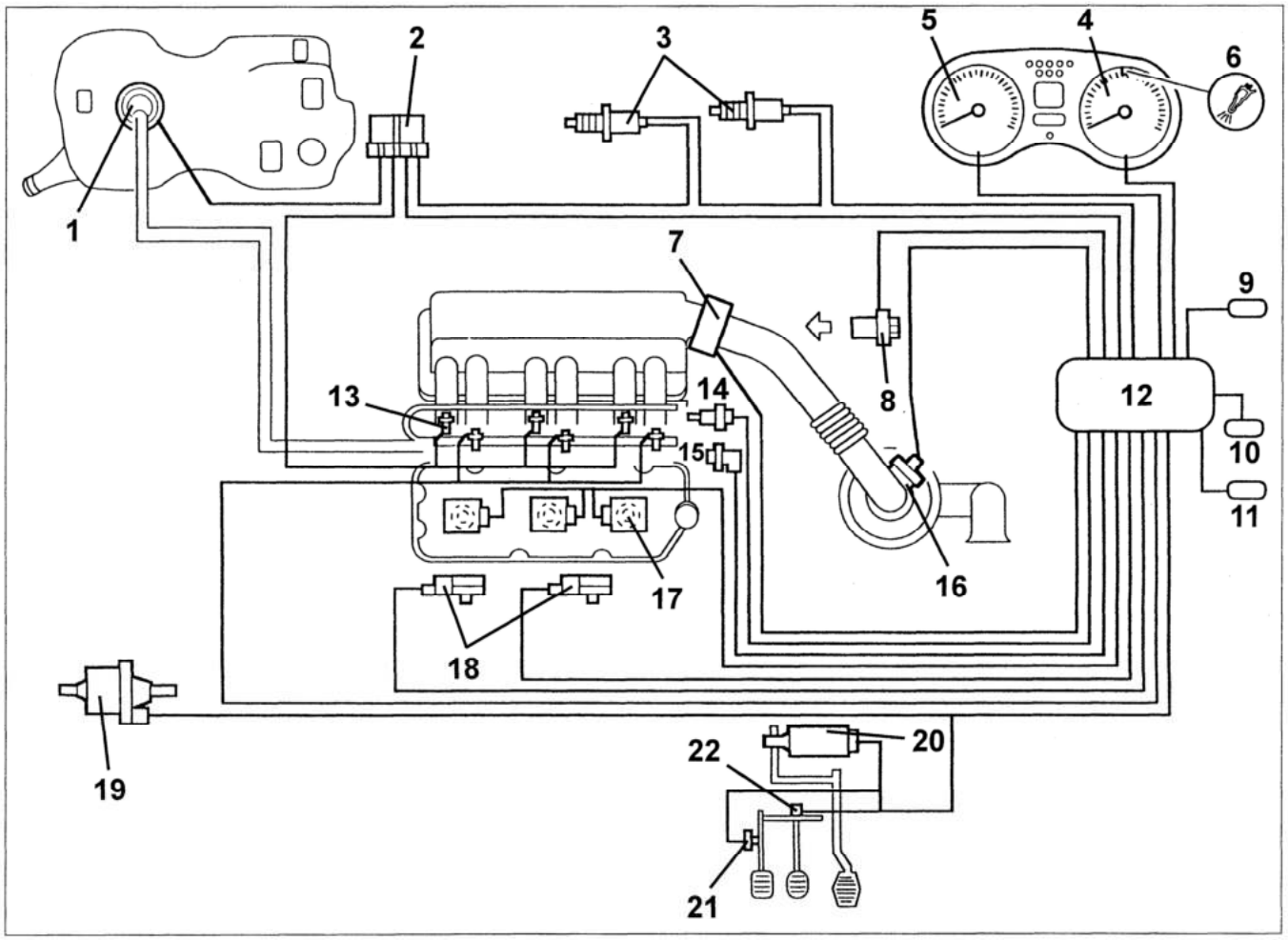
## ME2.1 INJECTION-IGNITION SYSTEM FUNCTION DIAGRAM




1. *Fuel pump*
2. *Climate control compressor*
3. *Fan*
4. *Injector*
5. *Four level pressure switch*
6. *Brake-clutch pedal switch*
7. *Phase sensor*
8. *Tachometer*
9. *Lambda sensor*
10. *Coolant temperature sensor*
11. *Knock sensors*
12. *Rev sensor*
13. *Accelerator pedal potentiometer*
14. *Air flow meter and temperature sensor*
15. *Battery*
16. *Throttle casing with built-in DVL*
17. *Alfa Romeo CODE*
18. *Diagnostic socket*
19. *Fuel vapour recirculation solenoid valve*
20. *Ignition coils*
21. *Injection warning light*
22. *Rpm counter*


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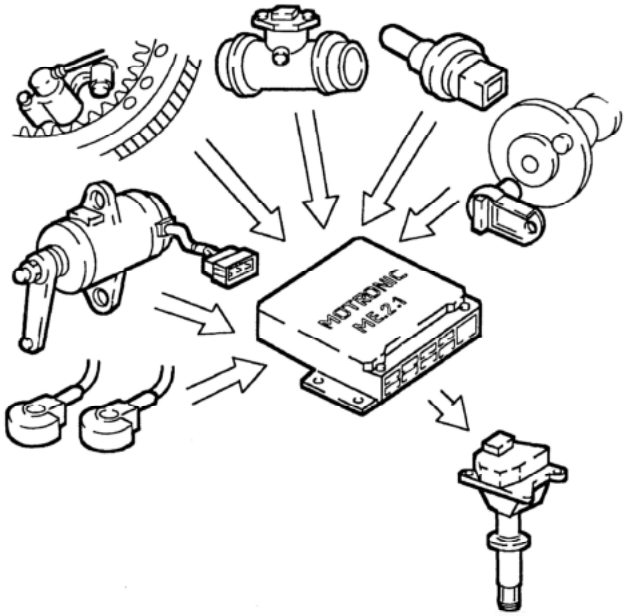
## ME2.1 INJECTION-IGNITION SYSTEM COMPONENTS




1. *Fuel pump*
2. *Relays*
3. *Lambda sensors*
4. *Tachometer*
5. *Rpm counter*
6. *Injection warning light*
7. *Throttle casing actuator with built-in DVL*
8. *Phase sensor*
9. *Climate control system connector*
10. *Diagnostic connector*
11. *Alfa Romeo CODE connector*
12. *Injection-ignition ECU*
13. *Injectors*
14. *Coolant temperature sensor*
15. *Rpm sensor*
16. *Air flow meter with temperature sensor*
17. *Ignition coils*
18. *Knock sensors*
19. *Fuel valve recirculation solenoid valve*
20. *Accelerator pedal potentiometer*
21. *Clutch pedal switch*
22. *Brake pedal switch*

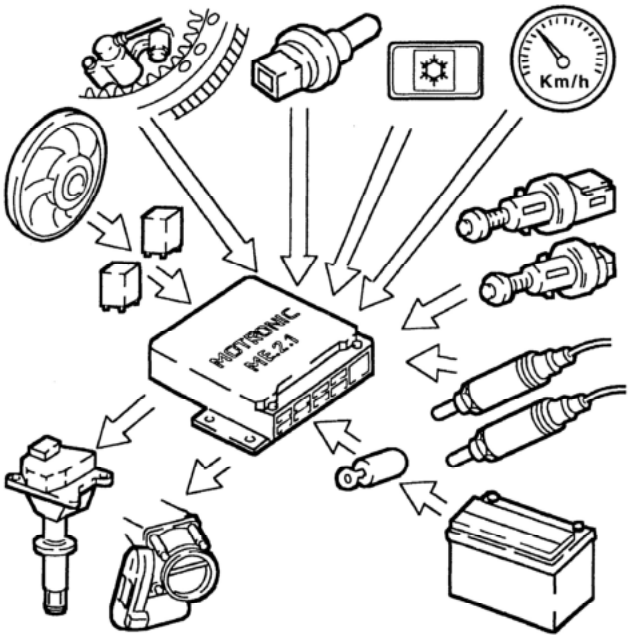
### Spark advance

The ECU processes the signals from the sensors and defines:
- spark advance for each cylinder
- spark delay for the required cylinder (according to knock).




### Idling ratio management

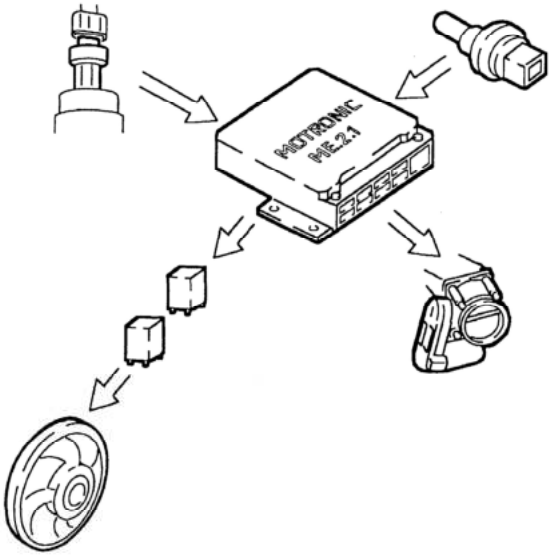
The ECU acknowledges idling condition when the accelerator pedal is released. The ECU controls idling speed by piloting the driven throttle according to the devices which are on and the signals from the brake-clutch pedals. When the fans are running at second speed, idling ratio goes from 700 to 750 rpm.




### Fan control

According to the coolant temperature, the ECU controls fan operation as follows:
- 1st speed at 95°C
- 2nd speed at 102°C.

If the climate control system is on, the ECU controls the fan at 1st speed.
Without the coolant temperature signal the ECU implements a recovery function by controlling the fan at 2nd speed until the error is removed.
Before starting the fans, the idling ratio is adapted by increasing the air delivery according to the fan to be started.

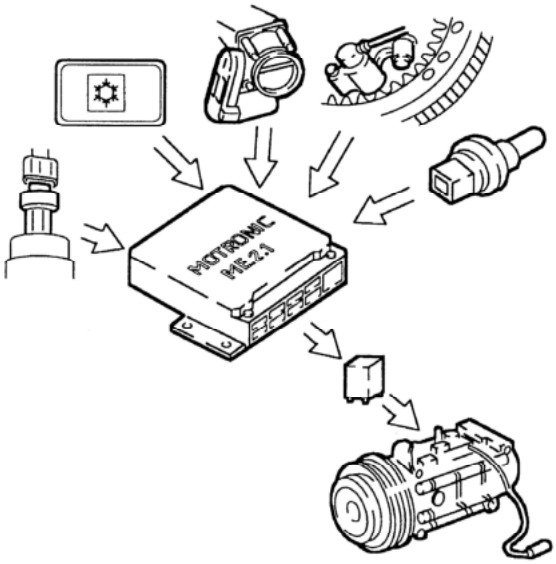




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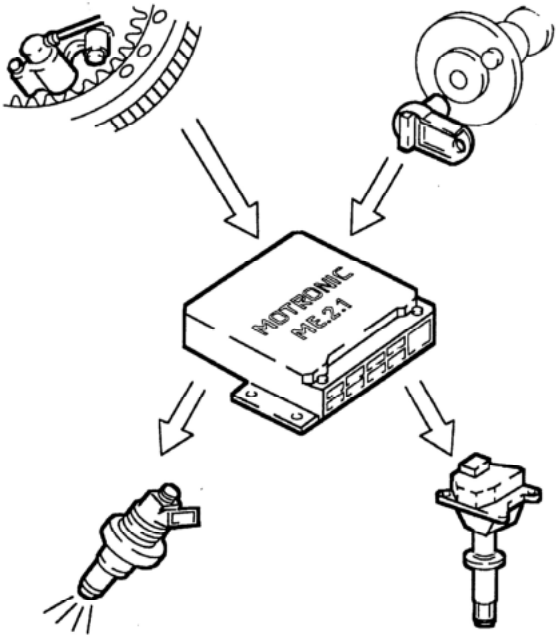
### Connection to climate control system

The climate control system compressor intakes engine power. When idling, the ECU suits the new air intake requirement to the required power to ensure optimal driveability.
The ECU excludes the compressor in the following conditions:
- over 6500 rpm;
- over a certain engine coolant temperature threshold (117°C);
- at start up.



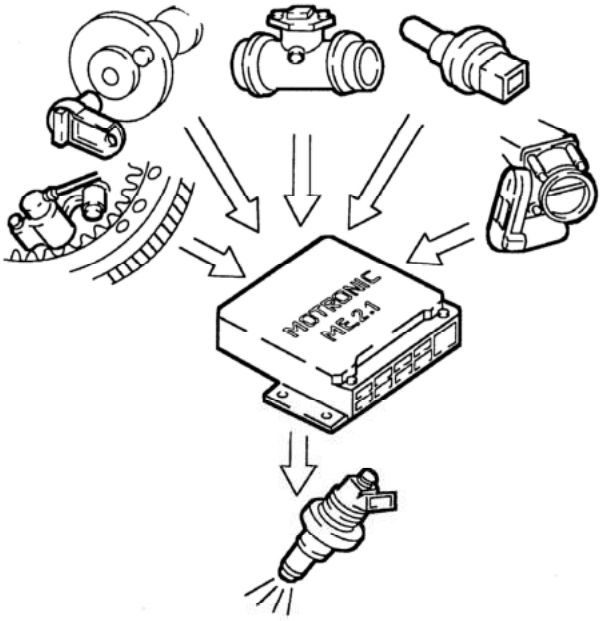

### Cylinder position acknowledgement

At each engine revolution the ECU acknowledges which cylinder is firing and:
- controls the injection and ignition sequence to the suitable cylinder.
If the phase sensor is faulty, the ECU cannot acknowledge whether cylinder 1 or 5 is at firing stroke; consequently it adopts the following strategies:
- engine running: the engine runs normally on the basis of the stored cylinder firing sequence
- engine stopped and re-started: coil pair ignition is started and a fixed delay is applied to all cylinders.




### Optimal cylinder injection time

The ECU compute optimal injection time for each cylinder according to specific maps:
- it changes the injector opening instant
- it keeps the injector closing instant planned in the maps according to engine rpm
- the fuel injection is sequential and phased in each cylinder (S.E.F.I.).

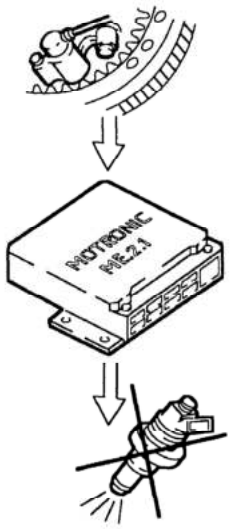


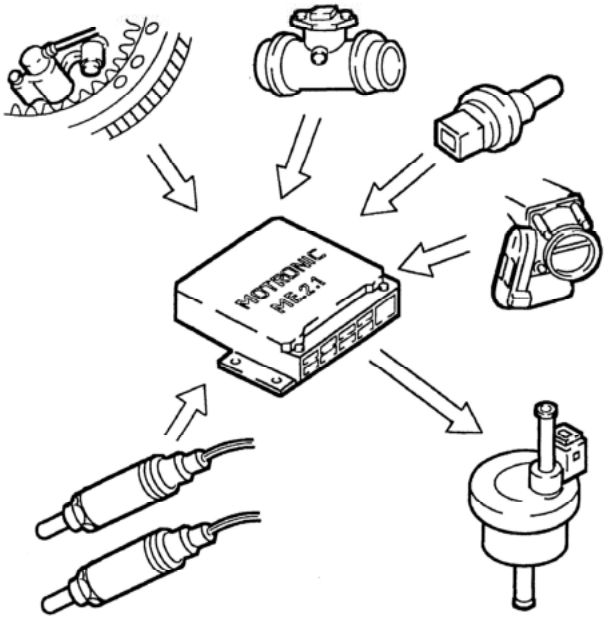


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### Fuel vapour recovery

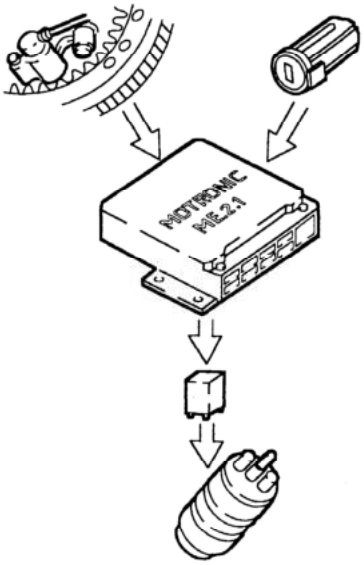
Fuel vapours (pollutants) are collected in an active carbon canister and are conveyed to the intake ducts to be burnt.
This is ensured by means of a solenoid valve controlled by the ECU.
The valve is closed for 60 seconds after start-up and opened for 90 seconds.
During this time (90 seconds) the lambda sensors meter carburation and the values are compared against the basic ECU maps.
If there are no variations, the ECU closes the solenoid valve, otherwise it is kept open for other 90 seconds to allow canister wash-out.
The canister wash-out is nominally limited to a small percentage of intake air detected by the flow meter to ensure balance and disrupt driveability as little as possible.




### Fuel pump control

The ECU:
- powers the fuel pump in the following conditions:
  - key at MAR (for 5 sec.)
  - key at AVV and rpm > 25.
- cuts off fuel pump power in the following conditions:
  - key at STOP
  - rpm < 25.




### Engine rpm limitation

According to the engine rpm, the ECU:
- stops feed to the injectors over 6800 rpm (a maximum of 7000 rpm is allowed for less than 5 sec.).
- start piloting the injectors again under 6600 rpm.

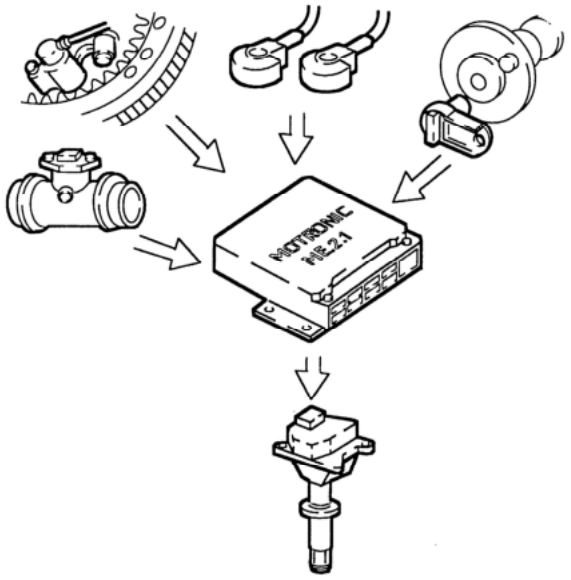

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### Knock control

The ECU can delay ignition selectively on each cylinder as required according to the combination of values received from the knock and phase sensors. It:
- reduces spark advance by 3° steps to reach a maximum of 9°
- updates the threshold considering:
  - basic noise
  - engine ageing.

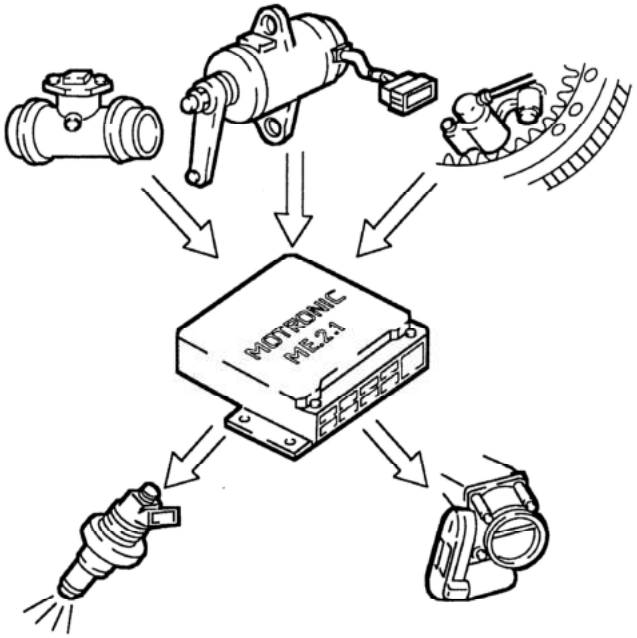
During acceleration, the ECU employs a higher threshold to adapt to increased engine noise. When knock disappears, the ECU decreases spark advance in 0.75° steps to complete recovery.
The self-adapting feature of the ECU:
- stores the continuous, repeated spark advance reductions
- updates the map to the various conditions in which the engine is working.

Recovery:
- in the event of failures to either the phase sensor, the knock sensor or the injection ECU, a spark delay - which is variable according to the rpm and the engine temperature - is implemented. Maximum spark delay is always lower than 9° engine.




### Acceleration enrichment control

Upon considerable demand for acceleration, the ECU adjusts the injection time and the throttle position.
Recovery
- the ECU replaces the signal from the faulty air flow meter with the signal from the potentiometer built-into the throttle and DVL.

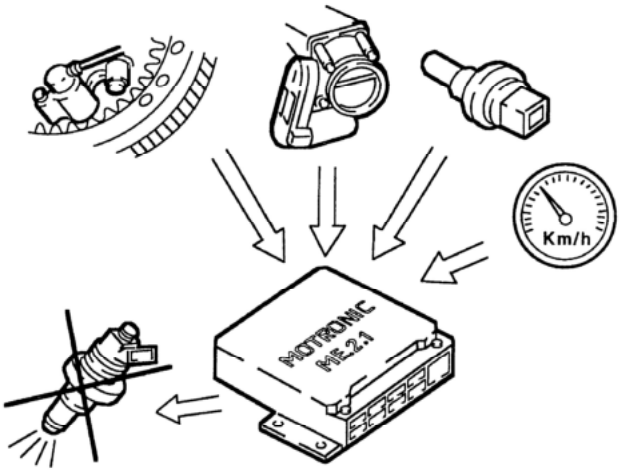



### Fuel cut-off upon accelerator pedal release

In the following conditions:
- acknowledge idling ratio
- rpm exceeding a certain threshold

the ECU deactivates injection according to:
- rpm
- engine temperature
- vehicle speed.

Before reaching idling speed, the rpm decrease dynamics is checked.
If this is higher than a certain value, fuel injection is partially reactivated according to a logic to take the engine to idling speed smoothly. Once idling conditions are reached, the normal functions are reactivated.
Fuel cut off is active only 20 seconds after engine start-up.





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## GENERAL DESCRIPTION

The Bosch Motronic ME2.1 driven throttle system a belongs to the category of integrated electronic sequential, phased ignition and injection systems.
The ECU controls the idling ratio air intake by means of the electronic throttle.
The ECU controls spark advance to adjust the engine to changes in environmental parameters and applied loads.
The ECU controls and manages injection so that the stoichiometric ratio (air-to-fuel ratio) is constantly optimal.
Essentially, the main functions of the system are:
- self-learning;
- system self-adapting;
- self-test;
- Alfa Romeo CODE (Immobilizer) ECU acknowledgement;
- cold start control;
- fuel-lambda sensor control;
- knock control;
- acceleration enrichment control;
- fuel cut-off upon accelerator pedal release;
- fuel vapour recovery;
- engine rpm limitation;
- fuel pump control;
- connection to climate control system;
- cylinder position acknowledgement;
- optional cylinder injection time control;
- spark advance;
- idling ratio management (also according to battery voltage);
- fan control;
- connection to instrument panel.

## INJECTION SYSTEM

The essential conditions which should always be fulfilled in preparing the air-to-fuel mixture for the good operation of controlled ignition engines are mainly:
- "metering": the air-to-fuel ratio should be kept as close as possible to the stoichiometric value to ensure maximum catalytic converter efficiency.
- the mixture should be homogenous, i.e. consist of petrol diffused as finely and uniformly as possible.

The information processed by the ECU for controlling optimal metering is received in the form of electrical signals emitted by the:
- air flow meter and temperature sensor, for the exact quantity of intake air
- rpm sensor which produces an alternating single phase signal indicating the engine rpm
- throttle potentiometer, to acknowledge the required accelerator conditions
- coolant temperature sensor on the thermostat
- lambda sensor to determine the oxygen content in exhaust gases.

## IGNITION SYSTEM

The ignition system is the static advance induced discharge type (i.e. without high voltage distributor) with power modules inside the injection ECU.
The system has a single coil for each spark plug (MONOCOIL).
The advantages of this solution are:
- less electrical overload;
- guarantee of constant discharge at each spark plug.

A map containing the entire set of optimal spark advance values (for each cylinder at power stroke) which the engine can adopt according to the ratio and the engine load is stored in the ECU.
The ECU corrects spark advance mainly according to:
- air coolant temperature
- air intake temperature
- knock.

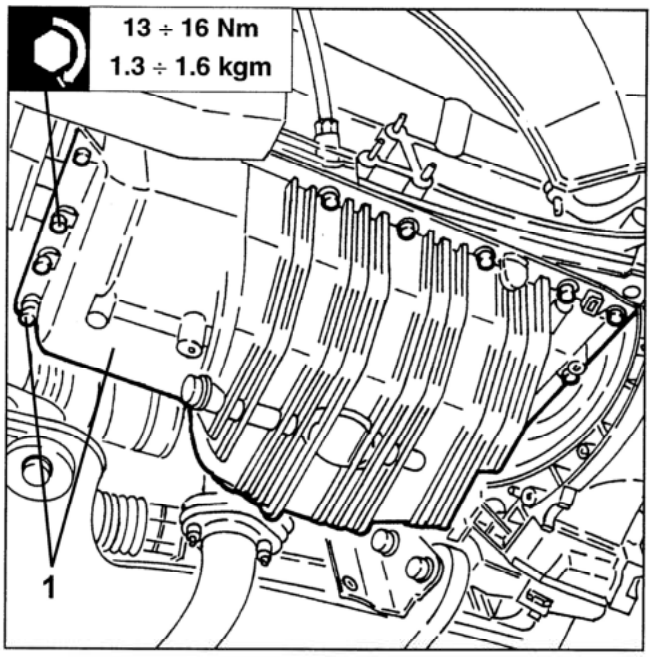
The information that the ECU processes to pilot the monocoils is received in the form of electrical signals emitted by:
- air flow meter and temperature sensor, for the exact quantity of intake air
- rpm sensor which produces an alternating single phase signal indicating the engine rpm
- knock sensors (on the upper part of the crankcase between the two heads) to acknowledge the cylinder where detonation is occurring and to correct spark advance
- throttle potentiometer to acknowledge load conditions (idling, partial and full)
- phase sensor.


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Refit by reversing the removal operation sequence. Attain to the following precautions.
- Clean the oil sump and engine crankcase coupling surfaces.

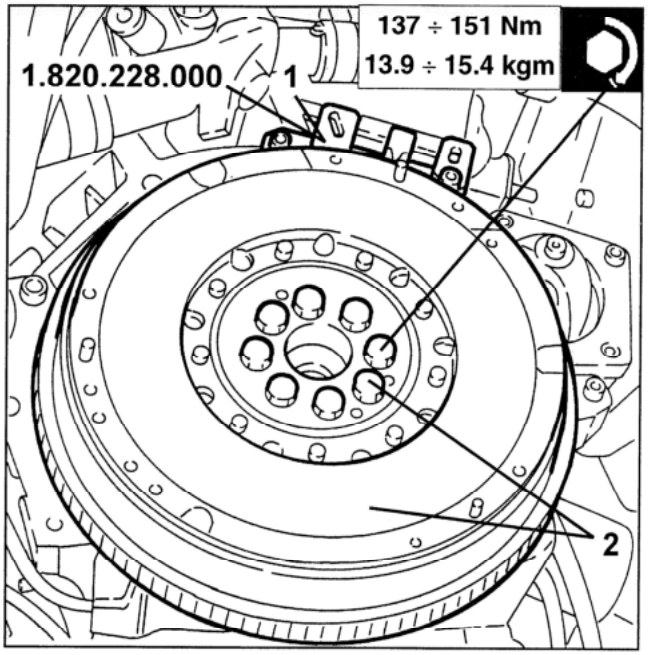
**IMPORTANT: Check intactness of rear main bearing seal; if this is not so, restore it.**

- Apply "Dow Corning 7091" silicon sealant on the entire oil sump perimeter.
1. Position the oil sump avoiding movements which could remove the sealant. Then torque the fastening screws as prescribed.

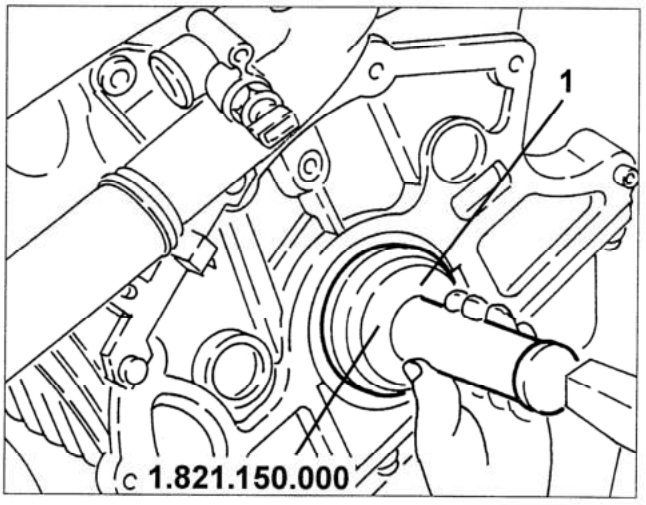



## REAR CRANKSHAFT OIL SEAL REPLACEMENT

- Remove the gearbox (see Assembly 21).
- Remove the clutch (see Assembly18).
1. Fit flywheel retainer tool no. 1.820.228.000
2. Loosen the fastening screws and remove the flywheel.



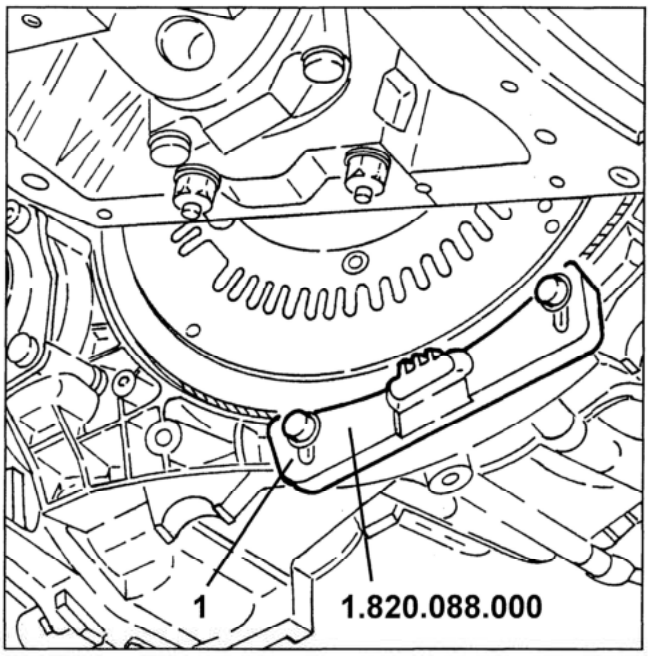

- Remove the crankshaft rear oil seal.
1. Introduce a new crankshaft rear oil seal with tool no. 1.821.150.000.



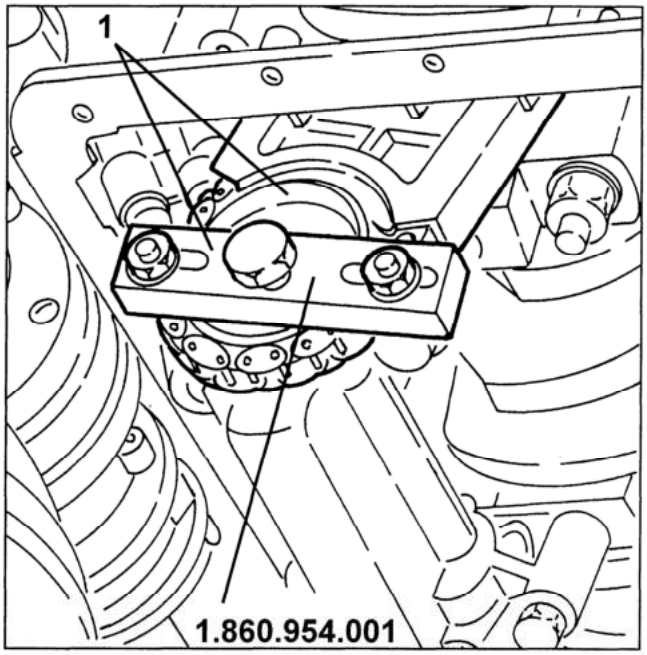

- Complete refitting by reversing the removal sequence.


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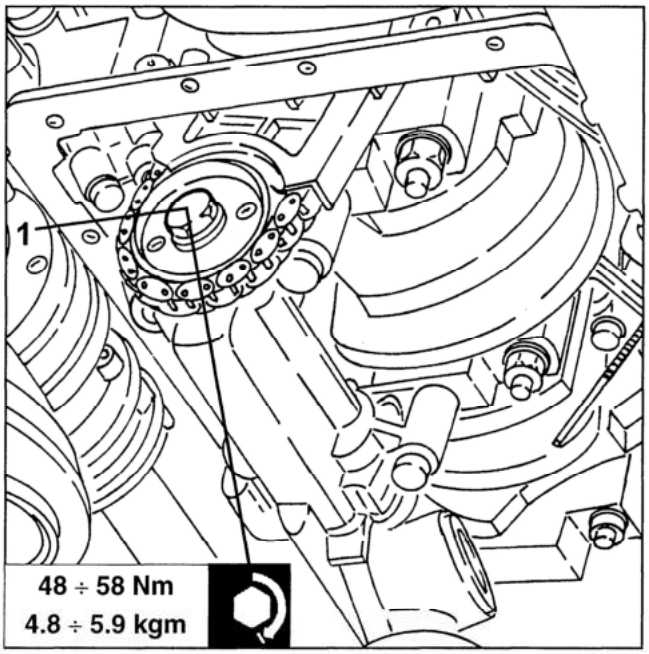
1. Fit flywheel retainer tool no. 1.820.088.000.



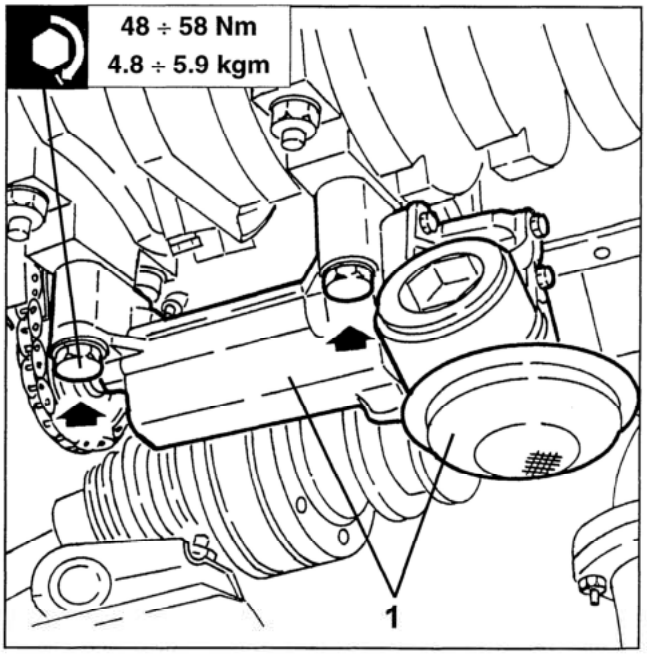

1. Use tool no. 1.860.954.001 to remove the drive gear from the oil pump shaft.




1. Loosen the oil pump drive gear fastening screw.



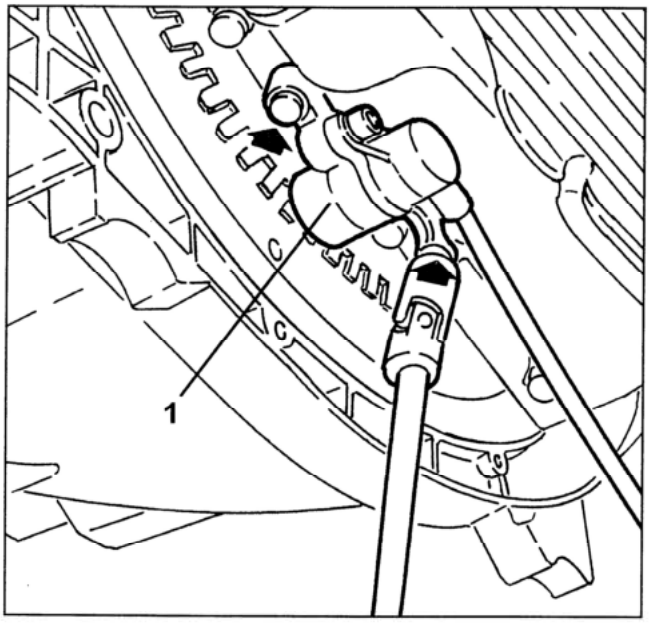

1. Loosen the fastening screws and remove the complete oil pump.



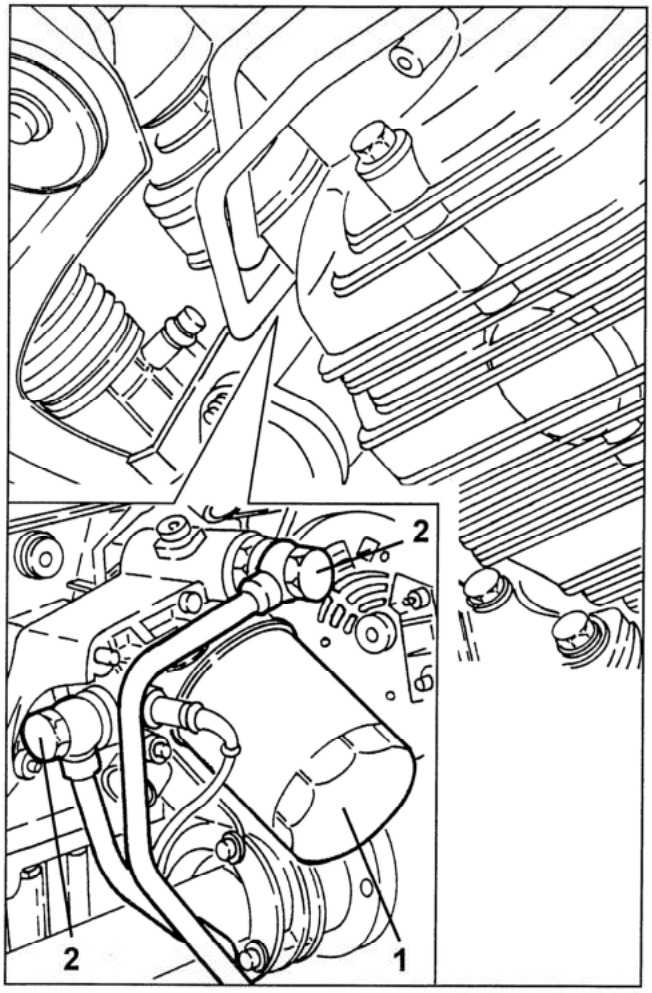


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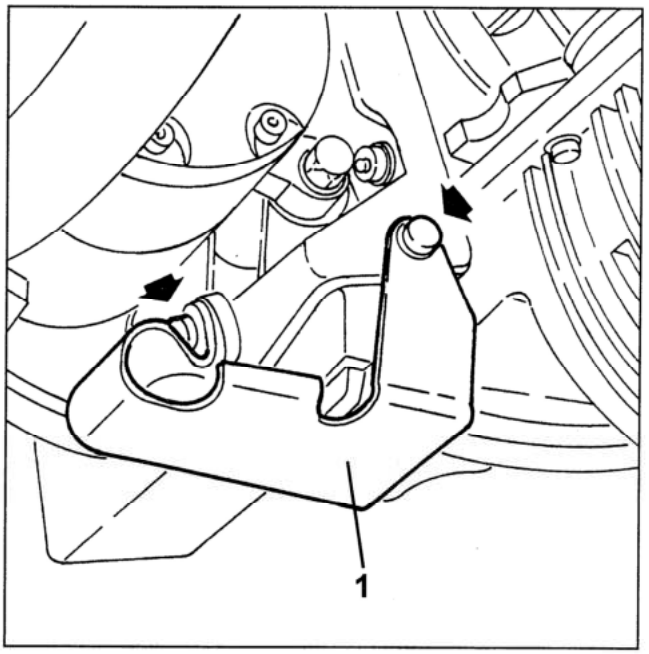
1. Loosen the fastening screws and move the rpm and phase sensor aside.



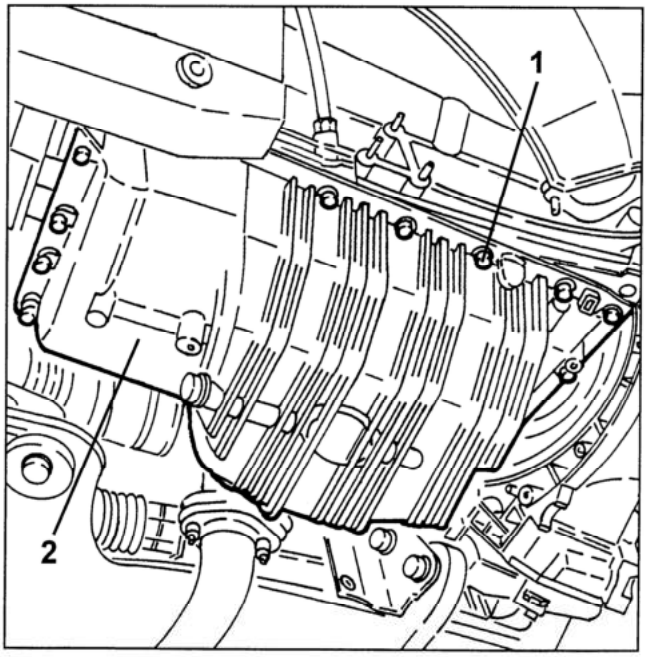

1. Remove the engine oil filter with a suitable wrench.
2. Loosen the fittings and disconnect the coolant radiator delivery and return pipes from the oil filter bracket.




1. Loosen the fastening screws and remove the coolant radiator engine oil delivery and return pipe bracket.
- Move the coolant radiator engine oil delivery and return pipes aside provisionally as not to interfere with the following operations.




1. Loosen the screws fastening the sump to the crankcase.
- Heat the crankcase sump coupling area and cut the sealant.
2. Remove the sump from the crankcase.



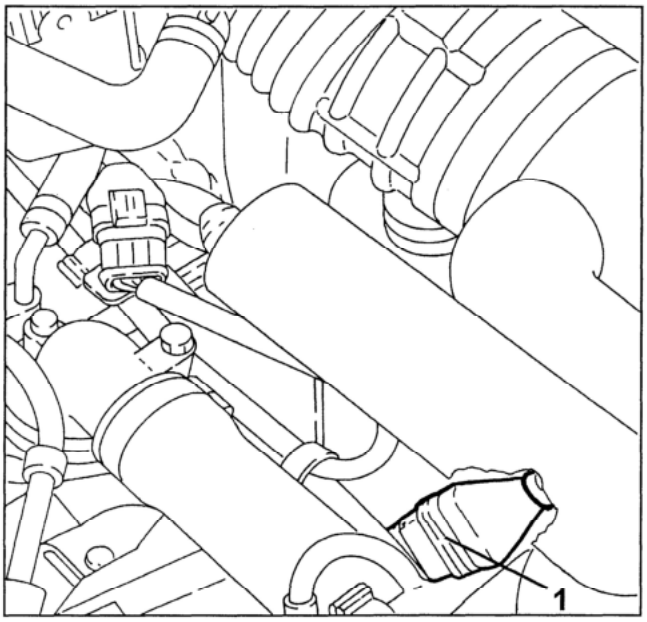


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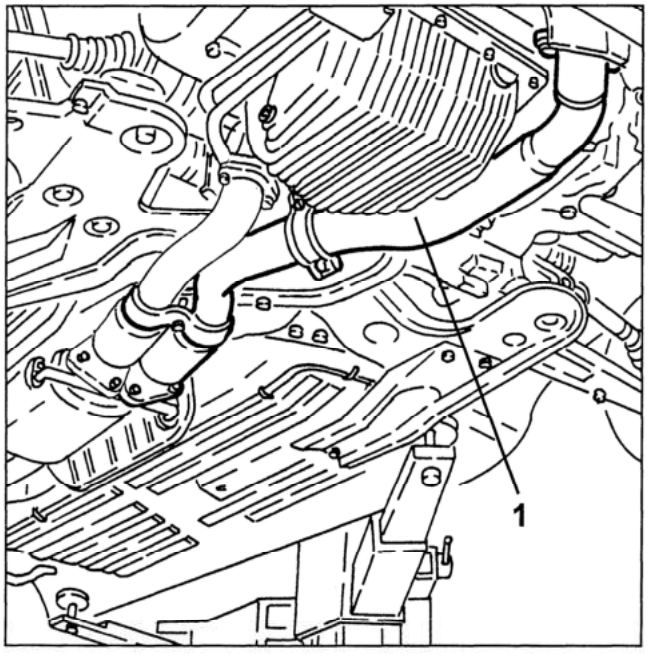
## OIL PUMP

### REMOVAL/REFITTING

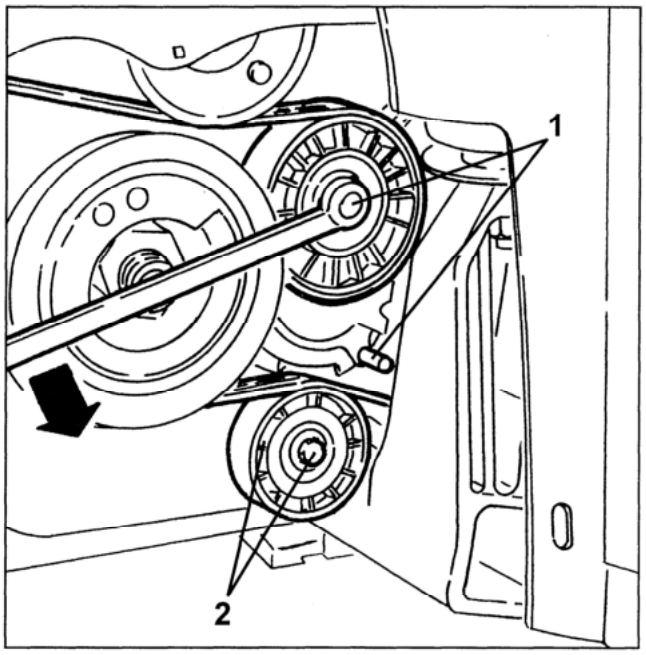
- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
1. Disconnect the lambda sensor electrical connection from the left-hand exhaust manifold and release the respective wiring from the fastening clips.




- Remove the front right-hand wheel and the respective dust guard.
- Drain engine oil (see assembly 00).
1. Loosen the fasteners and remove the front left-hand exhaust pipe section and lambda sensor.



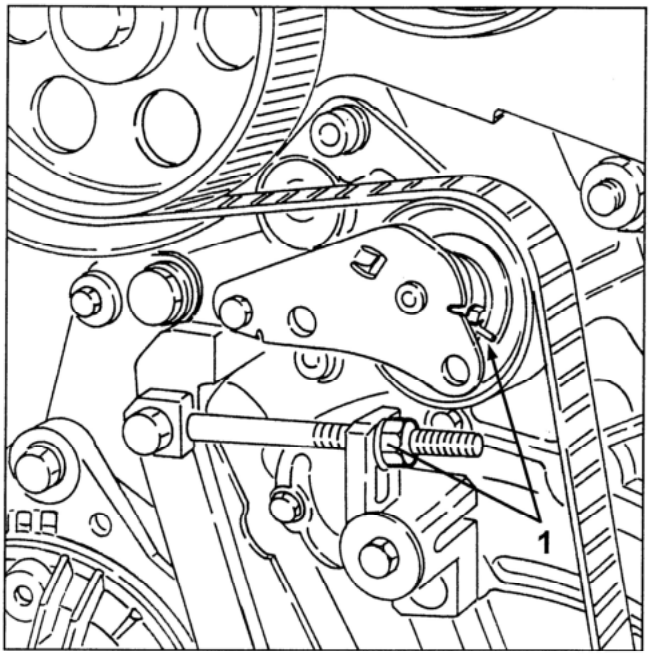

1. With a wrench on the belt take-up pulley fastening screw, overcome the automatic take-up force and lock it in this position (belt loose) with a pin as shown in the figure.
2. Loosen the fastening screw and remove the lower engine drive belt runner.



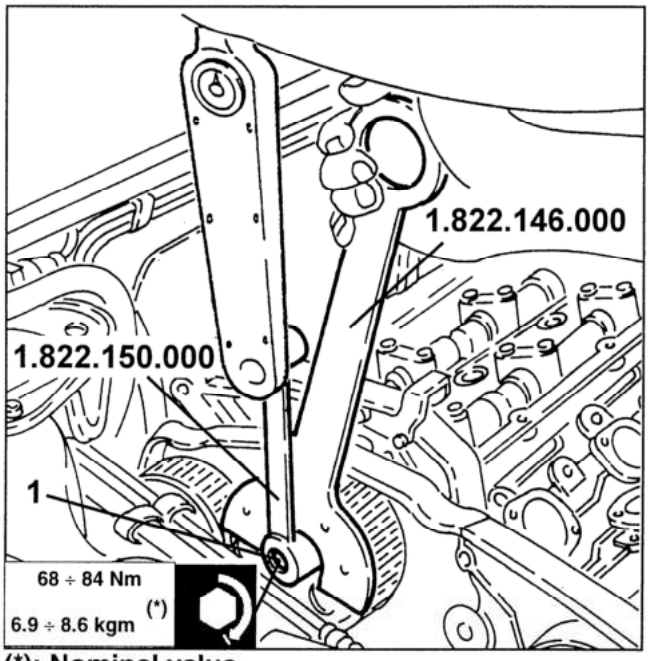

1. Loosen the fasteners and remove the lower flywheel and rpm and phase sensor guards.



1. Take the mobile notch under the belt take-up fixed notch as shown in the figure.

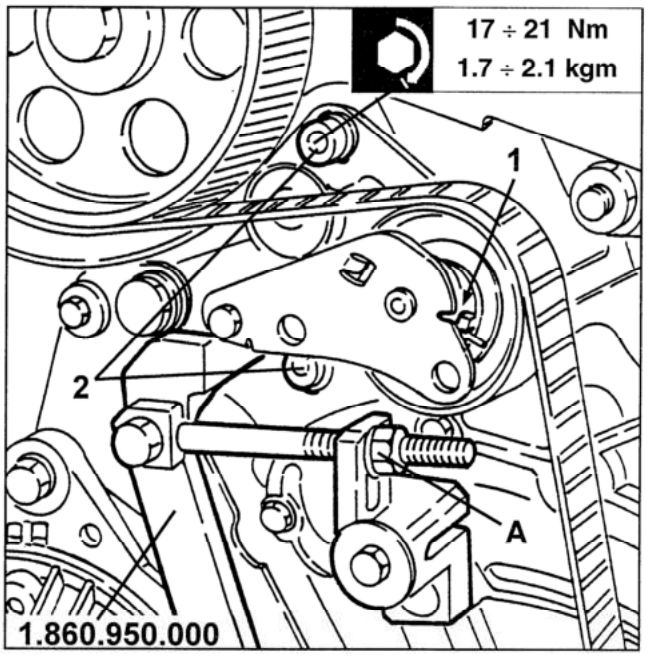



1. Use extension no. 1.822.150.000 and tool no. 1.822.146.000 to contrast torque. Fasten the camshaft drive pulley screws at the prescribed torque.




**(*): Nominal value**

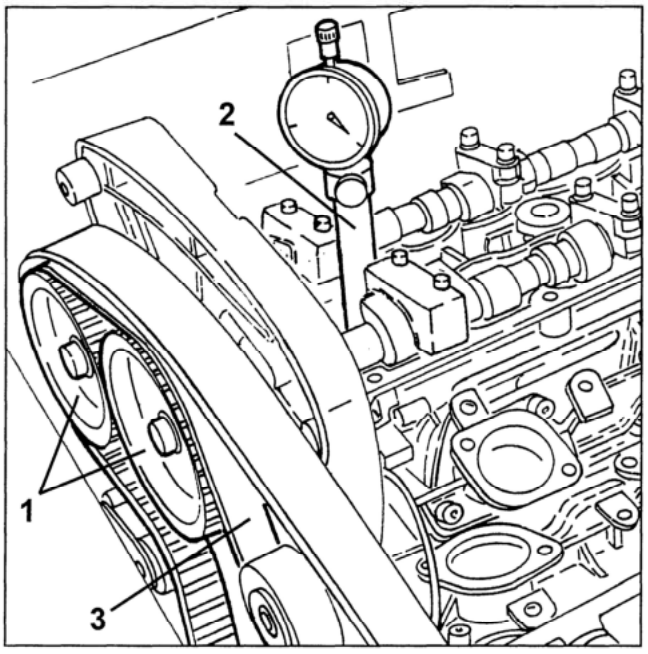
- Remove the previously fitted templates no. 1.825.040.000. Fit the previously fitted bearings in their place and fasten the screws at the prescribed torque.
- Turn the crankshaft twice in the direction of revolution to fit the timing belt well.
1. Check whether the fixed notch on the belt take-up coincides with the mobile notch. If not, loosen the belt take-up tension by turning nut (A) until the notches meet.
2. Torque the belt take-up fastening nuts as prescribed and remove belt tension tool no. 1.860.950.000.



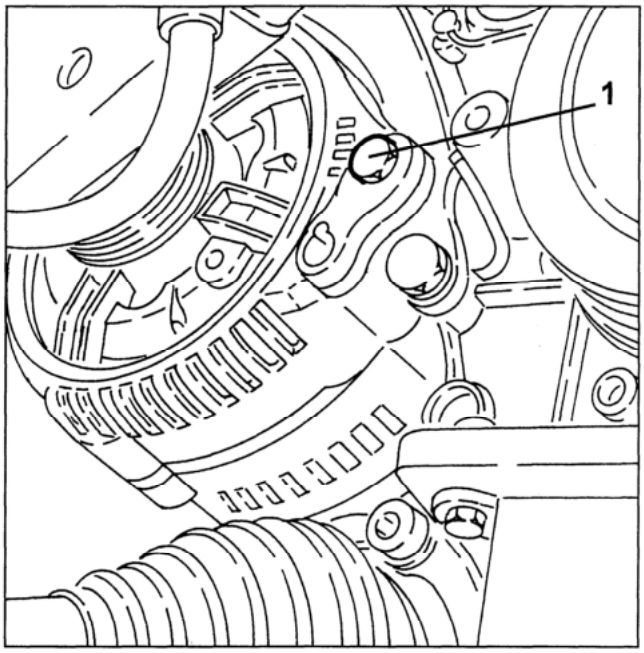

- Complete refitting by reversing the removal sequence.

**NOTE: ASTADUR cylinder head seals are used. The special material the seals are made of polymerises during engine operation and consequently becomes very hard.**
**The following precautions are required to ensure cylinder head seal polymerisation:**
**- keep the seals closed in their nylon bags;**
**- take them out of the packaging just before fitting;**
**- do not lubricate or soil the seals with oil. Make sure the cylinder head and crankcase surface are clean.**

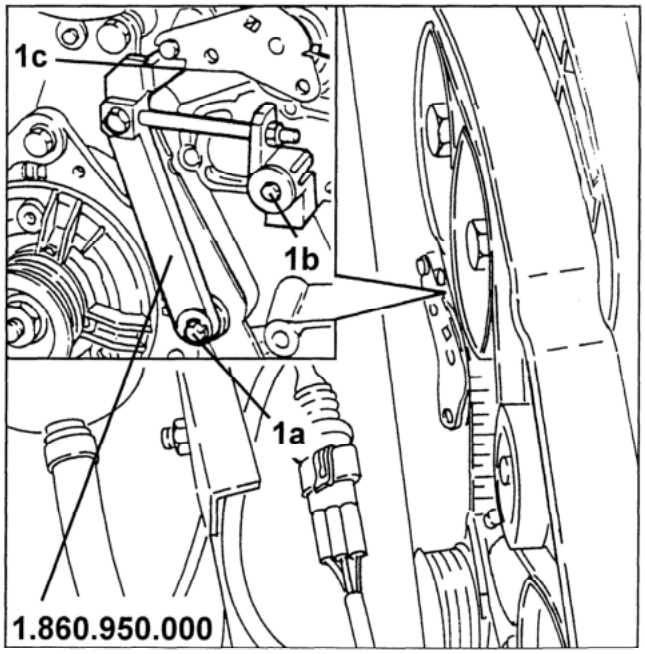
1. Reverse the removal sequence and refit the right-hand cylinder head camshaft drive pulleys, fastening the screws by hand.
- Use extension no. 1.822.150.000 and tool no. 1.822.146.000 to contrast torque. Loosen the left-hand cylinder head camshaft drive pulley fastening screws.
- Use tool no. 1.860.954.001. Extract the left-hand cylinder head camshaft drive pulleys are reposition them fastening the screws by hand.
2. Check whether the 1st cylinder piston is at TDC, firing stroke. If not, move it to this position by slightly turning in both directions the auxiliary unit drive pulley fastening nut.
**NOTE: Make sure the last revolution of the crankshaft is in the direction of operation.**
3. Fit the camshaft drive pulley drive belt.



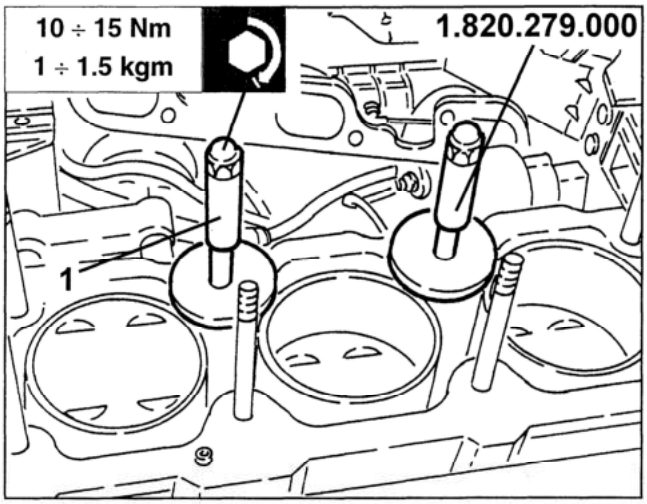

- Remove the cylinder head alternator bracket upper screw.
1. Loosen the lower alternator fastening screw to fit the timing belt tension tool.

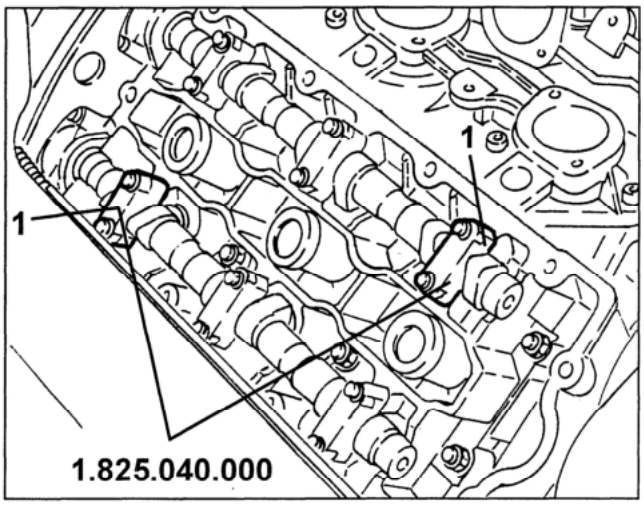



1. Fit timing belt tension tool no. 1.860.950.000 and fasten the previously loosened screw to the alternator (1a) and screw (1b) to the coolant pump; tool pin (1c) should contrast the belt take-up device mobile part.



1. Fit cylinder liner retainer tools no. 1.820.279.000 as shown in the figure.

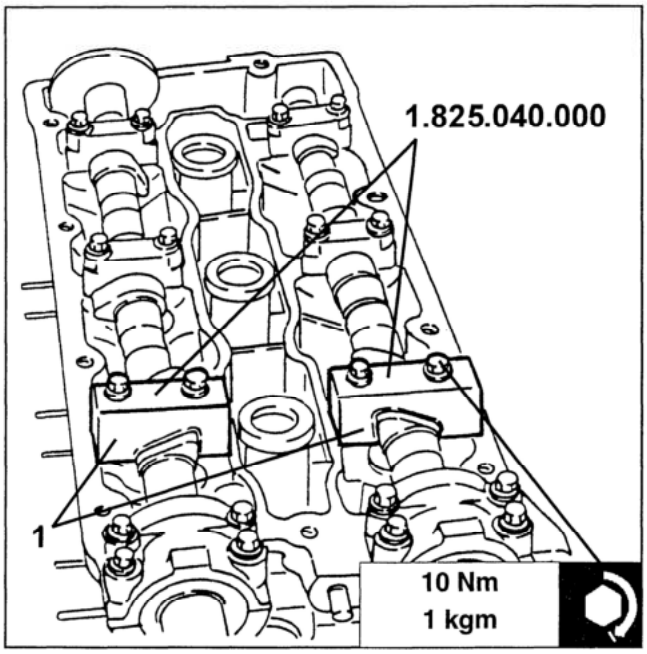



## REFITTING PRECAUTIONS

Reverse the removal sequence and attain to the following precautions.

1. Fit templates no. 1.825.040.000 in the position printed on the templates in the place of camshaft bearings **B** and **G** after overhauling the right-hand cylinder head and before refitting it on the engine.

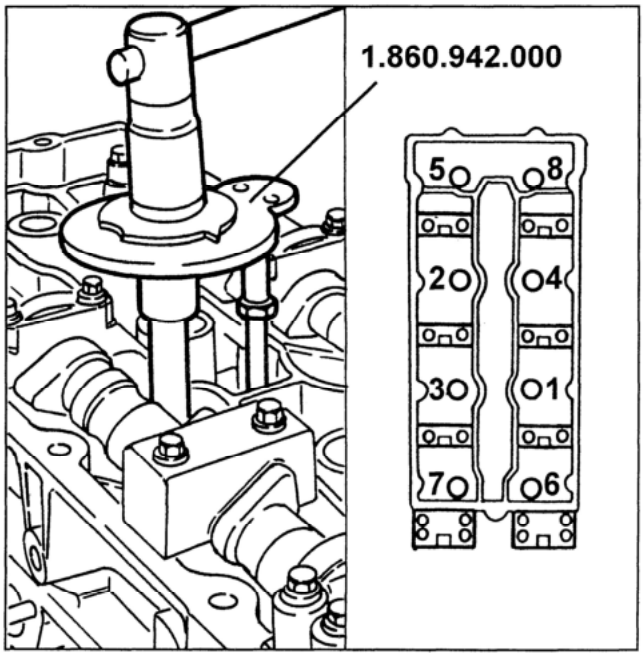



1. Fit templates no. 1.825.040.000 in the position printed on the templates in the place of left-hand cylinder head camshaft bearings **7** and **4**.

- Remove the previously fitted cylinder liner retainers no. 1.820.279.000.
- Refit the right-hand cylinder head with a new seal.
- Lubricate threading, nuts and washers with engine oil and torque as shown below in the order shown in the figure.

**NOTE: Use the tool and gauge no. 1.860.942.000 for angle torque.**

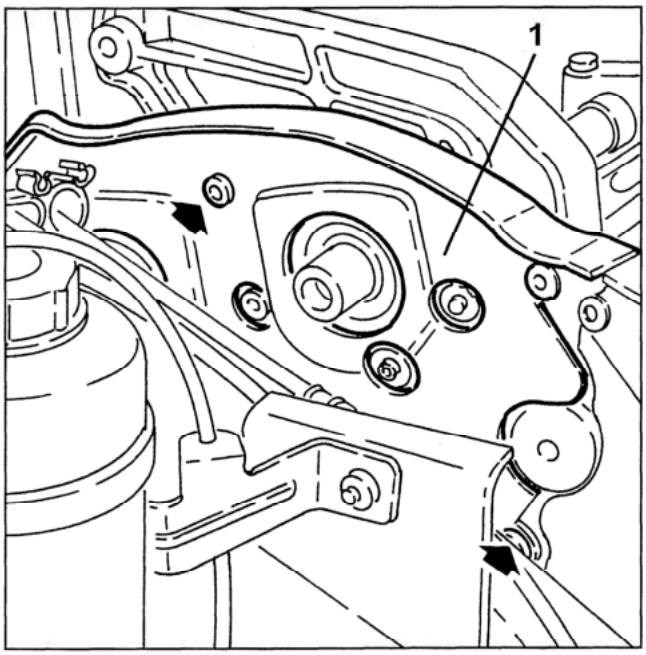
| Tightening procedure | |
|---|---|
| Tighten all nuts at: | 24 ÷ 26 Nm<br>2.5 ÷ 2.7 kgm |
| Complete torque with additional: | 240° ± 2° |



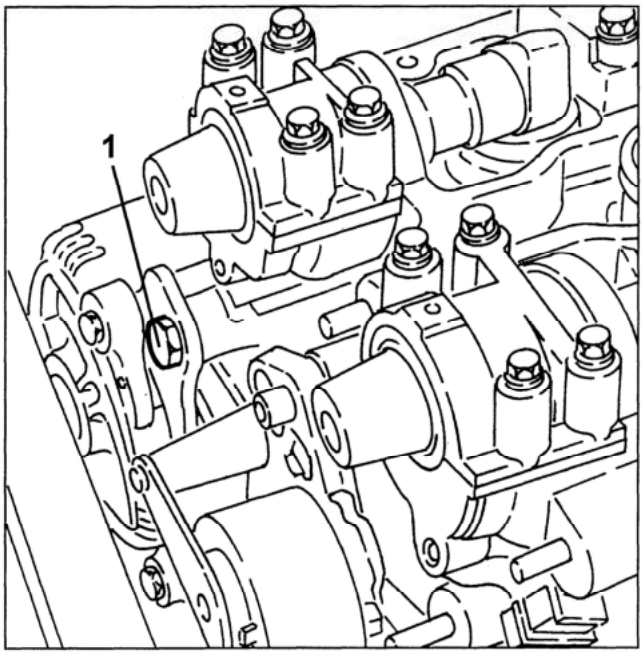


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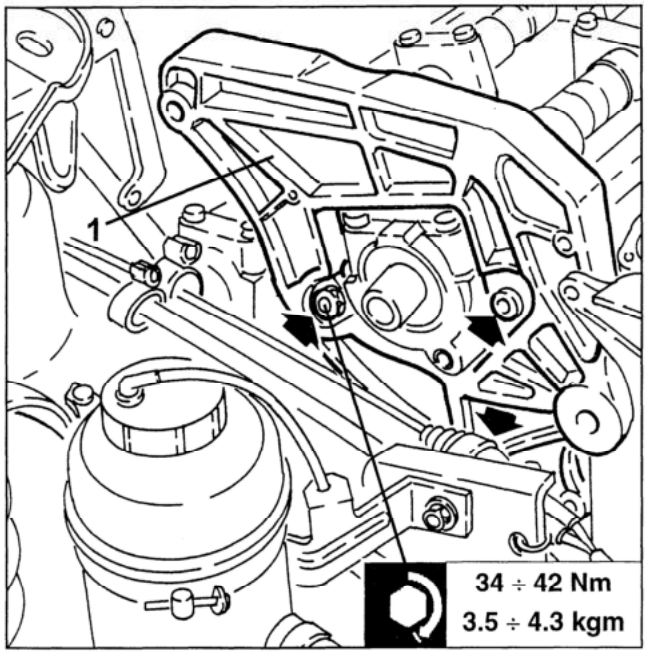
1. Loosen the fastening screws and remove the rear timing belt guard from the right-hand cylinder head.



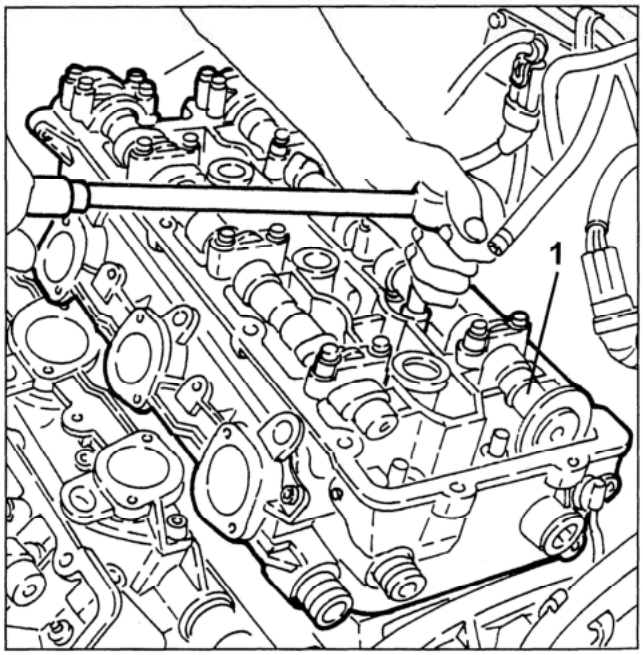

1. Loosen the upper alternator bracket fastening nut.




1. Loosen the fastening nuts and remove the engine tie-rod bracket.




1. Loosen the fastening nuts and remove the right-hand cylinder head.
- Remove the respective seal.

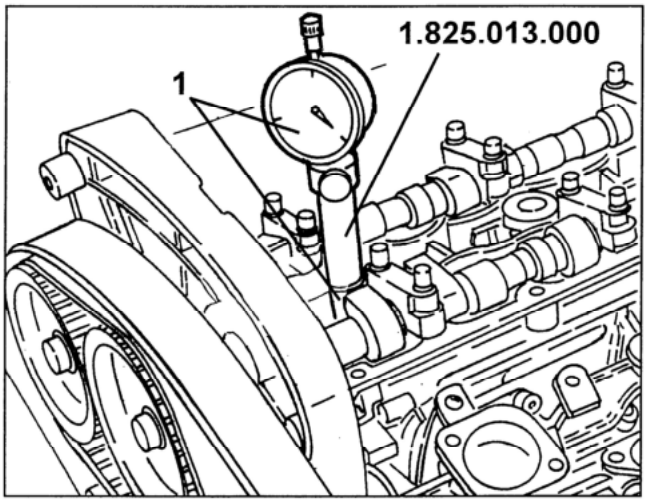




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- Loosen the exhaust manifold fastening nuts from the right-hand cylinder head and leave it on the power steering unit.
1. Fit tool no. 1.825.013.000 in cylinder 1 spark plug seat.
- Move the auxiliary unit drive pulley nut and slightly turn the crankshaft in both directions to take cylinder 1 piston to TDC, firing stroke.

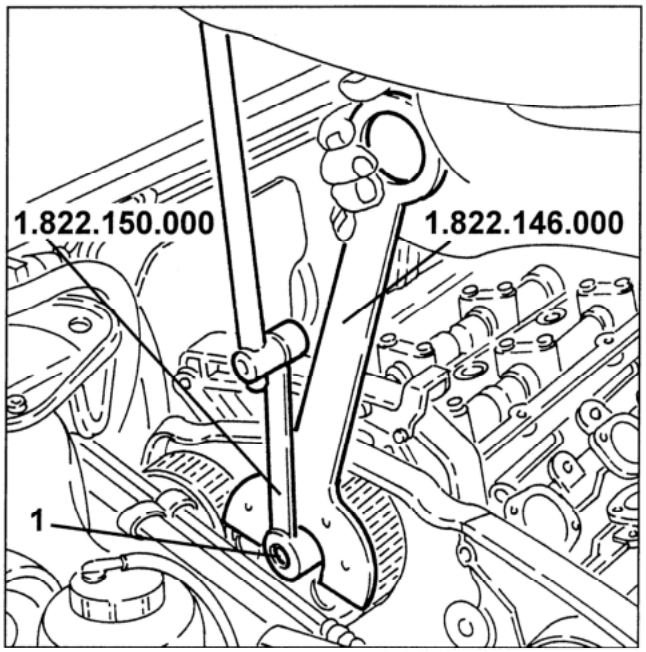
**NOTE: Make sure the last rotation of the crankshaft is in the direction of operation.**



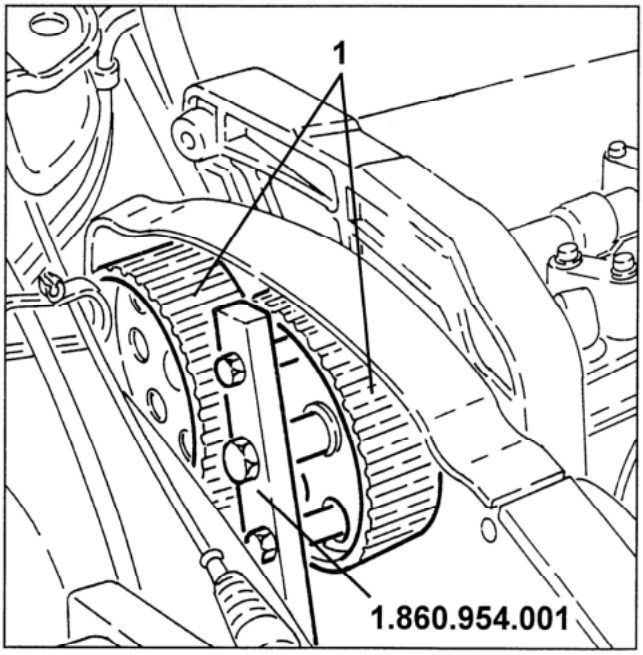

1. Loosen the two timing belt take-up fastening screws and remove the belt from the camshaft pulleys.
2. Loosen the fastening screw and remove the timing belt runner.




1. Use extension no. 1.822.150.000 and tools no. 1.822.146.000 to contrast torque. Loosen the camshaft drive pulley fastening screws from the right-hand cylinder head.



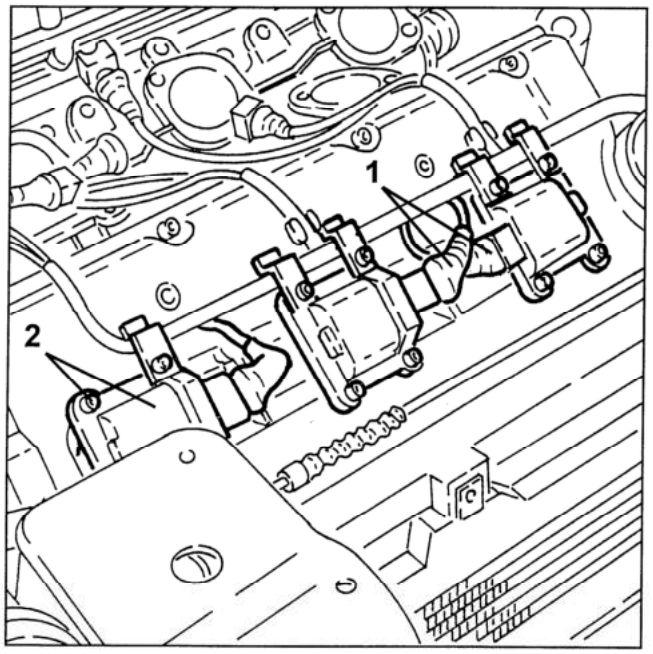

1. Use tool no. 1.860.954.001 and remove the camshaft drive pulleys from the right-hand cylinder head.



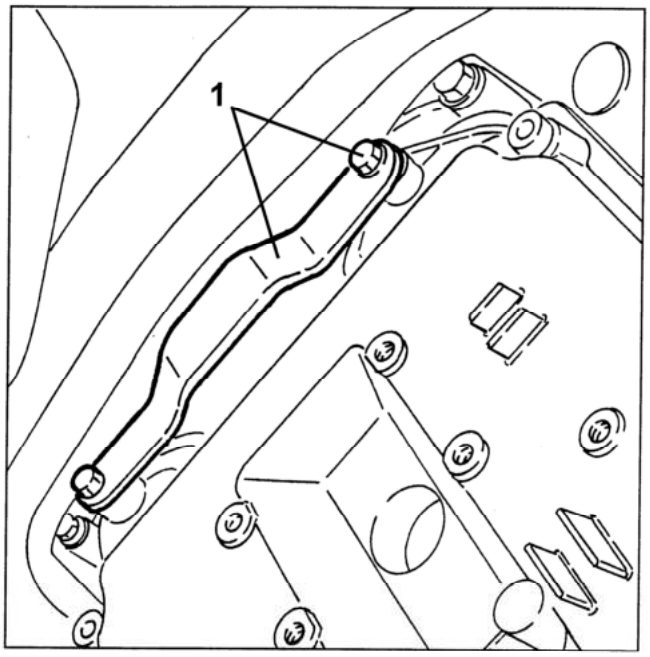


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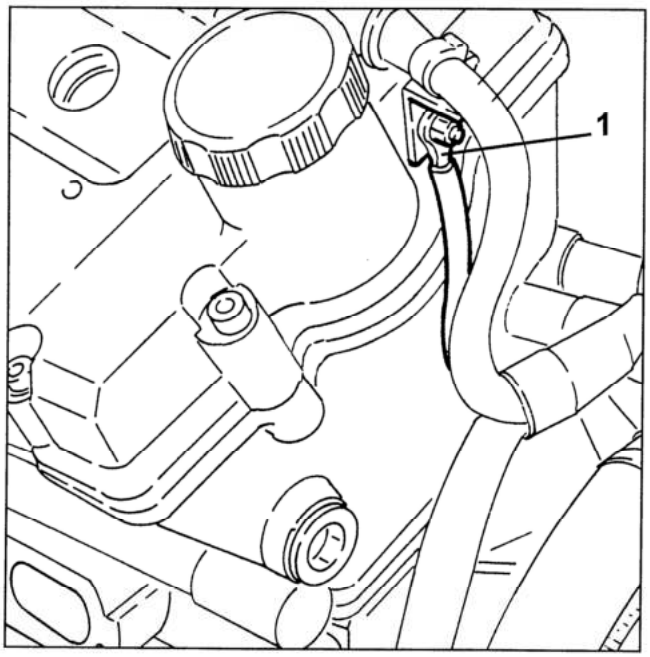
1. Disconnect the electrical connections from the left-hand cylinder head ignition coils.
2. Loosen the fastening screws and remove the left-hand cylinder head ignition coils.



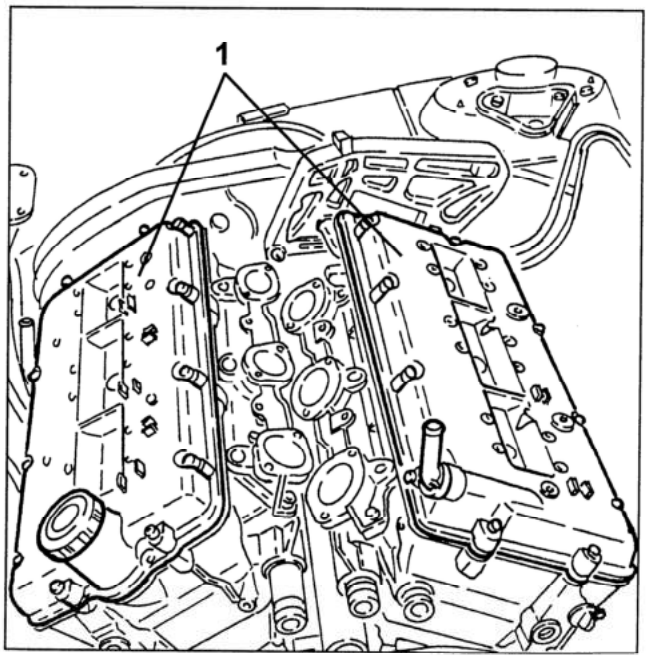

1. Loosen the fastening screws and remove the bracket and threaded nut fastening the upper timing belt guard from the left-hand cylinder head.



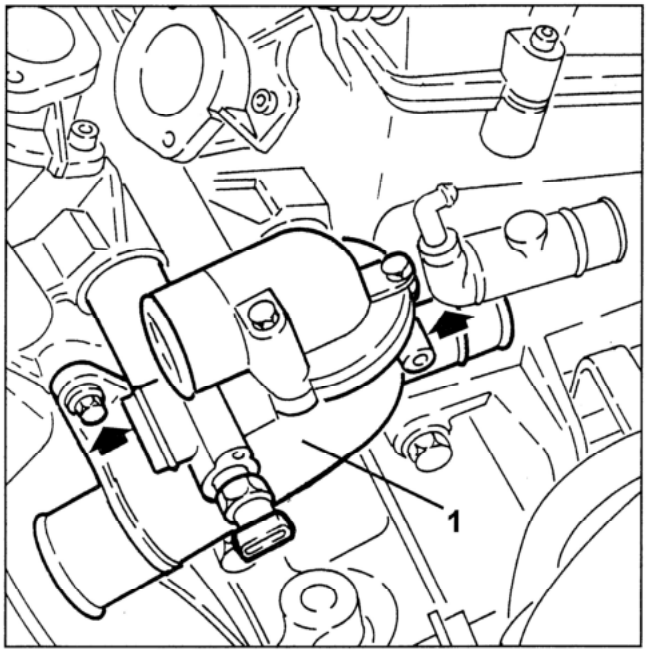

1. Disconnect the earth wire from the left-hand cylinder head and move the respective wiring aside.



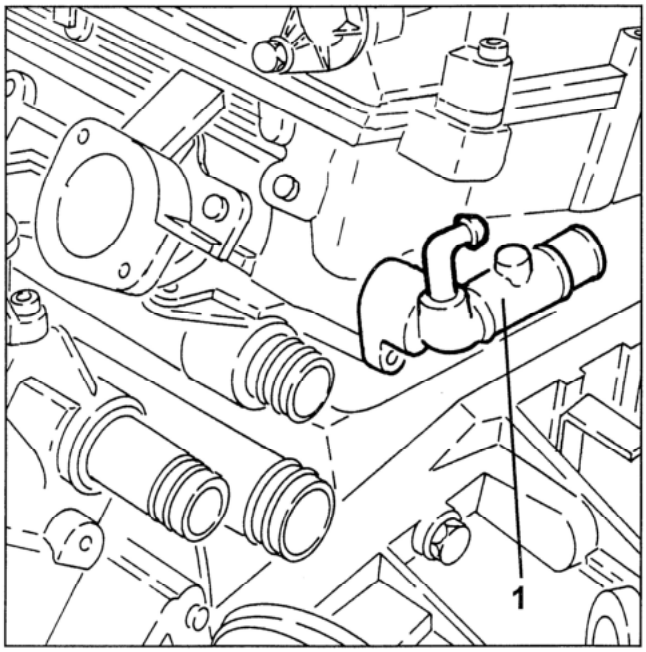

1. Loosen the fastening screws and remove the cylinder head covers and respective seals.



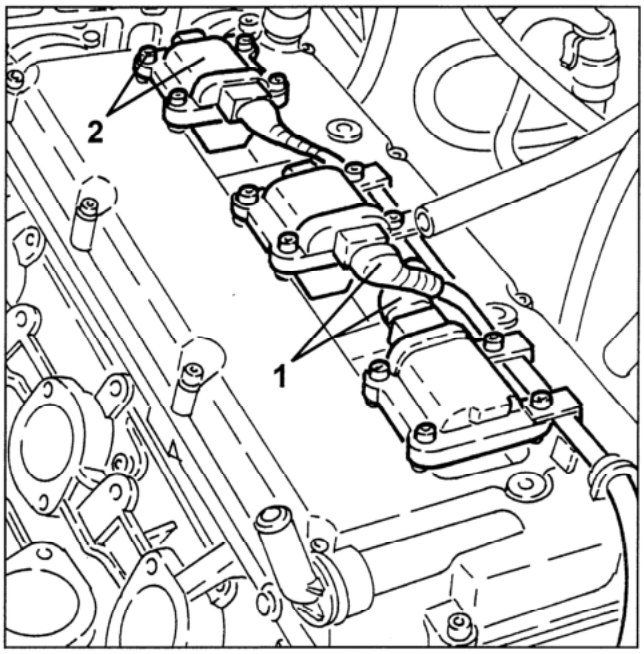
1. Loosen the fastening screws and remove the thermostat.



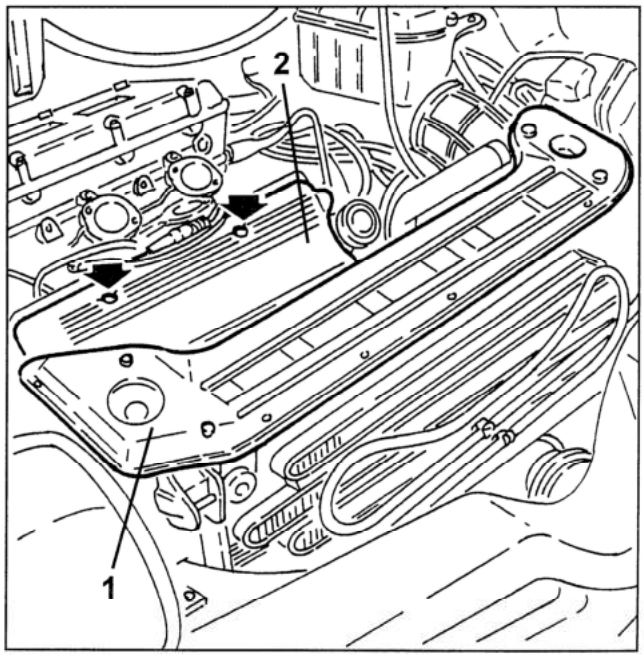

1. Loosen and remove the right-hand cylinder head coolant outlet fitting.




1. Disconnect the electrical connections from the right-hand side cylinder head ignition coils and move the respective wiring aside.
2. Loosen the fastening screws and remove the right-hand cylinder head ignition coils.



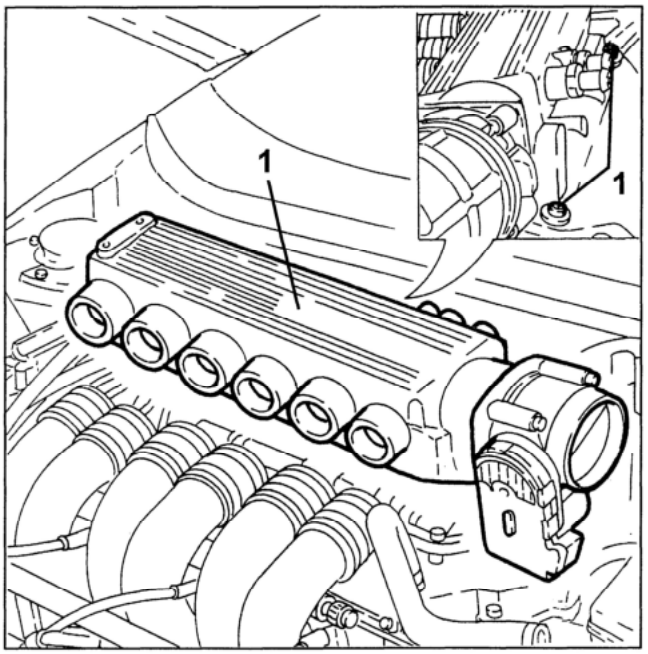

- Release the engine cooling fan wiring from the fasteners on the front crossmember.
1. Loosen the fastening screws and remove the upper radiator crossmember.
2. Loosen the fastening screws and remove the left-hand cylinder head ignition coils.



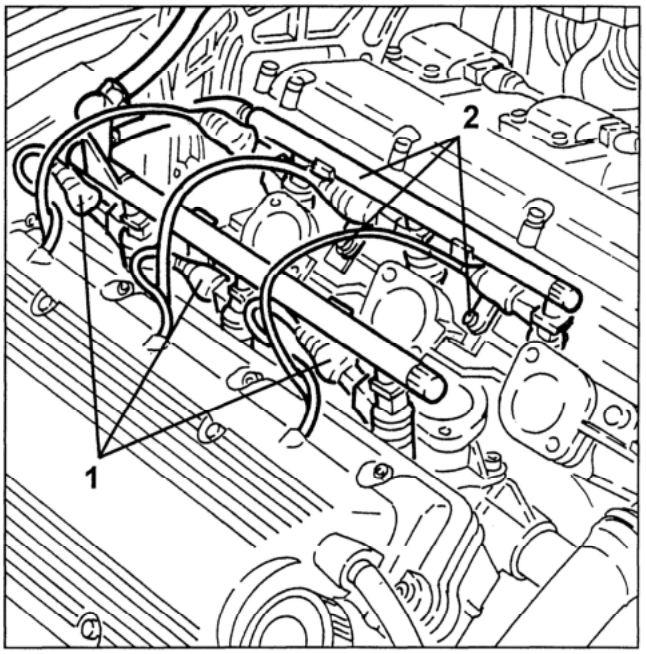


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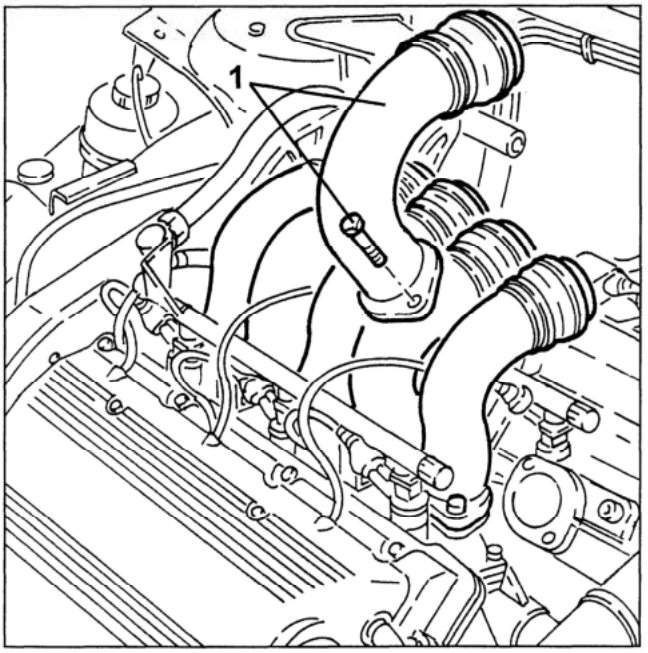
1. Loosen the fastening screws and remove the intake manifold.



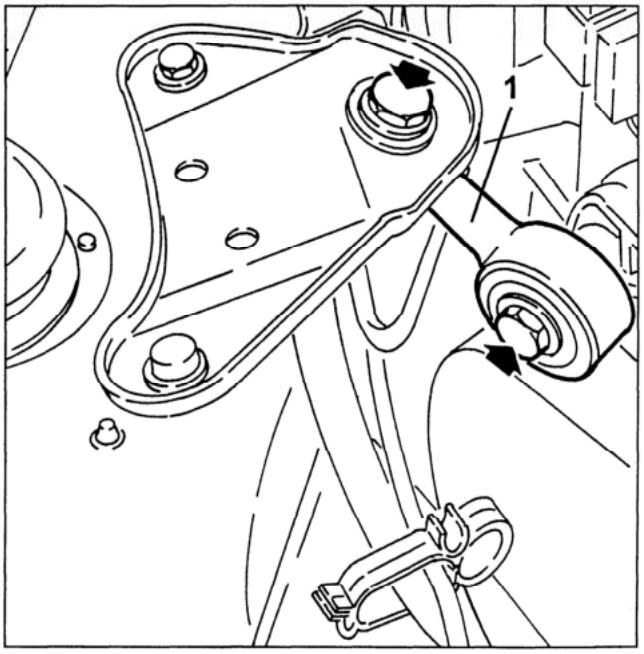

1. Disconnect the injector electrical connections.
2. Loosen the fastening screws and move the fuel distribution manifold with injectors aside.



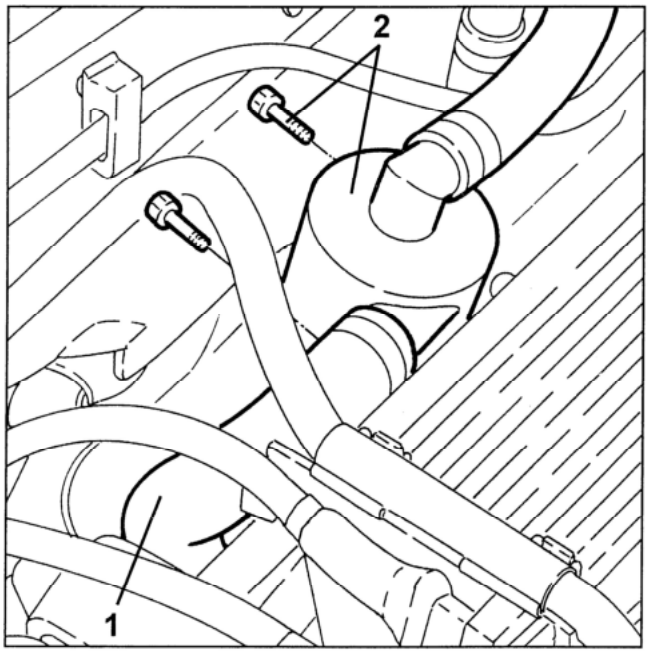

1. Remove the previously loosen screws and remove the intake ducts.
- Refit the respective seals.



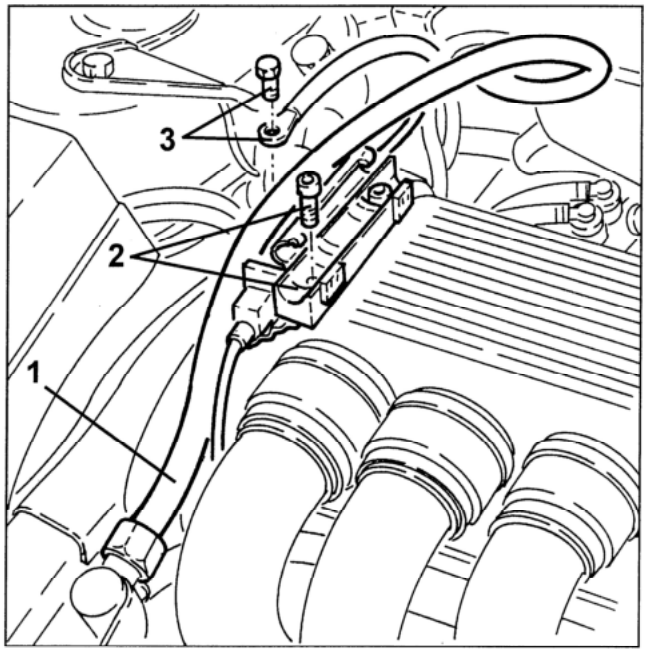

1. Loosen the fastening screws and remove the engine assembly tie-rod.



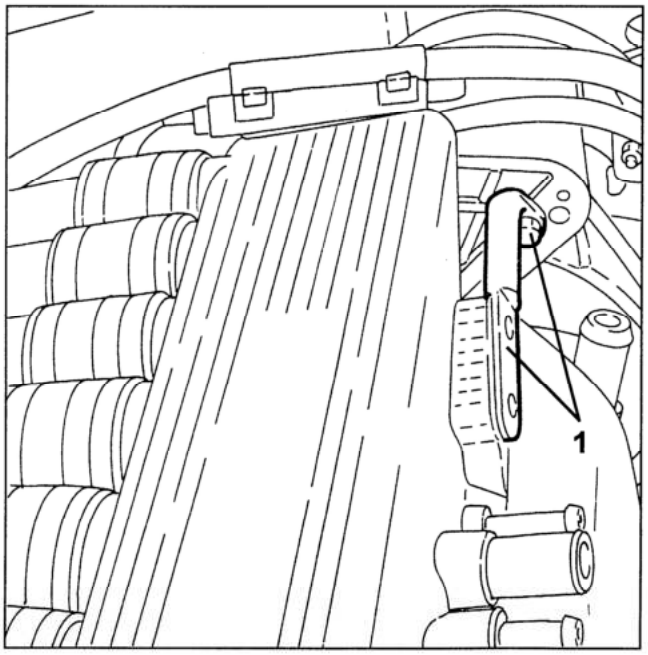
1. Disconnect the oil vapour recovery pipe from the right-hand cylinder head tappet cover.
2. Loosen the fastening screws and move the oil vapour separator from the intake manifold.



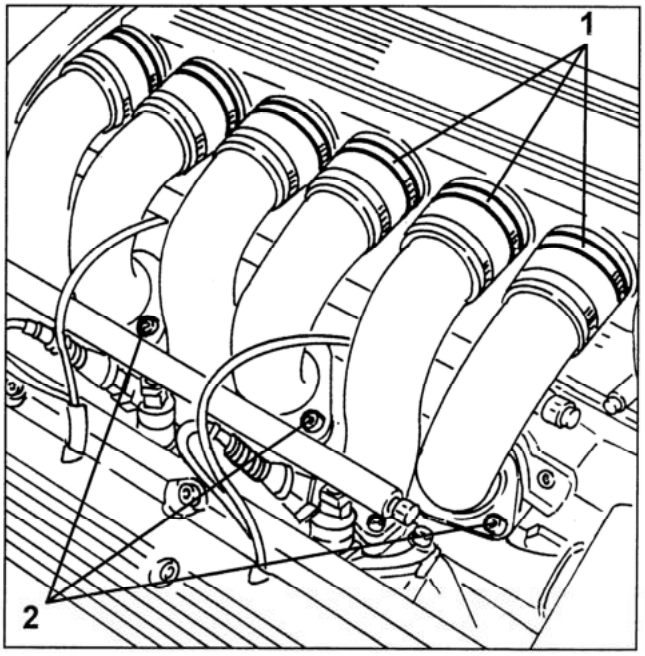

1. Release the fuel delivery pipe from the bracket.
2. Loosen the screws and remove the fuel delivery pipe bracket.
3. Disconnect the engine tie-rod earth wire.




1. Loosen the screw and remove the intake manifold connection to engine tie-rod bracket.



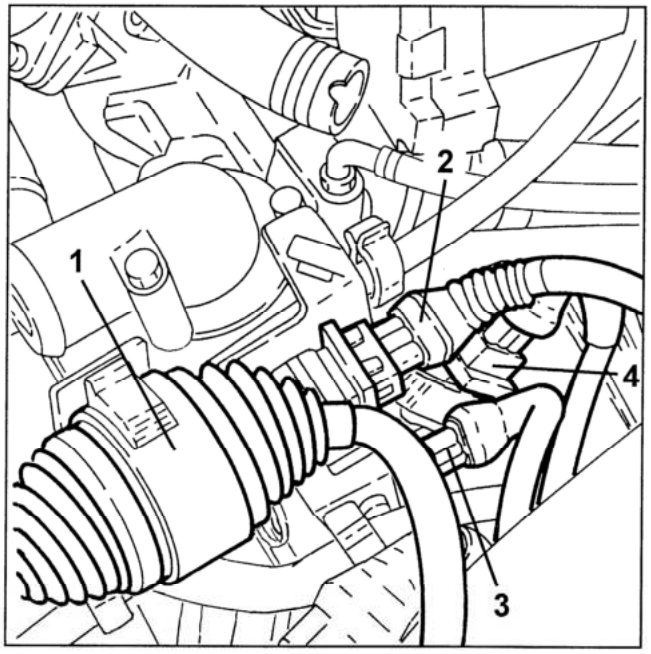

1. Loosen the intake manifold duct clips.
2. Loosen the air intake duct fastening screws on the cylinder head.



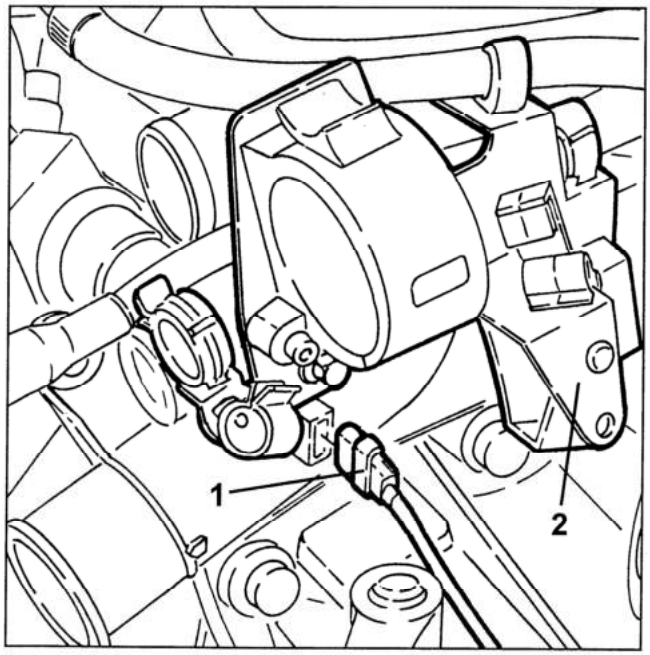


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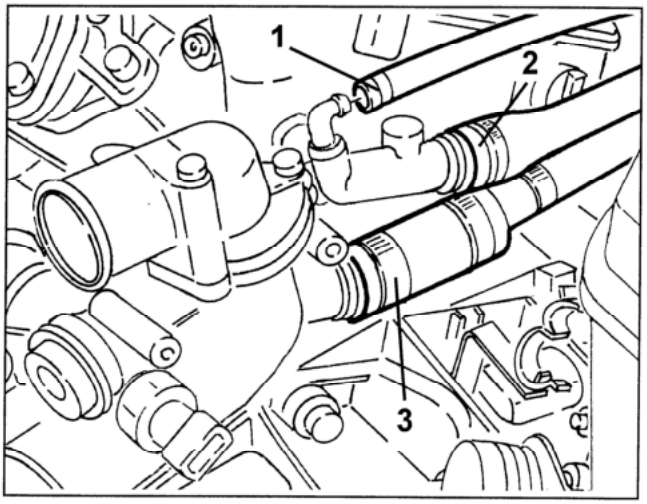
1. Disconnect the injection wiring joint from the bracket.
2. Disconnect the rpm and phase sensor electrical connection.
3. Disconnect the rear knock sensor electrical connection.
4. Disconnect the cam angle sensor electrical connection.



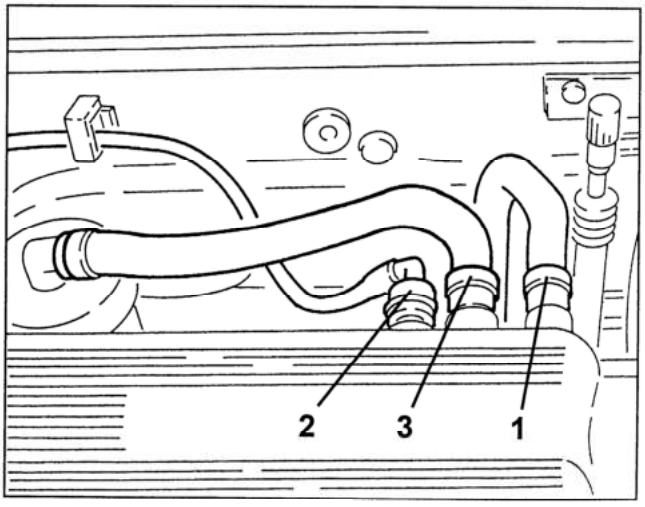

1. Disconnect the engine coolant temperature sensor electrical connection.
2. Loosen the fastening screws and remove the electrical connection bracket and pipes.




1. Disconnect the coolant return pipe to the expansion reservoir from the right-hand cylinder head.
2. Disconnect the coolant delivery pipe to the climate control system from the right-hand cylinder head fitting.
3. Disconnect the climate control system coolant return sleeve from the thermostat.



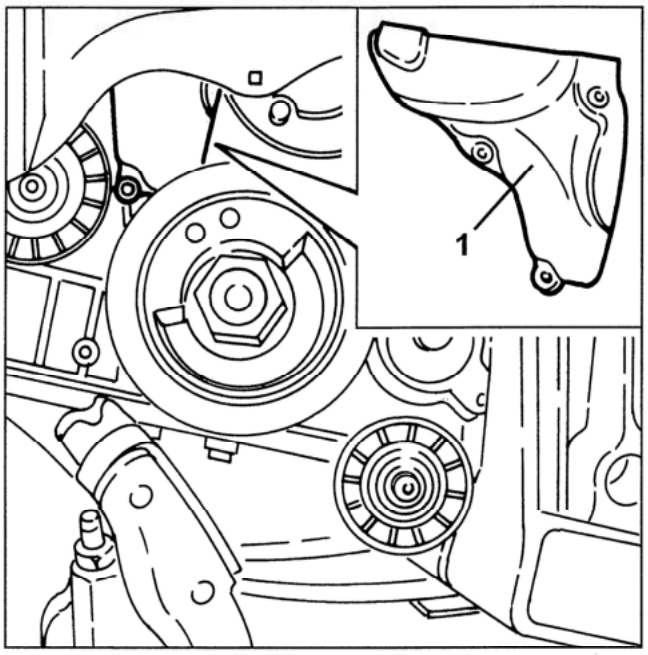

1. Disconnect the brake booster vacuum pipe from the intake manifold.
2. Disconnect the fuel vapour pipe quick coupling fitting from the intake manifold.
3. Disconnect the oil vapour recirculation pipe from the intake manifold.





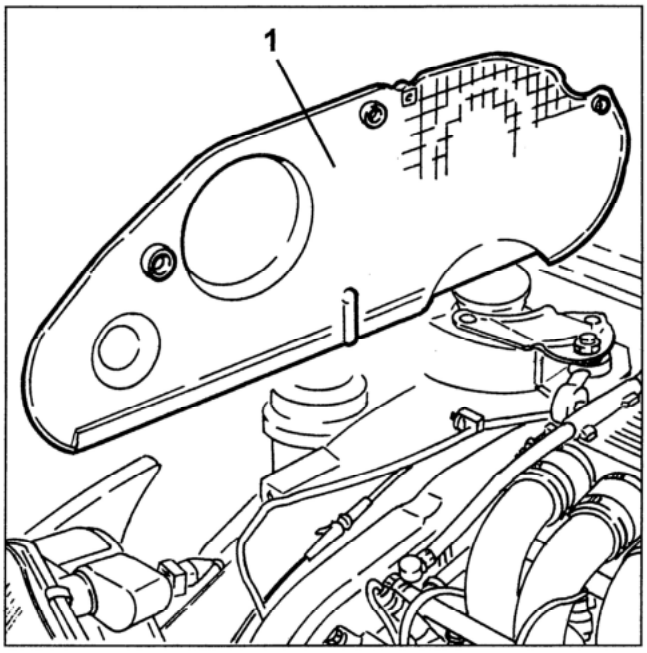
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1. Loosen the fastening screws and remove the lower right-hand timing belt guard.

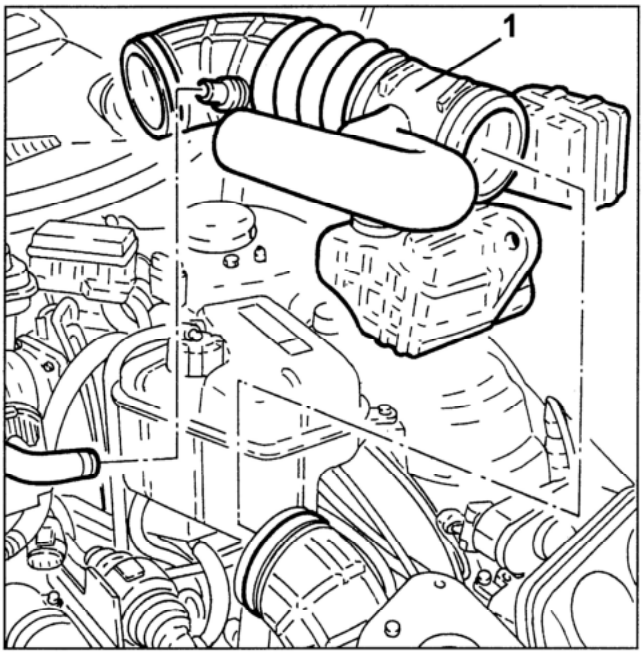



- Lower the vehicle.

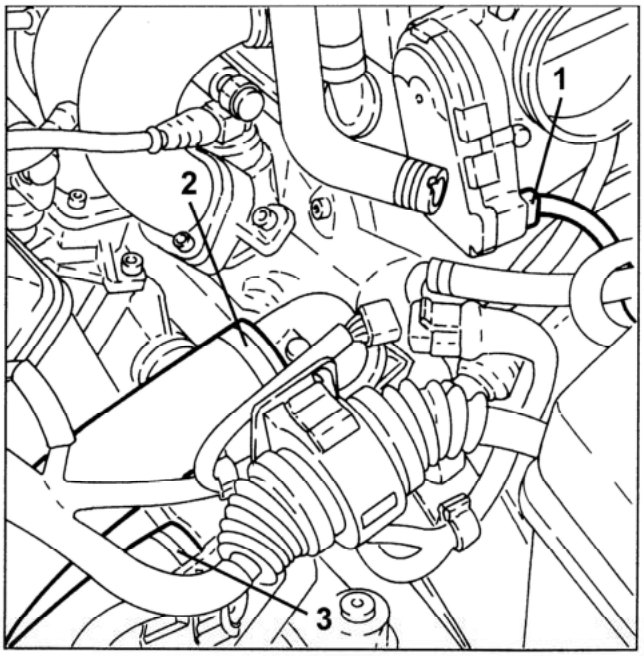
1. Loosen the fastening screws and remove the upper timing belt guard.




1. Loosen the clips and remove the corrugated sleeve with resonators after releasing the intermediate resonator from the fastening pin.



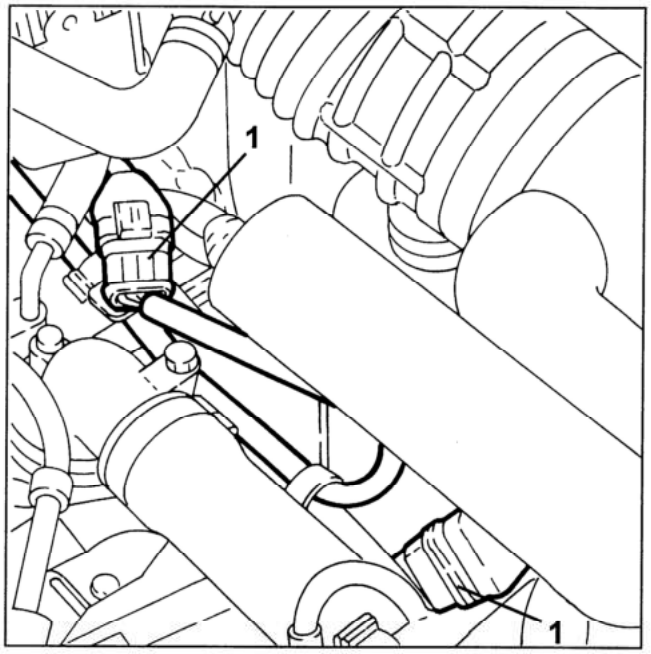

1. Disconnect the electrical connection from the throttle casing with built-in DVL.
2. Disconnect the radiator coolant delivery sleeve from the thermostat.
3. Disconnect the radiator coolant return sleeve from the thermostat.



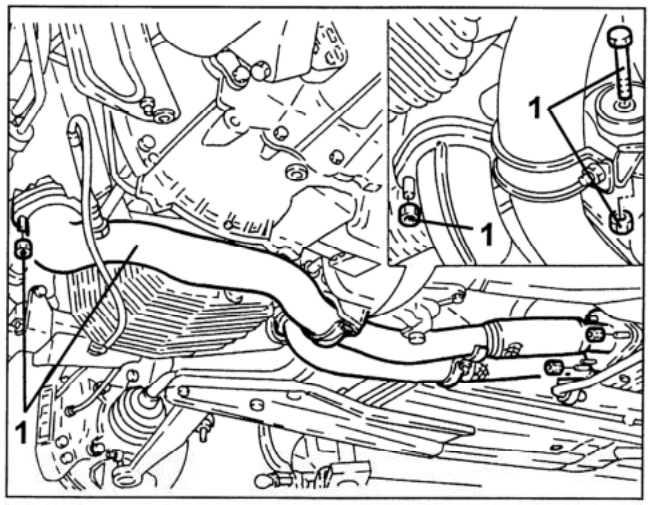


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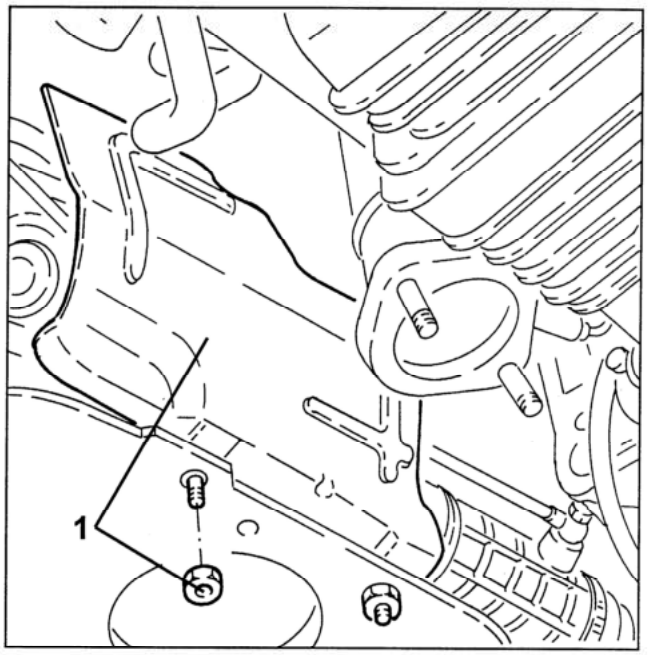
- Lower the vehicle.
1. Disconnect the lambda sensor electrical connections.



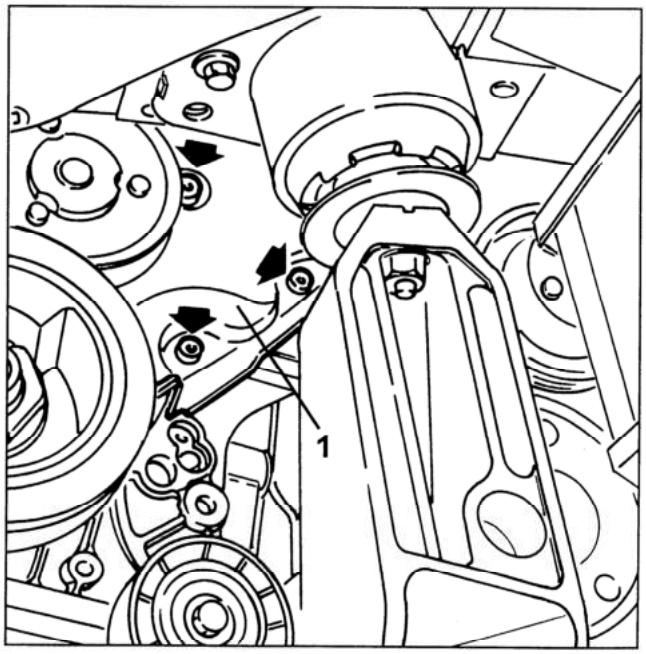

- Lift the vehicle.
1. Loosen the fasteners and remove the front exhaust pipe section.



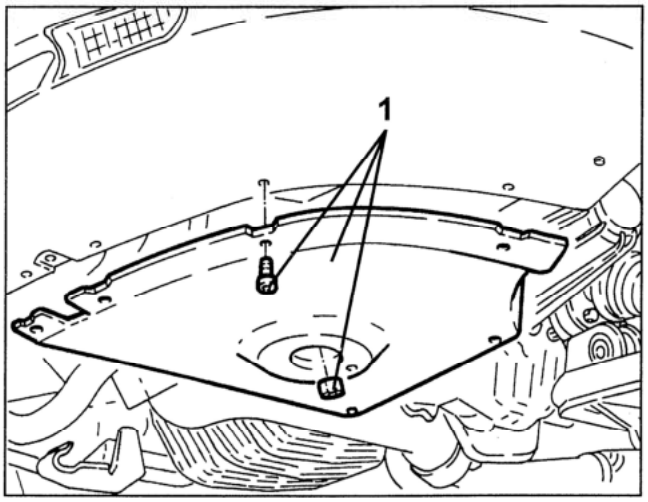

1. Loosen the nuts and remove the power steering unit firewall.

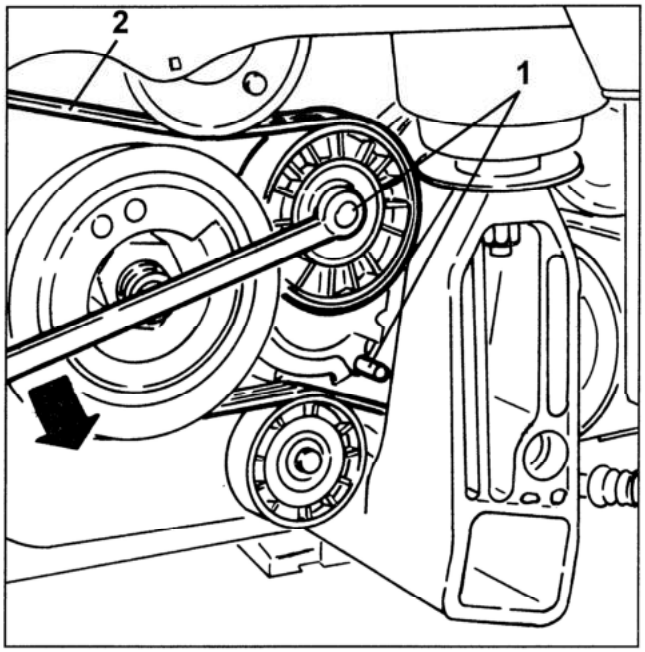



1. Loosen the fastening screws and remove the lower left-hand timing belt guard.

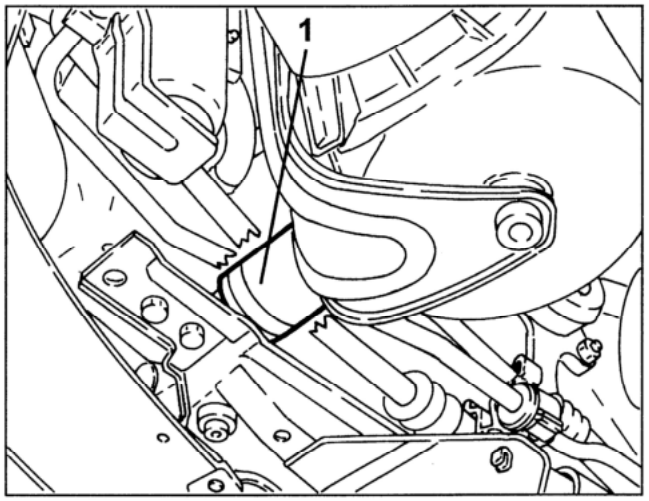


1. Loosen the nut and the screws. Then remove the lower air cleaner guard.



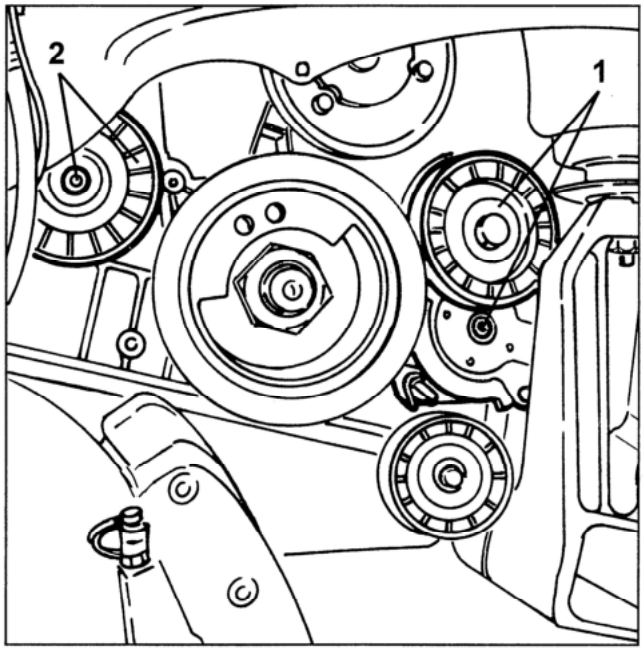




1. Drain the engine coolant by disconnecting the radiator outlet sleeve and collect the coolant in a suitable container.




1. With a wrench on the belt take-up pulley fastening screw, overcome the automatic take-up force and lock it in this position (belt loose) with a pin as shown in the figure.
2. Remove the auxiliary unit drive belt.

1. Loosen the fastening screw and remove the engine unit drive belt take-up.
2. Loosen the fastening screw and remove the auxiliary unit drive belt runner.





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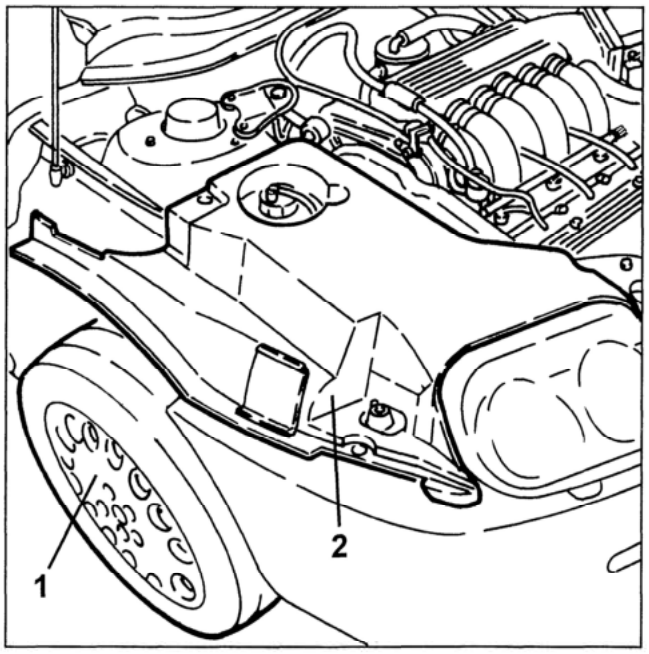
## CYLINDER HEAD

**NOTE: Only the right-hand cylinder head can be removed in the vehicle as shown below. Remove the engine assembly to remove the left-hand cylinder head (see specific paragraph).**

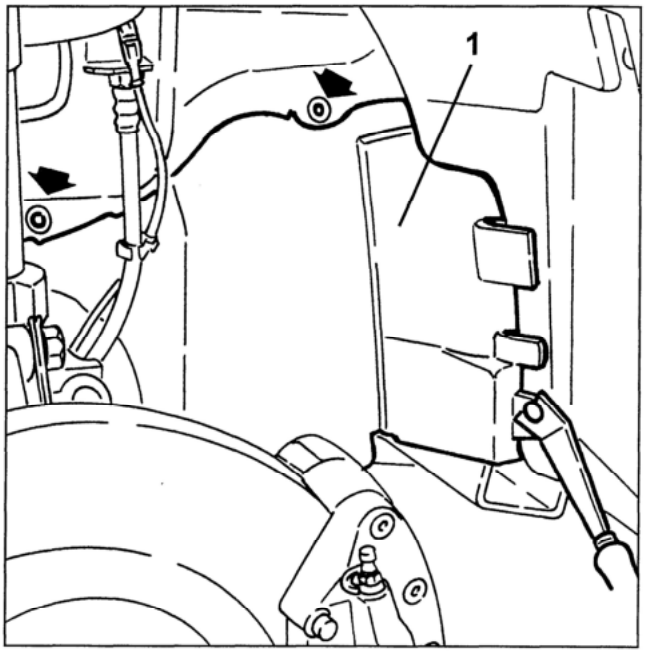
### REMOVAL/REFITTING RIGHT-HAND CYLINDER HEAD

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.

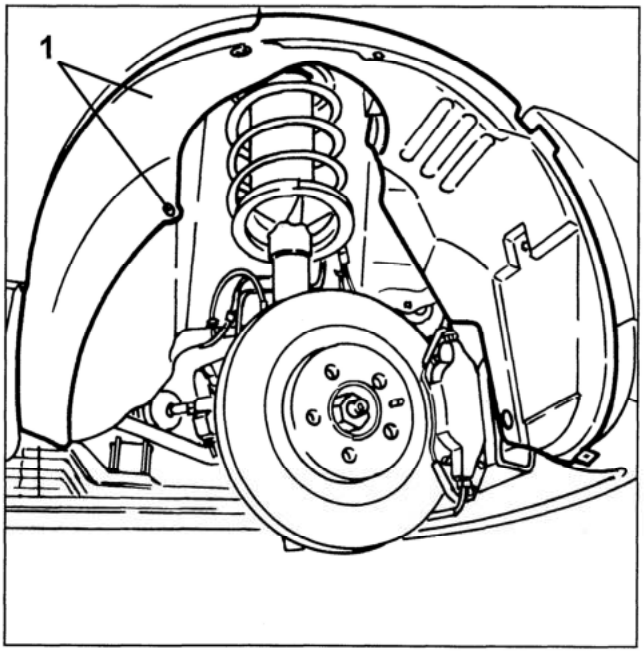
1. Remove the front right-hand wheel.
2. Loosen the screws and remove the two engine compartment side guards.




1. Loosen the two fastening screws, remove the plastic button and remove the dust guard from the front right-hand wheel compartment.

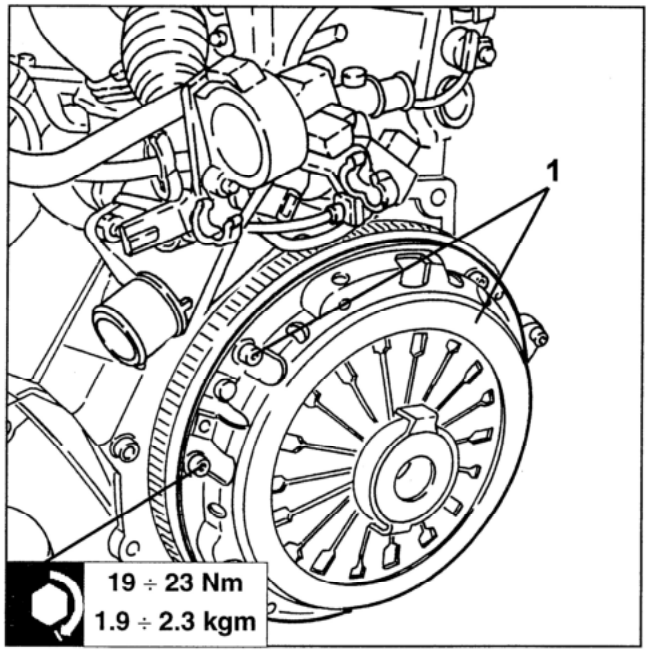



1. Loosen the fasteners and remove the front right-hand wheelhouse.

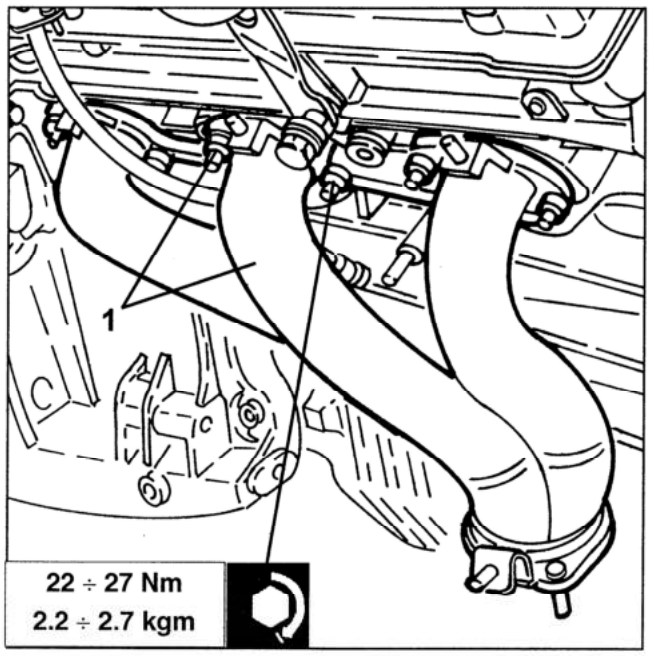



- Lift the vehicle.

1. Loosen the fastening screws and remove the thrust plate with thrust bearing and clutch plate.




1. Loosen the fastening nuts and remove the exhaust manifold, left-hand side.
- Remove the respective seals.



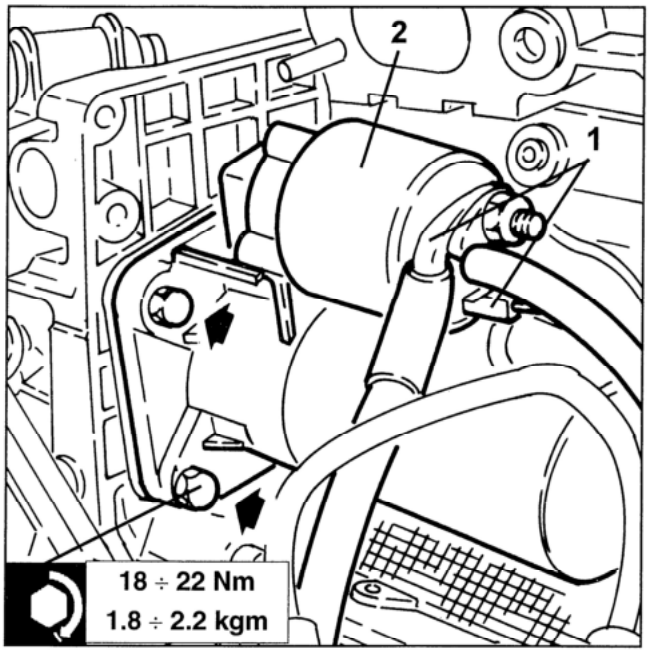

## REFITTING

Reverse the removal sequence and observe the following warnings:
- Prepare the engine compartment to insert the engine assembly by positioning all the electrical wires, pipes, etc. so that they do not interfere with the refitting operations.
- Be careful not to damage the single components when refitting the engine.

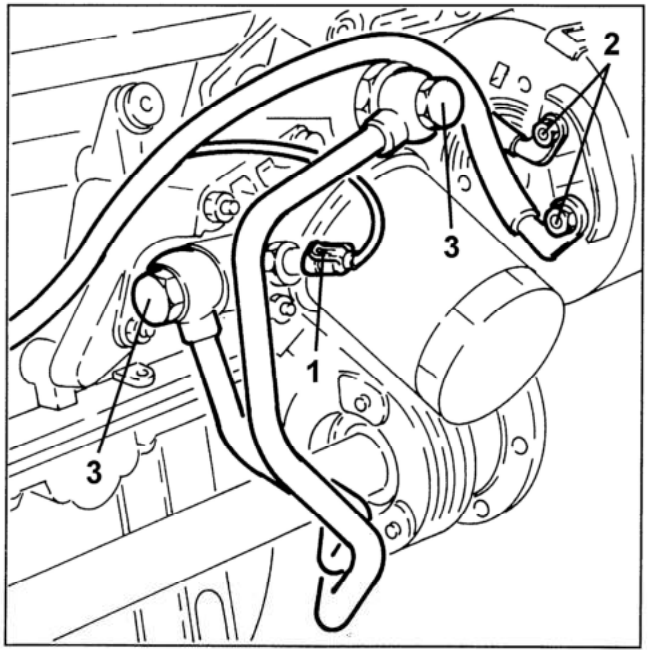
**IMPORTANT: Make sure the engine assembly mounts are correctly fastened.**

- After refitting, top the various systems up as required (see Assembly 00).
- Perform all the checks and interventions required (see Assembly 00).

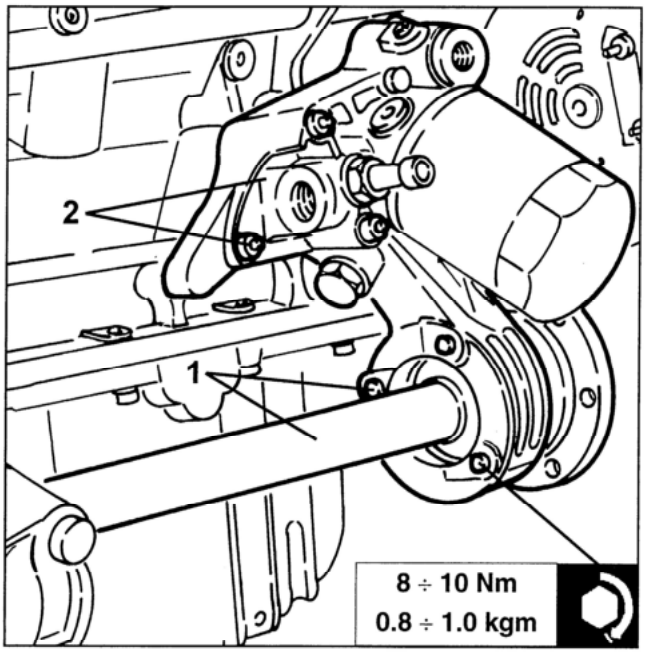
1. Disconnect the starter motor electrical connections.
2. Loosen the three fastening screws and remove the starter motor.



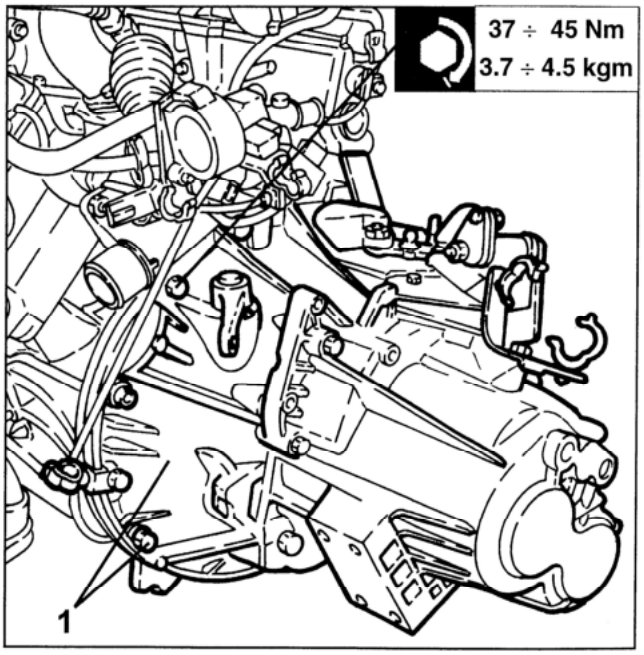

1. Disconnect the engine oil minimum pressure sensor electrical connection.
2. Disconnect the alternator electrical connections. Then remove the electrical wiring by releasing it from the fasteners.
3. Disconnect the radiator engine oil delivery and return pipe fittings from the oil filter bracket. Then remove them with the bracket.




- Drain the gearbox-differential oil.
1. Loosen the fastening screws and release the intermediate shaft.
- Remove the dust guard ring.
2. Loosen the fastening nuts and remove the oil filter bracket.




1. Loosen the fastening screws and remove the gearbox-differential with a hydraulic crane.

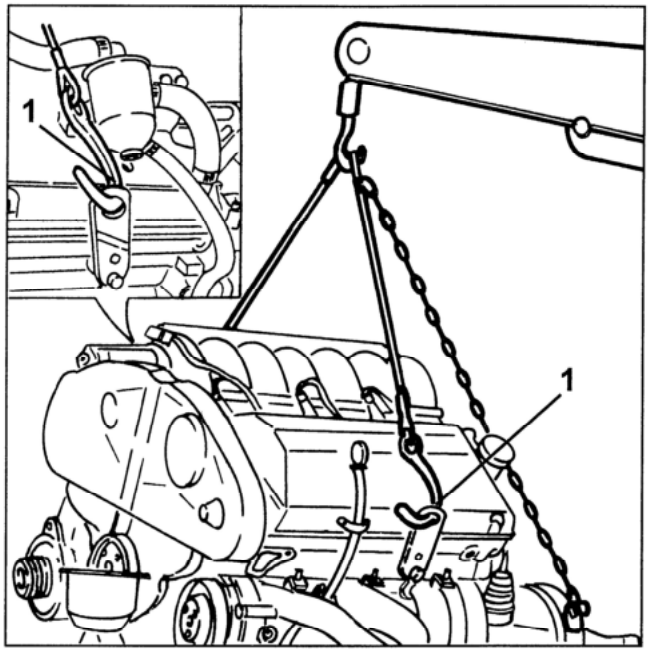



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- Release the electrical wires from any clips and move them away from the engine so that they will not get caught when the engine is removed.
- Lower the hydraulic jack completely and remove the engine from the engine compartment.

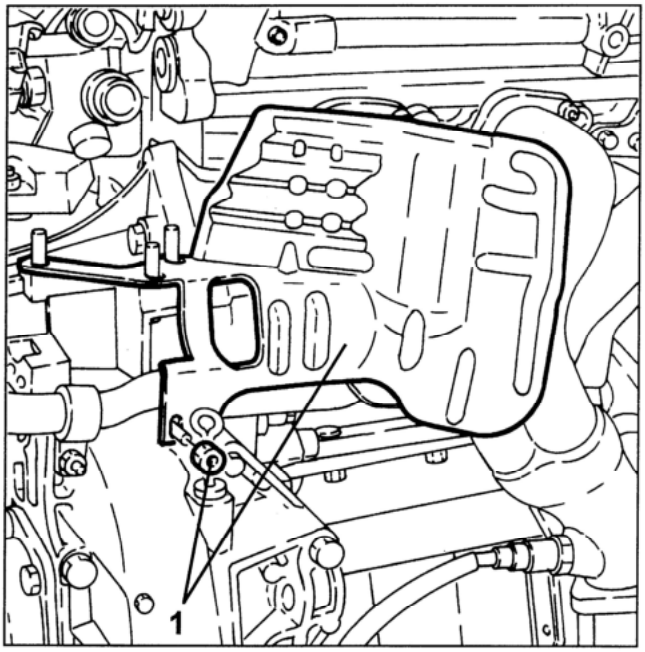
**IMPORTANT: The hydraulic jack must have a payload of at least 1000 kg.**
**When lowering the engine, make sure no wires or pipes are still connected.**
**Be careful not to damage any components.**

1. Support the engine with the hydraulic jack used for removal and with a hydraulic crane as shown in the figure.

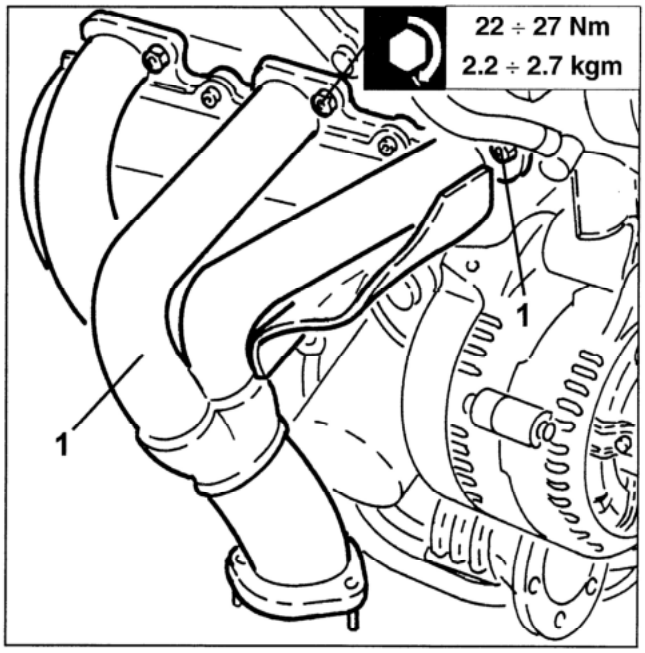



**IMPORTANT: Use a hydraulic crane to move the engine after releasing it from the hydraulic jack.**

- Lower the hydraulic crane and position the engine on a specific engine stand.
1. Loosen the fastening nut and remove the upper firewall from the right-hand exhaust manifold.



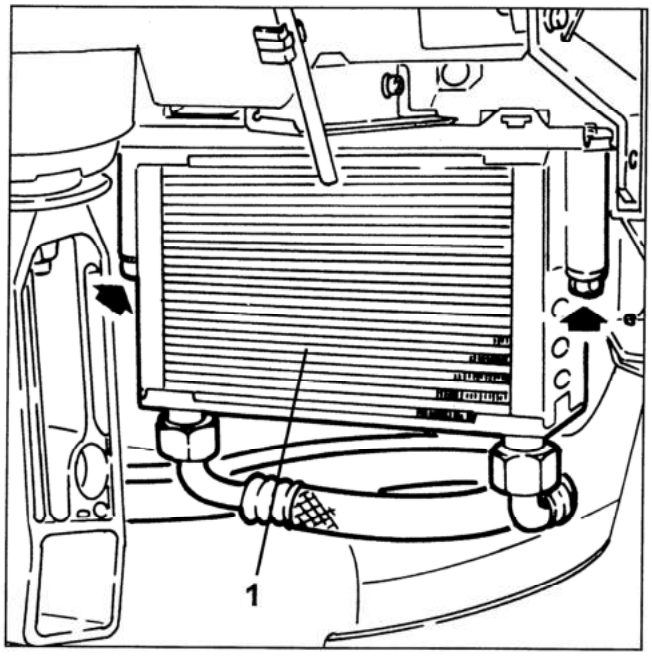

1. Loosen the fasteners and remove the right-hand exhaust manifold and starter motor firewall.
- Remove the respective seals.



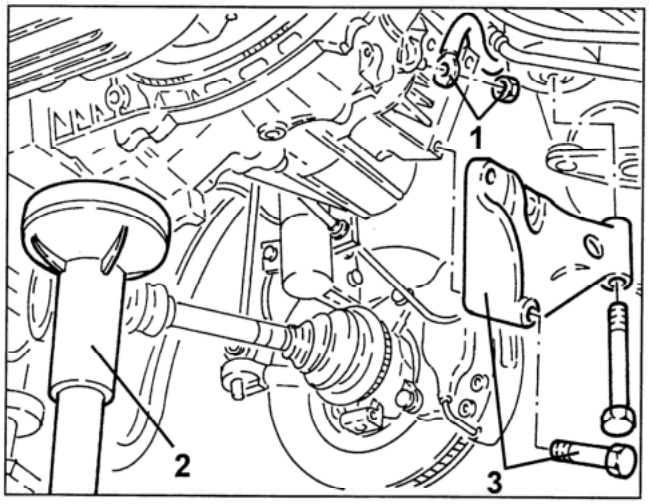


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1. Loosen the fastening screws and remove the engine oil radiator from the bracket. Then fasten it to the engine as not to obstruct the following operations without disconnecting it.



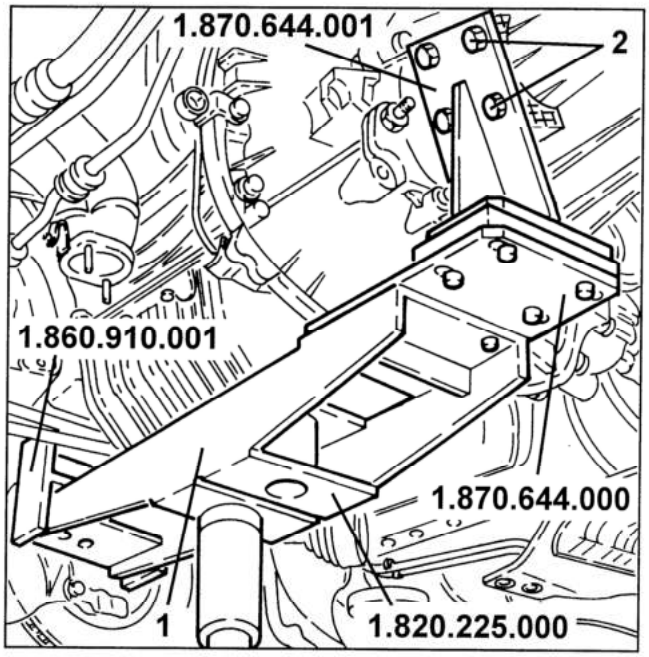

1. Disconnect the gearbox earth braid.
2. Position a hydraulic jack under the differential.
3. Loosen the screws and remove the gearbox bracket on engine side.
- Remove the hydraulic jack from under the differential.



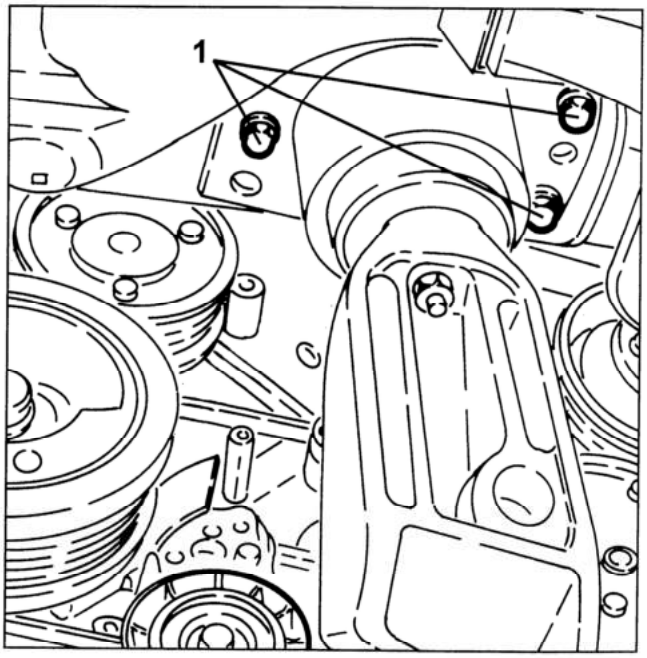

1. Position tool no. 1.820.225.000 with tools no. 1.870.644.000, no. 1.870.644.001 and no. 1.860.910.001 on the hydraulic jack.

**NOTE: Position the hydraulic jack in the central hole in tool 1.820.225.000 to ensure the engine is balanced correctly on the fixture.**

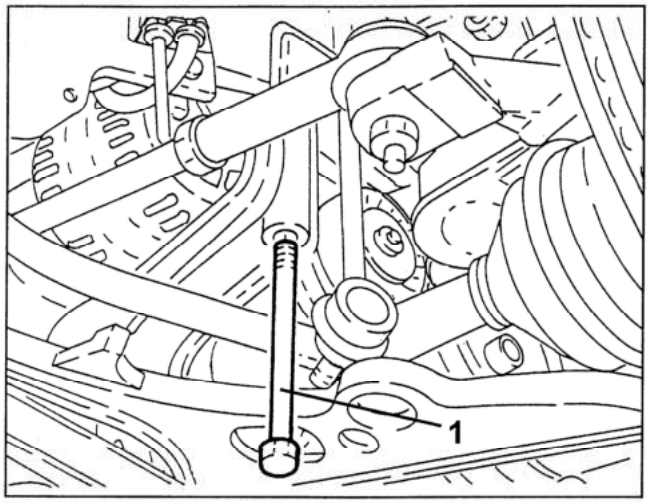
2. Fasten the fixture to the engine.



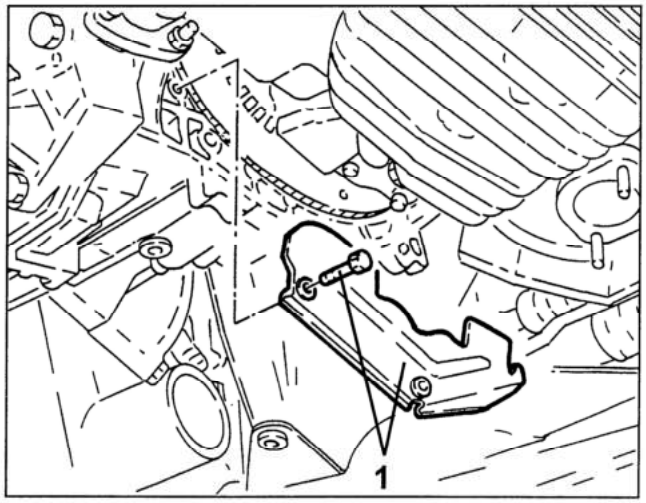

- Release the engine safety fixture tie-rods from the cylinder head brackets.
1. Loosen the engine stiff rubber mount fastening screws, timing side.



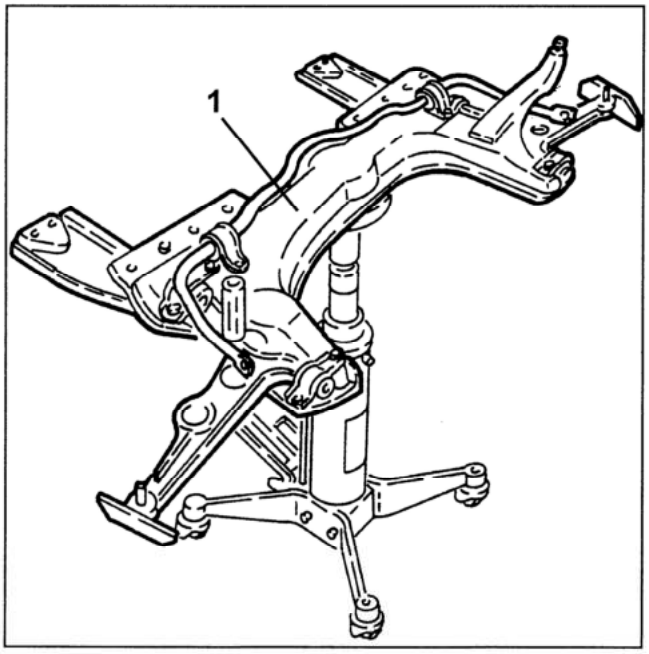
1. Loosen the side screws fastening the crossmember to the underbody.



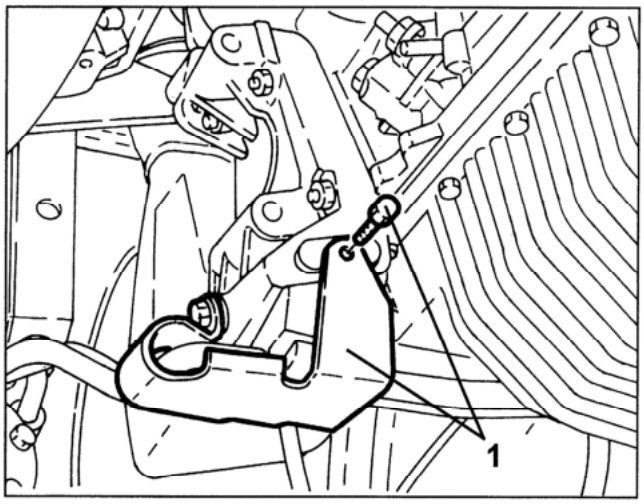

1. Loosen the fastening screws and remove the flywheel guard.




1. Lower the hydraulic jack and remove the crossmember with wishbones, stabiliser and reinforcements.



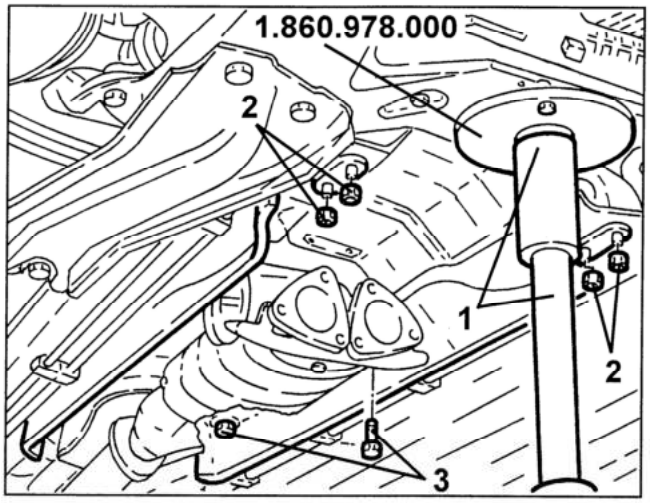

1. Loosen the fastening screws and remove the cooling radiator engine oil delivery and return pipe bracket.



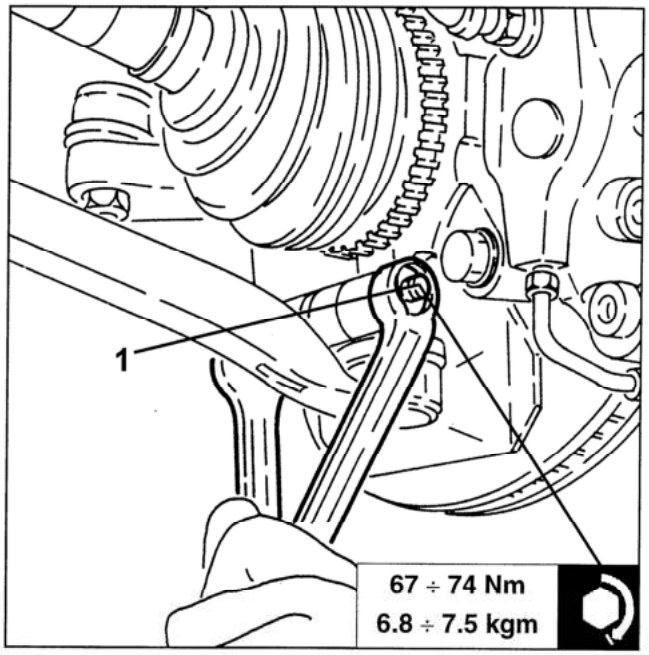


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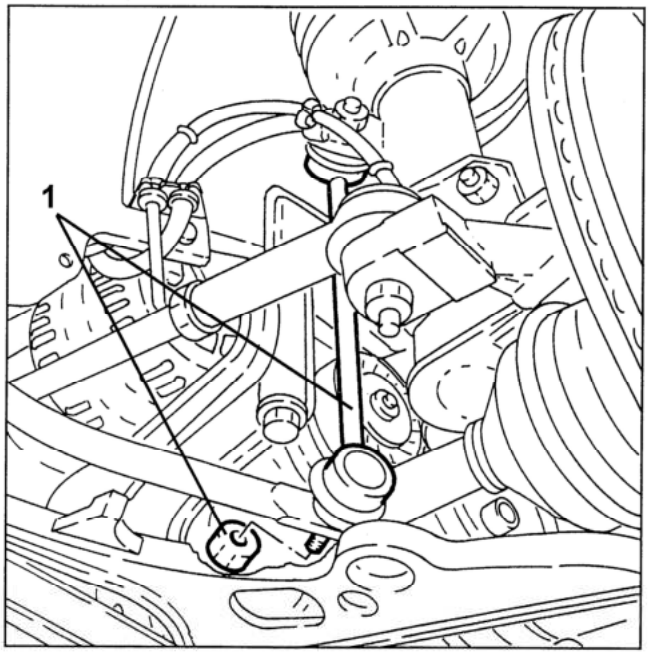
1. Use a hydraulic jack to support the crossmember by means of tool no. 1.860.978.000.
2. Loosen the gear lever bracket front fastening nuts.
3. Loosen the gear lever bracket rear screws and the remaining screws.



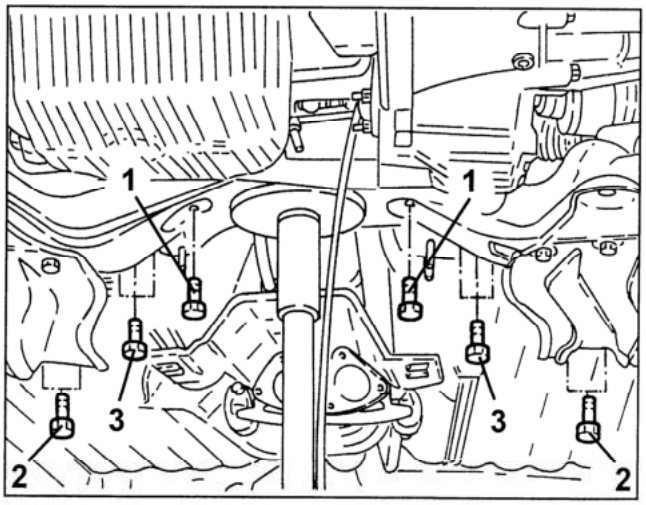

1. Loosen the bolts fastening the wishbones to the wheel risers.



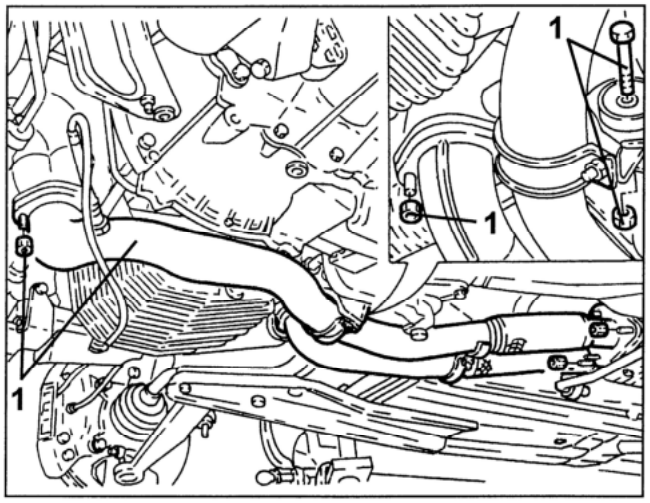

1. Loosen the nuts and disconnect the stabiliser bar tie-rods.

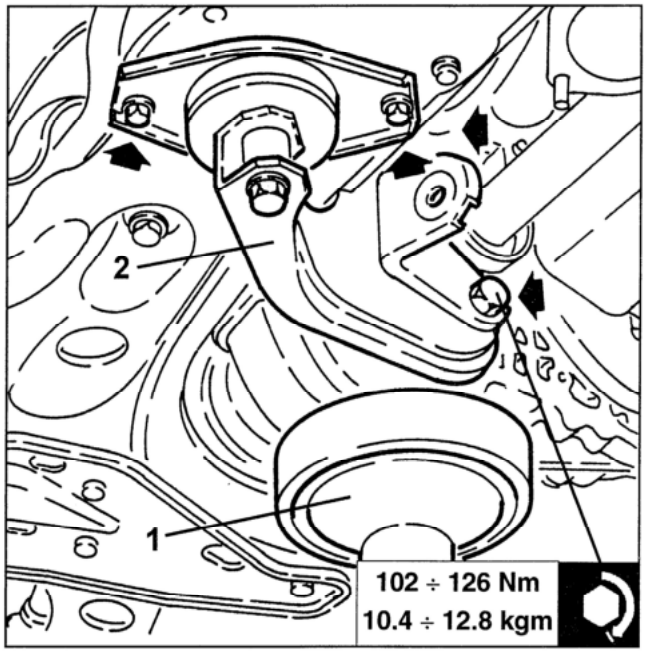



1. Loosen the screws fastening the power steering unit to the crossmember.
2. Loosen the rear screws fastening the crossmember reinforcement to the underbody.
3. Loosen the central screws fastening the crossmember to the underbody.

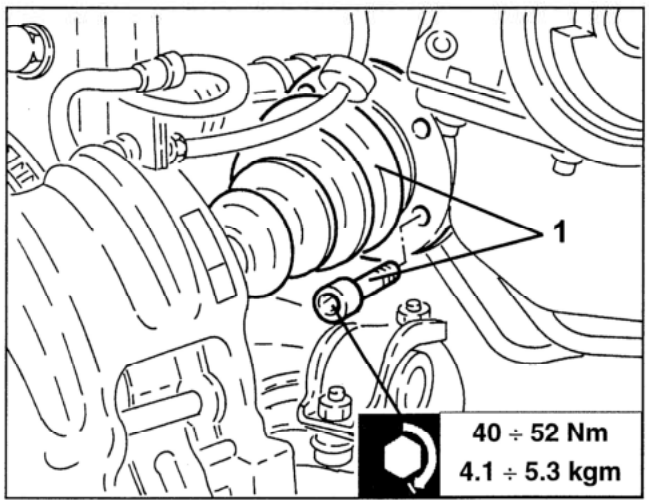


1. Loosen the fasteners and remove the front exhaust pipe section.

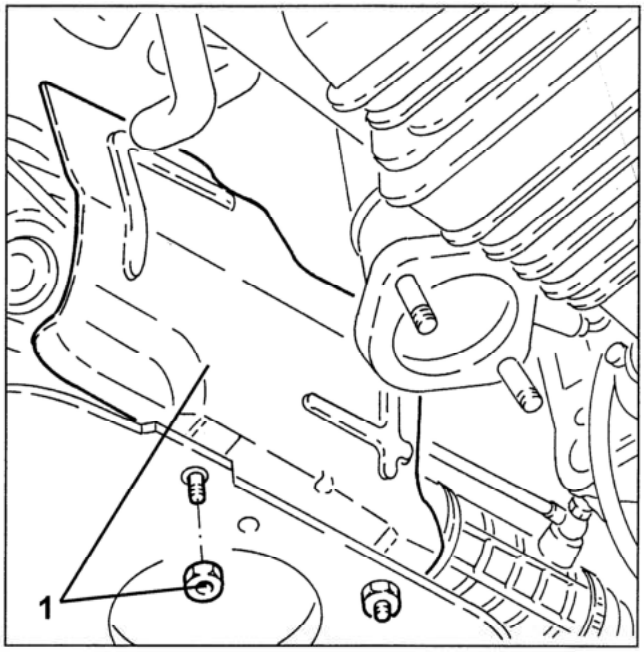



1. Loosen the fastening bolts and disconnect the drive shafts.

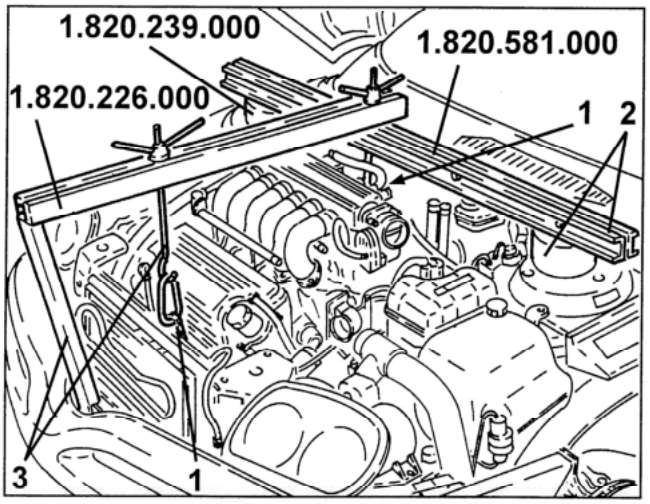



1. Loosen the nuts and remove the power steering unit firewall.

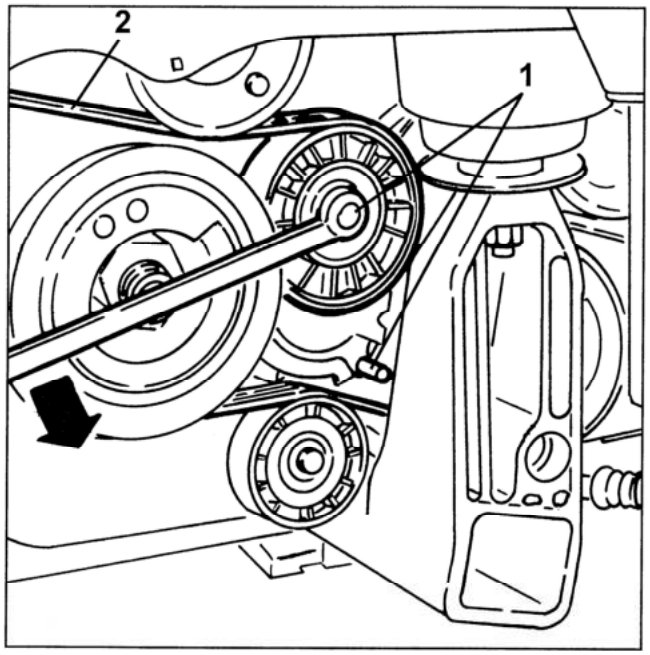



1. Position a hydraulic jack under the differential.
2. Loosen the fastening screws and remove the rear engine mount.
- Remove the hydraulic jack from under the differential.

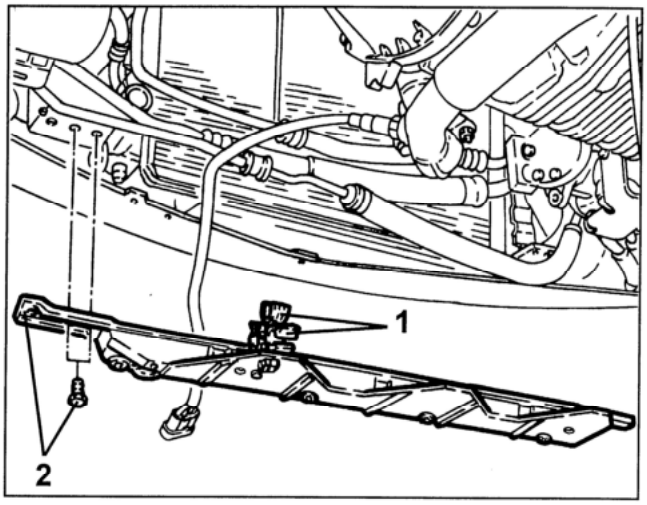
1. Fit the two engine mount rods on the cylinder heads.
2. Fit the crossmember no. 1.820.581.000 with mounts no. 1.820.239.000.
3. Fit mount no. 1.820.226.000 and connect the respective tie-rods on the brackets previously fitted on the cylinder heads.



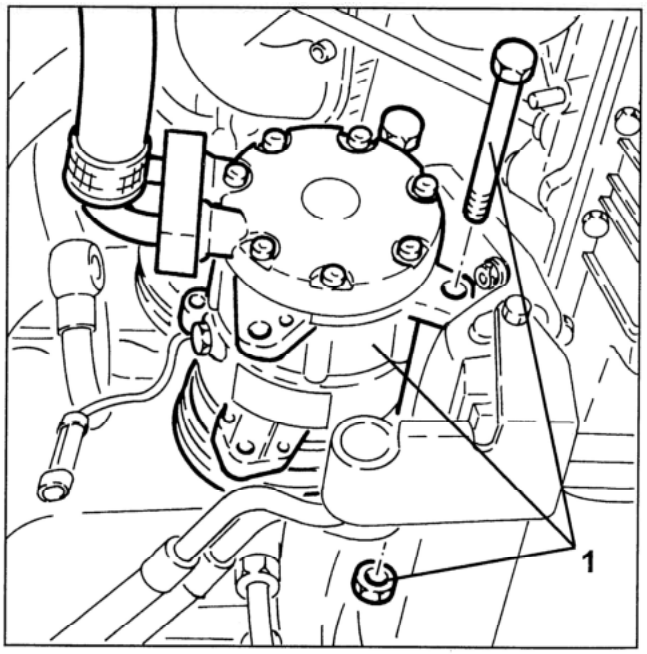

- Lift the vehicle.
1. With a wrench on the belt take-up pulley fastening screw, overcome the automatic take-up force and lock it in this position (belt loose) with a pin as shown in the figure.
2. Remove the engine unit drive belt.



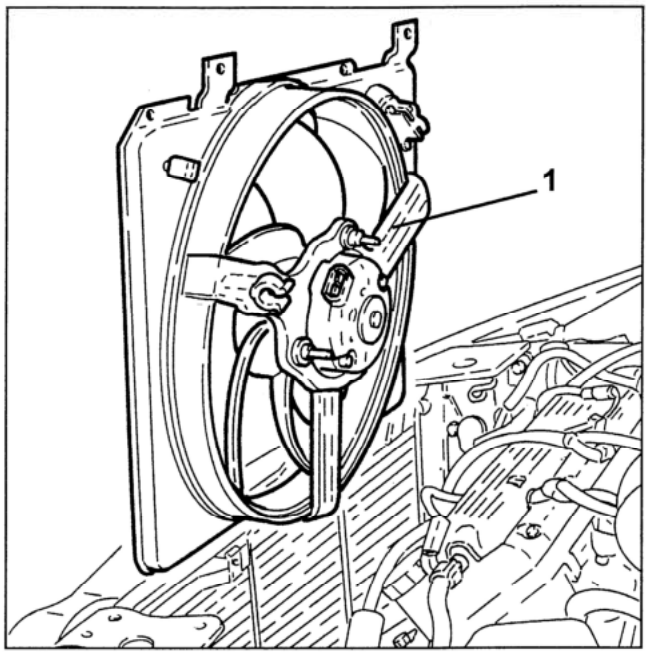

1. Release the power steering and climate control pipes from the clips on the lower radiator crossmember.
2. Loosen the screws and remove the lower engine cooling crossmember.



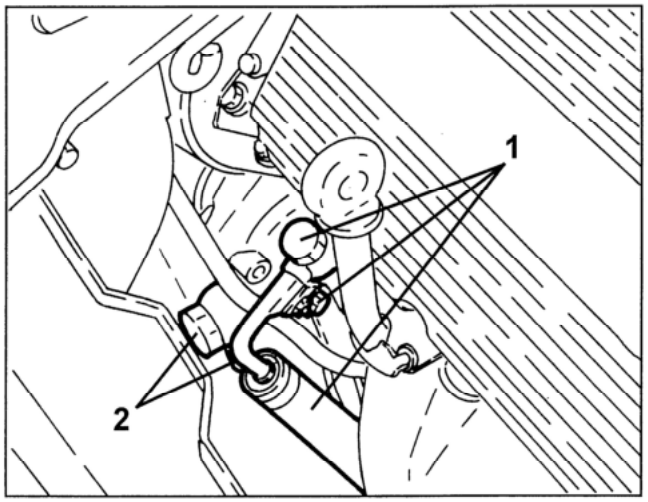

1. Loosen the conditioner compressor fastening screws. Move it aside and fasten it to the underbody.



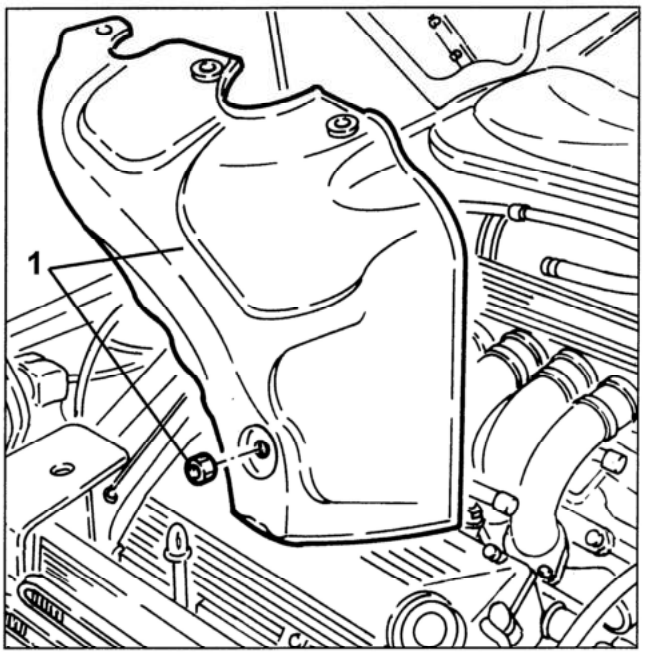
1. Move the radiator aside just enough to remove the engine cooling fan.
- Provisionally refit the engine cooling radiator upper screws.



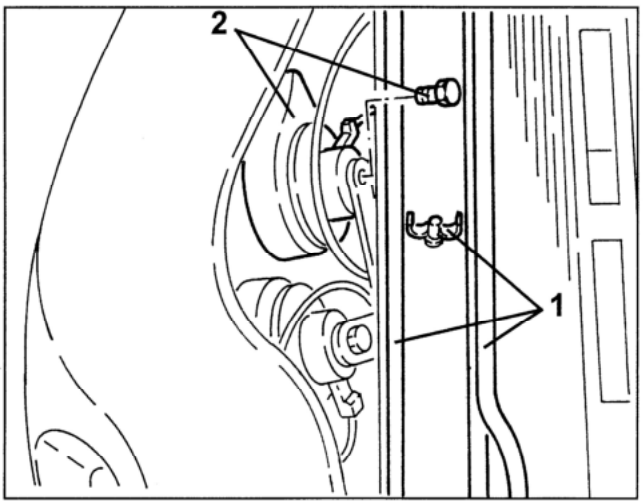

- Empty the power steering oil reservoir with a suitable syringe.
1. Loosen the screw and the fitting. Then disconnect the power steering pump oil delivery pipe.
2. Loosen the fitting and disconnect the power steering pump oil intake pipe.




1. Loosen the nuts and remove the firewall from the left-hand exhaust manifold.



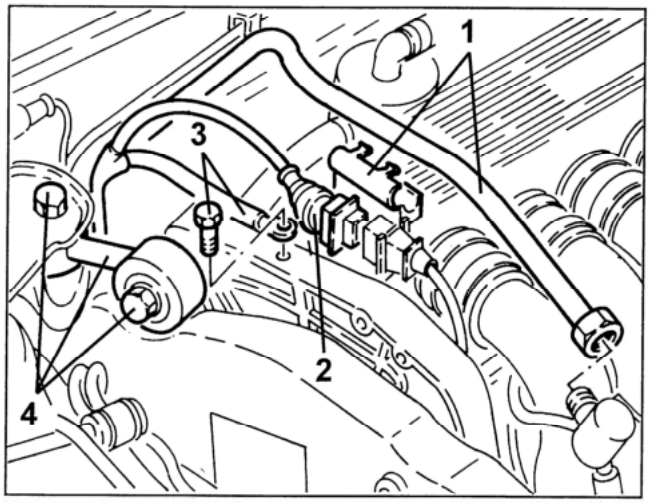

1. Loosen the power steering cooling serpentine from the retainers on the front underbody crossmember.
2. Loosen the fastening screw and move the right-hand horn aside.



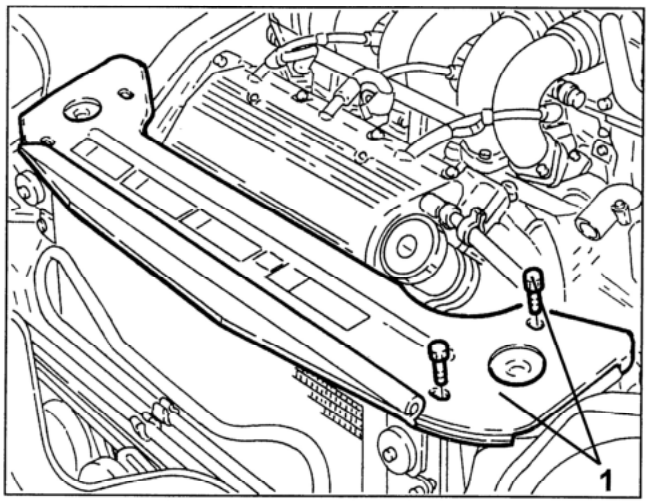


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1. Disconnect the fuel delivery pipe from the distribution manifold and release it from the fastening bracket.
2. Disconnect the front knock sensor electrical connection.
3. Disconnect the earth wire from the engine tie-rod.
4. Loosen the screws and remove the engine tie-rod.

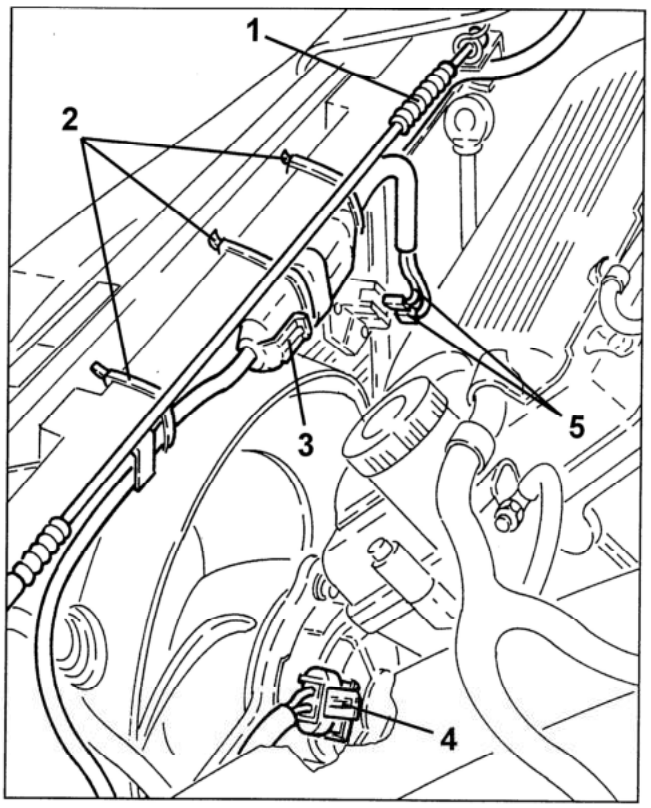



1. Loosen the screws and remove the upper radiator crossmember.

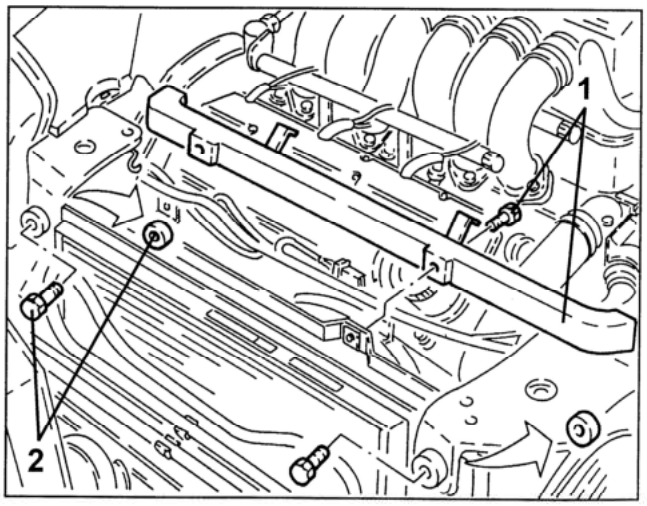



1. Disconnect the bonnet lock wire and move it aside.
2. Release the electrical wiring from the fastening clips and the duct.
3. Disconnect the electrical connection.
4. Disconnect the engine cooling fan electrical connection.

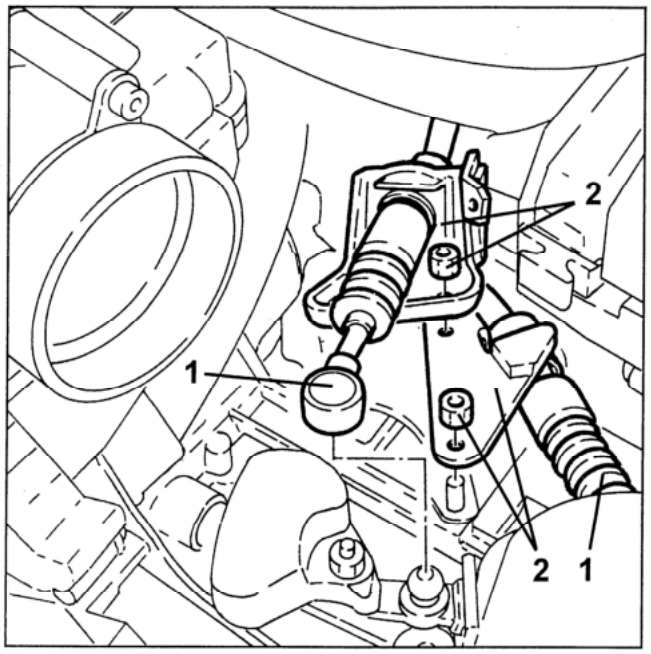
5. Disconnect the engine cooling fan resistor electrical connection and move the electrical wiring aside.



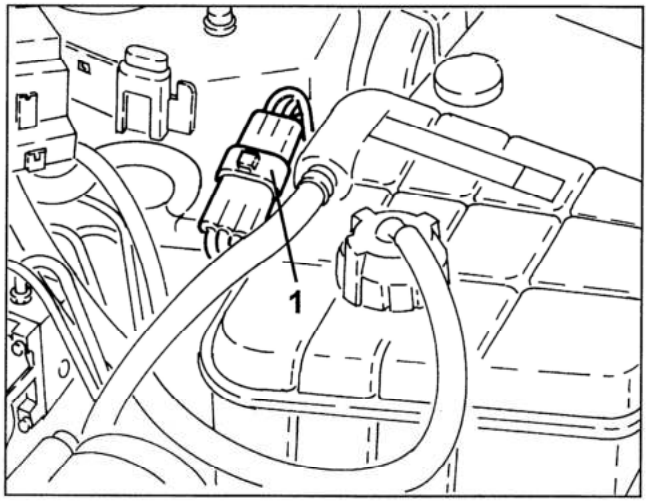

1. Loosen the screws and remove the electrical wiring duct.
2. Loosen the upper radiator fastening screws and take the respective shims.



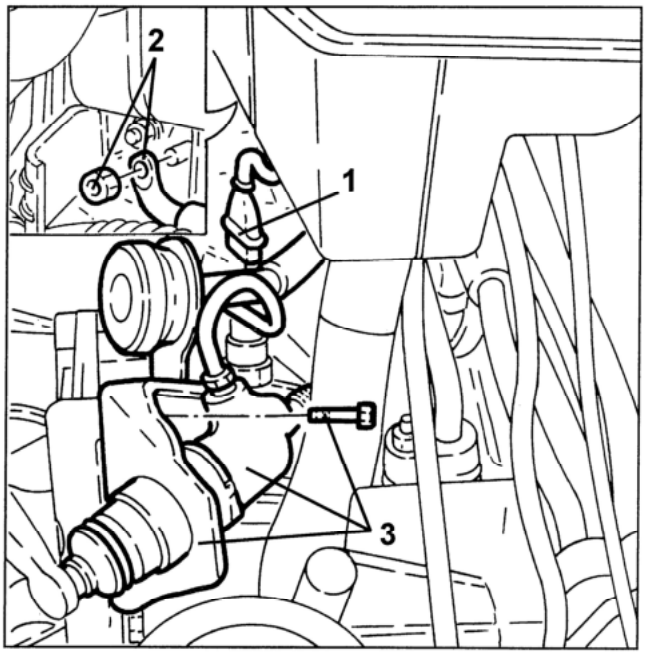
1. Disconnect the gear engagement and selection wires.
2. Loosen the nuts and move the brackets and gear engagement and selection wires aside.



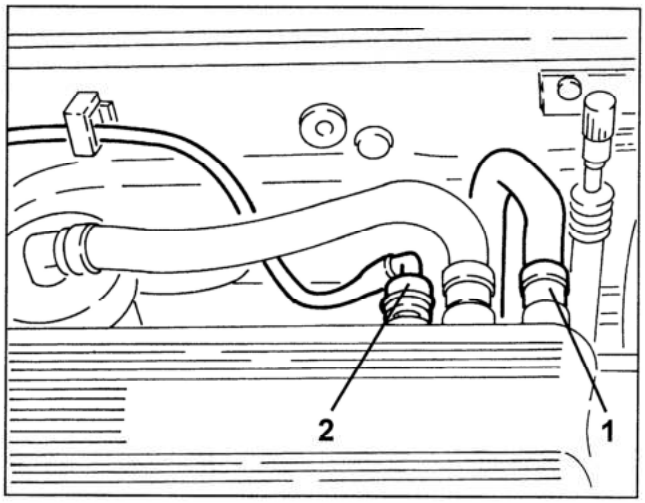

1. Disconnect the starter motor wiring electrical connection.




1. Disconnect the reversing light switch electrical connection.
2. Open the junction unit and disconnect the starter motor and alternator power wire.
3. Loosen the fastening screws and move the bracket with clutch cylinder and vibration damper aside without disconnecting the respective pipes.




1. Disconnect the brake booster vacuum pipe from the intake manifold.
2. Disconnect the fuel vapour pipe quick coupling from the intake manifold.

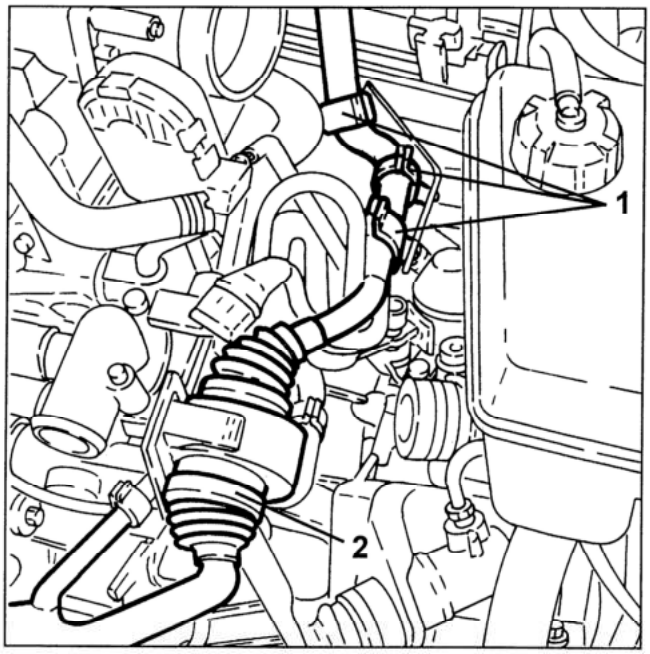



- Drain the fuel pressure by removing the specific caps on the distribution manifold and operating the valves underneath.

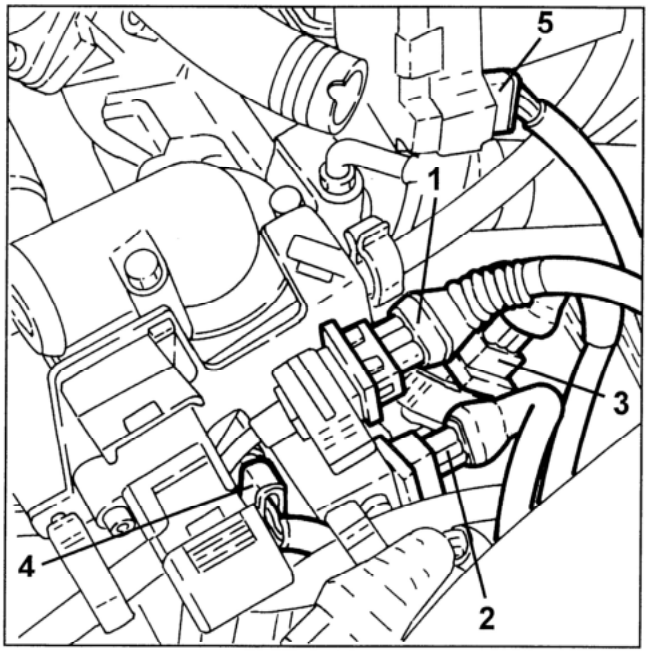
**NOTE: Collect the fuel in a suitable container.**


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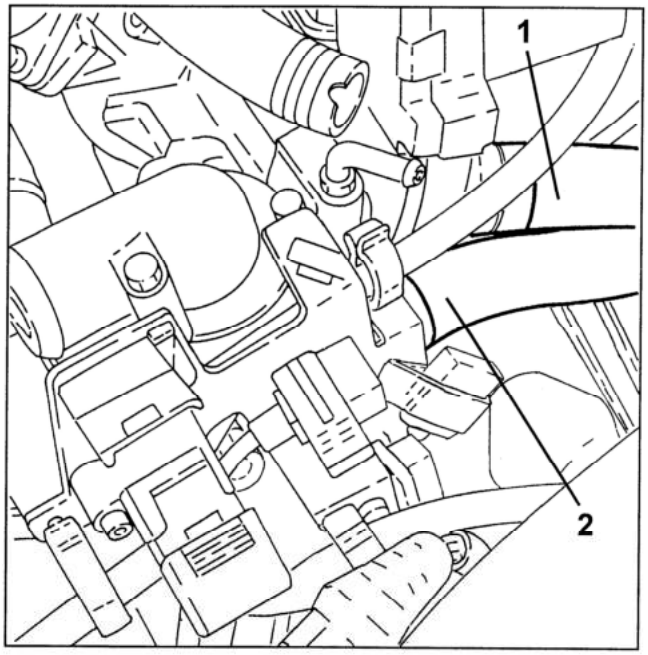
1. Release the injection wiring from the fastening clips.
2. Disconnect the injection wiring joint.



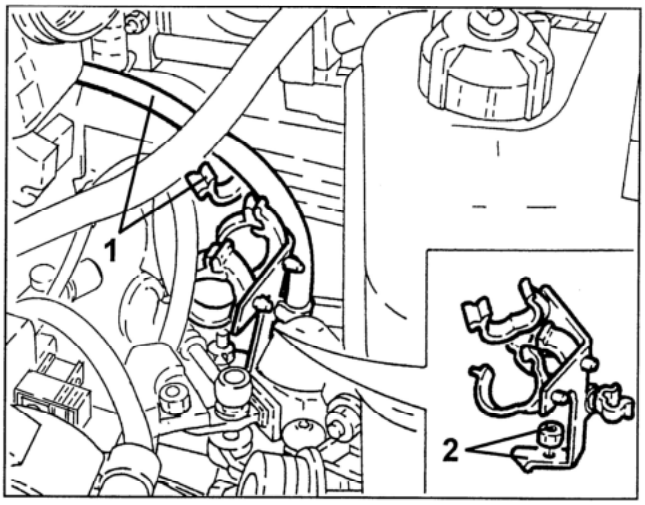

1. Disconnect the rpm and phase sensor electrical connection.
2. Disconnect the rear knock sensor electrical connection.
3. Disconnect the cam angle sensor electrical connection.
4. Disconnect the engine coolant temperature sensor electrical connection.
5. Disconnect the throttle casing with built-in DVL electrical connection.



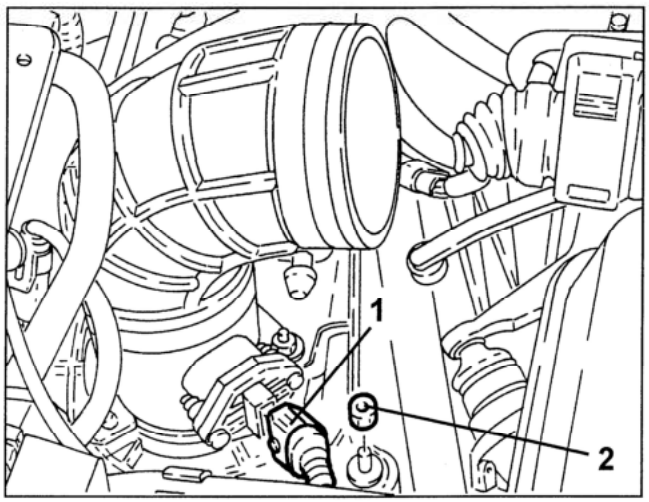

1. Disconnect the climate control system heater coolant delivery pipe from the right-hand cylinder head fitting.
2. Disconnect the climate control system coolant return sleeve from the thermostat.



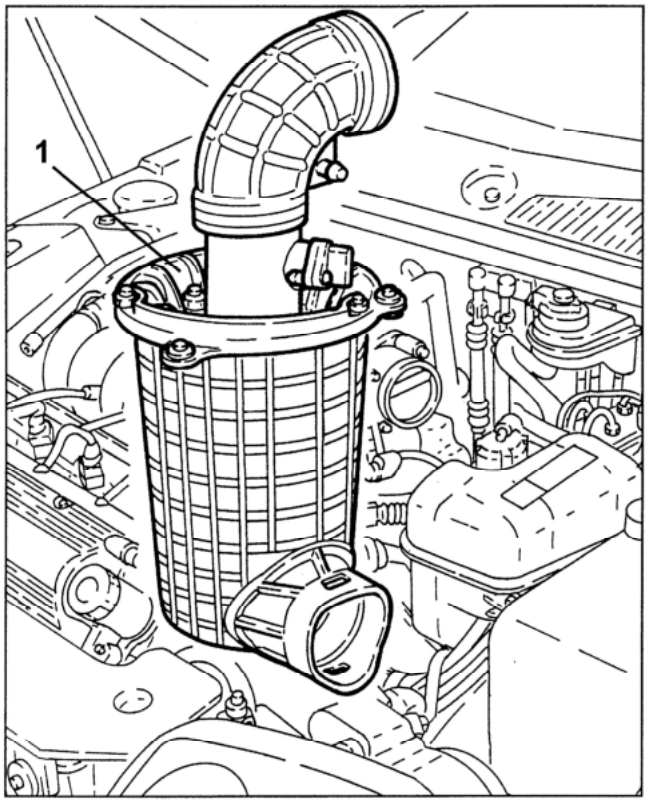

1. Release the lambda sensor wiring from the injection wiring bracket.
2. Loosen the nut and remove the injection wiring bracket.



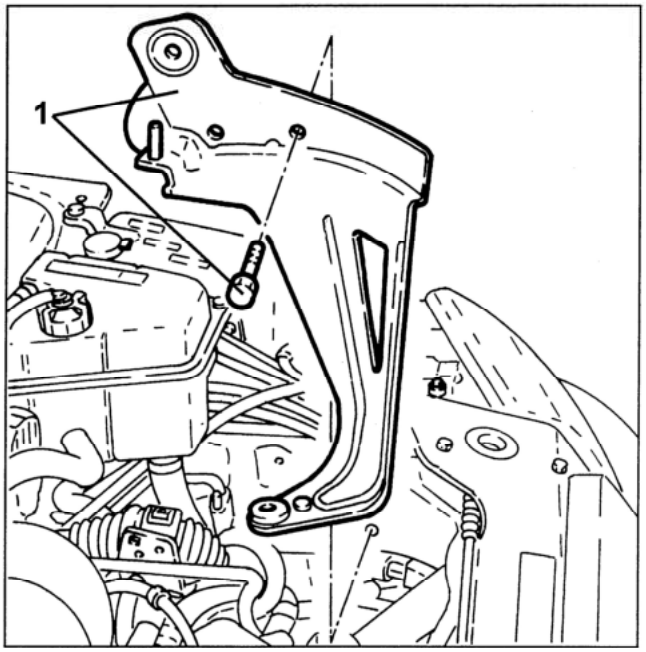
1. Disconnect the hot film air flow meter electrical connection.
2. Loosen the air cleaner fastening nuts.



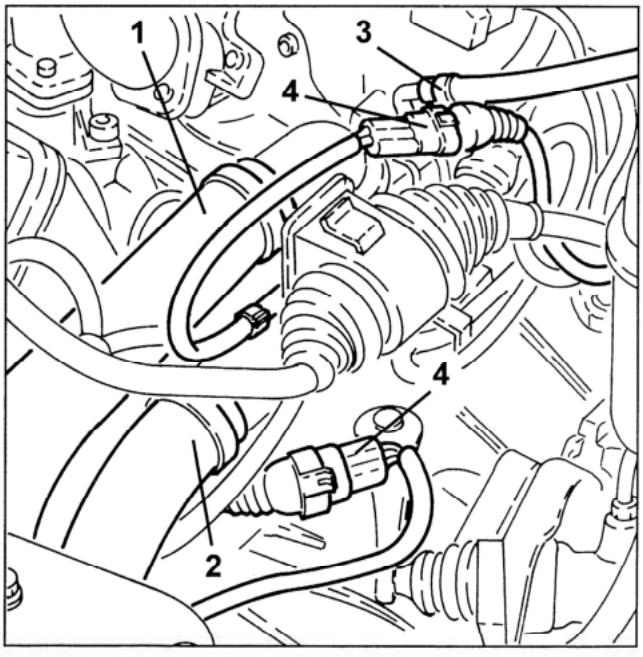

- Release the air cleaner from the lower resonator sleeve.
1. Remove the air cleaner and hot film air flow meter.




1. Loosen the screws and remove the air cleaner bracket.



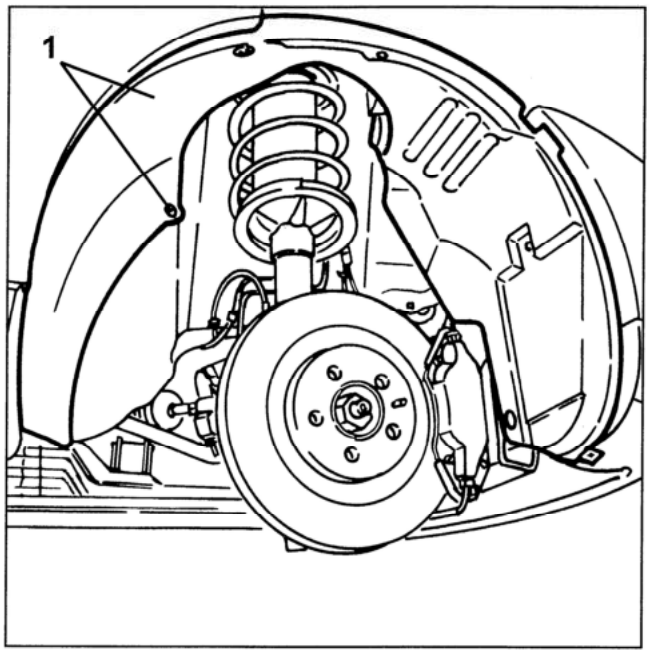

1. Disconnect the radiator coolant delivery sleeve from the thermostat.
2. Disconnect the radiator return coolant sleeve from the thermostat and move it aside.
3. Disconnect the expansion reservoir coolant return pipe from the right-hand cylinder head fitting.
4. Disconnect the lambda sensor electrical connections and release the respective wiring from the fastening clips.



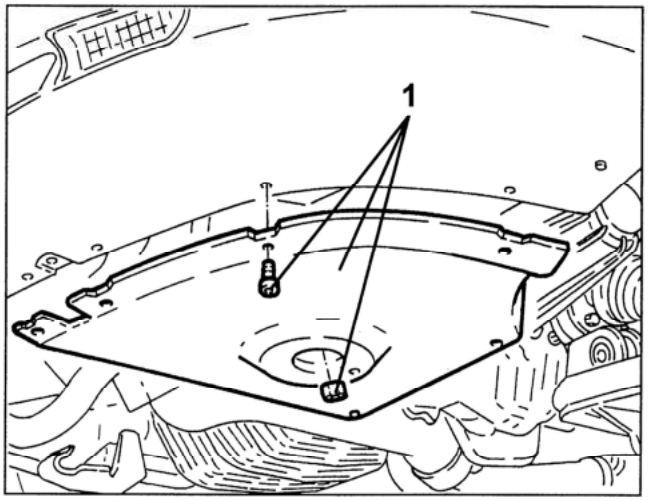


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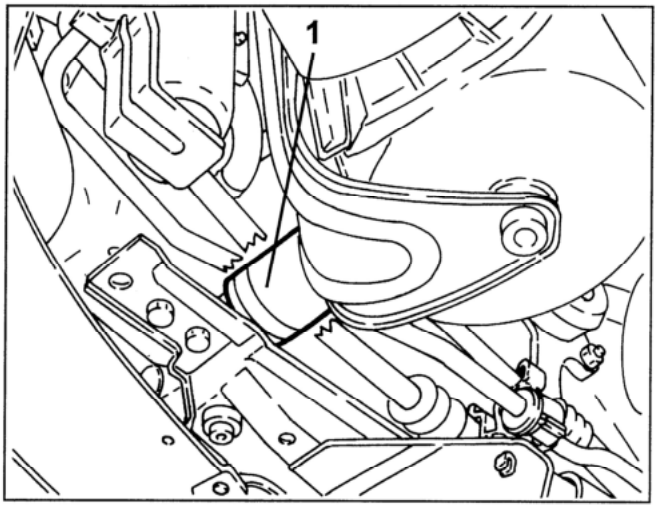
1. Loosen the fasteners and remove the right-hand front wheelhouse.



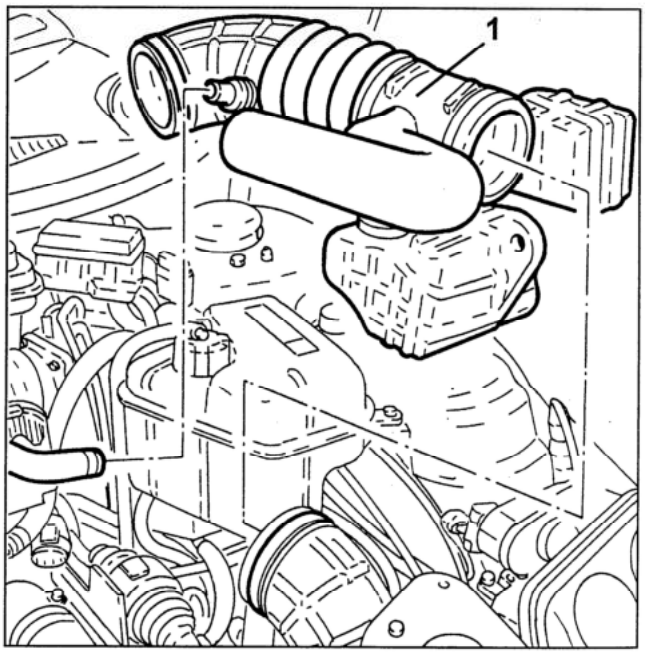

- Lift the vehicle.
1. Loosen the nut and the screws and remove the lower air cleaner guard.




1. Drain the engine coolant by disconnecting the radiator fluid output sleeve and collect the coolant in a suitable container.



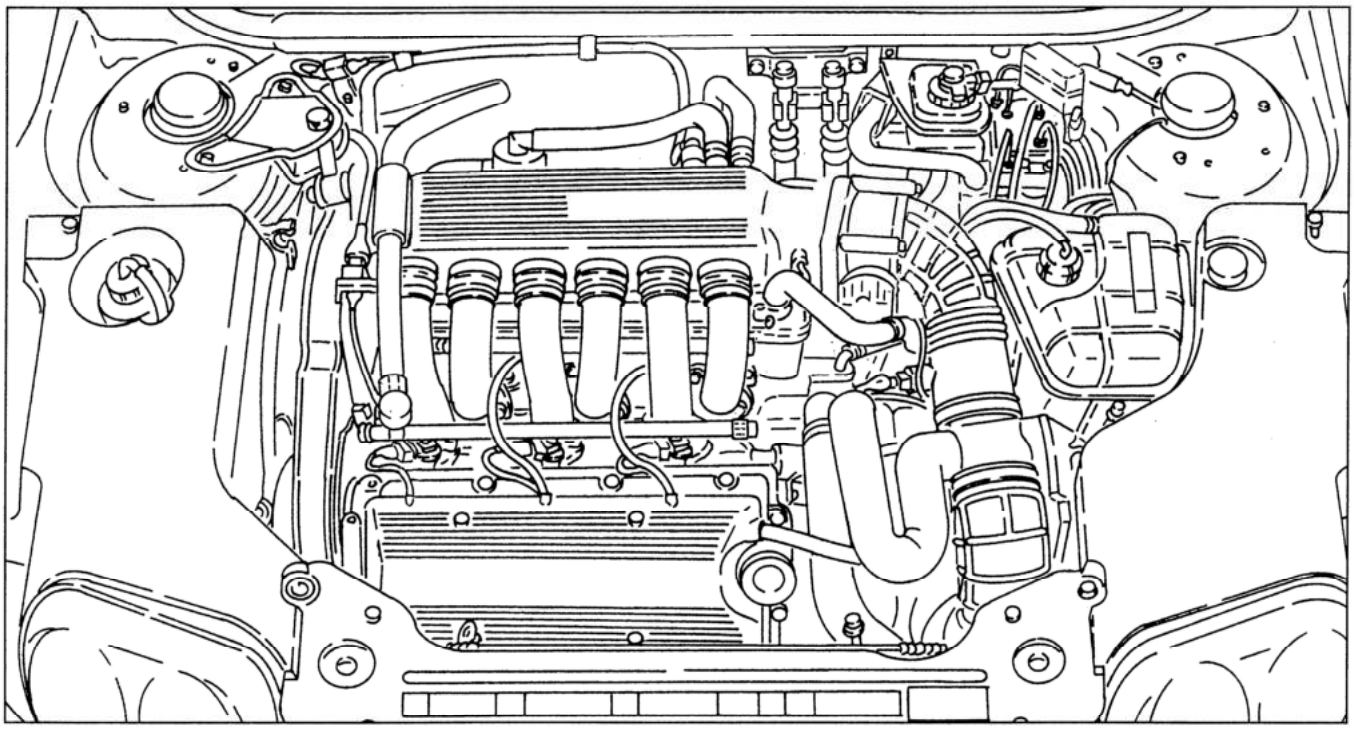

- Lower the vehicle.
1. Loosen the clips and remove the corrugated sleeve and resonators after releasing the intermediate resonator from the fastening pin.



## DESCRIPTION

The following information and illustrations allow quick engine removal and refitting.

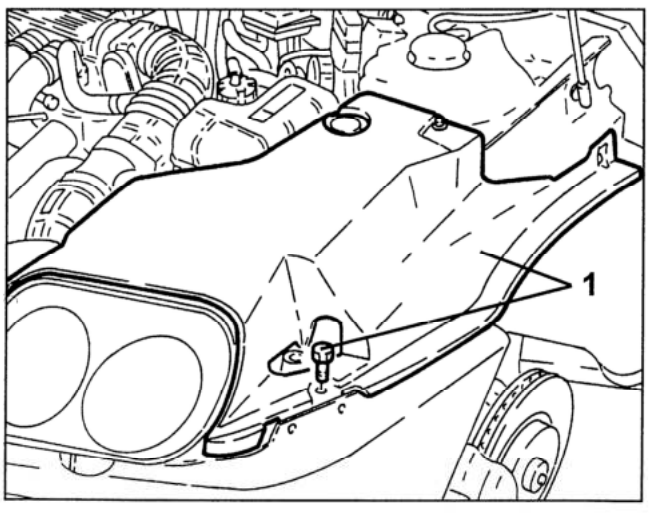
Bench disassembly instructions for single components are contained in the "ENGINE OVERHAUL" volume.
The following procedures may be used only in part, according to requirements.
For additional information and details, refer to the specific component and assembly chapters.



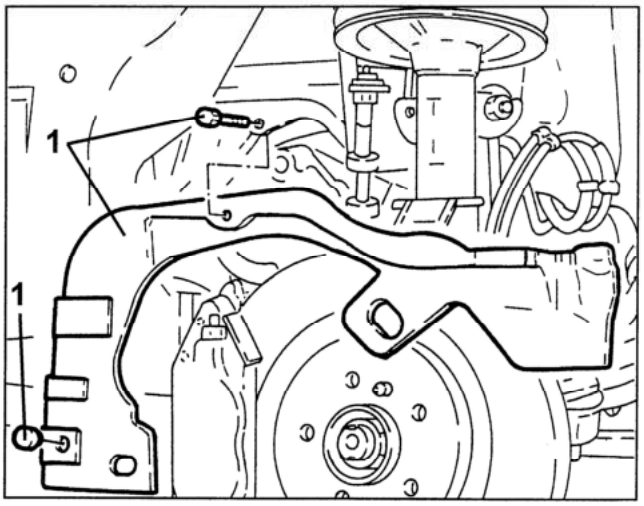
## REMOVAL

- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Remove the front wheels.

1. Loosen the screws and remove the two side engine guards.




1. Release the buttons, loosen the screws and remove the front wheel compartment dust guards.





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## DESCRIPTION

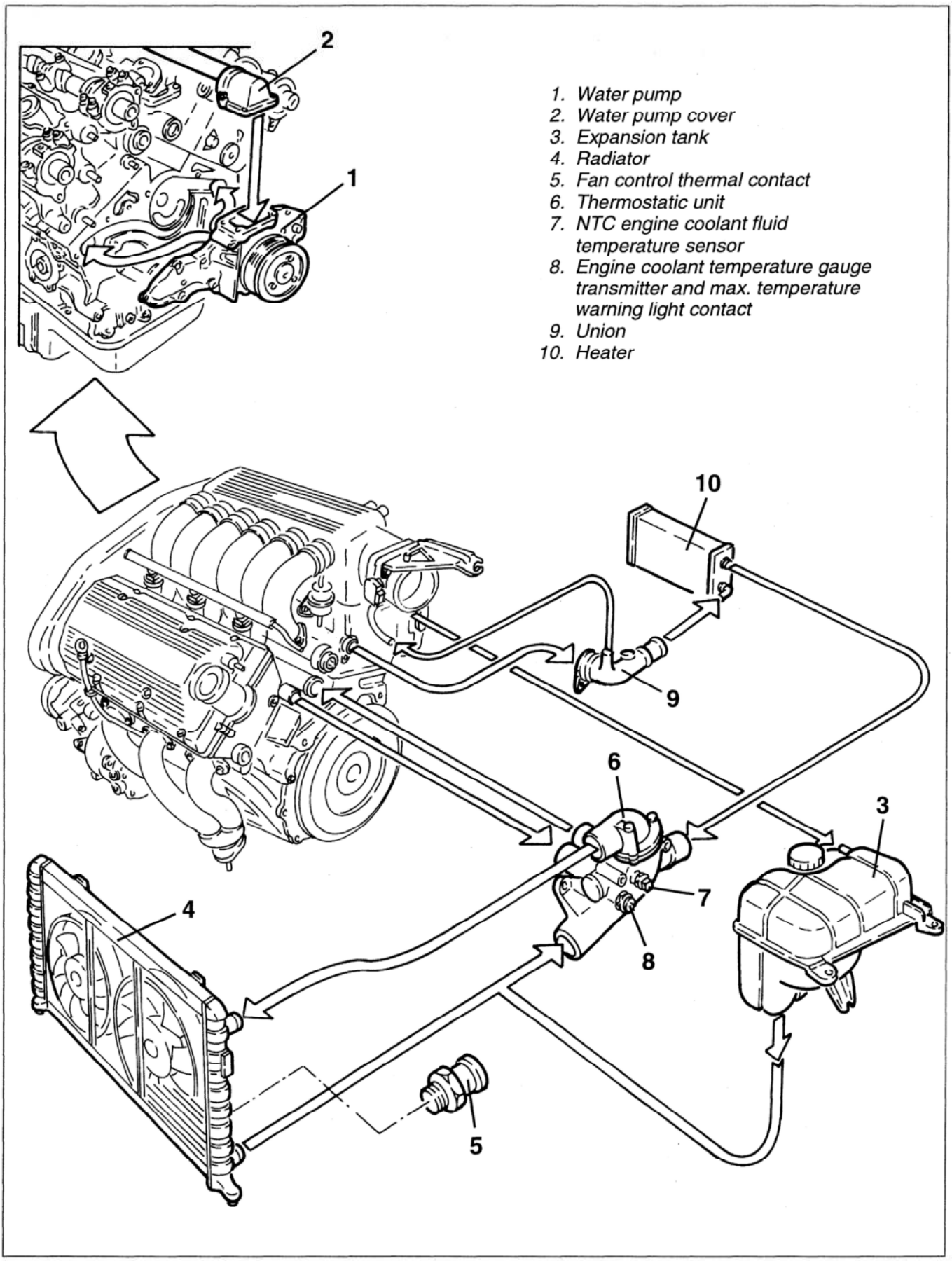
The cooling system is sealed and of the forced circulatio type. It features a centrifuge pump (1) operated by the crankshaft by means of a Poly-V belt.
A thermostat valve (6) located on the rear of the engine ensures optimal engine temperature. It opens when the coolant reaches a temperature of 87 ± 2°C.
The radiator (4) cools the fluid by means of dynamic air and a two double speed fans. The fans are controlled by a thermal contact (5) located on the radiator. An additional resistance and a relay operate the fans at higher speed when the temperature is high.
The expansion reservoir (3) feeds the circuit if the level decreases and absorbs the fluid variations in volume according to the temperature. Furthermore, it acts as a circuit air bleeder.
The circuit is equipped with an engine coolant temperature sensor (8) for the gauge and a maximum temperature thermal contact for the warning light up when the coolant temperature exceeds 115°C.

### CIRCUIT OPERATION

The fluid cools the engine and reaches the thermostat (5) via the cylinder head. If its temperature is lower than 87°C the coolant is sucked by the pump (1) via a longitudinal return manifold located between the two cylinder heads.
If the temperature is higher than this values, the coolant is conveyed to the radiator (4) via the thermostat opening.
After being cooled in the radiator, the coolant returned to the thermostat from where it is conveyed to the pump via the longitudinal manifold.
A specific fitting (9) on the right-hand cylinder head receives the coolant from a suppelementary duct on the head and sends it via two specific pipes to the climate control system heater (10) and to the throttle casing for heating it.
The throttle is connected to the expansion reservoir (3) by means of a specific pipe which ensures fluid return and also bleeds the system.


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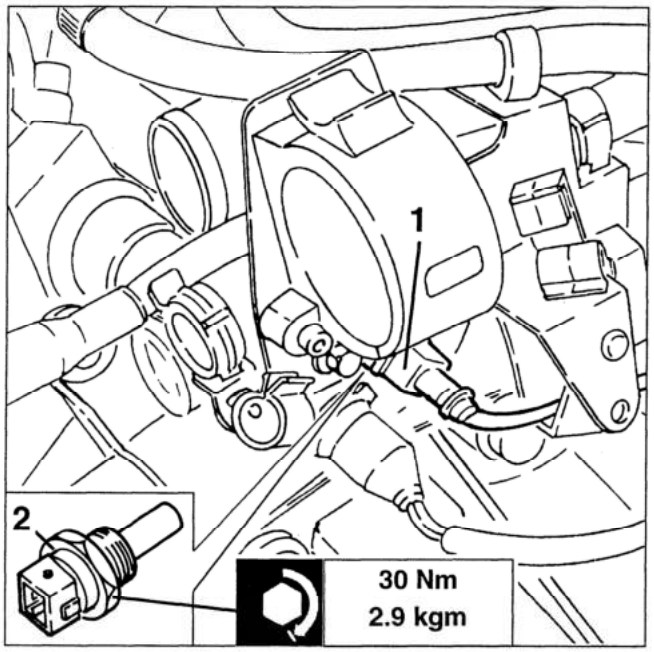
## ENGINE COOLING SYSTEM




1. *Water pump*
2. *Water pump cover*
3. *Expansion tank*
4. *Radiator*
5. *Fan control thermal contact*
6. *Thermostatic unit*
7. *NTC engine coolant fluid temperature sensor*
8. *Engine coolant temperature gauge transmitter and max. temperature warning light contact*
9. *Union*
10. *Heater*

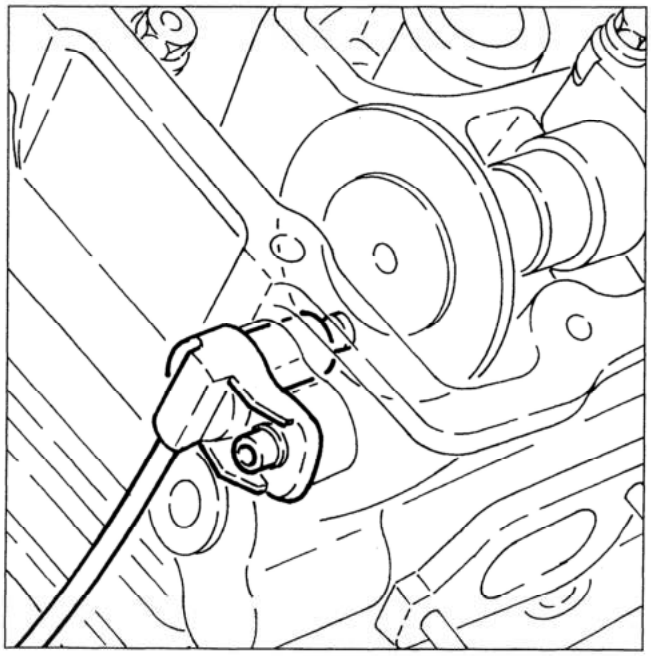
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1. Disconnect the electrical connection from the engine coolant temperature sensor (NTC).
2. Slacken and remove the engine coolant temperature sensor (NTC) from the thermostatic cup.




## CAM ANGLE SENSOR

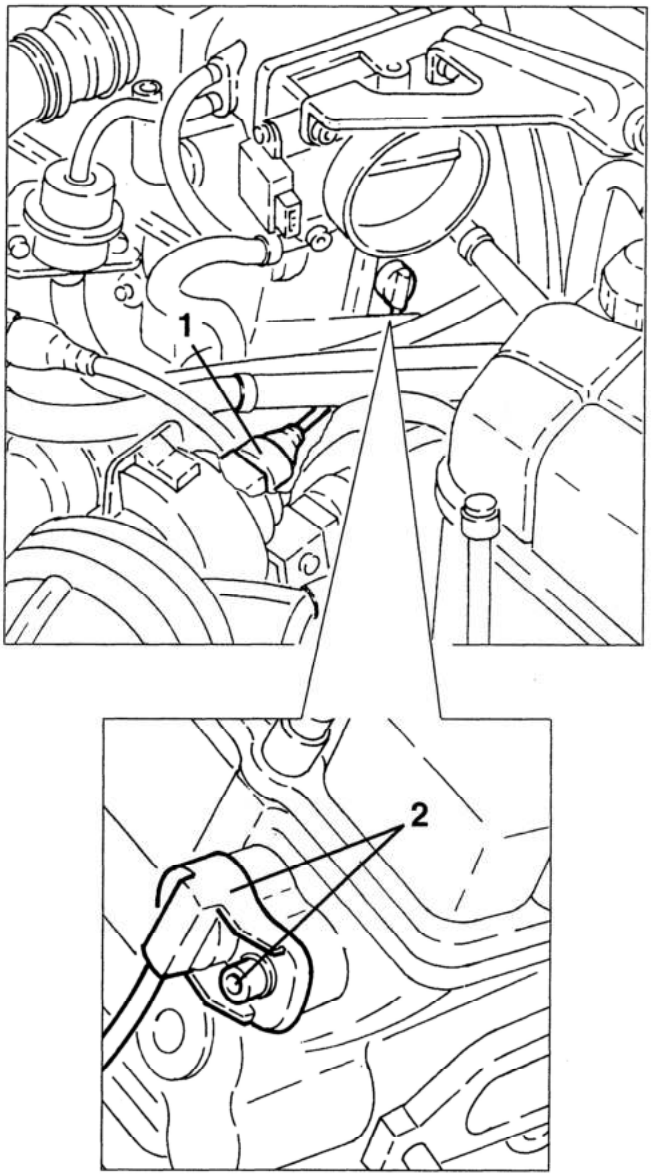
The cam angle sensor comprises a Hall effect device. The voltage signal "lowers" sharply" when the peg machined on the exhaust camshaft of the right cylinder head facing the sensor passes in front of the sensor itself.



## REMOVING/REFITTING

**- Proceed as described in the first seven steps of the procedure "Engine coolant temperature sensor (NTC) - REmoving/Refitting".**

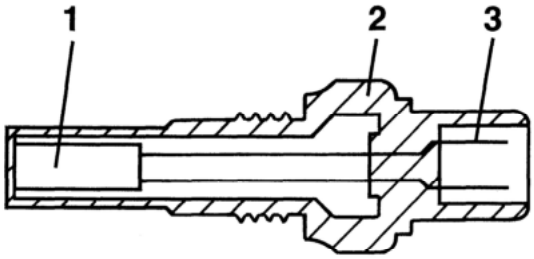
1. Disconnect the electrical connection of the cam angle sensor.
2. Slacken the fastening screw and remove the cam angle sensor complete with wiring from the right cylinder head.




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## ENGINE COOLANT TEMPERATURE SENSOR (NTC)

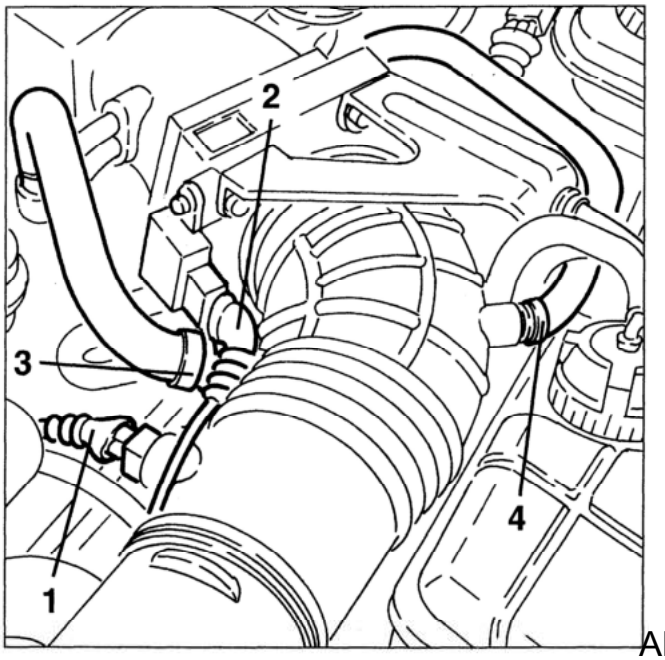
This sensor detects the temperature of the engine coolant on the thermostatic cup by a thermistor (NTC) with negative resistance coefficient, i.e. capable of lowering its resistance as the temperature increases. The electrical signal obtained reaches the electronic control unit and is used to correct the titration of the air - fuel mixture.



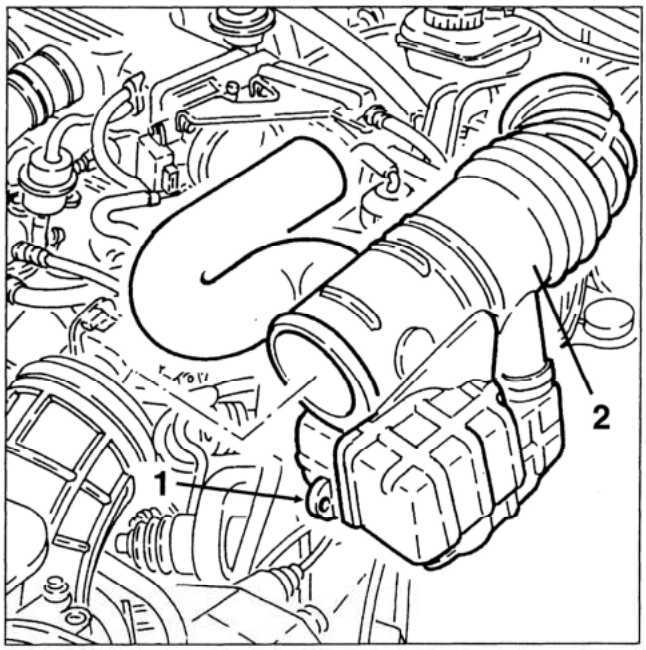

*1. NTC resistance*
*2. Body*
*3. Connector*

### REMOVING/REFITTING

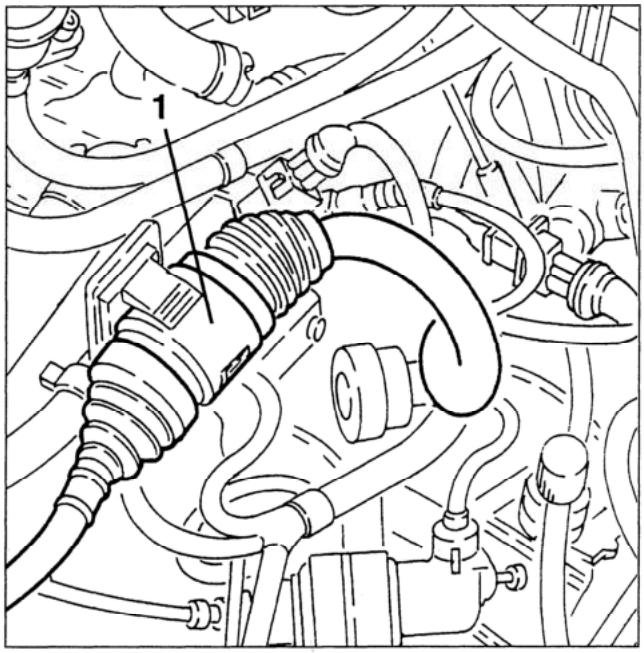
- Disconnect the battery (-) terminal.
1. Disconnect the electrical connection from the intake air temperature sensor.
2. Disconnect the electrical connection from the throttle potentiometer.
3. Disconnect the oil vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.
4. Disconnect the air takeoff pipe for the constant idle device from the corrugated sleeve.




1. Prise off the fastening button of the first section of corrugated sleeve to the intermediate resounder.
2. Slacken the two fastening clamps and remove the second section of corrugated sleeve complete with resounders.

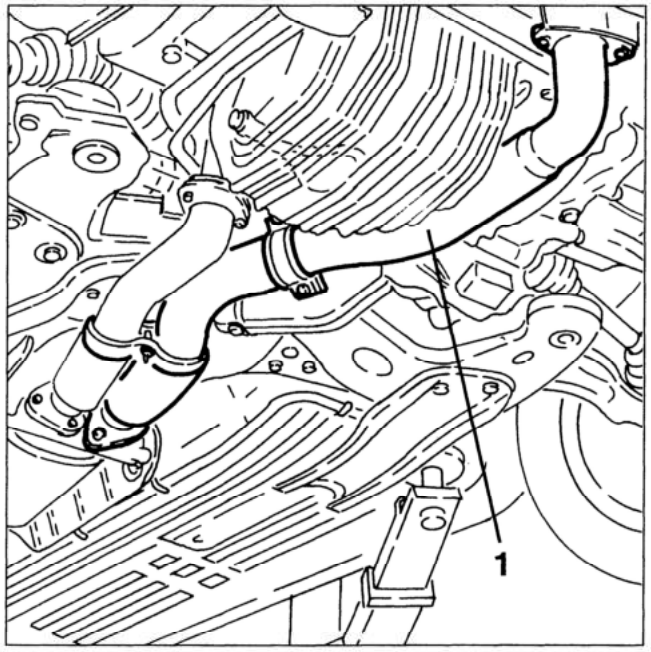



1. Release the injection wiring connector from the support bracket.

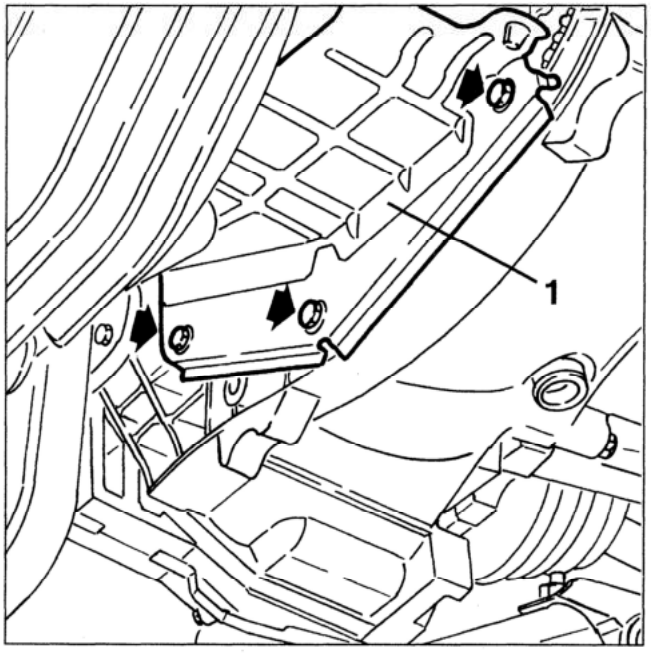



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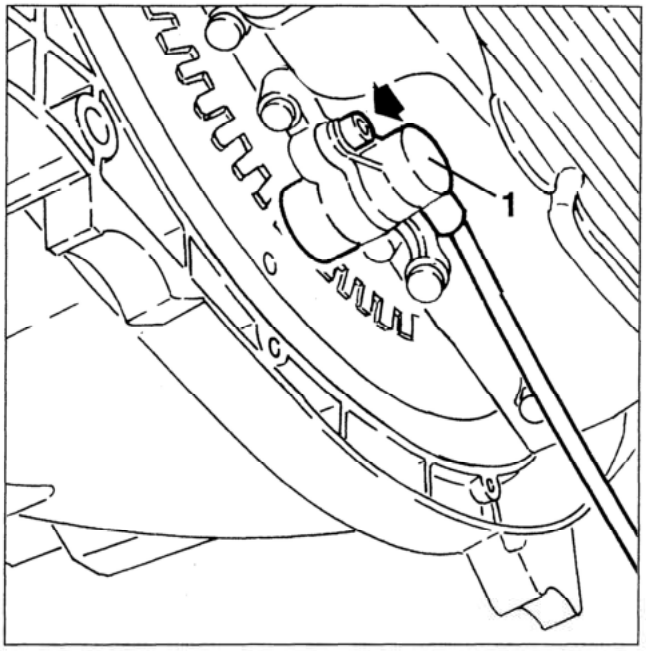
1. Raise the car, then slacken the fastenings and disconnect the front section of the exhaust pipe from the left cylinder head.




1. Slacken the fastening screws and remove the flywheel cover.



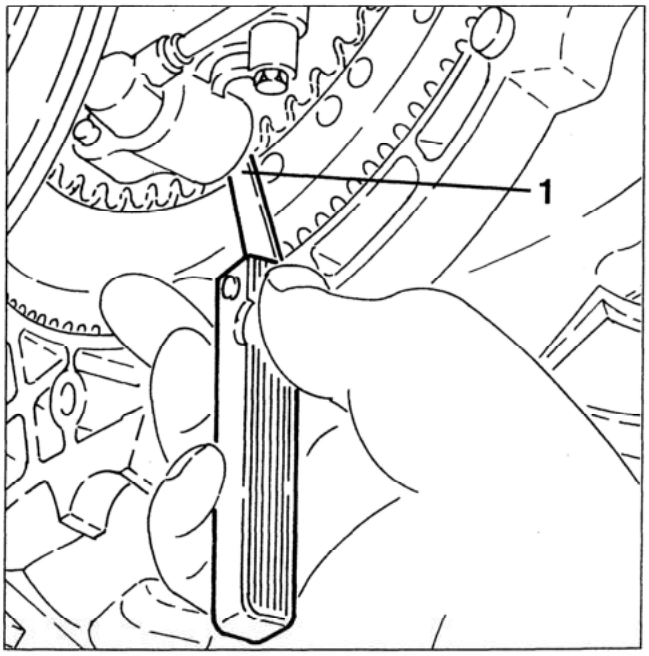

1. Slacken the fastening screw and remove the rpm and timing sensor.
- If necessary, slacken the two fastening screws and remove the support of the rpm and timing sensor.




## CHECKING THE GAP

- Proceed as described in removing/refitting to gain access to the rpm and timing sensor.
1. Using a thickness gauge, check that the gap between the sensor and phonic wheel is within the specified limits.

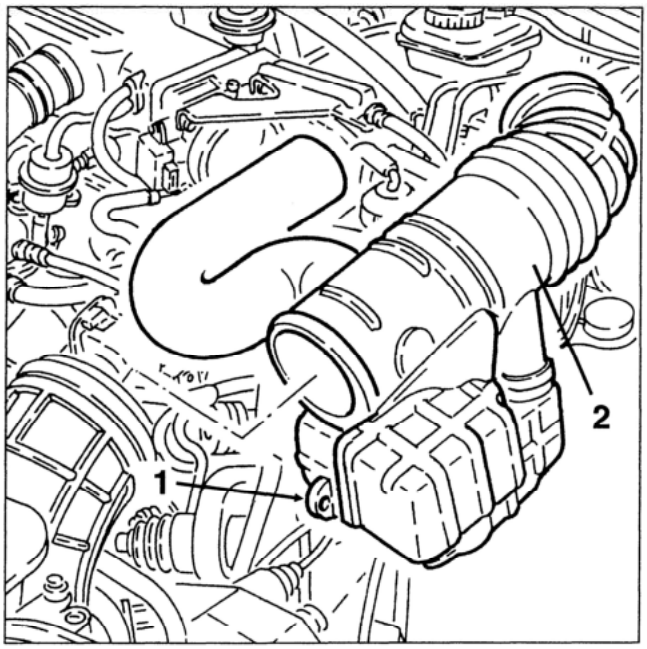
| Rpm and timing sensor gap |
| --- |
| 0.8 ÷ 1.5 mm |




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## RPM AND TIMING SENSOR

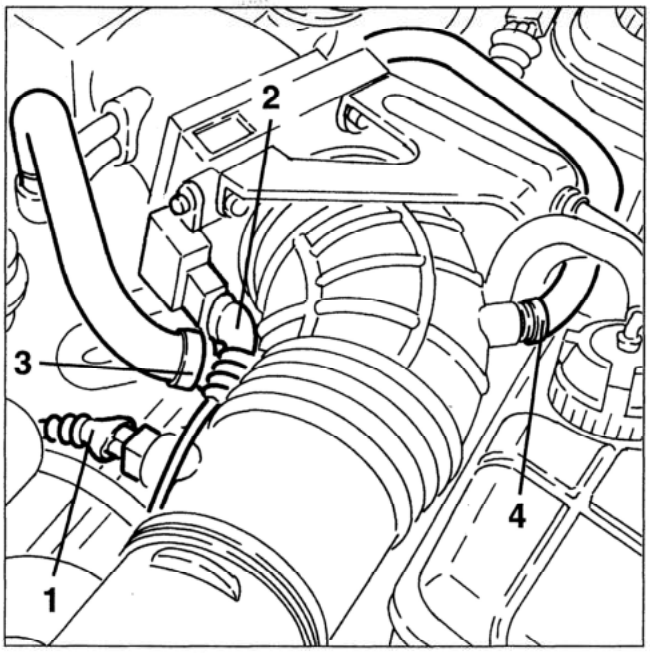
The rpm and timing sensor used on this car do not differ from the previous versions; but it faces a phonic wheel on the flywheel instead of on the auxiliary components drive pulley.
This is to eliminate the effect of torsional oscillation improving angular speed sensitivity thus better location of any misfiring.




## REMOVING/REFITTING

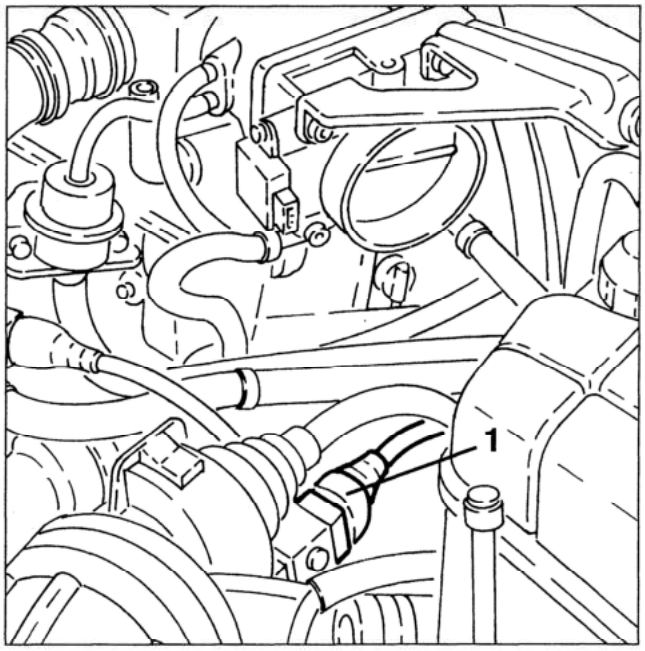
- Set the car on a lift.
- Disconnect the battery (-) terminal.

1. Disconnect the electrical connection from the intake air temperature sensor.
2. Disconnect the electrical connection from the throttle potentiometer.
3. Disconnect the oil vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.
4. Disconnect the air takeoff pipe for the constant idle device from the corrugated sleeve.




1. Prise off the fastening button of the first section of the corrugated sleeve to the intermediate resounder.
2. Slacken the two fastening clamps and remove the second section of corrugated sleeve complete with resounder.

1. Disconnect the electrical connection of the rpm and timing sensor and release the wiring of any fastening clamps.

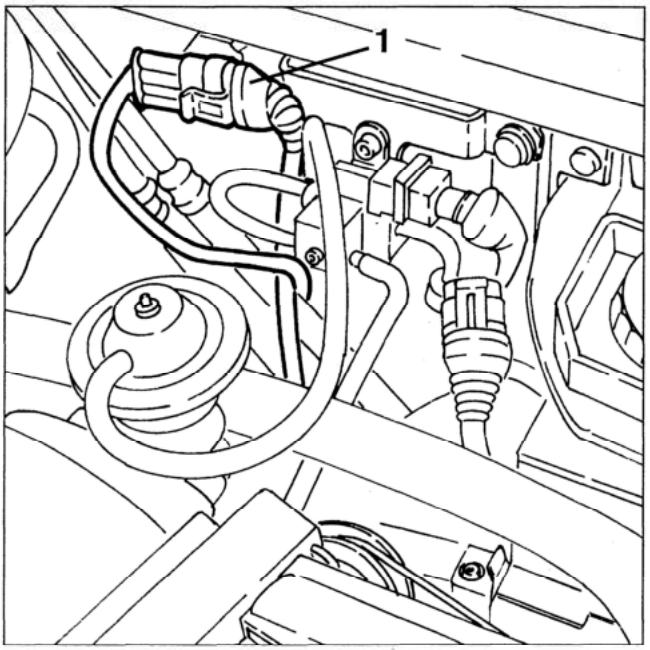



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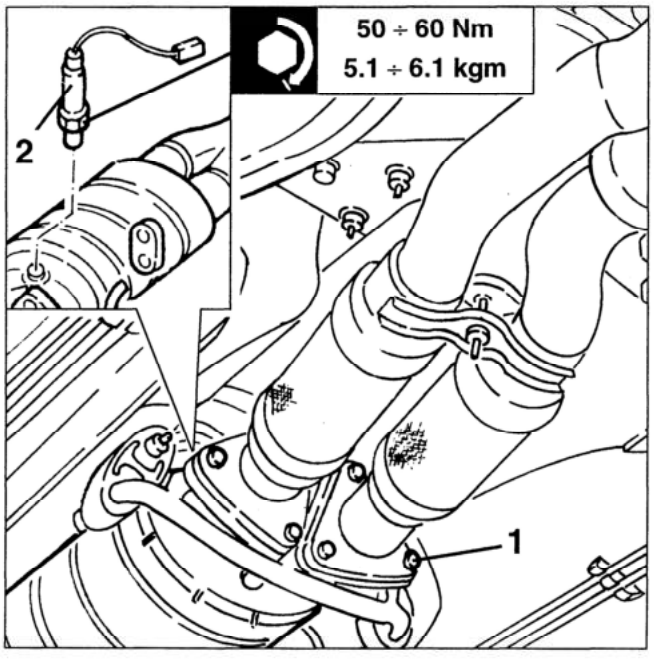
## LAMBDA SENSOR

### REMOVING/REFITTING

- Disconnect the battery (-) terminal.
1. Disconnect the electrical connection of the lambda sensor.




1. Slacken the bolts fastening the catalytic converter to the front section of the exhaust pipe, then lower it enough to gain access to the lambda sensor.
2. Slacken and remove the lambda sensor complete with wiring.



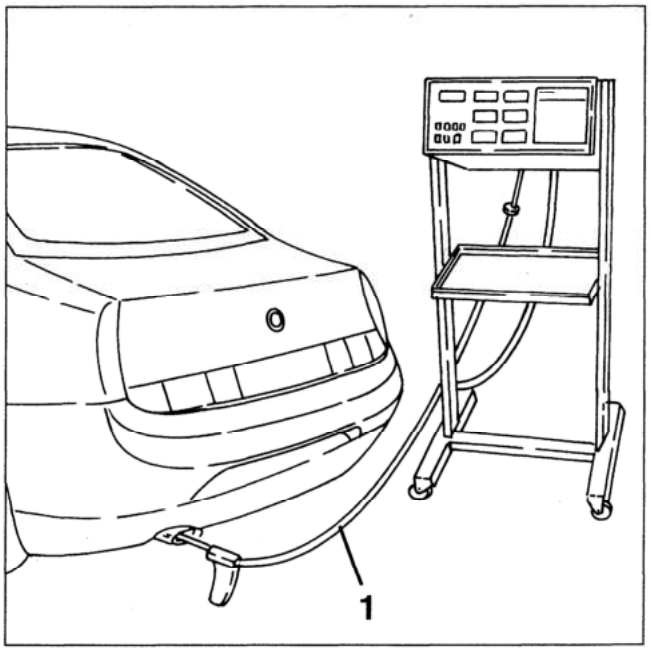

## CHECKING EXHAUST EMISSION

**WARNING:**
**Emission levels at the exhaust should be checked outdoors, or at least in a suitably equipped place according to current laws.**

**The test should be carried out with the engine at normal operating temperature (i.e. when the fan has come on and then turned off) and at idle speed.**
**If idle speed is not within the specified limits, check that the constant idle speeddevice is working properly.**

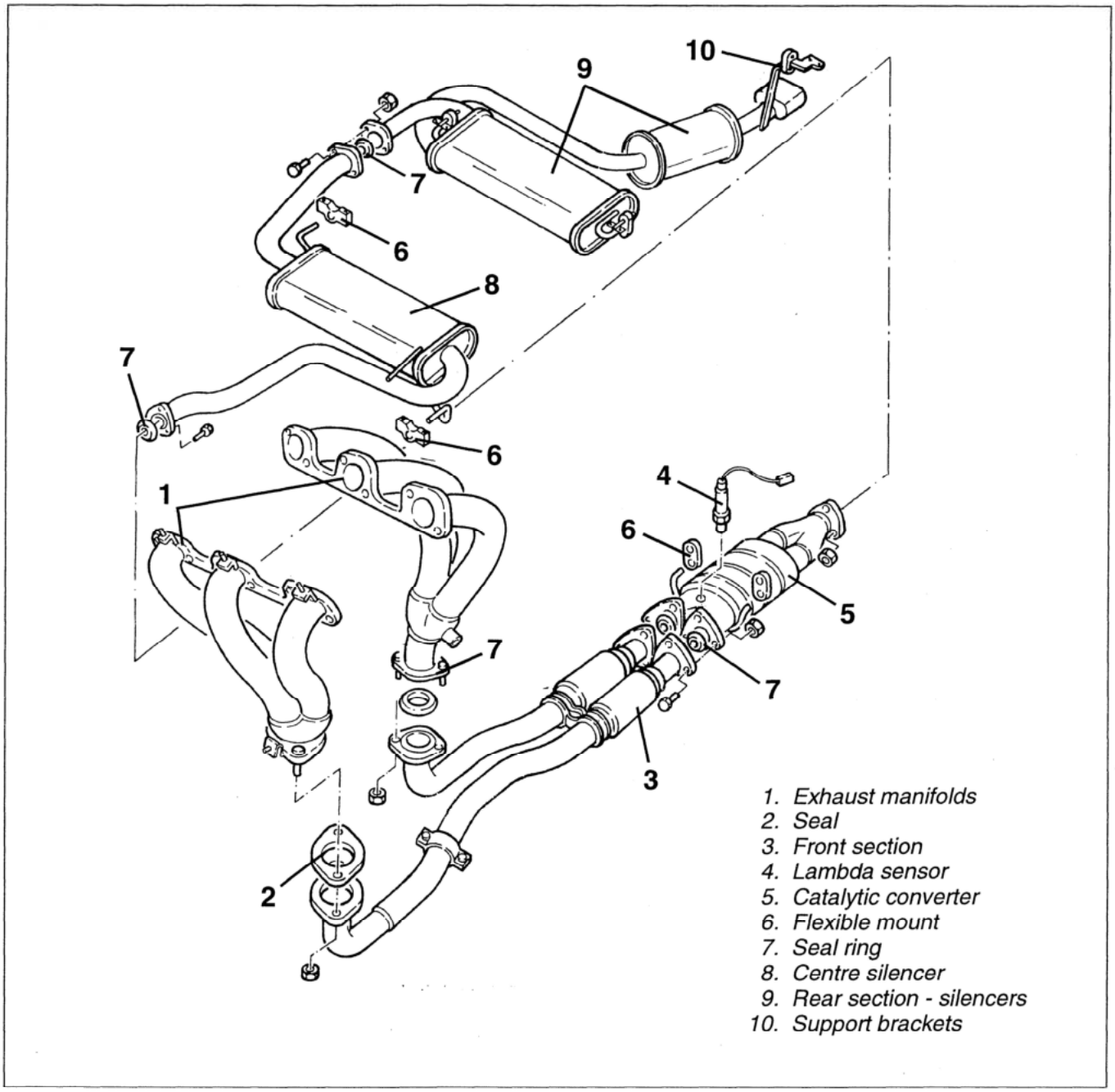
- Check that the engine oil level is correct and that the air cleaner cartridge is clean.
- Start the engine and run it at idle speed.
1. Insert the analyser feeler in the end of the exhaust pipe and check that the quantity of CO and HC is within the specified limits.

| | | |
|---|---|---|
| **CO at the exhaust** | **% vol.** | < 0.2 |
| **HC at the exhaust** | **p.p.m.** | ≤ 50 |




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## DESCRIPTION



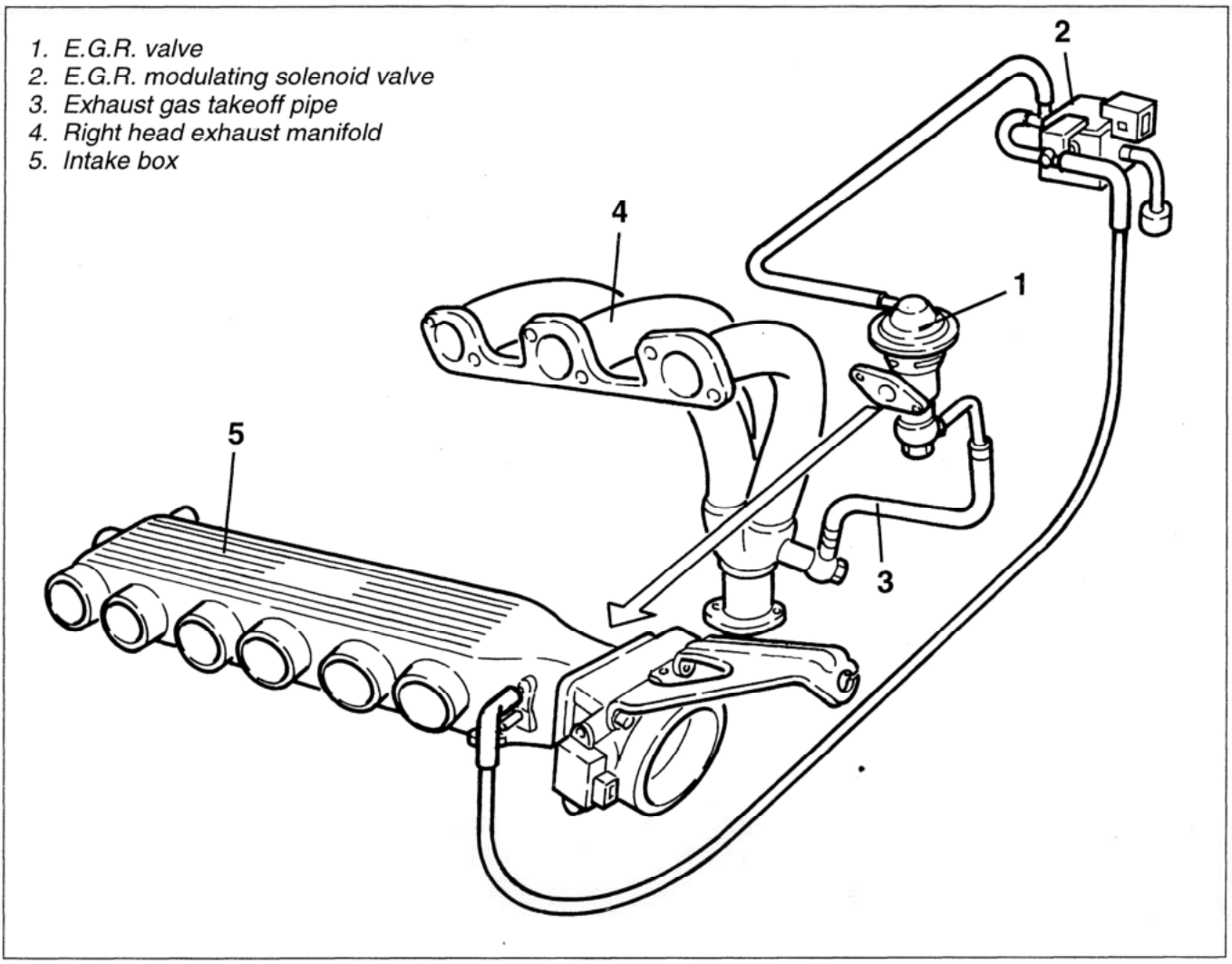

1. *Exhaust manifolds*
2. *Seal*
3. *Front section*
4. *Lambda sensor*
5. *Catalytic converter*
6. *Flexible mount*
7. *Seal ring*
8. *Centre silencer*
9. *Rear section - silencers*
10. *Support brackets*

The exhaust gas leading from the cylinder heads converges through the manifolds (1) in the first section of the exhaust piping (3) on which there are two flexible pieces which restrict the transmission of vibration. From the front section, the exhaust gas reaches the three-way catalytic converter (5) where most of the polluting substances are transformed.
At the beginning of the catalytic converter there is the lambda sensor (4) which informs the control unit of the amount of oxygen contained in the exhaust gas so that injection time can be adjusted to keep the stoichiometric ratio (air-fuel) at an optimum level.

The exhaust gas leaves the catalytic converter and crosses three special silencers (8 - 9).
The connection between the various sections of exhaust pipe is by flanges with seals in between and connection to the body is by brackets with flexible mounts.
The very high amount of heat radiated towards the body owing to the presence of the catalytic converter is limited by a series of heat guards between the exhaust pipe and the body.

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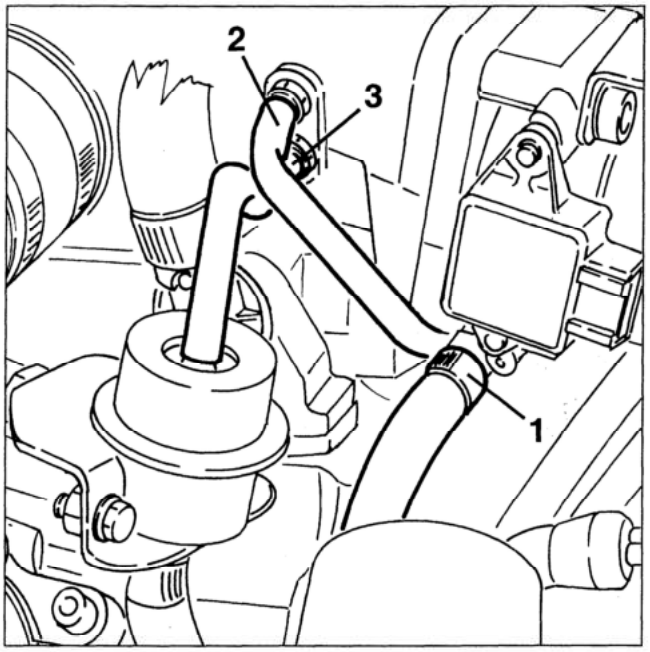
## DESCRIPTION



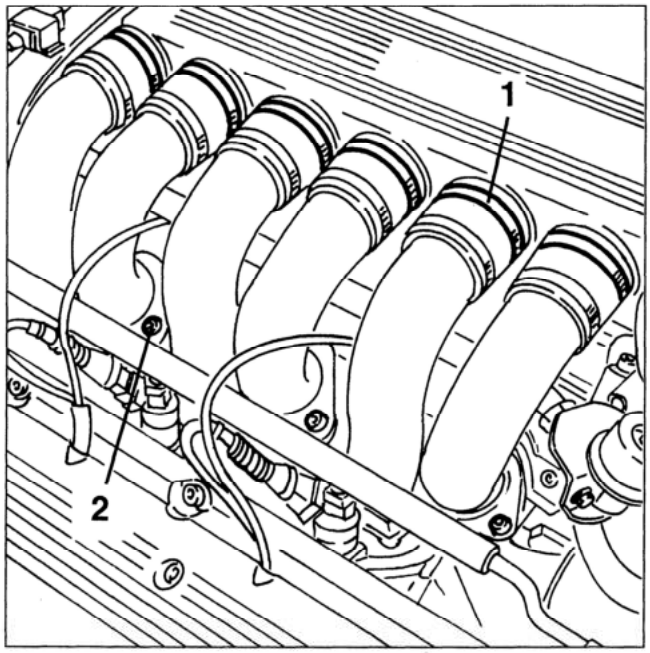

In order to further reduce NOx (nitric oxide) emissions, the supply system is fitted with an E.G.R. valve (1).
The E.G.R valve (Exhaust Gas Recirculation) withdraws part of the exhaust gas and sends it back into the intake box (5), where it is mixed with the intake air and burnt in the engine.
The E.G.R. valve is operated by the modulated vacuum of the electromagnetic valve (2) controlled by the MOTRONIC control unit.
The amount of exhaust gas sent to the engine is defined by the MOTRONIC control unit, taking account of the characteristic curve of the E.G.R. command depending on the engine load and speed and on the coolant fluid temperature.
Through the MOTRONIC control unit, the electromagnetic valve modulates the vacuum to be sent to the E.G.R. valve for opening.
The stainless steel exhaust gas takeoff pipe (3) is fitted with an expansion compensation bellows and covered with thermal insulation.

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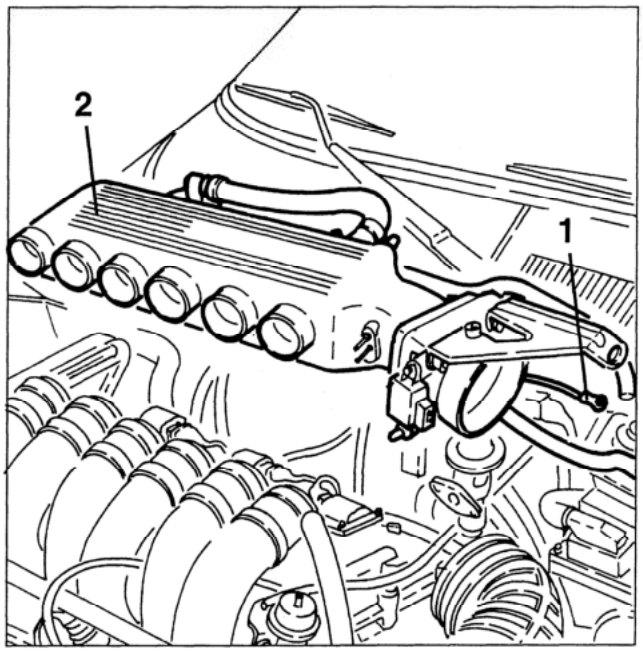
1. Disconnect the coolant inlet pipe from the throttle body.
2. Disconnect the vacuum takeoff pipe for the E.G.R. modulation solenoid valve from the intake box.
3. Disconnect the fuel pressure regulator vacuum takeoff pipe from the intake box.



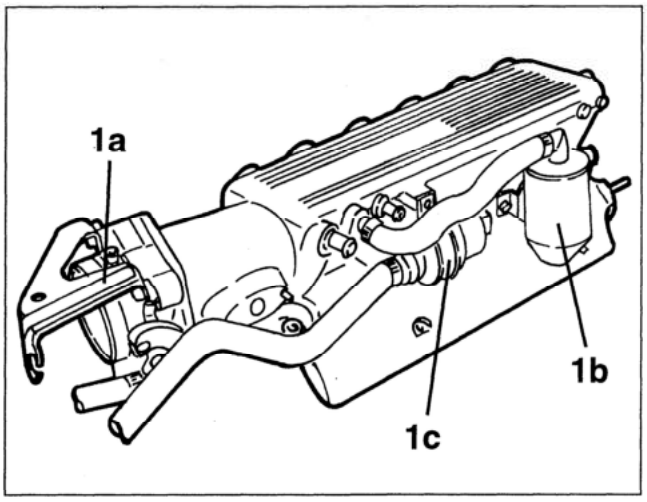

1. Slacken the clamps fastening the air supply ducts to the intake box.
2. Slacken the screws fastening the supply ducts to the cylinder heads.




1. Disconnect the earth cable (rear) from the intake box.
2. Slacken the two fastening screws and remove the intake box complete.

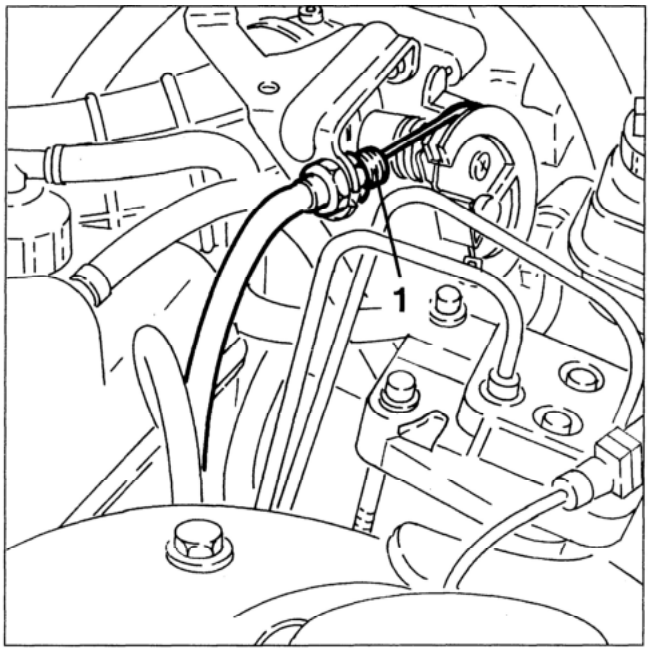



1. If necessary on the bench separate the throttle body (1a), oil vapour separator (1b) and the constant idle speed device (1c) from the intake box.

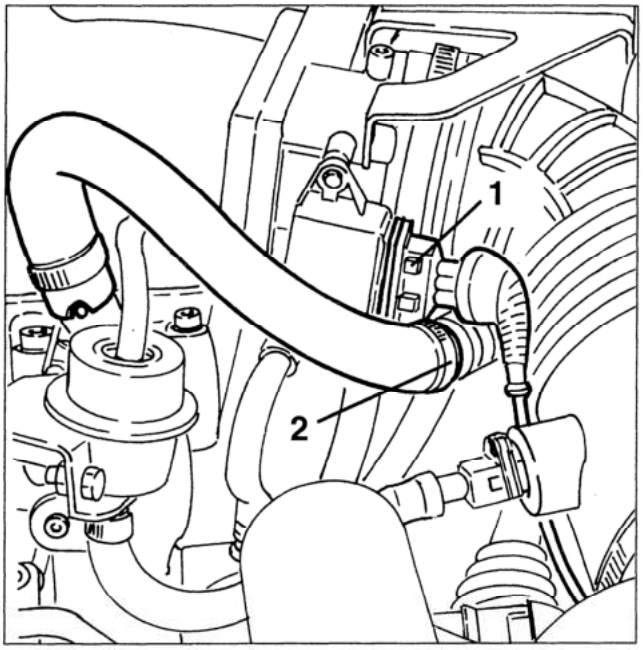



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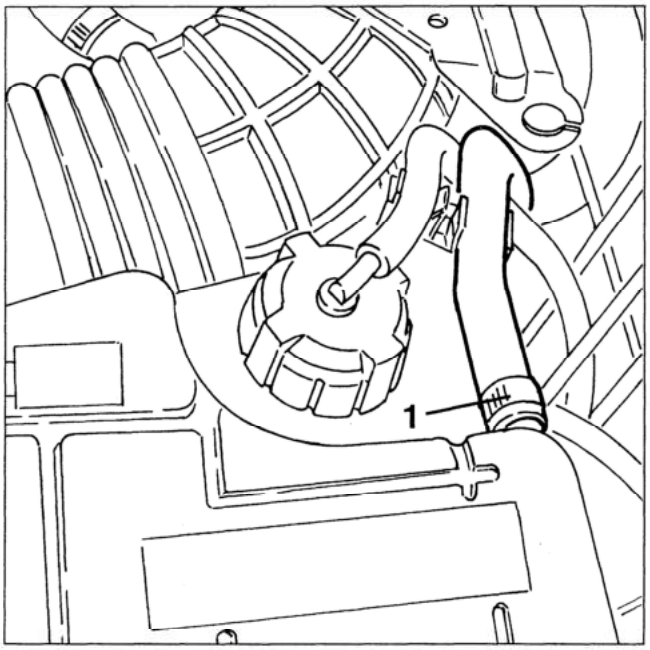
1. Disconnect the accelerator cable from the throttle cam.



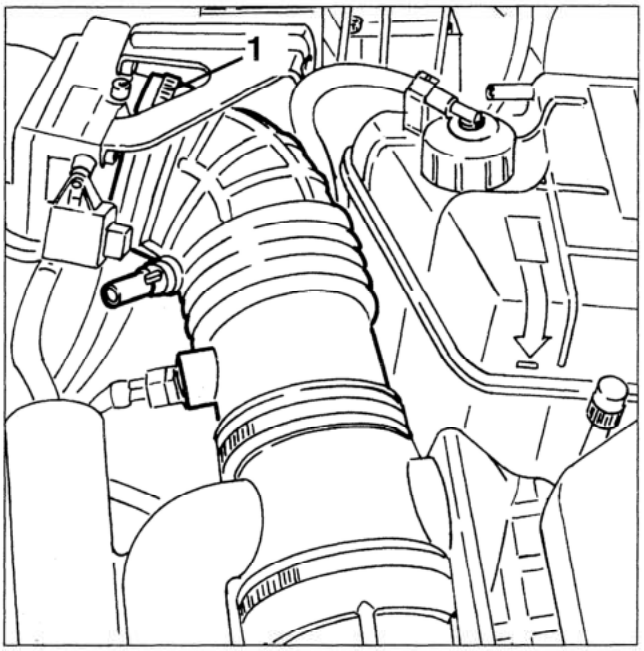

1. Disconnect the electrical connection from the throttle potentiometer.
2. Disconnect the oil vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.




1. Disconnect the throttle body coolant return pipe from the expansion tank.




1. Slacken the fastening clamp and disconnect the corrugated sleeve from the throttle body.

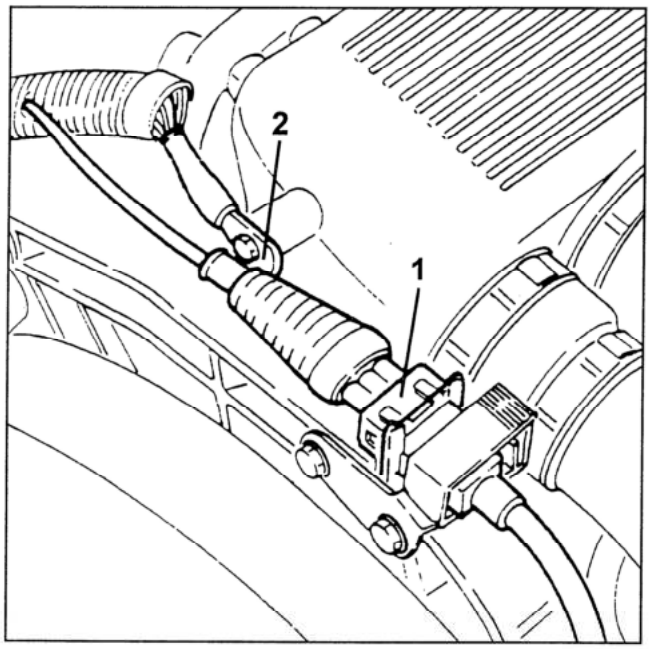



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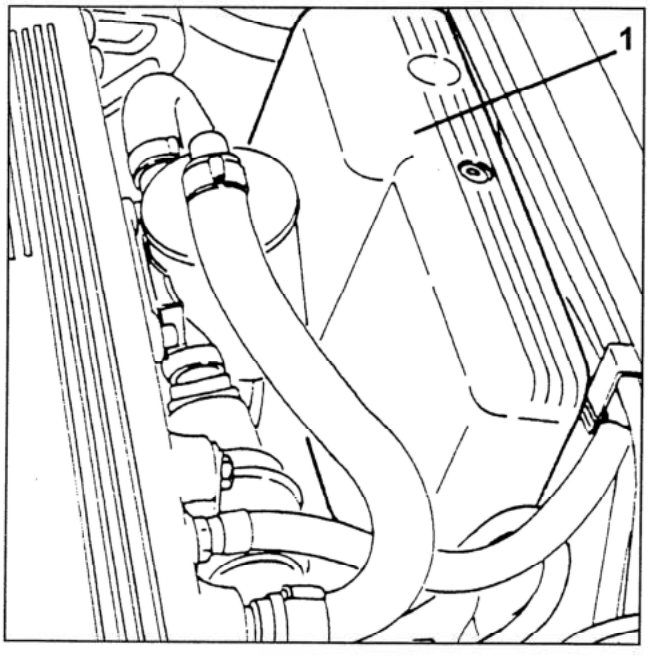
## INTAKE MANIFOLD

### REMOVAL/REFITTING

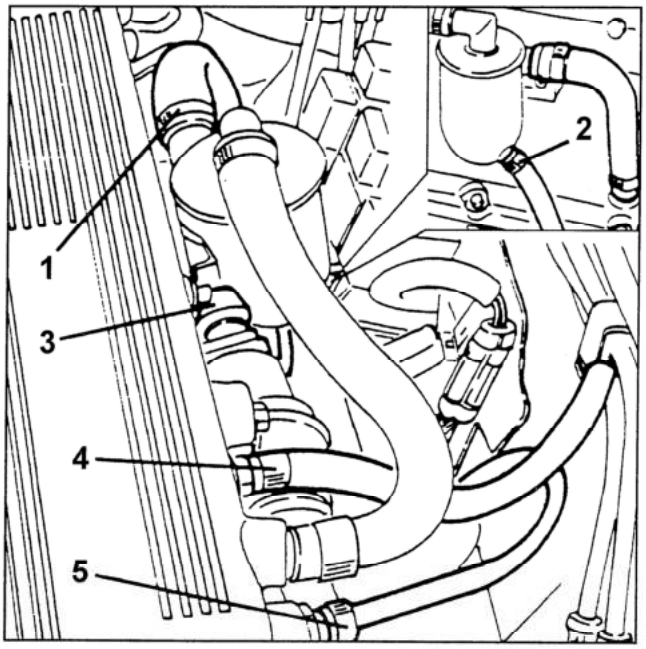
- Disconnect the (-) battery terminal.
1. Disconnect the front knock sensor electrical connection.
2. Disconnect the intake manifold earth wire (front).



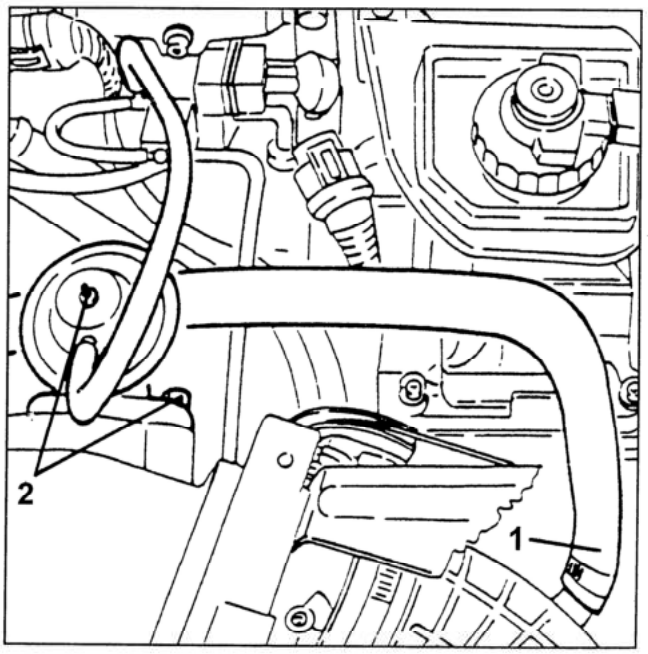

1. Remove the plastic relay, fuse and electrical connection guard.




1. Disconnect the oil vapour recovery pipe from the separator.
2. Disconnect the condensed oil recovery pipe from the separator.
3. Disconnect the constant idling actuator electrical connection.
4. Disconnect the fuel vapour recovery pipe from the intake manifold.
5. Disconnect the brake booster vacuum pipe from the intake manifold.



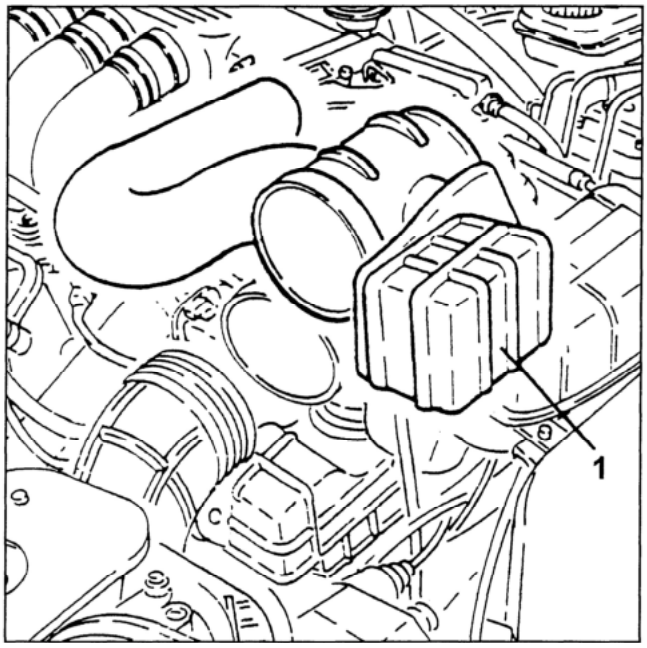

1. Disconnect the constant idling actuator air intake pipe from the corrugated sleeve.
2. Loosen the two fastening nuts and remove the EGR valve from the intake manifold.



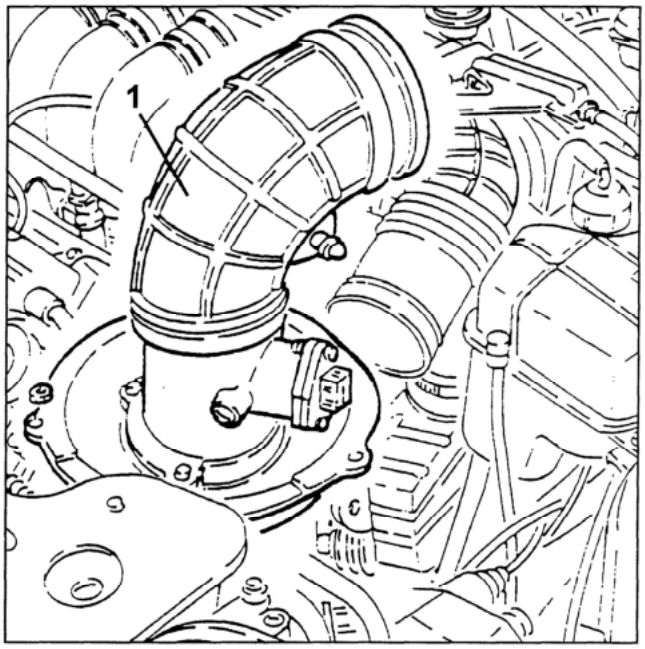


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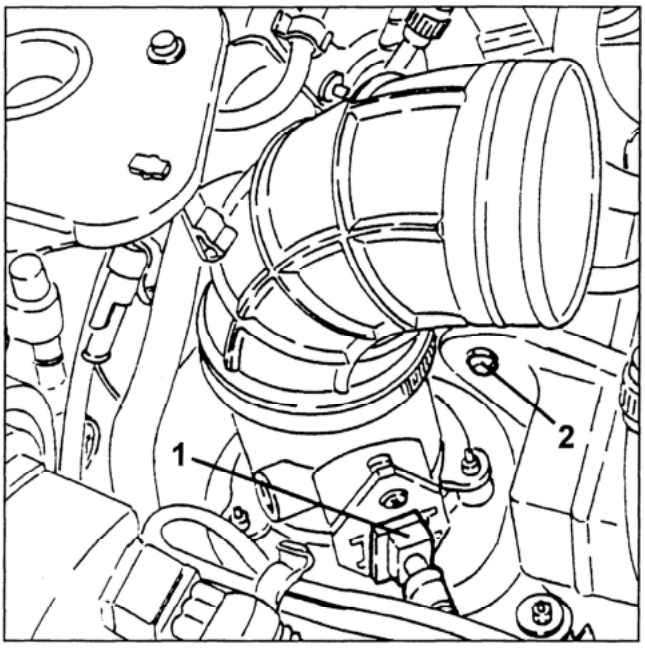
1. Remove the upper resonator.




1. Loosen the three fastening screws and remove the air cleaner with hot film flow meter and corrugated sleeve elbow. Separate at the bench.



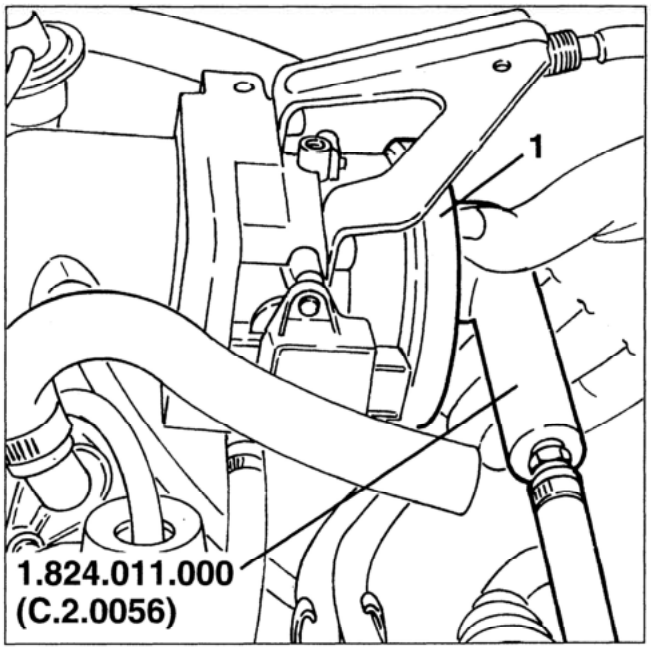

1. Disconnect the hot film flow meter electrical connection.
2. Remove the corrugated sleeve elbow fastening button from the intermediate resonator.



## FLUX TEST

Proceed as described for the first steps of the procedure "Throttle body - Removing/Refitting".
1. Make sure that the throttle is in the closed position, then using tool no. 1.824.011.000 (C.2.0056) connected to the flux meter, check that leakage is within the specified limits.

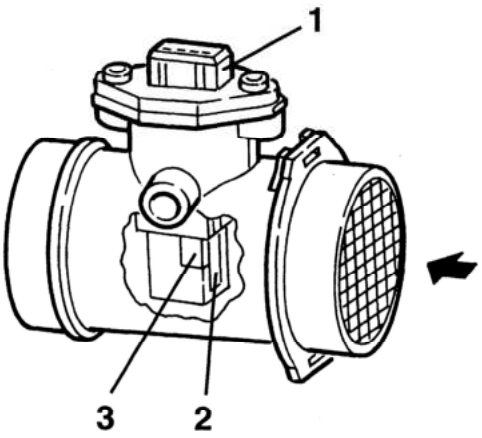
| Air leakage with throttle in the closed position |
|---|
| 280 ± 10 Scale N |




## AIR FLOW METER

The air flow meter is of the "heated film" type.
Its operating principle is based on a heated diaphragm in a measurement channel through which the intake air admitted to the engine flows.
The hot film diaphragm is kept at a constant temperature (~ 120°C above the temperature of the incoming air) by the heating resistance placed in contact with it.
The air crossing the measurement channel tends to withdraw heat from the diaphragm, therefore in order to keep it at a constant temperature, a certain amount of current must flow to the resistance.
This current is measured by an appropriate Wheatstone bridge.
Therefore the current is proportionate with the flow of air.

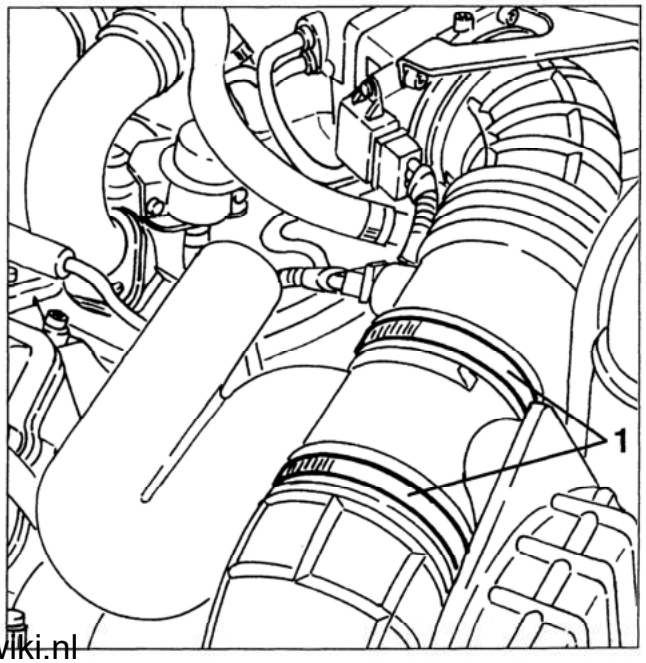
**NOTE: This air flow meter measures directly the mass of air (and not the volume) thereby eliminating problems of temperature, altitude, pressure, etc.**
**Correct operation of the flow meter depends on the condition of the air cleaner, which must therefore be checked often.**




*1. Connector*
*2. Measurement channel*
*3. Hot film sensor*

## REMOVING/REFITTING

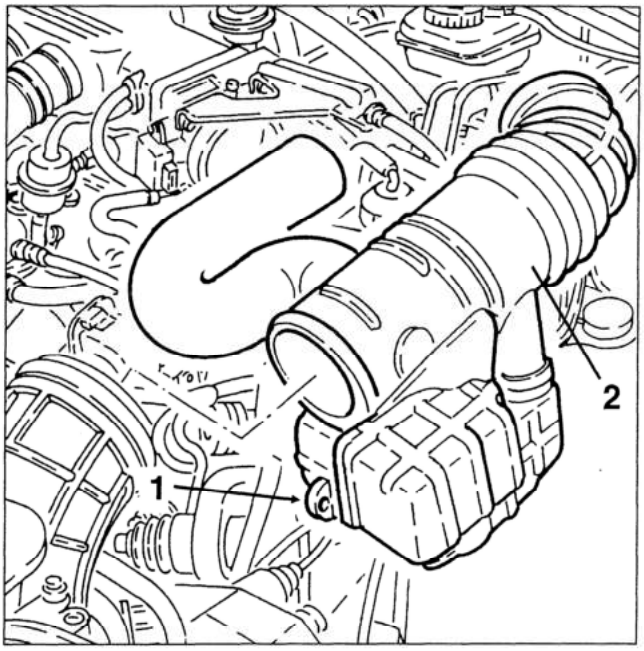
- Disconnect the battery (-) terminal.
- Remove the left hand engine compartment trim.
1. Slacken the two clamps fastening the upper resounder to the corrugated sleeve.




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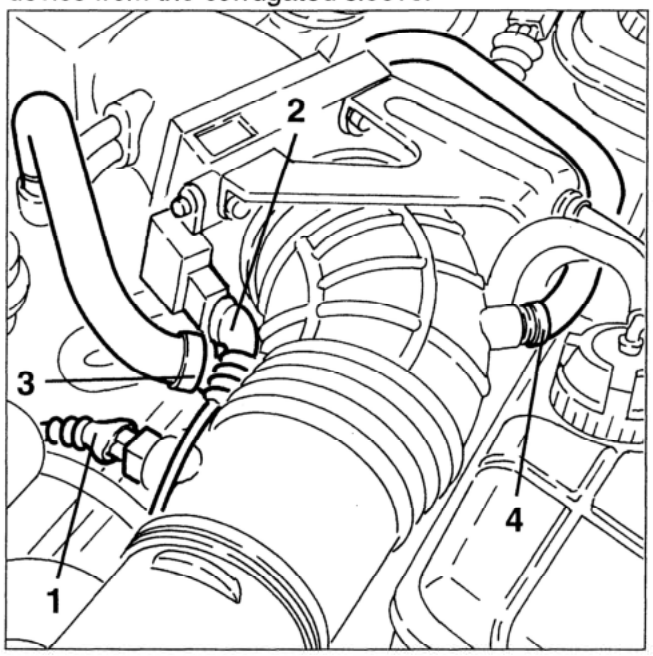
## THROTTLE BODY

The throttle body adjusts the amount of air sent to the intake box depending on the accelerator pedal position.
The accelerator cable acts on a special sector of pulley locked on the throttle valve pivot pin. A coil spring allows the throttle to return to the closed position.
To prevent the formation of ice on the throttle valve which would prevent it from returning to the closed position, the throttle body is heated by the engine coolant fluid.



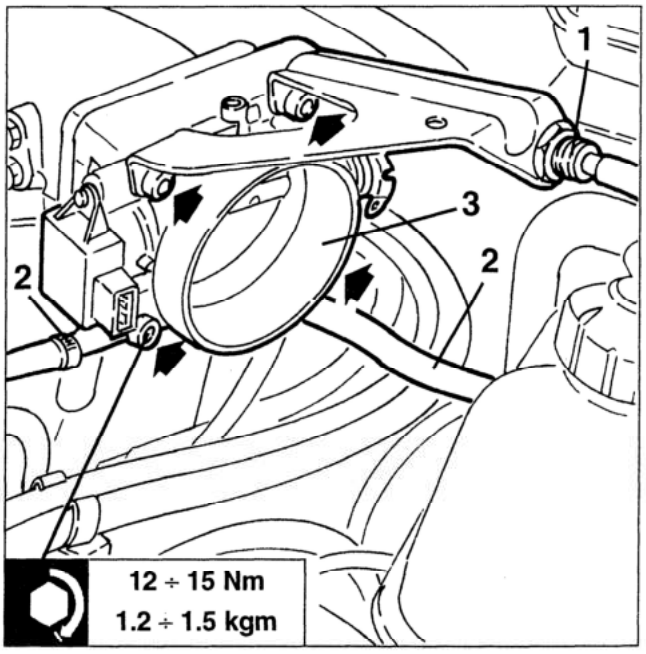

### REMOVING/REFITTING

- Disconnect the battery (-) terminal.
1. Disconnect the electrical connection from the intake air temperature sensor.
2. Disconnect the electrical connection from the throttle potentiometer.
3. Disconnect the oil vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.
4. Disconnect the air takeoff tube for the constant idle device from the corrugated sleeve.



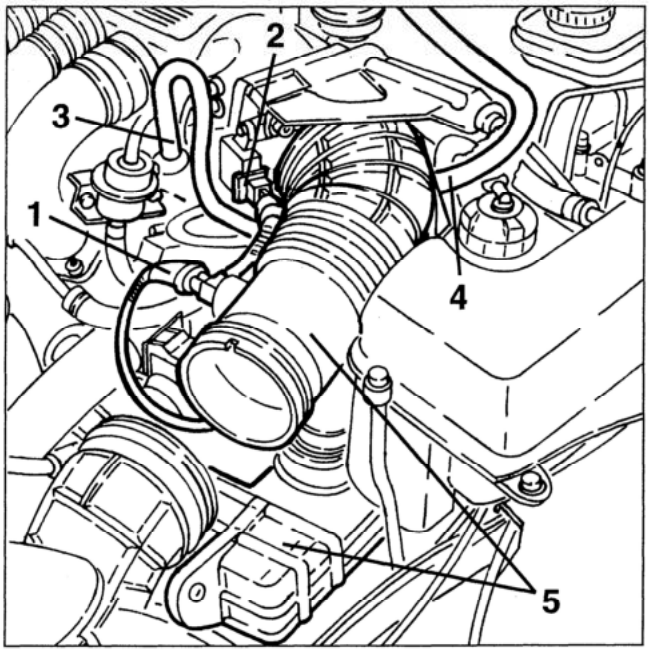

1. Prise of the button fastening the first section of the corrugated sleeve to the intermediate resounder.
2. Slacken the two fastening clamps and remove the second section of the corrugated sleeve complete with resounders.

1. Disconnect the accelerator cable from the throttle.
2. Disconnect the engine coolant inlet and outlet pipes from the throttle body.
3. Slacken the fastening screws and remove the throttle body complete with potentiometer, and, if necessary separate them on the bench.
- Retrieve the accelerator cable support bracket and the throttle body seal.




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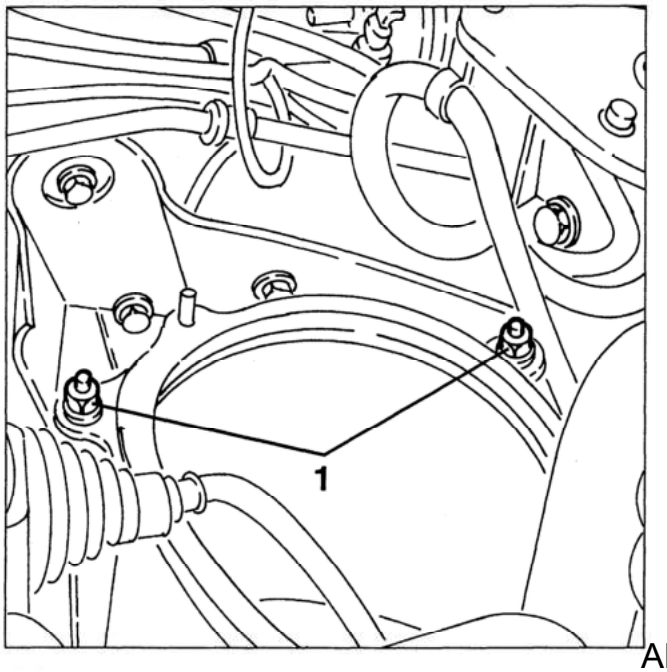
1. Disconnect the electrical connection from the intake air temperature sensor.
2. Disconnect the electrical connection from the throttle potentiometer.
3. Disconnect the oil vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.
4. Disconnect the air takeoff pipe for the constant idle speed device from the corrugated sleeve.
5. Slacken the clamp fastening to the throttle body, then remove the intermediate resounder complete with corrugated sleeve and separate them on the bench.



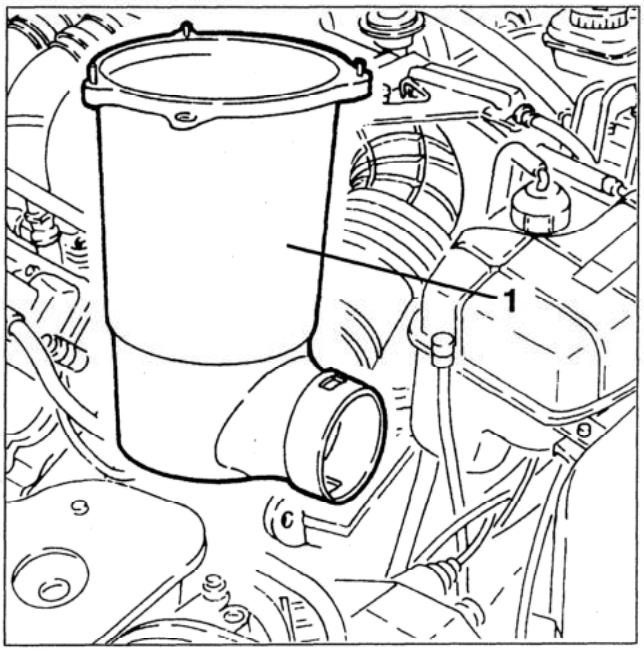

## AIR CLEANER BOX

### REMOVING/REFITTING

- Remove the air cleaner cartridge (see specific paragraph).
1. Slacken the two nuts fastening the air cleaner box.



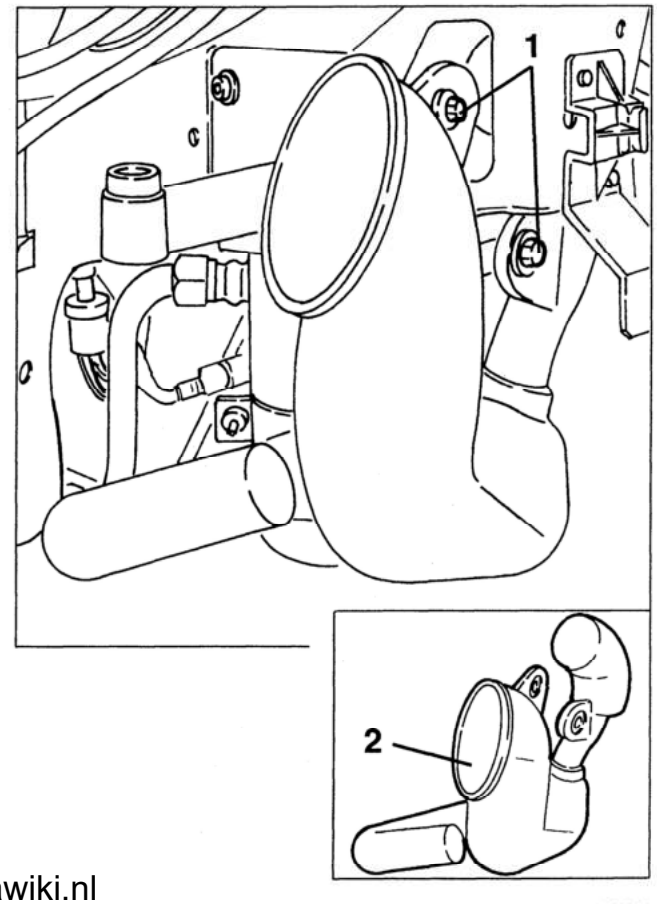

1. Remove the the air cleaner box releasing it from the lower resounder.




## LOWER RESOUNDER

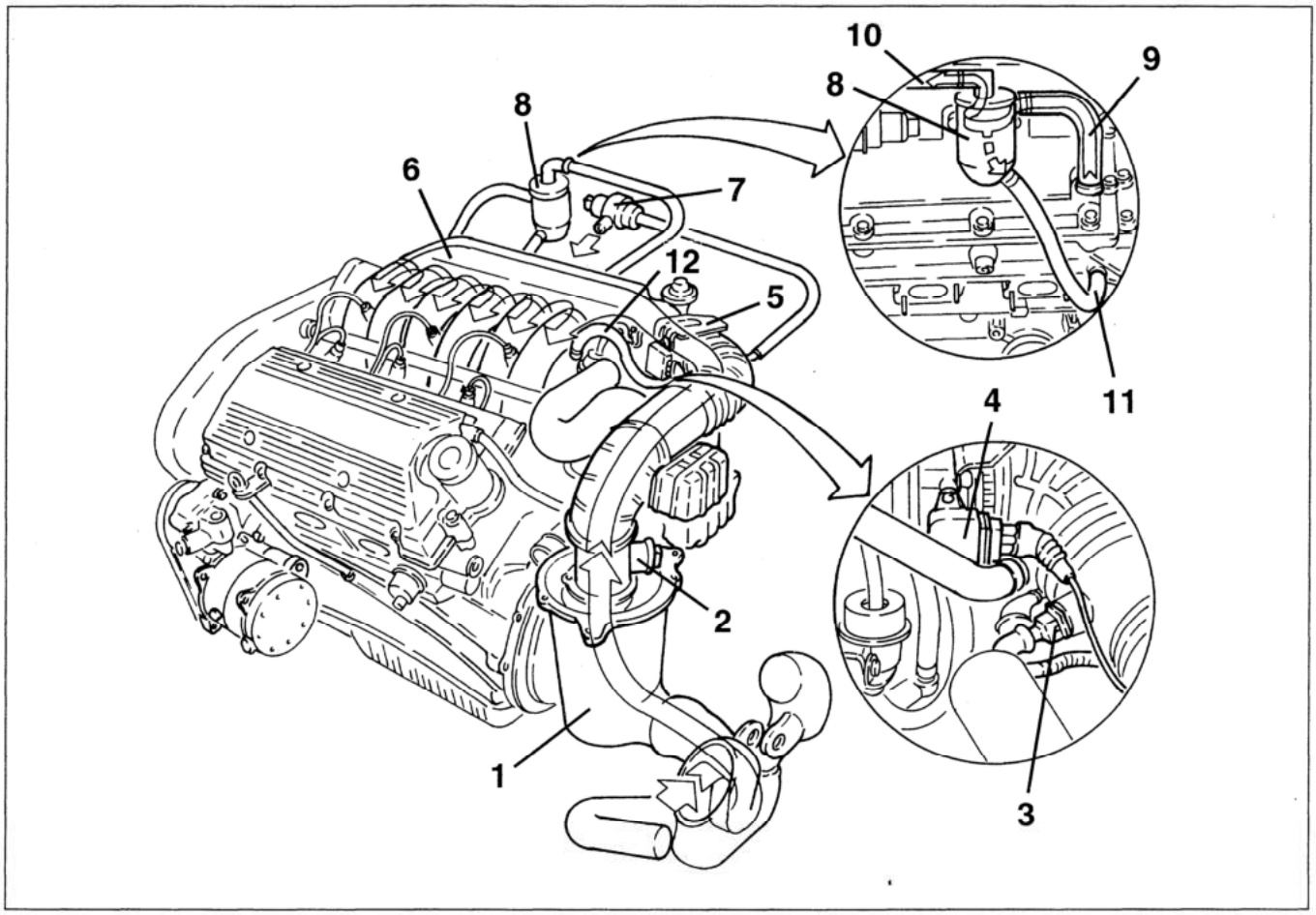
### REMOVING/REFITTING

- Remove the front bumper (see GROUP 70).
1. Slacken the two screws fastening the lower resounder.
2. Remove the lower resounder releasing it from the air cleaner box.




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# DESCRIPTION OF THE AIR SUPPLY AND OIL VAPOUR RECOVERY SYSTEM



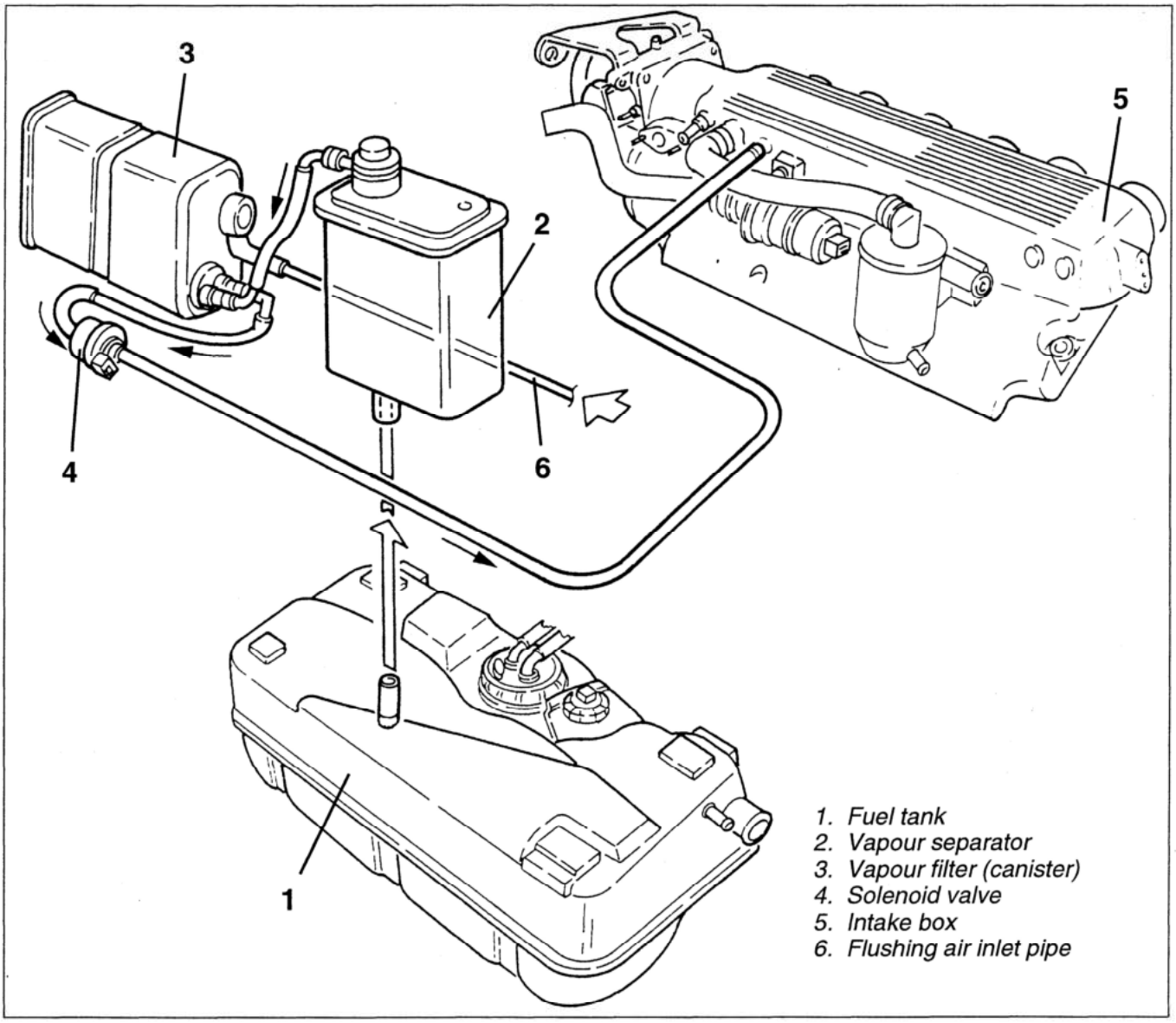

1. *Air cleaner*
2. *Air flow meter*
3. *Intake air temperature sensor*
4. *Throttle potentiometer*
5. *Throttle body*
6. *Intake box*
7. *Constant idle speed actuator*
8. *Oil vapour separator*
9. *Oil vapour recovery pipe*
10. *Oil vapour recirculation pipe*
11. *Condensed oil recovery pipe*
12. *Oil vapour recovery pipe*

The air, taken in through a dynamic inlet and filtered by a cartridge element (1), flows through the hot film flow meter (2) and from here, through the corrugated sleeve, on which the intake air temperature sensor (3) is fitted, it reaches the throttle body (5). Along the intake duct, "resounders" are installed, some of which are machined directly on the pipes and others are separable.
The throttle body, controlled by the accelerator cable, adjusts the quantity of air taken in by the box (6).
On one side of the throttle body there is the potentiometer (4) fastened to the throttle rotation spindle which informs the control unit of the position of the throttle. On the intake box there is an additional electromagnetic valve (7) which, through a special tube, by-passes the throttle body making it possible to keep idle speed constant under particular engine operating conditions.

The fuel vapours and oil vapours converge at the air supply system.
The latter are developed while the engine is running and are collected in the special separator via a pipe (9) leading from the right cylinder head; as the separator temperature is lower, the oil vapours are partially condensed.
The condensed oil returns to the engine via a special pipe (11), while the remaining vapours are sent directly to the intake box through a pipe (10) and then burnt in the engine.
An additional pipe (12) collects the oil vapours from the right cylinder head and sends them to the intake corrugated sleeve.

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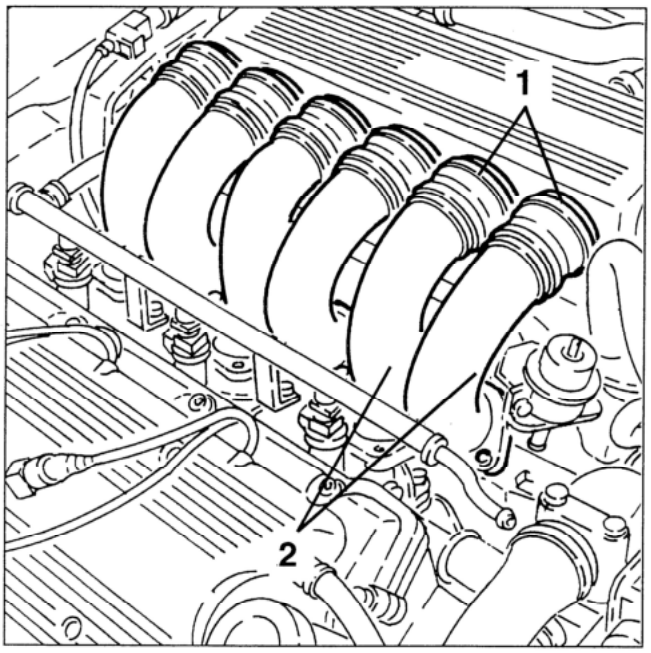
## DESCRIPTION OF THE FUEL VAPOUR RECOVERY SYSTEM



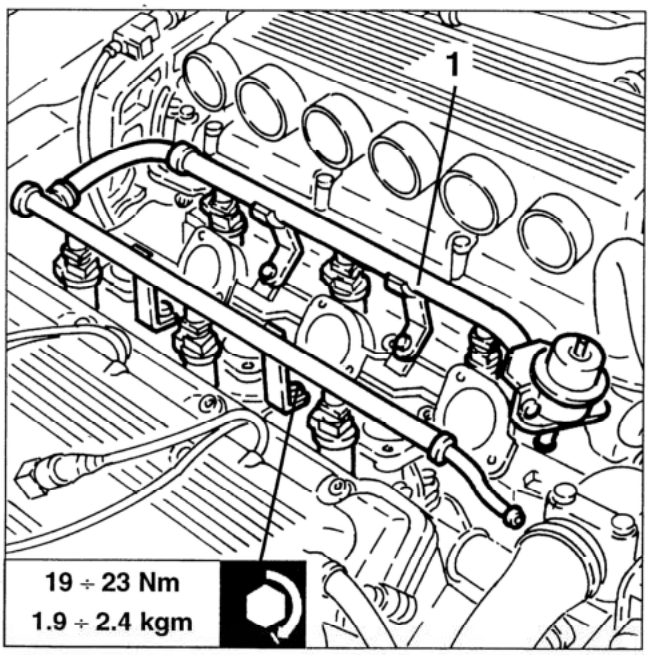

The fuel contained in the fuel tank produces a considerable amount of vapours which would pollute if released to the environment.
The system for controlling and recovering these vapours makes it possible to recover them and burn them in the engine.
The vapours leading from the fuel tank (1) through a special tube reach the vapour separator (2) which, due to its shape, allows the condensed fuel to return to the tank in droplet form.
The remaining vapours are then sent to the fuel vapour filter "canister" (3) where they are absorbed and stored by the activated carbon it contains.
There is a solenoid valve (4) between the fuel vapour filter and the engine intake; when the solenoid valve is not activated, the connection with the intake box is closed and the vapours are gathered inside the canister by the activated carbon.
Under certain load conditions, the control unit opens the solenoid valve allowing any vapours in the canister to be taken in.
This condition remains even if the lambda sensor detects a lowering of the oxygen at the exhaust which, due to excess presence of fuel in the combustion chamber, is signalled to the control unit which lowers the delivery rate of the injectors so that the engine is always supplied under optimum conditions.
In the event of a lack of fuel vapours in the canister, resulting in only air being withdrawn, the lambda sensor detects this and signals an increase of oxygen to the control unit.
In this case, the control unit shuts the solenoid valve, preventing connection of the canister with the intake box, thereby eliminating the excess air.

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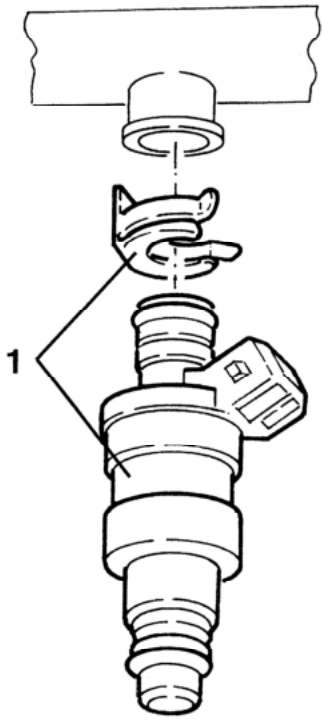
1. Slacken the clamps fastening the supply ducts to the intake box.
2. Slacken the fastening screws and remove the supply ducts.




1. Slacken the fastening screws and remove the distributor manifold complete with pressure regulator and injectors.




1. Working on the bench, remove the safety catches and remove the injectors from the distributor manifold.



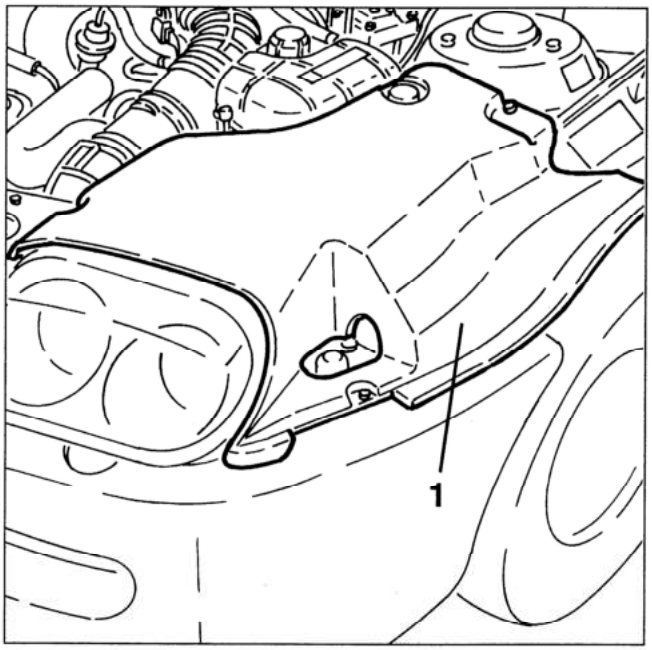

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# INJECTORS

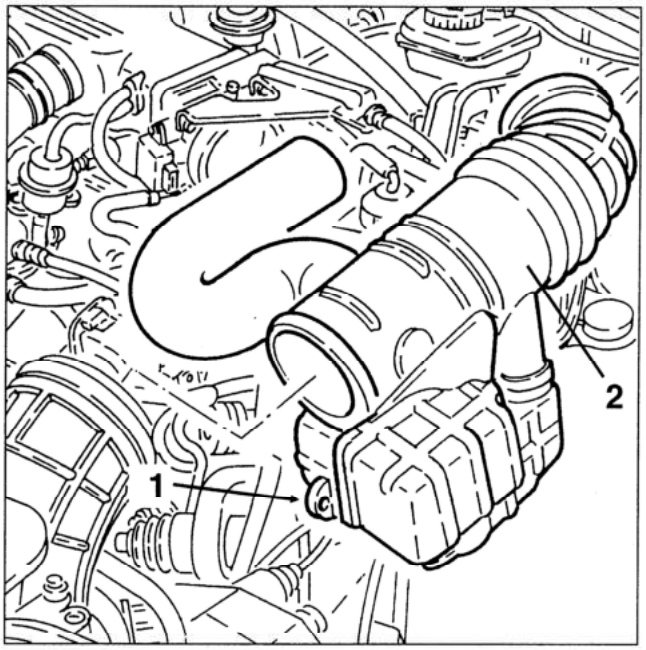
## REMOVING/REFITTING

- Set the car on a lift.
- Disconnect the battery (-) terminal.

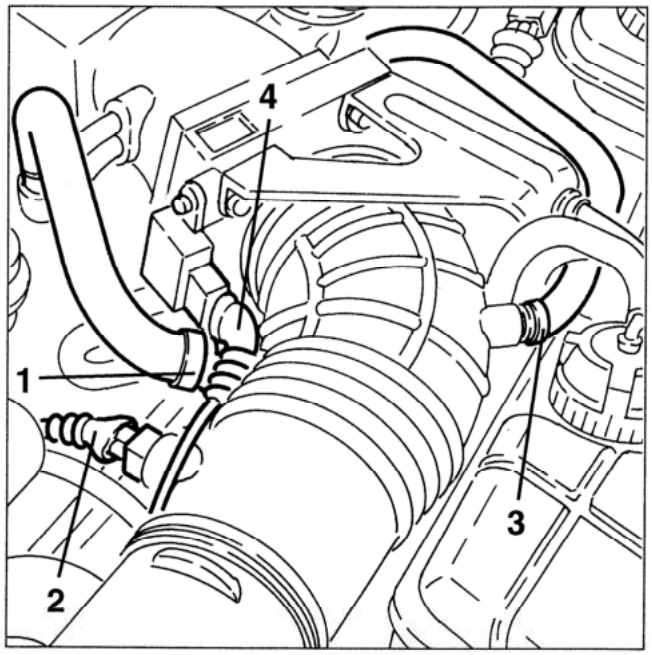
1. Remove the left hand engine compartment trim.



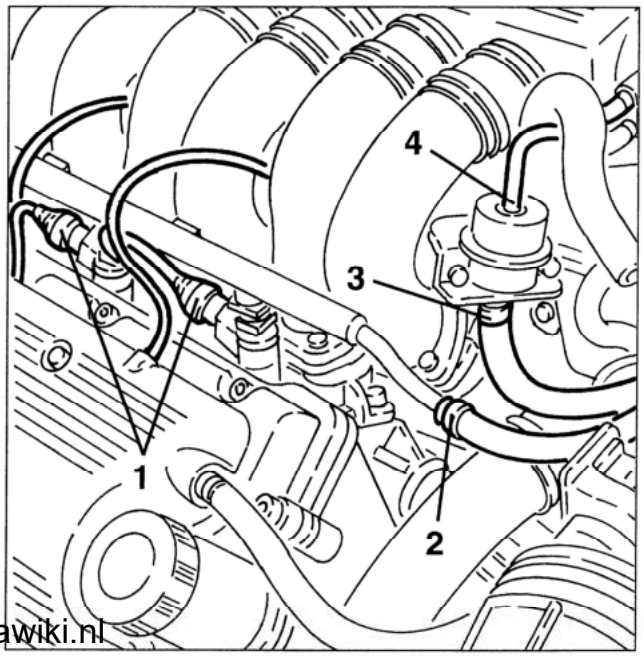

1. Remove the button fastening the first section of the corrugated sleeve to the resounder.
2. Slacken the two fastening clamps and remove the second section of the corrugated sleeve complete with resounders.




1. Disconnect the fuel vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.
2. Disconnect the electrical connection from the intake air temperature sensor.
3. Disconnect the air takeoff pipe for the constant idle speed device from the corrugated sleeve.
4. Disconnect the electrical connection from the throttle potentiometer.



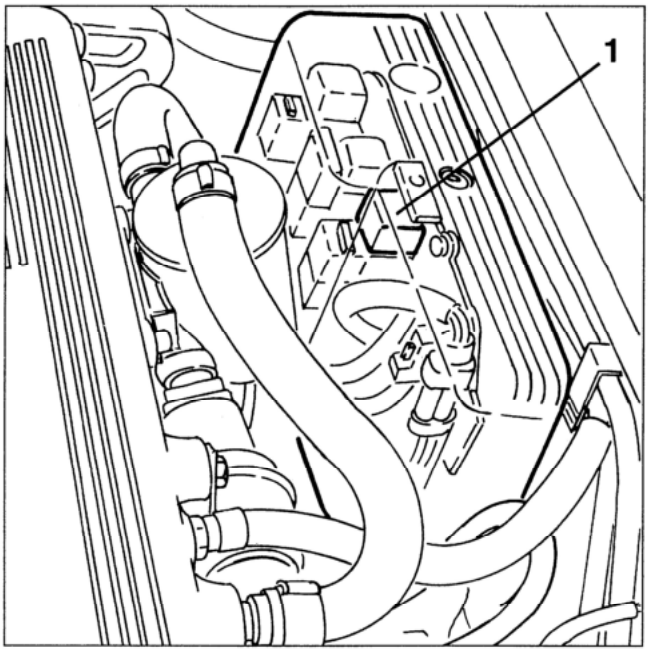

1. Disconnect the electrical connections from the injectors
2. Disconnect the fuel delivery pipe from the distributor manifold.
3. Disconnect the excess fuel return pipe from the pressure regulator.
4. Disconnect the vacuum takeoff pipe from the pressure regulator.




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## WARNINGS

Before working on components of the fuel supply system, to prevent dangerous fuel spilling, proceed as follows:
- Disconnect the fuel pump supply relay (1).

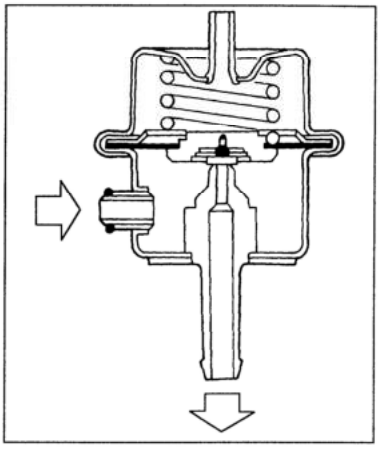



- Run the engine until it stops.

## FUEL PRESSURE REGULATOR

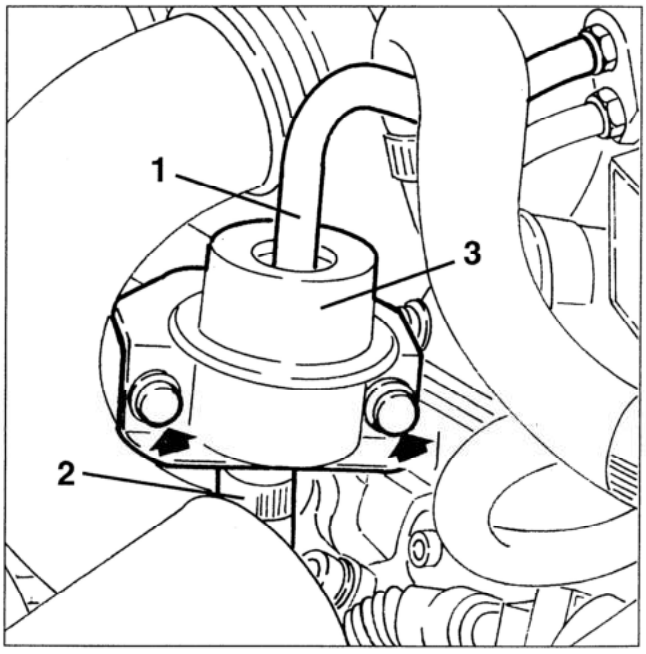
The task of the fuel pressure regulator is to keep a constant difference between the pressure of the fuel and the pressure in the intake manifold.
This way it is possible to meter the quantity of fuel solely on the basis of the injector opening time.
The pressure regulator is fitted downstream of the fuel distributor manifold.
It is a regulating-limiting device controlled by a diaphragm which adjusts the fuel pressure at 3 bar.
When the fuel pressure exceeds the maximum rating, the diaphragm operates a valve which opens the return pipe, through which the excess fuel retruns to the tank.

A tube connects the regulator spring chamber with the intake box.
Through this connection an interdependence is created between the pressure of the fuel circuit and pressure in the intake box, so that the pressure between the injector inlet and outlet is always the same when they are open.



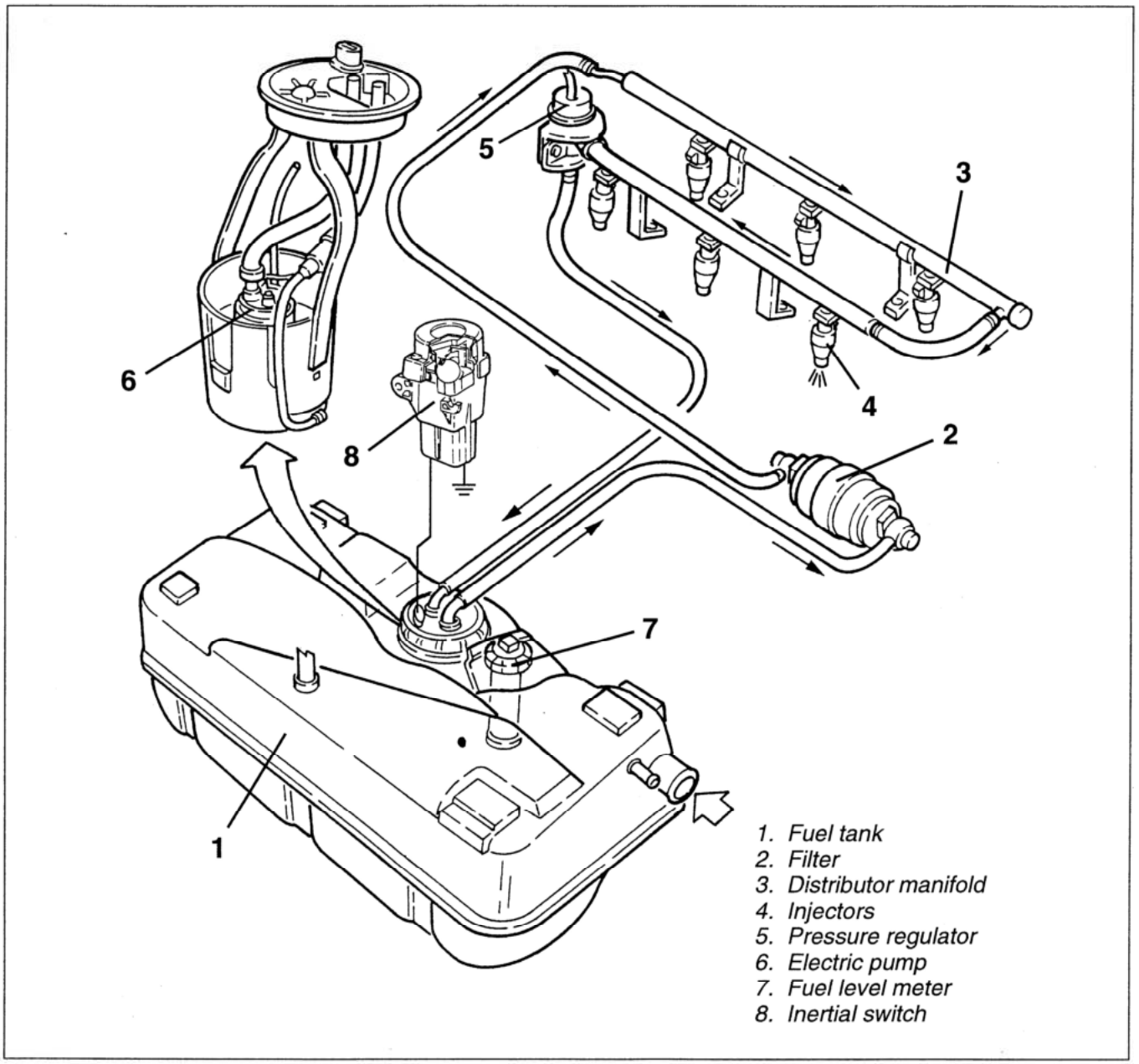
## REMOVING/REFITTING

1. Disconnect the vacuum takeoff pipe from the fuel pressure regulator.
2. Disconnect the excess fuel return pipe from the fuel pressure regulator.
3. Slacken the fastening screws and withdraw the fuel pressure regulator from the fuel distributor manifold and retrieve the O-Ring.




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## DESCRIPTION OF THE FUEL SUPPLY SYSTEM




1. *Fuel tank*
2. *Filter*
3. *Distributor manifold*
4. *Injectors*
5. *Pressure regulator*
6. *Electric pump*
7. *Fuel level meter*
8. *Inertial switch*

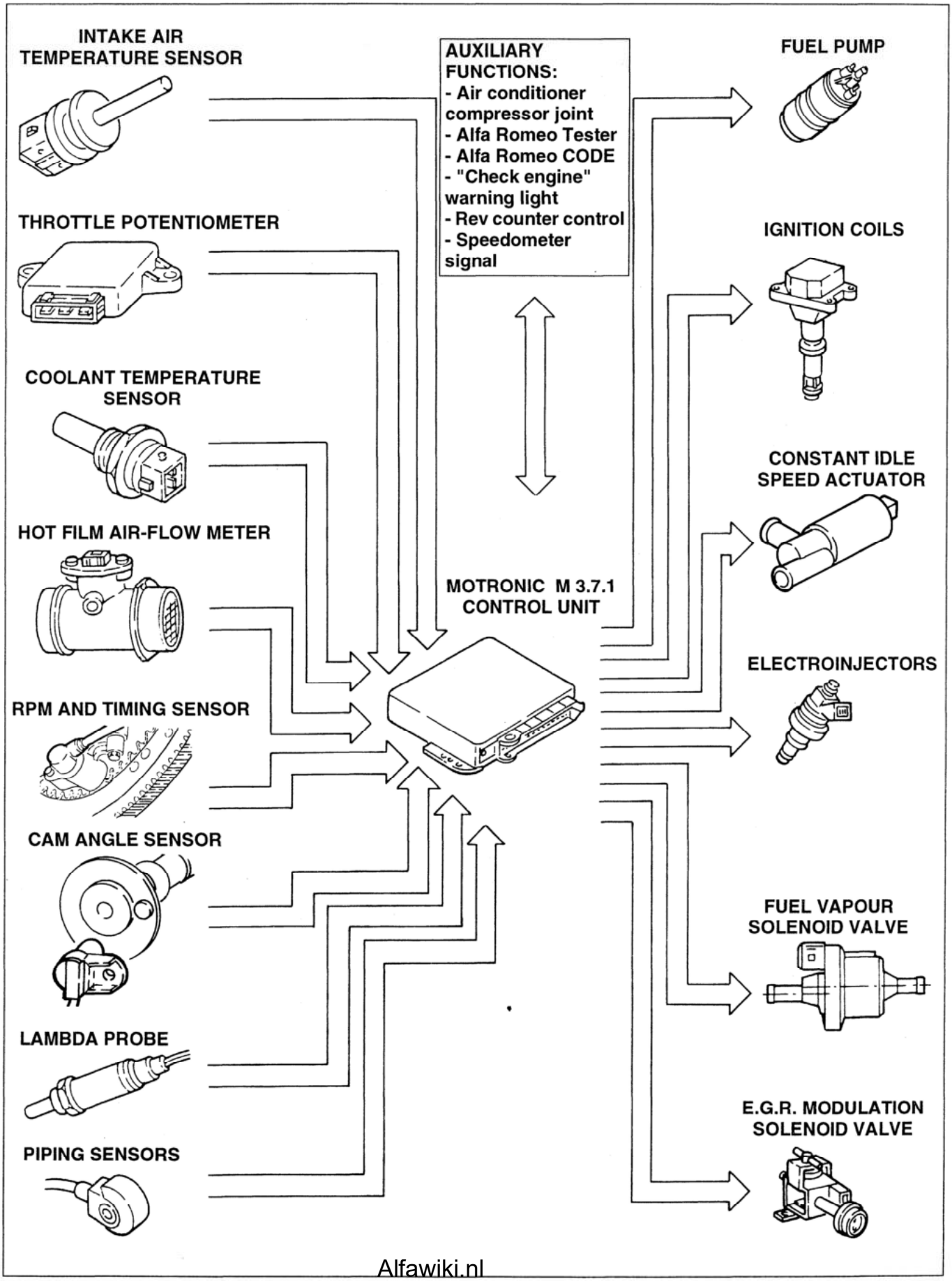
The fuel supply circuit comprises an electric pump (6) located in the fuel tank (1) which sends the fuel under pressure to the filter (2) through a special pipe.
From here the fuel is sent to the distributor manifold (3) which distributes it to the injectors (4).
Through the pressure regulator (5) controlled by the vacuum withdrawn from the intake box, the excess fuel returns to the tank via a special pipe.
The amount of fuel injected depends solely on the injection time which is controlled by the control unit.
The various sections of fuel pipe are connected by special joints.

The fuel supply system is fitted with an inertial switch which is triggered in the event of a crash, cutting off the fuel pump connection to earth and thereby the supply to the injection system.

**Notes on utilisable fuels:**
in order to work properly, the engine requires the use of unleaded petrol (95 R.O.N.) as the presence of lead would quickly wear out the catalytic converter of the exhaust system.

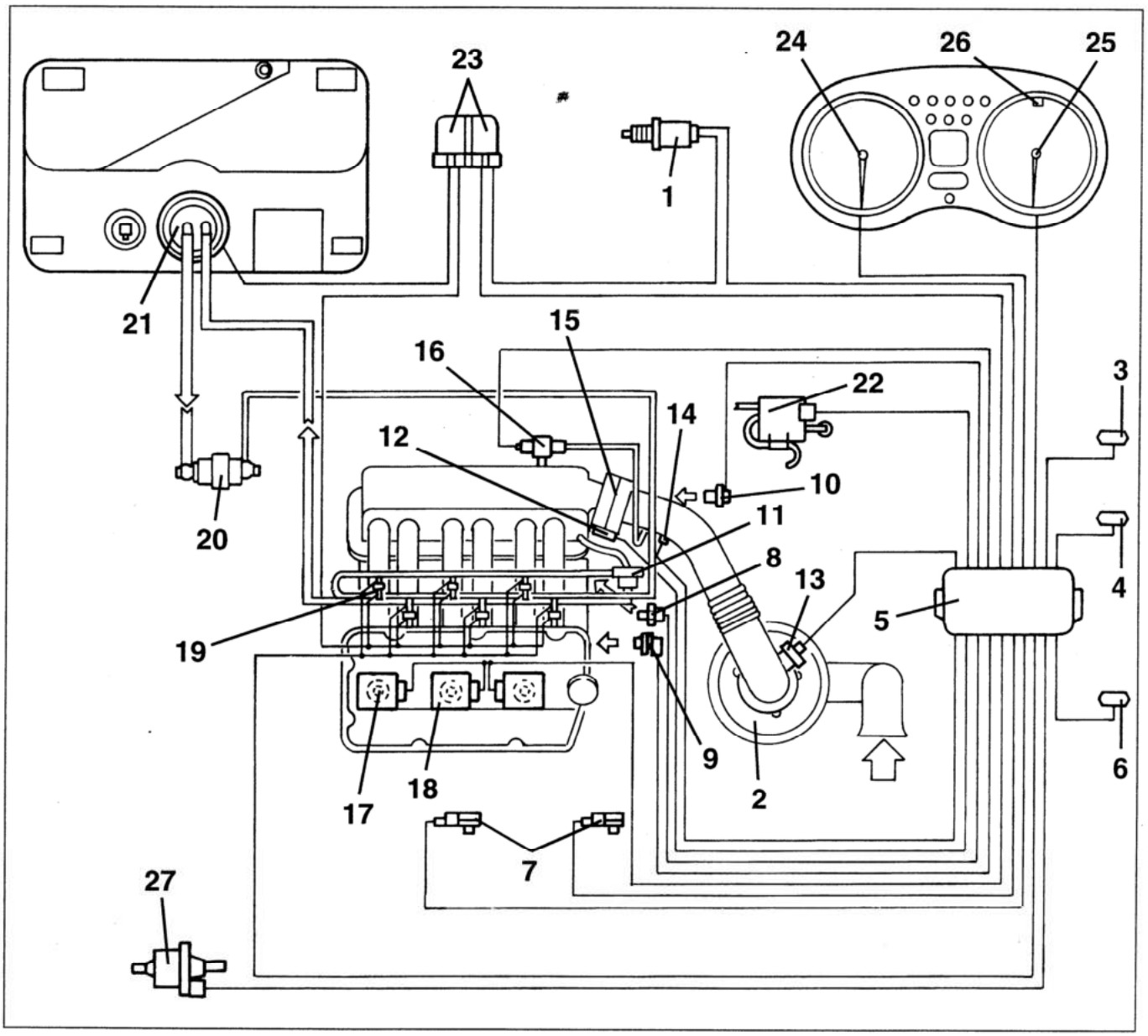
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## OPERATING LAYOUT OF MOTRONIC M 3.7.1 INJECTION-IGNITION SYSTEM




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## COMPONENTS OF THE MOTRONIC M 3.7.1 INJECTION-IGNITION SYSTEM




1. *Lambda sensor*
2. *Air cleaner*
3. *Climate control unit connector*
4. *Diagnosis socket (Alfa Romeo Tester)*
5. *Injection-ignition control unit*
6. *Alfa Romeo CODE control unit connector*
7. *Pinging sensors*
8. *Coolant fluid temperature sensor (NTC)*
9. *Rpm and timing sensor*
10. *Timing sensor*
11. *Fuel pressure regulator*
12. *Throttle potentiometer*
13. *Air flow meter*
14. *Intake air temperature sensor (NTC)*
15. *Throttle body*
16. *Constant idle speed device*
17. *Spark plugs*
18. *Ignition coils*
19. *Injectors*
20. *Fuel filter*
21. *Electric fuel pump*
22. *E.G.R. modulation solenoid valve*
23. *Relay unit*
24. *Rev counter*
25. *Tachometer*
26. *"check engine" warning light*
27. *Fuel vapour solenoid valve*

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– **Self-diagnosis:**
the control unit possesses a **self-diagnosis system**, which continuously monitors the plausibility of the signals from the various sensors and compares them with the limits allowed: if these limits are exceeded, the system detects a fault and turns on the corresponding warning light on the instrument cluster.
The warning light turns on when the engine is started to indicate the initial test of the entire system (appr. 4 seconds), it then turns off if no errors have been memorised: otherwise it stays on.
For certain parameters, the control unit replaces the abnormal values with suitable mean ones so that the car can "limp" to a point of the Service Network.
These "recovery" values depend on the other correct signals and they are defined individually by the control unit operating logic.
The self-diagnosis system also enables quick and effective location of faults connecting with the ALFA ROMEO Tester (see "Fault-finding), through which all the errors memorised can be displayed. It is also possible to check the operating parameters recorded by the control unit and operate the single actuators to check whether they are working properly.

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– **Control of idle speed:**
the adjustment of the engine idle speed is carried out through the special actuator which acts on the throttle by-pass.
This device acts as a regulator for cutting in the various services (e.g. conditioner compressor): in fact, when the throttle is closed, this valve adjusts the by-pass gap compensating the load required by the services in order to ensure that idle speed is as constant as possible.

– **Maximum Rpm limiting:**
above a certain threshold the control unit automatically stops the injection of fuel preventing the engine from "over-revving".

– **Combustion control -lambda probe-:**
the oxygen sensor (or "lambda" probe) informs the control unit of the amount of oxygen at the exhaust, and therefore the correct air-fuel metering.
The optimum mixture is obtained when the lambda coefficient = 1 (optimum stoichiometric mixture). The electric signal sent by the probe to the control unit changes abruptly when the composition of the mixture departs from lambda = 1. When the mixture is "lean" the control unit increases the amount of fuel, reducing it when the mixture is "rich" so that in this way the engine operates as far as possible around the ideal lambda rating.
The signal from the lambda probe is processed inside the control unit by a special integrator which prevents sudden "oscillations".
The probe is heated by an electrical resistance so that it quickly reaches the correct operating temperature (appr. 300 °C).
Through this probe it is therefore possible to adjust engine carburetion precisely. Among other items, this makes it possible to meet emission limit regulations.

– **Knocking control:**
Through knocking sensors the control unit is informed if any pinging or "knocking" occurs and it corrects the spark advance "delaying" it accordingly; a further correction also takes account of the air temperature, in fact when the temperature of the intake air is high, pinging is more accentuated.
The intaken air temperature, to be found just downstream of the air-flow meter, is not used to calculate the engine load but to control the knocking parameters and spark advances.

– **Fuel vapour recovery:**
the fuel vapours collected from the various points of the supply circuit in a special active carbon canister are ducted to the engine where they are burnt: this takes place through a solenoid valve which is opened by the control unit only when the engine is in a condition that allows correct combustion without adversely affecting the operation of the engine: in fact the control unit compensates this amount of incoming fuel by reducing delivery to the injectors.

– **E.G.R. valve control**
The percentage of exhaust gas to be returned to the engine is determined by the control unit taking account of a specific characteristic curve which depends on the engine load and speed: recirculation is only activated when the engine speed is between 2500 and 4000 rpm., also in relation to the temperature of the engine (higher recirculation percentage with high temperatures).

– **Connection with the air conditioner compressor:**
the control unit is connected with the air conditioner compressor and it cuts in the compressor in relation to operation of the engine. As this service absorbs a considerable amount of power, the control unit:
- adapts the engine idle speed each time the compressor cuts in; if the engine speed falls below 700 rpm, the compressor is turned off;
- when there is the need for power (high throttle opening speed starting from below 3500 rpm, or full load, or high engine temperature - over 117°C), it momentaneously cuts out the compressor
- when the engine is being started the compressor is disabled until normal operating conditions have been reached.

– **Connection with the Alfa Romeo CODE system**
as soon as the Motronic control unit receives the signal that the key has been turned to MARCIA, it "asks" the above-mentioned system for consent to start the engine: this consent is given only if the Alfa Romeo CODE control unit recognizes the code of the key engaged in the ignition switch as correct. This dialogue between the control units takes place on diagnosis line K already used for the Alfa Romeo Tester (see specific paragraph).
**N.B.** Before doing any work on the system it is advisable to read the corresponding chapter.

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## Fuel pump

The control logic of the fuel pump carried out by the control unit which is mainly based on the rpm signal immediately cuts off the supply to the pump as soon as the engine stops.
Moreover, the pump will not operate with the key engaged and the engine not running.
In this car, this logic is integrated - in order to further higher the standards of safety - by the **inertial switch** device: this is an electromechanical switch which, in the event of heavy shocks, opens to cut off the circuit that takes the earth to the fuel pump, which stops instantaneously. This device is particularly important as an integration of the safety guaranteed by the logic of the control unit, especially if the car is hit from behind or in the case of other accidents in which the engine does not stop immediately.

## Percentage of exhaust gas recirculation

Nox (nitric oxide) is developed at high temperatures in the bursting chambers.
To reduce these emissions an E.G.R. (Exhaust Gas Recirculation) system is adopted which by recirculating part of the exhaust gases, lowers the temperature, thus the Nox produced, in the combustion chambers.
In fact, part of the exhaust gas is withdrawn through the special EGR Valve and re-admitted to the intake box where it is mixed with the intaken air and burnt again in the engine. The EGR valve is modulated by a solenoid valve controlled by the injection control unit and, as a result of the type of control, in addition to reducing the amount of Nox, consumption levels are also optimised.
The percentage of exhaust gas to be returned to the engine is established by the control unit taking account of a specific characteristic curve which depends on the load, speed and temperature of the engine.

## OPERATING LOGIC

– **Identification of the "operating point":**
the "point of operation of the engine" is located mainly through two sensors: the rpm sensor informs the control unit of the speed of rotation of the engine; the air flow meter supplies the value of the mass of air actually entering the cylinders, defining the instantaneous volumetric yield of the engine.

– **Adjustment of injection times (quantity of fuel):** the control unit controls the injectors very quickly and precisely, calculating the opening time on the basis of engine load (rpm and air flow), also taking into account the battery voltage and the temperature of the engine. Injection is "sequential", i.e. the injectors are opened in correspondence of the exhaust stroke of the corresponding cylinder.

– **Ignition adjustment (calculation of advances)**:
the control unit calculates the advance on the basis of the engine load (rpm and air flow); the value is also corrected according to the temperature of the intaken air and that of the engine.

– **Cold starting control:**
during cold starts the control unit uses special advance values and injection times.
When a determinate temperature/rpm ratio is reached, the control unit resumes normal operating conditions.

– **Control of enrichment during acceleration:**
upon the need for acceleration, the control unit increases injection in order to reach the required load as quickly as possible.
This function takes place through the potentiometer located on the throttle which instantaneously informs the control unit of the need to accelerate.

– **Fuel cut-off during deceleration:**
with the throttle closed and an engine speed above a certain threshold, the control unit de-activates fuel injection; this way the rpms decrease rapidly towards idle speed reducing the speed and fuel consumption. The cutoff threshold value varies according to the temperature of the engine and the speed of the car.

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# GENERAL DESCRIPTION

Engines are governed by an electronic control system which manages and adjusts parameters, optimising performance and consumption by real time response to the various operating conditions.
This last generation, sophisticated system consists of a tested and reliable BOSCH MOTRONIC M 3.7.1 ECU which controls both ignition and injection.

## SYSTEM OPERATION

### Sequential, phased injection (S.E.F.I.)

Fuel injection governed by this ECU is sequential and phased for each cylinder.
The injection instant (when fuel is conveyed in the intake manifolds by opening the injectors) is not simultaneous in all cylinders but corresponds to the optimal injection point computed by the ECU according to specific maps on the basis of engine load, ratio and temperature.

### Static ignition

An electronic "static distribution" ignition system is adopted (with semiconductors and without distributor). This solution eliminates rotating components.
Furthermore, the risk of interference is reduced.
Finally, high voltage wires and connections are reduced, as the power modules controlling the coil primary windings are inside the ECU.
The static ignition is ensured by six coils located on the cylinder heads.
Each coil directly powers a spark plug without intermediate wires.

### Air intake flow meter

A modern "hot film" system is used to measure the intake air flow.
The flow meter is a duct located between the intake manifold and the air cleaner.
An electronic circuit and film are contained in the flow meter and are crossed by the air flowing in the duct.
The film is maintained at constant temperature (approximately 120°C warmer than the intake air temperature) by a resistance in contact with it.
The air flow in the duct tends to take heat from the film.
Consequently, a certain current is required by the resistance to keep the temperature.
This current is measured and is proportional to the air flow.
**N.B.** This air flow meter directly measures the air mass (and not volume, as in the previous "floating flap" meters) thus eliminating problems related to temperature, altitude, pressure, etc. and ensuring optimal air and petrol mixture ratio.

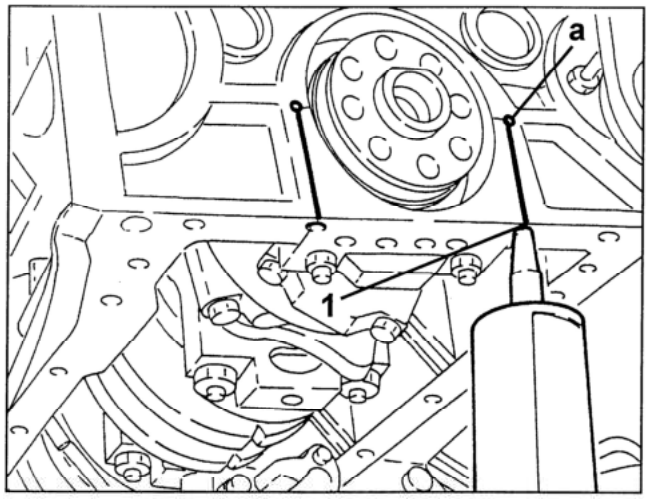
### Cylinder acknowledgement

A phase sensor has been introduced with the sequential, phase injection system (cam sensor angle).
This allows the system to acknowledge which cylinder is in firing stroke to start the correct injection sequence.
This sensor is a Hall effect device: the voltage signal sent to the ECU goes down suddenly when the pin on the right-hand cylinder head exhaust shaft crosses the sensor.
Consequently, the signal is sent each two crankshaft revolutions.
The rpm sensor, on the other hand, sends a reference signal at each engine revolution.
Each tooth step on the phonic wheel informs the ECU of the increased crankshaft angular position so to send injection to the suitable cylinder and to ignite the respective pair of cylinders.

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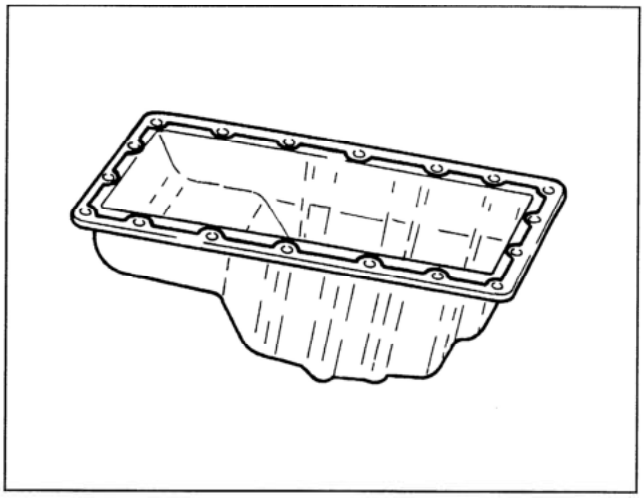
1. Apply "**DOW CORNING 7091**" silicon sealant with a mechanical gun through the holes shown in the figure.

**NOTE: Check that the sealant seeps out from the rear crankcase-main bearing coupling along the entire length from holes (a) (for vehicles from engine no. 00708 only).**




Refit by reversing the removal sequence attaining to the following precautions.

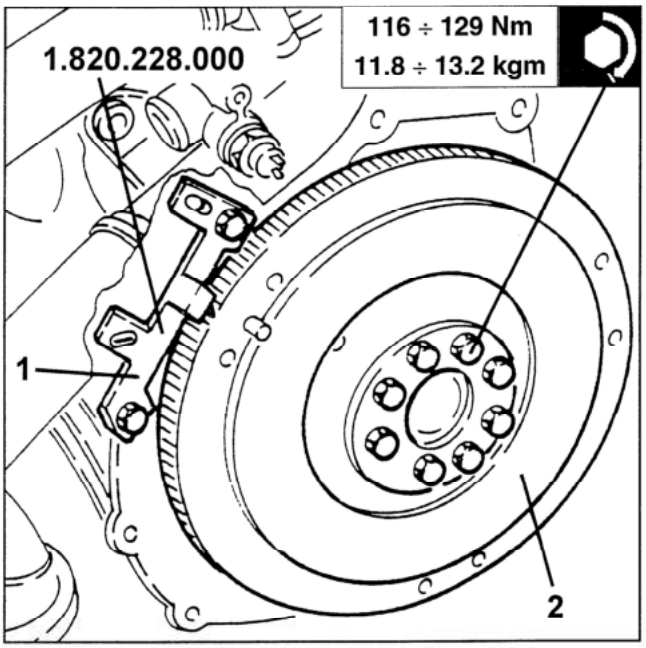
- Apply sealant to the oil sump. Make sure the strip of sealant (not wider than approximately 1.5 mm in diameter) is within the oil sump fastening holes (between reservoir and hole).



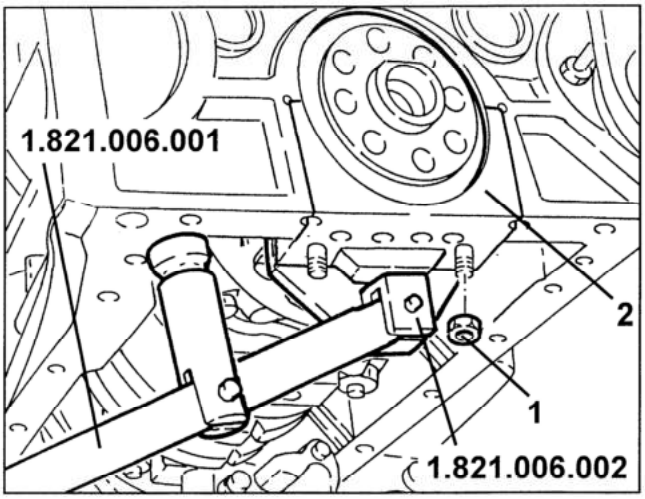
**IMPORTANT: Fit the oil sump within 15 minutes from applying the sealant in the crankshaft rear seal holes.**

## REAR CRANKSHAFT JOURNAL SILICON SEAL RESTORING

- Remove the gearbox (see assembly 21).
- Remove the clutch (see assembly 18).
- Remove the oil sump (see "Oil pump - Removal/Refitting").
1. Fit the flywheel retainer no. 1.820.228.000.
2. Loosen the fastening screws and remove the flywheel.




1. Loosen the rear main bearing fastening nuts.
2. Remove the rear main bearing with tools no. 1.821.006.001 and no. 1.821.006.002.

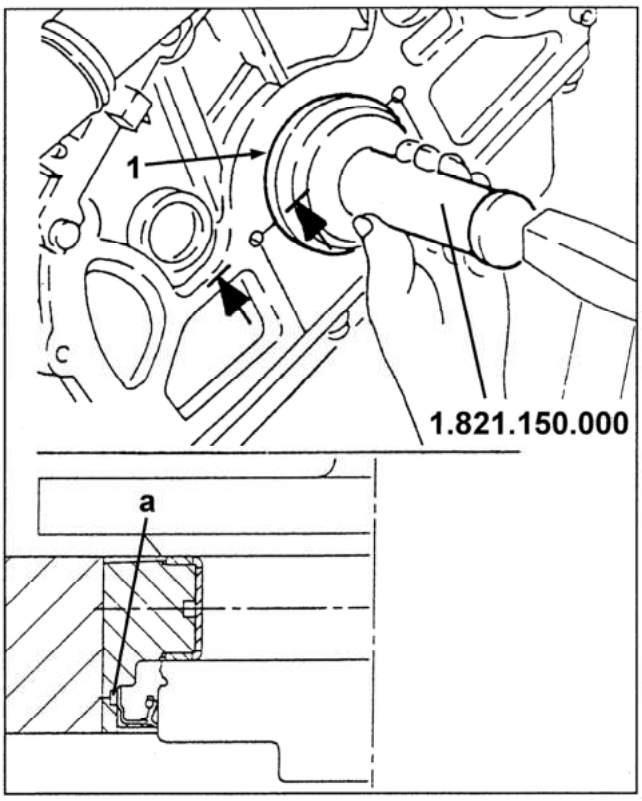



- Remove the main half-bearings.
- Remove the rubber seals (for vehicles up to engine no. 00708 only).
- Remove the engine rear crankshaft seal.
- Carefully remove sealant residues from the rear bearing seats, oil sump coupling surfaces and sealant drain holes (for vehicles from engine no. 00709 only).
- Carefully remove all traces of engine oil with heptane or similar solvent.
- Refit the rear main bearing with main half-bearing (after lubricating with engine oil) and torque the nuts at **25 Nm + 79°**.

**NOTE: Use tool no. 1.860.942.000 for angle torque.**

1. Refit crankshaft rear oil seal with tool no. 1.821.150.000.

**NOTE: Fit the oil seal so that it covers holes (a).**



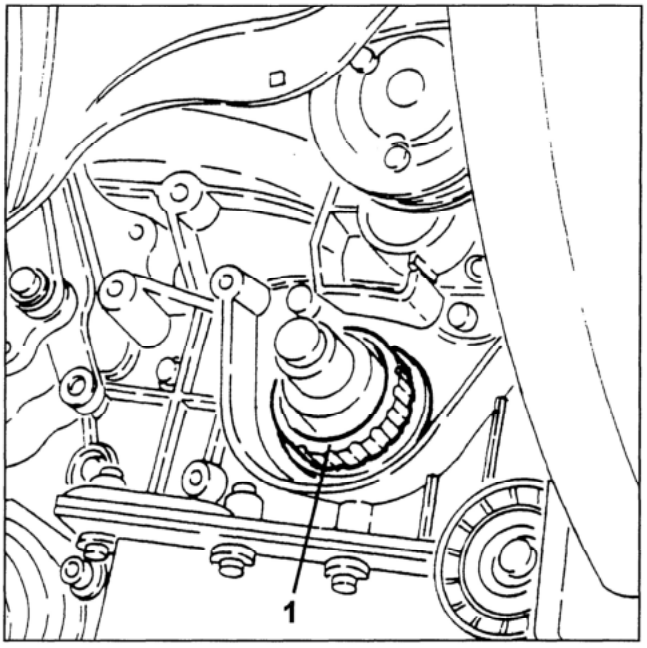


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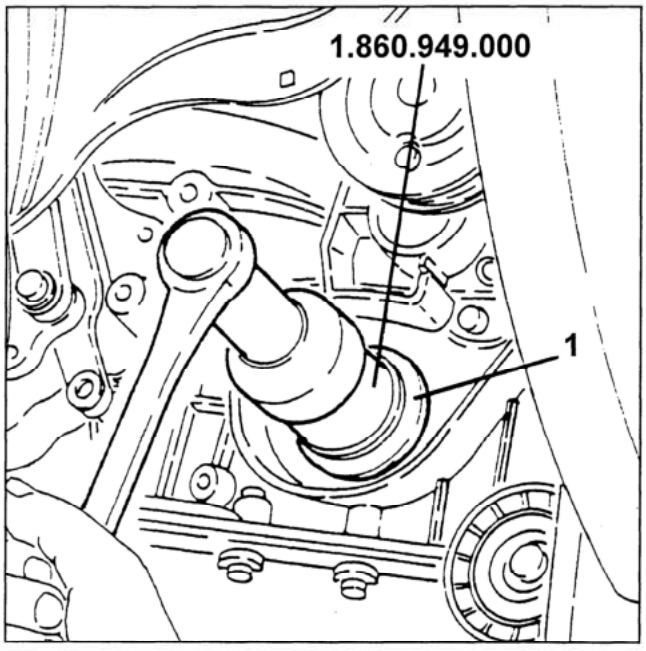
## FRONT CRANKSHAFT OIL SEAL REPLACEMENT

**Proceed as shown in Assembly 00, procedure "Replacing the timing belt" to remove the timing belt.**

1. Remove the timing belt and thrust ring.



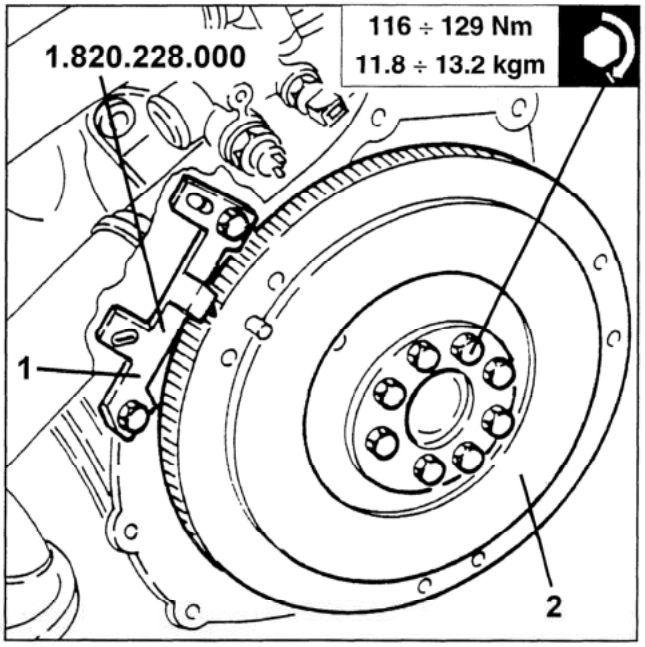

- Remove the crankshaft front oil seal.
1. Use tool no. 1.860.949.000 to introduce a new oil seal on the crankcase front cover.



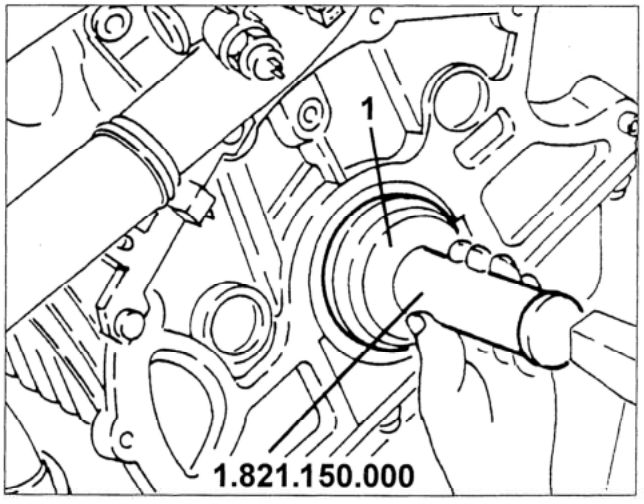

- Reposition the thrust ring. Make sure the convex surface is facing the front crankcase cover. Then refit the timing belt pulley.
Complete the refitting operation as described in the "Timing belt replacement" procedure from where it was interrupted.

## REAR CRANKSHAFT OIL SEAL REPLACEMENT

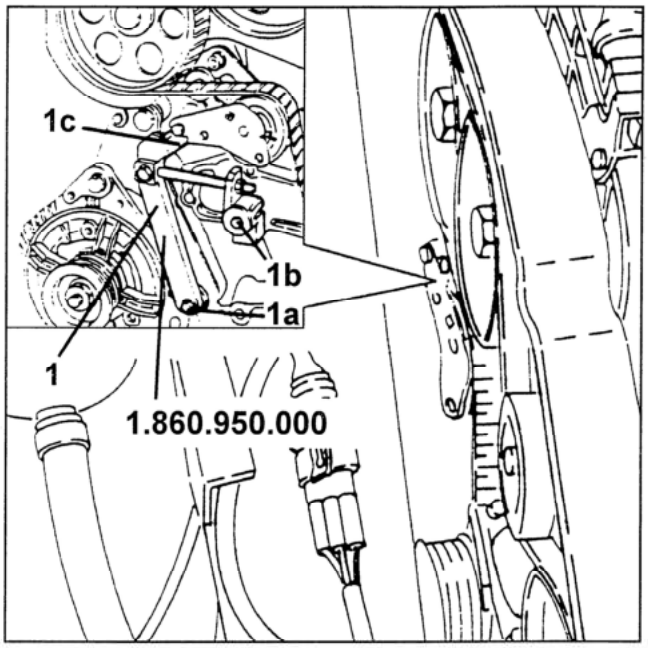
- Remove the gearbox (see ASSEMBLY 21).
- Remove the clutch (see ASSEMBLY 18).
1. Fit the flywheel retainer no. 1.820.228.000.
2. Loosen the fastening screws and remove the flywheel.



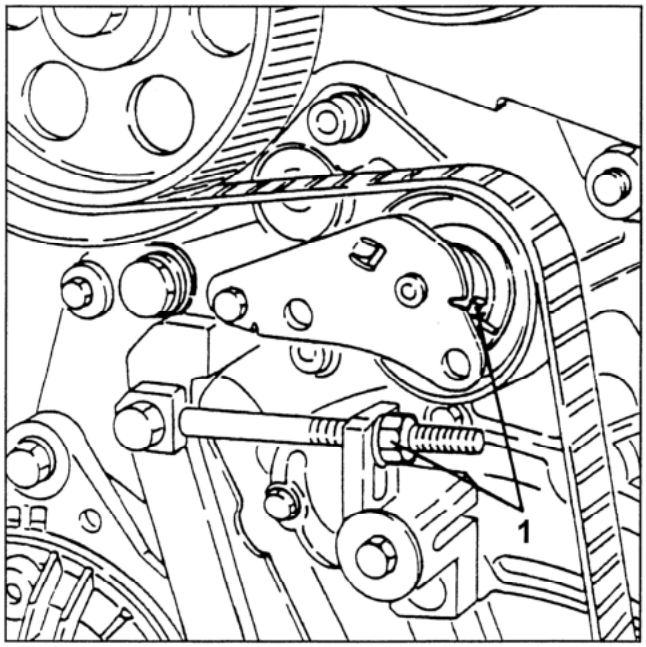

- Remove the rear crankshaft oil seal.
1. Use tool no. 1.821.150.000 to introduce a new rear crankshaft oil seal.



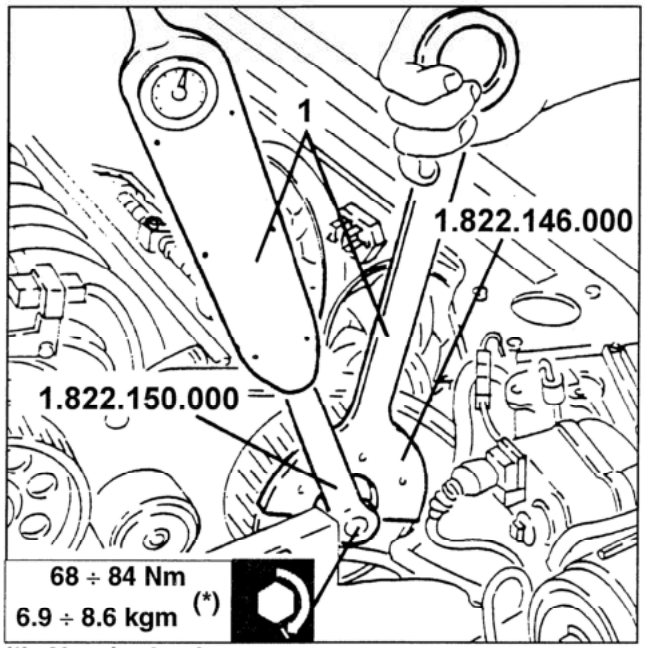
1. Fit timing belt tension tool no. 1.860.950.000 and fasten the previously loosened screw (1a) to the alternator and screw (1b) to the coolant pump; tool pin (1c) should contrast the belt take-up device mobile part.




1. Take the mobile notch under the belt take-up fixed notch as shown in the figure.

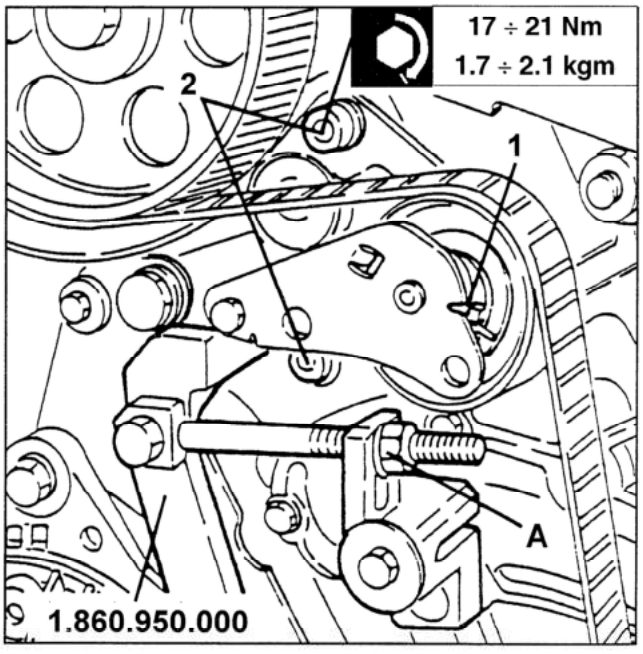



1. Use extension no. 1.822.150.000 and tool no. 1.822.146.000 to contrast torque. Fasten the camshaft drive pulley screws at the prescribed torque.




(*): Nominal value

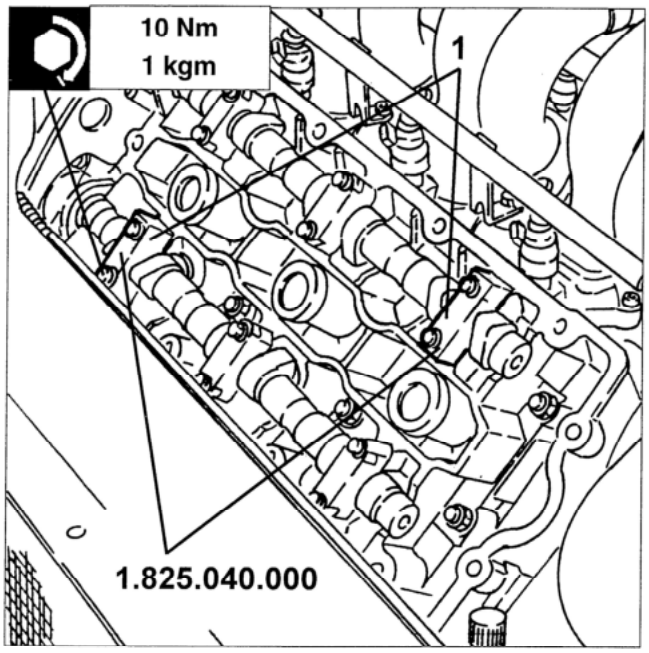
- Remove the previously fitted templates no. 1.825.040.000. Fit the previously fitted bearings in their place and fasten the screws at the prescribed torque.
- Turn the crankshaft twice in the direction of revolution to fit the timing belt well.
1. Check whether the fixed notch on the belt take-up coincides with the mobile notch. If not, loosen the belt take-up tension by turning nut (A) until the notches meet.
2. Torque the belt take-up fastening nuts as prescribed and remove belt tension tool no. 1.860.950.000.



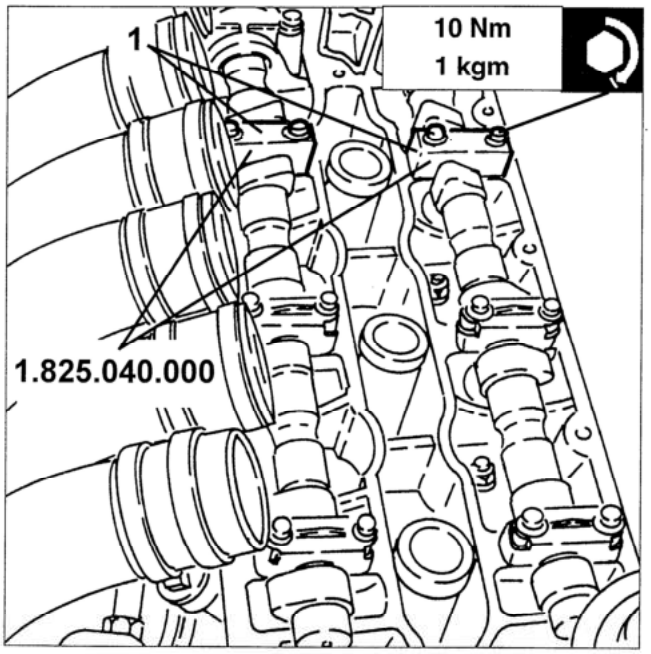

- Complete refitting by reversing the removal sequence.

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1. Fit templates no. 1.825.040.000 in the position printed on the templates in the place of camshaft bearings **4** and **7**.

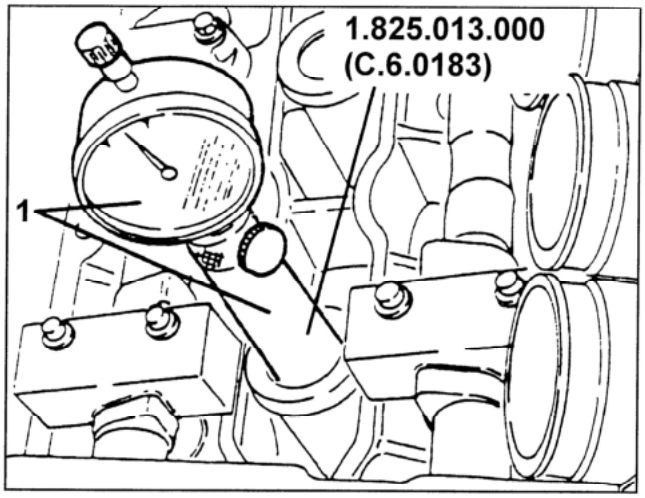



1. Fit templates no. 1.825.040.000 in the position printed on the templates in the place of camshaft bearings **B** and **G**.

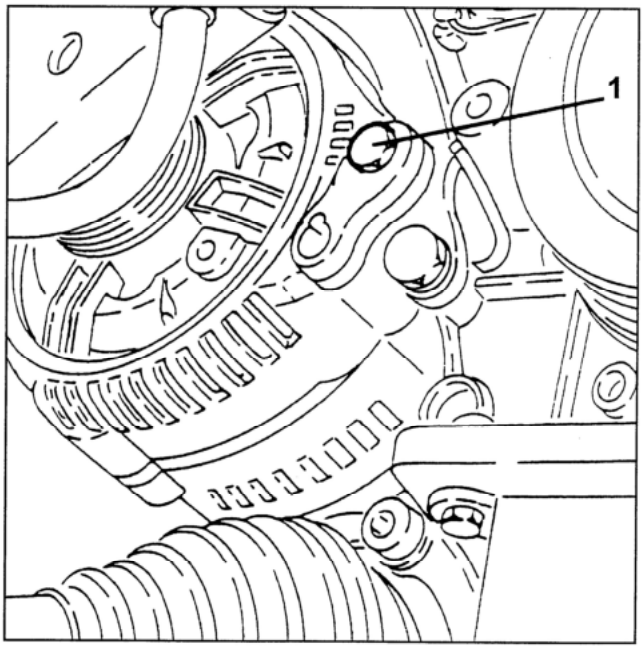



1. Check whether the 1st cylinder piston is at TDC, firing stroke. If not, move it to this position by slightly turning in both directions the auxiliary unit drive pulley fastening nut.

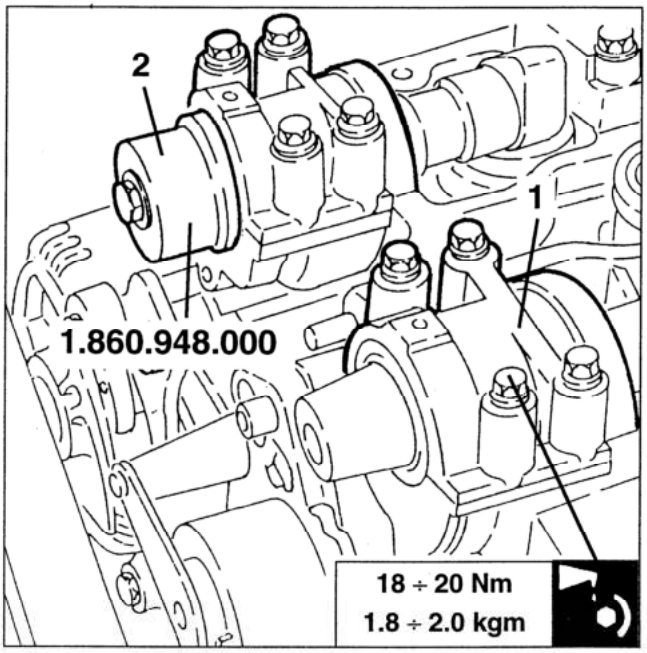
**NOTE: Make sure the last revolution of the crankshaft is in the direction of operation.**



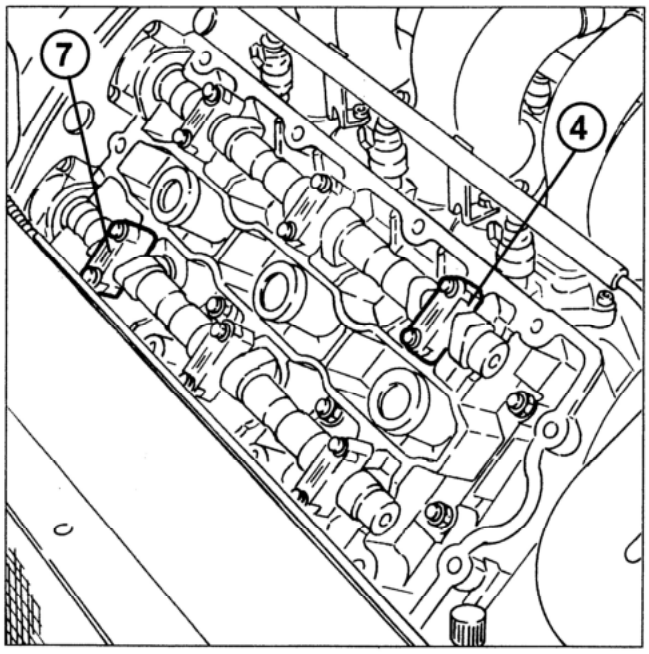

1. Loosen the lower alternator fastening screw to fit the timing belt tension tool.



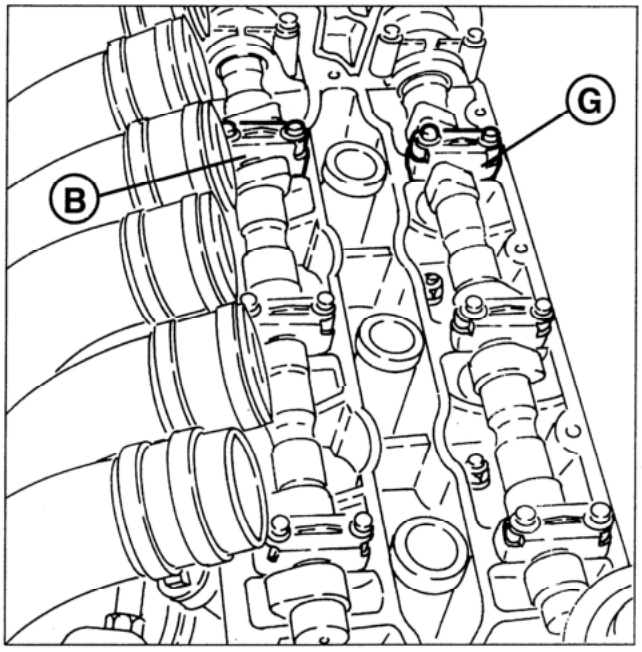
1. Refit the camshaft front caps and tighten the fastening screws to the specified torque.
2. Using tool no. 1.860.948.000, insert new camshaft oil seals.




- Refit the engine stay rod support bracket and the timing gear belt inner guard.
- Remove camshaft caps **4** and **7** for the left cylinder head.

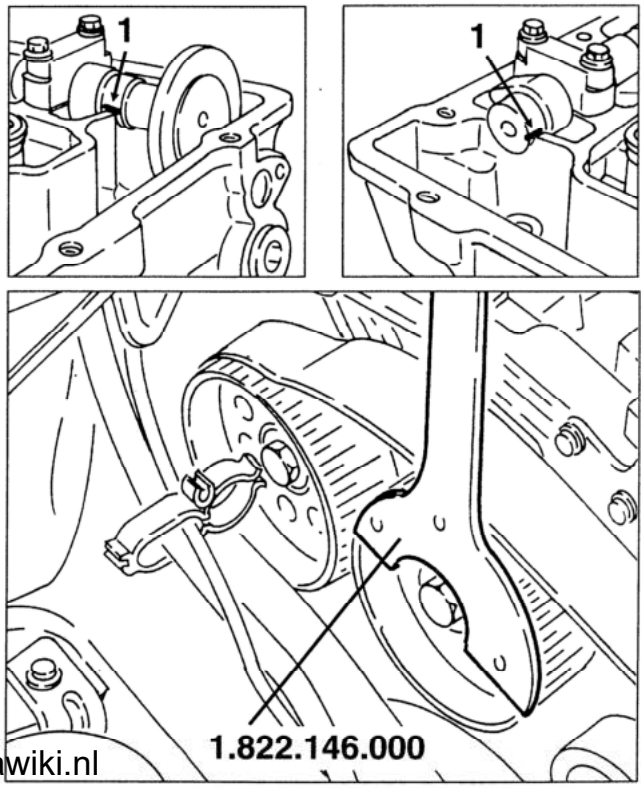



- Remove camshaft caps **B** and **G** for the right cylinder head.



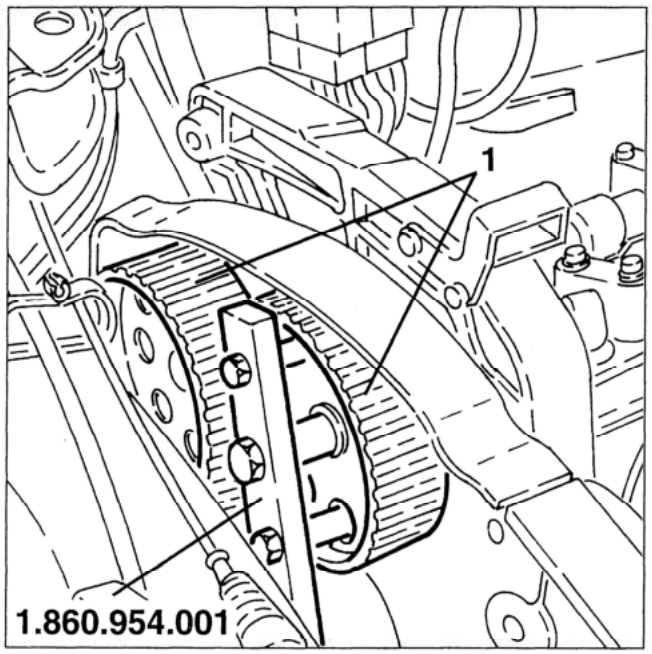

- Refit the camshaft drive pulleys tightening the fastening screws by hand.
1. Using tool no. 1.822.146.000, turn each camshaft until the reference notches on the shafts coincide with the upper surface of the cylinder head.

**NOTE: The reference marks should face towards the centre of each head.**

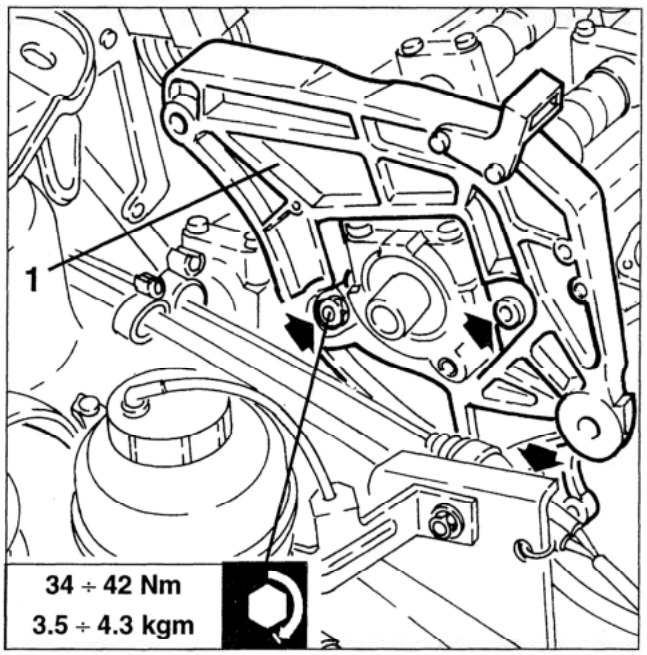



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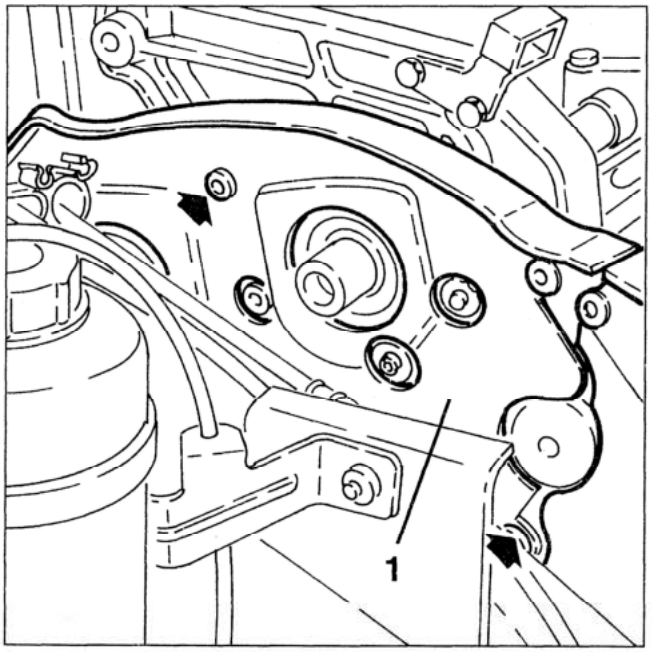
1. Using tool no. 1.860.954.001 pull remove the drive pulleys from the camshafts.



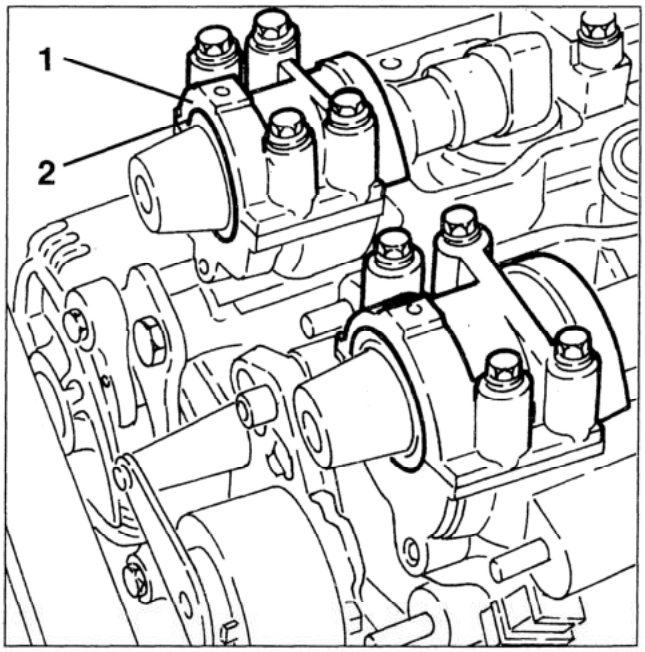

1. Slacken the fastening nuts and remove the engine stay rod support bracket.




1. Slacken the fastening screws and remove the inner timing gear belt guard.




1. Slacken the fastening screws and remove the camshaft front caps.
2. Remove the oil seal rings.

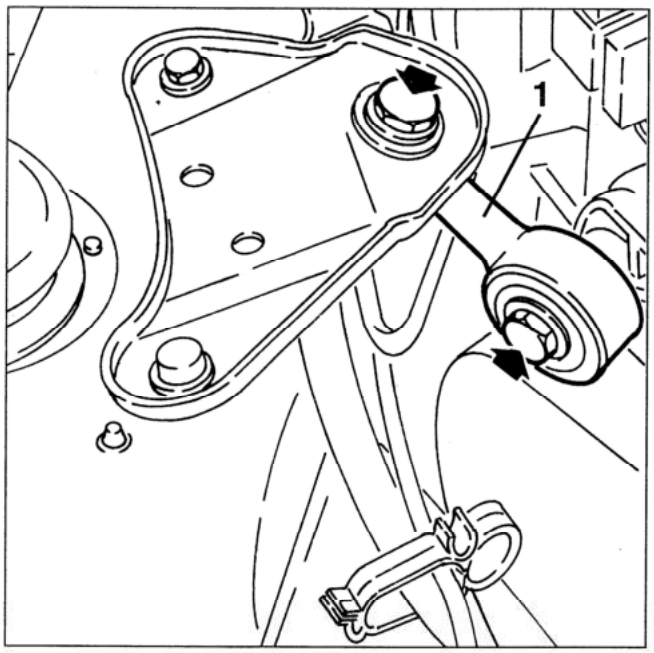



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## CHANGING THE CAMSHAFT OIL SEALS

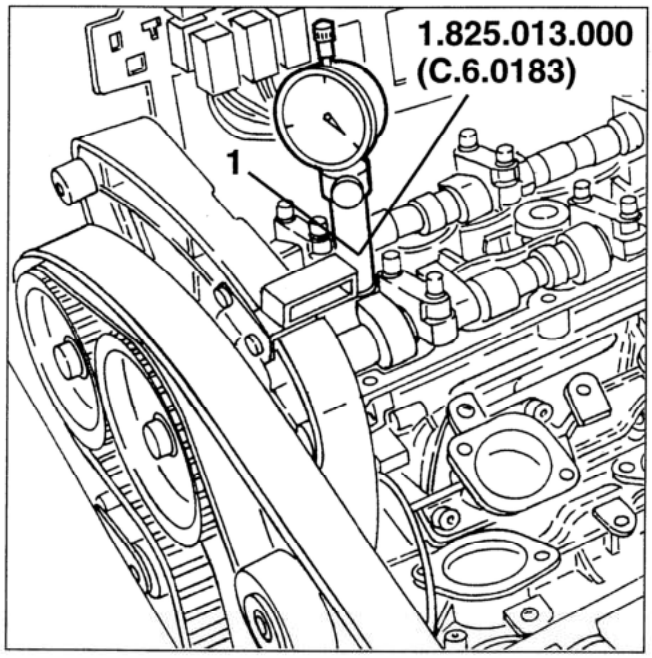
**Proceed as described in Group 00 in the procedure "Changing the timing gear belt" up to removing the cylinder head covers.**

1. Slacken the fastening screws and remove the engine stay rod.

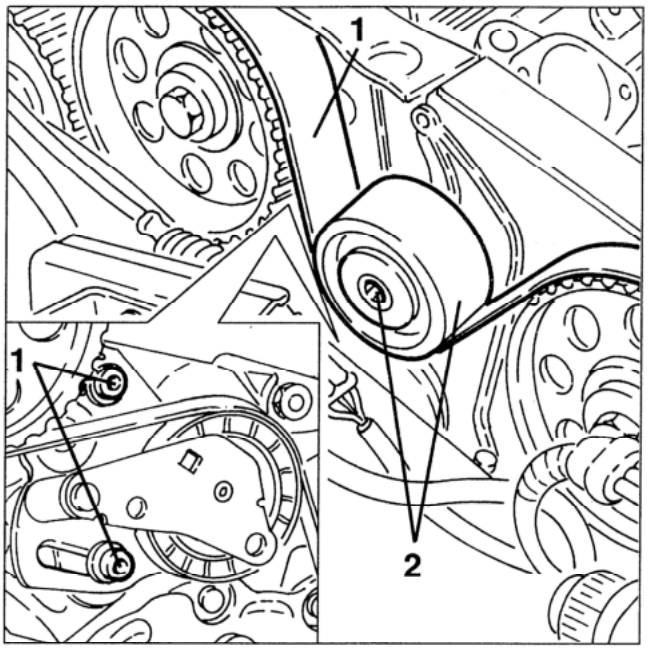



1. Install tool no. 1.825.013.000 (C.6.0183) complete with dial gauge in the seat of the 1st cylinder spark plug.
- Working on the fastening nut of the auxiliary components drive pulley turn the crankshaft slightly (both ways) until the piston of the 1st cylinder reaches T.D.C. in the bursting stroke.

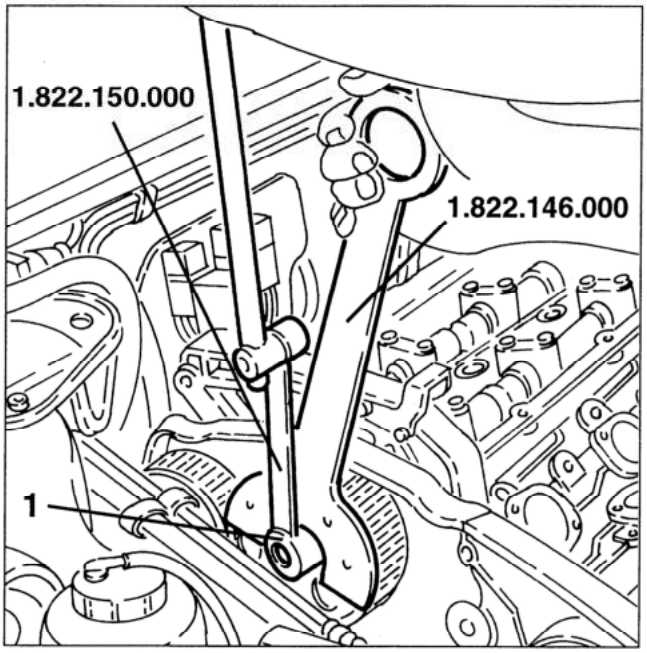
**NOTE: Make sure that the last turn of the crankshaft is in the operating direction.**




1. Slacken the two screws fastening the timing gear drive belt tensioner and remove the belt from the camshaft drive pulleys.
2. Slacken the fastening screw and remove the timing gear drive belt guide pulley.

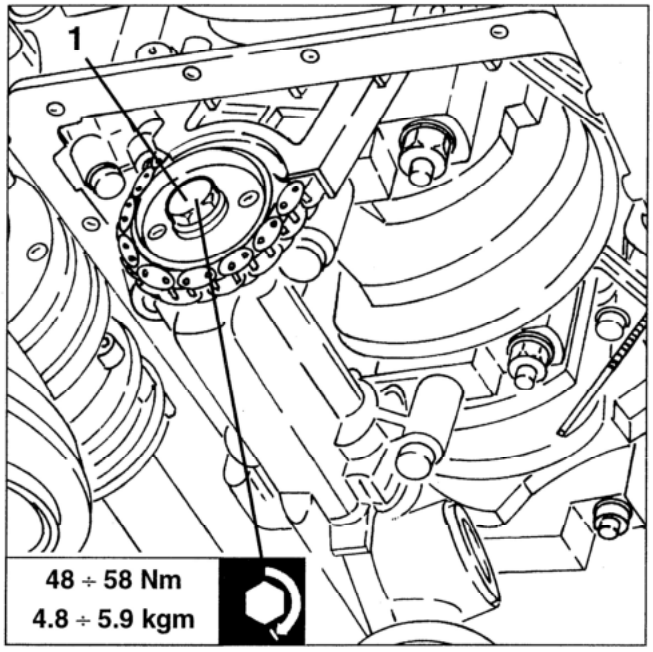



1. Using extension no. 1.822.150.000 and tool no. 1.822.146.000 as counter torque, slacken the screws fastening the camshaft drive pulleys.

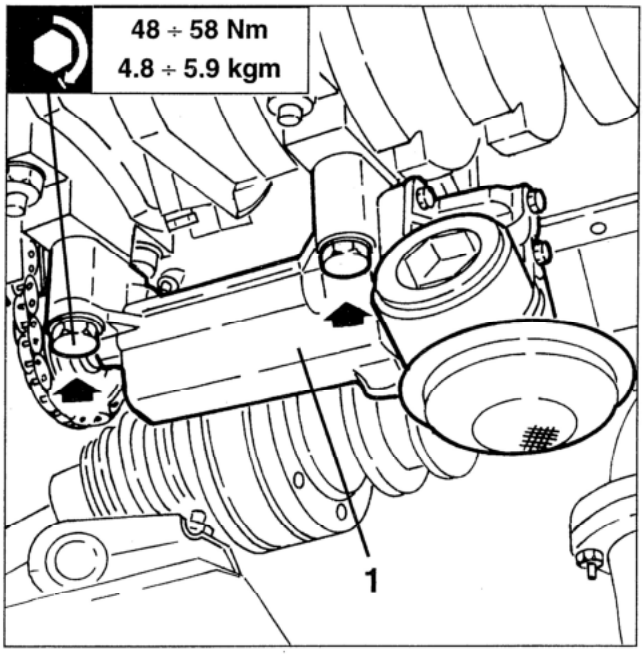



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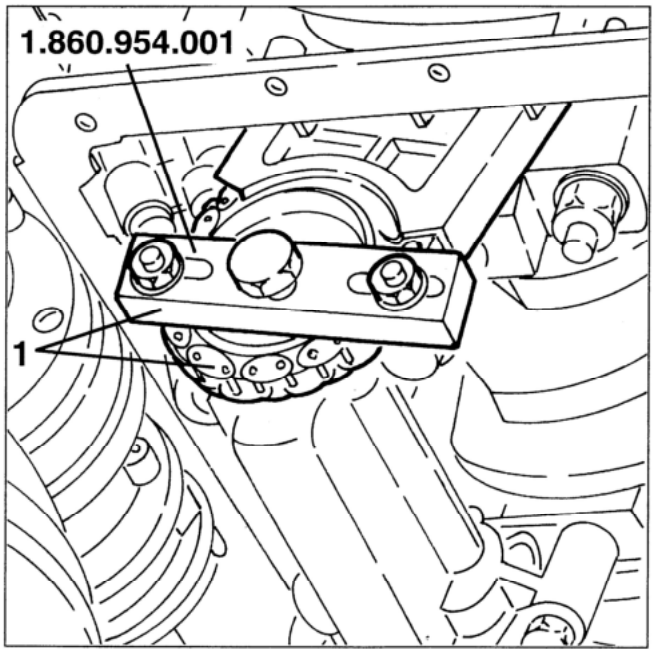
1. Slacken the fastening screw of the oil pump drive gear.



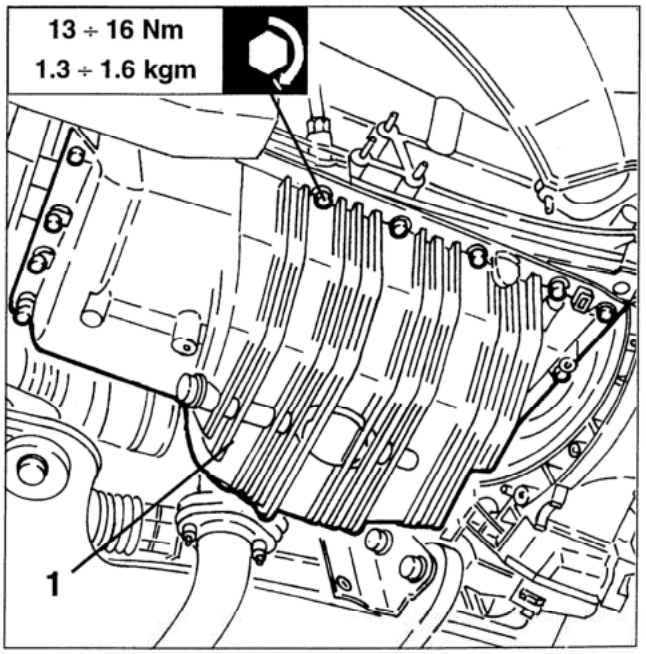

1. Slacken the fastening screws and remove the oil pump complete.




1. Using tool no. 1.860.954.001, remove the drive gear from the oil pump spindle.

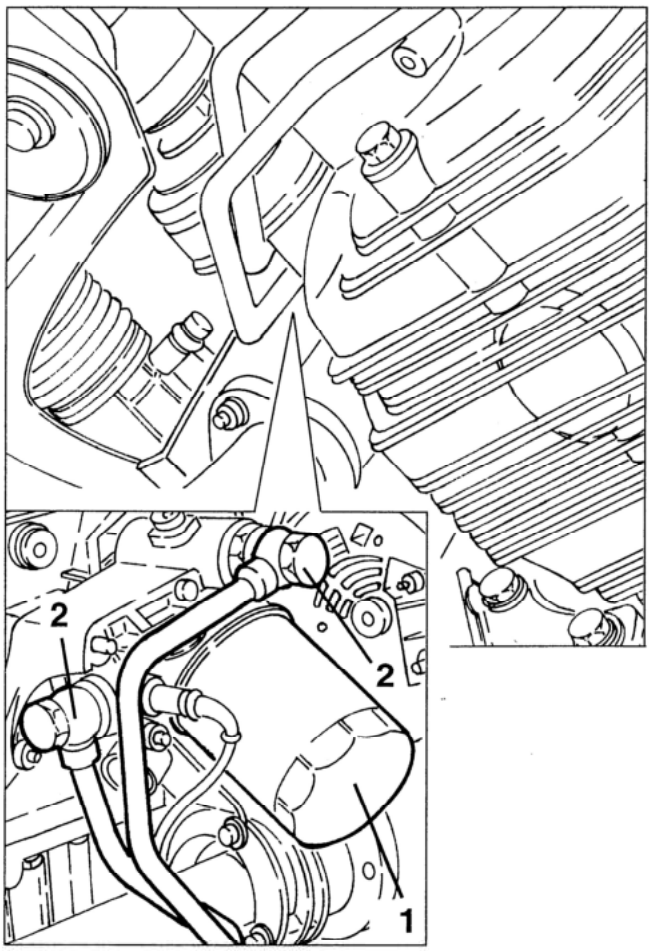



Refit reversing the sequence followed for removal and adhering to the following instructions.
- Remove any traces of sealant on the mating surfaces of the oil sump - crankcase.
- Use a dry cloth to eliminate traces of oil to avoid compromising the sealing.
- Continuously apply (without interruptions) a seam of silicone sealant taking care to join the end with the beginning well.
1. Position the oil sump avoiding horizontal movements which could remove the silicone sealant, then tighten the oil sump fastening screws to the specified torque.

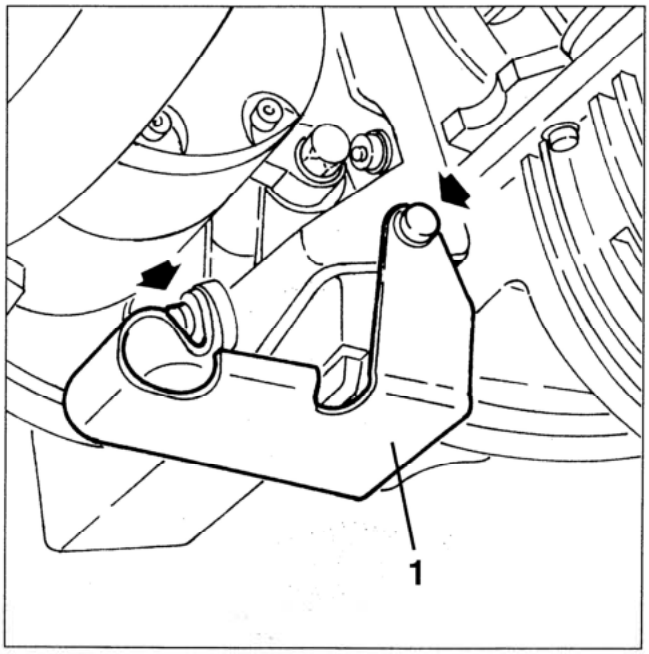



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1. Using a suitable wrench, slacken and remove the oil filter.
2. From the oil filter support disconnect the fittings of the radiator oil delivery and return pipes.

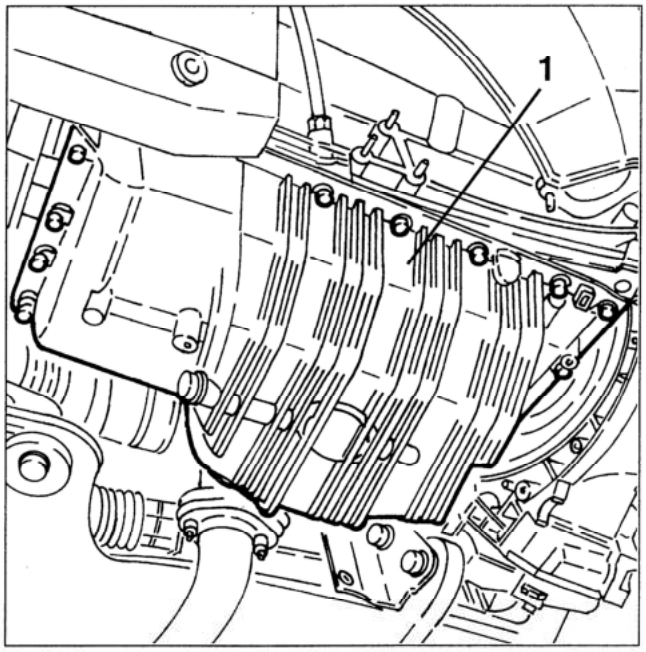



1. Slacken the fastening screws and remove the engine oil delivery and return pipe support bracket to the radiator, then without disconnecting the latter restrain them temporarily so that they do not hinder the following operations.

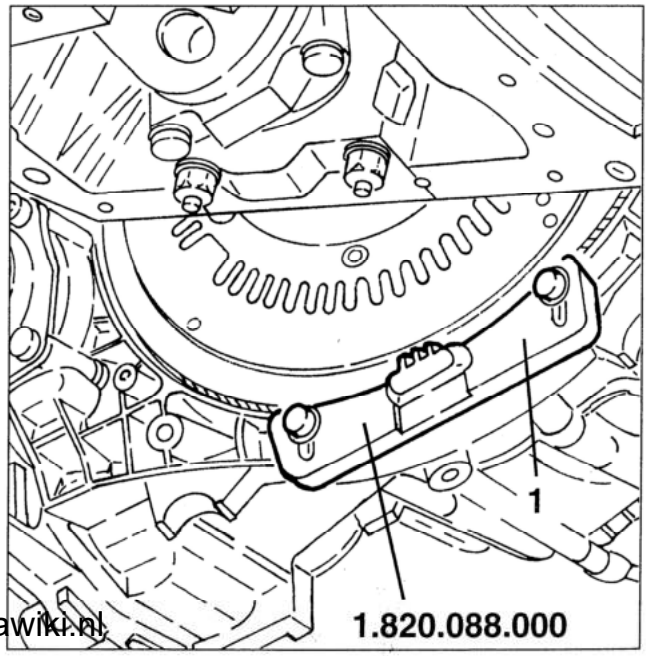



1. Slacken the fastening screws and remove the oil sump.

**WARNING:**
**Sealant is applied between the oil sump and crankcase to ensure tightness; when the sump is removed it is necessary to cut the sealant taking care not to damage that in the two holes of the rear main bearing cap.**
**If not, restore the sealant inside the holes.**




1. Install flywheel stopper tool no. 1.820.088.000.



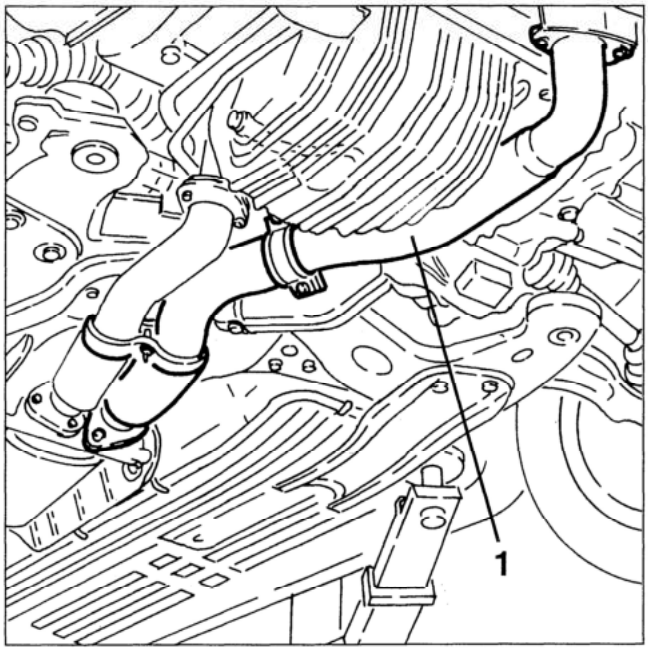

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# OIL PUMP

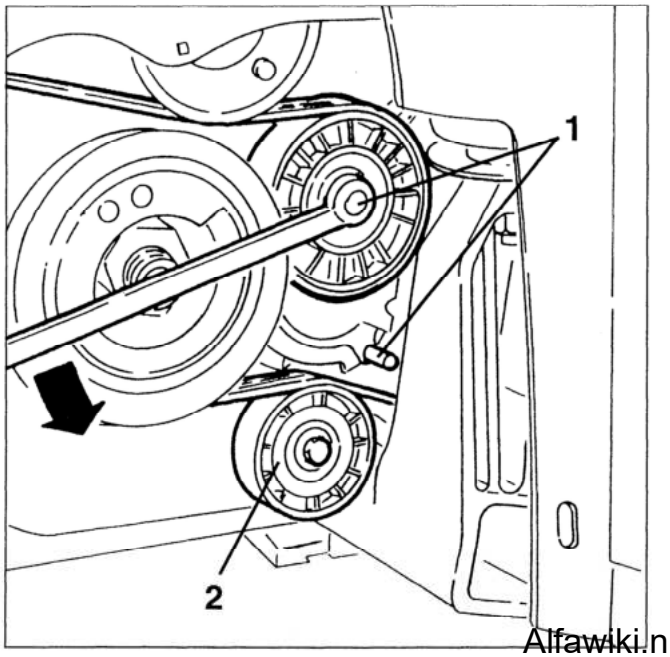
## REMOVING/REFITTING

- Set the car on a lift.
- Disconnect the battery(-) terminal.
- Remove the right front wheel and mud flap.
- Drain the engine oil (see Group 00).

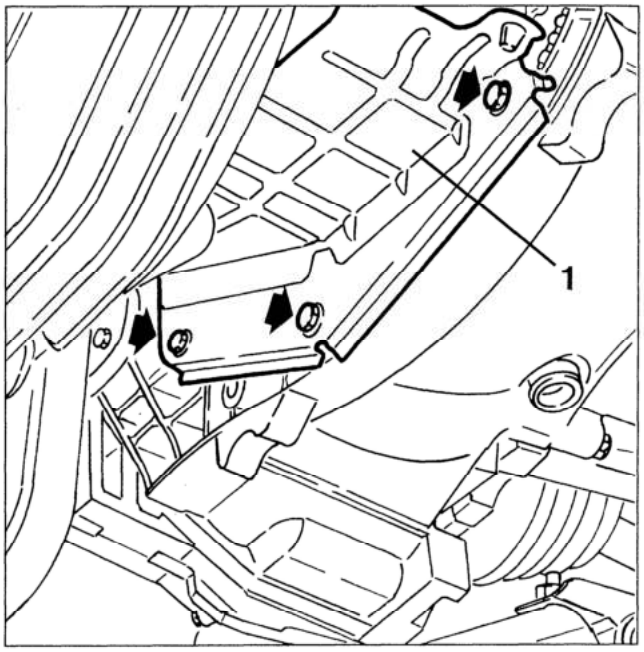
1. Slacken the fastenings, then remove the front section of the exhaust pipe only from the left cylinder head.



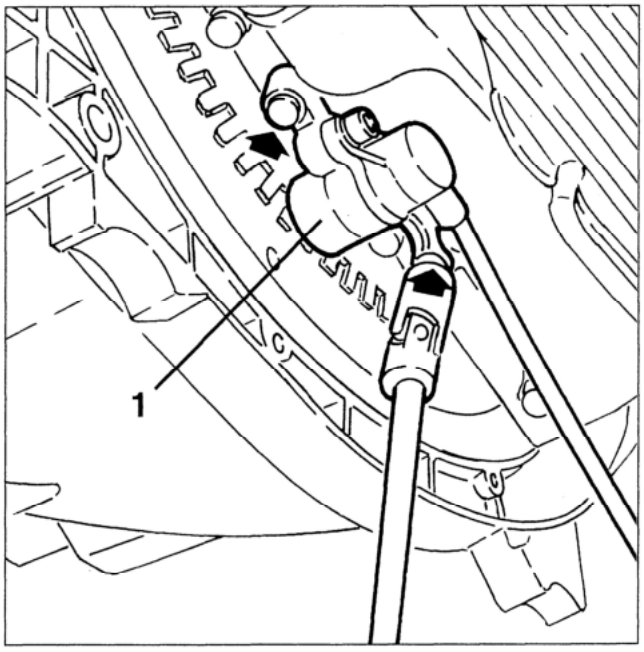

1. Using a wrench on the screw fastening the belt tensioner pulley, overcome the force of the tensioner and lock it in this position (belt slack) inserting the special peg as illustrated.
2. Slacken the fastening screw and remove the lower guide pulley of the auxiliary components drive belt.




1. Slacken the fastening screws and remove the flywheel guard.

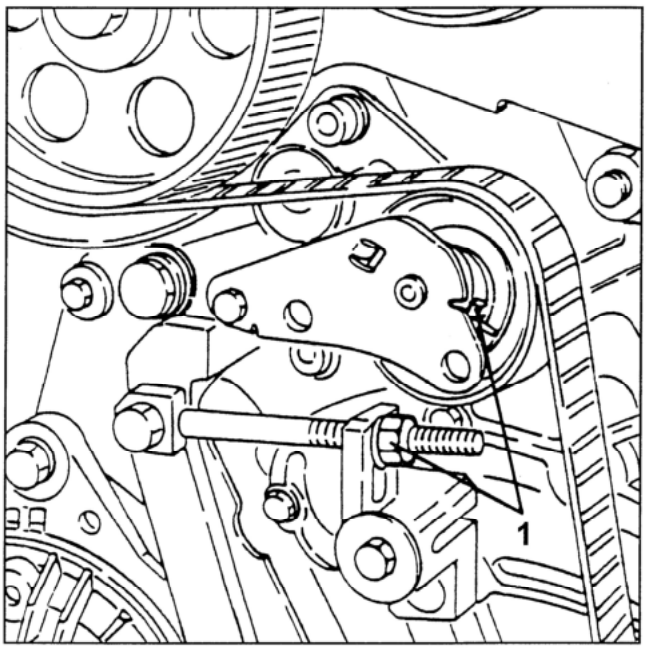



1. Slacken the fastening screws and remove the rpm and timing sensor.

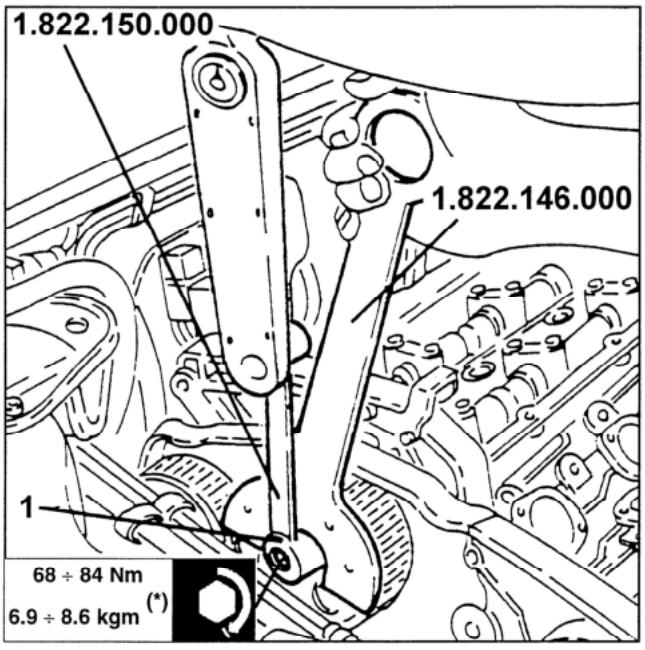



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1. Take the mobile notch under the belt take-up fixed notch as shown in the figure.

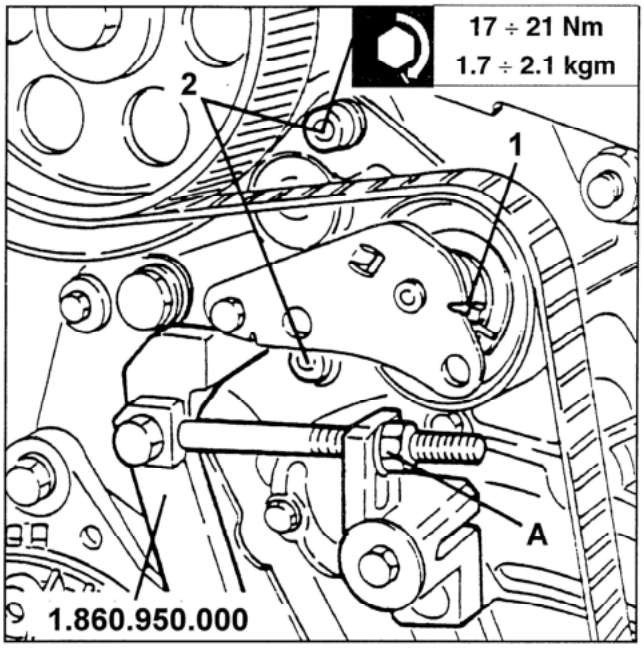



1. Use extension no. 1.822.150.000 and tool no. 1.822.146.000 to contrast torque. Fasten the camshaft drive pulley screws at the prescribed torque.




**(*): Nominal value**

- Remove the previously fitted templates no. 1.825.040.000. Fit the previously fitted bearings in their place and fasten the screws at the prescribed torque.
- Turn the crankshaft twice in the direction of revolution to fit the timing belt well.
1. Check whether the fixed notch on the belt take-up coincides with the mobile notch. If not, loosen the belt take-up tension by turning nut (A) until the notches meet.
2. Torque the belt take-up fastening nuts as prescribed and remove belt tension tool no. 1.860.950.000.




- Complete refitting by reversing the removal sequence.

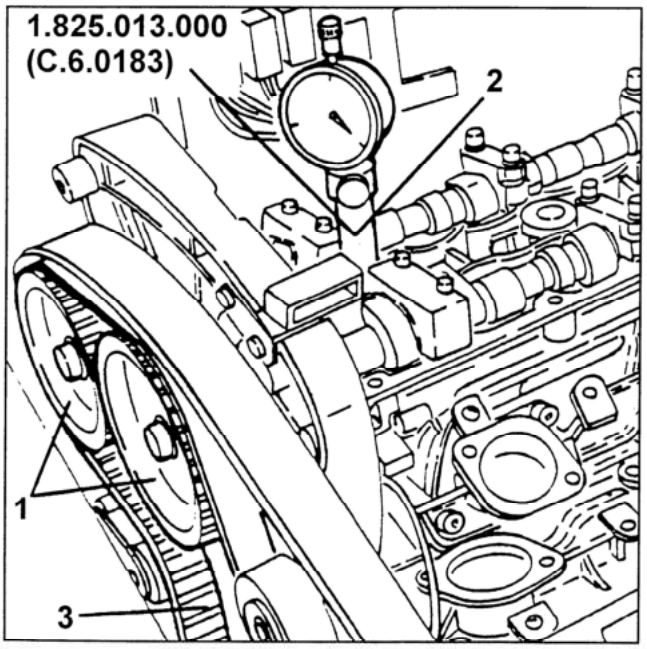
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**NOTE: ASTADUR cylinder head seals are used. The special material the seals are made of polymerises during engine operation and consequently becomes very hard.**
**The following precautions are required to ensure cylinder head seal polymerisation:**
**- keep the seals closed in their nylon bags;**
**- take them out of the packaging just before fitting;**
**- do not lubricate or soil the seals with oil. Make sure the cylinder head and crankcase surface are clean.**

1. Reverse the removal sequence and refit the right-hand cylinder head camshaft drive pulleys, fastening the screws by hand.
- Use extension no. 1.822.150.000 and tool no. 1.822.146.000 to contrast torque. Loosen the left-hand cylinder head camshaft drive pulley fastening screws.
- Use tool no. 1.860.954.001. Extract the left-hand cylinder head camshaft drive pulleys are reposition them fastening the screws by hand.
2. Check whether the 1st cylinder piston is at TDC, firing stroke. If not, move it to this position by slightly turning in both directions the auxiliary unit drive pulley fastening nut.

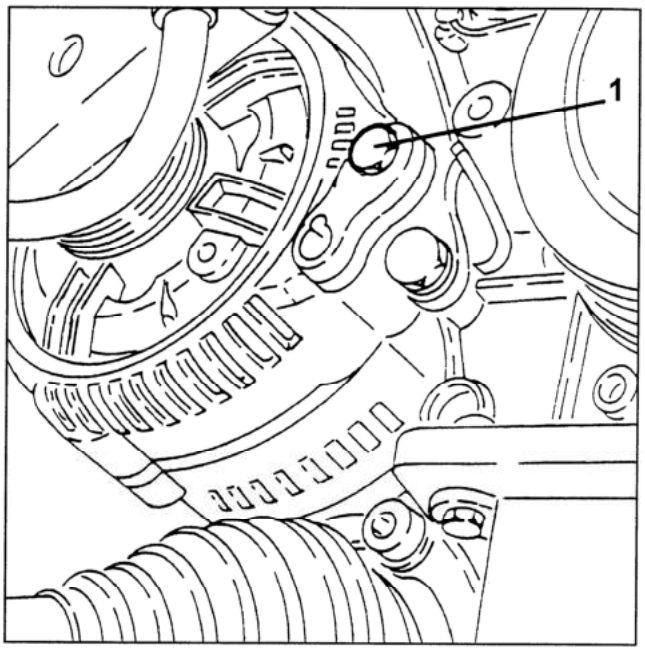
**NOTE: Make sure the last revolution of the crankshaft is in the direction of operation.**

3. Fit the camshaft drive pulley drive belt.

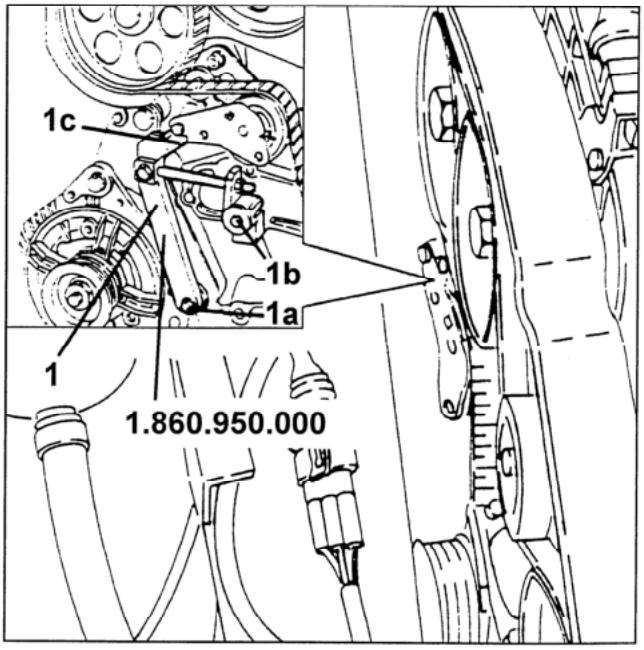



- Remove the cylinder head alternator bracket upper screw.

1. Loosen the lower alternator fastening screw to fit the timing belt tension tool.

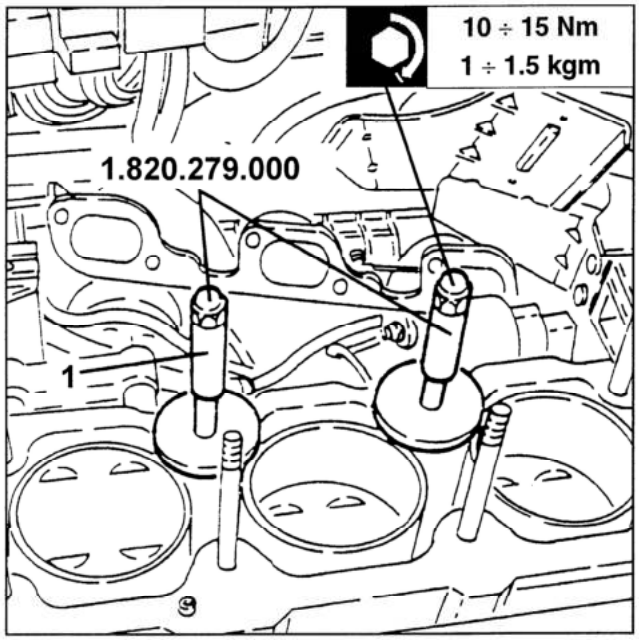



1. Fit timing belt tension tool no. 1.860.950.000 and fasten the previously loosened screw (1b) to the coolant pump; tool pin (1c) should contrast the belt take-up device mobile part.



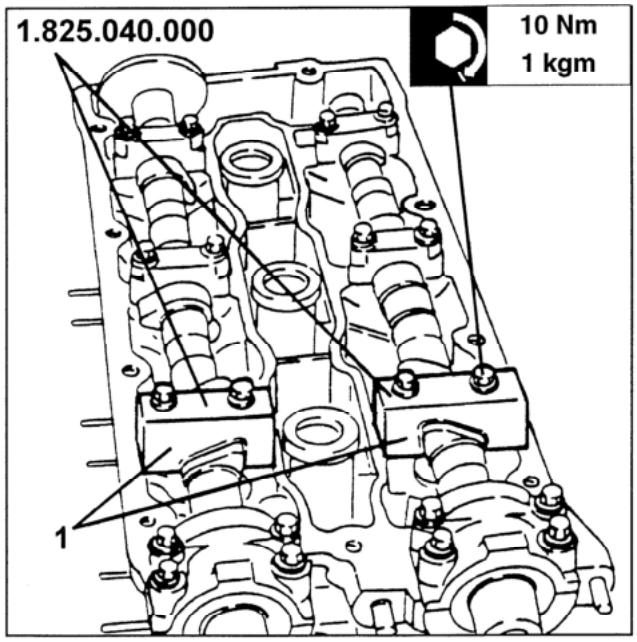

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1. Fit cylinder liner retainer no. 1.820.279.000 as shown in the figure.

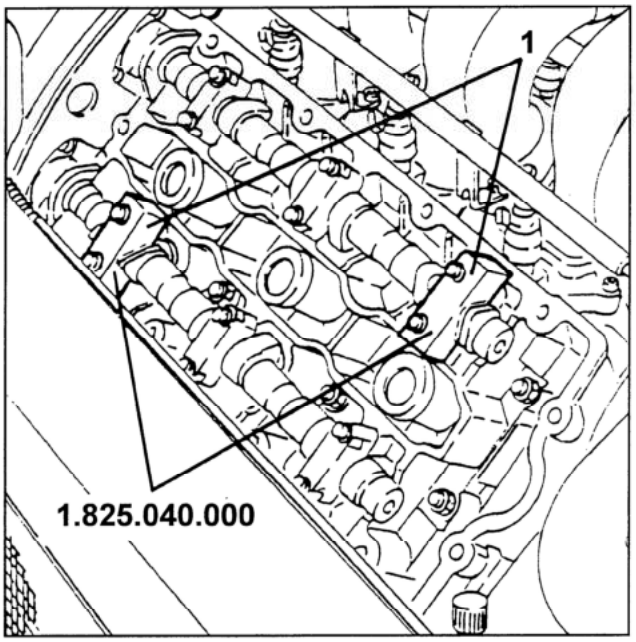



## REFITTING PRECAUTIONS

Reverse the removal sequence and attain to the following precautions.
1. Fit templates no. 1.825.040.000 in the position printed on the templates in the place of camshaft bearings **B** and **G** after overhauling the removed cylinder head and before refitting it on the engine.



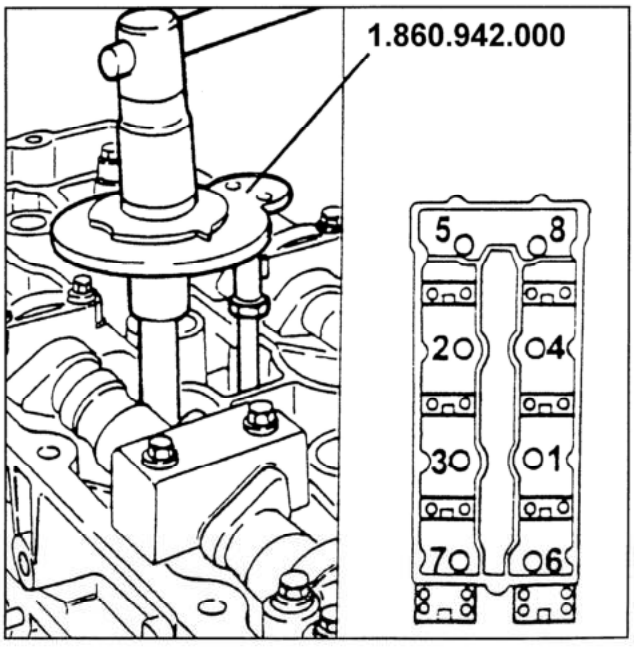

1. Fit templates no. 1.825.040.000 in the position printed on the templates in the place of camshaft bearings **7** and **4**.




- Remove the previously fitted cylinder liner retainers no. 1.820.279.000.
- Refit the right-hand cylinder head to the crankcase.
- Lubricate threading, nuts and washers with engine oil and torque as shown below in the order shown in the figure.

NOTE: Use the tool and gauge no. 1.860.942.000 for angle torque.

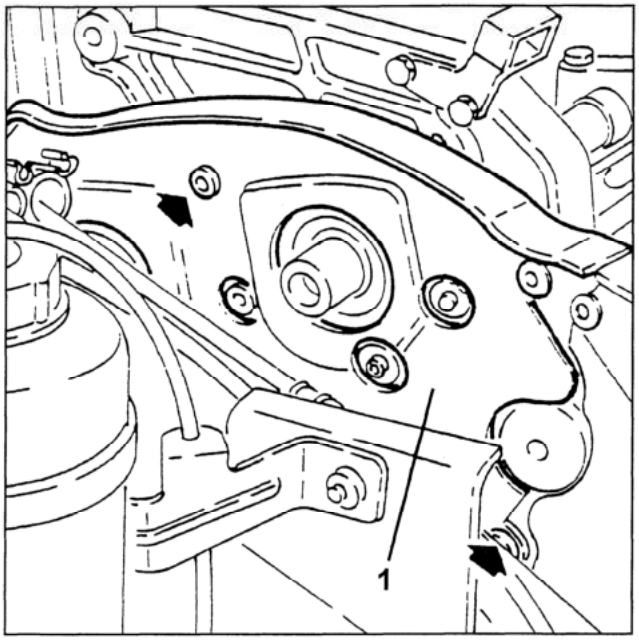
| Tightening procedure | |
|---|---|
| Tighten all nuts at: | 24 ÷ 26 Nm<br>2.5 ÷ 2.7 kgm |
| Complete torque with additional: | 240° ± 2° |



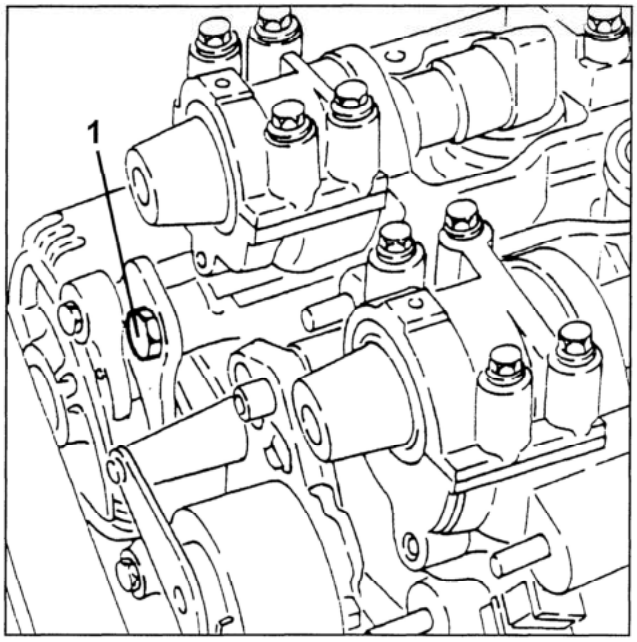


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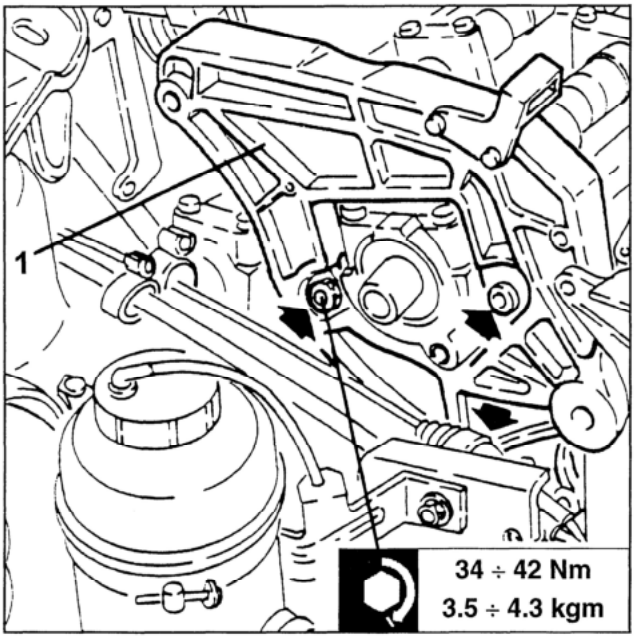
1. Loosen the fastening screws and remove the right-hand cylinder head from the timing belt internal guard.



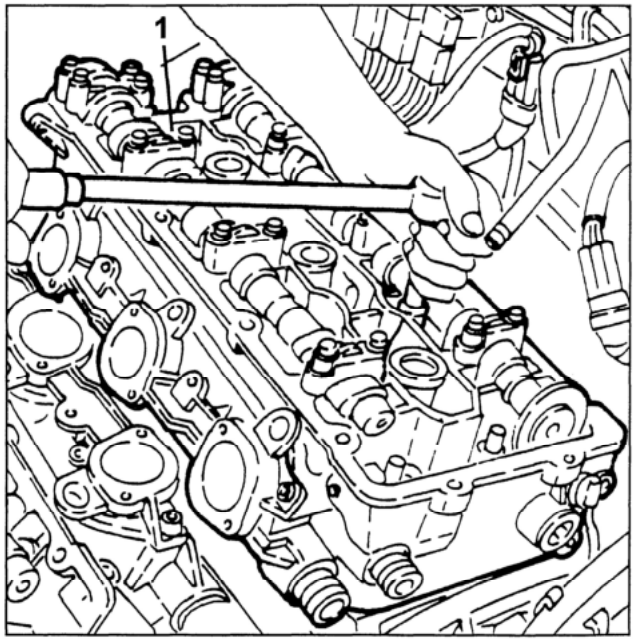

1. Loosen the upper alternator fastening bracket screw.




1. Loosen the fastening nuts and remove the engine shock-proof connecting rod bracket.

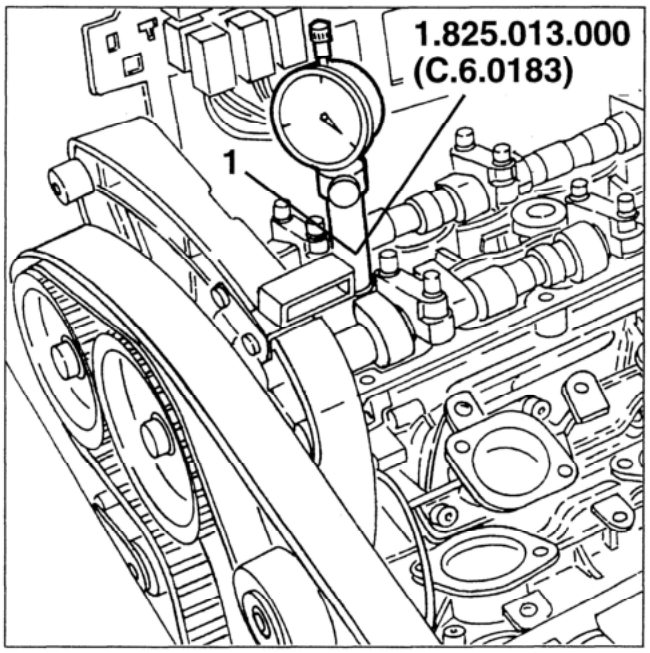



1. Loosen the fastening nuts and remove the right-hand cylinder head.
- Remove the respective seal.

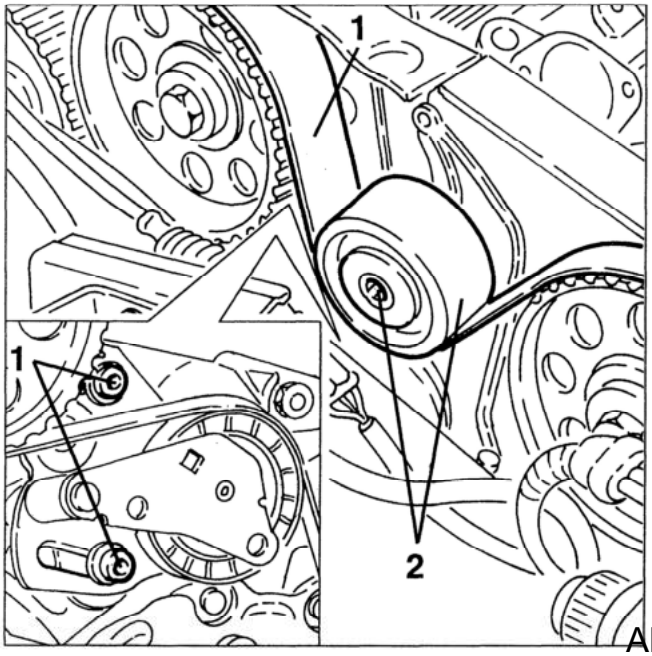


- Slacken the fastening nuts of the exhaust manifold of the right cylinder head, complete with heat guard and leave it rested against the power steering box.
1. Install tool no. 1.825.013.000 (C.6.0183) in the seat of the first cylinder spark plug.
- Working on the fastening nut of the auxiliary components drive pulley turn the crankshaft slightly (both ways) until the piston of the 1st cylnder reaches T.D.C. in the bursting stroke.

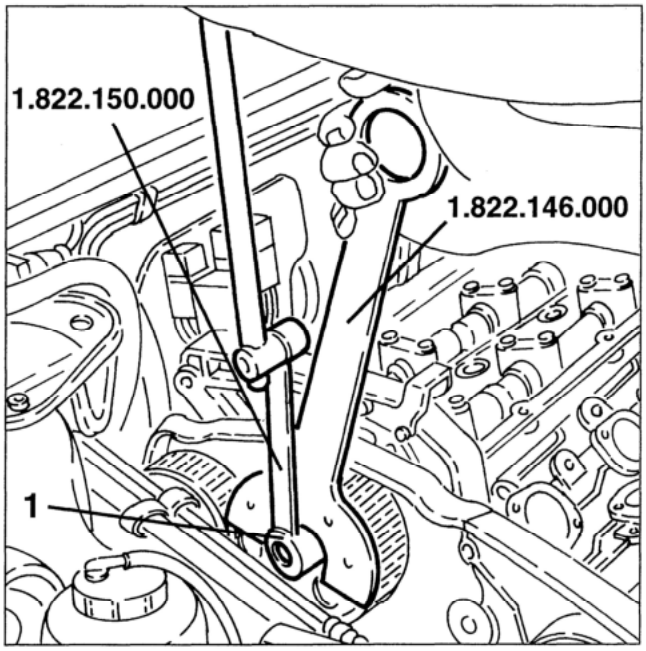
**NOTE: Make sure that the last turn of the crankshaft is in the operating direction.**



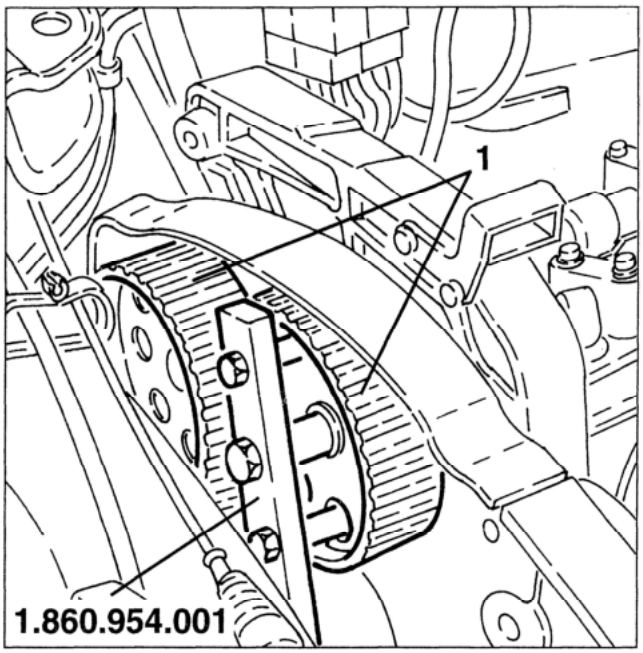

1. Slacken the two screws fastening the belt tensioner for the timing gear drive belt and prise the belt off the camshaft drive pulleys.
2. Slacken the fastening screw and remove the timing gear drive belt pulley guide.




1. Using extension no. 1.822.150.000 and tool no. 1.822.146.000 as counter torque, slacken the screws fastening the timing gear drive pulleys of the right cylinder head.

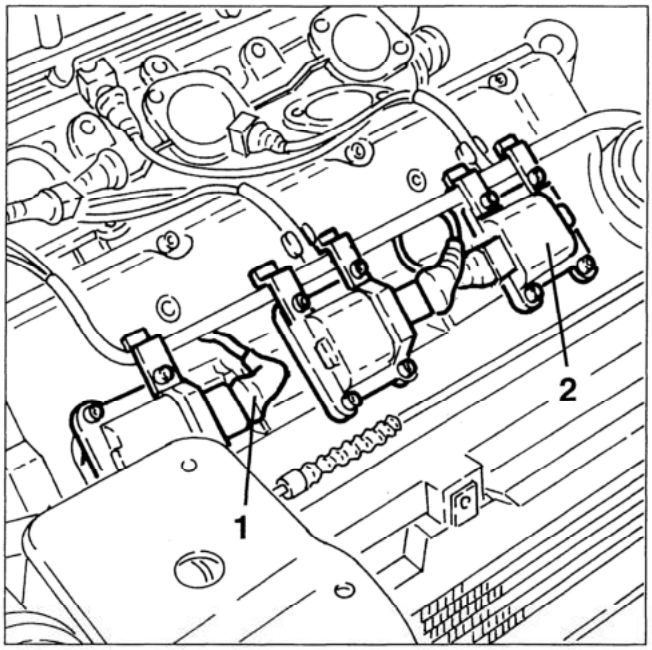



1. Using tool no. 1.860.954.001 withdraw and remove the drive pulleys from the camshafts of the right cylinder head.

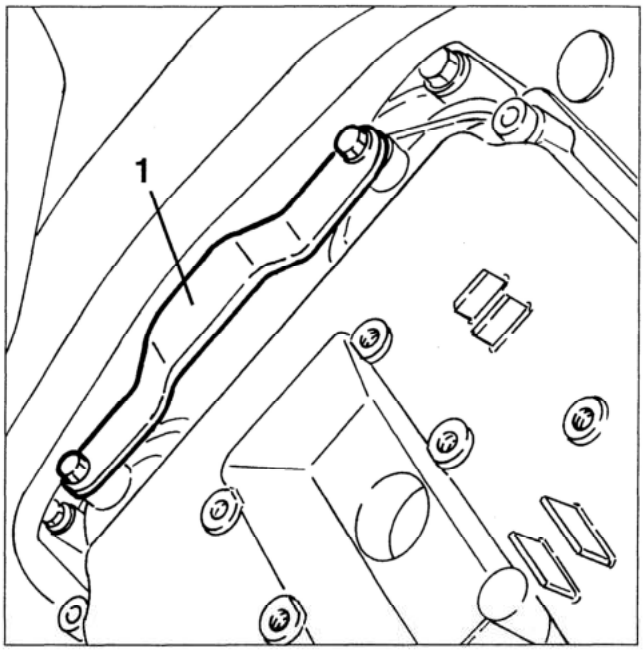



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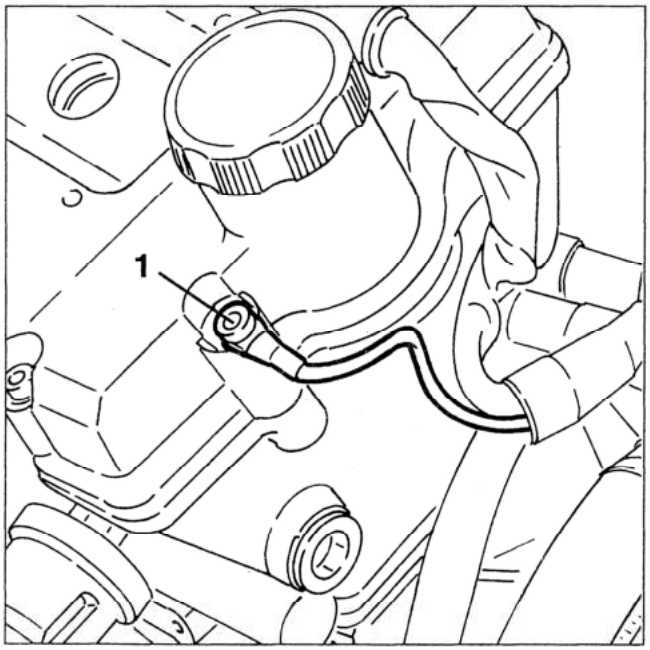
1. Disconnect the electrical connections from the left cylinder head ignition coils.
2. Slacken the fastening screws and remove the left cylinder head ignition coils.



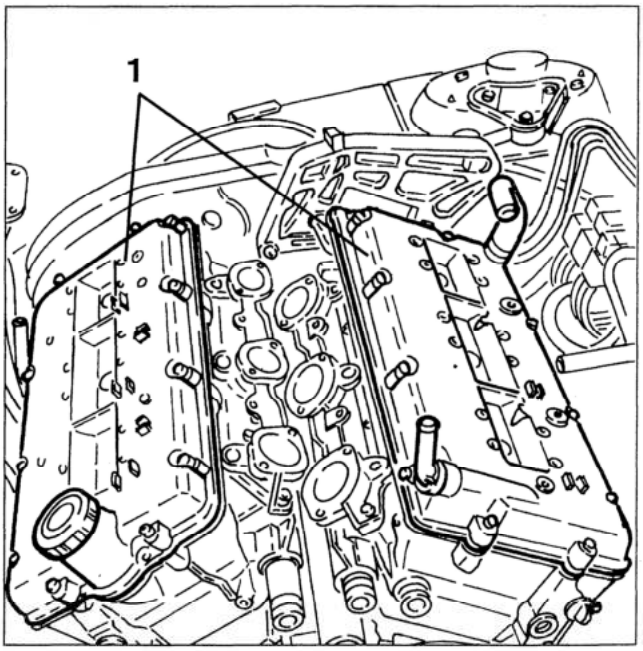

1. Slacken the fastening screws and remove the, bracket complete with threaded nut for fastening the timing gear belt upper guard from the left cylinder head.




1. Disconnect the earth cable from the left cylinder head, then move aside the wiring.

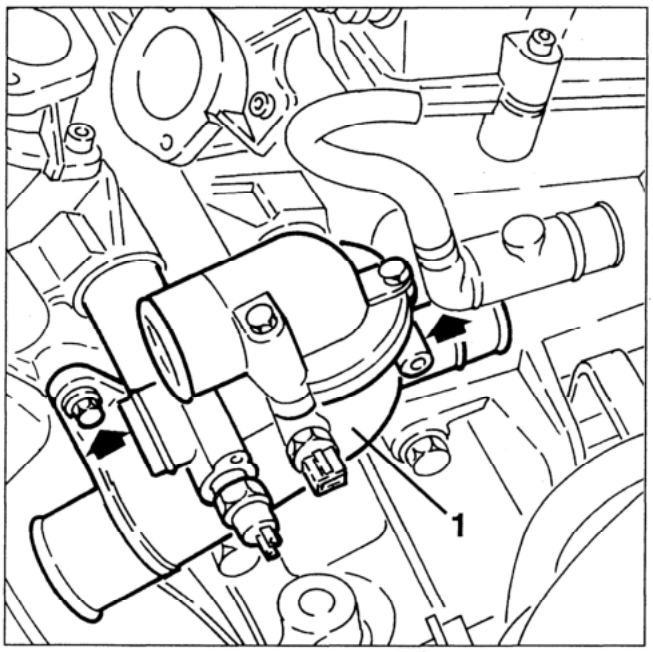



1. Slacken the fastening screws and remove the cylinder head covers with their seals.

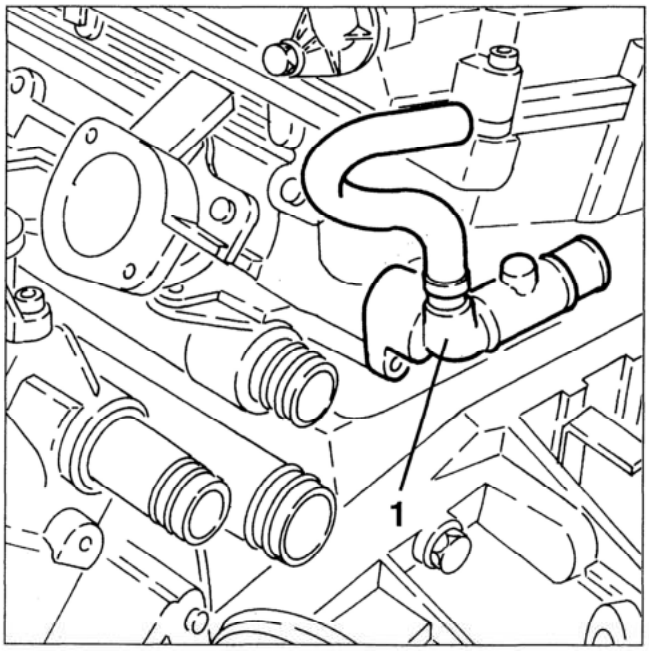



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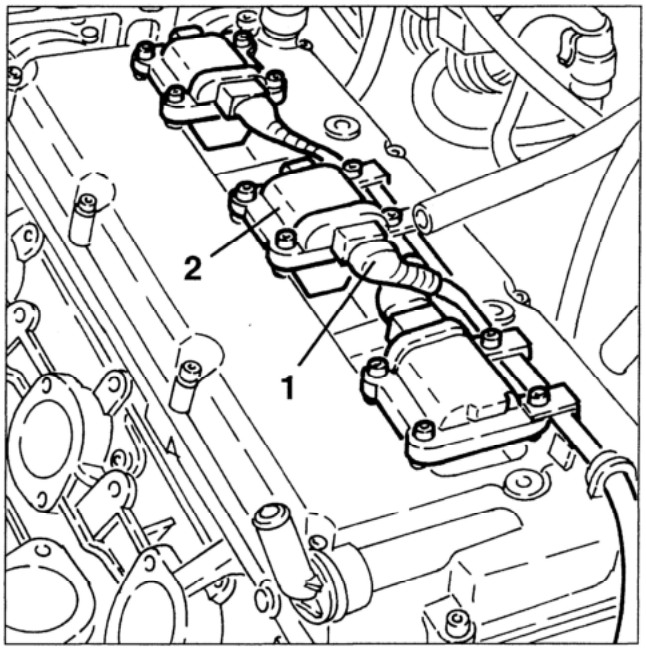
1. Slacken the fastening screws and remove the thermostatic cup.



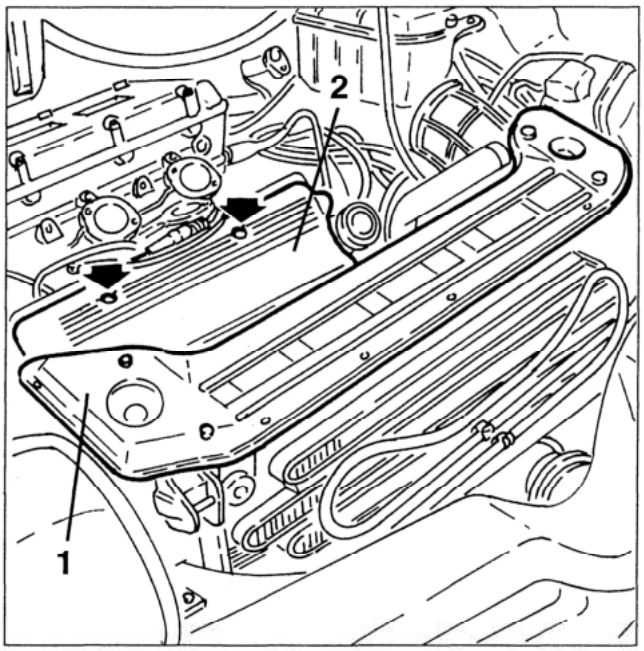

1. Withdraw and remove the fitting for the coolant fluid delivery pipe to the climate control system heater.




1. Disconnect the electrical connections from the ignition coils of the right cylinder head, then move the wiring aside.
2. Slacken the fastening screws and remove the right cylinder head ignition coils.

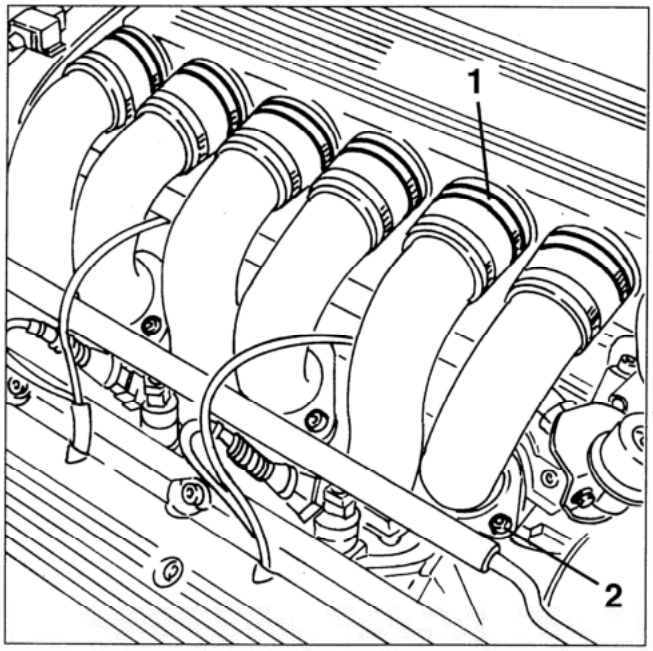



1. Slacken the fastening screws and remove the upper radiator crossmember.
2. Slacken the fastening screws and remove the left cylinder head ignition coil cover.

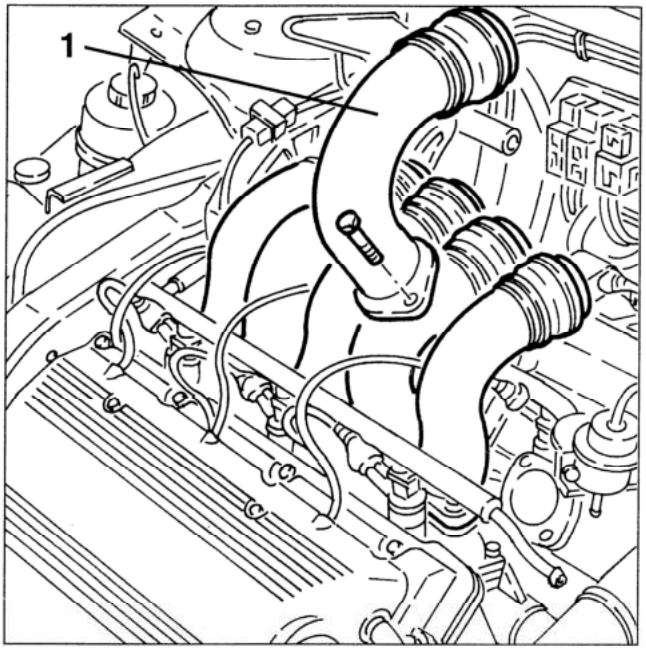



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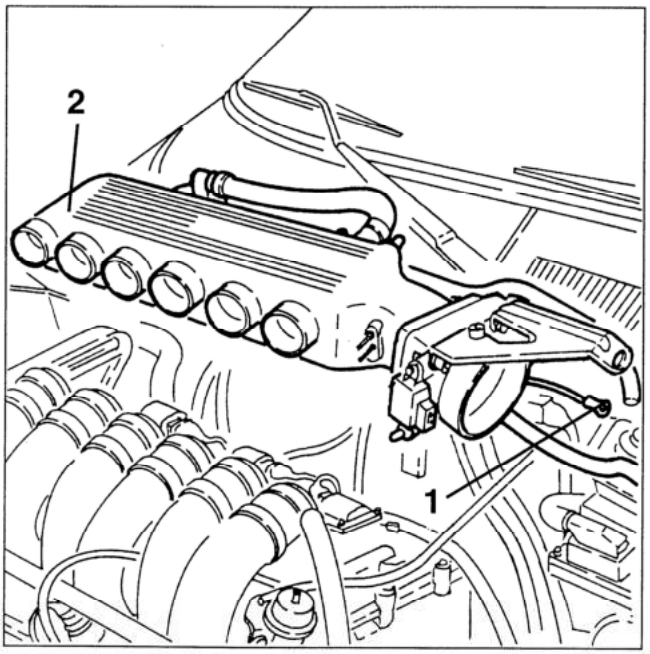
1. Slacken the clamps fastening the air ducts to the intake box.
2. Slacken the screws fastening cylinder head supply ducts.



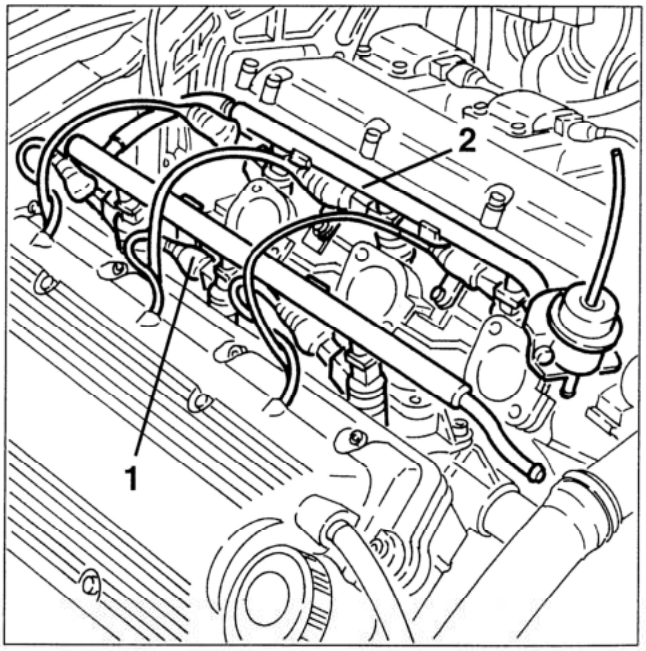

1. Completely slacken the fastening screws loosened previously and remove the intake ducts.
- Remove the corresponding seals.




1. Disconnect the earth cable (rear) from the intake box.
2. Slacken the two fastening screws and remove the intake box complete.

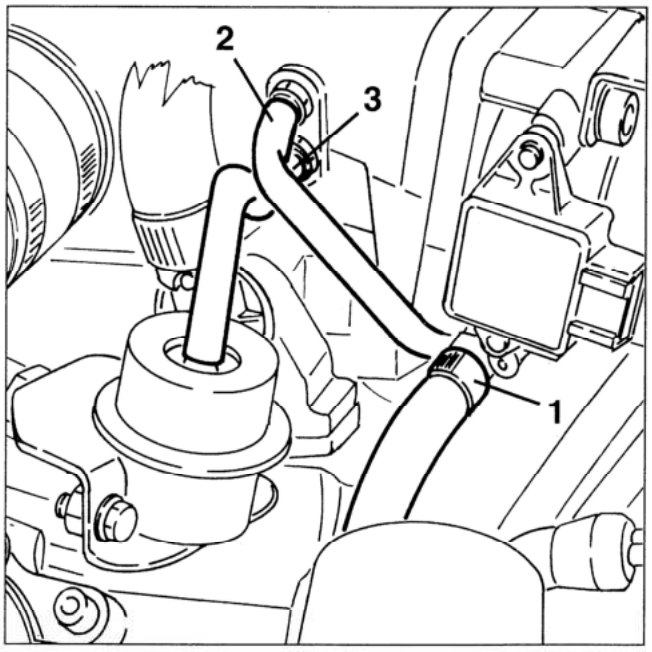



1. Disconnect the injector electrical connections.
2. Slacken the fastening screws and remove the fuel distributor manifold complete.

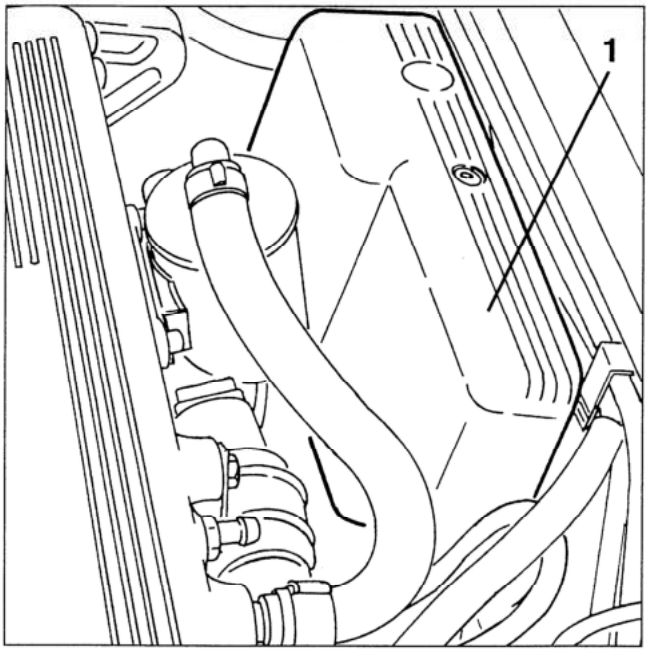



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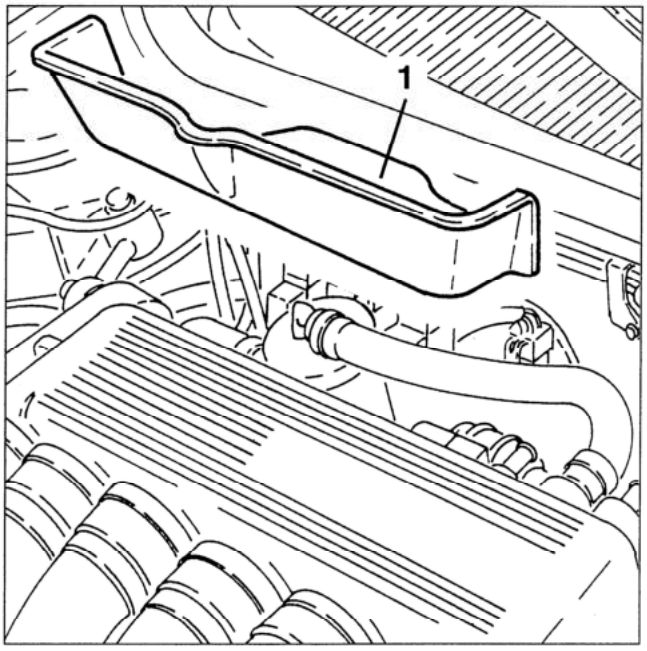
1. Disconnect the coolant fluid inlet pipe from the throttle body.
2. Disconnect the vacuum takeoff pipe for the E.G.R. modulating solenoid valve from the intake box.
3. Disconnect the fuel pressure regulator vacuum take off pipe from the intake box.



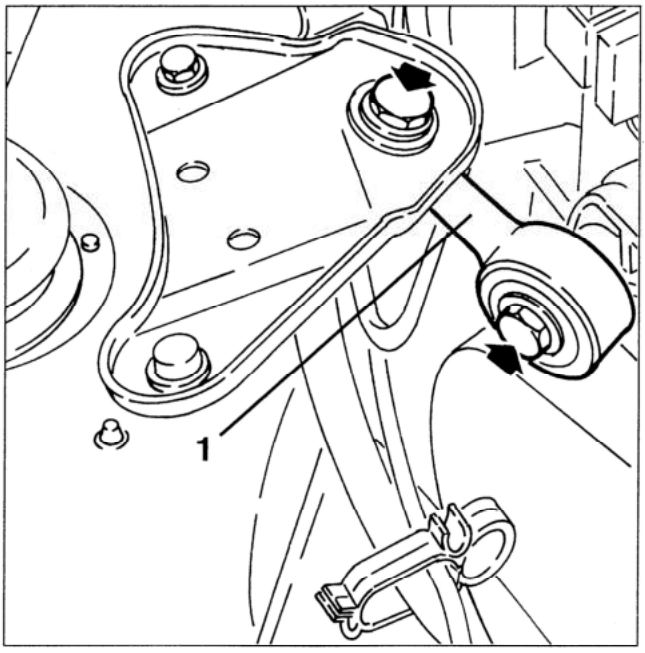

1. Remove the plastic cover protecting the relays, fuses and electrical connections.




1. Slacken the fastenings and remove the heat guard.

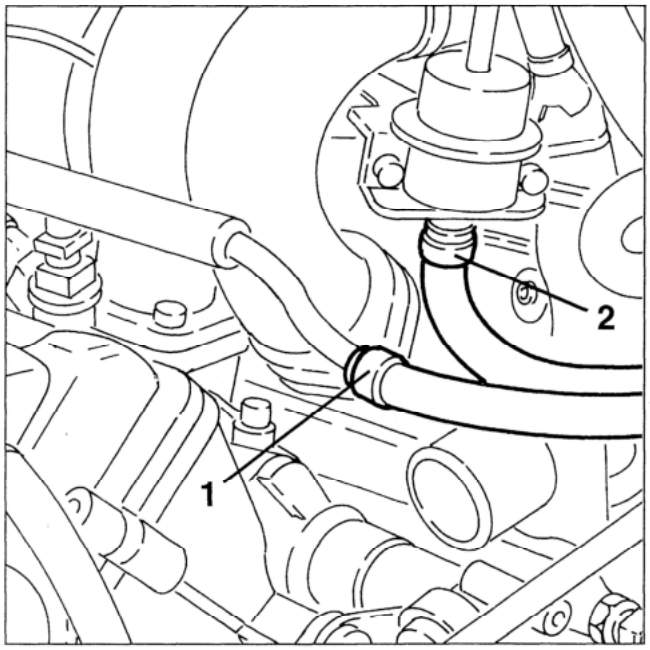



1. Slacken the fastening screws and remove the engine stay rod.

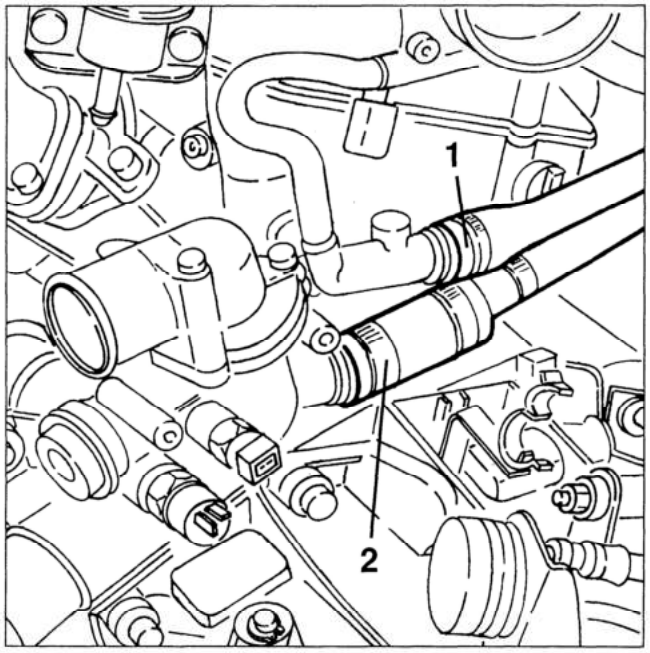



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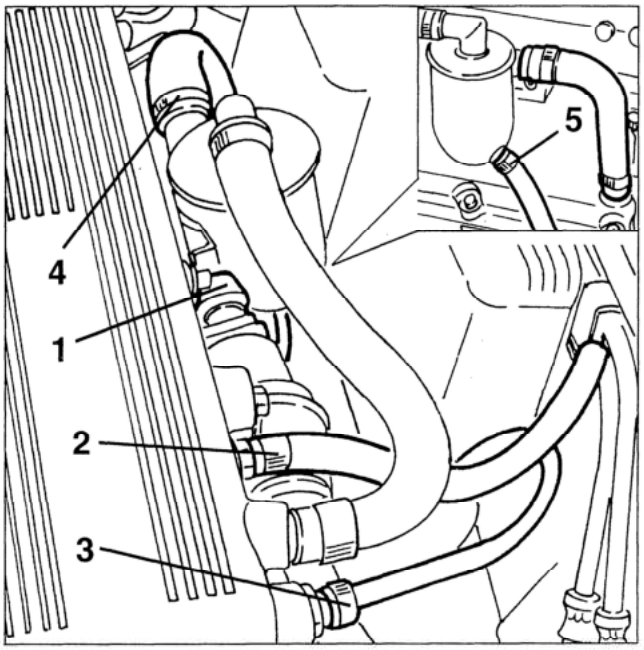
1. Disconnect the fuel delivery pipe from the distributor manifold.
2. Disconnect the excess fuel return pipe from the pressure regulator.



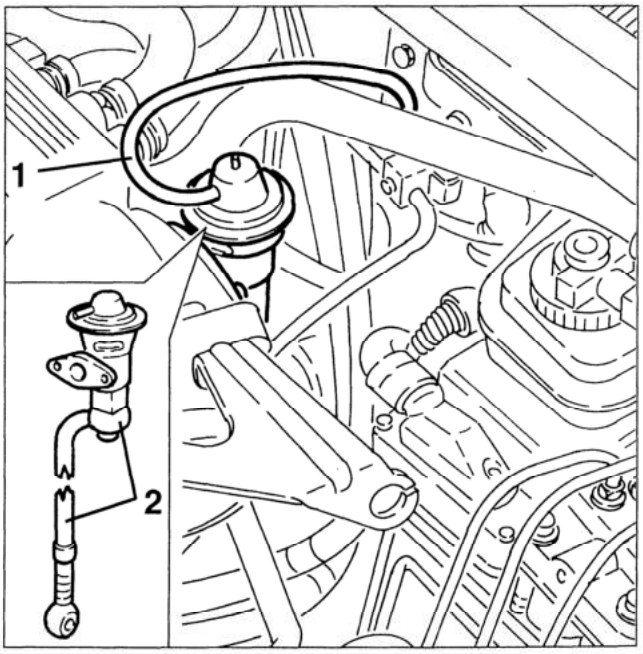

1. Disconnect the climate control system heater coolant delivery sleeve from the fitting on the cylinder head.
2. Disconnect the climate control system heater coolant return sleeve from the thermostatic cup.




1. Disconnect the electrical connection from the constant idle speed device.
2. Disconnect the fuel vapour recovery pipe from the intake box.
3. Disconnect the servobrake vacuum takeoff pipe from the intake box.
4. Disconnect the oil vapour recovery pipe from the separator.
5. Disconnect the condensed oil recovery pipe from the separator.

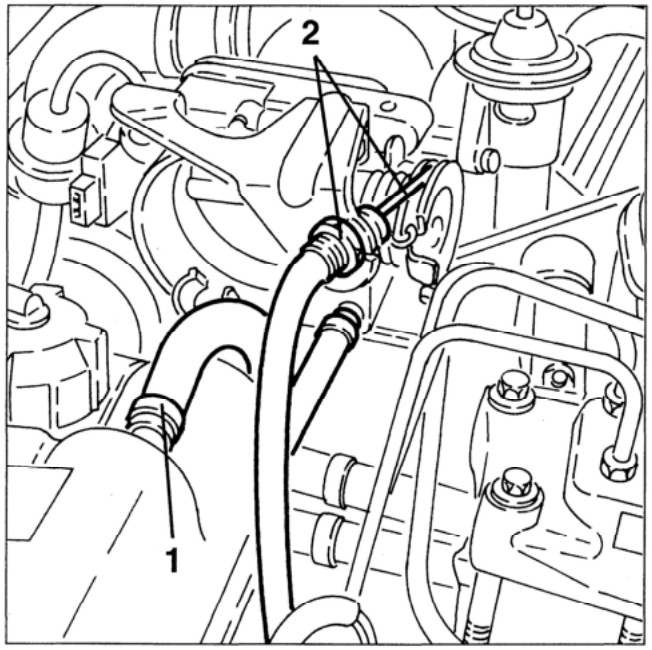



1. Disconnect the vacuum pipe leading from the modulating solenoid valve from the E.G.R. valve.
2. Slacken the two fastening screws and remove the E.G.R. valve complete with exhaust gas takeoff pipe.

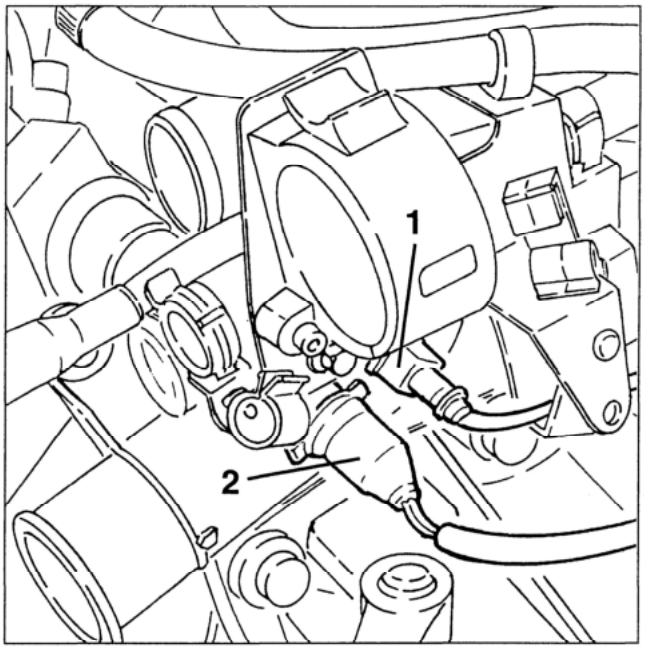



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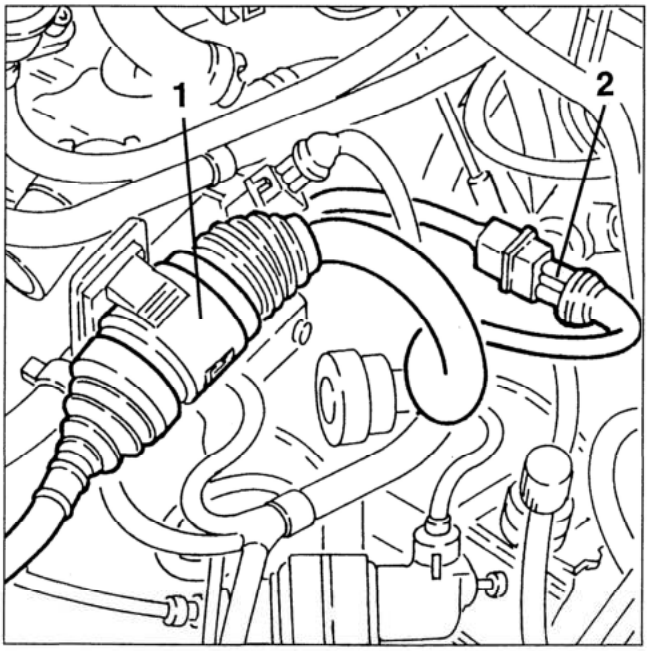
1. Disconnect the throttle body coolant outlet pipe from the expansion tank.
2. Disconnect the accelerator cable from the throttle cam.



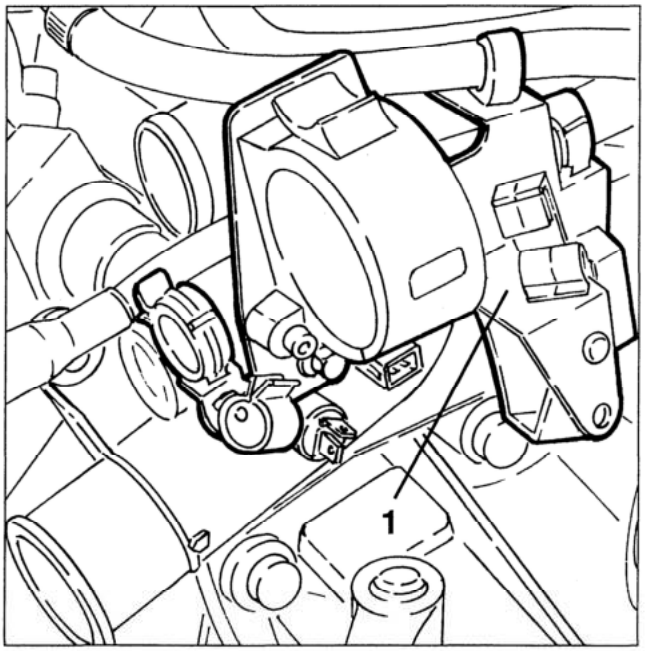

1. Disconnect the electrical connection from the engine coolant temperature transmitter (NTC).
2. Disconnect the electrical connection from the coolant temperature transmitter and max. temperature thermal contact.




1. Release the injection wiring connector from the support bracket.
2. Disconnect the electrical connection of the cam angle sensor.

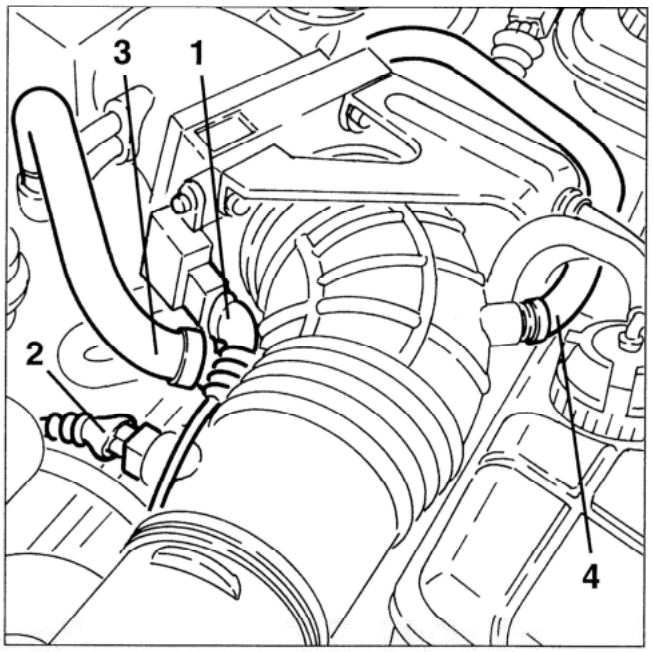



1. Slacken the fastening screws and remove the bracket supporting the injection wiring connector and fastening the pipes.

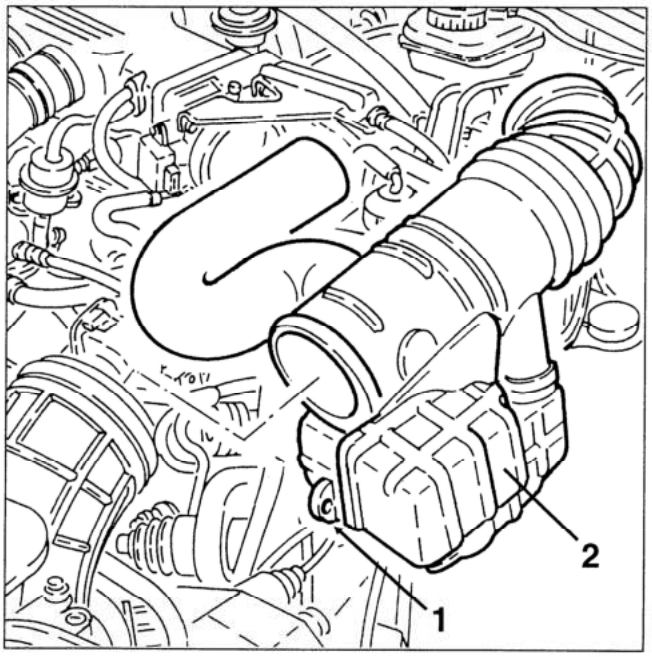



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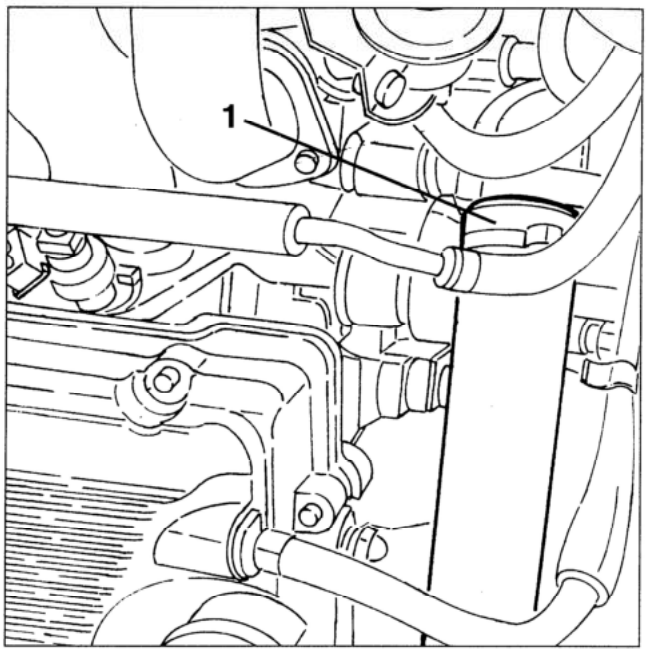
1. Disconnect the electrical connection from the throttle potentiometer.
2. Disconnect the electrical connection from the intake air temperature sensor.
3. Disconnect the oil vapour rcovery pipe leading from the right cylinder head from the corrugated sleeve.
4. Disconnect the air takeoff pipe for the constant idle speed device from the corrugated sleeve.



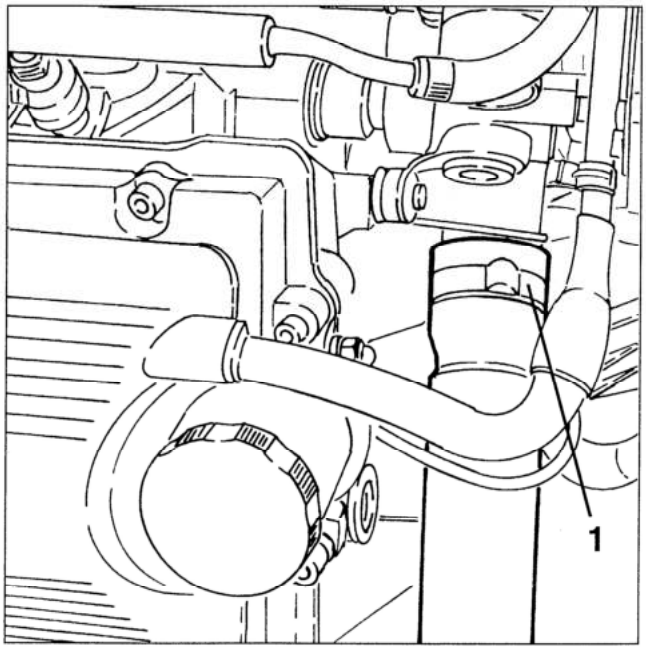

1. Remove the button fastening the first section of the corrugated sleeve to the resounder.
2. Slacken the two fastening clamps and remove the second section of the corrugated sleeve complete with resounders.




1. Disconnect the radiator coolant delivery sleeve from the thermostatic cup.

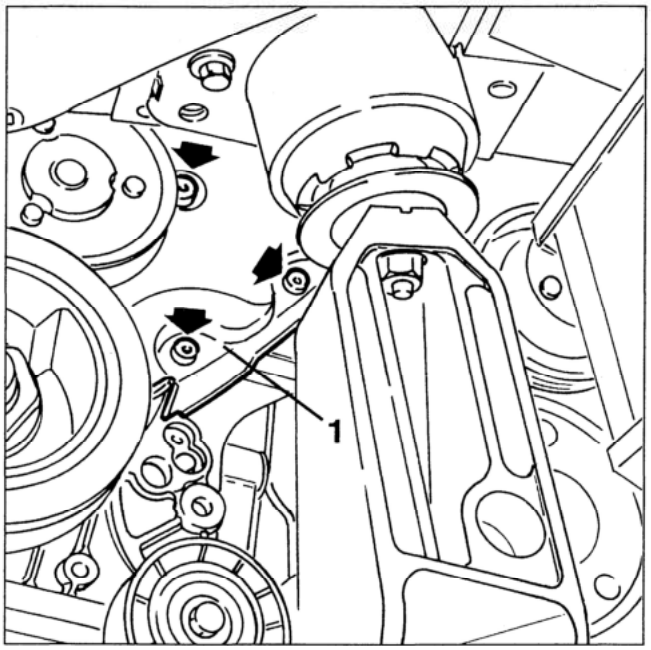



1. Disconnect the radiator coolant return sleeve from the thermostatic cup.

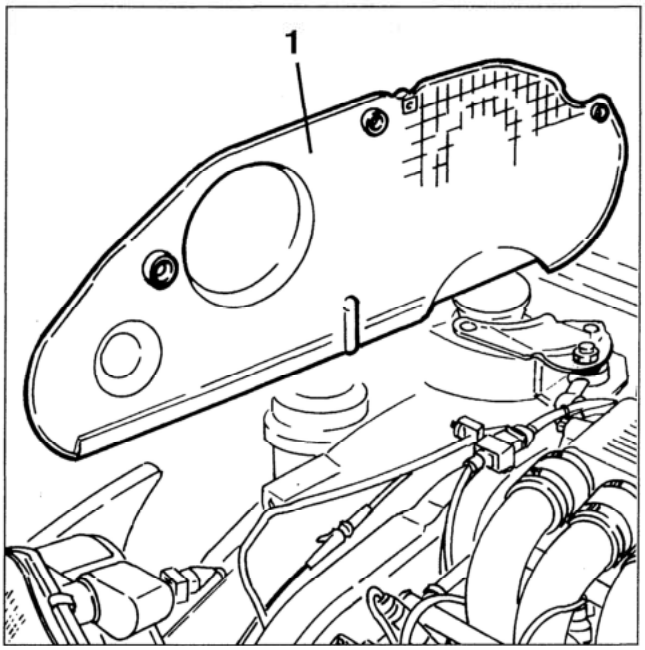



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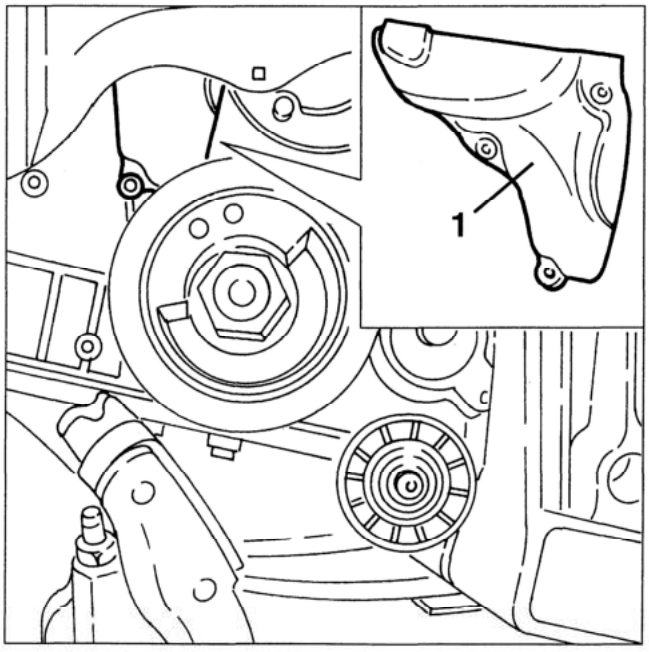
1. Slacken the fastening screws and remove the timing gear belt left lower guard.



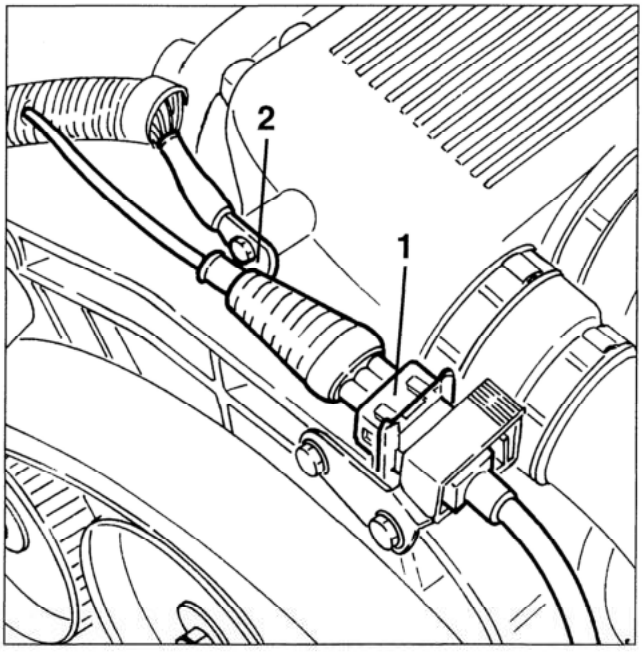

1. Slacken the fastening screws and remove the timing gear belt upper guard.




1. Slacken the fastening screws and remove the timing gear belt right lower guard.

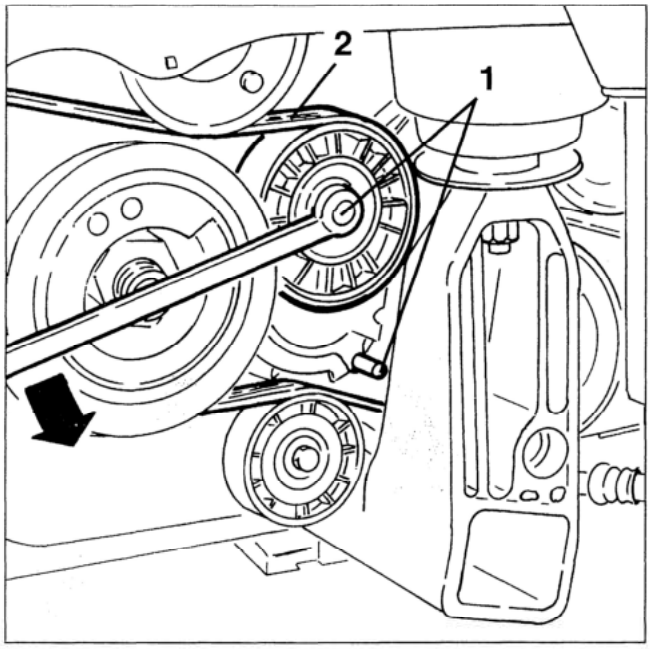



1. Disconnect the electrical connection of the front pinging sensor.
2. Disconnect the earth cable (front) from the intake box.

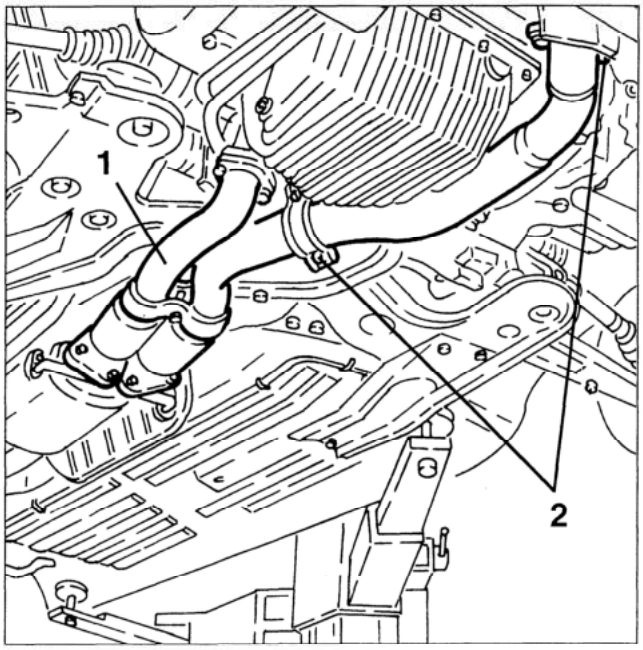



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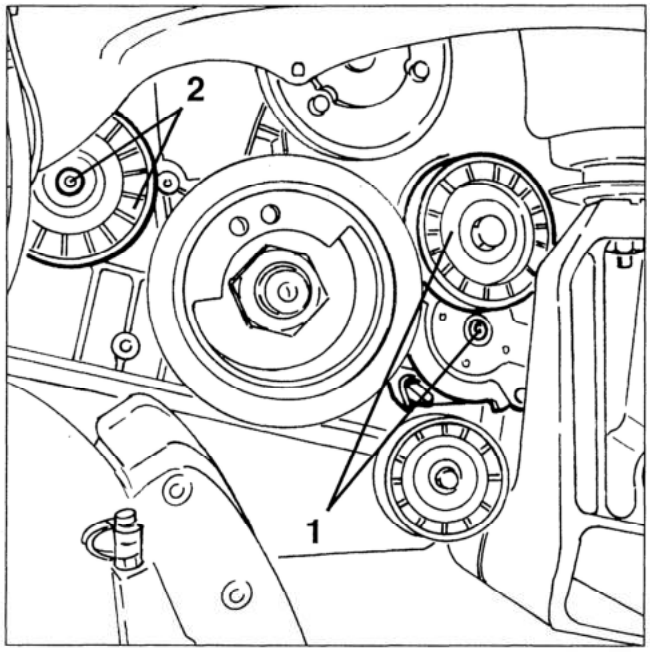
1. Using a wrench on the fastening screw of the belt tensioner pulley, overcome the force of the automatic belt tensioner and lock it in this position (belt slack) inserting the special peg as illustrated.
2. Prise and remove the auxiliary components drive belt.



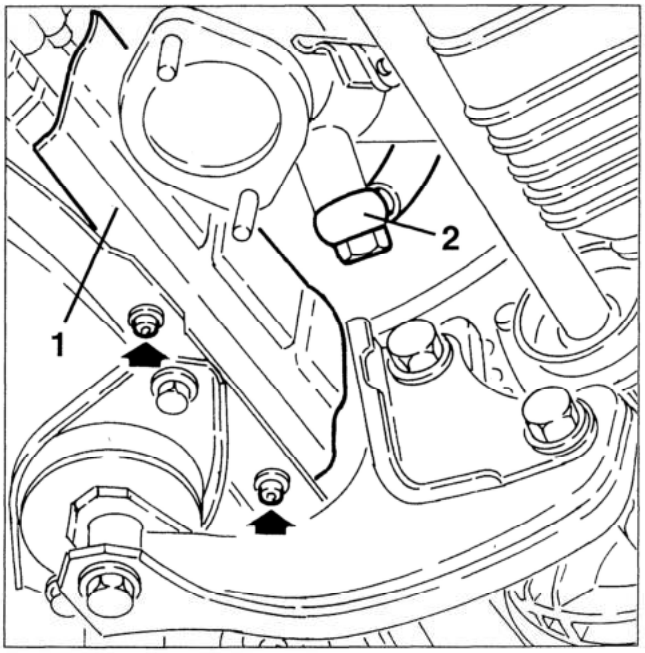

1. Remove the front section of the exhaust pipe only of the right cylinder head.
2. Disconnect the front section of the exhaust pipe from the left cylinder head and from the intermediate support clamp.




1. Slacken the fastening screw and remove the guide pulley for the auxiliary components drive belt.
2. Slacken the fastening screw and remove the auxiliary components guide pulley.




1. Slacken the fastenings and remove the heat guard of the power steering box.
2. Disconnect the fitting of the exhaust gas takeoff pipe for the E.G.R. valve from the right cylinder head exhaust manifold.




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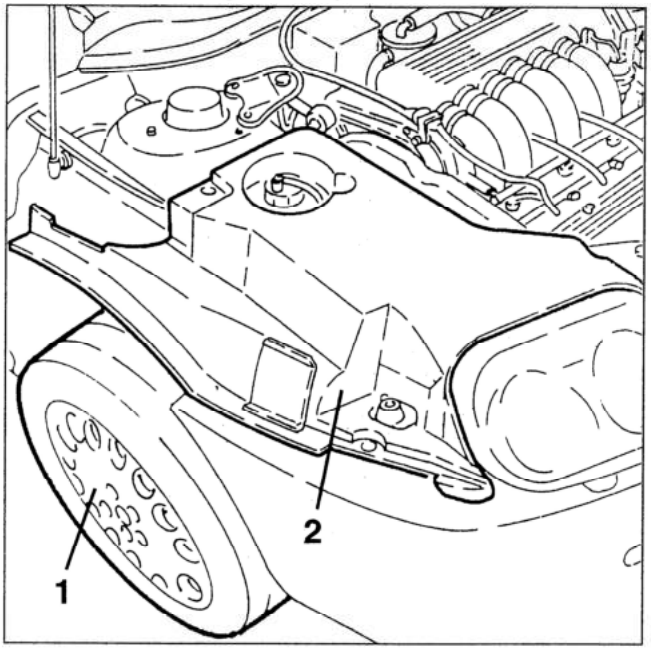
## CYLINDER HEADS

**NOTE: In the car it is only possible to remove the right cylinder head proceeding as described below.**
**When needing to remove the left cylinder head, it is necessary to remove the power unit (see specific paragraph).**

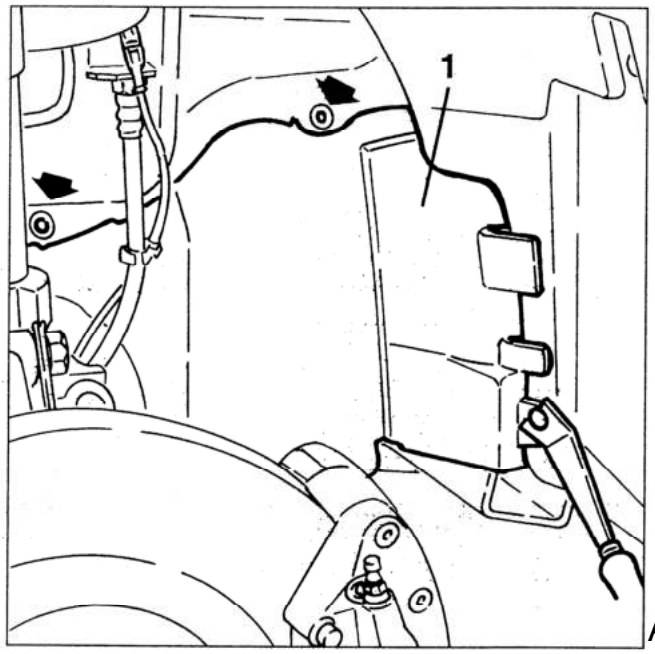
### REMOVAL/REFITTING RIGHT CYLINDER HEAD

- Set the car on a lift.
- Disconnect the battery (-) terminal.

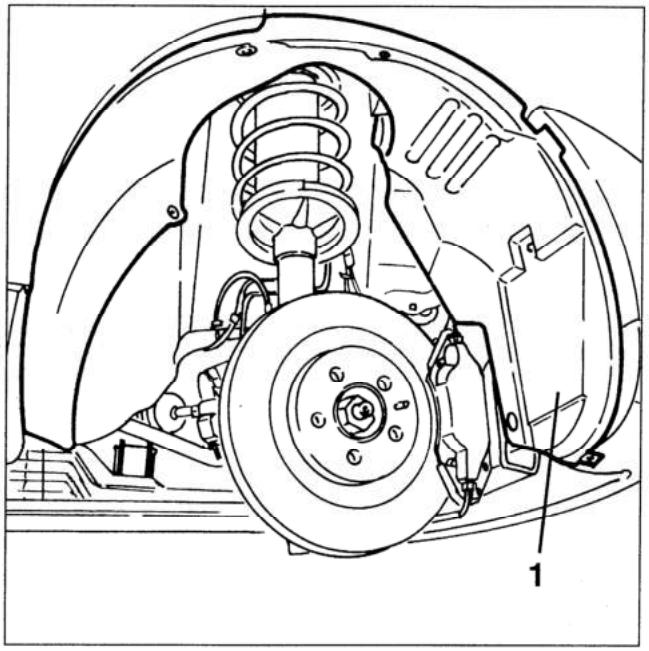
1. Remove the right front wheel.
2. Remove the engine compartment trim.



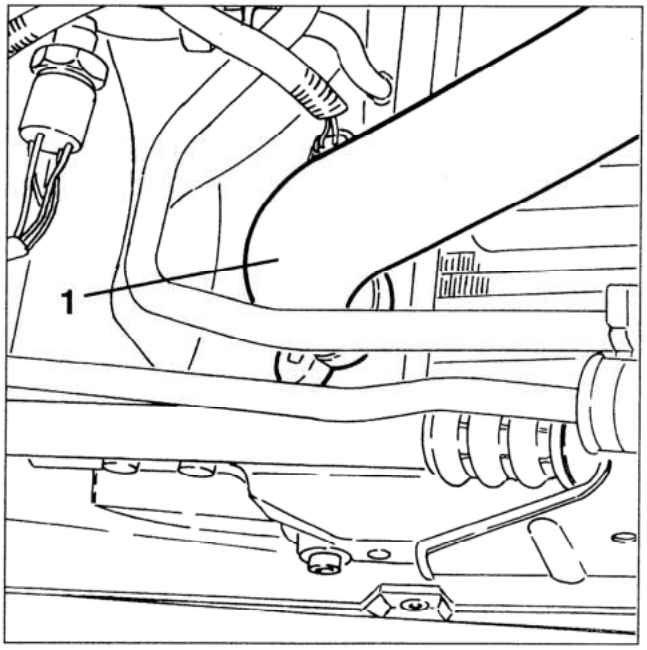

1. Slacken the two fastening screws, remove the plastic button and remove the right front wheel house mud flap.




1. Slacken the fastenings and remove the right front wheel house.

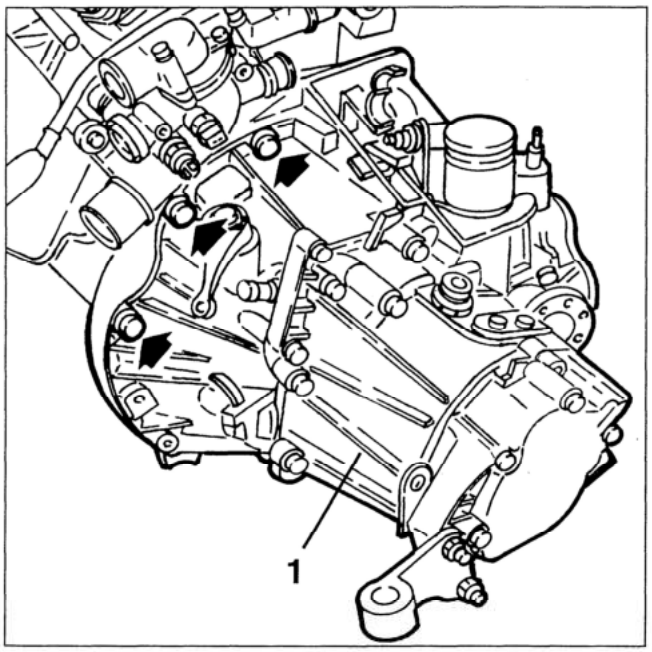



1. Raise the car and remove the engine coolant fluid, disconnecting the radiator outlet sleeve and retrieve it in a suitable container.

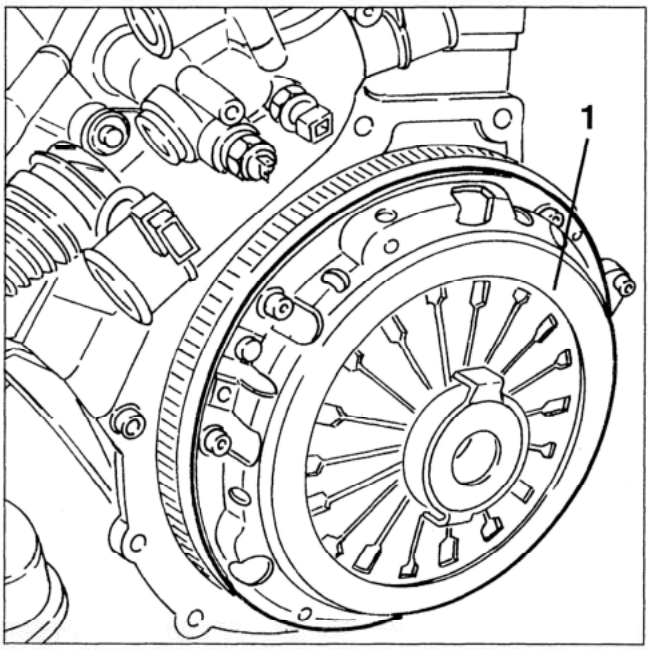



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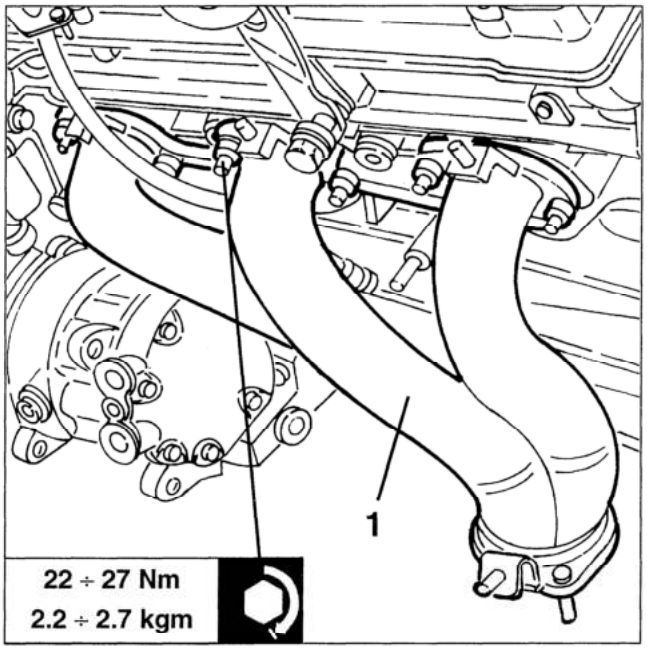
1. Slacken the fastening screws and, using a hydraulic hoist, remove the gearbox - differential unit.




1. Slacken the fastening screws and remove the pressure plate complete with thrust bearing and clutch plate.




1. Slacken the fastening nuts and remove the left exhaust manifold
- Remove the seals.




## REFITTING

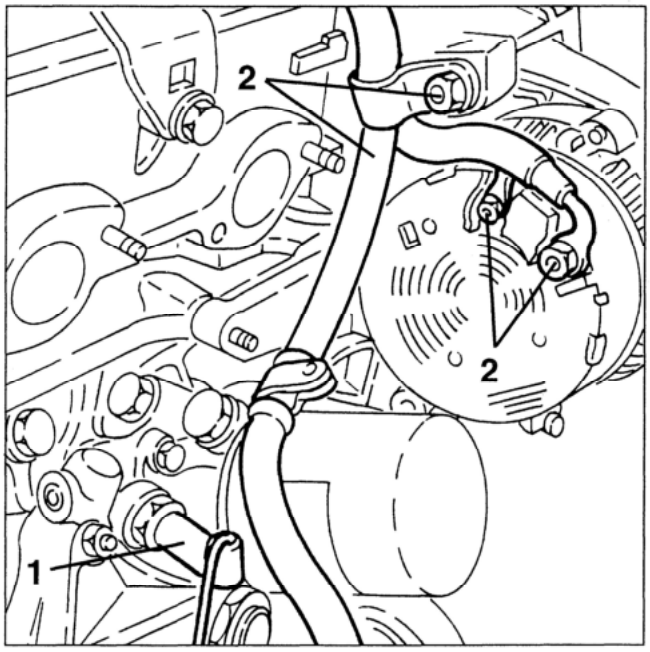
Reverse the sequence followed for removal, keeping to the following instructions:
- Prepare the engine compartment for inserting the power unit assembly, placing all the electric cables, pipes, etc. so that they do not interfere with reassembly operations.
- Take due care when fitting the power unit to avoid damaging the single components.

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

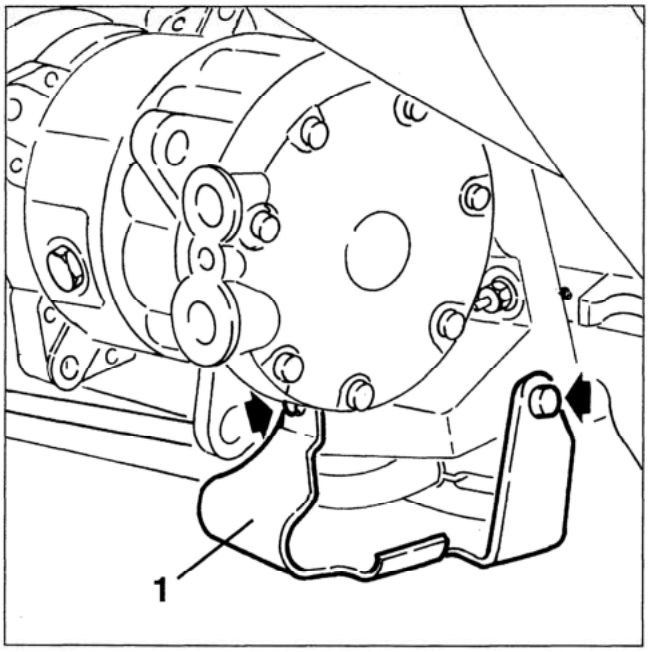
- After assembly, fill the various systems as specified (see Group 00).
- Carry out all the necessary checks and operations (see Group 00).

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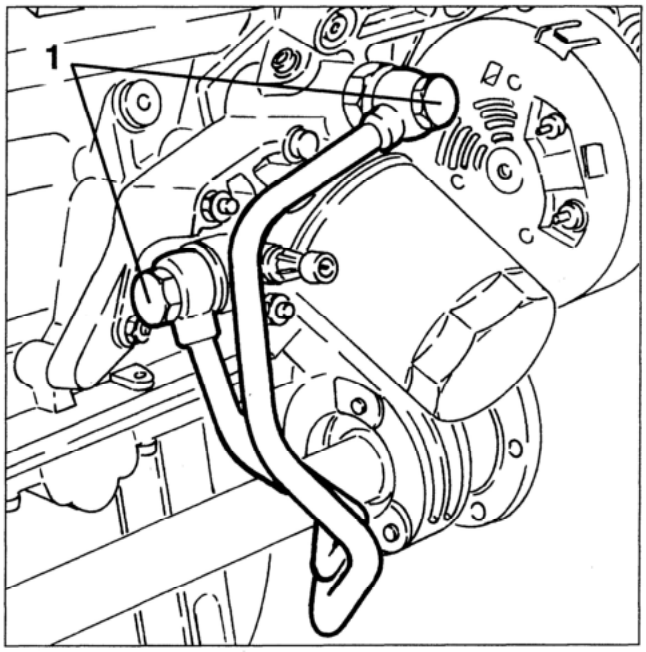
1. Disconnect the electrical connection from the engine oil minimum pressure sensor.
2. Disconnect the electrical connections from the alternator, then remove the wiring loom after releasing it from the fasteners.



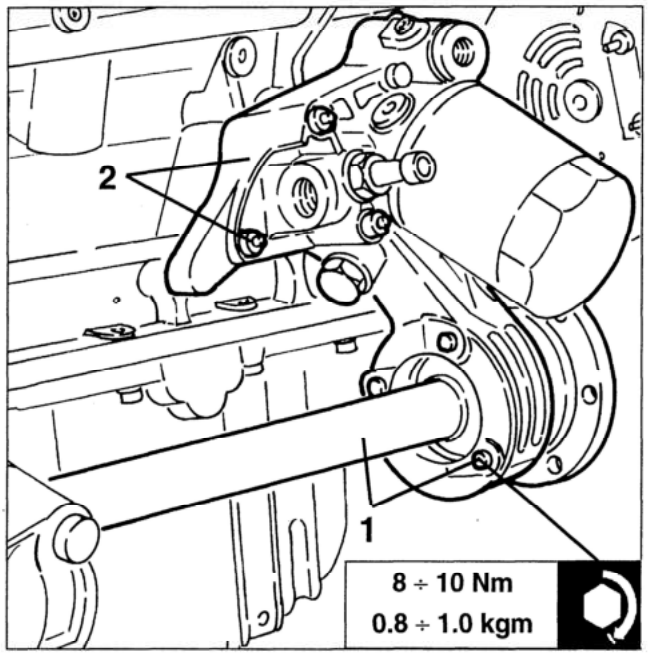

1. Slacken the fastening screws and remove the support bracket of the radiator engine oil delivery and return pipes.




1. From the oil filter support bracket disconnect the unions of the radiator engine oil delivery and return pipes, then remove them complete with the radiator.



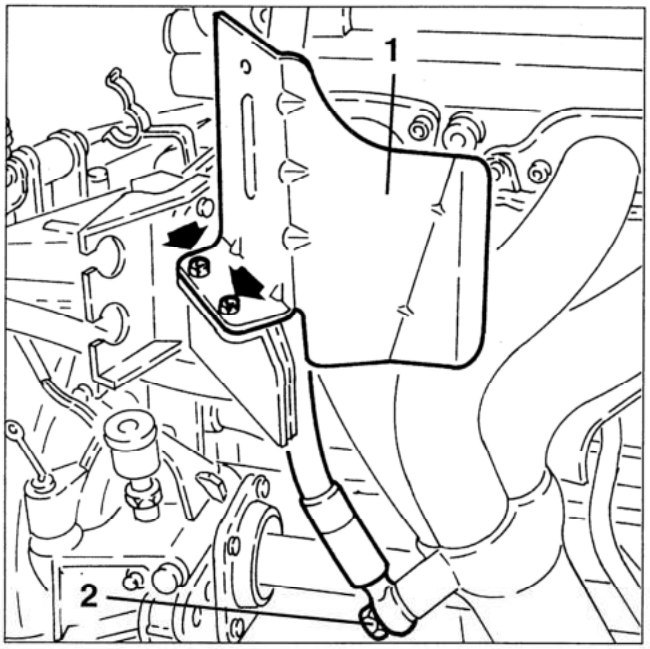

- Drain the gearbox - differential oil.
1. Slacken the fastening screws and withdraw the intermediate shaft.
- Remove the dust ring.
2. Slacken the fastening nuts and remove the oil filter support complete.



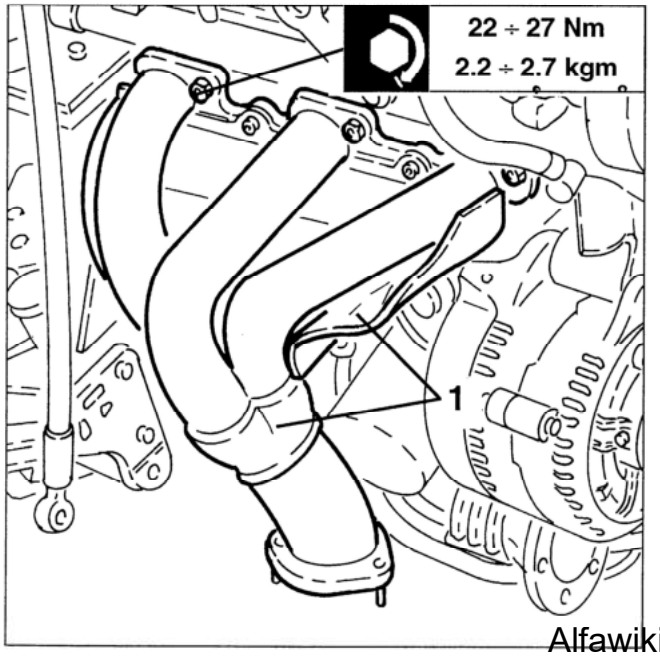

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**WARNING:**
**For handling the power unit use a hydraulic hoist after releasing it from the hydraulic jack.**

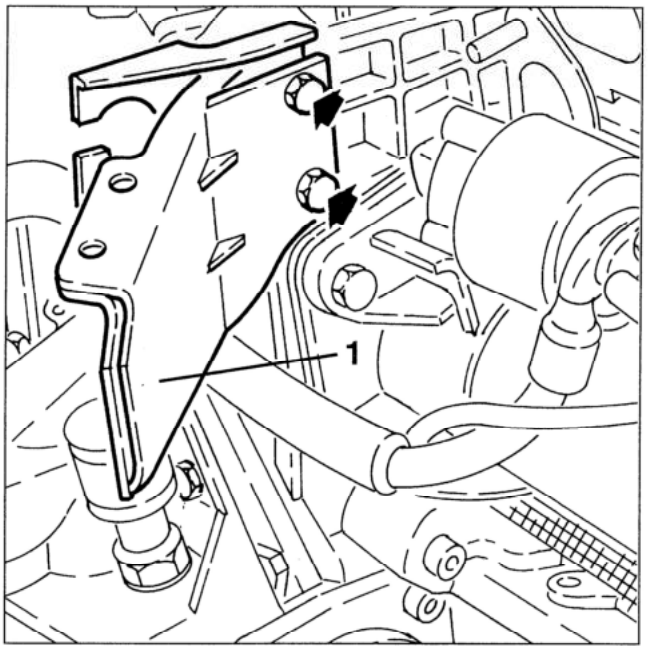
- Lower the hydraulic lift and position the power unit on a special work bench.
1. Slacken the fastenings and remove the upper heat shield from the exhaust manifold.
2. Disconnect the the union of the gas takeoff pipe for the E.G.R. valve from the manifold.



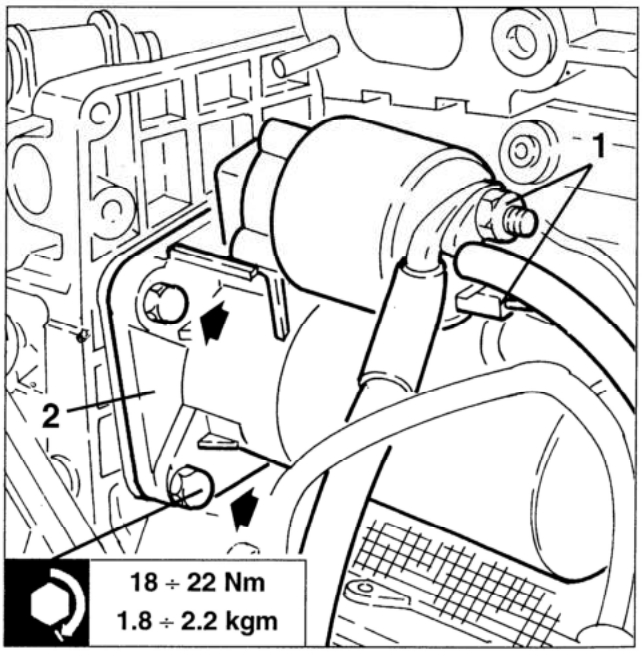

1. Slacken the fasteners and remove the exhaust manifold complete with heat shield for starter motor.
- Remove the seals.




1. Slacken the two fastening screws and remove the gears control cable support bracket complete with lower heat shield.

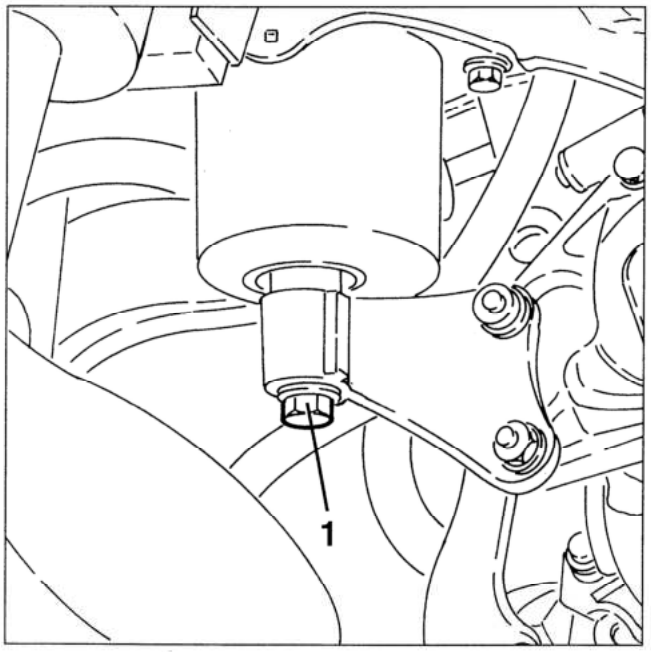



1. Disconnect the electrical connections from the starter motor.
2. Slacken the three fastening screws and remove the starter motor.

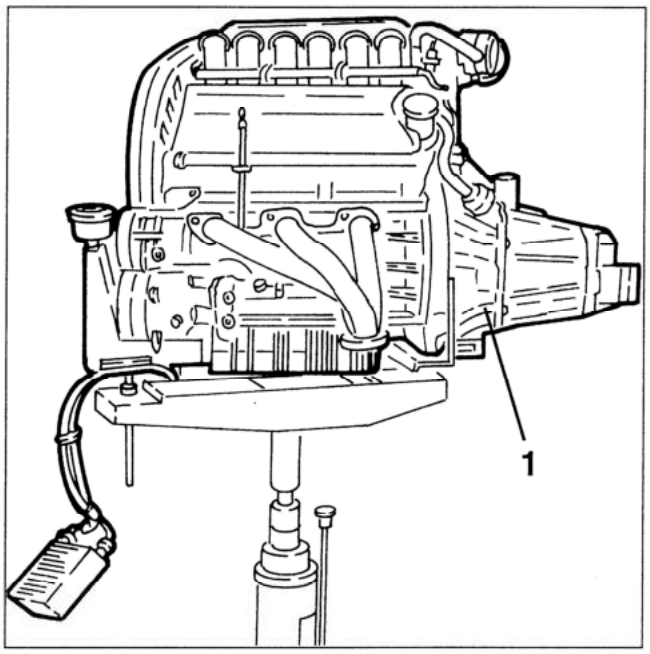



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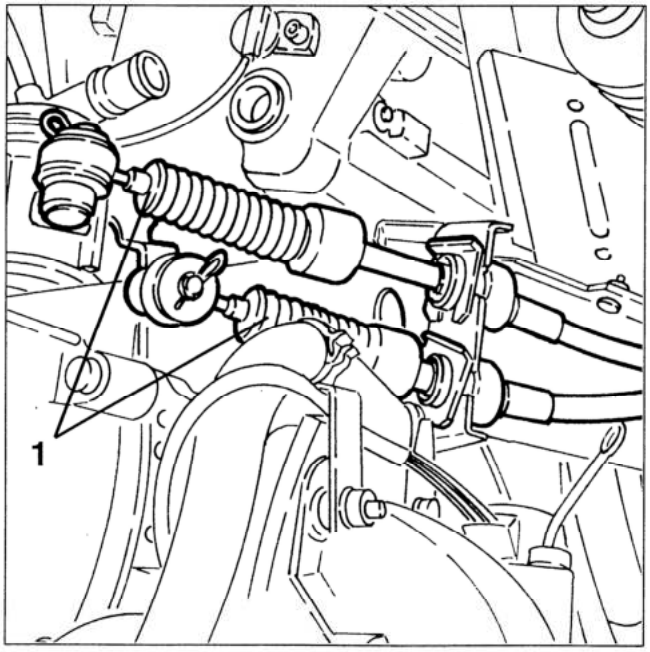
1. Slacken the power unit support fastening screw on the gearbox side.




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



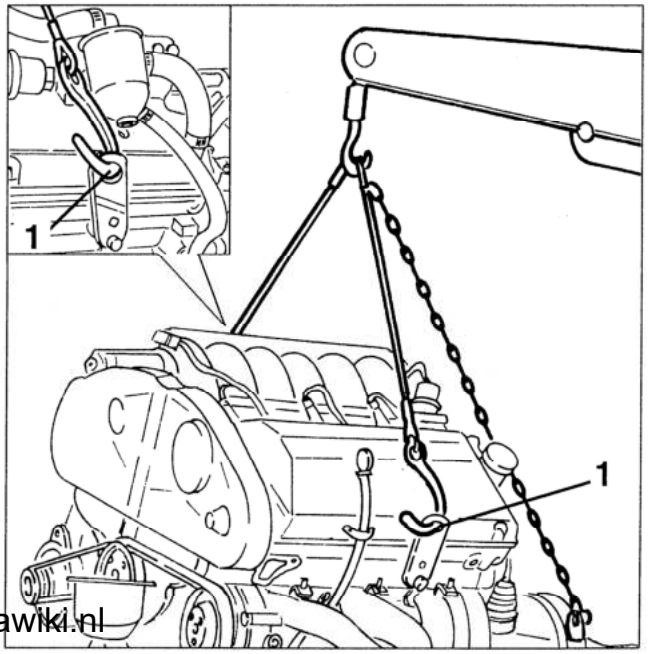

1. Lower the power unit with the hydraulic jack just enough to disconnect the gear control cable.




**WARNING:**
**The hydraulic jack must have a capacity of at least 1000 kg.**
**Release the electric cables from any wire stays and move them away from the engine, to prevent them from getting stuck in the engine when it is removed.**

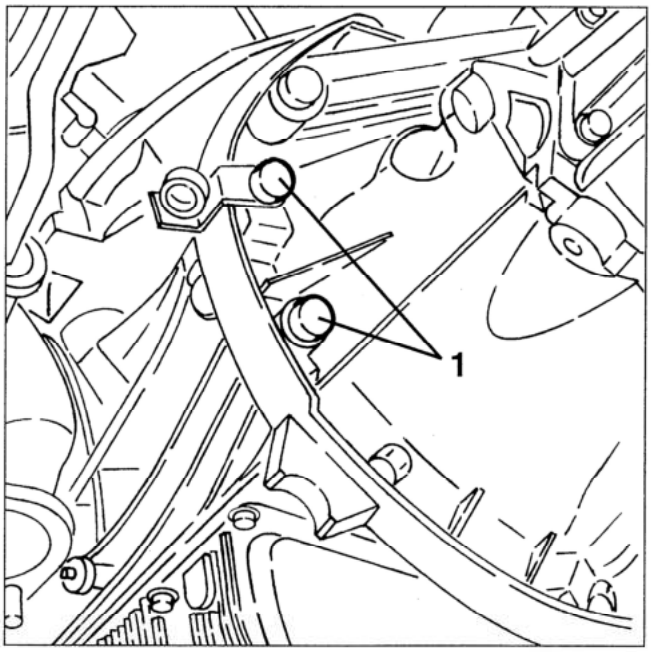
**WARNING:**
**During the lowering operation make sure that there are no cables or pipes still connected.**
**Take due care not to damage any component.**

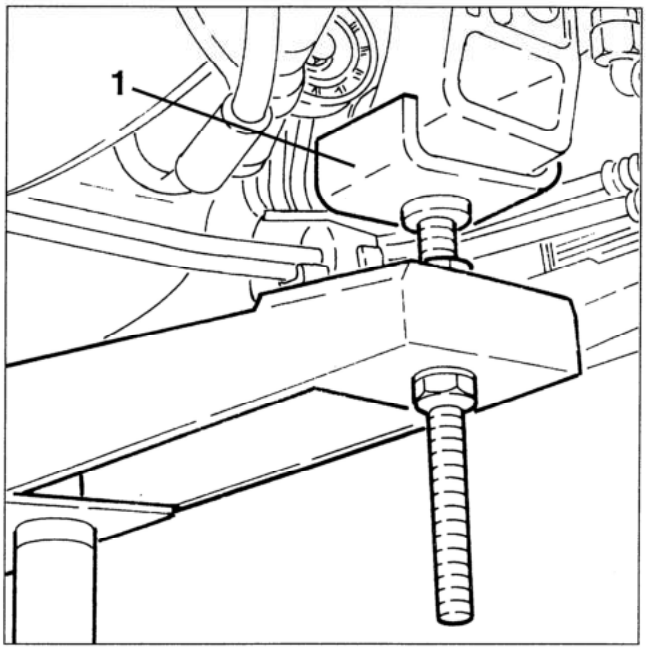
1. In addition to the hydraulic jack used for removal, support the power unit with a hydraulic hoist restraining as illustrated.



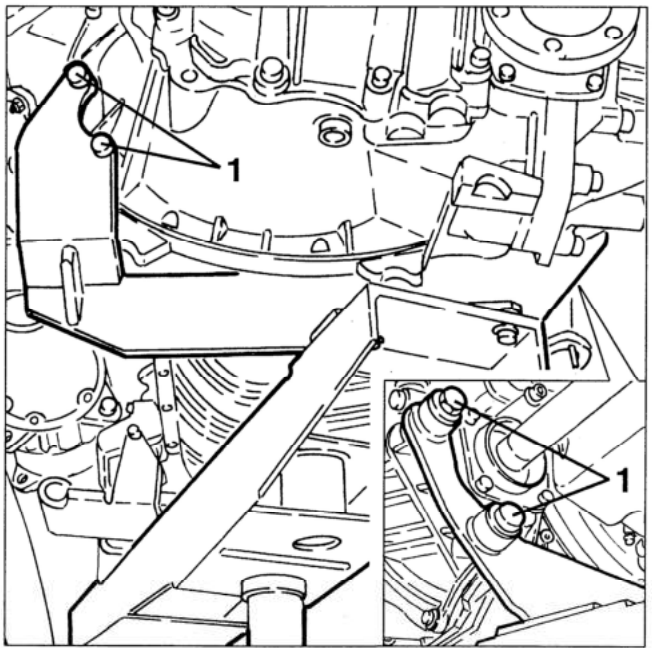

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1. Remove the two screws illustrated for fastening the gearbox to the crankcase to be able to fasten the power unit support tool.

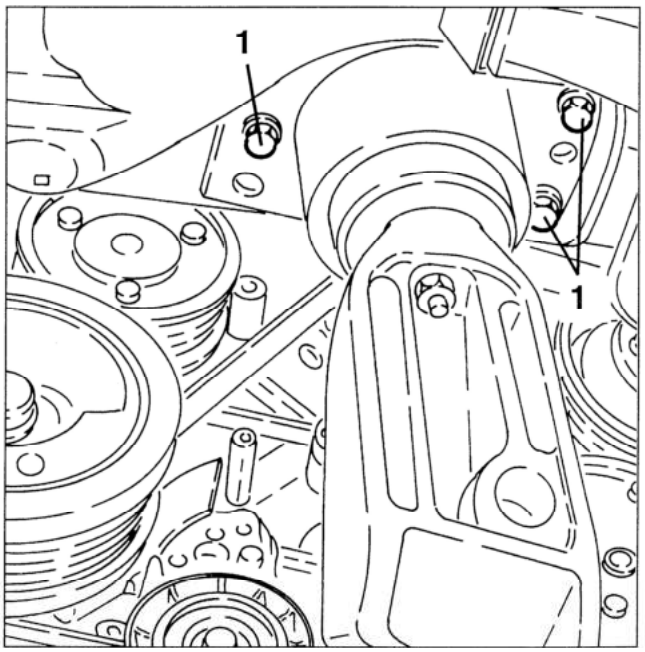



1. Position the hydraulic jack under the power unit and fasten the support tools as illustrated below.

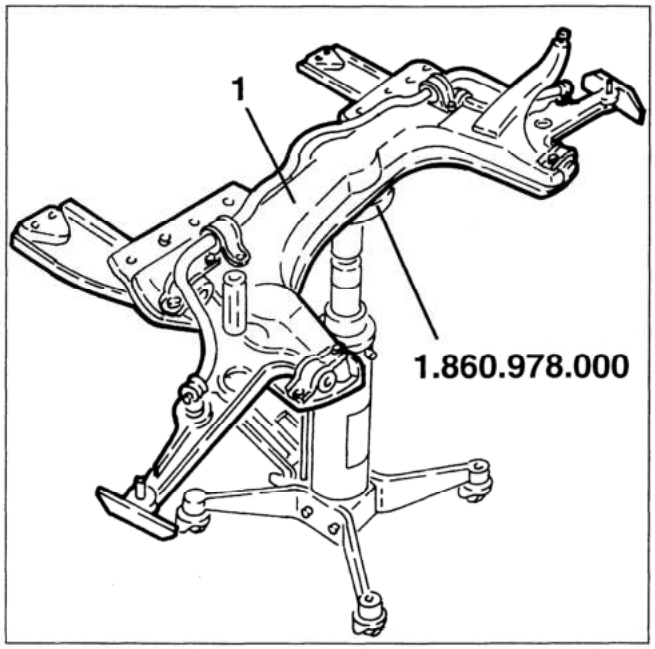



- Release the tierod of the safety cross rail of the power unit support installed previously from the support bracket.
1. Slacken the three screws fastening the power unit support on the camshaft side.

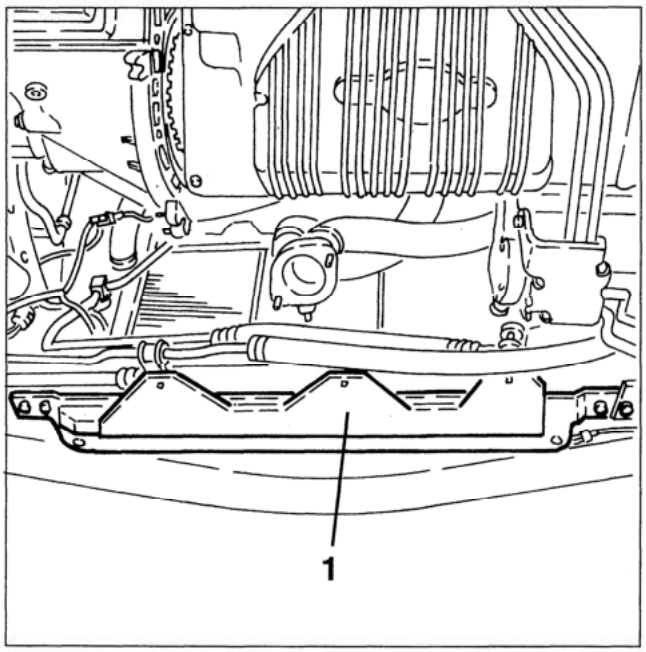



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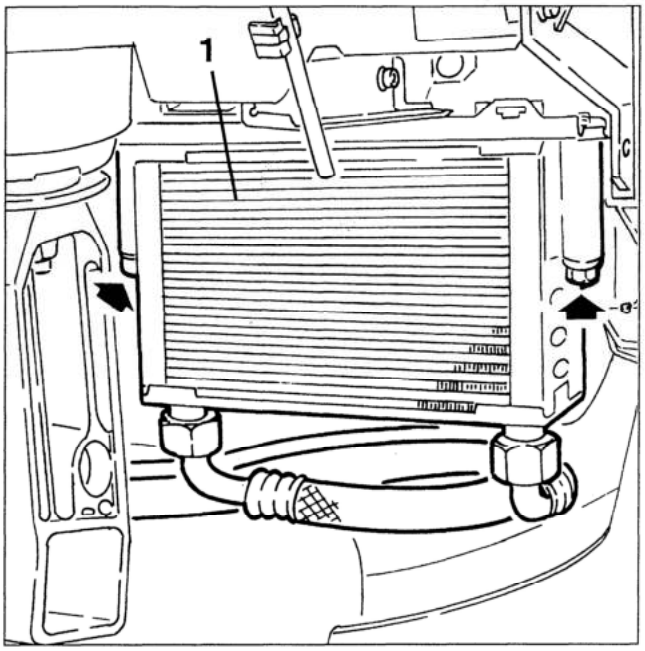
- Using a hydraulic jack support the crossmember using tool no. 1.860.978.000.
1. Slacken the screws and nuts fastening the crossmember, then remove it complete with wishbones, stabiliser bar and reinforcements.




1. Slacken the fastening screws and remove the radiator lower cross rail.

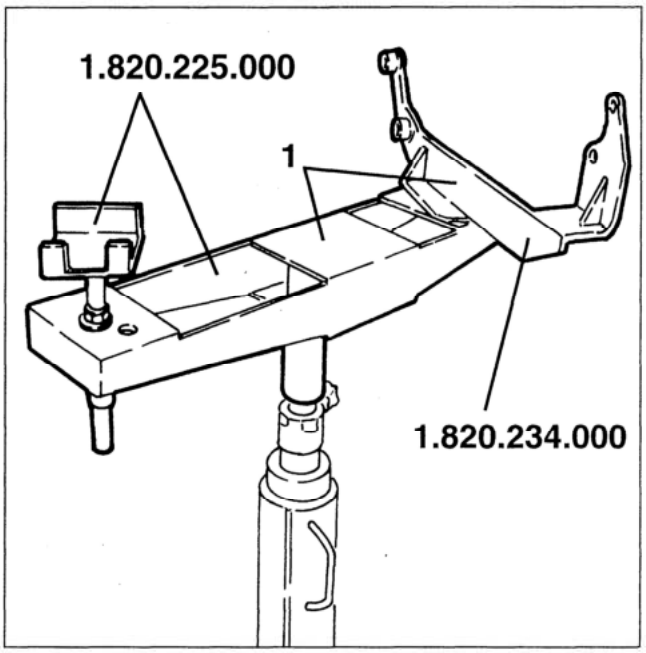



1. Slacken the fastening screws and remove the engine oil radiator from the support bracket, then without disconnecting the pipes, restrain it to the engine to prevent it from hindering the following operations.



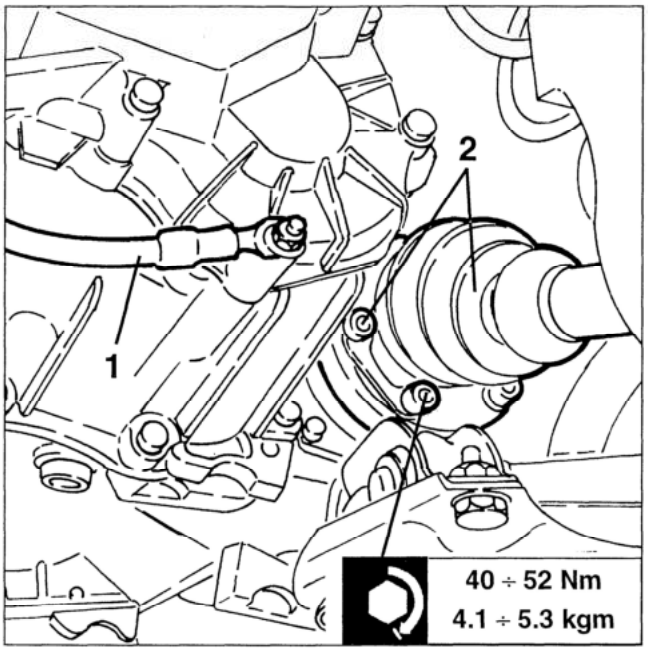

1. Position tool no. 1.820.225.000 complete with tool no. 1.820.234.000 on a hydraulic jack as illustrated.

**NOTE: In order to balance the power unit on the support tool the jack should be placed in the centre hole of tool no. 1.820.225.000.**

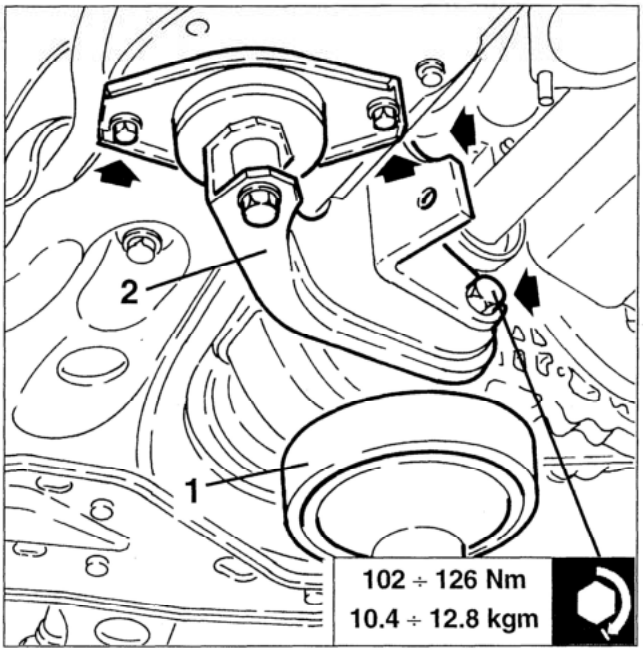



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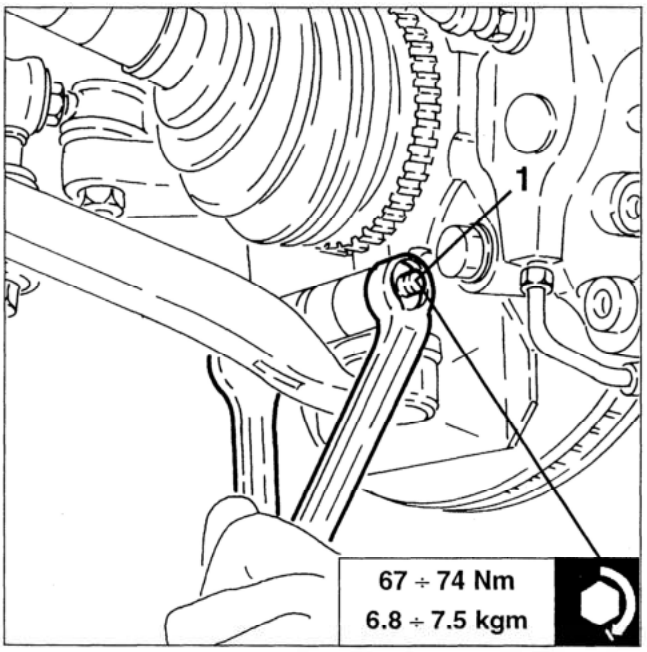
1. Disconnect the earth braid from the gearbox rear cover.
2. Slacken the fastening bolts and disconnect the axle shafts.



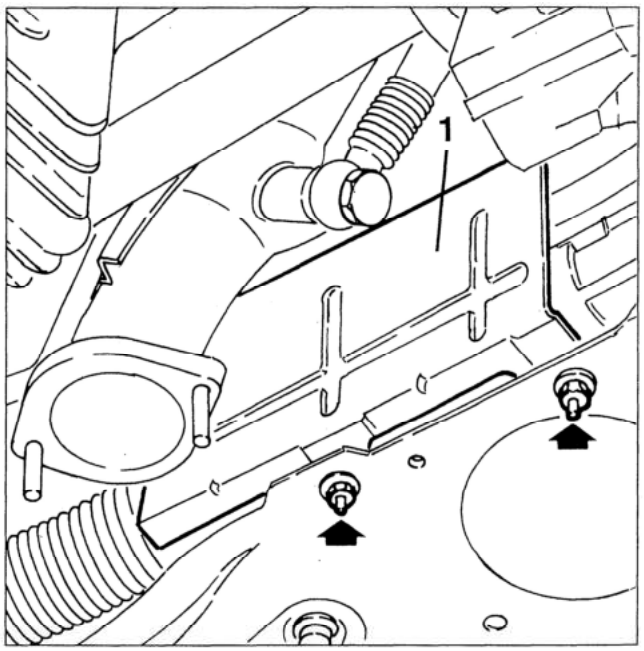

1. Position a hydraulic jack under the gearbox as illustrated.
2. Slacken the fastening screws and remove the powerplant rear support.




1. Slacken the bolts fastening the wishbones to the wheel uprights.

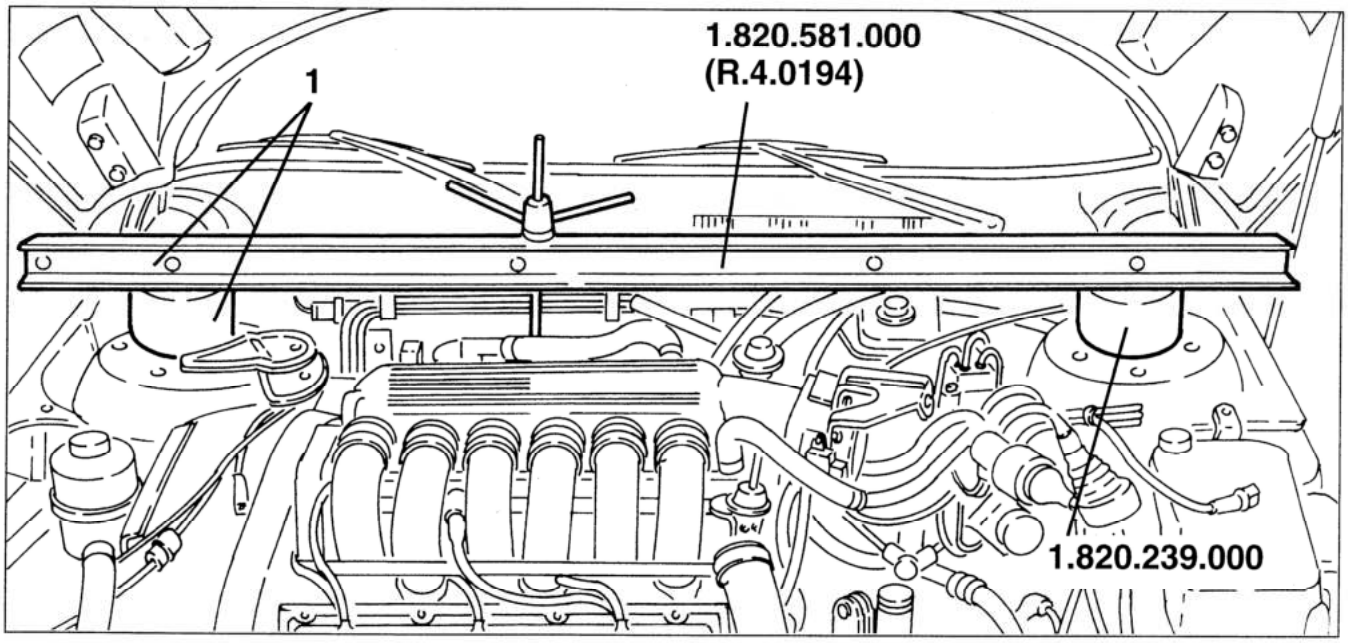



1. Slacken the fastenings and remove the heat shield from the power steering box.

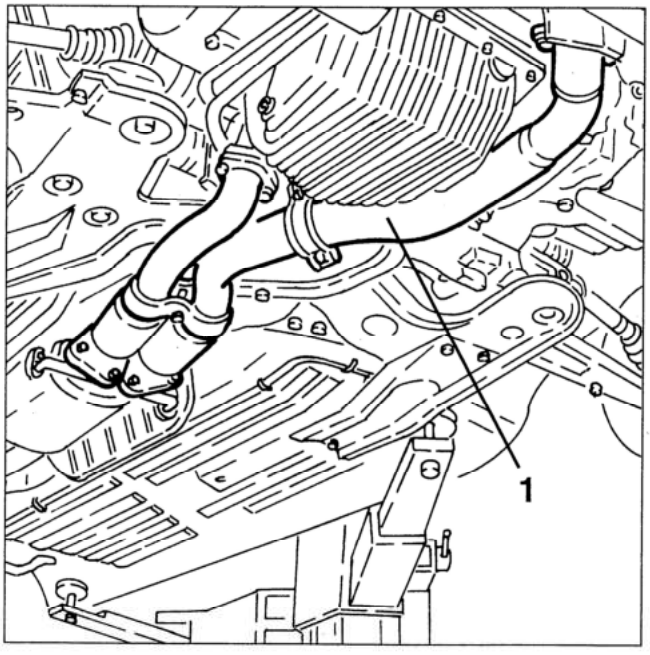



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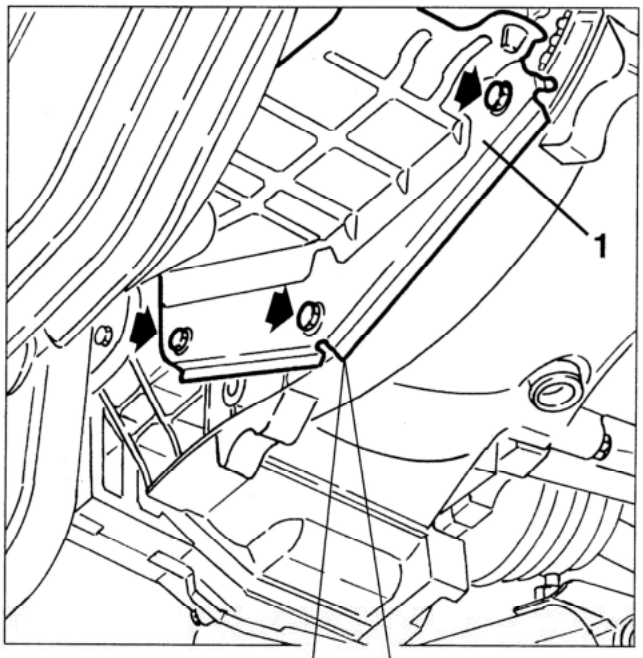
1. Install cross rail no. 1.820.581.000 (R.4.0194) complete with supports 1.820.239.000 to support the power unit.

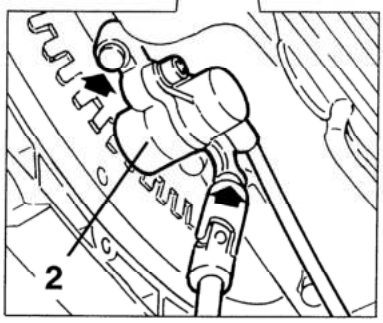



1. Raise the car and remove the front section of the exhaust pipe.



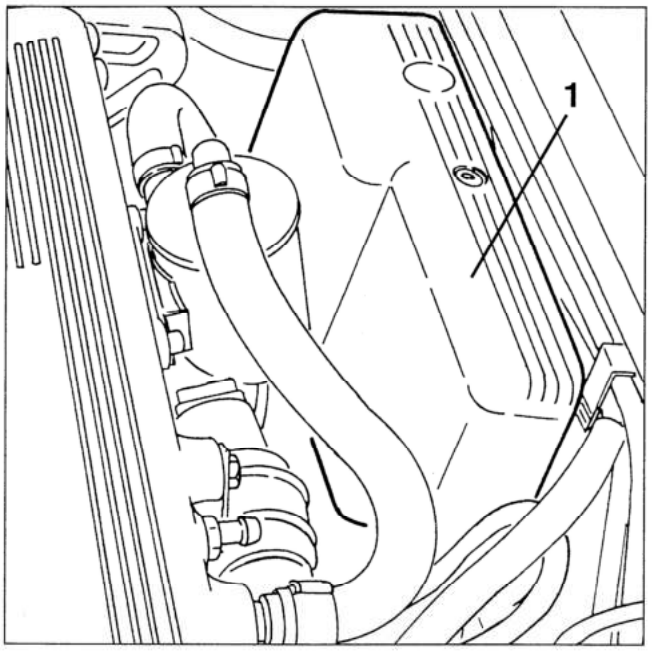

1. Slacken the fastening screws and remove the flywheel cover.
2. Slacken the fastening screws and remove the rpm and timing sensor.



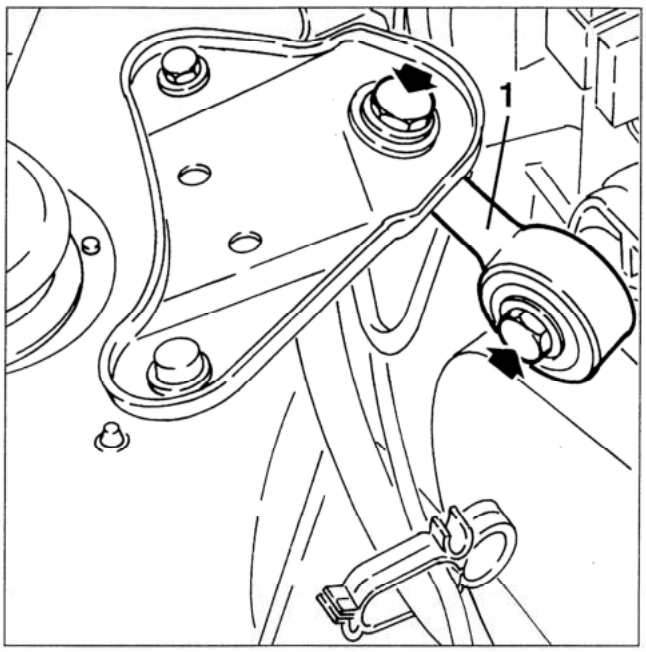




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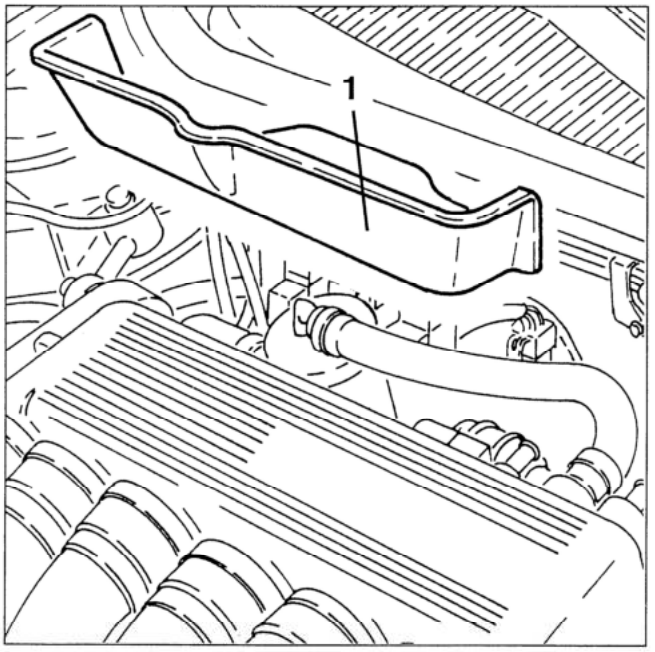
1. Remove the plastic cover of the relays, fuses and electrical connections.



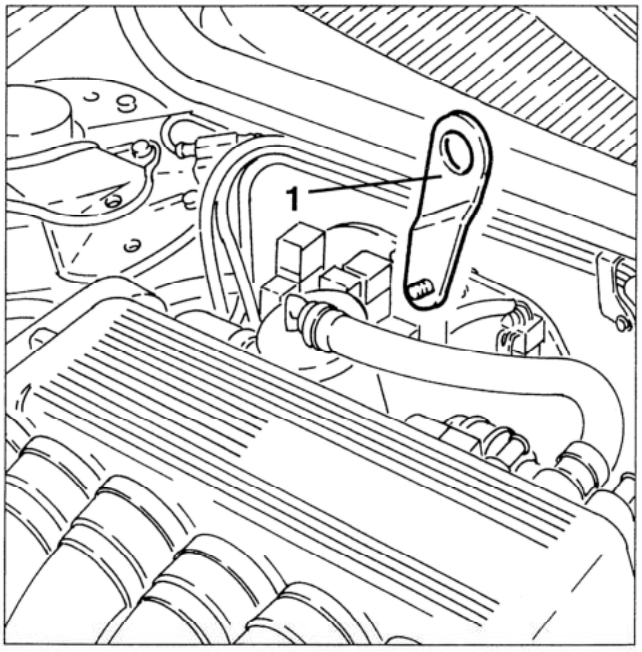

1. Slacken the fastening screws and remove the engine stay rod.




1. Slacken the fasteners and remove the heat shield.

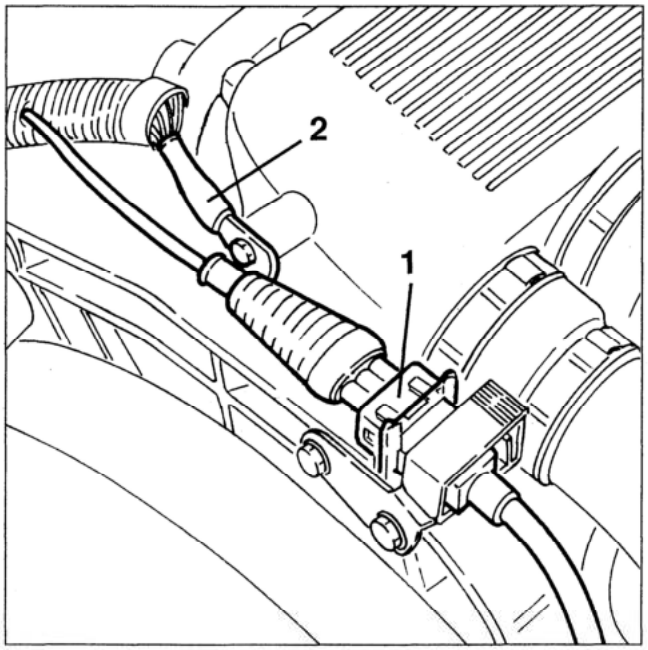



1. On the right cylinder head assemble a special engine support bracket.

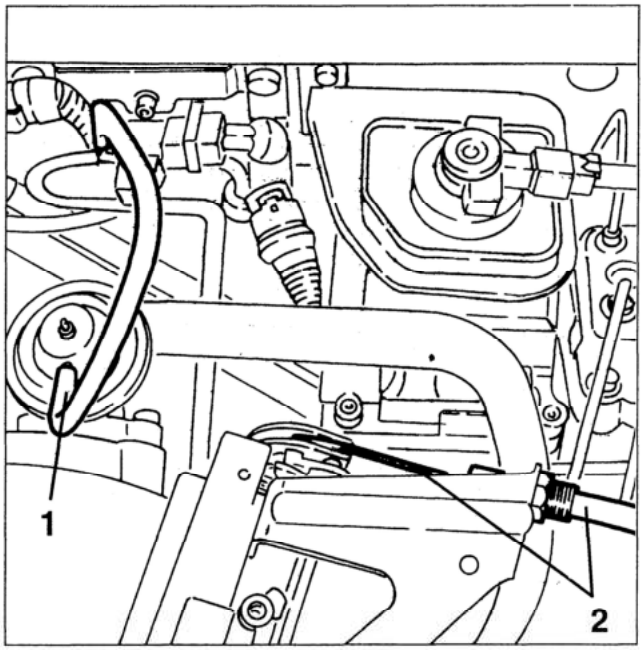



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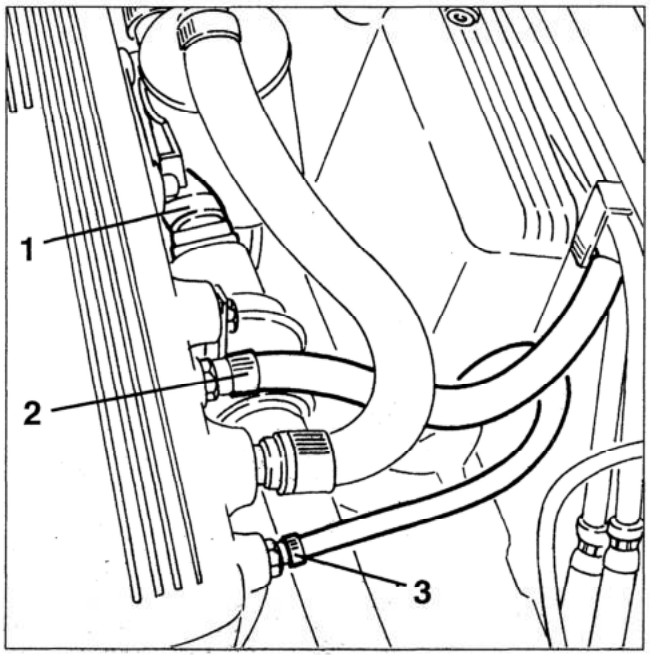
1. Disconnect the electrical connection of the front pinging sensor.
2. Disconnect the earth cable (front) from the intake box.



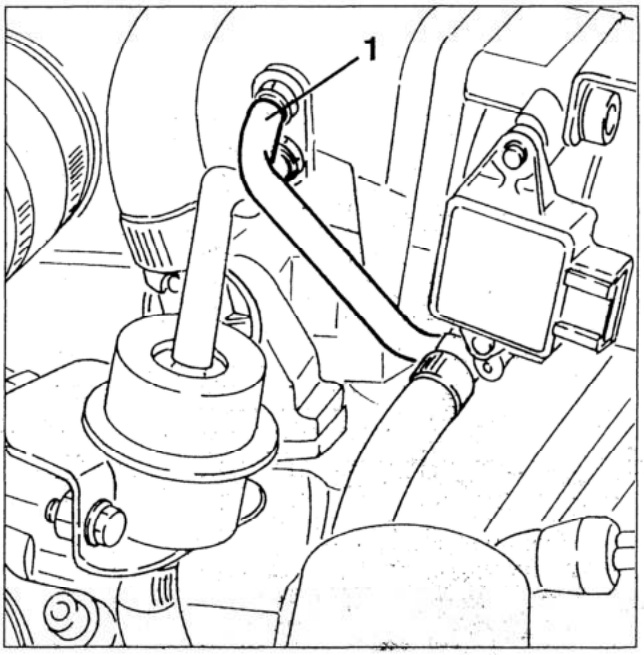

1. Disconnect the pneumatic signal inlet pipe leading from the solenoid valve from the E.G.R. valve.
2. Disconnect the accelerator cable from the throttle.




1. Disconnect the electrical connection from the constant idle device actuator.
2. Disconnect the fuel vapour recovery pipe from the intake box.
3. Disconnect the servobrake vacuum takeoff pipe from the intake box.

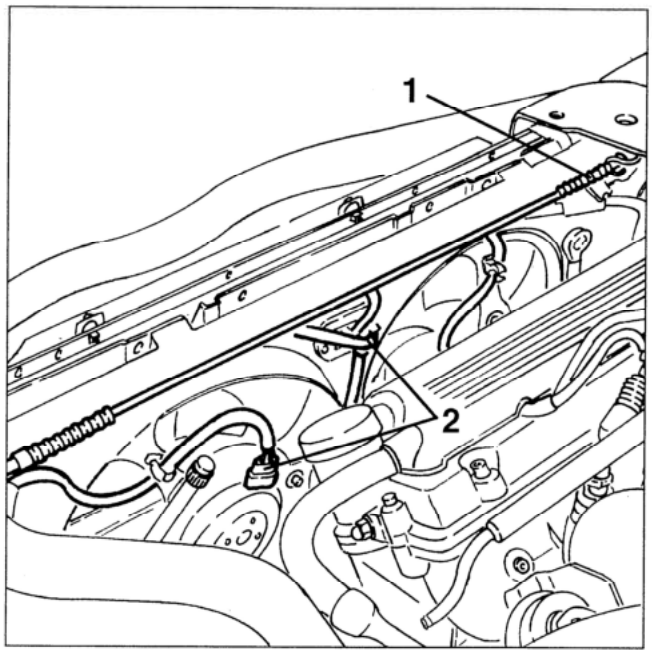



1. Disconnect the vacuum takeoff pipe for the E.G.R. modulation solenoid valve from the intake box.

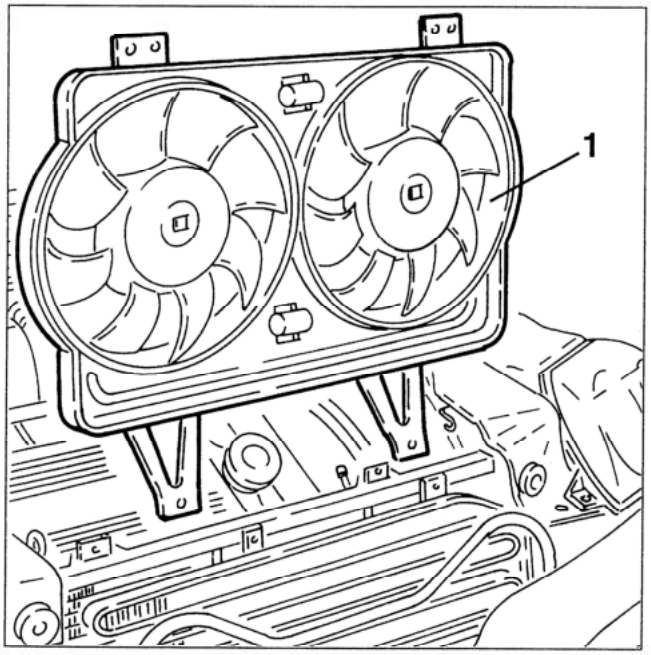



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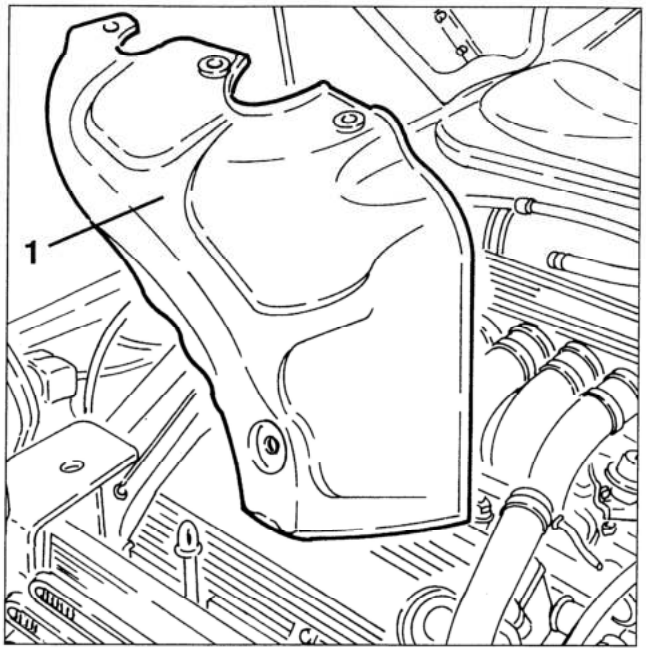
1. Disconnect the bonnet opening cables and move it aside to prevent it from hindering the following operations.
- Disconnect the electrical connection for supplying the electromagnetic joint of the conditioner compressor.
2. Disconnect the electrical connections from the fans and additional resistances, then release the cables from the clamps and groove.



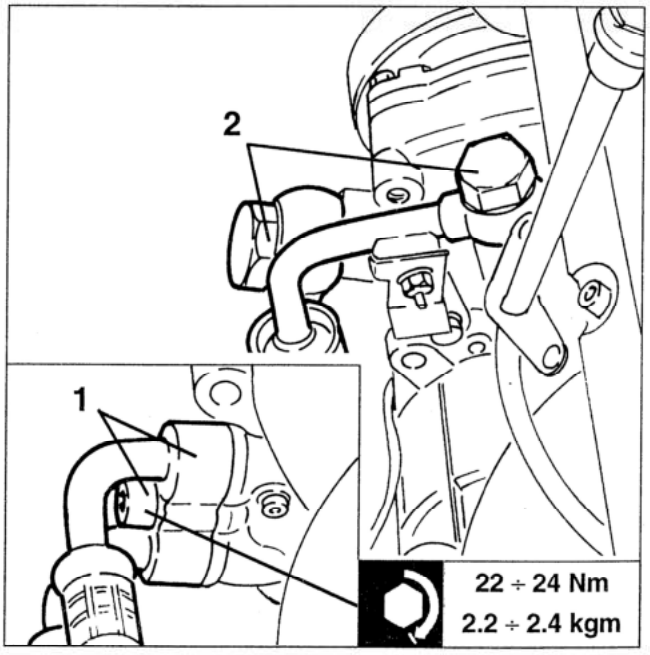

1. Slacken the fastening screws and remove the cooling fans withdrawing them upwards.




1. Slacken the fasteners and remove the heat shield from the exhaust manifold of the left cylinder head.

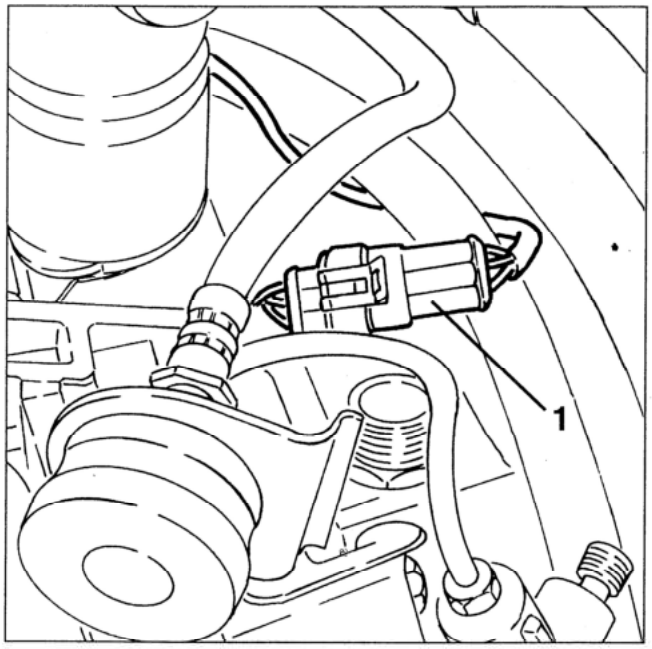



1. Slacken the fastening screw and disconnect the flange of the coolant fluid inlet and outlet pipes from the conditioner compressor (R134a).
- Using a suitable syringe drain the power steering tank oil.
2. Disconnect the unions of the oil intake and delivery pipes from the power steering pump.

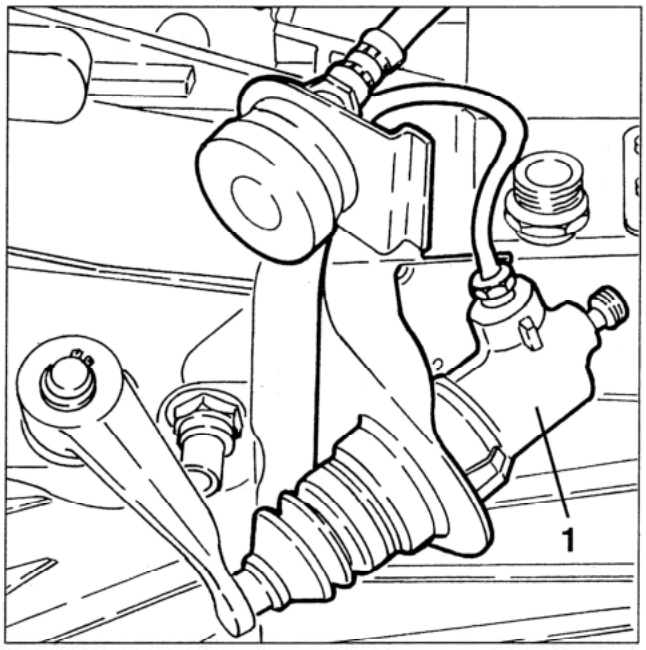



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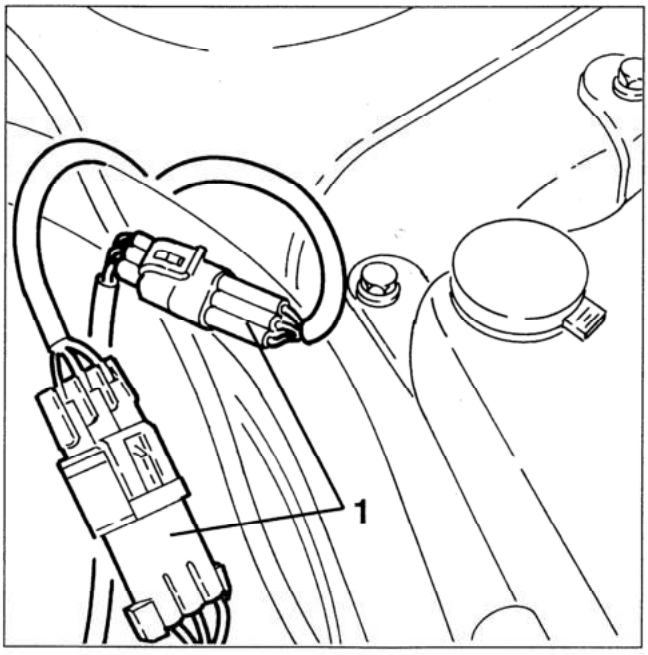
1. Disconnect the electrical connection of the tachometric sensor.



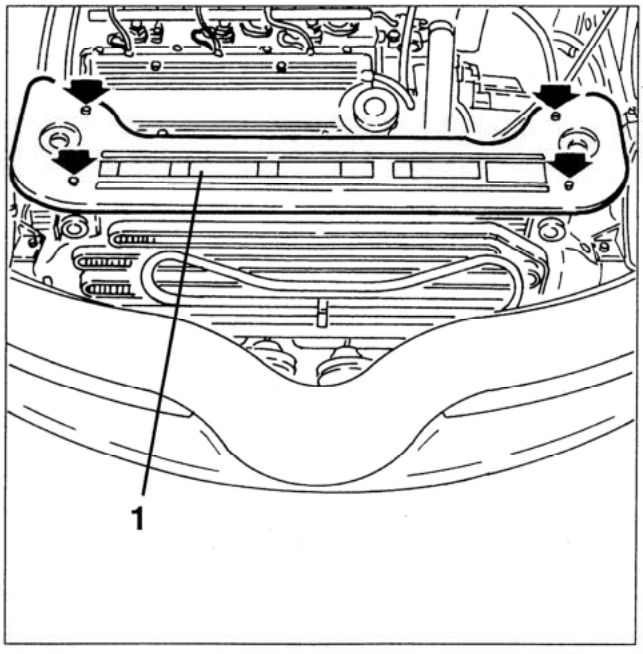

1. Slacken the screws fastening the clutch control cylinder support, then move everything aside without disconnecting the pipes.




1. Disconnect the two electrical connections of the front services cable loom.

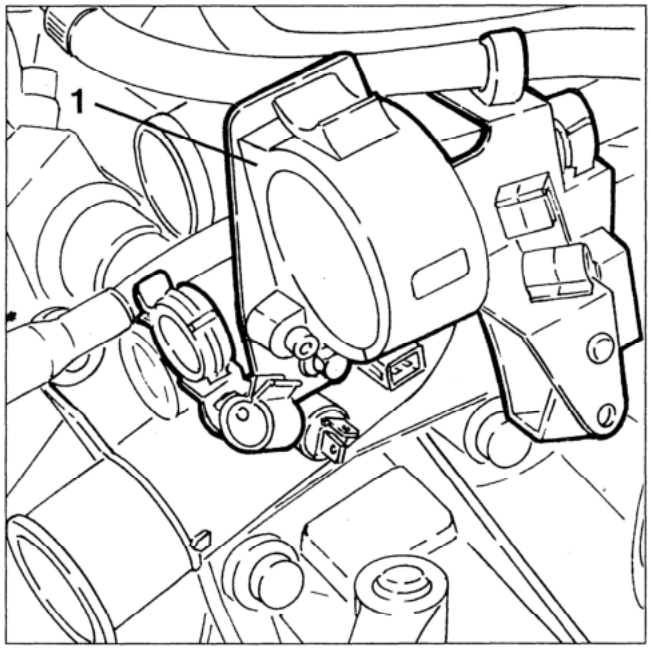



1. Slacken the fastening screws and remove the upper radiator crossmember.

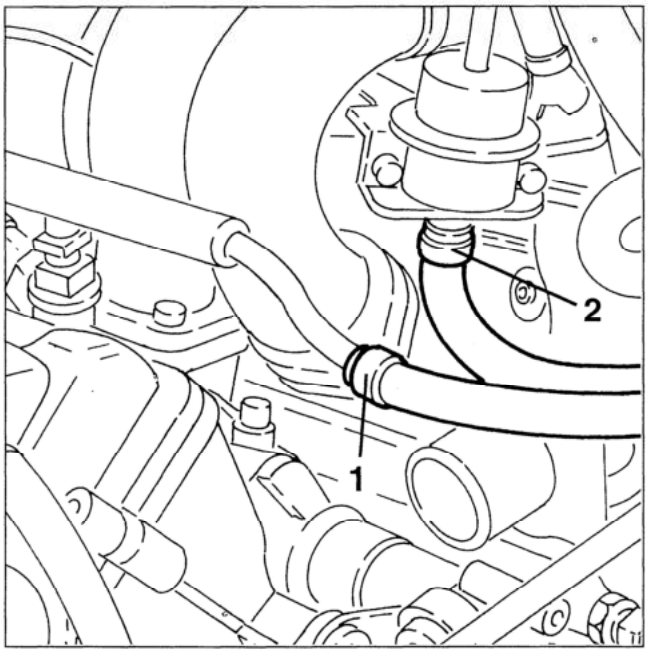



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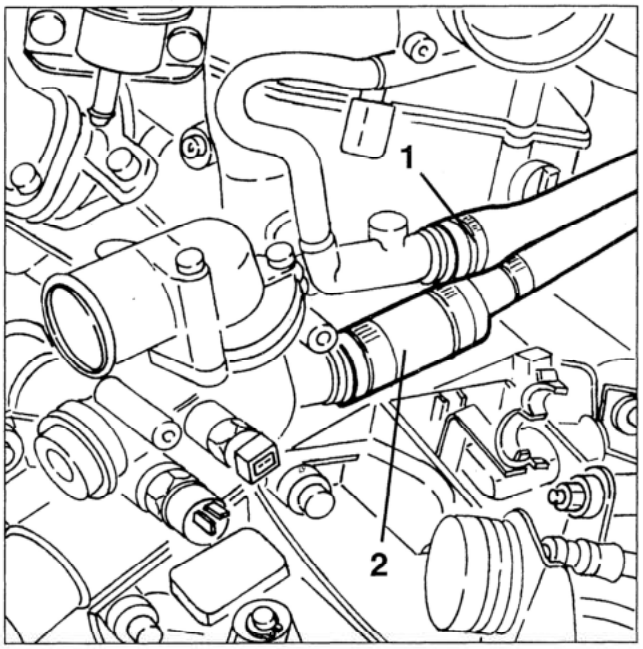
1. Slacken the fasteners and remove the injection wiring connector supports and pipe fasteners.



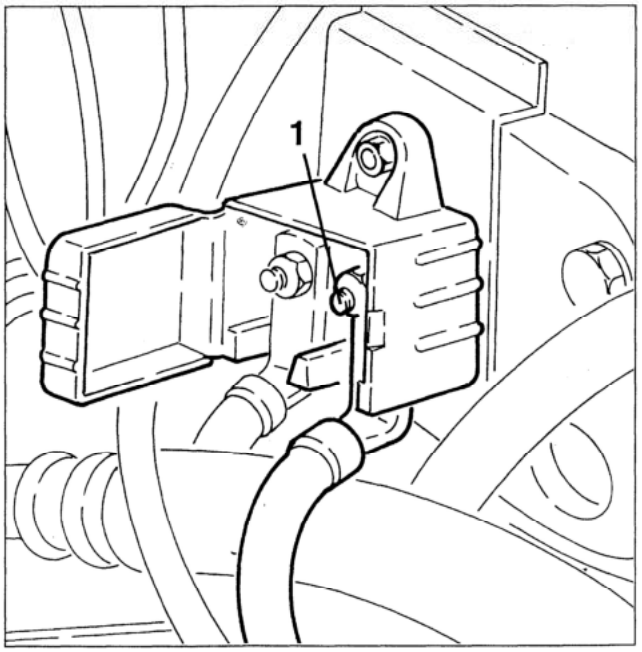

1. Disconnect the fuel delivery pipe from the distributor manifold.
2. Disconnect the excess fuel return pipe to the tank from the pressure regulator.




1. Disconnect from the union on the cylinder head the coolant delivery sleeve to the climate control system heater.
2. Disconnect from the thermostatic cup the coolant fluid return sleeve from the climate control system heater.

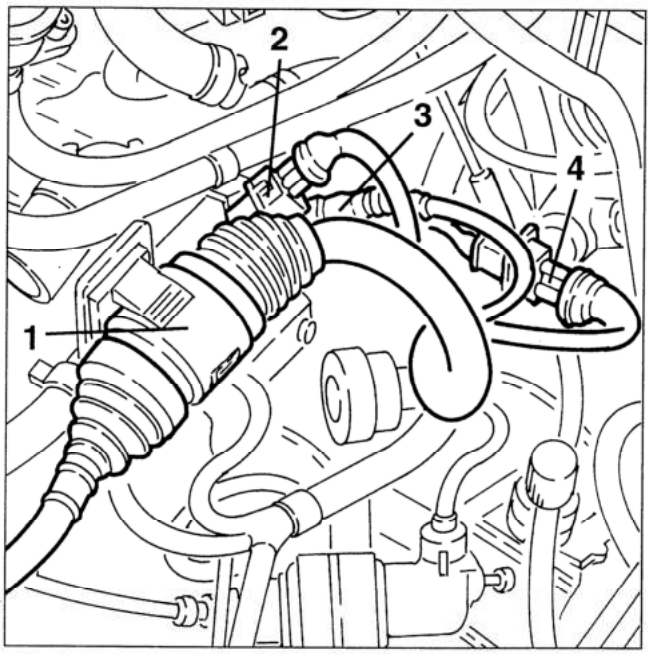



1. Working on the branch box, slacken the fastening nut and disconnect the earth terminal for the starter motor and alternator.

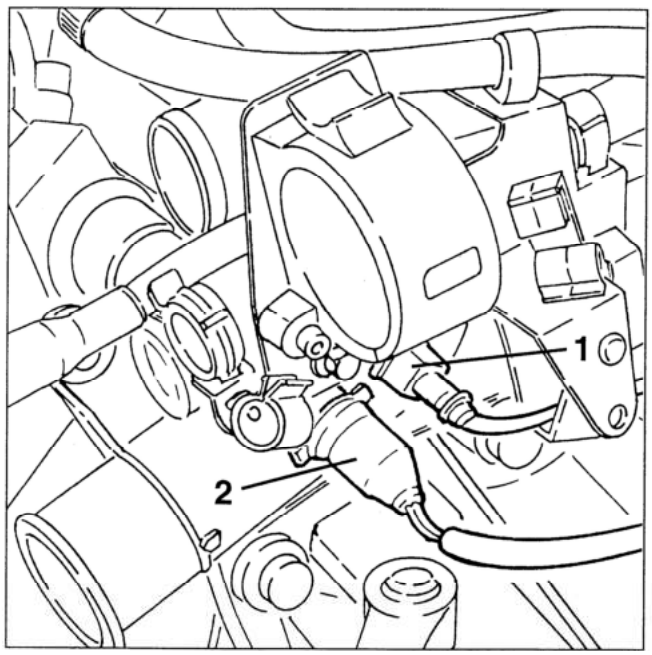



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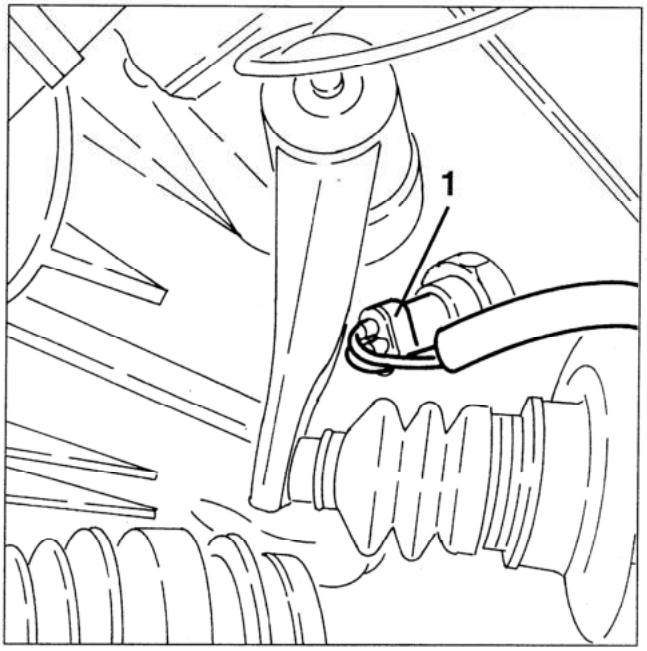
1. Disconnect the injection wiring connector.
2. Disconnect the electrical connection of the rear pinging sensor.
3. Disconnect the electrical connection of the rpm and timing sensor.
4. Disconnect the electrical connection of the cam angle sensor.



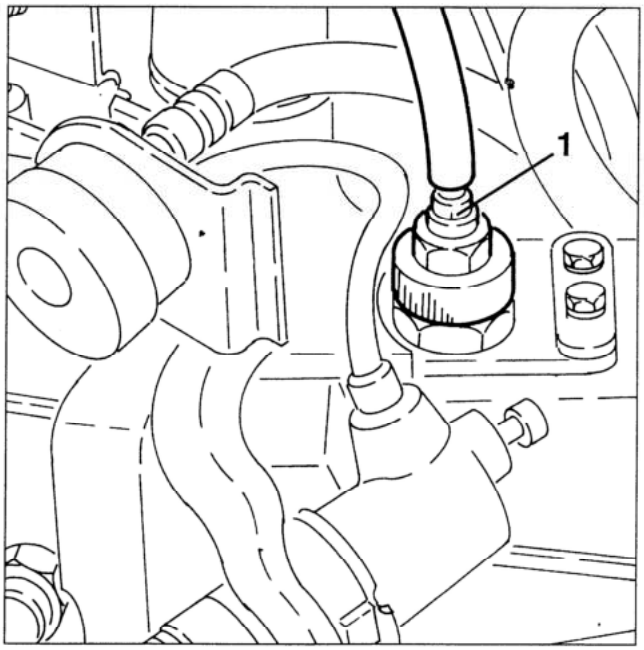

1. Disconnect the electrical connection from the engine coolant temperature sensor (NTC).
2. Disconnect the electrical connection from the coolant temperature transmitter and maximum temperature thermal contact.




1. Disconnect the electrical connection from the reverse gear sensor.

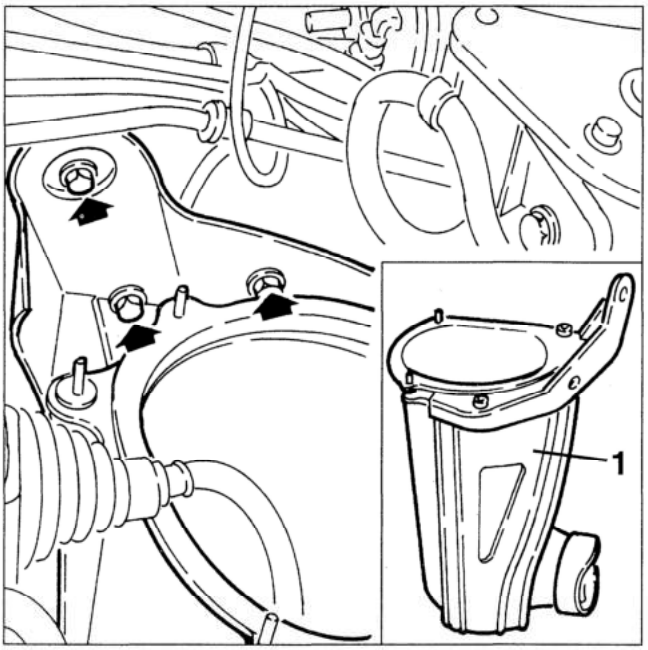



1. Disconnect the cable for synchronised reverse gear engagement.

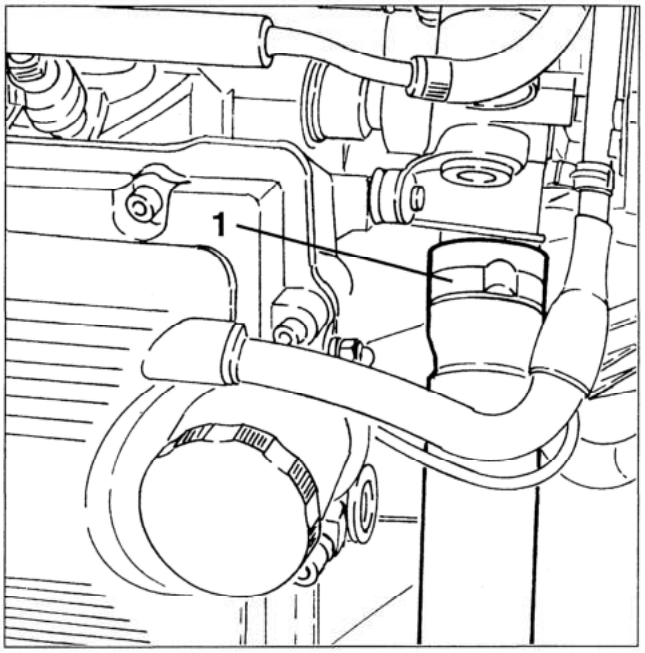



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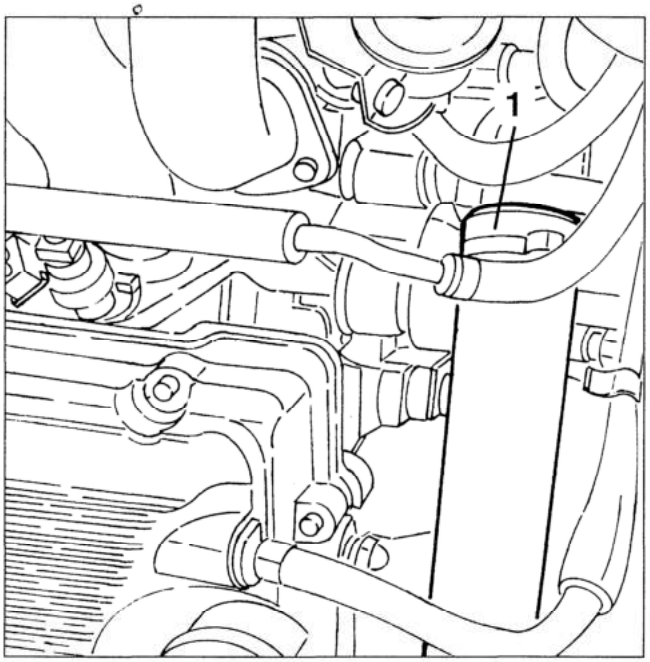
1. Slacken the fastening screws and remove the air cleaner container complete with support bracket.



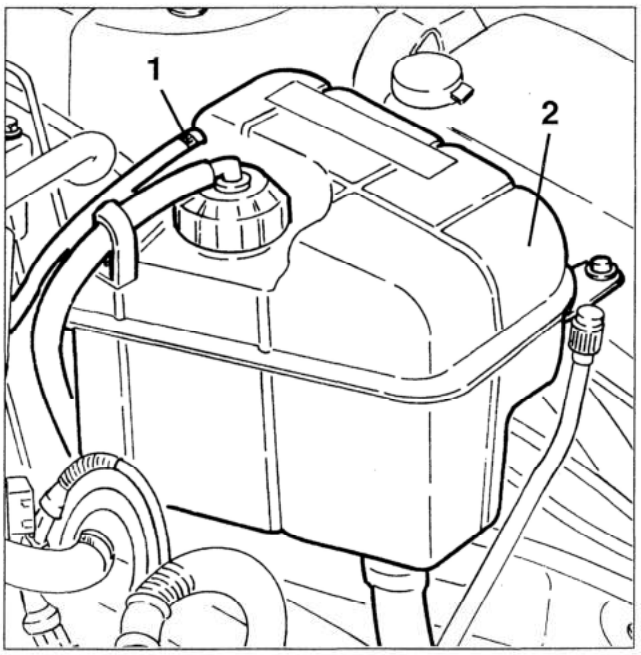

1. Disconnect the coolant return sleeve from the radiator from the thermostatic cup.




1. Disconnect the the coolant delivery sleeve to the radiator from the thermostatic cup.

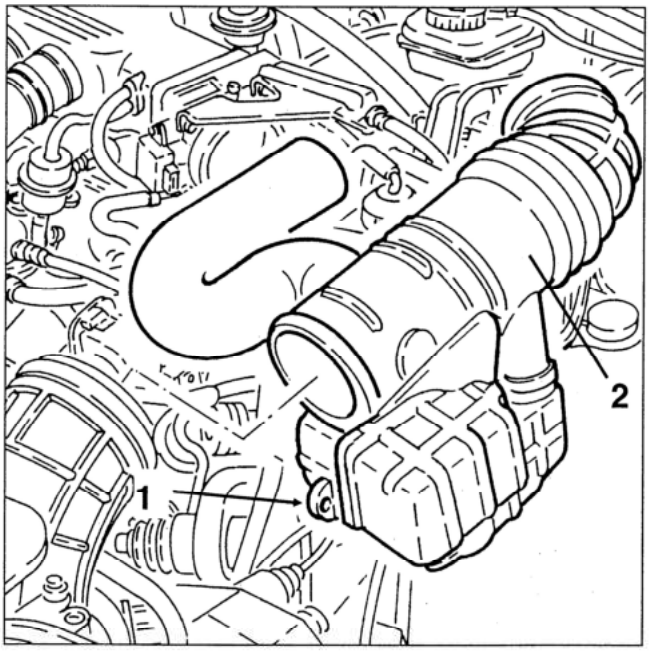



1. Disconnect the throttle barrel coolant outlet pipe from the expansion tank.
2. Slacken the fastening screws and remove the expansion tank complete with sleeve.

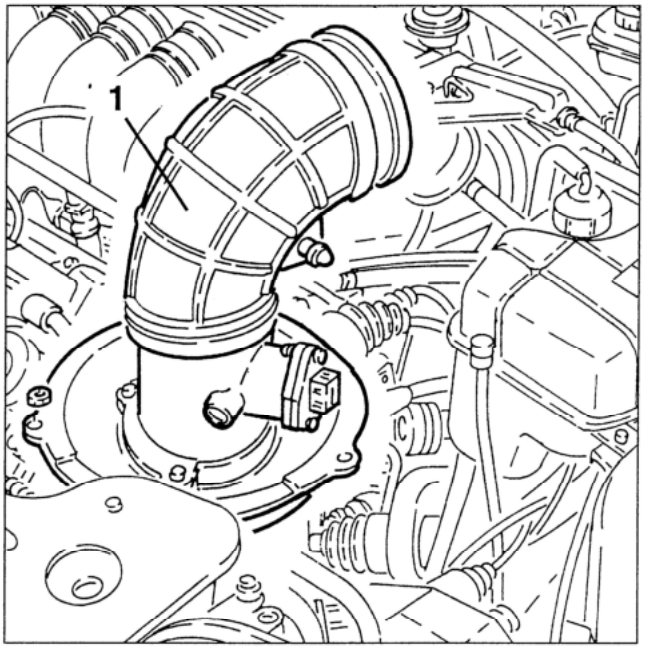



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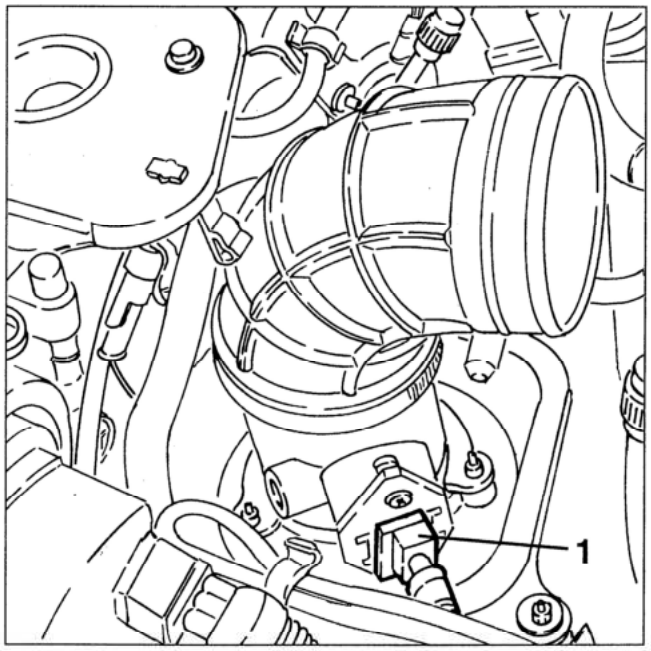
1. Remove the fastening button of the first section of corrugated sleeve to the resounder.
2. Slacken the two fastening clamps and remove the second section of the corrugated sleeve complete with resounders.



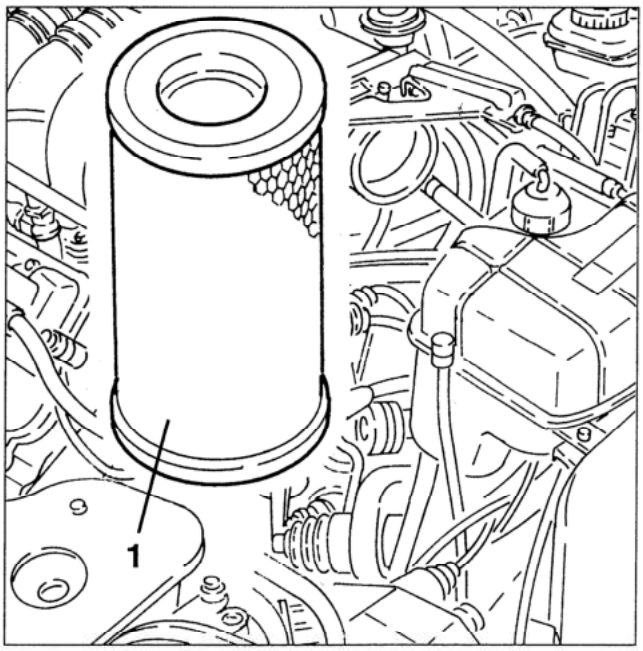

1. Slacken the three fastening nuts and remove the air cleaner cover complete with hot film air flow meter and the first section of the corrugated sleeve.




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




1. Remove the filtering element with its duct.

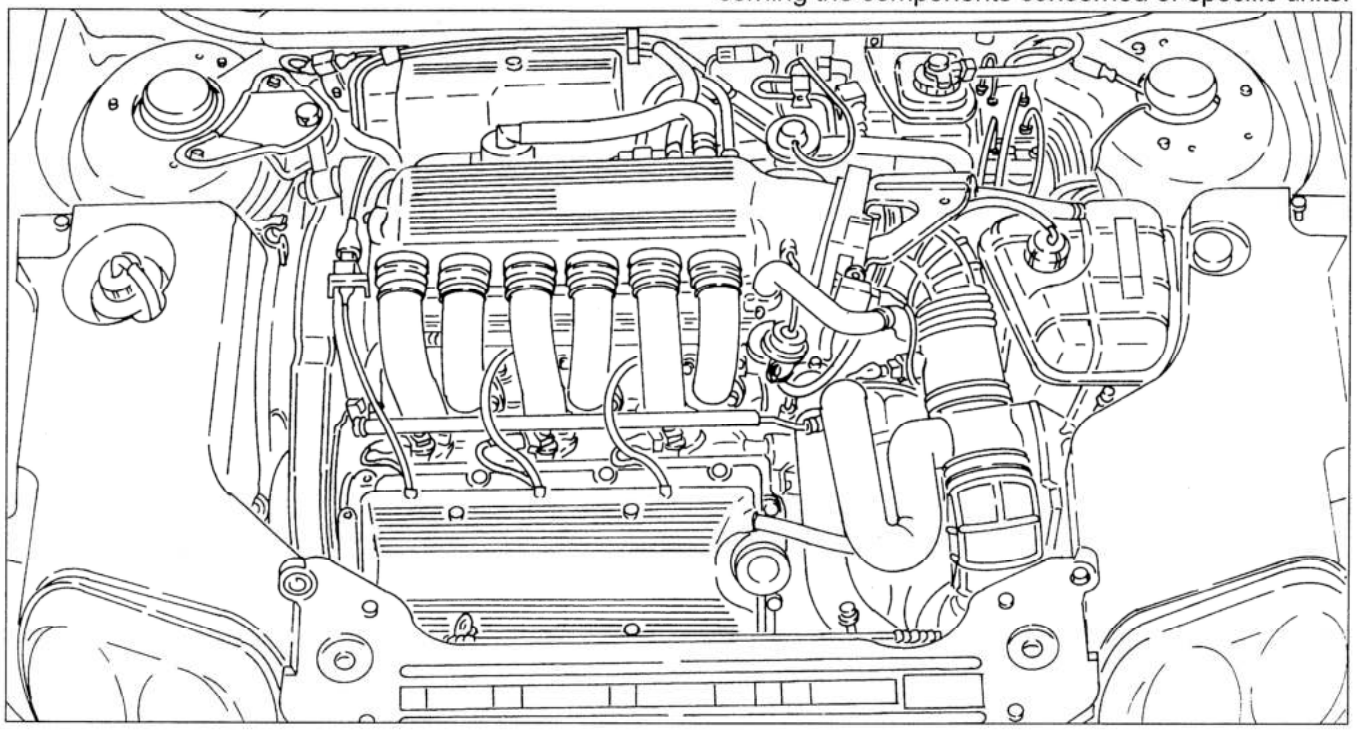



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## DESCRIPTION

The information and illustrations given below make it possible to quickly remove the power plant from its housing and subsequent refitting.

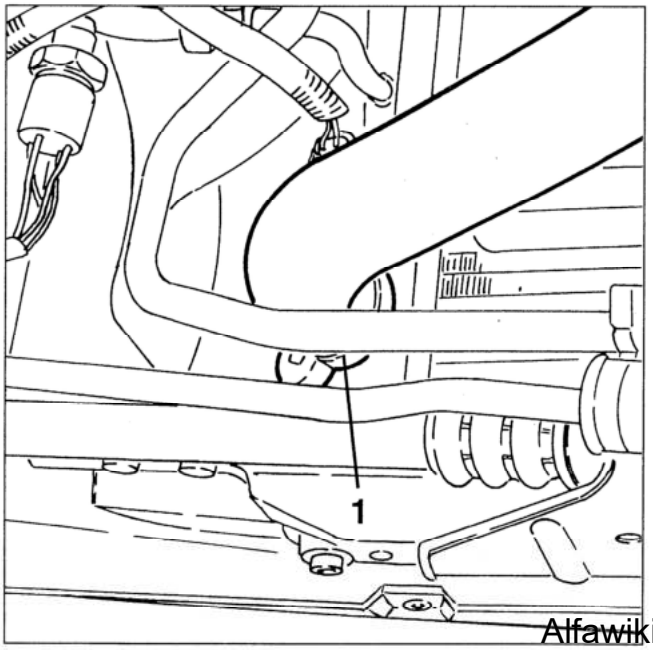
Disassembly of the engine on the bench is described in the volume "ENGINE OVERHAULING".
The following procedure gives the possibility to be used only in part depending on requirements. For further information and details see the chapters concerning the components concerned or specific units.



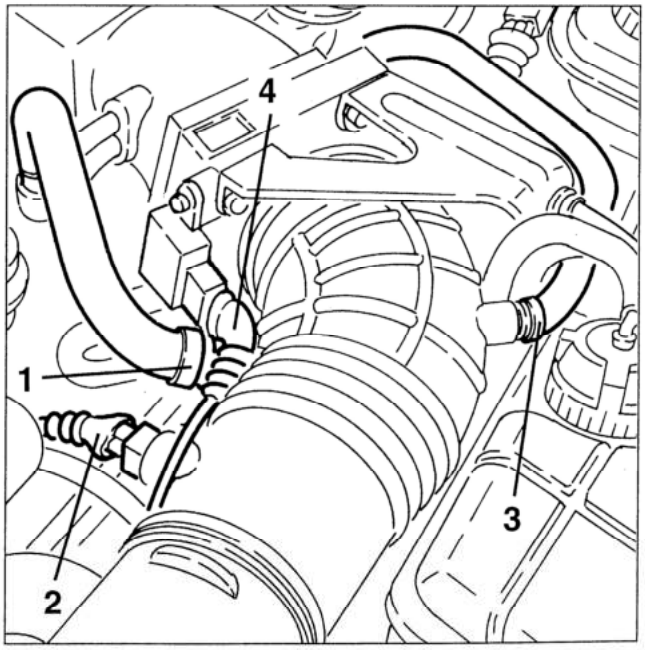
## REMOVAL

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Remove the front wheels and mud flaps.
- Remove the engine compartment trim.
- Remove the right front wheel house.
- Drain the coolant fluid (R134a) of the air conditioning system (see specific paragraph).

1. Raise the car and drain the coolant fluid, disconnecting the radiator outlet sleeve and collect it in a suitable container.

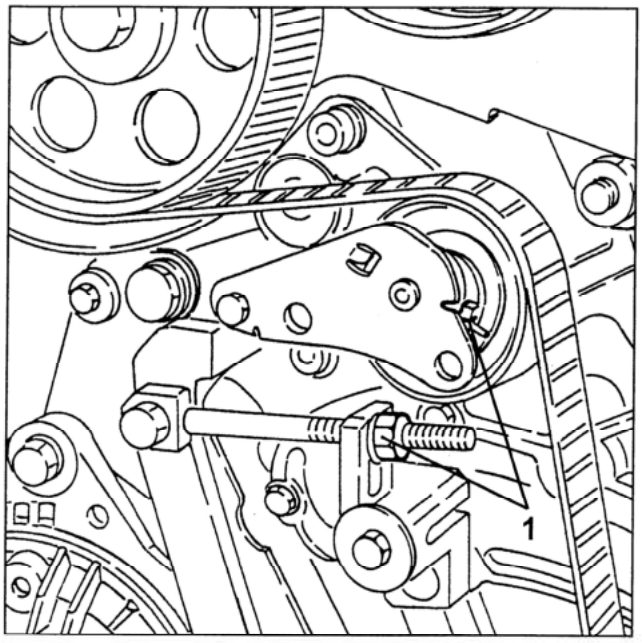



1. From the corrugated sleeve disconnect the oil vapour recovery pipe leading from the cylinder head.
2. Disconnect the electrical connection from the intake air temperature sensor.
3. From the corrugated sleeve disconnect the air intake pipe for the constant idle speed device.
4. Disconnect the electrical connection from the throttle potentiometer.

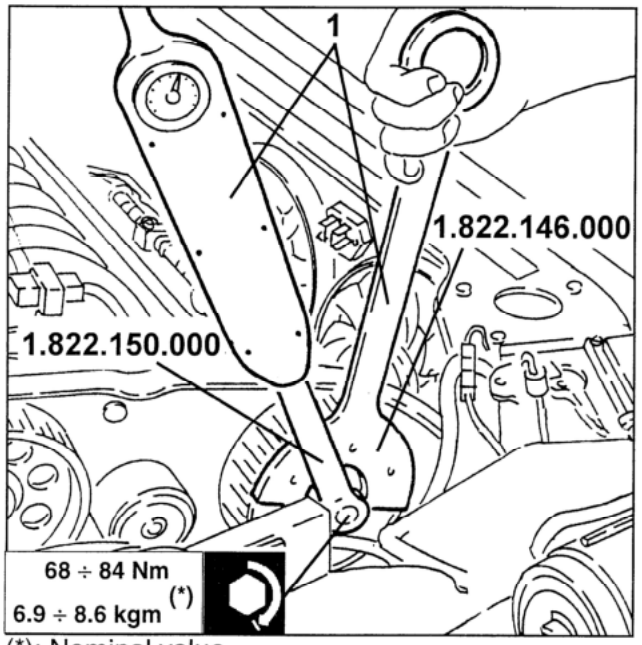



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1. Take the mobile notch under the fixed notch on the belt take-up by means of the nut shown in the figure.

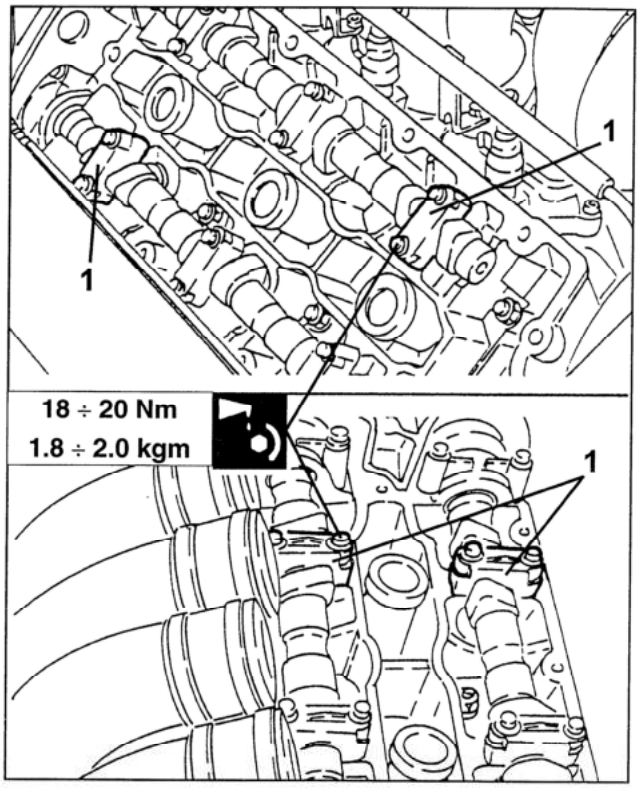



1. Use extension no. 1.822.150.000 and tool no. 1.822.146.000 to contrast torque: Torque the shaft drive pulley fastening screws as prescribed.

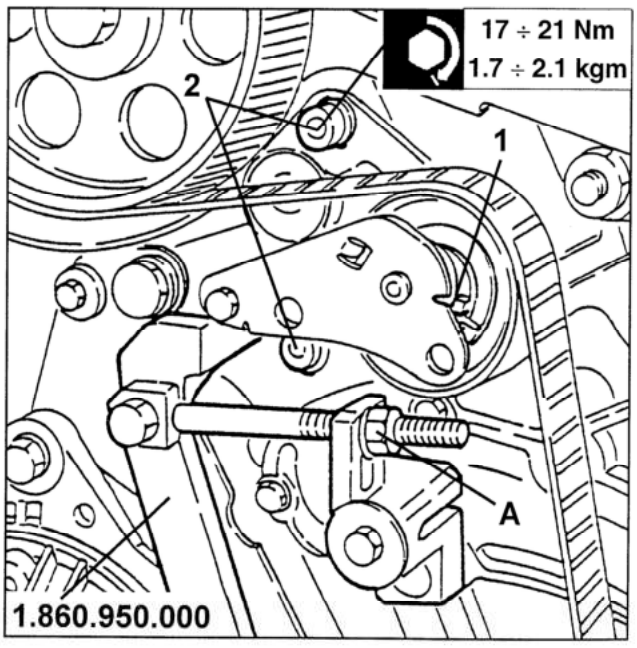



(*): Nominal value

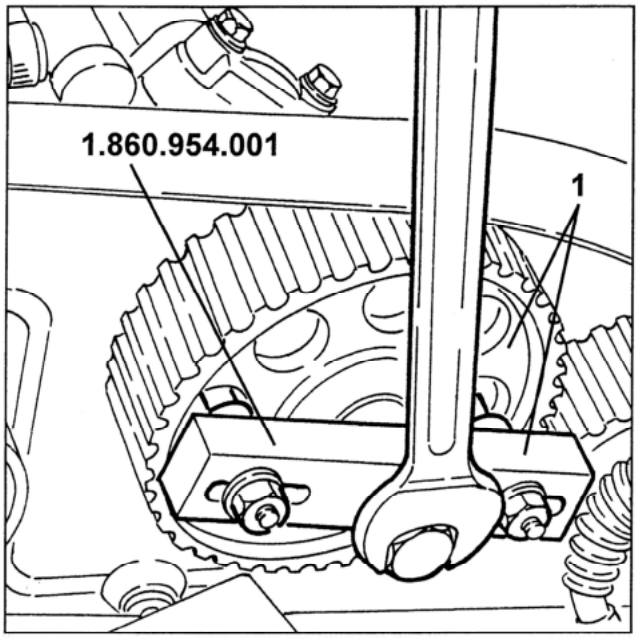
1. Remove the previously fitted templates no. 1.825.040.000 and fit the respective bearings in their place. Torque the fastening screws as prescribed.




- Turn the crankshaft twice in the direction of rotation so to fit the timing belt well.
1. Check whether the fixed notch on the belt take-up coincides with the mobile notch. If this is not so, adjust take-up tension by means of nut (A) until the notches coincide.
2. Torque the belt take-up fastening screws and remove tension tool no. 1.860.950.000.

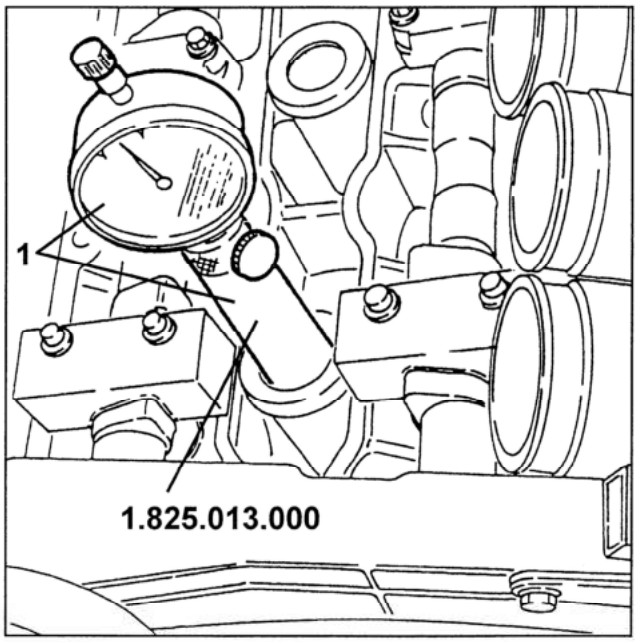


1. Use tool no. 1.860.954.001. Extract the camshaft drive pulleys and reposition in their seats fastening the screws by hand.



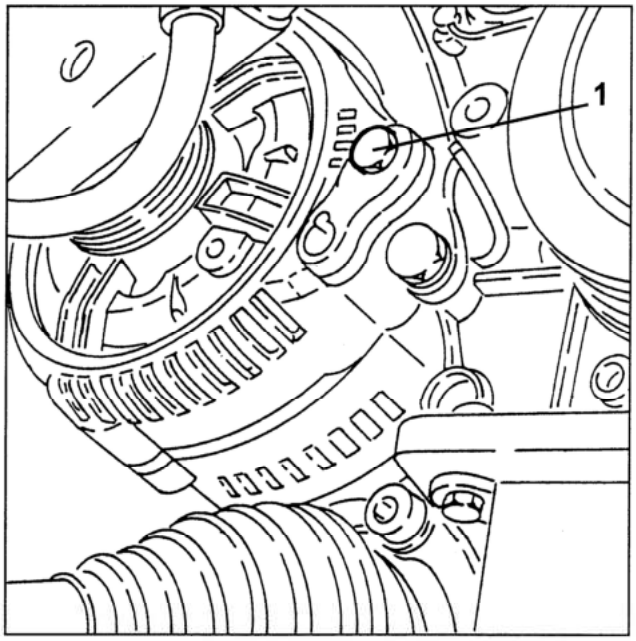

1. Turn the engine pulley fastening nut slightly in both direction to take 1st cylinder piston to TDC, firing stroke.

**NOTE: Make sure the last crankshaft turn is in the direction of operation.**

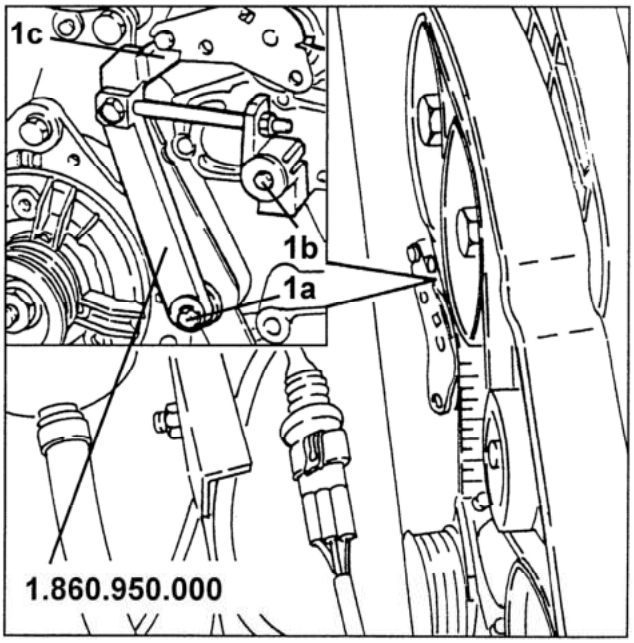



- Complete timing belt assembly by fitting it on the drive pulley.

1. Loosen the lower alternator screw to fit the timing belt tension tool.



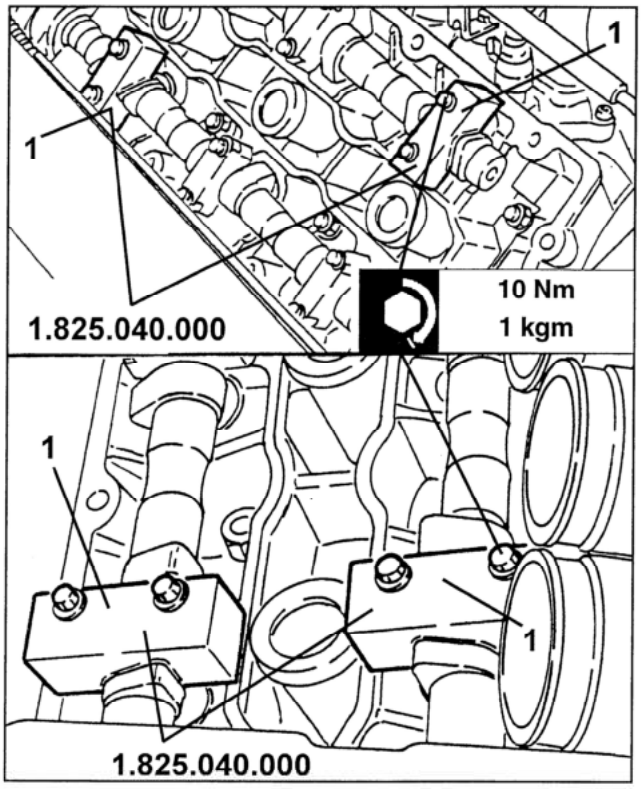

1. Fit timing belt tension tool no. 1.860.950.000 and fasten it with the previously screw (1a) to the alternator and screw (1b) to the coolant pump; tool pin (1c) should contrast the mobile part of the belt take-up.



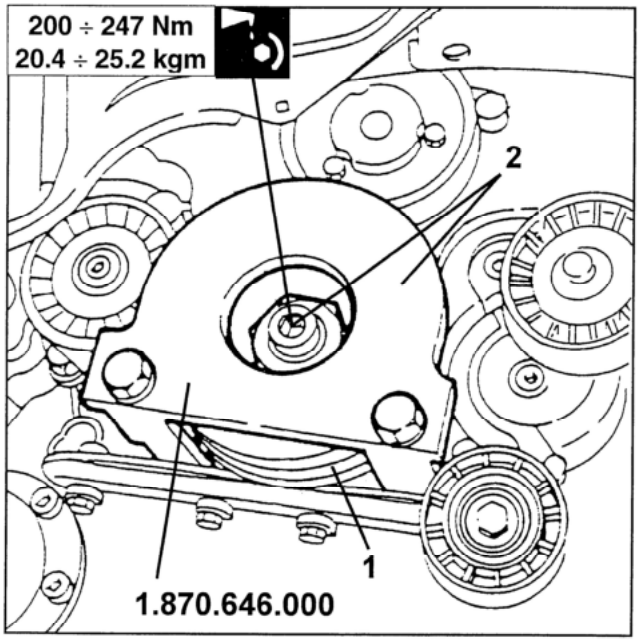


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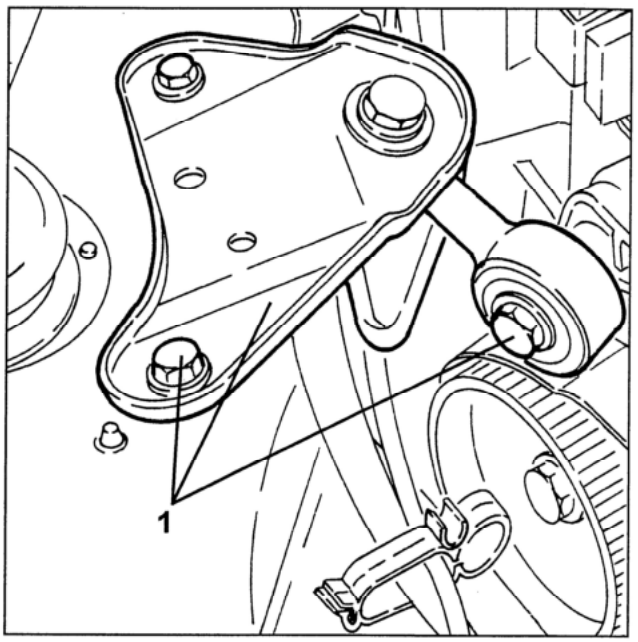
1. Fit templates no. 1.825.040.000 in the position shown on the templates in the place of the removed camshaft bearings.



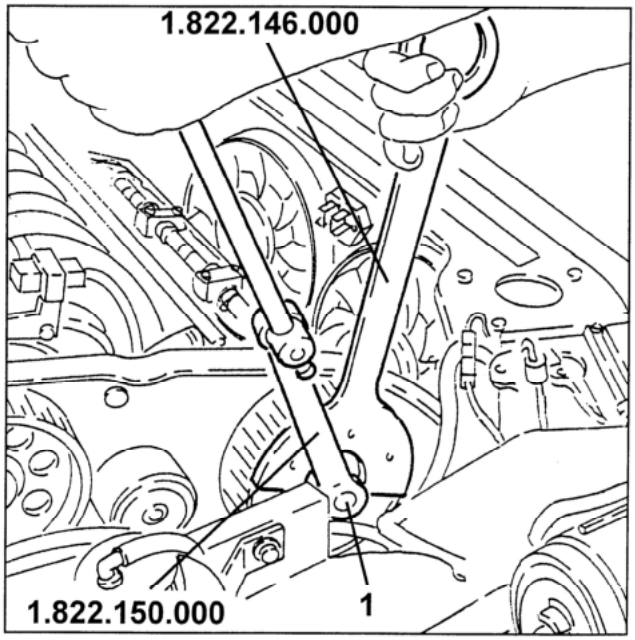

- Lift the vehicle and fit a new timing belt on the drive pulley.
1. Refit the engine pulley and fasten the respective nut without torquing.
2. Fit tool no. 1.870.646.000 and torque the engine pulley fastening nut as prescribed.
- Remove tool no. 1.870.646.000.



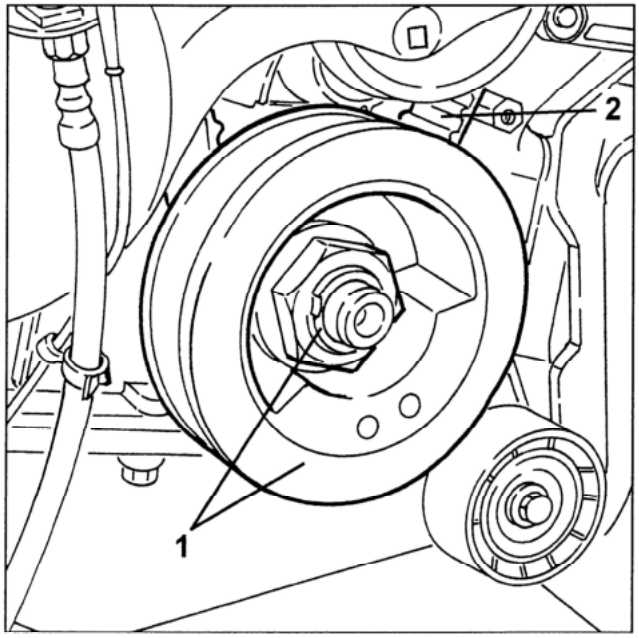

1. Loosen the fastening screws and remove the tie-rod and bracket on underbody side.



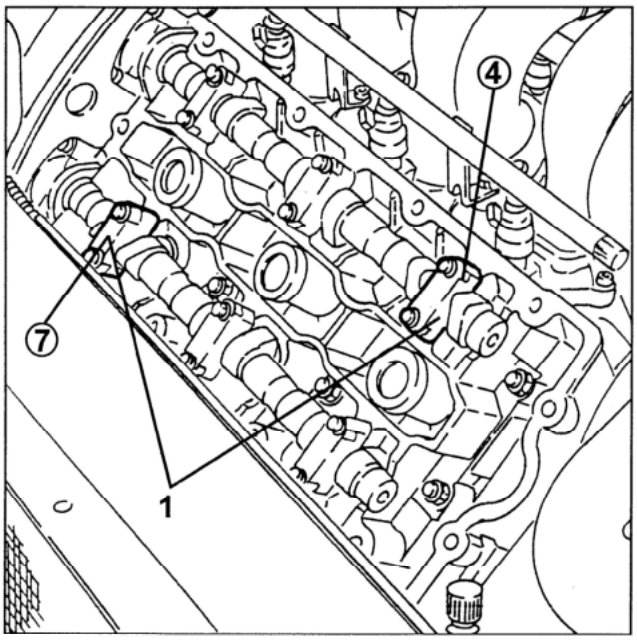

1. Lower the vehicle. Use extension no. 1.822.150.000 and tool no. 1.822.146.000 to contrast torque. Loosen the camshaft drive pulley fastening screws.



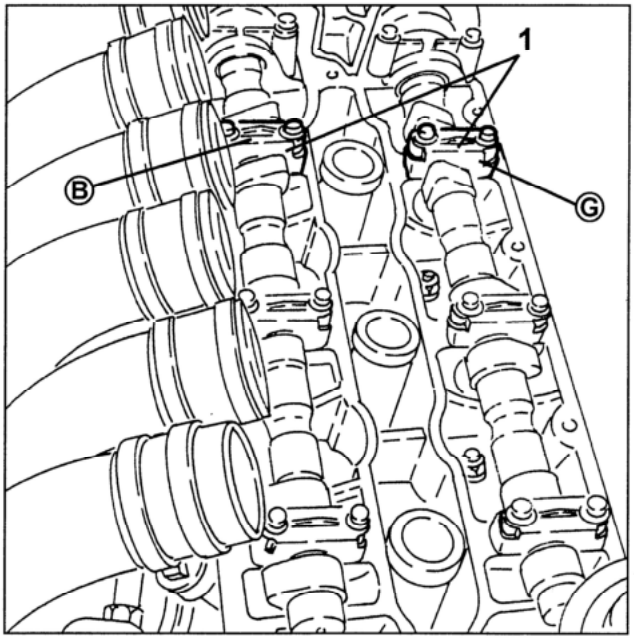
- Remove tool no. 1.870.646.000.
1. Loosen the nut and remove the engine pulley.
2. Remove the timing belt.




1. Remove the left-hand cylinder head camshaft bearings **4** and **7**.

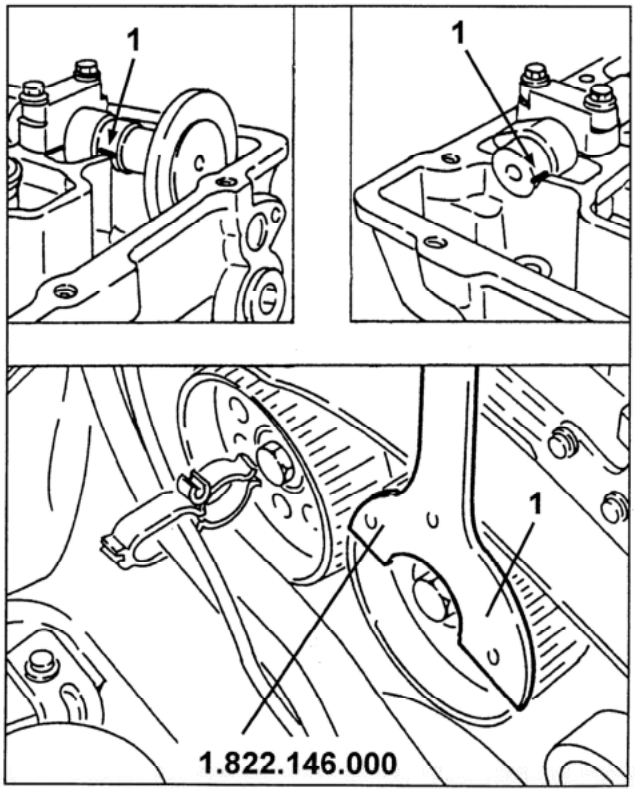



1. Remove the right-hand side camshaft bearings **B** and **G**.




1. Use tool no. 1.822.146.000 and turn each camshaft so that the reference marks on the shafts coincide with the upper cylinder head surface.

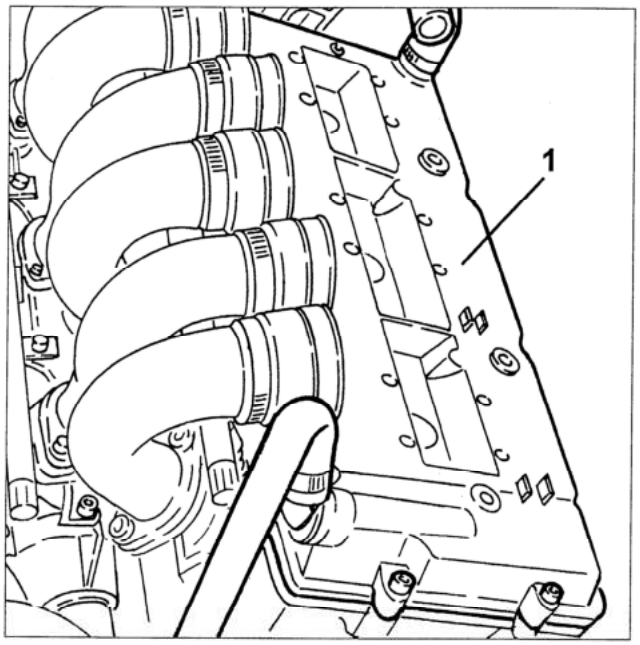
**NOTE: The reference marks must face the centre of each cylinder head.**



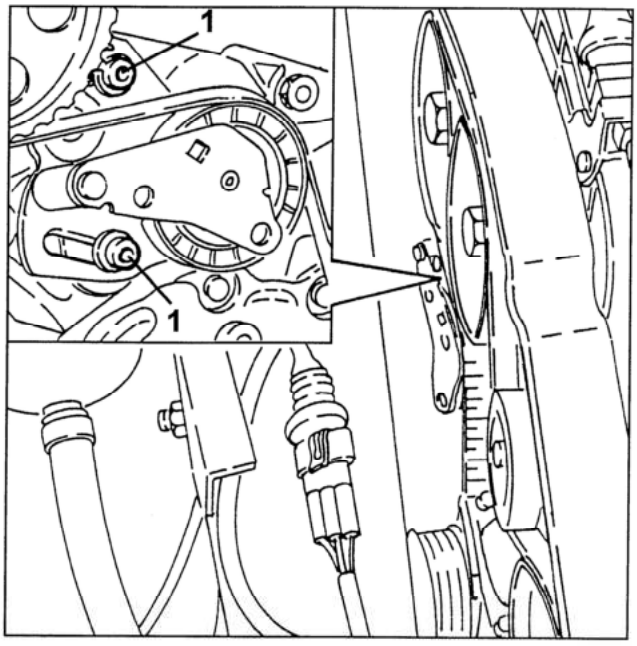


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1. Loosen the fastening screws and remove the right-hand cylinder head cover.

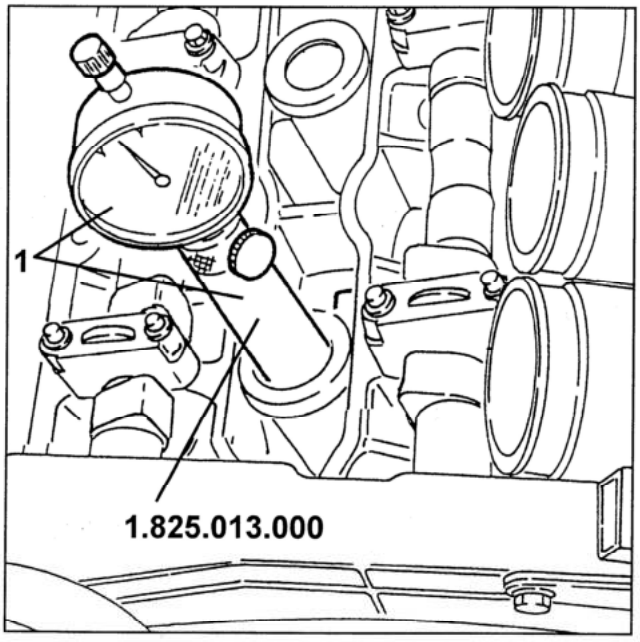



1. Loosen the timing belt take-up device fastening screws.

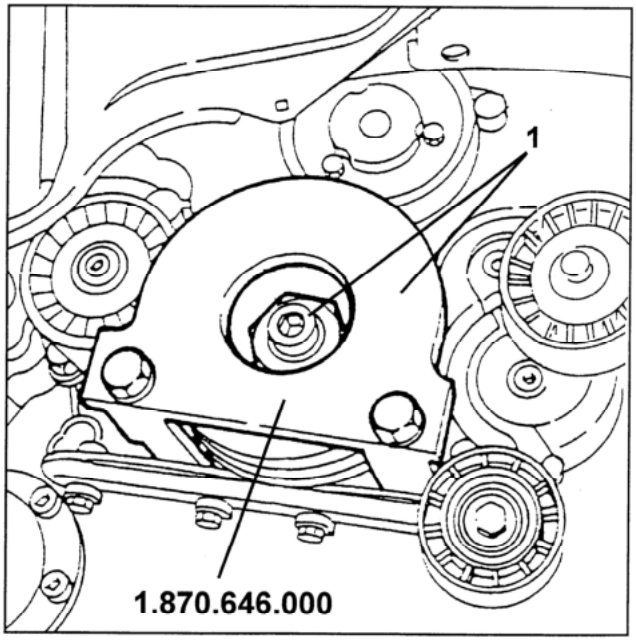



1. Fit tool no. 1.825.013.000 in the first cylinder spark plug seat.
- Take 1st cylinder piston to TDC, firing stroke, by slightly turning the crankshaft in both directions by means of the auxiliary unit drive pulley.

**NOTE: Make sure the last crankshaft rotation is in the direction of operation.**



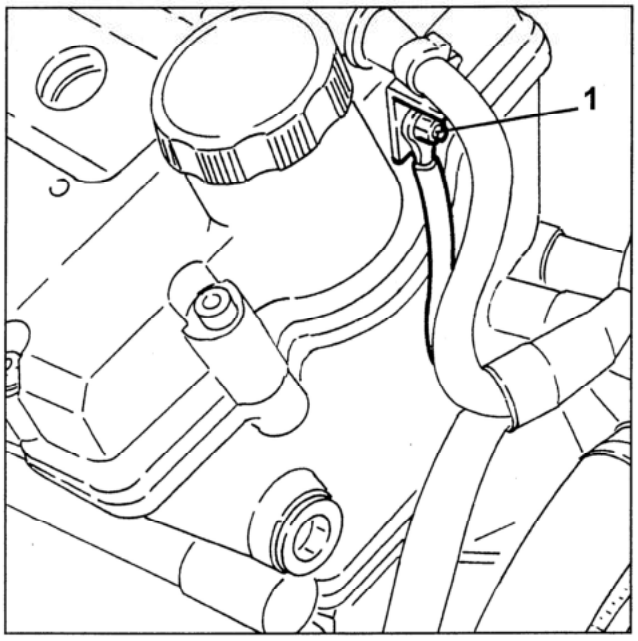

1. Loosen the engine pulley nut with tool no. 1.870.646.000 to contrast torque.



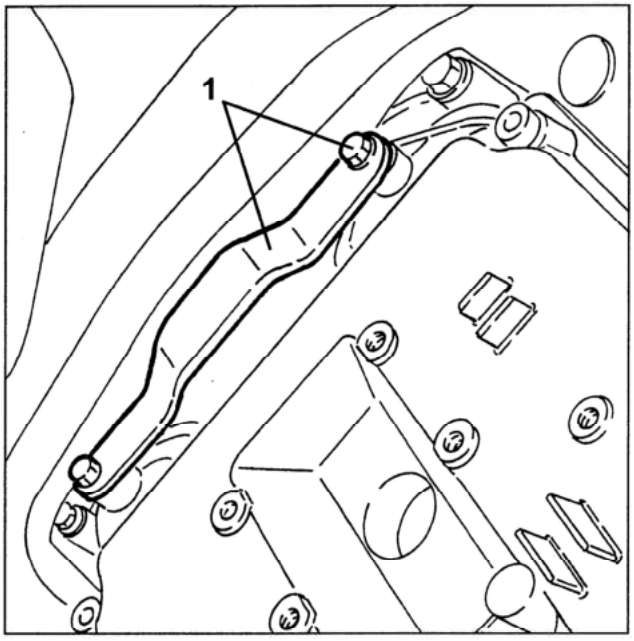


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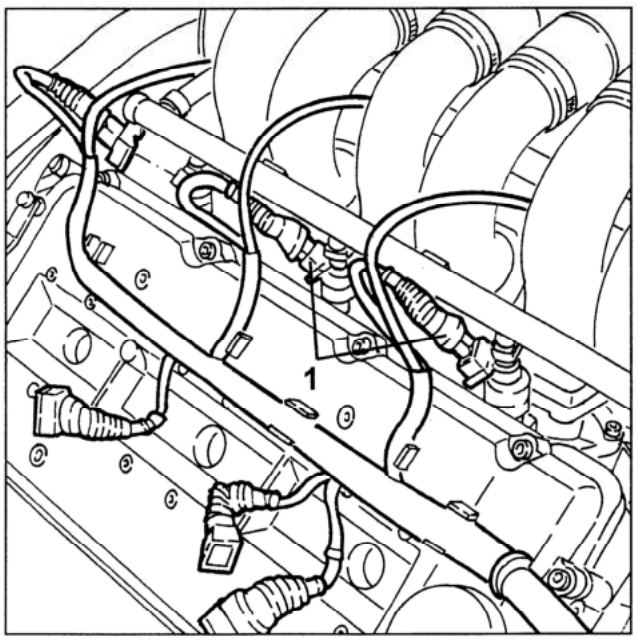
1. Disconnect the earth wire from the left-hand cylinder head tappet cover.



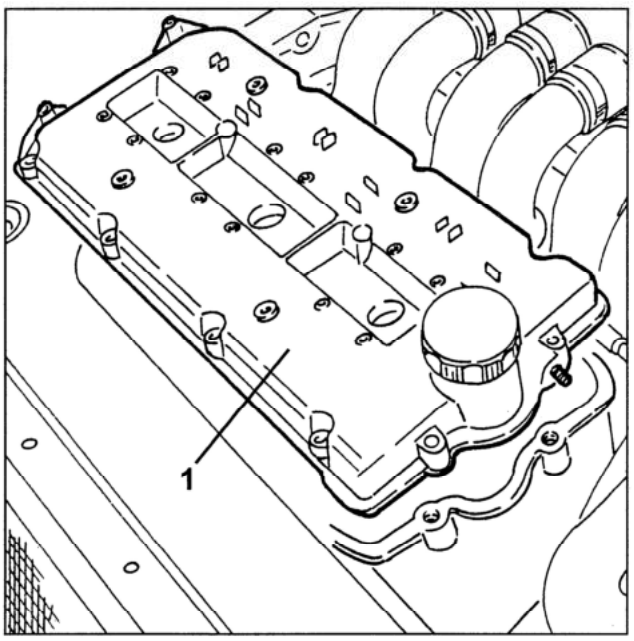

1. Loosen the fastening screws and remove the timing belt upper guard bracket nut from the left-hand cylinder head.



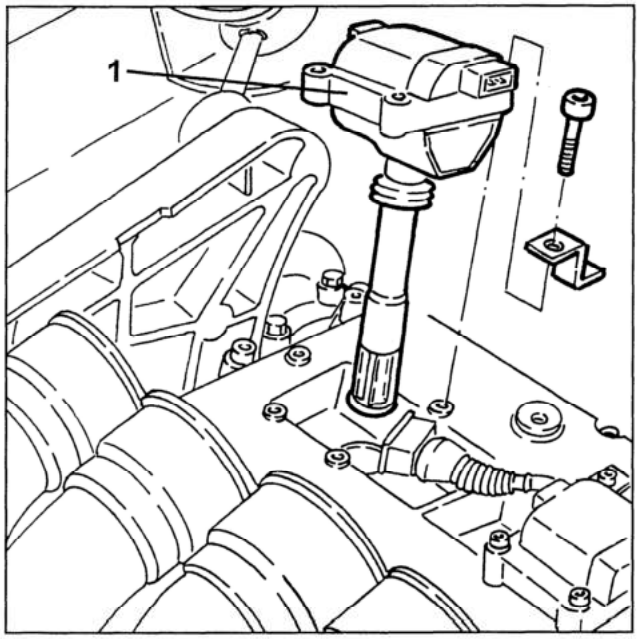

1. Disconnect the injector electrical connections and move the wiring aside.



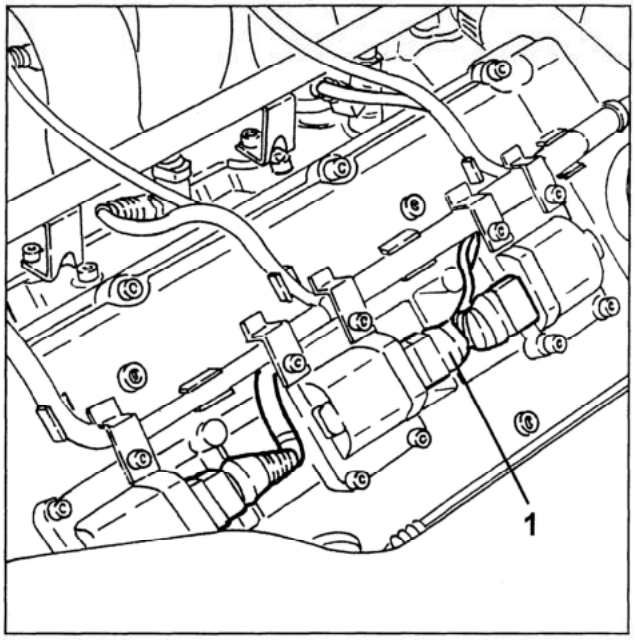

1. Loosen the fastening screws and remove the cover from the left-hand cylinder head cover.



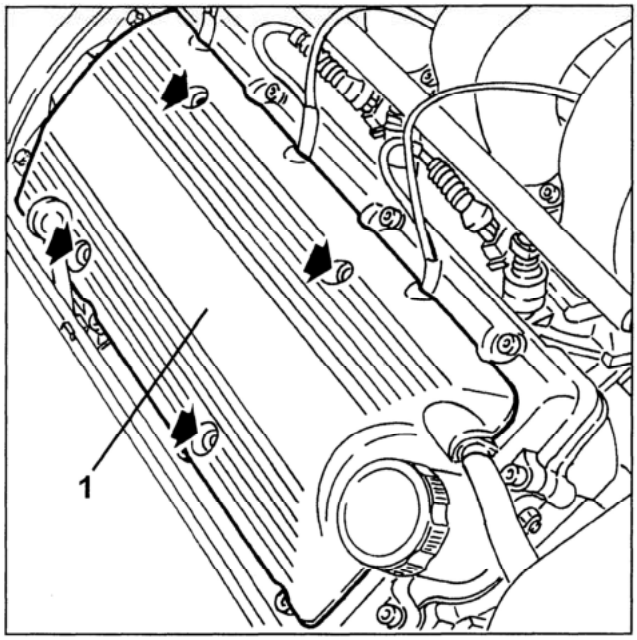
1. Loosen the fastening screws and remove the ignition coils from the right-hand cylinder head.



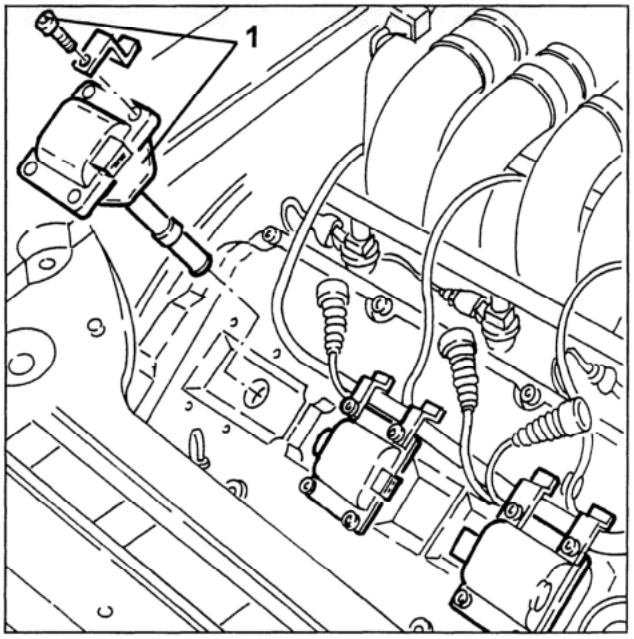

1. Disconnect the left-hand cylinder head ignition coil electrical connections.



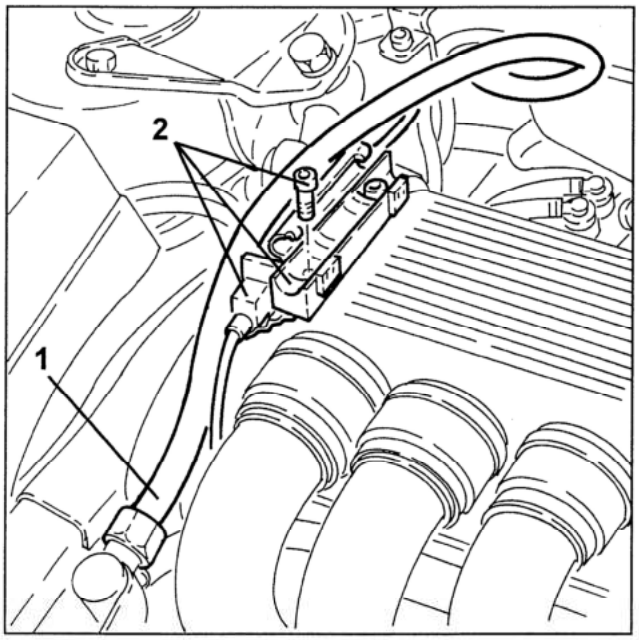

1. Loosen the fastening screws and remove the ignition coils from the left-hand cylinder head.



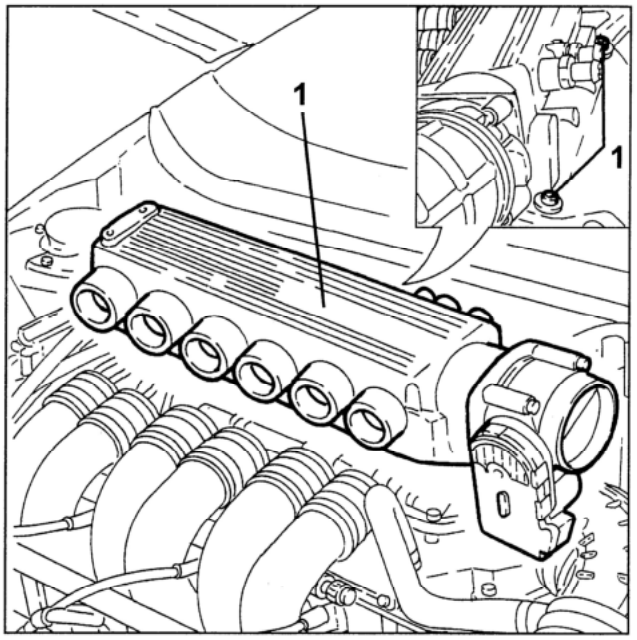

1. Loosen the fastening screws and remove the left-hand cylinder head ignition coils.



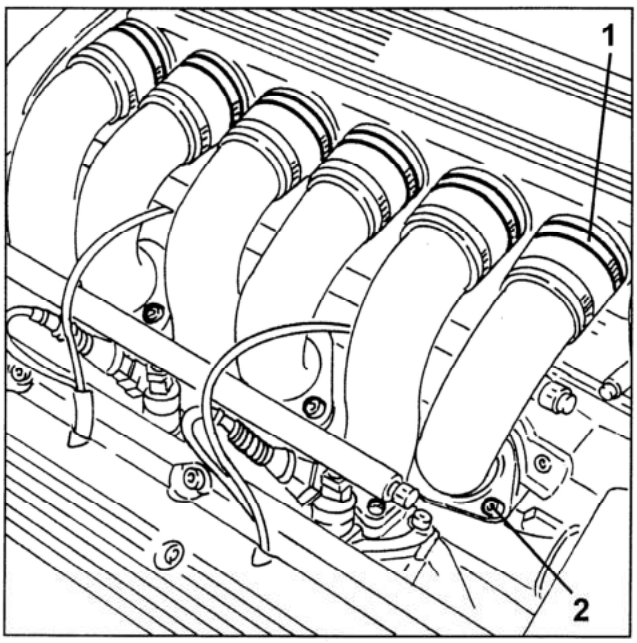
1. Release the fuel delivery pipe from the bracket.
2. Loosen the fastening screws and remove the fuel delivery pipe bracket and front knock sensor electrical connection.



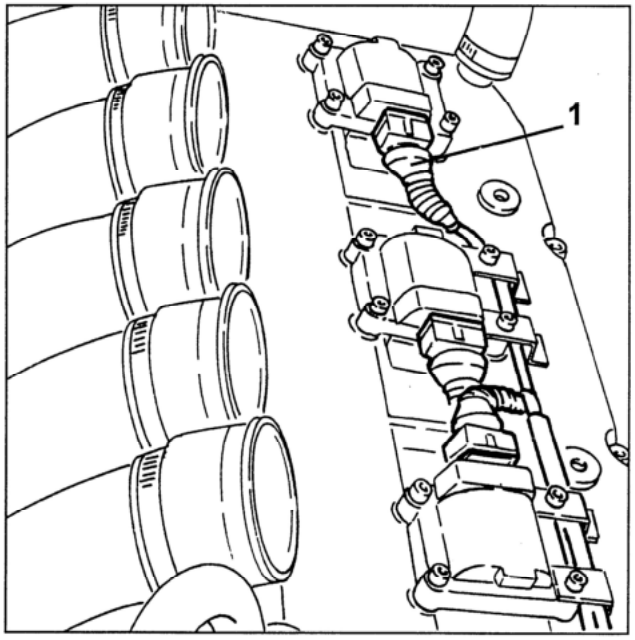

1. Loosen the fastening screws and remove the intake manifold.




1. Loosen the intake manifold air feed duct fastening clips.
2. Loosen the cylinder head feed duct fastening screws.
- Release the air feed ducts from the intake manifold.

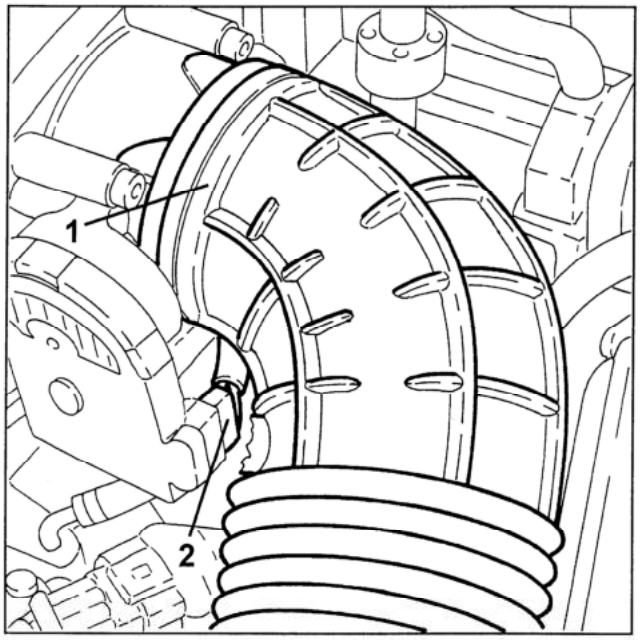



1. Disconnect the right-hand cylinder head ignition coil electrical connections.

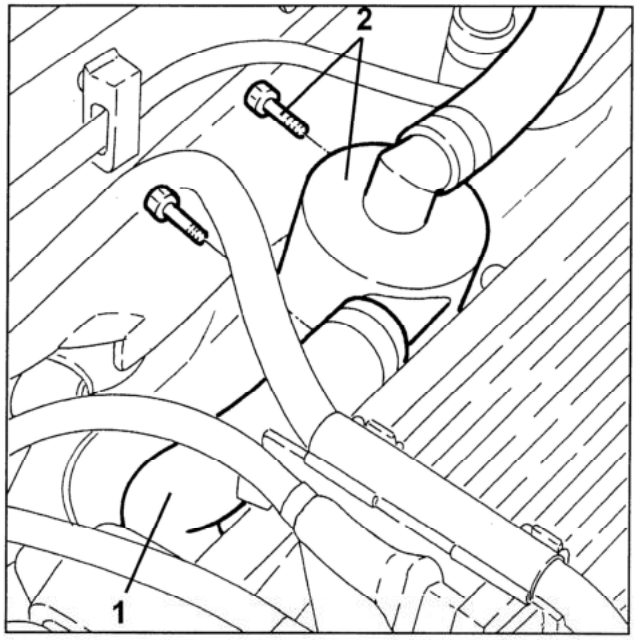



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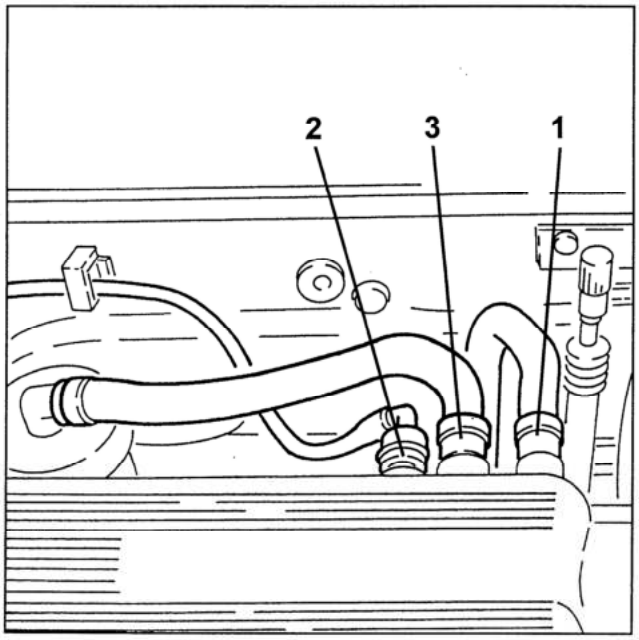
1. Disconnect the corrugated sleeve from the throttle with built-in DVL.
2. Disconnect the throttle and built-in DVL electrical connection.



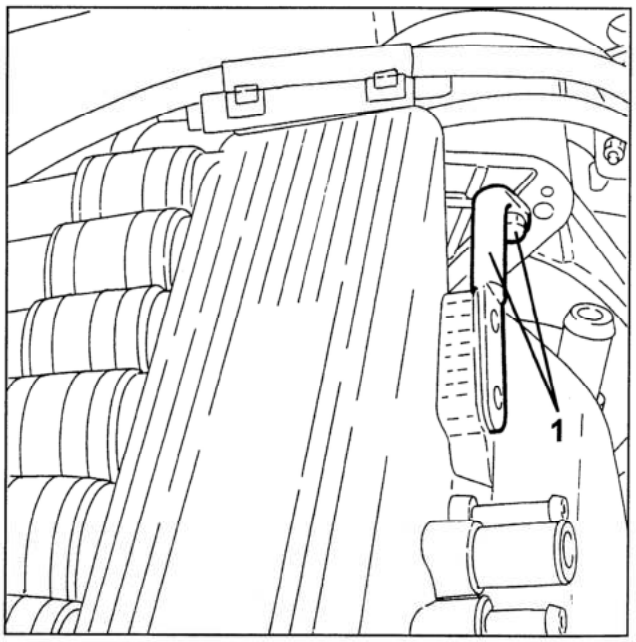

1. Disconnect the oil vapour recovery pipe from the right-hand cylinder head tappet cover.
2. Loosen the fasten screws and move the oil vapour separator from the intake manifold.



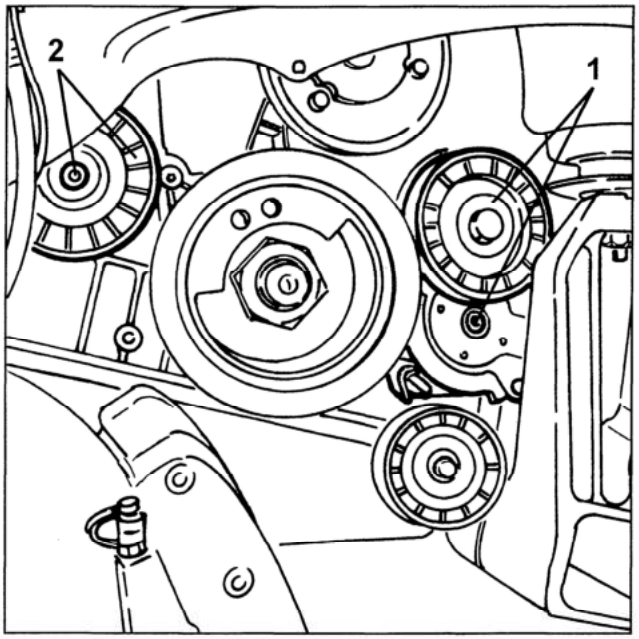

1. Disconnect the brake booster vacuum pipe from the intake manifold.
2. Disconnect the fuel vapour recovery pipe from the intake manifold.
3. Disconnect the oil vapour recirculation pipe from the intake manifold.



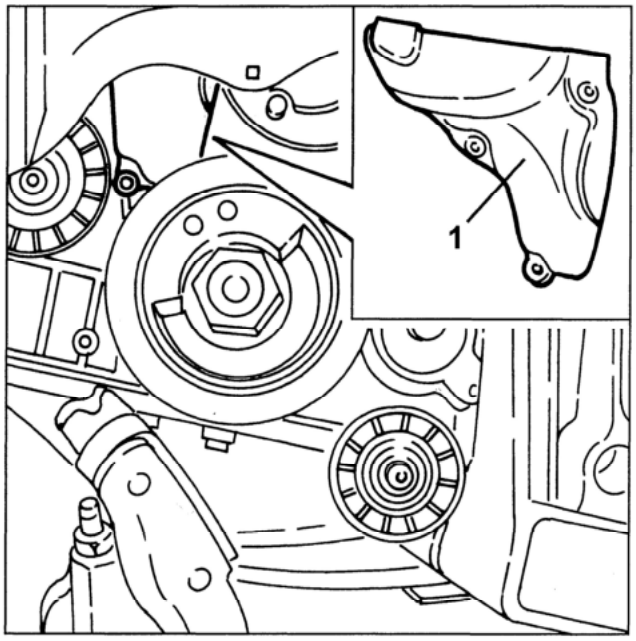

1. Loosen the screw and remove the intake manifold connection from the engine tie-rod.



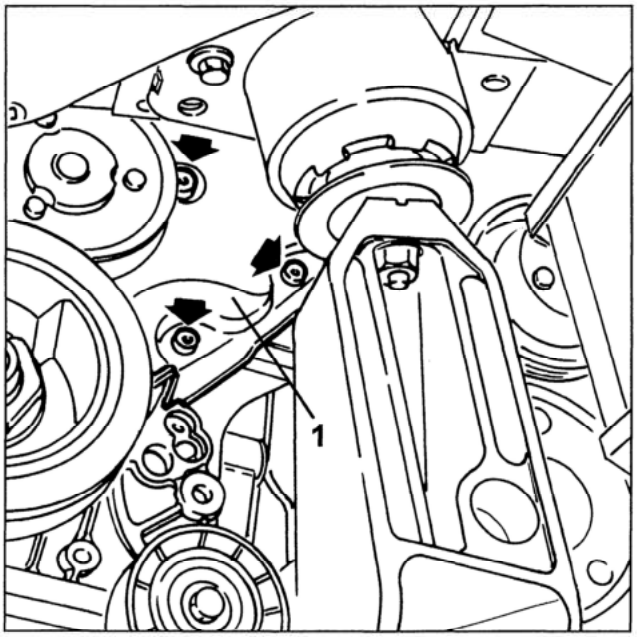
1. Loosen the fastening screw and remove the engine unit drive belt take-up device.
2. Loosen the fastening screw and remove the engine unit drive belt runner.



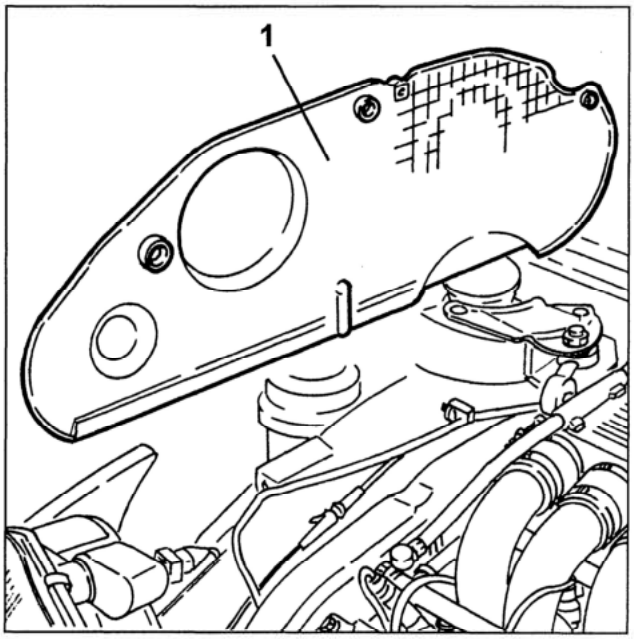

1. Loosen the fastening screws and remove the lower right-hand timing belt guard.




1. Loosen the fastening screws and remove the lower left-hand timing belt guard.




1. Loosen the fastening screws and remove the upper timing belt guard.





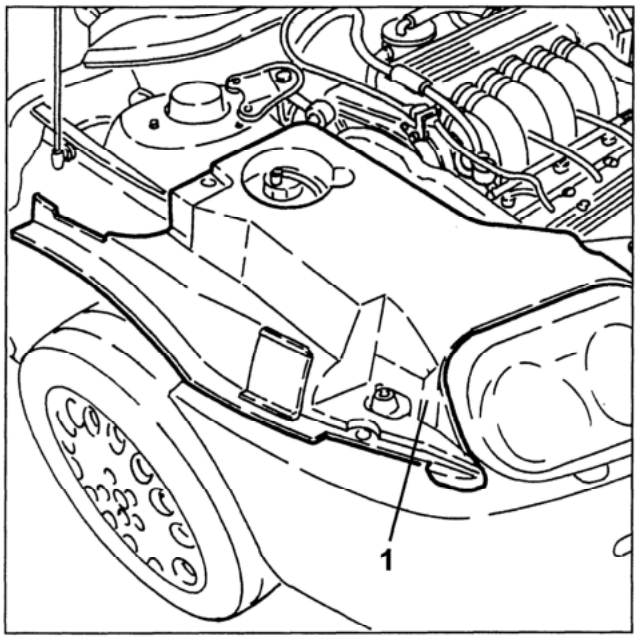

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## ENGINE MAINTENANCE

### TIMING BELT REPLACEMENT

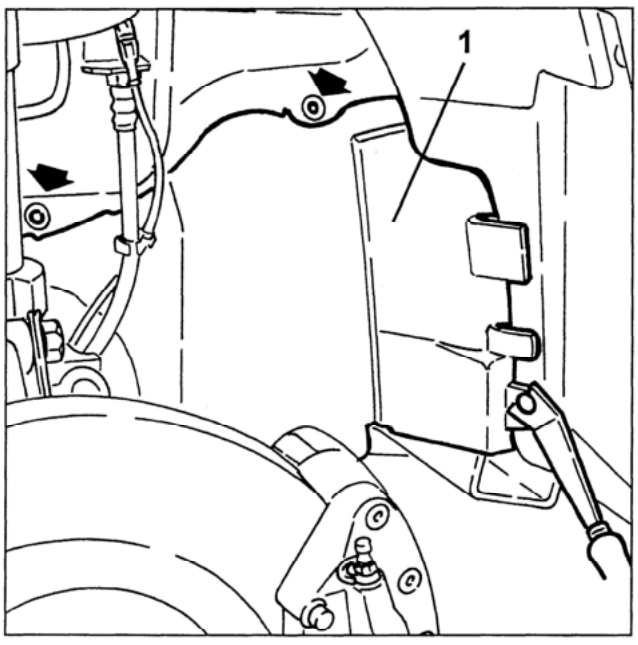
- Position the vehicle on a shop jack.
- Make sure the ignition key is at "STOP" and disconnect the (-) battery terminal.
- Remove the front right-hand wheel.

1. Loosen the fastening nuts and remove the engine compartment side guard.

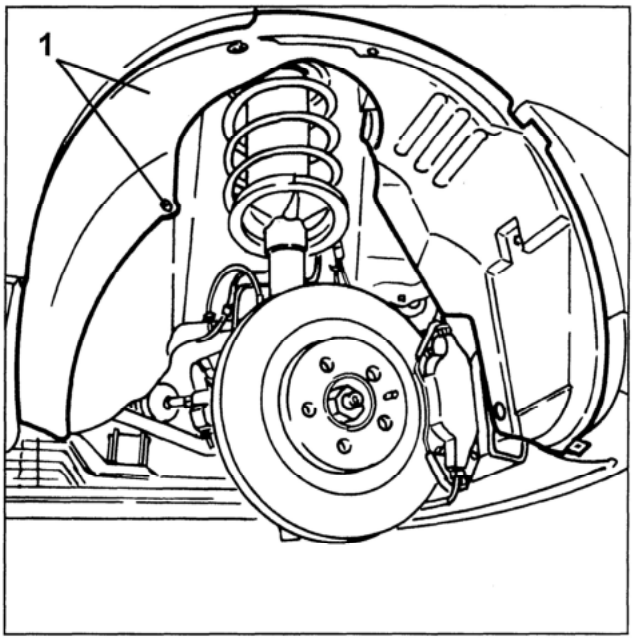



- Remove the front right-hand light cluster (see assembly 55).

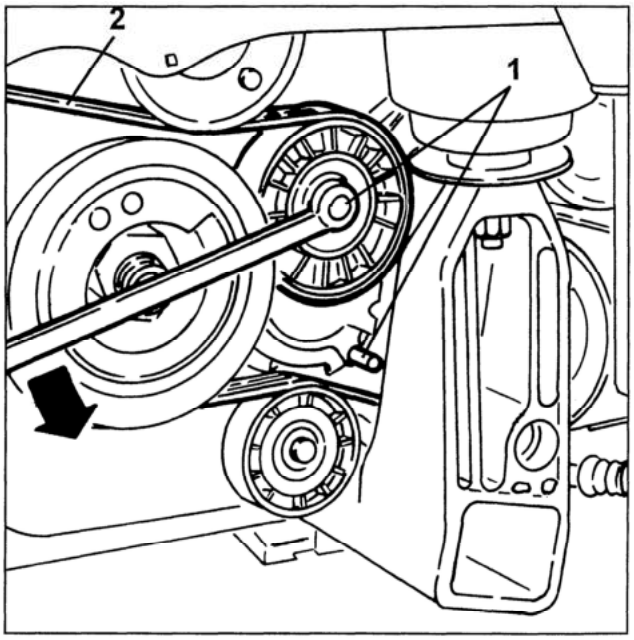
1. Loosen the fastening screws, remove the plastic button and remove the mud flap from the front right-hand wheel compartment.




1. Loosen the fasteners and remove the front right-hand wheelhouse.



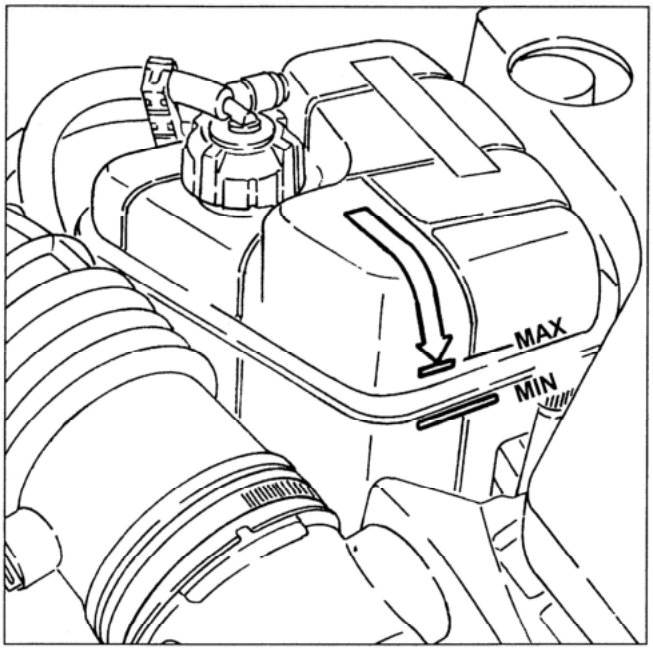

1. Loosen the belt take-up pulley fastening screw with a wrench to overcome the automatic take-up device force (belt loose) by inserting the pin as shown in the figure.
2. Remove the engine unit drive belt.



## CHECKING THE LEVEL AND CHANGING THE ENGINE COOLANT FLUID

### Checking

- Visually check that the level of the coolant in the expansion tank cold is between the MIN and MAX marks.



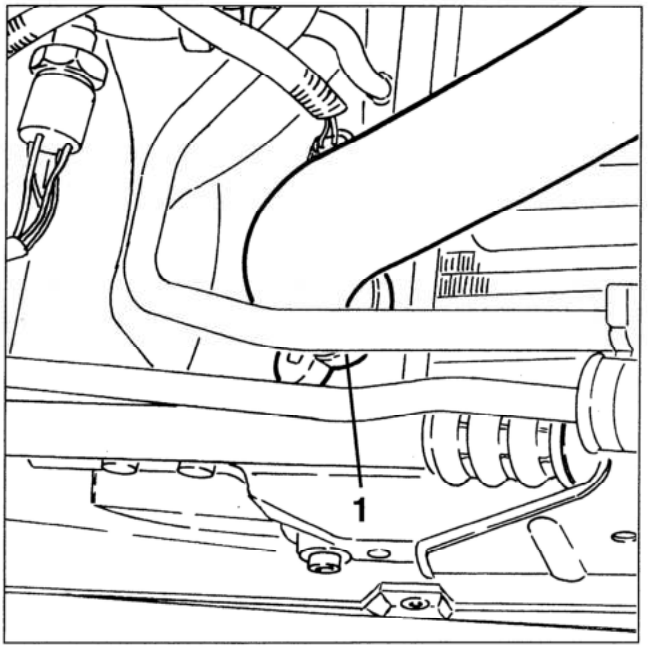

### Changing

- Set the car on a lift.
- Slacken and remove the expansion tank plug.

**WARNING:**
**Absolutely never remove the expansion tank plug when the engine is hot.**

1. Raise the car and drain the engine coolant fluid, disconnecting radiator fluid outlet sleeve and retrieve it in a suitable container.

**WARNING:**
**The antifreeze mixture used as coolant fluid is harmful for paint: therefore avoid contact with painted parts.**



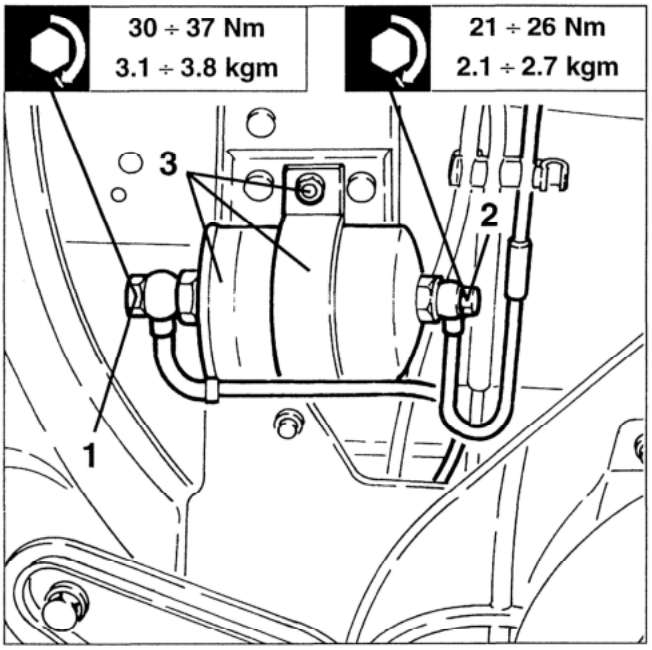

- Reconnect the sleeve to the radiator and any disconnected pipes, checking that all the clamps are tightened.
- Fill with fluid of the specified type and quantity, until reaching the MAX mark of the expansion tank.
- Start the engine and bring it to normal operating temperature so that the opening of the thermostat releases the residual air contained in the circuit.
- With the engine cold, top up to the MAX mark of the expansion tank.
- Retighten the pressurised cap of the expansion tank.

**WARNING:**
**It is unwise to mix antifreeze fluids of different types and make.**
**Do not use antirust additives: they may not be compatible with the antifreeze used.**

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## CHANGING THE FUEL FILTER

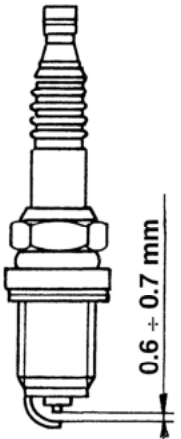
- Set the car on a lift and raise it.
1. Disconnect the fuel inlet pipe fitting from the filter.
2. Disconnect the fuel outlet pipe fitting from the filter.
3. Slacken the fastening clamp and remove the fuel filter.




- Refit the new filter reversing the sequence followed for removal and adhering to the following instructions:
• replace the copper seals of the fittings;
• assemble the filter so that the arrow stamped on it is in the direction of the flow of fuel.

## CHECKING AND CHANGING THE SPARK PLUGS

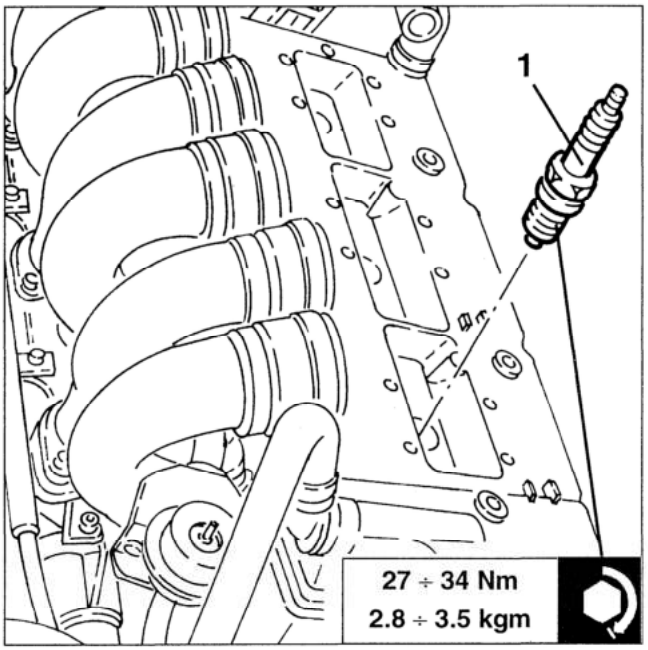
The standard fitted spark plugs are of the type with surface discharge with a peripheral point and a centre electrode.
In order to be able to work correctly, the gap between electrodes must be maintained.




| Spark plugs |
|---|
| NGK PFR6B |

### Checking and replacement

- Remove the ignition coils (see specific paragraph).
1. With the engine cold, remove the spark plugs firstly blowing in the recesses to remove any impurity and traces of dirt.




- Check cleaning and for any breaks on the ceramic insulation. In this case replace the spark plugs.

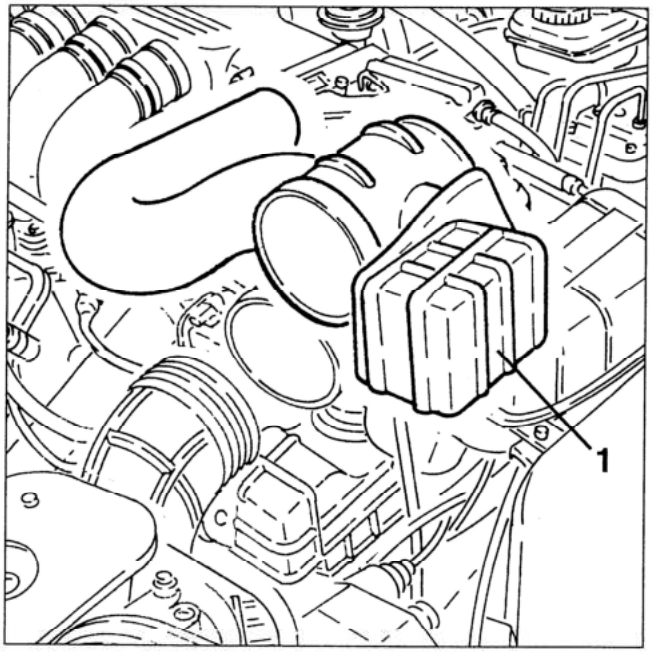
**WARNING:**
**The use of spark plugs with characteristics or dimensions other than those specified can cause damage to the engine and alter the level of harmful emission at the exhaust.**

**A dirty or burnt spark plug is often a symptom of an engine fault. For example:**
**• traces of carbon dust: incorrect mixture, air cleaner very dirty;**
**• oil stains: oil leaking from the piston rings;**
**• formation of ash: presence of aluminium particularly in the oil;**
**• melted electrodes: overheating due to unsuitable fuel, defects in the valves;**
**• high electrode wear: harmful additives in the fuel or oil, pinging in the cylinder head, overheating.**

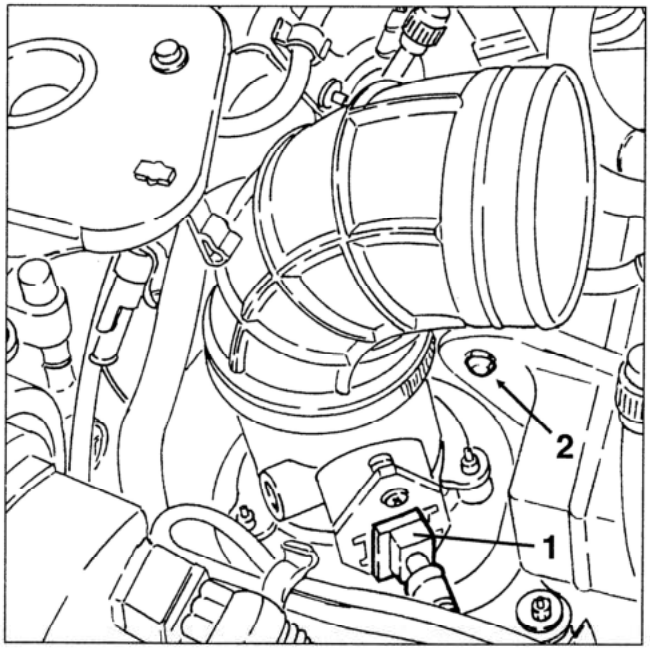
- Install the new spark plugs tightening them to the specified torque, then complete reassembly, reversing the sequence followed for removal.

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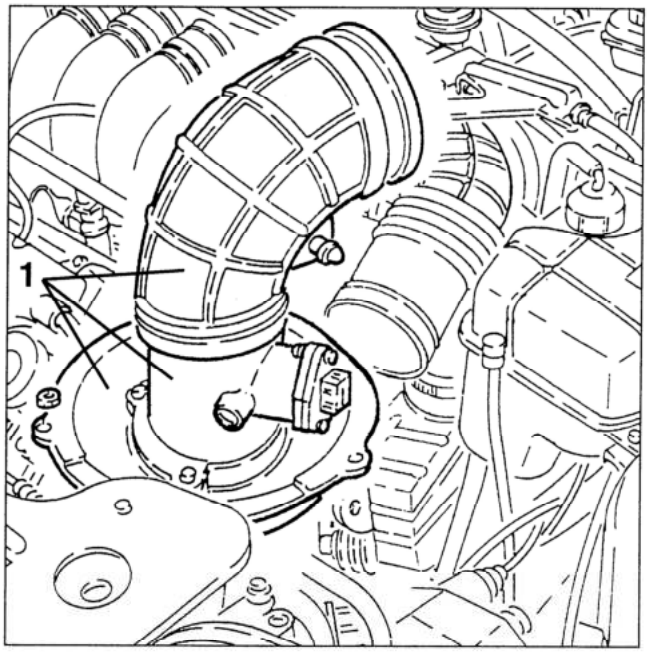
1. Withdraw and remove the upper resounder.



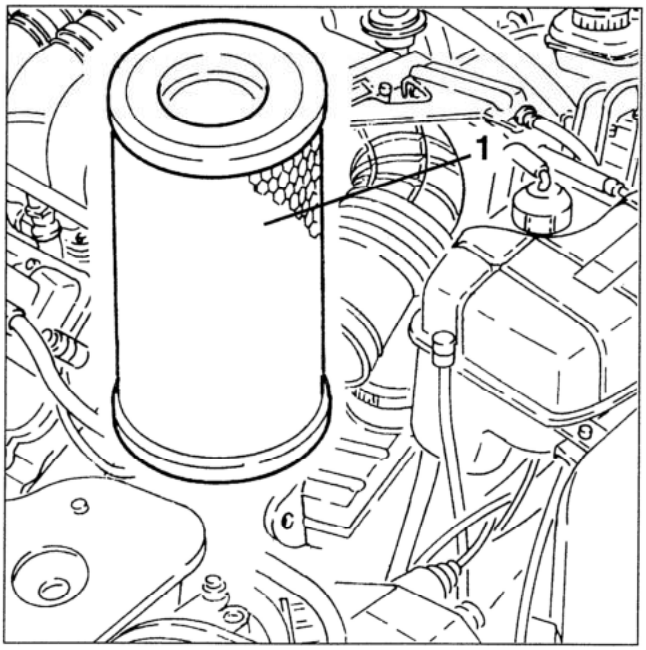

1. Disconnect the electrical connection from the hot film flow meter
2. Remove the button fastening the elbow of the corrugated sleeve to the resounder.




1. Slacken the three fastening nuts and remove the air cleaner cover complete with hot flm flow meter and corrugated sleeve.




1. Remove the filtering element with its duct.



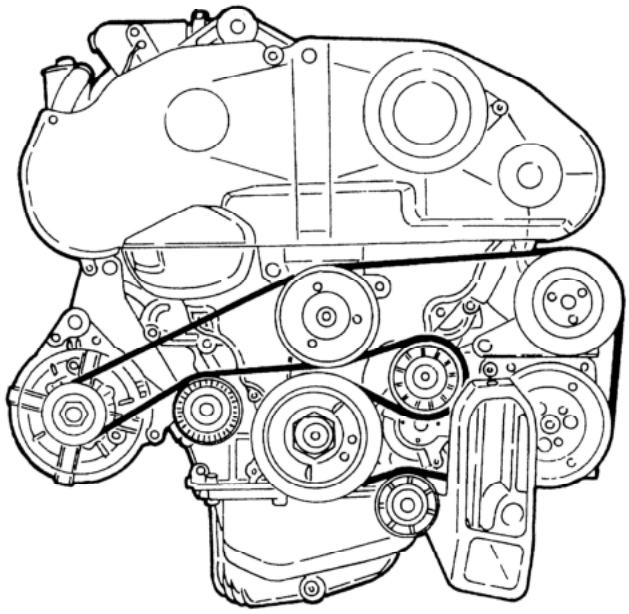

**WARNING:**
**Any cleaning operation may damage the cleaner with the risk of compromising operation of the engine.**

- Fit a new air cleaner reversing the sequence followed for removal.

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## AUXILIARY COMPONENTS BELT

The drive to the engine auxiliary components is transmitted through the single Poly V belt.
This belt is tensioned by an automatic tensioner: therefore it is unnecessary to check tensioning.



### Replacement

- Set the car on a lift.
- Remove the right front wheel and mud flap.

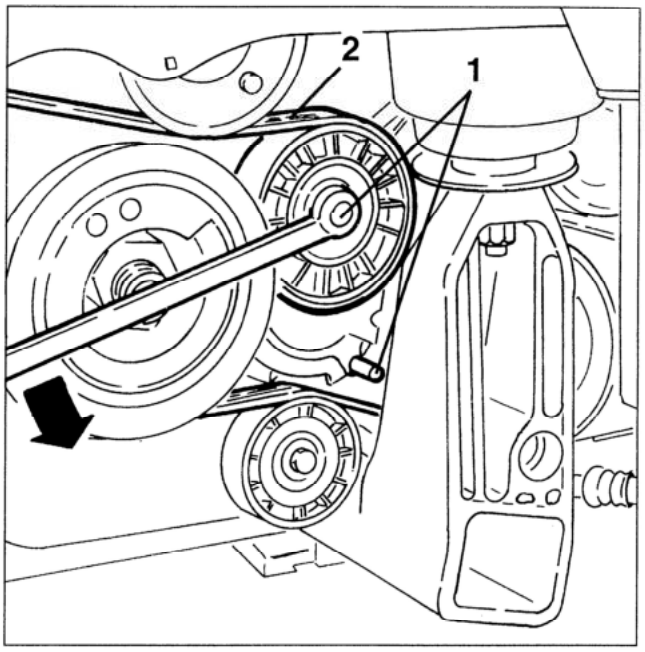
- Visually check that the belt is intact and in particular for the absence of:
• cuts
• cracks
• surface wear of the material (which appears smooth and shiny)
• dry or stiff parts (lack of adherence).

In the presence of any one of the above defects, replace the belt.

**WARNING:**
**Contact of the belt with oil or solvents may compromise the elasticity of the belt rubber and reduce its adherence.**

1. Working with a wrench on the belt tensioner pulley fastening screw, overcome the force of the automatic tensioner and lock it in this position (belt slack) inserting the special peg as illustrated.

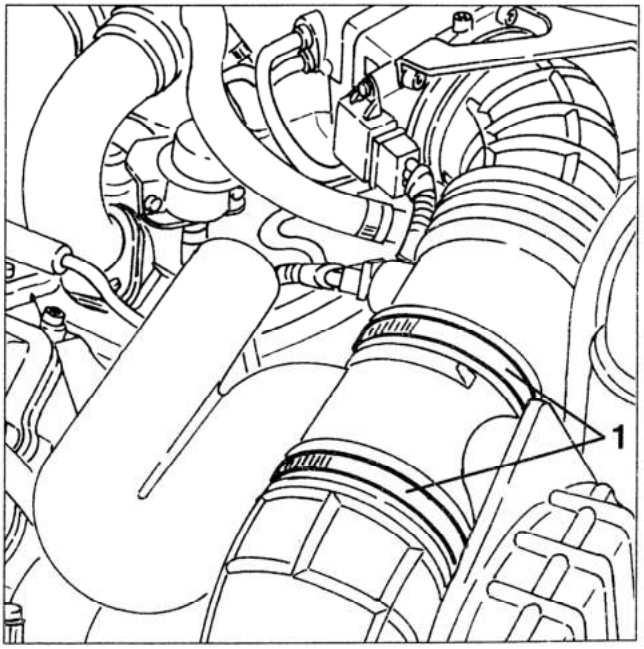
2. Prise and remove the auxiliary components belt.




- Assemble a new belt reversing the sequence followed for removal.

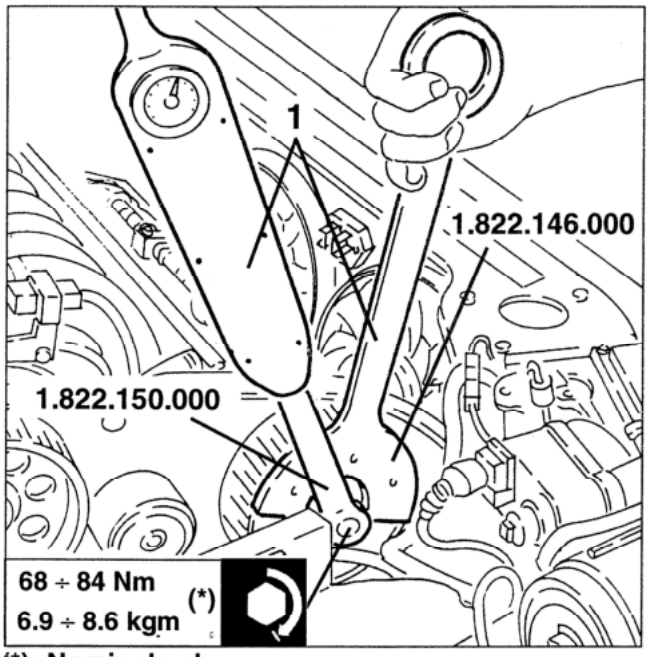
## CHANGING THE AIR CLEANER CARTRIDGE

- Disconnect the battery (-) terminal.
- Remove the engine compartment trim on the left hand side
1. Slacken the two clamps fastening the resounder to the corrugated sleeve.



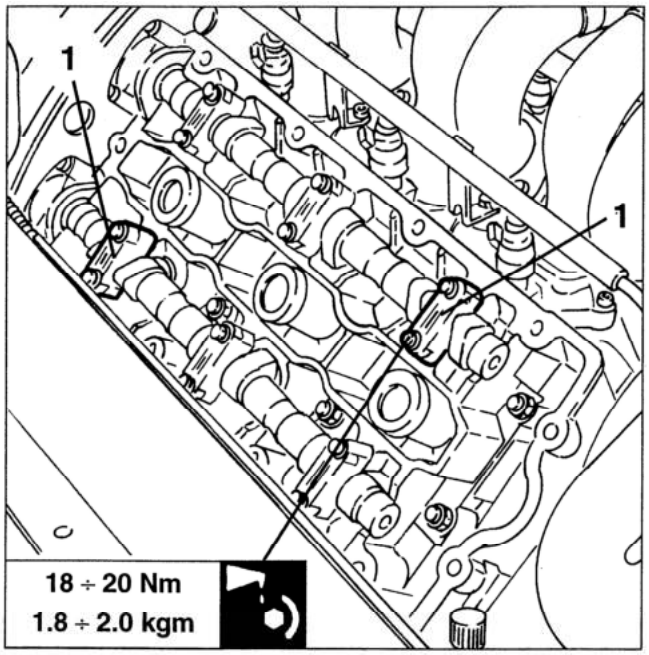

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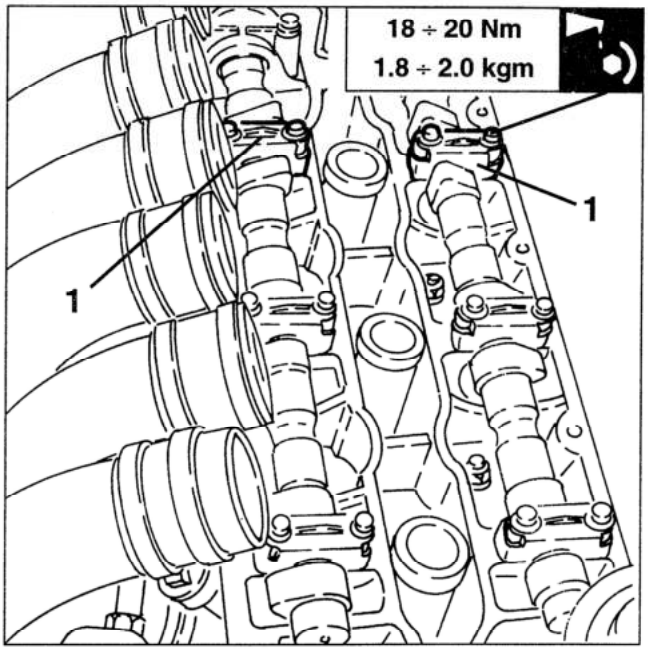
1. Using extension no. 1.822.150.000 and tool no. 1.822.146.000 as counter torque, tighten the camshaft drive pulley fastening screws to the specified torque.



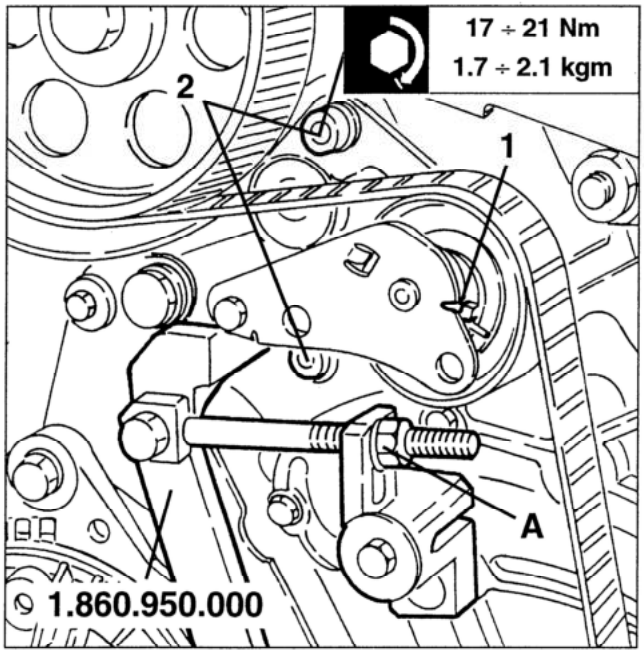

**(*): Nominal value**

1. Remove the templates no. 1.825.040.000 installed previously and in place of them fit the respective caps and tighten the fastening screws to the specified torque.




- Turn the crankshaft twice in its direction of rotation to allow the timing gear drive belt to settle.
1. Make sure that the fixed index of the tensioner coincides with the mobile index; if not slightly relieve the tension of the tensioner working on the nut (A) until the indexes coincide.
2. Tighten the belt tensioner fastening screws to the specified torque and remove tool no. 1.860.950.000 used for tensioning.

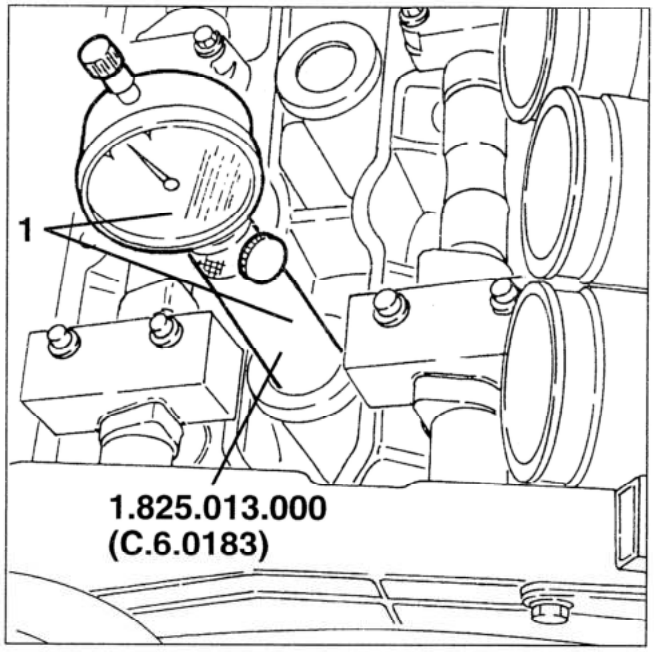



- Complete refitting reversing the sequence followed for disassembly.

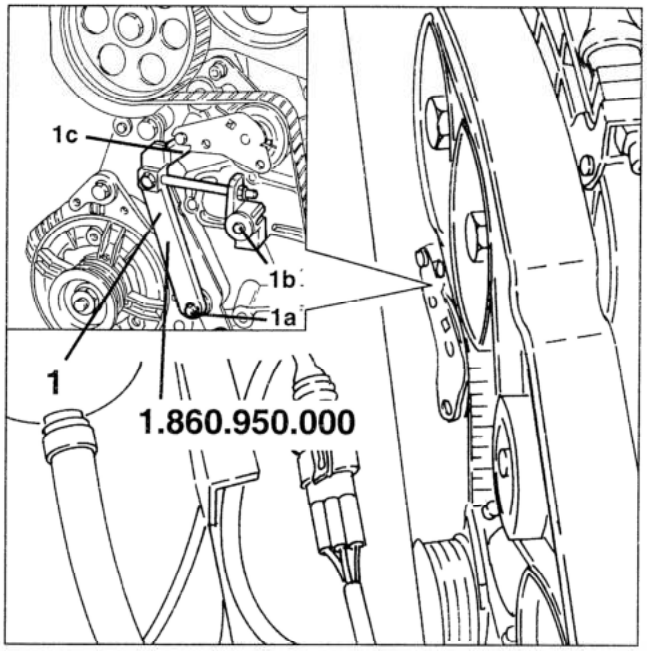
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1. Working on the fastening nut from the auxiliary components drive pulley, make the crankshaft turn a little (both ways) until the piston of the 1st cylinder reaches the T.D.C. in the bursting stroke.

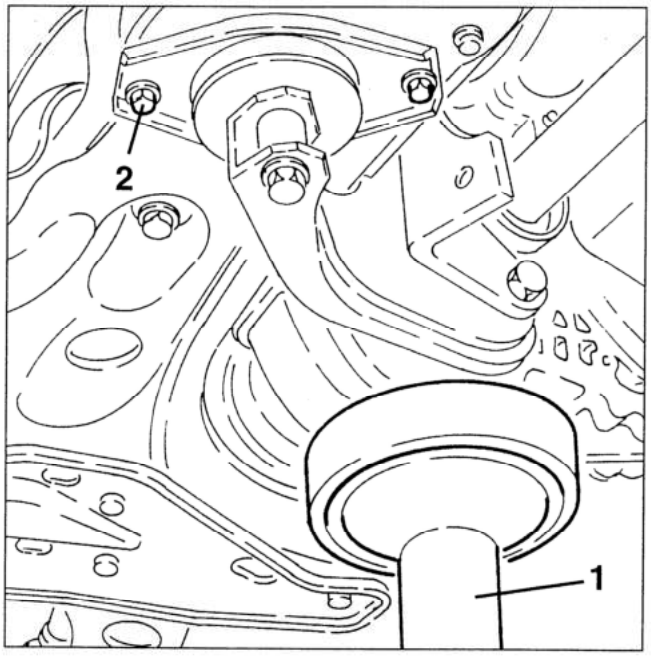
**NOTE: Make sure that the last turn of the crankshaft is in the operating direction.**



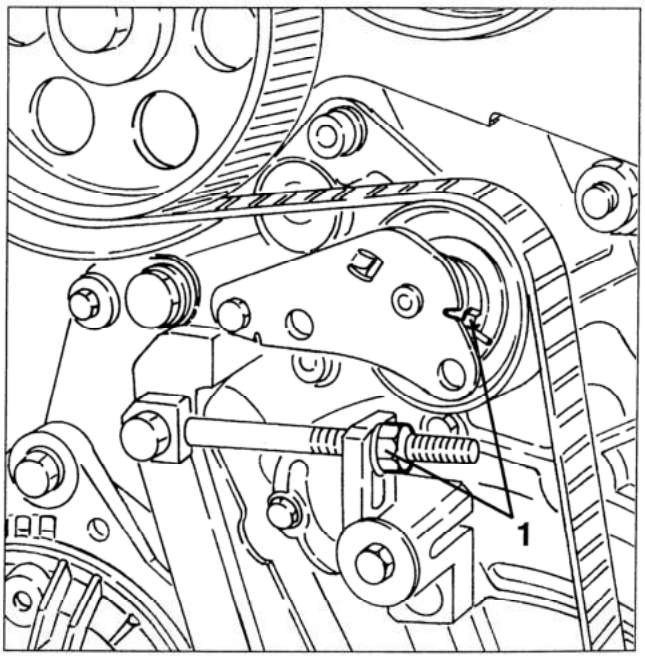

1. Install tool no. 1.860.950.000 for tensioning the timing gear drive belt fastening it with the screw removed previously (1a) to the alternator and with screw (1b) to the water pump, pin (1c) of the tool should lever on the mobile part of the belt tensioner.




- Complete assembly of the timing gear drive belt fitting it on the camshaft drive pulleys.
1. Place a hydraulic jack under the differential as illustrated.
2. Slacken the two screws fastening the power unit rear support to the suspension cross rail.
- Remove the lower alternator fastening screw.

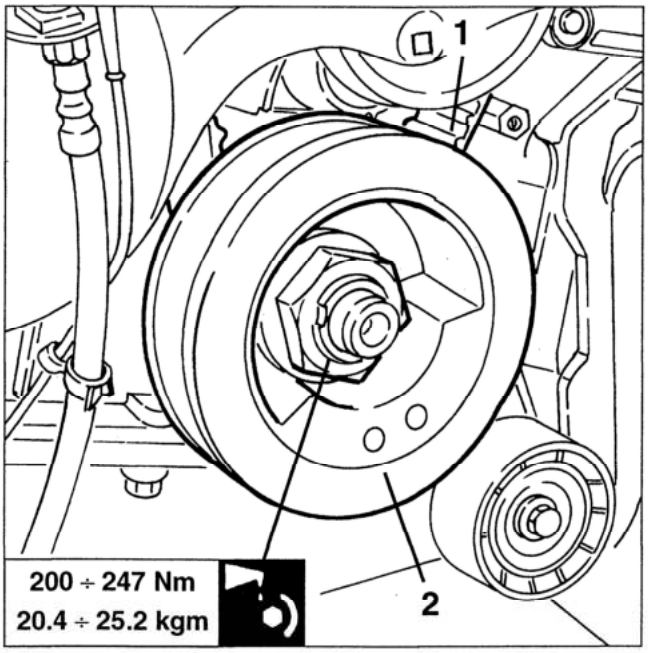



1. Working on the nut illustrated move the notch of the mobile index under the fixed notch of the tensioner.

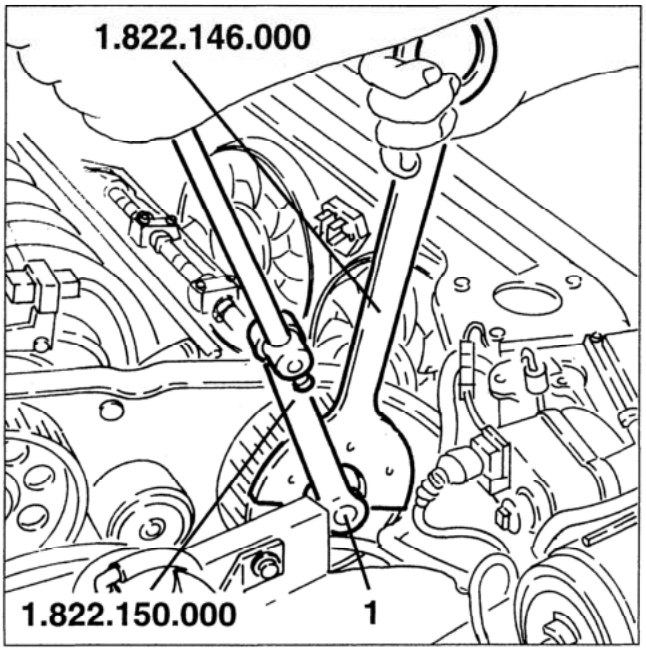



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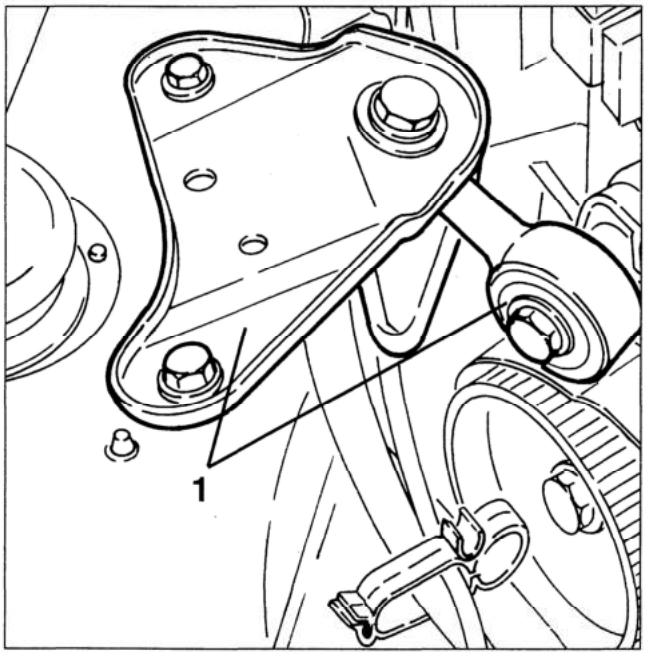
1. Raise the car and fit a new timing gear belt on the crankshaft drive pulley.
2. Fit the auxiliary components drive pulley and tighten the fastening nut to the specified torque.
- Remove the flywheel stopper tool no. 1.820.088.000 installed previously.



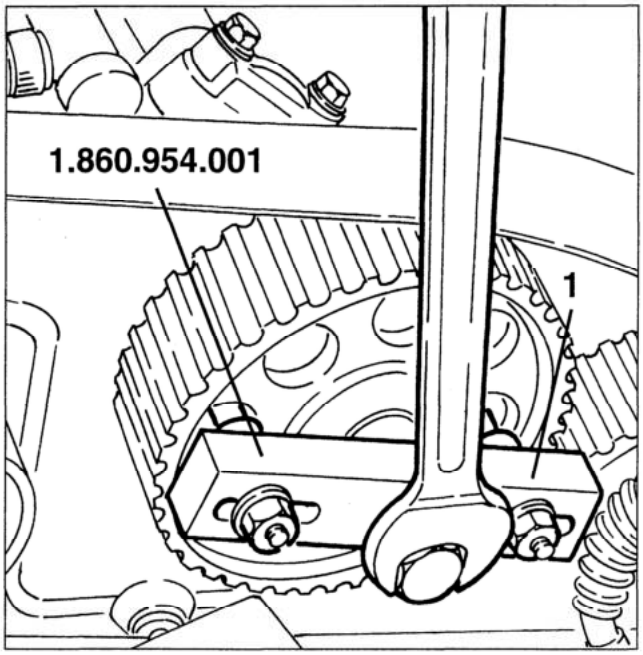

1. Lower the car and using extension no. 1.822.150.000 and tool no. 1.822.146.000 as counter torque, slacken the fastening screws of the camshaft drive pulleys.




1. Slacken the fastening screws and remove the engine stay connecting rod complete with support bracket.

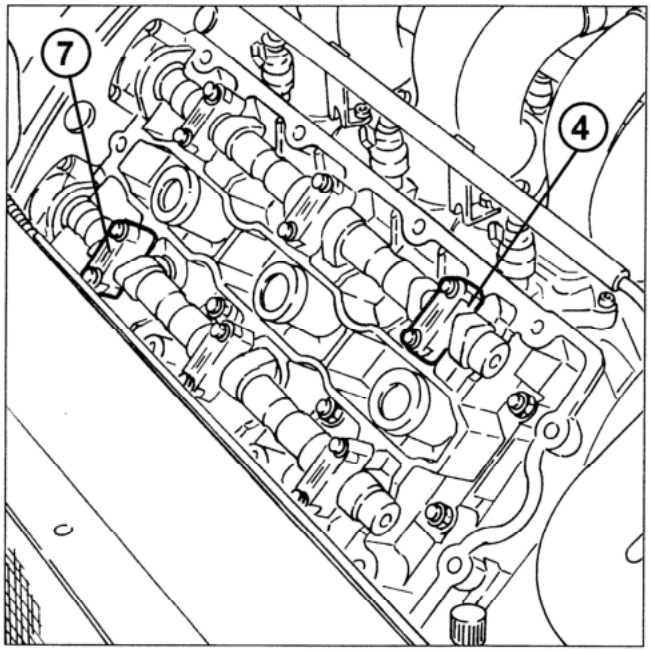


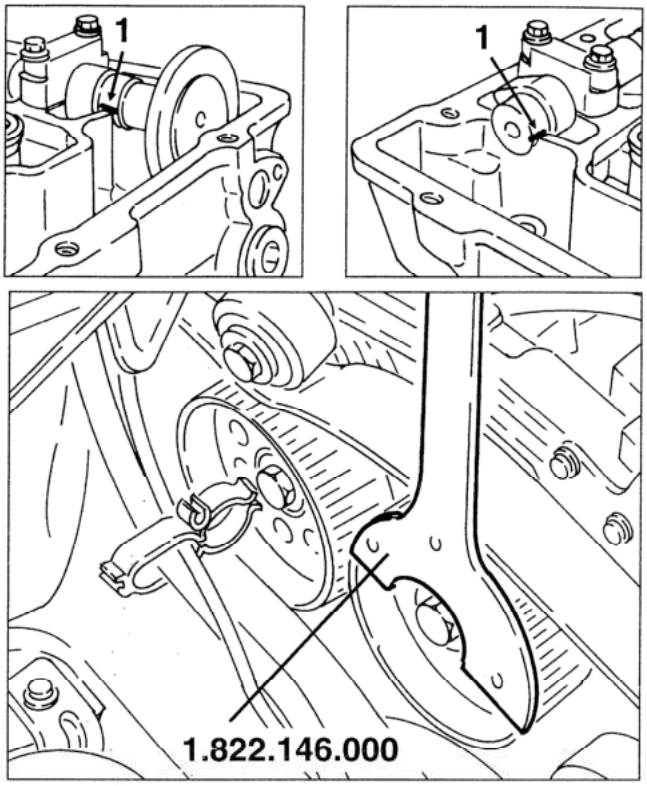

1. Using tool no. 1.860.954.001 remove the drive pulleys from the camshafts, then reposition them tightening the screws by hand.



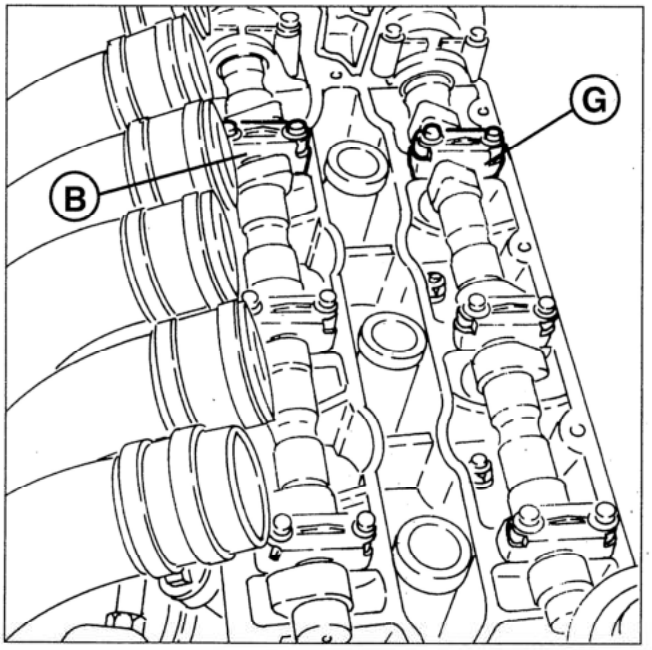

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- Remove the camshaft caps **4** and **7** for the left cylinder head.



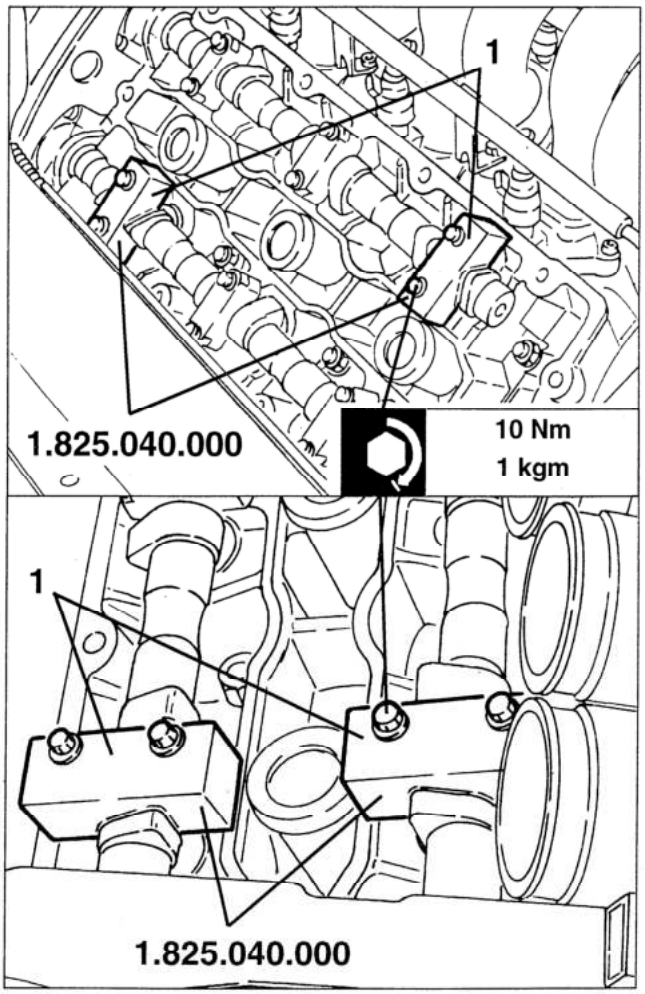

- Remove the camshaft caps **B** and **G** for the right cylinder head.




1. Using tool no. 1.822.146.000, turn each camshaft until the reference notches on them coincide with the upper surface of the cylinder head.

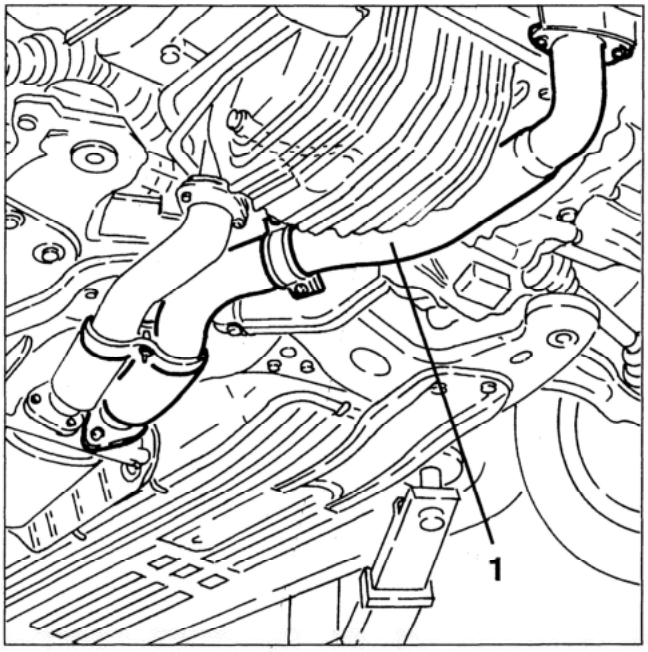
**NOTE: The reference notches should face the centre of each head.**

1. In place of the removed camshaft caps set templates no. 1.825.040.000 in the position shown by the stamping on the templates.

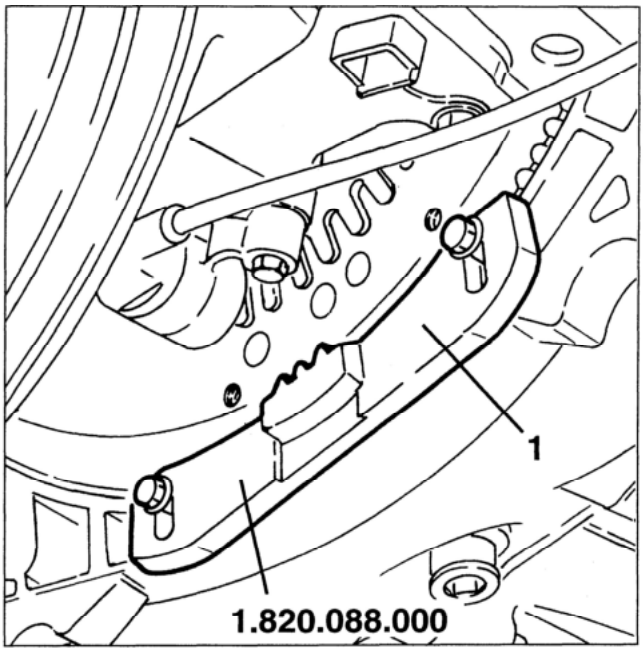



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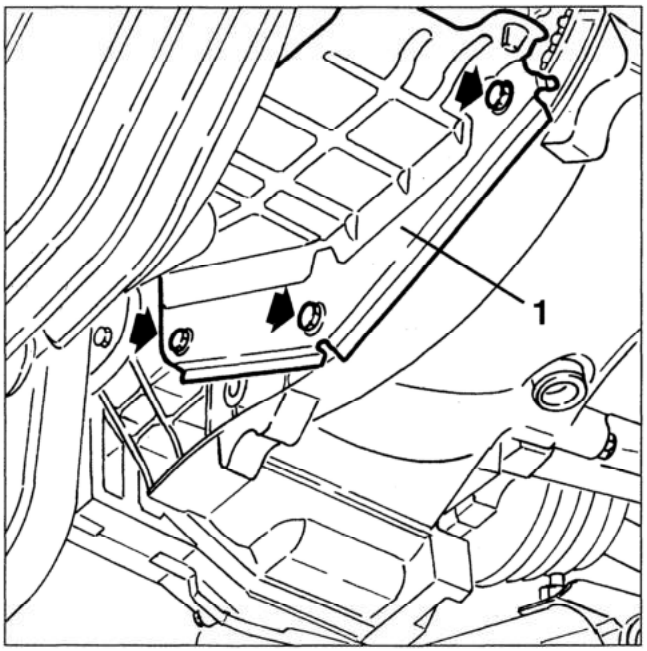
1. Raise the car, slacken the fastenings, then remove the front section of exhaust pipe only of the left cylinder head.



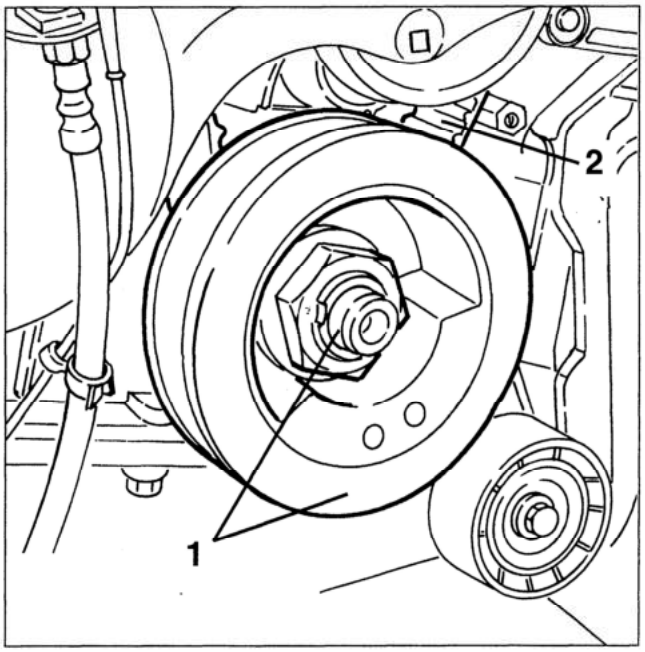

1. Install the flywheel stopper tool no. 1.820.088.000.




1. Slacken the fastening screws and remove the flywheel guard.

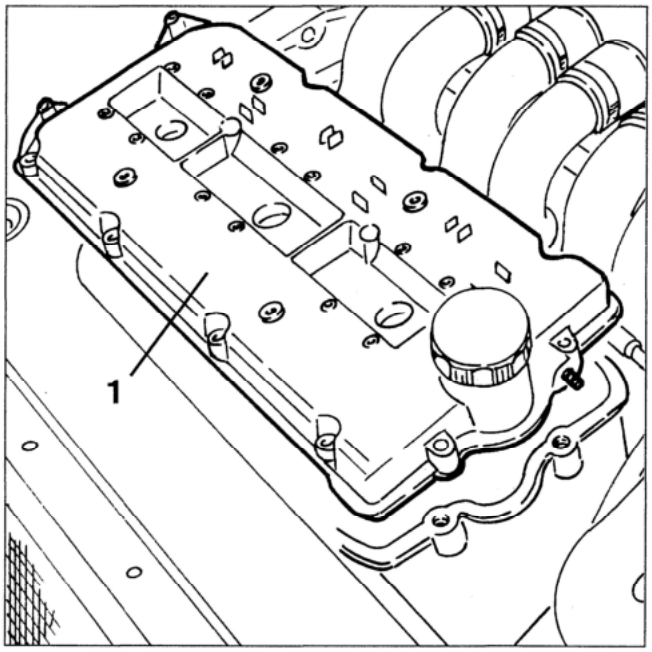



1. Remove the caulking and remove the fastening nut, then remove the auxiliary components drive pulley.
2. Prise and remove the timing gear drive belt.

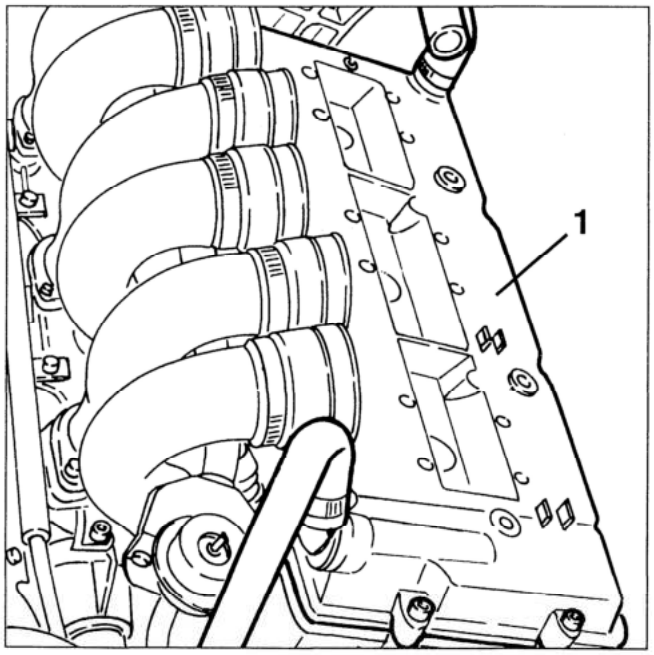



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1. Slacken the fastening screws and remove the cover from the left cylinder head.



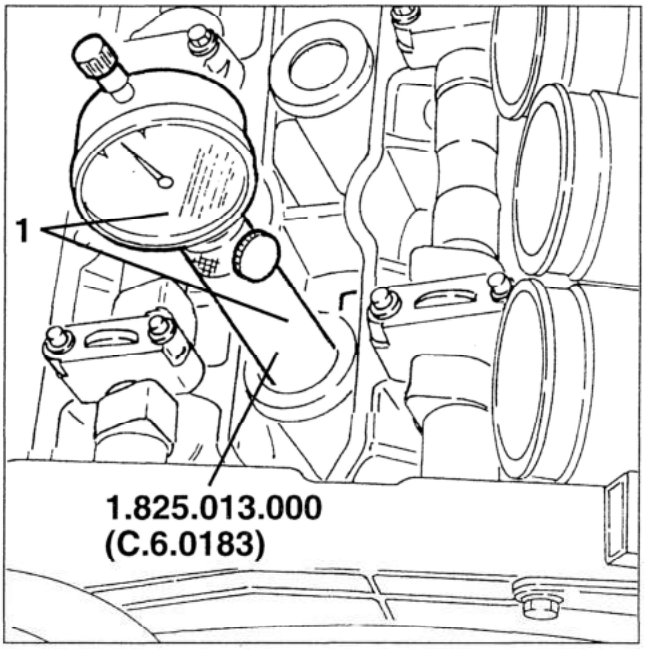

1. Slacken the fastening screws and remove the cover from the right cylinder head.



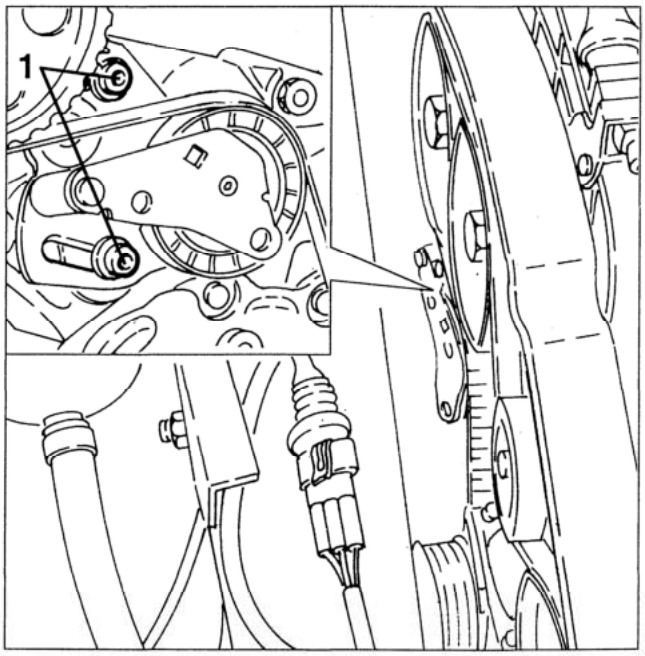

1. Install tool no. 1.825.013.000 (C.6.0183) in the housing of the first cylinder spark plug.

- Working on the fastening nut from the auxiliary components drive pulley, make the crankshaft turn a little (both ways) until the piston of the 1st cylinder reaches the T.D.C. in the bursting stroke.

**NOTE: Make sure that the last turn of the crankshaft is in the operating direction.**

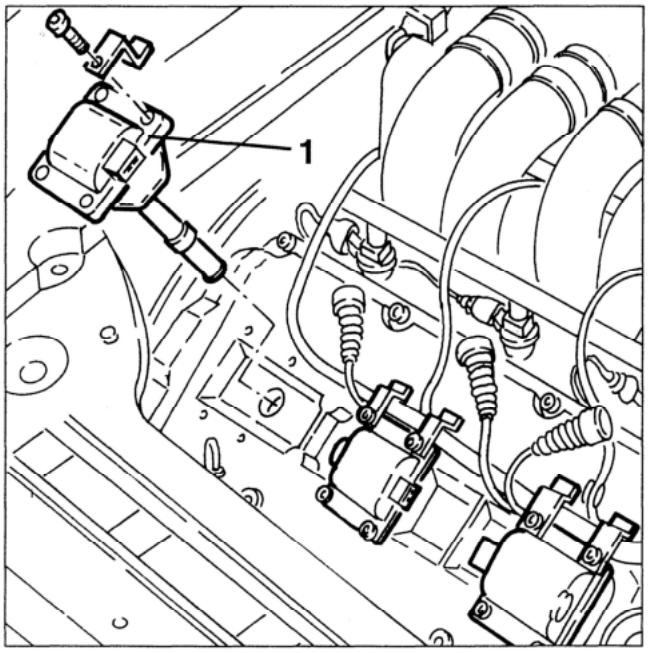



1. Slacken the two screws fastening the belt tensioner for the timing gear drive belt.

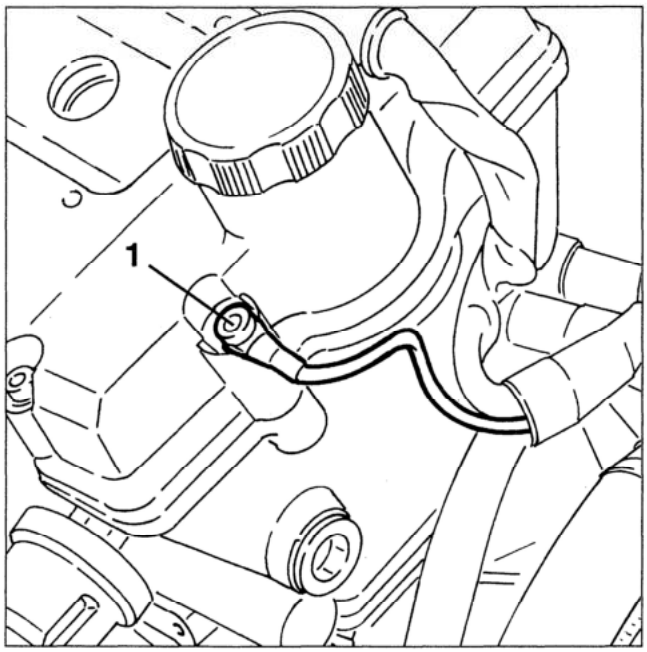



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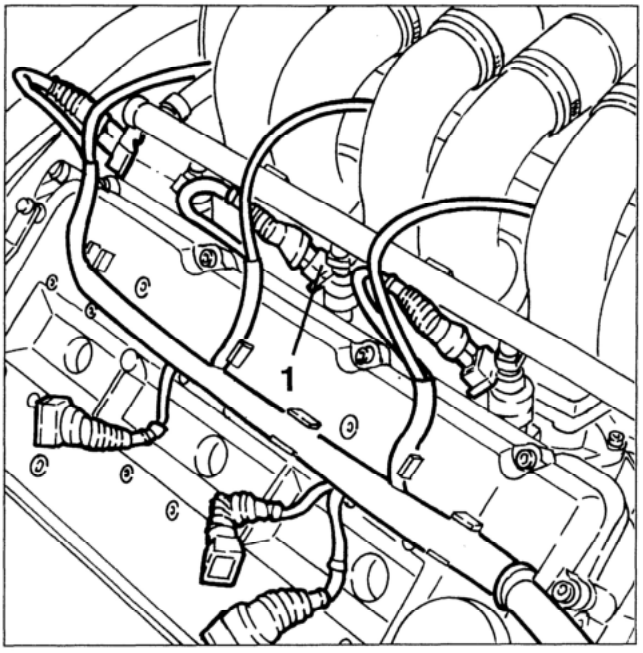
1. Slacken the fastening screws and remove the ignition coils from the left cylinder head.



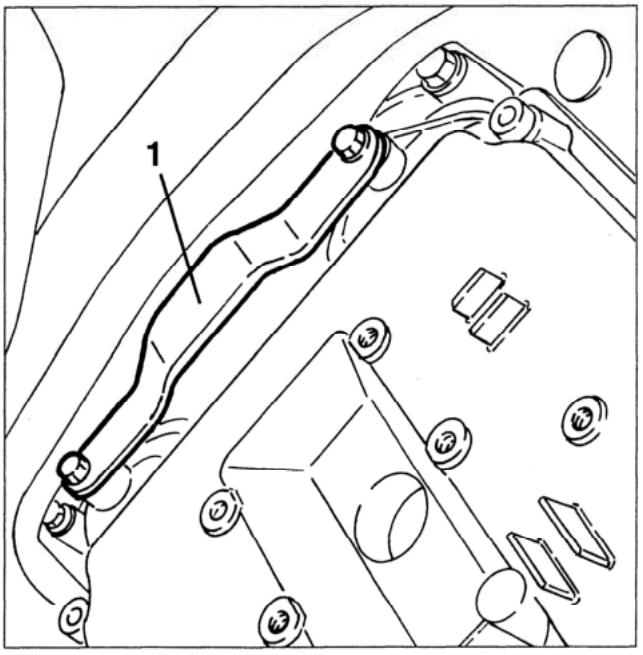

1. Disconnect the earth cable from the left cylinder head.




1. Disconnect the electrical connections from the injectors, then move the wiring to one side.

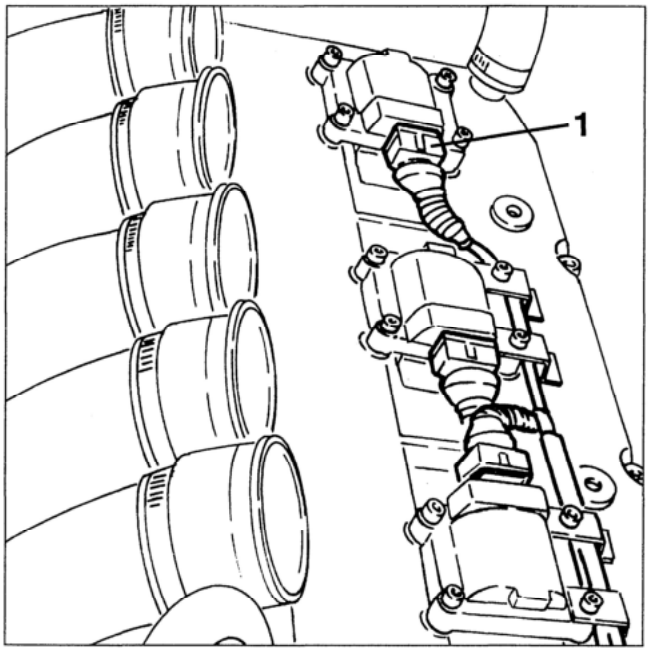



1. Slacken the fastening screws and remove the bracket complete with threaded nut for fastening the timing gear belt upper guard from the left cylinder head.

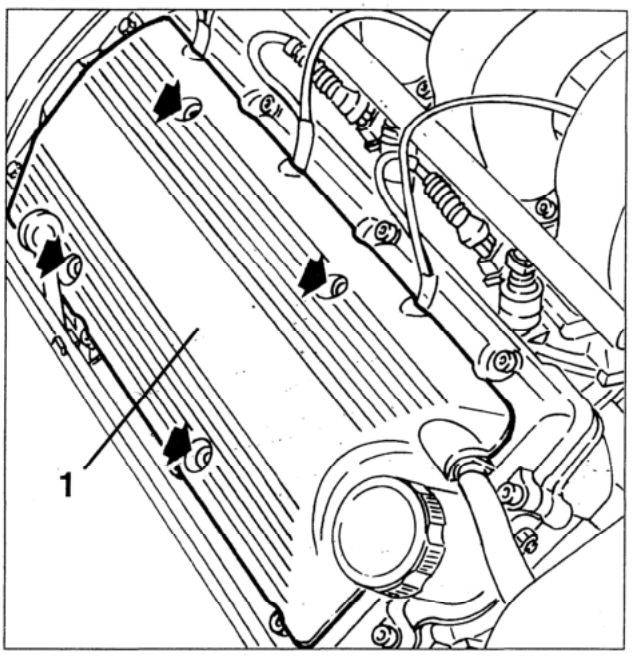



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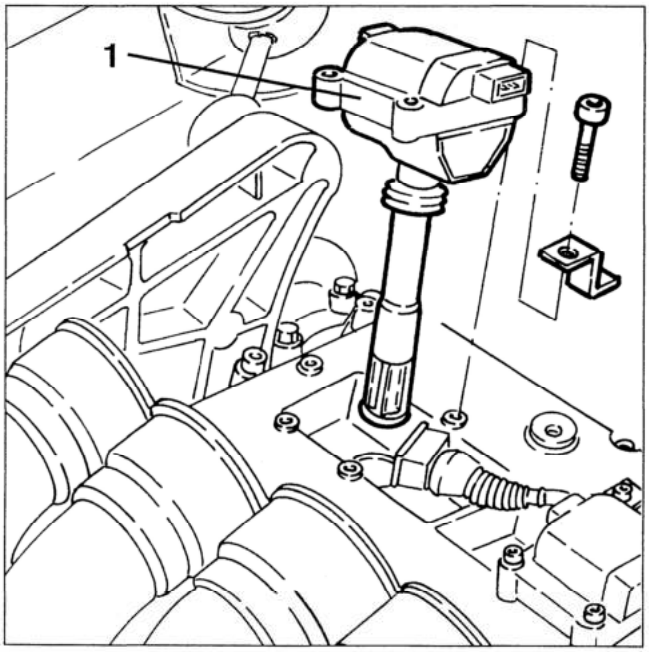
1. Disconnect the electrical connections from the ignition coils of the right cylinder head.



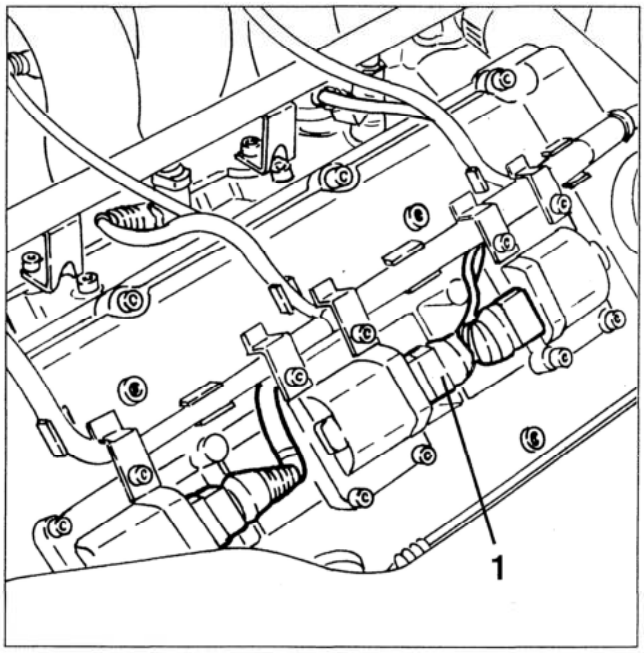

1. Slacken the fastening screws and remove the cover of the ignition coils of the left cylinder head.




1. Slacken the fastening screws and remove the ignition coils from the right cylinder head.

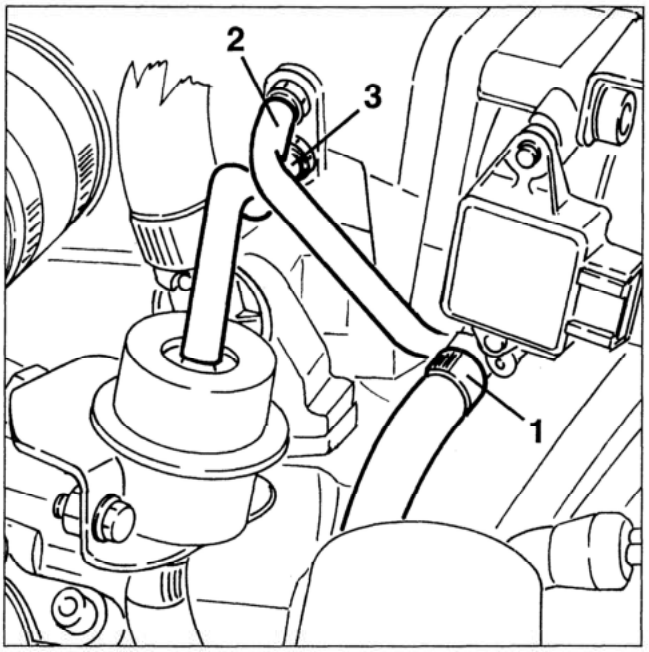



1. Disconnect the electrical connections from the ignition coils of the left cylinder head.

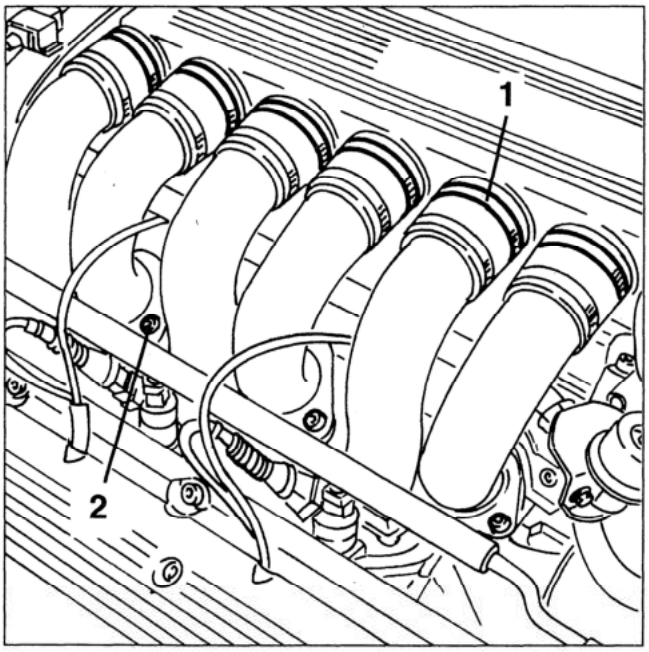



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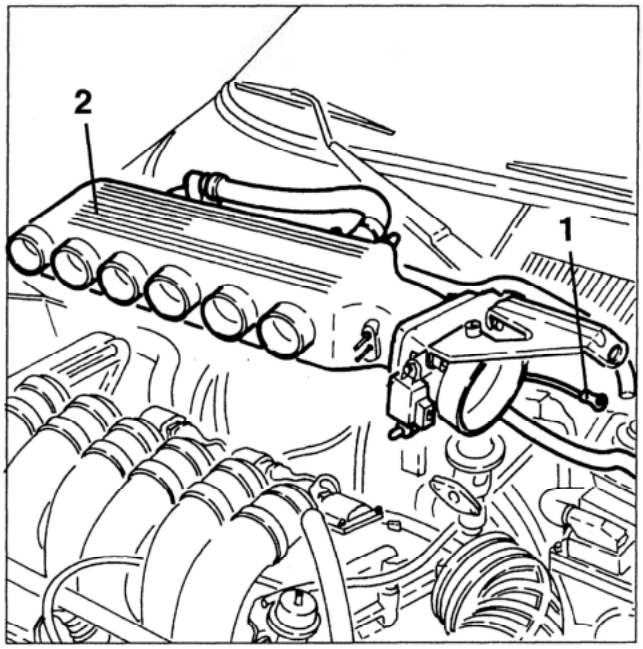
1. Disconnect the coolant fluid inlet pipe from the throttle body.
2. Disconnect the vacuum takeoff pipe for the E.G.R. modulating valve from the intake box.
3. Disconnect the vacuum takeoff pipe for the fuel pressure regulator from the intake box.



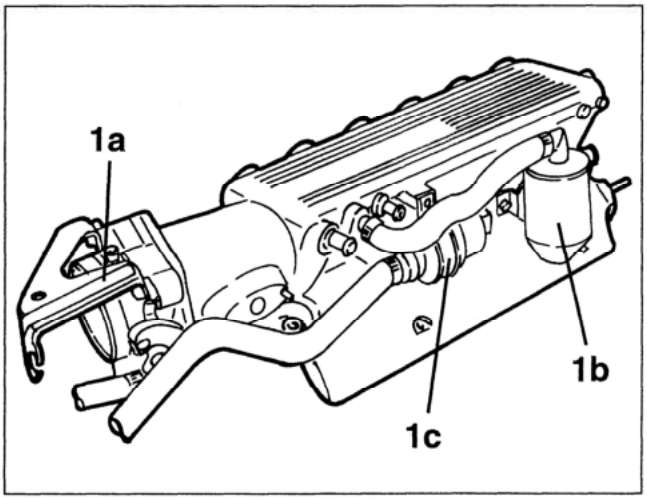

1. Slacken the clamps fastening the air supply ducts to the intake box.
2. Slacken the fastening screws of the cylinder head supply ducts.




1. Disconnect the earth cable (rear) from the intake box.
2. Slacken the two fastening screws and remove the complete intake box.

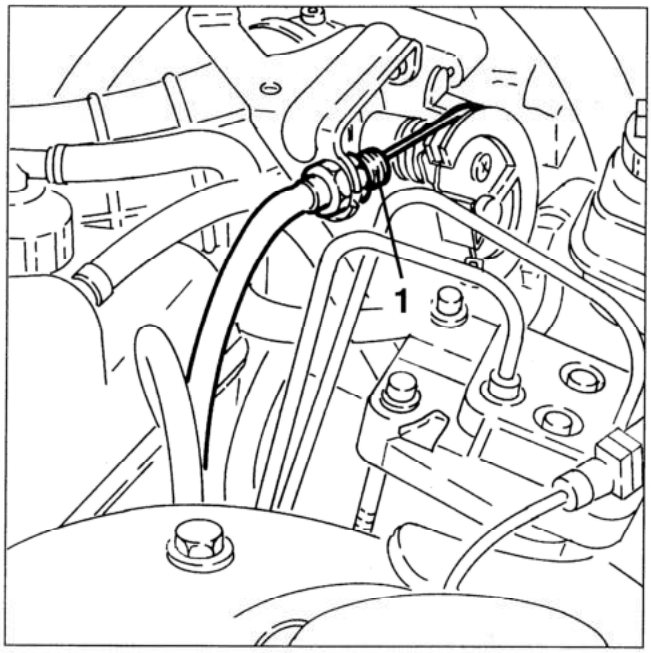



1. If necessary, on the bench separate the throttle body (1a), the oil vapour separator (1b) and the constant idle actuator (1c).

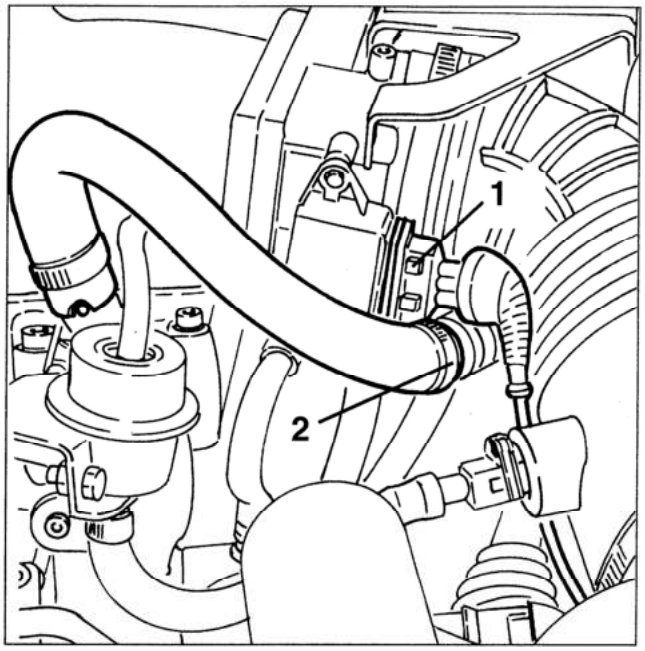



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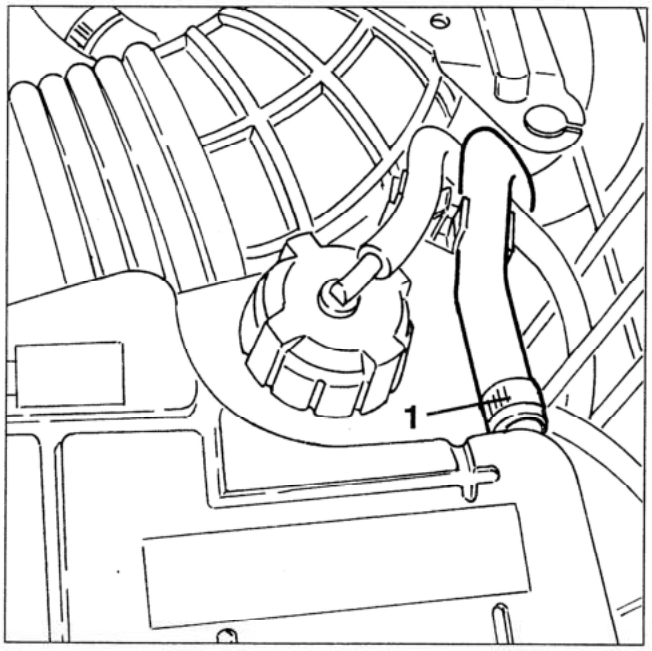
1. Disconnect the accelerator cable from the throttle cam.



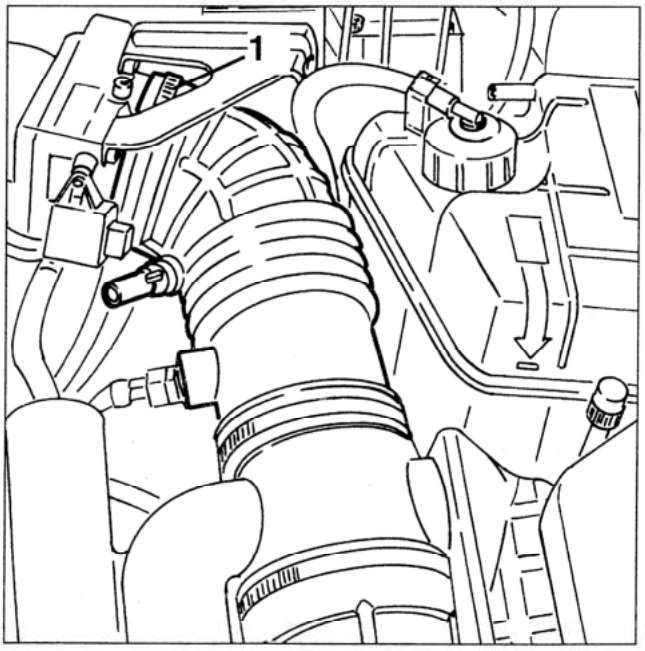

1. Disconnect the electrical connection from the throttle potentiometer.
2. Disconnect the oil vapour recovery pipe leading from the right cylinder head from the corrugated sleeve.




1. Disconnect the engine coolant return pipe from the throttle body from the expansion tank.

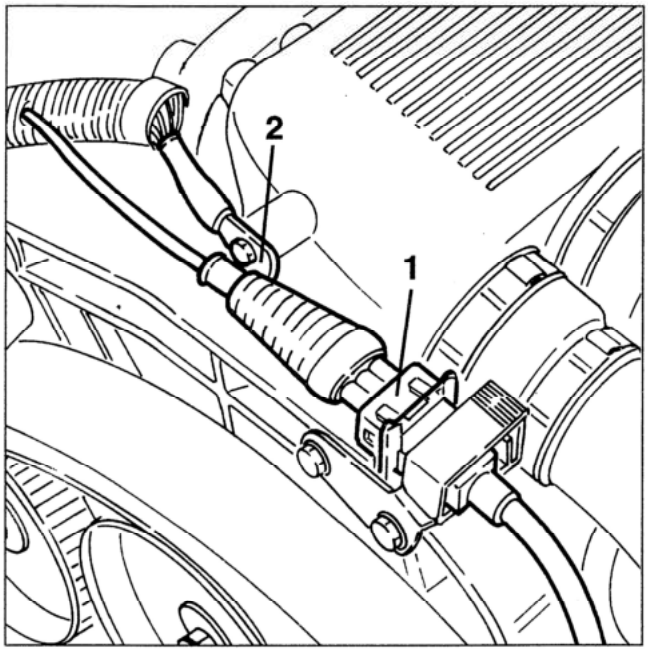



1. Slacken the fastening clamp and disconnect the corrugated sleeve from the throttle body.

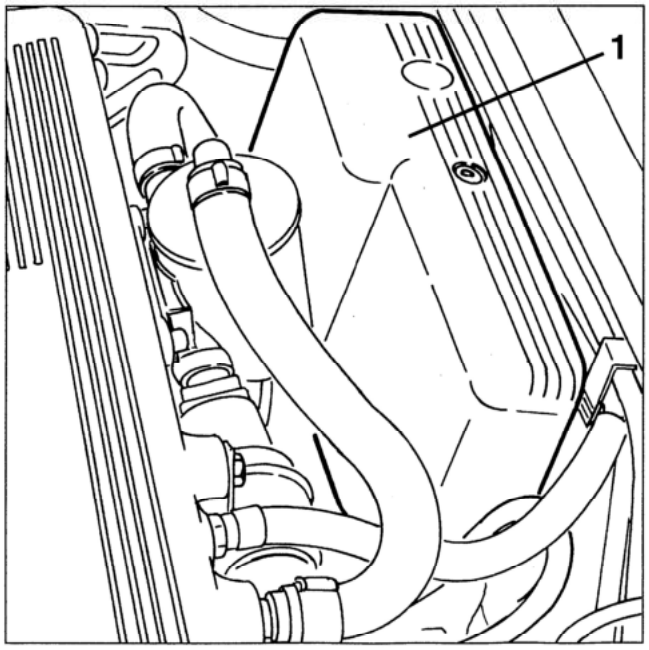



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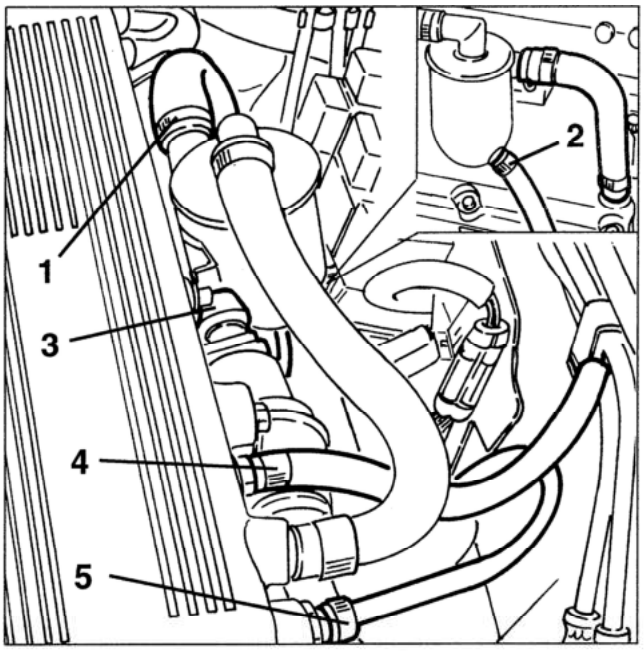
1. Disconnect the electrical connection of the front pinging sensor.
2. Disconnect the earth cable (front) from the intake box.



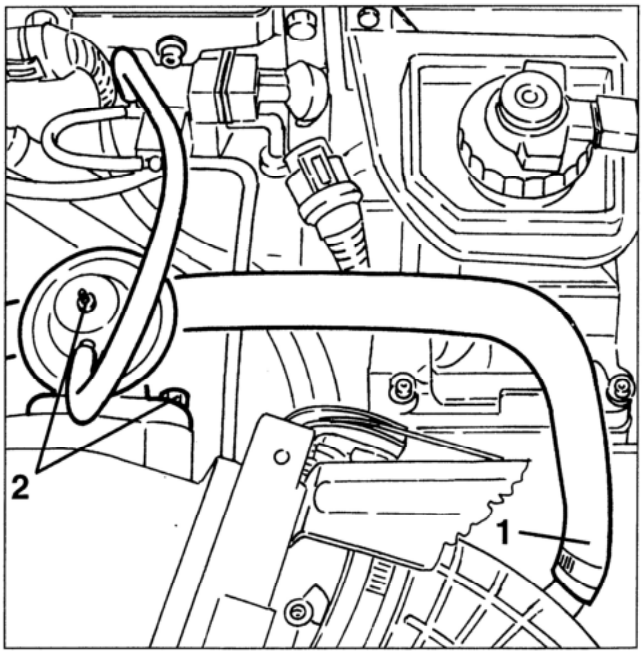

1. Remove the cover from the relays, fuses and electrical connections.




1. Disconnect the oil vapour recovery pipe from the separator
2. Disconnect the condensed oil recovery pipe from the separator.
3. Disconnect the electrical connection from the constant idle actuator.
4. Disconnect the fuel vapour recovery pipe from the intake box.
5. Disconnect the servobrake vacuum takeoff pipe from the intake box.

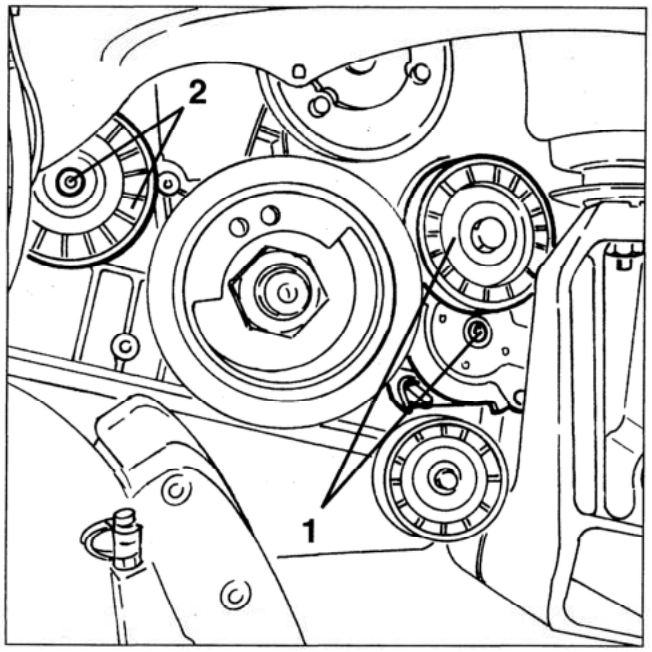



1. Disconnect the air inlet pipe for the constant idle speed actuator from the corrugated sleeve.
2. Slacken the two fastening nuts and remove the E.G.R. valve from the intake box.

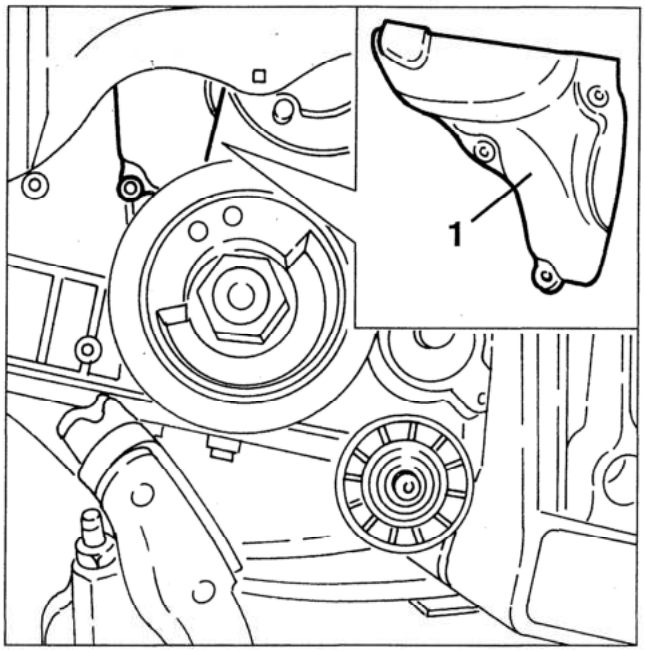



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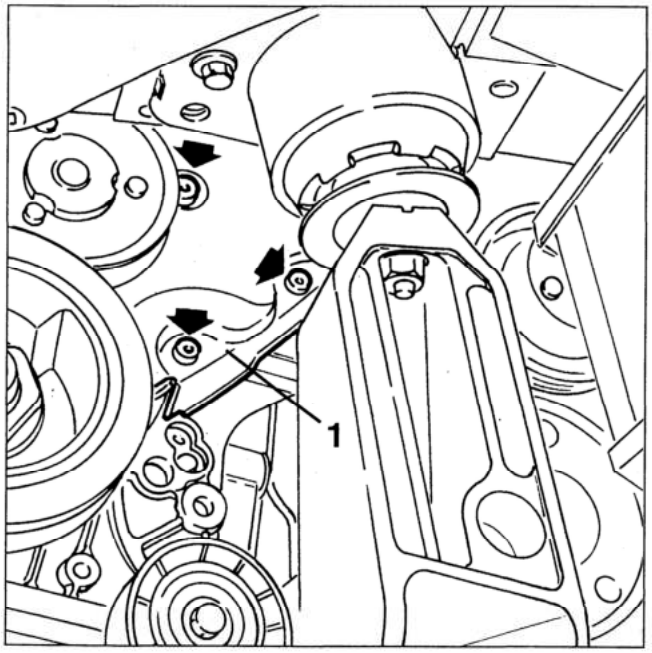
1. Slacken the fastening screw and remove the tensioner for the auxiliary components drive belt.
2. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.



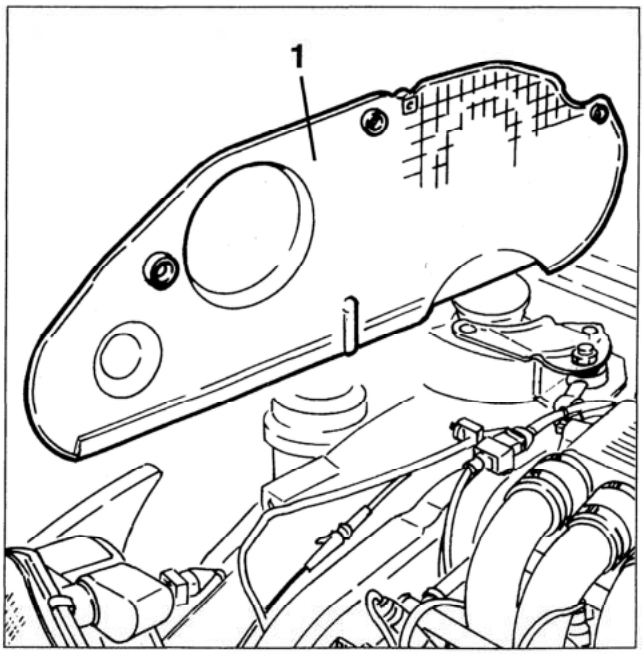

1. Slacken the fastening screws and remove the timing gear belt right lower guard.




1. Slacken the fastening screws and remove the timing gear belt left lower guard.




1. Slacken the fastening screws and remove the timing gear belt upper guard.

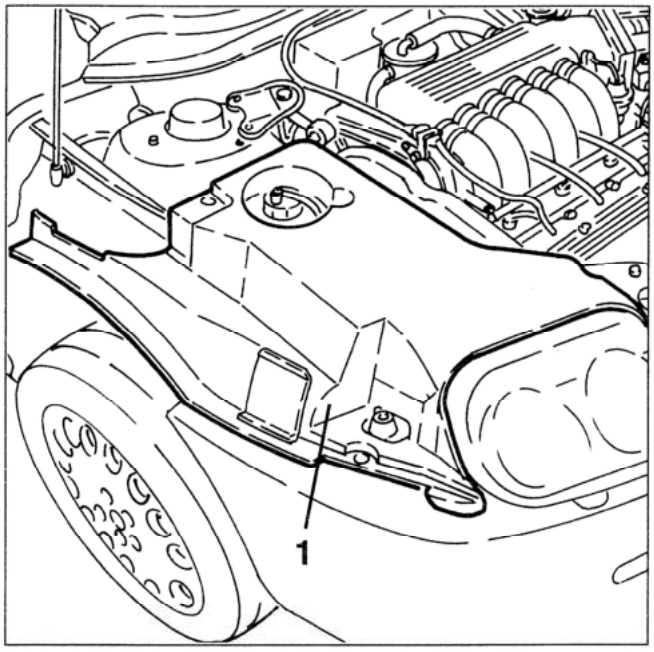



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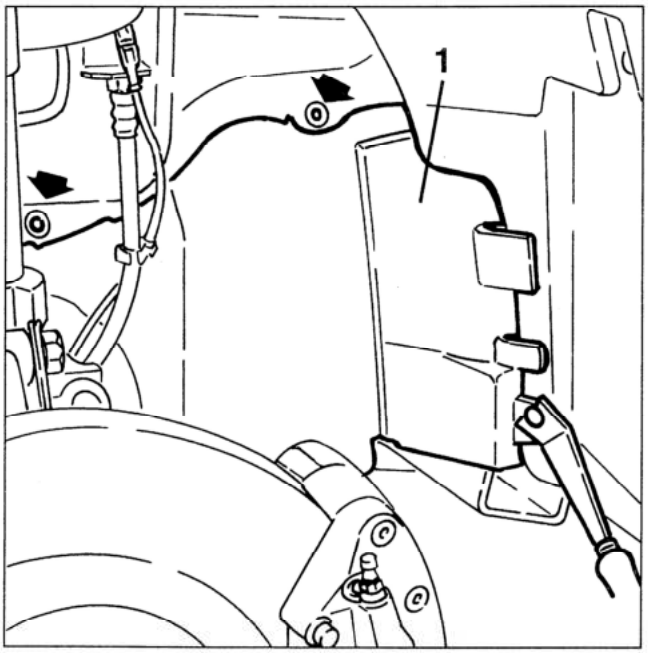
## CHANGING THE TIMING GEAR DRIVE BELT

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Remove the right front wheel.

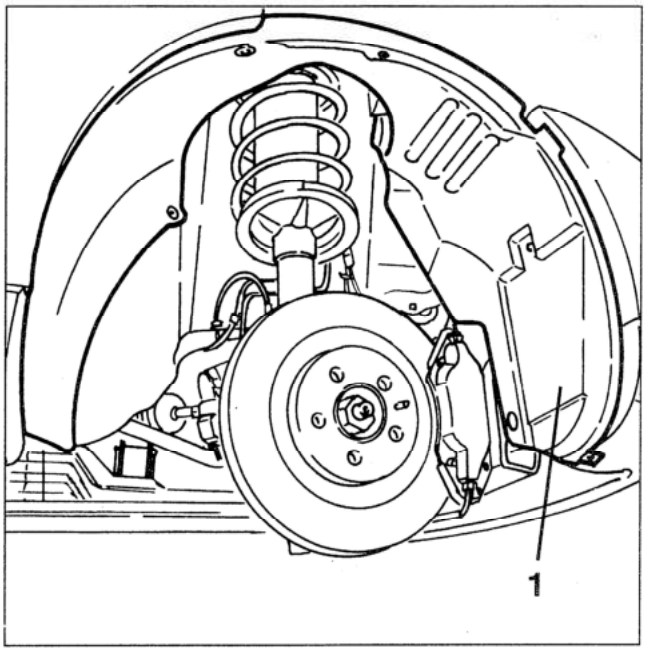
1. Slacken the fastening screws and remove the engine compartment right-hand trim.



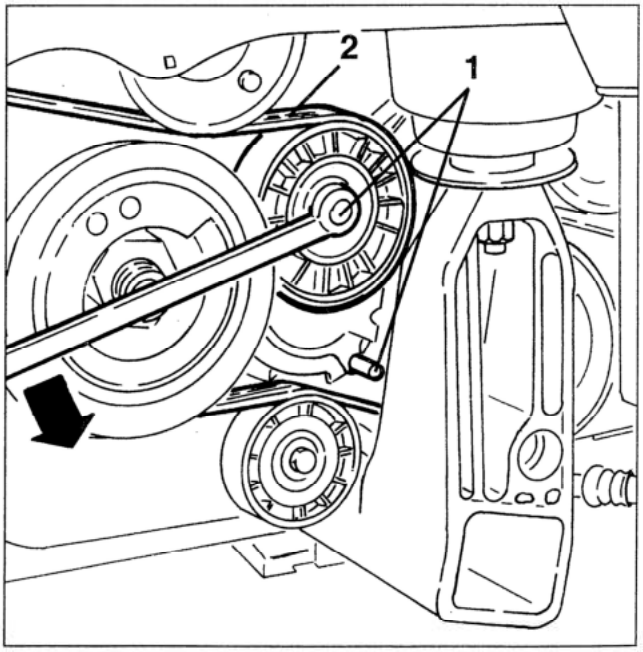

1. Slacken the two fastening screws, prise off the plastic button and remove the mud flap from the right front wheel house.




1. Slacken the fastenings and remove the right front wheel house.




1. Using a wrench on the belt tensioner pulley fastening screw, overcome the force of the automatic tensioner and lock it in this position (belt slack) inserting the special peg as illustrated.
2. Prise and remove the auxiliary components drive belt.



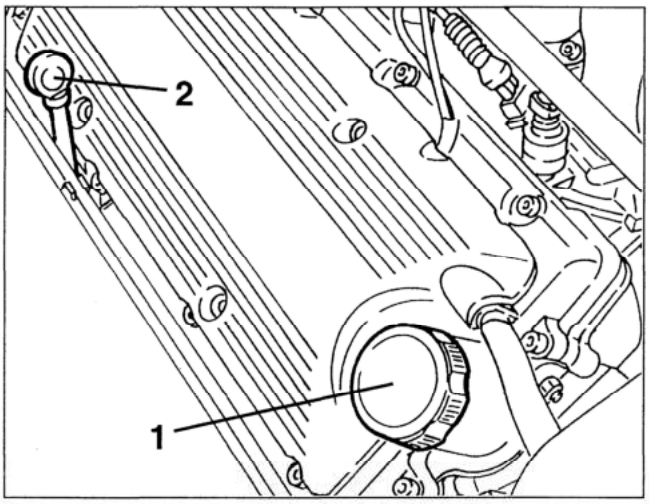

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# ENGINE MAINTENANCE

## CHANGING THE ENGINE OIL AND FILTER

**WARNING:**
**Engine oil is harmful to the skin: minimise contact of the oil with the skin; if not wash with soap and water.**

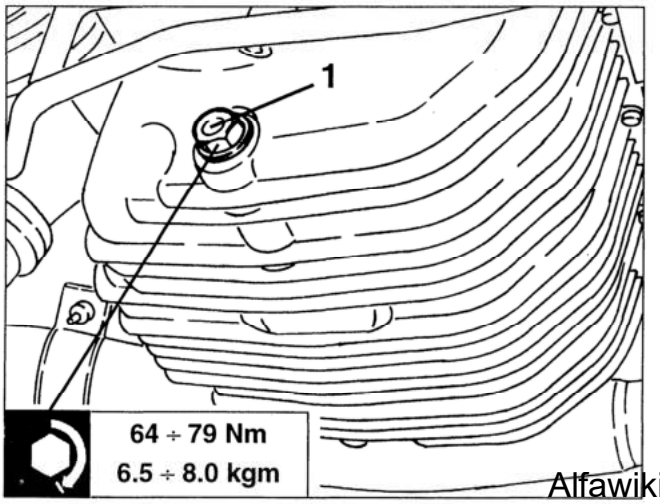
1. With the engine hot, remove the topping up cap.
2. Remove the dipstick.




- Raise the car.

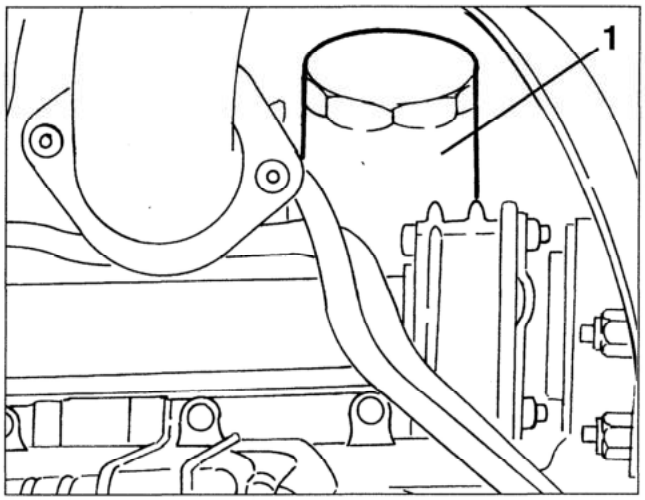
1. Slacken the drain plug and allow the oil to drain completely into a suitable container.

**WARNING:**
**When removing the drain plug proceed with care; the oil could be very hot.**




**WARNING:**
**Do not discard the oil in the environment, as the indiscriminate dispersion of this product is a source of pollution.**

1. Working under the car with the special wrench, release the oil filter and remove it.




- Clean the drain plug and screw it with its seal to the specified torque
- Moisten the seal of the new filter with engine oil and screw it tightening completely by hand.
- Lower the car.
- Fill with engine oil of the type and in the quantity specified.
- Check the level of the engine oil with the dipstick.

**WARNING:**
**The oil level should be checked with the car on level ground. Oil level above the MAX mark may cause excessive evaporation of the oil resulting in lack of pressure.**

- Fit the topping up cap, run the engine at idle speed for appr. 2 minutes, then turn off the engine and wait for a few minutes.
- Check the oil level and for leaks.

**WARNING:**
**When topping up the oil take the utmost care to avoid spilling it in the alternator ventilation slots which could cause serious damage to it and also the risk of fire.**

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## Dust/pollen filter (cars with climate control only)

Have the filter checked once a year, preferably at the beginning of summer, by an Alfa Romeo Dealership.
If the car is frequently used in dusty or very polluted environments, we recommend you have the filtering element checked more frequently than shown in the Service Schedule.
The filter should be replaced in particular if decreased air intake into the passenger compartment is noticed.

## Anti-freeze

We recommend topping up with Climafluid Super Permanent -40°C Alfa Romeo to preserve the protective features of the mixture.

## Rubber hoses

The rubber hoses in the brake, power steering, fuel feed lines, etc. should be carefully checked at the frequency shown in the Service Schedule.

## Wheels

Periodically and before long trips, check the pressure of each tyre, including the spare.
Check pressure on cold tyres.
Periodically check that the depth of the tread complies with the minimum legal prescriptions.
Periodically check that the tyres are not cut, swollen or present irregular wear.
If this is so, go to an Alfa Romeo Dealership.
If a tyre is punctured, stop immediately and replace it to prevent damage to the tyre, the rim, the suspension and the steering.
The factory fitted wheels (rims and tyres) are suited to the features of the car and ensure maximum safety and comfort in all normal conditions of use.
Before replacing the rims or tyre fitted on the car, check the allowed type table.
However, observe the rim-tyre coupling of the original fitting.
Always fit new tyres.
Avoid tyres from unknown sources.


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## IMPORTANT:

Perfect operation and long working life of a car is strictly related to its good use and, above all, to the care with which regular service is performed.
Considering product evolution, new service schedules have been adopted.
The scheduled service coupons are planned at 20,000 km. It is, however, important to note that the car requires ordinary precautions, such as systematic fluid checks and topping up, tyre pressure checks, etc.
In any case, remember that the correct car maintenance is certainly the best way to ensure performance, safety, environmental friendliness and low running costs in time.

## Additional operations

The following precautions are required in addition to the operations shown in the Service Schedule to ensure good operation of the car:
Every 1000 km or before long trips, check and top up if required:
- engine oil
- engine coolant
- brake/clutch fluid
- power steering fluid
- battery electrolyte
- tyre pressure
- windscreen washer fluid.

## Engine oil

If the car is mainly used in one of the following especially demanding conditions:
- towing trailers
- dusty roads
- short, repeated trips (less than 7-8 km) with temperature below zero degrees centigrade
- engine frequently idling or long distances at slow speed (or after a long storage period)

we recommend changing the engine oil more frequently than shown in the Service Schedule.

## Air cleaner

Replace the air cleaner more frequently than prescribed if the car is mainly used on dusty roads.

## Brake pads

The brake pads are subject to different use and wear, according to conditions of use and to driving style.
Have the pad thickness checked at an Alfa Romeo Dealership as soon as the front brake pad warning light comes on.
As the car is equipped with front brake pad wear sensors only, check the rear pads when the front pads are replaced.
According to the car use, the rear brake pads may not need to be replaced immediately.
We recommend in this case to check them later.

## Brake/clutch fluid

Brake fluid is hygroscopic, i.e. it absorbs moisture. To prevent faulty braking, change the brake fluid every two years, regardless of the mileage (see the Service Schedule).

## Battery

Check the battery charge status, preferably at the beginning of winter, to prevent the electrolyte from freezing.
Perform this check more frequently if the car is mainly used for short trips or if permanent intake devices also running when the key is removed are fitted, especially those fitted after market.

## Climate control system

To keep the system in perfect shape, simply turn it on once every fortnight - also in winter - and run the compressor for a few minutes.
Furthermore, we recommend having the system checked before the summer, when the system will be used.

## SERVICE SCHEDULE ('98 models)

| Operations to be performed at the indicated km | km x 1,000 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| Check tyre conditions and wear | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check front disc brake pad wear warning light operation | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check rear disc brake pad wear | | ● | | ● | | ● | | ● | |
| Check intactness of drive shaft bellows, power steering, joint caps and tightness of fuel and brake lines | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Inspect conditions of: external bodywork and underbody protection (exhaust - fuel feed - brakes); rubber parts (boots - sleeves - bushings - etc.) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Inspect conditions of accessory drive Poly-V belt | | ● | | | | | | | ● |
| Check handbrake lever travel | | ● | | ● | | ● | | ● | |
| Check exhaust emissions | | ● | | ● | | ● | | ● | |
| Check evaporation system operation | | | | ● | | | | ● | |
| Replace air cleaner cartridge | | ● | | ● | | ● | | ● | |
| Check fluids and top up if required (brakes, hydraulic clutch, power steering, windscreen washer, battery, engine coolant, etc.) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Replace timing belt and accessory drive Poly-V belt | | | | | | ● | | | |
| Replace spark plugs | | | | | ● | | | | |
| Check engine control system operation (via diagnostic socket) | | ● | | ● | | ● | | ● | |
| Check gearbox and differential oil level | | | | ● | | | | ● | |
| Change engine oil and filter (*) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Change brake fluid (or every 24 months) | | | ● | | | ● | | | ● |
| Check dust/pollen filter | ● | ● | ● | ● | ● | ● | ● | ● | ● |

(*): Or every 18 months for lower mileage.



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## MAINTENANCE OPERATIONS

Maintenance operations consist in checking and restoring working conditions of car parts subject to wear and to displacement following normal conditions of use.
Here follows a list of the maintenance operations to be performed at the lieage shown in the service schedule.

**IMPORTANT:**
**Precautions to be followd. The engine compartment contains many potentially dangerous moving, high temperature and high voltage parts.**
**Scrupulously observe following:**
**- Stop the engine and wait for it to cool down.**
**- Do not smoke. Do not use naked flames. The fuel could catcj fire.**
**Keep a fire extinghisher at hand.**

| Operations to be performed at the indicated km | km x 1.000 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| Check tyre conditions and wear | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check front disc brake pad wear warning light operation | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check rear disc brake pad wear | | ● | | ● | | ● | | ● | |
| Check intactness of drive shaft bellows, power steering, joint caps and tightness of fuel and brake lines | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Inspect conditions of V-belt and/or accessory drive Poly-V belt | | ● | | ● | | ● | | ● | |
| Check handbrake lever travel | | ● | | ● | | ● | | ● | |
| Check exhaust emissions | | ● | | ● | | ● | | ● | |
| Check evaporation system operation | | | | ● | | | | ● | |
| Replace fuel filter | | | | ● | | | | ● | |
| Replace air cleaner cartridge | | ● | | ● | | ● | | ● | |
| Check fluids and top up if required (brakes, hydraulic clutch, power steering, windscreen washer, battery, engine coolant, etc.) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Replace timing belt | | | | | | ● | | | |
| Replace spark plugs | | | | | ● | | | | |
| Check engine control system operation (via diagnostic socket) | | ● | | ● | | ● | | ● | |
| Check gearbox and differential oil level (mechanical gearbox versions only) | | | | ● | | | | ● | |
| Change gearbox/differential oil and filter (automatic gearbox versions only) | | ● | | ● | | ● | | ● | |
| Change engine oil (*) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Replace engine oil filter | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Change brake fluid (or every 24 months) | | | ● | | | ● | | | ● |
| Check dust/pollen filter (or howerver every 12 months) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check timing belt conditions | | | | ● | | | | | |

(*): Or every 18 months for lower mileage.


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*(CONTINUED)*

| | |
|---|---|
| 1.860.949.000 | Crankshaft front oil seal taker-in |
| 1.860.950.000 | Timing belt tension tool |
| 1.860.954.001 | Camshaft pulley/oil pump gear extractor |
| 1.860.978.000 | Suspension crossmember removal tool |
| 1.821.006.001 | Rear main bearing removal lever |
| 1.821.006.002 | Rear main bearing removal extractor |

## Assembly 10 - Engine removal/refitting ('98 models)

| | |
|---|---|
| 1.820.088.000 | Flywheel retainer (to be used on vehicle) |
| 1.820.225.000 | Engine removal/refitting support |
| 1.820.226.000 | Engine bracket |
| 1.820.239.000 | Engine support crossmember brackets |
| 1.820.581.000 | Engine support crossmember |
| 1.821.150.000 | Crankshaft rear oil seal taker-in |
| 1.822.150.000 | Camshaft drive pulley fastening screw extension wrench |
| 1.860.910.001 | Engine removal/refitting adapter |
| 1.860.978.000 | Suspension crossmember removal tool |
| 1.870.644.000 | Engine removal/refitting base |
| 1.870.644.001 | Engine removal/refitting bracket |

## Assembly 10 - Engine fuel feed

| | |
|---|---|
| 1.821.167.000 | Wrench for removing fuel pump and gauge ('98 models) |
| 1.822.135.000 | Wrench for removing nut screw fastening fuel pump to tank |
| 1.822.159.000 | Wrench for removing nut screw fastening gauge to tank |
| 1.824.011.000 (C.2.0056) | Flow test pad |

## Assembly 21 - Gearbox-Differential ('98 models)

| | |
|---|---|
| 1.820.028.000 | Flywheel retainer |
| 1.820.124.000 | Clutch plate and frame refitting centring device |
| 1.820.226.000 | Engine bracket (use with 1.820.239.000 and 1.820.581.000) |
| 1.820.229.000 | Differential internal drive shaft extractor flange |
| 1.820.239.000 | Engine gearbox brackets (use with 1.820.581.000 and 1.820.226.000) |
| 1.820.581.000 | Engine support horizontal crossmember (use with 1.820.239.000 and 1.820.226.000) |
| 1.821.161.000 | Differential internal drive shaft extractor ram |
| 1.821.170.000 | Differential flange oil seal taker-in (left and right) |
| 1.821.171.000 | Differential flange oil seal taker-in handle (left and right) |
| 1.821.215.000 | Clutch thrust bearing extractor |
| 1.860.978.000 | Suspension crossmember support tool |
| 1.870.644.001 | Gearbox support |
| 1.870.668.000 | Gear stick knob extractor |
| 1.870.974.000 | Gear selection/engagement wire assembly shim |


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*(CONTINUED)*

| | |
|---|---|
| 1.821.124.000 (A.3.0522) | Valve removal/refitting support |
| 1.821.176.000 (A.3.0641) | Valve guide extractor |
| 1.821.205.000 | Valve removal/refitting cage |
| 1.821.206.000 | Take-in for oil seal caps on guide valves |
| 1.821.207.000 | Valve guide taker-in |
| 1.821.208.000 | Extractor for oil seal caps on guide valves |
| 1.821.250.000 | Crankshaft rear oil seal taker-in |
| 1.822.121.000 | Cylinder head fastening nut wrench |
| 1.822.146.000 | Pulley wrench support |
| 1.825.003.000 (C.6.0148) | Cylinder liner projection check tool |
| 1.825.013.000 (C.6.0183) | TDC check tool |
| 1.825.040.000 | Camshaft timing template |
| 1.860.942.000 | Angle torque goniometer |
| 1.860.948.000 | Camshaft oil seal taker-in |
| 1.860.949.000 | Crankshaft front oil seal taker-in |
| 1.860.950.000 | Timing belt tensioning tool |
| 1.860.952.000 | Pair of studs to support cylinder head during overhaul |
| 1.860.954.001 | Camshaft pulley/oil pump gear extractor |

## Assembly 10 - Engine removal/refitting

| | |
|---|---|
| 1.820.088.000 | Flywheel retainer (to be used on vehicle) |
| 1.820.225.000 | Engine removal/refitting support |
| 1.820.228.000 | Flywheel retainer |
| 1.820.234.000 | Engine removal/refitting bracket |
| 1.820.239.000 | Engine support crossmember brackets |
| 1.820.279.000 | Liner retainer |
| 1.820.581.000 (R.4.0194) | Engine support crossmember |
| 1.821.150.000 | Crankshaft rear oil seal taker-in |
| 1.822.146.000 | Pulley wrench support |
| 1.822.150.000 | Camshaft drive pulley fastening screw extension wrench |
| 1.825.013.000 (C.6.0183) | TDC check tool |
| 1.825.040.000 | Camshaft timing template |
| 1.860.942.000 | Angle torque goniometer |
| 1.860.948.000 | Camshaft oil seal taker-in |

*(CONTINUED)*

## General

Specific tools play an important role in vehicle maintenance and are essential to ensure accurate, reliable and fast service.
It is important to note that intervention times are computed supposing the use of these tools.

This handbook lists and illustrated the specific tool expressly made by the Manufacturer for overhauling, maintenance and servicing.
The service network may provide specific tools according to the procedures in force at individual Alfa Romeo Dealerships.
Here follows the list of specific tools used.

**NOTE: Refer to the tools for 2959 V6 engines for the assemblies not mentioned here.**

## Assembly 00 - Engine servicing

| | |
|---|---|
| 1.820.088.000 | Flywheel retainer (to be used on vehicle) |
| 1.822.146.000 | Pulley wrench support |
| 1.822.150.000 | Camshaft pulley fasten screw extension wrench |
| 1.825.013.000 (C.6.0183) | TDC check tool |
| 1.825.040.000 | Camshaft timing templates |
| 1.860.950.000 | Timing belt tension tool |
| 1.860.954.001 | Camshaft pulley/oil pump gear extractor |
| 1.870.646.000 | Crankshaft pulley torque reaction tool ('98 models) |

## Assembly 10 - Engine overhaul

| | |
|---|---|
| 1.820.011.000 (A.2.0192) | Valve support tool |
| 1.820.012.000 (A.2.0195) | Cylinder head adjustable support |
| 1.820.049.000 (A.2.0359) | Valve support tool special nut |
| 1.820.050.000 (A.2.0360) | Cylinder head support fork |
| 1.820.145.000 (R.4.0178) | Overhaul bench engine mount brackets |
| 1.820.228.000 | Flywheel retainer (to be used on bench) |
| 1.820.279.000 | Liner retainer |
| 1.820.618.000 | Cranlshaft revolving tool |
| 1.821.006.001 (A.3.0139/0001) | Rear main bearing removal lever |
| 1.821.006.002 (A.3.0139/0002) | Rear main bearing extraction fork |
| 1.821.058.000 (A.3.0324) | Valve removal/refitting lever |

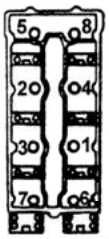
(CONTINUED)

*(CONTINUED)*

| Part | Nm | kgm |
|---|---|---|
| Flywheel fastening screws (double) | 137 ÷ 151 | 13.9 ÷ 15.4 |
| Fuel distribution manifold fastening screws | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Throttle casing fastening screws | 12 ÷ 15 | 1.2 ÷ 1.5 |
| Lambda sensor | 50 ÷ 60 | 5.1 ÷ 6.1 |
| Engine coolant temperature sensor (NTC) | 30 | 2.9 |
| Auxiliary unit belt take-up device fastening screw | 17 ÷ 21 | 1.7 ÷ 2.1 |

## Assembly 10 - Engine overhaul

| Part | Nm | kgm |
|---|---|---|
| Engine oil dipstick guide fastening fitting to crankcase | 36 ÷ 84 | 3.7 ÷ 8.6 |
| Auxiliary unit drive pulley fastening nut (1) | 200 ÷ 247 | 20.4 ÷ 25.2 |
| Camshaft drive pulley fastening screws | 68 ÷ 84 | 6.9 ÷ 8.6 |
| Vibration damper connecting rod bracket fastening nuts to cylinder head | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Coolant pump fastening screws to crankcase | 7 ÷ 9 | 0.7 ÷ 0.9 |
| Knock sensor fastening screws | 14 ÷ 23 | 1.4 ÷ 2.3 |
| Oil sump fastening screws to crankcase | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Drive gear fastening screw to oil pump | 48 ÷ 58 | 4.8 ÷ 5.9 |
| Oil pump fastening screws to main bearings | 48 ÷ 58 | 4.8 ÷ 5.9 |
| Flywheel fastening screws | 116 ÷ 129 | 11.8 ÷ 13.2 |
| Flywheel fastening screws (double) | 137 ÷ 151 | 13.9 ÷ 15.4 |
| Connecting rod bearing fastening nuts (1) | 53 ÷ 59 | 5.4 ÷ 6.0 |
| Main bearing fastening nuts (1) | 84 ÷ 93 | 8.5 ÷ 9.5 |
| Camshaft bearing fastening nuts (1) | 18 ÷ 20 | 1.8 ÷ 2.0 |
| Cylinder head torque | | |
| Fasten all screws at a torque of: | 24 ÷ 26 | 2.5 ÷ 2.7 |
| Turn all screws by an additional angle of: | 240° ± 2° | |
| Timing belt take-up fastening screws | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Engine oil minimum pressure warning light sensor | 20 ÷ 25 | 2.1 ÷ 2.6 |




(1): Lubricate with engine oil

## Assembly 55 - Electrical system

| Part | Nm | kgm |
|---|---|---|
| Ignition coil fastening screws | 5 ÷ 8 | 0.5 ÷ 0.8 |
| Spark plugs | 27 ÷ 34 | 2.8 ÷ 3.5 |
| Rear engine mount fastening screws to gearbox | 102 ÷ 126 | 10.4 ÷ 12.8 |
| Wishbone fastening bolts to wheel hubs | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Starter motor fastening screws | 18 ÷ 22 | 1.8 ÷ 2.2 |

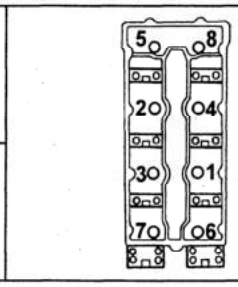
## NOTE: For the tightening torques of the groups not mentioned, refer to those of the engine 2959 V6

## Group 00 - Engine maintenance

| Part | Nm | kgm |
|---|---|---|
| Oil sump drain plug | 64 ÷ 79 | 6.5 ÷ 8.0 |
| Camshaft cap fastening screws (1) | 18 ÷ 20 | 1.8 ÷ 2.0 |
| Nuts fastening auxiliary components drive pulley (1) | 200 ÷ 247 | 20.4 ÷ 25.2 |
| Screws fastening camshaft drive pulleys | 68 ÷ 84 | 6.9 ÷ 8.6 |
| Screws fastening timing gear belt tensioner | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Filter fuel inlet fitting | 30 ÷ 37 | 3.1 ÷ 3.8 |
| Filter fuel outlet fitting | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Spark plugs | 27 ÷ 34 | 2.8 ÷ 3.5 |
| Screw fastening auxiliary components belt tensioner | 17 ÷ 21 | 1.7 ÷ 2.1 |

(1): Lubricate with engine oil

## Group 10 - Engine Removing/Refitting

| Part | Nm | kgm |
|---|---|---|
| Screw fastening coolant fluid inlet/outlet pipe flange from turbocharger | 22 ÷ 24 | 2.2 ÷ 2.4 |
| Bolts fastening axle shafts | 40 ÷ 52 | 4.1 ÷ 5.3 |
| Bolts fastening wishbones to wheel uprights | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Screws fastening power plant rear support to gearbox | 102 ÷ 126 | 10.4 ÷ 12.8 |
| Nuts fastening exhaust manifolds to cylinder heads | 22 ÷ 27 | 2.2 ÷ 2.7 |
| Screws fastening starter motor | 18 ÷ 22 | 1.8 ÷ 2.2 |
| Screws fastening lay shaft | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Nuts fastening stay rod support bracket to cylinder head | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Cylinder head tightening | | |
| Approach all screws to a torque of:  | 24 ÷ 26 | 2.5 ÷ 2.7 |
| Turn the screws by an angle of: | 240° ± 2° | |
| Screws fastening camshaft drive pulleys | 68 ÷ 84 | 6.9 ÷ 8.6 |
| Screws fastening camshaft belt tensioner | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Screw fastening drive gear to oil pump | 48 ÷ 58 | 4.8 ÷ 5.9 |
| Screws fastening oil pump main bearing caps | 48 ÷ 58 | 4.8 ÷ 5.9 |
| Screws fastening oil sump to crankcase | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Screws fastening camshaft caps (1) | 18 ÷ 20 | 1.8 ÷ 2.0 |
| Screws fastening flywheel | 116 ÷ 129 | 11.8 ÷ 13.2 |

(1): Lubricate with engine oil

*(CONTINUED)*

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# IGNITION

## SPARK PLUGS

| | |
|---|---|
| Type | NGK PFR6B |

# STARTING

## STARTER MOTOR

| | | | |
|---|---|---|---|
| Nominal voltage | | (V) | 12 |
| Nominal power | | (kW) | 1.4 |
| Operating test (*) | Voltage | (V) | 8.5 |
| | Absorption | (A) | 360 |
| | Rpm | (rpm) | 1800 |
| | Torque | (Nm) | 9.8 |
| Loadless test (*) | Voltage | (V) | 11.8 ÷ 12 |
| | Absorption | (A) | 25 ÷ 40 |
| | Rpm | (rpm) | 3000 ÷ 4000 |
| Pickup test (*) | Voltage | (V) | 4.8 ÷ 5.2 |
| | Absorption | (A) | 690 ÷ 730 |
| | Torque | (Nm) | 21.5 |

(*): Data measured at room temperature of 20°C.

# CHARGING

## BATTERY

| | |
|---|---|
| Nominal voltage | 12V |
| Capacity | 70 Ah |

## ALTERNATOR

| | |
|---|---|
| Nominal voltage | 12V |
| Nominal curremt | 120A |
| Max. continuous speed | 18000 rpm |
| Indctor winding resistance (measured between collector rings at 20°C) | - |

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# FRONT SUSPENSIONS

## SHOCK ABSORBERS

| | |
|---|---|
| Rod diameter | 22 mm |
| Stroke | 159 mm |

## STABILISER BAR

| | |
|---|---|
| Bar diameter | 15 mm |

# REAR SUSPENSIONS

## HELICOID SPRINGS

| | |
|---|---|
| Wire diameter | 13.35 ÷ 13.45 mm |
| Free length | 293 mm |

## SHOCK ABSORBERS

| | |
|---|---|
| Rod diameter | 39.4 mm |
| Stroke | 91.5 mm |

## STABILISER BAR

| | |
|---|---|
| Bar diameter | 21 mm |

# WHEEL TRIM AND CHARACTERISTIC ANGLES

| Features | | Unladen and filled | |
|---|---|---|---|
| | | **To '97 models** | **'98 models** |
| Front trim (B - A) | (mm) | -36 ± 5 | -45 ± 5 |
| Rear trim (C - D) | (mm) | -74 ± 5 | -69 ± 3 |
| Front wheel toe-in ($D_2$ - $D_1$) | (mm) | -1.5 ± 0.5 | -2.0 ± 1 |
| Rear wheel toe-in ($D_2$ - $D_1$) | (mm) | +2.5 - 0.5 | +3.0 ± 1 |
| Front wheel camber ($\alpha$) | | 0°1' ± 20' | -0°56' ± 20' |
| Caster ($\beta$) | | 3°5' ± 30' | 2°42' ± 30' |
| Rear wheel camber ($\gamma$) | | -2°3' ± 20' | -1°47' ± 20' |


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## CLUTCH

| | | |
|---|---|---|
| Clutch plate thickness | New | 7.1 ÷ 7.7 mm |
| | Wear limit | 6.3 mm |
| Clutch plate diameter | | 235 mm |

# GEARBOX

## RATIOS (To '97 models)

| Axle ratio | Gear engaged | Gear ratio | Total ratio |
|---|---|---|---|
| 17/57<br>1 : 3.353 | 1st<br>2nd<br>3rd<br>4th<br>5th<br>Reverse | 1 : 3.800<br>1 : 2.235<br>1 : 1.520<br>1 : 1.156<br>1 : 0.914<br>1 : 3.545 | 1 : 12.741<br>1 : 7.494<br>1 : 5.100<br>1 : 3.876<br>1 : 3.065<br>1 : 11.886 |

## RATIOS ('98 models)

| Axle ratio | Gear engaged | Gear ratio | Total ratio |
|---|---|---|---|
| 16/57<br>1 : 3.563 | 1st<br>2nd<br>3rd<br>4th<br>5th<br>6th<br>Reverse | 1 : 3.800<br>1 : 2.235<br>1 : 1.520<br>1 : 1.156<br>1 : 0.971<br>1 : 0.816<br>1 : 3.545 | 1 : 12.471<br>1 : 7.963<br>1 : 5.416<br>1 : 4.119<br>1 : 3.460<br>1 : 2.907<br>1 : 12.631 |

# BRAKES

## BRAKE DISCS

| | | FRONT | REAR |
|---|---|---|---|
| Diameter | (mm) | 305 | 240 |
| Use thickness limit | (mm) | 26.4 | 9.2 |
| Min. thickness after grinding | (mm) | - | 10.1 |
| Nominal thickness | (mm) | 28 | 11 |

## FRONT BRAKE CALLIPERS

| | |
|---|---|
| Type | BREMBO |
| Piston diameter | 42 mm and 38 mm |
| Brake pad area | 52.3 $cm^2$ |
| Pad nominal thickness | 17.3 ÷ 18.0 mm |

# COOLING SYSTEM

## THERMOSTAT

| | |
|---|---|
| Opening start temperature | 85° ÷ 89°C |

## COOLING FAN THERMAL CONTACT

| Fan on/off temperature | | |
|---|---|---|
| 1st speed | On (contacts closed) | 92° ± 2°C |
| | Off (contacts open) | 87° ± 2°C |
| 2nd speed | On (contacts closed) | 97° ± 2°C |
| | Off (contacts open) | 92° ± 2°C |

## COOLANT MAXIMUM TEMPERATURE TRANSMITTER

| | |
|---|---|
| Contact closed temperature | 115° ± 3°C |
| Contact open temperature | ≥ 102°C |


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# FUEL FEED

## FUEL

| | |
|---|---|
| Unleaded petrol | Minimum R.O.N. = 95 |

## FUEL TANK

| | |
|---|---|
| Total capacity | 70 litres |
| Reserve | ~ 9 litres |

## FUEL FEED PRESSURE

| | |
|---|---|
| Idling fuel pressure | 3 bar<br>3.3 ÷ 3.7 bar (▲) |
| Maximum fuel pressure | 4 bar |

**(▲): '98 models**

# FUEL FEED

## FLOW TEST (with SOLEX flow meter)

| | |
|---|---|
| Leaks with throttle closed | 280 ± 10 on scale "N" |

## EXHAUST EMISSIONS

| | | |
|---|---|---|
| CO in exhaust | % vol. | < 0.2 |
| HC in exhaust | p.p.m. | ≤ 50 |

# SENSORS

## RPM AND PHASE SENSOR GAP

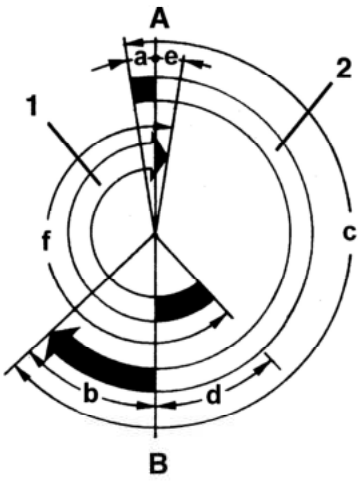
| |
|---|
| 0.8 ÷ 1.5 mm |

## CAM ANGLE SENSOR GAP

| |
|---|
| ≤ 1.5 mm |


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## ANGLES OF ACTUAL TIMING DIAGRAM

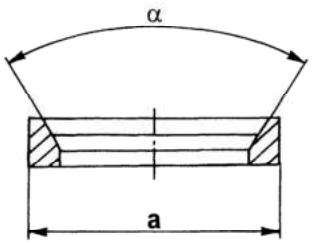



| | | | |
|---|---|---|---|
| Intake | Opens (before T.D.C.) | "a" | 9° |
| | Closes (after B.B.C.) | "b" | 47° |
| | Intake angle | "c" | 236° |
| Exhaust | Opens (before B.D.C.) | "d" | 47° |
| | Closes (after T.D.C.) | "e" | 9° |
| | Exhaust angle | "f" | 236° |

(1) Exhaust
(A) T.D.C.
(2) Intake
(B) B.D.C.

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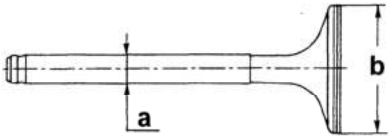
## Valve seats




Unit: mm

| | | |
|---|---|---|
| Outside diameter of valve seats "a" | Intake | 36.600 ÷ 36.616 |
| | Oversize 0.3 | |
| | Exhaust | 32.100 ÷ 32.116 |
| | Oversize 0.3 | |
| Valve seat taper "α" | | 90° ± 20' |
| Interference between valve seats and their seats | Intake | 0.075 ÷ 0.116 |
| | Exhaust | 0.075 ÷ 0.110 |
| Heating temperature of cylinder heads for fitting valve seats | | 100 ÷ 120 °C |

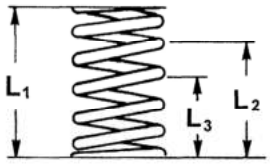
## Valves




Unit: mm

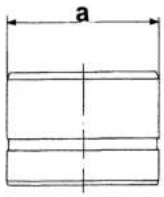
| | | |
|---|---|---|
| Diameter of valve stems "a" | | 6.965 ÷ 6.980 |
| Diameter of valve mushrooms "b" | Intake | 35.5 ÷ 35.7 |
| | Exhaust | 31.0 ÷ 31.2 |
| Radial clearance between valve stems and valve guides | | 0.020 ÷ 0.050 |

## Valve springs




| | Outer spring | Inner spring |
|---|---|---|
| Free length "$L_1$" | ~ 45 mm | ~ 42 mm |
| Length with valves closed "$L_2$" | 32.5 mm | 30.5 mm |
| Corresponding load at "$L_2$" | 219.1 ÷ 230.9 N (22.4 ÷ 23.6 kg) | 123.6 ÷ 131.4 N (12.6 ÷ 13.4 kg) |
| Length with valves open "$L_3$" | 23 mm | 21 mm |
| Corresponding load at "$L_3$" | 430.7 ÷ 450.3 N (43.9 ÷ 45.9 kg) | 240.2 ÷ 259.8 N (24.5 ÷ 26.5 kg) |

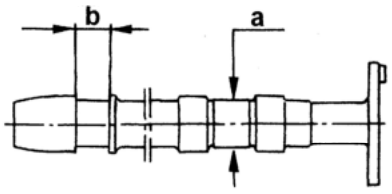
## Hydraulic tappets




Unit: mm

| | |
|---|---|
| Outside diameter of hydraulic tappets "a" | 32.959 ÷ 32.975 |
| Radial clearance between hydraulic tappets and their seats | 0.025 ÷ 0.066 |

## Camshafts

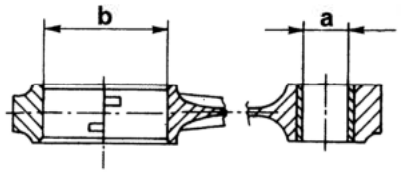



Unit: mm

| | | |
|---|---|---|
| Diameter of camshaft journals "a" | | 26.959 ÷ 26.980 |
| Length of camshaft shoulder "b" | | 20.000 ÷ 20.033 |
| Nominal cam lift | Intake | 9.30 |
| | Exhaust | 9.30 |
| Maximum eccentricity between journals | | 0.03 |
| Clearance between camshaft journals and their seats | | 0.030 ÷ 0.077 |
| Camshaft end float | | 0.065 ÷ 0.131 |

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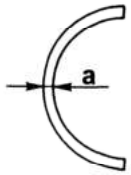
## Connecting rods




Unit: mm

| | | |
|---|---|---|
| Diameter of connecting rod bush hole "a" | | 20.005 ÷ 20.015 |
| Inside diameter of big ends "b" | | 55.511 ÷ 55.524 |
| Difference in weight between connecting rods | | ≤ 2 g |
| Big end end float | | 0.2 ÷ 0.3 |
| Clearance between gudgeon pins and small end bushes | Class A - Black | 0.008 ÷ 0.021 |
| | Class B - White | 0.005 ÷ 0.018 |

## Connecting rod half bearings

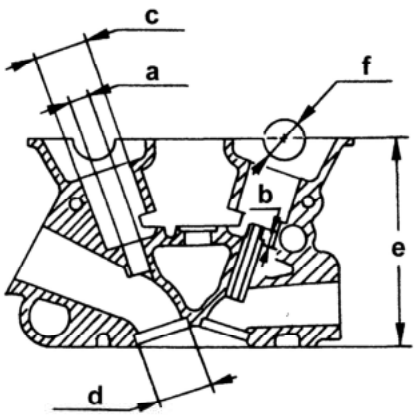



Unit: mm

| | | |
|---|---|---|
| Thickness of connecting rod half bearings "a" | Class A - Red | 1.737 ÷ 1.745 |
| | Class B - Blue | 1.741 ÷ 1.749 |
| Operating clearance between rod pins and their half bearings | Class A - Red | 0.034 ÷ 0.060 |
| | Class B - Blue | 0.036 ÷ 0.062 |

## CYLINDER HEADS

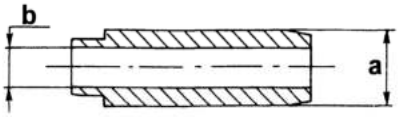
### Heads




Unit: mm

| | | |
|---|---|---|
| Diameter of valve guide seats "a" | | 12.000 ÷ 12.018 |
| Valve guide protrusion "b" | | 10.35 ÷ 10.65 |
| Diameter of hydraulic tappets "c" | | 33.000 ÷ 33.025 |
| Diameter of valve seat housings "d" | Intake | 36.500 ÷ 36.525 |
| | Exhaust | 32.000 ÷ 32.025 |
| Minimum permissible height of heads after refacing "e" | | 134.85 ÷ 135.15 |
| Maximum error of flatness of head lower surface | | 0.05 |
| Diameter of camshaft supports "f" | | 27.010 ÷ 27.036 |
| Length of camshaft support shoulders | | 19.902 ÷ 19.935 |

### Valve guides



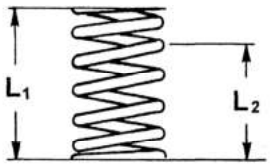

Unit: mm

| | | |
|---|---|---|
| Outside diameter of valve guides "a" | Intake | 12.040 ÷ 12.051 (*) |
| | Oversize 0.2 | |
| | Exhaust | 12.050 ÷ 12.068 (**) |
| | Oversize 0.2 | |
| Inside diameter of valve guides (bore) "b" | | 7.000 ÷ 7.015 |
| Interference between valve guides and their seats | Intake | 0.022 ÷ 0.051 |
| | Exhaust | 0.032 ÷ 0.068 |

(*): Spare 12.053 ÷ 12.064 (**): Spare 12.064 ÷ 12.082

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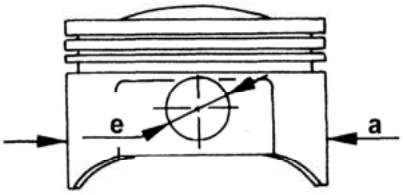
## Engine oil pressure limiting valve spring

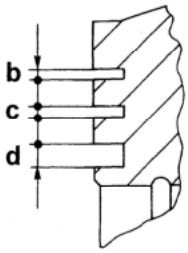



| | |
|---|---|
| Length of spring $L_1$ | 33.35 mm |
| Load corresponding to $L_1$ | 15.86 ÷ 16.86 daN |
| Length of spring $L_2$ | 36 mm |
| Load corresponding to $L_2$ | 13.816 ÷ 14.816 daN |

## CONNECTING ROD - PISTON ASSEMBLY

### Piston



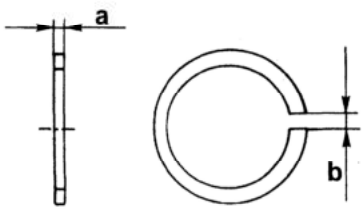




Unit: mm

| | | |
|---|---|---|
| Diameter of piston "a" (1) | Class A - Blue | 92.925 ÷ 92.935 |
| | Class B - Pink | 92.935 ÷ 92.945 |
| | Class C - Green | 92.945 ÷ 92.955 |
| Height of seats of first seal ring "b" | | 1.525 ÷ 1.545 |
| Height of seats of second seal ring "c" | | 1.525 ÷ 1.545 |
| Height of seats of oil scraper ring "d" | | 3.515 ÷ 3.535 |
| Diameter of gudgeon pin holes in pistons "e" | Class A - Black | 22.003 ÷ 22.006 |
| | Class B - White | 22.006 ÷ 22.009 |
| Clearance between liners and pistons | | 0.059 ÷ 0.060 |
| Difference in weight between pistons | | ≤ 4 g |

(1): To be measured perpendicularly to the gudgeon pin hole at a distance of 17 mm from lower edge of skirt.

### Seal rings

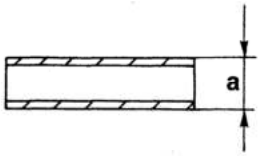



Unit: mm

| | | |
|---|---|---|
| Thickness of rings "a" | First ring | 1.475 ÷ 1.490 |
| | Second ring | 1.475 ÷ 1.490 |
| | Oil scraper ring | 3.475 ÷ 3.490 |
| Ring gap "b" (1) | First ring | 0.40 ÷ 0.65 |
| | Second ring | 0.40 ÷ 0.65 |
| | Oil scraper ring | 0.30 ÷ 0.60 |
| Axial play between rings and their seats | First ring | 0.035 ÷ 0.070 |
| | Second ring | 0.035 ÷ 0.070 |
| | Oil scraper ring | 0.025 ÷ 0.060 |

(1): To be measured in the check ring nut or in the cylinder liner

### Gudgeon pins

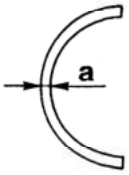



Unit: mm

| | | |
|---|---|---|
| Outside diameter of gudgeon pins "a" | Class A - Black | 21.994 ÷ 21.997 |
| | Class B - White | 21.997 ÷ 22.000 |
| Clearance between pins and their housings on pistons | | 0.006 ÷ 0.012 |

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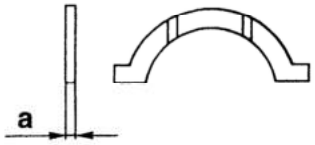
## Main half-bearings




Unit: mm

| | | |
|---|---|---|
| Main half-bearing thickness "a" | Class A - Red | 1.833 ÷ 1.839 |
| | Class B - Blue | 1.839 ÷ 1.845 |
| | Class C - Green | 1.845 ÷ 1.851 |
| Main half-bearing and bearing Operating play | | 0.000 ÷ 0.024 |

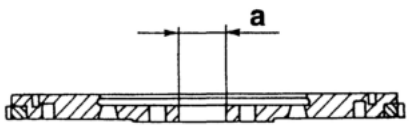
## Thrust half-rings




Unit: mm

| | |
|---|---|
| Thrust half-ring thickness "a" | 2.310 ÷ 2.360 |
| Crankshaft axial play | 0.080 ÷ 0.265 |

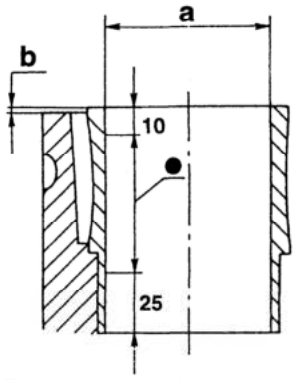
## Flywheel




Unit: mm

| | |
|---|---|
| Central bush internal diameter (bore) "a" | 35.000 ÷ 35.025 |
| Crown wheel heating temperature for fitting on flywheel | 120° ÷ 140°C |

## Cylinder liner

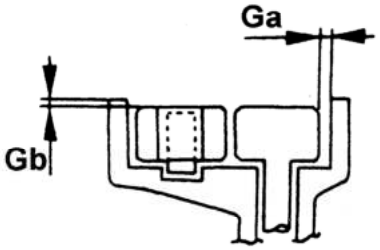



(•) Dimensional check area

Unit: mm

| | | |
|---|---|---|
| Cylinder liner diameter "a" | Class A - Blue | 92.985 ÷ 92.994 |
| | Class B - Pink | 92.995 ÷ 93.004 |
| | Class C - Green | 93.005 ÷ 93.014 |
| Cylinder liner projection from crankcase "b" | | 0.01 ÷ 0.06 |
| Cylinder liner ovality/taper limit | | 0.01 |

## Oil pump




Unit: mm

| | |
|---|---|
| Play "Ga" between gear edge and pump casing | 0.025 ÷ 0.075 |
| Play "Gb" between upper gear side and pump cover | 0.013 ÷ 0.062 |

# ENGINE TECHNICAL FEATURES

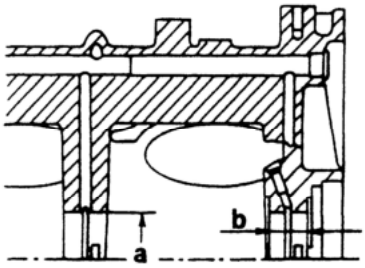
## CHARACTERISTIC DATA

| | | | |
|---|---|---|---|
| Engine | | AR 16102 | |
| Cycle | | Otto, four stroke | |
| Injection / Ignition | | Motronic M3.7.1 | Motronic ME2.1 (▲) |
| Firing order | | 1 - 4 - 2 - 5 - 3 - 6 | |
| Capacity | $cm^3$ | 2959 | |
| Number of cylinders | | 6 at V 60° | |
| Bore | mm | 93 | |
| Stroke | mm | 72.6 | |
| Maximum power | CV CEE (kW CEE)<br>rpm | 225 (165)<br>6300 | 220 (162)<br>6300 (▲) |
| Maximum torque | kgm CEE (Nm CEE)<br>rpm | 27.5 (270)<br>5000 | |
| Compression ratio | | 10.0 : 1 | |
| Engine oil pressure (at 100°C)<br>- Idling ratio<br>- At 4000 rpm | bar | <br>> 0.8<br>> 4.5 | |
| Idling ratio | rpm | 700 ± 20 | |

**(▲): For '98 models**

## COMPLETE CRANKCASE

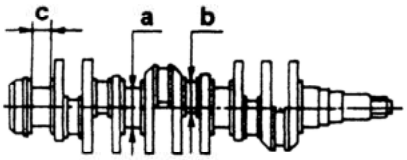
### Crankcase




Unit: mm

| | | |
|---|---|---|
| Main journal diameter "a" | Class A - Red | 63.657 ÷ 63.663 |
| | Class B - Blue | 63.663 ÷ 63.669 |
| | Class C - Green | 63.669 ÷ 63.675 |
| Central main journal Shoulder length "b" | | 26.450 ÷ 26.500 |

### Crankshaft



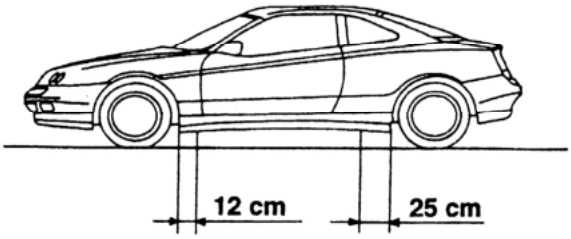

Unit: mm

| | | |
|---|---|---|
| Main journal diameter "a" | Class A - Red | 59.973 ÷ 59.979 |
| | Class B - Blue | 59.967 ÷ 59.973 |
| | Class C - Green | 59.961 ÷ 59.967 |
| Connecting rod journal diameter "b" | Class A - Red | 51.990 ÷ 52.000 |
| | Class B - Blue | 51.980 ÷ 51.990 |
| Rear main journal length "c" | | 31.300 ÷ 31.335 |
| Maximum main journal and connecting rod journal ovality | | 0.004 |
| Maximum main journal and connecting rod journal taper ratio | | 0.010 |
| Maximum parallel error between main journals and connecting rod journals | | 0.015 |
| Main journal maximum eccentricity | | 0.040 |

## JACKING POINTS

**With arm hoist or shop jack.**

- Position the arms or the jack in the areas shown.




**IMPORTANT:**
**Be very careful when positioning the arms or the jack in the front jacking points to avoid squeezing the brake and fuel lines.**

## TOWING POINTS

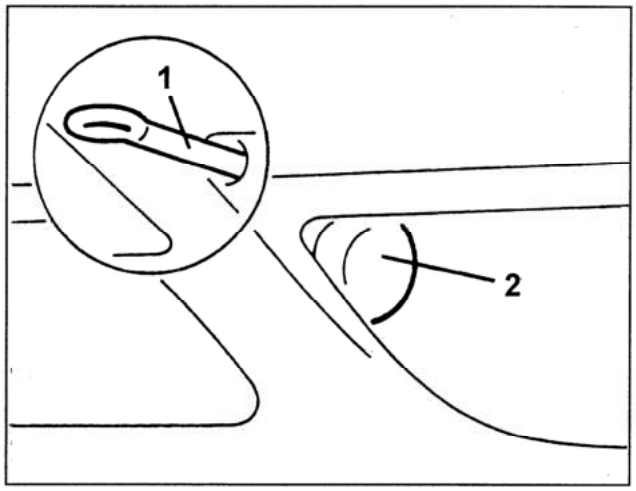
The vehicle is equipped with two threaded attachments - one at the front and the other at the back - where to screw the tow hitch which is provided in the tool bag (in the boot).

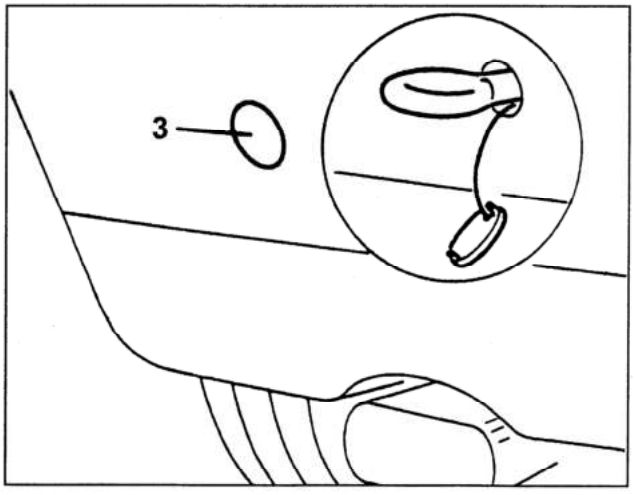
Attain scrupulously to the laws regulating towing.

**IMPORTANT:**
**Before towing the vehicle, turn the key to MAR and back to STOP without removing it to prevent the steering wheel from locking.**

Consider that while towing, the brake booster system is not running. Consequently, more effort on the brake pedal will be required.

Furthermore, when the engine is not running, the power steering system is neither working. Consequently, more effort on the steering wheel is required.




*1. Tow hitch*
*2. Front bumper slot*
*3. Rear bumper cover*


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## FLUIDS AND LUBRICANTS (Continued)

| Type | Assembly ref. | Application | Classification | Name |
|---|---|---|---|---|
| GREASE | 41 - Steering | Roller bushing seat on steering column | - | SPCA SPAGRAPH<br>ISECO ERGON RUBBER GREASE<br>REINACH SFERUL B2 AR |
| | 44 - Suspensions and wheels | Wishbone brackets | - | GREASE MOLYKOTE 7544 PG54<br>TUTELA MR3 |
| | | Side steering linkage | - | MOLYGUARD SYL 113 |

## INDICATIVE CAPACITIES

| Capacity \ Version | | GTV 3.0 24V |
|---|---|---|
| Fuel tank | | 70 litres |
| Fuel reserve | | ~ 9 litres |
| Engine oil | Total capacity: sumps + filter + lines + pipes | - |
| | Sump + filter (for regular replacement) | 6.0 litres |
| Gearbox-differential oil | | 2 litres |
| Power steering system oil | | - |
| Brake and clutch circuit oil | | - |
| Engine coolant fluid | | 11.7 litres |
| Climate control compressor oil | | - |
| Climate control system fluid | | - |

## FLUIDS AND LUBRICANTS

| Type | Assembly ref. | Application | Classification | Name |
|---|---|---|---|---|
| OIL | 10 - Engine | Engine (filling) | API SJ<br>CCMCG5<br>ACEA A3-96<br>SAE 10W/40 | SELENIA 20 K (*) |
| | 21 - Gearbox | Gearbox-differential (filling) | API GL-5<br>SAE 75W 90 | TUTELA ZC 75 SYNTH |
| | 50 - Additional units | Compressor (filling) | - | SANDEN SP 10 "PAG" |
| FLUID | 10 - Engine | Cooling circuit (filling) | - | ALFA ROMEO CLIMAFLUID SUPER PERMANENT -40°C |
| | 18 - Clutch | Hydraulic brake-clutch circuit (filling) | DOT 4<br>SAE J 1703 F | ALFA ROMEO BRAKE FLUID SUPER DOT 4 |
| | 33 - Brakes | | | |
| | 41 - Steering | Power steering (filling) | G.M. DEXRON II | TUTELA GI/A |
| | 50 - Additional units | Climate control system (filling) | - | RIVOIRA: SUVA R134a<br>HOECHST - TAZZETTI: FRIGEN R134a<br>ICI - TAZZETTI: KLEA R134a |
| GREASE | 18 - Clutch | Clutch thrust bearing and lever | - | TUTELA MR3 |
| | | Clutch cylinder strut | | |
| | 21 - Gearbox | Gear engage rod and ball lever bushings | - | TUTELA ZETA2<br>ISECO MOLYKOTE LONGTERM N. 2 |
| | 27 - Front axle | Drive shaft CV joints | - | OPTIMOL PU 035<br>BERUTOX GKN HTB |
| | 33 - Brakes | Pedal board joints and bushing | - | TUTELA ZETA 2 |
| | | ABS inductive sensor seats | | |

(*): For sportier use, we recommend **SELENIA Racing 10W/60** fully synthetic engine oil.



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## WEIGHTS AND LOADS

| Features \ Version | | GTV 3.0 24V |
|---|---|---|
| Kerb weight (without driver) | | 1415 |
| Maximum admitted load | | 1820 |
| Load | | 405 |
| Maximum weight allowed on each axle | front | 1060 |
| | rear | 870 |
| Towable weight | trailer with brakes | 1000 |
| | trailer without brakes | 500 |
| Maximum load on tow hitch | | 50 |

## WHEELS AND TYRES

| Features \ Version | | | GTV 3.0 24V | |
|---|---|---|---|---|
| | | | To '97 models | '98 models |
| Rim size | | Standard | 6.5J x 16" | |
| | | Optional | - | 7.5J x 17" |
| Tyre size | | Standard | 205/50 R16 87W<br>205/50 ZR16 | 205/50 R16 87Y |
| | | Optional | - | 225/45 ZR17 91Y |
| Tyre pressure (cold) | | bar (kg/cm$^2$) | front 2.7<br>rear 2.5 | |
| Space saver spare wheel | Rim size | | 4J x 16" C24 | |
| | Tyre size | | T125/80 R16 97M | |
| | Tyre pressure | bar (kg/cm$^2$) | 4.2 | |

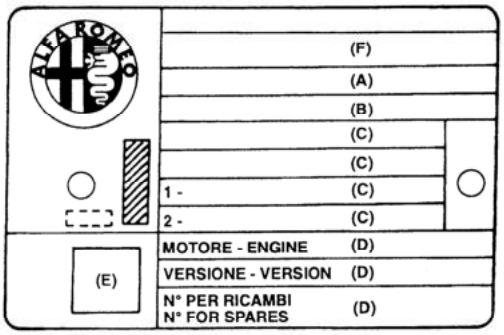
**Tyres for use with snow chains:** Snow chains can only be used with 205/45 ZR16 REINFORCED or 205/45 R16 87W REINFORCED tyres.

**Snow chains cannot be fitted on 225/45 ZR17 91Y tyres.**

**IMPORTANT:**
**Increase pressure by 0.3 bar in the event of constant driving at top speed.**

## IDENTIFICATION DATA PLATE

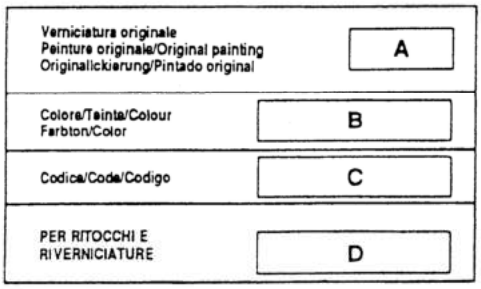
The plate is applied in the engine compartment on the upper left-hand shock absorber bracket. It contains the following data:




A. National homologation
B. Chassis number punch mark
C. Maximum authorised weights prescribed by national laws, where relevant
D. Version identification (e.g. 916C1) and for additional indications
E. Smokiness
F. Manufacturer's name punch marck

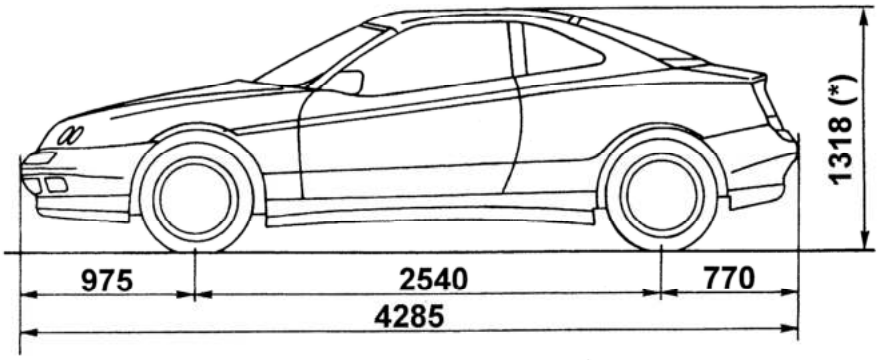
## PAINTWORK IDENTIFICATION PLATE

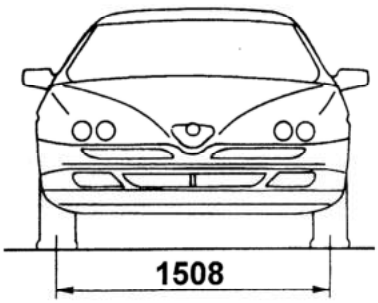
This plate is applied on the inside of the boot and contains the following data:

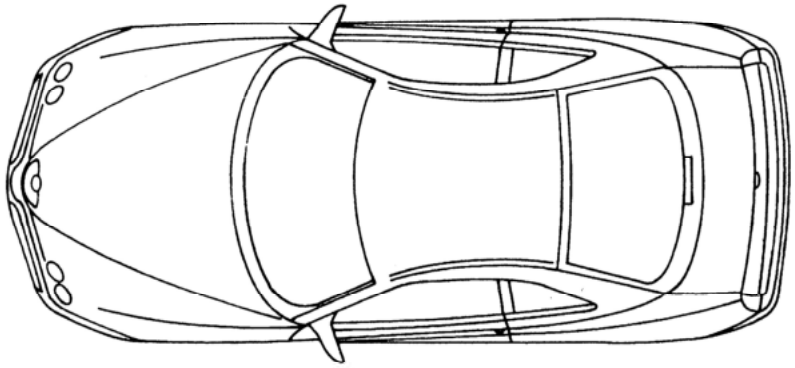


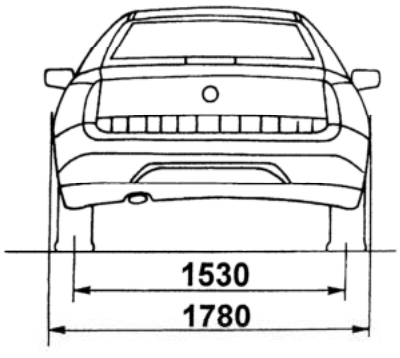

A. Paint manufacturer
B. Colour name
C. Colour code
D. Touch-up and re-spray code

## DIMENSIONS





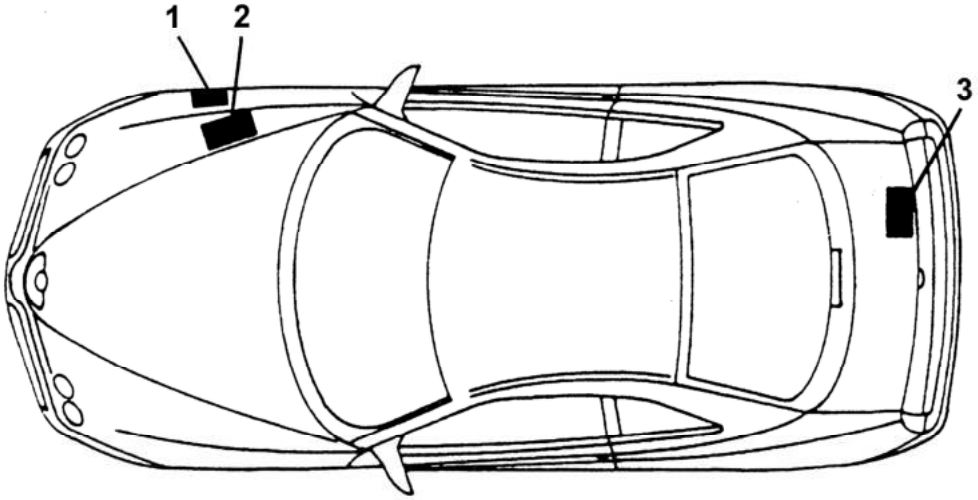

(*): Unladen vehicle

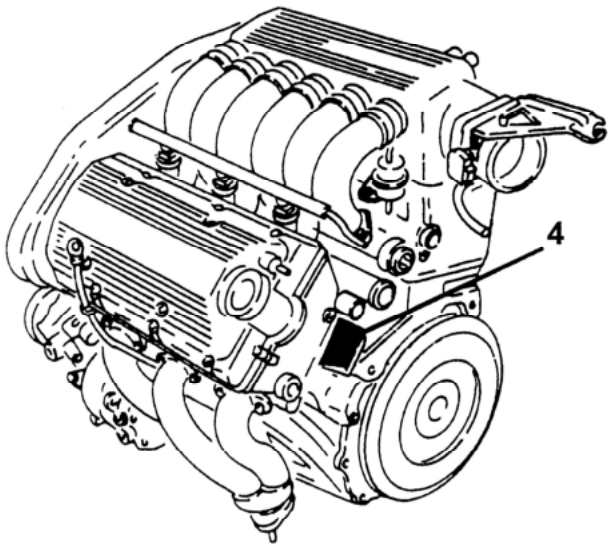
## MODEL IDENTIFICATION

| Brand name | GTV 3.0 24V |
|---|---|
| **Version** | Coupé |
| **Version** (on identification plate) | 916C1 |
| **Chassis** (in engine Compartment, on upper right-Hand shock absorber bracket) | - |
| **Progressive chassis number** | - |
| **Engine** (code) | AR 16102 |
| **Engine symbol** | 2959 24V |
| **Gearbox** (code) | C.503.5<br>C.530.6 (▲) |

(▲): **For '98 models**

## IDENTIFICATION PLATE LOCATION




1. *Identification data plate*
2. *Chassis marking*
3. *Paintwork identification plate*
4. *Engine marking*

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**FOR THE INFORMATION NOT GIVEN HEREIN, REFER TO THE CORRESPONDING GROUP OF "SPIDER-GTV".**
**THE REFERENCE ENGINE IS THE "6 CYLINDER " (3.0 V6 ENGINE)**


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(▲): See 1996 TB



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(▲): See 1996 TB



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