

CHECKS, ADJUSTMENTS AND REPAIR INTERVENTIONS ON THE HITACHI MPI SYSTEM



The following instructions should be observed when working on a vehicle fitted with a Hitachi MPI system:

- *do not start the engine when the terminals of the wiring connections are incorrectly connected or loose on the battery poles;*
- *do not use a fast charger to start the engine;*
- *never disconnect the battery from the electrical system when the engine is running;*
- *disconnect the battery from the electrical system before fast charging it;*
- *if the vehicle is placed in a drying oven after painting at temperatures exceeding 80°C, dismantle and remove the engine control unit from the vehicle;*
- *do not connect/disconnect the control unit's multi-connector when the ignition is on;*
- *always disconnect the battery's negative lead before carrying out electric arc welding on the vehicle.*



The system has a memory supplied directly from the battery, even with the ignition off, where the values learnt during self-adaptation are stored. If the battery is disconnected, these data will be lost, and can only be learnt again after a certain mileage has been travelled, so only disconnect the battery if strictly necessary.

CHECKING CONCENTRATION OF GAS EMISSIONS

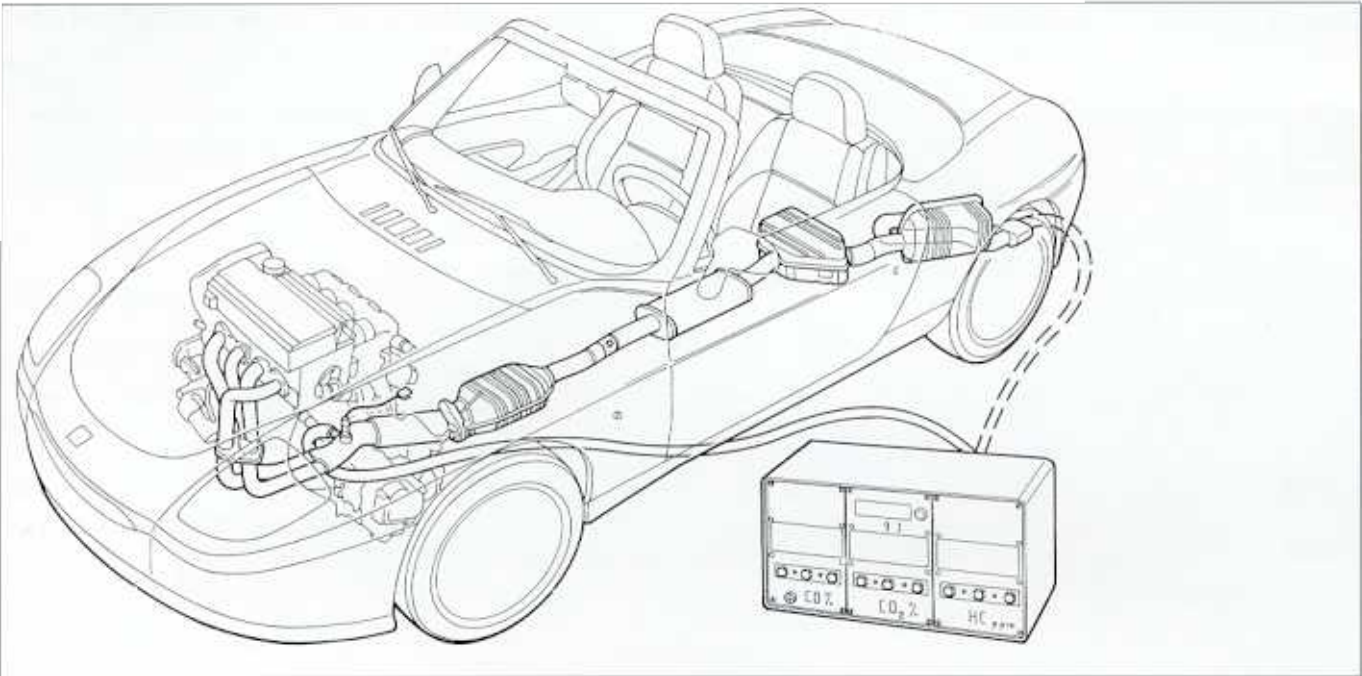
The system manages, without the possibility of adjustment, the advance, the carbon monoxide (CO) content and the air flow rate during idling, so no manual adjustments are necessary.

However, a check relating to the contents of the exhaust gases upstream and downstream of the catalytic converter can provide useful information on the operating conditions of the fuel injection-ignition, and the parameters of the engine or catalytic converter.

Checking concentration of CO and HC during idling upstream of the catalytic converter

To check the concentrations of carbon monoxide (CO) and unburnt hydrocarbons (HC) upstream of the catalytic converter, proceed as follows:

1. Undo the plug located on the exhaust pipe, upstream of the catalytic converter, and screw in the tool in its place.
2. Connect the probe of a suitably calibrated CO tester to the tool.
3. Start the engine and bring it up to temperature.
4. Check that the rpm is correct.
5. Check that the CO concentration during idling is within the specified values (see table); otherwise check:
 - that the Lambda probe is operating correctly, using the diagnostic equipment;
 - whether there are air leaks in the area surrounding the Lambda probe seat;
 - the fuel injection and ignition system (**in particular the state of wear of the spark plugs**).
6. Under the same conditions, check that the HC concentration is less than 500 p.p.m.
7. If the measured values are not correct, tune the engine, checking in particular:
 - timing;
 - engine compression.



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Summary table of tolerance values for polluting emissions

	CO(%)	HC (p.p.m.)	CO ₂ (%)
Upstream of catalyzer	0.4 - 1	< 500	> 12
Downstream of catalyzer	< 0.35	< 90	> 13

Checking CO and HC concentration in the exhaust

The concentration of carbon monoxide (CO) and unburnt hydrocarbons (HC) in the exhaust should be measured by inserting the probe of a suitably calibrated tester at least 30 cm into the end of the exhaust pipe.

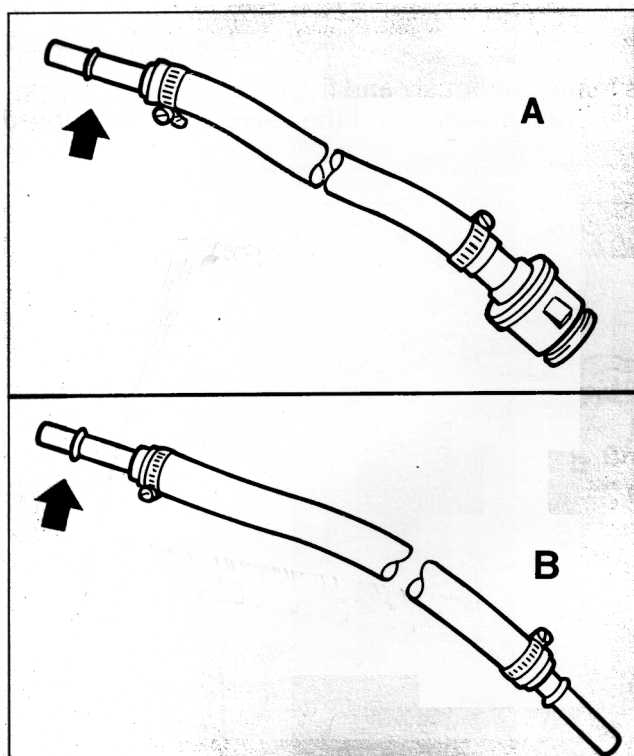
- 1 Check that the values of the CO and HC concentrations during idling are as specified (see table).
- 2. If the HC value is outside the specified limit, while the measurement upstream of the catalytic converter was correct, the engine parameters may be considered to be correct and so the cause of the fault may be sought in the reduced efficiency of the catalytic converter.

CHECKING ENGINE IDLE SPEED

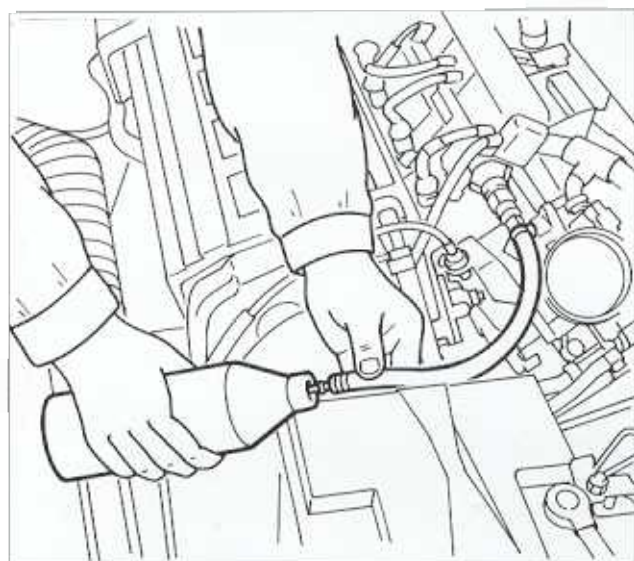
If the engine idle speed is not as specified, and as the system is of the self-adjusting type, no adjustment can be made. It is therefore necessary to check that the throttle control linkage is correctly adjusted, and then search for the fault by full diagnosis using the diagnostic equipment.

CHECKING IGNITION ADVANCE

The diagnostic equipment must be used to check the ignition advance angles at the various engine speeds.



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CHECKS ON THE FUEL SUPPLY SYSTEM



THERE MUST BE A SUITABLE VAPOUR EXTRACTION AND TREATMENT SYSTEM FOR THESE OPERATIONS

Checking pressure of fuel supply system

To check the supply pressure of the fuel system and to check the system for leaks, proceed as follows using the tool 1860955000, fitted with two adaptors to be made as described below:

- adaptor (A): use a quick-fit female terminal of the new type and a section of pipe contained in the Kit no. 1860955003 and a quick-fit male terminal of the old type contained in the Kit no. 1860955001;
- adaptor (B): use a quick-fit male terminal of the new type and a section of pipe contained in the Kit no. 1860955003 and a quick-fit male terminal of the old type in the Kit no. 1860955001;

Configure the adaptors as shown in the figure.



The arrow indicates the side to be inserted in the test equipment 1860955000 (pressure gauge)

Discharging fuel pressure in fuel supply system

The fuel supply system is kept constantly at a temperature of about 3.2 bar even when the engine is off; so before carrying out operations on the delivery pipe, the pressure in the system must be discharged, using adaptor no. 1870684000 and a suitable container into which to drain the surplus fuel.

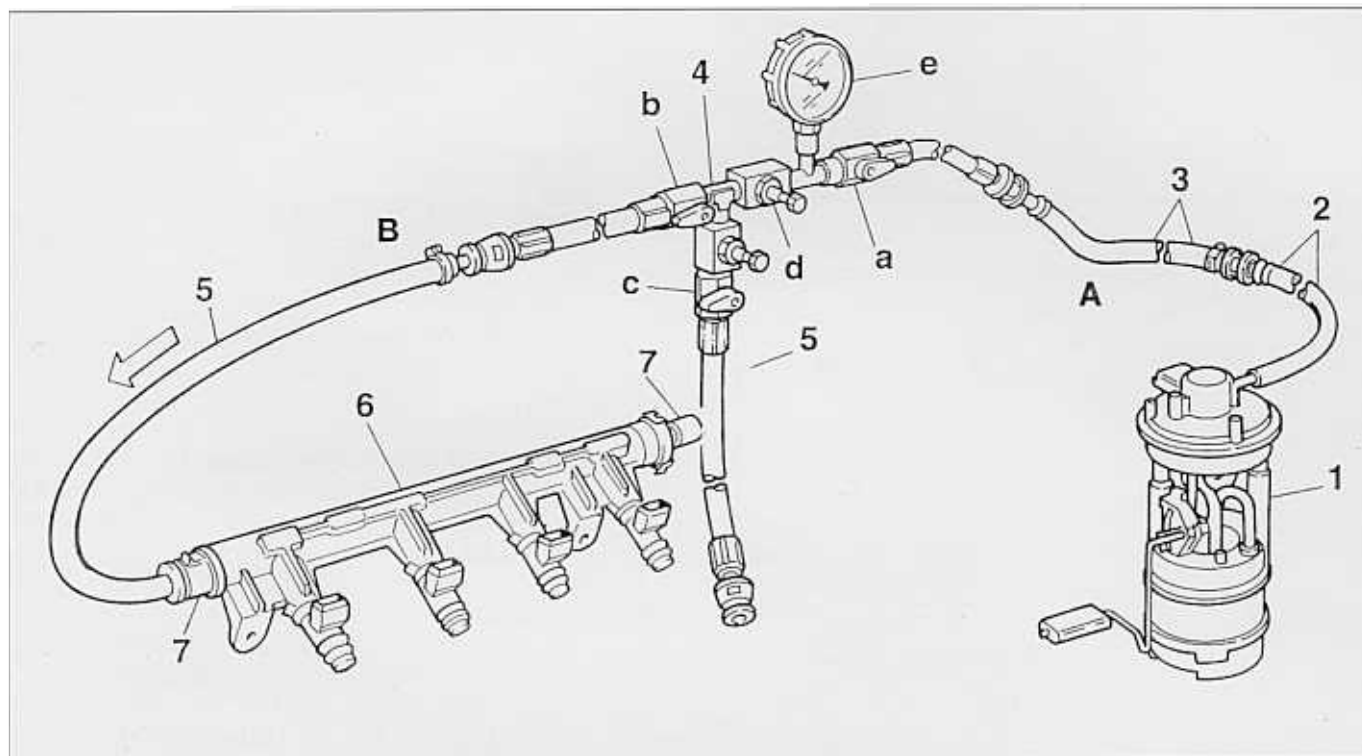
Proceed as described below:

- Remove the inlet hose from the throttle body.
- Remove the protective cover from the attachment on the fuel manifold.
- Insert the male end of the adaptor into the container and fit the quick-fit connector to the connection on the fuel manifold, as shown in the figure; in this way the small quantity of surplus fuel, which creates pressure, is discharged into the container and so the checks can be carried out on the fuel supply system.
- Disconnect the adaptor from the connection and refit the protective cover.

10.

Checking pressure in fuel supply system

Make up the test device 1860955000 using the adaptors made previously and fitted as shown in the figure below, with the ball valves (a), (b) and (d) in the fully open position and the valve (c) in the closed position.



- | | |
|-------------------------------|------------------------------------|
| 1. Complete fuel pump | 5. Adaptor (B) |
| 2. Fuel delivery pipe | 6. Fuel manifold |
| 3. Adaptor (A) | 7. Quick-fit connector on manifold |
| 4. Test device no. 1860955000 | |

After discharging the pressure, disconnect the end of the fuel delivery pipe (2) from the quick-fit connector (7) on the manifold, as described on the preceding pages, connect it to the female connector of the adaptor (A), connect the new male terminal of the adaptor (B) to the quick-fit connector on the fuel manifold (7) and check that the connectors are correctly seated.

Switch the ignition on and watch the pressure gauge (e) to check that after increasing to about 3.5 bar, the pressure settles to about 3.2 bar (the pressure drop is due to the fact that after a few seconds of operation the pump stops, as the engine has not started).

If the pressure falls below the above-mentioned values, check the part of the system upstream of the fuel manifold for leaks, and also check the fuel injectors for leaks as described below.

Checking fuel delivery pipe for leaks

Maintain the test equipment as described in the above sub-section, close the valve (b), keeping the valve (c) closed and the valve (a) fully open.

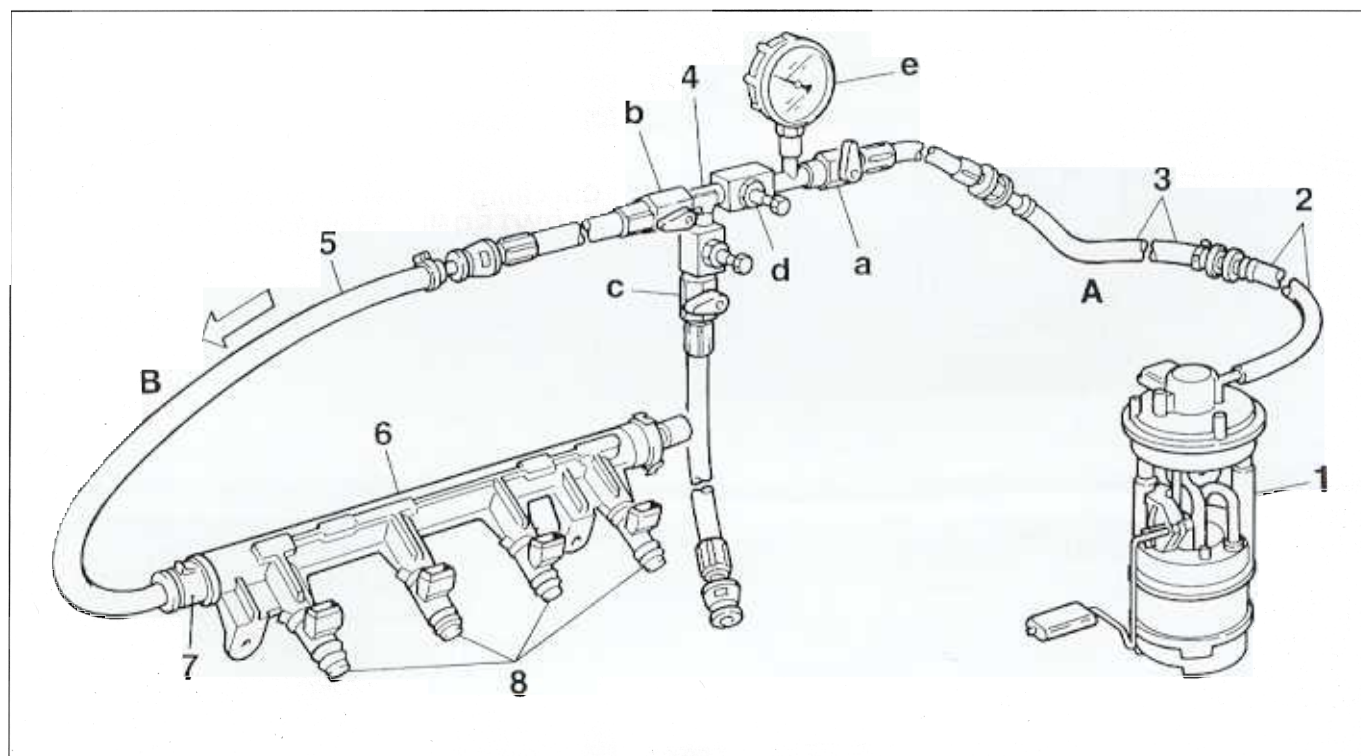
Switch the ignition on and check on the pressure gauge (e) that the pressure, after rising to a value of about 3.5 bar, settles to a pressure of about 3.2 bar (the pressure drop is due to the fact that after a few seconds of operation the pump stops, as the engine has not started).

If the pressure drops below the above-mentioned values, check the part of the system upstream of the manifold for leaks; if no leaks or damage on the fuel delivery pipe are found, replace the fuel pump assembly because, as described in the sub-section relating to the fuel pump, the pressure regulator is housed in the assembly and CANNOT be replaced.

After repeating the check, if the pressure exceeds the specified value and stabilizes at a higher level, replace the fuel pump as there are operating faults in the pressure regulator housed in the pump.

If the specified pressure is obtained, check the fuel manifold and fuel injectors for leaks in accordance with the procedure described below.

Checking fuel injectors for leaks



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- | | |
|-------------------------------|------------------------------------|
| 1. Complete fuel pump | 5. Adaptor (B) |
| 2. Fuel delivery pipe | 6. Fuel manifold |
| 3. Adaptor (A) | 7. Quick-fit connector on manifold |
| 4. Test device no. 1860955000 | 8. Fuel injectors |

Maintain the test device as described in the above sub-section, fully open the valve (b), keeping the valve (c) closed and the valve (a) in the fully open position.

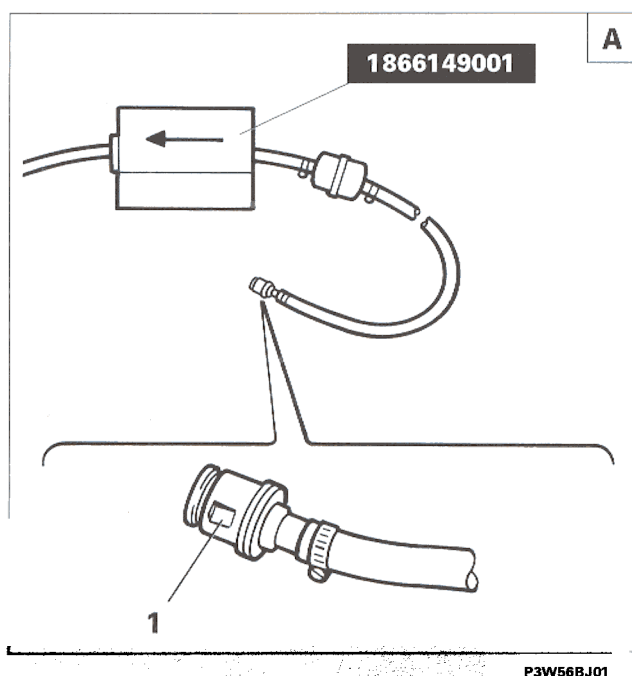
Switch the ignition on and watch the pressure gauge (e) to check that the pressure, after increasing to about 3.5 bar, settles to about 3.2 bar, then close the valve (a) and check that the pressure remains constant for at least one minute; if not, there is a leak from one or more injectors.

10.

Removing test device

Remove the test device 1860955000 with the ignition off (STOP position), as described below:

- insert the end of the pipe connected to the valve (c) into a suitable container;
- open the valve (c) and drain the surplus fuel into the container;
- keep the pipe in the container and disconnect the end of the delivery pipe from the female connector of the adaptor (A), keeping the coupling upwards;
- allow the fuel present in the pipes to flow into the container;
- disconnect the end of the adaptor (B) from the connector on the fuel manifold and allow the residual fuel to flow from the pipes into the container;
- f reconnect the fuel delivery pipe to the fuel manifold.



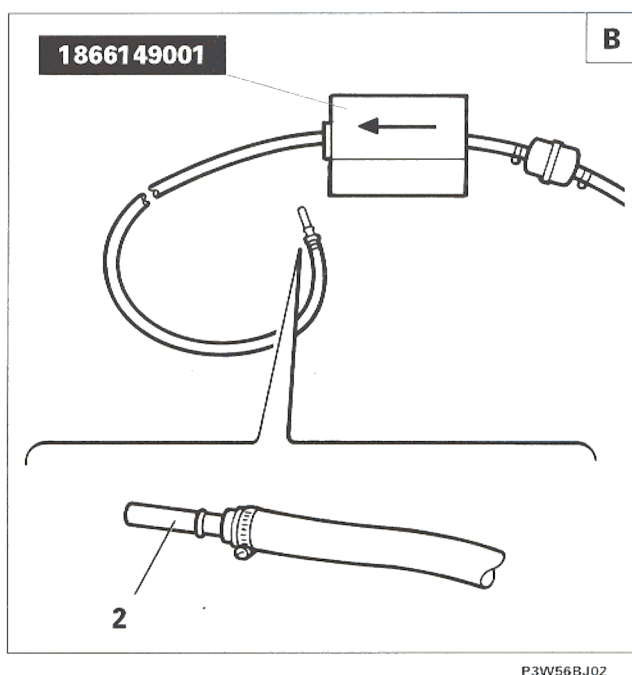
Checking fuel consumption with FLOWTRONIC 1866149001 device

To carry out the check, the device must be configured with the connections shown in the figures:

- A. delivery pipe side
- B. fuel manifold side

If the device cannot be adapted in this way, proceed as described below:

- cut the end on the inlet pipe to the FLOWTRONIC device and replace with a quick-fit female connector (1), contained in the Kit No. 1860955003, as shown in the figure A;

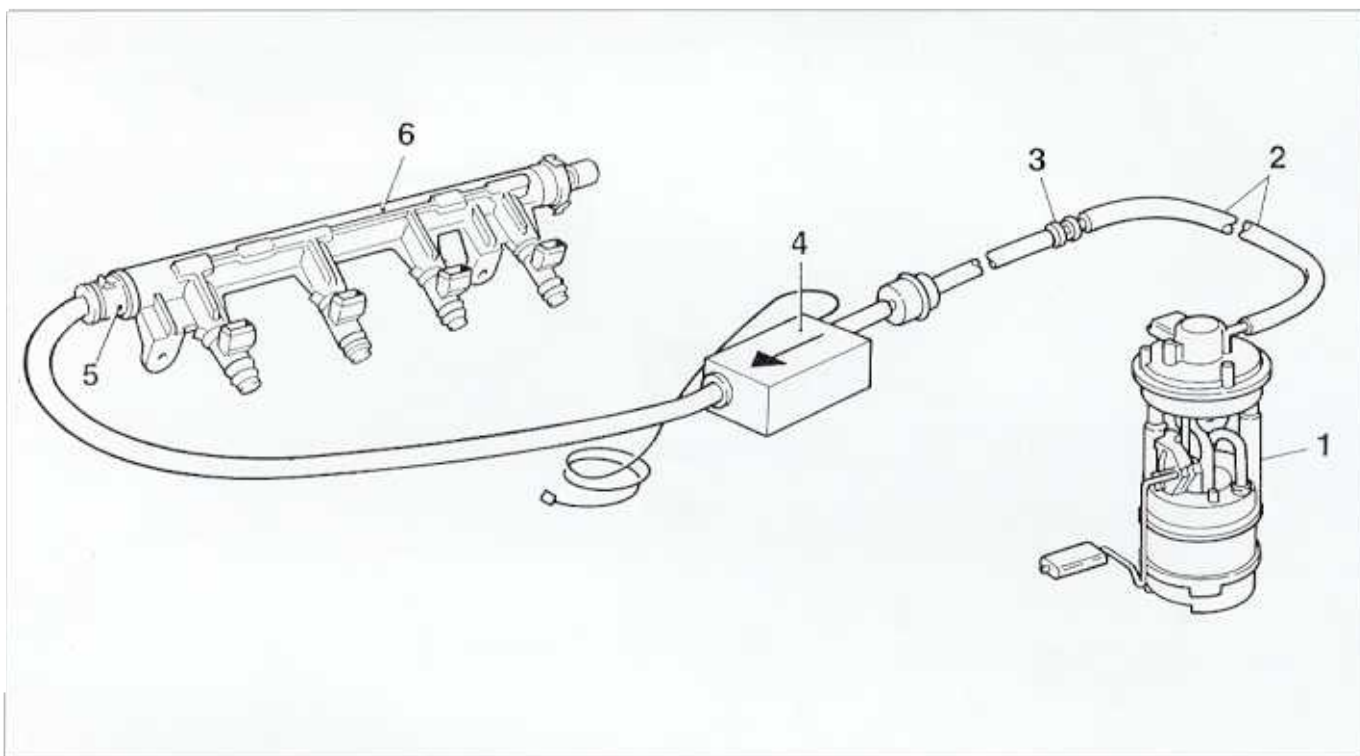


- cut the end on the outlet pipe from the FLOWTRONIC device and replace it with a male connector (2), contained in the Kit No. 1860955003, as shown in Figure B.



The removed connectors should be saved for future connections.

- discharge the fuel pressure in the delivery pipe and disconnect the pipe from the fuel manifold, as described in the preceding sub-sections;
- fit the end of the delivery pipe to the quick-fit female connector of the FLOWTRONIC device and the male connector to the quick-fit connection on the fuel manifold;
- place the device in the engine compartment, bring the connecting cable inside the car and connect the device as described in the instructions supplied with the device;
- check the consumption in accordance with 93/116 CE standards and check that the values correspond to those stated in Section 00 - Technical data.



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- | | |
|--------------------------------|----------------------|
| 1. Complete fuel pump | 4. FLOWTRONIC device |
| 2. Fuel delivery pipe | 5. Male terminal |
| 3. Quick-fit female connection | 6. Fuel manifold |

- carry out the consumption test on the road in accordance with the directive 93/116 CE (litres per 100 km);

URBAN CYCLE - includes one cold start, followed by a simulation of a varied town journey;

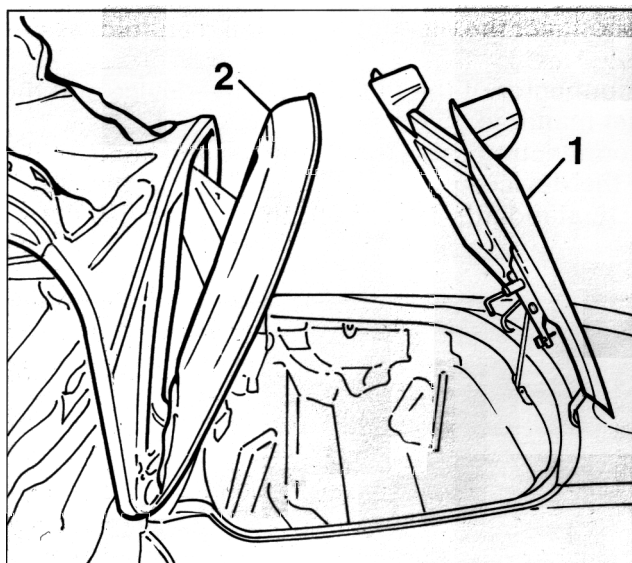
NON-URBAN CYCLE - includes frequent accelerations, in all gears, simulating normal non-urban use of the vehicle; the speed varies between 0 and 120 km/h;

AVERAGE COMBINED CONSUMPTION - covers 33% urban cycle and 67% non-urban cycle;

- check that the values measured correspond to those given in the "Introduction and technical data" section.

NOTE *Type, traffic situations, driving style, weather conditions, version/accessories, presence of roof rack, presence of special equipment and general condition of the vehicle, can lead to different fuel consumption values from those measured by the above-mentioned procedures.*

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FUEL CAGE ASSEMBLY

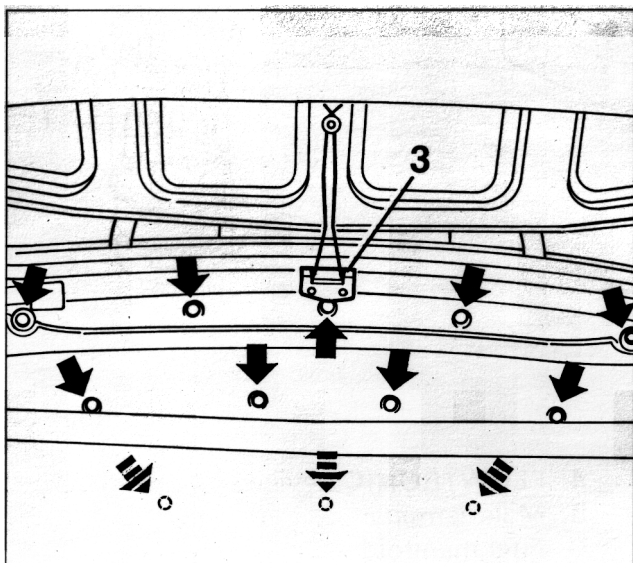
NOTE To remove the assembly from the tank, the fuel must not exceed half the maximum level.

Removal

- open the flap (1) covering the hood compartment (the lever is located in the rear door ledge on the driver's side) and lift the hood base frame (2);



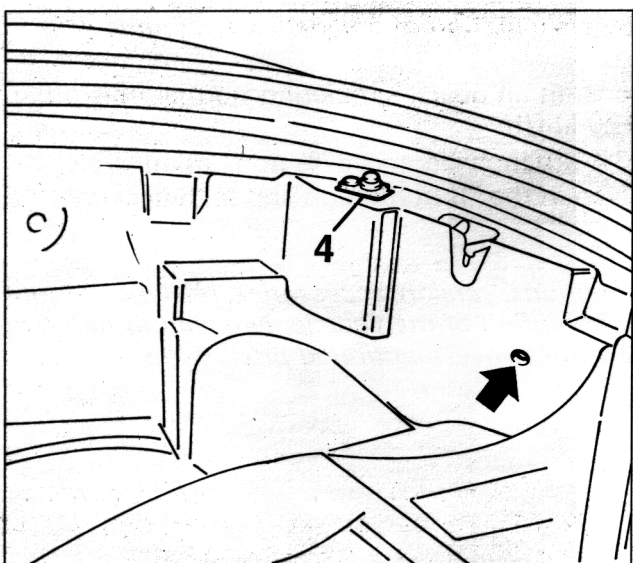
Secure the flap and hood frame safely in a raised position, to prevent them accidentally falling.



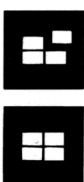
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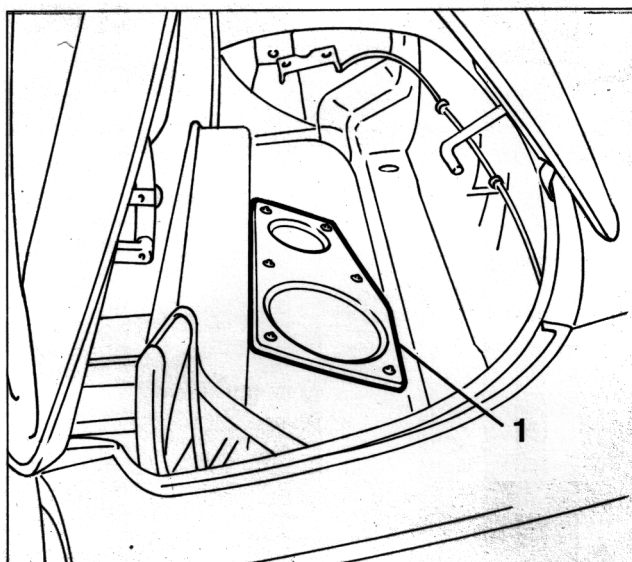
- remove all the buttons securing the trim panels, shown by the arrows, remove the flap stop supporting block (3) to release the panel, then reposition it;



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- remove the switch (4) on the side, remove the side button (arrowed) from both sides, then release and remove the trim panels from the hood compartment;



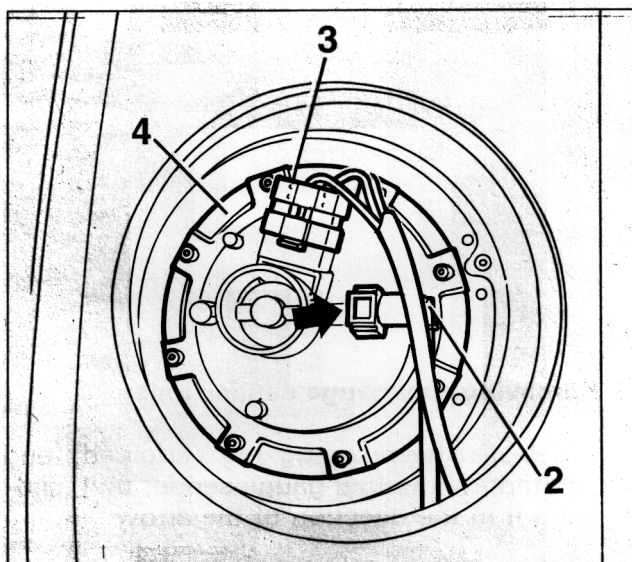
P3W59BJ01



- undo the screws and remove the flange (1) which shuts off the access to the cage assembly;
- disconnect the delivery pipe (2) by pressing the retaining clips of the quick-fit connector and plug the end of the pipe, then disconnect the wiring connector (3).



Because of the position of the tank, it is essential to avoid fuel drips which would cause persistent smells in the car interior.



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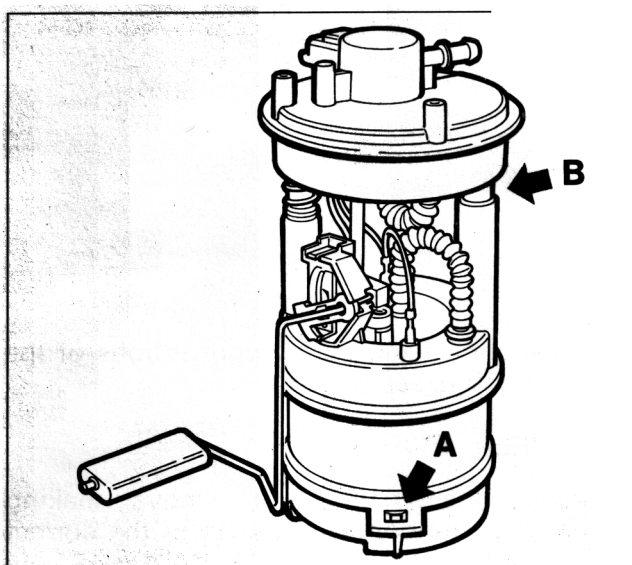
- undo the screws and remove the ring nut (4) securing the cage assembly to the tank;
- remove the complete cage assembly, taking care not to damage the seal.

Refitting

Reverse the order of operations for removal; at the end make sure that there are no fuel leaks.

Removing fuel pump

- release the three plastic locking teeth (arrow A) and remove the bottom of the cup, and then remove the mesh prefilter;
- withdraw the delivery pipe from the fuel pump, removing the attachment clip;
- disconnect the wiring terminals from the fuel pump and fuel gauge sender unit, then release the top of the cage, withdrawing the spyglass connection after releasing the stop lug (arrow B);
- release the stop lug and withdraw the fuel pump from the cage.



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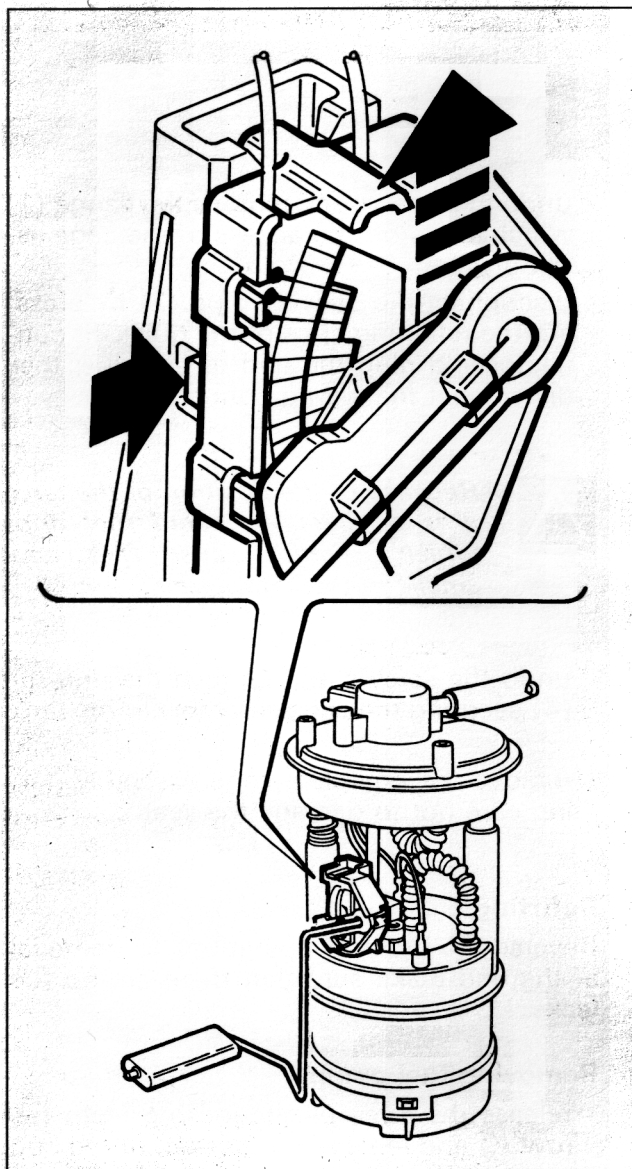
Refitting

To refit, reverse the procedure for removal.



During refitting, the wiring terminals cannot be reversed as they are of different sizes.

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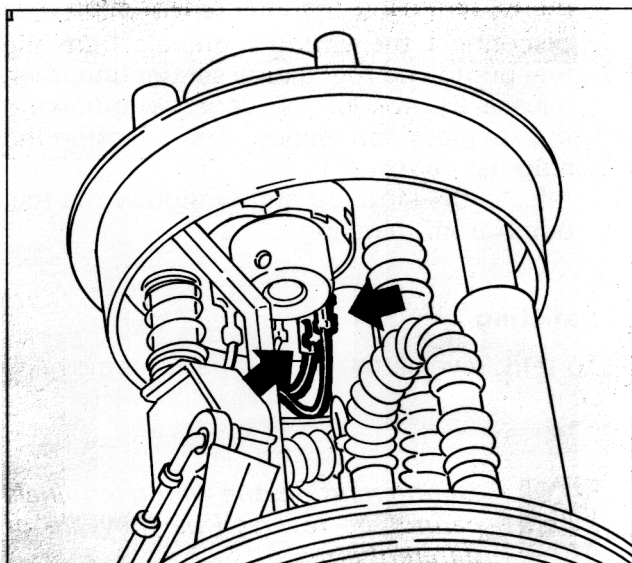


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Removing fuel gauge sender unit

- Release the retaining lug (arrowed) and withdraw the fuel gauge sender unit, sliding it in the direction of the arrow.



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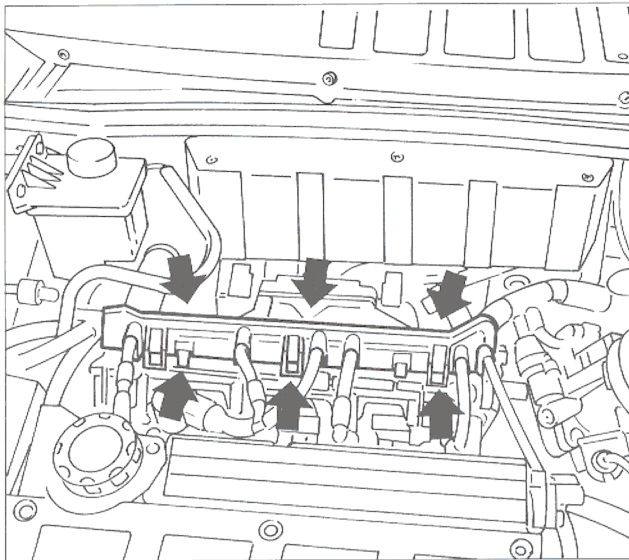


- Disconnect the wiring connections of the fuel gauge sender unit.

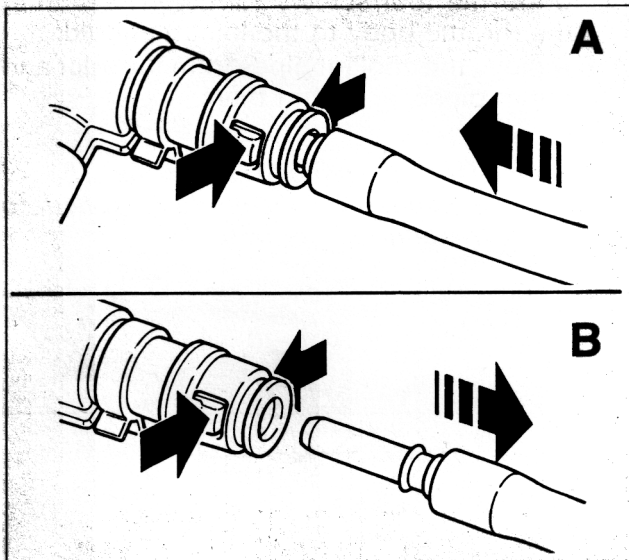
Refitting

Reverse the procedure for removal, making sure that the connections are in the correct position.

FUEL MANIFOLD AND FUEL INJECTORS



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⚠ Before removing the manifold, discharge the pressure by following the procedure described at the beginning of this sub-section.

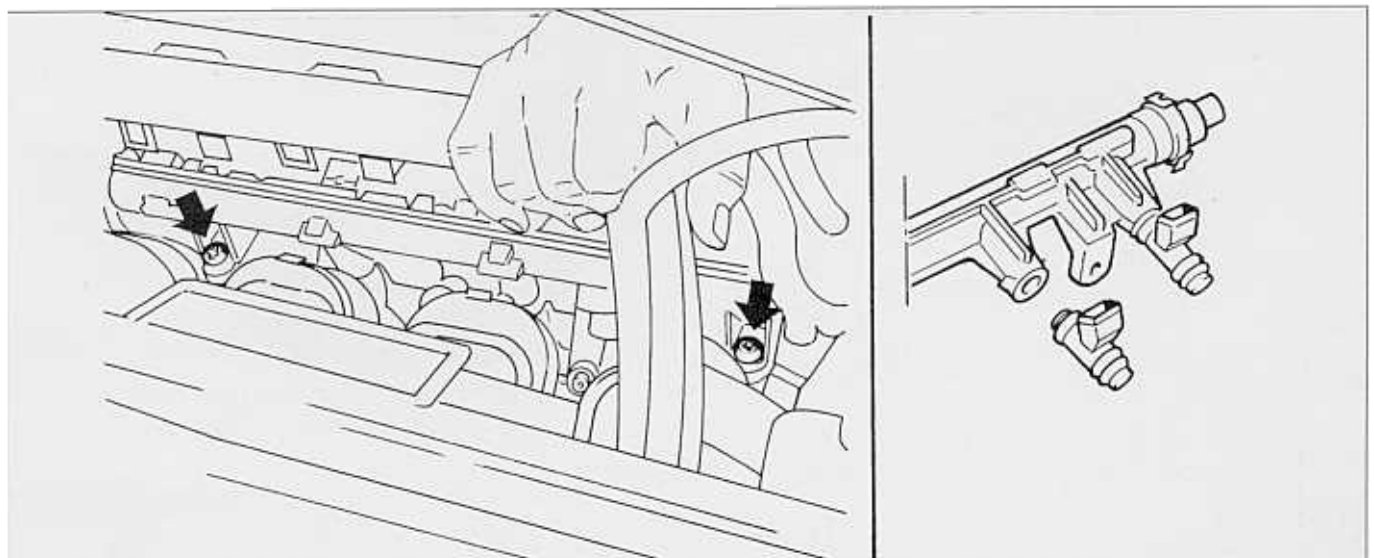
Remove the manifold as follows:

- release the front and rear clips (arrowed) securing the cable duct to the manifold;
- disconnect the wiring connectors from the fuel injectors and timing variator and move the cable duct aside;
- disconnect the fuel delivery pipe (1) from the manifold in two stages:

- press the retaining clips, at the same time pushing the end of the pipe in the direction indicated to release it;
- keep the clips pressed and withdraw the end from the manifold;

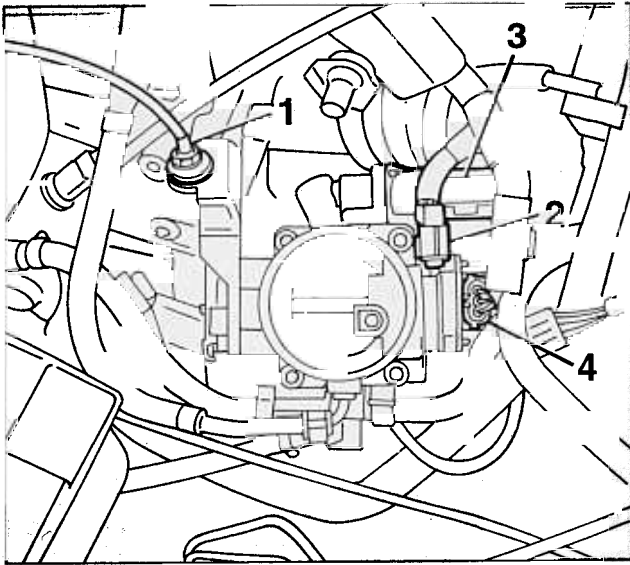
- undo the two screws (arrowed) securing the manifold and remove it.

The fuel injectors have no retainers; to remove them simply withdraw them from their seating (see detail).



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THROTTLE BODY

NOTE *The throttle body and air flow meter are integrated in the same unit.*

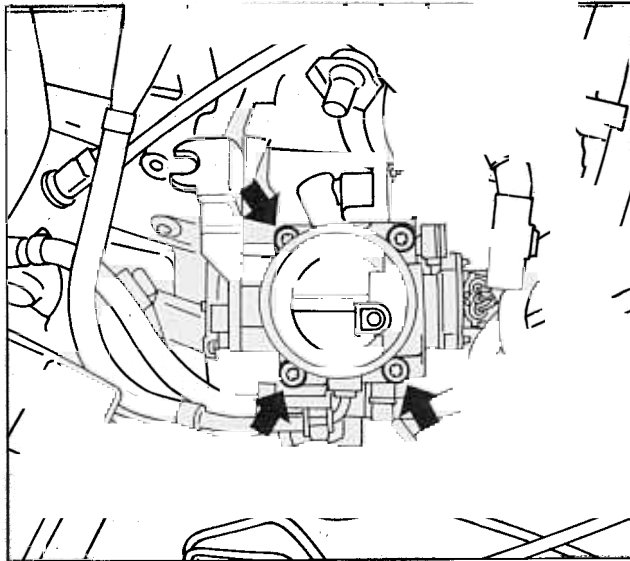
Removal-refitting

To remove the throttle body, proceed as follows:

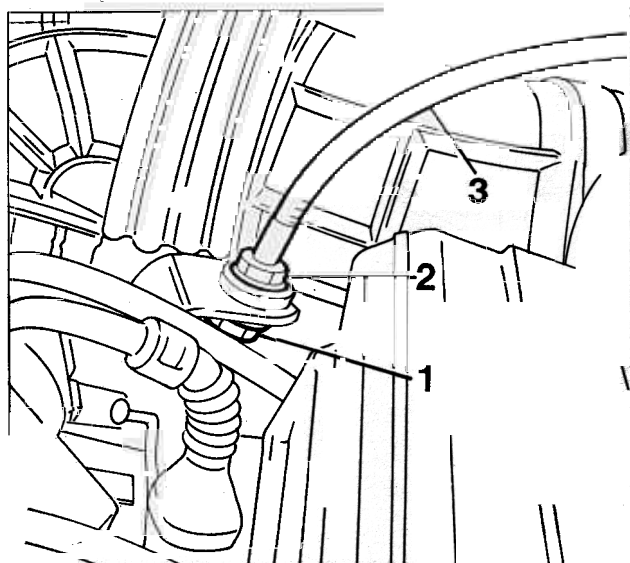
- remove the inlet hose from the throttle body, slackening the attachment clips;
- remove the throttle cable (1), fully undoing the connection on the adjustment bracket and releasing the cable from the lever on the throttle body;
- disconnect the wiring connectors from the throttle position sensor (2), idle adjustment solenoid (3) and air flow meter (4);
- withdraw both connecting pipes from the PCV valve;
- undo the four screws (arrowed) securing the throttle body to the inlet manifold;
- remove the coolant pipes from the inlet and outlet pipes, and plug them.



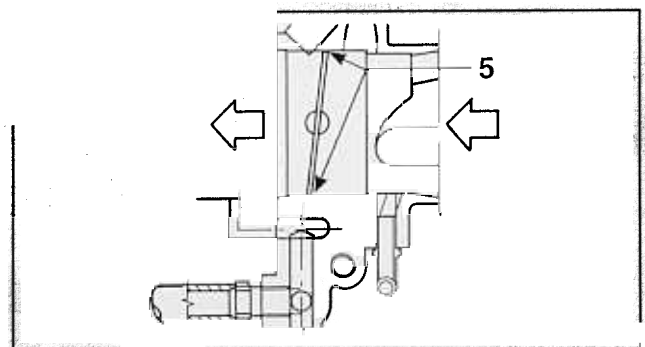
NOTE *Do not remove the layer (5) of molybdenum disulphide applied to the edge of the butterfly.*



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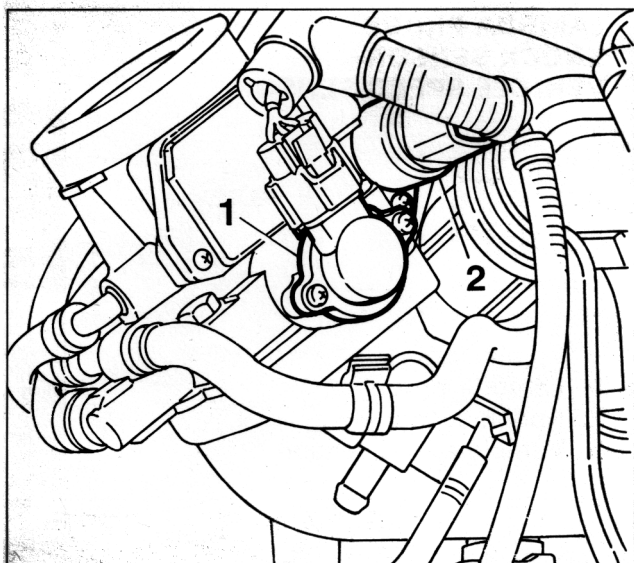
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P3W62BJ04

ADJUSTING THROTTLE CABLE

- after completing the adjustment, lock the locknut.



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ENGINE IDLE SPEED ADJUSTMENT ACTUATOR

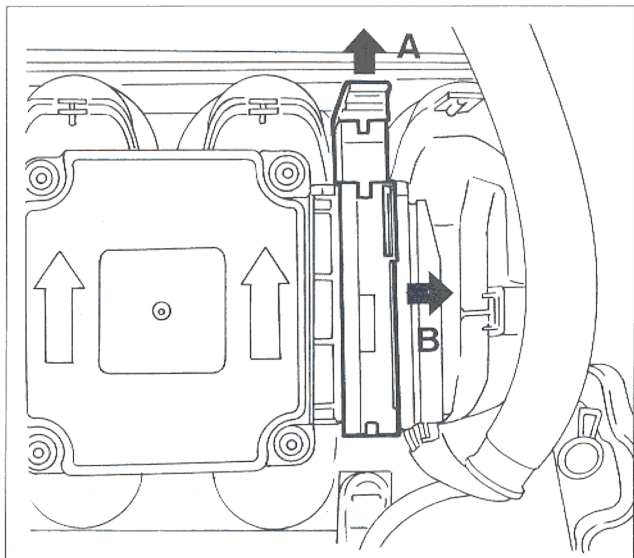
Removal-refitting

To remove the engine idle speed adjustment actuator, disconnect the connector and undo the attachment screws.

THROTTLE POSITION SENSOR

Removal-refitting

To remove the throttle position sensor (2), disconnect the connector and undo the attachment screws.



P3W63BJ02



ENGINE CONTROL UNIT

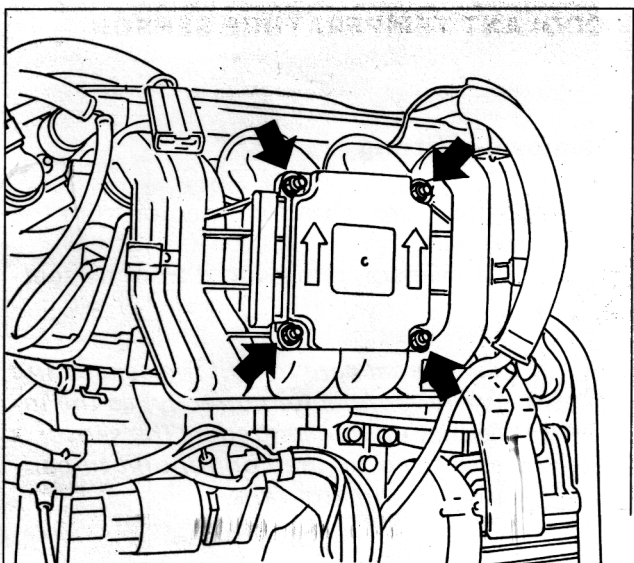
Removal-refitting

The control unit is mounted on the engine, secured by four nuts to the inlet manifold.

To remove the control unit, proceed as follows:

- disconnect both wiring connectors in two stages:

- pull the coloured button upwards to release the connector;
- pull the connector away.



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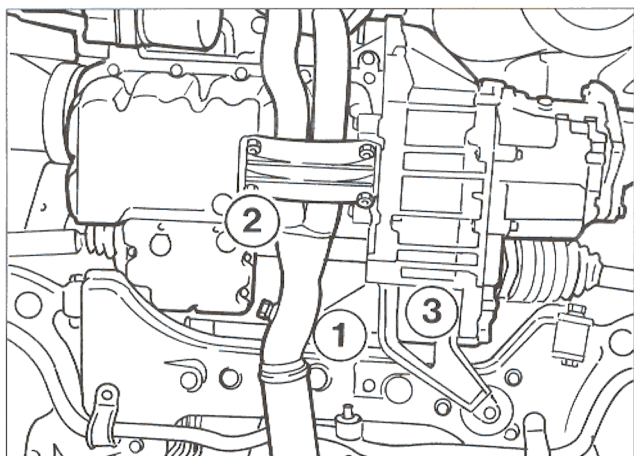


undo the screws securing the control unit and remove it.

NOTE When refitting the connector, proceed as follows:

- bring the connector in contact with the control unit;
- press the button and at the same time push the connector.

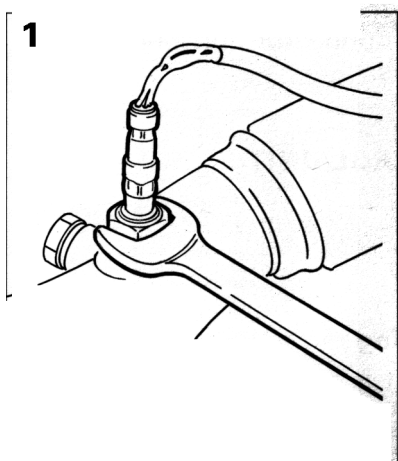
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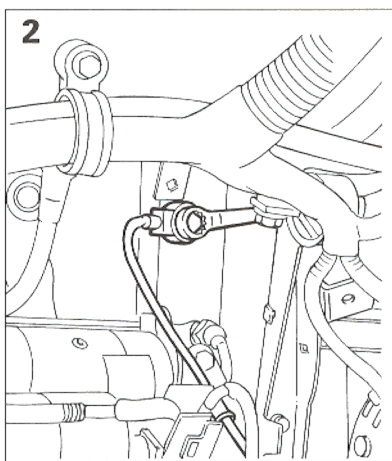
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**LAMBDA PROBE
KNOCK SENSOR
VEHICLE SPEED SENSOR**

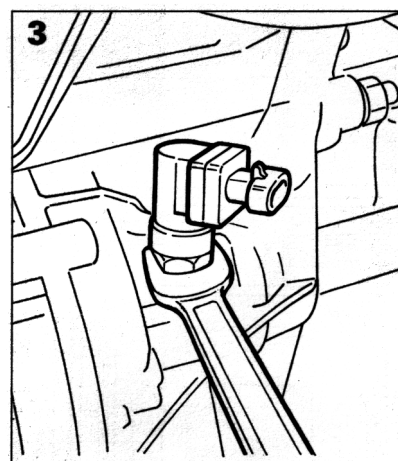
1. Lambda probe
2. Knock sensor
3. Vehicle speed sensor



P3W64BJ02



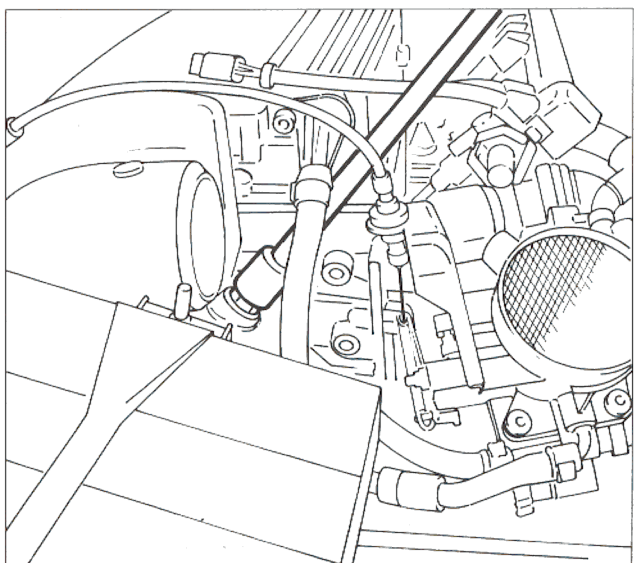
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P3W64BJ04

Removal-refitting

1. Disconnect the wiring connector, then unscrew the Lambda probe and remove it from its seating.
2. Disconnect the wiring connector and undo the screw securing the knock sensor, and remove it.
3. Disconnect the wiring connector and undo the vehicle speed sensor casing, and remove it from its seating.



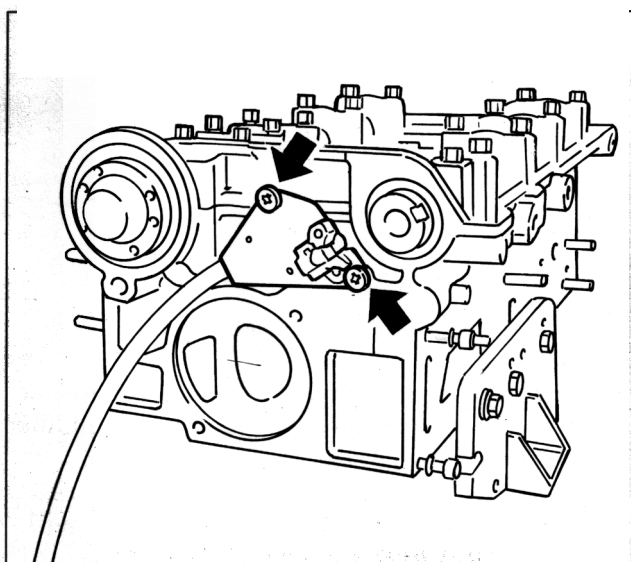
COOLANT TEMPERATURE SENSOR

Removal-refitting

- Disconnect the wiring connector from the sensor;
- undo the sensor, removing it from its seating.



Take great care to refit the sensor and wiring connector correctly, as the information transmitted by the sensor is also used by the control unit to control the radiator fans.



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ENGINE TIMING SENSOR

Removal-refitting

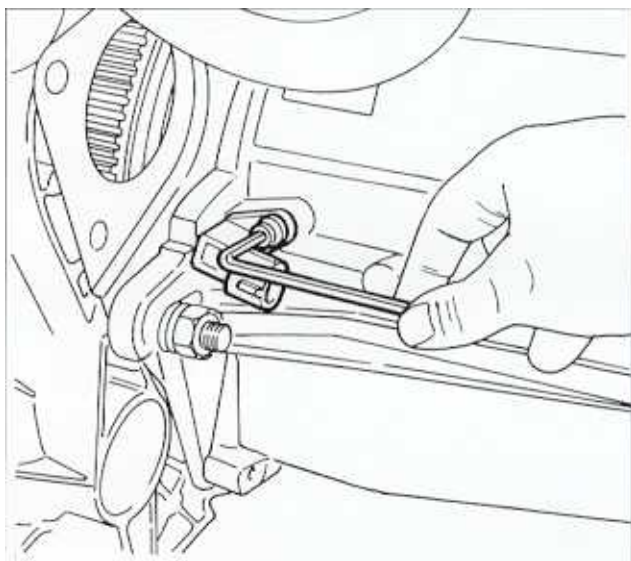
This operation involves removing the toothed timing belt and exhaust side camshaft sprocket.

After carrying out these operations:

- disconnect the electrical connector;
- undo the two screws (arrowed) and remove the sensor.

To refit, reverse the procedure for removal, following the instructions for fitting and tensioning the timing belt.

NOTE *The sensor does not require any form of adjustment.*



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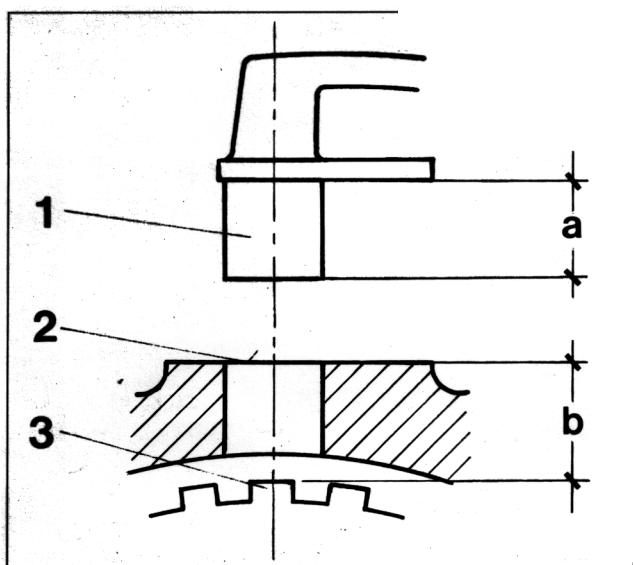
ENGINE RPM SENSOR

Removal-refitting

Place the vehicle on ramps, then, working from under the vehicle:

- disconnect the electrical connector;
- undo the screw securing the sensor and withdraw the sensor from its seating.

NOTE *The sensor is fitted in the factory with tolerances to ensure a gap of 0.8 ± 0.4 mm, without further need for adjustment. This gap is ensured even if the sensor is replaced.*



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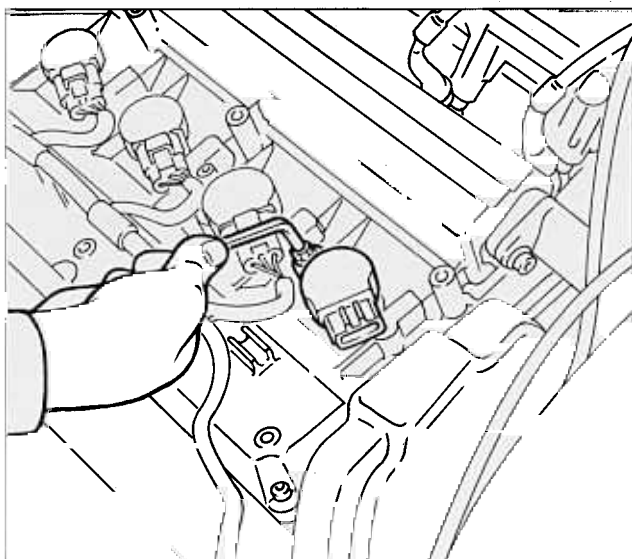
To check the gap between the sensor and phonic wheel, proceed as follows:

- measure the distance between the end of the sensor and the bottom of the sensor bracket (dimension "a");
- measure the distance between the mounting area on the engine block and the top of the tooth (dimension "b"), repeating the measurement on at least two opposing teeth;

The gap ($t = b - a$) must be between 0.4 and 1.2 mm.

1. Sensor
2. Mounting area
3. Phonic wheel tooth

10.



P3W66BJ01



IGNITION COILS

Removal-refitting

Remove the coils as follows:

- remove the coil cover by undoing the attachment screws and removing the oil filler plug;
- disconnect the electrical connector;
- undo the screw and remove the coil, withdrawing it from its seating.

NOTE *The coil has an extension of silicon material with high dielectric power, which contains a pressure contact loaded by a spring.
Do not dismantle the two parts, so as not to lose or dirty the internal contact.
In the case of replacement, it is not necessary to separate the coil from the extension, as the complete coil-extension assembly is supplied as a spare part.*