CONTENTS

TECHNICAL DATA

Introduction
This chapter illustrates the technical data for the new Fiat Bravo with 1.4 16V TJET engine

Technical data for Fiat Bravo 150 HP.

Type of vehicle

AUTOVEHICLE	198AXF1B 05 - 05B(1368 Turbo Bz - EURO 4) CM6 - 4 DOORS

Engine

ENGINE (Type)	198A1000
DISPLACEMENT (Bore and stroke)	1368 (72 x 84)
COMPRESSION RATIO	9,8 ± 0,2
MAX POWER (kW - rpm)	110 - 5500
MAX TORQUE (Nm - rpm)	206 – 2250 / 230 - 3000 (con overboost)
ENGINE IDLE SPEED (rpm)	750 ± 50
CO MIN AFTER CATALYSER	< 0,3%
INTAKE TIMING (Open/Close)	-2° p. P.M.S. / 34° d. P.M.I.
EXHAUST VALVES (Open/Close)	27° p. P.M.I. / -2° d. P.M.S.
LUBRICATION	
Engine oil SELENIA K P.E.	SAE 5W-40 Fiat qualification 9.55535-s2

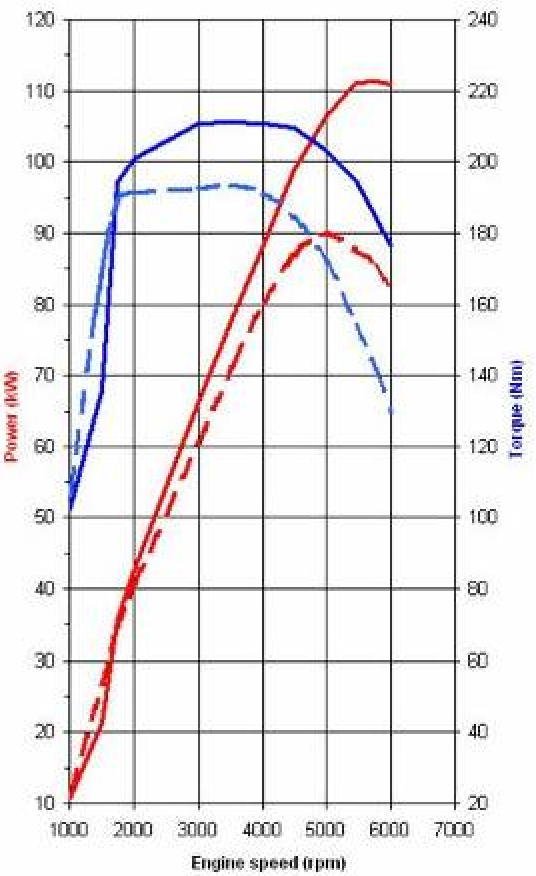
Engine Control

INJECTION	
ECU (Brand - Type)	BOSCH 7910A1
LAMBDA PROBE (Brand - Type)	BOSCH LSF4. 2 (upstream)
	BOSCH LSF4. 2 (downstream)
TURBOCOMPRESSOR (Brand - Type)	IHI VL33
IGNITION	
ECU (Brand - Type)	BOSCH M7. 9.10.A1
COIL (Brand - Type)	BOSCH 0.221.504.024
SPARK PLUGS (Brand)	NGK IKR9F8
INIT. ADVANCE (giri/min)	9° ± 4° at 750 ± 50

Transmission

GEARBOX TYPE	MANUAL M32
GEAR RATIOS	
1	1:3,818
2	1:2,158
3	1:1,475
4	1:1,067
5	1:0,875

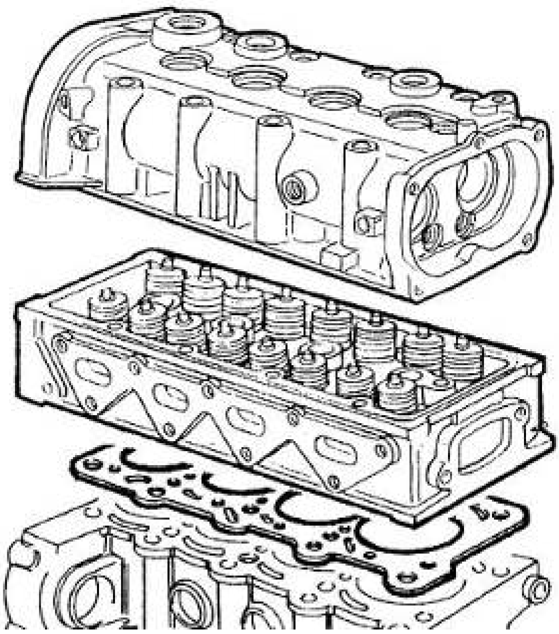
FIRE 1.4 TJET 150 HP AND 120HP ENGINES



General features

The portfolio of FIRE engines includes 8V and 16V versions with displacement from 1.1 to 1.4 litres.
All these engines have atmospheric intake.
With the start of production of the EVO version of the 8V and 16V engines halfway through 2005, the FIRE engines have confirmed a competitive position on the market for petrol engines in terms of performance, costs and fuel consumption.
To maintain competitiveness on a market increasingly oriented toward Diesel engines to the detriment of petrol engines, it is necessary:
Emphasise the reduction in fuel consumption to minimise the gap to reach CO2 targets
create the right “fun to drive” level to assure the right level of customer interest.
In this scenario, a FIRE 16V Turbo represents the first fundamental step with regard to the above points and the FIAT POWERTRAIN TECHNOLOGY petrol engines program.
The FIRE TURBO is directly derived from the FIRE 1.4 MPI.
This engine is developed with two max. power levels:
an 88.2 kW (120 HP) version
a 110 kW (150 HP) version
both versions are coupled with the M32 6 gear transmission.
Turbo charge is provided by a fixed pitch turbocompressor managed by an engine control unit through a turbo pressure electrovalve that regulates the waste gate and a shut off electrovalve (Dump valve).
The FIAT BRAVO represents the first application of the new FIRE Turbo engine.

Cylinder head/heads



Type
The cylinder head is a monolithic type in aluminium alloy.
The four valves per cylinder are mounted in the respective guides and operated by two camshafts via hydraulic tappets.
The valve guides are fitted into the corresponding seats in the head with interference.
Precision machining of the internal diameter is carried out after fitting with a specific reaming tool.
The camshafts are inserted into an upper head without tappet covers.
The upper head has two threaded holes through which engine timing tools can be inserted.
Note: the head and upper head are specific to the Turbo version, even though their basic dimensions are the same as for the 1.4 16V version.
A “metallic multi-layer” type gasket is inserted between cylinder head and engine block. The gasket is 0.72 mm thick and specific to the turbo version.
No cylinder head bolt retightening is required for the entire life of the engine.
The cylinder head has also been optimised for coolant circulation, and the head take-off has been eliminated.

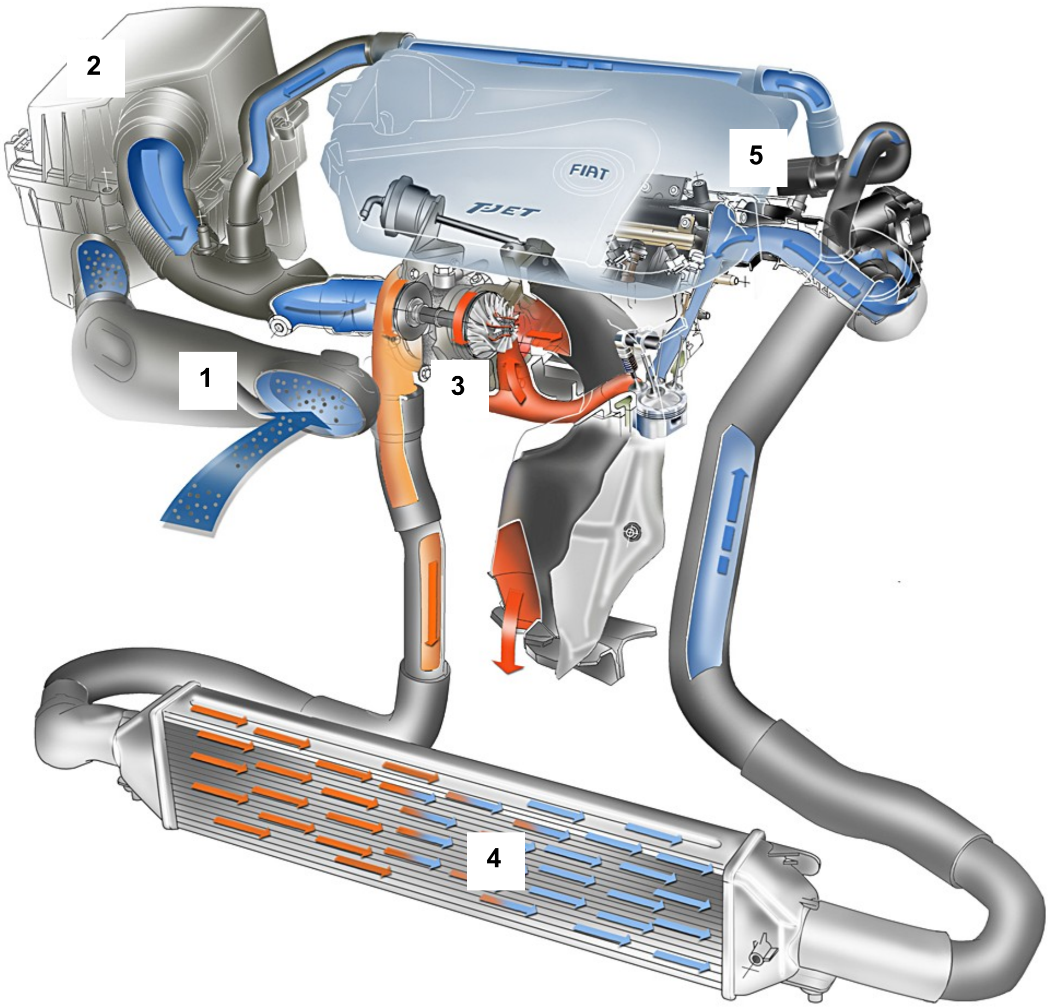
Circuits/systems

Introduction

This chapter describes the features of the following systems:

- *Intake,*
- *Exhaust,*
- *Fuel supply*
- *Crankcase gas/vapour recirculation,*
- *Evaporation control,*
- *Engine oil lubricating circuit,*
- *Engine cooling circuit*

Air intake circuit (turbocompressor)



The air intake circuit consists of:

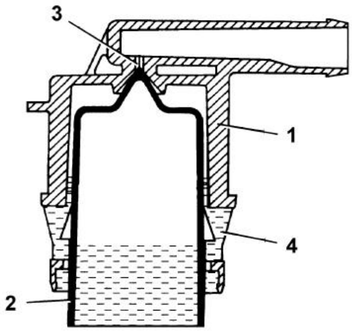
1. Dynamic air intake
2. Air filter
3. Turbocompressor
4. Intercooler
5. Intake manifold

A pipe to the air filter leads from the dynamic intake in the upper zone of the front crossbar.

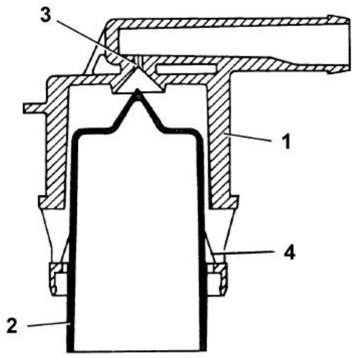
Float valve
These valves are used for the following functions:
- To prevent liquid fuel escaping in the event of an accident with vehicle overturned;
- To allow fuel vapour to vent from the tank to the separator and active carbon filter;
- To permit tank ventilation in case of internal vacuum formation.

This valve consists of a body (1) and float/valve (2).
The function of the valve can be summarised in the following cases, in relation to the amount of fuel in the tank.

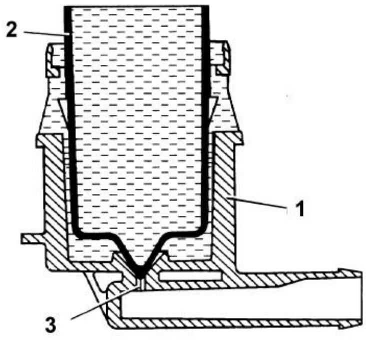
Tank full/vehicle inclined
If the tank is full the float (2) blocks the hole (3) preventing liquid fuel from reaching the separator.



Intermediate fuel level
If the fuel level in the tank is low, the float (2) drops, opening the passage (3). This allows fuel vapour to exit the tank and reach the separator and active carbon filter, or through the same circuit, ventilate the tank if tank internal pressure is lower than external pressure.

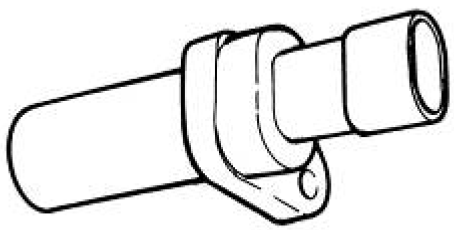


Seal in case of roll-over
If the vehicle rolls over, however full the tank is, the float (2) closes the hole (3) with its own weight plus that of the fuel, preventing a hazardous flow of fuel to the vapour separator and consequent fire risk.



Sensors

Revs sensor



Type

The revs sensor is an inductive type sensor, meaning that it functions by means of variations in the magnetic field generated by the passage of the teeth on a phonic wheel (60-2 teeth).

Function

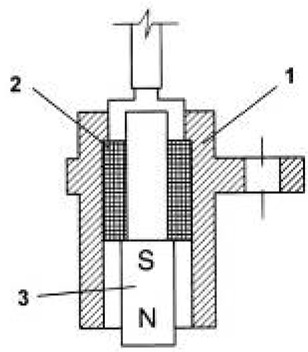
The revs sensor is used by the Engine Control Hub for:

- Determining crankshaft rotation speed
- Determining crankshaft angular position.

Location

The revs sensor is mounted on a bracket fastened to the engine block “facing” the phonic wheel positioned on the crankshaft pulley.

Specifications and function



The sensor consists of a tubular sheath (1) containing a permanent magnet (3) and an electric winding (2).
The magnetic flux created by the magnet (3) oscillates due to the passage of the phonic wheel teeth.
This oscillation induces an electromotive force in the winding (2), producing a voltage at the winding terminals that is alternately positive (tooth facing sensor) and negative (concave space facing sensor).

Location
Fastened in specific housings in the intake manifold and facing onto the two intake valve ducts. United by a shared feed line fitted with differential pressure regulator.

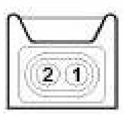
Specifications and function
The injector consists of:

- a central body, housing the command solenoid, connected to its supply,
- the shutter/sprayer assembly,
- the washers, one between injector and Rail connection, the other between injector and intake manifold
- a reference notch for correct orientation

The electroinjectors are double jet type (with spray inclined with respect to the injector axis), and are specific for engines with 4 valves per cylinder. They effectively manage to orient the jets toward the two intake valves.

Note: there are a total of 10 holes on the spray nozzle, divided into 2 banks of 5, which have ten small diffusion cones making up the two diffusion cones that point at the two intake valves.
The injectors are controlled via a grounding command by the Engine Control Hub in a timed sequential manner, meaning that the four injectors are commanded according to the intake sequence of the engine cylinders, whereas the delivery to each cylinder may already start in the expansion phase up to the phase where intake has already started.
When then Engine Control Hub grounds the circuit, a current passes through the winding creating a magnetic field that attracts the shutter and allows pressurised fuel to pass through the nozzle.
The quantity of fuel injected depends on the shutter opening time, which in turn depends on the delivery time of the electromagnet. This time, known as injection time, is calculated by the Engine Control Hub for the various operating condition the engine encounters.
Electrical specifications
Power supply voltage 12 V
Resistance 14,5 ± 5% ohm.

Electrical connections



Pin 1	+ 12 v power supply
Pin 2	Ground command from Engine Control Hub

Location
The electrovalve is located in the vicinity of the turbocompressor

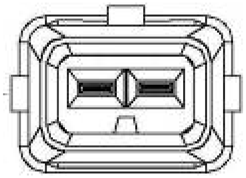
Specifications and function
The electrovalve consists of a plastic body that contains a shutter and an electromagnet.
The valve is connected by pipes to:

- turbo compressor outlet (high pressure socket)
- waste gate valve (regulation)
- intake pipes upstream of the turbine (excess high pressure air discharge).

Through the turbo pressure sensor, the Engine Control Hub measures the turbo pressure throughout the entire range of engine function. If this pressure exceeds the value set in the Engine Control Hub activates the valve by powering the electromagnet, that pulls the shutter in, freeing the passage of high pressure air toward the waste gate actuator, allowing it to open.
The command is given in PWM by the Engine Control Hub
On completing the regulation, the electromagnet is deactivated and the high pressure discharges upstream of the turbocompressor.

Electrical specifications
Electromagnet winding resistance **30 Ω±10% a 20**

Electrical connections

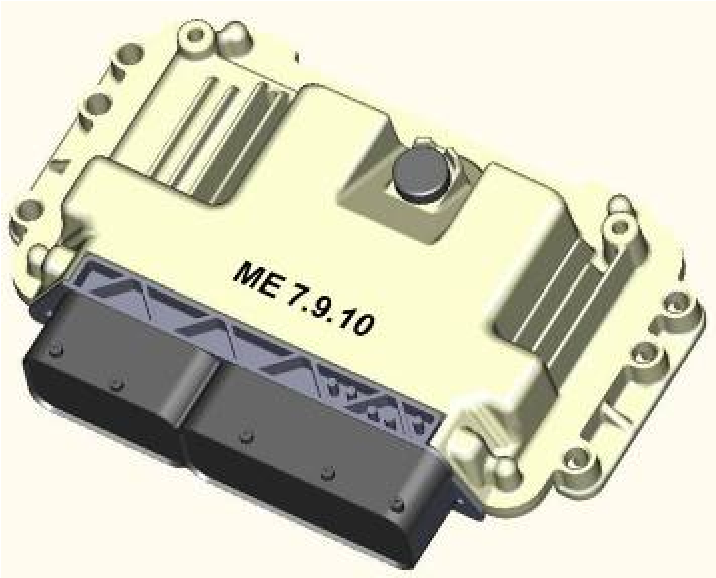


Pin 1	Ground command from Engine Control Hub
Pin 2	+ 12 V power supply

Engine control

Introduction

This chapter illustrates the features of the operating strategies adopted by the Engine Control Hub.



Injection system

The essential conditions that must always be met in the preparation of the air-fuel mixture for optimal engine function are principally:

- The “dose” (air/fuel ratio) has to be maintained as constantly as possible close to the stoichiometric value.
- The “uniformity” of the mixture, consisting of fuel vapour, diffused in the air as finely and as uniformly as possible.

In order to assure:

- ✓ The necessary rapidity of combustion and prevent fuel wastage and excessive exhaust emissions.
- ✓ Prolonged integrity and efficiency of catalyzer.

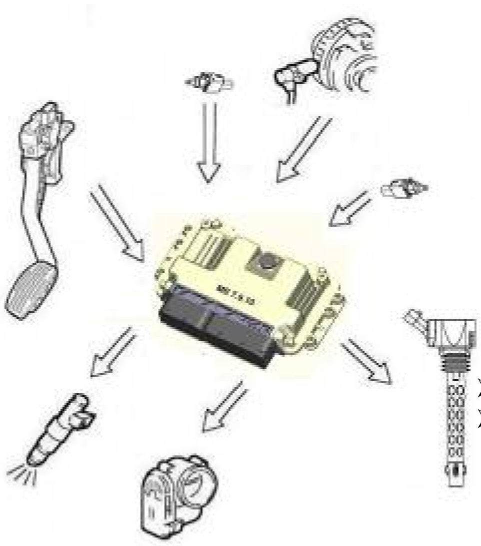
The Engine Control Hub uses a measurement system of the indirect type "SPEED DENSITY-LAMBDA", or angular rotation speed, density of the intake air and titre of the mixture (retroactive control) to calculate the air/fuel ratio.
In practical terms the system uses ENGINE SPEED data (number of rpm) and AIR DENSITY data (pressure and temperature) to measure the quantity of air taken in by the engine.
In addition to the density of the air drawn in, the quantity of air taken in by each cylinder also depends on the cylinder displacement, volumetric efficiency and turbo charging.

- Air density is understood as that of the air taken in by the engine and calculated according to absolute temperature and pressure, both detected in the intake manifold.
  Note: atmospheric pressure and turbo pressure values are used for this calculation.

- Volumetric efficiency is understood as the parameter related to the cylinder filling coefficient measured according to experimental tests carried out on the engine in all operating conditions and subsequently memorised by the Engine Control Hub.

Having established the quantity of air drawn in, the Engine Control Hub has to provide the quantity of fuel in relation to the titre of the required mixture.
The injection end pulse or injection timing is given by a map memorised in the Engine Control Hub, and is

Vehicle driveability strategy



The driveability strategies include all the actions that the Engine Control Hub carries out in order to make the lengthwise shaking of the vehicle, caused during transients, more gentle and progressive, so that driving the vehicle becomes as pleasant as possible.

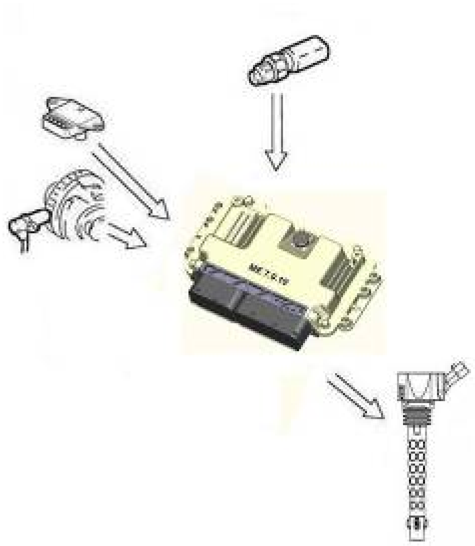
Note: in this case the term transients is intended to mean the accelerations and decelerations that may be more or less sharp due to the pressing of the acceleration pedal and the changes in gear.

The Engine Control Hub recognises the acceleration and deceleration transients through the following:

- The accelerator pedal sensor
- The clutch and brake pedal switches

It then intervenes on the management of the torque, and adapts it with the calculation modules called TIP-UP and TIP-DOWN.
Depending on the situation, the Engine Control Hub then sets a rapid torque control, which acts on the spark advances, and if this is not sufficient, a slow torque control that acts on the throttle opening and consequently on the injection times.

Ignition advance regulation



Through the map memorised in its internal memory, the engine control hub is able to calculate ignition advance according to:

- Engine load (idle, partial, full, according to revs and air flow-rate)
- Intake air temperature
- Engine coolant temperature.

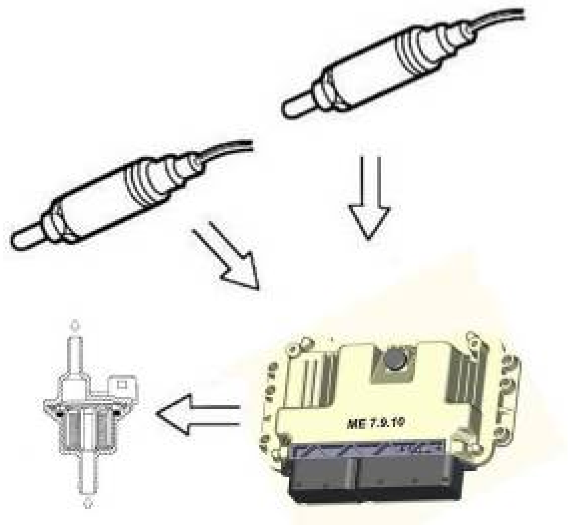
It is possible to selectively retard ignition at the cylinder requiring it, which is recognised by the combination of the value recorded by the rpm sensor and the "timing" data.

- acceleration is greater than calibrated maximum (example, rapid descent);
- deceleration greater than set maximum (using gear lever without clutch pedal).

The system in any case disables cruise control automatically if any signals used by cruise control logic are incorrect due to component faults:

- vehicle speed sensor;
- accelerator pedal potentiometer;
- brake switch plausibility;
- clutch switch plausibility;
- Cruise switch and Resume button plausibility;
- Cruise switch plausibility and position of speed increase or decrease stick.

Emissions control system



The emissions control system includes devices designed to reduce toxic emissions into the atmosphere.
The major pollutant emissions caused by the vehicle are:

- Exhaust emissions
- Vapour/gas emissions from the engine block
- Fuel vapour emissions from the fuel supply circuit

Exhaust emissions are limited by means of a trivalent catalytic converter, managed by two Lambda probes, the upstream one for obtaining the optimal stoichiometric ratios to improve catalyser performance, and the downstream one to control efficiency, (see EOBD strategies).

To ensure that the catalytic converter functions correctly for a long time, the Engine Control Hub checks the temperature of the exhaust gases using a mapped calculation model.

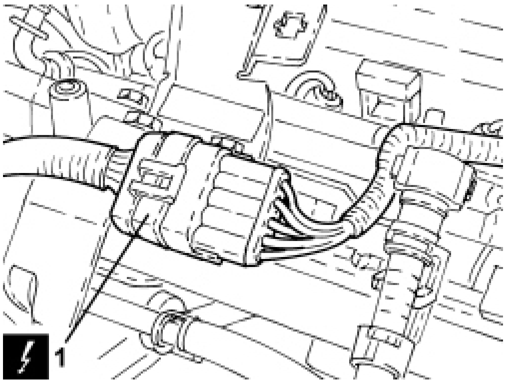
The crankcase vapour/gas emissions are controlled by the vapour recovery system
Note: system not controlled by the Engine Control Hub.
Fuel vapour emissions from the supply circuit are managed by the antievaporation system, a system fitted with an electrovalve controlled by the Engine Control Hub.
The canister valve is used to wash the active carbon filter to prevent it becoming saturated and sending the hydrocarbons (fuel vapours) that form in the tank, into the atmosphere, especially when the outside temperature is high or during shaking of the vehicle.
When the valve opens, it uses the vacuum in the intake manifold to draw in fresh air from the outside through the filter, collect the petrol vapours and take them to the intake manifold where they are aspirated by the engine.
This operation results in a variation of the mixture strength that is compensated for by the control unit (mixture strength control).
The adaptive parameters are deactivated during canister washing.
CANISTER washing takes place under the following conditions:

- At idle: washing takes place periodically.
- Under certain engine conditions, with throttle partially open

The NEDC areas have been used as an example of operation with throttle partially open.

- On the third ramp of the 1st urban sub-cycle
- On the second and third ramp of the 2nd urban sub-cycle
- Pratically for the whole EUDC cycle

Description	Unit of easurement/ Status value
STATUS LAMBDA 2 UPSTREAM CAT. Help not available	Closed Loop Open Loop
CATALYTIC CONVERT. 1 HEATING The 'Active' status indicates that the functions to bring the catalytic converter quickly to operating temperature have been activated.	Active Not active
STATUS LAMBDA 1 DOWNSTREAM CAT. Help not available	Closed Loop Open Loop
STATUS LAMBDA 2 DOWNSTREAM CAT. Help not available	Closed Loop Open Loop
ANTI-EVAPORATION VALVE May be 'Active' or 'Not active' and when 'Active' it can recover the hydrocarbon vapours emitted from the tank.	Active Not active
CONTROL UNIT POWER SUPPLY.	Present Absent
ANTI-SKID (ASR)	Present Absent
CATALYTIC CONVERTER 1	Present Absent
THROTTLE LEARN RESULTS Indicates whether the self-learn procedure of the lower limit of the motorised throttle has been terminated correctly	Correct Not correct
THROTTLE LEARN May be 'Not allowed' when the conditions are not, '...in progress' and 'Terminated' (if it has been completed successfully).	Not allowed ..in progress Terminated
FUEL PUMP RELAY Indicates the activation status of the fuel pump relay	Active Not active
BRAKE HUB (NFR) The presence of ABS/VDC/ASR (only if connected by CAN) is 'LEARNT' by the reception of at least one message on CAN	Learnt Not learnt
TYPE OF CRUISE PRESENT Indicates the type of cruise used on the vehicle. The status 'None' may only occur when the vehicle is not fitted with cruise control.	None Cruise control Adaptive (ACC)
AIR CONDITIONER CLIMATE CONTROL Is automatically 'LEARNT' by the control unit at the activation of the climate control	Learnt Not learnt
TYPE OF GEARBOX PRESENT Indicates the type of gearbox used on the vehicle. The 'Not plausible' status may only occur after the ECU is exchanged on vehicles with different types of gearbox, manual and selespeed	Automatic Manual Selespeed Not learnt



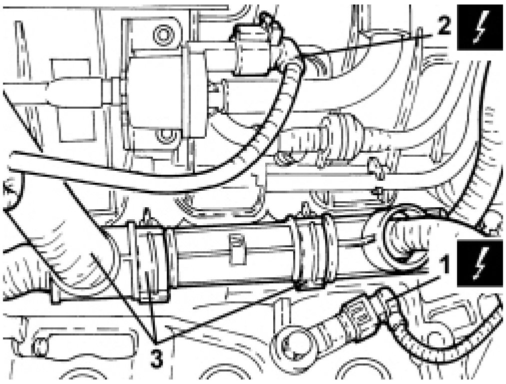
1. Electrically disconnect the pinging sensor.

	Name	Connector
1	Pinging sensor	K050 PINGING SENSOR

2. Electrically disconnect the fuel vapours solenoid.

	Name	Connector
2	Fuel vapours recovery solenoid	L010 FUEL VAPOURS RECOVERY SOLENOID

3. Open the retaining clips and move the wiring to one side.

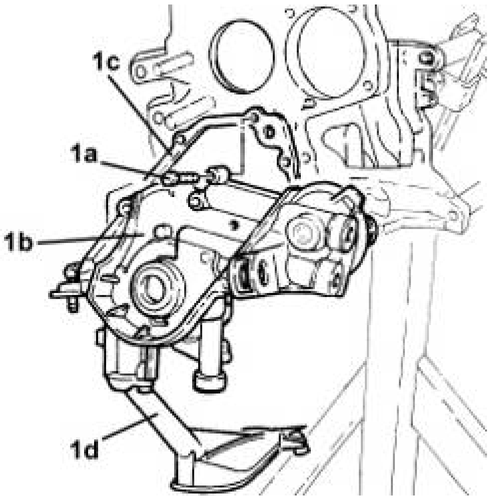


1. Electrically disconnect the throttle body.

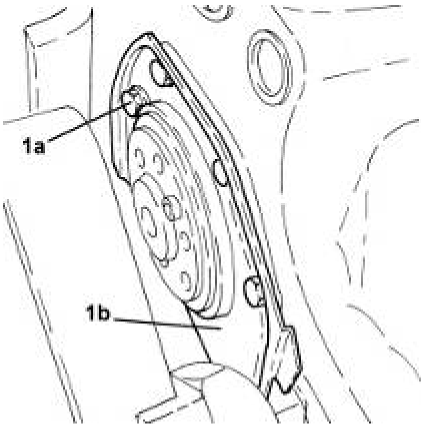
	Name	Connector
1	Built-in throttle body actuator	See N075 BUILT-IN THROTTLE BODY ACTUATOR

2. Electrically disconnect the solenoid controlling the air by-pass under pressure.

1. Unscrew the screws (1a) and remove the front crankcase cover (1b) with oil pump, complete with the gasket (1c) and intake funnel (1d).

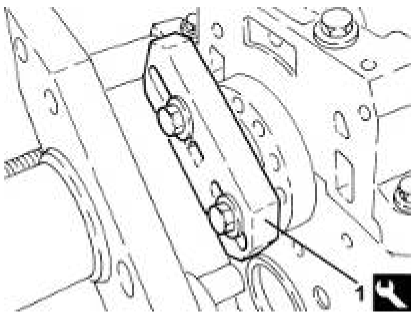


1. Unscrew the screws (1a) and remove the rear crankshaft cover (1b) with oil seal.



Turn the crankcase by 180°.
1. Fit the tool for turning the crankshaft.

1860815000	Flange	Crankshaft rotation	1.4 16v



1. Unscrew the screws (1a) and remove the big end caps (1b).
2. Remove the lower half-bearings.