

PUNTO eMANUAL

Engines

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WEBER-MARELLI 08F-5T MPI INTEGRATED INJECTION-IGNITION SYSTEM

Foreword

Because the IAW 08F.5T MPI system fitted to the 1242 engine uses the same operating strategies and components as the SPI systems fitted to the 1108 and 1242 engines, it is similar to those systems in many respects. This chapter will therefore discuss only the essential differences between the two systems. For further information, consult the previous chapter «S.P.I. fuel system 1108-1242»

Introduction

The I.A.W. 08F.5T system fitted to the Punto 1242 engine is an integrated digital electronic ignition system with solid-state advance and timing and electronic intermittent, multipoint, non-phased petrol injection. When all injectors are connected in parallel in a system (FULL-GROUP), and inject simultaneously upon each turn of the crankshaft half of the amount of fuel necessary for forming the air-fuel mixture, the mixture is said to be intermittent, multiple, non-phased.

The Weber-Marelli I.A.W. 08F.5T injection-ignition system uses a direct measurement system known as «SPEED DENSITY - LAMBDA».

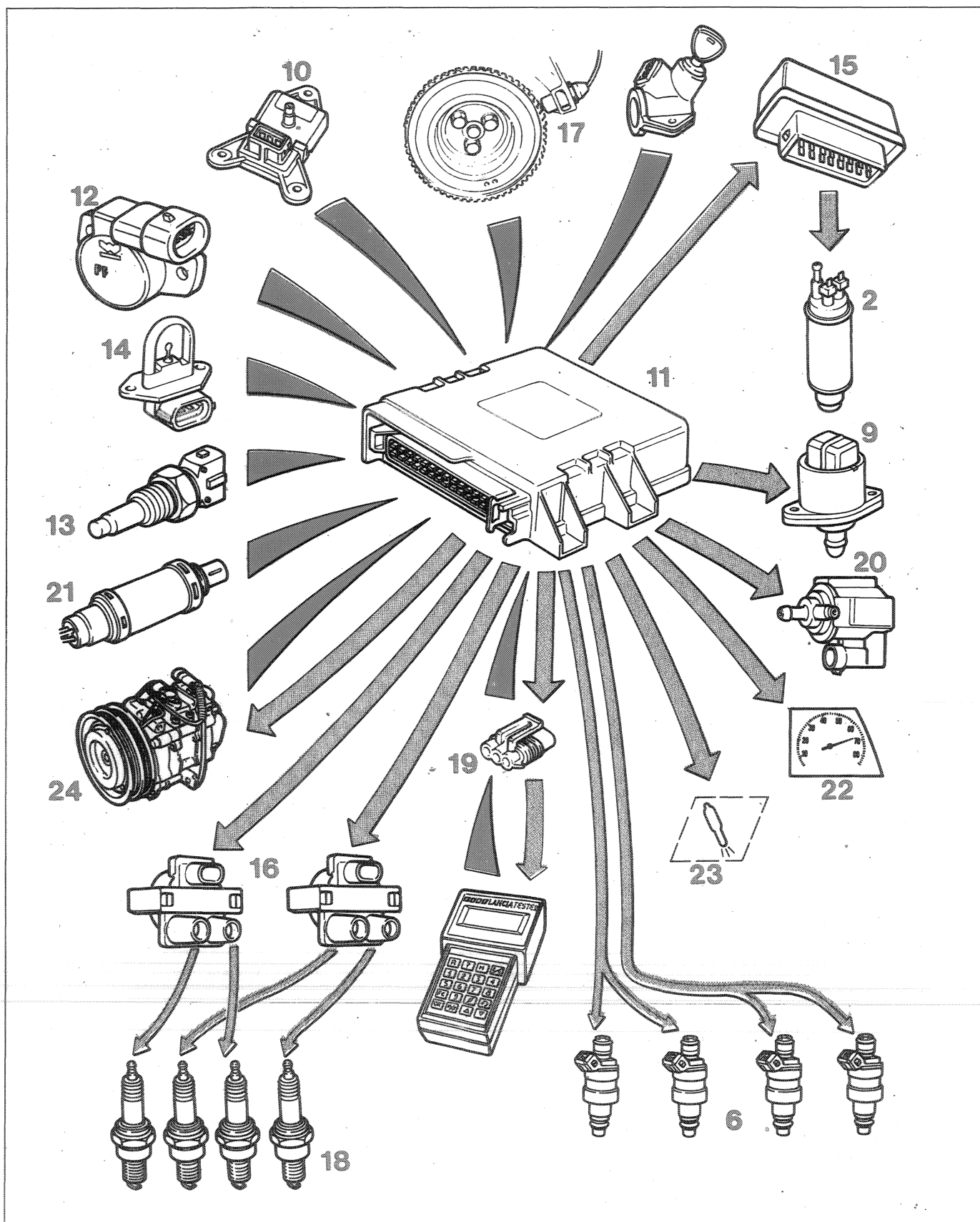
- in practice this system uses ENGINE SPEED (revs per minute) and AIR DENSITY (pressure and temperature) to measure the amount of air taken in by the engine.
The amount of air taken in by each cylinder upon each engine stroke depends on intake air density and also on standard displacement and volumetric efficiency.
- Air density is taken to be the density of air taken in by the engine and calculated as a function of absolute pressure and temperature - both measured in the inlet manifold.
- Volumetric efficiency is a parameter relating to the cylinder filling coefficient. It is calculated on the basis of experimental tests carried out on the engine throughout its range of operation and then memorized in the ECU.
Once the amount of air taken in has been established, the system must provide sufficient fuel to make up the required fuel mixture concentration.
- The information required for calculating the concentration (air-petrol) required for adhering as closely as possible to a stoichiometric ratio is obtained by sensors and converted to electrical signals.

The system is able to measure instantaneously:

1. Number of revs and relative position of pistons in relation to TDC
2. Instantaneous absolute pressure in the inlet manifold.
3. Accelerator throttle aperture.
4. Coolant temperature.
5. Inlet manifold air temperature.
6. Lambda probe signal or counter-check on concentration.

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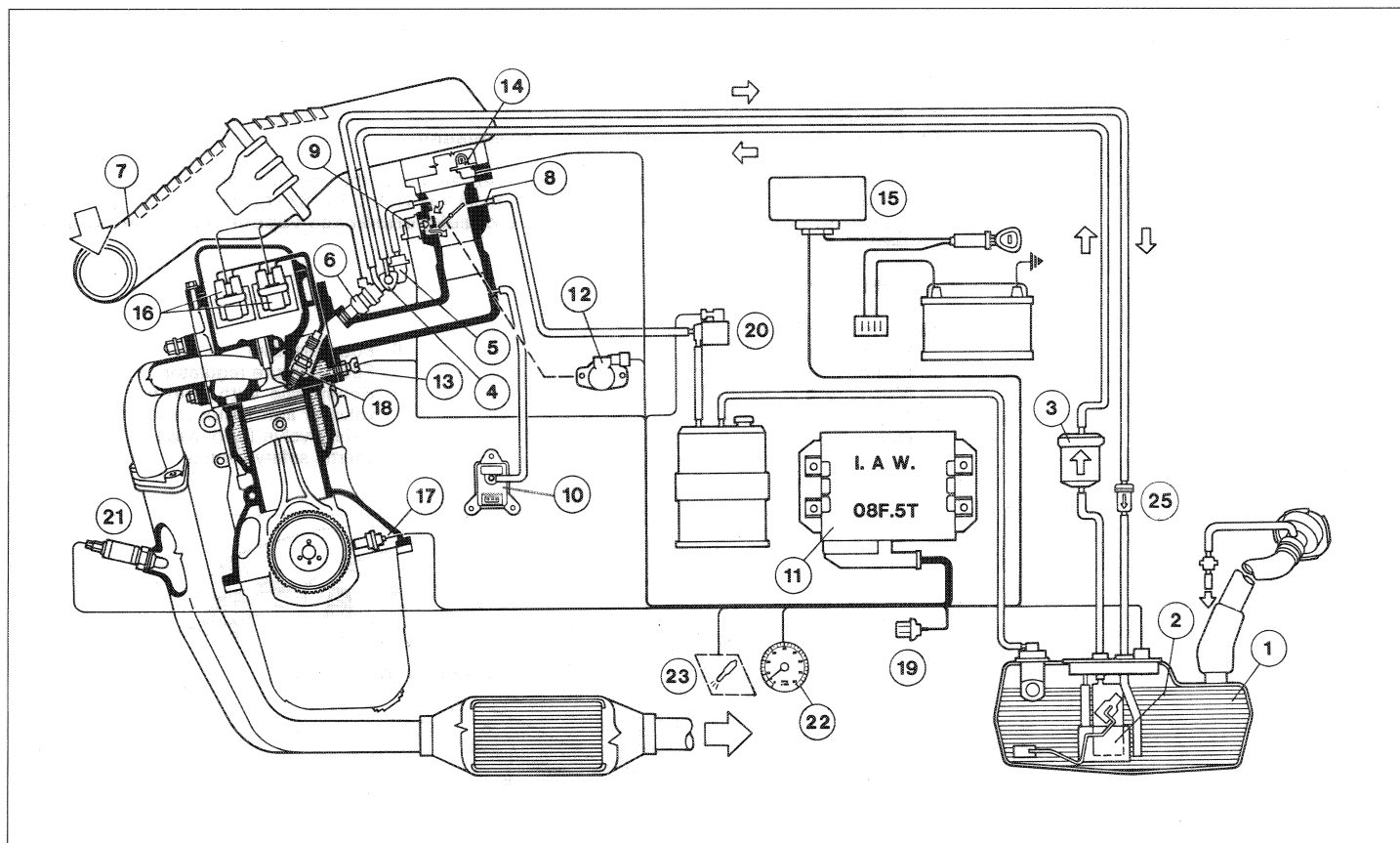
DIAGRAM SHOWING INFORMATION FLOWING INTO AND OUT OF THE CONTROL UNIT TO THE SENSORS AND ACTUATORS OF THE I.A.W. 08F SYSTEM.



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DIAGRAM OF M.MARELLI-WEBER I.A.W. 08F INJECTION-IGNITION SYSTEM



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- | | | |
|---------------------------------------|----------------------------------------------|----------------------------------------------|
| 1) Tank | 10) Absolute pressure sensor | 19) Diagnostic socket for Fiat/Lancia tester |
| 2) Electric fuel pump | 11) Electronic control unit | 20) Petrol vapour cut-off solenoid |
| 3) Filter | 12) Throttle position sensor (potentiometer) | 21) Lambda probe |
| 4) Fuel manifold | 13) Coolant temperature sensor | 22) Rev counter (if present) |
| 5) Pressure regulator | 14) Intake air temperature sensor | 23) IAW system failure warning light. |
| 6) Injectors | 15) Dual relay | 24) Air conditioner compressor |
| 7) Air cleaner | 16) Ignition coils | 25) Anti-reflux valve |
| 8) Throttle case | 17) Engine rpm and TDC sensor | |
| 9) Idle control actuator (step motor) | 18) Spark plugs | |

Engine Fuel system

Punto  MPI IAW

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COMPONENTS OF IAW SYSTEM.

The I.A.W. 8F.5T system is made up of four interdependent circuits:

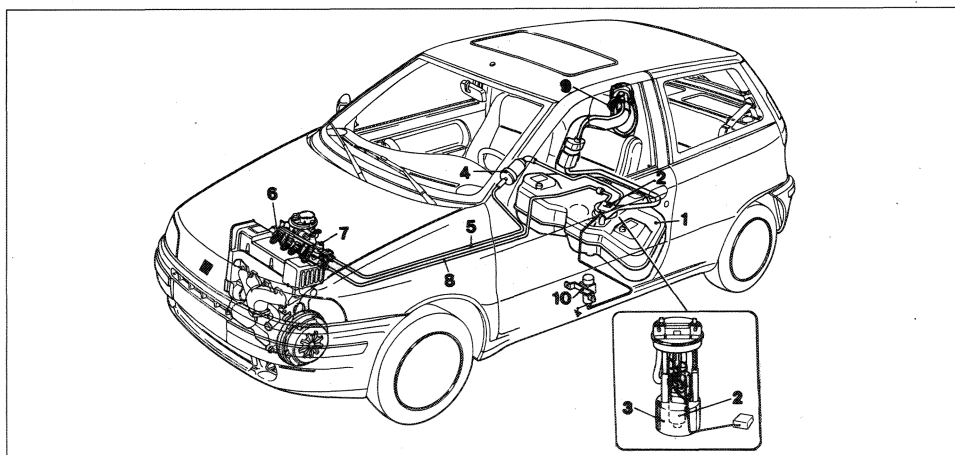
- A. Fuel supply circuit**
- B. Air intake circuit**
- C. Electric/electronic circuit**
- D. Circuit for checking harmful exhaust emissions**

The system also includes devices and circuits associated with the injection-ignition system, which are also designed to reduce harmful vehicle emissions in line with USA '83 standards. These include: **fuel evaporation control and vapour recovery circuit; crankcase vapour recirculation and recovery circuit;**

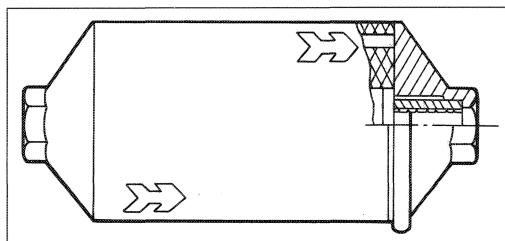
A. FUEL SUPPLY CIRCUIT

This consists of the following parts:

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|-------------------------------------------|----------------------------------------------------------------------|
| 1. Reservoir | 6. Four injectors |
| 2. Pump submerged in tank | 7. Fuel pressure regulator |
| 3. Mesh pre-filter located on pump intake | 8. Return line with one-way recirculation valve or anti-reflux valve |
| 4. Paper main fuel filter | 9. Safety valve (two-way) |
| 5. Outlet line | 10. Inertia safety switch |



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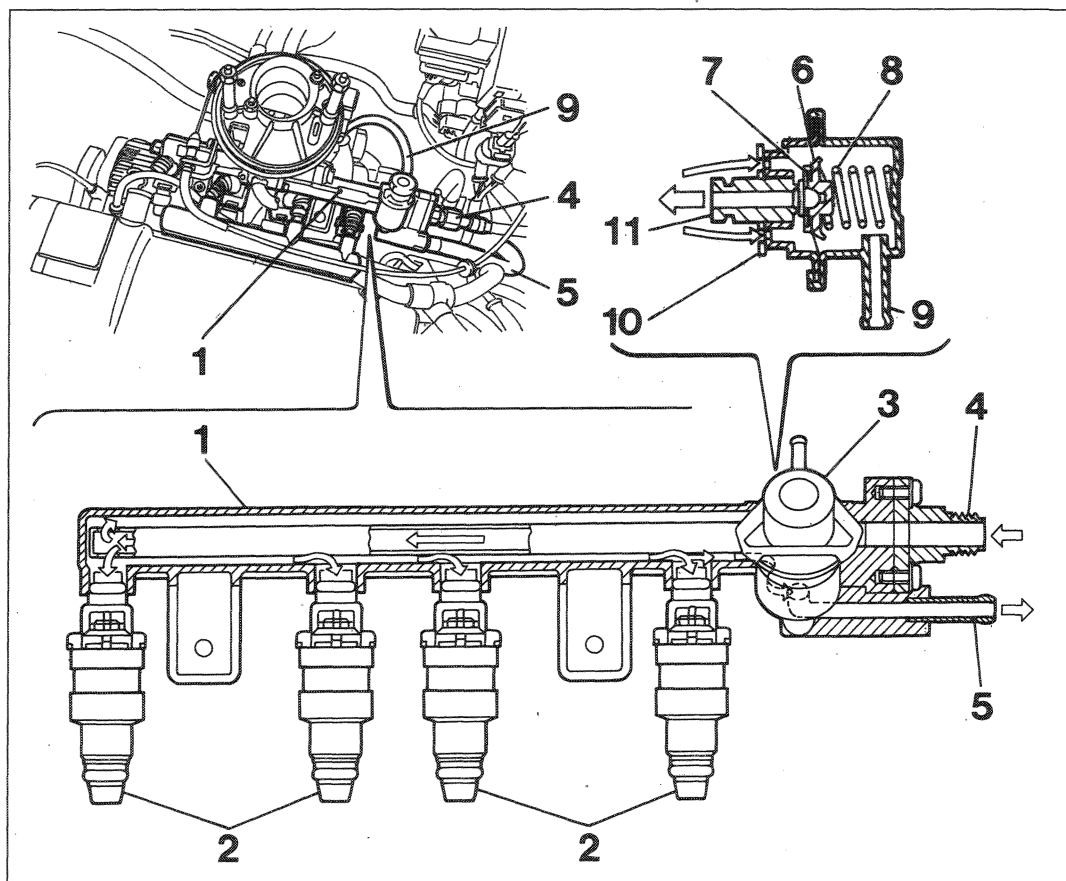
FUEL FILTER

The filter is fitted along the fuel delivery line. It is made up of an outer case in aluminium and an inner polyurethane mount that supports a paper element with high filtering capacity and surface area of about 1400 cm².

MANIFOLD SUPPLYING FUEL TO INJECTORS AND PRESSURE REGULATOR

The fuel manifold (1), which distributes fuel to the injectors (2) is pressure die cast and incorporates a pressure regulator (3) and the injectors themselves.

The fuel intake (4) is fastened with tapered sealed screws. Fuel recirculation (5) is via a pipe inside the manifold connected on the outside to a return pipe that leads to the tank.



1. Fuel manifold
2. Injectors
3. Pressure regulator
4. Fuel inlet fitting
5. Fuel return fitting to tank
6. Membrane
7. Reflux valve
8. Regulating spring
9. Vacuum socket
10. Fuel inlet
11. Fuel return

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FUEL PRESSURE REGULATOR (RPM 36)

The pressure regulator is essential for maintaining the injector pressure gap constant. It is a differential membrane device, set during manufacture to a pressure of 2.5 ± 0.05 bar.

Fuel under pressure from the pump presses against mobile parts (6 and 7) and is countered by calibrated spring (8).

When the pressure setting is overcome, gate valve (7) moves to allow excess fuel to flow back to the tank. The pressure regulator is also affected by the vacuum in the inlet manifold (where the injectors are housed). As a result, the pressure change occurring at the injector nozzle is also set up at the regulator membrane. This allows the pressure gap across the injector terminals to be maintained under all engine service conditions. Fuel flow is therefore determined by the injector opening time (T_j).

Example: if the vacuum at the injector nozzle increases by 0.5 bar, fuel pressure drops by 0.5 bar.



Fuel pressure is therefore a fixed parameter that cannot be controlled by the ECU, but is essential for calculating fuel quantity. It should therefore never be altered - otherwise engine/catalytic converter efficiency may be jeopardized.

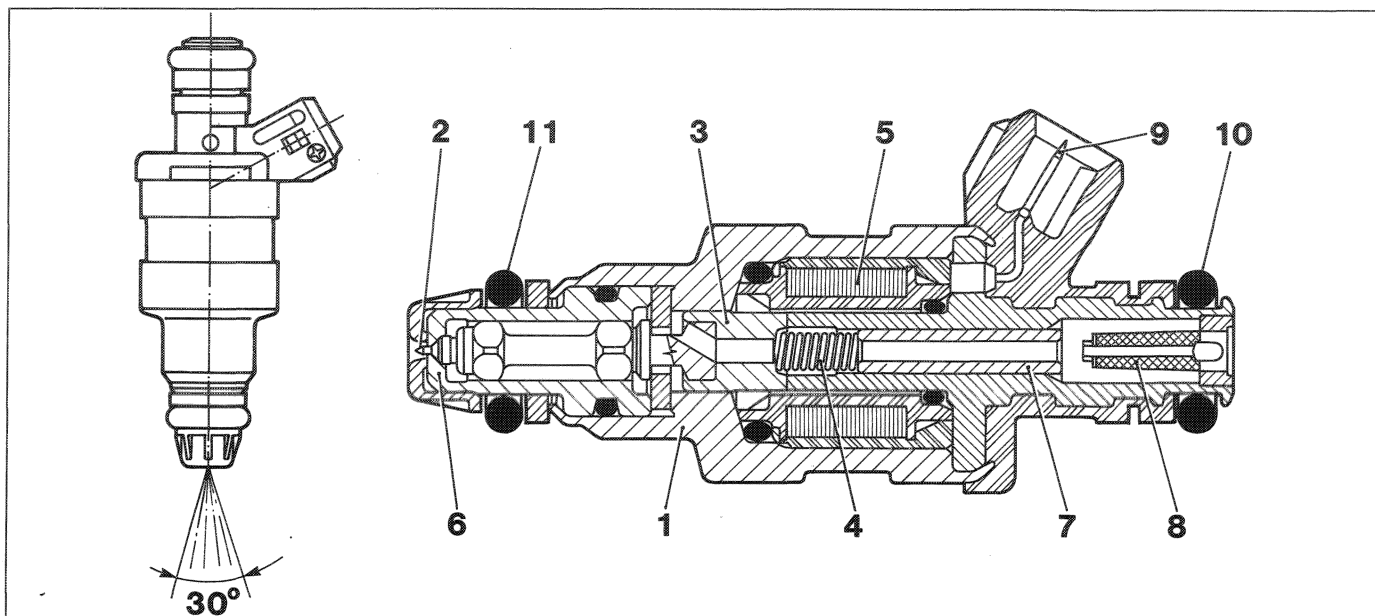
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INJECTOR IW 057

The injectors are fitted to the inlet ducts immediately before the inlet valve. They are responsible for metering the amount of fuel necessary to the engine.

The injector nozzle is positioned so that the fuel jet strikes the intake valve directly.

The injectors are held in place by the fuel manifold, which presses the injectors into their seats in the inlet ducts. They are also anchored to the fuel manifold by safety clips. Two rubber rings (10) and (11) seal the inlet duct and fuel manifold.



- | | | |
|------------------|-----------------------------|---------------------------------|
| 1. Injector case | 5. Winding | 9. Electrical connection socket |
| 2. Needle | 6. Injector tip | 10. Rubber vacuum seal ring |
| 3. Magnetic core | 7. Adjustable spring driver | 11. Rubber fuel seal ring |
| 4. Coil spring | 8. Fuel filter | |

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These devices may take up only two stable conditions - either open or closed.

They consist of a nozzle controlled by a solenoid and return spring (4).

In rest position needle (2), which is integral with core (3) is pushed by spring (4), against injector tip (6) in order to close the hole and ensure a seal to prevent fuel emerging.

As soon as winding (5) is excited, core (3) is attracted, the spring is compressed to open the nozzle hole and permit fuel to emerge.

Assuming fuel physical properties (viscosity and density) and the pressure gap (pressure regulator) to be constant, the amount of fuel depends only on injector opening time (T_j).

The injector needle is non-oxidizable and thus unaffected by any impurities (water, methanol, ethanol, etc.) in commercial fuels.

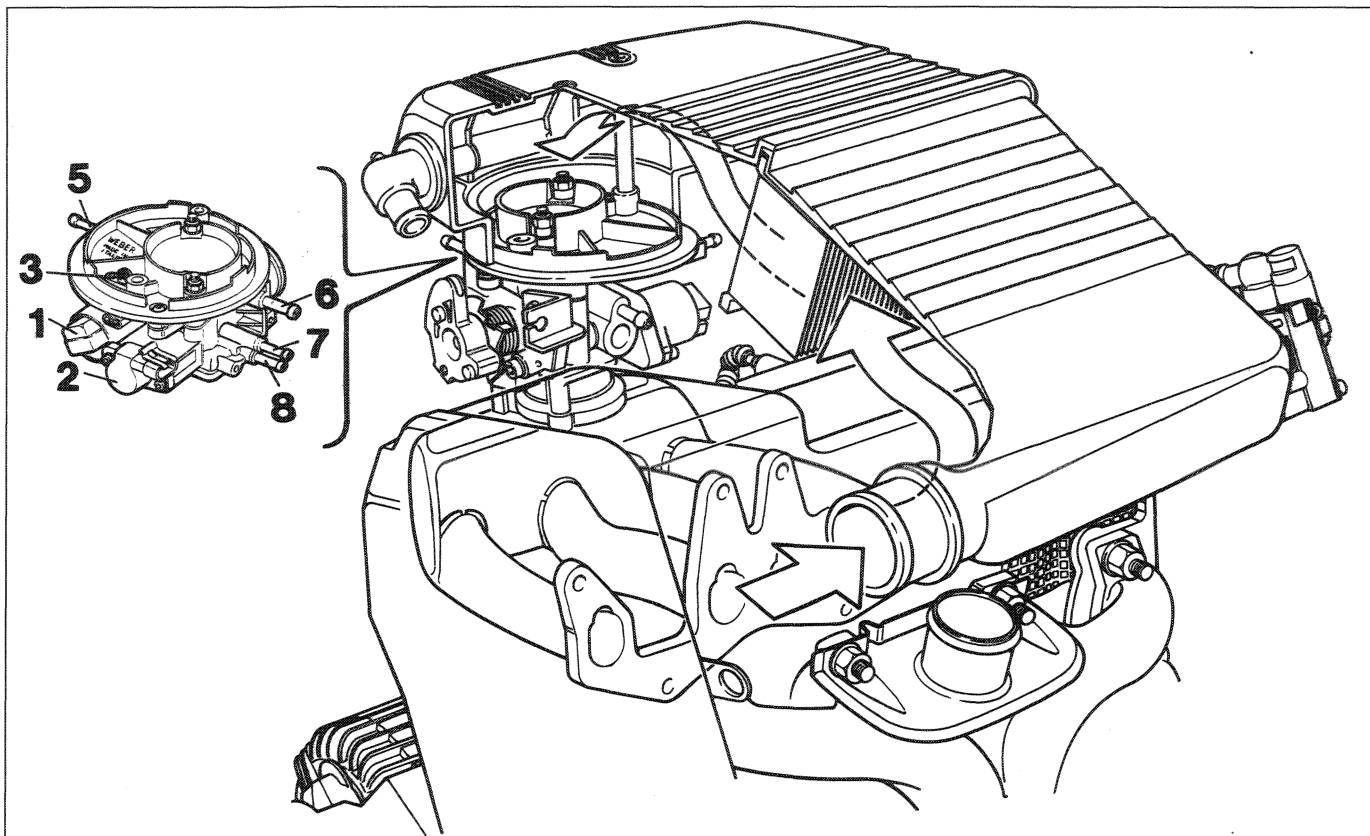
Technical specifications of Injector IW 057

- Electrical resistance 16.2 Ω .
- Static flow rate (Q_s) 190 cc/min. (depends on geometrical form and size of the jet with the injector fully open).
- Dynamic flow rate (Q_d) 6.05 cc/1000 in. (depends on internal spring setting carried out with 1000 cycles or injections).
- Supply voltage 6-16 Volt.
- Minimum activation time 2.0 msec a 14 V.
- Convex cone spray shape 30°.
- Service temperature -40° C-120° C.

B - AIR INTAKE CIRCUIT

This consists of the following components:

- A throttle case containing the **engine idle speed regulation step motor, throttle valve position potentiometer and inlet air temperature sensor.**
- An absolute pressure sensor with vacuum socket connected to the inlet manifold.



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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 1 - Engine idle speed regulation actuator (step motor) 2 - Throttle valve position potentiometer 3 - Intake air temperature sensor 4 - Absolute pressure sensor 5 - Attachment for throttle case heating fluid inlet pipe | <ul style="list-style-type: none"> 6 - Attachment for throttle case heating fluid outlet pipe 7 - Attachment for petrol vapour cut-off solenoid pipe (blue bush) 8 - Attachment for blow-by oil vapour pipe (brown bush) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

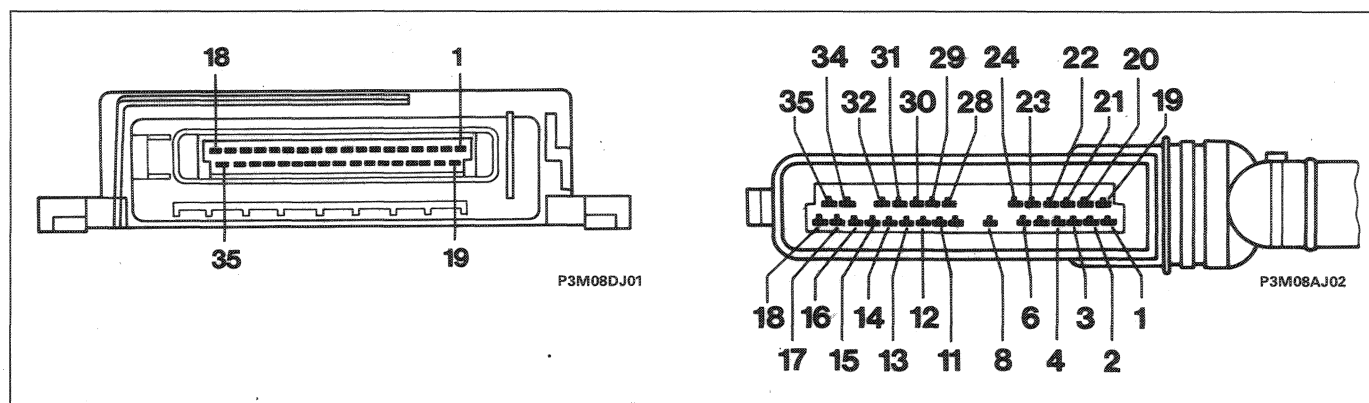
C - ELECTRIC/ELECTRONIC CIRCUIT

Connects and provides power to all injection/ignition system components. Consists mainly of an electronic control unit (ECU) and the following parts.

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> - Dual system supply relay - Throttle valve position sensor - Coolant temperature sensor - Fuel pump submerged in tank - Four injectors - Absolute pressure sensor - Intake air temperature sensor | <ul style="list-style-type: none"> - Engine idle speed regulation actuator (step motor) - Rpm and TDC sensor - Two ignition coils - Lambda probe - Fuel vapour control solenoid - Four spark plugs - Inertia safety switch - Diagnostic socket for Fiat/Lancia Tester |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

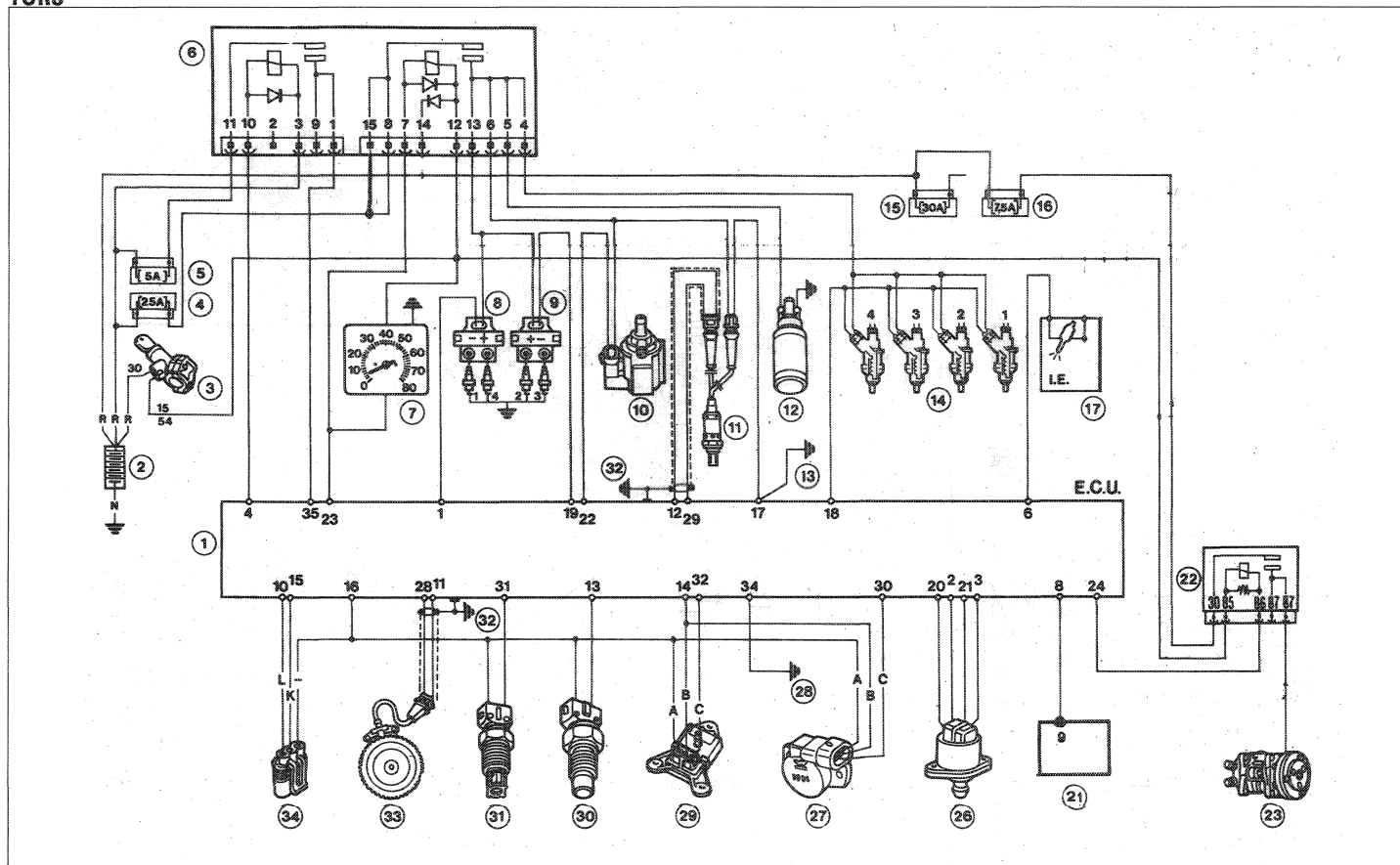
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INJECTION-IGNITION ELECTRONIC CONTROL UNIT



Terminal no.	Information received or transmitted	Terminal no.	Information received or transmitted
Input signals		Output signals	
5	Available	1	Governor for supply to ignition coil primary winding no. 1
7	Available	2	Governor for supply to step motor, stage B
8	Air conditioner signal input	3	Supply to step motor, stage D
9	Available	4	Internal earth (high or low) with electronic safety feature for governing ECU relay
10	L serial line input for Fiat-Lancia tester diagnostic socket.	6	Failure warning light control
11	Input for rpm sensor negative and synchronism	14	Supply (+ 5V) to absolute pressure and throttle position sensors
12	Input for oxygen sensor negative (or lambda probe)	15	To serial line K for Fiat-Lancia tester diagnostic socket
13	Coolant sensor input	16	Earth for sensors: throttle position, coolant, intake air temperature
23	Earth (high or low)	17	Power earth
26	Available - for automatic transmission (selection D/N).	18	Governor for injector supply
27	Available	19	Governor for supply to ignition coil primary winding n° 2
28	Rpm and synchronism sensor positive input	20	Governor for supply to step motor, stage A
29	Input for oxygen sensor positive (or lambda probe)	21	Governor for supply to step motor, stage C
30	Input for throttle open position potentiometer signal	22	Activation of petrol vapour cut-off solenoid to active carbon filter
31	Input for intake air temperature sensor signal	23	Signal for pump safety stop and rev counter control (if fitted)
32	Input for absolute pressure sensor signal	24	Air conditioner relay control
34	Power earth	25	Available
35	Input for 12 Volt supply: activates all ECU functions	33	Available

DIAGRAM SHOWING ELECTRICAL CONNECTIONS BETWEEN ECU/SENSORS AND ACTUATORS



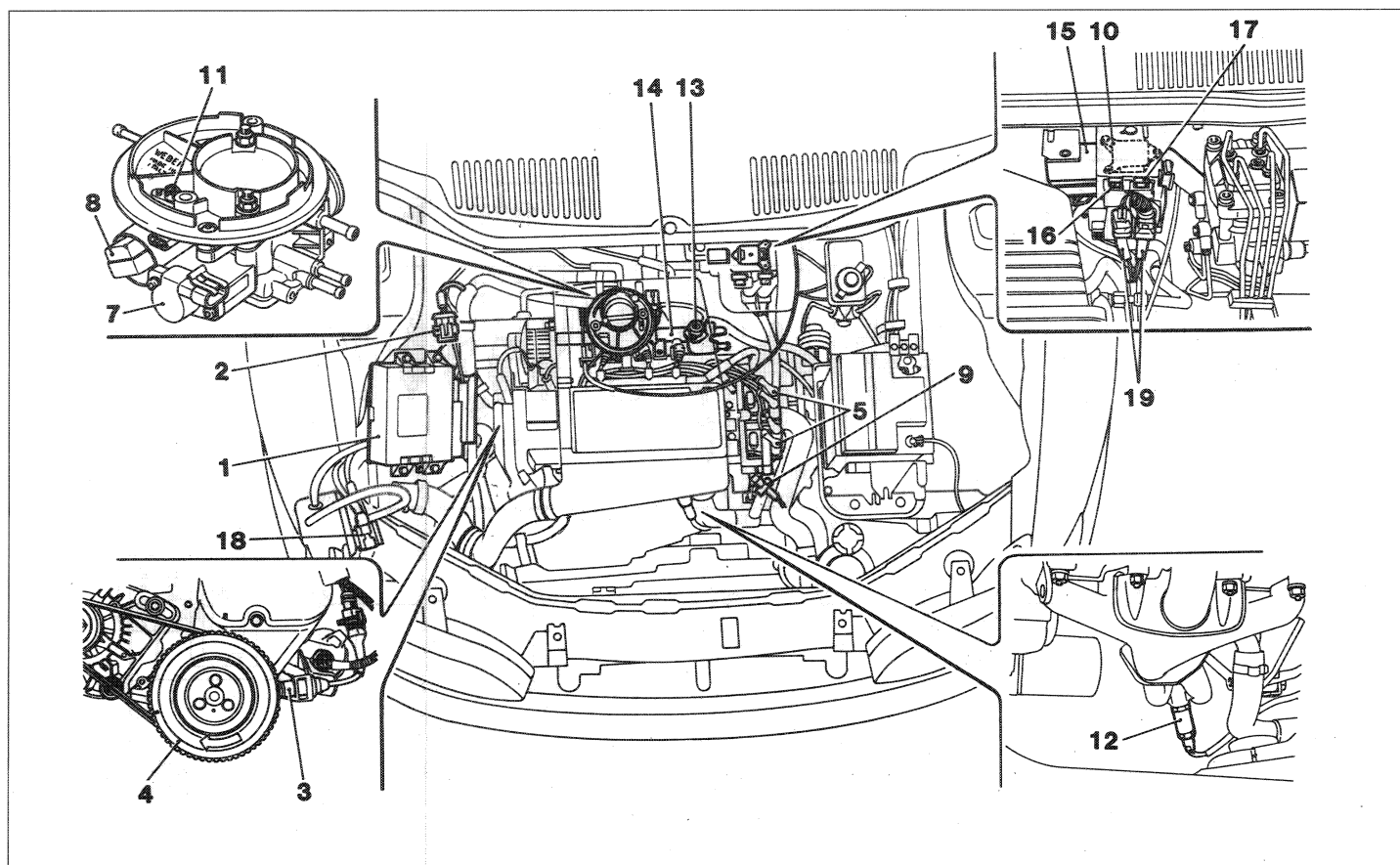
- | | | |
|--------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------|
| 1. IAW injection-ignition ECU. | 12. Electric fuel lift pump | 23. Compressor |
| 2. Battery | 13. Power earth | 26. Step motor |
| 3. Ignition switch | 14. Injectors | 27. Throttle-potentiometer position sensor |
| 4. 25A fuse protecting injection-ignition system | 15. 30A fuse for air conditioning system | 28. Power earth |
| 5. 5A fuse protecting electronic control unit | 16. 7.5A fuse for air conditioning system | 29. Absolute pressure sensor |
| 6. Dual relay | 17. Instrument panel with electronic injection failure warning light | 30. Coolant temperature sensor |
| 7. Rev counter (if present) | 21. Nippondenso ECU for air conditioner compressor | 31. Air temperature sensor |
| 8. Ignition coil N° 1 for spark plugs 1-4 | 22. Compressor coupling supply relay (located in air conditioner auxiliary ECU) | 32. Earth on case of screen ECU (11) and (33) |
| 9. Ignition coil N° 2 for spark plugs 2-3 | | 33. Rpm and TDC sensor. |
| 10. Petrol vapour cut-off solenoid | | 34. Fiat-Lancia tester diagnostic socket |

Engine Fuel system

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LOCATION OF COMPONENTS OF I.A.W. 03F.5T INJECTION-IGNITION SYSTEM IN ENGINE BAY



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1. Electronic injection-ignition control unit (with built-in ignition power module)
2. Diagnostic socket
3. Rpm and TDC sensor.
4. Engine pulley ring gear (phonic wheel)
5. Ignition coil with two high tension sockets

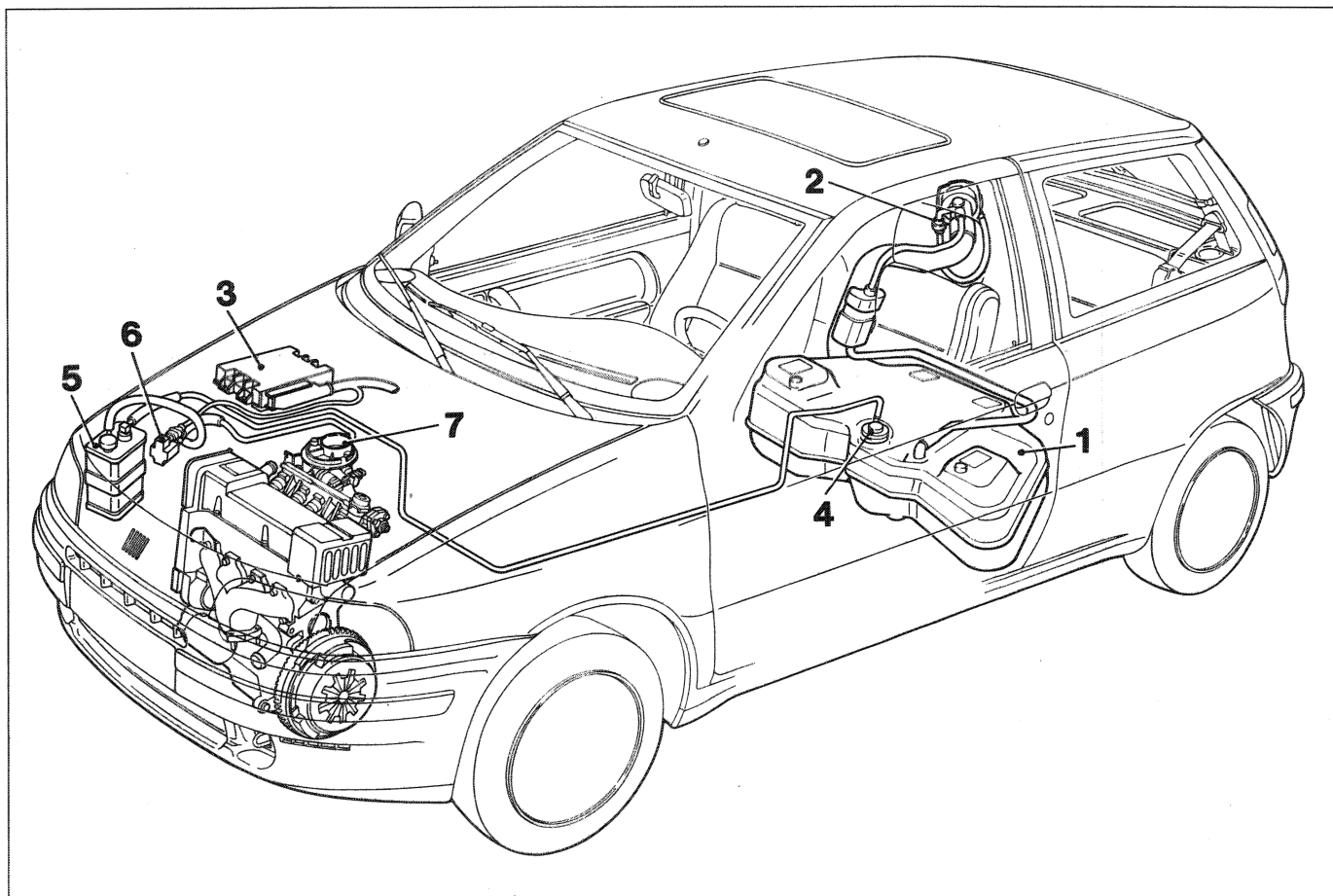
7. Throttle valve position sensor
8. Engine idle speed regulation actuator
9. Coolant temperature sensor
10. Absolute pressure sensor
11. Intake air temperature sensor
12. Lambda probe
13. Fuel pressure regulator

14. Injectors and fuel manifold
15. Dual relay supplying fuel pump ECU
16. System fuse (injection-ignition)
17. ECU fuse
18. Fuel vapour recirculation solenoid
19. Lambda probe connectors

FUEL EVAPORATION CONTROL AND VAPOUR RECOVERY CIRCUIT

NOTE The system adopted is similar to the system on S.P.I. versions, apart from the location of the active carbon trap filter and the cut-off solenoid, which are positioned in the wheel arch compartment instead of the engine bay

Diagram showing fuel evaporation control system and location of components on vehicle



P3M11DJ01

1. Petrol tank (with filler cap without ventilation hole)
2. Tank safety and ventilation valve
3. Injection/ignition control unit
4. Multifunction valve
5. Active carbon trap filter
6. Petrol vapour solenoid (N.C.)
7. Throttle case

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AUTOMATIC DIAGNOSIS OF I.A.W. 08F.5T SYSTEM

Emergency system (Recovery)

Automatic diagnosis aims to detect faults in the following components:

Actuators

- Injectors
- Step motor
- Coils (ignition coil)
- Vapour recirculation solenoid
- IAW system failure warning light.
- Fuel consumption gauge (where fitted)

SENSORS

- Rpm and TDC sensor.
- Absolute pressure sensor
- Coolant temperature sensor
- Intake air temperature sensor
- Throttle position sensor
- Lambda probe

When a fault is detected, a warning light lights up on the dashboard and, in the case of certain faults, the number of engine revs falls.

In the case of sensor failure, the system implements signal reconstruction strategies (**recovery**) in order to ensure engine and catalytic converter operation at an acceptable level without affecting function.

Under these conditions, the vehicle may be driven to a service centre for repairs.

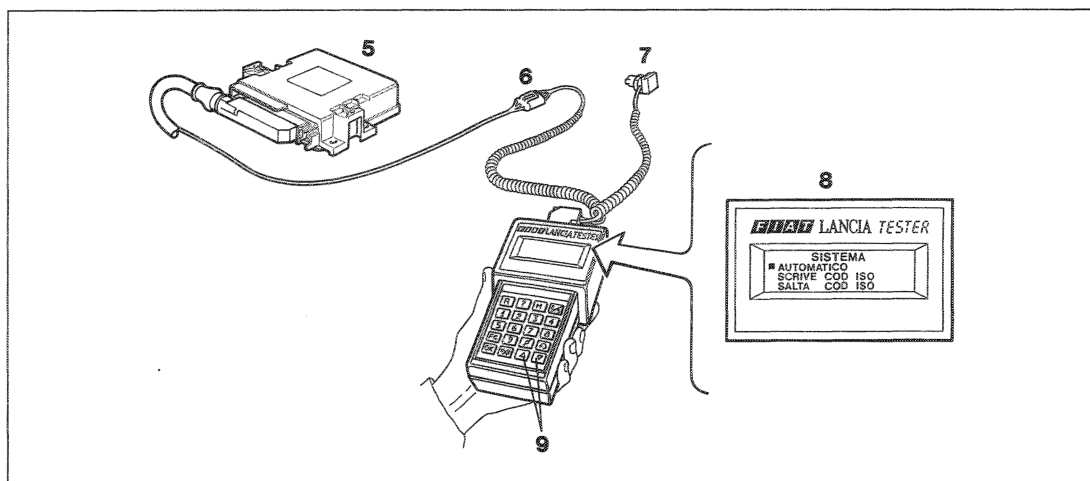
The warning light goes out when the fault is removed.

The system temporarily memorises faults within the control unit in order to facilitate service operations.

Diagnosing with the FIAT/LANCIA TESTER

Socket (6) for bi-directional diagnosis on the connector of electronic control unit (5) is used for connection of the F.L.T.

The TESTER must be connected to the ECU as follows:



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1. Connect the Fiat-Lancia Tester to adaptor «ADAPTER ADT 101 A»
2. Supply TESTER via cigar-lighter socket (7), or by connecting directly to the battery (a special alternative lead is provided for this purpose).
3. Connect the TESTER socket to the ECU socket (socket always located in engine bay).

The instrument is able to supply the following information:

- Engine parameter display
- Error display
- Active diagnosis

PARAMETERS DISPLAYED

UNITS OF MEASURE

Engine rpm	Revs per minute
Injection time	Milliseconds
Advance	Angular degrees
Absolute air temperature in inlet manifold	mm of mercury
Air temperature	Degrees centigrade
Coolant temperature	Degrees centigrade
Throttle opening angle	Angular degrees
Battery voltage	Volt
Lambda probe	<i>Mobile bar</i>
Step motor	Steps
Integral component	Steps
Proportional component	Steps
Trimram	Number
Air conditioner	ON/OFF
Self-adaptability	ON/OFF

LIST OF ERRORS

RPM sensor	Lost signals
Throttle potentiometer	AC-DC.
Absolute pressure sensor	AC-DC. - Inconsistency between value transmitted to ECU and rpm level and throttle position.
Air temp. sensor	AC-DC.
Coolant temp. sensor	AC-DC.
Battery	Supply < 15.5 V
	Supply > 6.2 V
Lambda probe	AC-DC. - Incorrect CO value
Injector	DC.
Ignition coil	AC-DC.
Ignition coil	AC-DC.
Step motor	DC.
Petrol vapour solenoid	AC-DC.
Actuator relays	DC.
Control unit	Microprocessor or ECU memory operating anomalies are indicated.
Self-adaptive parameters	These indications occur if ECU self-adaptive limits are reached.
	This indication shows that engine conditions are too far from normal and the cause could lie in faults of a mechanical nature.

ACTIVE DIAGNOSIS

The following active tests may be carried out using a Fiat-Lancia tester:

- Petrol pump
- Injector
- Ignition coils
- Fuel vapour flow solenoid
- Air conditioner
- Rev counter
- Step motor
- Error deletion

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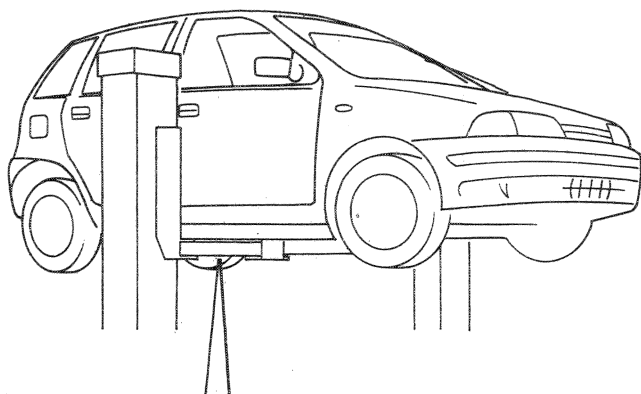
OPERATIONS ON VEHICLE

Removing-refitting fuel filter

- Raise the vehicle, then remove the screws retaining the filter to the clip
- Unscrew the fuel inlet and outlet fittings from the filter
- Collect fuel that flows out during the operation in a suitable container
- Thoroughly clean the terminals of the two pipes before fitting the new filter



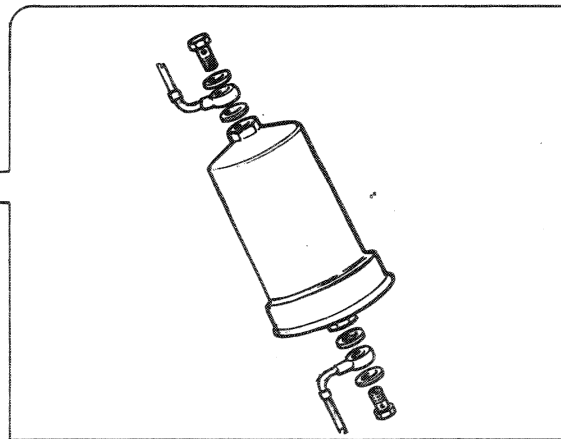
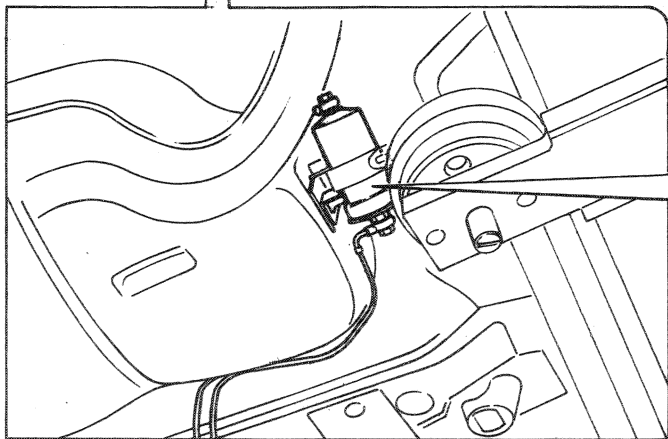
The fuel filter must be replaced at intervals of 30,000 km.



NOTE *An arrow on the outer filter case indicates direction of fuel flow and therefore the correct installation direction.*



Each time the filter is replaced, replace the seals, start up the engine and check that no leaks occur through the seals.



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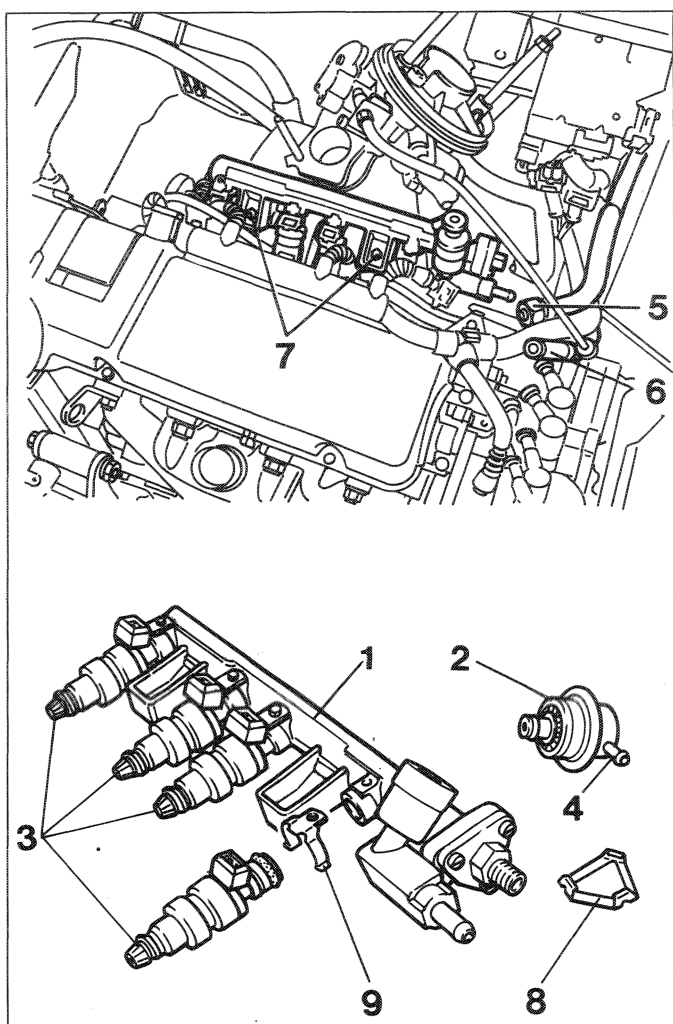


Fitting tightening torque: 3 - 3.8 da Nm.

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REMOVING-REFITTING FUEL MANIFOLD WITH INJECTORS AND PRESSURE REGULATOR

- Disconnect the fuel inlet pipe from the fitting
- Loosen the return pipe clip and disconnect the hose
- Disconnect electrical connectors from injectors
- Unscrew screws retaining the throttle case and remove from its seat (this operation facilitates removal of the fuel manifold and injectors).
- Unscrew the two screws retaining the fuel manifold to the inlet manifold
- Take out the injector manifold assembly
- To remove the injectors from the manifold, remove clip (9)
- To remove the pressure regulator, remove clip (8)



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1. Fuel manifold
2. Fuel pressure regulator
3. Injectors
4. Vacuum socket from engine inlet manifold
5. Fuel inlet pipe from pump
6. Fuel return lines to tank
7. Screws retaining fuel manifold
8. Clip retaining injector to fuel manifold



Important precautions for correct installation of pressure regulator and injectors to fuel manifold

Pressure regulator: Clip (8) should be replaced whenever the pressure regulator is removed from its housing. When refitting, it is advisable to use a ring of suitable size in order to press on the three anchorage points simultaneously.

Injectors: When fitting an injector in its housing, never exceed fitting position of clip (9); if this position is passed, the o-ring is bound to be damaged. If this occurs, remove the injector and replace the damaged ring that is left inside the manifold.

Fuel manifold: Never wash the manifold by submerging in strong fluids. Clean only on the outside using a brush. Otherwise the o-rings may be damaged.

NOTE *Lubricate injector and pressure regulator o-rings with pure vaseline (use as little as possible in order not to affect functional areas) before fitting.*



Fuel inlet duct fitting tightening torque (5) 2.1 - 2.7 da Nm

NOTE *When tightening, apply a reaction equal to the tightening torque to the fuel inlet fitting hexagonal nut*