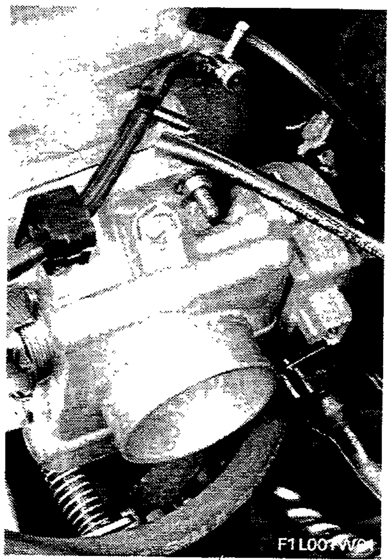
10.

Position the car on the lift.
Proceed as follows:
- drain off the coolant;
- remove the bonnet;
- disconnect the negative lead from the battery;
- carry out the following operations:

2000 i.e. turbo ENGINE



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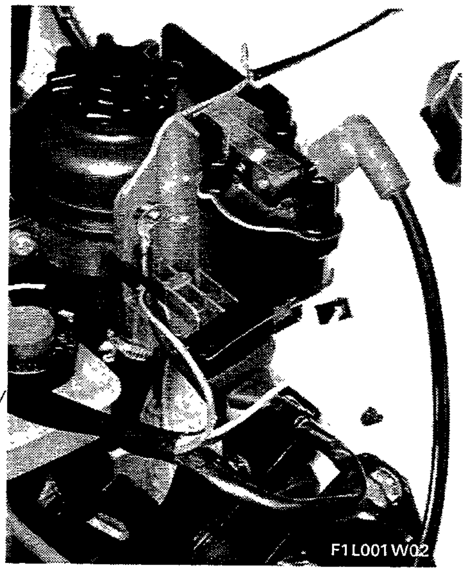

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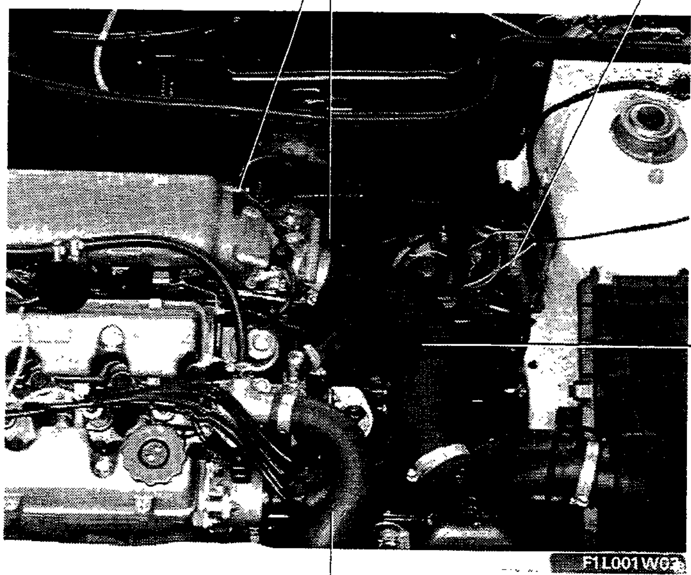

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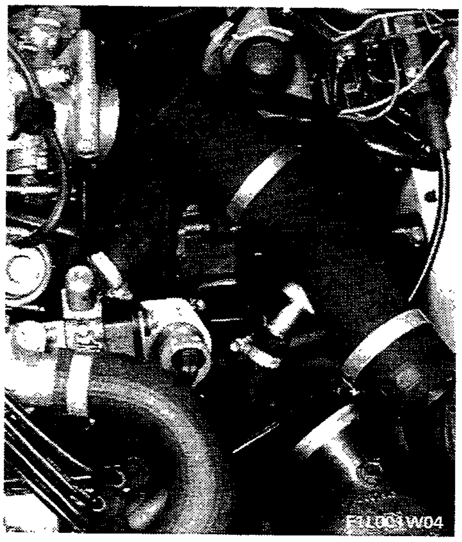

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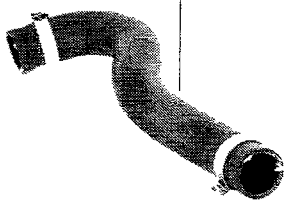

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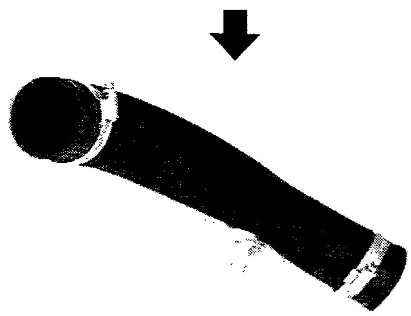

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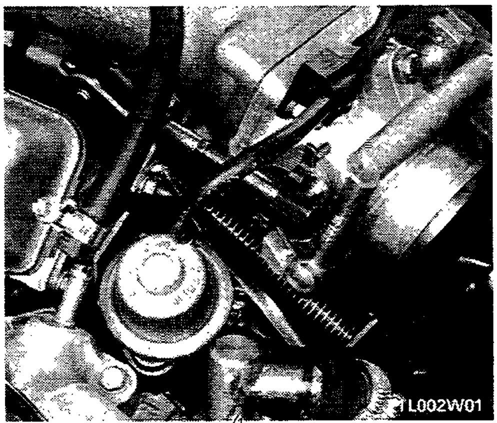
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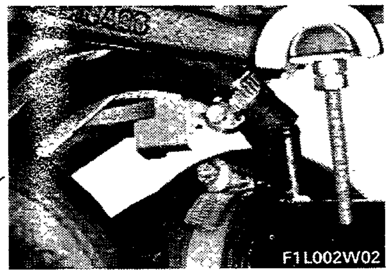
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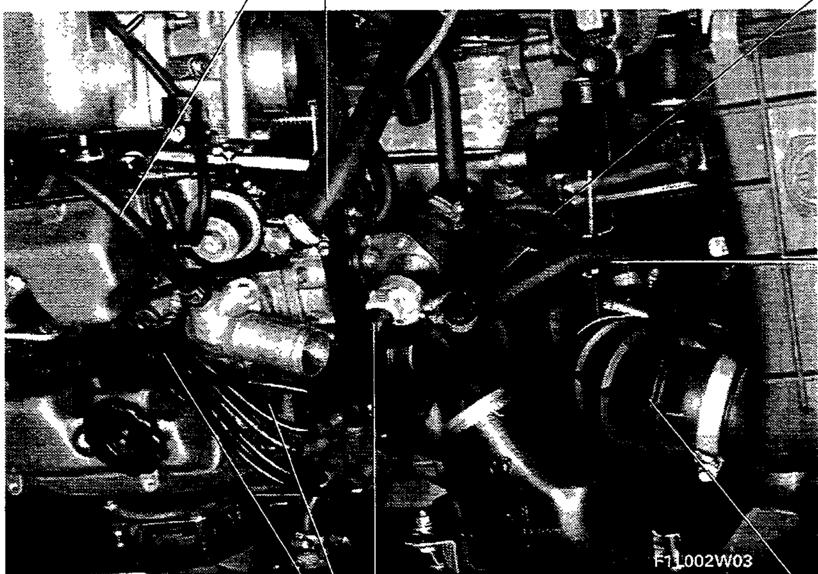
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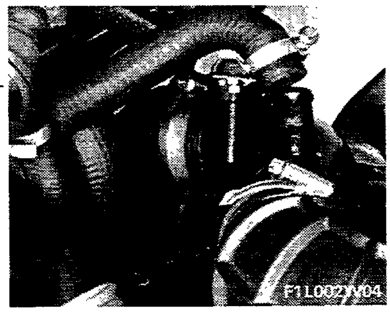
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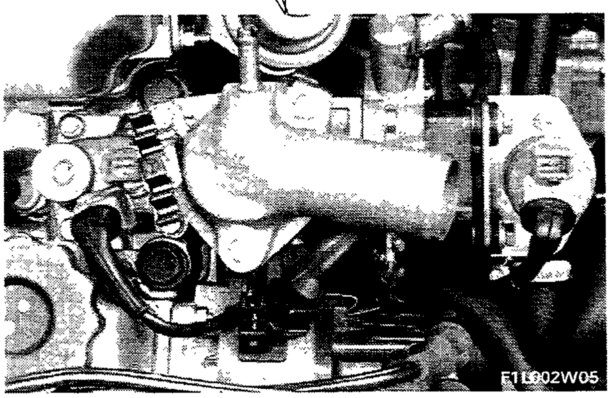
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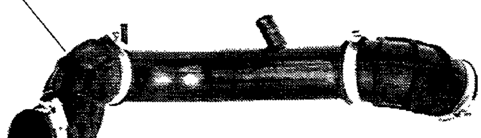
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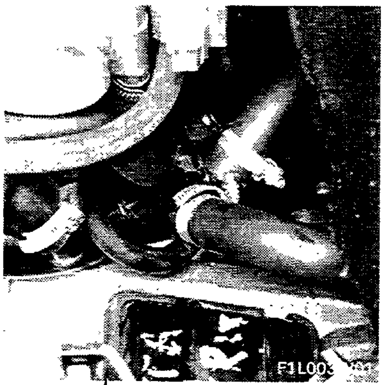
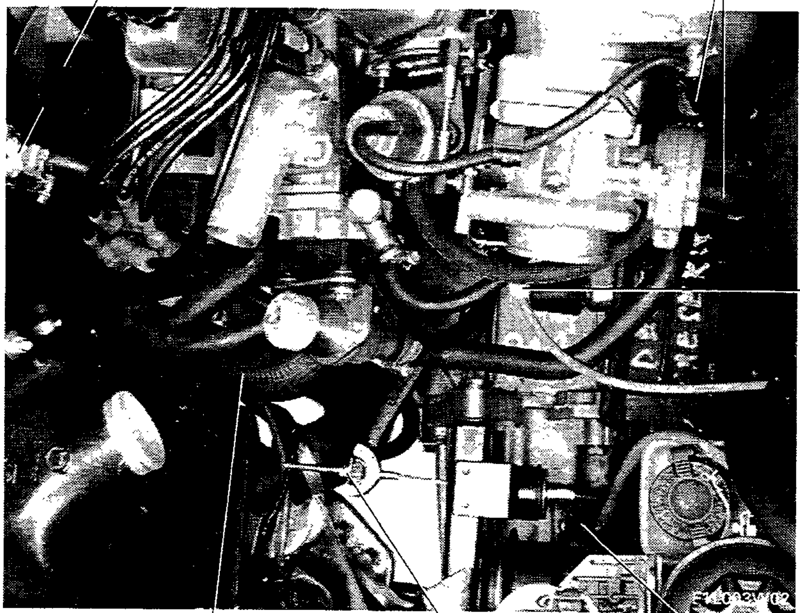
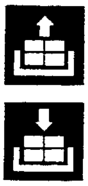
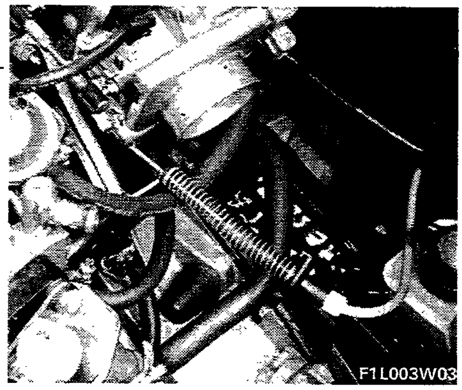
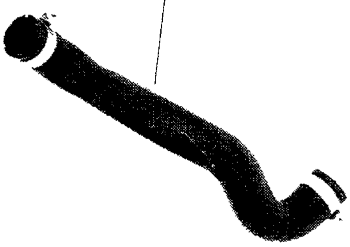
- Disconnect electrical connections from over-boost control solenoid;











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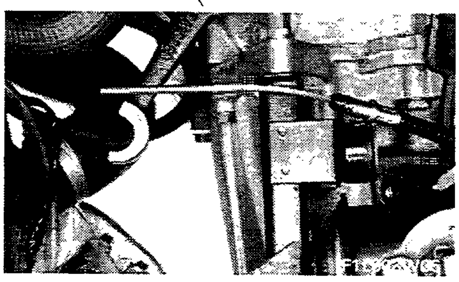

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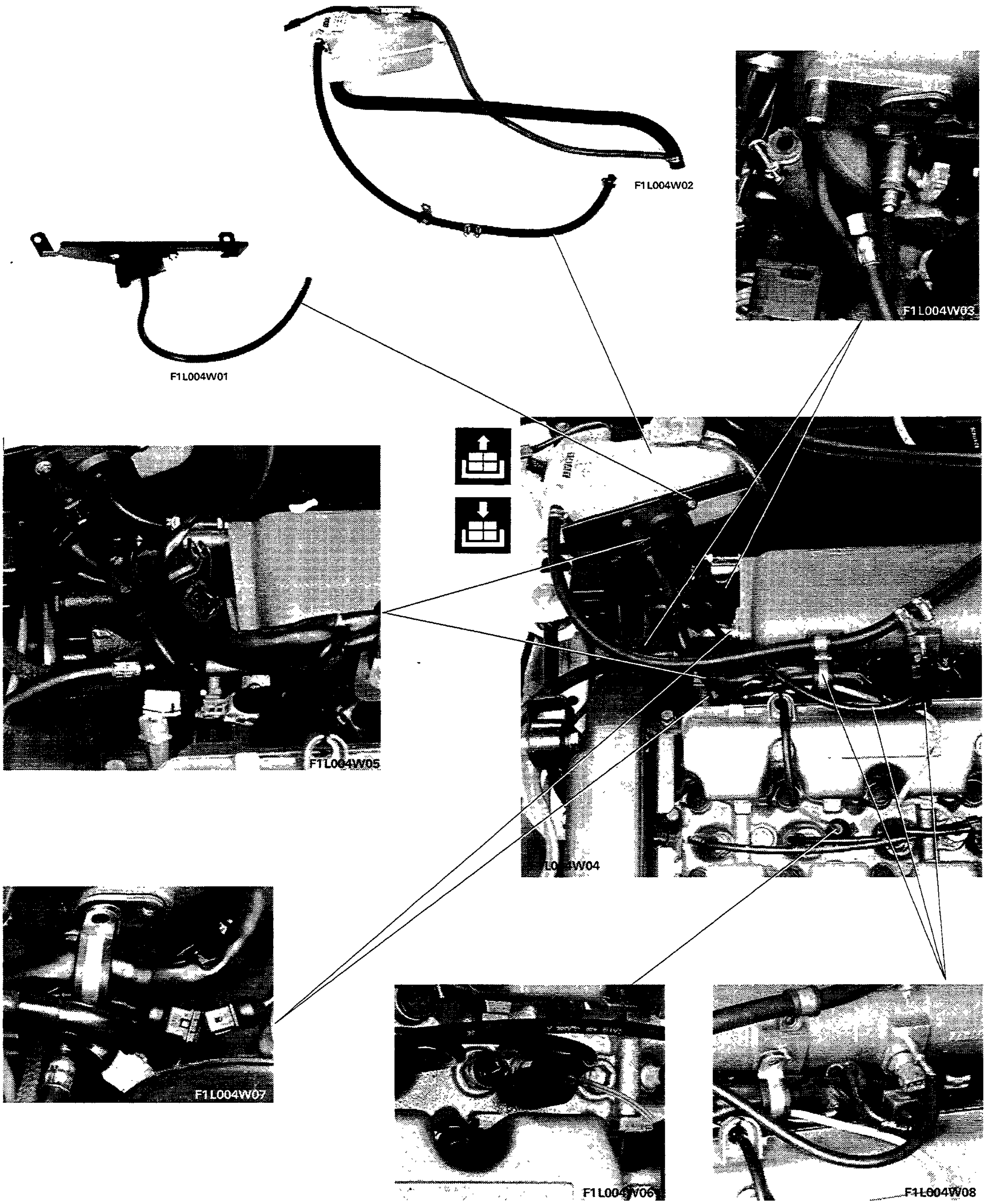
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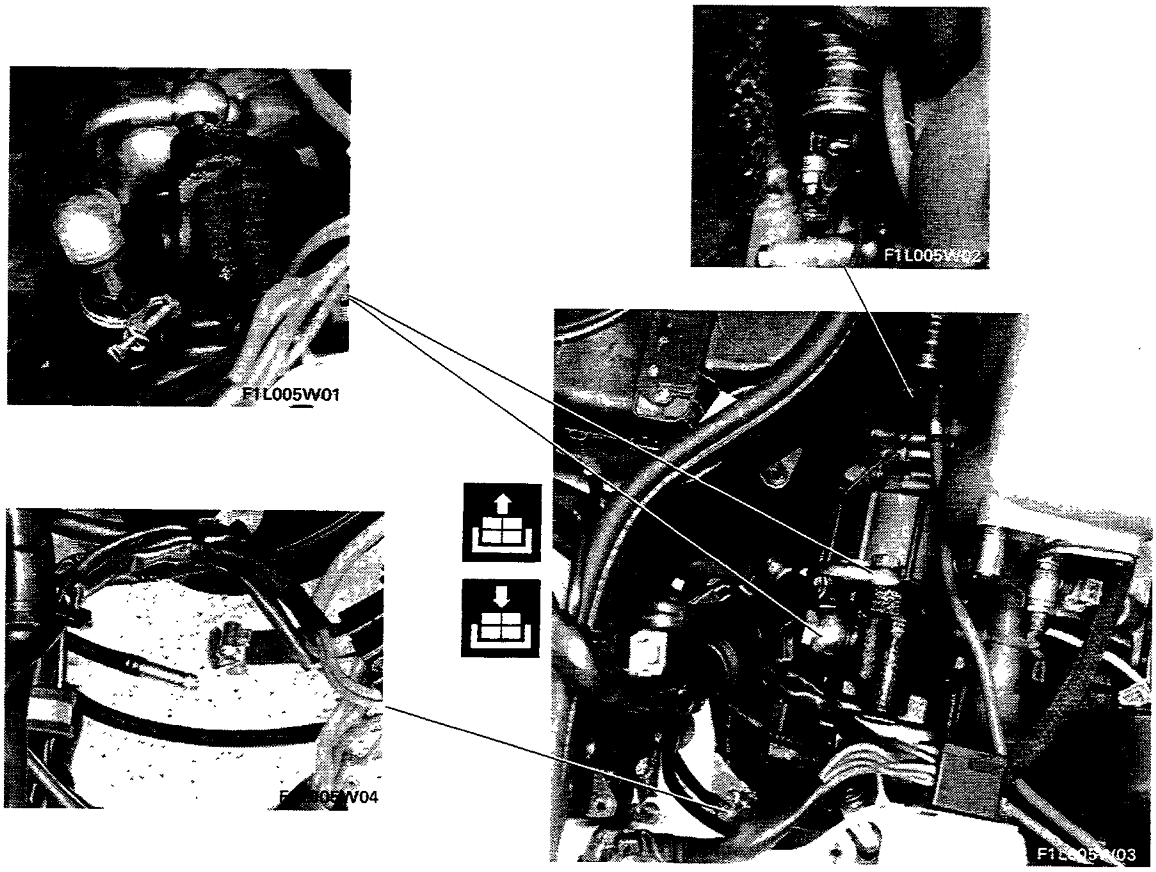
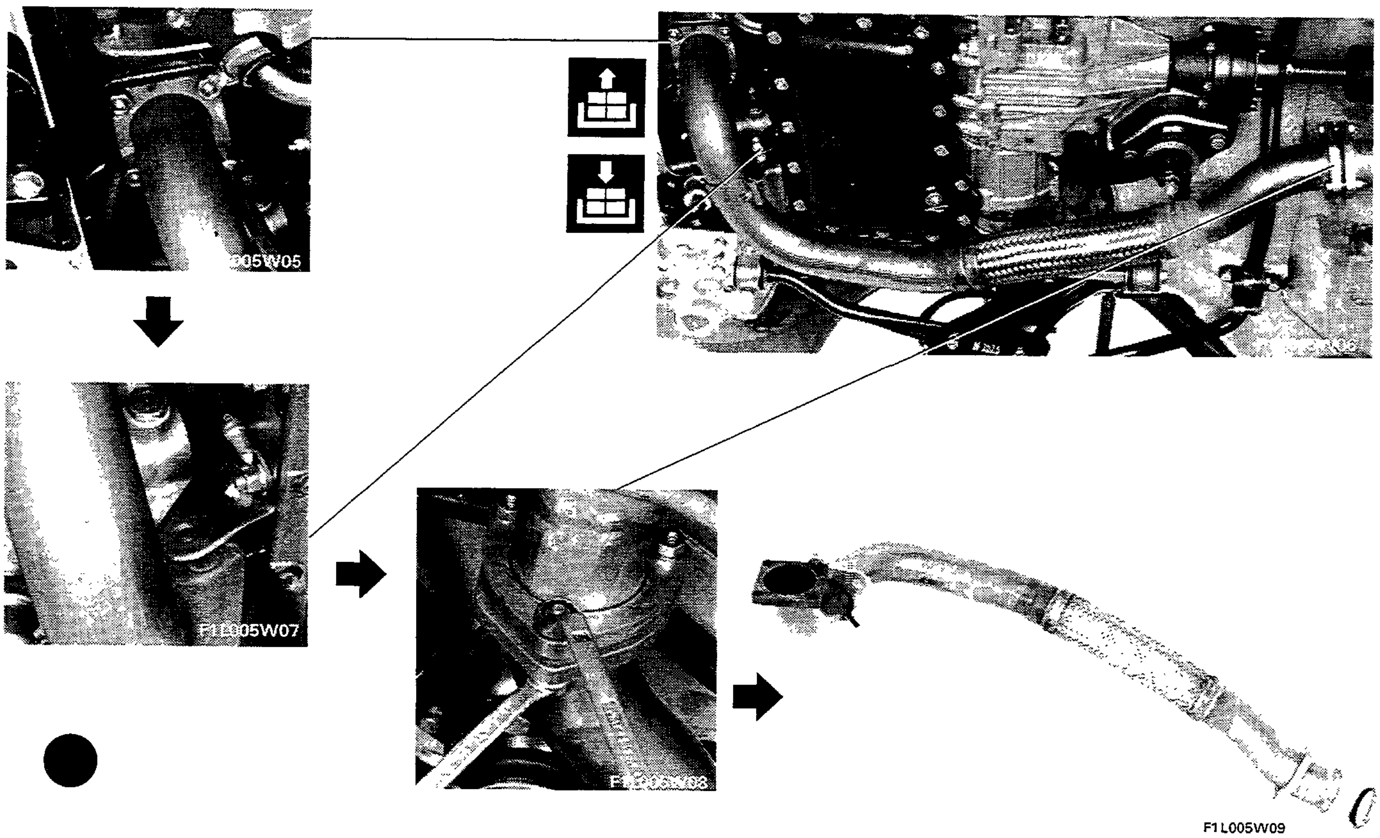


- remove the front wheels;
- raise the car and, working from underneath, drain the gearbox oil; then proceed as follows:



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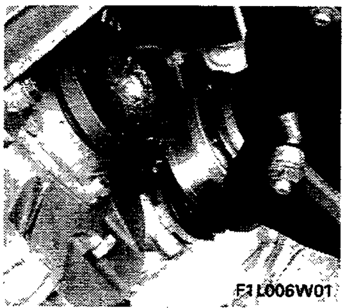

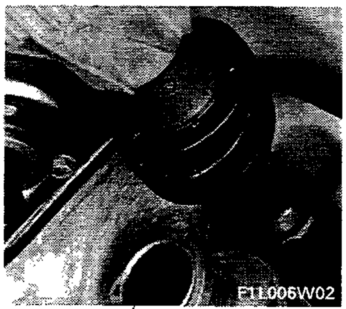

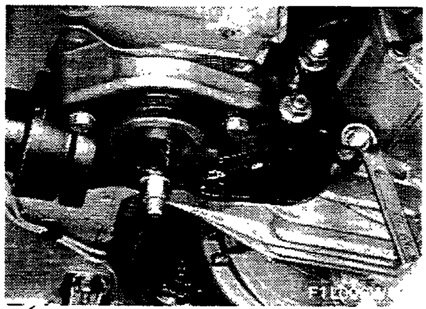

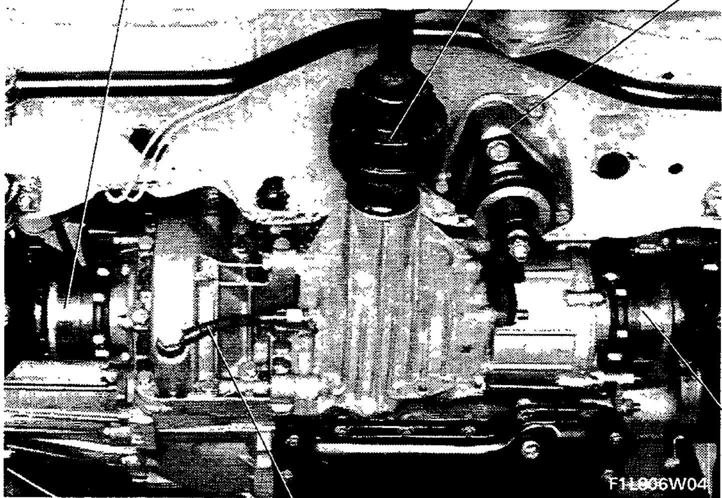

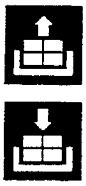

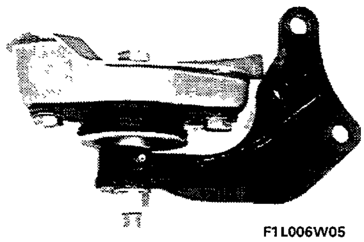

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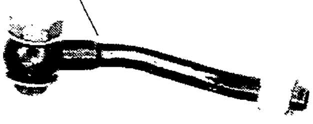

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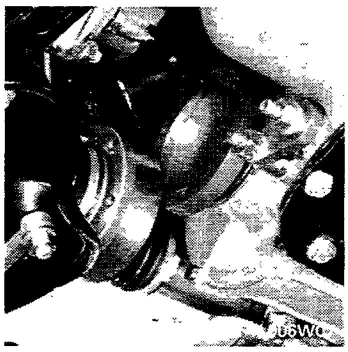

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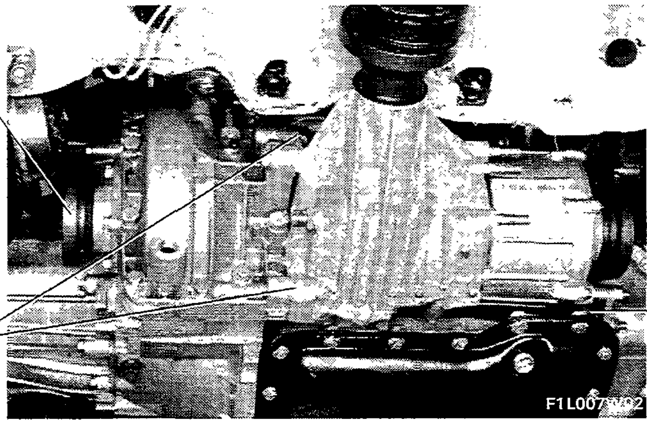

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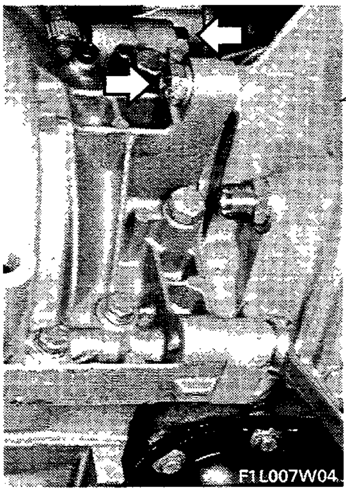

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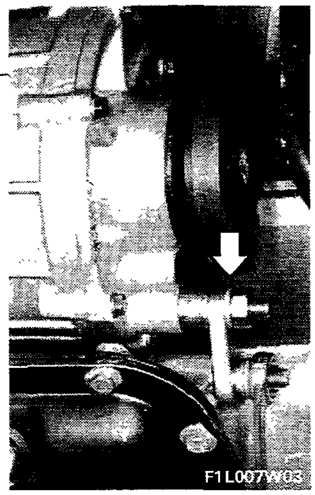

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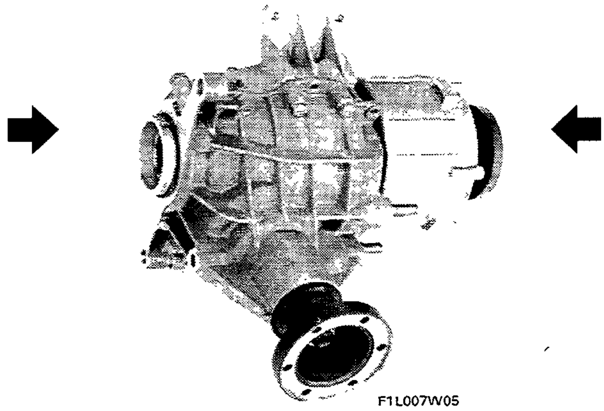

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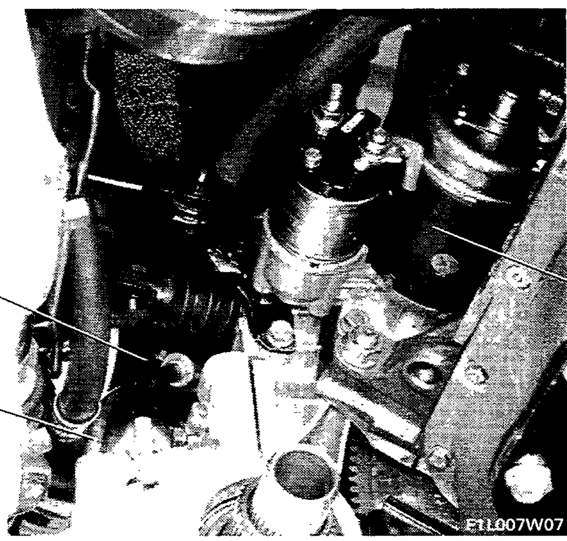

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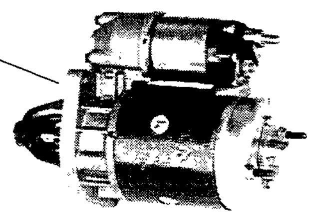

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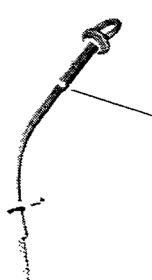

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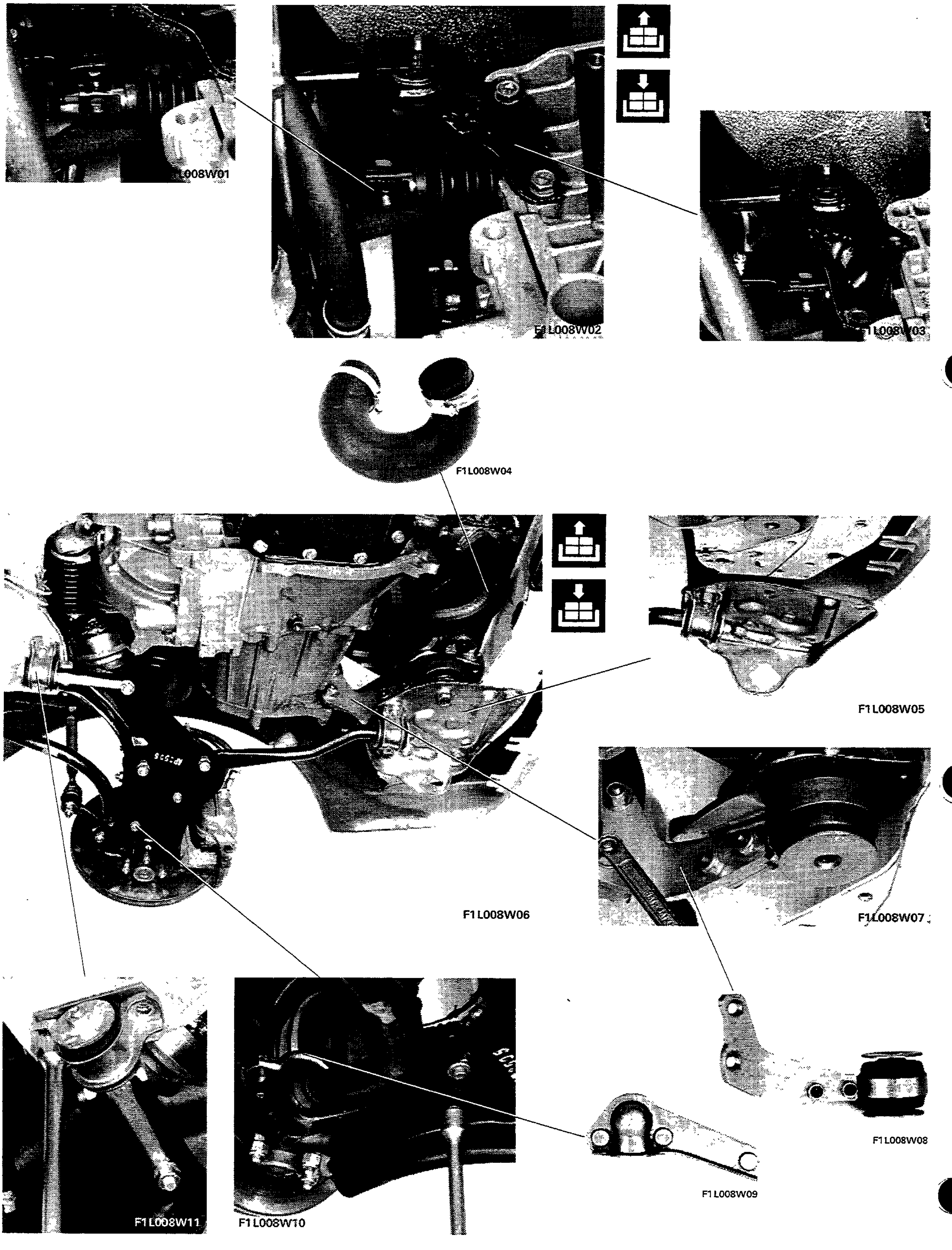
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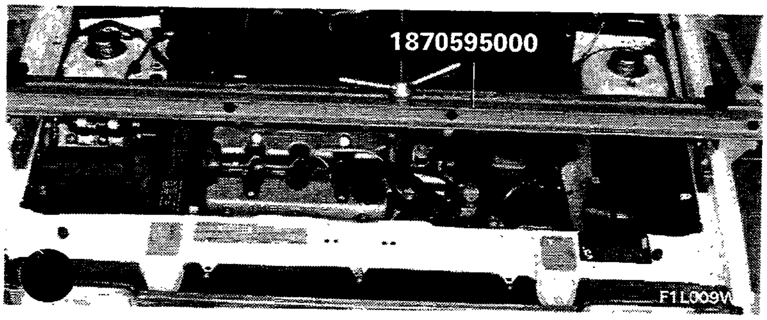
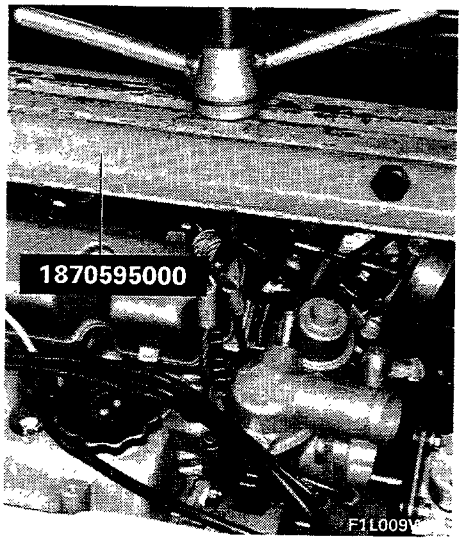
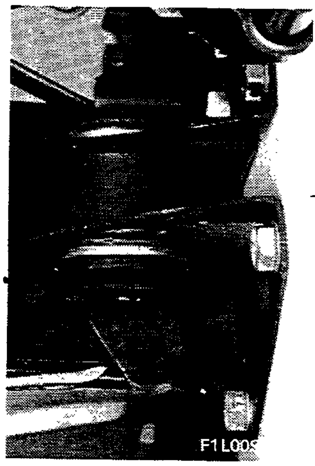
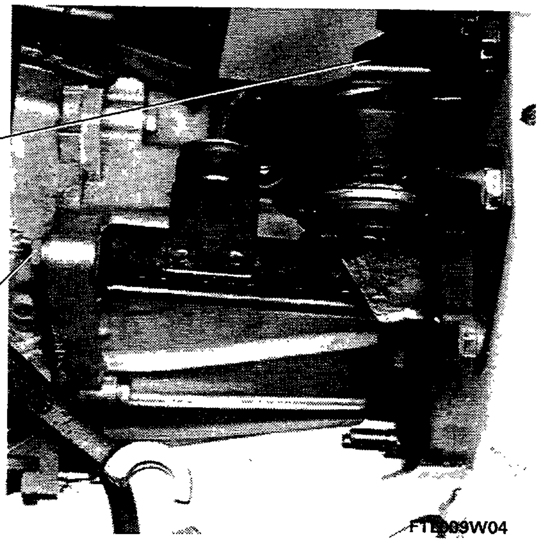
F1L008W05
F1L008W06
F1L008W07
F1L008W08
F1L008W09
F1L008W10
F1L008W11

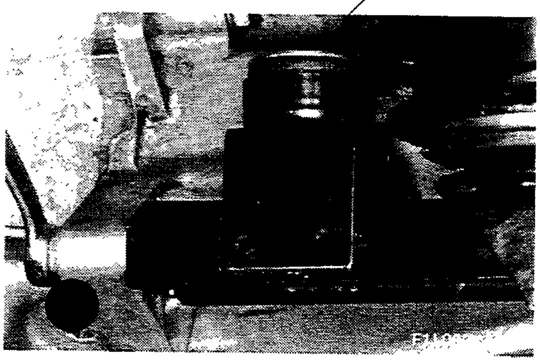
- disconnect electrical connections from alternator;
- lower lift, position crossbeam 1870595000 in engine compartment and support the engine using special hook;

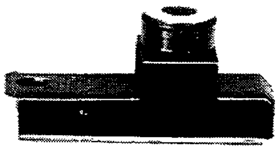












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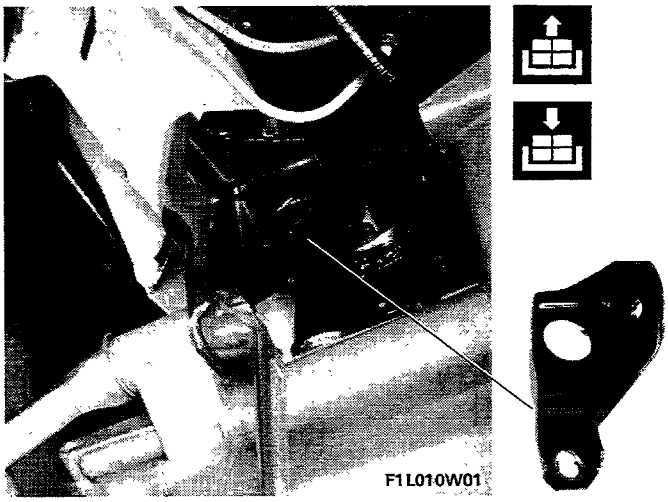
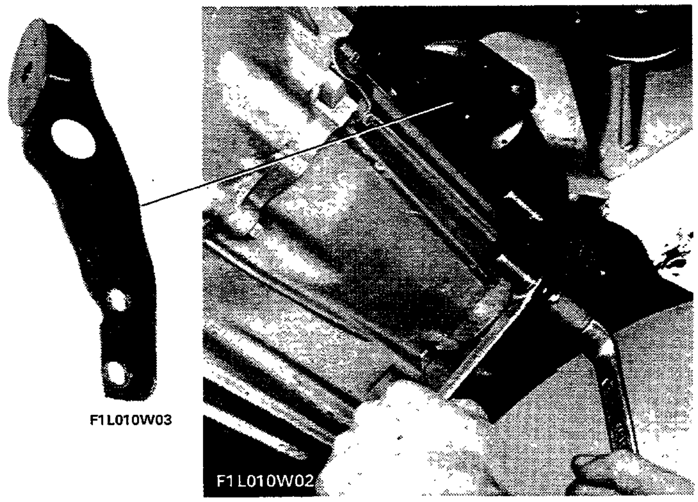
10.

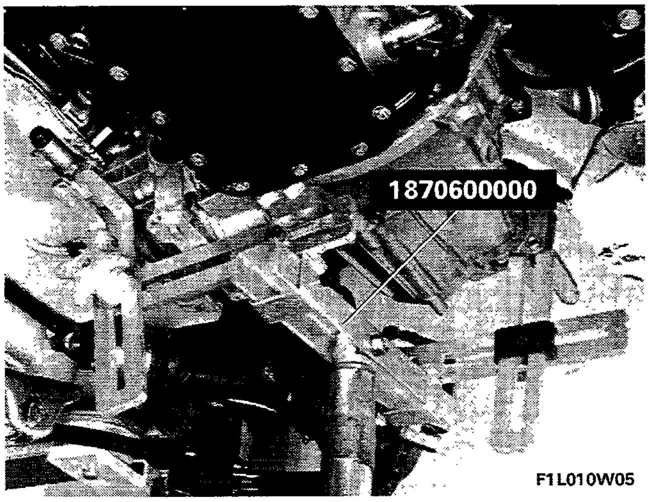
- raise the lift and, working from beneath, proceed as follows:



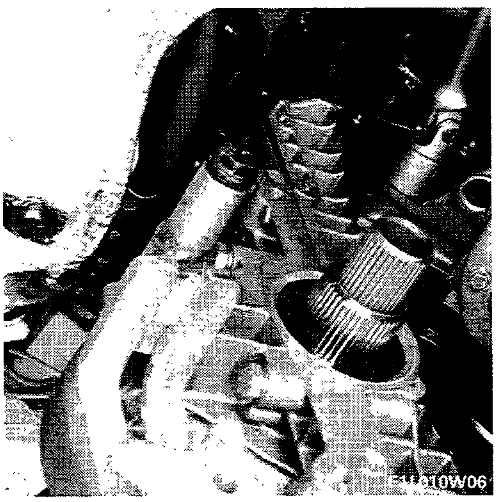
Removing-refitting rear gearbox support bracket

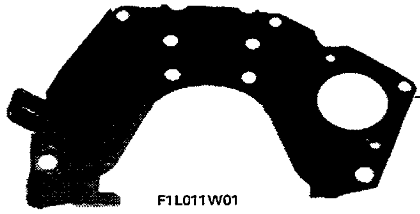


Removing-refitting front gearbox support bracket



- remove flywheel cover retaining bolts, arrange gearbox-differential support 1870600000 as shown in the diagram and position the hydraulic jack;
- remove bolts retaining gearbox-differential unit to engine;





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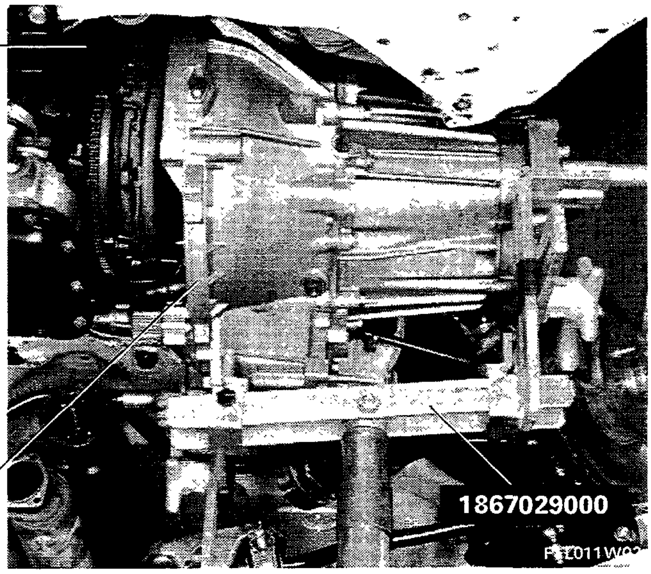
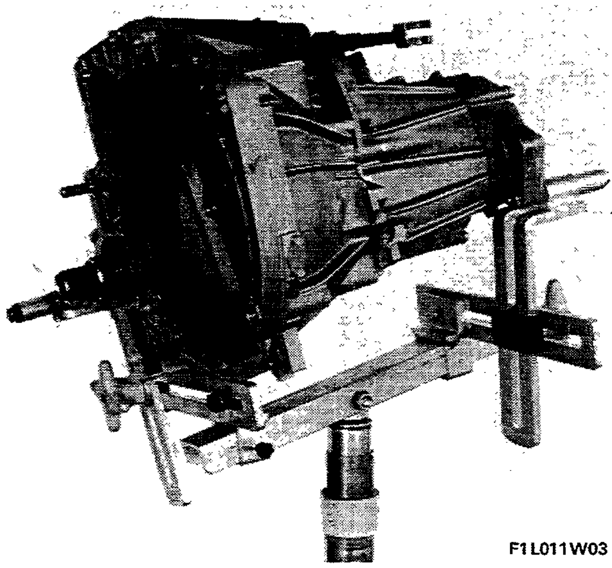
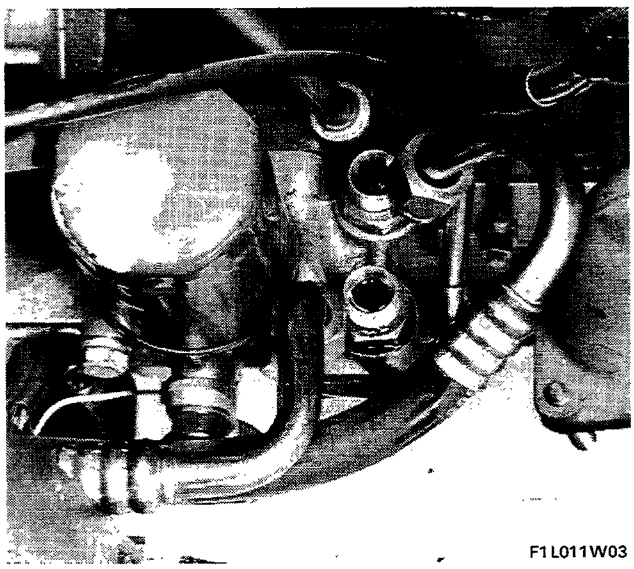




F1L011W03

- move the gearbox-differential unit until it is free of the centring pins on the engine and the clutch shaft slides out of the driven plate;

- lower the lift, remove the radiator grille and the hose connecting the radiator to the turbocharger and then withdraw the radiator together with the fan. Now proceed as follows:



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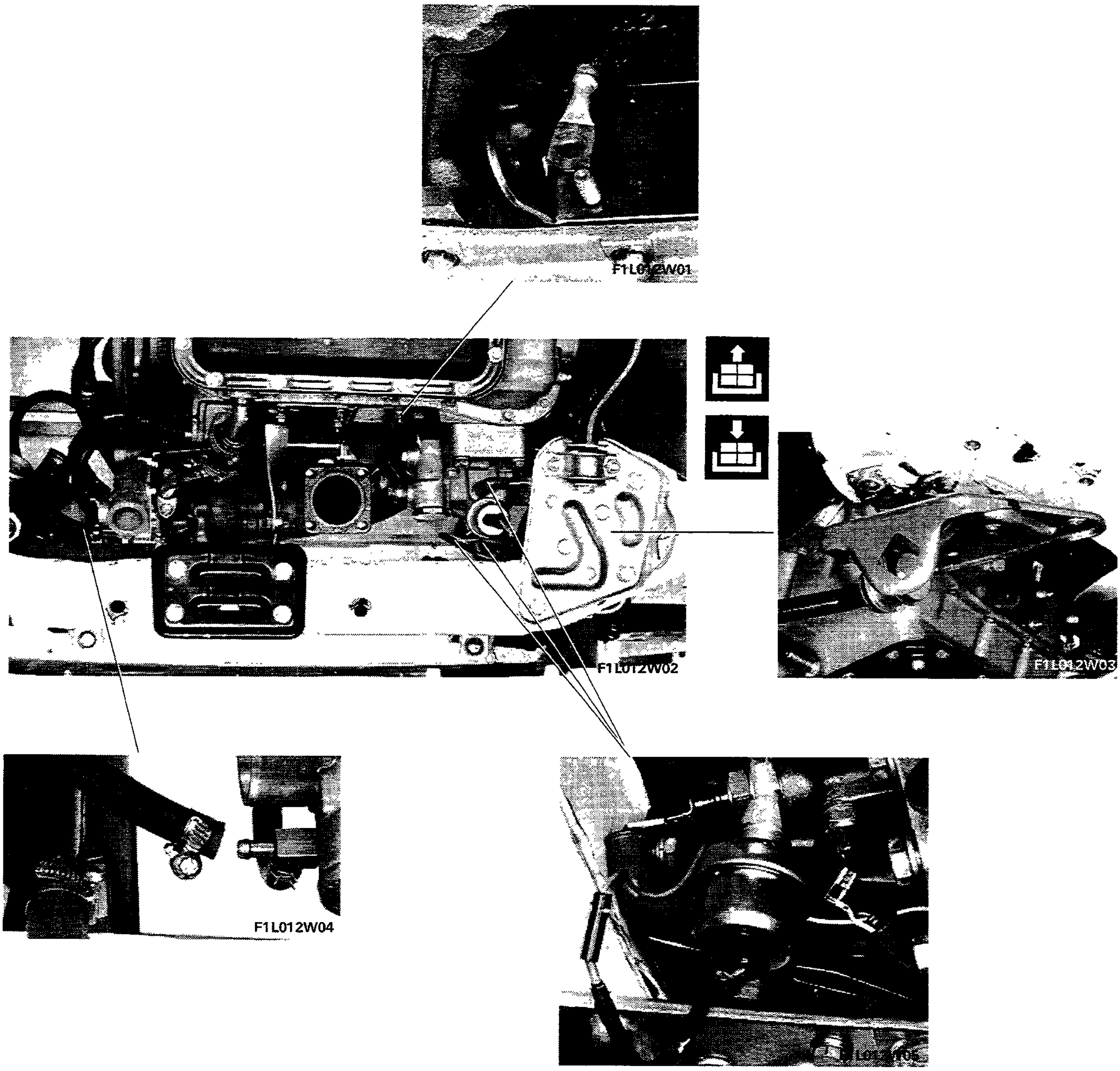
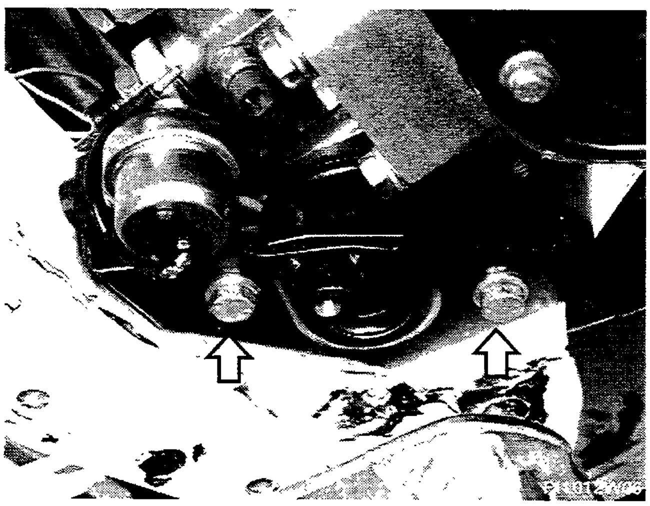
Removing-refitting oil lines from thermostatic valve on oil filter support

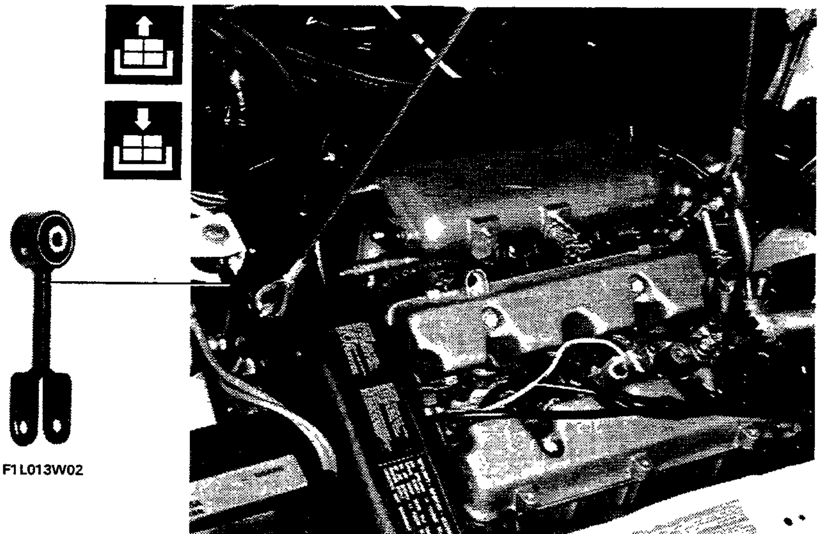
10.





- disconnect the camshaft end front engine supports via bolts shown in diagram;

- lower the lift, position universal hook 1860592000 in attachment brackets on engine then take up the slack on power unit using the hoist;
- disconnect support beam 1870595000;



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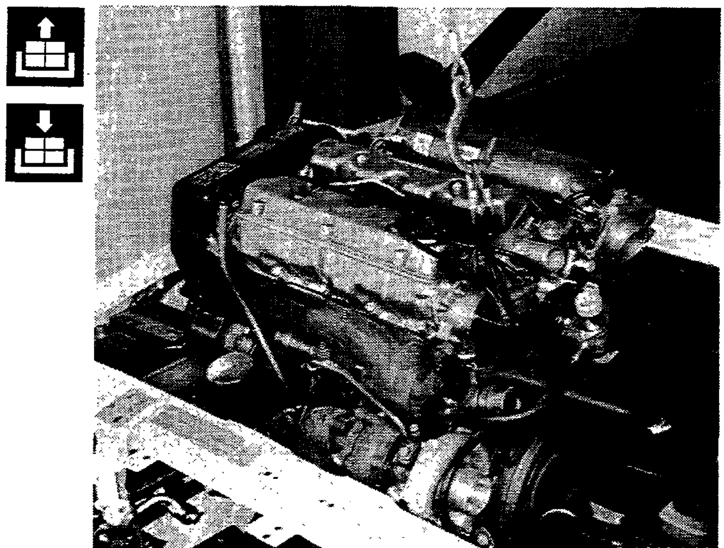
F1L013W01

- remove the link fastening engine to body shell;



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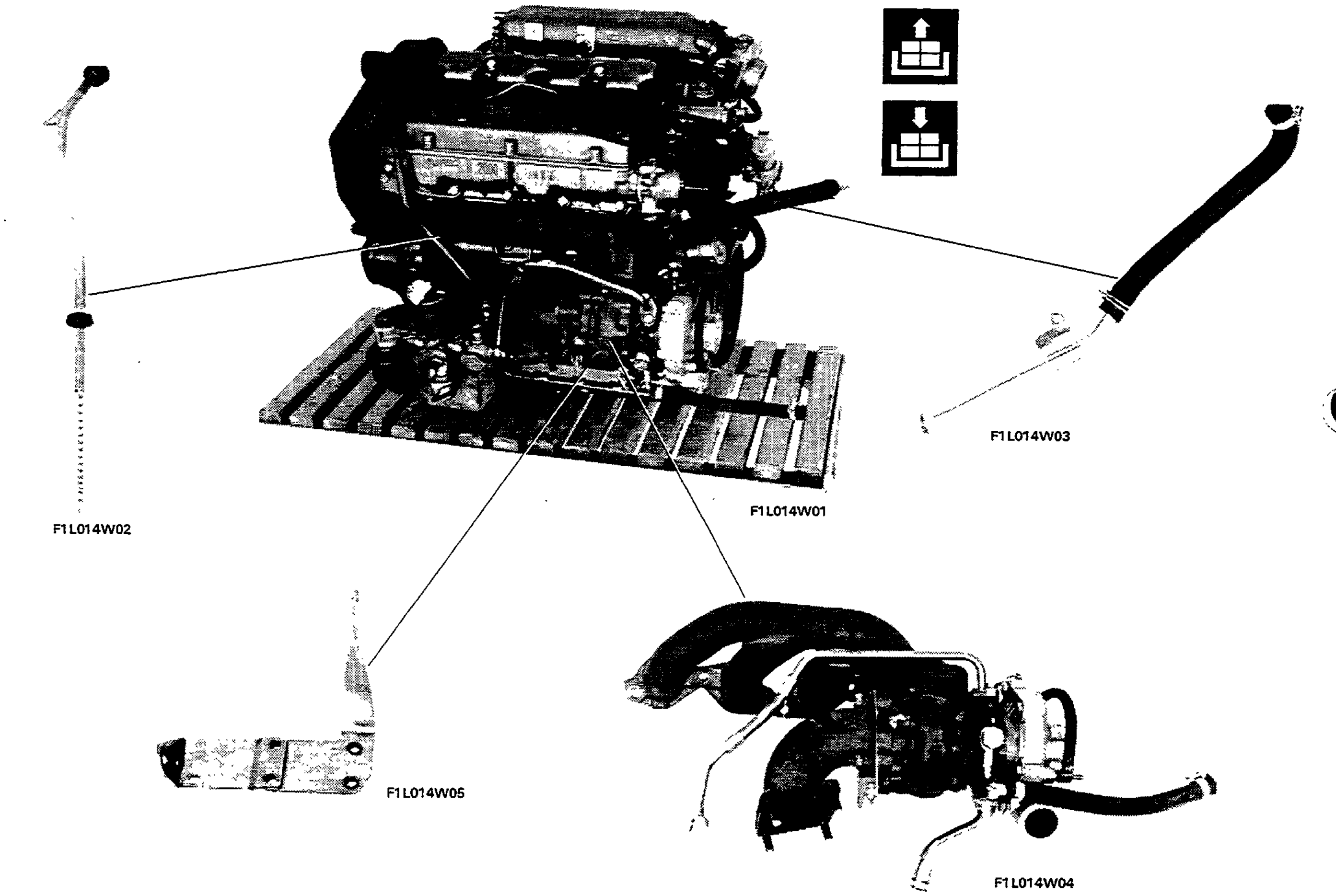
- raise engine with hoist;

10.

- rest engine on platform and then proceed as follows:



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F1L014W02

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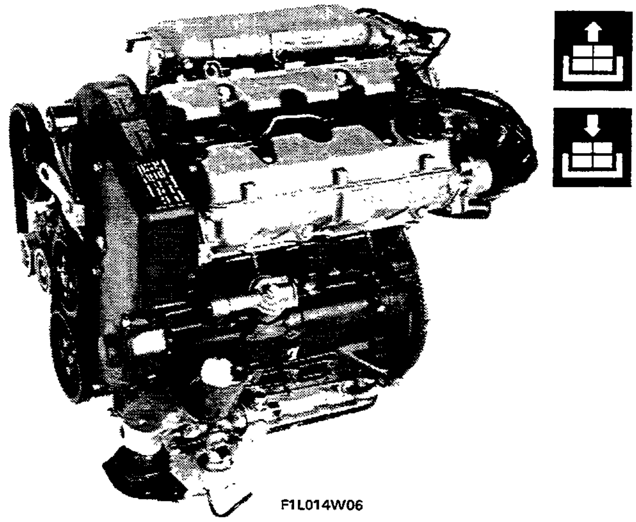

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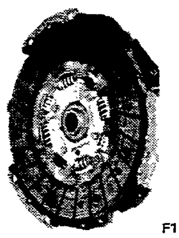

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Proceed as described for the 2000 i.e. turbo engine to remove and refit 2000 i.e. engine.

NOTE *To re-install power unit carry out removal instructions in reverse order.*

PART	Thread	Tightening torques daNm

ENGINE

PART	Thread	Tightening torques (daNm)
Bolt retaining central cap to engine block	M 12 x 1.25	2 + 130°
Self-locking bolts retaining caps to engine block	M 12 x 1.25	2 + 90°
Nut retaining link to aluminium sump and torque distributor	M 8	2.3
Bolt retaining vent housing to engine block	M 8	2.3
Bolt retaining reaction bracket to torque distributor	M 10 x 1.25	5.9
Bolt retaining cylinder head to engine block	M 10 x 1.25	4 +90° +90°
Bolt retaining top end of cylinder head	M 8	2.2
Bolt retaining intake manifold to cylinder head	M 8	2.5
Nut retaining intake manifold to cylinder head	M 8	2.5
Nut retaining reaction bracket to intake manifold	M 8	2.3
Bolt retaining reaction bracket to intake manifold	M 8	2.3
Self-locking bolt retaining exhaust manifold	M 8	2.9
Connecting rod cap retaining bolt	M 10 x 1	2.5 + 50°
Bolt retaining flywheel to crankshaft	M 12 x 1.25	14.2
Bolt retaining auxiliary pulley to timing gear	M 8	2.5
Bolt retaining timing gear to crankshaft ▲	M 14 x 1.5 Left	19
Bolt retaining belt tensioner bearing to support	M 10 x 1.25	4.4
Bolt retaining belt tensioner support to alternator and power steering support	M 8	2.3
Poly-V belt tensioner adjustment screw locknut	M 10 x 1	4.4
Timing gear retaining bolt	M 12 x 1.25	11.8
Belt tensioner retaining bolt	M 10 x 1.25	4.4

▲ Do not **lubricate** the bolt

10.

PART	Thread	Tightening torque daNm
Counter-rotating shaft gear retaining bolt	M 12 x 1.25	11.8
Counter-rotating shaft cover retaining bolt	M 8	2.3
Counter-rotating shaft belt tensioner retaining nut	M 8	2.3
Self-locking nut retaining turbocharger to exhaust manifold	M 10 x 1.5	5.9
Self-locking nut retaining flange to turbocharger	M 8	2.9
Bolt retaining turbocharger support bracket to engine block	M 8	2.9
Nut retaining turbocharger support bracket and exhaust pipe support bracket to engine block	M 8	2.9
Bolt retaining oil delivery lines to turbocharger	M 8	2.3
Union for adjustable fitting retaining oil delivery lines to oil filter support	M 14 x 1.5	5
Bolt retaining oil delivery line support bracket to exhaust manifold	M 10 x 1.25	4.3
Bolt retaining oil return line from turbocharger to sump	M 8	2.3
Union for adjustable fitting retaining turbocharger coolant delivery and return hoses	M 16 x 1.5	3.2
Bolt retaining oil filter and engine suspension support to engine block	M 10 x 1.25	4.3
Plug for thermostatic valve on oil filter support	M 35 x 1.5	11.8
Bolt retaining water pump to engine block	M 8 x 1	2.5
Bolts retaining water pump and power unit suspension bracket to engine block	M 8 x 1	2.5
Bolt retaining water pump hose to pump	M 8	2.5
Bolt retaining coolant return lines to cylinder head	M 10 x 1.25	4.3
Nut retaining power steering pump alternator support to engine block	M 10 x 1.25	4.3
Bolts retaining power steering pump alternator support to engine block	M 10 x 1.25	4.3
	M 8	2.5

PART	Thread	Tightening torque daNm
Bolt retaining alternator bracket to support	M 10 x 1.25	4.3
Alternator bracket retaining nut	M 10 x 1.25	4.3
Alternator retaining nut	M 12 x 1.25	6.9
Bolt retaining support brackets to power steering pump	M 8	2
Bolt retaining power steering support brackets to support	M 10 x 1.25	4.3
Nut retaining power steering pump driven pulley	M 14 x 1.5	9.5
Spark plugs	M 14 x 1.25	3.7
Oil temperature sending unit	M 14 x 1.5	3.7
Coolant temperature sending unit	M 16 x 1.5 bevel	4.9
Oil pressure switch	M 14 x 1.5	3.2
Oil sump plug	M 22 x 1.5 bevel	5
EXHAUST		
Nut for stud fastening exhaust pipe to turbocharger	M 10 x 1.5	3.7
Bolt retaining silencer flange on exhaust pipe	M 8 x 1.25	1.5
Bolt securing bracket retaining exhaust pipe to collar	M 10 x 1.25	5
Nut retaining collar on exhaust pipe to bracket	M 8 x 1.25	2.5
Nut retaining exhaust pipe to rubber bush	M 8 x 1.25	1
POWER UNIT MOUNTING		
Bolt retaining support for crankshaft end rubber engine mounting block	M 8 x 1.25	1.7
Bolt retaining rubber block, crankshaft end, to engine	M 12 x 1.25	5
Bolt retaining engine block to crankshaft end support	M 10 x 1.25	3.1

10.

PART	Thread	Tightening torques daNm
Bolt retaining crankshaft end power unit fastening link	M 10 x 1.25	4.2
Bolt retaining body shell end power unit fastening link	M 10 x 1.25	4.2
Bolt retaining gearbox end rubber block bracket	M 8 x 1.25	1.6
Bolt retaining rubber block to gearbox end bracket	M 12 x 1.25	8.5
Bolt retaining support for rubber block to body shell, gear-box end	M 10 x 1.25	3.1
Bolt joining gearbox end rubber block brackets	M 10 x 1.25	6
Bolt joining rubber block to gearbox end support	M 10 x 1.25	6
Self-locking nut for retaining rubber block to gearbox	M 10 x 1.25	6
Bolt retaining gearbox end rubber block	M 12 x 1.25	8.5
Self-locking nut retaining middle rubber block bracket	M 12 x 1.25	5
Bolt retaining middle rubber block bracket to differential	M 10 x 1.25	5
Bolt joining middle rubber block to supports	M 12 x 1.25	8.5
Bolt retaining middle block to body shell support	M 10 x 1.25	3.1
Bolt retaining middle block support to body shell	M 8 x 1.25	1.8

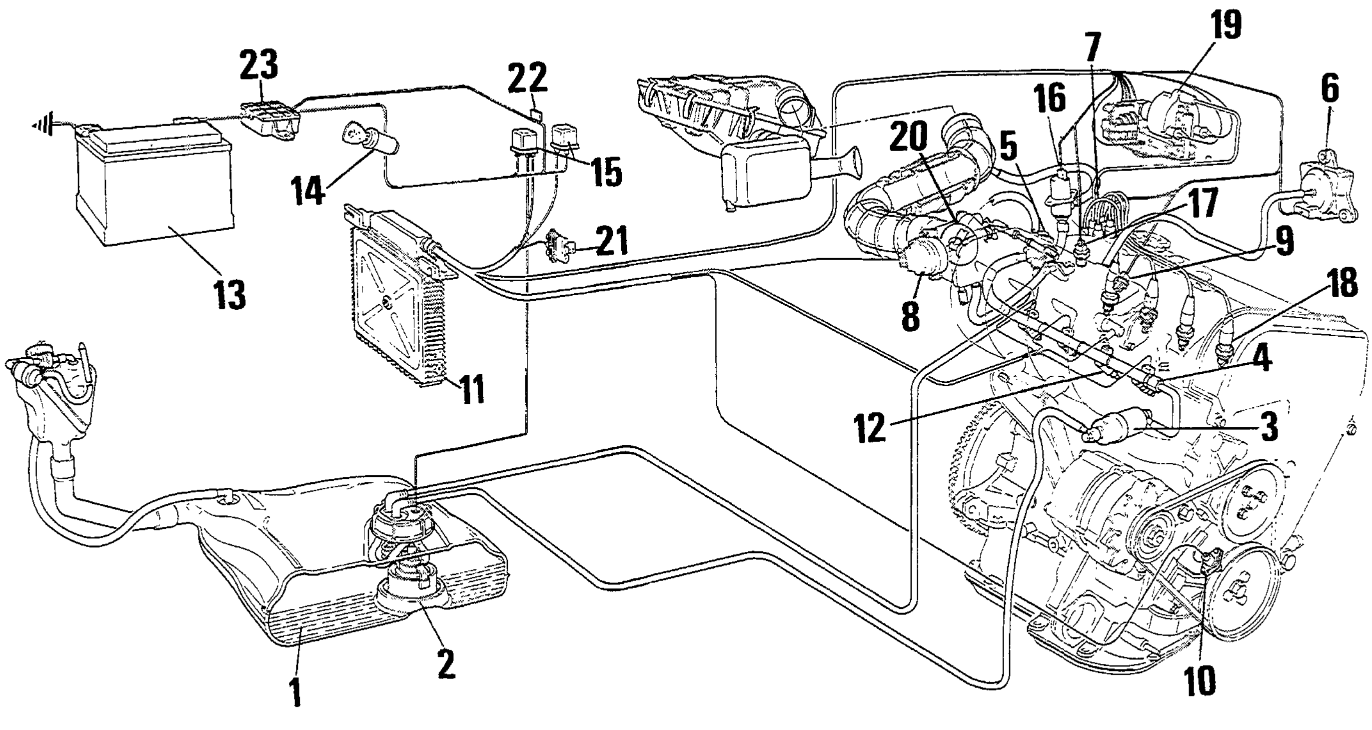
page

WEBER INJECTION/IGNITION SYSTEM

The IAW (Weber injection/ignition) system integrates the static advance digital electronic ignition system with an intermittent type, multipoint, low pressure electronic fuel injection system developed by Weber S.p.A. in conjunction with marelli Autronica.
This device reduces the number of elements which currently make up the ignition and injection systems by utilizing a single electronic control unit; it also has one set of cables and a single set of common sensors.

Ignition system operating principle

The electronic control unit **memorizes a mpa containing the entire range of optimum advance values which the engine can use in its operating range according to the engine speed and load** (= instant vacuum value in the manifold) **developed.**
These values have been obtained experimentally, using an exhaustive series of practical tests carried out on prototypes at the test bench, until it was possible to determine the advances which give the best compromise between the contrasting requirements of maximum power and minimum fuel consumption and harmfuul exhaust emissions.



Wiring diagram for Prisma 4WD injection/ignition system

1. Fuel tank
2. Electric fuel pump
3. Fuel filter
4. Fuel manifold
5. Fuel pressure regulator
6. Intake air absolute pressure sensor
7. HT distributor with injection timing sensor
8. Butterfly valve position sensor
9. Intake air temperature sensor
10. Rpm and TDC sensor
11. Electronic control unit
12. Injectors
13. Battery
14. Ignition switch
15. Injection/ignition relays
16. Supplementray air soleonid valve for automatic engine idle adjustment
17. Coolant temperature sensor
18. Spark plugs
19. Ignition unit
20. Butterfly valve
21. Diagnostic socket (located near the injection control unit connector)
22. IAW system protective fuse
23. Vehicle electrical system connector block

10.

The optimum advances are then memorized in the system control unit. Whilst the engine is operating the centraol control unit (11) is constantly supplied information concerning the following conditions **speed** (= engine speed) and **load** (= vacuum in the inlet manifold of the engine and on the basis of this information **it selects from its memory the advance value required** by the engine to control the ignition unit power module so that the spark reaches the spark plug in the cylinder during the explosion stroke with the optimum advance. Following the command from the control unit (11), the unit ignition module (19) causes a current to pass through the ignition coil primary circuit until it is completely energized and consequently cuts off the passage of this current and trhough self-induction there is an extremely high voltage in the secondary winding and the spark reaches the spark plug.
This information which the control unit (11) needs is trasmitted by means of electrical signals emitted by the foloowing two sensors:

a) **Rpm and TDC sensor (10)** which produces a **single-phase alternating** signal whose frequency indicates the engine speed and together with the timing sensor helps to determine the TDC position for the pairs of pistons in cylinders 1-4 and 3-2.
b) **Absolute pressure sensor (6)** which produces a **continuous current** signal whose voltage value is proportional to the absolute pressure value in the inlet manifold to which the sensor is connectred by means of a pipe.

Injection system operating principle

This consists of calculating **the exact weight of the air drawn in by the engine at each phase** of its operation by mens of an indirect measuring system (*) known as : **engine speed - density** of the air drawn in. This injection system uses a **micro computer** to calculate the exact weight of the air drawn in by the engine during the various operating stages in order to control the correct length of the injection period for the cylinder which is pre-set according to the instant read out of the engine operating conditions supplied by the following sensors:

1. Rpm and TDC sensor
2. Timing sensor located in the H.T. distributor
3. Absolute pressure sensor
4. Coolant temperature sensor and air intake temperature sensor
5. Butterfly valve position sensor

In addition, the solenoid valve for the automatic adjustment of the idle speed is also connected to the control unit. It causes the flow of supplementary air:

a) to sustain the "idling" with the engine warm (operating temperature) even when the external engine load varies suddenly when on of the accessories is switched on;
b) to determine a yfast idle" speed capable of sustaining the engine during cold starting and when testing its efficiency.

(*) The engine speed-intake air density method is based on the following calculation of the weight (mass) of the air drawn in and the weight of petrol to be injected to obtain the correct mixture strength (= air/petrol weight ratio):

Theoretical volume (V_T) of air drawn in per cycle

$$V_T = \frac{\text{engine idle speed}}{2} \text{ x capacity}$$

Actual volume (V_R) of air drawn in per cycle

$$V_R = V_T \,.\, \mu_v$$

where μ_v = engine volumetric output at various speeds

Actual volume (M_R) (mass) dof air drawn in by engine per cycle

$$M_R = V_R \,.\, \frac{P}{T}$$

where:

P = absolute pressure in engine inlet manifold
T = absolute temperature of intake air.

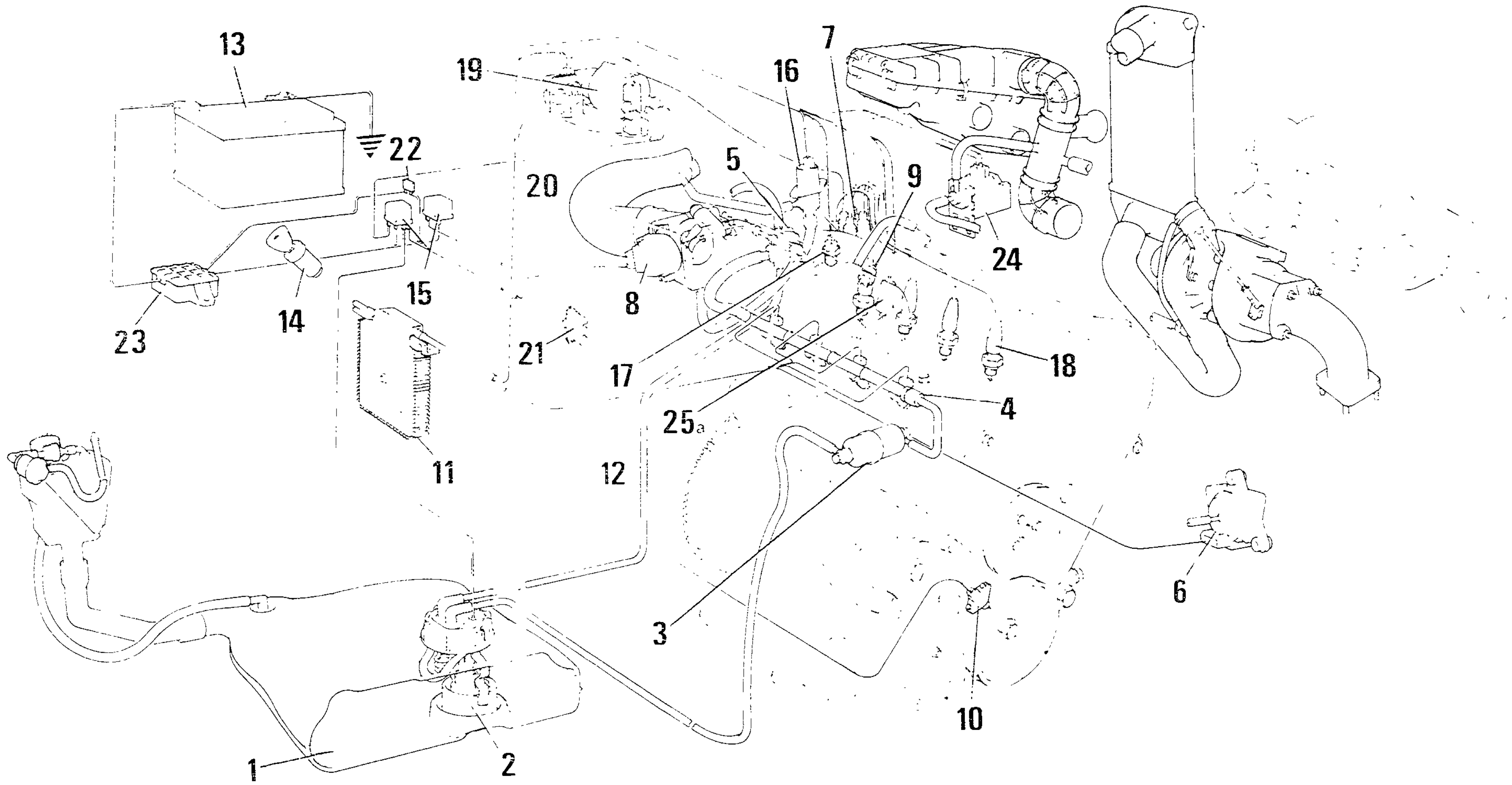
The amount (Q_B) of petrol to be injected depends on the stoichiometric ratio α desired and also on the injector flow constancy characteristic K

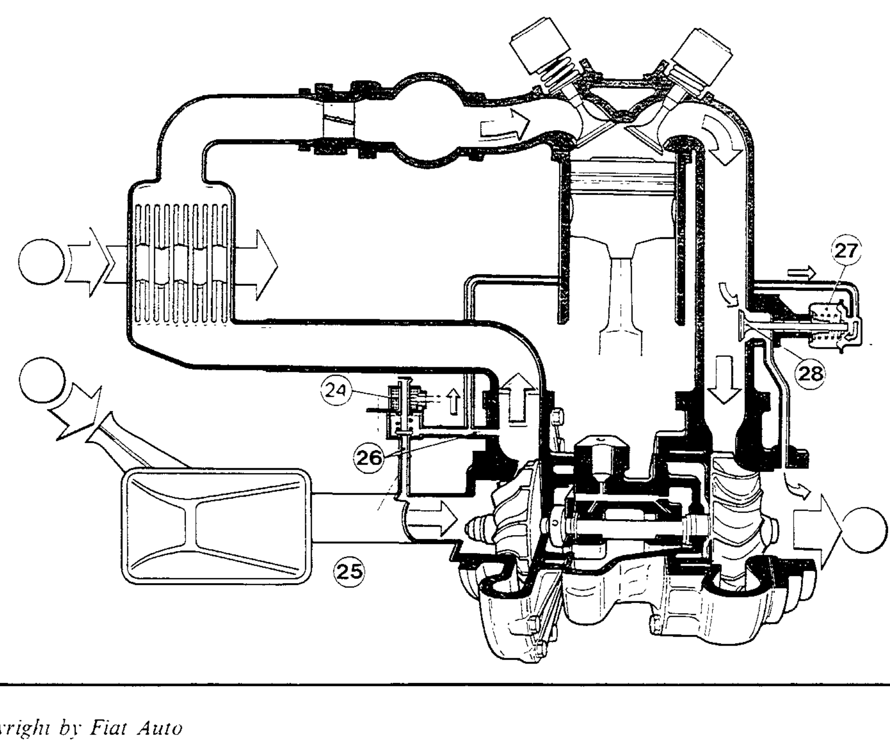
$$Q_B = \frac{1}{\alpha} \,.\, K \,.\, V_R.$$

Since during normal operation the injector injects fuel for each half revolution of the crankshaft, it makes a note of the engine speed and the amount of fuel to be injected to each open injector.
To sum up:

$$Q_B = K \,.\, \frac{\mu_v}{\alpha} \text{ rpm } \,.\, \frac{\text{capacity}}{2} \,.\, \frac{P}{T}$$

DELTA HF 4WD TURBO IAW INJECTION/IGNITION SYSTEM WIRING DIAGRAM





Key

1. Fuel tank
2. Electric fuel pump
3. Fuel filter
4. Fuel manifold
5. Fuel pressure regulator
6. Intake air absolute pressure sensor
7. HT distributor with injection timing sensor
8. Butterfly valve position sensor
9. Intake air temperature sensor
10. Rpm and TDC sensor
11. Electronic control unit
12. Injector
13. Battery
14. Ignition switch
15. Injection/ignition relays
16. Additional air solenoid valve for automatic adjustment of the engine idle speed
17. Coolant temperature sensor
18. Spark plugs
19. Ignition unit
20. Butterfly valve
21. Diagnostic socket
22. Fuse
23. Connector
24. Over-boost solenoid valve
25. Air intake duct from the filter

25a. Detonation sensor

26. Compressed air ducts from the turbocharger
27. Supercharging adjustment actuator
28. Wastegate valve

ANTI-DETONATION AND OVER-BOOST DEVICES

The IAW system fitted on the Delta 4WD differs from the one on the Prisma 4WD through the addition of anti-detonation and over-boost devices.

Anti-detonation device: this comprises a sensor (25a) bolted onto the cylinder head and connected to terminals 6 and 22 of the ignition injection control unit (11) in order to adjust the intensity of the vibrations (knocking) caused by the detonation in the combustion chamber whilst the engine is running. If this is the case, the sensor (25a) informs the ignition injection control unit (11) so that it can quickly reduce the engine ignition advance values. The reduction of the advance values takes place when the system recognizes "engine knock" due to detonation as distinct from normal combustion.
The advance curve for a given engine load is reduced by around 5°.
If the detonation should still persist, the advance is further reduced by 5° at a time up to a maximum of 15°. After a certain number of operating cycles without knocking the advance is then gradually reinstated to its original value. The advance curve cannot be reduced by more than 15° in relation to the original curve according to the engine load conditions, supercharging pressure and engine speed.
This device is essential in safeguarding the life of the engine as detonation can very easily occur whilst the engine is being supercharged.

Over-boost device: this closes the wastegate valve (28) so that all the exhaust gases blow into the turbine increasing the revs so that the speed of the compressor, connected to it, increases and causes an increase in the engine supercharging pressure (with a consequent increase in torque and or engine power).
When the device is activated the ignition injection control unit operates the solenoid valve (24), through terminal 16, which, on opening, places the wastegate valve actuator diaphragm (27) at atmospheric pressure via sleeves (25) and (26). The decrease in pressure at the wastegate actuator (27) obtained in this way causes the closure of the valve (28) and as a result prevents a substantial amount of exhaust gases from bypassing (i.e. avoiding) the turbine.
This device operates in two ways: it can increase the torque by 10% for a short period if the accelerator pedal is fully depressed when the engine speed is between 2000 rpm and 5300 rpm (it operates for a maximum of 30 secs to a minimum of secs). Or it can increase the maximum power of the engine for a limited length of time if the accelerator pedal is fully depressed starting at a speed of ⩾ 5000 rpm. The information conerning the engine speed is transmitted to the injection/ignition control unit by means of the rpm and TDC sensor (10).

COMPOSISTION OF IAW SYSTEM

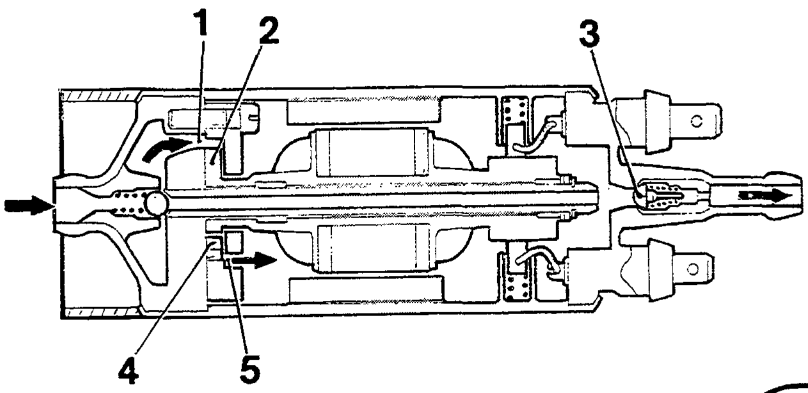
The Weber electronic injection/ignition system comprises three independent circuits, namely:

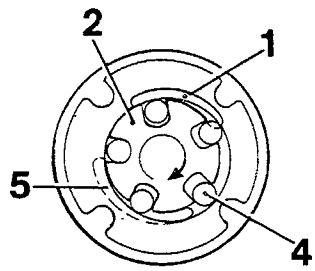
A. FUEL SUPPLY CIRCUIT

It comprises the following components: (see key on page 1)
- a tank (1)
- an electric pump (2)
- a filter (3)
- a fuel pressure regulator (5)
- four injectors (12)

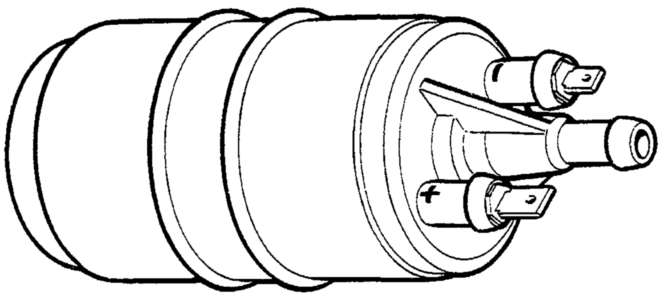
Electric fuel pump

The electric pump (2) is located in the tank where it draws in the fuel and sends it through the filter (3) to a distribution manifold (4) which shares it out equally amongst the injectors (12). The pressure of the fuel in the circuit is kept constant by means of a pressure regulator (5) which keeps the excess fuel in check by making it flow back to the tank (1).



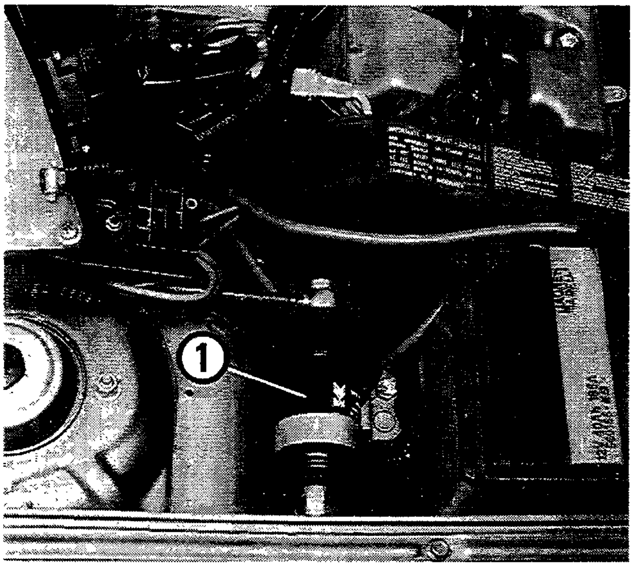


1. Inlet opening
2. Impeller
3. Non-return valve
4. Rollers
5. Delivery opening
6. Excess pressure valve



Electric fuel pump assembly and cross sections

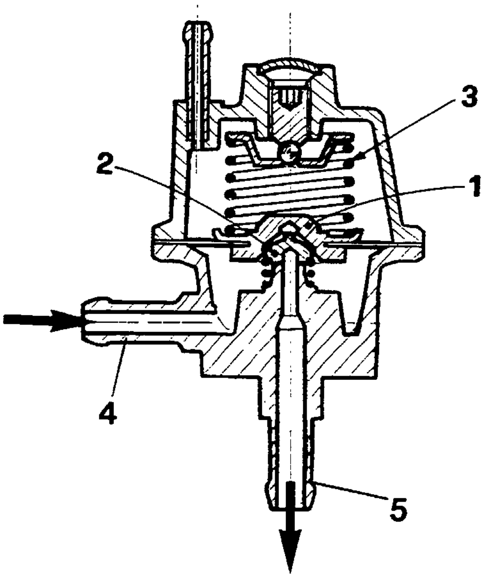
The electric pump is of the volumetric roller type with a motor energized by permanent magnets immersed in the fuel (2).
The impeller rotates, driven by the motor, creating volumes which move from the inlet opening (1) to the delivery opening (5). These volumes are defined by the rollers (4) which adhere to the outer race whilst the motor rotates.
The pump has two valves: one non-return valve to prevent the fuel circuit emptying when the pump is not operating and an excess pressure valve which short circuits the delivery with the inlet when the pressure exceeds 5 bar to prevent the electric motor from overheating.



Fuel filter (1)

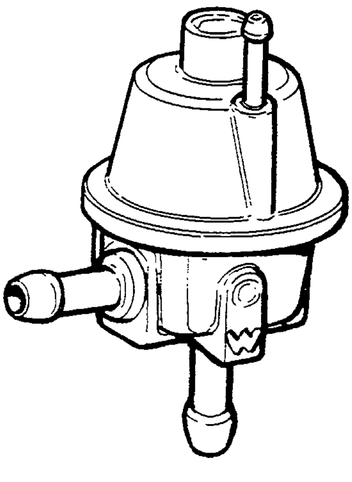
It has the task of trapping any impurities which may be present in the fuel as the injectors are extremely sensitive to foreign bodies.
It comprises a paper filter element with a surface area of around 1200 cm^2 and a filtering capacity of 10 μm.
The filter is fitted in the engine compartment between the pump and the fuel manifold.

NOTE *An arrow stamped on the filter casing shows the direction of the fuel. The filter should be replaced every 20,000 km or if it has been incorrectly fitted and worked like that even for a short length of time.*



Fuel pressure regulator

1. Diaphragm plate
2. Valve
3. Opposing spring
4. Fuel arriving under pressure from the injector manifold
5. Excess fuel outlet returning to the tank



The regulator is a device which maintains the pressure rise at the injectors constant.
It is of the differential diaphragm type and is adjusted during assembly at a pressure of 2.5 bar.
The fuel coming from the pump at a given pressure causes a thrust which is opposed by the calibrated spring (3) on the diaphragm plate (1) and the valve (2) below.
When the pressure exceeds the pre-set value (2.5 bar) the valve (2) moves and consequently the excess fuel flows back into the tank.
In order to maintain the rise in pressure at the injectors constant the difference between the pressure of the fuel and the absolute pressure of the air in the inlet manifold should be constant; this has been achieved by connecting the chmamber housing the calibrated spring (3) with the inlet manifold by means of a pipe.

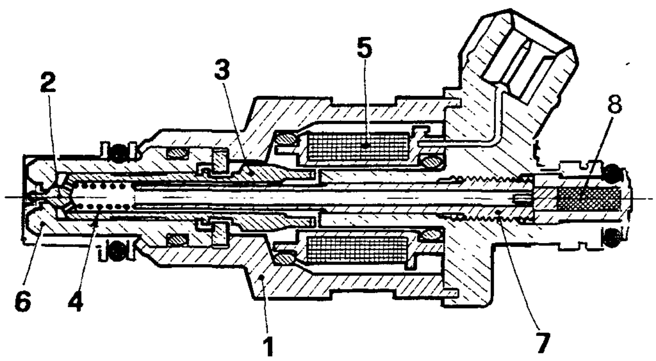
NOTE *The pressure regulator has been preadjsuted and if it is faulty it must be replaced.*

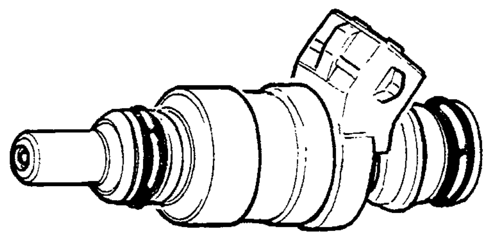
Injectors

The injectors control the amount of fuel which enters the engine.
An injector is a device which can only assume two positions: open or closed.
It comprises a casing (1) and a needle (2) which are fixed to the magnetic armature (3).
The needle (2) is thrust against the seat by a helical spring (4) whose loading is determined by an adjustable pusher.
In the rear section of the injector casing there is a winding (5) whilst in the front part there are the needle seats.
The electrical impulses coming from the electronic control unit create a magnetic field in the winding which attracts the armature (3) and causes the injector to open.
Taking the physical characteristics of the fuel (viscosity, density) and the rise in pressure (duue to the pressure regulator) as constant, the amount of fuel injected depends solely on the length of time the injector is open (injection time) which is established by the electronic control unit according to the engine operating conditions.
The jet of fuel at the differential pressure of 3 bar which comes out of the injector nozzle is instantly atomized forming a cone of around 30°.
The fuel is injected into the inlet manifold for each cylinder upstream of the inlet valve.
The control of the injectors is of the "sequential phased" type, in other words, the four injectors are controlled according to the intake order of the engine cylinders whilst the supply can already start for each cylinder during the expansion stroke until the intake stage has already begun.

Injector assembly and longitudinal section

1. Injector casing
2. Needle
3. Magnetic armature
4. helical spring
5. Winding
6. Front section of injector
7. Adjustable pusher
8. Fuel filter



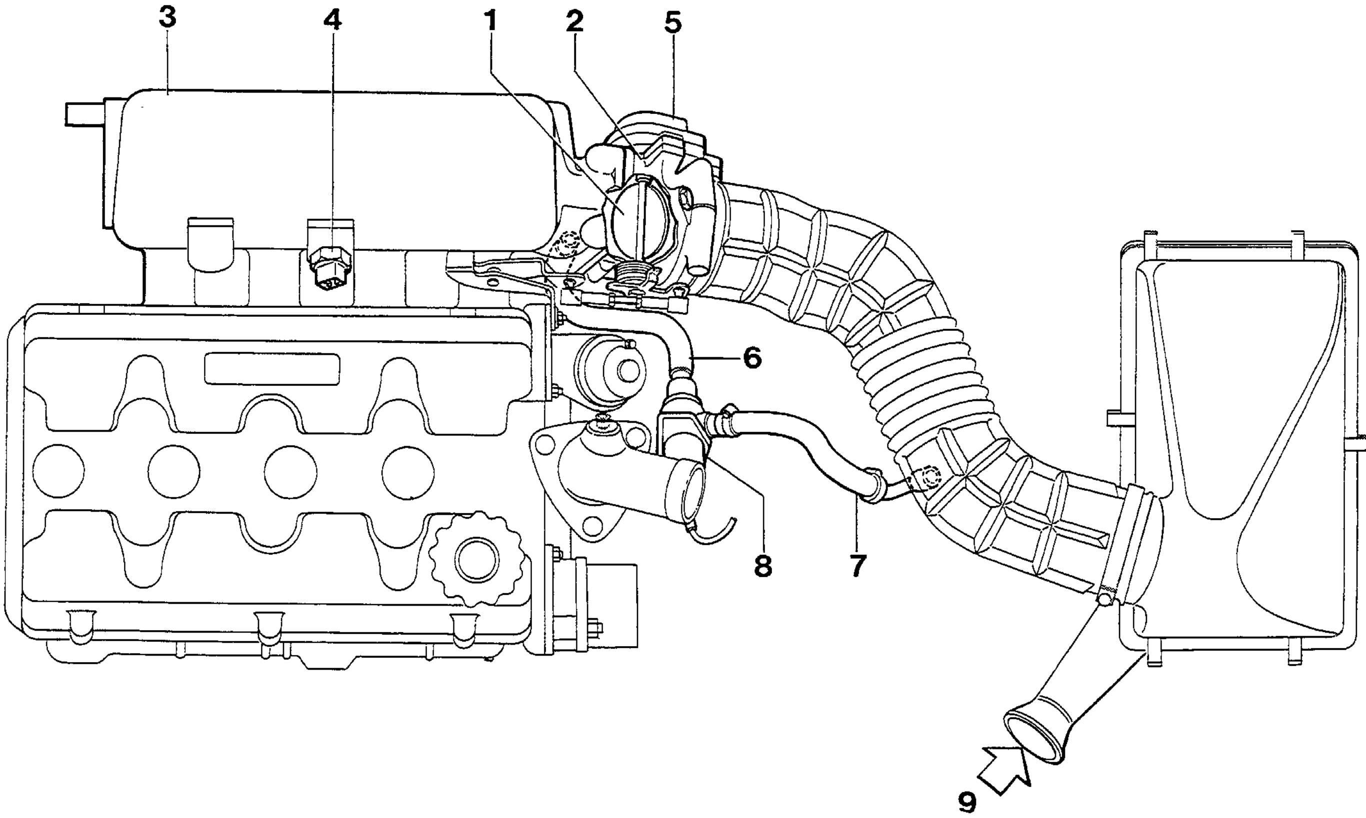


B. AIR INTAKE CIRCUIT

It basically comprises the following components:
- air filter
- air inlet manifold
- butterfly casing
- intake air temperature sensor
- intake air absolute pressure sensor
- idle speed automatic adjustment additional air solenoid valve.

10.

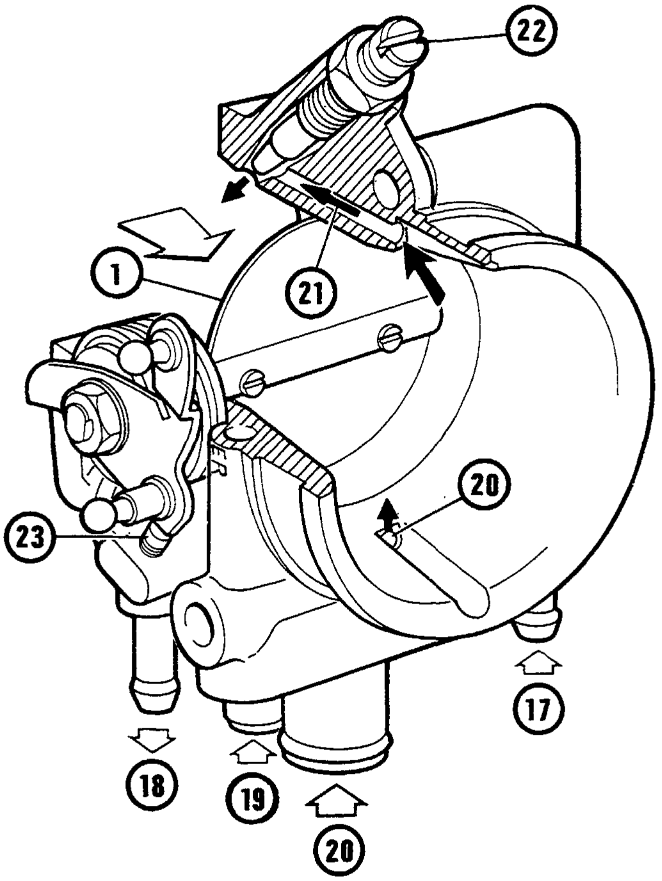
Inlet manifold and butterfly casing



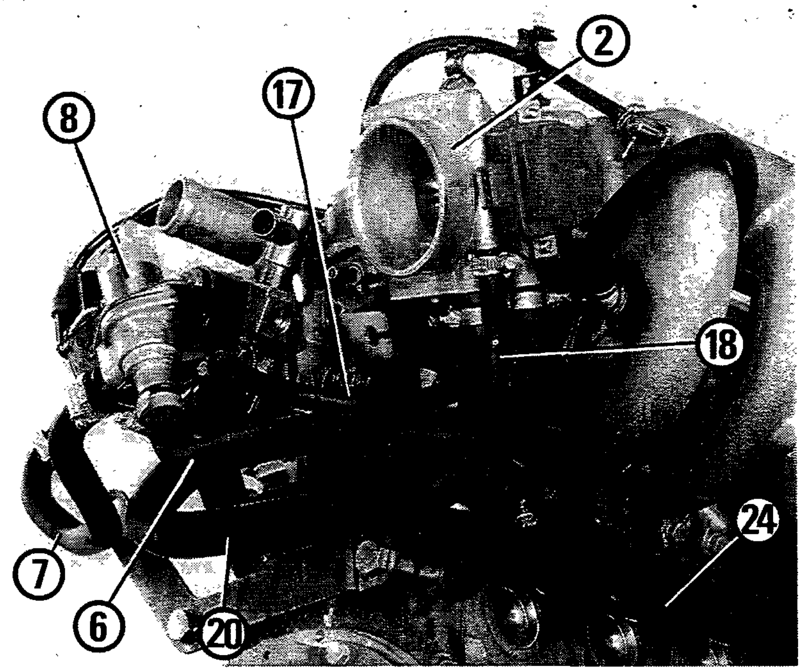
1. Butterfly valve
2. Butterfly casing
3. Inlet manifold
4. Intake air temperature sensor
5. Butterfly valve position sensor
6. Supplementary air sleeve solenoid valve
7. Supplementary air intake solenoid valve
8. Supplementary air solenoid valve for automatic adjustment of idle speed and checking efficiency of engine when cold
9. Air filter

The manifold contains the air temperature sensor (4) and the vacuum pick ups for the absolute pressure sensor, the fuel pressure regulator and the servo brake.
In addition, it also houses the sets for fixing the injectors.
The amount of air drawn in during idling depends on the adjustment of the butterfly valve closing position. **The butterfly stop adjustment screw in the butterfly casing (23) (see overleaf) should not be tampered with; it is checked by "fluxing" the butterfly casing during assembly at the factory.**
It is possible to alter the opening of the by-pass channel (21) by means of the idle pre-adjustment screw (22) to ensure that when the engine is warm the idle speed is 50 rpm below the normal idle speed (compared with when it is adjusted by the idle speed adjustment soleonid valve).

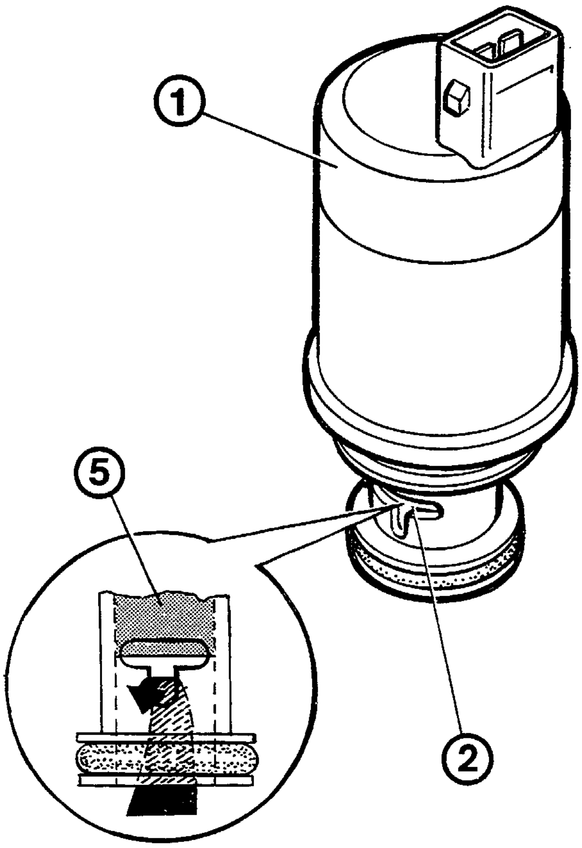
Lastly, the butterfly casing is heated by the coolant to prevent the engine being supplied with cold air since this could cause condensation of the fuel and consequently poor carburation.



17. Coolant arriving from the engine to heat the butterfly casing
18. Coolant returning from the butterfly casing to the engine
19. Air arriving from the idle speed adjustment solenoid valve
20. Gas arriving for ventilation of the crankcase
21. By-pass channel
22. Idle speed pre-adjustment screw
23. Butterfly valve stop screw
24. Coolant return sleeve to the pump

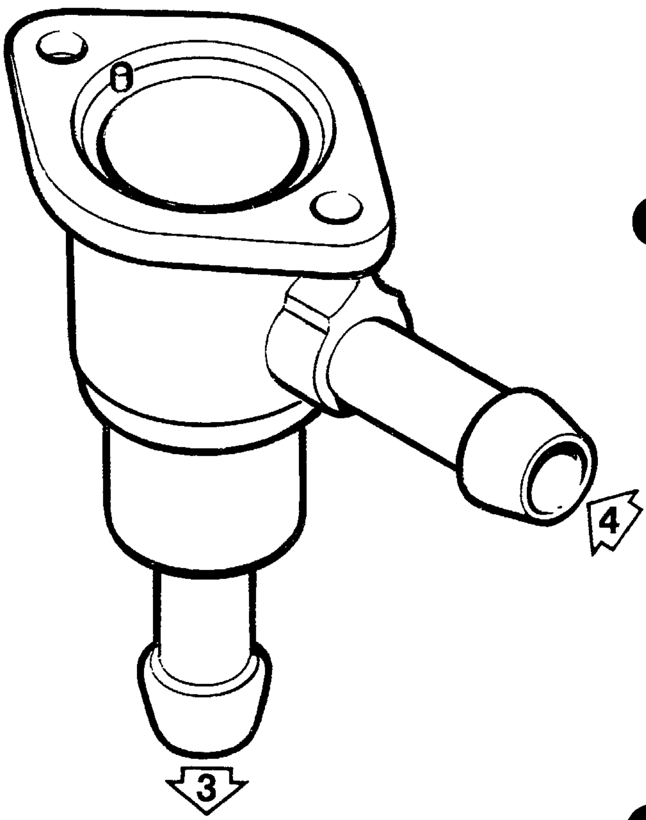


Engine components:
butterfly casing and connecting pipes



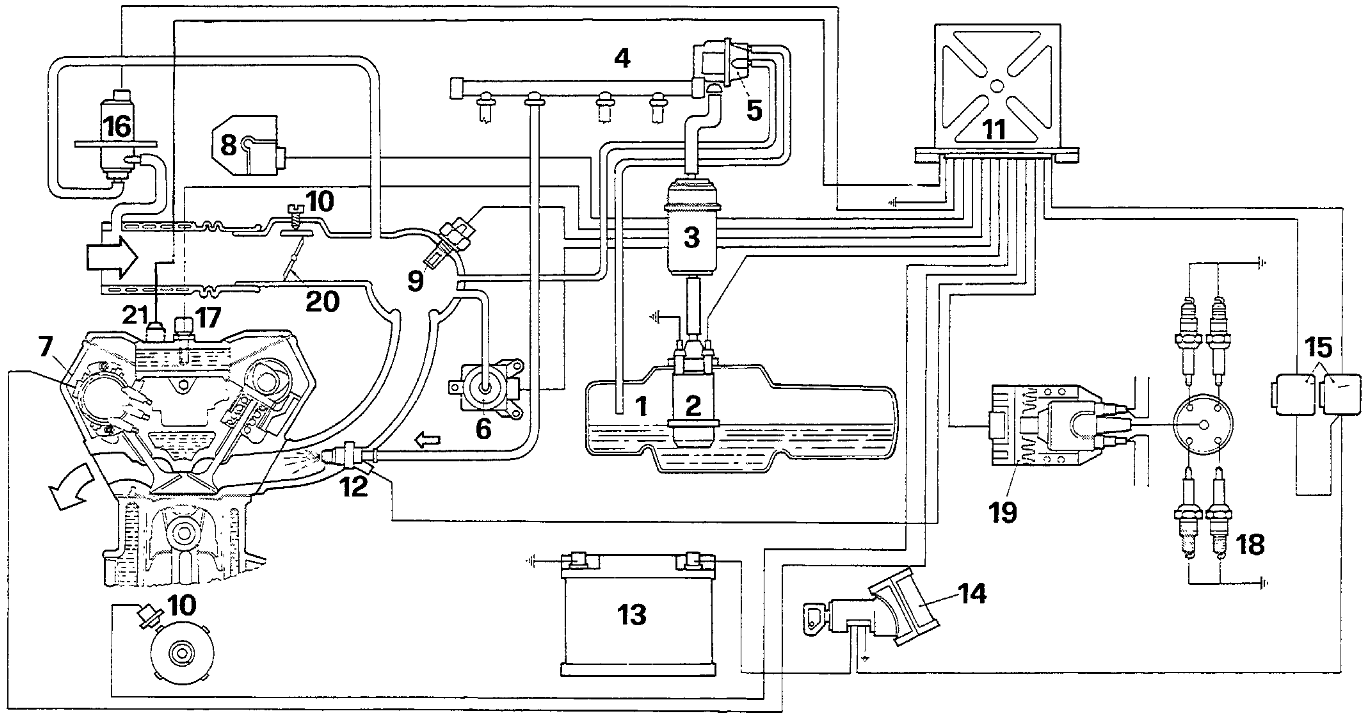
Idle speed supplementary air solenoid valve

1. Solenoid
2. Flow of supplementary air for automatic adjustment of idle speed and checking efficiency of engine when cold
3. Air outlet towards the butterfly casing downstream of the butterfly valve
4. Arrival of air from the filter
5. Piston adjusting air flow quantity. It is moved by the variation in magnetic flux developed in the solenoid (1).



This involves a proportional type solenoid valve with a variable size air flow.
A variable duty cycle electronic device with a frequency of 90 Hertz controls the supply to the winding of the above mentioned valve. if the engine speed frequency decreases during idling the effective current which supplies the solenoid valve winding (1) increases creating the maximum air flow openign (2). If the engine speed increase during idling the effective current absorbed by the solenoid winding decreases to a few tenths of an Ampere. consequently, the openign (1) of the additional air flow is restricted and the engine speed decreases.
This device makes it possbiel to (automatically) maintain the engine speed constant during idling even when the external load conditions vary slightly because the automatic gearbox is engaged or the power assisted steering is at the end of its travel or the alternator is operating a maximum output. When the engine is running cold or when it is warming up this valve allows the engine to operate at the fast idle speed**In these conditions the coolant temperature sensor signals the need for enrichment of the mixture strength to the control unit.**

WIRING DIAGRAM

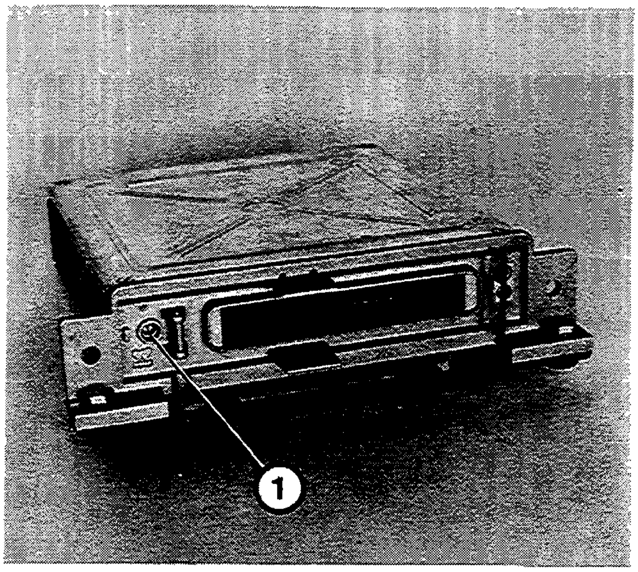


1. Fuel tank
2. Electric fuel pump
3. Fuel filter
4. Fuel manifold
5. Fuel pressure regulator
6. Intake air absolute pressure sensor
7. High tension distributor with injection timing sensor
8. Butterfly valve position sensor
9. Intake air temperature sensor
10. Rpm and TDC sensor
11. W.I.I. electronic control unit
12. Injector
13. Battery
14. Ignition switch
15. IAW injection/ignition system relays
16. Engine idle speed automatic adjustment supplementary air solenoid valve
17. Coolant temperature sensor
18. Spark plug
19. Ignition unit
20. Butterfly valve
21. Anti-detonation sensor (for Delta HF 4WD turbo only).

C) ELECTRICAL CIRCUIT

It basically comprises an electronic control unit (11) to which the following components are connected:

- Butterfly valve position sensor (8)
- Air temperature sensor (9)
- Four injectors (12)
- Absolute pressure sensor (6)
- Electric fuel pump (2)
- Rpm and TDC sensor
- Injection timing sensor (7) in the H.T. distributor
- Coolant temperature sensor
- Ignition coil with power moduel (19)
- Two relays (15)
- Ignition switch with key (14)
- Battery (13)



Electronic control unit

The Weber electronic injection/ignition system control unit is of the digital type with a micro computer which controls the parameters concerning the supply and ignition of the engine, namely:

- the amount of fuel supplied to each cylinder in sequence (1-3-4-2– in a single delivery;
- the start of the fuel supply (injection timing) in relation to the intake for each cylinder;
- the ignition advance.

In order to calculate the above parameters the control unit makes use of the following input signals:

- absolute pressure inside the inlet manifold;
- air intake temperature;
- coolant temperature;
- engine speed;
- position of each pair of cylinders in relation to TDC and engine timing;
- opening (or closure) position of the butterfly valve.

The control unit governs the operation of the ignition unit and the length of the sequence opening and timing of the individual injectors.

In addition to the above mentioned parameters it makes use of the following:

a) **Cut-off:** this device cuts off the flow of fuel into the engine each time the acceleartor pedal is released when the vehicle is slowing down. It has a fixed cut-off operating range whilst the speed at which the injection is renewed is variable and takes place when the engine is warm at speeds above 1100 rpm and when the engine is cold at speeds above 1800 rpm with the butterfly valve closed. At lower speeds the injection is renewed.

b) When the butterfly opening is › 30°, in other words during maximum power conditions, in order to exploit the maximum flame speed propagation during combustion, the mixture strength is suitably **enriched.**

c) During acceleration the amount of fuel injected must be considerably higher than the stoichiometric ratio for when the engine is operating at a normal speed.
The condition of acceleartion is recognized by the control unit by a rapid variation in the opening angle of the butterfly valve which the appropriate sensor undergoes when the accelerator is opened rapidly.

d) During cold starting the mixture strength is enriched in a manner which is inversely proportional to the temperature of the coolant.
In addition, under these conditions the engine speed is increased **(fast idle)** given that the control unit activates the automatic idle speed adjustment supplementary air solenoid valve.

NOTE *There is a special screw protected by an anti-tamper plug (1) in the electronic control unit to adjust the percentage of CO in the exhaust gases.*
This screw should be adjsuted very carefully making sure not to force it or break the adjustment trimmer which would mean that the complete control unit would have to be replaced.

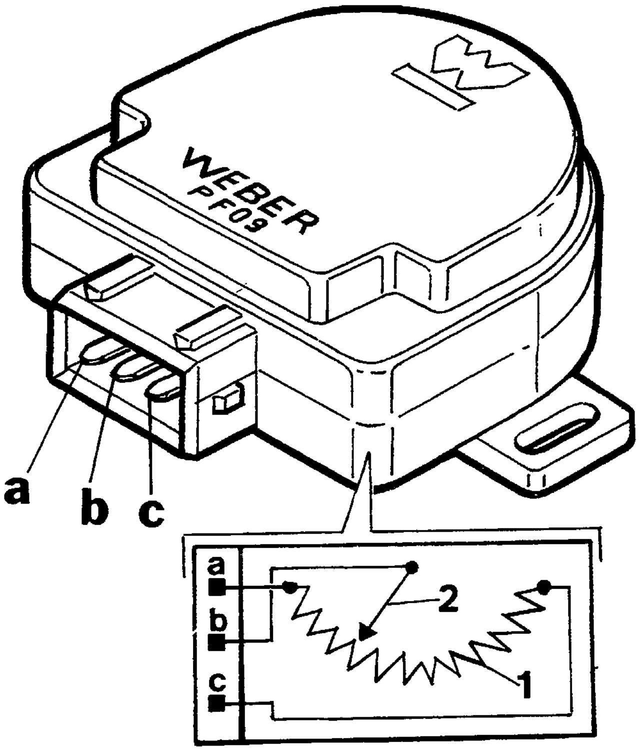
Butterfly valve position sensor (3)

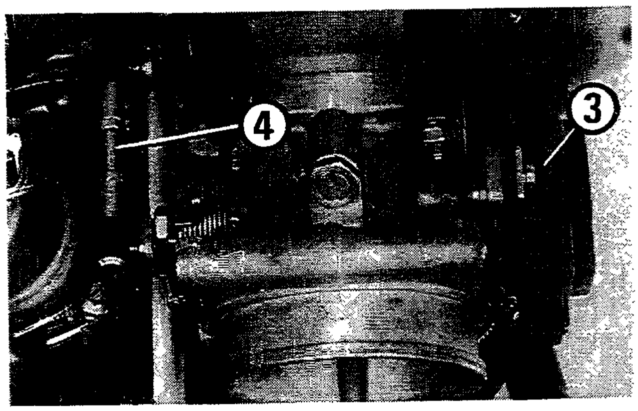
This comprises a potentiometer (1) the moveable part (2) of which is directly operated by the butterfly valve shaft.
During operation, the control unit supplies the potentiometer with a voltage of 5 Volts at terminals (a) and (c).
At terminal (b) the voltage is inversely proportional to the butterfly valve opening position.
According to the voltage sent by the terminal (b) the control unit recognizes the opening condition of the butterfly valve and corrects the mixture strength accordingly.
When the butterfly is closed an electrical voltage signal of ~ 0.5 V reaches the control unit: from this the latter recognizes the idle and cut-off condition (which is differentiated on the basis of the engine speed).
For butterfly valve openings greater than ~30° a voltage signal of around 3.3 V returns to the control unit and increases progressively until it reaches a voltage value of around 5 Volts when the butterfly valve reaches the maximum opening of 80°.

NOTE *When the butterfly valve reaches openings greather than 30° the control unit activates progressive enrichment by operating the injectors for a greater length of time than is necessary to achieve the fuel/air stoichiometric ratio. This strategy is also decided on the basis of the engine vacuum signal.*

Each type of injection control unit works with its own type of bytterfly valve position sensor.

Butterfly valve position sensor wiring diagram



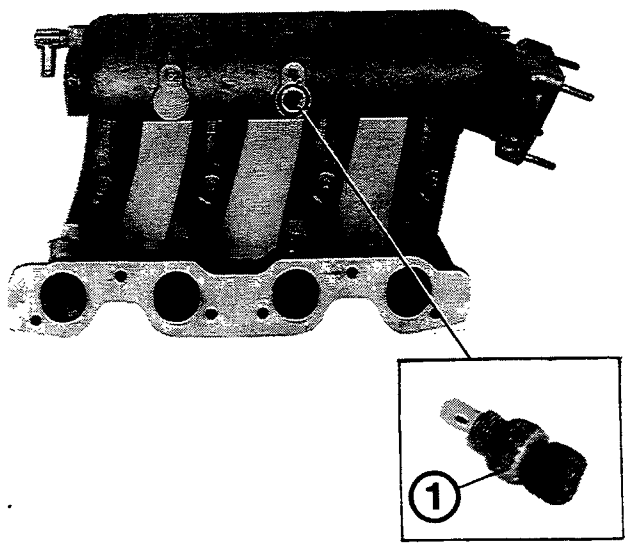


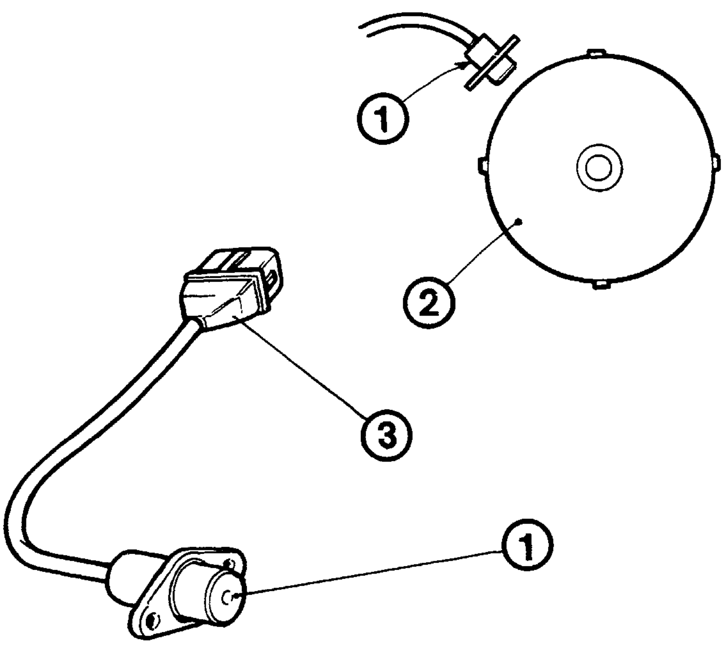
Butterfly valve sensor (3) with control rod (4)

Air temperture sensor (1)

This sensor measures the temperature of the air in the inlet manifold (2) by means of an NTC thermistor.
The electrical signal obtained reaches the electronic control unit where, together with the manifold pressure signal, it is used to calculate the density of the air.

NOTE *NTC means that the resistance of the thermistor decreases as the temperature increases.*





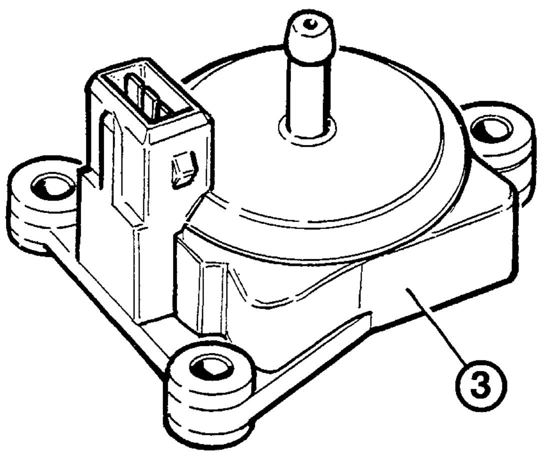
Rpm and TDC sensor (1)

1. Sensor or magnetic impulse generator
2. Crankshaft pulley with 4 projections
3. Connector for connection with electronic control unit

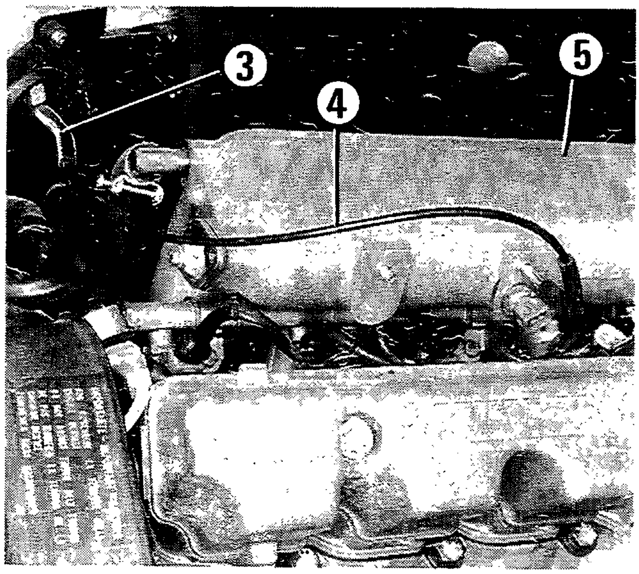
The sensor used is of the variable reluctance type and is facing the pulley (2) fitted on the crankshaft.
The latter has 4 projecting teeth 90° from one another and as each of these pass under the sensor they cause a variation in the flux and consequently an alternating electrical signal.
From the frequency of this signal the electronic control unit is able to obtain information on the engine speed and the TDC position of the pair of cylinders nos. 1 and 4 or 2 and 3 through the 2 projections which are 180° apart.

NOTE *Each TDC measurement for the pulley is facing the sensor exactly at TDC for each pair of cylinders.*

Absolute pressure sensor



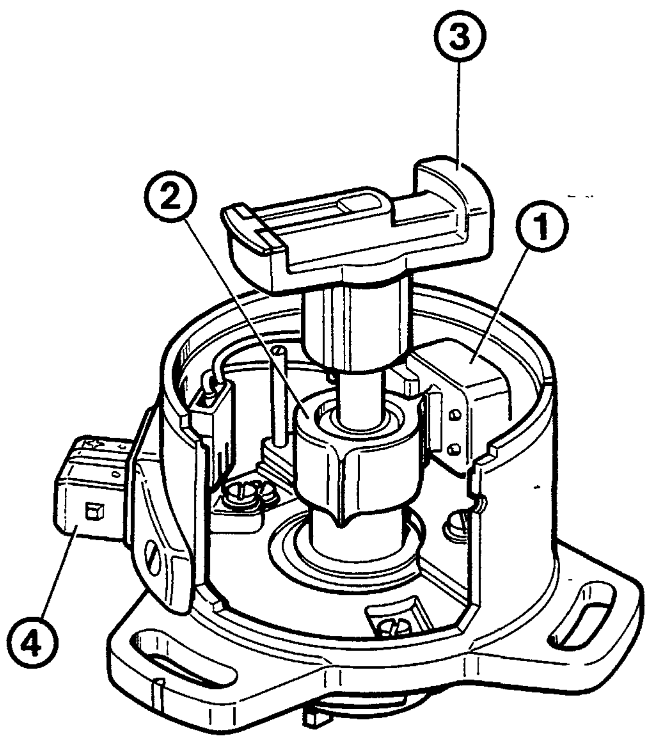
Location of absolute pressure sensor in the engine compartment



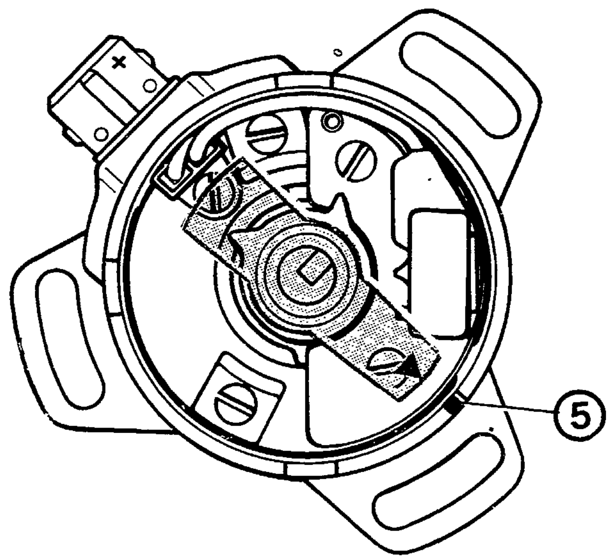
The pressure sensor (3) is a transducer connected by a rubber pipe (4) to the inlet manifold (5) which supplies a voltage signal proportional to the absolute pressure of the air.
The sensor is supplied by the electronic control unit and provides information concerning the absolute pressure of the air in the inlet manifold.
This information, together with the measurement of the temperature of the air and volumetric output corresponding to the engine operating speed, is used to calculate the density of the air.

H.T. distributor with injection timing sensor

The sensor (1) used is of the variable reluctance type and it is opposite a cam (2) with two teeth (90° apart) fitted on the distributor control shaft.
As each tooth passes in front of the sensor an alternating electrical signal is produced in the sensor winding which is sent to the control unit.
The superimposing of the timing sensor and rpm sensor signals on a single map, memorized in the control unit, makes it possible for the latter to identify the operating stage for each cylinder to control the injection adhering to the following sequence (cylinders 1,3,4,2).
A rotor arm (3) with a built in resistance **of 1000Ω distributes the sparks to the 4 spark plugs.** This is the only part of the distributor (together with the cap) belonging to the ignition system.

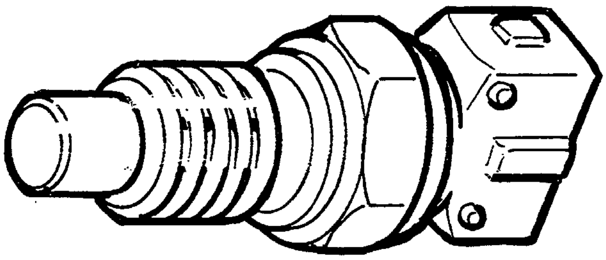


⚠ *If the distributor (and consequently the timing sensor) is not fitted correctly in relation to the correct riming, the control unit will no longer be able to control the injection because it will no longer recognize the engine timing in its memory.*



Distributor with rotor arm and casing opsitioned for correct timing with engine in TDC position

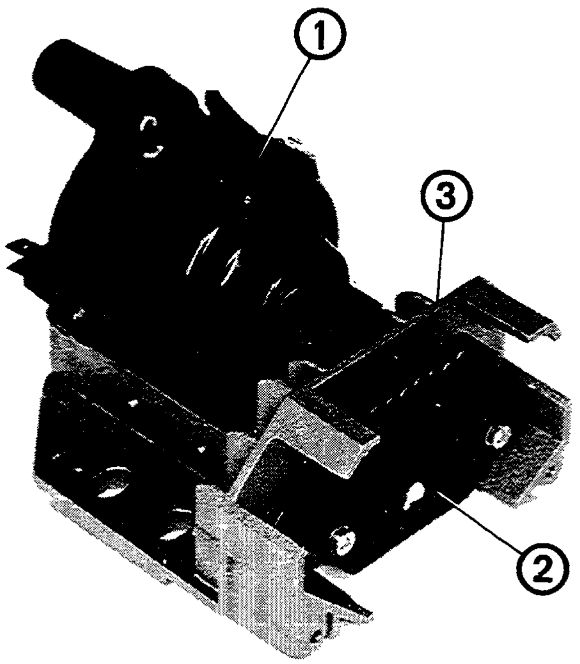
1. Timing sensor or magnetic impulse generator
2. 2 tooth cam or timer
3. H.T. rotor arm
4. Control unit connector terminal
5. Rereference mark with H.T. rotor arm centre line for distributor timing.



Coolant temperature sensor

The sensor comprises an NTC thermistor which measures the temperature of the coolant near the thermostat.
The electrical signal obtained reaches the electronic control unit and is used to correct the mixture strength.

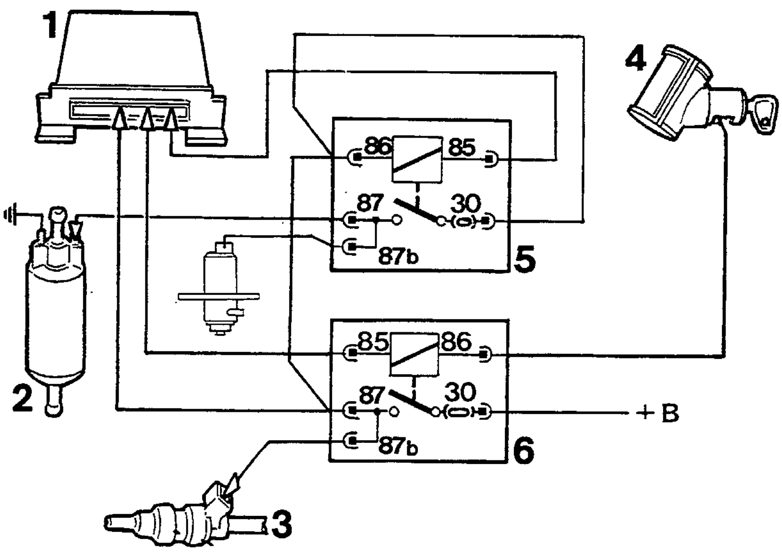
NOTE *N.T.C. means that the resistance of the thermistor decreases as the temperature increases.*



Ignition unit (coil and power module)

1. Ignition coil
2. Power module or ignition control
3. Heat dissipation plate

The ignition system used is of the inductive discharge type.
The ignition unit is composed of a coil and a power module. The latter receives the order to cut off the current from th electronic control unit, which processes the desired ignition advance.
The power module ensures a charge for the constant energy coil whatever the battery charge conditions.



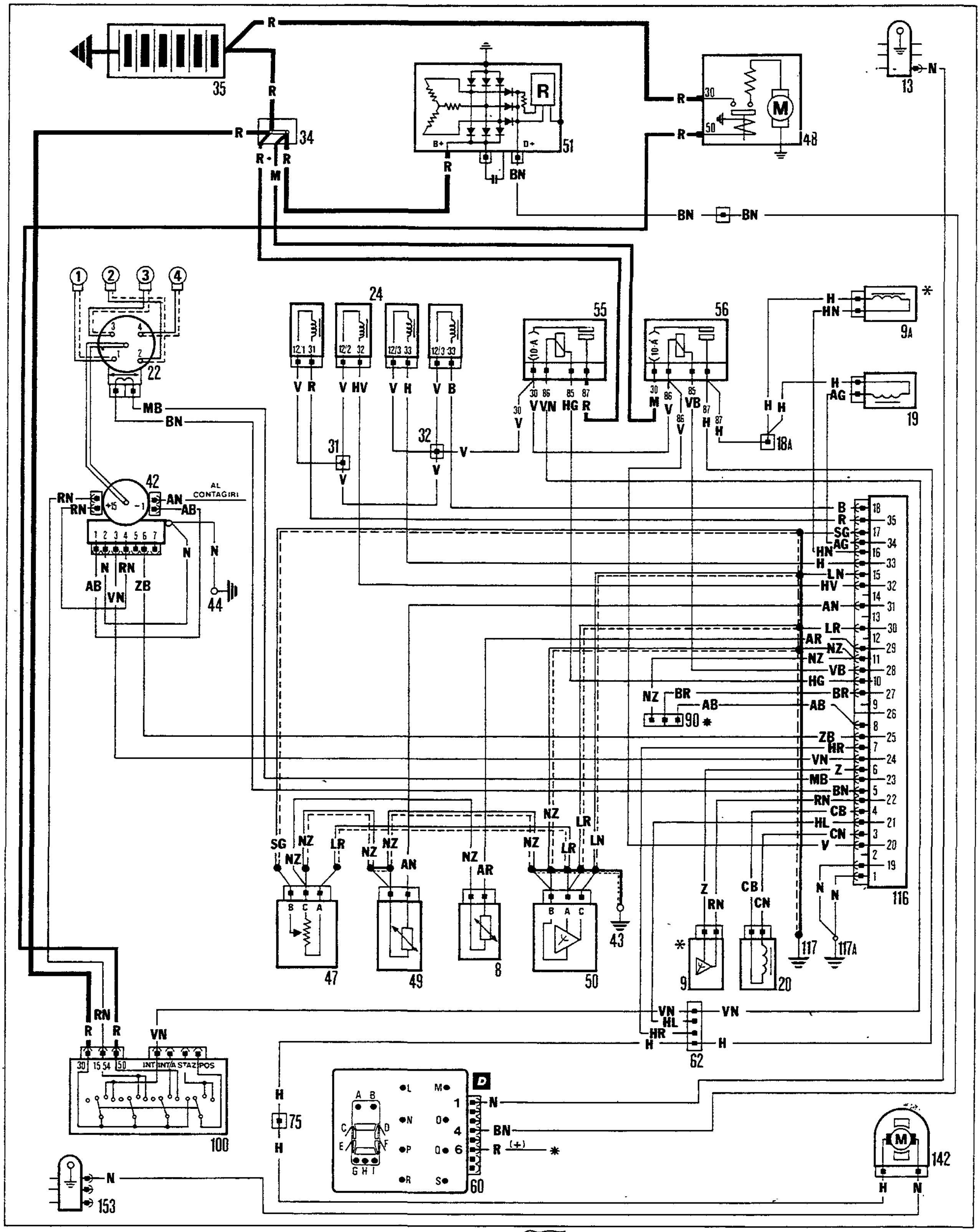
Relays

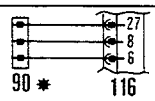
1. Electronic control unit
2. Electric fuel pump
3. Injector
4. Ignition switch with key

5.6. Relays

The post-modification relays are no longer protected by a fuilt in fuse.
Two relays are used in the WEBER injection/ignition system.
The connection to earth of the relay energizing circuits is carried out by the electronic control unit and is protected against pole reversal.
A relay (5) supplies the electric fuel pump and the automatic idle adjustment valve; whilst a second relay (6) supplies the injectors, control unit and electric pump relay feed.

WEBER INJECTION/IGNITION SYSTEM (ante-modification)
(see page 17 for key and cable colour code)



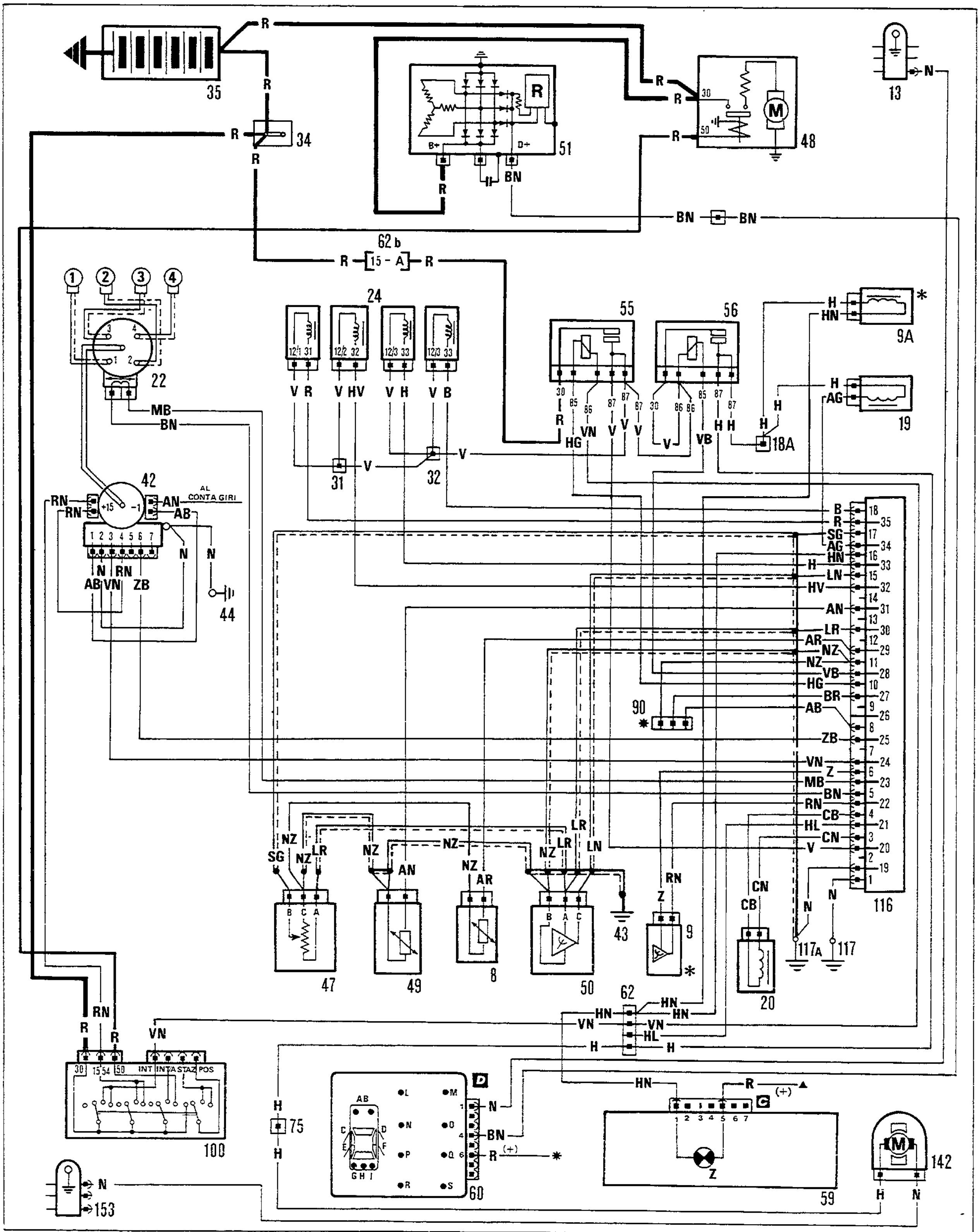


FOR THE PRISMA 4WD

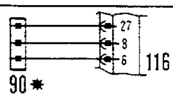
• TO CONNECTOR 6F OF THE CONTROL BOX FUSE BOX
* FOR THE DELTA 4WD TURBO

10.

WEBER INJECTION/IGNITION SYSTEM (post-modification)
(see page 17 for key and cable colour code)



* TO CONNECTOR 61 OF THE CONTROL BOX FUSE BOX
* FOR DELTA 4WD TURBO



FOR PRISMA 4WD

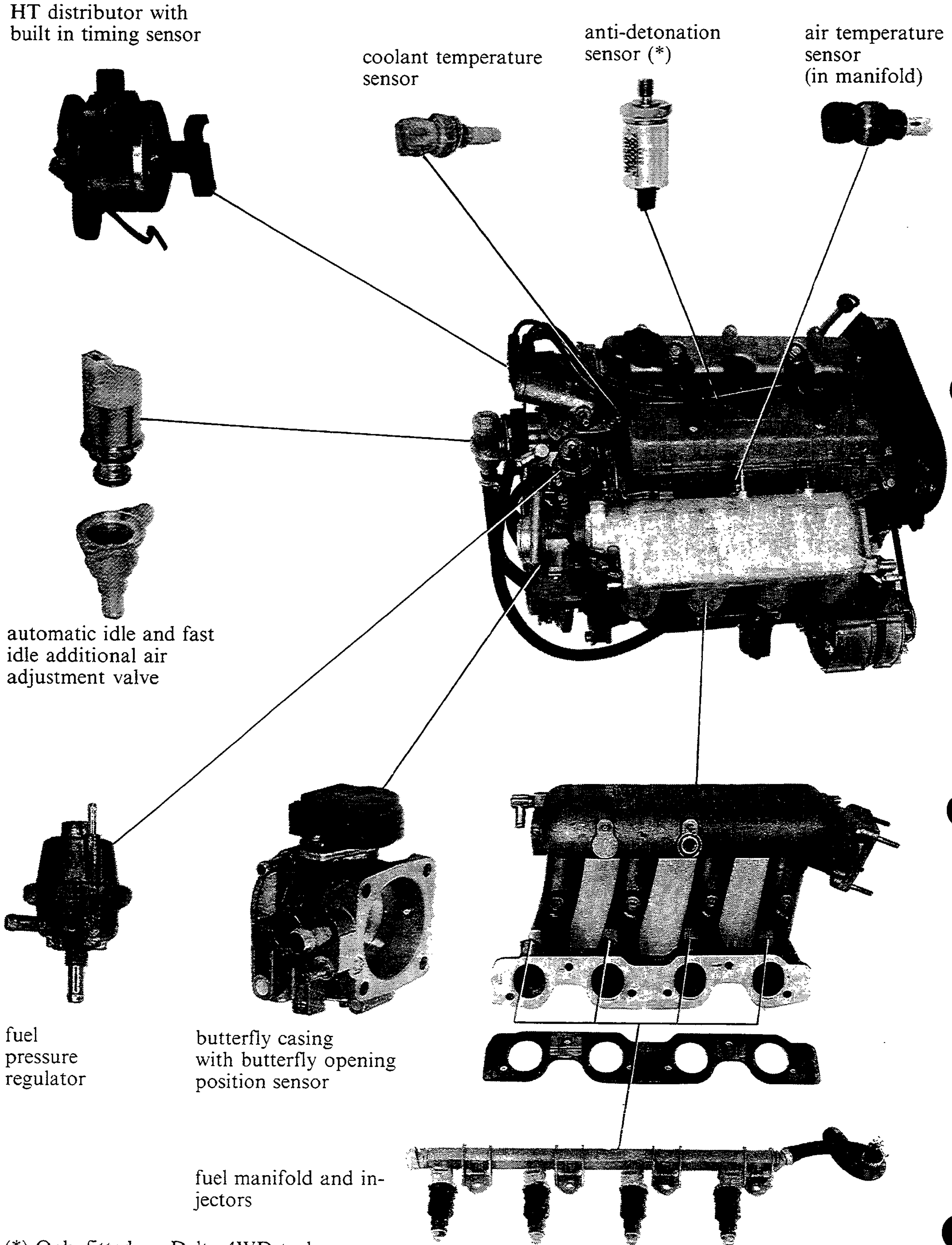
IAW injection/ignition system wiring diagram key for pages 15 and 16

8. Coolant temperature sensor
9. Detonation sensor
9A. OVER-BOOST solenoid valve (power increase)
13. Right front earth cable loom
18A. Connector
19. Automatic idle adjustment solenoid air valve
20. Rpm and TDC sensor
22. Ignition distributor with built in timing sensor
24. Fuel injectors
31. Connector
32. Connector
34. Connector
35. Battery
42. Ignition coil with power module
43. Earth connector
44. Earth
47. Butterfly valve position sensor
48. Starter motor
49. Intake air temperature sensor
50. Absolute pressure sensor
51. Alternator with built in regulator
55. Injector control relay
56. Electric fuel pump control relay
60. Control-system
62. Connector block (located in tunnel near the IAW electronic control unit)
62b. 15 A protective fuse locatdd between relays (55) and (56)
75. Connector block
90. Diagnostic socket for Fiat-Lancia tester (located in tunnel near IAW electronic control unit)
100. Ignition switch with key
116. IAW injection/ignition electronic control unit
117. Connector
117A. Connector
142. Electric fuel pump
153. Left rear earth cable loom

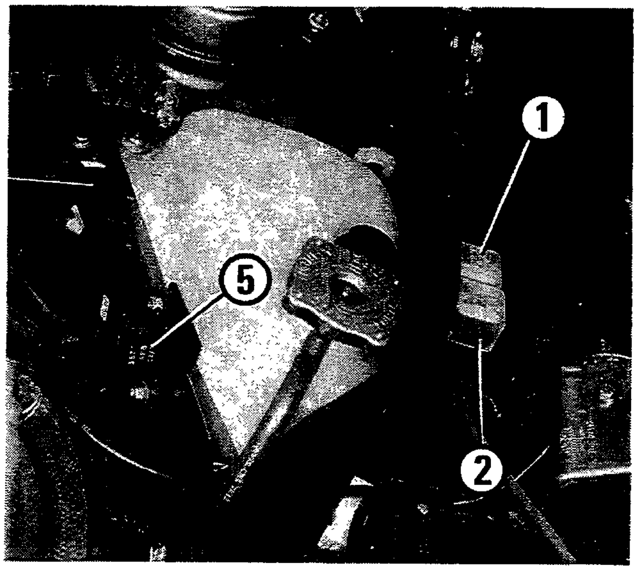
Cable colour code

A	Light Blue	**AB**	Light Blue-White	**HN**	Grey-Black
B	White	**AG**	Light Blue-Yellow	**HR**	Grey-Red
C	Orange	**AN**	Light Blue-Black	**LB**	Blue-White
G	Yellow	**AR**	Light Blue-Red	**LG**	Blue-Yellow
H	Grey	**AV**	Light Blue-Green	**LN**	Blue-Black
L	Blue	**BG**	White-Yellow	**LR**	Blue-Red
M	Brown	**BL**	White-Blue	**LV**	Blue-Green
N	Black	**BN**	White-Black	**MB**	Brown-White
R	Red	**BR**	White-Red	**MN**	Brown-Black
S	Pink	**BV**	White-Green	**NZ**	Black-Violet
V	Green	**BZ**	White-Violet	**RB**	Red-White
Z	Violet	**CA**	Orange-Light Blue	**RG**	Red-Yellow
		CB	Orange-White	**RN**	Red-Black
		CN	Orange-Black	**RV**	Red-Green
		GN	Yellow-Black	**SN**	Pink-Black
		GL	Yellow-Blue	**VB**	Green-White
		GR	Yellow-Red	**VN**	Green-Black
		GV	Yellow-Green	**VR**	Green-Red
		HG	Grey-Yellow		

10.

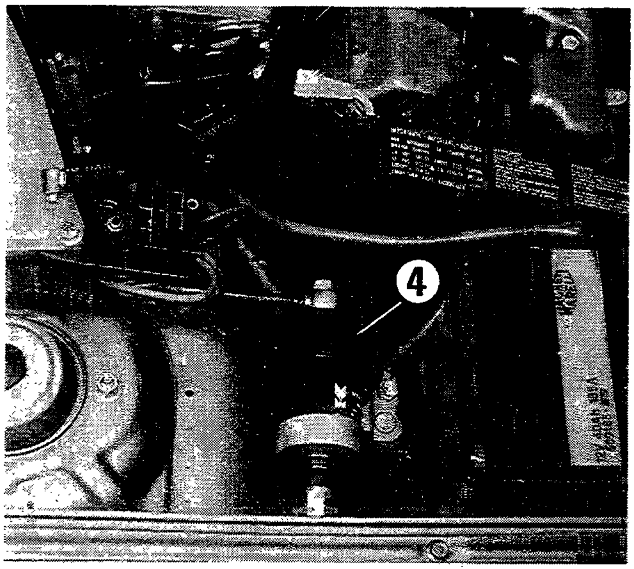


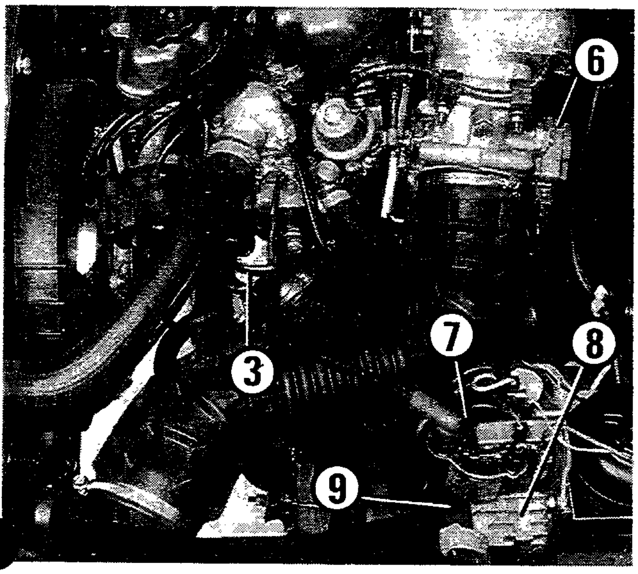
(*) Only fitted on Delta 4WD turbo

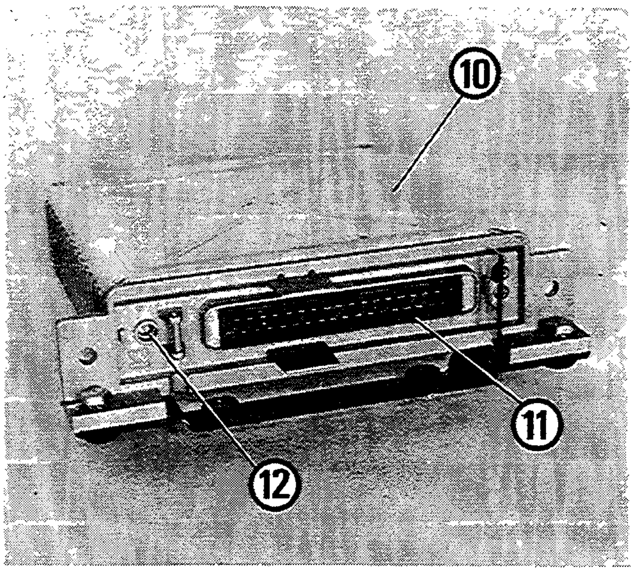


Location of IAW system components

1. Electric fuel supply pump relay (with or without fuse)
2. Injector control and control unit supply relay (with or without fuse)
3. Automatic idle adjustment supplementary air solenoid valve
4. Fuel filter
5. Absolute pressure sensor
6. Butterfly valve position sensor
7. Ignition coil
8. Ignition unit heat dissipator plate
9. Ignition module connector
10. Injection/ignition electronic control unit (located on the right side of the tunnel, under the dashboard)
11. Injection/ignition control unit terminals for connection to the system
12. CO adjustment screw (protected by an anti-tamper plug).

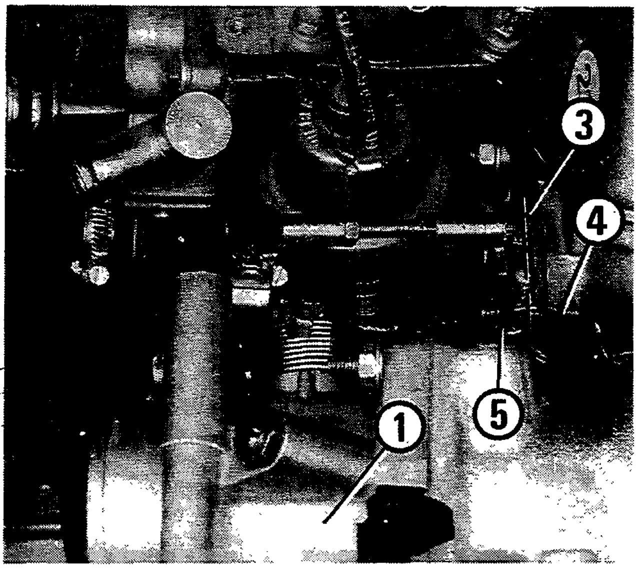






10.

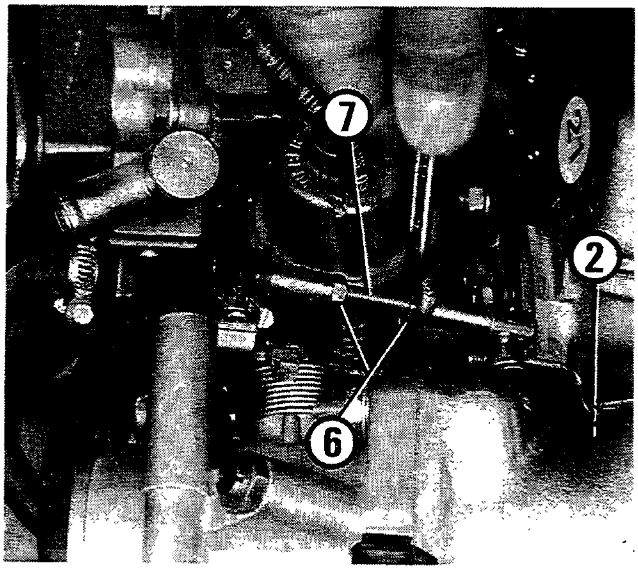
IAW SYSTEM CHECKS AND ADJUSTMENTS



ADJUSTING BUTTERFLY VALVE CONTROL ROD

NOTE *The butterfly valve stop screw (5) is adjusted in the factory and should never be tampered with because it is adjusted in such a way that a specific amount of air enters the engine with the butterfly closed.*

View of accelerator



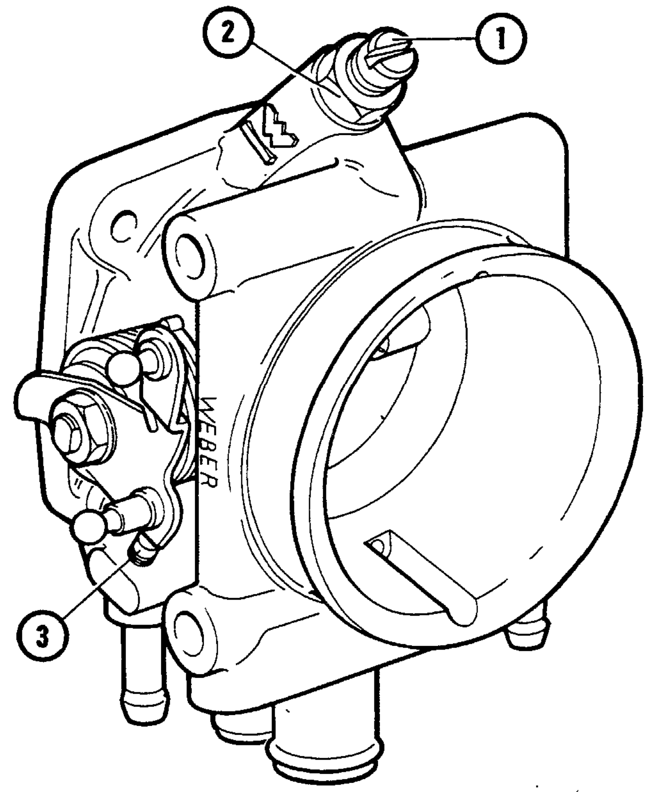
1. Butterfly casing
2. Butterfly valve control cable
3. Butterfly valve control rod
4. Control lever
5. Butterfly valve stop screw
6. Rod lock nuts
7. Rod length adjustment screw

Adjustment of butterfly valve control rod

In order to check whether the valve control rod is properly adjusted (in terms of length) simply start up the engine, let it warm up until it reaches the operating temperature and let it idle.
At this point disconnect the end of the rod from the control lever: the engine should continue to idle without any alternation in speed. If the engine speed odes change it is necessary to adjust the length of the rod by regulating the adjustment screw (7) after having undone the lock nuts (6).
The length of the contorl rod is correct when the engine idle speed is 800 - 850 rpm without any alternations when the end of the rod (3) is refitted to the butterfly valve control lever (4).

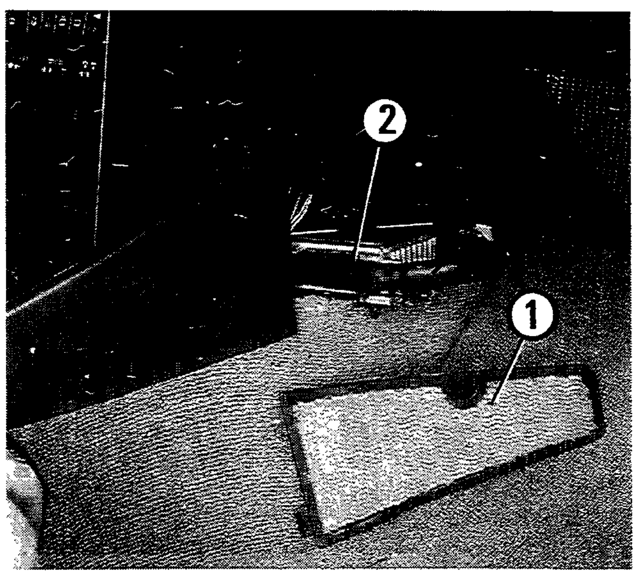
ADJUSTING IDLE SPEED AND CARBON MONOXIDE (C0)

Firstly check the condition of the connecting pipes between: the inlet manifold and the absolute pressure sensor, the fuel pressure regulator and the inlet manifold; the servo brake vacuum pipe; the air pipes for the automatic idle adjustmen solenoid valve.



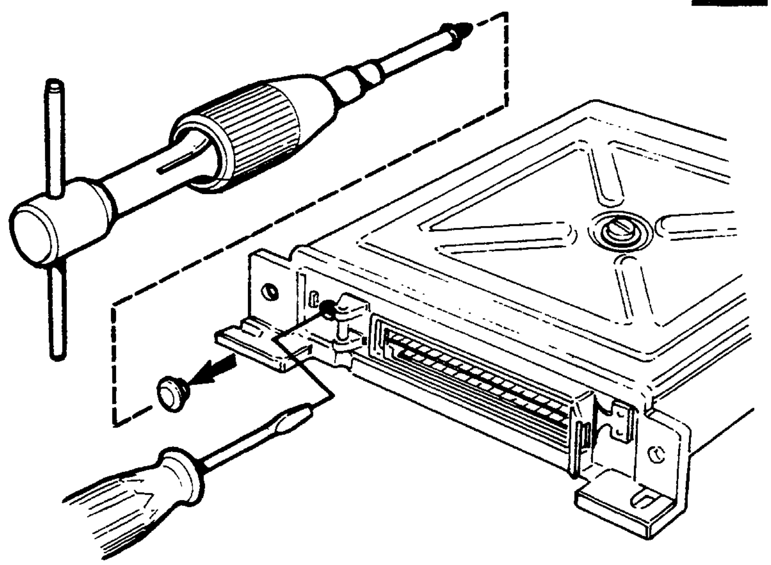
The idle speed is adjusted with the engine at the operating temperture, in other words when the cooling circuit fan has come on at least twice.
The adjustment of the idle speed is carried out with the fan switched off and without any other connectors engaged (heated rear windscreen, air conditioning, headlamps, etc.).
If the electric fan comes on during the adjustment, do not operate until it is completely still.
In order to adjust the exhaust CO correctly, the engine should operate with the correct ignition advance. (15° ± 2° for the Delta and 18° ± 2° for the Prisma).

- Connect a rev counter to the engine
- Insert the exhaust gas analyzer sensor probe into the silencer
- Disconnect the solenoid air valve connector and check that the idle speed is between 750 and 800 rpm for both vehicles with a manual gearbox or automatic transmission and that the CO percentage is between 1% and 2%.
- If the idle speed is not correct, loosen the by-pass screw (2) lock nut (1) and adjust it until the speed is between 750 and 800 rpm
- Reconnect the automatic idle adjustment solenoid valve connector: the engine operating speed should increase sharply (up to 1500 - 2000 rpm) but should then adjust itself straight afterwards to 800 - 850 rpm without any oscillations in speed.



Removing-refitting injection control unit

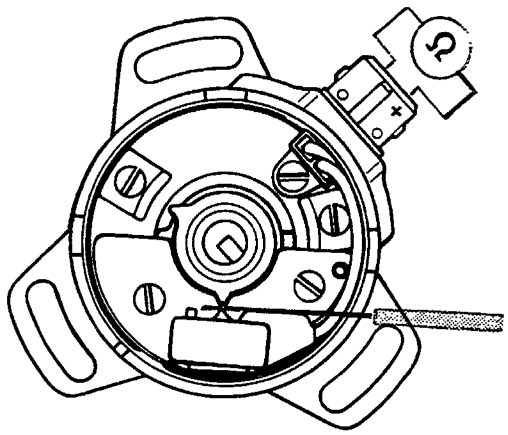
If the CO percentage measured is outside the permissible tolerance of 1.5 ± 0.5 it is necessary to remove the control unit plastic shield (1) on the right side of the tunnel and then free the control unit (2) by loosening the two bolts fixing it to the bodyshell



Adjusting CO content in control unit

Using tool 1848007000, remove the CO anti-tamper plug from the control unit and proceed to adjust the CO percentage with the engine at the operating temperature and correct idle speed, using a 4 mm maximum broad screwdriver, by tightening or loosening the adjustment screw until the correct CO percentage is obtained.
The CO adjustment screw has a rotation field of around 270°.
Never force this screw under any circumstances or this will damage the control unit.
Check that the rotation speed does not vary during this operation; if this is not the case, reset the speed at the nominal vlue by adjusting the butterfly casing by-pass screw and check that the CO percentage has not altered. Fit the new anti-tamper plug (black).

If the idle speed is irregular or cannot be adjusted, the problem may lie in the automatic idle adjustment solenoid valve (short circuit or break) or in the electronic control unit idle adjustment supply valve control.
In addition, the fault may be due to an overlfo of air in the valve supply ducts or the seals inside the actual valve.



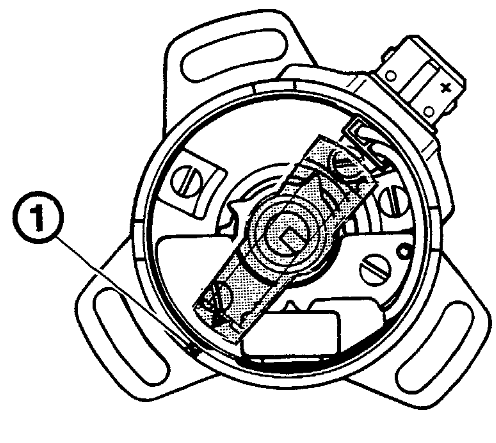
Checking HT distributor timing sensor gap

Rotate the distributor control shaft until each timer tooth is facing the sensor. Using a feeler gauge, measure the distance between the two, i.e. the gap, which should be between 0.3 and 0.4 mm.

Checking timing sensor winding resistance

Using an ohmmeter, measure the resistance value between the 2 connector terminals as shown in the diagram: the reading should be between 758Ω and 872Ω at 20°C.

HT distributor timing on engine



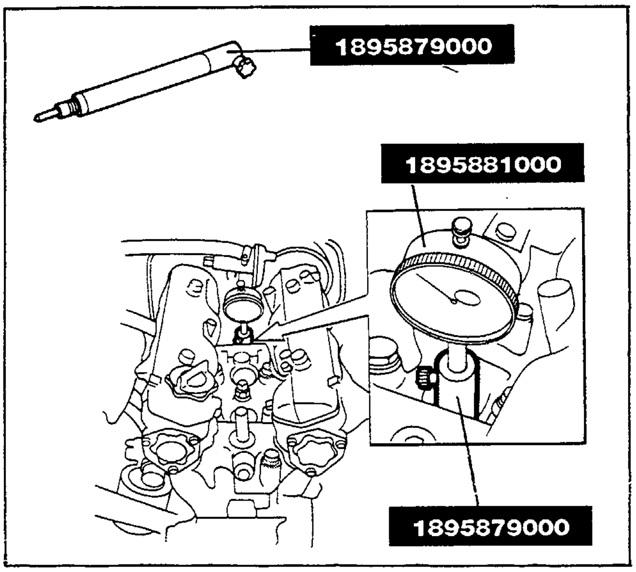
Position pistons 1 and 4 at TDC and the distributor rotor arm centre line facing the reference amrk (1) on the distributor casing. Then fit the distributor and fix it, in this position, to the cylinder head.

In order to position the distributor correctly, fit tool 1895896000 on the distributor, after having removed the cap, in such a way that the centering pin inside the tool fits into the reference mark (1) in the distributor casing.
This tool eliminates the parallax error in checking the reference marks.

When the engine is operating at the correct idle speed the ignition advance (memorized in the IAW control unit) should be 15°±2° for the Delta and 18°±2° for the Prisma. If this is not the case, the rpm and TDC sensor is incorrectly positioned or the control unit memory if faulty.

In order to check the resistance values for the various WII injection/ignition system sensors it is necessary to use precision digital testers for the temperature of the sensors being checked. It is advisable therefore, when the sensors are not short circuited or broken, to try and replace them with a test sensor before discarding them as faulty.

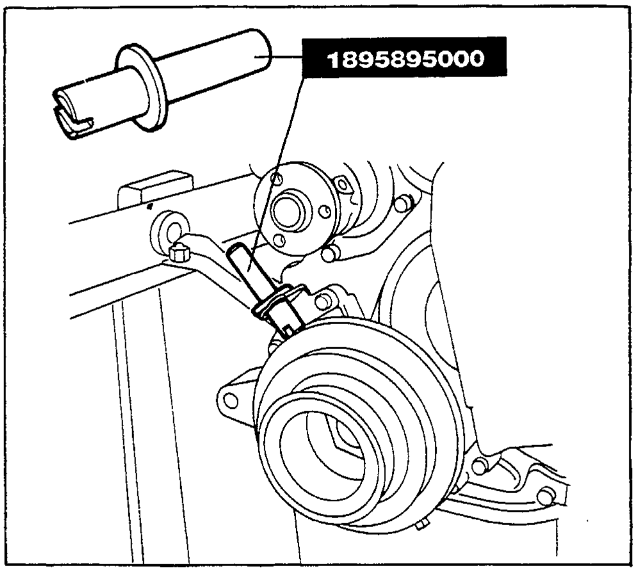
Method for determining TDC for piston no. 1



Checking rpm and TDC sensor position

Rotate the crankshaft to the TDC position; remove spark plug no. 1 and insert tool 1895879000 complete with dial gauge 1895881000 in its place; zero the dial gauge when piston no. 1 is exactly at TDC (i.e. the highest point reached during its stroke). Position tool 1895895000 in place of the sensor: the projection on the pulley should fit perfectly in the groove in the tool

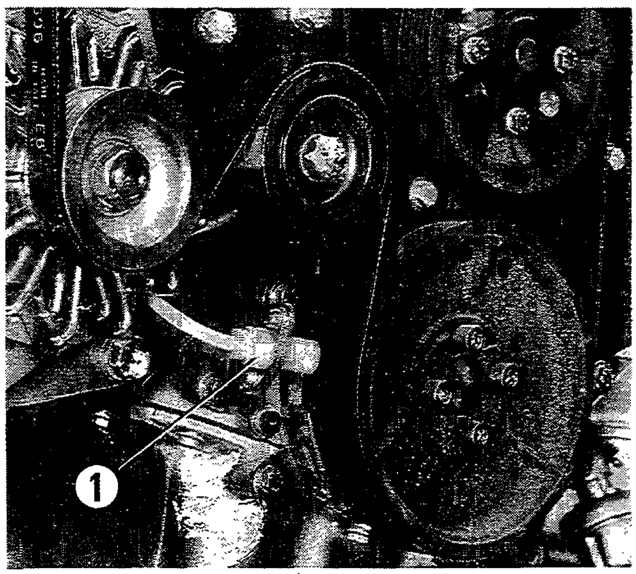
If this is not the case, loosen the sensor carrier plate and fix it with the above mentioned tool inserted in the pulley indentation.



Checking correct positioning or rpm and TDC sensor

Checking rpm and TDC sensor (1) winding resistance

Disconnect the sensor connector and using an ohmmeter measure: the value bewteen the 2 connector terminals which should be between 618Ω and 748Ω at 20°C.



Checking rpm and TDC sensor gap

Using a feeler gauge (1) check that the distance between each of the 4 notches in the cranksahft pulley and the sensor core, when they are facing, is between 0.6 and 1.2 mm.

Checking butterfly valve position sensor potentiometer

Insert an ohmmeter between contacts b and c of the sensor terminal, then gradually open the butterfly valve: the resistance value should vary without any sudden changes from ~450Ω up to ~80Ω with the butterfly valve completely open (approximate figures)

Checking efficiency of temperature sensors

Disconnect the sensor connectors; using an ohmmeter connected between the 2 contacts of the sensor being checked, check the resistance values.
They should be within the following limits:

1. **Coolant sensor for engine temperatures at**
   - 10°C from ~15,27 kΩ ÷ 17,93 kΩ
   + 20°C from ~3,56 kΩ ÷ 3,93 kΩ
   + 80°C from ~0,34 kΩ ÷ 0,41 kΩ
2. **Intake air temperature sensor for air temperatures**
   - 10°C from ~15,27 kΩ ÷ 17,93 kΩ
   + 20°C from ~3,56 kΩ ÷ 3,93 kΩ
   + 80°C from ~0,68 kΩ ÷ 0,82 kΩ

CHECKING FUEL PRESSURE, PRESSURE REGULATOR AND ELECTRIC PUMP

- Make sure that the ignition switch is in the OFF position.
- Remove the union fixing the fuel inlet pipe to the fuel injector manifold and insert the pressure gauge complete with unions no. 1895890030 in its place.

NOTE *The pressure gauge should be between the pressure regulator and the pressure gauge tap. The operation of fitting the pressure gauge should be carried out taking special care as regards cleanliness in order not to introduce any foreign bodies into the injectors which would obstruct them.*

- Open the pressure gauge tap (lever in line with tap axis).
- Turn the ignition switch to the ON position without starting up the engine (this energizes the fuel pump for a moment). Repeat this several times.
  The reading on the pressure gauge should be 2.5 ± 0.2 bar whilst the electric pump is operating.

NOTE *In order to reach the regulation pressure more quickly: remove the electric pump control relay (the outermost one) and connect terminals 30 and 87 to one another using a bridge incorporating a 20A fuse.*
The electric fuel pump should be supplied directly from the connection.

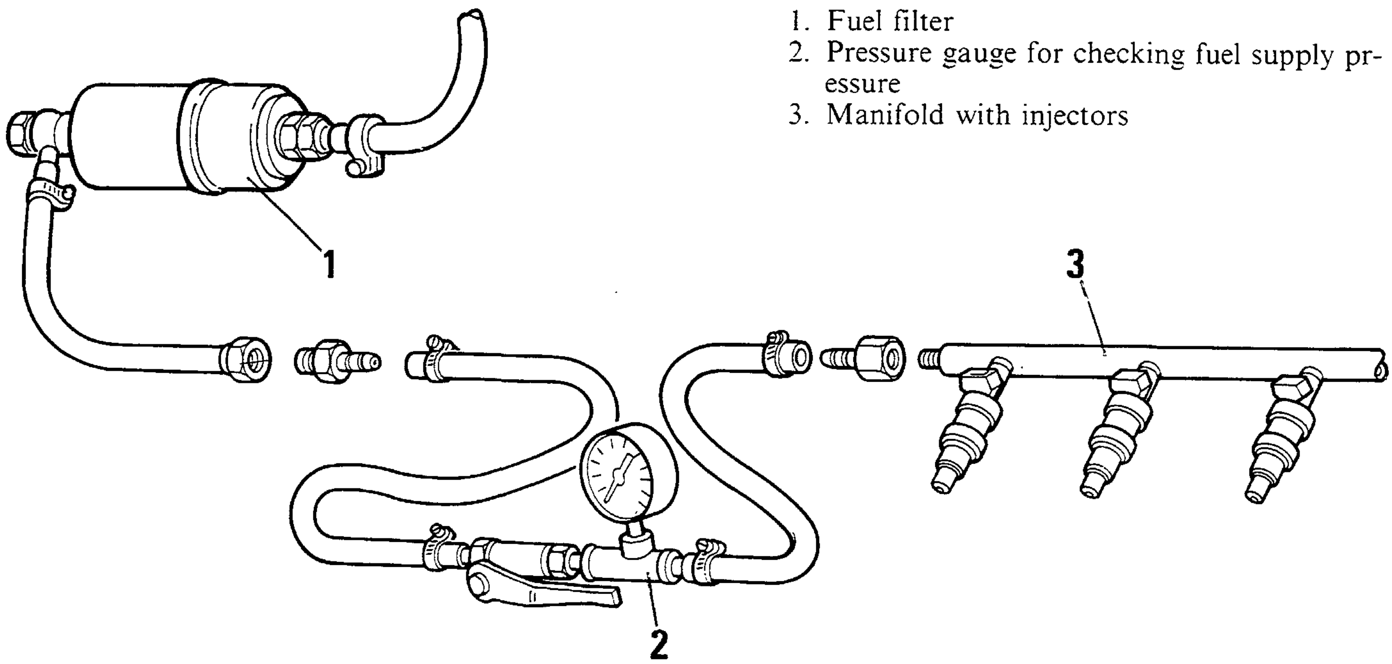
When the fuel pressure test is carried out the following may occur:

a) **The pressure shown on the pressure gauge is greater than 2,5 ± 0,2 bar**
If this is the case, proceed as follows:
disconnect the return pipe from the pressure regulator and fit a temporary pipe in its place from the regulator to a petrol collection tray. Repeat the test turning the ignition switch to the ON position. If the pressure is now 2.5 2 0.2 bar, the defect should be sought in a blockage of the vehicle return pip; if the pressure is still above 2.5 ± 0.2 bar, replace the pressure regulator.

b) **The pressure reading on the gauge is less than 2.5 ± o.2 bar,** or reaches this value very slowly: this may be cused by the filter being blocked (the filter should be replaced every 20,000 km), or by an obstruction in the pump inlet.

If neither of the above anomalies is encountered:

- using special pliers, close the regulator return pipe whilst the ignition switch is turned to the ON position. If the pressure goes above 5 bar, replace the pressure regulator as it is faulty; if the pressure remains at a value below 2.5 ± 0.2 bar, replace the pump because it is worn or defective.



1. Fuel filter
2. Pressure gauge for checking fuel supply pr-essure
3. Manifold with injectors

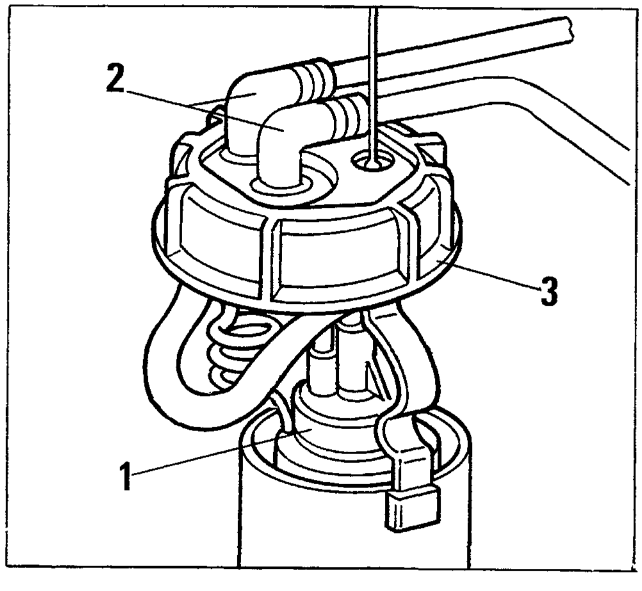
c) The pressure shown in the gauge falls rapidly even after being stabilized.

NOTE *The stabilization pressure varies according to the elasticity and length of the pressure gauge pipes. It may settle at 2.0 - 1.5 bar after a short time.*

If this condition occurs, turn the ignition switch to the ON position and whilst the pump is turning shut the pressure gauge tap.
The pressure reading on the gauge once it stabilizes should not vary.
If this is not the case, the fall in pressure is caused by the imperfect seal of the pressure regulator valve or one of the injector valves.
In order to locate the fault, open the pressure gauge tap once again; turn the ignition switch to the ON position; close the return pipe using pliers and keep it tightly closed throughout the duration of the test; shut the pressure gauge tap again and observe whether the pressure falls rapidly. If this is the caes, one or more injectors is dripping and they should be found and replaced. If this is not the case, the pressure regulator should be replaced because the internal valve is not properly sealed (observe whether or not there are leaks between the regulator ring seal and the injector manifold seat).
When the above tests have been completed, remove the pressure gauge and restore the fuel supply connections, making sure that there are no leaks.

Removing-refitting electric fuel pump (1)

The electric fuel pump is the immersion type and is located in the fuel tank. Remove the rear seat, disconnect the two petrol pipes (2) (removing the retaining springs) and loosen the securing ring nut (3) using tool A. 1854033000



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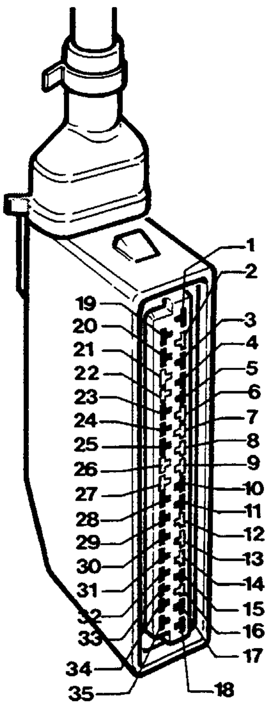
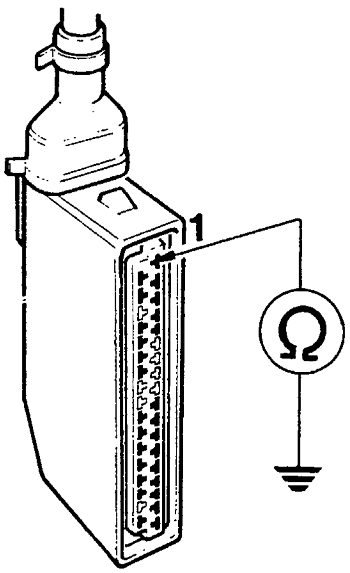
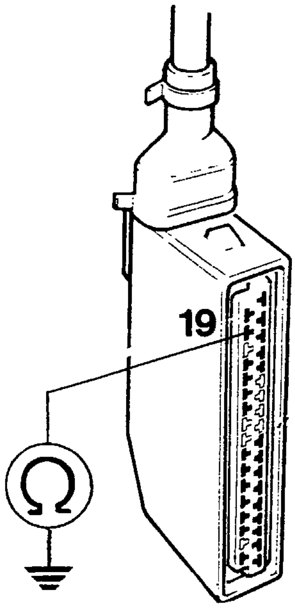






INJECTION/IGNITION ELECTRONIC CONTROL UNIT MULTIPLE CONNECTOR

Checking continuity of connection cables and sensor resistance

Remove the control unit protective cover on the right hand side of the tunnel, under the dashboard, then loosen the 2 bolts fixing the latter to the bodyshell and extract it. Make sure that the ignition switch is in the OFF position. Disconnect the multiple connector and, using an ohmmeter, check the continuity or the resistance of the following:

1. Negative supply (-)
2. Not used
3. Rpm and TDC sensor negative
4. Rpm and TDC sensor positive
5. Distributor timing sensor negative
6. To the over-boost solenoid valve (*)
7. Not used
8. To the Fiat-Lancia tester diagnostic socket
9. Not used
10. Negative at terminal 85 of the injector control relay
11. Absolute pressure, butterfly valve position and air intake temperture sensor negative
12. Not used
13. Not used
14. Not used
15. Absolute pressure sensor signal intake
17. Butterfly valve position sensor signal intake
18. Cylinder no. 4 injector
19. Negative supply (-)
20. Control unit supply (+) from injector control relay
21. Signal for idle adjustment solenoid valve for switching on air conditioning
23. Distributor timing sensor positive
24. Ignition period control
25. Ignition period control
26. Not used
27. To the diagnostic socket
28. To terminal 85 of the electric fuel pump relay feed
29. Coolant temperature sensor supply
30. Absolute pressure sensor and butterfly valve position sensor supply
31. Air intake temperature sensor supply
32. Cylinder no. 2 injector
33. Cylinder no. 3 injector
34. Supply intake from engine idle speed adjustment solenoid valve

(*) Only used on the Delta 4WD

> ⚠ *Before carrying out the checks illustrated below it is absolutely vital to make sure that the ignition switch is in the OFF position (switched off).*

Disconnect the multiple connector from the control unit, then carry out the following checks.

Checking continuity of multiple connector earth cables

There should not be any breaks but continuity between terminal 1 and an earth point and between terminal 19 and an earth point.
Renew any possible broken connections, ensuring that the earths are working properly.

Checking control unit supply cables continuity

Connect an ohmmeter between terminal 20 and terminal 87 of the injector relay carrier socket (disconnect the relay).

Checking rpm and TDC sensor resistance

Connect an ohmmeter between terminals 3 and 4.
The reading should be around 612 - 748 Ω at 20°C.

Checking timing sensor resistance (located in the distributor)

Connect an ohmmeter between terminals 5 and 23.
The reading should be about 750 - 880 Ω at 20°C.

Checking injector winding resistance

Connect an ohmmeter between terminal 20 and terminals 18 (cylinder no. 4) ; 33 (cylinder no. 3); 32 (cylinder no. 2) and 35 (cylinder no. 1), respectively.
The reading should be between 2 - 3 Ω at 20°C.

Checking coolant sensor resistance

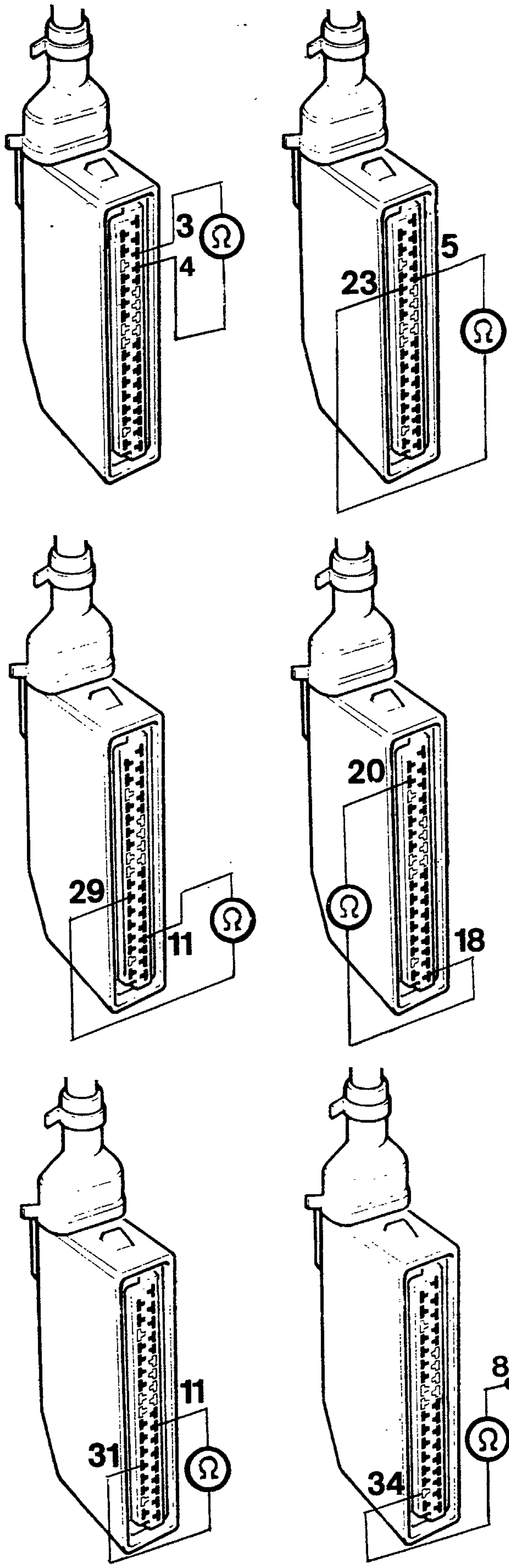
Connect an ohmmeter between terminals 29 and 11 (during the check disconnect the connector for the intake air temperture sensor, the butterfly valve position sensor and the absolute pressure sensor).
The reading should be 15.2 - 17.9 kΩ at - 10°C, 3.5 -3.9 kΩ at + 20°C, 0.3 - 0.4 kΩ at + 80°C.

Checking air temperature sensor resistance

Connect an ohmmeter between terminals 11 and 31 (during this check disconnect the connectors for the butterfly valve position sensor, absolute pressure sensor, coolant temperature sensor).
The reding should be 15.2 - 17.9 kΩ at - 10°C, 3.5 - 3.9kΩ at + 20°C, 0.6 - 0.8 kΩ at 80°C.

Checking automatic idle adjustment valve winding

Connect an ohmmeter between terminal 34 of the multiplec connector and terminal87 (relay disconnected) of the electric fuel pump relay carrier socket. The reading should be 7 Ω ± 0.4 at 20°C.



10.

Operation of control relays (refer to wiring diagram on page 16)

When the ignition switch is turned to the ON position the injector control relay winding (55) is energized; in actual fact, the current arrives from terminal 15/54 and goes to earth through terminal 10 of the electronic control unit.
The relay (55) contacts close and the battery voltage is available to supply the control unit (terminal 20), the injectors (but their earth is inhibited with the engine not running) and the electric pump relay (56) winding. Since the relay (56) winding is closed to earth, through terminal 28 of the control unit, the current passes through it and closes the contacts: therefore both the electric pump and the idle air adjustment valve (19) are suppplied.
If the engine is not started up, the electric fuel pump cuts out almost immediately (given that the control unit disconnects the relay earth by means of a timer).

Checking efficiency of relays

First of all check that the injection system protective fuse 62b located between the 2 relays is working properly.
If one of the relays does not click, replace it with a test relay. Remember that if the injector control relay (55) is not working then neither can the electric pump control relay (56).
If, after replacing the relays, they are still not working, check the continuity of the supply circuits - post-modification system - **relay (55):** between terminal 85 and earth terminal 10 of the injection control unit connector; between terminal 86 and terminal 15/54 of the ignition switch; **relay (56):** between terminal85 and terminal 28 of the injector control unit connector; between terminal 86 and terimnal 87 of the relay (55).

IAW ELECTRONIC INJECTION/IGNITION SYSTEM COMPONENTS

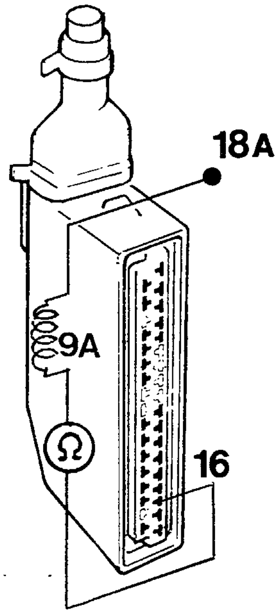
DESCRIPTION	QUANTITY	PRISMA 4WD	DELTA 4WD
ELECTRONIC CONTROL UNIT	1	WH2G.03/HAI-B8	WH4E.03/085-F6
BUTTERFLY CASING	1	56 CFL 18	52 CFL 15
INJECTOR	4	IW 023/03	IW 025/01
AUTOMATIC IDLE ADJUSTMEN AND ENGINE TIMING SOLENOID VALVE	1	VAE 02	VAE 02
PRESSURE REGULATOR	1	RP 1/3 bar	RP 1/3 bar
AIR TEMPERATURE SENSOR	1	ATS 04	ATS 04
WATER TEMPERATURE SENSOR	1	WTS 05	WTS 05
ABSOLUTE PRESSURE SENSOR	1	APS 03/01	APS 02/07
BUTTERFLY VALVE POSITION SENSOR	1	PF 09/01	PF 09/01
FUEL FILTER	1	FI 02/01	FI 02/01
ELECTRIC FUEL SUPPLY PUMP	1	PI 022/2	PI 022/2

SYSTEM VARIANTS FOR DELTA 4WD HF TURBO

This model is equipped with two additional devices:**anti-detonation** and **over-boost** devices which have been described previously (see page 2 bis).
Below is a description of the check on the anti-detonation sensor and the over-boost solenoid valve wiring.

Checking continuity of connection cables and over-boost solenoid valve resistance

Before carrying out the checks described below it is absolutely vital to make sure that the ignition switch is in the OFF position (switched off)



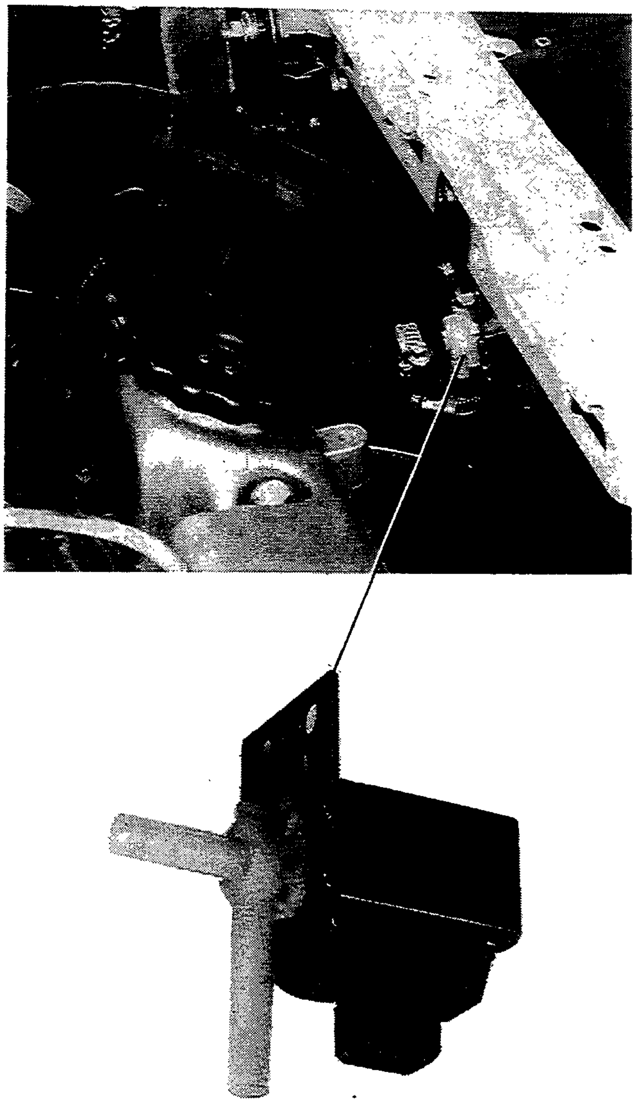
Disconnect the multiple connector from the injection/ignition control unit, then carry out the following checks:
connect an ohmmeter between terminal 16 of the connector for the injection/ignition control unit and terminal 9A for the solenoid valve (after having disconnected the latter from connector 18A). The resistance value measured should be ~40 Ω at 20°C.
If this is not the case, replace the solenoid valve as it is faulty.

If the solenoid valve is not defective, but the device does not work, check the mechanical operation of the valve supplying it with 12 Volts. Also make sure that the rubber pipes are securely connected to the inlet manifold and the turbocharger (see diagram on page 2 BIS)

Checking detonation sensor

This check can only be carried out by replacing and road testing the sensor having previously replaced the sensor with a test sensor.
In order to check the continuity of the connection cables, disconnect the sensor connector and, using an ohmmeter, check that the resistance is virtually nil between the respective connector terminals and terminals 6 and 22 of the injection/ignition control unit. If this is not the case, locate and renew the broken connection.

10.

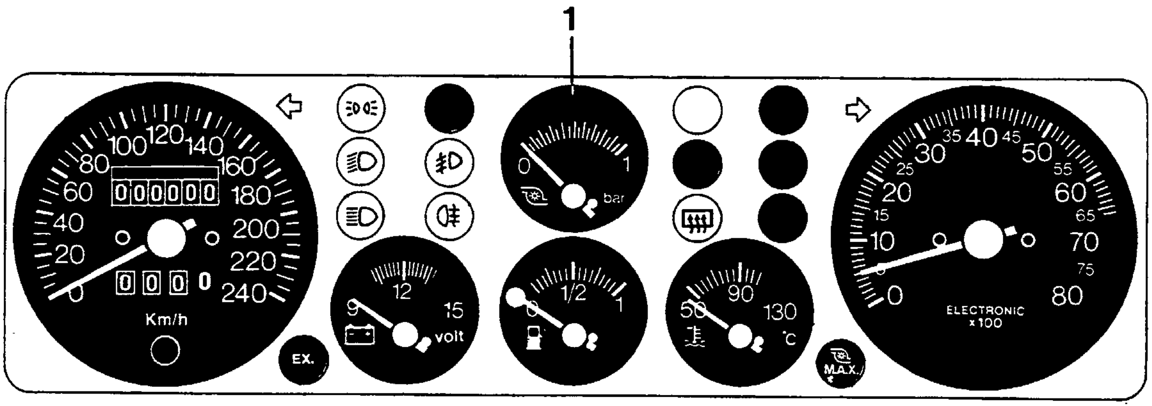


Location of over-boost solenoid valve device in engine compartment

Over-boost solenoid valve control device

Magnetic winding resistance: around 40 Ω at 20°C.
Supply: 12 Volts.

Delta 4WD instrument panel



The test lamp (2) should remain on (in the instrument panel) for the entire length of time that the over-boost valve is working. The supercharging pressure can be read off the pressure gauge (1).

IAW IGNITION SYSTEM CHECKS

As the fuel system is inter-connected with the ignition system it is difficult, in the case of a problem, to determine in which of the 2 systems (or possibly in both) the fault lies.

IN ORDER TO CHECK THE IAW ELECTRONIC INJECTION SYSTEM MORE EASILY AND QUICKLY USE THE FIAT-LANCIA AUTOMATED DIAGNOSTIC EQUIPMENT AND THE APPROPRIATE MEMORY WHICH CAN BE ORDERED FROM THE PARTS DEPARTMENT AT VOLVERA BY QUOTING PART NOS. 1806039000 AND 1806040000, RESPECTIVELY

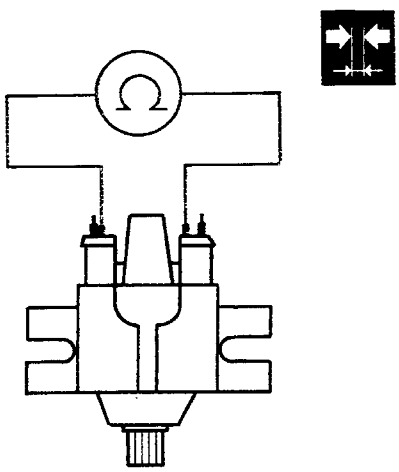
1. Checking efficiency of ignition control unit (or power) module and IAW control unit module control.

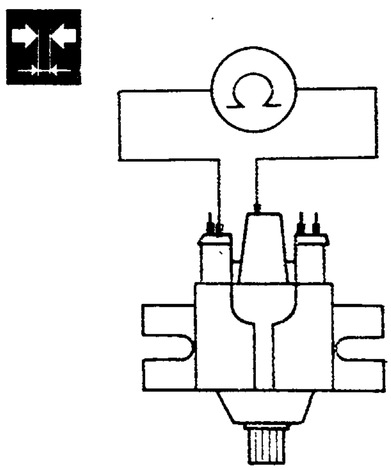
Open the bonnet lid.
Turn the ignition switch to the ON position: if the spark can clearly be heard in the distributor cap this means that the ignition module and the cntrol unit are working properly. If this is not the case (as one or the other or both may be defective) firstly replace the power module and, only if the fault still persists afterwards, replace the injection ignition control unit

NOTE *Before replacing the ignition unit power moduel, it is necessary to **carefully** check the ignitin coil (especially the resistance of th primary winding) because a short circuited coil can quickly damage even a new replacement module.*

If the check described above has a positive result, the follwoing components must be checked:

1. Ignition coil





Disconnect all the terminals from the ignition coil.

Primary winding resistance check
Check the resistance using an ohmmeter inserted between the two low voltage terminals: the reading should be 0.415 - 0.495 Ω at 20°C.

Secondary winding resistance check
Check the resistance using an ohmmeter inserted between the centre high tension terminal and one of the low voltage terminals: the reading should be between 4320 and 5280 Ω at 20°C.
The resistance of the rotor arm should be about 1000 Ω.

2. **Rpm and TDC sensor**
   Carry out the checking procedures illustrated on page 23.

⚠ *Disconnect all the terminals for the cables whose continuity is being checked.*

3. **IAW control unit connection circuits - power module - ignition coil supply**

   there should be continuity (= almost nil resistance) between terminals 24 and 25 of the IAW control unit multiple connector and terminals 3 and 6 of the ignition unit power module.

   In addition, there should be continuity (= almost nil resistance):
   - between terminal 15/54 of the ignition and terminal +15 of the coil;
   - between terminal -1 of the coil and terminal 1 of the ignition unit power module.

4. **Distributor cap - HT leads and spark plugs**

   Check, in the same way as for conventional ignition, that the distributor cap is not cracked, the rotor arm is not broken (resistance 1000 Ω), that the HT leads are not oxidized or broken and that the spark plugs are working properly.

NOTE *A fault in the coolant temperature sensor, intake air temperature sensor, buterfly valve position sensor, relys or IAW control unit ignition advance curve control sector would adversely affect the operation of the ignition system.*