FUNCTION : HDI DIRECT INJECTION SYSTEM

FOR 1C2X AND B0F7C AND DVY01 AND SINCE O 8001 OR

FOR 1CN6 AND B0F2X AND DVY01 AND SINCE O 8211 TO O 8688 OR

FOR 1CN7 AND B0F2X AND DVY01 AND SINCE O 8688 OR

FOR 1CX4 AND B0F2X AND DVY01 AND SINCE O 8688 OR

FOR 1CX4 AND B0F7C AND DVY01 AND SINCE O 8688 OR

FOR 1CU6 AND B0F7C AND DVY01 AND SINCE O 8276 OR

FOR 2CM4 AND B0F2X AND DVY01 AND SINCE O 8358 OR

FOR 1C6N AND B0F2X AND DVY01 AND SINCE O 8365 OR

FOR 2CU6 AND B0F7C AND DVY01 AND SINCE O 8421 OR

FOR 2CU6 AND B0F7U AND DVY01 AND SINCE O 8421

1 - High pressure fuel pump

1.1 - Role.

The high pressure fuel pump receives "low pressure" fuel from the booster pump.

Role of the high pressure fuel pump (BOSCH CP1 type with 3 pistons) :
- To supply high pressure fuel.
- To supply the diesel injectors through the high pressure common injection rail.

The high pressure fuel pump is driven by the timing belt (drive ratio 0,5).

1.2 - Description.

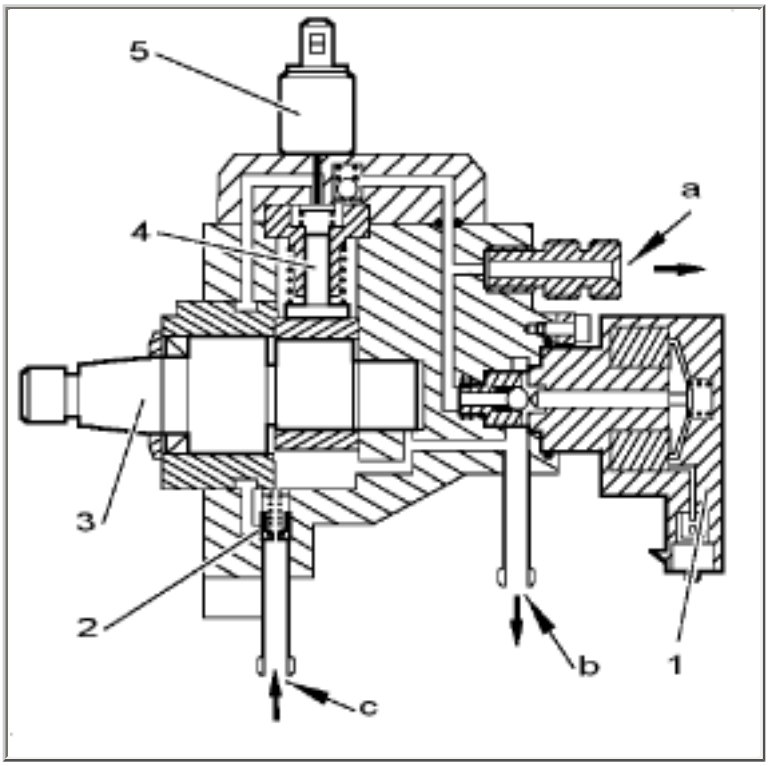


Fig : B1HP118C

A:high pressure fuel outlet (to the common injection rail).

B:return to fuel tank.

C:fuel inlet (booster pump).

(1) fuel high pressure regulator.

(2) lubricating valve.

(3) eccentric pump shaft.

(4) high pressure piston.

(5) deactivator of the 3rd piston of the high pressure fuel pump.

The high pressure fuel varies between 200 and 1350 bar.

NOTE : The high pressure fuel is controlled by the high pressure fuel regulator.
Components mounted on the high pressure fuel pump :

- (1) Fuel high pressure regulator.

- (5) Deactivator of the 3rd piston of the high pressure fuel pump.

NOTE : The high pressure pump is not a distributing pump and does not need setting.

Maximum absorbed power:3,5kW.

1.3 - Lubricating valve.

The lubricating valve lubricates the high pressure fuel pump in case the booster pressure is too low.

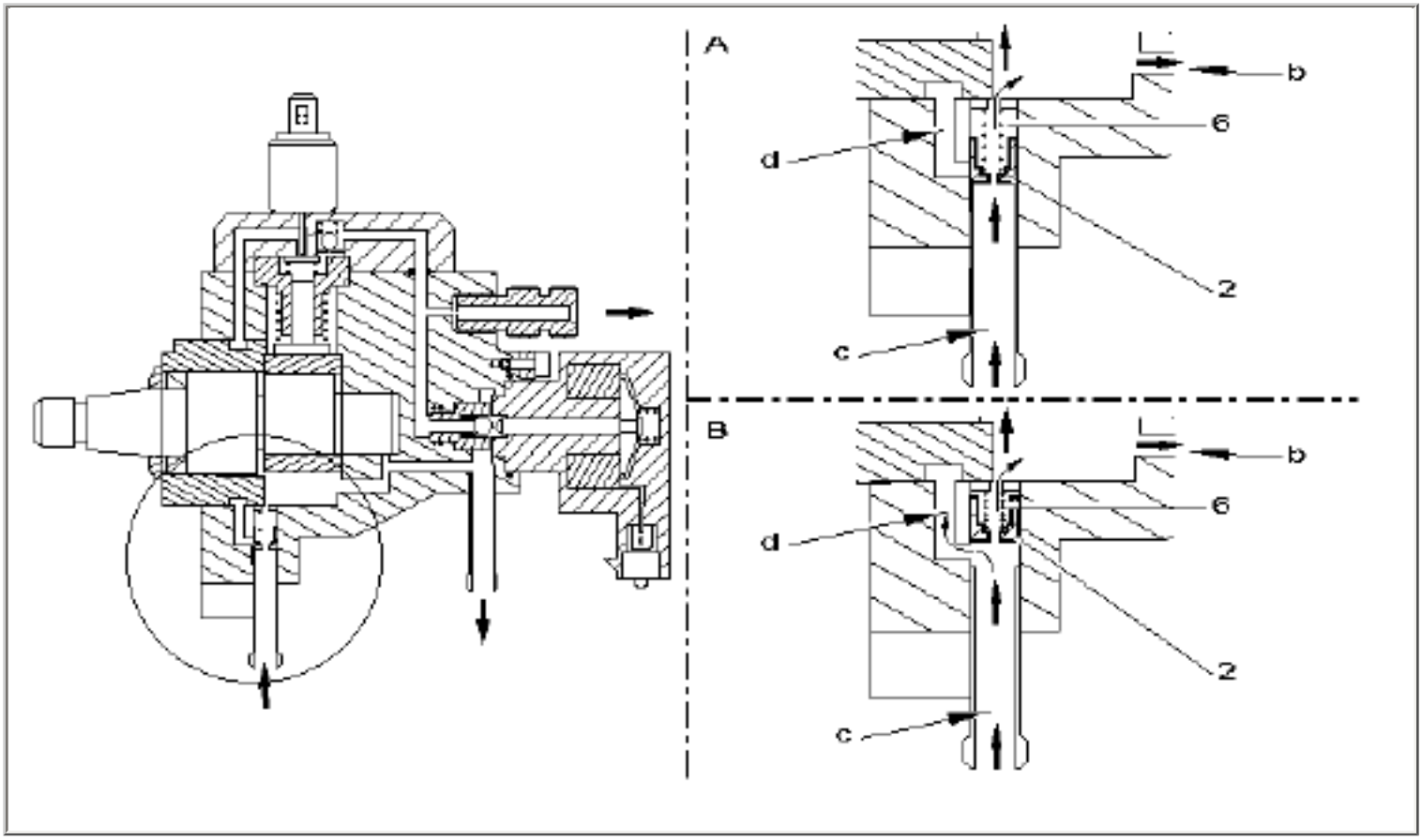


Fig : B1HP119D

Difference between the booster pressure and the pressure in the fuel tank return circuit :
- A:Pressure less than 0,8 bar.
- B:Pressure more than 0,8 bar.

B:return to fuel tank.

C:fuel inlet (booster pump).

D:to high pressure stage.

(2) lubricating valve.

(6) return spring.

The fuel enters the pump through inlet "c" and passes through the lubrication valve (2) (booster pump).

A :Pressure less than 0,8 bar :
- The fuel pressure is not sufficient to push back the valve (2).
- The fuel passes through the valve (restrictor hole).
- The fuel lubricates and cools the high pressure pump.

B :Pressure more than 0,8 bar :
- The fuel pushes back the valve (2).
- The fuel used for lubricating passes through the valve through its restriction.
- The fuel is distributed to the high pressure stage "d" of the high pressure pump.

1.4 - Creating the high pressure.

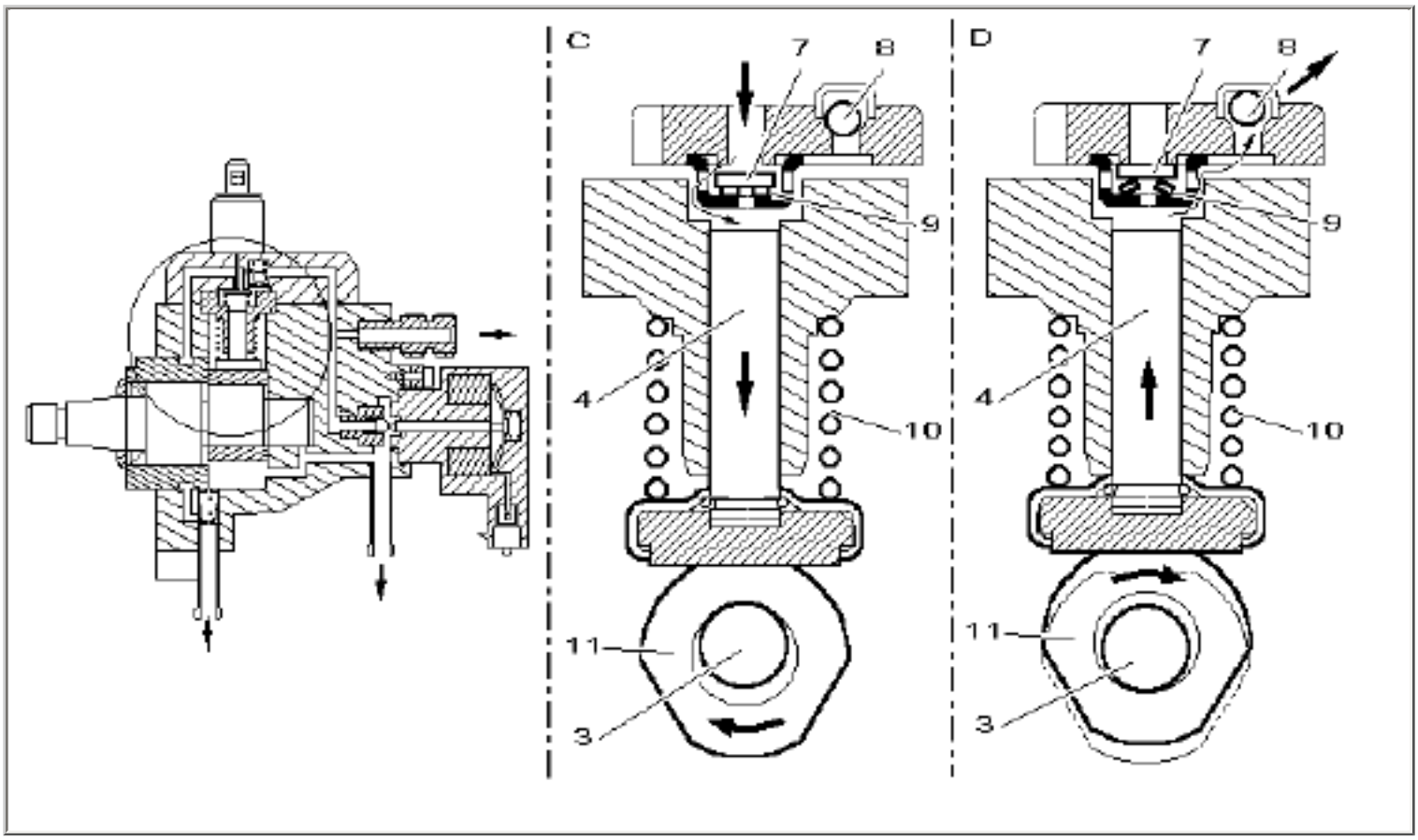


Fig : B1HP11AD

C:suction phase.

D:delivery phase.

(3) eccentric pump shaft.

(4) high pressure piston.

(7) fuel suction valve.

(8) delivery ball valve.

(9) suction valve return spring.

(10) high pressure piston return spring.

(11) drive cam.

The shaft of the high pressure fuel pump contains a cam.

The injection pistons are supplied with fuel by the low pressure circuit inside the high pressure pump.

The fuel is drawn in by the piston during the suction phase.

C Suction phase :
- The booster pump supplies fuel through the suction valve (7).
- The return spring pushes the piston back against the cam.
- The piston creates a vacuum in the liner.

D Delivery phase :
- After bottom dead centre.
- The drop in fuel pressure causes the suction valve to close (approximately 1 bar).
- The fuel is blocked in the chamber.
- The cam of the high pressure fuel pump pushes the piston.
- The fuel pressure increases.
- The fuel is delivered to the delivery valve.
- The delivery valve (8) opens.

After top dead centre, the delivery valve closes following the reduction in pressure.

2 - Deactivator of the 3rd piston of the high pressure fuel pump (1208-6)(1208-6)

2.1 - Role.

Role of the deactivator of the 3rd piston of the high pressure fuel pump :

- To reduce the power absorbed by the high pressure pump if the vehicle is used at low load.
- To limit the high pressure quickly in the event of a problem.

2.2 - Description.

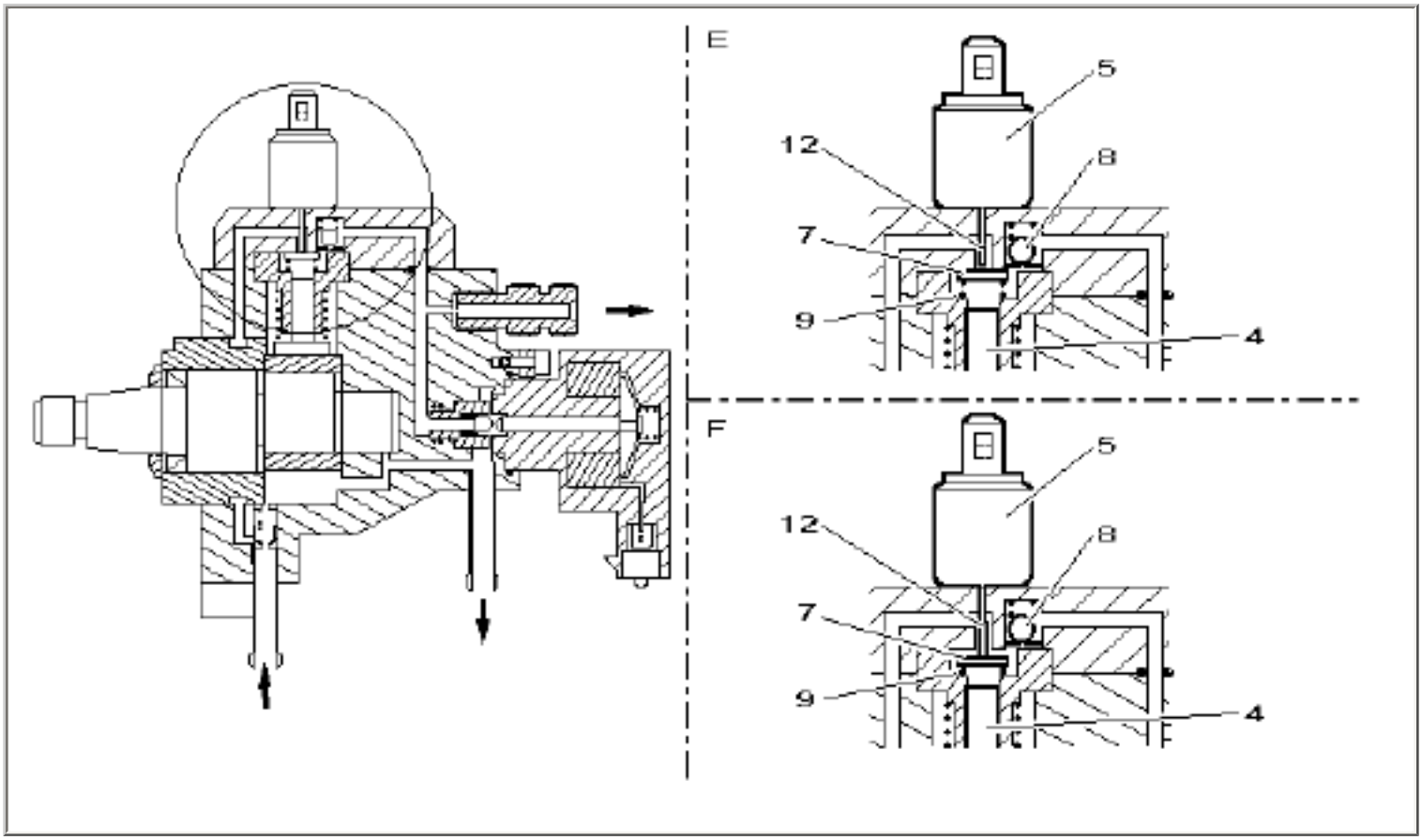


Fig : B1HP11BD

E:using 3 pistons.

F:using 2 pistons.

(4) high pressure piston.

(5) deactivator of the 3rd piston of the high pressure fuel pump.

(7) fuel suction valve.

(8) delivery ball valve.

(9) suction valve return spring.

(12) push rod.

Components of the deactivator of the 3rd piston of the high pressure fuel pump :
- An electromagnet.
- A push rod which moves under the action of the magnetic field created by the electromagnet.

When the 3rd piston deactivator is not energised :
- The fuel suction valve (7) is held against its seat by the spring (9).
- The cylinder is closed.
- The action of the pump shaft cam leads to a pressure being created.
- The fuel pressure lifts the delivery valve (8).
- The fuel is directed towards the high pressure outlet of the pump.

When the 3rd piston deactivator is energised :
- The push rod (12) raises the suction valve (7) from its seat.
- The cylinder is open:No pressure is created.
- The fuel is directed towards the low pressure part of the high pressure pump.

2.3 - Electrical features.

Control:injection ECU.

Type:"all or nothing" control through earth.

When the 3rd piston deactivator is energised:the pump operates on 2 pistons.

When the 3rd piston deactivator is not energised:the pump operates on 3 pistons.

3 - Fuel high pressure regulator (1322)(1322)

3.1 - Role.

The high pressure fuel regulator regulates the pressure of the fuel at the outlet of the high pressure fuel pump.

3.2 - Description.

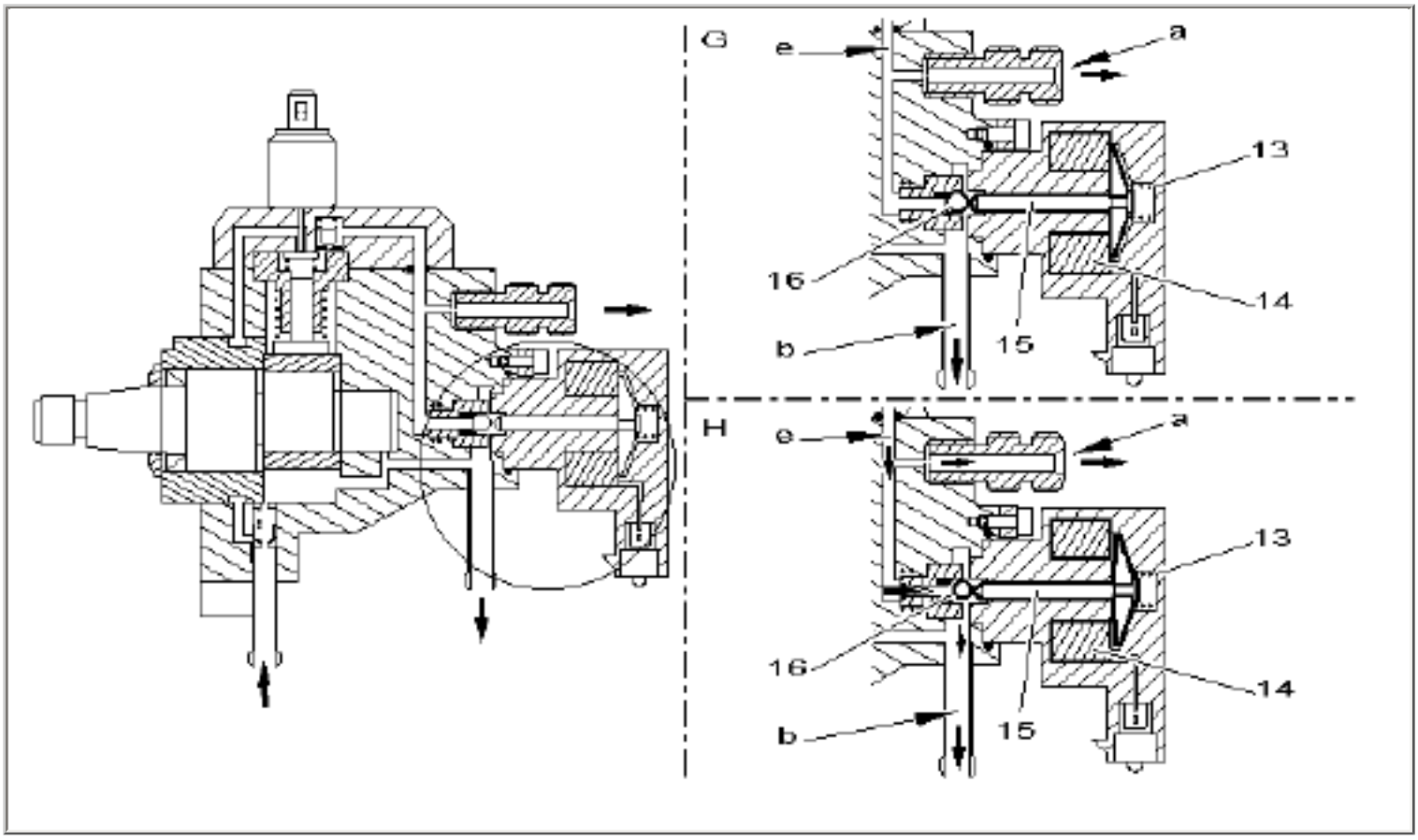


Fig : B1HP11CD

G:high pressure regulator not energised.

H:high pressure regulator energised.

A:high pressure fuel outlet (to the common injection rail).

B:return to fuel tank.

E:high pressure fuel circuit.

(13) spring.

(14) electric coil.

(15) magnetic core.

(16) ball.

The fuel high pressure is regulated by modifying the rating of the high pressure fuel regulator.

The high pressure fuel regulator consists of 2 pressure control circuits :
- The electrical circuit which acts directly on the high pressure which controls the electromagnet of the high pressure fuel regulator (injection ECU).
- The mechanical circuit which provides a minimum pressure and dampens pulses.

3.3 - Mechanical operation.

The high pressure fuel circuit is subject to pressure variations.

The fuel high pressure increases when a pump piston delivers.

The fuel high pressure decreases when a diesel injector is opened.

The movement of the ball dampens pressure variations.

3.4 - Electrical operation.

When the high pressure fuel regulator is not energised :
- The fuel high pressure opposes the mechanical action of the spring (13).
- The regulator opens for a high pressure which is greater than the spring pressure (ð 100 bar).
- The fuel released by the high pressure regulator returns to tank through the outlet "b".

NOTE : Engine off for 30 seconds, there is no residual pressure in the high pressure fuel circuit.
Pressure rise control phases :
- The injection ECU supplies the high pressure fuel regulator with an OCR current.
- The coil of the high pressure fuel regulator drives the magnetic core (magnetic force).
- The force applied to the ball is the sum of the spring force (13) and the magnetic force of the core.
- The cut-out value of the high pressure regulator increases.

Pressure reduction control phases :
- The injection ECU reduces the OCR supplied to the coil of the high pressure fuel regulator.
- The coil of the high pressure fuel regulator drives the magnetic core (magnetic force).
- The force applied to the ball reduces.
- The cut-off valve of the high pressure regulator decreases.

NOTE : OCR : Open Cycle Ratio.

3.5 - Electrical features.

When the high pressure fuel regulator is not energised:the pressure is limited to ð 100 bar.

Control:injection ECU (earth).

Variable voltage control (OCR) :
- Maximum voltage (maximum OCR)=Maximum pressure.
- Minimum voltage (minimum OCR)=Minimum pressure.

IMPORTANT : After switching off the engine, wait for 30 seconds before starting any repair work.

4 - Fuel high pressure common injection rail

4.1 - Role.

The fuel high pressure common injection rail acts as a fuel accumulator.

The fuel is available for all diesel injectors.

4.2 - Description.

Components connected to the fuel high pressure common injection rail :
- High pressure fuel supply pipe.
- Diesel injector supply pipes.
- Fuel temperature sensor.
- Fuel high pressure sensor.

The volume of the fuel high pressure common injection rail is suited to the engine capacity.

5 - Battery (BB00)BB00

The charge level of the battery is important for the HDI direct injection system to operate.

WARNING : A battery voltage of less than 10 volts disturbs the operation of the HDI direct injection system.
The ECU memorises a fault in the following cases :
- Battery voltage greater than 17,5 volts.
- Battery voltage less than 7 volts.

6 - Double injection relay (1304)1304

The double injection relay is controlled directly by the injection ECU.

The first relay of the double injection relay supplies the following components :
- Booster pump (low pressure).
- Boost pressure regulation electrovalve.
- Air flowmeter.
- Recycling regulation electrovalve (EGR).

The second relay of the double injection relay supplies the following components :
- Injection ECU (power part).
- Control relay of the electric cooling fans.

NOTE : After switching off the ignition, the double injection relay remains energised for 4 seconds or for 6 minutes in the event of post-ventilation.

During a request to unlock the injection ECU by the engine immobiliser system (specific ECU channel) :
- The ECU supplies the double injection relay.
- The ECU is re-supplied by the double injection relay (power).
- Dialogue between the injection ECU and the engine immobiliser system is possible.
- At the end of dialogue, the injection ECU cuts the supply to the double injection relay.

WARNING : The engine immobiliser system wakes up the injection ECU via channel 66 of the connector.

7 - Accelerator pedal sensor (1261)(1261)

7.1 - Role.

The sensor is linked to the accelerator pedal by a cable.

The wheel sensor :
- Records the driver's request (acceleration, decelaration).
- Sends information to injection ECU.

Using this information, the ECU works out the fuel flow to inject (time and injection pressure).

7.2 - Description.

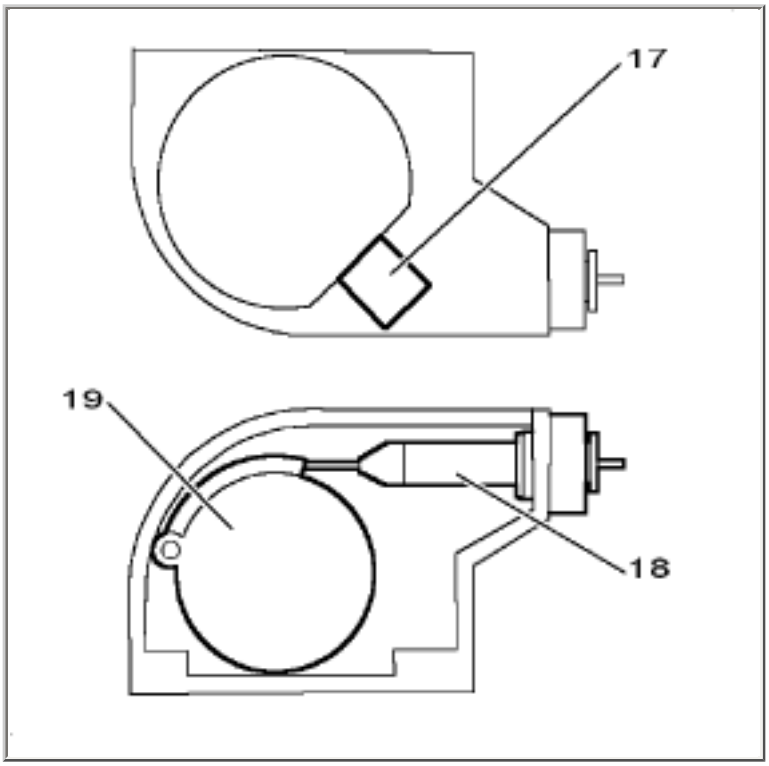


Fig : B1HP11DC

(17) electrical connector.

(18) accelerator cable.

(19) drive cam.

The accelerator pedal sensor provides 2 signals (voltage).

The voltage value of one signal is equivalent to half of the other one.

Items of information from the connector channels are constantly compared with each other to detect a possible fault.

NOTE : The accelerator pedal sensor does not have a contact.

7.3 - Electrical features.

Allocation of the connector channels :

- Channel 1:Output signal 1.
- Channel 2:Output signal 2.
- Channel 3:5 volts.

- Channel 4:Earth.

Accelerator pedal released :

- Voltage between earth and channel 1:0,5 volt.
- Voltage between earth and channel 2:0,28 volt.

Accelerator pedal pressed fully down :

- Voltage between earth and channel 1:3,35 volts.
- Voltage between earth and channel 2:1,6 volt.

7.4 - Location.

In the engine compartment.

8 - Engine speed sensor (1313)(1313)

8.1 - Role.

The sensor is located opposite the teeth of the flywheel.

The sensor is used to work out the following parameters :

- Engine rpm.
- Position of removable coupling.

8.2 - Description.

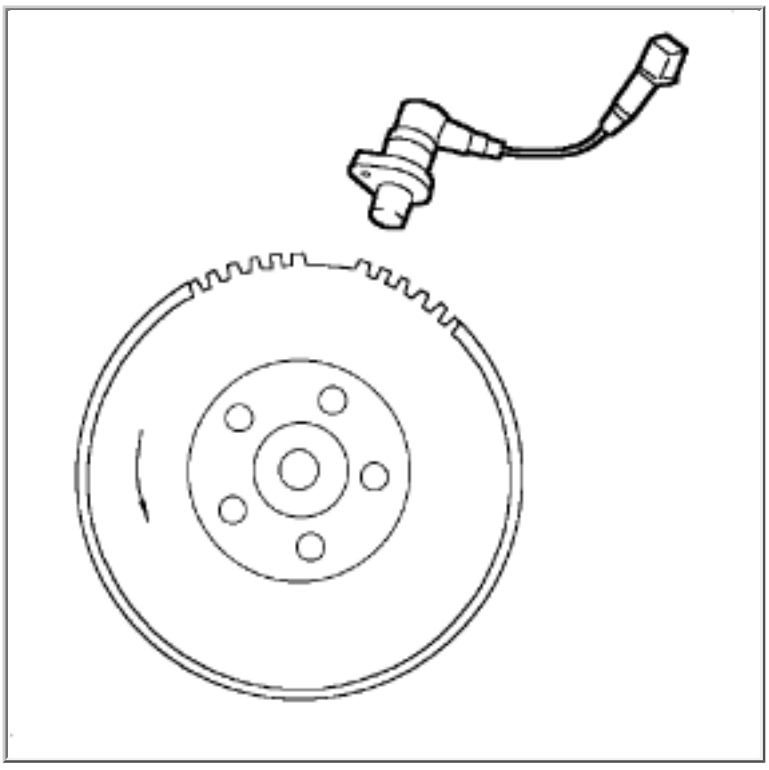


Fig : B1HP06VC

The sensor is of the inductive type.

Components of the sensor :
- A permanent magnet.
- An electric winding.

The sensor provides an electrical signal every time a tooth on the flywheel passes by (change in magnetic field).

The 58 teeth are used to work out the engine speed.

The 2 missing teeth are used to work out the crankshaft position (no signal).

NOTE : The air gap is not adjustable.

8.3 - Electrical features.

Allocation of the connector channels :
- Channel 1:Signal.
- Channel 2:Earth.

Resistance between channels 1 and 2:50 ohms.

Features of the signals emitted:variable frequency alternating voltage.

WARNING : The sensor wire is not screened, therefore always follow the correct harness route.

8.4 - Location.

Location:on the clutch housing.

9 - The camshaft position sensor (1115)1115

9.1 - Role.

Role of the injection ECU according to the data received :
- To synchronise fuel injections with respect to the position of the pistons.

- To recognise top dead centres.

9.2 - Description.

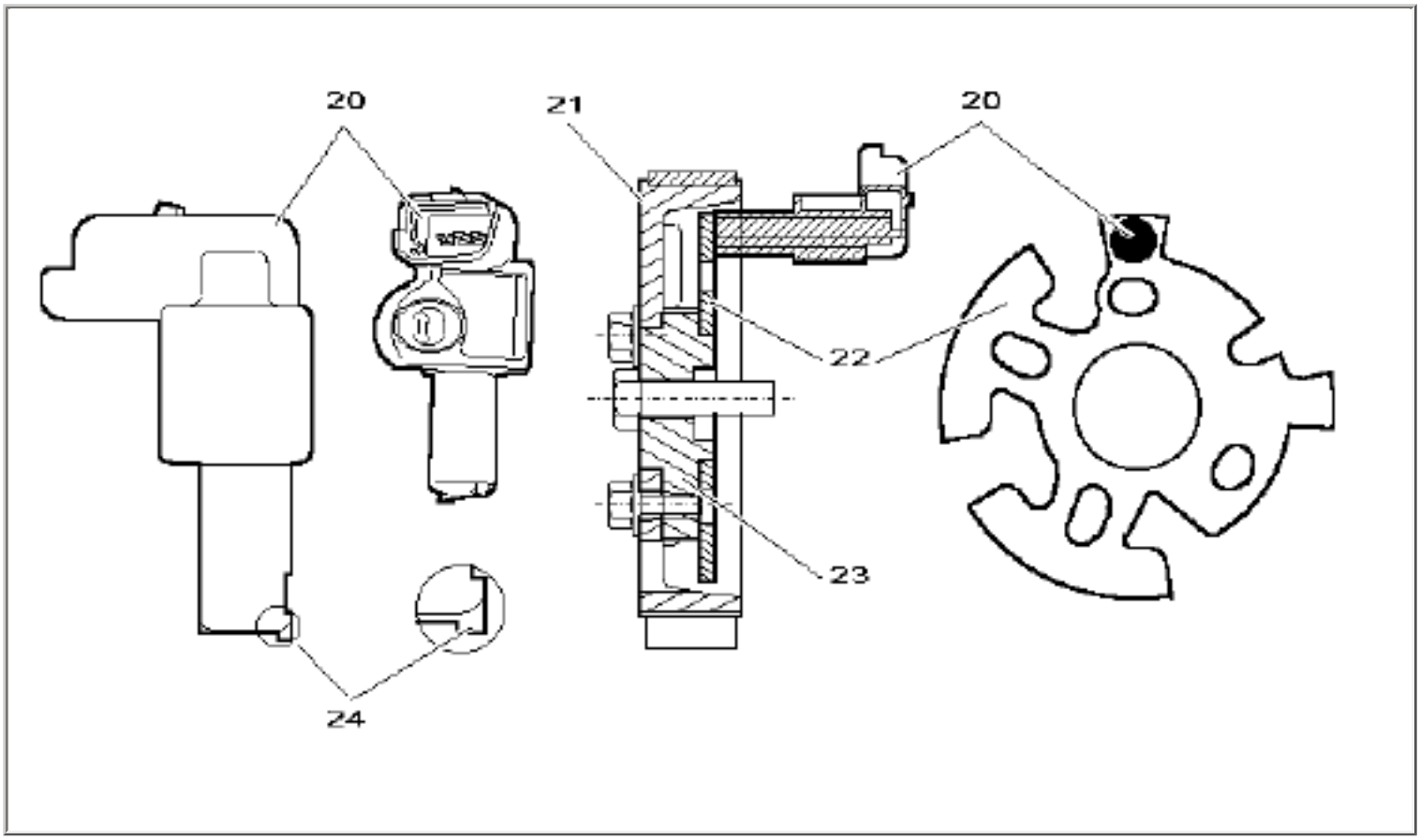


Fig : B1HP11ED

"Hall effect" sensor.

(20) camshaft position sensor.

(21) camshaft pulley.

(22) target driven by the camshaft.

(23) camshaft hub.

(24) plastic lug.

The camshaft sensor provides a square signal for the injection ECU.

The camshaft sensor is located opposite a target driven by the camshaft pulley.

The sensor is used to synchronise fuel injections with respect to piston position (sequential injection).

The plastic lug (24) is used to adjust the air gap in the factory.

NOTE : The plastic lug is destroyed the first time the engine is started.

IMPORTANT : When refitting a camshaft sensor, it is necessary to keep the gap between the sensors and target E = 1,2 (+0 ; +0,1) mm.

9.3 - Electrical features.

Air and fuel supply:injection ECU.

Allocation of the connector channels :
- Channel 1:5 volts supply.
- Channel 2:Signal.
- Channel 3:Earth.

The voltage slots are between 0 and 5 volts.

Signal emitted :
- Presence of metal earth opposite the sensor:0 volt.
- Absence of metal earth opposite the sensor:5 volts.

10 - Engine coolant temperature sensor (1220)(1220)

10.1 - Role.

The engine coolant temperature sensor informs the ECU about the engine coolant temperature.

Role of the injection ECU according to the data received :
- To adjust the preheating time.
- To adjust the postheating time.
- To adjust the starting flow.
- To adjust the idle speed.
- To authorise exhaust gas recycling (EGR).
- To adjust the fuel flow.
- To limit the flow injected if the temperature of the coolant is critical (anti-boil function).
- To operate the fans.

- To operate the logometer on the control panel (*).
- To operate the warning and prewarning lights (*).

NOTE : (*) according to model.

10.2 - Description.

There are 2 assembly possibilities :
- 3-way blue sensor.
- 2-way green sensor.

10.2.1 - 3-way blue sensor.

The sensor consists of 2 NTC (negative temperature coefficient resistor).

Allocation of the connector channels :
- Channel 1-Channel 2:NTC for the injection ECU.
- Channel 3-Earth:NTC for the gauge on the control panel.

Electrical specifications :
- Channel 1-Channel 2:Resistance at 20 °C=6200 ohms.
- Channel 3-Earth:Resistance at 30 °C=1925 ohms.

10.2.2 - 2-way green sensor.

The sensor consists of a Negative Temperature Coefficient (NTC) resistor.

The higher the temperature, the greater its resistance.

Electrical specifications:resistance at 20 °C =6200 ohms.

10.2.3 - Location.

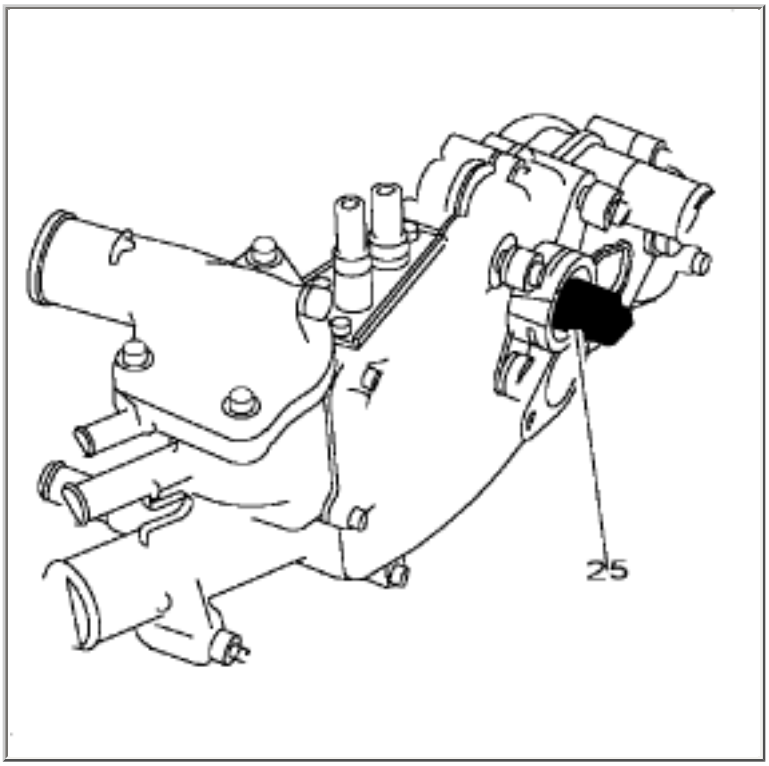


Fig : B1GP078C

(25) engine coolant temperature sensor.

The water temperature sensor is fitted to the coolant unit.

There are 2 assembly possibilities.

Metal coolant outlet housing :
- The coolant temperature sensor is screwed in.
- It is sealed with a copper seal.

Plastic coolant outlet housing :
- The coolant temperature sensor is secured by a plastic clip.
- It is sealed with an O-ring.

11 - Air temperature sensor (1310)(1310)

11.1 - Role.

The air temperature sensor informs the ECU about the temperature of the air taken in.

Role of the injection ECU according to the data received :
- To control the additional heating.
- To calculate the density of the ambient air.

WARNING : The air temperature probe is incorporated into the air flow meter.

11.2 - Description.

The sensor consists of a Negative Temperature Coefficient (NTC) resistor.

The more the temperature increases, the more its resistance value is reduced.

Electrical specifications:resistance at 25 °C =3300 ohms.

11.3 - Location.

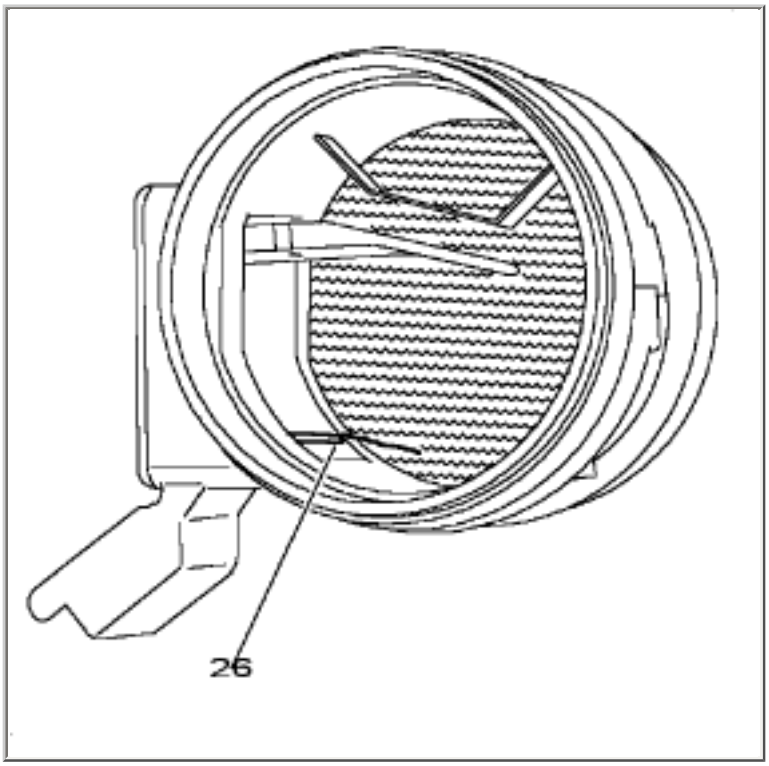


Fig : B1HP11FC

(26) air temperature sensor.

The air temperature probe is incorporated into the air flow meter.

12 - Fuel temperature sensor (1221)(1221)

12.1 - Role.

Role of the injection ECU according to the data received :

- To adjust the fuel flow.
- To calculate the fuel density.

12.2 - Description.

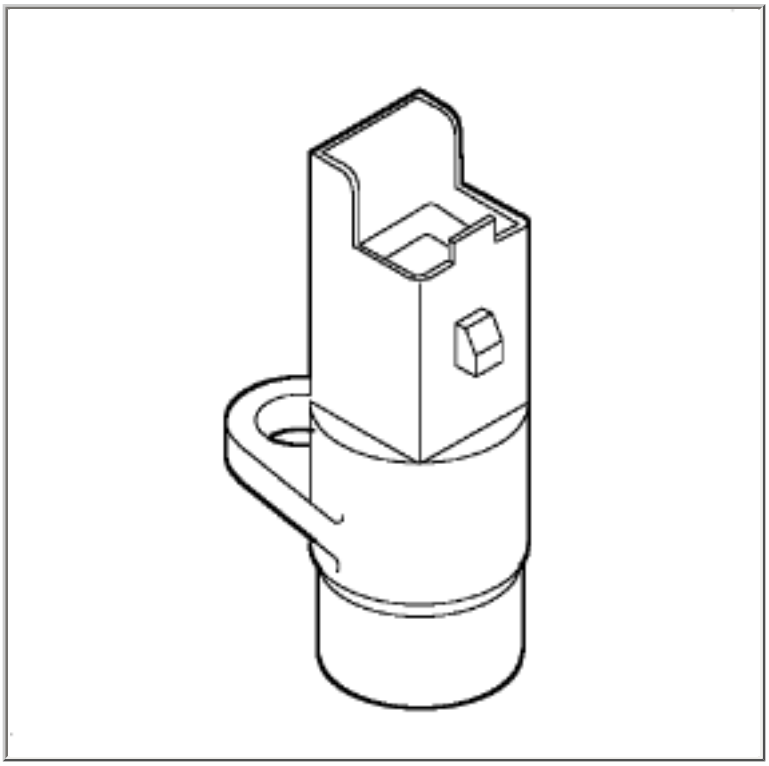


Fig : B1HP11GC

The sensor consists of a Negative Temperature Coefficient (NTC) resistor.

A variation of this assembly measures the fuel temperature directly on the return to tank circuit :
- Resistance at 25 °C=2400 ohms.
- Resistance at 80 °C=270 ohms.

12.3 - Location.

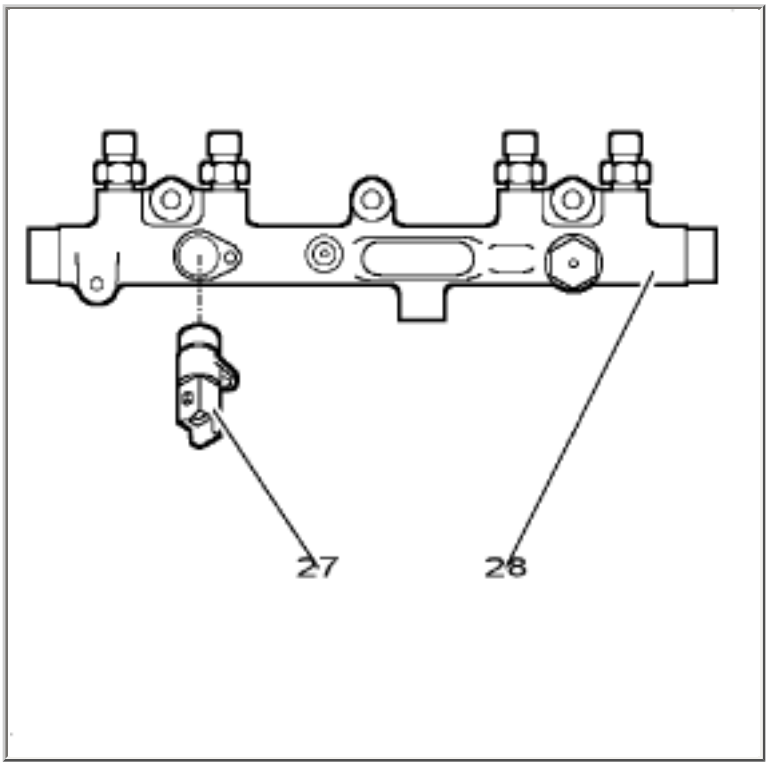


Fig : B1HP11HC

(27) fuel temperature sensor.

The fuel temperature sensor is secured to the fuel high pressure common injection rail (28).

13 - Fuel high pressure sensor (1321)(1321)

13.1 - Role.

The sensor measures the value of the high pressure in the fuel high pressure common injection rail.

Role of the injection ECU according to the data received :
- To work out the amount of fuel to inject=Injection time.
- To regulate the fuel high pressure in the fuel high pressure common injection rail.

13.2 - Description.

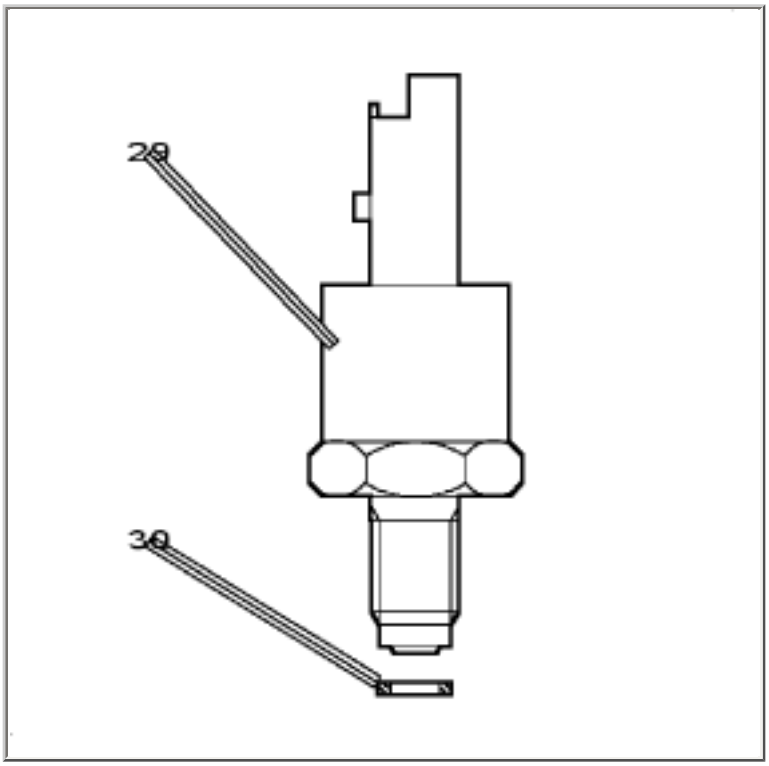


Fig : B1HP11JC

(29) fuel high pressure sensor.

(30) metal seal.

The sensor is of the piezoelectrical type.

The sensor consists of stress gauges.

The sensor provides a voltage which is proportional to the fuel pressure in the high pressure common injection rail.

13.2.1 - Electrical features.

Allocation of the connector channels :
- Channel 1:Earth.
- Channel 2:Pressure information (0 to 5 volts).
- Channel 3:+5 volts supply.

Voltage provided for a pressure of 100 bar:ð 0,5 volt.

Voltage provided for a pressure of 300 bar:ð 1,3 volt.

13.2.2 - Location.

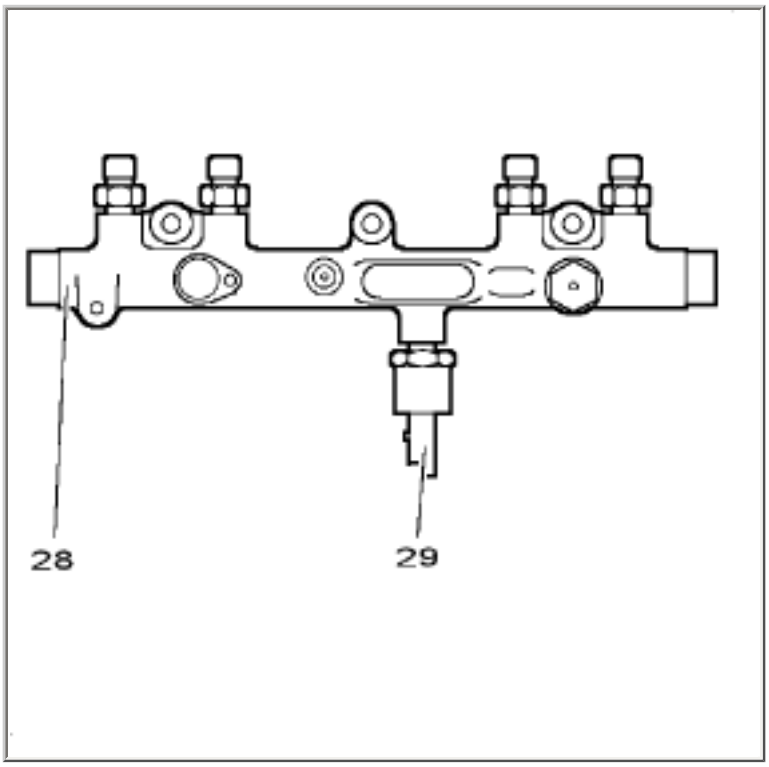


Fig : B1HP11KC

(29) fuel high pressure sensor.

The sensor is located on the fuel high pressure common injection rail (28).

14 - Vehicle speed sensor (1620)1620

14.1 - Role.

Role of the injection ECU according to the data received :
- To work out the vehicle speed (vehicle stationary or vehicle moving).
- To work out the ratio of the gear engaged.
- To improve idling speed when the vehicle is moving.
- To optimise acceleration.
- To reduce engine hesitation.

14.2 - Description.

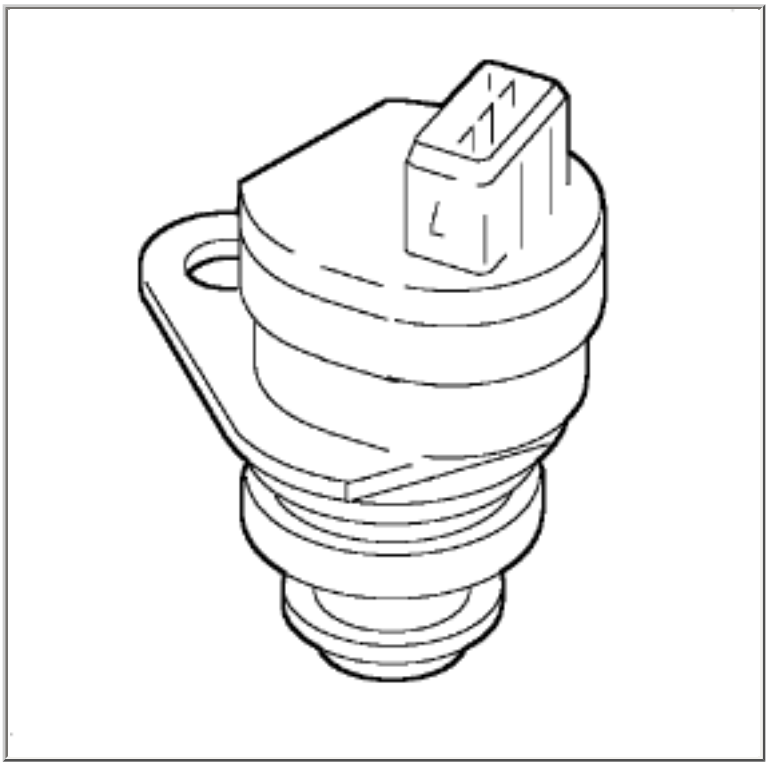


Fig : B2CP399C

The sensor informs the ECU of the speed of the vehicle.

"Hall effect" sensor :
- 5 impulses per metre.
- 8 impulses per revolution.

14.3 - Electrical features.

Allocation of the connector channels :
- Channel 1:+12 volts supply.
- Channel 2:Earth.
- Channel 3:Signal.

14.4 - Location.

The sensor in located in the gearbox.

15 - Brake switch

15.1 - Role.

The switch ensures the injection ECU provides good driving pleasure.

15.2 - Location.

The brake switch is located on the pedal.

16 - Injection ECU (1320)(1320)

16.1 - Role.

The ECU controls the whole injection system.

The ECU software integrates :
- Check functionalities of injection and pollution control.
- Driving improvement strategies.
- Engine immobiliser function.
- Emergency strategies.
- Fan unit and warning lamp operating management (*).
- Control of coolant heater systems for the heat exchanger (*).
- The diagnostic with memorisation of failures.

NOTE : (*) according to model.
The ECU ensures the electrical control of the following elements :
- Diesel fuel injectors.
- Boost pressure regulation electrovalve.
- Fuel high pressure regulator.
- Recycling regulation electrovalve (EGR).
- Pre and post-heating control unit (post-heating cut-off).
- Deactivator of the 3rd piston of the high pressure fuel pump.

The ECU supplies the following information :
- Engine speed:To the instrument panel.
- Consumption at any one time:To the on-board ECU.
- Air conditioning interruption.
- Coolant heater operation authorisation (depending on the version).

The atmospheric pressure sensor can not be separated from the injection ECU.

The ECU contains a power stage which can supply the very high control current required for the diesel injectors to operate.

The injection ECU is connected to the injection harness by a 88-way connector.

The injection ECU software is updated by downloading (ECU fitted with a flash EPROM).

16.2 - Allocation of the connector channels.

Channel No.	Description
1	+12 volts supply (after double relay)
2	Output:control of injector N° 1
3	Output:control of injector N° 3
4	Output:control of injector N° 4
5	Output:control of injector N° 2
6	Output:control of injector N° 2
7	---
8	Diagnostic line for the coils of the fan unit control relays
9	---
10	Diagnostic line l
11	Input:air temperature sensor (flowmeter)
12	5 volt output:sensor supply
13	Input:air flow signal (flowmeter)
14	Input:engine speed sensor signal
15	Input:accelerator pedal sensor signal
16	---
17	---
18	Input:camshaft sensor signal
19	Input:vehicle speed (vehicle speed sensor)
20	---
21-22	---
23	Output:engine coolant temperature information (gauge and warning lamp in the instrument panel)
24	---
25	Output:control of fan unit group 1
26	Output:boost pressure regulation electrovalve

27	Earth:air conditioning pressostat
28	---
29	+12 volts supply (after double relay)
30	Output:control of injector N° 1
31	Output:control of injector N° 3
32	Output:control of injector N° 4
33	Earth
34	Sensors earth
35	---
36	Engine immobiliser serial line
37	---
38	Diagnostic line k
39	Input:fuel temperature sensor
40	Earth
41	Input:engine speed sensor signal
42-43	---
44	Power supply to sensors (5 volts)
45	Earth:water temperature sensor
46	Input:engine coolant temperature information
47	Input:air conditioning on information (AC/ON)
48	Input:stop lamp switch connection
49	Earth
50	Input:fuel pressure information
51	Earth
52	Output:recycling electrovalve control (EGR)
53	Earth
54-55	---
56	Output:preheating warning lamp
57	---

58	Output 1:control of additional heating 1
59-60	---
61	---
62	Output:engine speed to instrument panel
63	Output:fuel consumption at any moment (trip computer)
64	Input:accelerator pedal sensor
65	---
66	Input:wake up for injection ECU, wake up for ADC
67	Output:control for preheating unit
68	Input:accelerator pedal sensor
69	After ignition +
70	Input:catalytic converter temperature
71	Input:inlet manifold air pressure
72	---
73	Input:unused brake switch
74	Input:fuel pressure
75	Air conditioning pressostat (26 bar control stage)
76-79	---
80	Output:deactivator of the 3rd piston of the high pressure fuel pump
81	Output:engine coolant temperature information (instrument panel)
82	Output:diagnostic warning lamp (instrument panel)
83	Output:control of fan unit group 2
84	Output:air conditioning compressor control
85	Output 2:control of additional heating 2
86	Output:double relay control
87	Output:double relay control

88	Output:control for preheating unit

17 - Feature of the diesel injector control

The diesel injectors are controlled by 2 control stages of the injection ECU :
- Control stage 1:Injector group 1 - 4.
- Control stage 2:Injector group 2 - 3.

The control stages of the diesel injectors are used to obtain the following voltages :
- A peak voltage of 80 volts required when the diesel injectors start to lift.
- A voltage of 50 volts required to keep the diesel injectors open.

The control stages incorporated into the injection ECU each have a capacitor which stores the power required to control the diesel injectors.

Between each injection, the injection ECU sends pulses on the coil of the injector which is not working.

The pulses create an induced voltage to charge the corresponding control stage (capacitor).

WARNING : The control stage cannot charge itself when a fault is present on the supply line of a diesel injector.

IMPORTANT : Given the presence of high voltages at the terminals of the ECU and diesel injectors, voltages should always be measured with the recommended equipment.

18 - Diesel fuel injectors 1331, 1332, 1333, 13341331, 1332, 1333, 1334

18.1 - Role.

The diesel injectors inject the amount of fuel required for the engine to operate.

Injecting the fuel directly into the top of the pistons improves engine efficiency.

The fuel can be injected in the following cases :
- Pre-injection.
- Main injection.
- Post-injection.

18.2 - Description.

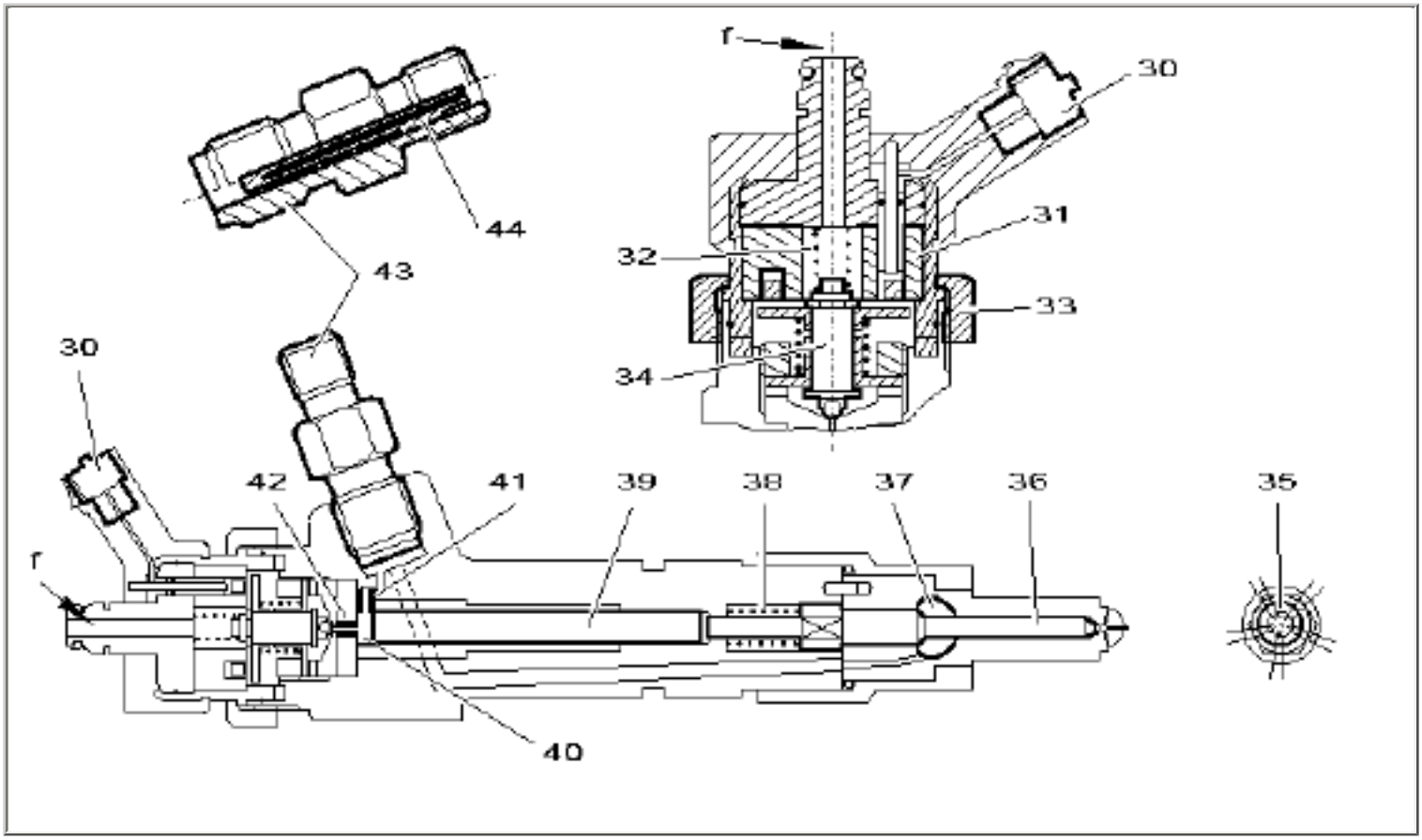


Fig : B1HP11LD

F:return to fuel tank.

(30) electrical connector.

(31) control electrovalve coil.

(32) control electrovalve spring.

(33) nut.

(34) control electrovalve needle.

(35) diesel injector tip.

(36) diesel injector needle.

(37) pressure chamber.

(38) diesel injector spring.

(39) control piston.

(40) control chamber.

(41) supply nozzle.

(42) fuel return circuit nozzle.

(43) high pressure fuel inlet connector.

(44) laminar filter included in the connector (43).

The control electrovalve is located in the upper part of the diesel injector.

The control electrovalve is secured to the body of the diesel injector by the nut (33).

The diesel injectors have 5 holes which encourage air/fuel mixing.

NOTE : The diameter of the 5 holes of the diesel injectors are suited to the engine version.

IMPORTANT : Do not handle a diesel injector by means of its upper nut (33) (diesel injector will be damaged).

NOTE : The laminar filter requires no maintenance.
The amount of fuel injected depends on the following parameters :

- Duration of the electrical control (injection ECU).
- Opening speed of the diesel injector.
- Hydraulic flow of the diesel injector (number and diameter of holes).
- Fuel pressure in the fuel high pressure common injection rail.

The fuel pressures used in the HDI direct injection system prevent the diesel injectors from being directly electrically controlled.

The diesel injectors open due to the pressure difference between the control chamber (40) and the pressure chamber (37).

The diesel injector needle (36) is held against its seat by the spring (38).

The control piston (36) is fitted on top of the diesel injector needle (39) (the control piston is free within its bore).

The top of the control piston opens out into the control chamber (40).

The control chamber is connected to the following circuits :
- High pressure fuel circuit through the nozzle (41).
- Fuel tank return circuit through the nozzle (42).

The control chamber (40) is isolated from the fuel return circuit by the electrovalve needle (34).

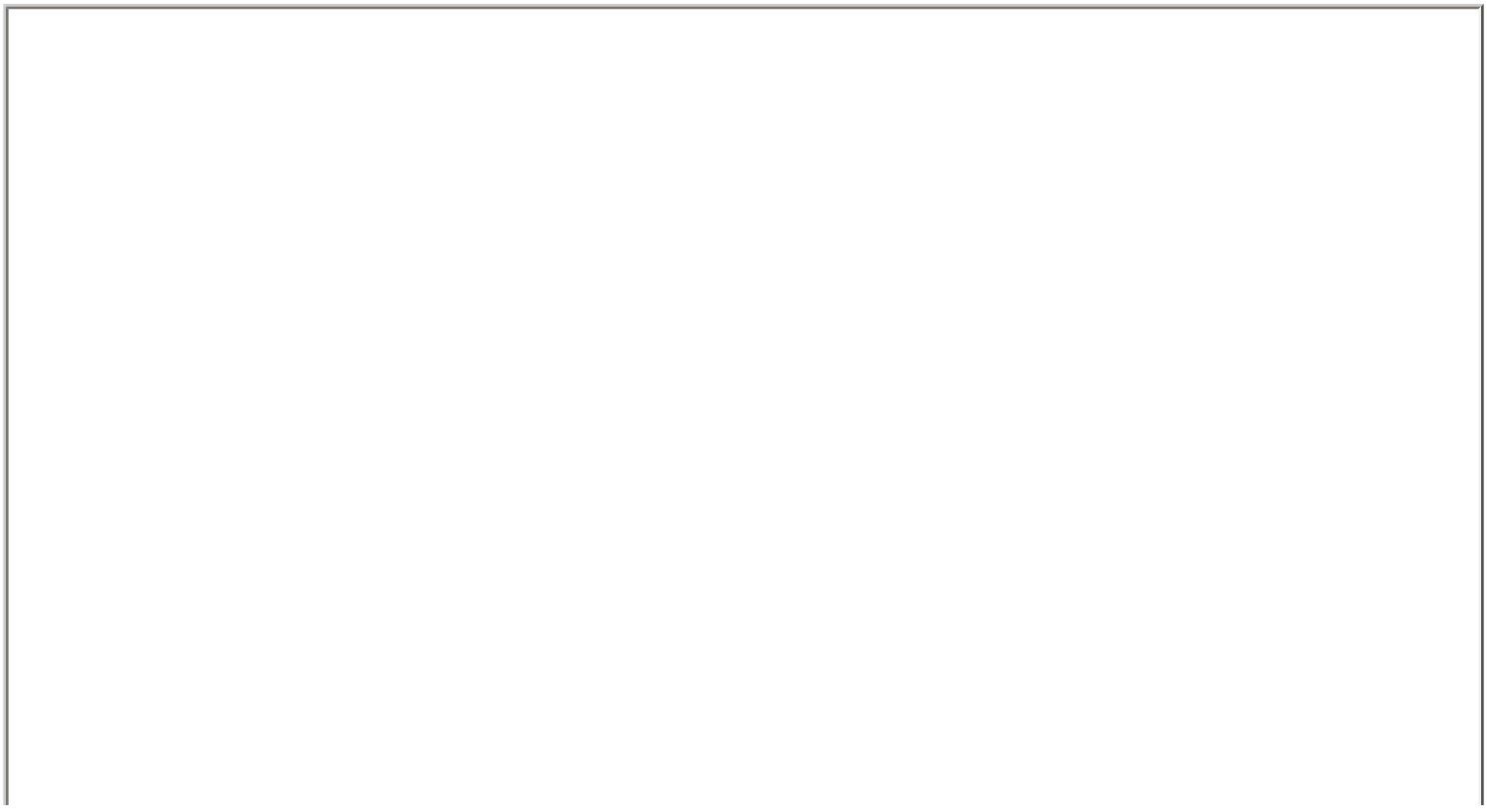
The diesel injector needle (36) is held against its seat by the spring (32).

The fuel is distributed evenly between chambers (40) and (37).

Nozzle (42) is larger than nozzle (41).

The electrovalve needle rises as soon as the electrovalve coil is energised (magnetic field).

18.3 - Lifting principle of a diesel injector.



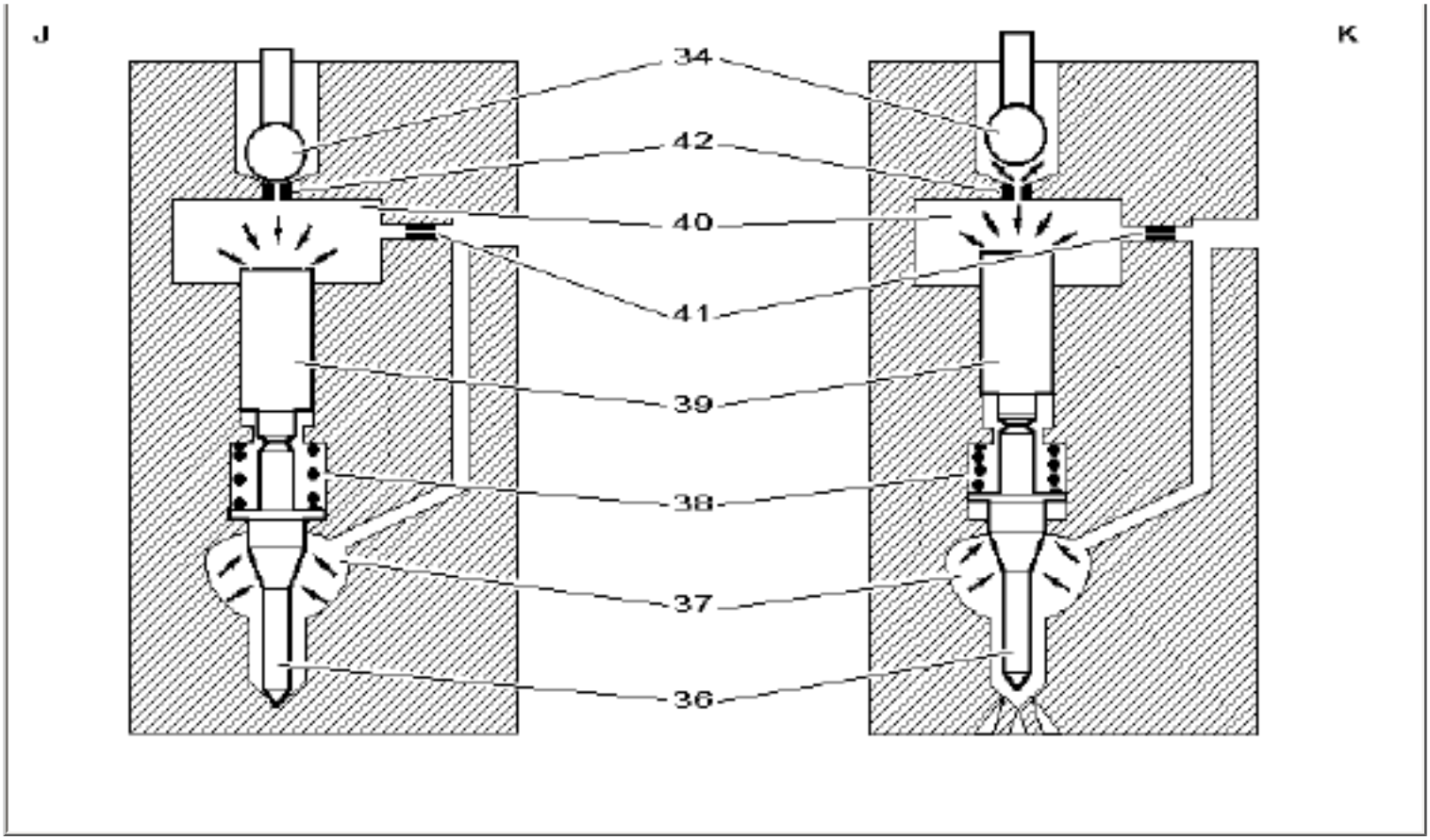


Fig : B1HP11MD

J:diesel injector closed.

K:opening of a diesel injector.

(34) control electrovalve needle.

(36) diesel injector needle.

(37) pressure chamber.

(38) diesel injector spring.

(39) control piston.

(40) control chamber.

(41) supply nozzle.

(42) fuel return circuit nozzle.

18.3.1 - Diesel injector closed.

The force exerted by the high pressure is the same between the control chamber (40) and the pressure chamber (37).

The control piston is locked (held against the diesel injector needle).

The rise in pressure in the fuel high pressure common injection rail encourages the diesel injector to close.

18.3.2 - Opening principle of a diesel injector.

The injection ECU supplies the control electrovalve.

Operating phase as soon as the electrovalve needle (34) lifts up under the action of the control electrovalve (magnetic field) :
- A fuel leak is created through the nozzle (42).
- Fuel entering through the nozzle (41) does not compensate for the leak through the nozzle (42).
- There is no longer a pressure balance between chambers (40) and (37).
- The pressure in the pressure chamber (37) lifts the diesel injector needle.
- The control piston lifts up.
- The fuel is sent to the top of the piston.

NOTE : Fuel injection lasts for as long as the diesel injector electrovalve is energised.

NOTE : Maximum lifting of the control electrovalve needle:ð 0,06 mm.

18.3.3 - Features depending on the time for which the electrovalve is controlled.

Short duration control :
- The control piston has a certain inertia.
- The diesel injector needle is lifted slightly.
- A small amount of fuel is injected.
- The injection pressure is lower than the pressure in the fuel high pressure injection rail.

Long duration control :
- The control piston and the diesel injector needle have lifted up completely.
- A large amount of fuel is injected.
- The injection pressure is equal to the pressure in the high pressure fuel injection rail.

NOTE : The mechanical behaviour of the diesel injector is stored in a cartographic map.

18.3.4 - Closing principle of a diesel injector.

Operating phase as soon as the injection ECU cuts the supply to the diesel injector electrovalve :

- The electrovalve spring holds the electrovalve needle against its seat.
- The nozzle (42) is blocked.
- The fuel leak to the return circuit stops.
- The rise in pressure in the control chamber (40) causes the diesel injector to close.
- The pressure balance is restored between chambers (40) and (37).
- The diesel injector is ready for a new cycle.

18.4 - Control of the diesel injector electrovalves.

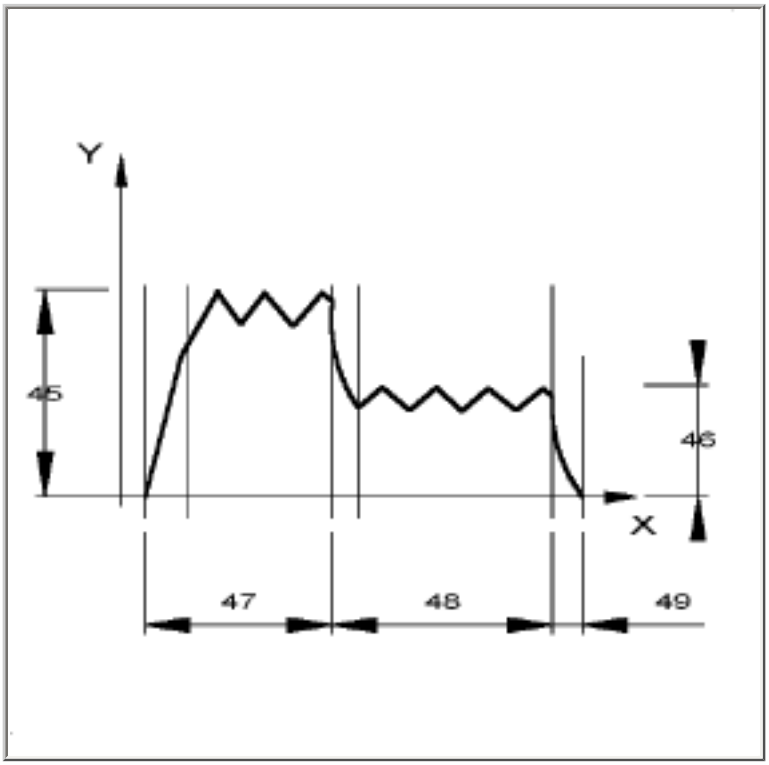


Fig : D3AP015C

Diesel injector control current.

Y:amps.

X:duration.

(45) initial current.

(46) holding current.

(47) initial phase.

(48) holding phase.

(49) end of control.

The electrical supply to an electrovalve consists of 2 phases :
- Initial phase (initial voltage and current).
- Holding phase (holding voltage and current).

18.4.1 - Initial phase.

The aim of the initial phase is to cause the electrovalve needle to rise rapidly.

The diesel injector electrovalve is supplied as follows :
- A voltage of approximately 80 volts.
- A current of approximately 20 A.

NOTE : The initial phase is limited to a few milliseconds (0,3 ms).

18.4.2 - Holding phase.

The holding phase is used to continue the supply to the electrovalve whilst limiting the electrical power absorbed.

The diesel injector electrovalve is supplied as follows :
- A voltage of approximately 50 volts.
- A current of approximately 12 A.

18.4.3 - Features of the electrical control.

WARNING : Do not supply a diesel injector with 12 volts (electrovalve is destroyed).