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## Technical Note 3444A

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### JE0K - JE0S

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Basic manual: Workshop Repair Manual 315 and Technical Note 3426A

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# SPECIAL FEATURES OF THE ESPACE FITTED WITH THE G9T ENGINE

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77 11 297 982

AUGUST 2000

EDITION ANGLAISE

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"The repair methods given by the manufacturer in this document are based on the technical specifications current when it was prepared.

The methods may be modified as a result of changes introduced by the manufacturer in the production of the various component units and accessories from which his vehicles are constructed."

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# DIESEL EQUIPMENT Specifications

# 13

Vehicle	Gearbox	Engine							Depollution standard
		Type	Index	Bore (mm)	Stroke (mm)	Cubic capacity (cm <sup>3</sup> )	Compression ratio	Catalytic converter	
JEO K JEO S	PK1	G9T	718	87	92	2 188	18/1	◇ C93	Euro 2000

ENGINE SPEED (rpm)			SMOKE DENSITY	
IDLING SPEED	Max. - no load	Max. - under load	Homologation value	Max. - Max
800 ± 10	4500	4250 ± 100	0.44 m <sup>-1</sup>	2.5 m <sup>-1</sup>

DESCRIPTION	BRAND/TYPE	SPECIAL NOTES
High pressure pump	BOSCH CP1	Pressure from <b>250 to 1350 bar</b>
Supercharging pump (low pressure)	BOSCH EKP3	Pressure from <b>2.5 to 4 bar</b>
Diesel pressure sensor	BOSCH	Fitted to the injection rail Resistance: <b>tracks 1,2 and 1,3 at 4.3 MΩ</b> <b>tracks 2,3 at 1050Ω</b>
Injectors	BOSCH	Solenoid injector Resistance: <b>&lt; 2 Ω</b> Maximum pressure <b>1525 bar</b>
Pressure regulator	-	Integrated with the high pressure pump Resistance: <b>≈ 5 Ω at 20° C</b>
Injection computer	BOSCH EDC15C 4.2	3 connector computer ( <b>32/48/48 tracks</b> )
Pre-postheating unit	NAGARES BED/7-12	With pre-postheating function controlled by the injection computer
Heater plugs	BERU or CHAMPION	Resistance: <b>0.6 Ω</b> connector removed
Accelerator potentiometer	HELLA	Double track potentiometer <b>track 1</b> potentiometer earth n°2 <b>track 2</b> potentiometer earth n°1 <b>track 3</b> potentiometer signal n°1 <b>track 4</b> potentiometer supply n°1 <b>track 5</b> potentiometer supply n°2 <b>track 6</b> potentiometer signal n°2
Air intake temperature sensor	SIEMENS	Integrated in the flow meter Resistance between <b>100 Ω and 40 Ω</b>

# DIESEL EQUIPMENT Specifications

# 13

DESCRIPTION	BRAND/TYPE	SPECIAL NOTES
Diesel temperature sensor	ELTH	Resistance $\approx$ <b>2050 <math>\Omega</math> at 25° C <math>\pm</math> 123 <math>\Omega</math></b>
Engine speed sensor	MGI	Resistance: <b>200 to 270 <math>\Omega</math> at 23°</b>
Atmospheric pressure sensor	BOSCH	Integrated in the computer <b>track 1</b> controlled earth <b>track 2</b> pressure signal <b>track 3</b> sensor supply
Camshaft sensor	ELECTRIFIL	Hall effect sensor
Turbocharging pressure sensor	DELCO	<b>track A</b> controlled earth <b>track B</b> pressure signal <b>track C</b> sensor supply
Turbocharger operating solenoid	BITRON/ SIEMENS	Resistance: <b>16.5<math>\pm</math> 1.7 <math>\Omega</math> at 25° C</b>
Air flow meter	SIEMENS	Flow meter with integrated air temperature sensor <b>track 1:</b> air temperature <b>track 2:</b> earth <b>track 3:</b> <b>5 V</b> reference <b>track 4:</b> <b>+ 12 V</b> after injection relay <b>track 5:</b> air flow signal <b>track 6:</b> earth
EGR solenoid valve	PIERBURG	Solenoid valve resistance: <b>8 <math>\pm</math> 0.5 <math>\Omega</math> at 20° C</b> (tracks 1 and 5) Potentiometer resistance: <b>4 K<math>\Omega</math> <math>\pm</math> 1.6</b> at 20° C (tracks 2 and 4)
Turbocharger	GARRETT	Calibration: <b>120 mbar</b> for rod travel between <b>1 and 4 mm</b> <b>400 mbar</b> for a stroke between <b>10 and 12 mm</b>
Thermoplungers	EUROPALU	Resistance: <b>0.45 <math>\pm</math> 0.05 <math>\Omega</math> at 20° C</b> - 4 x 300 Watts
Coolant temperature sensor	ELTH	NTC C type sensor <b>track 2</b> controlled earth <b>track 3</b> coolant temperature Track 2/3 resistance: <b>2252 <math>\Omega</math> <math>\pm</math> 112 <math>\Omega</math></b>
Damper flap solenoid valve	EATON	Resistance: <b>43 to 49 <math>\Omega</math> at 25° C</b>
Turbulator flap solenoid valve (SWIRL)	EATON	Resistance: <b>43 to 49 <math>\Omega</math> at 25° C</b>

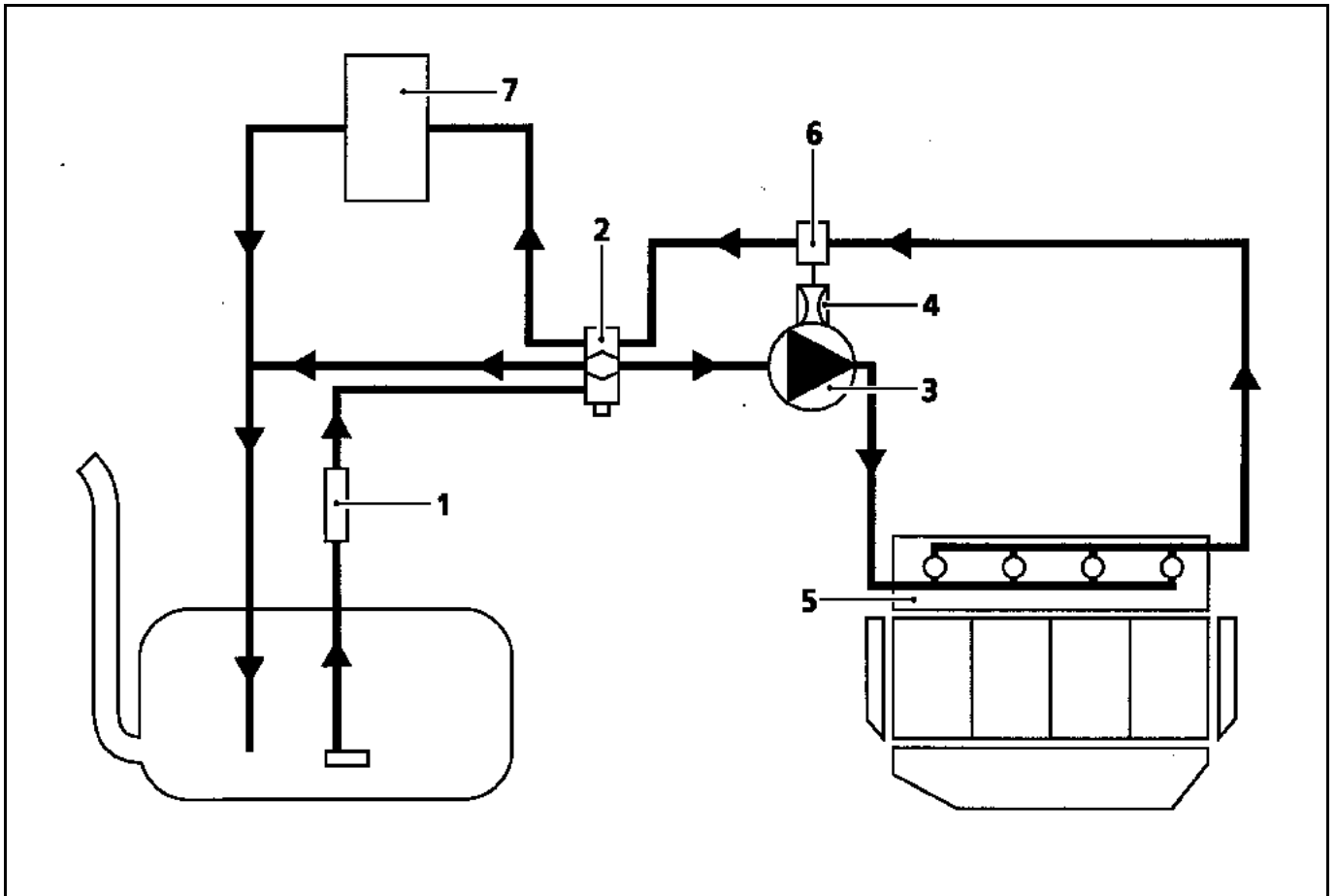
The common rail direct high pressure injection system is intended to deliver a specific quantity of diesel to the engine at a specific time.

### DESCRIPTION

The system consists of:

- a low pressure pump (1) (located between the air intake unit and the fuel filter),
- a fuel filter (2),
- a high pressure pump (3),
- a high pressure regulator (4) mounted on the pump,
- an injection rail (5) fitted with a diesel pressure sensor,
- a repriming valve (6) (open when operating normally),
- a fuel cooler (7),
- four solenoid injectors,
- various sensors,
- an injection computer.

Removal of the interior of the high pressure pump and the injectors is prohibited.



### OPERATION

The **common rail** direct high pressure injection system is a sequential diesel injection system (based on the operation of multipoint injection for petrol engines).

This new injection system reduces operating noise, lowers the quantity of polluting gas and particles and produces significant engine torque at low engine speeds thanks to a pre-injection procedure.

The low pressure pump (also called the supercharging pump) supplies the **HP** pump, through the filter with pressure of between **2** and **4 bar**.

The **HP** pump generates the high pressure sent to the injection rail. The pressure regulator located on the pump modulates the value of the high pressure via the computer. The rail supplies each injector through a steel pipe.

The computer:

- determines the value of injection pressure necessary for the engine to operate well and then controls the pressure regulator. It checks that the pressure value is correct by analysing the value transmitted by the pressure sensor located on the rail,
- determines the injection time necessary to deliver the right quantity of diesel and the moment when injection should be started,
- controls each injector electrically and individually after determining these two values.

The volume injected into the engine is determined as a function of:

- the duration of injector control,
- the injector opening and closing speed,
- the needle stroke (determined by the type of injector),
- the nominal hydraulic flow of the injector (determined by the type of injector),
- the high pressure rail pressure controlled by the computer.

**FOR ANY INTERVENTION IN THE HIGH PRESSURE INJECTION SYSTEM YOU MUST RESPECT THE CLEANING AND SAFETY ADVICE SPECIFIED IN THIS DOCUMENT.**

### POST-REPAIR CHECK

Reprime the circuit using the priming bulb.

After any operation, check that there are no diesel leaks. Start the engine at idle speed until the fan starts up, then accelerate several times under no load.

**IMPORTANT:** the engine must not run with diesel containing more than **10 %** diester.

The system can inject the diesel into the engine at a pressure of up to **1350 bar**. **Before any intervention, check that the injector rail is depressurised.**

It is absolutely vital that you observe the tightening torque:

- of the high pressure pipes,
- of the injector on the cylinder head,
- of the pressure regulator,
- of the pressure sensor.

**When the high pressure pump, injectors, supply, return and high pressure output unions are repaired or removed, the bores should be fitted with new and appropriate core seals to avoid impurities.**

**WARNING: ALL PIPES REMOVED MUST BE REPLACED.**

Follow the method described below when replacing the high pressure pipe:

- remove the high pressure pipe, holding the filter rod on the injector with a lock-wrench,
- fit the cleanliness plugs,
- undo the high pressure rail,
- fit the new high pressure pipe,
- offer up the unions by hand until they touch,
- tighten the high pressure rail mountings to torque,
- tighten the injector side union to torque,
- tighten the high pressure rail connection to torque.



**It is prohibited to remove the interior of the pump.**

**It is vital that you replace the fuel return pipe placed on the injectors during removal.**

**The diesel temperature sensor is not removable. It is part of the fuel return rail.**

**It is forbidden to loosen a high pressure pipe connection when the engine is running.**

### CLEANLINESS INSTRUCTIONS WHICH MUST BE FOLLOWED WHEN WORKING ON THE HIGH PRESSURE DIRECT INJECTION SYSTEM

#### Risks relating to contamination

The system is very sensitive to contamination. The risks caused by the introduction of contamination are:

- damage to or destruction of the high pressure injection system,
- seizing of a component or a component which is not sealed.

All After-Sales operations must be performed under very good cleanliness conditions. This means that no impurities (particles a few microns in size) have penetrated into the system during removal or into the circuits via the fuel unions.

**The cleanliness principle must be applied from the filter to the injectors.**

#### WHAT ARE THE POLLUTING ELEMENTS?

The elements which contaminate are:

- metal or plastic chips,
- paint,
- fibres:
  - of cardboard,
  - of brushes,
  - of paper,
  - of clothing,
  - of cloths.
- foreign bodies such as hair,
- ambient air,
- etc.

**WARNING:** it is impossible to clean the engine using a high pressure washer because of the risk of damaging connections. Also the moisture may collect in the connectors and cause electrical connection problems.

#### INSTRUCTIONS TO BE FOLLOWED BEFORE ANY WORK IS CARRIED OUT ON THE INJECTION SYSTEM

- Ensure that you have the plugs for the unions to be opened (bag of parts sold at the Parts Stores **part no. 77 01 206 381**).  
Plugs are to be used once only. After use, they must be thrown away (once used they are soiled and cleaning is not sufficient to make them reusable).  
Unused plugs must be thrown away.
- Ensure that you have the hermetically resealable plastic bags for storing removed parts. There is less risk of parts stored in this way being exposed to impurities. The bags can be used only once, and once used they must be thrown away.
- Ensure that lint-free cleaning wipes are available (**SODICAM** wipes, part no. **77 00 211 707**). **The use of conventional cloth or paper is prohibited.** These generate lint and may contaminate the system's fuel circuit. Each lint free cloth should only be used once.

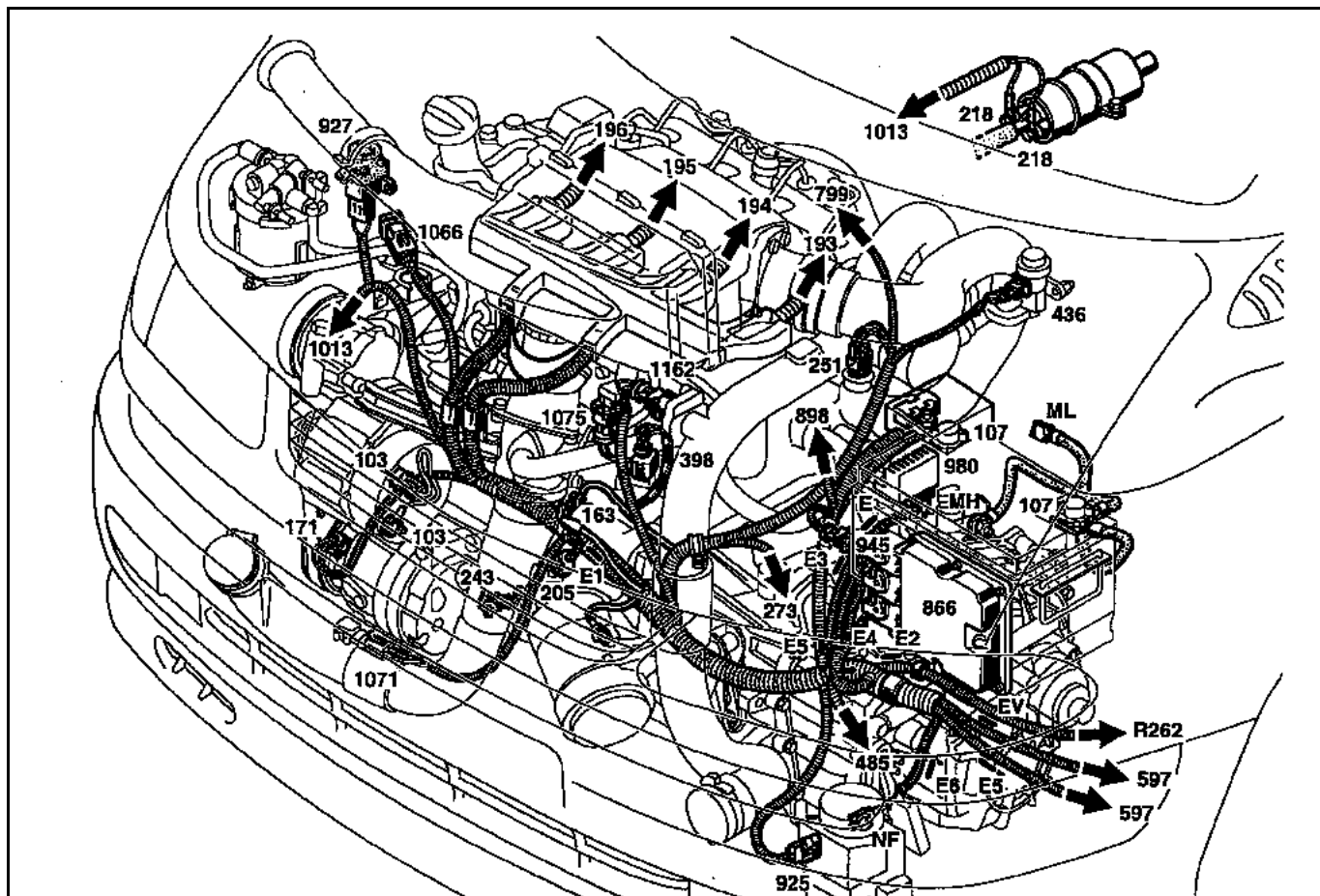


### INSTRUCTIONS TO BE FOLLOWED BEFORE OPENING THE FUEL CIRCUIT

- Use new thinner for every operation (used thinner contains impurities). Pour it into a clean receptacle.
- Use a clean brush which is in good condition for every operation, (the brush must not shed its bristles).
- Use a brush and thinner to clean the connections to be opened.
- Blow compressed air over the cleaned parts (tools cleaned the same way as the parts, connections and injection system zone). Check that no bristles are left.
- Wash your hands before and during the operation if necessary.
- Leather protective gloves must be covered with latex gloves (available from **SODICAM**).

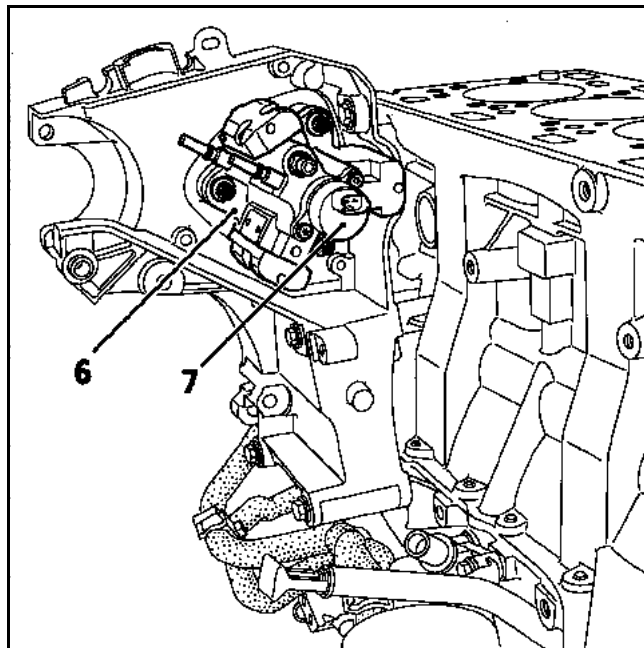
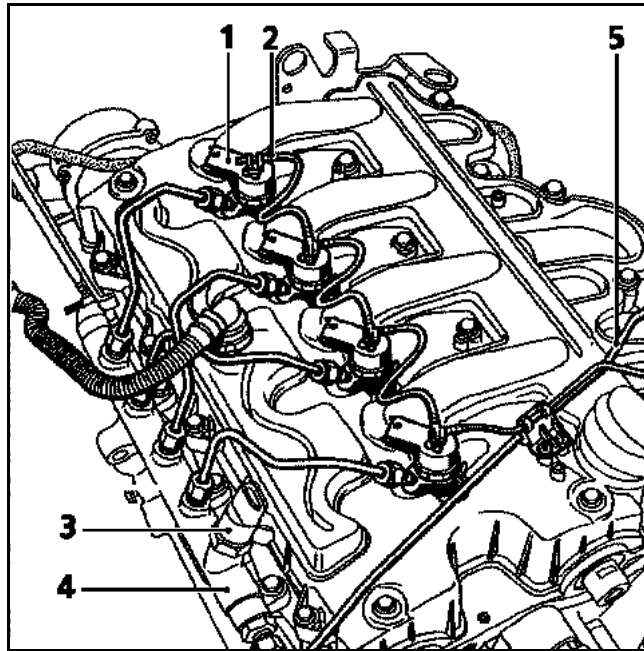
### INSTRUCTIONS TO BE FOLLOWED DURING THE OPERATION

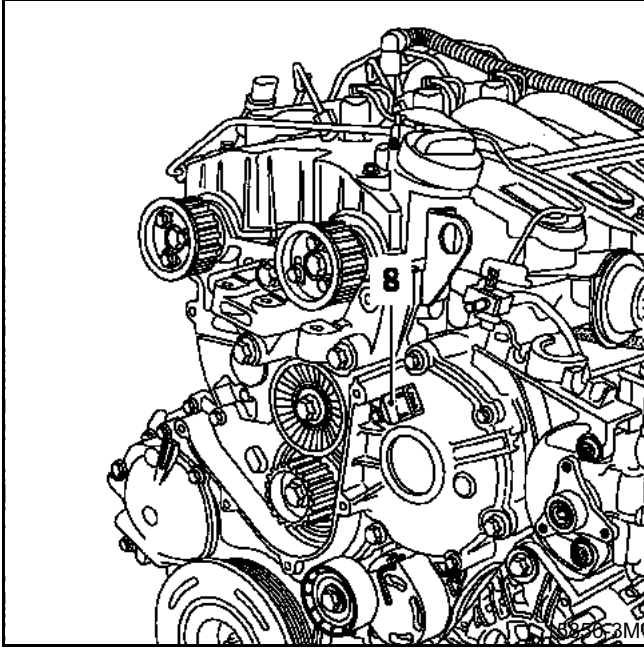
- All openings made in the circuit must be plugged immediately to prevent pollution from penetrating the circuit. The plugs to be used are available from the Parts Stores. They must not be reused under any circumstances.
- Reseal the bag hermetically, even if it has to be reopened only a short time later. Ambient air carries contamination.
- All components of the injection system must be stored in a hermetically sealed plastic bag once the plugs have been inserted.
- The use of a brush, thinner, bellows, sponge or normal cloth is strictly forbidden once the circuit has been opened. Such items are liable to permit the entry of impurities into the system.
- A new component replacing an old one must not be removed from its packaging until it is to be fitted to the vehicle.



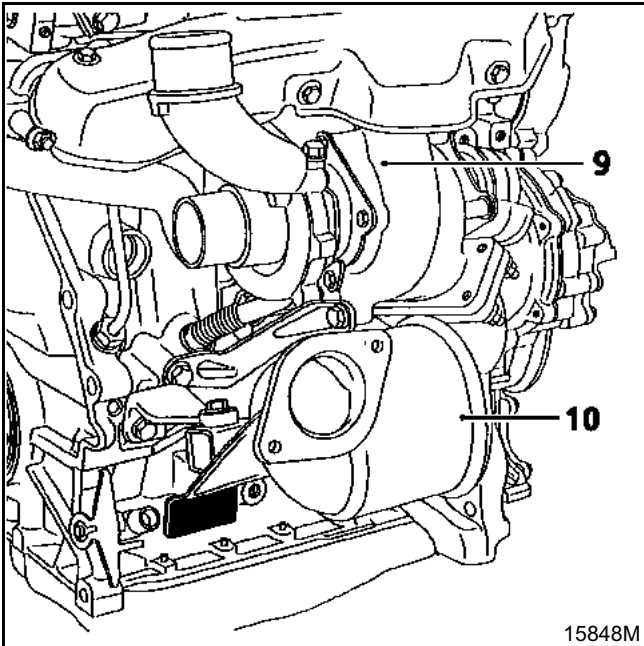
- 193** injector control
- 218** fuel pump
- 243** oil level sensor
- 251** engine coolant dual function temperature sensor
- 398** exhaust gas recirculation solenoid valve control
- 436** wastegate control
- 799** air duct air flow sensor
- 866** diesel injection computer
- 925** boiler connector
- 927** impact sensor
- 980** preheating plugs relay unit
- 1013** phase sensor
- 1071** turbocharging pressure sensor
- 1075** air cut-out solenoid valve control (stop damper)
- 1162** control for inlet manifold turbulator flap control

- 1 Injector
- 2 Injector diesel return pipe
- 3 Pressure sensor
- 4 Common injection rail
- 5 HP pump/rail supply pipe
- 6 High pressure pump
- 7 Pressure regulator

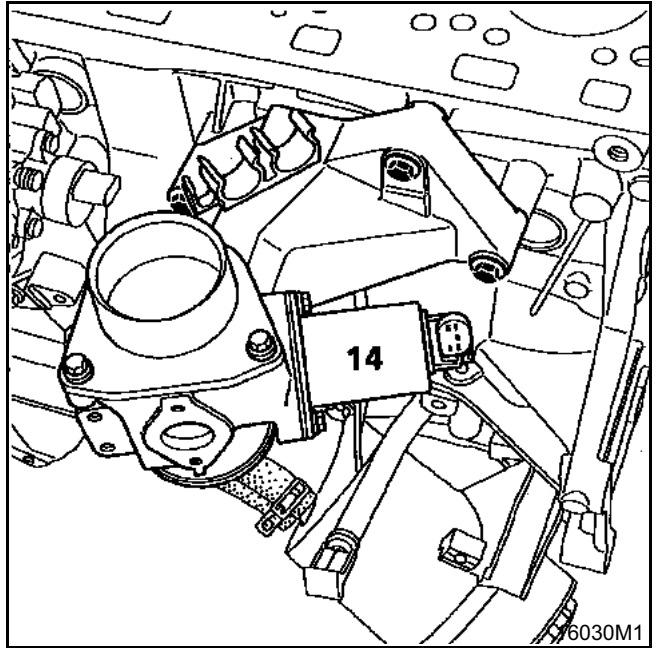
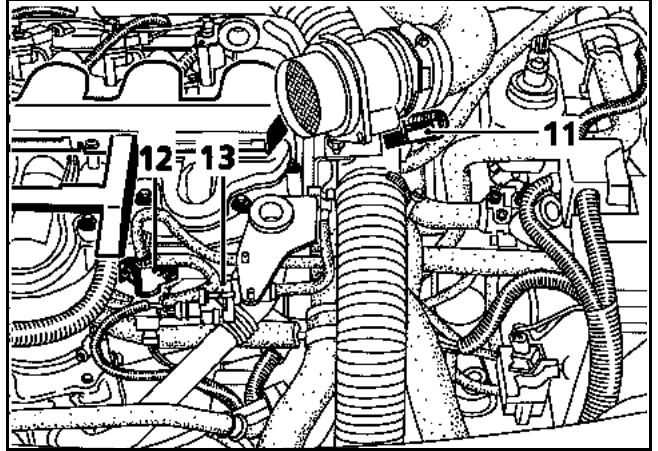




- 8 Cylinder marking sensor
- 9 Turbocharger
- 10 Priming catalytic converter



- 11 Air flow meter with air temperature sensor
- 12 Inlet turbulator control
- 13 Damper flap control
- 14 EGR control



Vehicles using the high pressure diesel system are fitted with two injection warning lights used during the preheating phase and in case of an injection fault.

### WARNING LIGHT PRINCIPLE

- When ignition is switched on, the preheating light is lit during the preheating phase and then goes out (see section 13 "Pre-postheating control").
- The fault warning light lights up when there is a fault on the injection system. These faults are:
  - Internal computer fault
  - Engine speed fault (1)
  - Main relay or low pressure pump fault (1)
  - Injector fault (1)
  - TDC sensor and camshaft sensor consistency fault (1)
  - Fuel pressure sensor fault
  - Fuel pressure regulator solenoid valve fault (1)
  - Accelerator potentiometer fault
  - Immobiliser fault
  - Computer supply voltage fault
  - Condenser voltage fault (1)
  - Turbocharging pressure sensor fault
  - Turbocharger solenoid valve fault

(1) In this case, the injection system cuts out.

If a fault is present when the ignition is switched on, the warning light lights up for a few seconds during the preheating phase, goes out and then lights up again if the fault persists.

**NOTE:** the **OBD** (On Board Diagnostic) warning light (symbolised by an engine), illuminated when the ignition is switched on, is never illuminated when the engine is running.

This vehicle is fitted with an engine immobiliser controlled by a key recognition system.

### REPLACING AN INJECTION COMPUTER

The injection computers are supplied without a code but they must all be programmed with one.

When the computer is replaced, the vehicle code must be programmed in and then a check must be made to ensure that the immobiliser system is operational.

To do this, simply switch on the ignition for a few seconds without starting the engine then switch it off. With the ignition off, the engine immobiliser function comes into operation after approximately **10 seconds** (the red engine immobiliser warning light flashes).

#### **IMPORTANT:**

**These vehicles have a specific injection computer which does not function unless coded.**

**Consequently, we strongly advise that you do not test computers borrowed from the shop or on another vehicle so that coding and decoding problems, which could leave them useless, are avoided.**

**INJECTION COMPUTER / AIR CONDITIONING COMPUTER CONNECTION**

**The compressor is of the variable capacity type.**

The injection computer and the air conditioning computer are connected by two wires:

The injection computer "AC OUT" connection to the air conditioning computer transmits authorisation or inhibition of compressor operation.

The "AC ON" connection is used by the air conditioning system computer to request control of the air conditioning compressor from the injection computer.

When air conditioning is selected, the idle speed rises above **800 rpm** to reach a maximum speed of **875 rpm**.

### COMPRESSOR OPERATION PROGRAMMING

During certain stages of operation, the diesel injection computer inhibits the compressor.

#### Engine start programming

The compressor is inhibited for **5 seconds** after the engine has started.

#### Recovery of performance

During a significant change in the position of the accelerator pedal, if the engine speed is less than **3000 rpm** and if the vehicle speed is less than **70 mph (110 km/h)**, operation of the compressor is inhibited for **5 seconds**.

#### Recovery of output when the vehicle starts moving

If the potentiometer position is greater than **50 %**, if the engine speed is less than **2250 rpm** and if the vehicle speed is below **20 km/h**, the compressor is inhibited for **5 seconds**.

#### Anti-stall protection

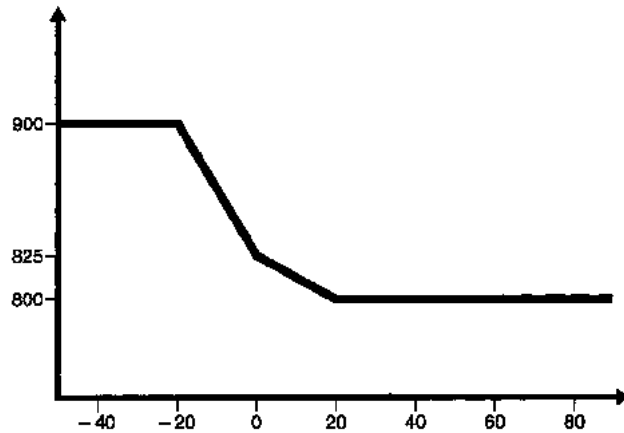
If the no load position is not detected and if the engine speed is less than **675 rpm**, the compressor is inhibited. It is restarted after **5 seconds** if the engine speed has increased.

#### Thermal protection programming

The compressor does not start in cases where the coolant temperature is greater than **+ 112 °C**. The compressor is restarted after inhibition at **110 °C**. The coolant temperature warning light illuminates at **120 °C** and extinguishes at **115 °C**.



### IDLE SPEED CORRECTION AS A FUNCTION OF COOLANT TEMPERATURE



### CORRECTION AS A FUNCTION OF THE ELECTRICAL CAPACITY

The purpose of this correction is to compensate for the drop in voltage due to operation of a consumer component when the battery is at low charge. To correct this, the idle speed is increased, allowing the alternator to rotate faster and consequently increase the battery voltage.

The lower the voltage, the more significant the correction. Correction of the engine speed is therefore variable. It begins when the voltage drops to below around **12 volts**. Idle speed may reach a speed of **900 rpm**.

### IDLE SPEED CORRECTION WHEN THE POTENTIOMETER IS FAULTY

If the accelerator pedal potentiometer is faulty, idle speed is held at **1200 rpm**.

If the information from the accelerator pedal position potentiometer and the brake switch information does not correspond, the speed is changed to **1250 rpm**.

### IDLE SPEED CORRECTION WHEN DRIVING

The idle speed when driving is **875 rpm**, with the vehicle moving at more than **2.5 km/h**.

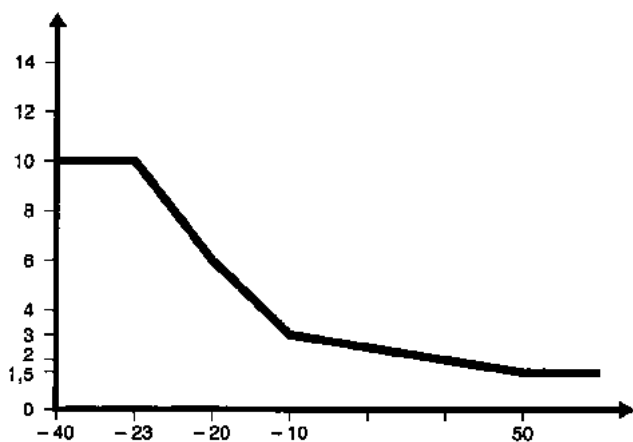
The pre-postheating function is controlled by the preheating unit.

### PRE-POST HEATING OPERATING PRINCIPLE

#### 1) Switching on the "Preheating" ignition

##### a) Variable preheating

The warning light lighting time and the supply to heater plugs time depends on the coolant temperature and the battery voltage.



In all cases the injection warning light lighting time cannot exceed **15 seconds**.

##### b) Fixed preheating

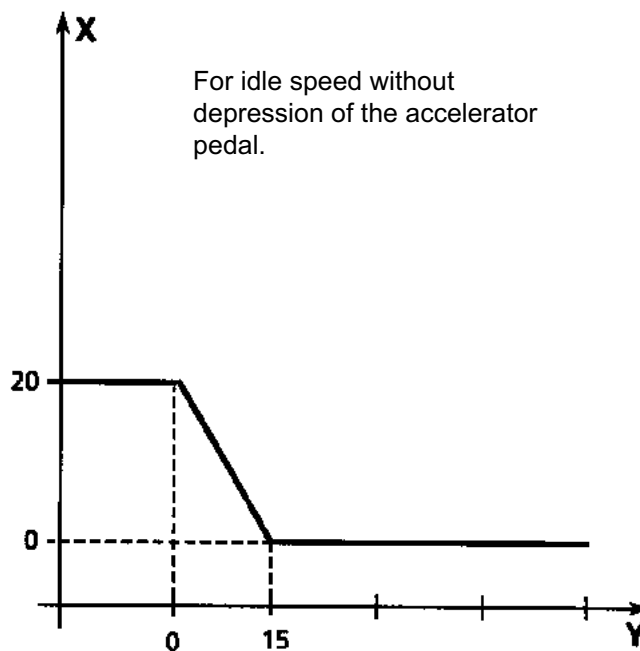
After the warning light goes out the plugs remain supplied for a fixed period of **10 seconds**.

#### 2) Starting the engine

The plugs remain supplied while the starter is being activated.


#### 3 "Postheating" while the engine is running

During this phase, the plugs are supplied continuously depending on coolant temperature.



X = Time  
Y = Coolant temperature °C

The preheating plug resistance is **0.6  $\Omega$**  (connector disconnected).

TIGHTENING TORQUE (in daN.m)	
Heater plug	1.1

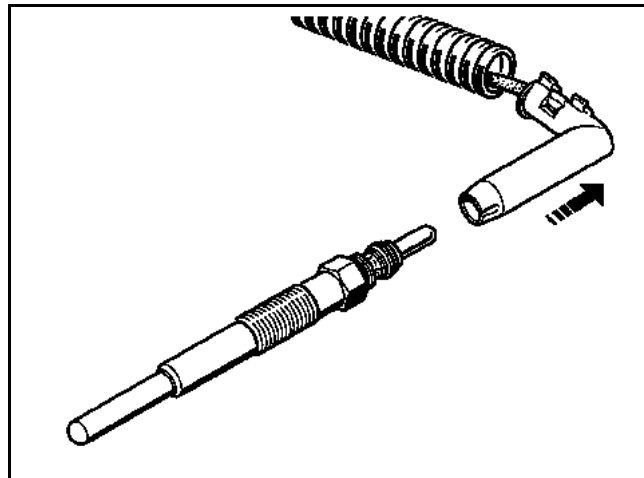
Plugs may be removed without the need to open the high pressure circuit.

### REMOVAL

Unclip the plug connector.

Clean around the plug to prevent any dirt entering the cylinder.

Unscrew and then remove the plugs.



### REFITTING

Proceed in the reverse order to removal.

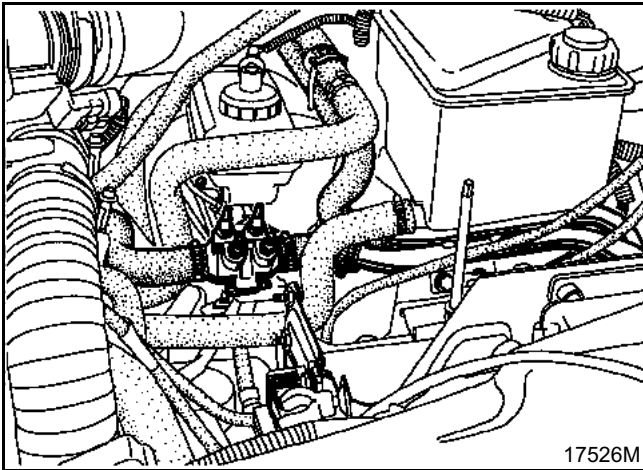
Ensure that no impurities can enter the cylinder during this operation.

The four thermoplungers are located on a water unit fixed under the manifold at the battery.

The purpose of the system is to reheat the coolant.

The thermoplungers are supplied with **12 volts** by three relays when the engine is running. One relay controls two thermoplungers, the two other relays control one thermoplunger each. This enables control of one, two, three or four thermoplungers as required.

The thermoplunger resistance is:  
 **$0.45 \pm 0.05 \Omega$  at  $20^\circ \text{C}$ .**



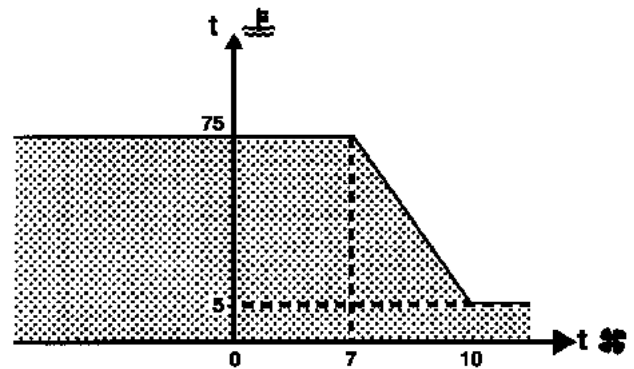
### Control strategy

When the thermoplungers are operating the idle speed is increase to **900 rpm**.

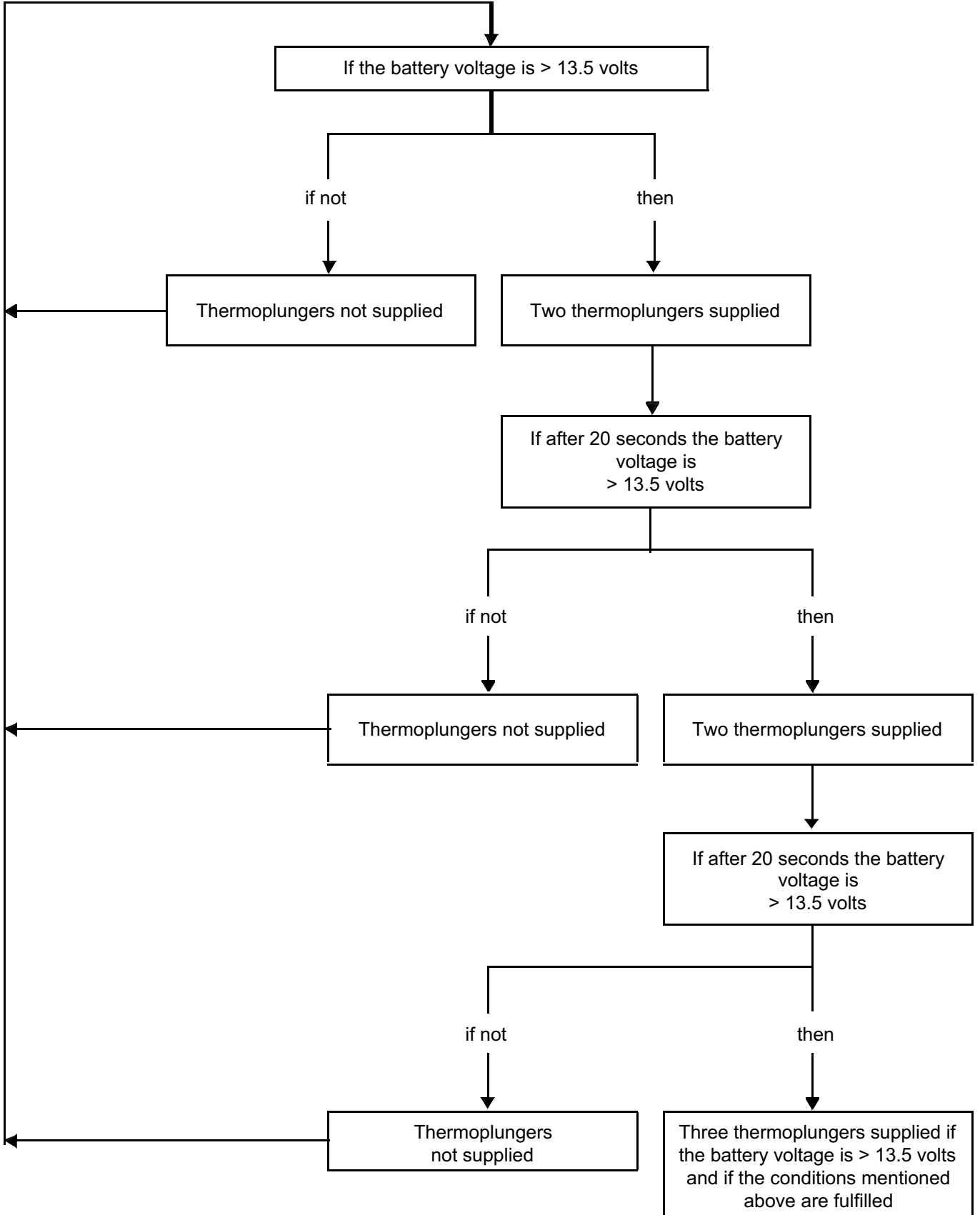
Thermoplungers cannot operate in the case of:

- preheating,
- post heating,
- if the engine speed is below **700 rpm**.

If the conditions mentioned above apply, the thermoplungers are controlled according to a characteristics map linked to the air and coolant temperature.



**Unshaded zone:** Thermoplunger not supplied  
**Shaded zone:** Thermoplunger supplied



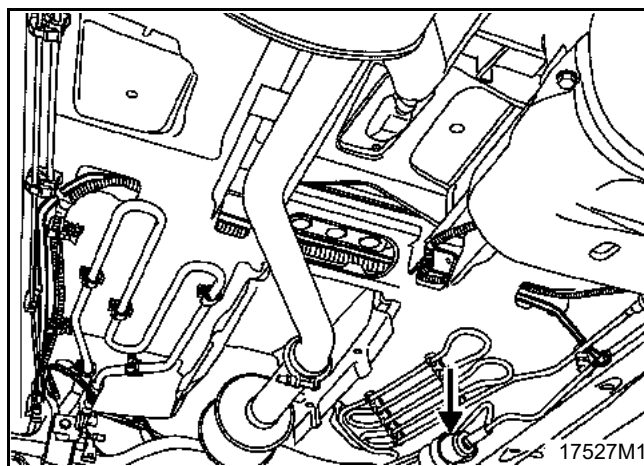
## Low pressure pump (supercharging pump)

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The supercharging pump is an electric pump located against the right-hand side member.

PAY STRICT ATTENTION TO THE RULES REGARDING CLEANLINESS DURING REPLACEMENT.

**IMPORTANT:** note that there is a quantity of diesel and residual pressure in the pipes.



The fuel filter is located in the engine compartment. It is contained in an unremovable cartridge. This cartridge contains a regulating valve which limits the flow of diesel circulating to the engine.

To replace the filter it is therefore necessary to replace the whole unit.

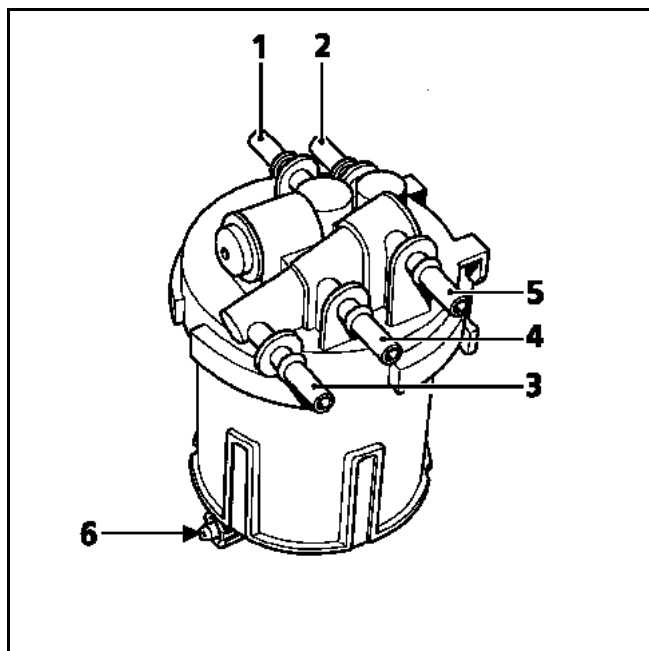
### REMOVAL

**PAY STRICT ATTENTION TO THE RULES REGARDING CLEANLINESS**

**IMPORTANT:** note that there is a quantity of diesel and residual pressure in the pipes.

Disconnect the pipes on the filter which:

- feed the engine (1),
- come from the fuel tank (2) (low pressure pump),
- return to the tank (3) via the fuel cock,
- return from the engine (4),
- which return to the tank via the temperature exchanger (5).



### REFITTING

It is vital that you respect the position of the connections to the filter.

Be careful not to squeeze or damage the pipes.

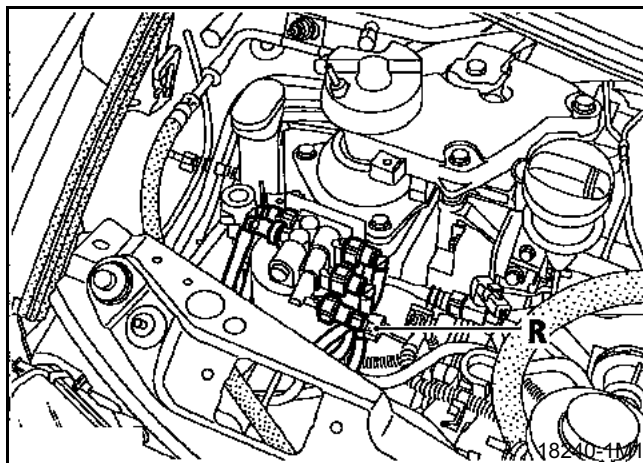
#### **IMPORTANT:**

A fuel cock (R) is fitted to the fuel filter at the level of the diesel return pipe to the tank.

It should be in open position for normal operation.

To reprime the circuit after an intervention, a filter change or a fuel fault you should:


- close the fuel cock (R),
- start the low pressure pump by switching on the ignition several times,
- start the engine,
- OPEN THE FUEL COCK (the valve is open when the two coloured lines are aligned).



It is necessary to periodically bleed the water trapped in the diesel filter via the bleed plug (6).

**IT IS PROHIBITED TO REMOVE THE INTERIOR OF THE PUMP.**

SPECIAL TOOLING REQUIRED		
Mot.	1503	Tool for fitting rubber pads.
Mot.	1536	Top Dead Centre pin
Mot.	1548	G9T high pressure pump extractor
Mot.	1566	Tool for removing the high pressure pipes
ESSENTIAL SPECIAL TOOLING		
Facom wrench for DM19 high pressure pipes Facom "Crowfoot 18-17" jaws for tightening the rail high pressure pipe "Low torque" torque wrench		

TIGHTENING TORQUES (in daN.m) 	
High pressure pipe	2.5±0.2
High pressure pump mounting	3.2± 0.3
High pressure pump pulley nut	5 ± 0.5
Suspended mounting cover bolt	6.2 ± 1
Engine tie-bar bolt	15

**IMPORTANT:** before any intervention, connect the After-Sales diagnostic tool, query the injection computer and check that the injection rail is not under pressure.

Take note of the fuel temperature.



### REMOVAL

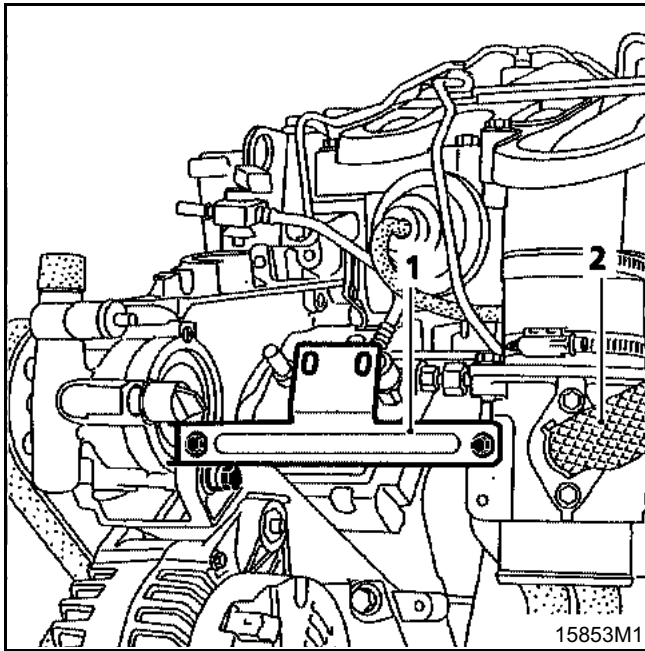
**YOU MUST OBSERVE THE CLEANLINESS  
ADVICE GIVEN IN THIS SECTION**

Disconnect:

- the battery,
- the air flow meter.

Remove:

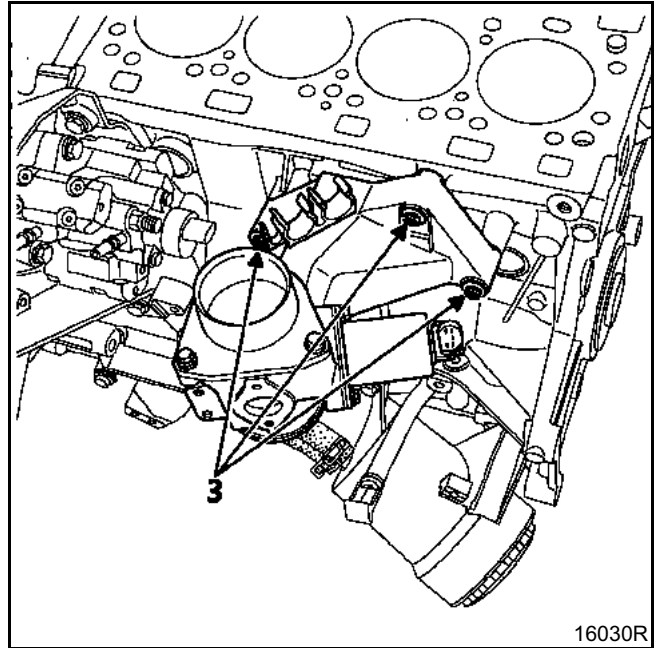
- the air filter unit,
- the expansion bottle and release it,
- the air exchanger/damper unit pipe by disconnecting the wastegate pipe,
- the stiffening bracket (1) between the damper unit and the power assisted steering pump,
- the exhaust gas recirculation pipe (2) and the seals. Plan for the replacement of the pipe and the seals when refitting.



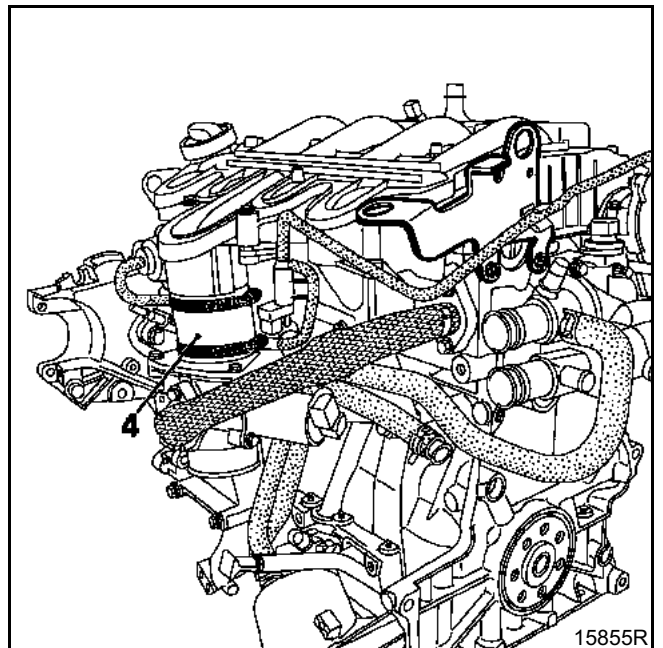
Disconnect the exhaust gas recirculation control solenoid valve connector.

Remove:

- the damper unit mounting bolts (3),



- the connection pipe (4) with the inlet manifold,
- the damper unit from underneath.



Set the engine to top dead centre using pin **Mot. 1536**.

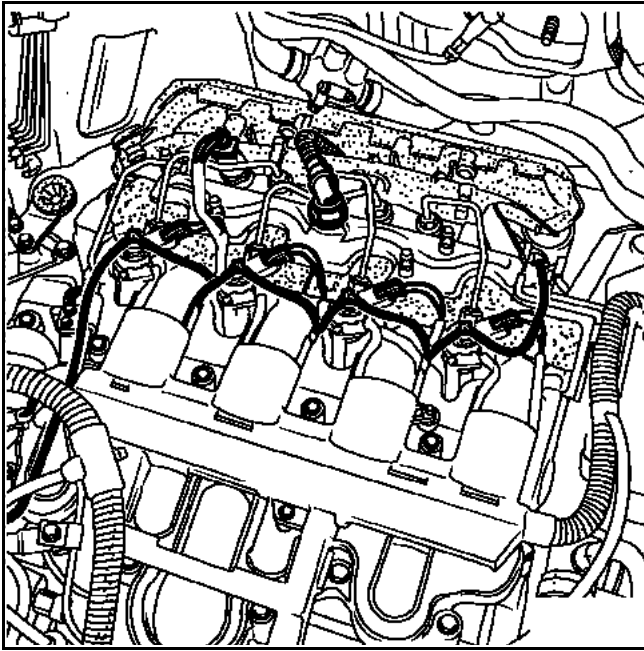
Disconnect:

- the pump pressure regulator (RSV),
- the diesel temperature sensor,
- the position sensor,
- the fuel return and supply pipe on the pump, and fit the cleanliness plugs.

Remove the expansion bottle mounting.

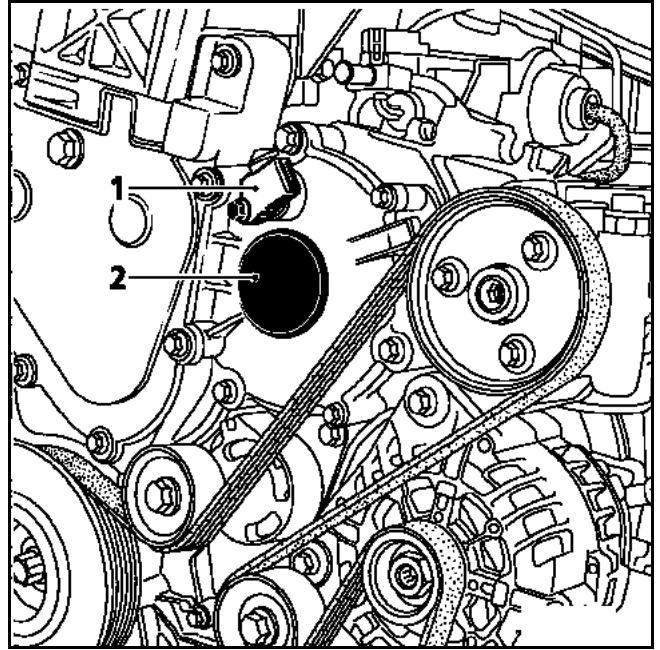
Unclip:

- the rail cover and move as far away as possible,
- the pump outlet / rail inlet high pressure pipe and fit the sealing plugs.

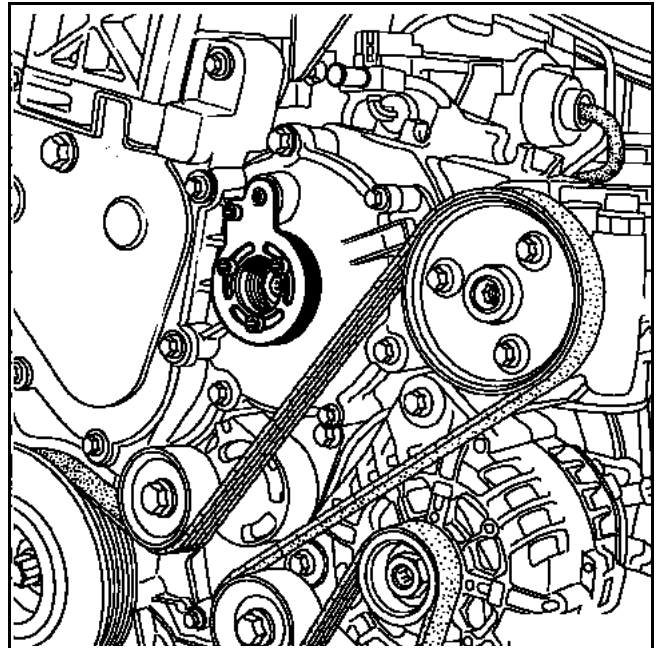


Remove:

- the position sensor (1) taking care not to drop the O-ring into the timing gear assembly,
- the pump hub plug (2).



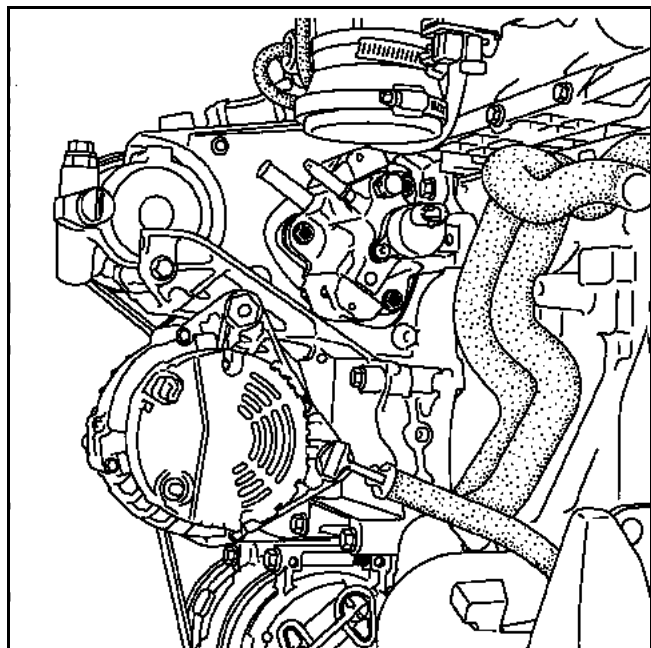
Fit tool **Mot. 1548**, using the central dowel, then remove the central dowel once the tool is in place.



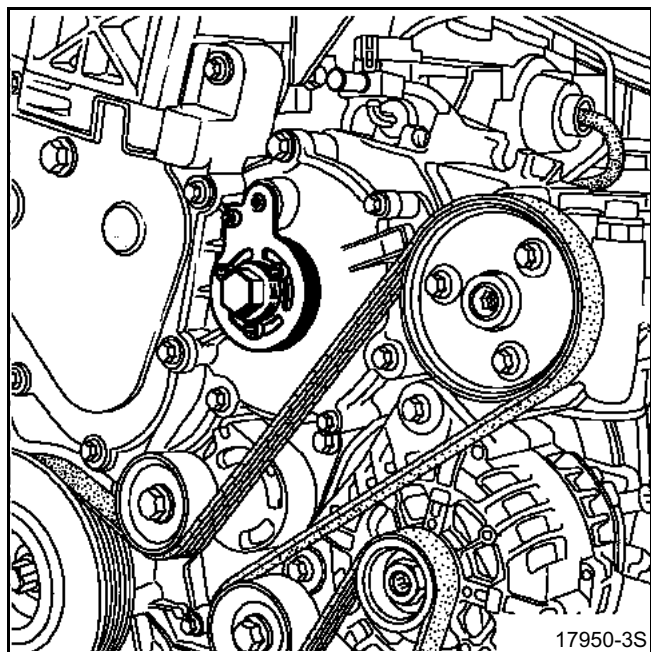
Remove the Top Dead Centre pin **Mot. 1536**.

Remove the pump hub central mounting nut, locking the engine flywheel using a large screwdriver.

Loosen the three mounting bolts on the multifunction support pump by a few turns.



Drive out the pump by tightening the dowel on tool **Mot. 1548**.



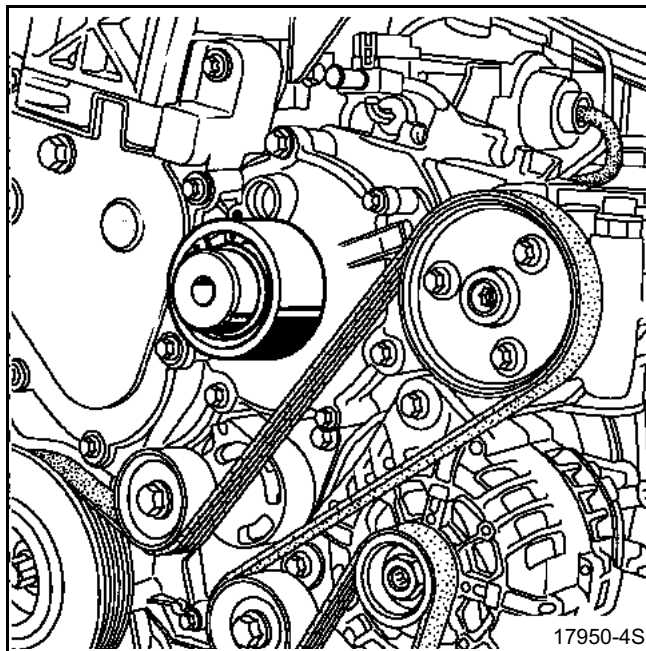
Remove the pump mounting bolts, then the high pressure pump.

### REFITTING

Proceed in the reverse order to removal using the central nut to engage the new pump.

**NOTE** to correct position of the rear pump mounting holes.

Refit a hub plug for the new pump using tool **Mot. 1503**.



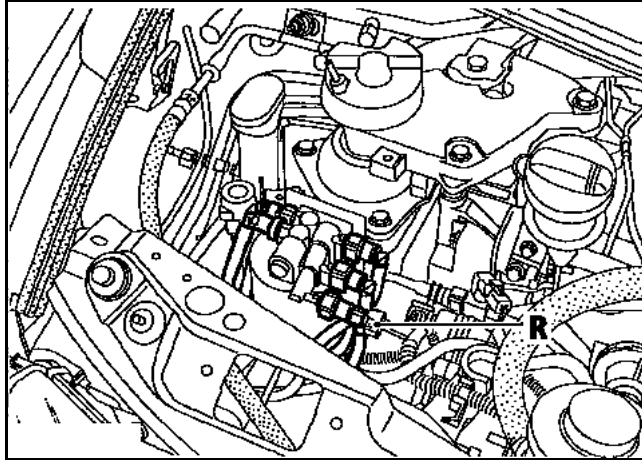
**NOTE:** be careful not to place the high pressure pipe under stress. To do this:

- loosen the high pressure rail,
- offer up the high pressure pipe nuts to the pump and rail before tightening them to torque,
- tighten the rail to the correct torque,
- tighten the pump end and rail end to torque.

You must replace the diesel return pipe if it has been removed.

Reprime the circuit:

- close the fuel cock (R),
- start the low pressure pump by switching on the ignition several times,
- start the engine,
- OPEN THE FUEL COCK (R) (the valve is open when the two coloured lines are aligned).



**After any intervention**, check that there are no leaks in the diesel circuit. Start the engine at idle speed until the fan starts up, then accelerate several times under no load.

Check that there are no stored faults using the fault finding tool. Erase them if necessary.

SPECIAL TOOLING REQUIRED		
Mot.	1549	Injector extractor
Mot.	1566	Tool for removing the high pressure pipes
ESSENTIAL SPECIAL TOOLING		
"Low torque" torque wrench		
Facom wrench for DM19 high pressure pipes		

TIGHTENING TORQUES (in daN.m)	
Flywheel end injector bracket nut	360±30 °
High pressure pipe nuts	2.5±0.2
Injection rail mounting bolt	2.3±0.3
Injector bracket bolt	5±0.5
Pump/rail pipe bracket bolt	2.5±0.2
Injector bracket studs	0.2±0.05
Injector bracket bolt pretightening	0.6±0.1

**IMPORTANT:** before any intervention, connect the After-Sales diagnostic tool, query the injection computer and check that the injection rail is not under pressure.

Take note of the fuel temperature.

Order the special injection circuit plugs kit, part no. **77 01 206 381**

## REMOVAL

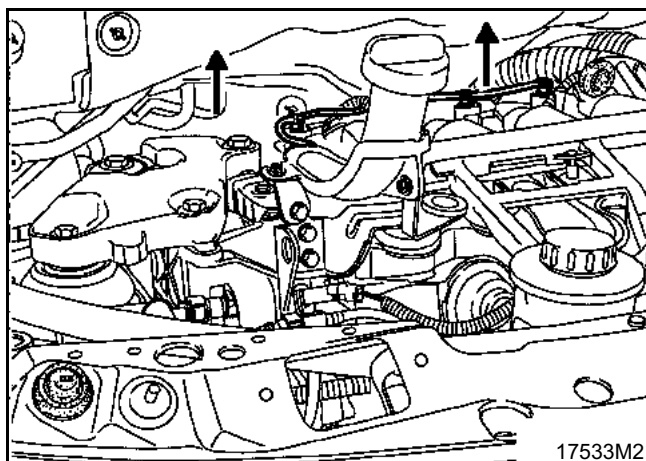
### PAY STRICT ATTENTION TO THE RULES REGARDING CLEANLINESS

Disconnect the battery.

Remove:

- the air filter,
- the bulkhead soundproofing material.

**IMPORTANT:** to remove this you must remove the turbocharger pressure regulation control solenoid valve on the bulkhead, without disconnecting it.



Remove the pipe at the turbocharger inlet, disconnecting the oil vapour rebreathing pipe.

Unclip the side partitions of the rubber flap.

Unclip the rubber flap from the engine mounting, then the cylinder head cover and push as far as possible to the rear.

Remove the sealing cover attached by two nuts to the cylinder head cover, holding the stud (on some versions), and remove the absorbent foam.

Blow underneath the engine.

Remove the oil filler funnel and the air filter mounting pad on the left-hand side of the engine.

Plug the oil filler hole using a clean cloth.

Disconnect the pressure sensor electrically (1).

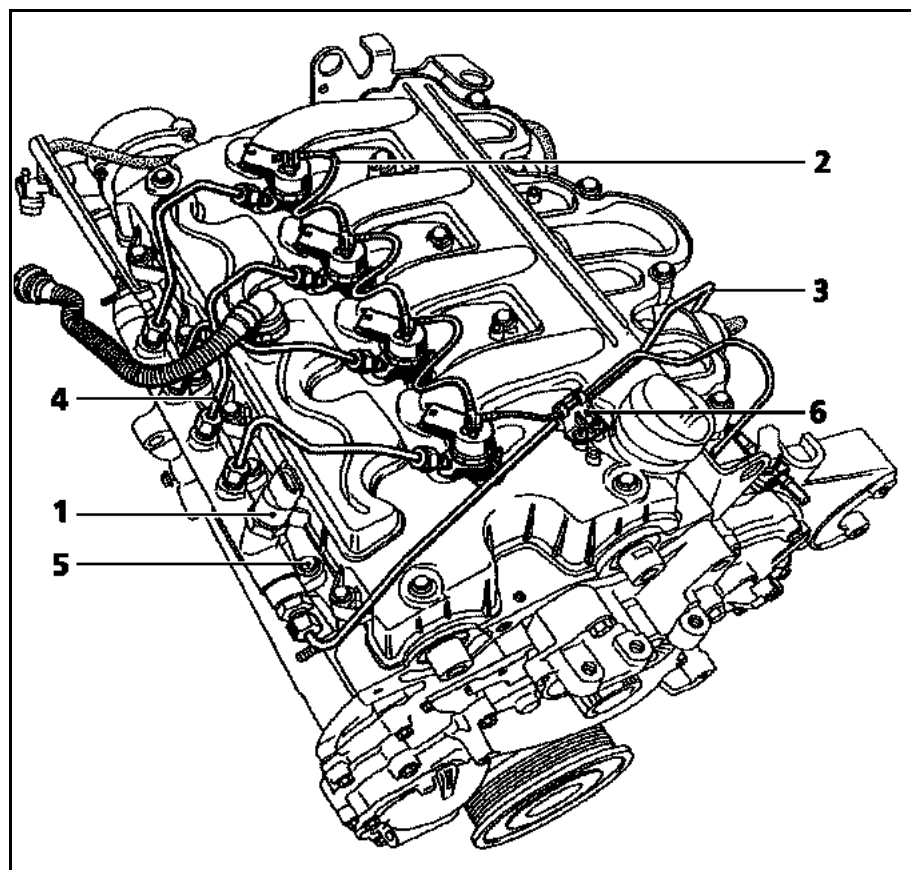
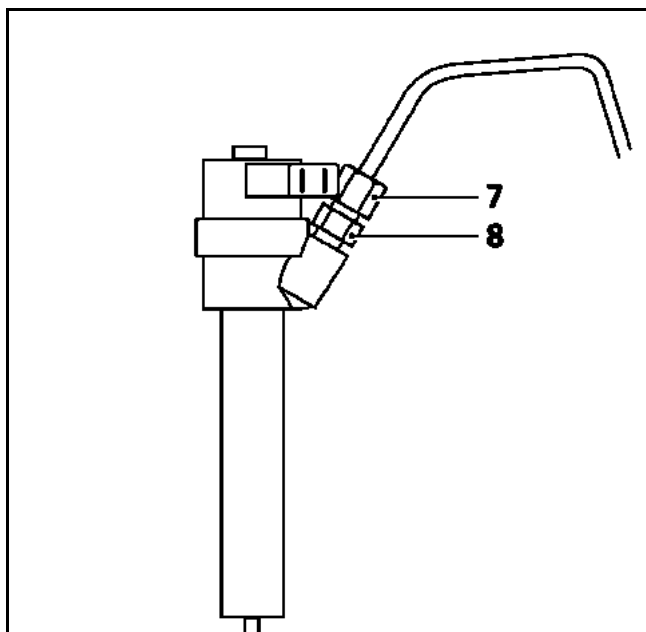
Remove:

- the injector diesel return pipe (2) (to be replaced),
- the injection harness (3) between the high pressure pump and the rail, NOTE that the cylinder mounting bolt (6) is very fragile,
- the injector harnesses (4).

**IMPORTANT:** when loosening the connections (7) of the injection harness on the injector holder, you must hold the filter-rod supporting bolts (8) with a lock wrench.

Insert the plugs to maintain cleanness.

Loosen the injection rail bolts (5) without removing it.



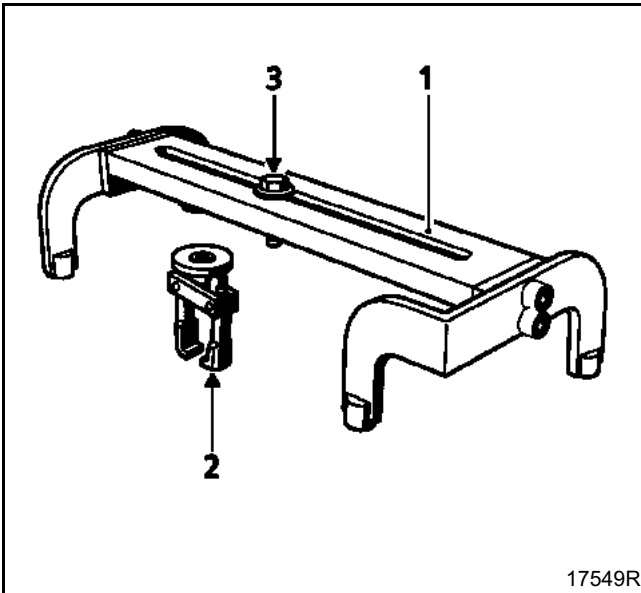
### REMOVE THE INJECTOR HOLDER (pipes removed)

Loosen the mounting bolts for each injection holder.

A special extractor must be used to remove the injectors. Never attempt to remove an injector holder locked in its cylinder socket unless using the tool described below.

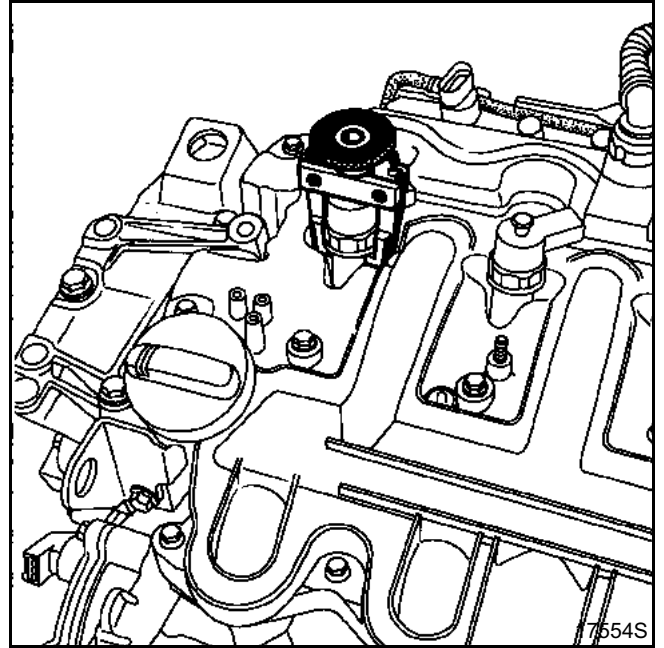
Description of tool **Mot. 1549**

- 1 Extractor support chassis; this is fitted on the cylinder head cover mounting bolts. Check that it is fitted correctly before use.
- 2 Extractor
- 3 Extraction bolt

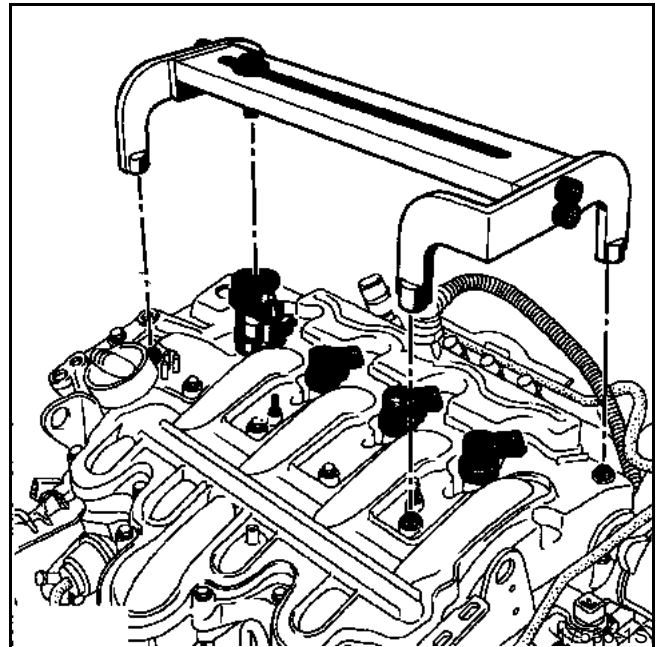


Apply releasing agent around the injector.

Fit the extractor on an injector holder. Tighten the knurled ring to bring the two jaws together on the flat surfaces without overtightening.



Fit the chassis of tool **Mot. 1549** on the cylinder head mounting bolts. Tighten the extraction bolt until the injector is released from the cylinder head.



Remove the washer from the bottom of each injector socket.

### REFITTING

**Do not remove the protection plugs from any component until the last minute.**

Clean the injector sockets and the injector bodies, as well as their brackets using a lint-free cloth (use the wipes recommended for this purpose, part no. **77 11 211 707**) dipped in clean solvent.

Dry off using a different new wipe.

Clean one of the old injector mounting bolts and tighten it to the end of the mounting hole thread to clean the tappings.

Fit new studs and injector mounting spacers after coating them with oil on the thread and tighten them as tightly as possible by hand (**0.2 daN.m**). **The studs and nuts must be replaced every time they are removed.**

Fit a new injector head washer on every injector.

Fit the injector equipped with its bracket and locking spring ring.

Oil the threads of the nuts.

**WARNING: tighten the nut at the timing end first and then that at the flywheel end.**

Tighten the mounting nuts (oiled) to **0.6 daN.m**, **first at the timing end, then at the flywheel end.**

Retighten only the **flywheel end nut by  $360^\circ \pm 30^\circ$ .**

Loosen the three rail mounting bolts in order to release it.

Remove the rail plugs, the injector holders and the injection pipes.

Fit the injection pipes between the rail and the injectors and pretighten by hand until they touch.

Torque tighten the:

- three rail mounting bolts to **2.3 daN.m**,
- the injection pipe connections on the injectors and the high pressure pump to **2.5 daN.m**,
- the injection pipe connections on the rail to **2.5 daN.m**.

Clip the pump/rail pipes mounting clip and tighten the two mounting bolts.

Refit the sealing partition, attached to the cylinder head cover by two nuts.

Refix the side partitions of the rail shield correctly.

Fold to the front and clip the rubber flap of the rail protector.

**During any operations on the rail protector, you must ensure that the system components are fitted properly after refitting (see rail protector section).**

**Non-observance of this advice may have serious consequences.**

Carry out the rest of the refitting operation in the reverse order to removal.

Throw away the bag of plugs used during the operation.

Use the fault finding tool to erase any faults which may be stored by the injection computer before restarting the engine.

**After any intervention**, check that there are no leaks in the diesel circuit.

Proceed as follows:

- Run the engine at idle speed until the fan starts up.
- Accelerate several times under no load.
- Carry out a road test.
- Switch the ignition off and check that there is no leakage of diesel.
- Check that the foam is not soaked in diesel.



### GENERAL

The rail protector, comprising ten parts, ensures insulation of the high pressure injection system from the engine compartment.



**THIS RAIL PROTECTOR ENSURES SAFE OPERATION AND REQUIRES SPECIAL ATTENTION WHEN BEING FITTED.**

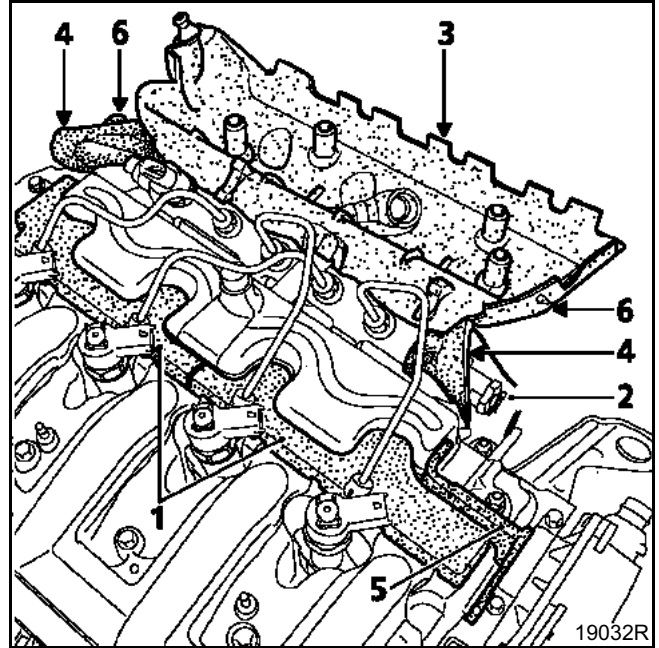
To ensure its safety function, the rail protector must consist of:

- two pieces of foam (1) to be replaced if they are damaged or impregnated with diesel,
- a lower metal protector (2) fixed between the rail and the cylinder head,
- a diesel drain pipe,
- a rubber flap fixed to the metal protector and to the cylinder head cover (3),
- two side partitions (4),
- a partition fixed to the cylinder head cover (5),
- two clips (6).

During any operations on the rail protector, you must ensure that the system components are fitted properly after refitting.



**NON-OBSERVANCE OF THIS ADVICE MAY HAVE SERIOUS CONSEQUENCES FOR SAFETY.**



SPECIAL TOOLING REQUIRED	
<b>Mot.</b>	<b>1566</b> Tool for removing the high pressure pipes
ESSENTIAL SPECIAL TOOLING	
Facom wrench for DM19 high pressure pipes Facom "Crowfoot 18-17" jaws for tightening the rail high pressure pipe "Low torque" torque wrench	

TIGHTENING TORQUES (in daN.m)	
<b>High pressure pipe nut</b>	<b>2.5±0.2</b>
<b>Injection rail mounting bolt</b>	<b>2.3±0.3</b>
<b>Pump/rail pipe bracket bolt</b>	<b>2.5±0.2</b>

**IMPORTANT: before any intervention**, connect the After-Sales diagnostic tool, query the injection computer and check that the injection rail is not under pressure.

Take note of the fuel temperature.

Order the special high pressure injection circuit plugs kit

### REMOVAL

**YOU SHOULD FOLLOW THE CLEANNESS ADVICE CLOSELY**

Disconnect:

- the battery,
- the air flow meter.

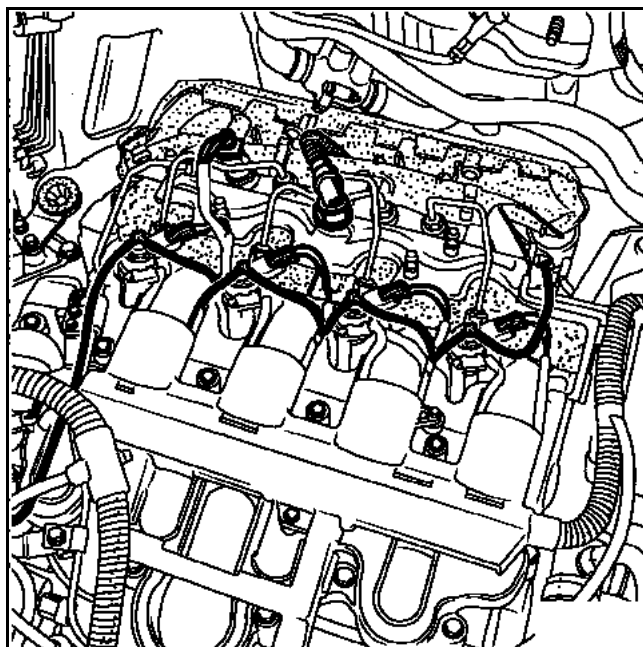
Remove:

- the air filter unit,
- the bulkhead soundproofing material,
- the expansion bottle mounting by disconnecting the pre-postheating unit,
- the pipe at the turbocharger inlet, disconnecting the oil vapour rebreathing pipe.

Unclip the side partitions of the rubber flap.

Unclip the rubber flap from the engine mounting, then the cylinder head cover and push as far as possible to the rear.

Remove the sealing cover attached by two nuts to the cylinder head cover, holding the stud (on some versions), and remove the absorbent foam.



Disconnect the pressure sensor (1) and the injectors electrically.

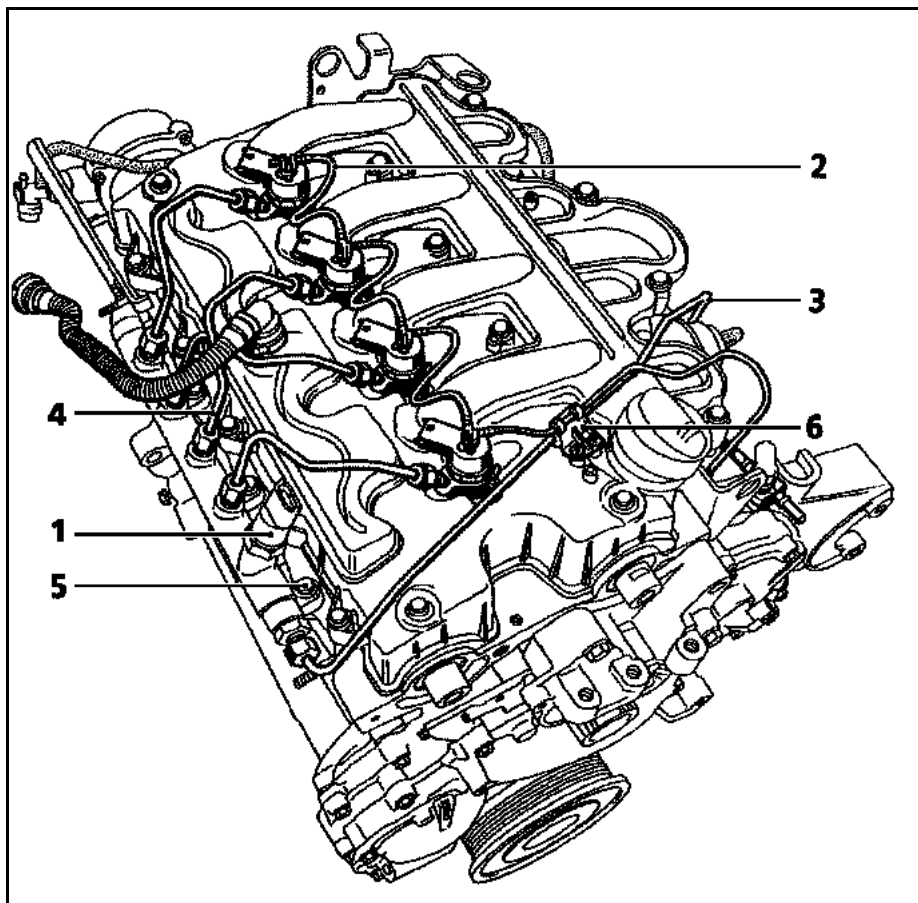
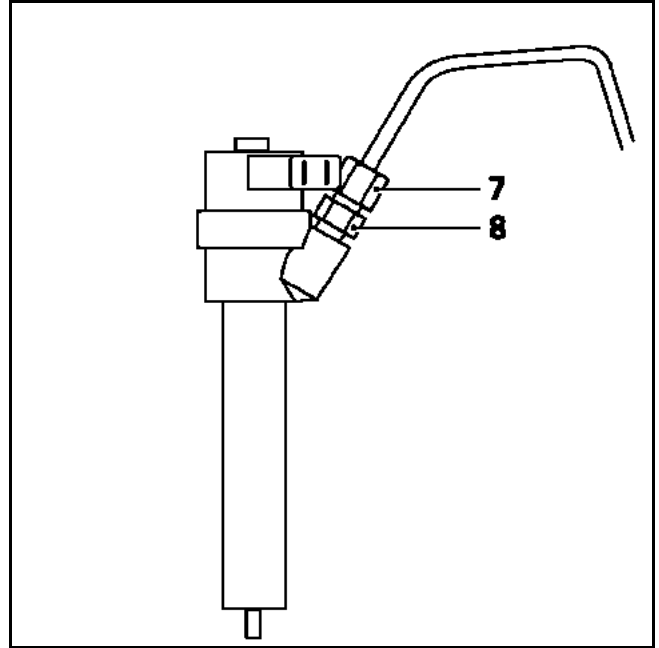
Remove:

- the injector diesel return pipe (2) (to be replaced),
- the injection pipes (3) between the high pressure pump and the rail. **WARNING:** the cylinder head mounting clip (6) is very fragile,
- the injector pipes (4).

Insert the plugs to maintain cleanness.

**WARNING:** when loosening the injection pipe unions (7) on the injector holders, you must hold the filter-rod supporting nuts (8) with a lockwrench.

Loosen the injection rail bolts (5) and the mounting clamp bolt for the rail on the lower metal protector, then remove the rail with its side partition.

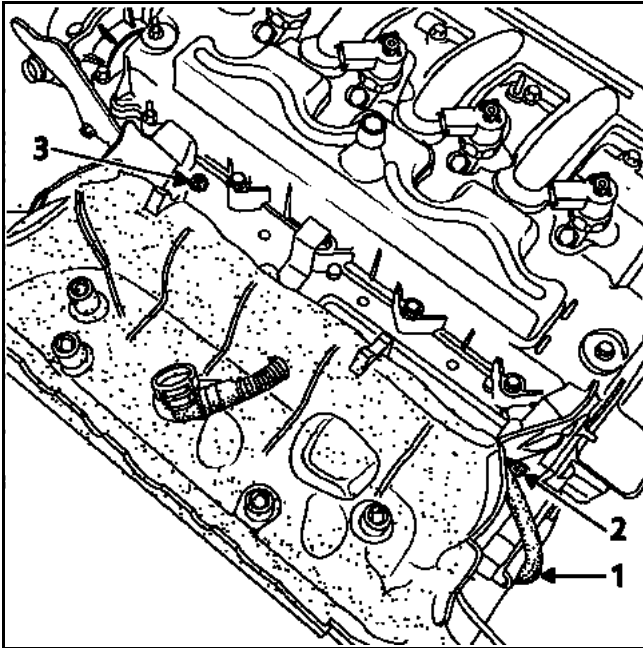


### REMOVAL

Disconnect the diesel drain pipe (1).

Remove:

- the side partition mounting bolt (2),
- the lower metal protector mounting bolt (3),



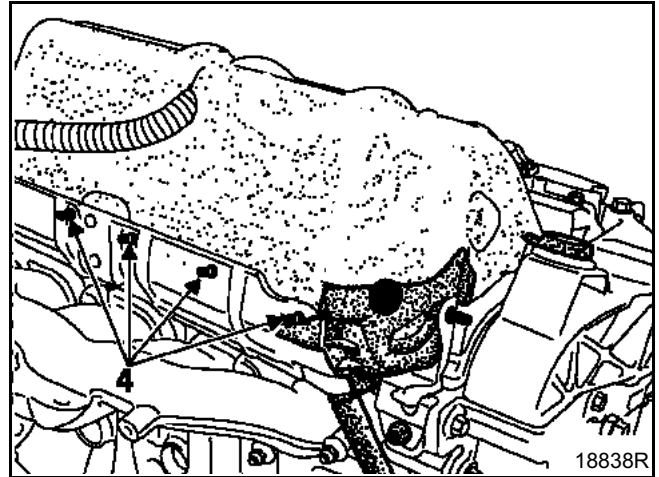
- the rail protector with the side partition, then remove the partition of the central section.

Separate the rubber flap from the lower metal protector.

### REFITTING

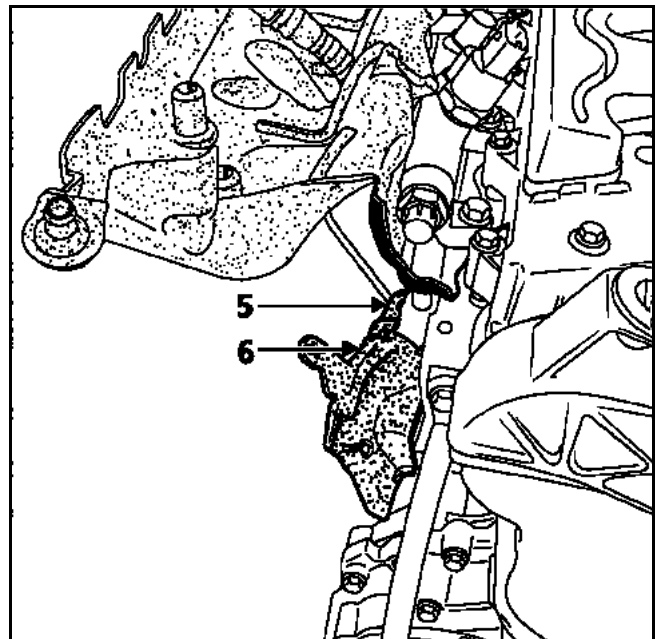
Refit the rubber flap to the lower metal protector by pulling on the five rubber wall staples (4). **Check that the wall staples are clipped correctly.**

Refit the rubber flap/lower metal protector assembly on the engine.

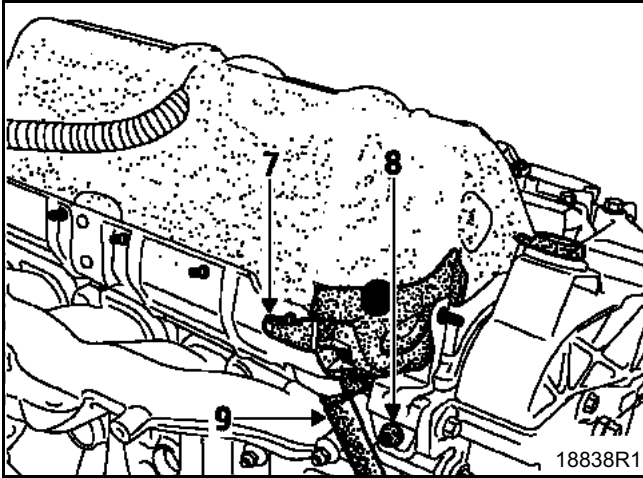


To refit the side partition on the lower metal protector it is **essential** that you follow the method below:

- Fit the lower strap (5).
- Fit the rubber ring (6) of the partition onto the lower metal protector.
- Then fit the upper section of the partition to the metal protector.



- Fit the upper strap (7).
- Refit the partition mounting bolts (8).
- Reconnect the diesel drain pipe (9), checking that it is not plugged.



Refit the injection rail with its partition without tightening the rail mounting bolts.

Remove the plugs from the rail, the injector holders, the pump and the injection pipes.

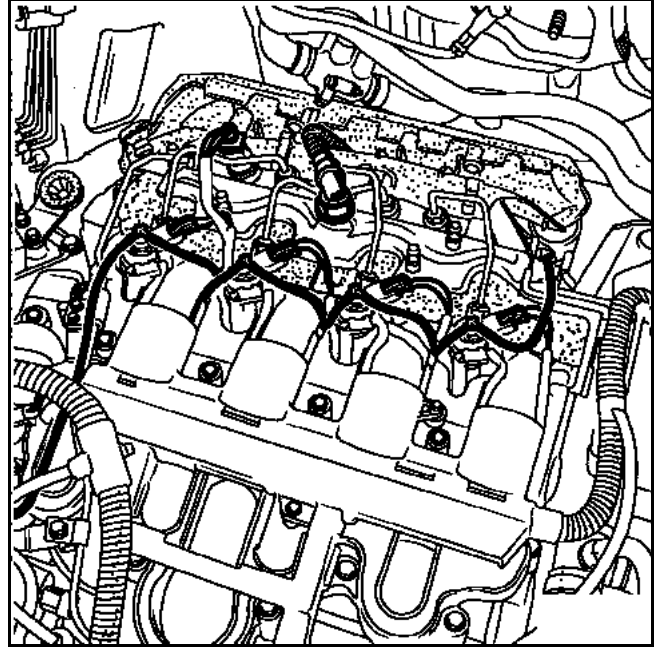
Fit the injection pipes between the rail and the injectors and between the pump and the rail, then pretighten by hand until they touch.

Torque tighten the:

- three rail mounting bolts to **2.3 daN.m**,
- the injection pipe connections on the injectors and the high pressure pump to **2.5 daN.m**,
- the injection pipe connections on the rail to **2.5 daN.m**.

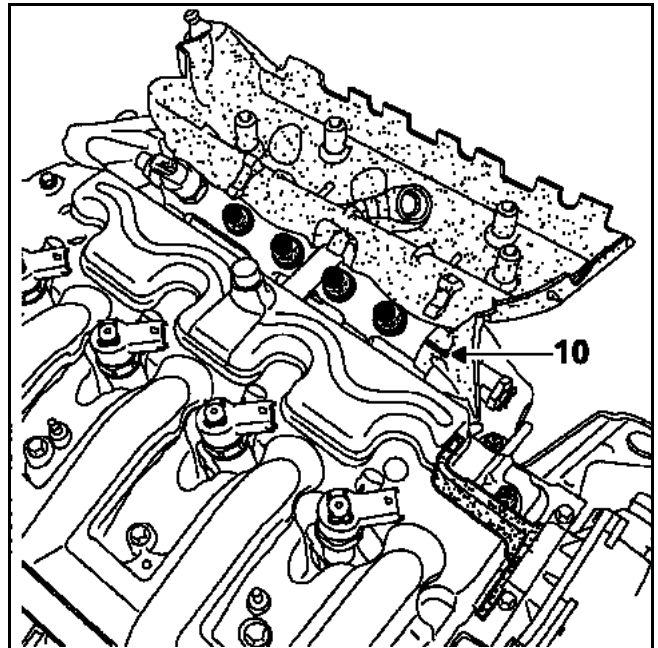
Refit:

- the absorbent foam, replacing it if it is damaged or impregnated with diesel,



– the sealing partition, attached to the cylinder head cover by two nuts.

**Check that the mark (10) on the rail partition is positioned correctly (in the axis of the high pressure rail outlets).**



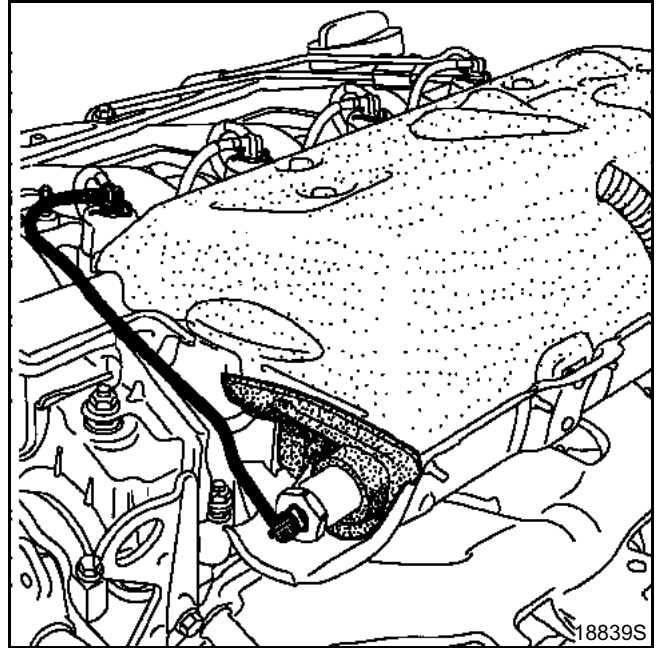
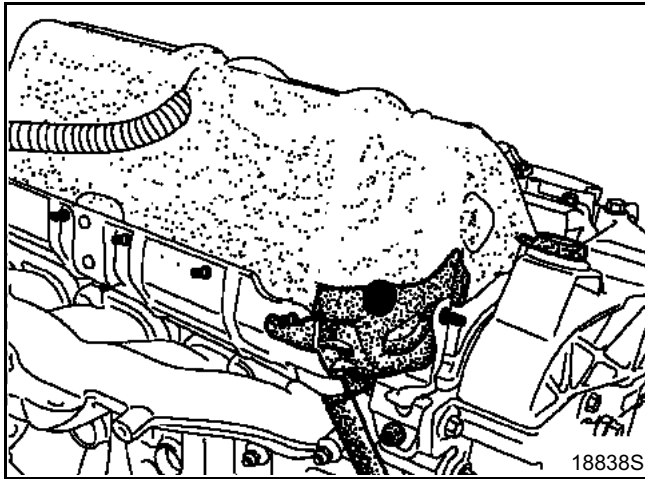
Reconnect the injectors and the rail pressure sensor.

Refit a new diesel return pipe ensuring that the mounting clips are properly fitted at the injectors and at the end of the rail at the overpressure valve.

Fold the rubber flap to the front and clip the side sealing partitions to it.

Check that the clip buttons are correctly welded to the partitions and that the rubber flap skirts are correctly fitted.

**IMPORTANT:** check that the diesel drain pipe is correctly reconnected.



Reclip the rubber flap to the cylinder head cover and the engine mountings.

**Check that the rubber flap is correctly clipped to the cylinder head cover and engine mountings studs.**

Use the fault finding tool to erase any faults which may be stored by the injection computer before restarting the engine.

**After any intervention,** check that there are no leaks in the diesel circuit.

Proceed as follows:

- Run the engine at idle speed until the fan starts up.
- Accelerate several times under no load.
- Carry out a road test.
- Switch the ignition off and check that there is no leakage of diesel.
- Check that the foam is not soaked in diesel.

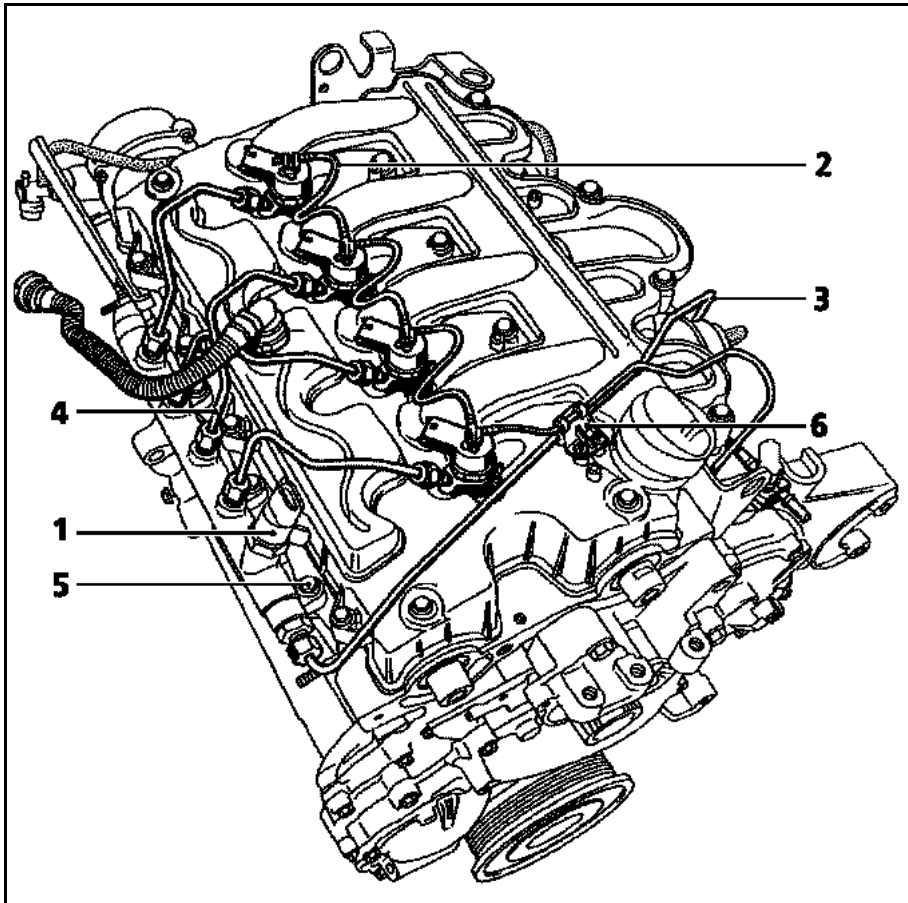
**PAY STRICT ATTENTION TO THE RULES REGARDING CLEANLINESS.**

**IMPORTANT:** before any intervention, connect the After-Sales diagnostic tool, query the injection computer and check that the injection rail is not under pressure.

Take note of the fuel temperature.

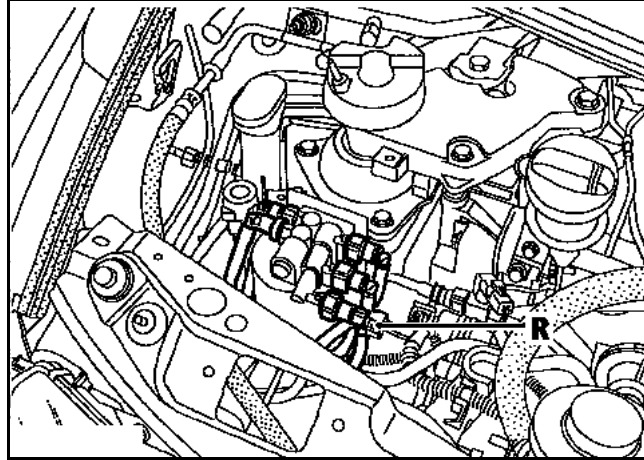
Removal of the common rail requires the removal of the harnesses (3), (4) and disconnection of the pressure sensor (1). Refer to the "High pressure injection circuit" section above

Remove the bolts (5) and remove the rail



**NOTE:** it is imperative that you replace the fuel return pipe (5) placed on the injectors during removal.

Reprime the circuit using the fuel cock (R) mounted on the diesel filter.



**After any intervention**, check that there are no leaks in the diesel circuit.

Proceed as follows:

- run the engine at idle speed until the fan starts up,
- accelerate several times under no load,
- switch the ignition off and check that there is no leakage of diesel.

It is forbidden to check for diesel leaks from the high pressure circuit visually when the engine is running.



# DIESEL EQUIPMENT

## Checking diesel pressure and flow

13

It is possible to check the pressure and flow in the low pressure fuel circuit.

The low pressure is delivered by the supercharging pump (electric pump located under the diesel filter designed to feed the high pressure pump).

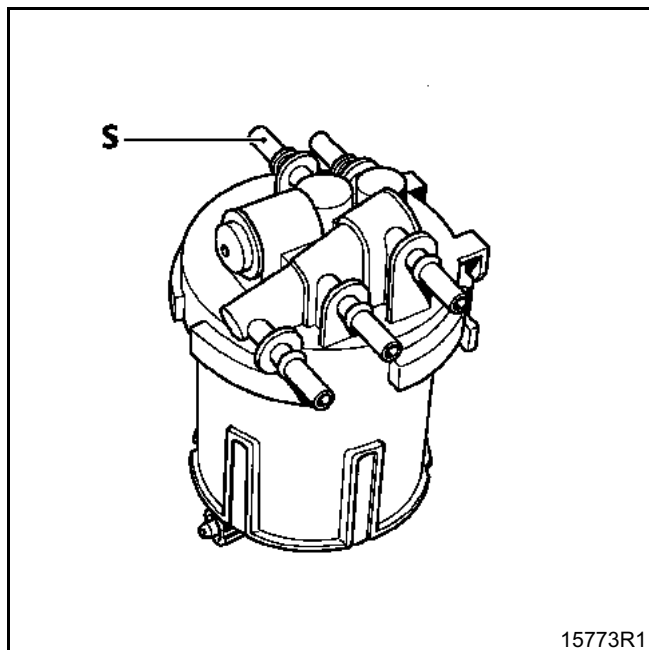
SPECIAL TOOLING REQUIRED	
Mot. 1311-01	} Pressure gauge
or Mot. 1328	
Mot. 1311-08	Pressure measuring connector
ESSENTIAL SPECIAL TOOLING	
Graduated 2000 ml test tube	

### CHECK LOW PRESSURE (SUPERCHARGING PUMP)

Fit a "T" connection **Mot. 1311-08**, to position the pressure gauge **Mot. 1311-01 or Mot. 1328** at outlet (S) of the fuel filter or at the inlet of the high pressure pump.

Turn the fuel pump using the diagnostic tool or by directly feeding the pump (each time the ignition is switched on, the low pressure pump is supplied for **30 seconds**).

Measure the pressure which should be between **2.5 and 3 bar**.



### CHECK THE FLOW (SUPERCHARGING PUMP)

Make the pump flow into a **2000 ml** graduated test tube. Turn on the ignition to run the pump. The pump is supplied for **30 seconds** if the engine is not started.

The flow measured should be **130 litres/hour**.

**IMPORTANT:** it is forbidden to measure the pressure and the flow of the high pressure pump.

**TIGHTENING TORQUES (In daN.m or/and°)** 

Pressure sensor	3.5 ± 0.5
-----------------	-----------

**IMPORTANT:** before any intervention, connect the After-Sales diagnostic tool, query the injection computer and check that the injection rail is not under pressure. Take note of the fuel temperature.

### PRESSURE SENSOR (1)

**PAY STRICT ATTENTION TO THE RULES REGARDING CLEANLINESS**

#### REMOVAL

Disconnect the battery.

Remove the sensor connector (1).

Unscrew the pressure sensor.

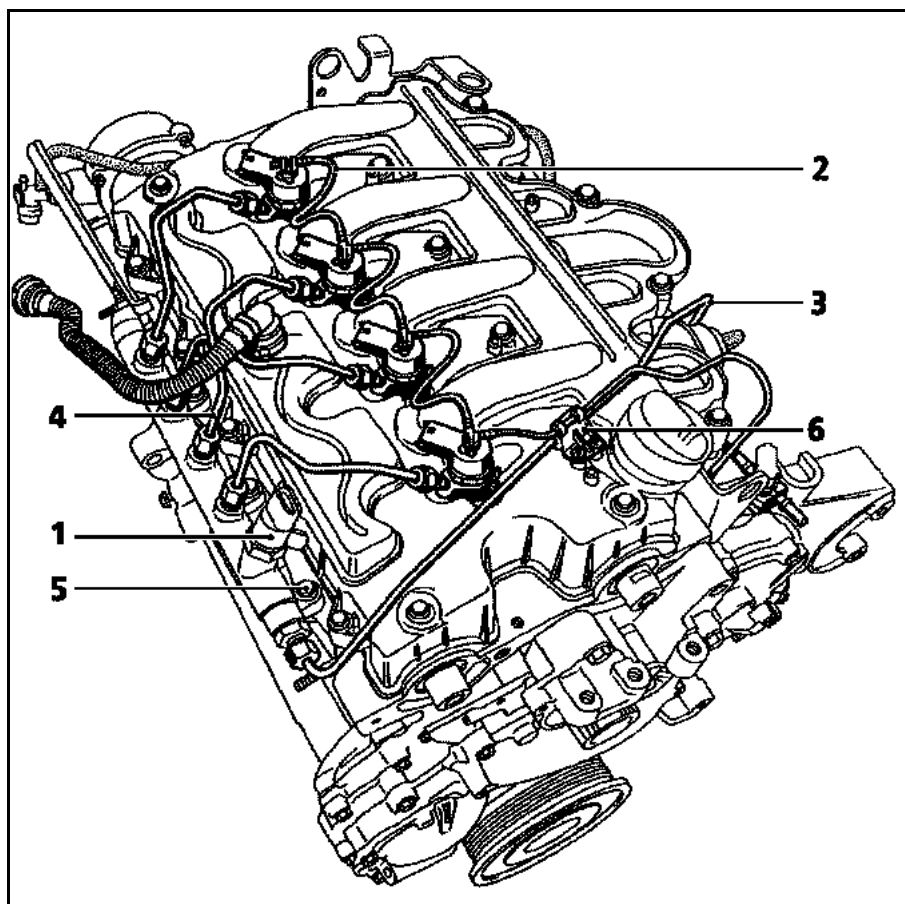
#### REFITTING

Replace the seal.

Screw in the sensor then tighten it to torque.

Connect the connector.

**After any intervention**, check that there are no leaks in the diesel circuit. Start the engine at idle speed until the fan starts up, then accelerate several times under no load.



**TIGHTENING TORQUES (In daN.m or/and°)** 

Regulator bolt	0.9 ± 0.1
----------------	-----------

**IMPORTANT: before any intervention**, connect the After-Sales diagnostic tool, query the injection computer and check that the injection rail is not under pressure.  
Take note of the fuel temperature.

### PRESSURE REGULATOR (1)

**PAY STRICT ATTENTION TO THE RULES REGARDING CLEANLINESS**

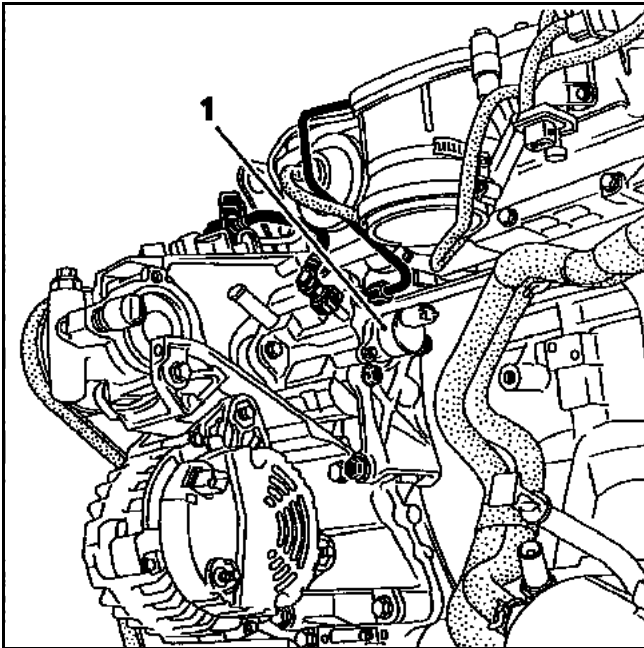
#### REMOVAL

Disconnect the battery.

Remove the regulator connector.

Unscrew the regulator mounting bolts.

Remove the regulator by turning in an anticlockwise direction (do not use any tools as a lever when removing the pump regulator).



#### REFITTING

Change the seals.

Moisten the seals with clean diesel.

Replace the regulator in the pump by turning it in an anticlockwise direction (do not use any tools as a lever when replacing the pump regulator).

Fit the mounting bolts then tighten to torque.

Connect the connector.

**After any intervention**, check that there are no leaks in the diesel circuit. Start the engine at idle speed until the fan starts up, then accelerate several times under no load.