

ENGINE AND LOWER ENGINE Identification

10

Vehicle type	Engine	Gearbox	Capacity (cm ³)	Bore (mm)	Stroke (mm)	Compression ratio
XLOB						
XLOC	F9Q 760	PK5 PK6	1870	80	93	19:1

OIL CONSUMPTION MEASUREMENT PROCEDURE

a) Topping up to the maximum level

The operation must be carried out with the engine warm (the **cooling fan** having cut in) and after leaving to stabilise for **15 minutes** to allow all the oil to drain into the sump.

Check visually using the dipstick.

Top up to the maximum level.

Seal the drain plug (with a paint mark on both the filler plug and the sump drain plug) in order to be able to check later that it has not been removed.

b) Customer driving

Ask the customer to drive the vehicle for a period corresponding to about **1250 miles** (2,000 km) or before the minimum level is reached.

c) Topping up to the maximum level

The operation must be carried out with the engine hot (the **cooling fan** having cut in) and after leaving to stabilise for **15 minutes**.

Check visually using the dipstick.

Top up to the maximum level.

Note the quantity of oil and the mileage covered since the last top-up to maximum level.

d) Measurement of oil consumption

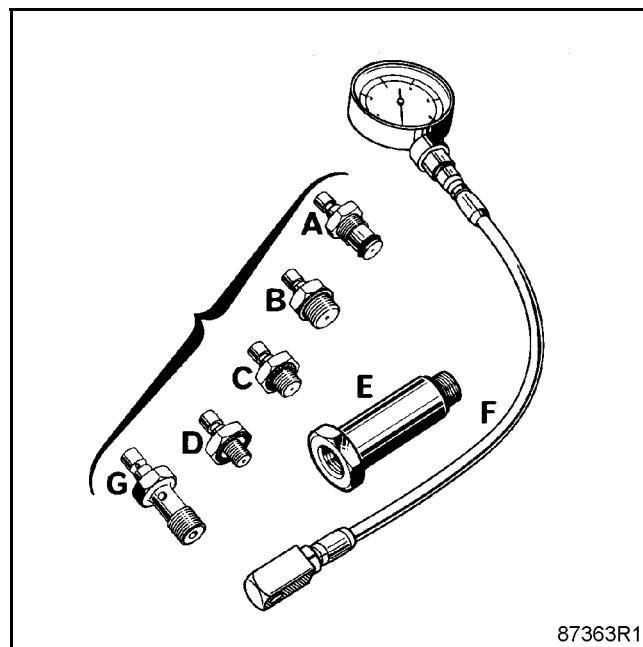
$$\text{OIL CONSUMPTION} = \frac{\text{Quantity of oil added (in litres)}}{\text{km (in thousands)}}$$

SPECIAL TOOLING REQUIRED
Mot. 836-05 Oil pressure measuring kit
EQUIPMENT REQUIRED
22 mm long socket

CHECKING

The oil pressure should be checked when the engine is warm (approximately 80°C).

Contents of kit Mot. 836-05.



USE

B + F

Connect the pressure gauge in place of the oil pressure switch.

Oil pressure

1000 rpm	1.2 bar
3000 rpm	3.5 bar

SPECIAL TOOLING REQUIRED	
Mot. 1202-01	Hose clip pliers
Mot. 1202-02	
Mot. 1448	Distance pliers for cooling system hose clips
T. Av. 476	Ball joint extractor

TIGHTENING TORQUES (in daNm)	
Shock absorber base bolts	18
Steering ball joint nut	3.7
Suspended gearbox mounting fixing nut	6.2
Lower ball joint nut	11
Brake calliper mounting bolt	3.5
Engine tie-bar fixing bolt:	10.5
Suspended engine mounting upper linkage mounting bolt	10.5
Driveshaft gaiter mounting bolt	3
Body mounting bolt for the suspended engine mounting movement limiter	4.4
Mounting bolt on the engine for suspended engine mounting cover	6.2
Wheel bolt	14.2

REMOVAL

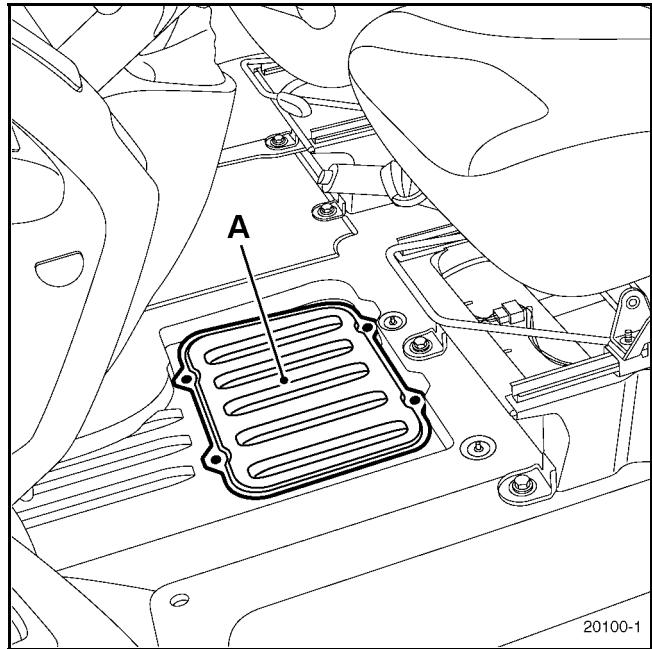
Put the vehicle on four axle stands (see **Section 02 Lifting equipment** to correctly position the lifting jack and axle stands) or on a lift.

During this operation (if using a lift) it is necessary to lash the vehicle to the lift with a strap to prevent the vehicle from toppling over.

Refer to **Section 02 Underbody lift for the strap positioning.**

**FOLLOW CAREFULLY THE INSTRUCTIONS
GIVEN IN SECTION 13 SPECIAL FEATURES AND
CLEANLINESS BEFORE CARRYING OUT ANY
WORK**

Disconnect the battery.



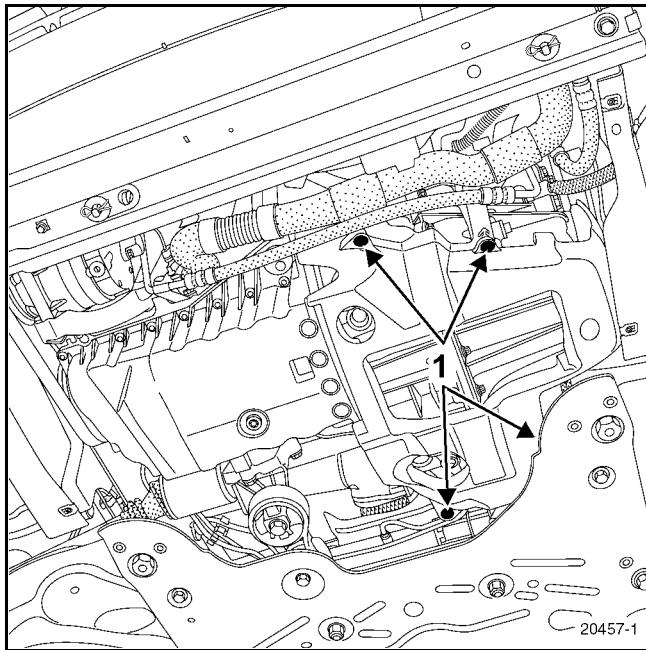
NOTE:

Because the battery is located under the left-hand seat, the carpet must be unclipped and removed, then the battery cover (A) by undoing the screws.

Remove:

- battery cables,
- the front wheels,
- the engine undertray,
- battery earth strap under the body and move all cables away from the battery,

- lower gearbox soundproofing material at (1).



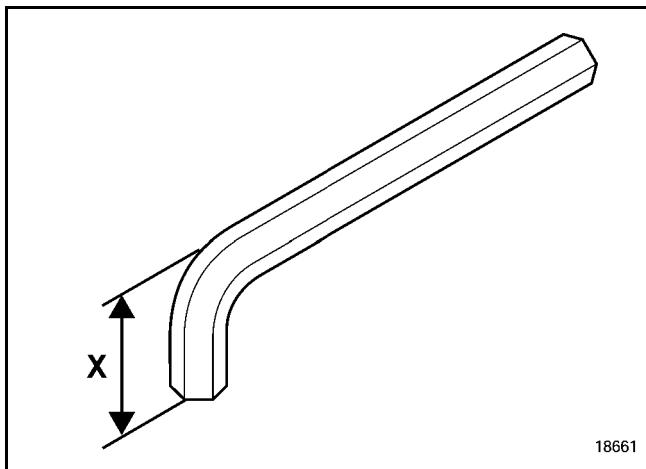
Drain:

- the coolant circuit using filling equipment.
- the cooling system through the radiator bottom hose
- the gearbox and engine if necessary.

Right-hand side of the vehicle

Remove:

- the brake calliper and attach it to the suspension spring,
- the wheel speed sensor,
- lower ball joint nut (use an Allen key cut down to $X = 22 \text{ mm}$ to lock the ball joint if necessary),



- both transmission flange mounting bolts on the relay holder bracket,
- track rod end, using tool **T.Av. 476**,
- shock absorber base mounting bolts.

Remove the driveshaft and then remove the hub unit assembled with the driveshaft.

Left-hand side of the vehicle

Remove:

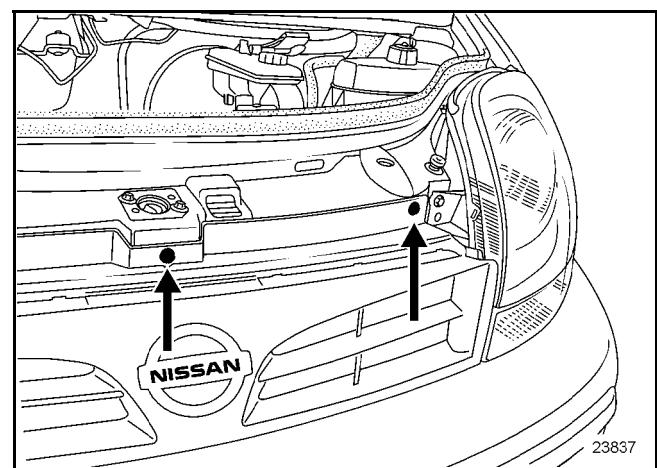
- brake calliper and attach it to the suspension spring,
- the wheel speed sensor,
- lower ball joint nut (use an Allen key cut down to $X = 22 \text{ mm}$ to lock the ball joint if necessary),

- track rod end, using tool **T. Av. 476**,
- driveshaft gaiter mountings,
- shock absorber base mounting bolts.

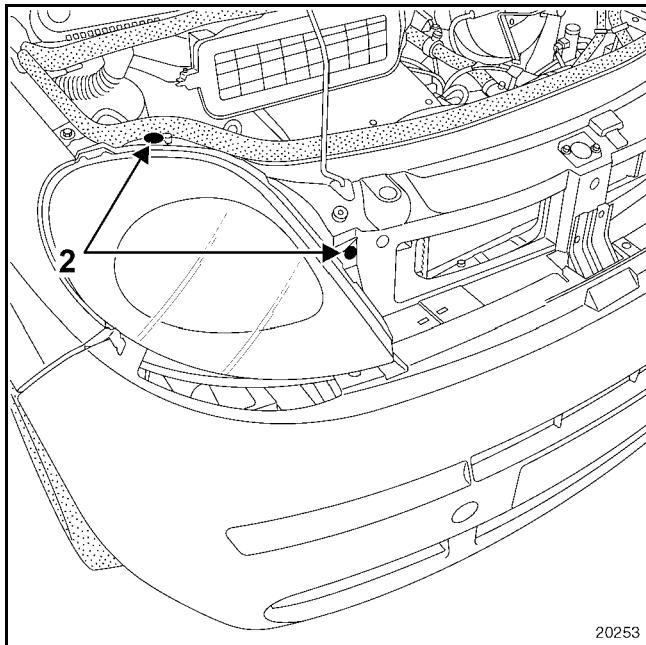
Remove the driveshaft and then remove the hub unit assembled with the driveshaft.

Remove:

- number plate,
- the direction indicators,
- the radiator grille,



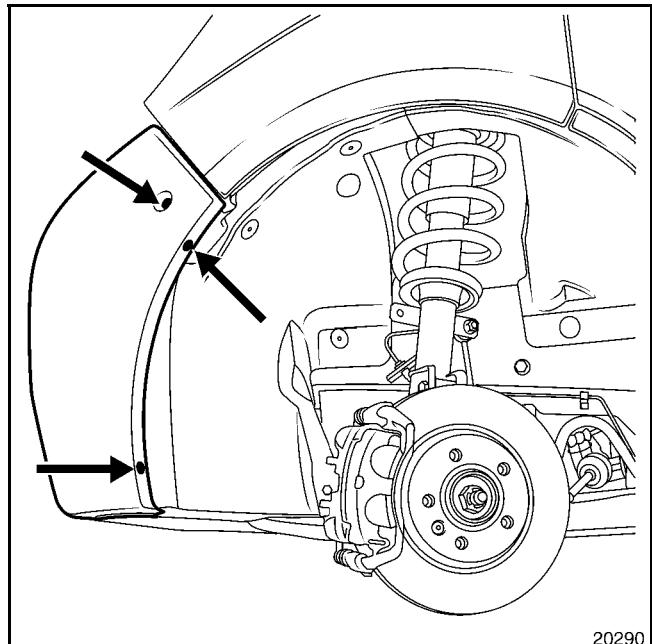
- lens unit mounting screws (2).



20253

Remove:

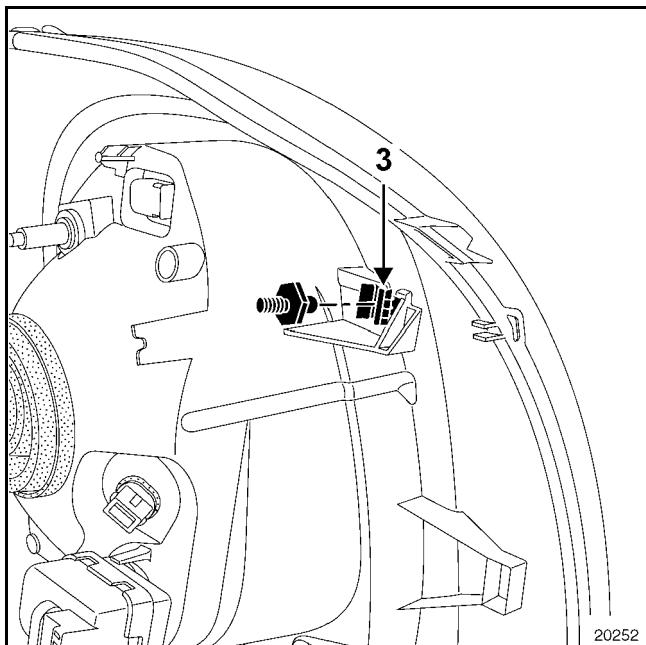
- the bumper.



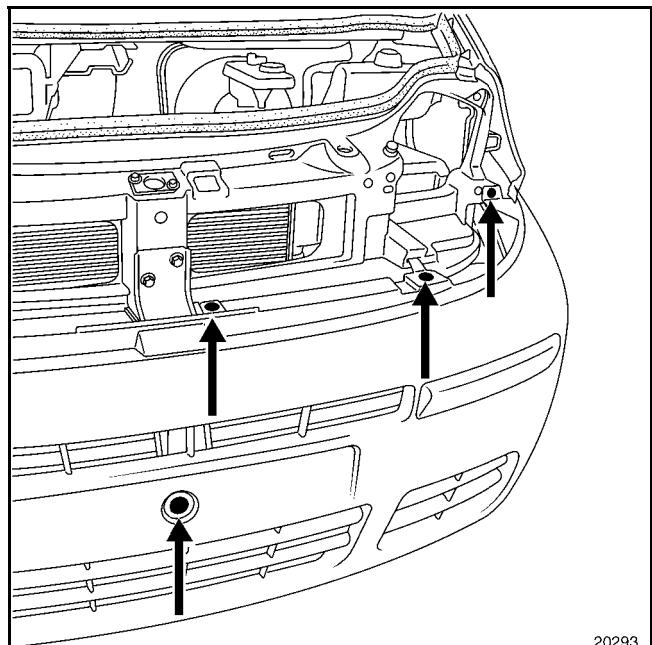
20290

Disconnect the connectors from the lens units.

Remove the lens units, by removing the retaining clip (3).

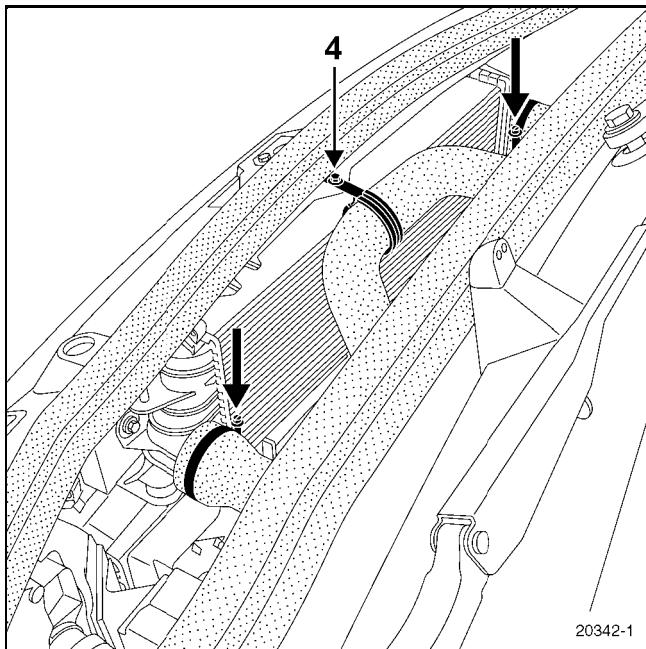


20252

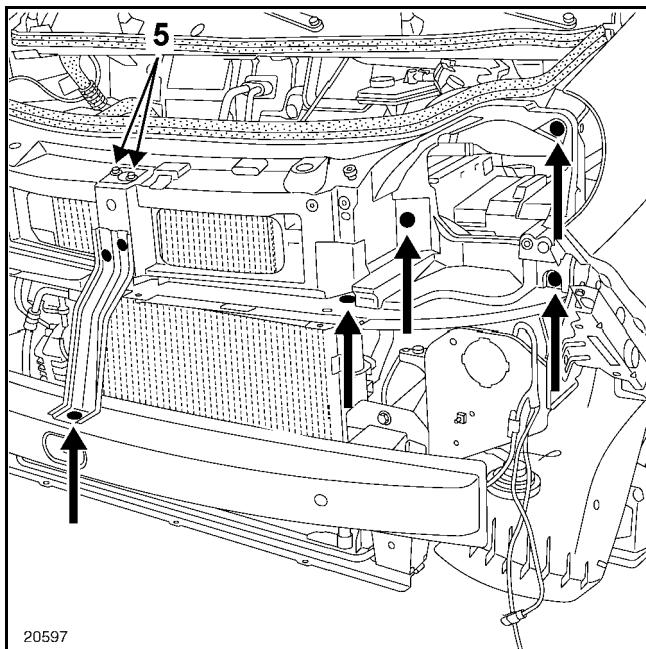


20293

- the power steering reservoir from its bracket,
- the air ducts on the heat exchanger and the mounting (4),



- the bonnet catch system mountings (5) and disconnect the cable,
- the front panel,



- the lower radiator mountings as well as the top hose,
- the connectors on the fan assembly and the condenser,

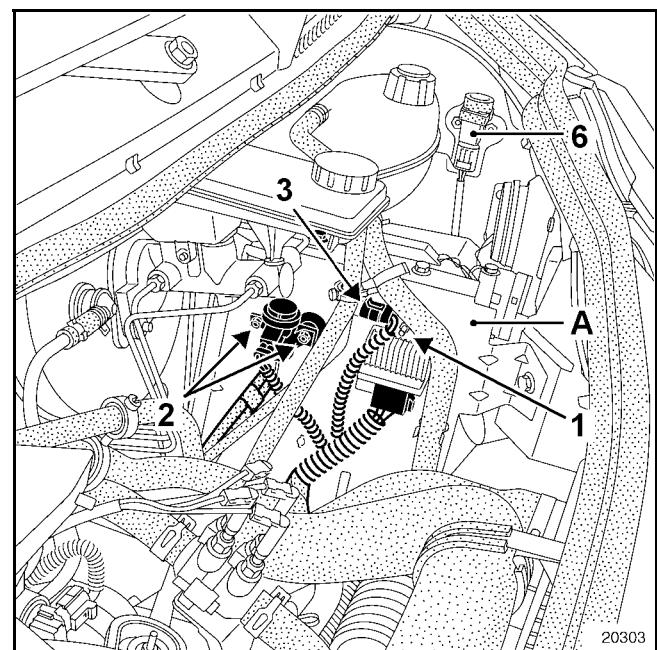
- the air conditioning hose mountings (if fitted) on the compressor and the condenser.

NOTE:

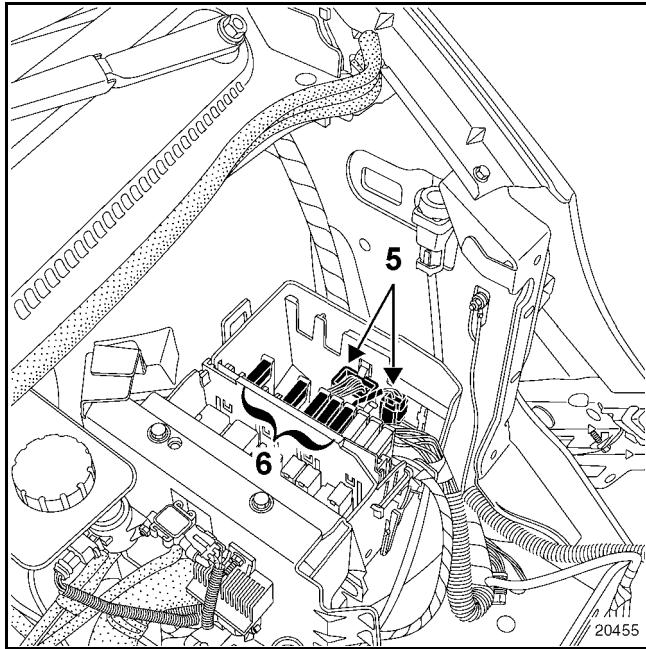
Plugs must be fitted to the hoses and the expansion valve to prevent moisture from entering the system.

Remove:

- the cooling unit,
- the air filter unit air intake tube,
- the preheater unit mounting (1),
- the turbocharger regulation solenoid valve at (2),
- the turbocharging pressure sensor (3) from its mounting,
- the impact sensor connector (6),
- the expansion bottle and remove it,
- the computer protection plate (A).



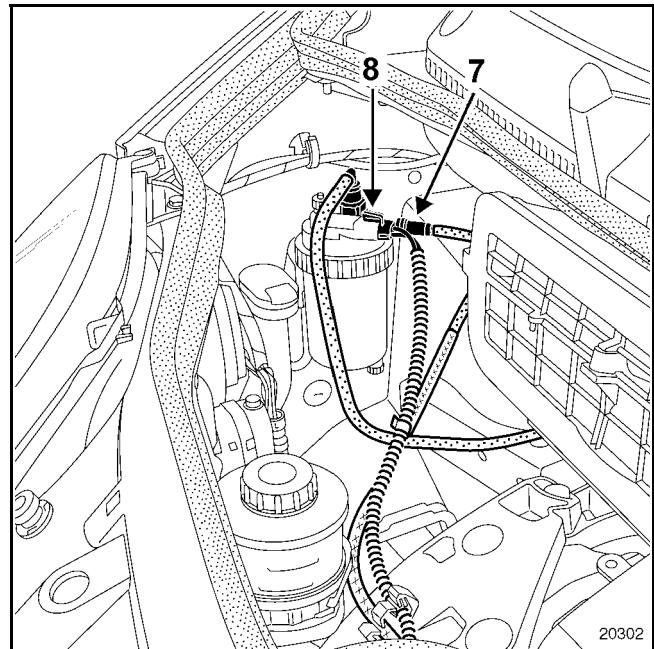
Disconnect the connectors (5) and unclip fuse holders (6).



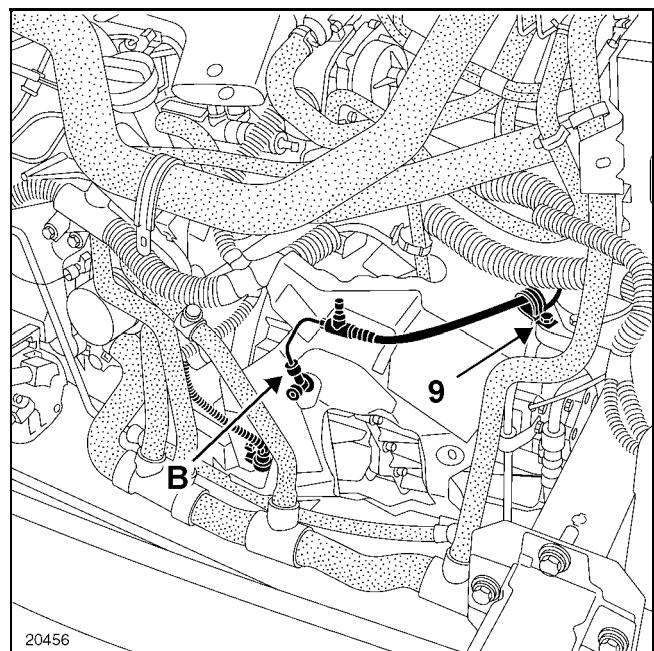
Remove the earth strap mountings on the gearbox and on the left-hand side member then remove the whole connection unit.

Disconnect:

- the heater hoses at the bulkhead,
- the brake servo vacuum pipe,
- the fuel supply pipe (7) (**fit anti-contamination plugs**) and connector (8),

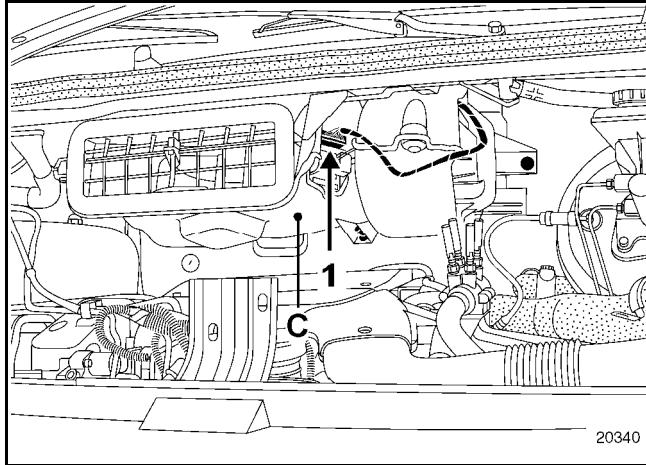


- the mounting (9),
- the clutch slave cylinder pipe by removing clip (B) and remove it,

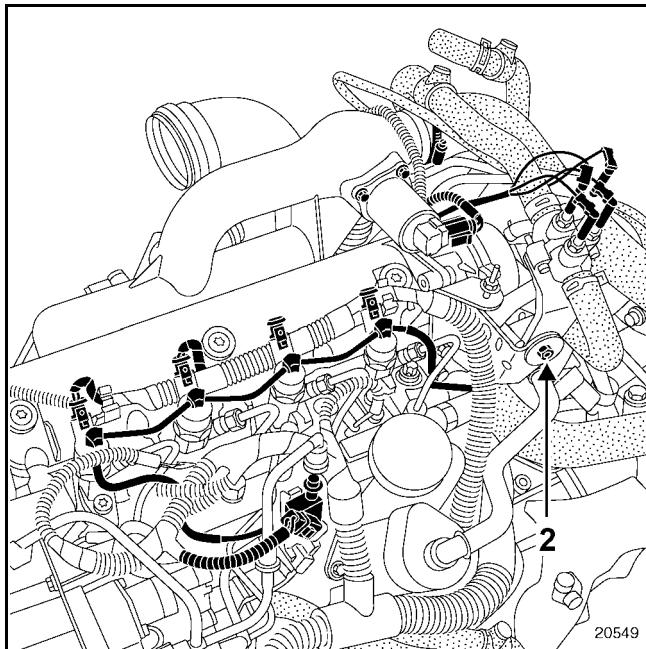


- the upper gearbox soundproofing material,

- the gearbox control cables,
- the heater matrix casing (C) by disconnecting the connector (1),

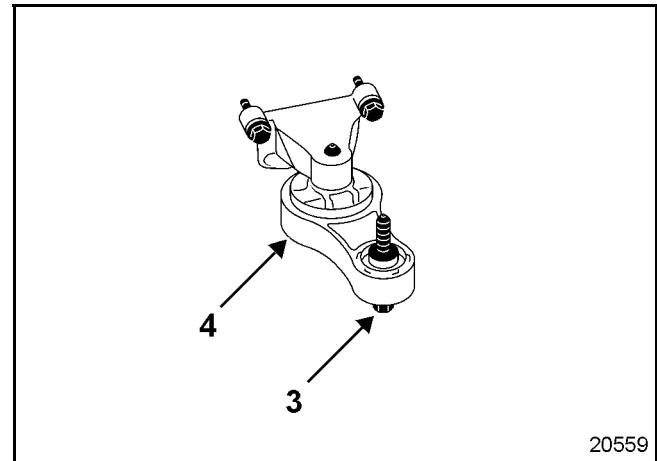


- the thermoplunger unit mounting (2) and remove the thermoplunger unit,



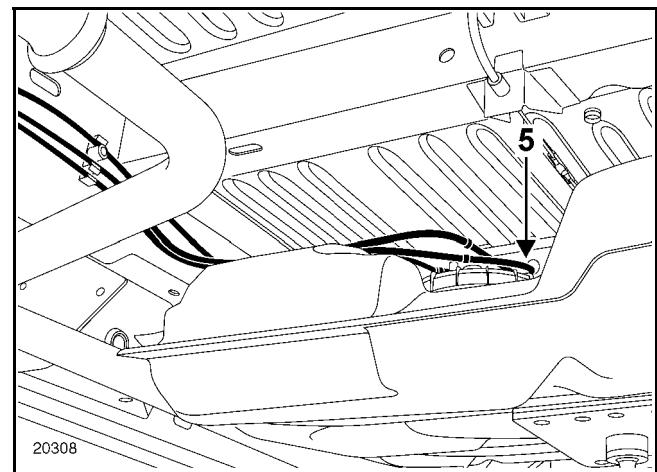
- the power assisted steering hoses on the steering box (drain the power steering reservoir first).

- the mounting bolt (3) and undo bolt (4),



- the exhaust downpipe mountings.

Disconnect the fuel tank sender connector at (5), unclip it from under the body and attach it to the engine.

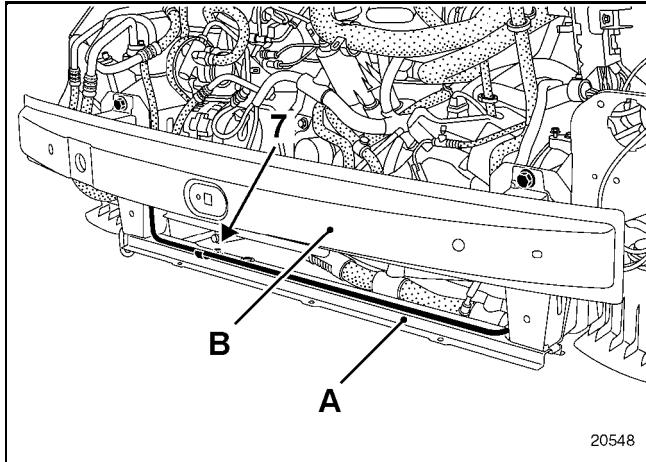


Attach the workshop hoist.

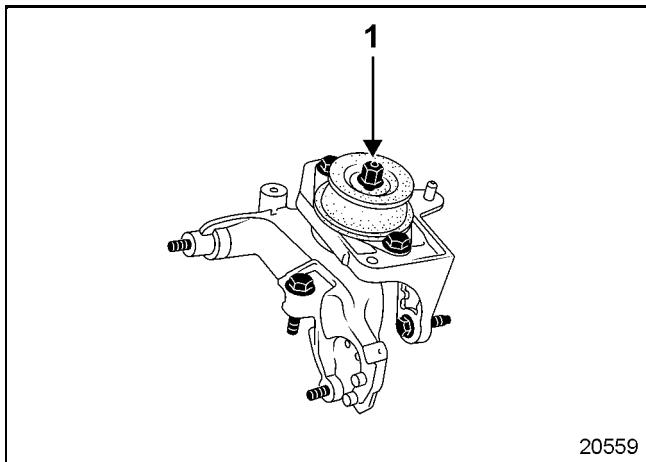
Support the engine and gearbox assembly using a hoist.

Remove:

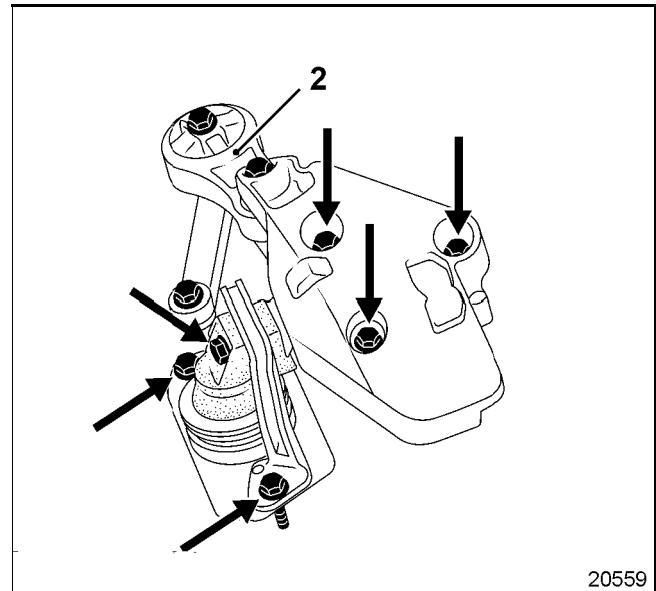
- the power steering pipe mounting (7) and remove the power steering pipe,
- the lower crossmember (A) and front crossmember (B),



- the nut (1) and tap it with a copper hammer to release the stud,



- the tie-rod (2) mounting bolts, then remove the suspended mounting movement-limiter assembly.



Using a workshop crane, remove the engine-gearbox assembly.

REFITTING

Refit the engine-gearbox assembly following the same method as for removal.

Refit:

- the left suspended mounting,
- the right suspended mounting,
- the engine tie-bar.

See **Section 19 Suspended engine mounting** for the tightening torques.

Special notes on the clutch slave cylinder when separating the engine and gearbox

IMPORTANT:

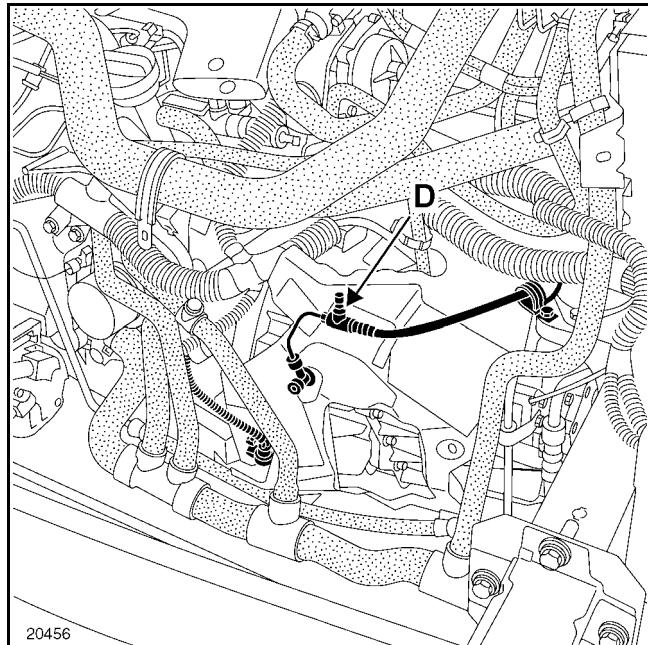
To prevent damage occurring to the slave cylinder, do not coat the gearbox output shaft with lubricant.

NOTE:

To prevent leaks, replace the slave cylinder after replacing the clutch mechanism.

Add brake fluid to the reservoir.

Bleed the system using bleed screw (A) located on the union on the slave cylinder.



Make sure that the brake fluid reservoir is never empty.

Top up the brake fluid.

IMPORTANT:

Tighten the bleed screw to a torque of 1 daNm.

Refit the engine-gearbox assembly following the same method as for removal.

Refit:

- the left suspended mounting,
- the right suspended mounting,
- the engine tie-bar.

See **Section 19 Suspended engine mounting** for the tightening torques.

Refit in reverse order to that for removal.

**FOLLOW CAREFULLY THE INSTRUCTIONS
GIVEN IN SECTION 13 SPECIAL FEATURES FOR
THE PROCEDURE FOR STARTING THE ENGINE.**

Perform the following operations:

- fill the gearbox with oil,
- fill the engine with oil, if necessary,
- fill and bleed the cooling circuit (see **Section 19 Filling - bleeding**),
- fill and bleed the power assisted steering circuit,
- fill the coolant circuit using the filling equipment.

Apply **Loctite FRENBLOC** to the brake calliper mounting bolts before fitting and tighten them to the correct torque.

Depress the brake pedal several times to bring the pistons into contact with the brake pads.

OPERATION

The **Common Rail** high-pressure direct injection system is a sequential diesel injection system (based on the multipoint injection system for petrol engines).

This new injection system reduces operating noise, reduces the volume of pollutant gases and particles and produces high engine torque at low engine speeds thanks to a pre-injection procedure.

The low pressure pump supplies the high pressure pump via the pressure regulator filter and then the fuel filter **exclusively during the starting phase**.

With a pressure between **2 and 4 bar**.

The **High Pressure** pump generates the high pressure sent to the injector rail. The pressure regulator located on the pump modulates the high pressure pump supply flow. The rail supplies each injector through a steel pipe.

The computer:

- determines the value of injection pressure necessary for the engine to operate correctly 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 start,
- controls each injector electrically and individually after determining these two values.

The injected flow to the engine is determined by:

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

THE CLEANLINESS AND SAFETY ADVICE SPECIFIED IN THIS DOCUMENT MUST BE FOLLOWED DURING ANY WORK CARRIED OUT ON THE HIGH-PRESSURE INJECTION SYSTEM.

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,
- a component seizing or leaking.

All After-Sales operations must be performed under very clean conditions. This means that no impurities (particles a few microns in size) should get into the system during dismantling or into the circuits via the fuel unions.

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

WHAT ARE THE SOURCES OF CONTAMINATION?

Contamination is caused by:

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

IMPORTANT:

it is forbidden to clean the engine using a high pressure washer because of the risk of damaging connections. Furthermore, 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 plugs sold by 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 resealable plastic bags for storing removed parts. Stored parts will therefore be less subject to the risk of impurities. The bags must be used only once, and after use they must be thrown away.
- Ensure that you have lint-free cleaning towels (towels referenced **77 11 211 707**). **The use of a normal cloth or paper for cleaning purposes is forbidden.** These are not lint free and may contaminate the fuel circuit of the system. Each lint-free cloth should only be used once.

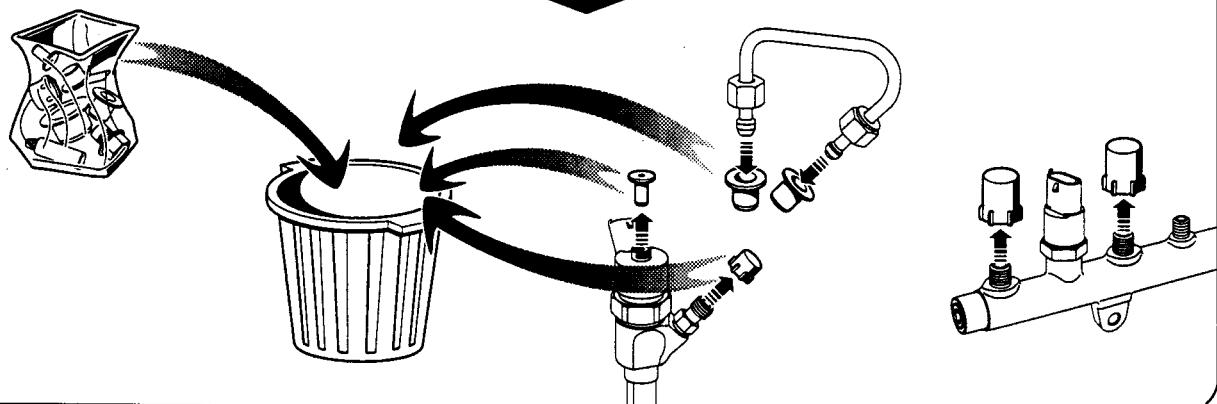
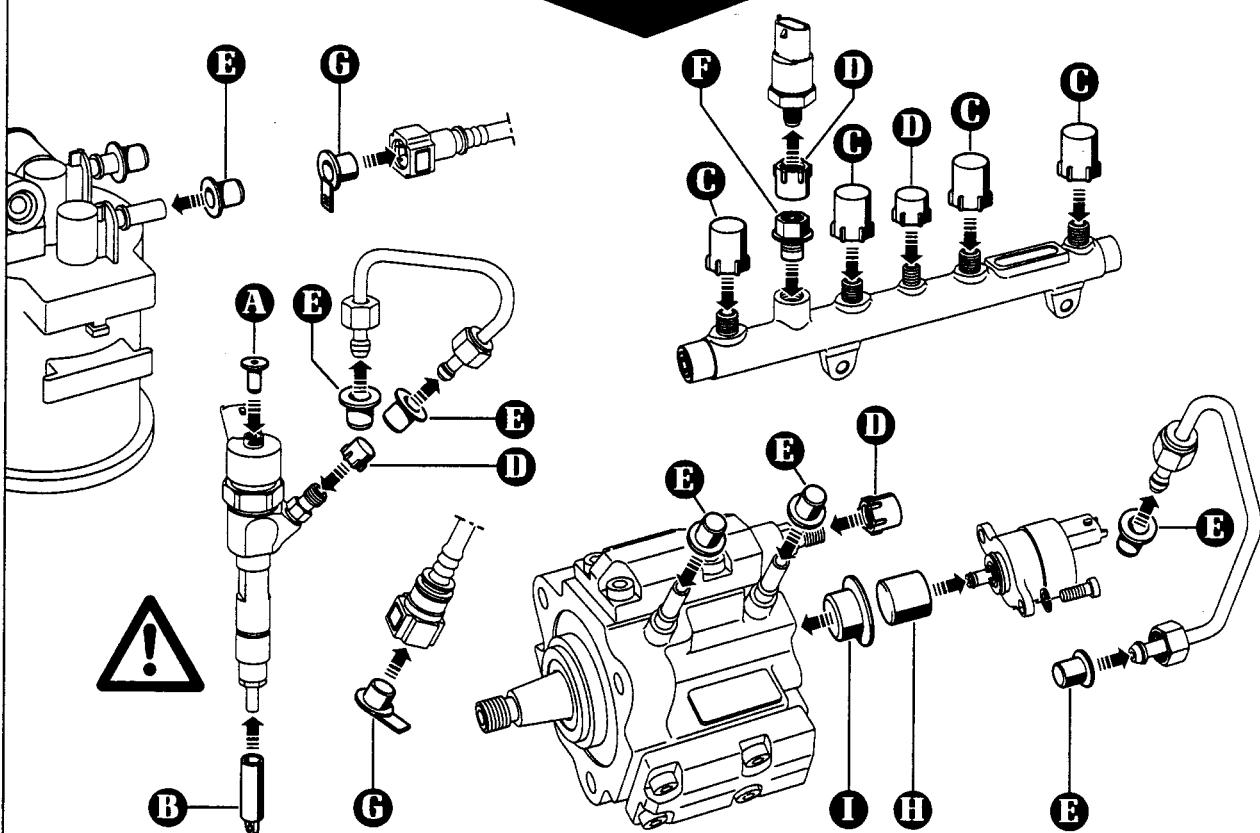
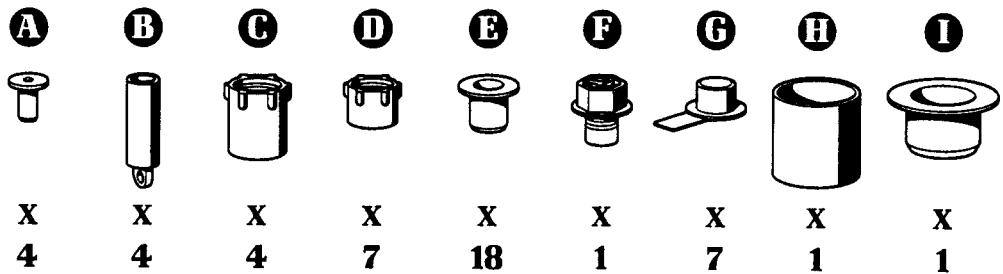
INSTRUCTIONS TO BE FOLLOWED BEFORE OPENING THE FUEL CIRCUIT

- Use new thinner for each operation, (used thinner contains impurities). Pour it into a clean receptacle.
- For each operation, use a clean brush which is in good condition (the brush must not lose its hairs).
- 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 have been left behind.
- Wash your hands before and during the operation if necessary.
- When wearing leather protective gloves, cover them with latex gloves.

INSTRUCTIONS TO BE FOLLOWED DURING THE OPERATION

- As soon as the circuit is open, all openings must be plugged to prevent impurities from entering the system. The plugs to be used are available from the **Parts Stores** (part number **77 01 206 381**). They must not, under any circumstances, be reused.
- Close the resealable bag, even if it has to be reopened shortly afterwards. Ambient air carries impurities.
- All components removed from 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. These items are likely to allow impurities to enter 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.

INSTRUCTIONS FOR FITTING THE PLUGS (part number 77 01 206 381)



POST-REPAIR CHECK

Re-prime the circuit. To do this, turn the low-pressure pump over by switching on the ignition several times, or turn the low-pressure pump over with the diagnostic tool using the "Actuator Commands" menu.

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

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

The system injects the diesel fuel 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 cylinder head injector,
- of the pressure sensor.

When the high-pressure pump, injectors and high pressure supply, output and return unions are removed or repaired, all openings should be fitted with new blanking plugs of the correct size to prevent contamination entering.

WARNING:

ALL PIPES REMOVED MUST BE REPLACED.

When replacing the high pressure pipe, follow the method below:

- remove the high pressure pipe, holding the filter rod on the injector with a lock-wrench,
- fit anti-contamination plugs,
- loosen 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,
- torque-tighten the union at the injector side,
- tighten the high pressure rail connection to torque.



Dismantling the interior components of the pump is prohibited.

The fuel return pipe fitted to the injectors must be replaced when it is removed.

The diesel temperature sensor cannot be removed. It is part of the fuel return rail.

Loosening a high pressure pipe connection when the engine is running is prohibited.

USING THE MANUAL

There are two main sections in this manual:

- **technical specifications,**
- **overhauling the engine.**

UNITS OF MEASUREMENT

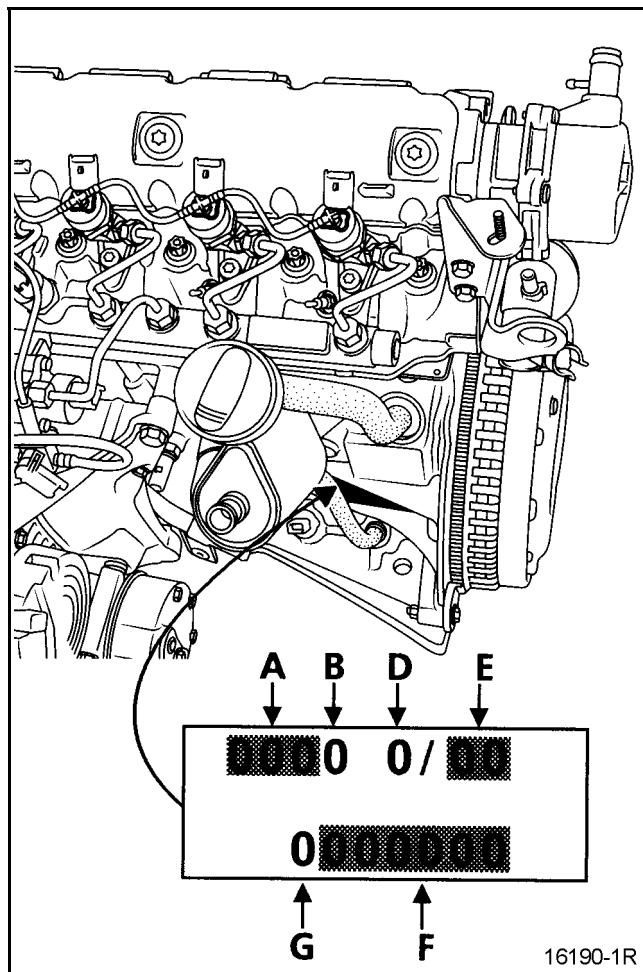
- All dimensions are given in millimetres (**mm**) (unless stated otherwise).
- Tightening torques are expressed in decaNewton.metres (**daN.m**).
Reminder: **1 daN.m = 1.02 m.kg.**
- Pressures in **bar**
Reminder: **1 bar = 100,000 Pa.**

TOLERANCES

Tightening torques given without a tolerance must be accurate to within:

- in **degrees** ($\pm 3^\circ$),
- in **daN.m** ($\pm 10\%$).

The engine identification is stamped on the cylinder block.



It includes:

- A:** the engine type
- B:** the engine approval letter
- D:** the identification of **RENAULT**
- E:** the engine suffix
- F:** the engine fabrication number
- G:** the engine assembly plant

Engine	Suffix	Compression Ratio	Bore (mm)	Stroke (mm)	Cubic capacity (cc)
F9Q	718, 732, 733, 738, 740, 746, 748, 750, 751, 752, 754, 756, 760, 762, 772, 790	19:1	80	93	1870

UPPER ENGINE

Description	Tightening torques
Cylinder head cover bolts	*
Cam shaft line beam bolt	2
Camshaft pulley bolt	6
High pressure pipe nuts	2.5
Common rail mounting bolt	2.2
Cylinder head bolts	*
Inner timing housing bolt	1
Valve timing cover bolt	1
Heater plug	1.5
Lifting bracket fastening bolt (timing end)	2
Lifting bracket fastening bolt (engine flywheel end)	1.3
Injector clamp bolts	3
Vacuum pump mounting bolts	2.3
Suspended mounting bolt	3.5
High pressure pump mounting bolt	3
Rear high pressure pump support bolts and nuts	3
High pressure pump pulley nuts	1.5 plus an angle of $60^\circ \pm 10^\circ$
Thermostat mounting bolt	0.8
Camshaft sensor bolts	0.9
Exhaust gas recirculation valve mounting bolt	0.9
Inlet - exhaust manifold nuts	2.8
Thermal unit mounting bolt	0.8

* See procedure.

LOWER ENGINE

Description	Tightening torques
Oil pressure sensor	3.8
Oil level sensor	3
Crankshaft accessories pulley bolt	2 plus an angle of $115^\circ \pm 15^\circ$
Bolts on crankshaft bearing caps (tightening order: 34251)	2 plus an angle of $62^\circ \pm 4^\circ$
Con rod head cap bolts	2 plus an angle of $40^\circ \pm 6^\circ$
Oil pump bolts	2.4
Crankshaft closure panel bolt	1.4
Oil sump bolts (see tightening sequence)	1.5
F9Q engine flywheel bolt	2 plus an angle of $70^\circ \pm 7^\circ$
Clutch bolts	2
Bolt of F9Q water pump	1
Timing tensioner plate bolts	1
Timing tensioner nut	5
Coolant inlet pipe mounting bolt	1
Coolant pipe mounting bolt	4
Multifunction support bolts	5
Power assisted steering pump bolt	2.5
Air conditioning compressor bolts	2.5
FLEXIBLE engine flywheel bolts	3 plus an angle of $35^\circ \pm 6^\circ$

ENGINE AND PERIPHERALS

Tightening torques (in daN.m or in degrees)

10A

Description	Tightening torques
Alternator bolts	2.5
Accessories tensioner roller bolts on cylinder block	2.5
Oil decanter bolts	1
Top dead centre plug	2
Turbocharger mounting nuts	2.4
Turbo oil inlet union (cylinder block end)	2.3
Turbo oil inlet union (pipe end)	2.4
Turbo oil inlet union (turbocharger end)	2.6
Mounting bolts on turbocharger oil return pipe (turbocharger end)	1.2
Light-off catalyst mounting nuts to turbo	2.5
Exhaust stay bolt: – M8 – M10	2.4 4.3
Anti-emulsion plate mounting bolts	2.4
Auto tensioner mounting bolts	4.3

CYLINDER HEAD

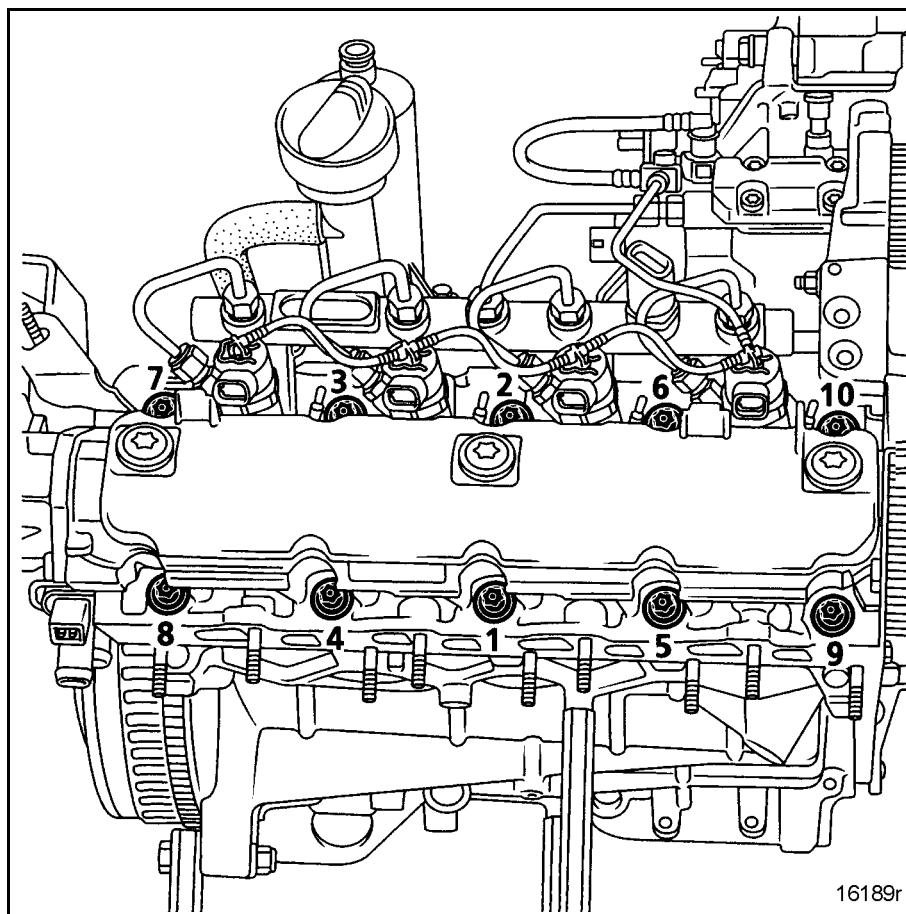
Cylinder head tightening procedure

REMINDER:

to obtain correct tightening of the bolts, remove any oil from the cylinder head securing holes using a syringe.

All cylinder head bolts must always be changed after removal. There is no cylinder head retightening operation.

Tighten all the bolts to **3 daN.m**, then angle tighten to **$100^\circ \pm 4^\circ$** , in the sequence shown below.



Wait 3 minutes settling time.

Cylinder head tightening is carried out in stages, and the following procedure is applied successively to bolts **1-2 then 3-4, 5-6, 7-8 and 9-10**

Loosen bolts **1-2** until they are completely free.

Tighten bolts **1-2** to **2.5 daNm**, then angle tighten to **$213^\circ \pm 7^\circ$** .

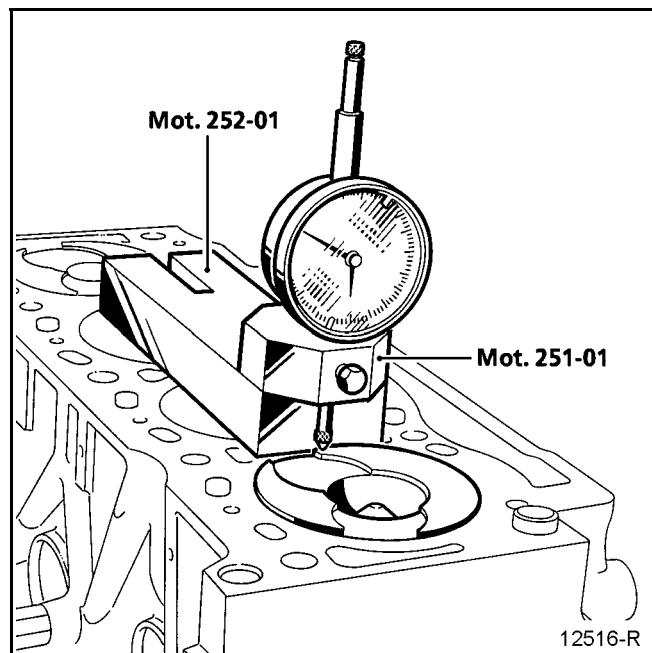
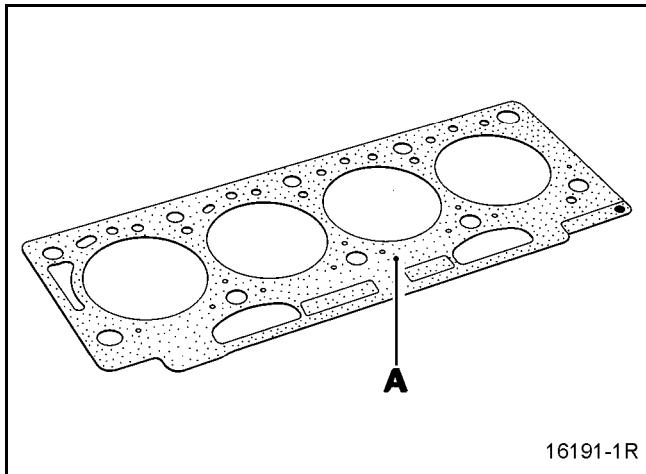
Repeat the loosening and tightening operations for bolts **3-4, 5-6, 7-8 and 9-10**.

There is no cylinder head retightening operation.

Thickness of the cylinder head gasket

The thickness of the cylinder head gasket is measured at (A):

- thickness of the gasket when tightened:
 1.32 ± 0.05 mm.



Checking piston protrusion

Clean the piston heads in order to eliminate any traces of deposits.

Turn the crankshaft one turn in its operating direction to bring piston **No. 1** close to top dead centre.

Fit tool **Mot. 251-01** equipped with a gauge on support plate **Mot. 252-01**, and find top dead centre.

NOTE:

All measurements are to be carried out in the longitudinal axis of the engine, in order to eliminate any errors due to piston tilting.

WARNING:

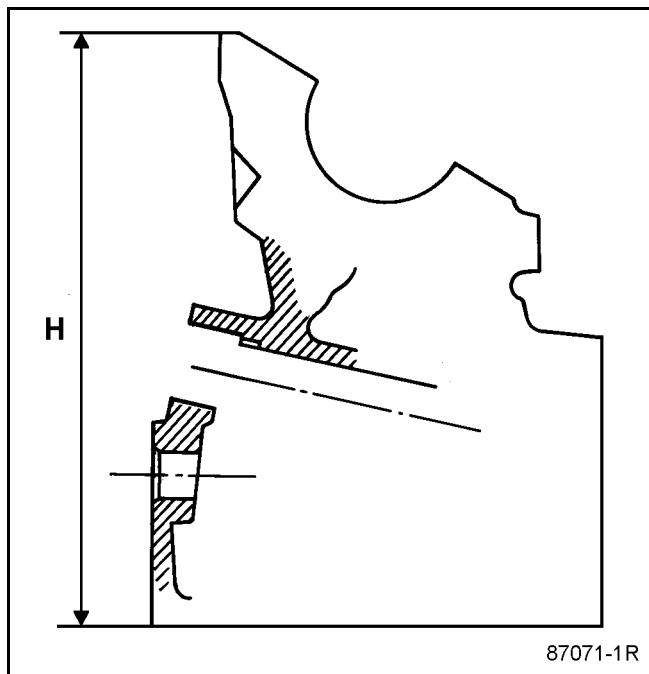
the gauge detector must not be in the valve clearance.

Measure the piston protrusion.

The protrusion must be: **0.56 ± 0.06 mm.**

Height of the cylinder head (in mm)

$H = 162.75 \pm 1.75$



Gasket face deformation (in mm): **0.05**

NO REGRINDING IS AUTHORISED

Valves

Stem diameter (in mm)

Inlet:	6.985 ± 0.011
Exhaust:	6.971 ± 0.011

Face angle

Inlet and exhaust::	90°
---------------------	------------------------------

Head diameter (in mm)

Inlet:	35.325 ± 0.125
Exhaust:	32.625 ± 0.125

Valve length (in mm)

Inlet:	110.99 ± 0.20
Exhaust:	110.79 ± 0.20

Max. valve lift (in mm)

Inlet:	8.866
Exhaust:	10.344

Protrusion of valves in relation to the cylinder head gasket face (in mm)

Inlet and exhaust:	0.09 ± 0.12
--------------------	-----------------------------------

Valve clearance settings (in mm)

Inlet:	0.20 ± 0.05
Exhaust:	0.40 ± 0.05

Valve seats

Seat angle (α)

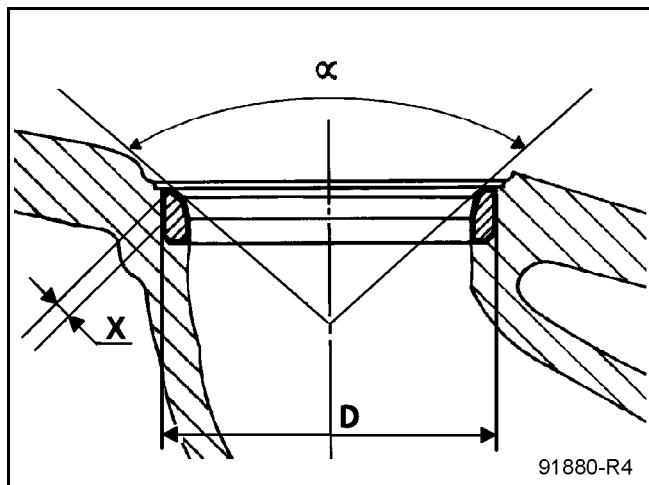
Inlet and exhaust: **89.5°**

Mating surface width X (in mm)

Inlet and exhaust: **1.8**

Seat external diameter (D) (in mm)

Inlet: **36.975 ± 0.008**
 Exhaust: **33.597 ± 0.008**



Diameter of the seat housing in the cylinder head (in mm)

Inlet: **36.9 ± 0.007**
 -0.023

Exhaust: **33.5 ± 0.029**
 0

Valve guides

Length (in mm)

Inlet and exhaust: **38.25 ± 0.15**

Guide external diameter (in mm)

Normal: **12 ± 0.05**

Guide internal diameter (in mm)

Inlet and exhaust

Not machined: **6.3 ± 0.12**

Machined*: **7 ± 0.022**

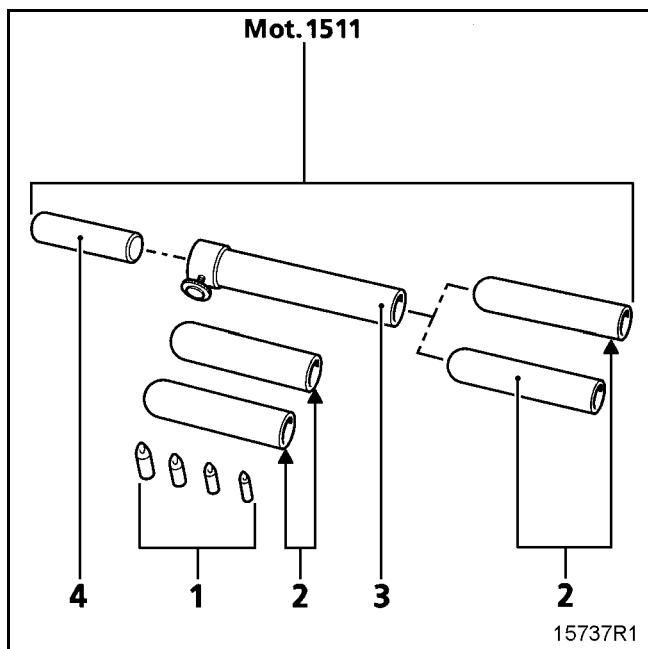
* This dimension is measured with the guide fitted in the cylinder head.

Diameter of the guide housing in the cylinder head (in mm)

Normal: **12 ± 0.05**

The inlet and exhaust guides have valve stem seals which must be replaced each time the valves are removed.

It is essential to fit the valve stem seals using tool Mot. 1511 or other suitable equipment.



NOTE:

Do not lubricate the valve stem seals before fitting them.

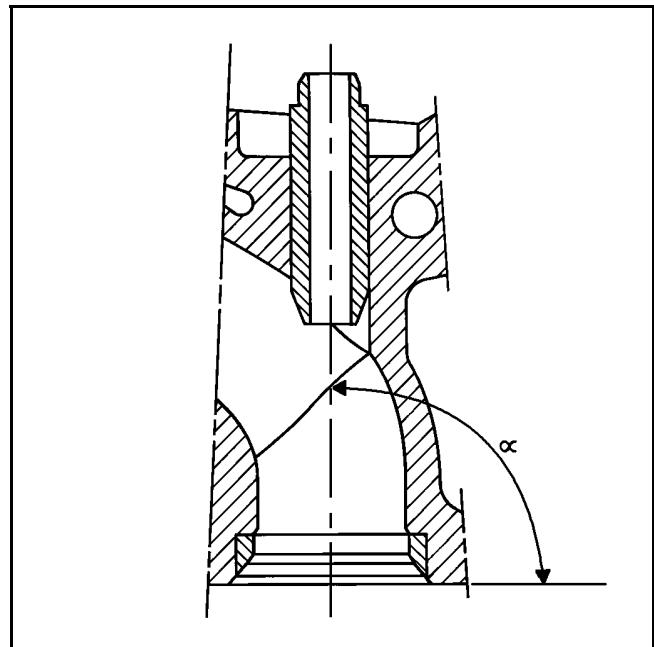
Tool **Mot. 1511** consists of:

- four cores (1),
- four pushrods (2),
- one guide tube (3),
- one sleeve (4).



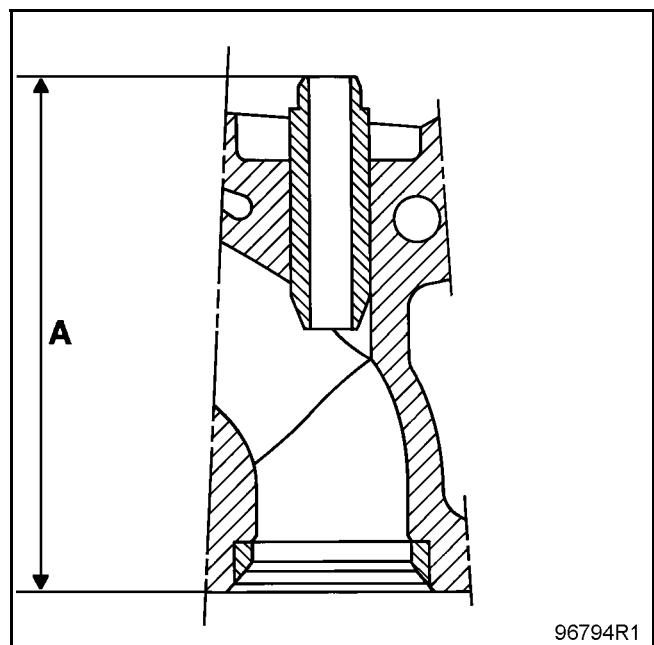
Angle of the inlet and exhaust guides (in degrees)

Inlet and exhaust: $\alpha = 90$



Position of the inlet and exhaust valve guides (in mm)

Inlet and exhaust: $A = 81.05 \pm 0.4$



Valve springs

Free length (in mm):	46 ± 2
Length under load (in mm):	
27 daN	37.5
61.4 daN	27.5
Close-wound coils (in mm):	25.07 ± 0.1
Diameter of wire (in mm):	3.90 ± 0.03
Internal diameter (in mm):	21.5 ± 0.1
External diameter (in mm):	29.5

Pistons

External diameter of tappet (in mm):	34.975 ± 0.01
--------------------------------------	-------------------------------------

Diameter of the housing in the cylinder head (in mm):

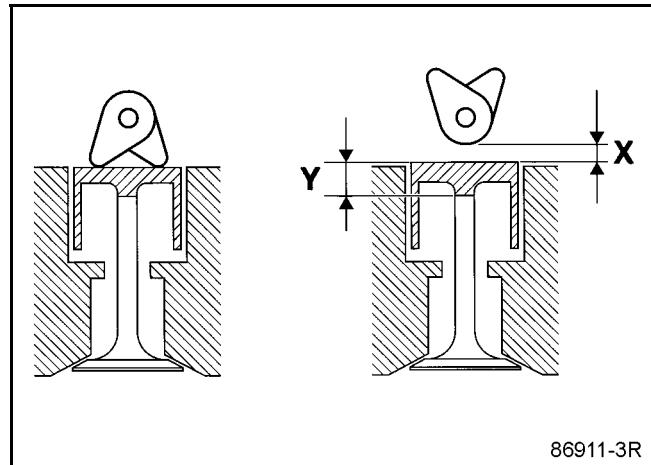
$35 \begin{smallmatrix} +0.039 \\ 0 \end{smallmatrix}$

Checking the valve clearance

Place the valves of the cylinder concerned at the "end of exhaust - beginning of inlet" position and check the clearance (X).

NOTE:

Dimension (Y) corresponding to the tappet thickness class (at the Parts Stores there are **25 classes**).



Y	X
1	4
3	2
4	1
2	3

Compare the values recorded with the values specified, then replace the tappets which are not within tolerance.

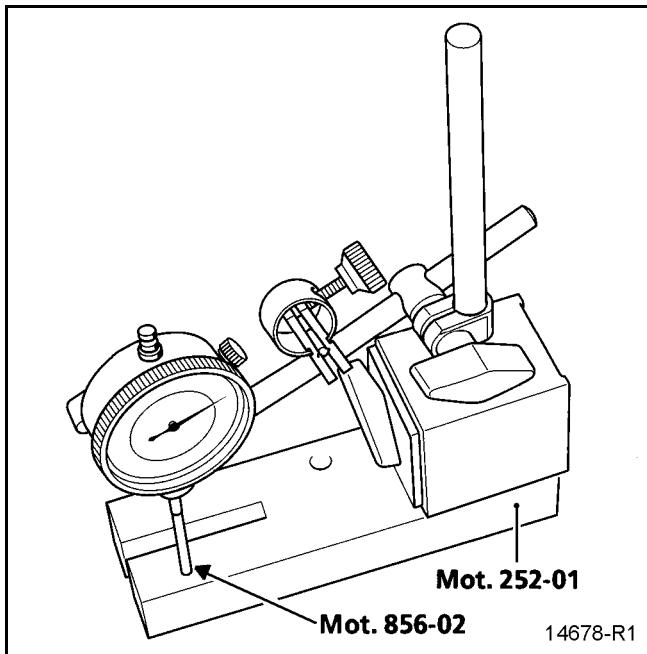
Clearance, when the engine is cold, in mm:

Inlet:	0.20 ± 0.05
Exhaust:	0.40 ± 0.05

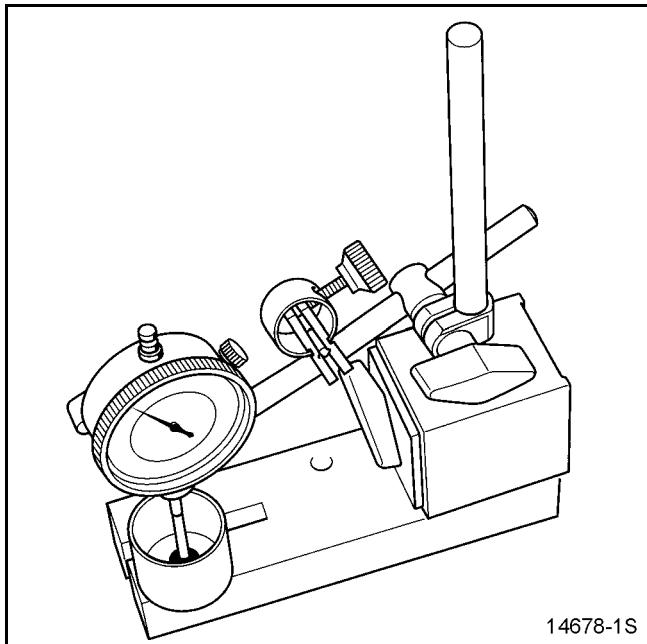
The camshaft must be removed to replace the tappets.

Determining dimension (Y).

Set up the following assembly using **Mot. 252-01** and **Mot. 856-02**, then calibrate the gauge.



Raise the gauge extension (without modifying the position of the magnetic support/gauge assembly), then slide in the tappet to be measured.



Note dimension (Y) and repeat the operation for the tappets where the valve clearance is not within tolerance.

Refer to the "Replacement parts catalogue" for the vehicle concerned to select the various thicknesses of the tappet(s).

Camshaft

End play (in mm) **0.045 to 0.135**

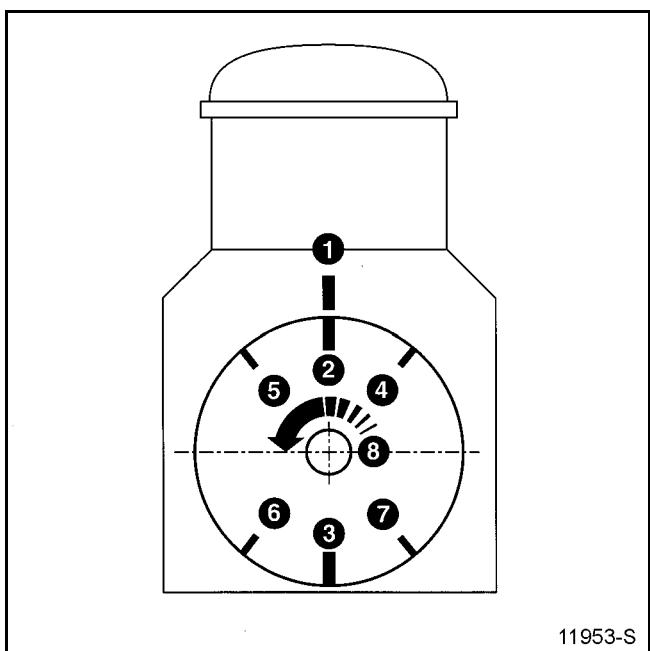
Number of bearings **5**

Timing diagram

– Inlet opening retardation *	- 3
– Inlet closing retard	21
– Exhaust opening advance	46
– Exhaust closing advance **	- 5

* **If the inlet opening delay** is negative, valve opening can be found after top dead centre.

** **If the exhaust closing advance** is negative, valve closing can be found before top dead centre.



11953-S

- 1 Cylinder block top dead centre fixed mark
- 2 Flywheel top dead centre moving mark
- 3 Flywheel bottom dead centre moving mark
- 4 Inlet opening retardation
- 5 Exhaust closing advance
- 6 Inlet closing retardation
- 7 Exhaust opening advance
- 8 Direction of engine rotation (flywheel end)

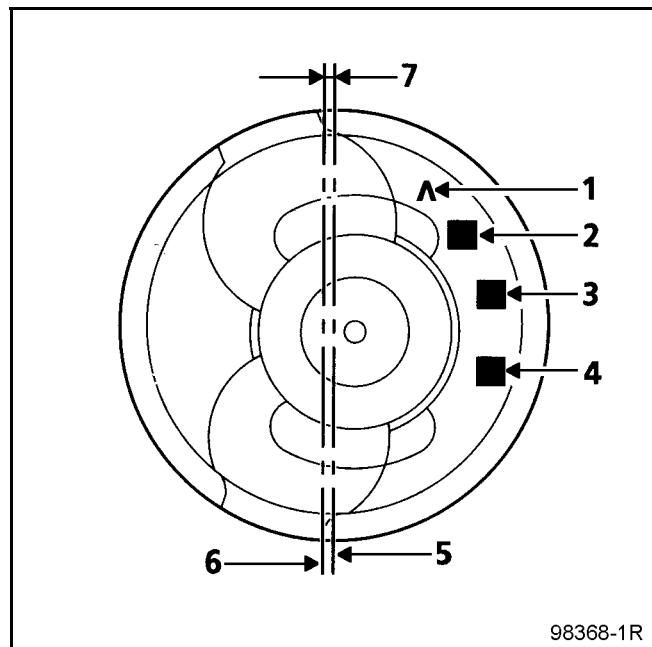
PISTONS

Fitting the gudgeon pin in the con rod and in the piston.

The gudgeon pin is retained by circlips.

These engines are fitted with **KOLBENSCHMIDT** pistons.

Piston marking



98368-1R

- 1 Direction of fitting of the piston: \wedge towards the flywheel
- 2 Height between the gudgeon pin and the top of the piston (see table on following page)
- 3 Used by the supplier only
- 4 Used by the supplier only
- 5 Piston axis of symmetry
- 6 Gudgeon pin hole axis
- 7 Offset between the hole of the pin (6) and the axis of symmetry of the piston (5): **0.5 mm**

Table of gudgeon pin heights

Mark on piston*	Pin height (mm)
K	47.046
L	47.088
M	47.130
N	47.172
P	47.214

The tolerance on the pin heights is ± 0.02 mm.

* The different gudgeon pin heights are exclusively reserved for the engine assembly plant.

The Parts Stores will only supply piston classes (height) L, M, N.

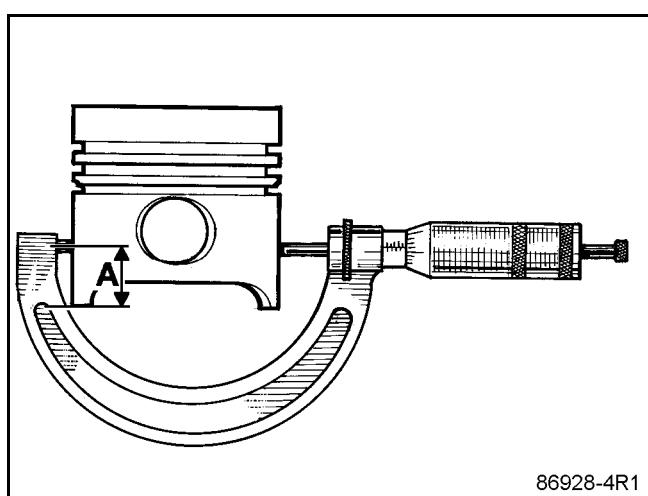
NOTE:

- if the engine is fitted with a **K class** piston, an **L class** piston must be fitted as a replacement,
- if the engine is fitted with a **P class** piston, an **N class** piston must be fitted as a replacement,

Measuring the piston diameter

The piston diameter is measured at height **A** = 39 mm.

Piston diameter (in mm): **79.866 ± 0.0075**

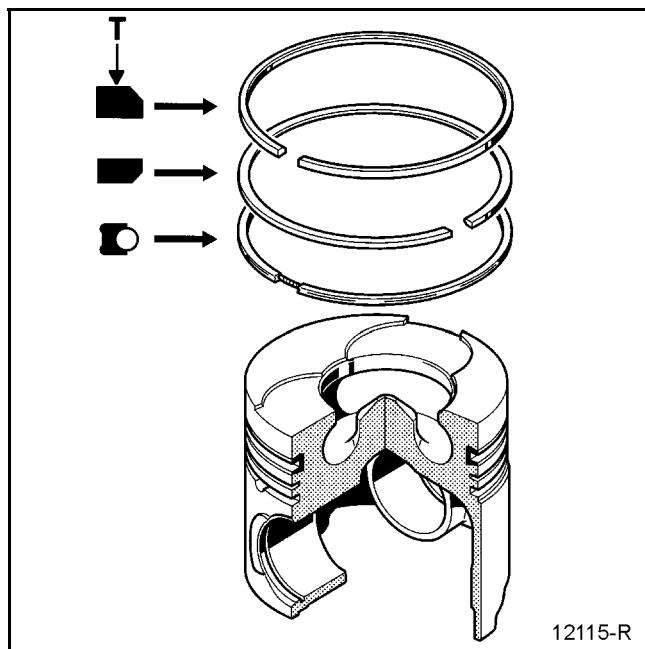


Rings

Three rings (thickness in mm)

– Compression ring	2.5	-0.01 -0.03
– Sealing	2	-0.01 -0.03
– Scraper	3	-0.01 -0.03

The rings are supplied ready adjusted.



T = Top

Clearance at the gap

Rings	Clearance at the gap (in mm)
Compression	0.2 to 0.35
Sealing	0.7 to 0.9
Scraper	0.25 to 0.5

Gudgeon pin (in mm)

All types except F9Q 750 and 756

Length: **59.7 to 60**

External diameter: **27.995 to 28**

Internal diameter: **13.8 to 14.1**

F9Q 750 and 756

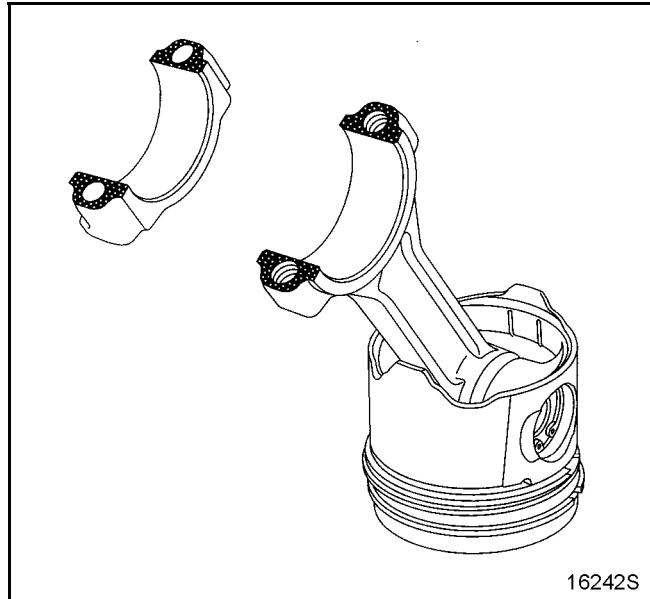
Length: **59.5 to 60**

External diameter: **27.995 to 28**

Internal diameter: **12.8 to 13.1**

CON RODS

The con rods are DIVISIBLE.



WARNING:

- The bolts must be sealed with engine oil under the heads and on the threads when the con rods are fitted in the engine.
- Positioning of the con rod heads on the body is ensured by roughnesses on the crack.
- The occurrence of impacts or a foreign body between the body-head mating surfaces will lead to rapid failure of the con rod.

Lateral play of the con rod big end (in mm):

0.22 to 0.482

Diametral play of the con rod big end (in mm):

0.027 to 0.086

Centre-to-centre distance between the con rod big end and small end (in mm):

139

Diameter of the big end (in mm):

51.587 ^{+0.019} ₀

Diameter of the small end (in mm):

(without ring) 30.24 ^{+0.025} ₀

(with ring) 28 ^{+0.025} _{+0.013}

NOTE:

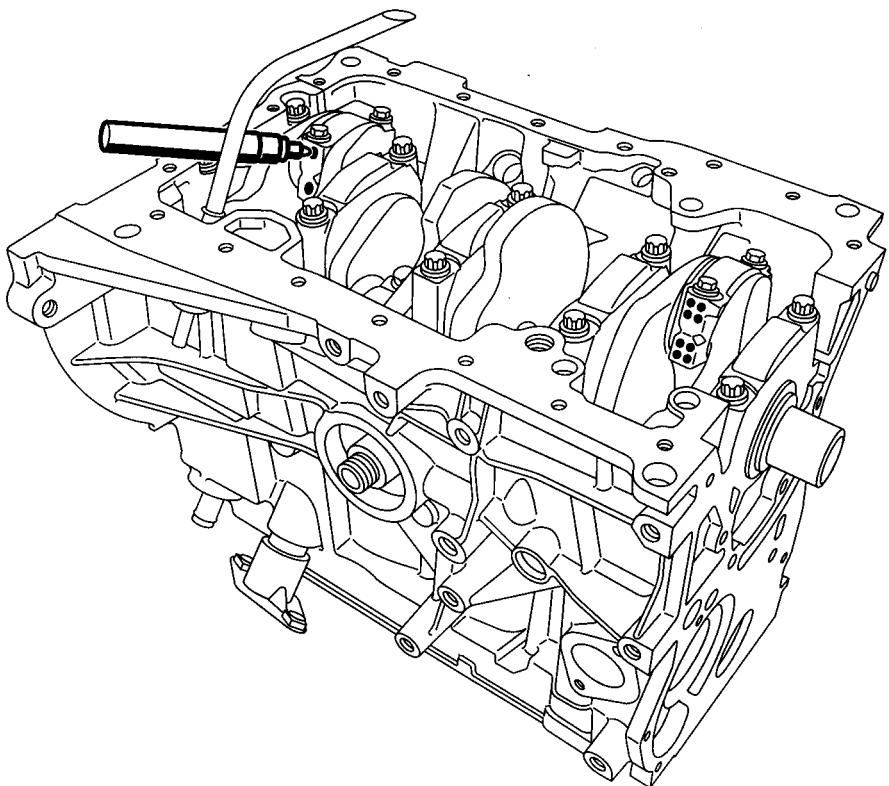
the con rod small end bushings cannot be replaced.

IMPORTANT:

Do not use a sharp point to mark the bearing caps in relation to their con rods to avoid starting a crack in the rod.

Use a permanent marker pen.

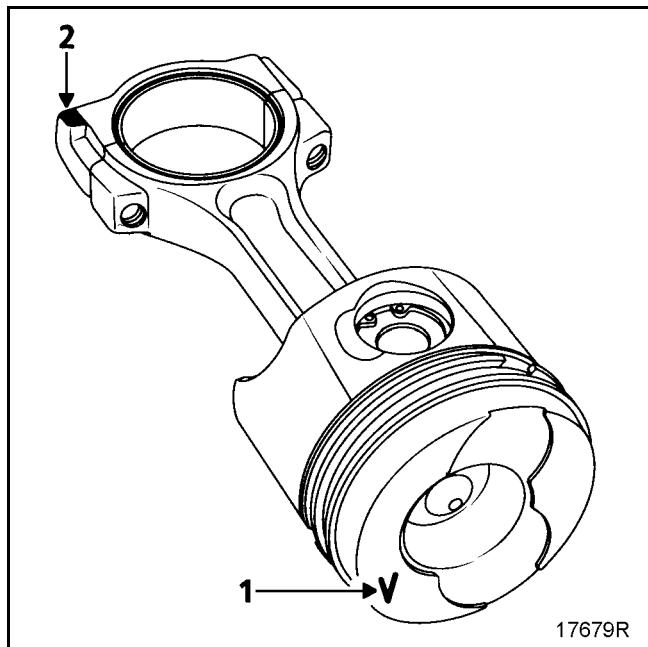
The maximum weight difference for the con rod, piston and gudgeon pin assemblies for the same engine must be **23 grams**.



16252-2S

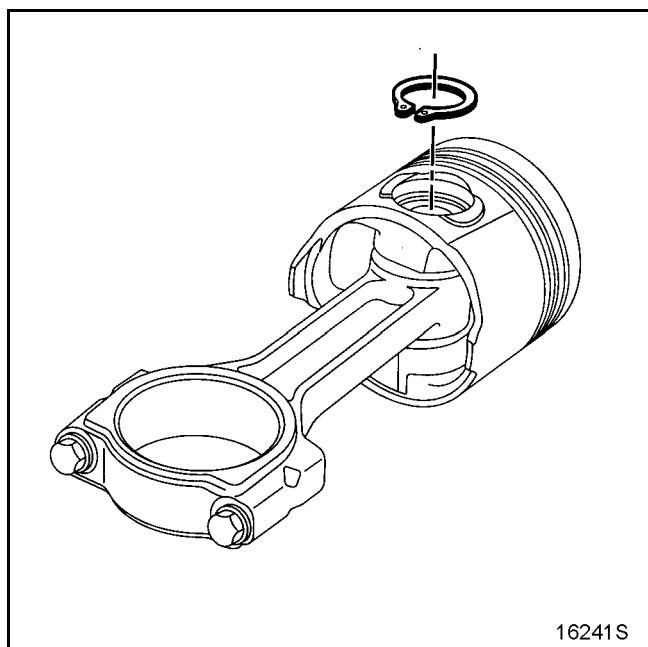
Direction of fitting of the con rod in relation to the piston

Place the "Λ" (1) engraved on the piston head downwards and the machined flat (2) of the con rod head upwards.



Direction for fitting the circlips on the piston

Fit the circlips on the piston as shown below.



CRANKSHAFT

Number of main journals **5**

Lateral crankshaft play (in mm): **0.067 to 0.233**

Diametral crankshaft play (in mm): **0.027 to 0.086**

Diameter of the main bearing journals

Main bearing journal diameters are shown on the crankshaft by paint marks.

Paint mark	Blue	Red
Journal diameter (in mm)	54.785 inclusive to 54.795 exclusive	54.795 inclusive to 54.805 exclusive

Diameter of the crankpins (in mm): **48.01 ± 0.01**

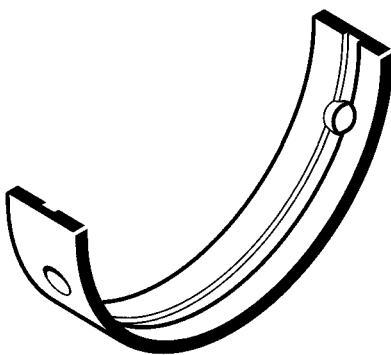
The lateral shims are located on **bearing No. 2**.

NO REGRINDING IS AUTHORISED

BEARING SHELLS

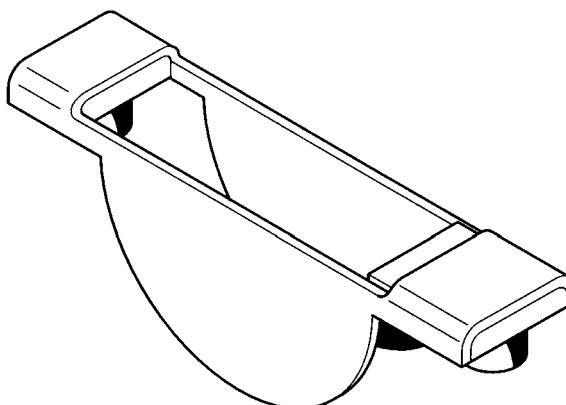
Crankshaft bearing shells

The engine is fitted with bearing shells without a locator notch.



15197S

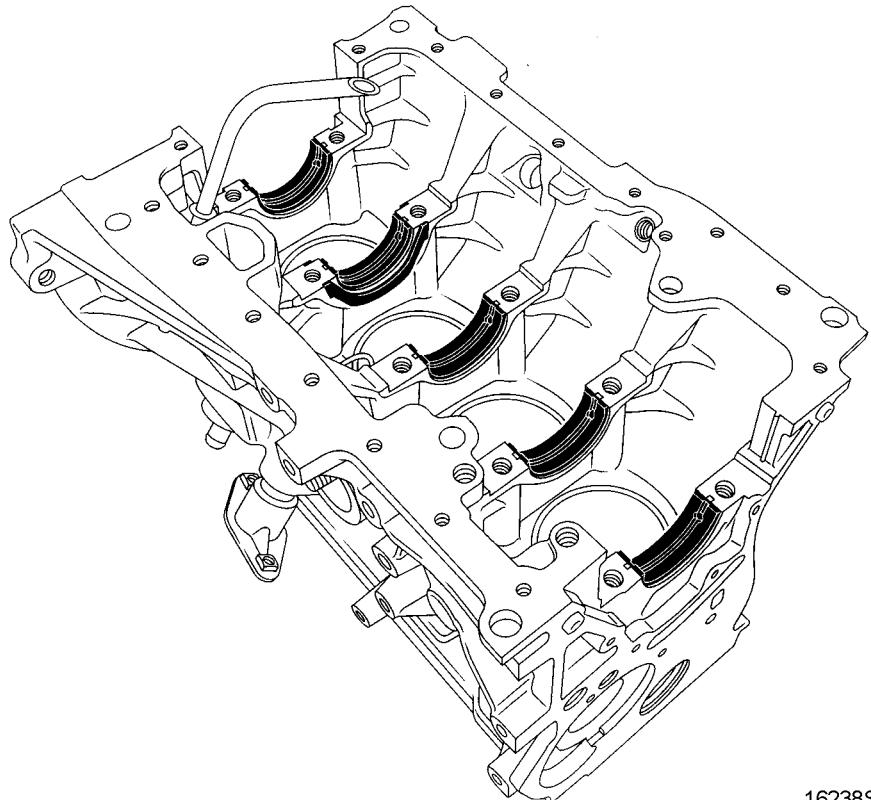
The crankshaft bearing shells are fitted on the cylinder block and on the bearings using tool **Mot. 1493**.



15866S

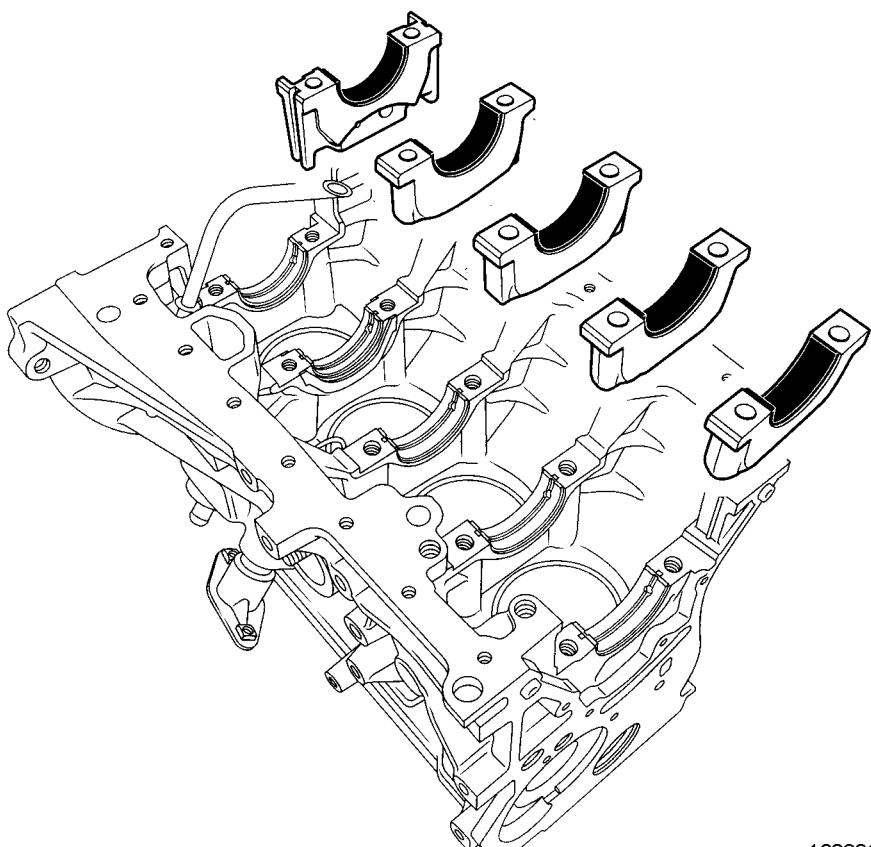
Direction of fitting:

- the **cylinder block** bearings are fitted with **grooved** bearing shells,



16238S

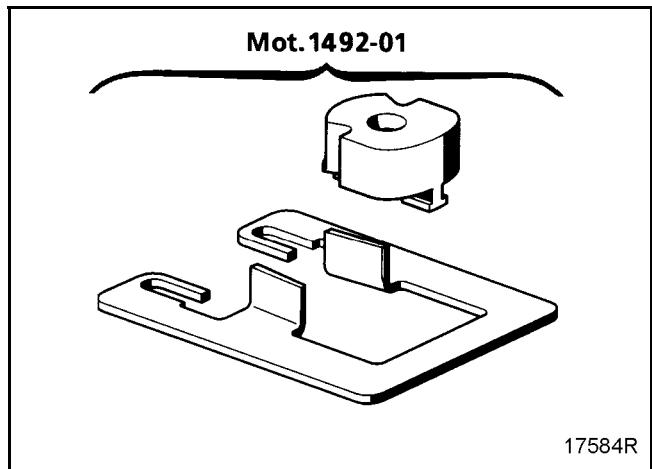
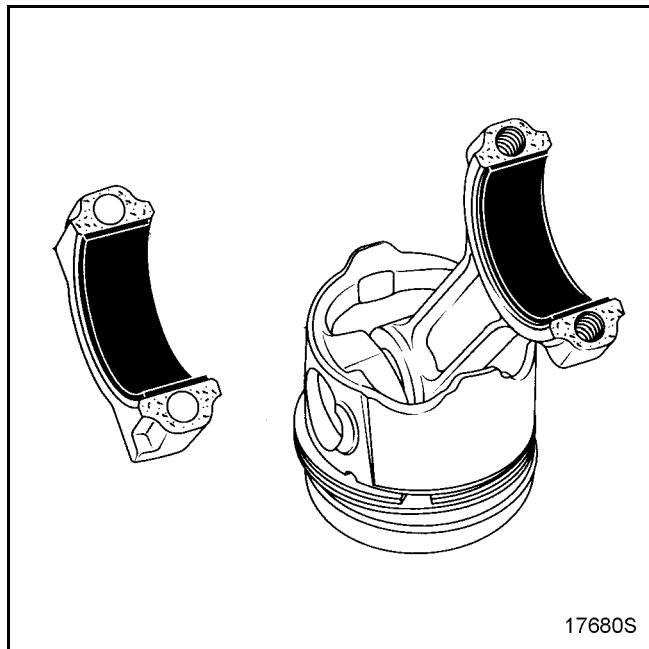
- the **bearing caps** are fitted with **non-grooved** bearing shells.



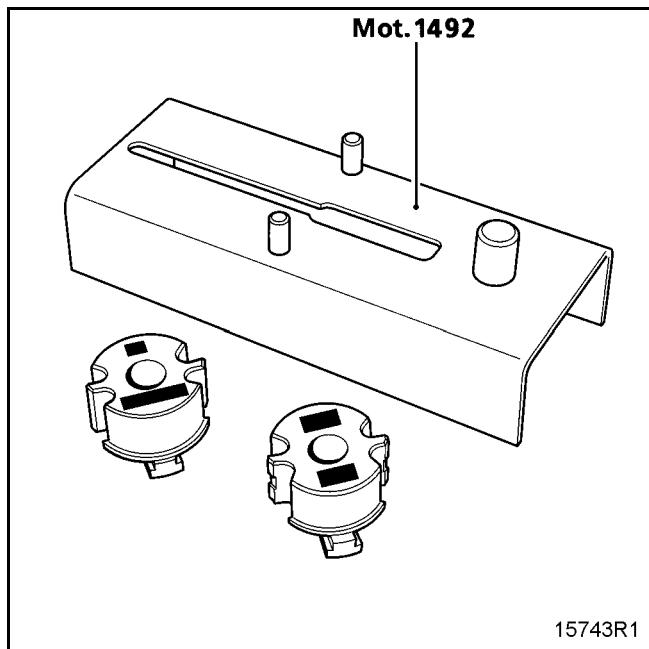
16239S

Con rod bearing shells

The engine is fitted with bearing shells without a locator notch.



The bearing shells are fitted using **Mot. 1492** and **Mot. 1492-01**.

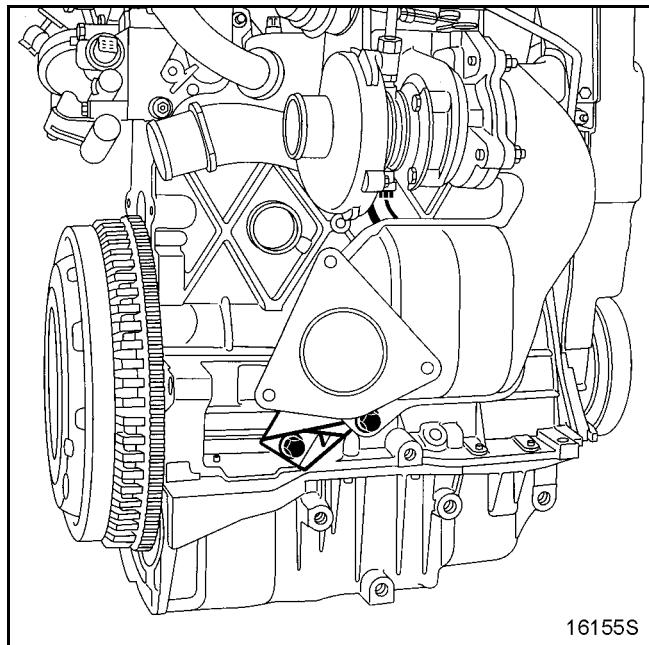


PREPARING THE ENGINE TO BE SET ON THE STAND

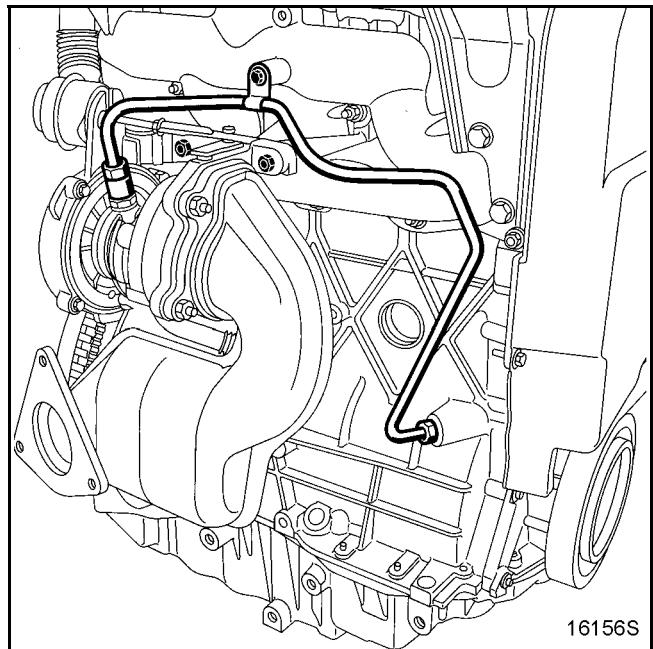
Before the engine is mounted on the stand **Mot. 792-03**, the engine's electrical harness must be removed and the engine oil drained.

Remove:

- the stay between the cylinder block and the light-off catalyst,
- the turbocharger oil return pipe,



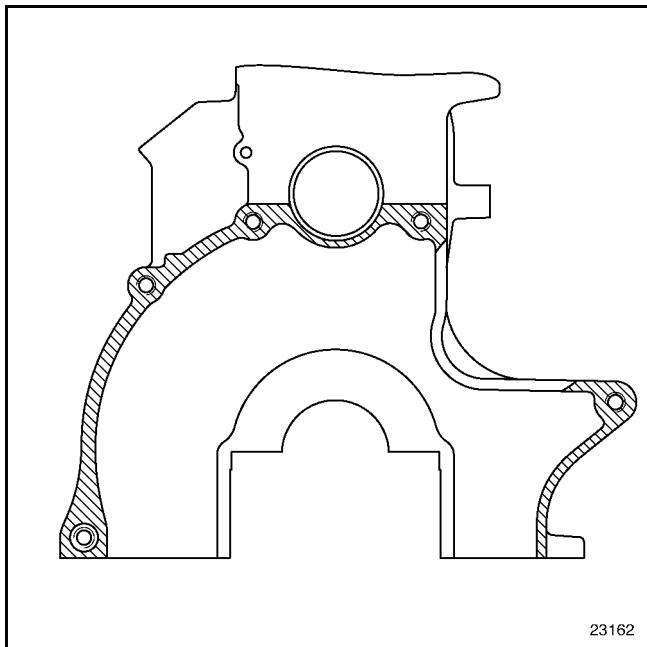
- the turbocharger oil supply pipe,
- the three turbocharger mounting nuts on the exhaust manifold.



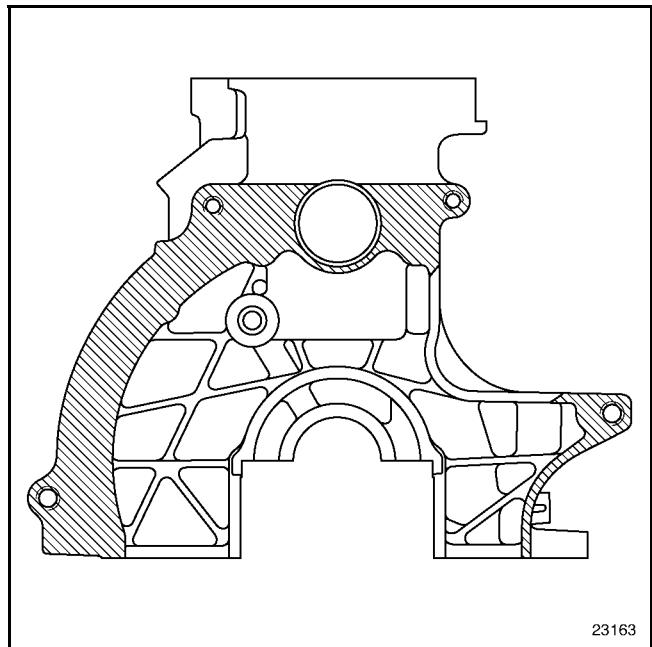
Change to the cylinder block

To optimise the acoustics, a change has been made to the cylinder block mating face.

Conventional cylinder block with a small mating face

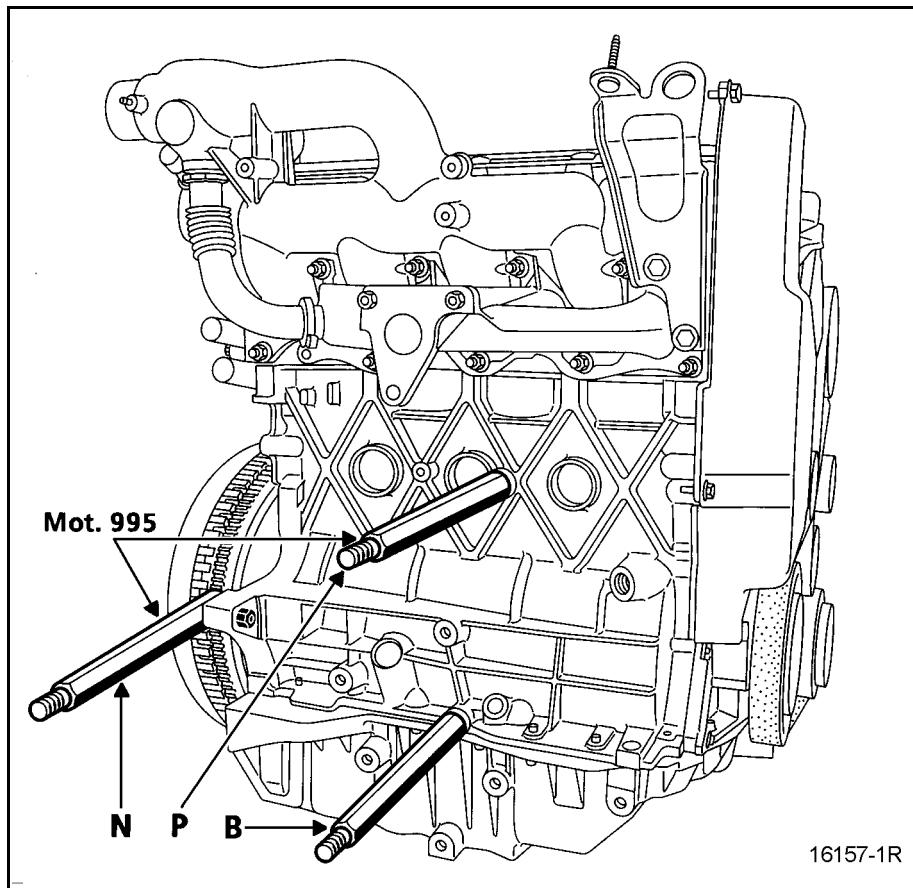


New cylinder block with a large mating face



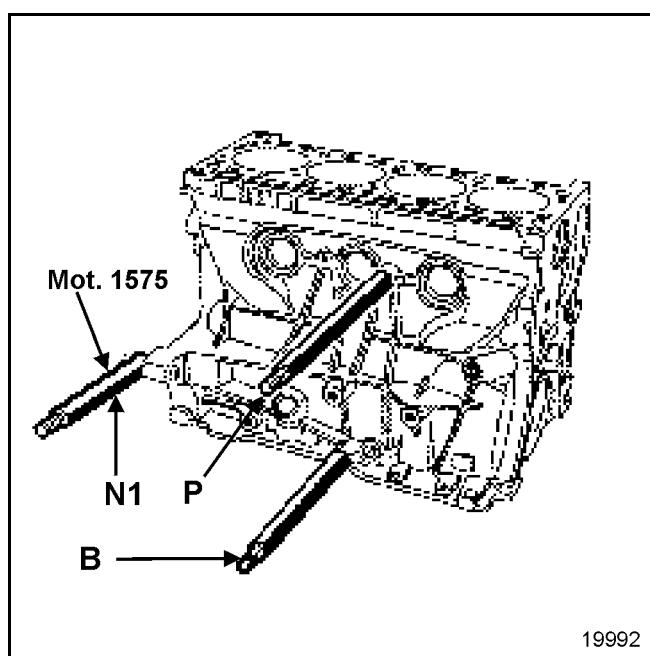
Conventional cylinder block with a small mating face

Fit rods (B), (N), (P) Mot. 995 onto the cylinder block such that they fit into holes (26, 12, 25) in the plate (Mot. 792-03).

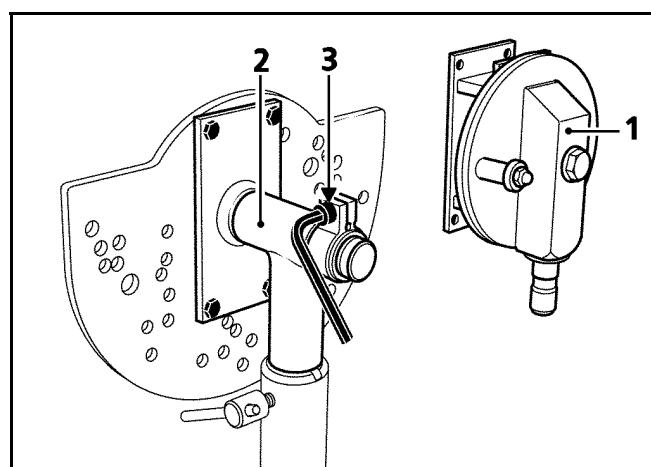


New cylinder block with a large mating face

Fit rods (B), (N1), (P) Mot. 1575 onto the cylinder block such that they fit into holes (26, 12, 25) in the plate (Mot. 792-03).



Change to **DESVIL** engine mountings head used in engine repair. Replacement of head **TS 126** (1) with head **TS 127** (2).



Special feature of this new head:

- axis of rotation permanently lubricated,
- variable locking of the head.

IMPORTANT:

The clamping bolt (3) must be fully undone to release the head when there is no longer an engine resting on the support.

CONSUMABLES

Type	Quantity	Component concerned
Cleaner	-	Cleaning parts
DECAPJOINT or equivalent	Coat	Cleaning gasket faces
RHODORSEAL 5661	Coat	Crankshaft bearing cap
Loctite 518	Coat	Cam shaft line beam
Loctite FRENETANCH	1 - 2 drops	Manifold studs, coolant pump bolt
Tube of RHODORSEAL 5661	Bead	Crankshaft closure plate

WARNING

IMPORTANT:
The cleanliness rules described at the start of this document must be strictly complied with when working on the fuel supply system.

PARTS TO BE REPLACED AFTER REMOVAL:

- all the gaskets,
- flywheel bolts,
- metal oil return pipe from the decanter,
- crankshaft bearing bolts,
- camshaft pulley bolt,
- crankshaft pulley bolts,
- con rod cap bolt,
- injector holder copper washers,
- diesel return pipe,
- pipe plugs,
- coolant circuit rigid hose,
- belts,
- timing gear tension wheel,
- the piston base cooling jets.

FITTING THREAD INSERTS

Threaded holes on all engine component parts can be repaired by using thread inserts **except on the camshaft line beam and the cylinder head cover.**

PREPARING THE USED ENGINE FOR RETURN

The engine should be cleaned and drained (oil and water).

Leave on the used engine or include in the return box:

- the oil filter,
- the oil pressure switch,
- the water pump,
- the high pressure pump,
- the rail,
- the injectors
- the heater plugs,
- the oil trap,
- the dipstick,
- the vacuum pump,
- the flywheel,
- the clutch

Remember to remove:

- all coolant pipes,
- the inlet and exhaust manifolds,
- the alternator,
- the power-assisted steering pump,
- the air conditioning compressor,
- the multifunction support,
- the oil level sensor,
- the cylinder head coolant outlet unit.

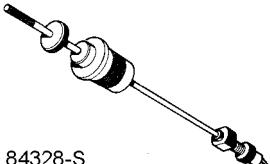
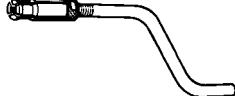
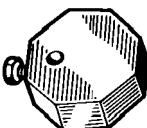
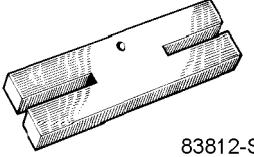
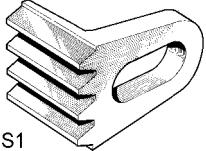
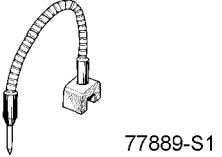
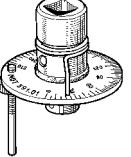
The used engine should be secured to the base under the same conditions as the overhauled engine:

- plastic plugs and covers fitted,
- cardboard cover over the assembly.

ENGINE AND PERIPHERALS

Essential special tooling

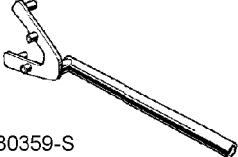
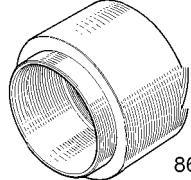
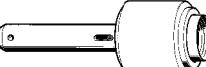
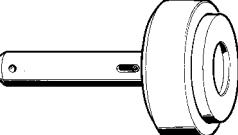
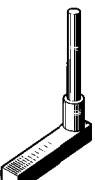
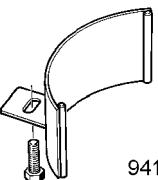
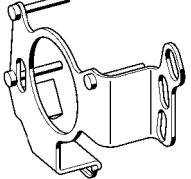
10A

Illustration	Part No. Method	Part Store reference	Description
	Emb. 880	00 00 088 000	Pin extractor.
	Mot. 11	00 01 072 500	Crankshaft bearing extractor.
	Mot. 251-01	00 00 025 101	Gauge stand; used with Mot. 252-01 .
	Mot. 252-01	00 00 025 201	Thrust plate for measuring the protrusion of cylinder liners, used with Mot. 251-01 .
	Mot. 445	00 00 044 500	Oil filter wrench.
	Mot. 582-01	00 00 058 201	Flywheel immobilisation segment.
	Mot. 591-02	00 00 059 102	Magnetised flexible shaft for angular wrench for tightening cylinder head.
	Mot. 591-04	00 00 059 104	Angular wrench for tightening cylinder head, 1/2" drive with index.

ENGINE AND PERIPHERALS

Essential special tooling

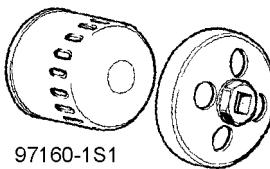
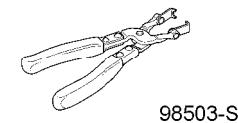
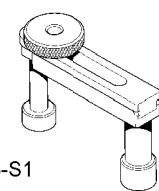
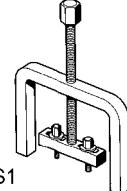
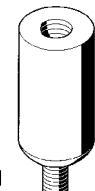
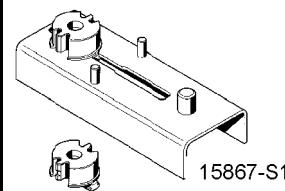
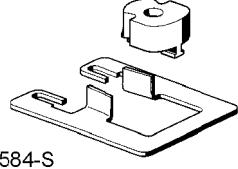
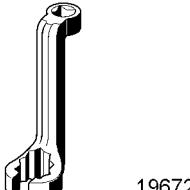
10A

Illustration	Part No. Method	Parts Store reference	Description
 80359-S	Mot. 799-01	00 00 079 901	Tool for immobilising pinions for the toothed timing belt
 86892-S1	Mot. 988-02	00 00 098 802	Tool for fitting the camshaft seal at the timing end.
 96897-S	Mot. 990-03	00 00 099 003	Tool for fitting crankshaft seal, timing end.
 96898-S	Mot. 991-01	00 00 099 101	Tool for fitting crankshaft seal, flywheel end.
 90277-S1	Mot. 1054	00 00 105 400	TDC setting rod.
 94161-S1	Mot. 1200-01	00 00 120 001	High pressure pump pin immobiliser.
 21563	Mot. 1200-02	00 00 120 002	Injection pump pulley immobiliser.

ENGINE AND PERIPHERALS

Essential special tooling

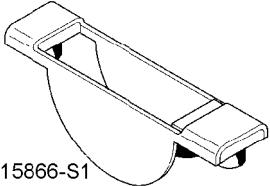
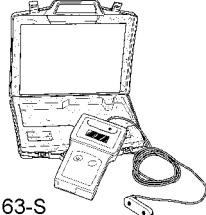
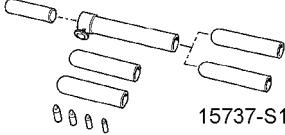
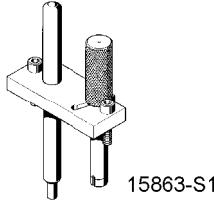
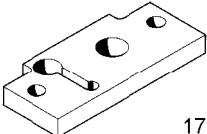
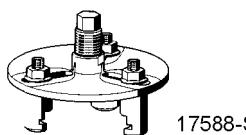
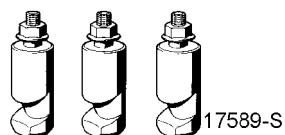
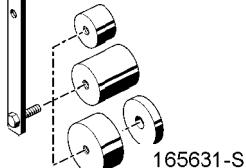
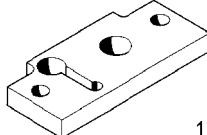
10A

Illustration	Part No. Method	Parts Store number	Description
 97160-1S1	Mot. 1281-01	00 00 128 101	Oil filter cap.
 98503-S	Mot. 1335	00 00 113 500	Tool for removing valve stem seals.
 11923-S1	Mot. 1387	00 00 138 700	Tool for checking the accessories belt tension.
 12875-S1	Mot. 1423	00 00 142 300	Tool for removing the silicon crankshaft bearing cap.
 15868-S1	Mot. 1485 Mot. 1485-01	00 00 148 500 00 00 148 501	Tool for removing piston coolers.
 15867-S1	Mot. 1492	00 00 149 200	Tool for fitting con rod bearing shells.
 17584-S	Mot. 1492-01	00 00 149 201	Adaptation kit for fitting the separable con rod bearing shells.
 19672	Mot. 1566	00 00 156 600	Tool for removing high pressure pipes

ENGINE AND PERIPHERALS

Essential special tooling

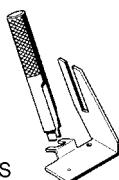
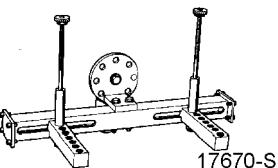
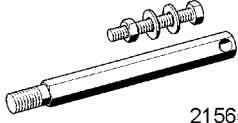
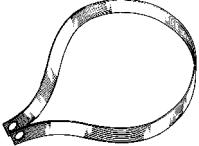
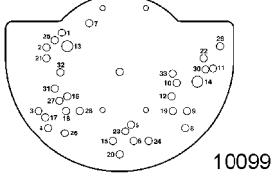
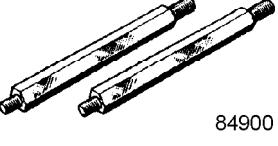
10A

Illustration	Part No. Method	Parts Store number	Description
	Mot. 1493	00 00 149 300	Tool for fitting crankshaft bearing shells.
	Mot. 1505	00 00 150 500	Device for checking the belt tension.
	Mot. 1511	00 00 151 100	Tool for fitting valve stem seals.
	Mot. 1516	00 00 151 600	Tool for refitting piston coolers orientated at 5°.
	Mot. 1516-01	00 00 151 601	Plate for refitting piston coolers orientated at 3° (addition to Mot. 1516).
	Mot. 1525	00 00 152 500	Tapered hub pump pin extractor.
	Mot. 1525-01	00 00 152 501	Fitting clips for Mot. 1525 for F9Q Common Rail engines.
	Mot. 1543	00 00 154 300	Timing belt pretensioning tool.
	Mot. 1516-02	00 00 151 602	Plate for refitting piston coolers (orientated at 0°) (addition to Mot. 1516).

ENGINE AND PERIPHERALS

Essential special tooling

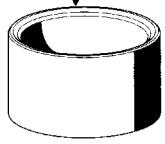
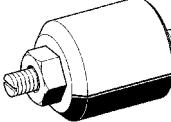
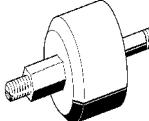
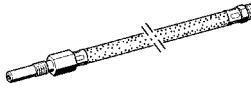
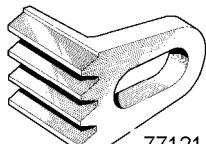
10A

Illustration	Part No. Method	Parts Store number	Description
	Mot. 1551	00 00 155 100	Tool for fitting the oil return pipe.
	Mot. 1573	00 00 157 300	Cylinder head support.
	Rou. 15-01	00 01 331 601	Internal shaft protector Ø 16 mm.
	Mot. 1575	00 00 157 500	Engine mounting pin "N1" (addition to Mot. 792-03 for Desvil engine stand).
	Mot. 445-01	00 00 044 501	Replacement strap for Mot. 445 .
	Mot. 792-03	00 00 079 203	Engine support plate for Desvil engine stand (with pins from A to W).
	Mot. 995	00 00 099 500	Set of two pins adaptable to engine mounting plate Mot. 792-03 .

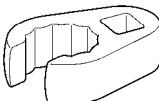
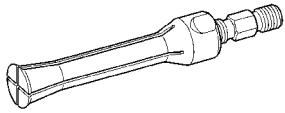
ENGINE AND PERIPHERALS

Essential special tooling

10A

Illustration	Part No. Method	Parts Store number	Description
 17587	Mot. 1569	00 00 156 900	Cone for fitting the pistons in the cylinder block.
	Mot. 1577	00 00 157 700	Lip seal extractor Ø 28 mm to Ø 50 mm.
	Mot. 1578	00 00 157 800	Lip seal extractor Ø 50 mm to Ø 75 mm.
	Mot. 1579	00 00 157 900	Lip seal extractor Ø 80 mm to Ø 95 mm.
 18895	Mot. 1635	00 00 163 500	Tool for fitting elastomer crankshaft seal, flywheel end.
 18897	Mot. 1636	00 00 163 600	Tool for fitting elastomer crankshaft seal, timing end.
 21564	Mot. 1592	00 00 159 200	Flexible end piece for taking pressure at end of compression.
	Mot. 1676	00 00 167 600	Accessories belt tensioner.
 77121 S1	Mot. 1677	00 00 167 700	Flywheel immobilisation segment for cylinder block large face.

Description	
	Standard 22 mm long socket 1/2" (12.7 mm squared) for removing the oil pressure gauge.
	Standard 1/2" 8 / 12 / 14 female torx socket (12.7 mm squared).
	Angular tightening tool from: <ul style="list-style-type: none"> ● STAHLWILLE part number 540 100 03 for example, ● FACOM part number DM2360 for example, ● SAM part number 1 SA, for example.
 18077S	FACOM tool for fitting the valve stem seals, part number DM6J4 , for example.
	Gun for using tube of RHODORSEAL 5661 .
 19672	Wrench for removing high pressure pipes, e.g. FACOM part number DM 19
 19668	Articulated wrench for removing and refitting the heater plugs, e.g. FACOM part number B10R10A .
	Clamp for internal circlips.
	Valve spring compressor.

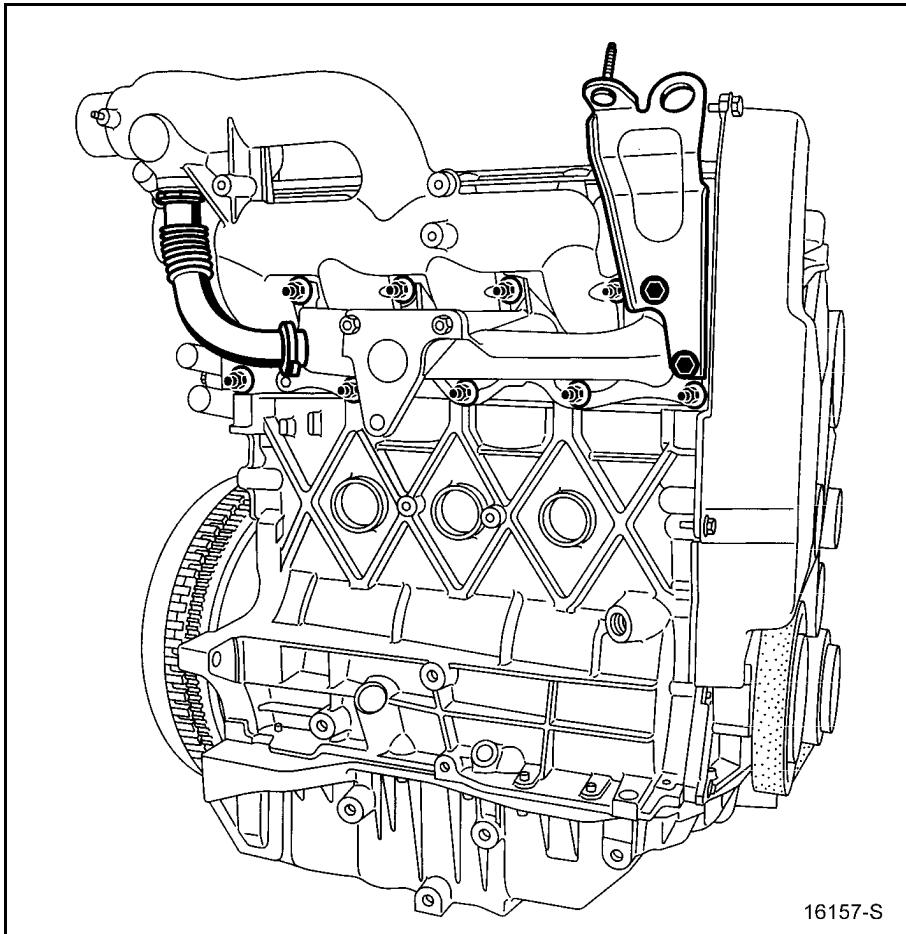
Description	
 19670	"Crowfoot" end-piece for torque-tightening high pressure pipes, e.g. FACOM part number 18.17 .
 19669	Crankshaft bearing puller, e.g. FACOM part number U49 A D5 .
	"Crowfoot" end-piece for torque-tightening high pressure pipes, e.g. FACOM part number 19.17 .

REMOVING THE UPPER ENGINE

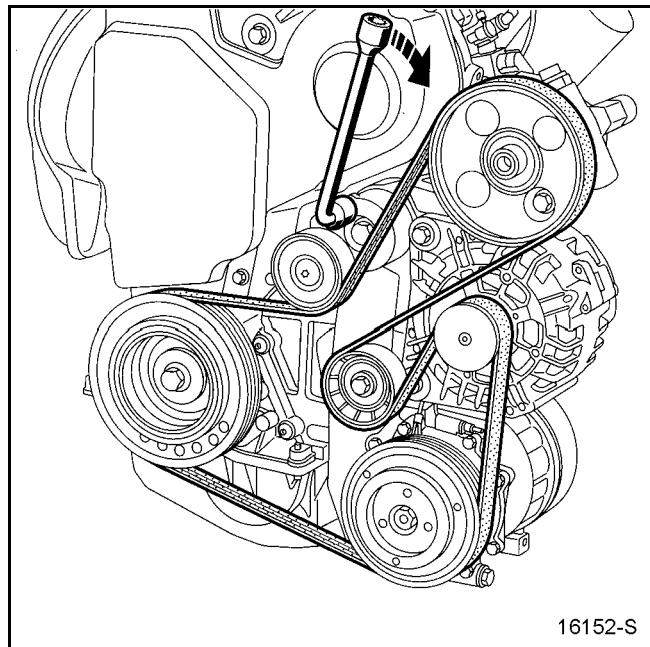
Engine fitted with a water pump driven by the timing belt.

Remove:

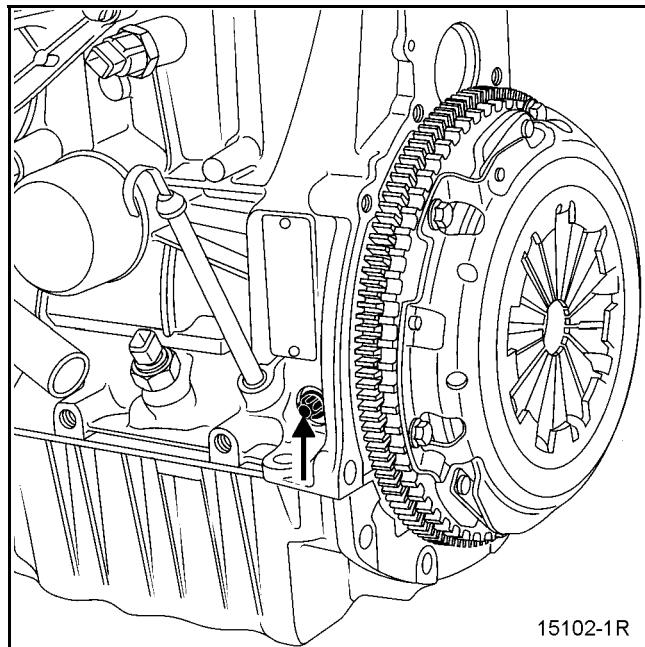
- the exhaust gas recirculation pipe,
- the ring for lifting the engine at the timing end,
- the intake and exhaust manifolds.



Remove the accessories drive belt by turning the spanner to the right to loosen the belt.



Remove the Top Dead Centre pin plug.

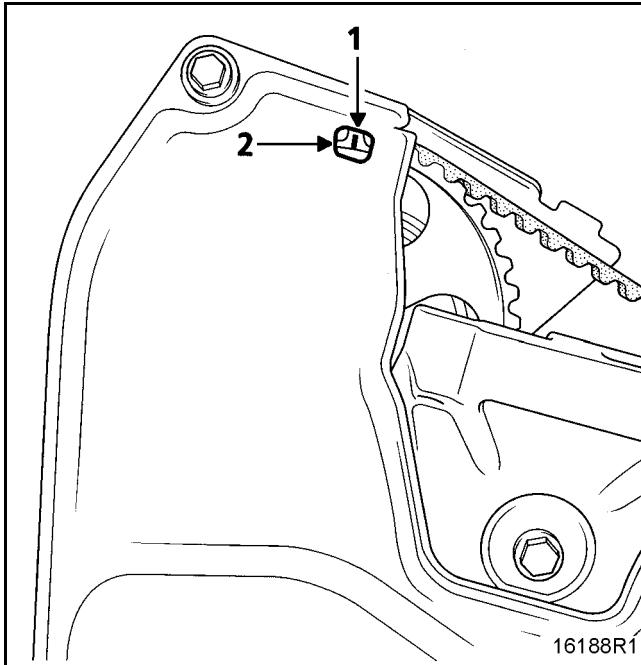


Overhauling the engine

Timing adjustment

Rotate the crankshaft in clockwise direction at the timing end.

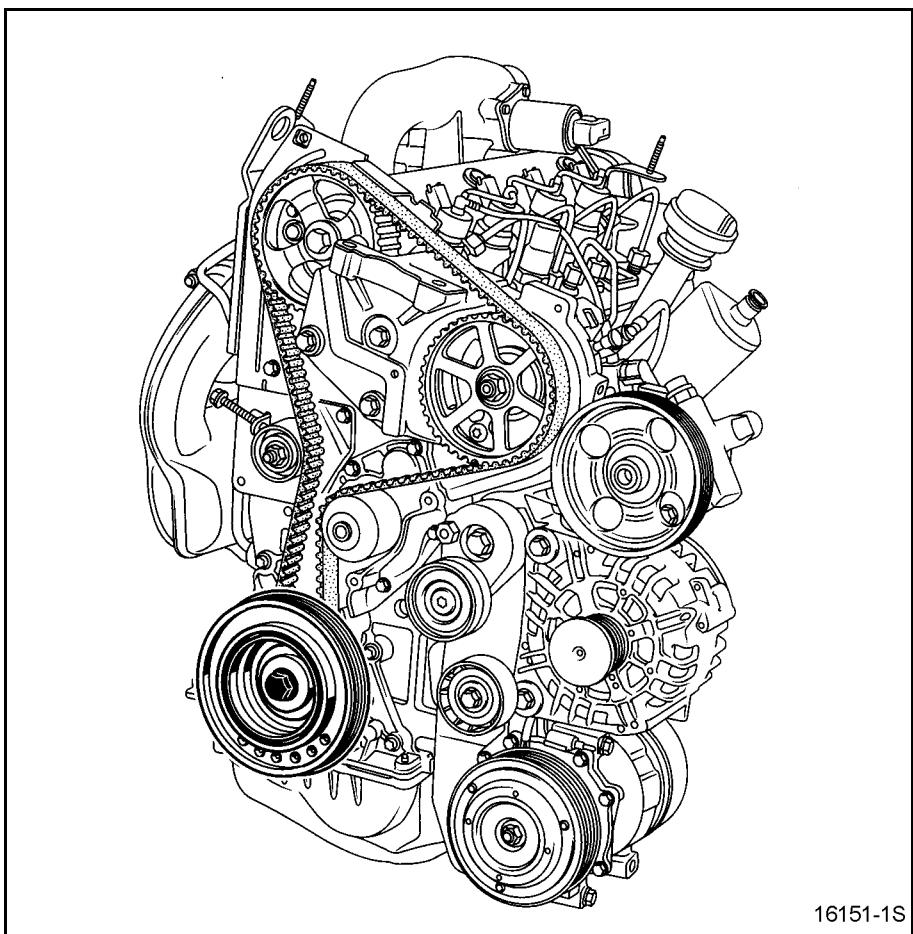
When the mark (1) on the camshaft pulley appears in the window (2) of the timing cover, push in the Top Dead Centre pin Mot. 1054 to pin the crankshaft (the mark on the camshaft pulley must be located approximately in the centre of the window).



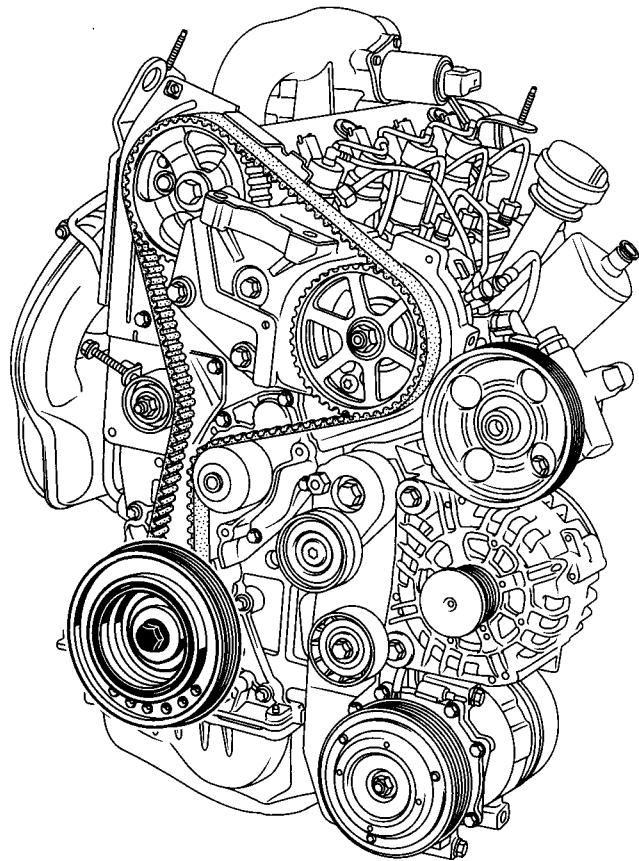
Remove the timing housing.

NOTE:

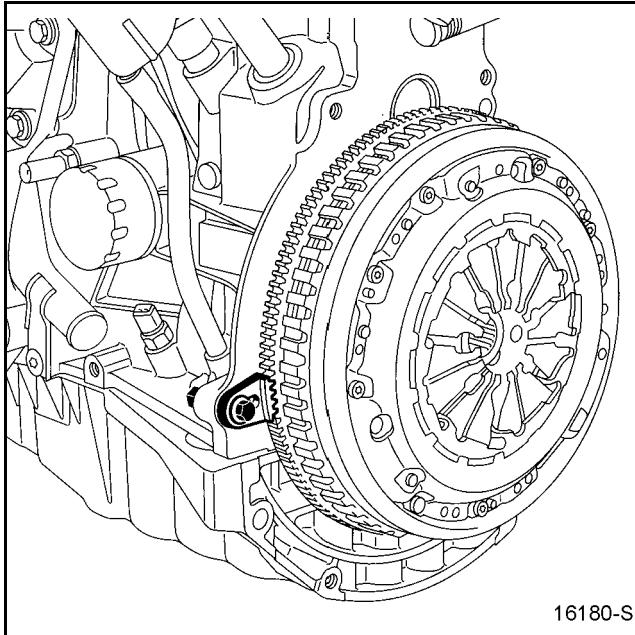
Use a pencil to mark the lower timing housing opposite the mark on the camshaft pulley.



Remove the crankshaft accessories pulley by blocking the flywheel using **Mot. 582-01** or **Mot. 1677**.

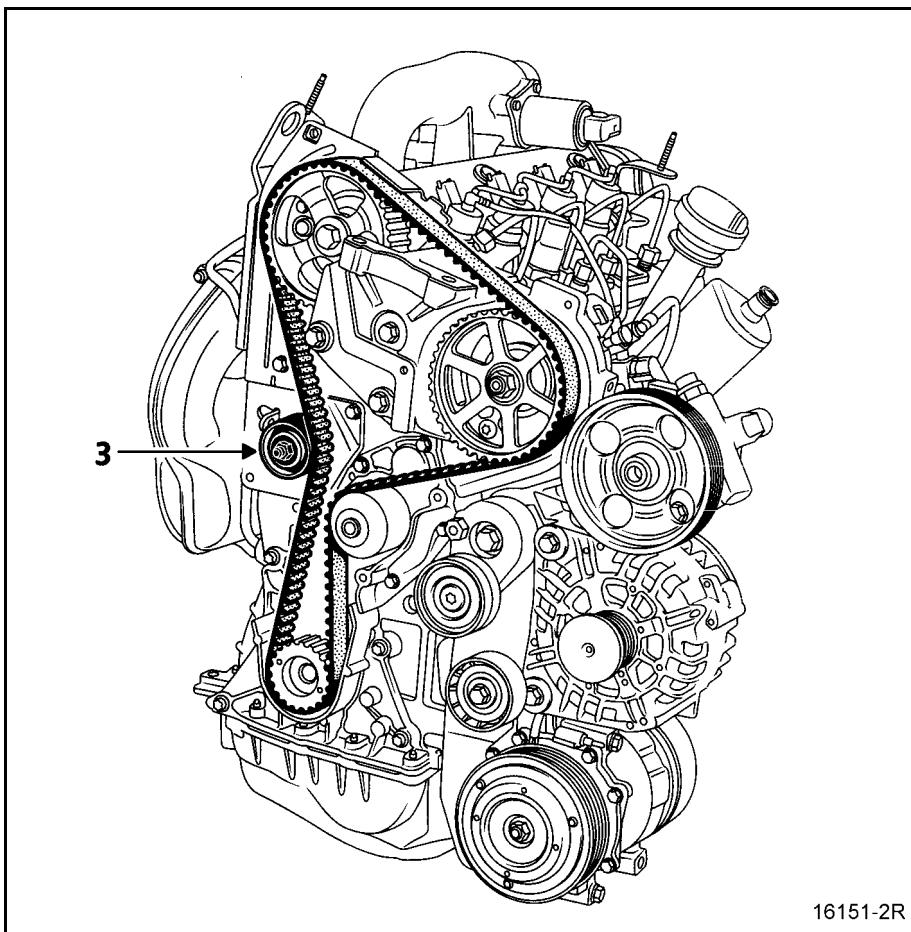


16151-1S

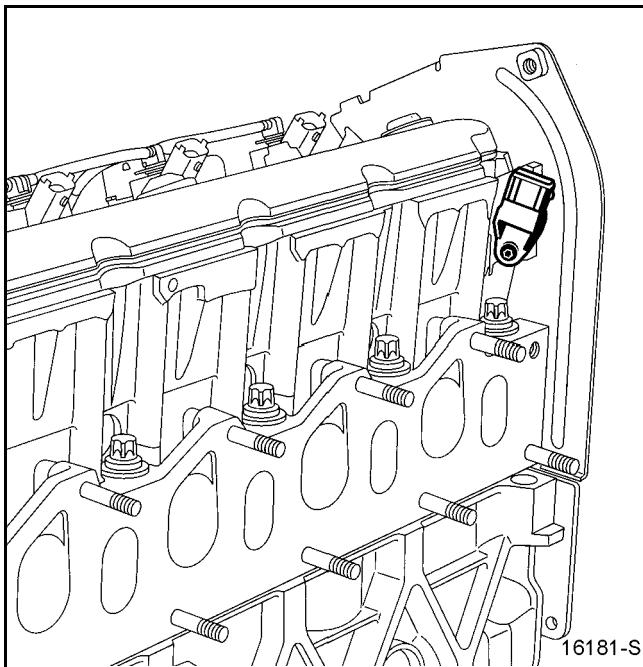


16180-S

Relax the tensioner by loosening the nut (3), then remove the timing belt.

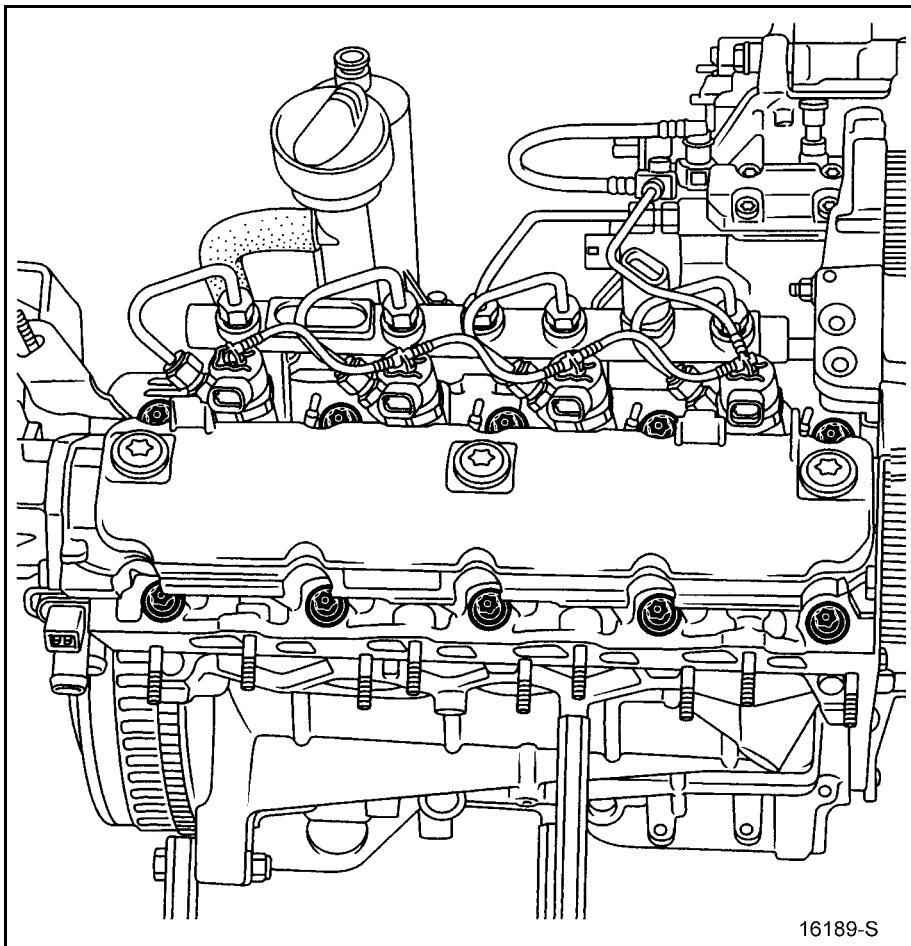


Remove the cylinder marking sensor.



Remove:

- the cylinder head bolts,
- the cylinder head.

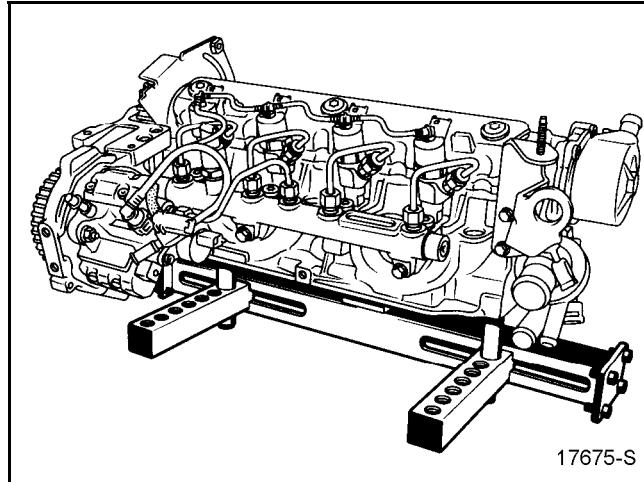


16189-S

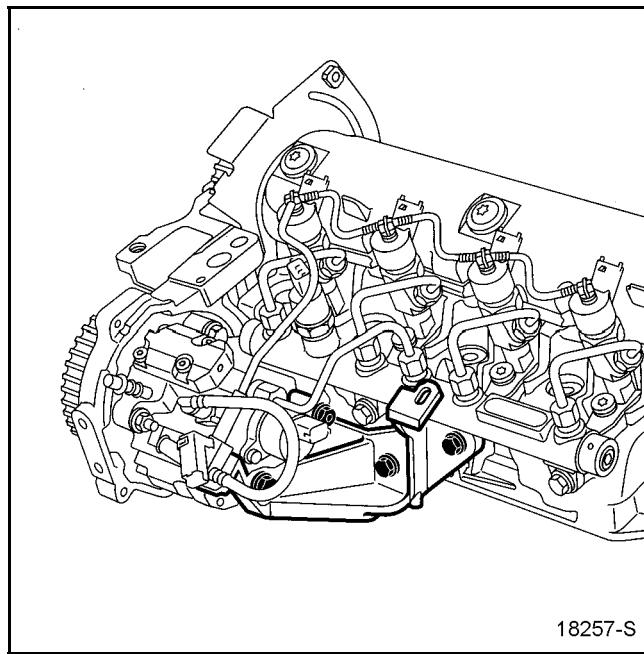
STRIPPING THE CYLINDER HEAD

Place the cylinder head on cylinder head support
Mot. 1573.

**Pay strict attention to the instructions regarding
cleanliness (see start of document)**

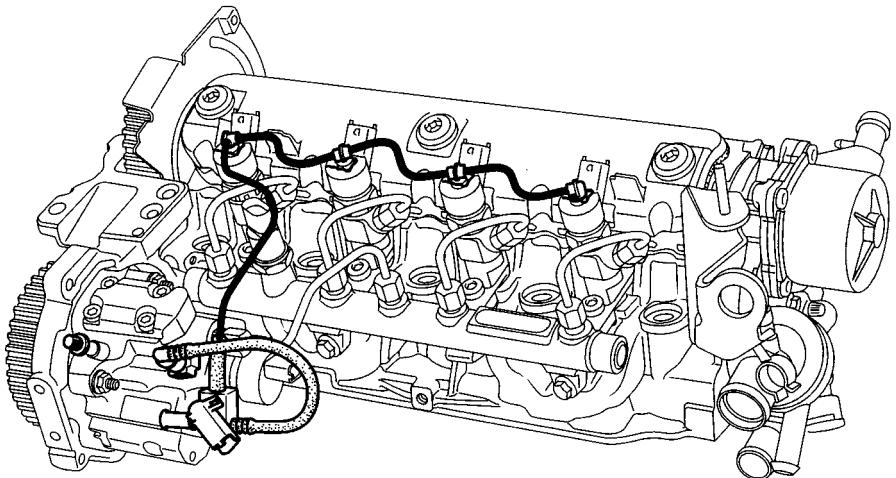


Remove the rear high pressure pump support.



Remove the diesel return pipe.

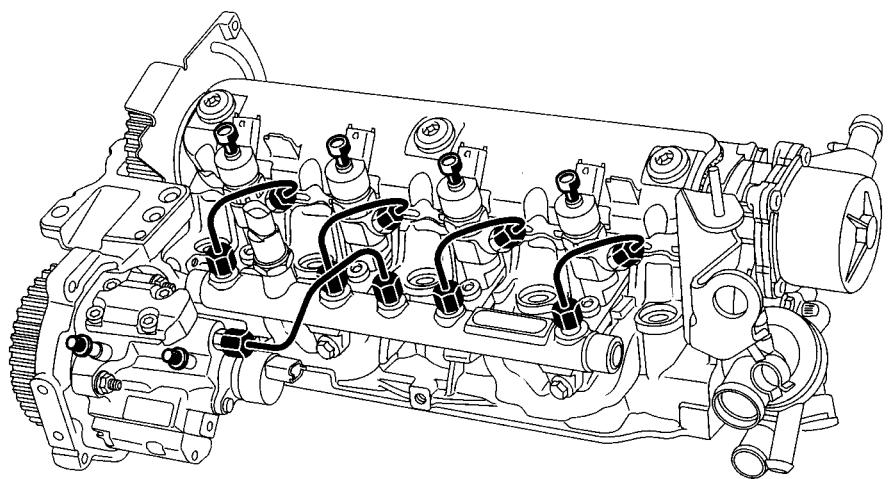
Fit the cleanliness blanking plates on the high pressure pump and the injectors.



16192S-1S

Remove the high-pressure diesel pipes using **Mot. 1566**.

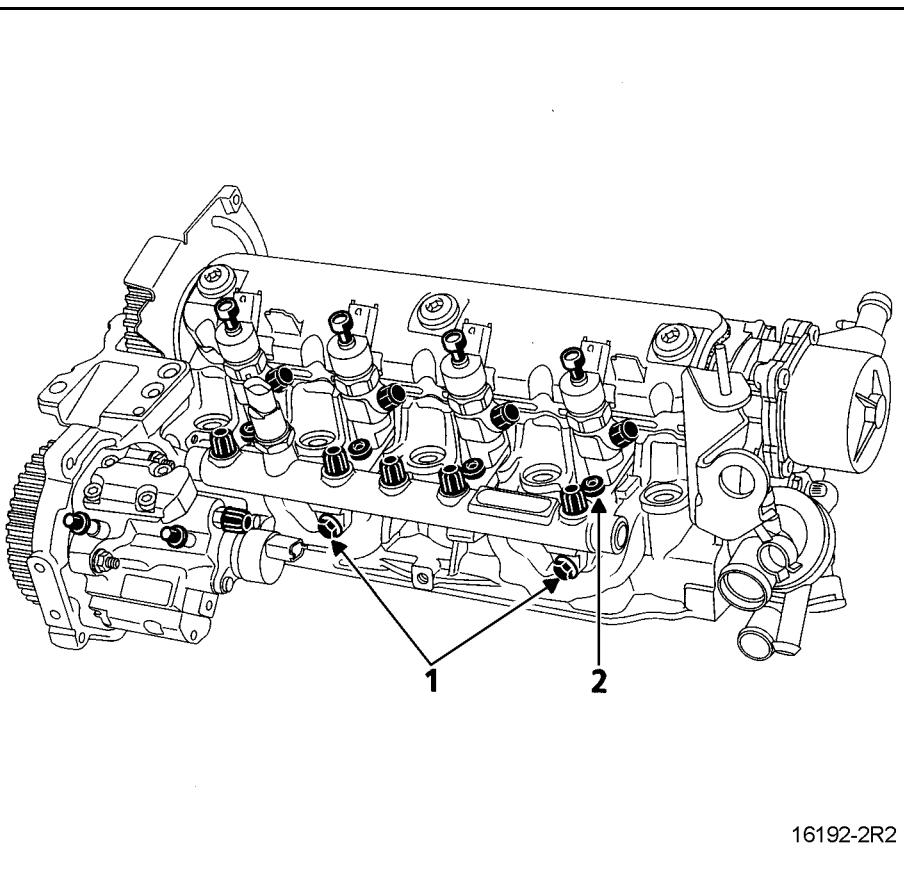
Fit the cleanliness blanking plates on the high pressure pump and the injectors.



16192-S

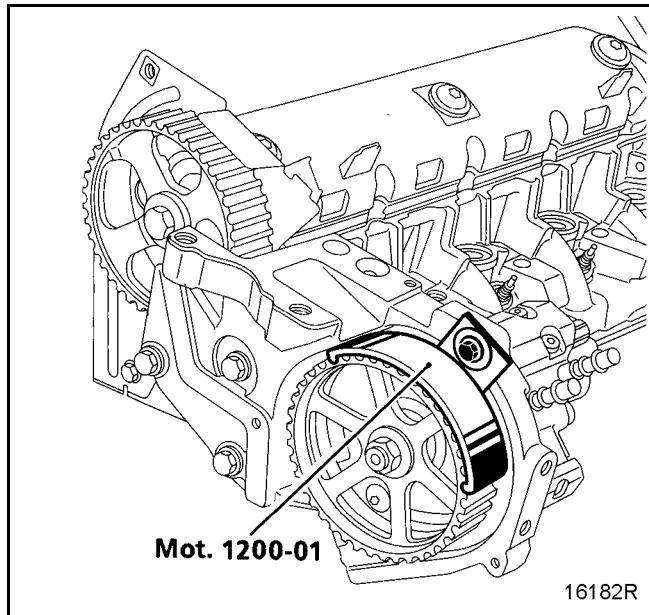
Remove:

- the two common rail bolts (1),
- the injector mounting bracket bolts (2),
- the injectors, **fitting cleanliness blanking plates on the injector noses**,
- flame arrestor washers.



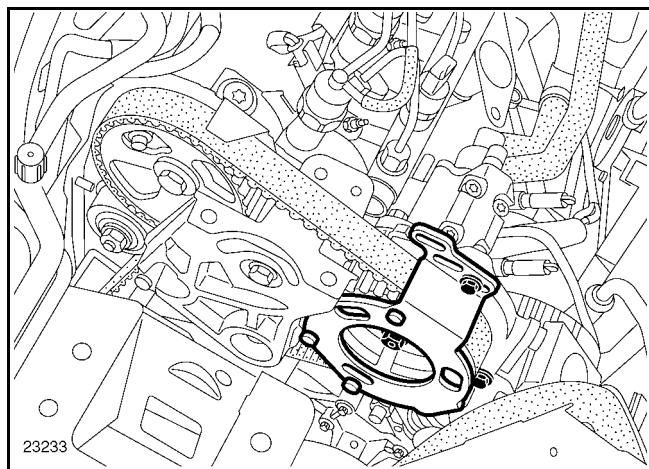
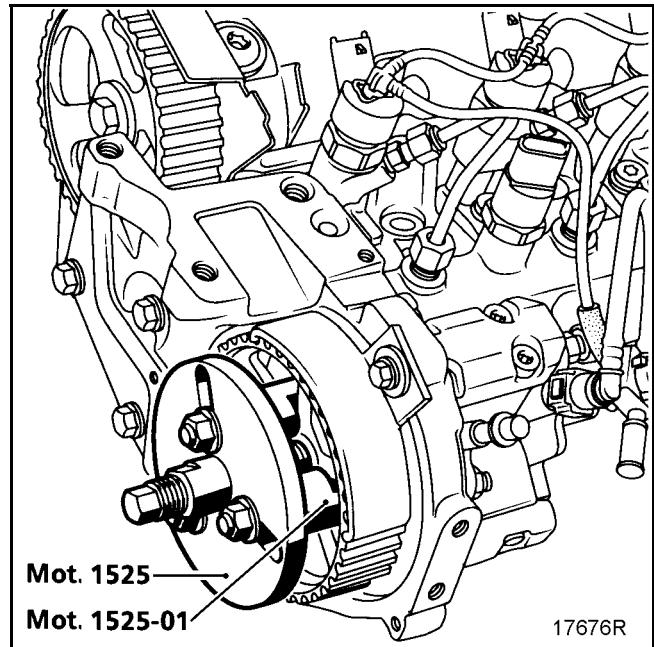
16192-2R2

Place in position on the high-pressure pump pulley tool Mot. 1200-01 or Mot. 1200-02.



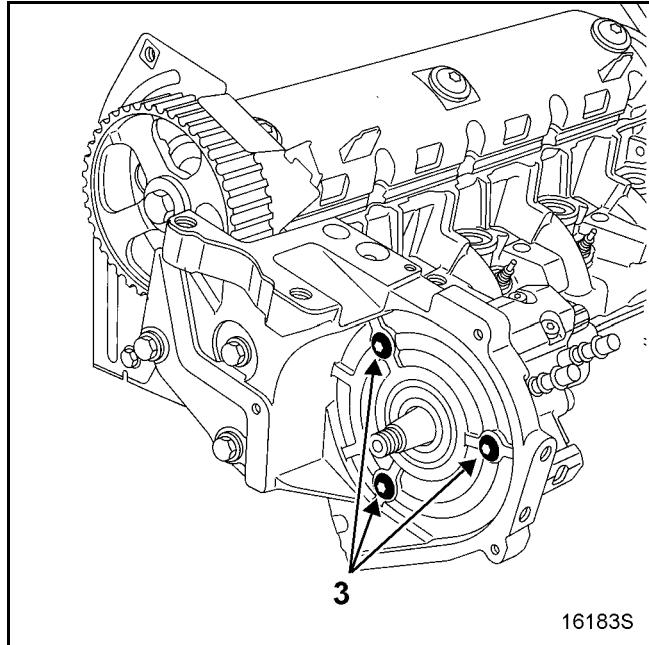
Remove the high pressure pump pulley nut.

Fit extractor Mot. 1525, fitted with Mot. 1525-01 clips, on the high pressure pump pulley, to separate the pulley from the high pressure pump shaft.

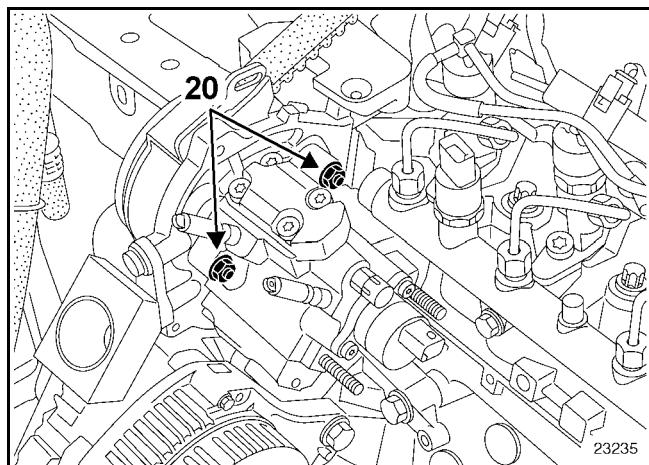


Remove:

- the high pressure pump pulley,
- the high pressure pump by withdrawing the studs (3) depending on the version.

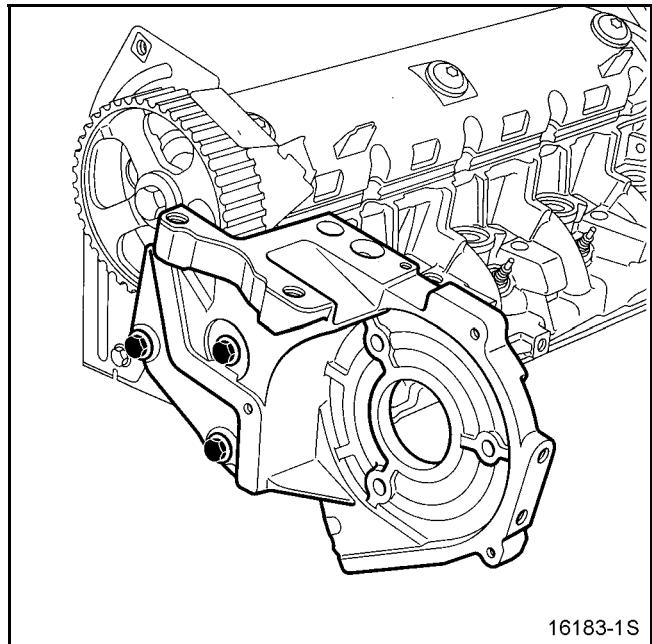


On other versions, the three mounting nuts (20) on the high pressure pump must be removed.

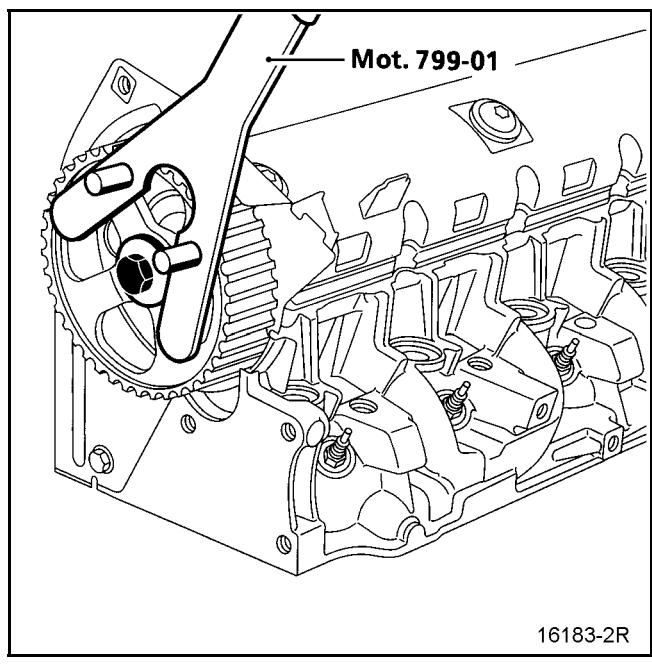


Remove:

- the cylinder head suspended mounting support,

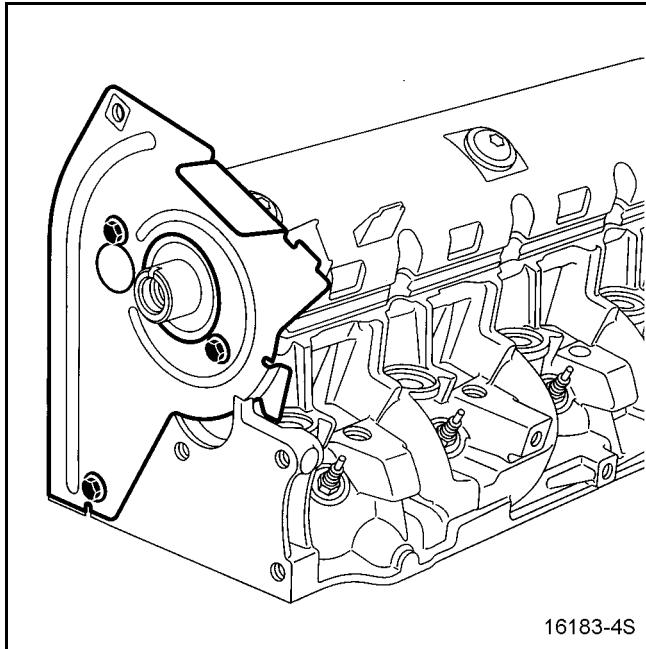


- the camshaft pulley bolt by locking the pulley using **Mot. 799-01**.

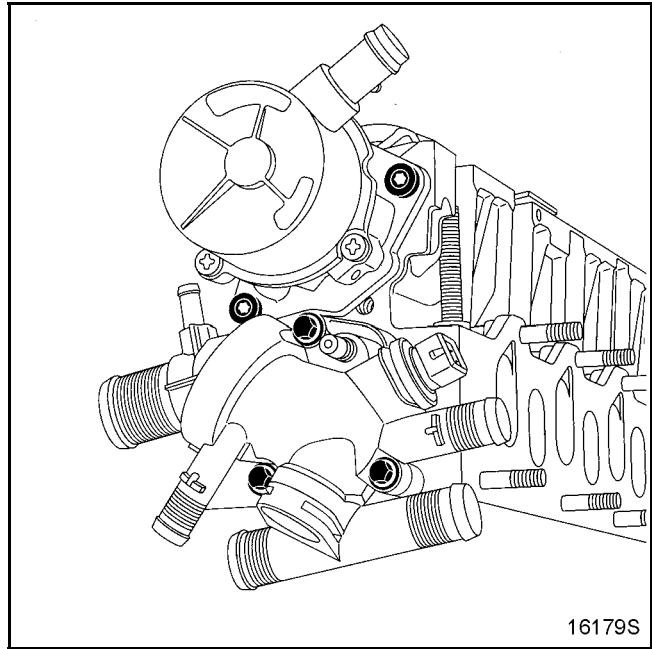


Remove:

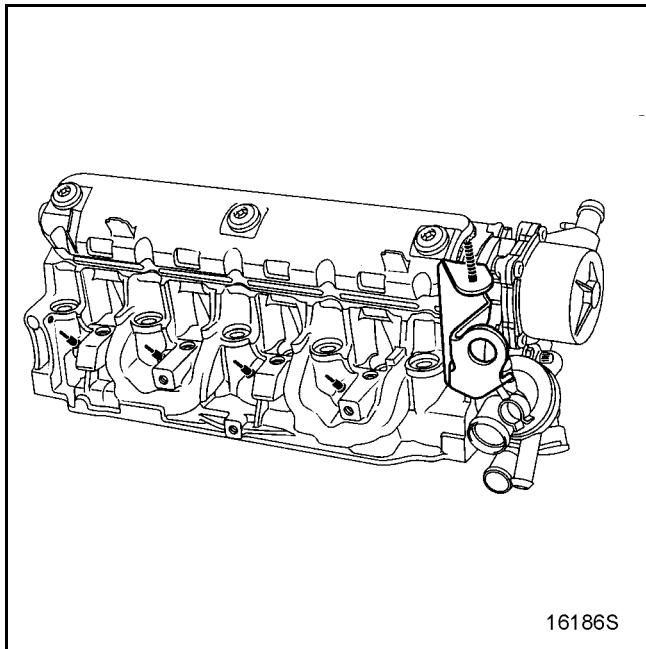
- the inner timing cover,



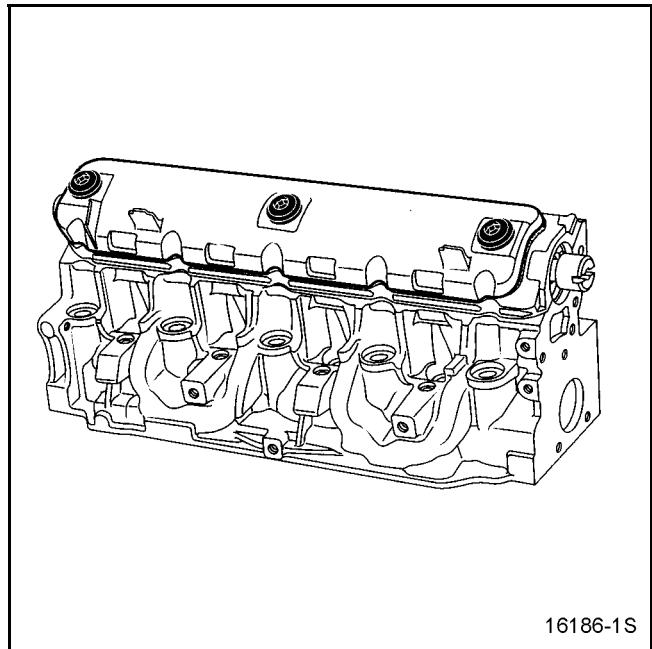
- the vacuum pump,
- the thermostatic unit,



- the ring for lifting the engine at the flywheel end,
- the pre-post heating plugs using a **10 mm** articulated wrench,



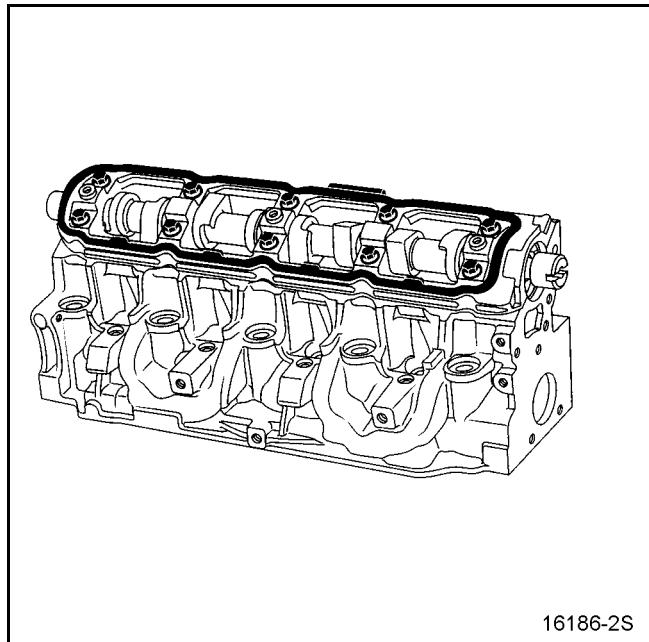
- the cylinder head cover.



Overhauling the engine

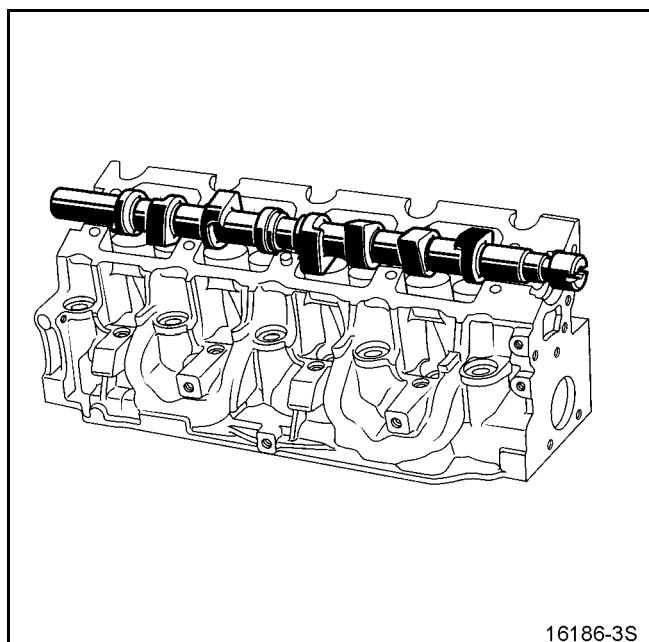
Remove:

- the cam shaft line beam



16186-2S

- the camshaft,



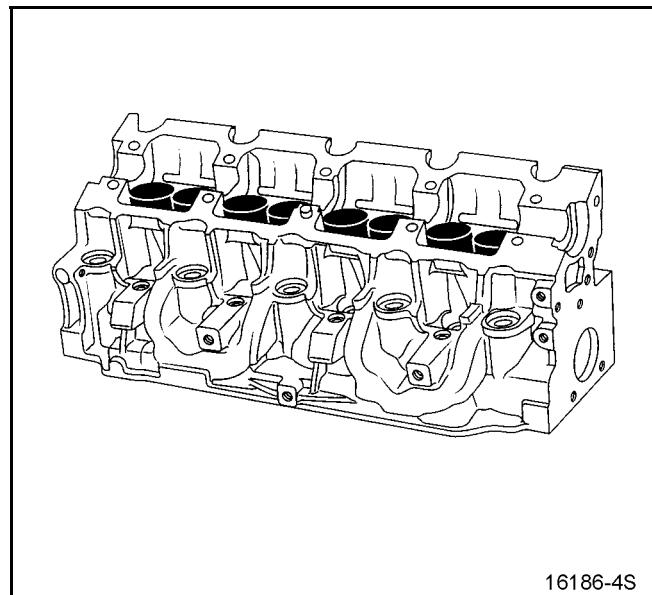
16186-3S

- the tappets, noting their position.

Compress the valve springs using the valve lifter.

Remove:

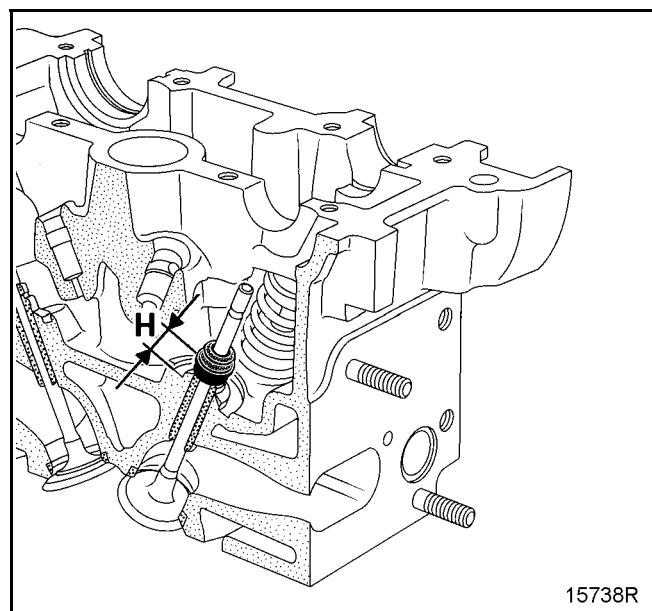
- the keys,
- the upper cups,
- the springs,
- the valves.



16186-4S

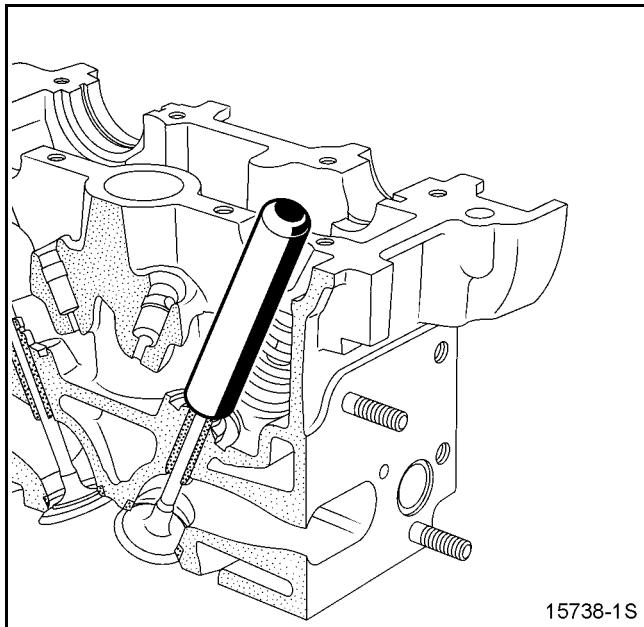
NOTE:

Before removing the valves and the valve stem seals, it is vital that you measure position H of one of the old seals in relation to the cylinder head using Mot. 1511 or using a FACOM tool with part number DM6J4.



15738R

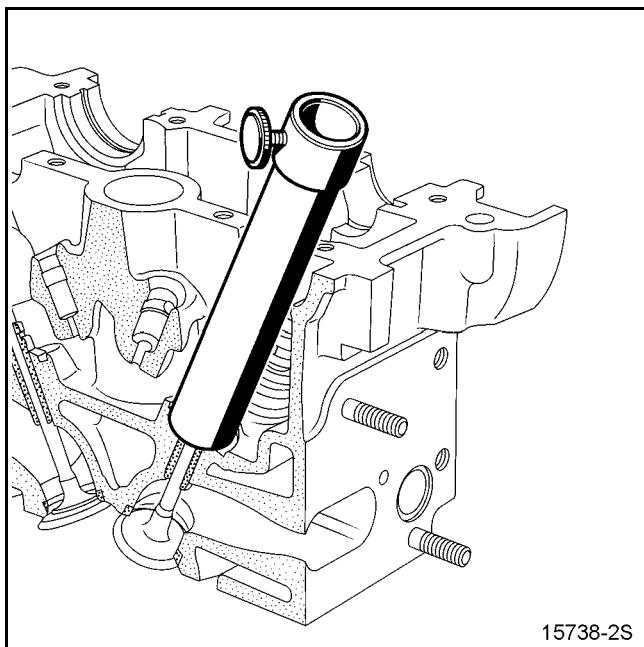
Fit the pushrod of **Mot. 1511** on the valve stem seal.



NOTE:

The internal diameter of the pushrod must be identical to that of the valve. Moreover, the pushrod must come into contact with the metallic upper section of the valve stem seal.

Fit the guide tube above the pushrod until it comes into contact with the cylinder head.



Insert sleeve (1) in the guide tube, until the sleeve comes into contact with the pushrod.

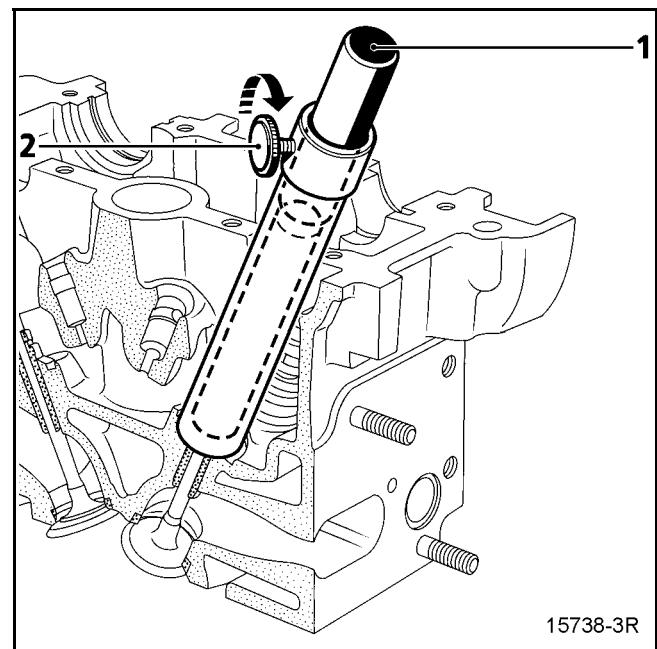
Then block the sleeve using the wheel (2).

Remove the guide tube plus sleeve assembly, being **careful not to loosen the tumblewheel**.

Withdraw the pushrod.

Remove:

- the valve stem seals using pliers **Mot. 1335**,
- the lower cups.



CLEANING

It is very important not to scratch the mating surfaces of any aluminium components.

Wear gloves whilst carrying out this operation.

Use "Décapjoint" product or equivalent to dissolve any part of the gasket remaining stuck.

Apply the product to the section to be cleaned.

Wait for about ten minutes, then remove using a wooden spatula.

Do not allow this product to drip on to the paintwork.

Great care should be taken when performing this operation, to prevent foreign objects entering the pipes taking oil under pressure to the camshafts (pipes in both the cylinder head and its cover) and the oil return pipes.

CHECKING THE GASKET FACE

Check for mating surface bow using a ruler and a set of shims.

Maximum bow **0.05 mm**.

NO REGRINDING OF THE CYLINDER HEAD IS PERMITTED

CHECKING THE CAMSHAFT END PLAY

Refit the camshaft.

Refit the camshaft line beam by tightening the bolts to a torque of **2 daN.m**.

Check the end play, which must be between **0.045** and **0.135 mm**.

Remove the camshaft line beam and the camshaft.

Check that the cylinder head lubrication ducts, camshaft bearings, and tappets are not obstructed.

Replace worn parts.

REBUILDING THE CYLINDER HEAD

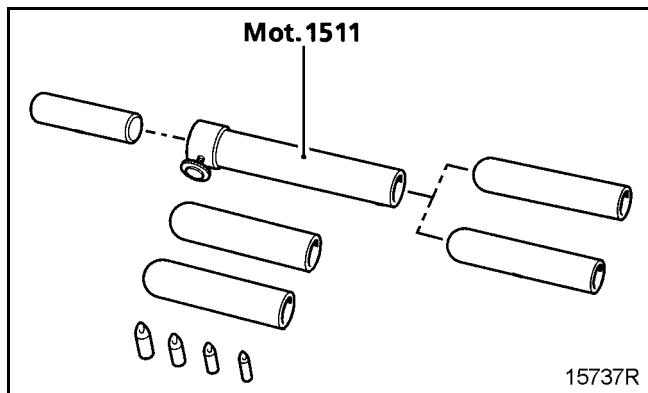
Fit new valves, grind them gently into their respective seats.

Clean all the parts thoroughly, mark them for identification purposes, then carry out the refitting operation.

Lubricate the inside of the valve guide.

Fit the valve spring collar rings.

The valve stem seals must be fitted using tool Mot. 1511 or with the FACOM tool, part number DM6J4.

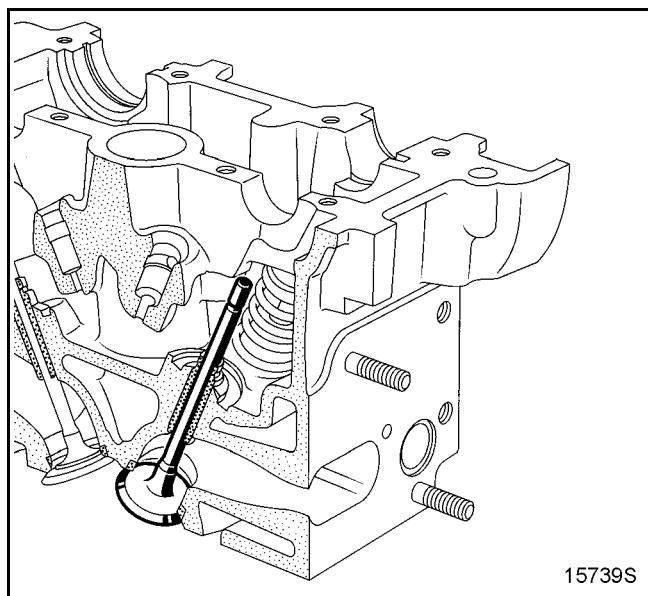


NOTE:

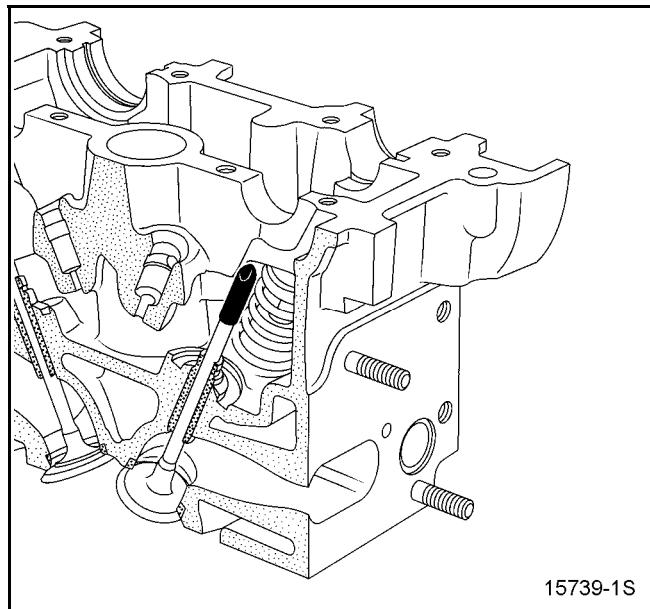
Do not lubricate the valve stem seals before fitting them.

Fitting new valve stem seals.

Place the valve in the cylinder head.

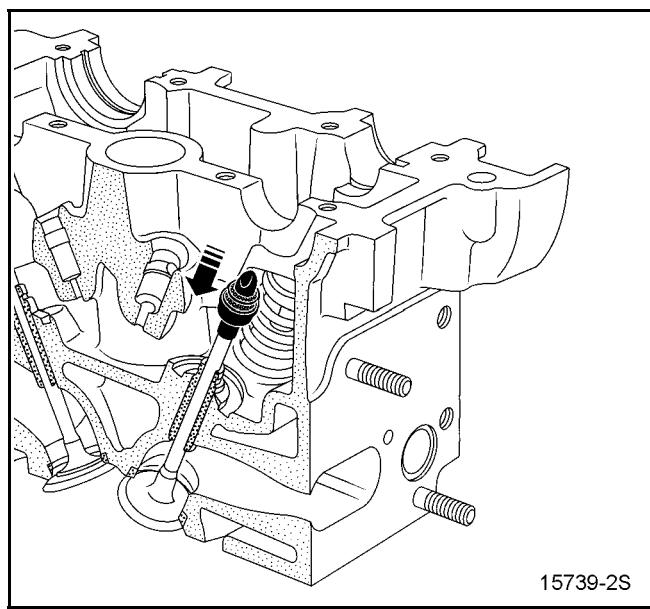


Place the barrel of the **Mot. 1511** tool over the valve stem (the internal diameter of the barrel must be identical to the diameter of the valve stem).

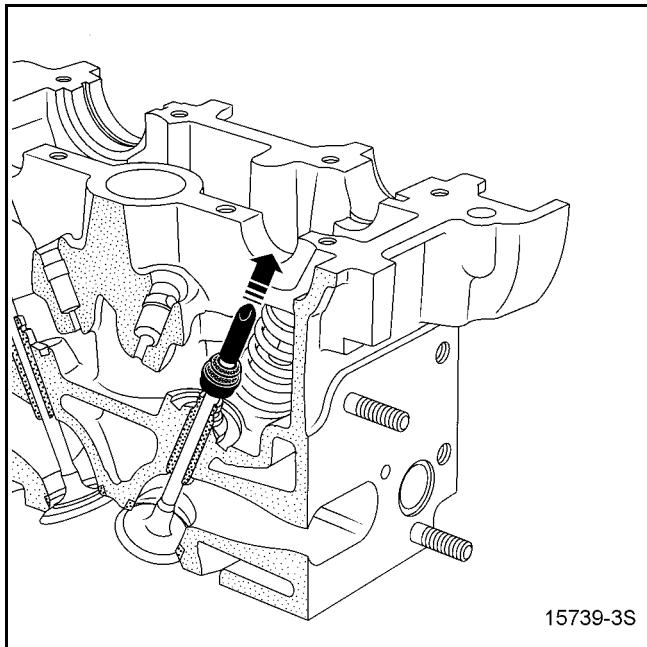


Keep the valve pressed against its seat.

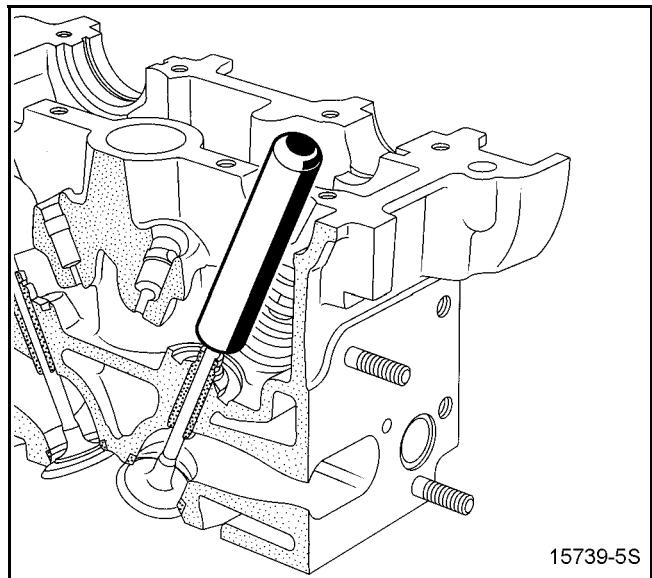
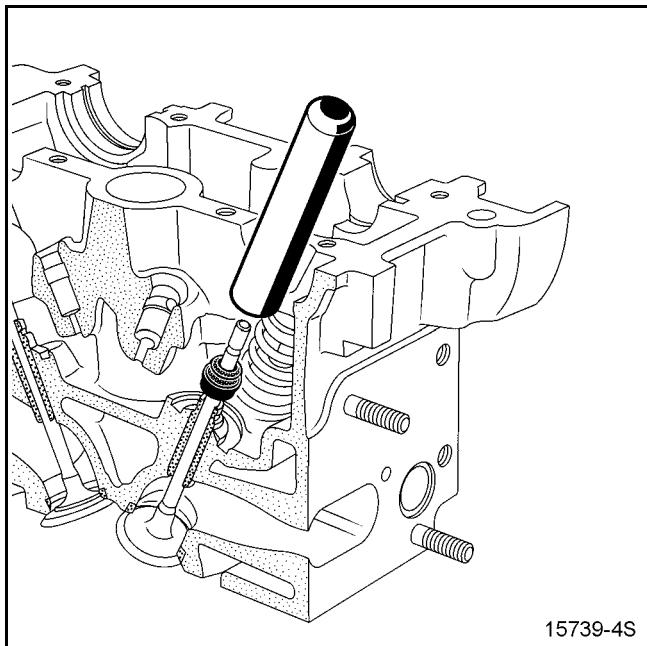
Place the valve stem seal (not lubricated) over the tool barrel.



Push the valve stem seal past the tool barrel, then withdraw the barrel.



Place the pushrod over the valve stem seal.

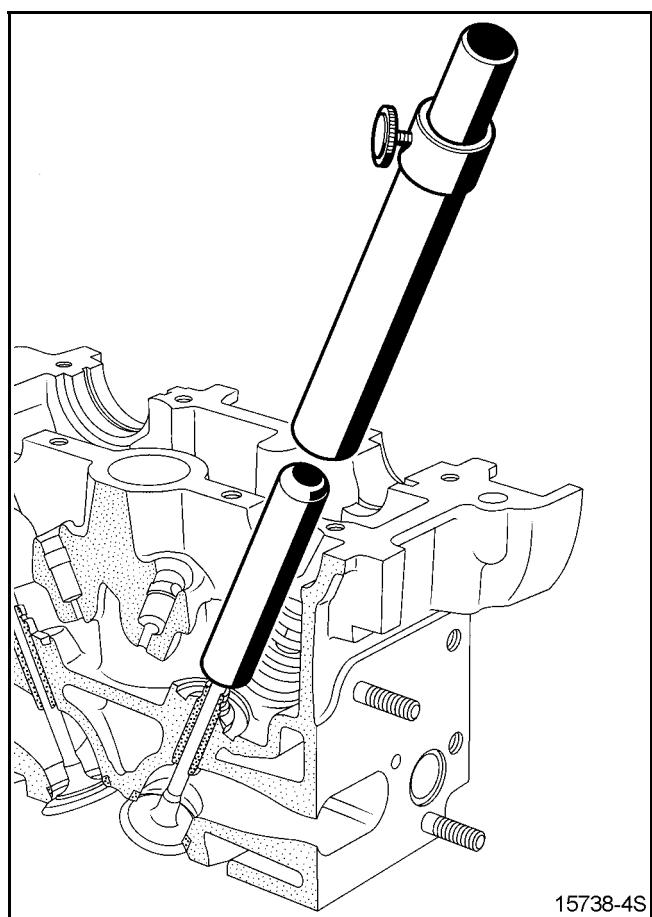


NOTE:

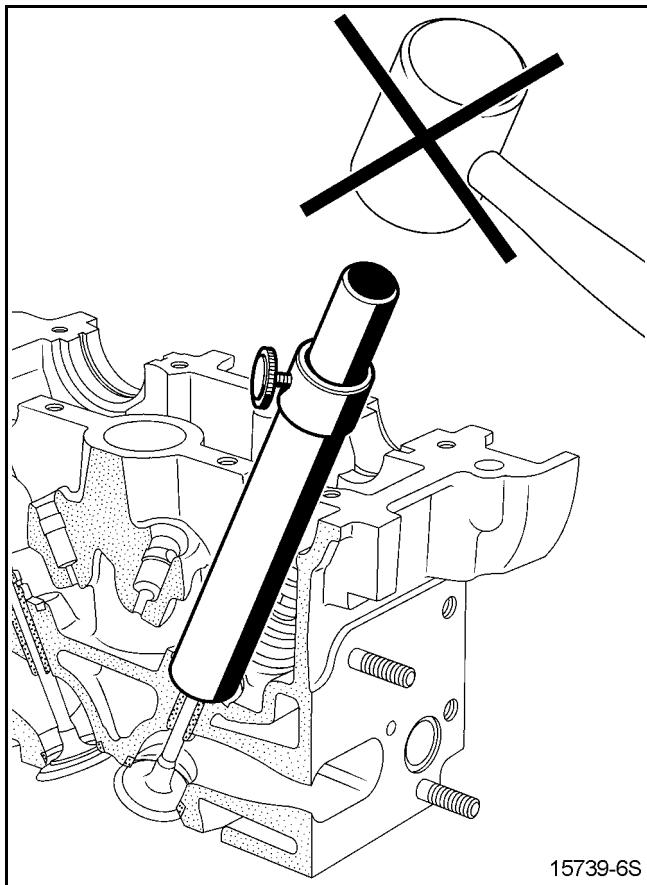
The internal diameter of the pushrod must be identical to the diameter of the valve stem.

Moreover, the lower part of the pushrod must be in contact with the upper section of the valve stem seal.

Place the guide tube and sleeve assembly over the pushrod.



Push the valve stem seal down by tapping **the top of the sleeve with the palm of your hand** until the guide tube touches the cylinder head.



Repeat these operations for all the valves.

Position the springs.

Position the upper cups.

Compress the springs.

Fit the pins.

Check the valve protrusion which should be **0.09 ± 0.12 mm**.

Check and adjust the valve clearance

Refit the tappets.

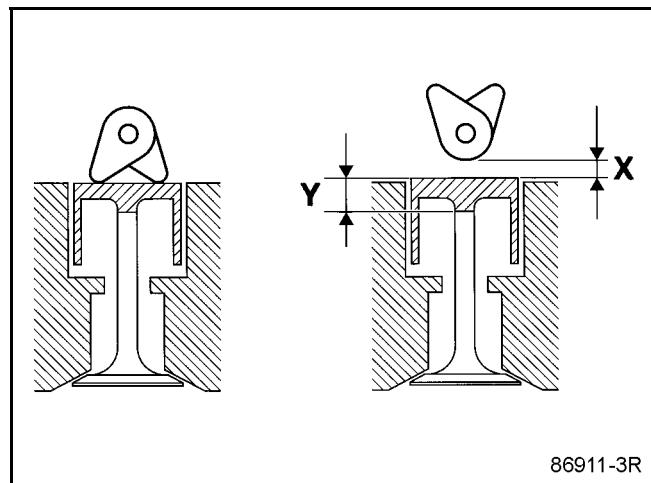
Refit the camshaft.

Refit the camshaft line beam by tightening it to a torque of **2 daN.m**.

Place the valves of the cylinder concerned at the "end of exhaust - beginning of inlet" position and check the clearance (X).

NOTE:

Dimension (Y) corresponds to the tappet thickness class (there are **25 classes** in the Parts Store).



Y	X
1	4
3	2
4	1
2	3

Compare the values noted with the specified values.

Clearance, when the engine is cold, in mm:

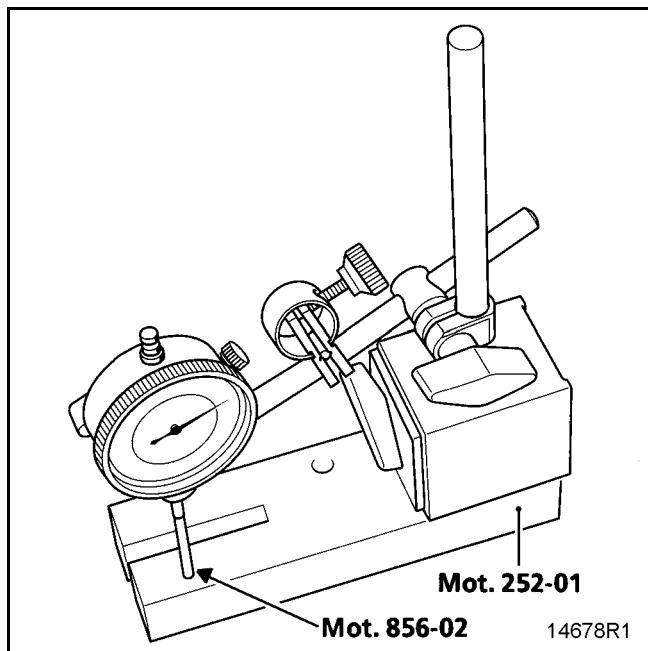
Inlet	0.20 ± 0.05
Exhaust	0.40 ± 0.05

Remove:

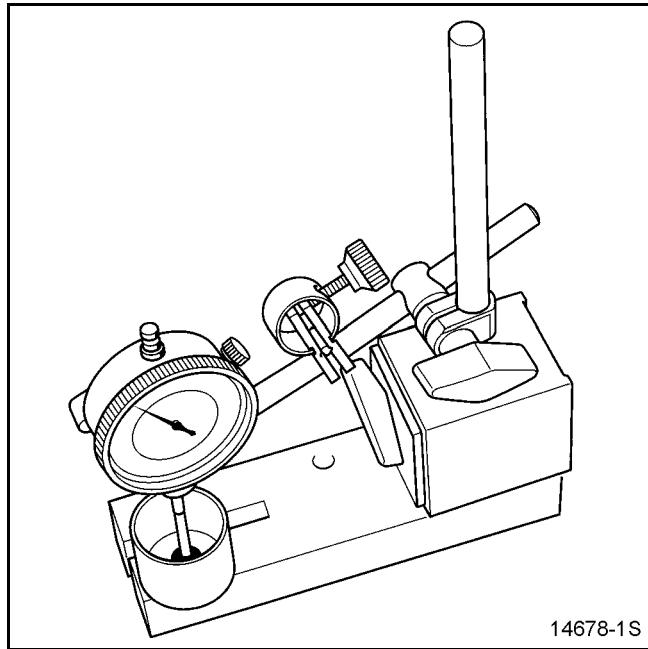
- the cam shaft line beam
- the camshaft,
- the tappet(s) not within tolerance.

Determining dimension (Y).

Set up the following assembly using **Mot. 252-01** and **Mot. 856-02**, then calibrate the gauge.



Raise the gauge extension (without modifying the position of the magnetic support/gauge assembly), then slide in the tappet to be measured.



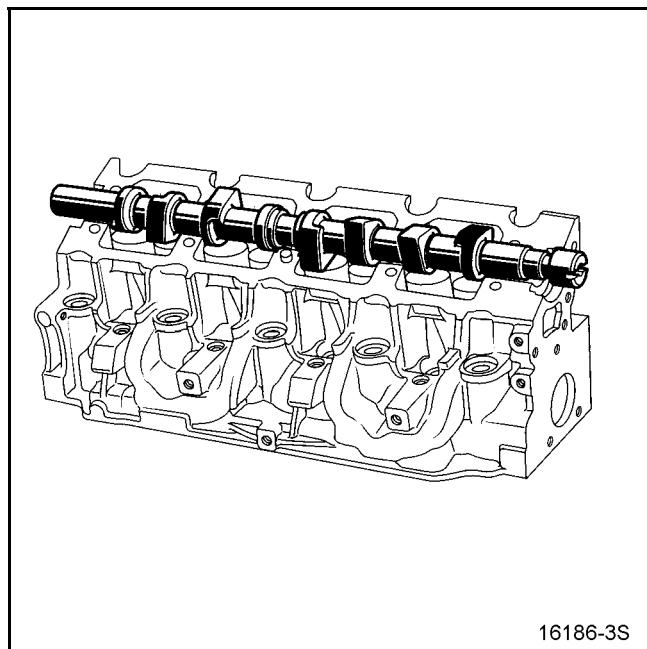
Note dimension (Y) and repeat the operation for the tappets where the valve clearance is not within tolerance.

Then select the various thicknesses of the tappet(s) by referring to the "Replacement parts catalogue" for the vehicle concerned.

Lubricate the camshaft bearings.

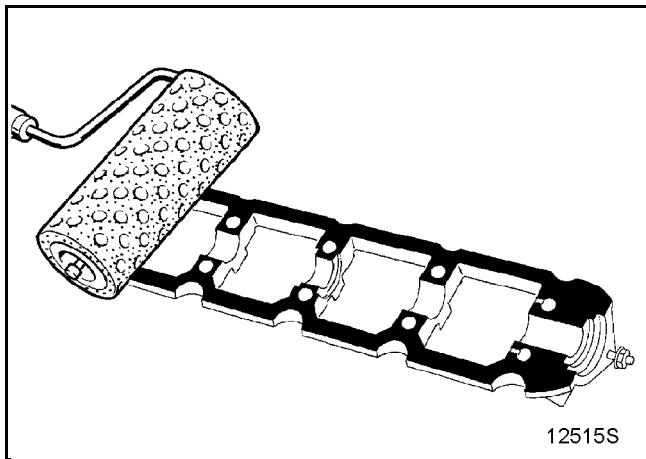
Degrease the mating faces, which they must be clean, dry and free from grease (in particular, avoid finger marks).

Fit the camshaft.



Overhauling the engine

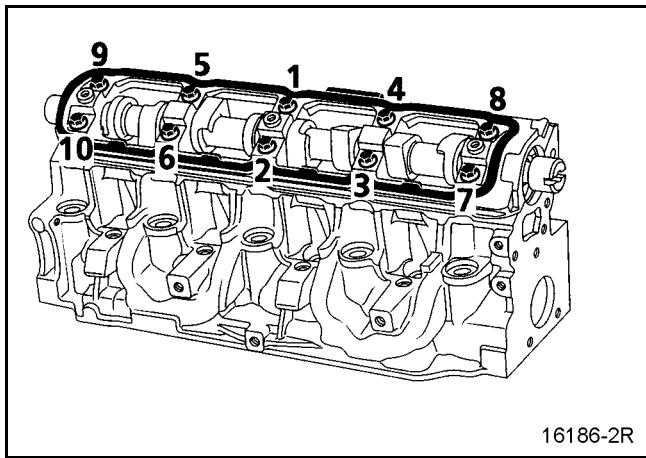
Using a stipple roller, apply **Loctite 518** to the gasket face of the camshaft line beam until it turns "reddish" in colour.

**NOTE:**

Using a cloth, remove any LOCTITE 518 in the five camshaft line beam bearings.

Place one or two drops of **LOCTITE FRENETANCH** on the five beam mounting bolts on the inlet and exhaust manifold end.

Tighten the camshaft line beam to a torque of **2 daN.m**, in the specified sequence.

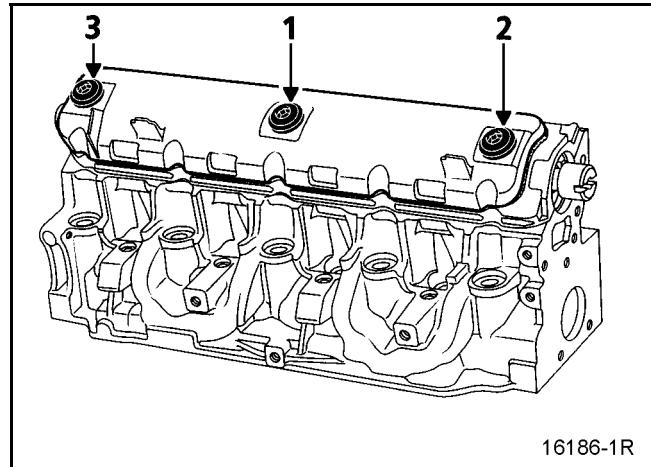


Degrease the mating faces of the cylinder head cover and the camshaft line beam. They must be clean, dry and free from grease (in particular, avoid finger marks).

Refit the new seal on the cylinder head cover.

Refit the cylinder head cover by tightening the bolts in the specified sequence:

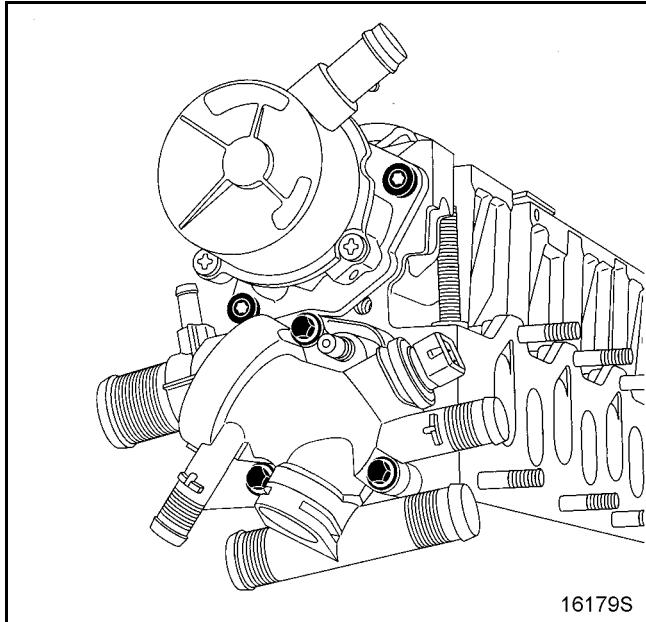
- tighten bolt (1) to a torque of **1.2 daN.m**,
- tighten bolts (2) and (3) to a torque of **1.2 daN.m**,
- retighten bolt (1) to a torque of **1.2 daN.m**.



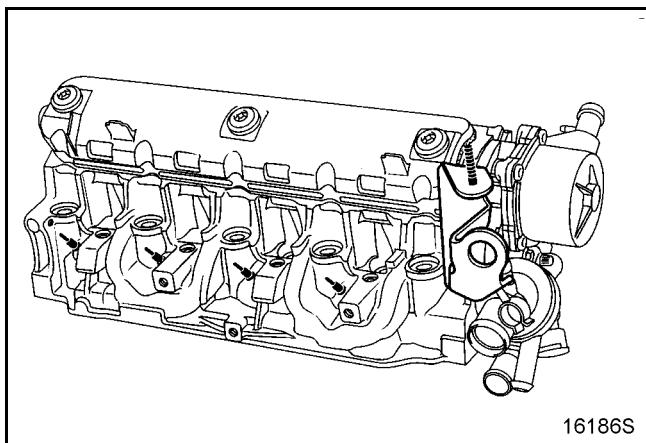
16186-1R

Refit:

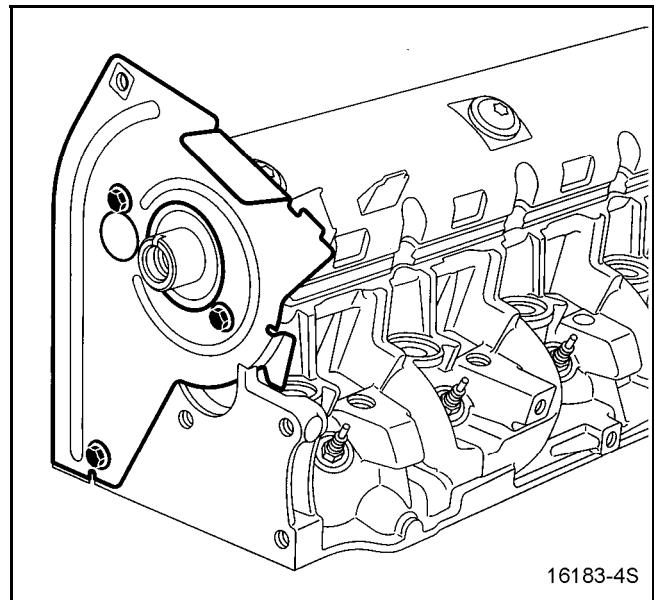
- the thermostatic support fitted with a new seal by tightening the bolts to a torque of **0.8 daN.m**,
- the vacuum pump by tightening the bolts to a torque of **2.3 daN.m**,



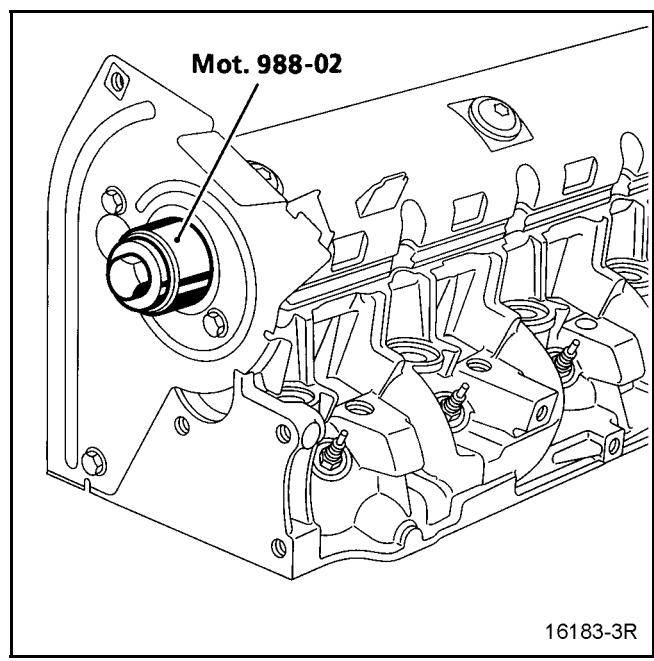
- the engine lifting ring (flywheel end) by tightening the bolts to a torque of **1.3 daN.m**,
- the pre-postheating plugs using an articulated wrench of **10 mm** by tightening them to a torque of **1.5 daN.m**,



- the inner timing housing by placing a drop of **LOCTITE FRENETANCH** on the bolts, then tightening them to a torque of **1 daN.m**,



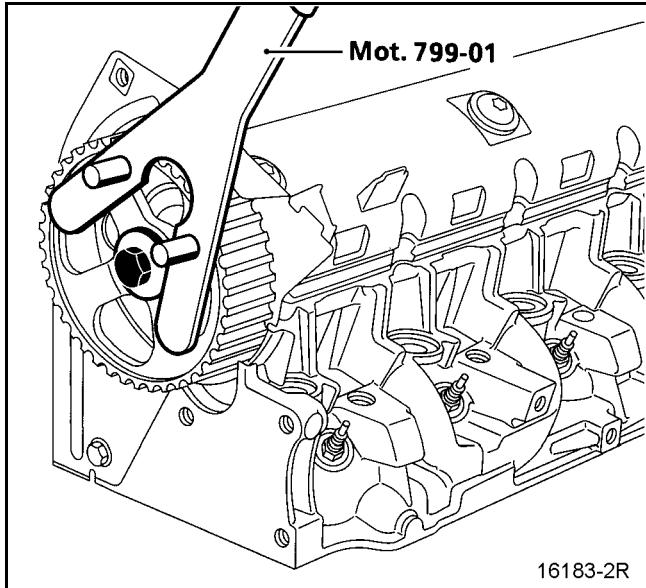
- the camshaft seal (timing end) using **Mot. 988-02**.



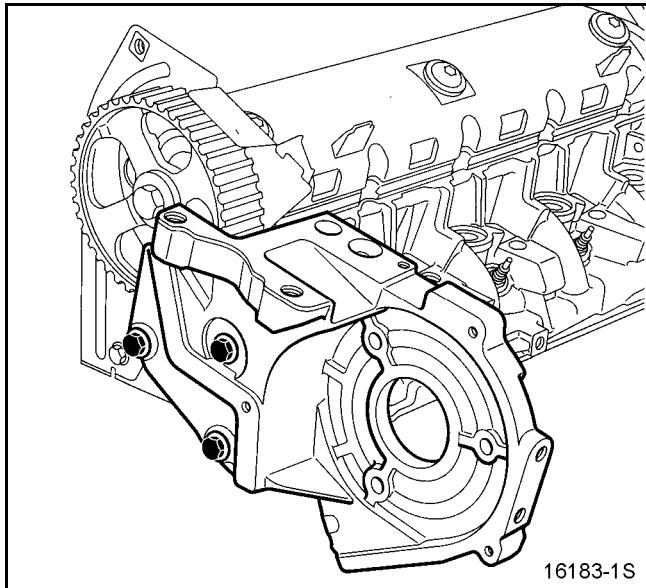
Overhauling the engine

Refit:

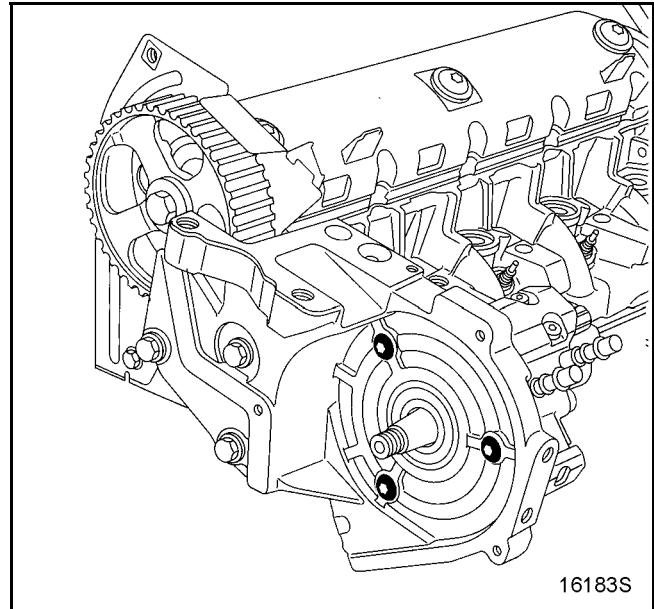
- the camshaft pulley by blocking it using **Mot. 799-01**, and tightening the bolt to a torque of **6 daN.m**,



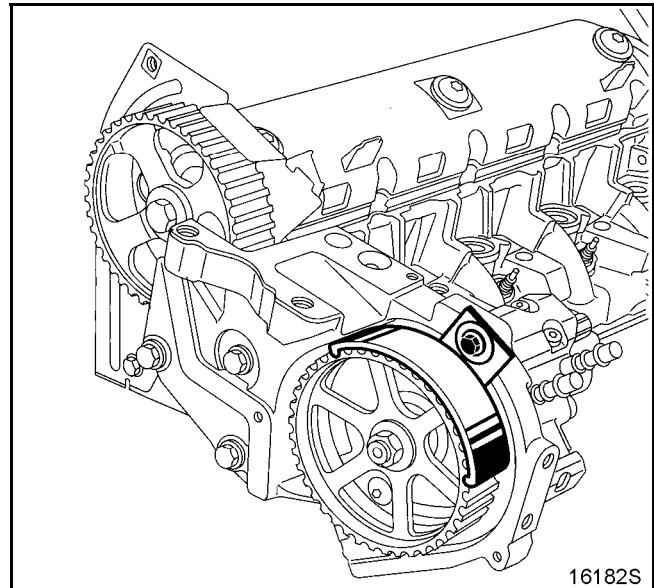
- the cylinder head suspended mounting, tightening the bolts to a torque of **3.5 daNm**,



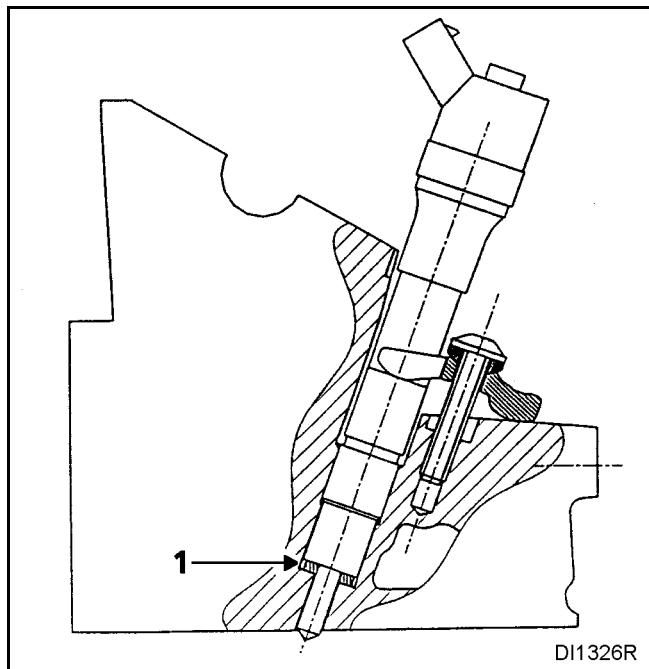
- the high pressure pump by tightening the studs to a torque of **3 daN.m**,



- the high pressure pump pulley, locking it using tool **Mot. 1200-01** or **Mot. 1200-02**. Tighten the nut to a torque of **1.5 daN.m plus an angle of 60° ± 10°**.



Change the washer (1) under the injectors.

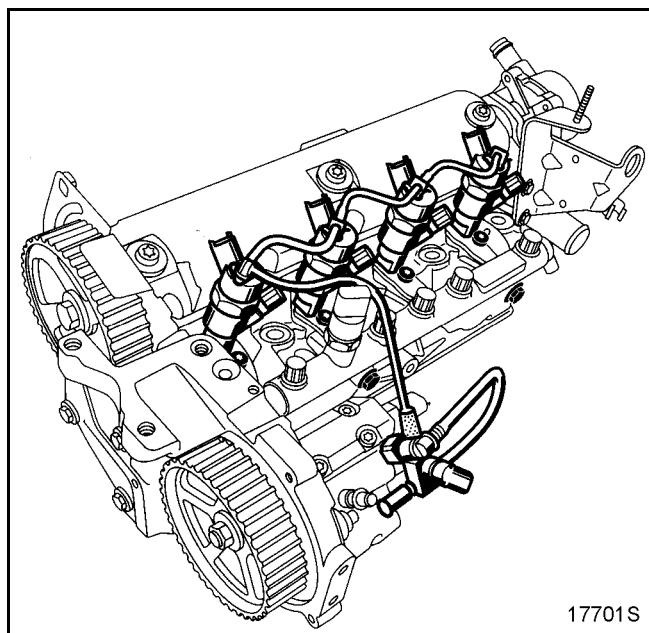


NOTE:

In order to refit the high pressure pipes correctly, it is vital that the following fitting sequence be complied with.

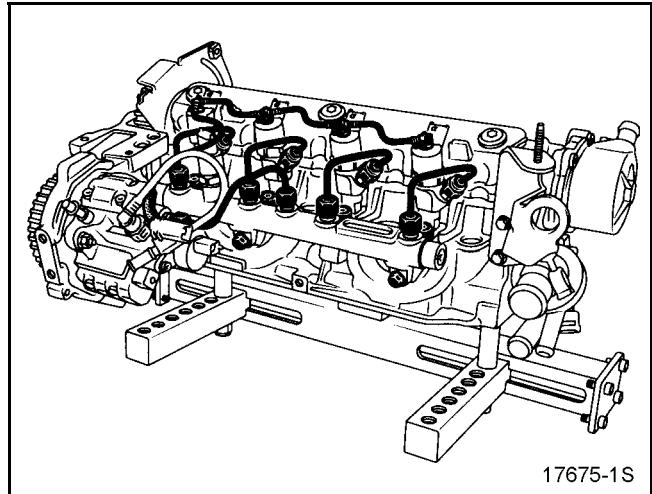
Refit:

- the injectors,
- the injector brackets **without blocking them**,
- the two rail bolts **without blocking them**,
- the new diesel return pipe.



Tighten the injector flanges to a torque of **2 daN.m**.

Refit the high pressure pipes.

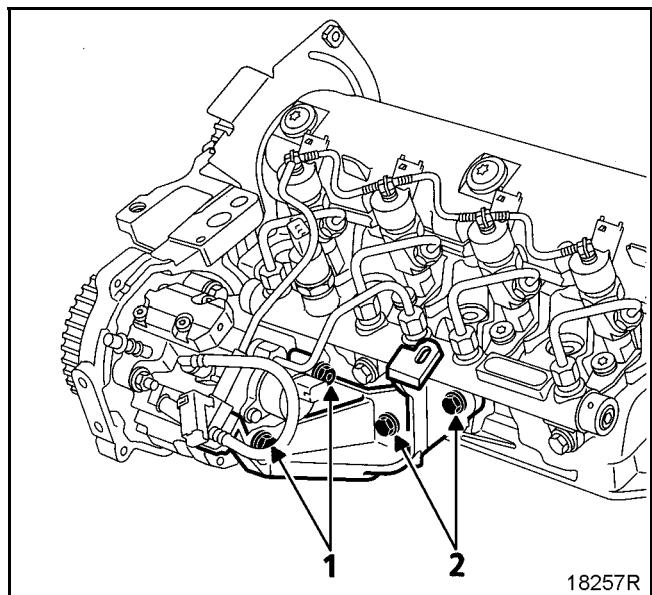


Tighten:

- the high pressure pipe nuts **at the injector end to a torque of 2.5 daN.m**,
- the high pressure pipe nuts **at the rail end to a torque of 2.5 daN.m**,
- the rail tightening bolts to a torque of **2.2 daN.m**,
- the pump/rail high pressure pipe to a torque of **2.5 daN.m**.

Bring the support into contact with the rear of the pump using the two nuts (1).

Tighten the two bolts (2), then the two nuts (1) to a torque of **3 daN.m**.

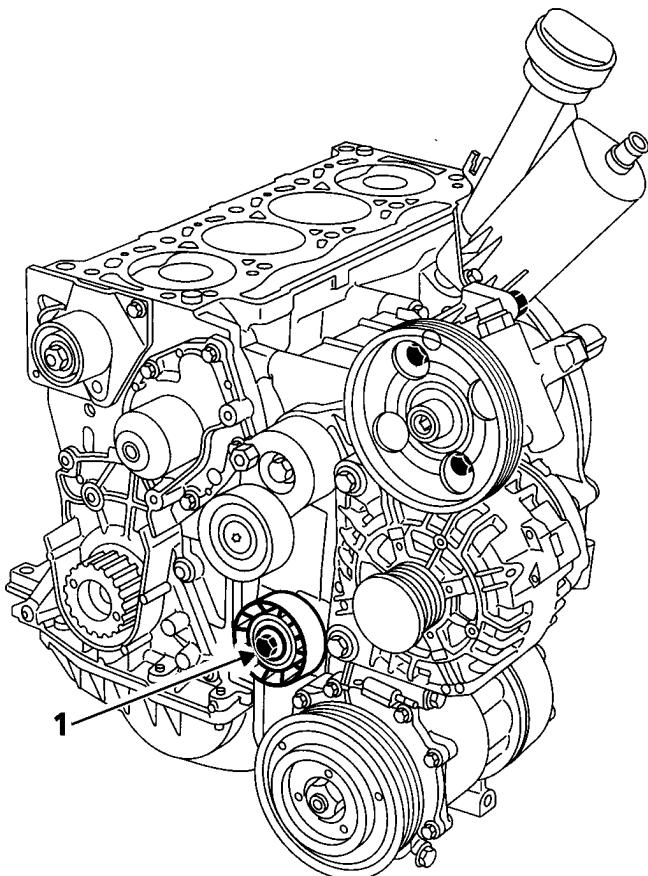


REMOVING THE LOWER ENGINE

Engine fitted with a water pump driven by the timing belt.

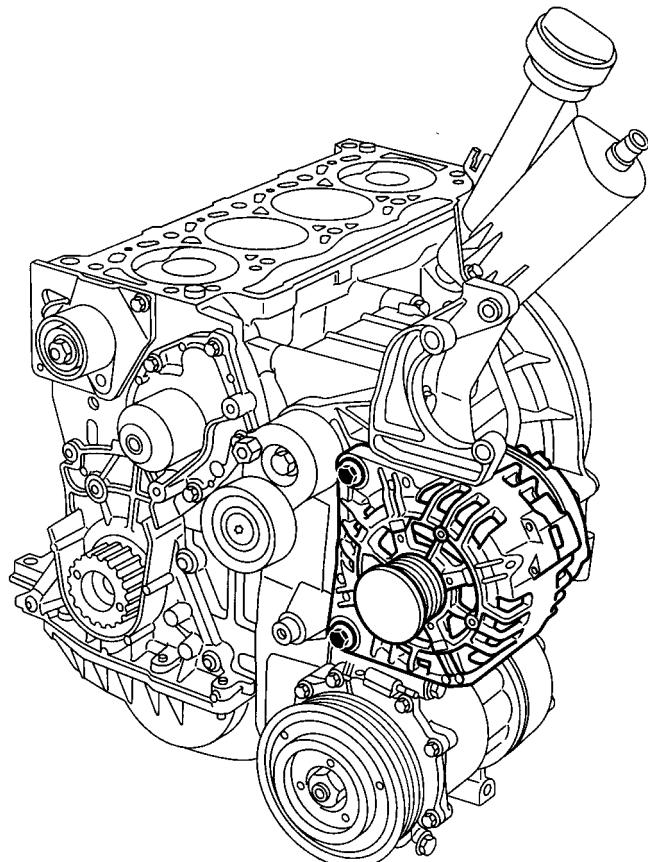
Remove:

- the power-assisted steering pump,
- the accessories tensioner roller by removing bolt (1),



16184-R

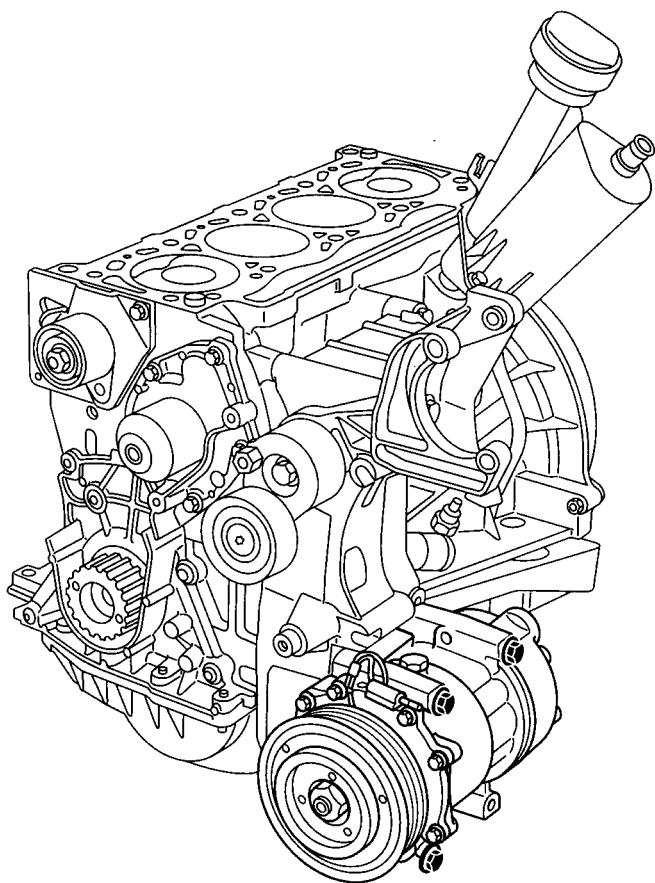
- the alternator.



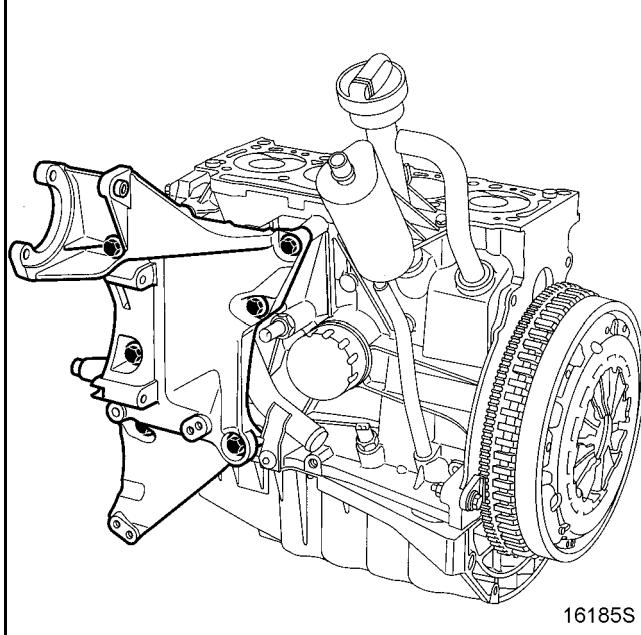
16184-1S

Remove:

- the air conditioning compressor,

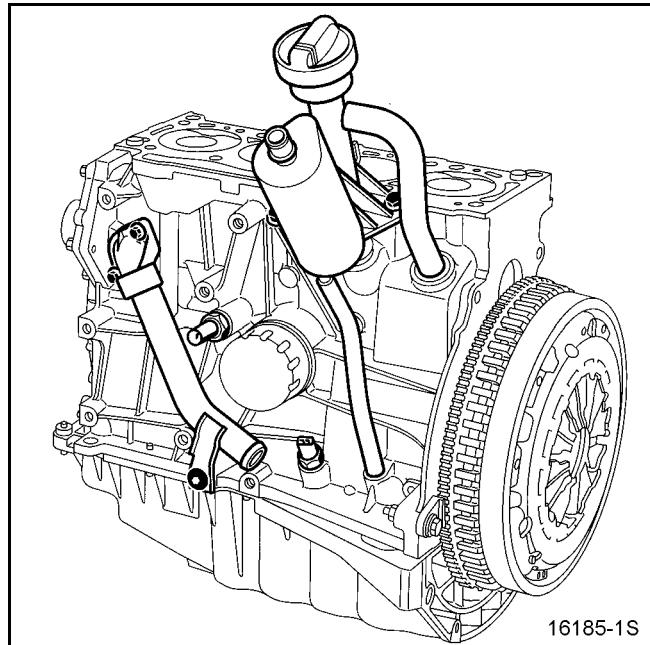


- the multifunction mounting.

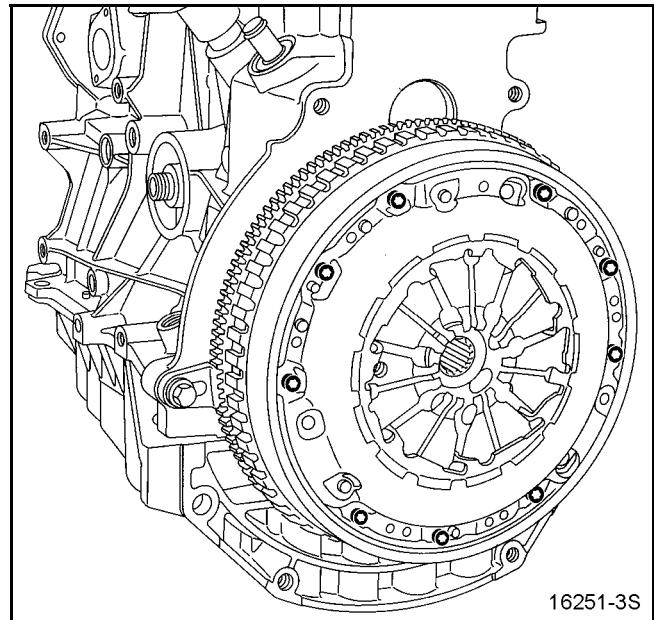


Remove:

- the oil decanter,
- the oil filter,
- the oil heat exchanger,
- the oil pressure sensor,
- the oil level sensor,
- the coolant hose,
- the pump inlet pipe.



– the clutch



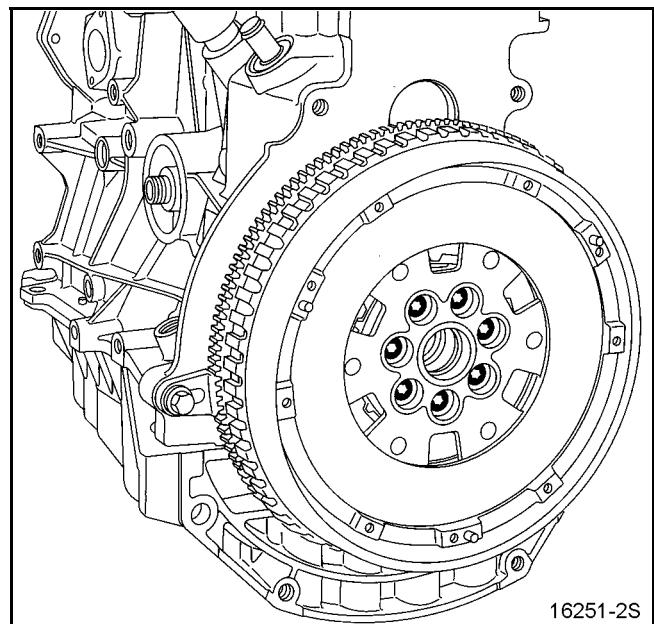
Checking the flywheel and the friction face

It is essential to change the flywheel if the contact surface is "bluish" or if the friction face is "worn out".

Position the immobilising tool **Mot. 582-01** or **Mot. 1677**.

Remove the flywheel mounting bolts (**these bolts must be replaced**).

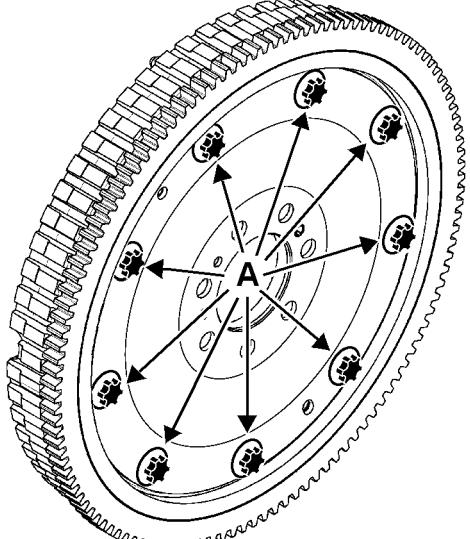
Remove the flywheel.



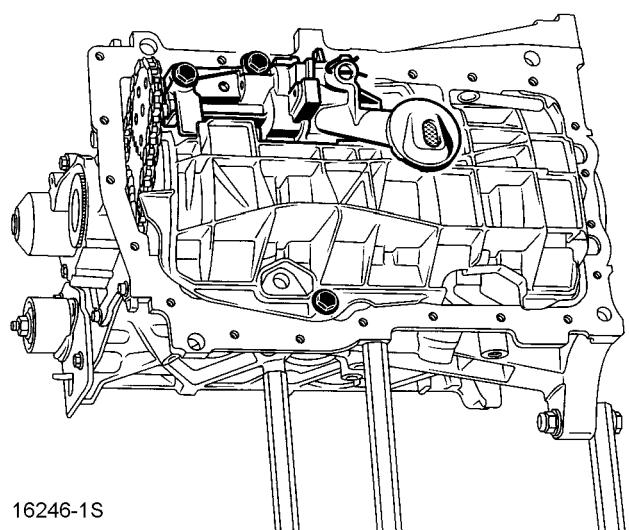
Overhauling the engine

Special notes concerning engines fitted with a flexible flywheel:

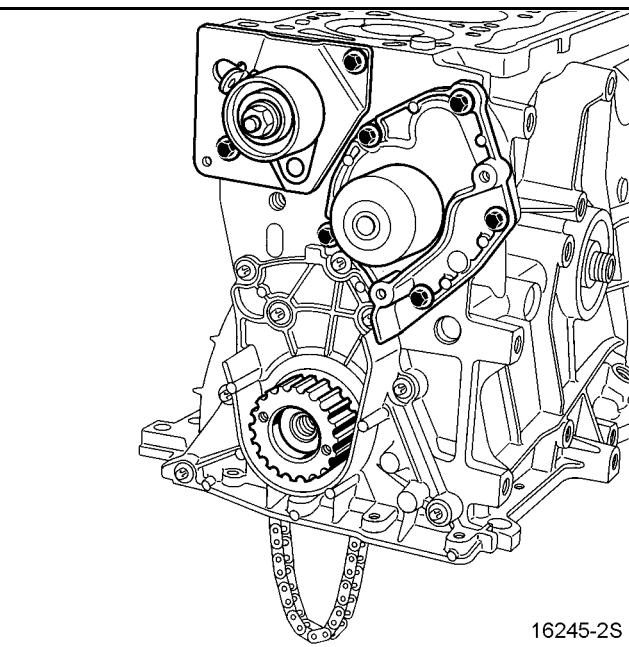
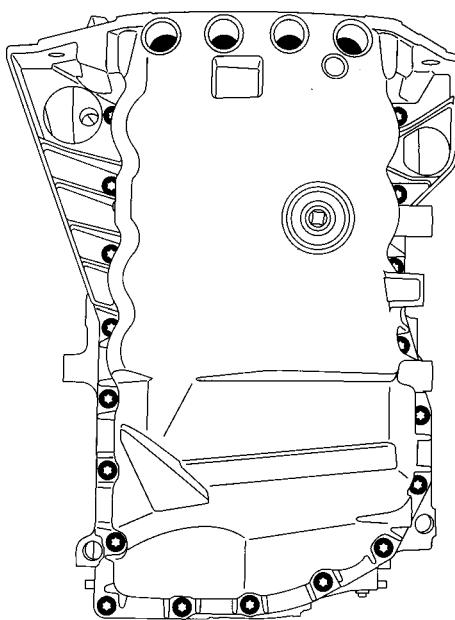
Under no circumstances should the bolts (A) be removed.



– the oil pump and the anti emulsion panel,

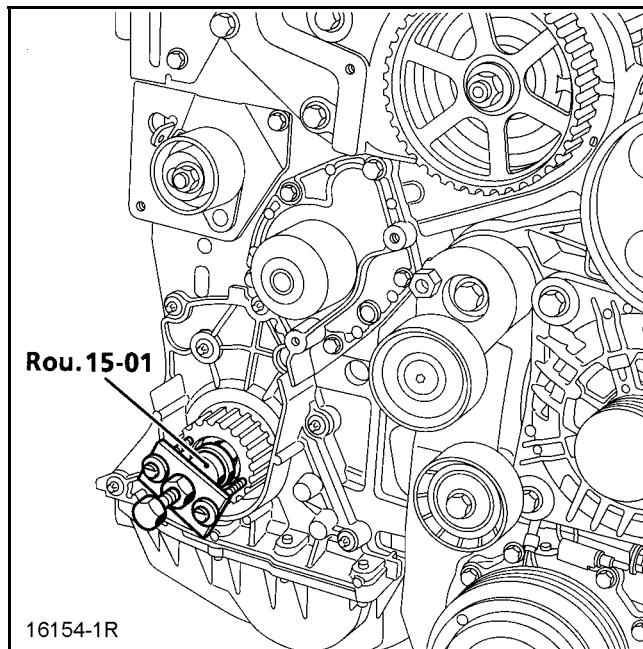


– the timing tensioner plate,
– the coolant pump.

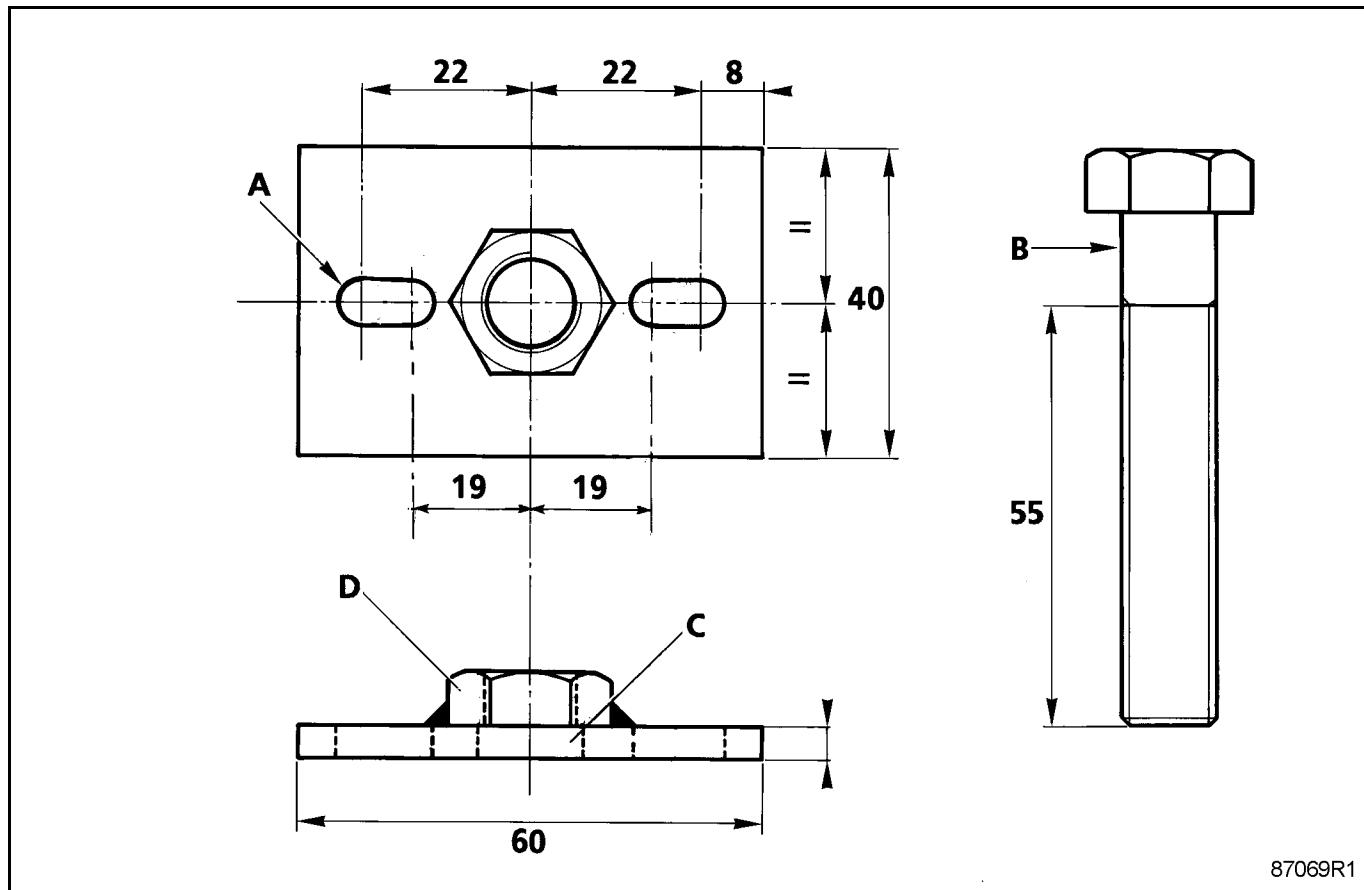


Remove the timing crankshaft sprocket.

If necessary, use the locally manufactured tool (see drawing on following page) with the thrust plate **Rou. 15-01**.

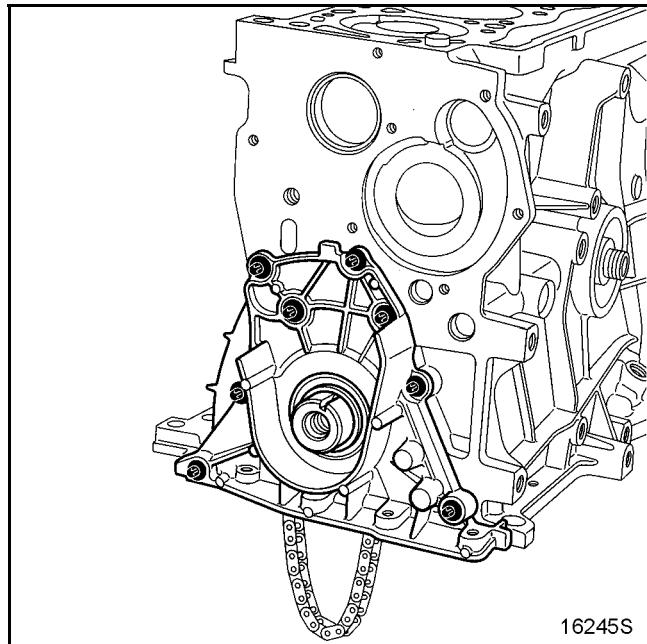


Drawing of locally manufactured tool (dimensions in **mm**)

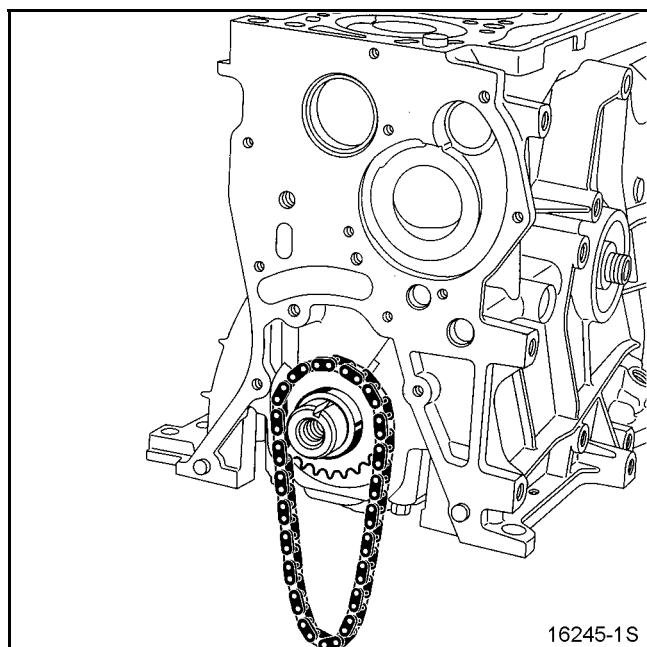


Remove:

- The crankshaft closure plate,



- the oil pump chain and the drive sprocket.

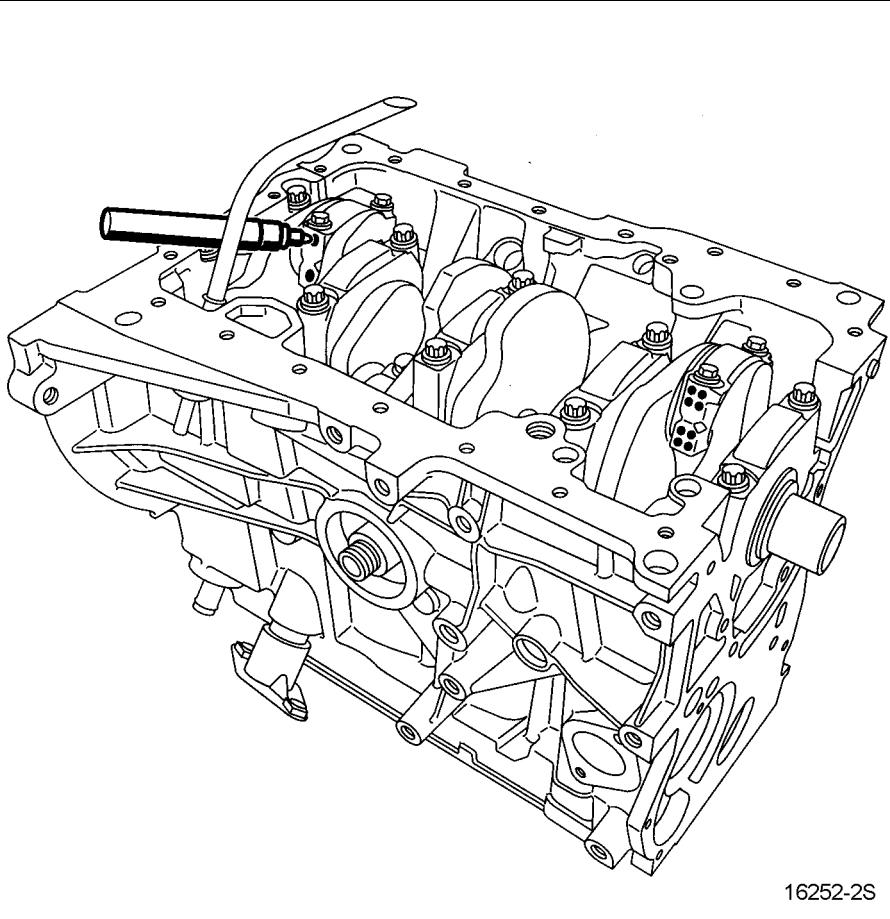


REMOVING THE LOWER ENGINE

IMPORTANT:

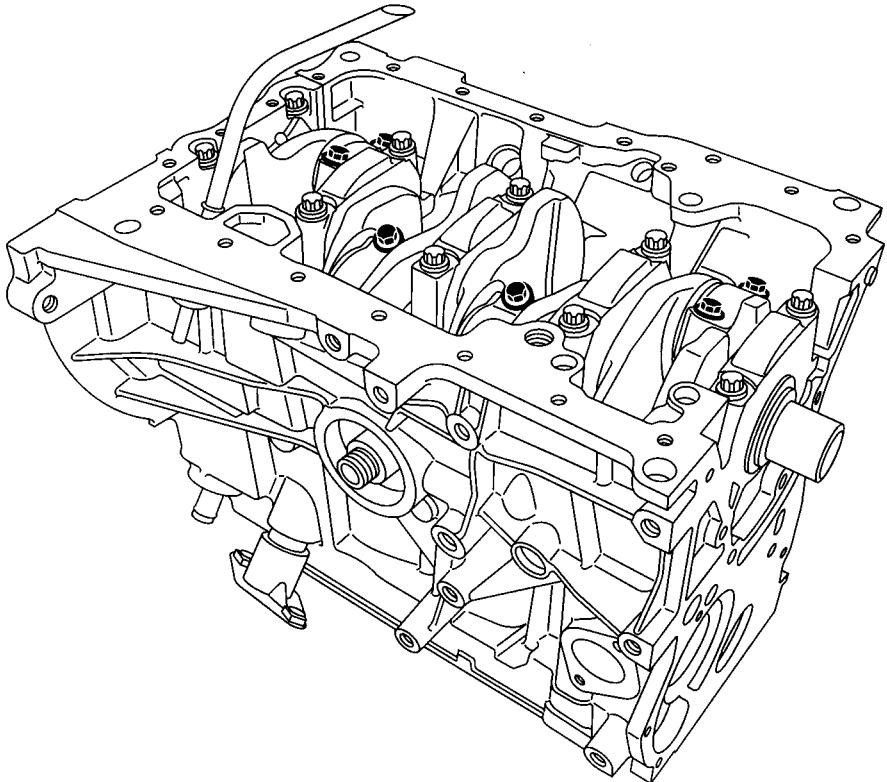
Do not use a sharp point to mark the bearing caps in relation to their con rods to avoid starting a crack in the rod.

Use a permanent marker pen.



Overhauling the engine

Remove the bearing caps and the connecting rod/piston assemblies.



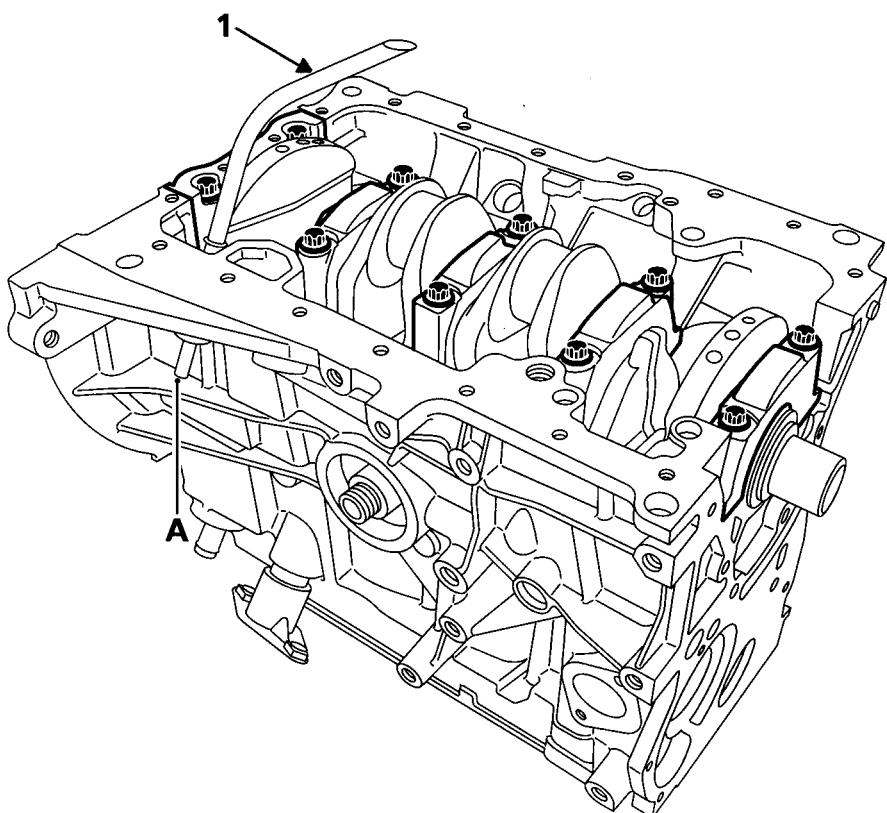
16252S

NOTE:

It is essential to mark the position of the crankshaft shells, as the category may be different for each bearing.

Remove:

- the crankshaft bearing caps,
- oil return tube (1) from the decanter by tapping (A).

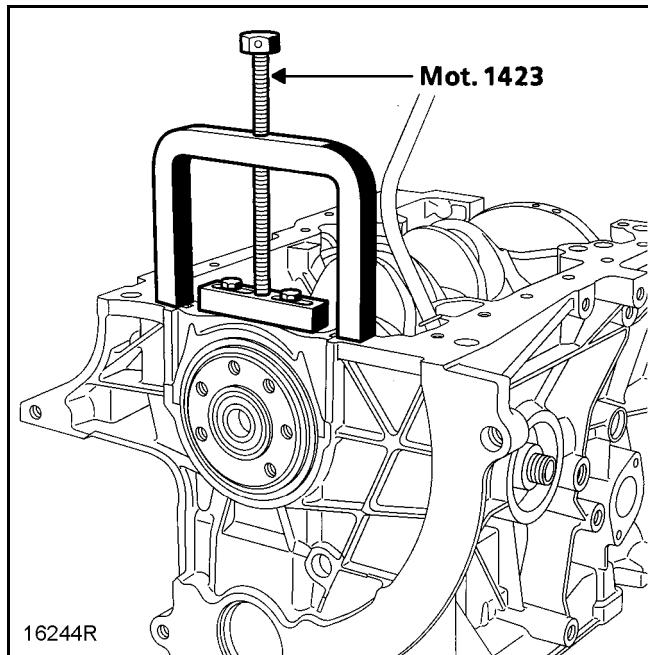


16252-1R

Overhauling the engine

Extraction of bearing No. 1, fitted with bars of injected silicon paste, is made easier by using **Mot. 1423**.

Remove the crankshaft.

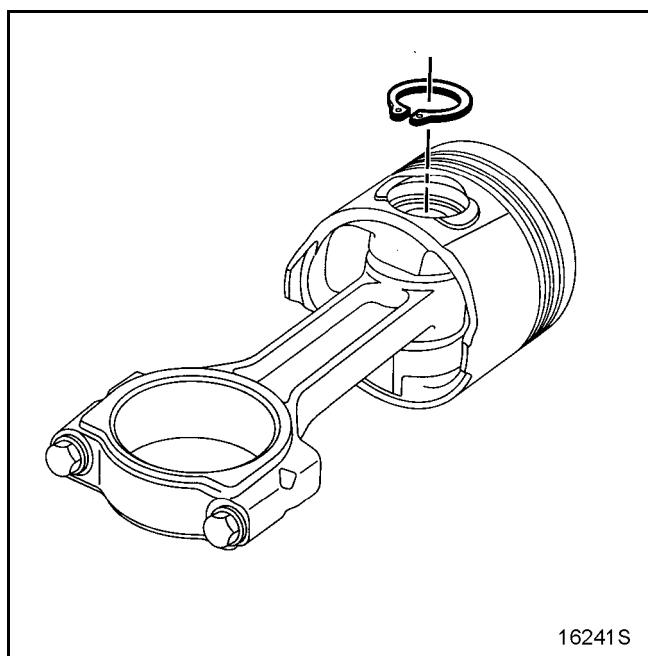


EXTRACTING THE GUDGEON PINS

NOTE:

It is essential to mark the connecting rod to match it to its piston, because the piston height classes in the same engine may be different (see Technical Specifications section).

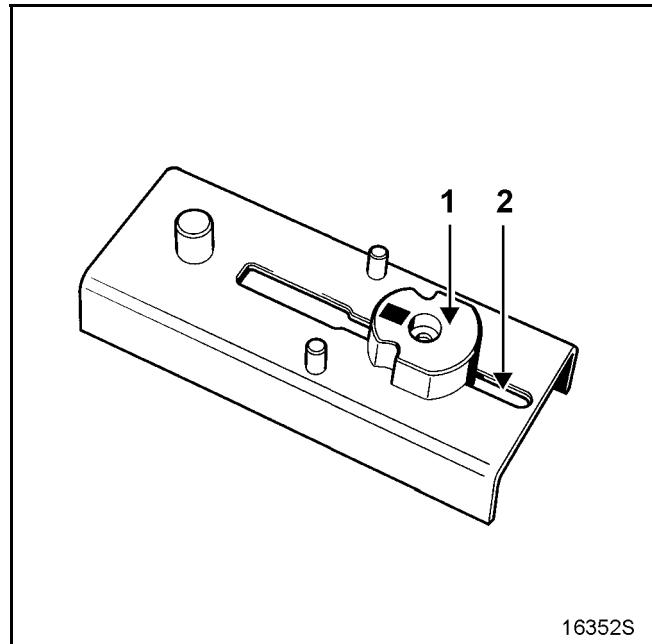
To extract the gudgeon pin, remove the circlips using internal circlip pliers, then release the pin.



FITTING THE CON ROD BEARING SHELLS

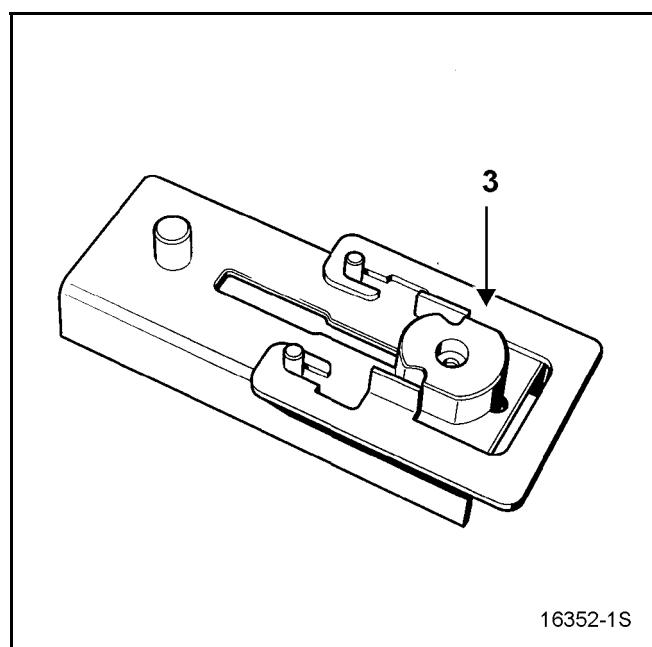
On the con rod body:

Slide the shell support (1) of **Mot. 1492-01** into the groove (2) on the base of tool **Mot. 1492**.



16352S

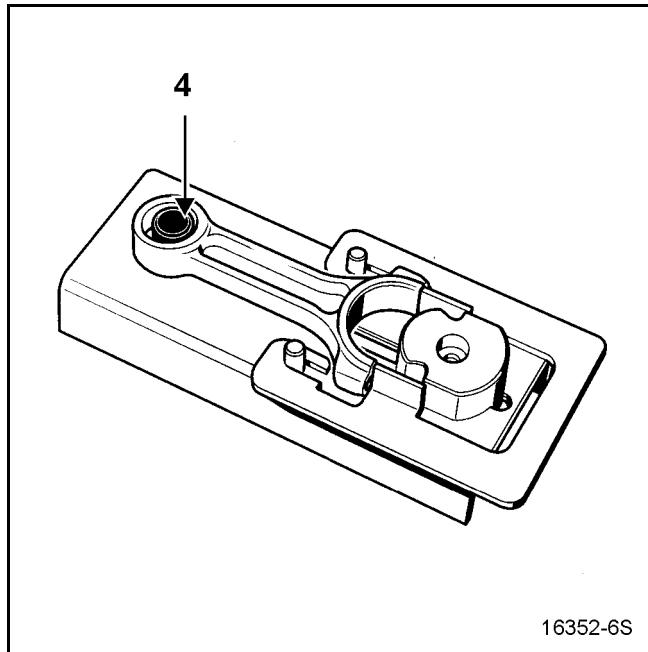
Fit the guide (3) of **Mot. 1492-01** onto the base (as shown in the diagram).



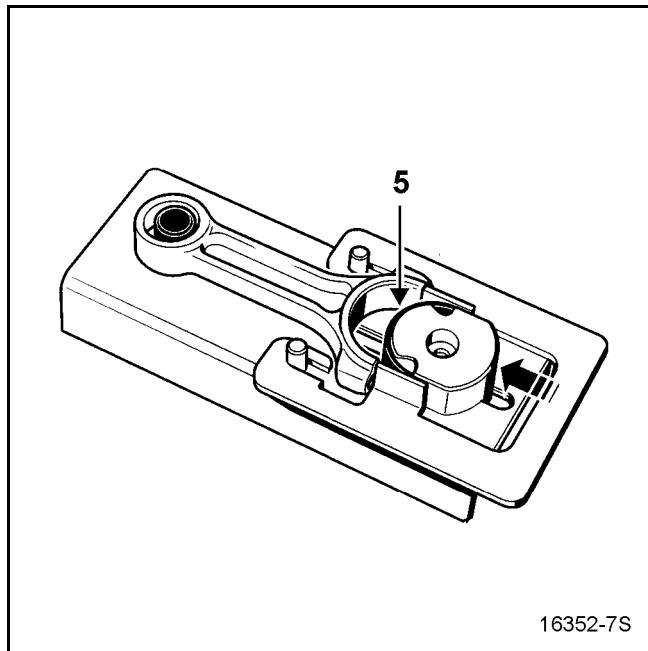
16352-1S

Lay the body of the con rod on the base of the tool (as shown in the diagram).

Ensure that the lower part (4) of the small end of the con rod is in contact with the guide pin.

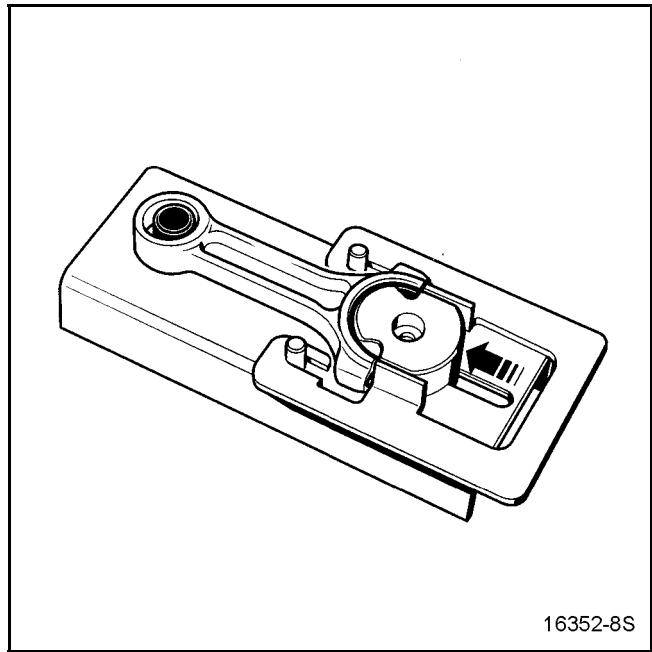


Fit the shell (5) on the shell support, then push it in the direction of the arrow (as shown in the diagram).



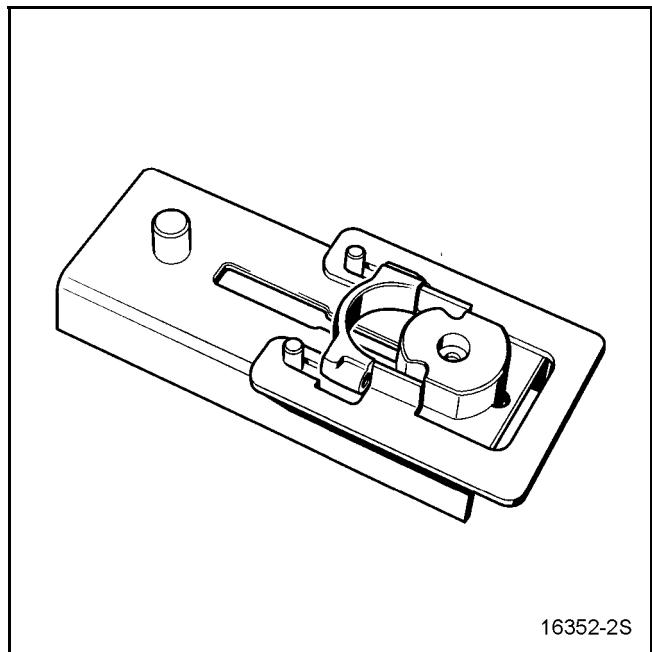
Bring the shell support up against the base of the con rod body.

Remove the con rod body support and repeat the operation for the remaining con rod bodies.

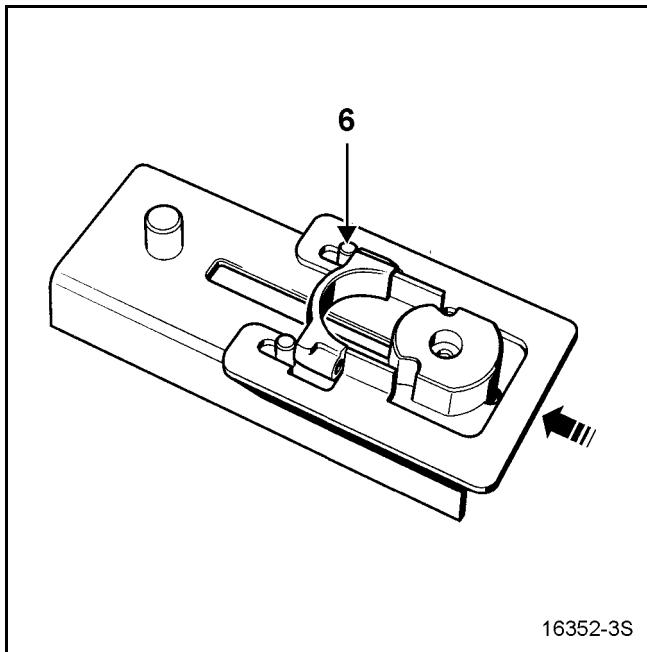


On the con rod cap

Fit the con rod cap as shown in the diagram.

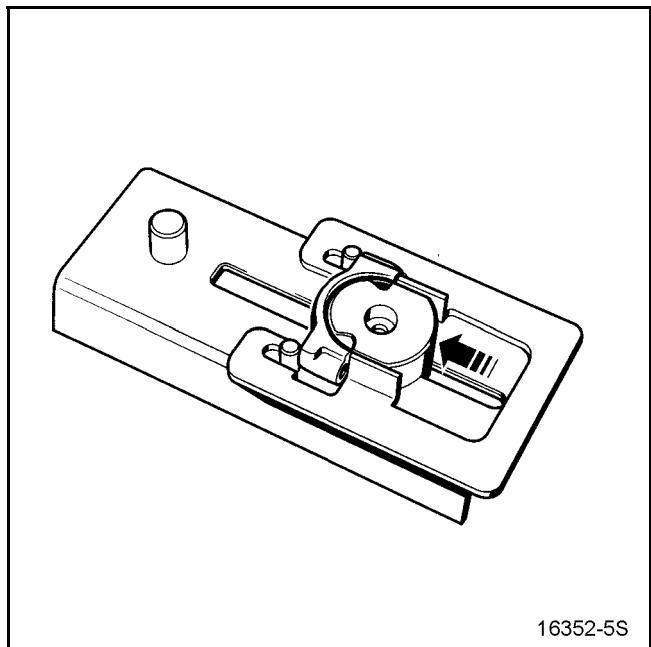


Push the guide (in the direction of the arrow) until the con rod cap is in contact with the pins (6) at the base of the tool.

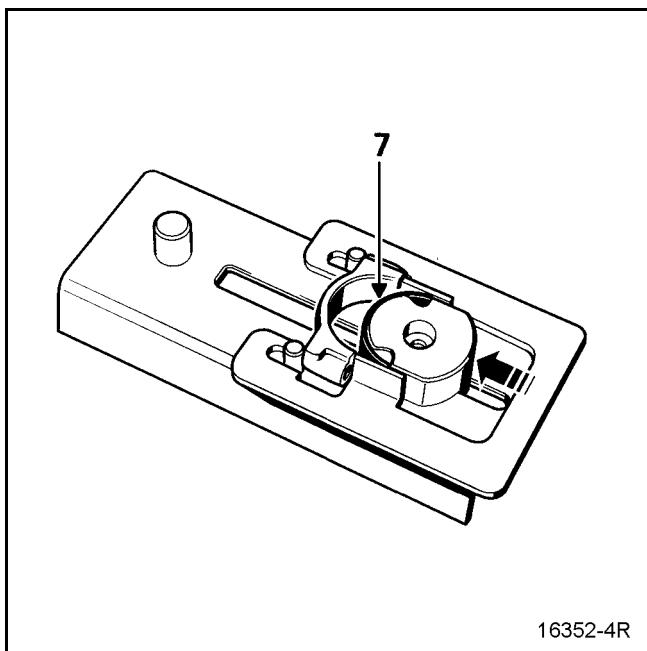


Bring the shell support up against the base of the con rod cap.

Remove the con rod cap support and repeat the operation for the remaining con rod caps.



Fit the shell (7) on the shell support, then push it in the direction of the arrow (as shown in the diagram).



Overhauling the engine

"CON RODS / PISTON" ASSEMBLY

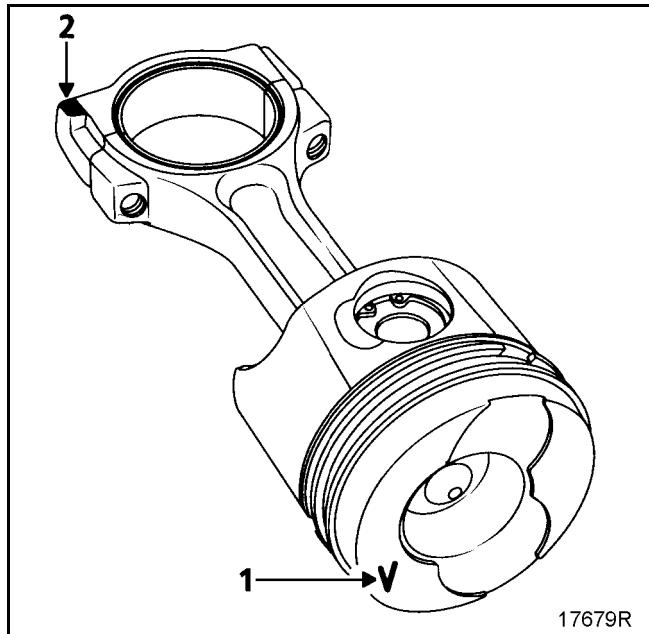
NOTE:

You must ensure that you match the con rods to the piston and cylinder as previously determined.

Direction of fitting of the con rod in relation to the piston

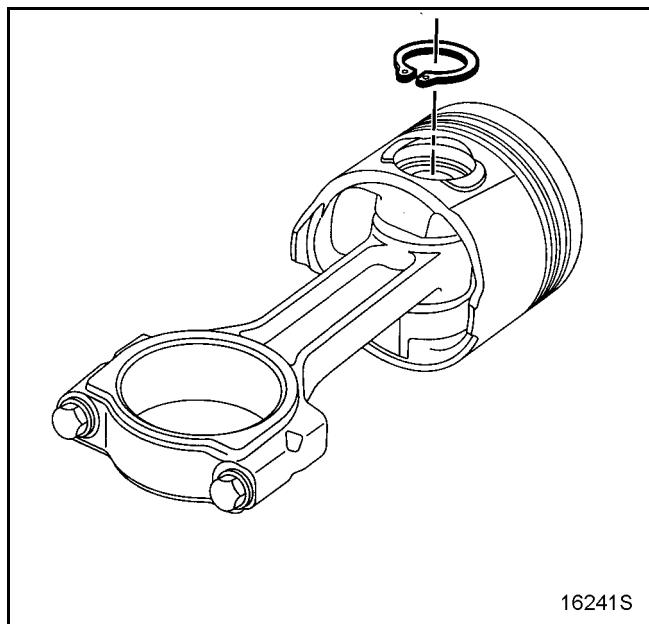
Place the "Λ" (1) engraved on the piston head downwards.

Place the machined flat (2) of the con rod head upwards.



Direction for fitting the circlips on the piston

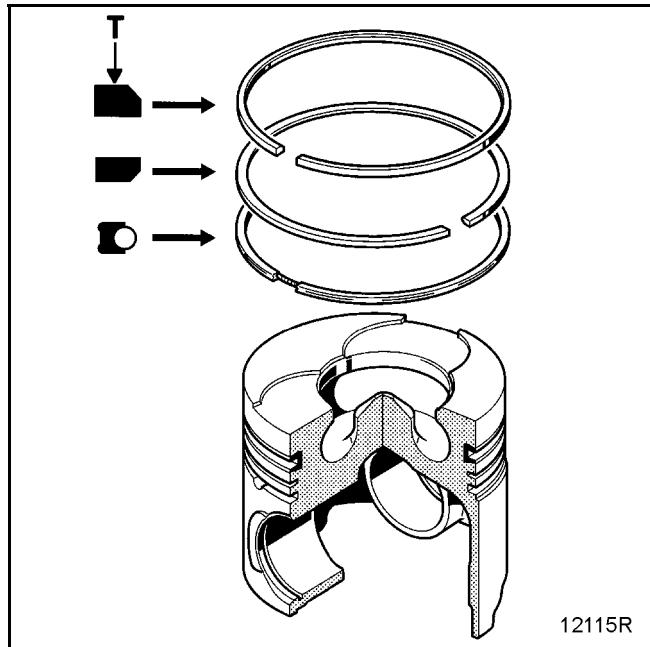
Fit the circlips on the piston as shown below.



FITTING THE RINGS

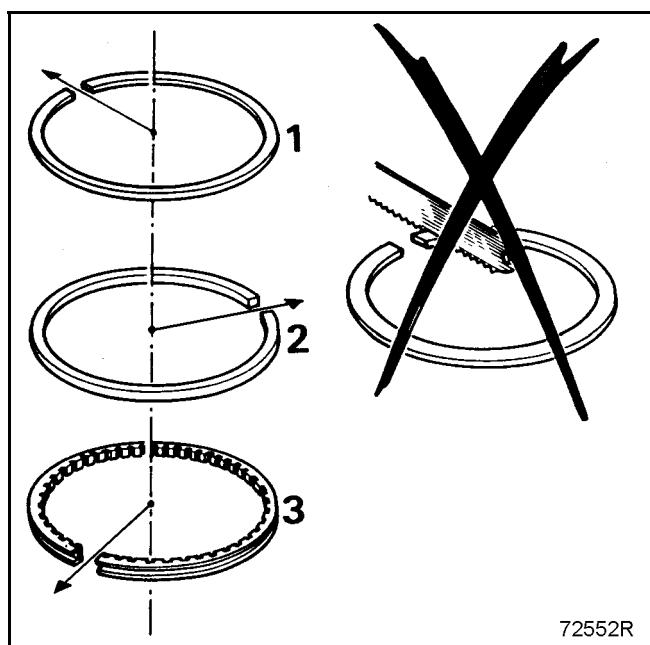
The rings set to their original adjustment must be free within their channels.

Ensure the rings are fitted in the correct orientation.



T = Top

Fit the rings such that the gaps are equally spaced around the piston.



PISTON BASE COOLING JETS

There are various orientations for piston cooling jets (0° , 3° and 5°).

To be sure of obtaining the correct cooling jet orientation when refitting, their orientation must be marked before they are removed.

To do that, use tools **Mot. 1516**, **Mot. 1516-01** and **Mot. 1516-02**.

Then, try to fit one of the three plates of these tools.

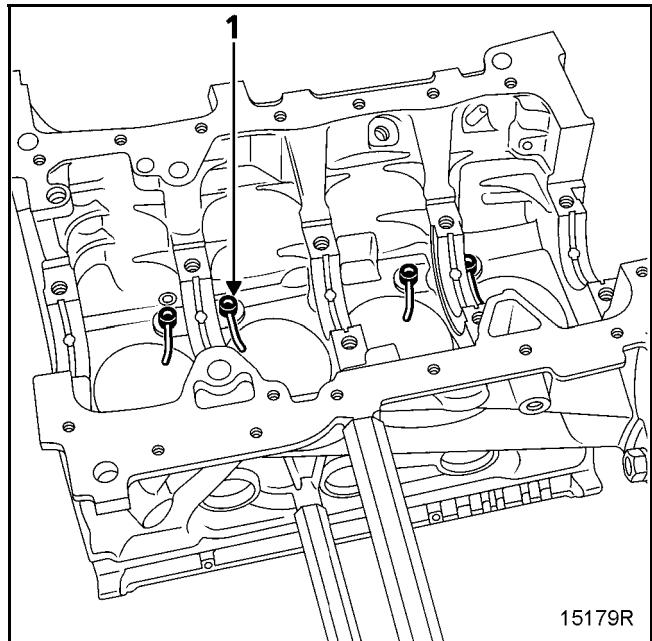
Each plate corresponds to a precise cooling jet orientation.

Orientation of cooling jets (in degrees)	Tools to be used for removal (marking the orientation) then for refitting (application of the correct orientation)
0°	Mot. 1516-02
3°	Mot. 1516-01
5°	Mot. 1516

Replacement of the piston base cooling jets

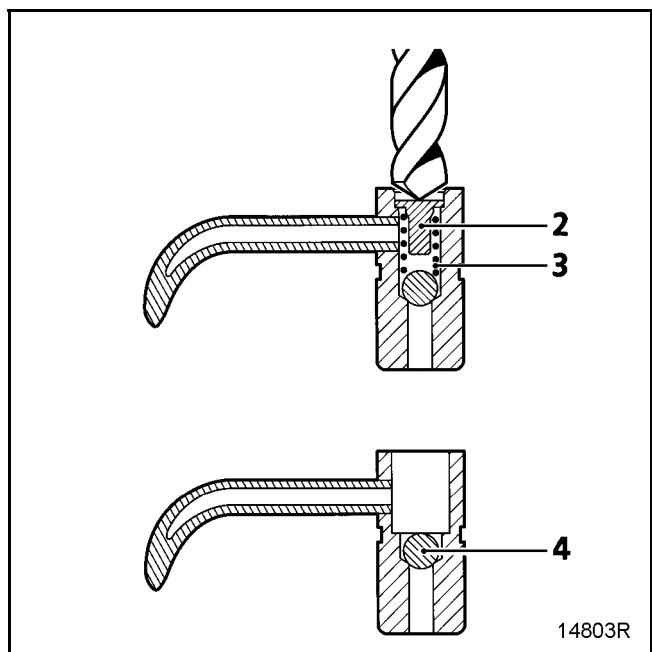
REMOVAL

To remove the piston base cooling jets (1), they must be drilled with a **7 mm** diameter drill. This is necessary in order to remove the spring stop (2) and the spring (3).

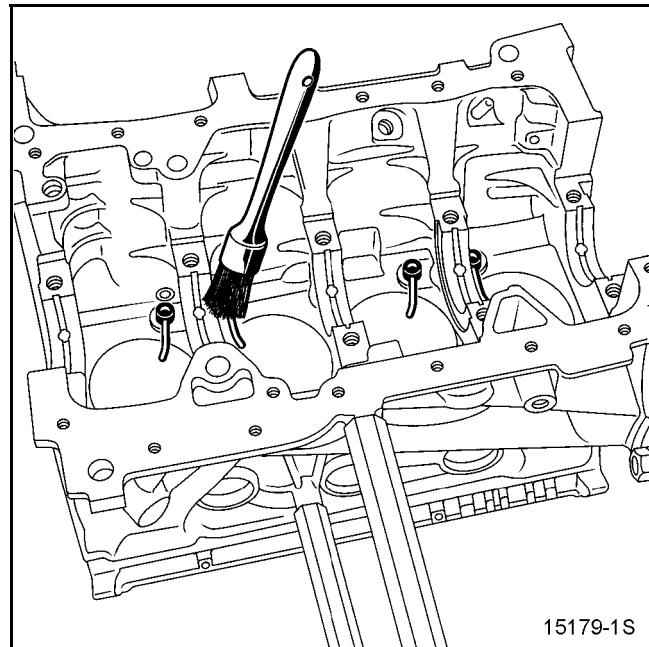


NOTE:

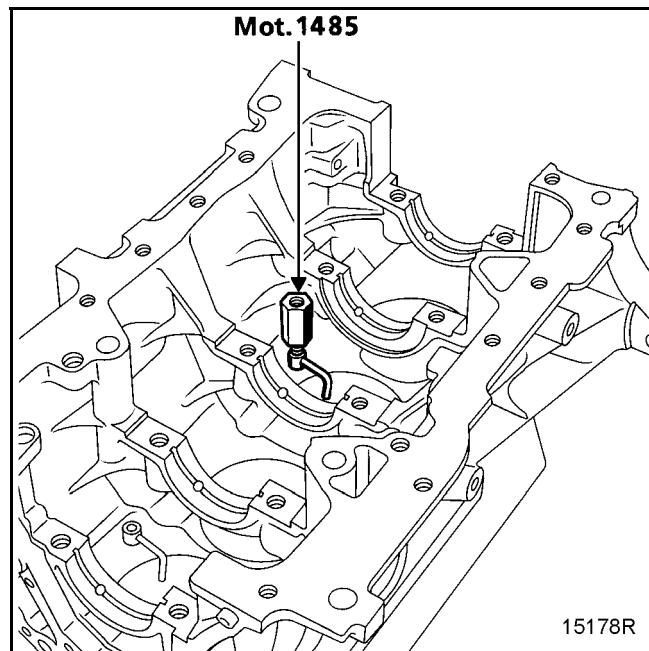
Do not remove the ball (4), to prevent swarf entering the cooling circuit.



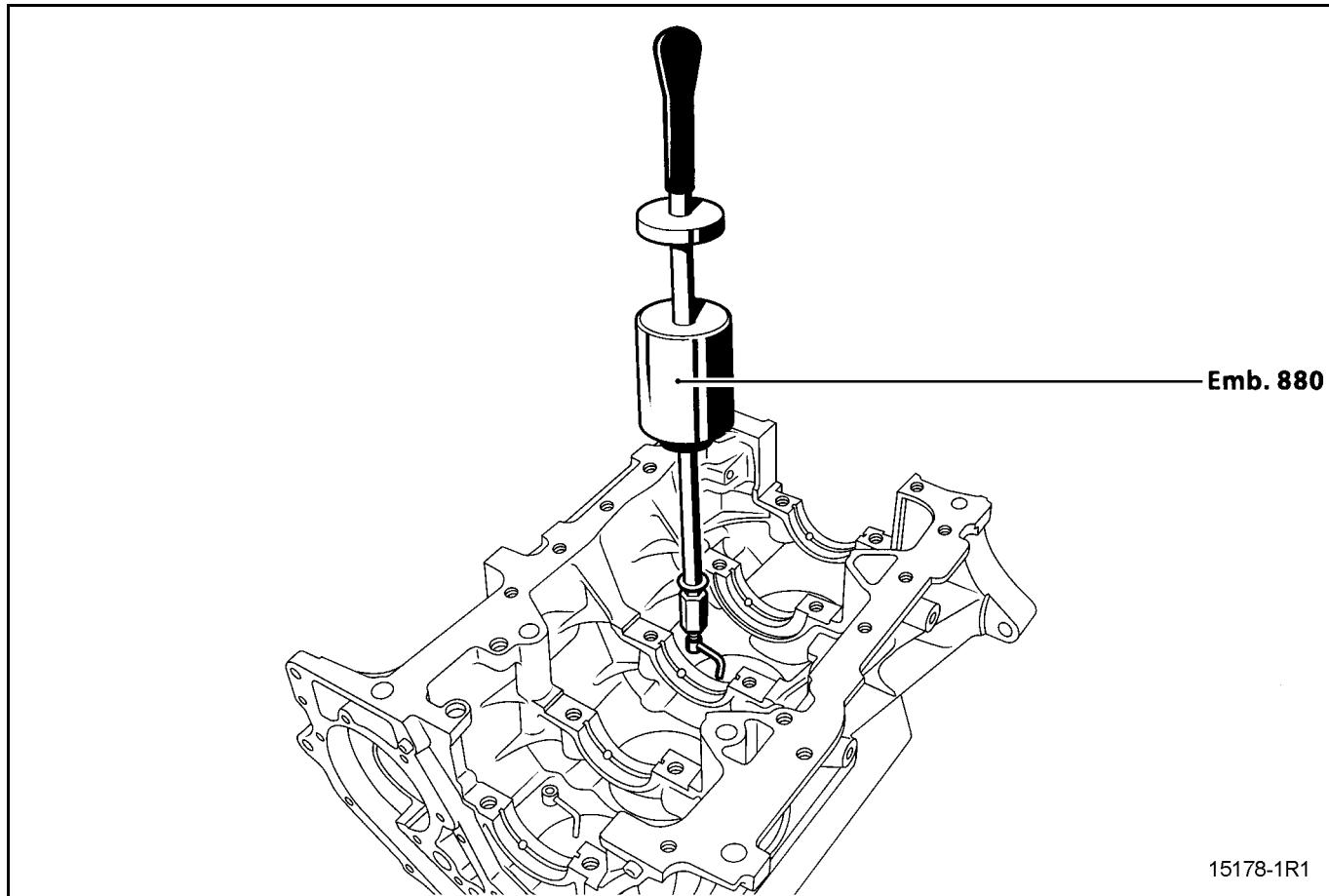
Remove the swarf using a brush.



Screw Mot. 1485 or Mot. 1485-01 into the drilled out jets using a **6 mm** Allen key which you slide inside the tool.

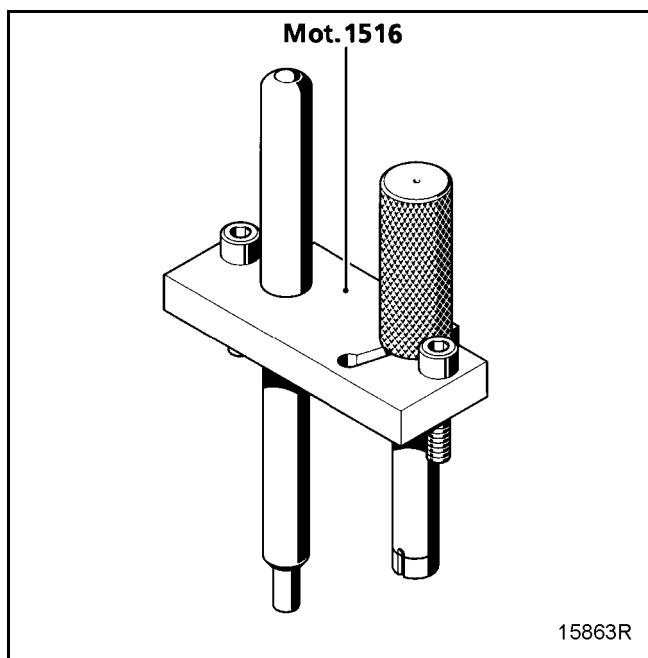


Screw the **Emb. 880** inertia extractor to the **Mot. 1485** or **Mot. 1485-01** tool and extract the jet.

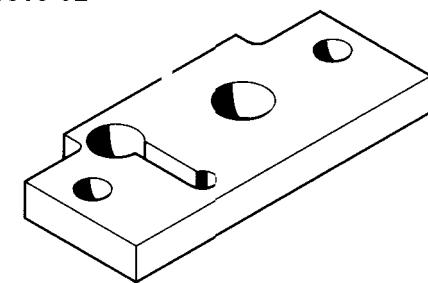


Fitting piston base cooling jets

It is essential that the cooling jets be fitted with tool **Mot. 1516** and plates **Mot. 1516-01** and **Mot. 1516-02**.

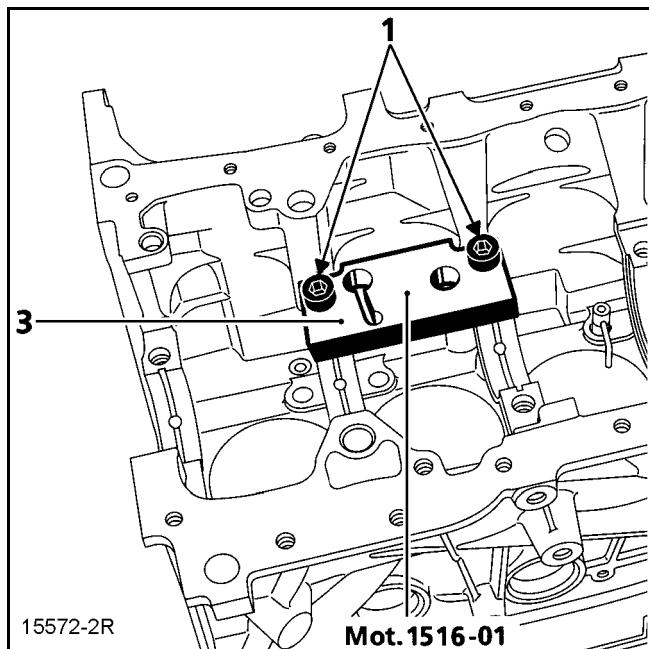


Mot. 1516-01
Mot. 1516-02

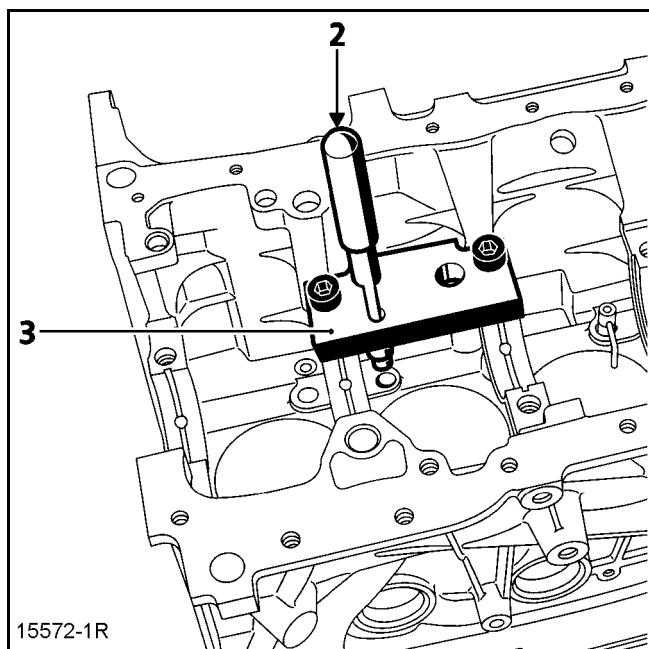


Fitting the jets for cylinders 1 and 3

Locate the plate (3) of the **Mot. 1516-01** tool on the cylinder block (as shown in the illustration below) without tightening the two bolts (1) of the **Mot. 1516** tool.



Position the guide rod (2) of tool **Mot. 1516** in the plate (3) and the end of the guide rod in the cooler hole to centre the plate (3).

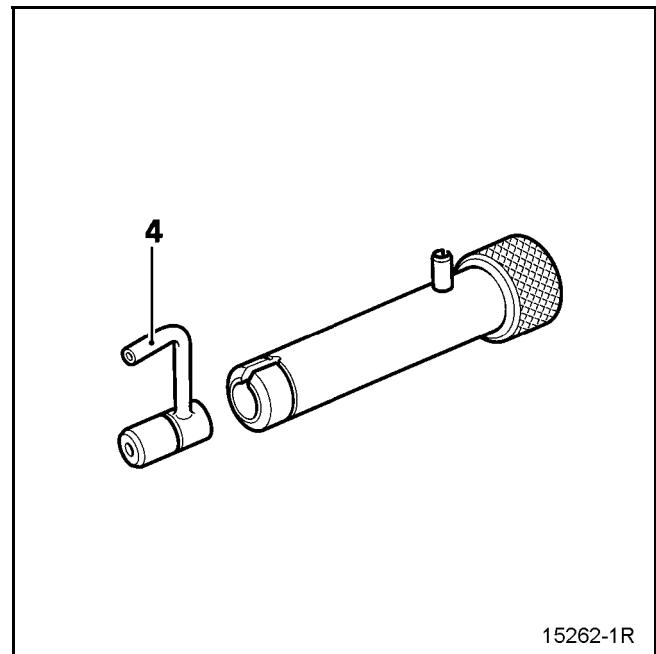


Tighten the two bolts (1), then remove the guide rod.

Insert the cooler into the pushrod.

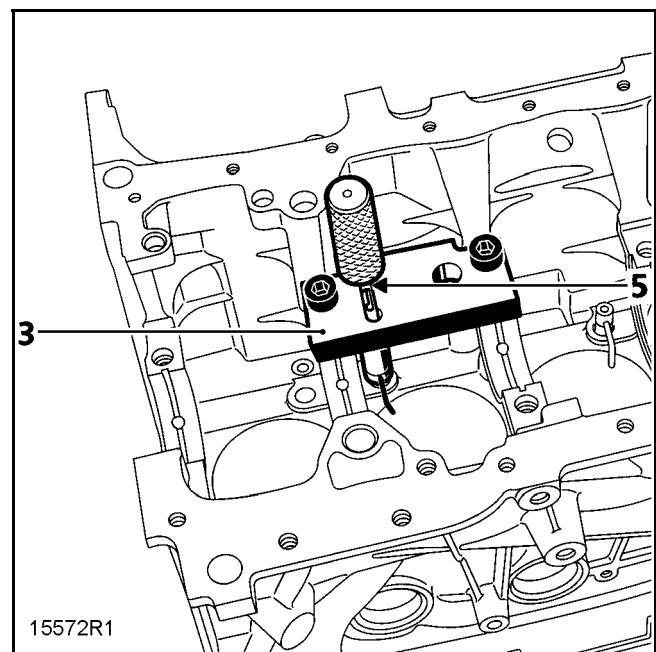
NOTE:

Check that the jet is correctly oriented, with the end of the jet (4) directed towards the centre of the cylinder.



Fit the pushrod in place and instead of the guide rod.

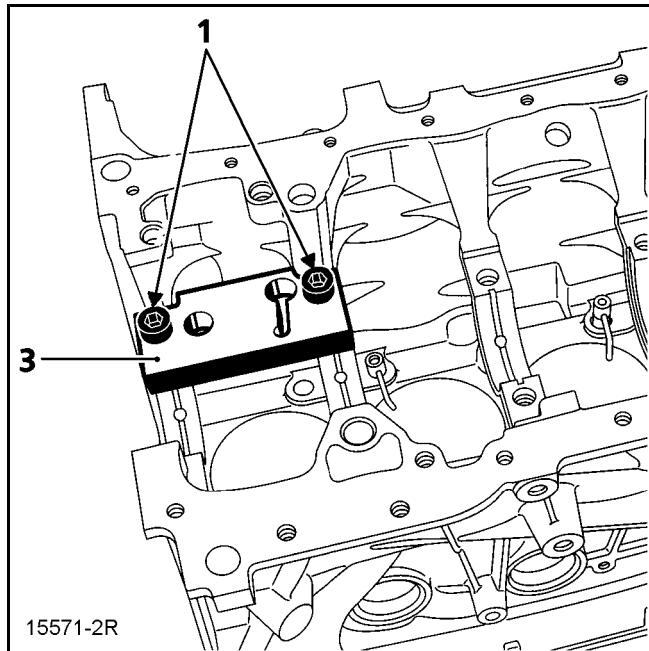
With a hammer, tap the pushrod until the shoulder (5) of the pushrod comes into contact with the plate (3).



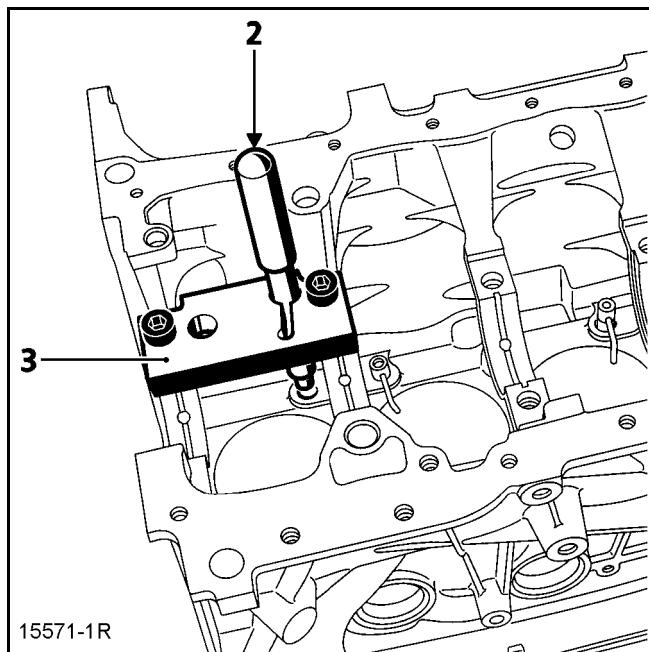
Overhauling the engine

Fitting the jets for cylinders 2 and 4

Locate the plate (3) of the **Mot. 1516-01** tool on the cylinder block (as shown in the illustration below) without tightening the two bolts (1) of the **Mot. 1516** tool.



Position the guide rod (2) of tool **Mot. 1516** in the plate (3) and the end of the guide rod in the cooler hole to centre the plate (3).

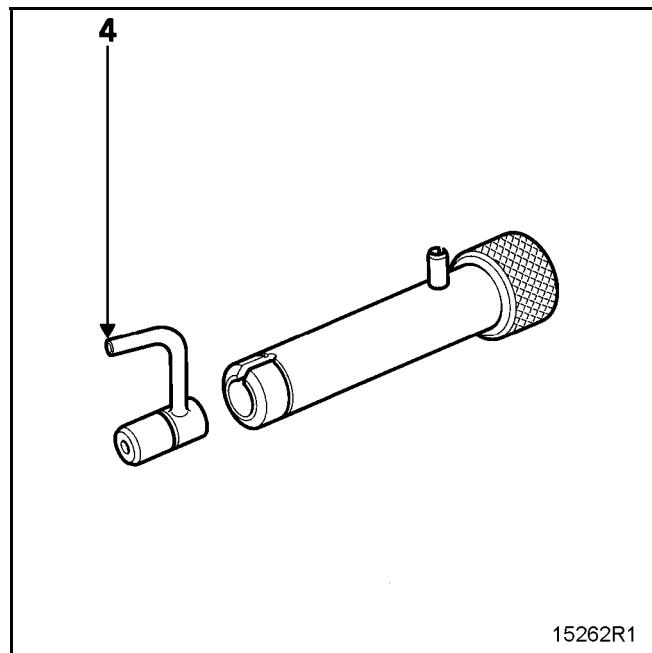


Tighten the two bolts (1), then remove the guide rod.

Insert the cooler into the pushrod.

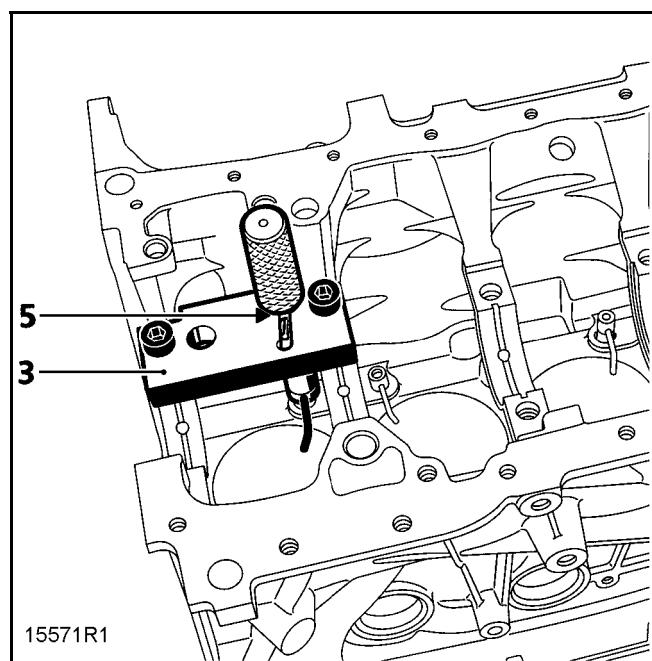
NOTE:

Check that the jet is correctly oriented, with the end of the jet (4) directed towards the centre of the cylinder.

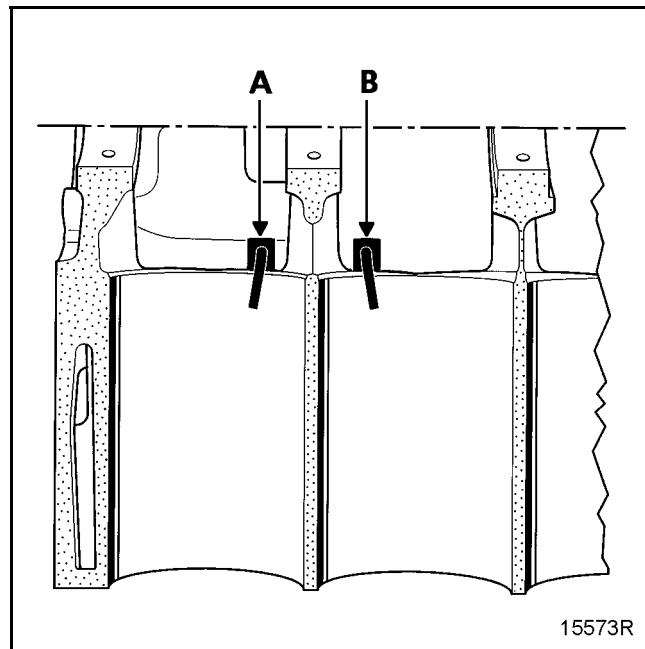


Fit the pushrod in place and instead of the guide rod.

With a hammer, tap the pushrod until the shoulder (5) of the pushrod comes into contact with the plate (3).



Orientation of the piston base cooling jets (see diagram below).



A: Orientation of the coolers of cylinders 2 and 4

B: Orientation of the coolers of cylinders 1 and 3

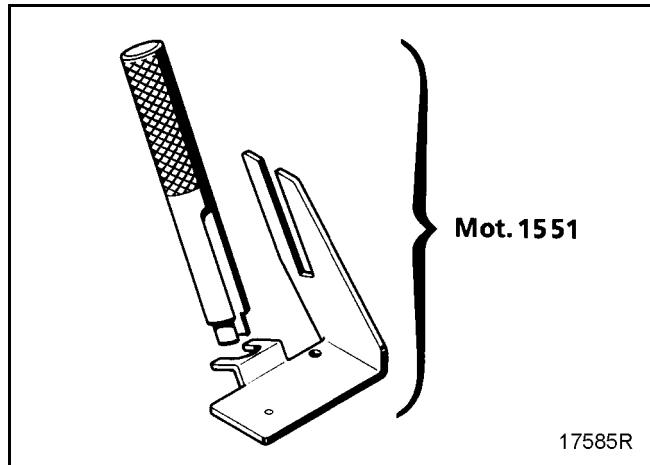
REFITTING THE LOWER ENGINE

Clean the cylinder block.

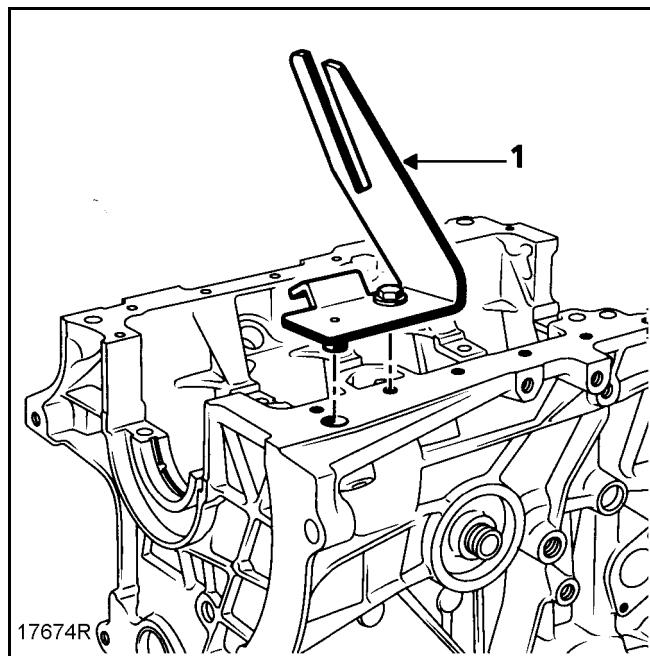
Clean the crankshaft by passing a wire through the lubrication channels.

Fitting the metal oil return pipe from the decanter

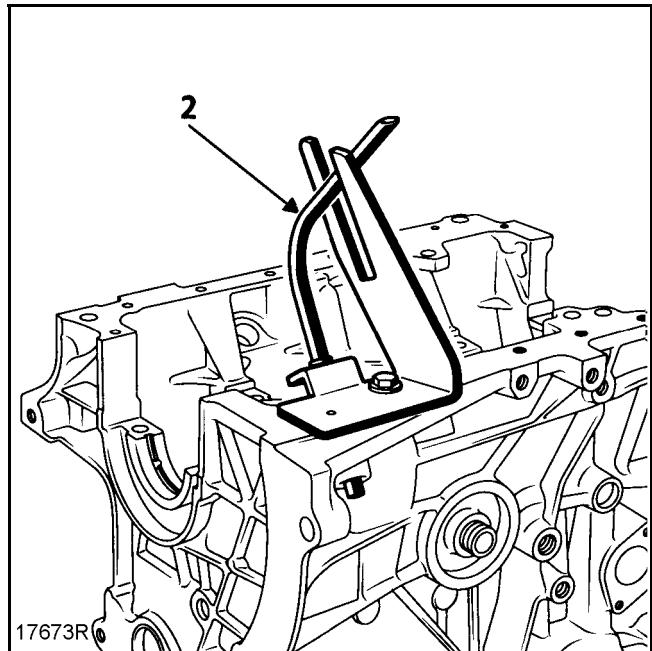
The pipe is fitted using **Mot. 1551**.



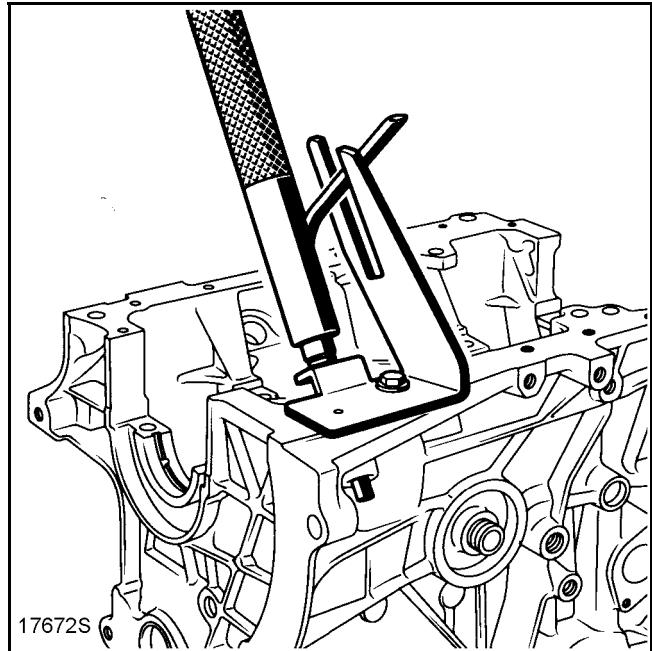
Fit the base (1) of **Mot. 1551** on the cylinder block (as shown in the diagram).



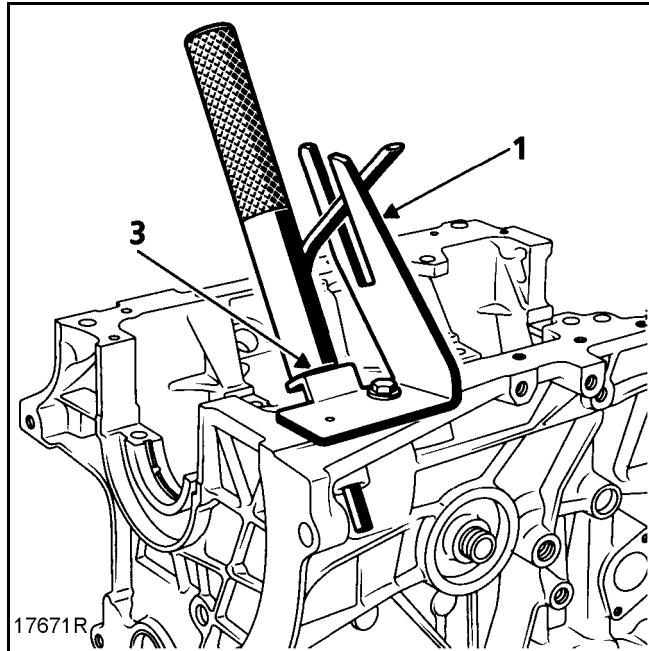
Slide the pipe (2) into the groove of the base of the tool.



Fit the snap fastener on the pipe collar.

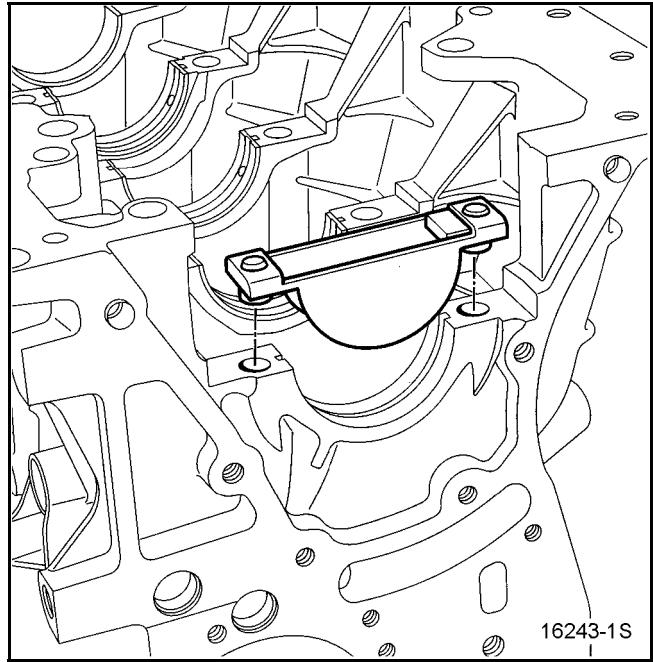


Tap the snap fastener using a hammer until the shoulder (3) of the snap fastener touches the base of the tool (1).

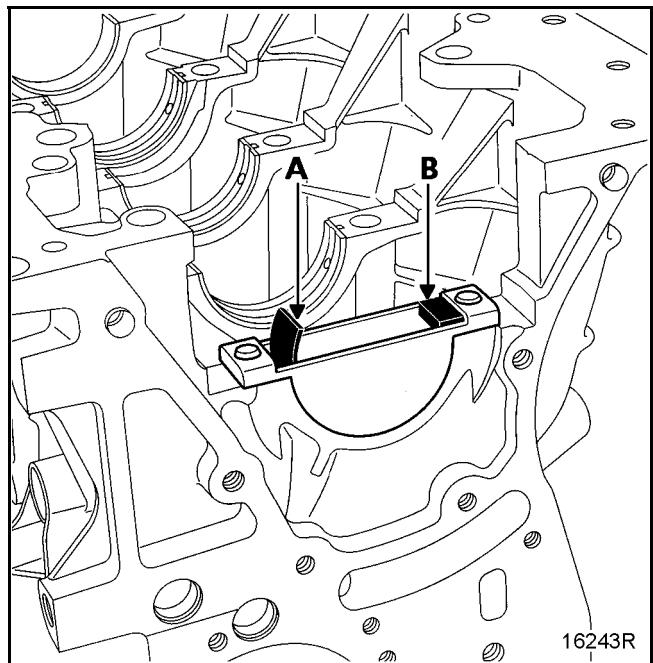


Fitting the bearings in the cylinder block

Position tool Mot. 1493 on the cylinder block.

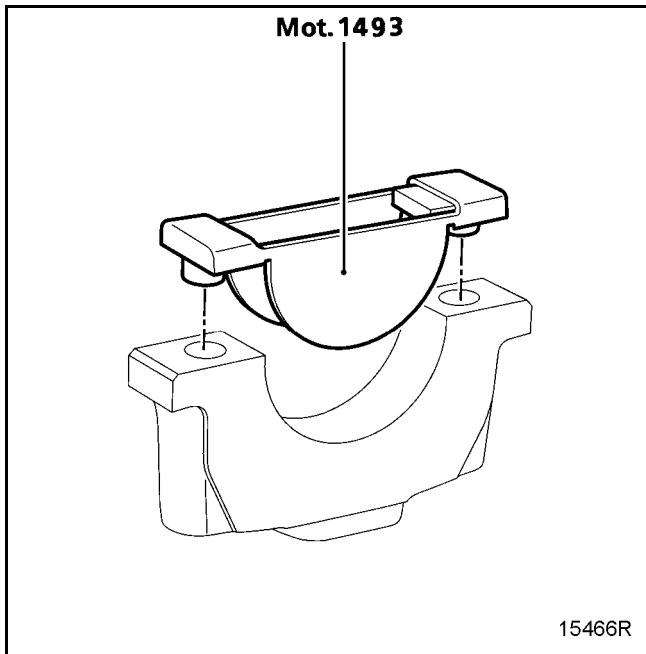


Fit the **grooved bearing shell** in tool Mot. 1493, then press at (A) until the bearing shell is touching tool Mot. 1493 at (B).



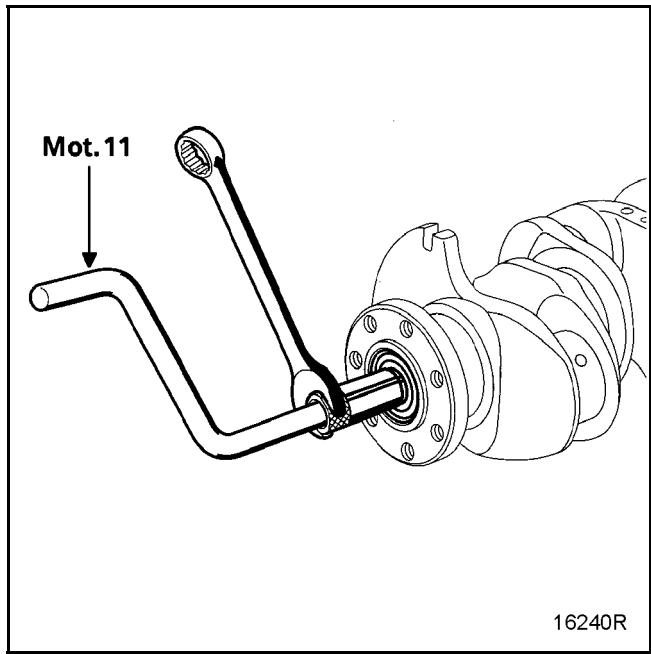
Fitting the bearing shells in the bearings

Position tool **Mot. 1493** on the bearing.

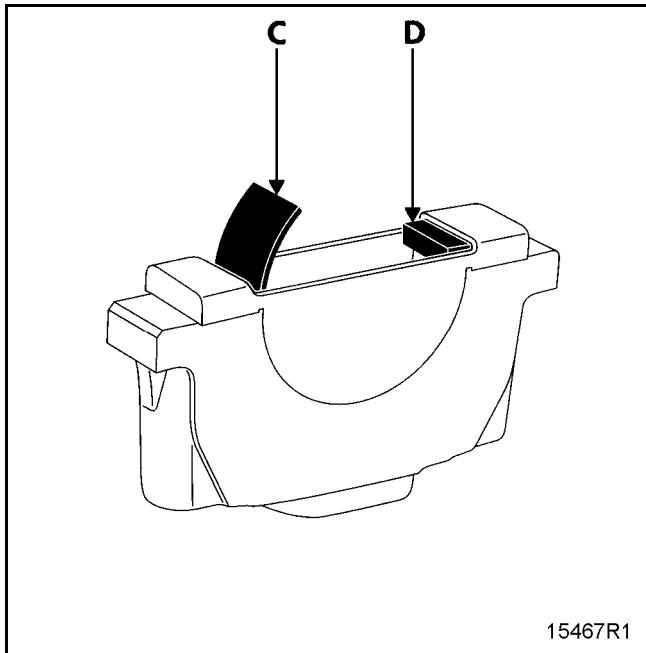


Replacement of the crankshaft bearing

The crankshaft bearing is extracted using **Mot. 11**.



Fit the **non-grooved bearing shell** in tool **Mot. 1493**, then press at (C) until the bearing shell is touching tool **Mot. 1493** at (D).



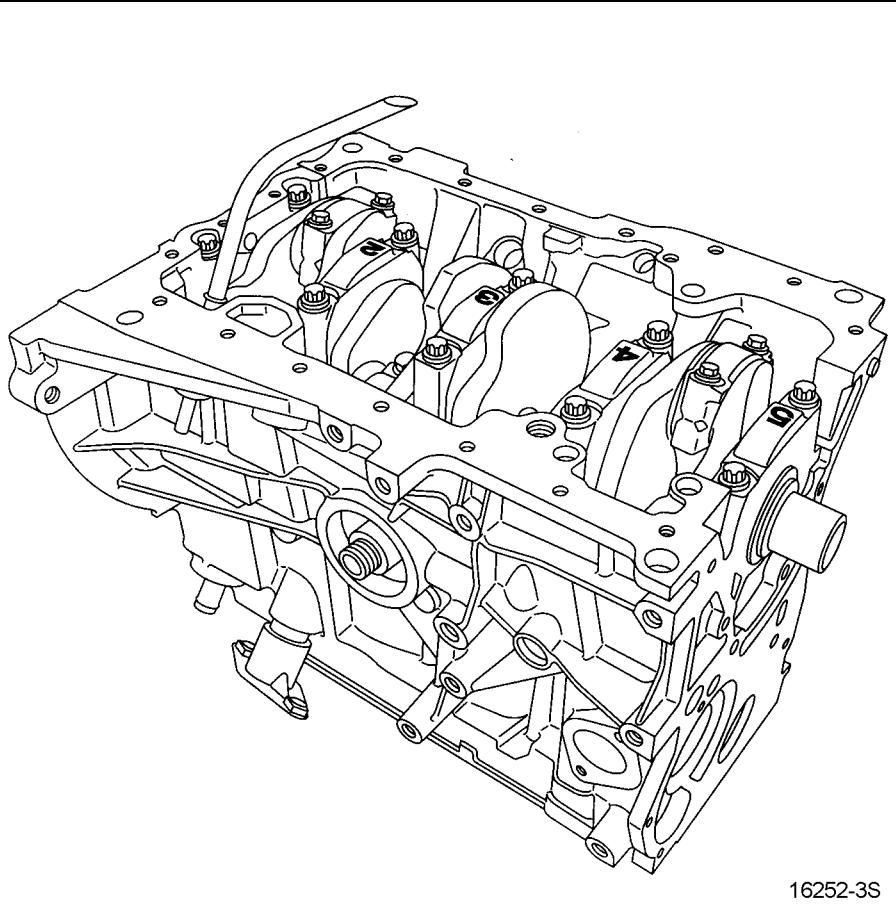
Overhauling the engine

Refit:

- the lateral crankshaft shims,
- the crankshaft.

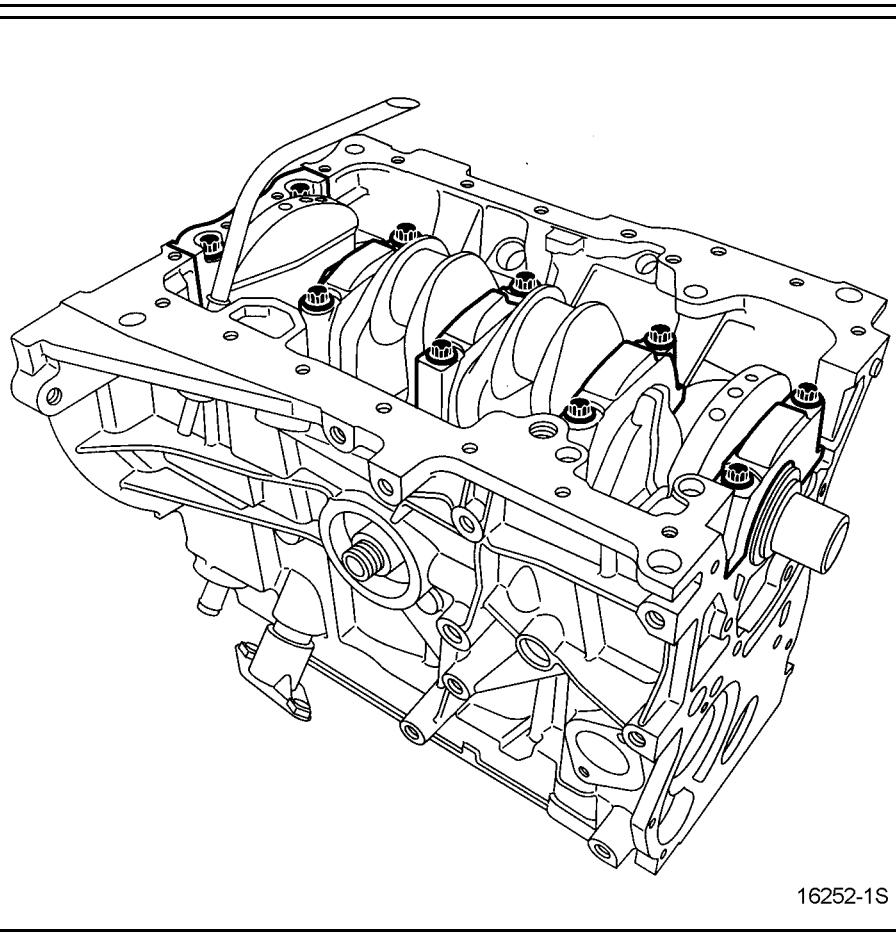
Oil the main journal bearings with engine oil.

Refit the crankshaft bearing caps **except cap N° 1** (the caps are numbered from **1** to **5** and position these numbers **opposite the oil filter side**).



16252-3S

Tighten the bolts to a torque of **2 daN.m** plus an angle of **$62^\circ \pm 4^\circ$** (tightening order 3 4 2 5 1).

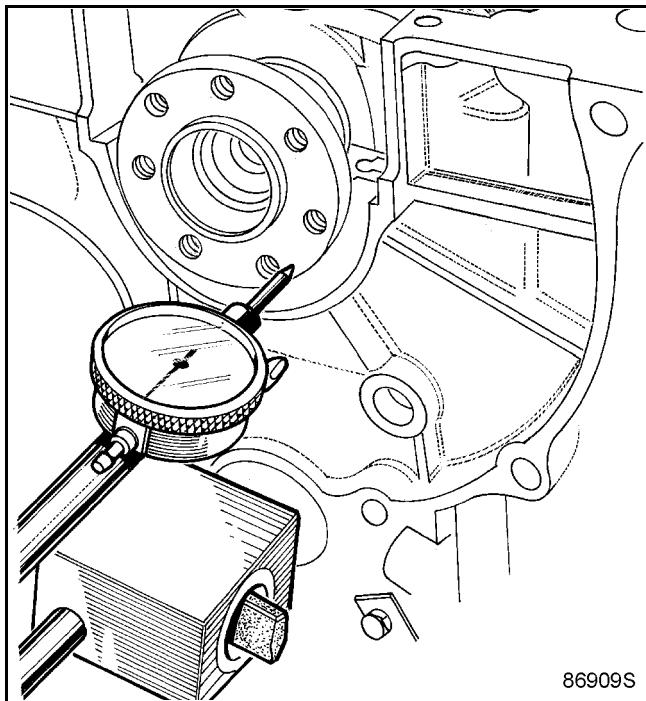


16252-1S

Overhauling the engine

Check the lateral clearance of the crankshaft which should be between **0.067** and **0.233 mm**.

Check that the crankshaft rotates freely.



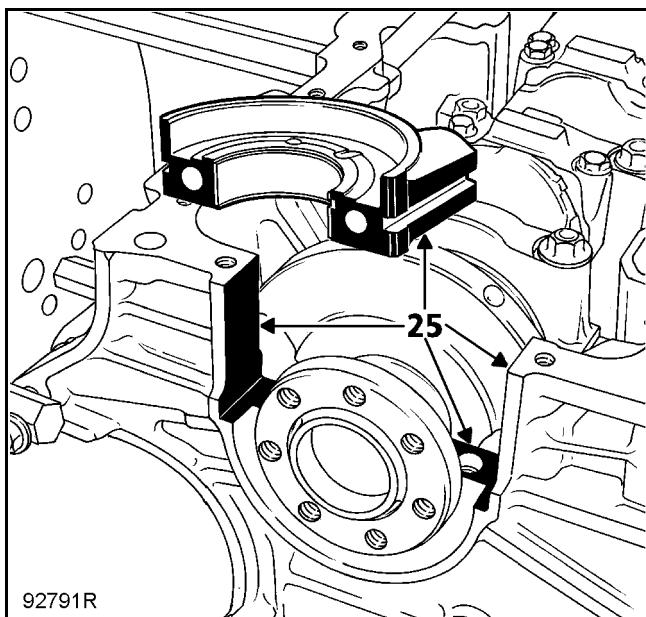
Fitting bearing N° 1 with silicon injection

IMPORTANT:

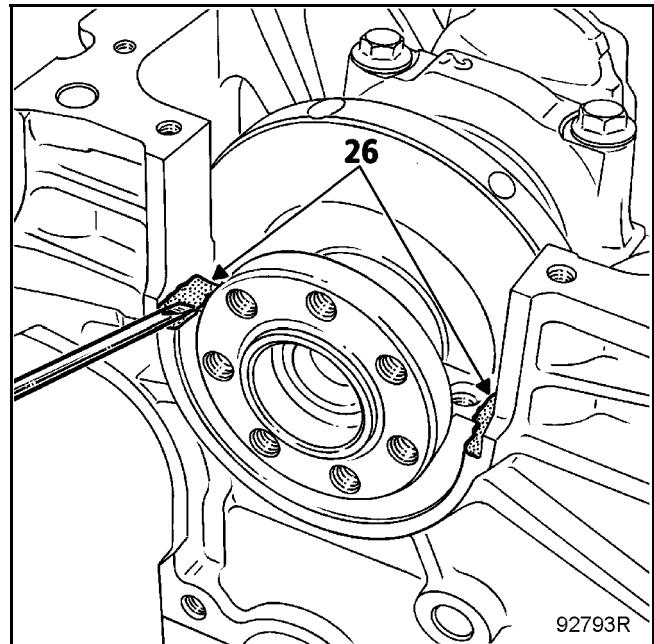
the mixture must be injected within approximately **5 minutes** to prevent it from polymerising in the syringe.

Clean the surfaces thoroughly at (25) of the cylinder block and the crankshaft cap, using a cloth soaked in cleaning thinner.

Allow to dry.

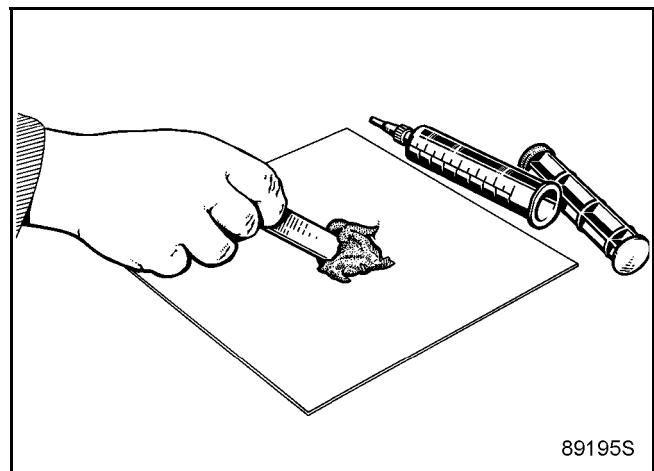


Coat the lower surfaces of the cylinder block at (26) with a thin layer of **RHODORSEAL 5661**.

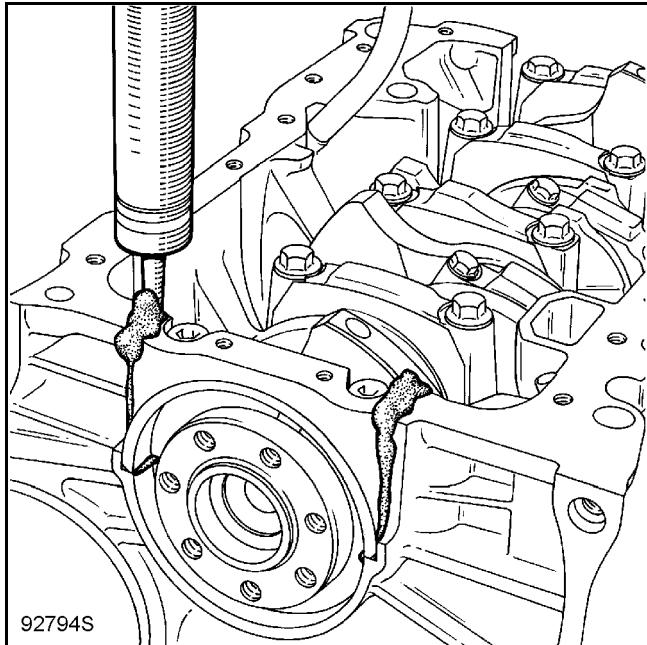


Install the crankshaft bearing cap and tighten it to a torque of **2 daN.m** plus an angle of **62° ± 4°**.

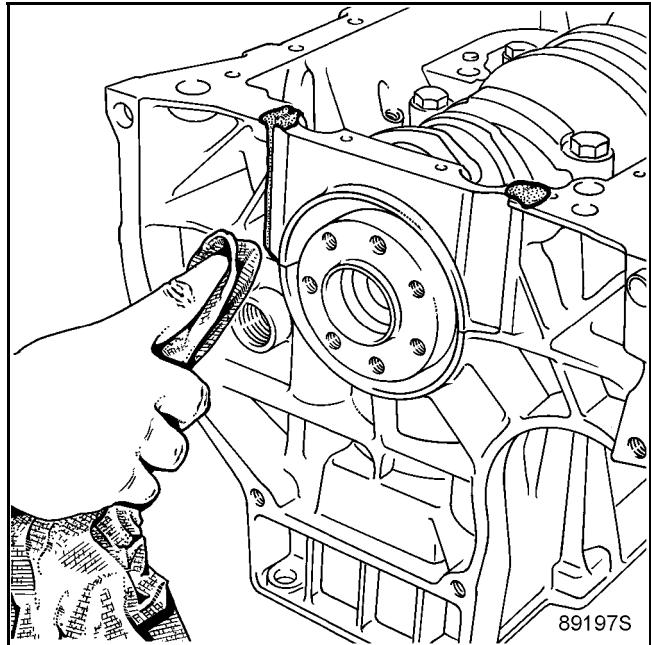
Mix **45 ml** of **RHODORSEAL 5661** (approximately half of a 100 gram tube) with half of the tube of hardener using the mixing stick to obtain a uniform, slightly pink mixture.



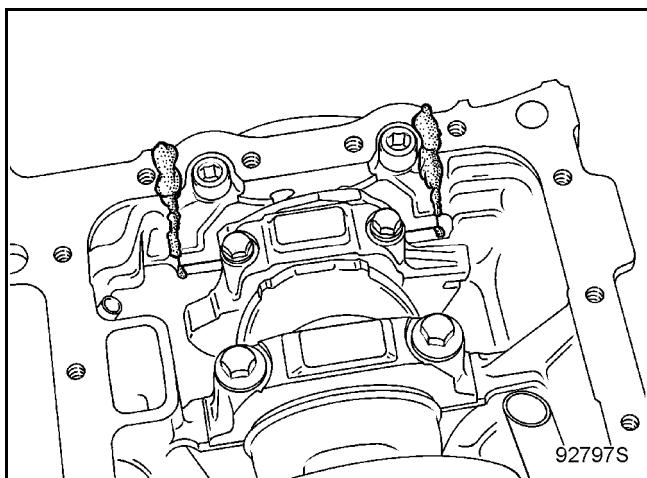
Insert the mixture into the syringe and inject it into the grooves of the crankshaft bearing cap.



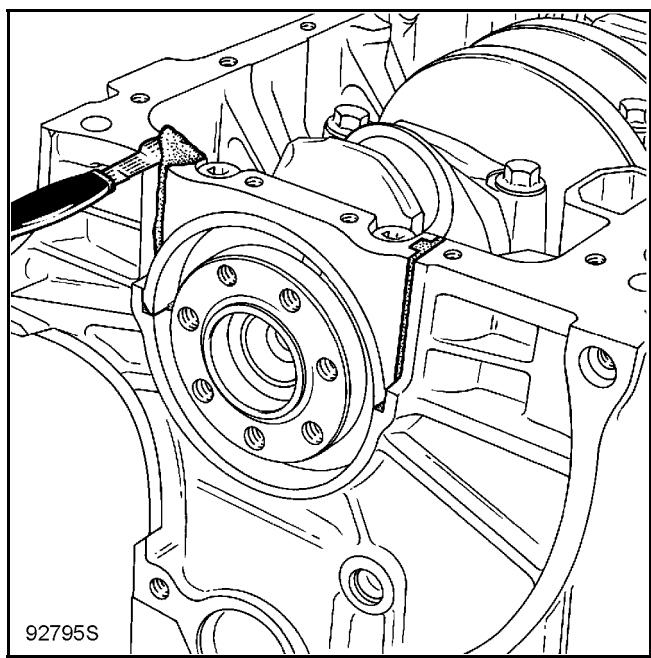
Using a cloth, wipe off the excess mixture, both inside and outside the cylinder block.



Allow the mixture to flow out slightly on either side of the grooves of the crankshaft bearing cap, to ensure that the injected mixture has totally filled the sealing groove.

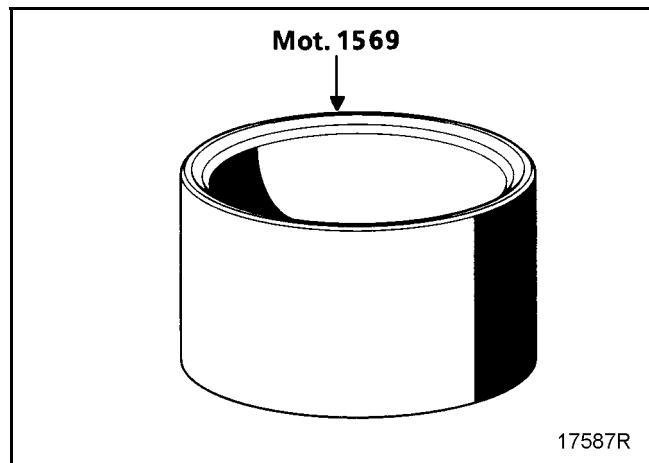


Allow to dry for a few moments and cut the excess off the gasket face.



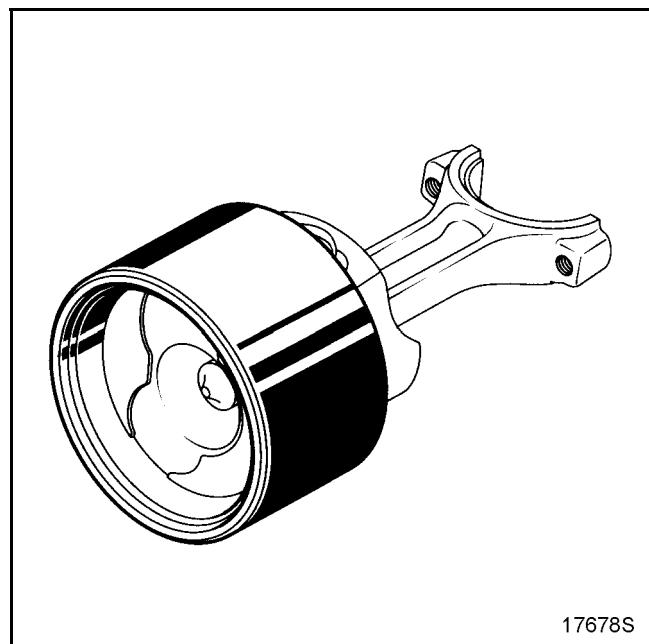
Fitting the pistons

The pistons are fitted using cone **Mot. 1569**.



Oil the pistons.

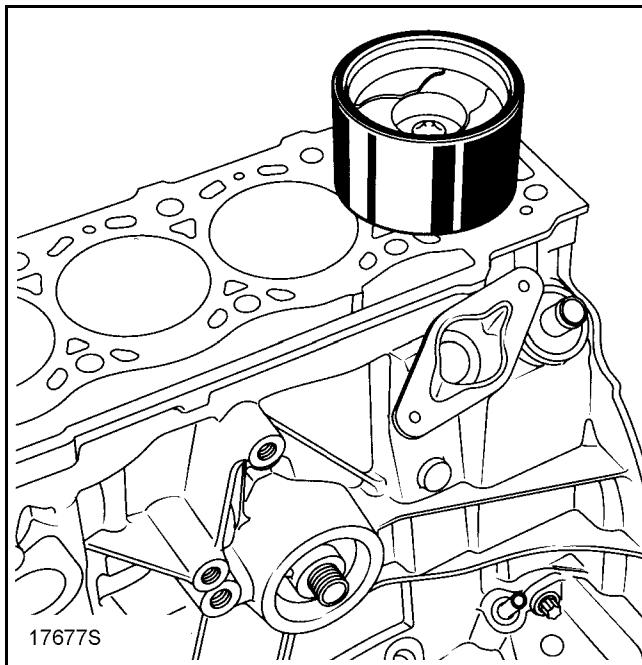
Fit the piston in the cone and allow the piston skirt to protrude from the cone by approx. **1 to 2 cm**.



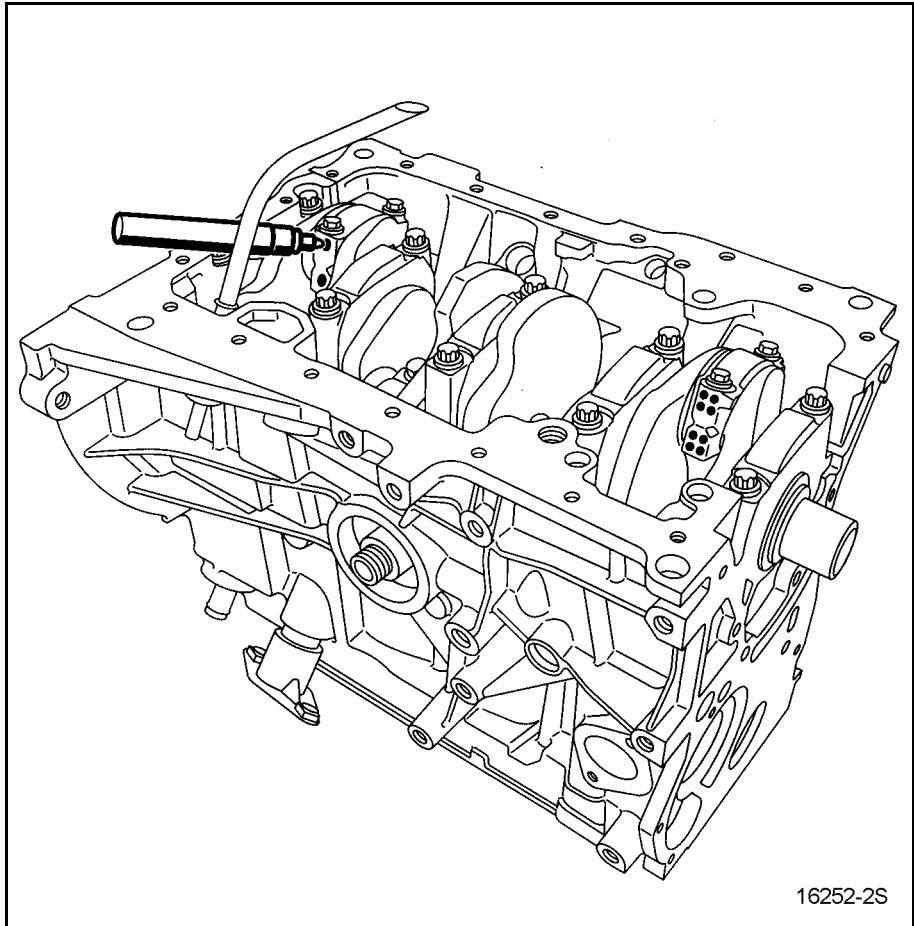
Overhauling the engine

Fit the piston-con rod assembly, fitted with the cone, on the cylinder block, paying attention to the direction (**the V towards the flywheel**). Then press the piston-con rod assembly into the jacket.

Fit the con rods onto the oiled big end journals of the crankshaft.

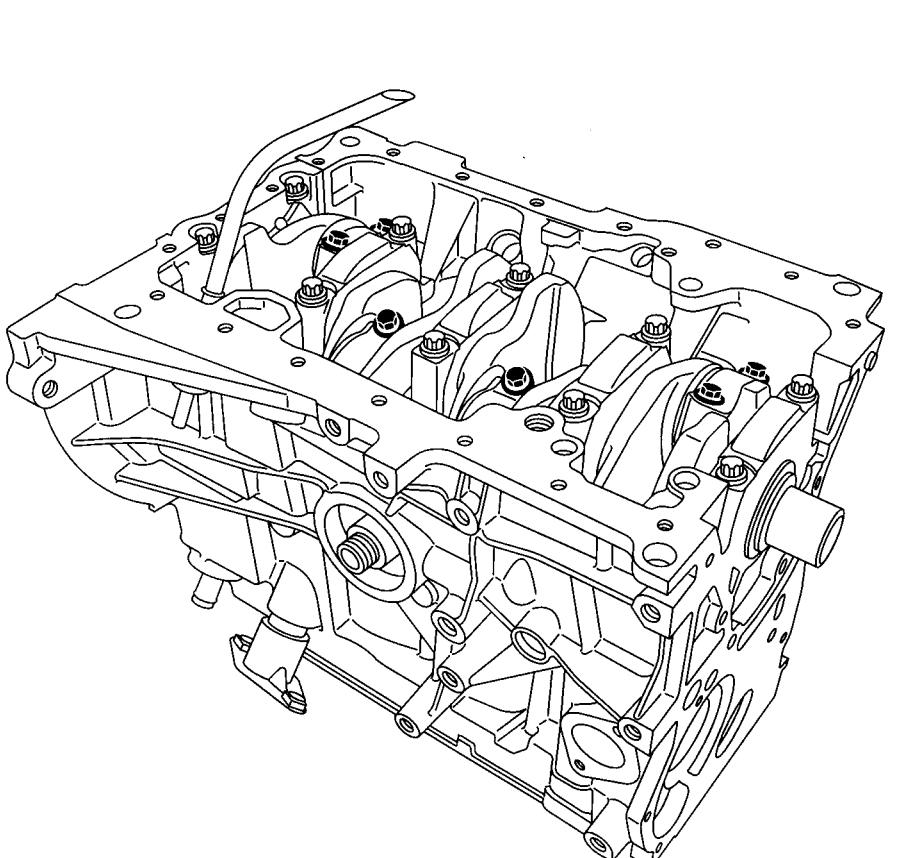


Fit the con rod caps, ensuring they are correctly matched (**marks made when dismantling**).



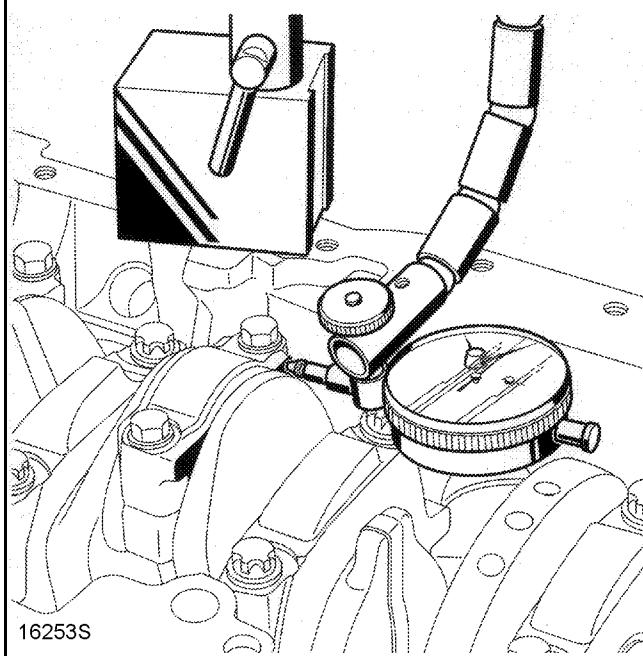
Overhauling the engine

Tighten the new bolts of the con rod caps to a torque of **2 daN.m**, then tighten to an angle of **$40^\circ \pm 6^\circ$** .



16252S

Check the lateral clearance of the con rod head, which should be between **0.22** and **0.482 mm**.



16253S

Checking piston protrusion

Clean the piston heads in order to eliminate any traces of deposits.

Turn the crankshaft one turn in its operating direction to bring piston **No. 1** close to top dead centre.

Fit tool **Mot. 252-01** on the piston.

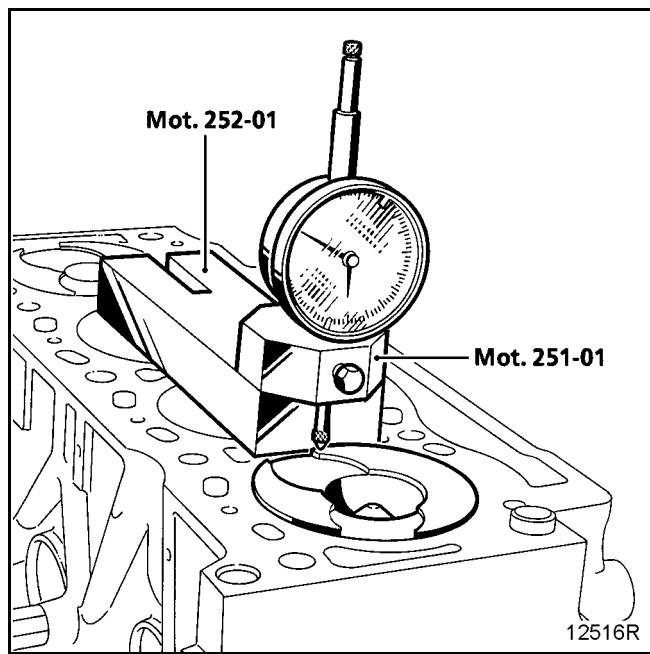
Fit tool **Mot. 251-01** equipped with a gauge on its base plate **Mot. 252-01**, and find top dead centre of the piston.

NOTE:

All measurements are to be carried out in the longitudinal axis of the engine, in order to eliminate any errors due to tilting of the piston.

WARNING:

the gauge detector must not be in the valve clearance.



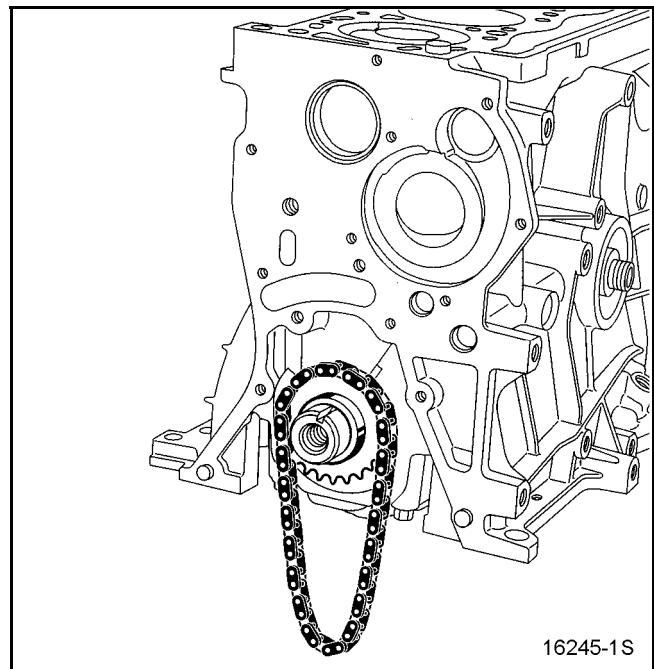
Measure the piston protrusion.

The protrusion must be: **0.56 ± 0.06 mm**.

NOTE:

To prevent any risk of piston/valve interference when the engine is running, the piston protrusion value must be less than 0.67 mm.

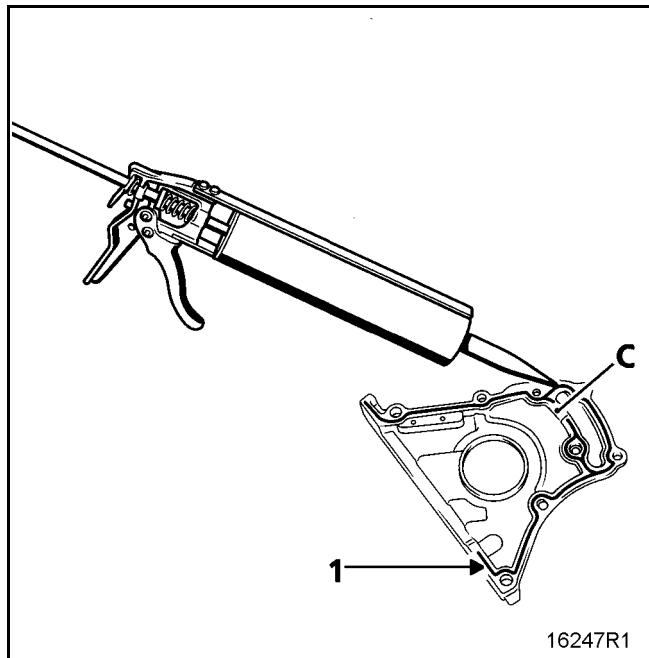
Refit the oil pump chain.



Crankshaft closure panel sealing

There are two possible solutions:

- Either it is sealed with **RHODORSEAL 5661**; the band (1) must be **1.75 mm** wide and be applied as shown in the drawing below.
Be careful not to obstruct the pipes (C).



- Or it is performed with a seal consisting of a steel sheet coated with elastomer on both sides.

NOTE:

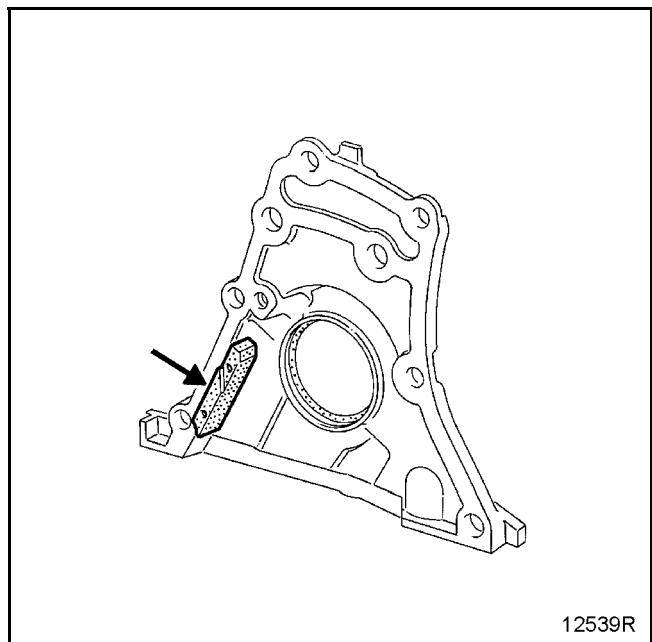
This type of seal projects from the plate. It should in no case be cut out, because the two projecting tabs provide sealing when the sump is fitted.

Oil pump chain guide

There are likewise two possible solutions:

For engines equipped with a water pump driven by the timing belt (water pump moved).

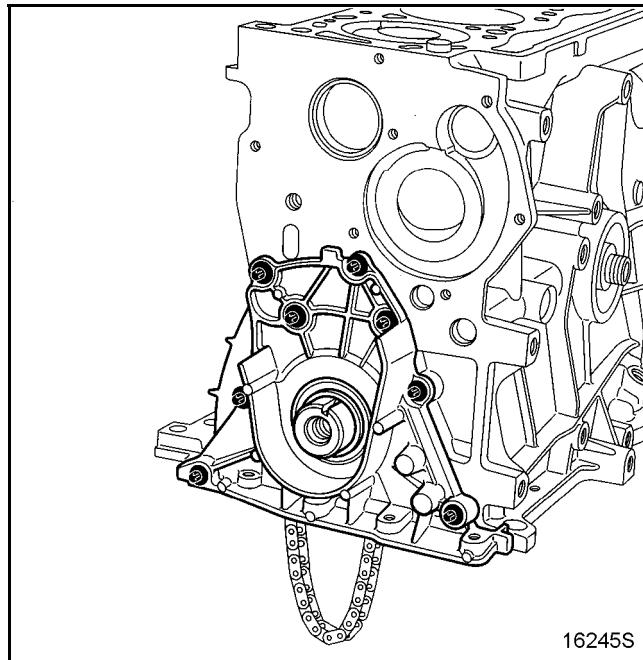
In this case, check presence of oil pump chain guide.



For engines equipped with a water pump driven by the accessories belt (water pump not moved).

In this case, the oil pump chain guide is no longer of any use.

Refit the closure panel, tightening the bolts to a torque of **1.4 daN.m.**



REFITTING THE LOWER ENGINE

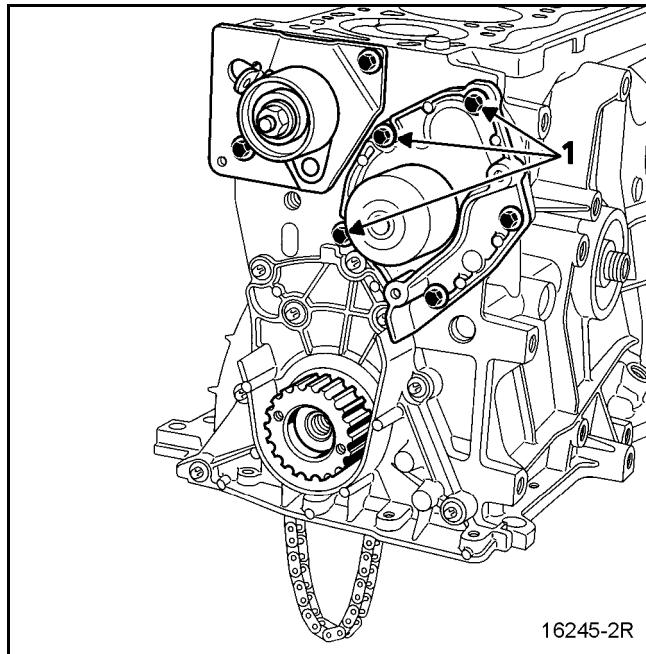
Engine fitted with a water pump driven by the timing belt.

NOTE:

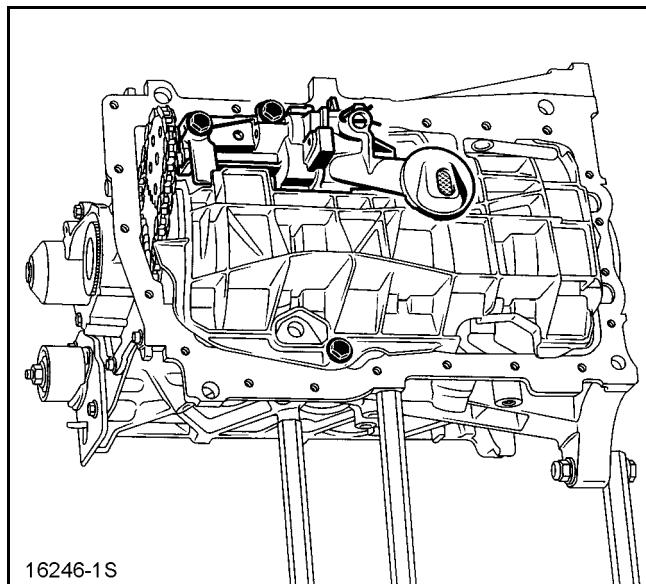
Put a drop of Loctite FRENETANCH on bolts (1).

Refit:

- the water pump fitted with a new seal, tightening the bolts to a torque of **1 daN.m**,
- the tensioner support plate, tightening the bolts to a torque of **1 daN.m**,

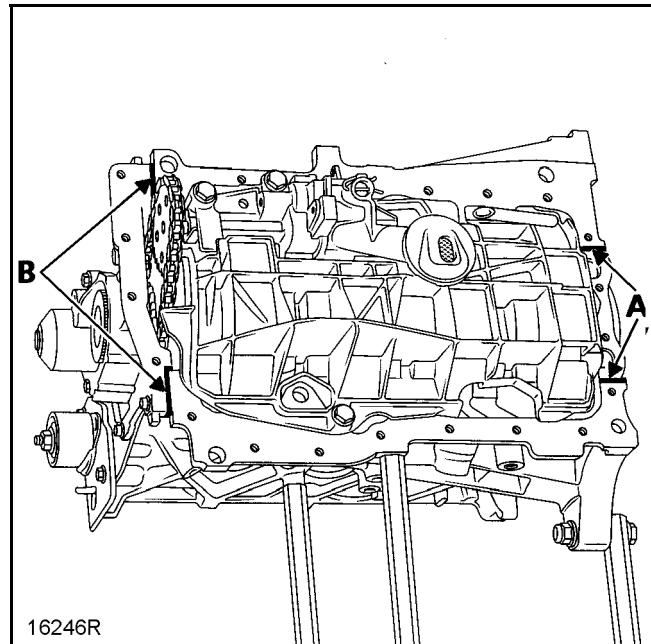


- the anti-emulsion plate,
- the oil pump, tightening the bolts to a torque of **2.4 daN.m**,



If sealing of the closure panel has been performed with **RHODORSEAL 5661**:

- Apply a drop of **RHODORSEAL 5661** to (A) (on either side of bearing No. 1), and at the intersection of the crankshaft closure panel and the cylinder block at (B).



If sealing of the closure panel has been performed with the gasket consisting of a steel sheet coated with elastomer:

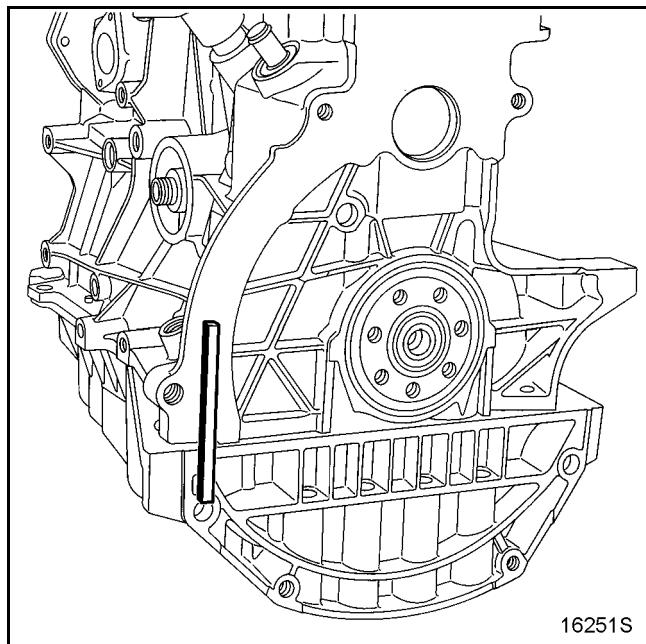
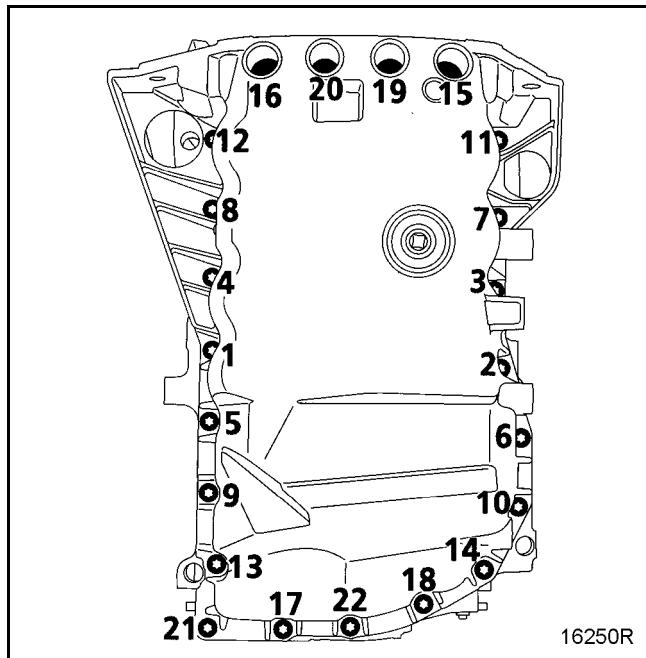
- Apply a drop of **RHODORSEAL 5661** to (A) (on either side of bearing No. 1).

NOTE:

For side (B), sealing will be implemented by the plate gasket. This type of gasket projects from the plate and it should in no case be cut out, because the two projecting tabs provide sealing when the sump is fitted.

Refit the sump with a new gasket, pre-tightening it to a torque of **0.8 daN.m**, then finally tightening it to a torque of **1.5 daN.m** in the recommended order.

The alignment of the cylinder block and the sump must be complied with on the **flywheel side** to prevent the clutch housing from being damaged when fitting the gearbox.



Fitting the crankshaft seal gaskets

GENERAL INFORMATION

Change of material on the engine elastomer seals (fitted on the crankshaft).

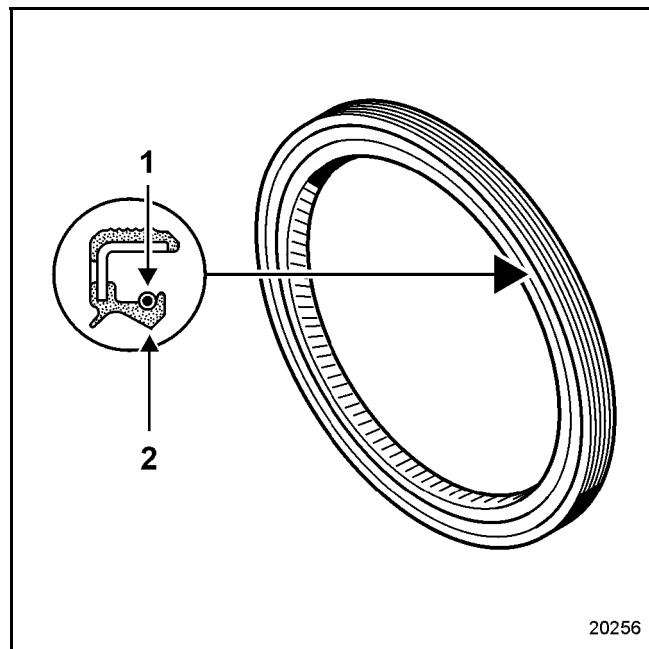
Fitting and removing the new type elastomer seal from the engine requires new tools and precautions compared to the old type seal.

The old and new type of seal can both be used on the same engine. **They are not interchangeable. Old type seals must be replaced with old type seals** (still available from the Parts Department), and **a new type seal with a new type seal**.

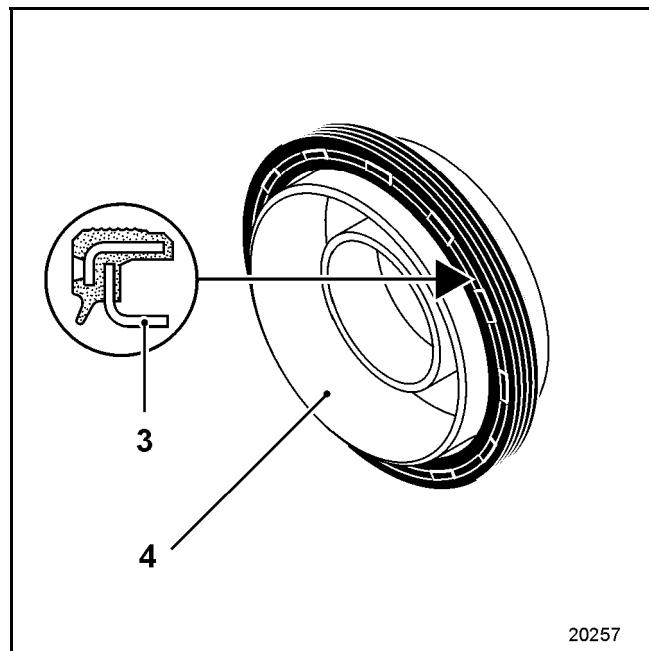
An old type seal can be replaced with a new type seal in the case of a crankshaft replacement. This is possible if the engine is fitted with one during its lifetime in series production.

Old and new seals are easily recognized.

The old elastomer seal is fitted with a spring (1) and has a "V"-shaped sealing lip (2).



The new elastomer seal has a flat sealing lip (3) and a protector (4) which also assists in fitting the seal to the engine.



Tooling required for fitting old type elastomer seals.

Engine type	Tool for the crankshaft seal	
	Timing end	Flywheel end
F9Q	Mot. 990-03	Mot. 991-01

Tooling required for fitting new type elastomer seals.

Engine type	Tool for the crankshaft seal	
	Timing end	Flywheel end
F9Q	Mot. 1636	Mot. 1635

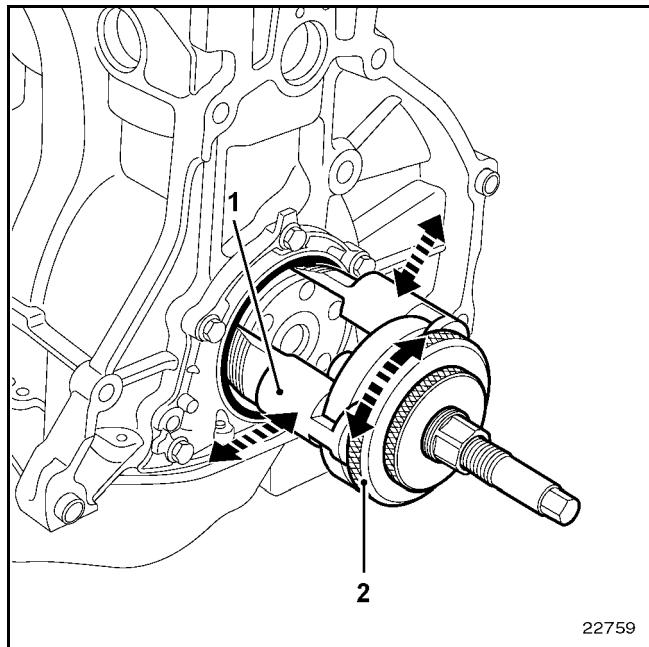
Tooling required for removing new type elastomer seals.

Engine type	Tool for the crankshaft seal	
	Timing end	Flywheel end
F9Q	Mot. 1577	Mot. 1579

Method for removing elastomer seals

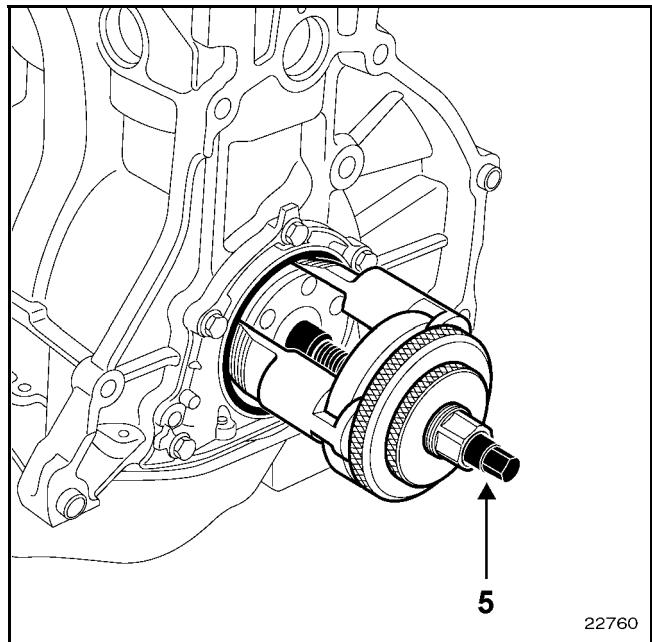
This procedure is applicable for crankshaft seals.

Fit the extractor tool onto the shaft by adjusting plungers (1) to the shaft diameter with knurled back-plate (2).

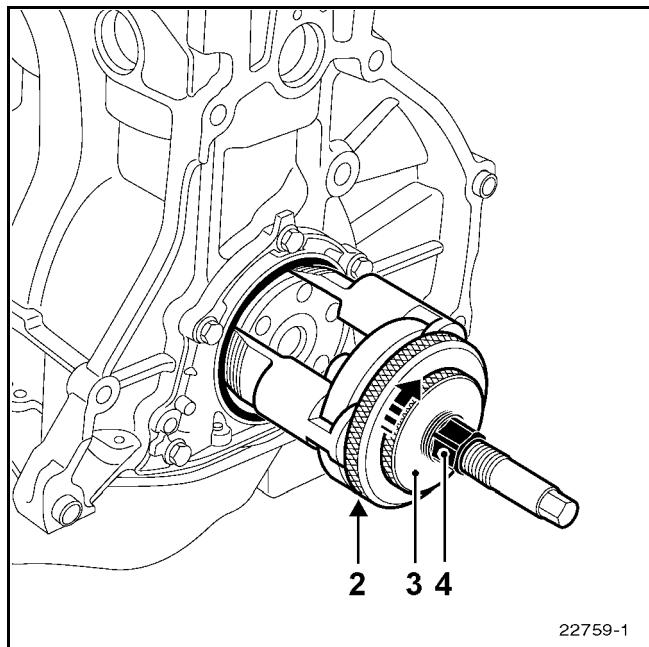


Screw extractor tool into the seal using hexagon bar (4).

Extract the seal by tightening threaded rod (5).



Tighten knurled back-plate (3) until it locks on knurled back-plate (2) to keep the plungers correctly adjusted on the shaft.

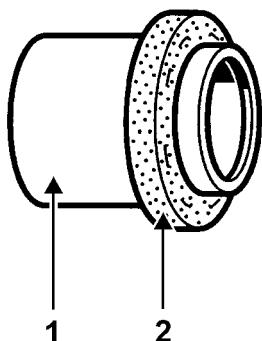


Method for fitting new type elastomer seals.

IMPORTANT:

This type of seal is extremely **FRAGILE**. Only touch the protector part (1) when handling the gasket. It is strictly forbidden to touch the seal (2). This is to ensure that there will be no oil leaks once the gasket is fitted on the engine.

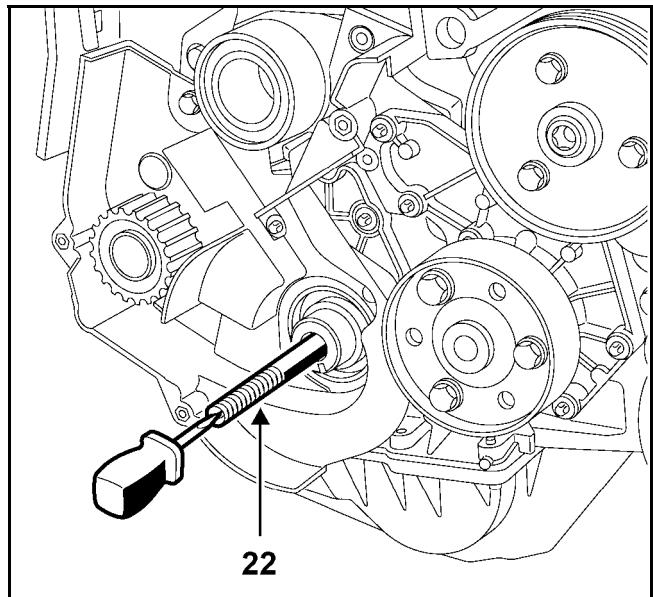
This new seal must be fitted using the tooling mentioned previously.



18687

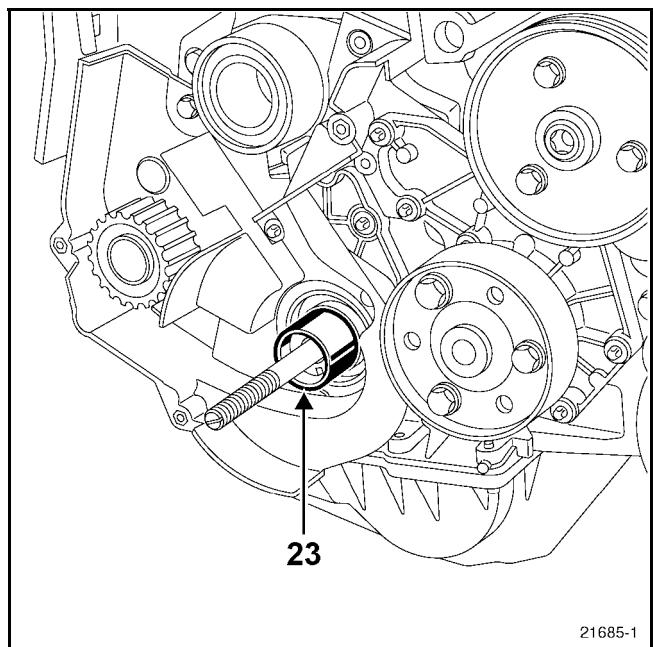
Crankshaft elastomer seal (timing end)

Screw the threaded rod (22) of Mot. 1636 into the crankshaft.



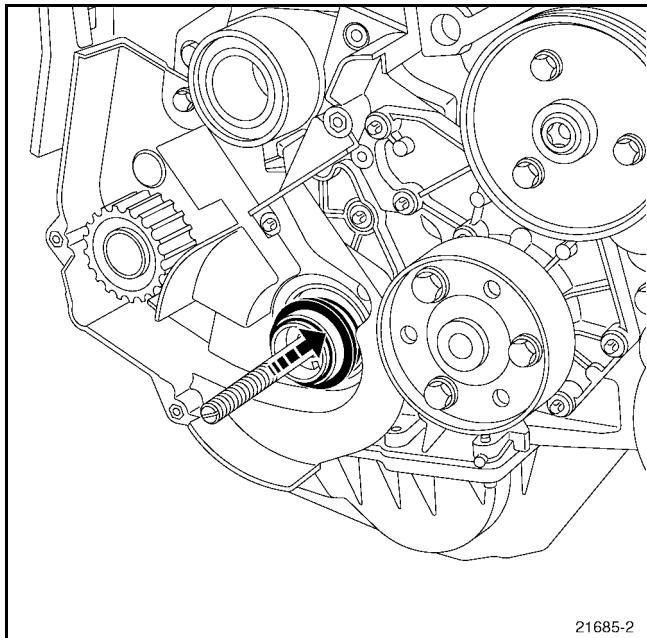
21685

Fit spacer (23) of Mot. 1636 to the crankshaft.

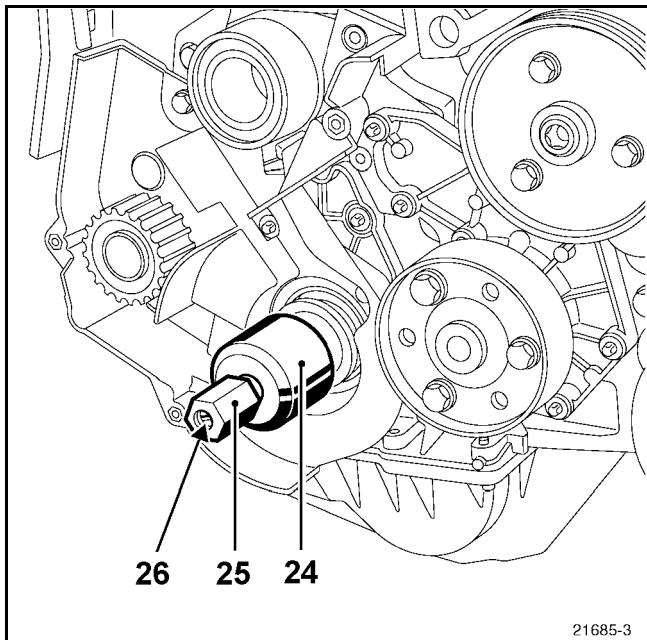


21685-1

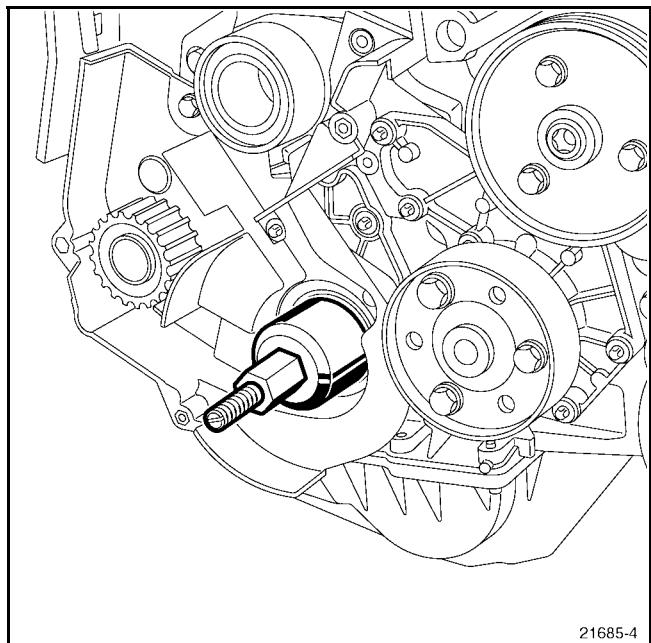
Fit the protector complete with the seal onto the spacer, taking care not to touch the seal.



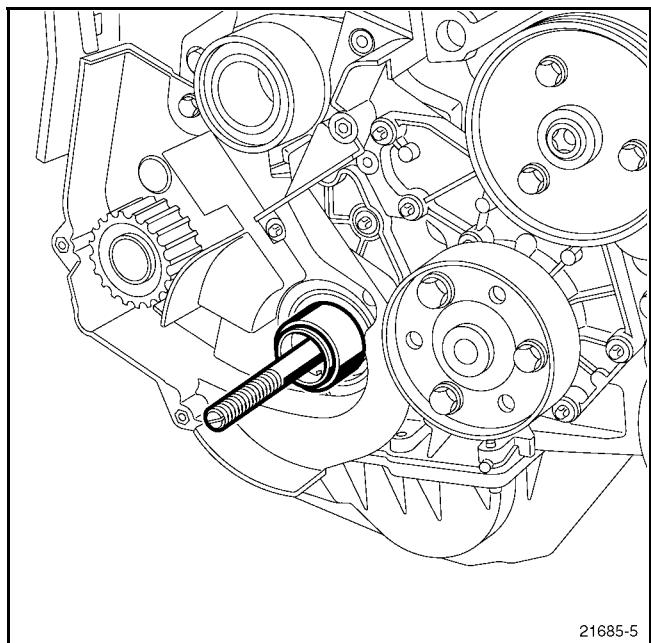
Fit cup (24) and nut (25) (putting threaded hole (26) of the nut on the side facing away from the engine) of Mot. 1636.



Tighten the nut until the cover touches the spacer.

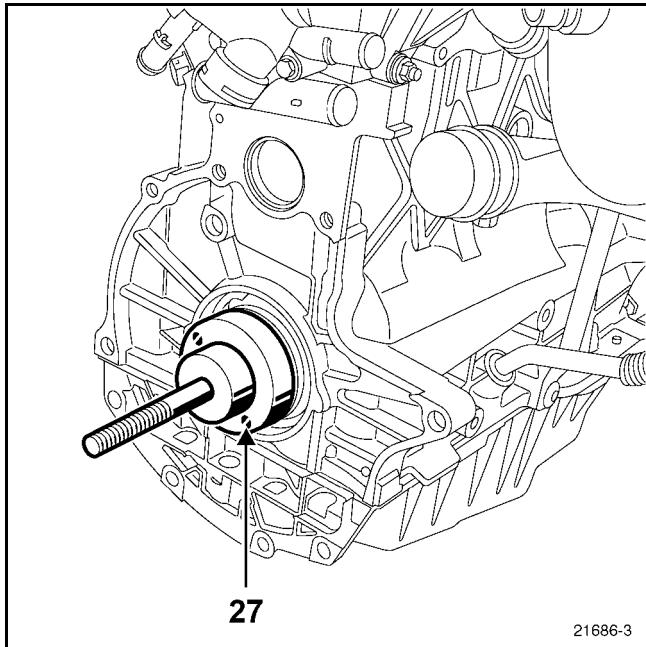


Remove the nut, the cup, the protector, the spacer and the threaded rod.

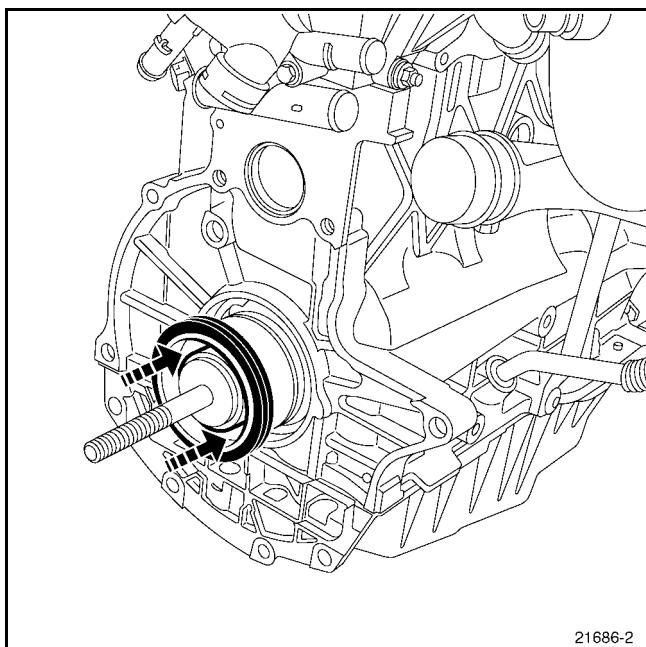


Crankshaft elastomer seal, flywheel end

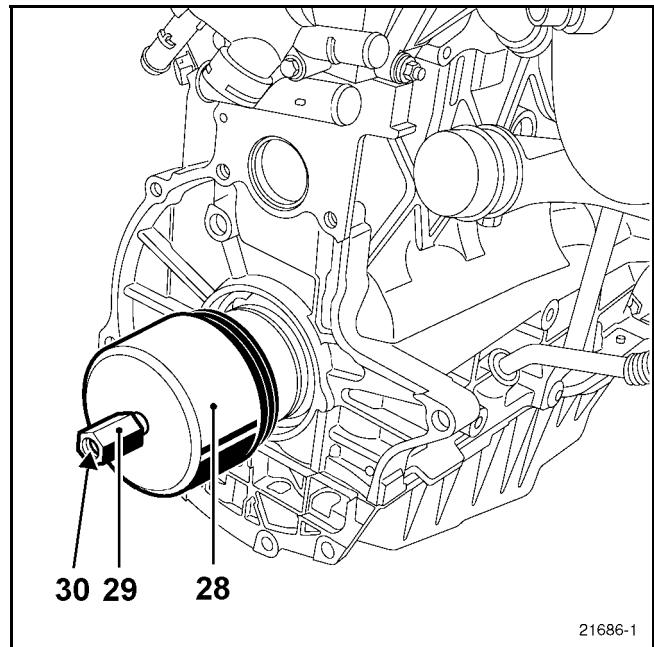
Install tool **Mot. 1635** on the crankshaft, attaching it with bolts (27).



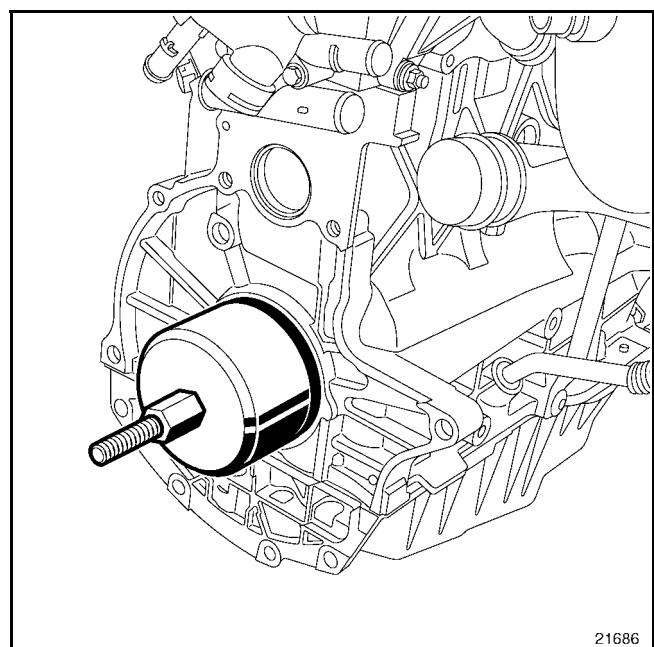
Fit the protector complete with the seal onto tool **Mot. 1635**, being careful not to touch the seal.



Fit cup (28) and nut (29) (putting the threaded hole (30) of the nut on the side facing away from the engine) of **Mot. 1635**.



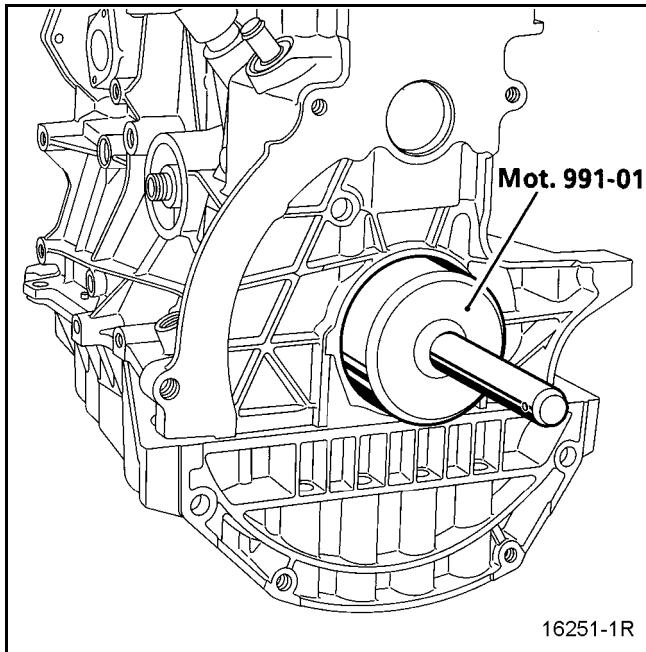
Tighten the nut until the cup makes contact with the base plate of **Mot. 1635**.



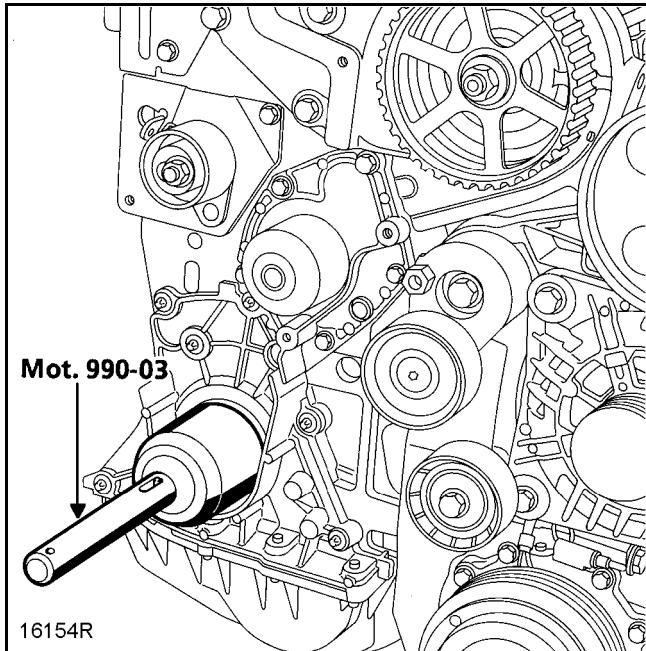
The method for fitting old type seals remains unchanged.

Fitting old type crankshaft seal gaskets

– Flywheel side, use tool **Mot. 991-01**,



– Timing side, use tool **Mot. 990-03**.

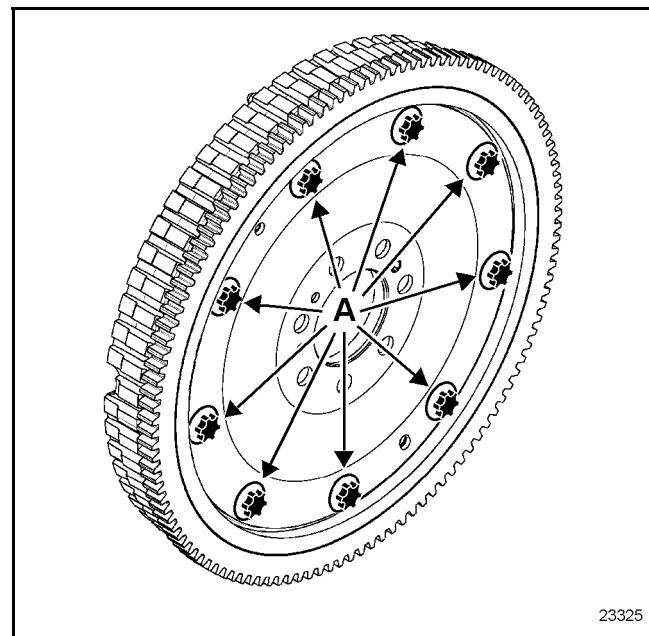


Lock the flywheel with tool **Mot. 582-01** or **Mot. 1677** depending on the cylinder block (large or small side).

Refit the flywheel, tightening the new bolts to a torque of **2 daN.m**, then **tighten to an angle of $70^\circ \pm 7^\circ$** .

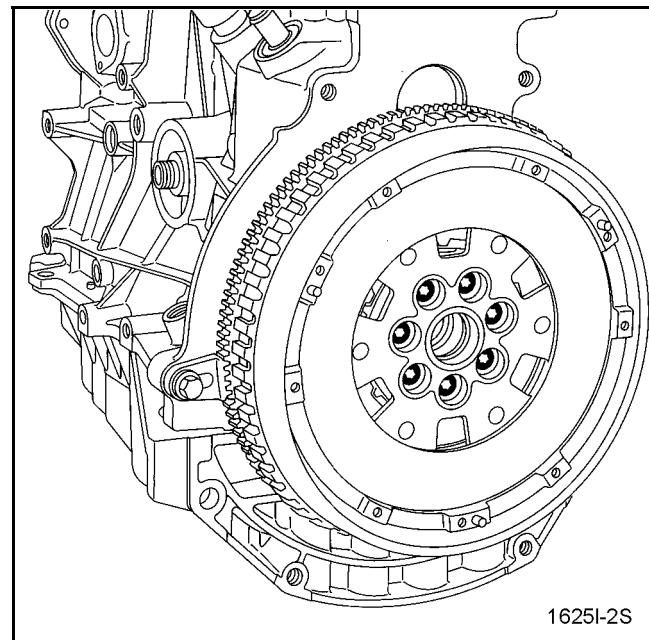
If the flywheel is flexible, tighten the new type bolts to a torque of **3 daN.m** et then turn them through an angle of **$35^\circ \pm 6^\circ$** .

Flexible flywheel:

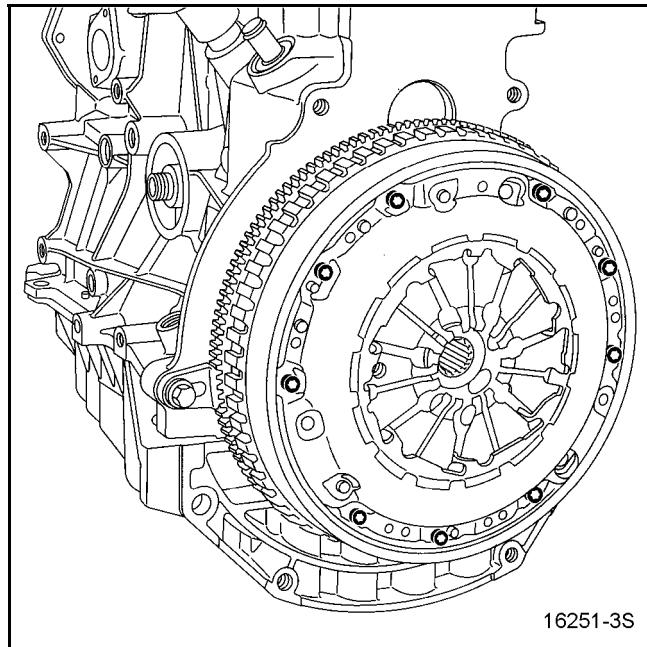


NOTE:

Under no circumstances should bolts (A) be removed.



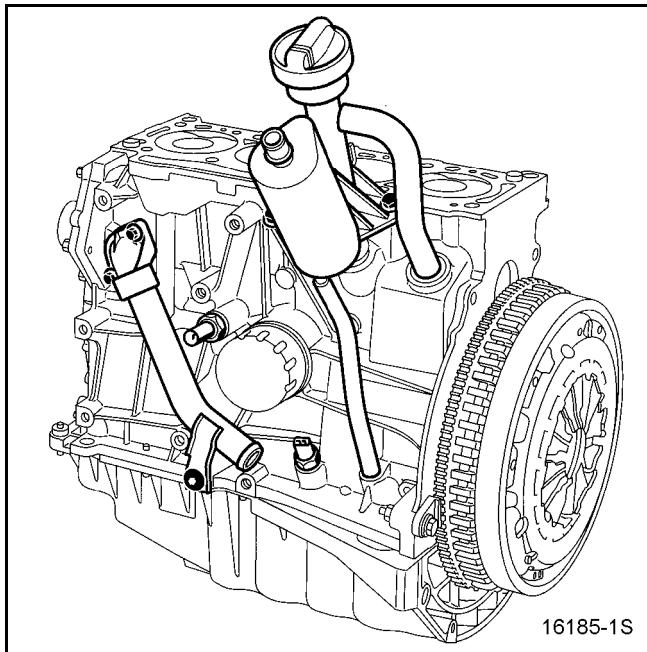
Refit the clutch, tightening the bolts to a torque of
2 daN.m.



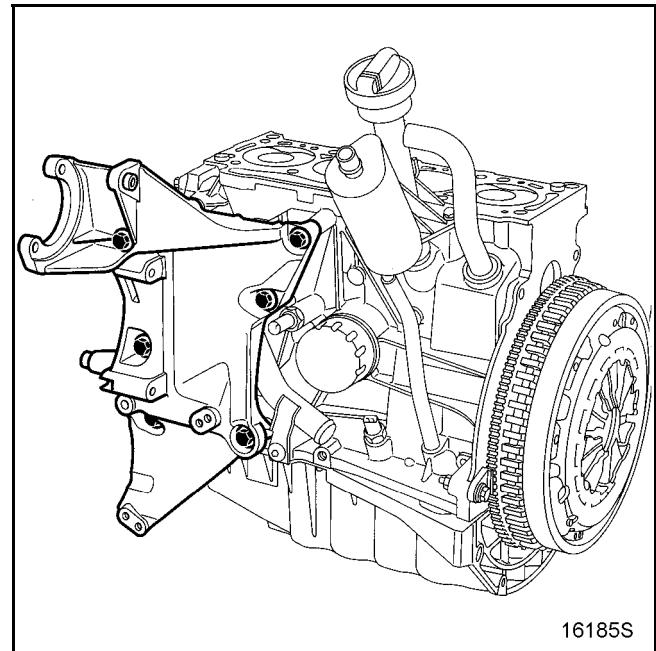
Withdraw the flywheel immobiliser **Mot. 582-01** or
Mot. 1677.

Refit:

- the oil decanter fitted with a new seal by tightening the bolts to a torque of **1 daN.m**,
- the oil heat exchanger,
- the oil filter,
- the oil pressure sensor by tightening to a torque of **3.8 daN.m**,
- the oil level sensor by tightening it to a torque of **3 daN.m**,
- the coolant pipe by tightening the bolt to a torque of **4 daN.m**,
- the coolant pump inlet pipe fitted with a new seal, by tightening the bolts to a torque of **1 daN.m**,

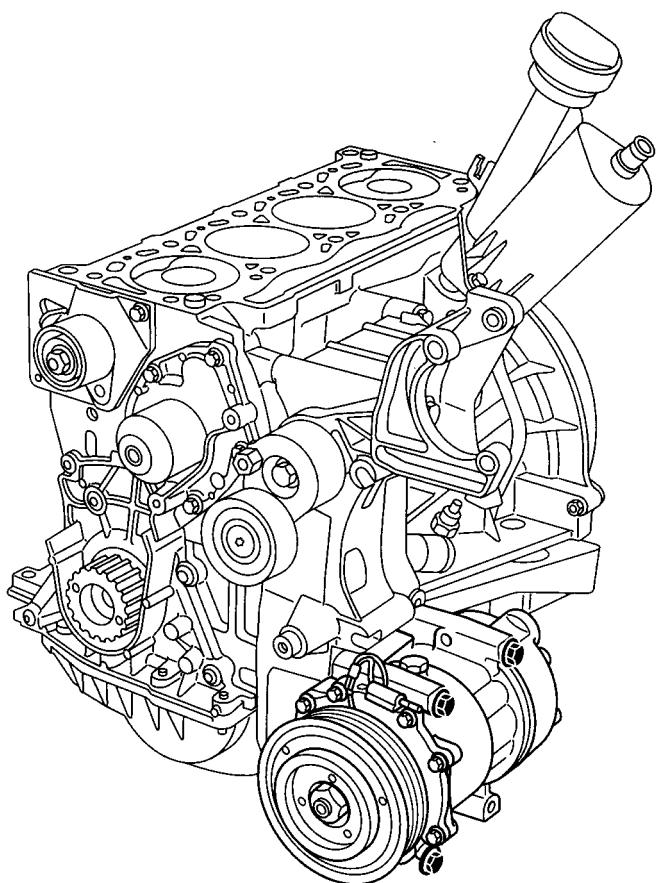


- the multifunction support by tightening the bolts to a torque of **5 daN.m**,



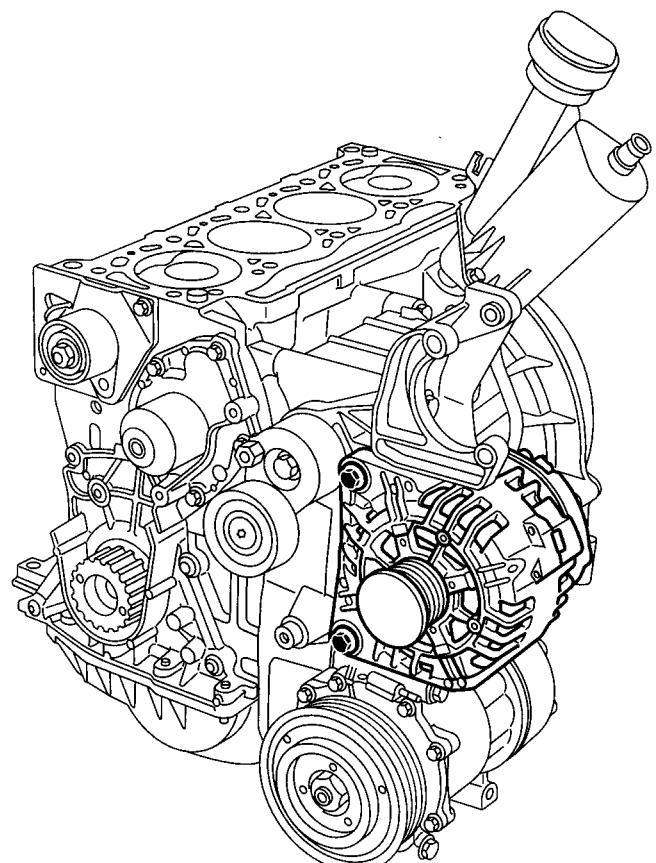
Refit:

- the air conditioning compressor, tightening the bolts to a torque of **2.5 daN.m**,



16184-2S

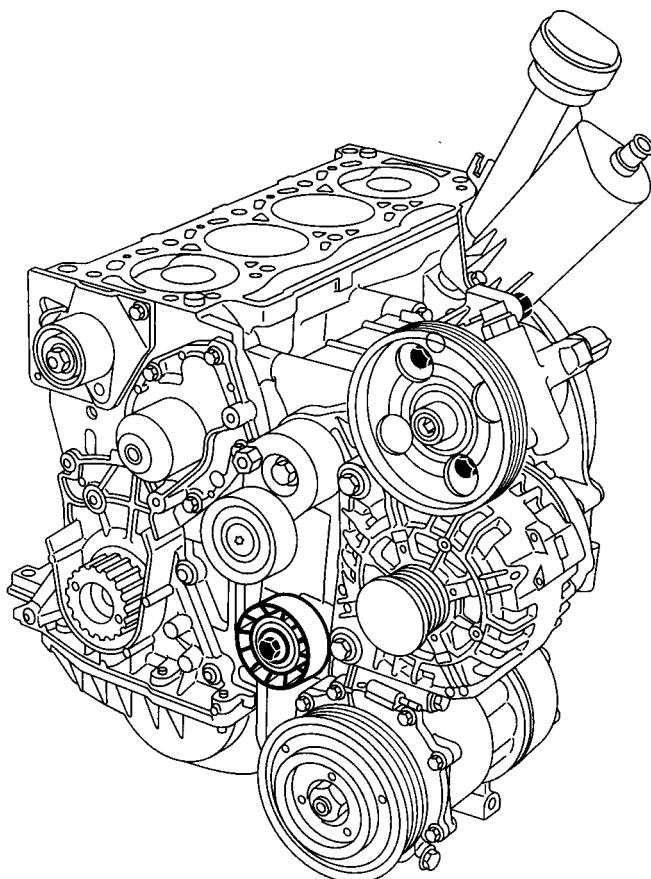
- the alternator, tightening the bolts to a torque of **2.5 daN.m**.



16184-1S

Refit:

- the power assisted steering pump by tightening the bolts to a torque of **2.5 daN.m**,
- the accessories roller tensioner by tightening the bolts to a torque of **2.5 daN.m**.



16184S

Overhauling the engine

REFITTING THE UPPER ENGINE

Refitting the cylinder head

Position the pistons at mid-stroke.

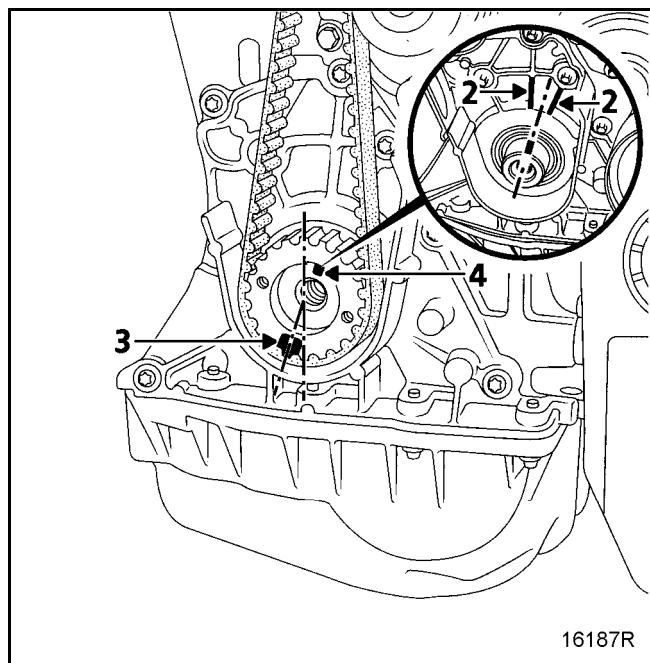
Fit the cylinder head gasket using the centring sockets of the cylinder block.

Tighten the cylinder head (see the Cylinder head characteristics).

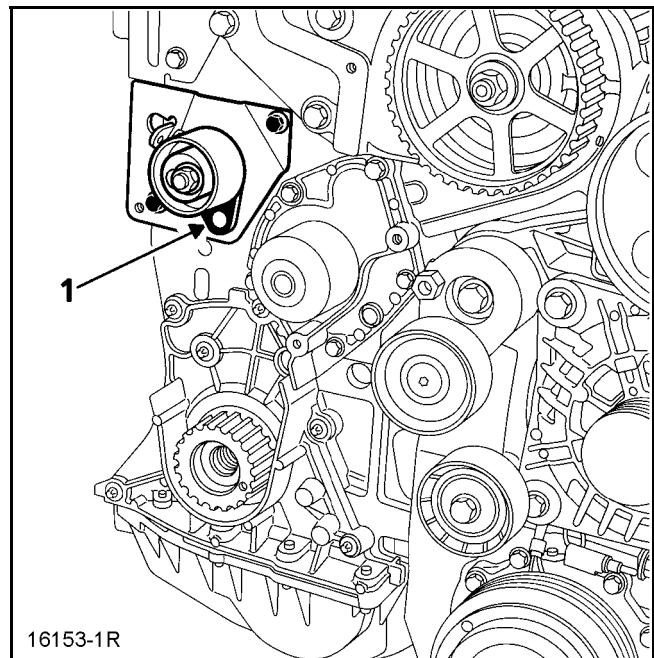
Timing adjustment

Check that pin **Mot. 1054** is in place.

The notch (4) in the crankshaft must be located in the middle of the two grooves (2) on the crankshaft closure housing. The mark (3) of the crankshaft timing sprocket should be moved to the left by one notch of the engine vertical axis.

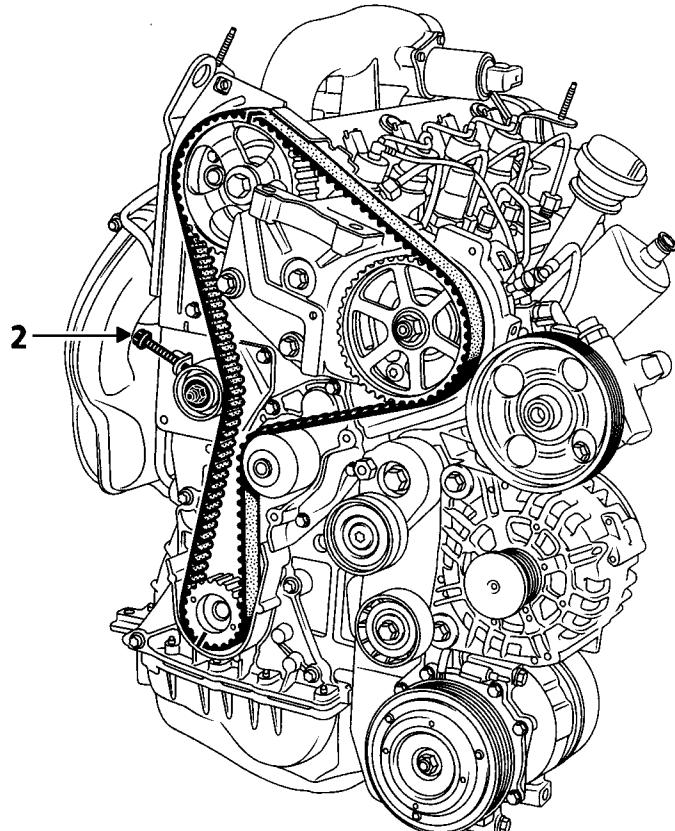


Check that the tensioner is securely positioned on the pin (1).



Fit the timing belt, aligning the marks on the belt with the marks on the camshaft and crankshaft sprockets (**77 teeth between the two marks on the belt**).

Place the tensioner against the belt by tightening bolt (2) on the tensioner mounting.



16151-4R

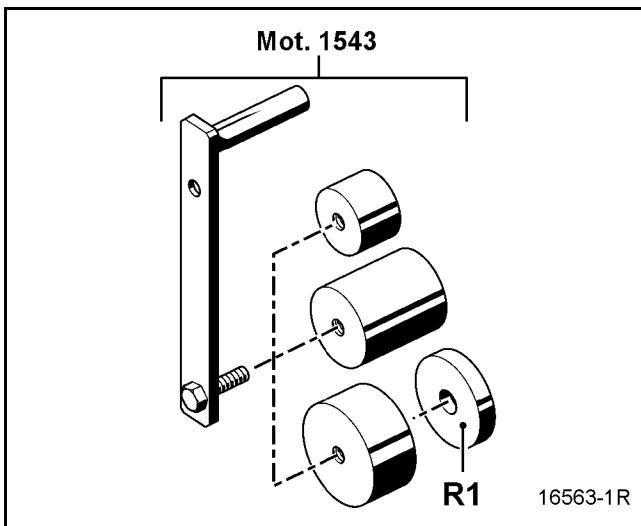
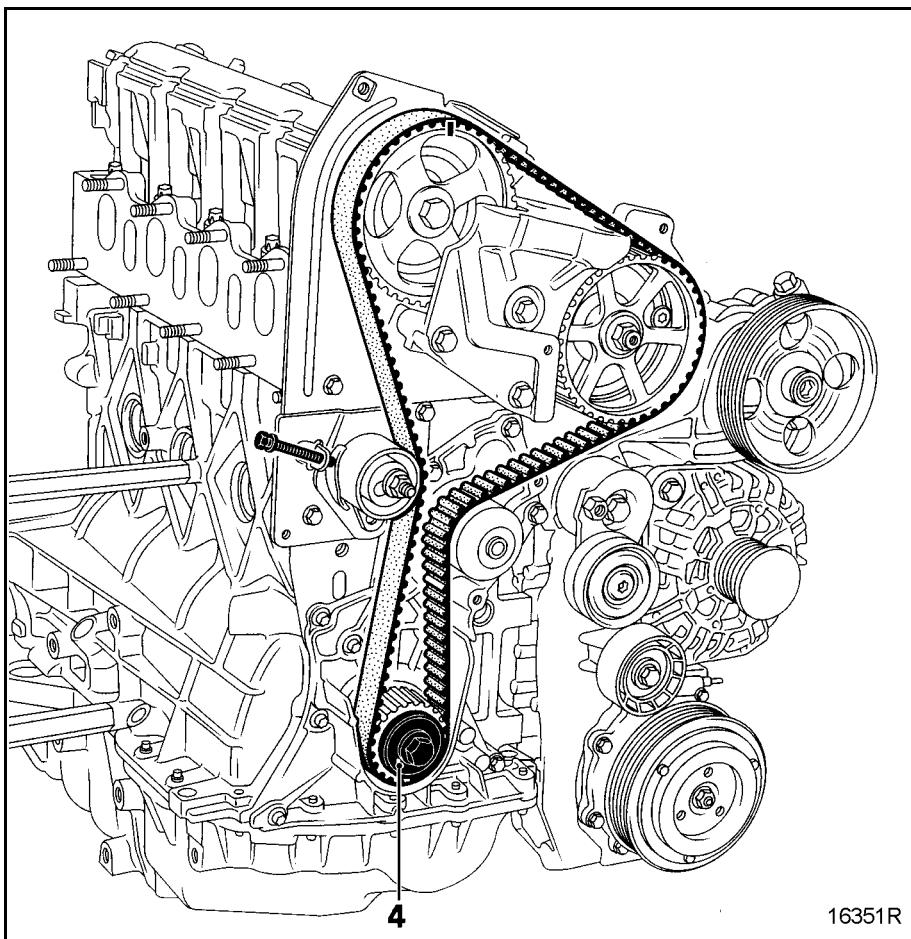
Remove pin **Mot. 1054**.

Fit the crankshaft accessories pulley bolt.

IMPORTANT:

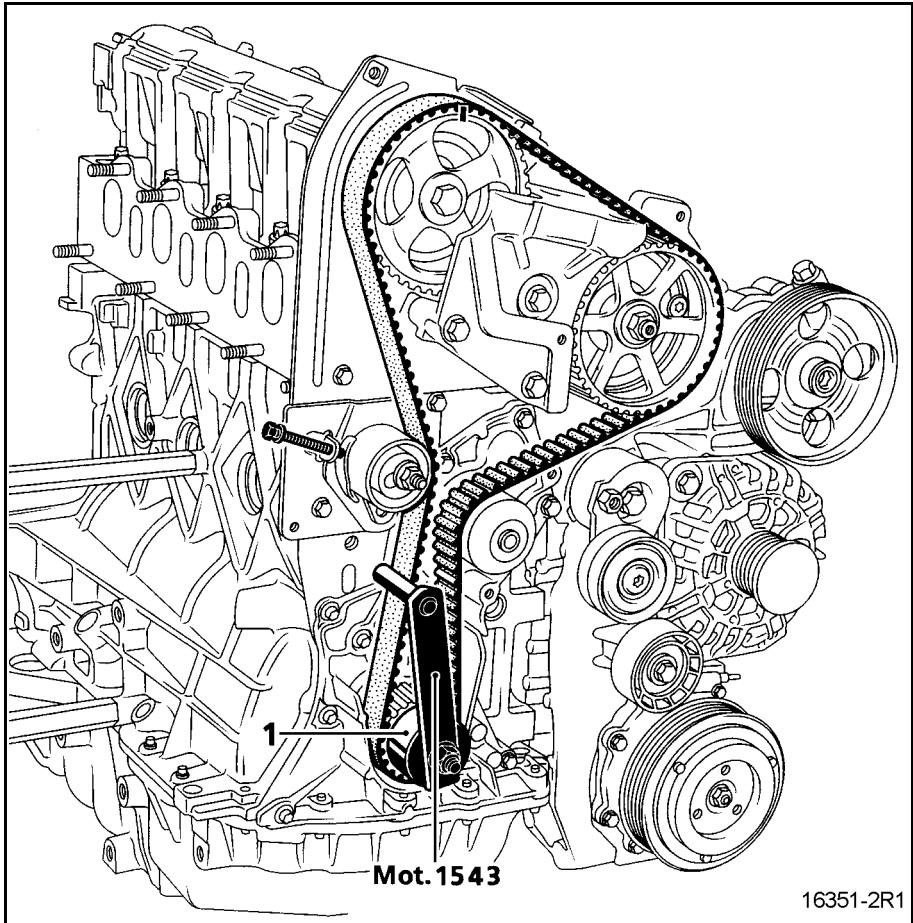
If the bolt is not fitted with a washer, fit the washer **R1** (4) included in the tool kit **Mot. 1543**.

Do not forget to remove it again when fitting the crankshaft pulley.

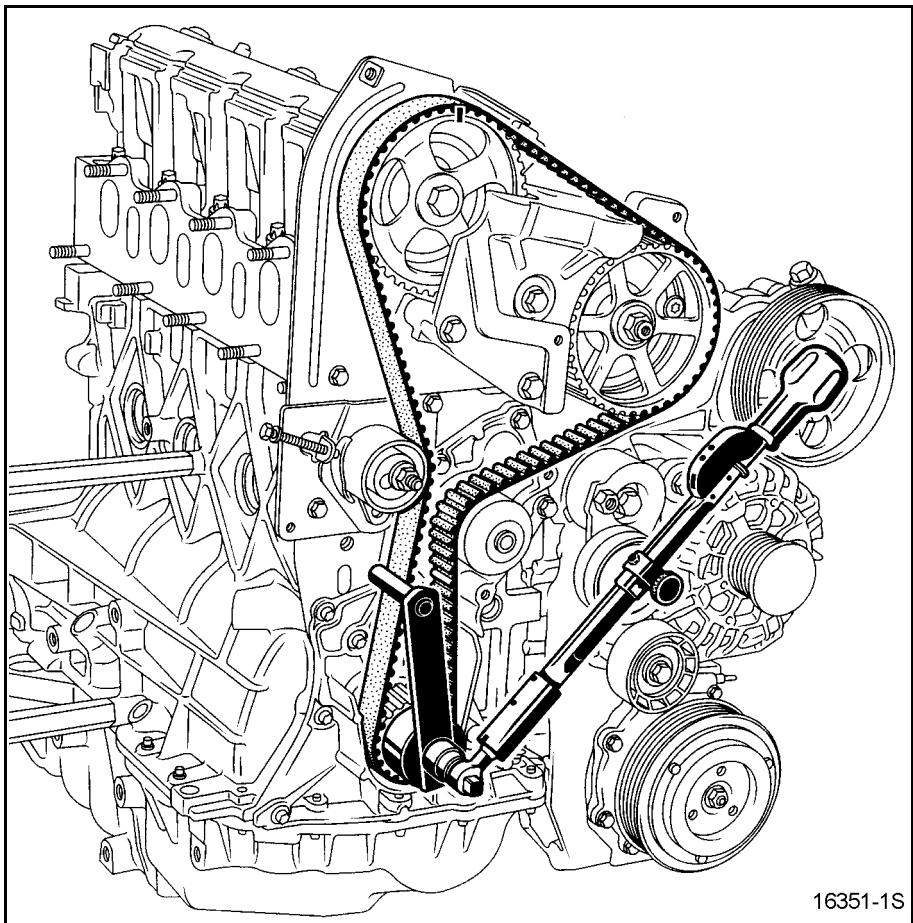


Overhauling the engine

Fit **Mot. 1543** and the cover numbered 1 on the crankshaft accessories pulley bolt.



Apply pre-tension between the crankshaft timing sprocket and the tensioner using the tool **Mot. 1543** and the cover 1, adjusting the torque wrench to a torque of 1.1 daNm.



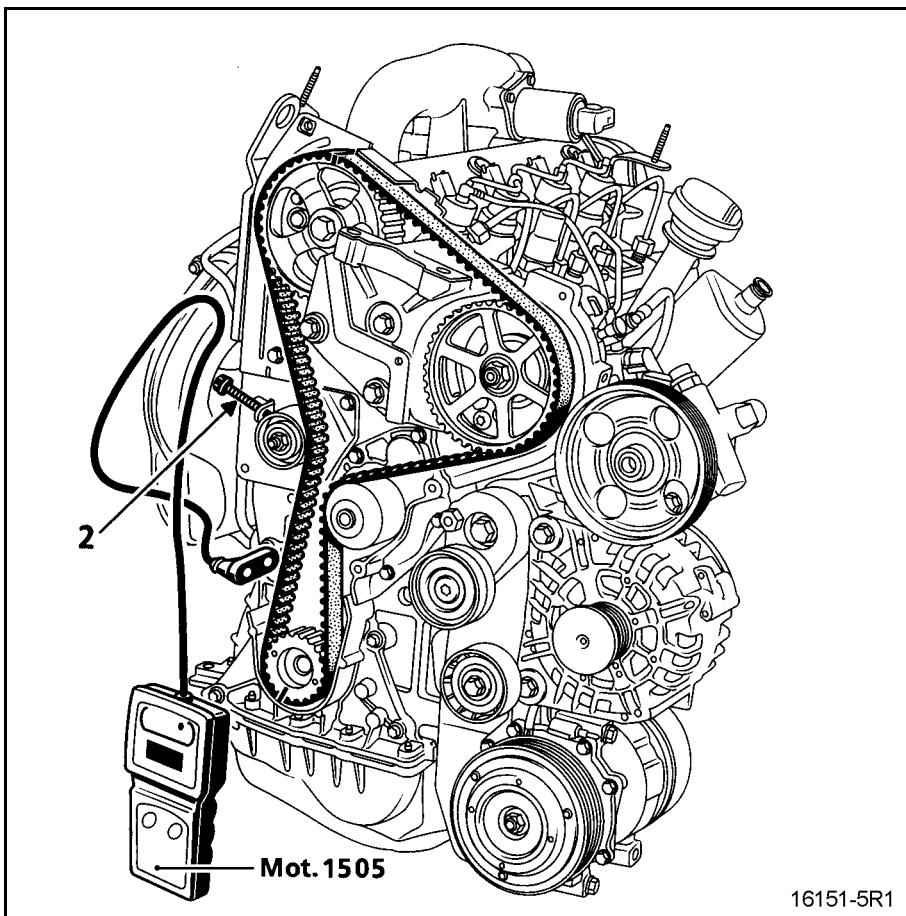
Overhauling the engine

Fit the sensor of **Mot. 1505** between the crankshaft sprocket and the tensioner.

Tension the belt by turning bolt (2) until the recommended fitting value **95 Hz \pm 3 Hz** is obtained.

Tighten the tensioner to a torque of **1 daN.m**.

Turn the crankshaft over four times.



Check

Refit pin **Mot. 1054** and set the timing to its setting point, (begin to press on the pin a half-tooth before alignment of the mark on the camshaft pulley and that made by the operator on the lower timing housing, to avoid it falling into a crankshaft balance hole).

Remove the pin **Mot. 1054**.

Apply pretension between the crankshaft timing sprocket and the tensioner using the tool **Mot. 1543** and the cover **1**, adjusting the torque wrench to a torque of **1.1 daN.m**.

Position the sensor of **Mot. 1505**.

Check that the tension value is 90 Hz \pm 3 Hz, otherwise readjust it.

Tighten the tensioner nut to a torque of **5 daN.m**.

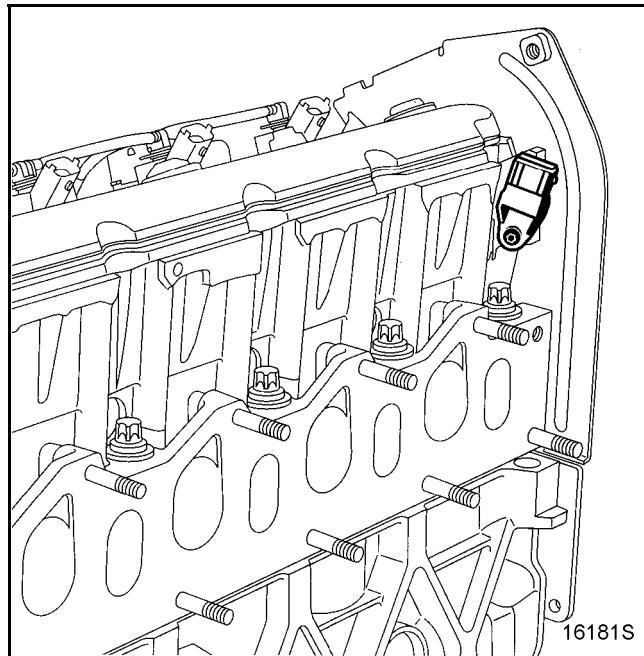
NOTE:

It is essential to tighten the tensioner nut to torque to avoid any loosening which may cause damage to the engine.

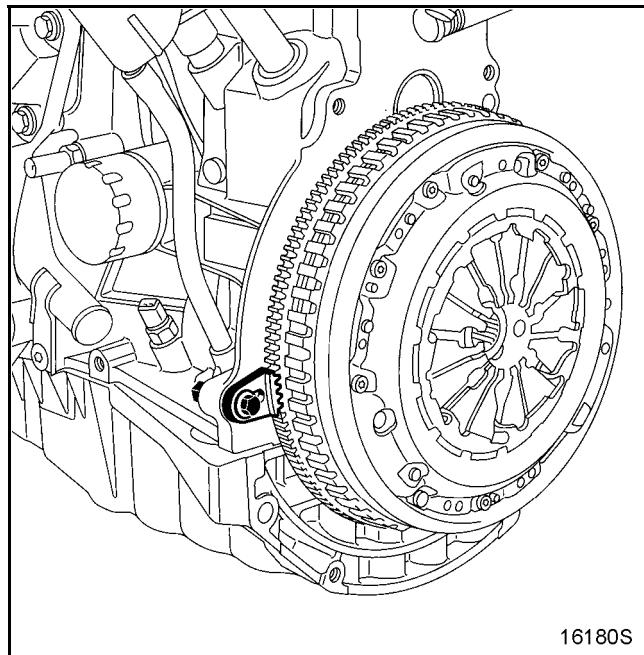
IMPORTANT:

Remove the washer R1 included in the tool kit Mot 1543 before fitting the crankshaft pulley.

Refit the camshaft sensor.



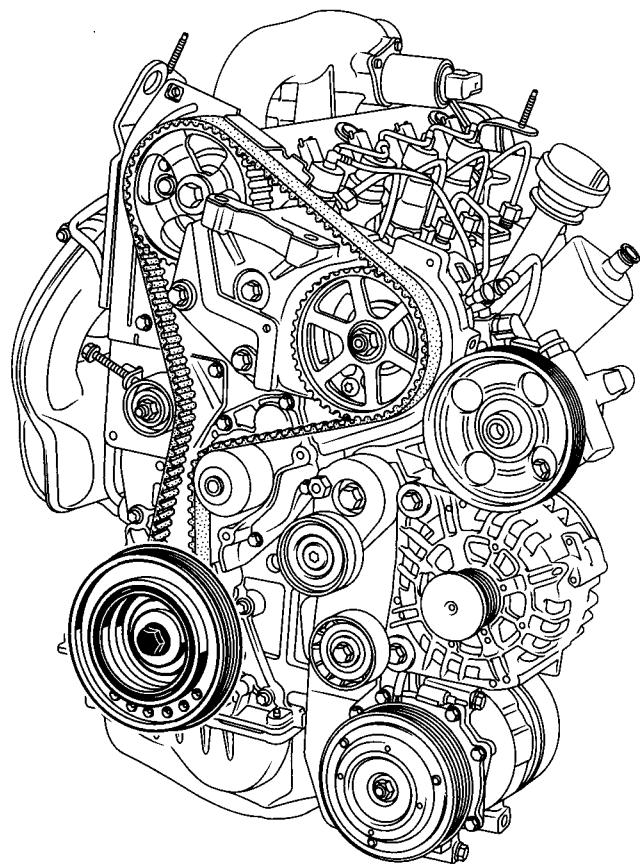
Install the flywheel immobiliser **Mot. 582-01** or **Mot. 1677**.



Overhauling the engine

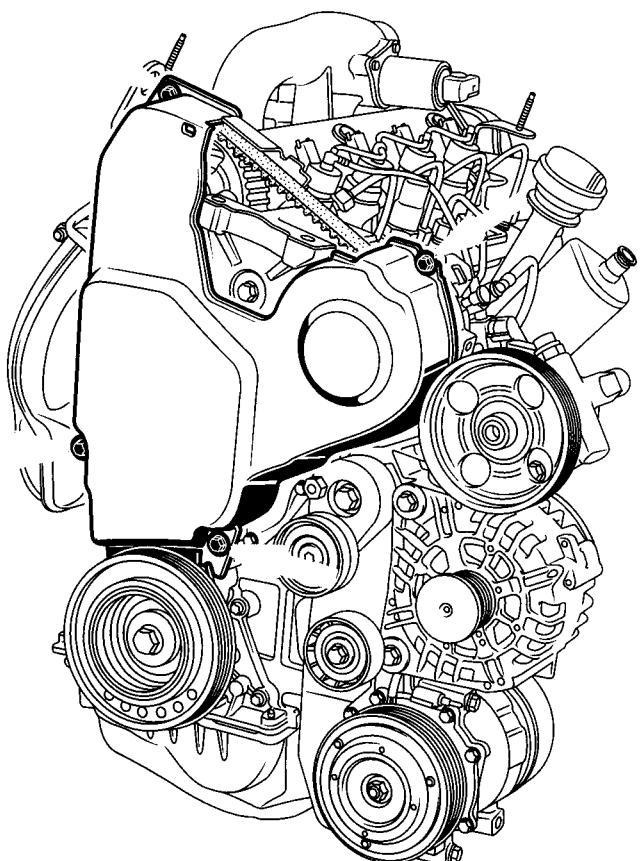
Refit the crankshaft accessories pulley by tightening the bolt to a torque of **2 daN.m**, then angle tighten to $115^\circ \pm 15^\circ$.

Withdraw the flywheel immobiliser Mot. 582-01 or Mot. 1677.



16151-1S

Refit the timing housing.

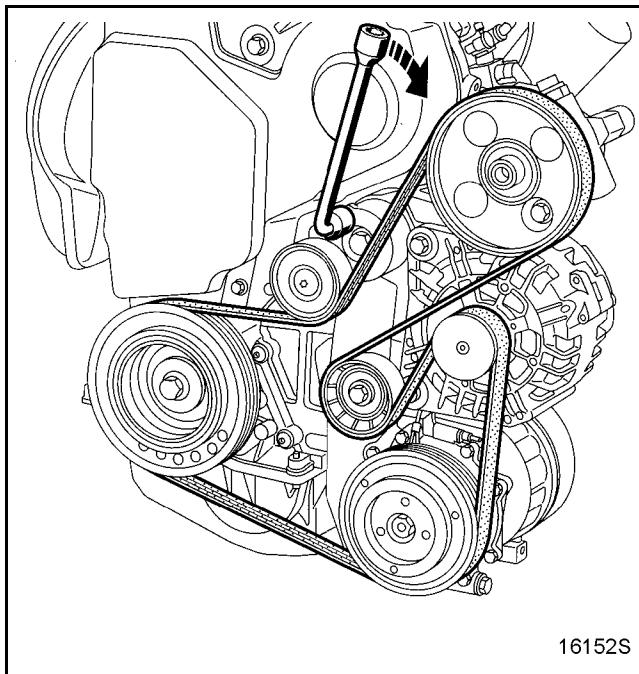


16151R

Refit the accessories belt.

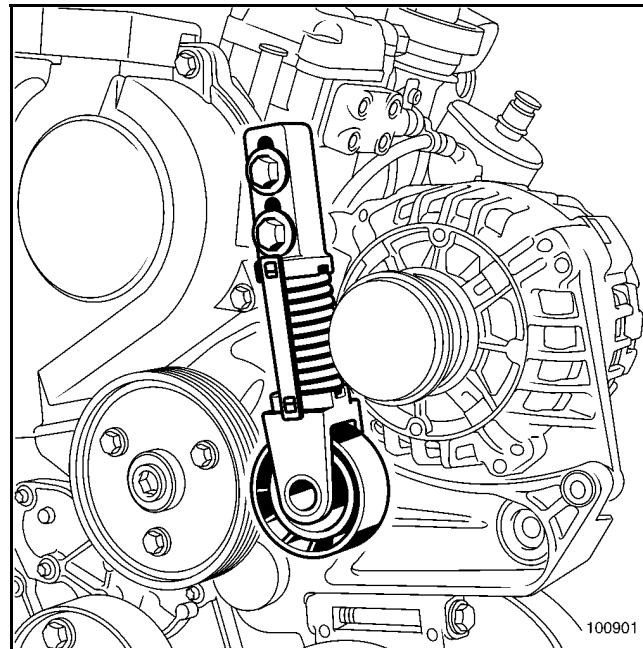
Turn the wrench in a clockwise direction to fit the belt.

The engine must be turned through two revolutions to position the belt correctly.



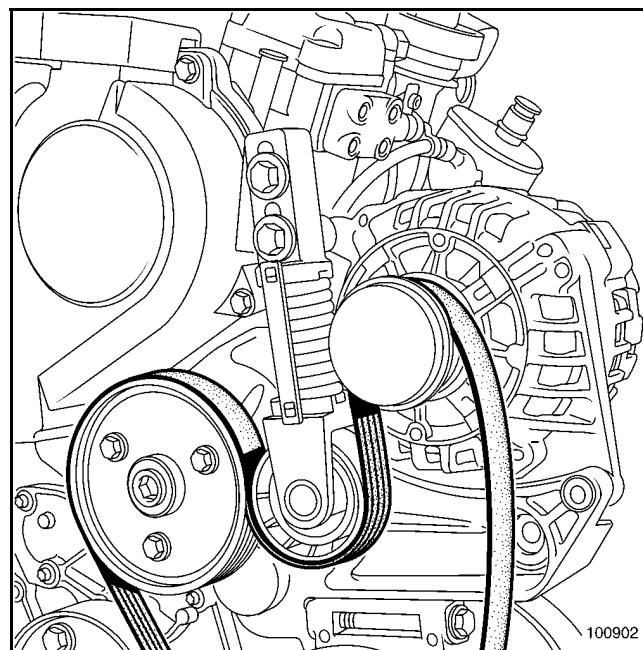
Special notes concerning engines fitted with an auto tensioner.

Position the apertures of the tension wheel end piece on the engine mounting and screw up without tightening the two bolts.



Keep the tension wheel in high position.

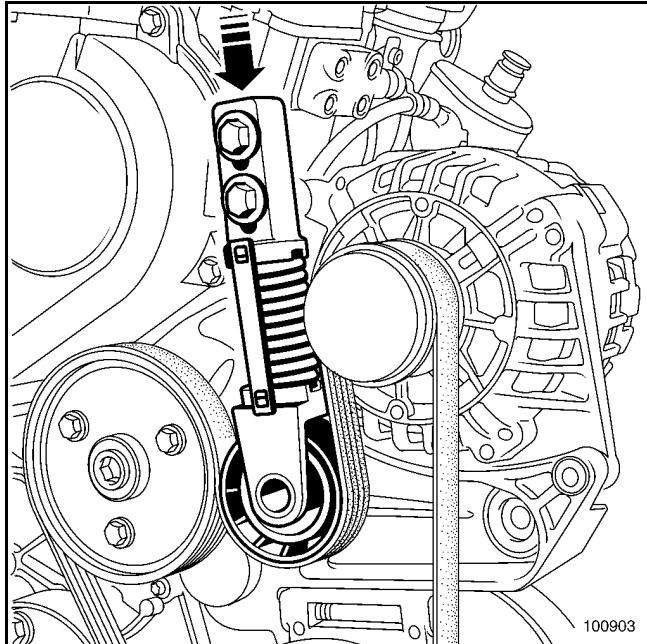
Install the belt, ending with the tension wheel.



Overhauling the engine

Exert merely pressure with the thumb on the end of the tension wheel to position said wheel.

While maintaining this light pressure with the thumb, tighten the two mounting bolts to a torque of **2.5 daN.m.**



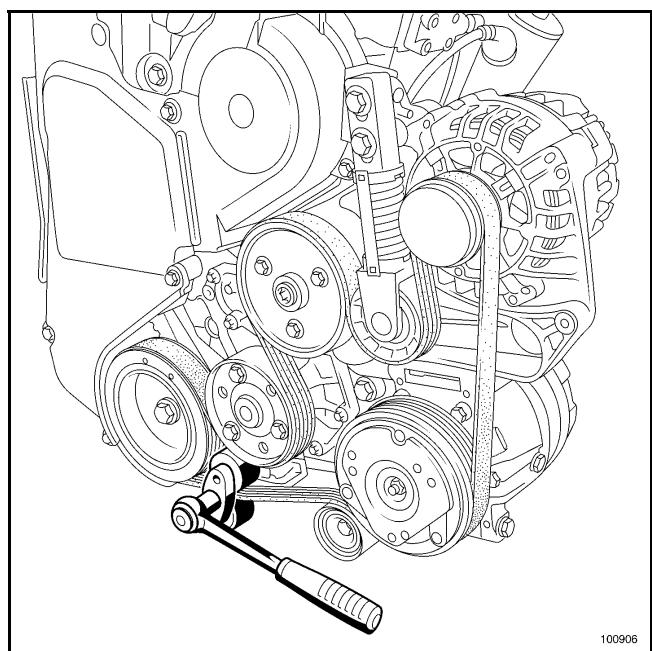
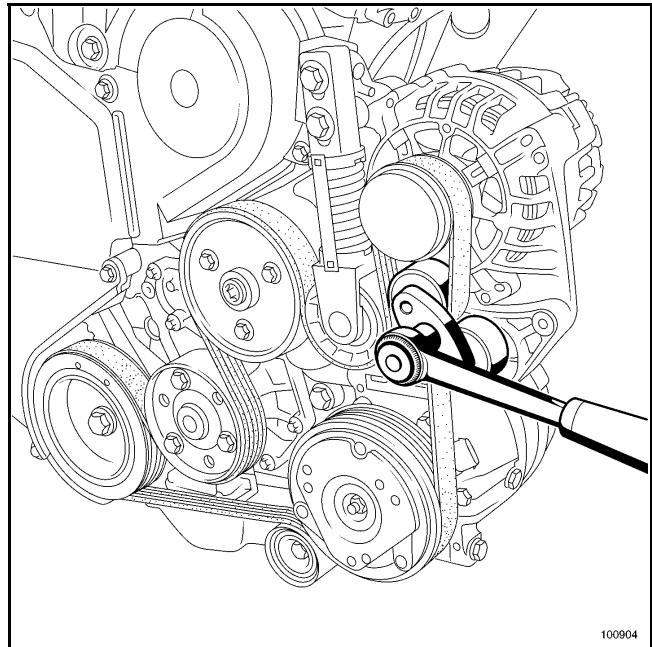
The tension wheel is now tightened in position.

Tensioning of the tension wheel.

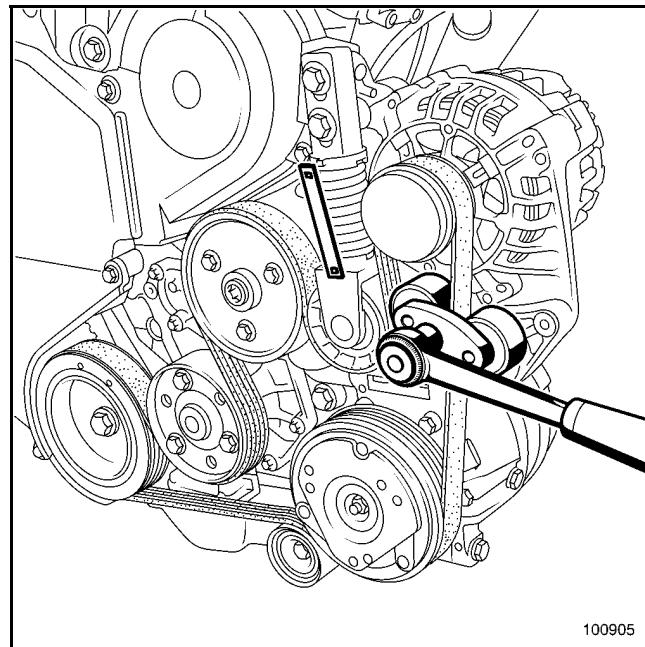
Depending on ease of access to the engine, place tool **Mot. 1676** on the belt strand:

- alternator-compressor or
- crankshaft-fixed roller.

Once the belt has been centred on the tool's rollers, take a ratchet spanner and apply a rotation movement to tension the belt.



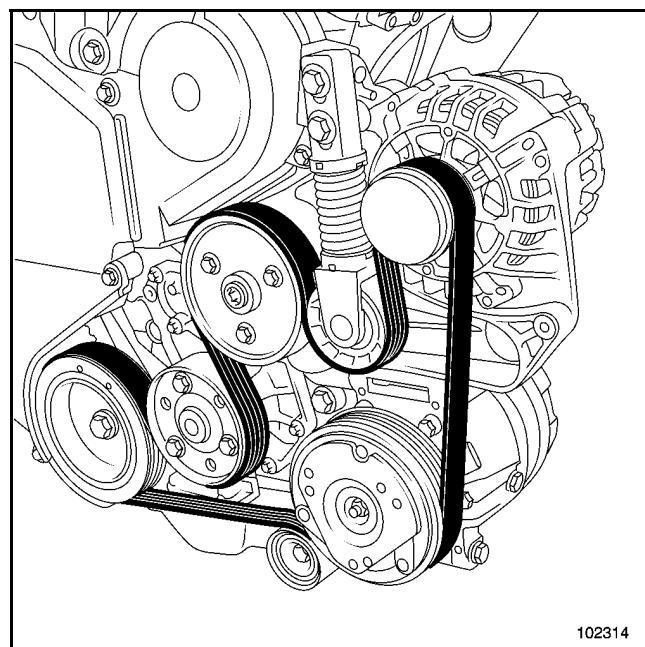
Maintain the force created by belt torsion until the tension wheel's pretensioning torque plate can be withdrawn manually.



100905

Apply tension to the tension wheel while gradually relaxing the force.

The tension wheel is now ready to operate.



102314

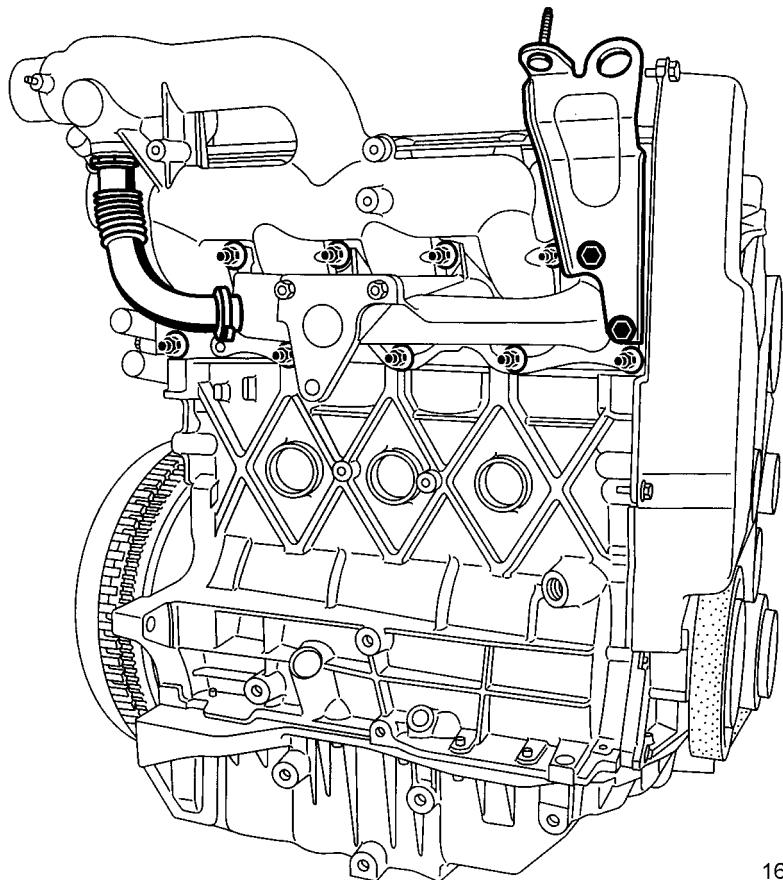
REFITTING THE UPPER ENGINE

Refit the inlet and exhaust manifolds fitted with new seals, tightening the nuts to a torque of **2.8 daN.m**.

Refit the engine lifting ring, tightening the bolts to a torque of **2 daN.m**.

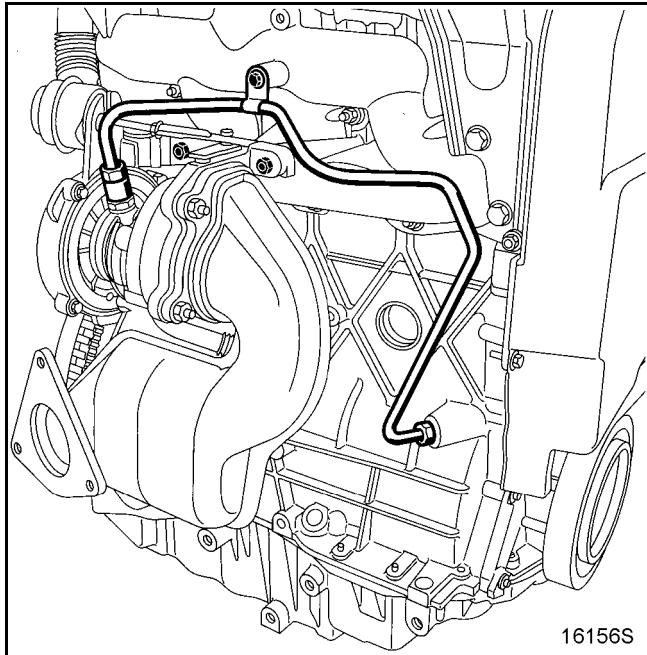
Refit the exhaust gas recirculation pipe.

Remove the engine from the stand
Mot. 792-03.



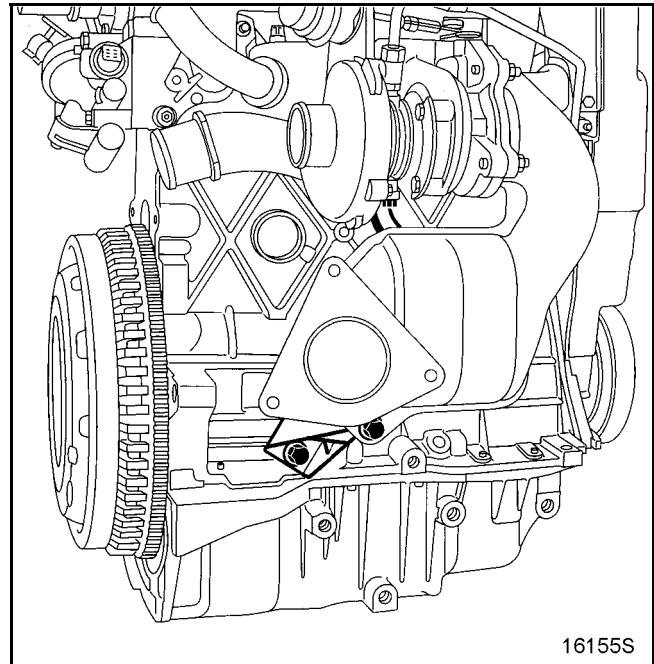
Refit the turbocharger, tightening the nuts to a torque of **2.4 daN.m**.

Refit the turbocharger oil supply pipe, tightening the couplings at the cylinder block end to a torque of **2.3 daN.m** and at the turbocharger end to a torque of **2.4 daN.m**.



Refit the turbocharger oil return pipe fitted with new seals, then tighten the bolts to a torque of **1.2 daN.m**.

Refit the exhaust stay by tightening the **M8** bolt to a torque of **2.4 daN.m** and bolt **M10** to a torque of **4.3 daN.m**.



SPECIAL TOOLING REQUIRED	
Mot. 1054	TDC setting pin
Mot. 1453	Engine support tool
Mot. 1505	Tool for checking belt tension
Mot. 1543	Tool for pre-tensioning the belt
EQUIPMENT REQUIRED	
Angular torque wrench 14 Torx socket	

TIGHTENING TORQUE (In daNm and/or°)	
Tension wheel nut	5
Tension wheel plate bolt	1
Crankshaft pulley bolt	$2+115^\circ\pm15^\circ$
Suspended engine mounting upper linkage mounting bolt	10.5
Body mounting bolt for the suspended engine mounting movement limiter	4.4
Mounting bolt on the engine for suspended engine mounting cover	6.2
Wheel bolt	14

REMOVAL

Put the vehicle on a two-post lift.

Disconnect the battery.

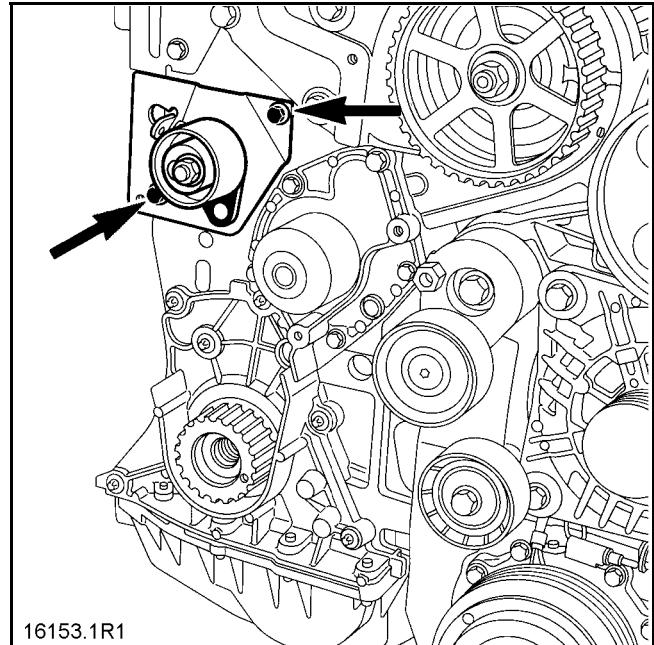
Remove:

- the timing belt (see Section 11 Timing belt),
- both tension wheel plate bolts.

REFITTING

Refit:

- tension wheel plate by tightening the bolts to a torque of 1 daNm,
- the timing belt (see Section 11 Timing belt).



SPECIAL TOOLING REQUIRED	
Mot. 1054	TDC setting pin
Mot. 1505	Tool for checking belt tension
Mot. 1543	Tool for pre-tensioning the belt
Mot. 1367-02	Engine support tool
EQUIPMENT REQUIRED	
Angular torque wrench 14 Torx socket	

TIGHTENING TORQUE (In daNm and/or°)	
Tension wheel nut	5
Crankshaft pulley bolt	$2+115^{\circ}\pm15^{\circ}$
Suspended engine mounting upper linkage mounting bolt	10.5
Body mounting bolt for the suspended engine mounting movement limiter	4.4
Mounting bolt on the engine for suspended engine mounting cover	6.2
Wheel bolt	14

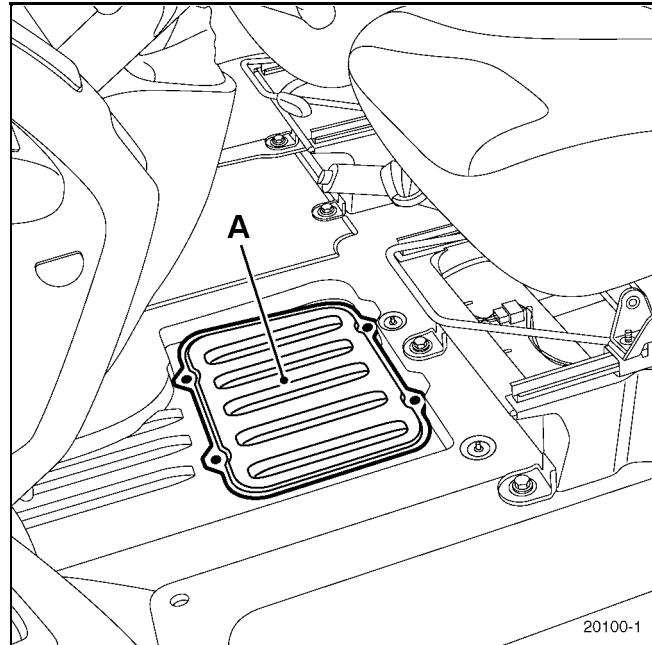
REMOVAL

Put the vehicle on four axle stands (see Section 02 **Lifting methods** for the correct positions of the lifting jack and axle stands) or on a lift.

Disconnect the battery.

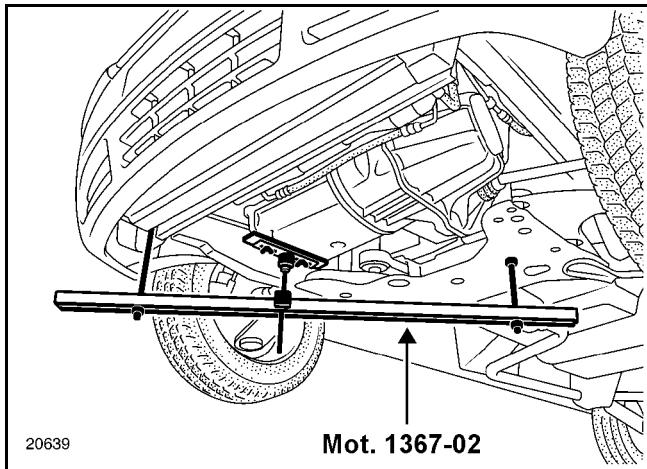
NOTE:

As the battery is situated under the left-hand seat, the carpet must be removed by unclipping it, then removing the battery flap (A) by undoing the bolts.



Remove the engine undertray and the left-hand side protection.

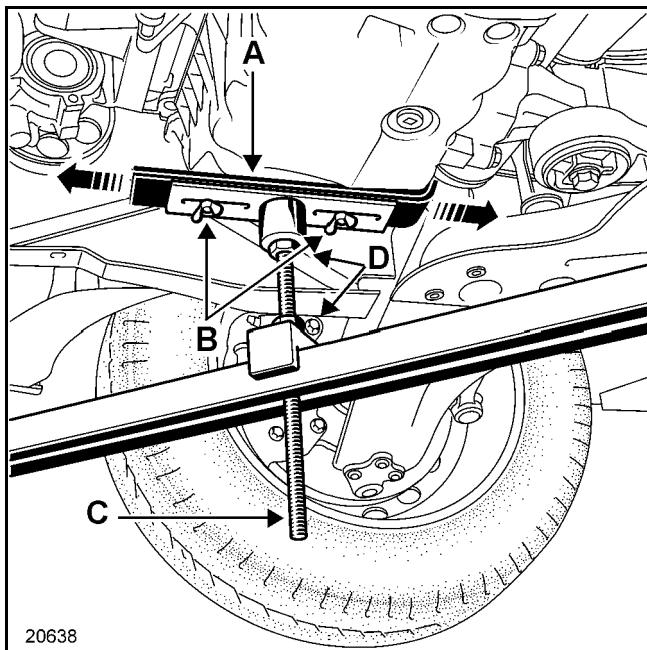
Fit engine support tool **Mot. 1367-02** between the lower crossmember and the sub-frame.



Bring the top part of the tool (A) into contact with the sump.

Adjust the position of section (A) on the sump using the mountings (B).

Lift the engine slightly at point (C), then tighten nuts (D).

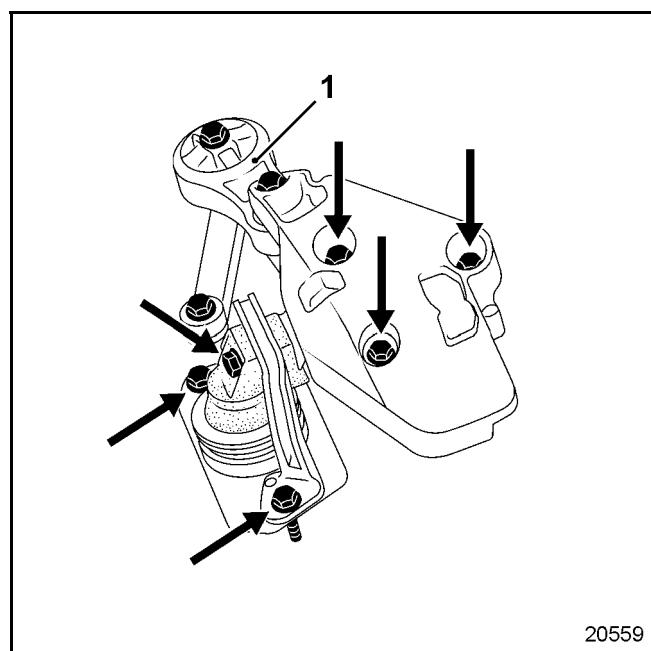


Unclip the wiring from the engine mounting and move it out of the way.

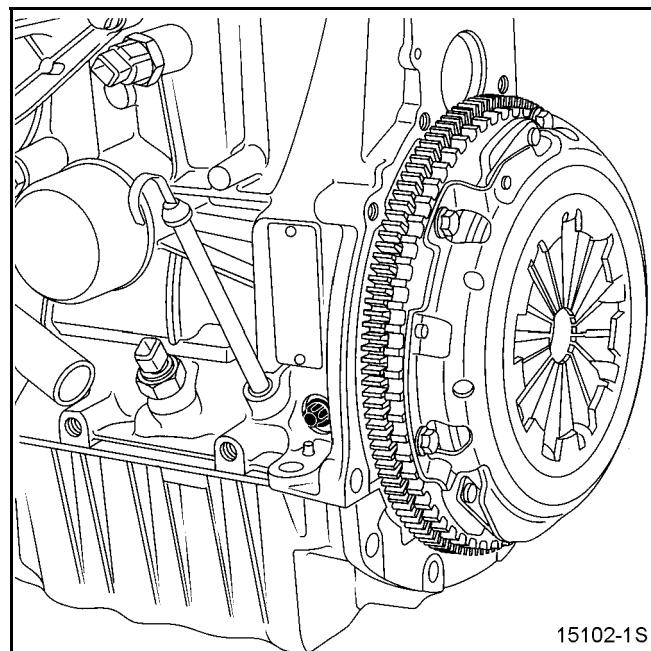
Unclip the power steering reservoir from its support and remove.

Remove:

- the accessories belt (see Section **07 Accessories belt tension**),
- tie-rod (1) mounting bolts, then remove the suspended mounting movement-limiter assembly,

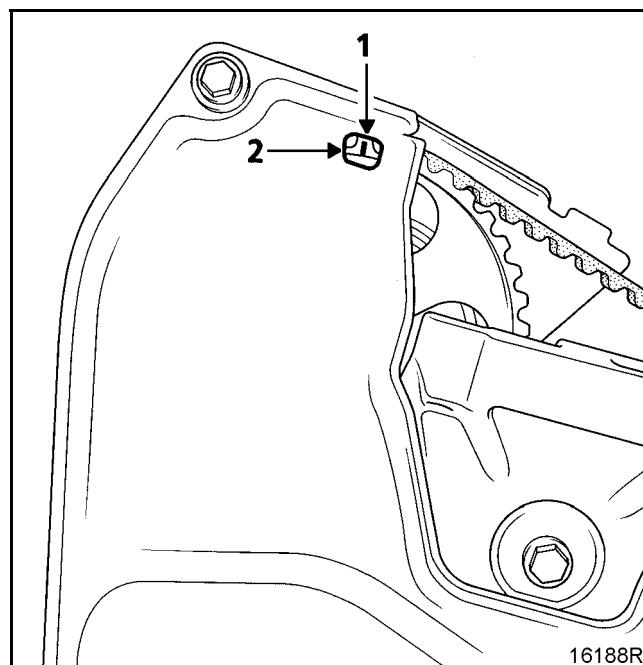


– the Top Dead Centre pin plug.



Timing adjustment

Turn the crankshaft in a clockwise direction (timing end). When the mark (1) on the camshaft pulley appears in the window (2) of the timing cover, push in the Top Dead Centre pin **Mot. 1054** to pin the crankshaft (the mark on the camshaft pulley must be located approximately in the centre of the window).

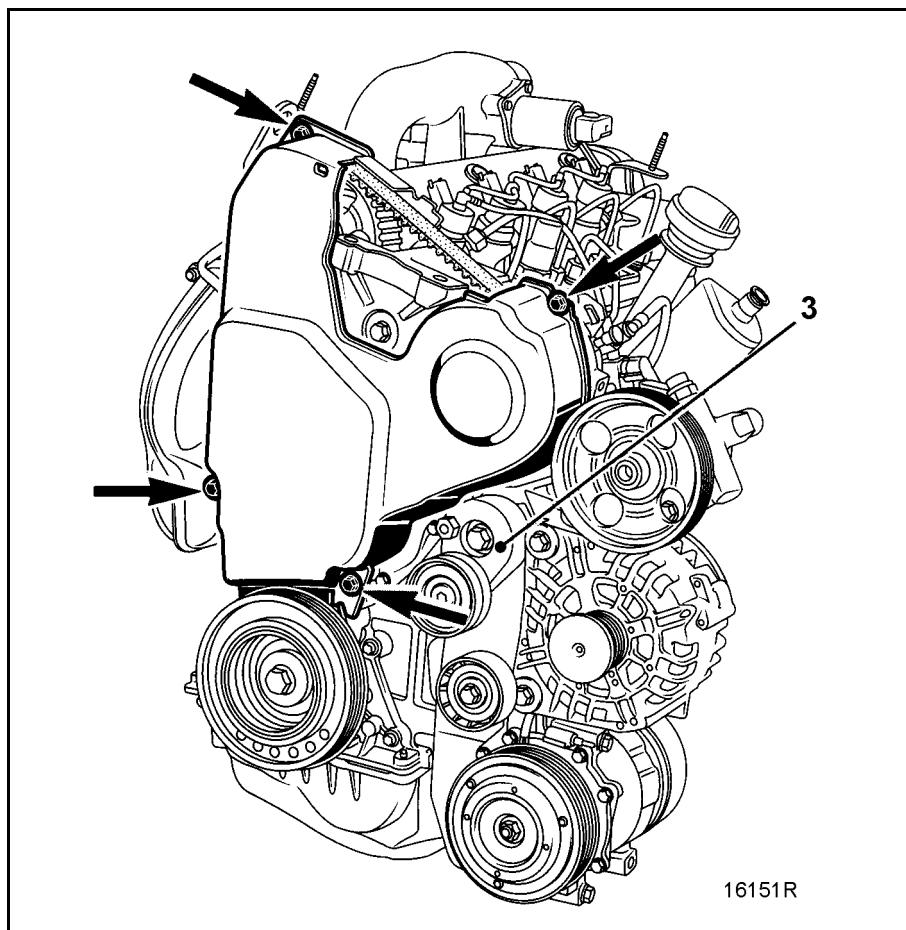


Remove:

- the accessories belt tensioner (3),
- the crankshaft accessories pulley by locking the flywheel,
- timing cover from underneath the car (lower the engine using the engine support tool **Mot. 1453**).

NOTE:

Use a pencil to mark the lower timing housing opposite the mark on the camshaft pulley.

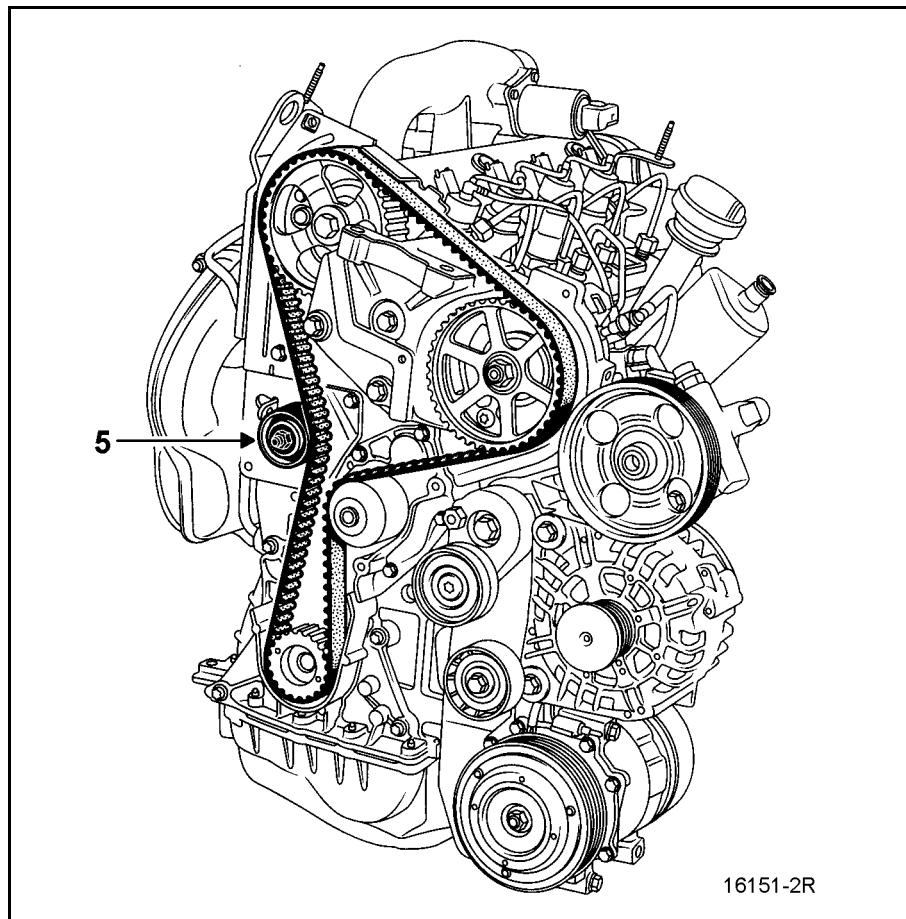


TOP AND FRONT OF ENGINE

Timing belt

11

Loosen the tensioner by loosening the nut (5), then remove the timing belt.

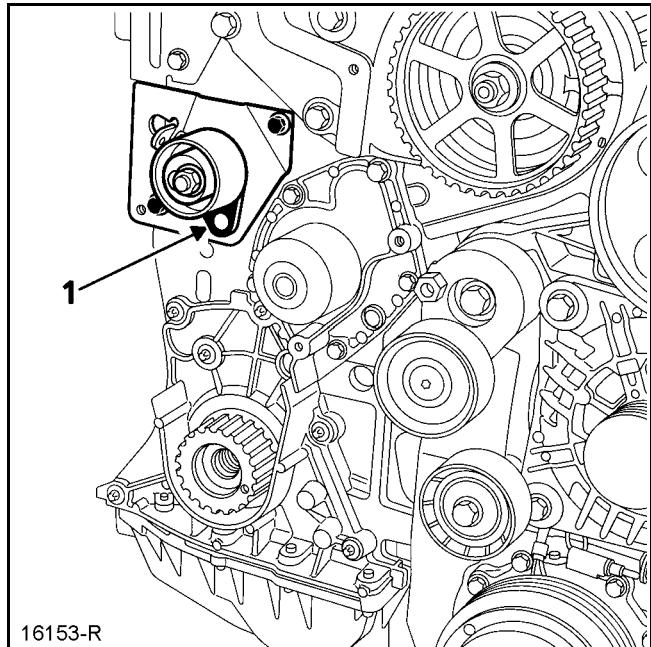


REFITTING

TENSIONING PROCEDURE

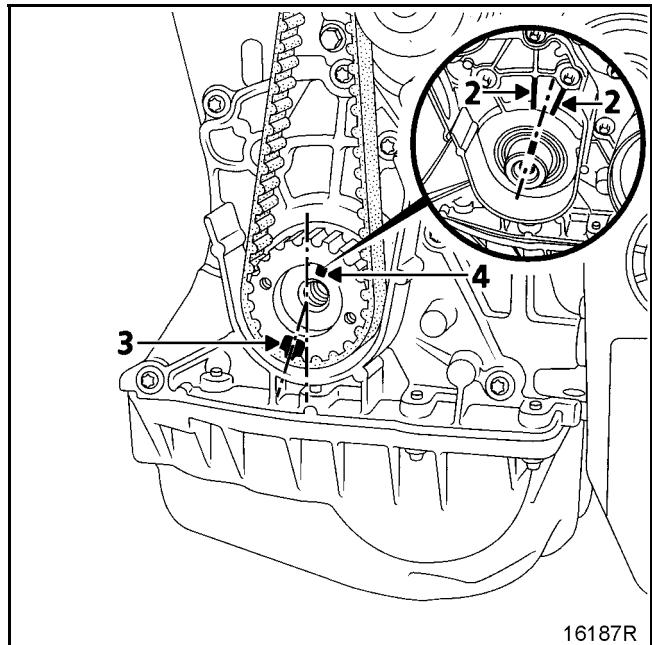
Engine cold (ambient temperature).

Check that the tensioner is securely positioned on the pin (1).



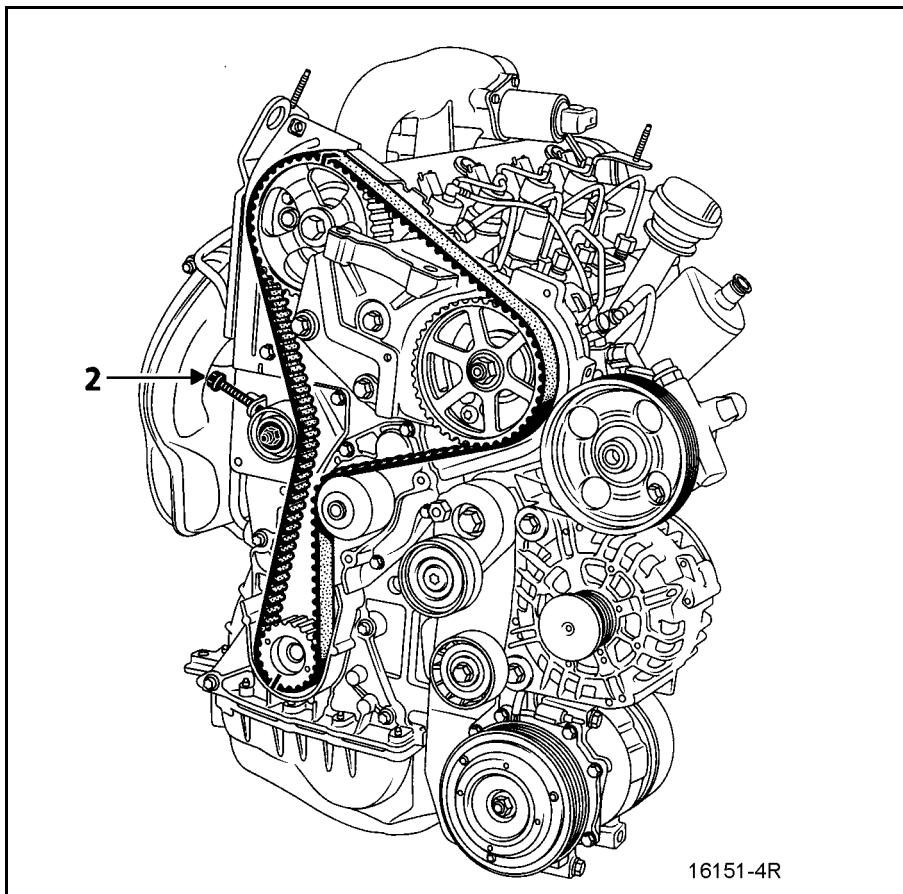
Check that pin **Mot. 1054** is in place.

The crankshaft groove (4) should be located at the centre of the two ribs (2) on the crankshaft closure housing, mark (3) on the crankshaft timing sprocket should be offset one tooth to the left of the vertical axis of the engine.



Fit the new timing belt by aligning the belt markings with those of the camshaft and crankshaft sprockets.

Place the tensioner against the belt by tightening bolt (2) on the tensioner mounting.

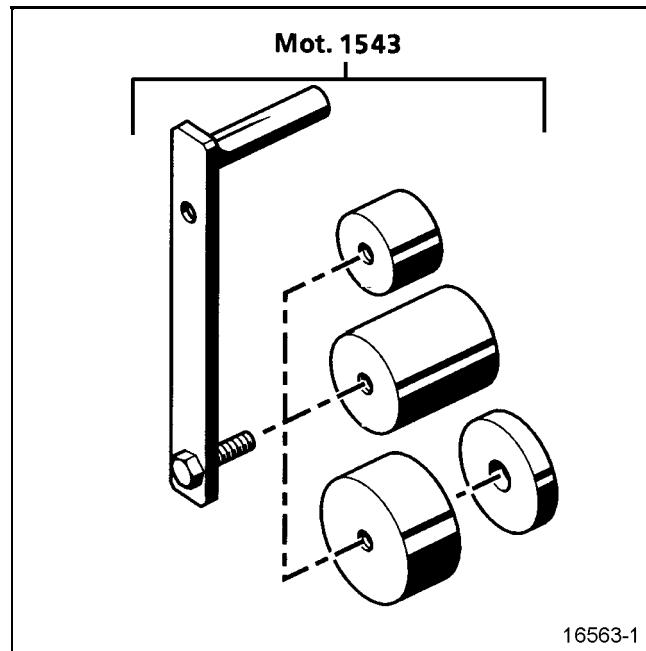
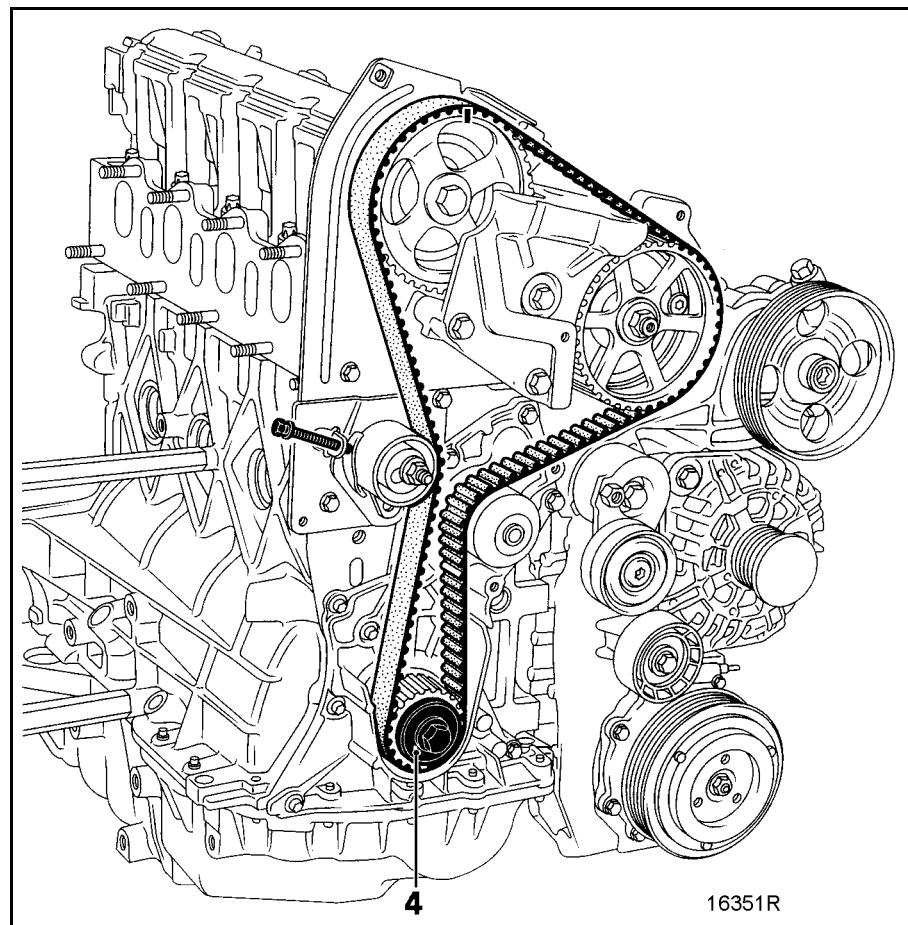


Remove pin **Mot. 1054**.

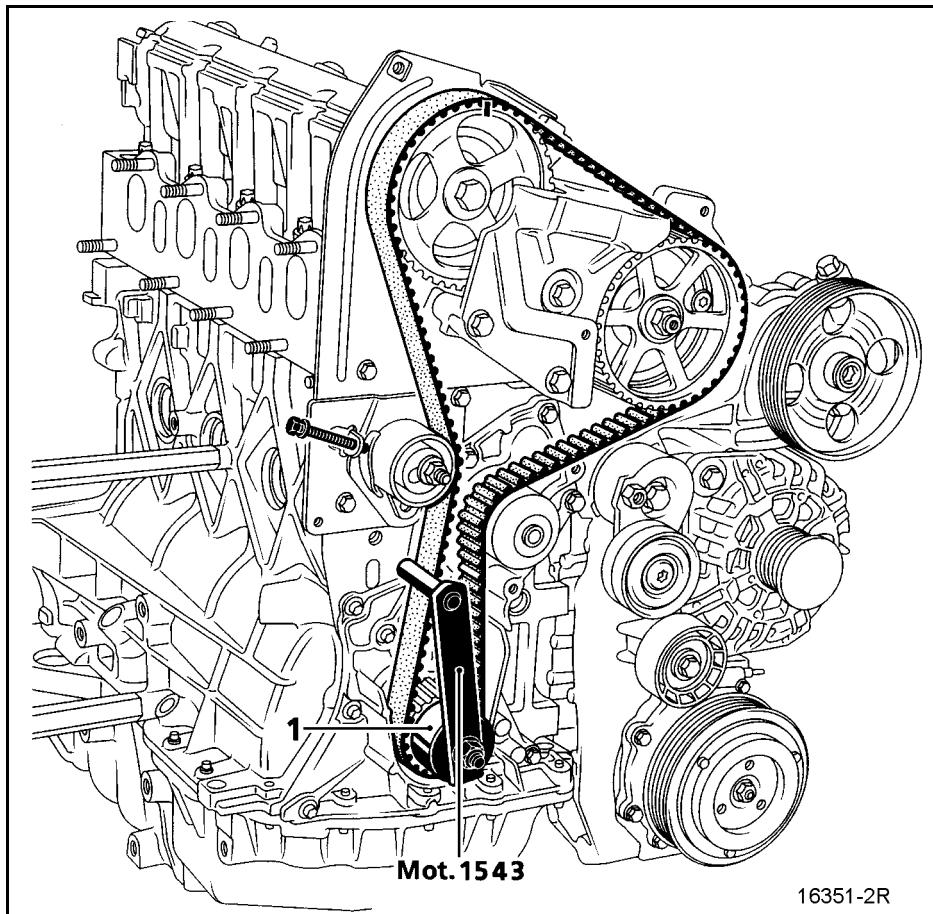
Fit the crankshaft accessories pulley together with washer **R1 (4)** which is included in the kit with tool **Mot. 1543**.

NOTE:

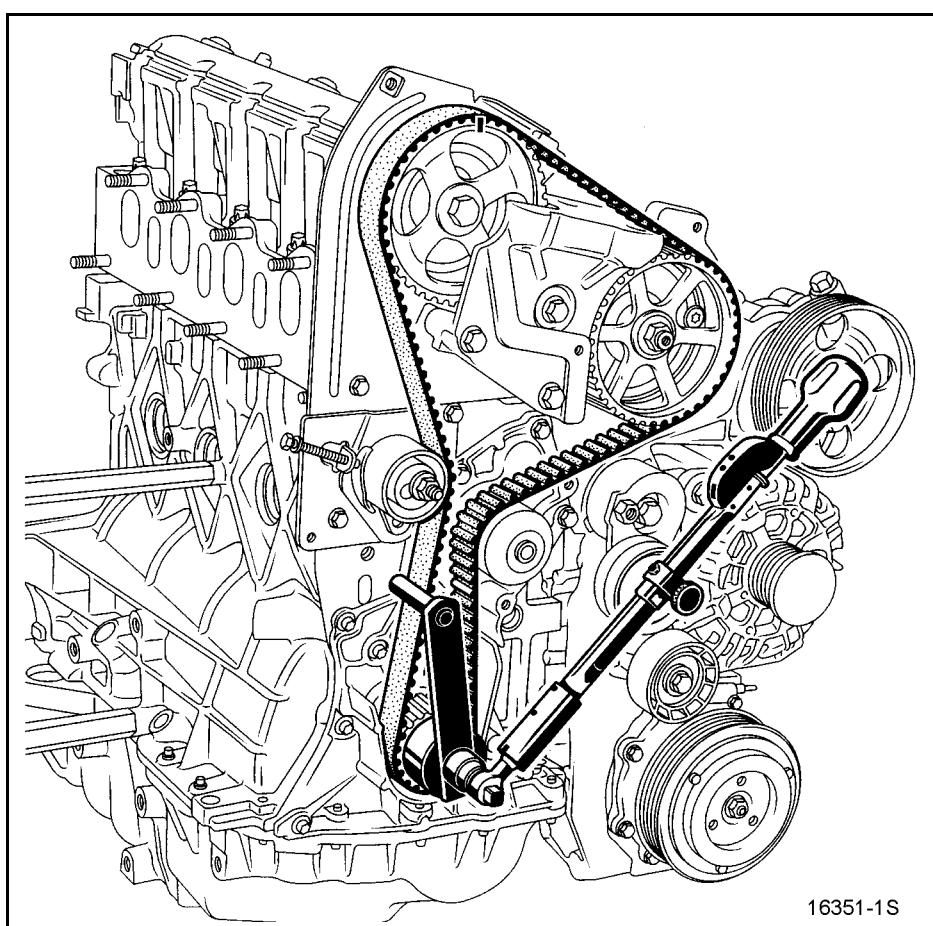
Do not forget to remove it again when fitting the crankshaft pulley.



Fit Mot. 1543 and the cover numbered 1 on the crankshaft accessories pulley bolt.



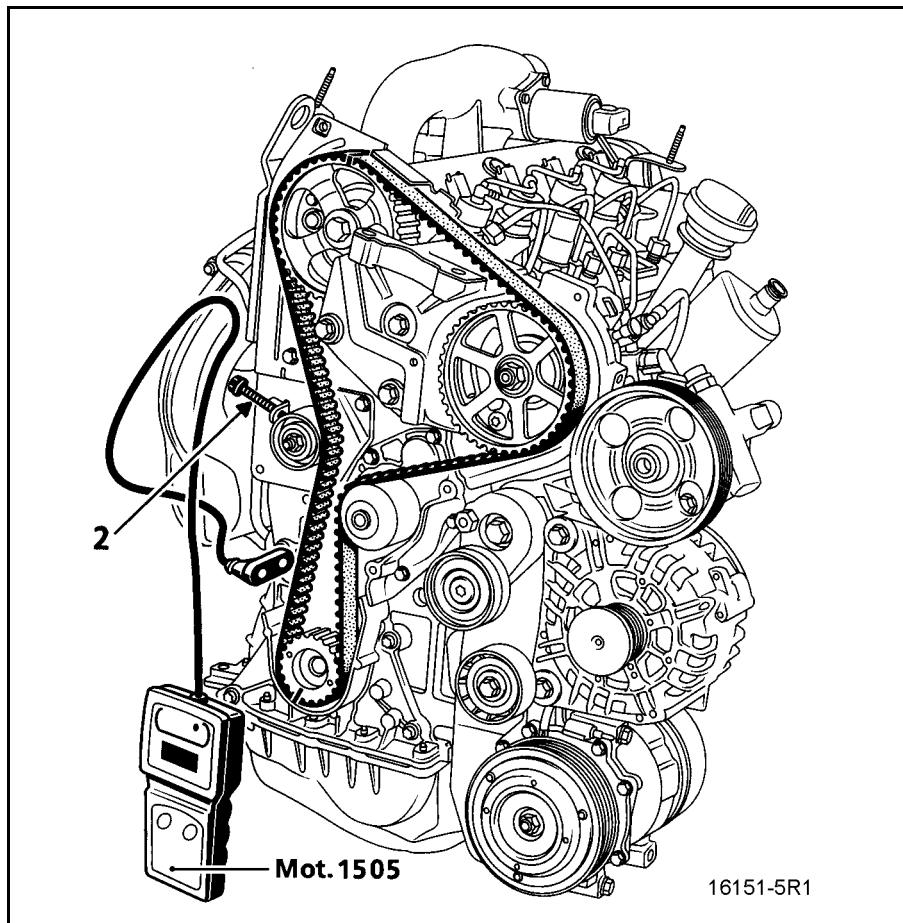
Apply pre-tension between the crankshaft timing sprocket and the tensioner using tool Mot. 1543 and the cover 1, adjusting the torque wrench to a torque of 1.1 daN.m.



Connect the sensor of **Mot. 1505**.

Tension the belt by turning bolt (2) until the recommended fitting value $95 \pm 3 \text{ Hz}$ is obtained.

Tighten the tensioner to a torque of **1 daN.m**.



Turn the crankshaft two revolutions.

Refit the pin **Mot. 1054** and set the timing to its setting point, (begin to press on the pin half a tooth before alignment of the mark on the camshaft pulley and that made by the operator on the inner timing housing, to prevent it falling into a crankshaft balance hole).

Remove pin **Mot. 1054**.

Apply pre-tension between the crankshaft timing sprocket and the tensioner using the tool **Mot. 1543** and the cover **1**, adjusting the torque wrench to a torque of **1.1 daN.m**.

Position the sensor of **Mot. 1505**.

Check that the tension value is **90 ± 3 Hz**. If not, readjust it.

Tighten the tension wheel nut to a torque of **5 daNm**.

NOTE:

It is essential to tighten the tensioner nut to torque to avoid any loosening which may cause damage to the engine.

IMPORTANT:

Remove the numbered washer **R1** included in tool kit **Mot. 1543** before fitting the crankshaft pulley.

The crankshaft accessories pulley bolt MUST be tightened to a torque of **2 daNm** plus an angle of **115° ± 15°**.

Refitting is the reverse of removal.

Refit the right-hand suspended engine mounting (see Section **19 Suspended engine mounting** for the tightening torques).

SPECIAL TOOLING REQUIRED	
Mot. 1054	TDC setting pin
Mot. 1202-01	Hose clip pliers
Mot. 1202-02	
Mot. 1448	Distance pliers for cooling system hose clips
Mot. 1505	Belt tension measuring tool
Mot. 1543	Tool for pre-tensioning the belt
EQUIPMENT REQUIRED	
14 Torx socket	
High pressure pipe wrench (e.g. Facom DM19 wrench)	
Angular tightening wrench	

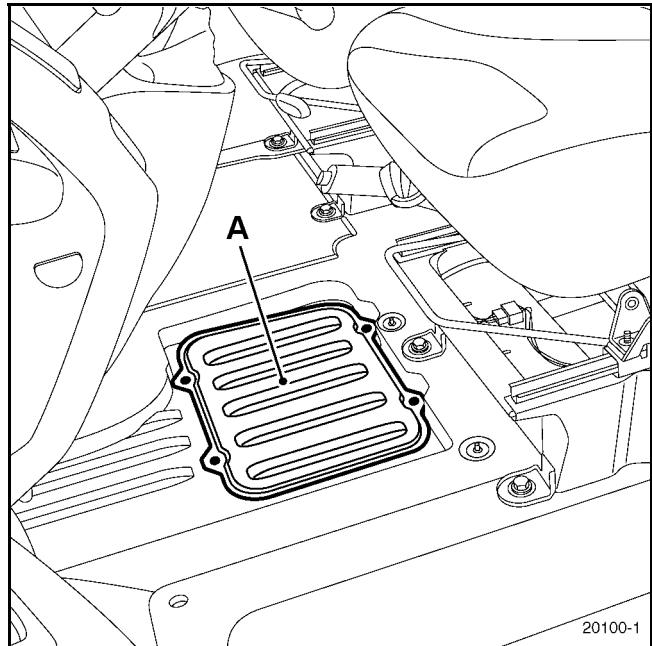
TIGHTENING TORQUE (In daNm and/or°)	
Tension wheel nut	5
Tension wheel plate bolt	1
Crankshaft pulley bolt	2+115°±15°
Suspended engine mounting upper linkage mounting bolt	10.5
Body mounting bolt for the suspended engine mounting movement limiter	4.4
Mounting bolt on the engine for suspended engine mounting cover	6.2
Wheel bolt	14

REMOVAL

Put the vehicle on four axle stands (see Section 02 **Lifting methods** for the correct positions of the lifting jack and axle stands) or on a lift.

**FOLLOW CAREFULLY THE INSTRUCTIONS
GIVEN IN SECTION 13 "SPECIAL FEATURES"
AND "CLEANLINESS" BEFORE CARRYING OUT
ANY WORK**

Disconnect the battery.



NOTE:

As the battery is located beneath the left seat, the carpet must be removed from the floor by unclipping it, then remove the battery flap (A) by loosening the bolts.

Drain the cooling circuit through the lower radiator hose.

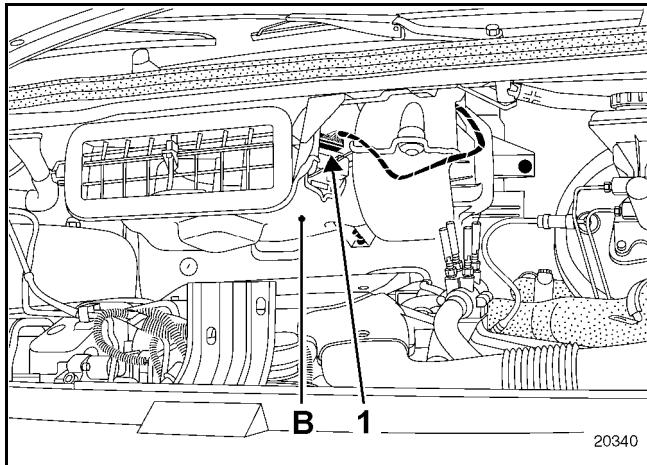
TOP AND FRONT OF ENGINE

Cylinder head gasket

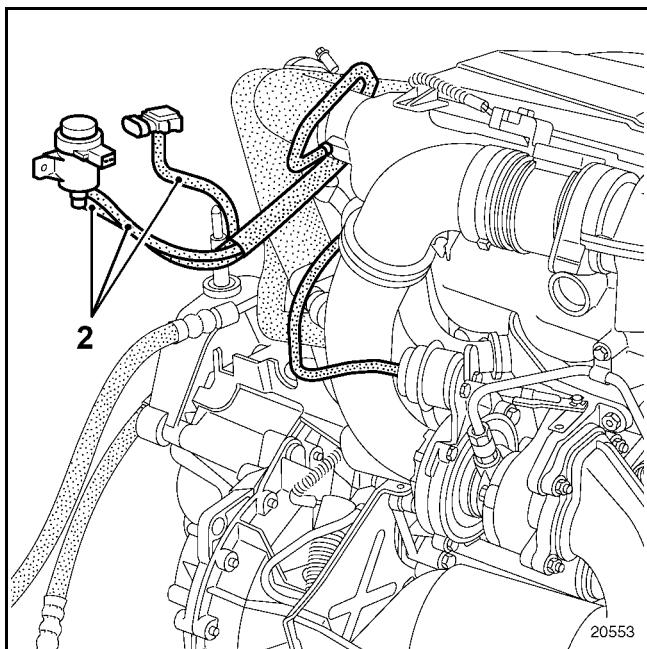
11

Remove:

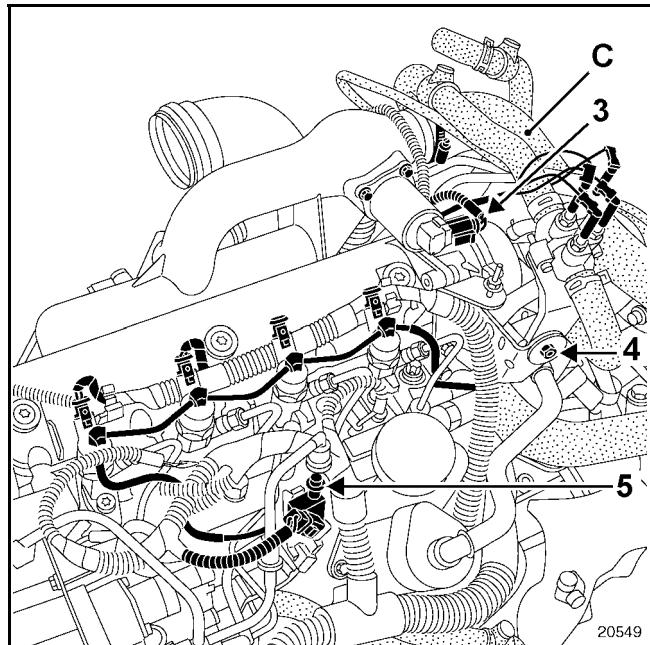
- the timing belt (see Section 11 Timing belt).
- the heater casing (B) by disconnecting the connector (1),



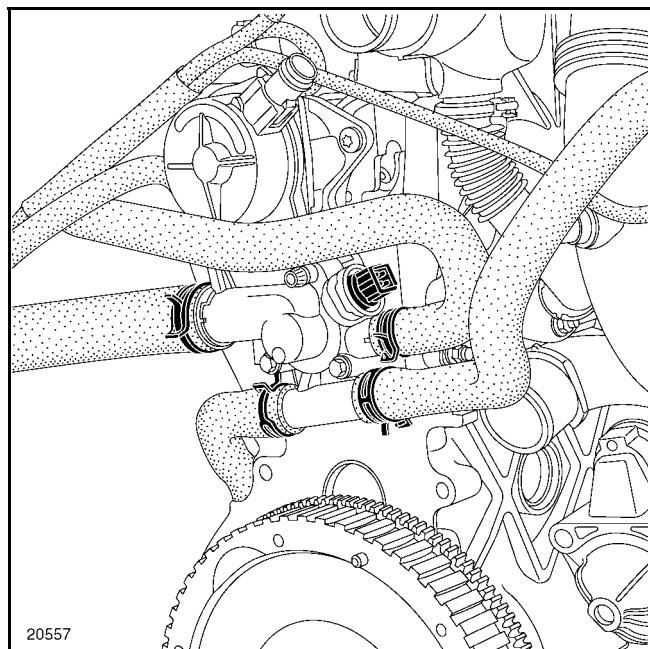
- the air filter unit,
- the vacuum pipes (2),



- the turbocharger pipe (C),
- the connector (3) as well as the injector and pre-heater plug connectors,
- thermoplunger unit mounting (4),
- fuel return pipe at (5) (**fit anti-contamination plugs**),



- the hoses on the cylinder head water outlet housing as well as the coolant temperature sensor connector,



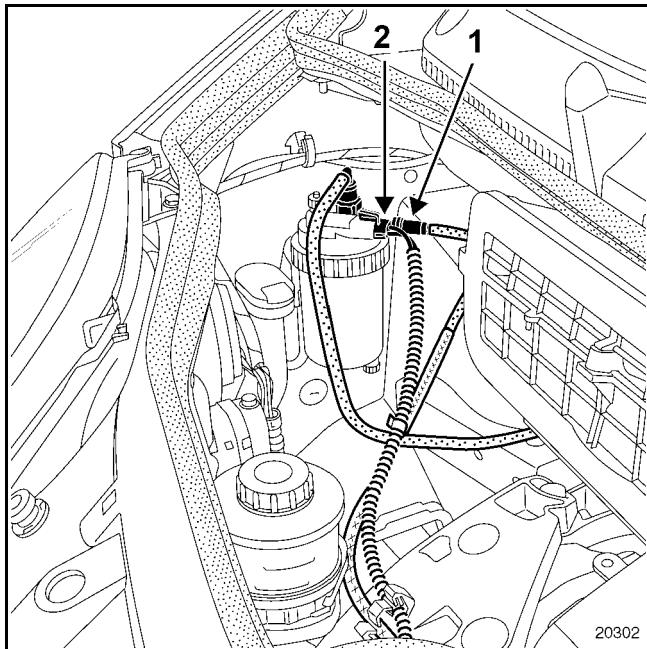
- the brake servo vacuum pipe,

TOP AND FRONT OF ENGINE

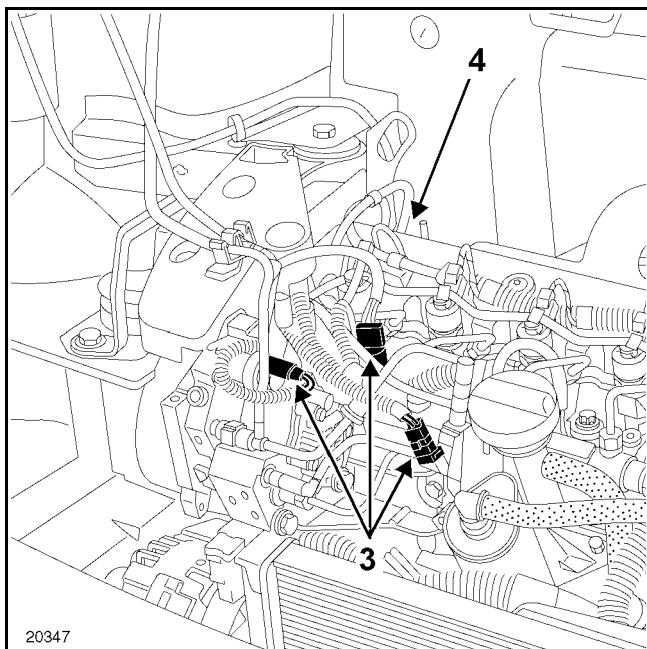
Cylinder head gasket

11

- fuel pipe (1) (fit anti-contamination plugs) and connector (2),

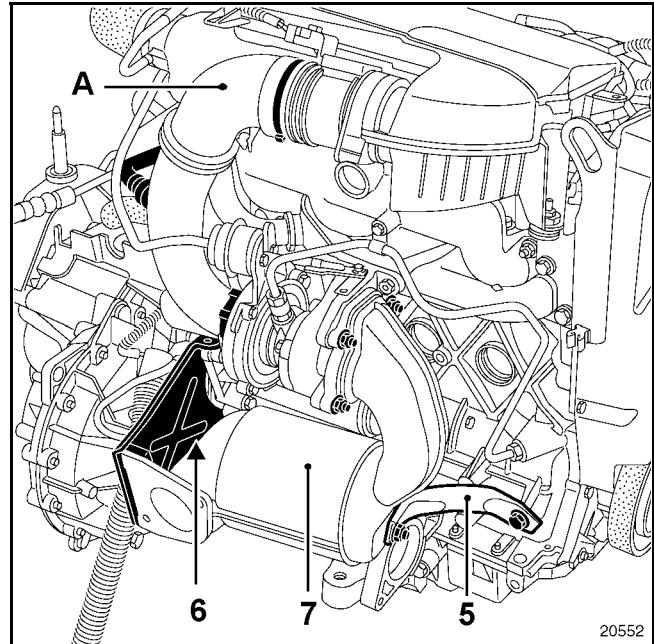


- the connectors (3) and Top Dead Centre sensor at (4),

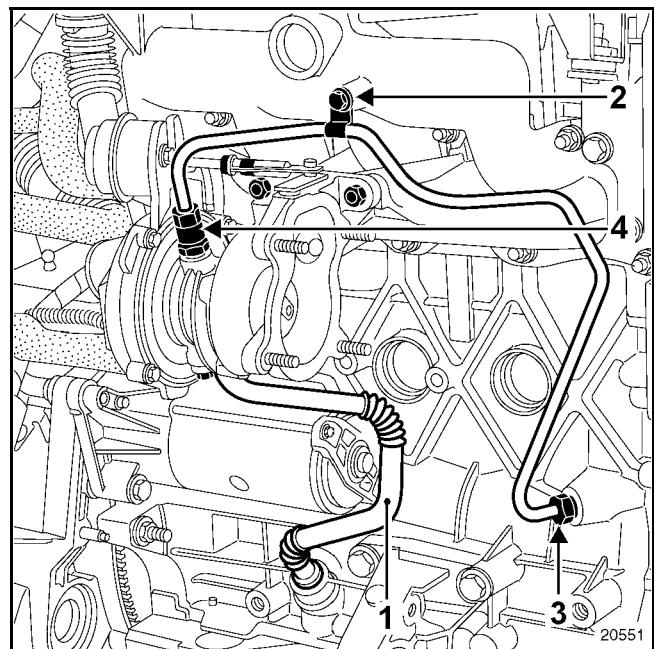


- the exhaust downpipe mountings,

- the air pipe (A) as well as the turbocharger air outlet pipe, then move it out of the way,
- the stays (5) and (6), then the catalytic converter (7),



- the oil return pipe (1),
- mounting (2), having loosened the pipe at (3), then remove the oil supply pipe at (4) and move it aside towards the bulkhead,



- the cylinder head bolts,
- the cylinder head.

CLEANING

It is very important not to scratch the gasket faces of any aluminium component.

Use the **Décapjoint** product to dissolve any remains of the gasket still adhering.

Wear gloves whilst carrying out the following operation.

Apply the product to the part to be cleaned, wait approximately ten minutes, then remove it using a wooden spatula.

Please take great care during this operation to prevent any foreign bodies from entering the oil galleries (channels located in the cylinder block and in the cylinder head).

CHECKING THE GASKET FACE

Check for mating surface bow using a ruler and a set of shims.

Maximum deformation: **0.05 mm.**

No regrinding of the cylinder head is permitted.

REFITTING

Special notes

Fit the cylinder head gasket. This is centred by two dowels.

Bring the pistons to mid-stroke position to prevent them from coming into contact with the valves as the cylinder head is tightened.

Centre the cylinder head on the dowels.

Lubricate the threads and under the heads of the mounting bolts.

Tighten the cylinder head using an angular tightening wrench (see Section **07 Tightening the cylinder head**).

Refitting is the reverse of removal.

Refit the timing belt (see procedure described in Section **11 Timing belt**).

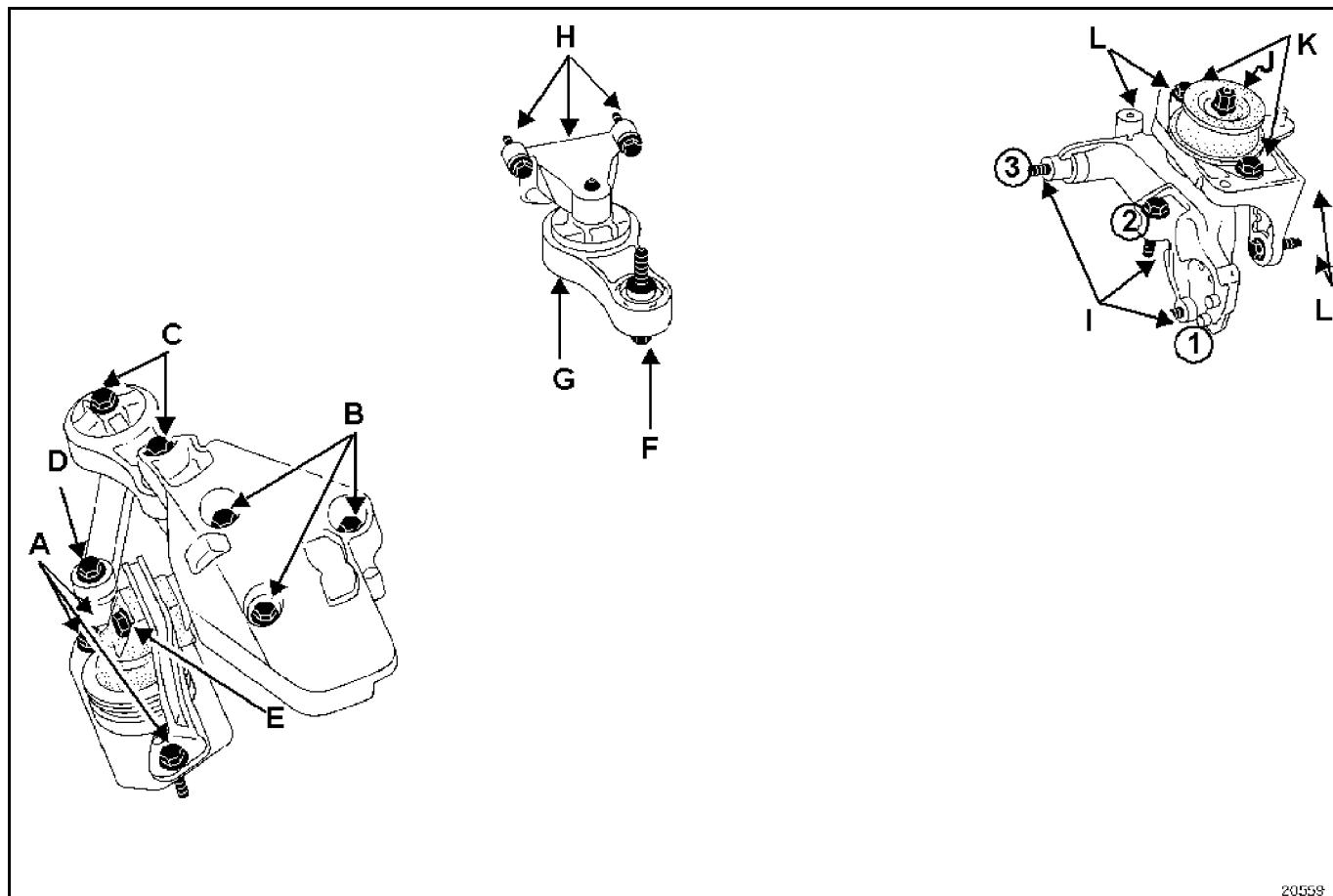
Fill and bleed the cooling system (see Section **19 Filling and Bleeding**).

TIGHTENING TORQUES (in daNm)



A	4.4
B	6.2
C	10.5
D	4.4
E	4.4
F	18

G	10.5
H	6.2
I	8.5
J	6.2
K	4.4
L	4.4



* Order of tightening: tighten bolt (1) then (2) and (3).

20559