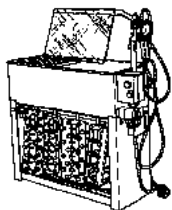


## Description

Ring for fitting pistons in the cylinder block

Standard 22 mm long 1/2" (12.7 mm) square drive socket for removing the oil pressure checking gauge



12624

Tooling for testing the cylinder head, including: a tray and the various kits suited for each model of cylinder head (plug, sealing plate, blanking plate). The approval number of the cylinder head test container is **664000**

Standard 1/2" (12.7 mm) square drive 8/12 /14 female torx socket .

Angular tightening tool from:

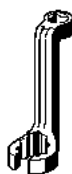
- e.g. **STAHL WILLE** part number **540 100 03**,
- e.g. **FACOM** part number **DM360**,
- e.g. **SAM** part number **1 SA**.



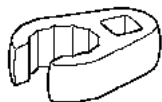
18077

Tool for fitting valve stem seals, e.g. **FACOM** part number **DM6J4**.

Angled nippers

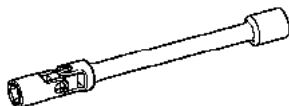


19672

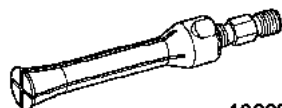
Wrench for removing high pressure pipes, e.g. **FACOM** part number **DM 19**

19670

Crowfoot adapter for tightening high pressure pipe



19668

Articulated wrench for removing and refitting the heater plugs, e.g. **FACOM** part number **B10R10A**.

19669

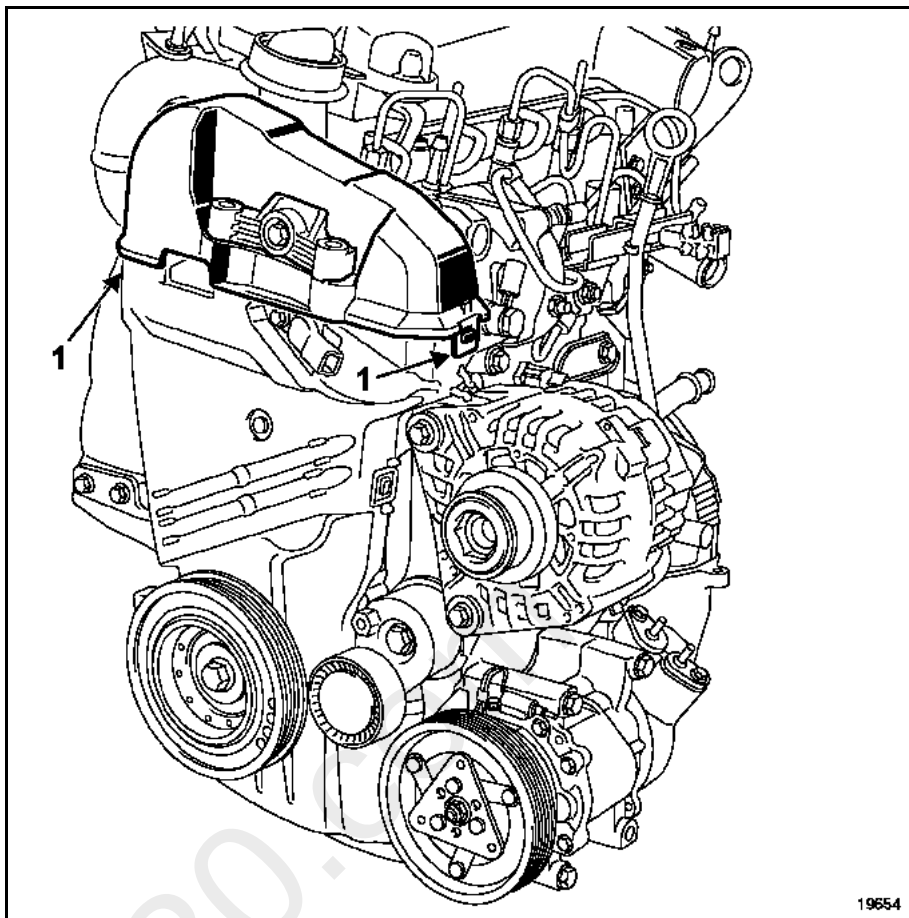
Wrench for removing crankshaft bearings, e.g. **FACOM U49 A D5**

Valve spring compressor

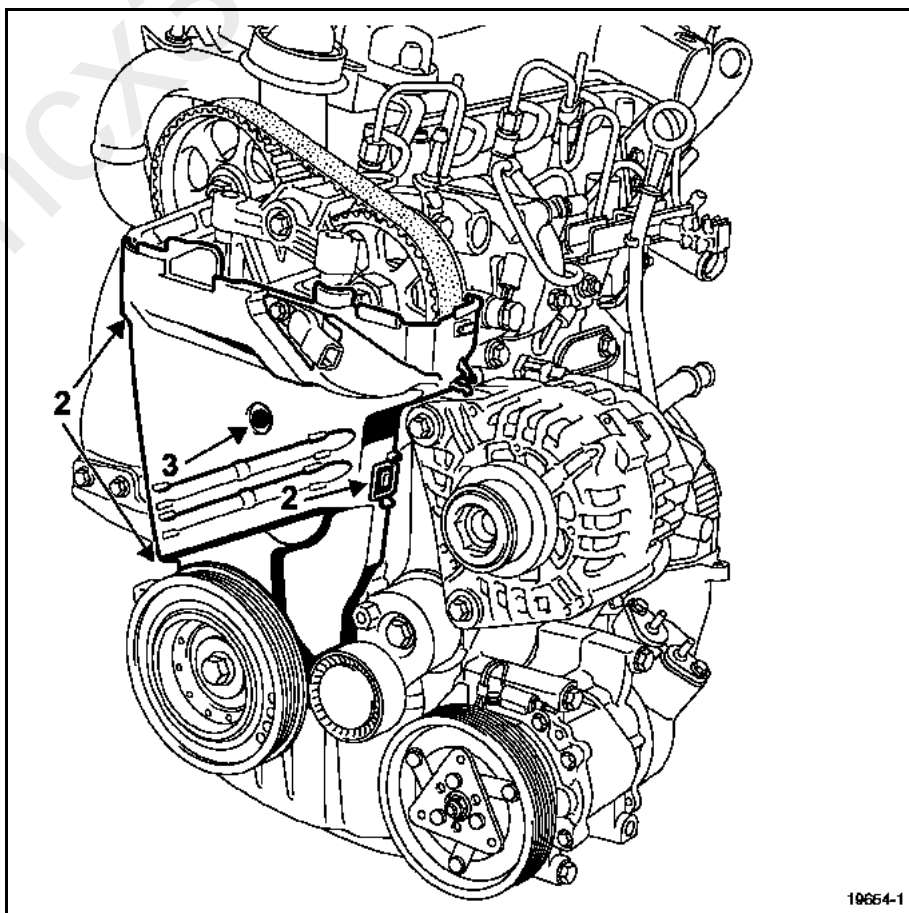
### Removing the upper engine

Remove:

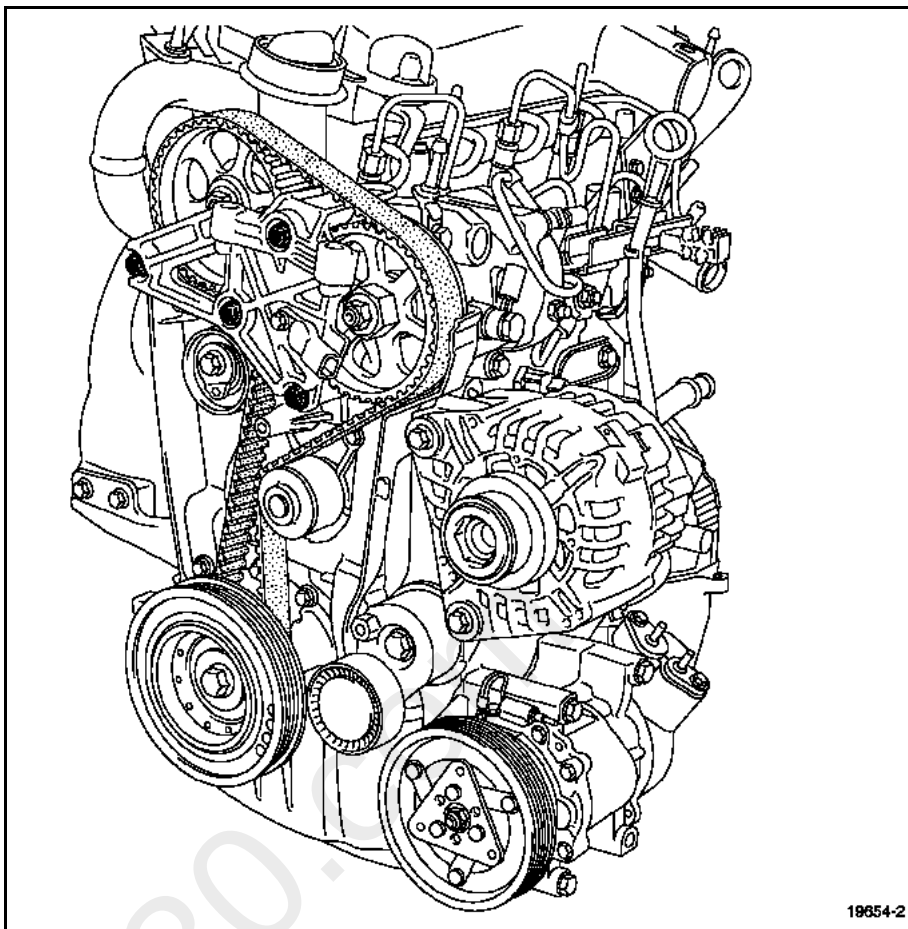
- the upper timing cover by unclipping the two tabs (1),



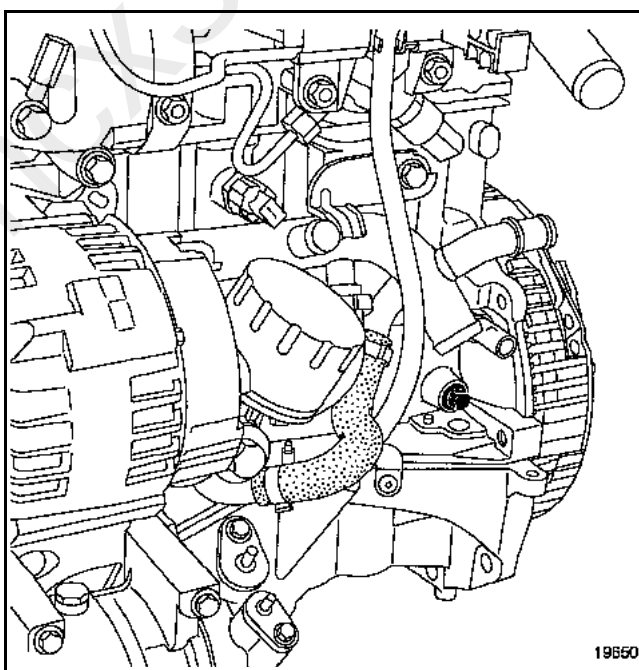
- the lower timing cover by unclipping the three tabs (2) and pulling out the plastic bolt (3),



- the cylinder head suspended mounting support,

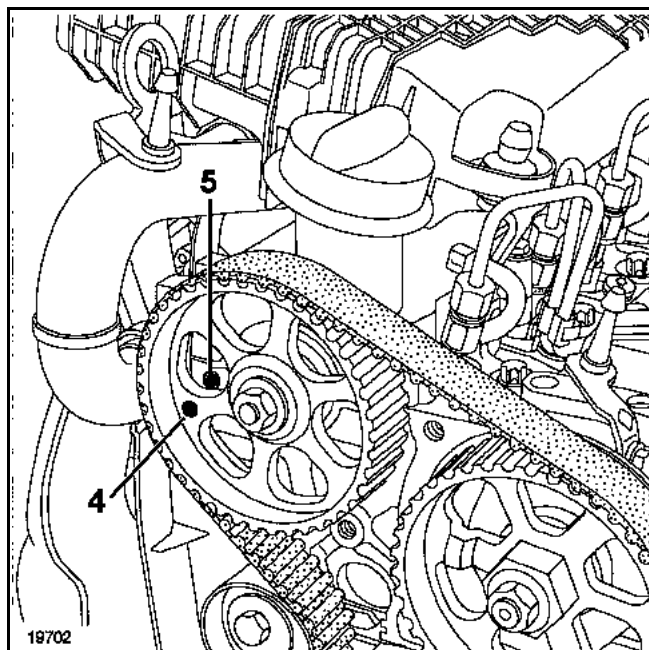


- the TDC pin cap.

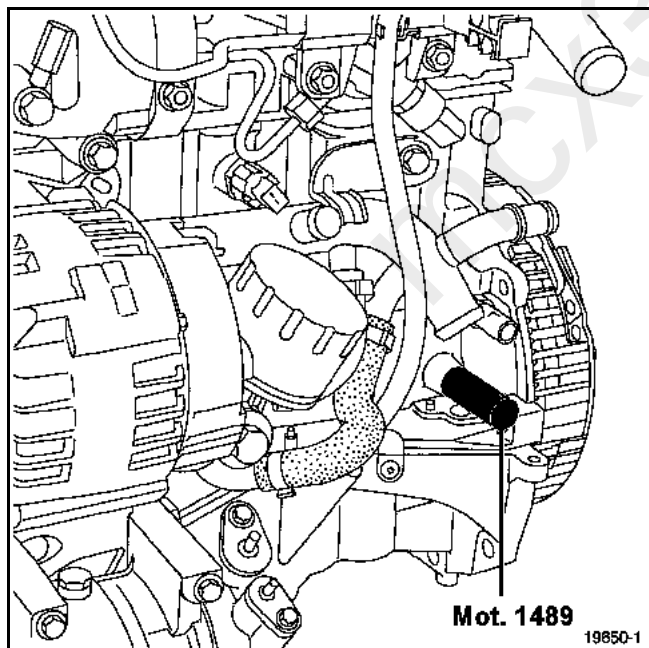


**Positioning the belt at the timing point**

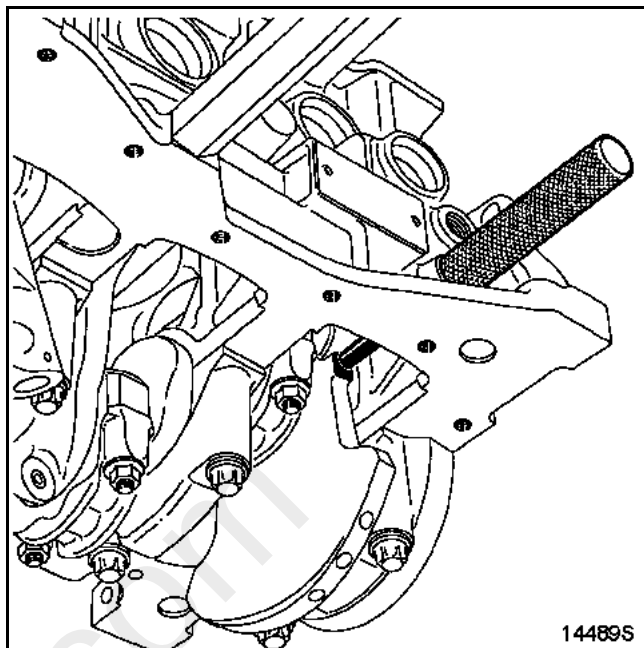
Position the hole (4) of the camshaft pulley almost opposite the hole (5) of the cylinder head.



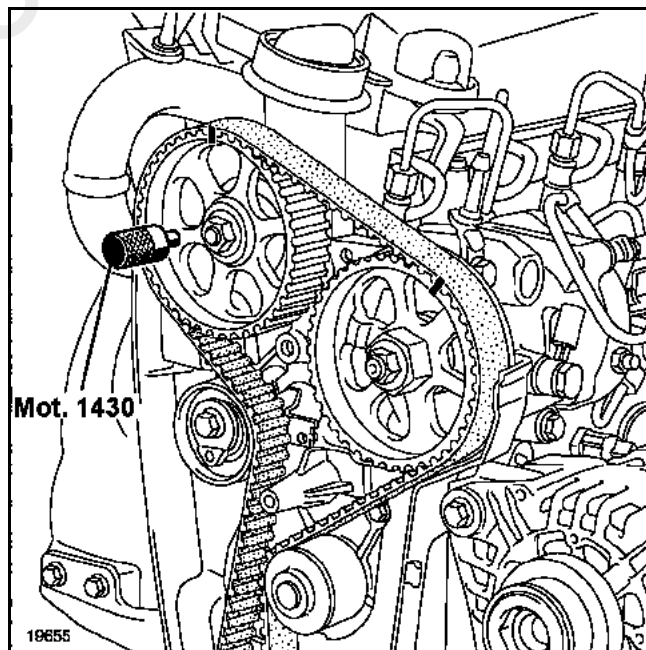
Screw in the TDC pin **Mot. 1489**.



Turn the engine clockwise (timing side) until the crankshaft touches the TDC pin **Mot. 1489**.

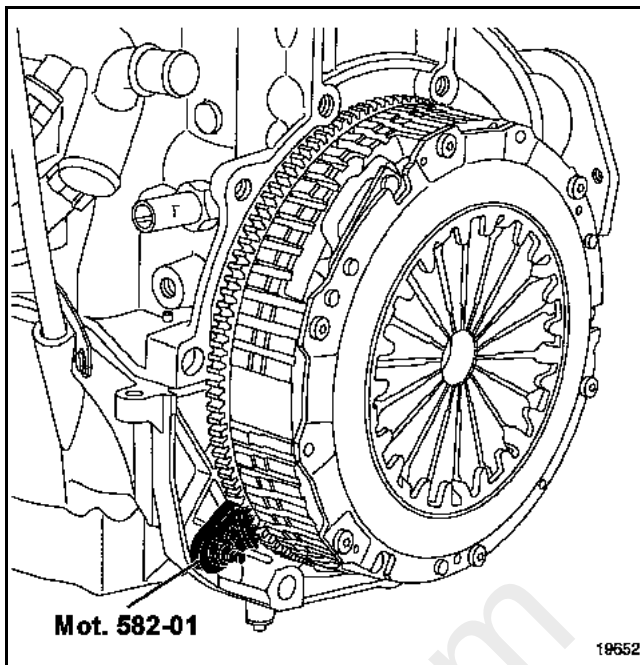


The pin **Mot. 1430** must engage in the camshaft pulley and cylinder head holes.

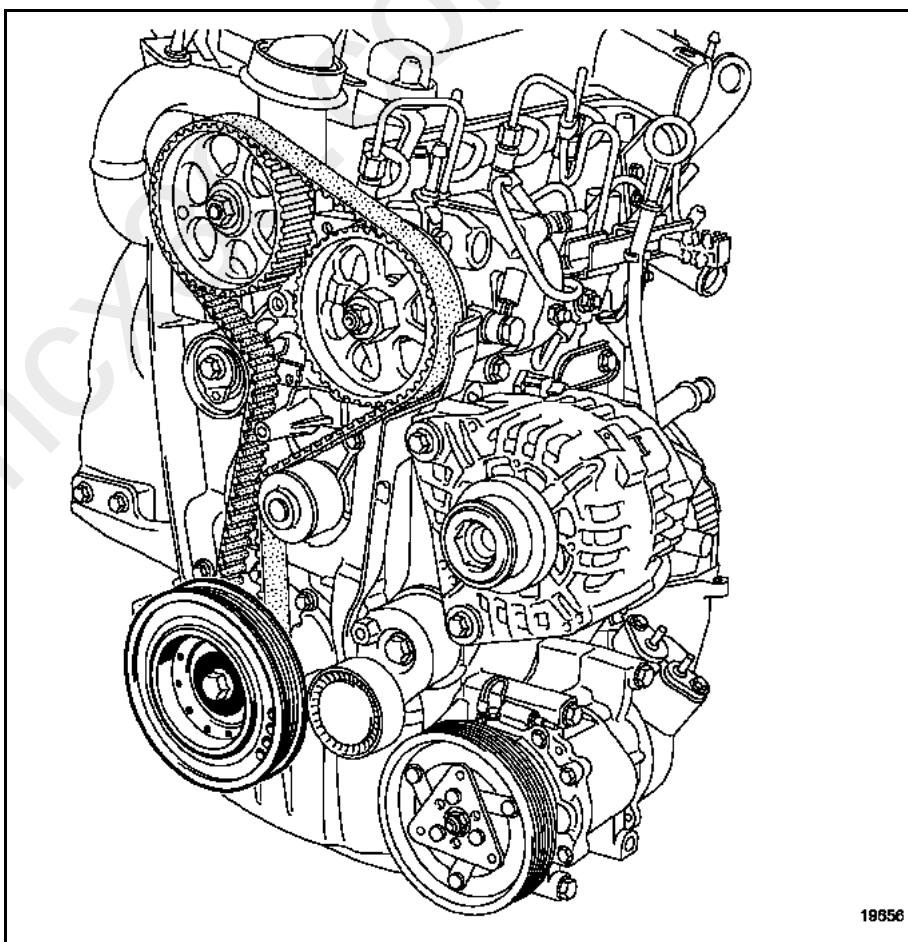


Remove **Mot. 1430** and **Mot. 1489**.

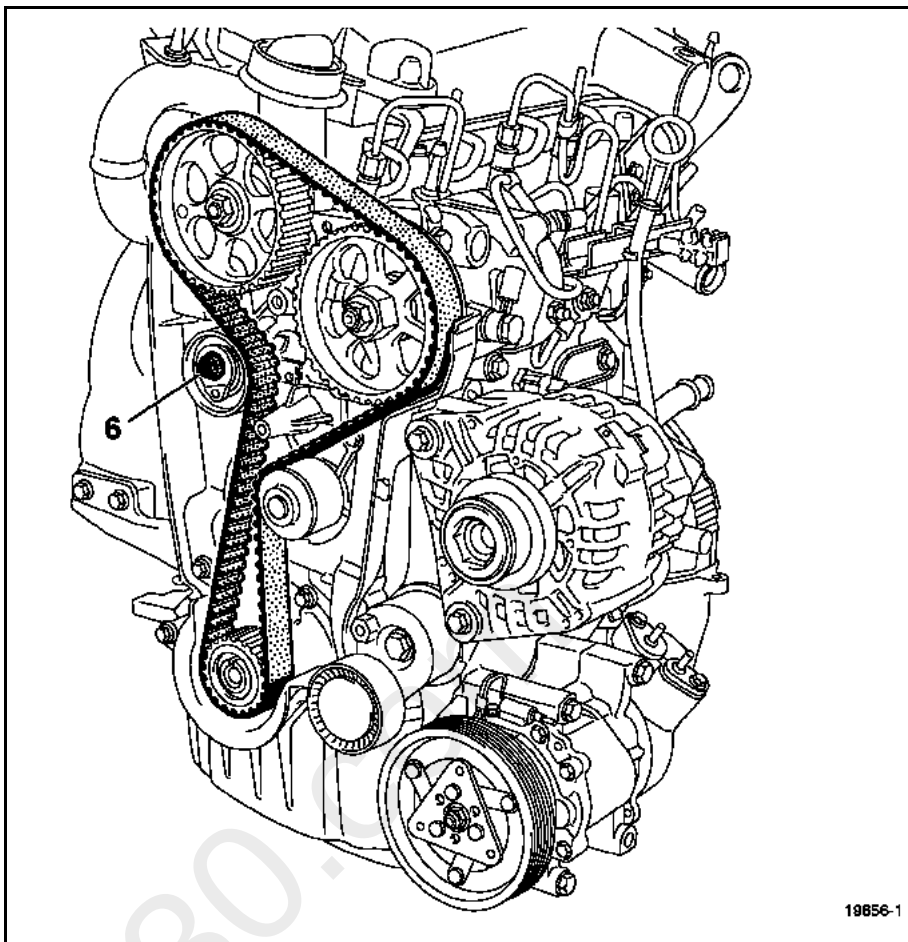
Fit flywheel block **Mot. 582-01**.



Remove the crankshaft accessories pulley.

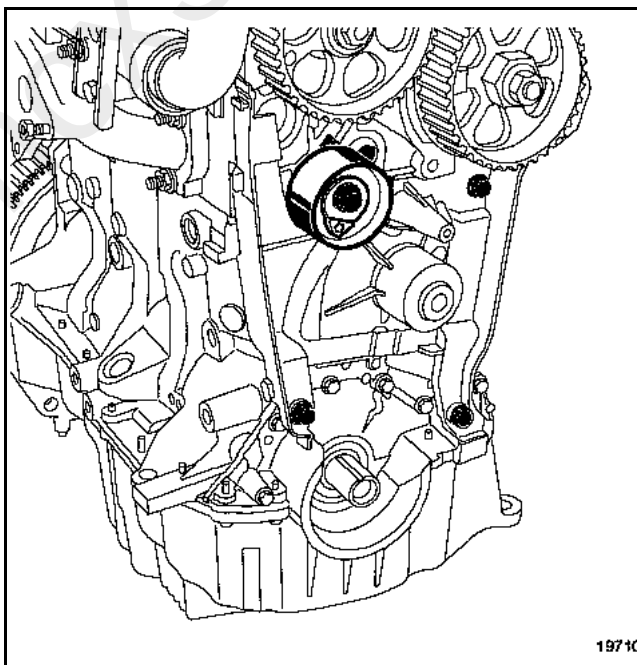


Slacken the timing belt by loosening the bolt (6) of the tension wheel, then remove the timing belt.

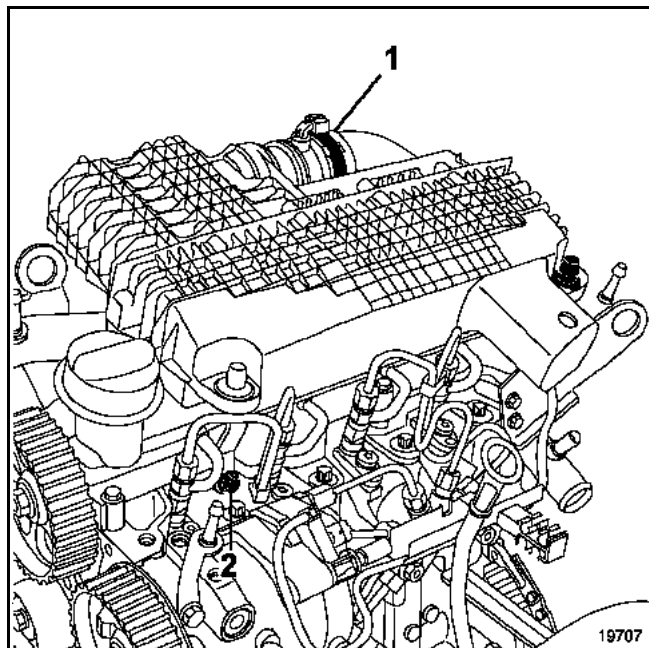


Remove:

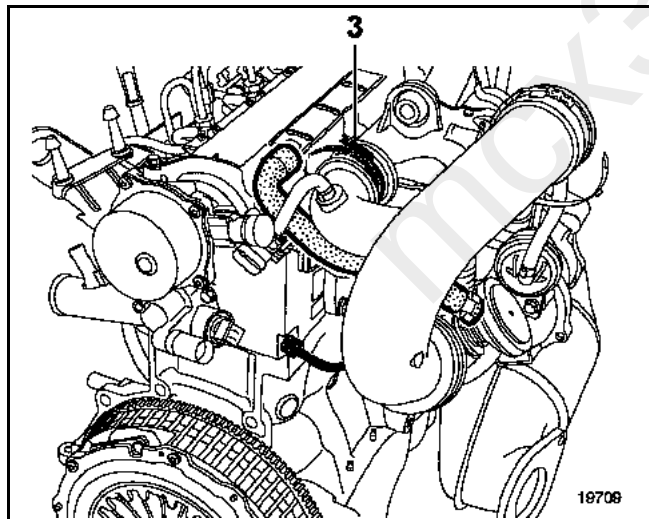
- the timing belt tension wheel,
- the inner timing cover,



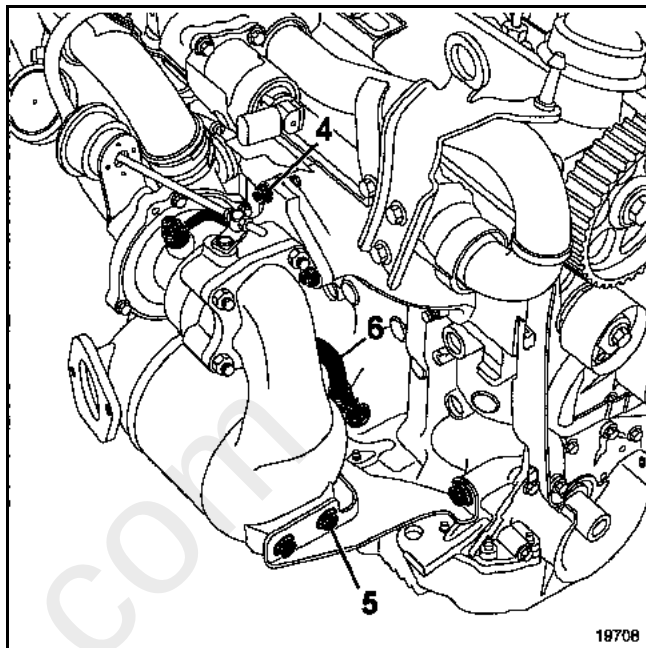
- the air filter unit, by removing the clamp (1) and the bolt (2),



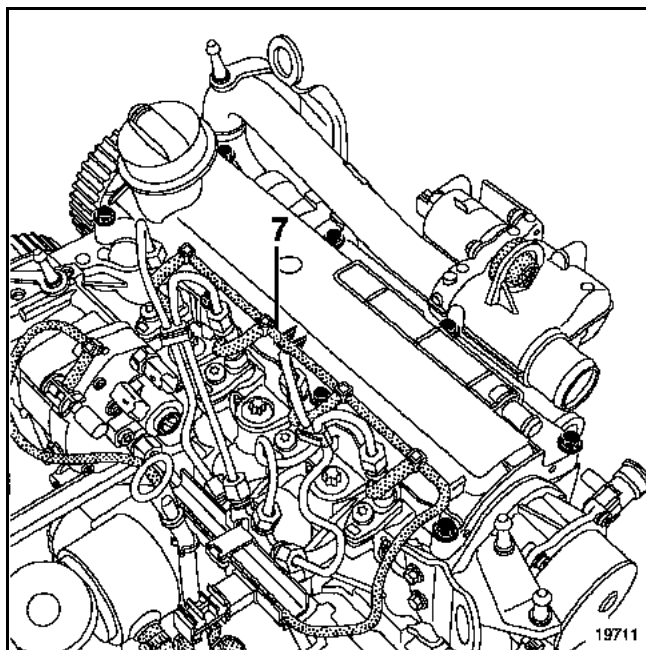
- the clamp (3),
- the oil vapour rebreathing pipe,
- the turbo oil supply pipe on the cylinder head side,



- the turbo oil supply pipe on the turbo side,
- the nuts (4) of the turbo flange,
- the bolts (5) of the catalytic converter bracket,
- the turbo oil return pipe (6).

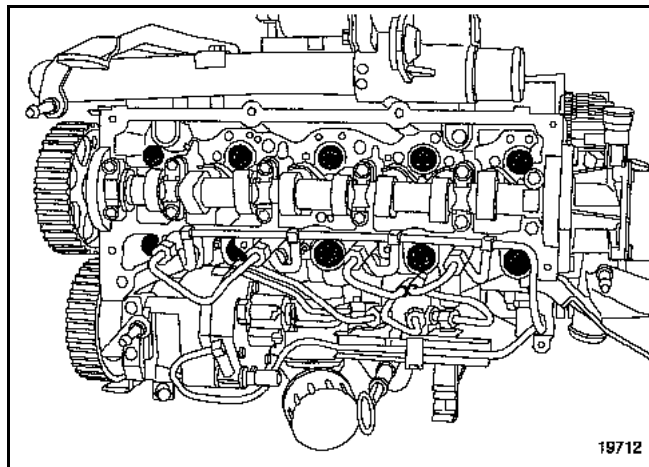


Unclip the fuel return pipe from the cylinder head cover at (7), then remove the cylinder head cover.



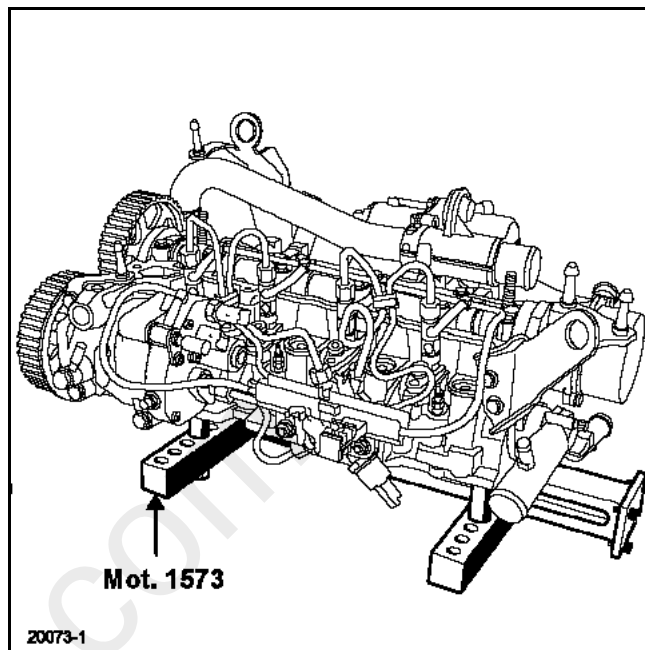
Remove:

- the dipstick guide,
- the cylinder head.



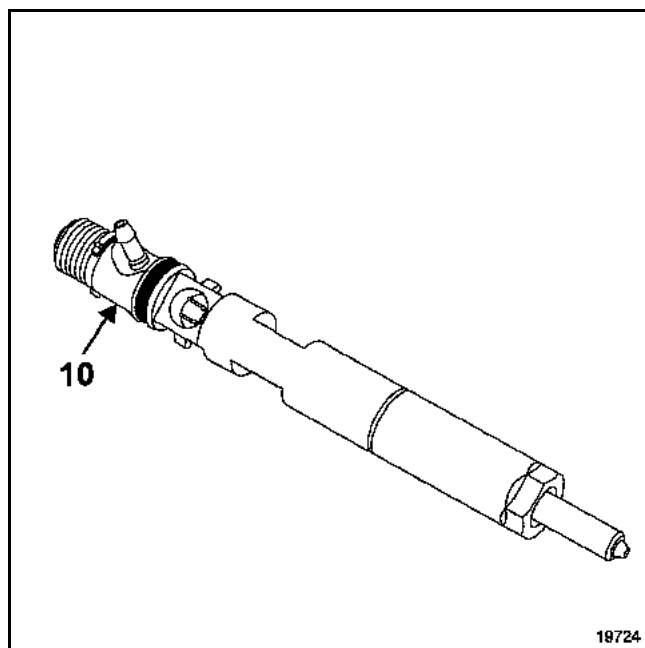
### STRIPPING THE CYLINDER HEAD

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



Pay strict attention to the rules regarding cleanliness (see start of document).

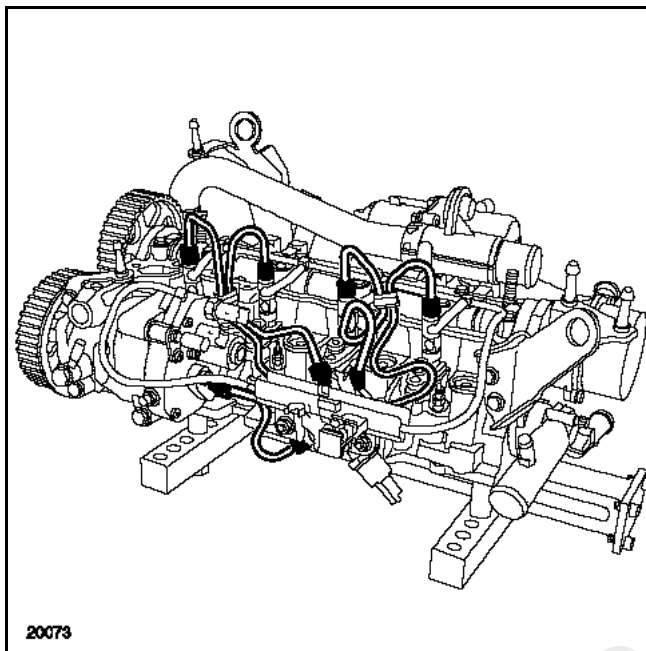
**WARNING:** when undoing the high pressure pipes, it is essential to secure the intermediate union (10) of the injector.



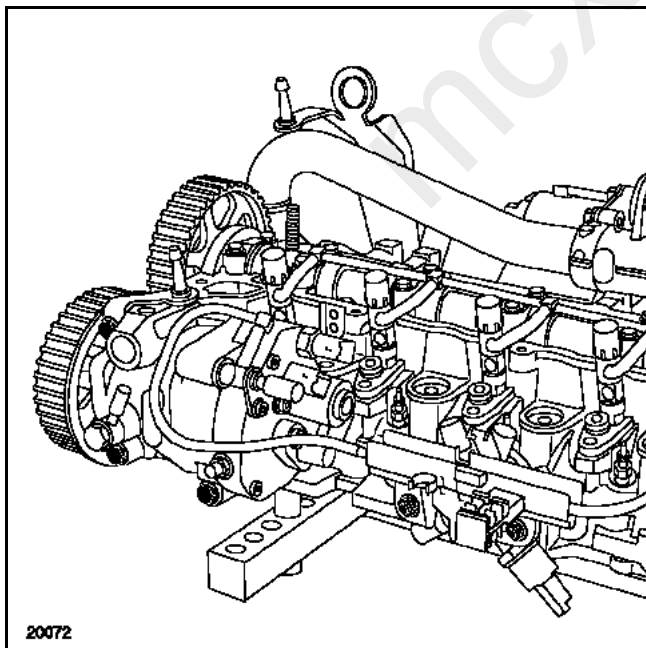
Remove:

- the high pressure pipes using **Mot. 1566** or a pipe wrench,

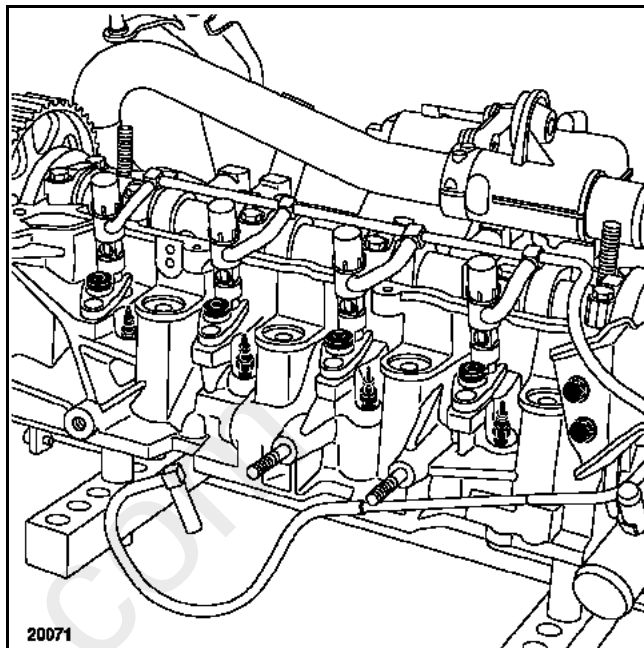
**fit the protective blanking plugs to the high pressure pump, the rail and the injectors.**



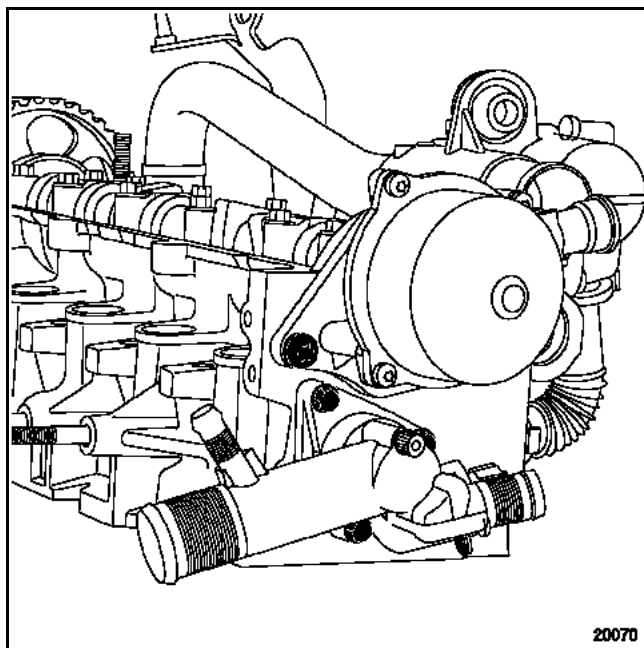
- the high pressure pump,
- the rail,



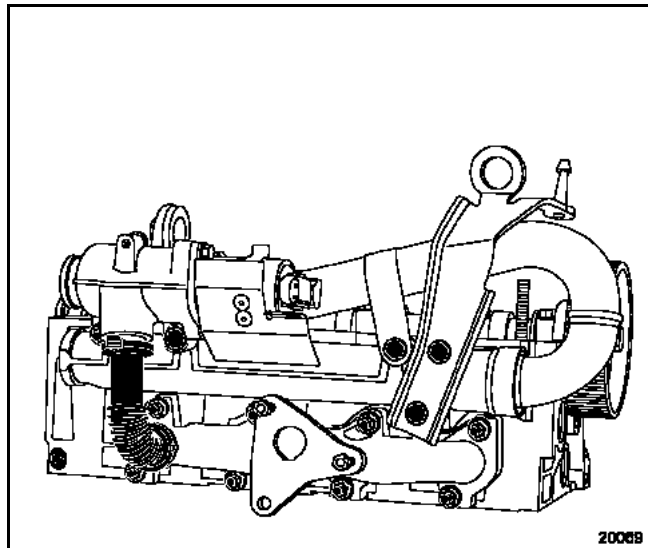
- the injectors (by marking them in relation to their cylinder),
- the pre-heater plugs using an angled spanner,
- the ring for lifting the engine (flywheel end),



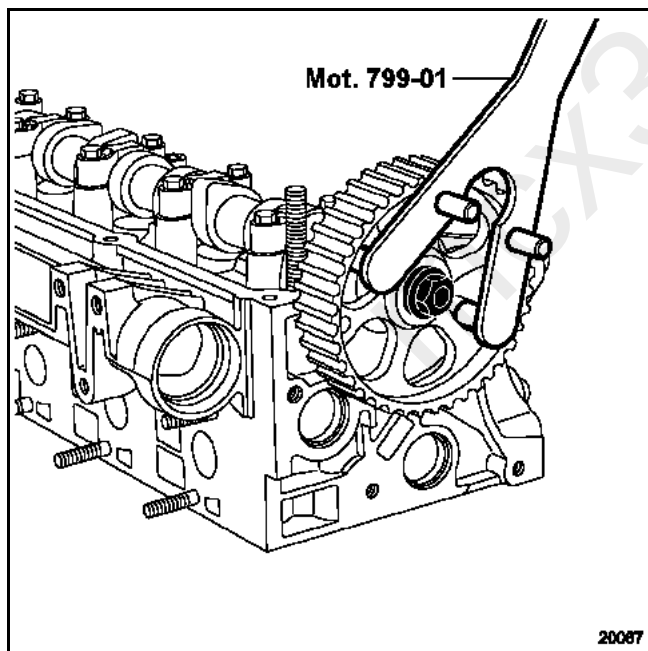
- the vacuum pump,
- the cylinder head coolant outlet unit,



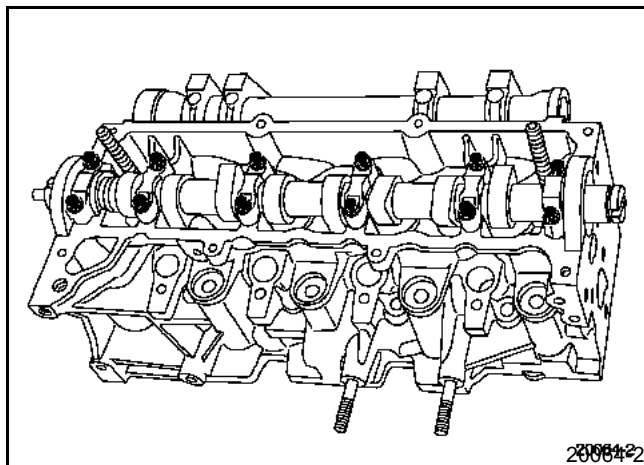
- the ring for lifting the engine (timing end),
- the exhaust gas recirculation pipe,
- the inlet pipe,
- the exhaust gas recirculation valve,
- the exhaust manifold,



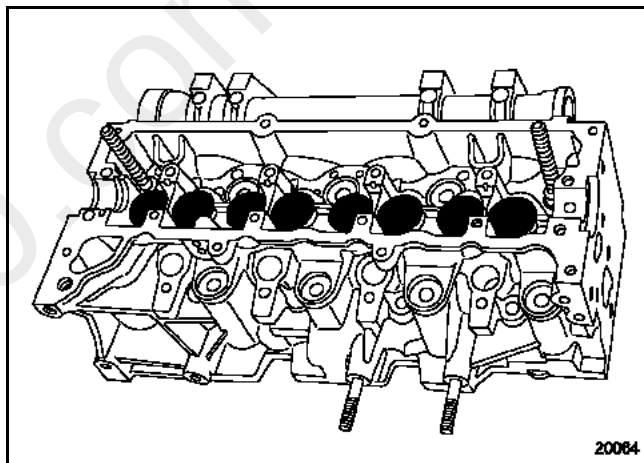
- the camshaft pulley using **Mot. 799-01**,



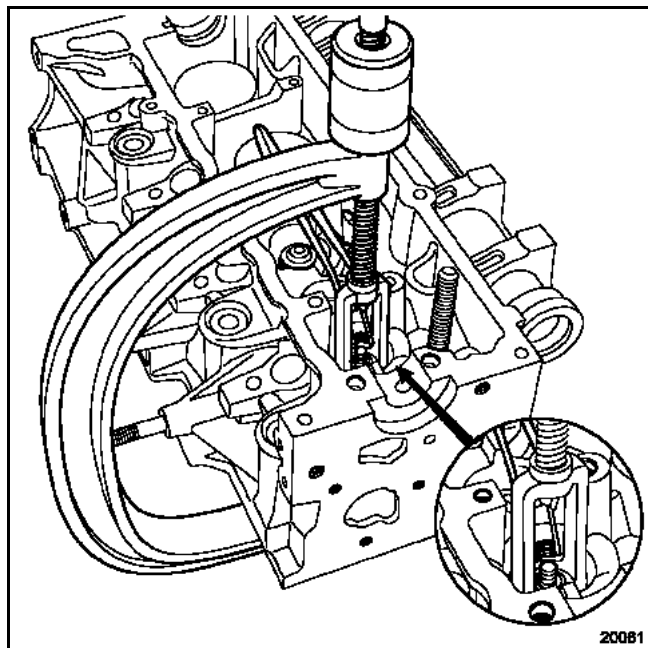
- the camshaft bearings,



- the tappets, **noting their position**.



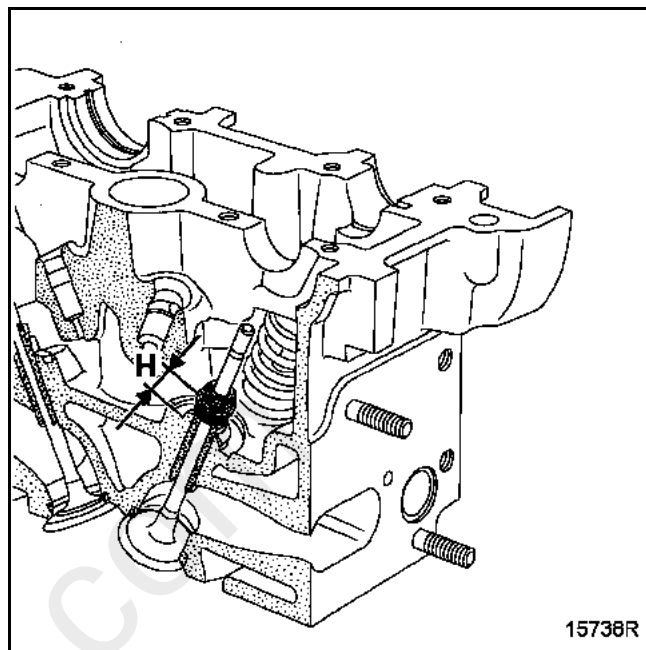
Compress the valve springs using the valve lifter.



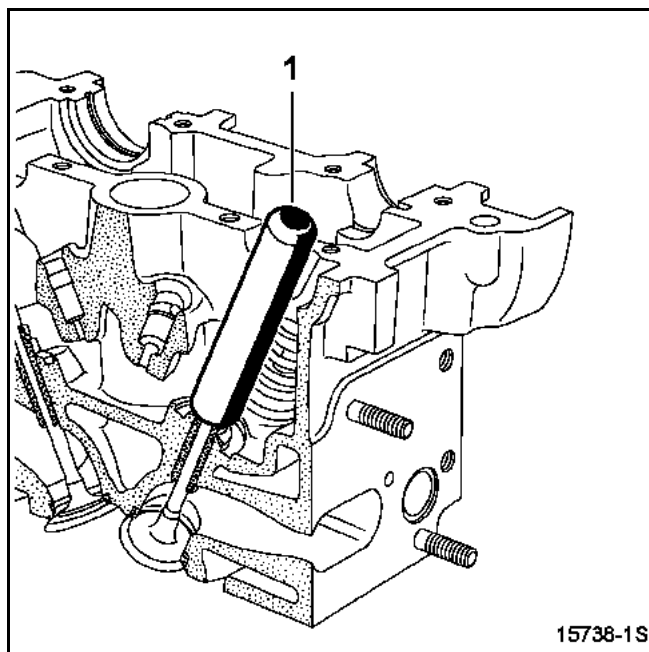
Remove:

- the keys,
- the upper cups,
- the springs,

**N.B.:** before removing the valves and the valve stem seals, it is vital to measure position H of one of the old seals in relation to the cylinder head using Mot. 1511 -01 or other suitable equipment.

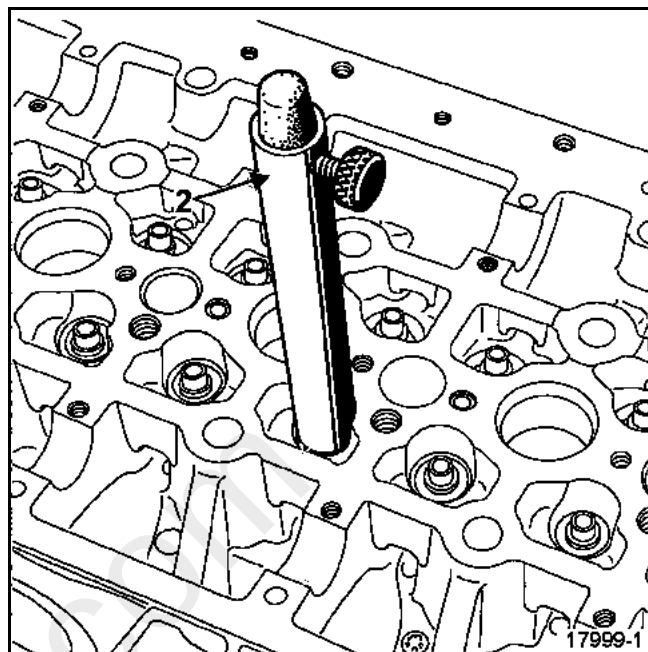


Fit the pushrod (1) of **Mot. 1511-01** on the valve stem seal.



**NOTE:** the internal diameter of the pushrod must be identical to that of the valve. In addition, the bottom of the pushrod must come into contact with the metal upper section of the valve stem seal.

Fit the guide tube (2) over the pushrod until the guide tube comes into contact with the cylinder head, locking the pushrod with the knurled wheel.



Remove the guide tube assembly plus pushrod, being careful not to loosen the knurled wheel.

Remove:

- the valves,
- the valve guide seals using the **Mot. 1335** pliers.

## CLEANING

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

Use **DECAPJOINT** to dissolve any part of the seal which remains stuck to the metal surface.

Apply the product to the part to be cleaned, wait approximately 10 minutes, then remove it using a wooden spatula.

Wear gloves whilst carrying out this operation.

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.**

**Failure to follow this instruction could lead to the blocking of the oilways, resulting in rapid and serious damage to the engine.**

## CHECKING THE GASKET FACE

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

Maximum bow **0.05 mm**

**Test the cylinder head to detect possible cracks** using the cylinder head test tools (comprising a tray and a kit suited to the cylinder head, plug, sealing plate, blanking plate). The approval number of the cylinder head test container is **664000**

## CHECKING THE CAMSHAFT END PLAY

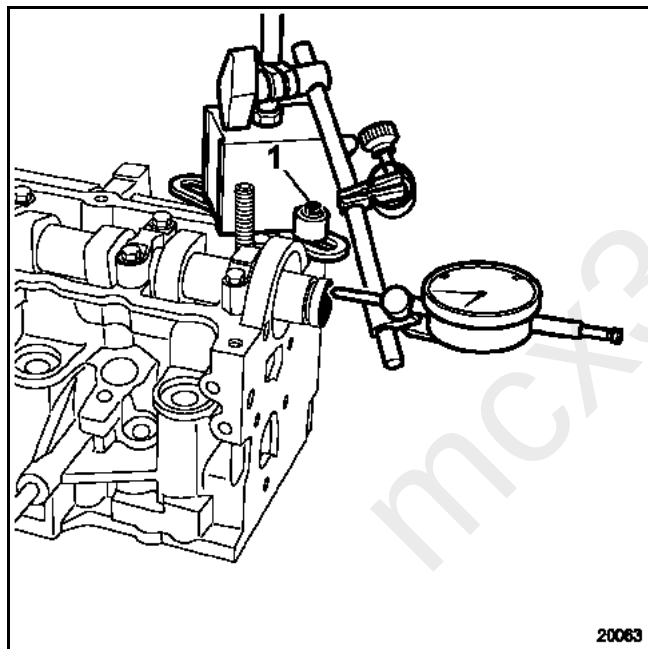
**NOTE:** to attach the magnetic gauge to the cylinder head, clamp **Mot. 588** must be used and secured using the oil filler attachment bolt (1) of the cylinder head cover and a spacer with the following dimensions:

- external diameter **18 mm**,
- diameter of bolt (1) hole **9 mm**,
- height **15 mm**.

Refit:

- the camshaft,
- the camshaft bearings (positioning them correctly with bearing 1 on the flywheel end), then tighten the bolts to a torque of **1 daN.m**.

Check the end play, which must be between **0.08** and **0.178 mm**.



Remove the camshaft bearings and the camshaft.

## 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.

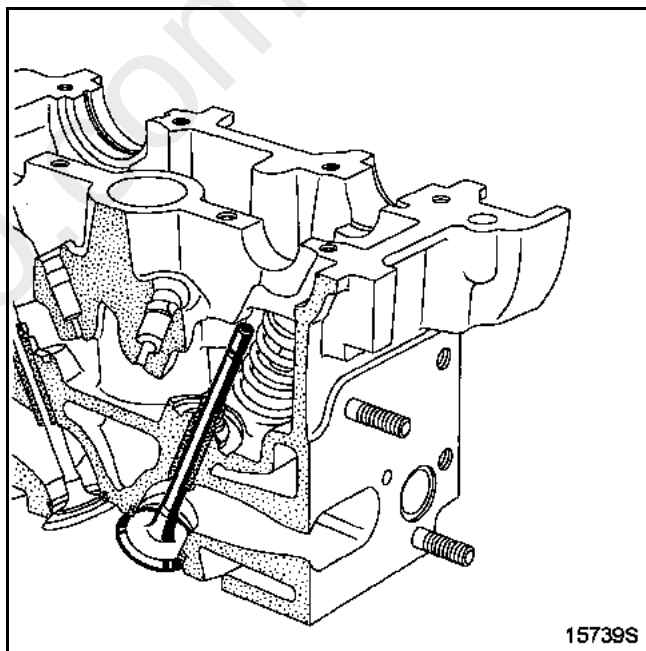
Lubricate the inside of the valve guide.

**It is imperative to fit the valve stem seals using tool Mot. 1511-01 or other suitable equipment.**

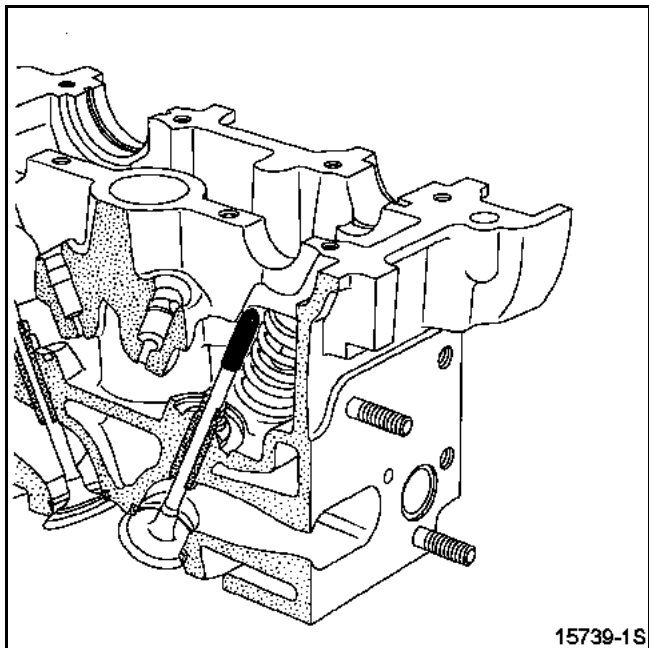
**NOTE: do not lubricate the valve stem seals before fitting them.**

## Fitting new valve stem seals

Place the valve in the cylinder head.

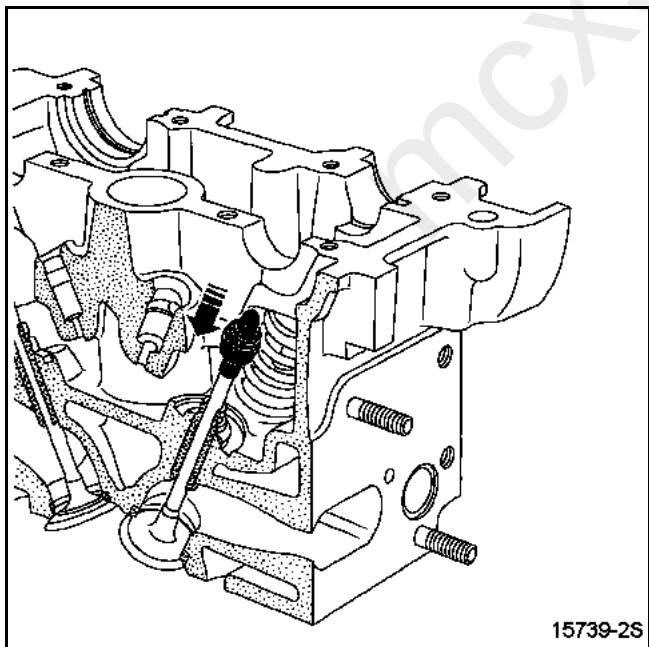


Place the barrel of tool **Mot. 1511-01** over the valve stem (the internal diameter of the barrel must be identical to the diameter of the valve stem).

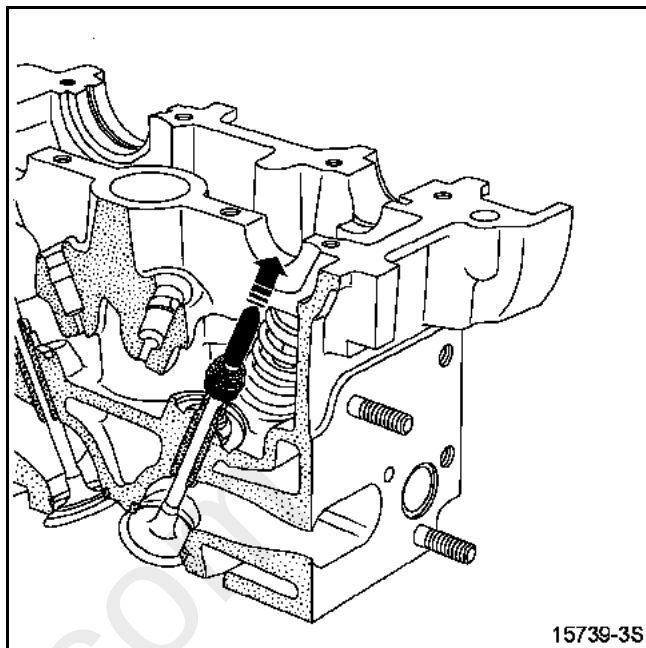


Keep the valve pressed against its seat.

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

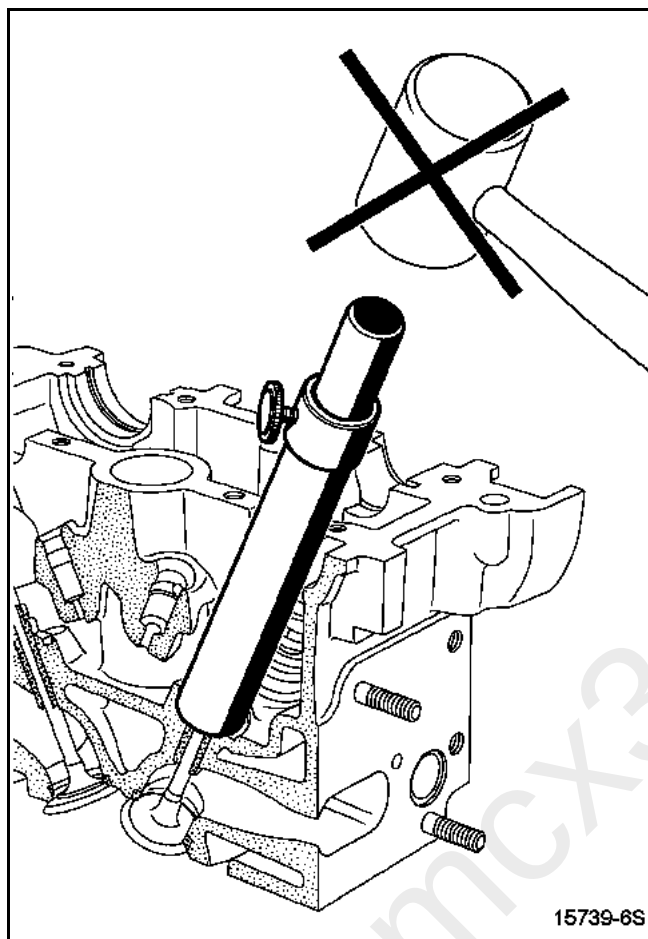


Push the valve stem seal past the tool barrel, then withdraw the barrel.



Place the guide tube plus pushrod assembly on the valve stem seal.

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.



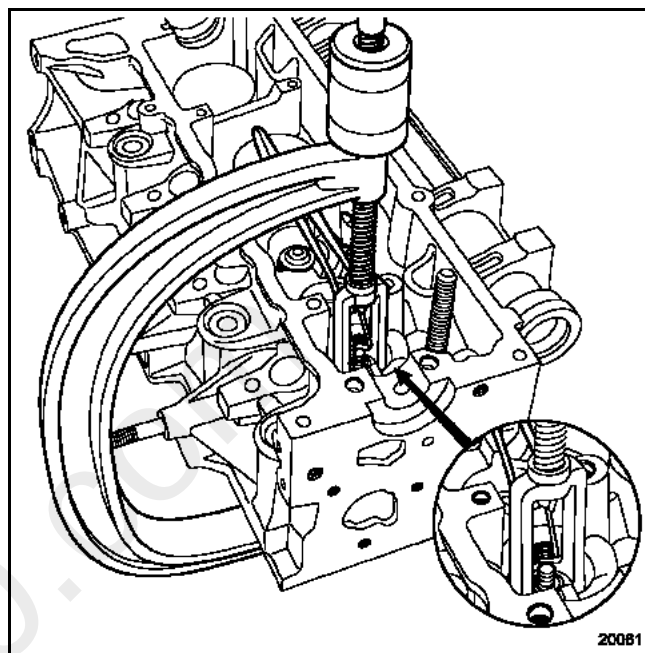
Repeat these operations for all the valves.

Fit:

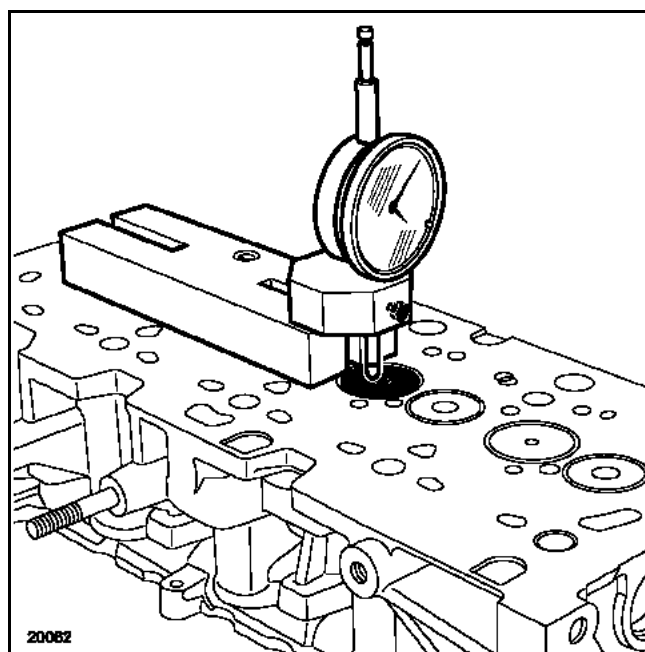
- the springs,
- the upper cups,

Compress the springs.

Refit the keys using tweezers.



Check the valve protrusion which should be  $0 \pm 0.07$  mm.



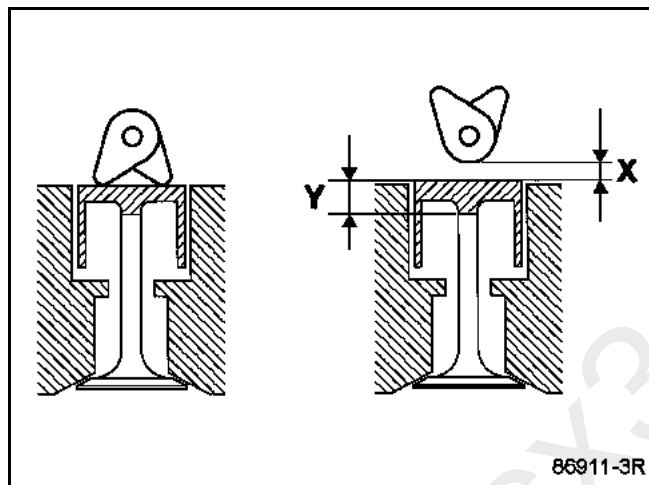
**CHECKING AND ADJUSTING THE VALVE CLEARANCE**

Refit:

- the tappets,
- the camshaft,
- the camshaft bearings, tightening the bolts to a torque of **1 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 at the Parts Store).



|   |   |
|---|---|
| 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:**

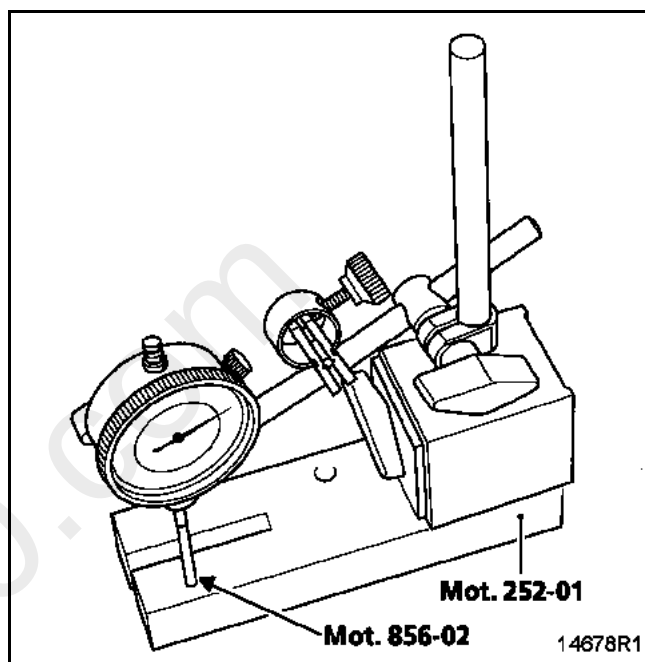
|          |      |                  |
|----------|------|------------------|
| Inlet    | 0.20 | + 0.05<br>-0.075 |
| Exhaust: | 0.40 | + 0.05<br>-0.075 |

Remove:

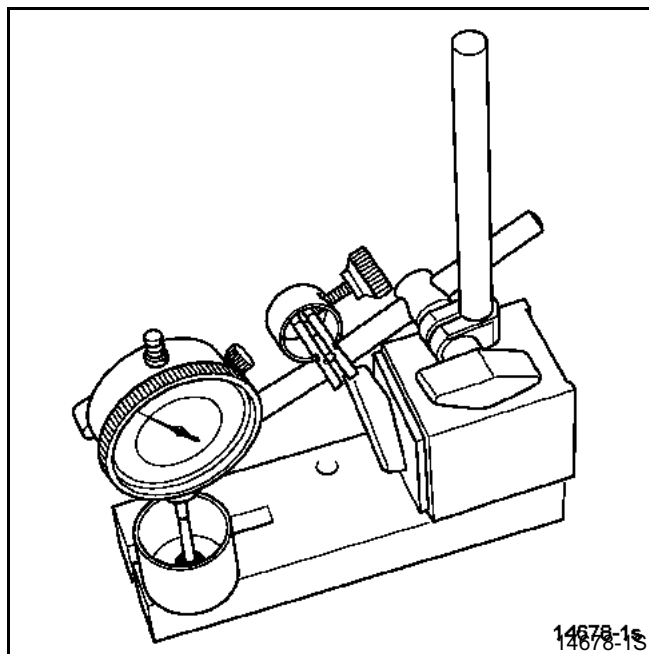
- the camshaft bearings,
- the camshaft,
- the tappet(s) not within tolerance.

**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.

Refer to the Replacement Parts Catalogue for the vehicle concerned to select the various thicknesses of the tappet(s) .

Check the valve clearance again.

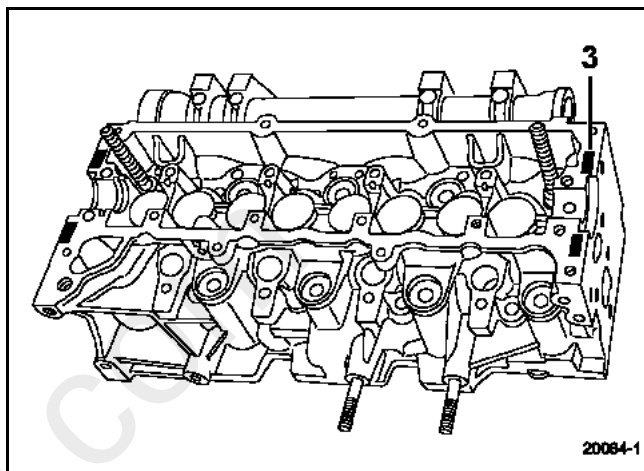
Remove:

- the camshaft bearings,
- the camshaft,
- the tappet(s) not within tolerance.

Grease the underside of the tappets and the camshaft bearings.

**Degrease the gasket faces (of the cylinder head and bearings numbers 1 and 6). They should be clean, dry and free from grease (in particular, remove finger marks).**

Lay four beads (3) of **Loctite 5181** with a width of **1 mm** on bearings 1 and 6 of the cylinder head.



Refit:

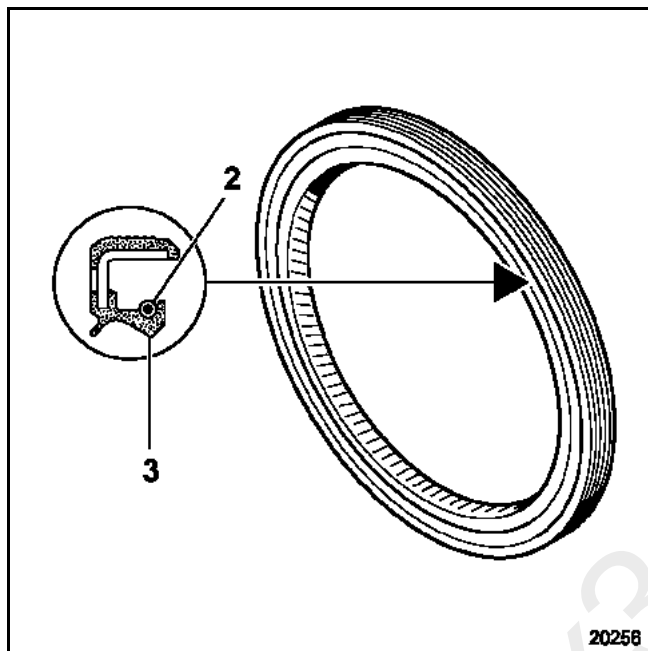
- the camshaft,
- the camshaft bearings (these are numbered from 1 to 6 and bearing (1) should be positioned **on the flywheel end**) tightening the bolts to a torque of **1 daN.m**.

**Fitting the camshaft seal**

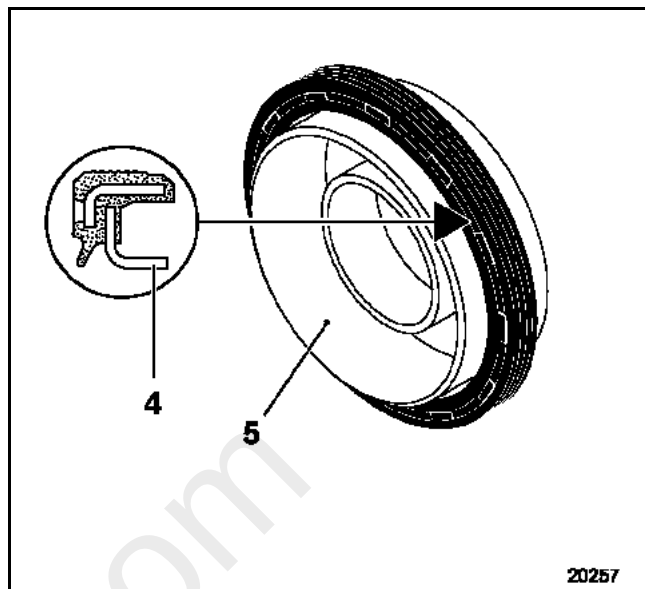
This engine can be fitted with two different types of seal.

Old and new seals are easily recognised.

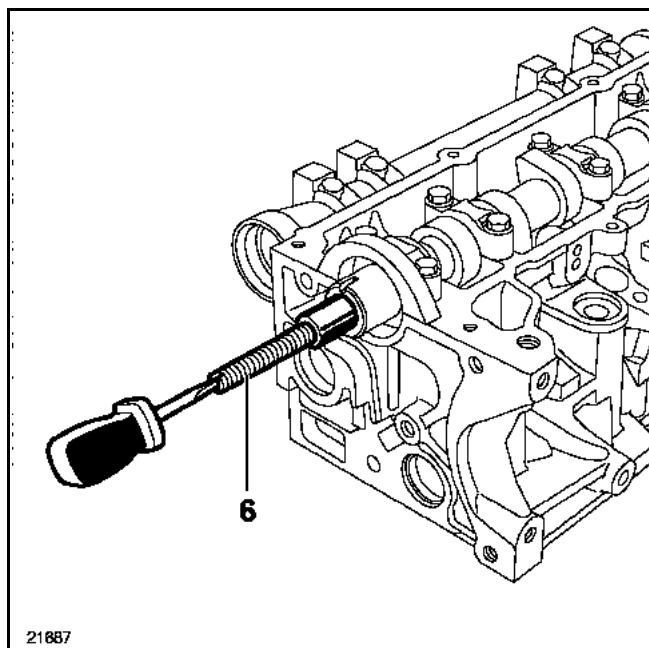
The old rubber seal is fitted with a spring (2) and has a "V"-shaped sealing lip (3).



The new rubber seal has a flat sealing lip (4) and a protector (5) which also assists in fitting the seal to the engine.

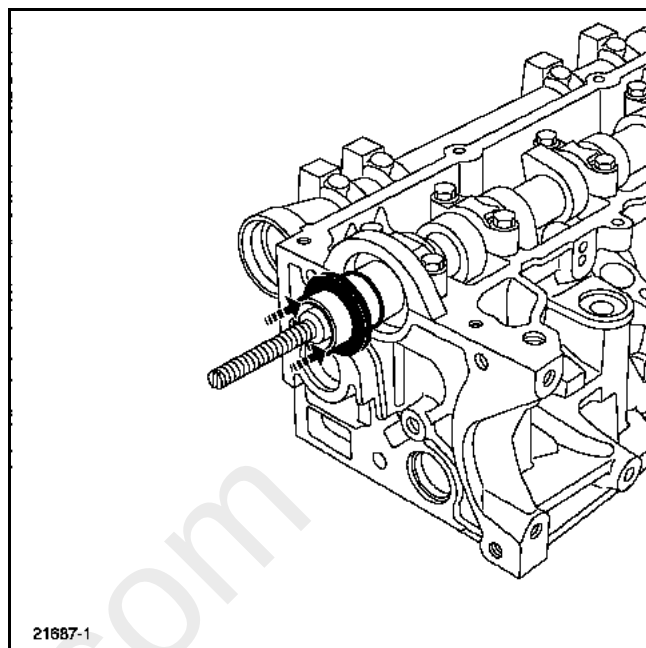


Screw the shouldered rod (6) of **Mot. 1632** onto the stud of the camshaft.

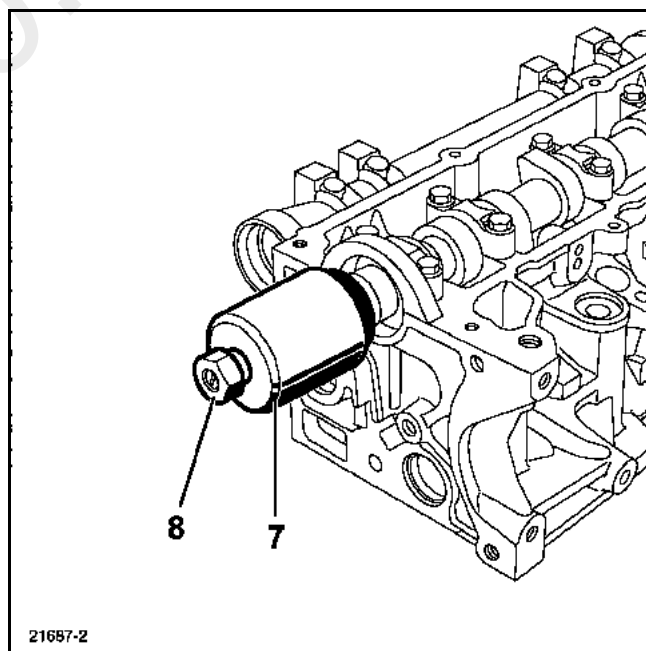


Fit the old seal on the camshaft.

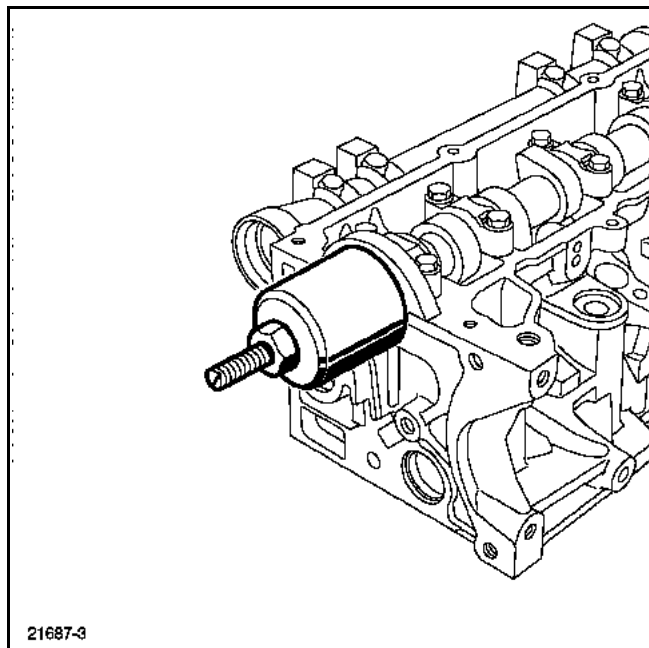
For the new seal, put the protector with the seal on the camshaft, taking care not to touch the seal.



Fit the cover (7) and the collar nut (8) of **Mot. 1632**.

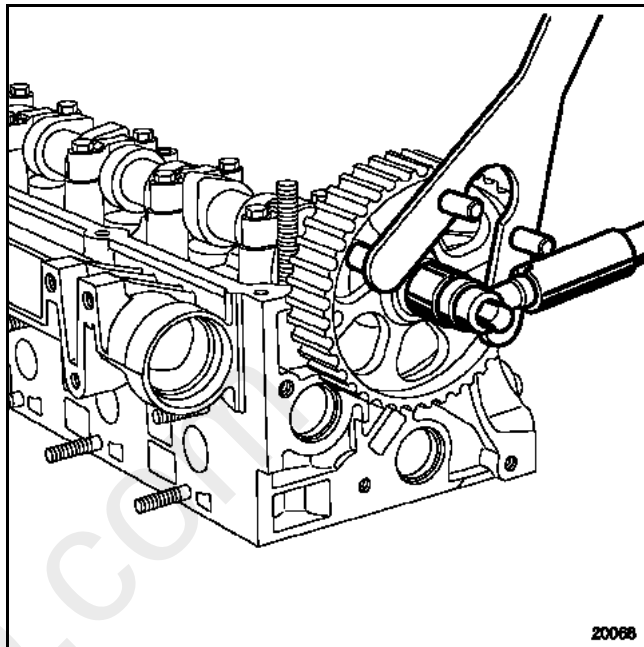


Screw the collar nut until the cover touches the cylinder head.



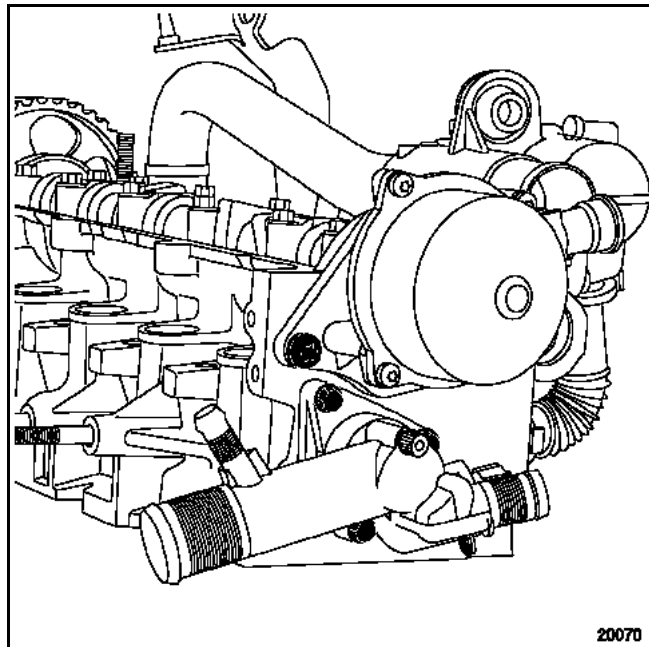
Remove the nut, the cover, the protector and the shouldered rod.

Refit the camshaft pulley, tightening the new nut to a torque of **3 daN.m plus an angle of 84°**.

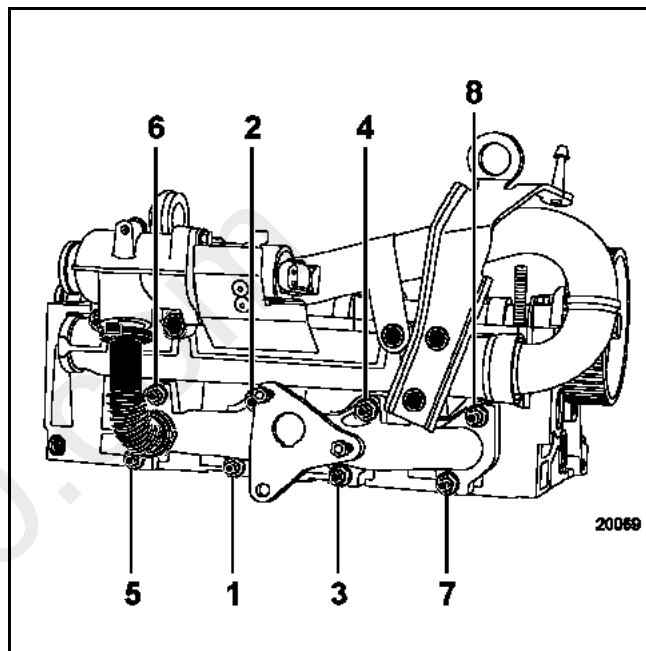


## Refit:

- the vacuum pump fitted with a new seal, tightening the bolts to a torque of **2.1 daNm**,
- the cylinder head coolant outlet unit fitted with a new seal, tightening the bolts to a torque of **1 daNm**,



- the exhaust manifold fitted with new seals, tightening the bolts to a torque of **2.6 daNm in the recommended order**,
- the exhaust gas recycling valve and the exhaust gas recycling pipe fitted with new clips. Tighten the mounting bolts of the valve to a torque of **2.1 daNm**, then tighten the clips of the pipe using pliers **Mot. 1567**,
- the inlet pipe fitted with a new seal,
- the ring for lifting the engine (timing end).



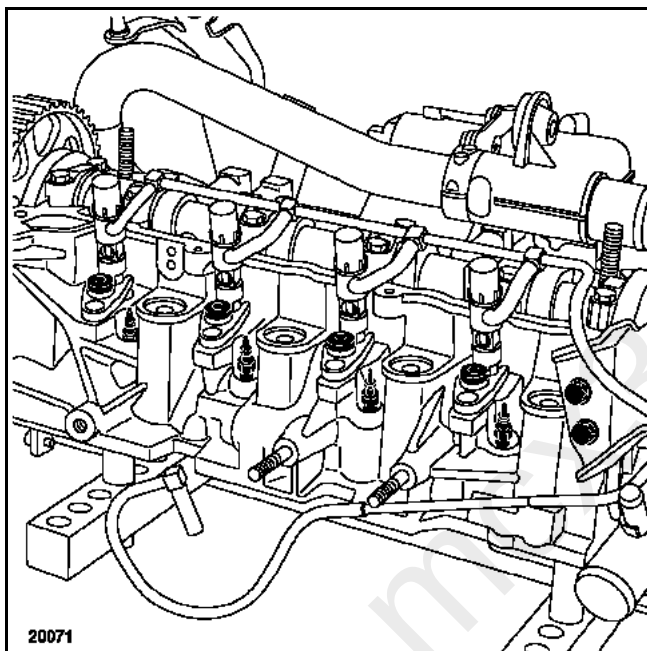
Clean the injector sockets and the injector bodies, as well as their brackets using a lint-free cloth (use the wipes recommended for this purpose, part no. **77 11 211 707**) dipped in clean solvent.

Dry off using a different new wipe.

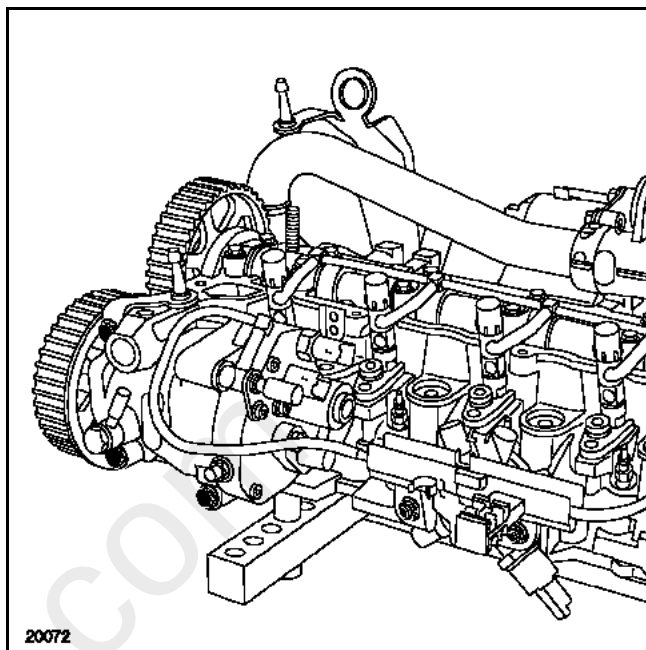
Replace the compression washer with a new washer.

Refit:

- the injectors (using the marks made during removal), tightening the mounting flanges to a torque of **2.8 daN.m**,
- the pre-heater plugs, tightening them to a torque of **1.5 daN.m**,
- the ring for lifting the engine (flywheel end),



- the high pressure pump, tightening the bolts to a torque of **2.1 daN.m**,
- the high pressure rail **without locking its mounting nuts**.



#### Method for refitting the injector pipes

**WARNING:** all removed high pressure pipes must be systematically replaced.

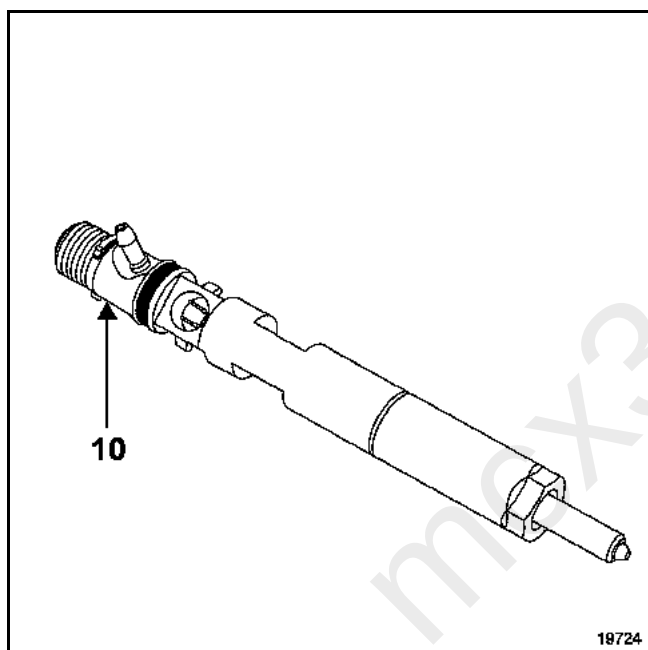
Before fitting the new high pressure pipes, lubricate the threads of the nuts with the applicator supplied with the kit of new parts.

### Fit the rail-high pressure pump pipe:

- remove the protective plugs from the pump high pressure outlet and the rail high pressure inlet.
- insert the olive of the high pressure pipe into the taper of the pump high pressure outlet.
- insert the olive of the high pressure pipe into the taper of the rail high pressure inlet.
- put the high pressure pipe nuts in position by hand beginning with the one located on the rail side.

### Fit the injector-high pressure rail pipe:

**WARNING:** when tightening the high pressure pipes, it is essential to secure the intermediate union (10) of the injector.



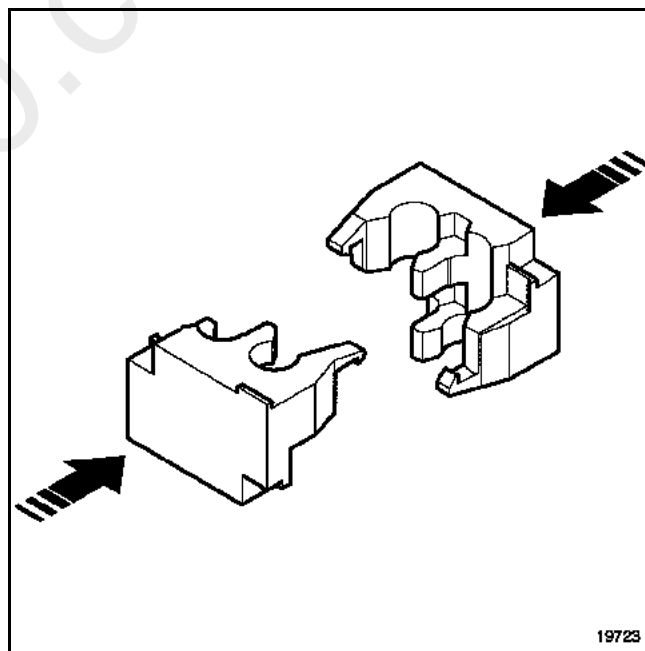
- remove the protective plugs from the rail high pressure rail outlet and the injector high pressure inlet.
- insert the olive of the high pressure pipe into the taper of the injector high pressure inlet.
- insert the olive of the high pressure pipe into the taper of the rail high pressure outlet.
- put the high pressure pipe nuts in position by hand beginning with the one located on the injector side.

Fit the remaining high pressure pipes as before.

Fit the clips supplied with the new pipes onto the high pressure pipes:

- Insert the first half of the clip using adjustable pliers,
- Insert the second half of the clip using adjustable pliers.

**IMPORTANT:** Pay attention to the direction of fitting of the second half of the clip. The tabs located in the centre of the clip will only fit together in one position.



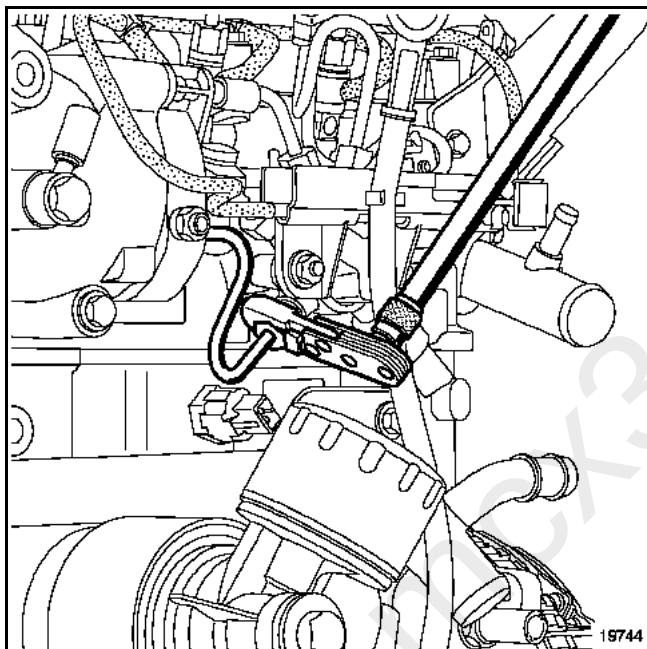
Tighten the rail nuts to a torque of 2.8 daNm.

**IMPORTANT:** do not touch the pipes with the wrench when torque tightening.

**WARNING:** the correct order and tightening torque must be used for the high pressure pipes.

Tighten the nuts of the pump-rail high pressure pipe using the recommended tool:

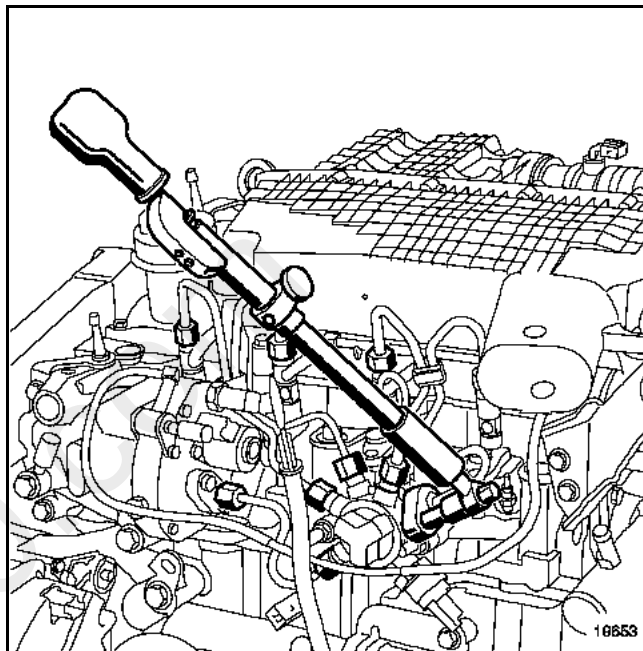
- tighten the nut on the rail side to a torque of 3.8 daN.m,
- tighten the nut on the pump side to a torque of 3.8 daN.m,



Tighten the nuts of the injector-rail high pressure pipes using the recommended tool:

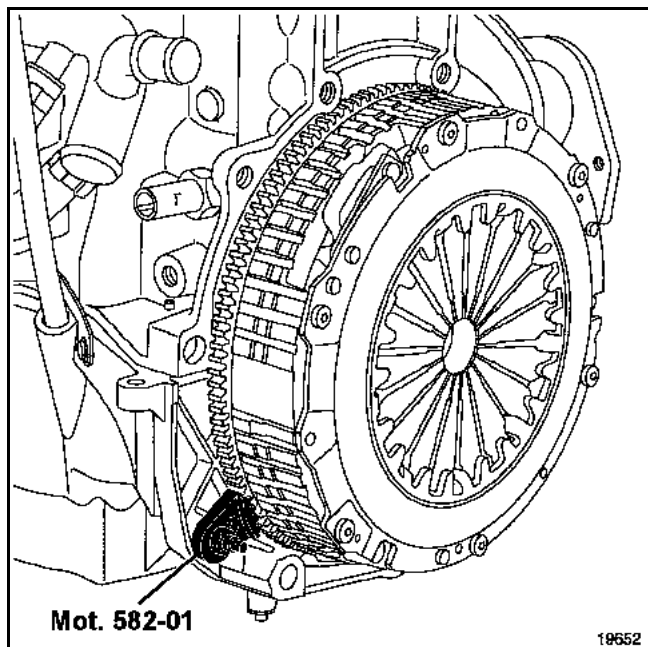
- tighten the nut on the injector side to a torque of 3.8 daN.m,
- tighten the nut on the rail side to a torque of 3.8 daN.m,

**NOTE:** Tighten one pipe fully before moving on to the next pipe.



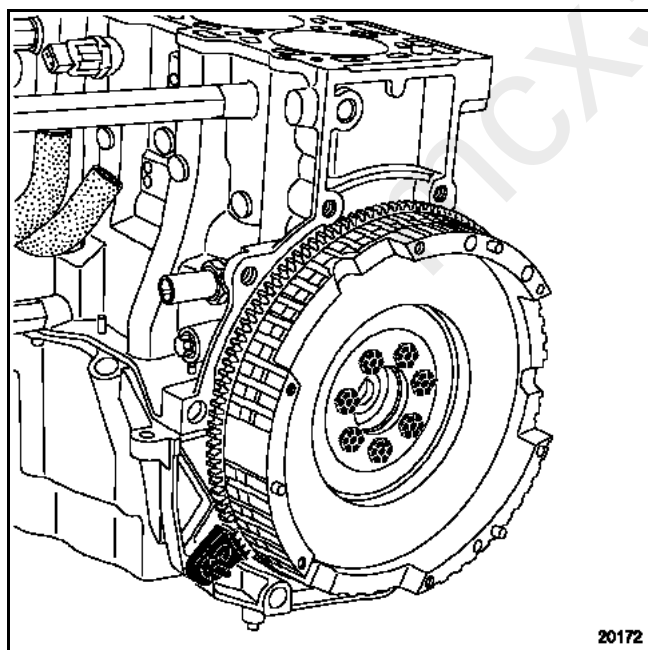
### REMOVING THE BOTTOM ENGINE

Fit flywheel block **Mot. 582-01**.

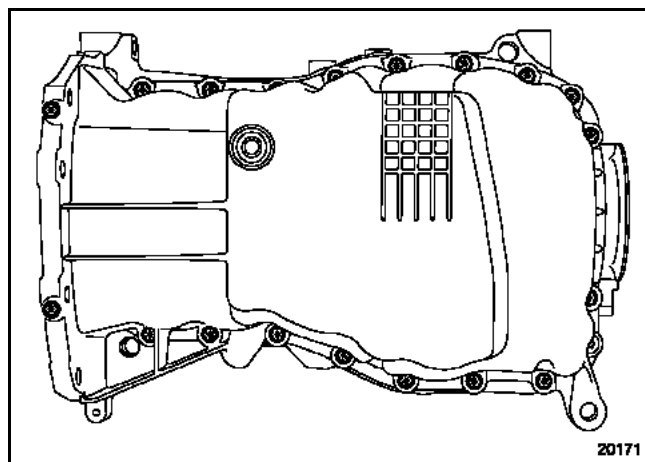


Remove:

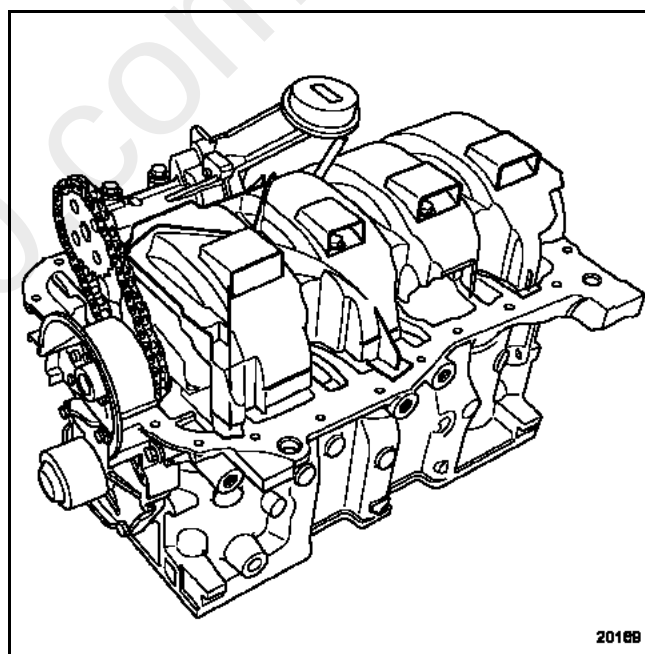
- the clutch mechanism,
- the flywheel,



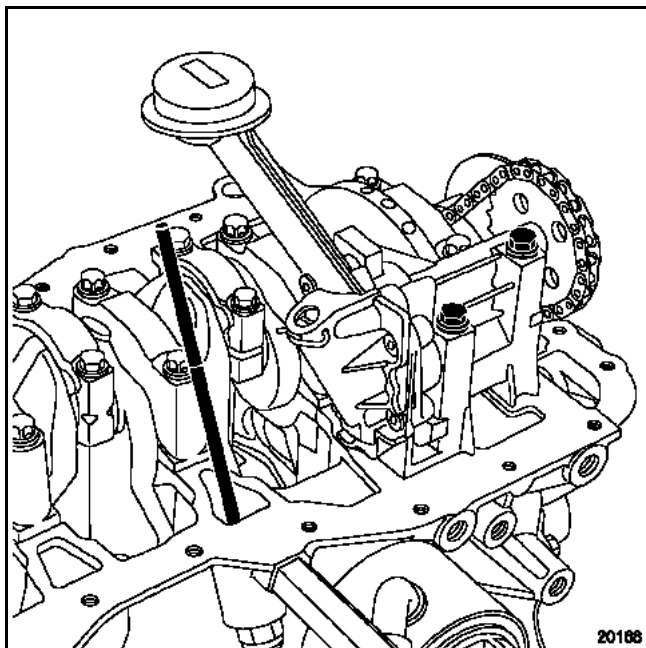
- the sump,



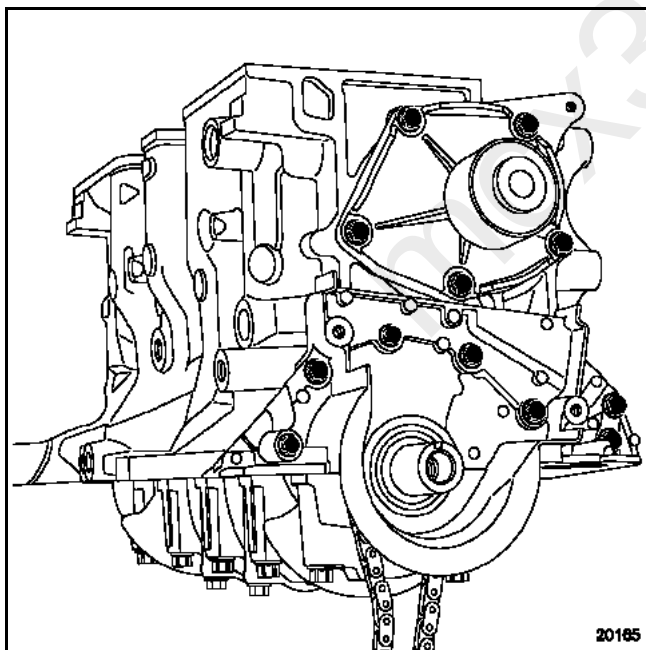
- the anti-emulsion plate,



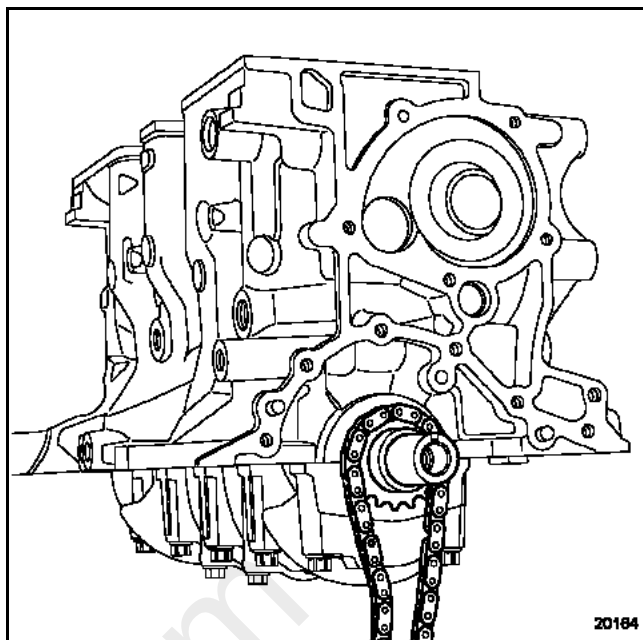
- the oil level sensor,
- the oil pump,



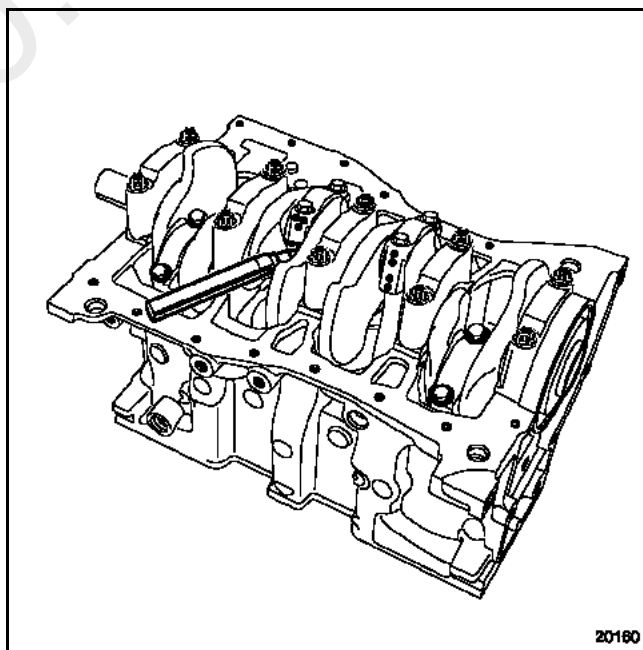
- the crankshaft closure plate,
- the water pump,



- the oil pump chain,
- the oil pump drive sprocket.



**WARNING:** 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.



Remove the big end cap bolts and the connecting rod/piston assemblies.

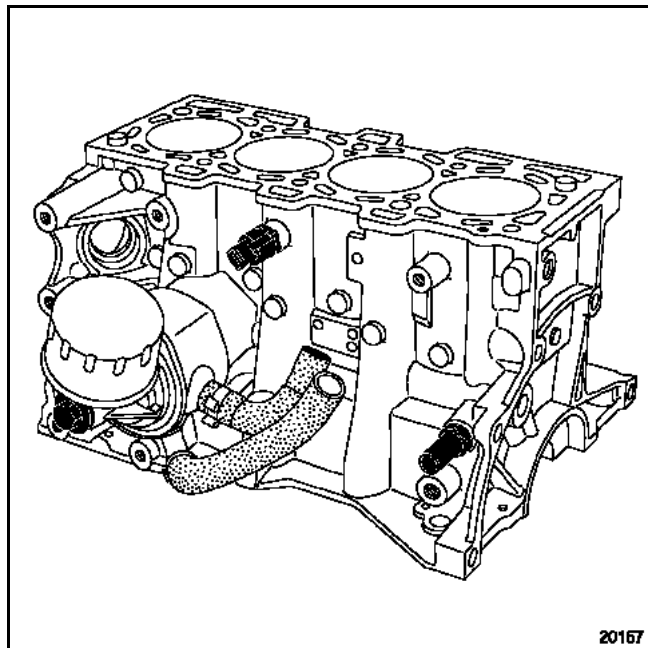
**NOTE:** It is essential to mark the position of the crankshaft shells, as the category may be different for each bearing.

Remove:

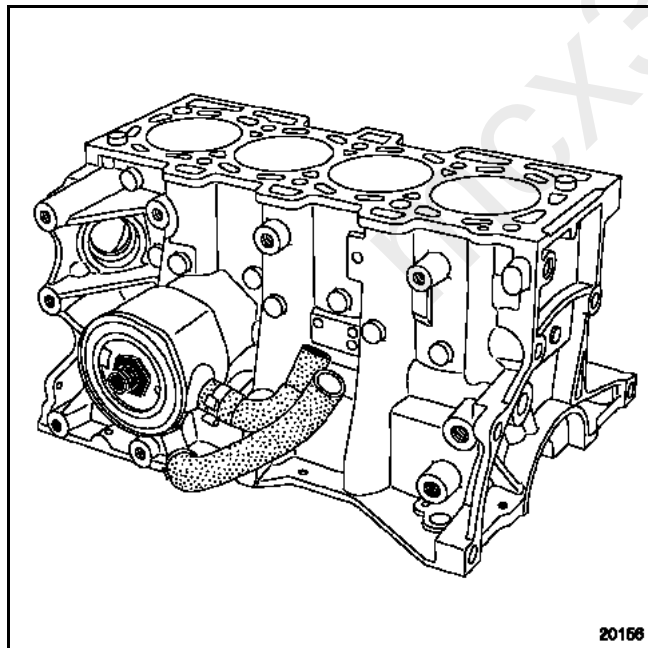
- the crankshaft bearing caps,
- the crankshaft.

Remove:

- the oil pressure sensor,
- the pinking sensor,
- the bolt of the oil filter unit bracket.



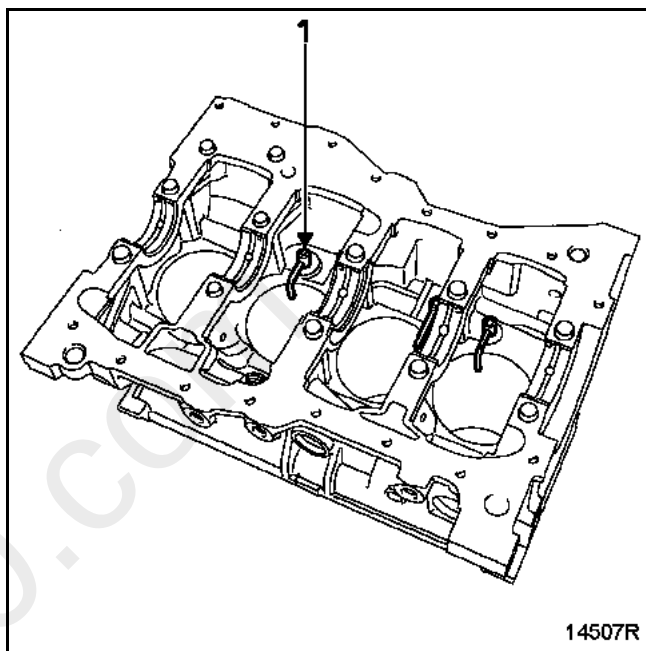
- the heat exchanger connector.



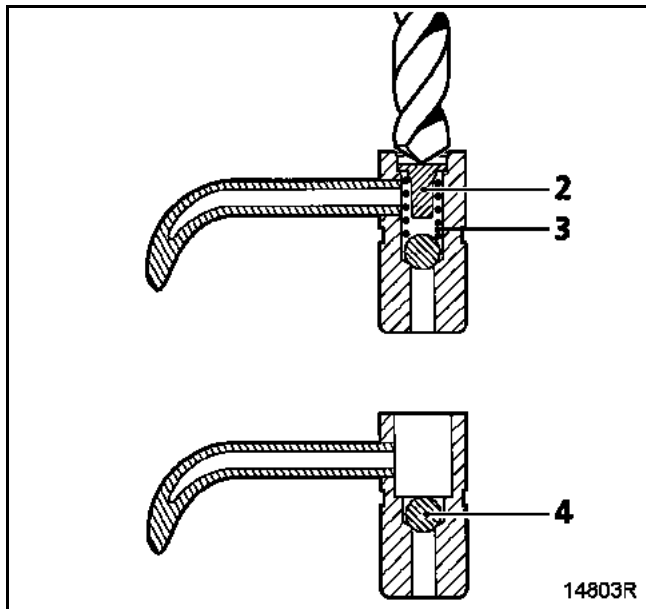
### Replacement of the piston base cooling jets

#### REMOVAL

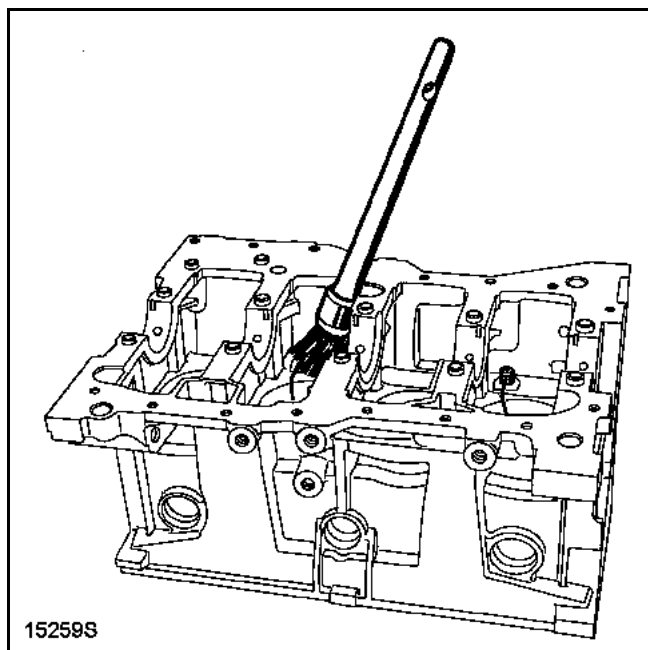
To remove the piston base cooling jets (1), they must be drilled with a **7 mm** diameter drill. This is necessary in order to remove the spring stop (2) and the spring (3).



**NOTE:** do not remove the ball (4) to prevent swarf entering the cooling circuit.

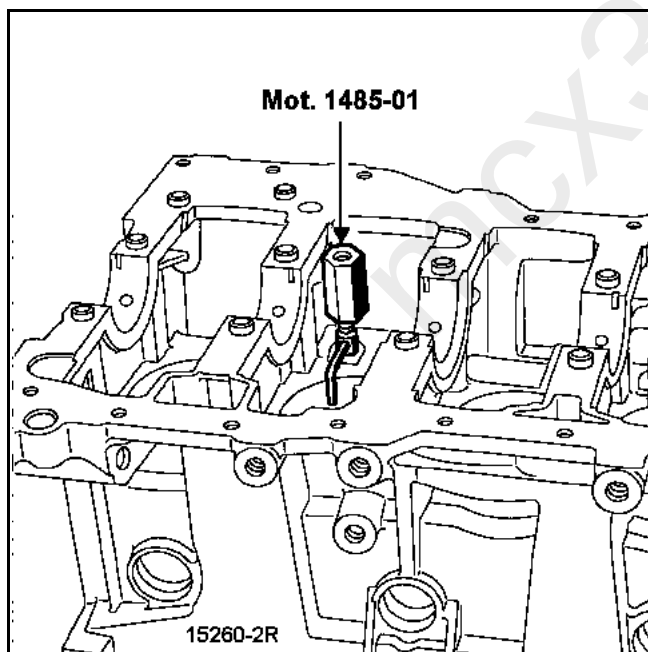


Remove the swarf using a brush.

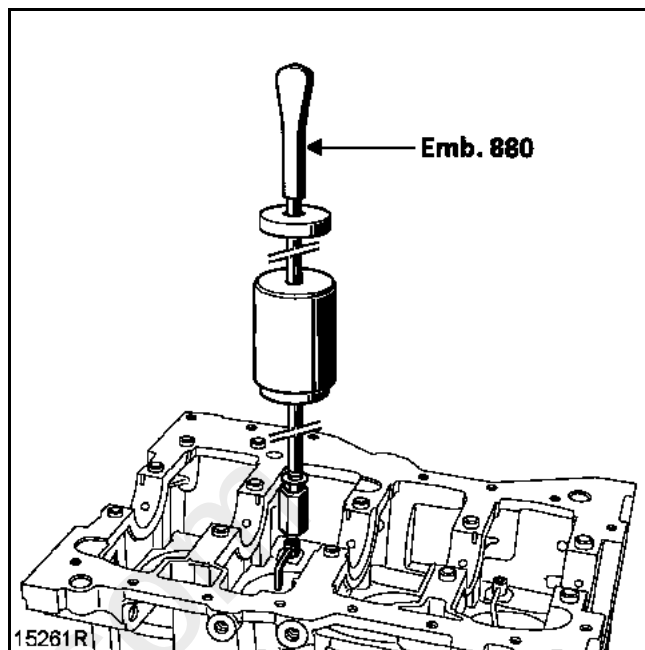


Screw:

- tool **Mot. 1485-01** in the drilled out jets using a 6 mm Allen key which must slide into the tool,



- the inertia extractor **Emb. 880** onto **Mot. 1485-01** and remove the jet.

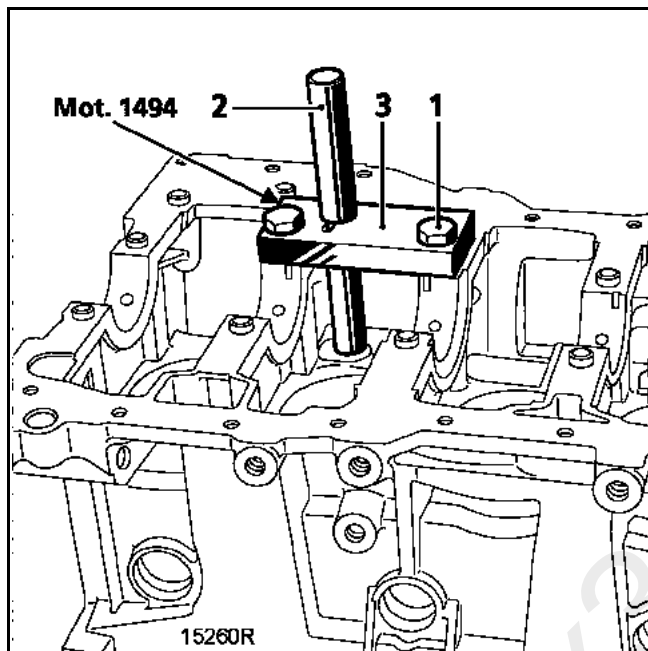


**Fitting piston base cooling jets**

The jets must be fitted using tool **Mot. 1494**.

**Fitting the jets for cylinders 1 and 3**

Fit plate (3) of tool **Mot. 1494** onto the cylinder block (as shown on the diagram below) without tightening the two bolts (1).



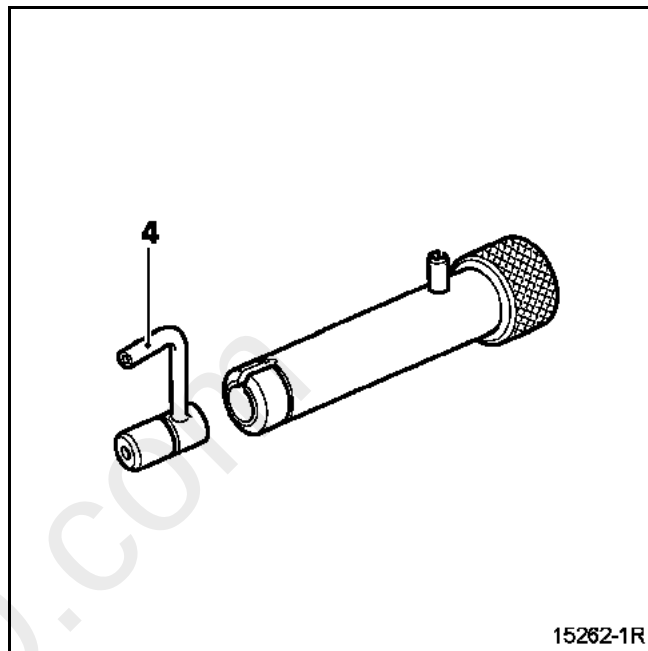
Position the guide rod (2) in the plate (3) and the end of the guide rod in the hole of the jet to centre the plate (3).

Tighten the two bolts (1).

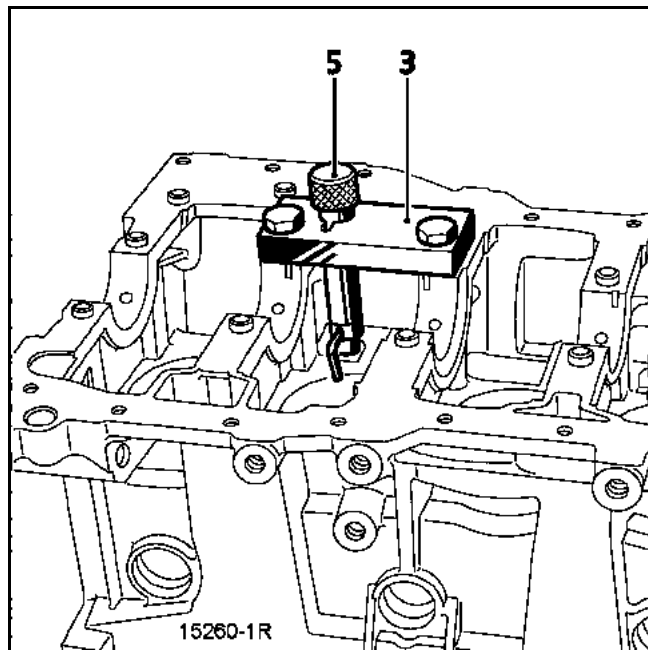
Remove the guide rod.

Fit the pushrod instead and in place of the guide rod, then insert the jet 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.

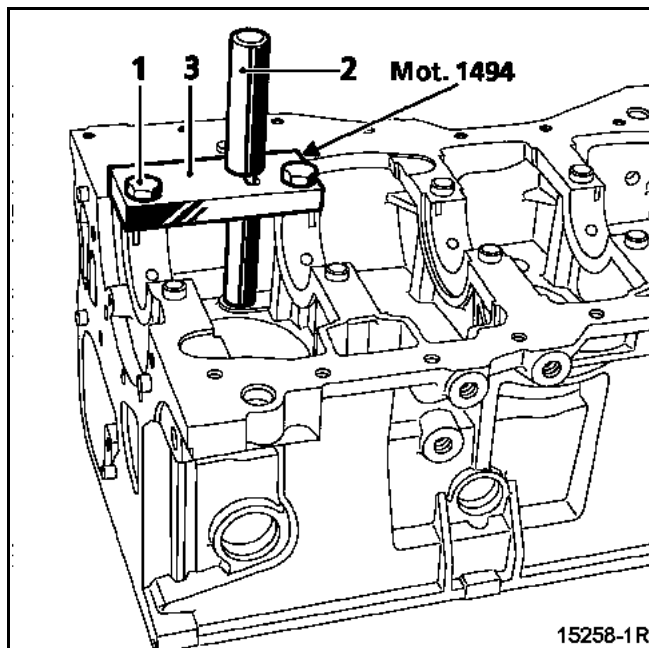


With a hammer, tap the pushrod until the shoulder (5) of the pushrod comes into contact with the plate (3).



**Fitting the jets for cylinders 2 and 4**

Fit plate (3) of tool **Mot. 1494** onto the cylinder block (as shown on the diagram below) without tightening the two bolts (1).



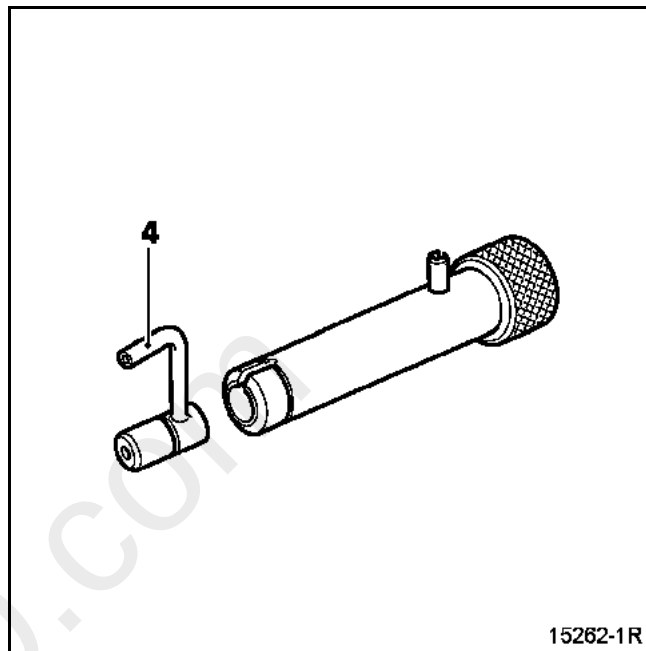
Position the guide rod (2) in the plate (3) and the end of the guide rod in the hole of the jet to centre the plate (3).

Tighten the two bolts (1).

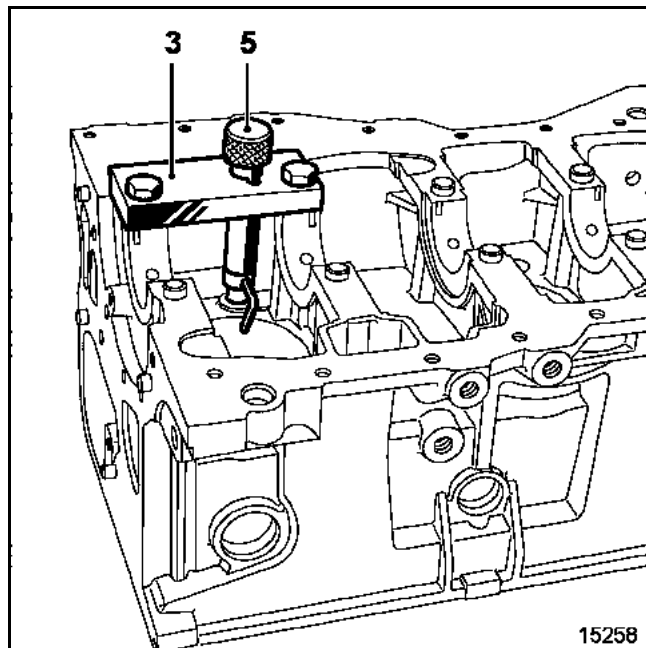
Remove the guide rod.

Position the pushrod instead and in place of the guide rod, then insert the jet into the pushrod.

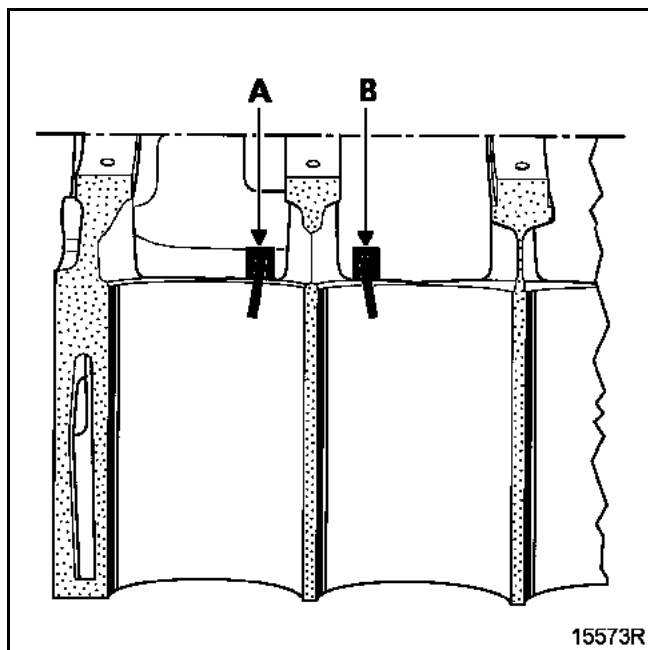
**NOTE:** check that the jet is correctly oriented with the end of the jet (4) directed towards the centre of the cylinder.



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



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



A: Orientation of the jets of cylinders 2 and 4  
B: Orientation of the jets of cylinders 1 and 3

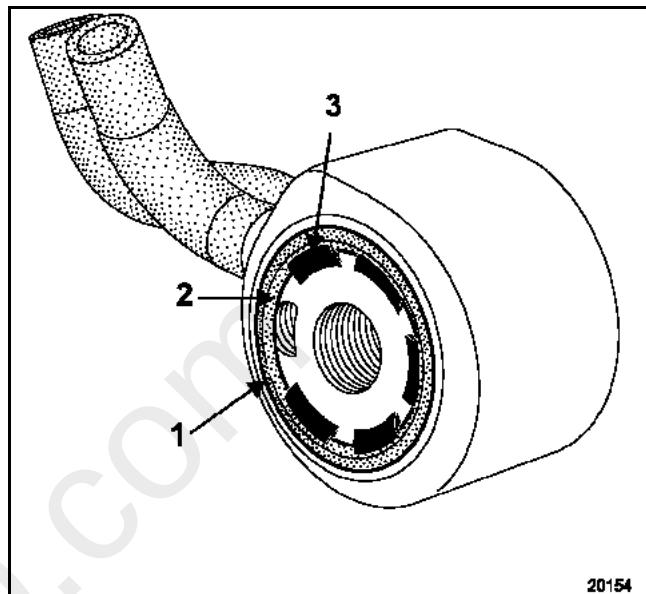
Clean:

- the cylinder block,
- the crankshaft by passing a wire through the lubrication channels.

### Method for refitting the heat exchanger

Remove the cylinder block from engine stand  
**Mot. 792-03.**

Replace the seal (1) of the exchanger, positioning the lip (2) of the seal behind the lugs (3) of the exchanger.



Proceed as follows to ensure the exchanger is correctly refitted.

Refit the inlet pipe of the water pump, securing using the bolt (4).

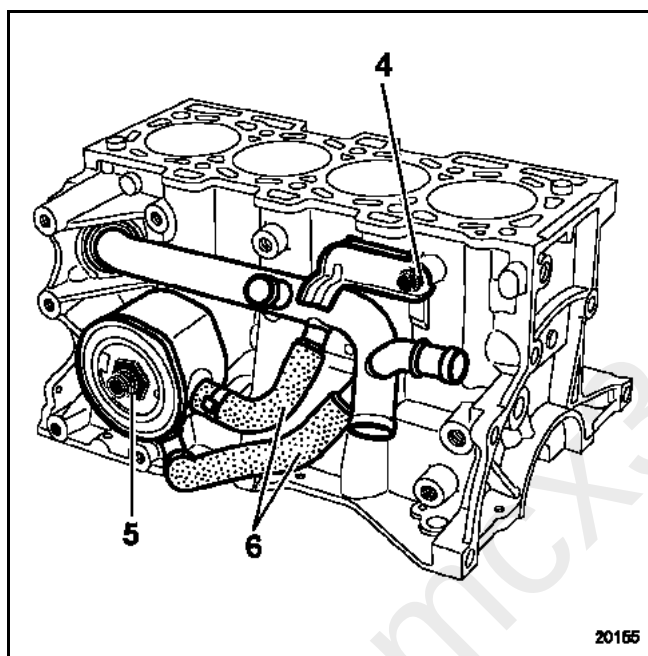
Fit the exchanger (with its coolant pipes) on the cylinder block using the connector (5) without locking the connector.

Insert the two coolant hoses (6) onto the ends of the coolant pipe.

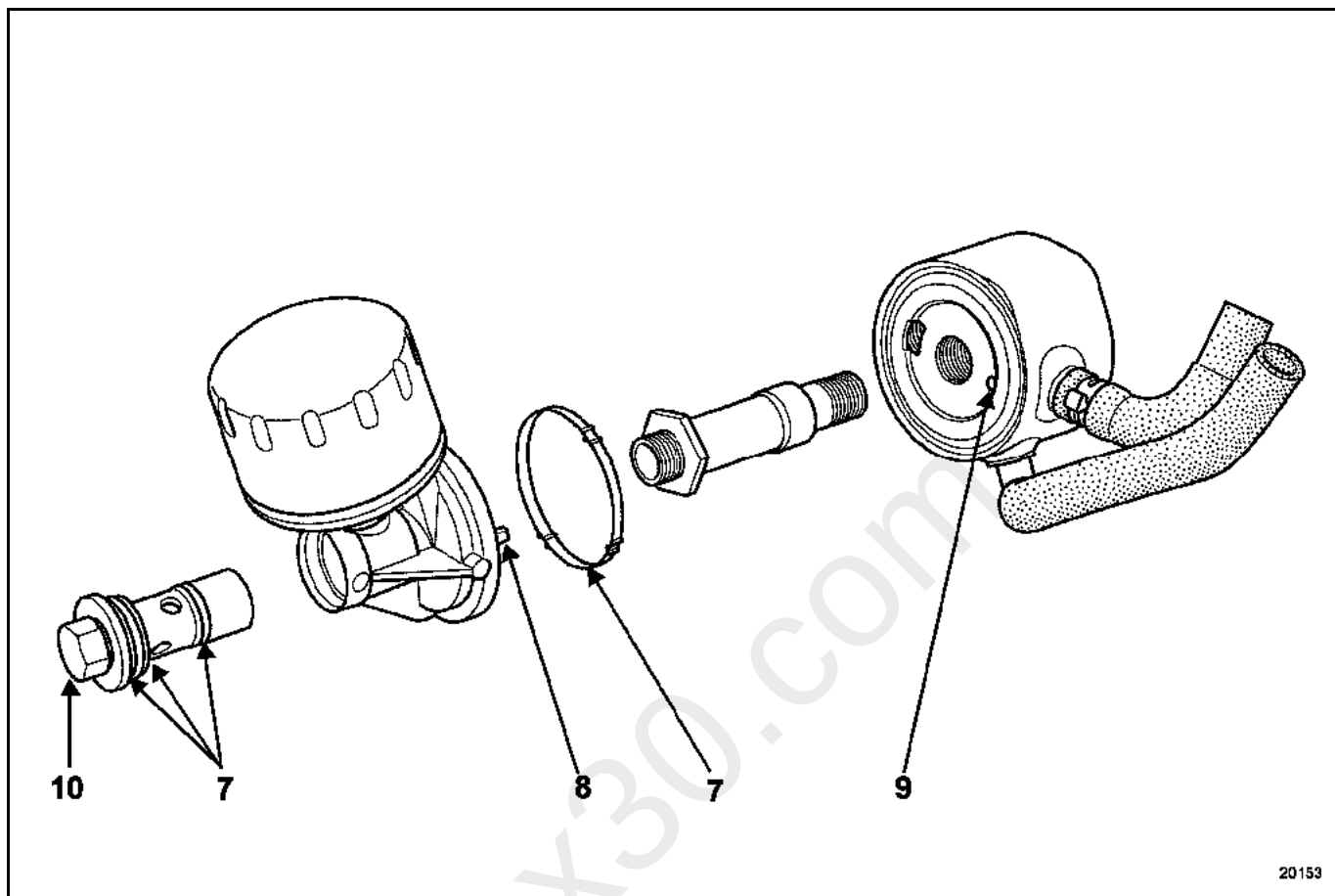
Hold the exchanger by hand whilst tightening the connector (5) to a torque of **4.5 daN.m**.

Remove the water pump inlet pipe.

Refit the cylinder block on engine stand **Mot. 792-03**.



Fit the oil filter support (complete with a new seal (7)), positioning the lug (8) in the hole (9) of the exchanger. Then tighten the bolt (10) fitted with new seals, to a torque of **4.5 daN.m**.



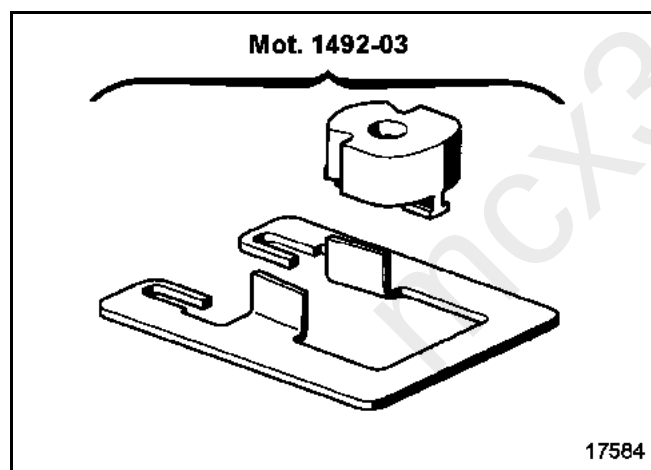
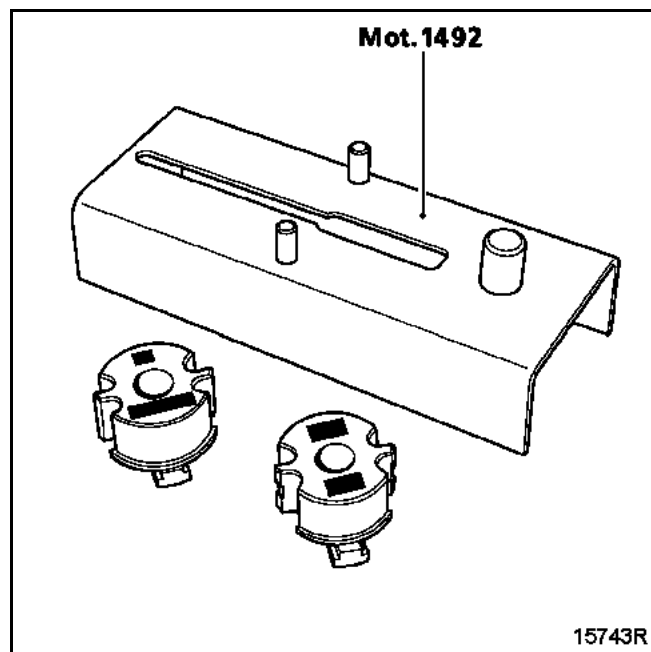
#### EXTRACTING THE GUDGEON PINS

**N.B.:** it is imperative 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 spring ring using a screwdriver, then release the pin.

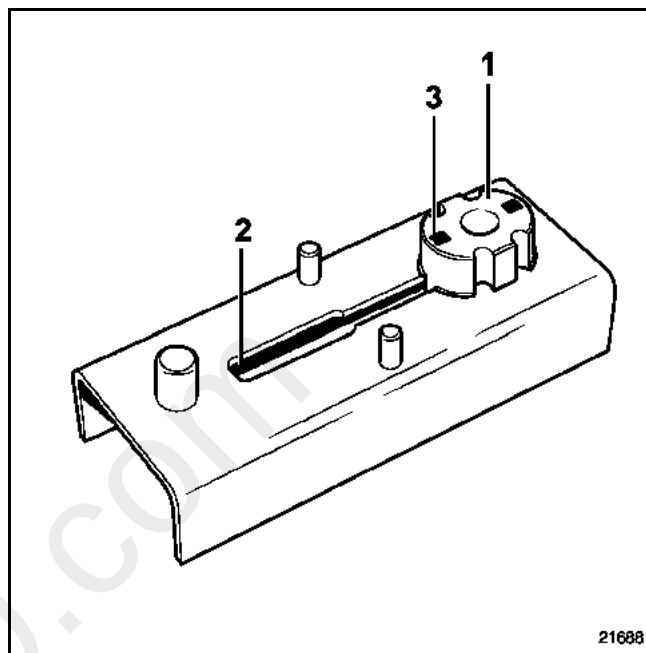
## FITTING THE CON ROD BEARING SHELLS

The bearing shells are fitted using **Mot. 1492** and **Mot. 1492-03**.

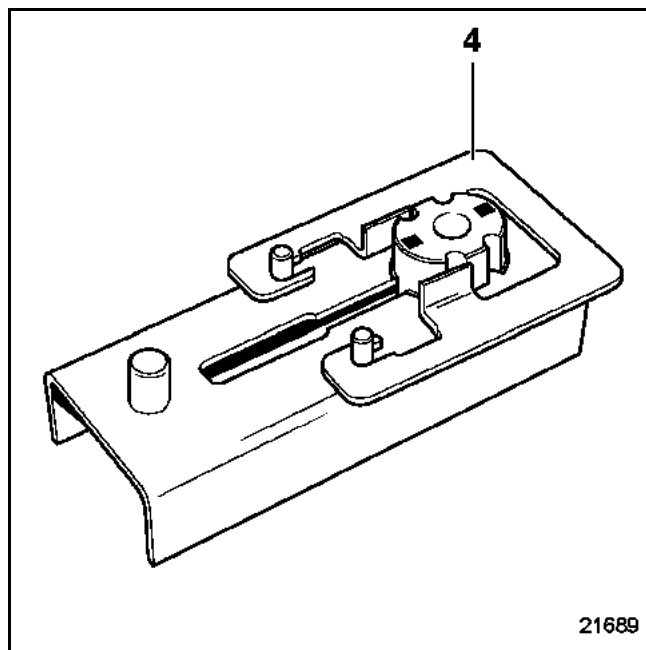


## On the con rod body

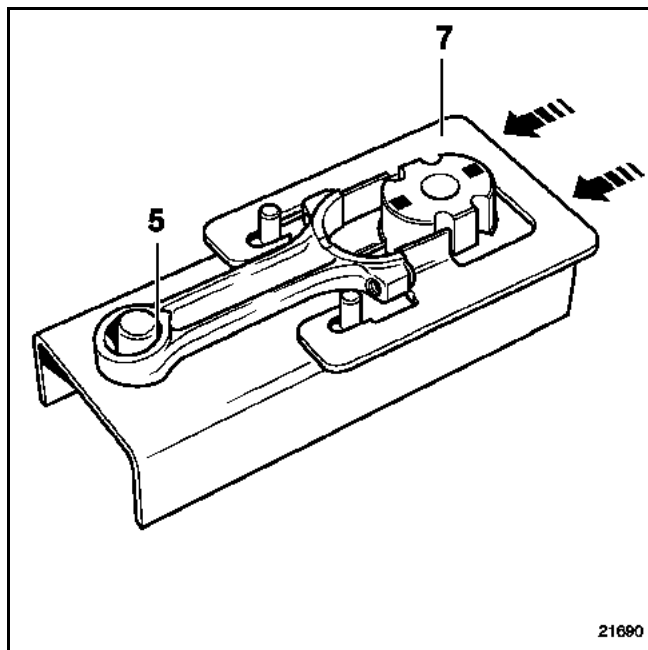
Slide the bearing shell support (1) of **Mot. 1492-03** (positioning the engraved mark (3) "A" as shown on the diagram below) into the groove (2) of the base of **Mot. 1492**.



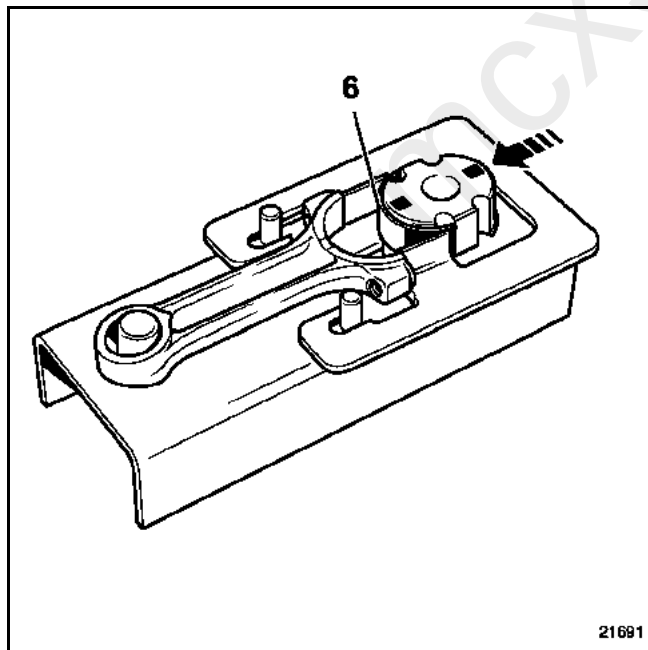
Fit the guide (4) of **Mot. 1492-03** onto the base (as shown in the diagram).



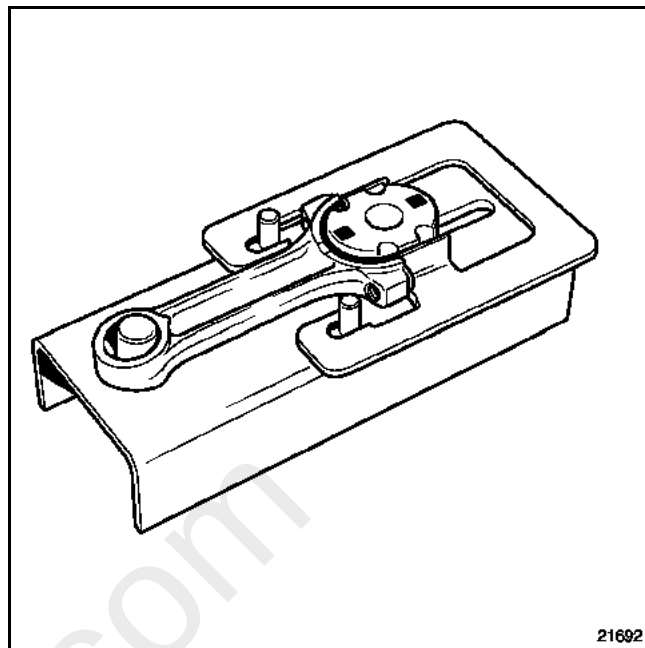
Lay the body of the con rod on the base of the tool (as shown in the diagram). Check that the lower part (5) of the small end is touching the centring pin and push the guide (7) in the direction of the arrow.



Lay the bearing shell (with a width of **20.625 mm**) (6) on the bearing shell support, then push it in the direction of the arrow (as shown on the diagram).



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

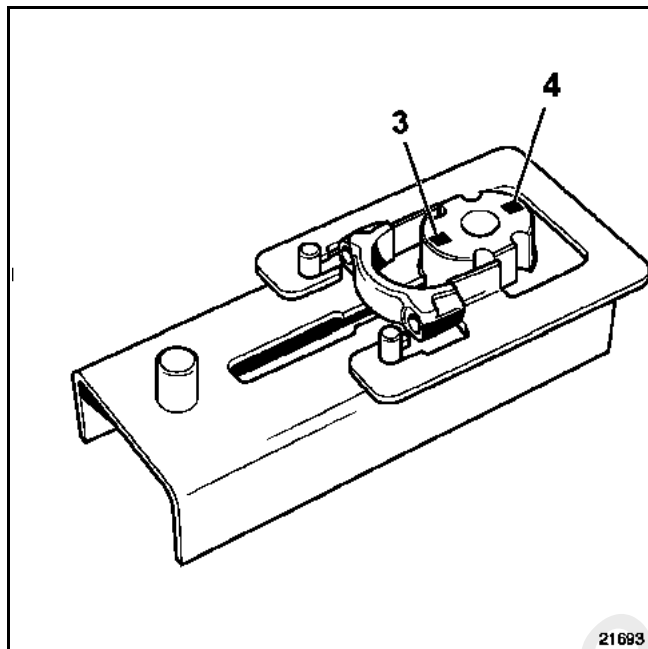


Remove the con rod body support and repeat the operation for the remaining con rod bodies.

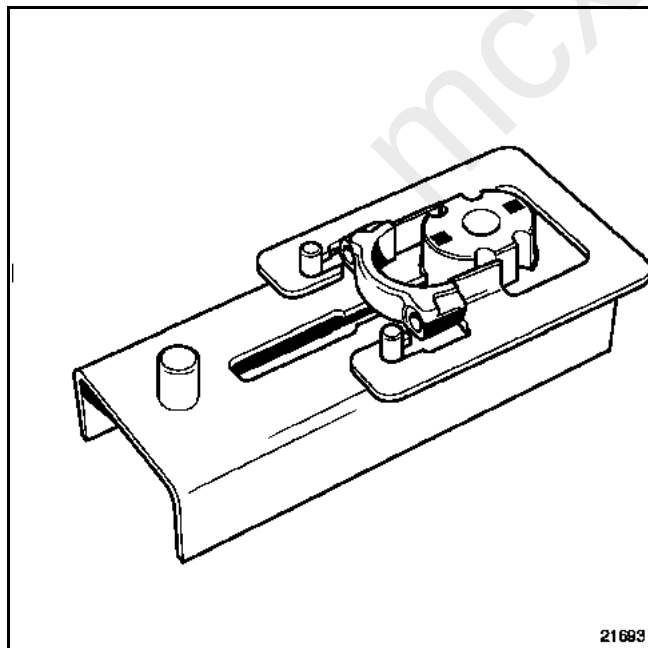
**On the con rod cap**

Position the bearing shell support either on:

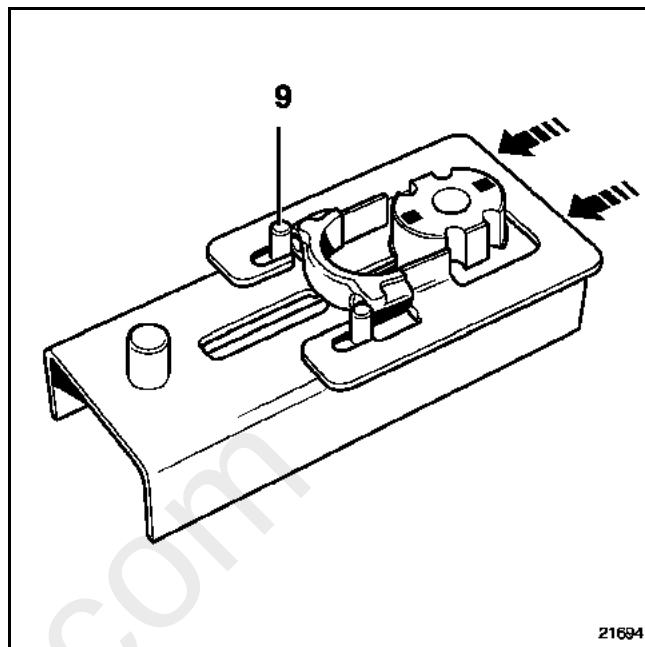
- the engraved mark (3) "A" if the width of the bearing shell is equal to **20.625 mm**,
- the engraved mark (4) "B" if the width of the bearing shell is equal to **17.625 mm**,



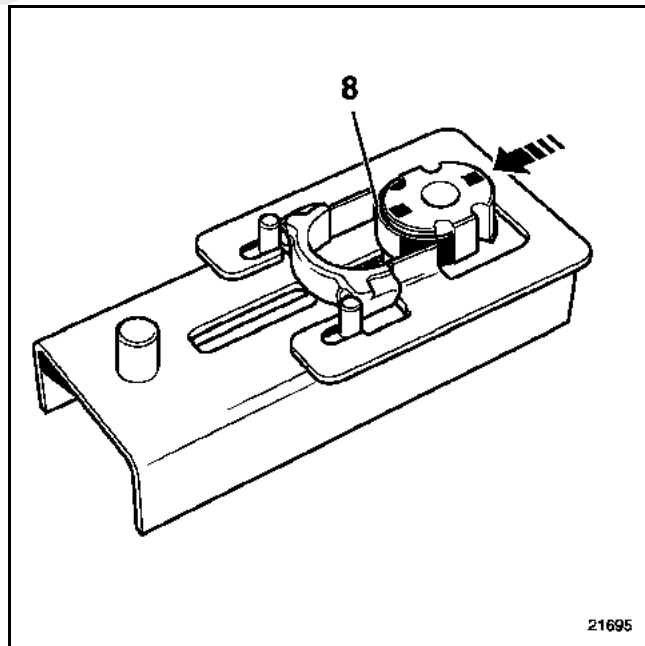
Fit the con rod cap as shown in the diagram.



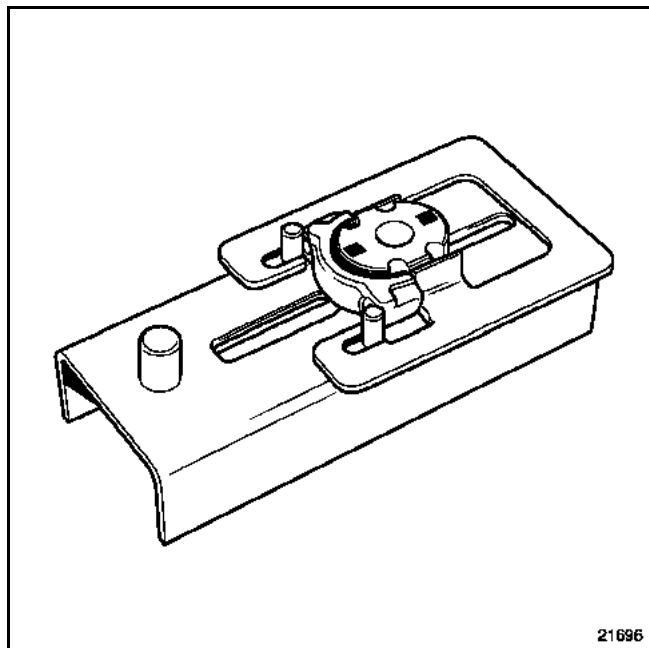
Push the guide (in the direction of the arrow) until the con rod cap is in contact with the pins (9) on the base of the tool.



Fit the shell (8) 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 cap.



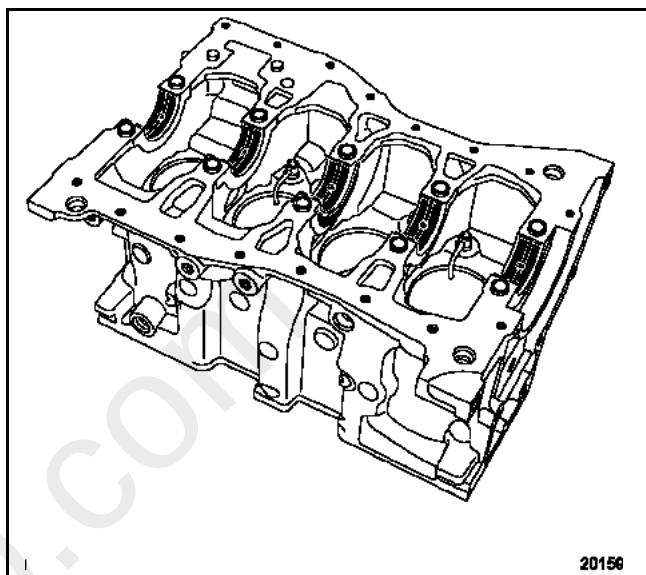
Remove the con rod cap support and repeat the operation for the remaining con rod caps.

### REFITTING THE BOTTOM ENGINE

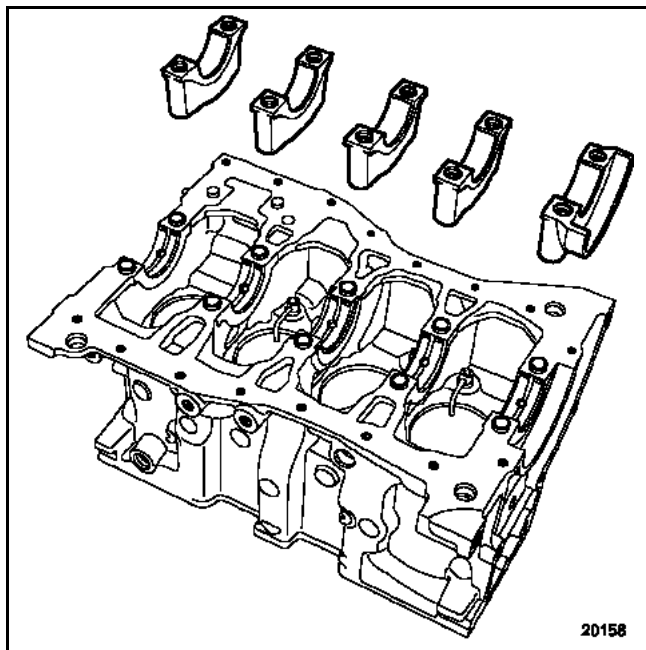
#### Fitting the crankshaft bearing shells

Direction of fitting.

Position the grooved bearing shells on the cylinder block.

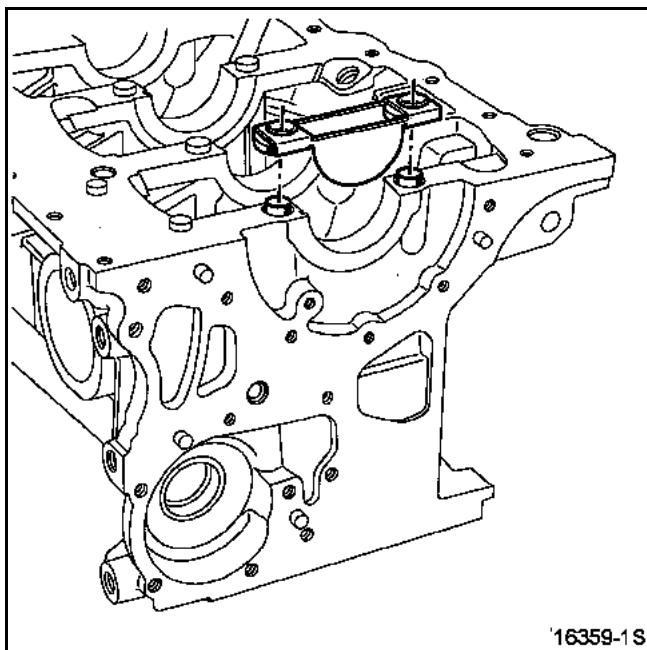


Fit the smooth bearing shells on the bearings.

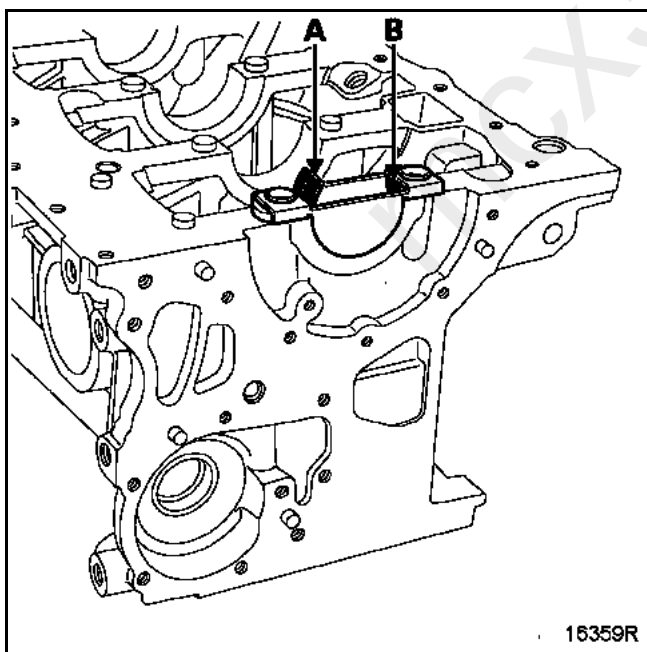


### On the cylinder block

Position tool **Mot. 1493-01** on the cylinder block.

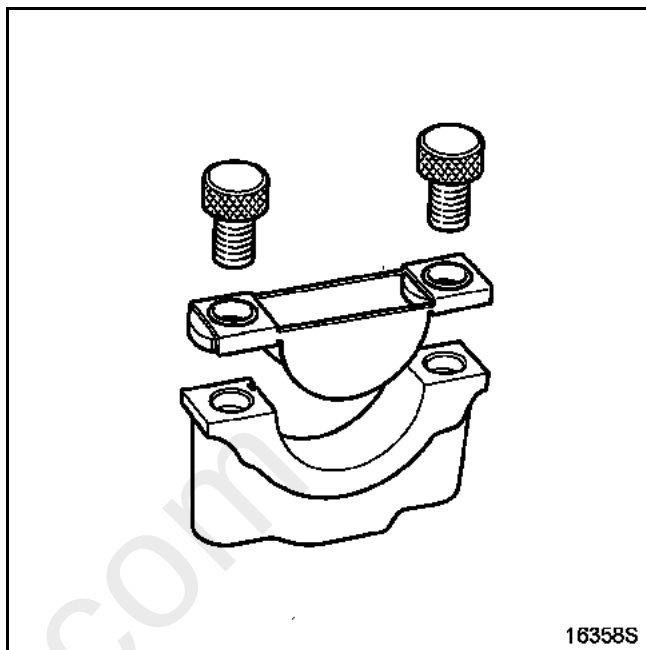


Fit the bearing shell in **Mot. 1493-01**, then press at (A) until the bearing shell is touching at (B) with **Mot. 1493-01**.

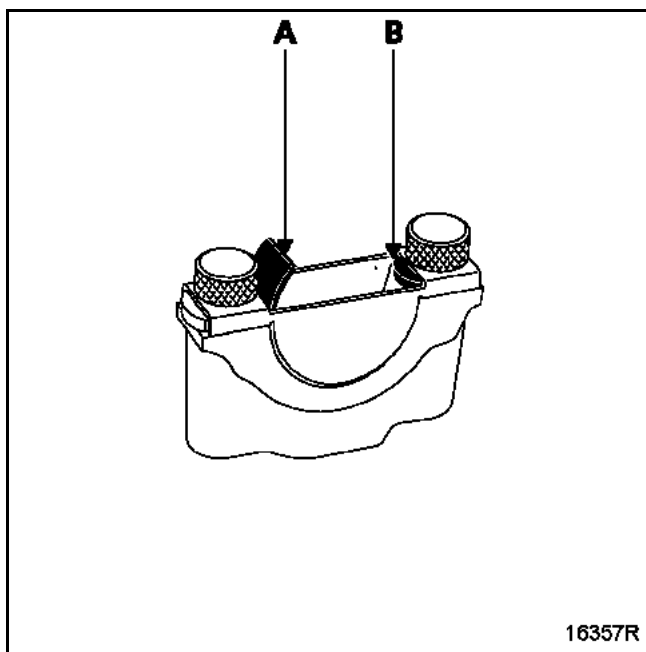


### On the bearings

Position **Mot. 1493-01** on the bearing.



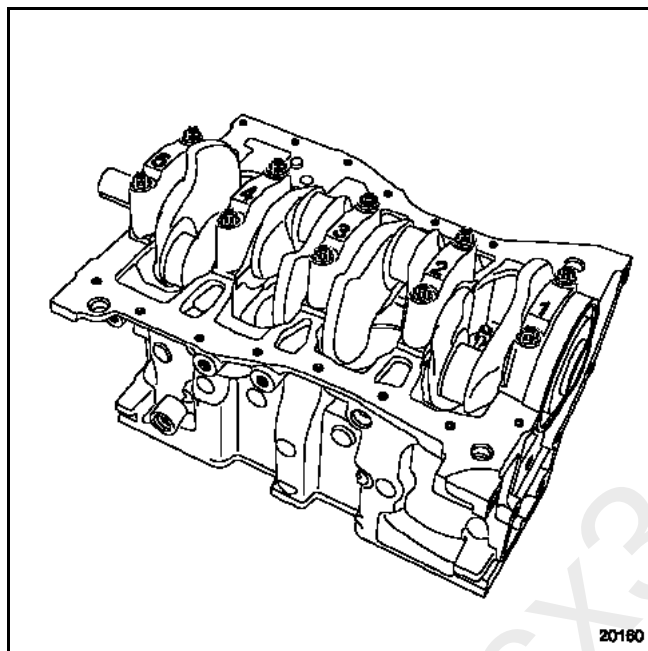
Fit the bearing shell in **Mot. 1493-01**, then press at (A) until the bearing shell is touching at (B) with **Mot. 1493-01**.



Oil the crankshaft bearing shells.

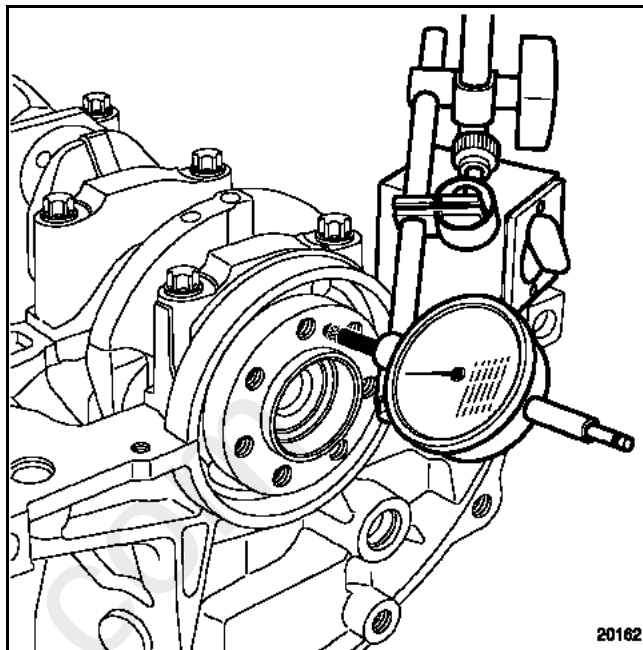
Refit:

- the crankshaft,
- the lateral shims on bearing no.3, putting the grooves on the crankshaft side,
- the crankshaft bearing caps **on bearing cap no.1** (these are numbered from 1 - 5 and these numbers should be positioned **opposite the water pump**). Then tighten the bolts to a torque of **2.7 daN.m** plus an angle of **47° ± 5°**.



Check the lateral clearance of the crankshaft (in mm) which should be:

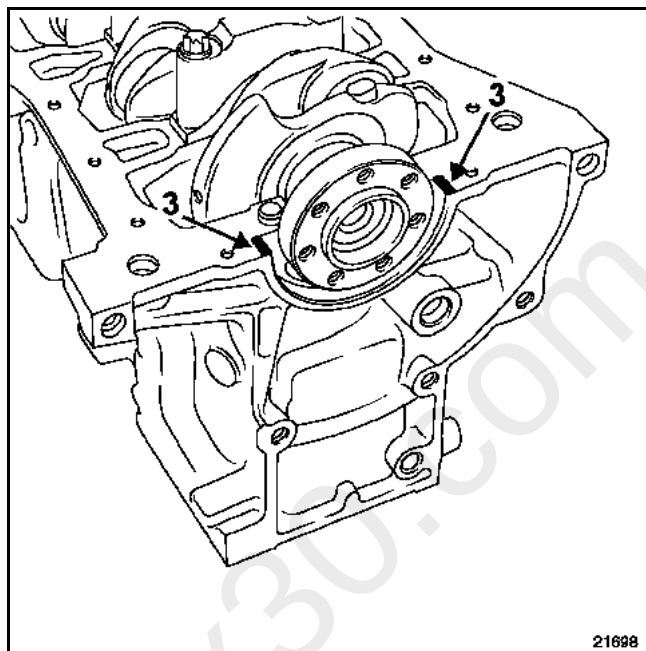
- without wear on lateral shims: **0.045 - 0.252**
- with wear on the lateral shims: **0.045 - 0.852**



### Fitting bearing number 1

Degrease the gasket faces (of the cylinder block and bearing number 1). They should be clean, dry and free from grease (in particular, remove finger marks).

Lay two beads (3) of **Threebond silicon** with a width of **1 mm** on bearing no.1 of the cylinder block.



Tighten the bolts of bearing cap no. 1 to a torque of **2.7 daN.m** plus an angle of **47° ± 5°**.

**"CON RODS / PISTON" ASSEMBLY**

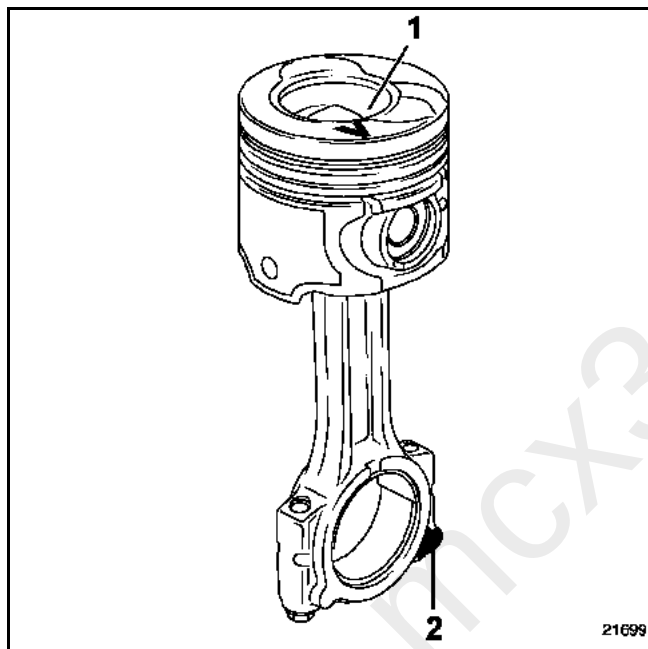
The pistons have a "Λ" mark engraved on their heads indicating the **flywheel side**.

Oil the gudgeon pin.

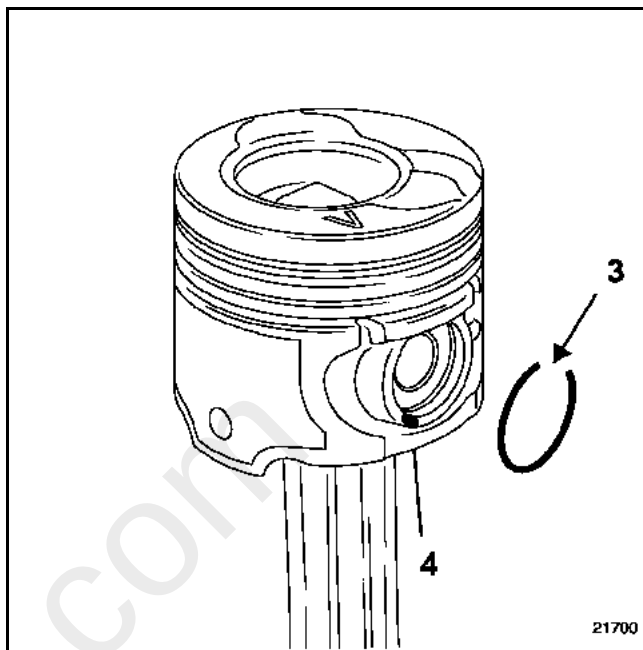
Check that the gudgeon pins rotate correctly in the new piston and in the matching connecting rod.

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

Point the "Λ" (1) engraved on the top of the piston downwards and the flat (2) of the big end as shown on the diagram below.

**Direction for fitting the circlips on the piston**

Position the opening (3) of the spring rings opposite the removal and fitting channel (4).



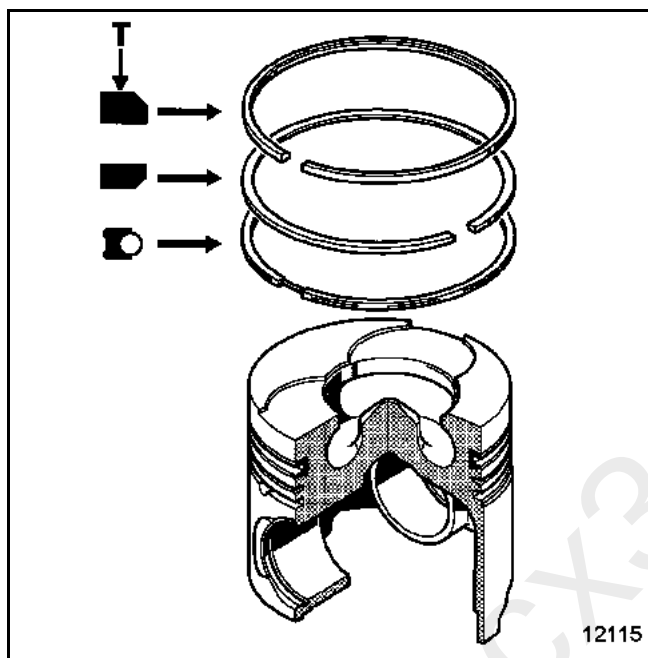
### FITTING THE RINGS

Rings set to their original adjustment must be free within their channels.

Ensure the rings are fitted the correct way round with the word **TOP** pointing upwards.

#### Orientation of the rings in the piston

Ensure the break in each ring is correctly oriented as shown in the diagram below.



T = Top

Oil the pistons.

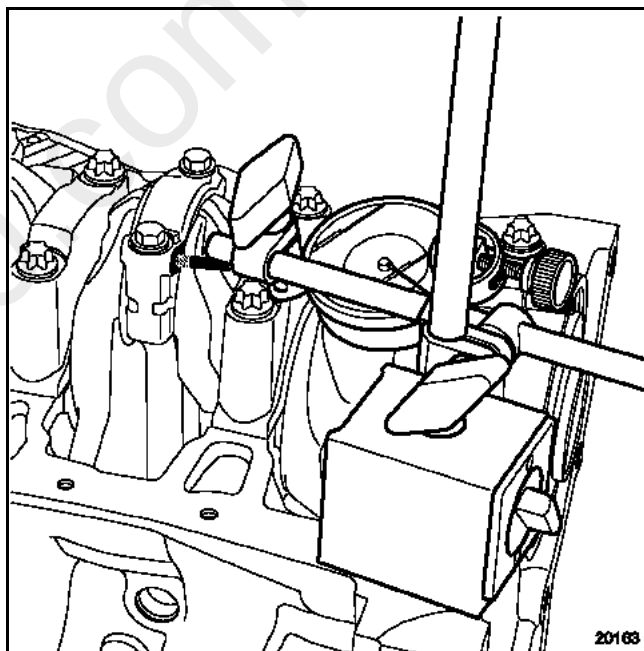
Fit the con rod/piston assemblies into the cylinder block using the ring (e.g.: **FACOM 750 TB**), being careful to fit them the right way round ("**Λ**" **towards the flywheel**).

Fit the con rods onto the oiled crankpins of the crankshaft.

Fit the con rod caps, ensuring they are correctly matched.

Tighten the big end cap bolts to a torque of **2 daNm**, plus an angle of  $45^\circ \pm 6^\circ$ .

Check that the big ends have the correct lateral clearance of **0.205 to 0.467 mm**.



### Checking piston protrusion

Clean the piston head.

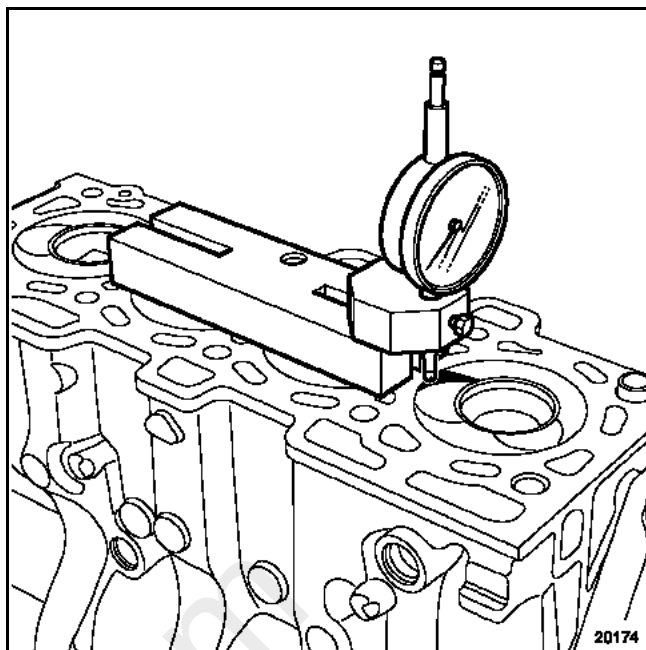
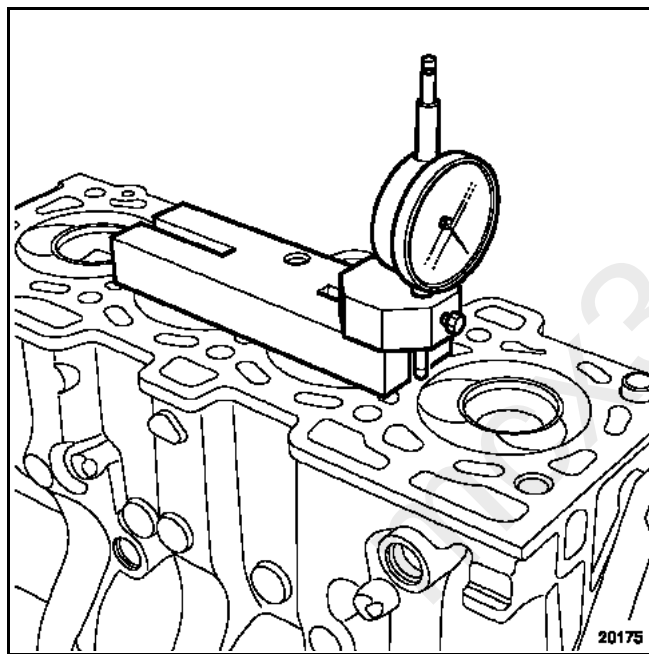
Turn the crankshaft one turn in its operating direction to bring piston no.1 close to Top Dead Centre.

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

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

**N.B.:** All measurements must be carried out along the longitudinal axis of the engine, in order to eliminate any errors due to tilting of the piston.

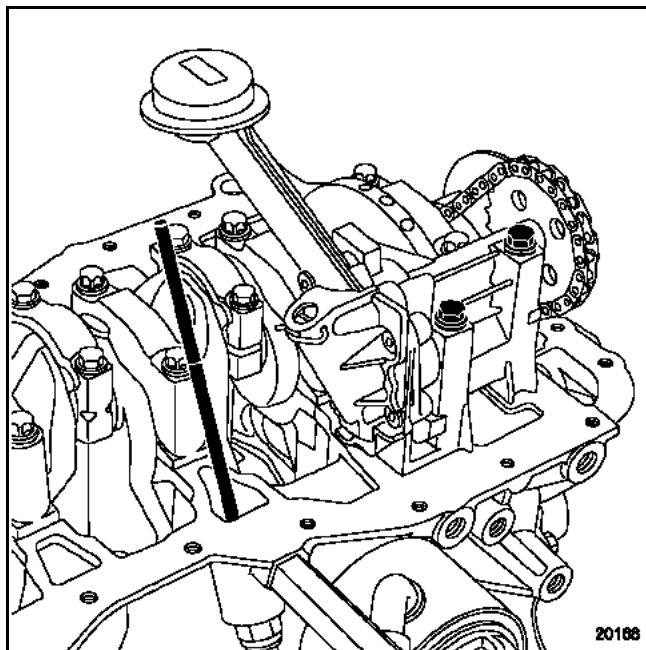
**WARNING:** the gauge follower must not be in the valve clearance.



Check the piston protrusion which must be  $0.192 \pm 0.093$  mm.

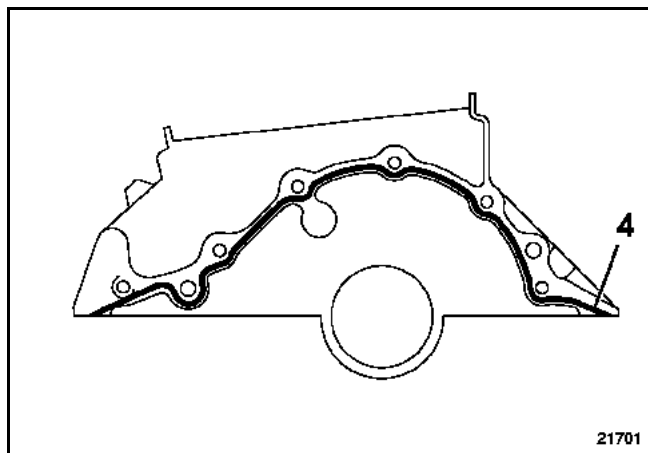
Refit:

- the pinking sensor to a torque of **2 daN.m**,
- the oil pressure sensor to a torque of **2.2 daN.m**,
- the oil pump sprocket and chain to a torque of **2.5 daN.m**.



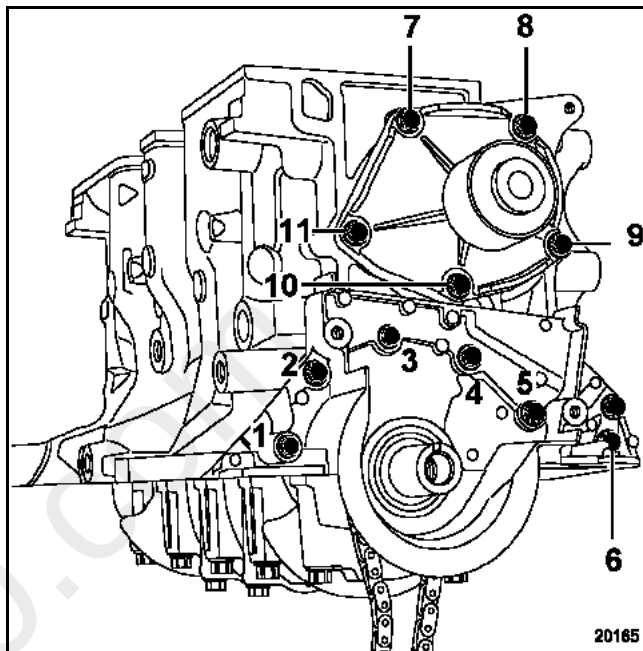
**NOTE:** the gasket faces (cylinder block, crankshaft closure plate and water pump) must be clean, dry and free from grease (in particular, remove finger marks).

The crankshaft closure plate is sealed with **THREEBOND** silicon. The bead (A) must be 1.5 - 2 mm wide and be applied in accordance with the diagram below.



Refit:

- the crankshaft closure plate by:
  - pre-tightening bolts 1 and 6 to a torque of **0.8 daN.m**,
  - tightening bolts 2, 3, 4 and 5 to a torque of **1.2 daN.m**,
  - tightening bolts 1 and 6 to a torque of **1.2 daN.m**,

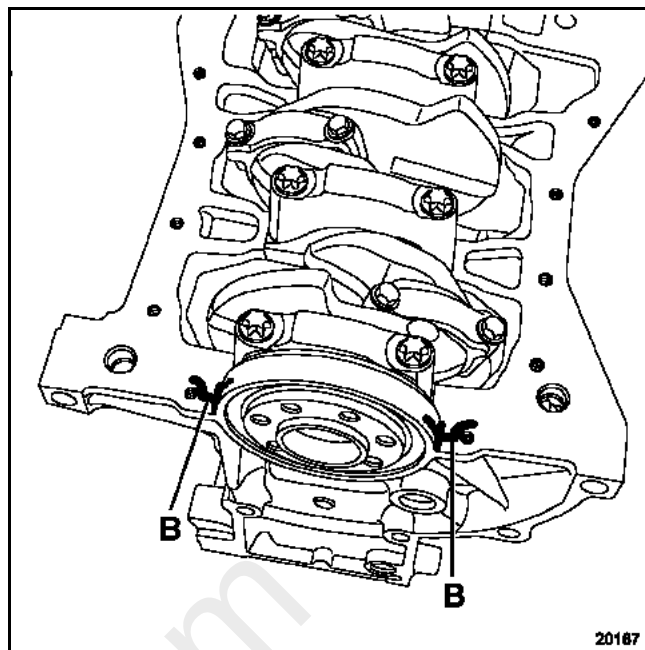
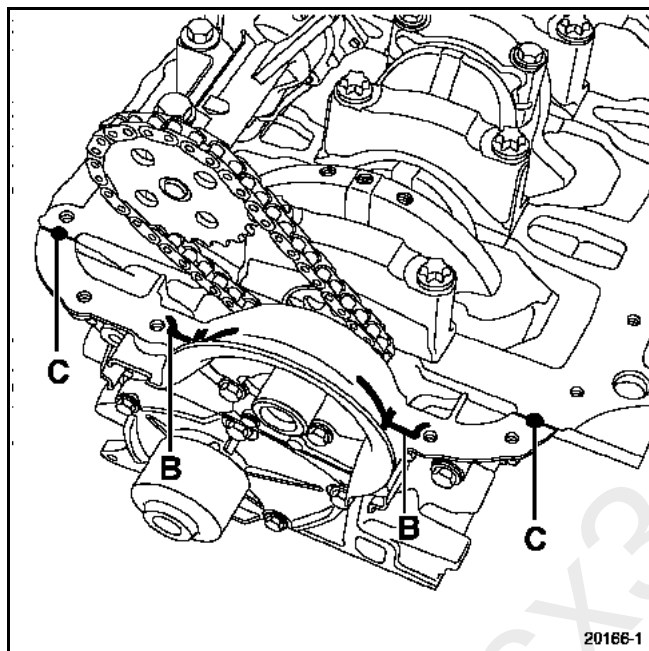


- the water pump fitted with a new seal. Put a drop of **LOCTITE FRENATANCH** on the bolts, then tighten them to a torque of **1.1 daN.m** in the recommended order.

**NOTE:** the gasket faces (cylinder block and crankshaft closure plate) must be clean, dry and free from grease (in particular, remove finger marks).

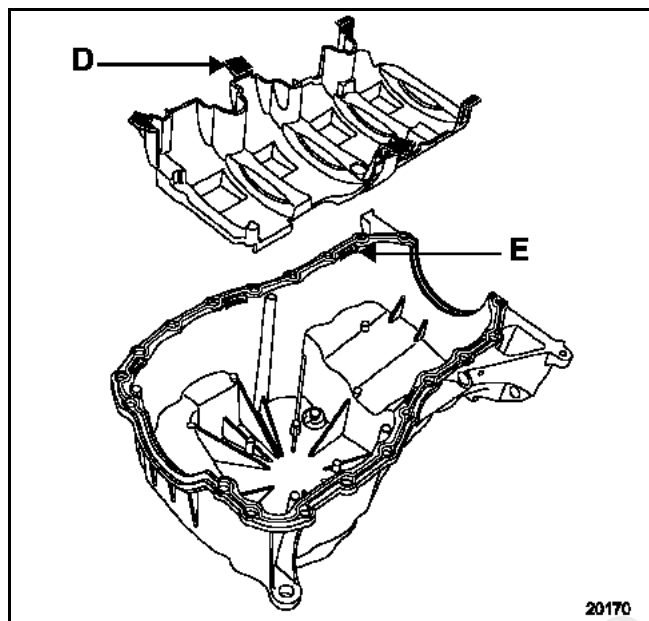
Apply:

- four beads (B) of **THREEBOND silicon**, with a diameter of **5 mm**,
- two drops (C) of **THREEBOND silicon**, with a diameter of **7 mm** at the intersection of the crankshaft closure plate and the cylinder block.



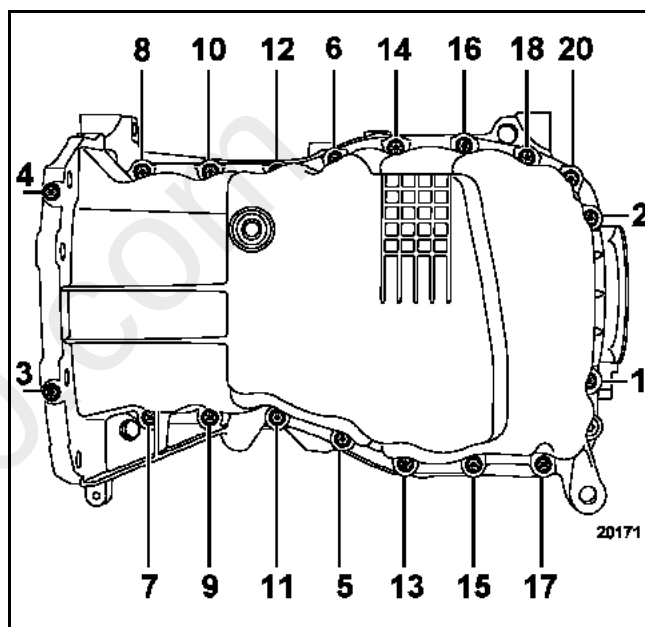
When refitting the oil sump, ensure that:

- the tabs (D) of the anti-emulsion plate are correctly positioned in the slots (E),
- the cylinder block and the oil sump are correctly aligned **on the flywheel side**, to prevent the clutch housing from being damaged when fitting the gearbox.



Refit:

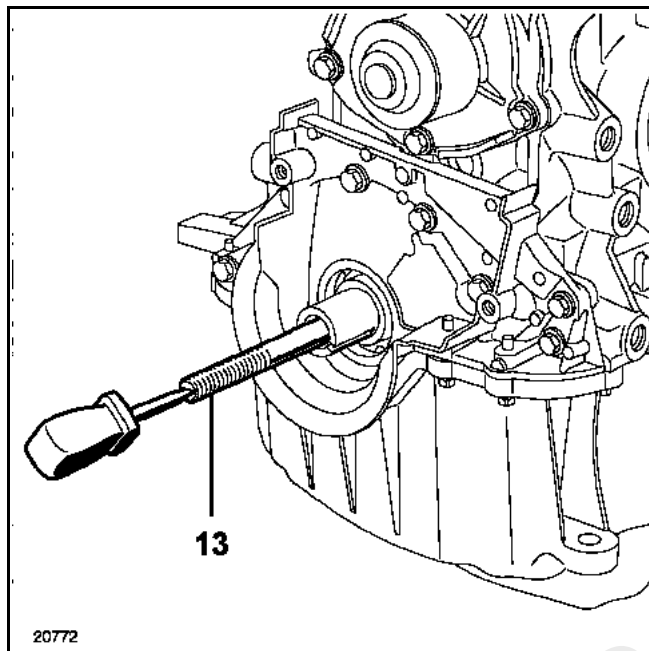
- the anti-emulsion plate,
- the oil sump, tightening the bolts as follows:
  - pretighten the bolts in the recommended order of **1, 2, 3, 4, 5, 6, 7, 8** to a torque of **0.8 daN.m**,
  - tighten the bolts in the recommended order of **1, 2, 3, 4, 5, 6, 7, 8** to a torque of **1.5 daN.m**,
  - pretighten the bolts in the recommended order of **9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 1, 2** to a torque of **0.8 daN.m**,
  - tighten the bolts in the recommended order of **9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 1, 2** to a torque of **1.5 daN.m**,



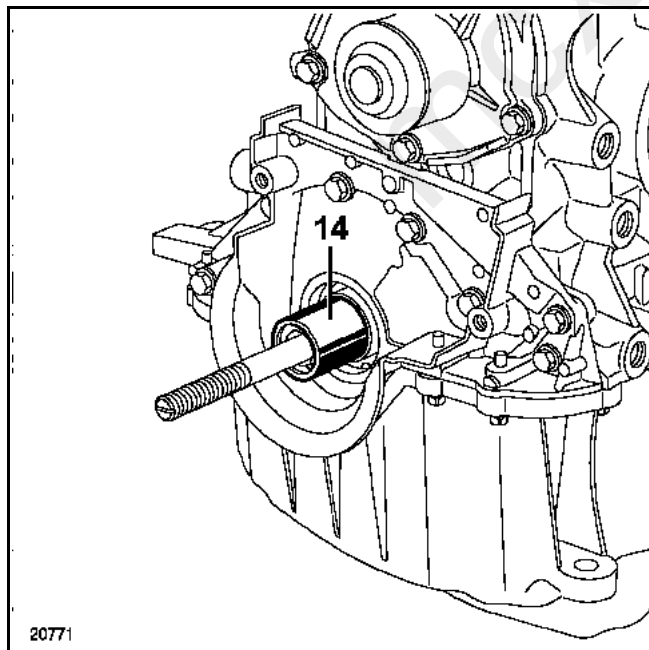
**Fitting the crankshaft seal gaskets**

Crankshaft elastomer seal, timing side.

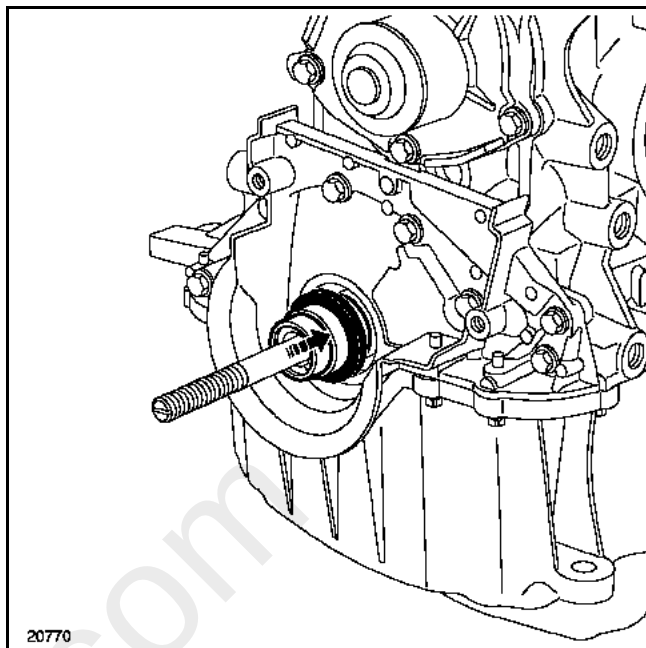
Screw the threaded rod (13) of **Mot. 1586** into the crankshaft.



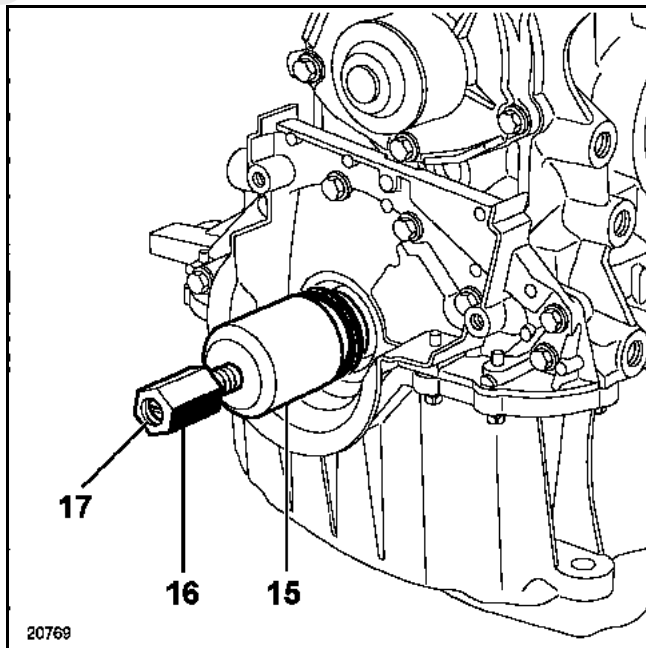
Position the spacer (14) of tool **Mot. 1586** on the crankshaft.



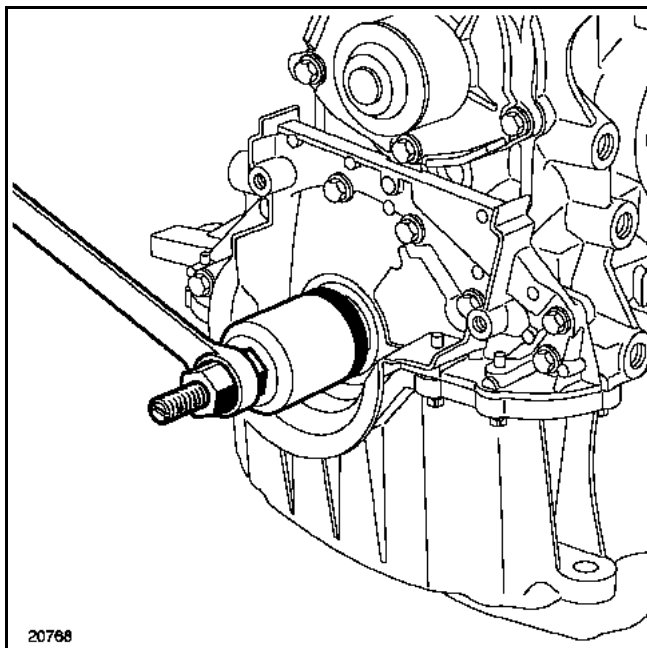
Fit the protector complete with the seal onto the spacer, taking care not to touch the seal.



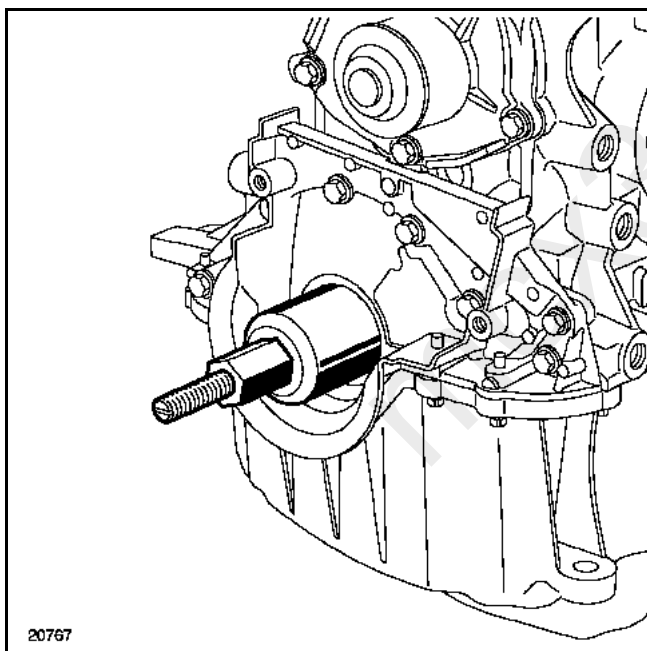
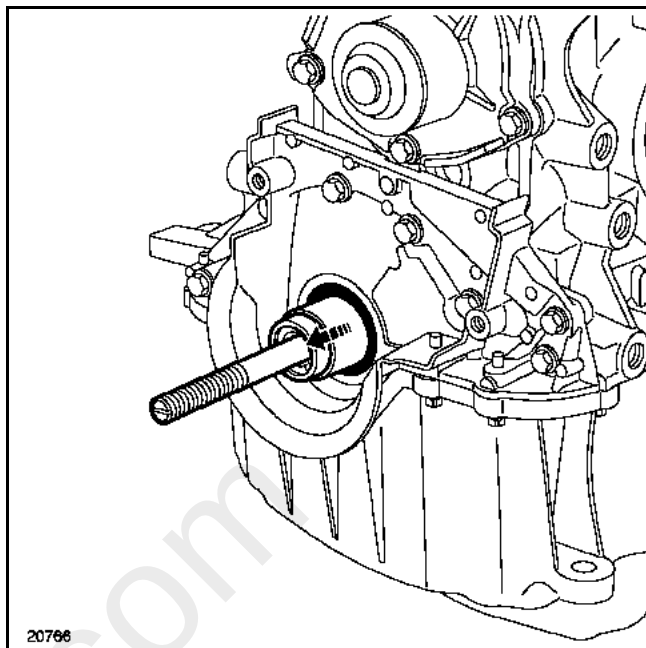
Fit the cover (15) and the nut (16) (putting the threaded part (17) of the nut on the side away from the engine) of tool **Mot. 1586**.



Tighten the nut until the cover touches the spacer.

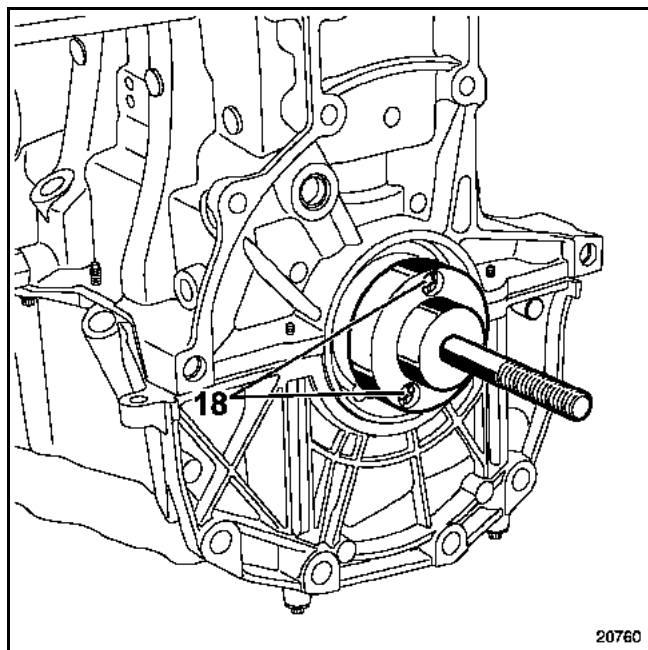


Remove the nut, the cover, the protector and the threaded rod.

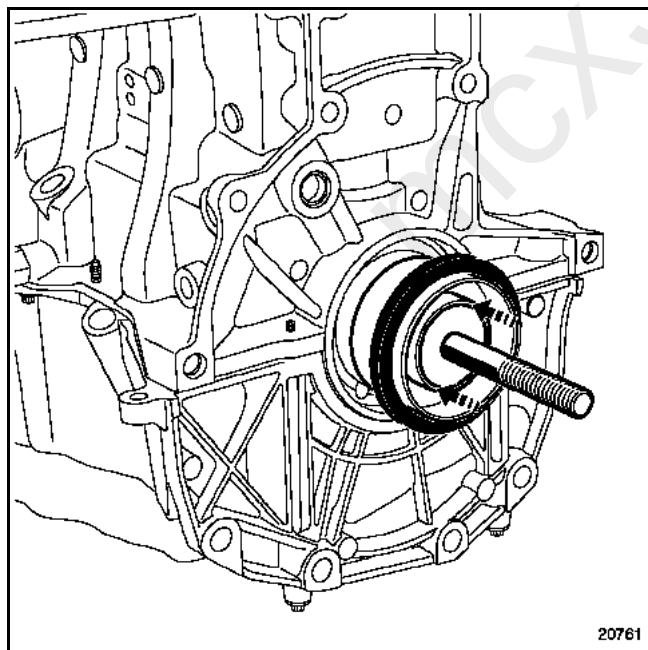


Crankshaft elastomer seal, flywheel side.

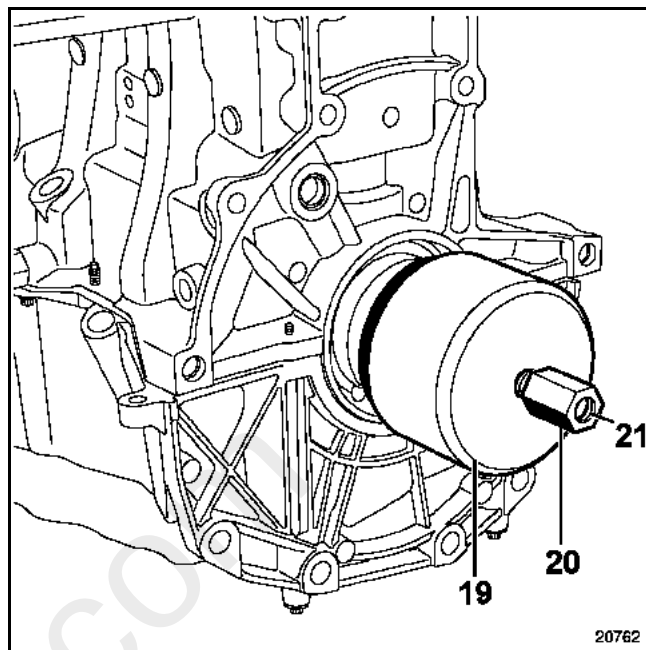
Fit tool **Mot. 1585** on the crankshaft, securing it with bolts (18).



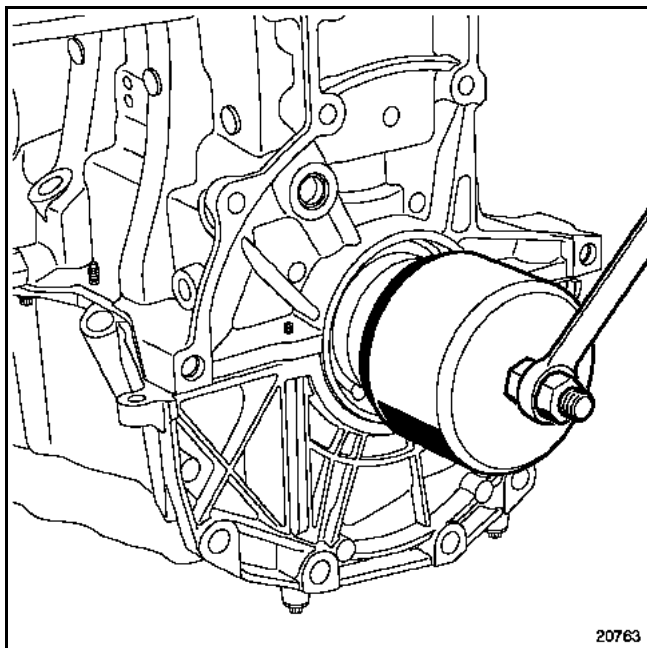
Put the protector complete with the seal on tool **Mot. 1585**, being careful not to touch the seal.



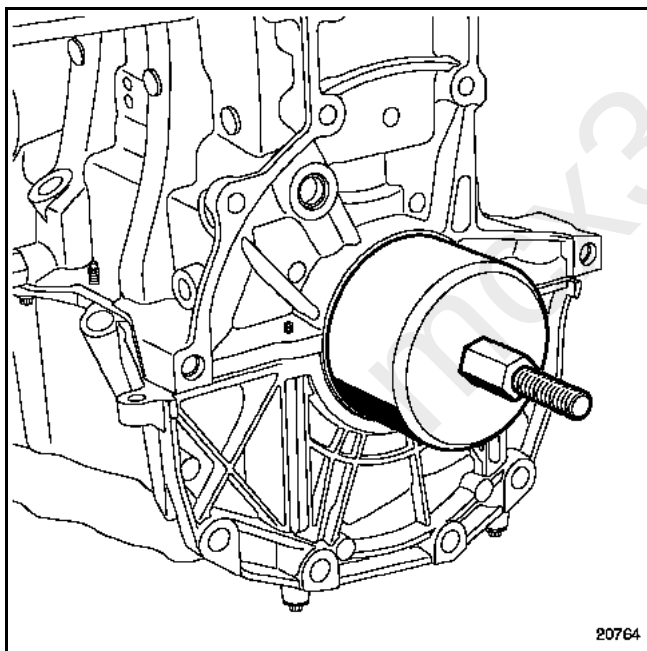
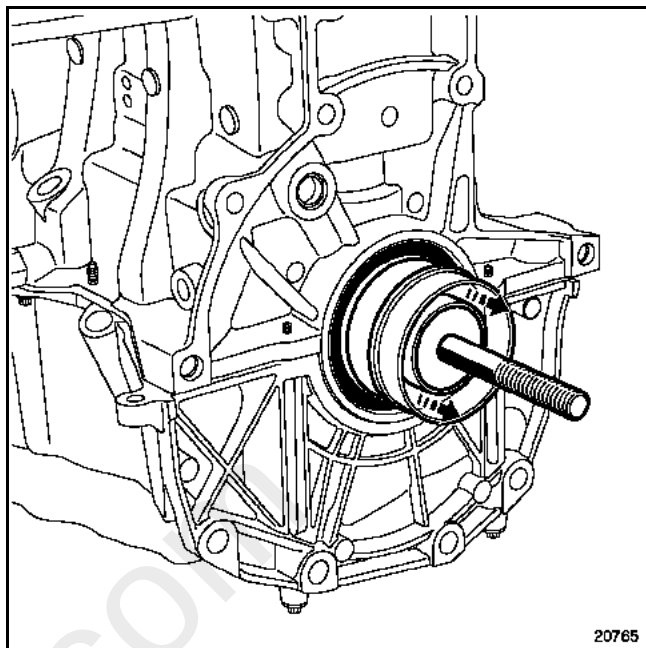
Fit the cover (19) and nut (20) (putting the threaded part (21) of the nut on the side away from the engine) of **Mot. 1585**.



Tighten the nut until the cover touches the cylinder block.

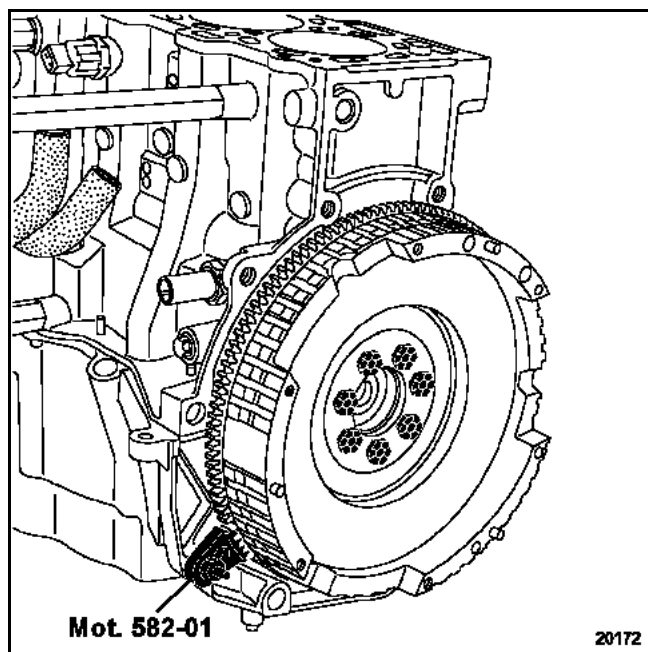


Remove the nut, the cover, the protector and the threaded rod.

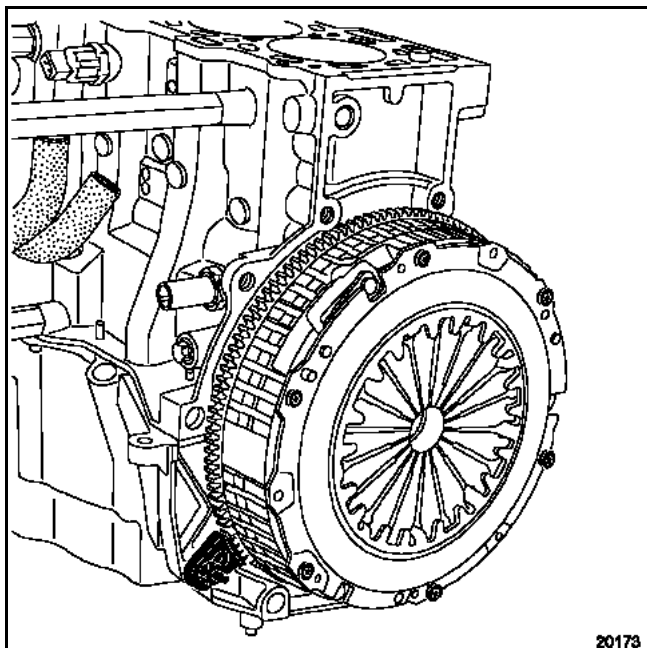


Refit:

- the flywheel, tightening the new bolts to a torque of **5 - 5.5 daN.m** (blocking the flywheel using **Mot. 582-01**),



- the clutch and mechanism, tightening the bolts to a torque of **0.8 daN.m**.



Remove flywheel block **Mot. 582-01**.

### REFITTING THE UPPER ENGINE

#### Refitting the cylinder head

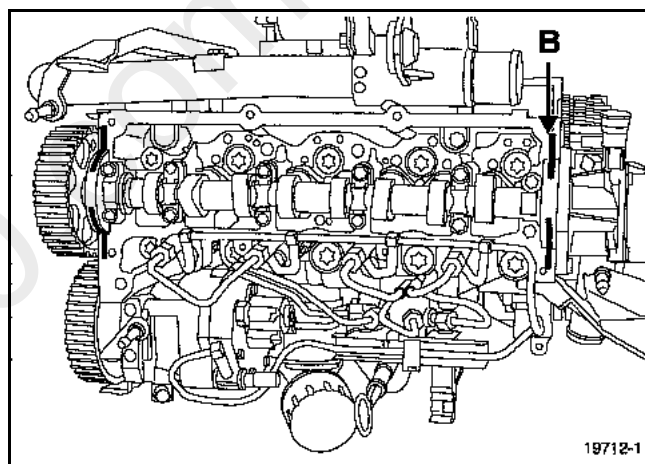
Position the pistons at mid-stroke.

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

Tighten the cylinder head (see the section "**Cylinder head specifications**").

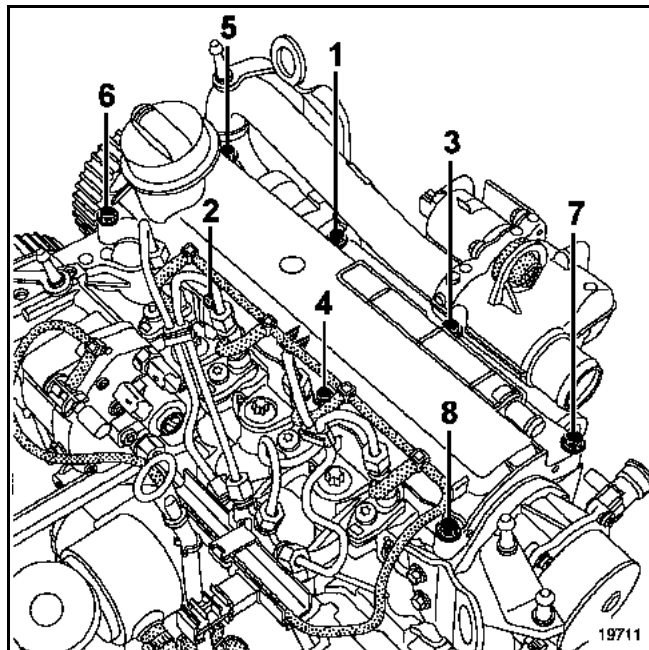
**NOTE:** the gasket faces (cylinder head and cylinder head cover) must be clean, dry and free from grease (in particular, remove finger marks).

Lay four beads (B) of **THREEBOND** silicon, with a diameter of **2 mm**.

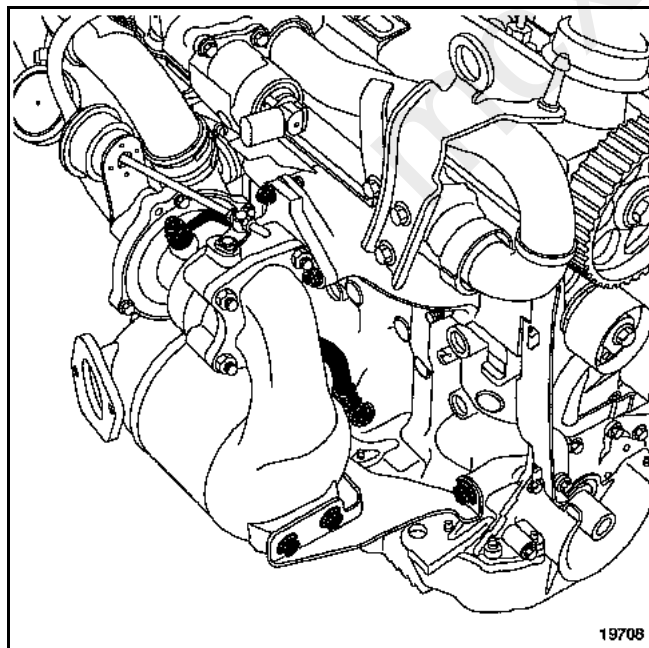


### Refit:

- the cylinder head, tightening the bolts to a torque of **1 daN.m** in the recommended order,



- the turbo oil return pipe fitted with new seals,
- the turbo, tightening the nuts to a torque of **2.6 daN.m**,
- the catalytic converter bracket,
- the turbo oil supply pipe,

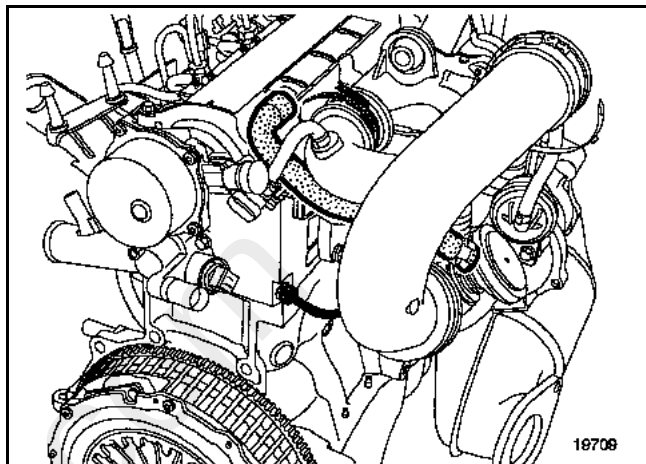


### Tighten:

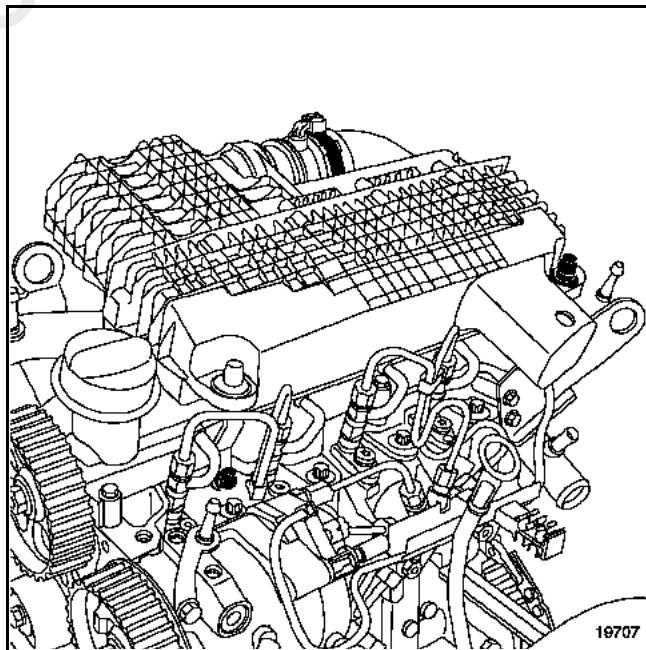
- the bolts of the turbo oil return pipe to a torque of **0.9 daN.m**,
- the nut and the bolt of the turbo oil supply pipe to a torque of **2.3 daN.m**.

### Refit:

- the oil vapour rebreathing pipe,
- the new turbo air ducts,

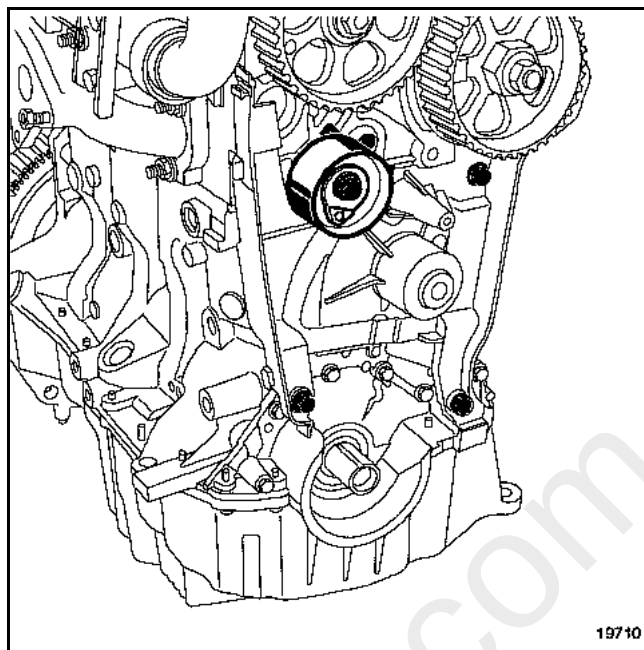


- the air filter unit.



Refit:

- the inner timing cover,
- the timing tension wheel.



## Timing adjustment

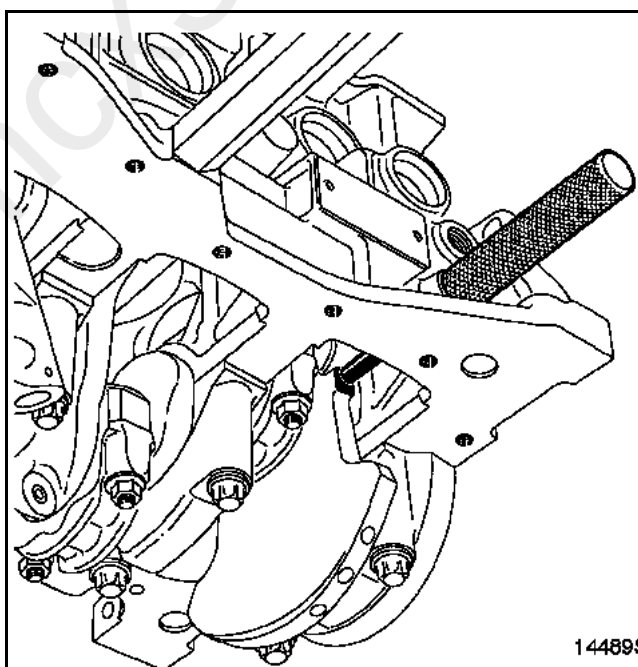
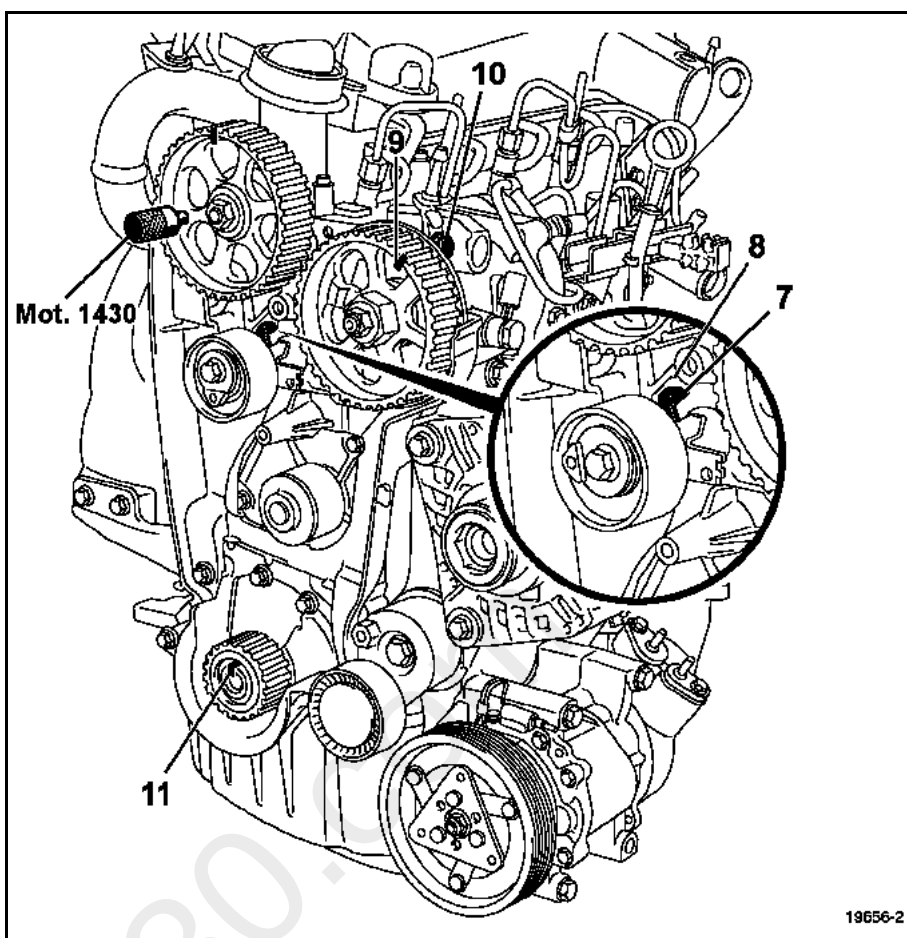
**IMPORTANT:** it is essential to degrease the end of the crankshaft, the bore of the crankshaft sprocket and the bearing faces of the accessories pulley to prevent any slip between the timing and the crankshaft which would risk destroying the engine.

Ensure that the peg (7) of the tension wheel is correctly positioned in the groove (8).

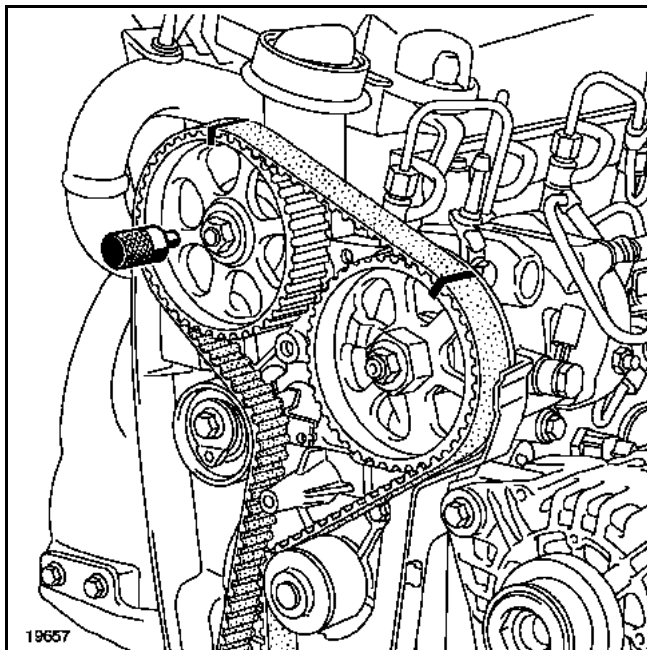
Insert pin **Mot. 1430** in the camshaft and cylinder head pulley holes.

Check that:

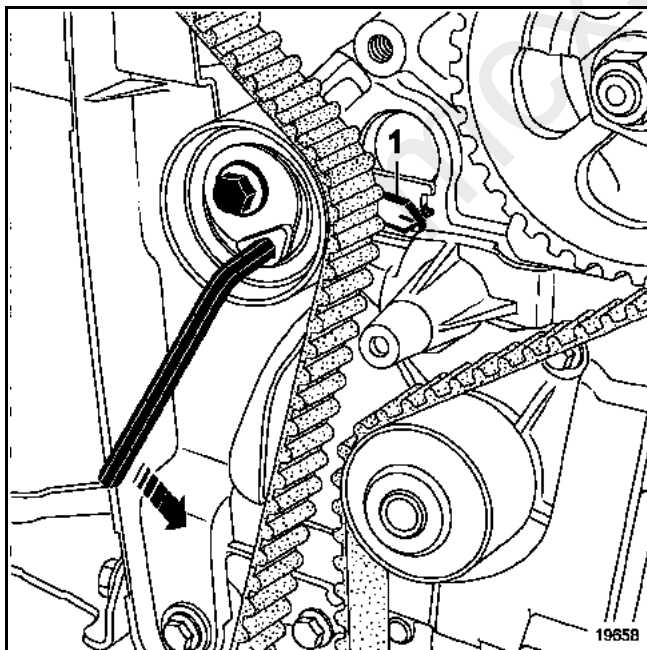
- the mark on the high pressure pump pulley (9) is opposite the bolt head (10),
- the crankshaft is touching the Top Dead Centre pin **Mot. 1489** (the crankshaft groove (11) must be facing upwards).



Fit the timing belt, aligning the marks on the belt with those on the camshaft and high pressure pump sprockets (**19 teeth spaces on the belt** between the marks on the camshaft and pump sprockets).



Using a **6 mm** Allen key, move the movable index (1) of the tension wheel into the position shown below, by turning the key anticlockwise.

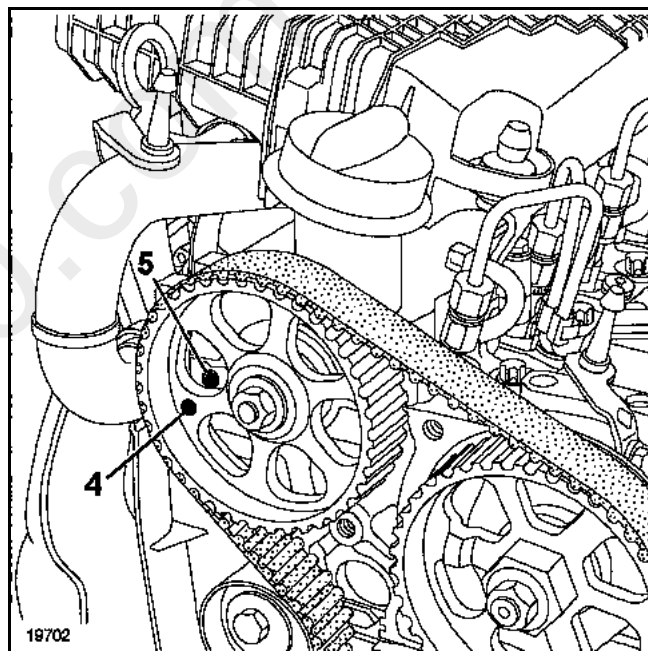


Tighten the tension wheel bolts to a torque of **2.5 daNm**.

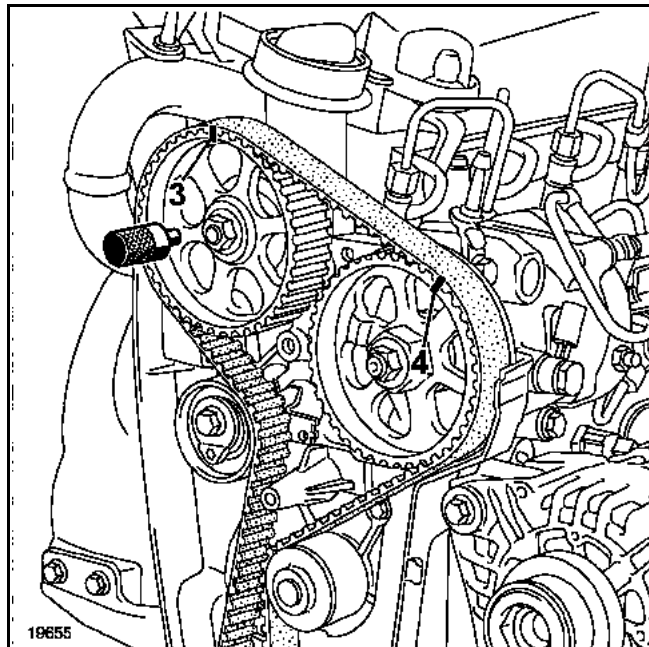
Refit the crankshaft accessories pulley, tightening the bolt to a torque of **2 daNm**, then angle tighten to **130° ± 15°** (crankshaft touching the Top Dead Centre pin).

Remove the Top Dead Centre pin **Mot. 1489** and the camshaft pulley timing pin **Mot. 1430**.

Turn the crankshaft two full turns in a clockwise direction (timing side). Just before the hole (4) of the camshaft pulley is opposite the cylinder head hole (5), screw pin **Mot. 1489** into the cylinder block. Then move the crankshaft slowly and without jolting it until it is resting on the pin.

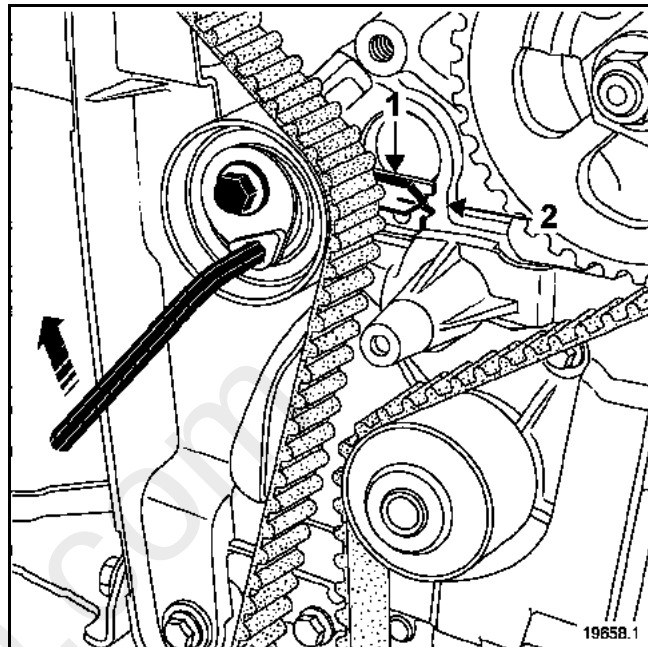


Check that pin **Mot. 1430** is correctly inserted in the holes of the camshaft and cylinder head pulleys and that there are **19 teeth spaces** between the marks on the camshaft (3) and the high pressure pump (4) sprockets.



Remove the Top Dead Centre pin **Mot. 1489** and the camshaft pulley timing pin **Mot. 1430**.

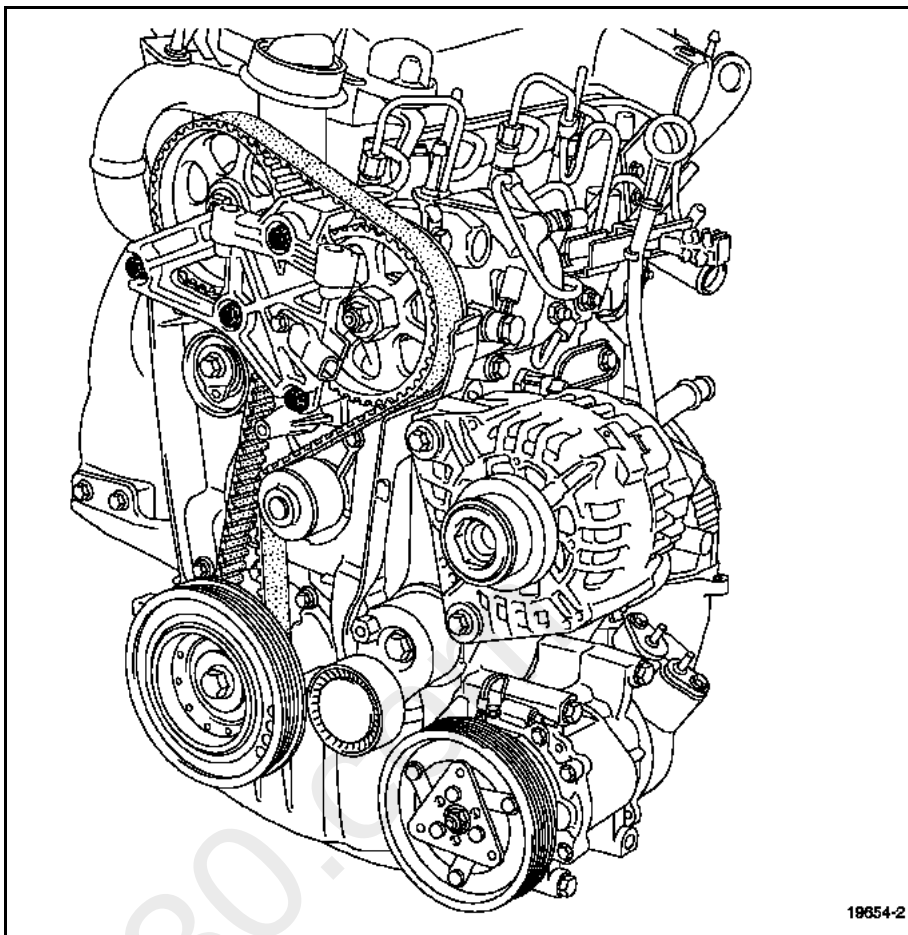
Undo the tension wheel bolt by a maximum of one turn while holding it using a **6 mm** Allen key, then gradually bring the movable index (1) (by turning the key clockwise) to the centre of the timing window (2) and tighten the nut to a torque of **2.5 daNm**.



Refit the cap of the Top Dead Centre pin, applying **RHODORSEAL 5661** to the thread and tightening to a torque of **2 daNm**.

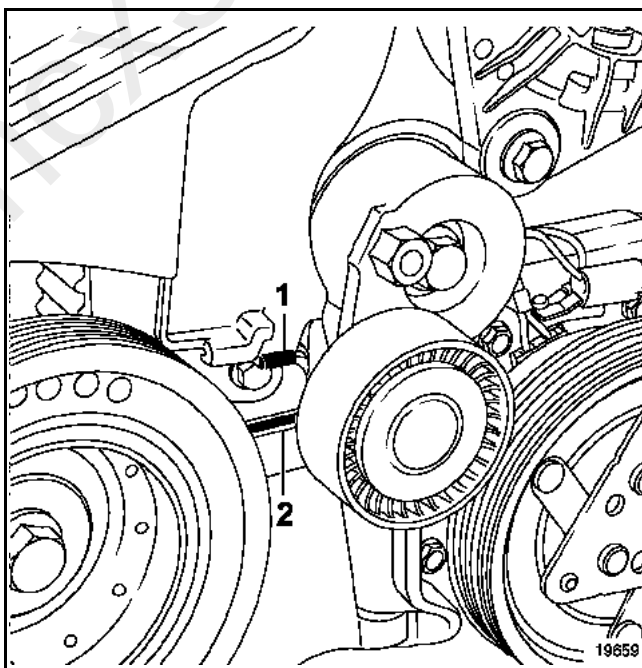
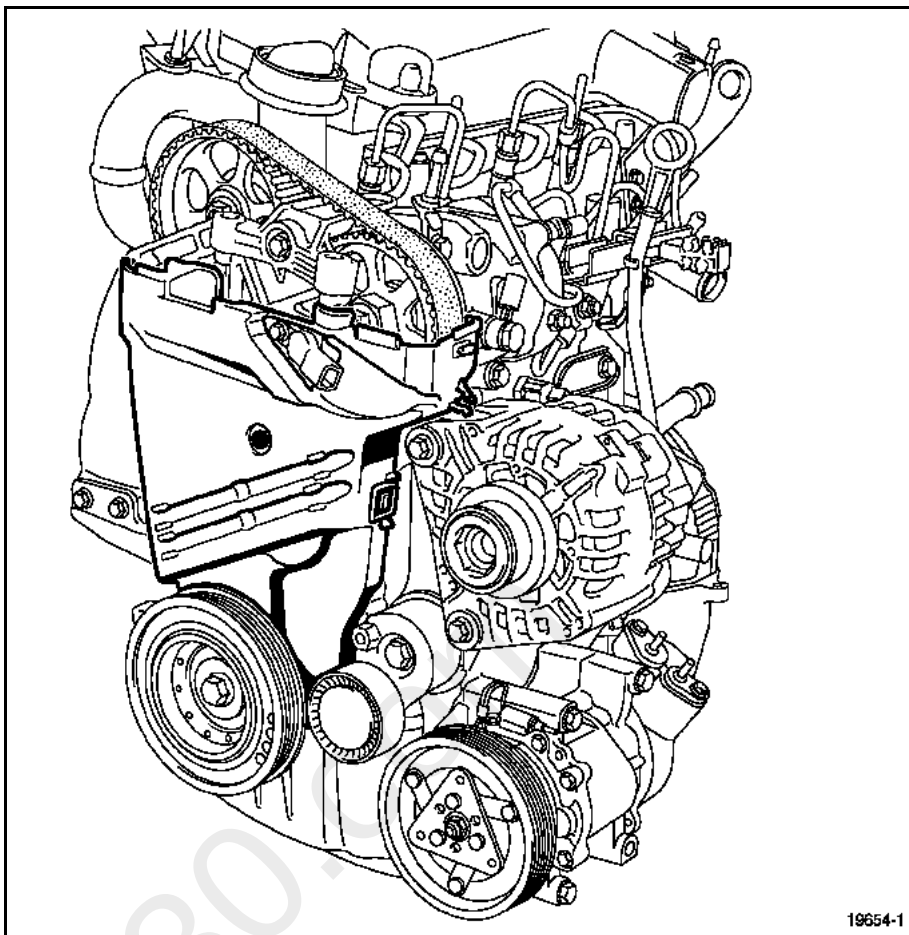
Refit:

- the cylinder head suspended mounting, tightening the bolts to a torque of **2.1 daNm**,

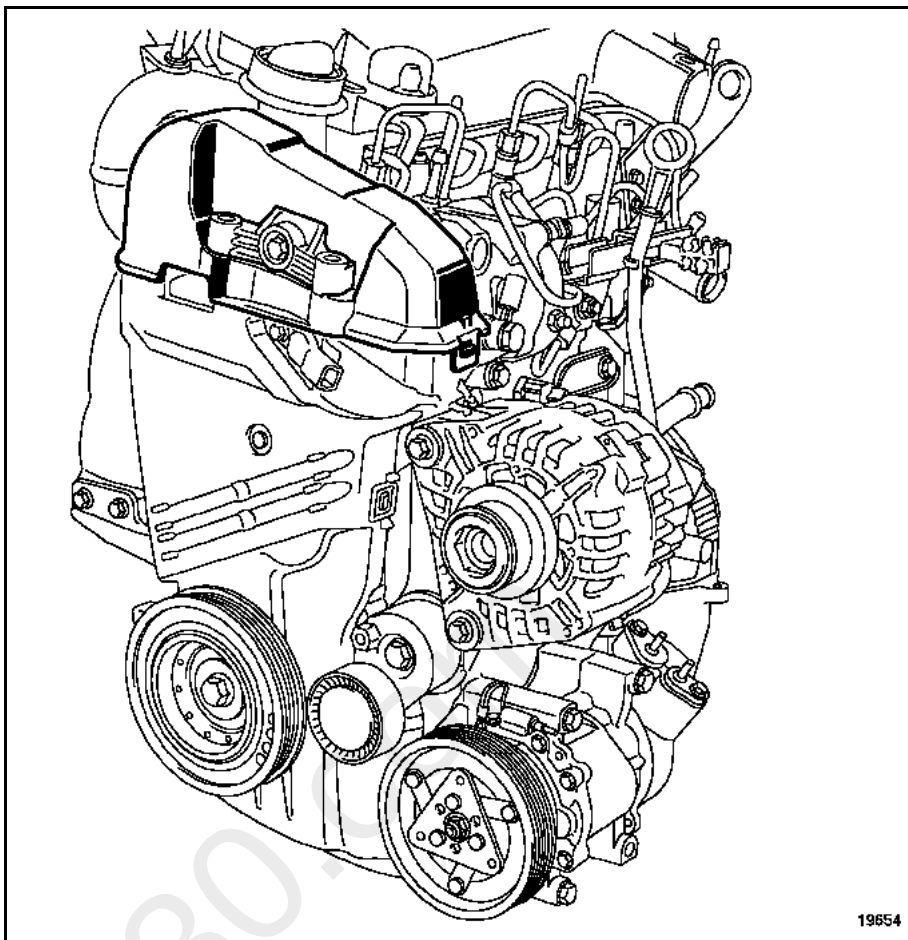


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- the lower timing cover by positioning the tab (1) into the hole (2) on the inner timing cover,



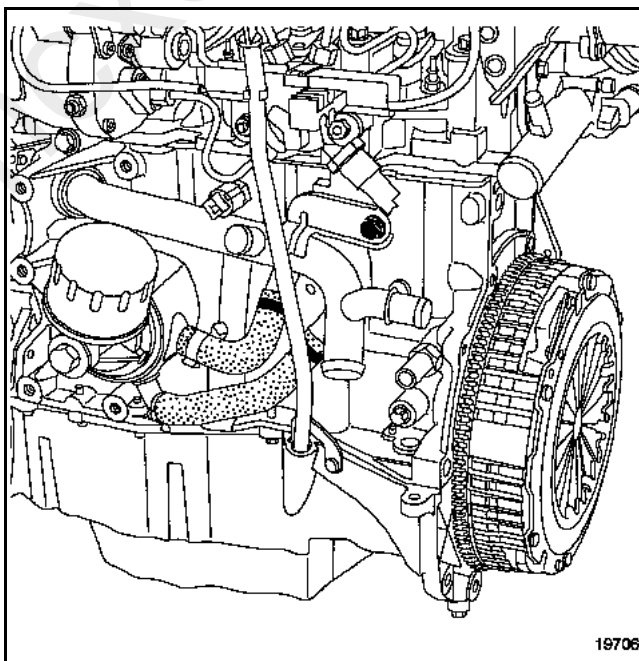
- the upper timing cover.



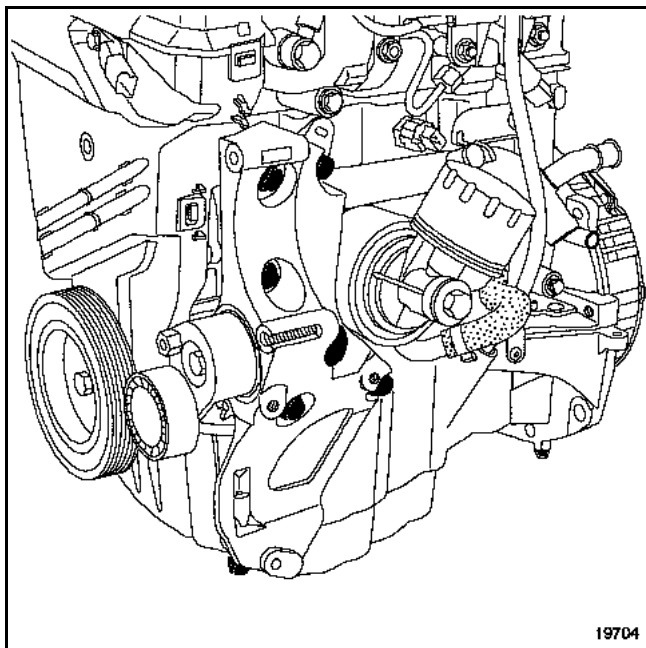
Remove the engine from the engine stand **Mot. 792-03**.

Refit:

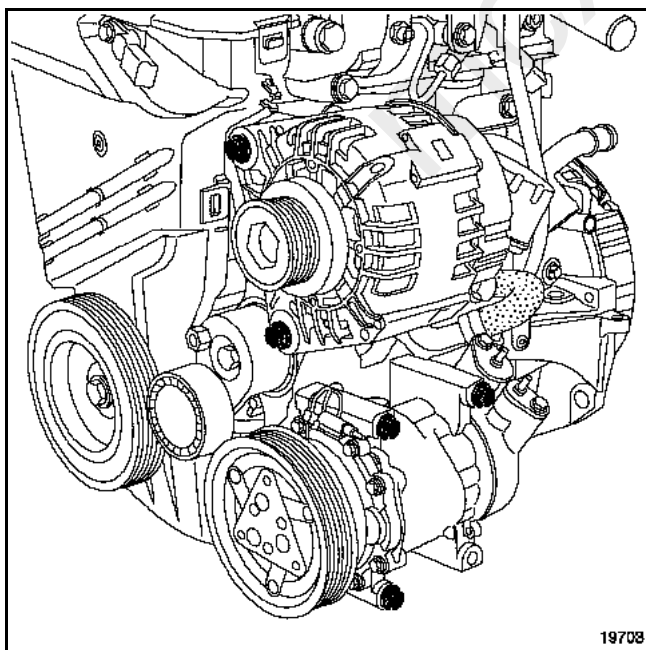
- the coolant pipe, tightening the bolt to a torque of **2.2 daN.m**,
- the two heat exchanger pipes,



- the multifunction support, tightening the bolts to a torque of **4 daN.m**,

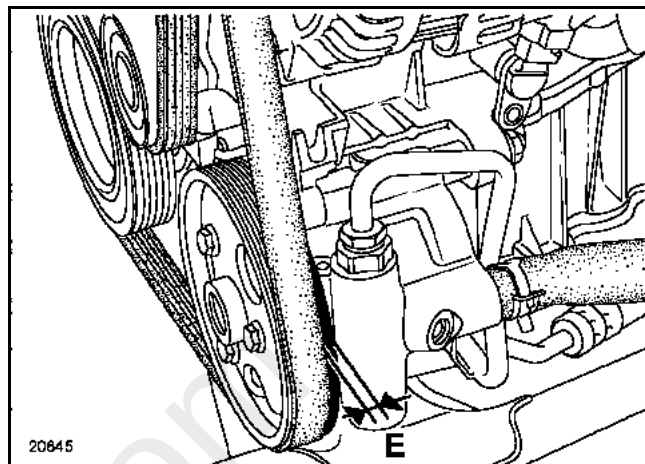


- the alternator, tightening the bolts to a torque of **2.1 daNm**,
- the air conditioning compressor, tightening the bolts to a torque of **2.1 daN.m**,
- the power-assisted steering pump or the washer which replaces the pulley (if the engine has one), tightening the bolts to a torque of **2.1 daN.m**,



- the accessories belt.

**NOTE:** the accessories belt has five teeth as opposed to the pulleys which have six. It is therefore essential to ensure that tooth "E" remains free when fitting the belt.



Version with air conditioning.

**NOTE:** the engine must be turned through two revolutions in order to position the belt correctly.

