

RENAULT

Workshop repair manual

ENGINE (Diesel) Indirect injection Aluminium, 4 cylinders

Types	Vehicles
852	Renault 18 Fuego
J8S	Renault 20 Renault 21 Renault 25 Renault 30 Safrane Espace Trafic Master Jeep

Cancel and replaces note dated JULY 1991

77 11 293 322

DECEMBER 2000

EDITION ANGLAISE

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

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

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Contents

Page

10 ENGINE AND PERIPHERALS

Foreword	10-1
Diagram	10-2
Engine identification	10-4
Tightening torques (in daNm)	10-7
Lubrication circuit diagram	10-14
Specifications	10-16
Standard replacement	10-38
Special tooling required	10-39
Essential equipment	10-44
Cylinder head exploded drawing	10-45
Overhauling the engine	
Removing top engine	10-46
Stripping the cylinder head	10-51
Cleaning	10-54
Checking the gasket face	10-54
Redressing the valve seats	10-55
Assessment and repair of rocker arm rails	10-56
Rebuilding the cylinder head	10-57
Cylinder block exploded drawing	10-65
Removing bottom engine	10-66
Extracting the con rod -pistons	10-74
Refitting bottom engine	10-75
Refitting and assembling con rod and pistons	10-84
Fitting the rings	10-85
Checking cylinder liner protrusion	10-85
Refitting cylinder liner - pistons - con rods	10-86
Checking piston protrusion	10-89
Refitting top engine	10-98
Tensioning procedure	10-108
Notes on fitting accessory belts	10-114

USING THE MANUAL

There are two main sections in this manual:

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

To repair the component on the vehicle, refer to the **Workshop Repair Manual** and **Technical Notes** for the vehicle.

UNITS OF MEASUREMENT

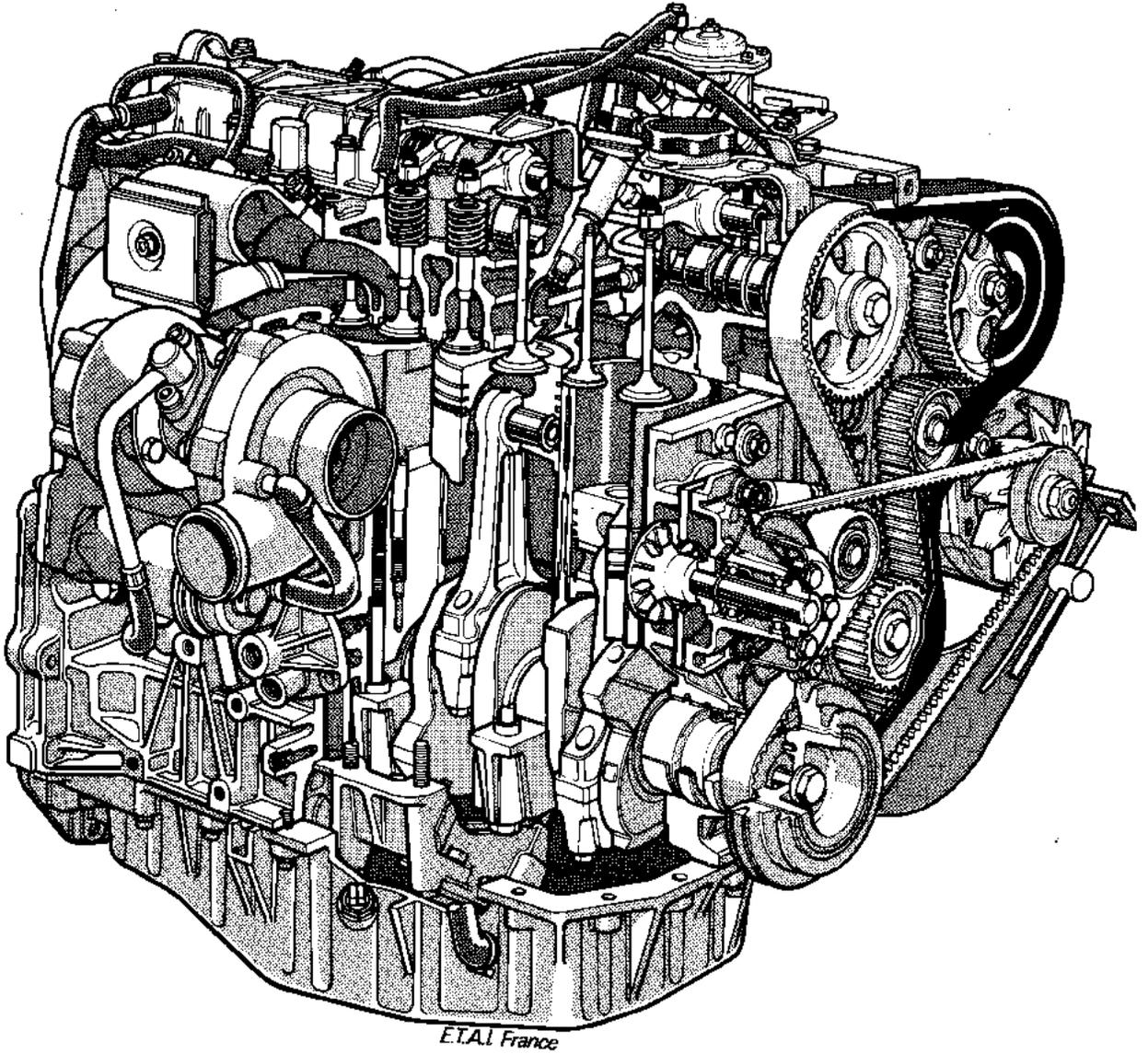
- All dimensions are given in millimetres (**mm**) (except where stated otherwise).
- Tightening torques are expressed in decaNewtonmetres (**daNm**).
Reminder: **1 daNm = 1.02 m.kg.**
- Pressures in **bar**
Reminder: **1 bar = 100 000 Pa.**

TOLERANCES

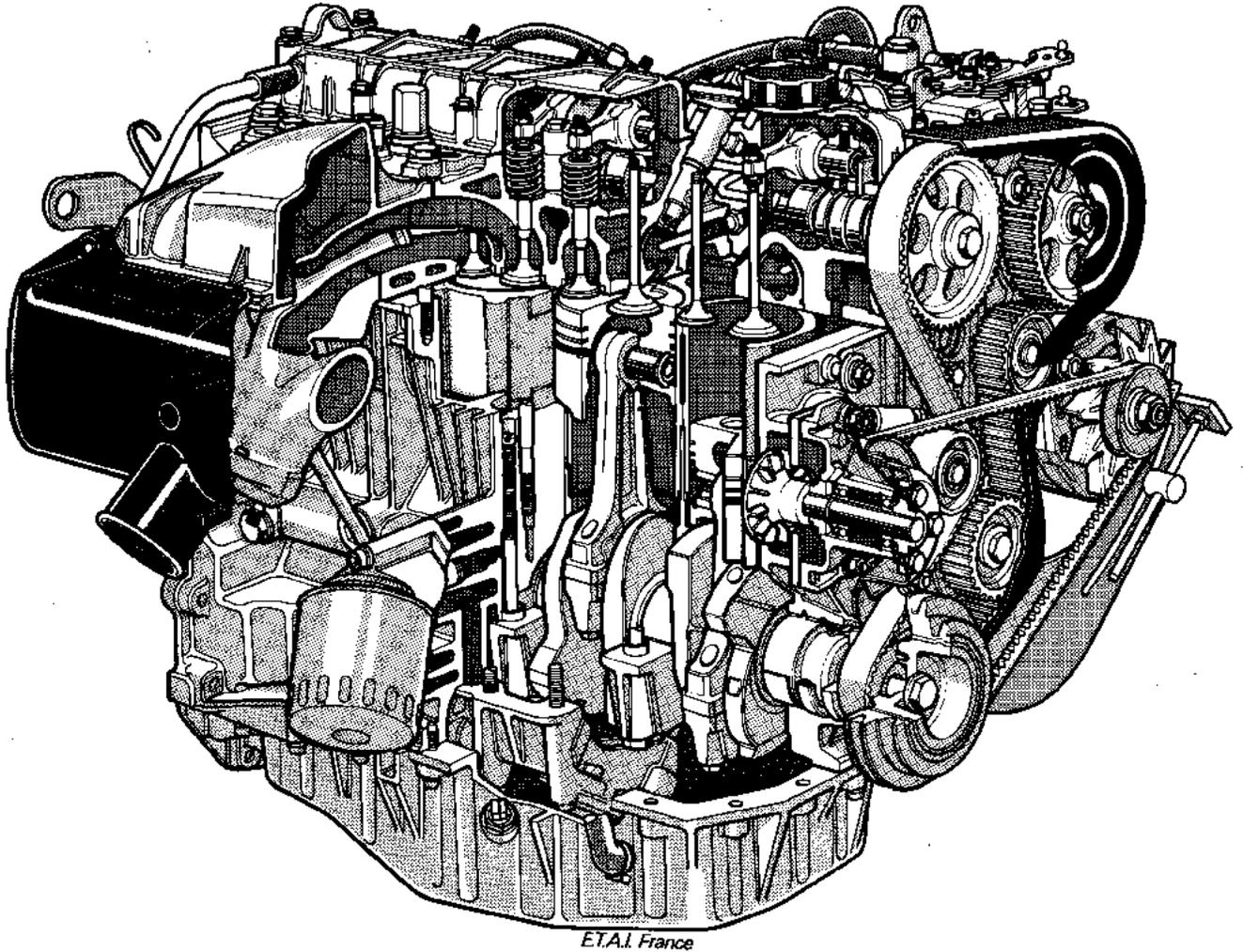
Tightening torques given without a tolerance must be accurate to within:

- in **degrees** ($\pm 3^\circ$).
- in **daNm** ($\pm 10\%$).

J8S TURBO ENGINE

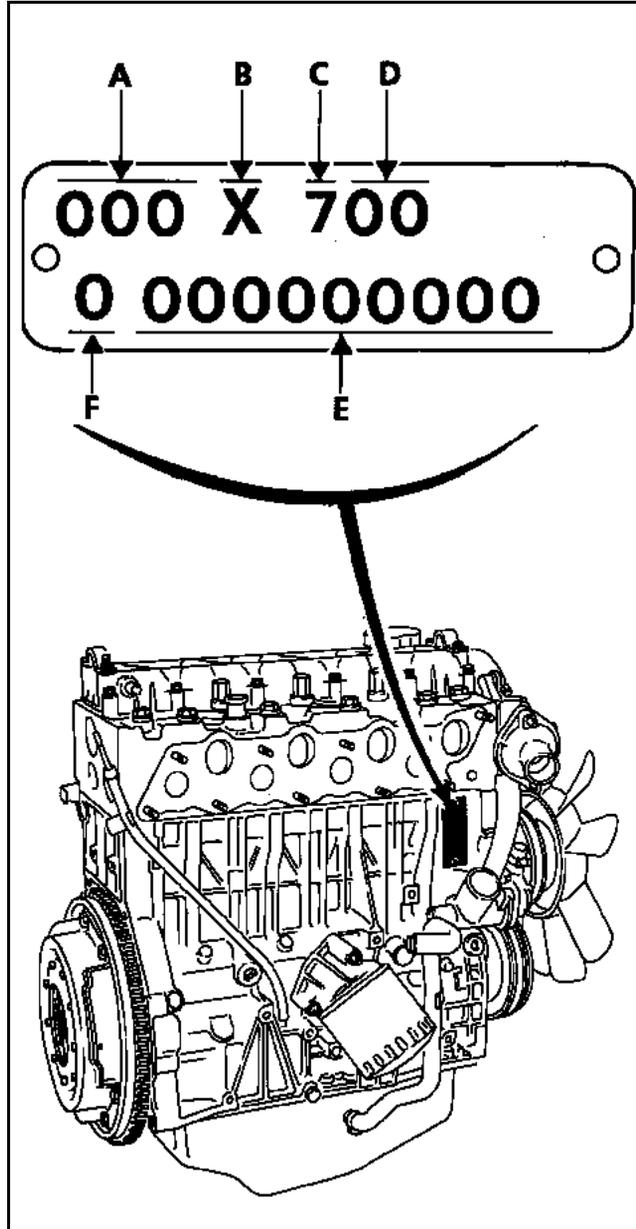


J8S AND 852 ENGINES



ETA.I. France

The engine is identified by a plate riveted onto the cylinder block.



It includes:

- A:** the engine type
- B:** the engine approval letter
- C:** the manufacturer code
- D:** the engine index
- E:** the engine fabrication number
- F:** the engine assembly works

ENGINE AND PERIPHERALS

Engine identification

10

Engine	Index	Type	Compression ratio	Bore (in mm)	Stroke (mm)	Capacity (in cm ³)
852	700 710 720 750	1276 1344, 2354, 1354 Pxx3 { Txx3 Vxx3				
J8S	240 330 600 604 620 622 704 708 714 738 742 746 758 774 786 788	J115, S115 Rxx3 X480 X48A PxxF TxxK X486 B290 X488 B29W X488 X486, X48W TxxF J114 X487 X48P	21/1	86	89	2068

ENGINE AND PERIPHERALS

Engine identification

10

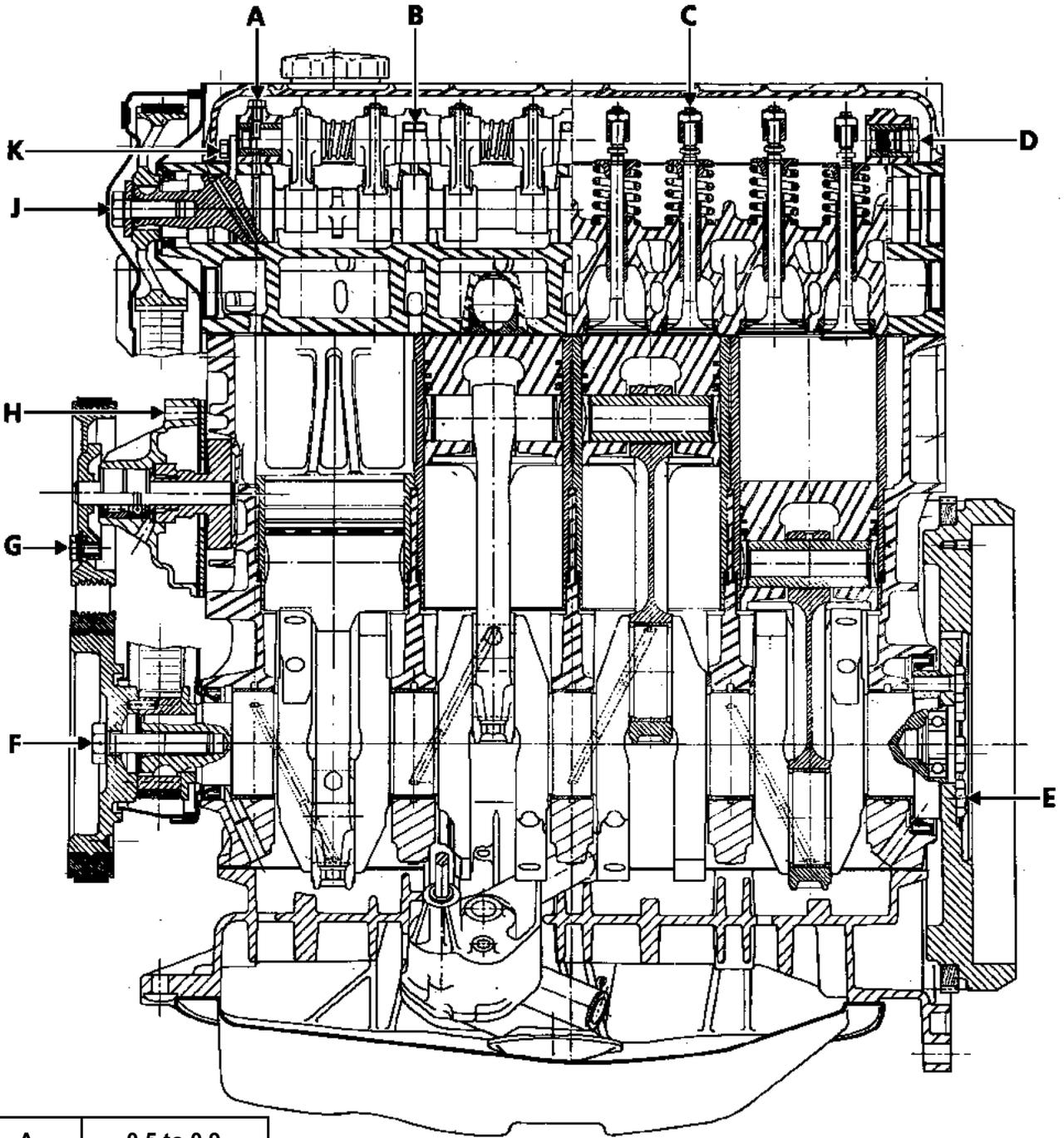
Engine	Index	Type	Compression ratio	Bore (in mm)	Stroke (in mm)	Capacity (in cm ³)
J8S	610 612 702 706 711 712 736 740 760 772 776 778	J63D, S63D J63E 1270 B296 1344 TA, 1354TA 1346, 1356, 1366 B296 X48, 6, V, V 4x4 B546 J635, S635 J634 J633	21.5/1	86	89	2068
J8S	784 800 814	X480 CJ XJ	21.5/1	86	89	2068

ENGINE AND PERIPHERALS

Tightening torques (in daNm)



10



A	0.5 to 0,9
B	2.5 to 3
C	1.3 to 1.8
D	2
E	6 to 6.5
F	13
G	2.5
H	1.3
J	5
K	1.25

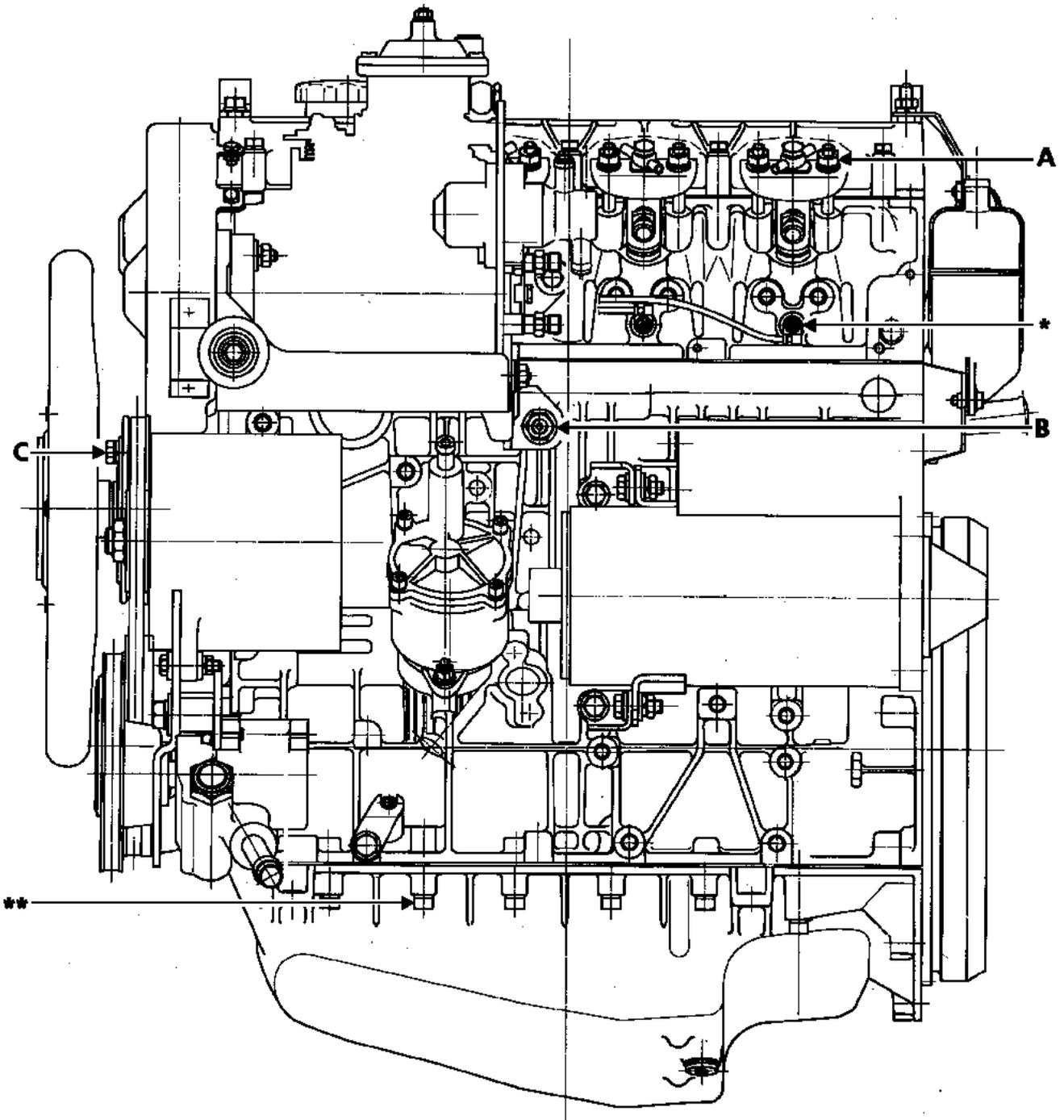
ENGINE AND PERIPHERALS

Tightening torques (in daNm)



10

CYLINDER BLOCK



A	2
B	2
C	2.5

* Preheating shunt nut connector: **0.25 daNm**

** Aluminium sump : **1.4 to 1.7 daNm**

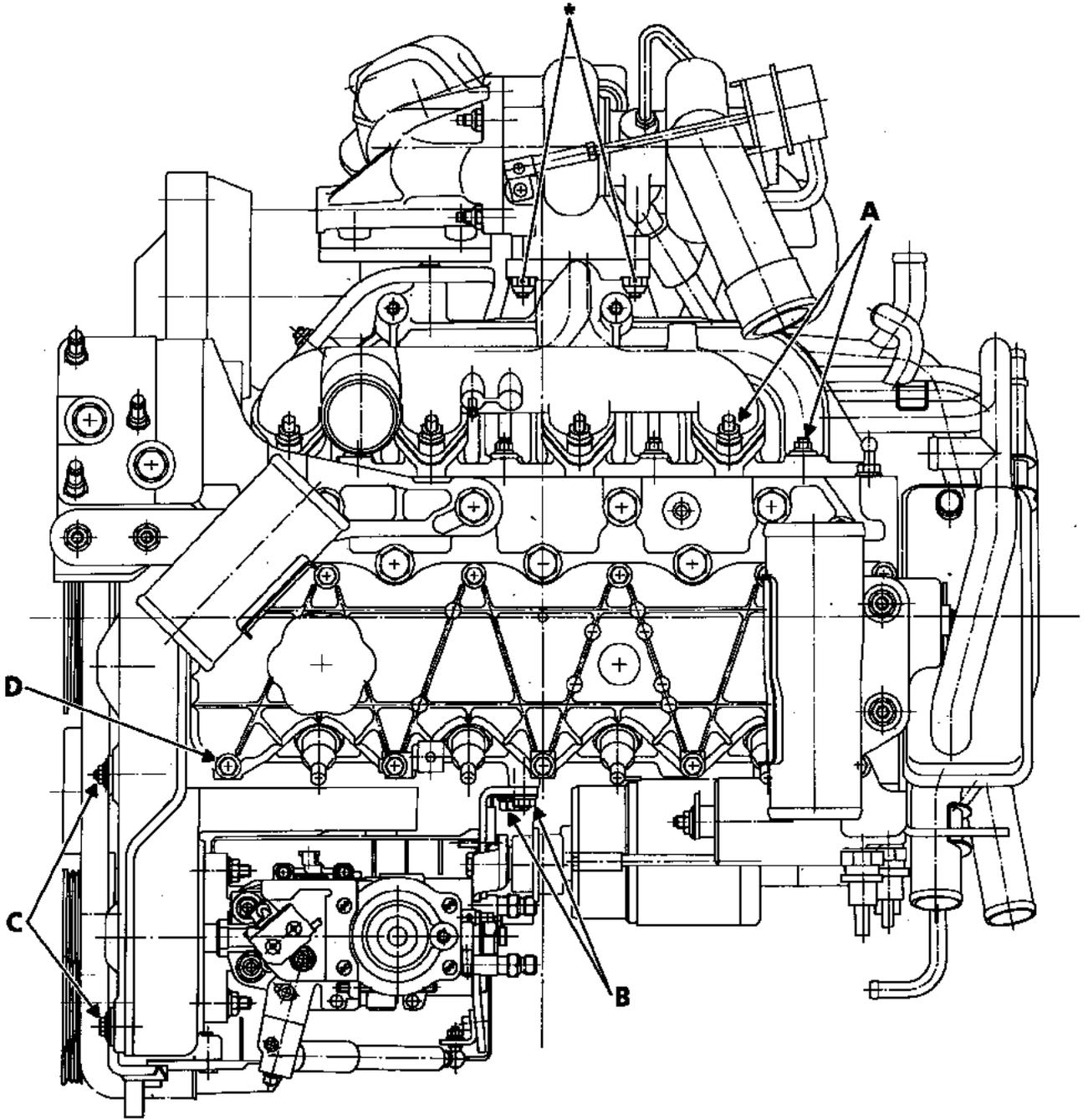
Metal sump : **1.25 daNm**

ENGINE AND PERIPHERALS

Tightening torques (in daNm)



10



A	3.2 to 3.9
B	2
C	1.3
D	1.4

* Turbo:

IHI : 4.5 daNm

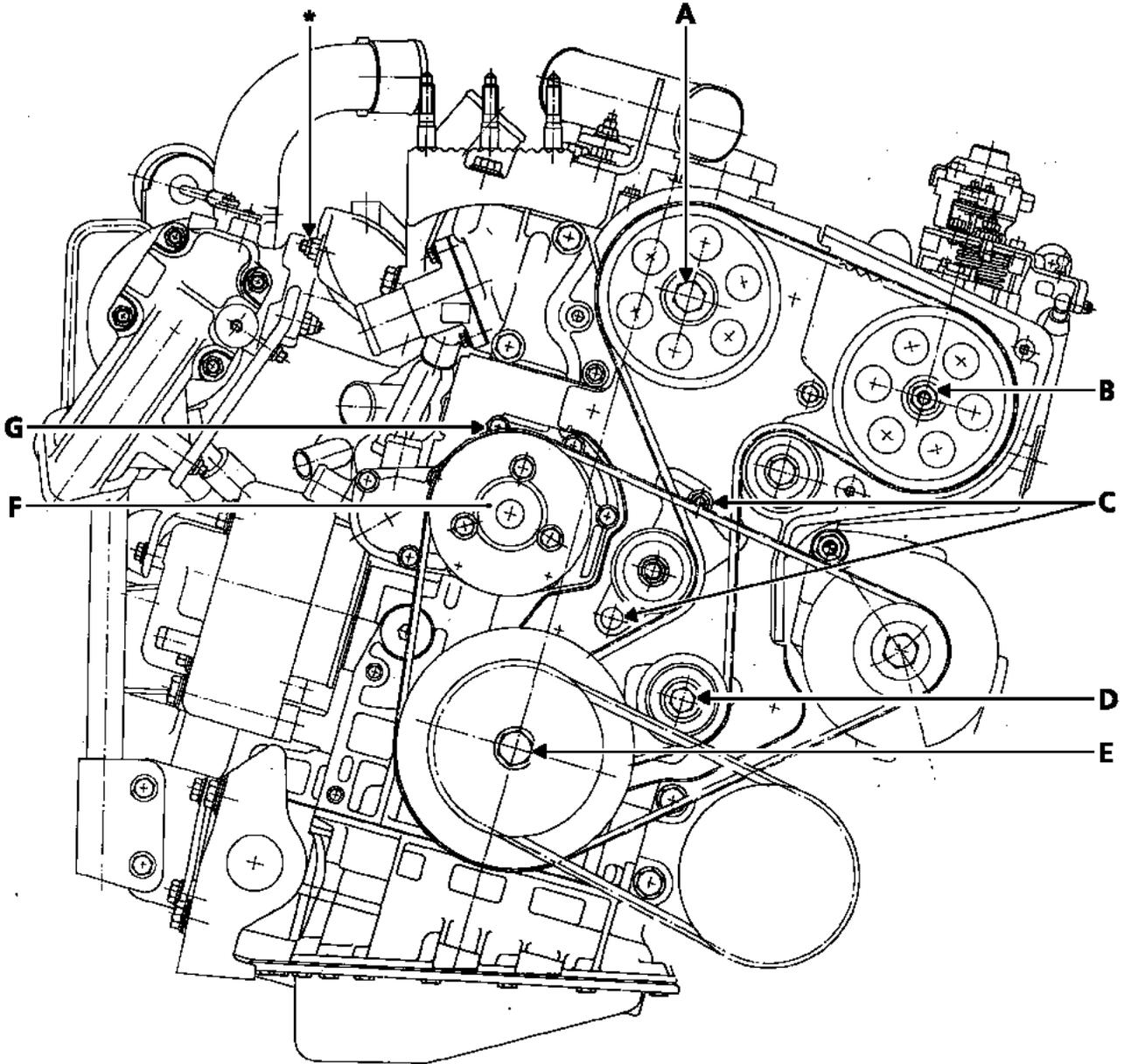
Garrett : 2.6 daNm

ENGINE AND PERIPHERALS

Tightening torques (in daNm)



10



A	5
B	5
C	2.25 to 2.75
D	5
E	13
F	2.5
G	1.3

* Turbo:

IHI : 4.5 daNm

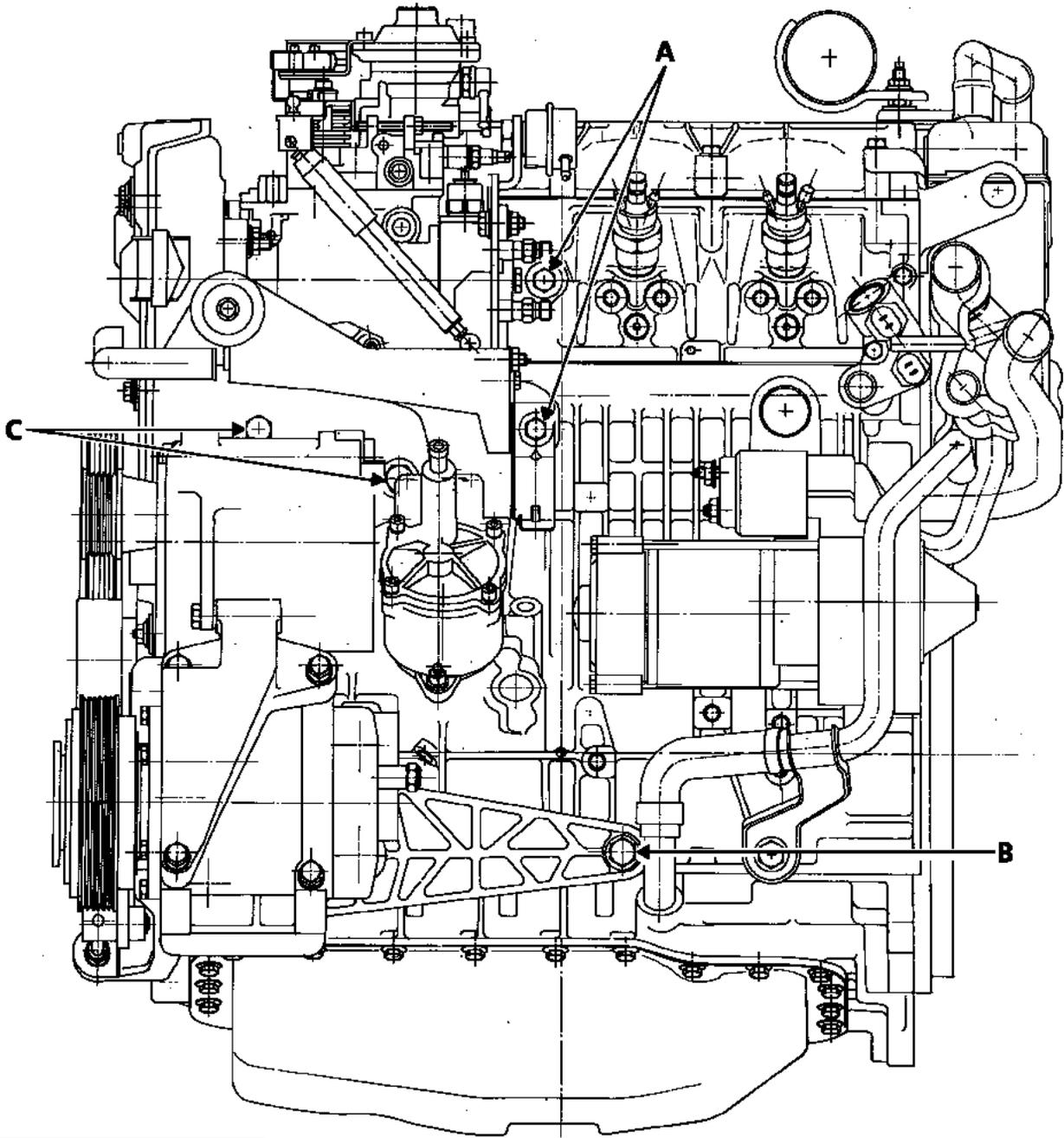
Garrett : 2.6 daNm

ENGINE AND PERIPHERALS

Tightening torques (in daNm)



10



A	2
B	4
C	5 to 5.5

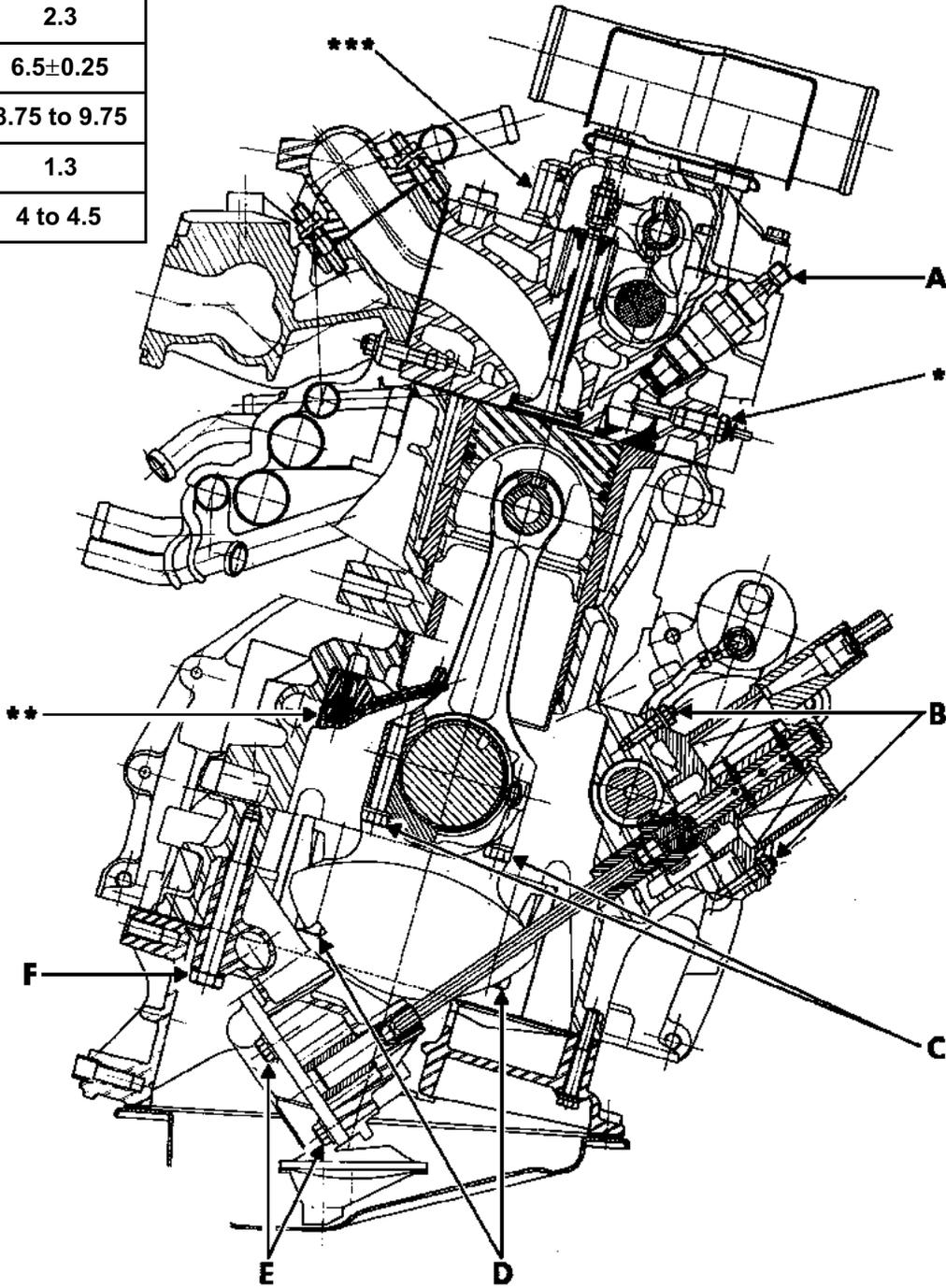
ENGINE AND PERIPHERALS

Tightening torques (in daNm)



10

A	7
B	2.3
C	6.5±0.25
D	8.75 to 9.75
E	1.3
F	4 to 4.5



* Spark plug **M12** tighten to **2 daNm**
 Spark plug **M10** tighten to **1.6 daNm**

** **1st model:**
 – coolant pipe : **0.8 to 1 daNm**
 – coolant rail : **2 to 2.5 daNm**
2nd model:
 – cooling jets only : **1.2 to 1.4 daNm**

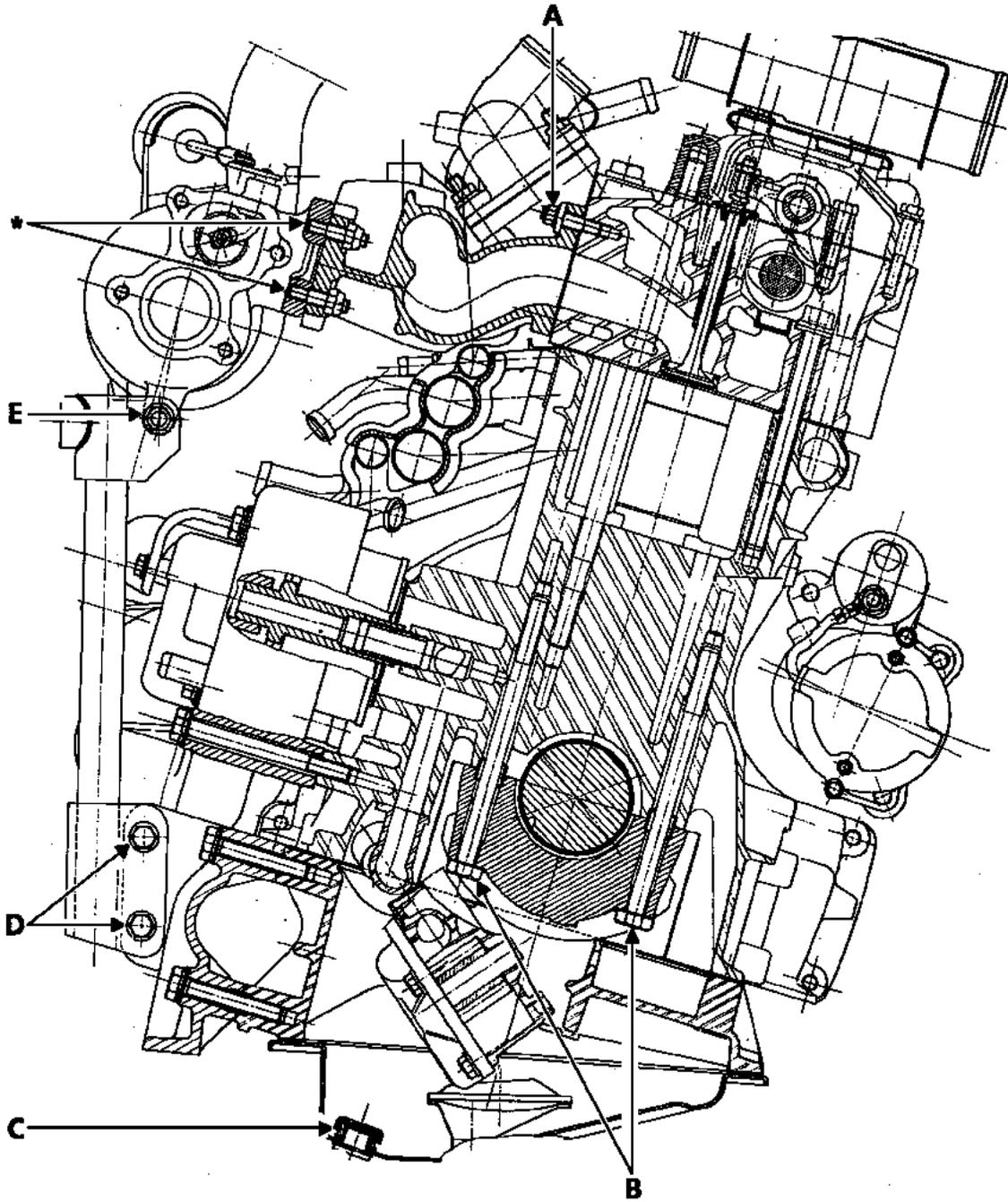
*** See the cylinder head tightening procedure page 10-16

ENGINE AND PERIPHERALS

Tightening torques (in daNm)



10



A	3.2 to 3.9
B	8.75 to 9.75
C	2.5 to 3
D	3
E	2.3

* Turbo:
IHI : 4.5 daNm
Garrett : 2.6 daNm

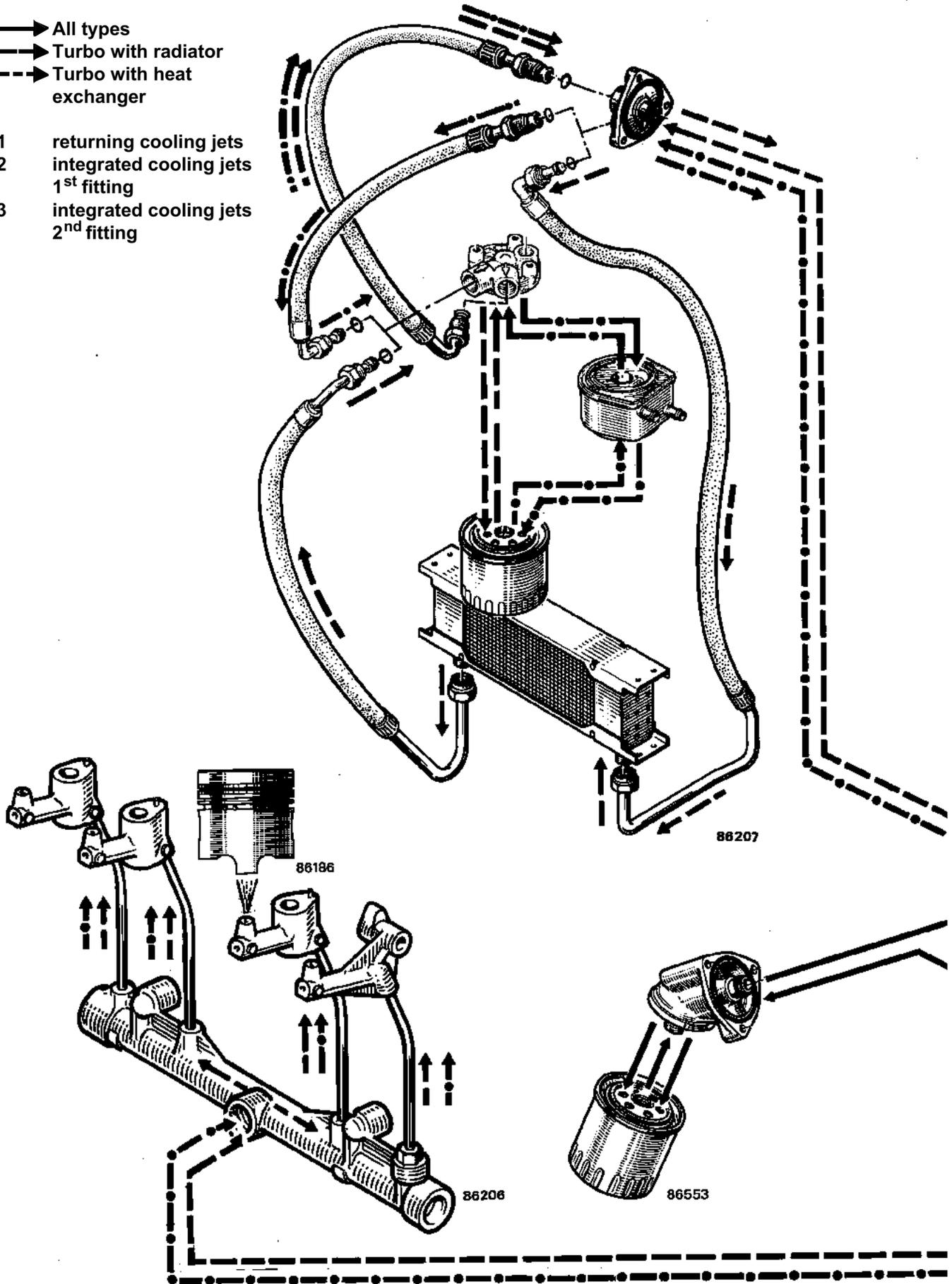
ENGINE AND PERIPHERALS

Lubrication circuit diagram

Key:

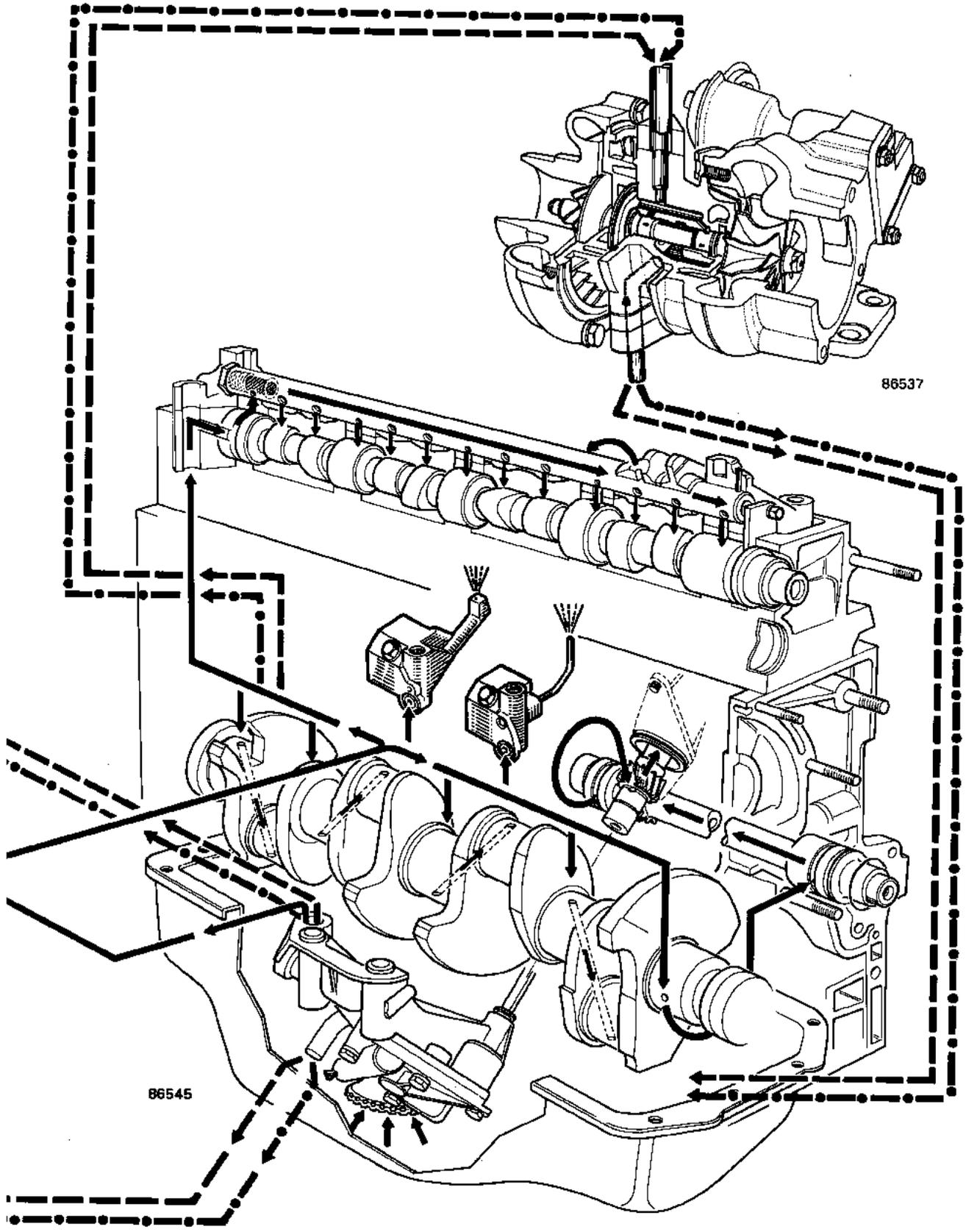
- All types
- Turbo with radiator
- - -→ Turbo with heat exchanger

- 1 returning cooling jets
- 2 integrated cooling jets 1st fitting
- 3 integrated cooling jets 2nd fitting



ENGINE AND PERIPHERALS

Lubrication circuit diagram



CYLINDER HEAD

Tightening procedure

All the cylinder head bolts must always be changed after removal (including the mounting studs).

Lubricate the threads and under the bolt heads with engine oil.

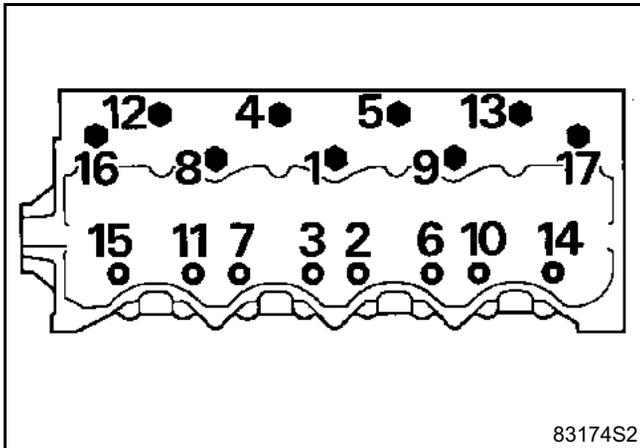
REMINDER: Use a syringe to remove any oil which may have entered the cylinder head mounting bolt holes to achieve correct tightening of the bolts.

J8S transverse engine

Carry out the following in the order prescribed:

1st tightening : **3 daNm**

2nd tightening : **5 daNm**



Wait 3 minutes settling time.

Unscrew **bolt 1** until it is completely free, and then carry out:

1st retightening **2 daNm**

2nd retightening (angle) according to the table:

Symbol	Angle (in degrees)	Symbol	Angle (in degrees)
1	105	10	60
2	60	11	60
3	60	12	80
4	80	13	70
5	70	14	60
6	60	15	60
7	60	16	90
8	105	17	80
9	105		

Repeat the above operation for all the bolts.

3rd retightening (angle) according to the table:

Symbol	Angle (in degrees)	Symbol	Angle (in degrees)
1	105	10	60
2	60	11	60
3	60	12	80
4	80	13	70
5	70	14	60
6	60	15	60
7	60	16	90
8	105	17	80
9	105		

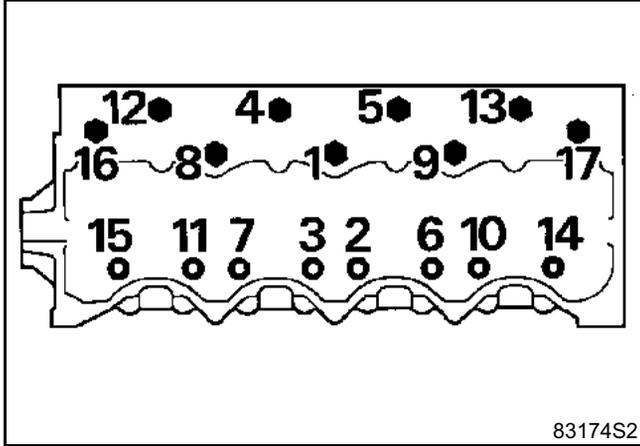
There is no cylinder head retightening operation.

J8S longitudinal engine

Carry out the following in the order prescribed:

1st tightening : **3 daNm**

2nd tightening: **5 daNm**



Wait 3 minutes settling time.

Unscrew **bolt 1** until it is completely free, and then carry out:

1st retightening 2 daNm

2nd retightening (angle) according to the table:

Symbol	Angle (in degrees)	Symbol	Angle (in degrees)
1	105	10	60
2	60	11	60
3	60	12	70
4	70	13	70
5	70	14	60
6	60	15	60
7	60	16	80
8	105	17	80
9	105		

Repeat the operation for all the bolts.

3rd retightening (angle) according to the table:

Symbol	Angle (in degrees)	Symbol	Angle (in degrees)
1	105	10	60
2	60	11	60
3	60	12	70
4	70	13	70
5	70	14	60
6	60	15	60
7	60	16	80
8	105	17	80
9	105		

There is no cylinder head retightening operation.

Thickness of the cylinder head gasket

There are several different thicknesses of cylinder head gasket as replacements. When the **1 model** (A) gaskets have been used up, the **Parts Store** will only deliver **2nd model** (B, C or D) gaskets.

1st model

On engines fitted with a **1st model** cylinder head gasket (marked A on the drawing opposite), the label showing the gasket thickness cannot be seen from the outside. The thickness of the gasket must therefore be calculated before each operation.

Cylinder head gasket thickness **1.6 mm**:
– **1.6** is stamped on the gasket.

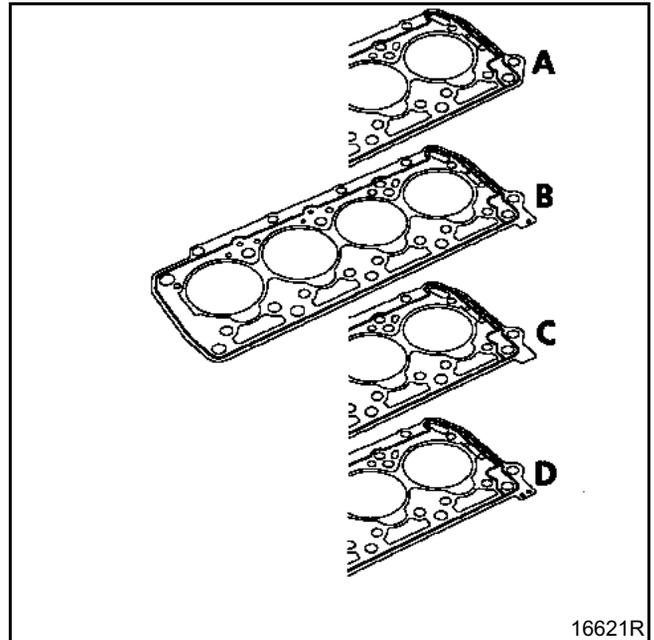
Cylinder head gasket thickness **1.7 mm**:
– not stamped.

Cylinder head gasket thickness **1.8 mm**:
– **1.8** is stamped on the gasket.

2nd model

On engines fitted with a **2nd model** cylinder head gasket, the label showing the gasket thickness can be seen from the outside. There is no need to recalculate the gasket thickness if the operations performed have not involved modifying the piston protrusion dimension.

- B** - Cylinder head gasket thickness **1.6 mm**:
marked with a hole
- C** - Cylinder head gasket thickness **1.7 mm**:
no hole
- D** - Cylinder head gasket thickness **1.8 mm**:
marked with two holes



NOTE: if replacing:

- the crankshaft,
- the cylinder block,
- the con rods,
- the pistons,

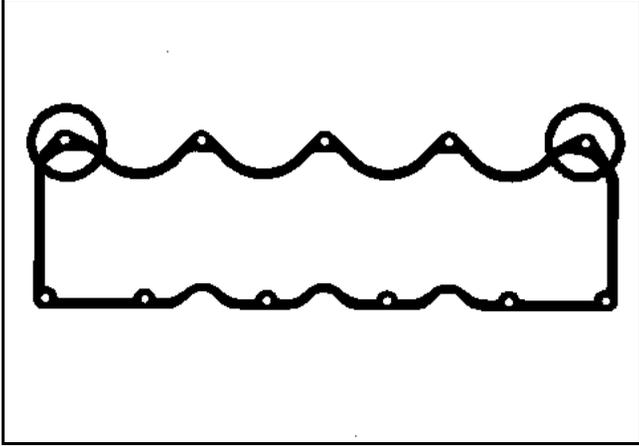
it is essential to calculate the thickness of the cylinder head gasket.

Cylinder head cover gasket

All types except J8S 736

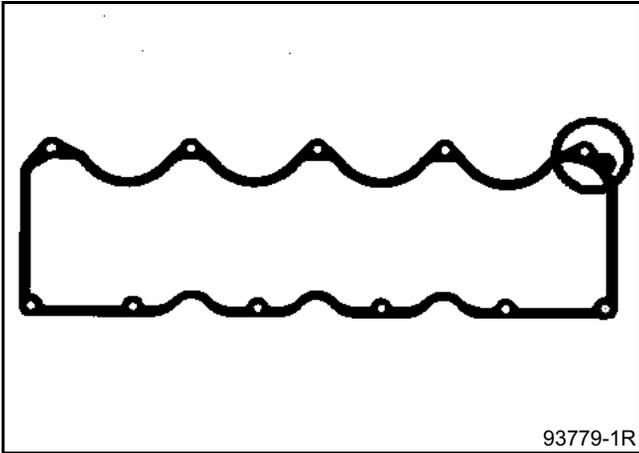
1st model:

This gasket is not symmetrical.
Cylinder side graphitised surface.



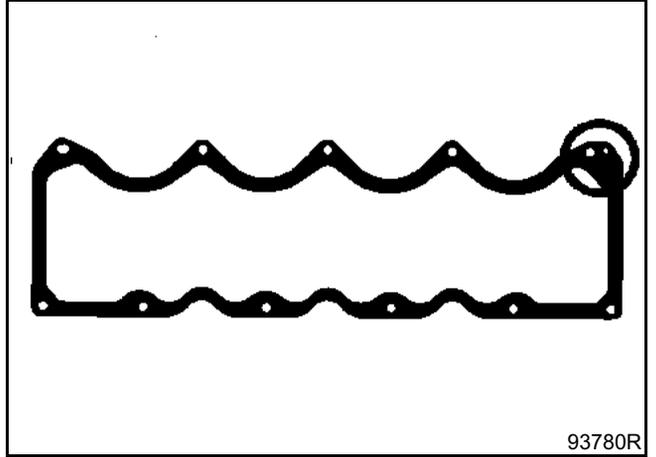
2nd model:

This gasket has a an area intended to prevent confusion; it is located opposite the timing end.

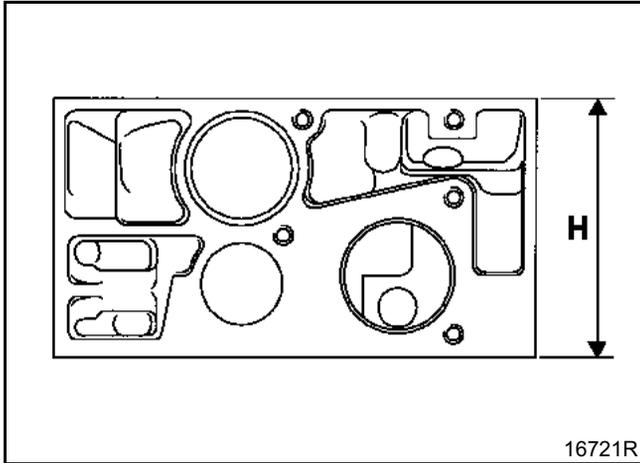


3rd model:

same position as the 2nd model.



Height of the cylinder head (in mm)
H = 104.5 ± 0.04



NO REDRESSING IS PERMITTED

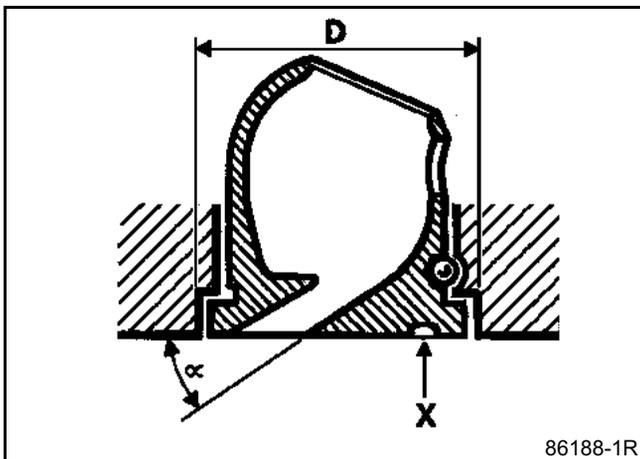
Test the cylinder head for cracks. (refer to the mating face checking section in the **Engine overhaul section**).

Maximum mating face deformation **0.05 mm**

Prechamber

Assembled prechamber

This is fitted in the cylinder head.

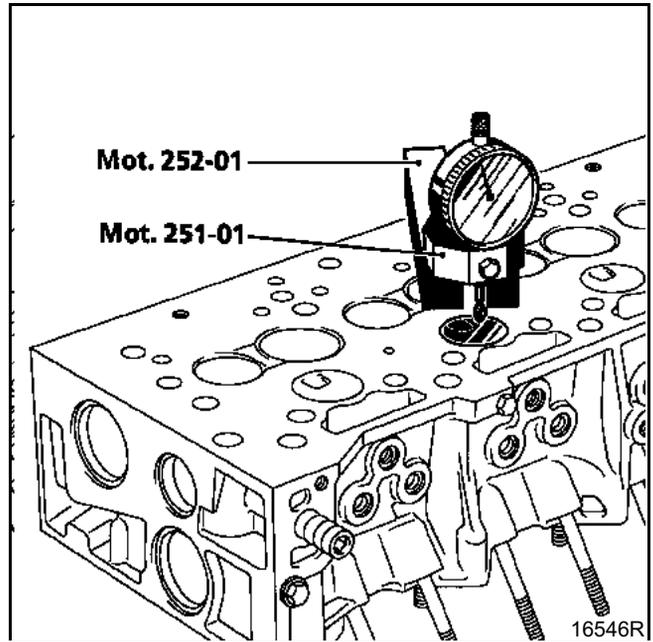


	Engine type	
	Normally aspirated	Turbo
Channel angle (α)	35°	31°
Mark (X)	None.	A drill stamp

Diameter (D) of the housing in the cylinder head (in mm)	
– Original dimension 1	35.5
– Original dimension 2	35.7

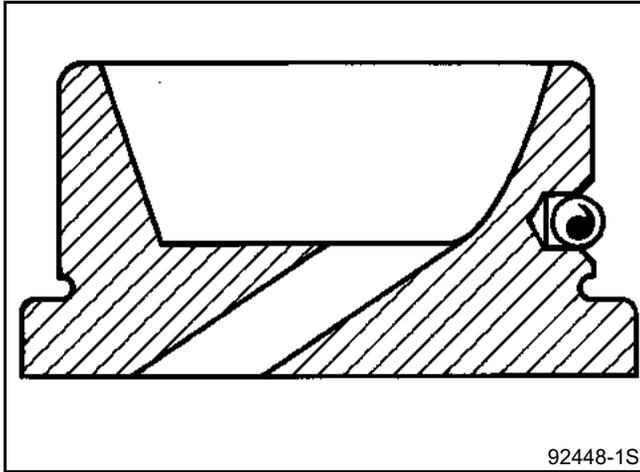
Original dimension **2** is exclusively for works-repaired cylinder head dimensions.

Protrusion in relation to cylinder head:
 it should be between **0.01** and **0.04 mm**.



Bare prechamber

Half-prechamber



Valves

Stem diameter (in mm)

Inlet:	7.991	+ 0 - 0.02
Exhaust:	7.978	+ 0 - 0.02

Setting angle 90°

Head diameter (in mm)

Inlet:	40.32 ± 0.12
Exhaust:	33.32 ± 0.12

Maximum valve lift (in mm)

Inlet:	9.27
Exhaust:	8.80

Valve set back in relation to the cylinder head mating surface (in mm) 0.80 to 1.15

Valve clearance settings (in mm)

Inlet:	0.20 ± 0.02
Exhaust:	0.25 ± 0.02

Valve seats

Seat angles (α)

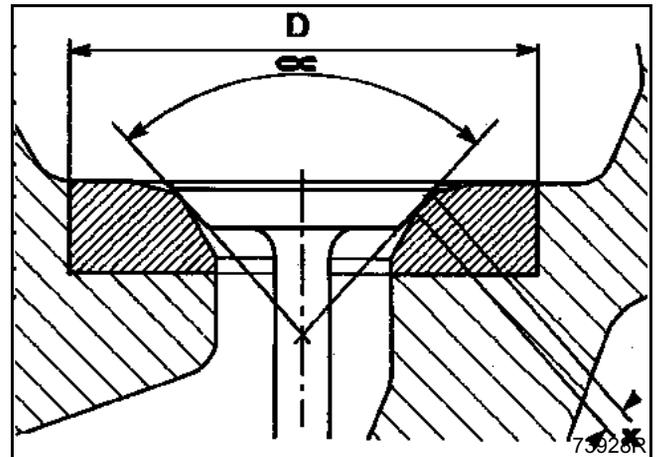
Inlet and exhaust: 90°

Mating surface width X (in mm)

Inlet and exhaust: 1.75 ± 0.2

External diameter D (in mm)

Inlet:	42	+ 0.13 + 0.11
Exhaust:	34.6	+ 0.03 + 0.01



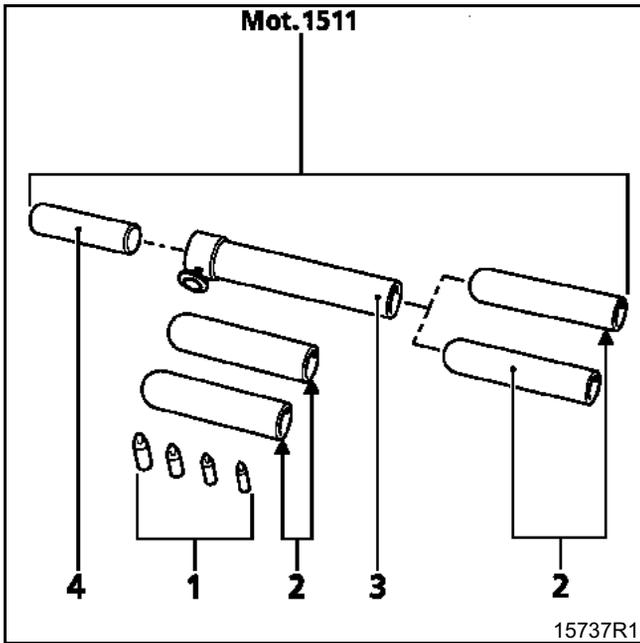
See the "Overhauling the engine" section for how to redress the valve seats.

Valve guides

Internal diameter (in mm)	8
External diameter (in mm):	
– Normal	13.10
– Repair (two grooves)	13.35

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

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



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

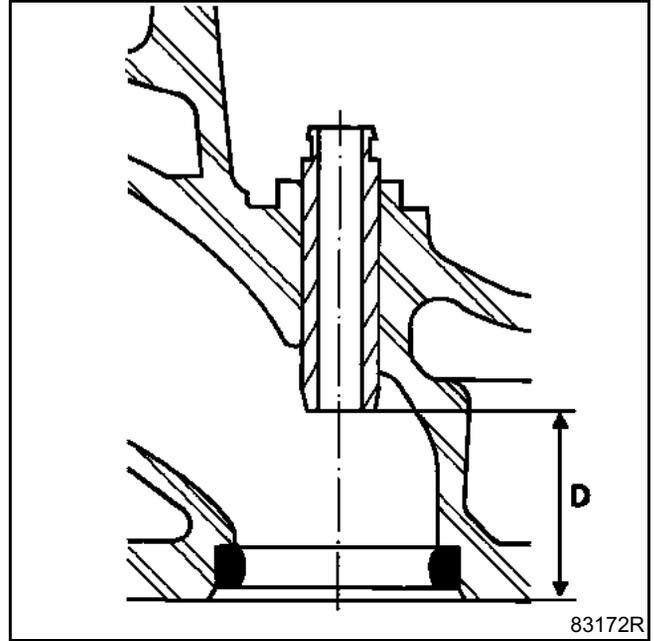
Mot. 1511 consists of:

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

Position of the inlet and exhaust valve guides

Position of guides in relation to the cylinder head mating face (in mm):

$$D = 32.5$$



The diameter of the housing is smaller (by approximately 0.1 mm) to obtain the necessary seal.

It is vital to drill the guide after fitting.

Valve springs

The inlet and exhaust valve springs are identical.

Free length (in mm):	45.2
Length under a load of (in mm):	
23 daNm	39.3
60 daNm	29.8
Sealing turns (in mm):	27.2
Wire diameter (in mm):	4.25
Internal diameter (in mm):	21.5

Camshaft

All types except J8S 736 and J8S 740

Longitudinal play (in mm):	0.05 to 0.15
Number of bearings	5
Timing diagram:	
– Inlet opening advance	14°
– Inlet closing retardation	46°
– Exhaust opening advance	50°
– Exhaust closing retardation	10°

With a theoretical clearance to the valve stem of **0.35 mm** (All types).

Engines J8S 736 and J8S 740

Longitudinal clearance (in mm)	0.05 to 0.15
Number of bearings:	5
Timing diagram:	
– Inlet opening advance	14°
– Inlet closing retardation	46°
– Exhaust opening advance	58°
– Exhaust closing retardation	14°

The value of the theoretical clearance to the valve stems is only valid following a check on the timing diagram and has no relation to the rocker arm clearances.

Rocker arm rail

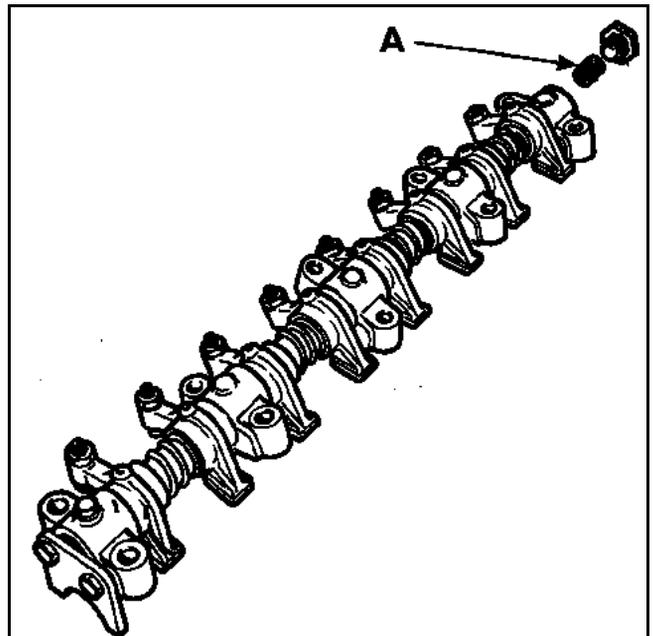
When performing operations on faults that cause metallic particles to become suspended in the lubricating oil, e.g.:

- damaged con rod bearing shells or crankshaft,
- parts grating,

it is essential to replace:

- the oil filter (A) located in the rocker arm rail shaft,
- the oil filter located on the main pipe,
- the lubricating oil.

REMINDER: The rocker arm rail filter must be replaced if an operation requires the removal of the rocker box cover.

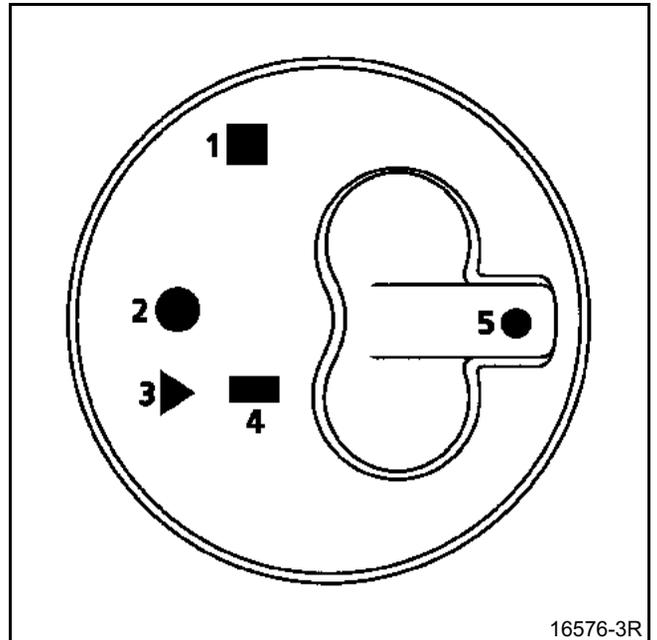
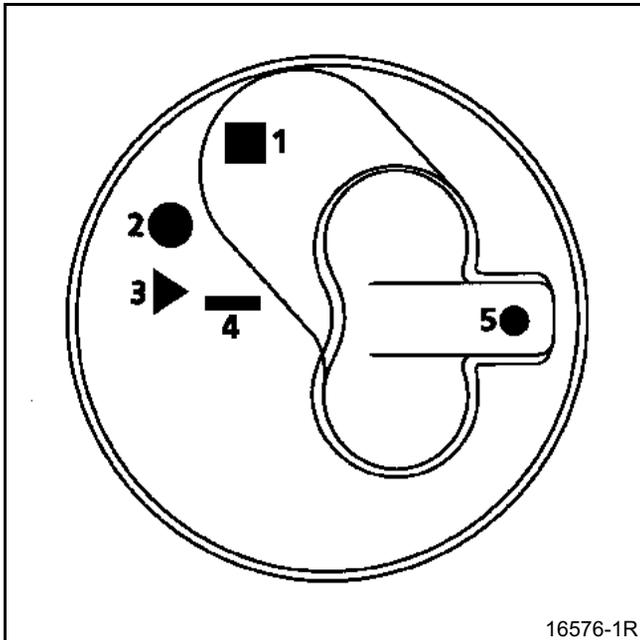
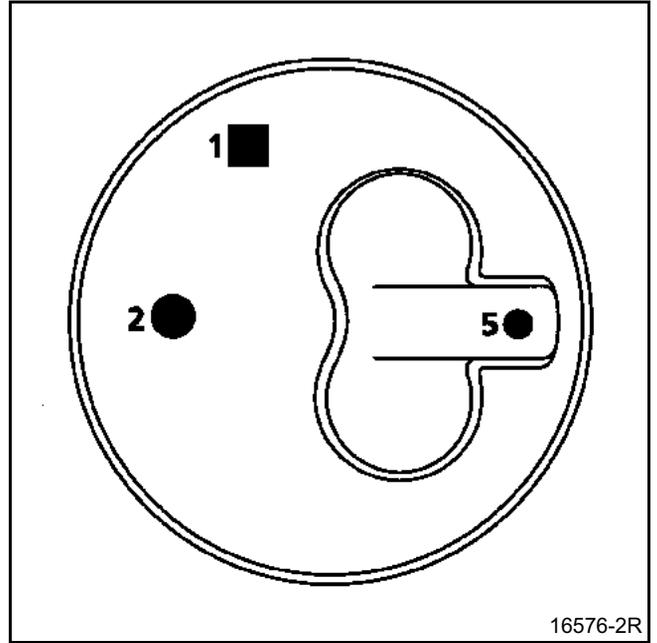
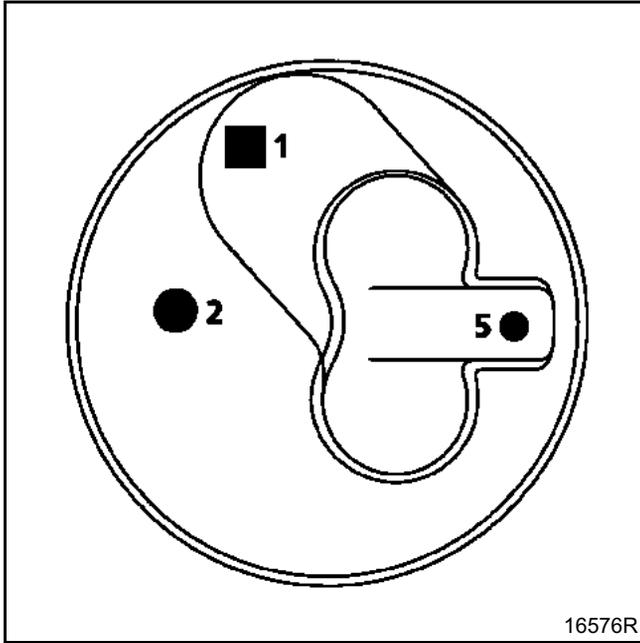


PISTONS

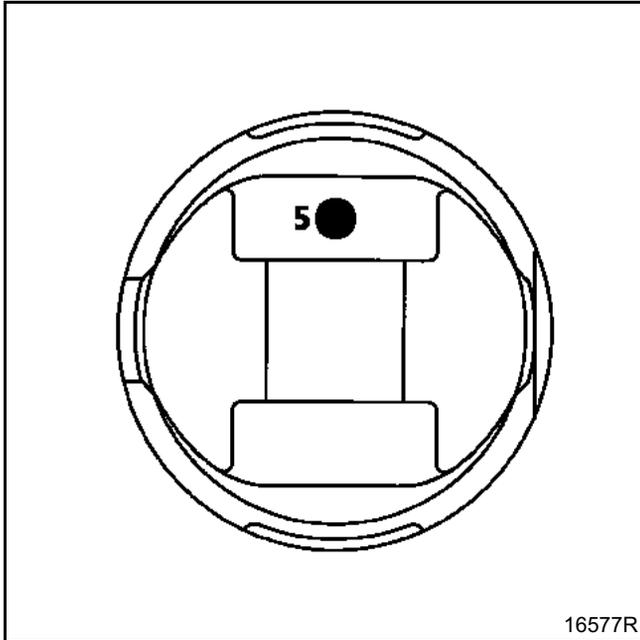
These engines are fitted with **Floquet Monopole** pistons.

The gudgeon pin is free in the con rod and in the piston.

Piston marking



The paint mark that indicates diameter class is also present on the piston.



- 1 Height between the gudgeon pin and the top of the piston (see table below).
- 2 Modification index, for supplier's use only.
- 3 For supplier's use only.
- 4 Dater, for supplier's use only.
- 5 Diameter class mark, paint mark (see following table).

Table of piston diameter classes

Piston mark	Piston diameter (in mm):
Blue	85.875 to 85.890
Red	85.890 to 85.905

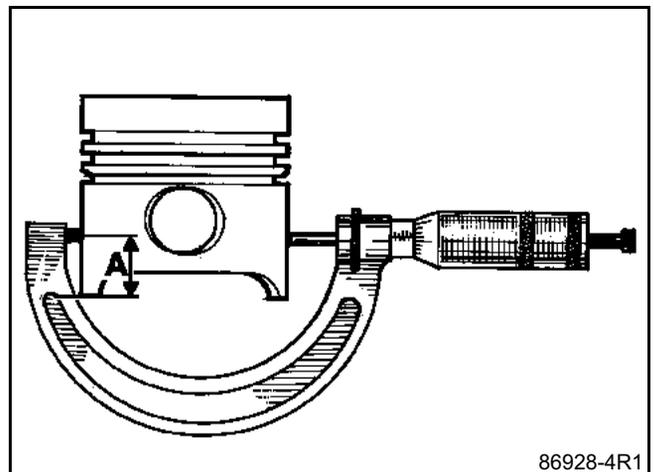
Table of gudgeon pin heights

Classes and marks on piston	Shaft height (in mm)
H	50.890 to 50.930
K	50.931 to 50.970
M	50.971 to 51.010
P	51.011 to 51.050
R	51.051 to 51.090

Measuring the piston diameter

The diameter of the piston (**86 mm diameter**) should be measured at position:

Engine type	Piston measuring point (A) (in mm)
J8S 852 normally aspirated	24.35
J8S Turbo	24



Rings

Three rings (thickness in mm)

Normally aspirated engine

- Compression 2
- Sealing 2 (tapered)
- Scraper 2 (rounded)

Turbo engine

- Compression 2.5 (trapezoidal)
- Sealing 2.5 (trapezoidal)
- Scraper 4 (rounded)

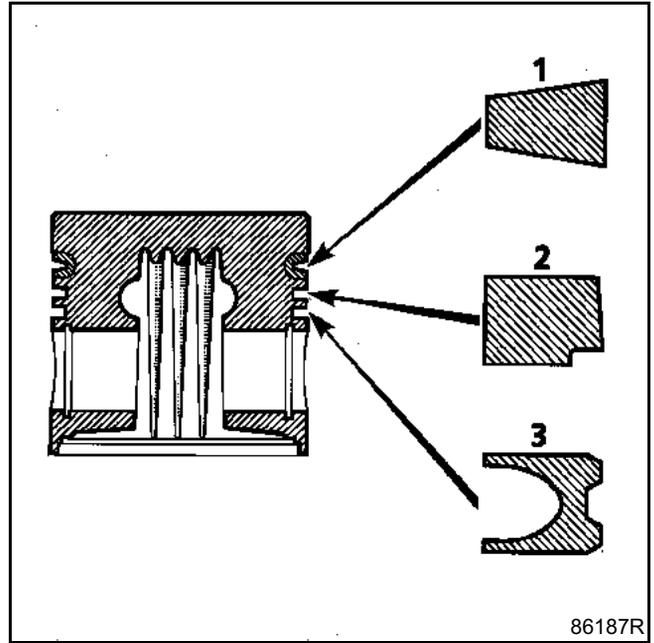
Gudgeon pin (in mm)

- Length: 75
- External diameter: 28
- Internal diameter: 16

FITTING THE RINGS

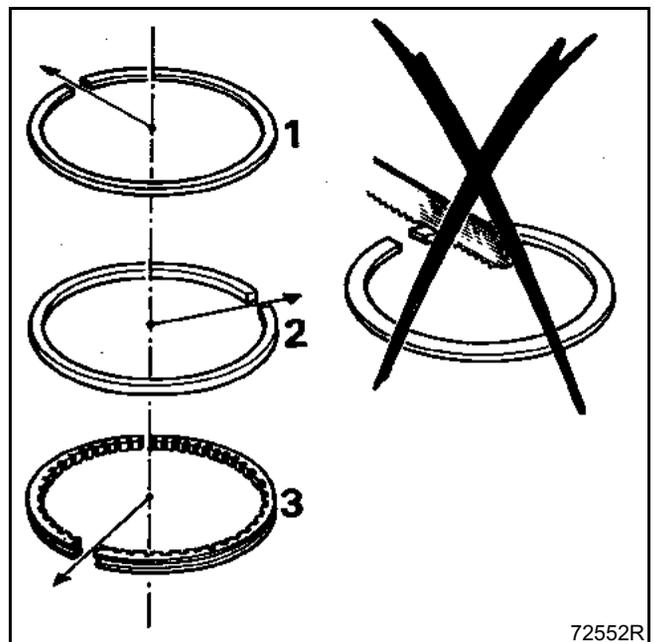
Rings set to their original adjustment must be free within their channels.

Ensure the fitting direction is observed.



86187R

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



72552R

CON RODS

	in mm
Lateral play in the big end	0.31 to 0.57
Centre-to-centre distance between big end and small end	155 ± 0.035
Big end diameter	60 + 0.019 - 0.005
Small end diameter	
● without ring	30 + 0.021 0
● with ring	28 + 0.01 + 0.003

The small end has a bush.

N.B.: the small end bushes cannot be replaced or re-drilled.

WARNING: do not use a sharp point to mark the bearing caps in relation to their con rods as this could start a crack in the rods. Use an indelible marker pen.

Normally aspirated engine

The big end and the half bearing are pierced to allow an oil jet to pass through.

Turbo engine

The con rods do not have a hole for an oil jet. The upper and lower bearing shells are not pierced.

Refitting and assembling con rods and pistons

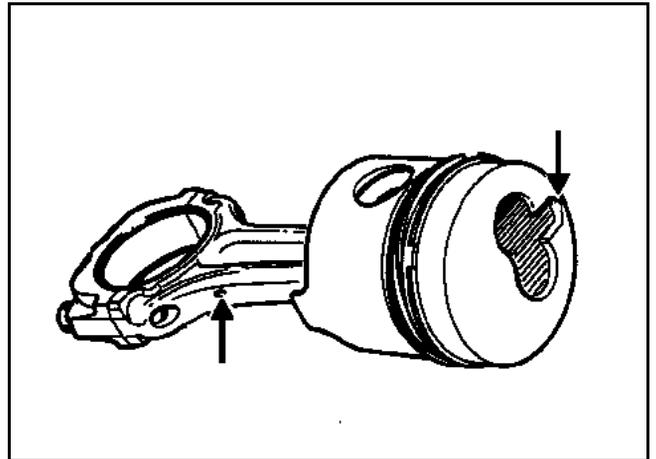
Direction of fitting:
rotochamber on the injector side or the side opposite the oil filter.

Check that the gudgeon pins rotate properly in the new piston and the con rod.

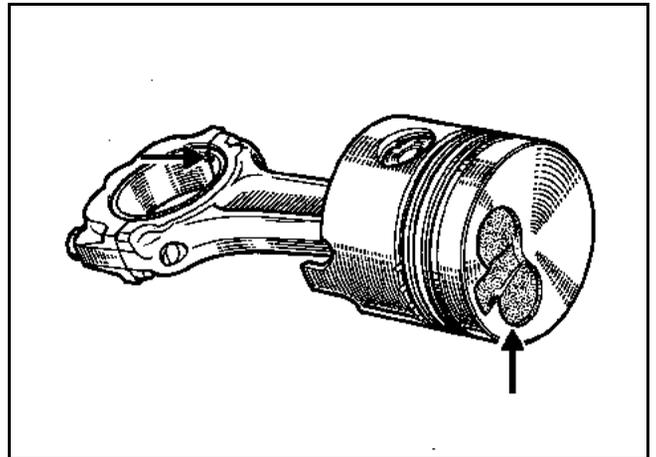
Oil the gudgeon pin.

Ensure that the piston and con rod are fitted the right way around (follow the arrows):

Engines 852 J8S all types except turbo

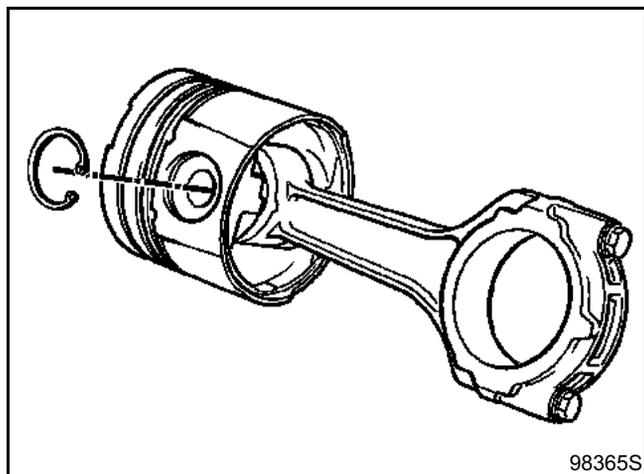


Turbo engine



Direction for fitting the circlips on the piston

Fit the circlips on the piston as shown below.



CRANKSHAFT

Number of bearings 5

Burnishing

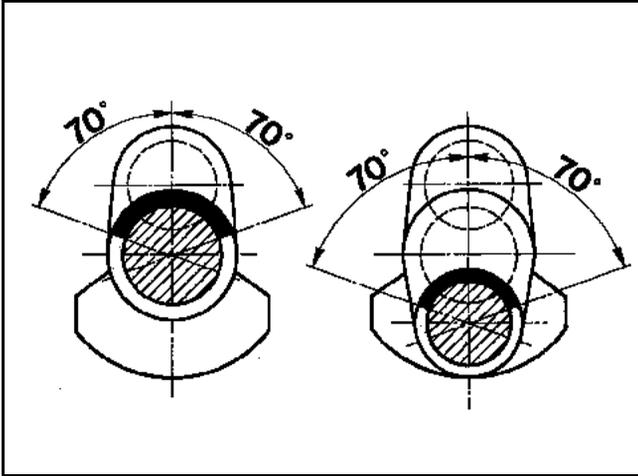
- *normally aspirated engine* with
- *turbo engine 1st fitting* without
- *turbo engine 2nd fitting* with

		in mm
Longitudinal play		
● <i>normally aspirated engine 1st model: 1 to 32 909</i>		0.07 to 0.25
● <i>normally aspirated engine 2nd model: from 32 910</i>		0.20 to 0.30
● <i>turbo engine 1st and 2nd models</i>		0.20 to 0.30
Bushing		
Nominal diameter	62.88	- 0 - 0.019
Repair diameter	62.63	- 0 - 0.019
Crankpin		
Nominal diameter	56.296	- 0.010 - 0.029
Repair diameter	56.046	- 0.010 - 0.029

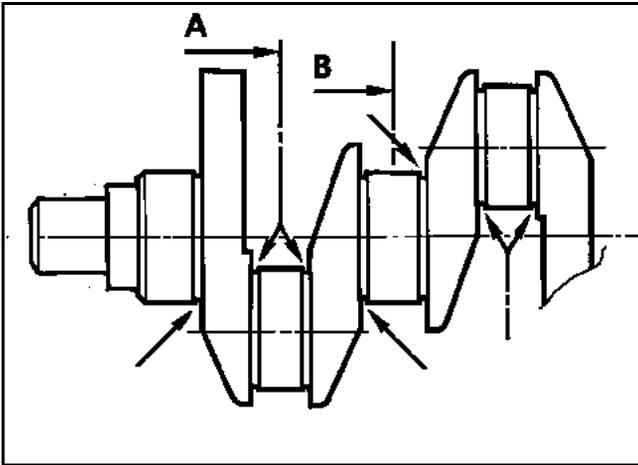
N.B.: non-burnished crankshafts fitted on turbo engines can be redressed using the values given in the table.

Burnished crankshaft

In case of correction, the burnishing must remain intact on **140°** in the areas indicated by the arrows.



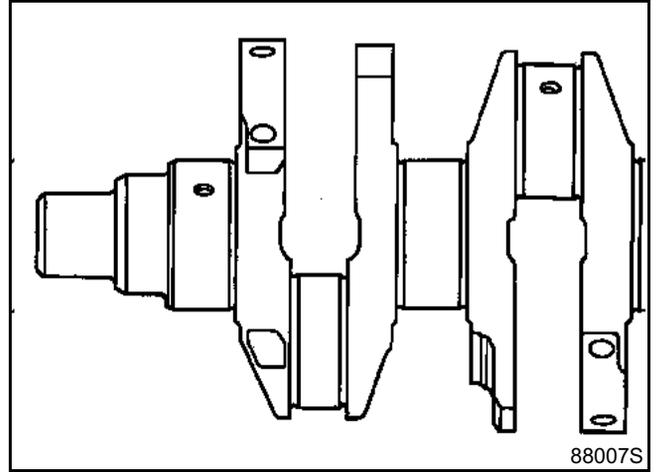
These zones are defined in sections (A) and (B), used as examples.



Identification of crankshafts:

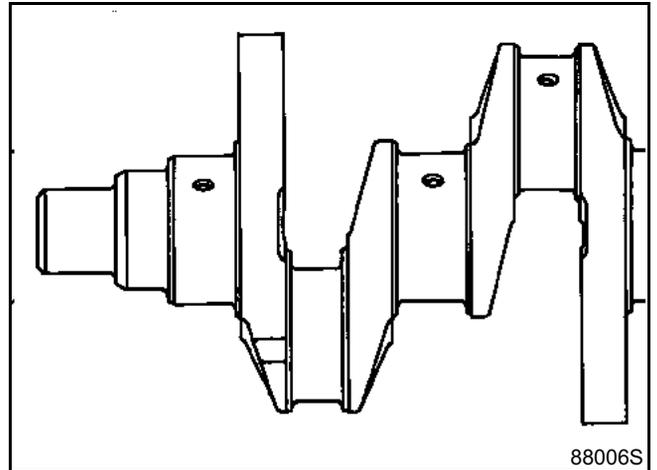
Normally aspirated engine

- eight counterweights,
- Burnished bushings and crankpins.



Turbocharged engine

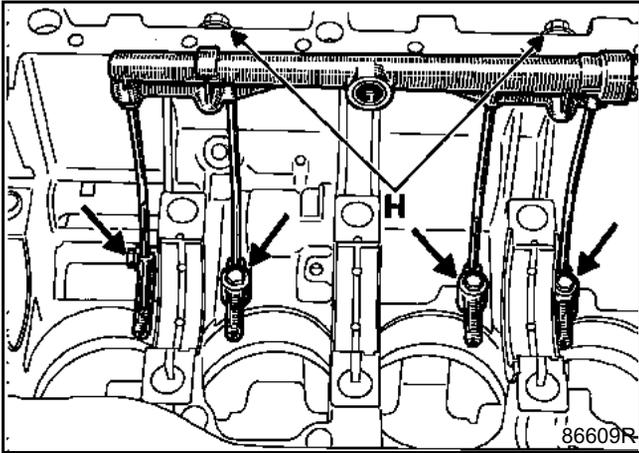
- four counterweights,
- Burnished or non-burnished bushings and crankpins according to model.



RELAY SHAFT

Longitudinal play (in mm) **0.05 to 0.15**

PISTON BASE COOLING RAIL

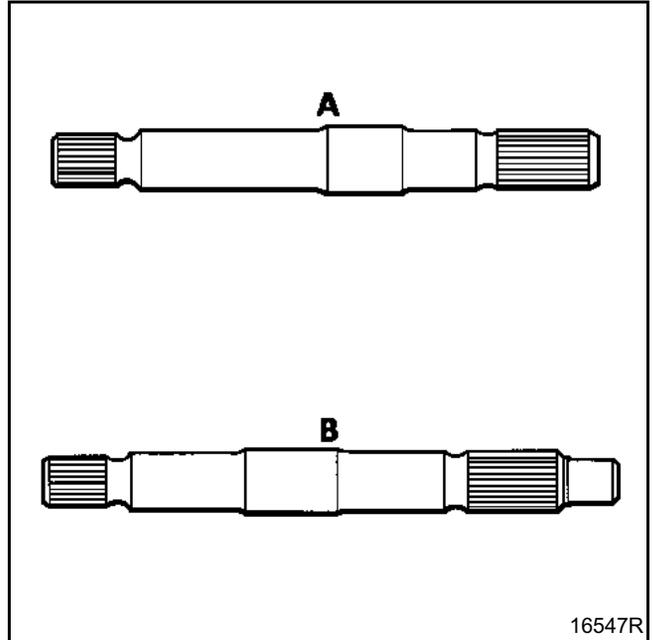


Never remove the mounting bolts (H) if the sump is not removed.

CLUTCH SHAFT CENTERING BEARINGS

Gearbox:

- with bearing in the clutch housing: **short clutch shaft (A)**.
- without bearing in the clutch housing: **long clutch shaft (B)**.



If the gearbox is fitted with a long shaft (B) it is **essential** to fit a bearing in the crankshaft. In cases where the flywheel has no stop, cement the bearing into the crankshaft using Loctite **FRENBLOC**.

If the gearbox is fitted with a short shaft (A) it is **essential** to remove the bearing from the crankshaft.

CYLINDER LINER

	in mm
Internal diameter	86
Diameter of the base centering (D)	93.6
Protrusion of cylinder liner without gasket (X)	0.07 to 0.13

Base seal (J)

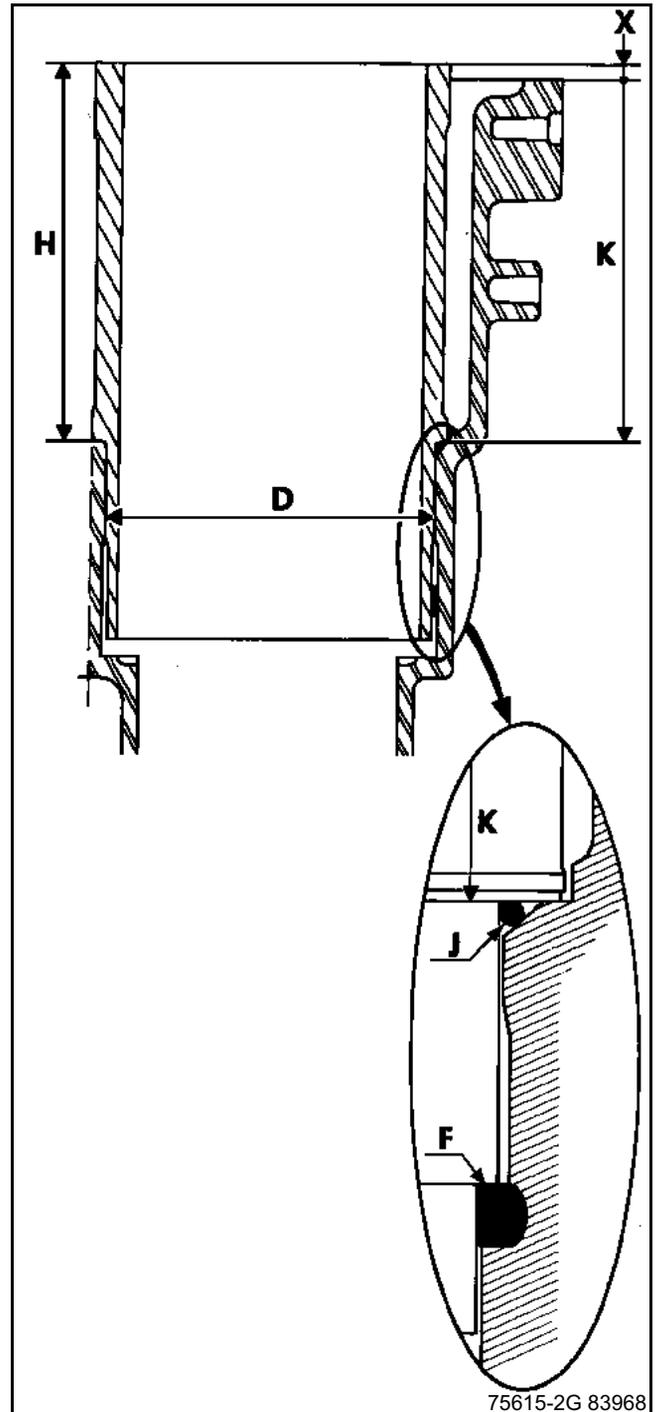
Shaft seal (F)

O ring.

barrel shape

Assembling cylinder liners - cylinder block

	in mm
Height (H) of the cylinder liner	93.035 to 93.065
Depth (K) of cylinder block	92.945 to 92.985

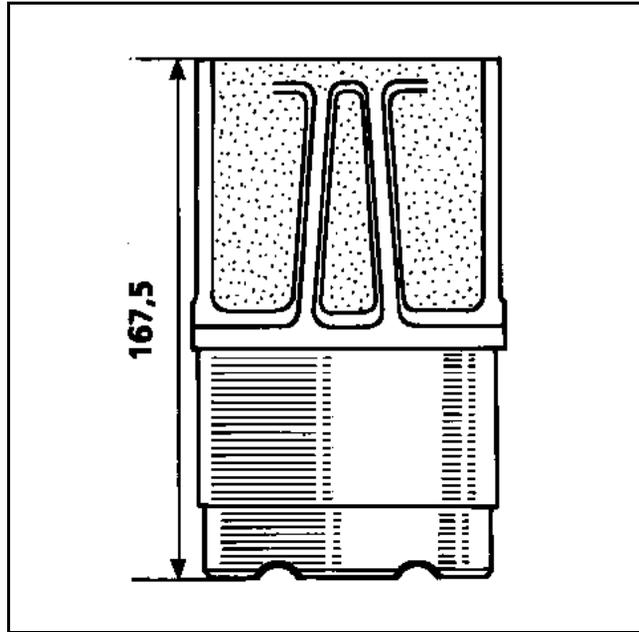


75615-2G 83968

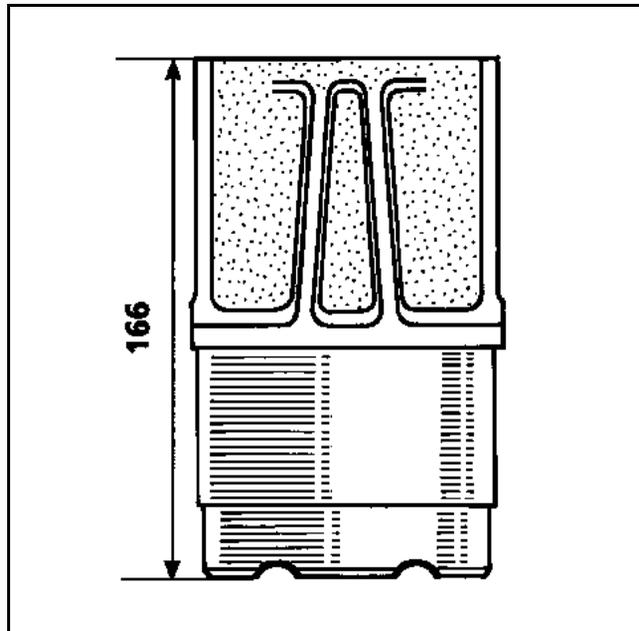
Identification of liners

Normally aspirated engine

1st model

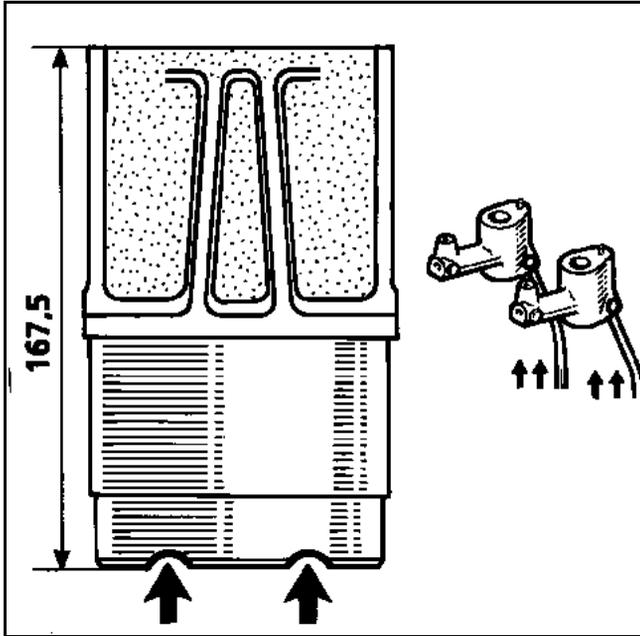


2nd model



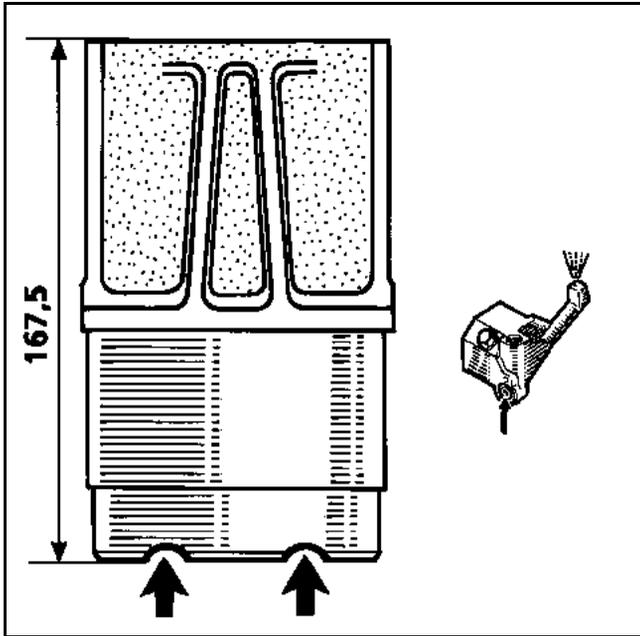
Turbo engine

1st model



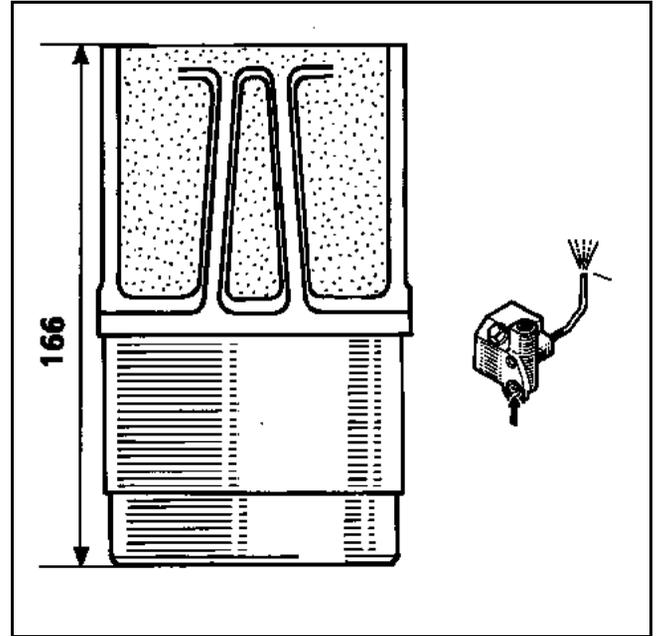
Cylinder liner with two notches and piston fitted cooling oil jets.

2nd model



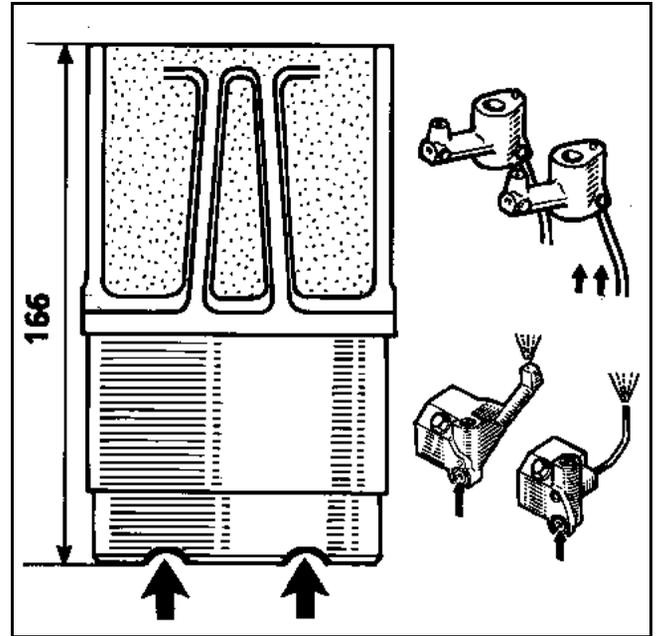
Cylinder liner with four notches and integral piston cooling oil jets.

3rd model



Cylinder liner with no notches and tube piston cooling oil jets.

4th model



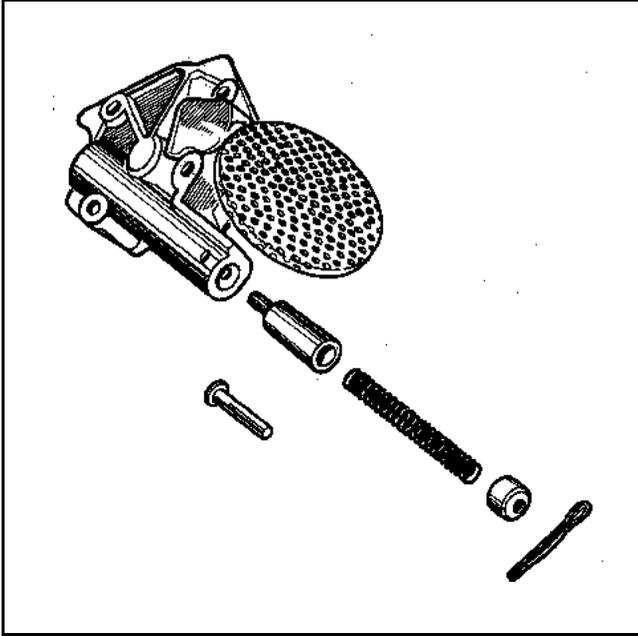
Special **Parts store** cylinder liner with four notches. May be fitted on all types of **turbo** engines.

OIL PUMP

Removal

Remove:

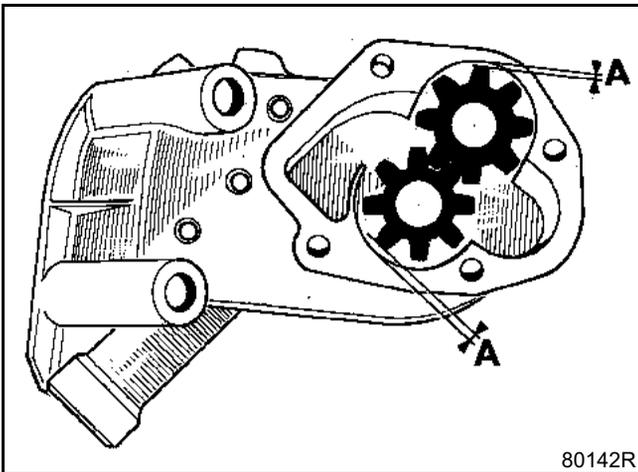
- the oil pump cover,
- the discharge valve and its spring.



Checking clearances

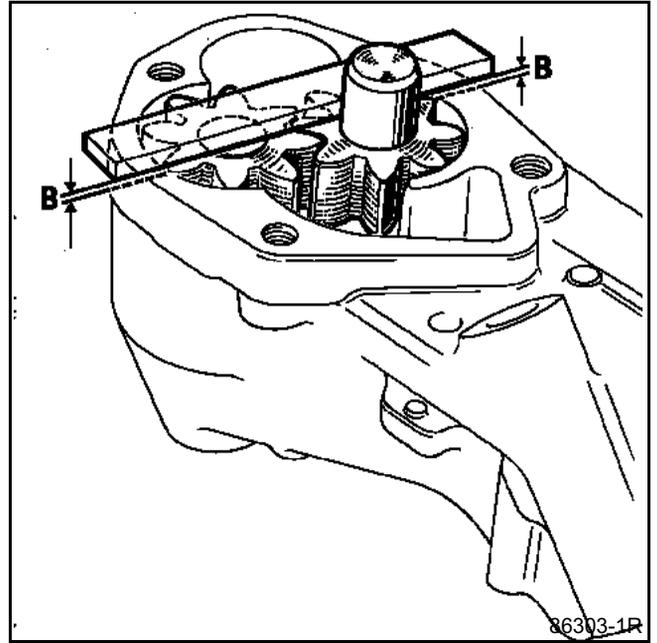
Clearance (A)

- minimum (in mm) 0.05
- maximum (in mm) 0.12



Clearance (B)

- minimum (in mm) 0.02
- maximum (in mm) 0.10



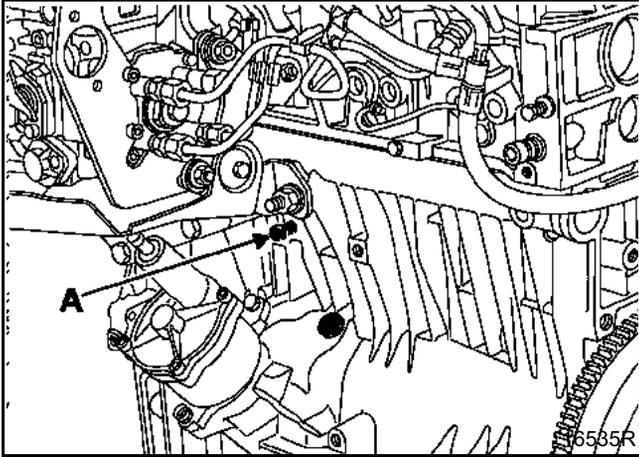
Refit:

- the oil pump cover by tightening the bolts to a torque of **1 daNm**,
- the discharge valve and its spring.

N.B.: Pour oil into the pump (to make repriming easier).

PREPARING THE ENGINE TO BE SET ON THE STAND

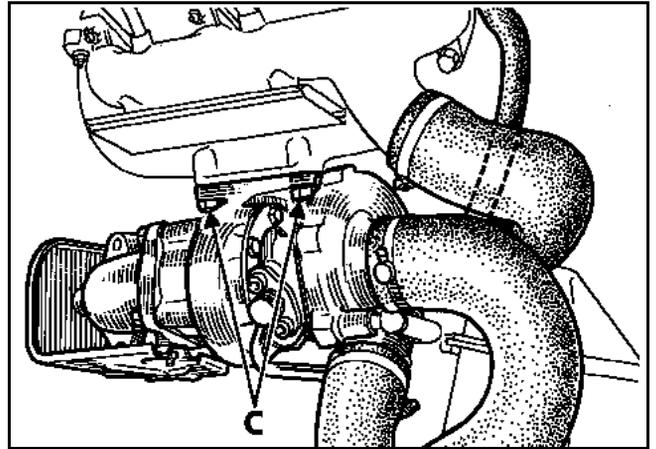
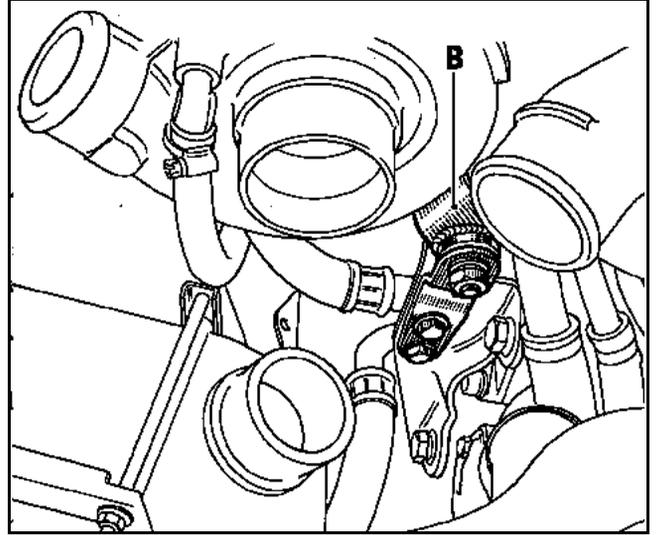
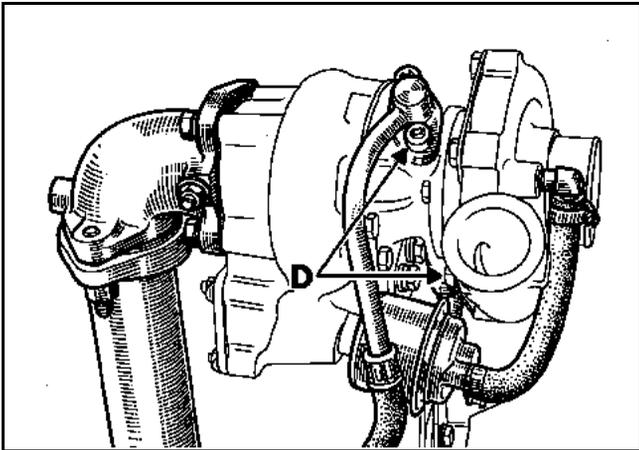
Before fitting the engine to support plate **Mot. 792-03**, remove the engine electrical wiring harness and drain the engine oil and the coolant by removing the drain plug (A).



Turbo engine

Remove:

- the supply and oil return pipes (D),
- the strut (B),
- the turbocharger mounting bolts (C) and the turbocharger.

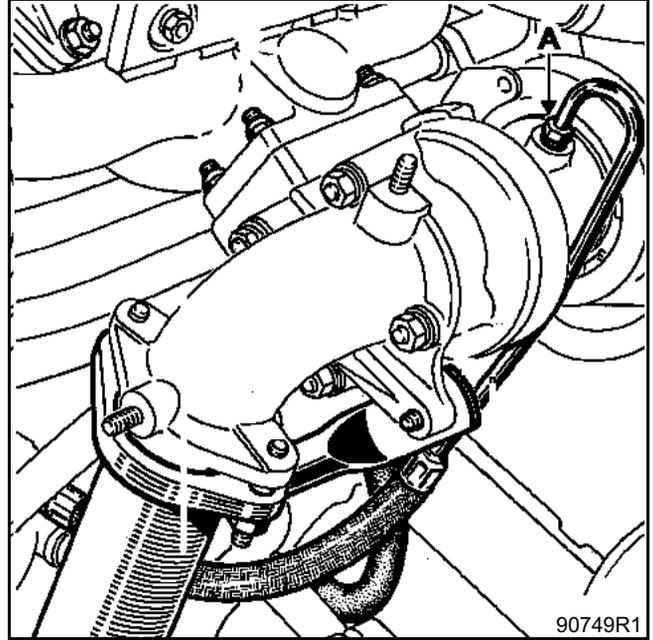
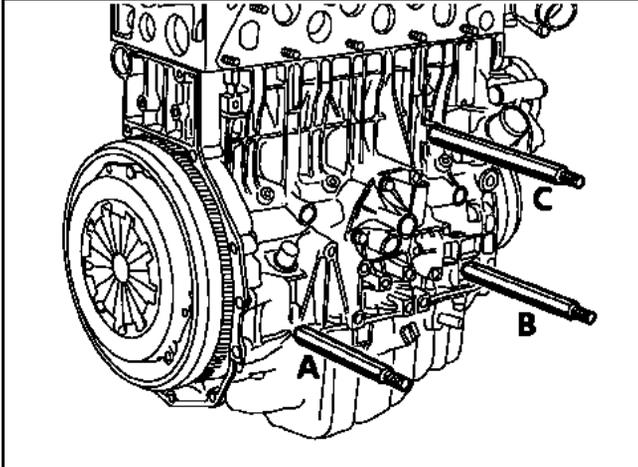


FITTING THE ENGINE TO SUPPORT Mot. 792-03 AND THE THREE RODS A, B AND C

Engines of all types

Remove the intake and exhaust manifolds,

The rods (A), (B) and (C) are mounted on the cylinder block so that they fit into the holes (1, 8, 17) on the plate.



SAFETY PRECAUTIONS

Turbocharger engine

After performing an operation on the engine that involves disconnecting the oil gallery, it is essential to reprime the turbocharger oil circuit, ensuring that the following conditions are respected:

- connect the oil return and attach it using a new bolted clamp,
- fill up the turbo with engine oil through the inlet opening (A),
- run the starter motor to reprime the turbocharger oil circuit, until the oil begins to escape from the turbocharger inlet opening,
- reconnect the turbocharger inlet pipe,
- run the engine at idle speed so that the circulation of oil in the turbocharger is reestablished.

SAFETY PRECAUTIONS WHEN STOPPING THE ENGINE

Let the engine run at idle speed for 30 seconds and then switch off the ignition.

Do not rev the engine to avoid starting the turbocharger. If this occurs, the turbo may run by inertia without lubrication when the ignition is switched off and there is a risk that the turbine shaft will grate.

ENGINE AND PERIPHERALS

Specifications

10

CONSUMABLES

Type	Quantity	Component concerned	Part no.
RAVITOL S 56	-	Cleaning parts	77 01 421 513
DECAPJOINT	Coat	Cleaning gasket faces	77 01 405 952
RHODORSEAL 5661	Coat	Crankshaft bearing cap	77 01 404 452
Loctite 518	Coat	Crankshaft cover, coolant pump	77 01 421 162
Loctite FRENETANCH	1 - 2 drops	-	77 01 394 070

PRECAUTIONS

WASHING THE ENGINE

Do not let the alternator come into contact with water or cleaning products.

Do not let water run into the air intake pipes.

FITTING THREAD INSERTS

Threaded holes on all engine component parts can be repaired by using thread inserts.

PARTS TO BE REPLACED WHEN THEY HAVE BEEN REMOVED

- All the gaskets.
- Flywheel bolts.
- Flywheel mounting bolt stops.
- Con rod bolts.
- Rocker arm rail oil filter.
- Cylinder block cap seals if they have been removed.
- Timing sprocket split pins on the crankshaft.
- Belts.
- Timing gear tensioner.
- Cylinder head bolts

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:

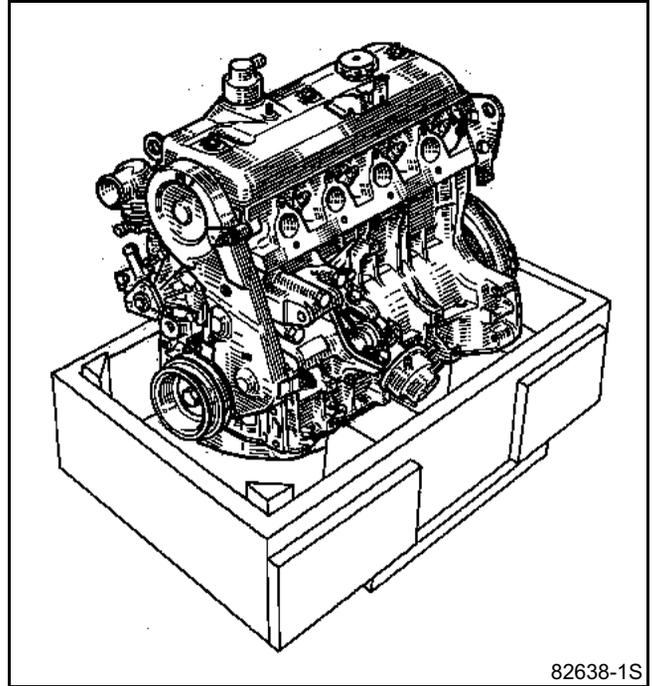
- the dipstick,
- the water pump,
- the cylinder head cover,
- the heater plugs,
- the timing belt tensioner,
- the timing gear cases,
- the oil filter,
- the injection pump pulley,
- the camshaft pulley,
- the relay shaft pulley,
- the crankshaft timing pulley,
- the clutch and the engine flywheel,
- the crankshaft accessories pulley,
- the injection pump,
- the injector pipes,
- the injectors,
- the vacuum pump.

Remember to remove:

- the coolant hoses,
- the water pump pulley,
- the oil pressure switch,
- the thermostat and its mounting.

The engine being returned should be attached to the wooden base in the same way as the service exchange engine:

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



82638-1S

NEW EXCHANGE ENGINE

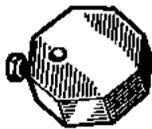
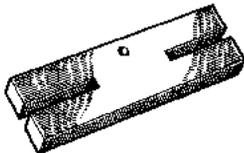
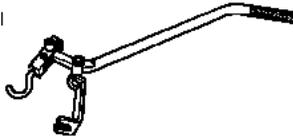
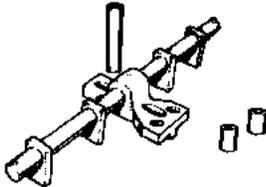
The new engine does not have:

- a clutch mechanism,
- a clutch plate,
- a flywheel.

ENGINE AND PERIPHERALS

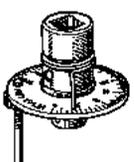
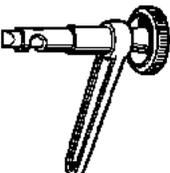
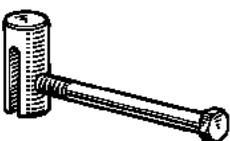
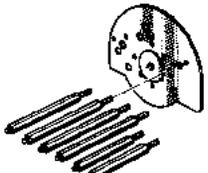
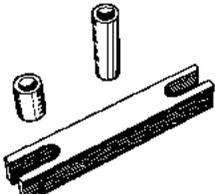
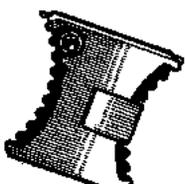
Essential special tooling

10

Illustration	Tool number	Parts Department number	Description
	Mot. 11	00 01 072 500	Crankshaft spigot bush extractor.
	Mot. 251-01	00 00 025 101	Dial gauge support. Used with Mot. 252-01 .
	Mot. 252-01	00 00 025 201	Dial gauge support thrust plate. Used with Mot. 251-01 .
	Mot. 382	00 00 038 200	Valve spring compressor tool.
	Mot. 445	00 00 044 500	Oil filter strap wrench.
	Mot. 452	00 00 045 200	Oil pressure contact wrench (22 mm across flats).
	Mot. 521-01	00 00 052 101	Cylinder liner clamp.
	Mot. 582	00 00 058 200	Flywheel locking tool.

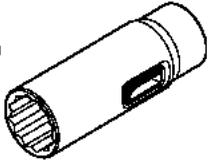
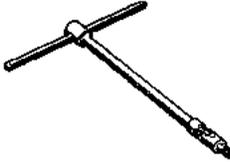
ENGINE AND PERIPHERALS

Essential special tooling

Illustration	Tool number	Parts Department number	Description
	Mot. 591-02	00 00 059 102	Magnetised flexible shaft for cylinder head angular wrench.
	Mot. 591-04	00 00 059 104	Cylinder head angular wrench, 1/2" drive with gauge.
	Mot. 647	00 00 064 700	Tappet adjuster.
	Mot. 720	00 00 072 000	Cylinder head locating tool.
	Mot. 792-03	00 00 079 203	Engine support plate for Desvil engine stand.
	Mot. 799-01	00 00 079 901	Timing gear wheel immobiliser
	Mot. 853	00 00 085 300	Liner seal compression tool.
	Mot. 854	00 00 085 400	Diesel injection pump sprocket locking tool.

ENGINE AND PERIPHERALS

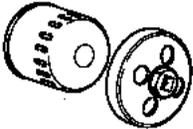
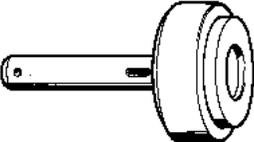
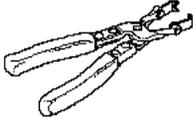
Essential special tooling

Illustration	Tool number	Parts Department number	Description
	Mot. 855	00 00 085 500	Timing gear locking strap.
	Mot. 856	00 00 085 600	BOSCH diesel injection pump timing gauge support.
	Mot. 861	00 00 086 100	TDC setting rod.
	Mot. 997-01	00 00 099 701	Diesel injector removal/refitting wrench.
	Mot. 1054	00 00 105 400	TDC setting rod.
	Mot. 1063	00 00 106 300	Socket spanner for removal/refitting engine sump bolts.
	Mot. 1079	00 00 107 900	Timing gauge kit for Roto-Diesel pumps with rear cover access.
	Mot. 1079-01	00 00 107 901	Spare checking rod and support bracket for Mot 1079. Used with Mot. 1079-02 .

ENGINE AND PERIPHERALS

Essential special tooling

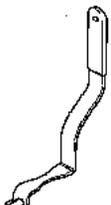
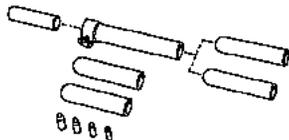
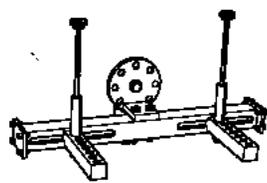
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Illustration	Tool number	Parts Department number	Description
	Mot. 1079-02	00 00 107 902	Dial gauge for Mot. 1079-01 timing gauge kit for Roto-Diesel pumps.
	Mot. 1281-01	00 00 128 101	Oil filter removing tool 96 mm diameter .
	Mot. 1297	00 00 129 700	Crankshaft oil seal fitting tool (flywheel end).
	Mot. 1298	00 00 129 800	Crankshaft oil seal fitting tool (timing end).
	Mot. 1299	00 00 129 900	Intermediate shaft oil seal fitting tool.
	Mot. 1300	00 00 130 000	Camshaft oil seal fitting tool.
	Mot. 1335	00 00 133 500	Tool for removing valve stem seals.
	Mot. 1383	00 00 138 300	17 mm diesel pump HP connection spanner.

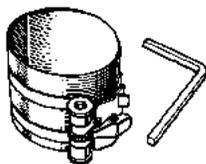
ENGINE AND PERIPHERALS

Essential special tooling

10

Illustration	Tool number	Parts Department number	Description
 A long, thin, curved metal tool with a hook-like end and a small circular feature at the top.	Mot. 1384	00 00 138 400	Belt tensioner adjusting tool.
 A device consisting of a rectangular case, a digital display unit, and a coiled cable.	Mot. 1505	00 00 150 500	Belt tension setting tool.
 A set of tools including a long handle with a hook, several cylindrical rods of varying lengths, and a small component with four teeth.	Mot. 1511	00 00 151 100	Valve stem seal tool.
 A heavy-duty metal frame with two vertical posts and a central circular component, used for supporting a cylinder head.	Mot. 1573	00 00 157 300	Cylinder head support.

Description

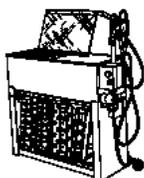


Ring for fitting piston with rings into the liner.

Grinding kit for redressing the valve seat, for example **CERGYDIS C 108 NEWAY**.

Valve lifter.

Angular tightening tool:
– **STAHLWILLE**, part number **540 100 03** for example,
– **FACOM**, part number **DM360** for example.



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 **664 000**

Cylinder ring pliers.



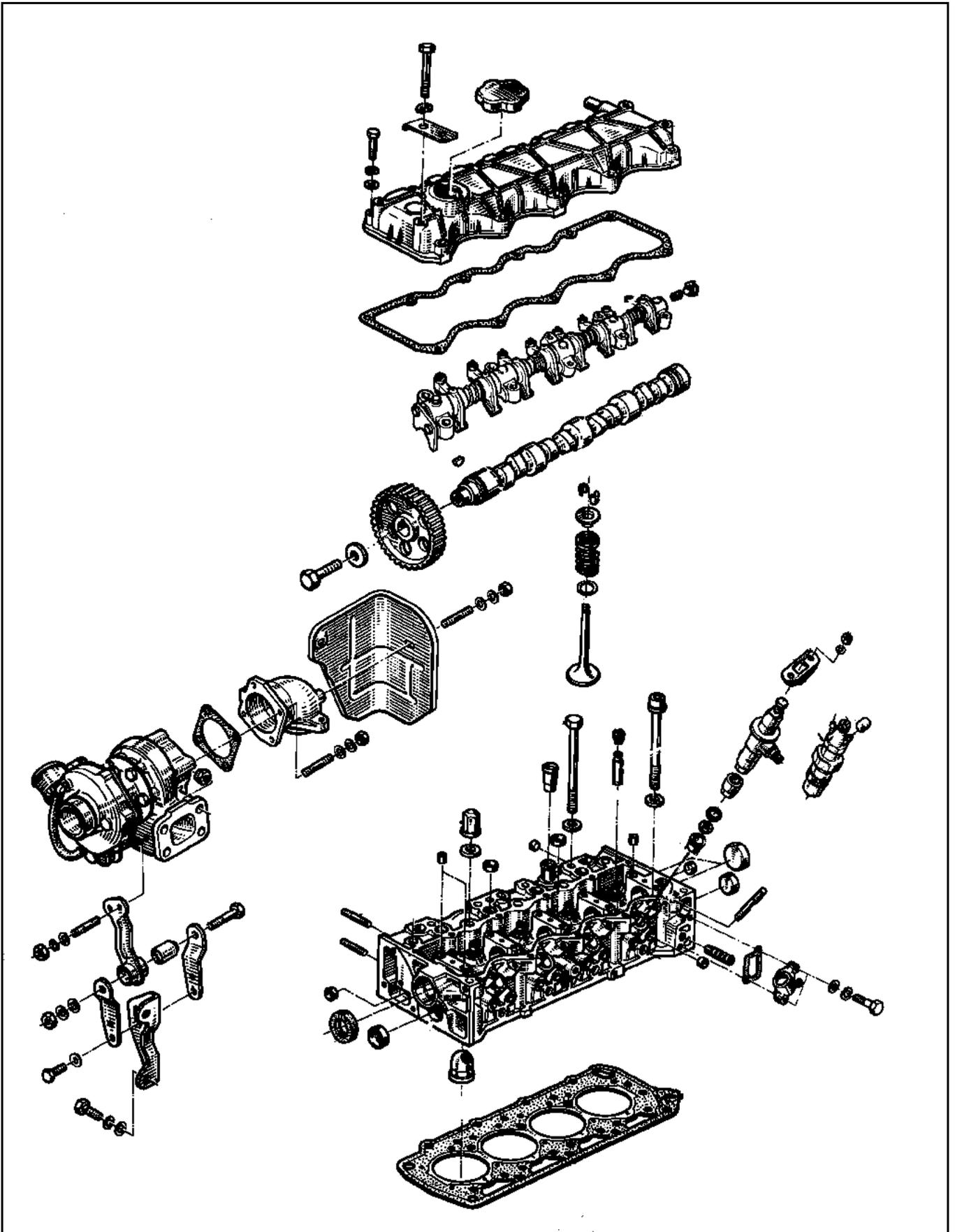
Tool for fitting the valve stem seals, **FACOM** part number **DM 6J4** for example.

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

ENGINE AND PERIPHERALS

Cylinder head exploded drawing

10

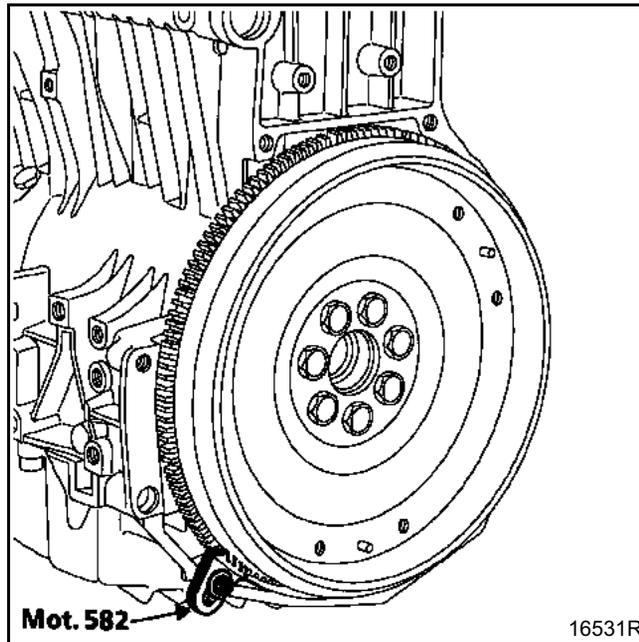


REMOVING THE TOP ENGINE

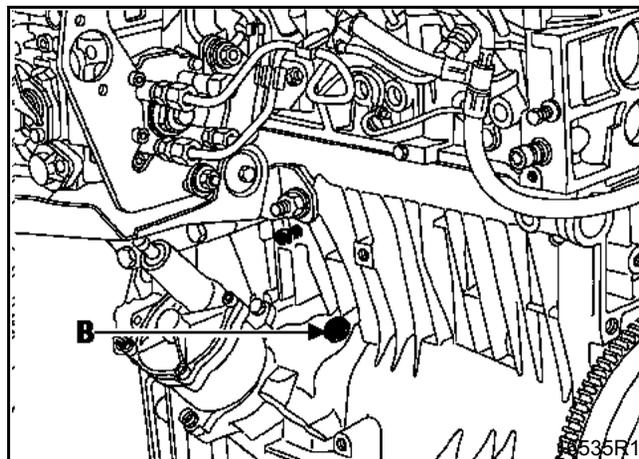
Remove:

- the accessories belt,
- the air conditioning compressor (if fitted),
- the power assisted steering pump,
- the alternator,
- the multifunction mounting,
- the engine lifting bracket on the flywheel end.

Fit the flywheel locking tool **Mot. 582** and loosen the accessories belt bolt.

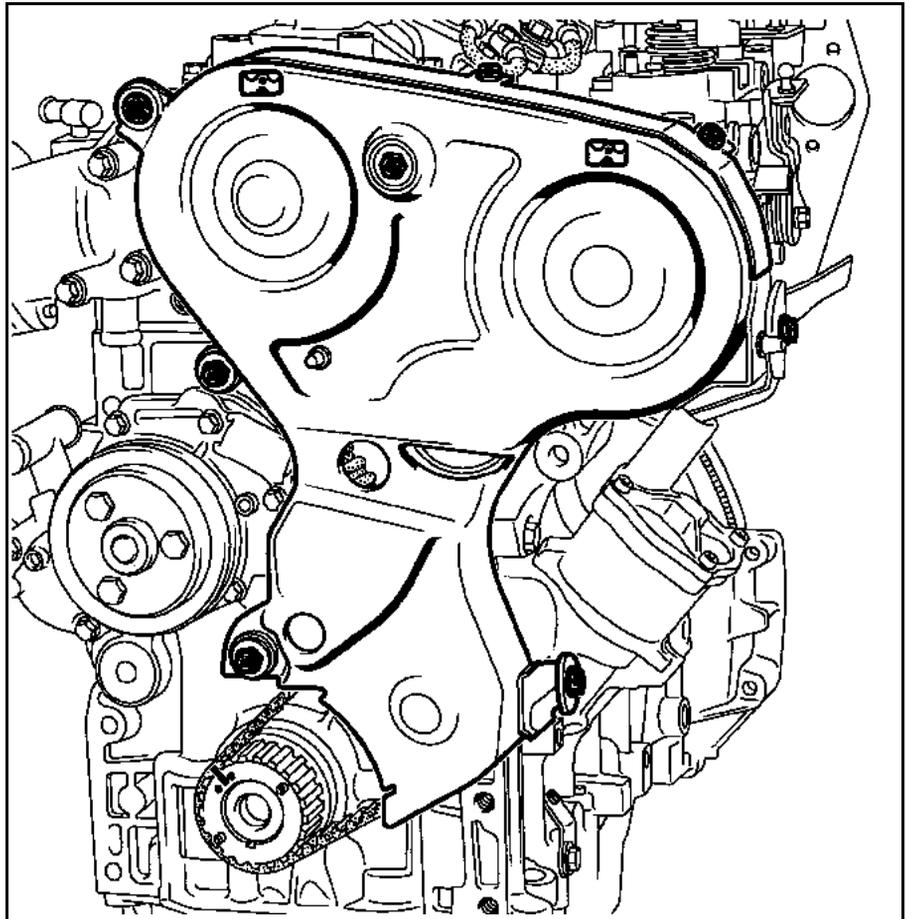
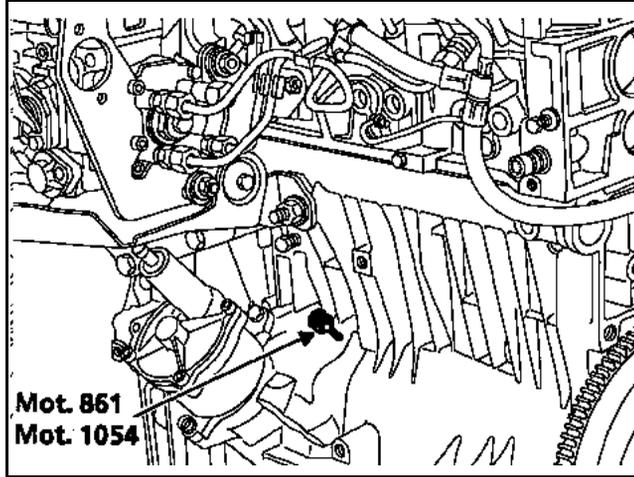


Remove the TDC setting rod cap (B).



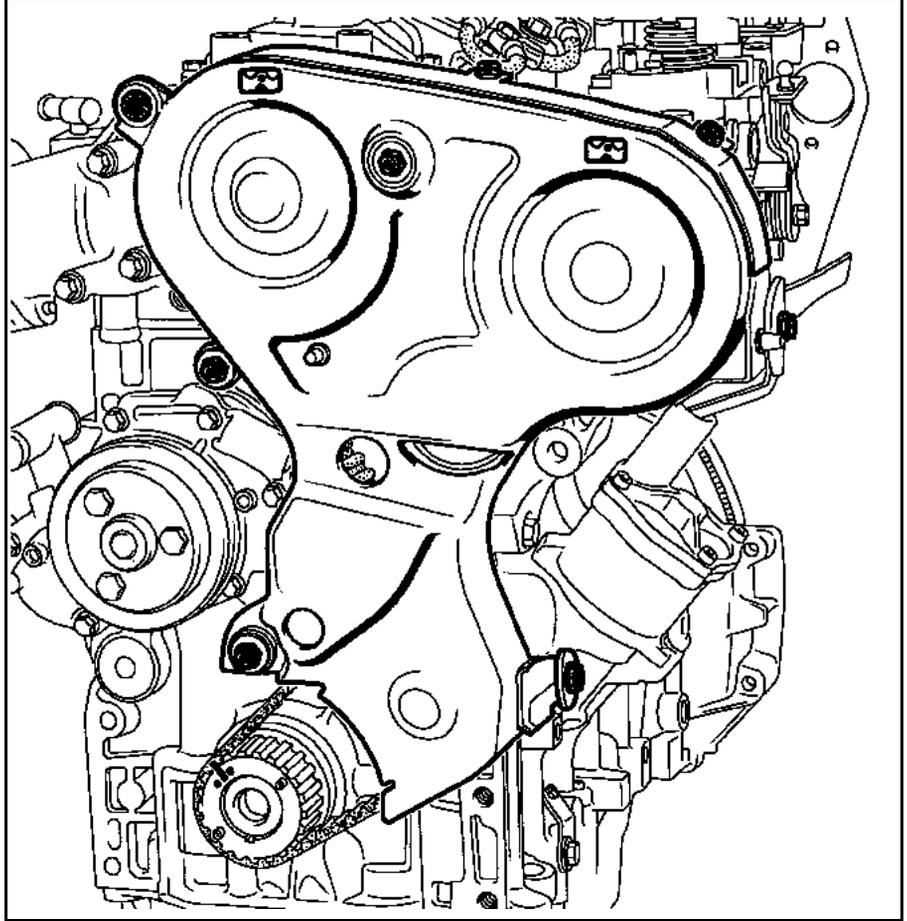
Adjusting the timing

Fit the TDC setting rod on **Mot. 861** or **Mot. 1054**, then turn the engine (clockwise from the timing end) to bring the camshaft sprocket and injection pump marks in line with the valve timing cover marks (**start to pull on the rod one half-tooth before the marks are aligned**), in order to avoid dropping into a balance hole.



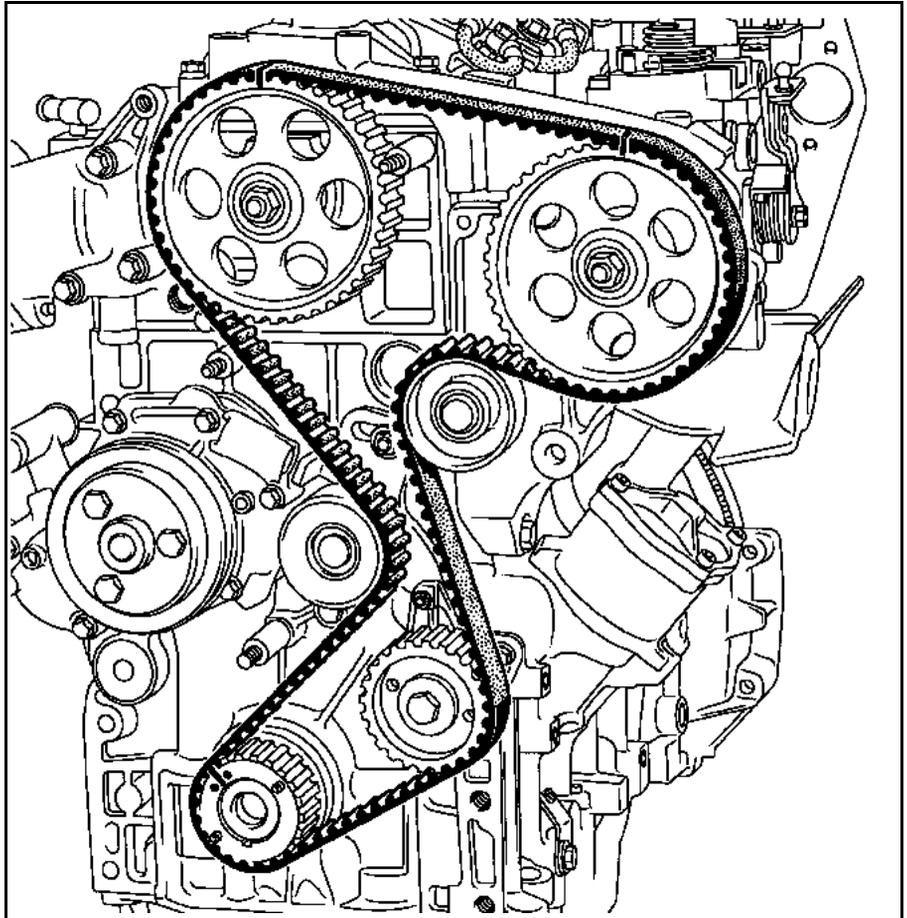
Check the timing on the camshaft sprocket and injection pump (marks on the valve timing cover must be aligned with pulley marks).

Remove the timing cover.



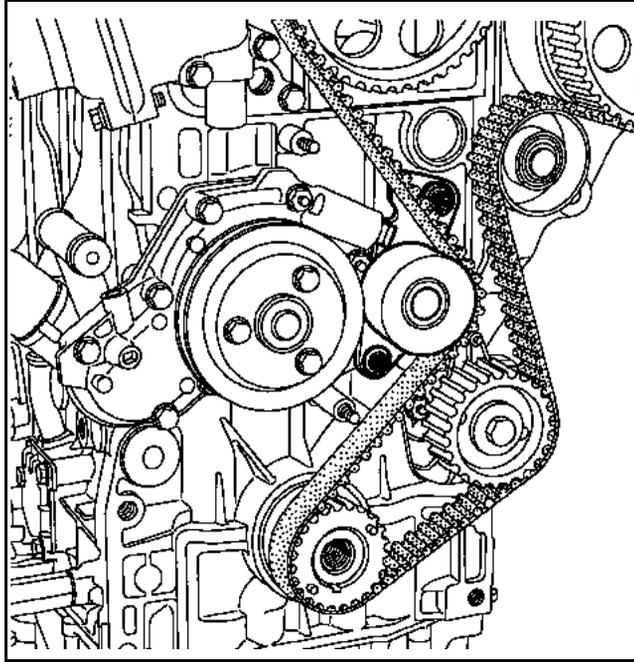
Check the marks on the crankshaft timing sprocket (see diagram).

Make a fixed mark on the cylinder head cover and another on the injection pump where they are aligned with the pulley marks.



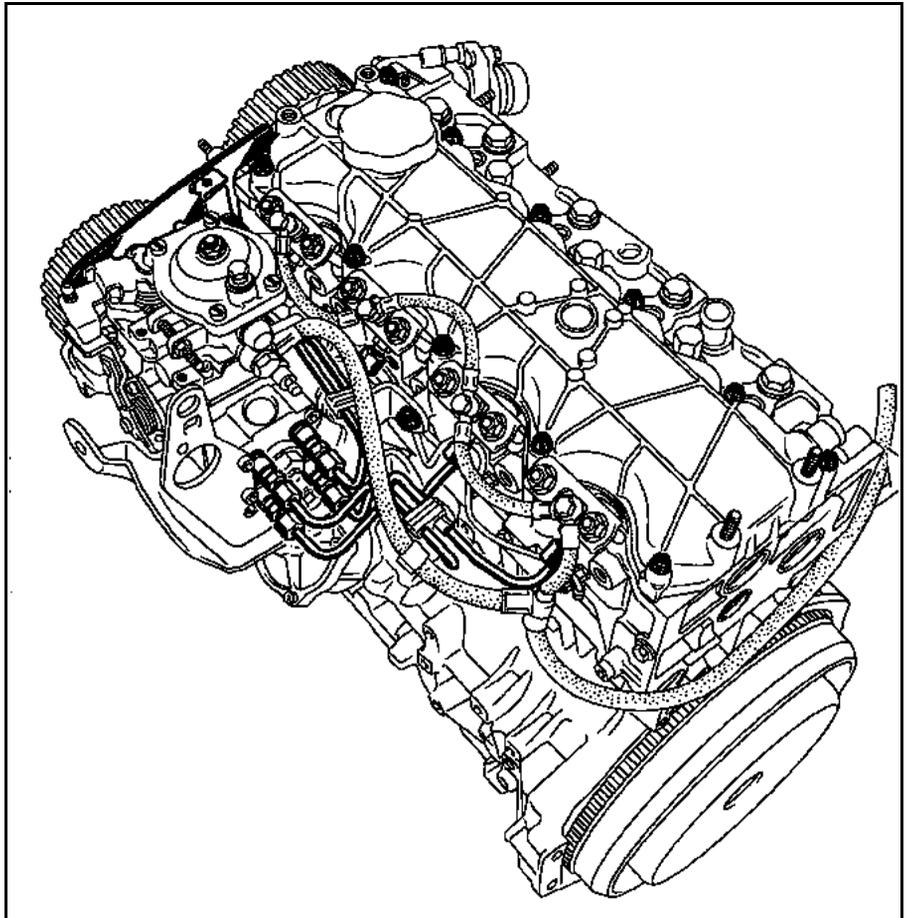
Remove the TDC setting rod
Mot. 861 or Mot. 1054.

Slacken and then re-tighten the
tensioner in order to remove the
timing belt.



Remove:

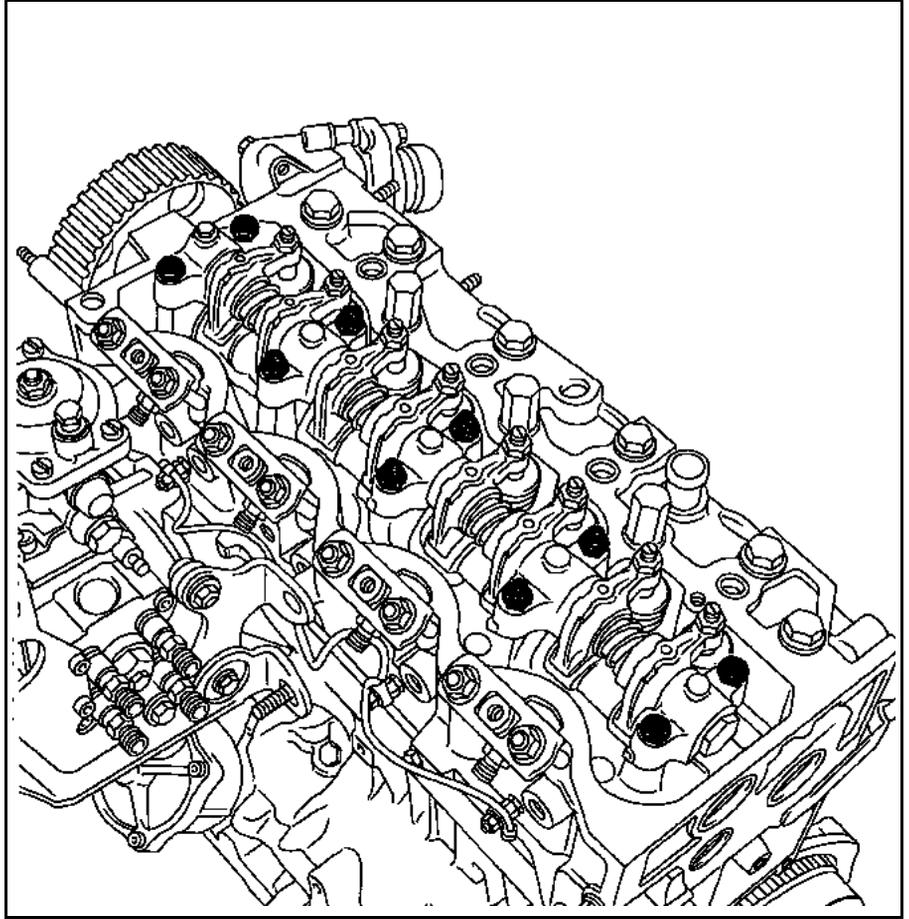
- the fuel return pipes,
- the high pressure pipes on the injection pump using **Mot. 1383**,
- the cold start coolant pipe,
- the injection pump rear mounting bolt on the cylinder head,
- the timing cover support,
- the rocker box cover.



Remove the camshaft lateral shim (pulley end).

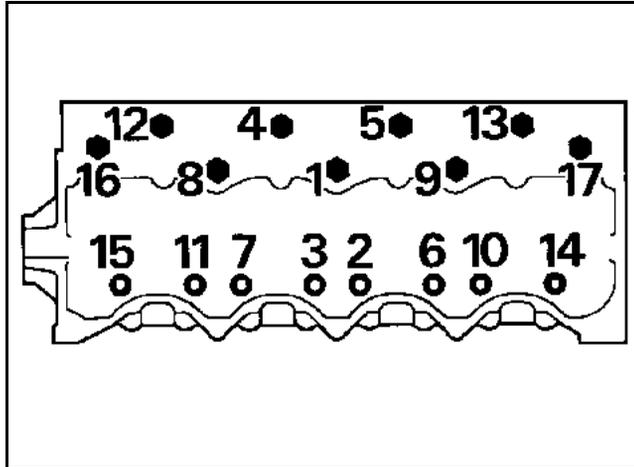
Undo the rocker arm adjusting bolts.

Remove the rocker arm rail.



Remove the cylinder head bolts and fastening nuts.

Insert a wooden shim and strike the side of the cylinder head to unstick it from the sealing face **within the clearance limit between the cylinder head and the studs**. As the cylinder head gasket is cemented to the cylinder block, the cylinder head and the cylinder liners, it is very important not to raise the cylinder head, which would unstick the cylinder liners from their base and allow dirt to penetrate.



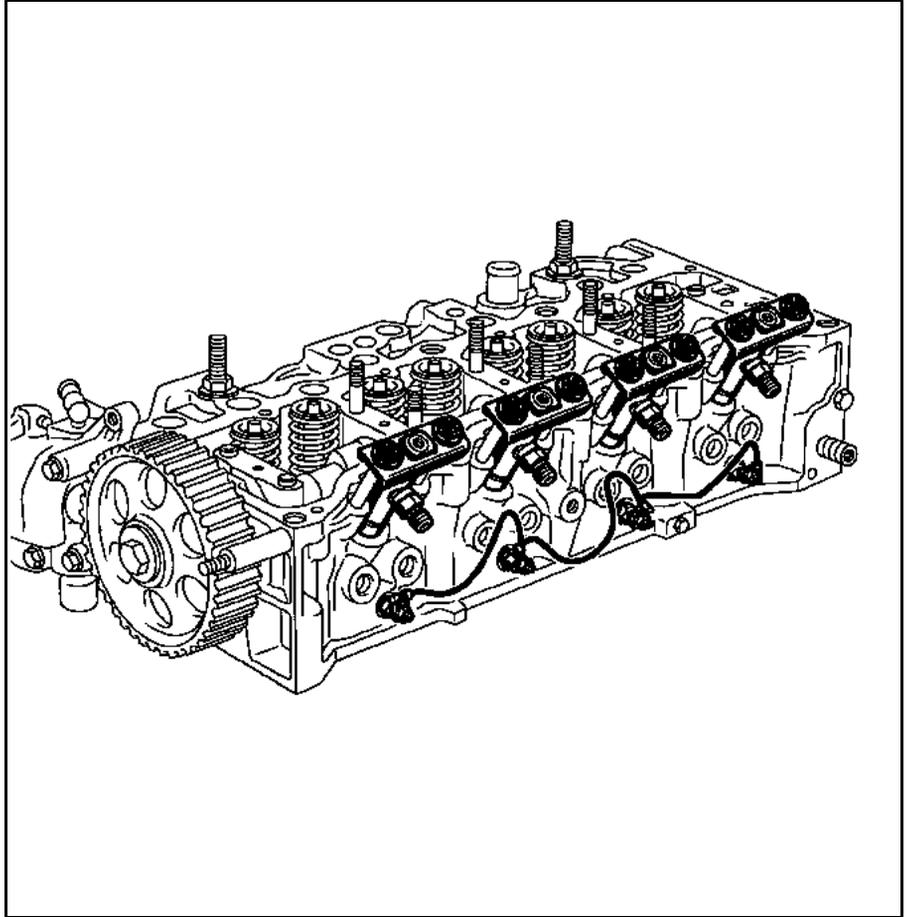
Remove the cylinder head.

STRIPPING THE CYLINDER HEAD

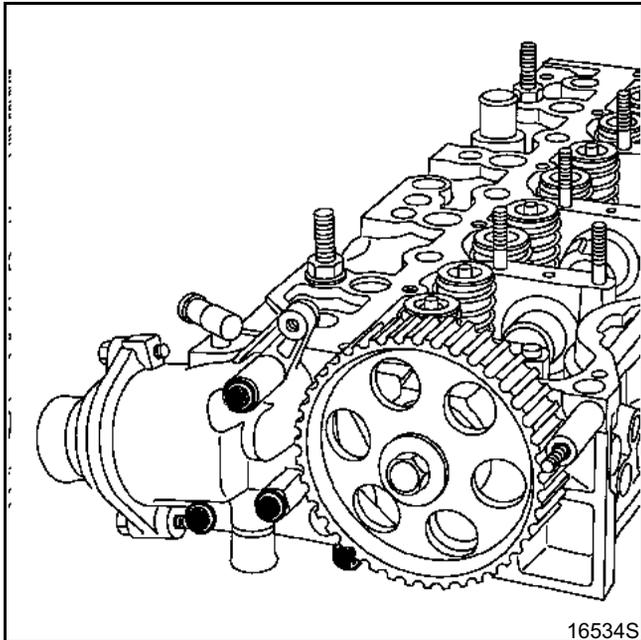
Place the cylinder head on the cylinder head support **Mot. 1573**.

Remove:

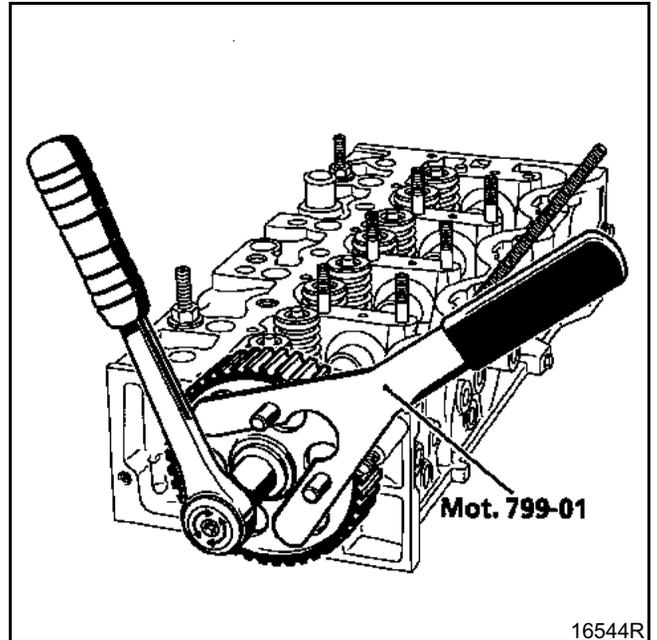
- the heater plugs and their electrical wiring,
- the injectors and injector holders with seals,
- the flame-shield washers between the cylinder head and the injector holder,



- the thermostatic unit,



- the camshaft pulley using **Mot. 799-01** (take care with the key),

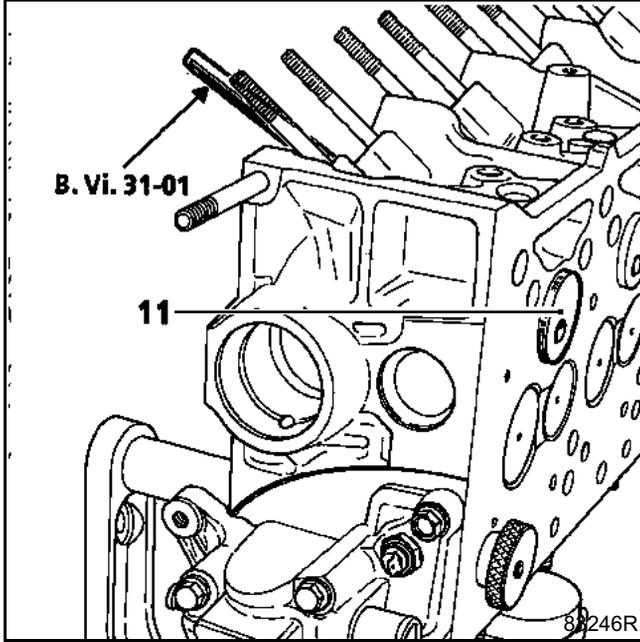


- the gasket.

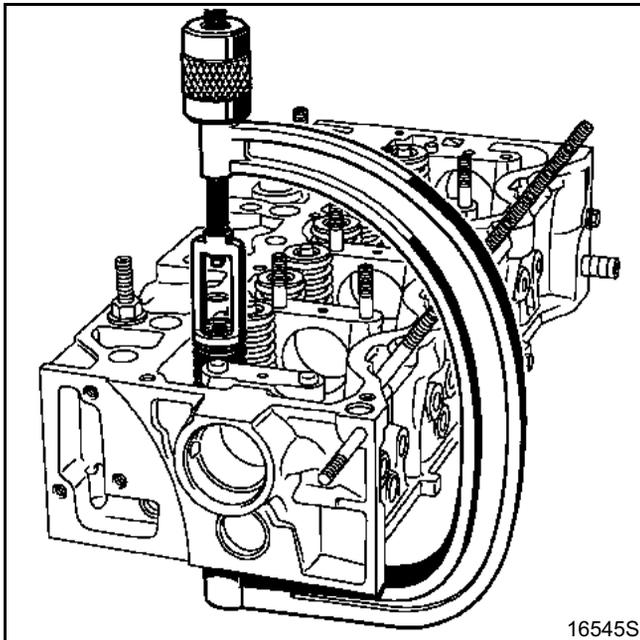
Remove:

- the camshaft,
- the prechambers (11) and, if necessary, gently tap with tool **B. Vi. 31-01** inserted in the injector housing.

Some prechambers may be free; be careful not to let them fall out.

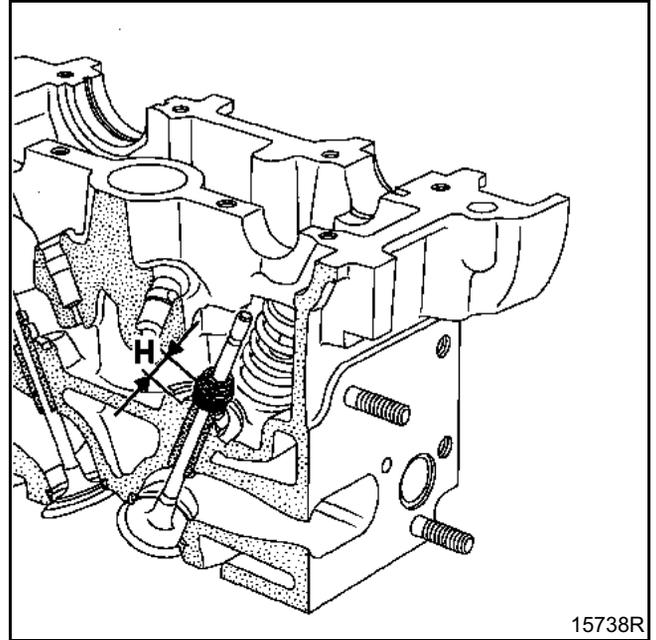


Compress the valve springs.

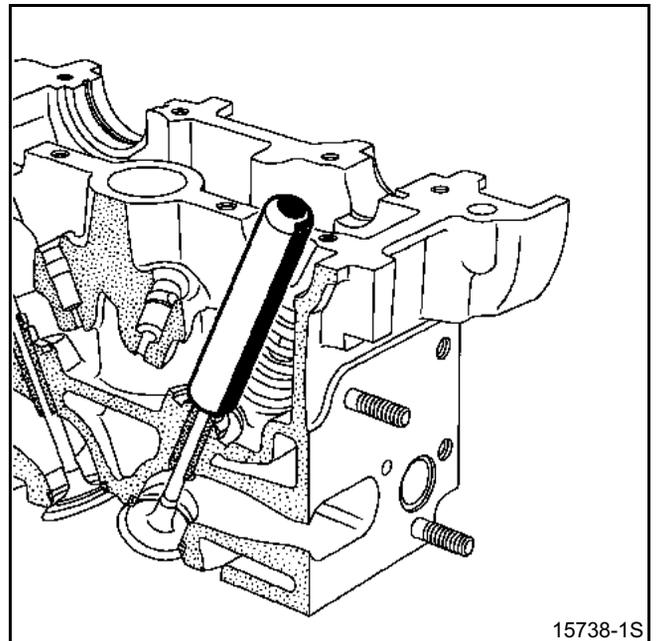


Remove the half rings, the upper and lower cups and the springs.

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.

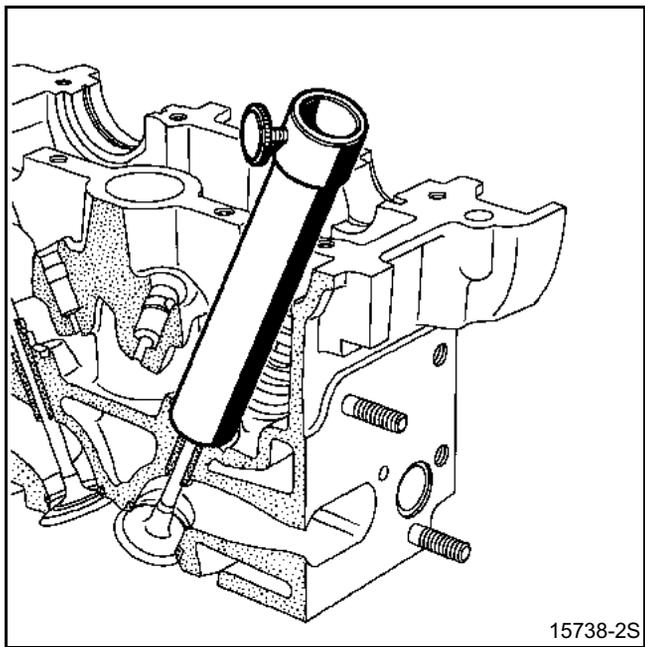


Fit the pushrod from **Mot. 1511** on the valve stem seal.



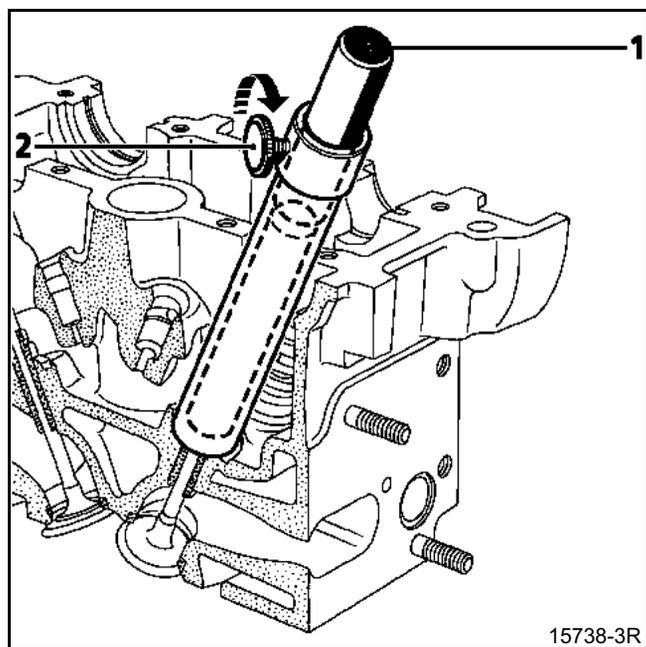
NOTE: the internal diameter of the pushrod must be identical to that of the valve. Moreover, the pushrod must contact the metallic upper section of the valve stem seal.

Fit the guide tube from 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 secure the sleeve using the wheel (2).

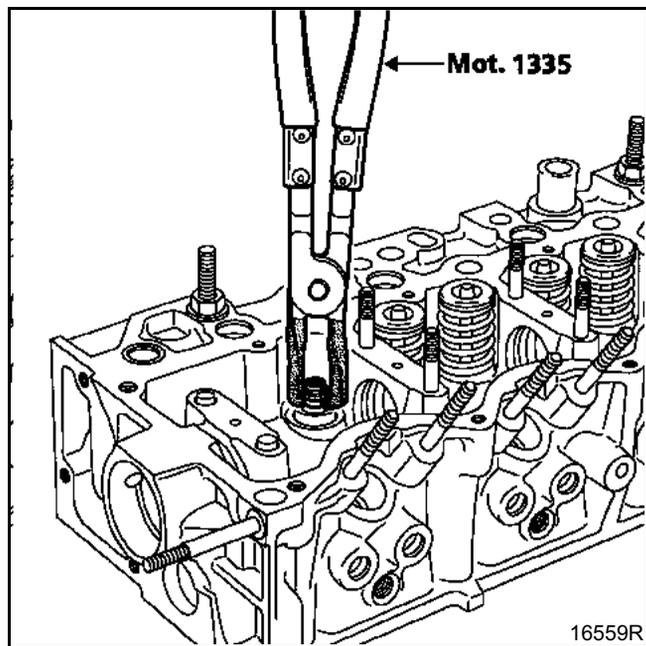


Remove:

- the guide tube and sleeve, being **careful not to loosen the wheel**,
- the pushrod.

Remove:

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



Put the parts in order and mark them.

CLEANING

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

Use the **Décapjoint** product to dissolve any part of the gasket which remains attached.

Apply the product to the parts to be cleaned; wait about ten minutes, then remove it using a wooden spatula.

Wear gloves whilst carrying out this operation.

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

Great care should be used in performing this operation to avoid allowing foreign objects into the piping taking oil under pressure to the camshafts (piping in both the cylinder head and its cover) and the oil return piping.

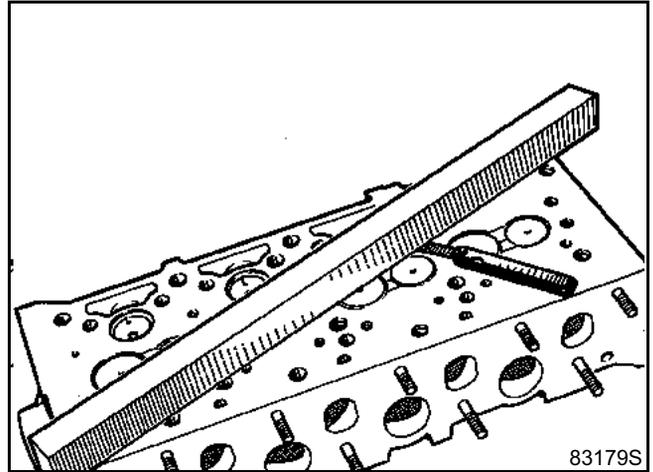
CHECKING THE GASKET FACE

Check for gasket face bow using a straight edge and a set of shims.

Maximum bow

0.05 mm

No regrinding of the cylinder head is permitted.



Test the cylinder head for cracks using the cylinder head test tools (a container and a kit for the particular cylinder head, plug, sealing plate, blanking plate):. The approval number of the cylinder head test container is **664 000**

REDRESSING THE VALVE SEATS

INLET

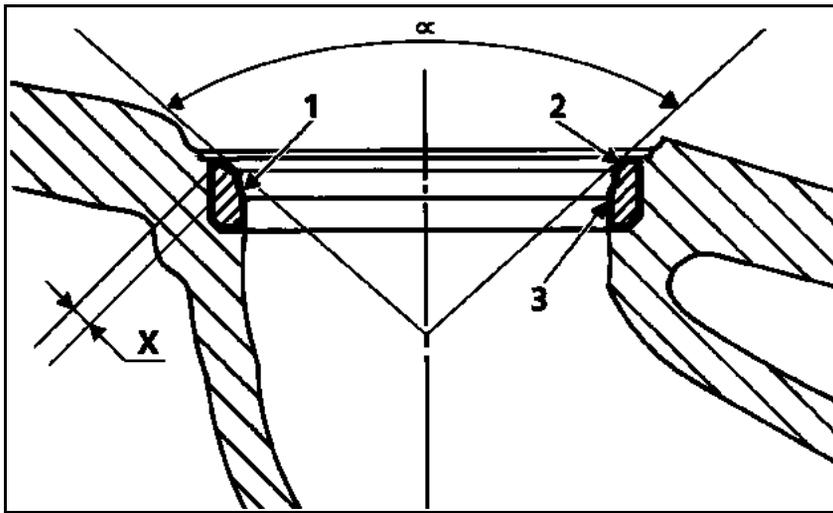
Width of mating faces X (in mm)	1.75 ± 0.2
Angle (α)	90°

The mating face is corrected (1) using **burr N 208 46°**.
Reduce the width of this mating face at (2) using burr **N 213 15°** until width **X** is obtained.

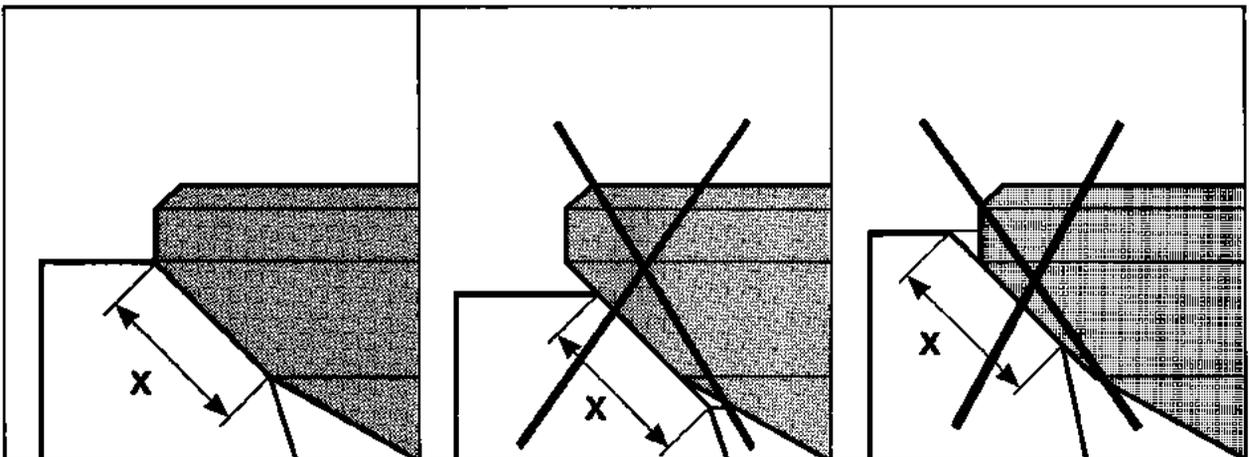
EXHAUST

Width of mating faces X (in mm)	1.75 ± 0.2
Angle (α)	90°

The mating face is corrected (1) using **burr N 204 46°**.
Reduce the width of this mating face at (3) using burr **N 212 75°** until width **X** is obtained.



N.B.: respect the mating face position of the valve on its seat.



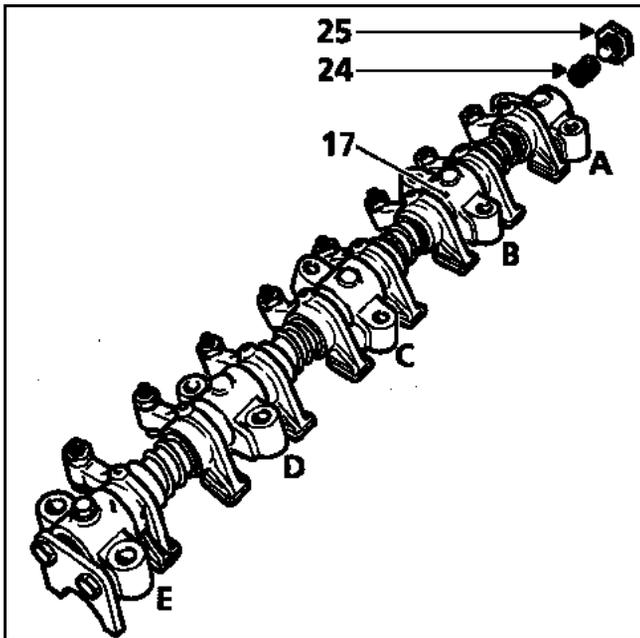
ASSESSMENT AND REPAIR OF ROCKER ARM RAILS

The filter (24) located in the rocker arm rail (17) must be replaced in all operations on faults that cause metallic particles to become suspended in the lubricating oil.

In this case, the engine oil and oil filter on the main pipe must also be replaced.

Removal

Remove the cap at the end of the rocker arm shaft and the filter. Separate the different parts and clean them. Put them in order.



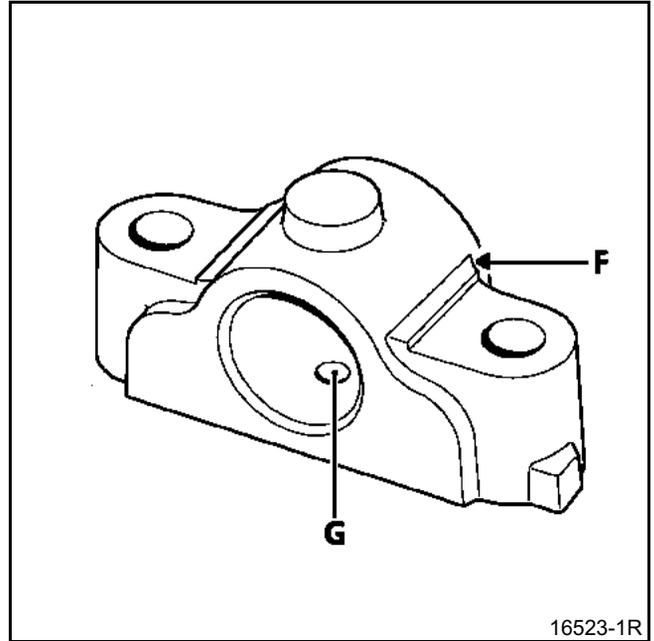
Identification of parts:

Rocker arm shaft bearings

Bearings A, B, C and D are identical.

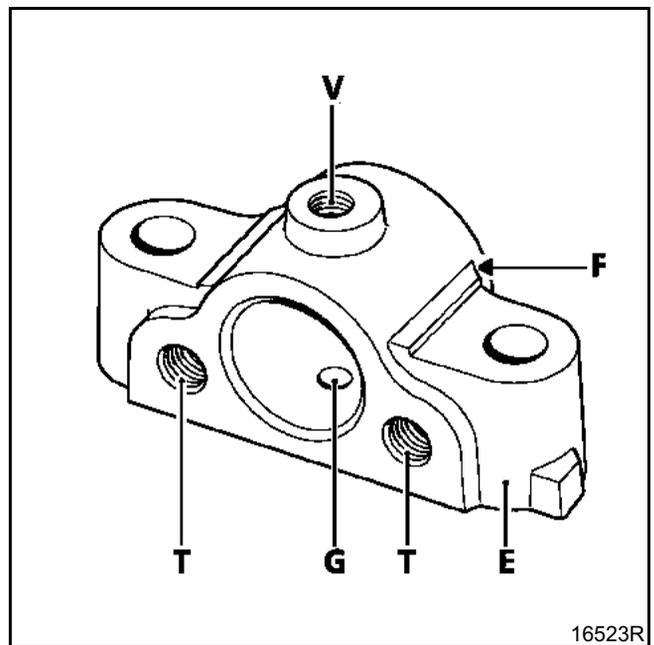
They comprise:

- a greasing hole (G) for corresponding camshaft bearings,
- an offset (F) directed towards the flywheel.



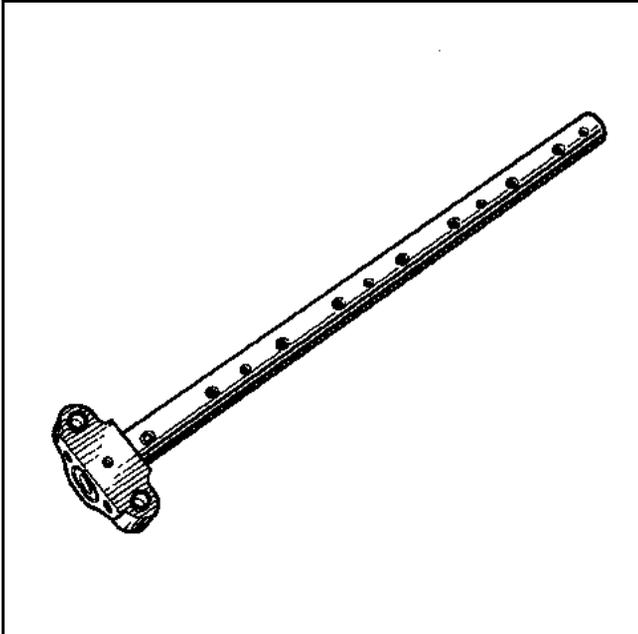
Bearing (E) also comprises:

- two threaded holes (T) for attaching the shim to limit camshaft side play,
- a threaded hole (V) for attaching the bolts to orient the rocker arm shaft.



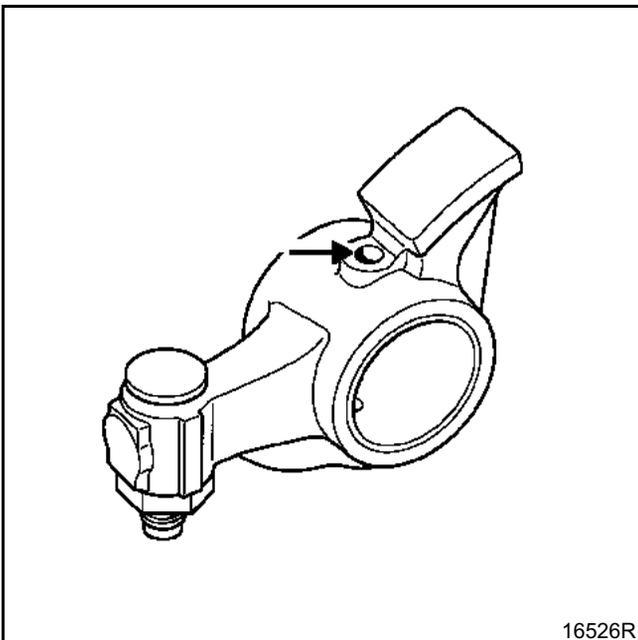
The rocker arm shaft is oriented using a full dog point screw.

The shaft bearing greasing holes are directed towards the camshaft (the oil passes through the rocker arm shaft bearings).



Rocker arms

The inlet and exhaust rocker arms are identical and both have an oil way to lubricate the cams on the camshaft.



Refitting

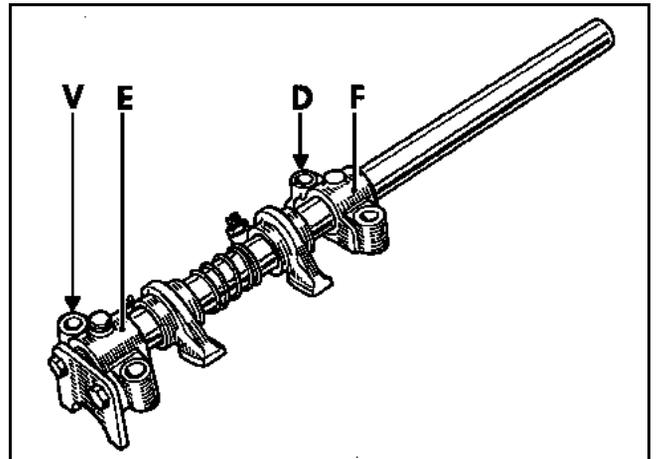
Place the bearing (E) on the shaft and fix it so that the greasing holes point towards the bearing plate.

Then fit:

- a rocker arm,
- a spring,
- another rocker arm,
- an intermediate bearing, offset (F) pointing to the flywheel.

Continue refitting in the same order, fit the cap with a new oil filter and tighten to a torque of **2 daNm**.

This torque has to be respected as the rocker arm shaft is only kept rotating by the full dog point screw on the bearing (E).

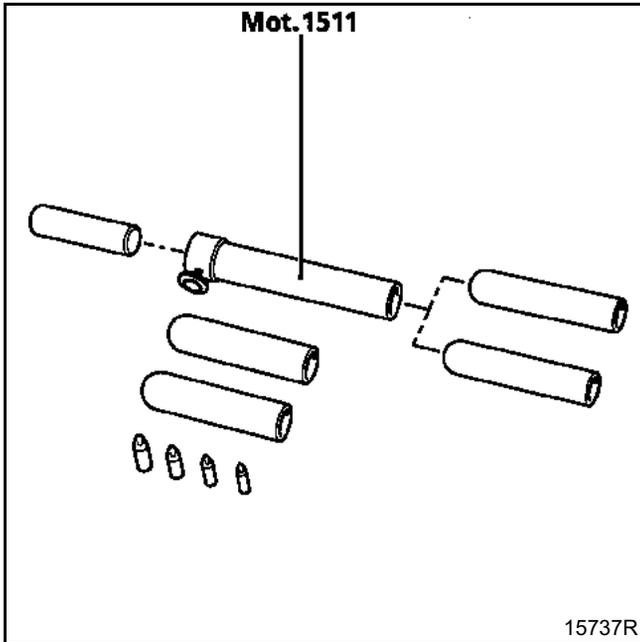


REBUILDING THE CYLINDER HEAD

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.

Oil all the parts.

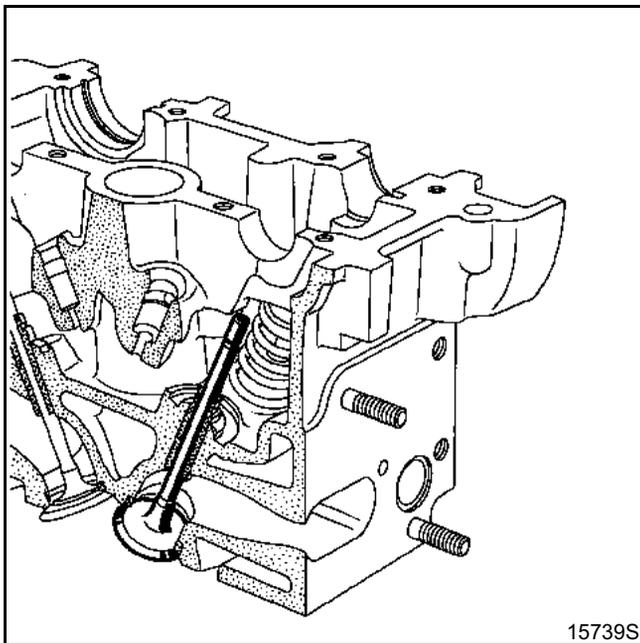
The valve stem seals must be fitted using tool **Mot. 1511** or with the **FACOM** tool, part number **DM6J4**.



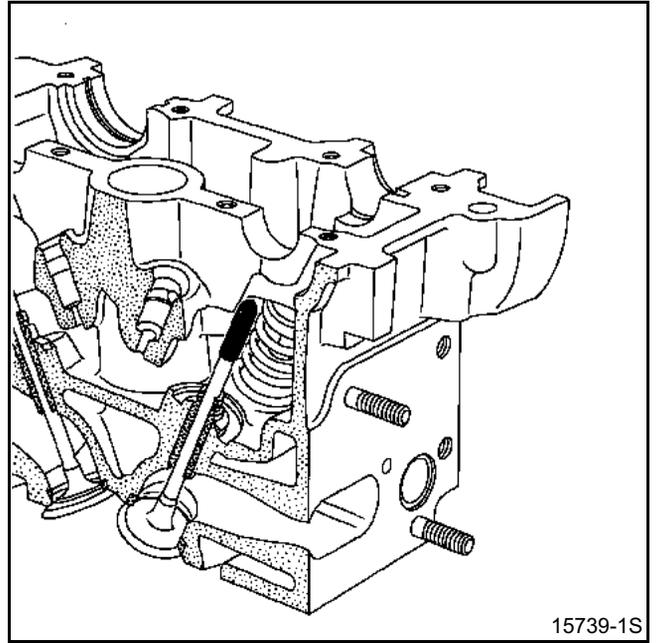
NOTE: do not lubricate the valve stem seals before fitting them.

Fitting new valve stem seals.

Locate the valve in the cylinder head.

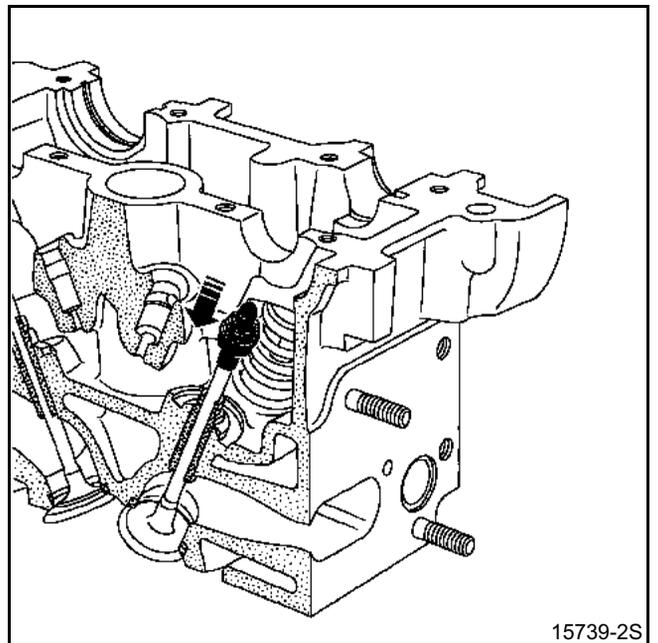


Place the barrel of the **Mot. 1511** tool over the valve stem (the internal diameter of the barrel must be identical to the diameter of the valve stem).

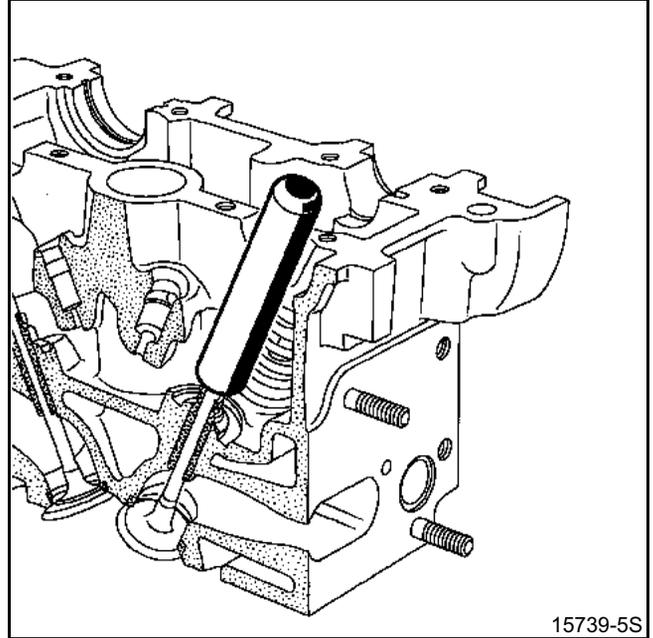
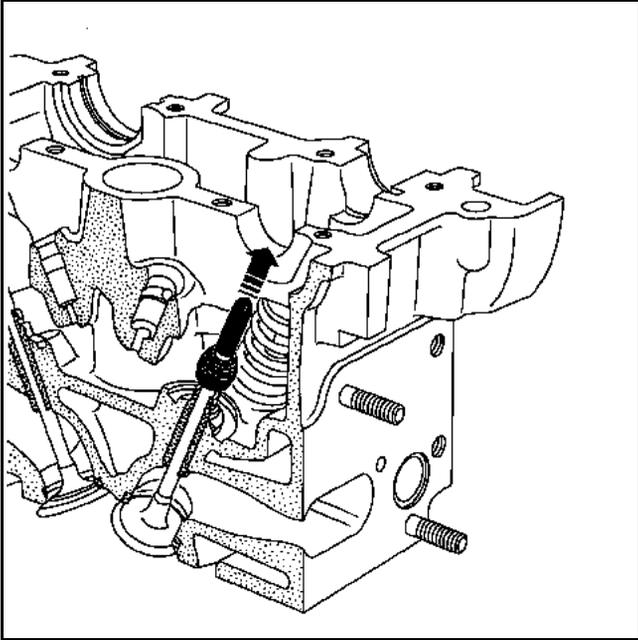


Keep the valve pressed against its seat.

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

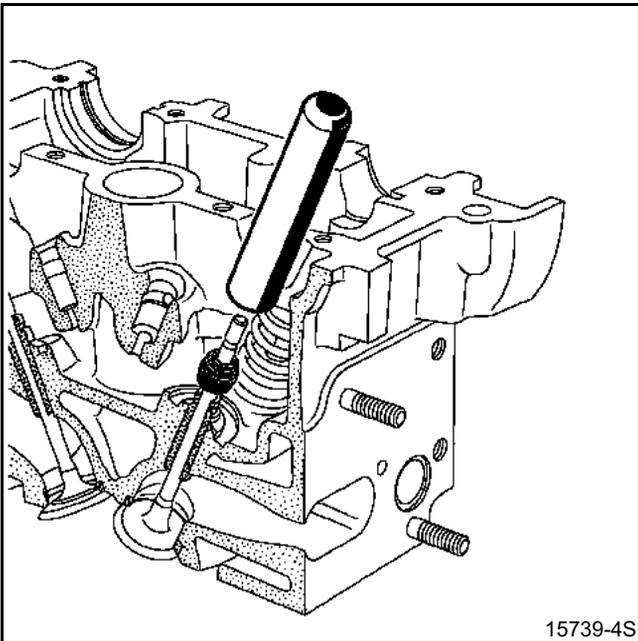


Push the valve stem seal past the tool barrel, then withdraw the barrel.



15739-5S

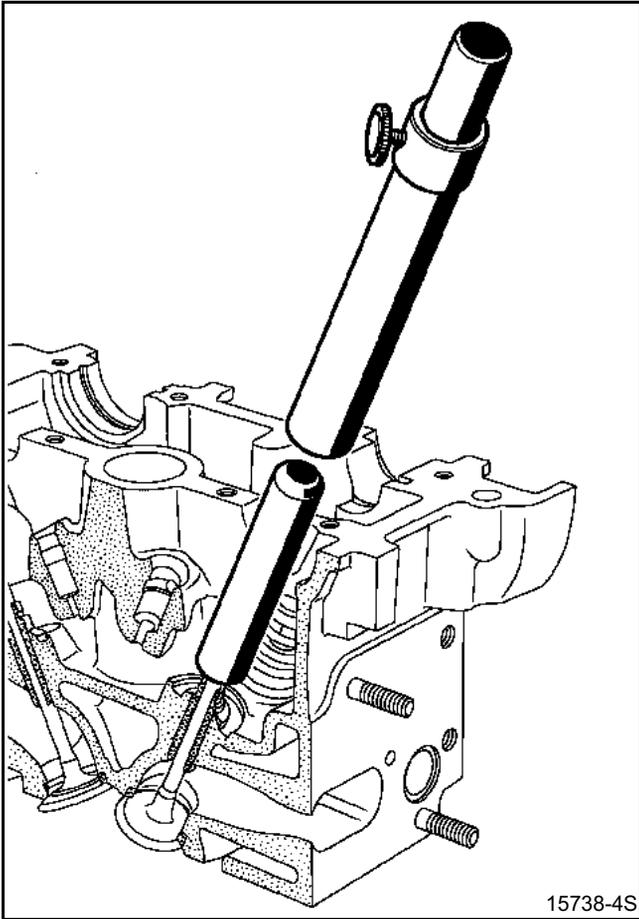
Place the pushrod over the valve stem seal.



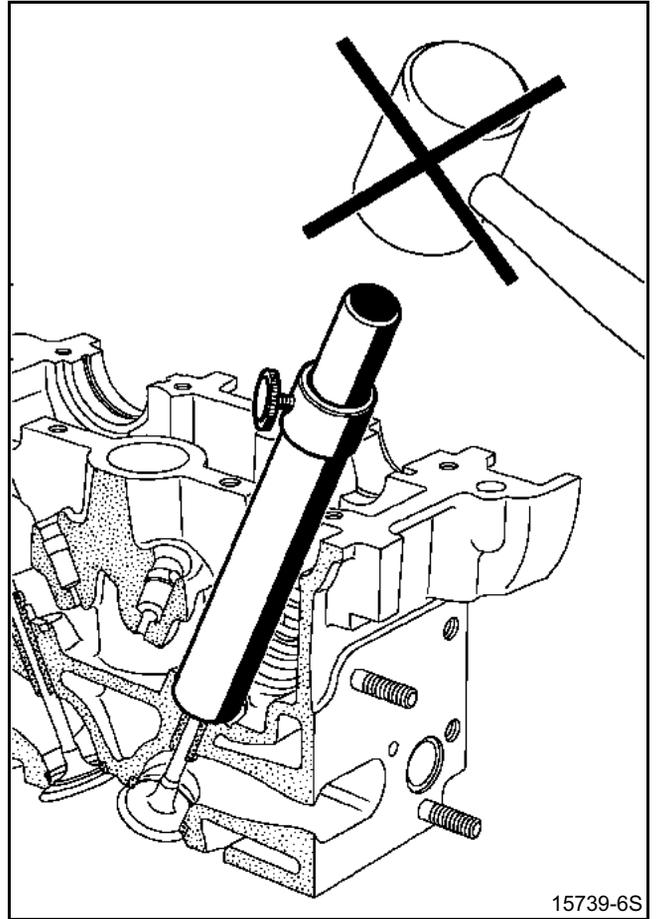
15739-4S

NOTE: the internal diameter of the pushrod must be identical to the diameter of the valve stem. Moreover, the pushrod must be in contact with the upper section of the valve stem seal.

Place the guide tube and sleeve assembly, adjusted at removal, 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.



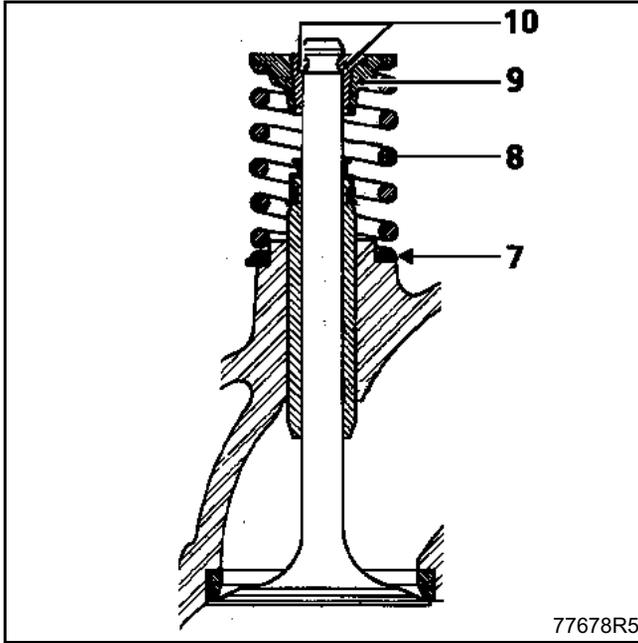
Repeat the above sequence of operations for all the valves.

Fit:

- the spring collar rings (7),
- the springs (8) (inlet and exhaust springs are identical),
- the cups (9).

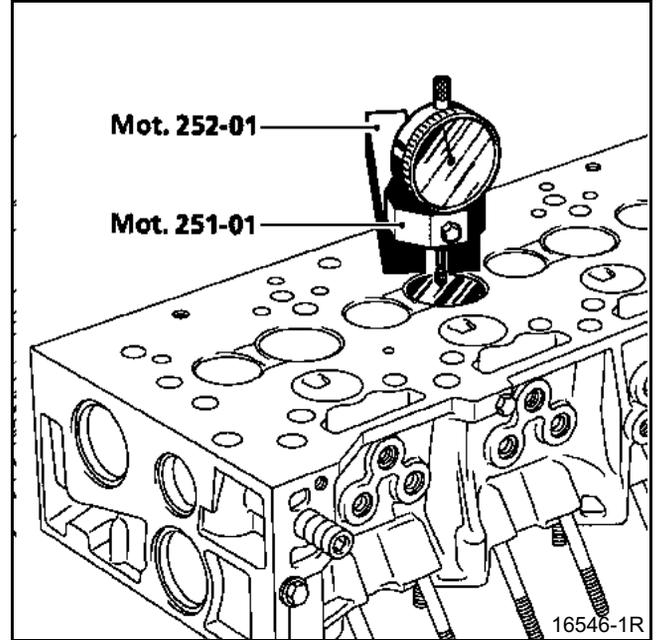
Compress the springs.

Fit the half rings (10) (inlet and exhaust valve half rings are identical).



Check the amount by which the valve is retracted from the cylinder head gasket face using tools **Mot. 251-01** and **Mot. 252-01**.

It should be between **0.80** and **1.15 mm**.



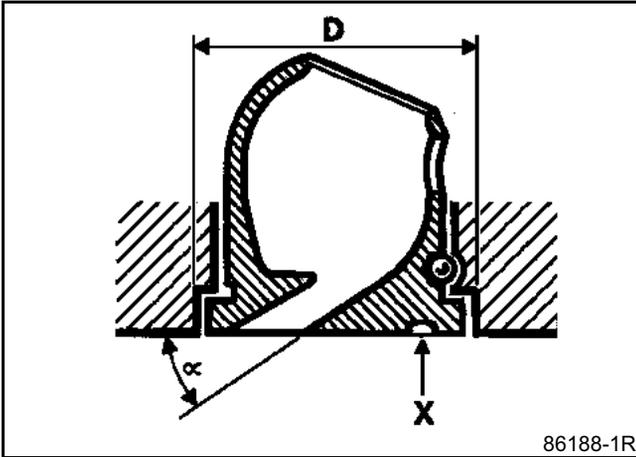
It is **essential** to take a note of the valve retraction for later checks on the piston-cylinder head clearance.

Turbo engine

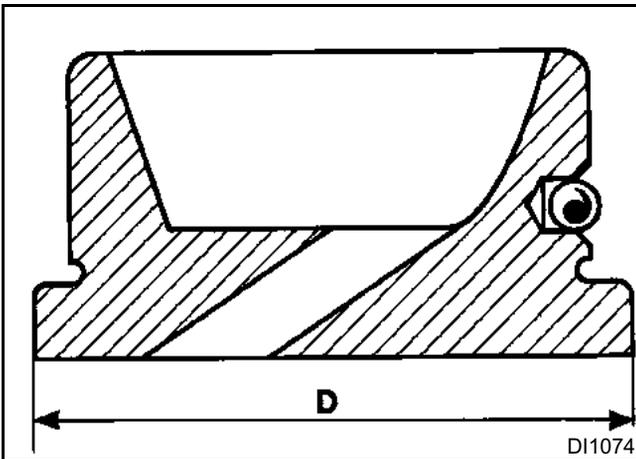
Mark **X**: a drill stamp.

Normally aspirated engine

Mark **X**: none.



Engines J8S 736 and 740



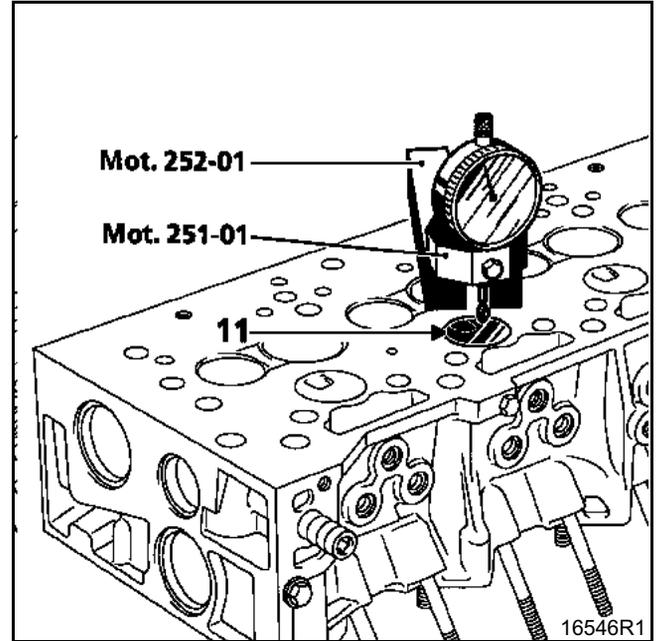
Diameter (D) in mm:

- Original dimension 1 = 35.5
- Original dimension 2 = 35.7

It is essential to take a note of the diameter (D) of the prechamber housing in the cylinder head and to refit a chamber of the same diameter.

Fit the prechambers (11) then use tools **Mot. 251-01** and **Mot. 252-01** to check their protrusion.

It should be between **0.01** and **0.04 mm**.



Refit the heater plugs (12) and their electrical wiring.

Place new heat flange welds (27) on a cylinder head being re-used.

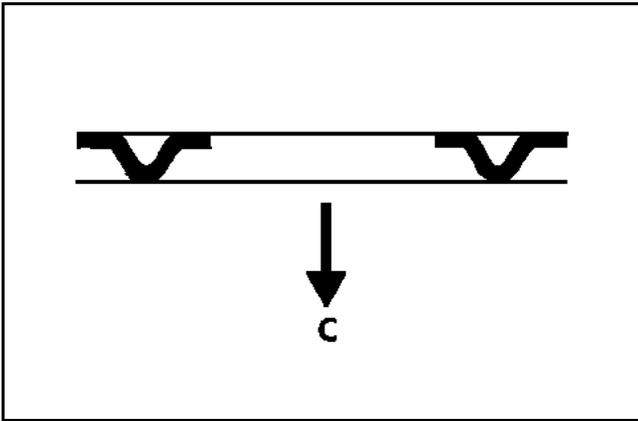
Take a note of the dimensions of the removed flame-shields and replace them with new ones of the same diameter.

Diameter (D) in mm:

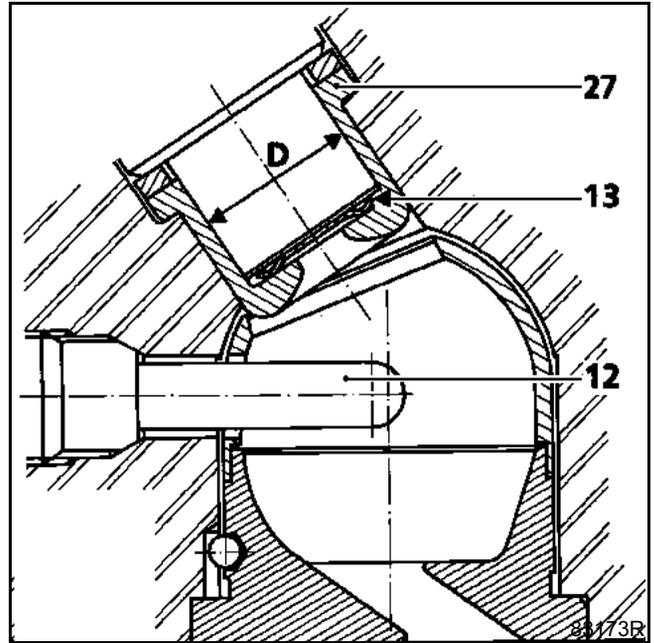
- original dimension 1 = **15.5**
- original dimension 2 = **17.7**

Replace the injector flame-shield washers (13) making sure that they are the right way round.

The mark (C) points towards the prechamber.



All engine types except J8S 736 and 740



Replace the injectors and injector holders fitted with new copper seals and tighten the nuts to torque (**2 daNm**).

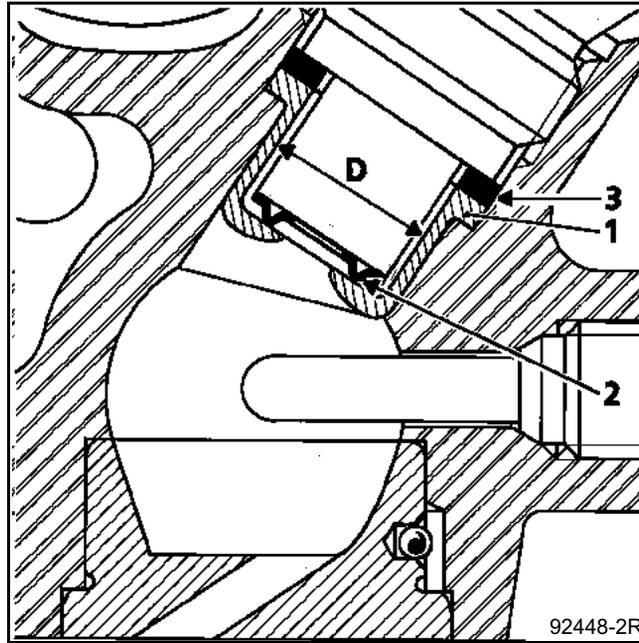
Tighten both nuts equally.

Refit the thermostatic unit fitted with a new seal.

Engines J8S 736 and 740

Injector holders - special features

The cylinder head has been modified to accept **BOSCH "KCA" threaded injector holders.**

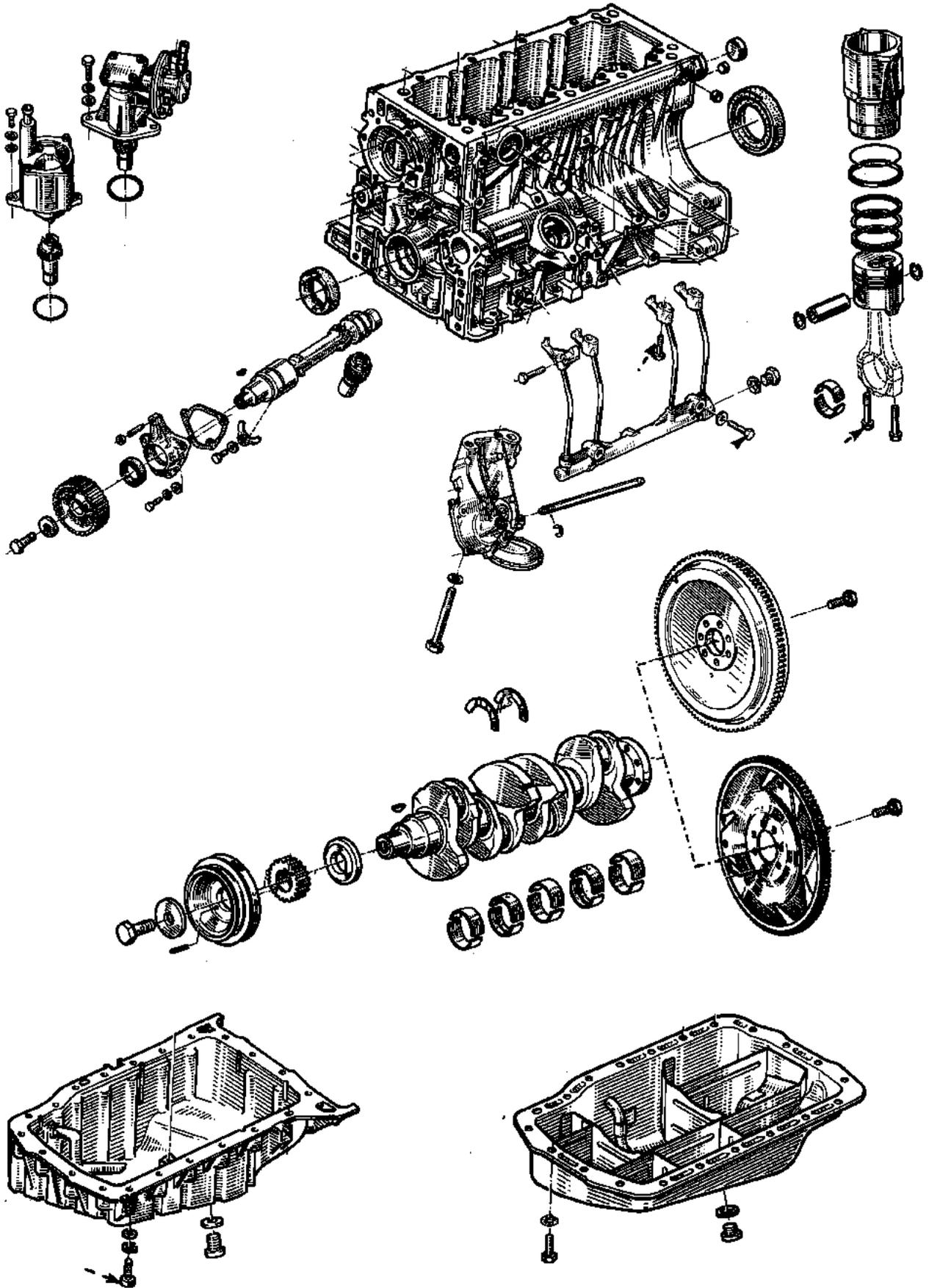


- 1 Flame-shield
- 2 Flame-shield washer
- 3 Seal

Fit a new seal and a new flame-shield washer (oriented as shown in the diagram) every time the injector holder is refitted.

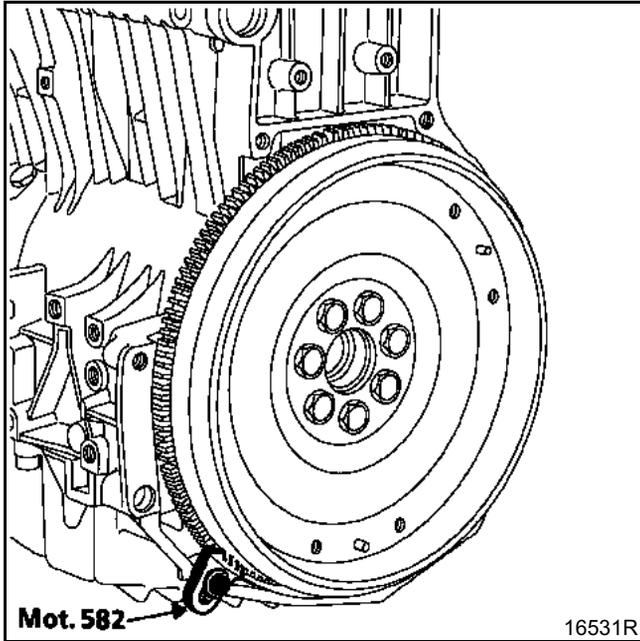
Tighten the injector holders to **7 daNm** using tool **Mot. 997-01.**

CYLINDER BLOCK EXPLODED DRAWING



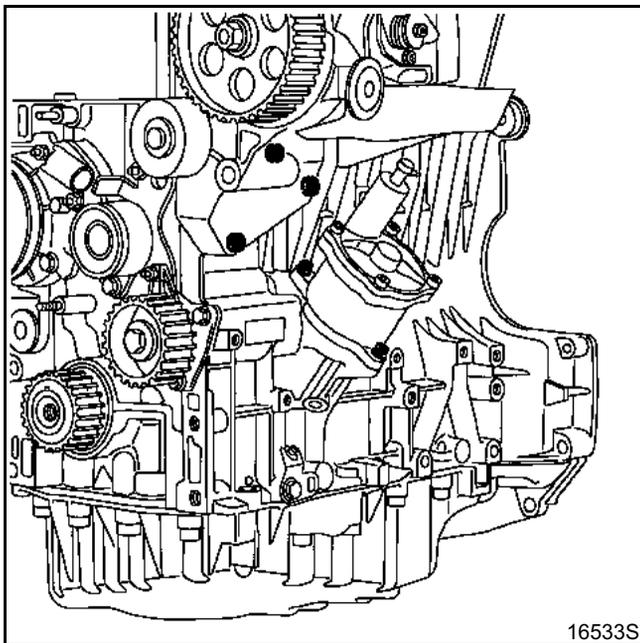
REMOVING THE BOTTOM ENGINE

Fit the flywheel locking tool **Mot. 582** and remove the clutch and the flywheel.

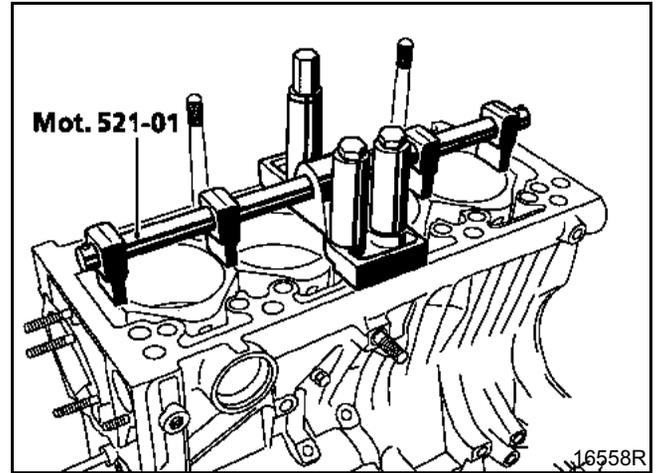


Unscrew the three mounting bolts on the injection pump support to remove the unit comprising the pump, the support and the injection pump pulley.

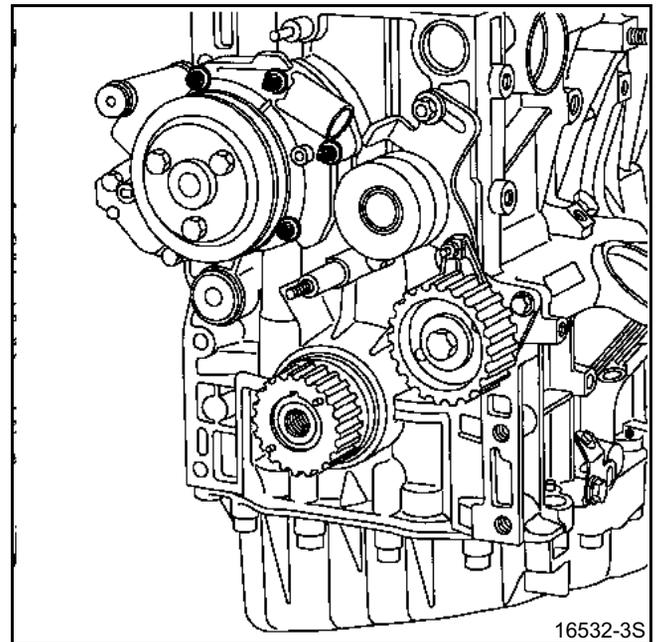
Remove the vacuum pump then remove the pinion and the six pieces holding the oil pump.



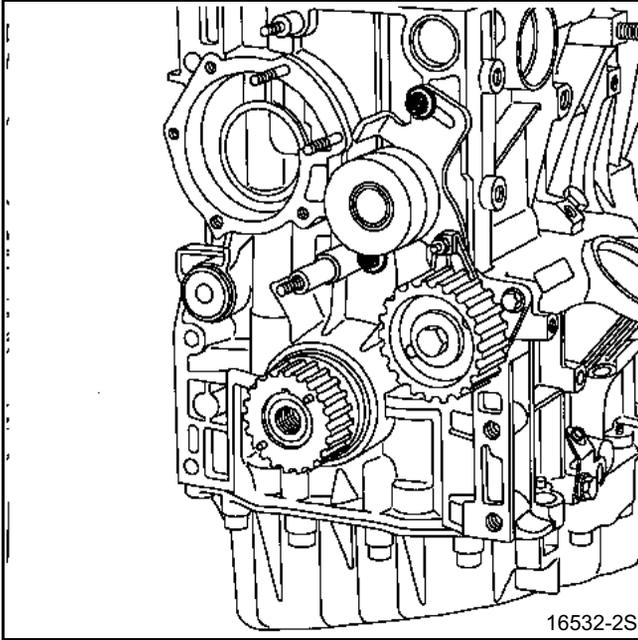
Fit the cylinder liner clamp **Mot. 521-01**.



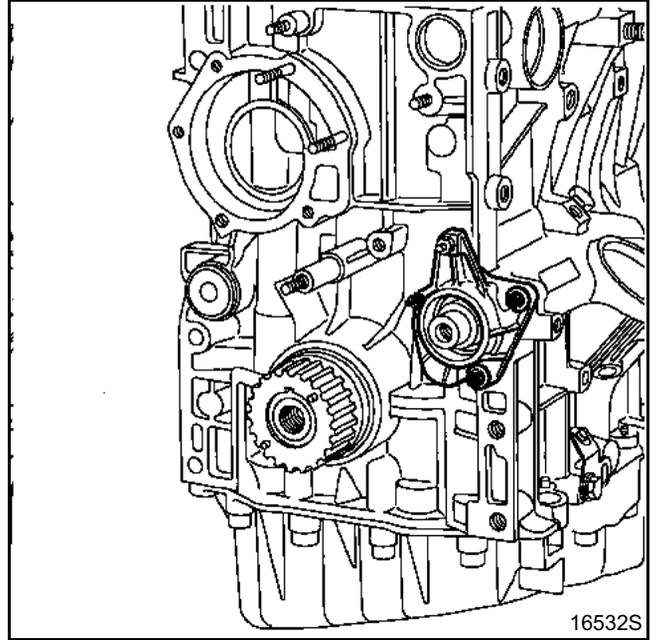
Remove:
– the water pump.



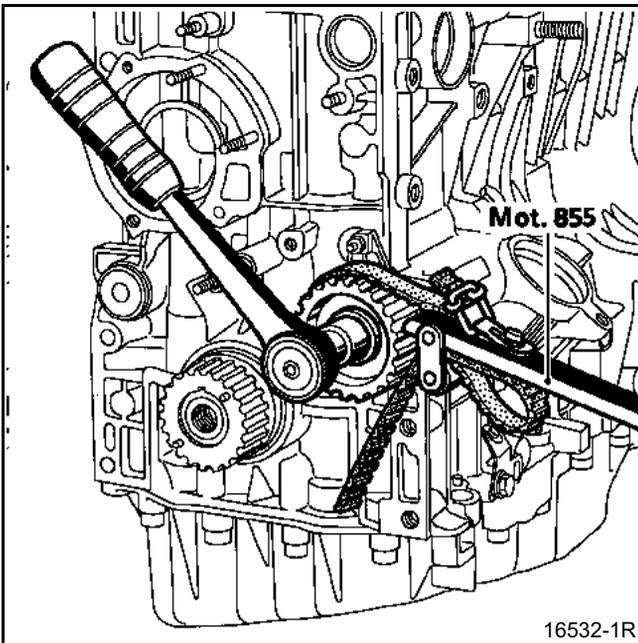
- the tension wheel,



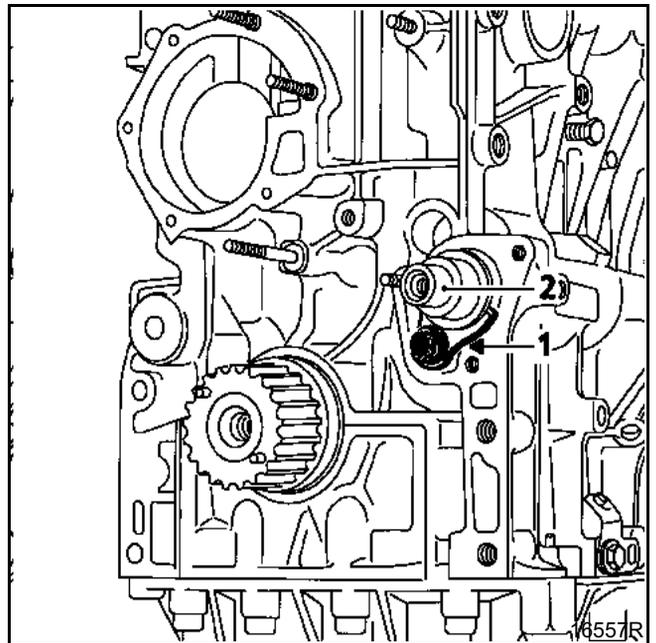
- the relay shaft cover,
- the seal using a lever,



- the relay shaft pinion, use immobiliser **Mot. 855**,
- the key,



- the relay shaft retainer,
- the relay shaft (2),

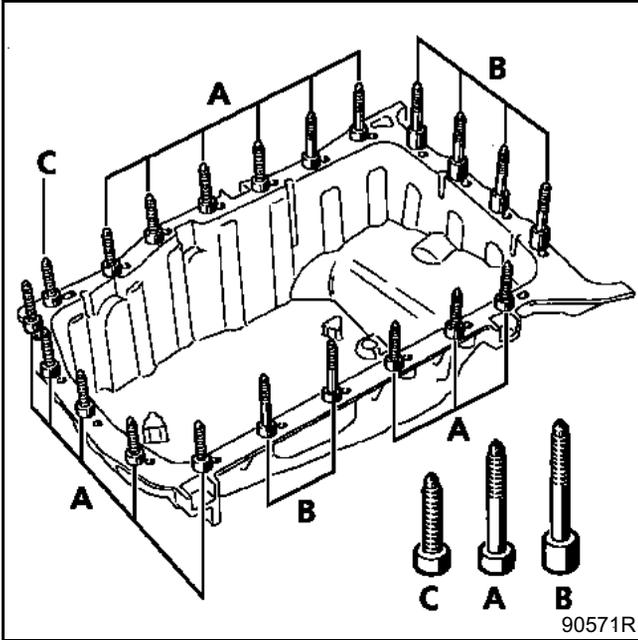


- the crankshaft timing sprocket using a two handle extractor,
- the key.

Remove the sump.

1st model

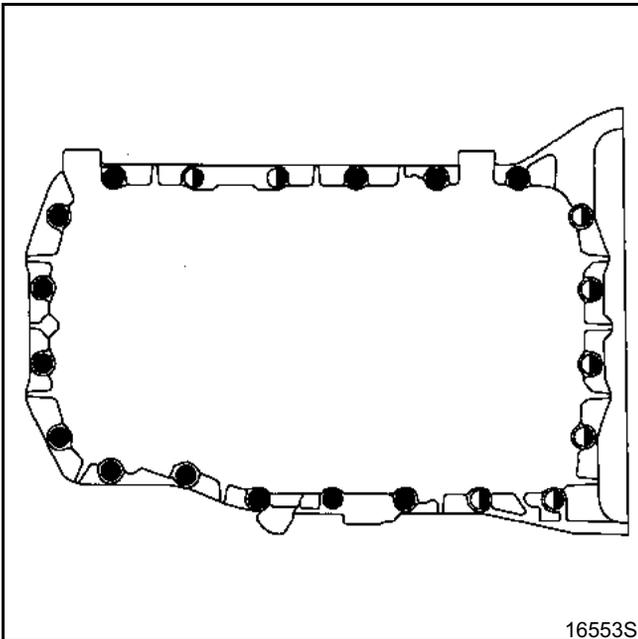
Three types of bolt marked A, B and C.



2nd model

Two types of bolt marked as follows:

- 13 bolts (M7 x 100-40),
- 8 bolts (M7 x 100-52).

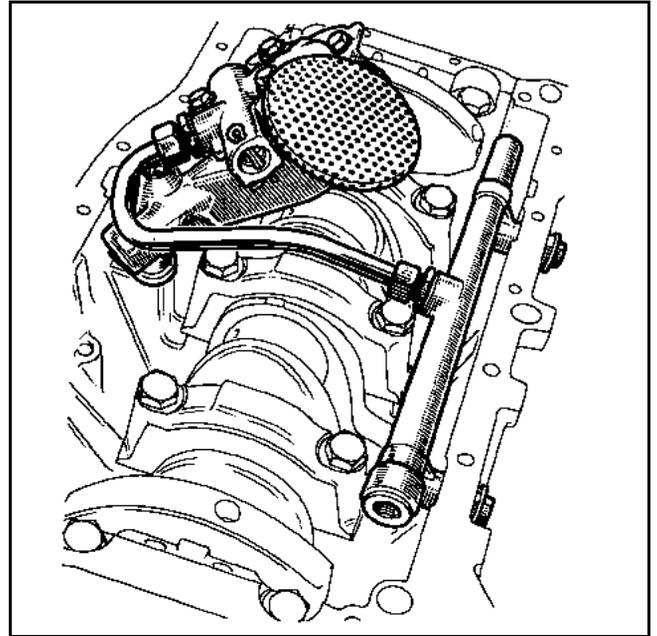


Remove:

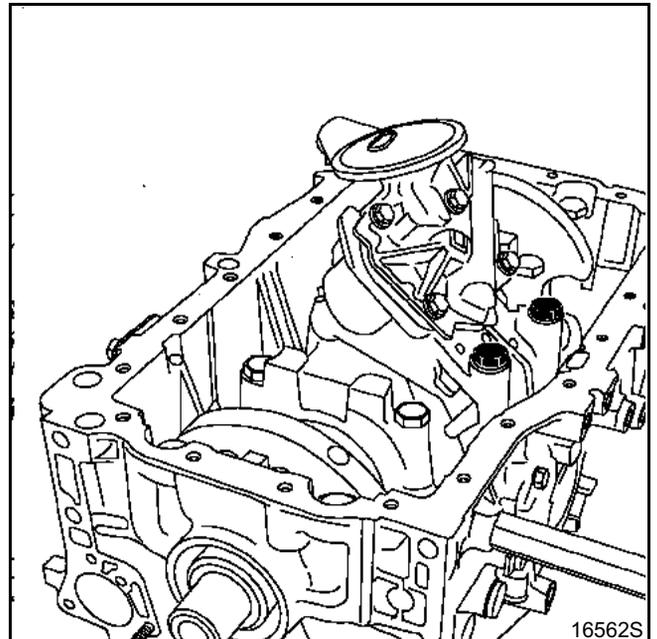
- the crankshaft seals,
- the oil filter using **Mot. 1281-01**.

Position the pistons at mid-stroke.

Disconnect the connection tube between the oil pump and the lubricating gallery (if fitted).



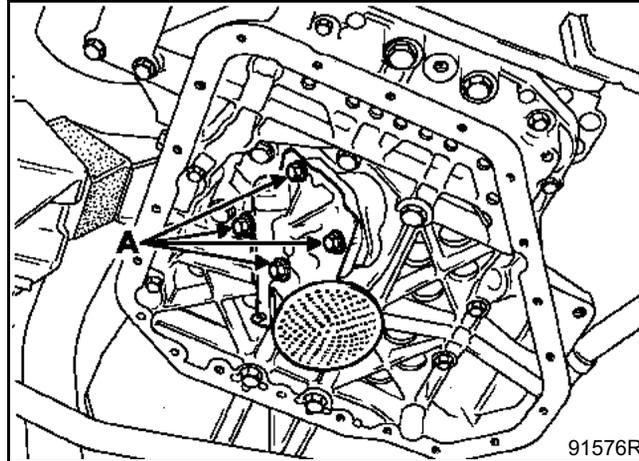
Remove the oil pump.



For engine sump with reinforcing plate

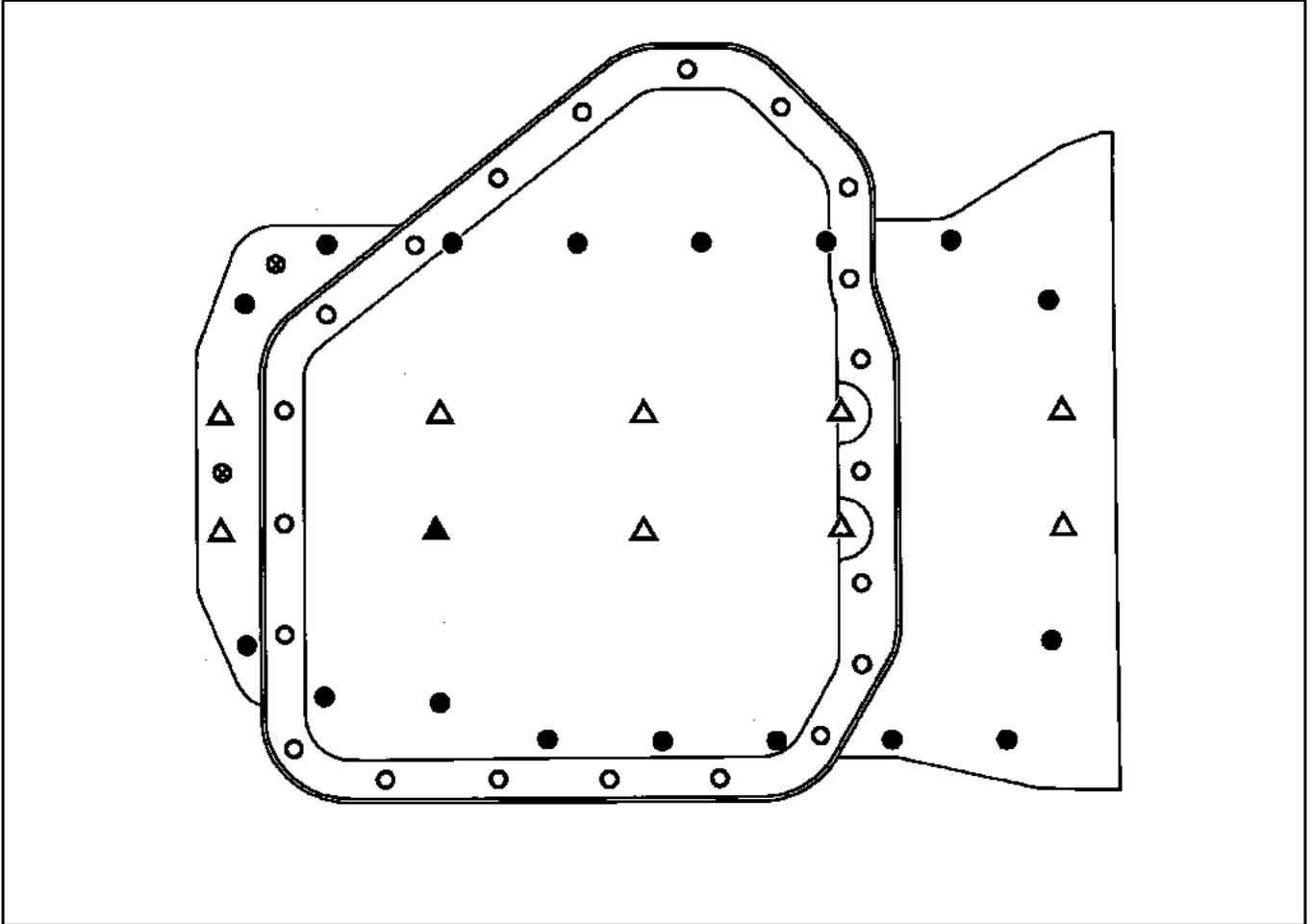
Remove:

- the oil pump strainer, bolt (A), keeping the pump pinions,



- the two bolts on the oil pump body,
- the oil pump body,
- the oil level sensor,
- the plate mounting bolts (then remove all the marked bolts).

Marking of the mounting bolts on the cylinder block plate and on the sump on the plate.



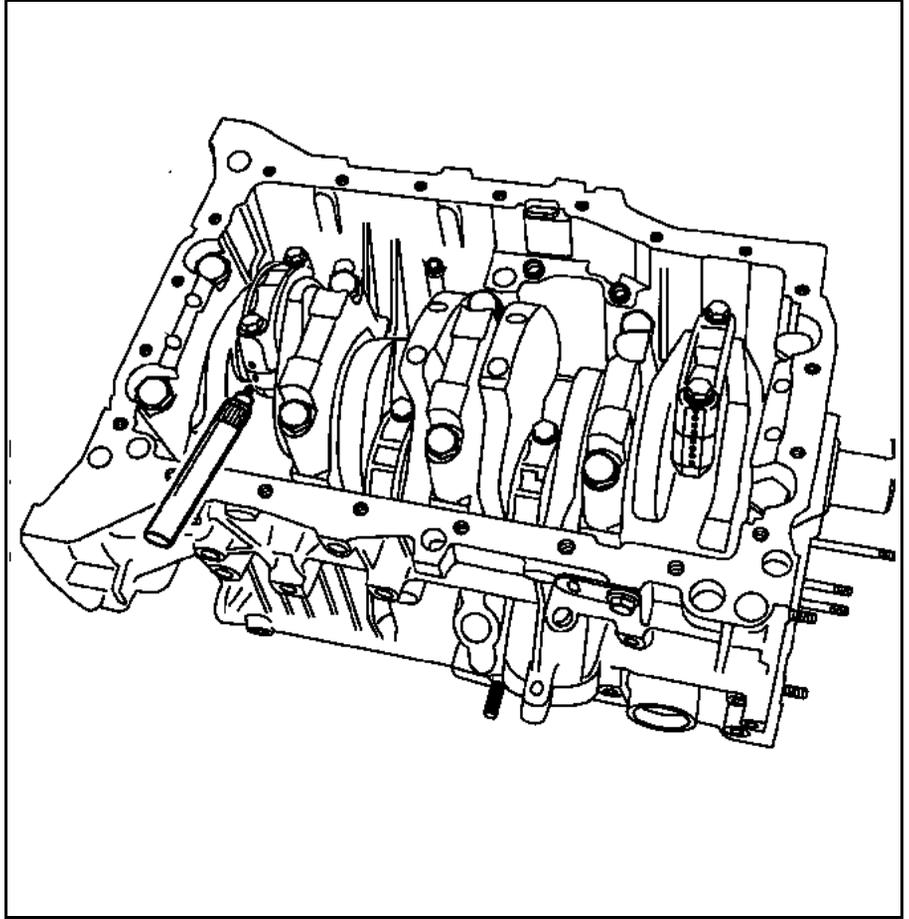
4 types of bolt marked as follows:

- : 17 bolts (M7 x 100-50).
- : 21 bolts (M6x100-16),
- ▲ : 1 bolt (M10x150-40),
- △ : 9 bolts (M10x150-75),
- ⊗ : bolt not used

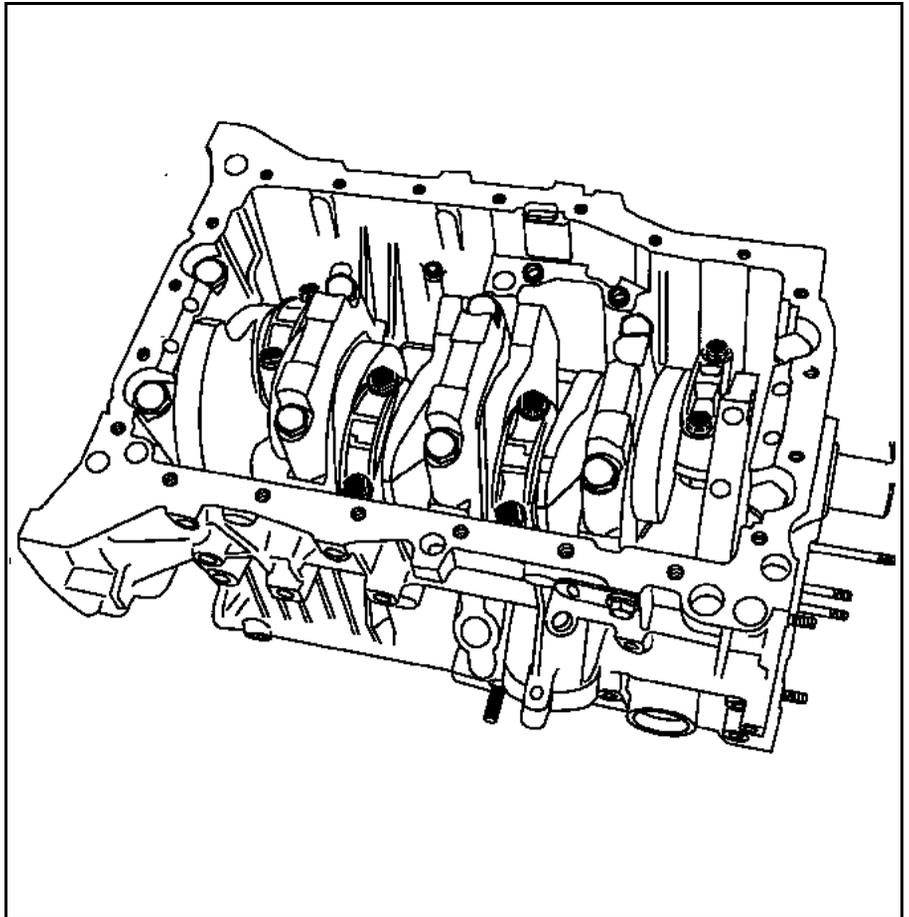
Mark the bearing caps according to their con rods:

- n° 1 flywheel end,
- relay shaft end.

WARNING: do not use a sharp point for marking as this could start a crack in the rods. Use an indelible marker pen.

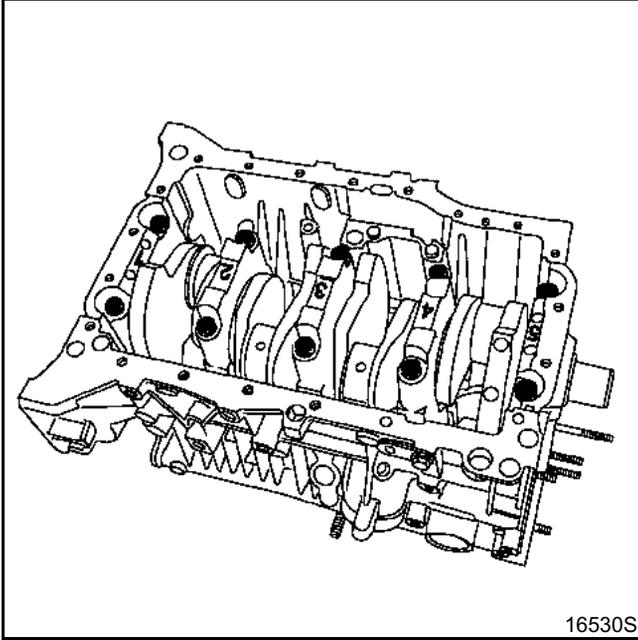


Remove the bearing caps and shells.



Extract the cylinder liners and pistons (mark them).

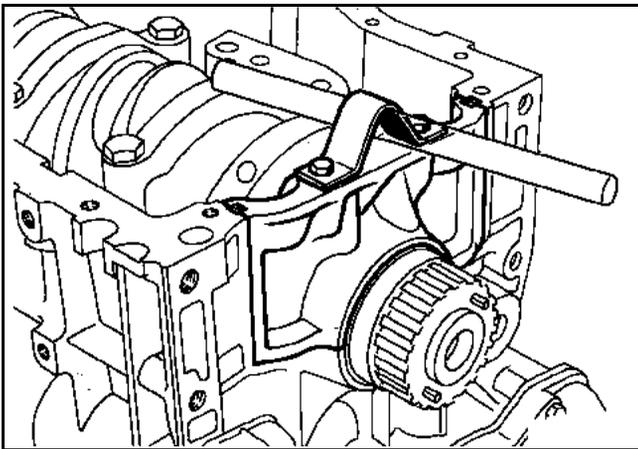
Mark the crankshaft bearing caps according to their housing and then remove them.



NOTE:

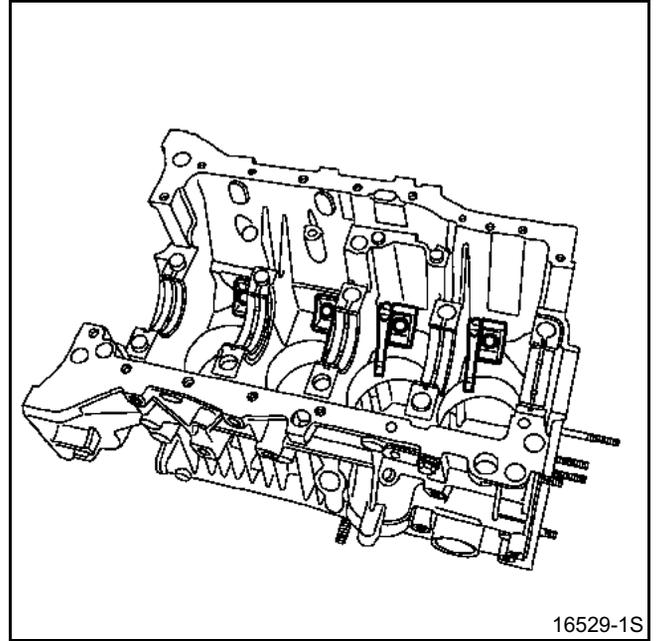
Extracting crankshaft bearings 1 and 5

To extract the silicone injected crankshaft bearings 1 and 5 use a locally manufactured metal tool of an approximate thickness of 2.5 mm.

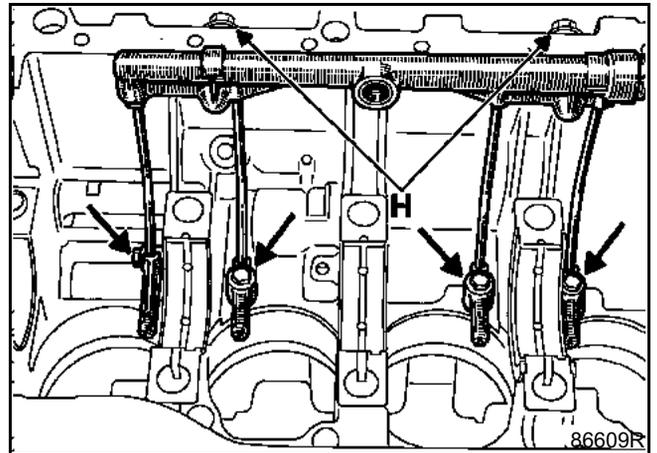


Remove:

- the crankshaft,
- the lateral play stops,
- the crankshaft bearing shells,
- the piston base cooling jets incorporated in the cylinder block.

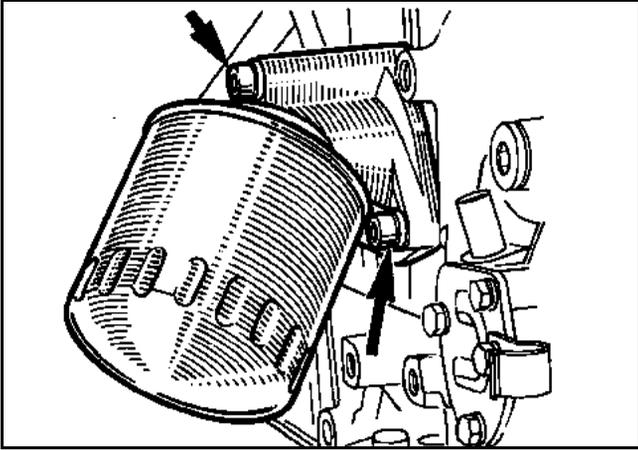


For engines fitted with a cooling gallery, remove the piston base cooling gallery.



REMINDER: never remove the mounting bolts (H) if the sump is not removed.

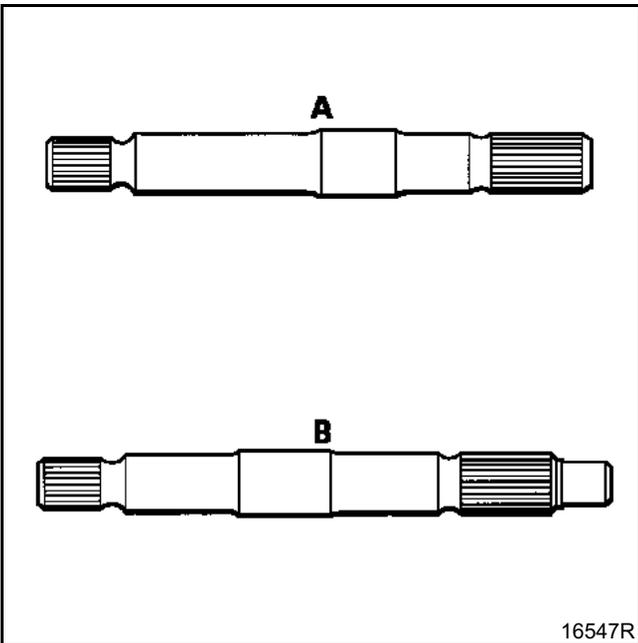
Remove the filter holder.



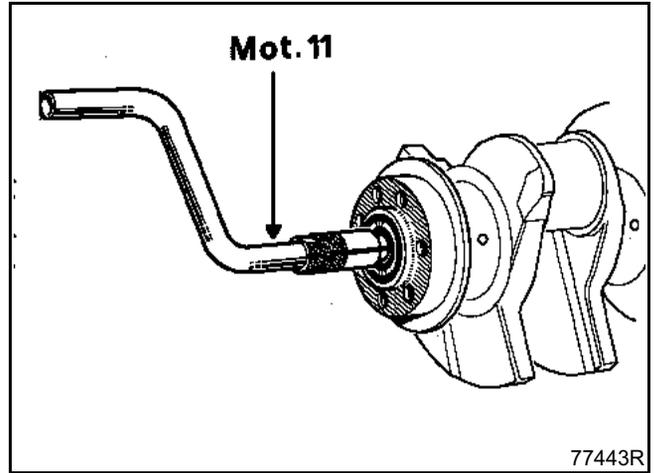
Replacing the bearing

NOTE: if the gearbox is fitted with a **short shaft (A)**, it does not need a bearing in the crankshaft.

If the gearbox is fitted with a **long shaft (B)** the crankshaft must be fitted with a bearing.

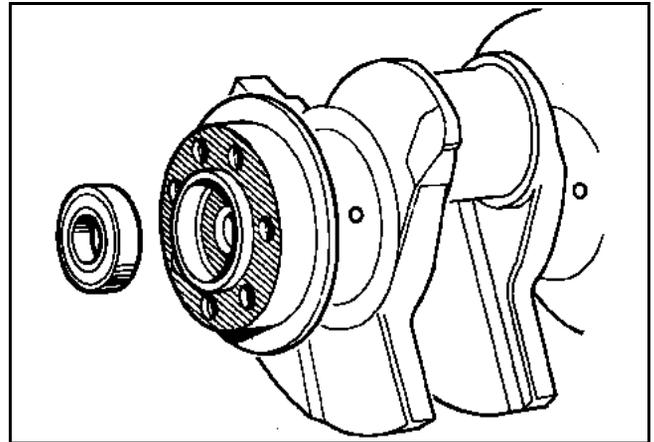


Remove the bearing using tool **Mot. 11**.



Refitting the bearing

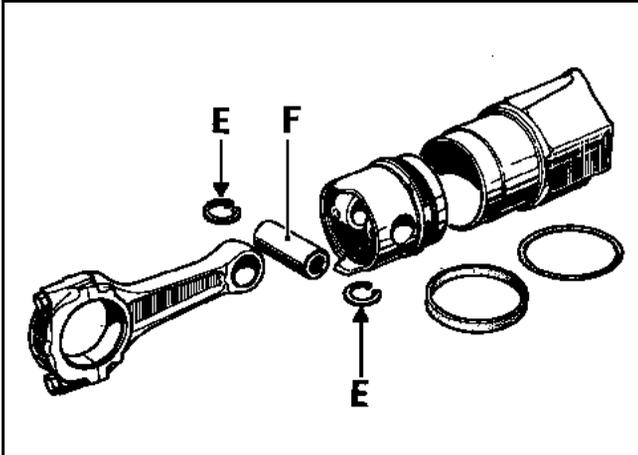
Cement the bearing with **loctite FRENBLOC** for engines fitted with flywheel mounting bolts that have no stop.



EXTRACTING THE CON RODS - PISTONS

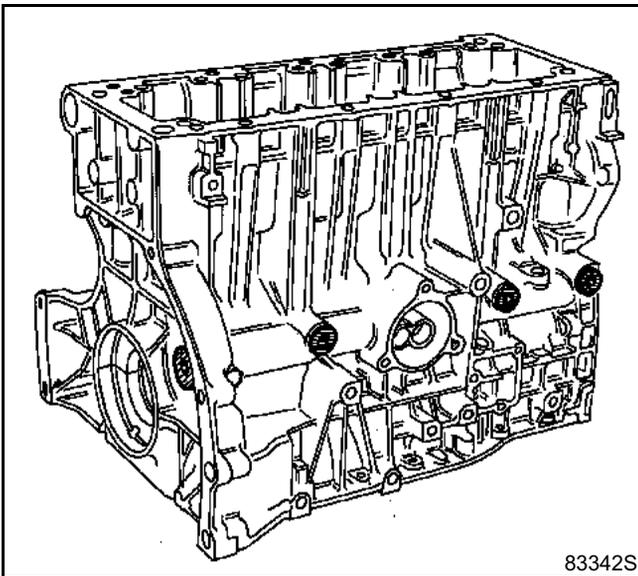
Remove:

- the rings using ring pliers,
- the circlips (E) retaining the gudgeon pin,
- the gudgeon pin (F).



CLEANING

Remove the threaded plugs in the lubricating pipes to clean the cylinder block.



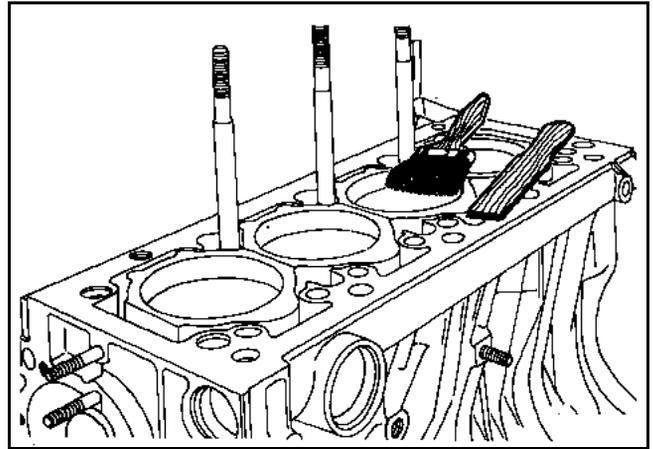
It is very important not to scratch the mating faces of any aluminium components.

Use the **Décapjoint** product to dissolve any part of the gasket which remains attached.

Apply the product to the parts to be cleaned; wait about ten minutes, then remove it using a wooden spatula.

Wear gloves whilst carrying out this operation.

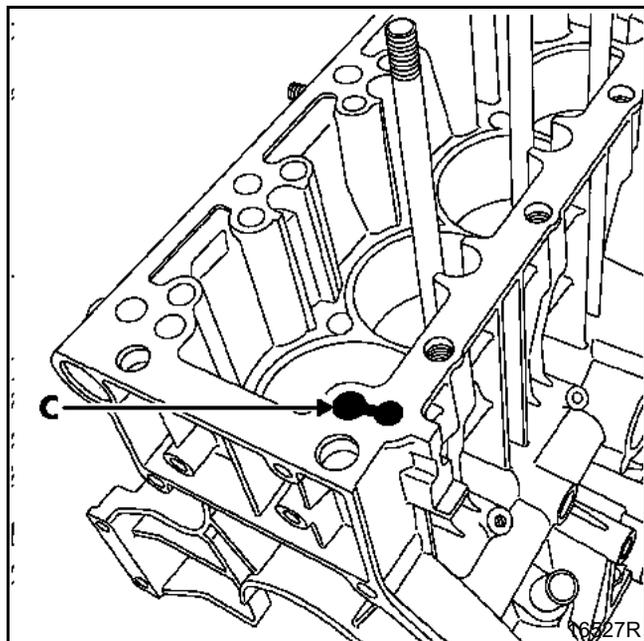
Do not allow this agent to drip on to the paintwork.



Your attention is drawn to the care which must be taken when carrying out this operation to prevent the introduction of foreign bodies into the pressurized oil feed pipes leading to the camshafts (pipes located both in the cylinder block and in the cylinder head).

Failure to follow to this advice could lead to blocking of the filter in the rocker arm rails or the jets and thus quickly cause damage to the cams and tappets.

Clean the cylinder head mounting holes, especially in the oil outlet duct (C).



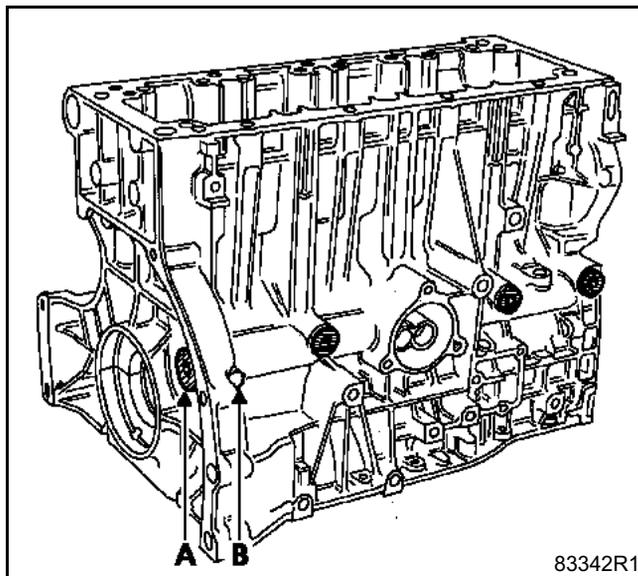
This is necessary in order to obtain the correct tightening of the bolts.

Also pass a wire through the crankshaft pipes.

REFITTING THE BOTTOM ENGINE

Replace the lubrication channel plugs, tightening them to:

- **8 daNm** for the plugs (A),
- **2 daNm** for the plugs (B) for bearing n° 1,
- **4 daNm** for the other plugs.



Check that the cylinder head mounting bolts can be screwed easily.

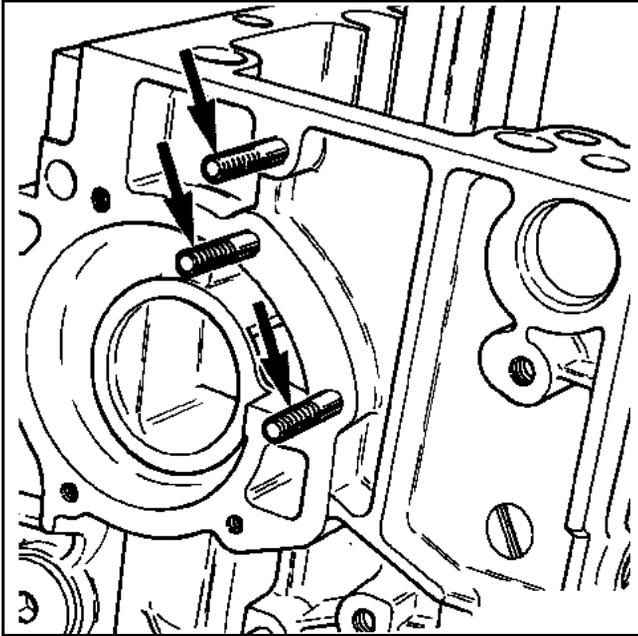
Screw and unscrew the bolts several times to clear the threads if necessary.

The cylinder head studs in the cylinder block must be fitted with **Loctite SCELBLOC**.

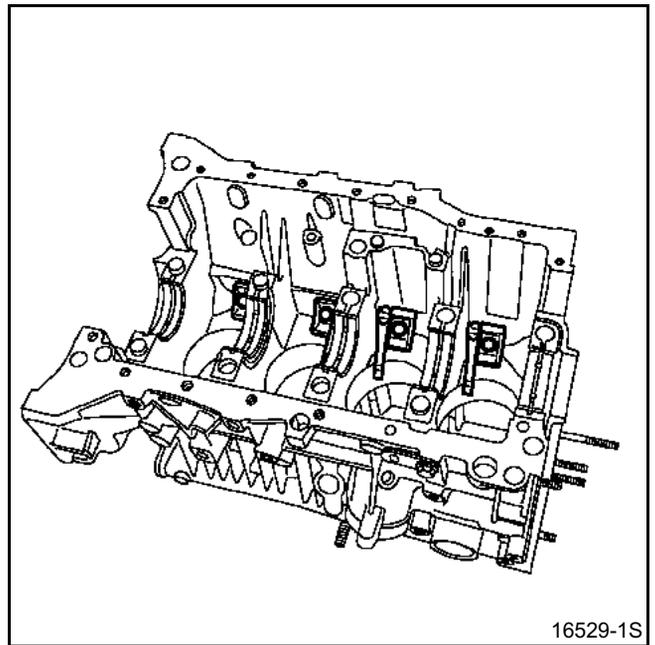
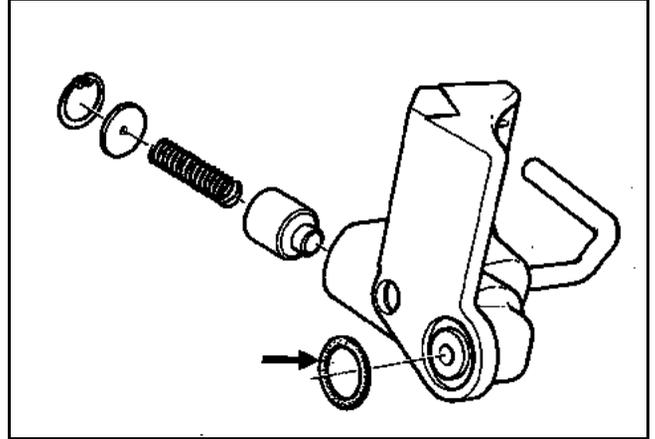
When fitting the dipstick guide tube, fit the collar to butt against the cylinder block.

If necessary, wind a cloth around the external diameter of the tube to make fitting easier and coat it with **Loctite SCELBLOC**.

Fit the various mounting studs. The water pump, cylinder block and timing belt studs need one or two drops of **Loctite FRENETANCH**, as their threads extend into the cooling system.

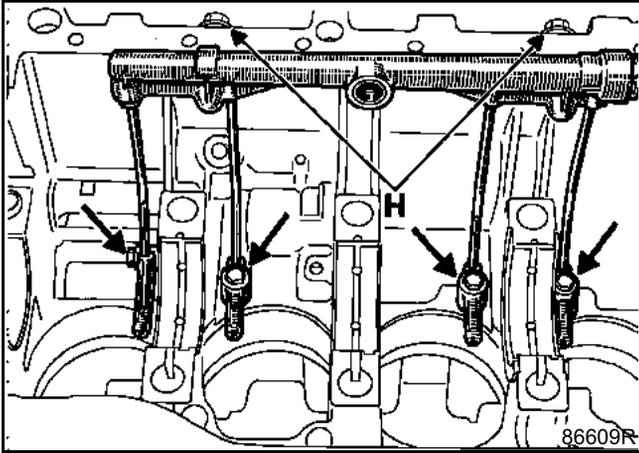


Replace the piston base cooling jets incorporated in the cylinder block and tighten to a torque of **1.2 to 1.4 daNm**. Check that the O-ring is present.



16529-1S

For engines fitted with a piston base cooling rail, the oil gallery mounting bolts (H) need a drop of **Loctite FRENETANCH**. Do not add more, as too much increases the risk of blocking the oil circulation around the mounting bolt.

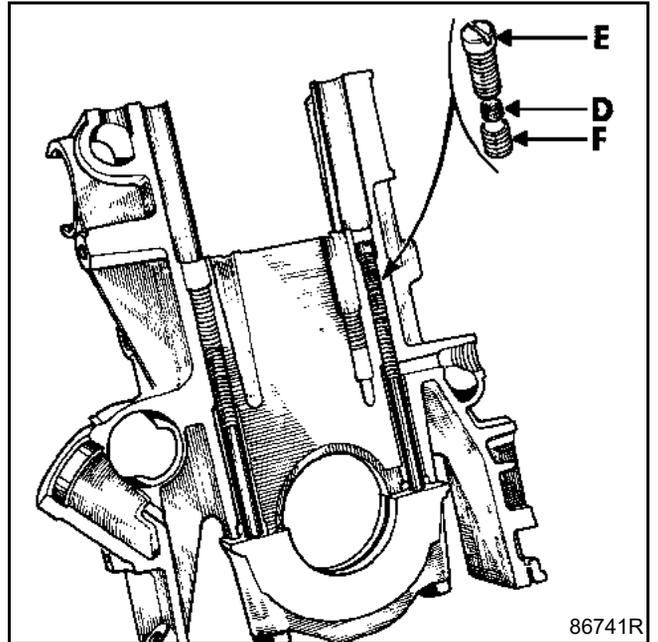


Engines 852 before n° 42 253

Check that seals (D) are present between the original bolts (E) and the bearing bolt, oil filter side of bearings 2, 3 and 4.

If the engine does not have these seals, fit a seal (D) and a cap (F) coated with **Loctite FRENETANCH** and secure tightly using a **6 mm Allen key (200 mm long)**.

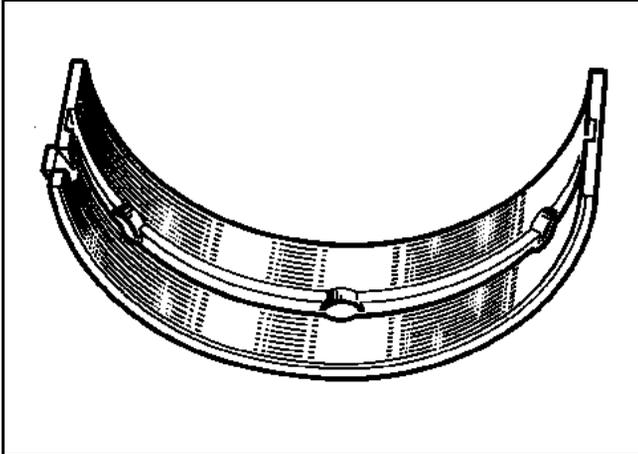
This is to prevent oil entering the cooling system.



Fitting the crankshaft bearing shells

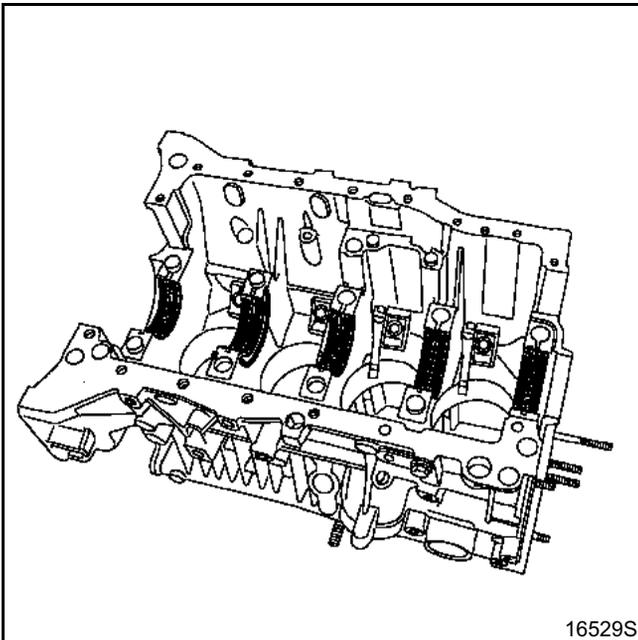
Identification

Only **grooved and pierced** crankshaft bearing shells are supplied as spares, whatever the crankshaft lubrication configuration.



Fit the shells on to the bearings and the cylinder block and oil them.

Fit the side shims for crankshaft n° 2 (grooves on the crankshaft side).

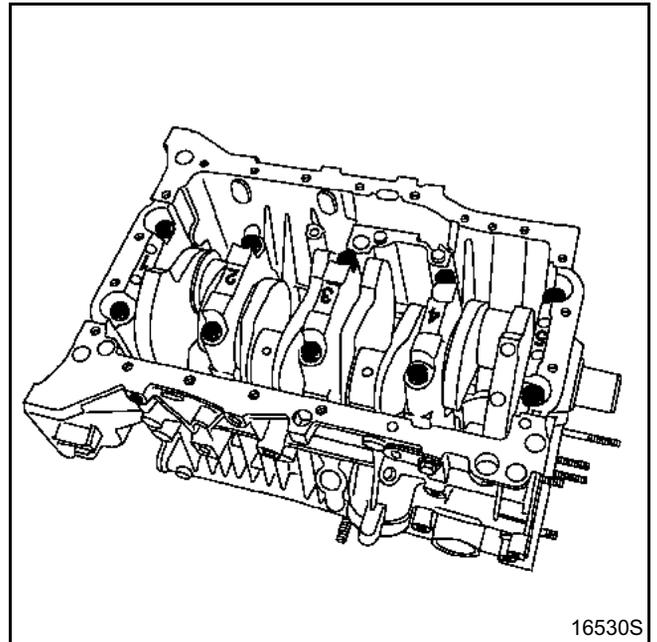


Grease the crankpins and bushings with engine oil.

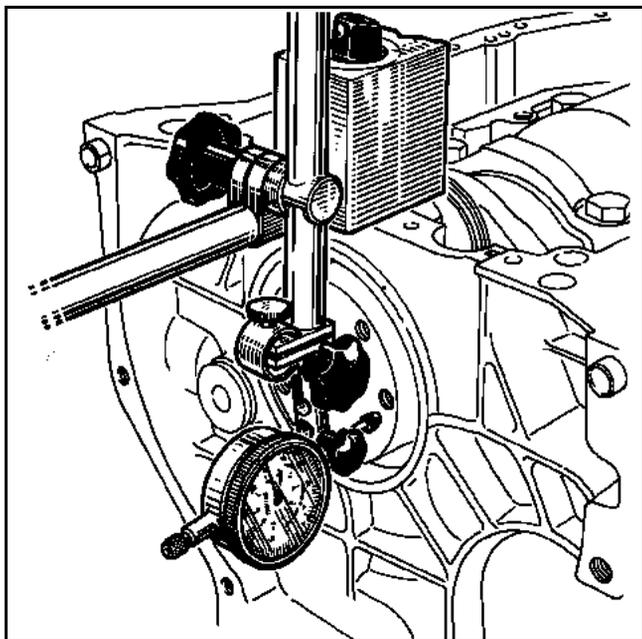
Refit:

- the crankshaft,
- the crankshaft bearing caps **except caps 1 and 5**.

Tightening torque: **8.75 to 9.75 daNm**



Temporarily fit bearing n° 1 with no lateral seals in order to fit the magnetic holder.



Checking end play (in mm):

852	J8S
0.07 to 0.25 (1) 0.20 to 0.30 (2)	0.20 to 0.30
(1) 1 st model: n° 1 to 32909 (2) 2 nd model: n° 32910 to ...	

Fitting the crankshaft bearings

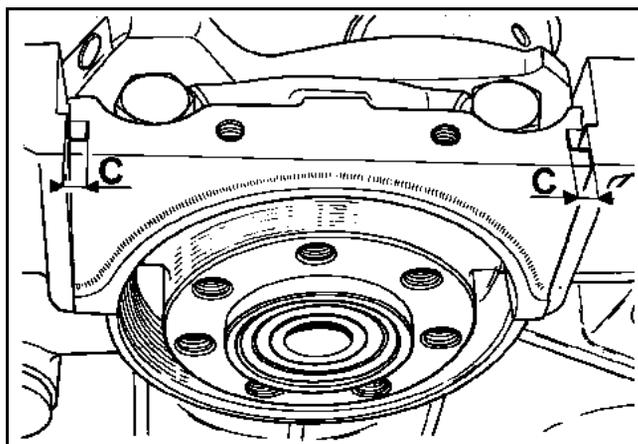
There are two ways to ensure that bearings 1 and 5 are properly sealed:

- 1 - Fit butyl rubber seals.
- 2 - Inject with silicone.

1 - Fitting butyl rubber seals

Position bearing caps 1 to 5.

Measure dimension (C) using a drill.

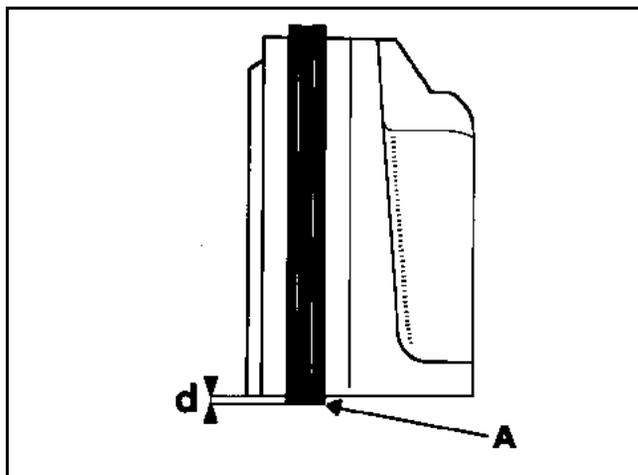


If the dimension (C) is less than or equal to **5 mm**, use a **5.1 mm** thick seal.

If the dimension (C) is greater than **5 mm**, use a colour marked **5.4 mm** thick seal.

Fit the lateral seals:

- seal groove pointing to the outside,
- protrusion **d = 0.2 mm** approximately on (A).



Apply a thin coating of **RHODORSEAL 5661** to the supports on bearings 1 and 5 without blocking the oil return on the sump seals.

Screw the \varnothing **12 mm** centering studs (G) (**span 1.50**) in to the cylinder block.

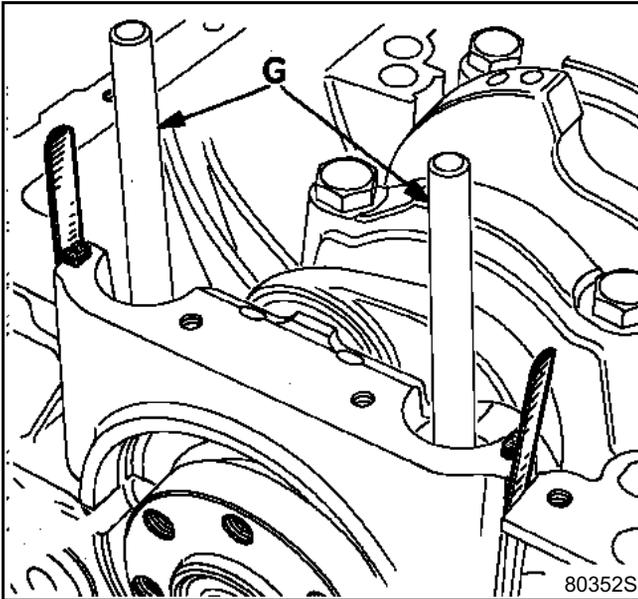
Fit the bearings.

Oil the two seals.

Use two steel shims placed either side of the bearing cap.

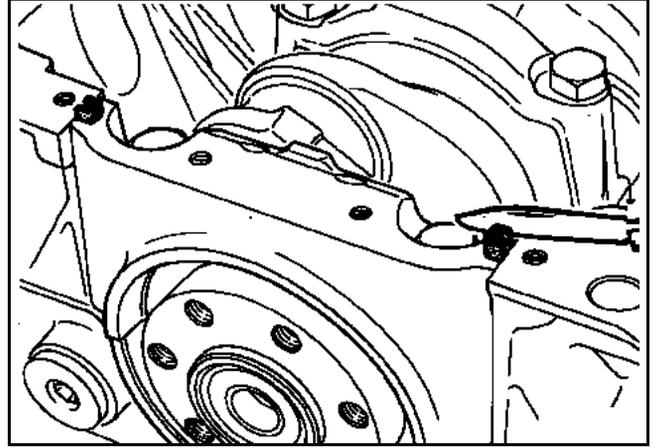
Lower the whole assembly.

When the bearing is almost in place, make sure that the side seals protrude slightly over the cylinder block on the pressure face side.



Remove the shims and the studs.

Cut the side seals so that they protrude **0.5 to 0.7 mm** in relation to the sump gasket face.



Check that the crankshaft rotates freely.

2 - Injecting with silicone.

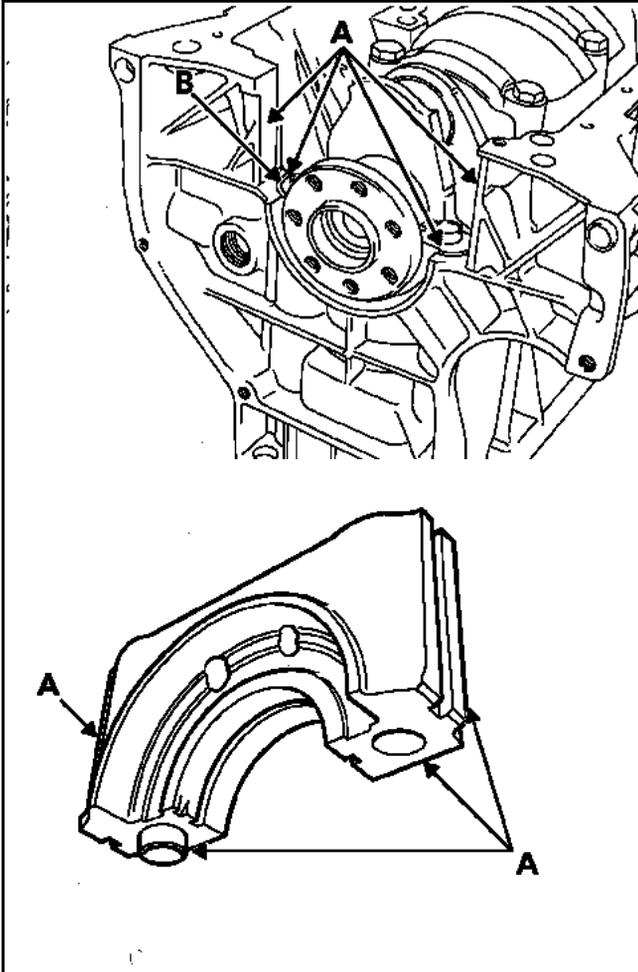
To carry out this operation you will need:

- a **50 ml** syringe
- a **5 ml** tube of hardener,
- a spatula for mixing,
- a user's guide.

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

Thoroughly clean the cylinder block and the bearing cap surfaces (A). Degrease using a cloth soaked in diluted cleaning agent.

Allow to dry.



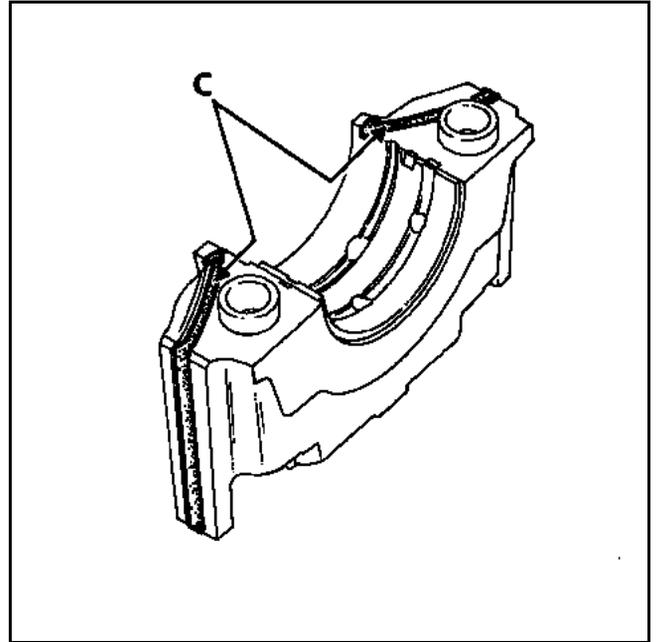
NOTE: older engines have grooves (B) in their cylinder blocks. Do not obstruct these oil grooves when applying **RHODORSEAL 5661**.

NOTE: New fitting (J engine)

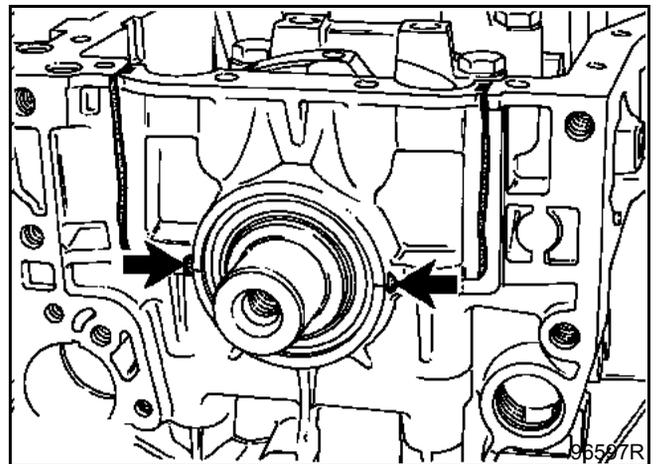
The bearing caps have watertight grooves (C).

Following modifications to the bearing caps:

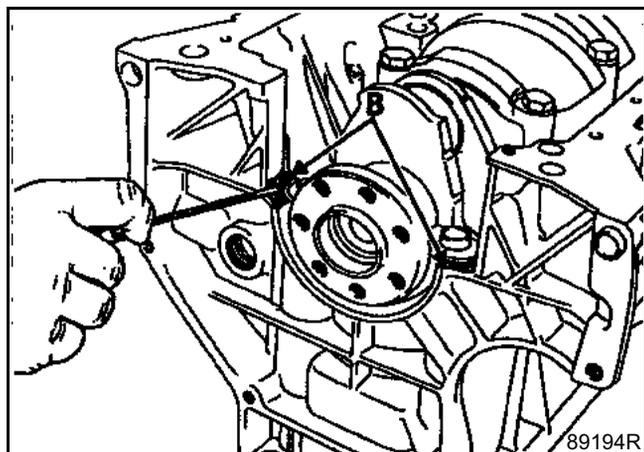
- do not coat the inner surfaces of the cylinder block,
- fit the crankshaft and timing seal(s) before injecting the silicone.



- let the silicone run out through the watertight grooves on the crankshaft bearing.

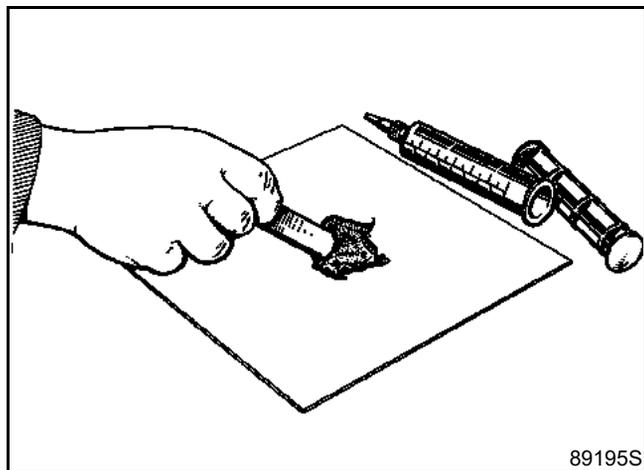


Lightly coat the inner surfaces of the cylinder block in (B) with **RHODORSEAL 5661** without obstructing the oil grooves.

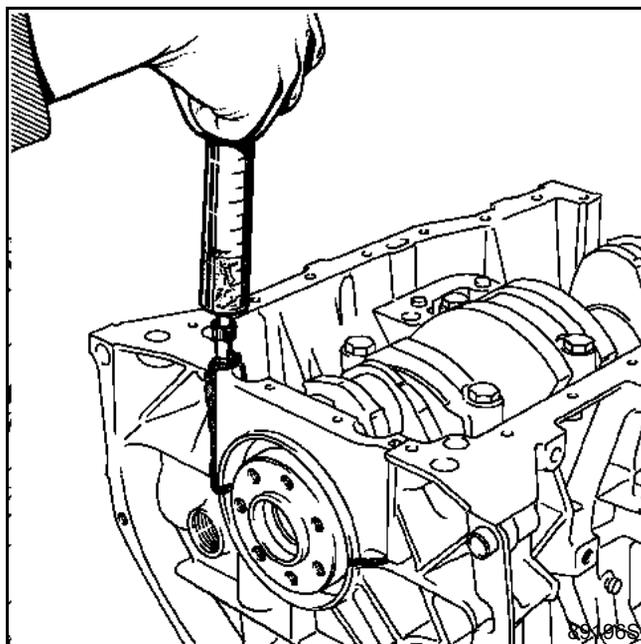


Fit the caps and tighten them to a torque of **8.75 to 9.75 daNm**.

Mix **45 ml** of **RHODORSEAL 5661** (approximately half a **100 g tube**) with half the tube of hardener. Stir with the spatula until the mixture forms a smooth, light pink paste.

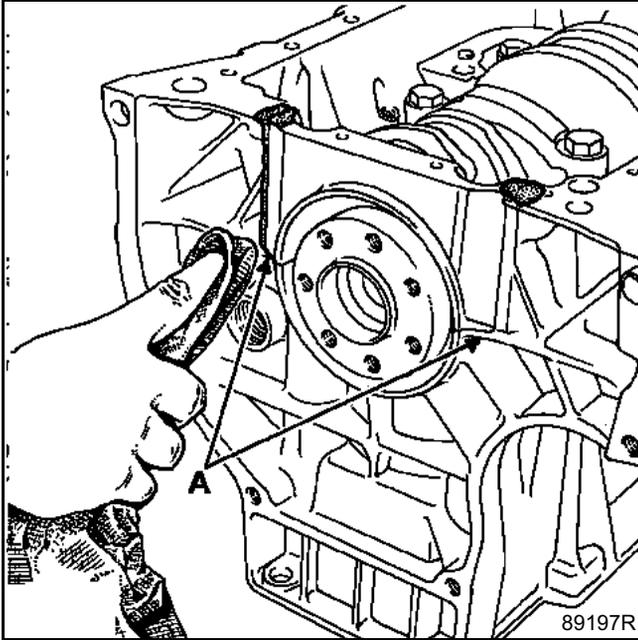


Insert the mixture into the syringe and inject it into the grooves of the crankshaft bearing cap.

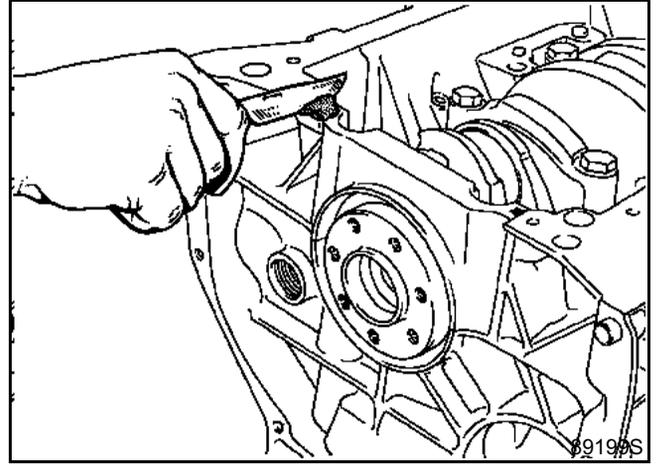


Let the paste run out slightly on either side of the grooves of the crankshaft bearing cap, to ensure that it has completely filled the sealing groove.

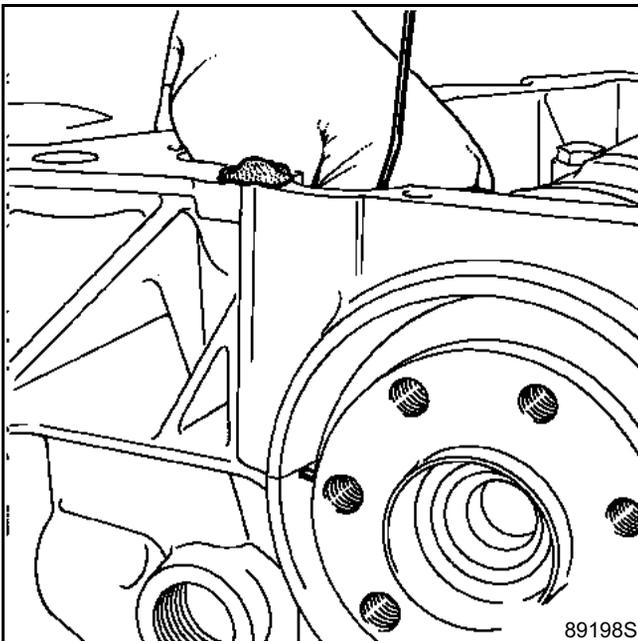
Use a cloth to wipe up any excess paste, both inside and outside the cylinder block, and at (A).



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



Pass a thin wire through the lubricating channels to check that they have not been blocked (this can also be done using a compressed air gun).



REFITTING AND ASSEMBLING PISTON CON RODS

Go to the **cylinder liner-piston** replacement section. The parts in the **cylinder liner-piston** section are identical to those used for this operation.

Mark the parts in each box from A to D to ensure they remain identical.

Completely dissolve the non-stick film **without scratching the parts**.

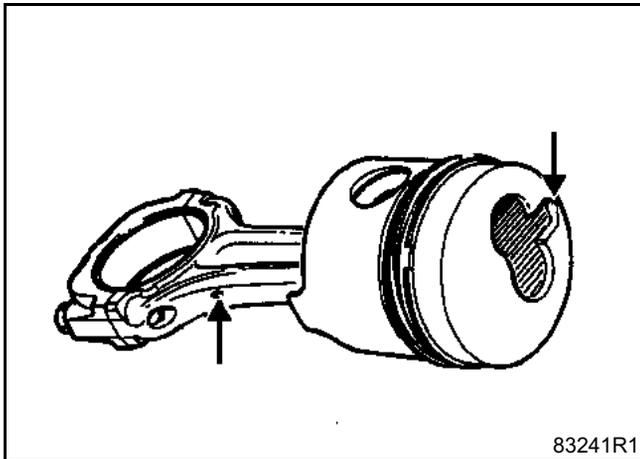
Oil the gudgeon pin.

Check that the gudgeon pins rotate properly in the new piston and the corresponding con rod.

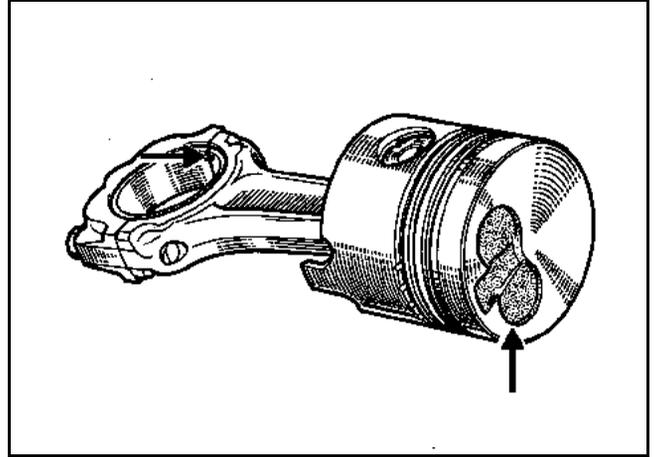
Some con rods are pierced to allow an oil jet to pass through; ensure that these are not blocked.

Ensure that the piston and con rod are fitted the right way round:

Normally aspirated engine



Turbo engine

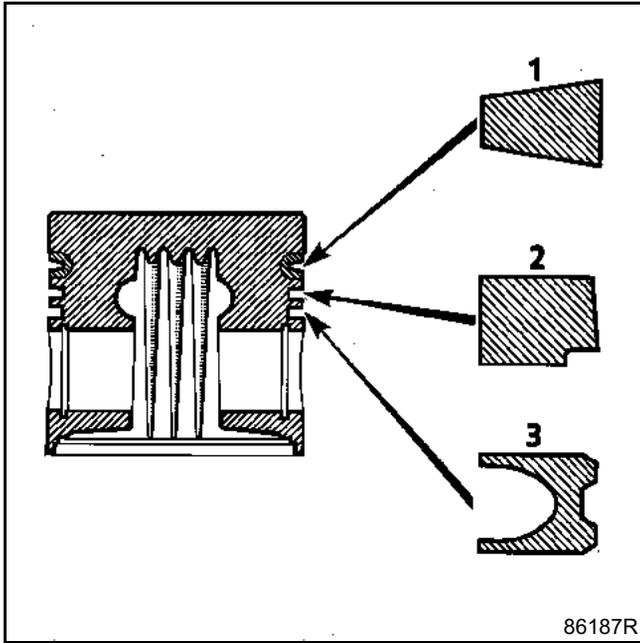


Fit the con rod bearing shells.

FITTING THE PISTON RINGS

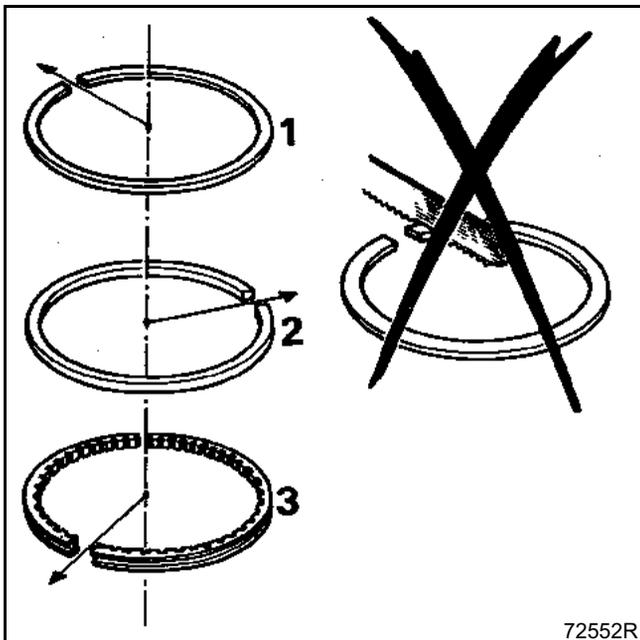
Rings set to their original adjustment must be free in their channels.

Ensure the rings are fitted in the correct orientation.



86187R

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



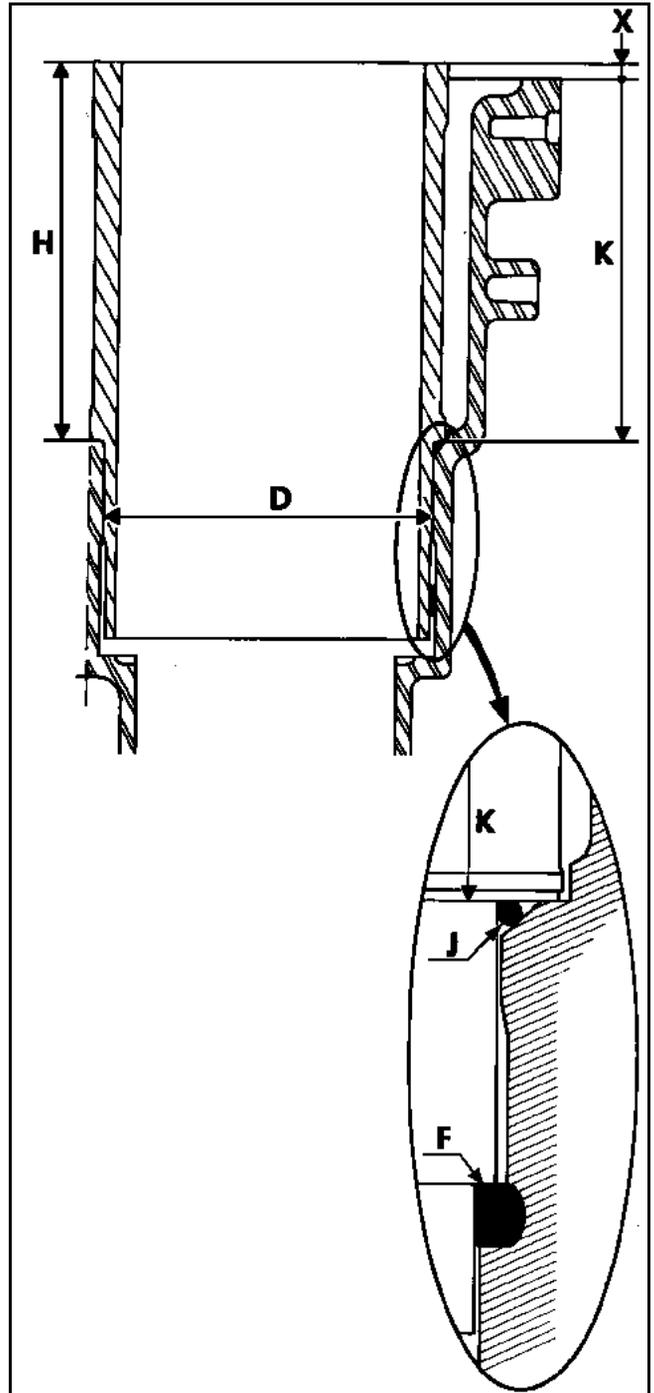
72552R

CHECKING CYLINDER LINER PROTRUSION

This engine is fitted with cylinder liner base O-rings (J) and cylinder liner shaft seals (F).

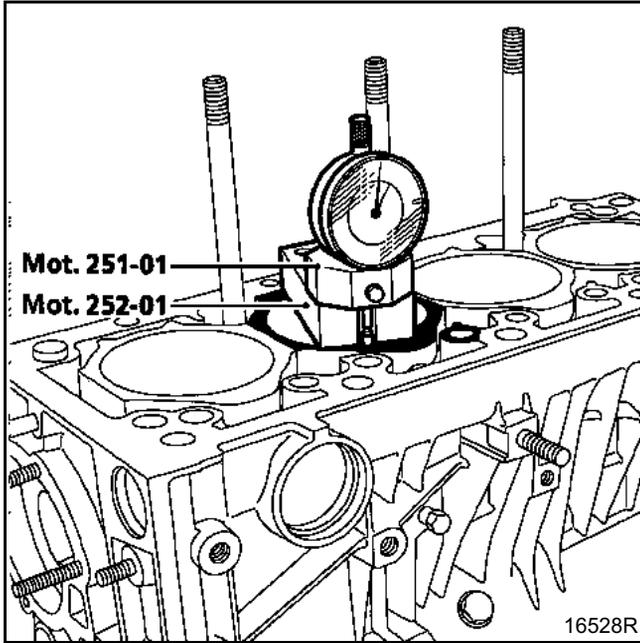
The seals only maintain tightness

The cylinder liner is directly supported by the cylinder block and the cylinder liner protrusion (X) is assured by the manufactured dimensions.



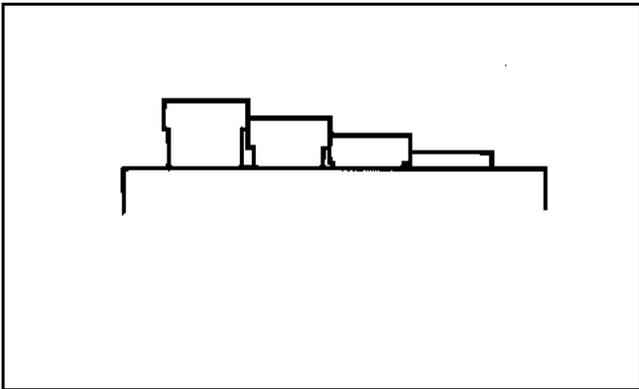
Therefore, the protrusion (X) should be checked in the following way:

- place the cylinder liner **not fitted with seals**, in the cylinder block,
- check protrusion (X) using tools **Mot. 251-01** and **Mot. 252-01**. It should be between **0.07** and **0.13 mm**.



Position the cylinder liners so that:

- the protrusion is graduated from cylinder n° 1 to cylinder n° 4 (or vice versa),
- the difference in protrusion between two neighbouring cylinders is no more than **0.04 mm** (in tolerance).



NOTE: the parts supplied in the cylinder liner-piston operation kit are identical to those used for this operation. Mark the parts in each box from A to D to ensure they remain identical.

Once the correct protrusion has been obtained, reassemble groups A, B, C and D with the cylinder liners, pistons and gudgeon pins and mark their position in the cylinder block.

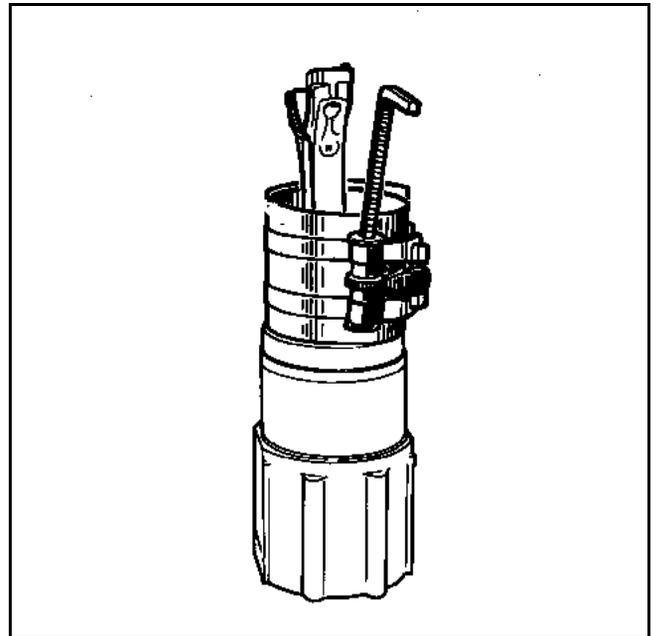
NOTE: If the protrusion is incorrect, check using a new cylinder liner set to find out whether the cylinder block or the cylinder liner is at fault.

REFITTING CYLINDER LINERS - PISTONS - CON RODS

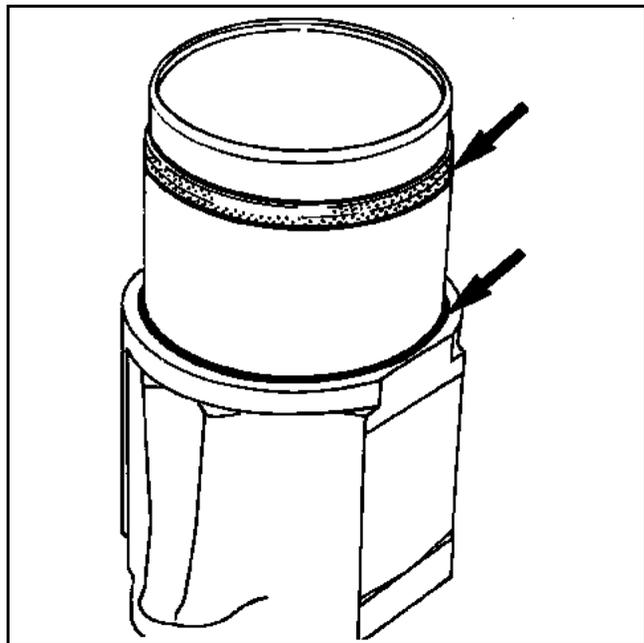
Oil the pistons.

Fit the piston-con rod assemblies into the cylinder liners with the tool, paying attention to the direction (**the V towards the flywheel**).

The big end surfaces must be parallel with the flat bottom of the cylinder liner.



Before fitting the **cylinder liners-pistons-con rods** assemblies in the cylinder blocks, **don't forget to place an O-ring on each cylinder liner**, making sure that it is not twisted, **as well as a shaft seal.**

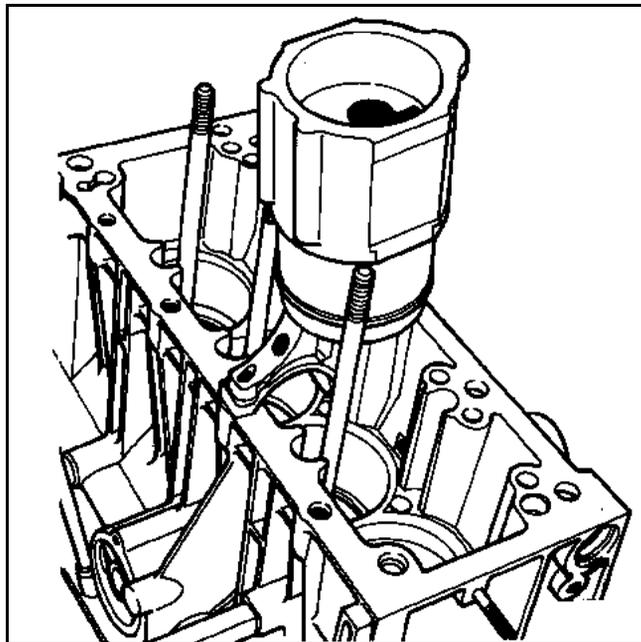


Fit the **cylinder liners-pistons-con rods** assemblies in the cylinder block, making sure they are in the right positions.

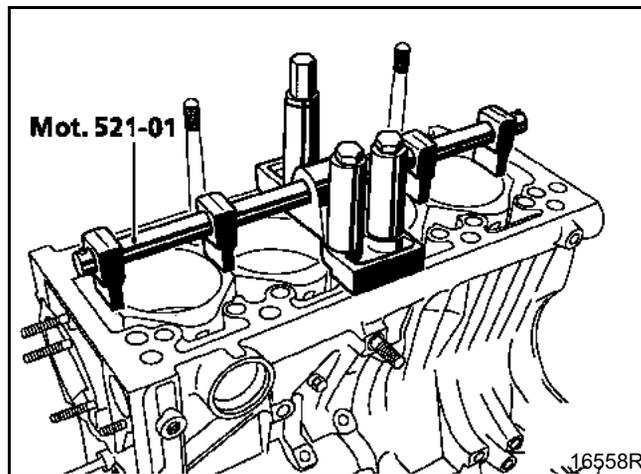
The cylinder liner flat surfaces need to be parallel.

The piston combustion cut-out should be pointing towards the relay shaft side.

If the con rod is pierced, point the oil jet towards the end opposite the relay shaft.



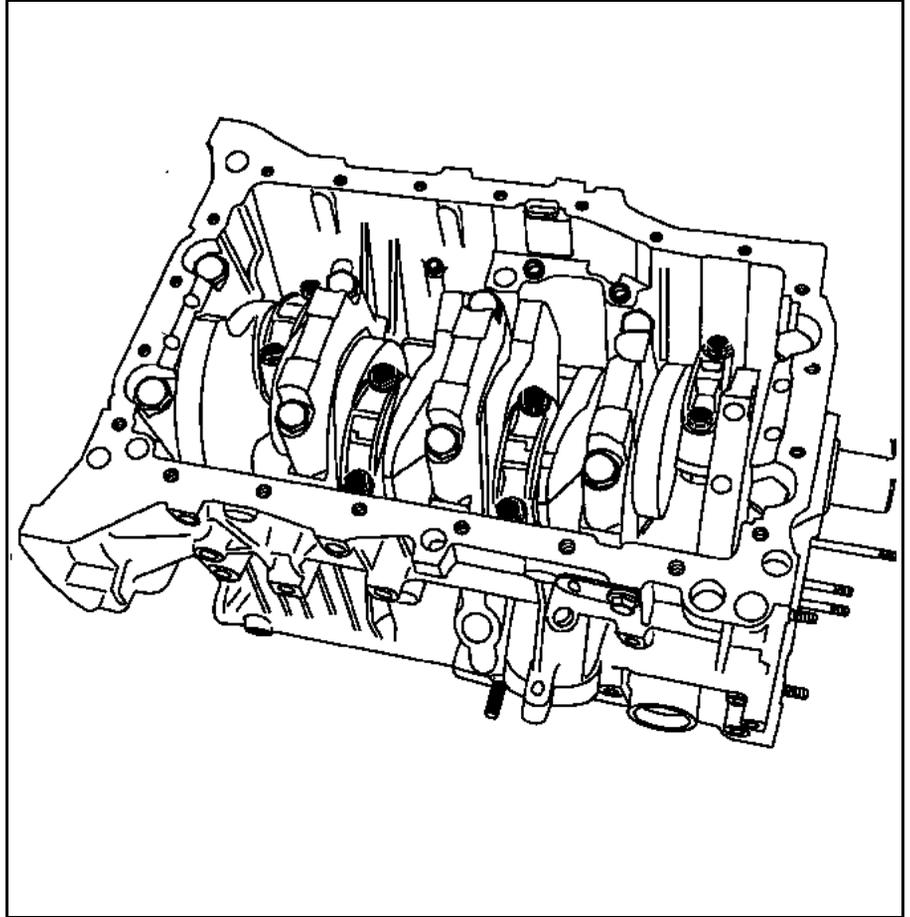
Fit the cylinder liner retaining flange **Mot. 521-01** and tighten the bolts and mounting nuts to **5 daNm**.



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

Fit the con rod bearings caps with their shells, observing the pairing with the con rods.

Fit and tighten the new con rod bearing bolts to a torque of **6.5 daNm**.



Check that the mobile assembly can rotate freely.

CHECKING PISTON PROTRUSION

Clean the piston heads.

Turn the crankshaft once clockwise at the timing end to bring piston n° 1 near to top dead centre.

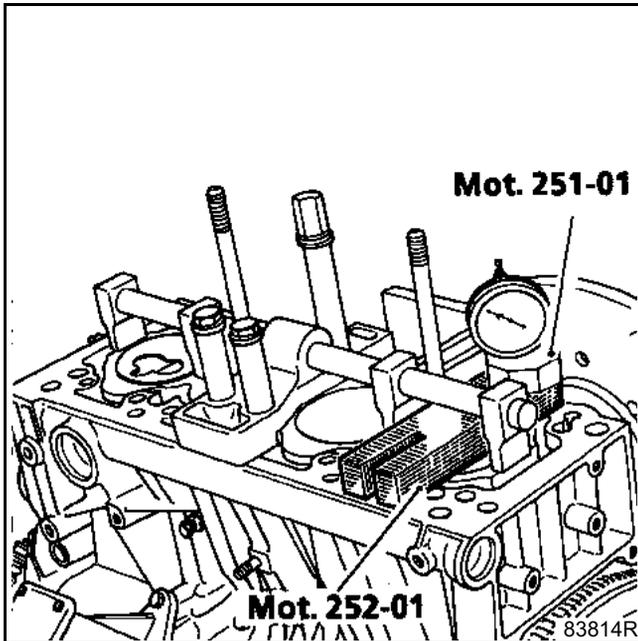
Place tool **Mot. 252-01** on the piston.

Place tool **Mot. 251-01** fitted with a gauge on the thrust plate **Mot. 252-01**, the dial gauge measuring pin being in contact with the cylinder block, and look for the TDC of the piston (turn the crankshaft clockwise at the timing end).

Without putting pressure on the tools or the piston, to avoid tilting of the piston during measurement, measure the protrusion when the piston is in position **1**, then in position **2** and calculate the average of the two measurements.

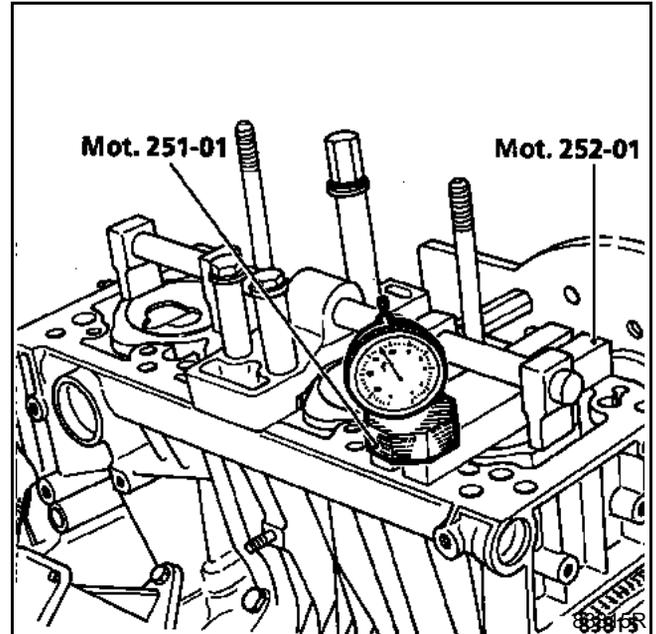
Example:
Protrusion in position 1: 0.83 mm.

Position 1



Example:
Protrusion in position 2: 1.09 mm.

Position 2



Calculate the average piston protrusion:

$$(0.83 + 1.09) : 2 = 0.96 \text{ mm}$$

Carry out this procedure for the other pistons (look for the TDC by turning the crankshaft clockwise at the timing end, do not put pressure on tools **Mot. 251-01**, and **Mot. 252-01** or on the piston).

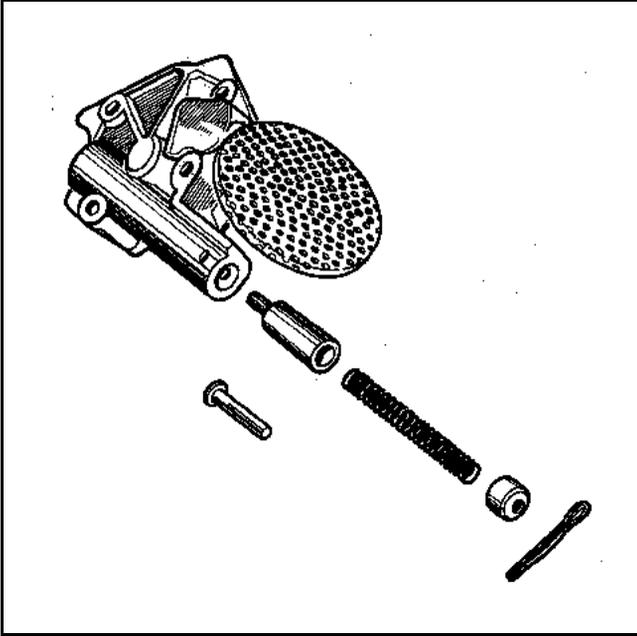
ONLY CONSIDER THE DIMENSIONS OF THE PISTON WITH THE GREATEST PROTRUSION

For a protrusion:

- less than **0.96 mm** use a cylinder head gasket **1.6 mm** thick, marked with **1.6** or **1 hole**,
- between **0.96** and **1.04 mm**, use a cylinder head gasket **1.7 mm** thick, without a stamped mark or a hole,
- more than **1.04 mm** use a cylinder head gasket **1.8 mm** thick, marked with **1.8** or **2 holes**.

Assessment and repair of the oil pump

Removing the valve

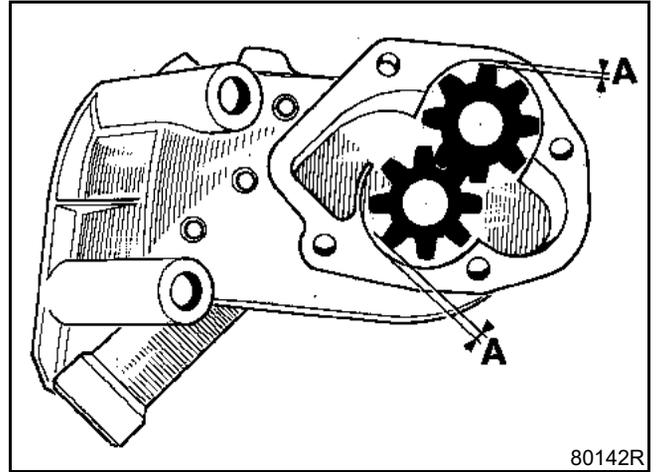


Checking the oil pump

Check the clearances:

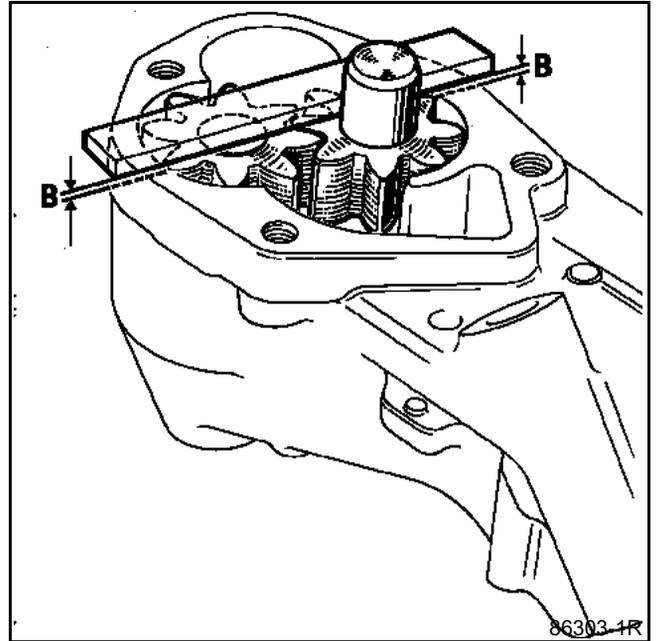
Clearance A

- minimum (in mm) 0.05
- maximum (in mm) 0.12



Clearance B

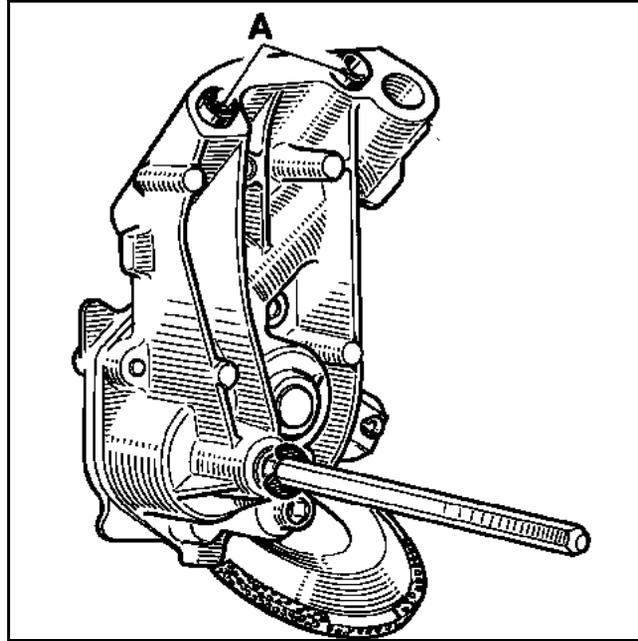
- minimum (mm) 0.02
- maximum (mm) 0.10



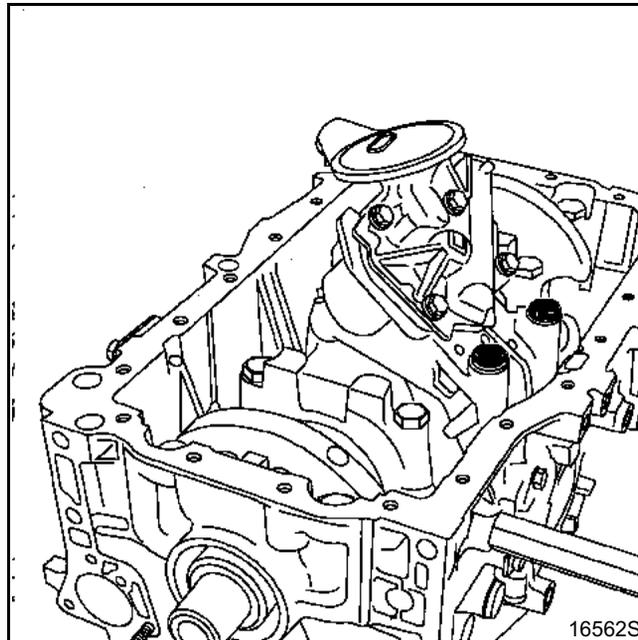
Refitting the oil pump

Refit the oil pump control shaft, circlip on the oil pump side.

Check for the presence of the two centring pins (A).



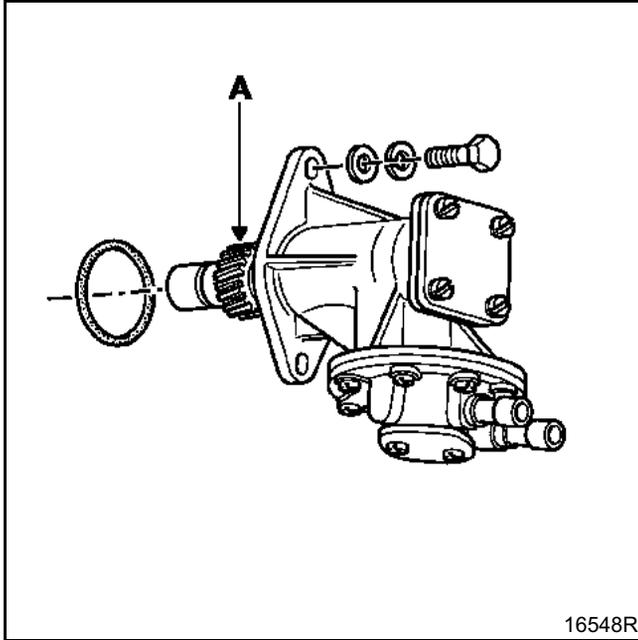
Refit the oil pump and tighten to a torque of **4 daNm**.



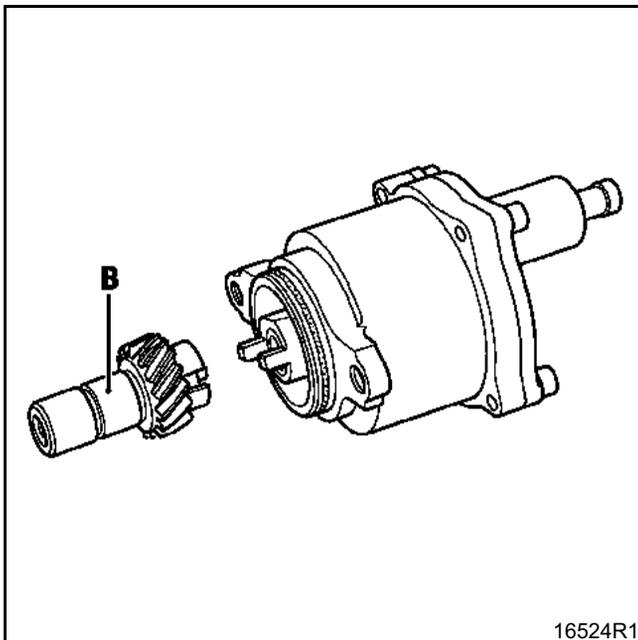
Refitting the relay shaft

Refit the vacuum pump.

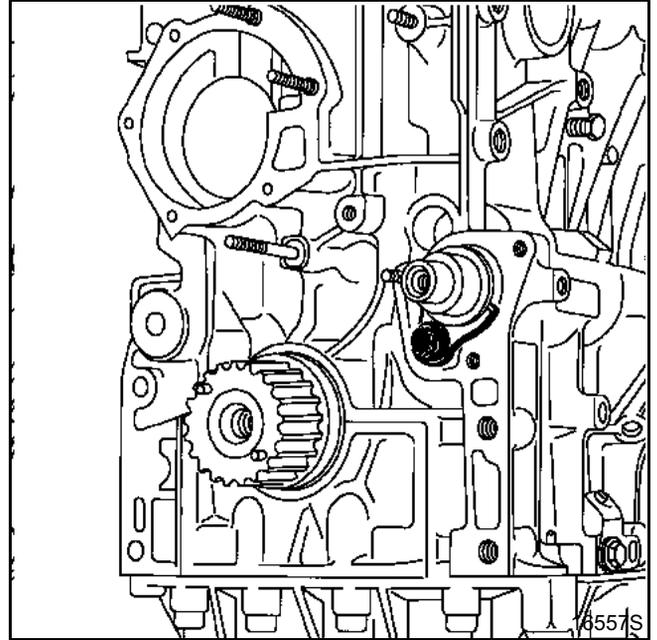
On **APG** pumps, the pinion (A) is force fitted.



On the **BARMAG** pumps, the pinion (B) is not fixed to the pump. Refit the relay shaft before refitting the pinion (B).

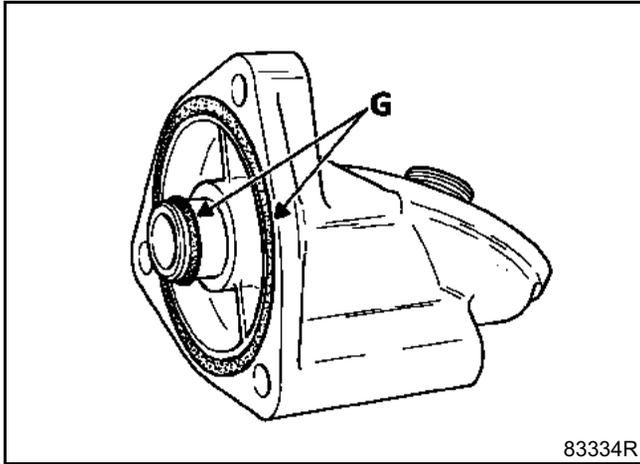


Oil and fit the relay shaft, tightening the clamp bolts to a torque of **1 daNm**.



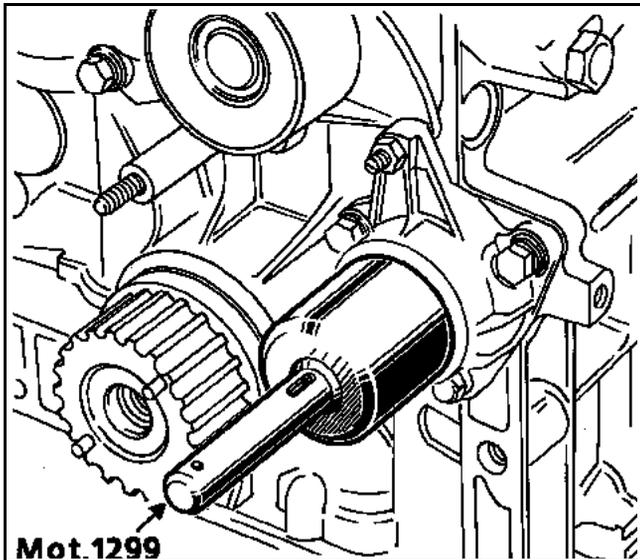
Refitting the oil filter holder

Replace the O-rings (G) when refitting.



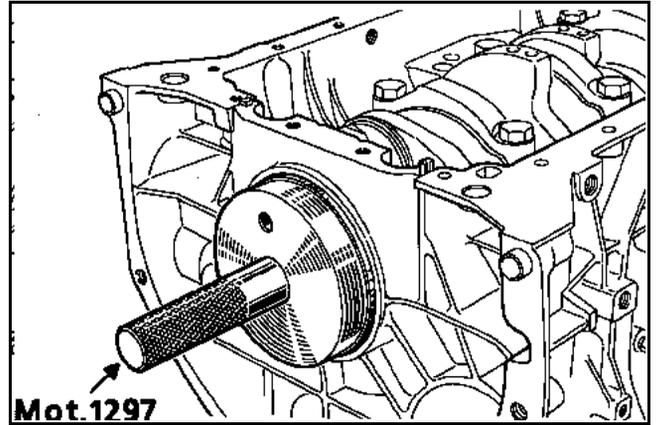
Fitting the relay shaft seal

Push the seal in until tool **Mot. 1299** butts up against the holder.

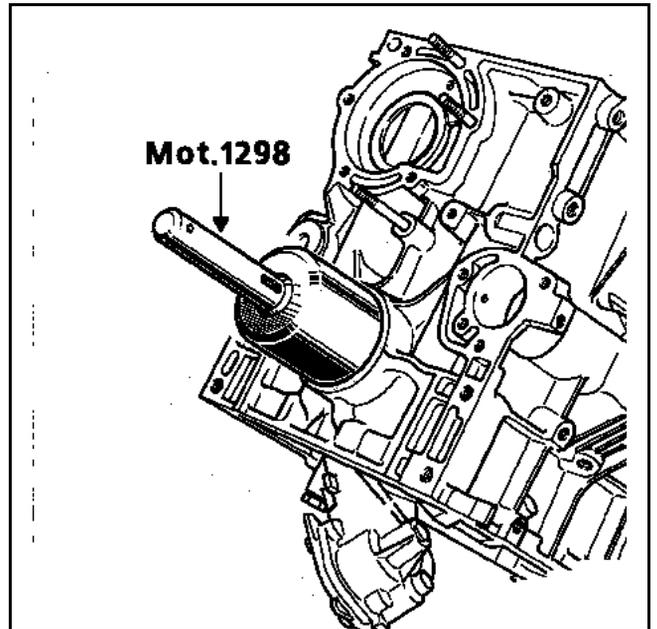


Fitting the crankshaft seals

– flywheel side, **Mot. 1297**.



– timing side, **Mot. 1298**.



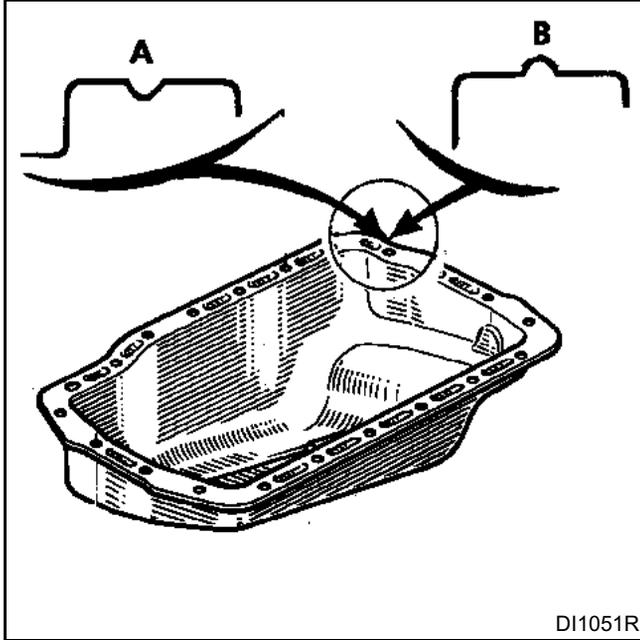
If the seal lip marks the crankshaft mating face, a **1.5 mm** thick washer must be placed between the seal and the tool to shift the mating face.

Refitting the sump

Metal sump

1st model:

Fit a cork or rubber gasket.



DI1051R

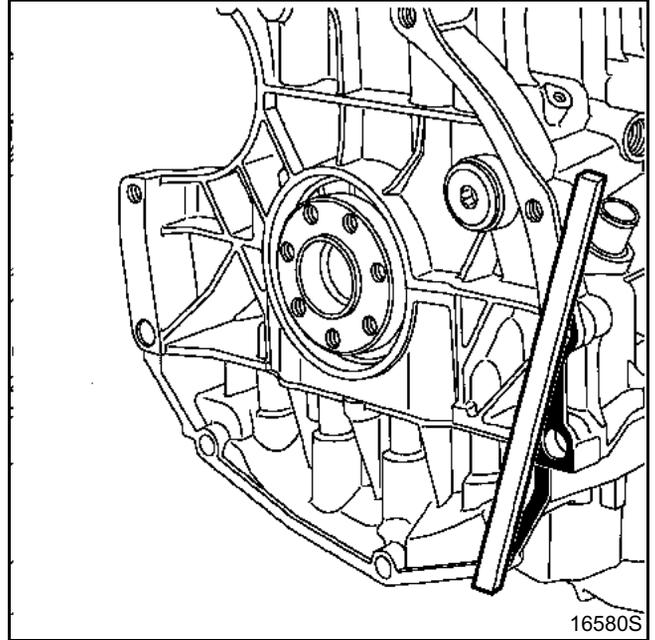
- A 1st model
- B 2nd model

2nd model:

Only fit a rubber gasket.

Aluminium sump

Fit a rubber gasket. The alignment of the cylinder block and the sump must be respected (flywheel side) to prevent the clutch housing from being damaged when the gearbox is fitted to the engine.



16580S

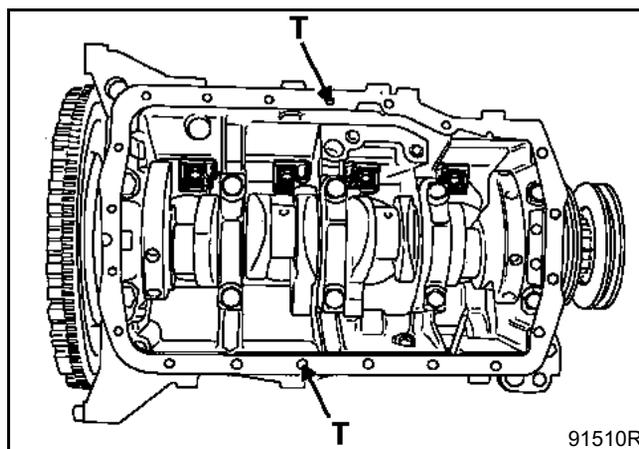
The sump is refitted with a new gasket and tightened to a torque of **1.4 to 1.7 daNm**.

For engine sump with reinforcing plate

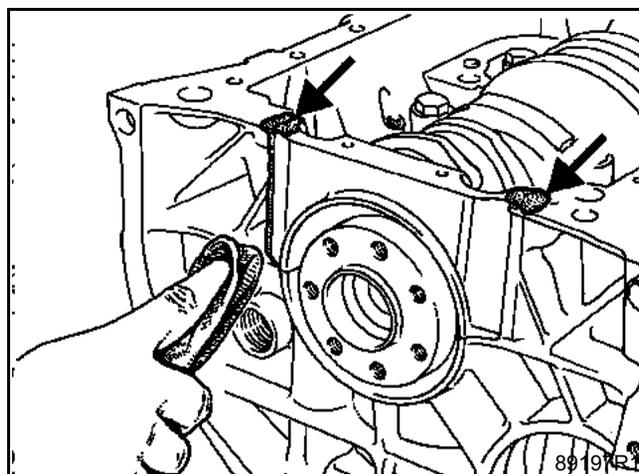
Refitting

Remove all traces of grease from the cylinder block and the reinforcing plate with brake cleaner (for example).

Fit two threaded rods (T) \varnothing 7 length 30 mm and cut a groove at the end of one rod with a hacksaw.

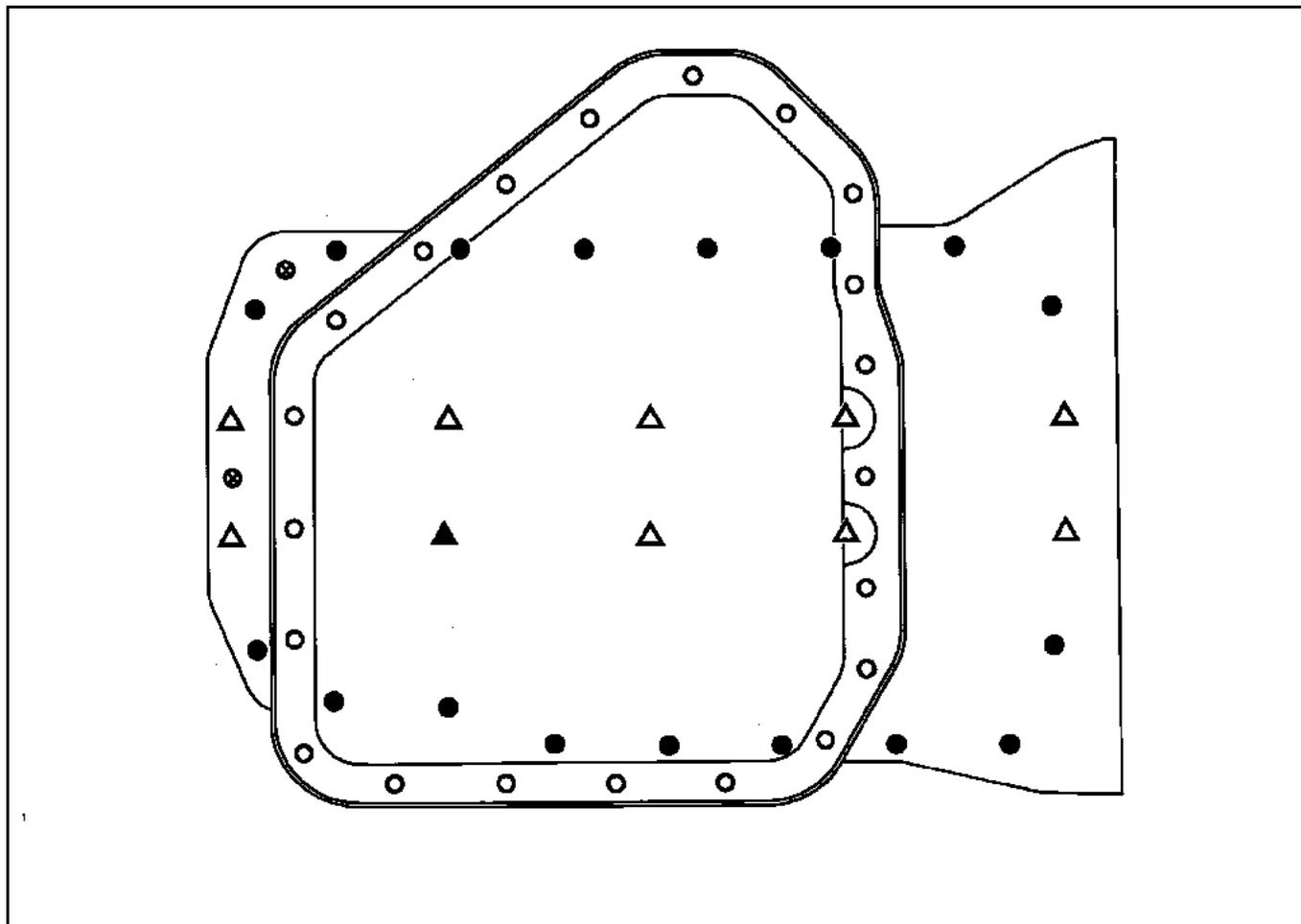


Put a blob of **RHODORSEAL 5661** where bearing caps 1 and 5 are joined to the cylinder block. Do not do this if the injection was done using butyl seals.



Position the oil pump control shaft, circlip on the oil pump side.

Marking of the bolts fitting the plate to the cylinder block plate and the sump to the plate.



NOTE: the plate gasket is fitted dry.

Four types of bolt marked as follows:

- : 17 bolts (M7 x 100-50), tightening torque: 1.2 to 1.8 daNm
- : 21 bolts (M6x100-16), tightening torque: 0.7 to 1.1 daNm
- ▲ : 1 bolt (M10x150-40), tightening torque: 3.2 to 4.8 daNm
- △ : 9 bolts (M10x150-75), tightening torque: 3.2 to 4.8 daNm
- ⊗ : bolt not used

Fit and tighten the oil pump body (**4 to 4.5 daNm**).
(Ensure that the drive shaft and pinions are correctly positioned).

Remove the threaded centring rods and fit the bolts.

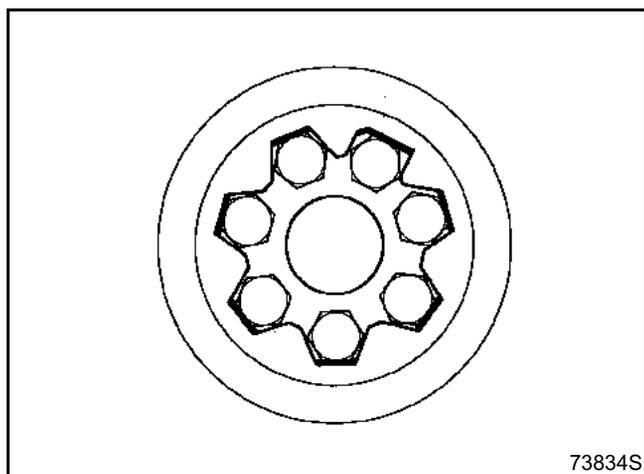
Fitting the flywheel

Use **Loctite AUTOFORM** to coat the flywheel bearing face on the crankshaft

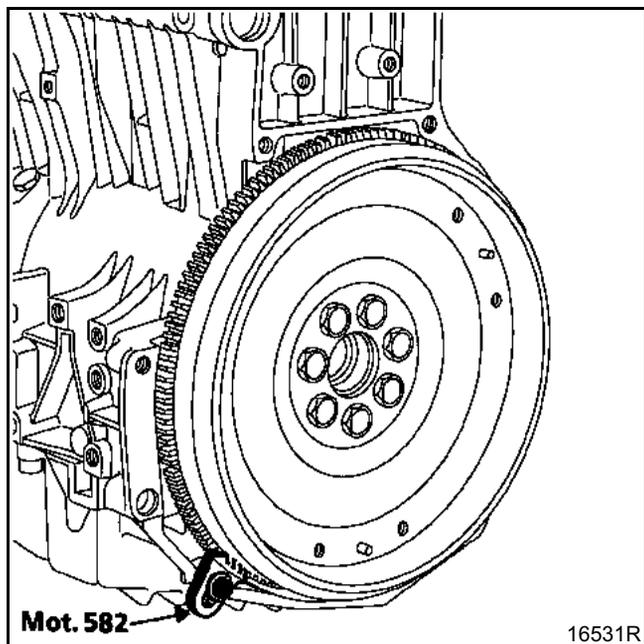
Fit the flywheel.

Place a drop of **Loctite FRENETANCH** on the new bolts.

Replace the flywheel bolt stop if there is one fitted.



Lock off the flywheel using locking tool **Mot. 582** and tighten the bolts to a torque of **6 to 6.5 daNm**.



Close the stop, if there is one fitted on the flywheel.

Refit:

- the clutch, tightening it to a torque of **2 daNm**.
- the timing tensioner roller,
- the coolant pump and the coolant return pipe on the cylinder block. The water pump should be fitted with a new seal and tightened to a torque of **1.3 daNm**.
- the crankshaft timing sprocket,
- the relay shaft pinion with the key and tighten to a torque of **5 daNm** using **Mot. 855**,
- the water pump pulley by tightening it to a torque of **2 daNm**.

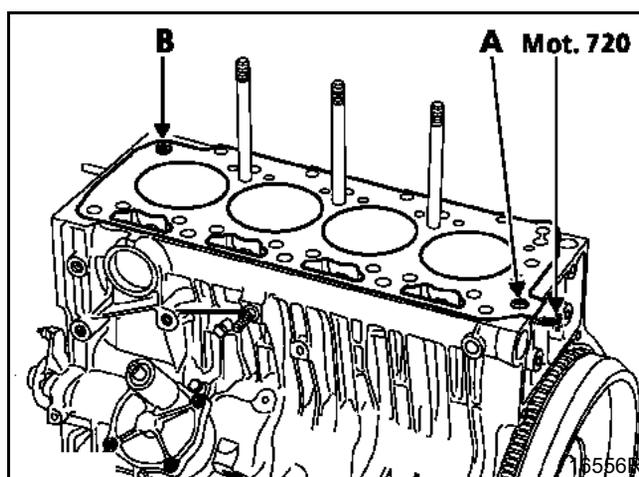
REFITTING THE TOP ENGINE

Position the pistons in mid-stroke and remove tool **Mot. 521-01**.

Positioning the cylinder head gasket

It is necessary to use tool **Mot. 720** placed in the hole (A) on the cylinder block. Check for the presence of the centring pin (B).

Fit the cylinder head gasket.



Refit the cylinder head and centre it on the studs.

Lubricate the threads on the mounting bolts and the washers under the heads with engine oil.

All the cylinder head bolts must always be changed after removal (including the studs). Lubricate the threads and under the bolt heads with engine oil.

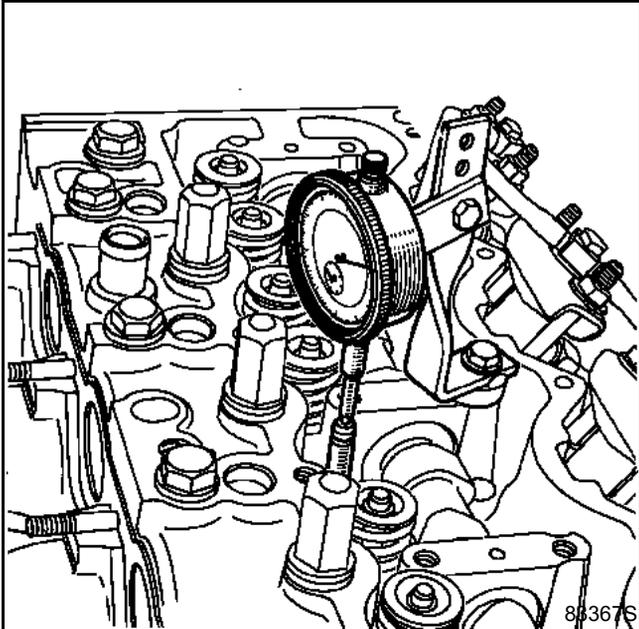
Tightening procedure for cylinder head

REMINDER: Use a syringe to remove any oil which may have entered the cylinder head mounting bolt holes to achieve correct tightening of the bolts.

Consult the **Technical specifications** section for information on the cylinder head tightening procedure.

Value of the piston-cylinder head clearances

Form this dimension (piston - valve), subtract the valve clearance value measured earlier; the result (piston - cylinder head clearance) should be more than **0.6 mm**.



Example of completed measurement, cylinder head removed from the engine:

- 1) **Piston protrusion** (after turning the crankshaft clockwise at the timing end)

(Measurement A):

- cylinder n° 1, **A = 1.05 mm**
- cylinder n° 2, **A = 1.04 mm**
- cylinder n° 3, **A = 1.05 mm**
- cylinder n° 4, **A = 1.07 mm**

In this case use **measurement A = 1.07 mm** for cylinder 4.

This measurement being greater than **1.04 mm**, fit a cylinder head gasket **1.8 mm** thick.

2) Valve clearance (measurement B)

On the inlet and exhaust valves of the 4th cylinder:

Inlet: **B = 0.92 mm**
Exhaust: **B = 0.87 mm**

(The clearance is between **0.80** and **1.15 mm**).

In this case, use the measurement **B = 0.87 mm** for the exhaust valve, it being the smaller.

Cylinder head fitted on the engine (with the cylinder head gasket and tightened to torque):

3) Valve - piston clearance (measurement C)

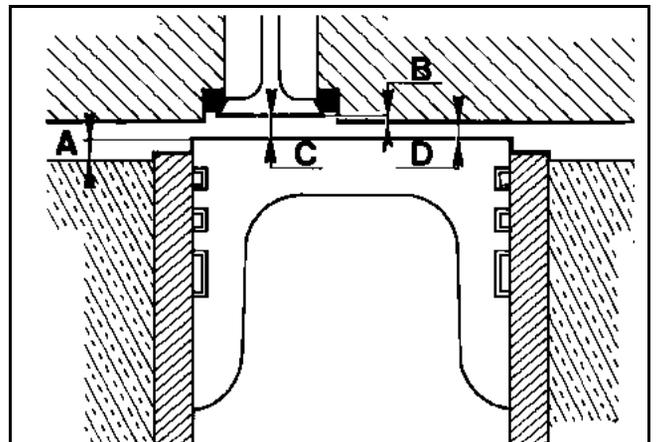
On the exhaust valve stem of the 4th cylinder (**reminder**: piston at top dead centre):

C = 1.57 mm

which gives the **PISTON/CYLINDER HEAD CLEARANCE**:

$$D = C - B = 1.57 - 0.87 = 0.7 \text{ mm}$$

(This clearance is thus greater than **0.6 mm**).

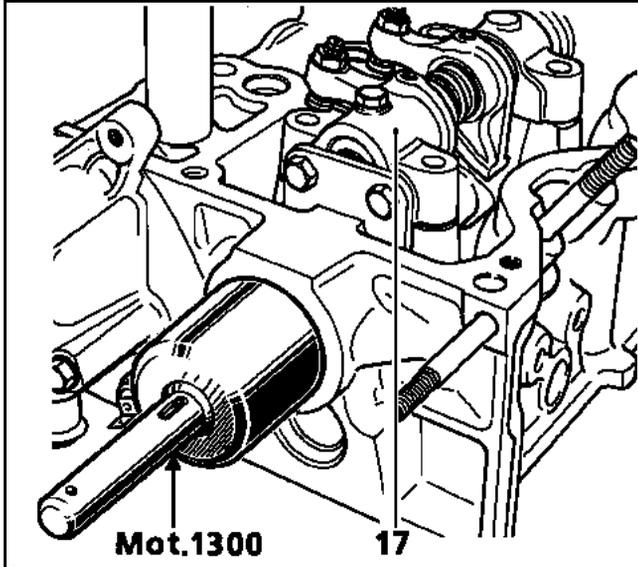


Refit:

- the camshaft (16),
- the rocker arm rail (17),
- the fuel return rail to the tank, fitted with new copper seals.

Fitting the camshaft seal (timing side)

Fit the seal (18) to the mounting bush **Mot. 1300**. Oil the external diameter of the seal. Fit the assembly on to the camshaft (16).



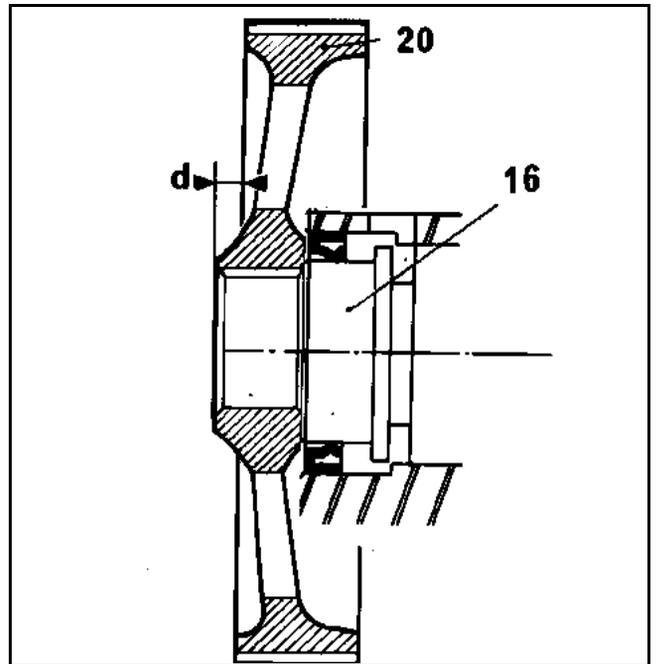
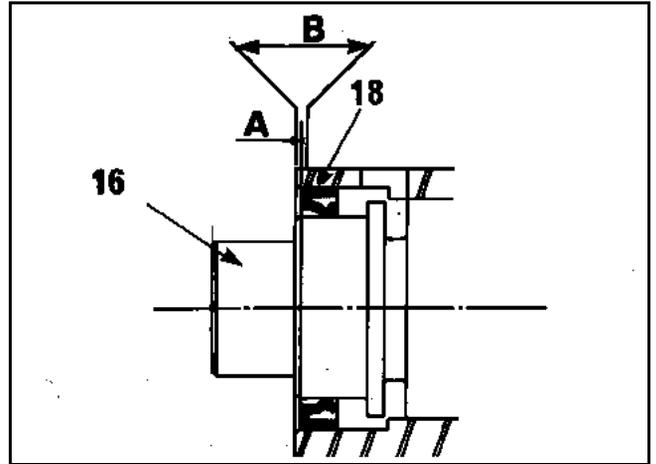
If the seal lip marks the crankshaft mating face a **1.5 mm** thick washer (fitting the tool) must be placed between the seal and the tool to shift the seal.

Refit:

- the camshaft sprocket and tighten to a torque of **5 daNm**,
- the injection pump rear mounting by tightening the bolts to a torque of **2.5 daNm (do not tighten the bolts at the front of the pump to carry out the injection pump setting)**,
- Timing tensioning roller.

A: fitting dimension with tool **Mot. 1300**

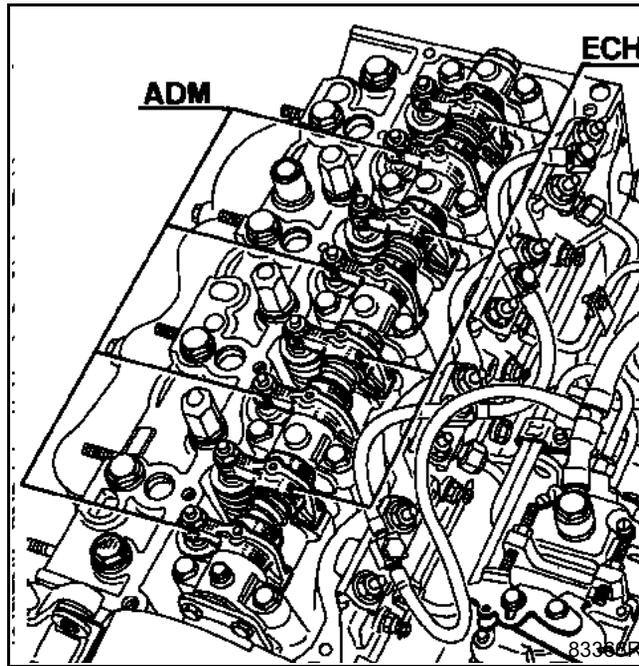
B: fitting dimension with tool **Mot. 1300**, and the washer (repair).



Adjusting the rocker arms

Bring the exhaust valve of cylinder n° 1 to the fully open position, then adjust the inlet valve clearance for cylinder n° 3 and the exhaust valve clearance for cylinder n° 4.

Use the same method for the other cylinders following the order given in the table below. To adjust the rocker arms, use tool **Mot. 647**.



Clearance (in mm) when the engine is cold:

Inlet	0.20 ± 0.02
Exhaust	0.25 ± 0.02

Exhaust valve to the fully open position

Inlet valve to be adjusted.

Exhaust valve to be adjusted.

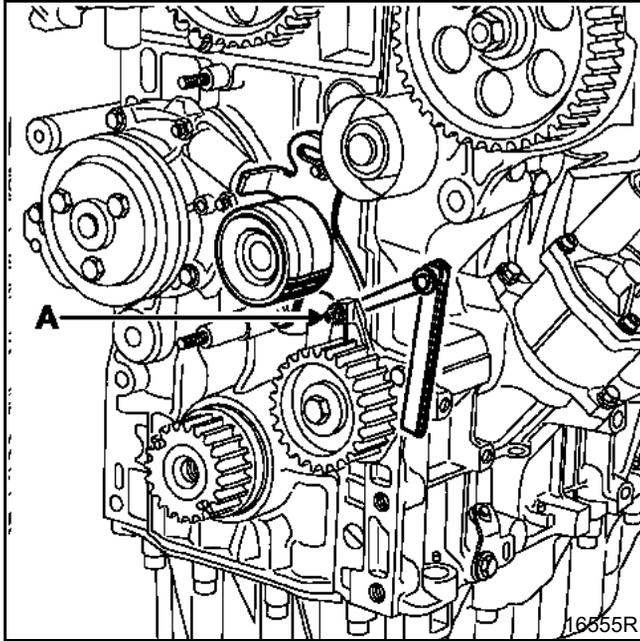
1
3
4
2

3
4
2
1

4
2
1
3

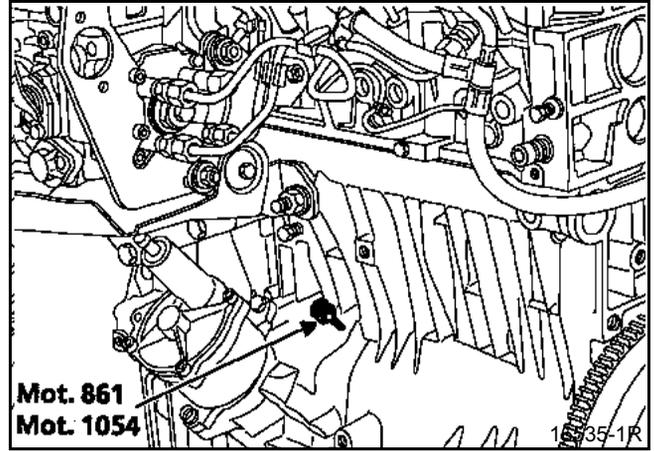
Setting the timing

Check the existing clearance between the tension wheel support in locked position and the setting bolt (A); a **0.1 mm** feeler gauge should fit between the support and the bolt, and then tighten the lock nut.



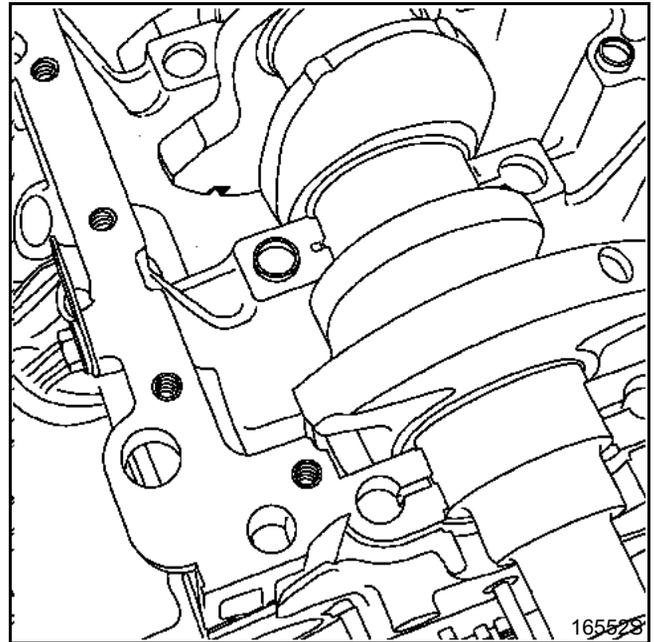
Fit TDC setting rod **Mot. 861** or **Mot. 1054**.

Bring the camshaft sprocket and the injection pump marks in line with the marks made earlier, located on the cylinder head cover and the injection pump.



Information:

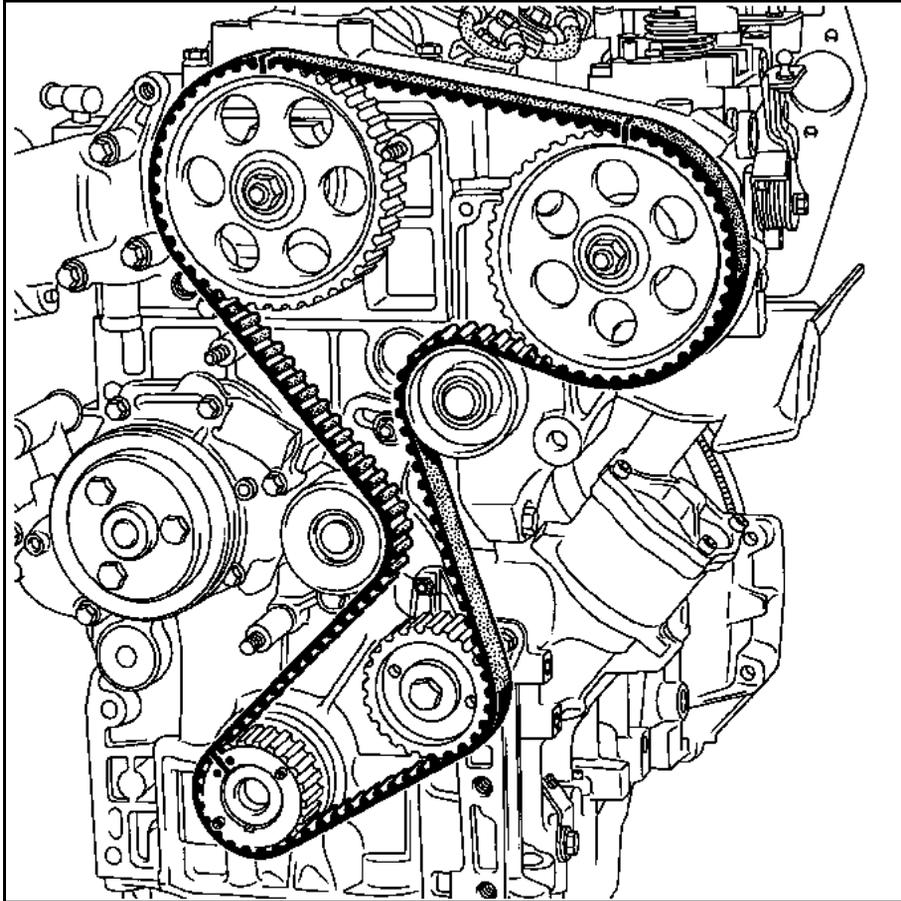
- the diameter of the balancing holes is **12 mm**,
- the diameter of the TDC setting rod is **8 mm**.



NOTE: fit the air conditioning compressor belt (if fitted) before replacing the timing belt.

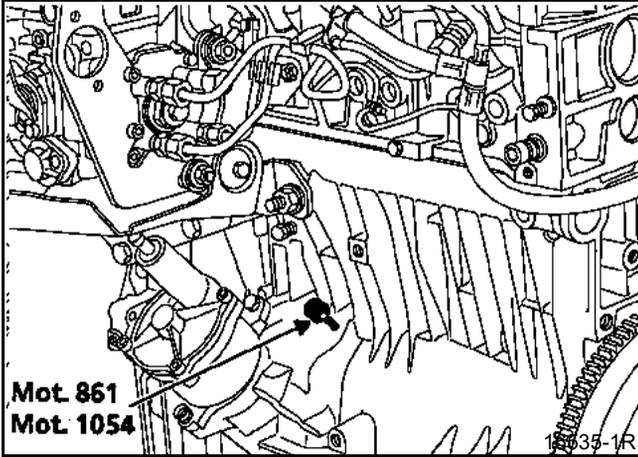
Fit the timing belt starting from the crankshaft and working towards the relay shaft.

Line up the markings of the timing belt with those of the pulleys and crankshaft sprockets.



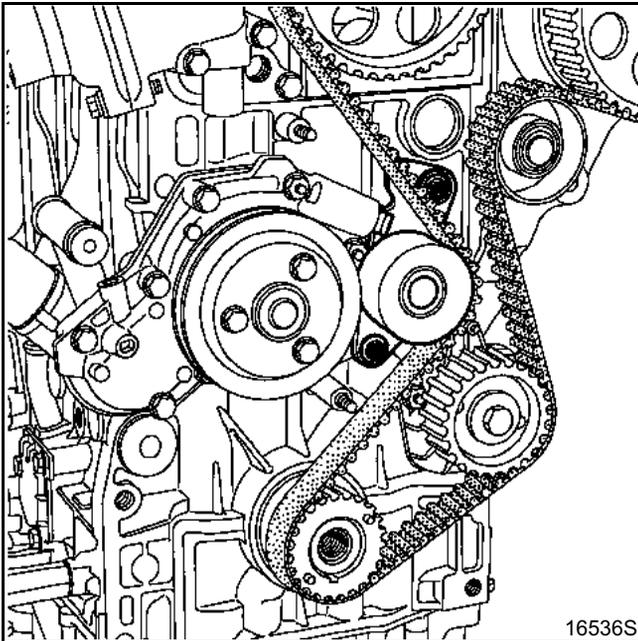
Check that the timing belt is stretched between the camshaft sprockets, the injection pump, the relay shaft and the crankshaft, so that the belt tension is not altered by the tension wheel.

Remove TDC setting rod **Mot. 861** or **Mot. 1054** and replace the cap.



Engine fitted with an automatic tension wheel

Undo the tension wheel fasteners half a turn and it will automatically shift under the action of its spring and come into contact with the belt. Redo the fasteners.



Turn the crankshaft four times and re-position the timing at setting point.

Undo the tension wheel fasteners half a turn again and it will automatically shift under the action of its spring and come into contact with the belt. Redo the fasteners.

Check the fitting tension.

NOTE:

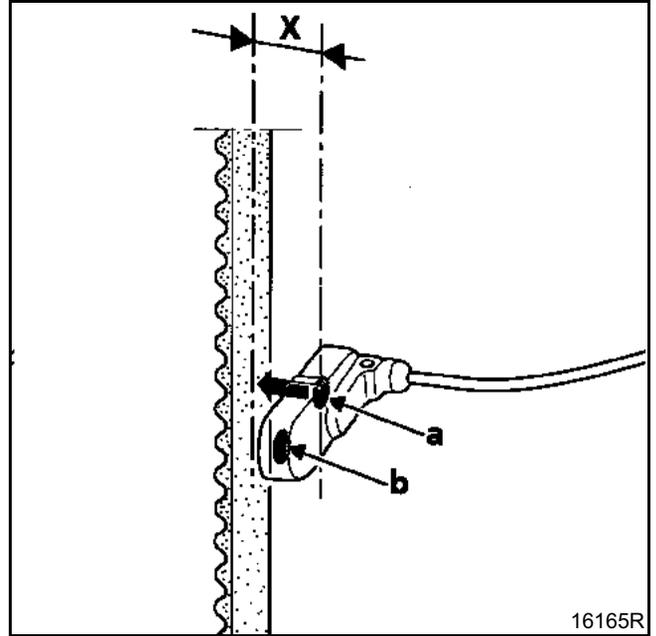
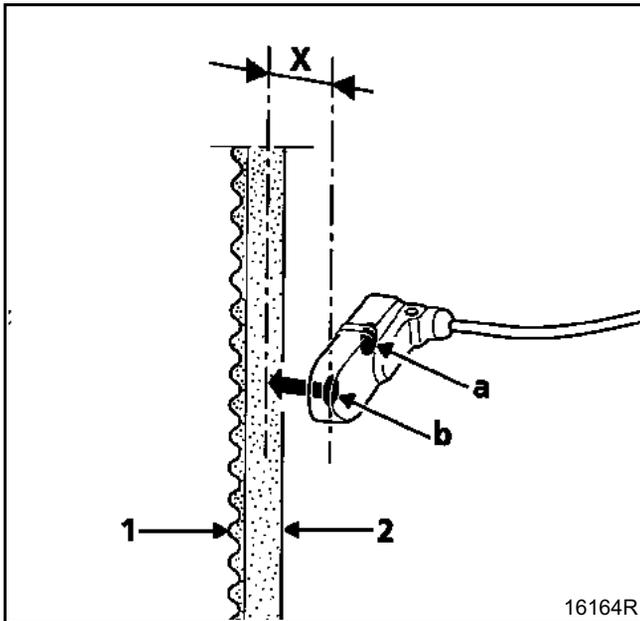
Using device Mot. 1505

Switch on the device and bring the read head (A) up to the belt wire for measuring.

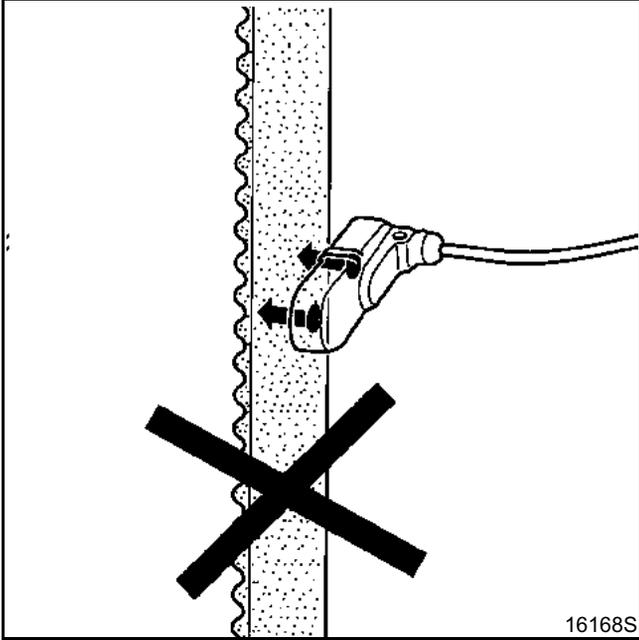
Hold the read head between approximately **5** and **10 mm** from the belt (distance X).

The measurement can be read on side (1) or (2) of the belt as appropriate.

Either sensor, (a) or (b), may be used, provided that the sensor being used as reference is outside the field of measurement.

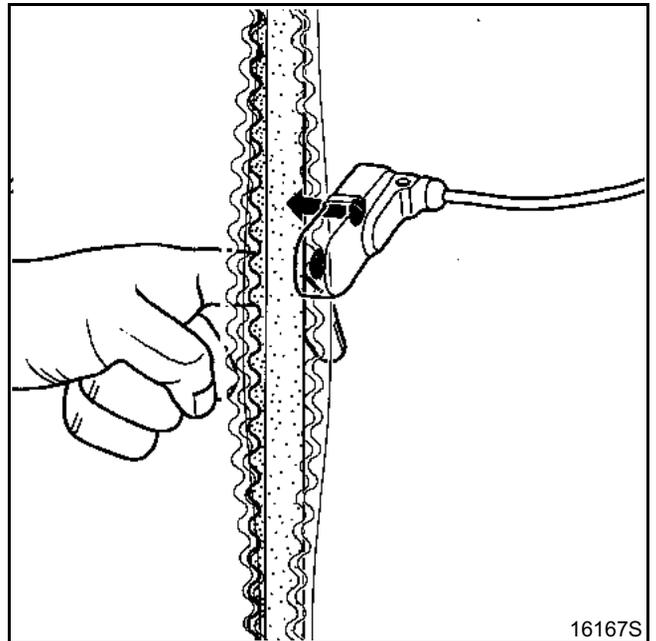
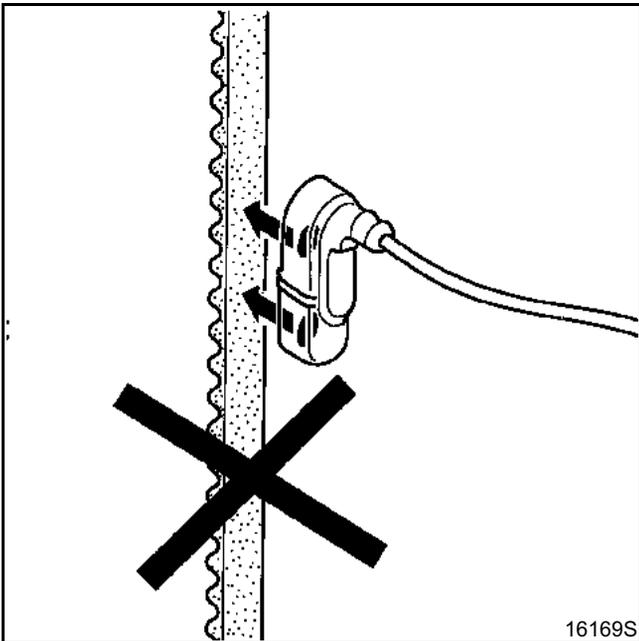
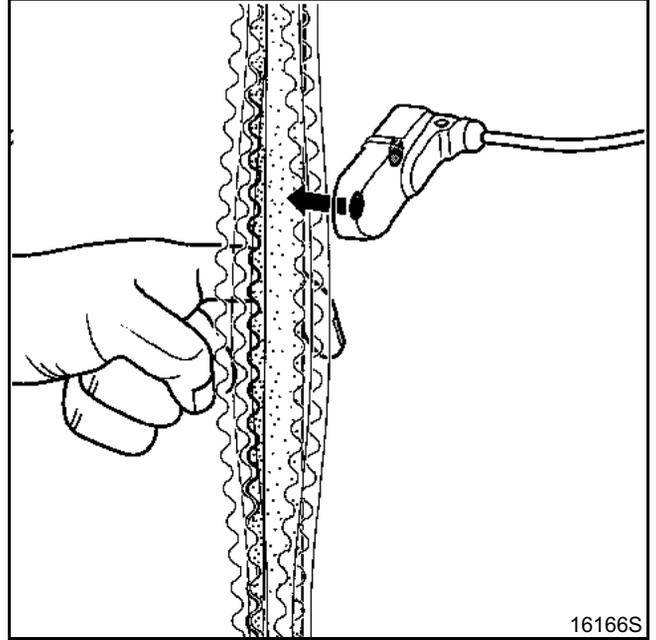


The two sensors must not both be facing the belt at the same time during measurement.



Take the measurement by vibrating the belt with your finger.

A beep sounds to confirm the measurement.



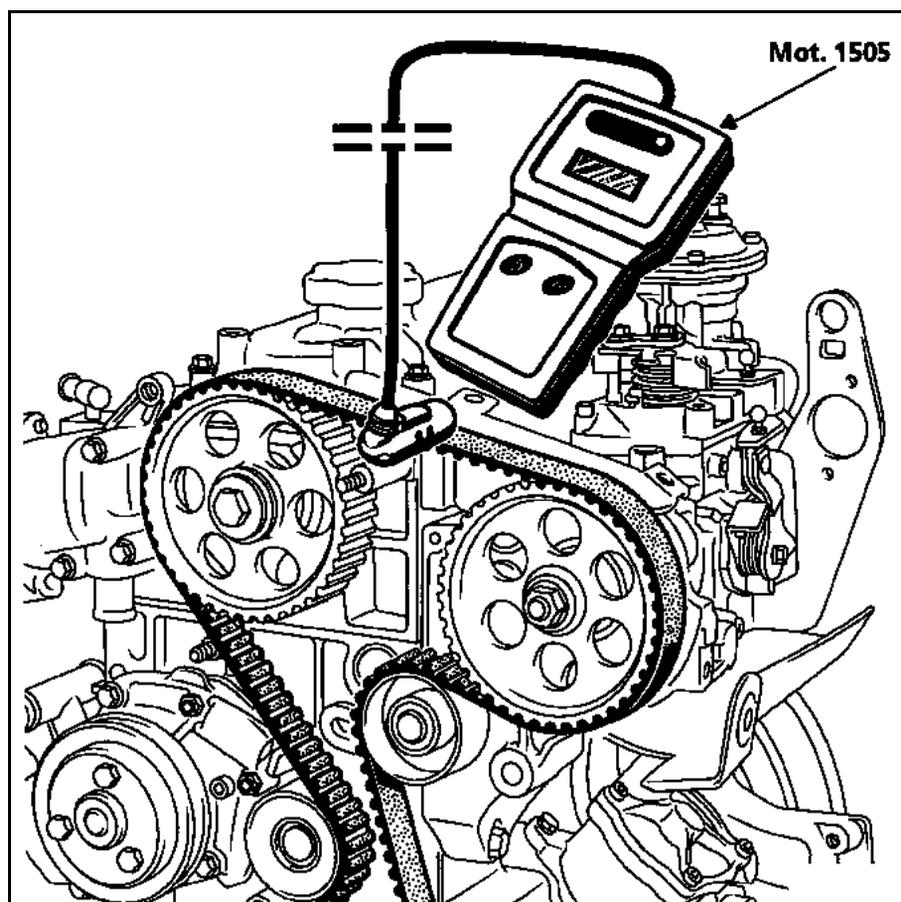
TENSIONING PROCEDURE

852 - J8S engines (without pretensioning)

It is very important to follow these instructions for tightening the belt:

- engine cold (ambient temperature),
- fit the new belt; the timing should be at the setting point (top dead centre),
- bring the tension wheel against the belt using **Mot. 1384** and tighten the belt to the required fitting tension using **Mot. 1505**.

ENGINE MODEL	FITTING TENSION IN SEEM UNITS	FITTING TENSION IN HERTZ
J8S (all types) 852 (all types) except J8S 760	45	84 ± 5
J8S 760	50	104 ± 4

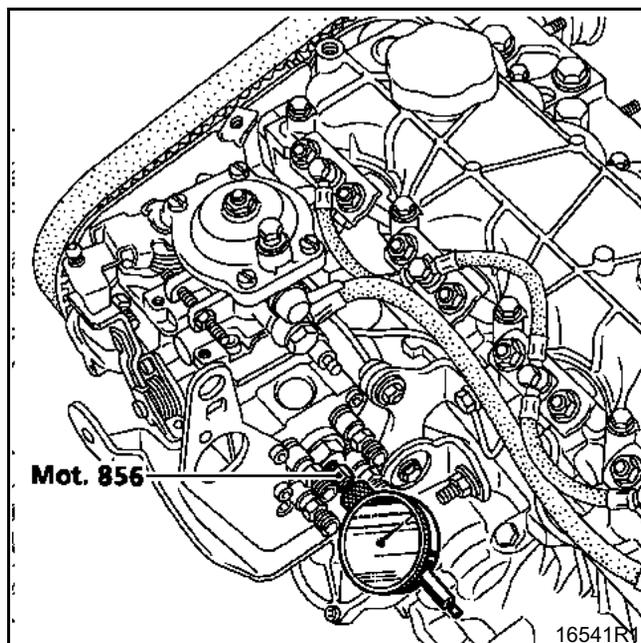


- tighten the tension wheel,
- turn the crankshaft four times and re-position the timing at setting point,
- Position the read head of **Mot. 1505** and take the measurement. Check to see if it is within in the fitting tension tolerance, and if not, adjust it using the tension setting tool,
- and tighten the tension wheel nut to a torque of **2.25** to **2.75 daNm**.

NOTE: this procedure is only valid for engines fitted with dynamic tensioners; for tensioners with springs, only test the fitting tension after installing the tensioner.

Injection pump setting

Remove the injector pump rear cap and fit dial gauge support **Mot. 856** and a dial gauge fitted with an adapter.



Turn the engine over once and calibrate the dial gauge on the **bottom dead centre** of the injection pump piston (check that the dial gauge pin can move freely in the pump body).

Turn the timing to the setting point (pin the engine using **Mot. 861** or **Mot. 1054**).

ENGINE AND PERIPHERALS

Overhauling the engine

10

Read the piston lift on the dial gauge, which should be:

MANUFACTURER	TYPE	Top dead centre setting (rod in the crankshaft)	
		Piston lift (mm)	Pin lift (mm)
BOSCH	VE.. R452 VE.. R452-1 VE.. R452-2	0.75	-
BOSCH	VE.. R158	0.70	-
ROTO DIESEL	DPC R 8443 B403C	-	dimension "X" on pump
BOSCH	VE.. R449 VE.. R449-1	0.75	-
BOSCH	VE.. R153 VE.. R153-1 VE.. R345 VE.. R345-1	0.70	-
BOSCH	VE.. R423 VE.. R423-1 VE.. R423-2 VE.. R423-3	0.75	-
BOSCH	VE.. R309 VE.. R309-1 VE.. R309-2 VE.. R309-3 VE.. R309-4	0.75	-
BOSCH	VE.. R153 VE.. R153-1 VE.. R153-2	0.70	-
BOSCH	VE.. R69	0.70	-

ENGINE AND PERIPHERALS

Overhauling the engine

10

MANUFACTURER	TYPE	Top dead centre setting (rod in the crankshaft)	
		Piston lift (mm)	Pin lift (mm)
BOSCH	VE.. R484 VE.. R484-1	0.75	-
ROTO DIESEL	DPC R8443 B142B DPC R8443 B143B	-	dimension "X" on pump
ROTO DIESEL	DPC R8443 A400 A to A409 A (A) DPC R8443 A401 B to A409 B (A) DPC R8443 B402 B to B409 B (B) DPC R8443 B403 C to B409 C (B)	-	1.80 (A) dimension "x" on pump (B)

If this is not the case, correct the setting.

IMPORTANT: the following operations must be carried out in this order.

Remove TDC **setting rod Mot. 861** or **Mot. 1054**.

Turn the injection pump to obtain the desired setting value (see above table).

Tighten the injection pump mounting bolts.

Turn the engine over twice and pin the engine again.

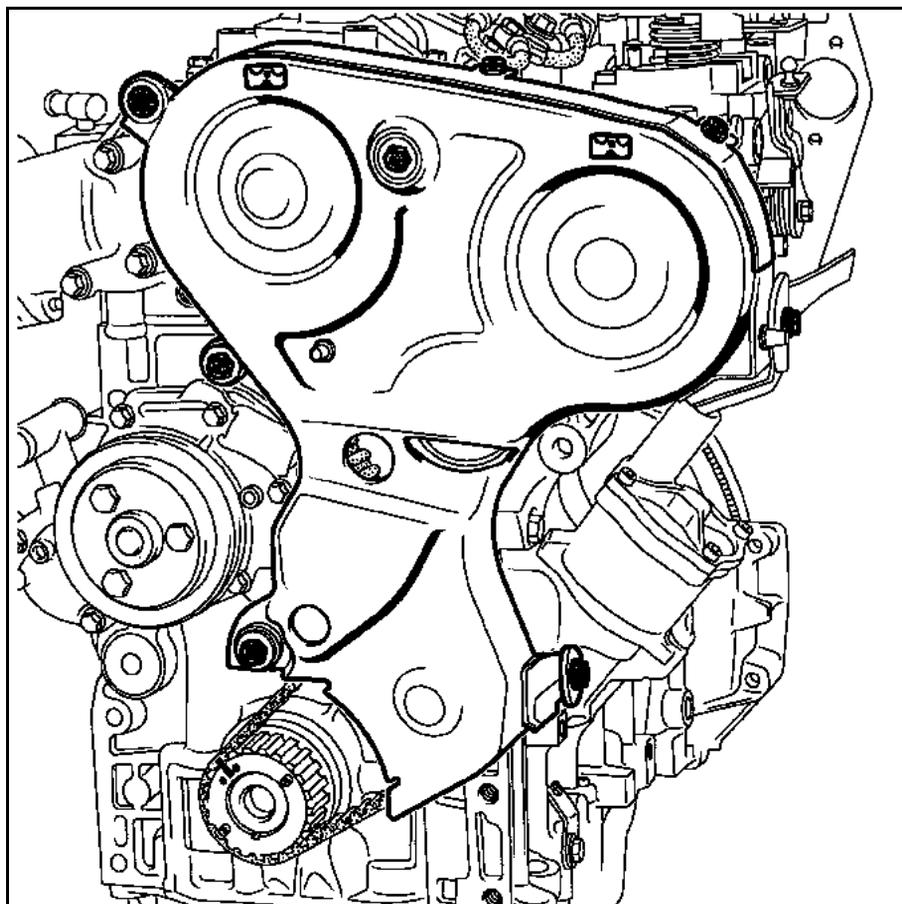
Check the corresponding setting value again.

Fit sprocket locking tool **Mot. 854** or use tool **Mot. 799-01**, then tighten the injector pump pulley to a torque of **5 daNm**.

Remove rod **Mot. 861** or **Mot. 1054**.

Turn the engine over twice and check the injection pump timing again.

- Refit:
- the timing cover,



- the high pressure pipes on the injection pump using **Mot. 1383**,
- the inlet and exhaust manifolds, by tightening the nuts to a torque of **2.8 daNm**,
- the lifting bracket at the flywheel end and the fuel pipe support plate,
- the multifunction support, tightening the nuts and bolts to a torque of **4.3 daNm**,
- the alternator,
- the air conditioning compressor (if fitted),
- the power assisted steering pump,
- the crankshaft accessories pulley by tightening the bolt to a torque of **2 daNm**, then angle tightening to **115° ± 15°**.

NOTES ON FITTING ACCESSORIES BELTS

V BELT

Tensioning procedure for new belts

Engine cold, ambient temperature.

Fit the new belt.

Bring the tension wheel into contact with the belt and tighten to obtain the recommended fitting tension.

Tighten the tension wheel.

Turn the crankshaft over **three times**.

Position the read head of **Mot. 1505** and perform the measurement. Check that it is **within the fitting tension tolerances, otherwise readjust it**.

Tensioning procedure for used belts

Engine cold, ambient temperature.

Fit the belt.

Bring the tension wheel into contact with the belt and tighten to obtain **80 % of the recommended fitting tension value**.

Tighten the tension wheel.

Turn the crankshaft over **three times**.

Fit the read head of **Mot. 1505** and perform the measurement. Check that it is **within 80 % of the tension value tolerances, otherwise readjust it**.

NOTE: the V belt is replaced according to **condition or noise**.

RIBBED BELT

Belt tensioning procedure

Engine cold, ambient temperature.

Fit the new belt.

Bring the tension wheel into contact with the belt and tighten to obtain the recommended fitting tension.

Tighten the tension wheel.

Turn the crankshaft over **three times**.

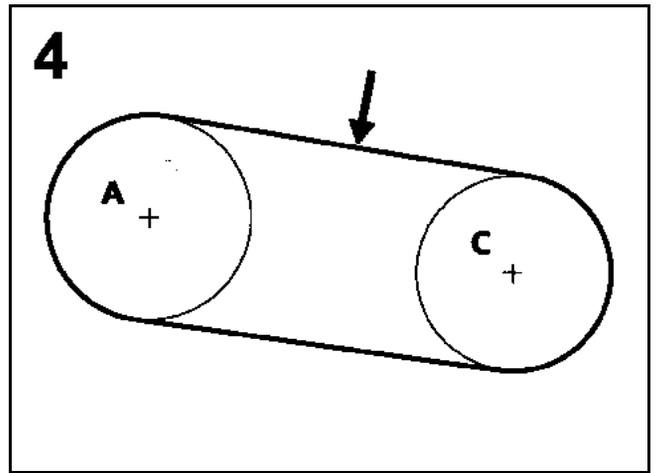
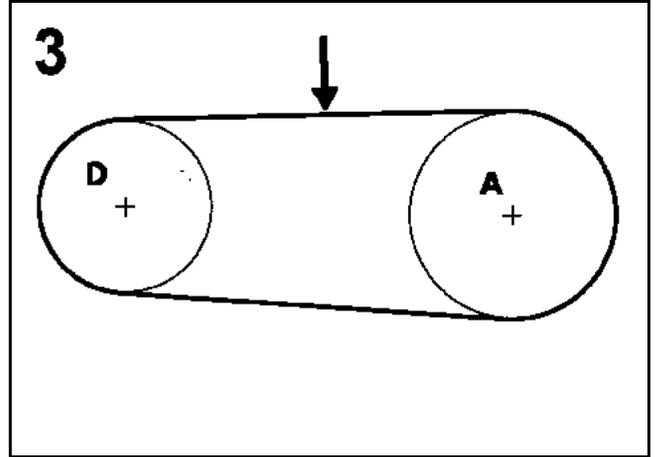
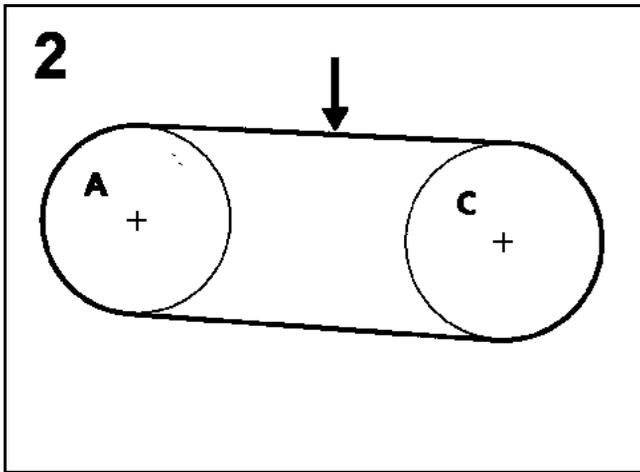
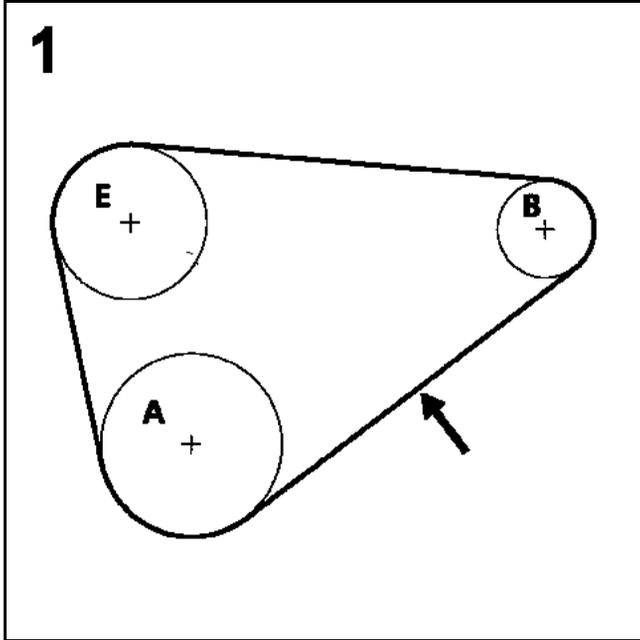
Fit the reading head of **Mot. 1505** and perform the measurement. Check that it is **within the fitting tension tolerances, otherwise readjust it**.

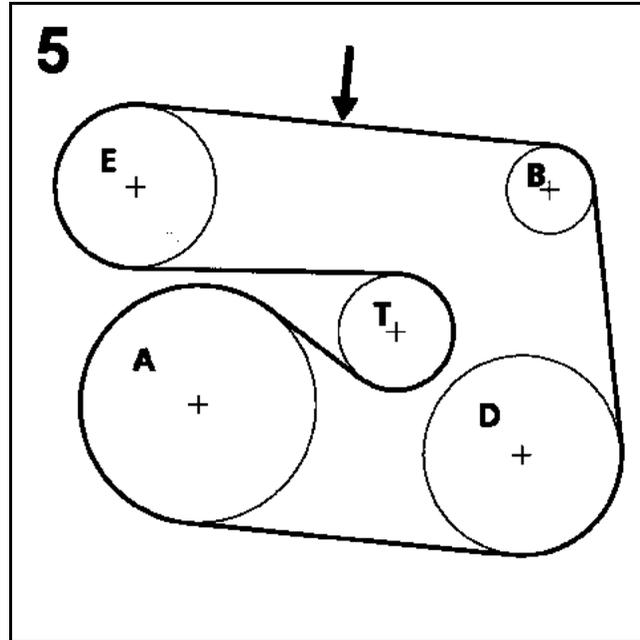
NOTE: DO NOT REFIT A BELT ONCE IT HAS BEEN REMOVED; REPLACE IT.

ENGINE AND PERIPHERALS

Overhauling the engine

ENGINE TYPE	BELT FUNCTION	FITTING TENSION IN SEEM UNITS	MINIMUM OPERATING TENSION IN SEEM UNITS	FITTING TENSION IN HERTZ	DIA-GRAM
J8S - 852	Alternator Water pump (V-belt)	106 ± 4	68	158 ± 5	1
J8S	Power steering (V-belt)	101 ± 4	74	222 ± 7	2
J8S	Air conditioning (four ribs)	85 ± 5	60	88 ± 4	3
J8S 760	Alternator Water pump (four ribs)	98 ± 7	58	164 ± 5	1
J8S 760	Power steering (four ribs)	99 ± 6	50	234 ± 10	4
J8S 760	Alternator Coolant pump Air conditioning (six ribs)	123 ± 9	76	164 ± 5	5





- A Crankshaft
- B Alternator
- C Power assisted steering pump
- D Air conditioning compressor
- E Water pump
- T Tension wheel
- Tension test point

Refit the engine wiring harness.

Remove the engine from the **DESVIL** support.

Refit:

- the metal oil vapour rebreather pipe tubes for the bottom engine.
- the turbocharger