RENAULT

Workshop Repair Manual

ENGINE (petrol)

6 cylinders - L7X 700 - 701

Engine
for the Laguna

X56 V

77 11 195 335 **JULY 1997** **Edition Angl**

"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

Contents

USING THE MANUAL

In this manual you will find three large sections :

- Specifications,
- Engine removal
- Engine refitting

For the repair of components on the vehicle, please refer to the vehicle **Workshop Repair Manual and Technical Notes.**

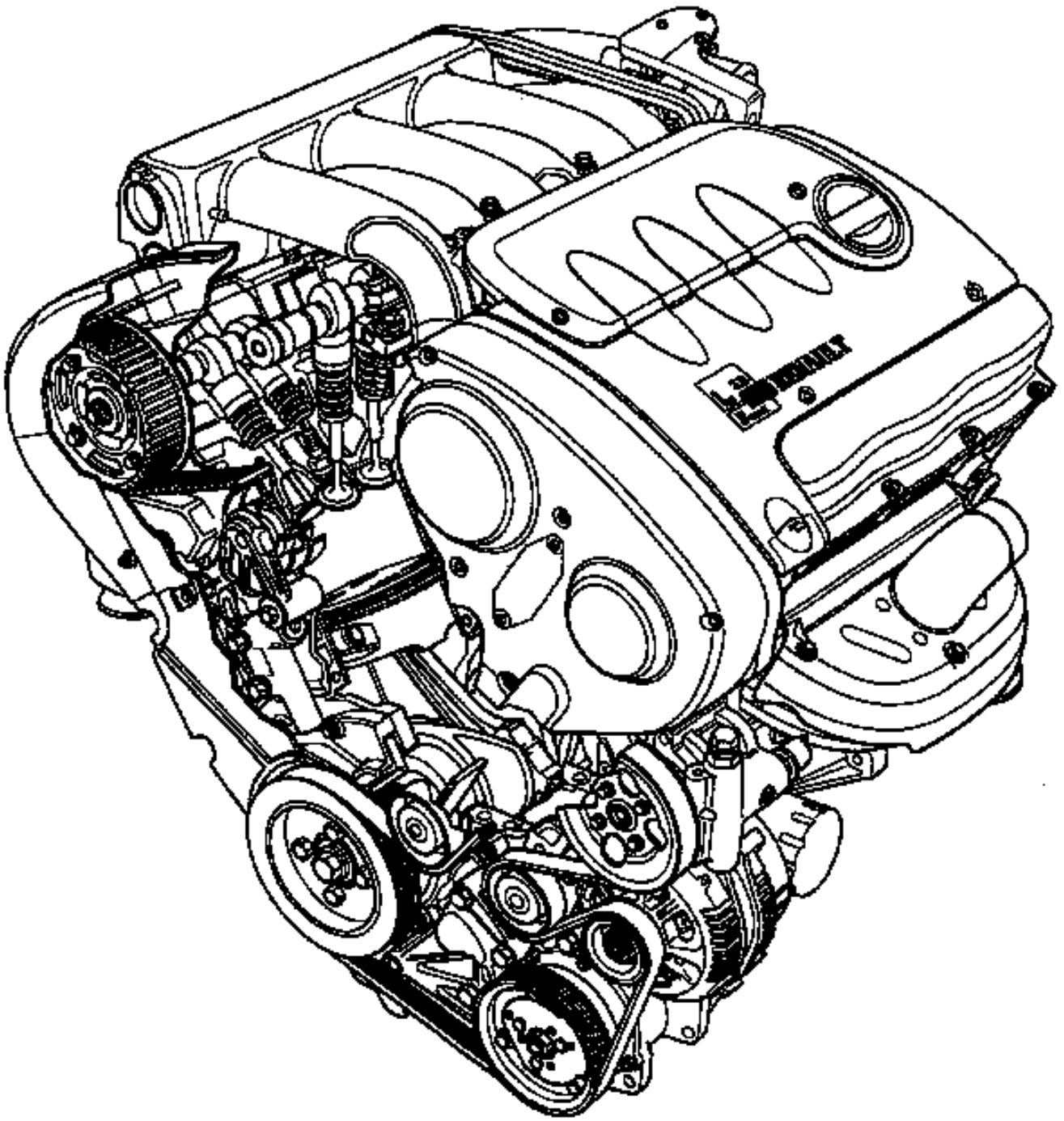
UNITS OF MEASUREMENT

- All dimensions are expressed in millimetres (**mm**) unless specified otherwise.
- The tightening torques are given in decaNewtonmetre (**daN.m**).
- The pressures is are given **bars** (reminder: **1 bar = 100 000 Pa**).
- The electrical resistances are given in ohms (Ω).
- The voltages are expressed in (**V**).

TOLERANCES

Tightening torques expressed without tolerances are to be observed :

- In **degrees** : ± **3**°.
- In **daN.m** : ± **10 %**.



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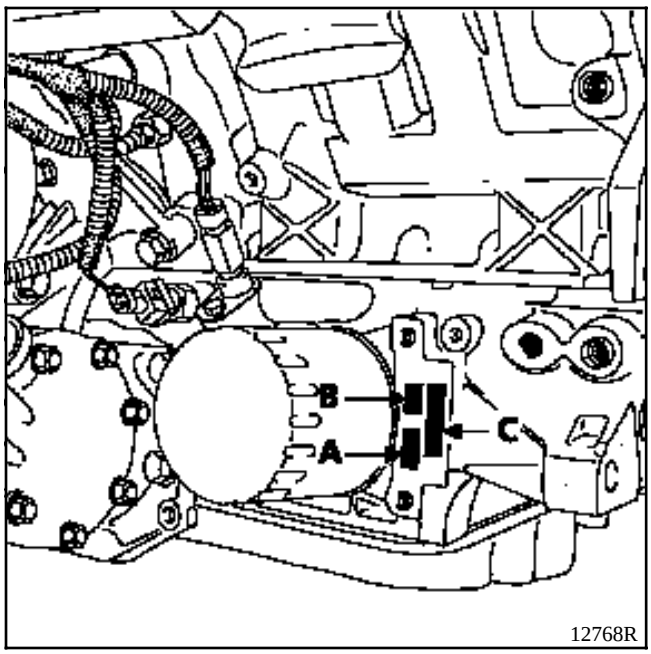
The identification of the engine is carried out following two methods :

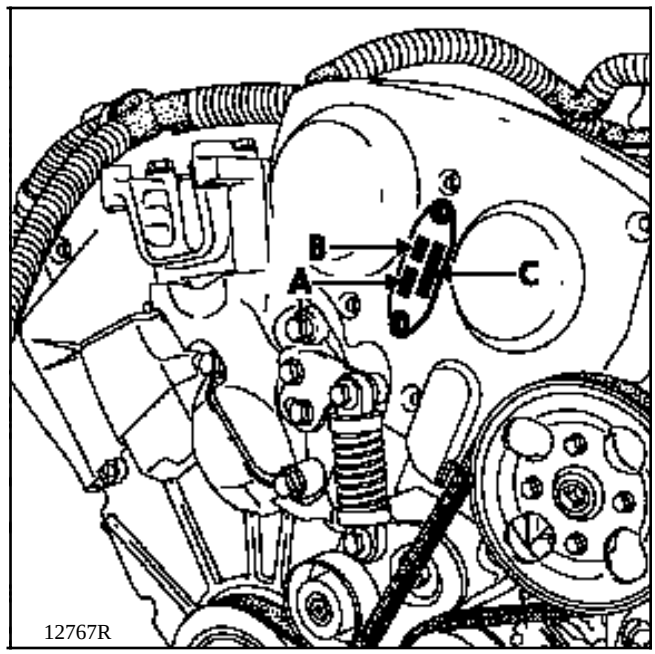
On the one hand :
- By a marking engraved on the crankshaft bearing block (next to the oil filter).



It shows :

- At **A** : The engine type and homologation letter,
- At **B** : **Renault identity** and the engine suffix,
- At **C** : The engine fabrication number.

On the other hand :
- By a plate riveted to the timing cover.



Engine	Suffix	Vehicle	Ratio	Bore (mm)	Stroke (mm)	Capacity (cm^3)
L7X	700 701	X56V	10.5 / 1	87	82.6	2946

Top of engine :

Description	Tightening torques
Camshaft bearing cap bolts	0.8
Cylinder head bolts	*
Bearing cap cover bolts	1
Air distributor bolts and nuts	**
Engine and cylinder head support bolts	6
Timing pulley bolts	8
Timing belt tension plate shouldered bolt	1
Timing belt tension plate mounting bolt	2.5
Camshaft pulley hub mounting bolt	2 and angle tighten by 60°
Camshaft pulley mounting bolt	1
Exhaust manifold nuts	3
Suspended engine mounting bolts on cylinder head	4.5
Inlet manifold bolts	2

***** See tightening method on page 10-6

****** See tightening method on page 10-81

Lower engine :

Description	Tightening torques
Crankshaft bearing block bolts	*
Big end nuts	2 and angle tighten by 74°
Sump bolts	0.8 **
Oil pump bolts	0.8 **
Timing sprocket bolts	2 and angle tighten by 80°
Water pump bolts	0.8 ***
Mounting bolt for accessories belt tensioner support plate	2.5
Mounting bolt for accessories belt tensioner	1.5
Flywheel bolts	2 and angle tighten by 60°

***** See tightening method on page 10-72

****** See tightening order on page 10-75

******* See tightening order on page 10-77

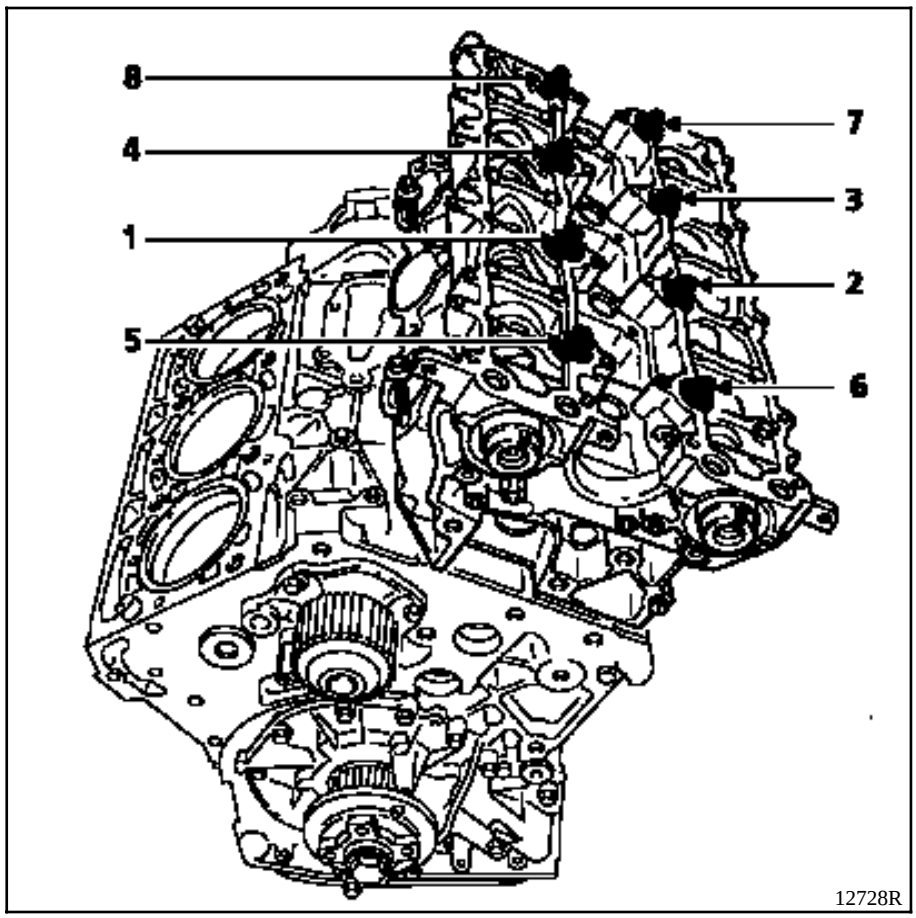
CYLINDER HEAD

Check the **length under the heads** of the bolts, which should be **147.5 ± 0.3 mm.**

Do not use the bolts again if the length is greater than 149.5 mm.

Re-used bolts must be brushed and greased with engine oil underneath the heads and on the threads .

CYLINDER HEAD TIGHTENING METHOD



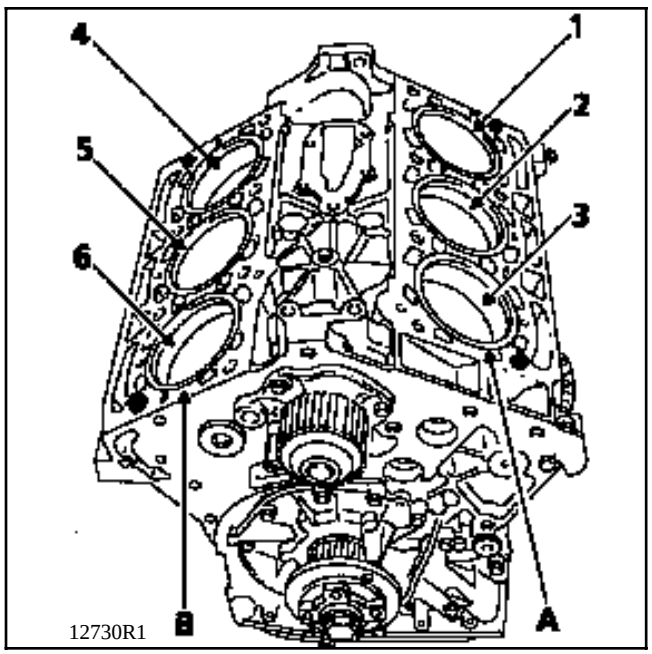
- Pretighten to **2 daN.m** in the order recommended above.
- Slacken bolt (1) completely.
- Retighten bolt (1) to **1.5 daN.m,** then **angle tighten by 225°**.
- Proceed in the same way for the other bolts.

Proceed in the same way for the other cylinder head.

Thickness of cylinder head gasket : Nominal dimension = **1.45 ± 0.04 mm**.
Repair dimension = **1.65 ± 0.04 mm**.

CYLINDER MARKING

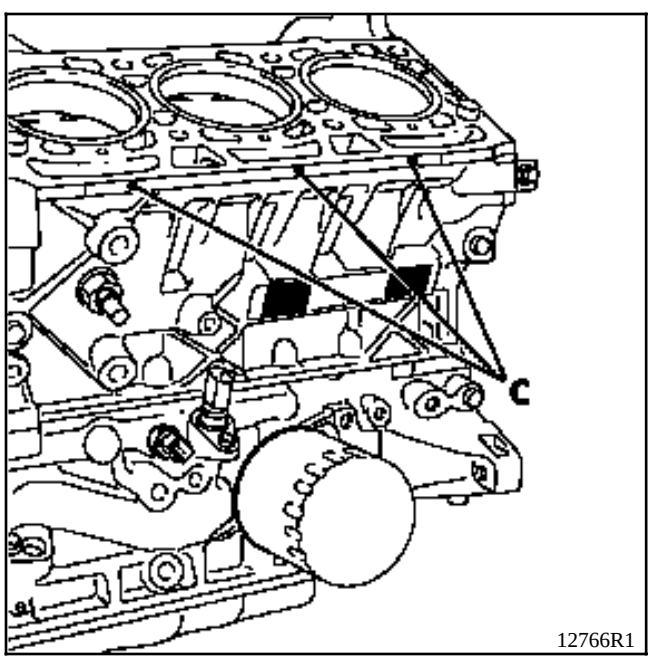
Cylinder **n°1** is situated **in the front bank at the flywheel end**



A : front bank of cylinders

B : rear bank of cylinders

The cylinder numbers are also engraved on the cylinder block at (C).

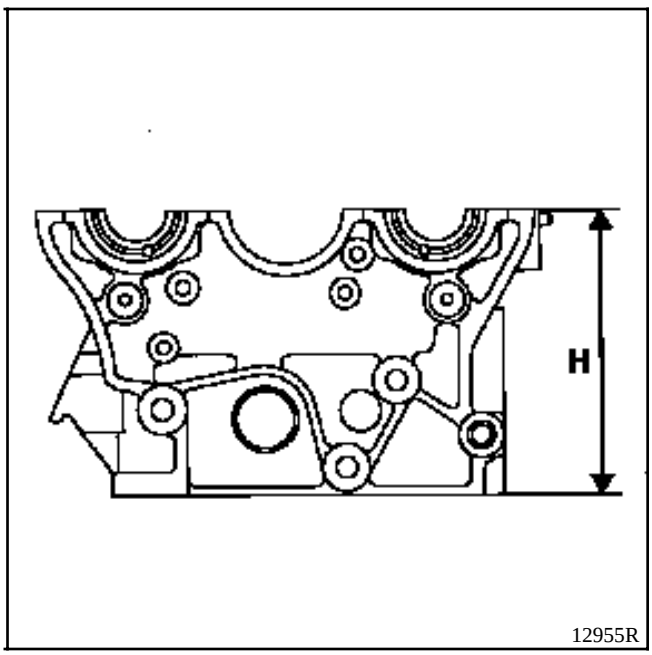


Firing order

1 - 6 - 3 - 5 - 2 - 4

Cylinder head height (in mm)

H = 139.8 $^{0}_{-0.3}$



CHECKING THE CYLINDER HEAD GASKET SURFACE

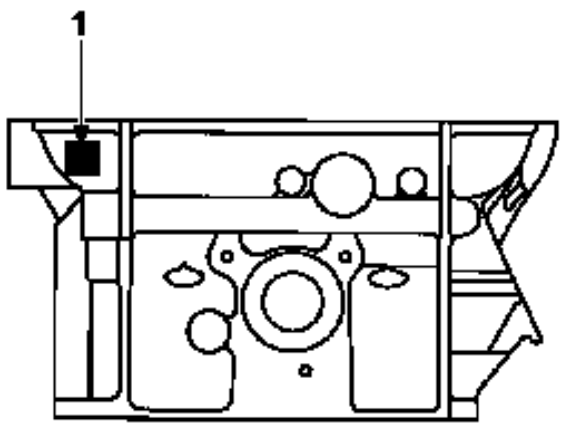
Check for cylinder head bow using a straight edge and a set of shims.

Maximum deformation : **0.05 mm**

During repairs, the cylinder heads may be reground by **0.20 mm. It is vital to carry out regrinding on both cylinder heads**

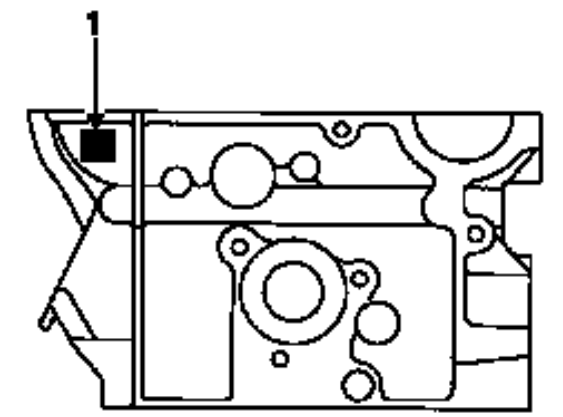
The reground cylinder heads must be marked with the letter **R** (1) engraved with an electric engraver.

Front cylinder head (viewed from the flywheel end).



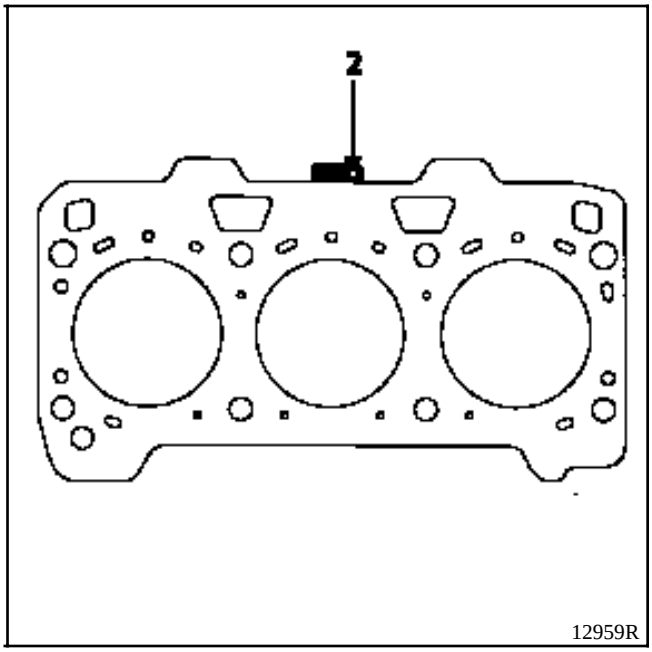
12957R

Rear cylinder head (viewed from the flywheel end)



12958R

The repair cylinder head gasket is marked by a hole (2) in the tab and is **1.65 ± 0.04 mm** thick.



12959R

Spark plug tightening torques (daN.m) : 2.5 to 3

Note : the spark plug is offset by **3 mm** towards the exhaust.

Hydraulic tappet

External diameter (in mm) :
Inlet and exhaust = **32** **- 0.015** **- 0.025**

VALVES

Valve lift (mm)

Inlet and exhaust	**9.2**

Diameter of the stem (mm)

Inlet and exhaust	**5.985**

Port angle :

Inlet and exhaust	**90°**

Head diameter (in mm)

Inlet	**33.83**
Exhaust	**31.50**

VALVE SEATS

Seat angle α

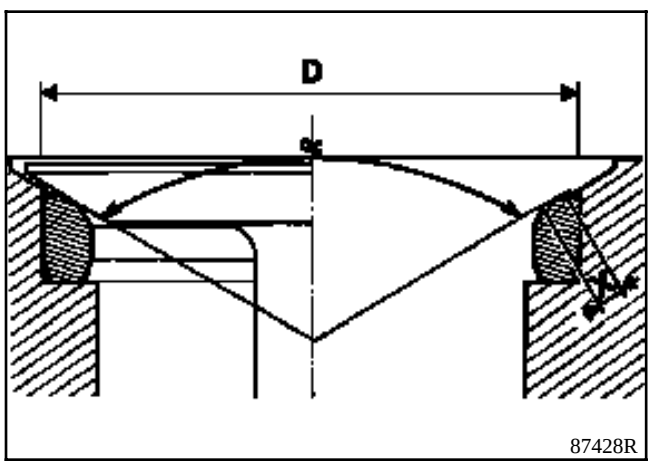
Inlet and exhaust	**90°**

Seat width (mm) X

Inlet	**1.6**
Exhaust	**2.1**

Exterior diameter (mm) D

Inlet	**35.239 to 35.264**
Exhaust	**33.139 to 33.164**



VALVE GUIDES

length (mm)	**39.75 to 40.25**

Internal diameter (mm)

Inlet and exhaust	**5.6 to 5.675**

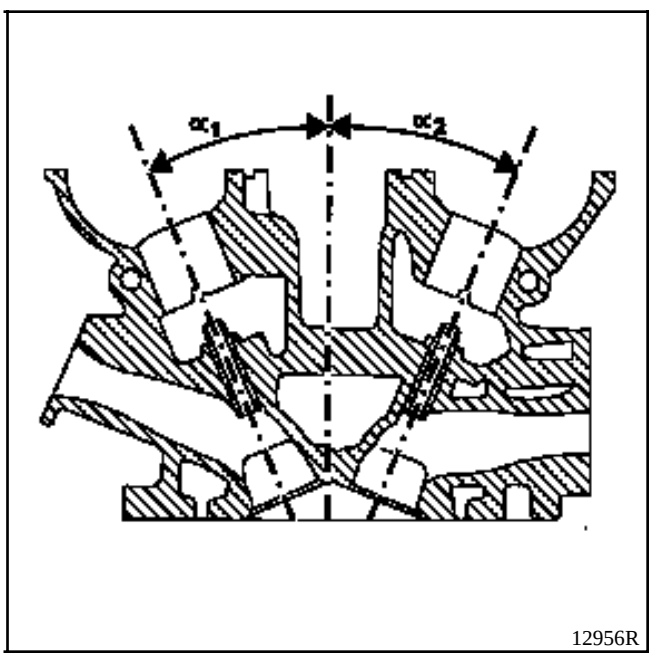
External diameter of guide (mm)

Inlet and exhaust	**11.062 to 11.073**

The inlet and exhaust guides are fitted with valve stem seals.

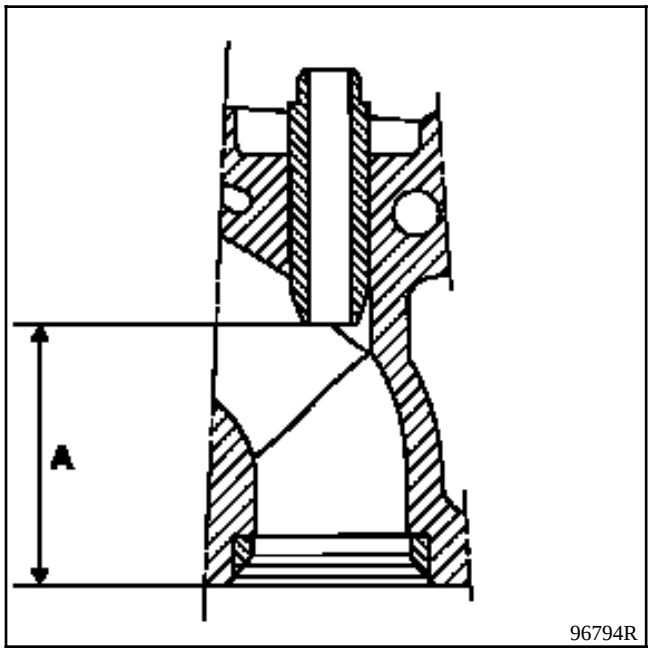
Angle of inlet and exhaust valve guides :

Inlet	α_1 **= 23°45**
Exhaust	α_2 **= 22°12**



Position of the inlet and exhaust valve guides in relation to the gasket surfaces (in mm)

Inlet	**A = 46.8**
Exhaust	**A = 45**



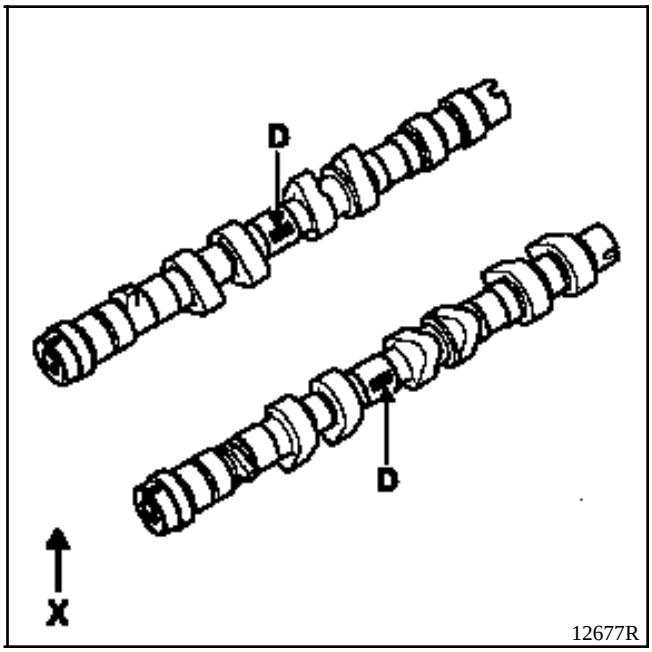
Valve springs (in mm) :

Free length		**41.30**
Length under load of	**25.2 daN.m**	**33.2**
	58 daN.m	**24**
Length (coils touching)		**21.6**
Wire diameter		**3.70**
Internal diameter		**19.3**
External diameter		**27.3**

CAMSHAFT

Camshaft identification :

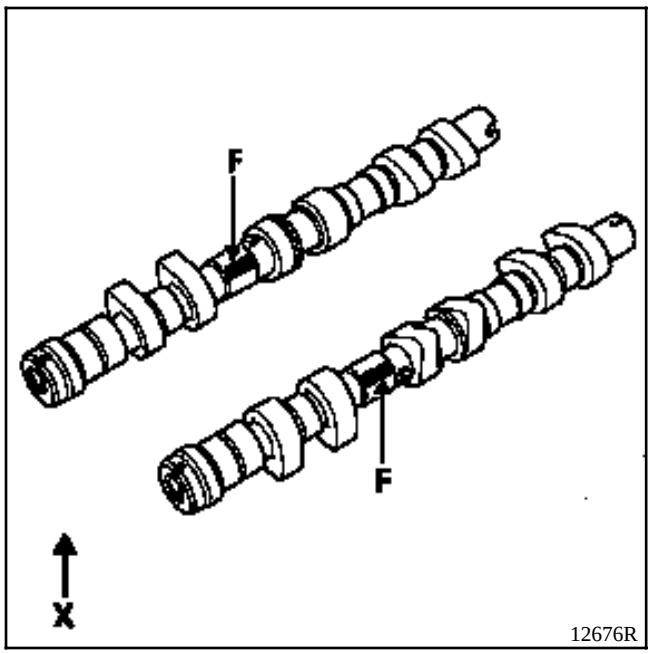
the longest camshafts are mounted on the front bank (cylinders **1 - 2 - 3**), and are identified by a marking at (**D**).



Inlet	**D = A 718**
Exhaust	**D = E 720**

X : Timing side

The shortest camshafts are mounted on the rear bank (cylinders **4 - 5 - 6**), and are identified by a marking at (**F**)



Inlet **F = A 717**
Exhaust **F = E 719**

X : timing side

End play (mm)

Between **0.070** and **0.27**, this is determined at the central bearing of the cylinder bearing block.

Number of bearings **4**

Cylinder head camshaft bearing diameter (mm)

Flywheel end	
1	28.03 to 28.096
2	28.03 to 28.096
3	28.03 to 28.096
4	31.01 to 31.049
Timing end	

Camshaft bearing diameter (mm)

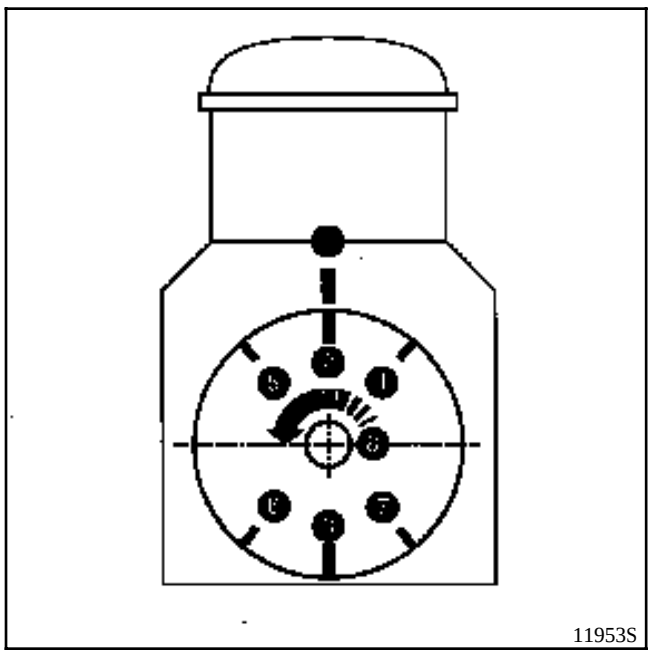
Flywheel end	
1	27.959 to 27.98
2	27.959 to 27.98
3	27.959 to 27. 98
4	30.950 to 30.975
Timing end	

Timing diagram (cannot be checked)

- Inlet opening retard * **- 7° 53'**
- Inlet closing retard **37° 50'**
- Exhaust opening advance **38° 07'**
- Exhaust opening advance** **- 7° 50'**

* As the inlet opening retard is negative, the opening of the valve is after TDC.

** As the exhaust closing advance is negative, the closing of the valve is before TDC.



1 - TDC fixed marking on cylinder block

2 - TDC mobile marking on flywheel

3 - BDC mobile marking on flywheel

4 - Inlet opening retard (IOR)

5 - Exhaust closing advance (ECA)

6 - Inlet closing retard (ICR)

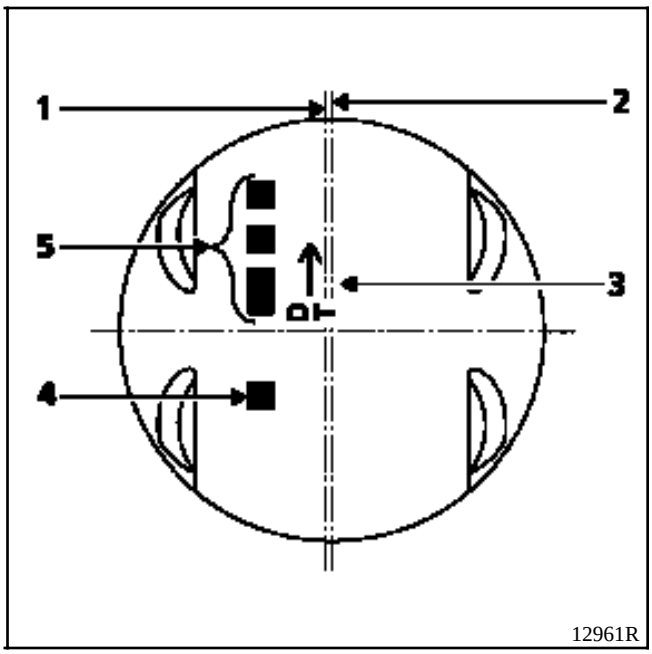
7 - Exhaust opening advance (EOA)

PISTONS

The gudgeon pin is fully floating in the connecting rod and the piston.

The gudgeon pin is secured by two circlips.

Piston marking

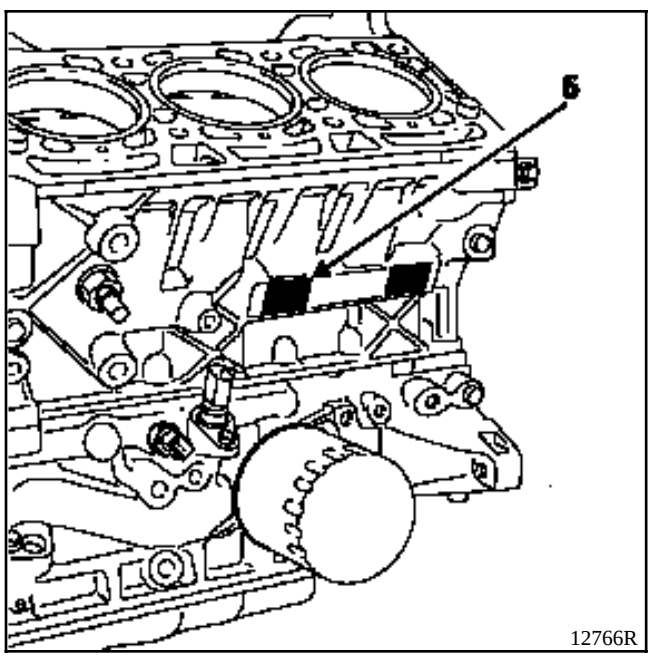


- The offset between the gudgeon pin hole (**1**) and the piston axis of symmetry (**2**) is **0.5 ± 0.15 mm**.
- The piston mounting direction is shown by the marking (**3**) ↑**plus DT towards the timing side**.
- The piston class is given by the marking (**4**) (piston class A-B-C).
- The marking (**5**) is for the supplier's reference only.

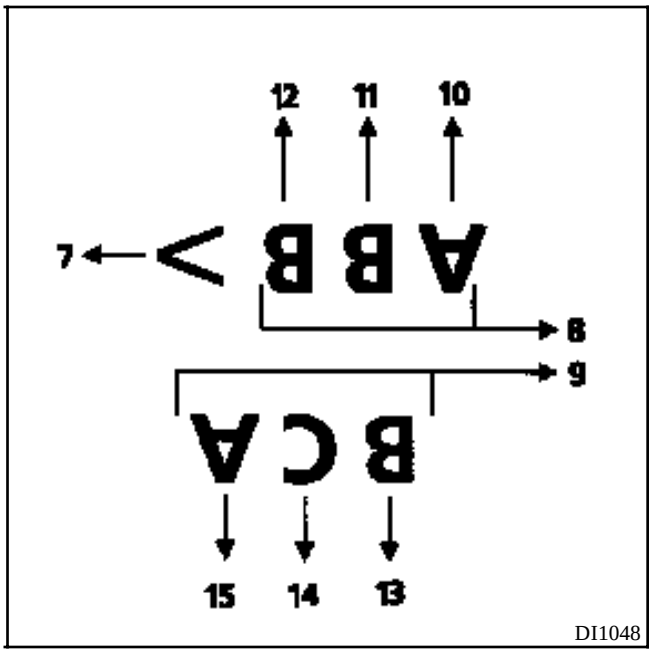
MARKING OF THE PISTON DIAMETER IN RELATION TO THE CYLINDER DIAMETER

Piston marking	Piston Diameter (mm)	Cylinder diameter (mm)
A	86.550 to 86.957 (excl)	87 to 87.007 (excl)
B	86.957 (incl) to 86.964 (excl)	87.007 (incl) to 87.014 (excl)
C	86.964 to 86.971 (incl)	87.014 to 87.021 (incl)

The markings of the piston diameters (**6**) are engraved on the cylinder block (above the oil filter)



Significance of marking (6) on the cylinder block



7 - Indicates timing end

8 - Front bank of cylinders

9 - Rear bank of cylinders

10 - Cylinder n°1 (front bank)

11 - Cylinder n°2 (front bank)

12 - Cylinder n°3 (front bank)

13 - Cylinder n°4 (rear bank)

14 - Cylinder n°5 (rear bank)

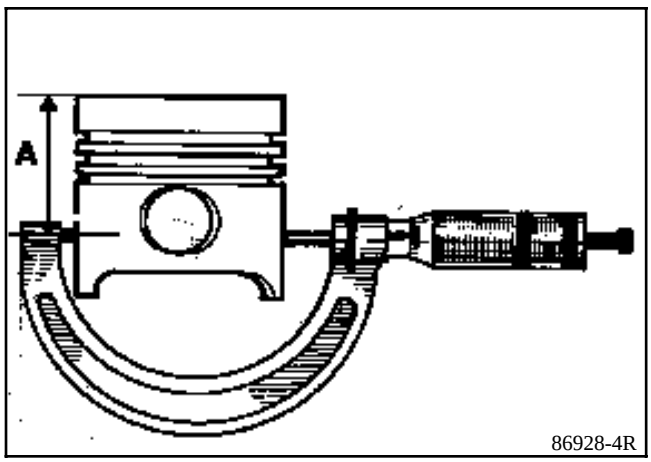
15 - Cylinder n°6 (rear bank)

CYLINDER LINERS

These are of the "**dry**" type (non -regrindable)

MEASURING THE PISTON DIAMETER

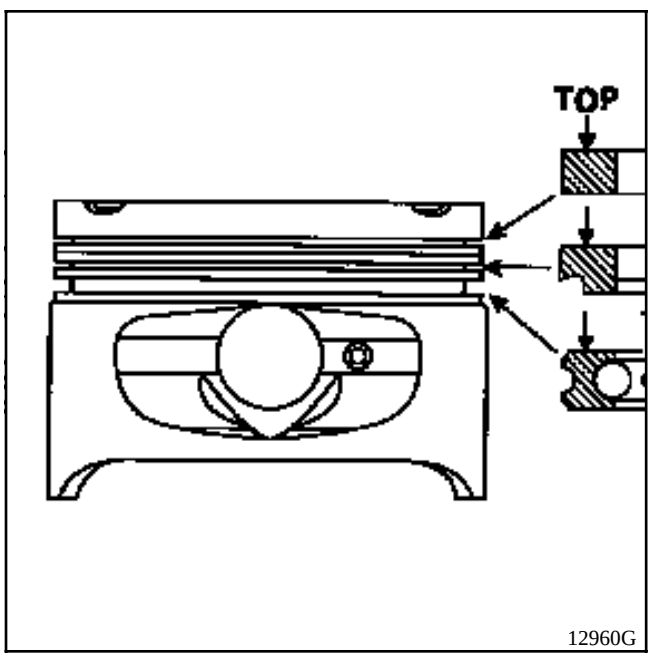
Measurement of the piston diameter must be carried out at a point where **A = 45 mm**.



PISTON RINGS

Three rings (thickness in **mm**) :

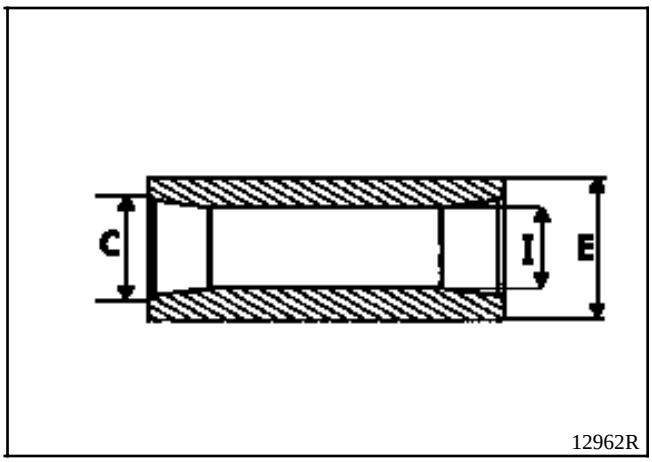
- Upper piston ring **1.5**
- Taper compression piston ring **1.5**
- Scraper ring **3**



Section clearance

Piston rings	Section clearance (mm)
Upper ring	0.20 to 0.35
Taper compression piston ring	0.40 to 0.65
Scraper ring	0.25 to 0.50

Gudgeon pin:



Length : **55.7 to 56 mm**

External diameter : **E = 21.99 to 22 mm**

Internal diameter : **I = 12.55 to 12.75mm**

C = 15.8 to 16.5 mm

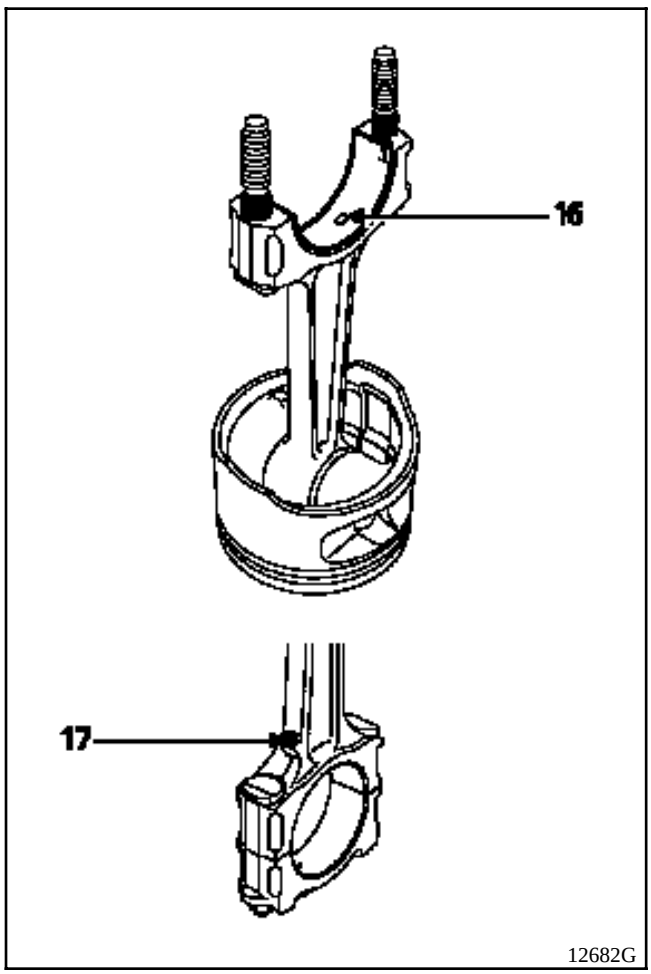
Note : the shaft is biconical, two machined areas allow the mass of the moving parts to be reduced.

Connecting rods

Big end end float: **0.20** to **0.80 mm**

Distance between big and little ends : **154 mm**

When fitting the big end bearing shells, ensure that the hole (16) in the bearing shell coincides exactly with the opening (17) in the connecting rod.



IMPORTANT

Do not use a scriber tool for the marking of the big end caps in relation to their bodies, in order to avoid starting any cracks in the connecting rods. Use an indelible pencil instead.

Crankshaft:

Number of bearings **4**

Roll hardened journals :

- Nominal diameter (**mm**) **65.971 to 65.990**

Roll hardened crankpins :

- Nominal diameter (**mm**) **51.171 to 51.190**

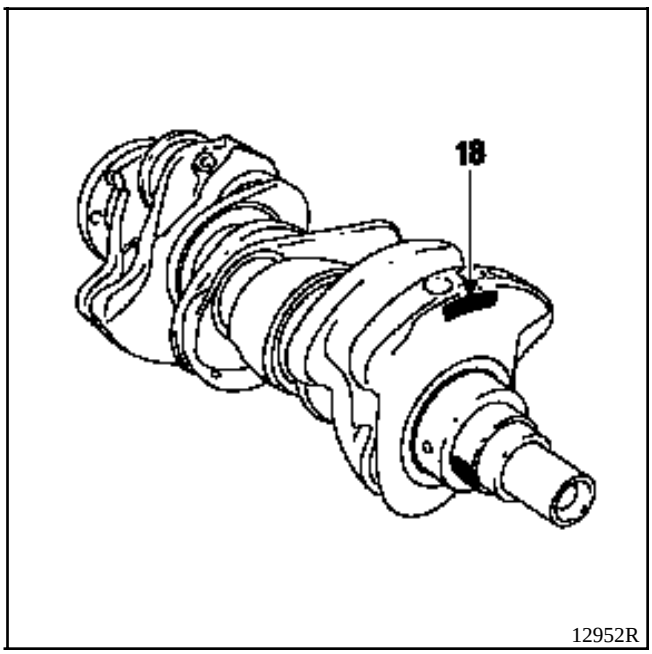
Six crankpins offset by **60°**

Crankshaft end float (mm) : **0.1 to 0.3**

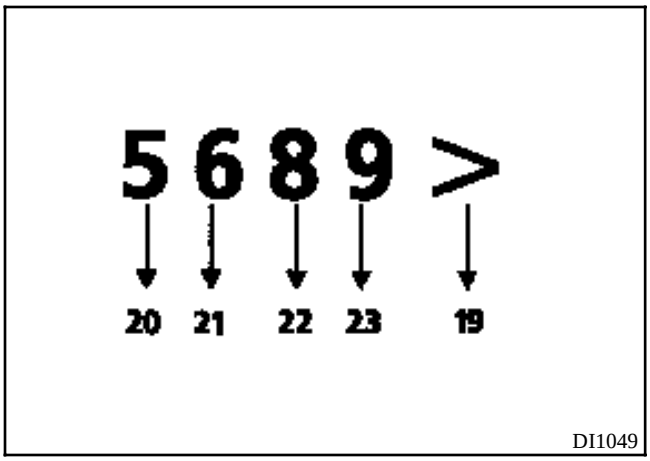
Note : The two flats on the crankshaft head drive the oil pump.

Marking on crankshaft :

Marking of the crankshaft journal diameter classes (18).



Significance of the marking :



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19 Indicates timing end

20 Marks the diameter class of journal **n°1**

21 Marks the diameter class of journal **n°2**

22 Marks the diameter class of journal **n°3**

23 Marks the diameter class of journal **n°4**

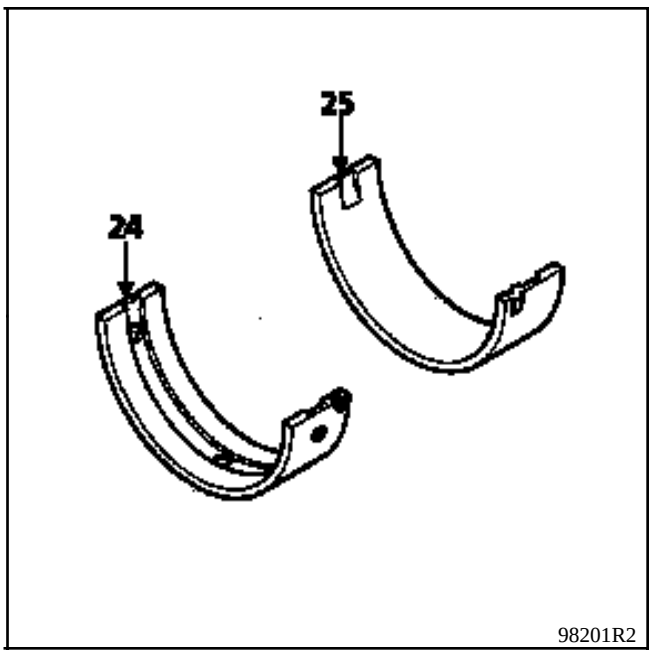
Table of diameter classes of the bearing journals

Marking of class on crankshaft	Journal diameter (mm)
5	65.971 to 65.974
6	65.975 to 65.978
7	65.979 to 65.982
8	65.983 to 65.986
9	65.987 to 65.990

CRANKSHAFT BEARING SHELLS

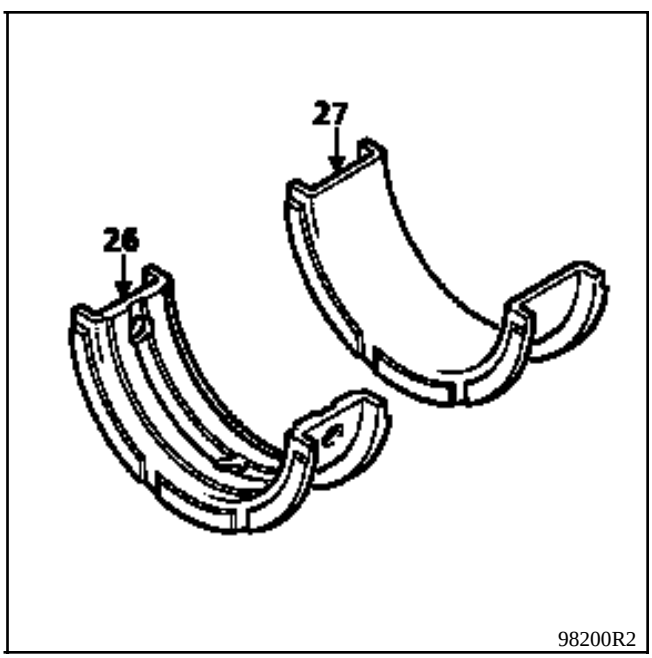
Fitting direction

- For bearings 1 - 3 - 4, place the grooved shell 24) **on the cylinder block side** and the non-grooved shell (25) **on the bearing block side**



98201R2

- For bearing 2, the end flanges are part of the half-shell. The grooved shell (26) **is fitted on the cylinder block side** and the shell without the groove (27) **on the bearing block side**.



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Determining the class of the crankshaft bearing shells

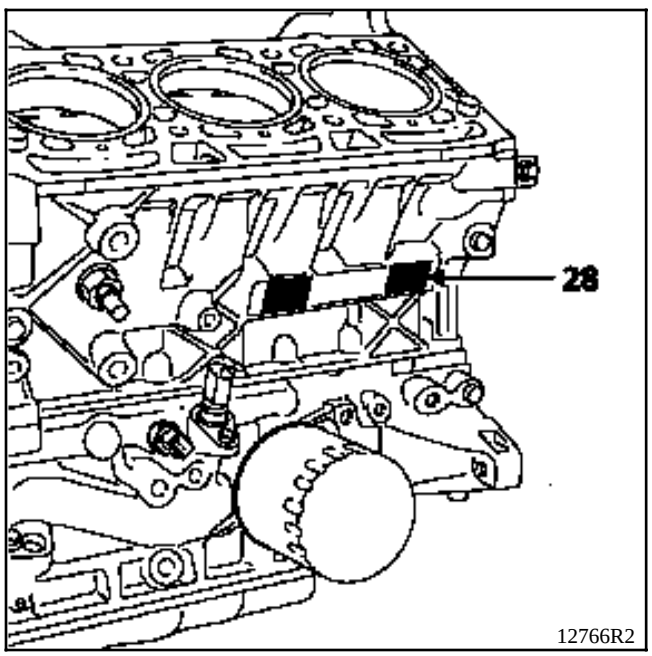
The upper half-shells are grooved and the lower ones are smooth.**It is vital to mark the position of the bearing shells, as the class may be different for each bearing of the bearing block.**

There is only **one class of upper bearing shells** (Cylinder block side) .

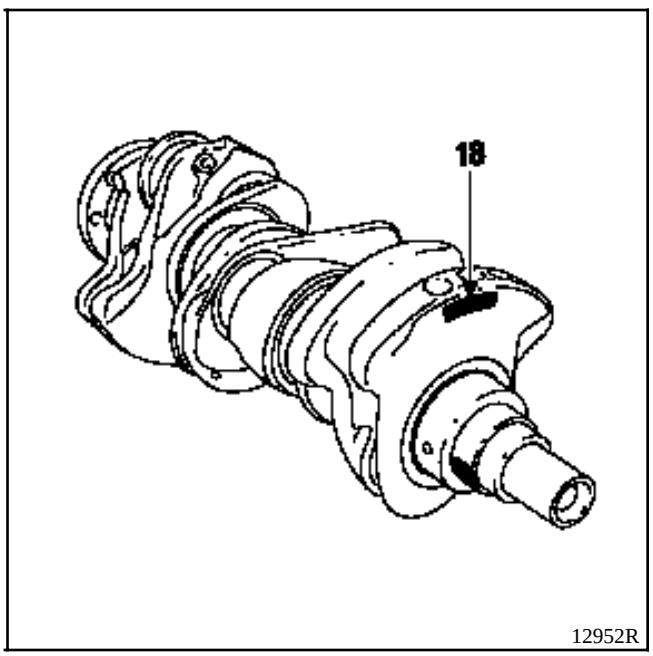
The operating clearance (radial clearance) of the crankshaft bearings must be between **0.026 and 0.053 mm** and is obtained by creating four classes of lower bearing shells (bearing block side).

The bearing shell classes are determined by the measurement of each bearing . The result is marked on the cylinder block (28) and on the crankshaft (18).

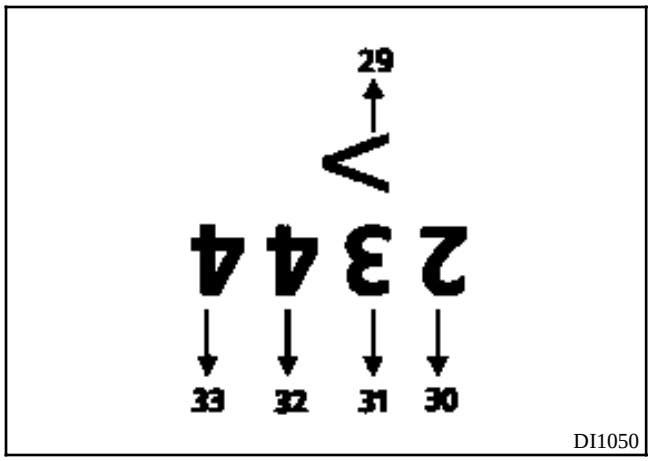
Cylinder block



Crankshaft



Significance of the marking (Cylinder block) :



29 Indicates timing end

30 Diameter class of bearing **n°1**

31 Diameter class of bearing **n°2**

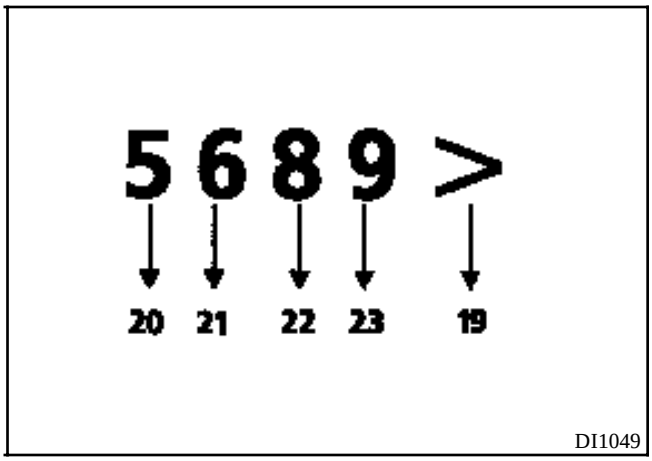
32 Diameter class of bearing **n°3**

33 Diameter class of bearing **n°4**

Table of different diameter classes of bearings

Marking of class on cylinder block	Bearing diameter (mm)
1	72 to 72.004
2	72.005 to 72.009
3	72.010 to 72.014
4	72.015 to 72.019

Significance of marking (on crankshaft) :



19 Indicates timing end

20 Marking of diameter class of journal **n°1**

21 Marking of diameter class of journal **n°2**

22 Marking of diameter class of journal **n°3**

23 Marking of diameter class of journal **n°4**

Table of different diameter classes of journals

Marking of class on crankshaft	Journal diameter (mm)
5	65.971 to 65.974
6	65.975 to 65.978
7	65.979 to 65.982
8	65.983 to 65.986
9	65.987 to 65.990

Method for selection of lower half-shell:

Note the different classes on the crankshaft and on the cylinder block

On crankshaft **5689**

On cylinder block **2344**

Bearing n°1 **5** 689
2 344

According to the information in the following table, a yellow **C3** class bearing shell is required.

Bearing n°2 5 **6** 89
2 **3** 44

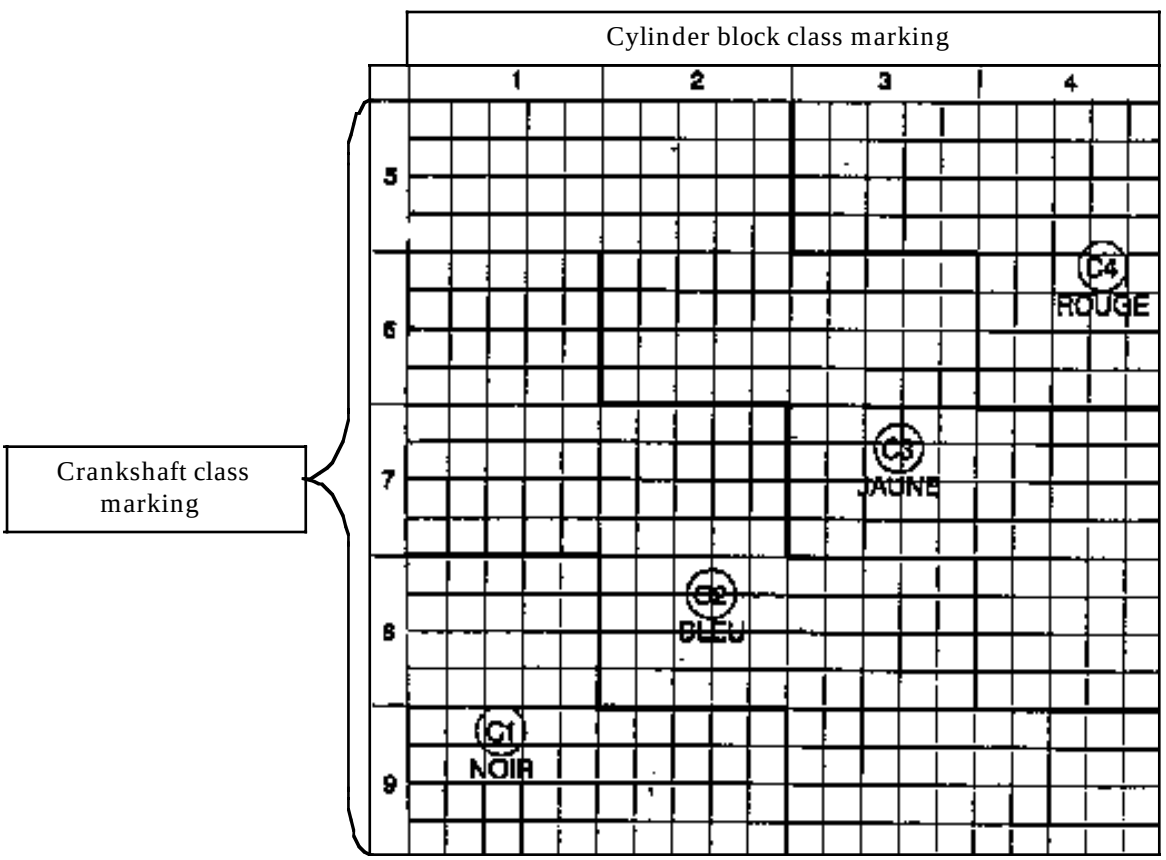
According to the information in the following table, a yellow **C3** class bearing shell is required.

Bearing n°3 56 **8** 9
23 **4** 4

According to the information in the following table, a yellow **C3** class bearing shell is required .

Bearing n°4 568 **9**
234 **4**

According to the information in the following table, a blue **C 2** class bearing shell is required.



DI1047

Table of thicknesses of crankshaft bearing shells

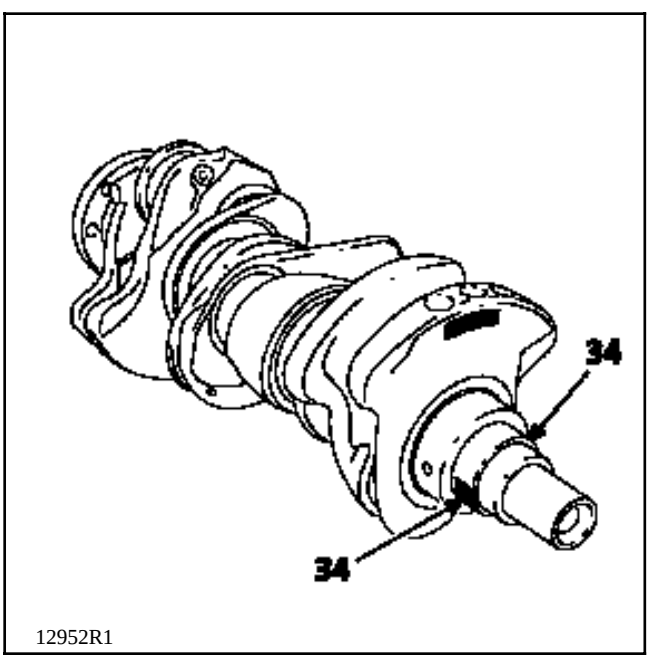
Half-shell	Marking	Class	Thickness(mm)
Upper	Grooved (no marking)		2.999 to 3.005
Lower	Black, smooth	C1	2.987 to 2.993
Lower	Blue, smooth	C2	2.995 to 3.001
Lower	Yellow, smooth	C3	3.003 to 3.009
Lower	Red, smooth	C4	3.011 to 3.017

OIL PUMP

Minimum oil pressure at 80 °C (in bar)

- Idle speed **2**
- 3000 rpm **5**

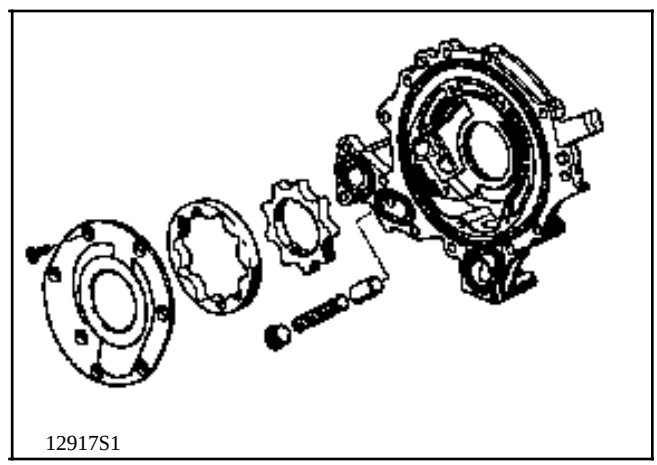
The oil pump is driven by the two flats at (34).



12952R1

The pump is a **rotor type** pump.

Exploded view of the oil pump.


12917S1

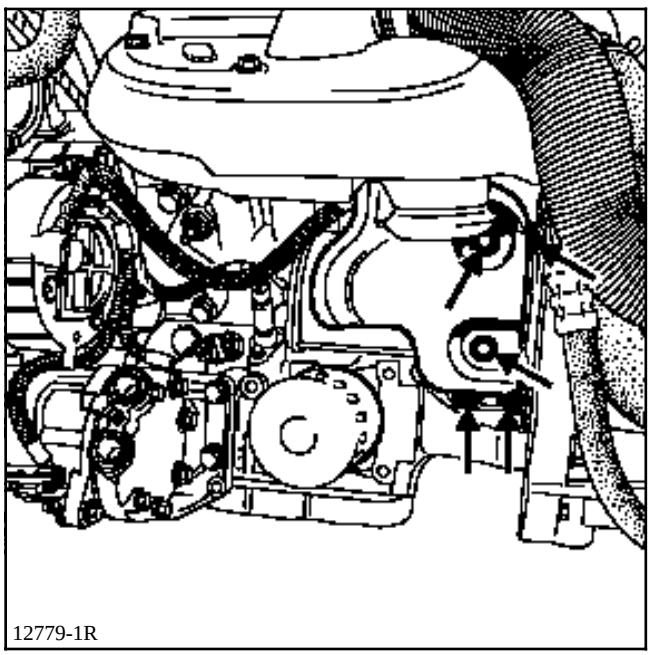
NOTE : Fill the pump with oil (in order to facilitate repriming).

Mounting the engine on the DESVIL stand

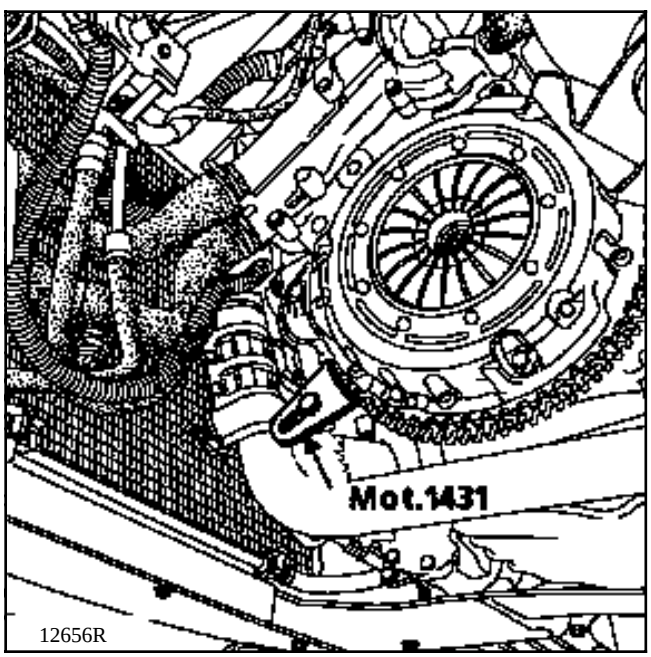
Remove:

- the starter motor heat shield,

- the starter motor ,


12779-1R

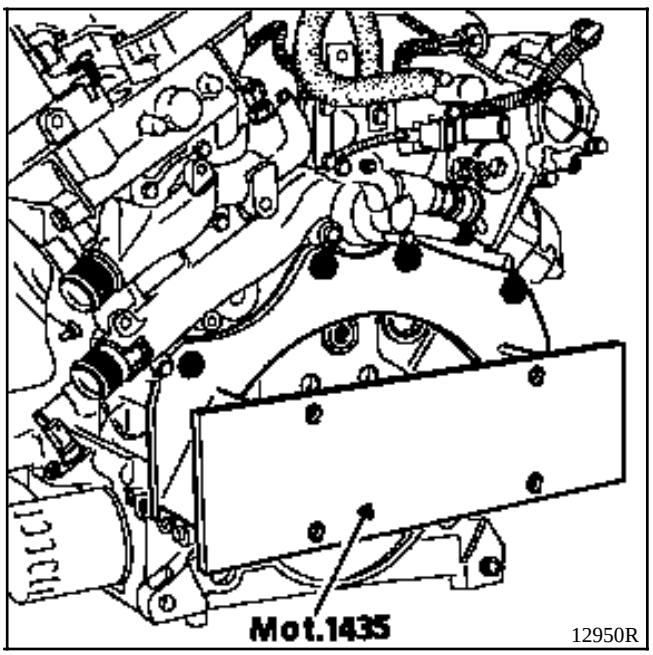
- the clutch and the flywheel using tool **Mot. 1431**.



12656R

Remove the engine support plate **Mot. 792-03** from the DESVIL stand.

Fit the engine support tool **Mot. 1435** onto the engine.



12950R

CONSUMABLES

Type	Quantity	Component concerned	Part Number (SODICAM)
Ravitol S 56	-	Cleaning parts	77 01 421 513
Loctite Frenetanch (braking and sealing resin)	1 to 2drops	-	77 01 394 070
Décapjoint	Coat	Cleaning gasket faces	77 01 405 952
Autojoint OR	Coat	Camshaft bearing block	77 01 422 751

PRECAUTIONS

WASHING THE ENGINE

Protect the timing and alternator belts to avoid splashing water and washing products on to them.

Do not allow water to penetrate the air inlet pipes.

FITTING OF THREAD INSERTS

The threaded holes in all the engine components may be repaired using thread inserts, except the mounting holes of :

- the cylinder head,
- the crankshaft bearing block.

PARTS TO BE REPLACED ONCE THEY HAVE BEEN REMOVED

- All seals.
- Flywheel bolts.
- Valve guides .
- Cylinder head bolts if their length is greater than **149.5 mm**.
- Crankshaft bearing block bolt if their length is greater than :
  - for M8 bolts : 119 mm.
  - for M11 bolts : 131. 5 mm.

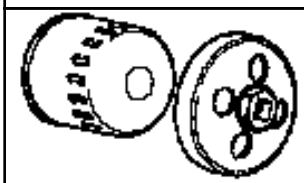
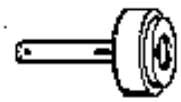
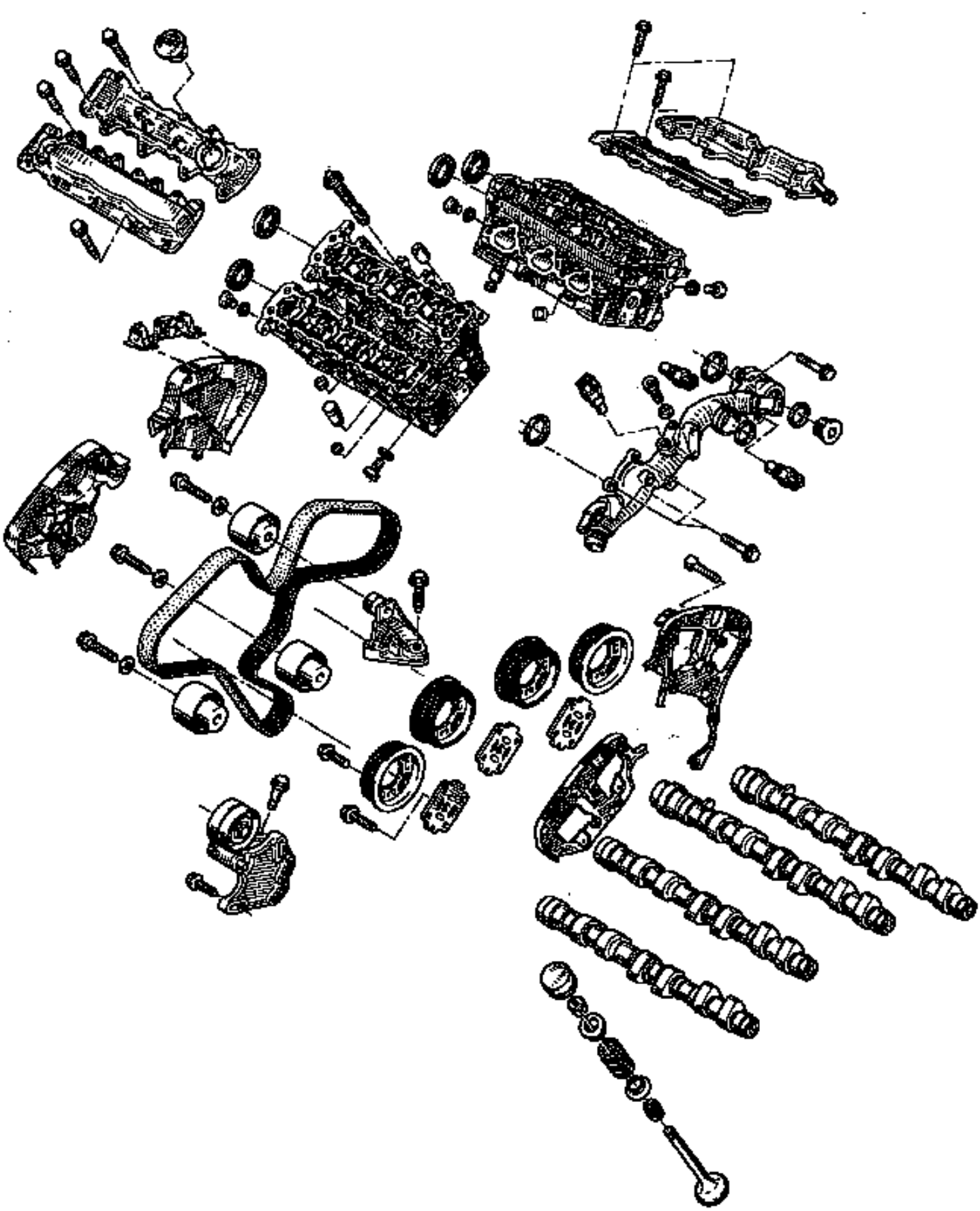
Diagram	Method reference	Part number	Description
 68603S1	**Mot. 11**	00 01 072 100	Crankshaft bearing extractor.
 69716S1	**Mot. 445**	00 00 044 500	Oil filter wrench.
 77889S1	**Mot. 591-02**	00 00 059 102	Magnetized adapter for cylinder head angle tightening wrench.
 78181S	**Mot. 591-04**	00 00 059 104	Angle tightening wrench for tightening the cylinder head, 1/2" drive with index.
 96508S1	**Mot. 1273**	00 00 127 300	Tool for checking belt tension
 97160-1S1	**Mot. 1280-01**	00 00 128 001	Oil filter cover
 98503S	**Mot. 1335**	00 00 133 500	Pliers to remove valve stem seals

Diagram	Method Reference	Part number	Description
 13290S1	**Mot. 1428**	00 00 142 800	Camshaft locking tool.
 13289S1	**Mot. 1429**	00 00 142 900	Timing belt tension wheel setting fork.
 13293S1	**Mot. 1430**	00 00 143 000	Five pins for setting camshaft and crankshaft pulleys.
 13292S1	**Mot. 1430-01**	00 00 143 001	Control pin
 13284S1	**Mot. 1431**	00 00 143 100	Flywheel immobiliser.
 13286S1	**Mot. 1432**	00 00 143 200	Tool for fitting camshaft seal.

Diagram	Method Reference	Part Number	Description
 96898-1S1	**Mot. 1433**	00 00 143 300	Tool for fitting crankshaft seal at flywheel end
 13287S1	**Mot. 1434**	00 00 143 400	Tool for fitting crankshaft seal (timing end).
 12950S1	**Mot. 1435**	00 00 143 500	Engine support tool, fits on DESVIL stand.
 13288S1	**Mot. 1436**	00 00 143 600	Timing belt locking pin.

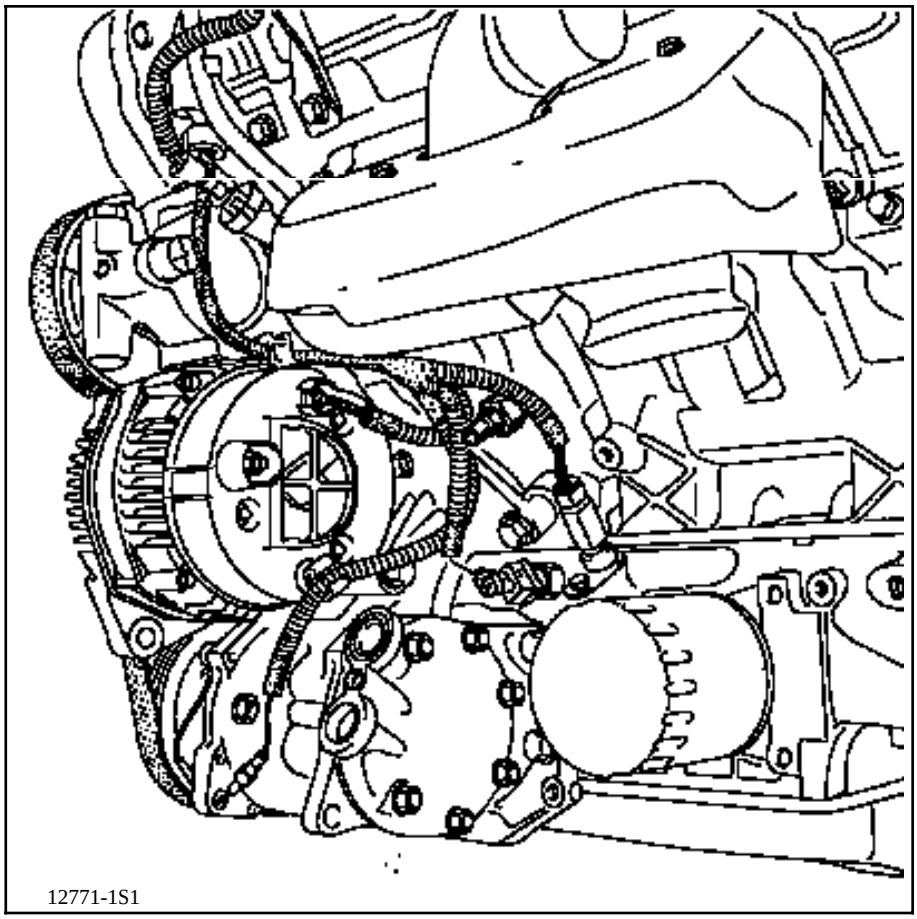
Description
 83391S — Ring for fitting piston with piston rings inside cylinder liner (all types).
Set of CERGYDIS C108 NEWAY burrs for grinding valve seats
Valve lifter
12/14 standard 1/2" female Torx sockets (12.7 mm square).
Tool for angle tightening bearing cap bolts, for crankshaft, cylinder heads, etc.
Piston ring pliers

EXPLODED VIEW OF CYLINDER HEAD

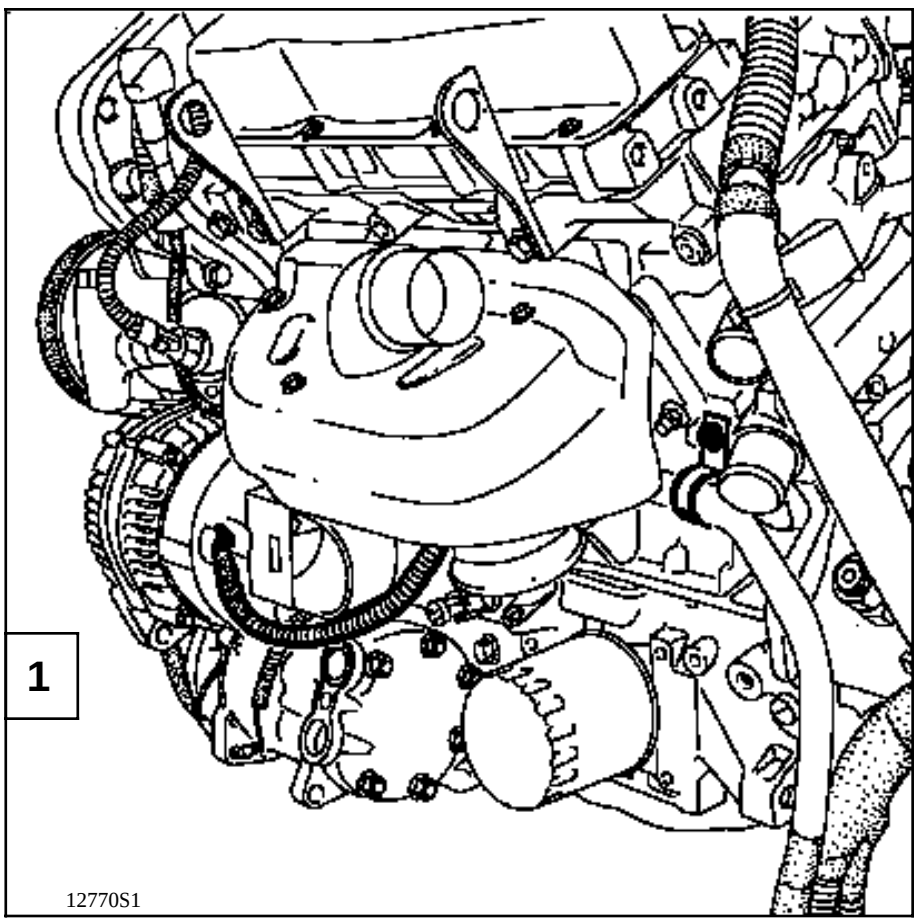


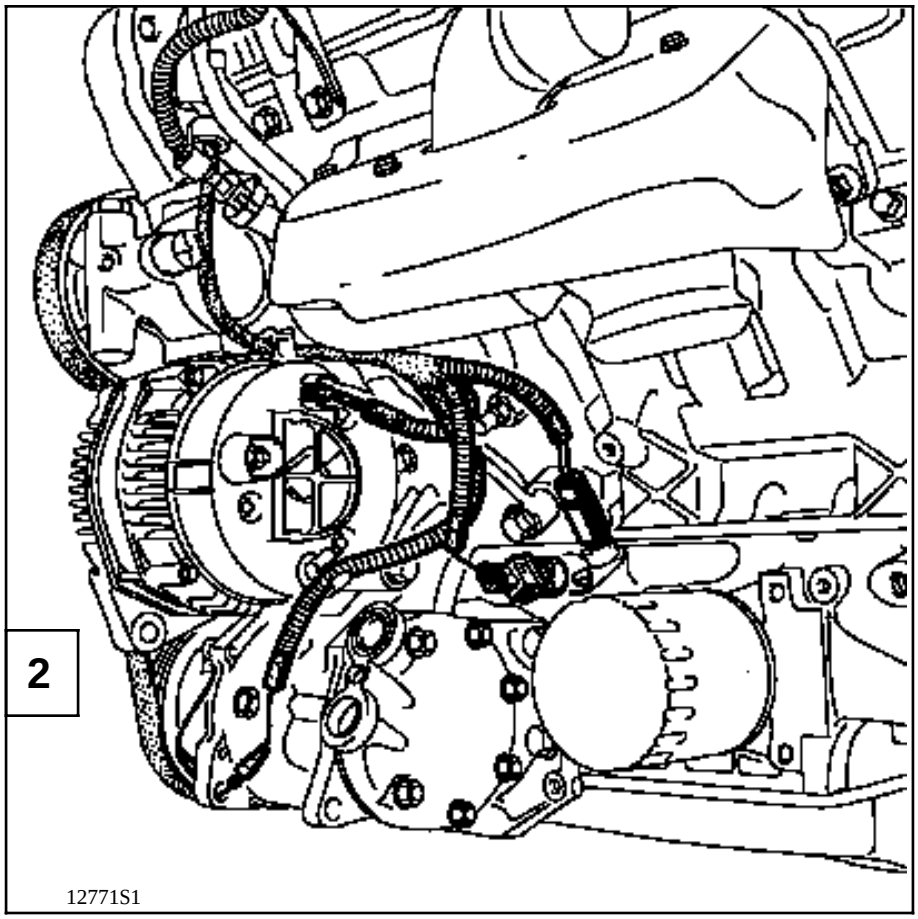
PRN1204

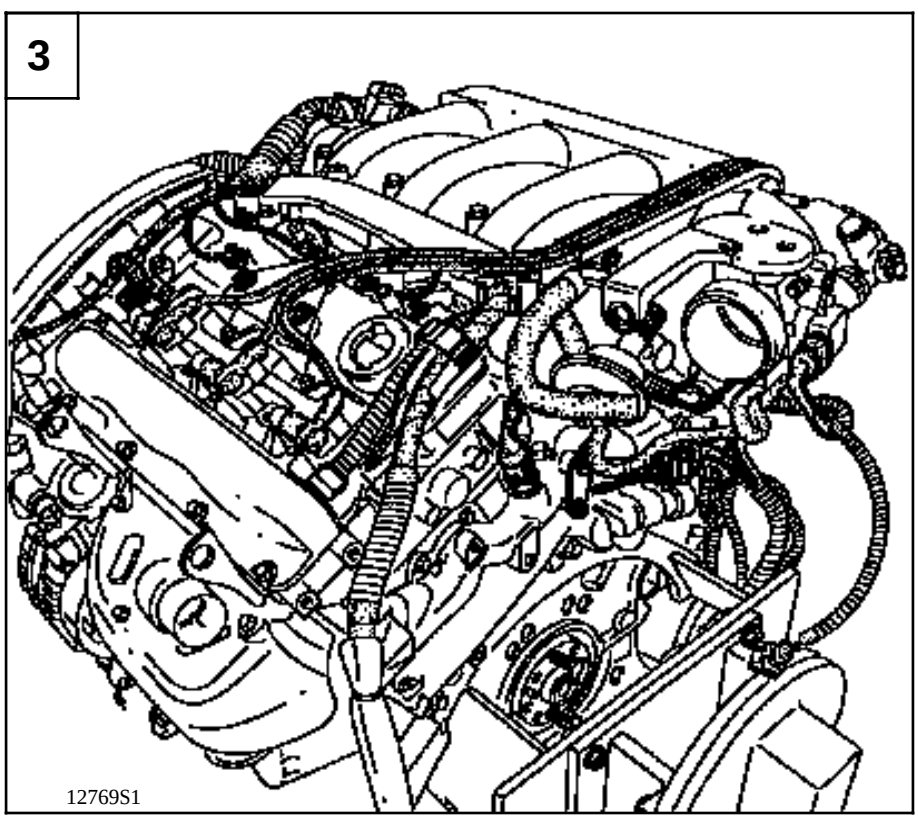
Drain the engine oil and cooling circuit.



Remove the engine electrical wiring loom (diagrams 1 to 9)




2
12771S1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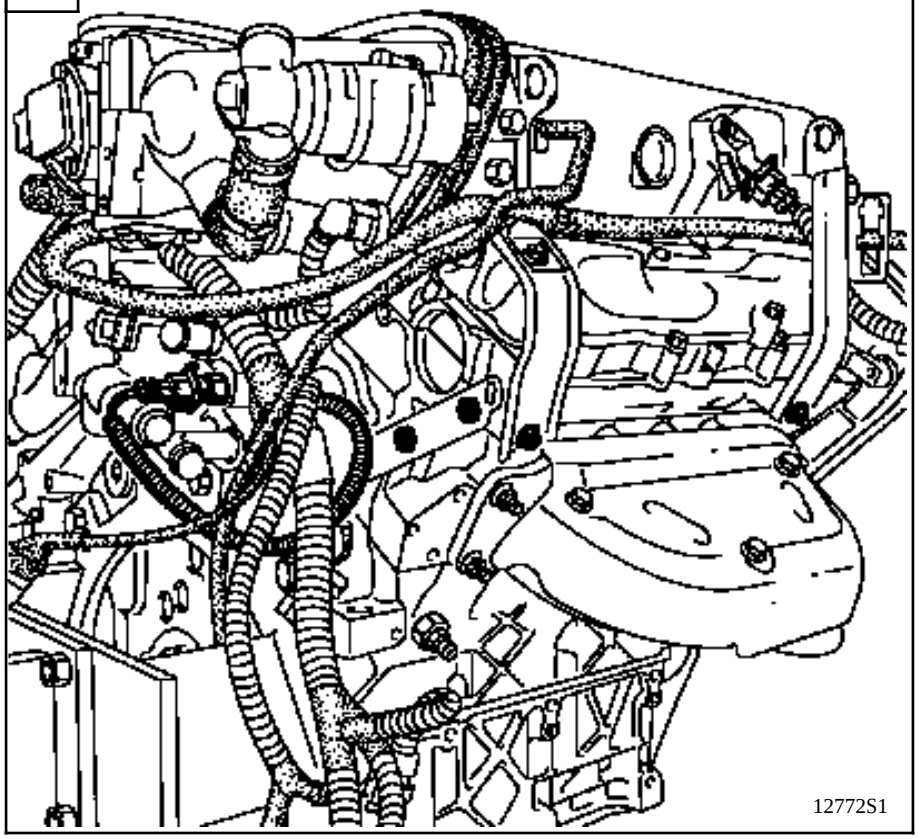
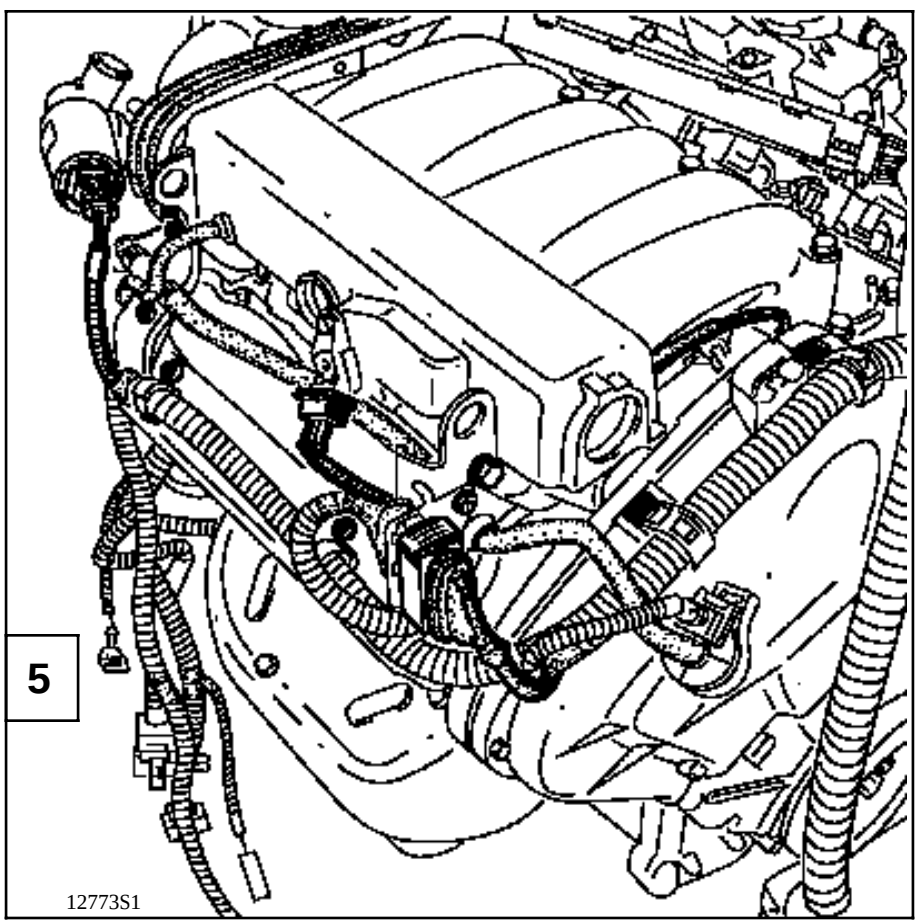
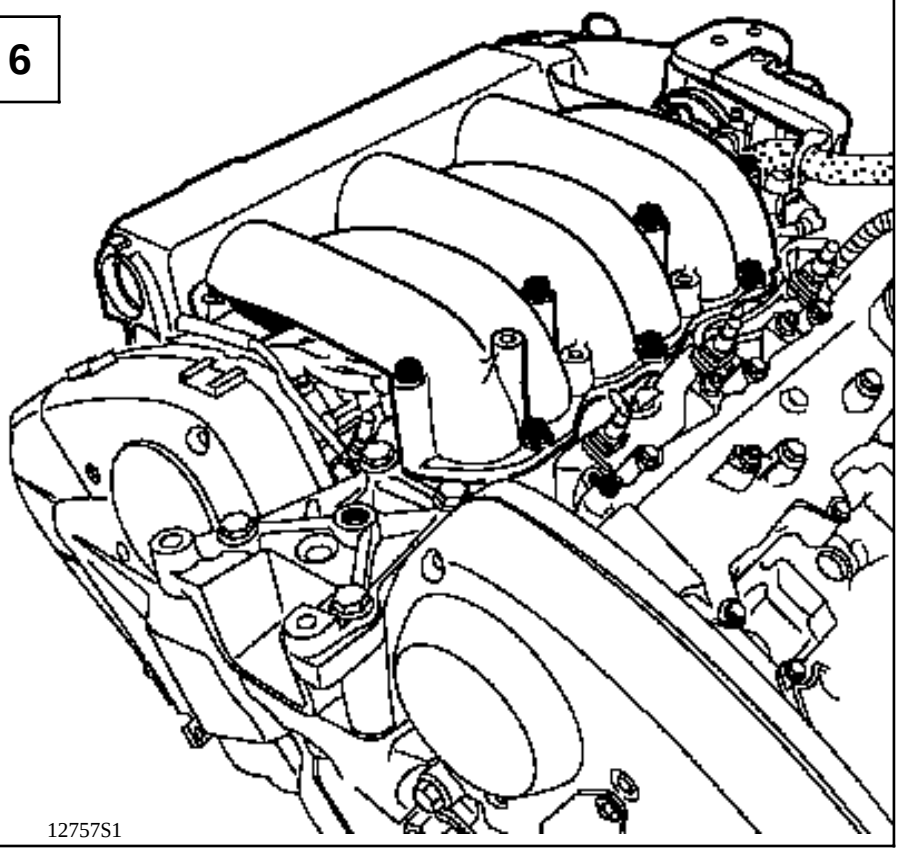
12769S1

4





6



12757S1

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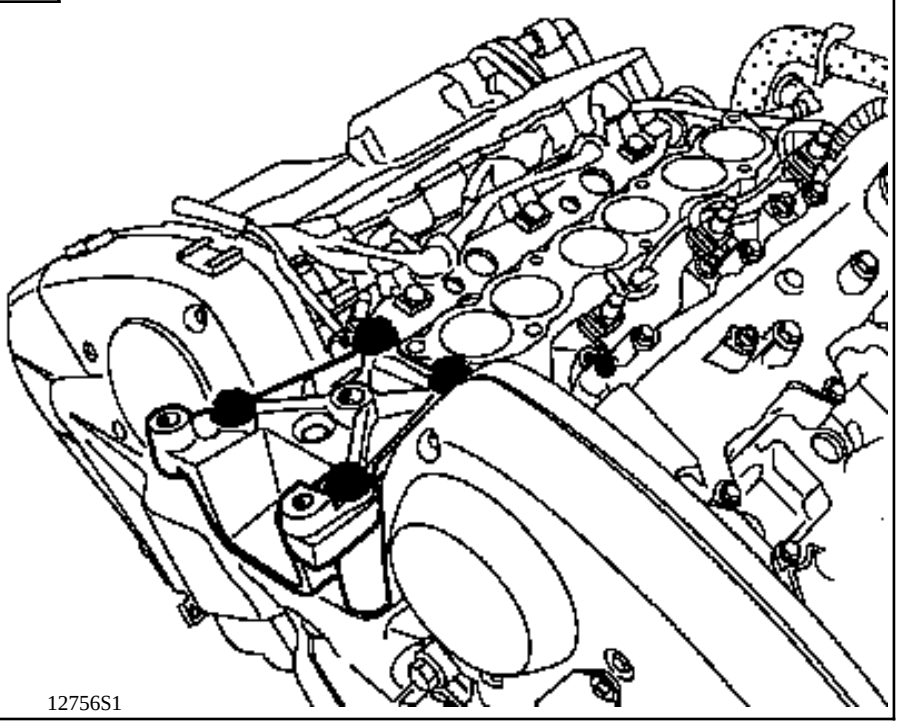

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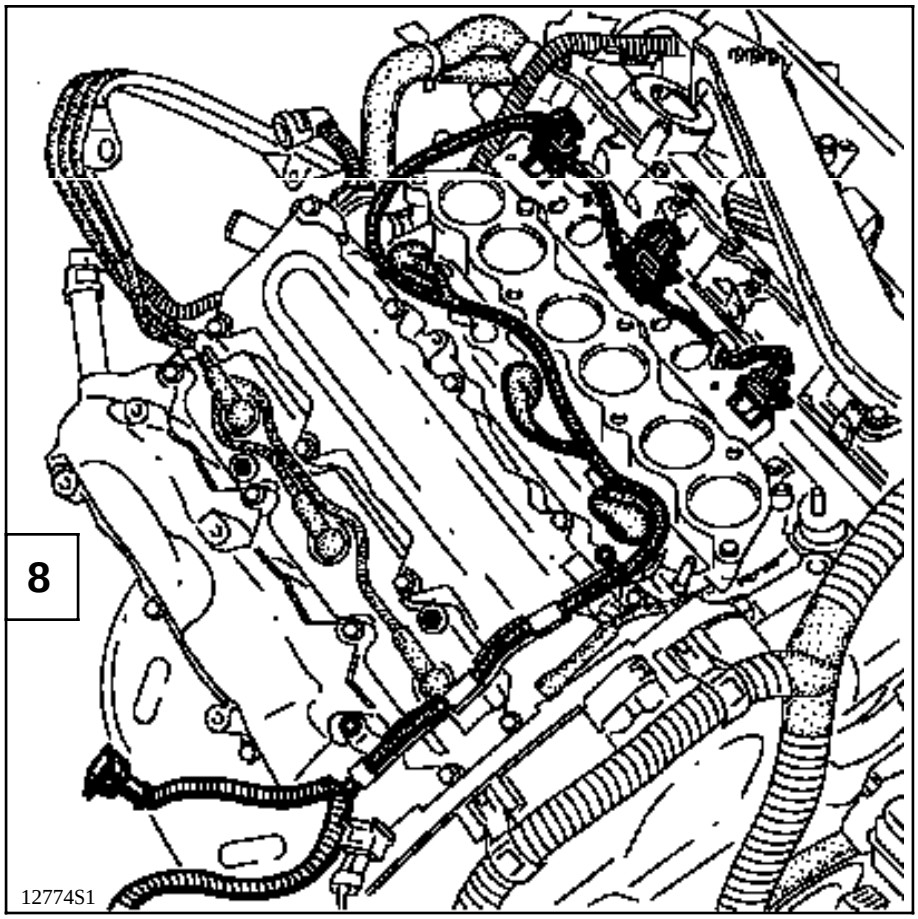
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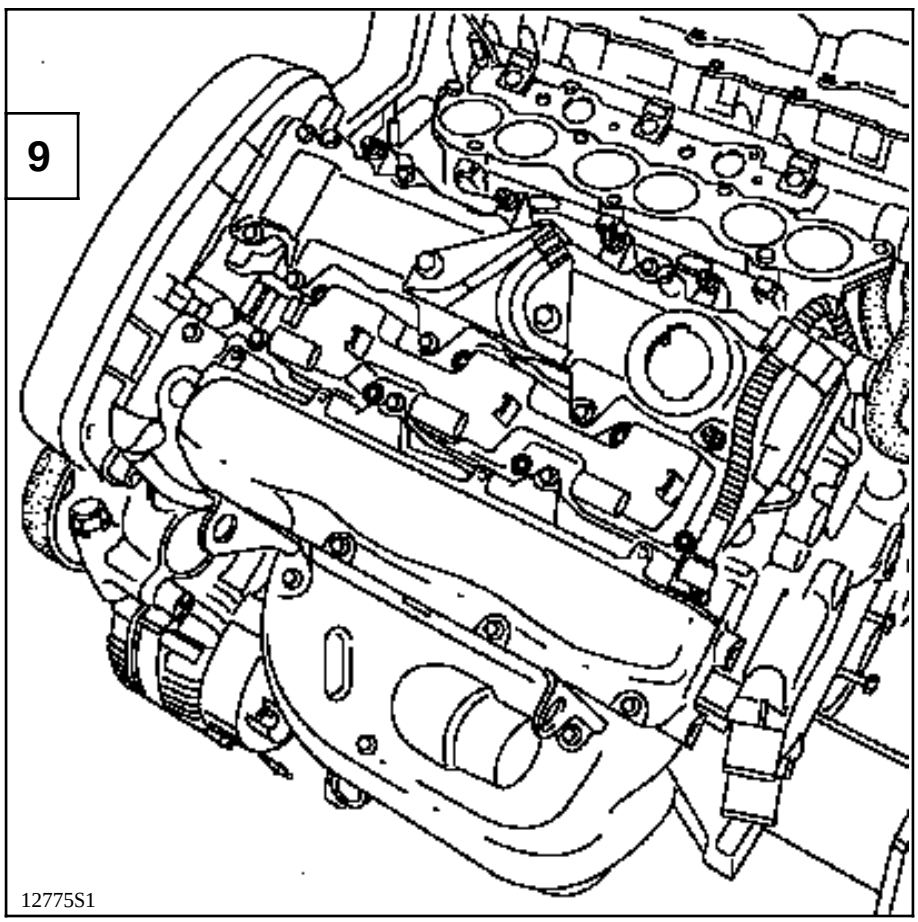
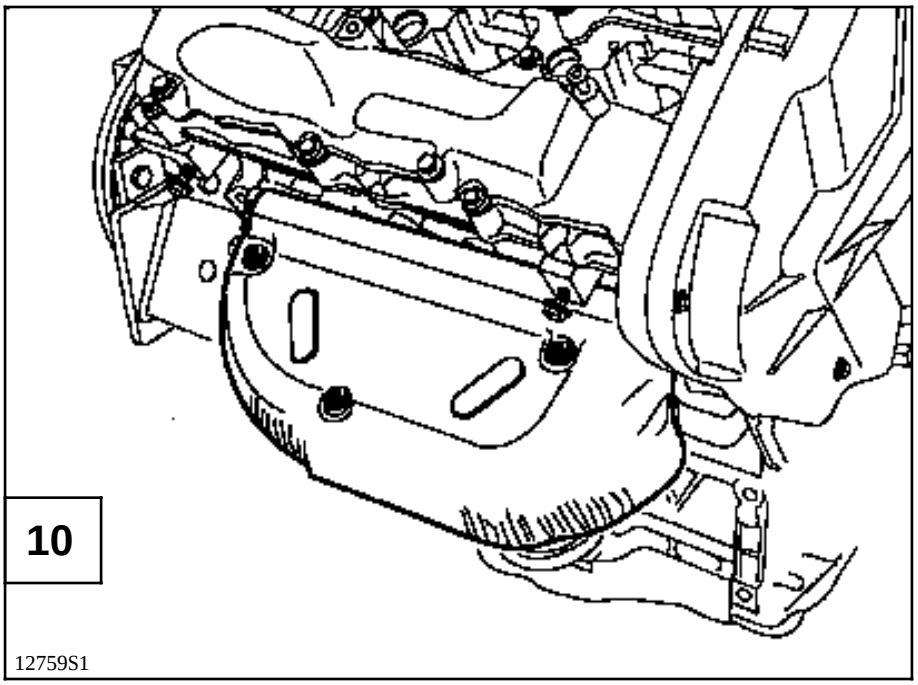
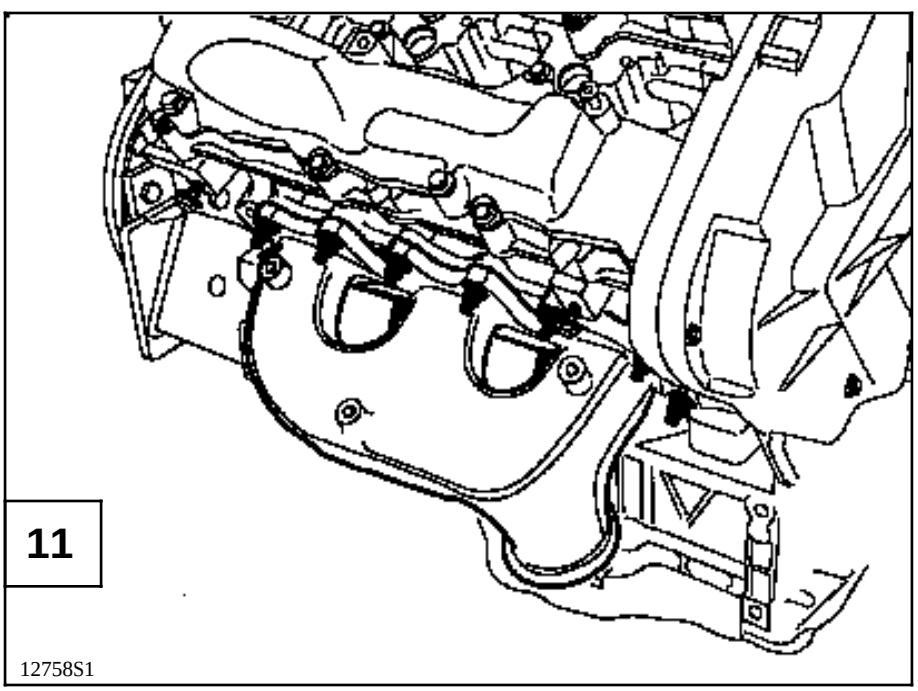
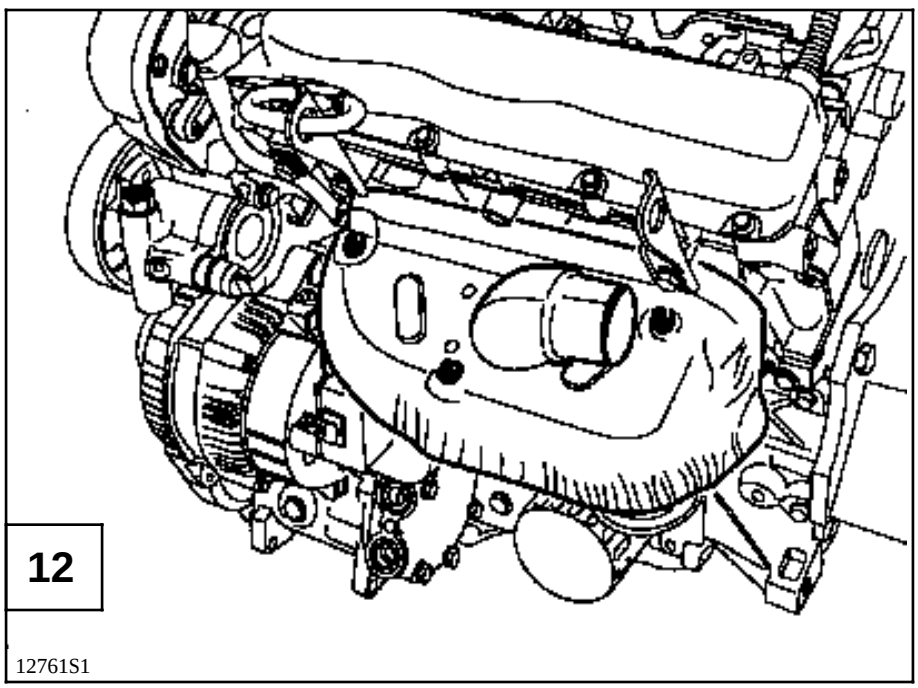
12774S1


9
12775S1

Remove from the top of engine in the order recommended below (diagrams 10 to 48)



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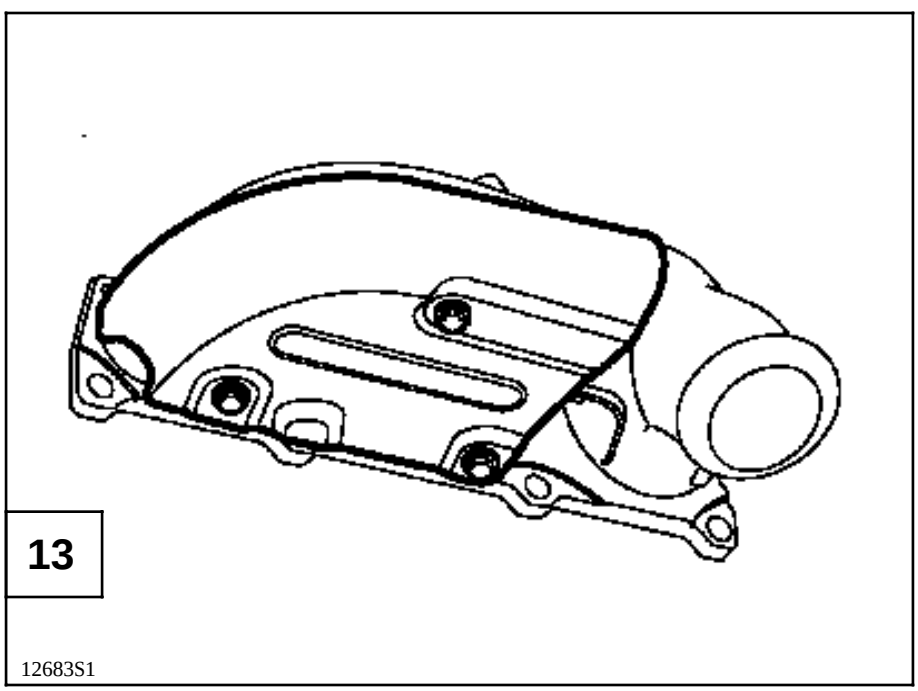
12761S1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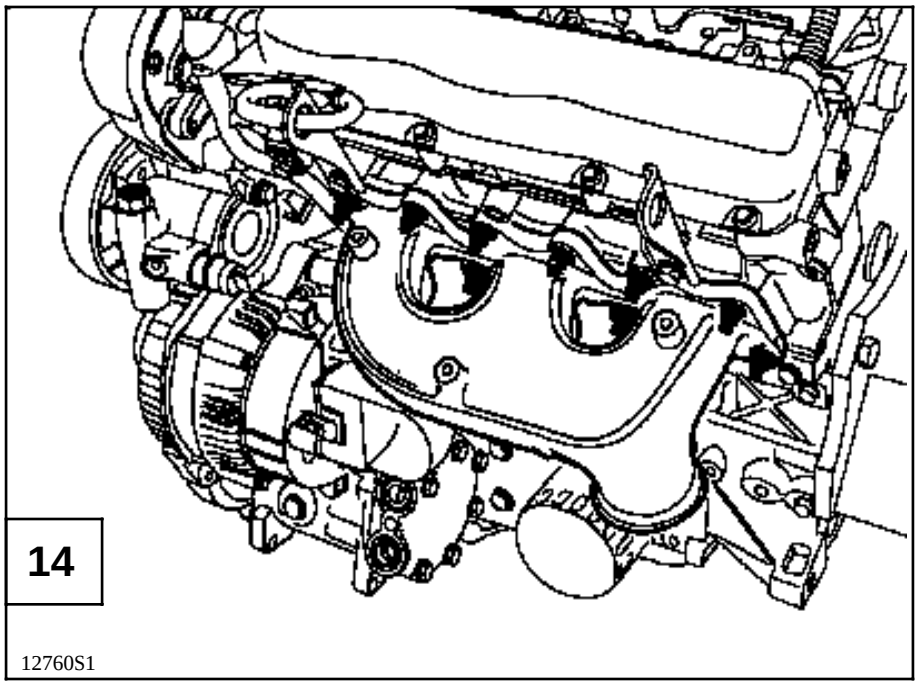
12683S1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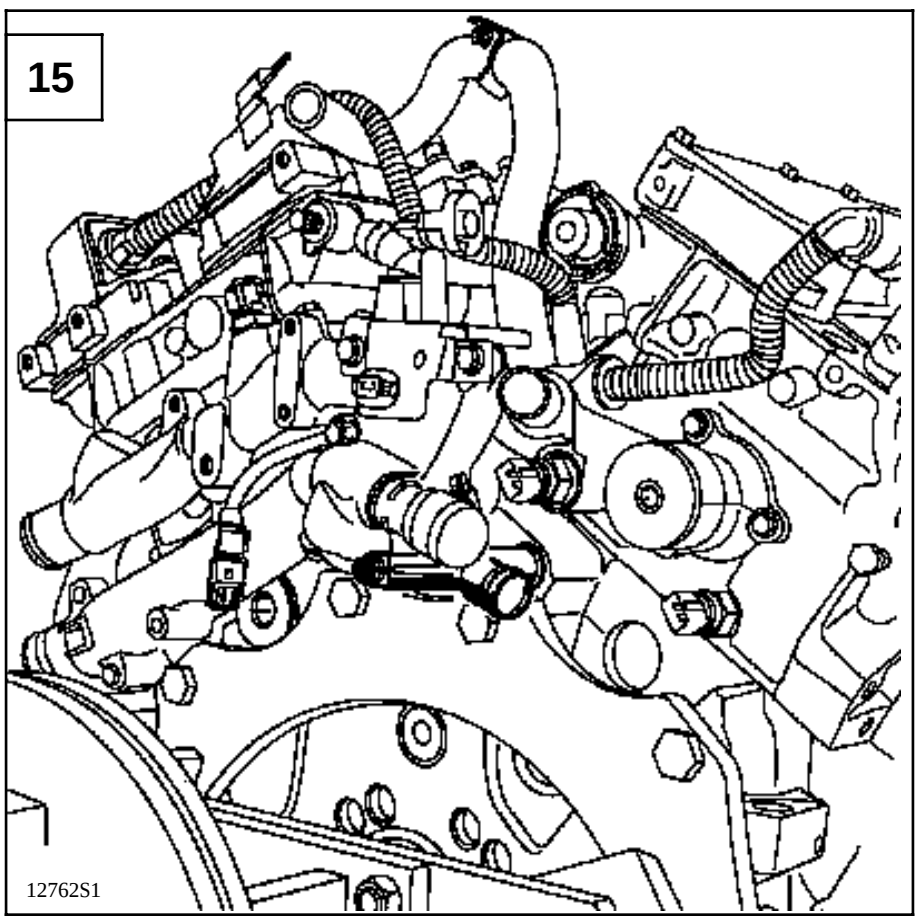
12760S1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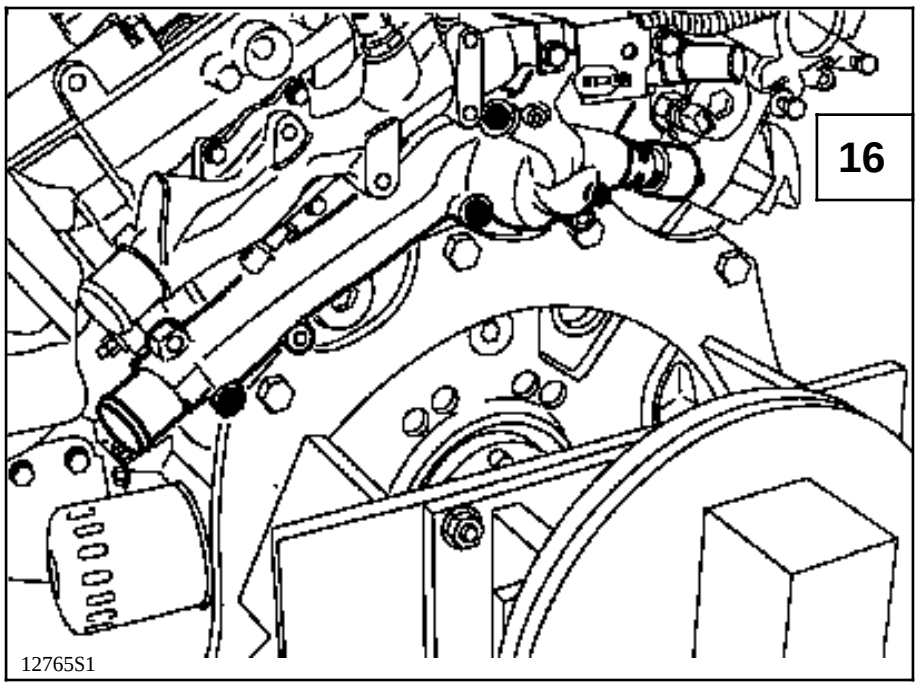
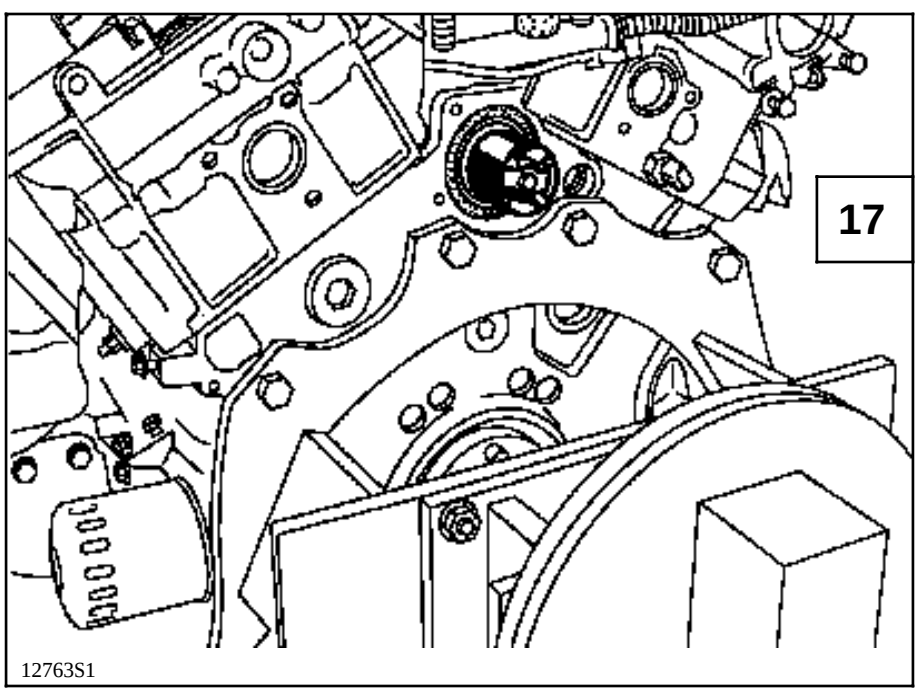
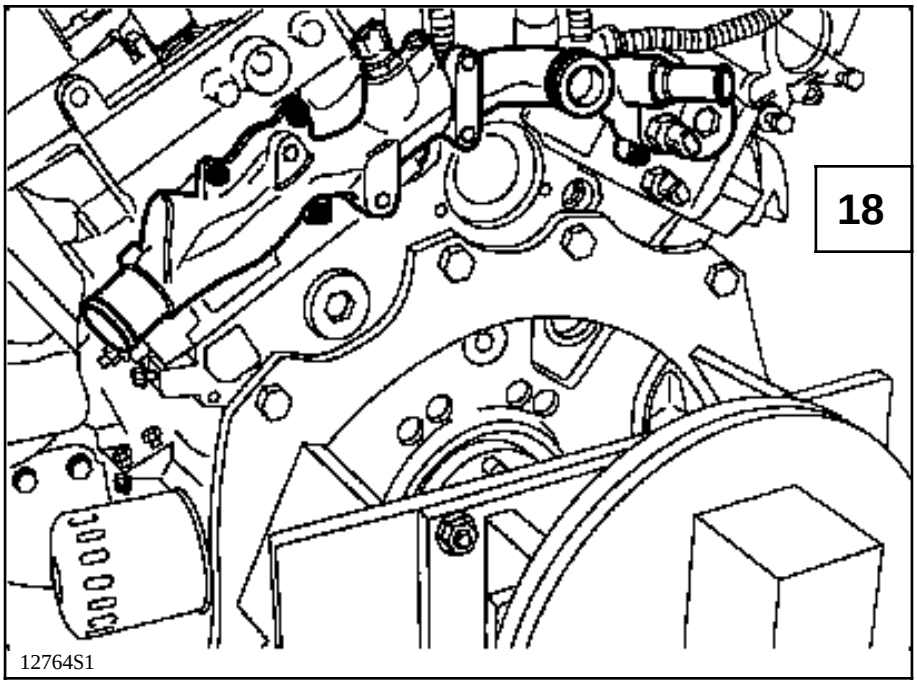
12762S1



Thermostat

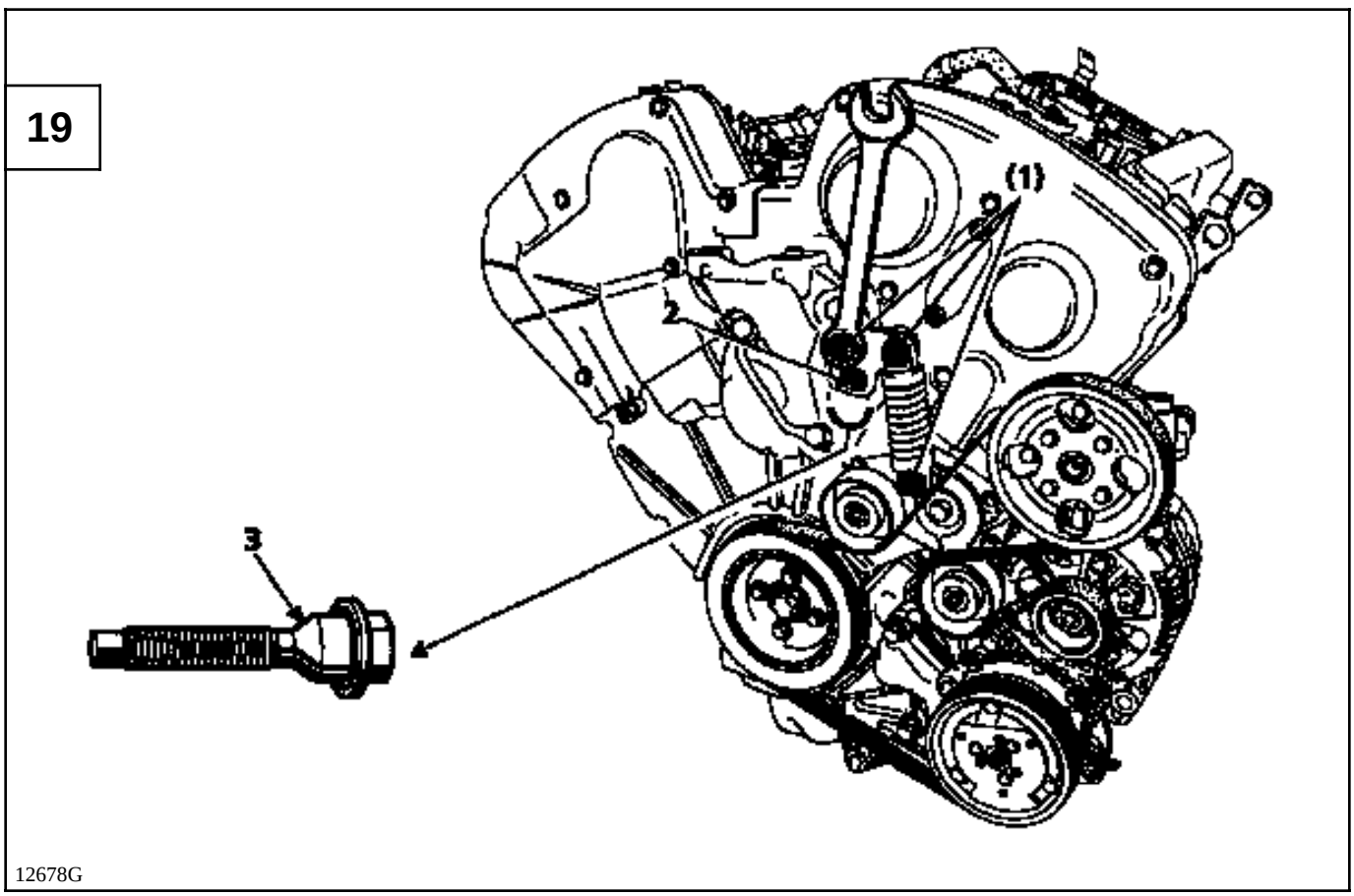


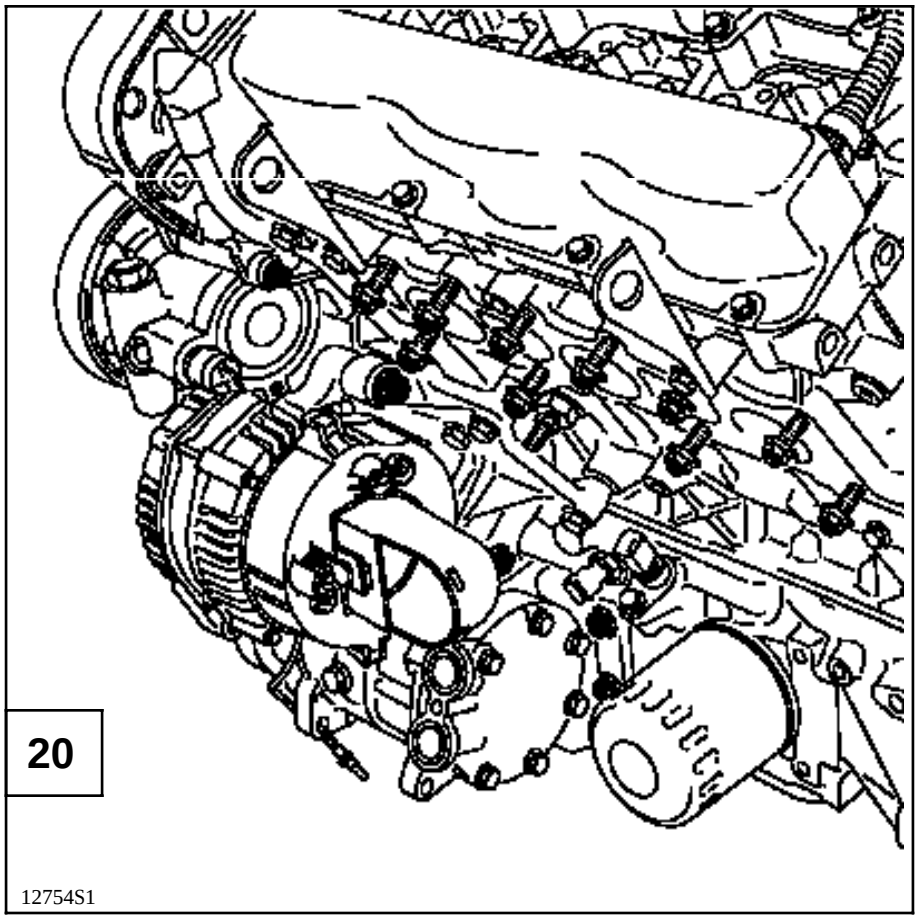


Release the three bolts at (1).

Slacken bolt (2) up to the conical section (3) (while holding the fork wrench).

Pivot the wrench to the **left** to slacken the belt.

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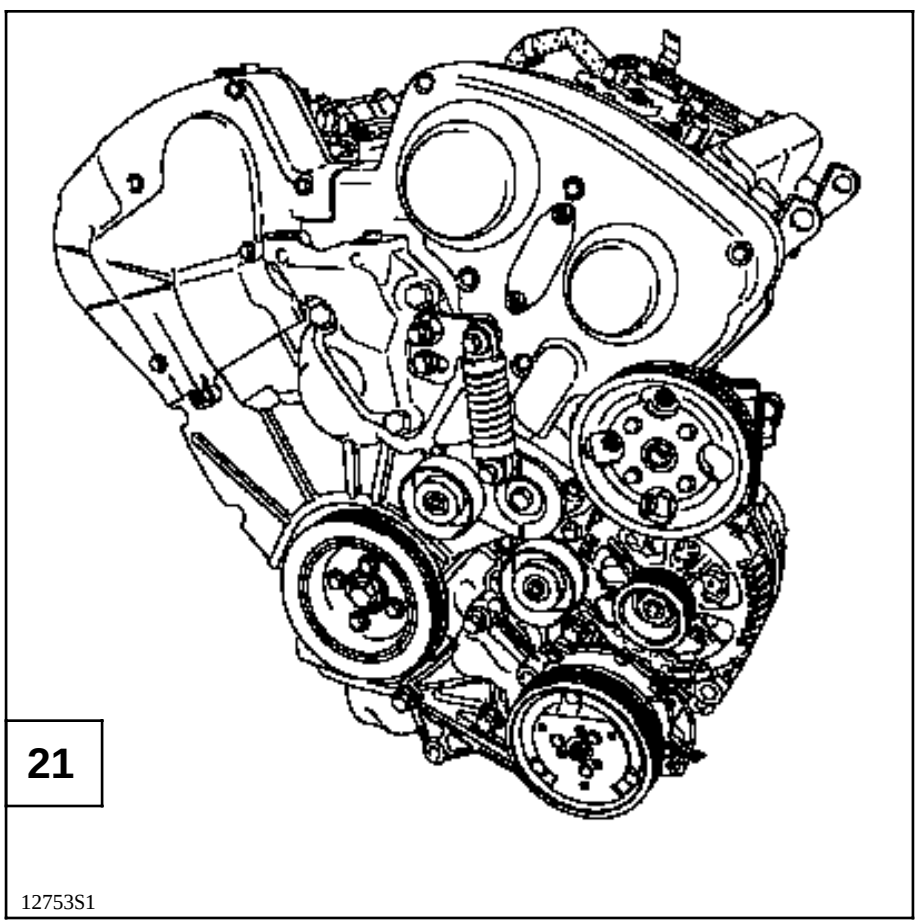
12754S1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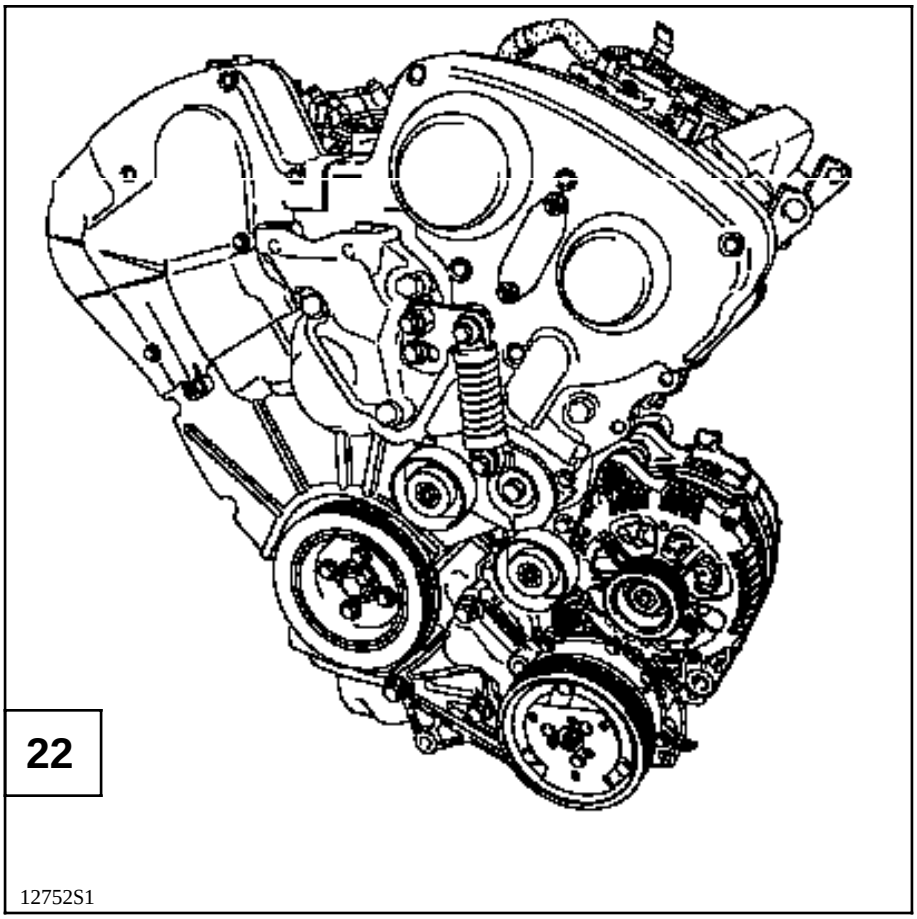
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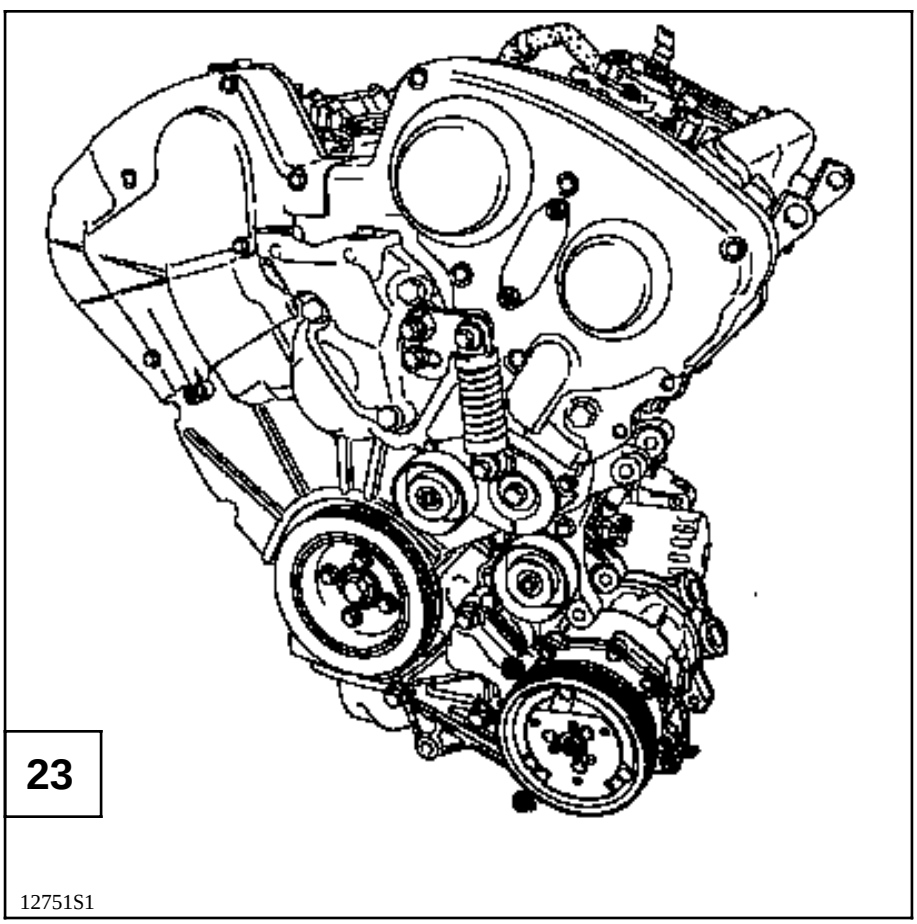
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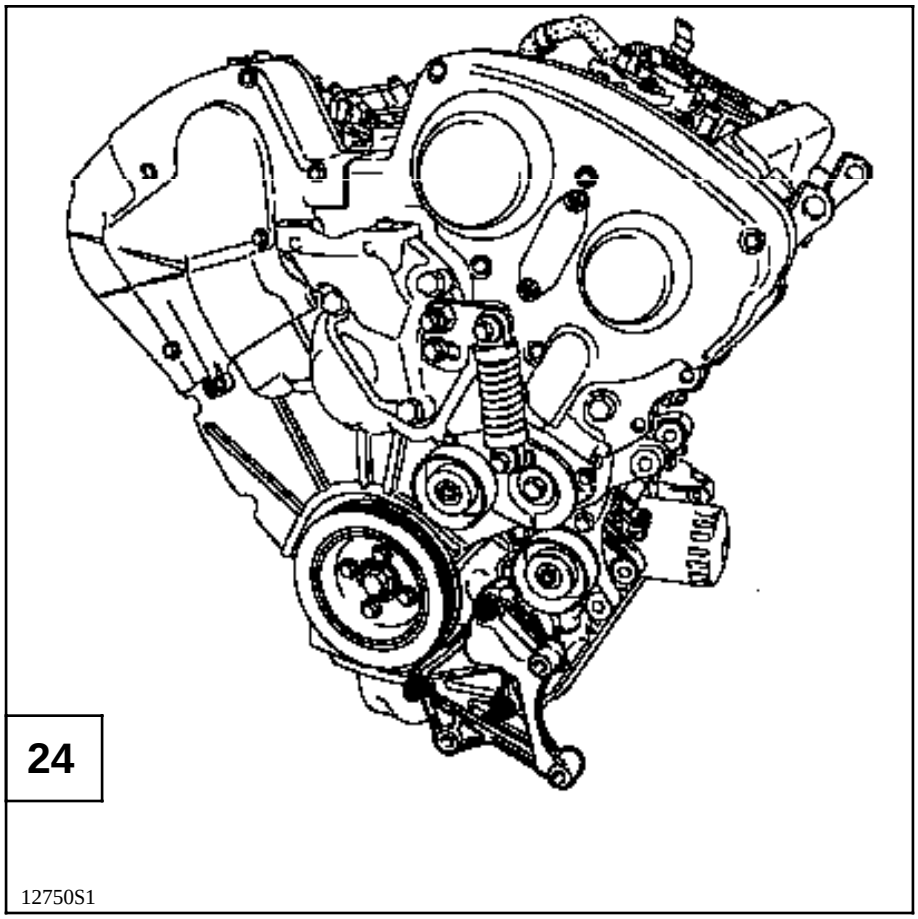
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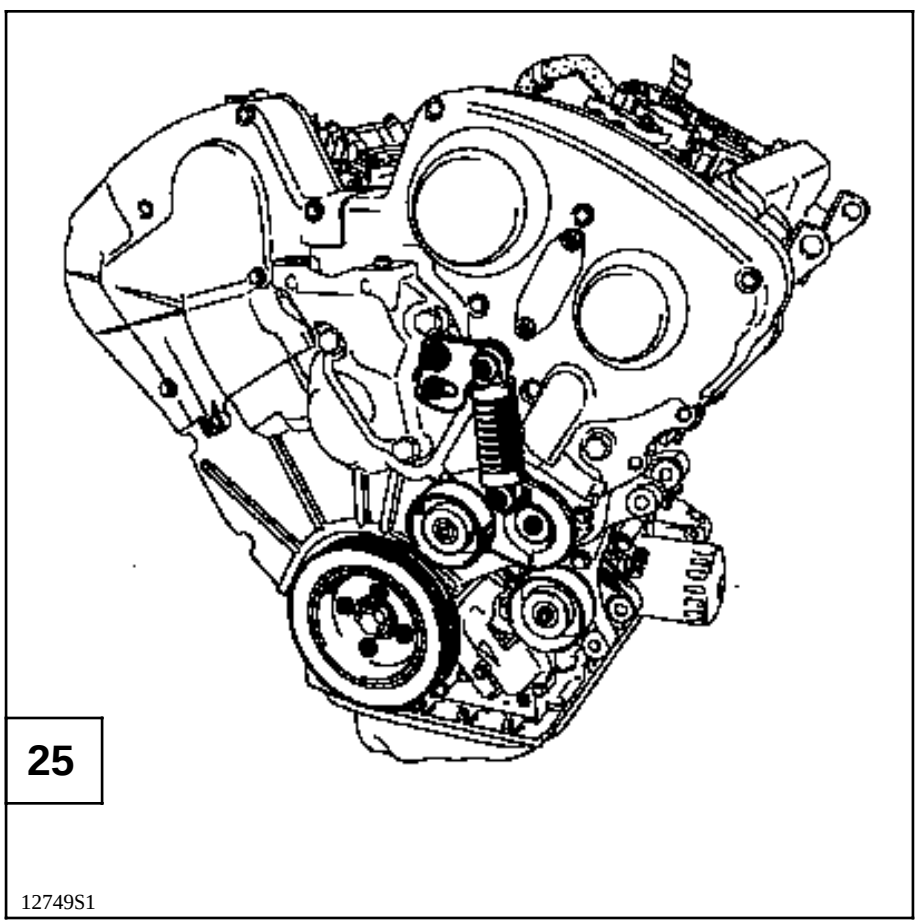
12750S1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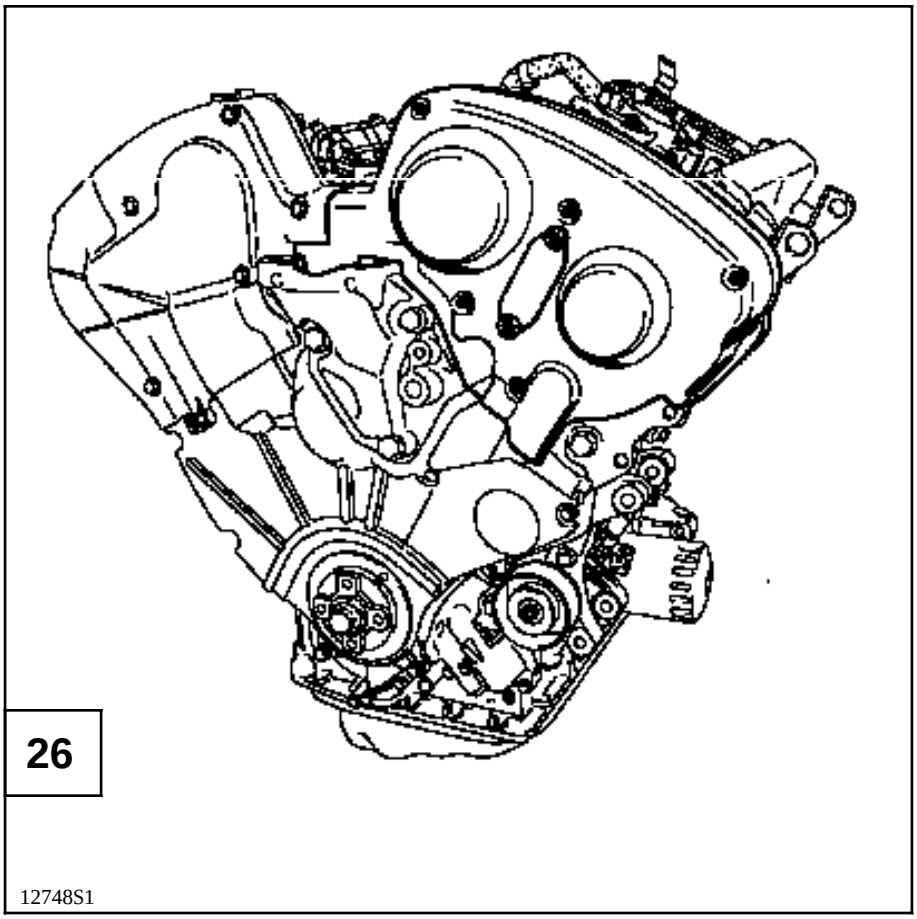
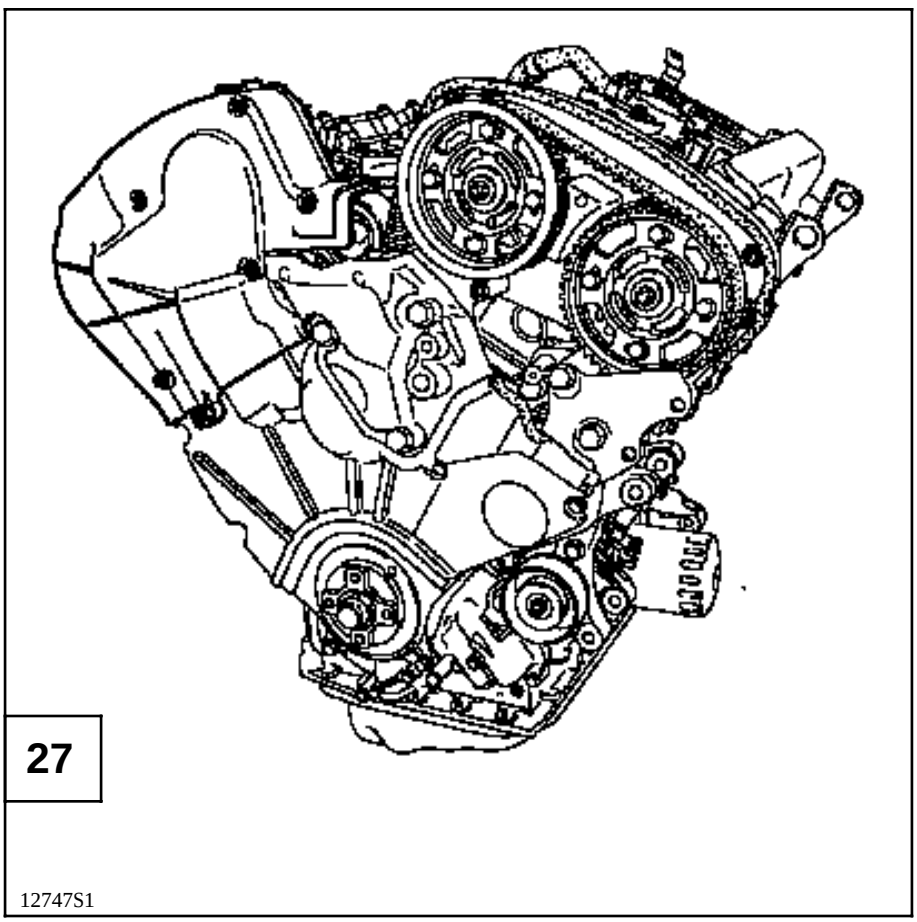
12749S1



26

12748S1



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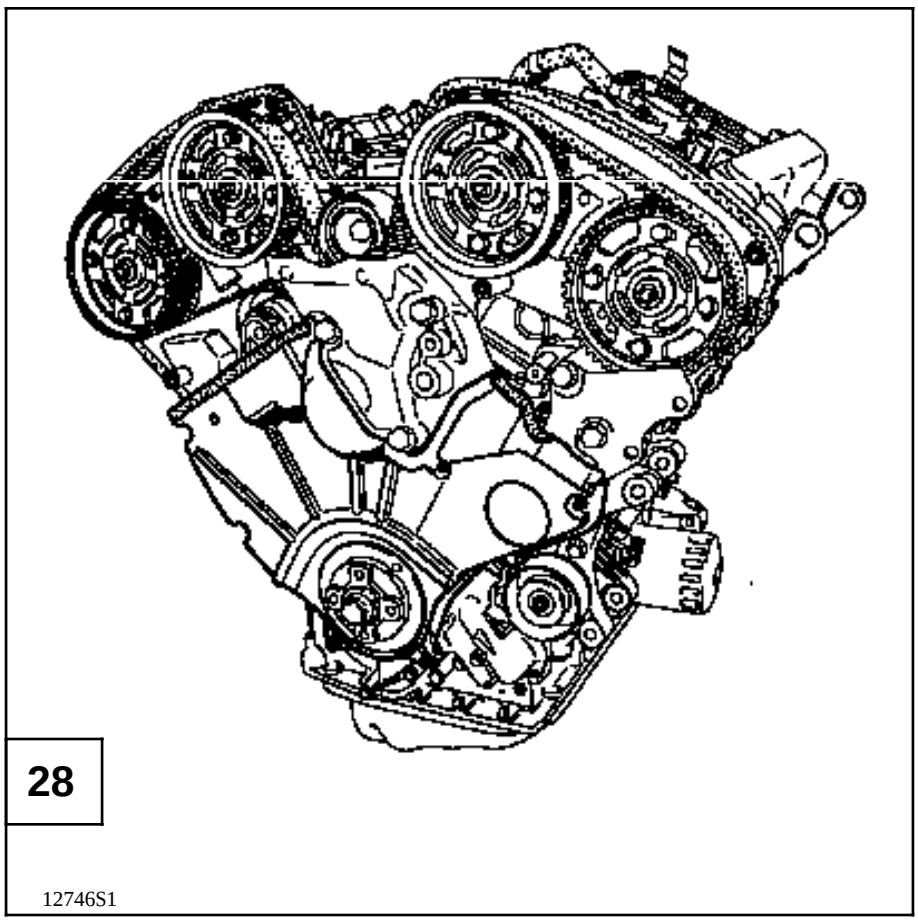
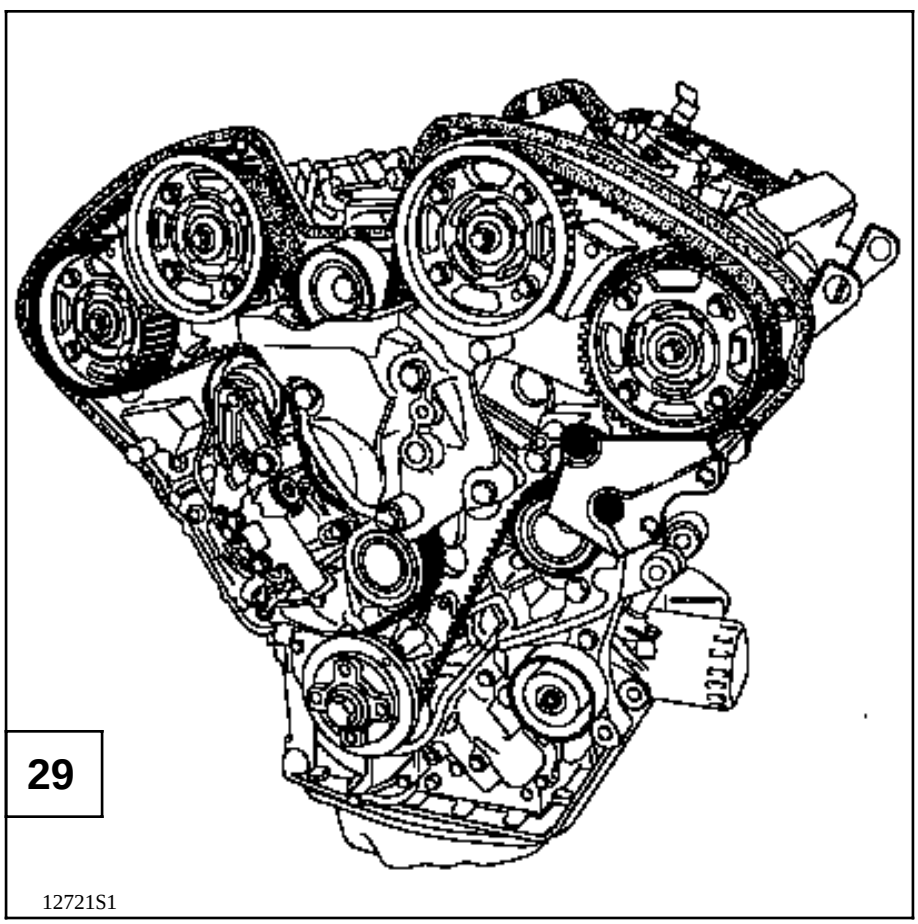
12747S1



28

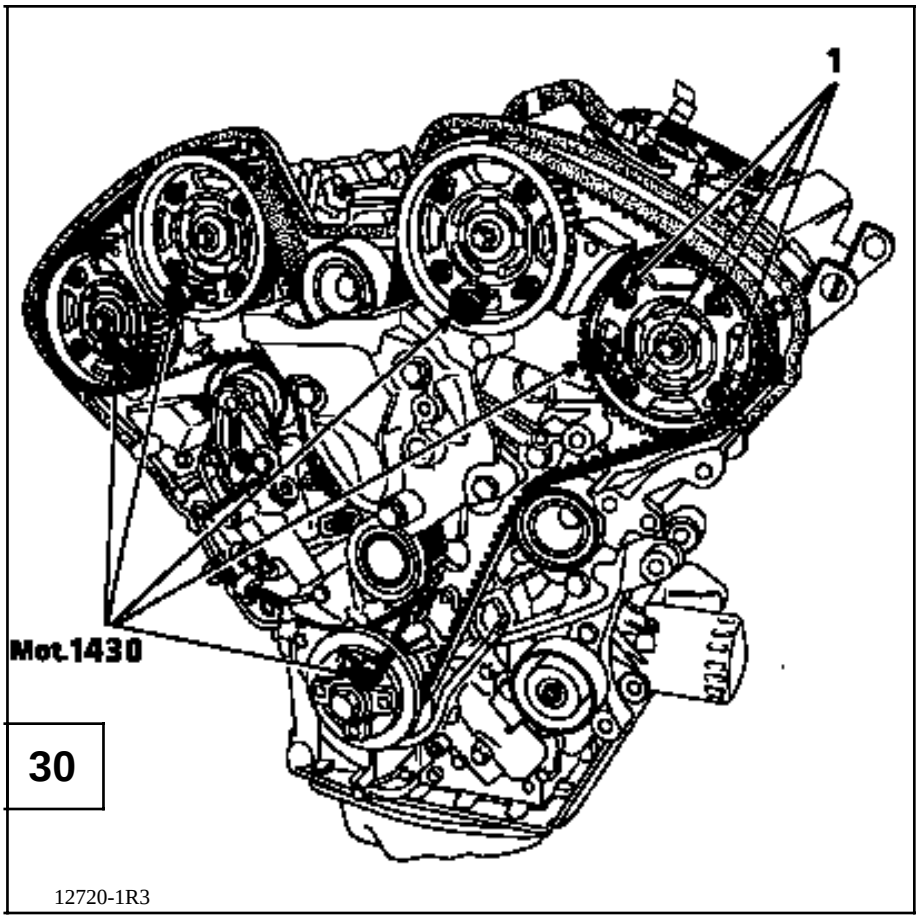
12746S1



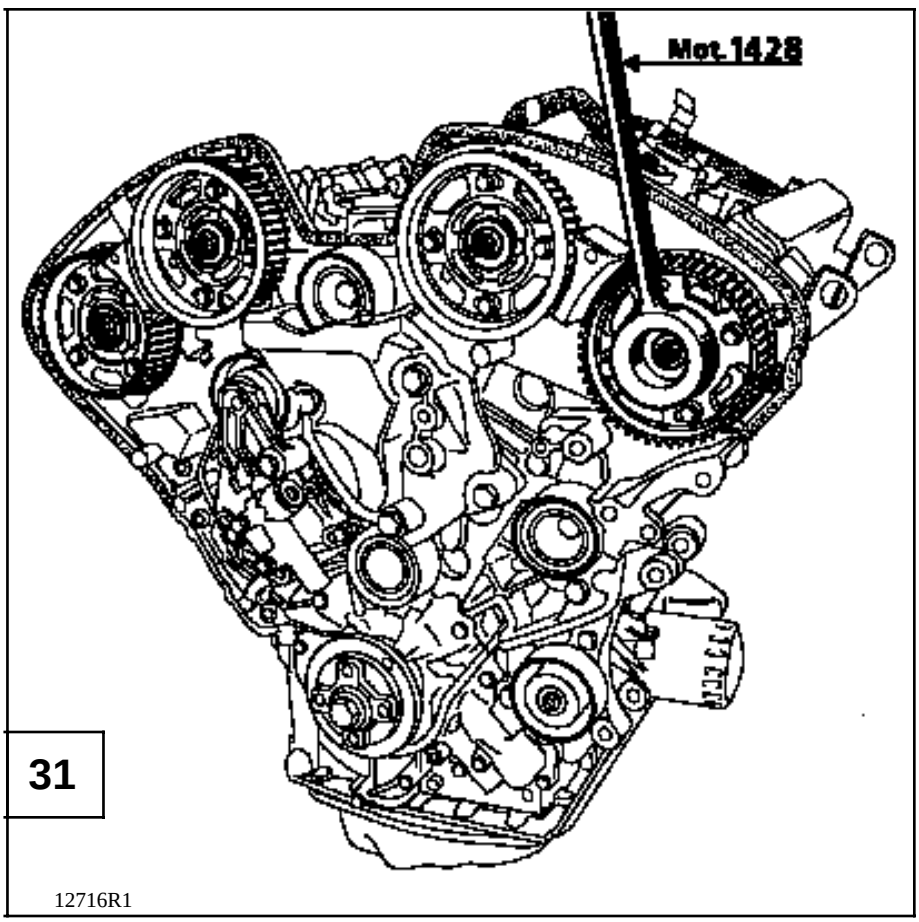
29

12721S1

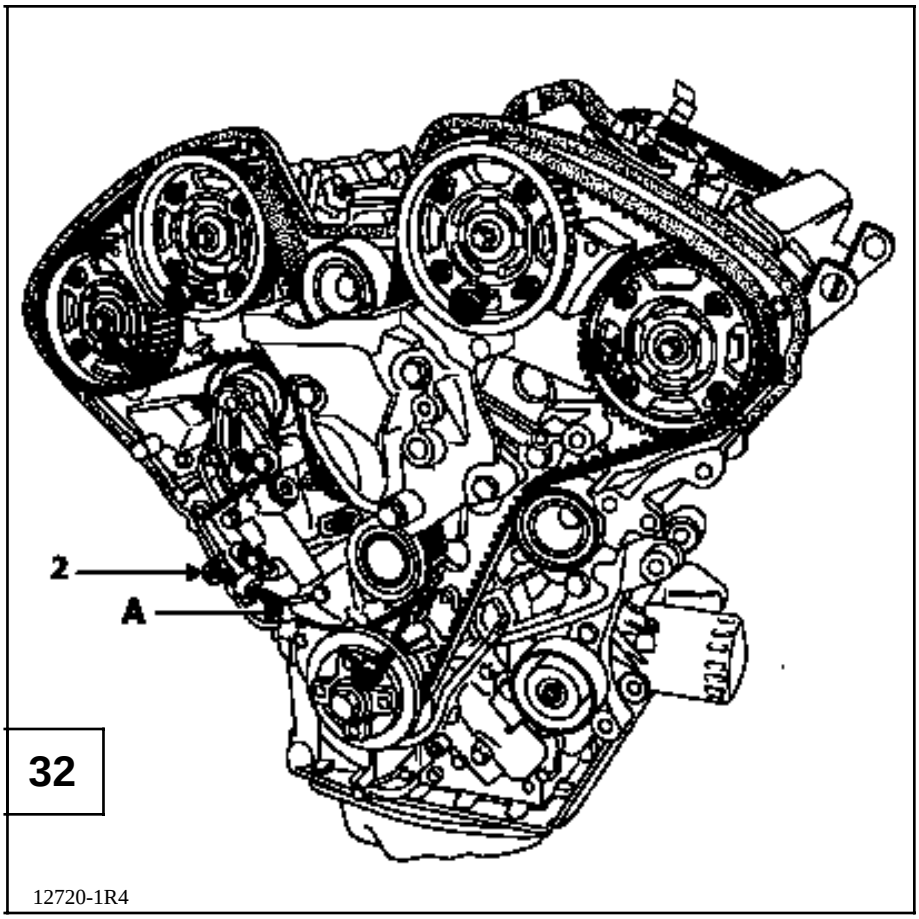
Turn the engine in the operating direction to bring the timing to its setting point and simultaneously insert pins **Mot. 1430** into the crankshaft and camshafts.



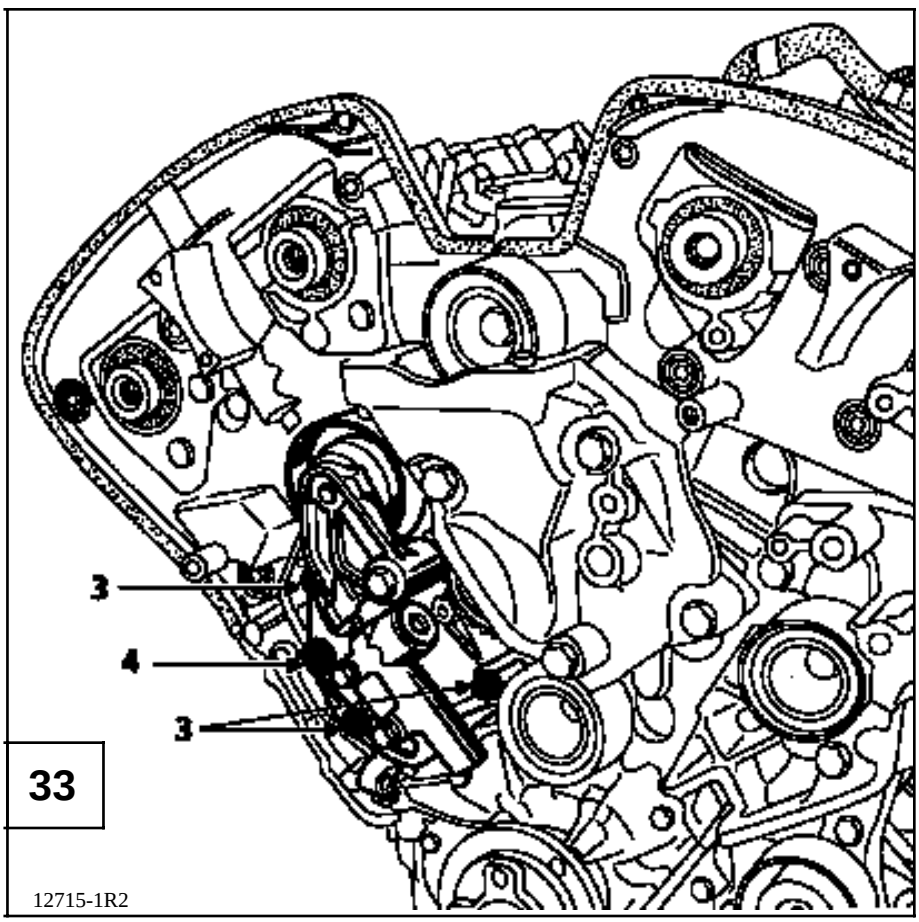
Note : The camshaft pinning operation becomes easier after having slackened the sprocket bolts at (1) and turned the camshaft hubs using tool **Mot. 1428**.



Fit a **75 mm M8** bolt (2) and tighten until it touches at (A) (without forcing it).

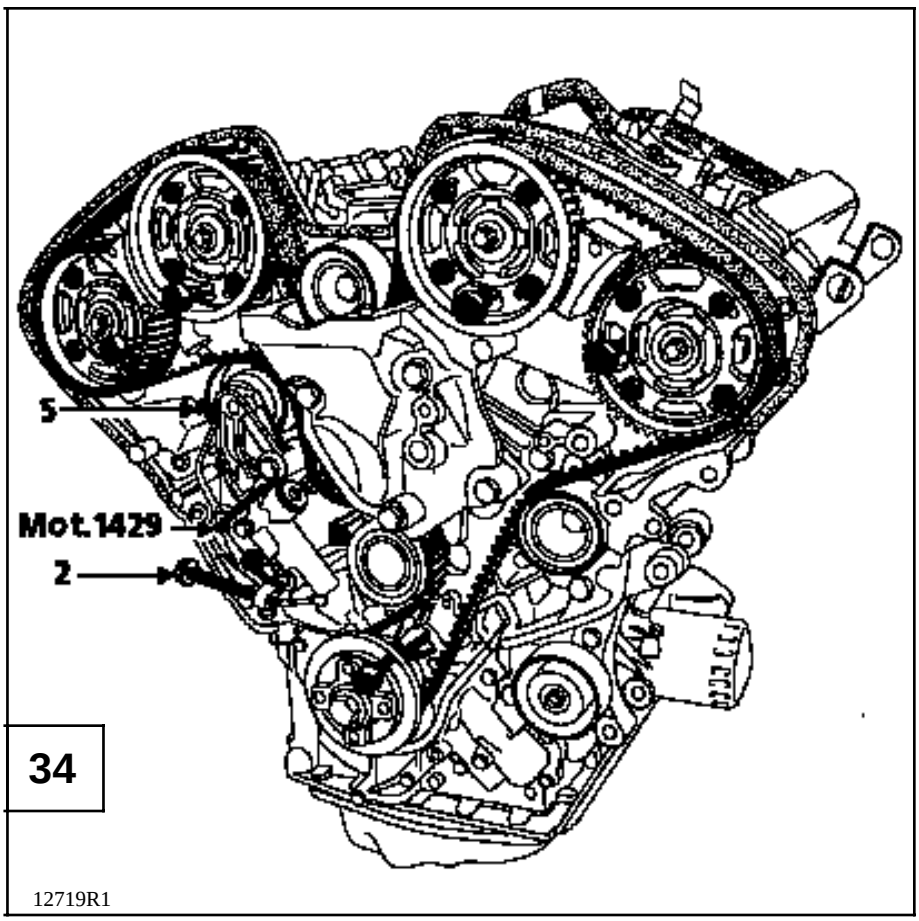


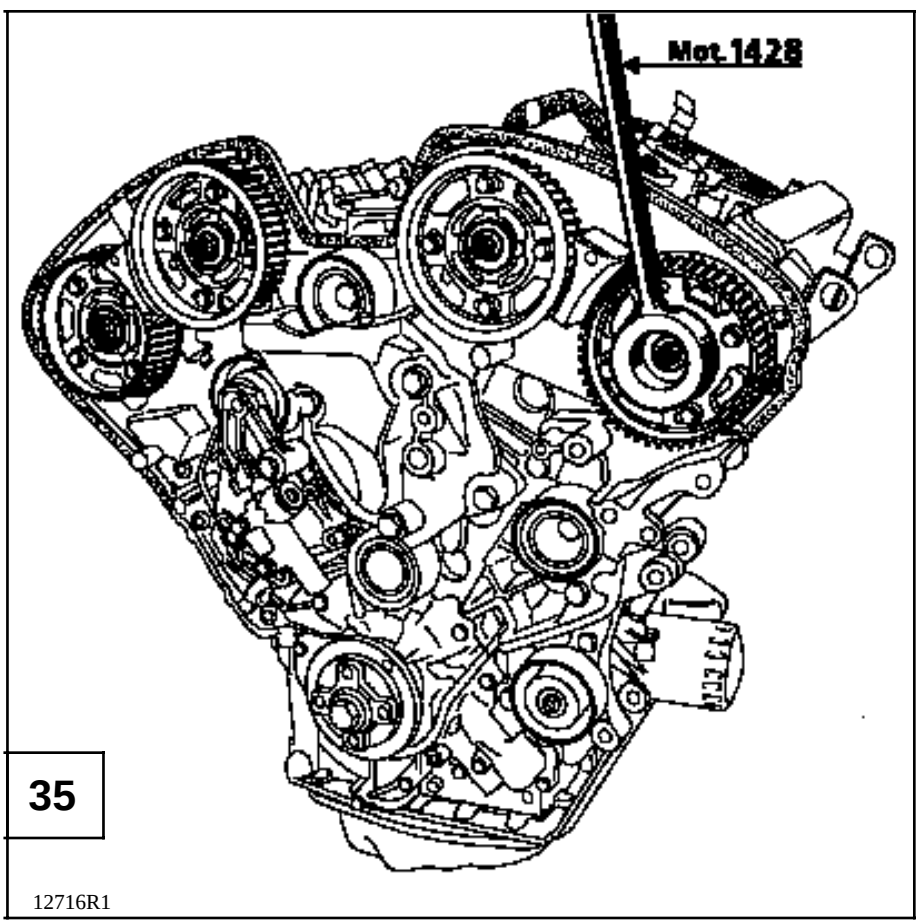
Slacken the three bolts at (3); **it is vital that the bolt at (4) remains tight**.



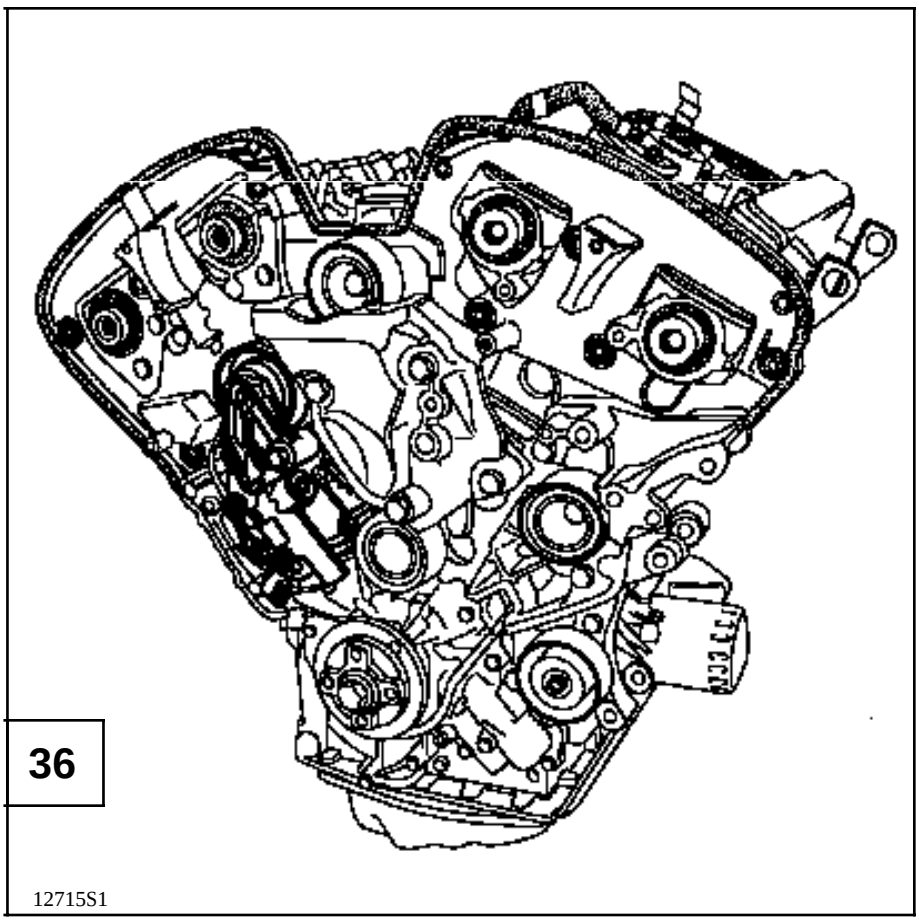
Position tool **Mot. 1429**, slackening bolt (2) if necessary: fit a **35 mm M8** bolt (5) and tighten it until tool **Mot. 1429** locks.

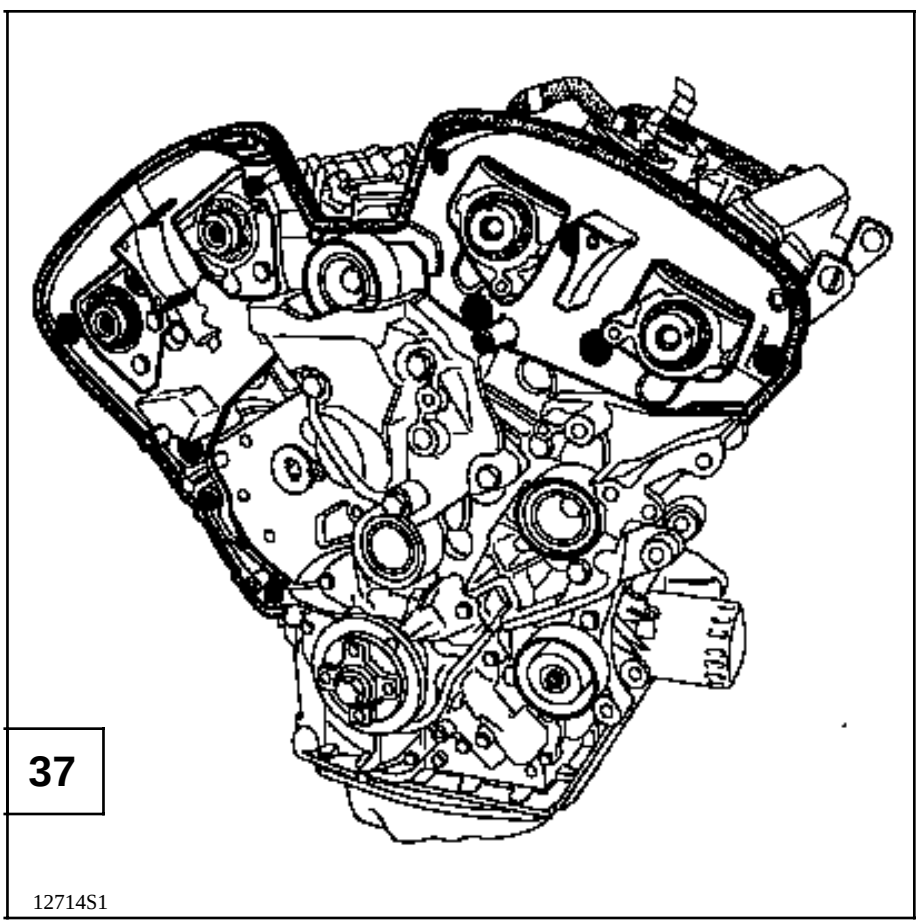
Slacken bolt (2) as far as possible to slacken the timing belt, then remove it.

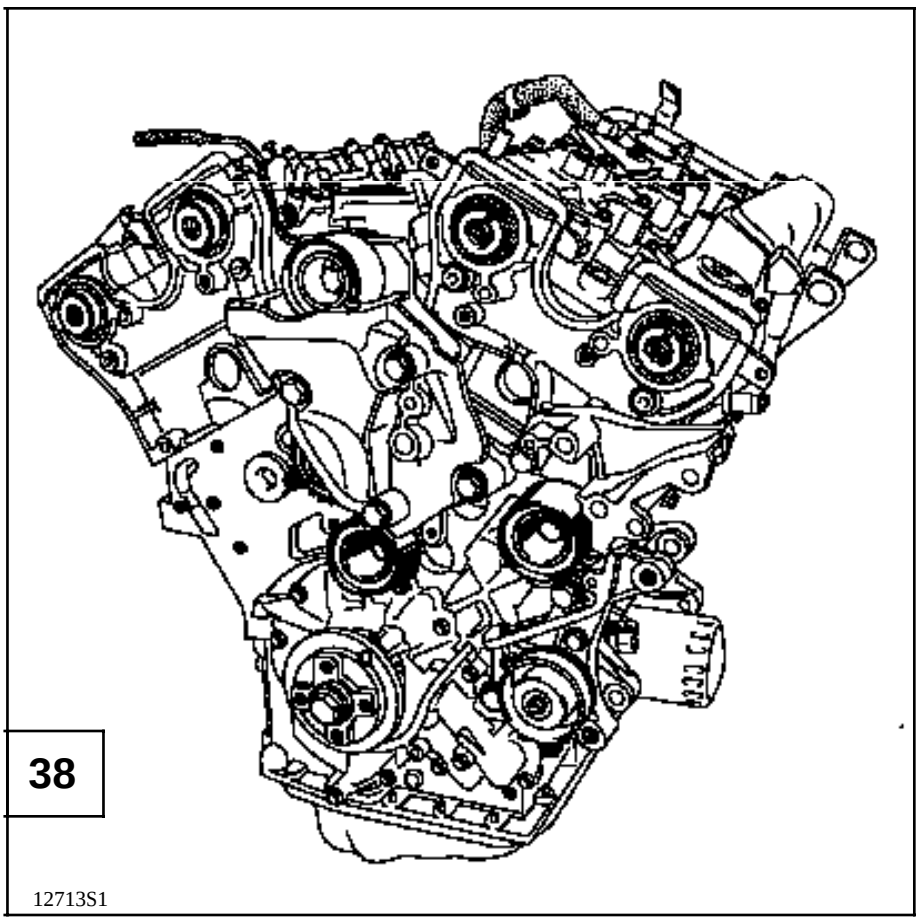




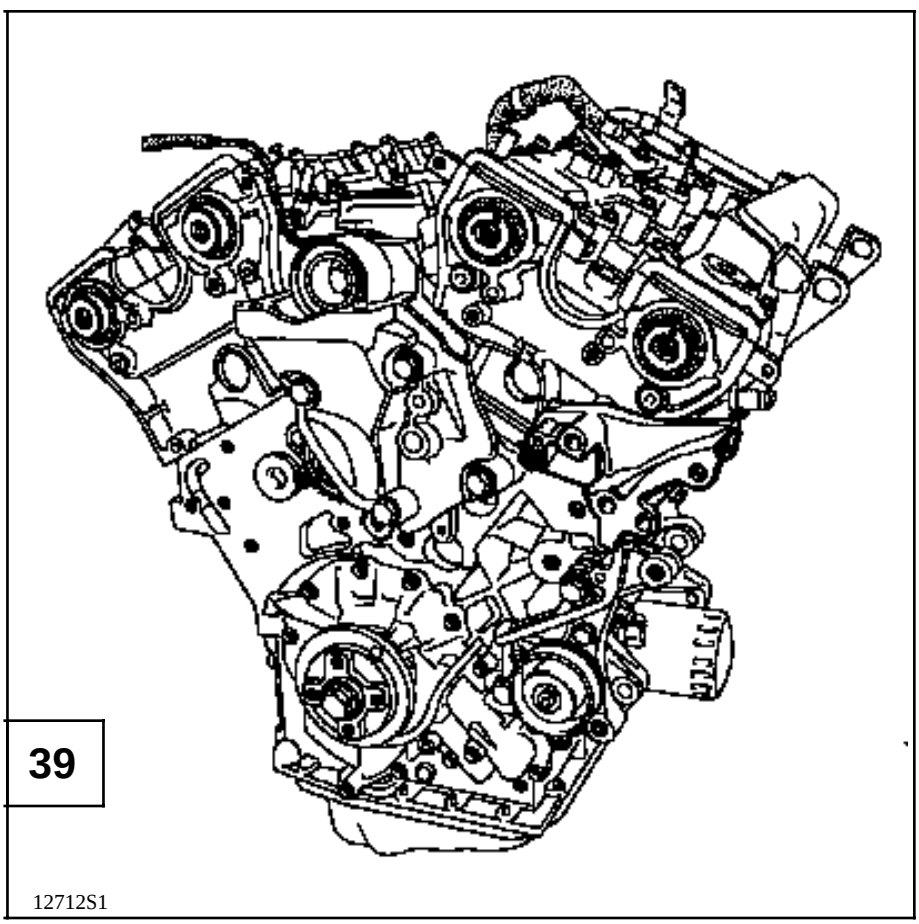
Timing plate

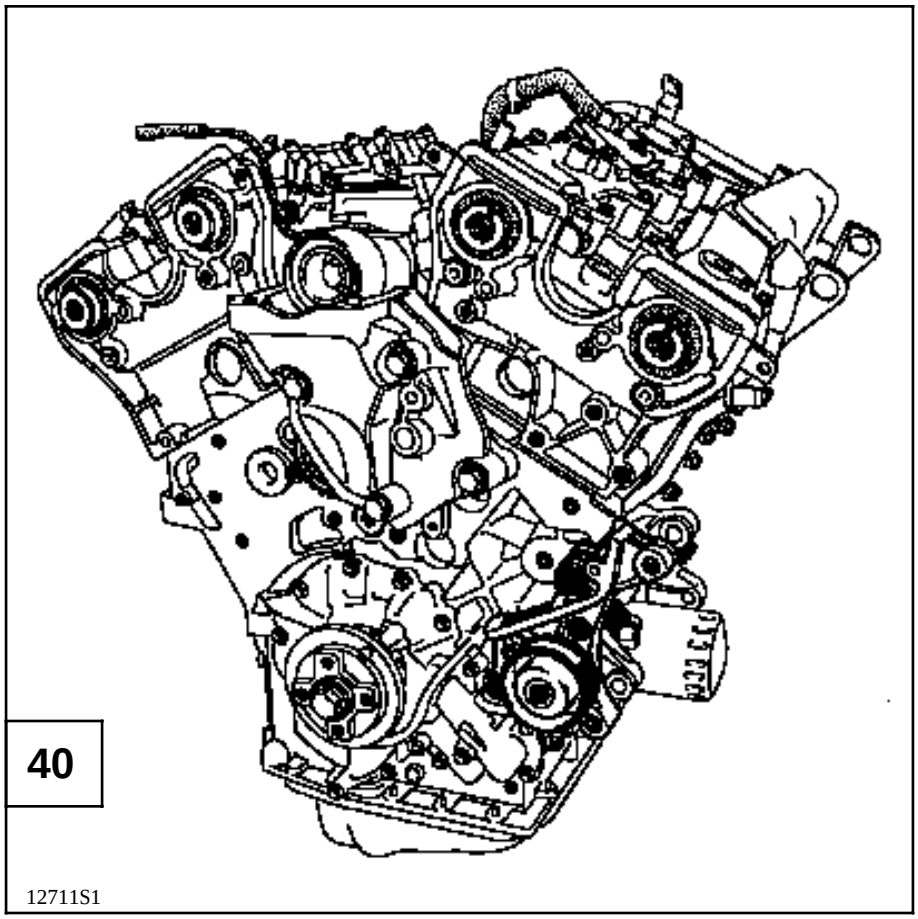






Power assisted steering pump mounting.

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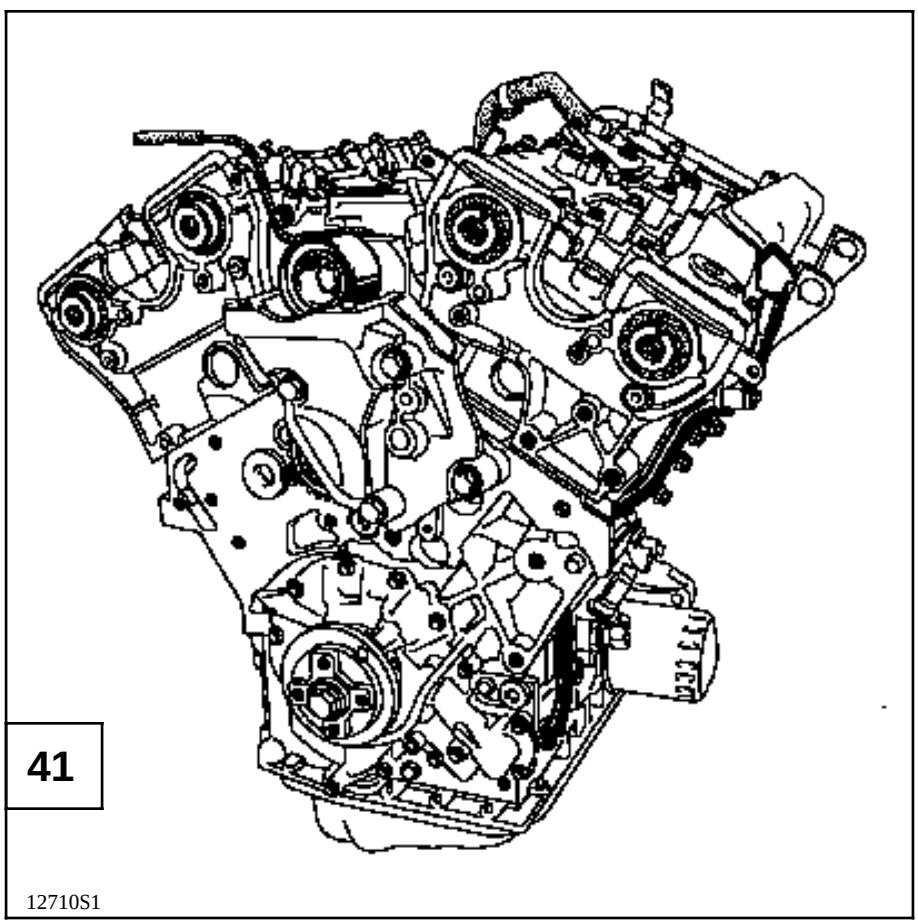
12711S1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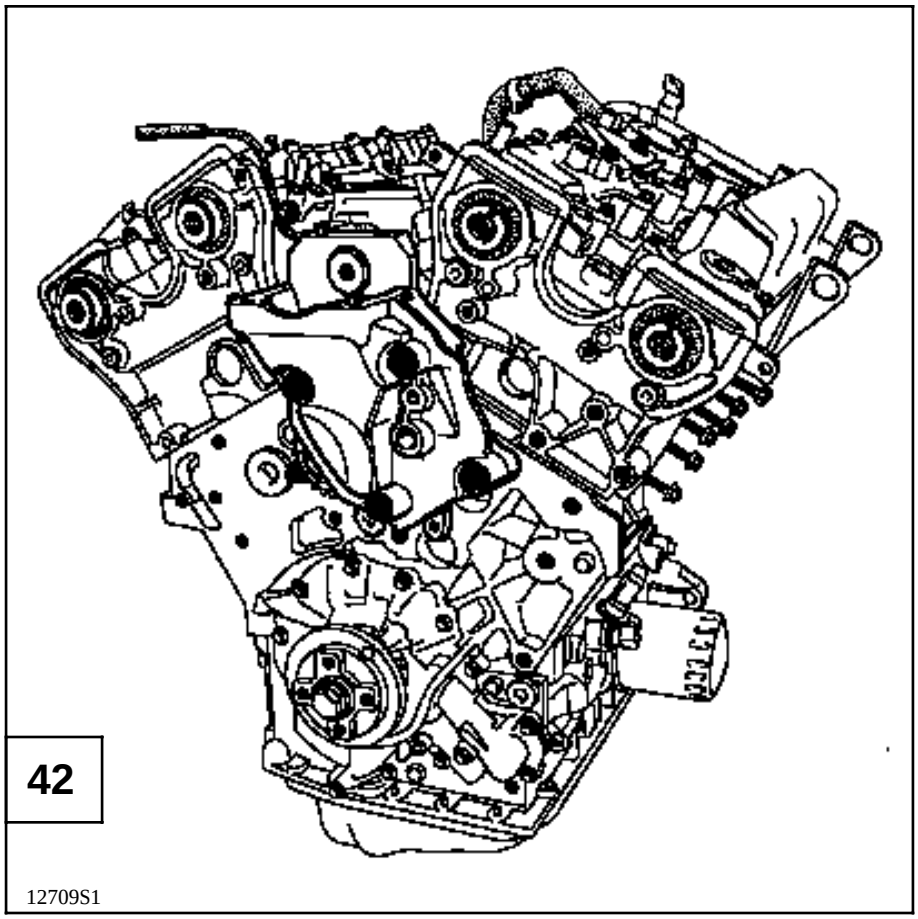
12710S1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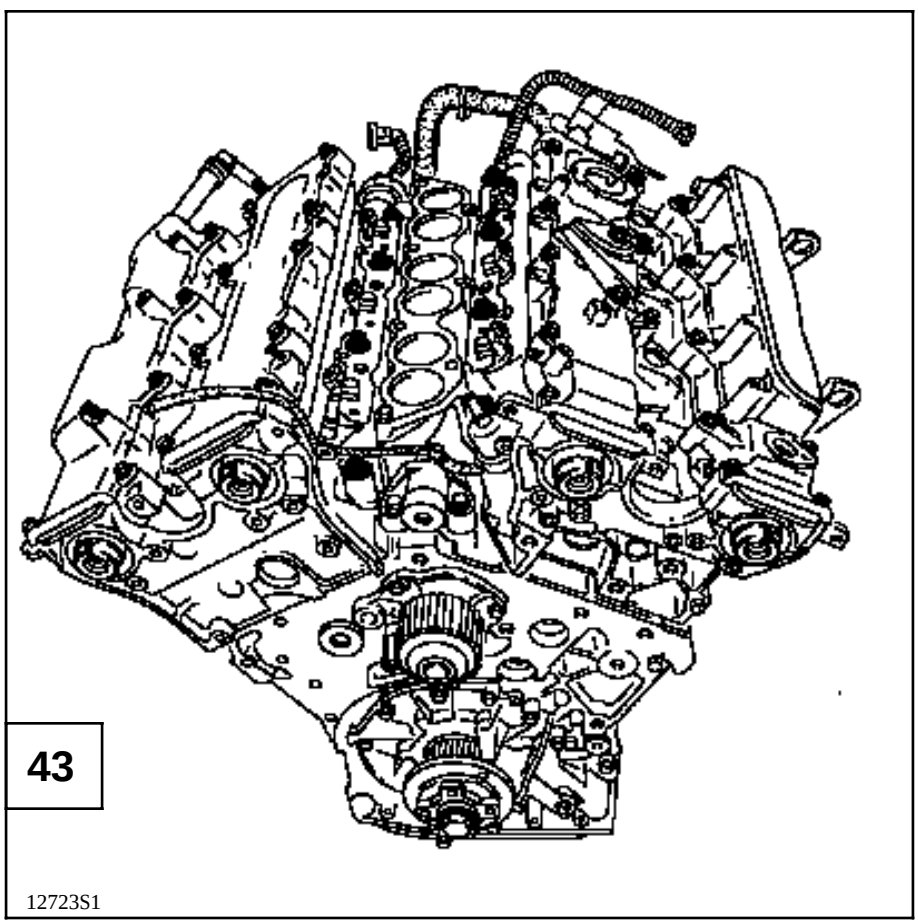
12709S1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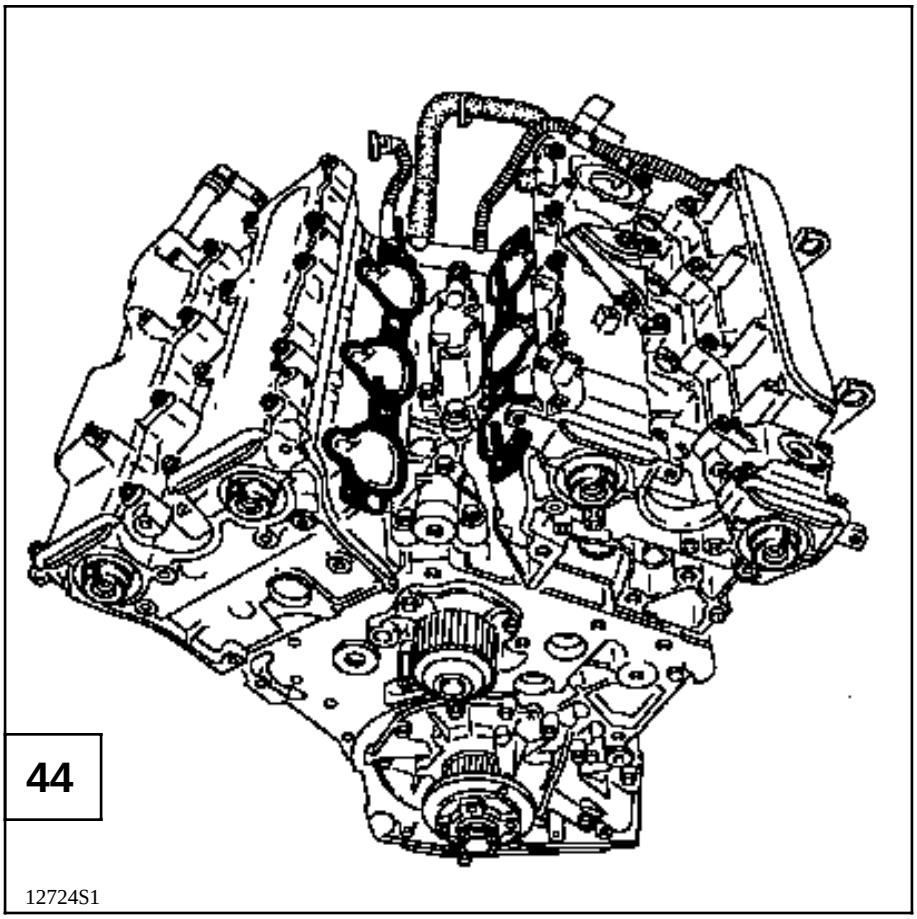
12723S1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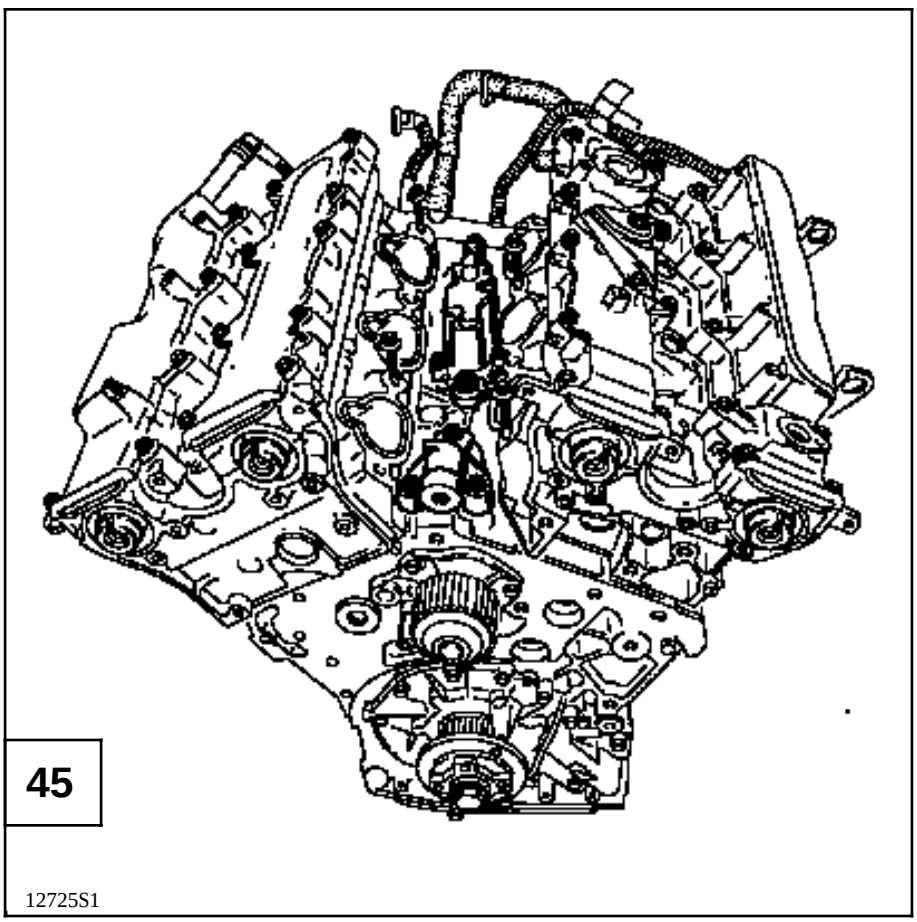
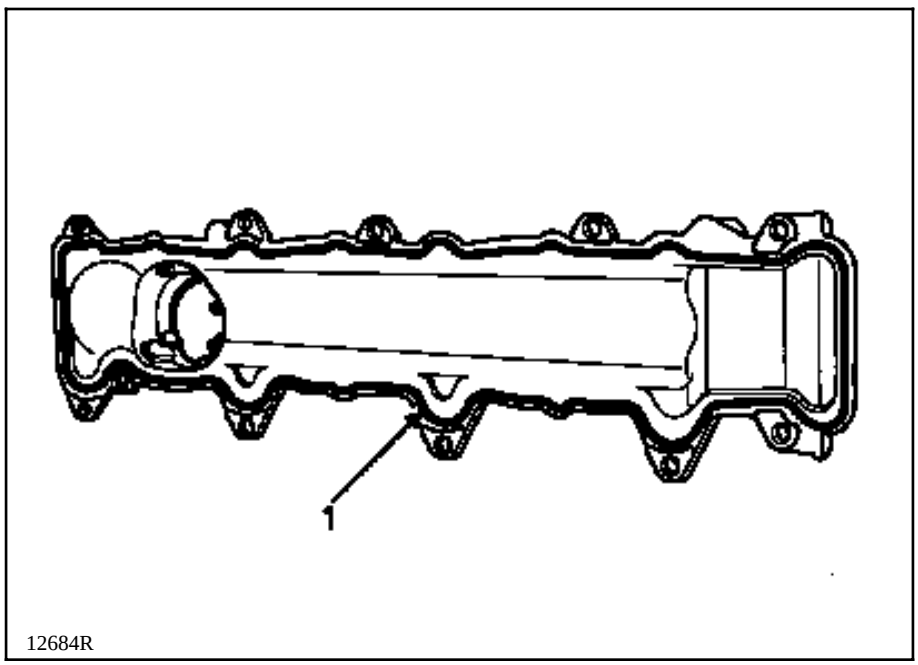
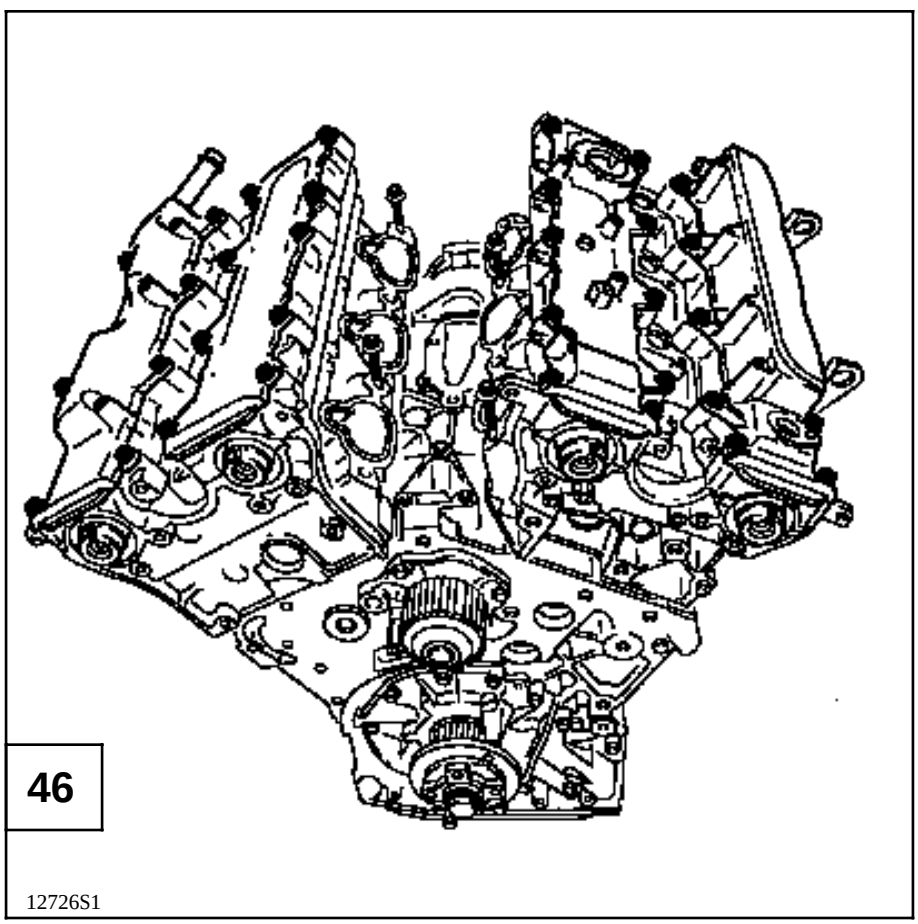
12724S1


45
12725S1

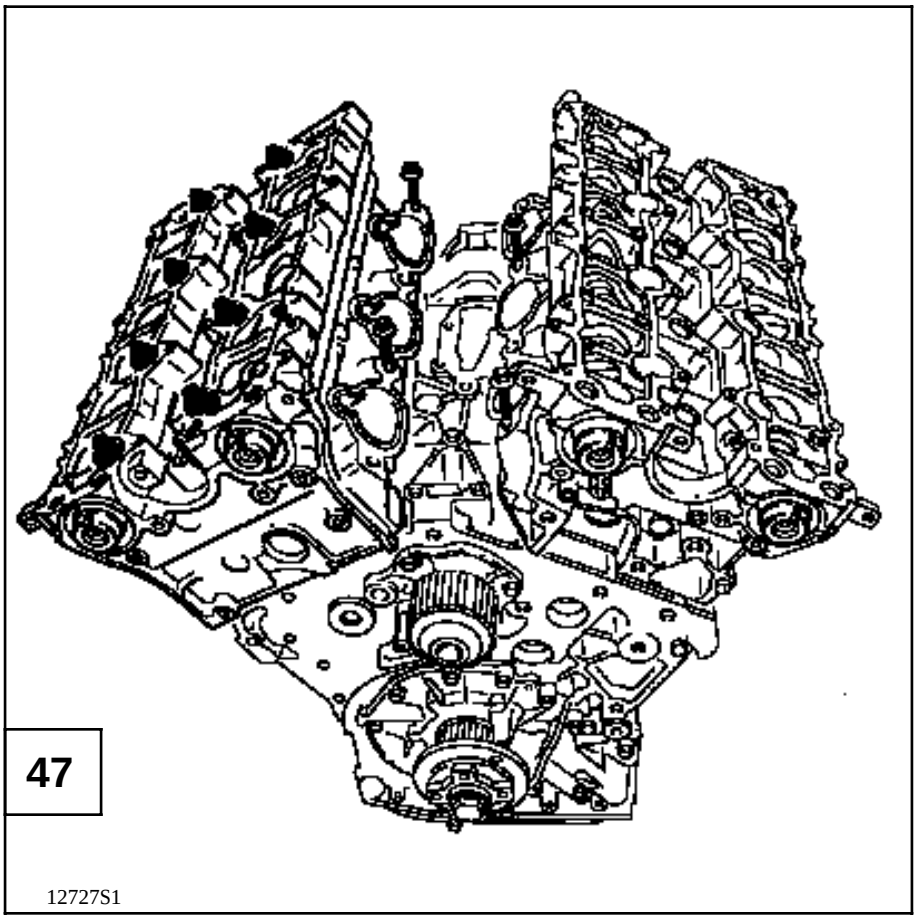
IMPORTANT: When removing the camshaft bearing block covers , it is imperative not to damage the seals (1) which are profiled on the part.
This seal can endure several removal operations. If damaged, it can be partly repaired using the sealing product Autojoint OR.

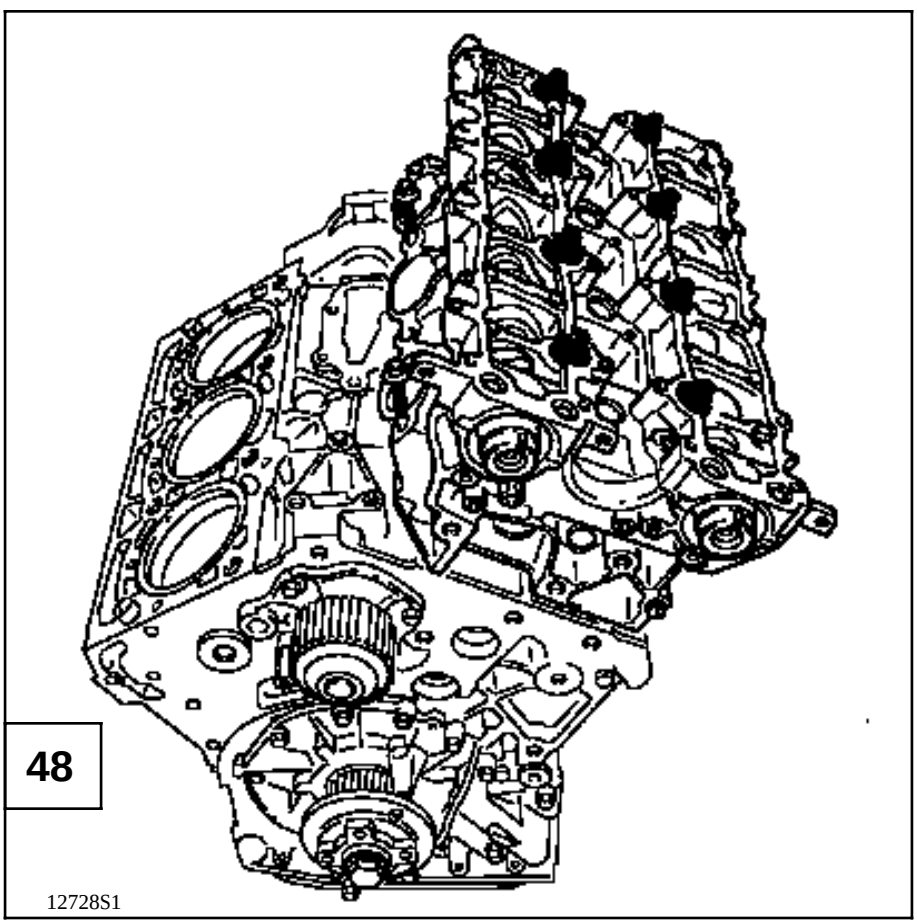


12684R



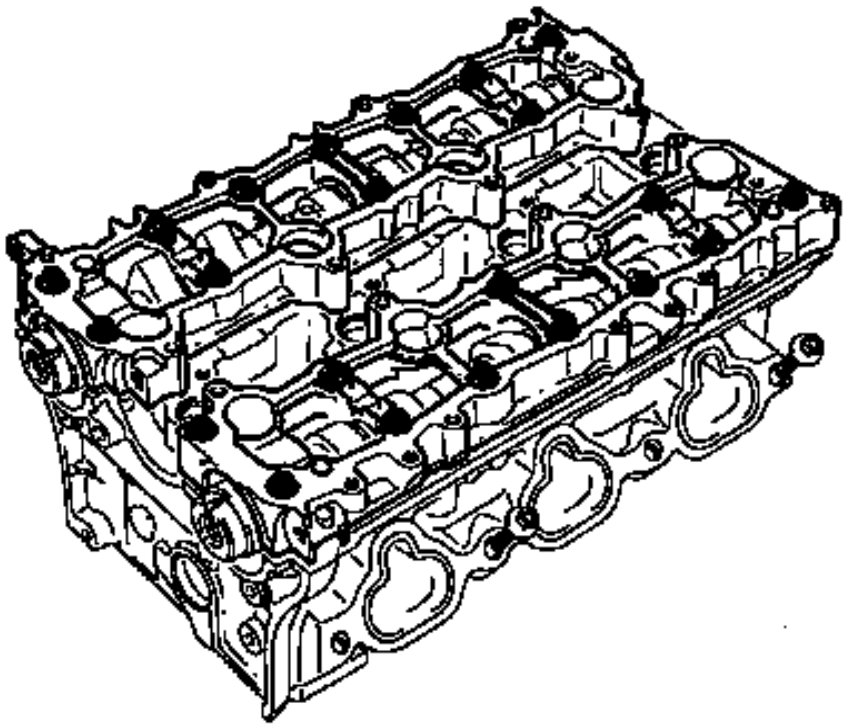
12726S1


47
12727S1

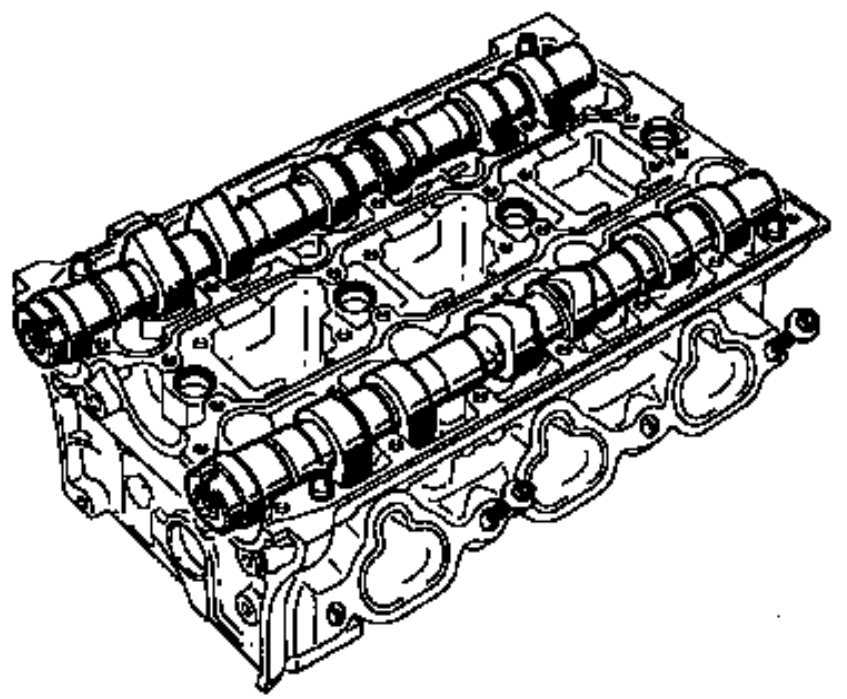

48
12728S1

Stripping the cylinder heads :

Rear cylinder head

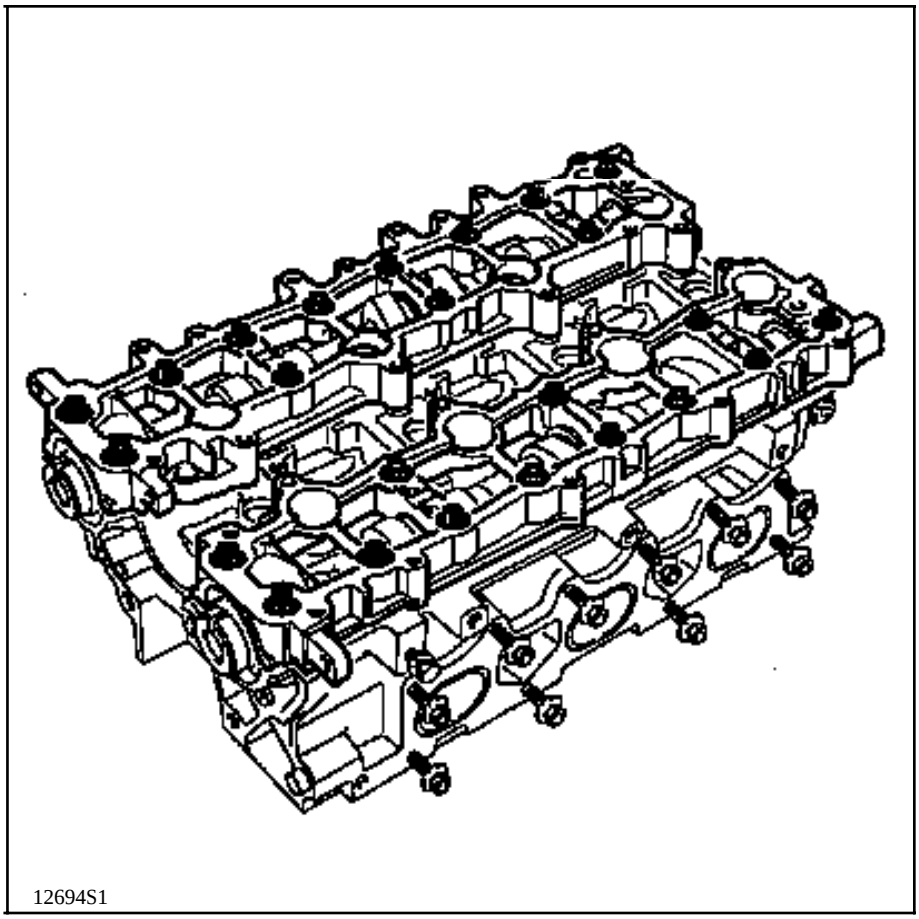


12692S1

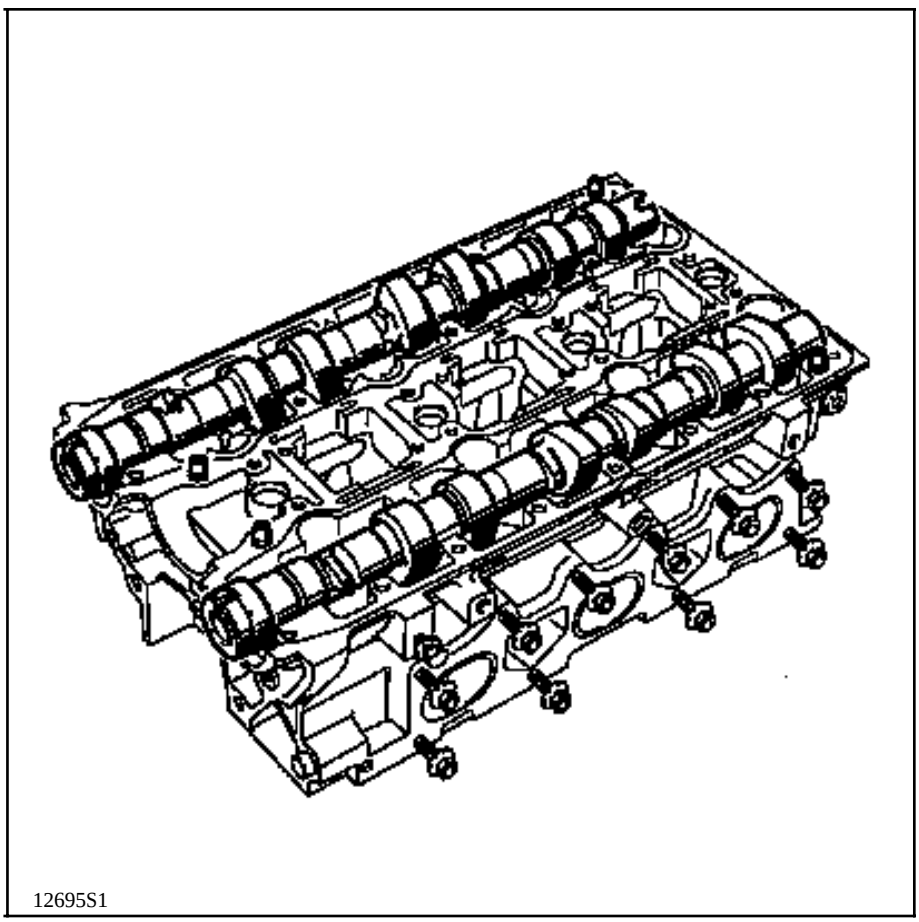


12693S1

Front cylinder head.



12694S1



12695S1

Remove the hydraulic tappets.

Compress the valve springs

Remove the collits, the upper cups, the springs, the valves, the valve seals using tool **Mot. 1335** and the lower cups.

Place the parts in order.

Cleaning

It is very important not to scratch the sealing faces of aluminium parts.

Use the product Decapjoint to dissolve any part of the seal which remains.

Apply the product to the part to be cleaned; wait about ten minutes, then remove it by means of a wooden spatula.

The wearing of gloves is recommended during this operation.

The utmost care should be taken in carrying out this operation to prevent foreign bodies from entering the oilways feeding oil under pressure to the camshafts (oilways located both in the cylinder block and in the cylinder head) and in the oil return pipe.

CHECKING THE GASKET FACE BOW

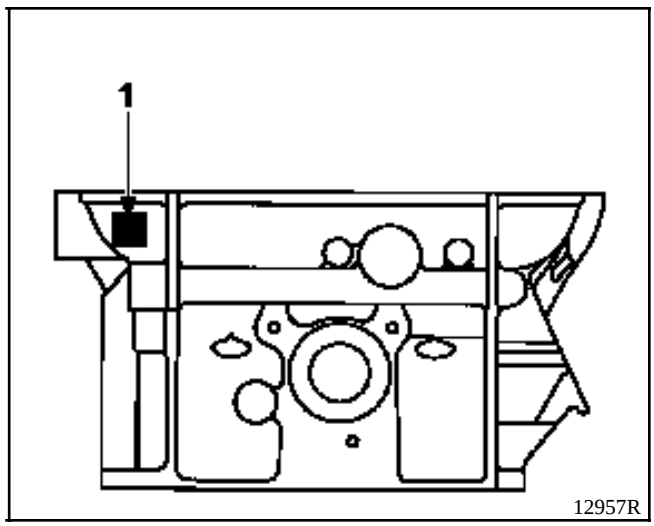
Check with a straight edge and a set of shims to determine if there is any gasket face bow.

Maximum bow : **0.05 mm**

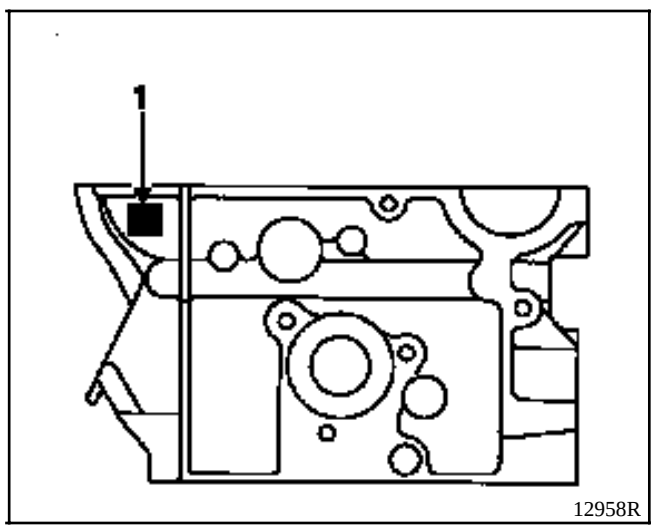
During repairs, the cylinder heads may be reground by **0.20 mm. Regrinding must be carried out on both cylinder heads.**

Reground cylinder heads must be marked with the letter R (1) engraved using an electric engraver.

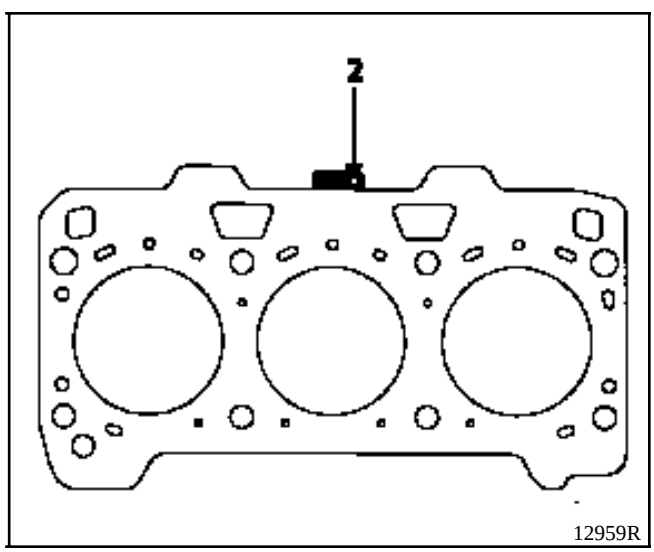
Front cylinder head (viewed from the flywheel end)



Rear cylinder head (viewed from the flywheel end)



The repair cylinder head gasket is marked by a hole (2) in the tab and is **1.65 ± 0.04 mm** thick.



REGRINDING OF THE VALVE SEATS

Inlet

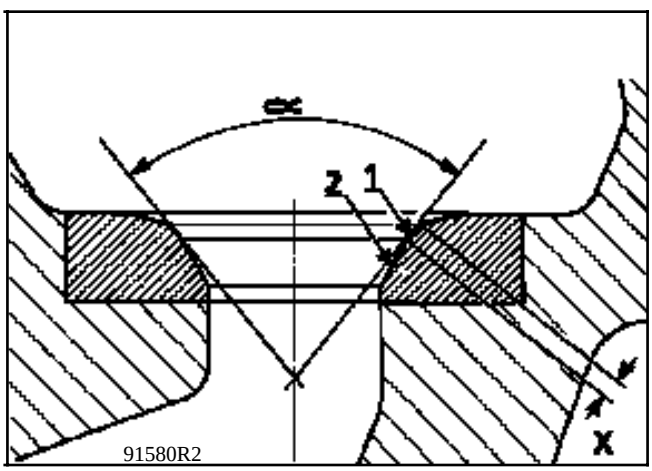
- Port width **X = 1.6mm**
- Angle α **= 90°**

The port (1) is straightened with **cutter 230, angle 45°**. Reduce the width of this port at (2) with cutter **n° 605** angle **65°** until width (X) is obtained.

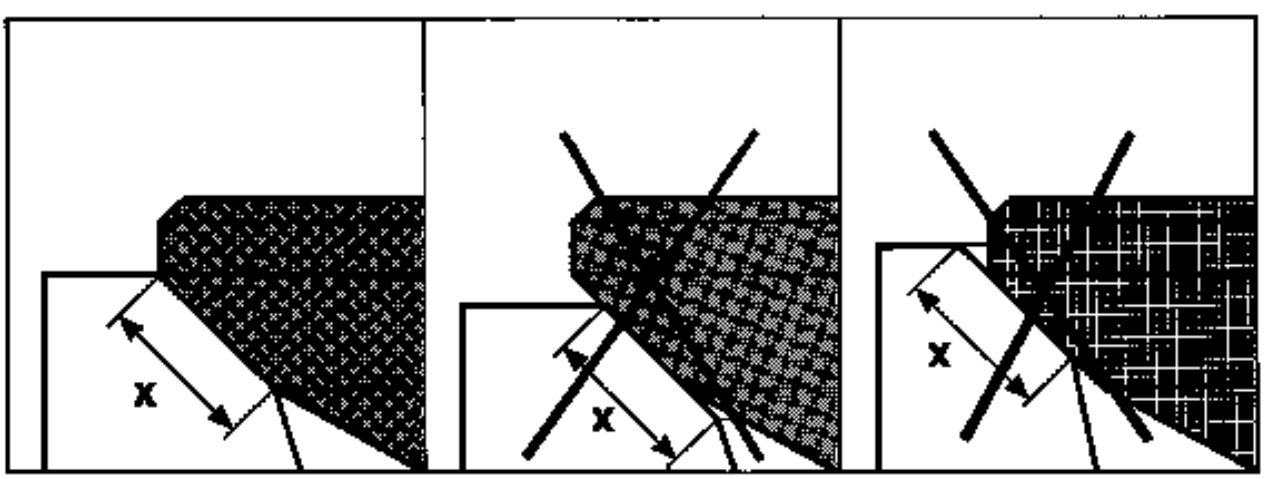
Exhaust

- Port width **X = 2.1 mm**
- Angle α **= 90°**

The port (1) is straightened with **cutter 274, angle 45°**. Reduce the width of this port at (2) with cutter **n° 605** angle **65°** until width (X) is obtained.

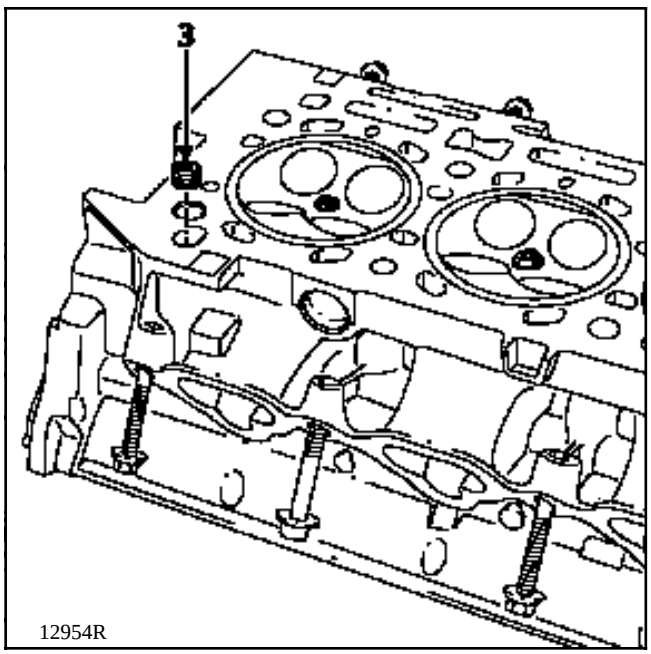


NOTE: Observe the position of the valve on its seat.

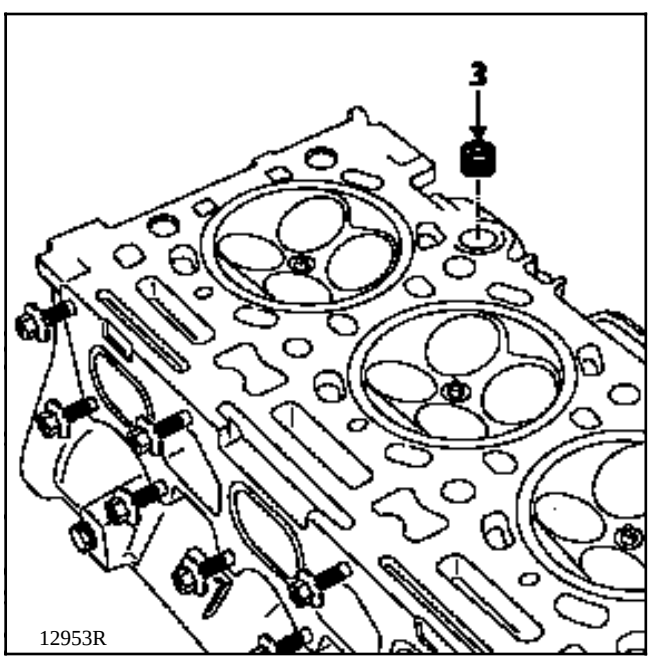


Check that all the ball valves (3) in the cylinder head open correctly.

Front cylinder head



Rear cylinder head



REFITTING THE CYLINDER HEAD

Place the new valves in position (26). Lap them in gently on their respective seats. Ensure that all parts are clean and marked, then refit.

Lubricate all the parts.

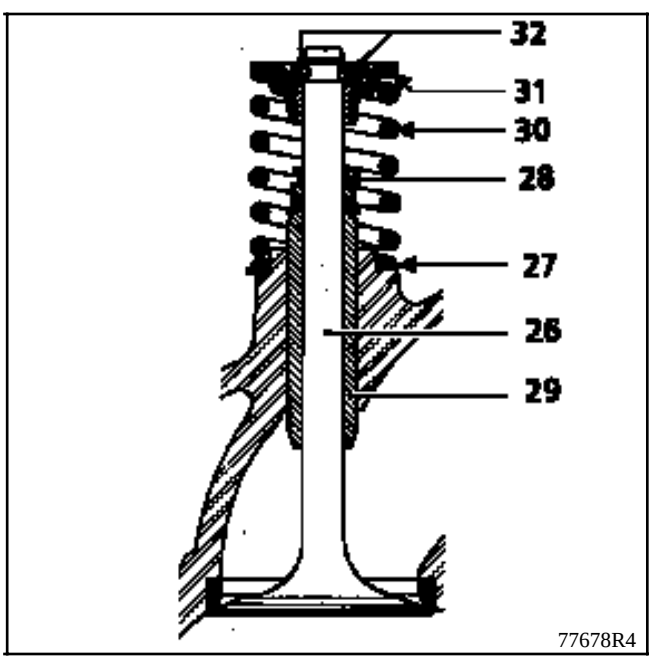
Place the spring base washers in position (27) .

Fit the seals (28) on the valve guides (29) with the aid of a pipe wrench.

Position :
- the new valves as you go along (26),
- the springs (30),
- the cups (31).

Compress the springs.

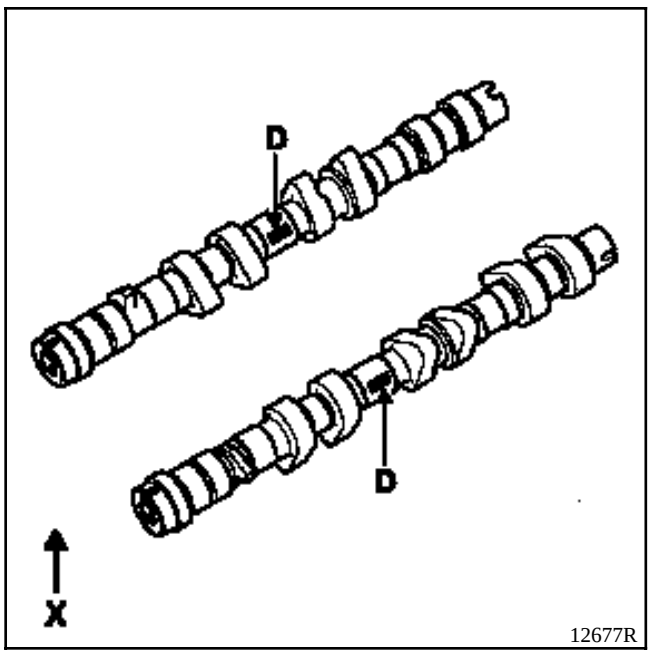
Position the collits (32).



Check the end play of the camshaft, which should be **0.070** to **0.27 mm**. This play is determined at the central bearing of the bearing block.

Positioning and identification of camshafts

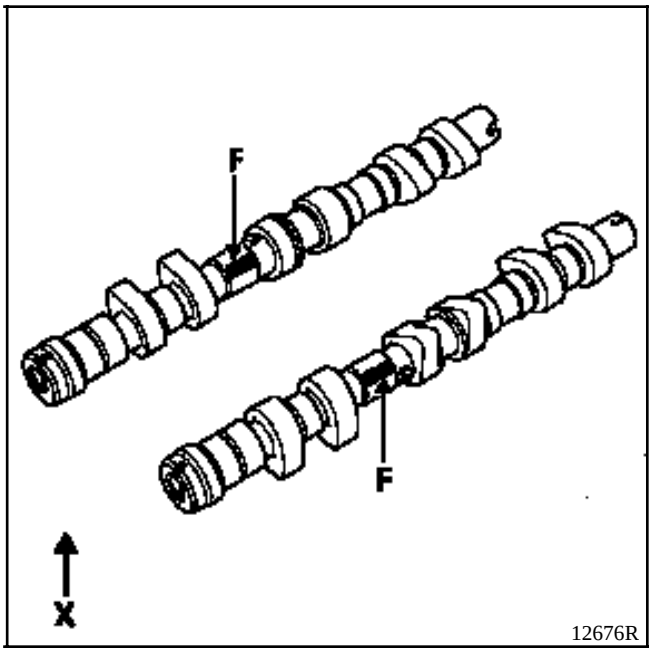
The **longest** camshafts are fitted on the **front bank** (cylinders **1 - 2 - 3**), and are identified by a marking at (**D**).



Inlet **D = A 718**
Exhaust **D = E 720**

X : timing end

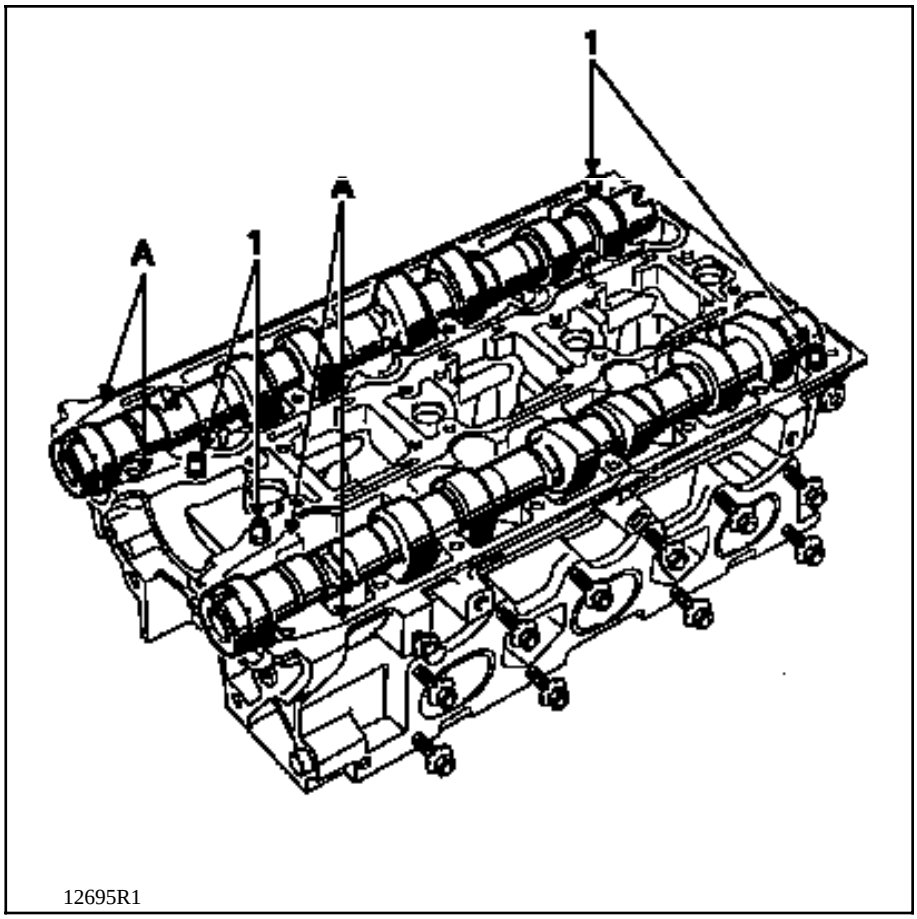
The shortest camshafts are fitted on the rear bank (cylinders **4 - 5 - 6**),and are identified by a marking at (**F**)



Inlet **F = A 717**
Exhaust **F = E 719**

X : timing end

Place a bead of **Autojoint OR** on the gasket surface at (A) and check for dowels at (1).

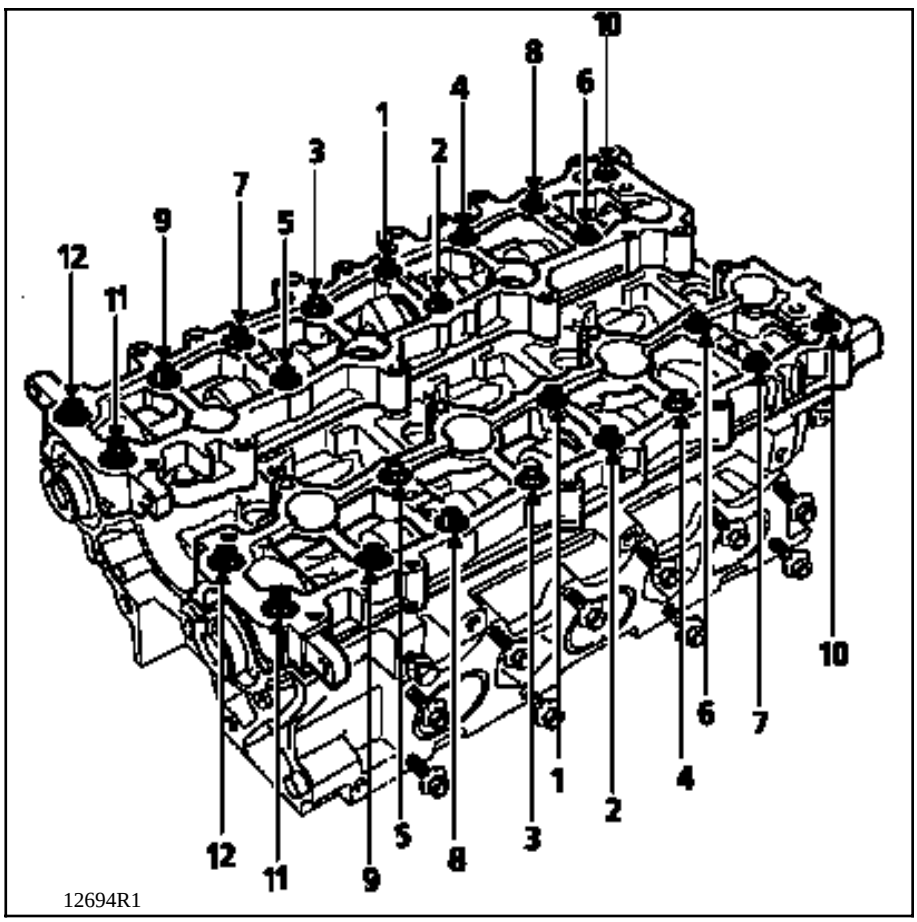


12695R1

Front cylinder head

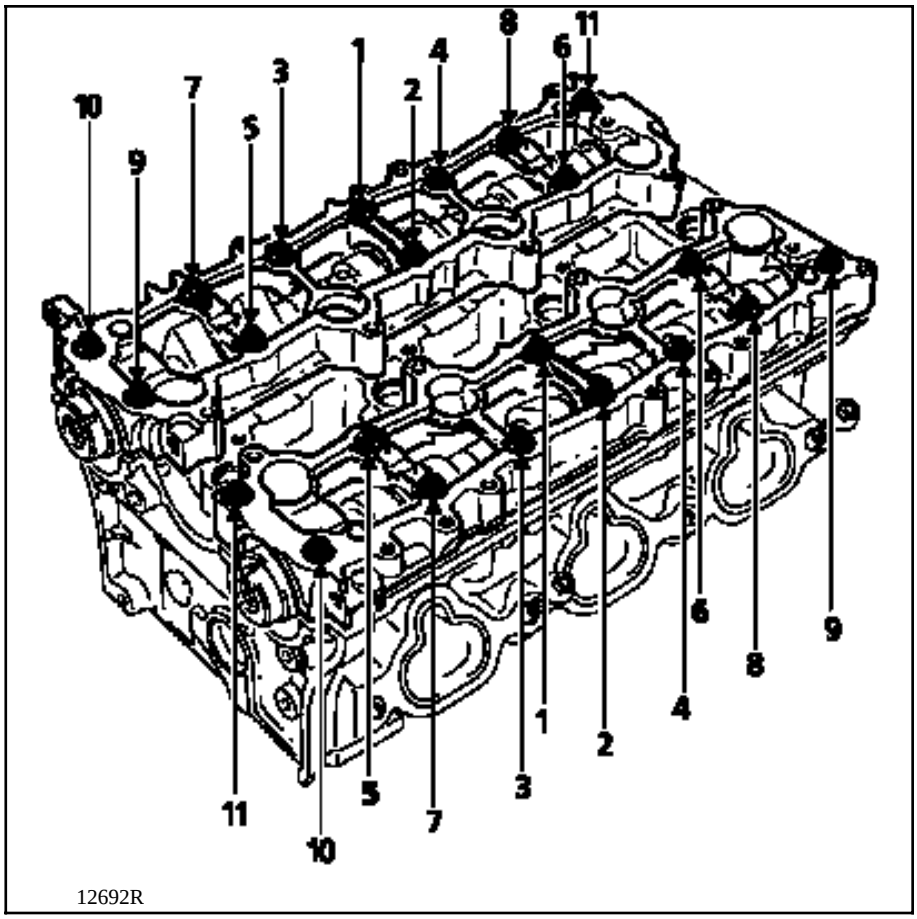
Refitting of the camshaft bearing blocks :

- Hand tighten then tighten progressively the mounting bolts in the order described Finally tighten bolts to a torque of **0.8 daN.m.**

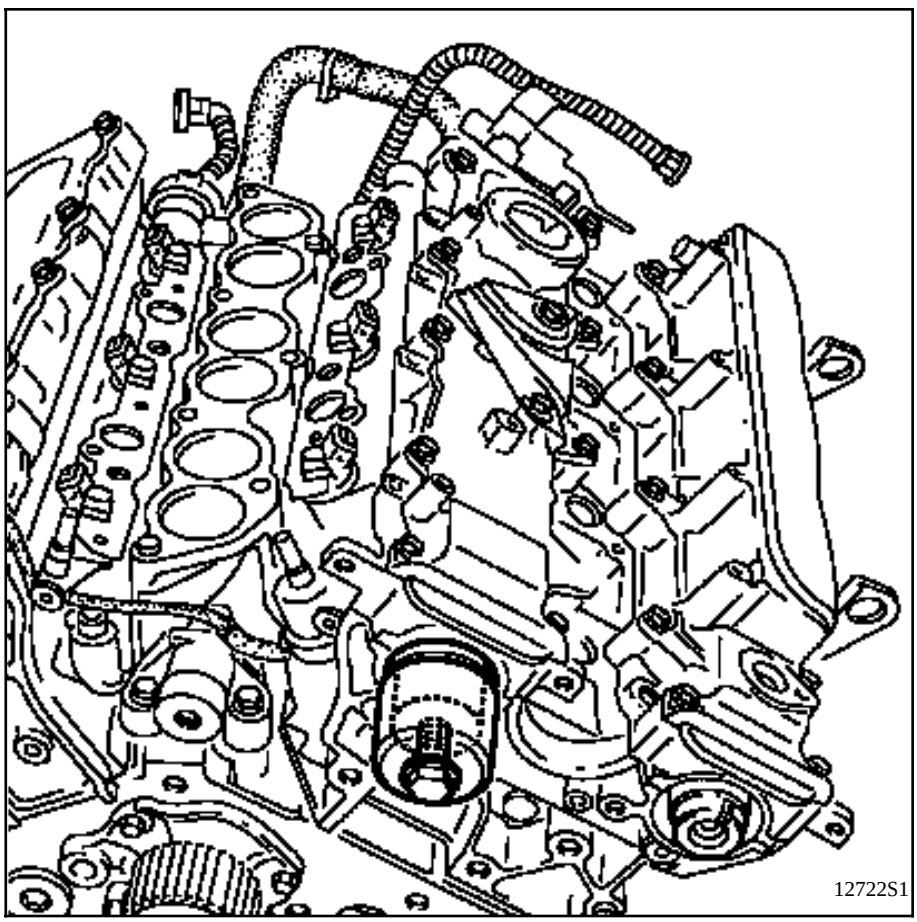


12694R1

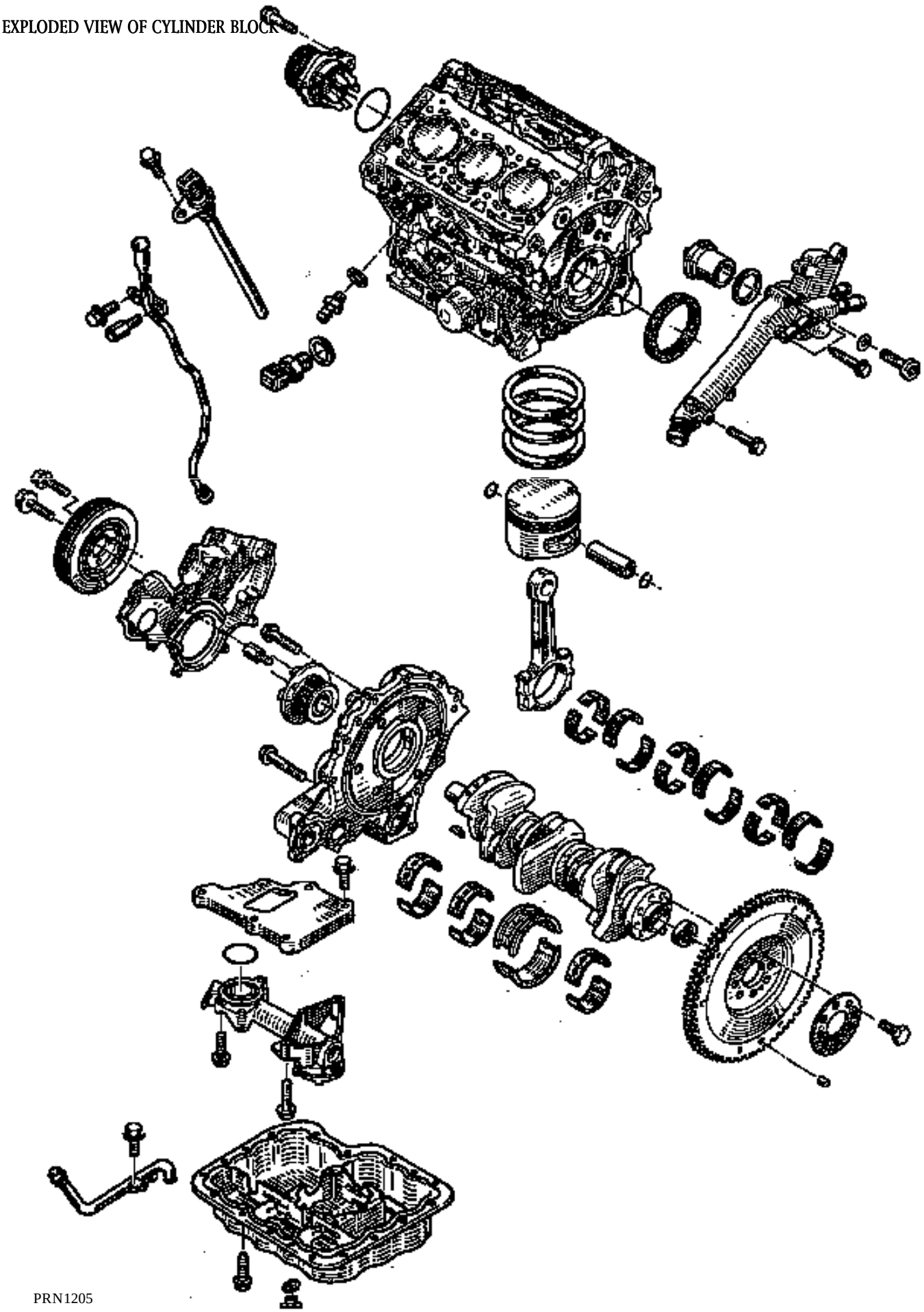
Rear cylinder head



Fitting of camshaft seals using tool **Mot. 1432**

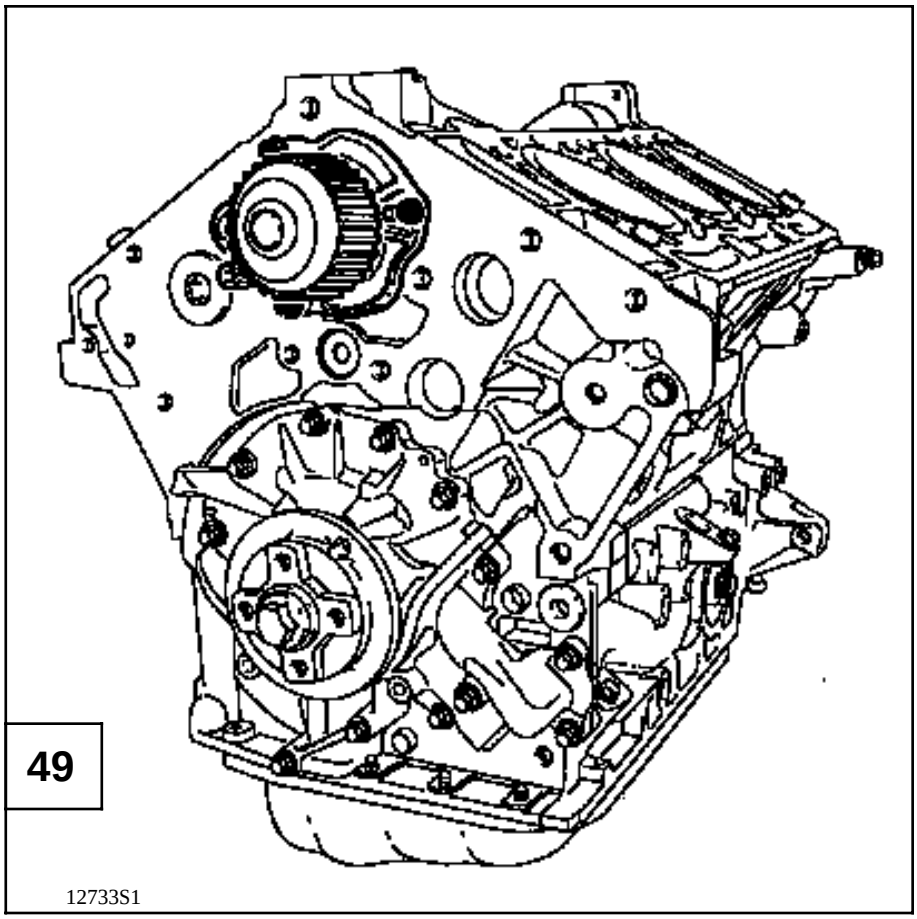


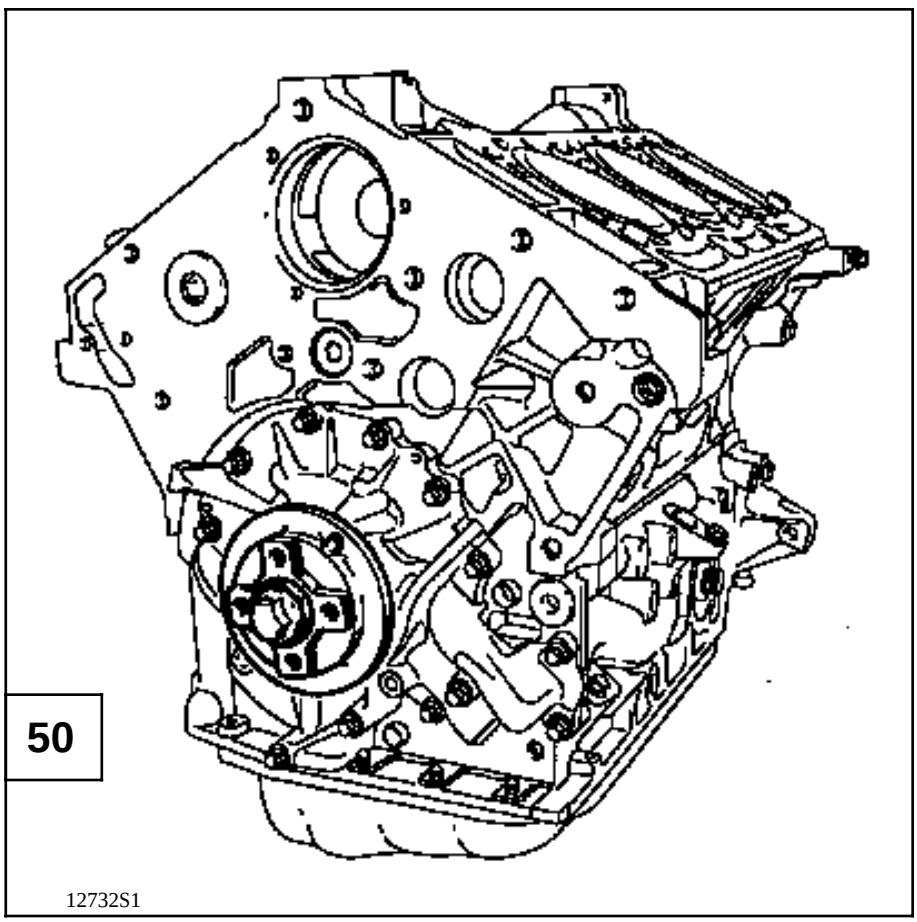
EXPLODED VIEW OF CYLINDER BLOCK



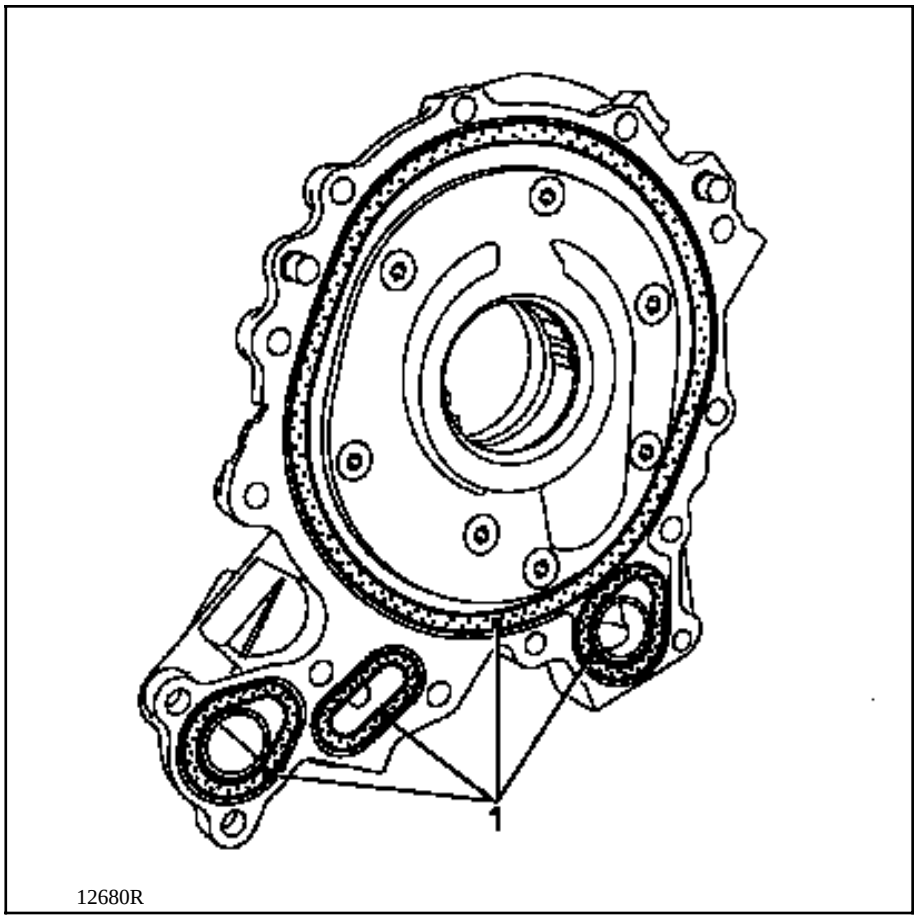
PRN1205

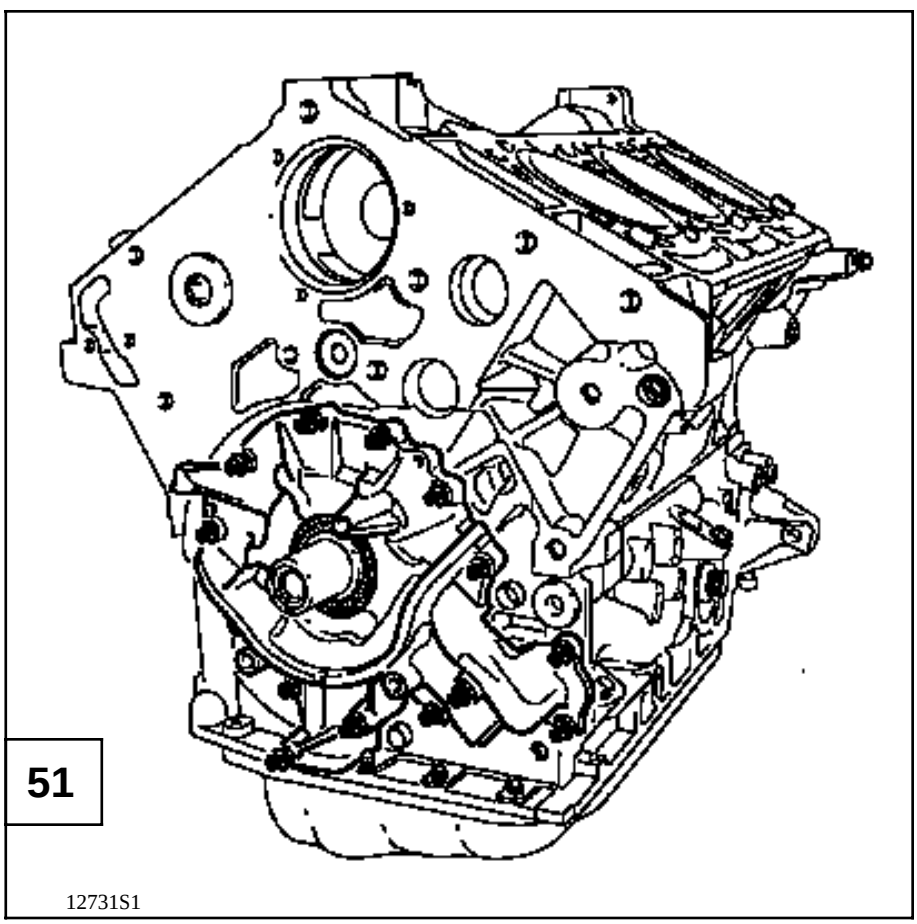
Removal of lower engine in the order recommended below
(diagrams 49 to 58).



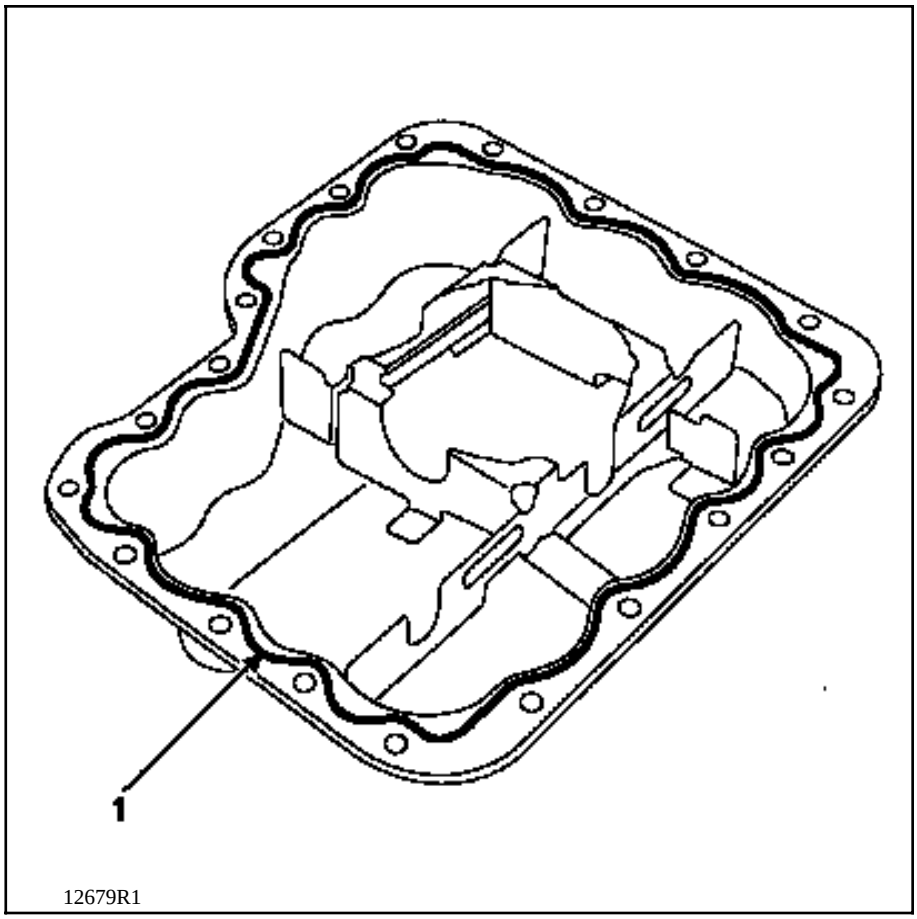


IMPORTANT : when removing **the oil pump, it is vital not to damage the seals (1). (Seals profiled on part). These seals can endure several removal operations. If damaged, they can be partly repaired with the sealing product Autojoint Or.**

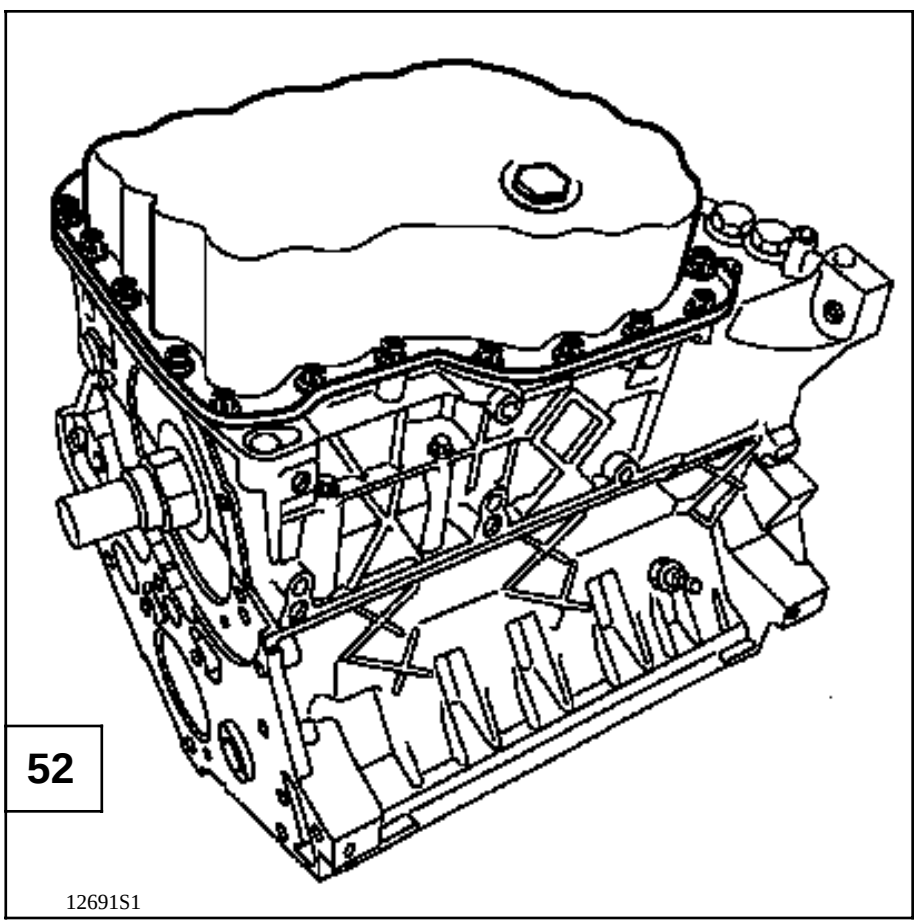




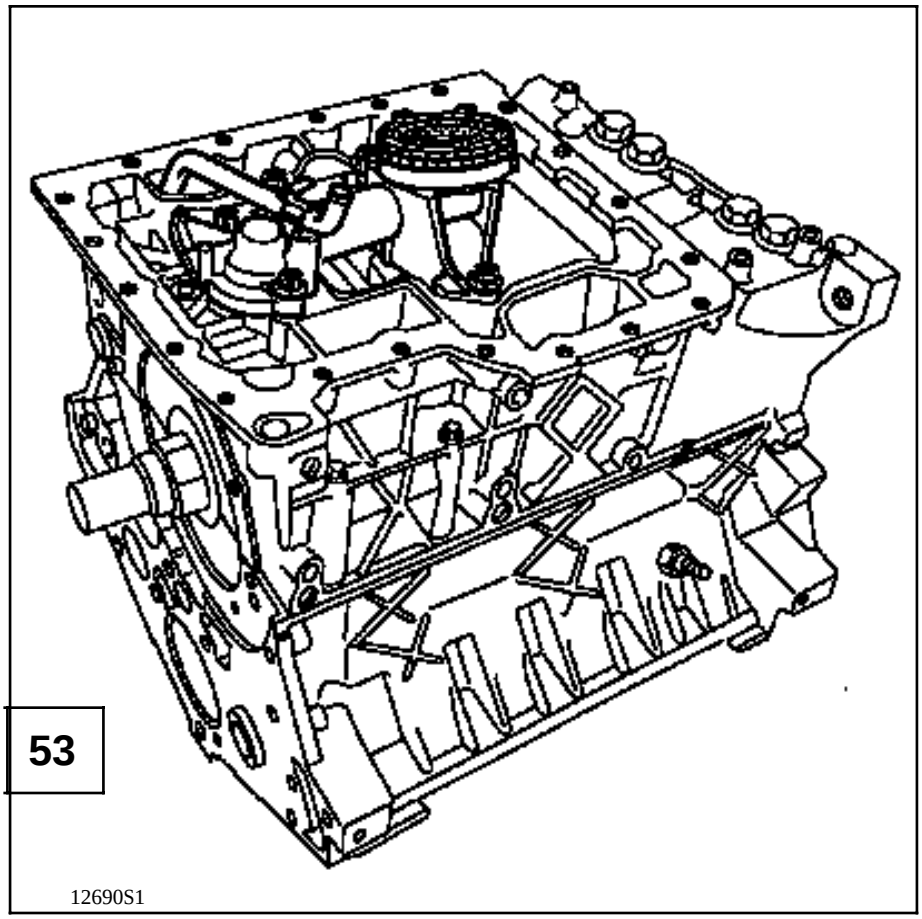
IMPORTANT : when removing **the sump, it is vital not to damage the seals (1). (Seals profiled on part). These seals can endure several removal operations. If damaged, they can be partly repaired with the sealing product Autojoint Or.**

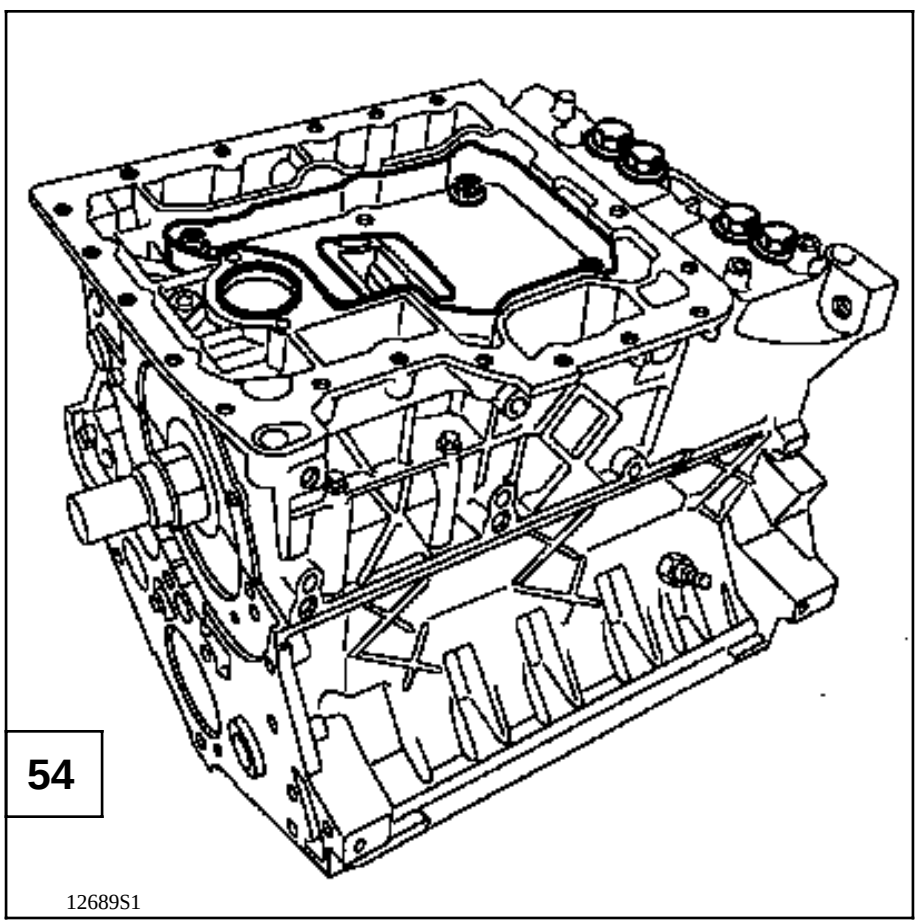


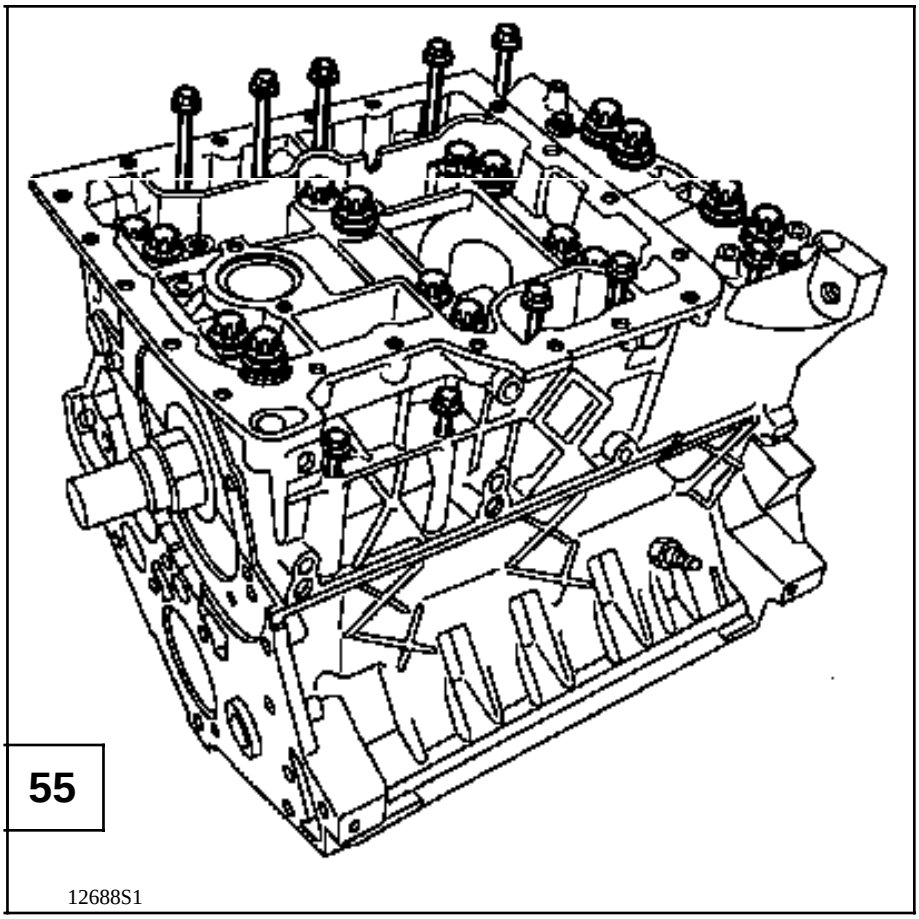
12679R1



12691S1


53
12690S1


54
12689S1

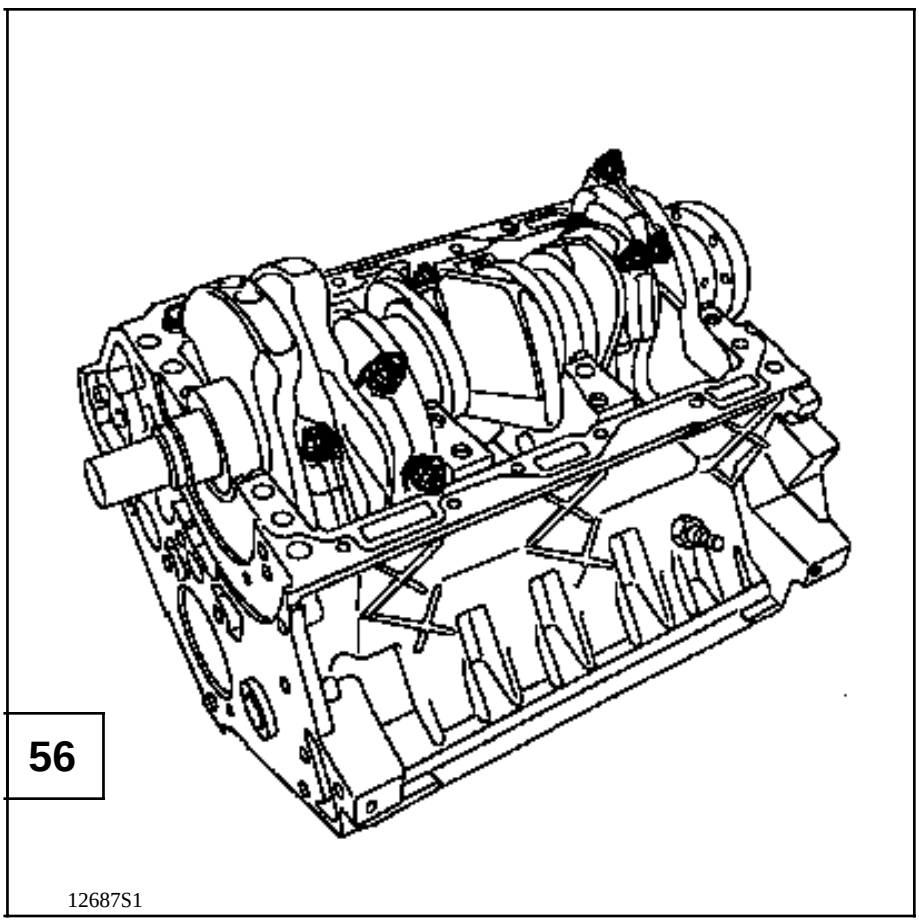


55

12688S1

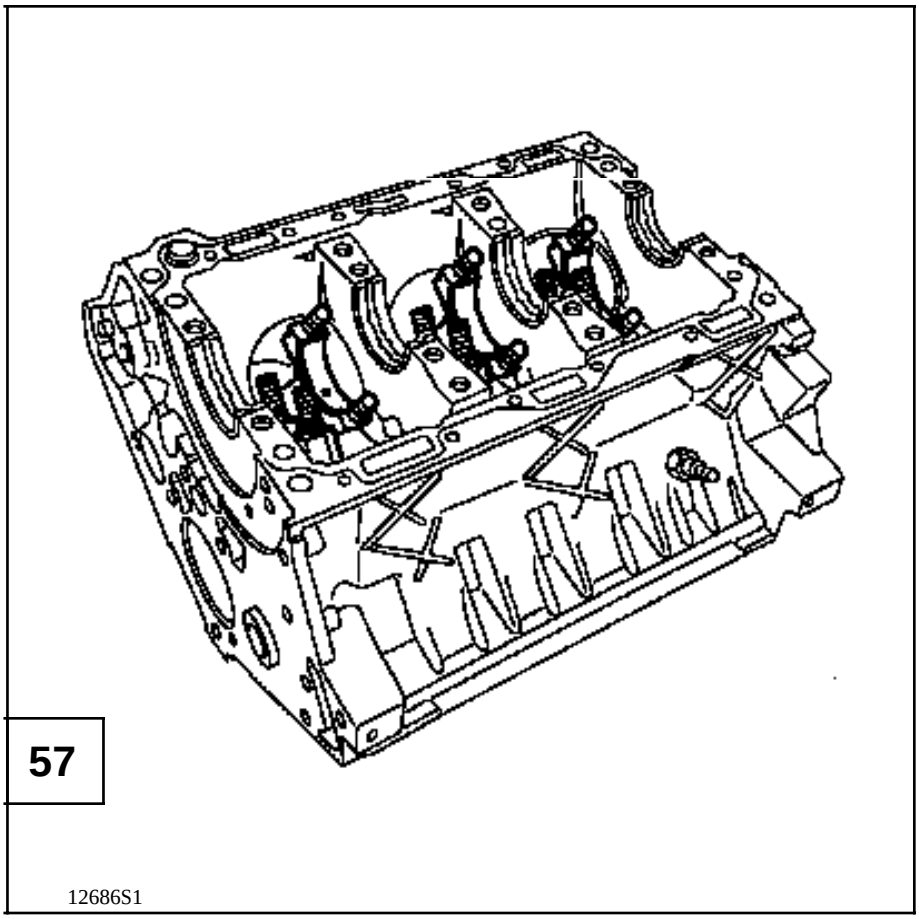
Mark the big end caps according to their body.

Important: do not use a scriber tool for the marking. In order to avoid cracking of the connecting rod, use an indelible pencil.



56

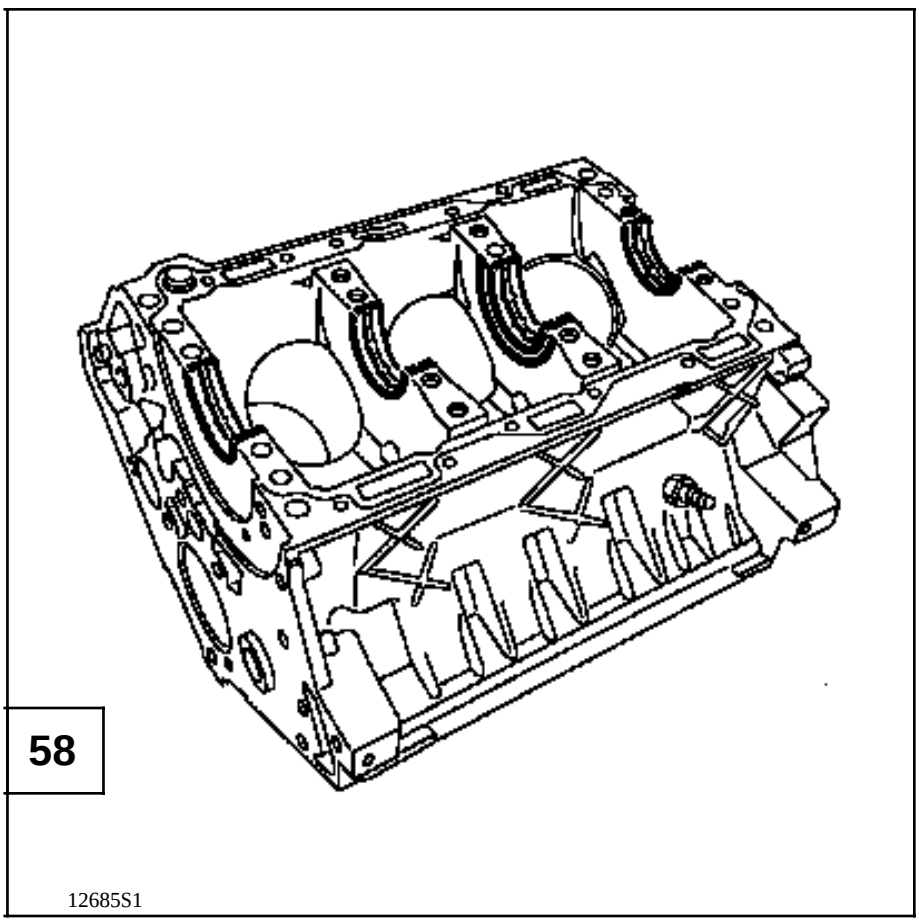
12687S1



57

12686S1

It is vital to mark the position of the shells, as the class may be different for each bearing in the block



58

12685S1

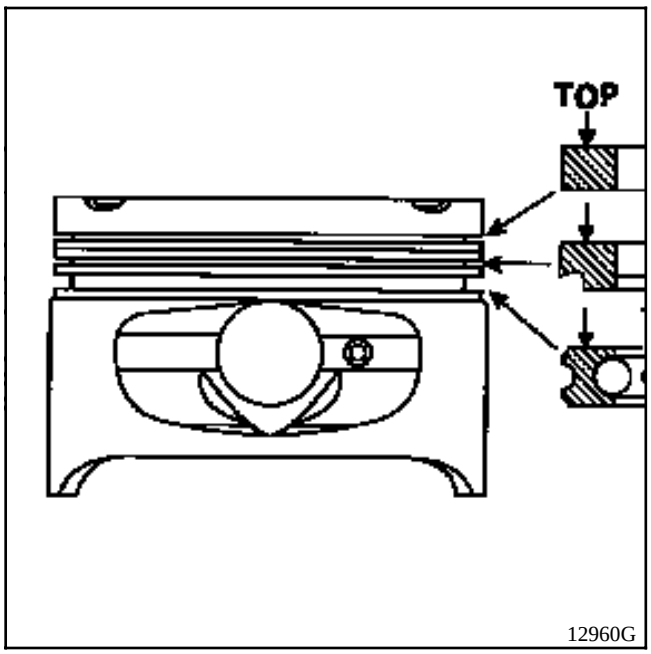
Check the piston ring play :

Upper piston ring	**0.20 to 0.35 mm**
Taper compression piston ring	**0.40 to 0.65 mm**
Scraper ring	**0.25 to 0.50 mm**

FITTING THE PISTON RINGS

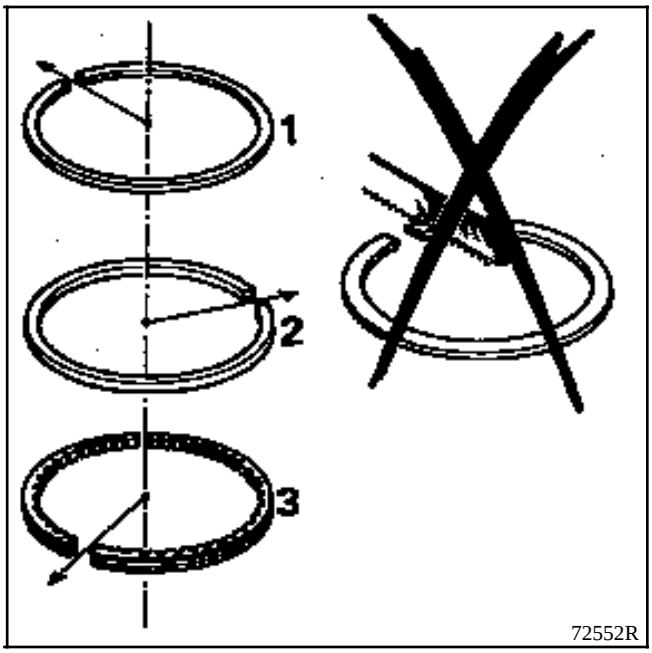
The piston rings, which are adjusted in the factory, should move freely in their grooves.

Ensure they are fitted the correct way round.



12960G

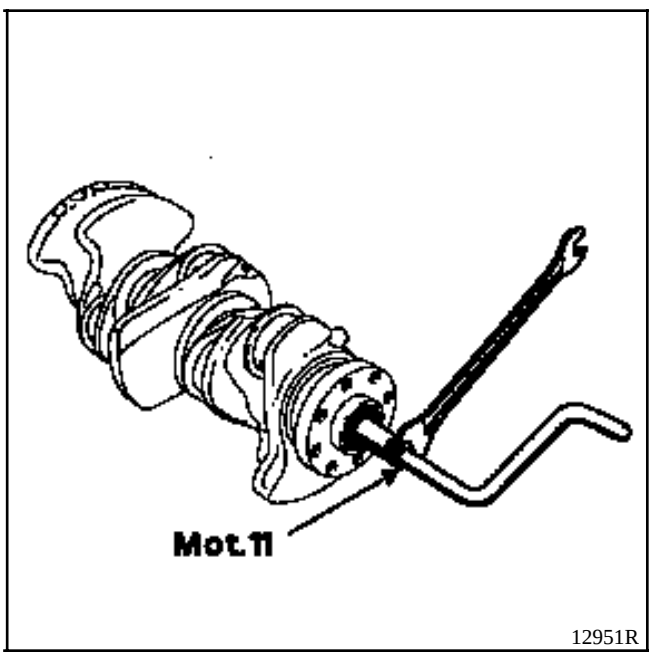
Stagger the rings.



72552R

Clean the crankshaft by passing a wire into the lubrication channels and clean the cylinder block and bearing block gasket faces.

Replace the bearing at the end of the crankshaft (flywheel end) if necessary using tool **Mot. 11**.

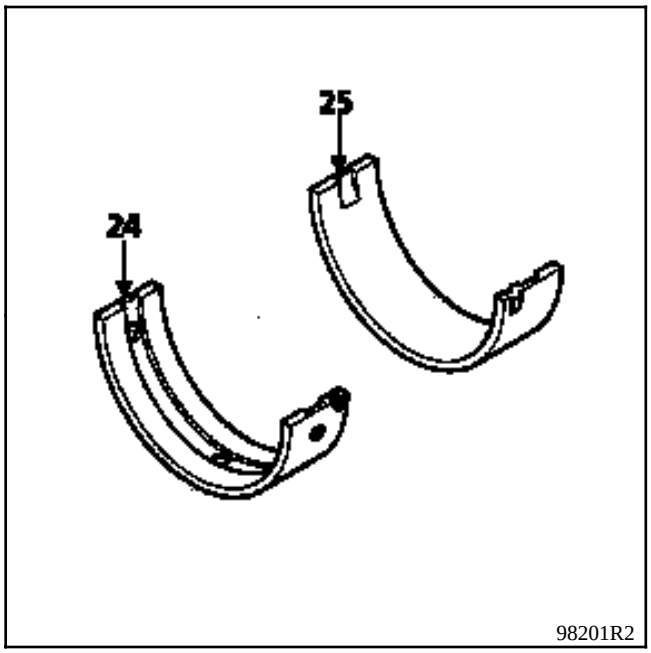


12951R

CRANKSHAFT BEARING SHELLS

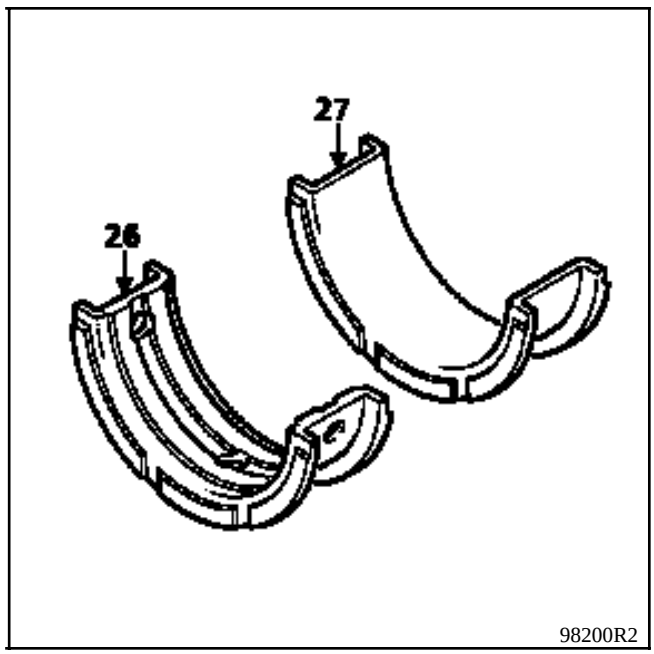
Fitting direction

- For bearings 1 - 3 - 4, fit the shells with the groove (24) **on the cylinder block side** and the shells without the groove (25) **on the bearing block side.**



98201R2

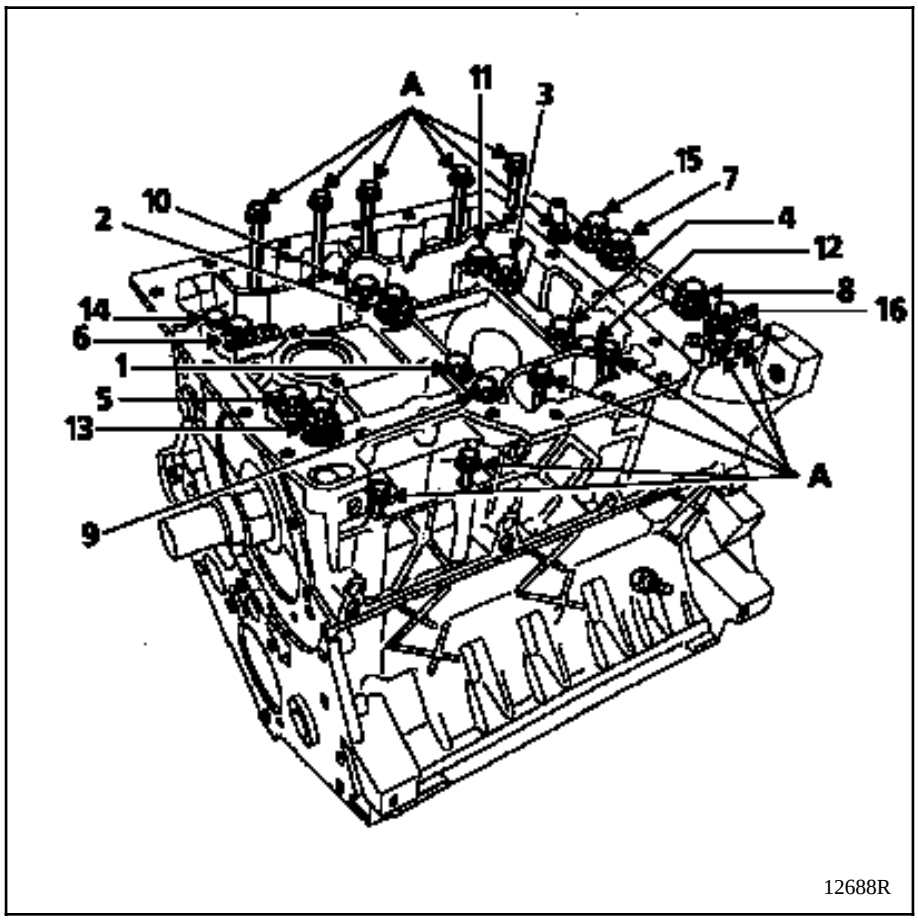
- For bearing 2, the end flanges are part of the half shell. The grooved shell (26) **is fitted on the cylinder block side** and the shell without the groove (27) **on the bearing block side**.



98200R2

Determining the crankshaft line shell class (see section "Specifications").

Fit the crankshaft and bearing block into position and torque tighten the bolts, following the order recommended below.



Important : do not re-use bolts whose length exceeds:

- **For M8 bolts : 119 mm**
- **For M11 bolts : 131.5 mm**

Tightening method:

- Re-used bolts must be brushed and lubricated with engine oil under the heads and on the threads.
- Tighten all bolts by hand.
- Tighten the **M11** bolts to **3 daN.m**, then the **M8** bolts to **1 daN.m** (in the recommended order).
- Tighten the edge bolts (A) **M6** to **1 daN.m** (tighten in a spiral).
- Completely slacken the **M8** and **M11** bolts.
- Retighten the **M11** bolts, bolt by bolt, to **3 daN.m then angle tighten by 180°**, then tighten the **M8** bolts to **1 daN.m then angle tighten by 180°** (in the recommended order).

Check the crankshaft end float which should be between 0.1 and 0.3 mm.

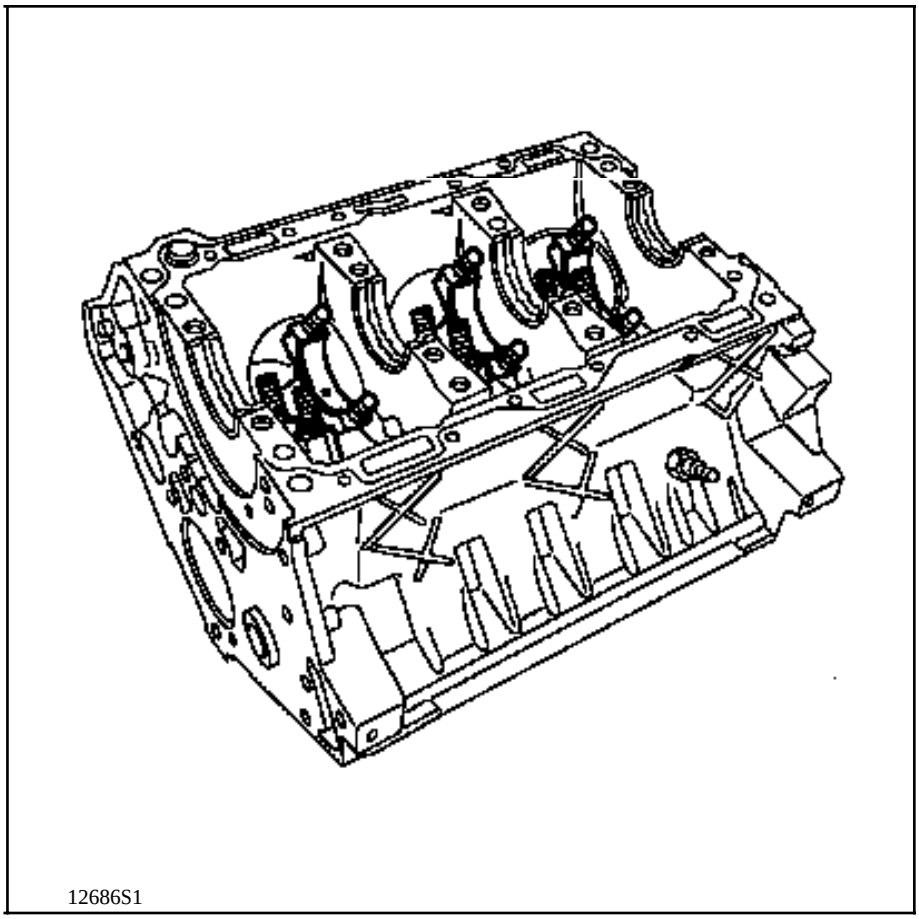
Remove the bearing block and the crankshaft once more.

Refitting

Lubricate the pistons.

Fit the "piston - connecting rod" assemblies into the cylinder block using the ring.

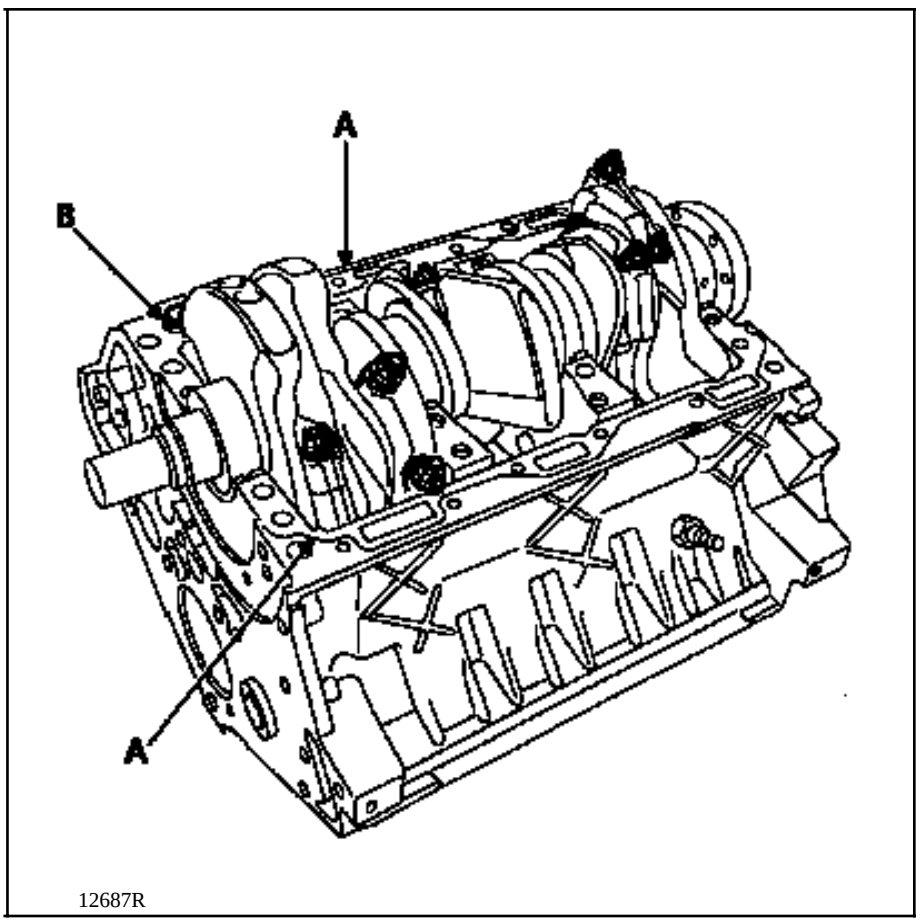
Take care when fitting the "piston - connecting rod" assemblies **- the arrow should point towards the timing end and the jet should be on the opposite side to the oil filter.**



12686S1

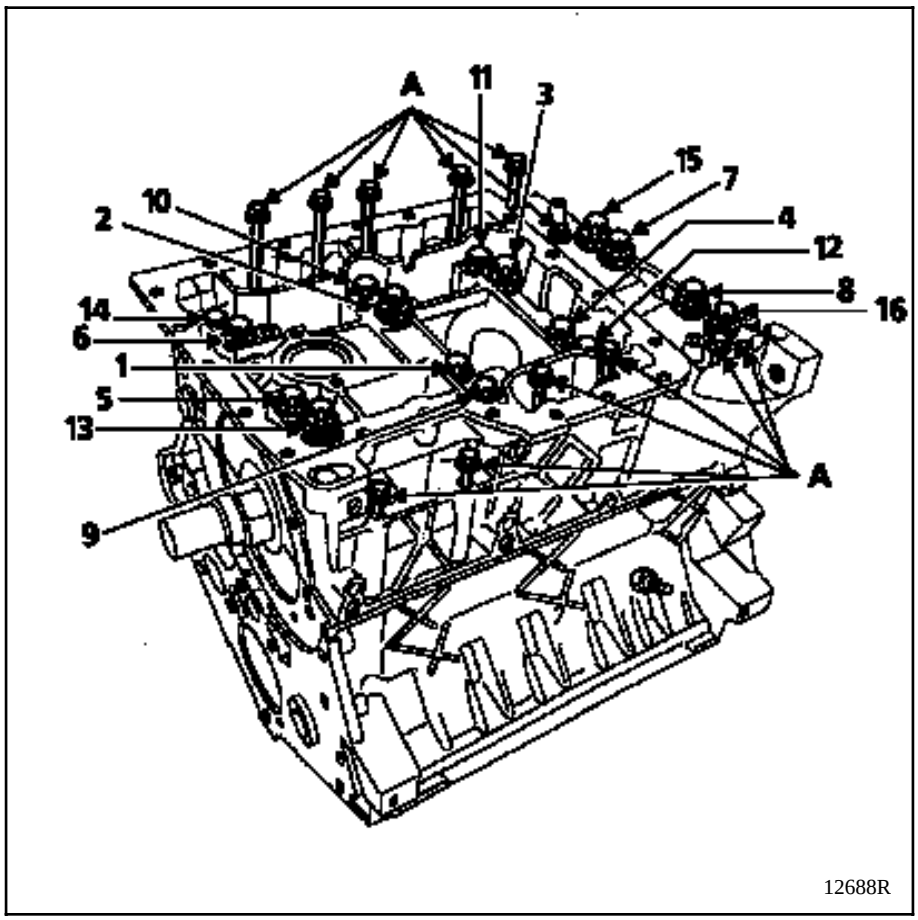
Fit the crankshaft (lubricate the journals and crankpins) and tighten the bearing caps to **2 daN.m then angle tighten by 74°**.

Apply a bead of **Autojoint OR** on the gasket face at (A) and fit a new O ring at (B).



12687R

Fit the bearing block into position and torque tighten the bolts, following the order recommended below.



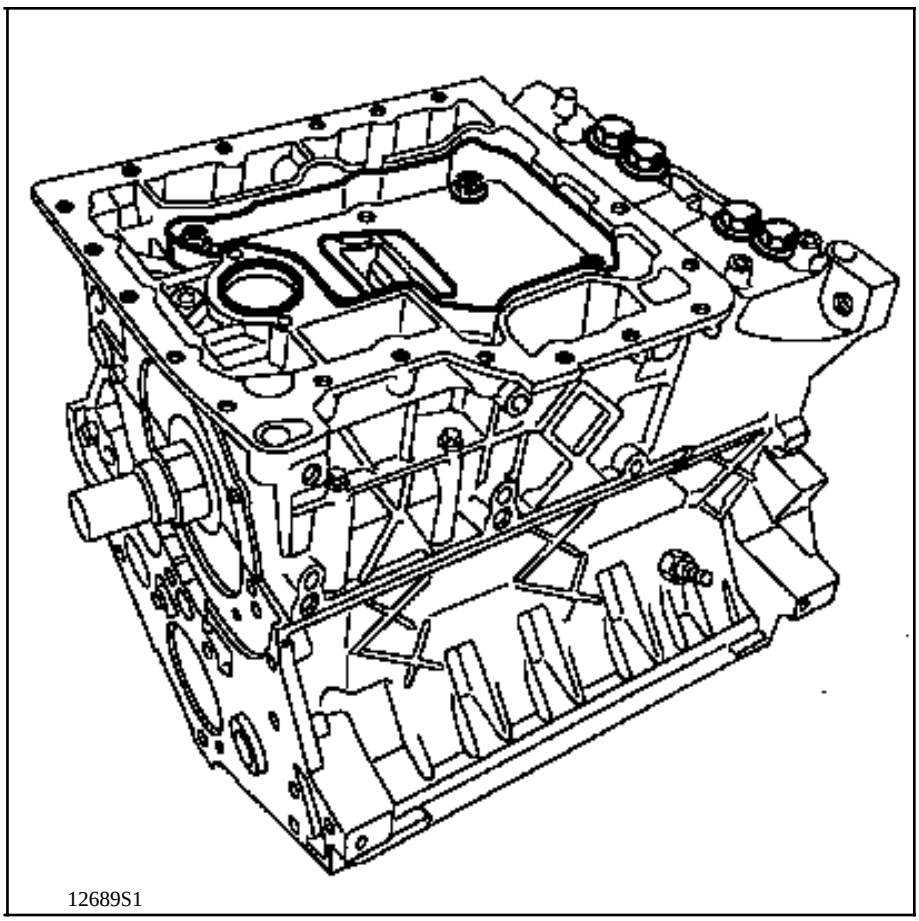
Important : do not re-use bolts whose length exceeds:

- **For M8 bolts : 119 mm**
- **For M11 bolts : 131.5 mm**

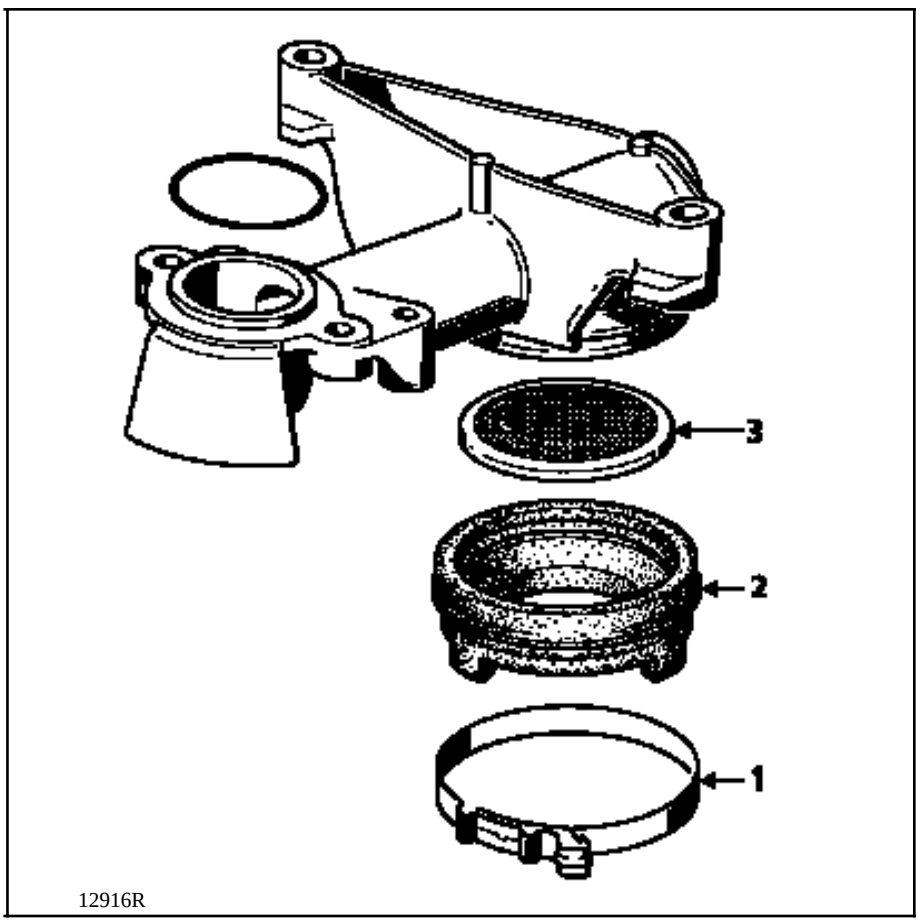
Tightening method:

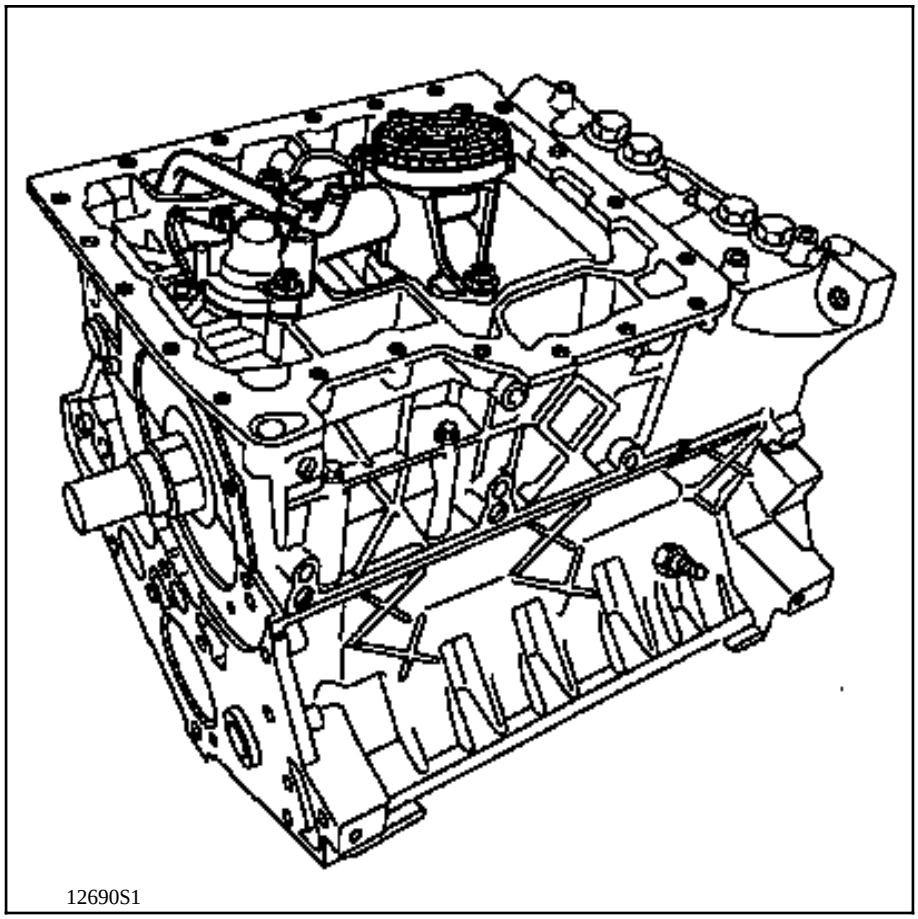
- Re-used bolts must be brushed and lubricated with engine oil under the heads and on the threads.
- Tighten all bolts by hand.
- Tighten the **M11** bolts to **3 daN.m**, then the **M8** bolts to **1 daN.m** (in the recommended order).
- Tighten the edge bolts (A) **M6** to **1 daN.m** (tighten in a spiral).
- Completely slacken the **M8** and **M11** bolts.
- Retighten the **M11** bolts, bolt by bolt, to **3 daN.m then angle tighten by 180°**, then tighten the **M8** bolts to **1 daN.m then angle tighten by 180°** (in the recommended order).

Refitting is the reverse of removal.

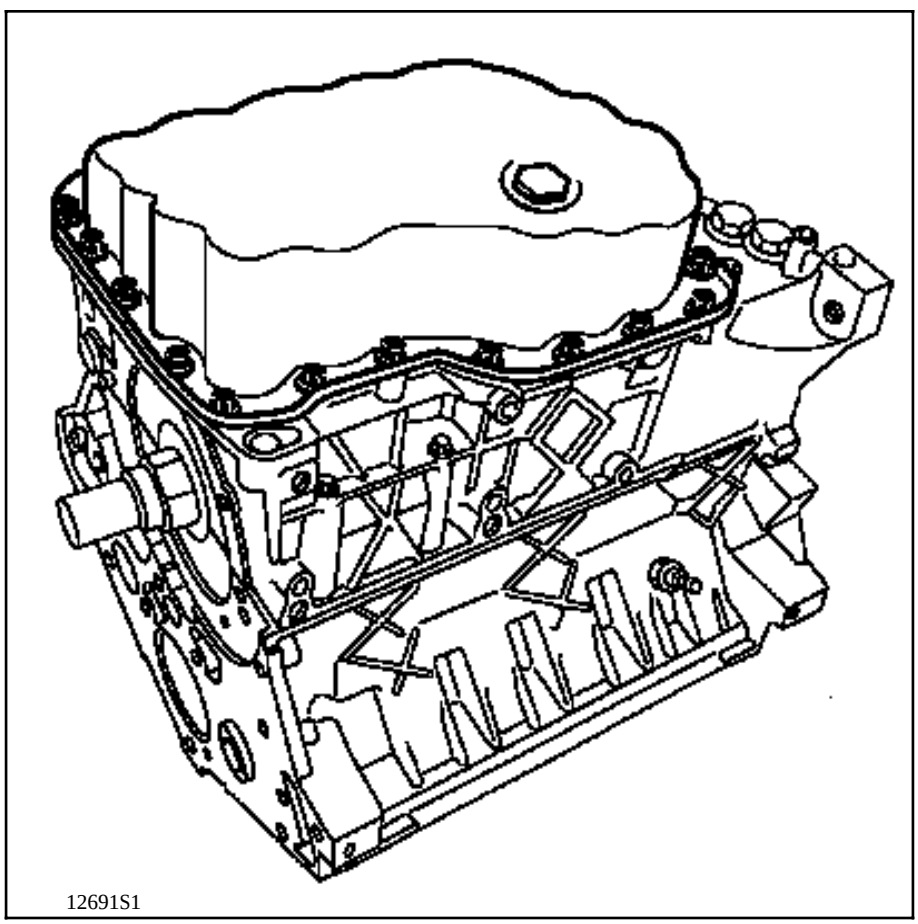


Clean mesh (3) of the strainer by removing clip (1) and rubber fitting (2).





12690S1

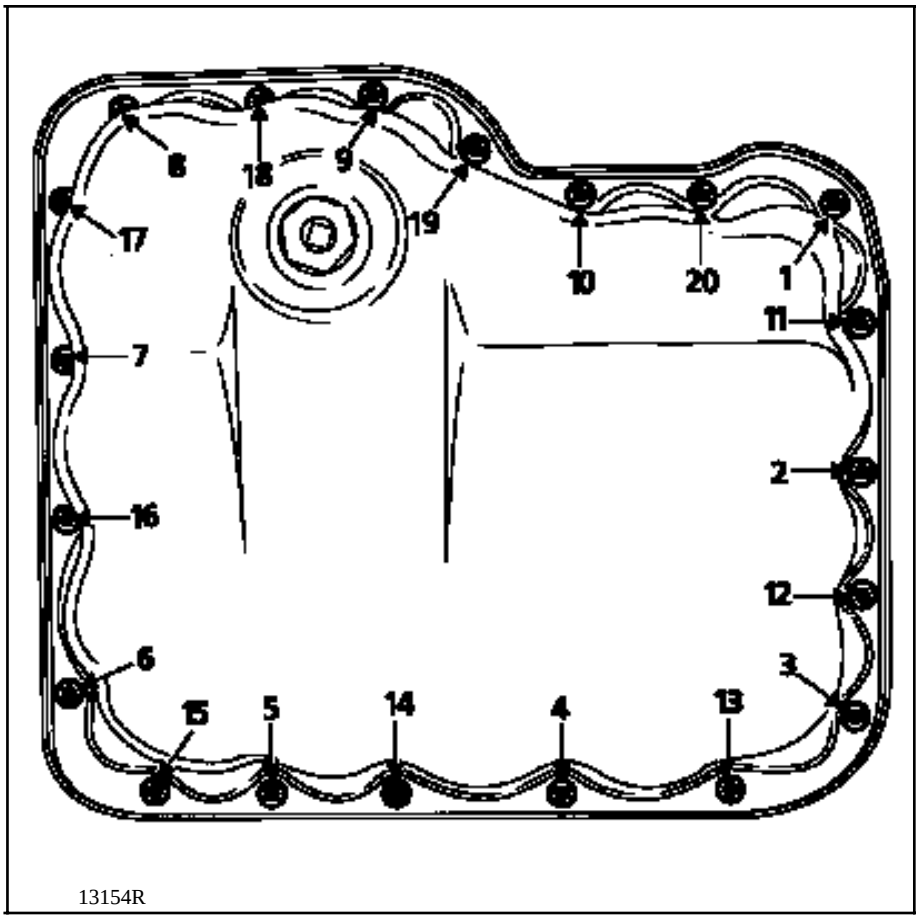


12691S1

Torque tighten the sump in the recommended order.

Hand tighten all the bolts, but do not lock them.

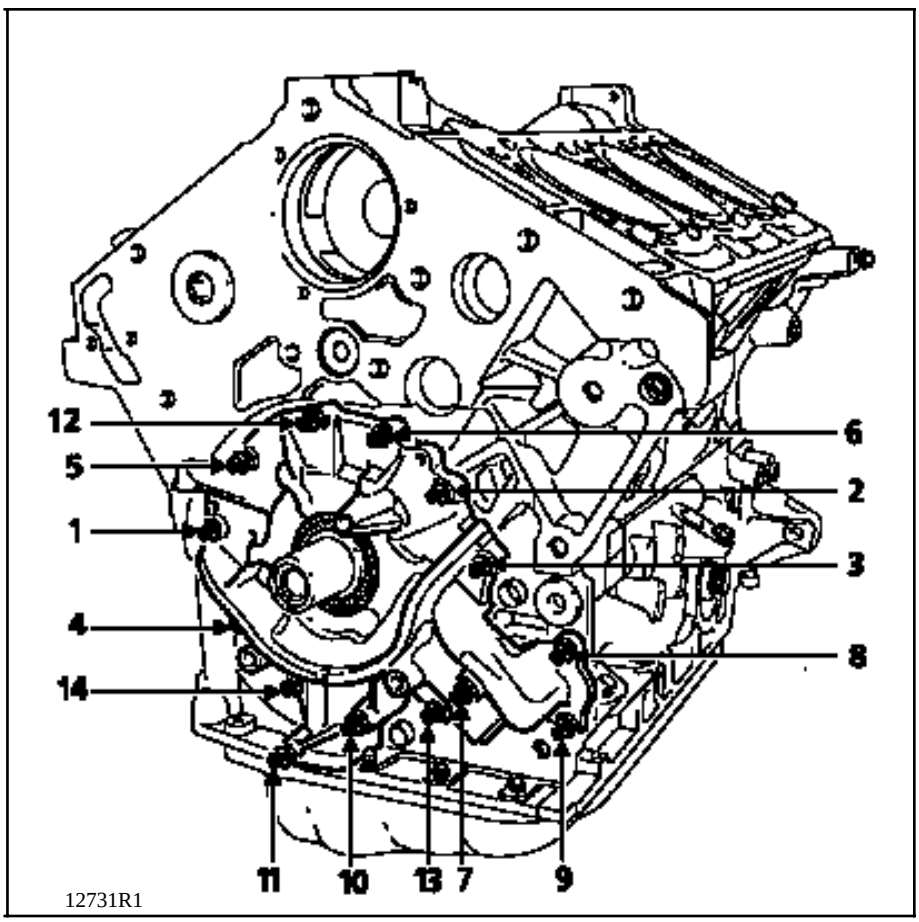
Tighten the bolts to a torque of **0.8 daN.m**.



13154R

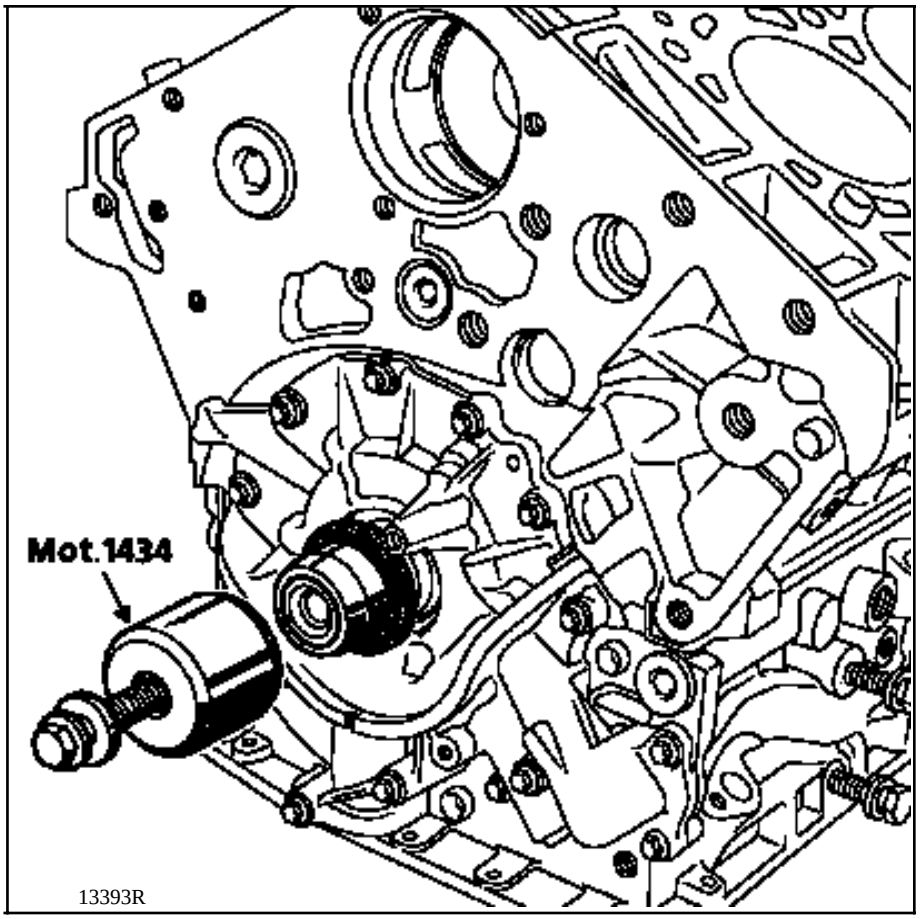
Refit the oil pump:

Hand tighten all the bolts, then torque tighten to **0.8 daN.m** in the recommended order.

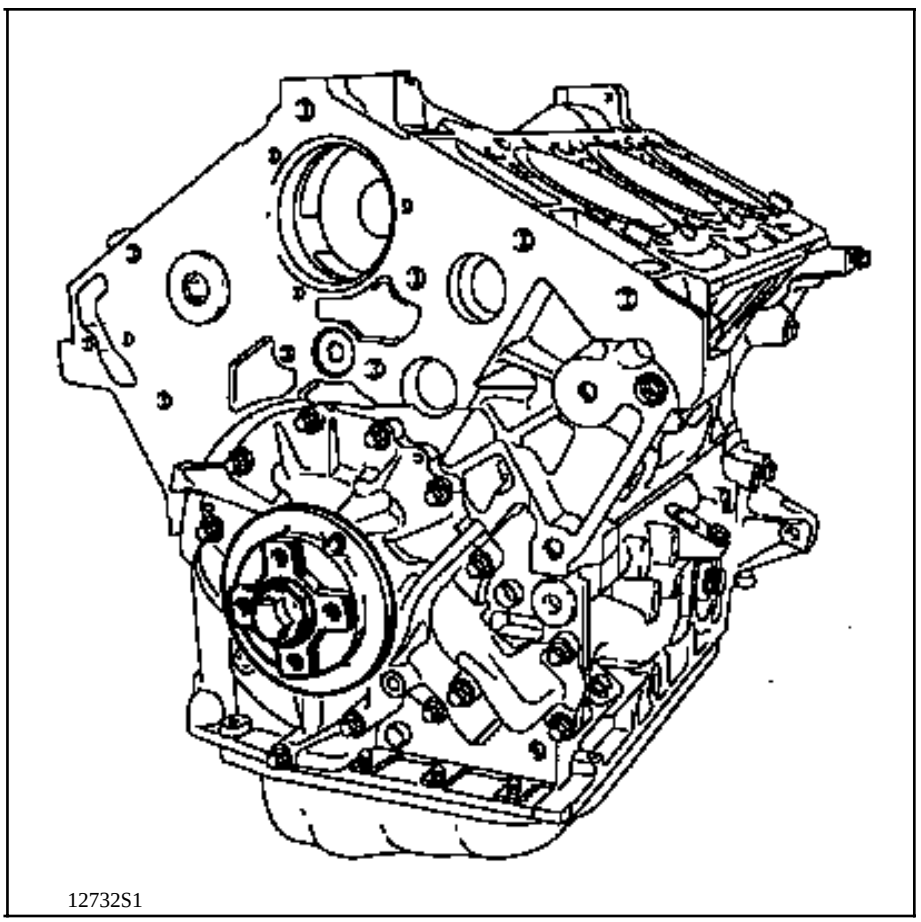


12731R1

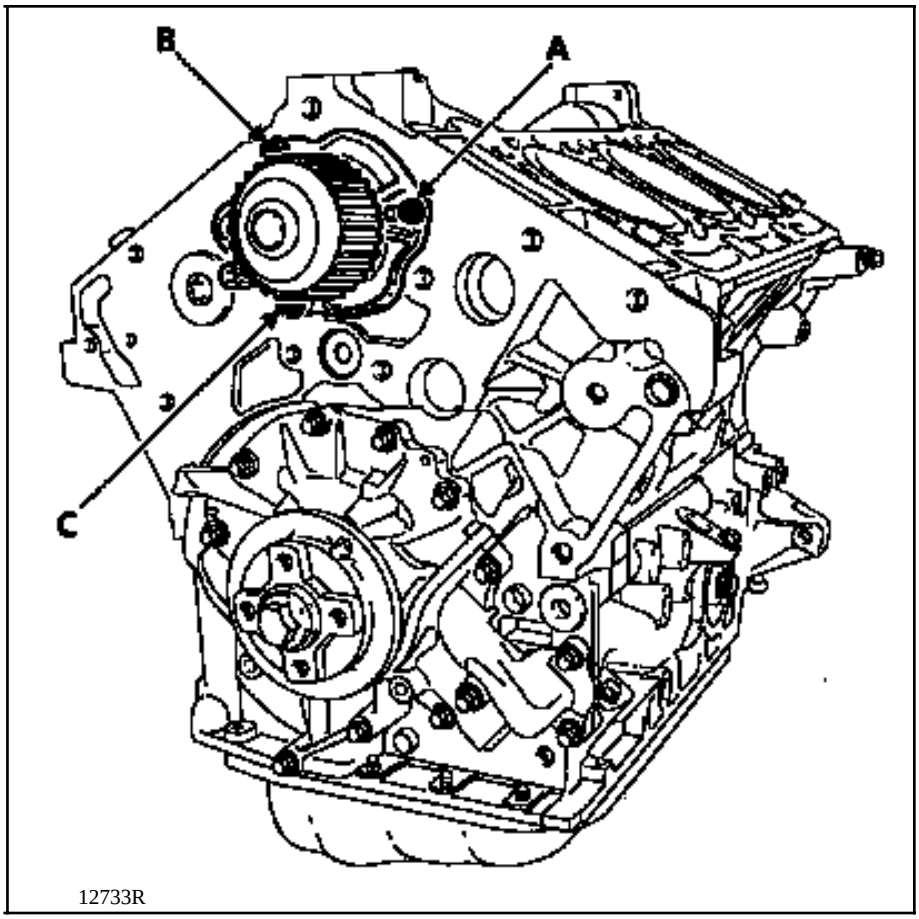
Fit the crankshaft seal using tool **Mot. 1434**.



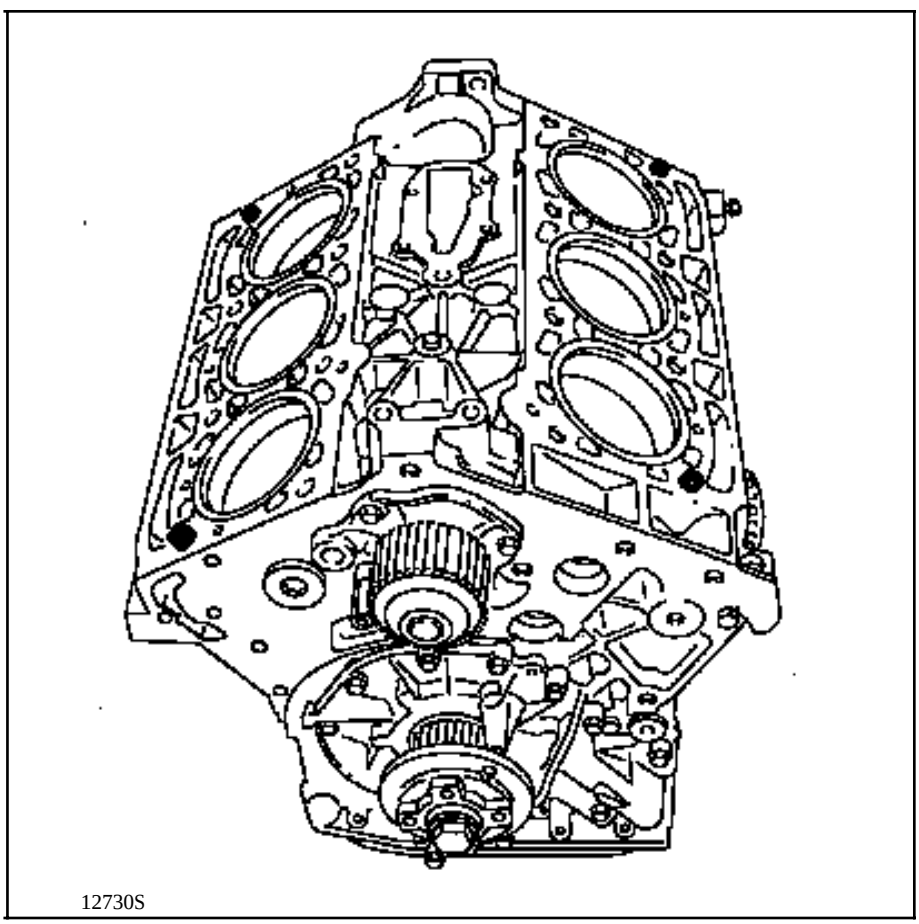
Refit the timing sprocket, tightening to a torque of **4 daN.m then an angle of 80°**.



Refit the water pump with a new O ring seal and torque tighten to **0.8 daN.m** beginning with bolt (A) then (B) and (C).

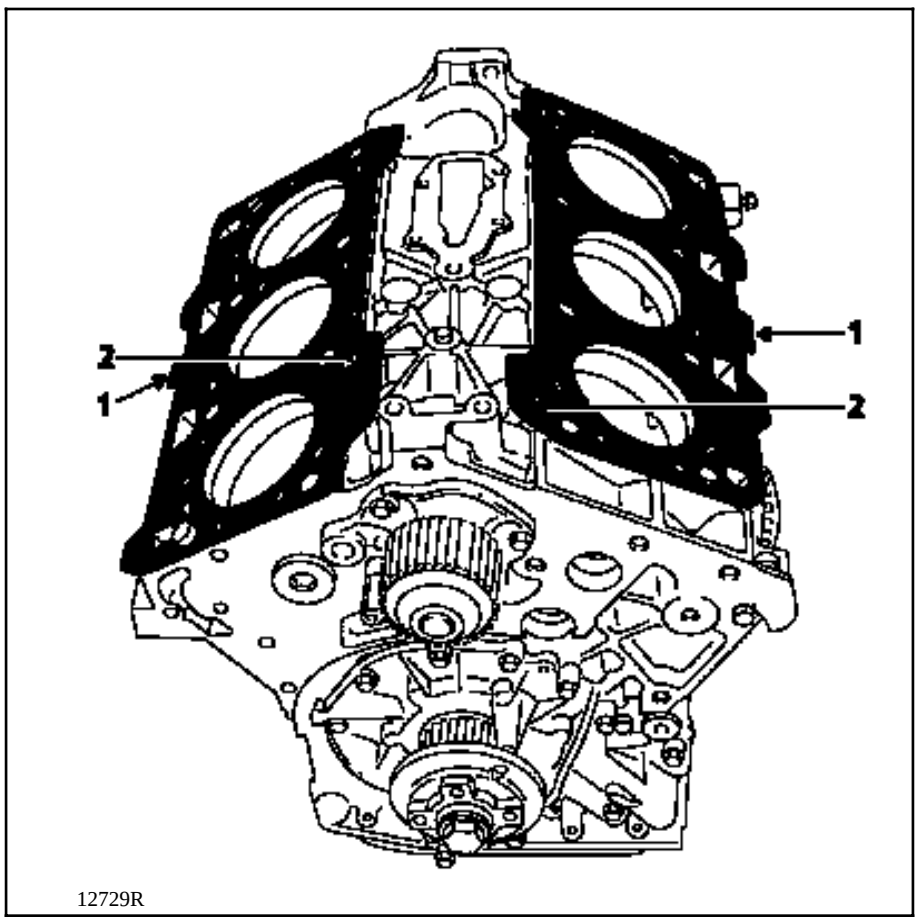


12733R


12730S

Position the pistons half way.

Fit the cylinder head gaskets, with tabs (1) towards the outside and check the oilway openings (2) are correctly positioned.



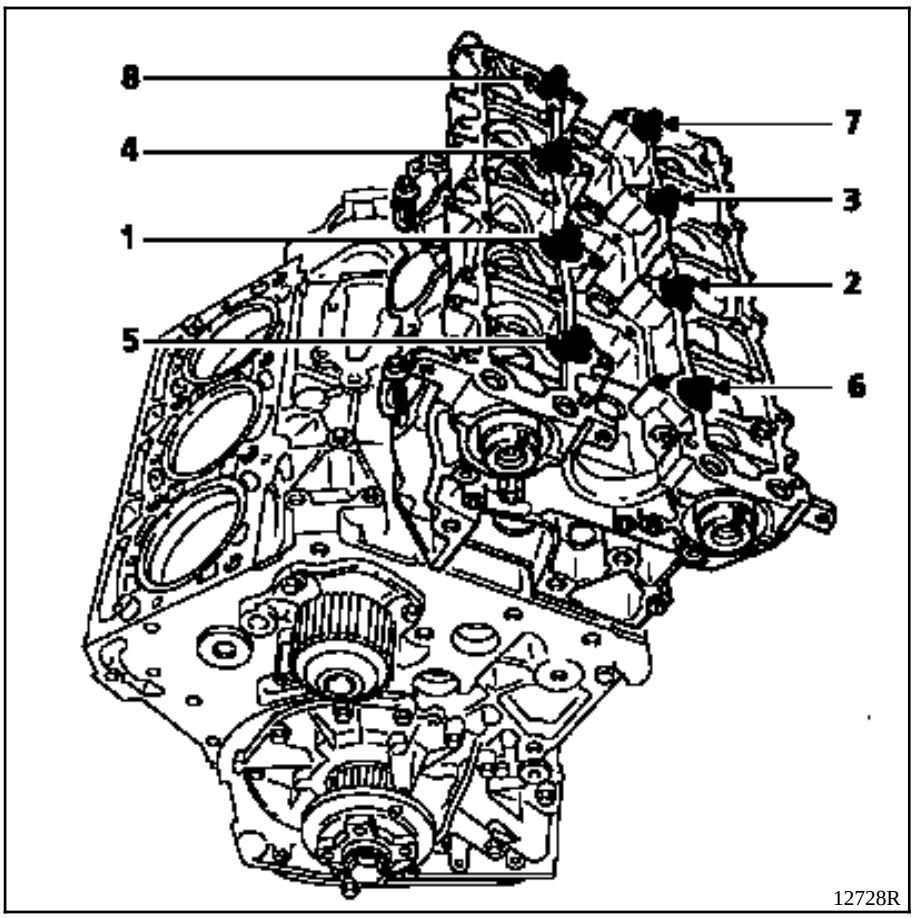
REFITTING THE CYLINDER HEADS

Check the length of the bolts **under the heads** which should be **147.5 ± 0.3 mm.**

Do not use bolts of length greater than 149.5 mm.

Re-used bolts should be brushed and lubricated with engine oil under the heads and on the threads.

METHOD FOR TIGHTENING THE CYLINDER HEAD

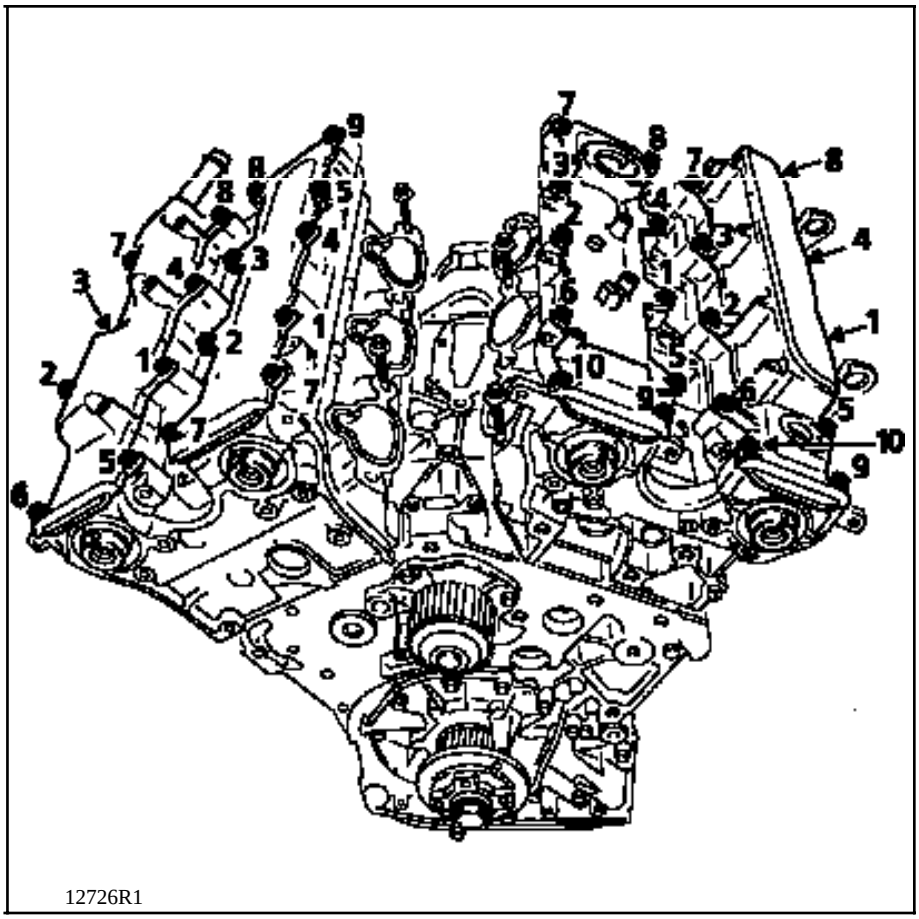


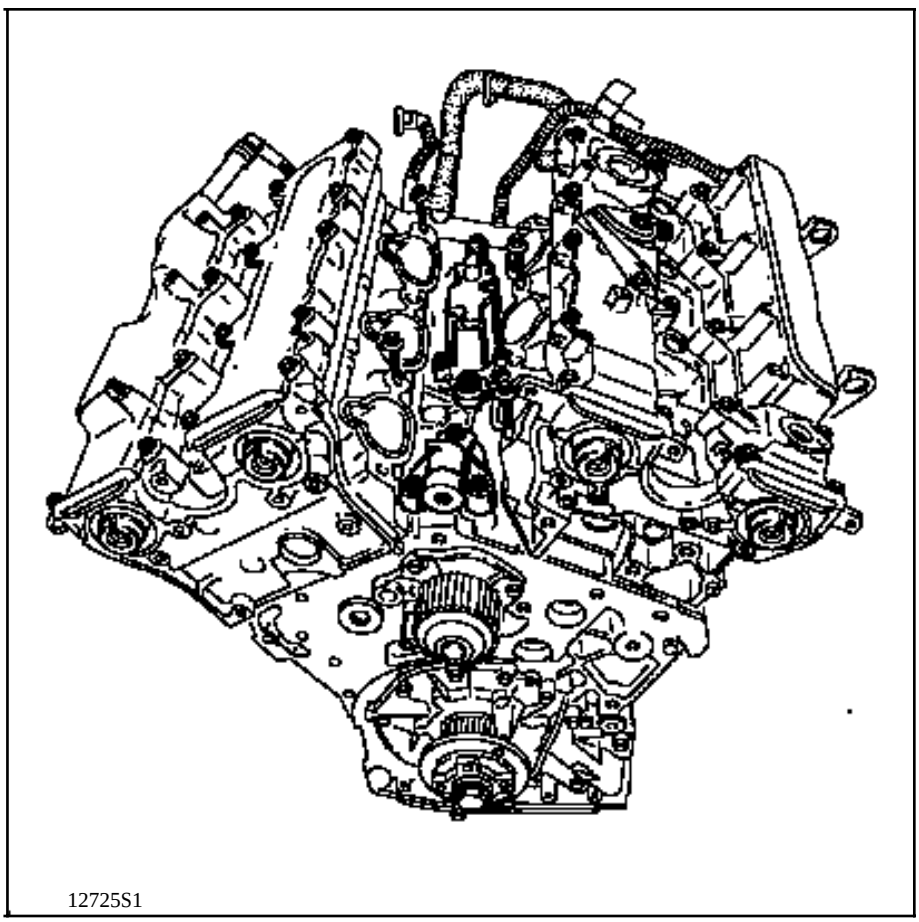
- Pretighten to **2 daN.m** in the recommended order.
- Slacken bolt (1) completely.
- Retighten bolt (1) to **1.5 daN.m,** then **angle tighten** by **225**°.
- Carry out the same operations for the other bolts.

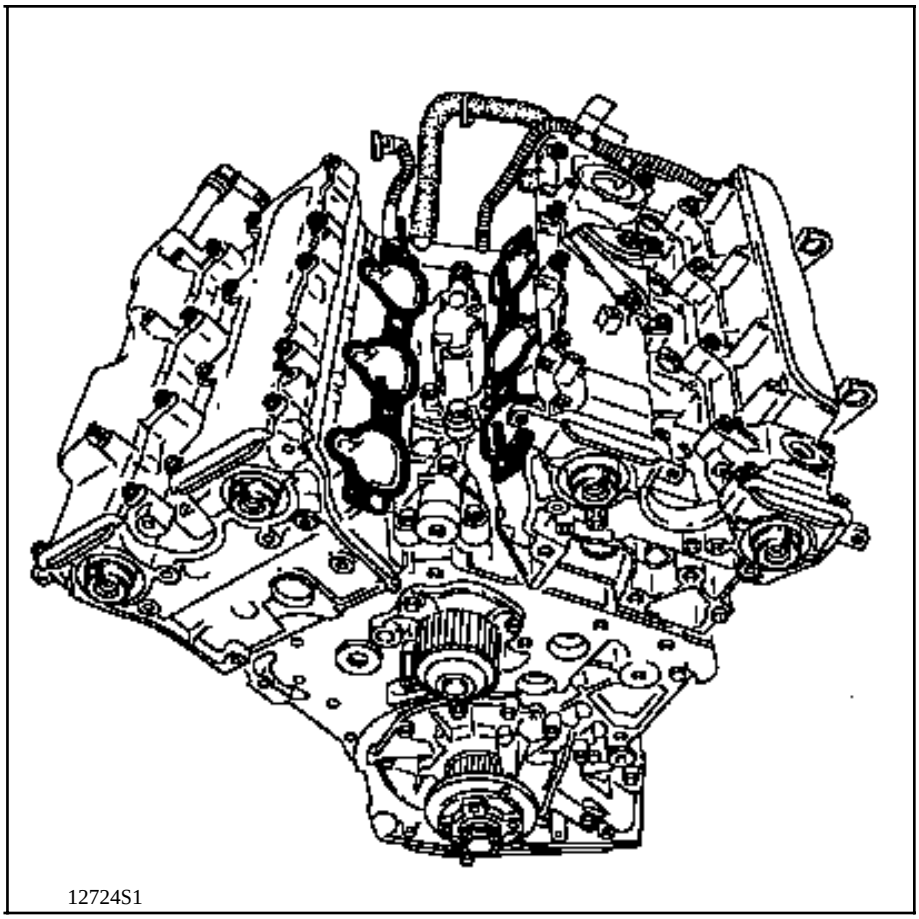
Carry out the same operations for the other cylinder head.

Cylinder head gasket thickness : nominal dimension= **1.45 ± 0.04 mm**.
repair dimension = **1.65 ± 0.04 mm**.

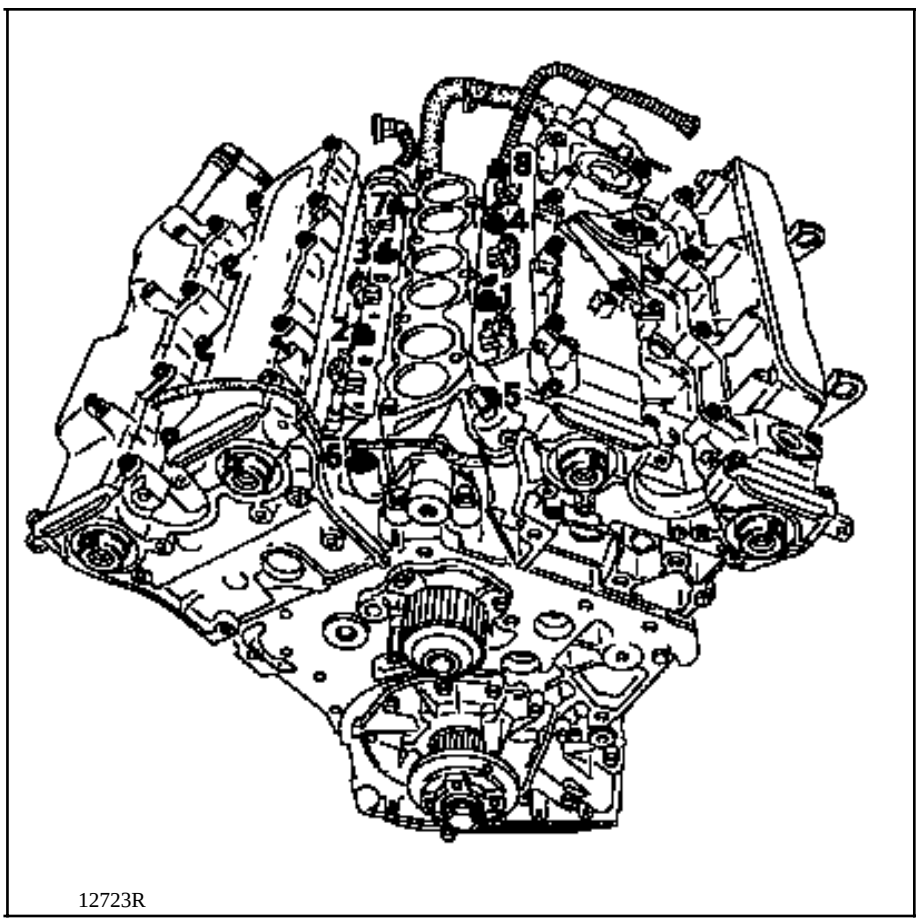
Hand tighten all the bolts without locking them then torque tighten to **1 daN.m** (in the recommended order).







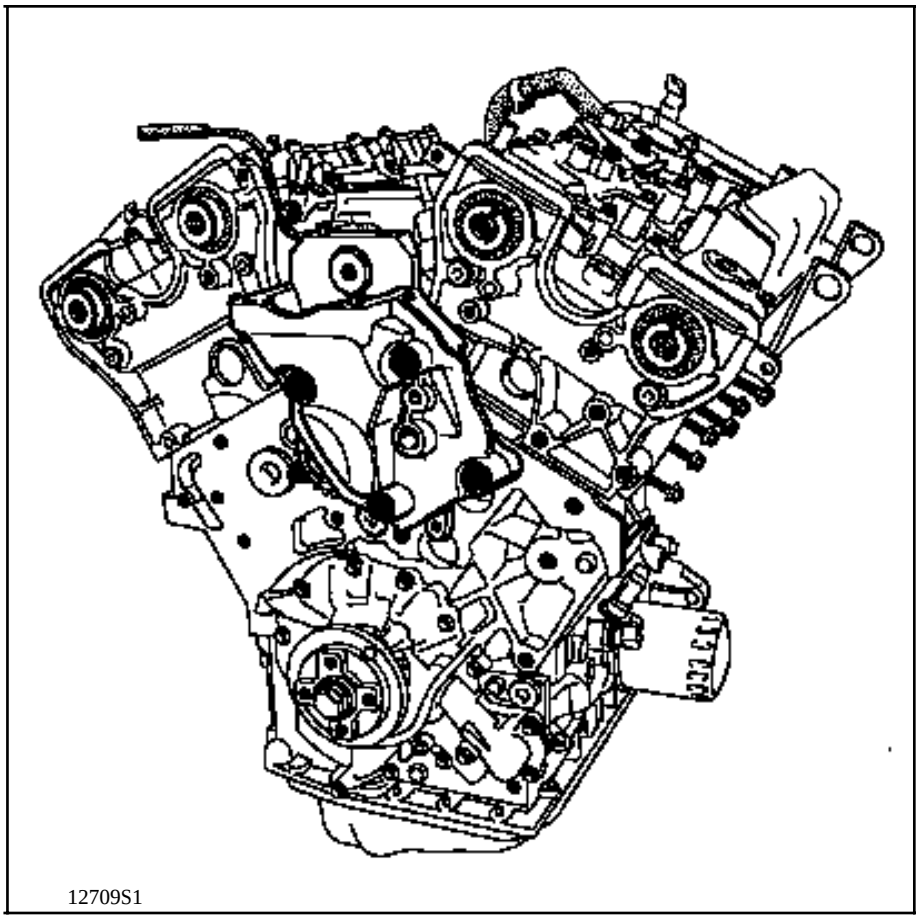
12724S1



12723R

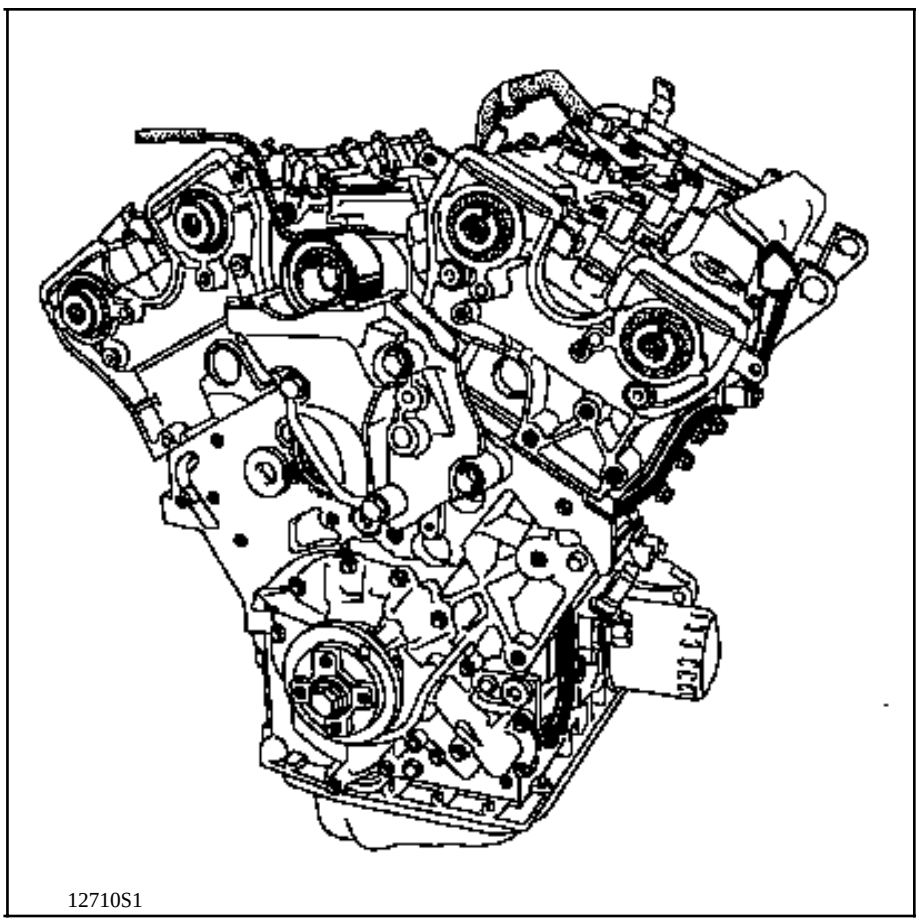
Hand tighten all the bolts, pre-tighten to **1 daN.m** (in the recommended order), then torque tighten to **2.5 daN.m** (in the recommended order).

Torque tighten the bolts to **6 daN.m**.

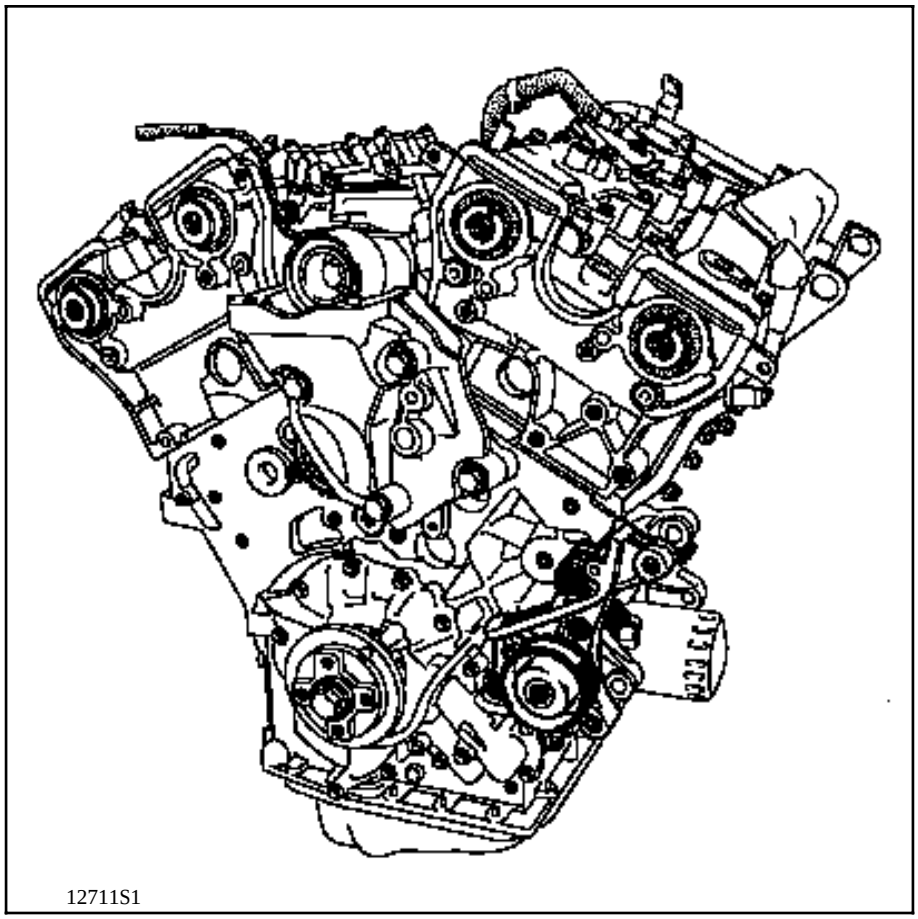


12709S1

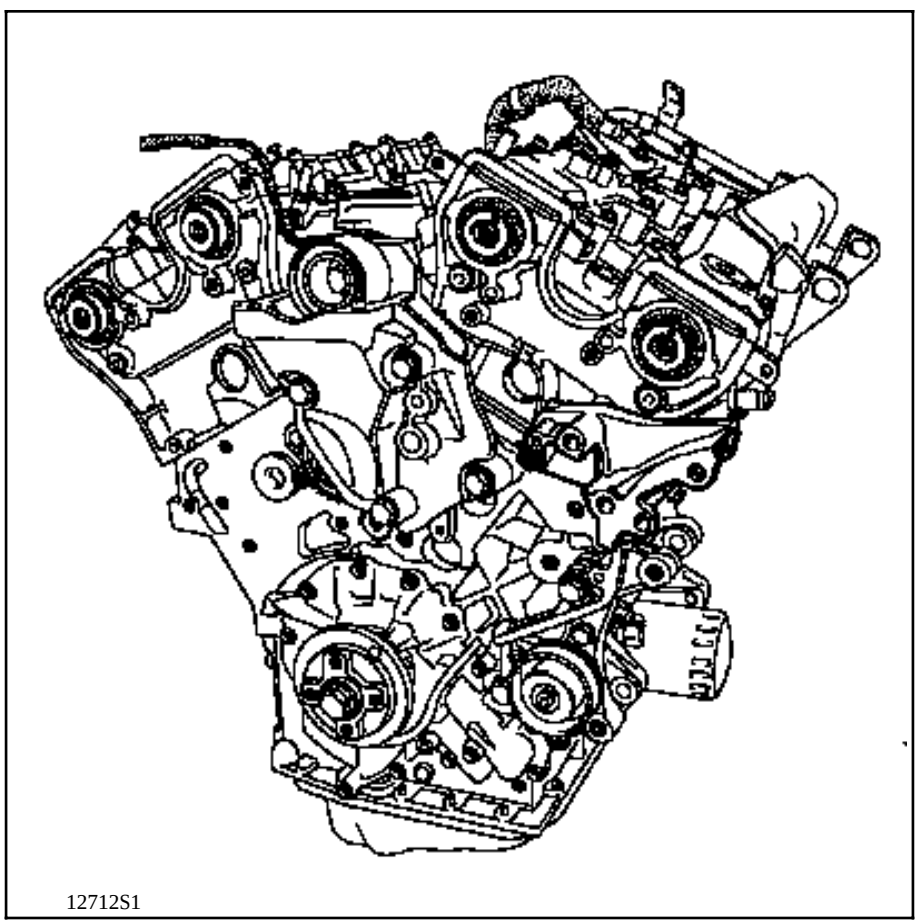
Torque tighten the pulley to **8 daN.m**.



12710S1

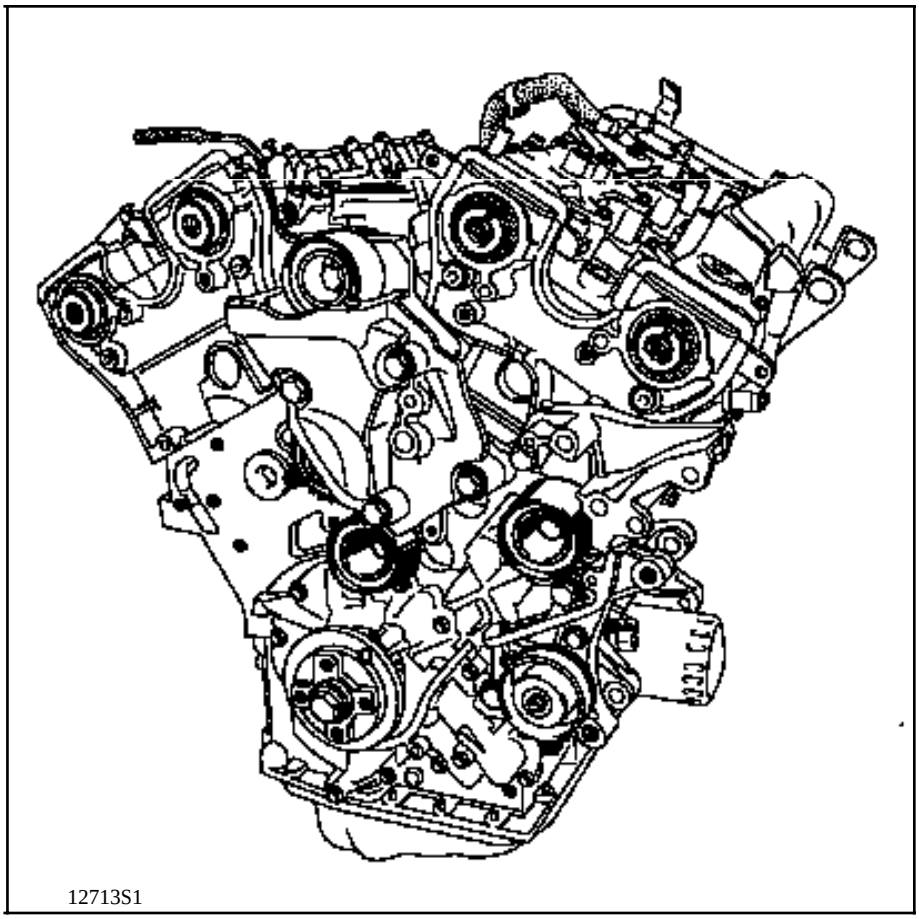


12711S1

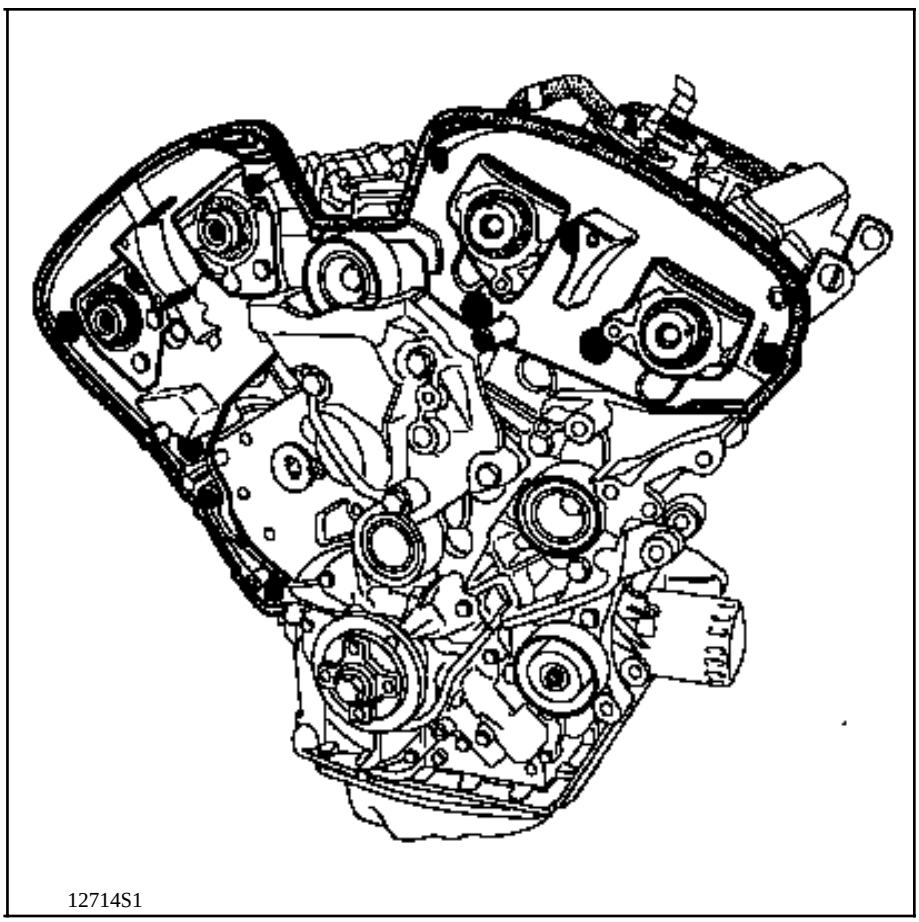


12712S1

Torque tighten the pulleys to **8 daN.m**.

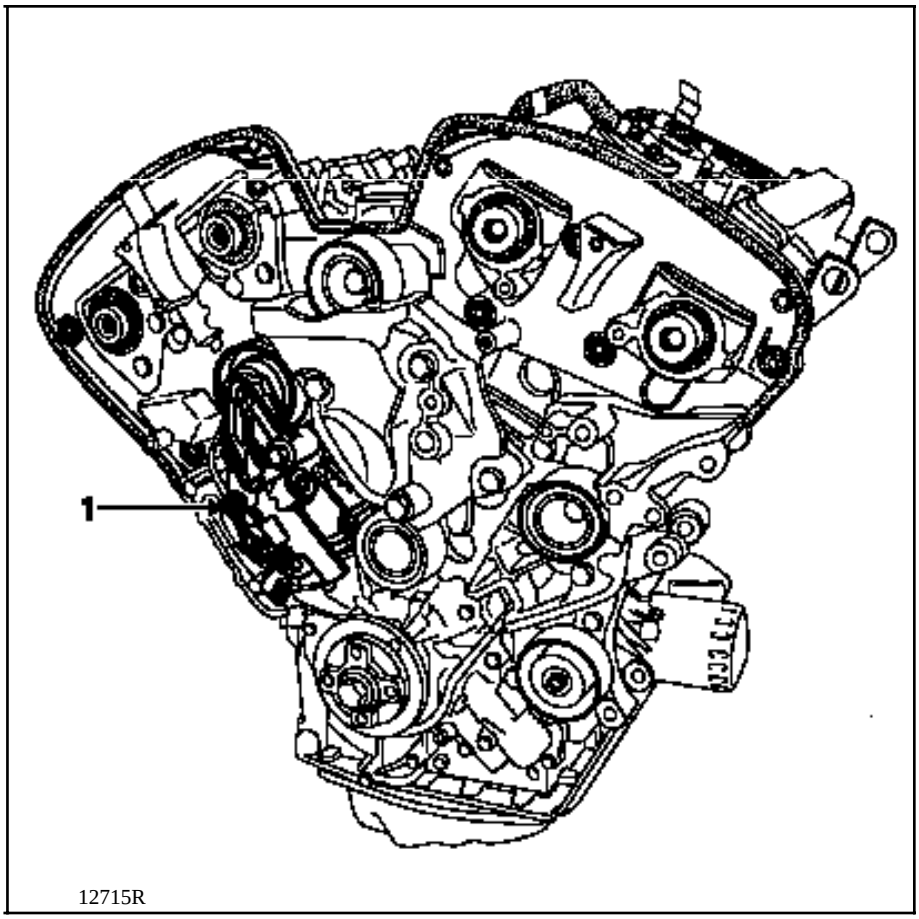


12713S1



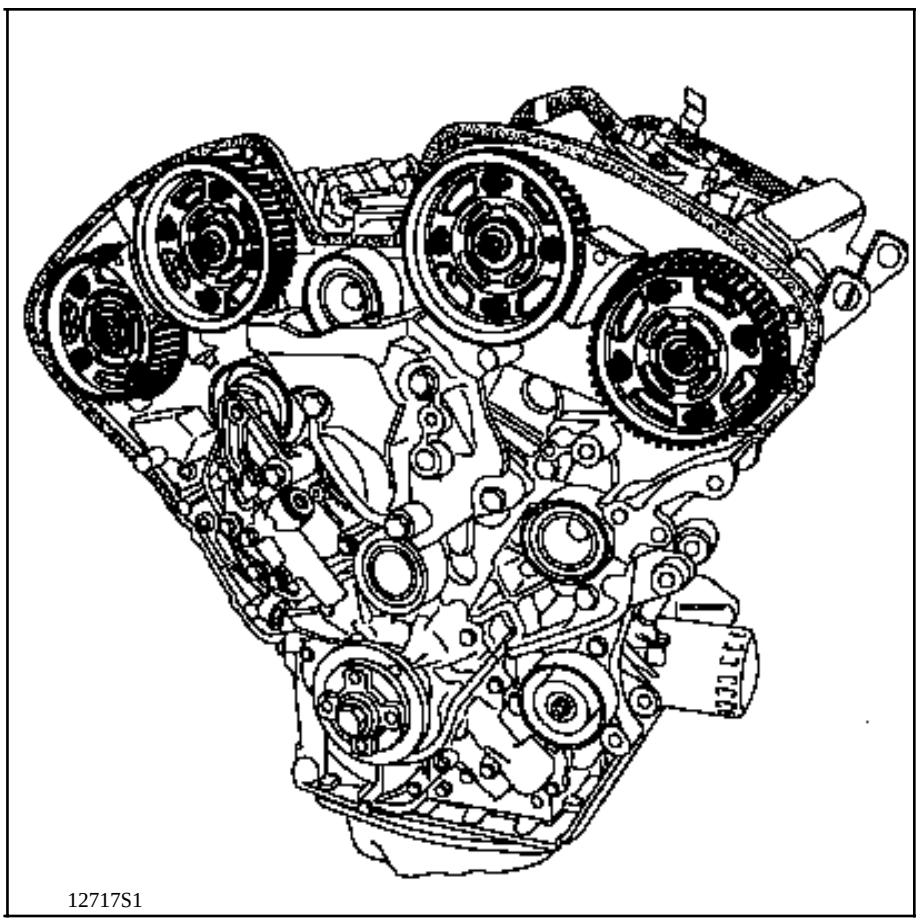
12714S1

Tighten bolt (1) to a torque of **1 daN.m** and hand tighten the three other bolts without locking them.

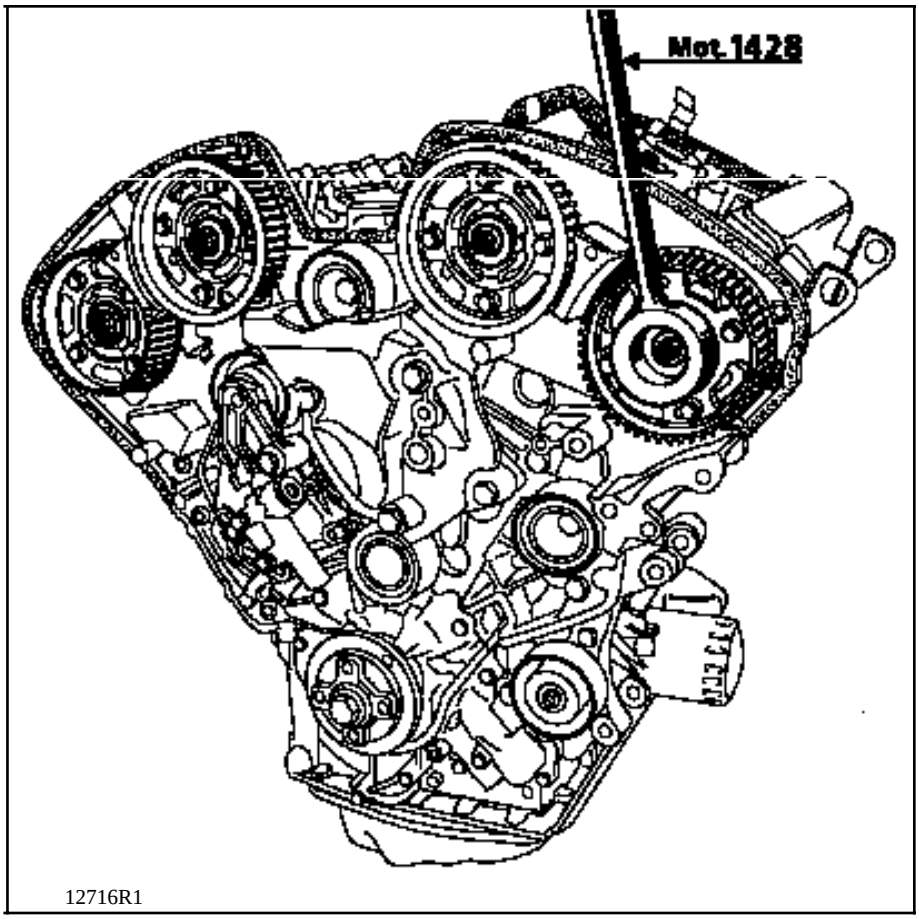


Fit the camshaft sprockets as shown on the diagram.

Check that the hub key is correctly located in the camshaft.



Tighten the camshaft hubs to a torque of **2 daN.m** then angle tighten by **60°,** locking them using tool **Mot. 1428**.



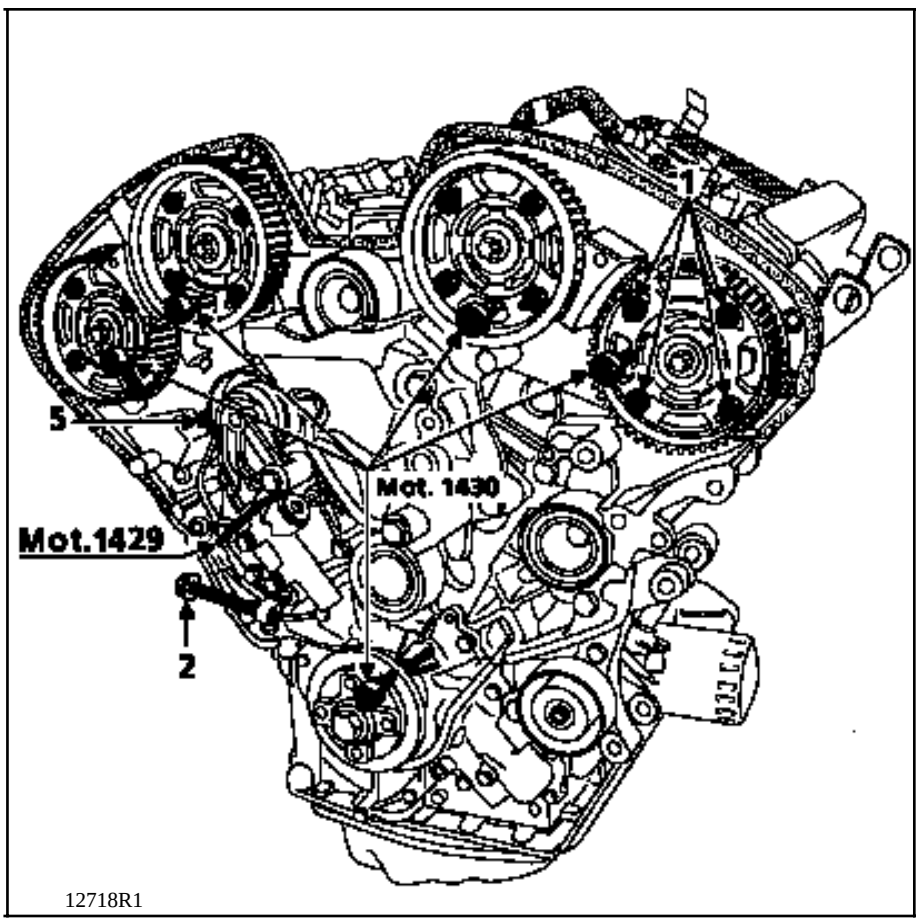
Position the camshafts and the crankshaft at the setting point, pinning them using tool **Mot. 1430**.

Fit bolt (5) **M8, length 35 mm** and tighten until tool **Mot. 1429** locks.

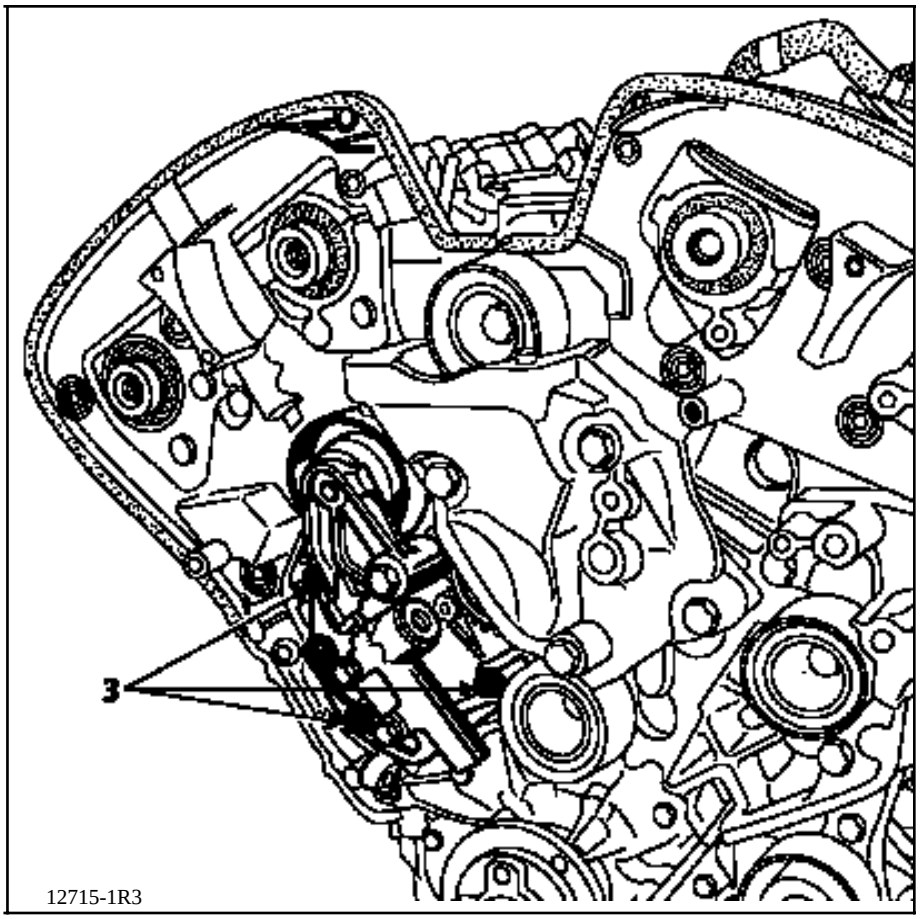
Fit bolt (2) **M8, length 75 mm** .

Turn the camshaft sprockets clockwise to the stop at the bottom of the slots.

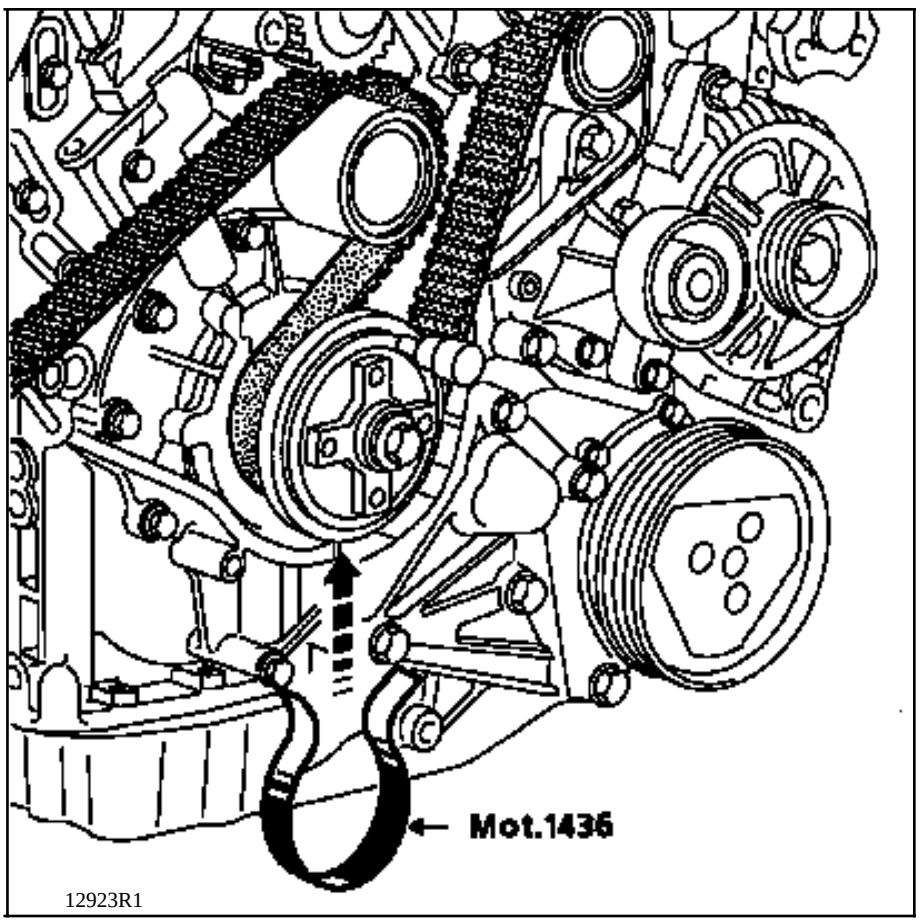
Torque tighten bolts (1) to **0.5 daN.m** then slacken them by **45°**.



Tighten the three bolts (3) to **1 daN.m** then slacken them by **45**°.



Fit the timing belt on the crankshaft sprocket and immobilise the belt using clip **Mot. 1436**.



Fit the belt on the pulley (1), ensuring that section (A) is correctly tensioned.

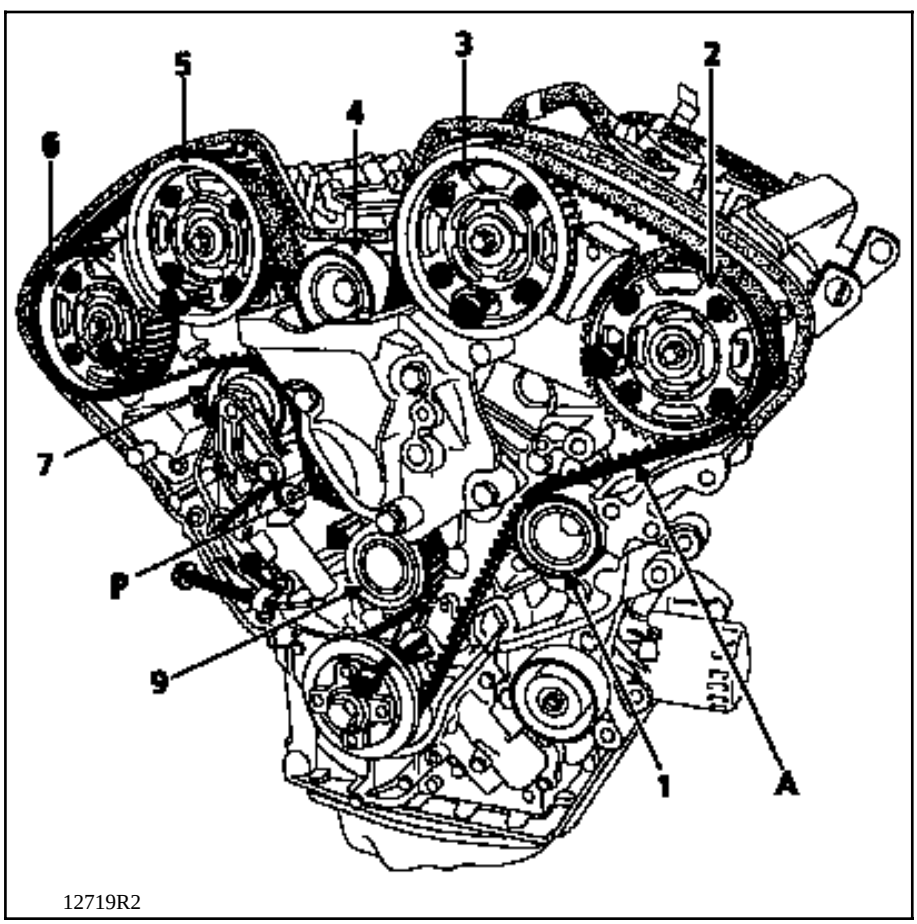
Gently turn the **left hand exhaust** camshaft sprocket (2) anti-clockwise to engage the belt.

Note :

Flatten the belt on the **left hand exhaust** camshaft sprocket. The angular movement value of the sprocket in relation to the belt should not exceed the width of one tooth and the sprockets must not be at the bottom of the slot.

Engage the belt:

- on the **left hand inlet** camshaft (3) as above,
- on the pulley (4),
- on the **right hand inlet** camshaft sprocket (5) then the **right hand exhaust** camshaft sprocket (6), (as before on the left hand camshafts),
- at the same time on the tension wheel (7), the water pump sprocket (8) and the pulley (9).

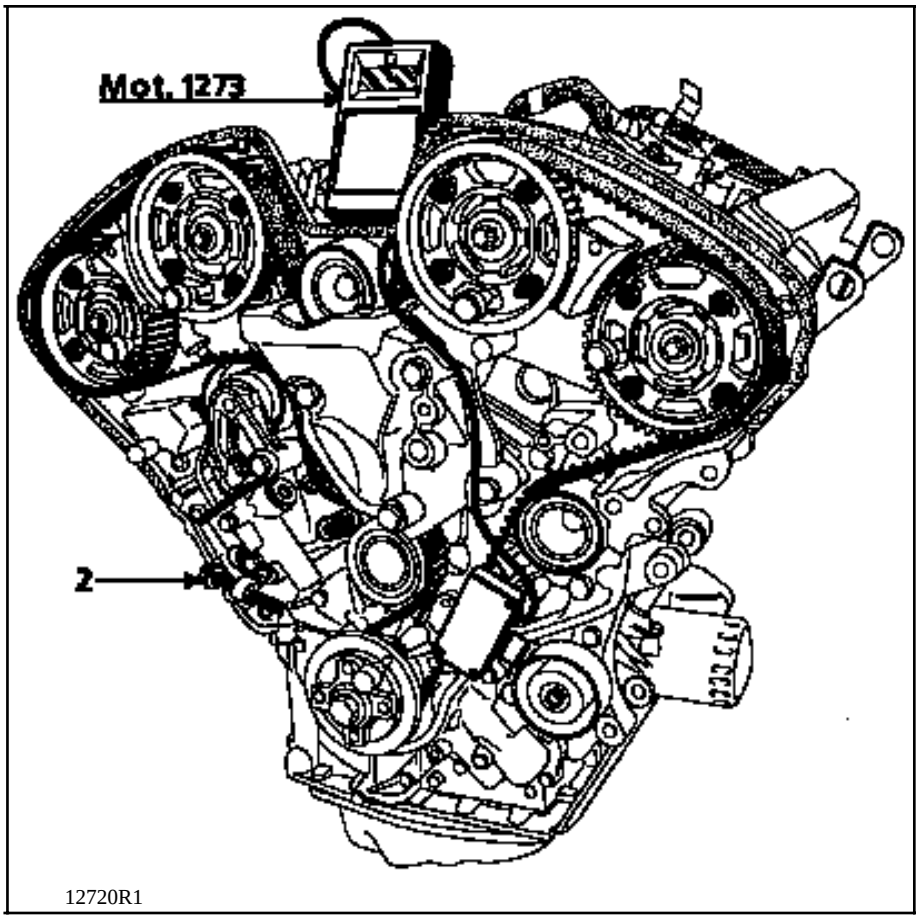


Remove clip **Mot. 1436**, and position the tool for checking belt tension **Mot. 1273**.

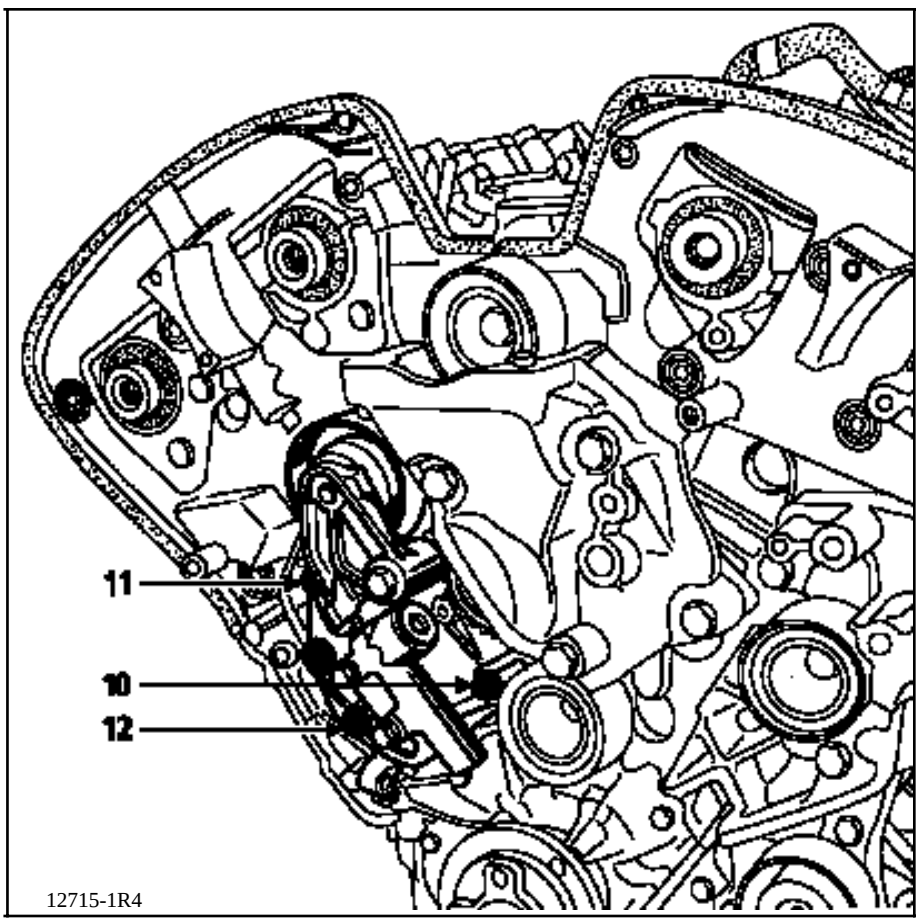
Turn the sensor wheel until it engages (three clicks).

Adjust bolt (2)to obtain the recommended fitting value of **83** ± **2 SEEM** Units.

Check and adjust the value if necessary.



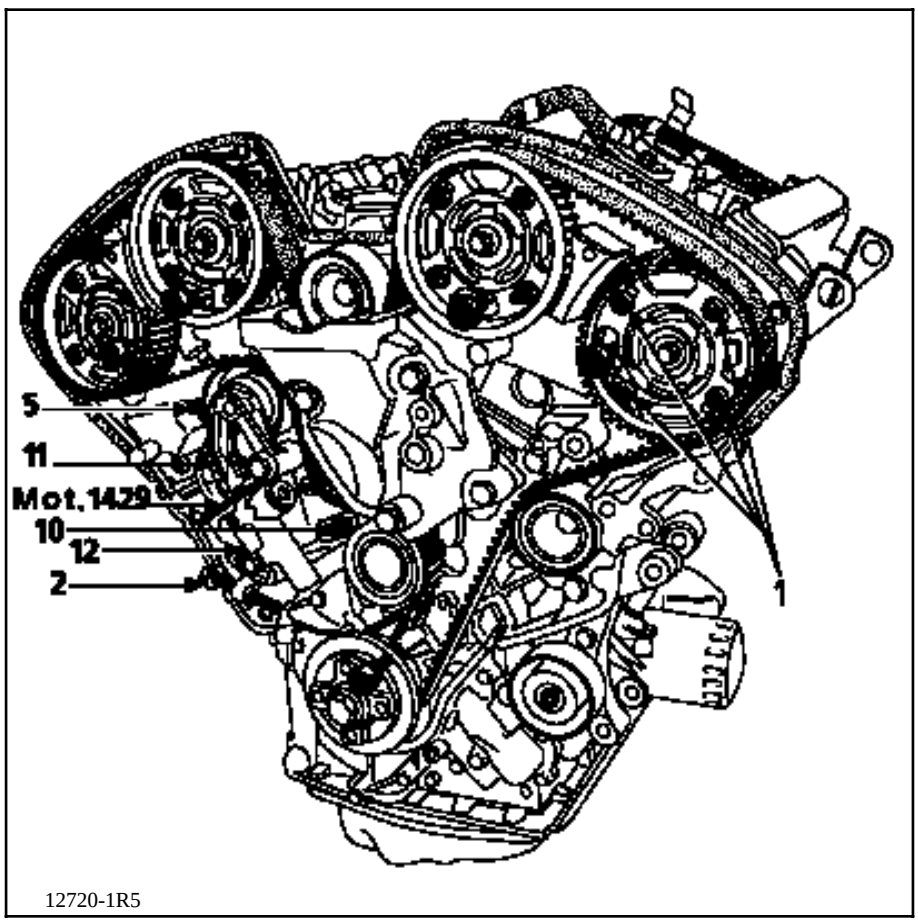
Torque tighten to **1 daN.m** in the recommended order :
bolts 10, 11, 12.



Important: check that the camshaft pulleys are not at the bottom of the slot (by removing one bolt).

If they are, repeat the operation for refitting the belt.

Tighten bolts (1) for the camshaft sprockets to **1 daN.m beginning with the left hand exhaust camshaft.**



Remove pins **Mot. 1430** from the camshafts and the crankshaft.

Turn the engine over twice in the operating direction.

Pin the crankshaft only.

Slacken the following bolts by **45**° : (10), (11), (12).

Remove bolt (5), and gently slacken bolt (2) to ensure tool **Mot. 1429 slides with no play**
(Important - wait one minute for the tension wheel to react).

Check the sliding of tool **Mot. 1429** and remove it.

Torque tighten to **2.5 daN.m** bolts (10), (11), (12) (in the recommended order).

Remove bolt (2) and the crankshaft pin.

Turn the engine over twice in the operating direction.

1) Pin in this order:

- the crankshaft using tool **Mot. 1430**,
- the left hand exhaust camshaft (A).

IMPORTANT :

- if pin **Mot. 1430** goes into position, slacken by **45**° bolts (1) of the camshaft sprocket,
- if pin **Mot. 1430** does not go into position, the camshaft pinning operation is made easier by first slackening by **45**° bolt (1), and turning the hub using tool **Mot. 1428.**

2) Pin the **left hand inlet** camshaft (B)

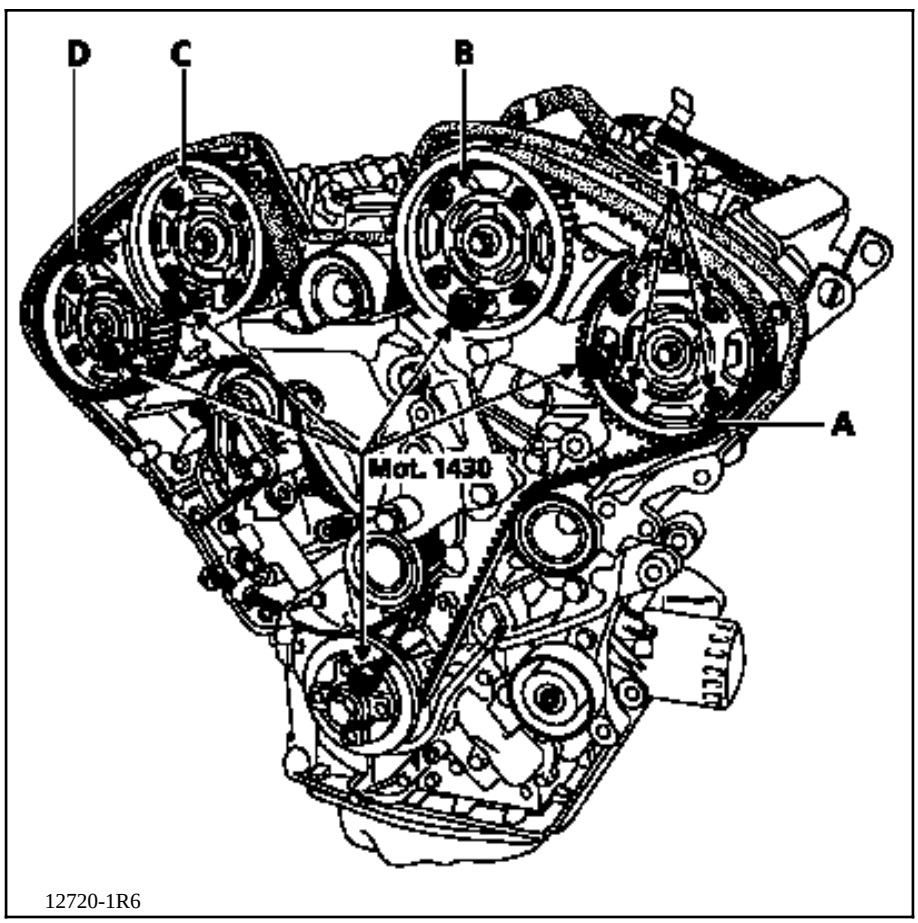
IMPORTANT :

- if pin **Mot. 1430** goes into position, slacken by **45**° bolts (1) of the camshaft sprocket,
- if pin **Mot. 1430** does not go into position, the camshaft pinning operation is made easier by first slackening by **45**° bolt (1), and turning the hub using tool **Mot. 1428.**

3) Carry out the same operations in the order indicated, first to the right hand inlet camshaft (C) then the right hand exhaust camshaft (D).

4) Tighten bolts (1) to a torque of **1 daN.m** beginning with sprocket (A), then (B), then (C) and (D).

5) Remove pins **Mot. 1430** from the camshafts and the crankshaft.



Checking the timing

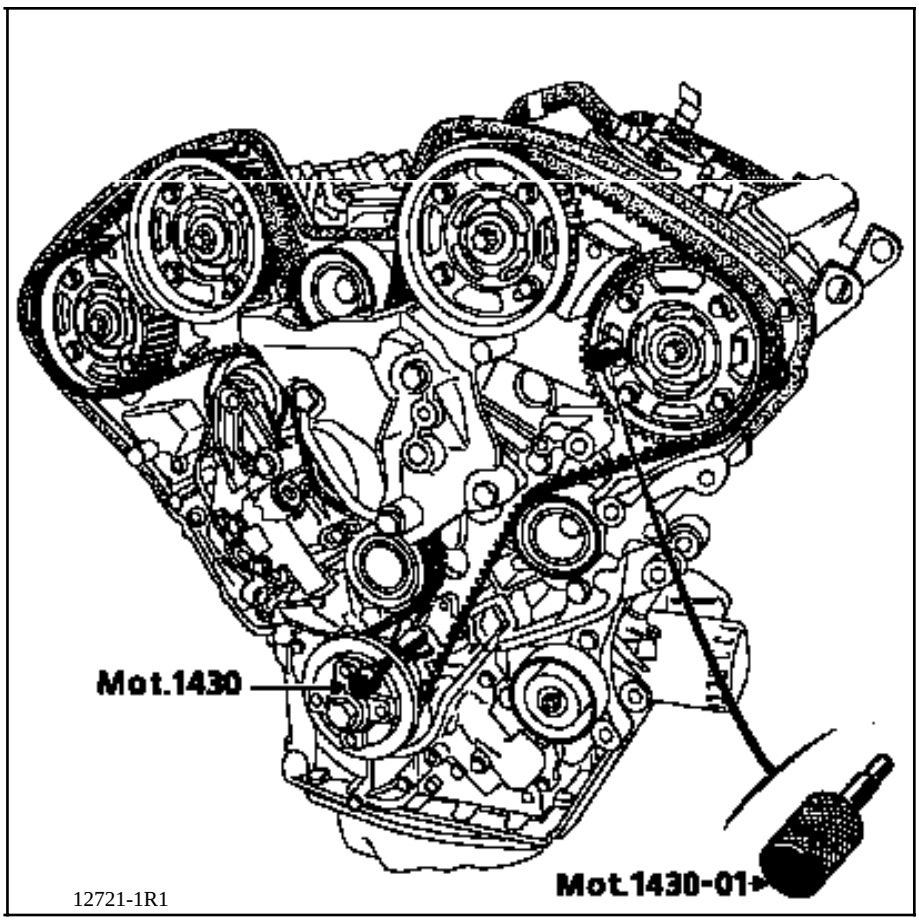
Turn the engine over twice in the operating direction.

Pin the crankshaft using tool **Mot.1430.**

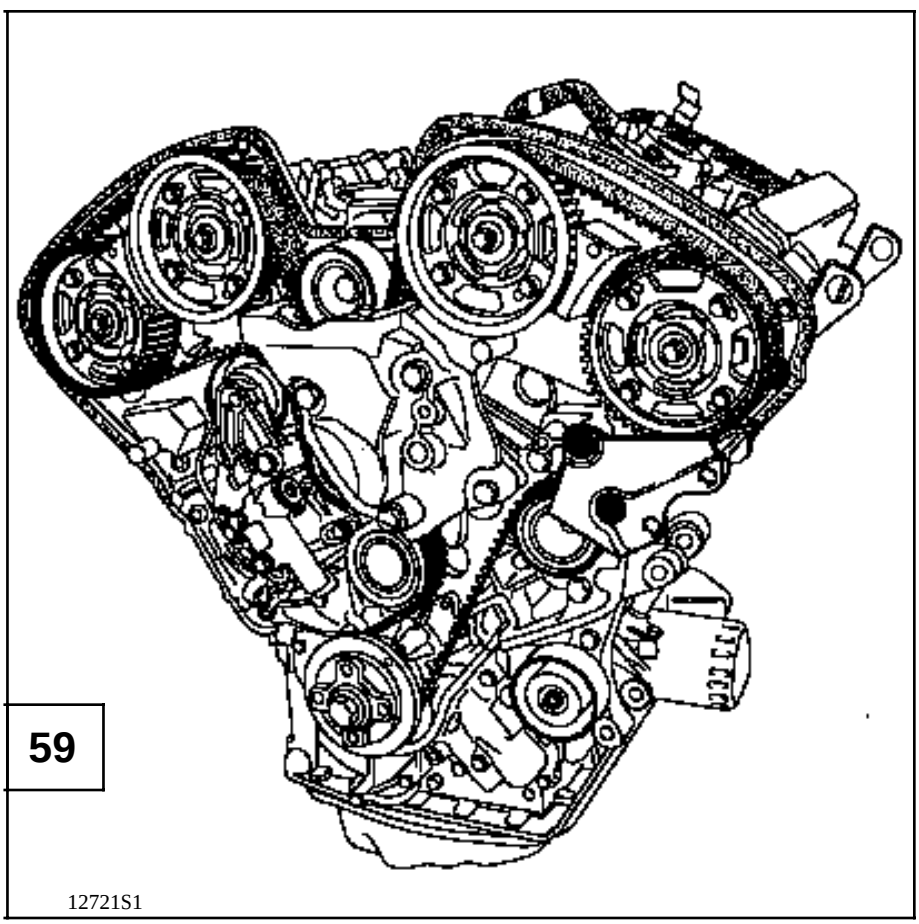
Check that the camshaft test pin **Mot.1430-01** fits freely into the cylinder heads and stops against the camshaft sprockets.

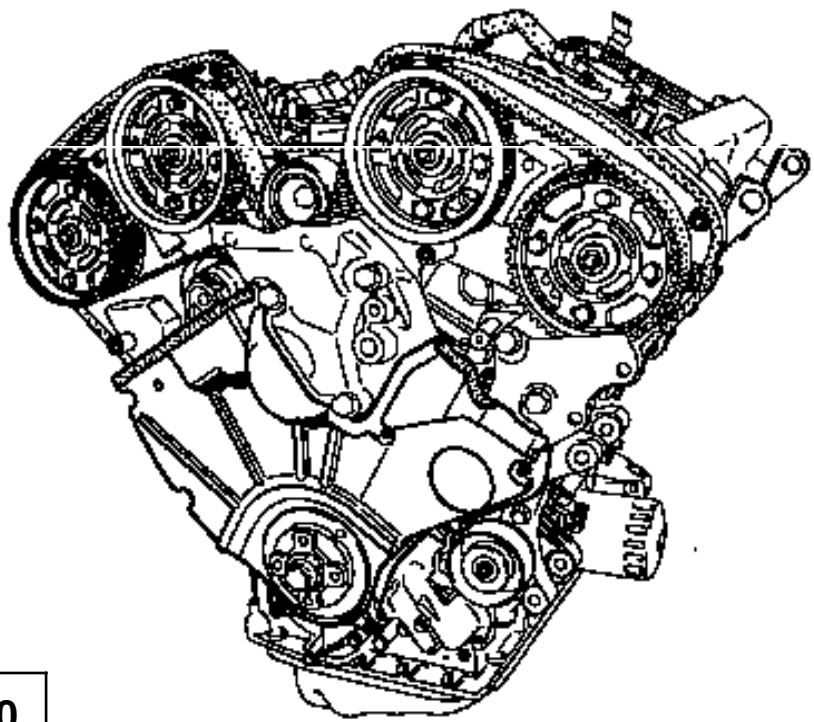
If it does not, repeat the operation for fitting the belt.

Remove crankshaft pin **Mot.1430**.



Refit (continued), in the recommended order below.
(diagrams 59 to 68)





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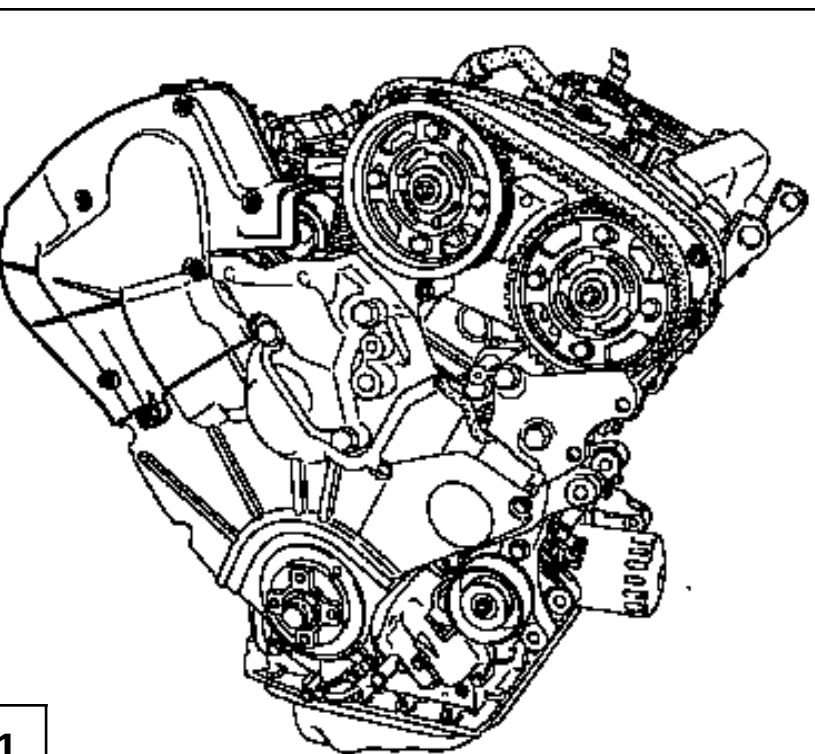
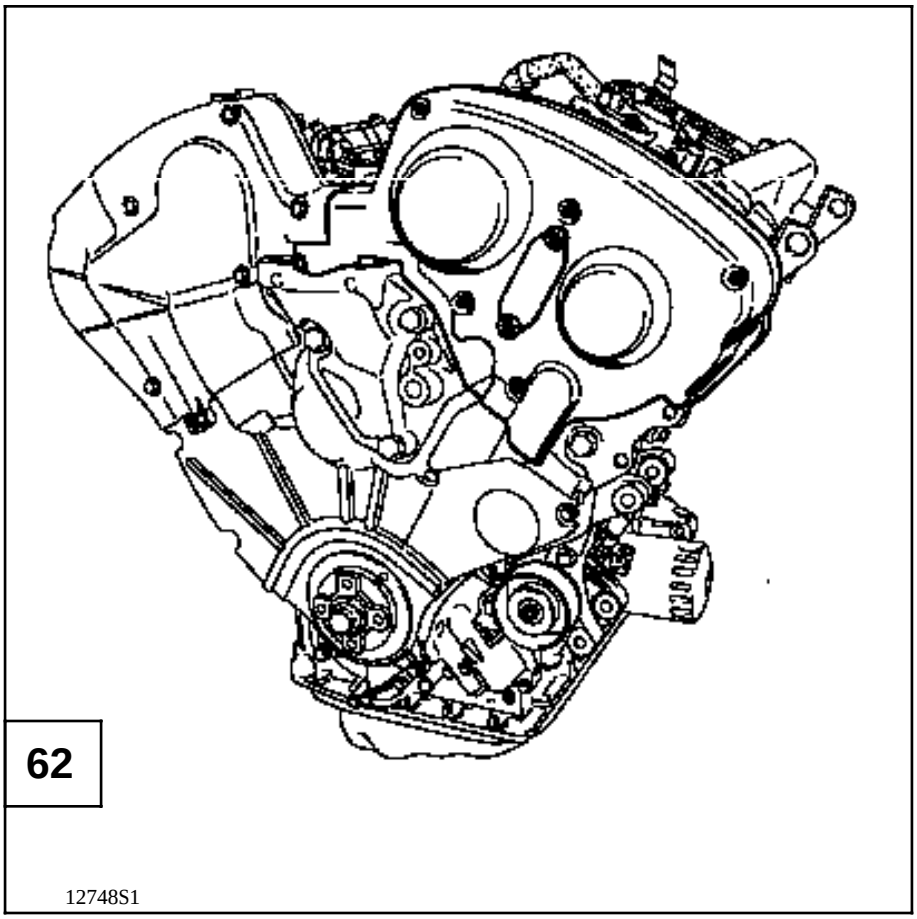
12746S1



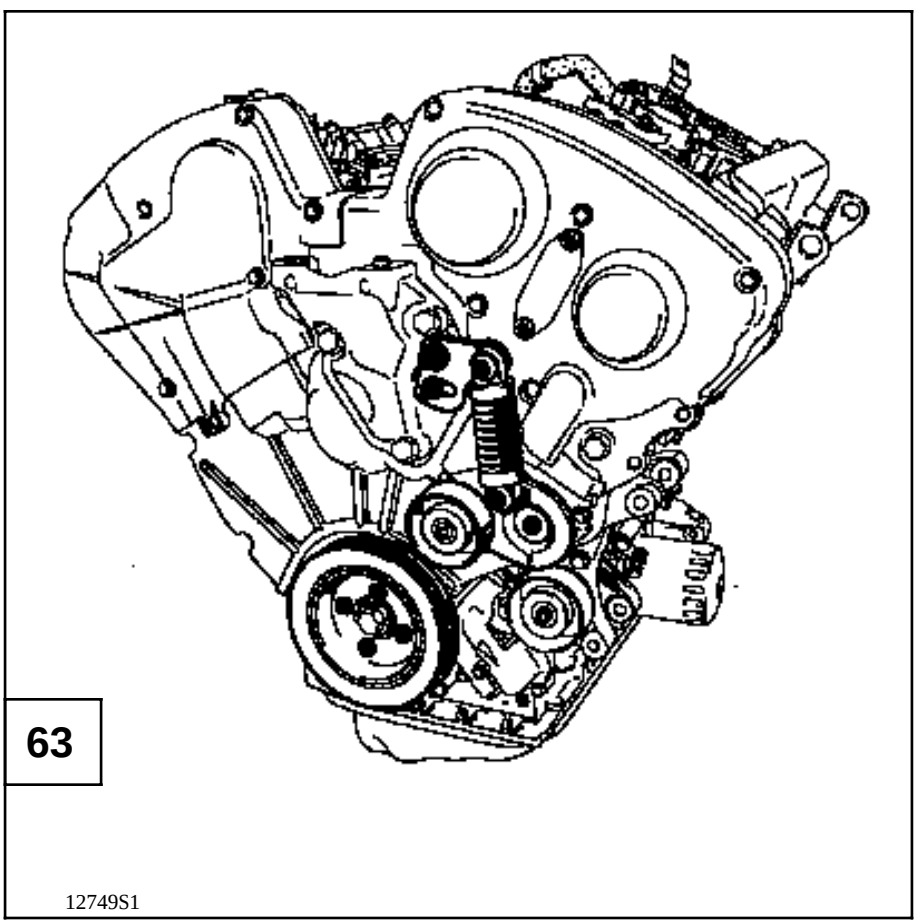
61

12747S1



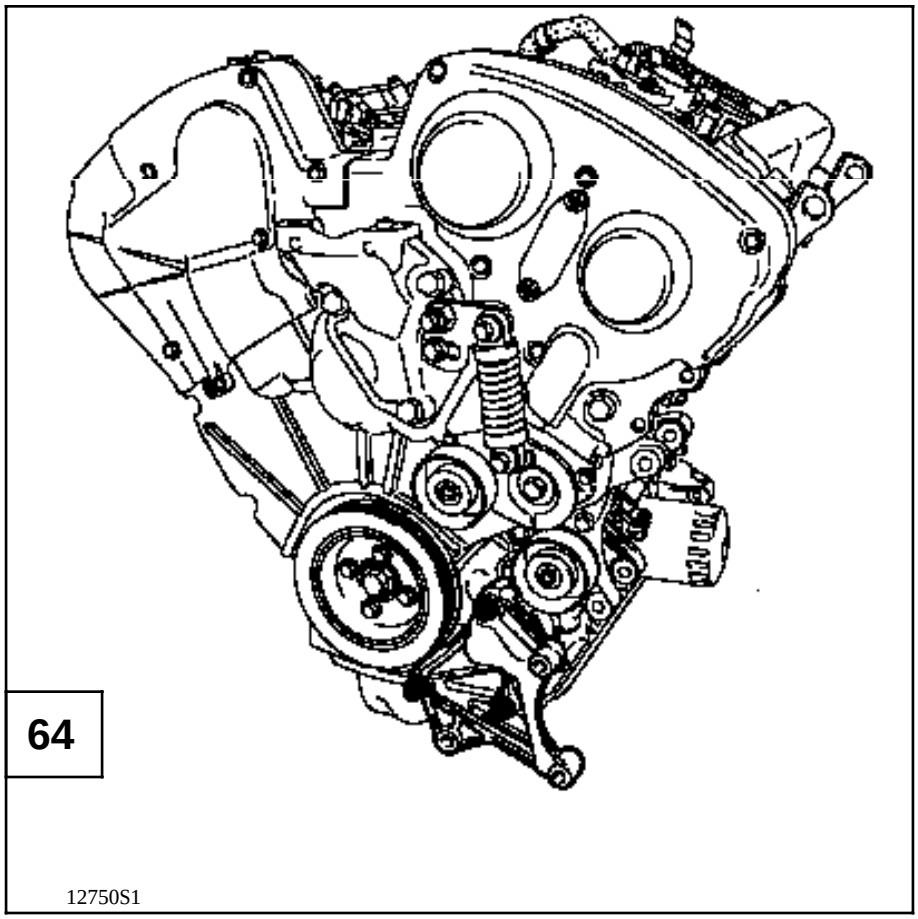
62

12748S1



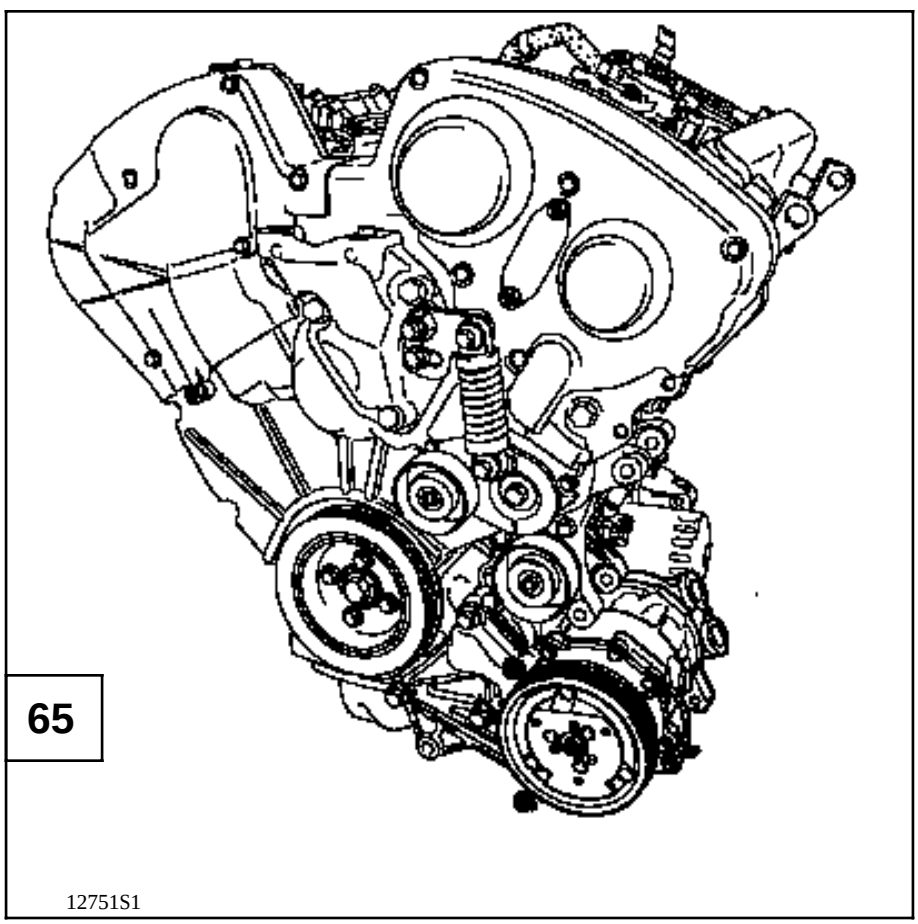
63

12749S1



64

12750S1



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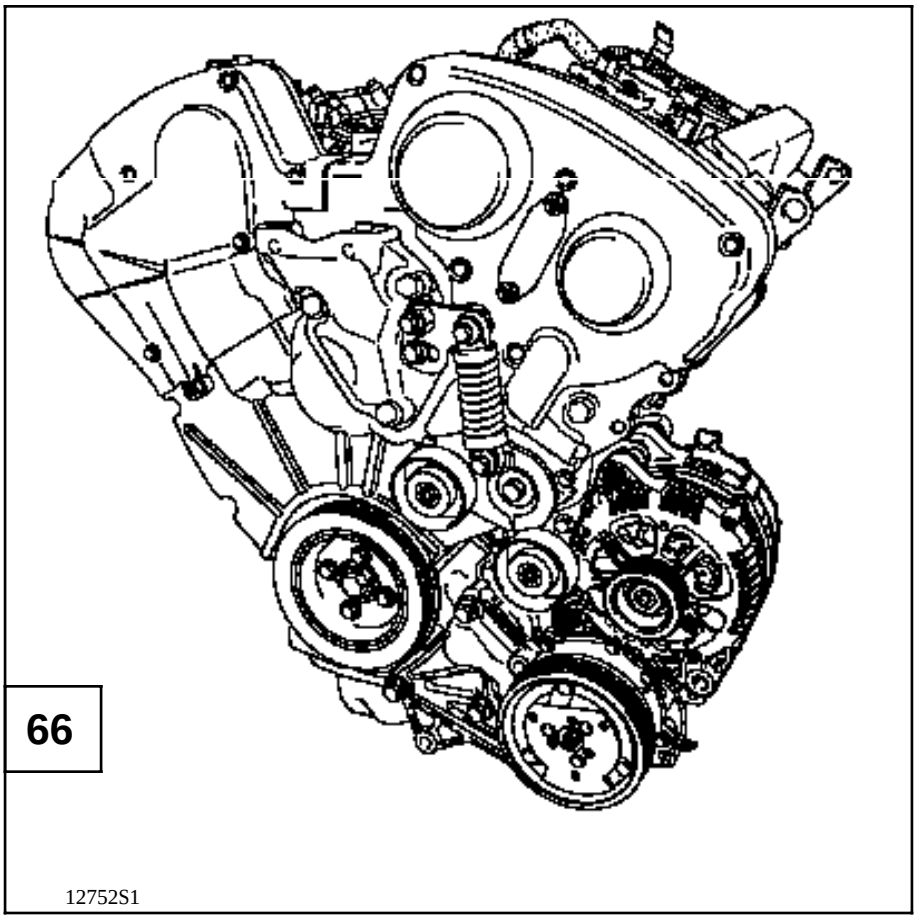
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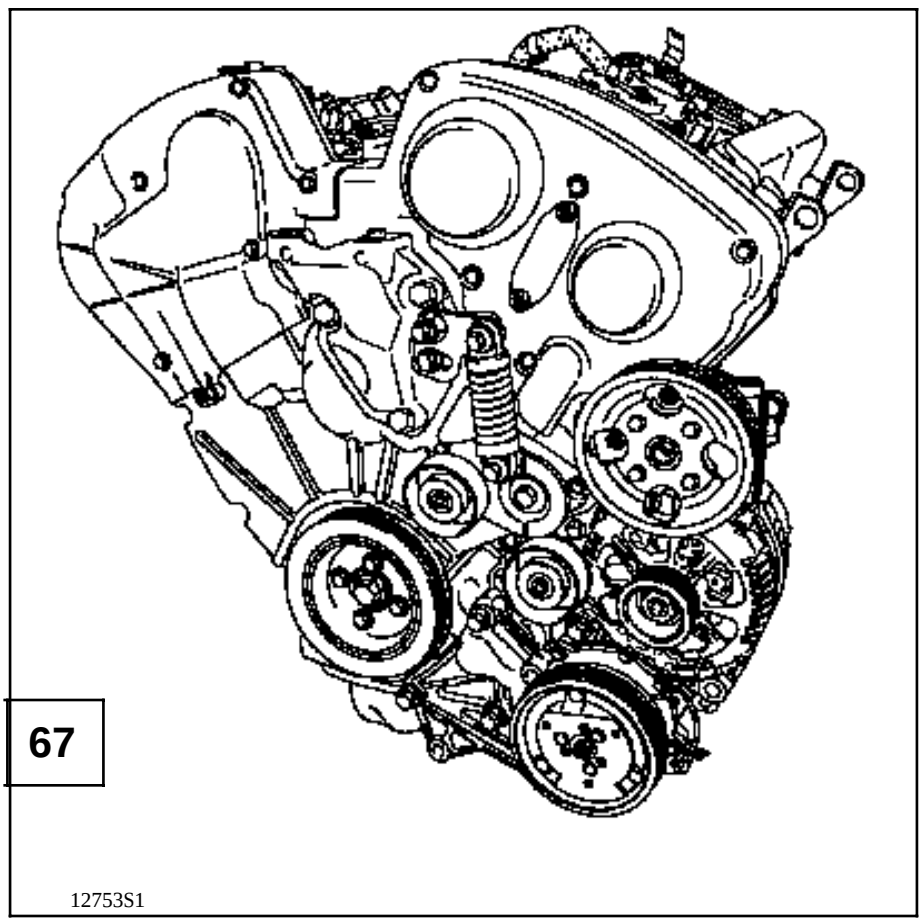
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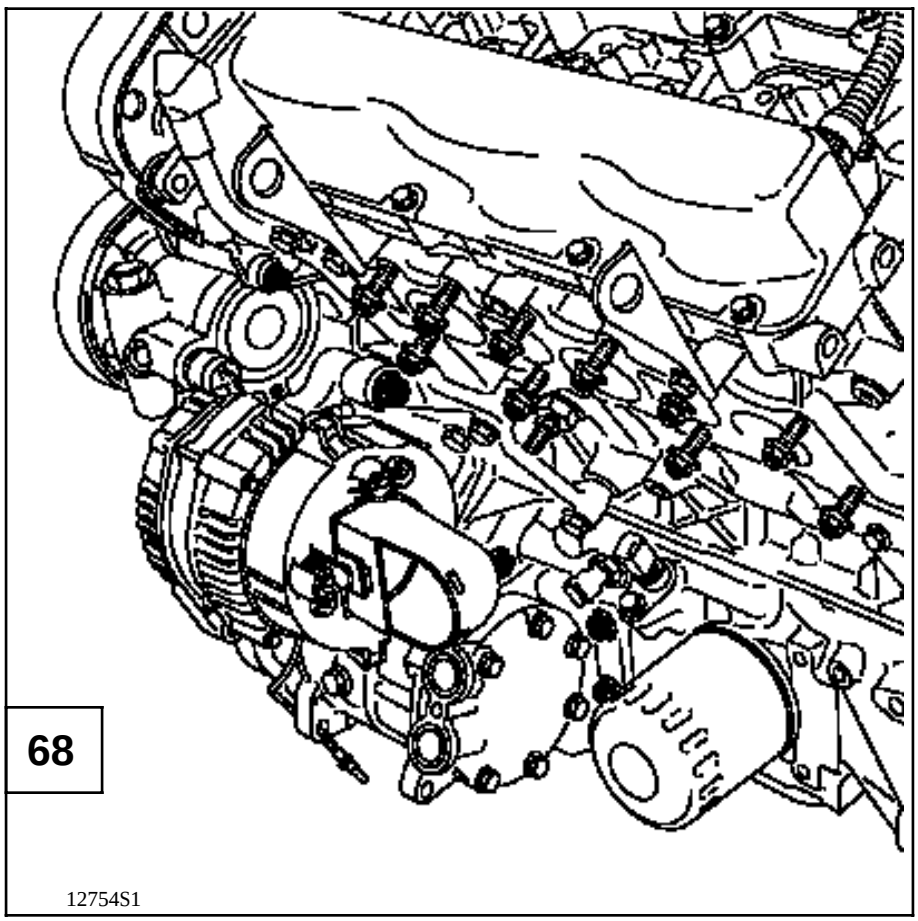
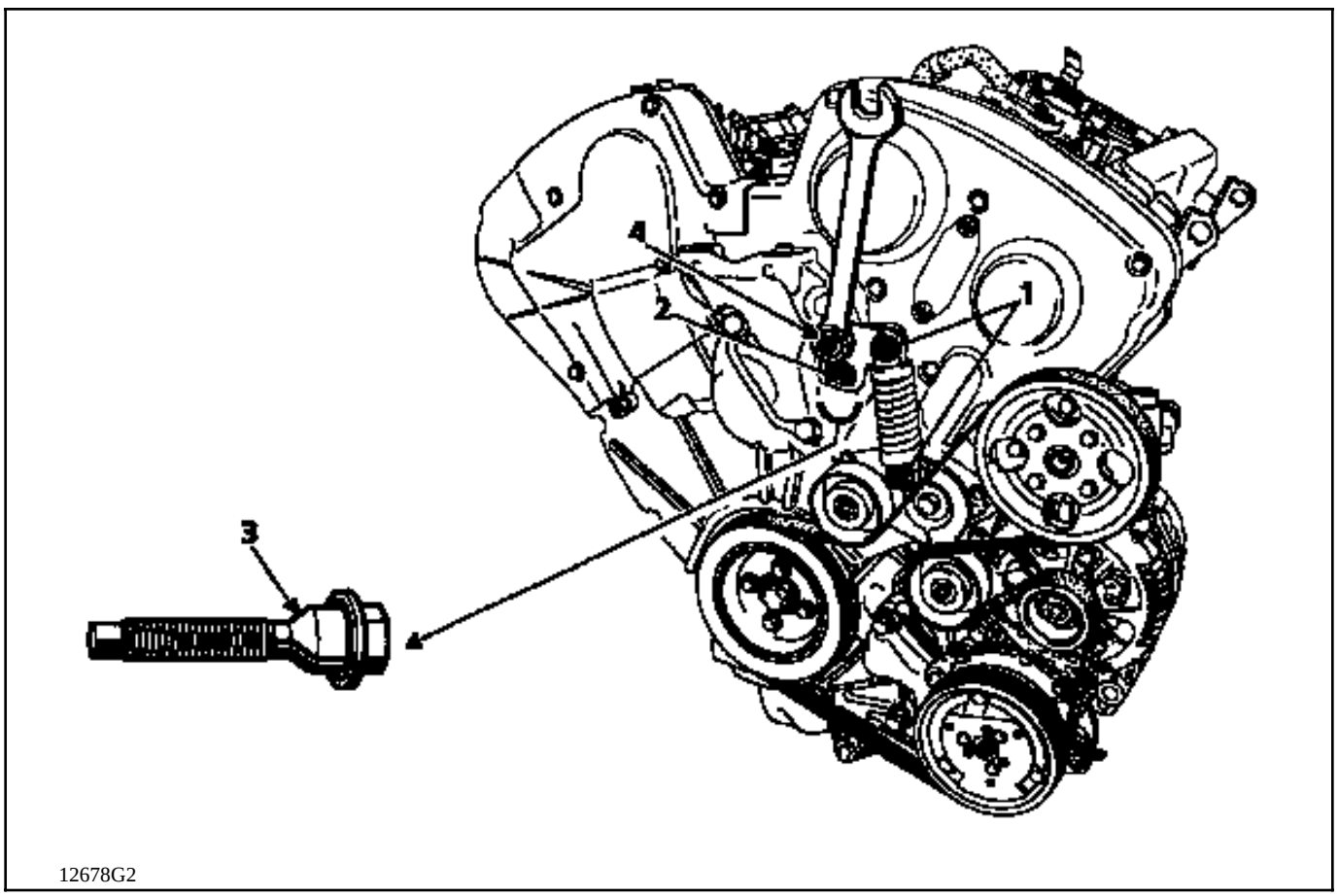

68
12754S1

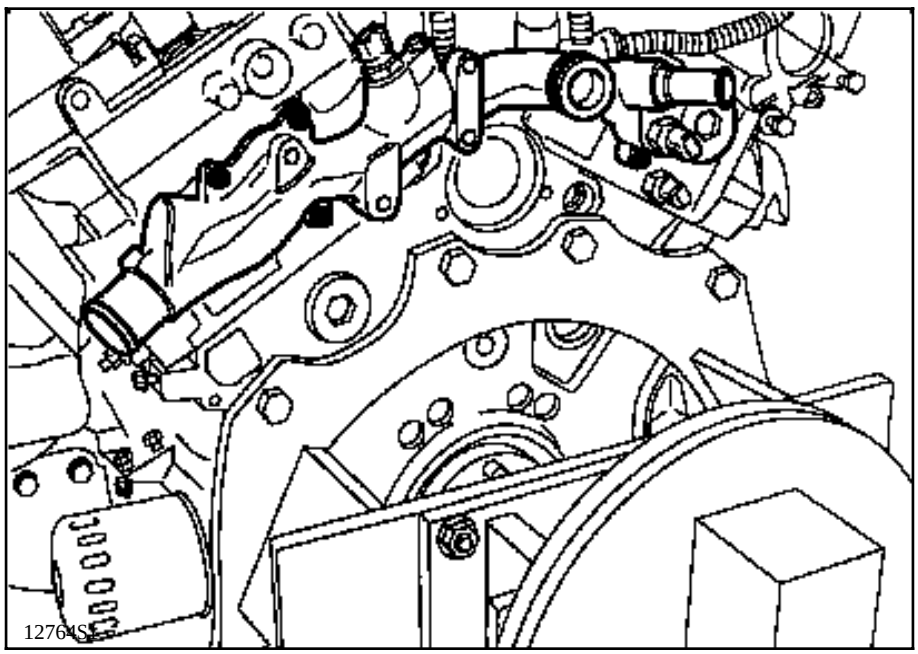
Refitting the accessories belt

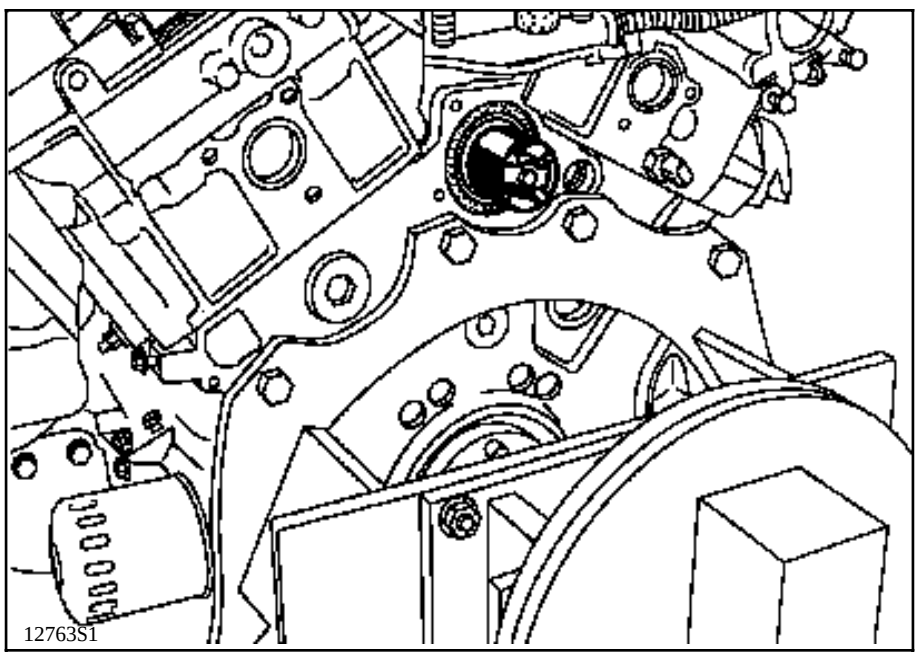
Slacken bolt (2)up to the tapered section (3).

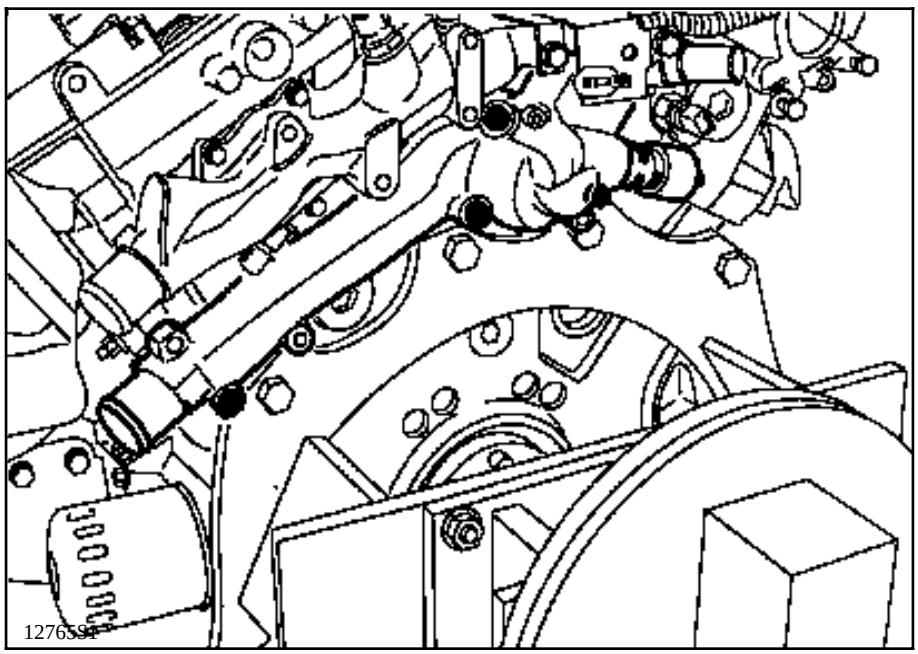
Pivot the fork wrench to the **right** then tighten bolts (2) and (4) to a torque of **2.5 daN.m** and then the two bolts (1).

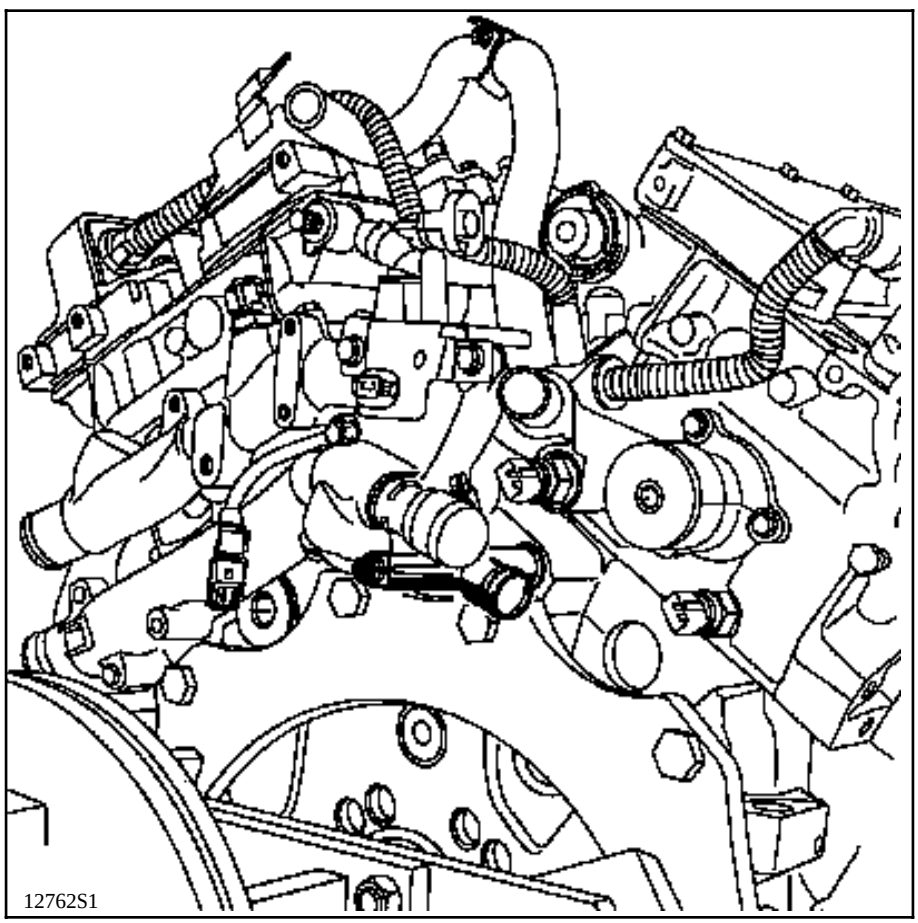


12678G2

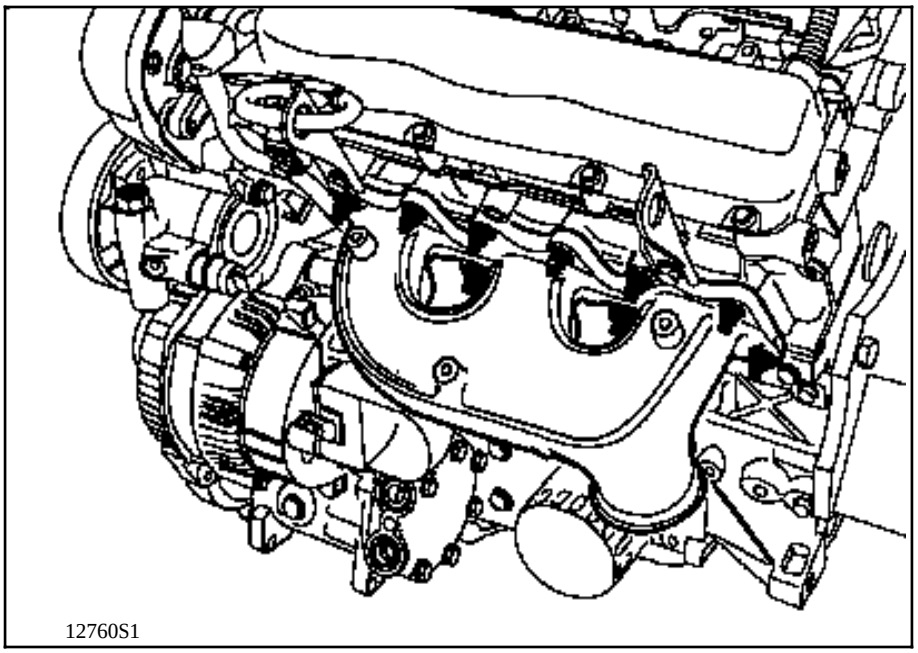

12764S1


12763S1

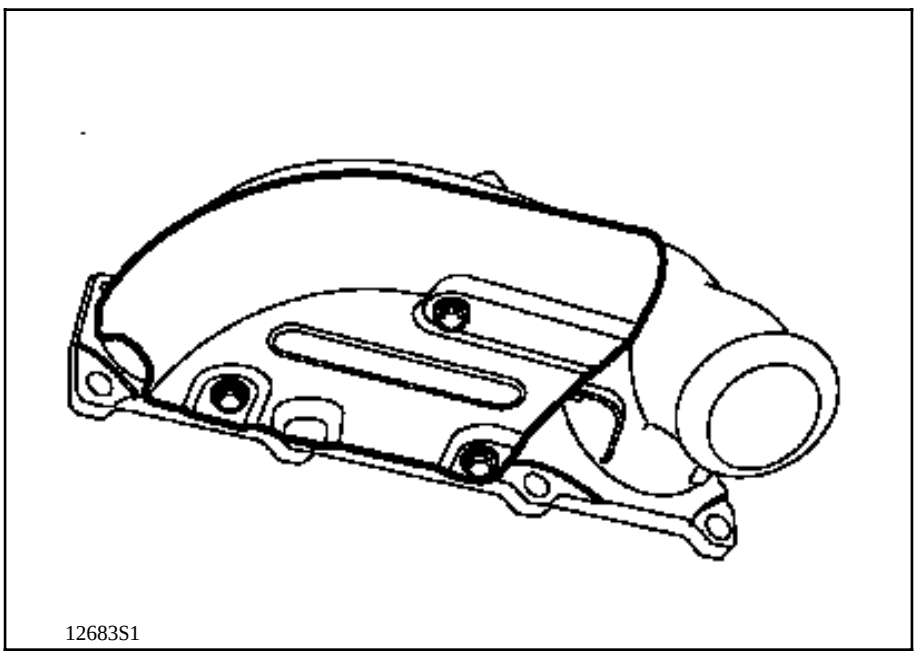

12765S1


12762S1

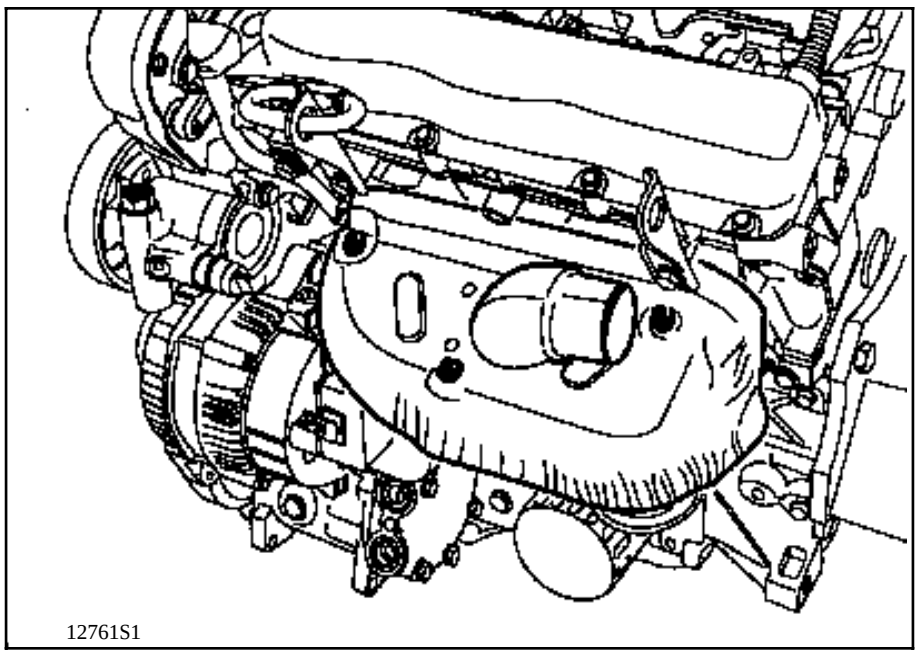
Tighten the manifold nuts to a torque of **3 daN.m**.



12760S1



12683S1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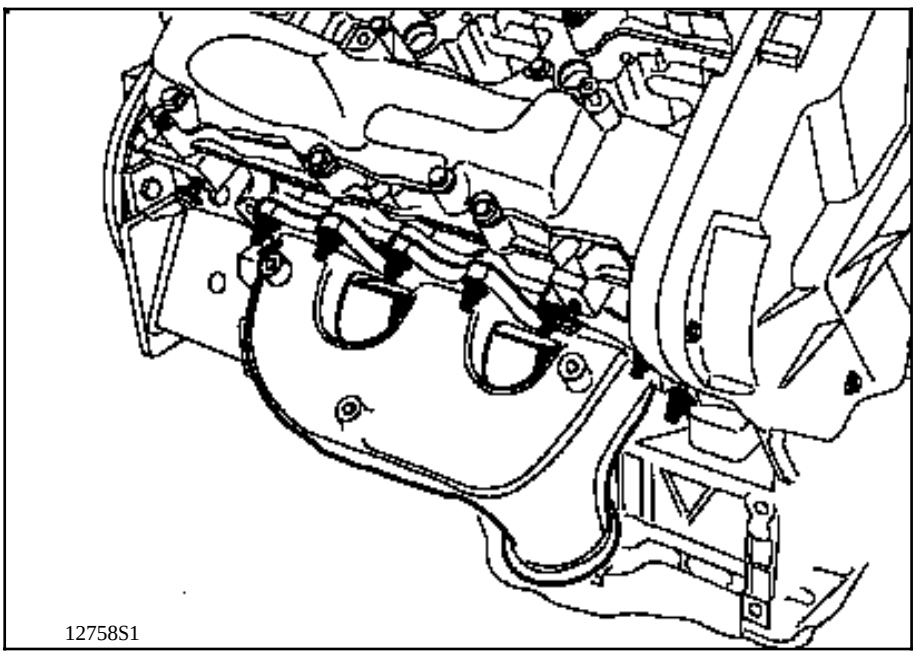
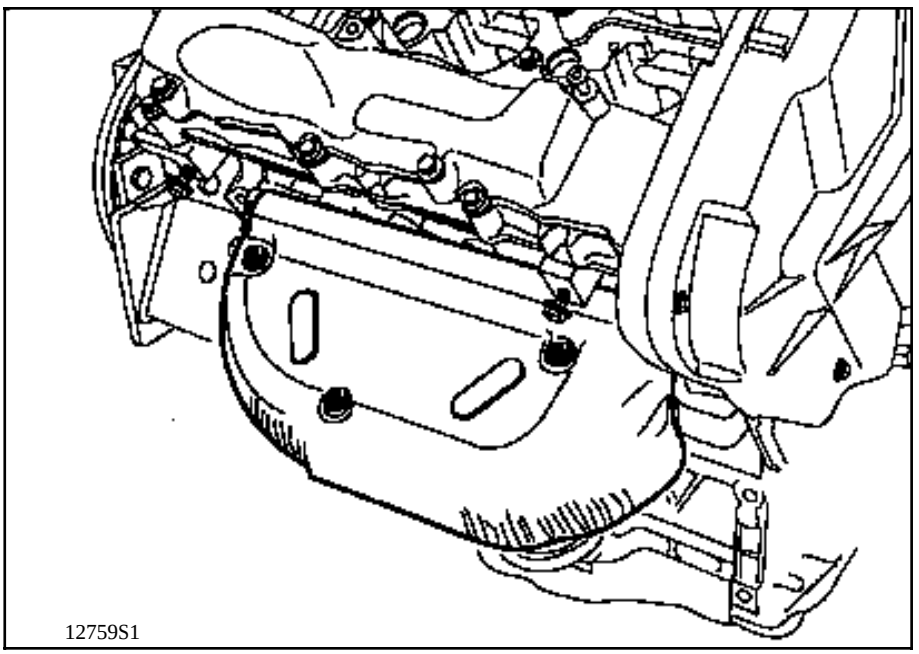
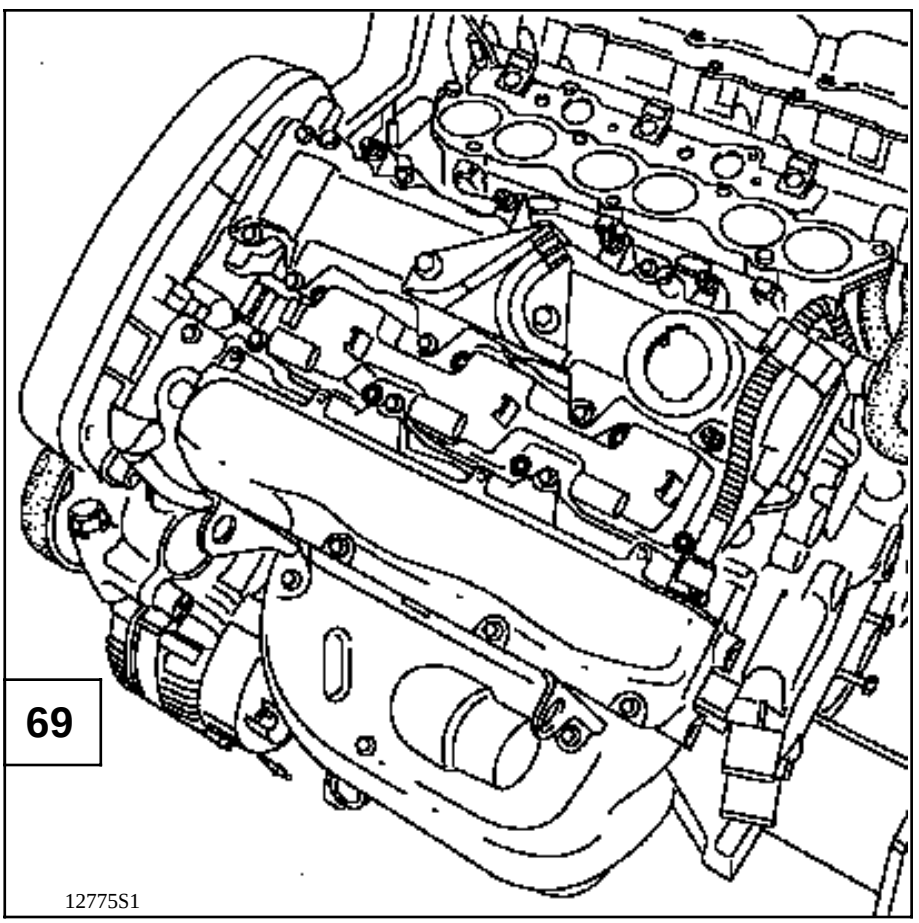
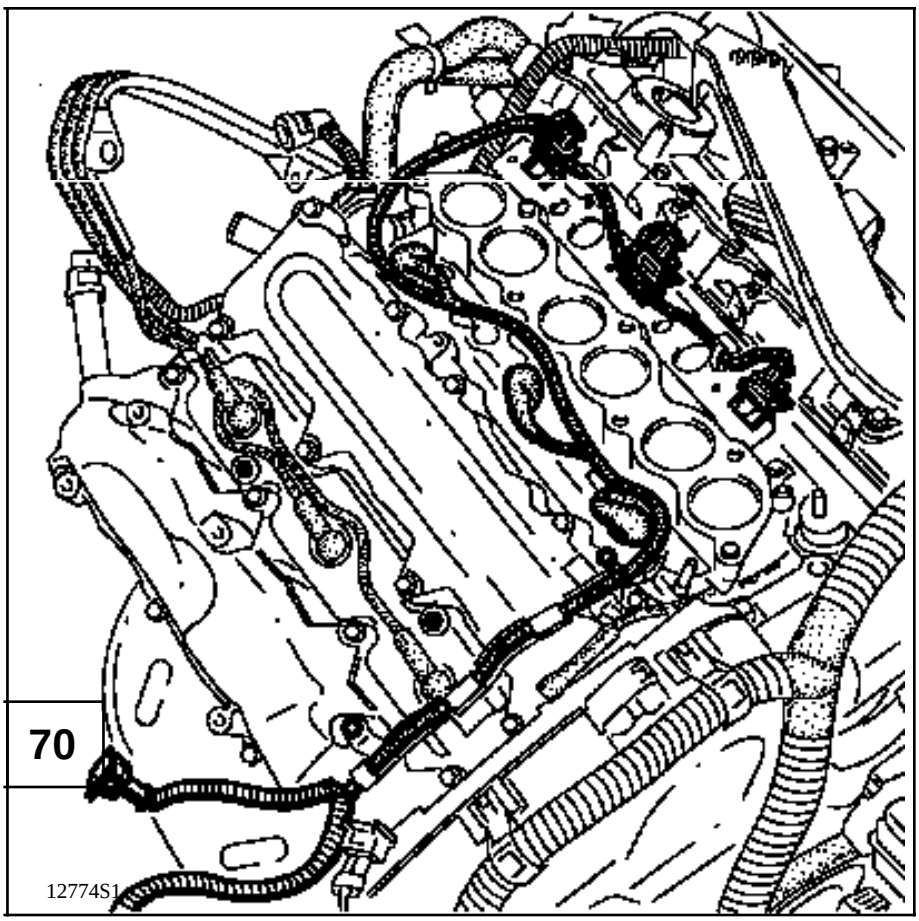

12758S1

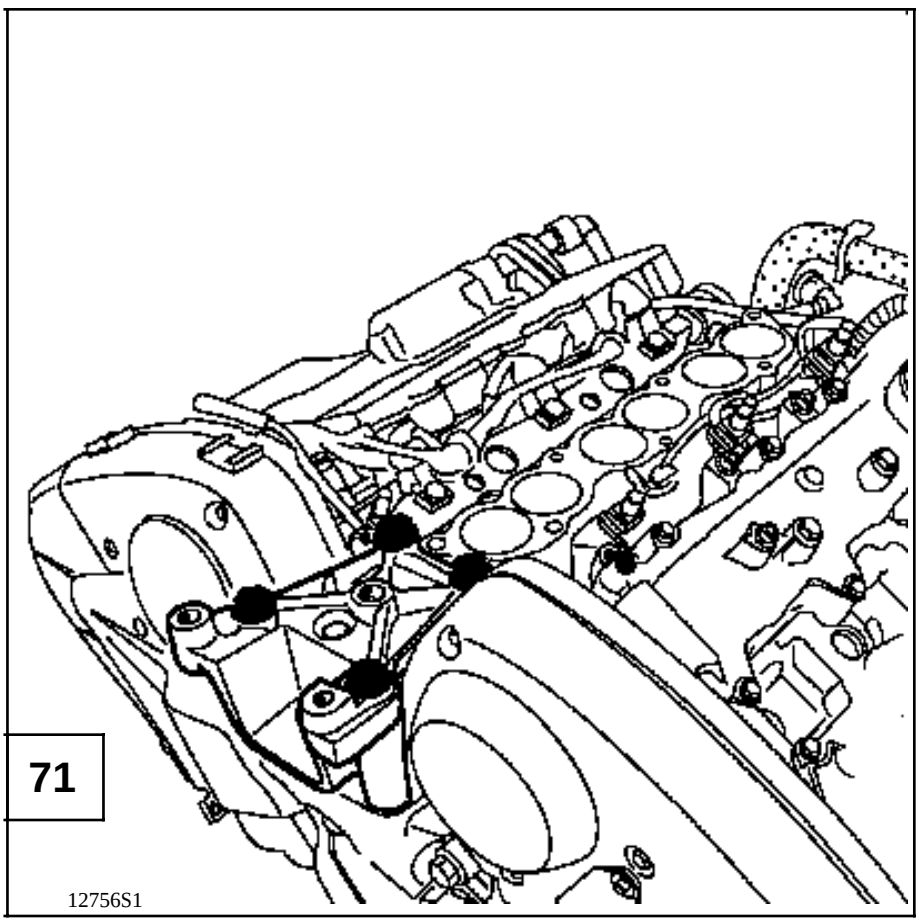


Refit the engine wiring harness in the recommended order
(diagrams 69 to 77)

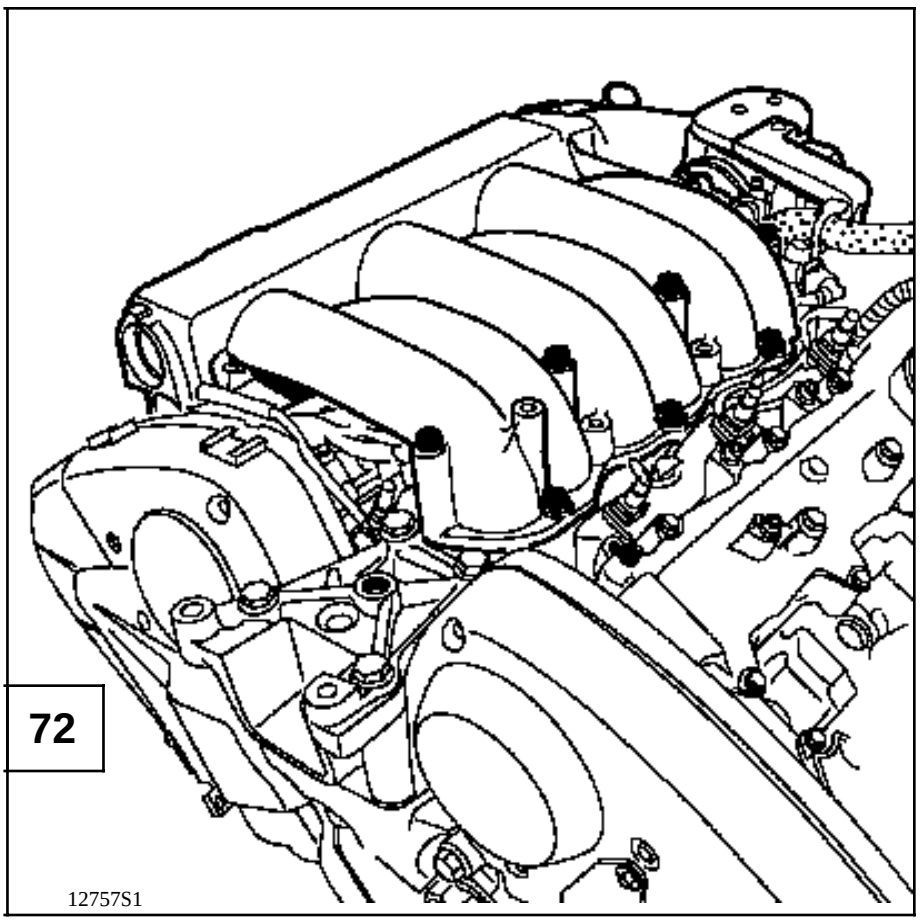


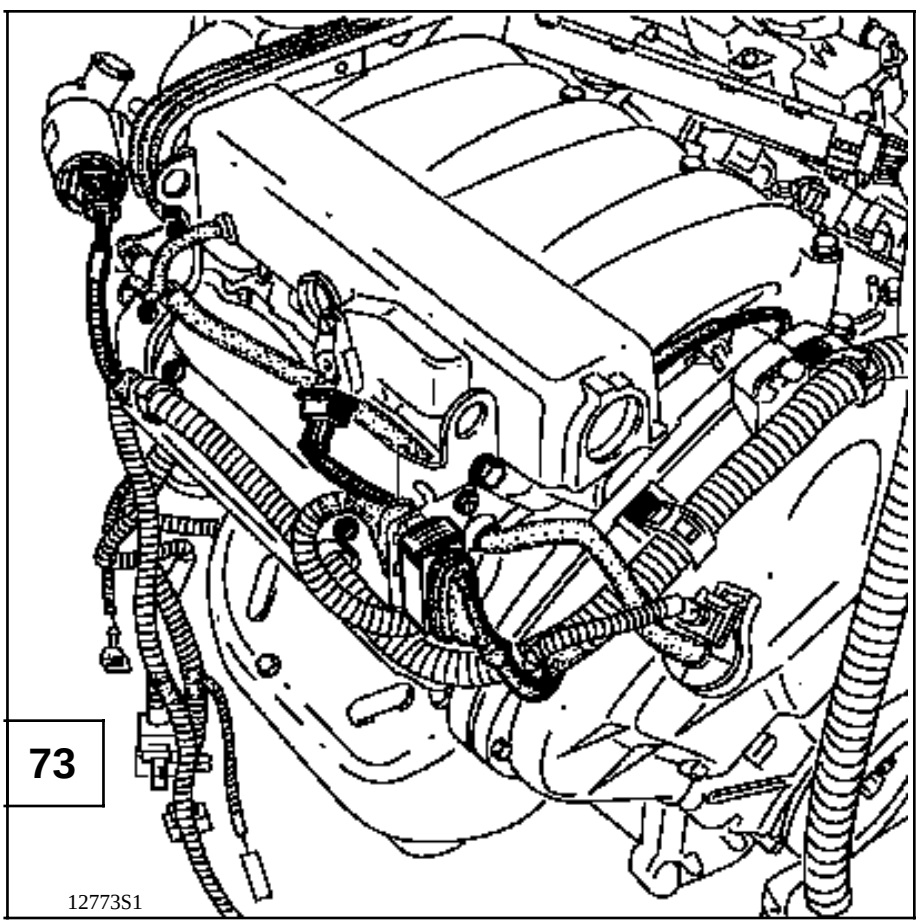


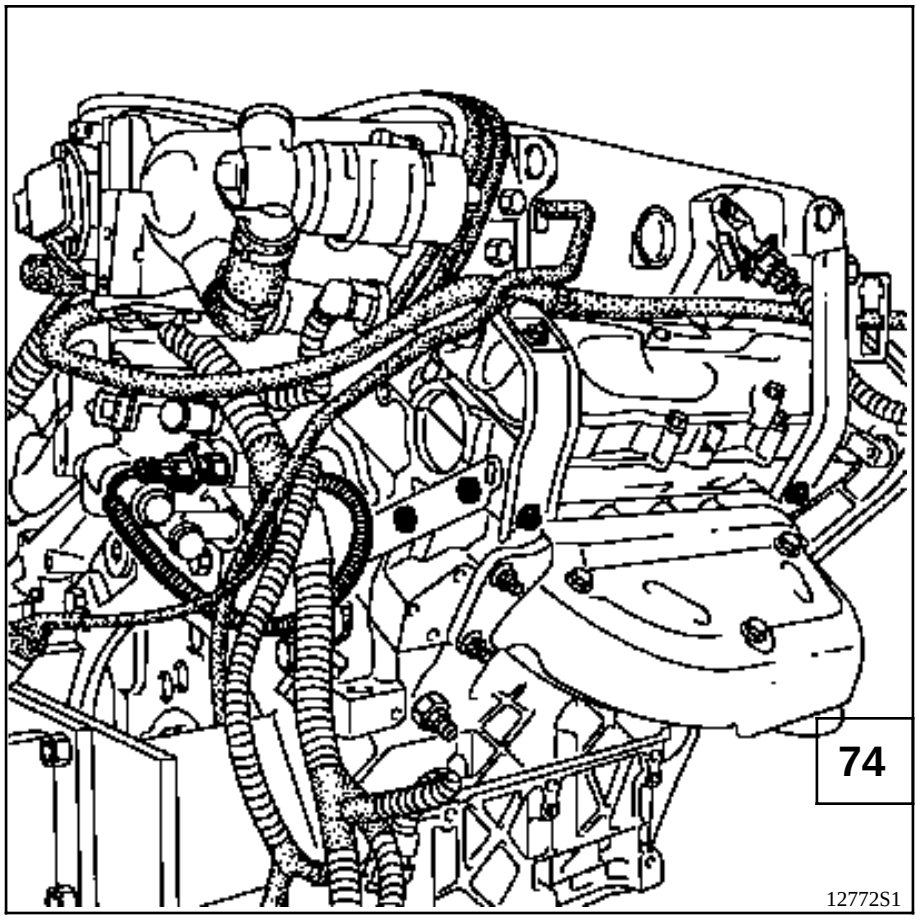
Torque tighten the bolts to **4.5 daN.m**.



Torque tighten the bolts to **2 daN.m**.



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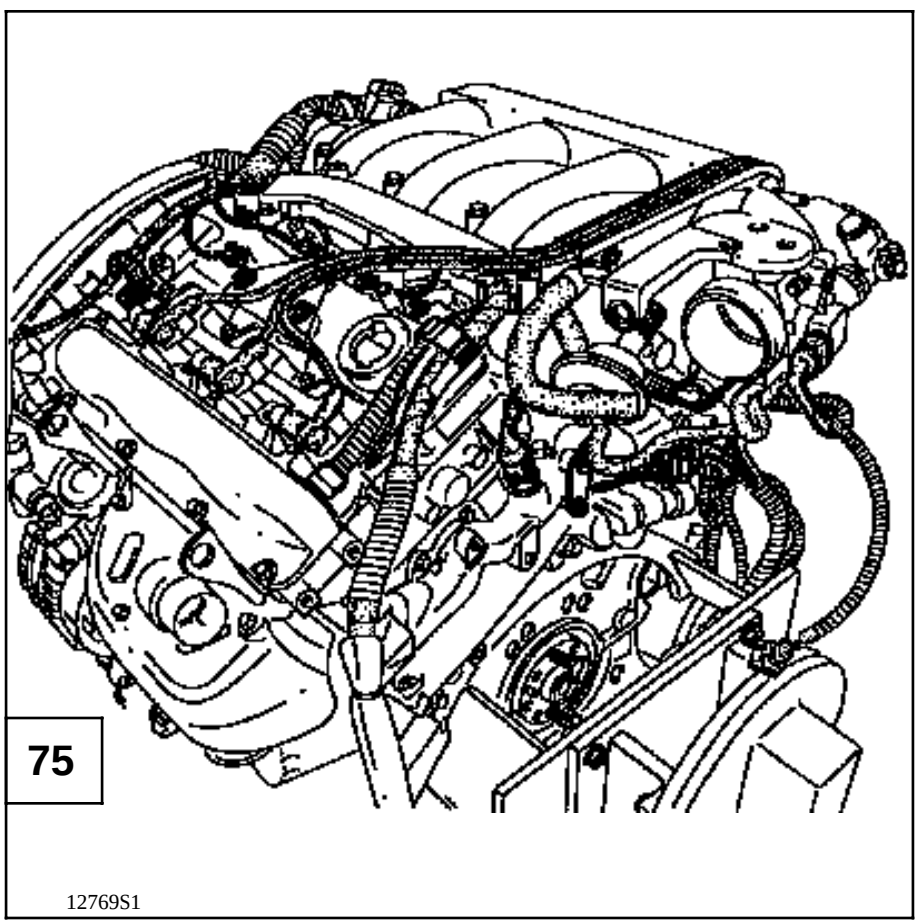
12772S1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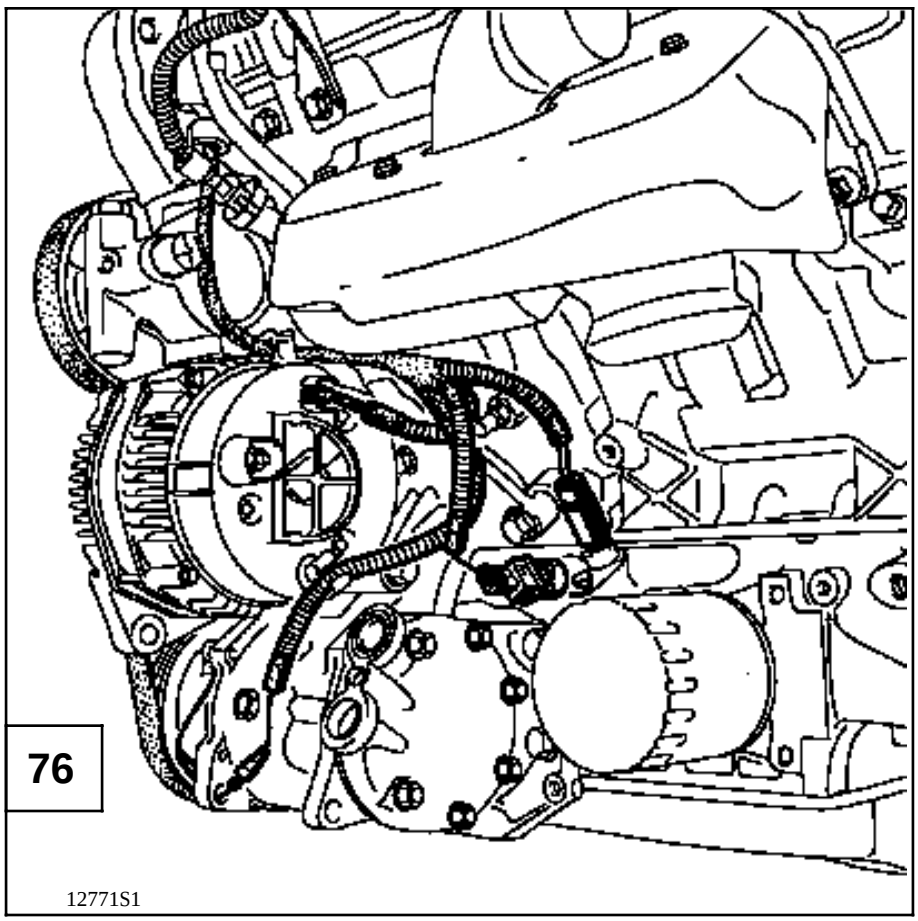
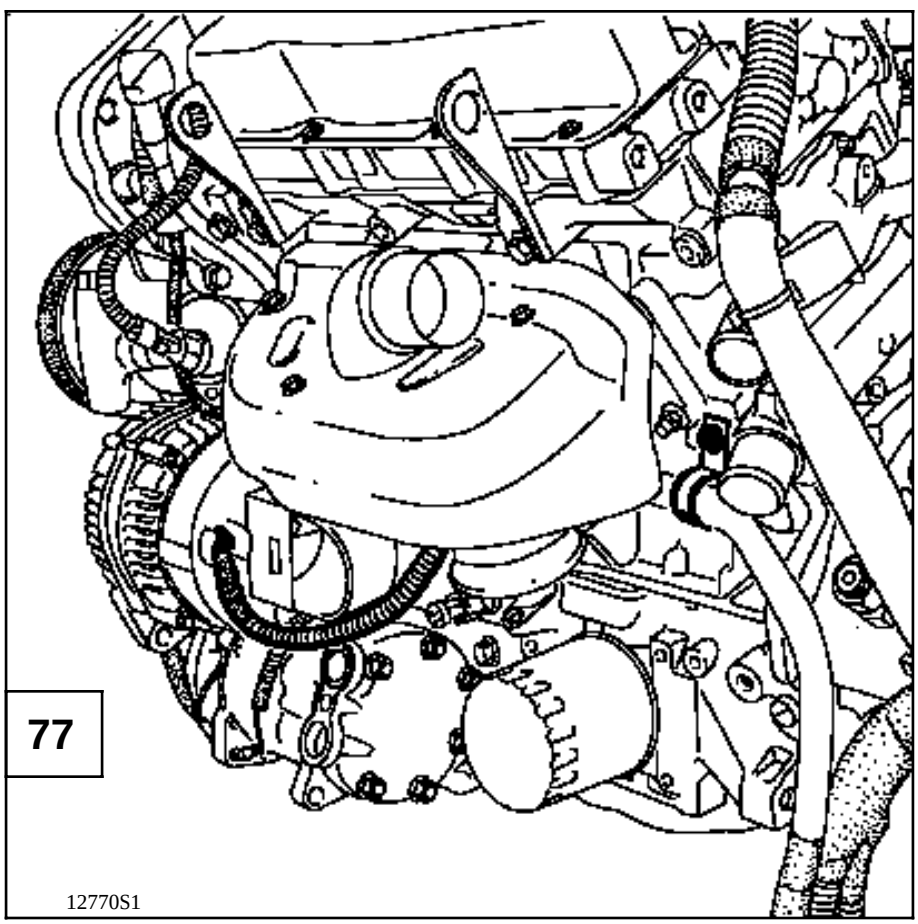
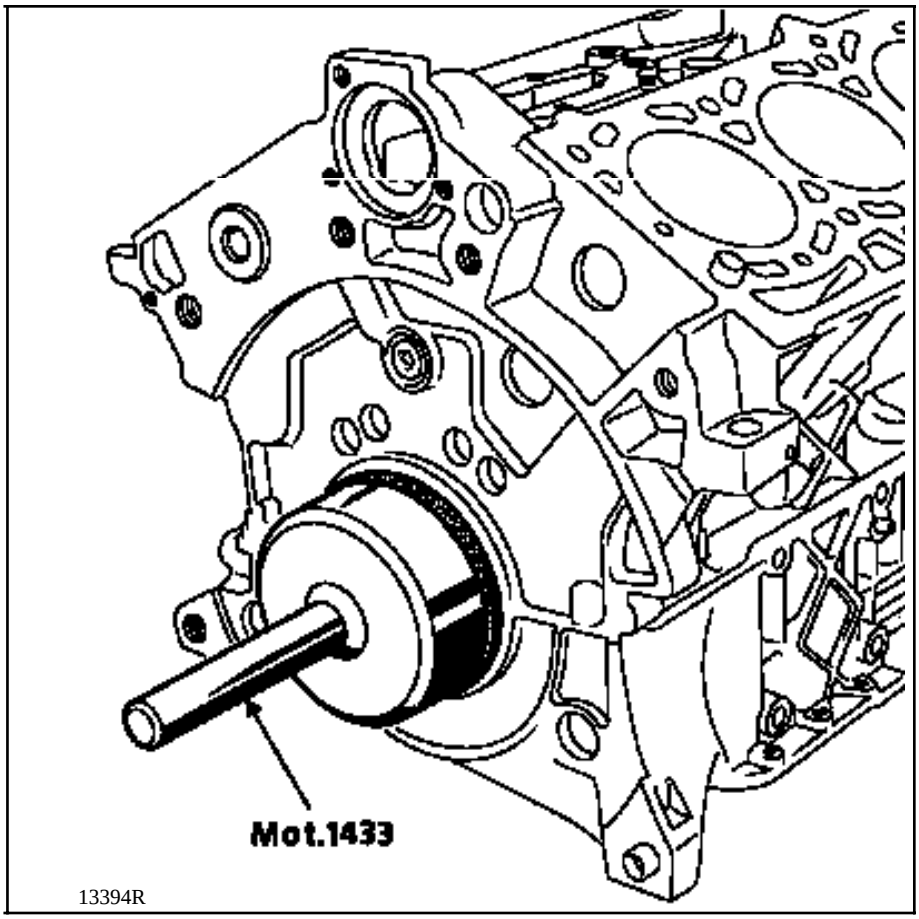
12769S1


76
12771S1


77
12770S1

Remove the engine from the DESVIL stand and the engine support tool **Mot. 1435**.

Fit the crankshaft seal on the flywheel end using tool **Mot. 1433**.



NOTE : Tool **Mot. 1433** has a specific direction: opening (1) opposite the index on the crankshaft.

Refit:

- the flywheel, torque tightening the bolts to **2 daN.m** then **angle tighten** by **60°** immobilising the flywheel using **Mot. 1431**,
- the clutch,
- the starter motor and its heat shield.