RENAULT

N.T. 3200A

CB0M	F4R	730
JA1B	F4R	740
	F4R	741
X56P	F4R	780
JE0N	F4R	700
	F4R	701

SPECIAL FEATURES OF THE F4R ENGINE

Supplement to manual F4P of JANUARY 1999

Cancels and replaces Technical Note N° 3238B of MAY 1999

For parts not dealt with in this Technical Note refer to Workshop Repair Manuals

MR 337-312-307-315

77 11 205 478 **JUNE 1999** **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 by the manufacturer in the production of the various component units and accessories from which his vehicles are constructed".

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Contents

This Technical Note deals with:

- **the internal specifications of the F4R engine,**
- **replacement of the phase shifter solenoid valve seal,**
- **replacement of the timing belt and the camshaft seals.**

Specifications

The specifications of the F4R engine are identical to those of the F4P engine with the exception of the following specifications:

Engine	Index	Cubic capacity (cm^3)	Bore (mm)	Stroke (mm)	Compression ratio
F4R	730	1998	82.7	93	11 / 1
F4R	700 - 701 740 - 741 780	1998	82.7	93	9.8 / 1

CYLINDER HEAD

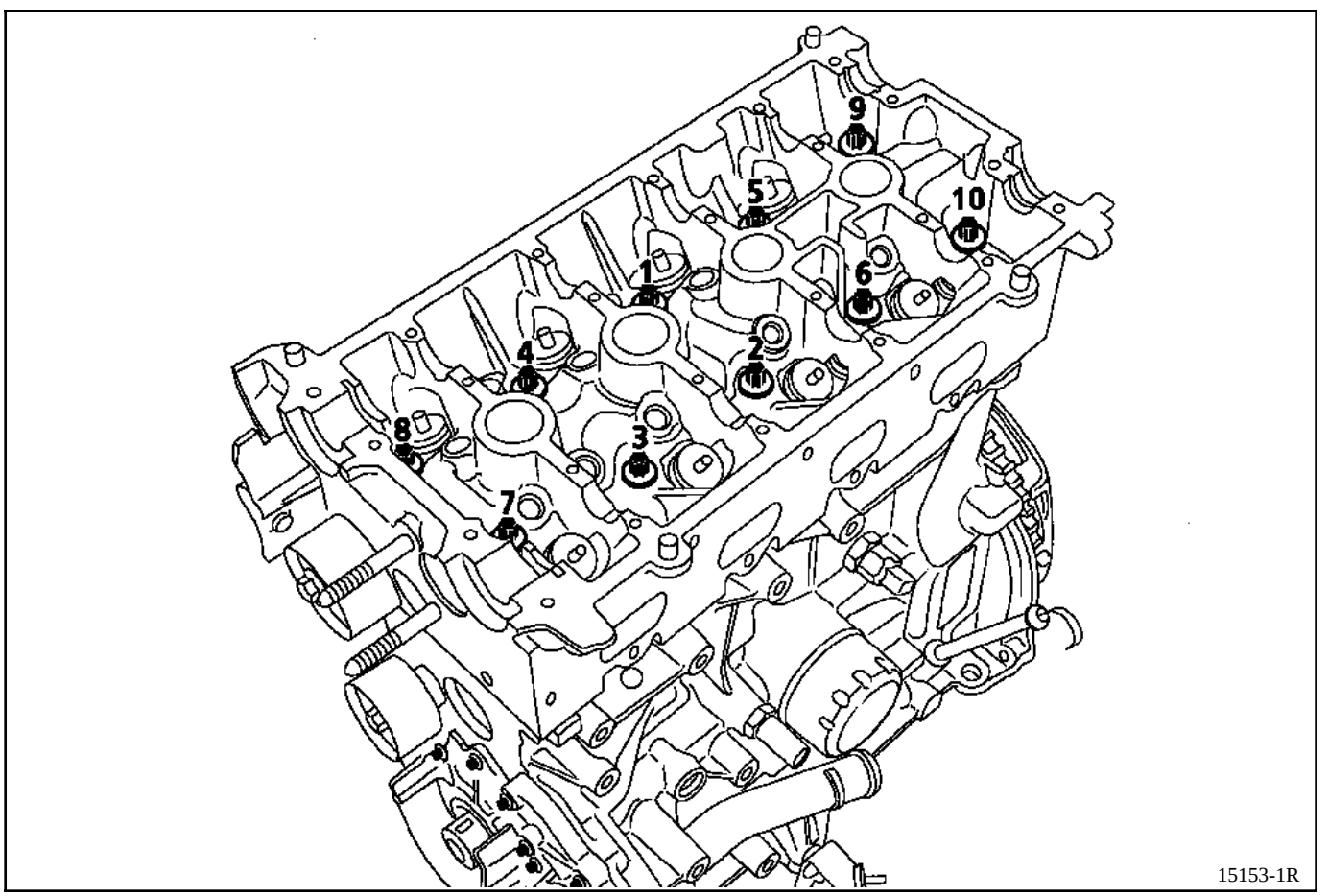
The bolts can be reused if the length under the head does not exceed 118.5 mm (otherwise change all the bolts).

Cylinder head tightening procedure

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

Do not coat new bolts with oil. However, if the bolts are reused, it is essential to coat them with engine oil.

Tighten all the bolts to **2 daN.m** in the order indicated below.



Check that all the bolts are correctly tightened to **2 daN.m,** then carry out angular tightening (bolt by bolt) of **165**° ± **6**°.

No retightening of the cylinder head bolts following application of this procedure.

VALVES

Valve lift (in mm)

	F4R 730	F4R (except F4R 730)
Inlet	10.998	10.009
Exhaust	9.999	10.014

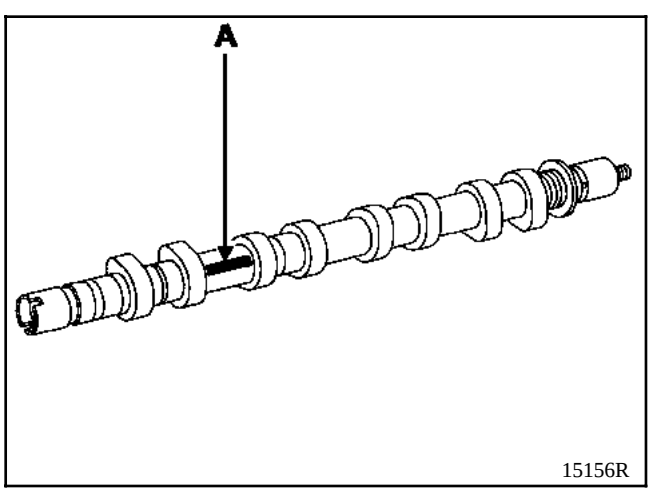
Valve spring (in mm)

	F4R 730	F4R (except F4R 730)
Free length	43.57	41.30
Length under load: - **27 daN** - **65 daN** - **19 daN** - **59 daN**	 34.50 23.50 - -	 - - 34.50 24.50
Length with coils touching **max**	22	23.20
Internal diameter	18.80	18.80
External diameter	27	27

Section of wire of the oval type.

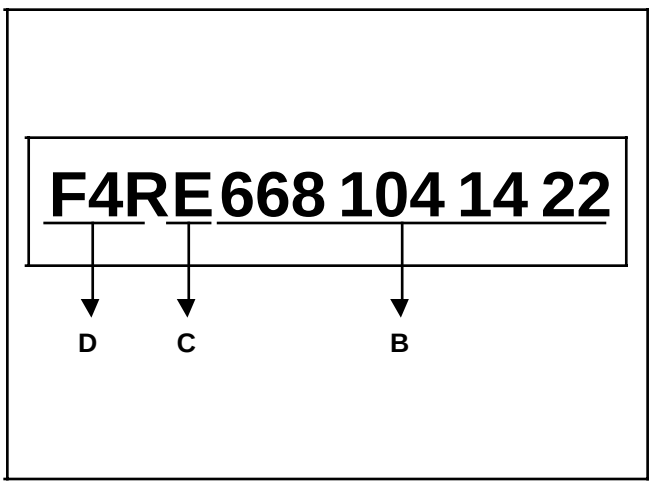
CAMSHAFTS

The camshafts are identified:
- either by a mark (A),

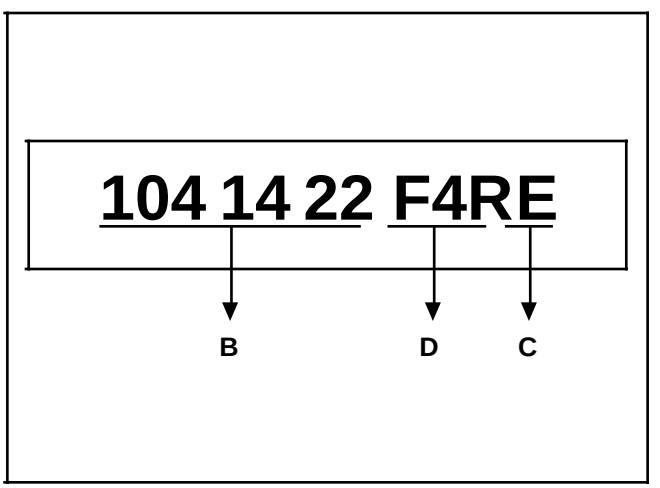


Details of mark (A) :
- mark (B) is only used by the supplier,
- mark (C) identifies the camshafts:
  A = Inlet
  E = Exhaust
- mark (D) indicates the engine type

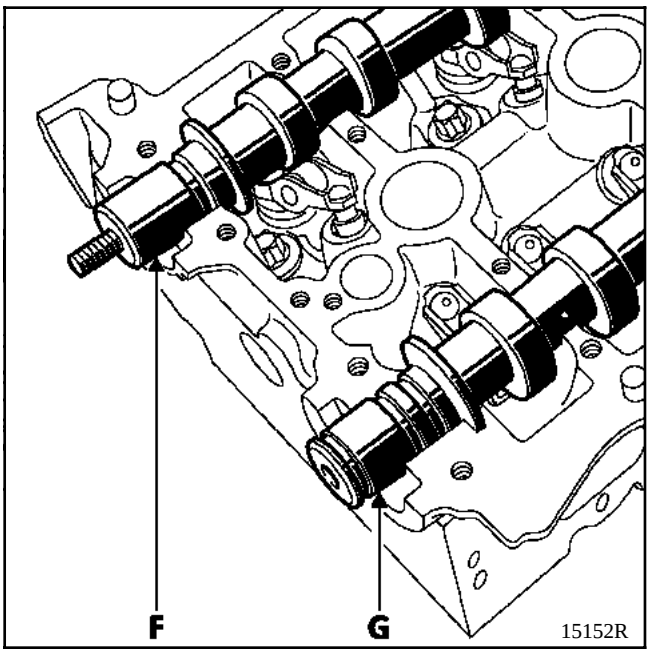
F4R engine (except F4R 730)



F4R 730 engine



- or by the ends of the camshafts.



- **F exhaust** camshaft
- **G inlet** camshaft

Timing diagram (cannot be checked)

F4R engine (except F4R 730)

Diagram with the intake not dephased

	Inlet camshaft		Exhaust camshaft	
	Cam 1	**Cam 2**	**Cam 1**	**Cam 2**
Intake opening delay*	- 10	- 14	-	-
Intake closing delay	40	44	-	-
Exhaust opening advance	-	-	24	20
Exhaust closing advance**	-	-	- 4	0

Diagram with the intake dephased

	Inlet camshaft		Exhaust camshaft	
	Cam 1	**Cam 2**	**Cam 1**	**Cam 2**
Intake opening delay*	6	2	-	-
Intake closing delay	24	28	-	-
Exhaust opening advance	-	-	24	20
Exhaust closing advance**	-	-	- 4	0

F4R 730 engine

Diagram with the intake not dephased

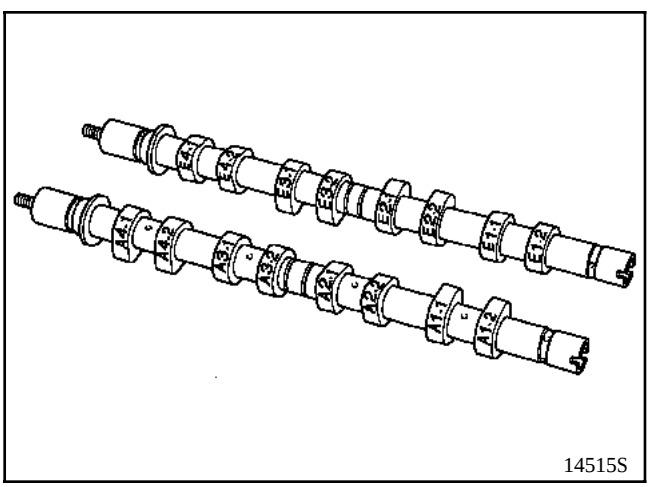
	Inlet camshaft		Exhaust camshaft	
	Cam 1	**Cam 2**	**Cam 1**	**Cam 2**
Intake opening delay*	- 7	- 11	-	-
Intake closing delay	61	65	-	-
Exhaust opening advance	-	-	41	37
Exhaust closing advance**	-	-	4	8

Diagram with the intake dephased

	Inlet camshaft		Exhaust camshaft	
	Cam 1	**Cam 2**	**Cam 1**	**Cam 2**
Intake opening delay*	9	5	-	-
Intake closing delay	45	49	-	-
Exhaust opening advance	-	-	41	37
Exhaust closing advance**	-	-	4	8

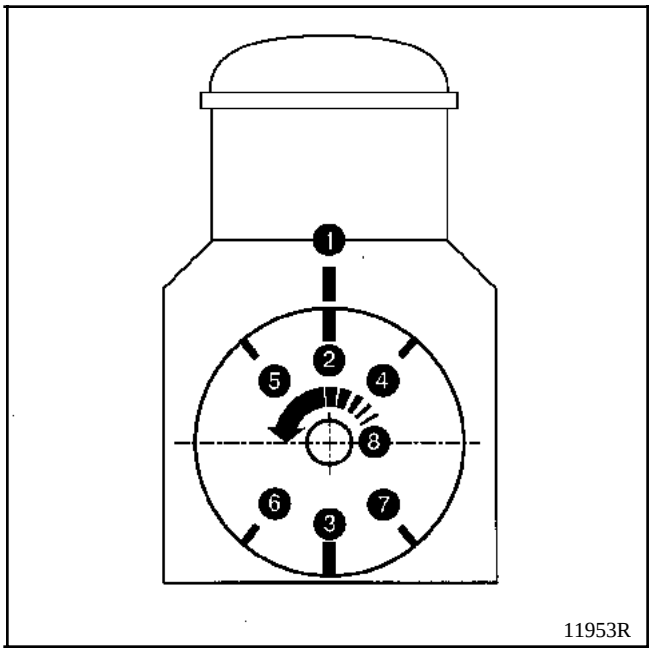
* As the Intake Opening Delay is negative, the valves open after **TDC**.

** As the Exhaust Closing Advance is negative, the valves close before **TDC**.



A 4 - 1 = Intake of cylinder 4 and cam n° 1.

E 4 - 1 = Exhaust of cylinder 4 and cam n° 1.



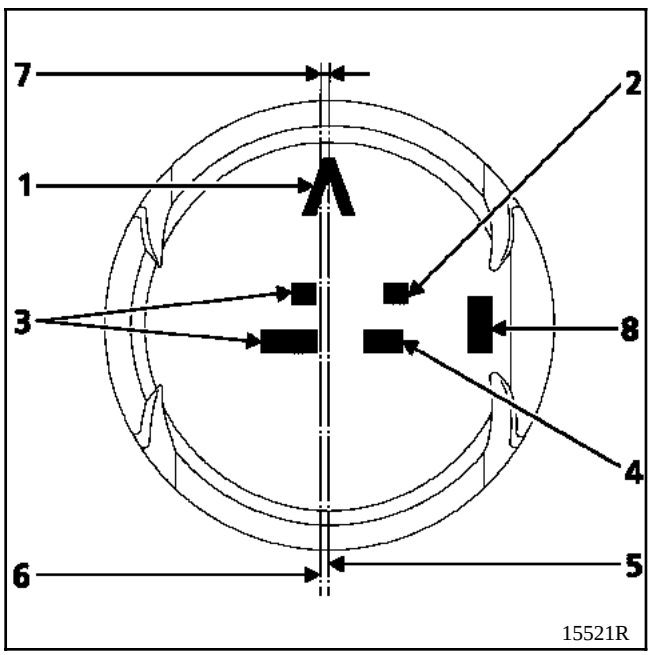
1 Cylinder block **TDC** fixed mark
2 Engine flywheel **TDC** movable mark
3 Engine flywheel **BDC** movable mark
4 Intake Opening Delay (**IOD**)
5 Exhaust Closing Advance (**ECA**)
6 Intake Closing Delay (**ICD**)
7 Exhaust Opening Advance (**EOA**)

PISTONS

SMP piston

The pin is free in the connecting rod and in the piston.

Piston marking



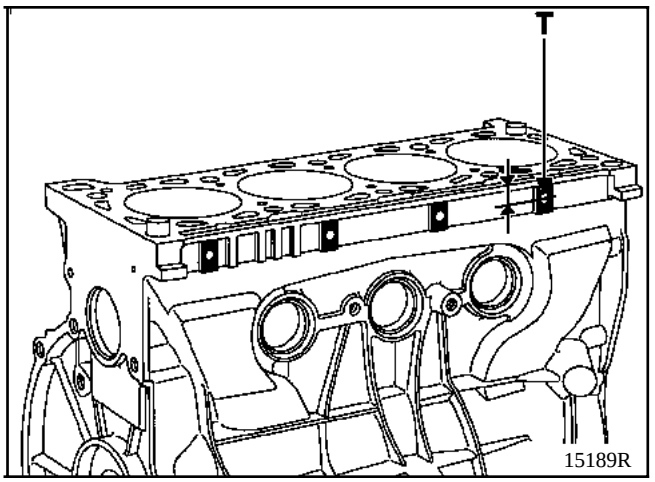
1 The direction of the piston Λ engine flywheel side
2 The piston category (**2-3** or **A-B**)
3 Only used by the supplier
4 Only used by the supplier
5 Piston line of symmetry
6 Piston pin hole line
7 Offset between the hole of line (6) and the piston symmetry line (5) is **0.8 mm**
8 Identification of the piston in relation to the engine:
- **2** corresponds to the **F4R** engine **(except F4R 730)**,
- **S** corresponds to the **F4R 730** engine

Marking of the diameter of the pistons in relation to the diameter of the cylinder block

Piston mark	Piston diameter (mm)		Cylinder diameter (mm)
	F4R (except F4R 730)	F4R 730	
2 or B	82.680 inclusive to 82.690 exclusive	82.675 inclusive to 82.685 exclusive	82.710 inclusive to 82.720 exclusive
3 or C	82.690 inclusive to 82.700 inclusive	82.685 inclusive to 82.695 inclusive	82.720 inclusive to 82.730 inclusive

Category of cylinder block bores

WARNING: it is essential to match the piston and cylinder block bore diameters correctly. To do this:
the position of the holes "T", in relation to the mating surface of the cylinder block, makes it possible to identify the original nominal dimension of the bore, and consequently, the diameter of the corresponding pistons.



NOTE: some cylinders blocks do not have a matching hole. This indicates that they are fitted with pistons of category B or 2.

Position of holes T on the cylinder block	Category mark on the piston	Diameter of the bore (in mm)	Piston diameter (in mm)	
			F4R (except F4R 730)	F4R 730
T = 13 mm	2 or B	82.710 inclusive to 82.720 exclusive	82.680 inclusive to 82.690 exclusive	82.675 inclusive to 82.685 exclusive
T = 19 mm	3 or C	82.720 inclusive to 82.730 inclusive	82.690 inclusive to 82.700 inclusive	82.685 inclusive to 82.695 inclusive

CONNECTING RODS

Lateral clearance of the big end **(in mm):**
0.22 to **0.402**

Diametral clearance of the big end **(in mm)**:
0.02 to 0.071

Centreline distance between the big end and the little end **(in mm):**
144 ± 0.035

Big end diameter **(in mm):**
$51.587\ ^{0}_{-0.019}$

Little end diameter **(in mm):**
- without ring: $23\ ^{+0.02}_{0}$
- with ring: $21\ ^{+0.02}_{+0.01}$

CRANKSHAFT

Number of bearings: **5**

Burnished journals:
- nominal diameter **(in mm)**: **54.795 ± 0.01**

Burnished crank pins:
- nominal diameter **(in mm)** $48\ ^{-0.02}_{0}$

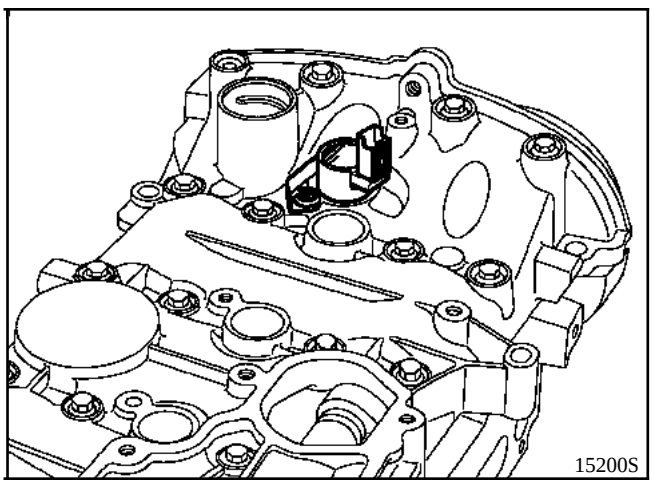
Crankshaft lateral clearance **(in mm)**:**0.07** to **0.23**

Crankshaft diametral clearance **(in mm):**
0.04 to 0.075

The side shims are on bearing **n° 2**.

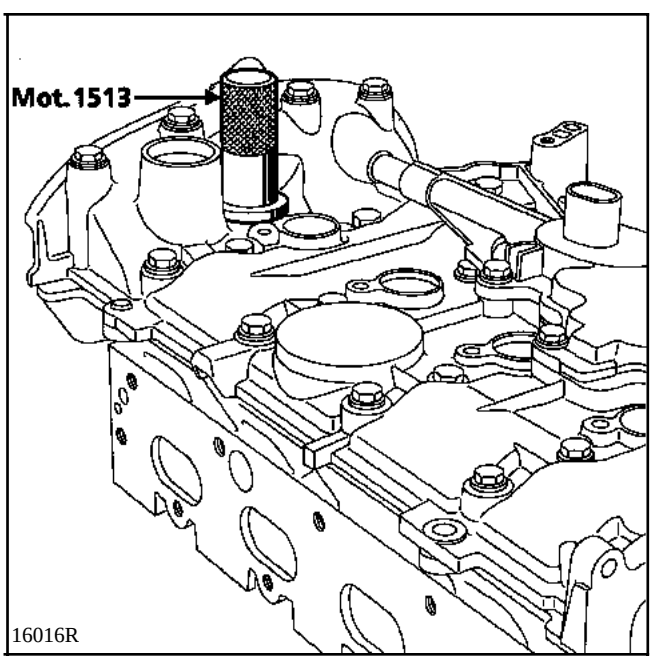
Replacement of the control solenoid valve seal

Remove:
- the coil,
- the solenoid valve,



- the seal.

The seal is refitted using tool **Mot. 1513**.



Refit in the reverse order to removal.

ESSENTIAL SPECIAL TOOLS	
Mot. 799-01	**Tool for immobilising pinions for toothed timing belt**
Mot. 1054	**Top dead centre pin**
Mot. 1487	**Tool for refitting the inlet camshaft plug**
Mot. 1488	**Tool for refitting the exhaust camshaft plug**
Mot. 1496	**Tool for setting camshafts**
Mot. 1509	**Tool for immobilising camshaft pulleys**
Mot. 1509-01	**Accessory for Mot. 1509**
Mot. 1512	**Tool for fitting the exhaust camshaft seal**
Mot. 1517	**Tool for fitting the inlet camshaft seal**

ESSENTIAL EQUIPMENT
Angular tightening wrench
14 mm hexagonal wrench

There are two very distinct procedures for setting the timing.

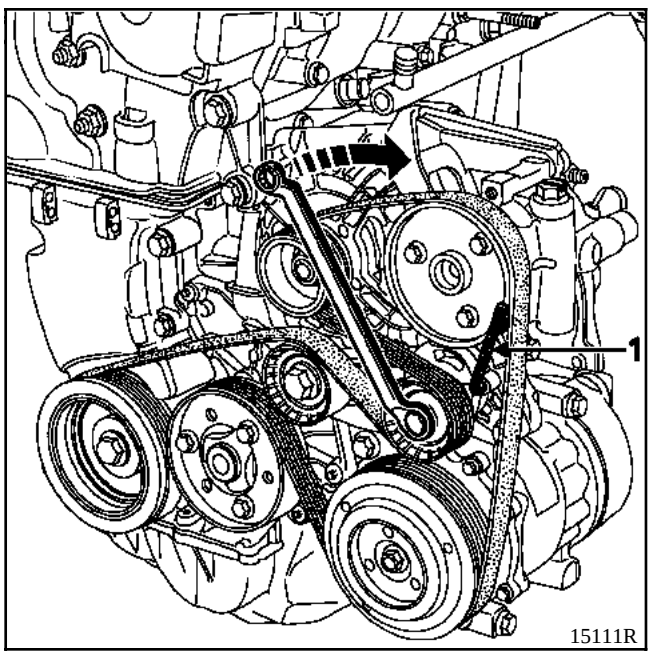
1st PROCEDURE

The first procedure is applied in the event of replacement of any components which require slackening of the exhaust camshaft pulley and of the inlet camshaft phase shifter.

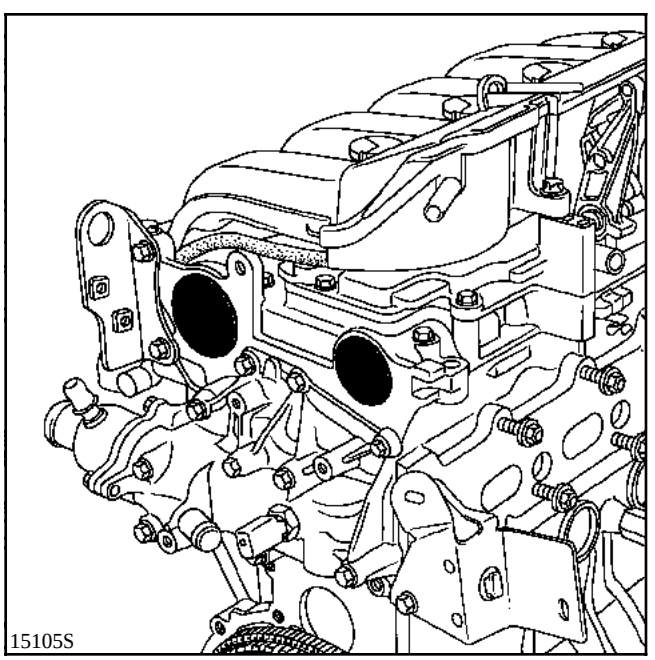
During this operation, it is essential to change:
- **the exhaust camshaft pulley nut,**
- **the inlet camshaft phase shifter bolt,**
- **the phase shifter camshaft seal,**
- **the phase shifter blanking piece seal.**

REMOVAL

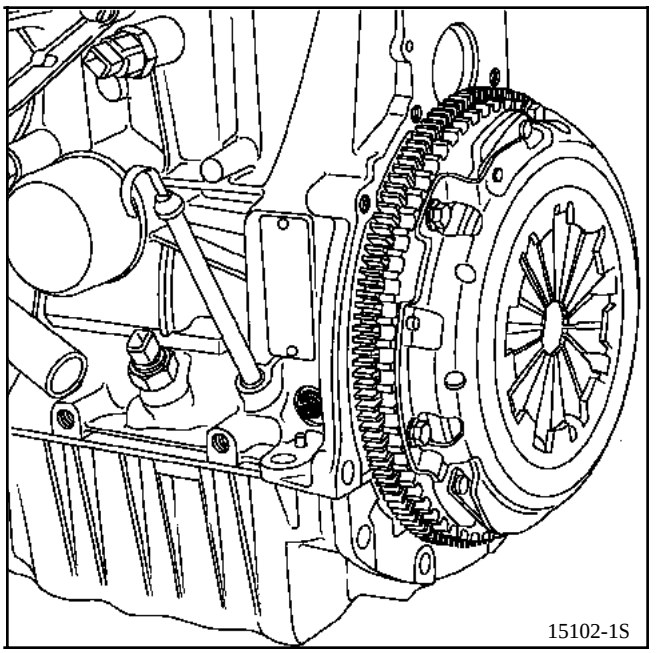
Remove:
- the accessories belt; tilt the belt's automatic tensioner in the direction indicated below using a **13 mm offset ring ended spanner**. Clamp the tensioner using a **6 mm hexagonal wrench (1)**.



- the inserts at the end of the camshafts,



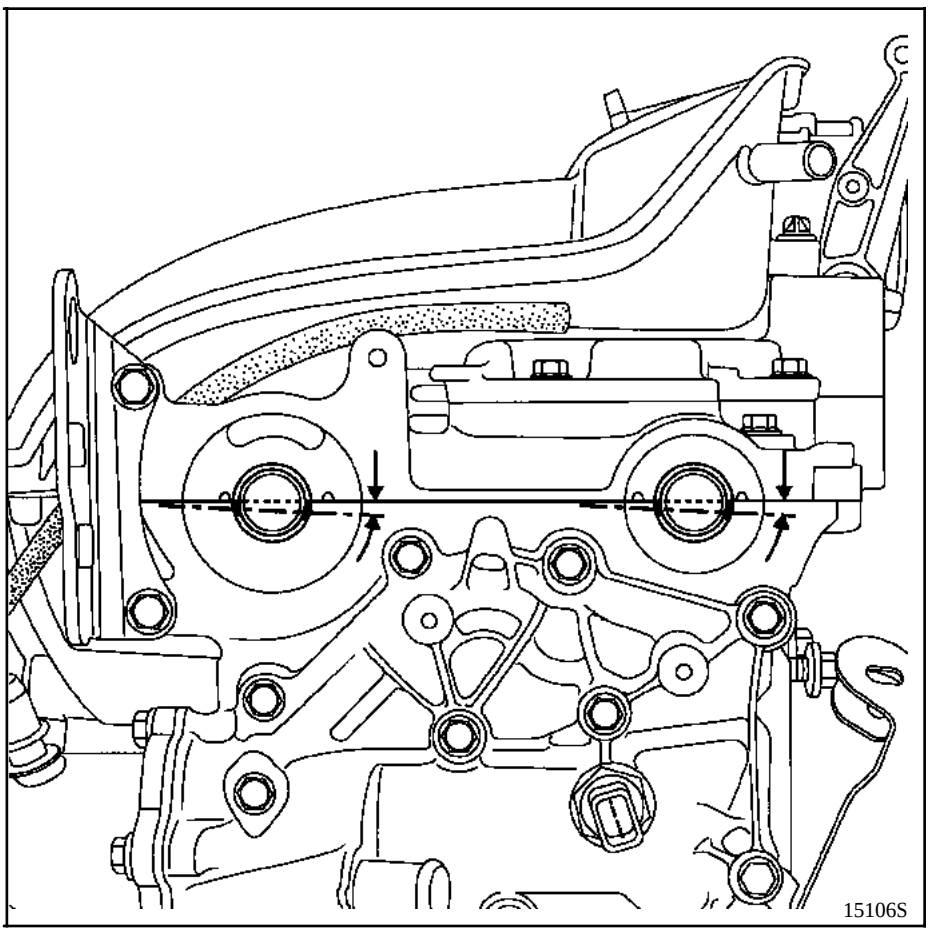
- the Top Dead Centre pin plug.

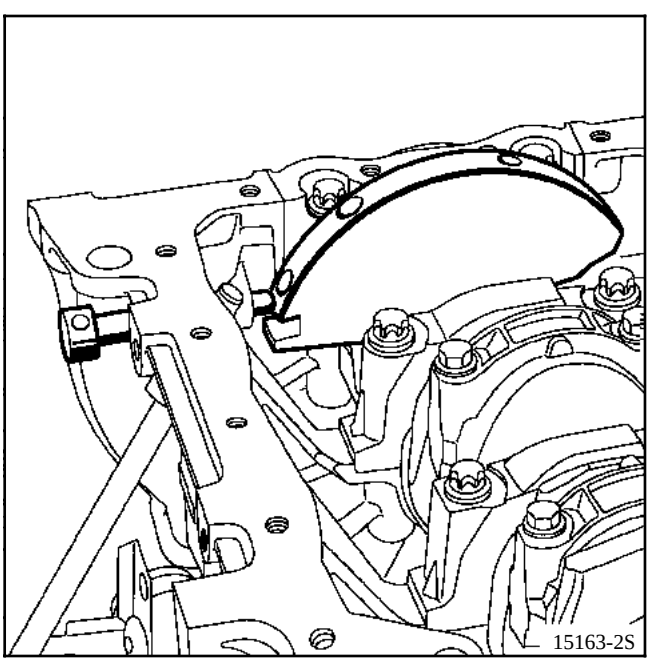


Positioning the timing at the setting point

Procedure

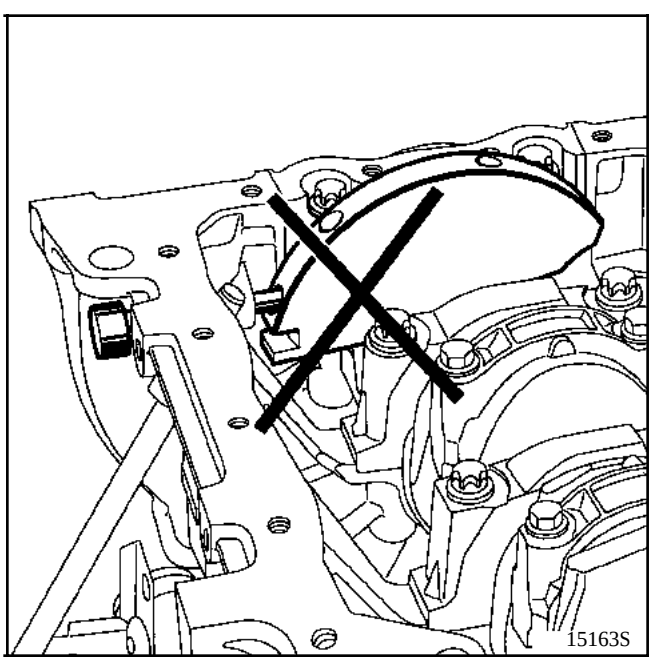
Position the camshaft grooves downwards and almost horizontal as **indicated below, then insert the Top Dead Centre pin Mot. 1054 to be between the balancing hole and the crankshaft setting groove.**





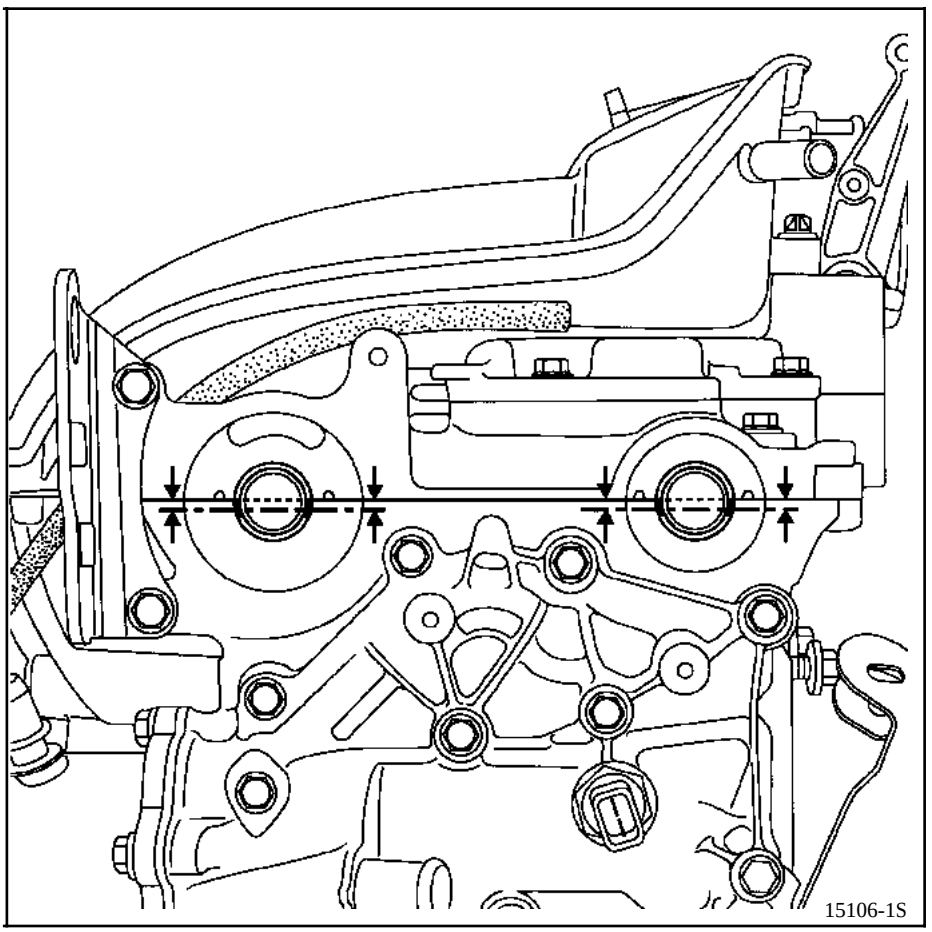
NOTE: this is to avoid setting the crankshaft in a balancing hole.

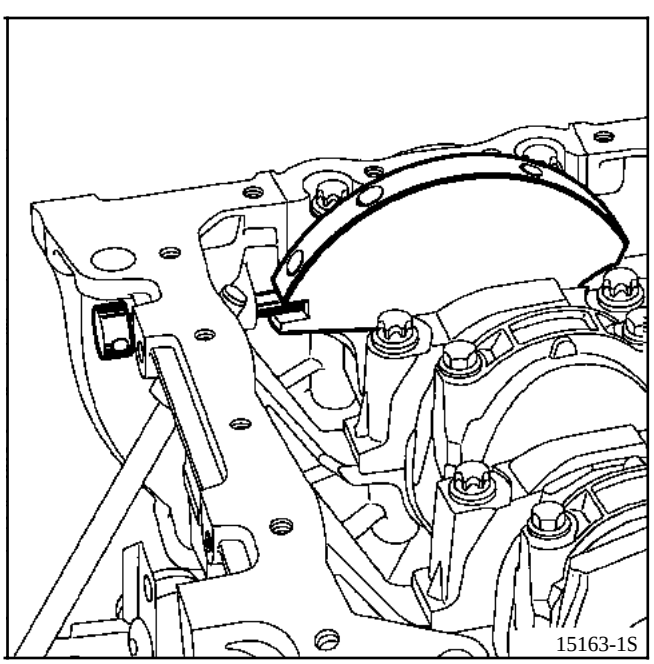
Incorrect position



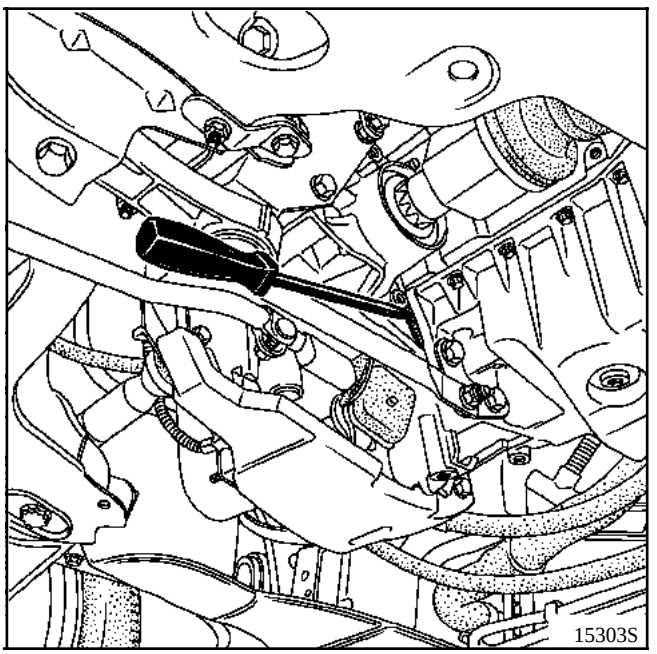
Turn the engine clockwise (timing side), to the timing setting point.

The camshaft grooves should be horizontal and offset downwards as indicated on the diagram below.

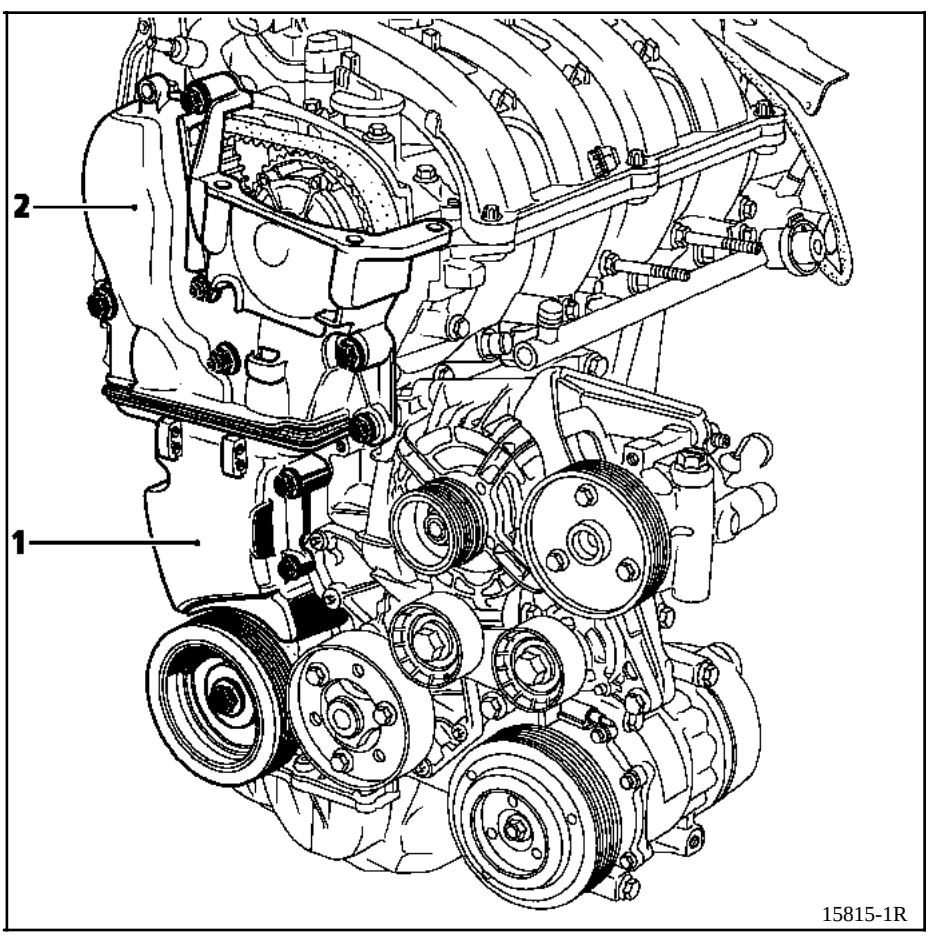




Immobilise the engine flywheel using tool **Mot. 582-01 or a large screwdriver.**

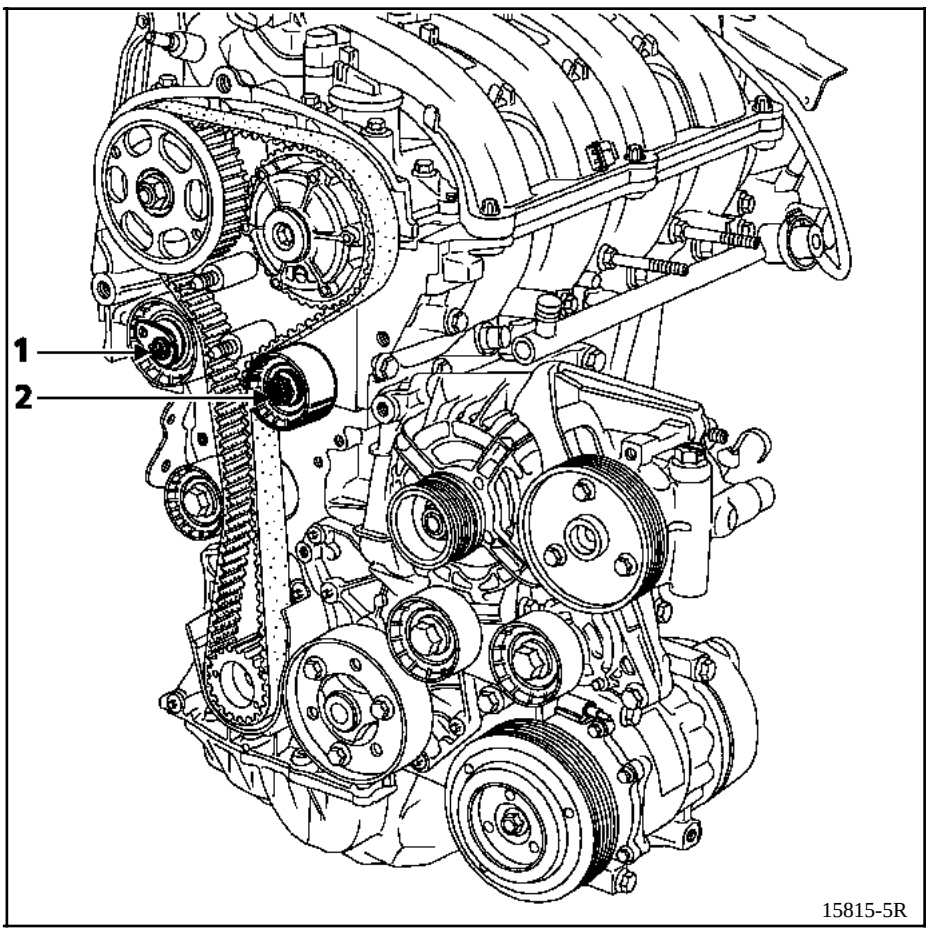


Remove:
- the crankshaft pulley,
- the intermediate timing cover (1),
- the upper timing cover (2).



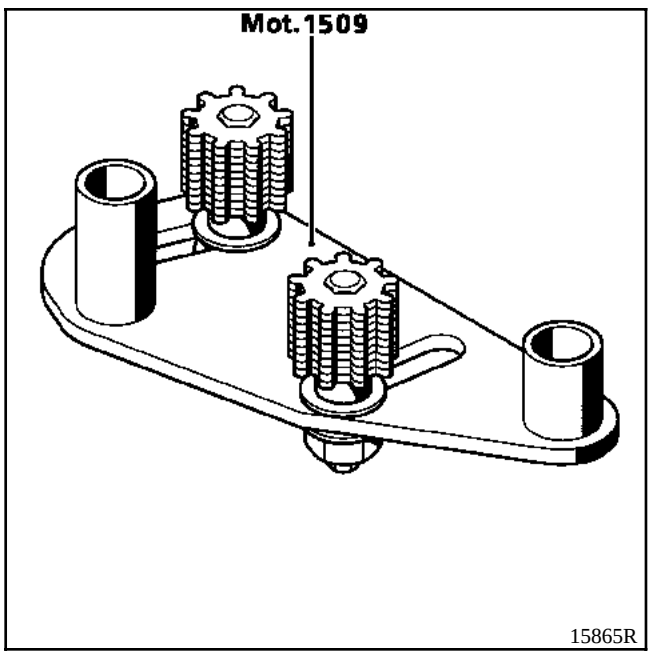
Slacken the tensioner nut (1).

Remove:
- the pulley (2),
- the timing belt **taking care not to let the crankshaft timing pinion fall.**
- the crankshaft timing pinion.

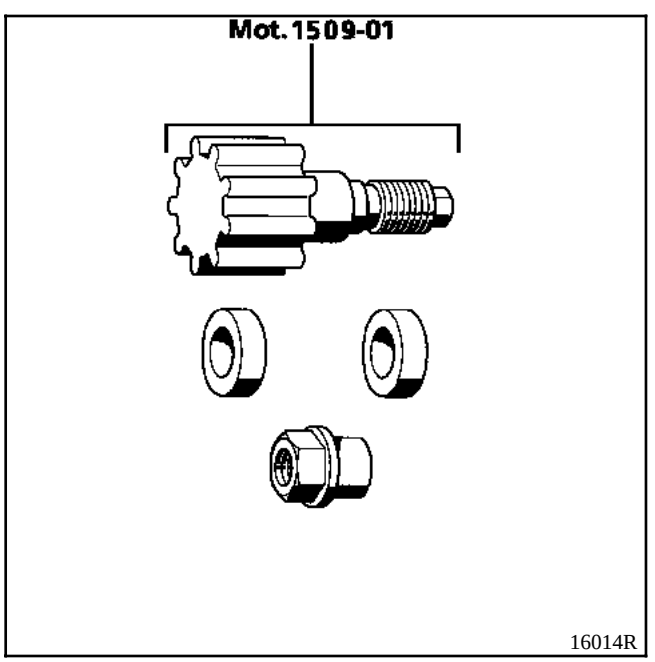


Procedure for slackening the exhaust camshaft pulley and the inlet camshaft phase shifter.

The operation is carried out using tools Mot. 1509 and Mot. 1509-01.



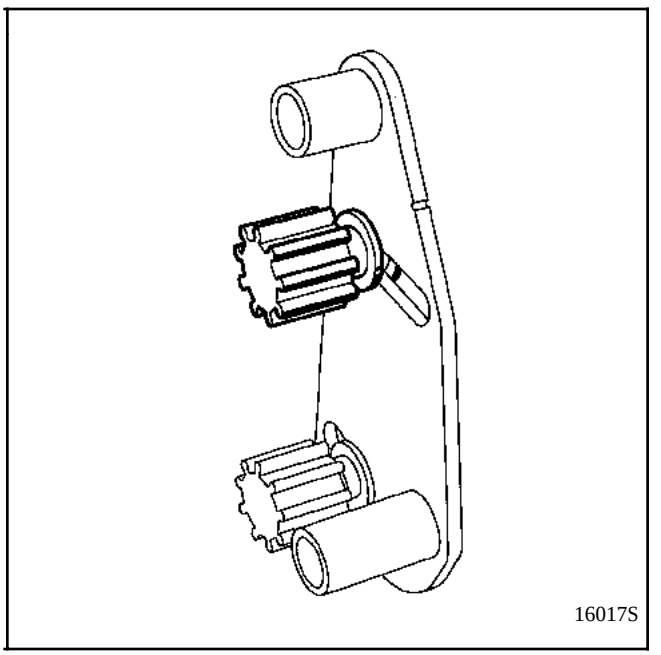
15865R



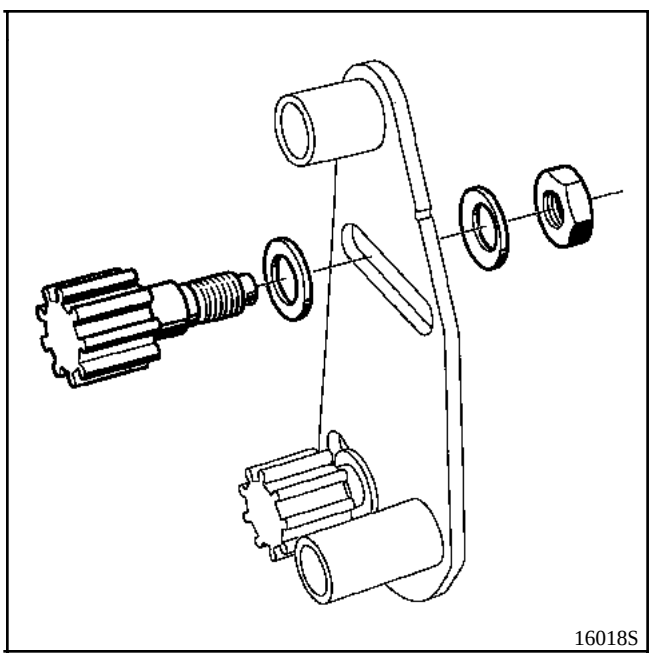
16014R

Preparation of tool Mot. 1509

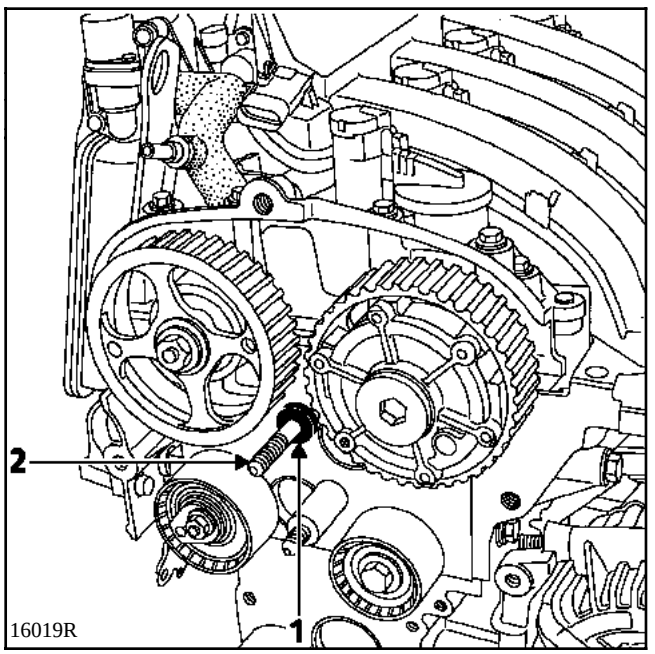
Remove the upper toothed pinion from the bracket.


16017S

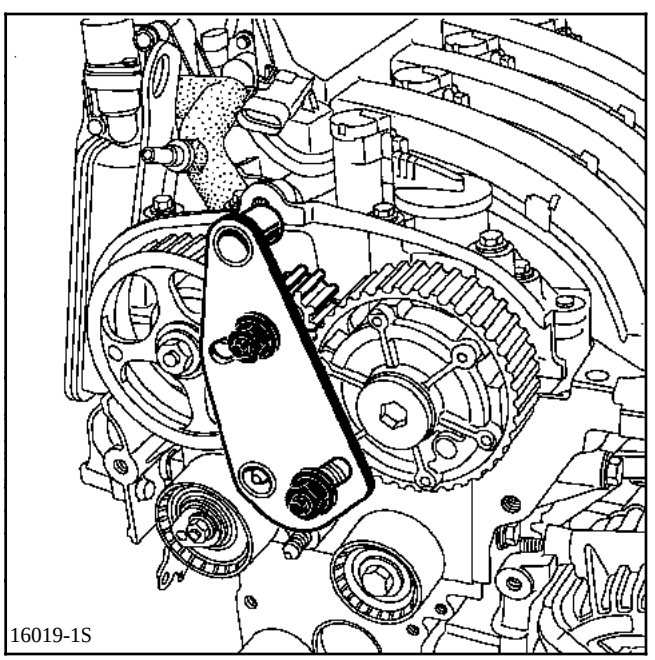
In its place fit the toothed pinion of tool **Mot. 1509-01** (reusing the two washers and the nut of **Mot. 1509**).


16018S

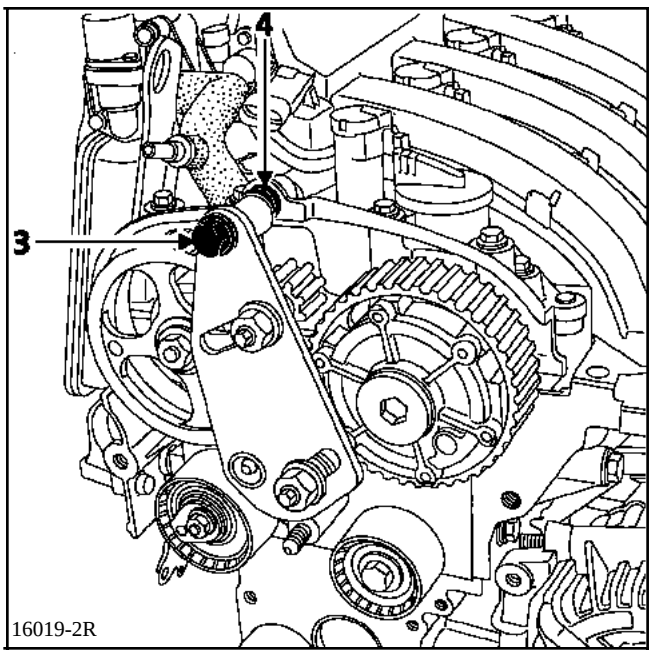
Fit:
- the spacer (1) of tool **Mot. 1509-09** on the stud (2),



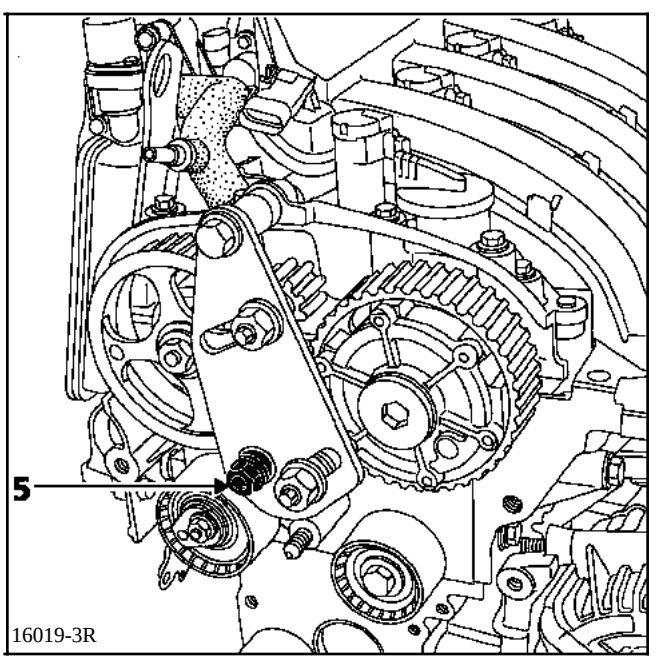
- tool **Mot. 1509** as indicated on the diagram below,



- the upper bolt (3) while positioning the spacer (4) of tool **Mot. 1509-01** between the tool and the camshaft bearing cap housing **(do not tighten the bolt)**.

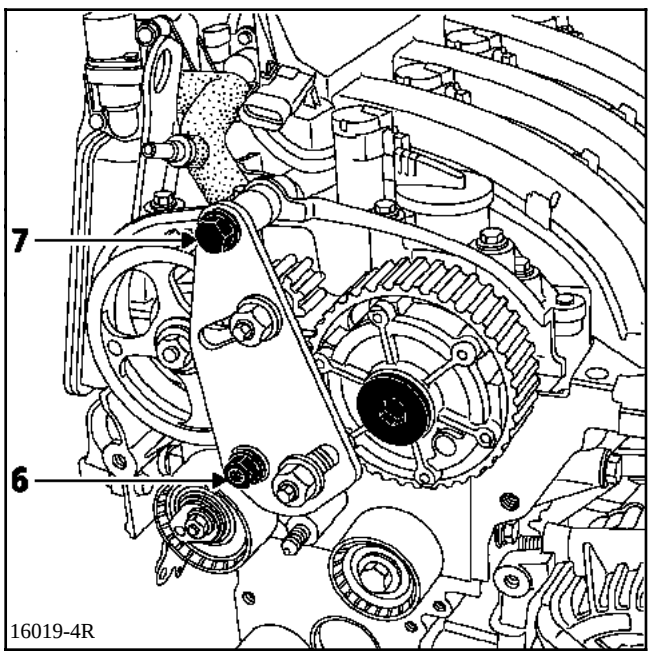


- the flanged nut (5) of tool **Mot. 1509-01**.

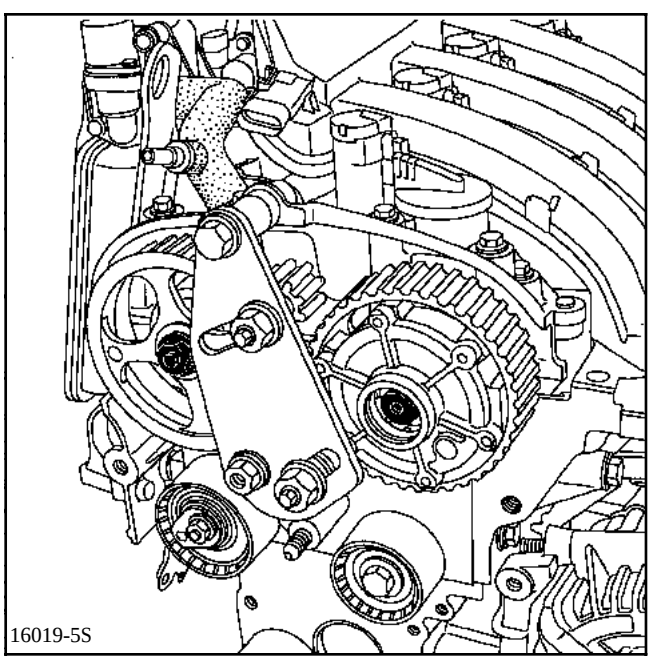


Tighten the flanged nut (6) and the bolt (7), then immobilise the pulleys using the toothed pinions of tool **Mot. 1509**.

Remove:
- the inlet camshaft phase shifter blanking piece using a **14 mm** hexagonal wrench,

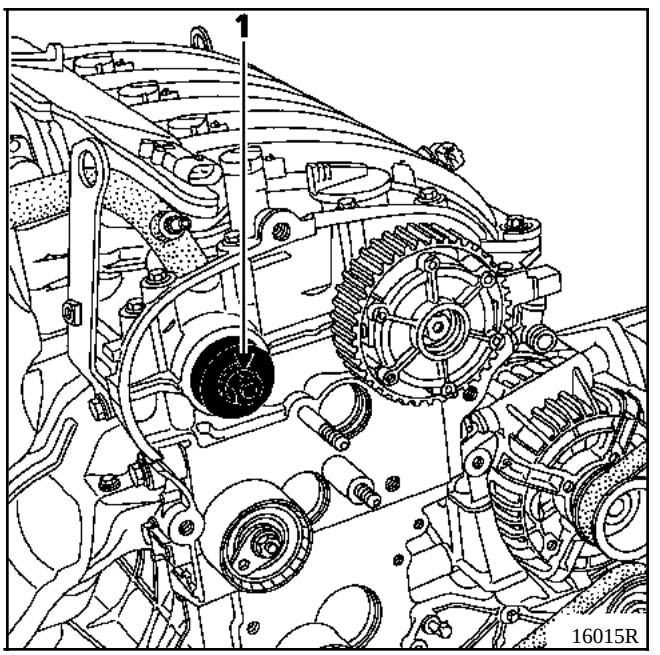


- the exhaust camshaft pulley nut,
- the inlet camshaft phase shifter bolt.

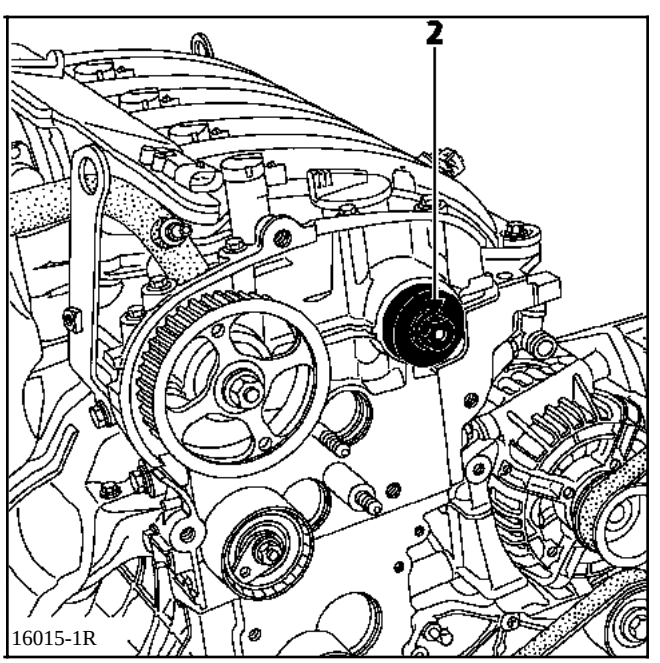


Replacement of the camshaft seals

Fitting of the **exhaust camshaft** seal using tool **Mot. 1512** using the old nut (1).



Fitting of the **inlet camshaft phase shifter** seal using tool **Mot. 1517** using the old bolt (2).

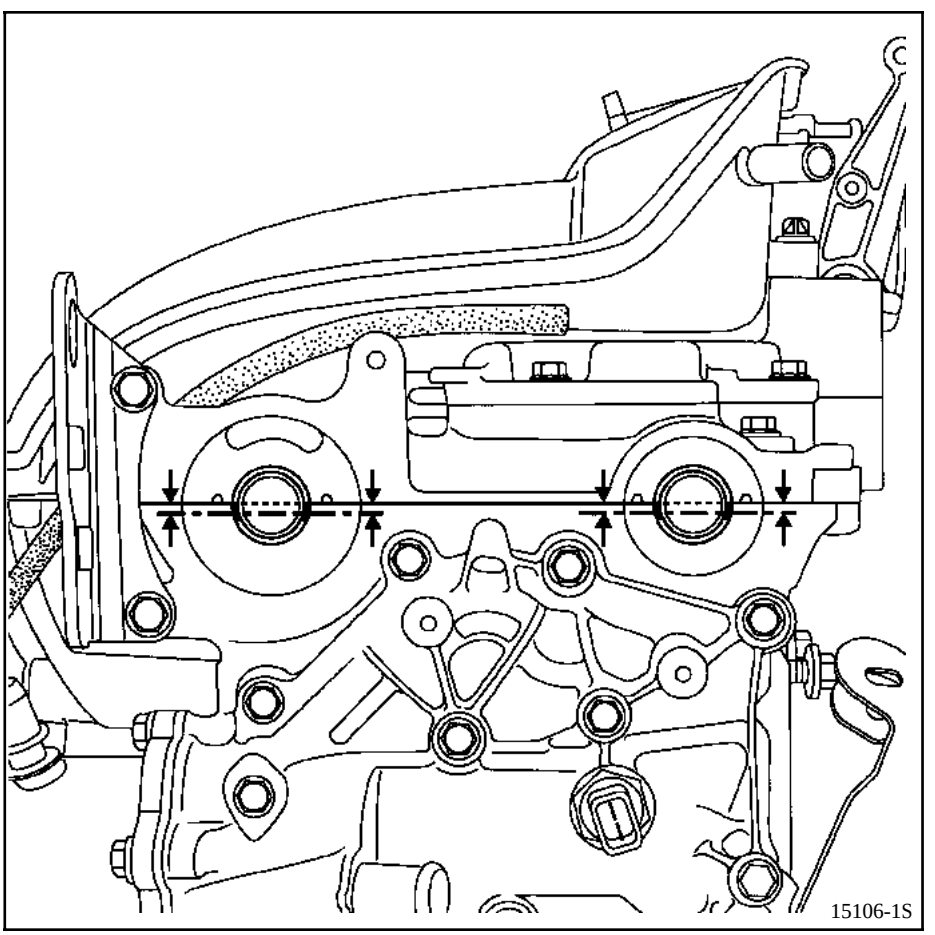


Setting the timing

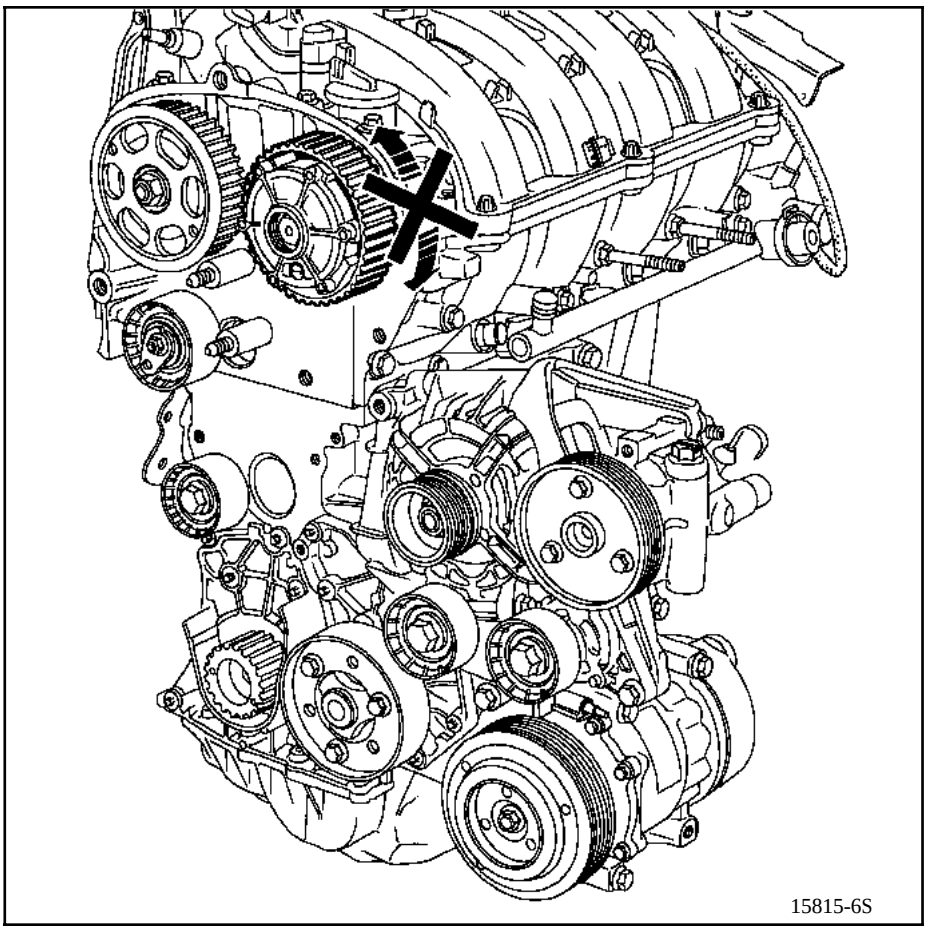
WARNING:
it is essential to degrease the end of the crankshaft (timing end), the bore and the contact surfaces of the timing pinion, the contact surfaces of the accessories pulley and the ends of the camshafts (timing end), the bores and contact surfaces of the exhaust camshaft pulley and the inlet camshaft phase shifter. This is to prevent sliding between the timing, the crankshaft and the exhaust camshaft pulleys and the inlet phase shifter which could destroy the engine.

NOTE:
to make it easier to place the grooves in a horizontal position, position the camshaft pulley and phase shifter, then screw in place the **old pulley nut and the old phase shifter bolt tightening them to 1.5 daN.m MAXIMUM, and position the pistons at mid-travel (to prevent any contact between the valves and the pistons).**

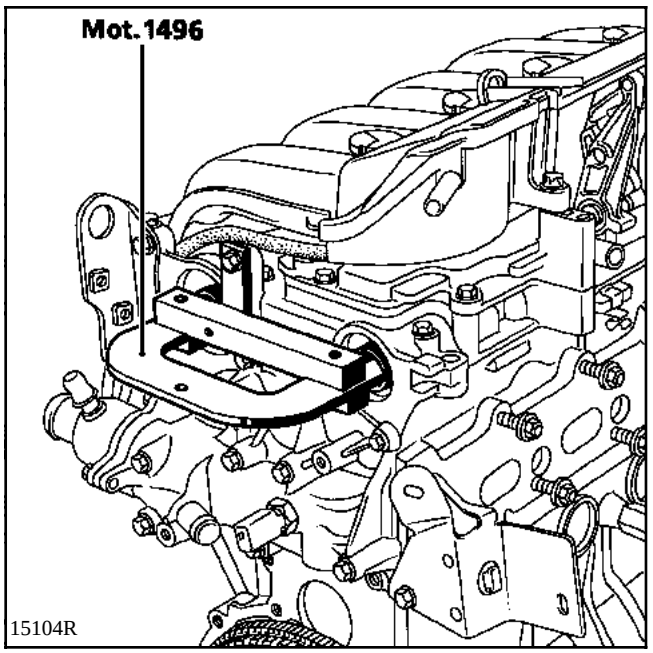
Place the camshaft grooves in a horizontal position as **indicated on the diagram below (turning the camshafts using tool Mot. 799-01 if necessary)**.



Check that the inlet camshaft phase shifter crown wheel is immobilised correctly (no rotation of the crown wheel to the left or the right).

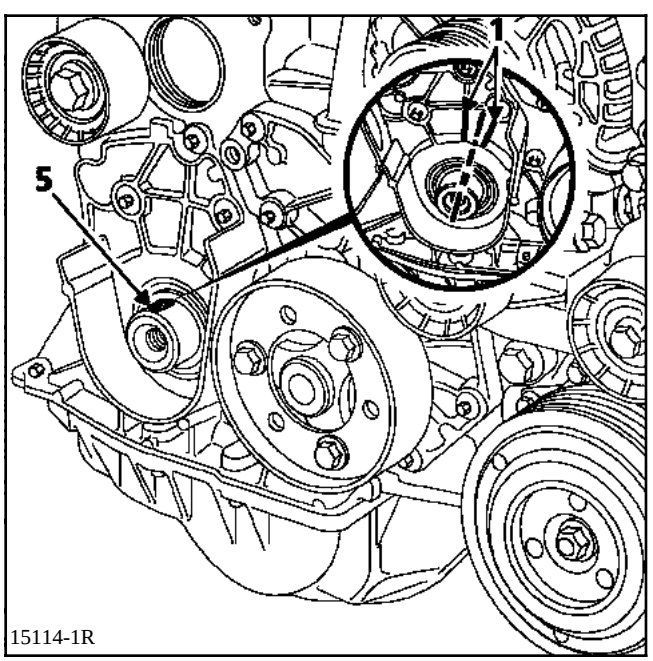


Fit tool **Mot. 1496** which is secured to the end of the camshafts.

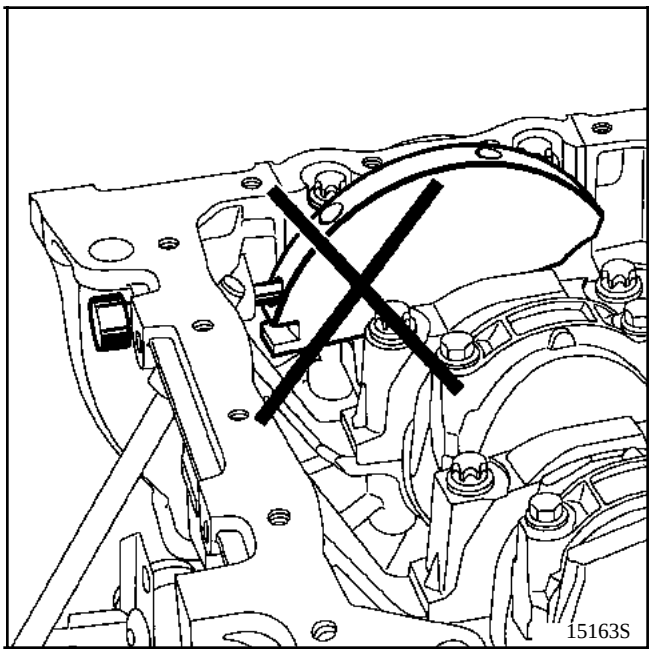


Remove the old pulley nut and the old phase shifter bolt and replace them with a new nut and bolt (without tightening the nut and the bolt, clearance of 0.5 to 1 mm between the nut or the bolt and the pulley).

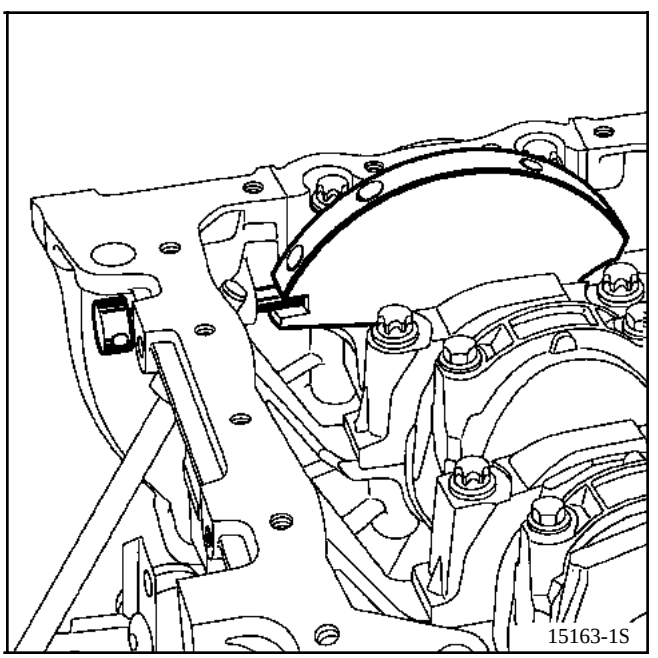
Check that the crankshaft is correctly pinned at Top Dead Centre and not in the balancing hole (the crankshaft groove (5) should be in the vertical centreline of the engine).



Incorrect position

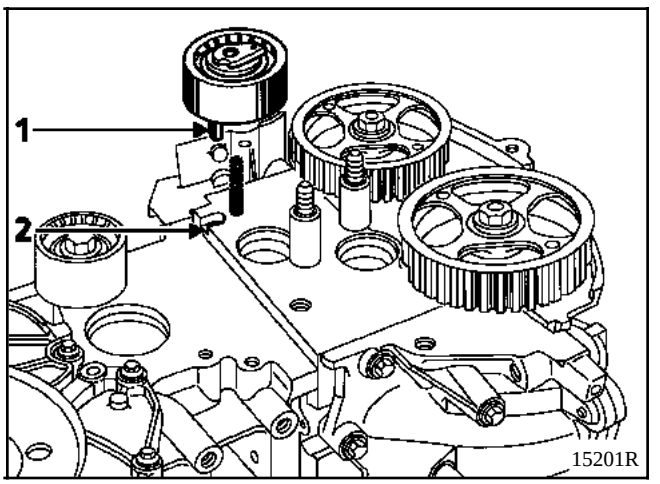


Pinned crankshaft

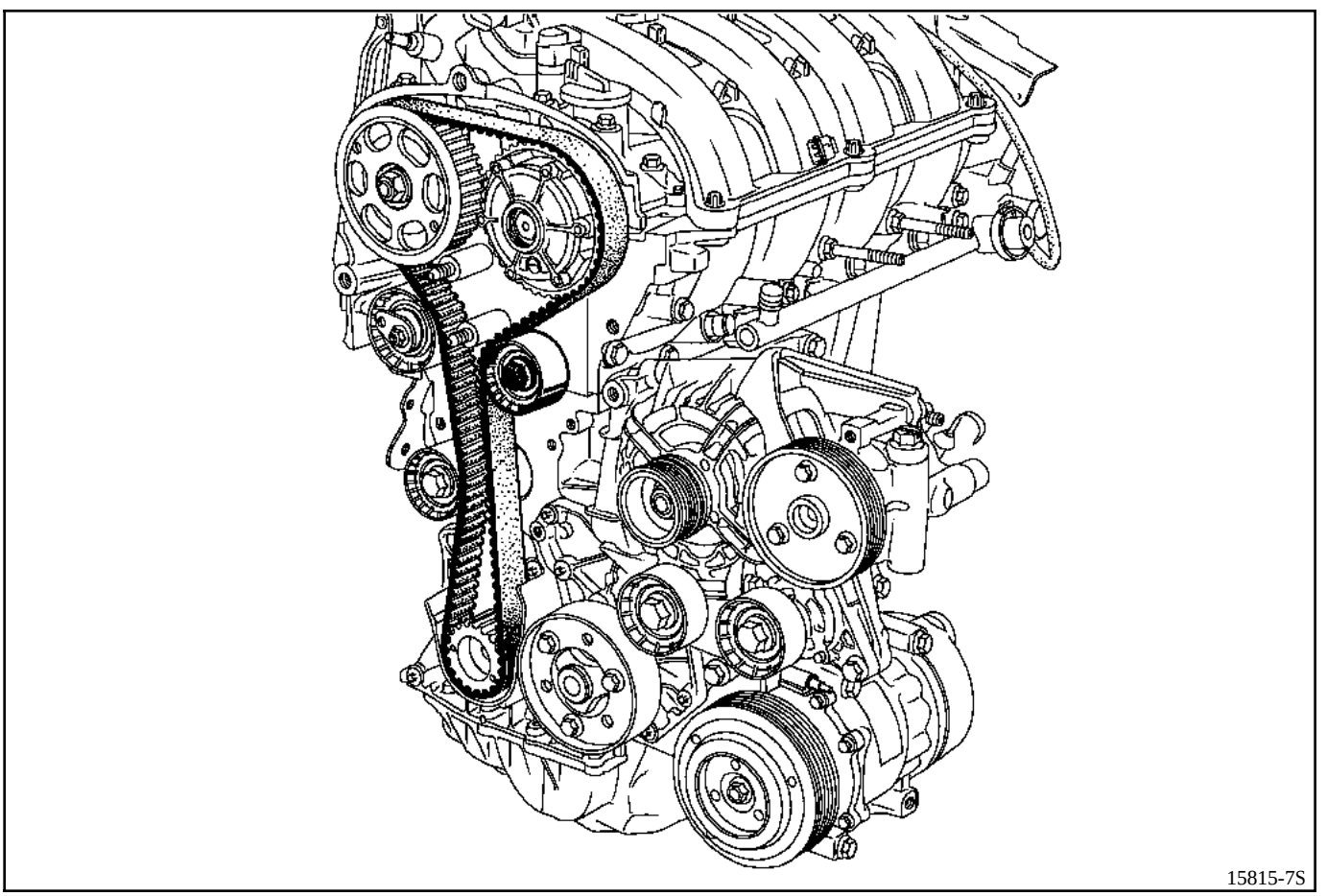


When a timing belt is changed, it is essential to change the timing tensioners and pulleys.

Check that the tensioner lug (1) is correctly positioned in the groove (2).



Refit:
- the timing belt,



- the crankshaft accessories pulley, pretightening the bolt **(without fully tightening the bolt, clearance of 2 to 3 mm between bolt/pulley)**.

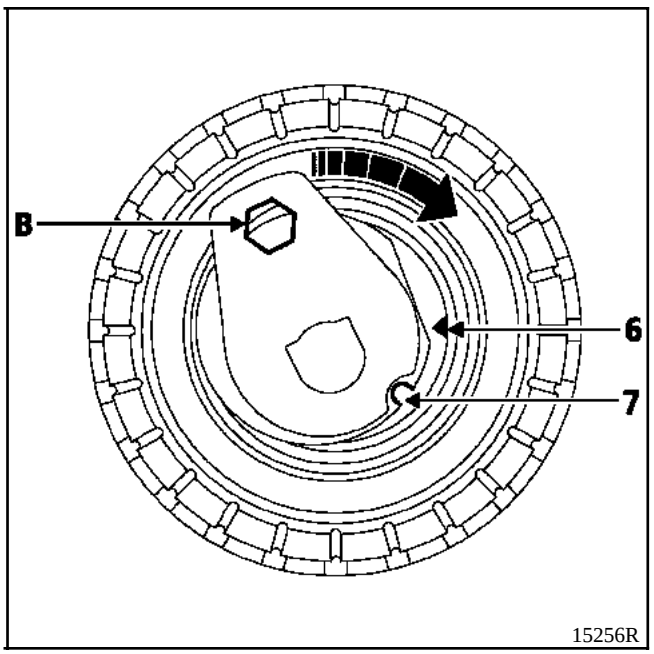
NOTE:
- the accessories crankshaft pulley bolt can be reused if the length under the head does does exceed **49.1 mm** (otherwise change it),
- do not oil a new bolt. However, if the old bolt is reused, it is essential to oil the threads and under the head.

Belt tension

Check that there is still a clearance of 0.5 to 1 mm between the nuts and the camshaft pulleys.

NOTE: do not turn the tensioner anti-clockwise.

Align tensioner marks (6) and (7) using a **6 mm** hexagonal wrench at (B).



Pretighten the tensioner nut to a torque of **0.7 daN.m.**

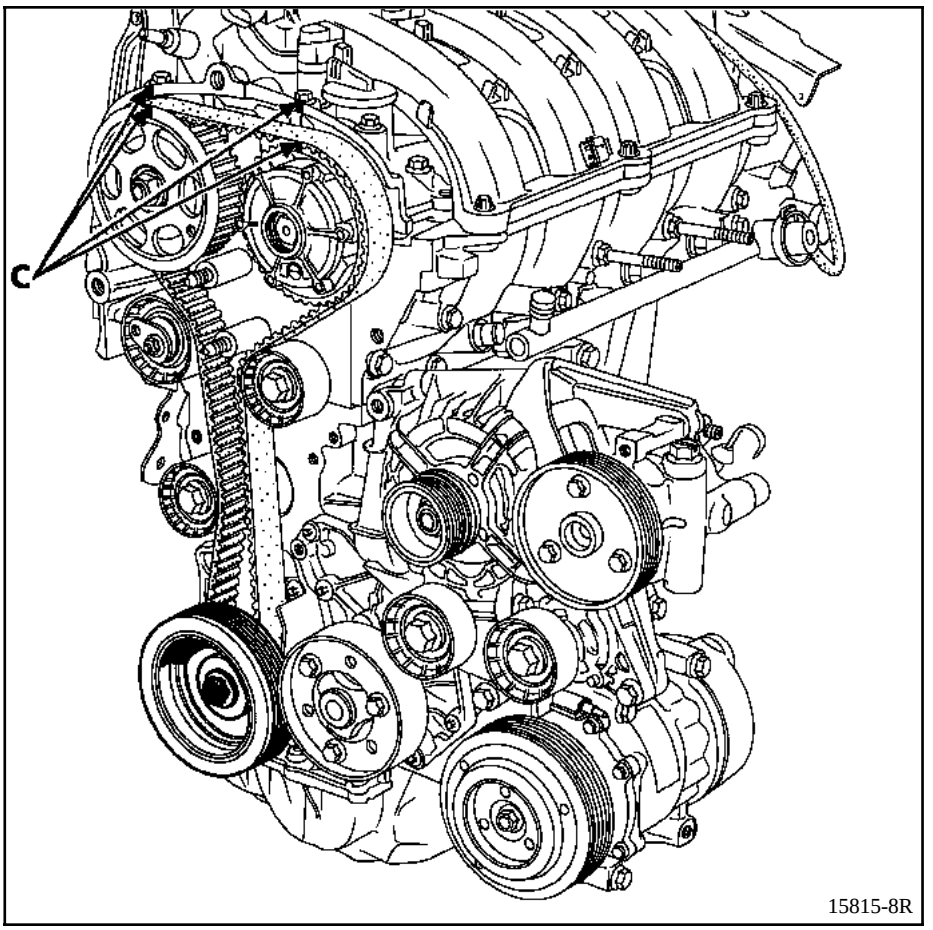
NOTE: check carefully that the nut and the bolt of the camshaft pulleys do not come into contact with their respective pulleys. Also, place the camshaft pulleys flush against the camshaft from time to time.

Turn the timing **six revolutions** clockwise (timing end) via the **exhaust pulley** using tool **Mot. 799-01**.

Align marks (6) and (7) if necessary, slackening the tensioner nut by one revolution maximum while retaining it using a **6 mm** hexagonal wrench. Then fully tighten the nut to a torque of **2.8 daN.m**.

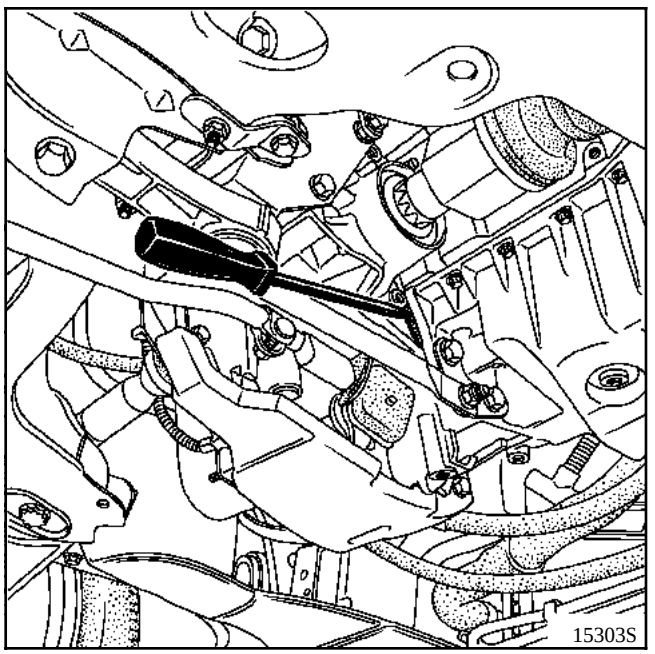
Tighten the accessories crankshaft pulley bolt to a torque of **2 daN.m (Top Dead Centre pin still in place in the crankshaft).**

Using a pencil, make a mark (C) between the camshaft pulleys and the camshaft bearing cap housing.



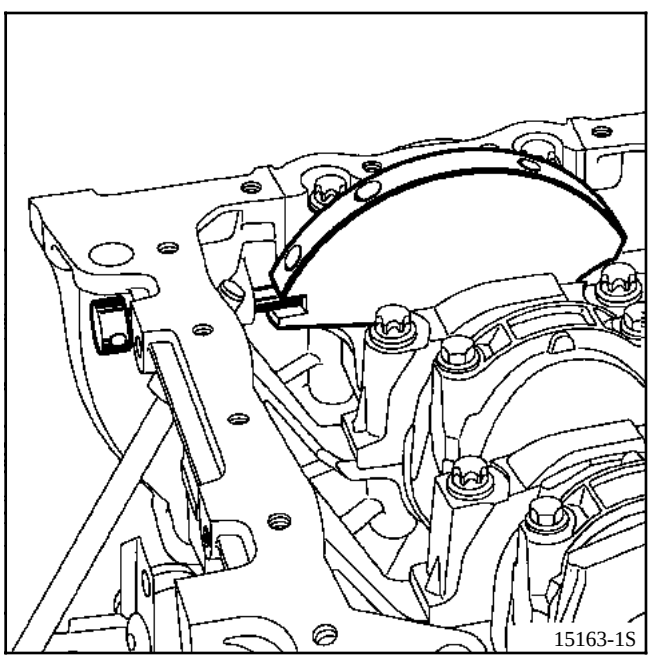
REMOVE THE TOP DEAD CENTRE PIN.

Immobilise the engine flywheel using tool **Mot. 582-01 or a large screwdriver**, then turn the accessories crankshaft pulley bolt through an angle of **115°± 15°**.

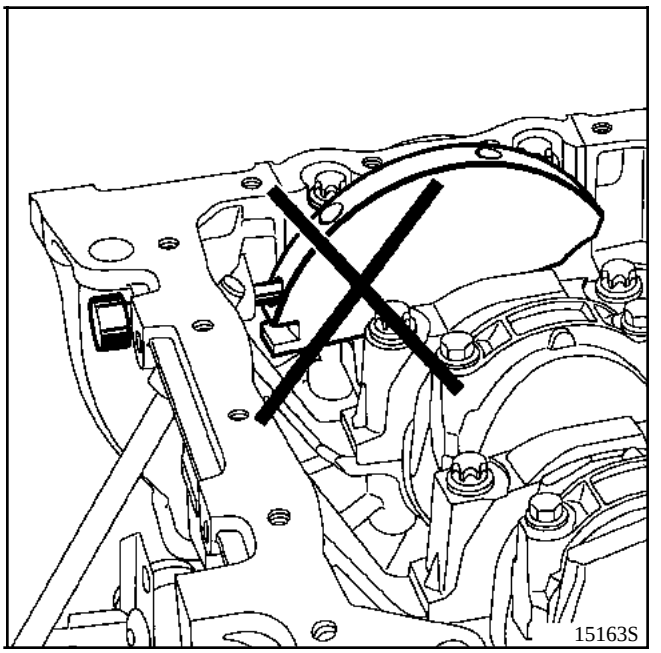


Pin the crankshaft using the marks made by the operator between the camshaft pulleys and the camshaft bearing cap housing. The marks must be aligned as this ensures that the pin is in the pin hole and not in the crankshaft balancing hole.

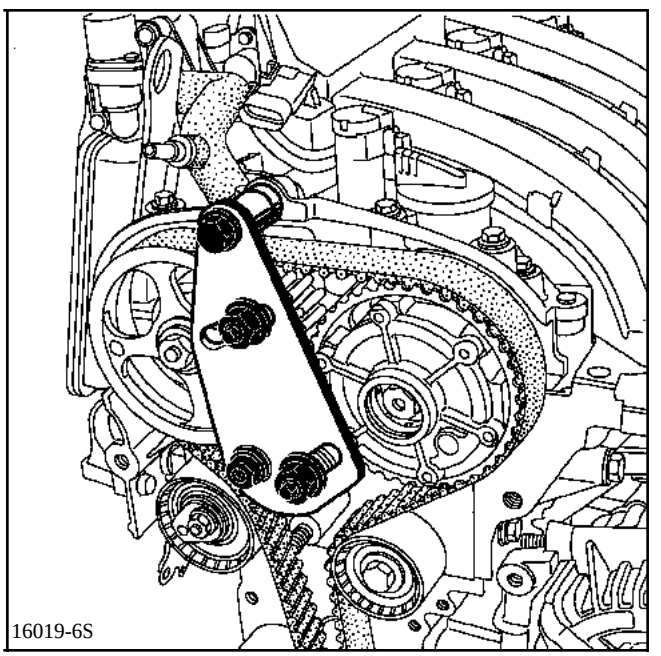
Correct position



Incorrect position



Fit the camshaft pulley immobilising tool **Mot. 1509 fitted with the accessory Mot. 1509-01**.



Tighten the new **inlet** camshaft phase shifter bolt to a torque of **10 daN.m**.

Tighten the **exhaust** camshaft pulley nut to a torque of **3 daN.m**, **then turn through an angle of 86° ± 6°**.

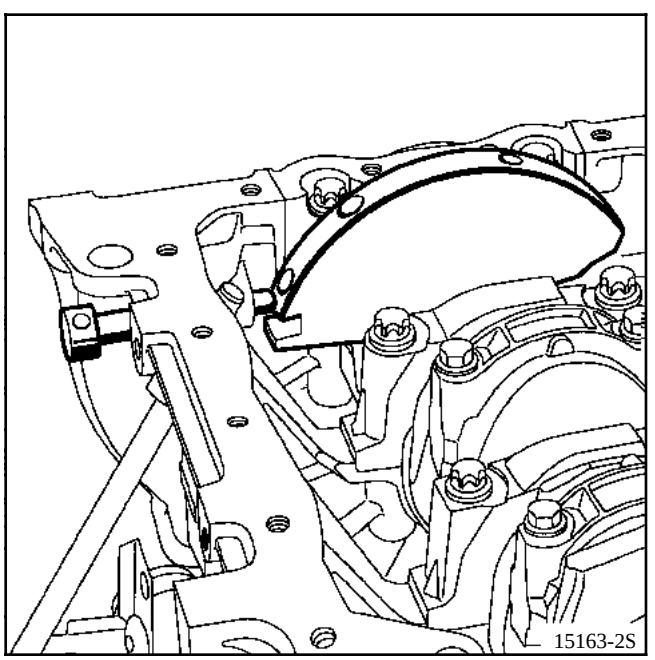
Remove camshaft setting tool **Mot. 1496**, camshaft pulley immobilising tool **Mot. 1509**, and Top Dead Centre pin **Mot. 1054.**

Checking the setting and tension

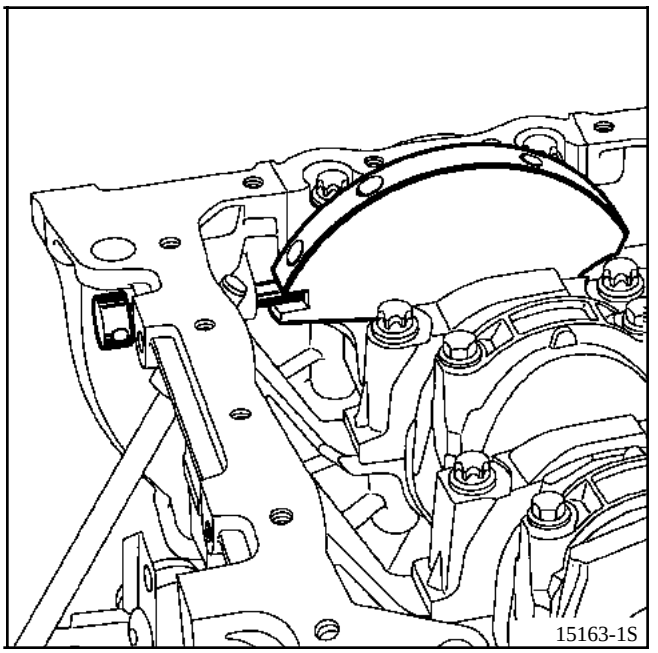
Checking the tension:

Turn the crankshaft two revolutions clockwise (timing end) and before the end of the two revolutions **(that is a half-tooth before alignment of the marks made previously by the operator)**, insert the crankshaft Top Dead Centre pin (to be between the balancing hole and the pinning hole), then move the timing to its setting point.

Before pinning



Pinned crankshaft



Remove the Top Dead Centre pin.

Check that the tensioner marks are correctly aligned and repeat the tensioning procedure if they are not. Slacken the tensioner nut by one revolution maximum while retaining it using a **6 mm** hexagonal wrench.

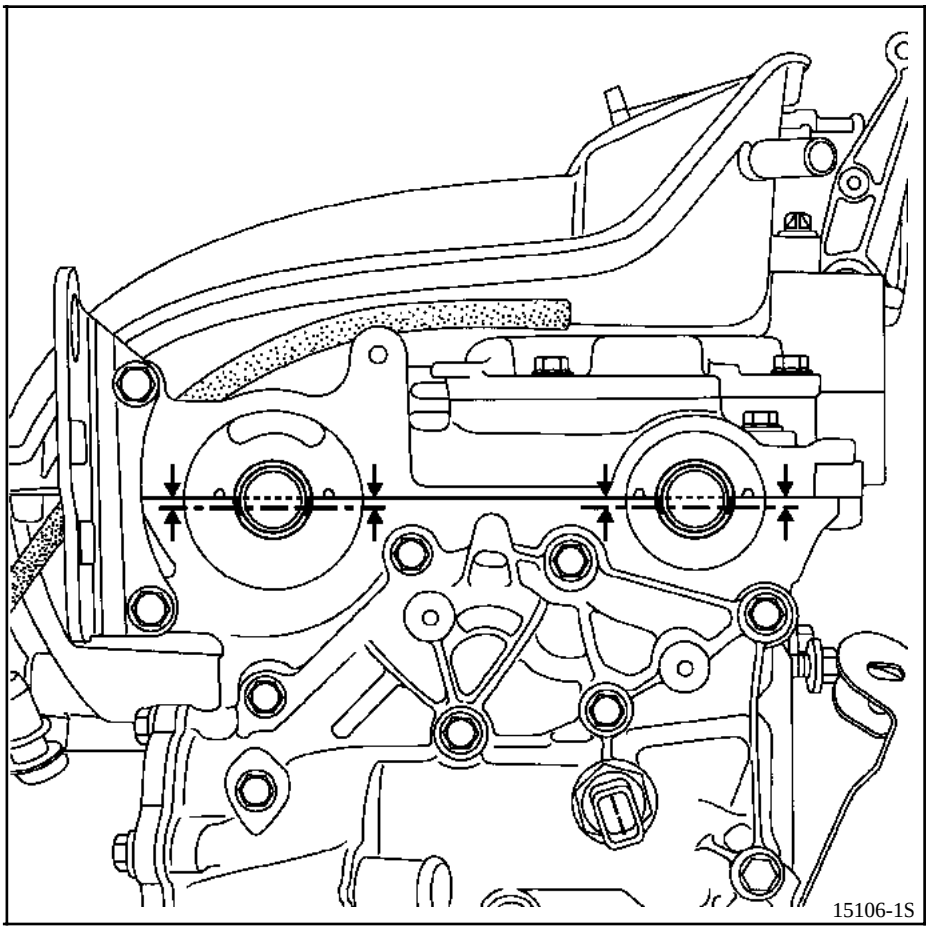
Align the tensioner marks and fully tighten the nut to a torque of **2.8 daN.m**.

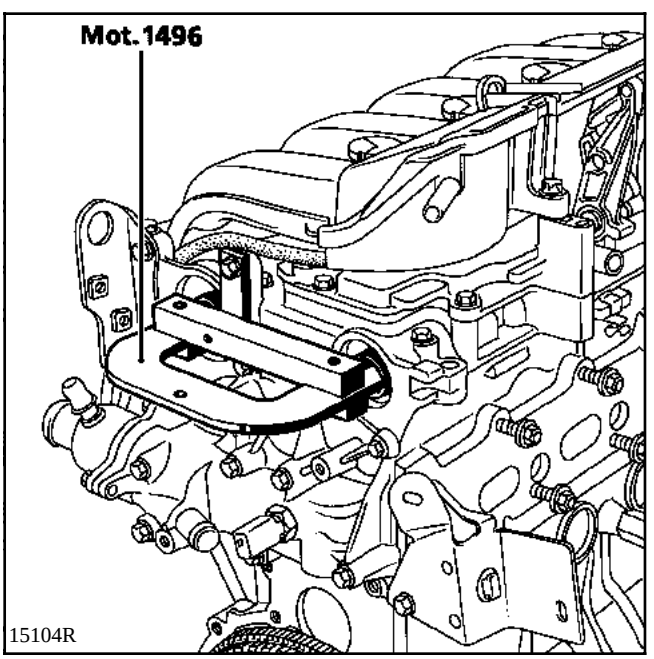
Checking the setting

Ensure that the tensioner marks are positioned correctly before checking the timing setting.

Fit the Top Dead Centre pin (check that the marks made on the camshaft pulleys by the operator are aligned).

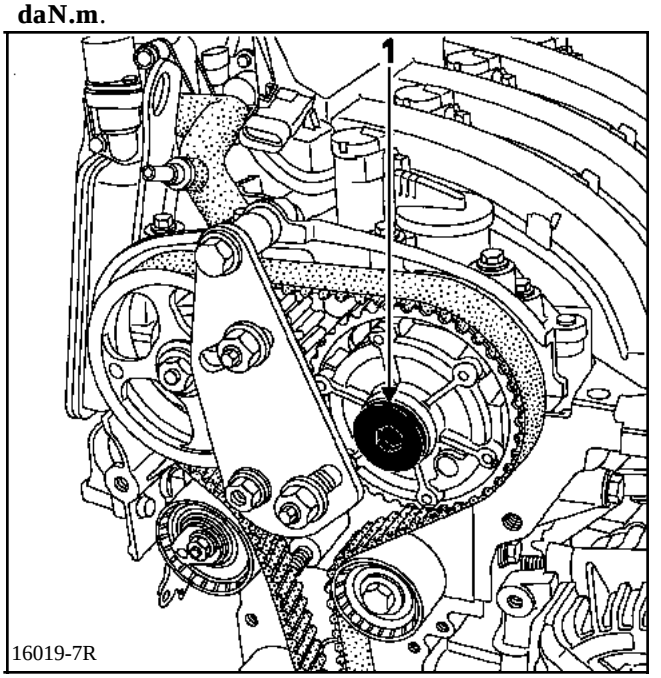
Fit (without using force) camshaft setting tool **Mot. 1496** (the camshaft grooves should be horizontal and offset downwards). If the tool does not engage, the timing setting and tensioning procedure must be repeated.


15106-1S



15104R

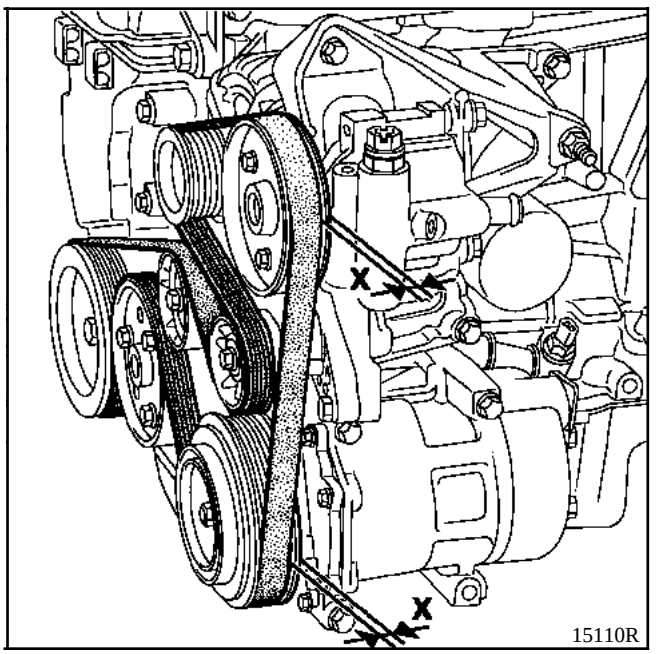
Refit the phase shifter blanking piece (1) (fitted with its new seal) tightening it to a torque of **2.5 daN.m**.



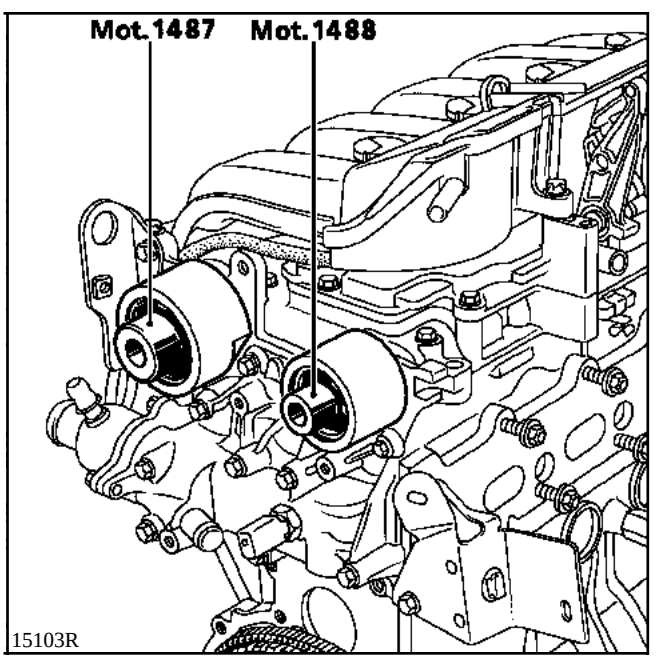
16019-7R

Refit in the reverse order to removal.

When refitting the accessories belt, it is essential to check that the tooth "X" inside the pulleys (timing end) remains "free".



Fit the new sealing plugs:
- of the inlet camshaft **(Mot. 1487)**,
- of the exhaust camshaft **(Mot. 1488)**.



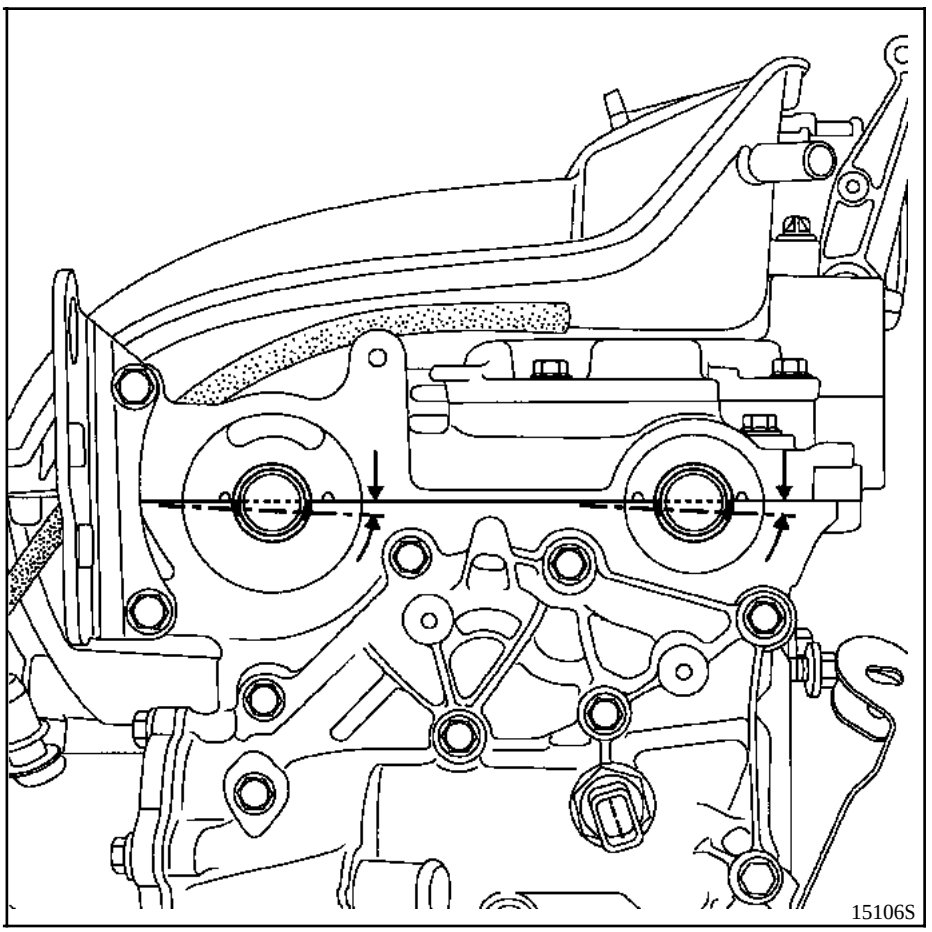
2nd PROCEDURE

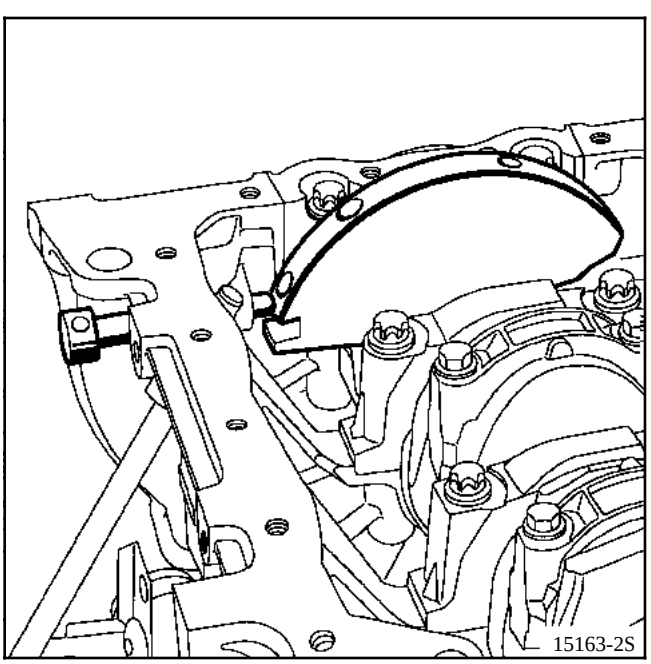
The second procedure is applied in the event of replacement of any components on the timing face which do not require slackening of the exhaust camshaft pulley and of the inlet camshaft phase shifter.

For removal of the accessories belt and the timing covers, refer to the beginning of the first procedure.

Setting the timing

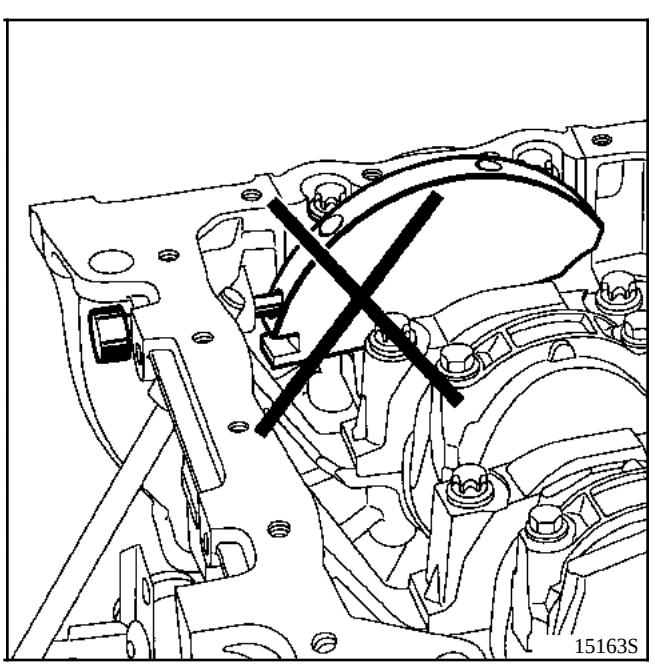
WARNING: it is essential to degrease the end of the crankshaft, the bore and the contact surfaces of the crankshaft pinion and the contact surfaces of the crankshaft pulley to prevent sliding between the timing and the crankshaft which could destroy the engine. Position the camshaft grooves downwards and almost horizontal as indicated in the diagram below, then insert the Top Dead Centre pin Mot. 1054 to be between the balancing hole and the crankshaft setting groove.





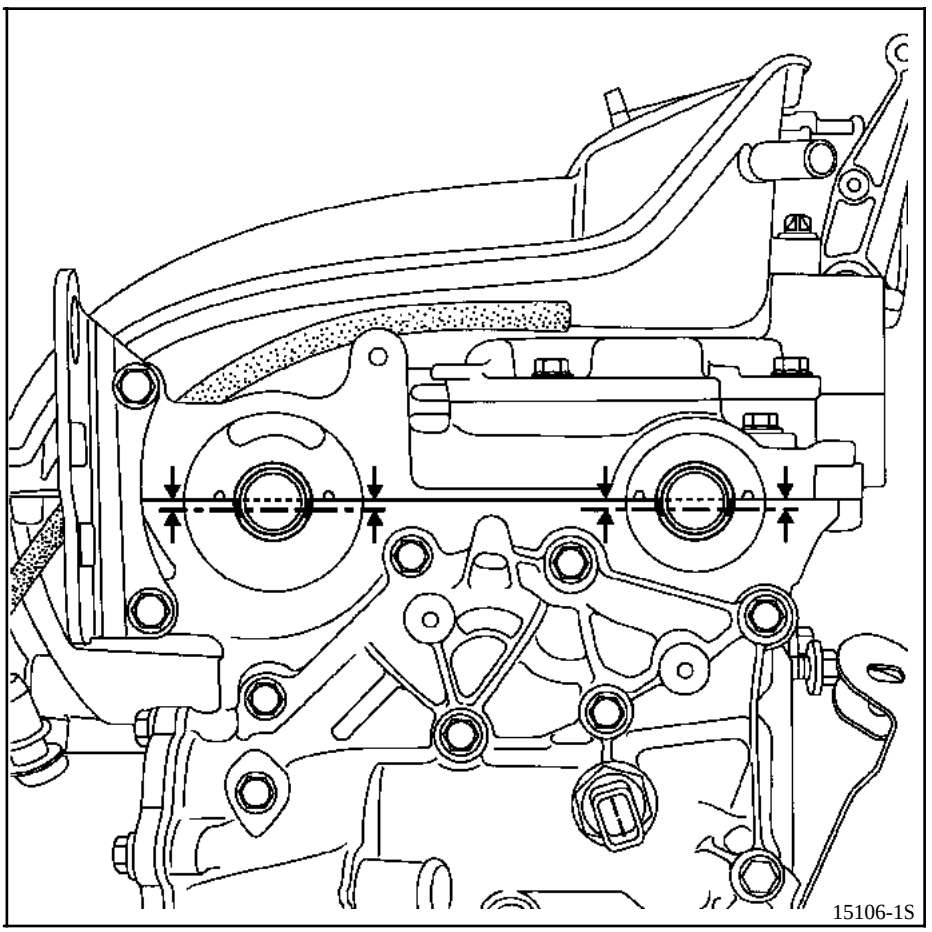
NOTE: this is to avoid pinning the crankshaft in the balancing hole.

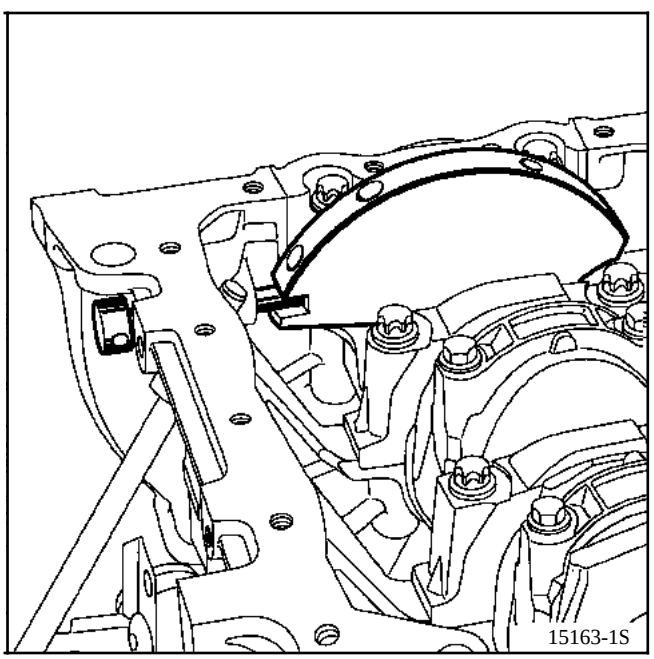
Incorrect position



Turn the engine clockwise (timing end), to the timing setting point.

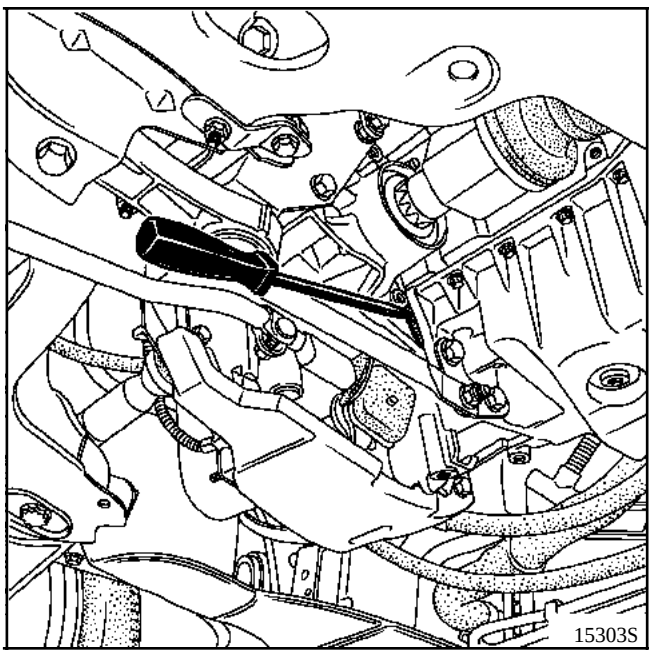
The camshaft grooves should be horizontal and offset downwards as indicated on the diagram opposite.





Remove the Top Dead Centre pin.

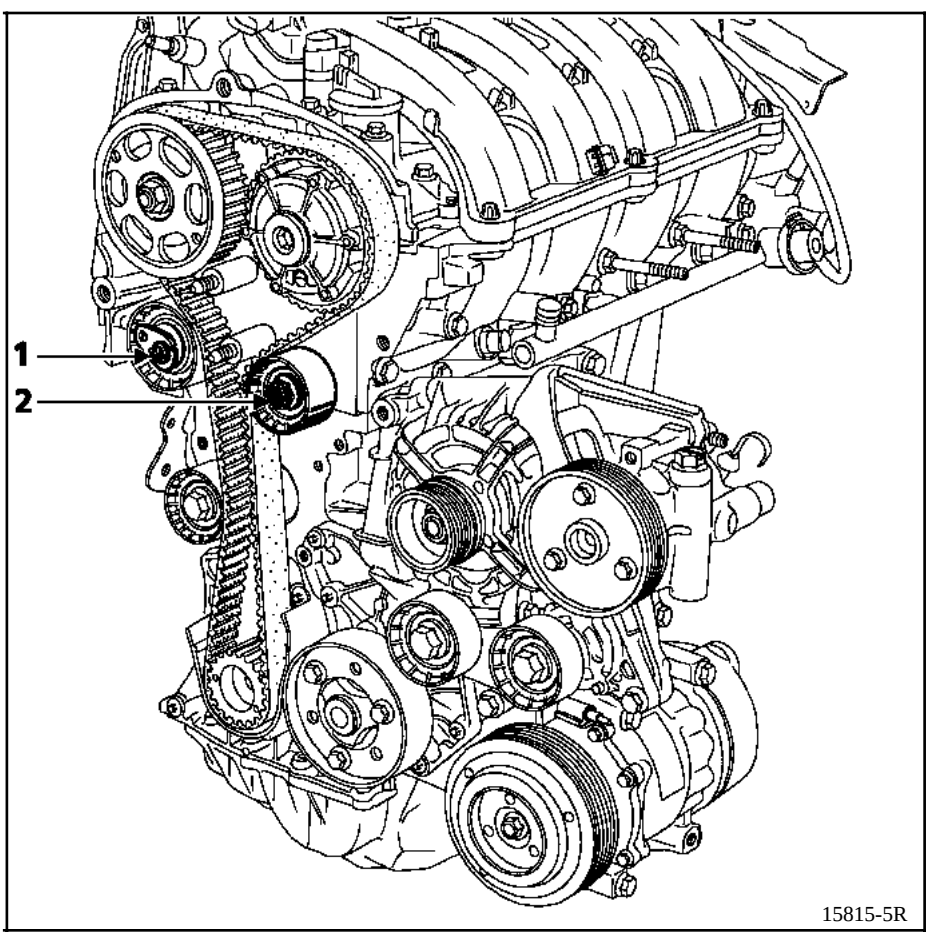
Immobilise the engine flywheel using tool **Mot. 582-01 or a large screwdriver.**



Remove the accessories crankshaft pulley.

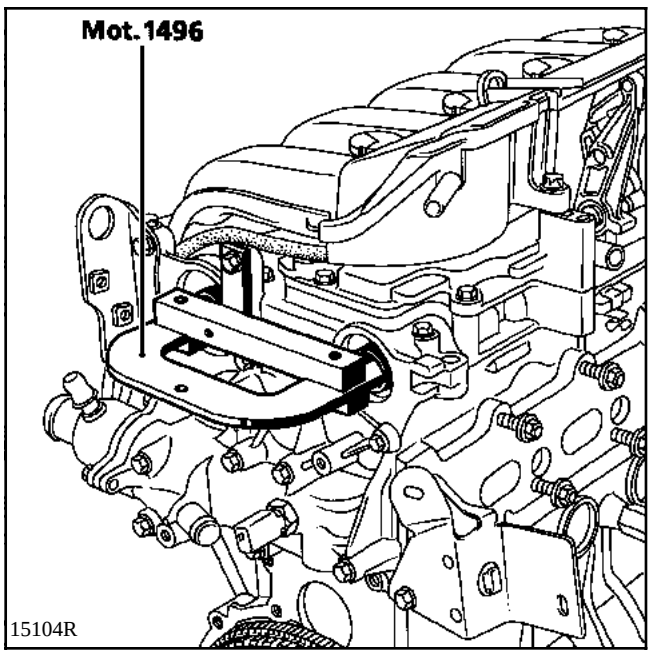
Slacken the timing tensioner by unscrewing nut (1).

Remove the pulley (2).

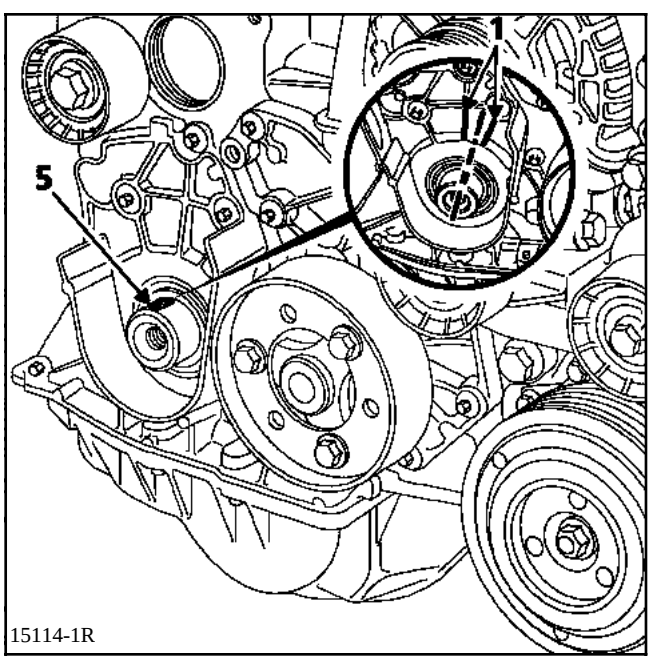


Remove the timing belt.

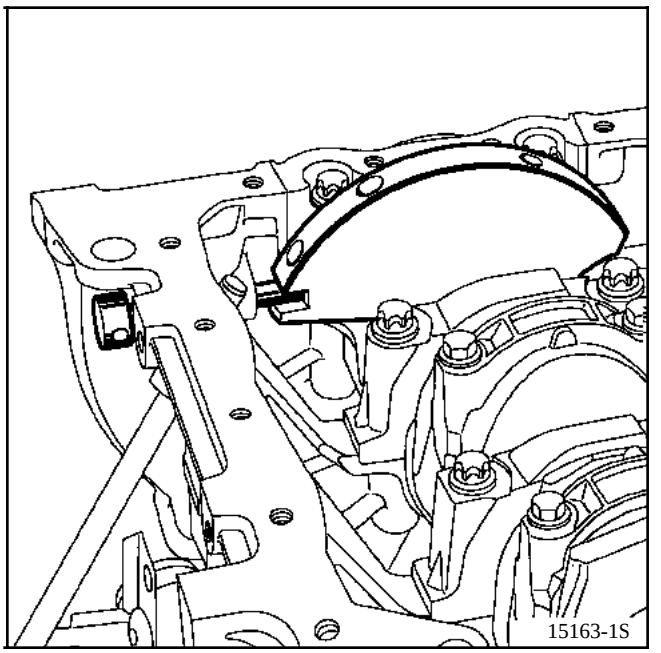
Fit tool **Mot. 1496**, which is secured at the end of the camshafts.



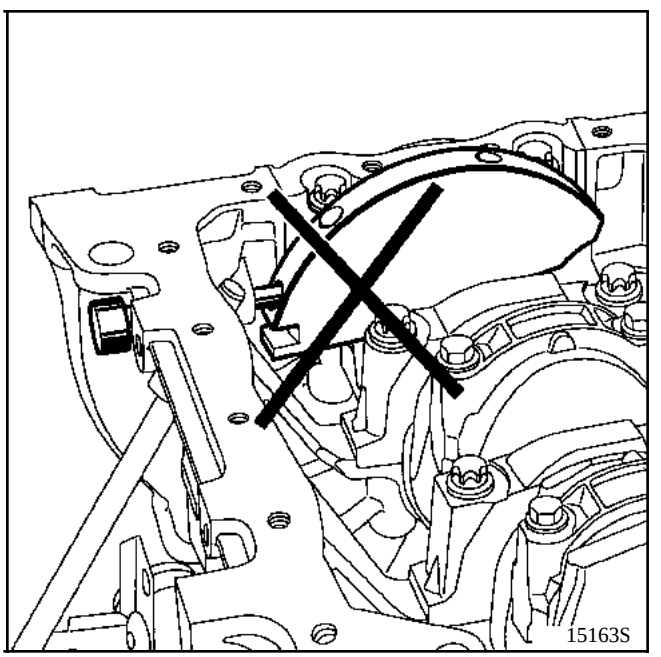
Check that the crankshaft is correctly pinned at Top Dead Centre and not in the balancing hole (1) (crankshaft groove (5) should be between the two ribs (1) of the crankshaft closing cover).



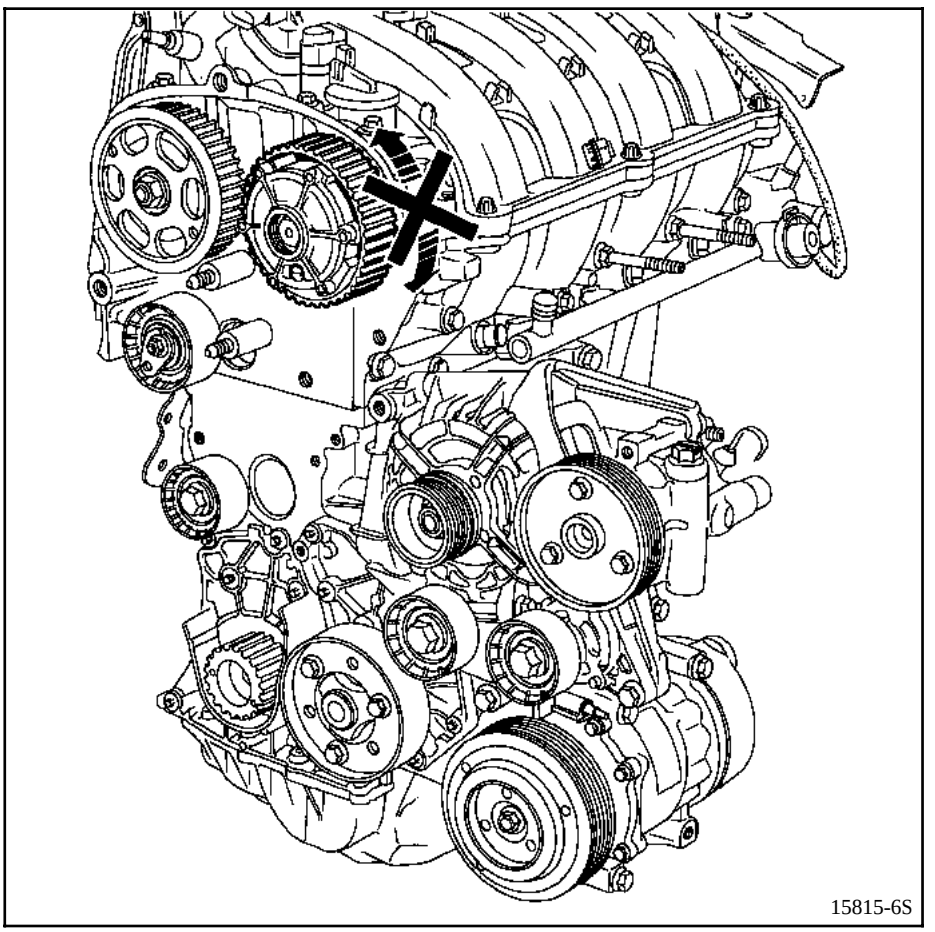
Pinned crankshaft



Incorrect position



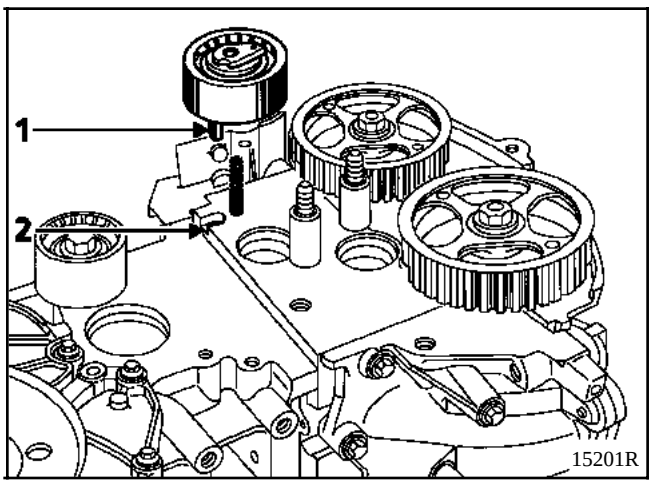
Also check that the inlet camshaft phase shifter crown wheel is immobilised correctly (no rotation of the crown wheel to the left or to the right).



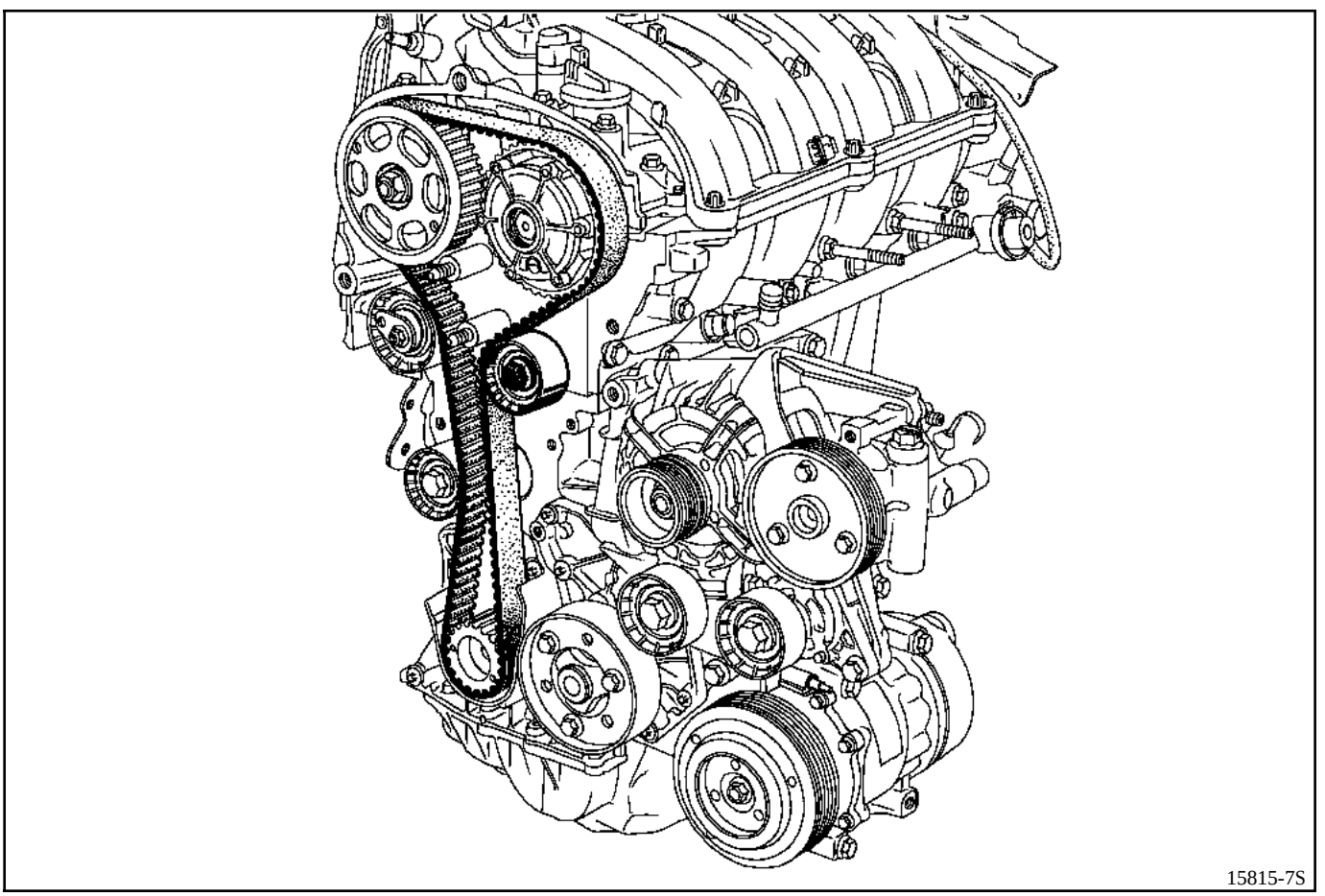
When a timing belt is changed, it is essential to change the timing tensioners and pulleys.

Check that the tensioner lug (1) is correctly positioned in the groove (2).

WARNING: it is essential to degrease the end of the crankshaft, the bore and the contact surfaces of the crankshaft pinion, the contact surfaces of the crankshaft pulley to prevent sliding between the timing and the crankshaft which could destroy the engine.



Refit:
- the timing belt,

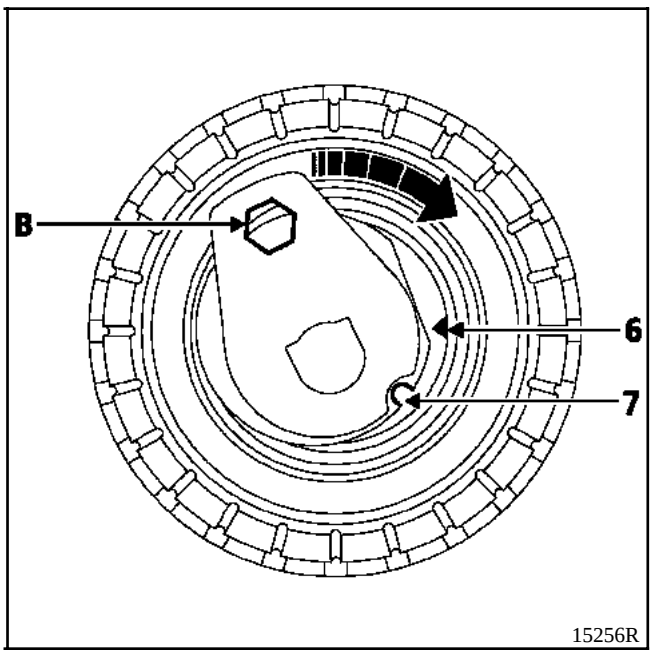


- the crankshaft accessories pulley, pretightening the bolt **(without fully tightening the bolt, clearance of 2 to 3 mm between bolt/pulley)**.

NOTE:
- the accessories crankshaft pulley bolt can be reused if the length under the head does does exceed **49.1 mm** (otherwise change it),
- do not oil a new bolt. However, if the old bolt is reused, it is essential to oil the threads and under the head.

NOTE: do not turn the tensioner anti-clockwise.

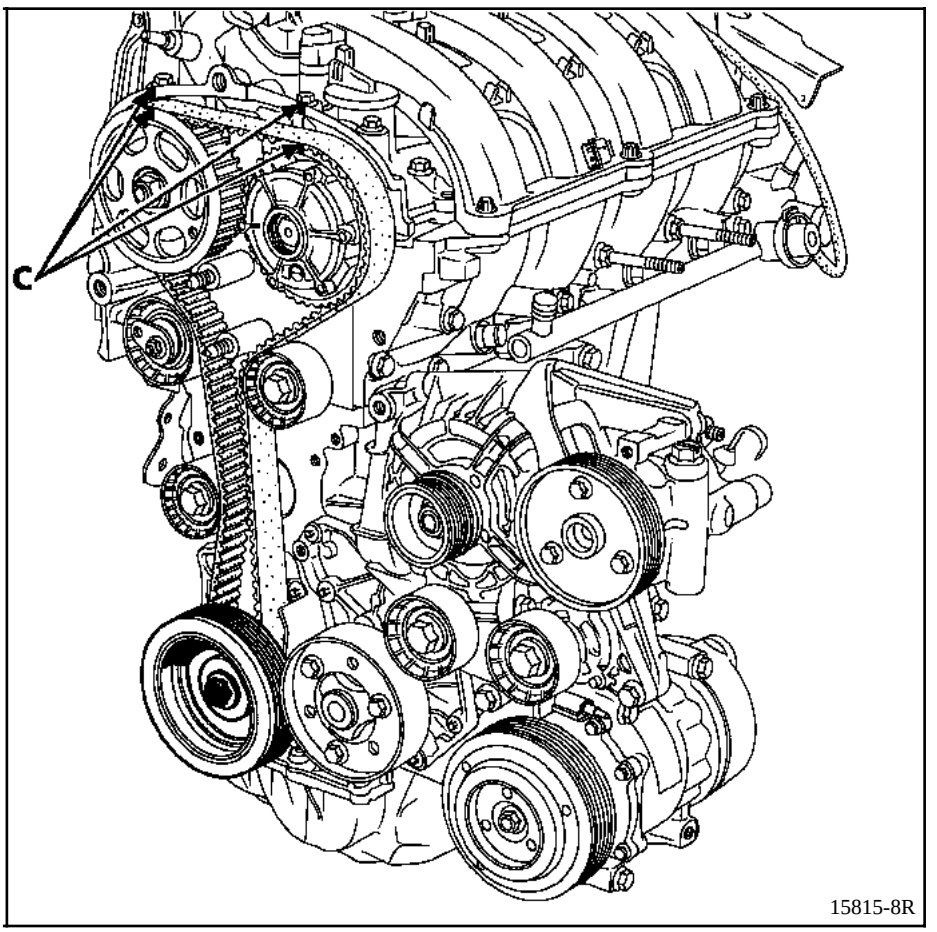
Align tensioner marks (6) and (7) using a **6 mm** hexagonal wrench at (B).



Pretighten the tensioner nut to a torque of **0.7 daN.m.**

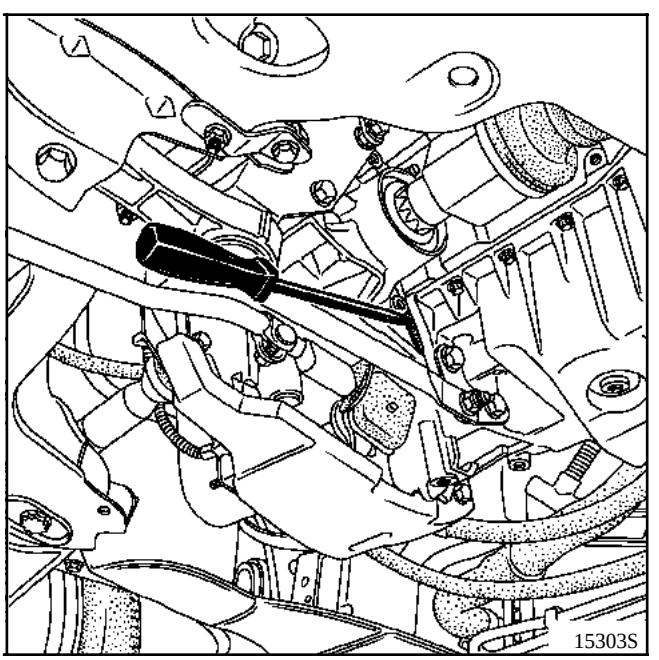
Tighten the accessories crankshaft pulley bolt to a torque of **2 daN.m (Top Dead Centre pin still in place in the crankshaft).**

Make a mark (C) on the inlet camshaft phase shifter crown wheel and the exhaust pulley in relation to the camshaft bearing cap housing.

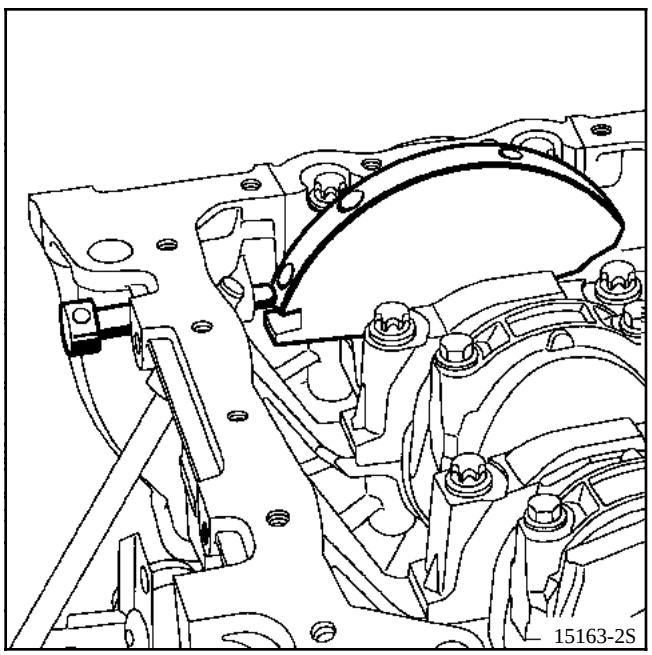


Remove camshaft setting tool **Mot. 1496** and Top Dead Centre pin **Mot. 1054**.

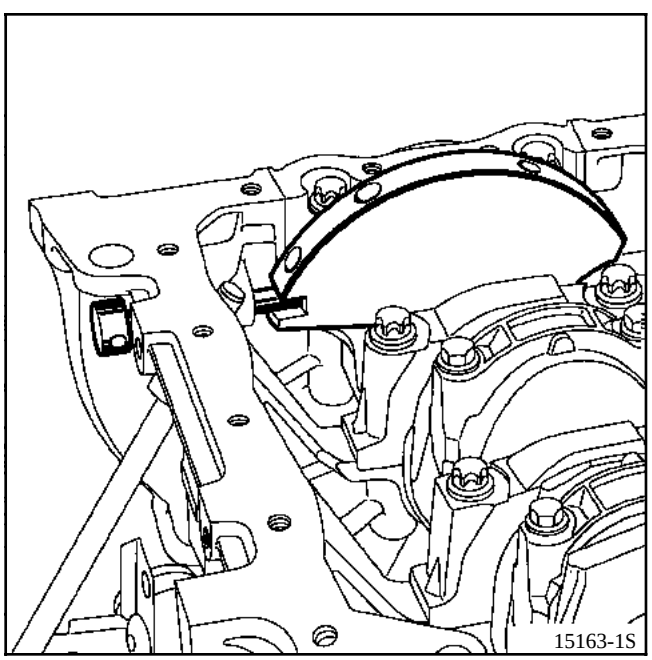
Carry out the angular tightening of the crankshaft pulley bolt to **115**°± **15**°, while immobilising the engine flywheel using a large screwdriver or tool **Mot. 582-01**.



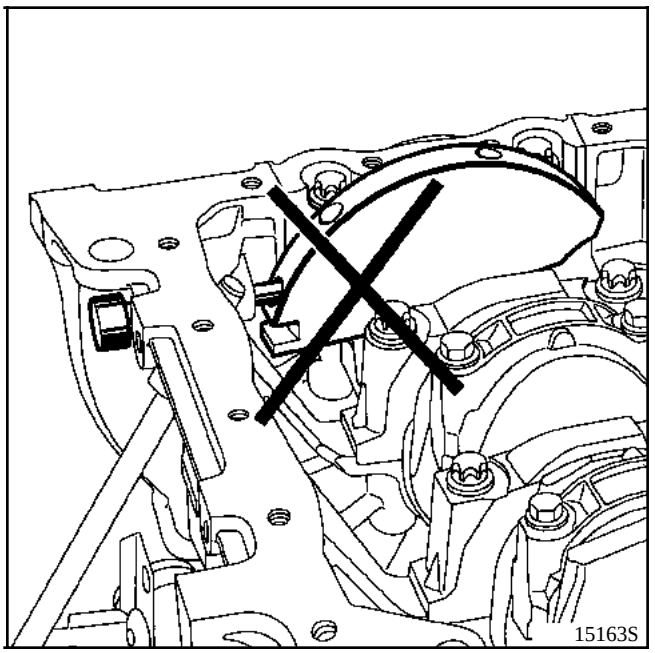
Turn the crankshaft two revolutions clockwise (timing end) and before the end of the two revolutions **(that is a half-tooth before alignment of the marks made previously by the operator)**, insert the crankshaft Top Dead Centre pin (to be between the balancing hole and the pinning hole), then move the timing to its setting point.



Correct position



Incorrect position



Remove Top Dead Centre pin **Mot. 1054**.

Check that the tensioner marks are correctly aligned and repeat the tensioning procedure if they are not. Slacken the tensioner nut by one revolution maximum while retaining it using a **6 mm** hexagonal wrench.

Align the tensioner marks and fully tighten the nut to a torque of **2.8 daN.m**.

Checking the setting and the tension

Checking the tension:

Turn the crankshaft two revolutions clockwise (timing end) and before the end of the two revolutions **(that is a half-tooth before alignment of the marks made previously by the operator)**, insert the crankshaft Top Dead Centre pin.

Remove Top Dead Centre pin **Mot. 1054**.

Check that the tensioner marks are correctly aligned and repeat the tensioning procedure if they are not. Slacken the tensioner nut by one revolution maximum while retaining it using a **6 mm** hexagonal wrench.

Align the tensioner marks and fully tighten the nut to a torque of **2.8 daN.m**.

Checking the setting

Ensure that the tensioner marks are positioned correctly before checking the timing setting.

Fit the Top Dead Centre pin (check that the marks made on the camshaft pulleys by the operator are aligned).

Fit (without using force) camshaft setting tool **Mot. 1496** (the camshaft grooves should be horizontal and offset downwards). If the tool does not engage, the timing setting and tensioning procedure must be repeated.