

REFITTING : ENGINE TOP (INDIRECT INJECTION)

URGENT : Follow the safety instructions ⓘ.

CAUTION : This procedure is intended for the replacement of faulty internal components of the cylinder head. If the cylinder head is damaged, replace it with a new cylinder head assembly.

Tooling ⓘ.

Refitting of valves ⓘ.

Refitting of valve rockers and tappets ⓘ.

Refitting of camshafts ⓘ.

Refit the cylinder head ⓘ.

Refitting of the timing ⓘ.

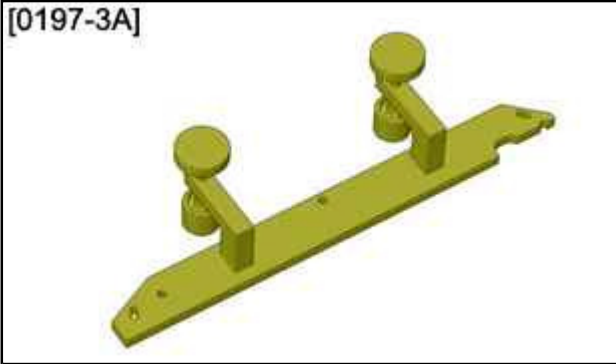
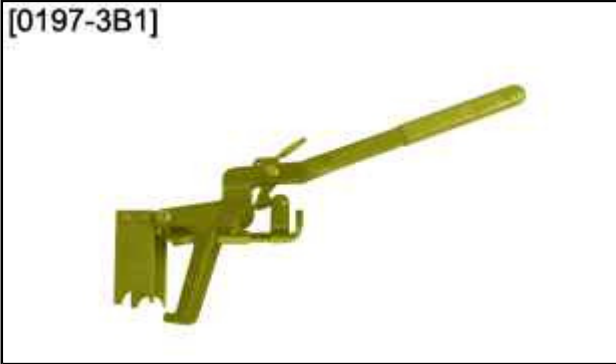
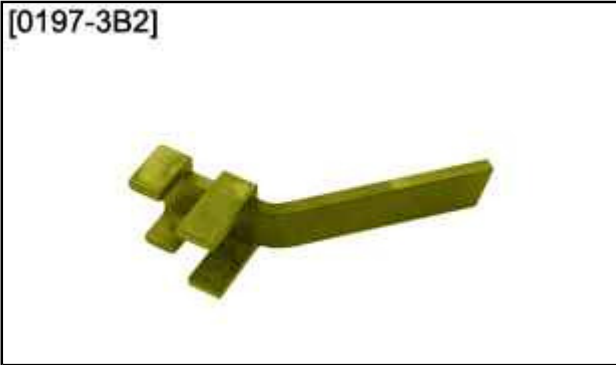
Re-assembling the cylinder head ⓘ.



1. Tooling

Equipment :

- Cylinder head support (type FACOM U.43)
- Valve spring compressor (type FACOM U.43 LA)
- Cup thrust pad (type FACOM SP 18380)

tool	Reference	Designation
	[0197-A3]	Inlet camshaft immobilisation and setting tool
	[0197-A1]	Exhaust camshaft immobilisation and setting tool
	[0197-B]	Crankshaft setting rod
	[0197-A4]	Fixing bolt of the tools [0197-A1], [0197-A3]
	[0197-E]	Timing chain retaining tool
Figure : E5AB0S8T	[0197-3A]	Camshaft retaining tool

<p>[0197-3A]</p>  <p>Figure : E5AB064T</p>		
<p>[0197-3B1]</p>  <p>Figure : E5AB065T</p>	[0197-3B1]	Spring compression clamp
<p>[0197-3B2]</p>  <p>Figure : E5AB066T</p>	[0197-3B2]	Tool for holding on vice
	[0197-3C]	Fitting tool

<div data-bbox="170 231 782 592"><p>[0197-3C]</p></div> <p data-bbox="170 598 341 630">Figure : E5AB067T</p>		
<div data-bbox="170 747 782 1108"><p>[0197-F]</p></div> <p data-bbox="170 1115 341 1146">Figure : E5AB0U3T</p>	<p>[0197-F]</p>	<p>valve stem seal fitting tool</p>

2. Refitting of valves

2.1. Refitting of valve stem seals

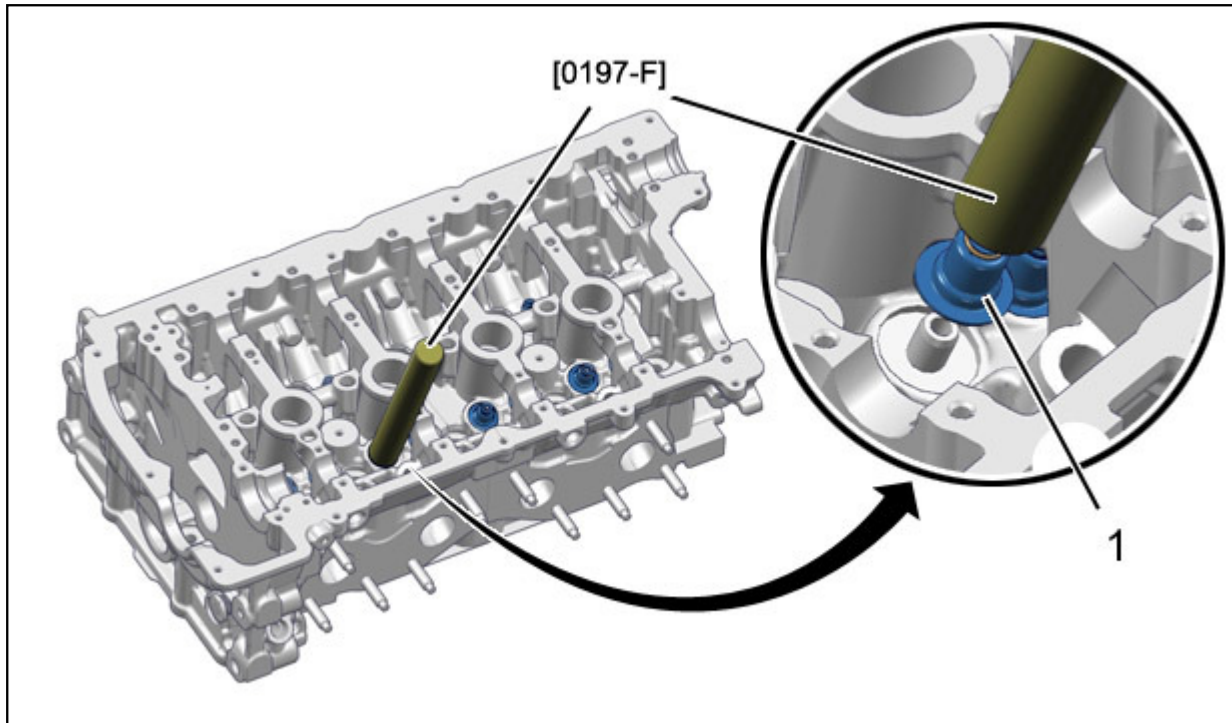


Figure : B1BG1YSD

The valve stem seals have to be put in place by hand.
Refit the valve stem seals (1) (new) ; Using tool [0197-F].

2.2. Refitting of valve springs

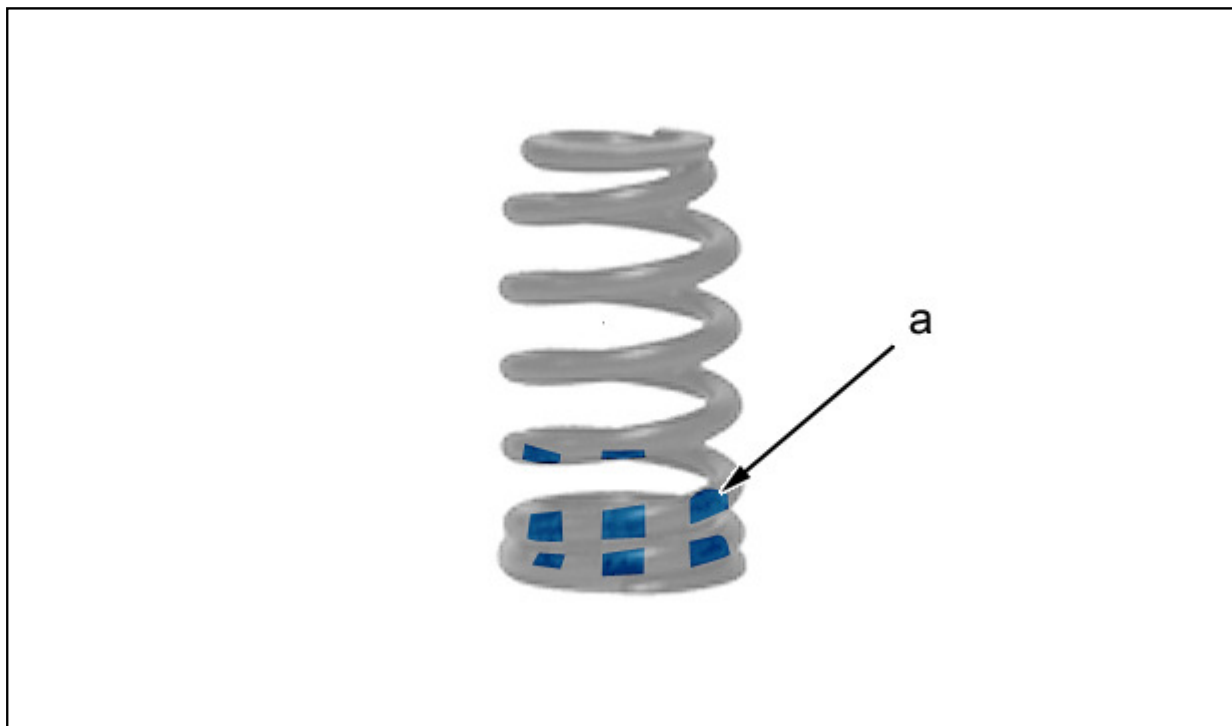


Figure : B1BG1YTD

N.B. : Direction of fitting of the valve springs indicated by a paint marking facing the cylinder head (at "a").

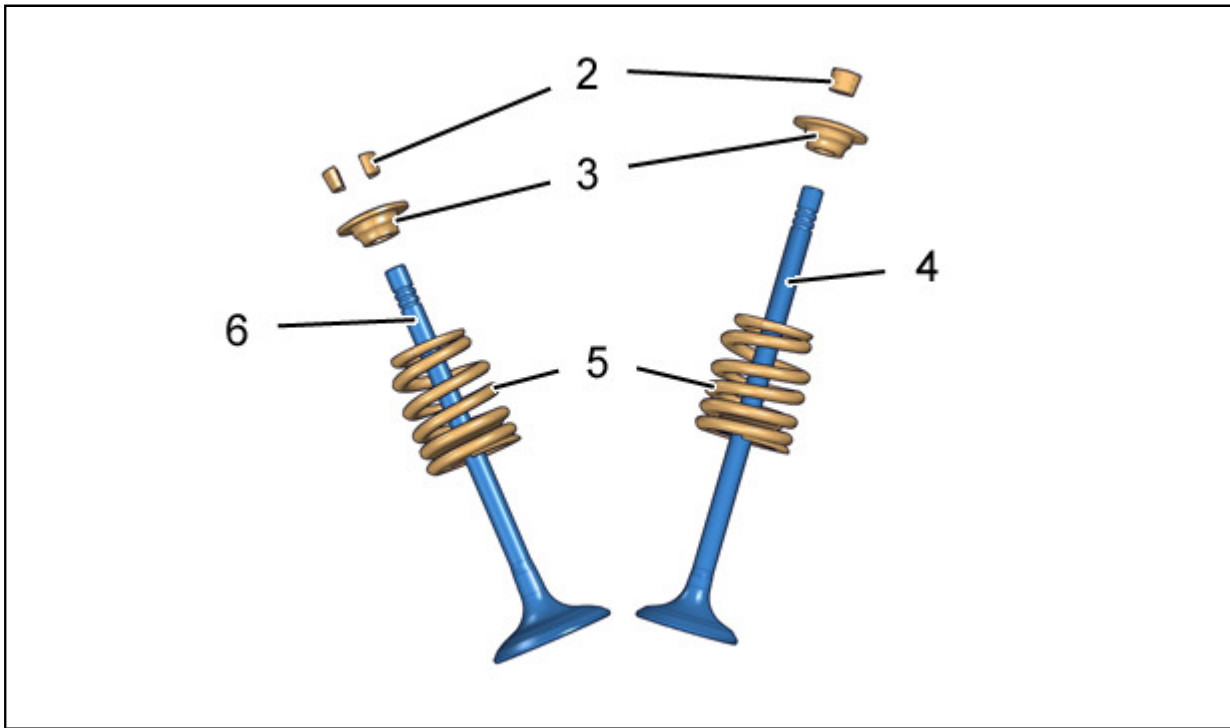


Figure : B1BG1YUD

CAUTION : The exhaust valves are longer than the inlet valves.

CAUTION : If replacing the valves, the valve journals have to be bedded in.

Lubricate the valve rods on refitting.

N.B. : Do the refitting of the springs, upper cups, valves, half-cones valve by valve; do not interchange the components of each assembly.

Fit :

- The intake valves (6)
- The outlet valves (4)
- The valve springs (5)

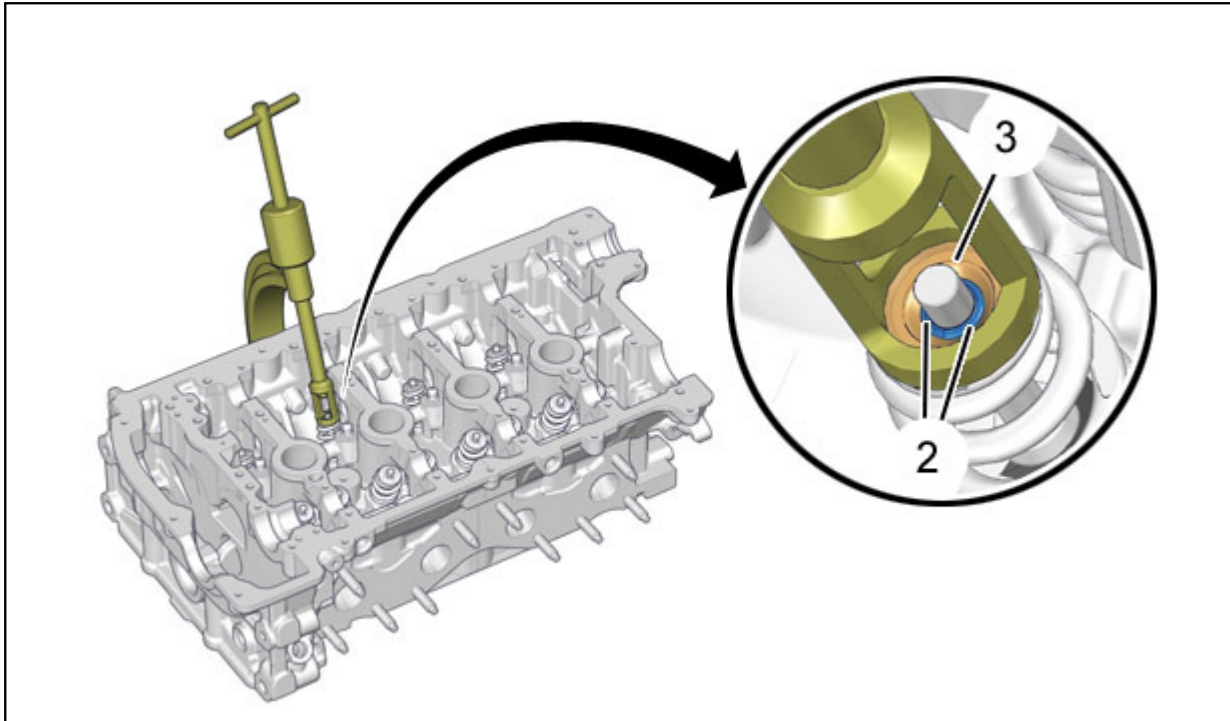


Figure : B1BG1YYD

CAUTION : Keep to the correct positions for the inlet valves and exhaust valves.

Refit the upper cup (3).
Place the tool FACOM SP 18380 on the upper cup (3).
Compress the valve springs ; Using tool FACOM SP 18380.
Refit the valve half-cones (2).

3. Refitting of valve rockers and tappets

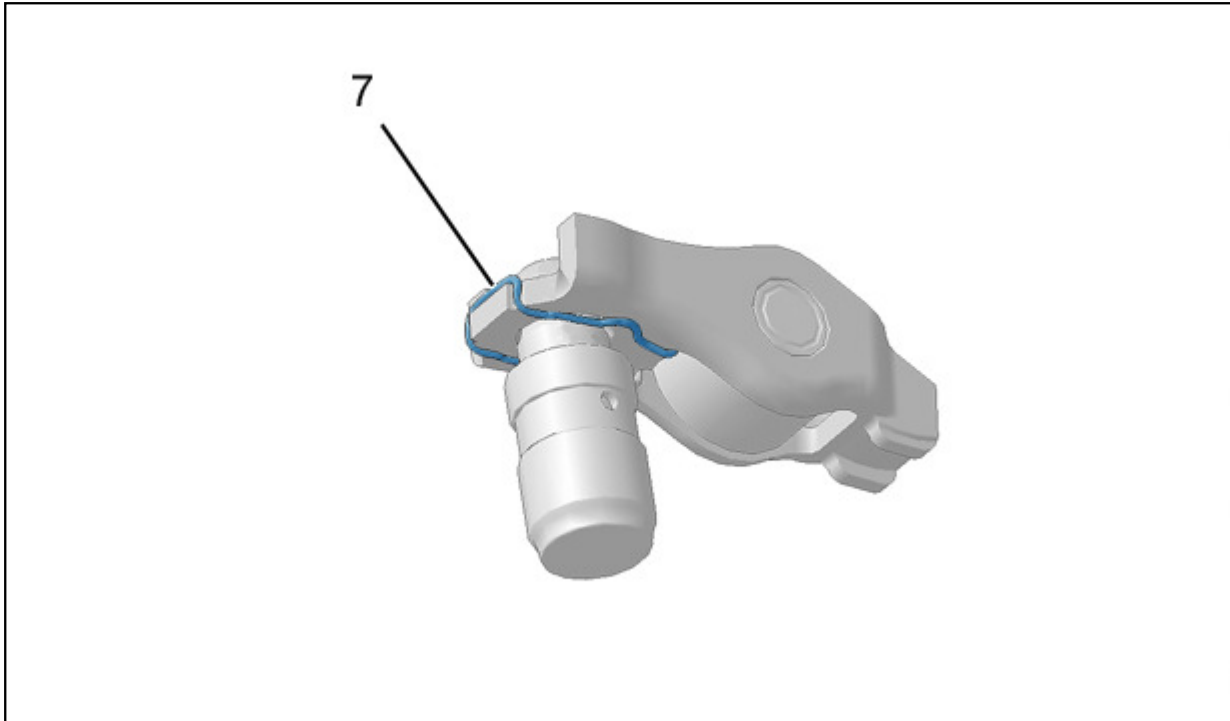


Figure : B1BG1Z6D

Check that the clips (7) are present on the valve rockers .

CAUTION : The clip (7) must not be distorted in any circumstances ; A clip that is deformed, even slightly, risks failure to retain the cam followers in position relative to the hydraulic tappets .

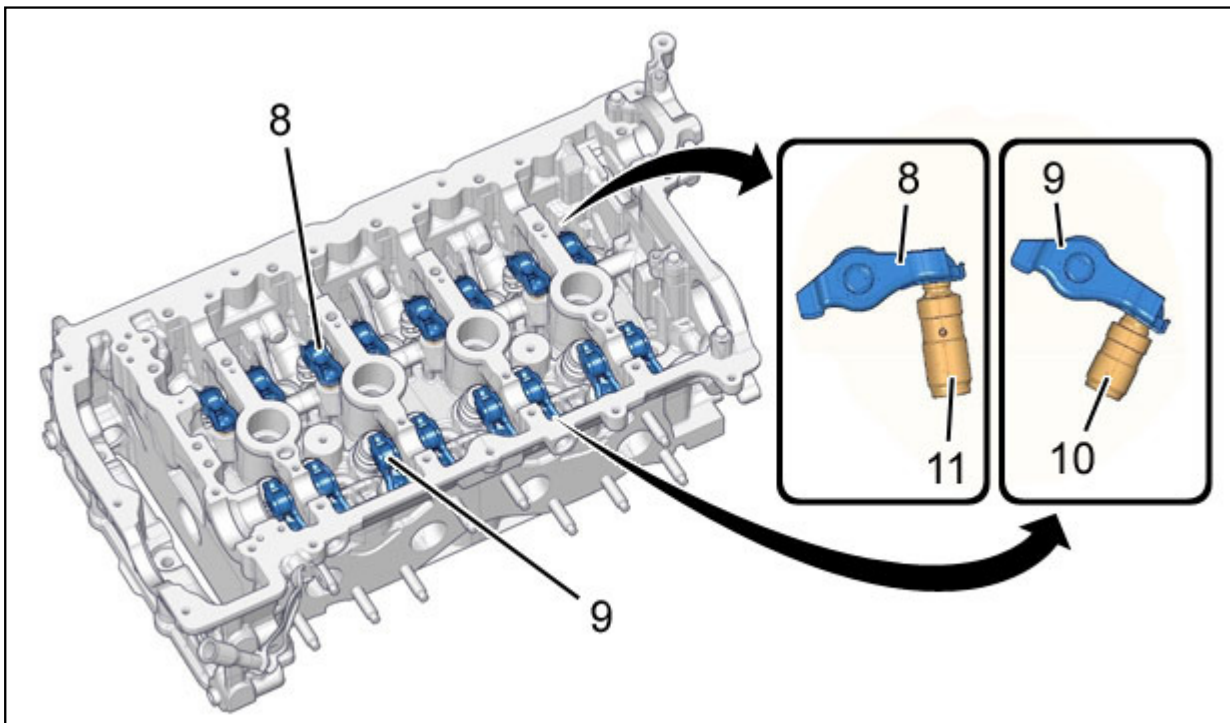


Figure : B1BG1Z8D

N.B. : Oil the hydraulic tappets prior to refitting.

CAUTION : The inlet and exhaust hydraulic tappets have different lengths.

Hydraulic inlet tappet : Long (11).

Hydraulic exhaust tappet : Short (10).

Refit the hydraulic cam followers (10), (11).

N.B. : Keep to the original positions for the hydraulic tappets.

Fit :

- The inlet rockers (8) fitted with the tappets (11)
- The exhaust rockers (9) fitted with the tappets (10)

Take care with the positioning of each valve rocker/tappet assembly.

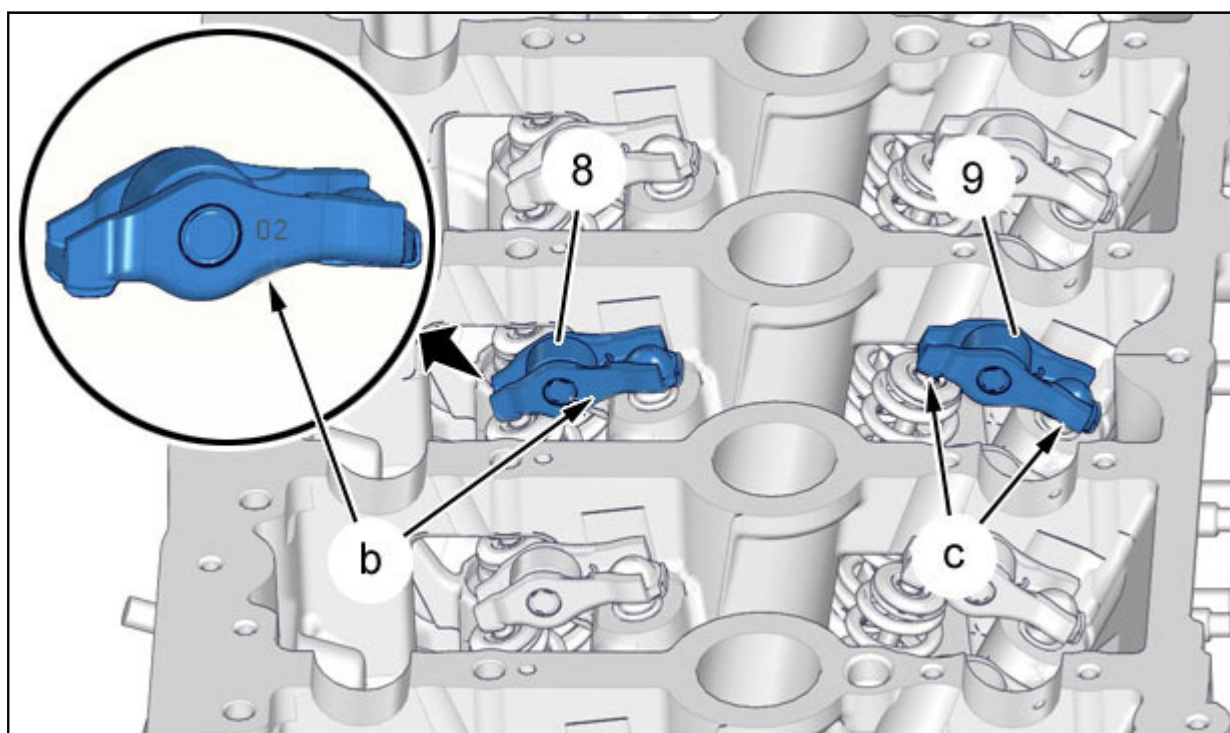


Figure : B1BG1ZBD

CAUTION : The inlet valve rockers (8) are specifically classed by valve ; Marking at "b".

If refitting the same rockers, keep to their original positions.

If replacing one or more inlet valve rockers, observe the marking (at "b") on the valve rocker to be replaced.

CAUTION : The inlet valve rockers are available in 5 different classes (1 to 5) but must be refitted identically.

N.B. : Do not take account of the valve rocker class marked (at "b"), exhaust side (9).

If refitting the same rockers, keep to their original positions.

If replacing one or more exhaust valve rockers , valve rockers of any class can be fitted regardless.

N.B. : Oil the valve rockers (at "c").

4. Refitting of camshafts

4.1. Refitting of eccentric shaft

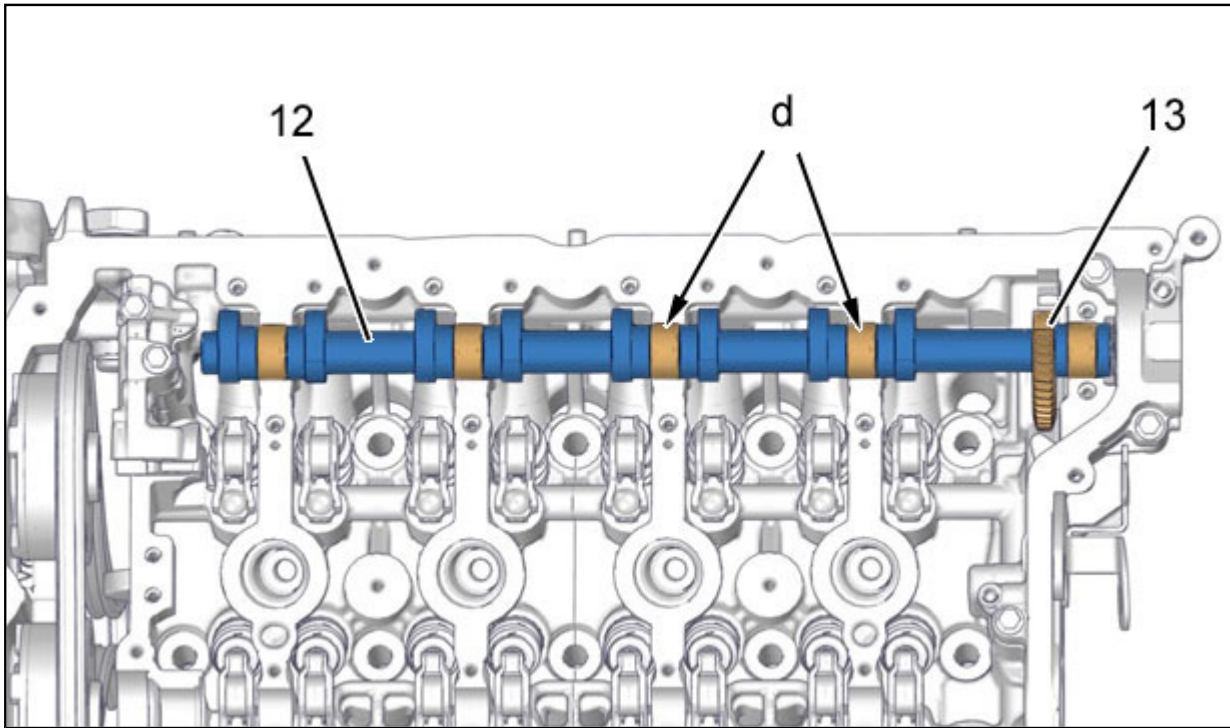


Figure : B1BG1ZID

Refit the eccentric shaft (12).

Check the condition of the needle bearings (at "d") : The eccentric shaft should rotate freely. If there is a tight spot, replace the eccentric shaft .

N.B. : Oil the toothed wheel (13).

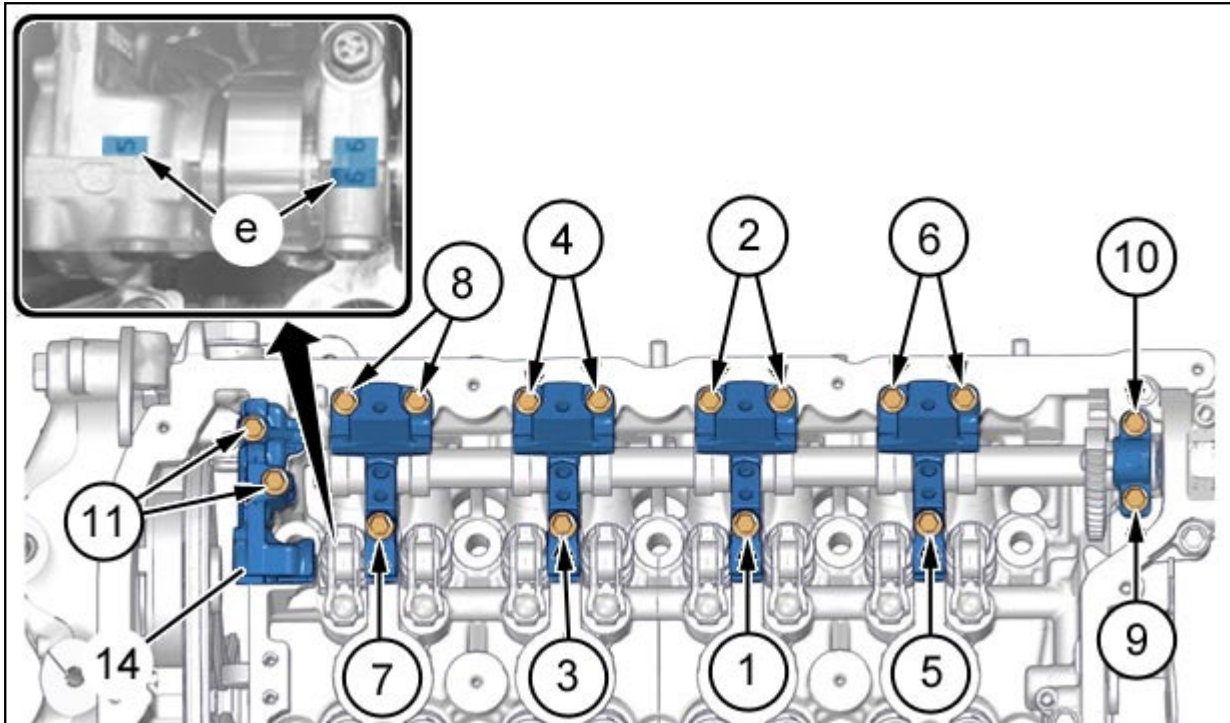


Figure : B1BG1ZQD

CAUTION : Follow the tightening sequence.

Clean oil out of the threads receiving the camshaft/eccentric shaft bearing caps.
Oil the inlet camshaft/eccentric shaft bearings (14).

CAUTION : Work to the markings on the inlet camshaft/eccentric shaft bearings (14) (at "e") ; From 5 to 9.

Refit the inlet camshaft/eccentric shaft bearings (14) ; Tighten to the specified torque.

4.2. Refitting the variable lift valve rockers

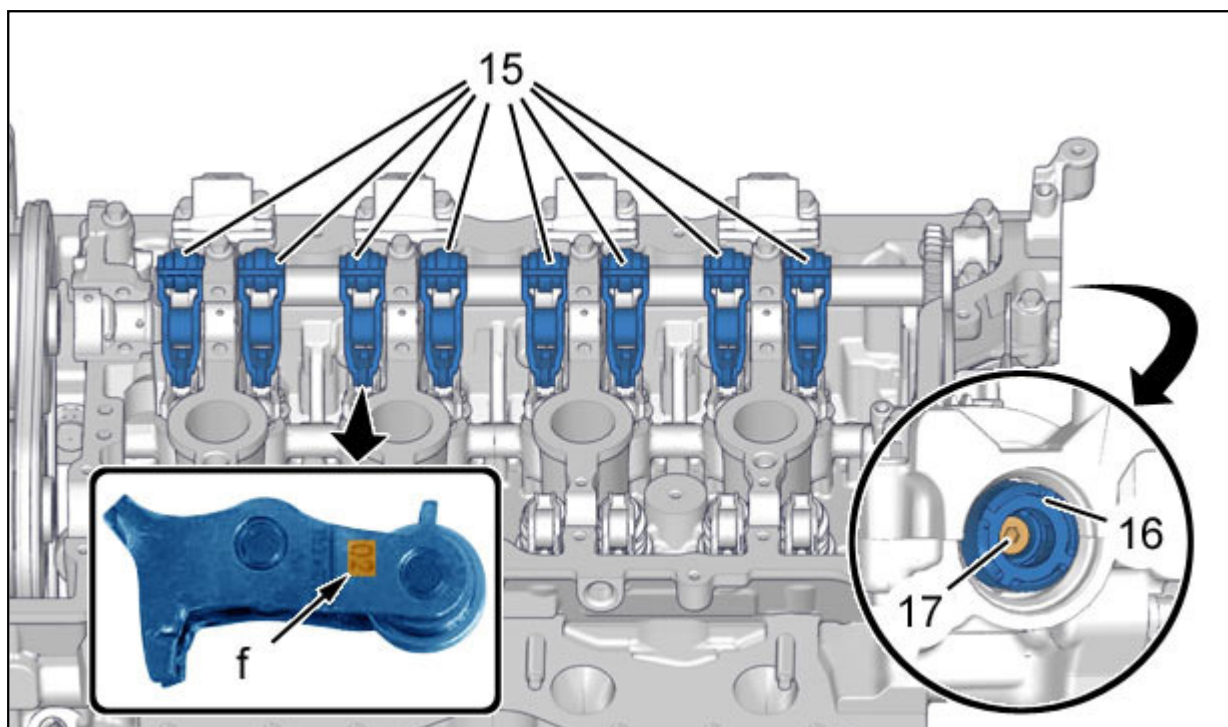


Figure : B1BG1ZRD

CAUTION : The variable lift valve rockers (15) are specifically classed by cylinder head.

If refitting the same rockers, keep to their original positions.

If replacing the valve rockers, keep to the markings (at "f").

CAUTION : The original valve rockers are classed from 0 to 5 (6 classes); the end classes 0 and 5 are not available as replacement parts.

If a cylinder head that has 8 intermediate valve rockers has one or more faulty parts, all 8 intermediate valve rockers must be replaced with 8 parts of the same class.

If the class of valve rockers to be replaced is 0 or 5, all 8 intermediate valve rockers must be replaced with 8 parts of the nearest class (respectively class 1 and 4).

CAUTION : In all cases, the 8 valve rockers must be of the same class.

Oil the variable lift valve rockers (15).

Fit :

- The variable lift valve rockers (15)
- The eccentric shaft target (16)
- The (17) bolt ; Tighten to the specified torque

4.3. Refitting the camshaft seals

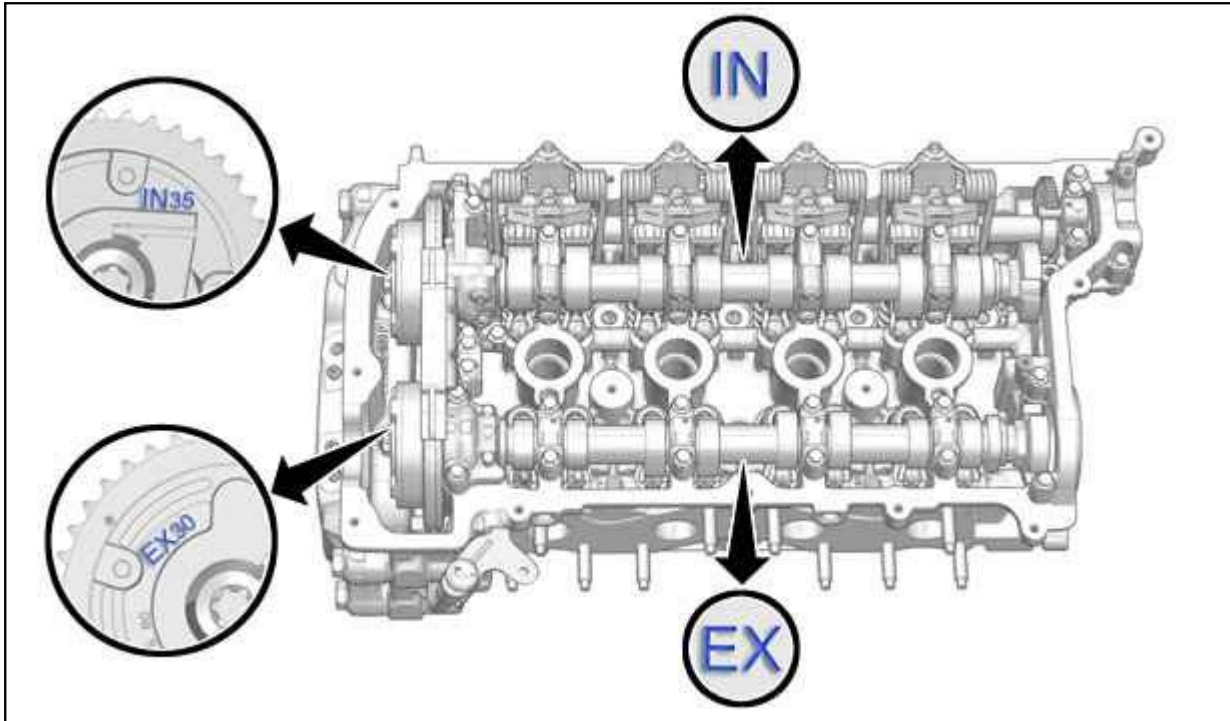


Figure : B1EG0CRD

CAUTION : The two camshafts have different markings.

IN : Inlet.
EX : Exhaust.

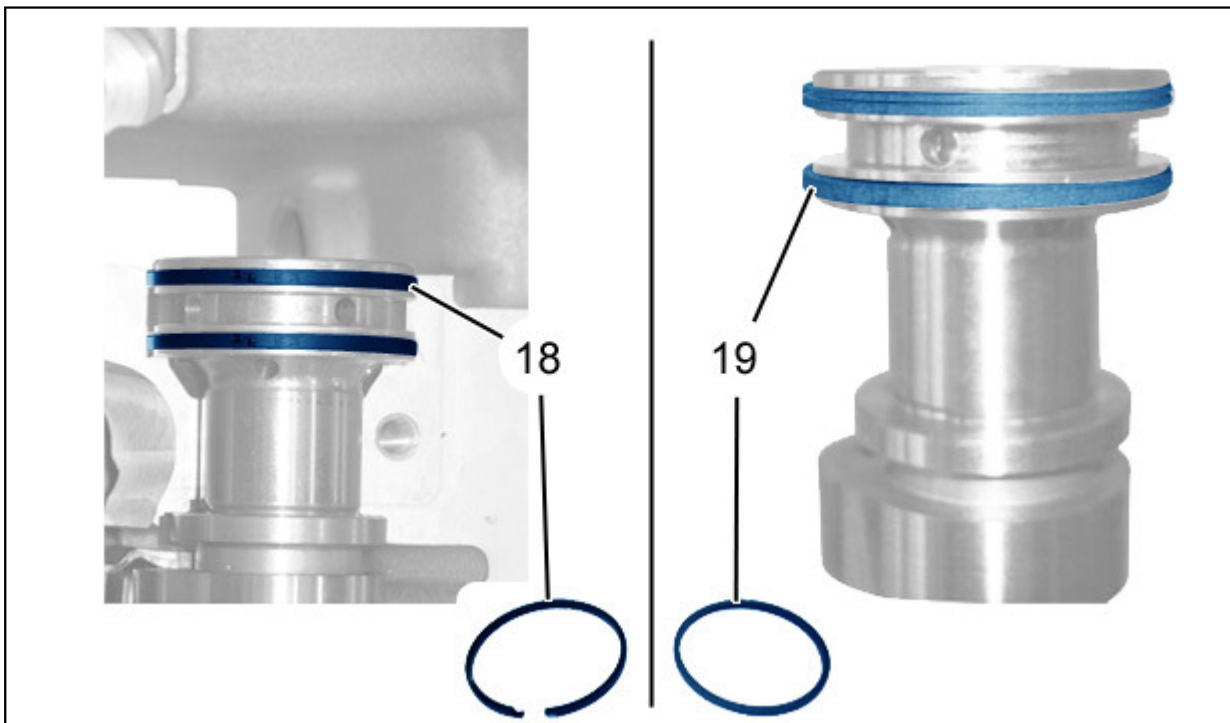


Figure : B1BG204D

Replace the old type metal ring seals (18) with the new ring seals PTFE (19).
 Do not scratch either the grooves or the shoulders when removing the metal ring seals.
 Do not oil the ring seals PTFE (19) prior to fitting.

CAUTION : Check that the seal has not turned over in its groove, rotate the seals a few times in their grooves to make sure they are correctly in place and there are no tight spots.

4.4. Refitting the inlet camshaft

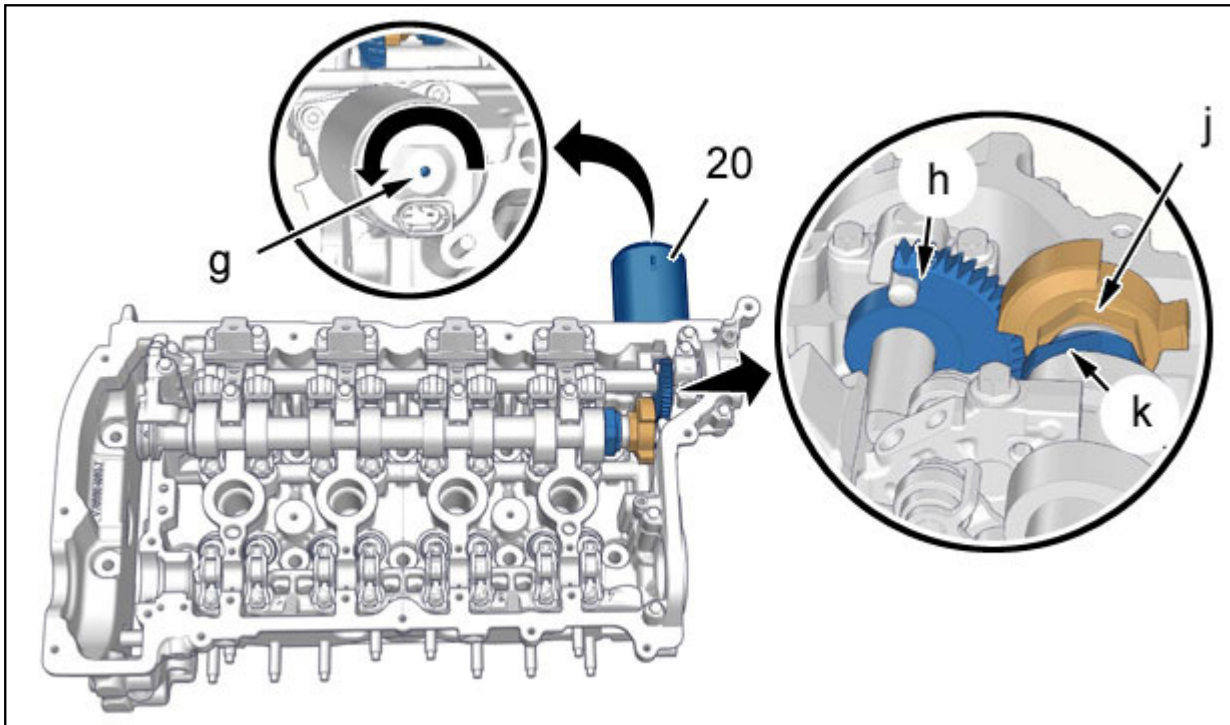


Figure : B1BG205D

Refit the variable lift motor (20).

CAUTION : Position the eccentric shaft: The toothed quadrant should be against "h", if not turn the bolt (at "g") anti-clockwise until it is ; Using a 4mm 6-sided spanner.

CAUTION : Turn the inlet camshaft anticlockwise by approximately 30° (at "j"). The upper surface of the cam "k" should be inclined by around 30°.

N.B. : These positions allow positioning of the tool [0197-3B1].

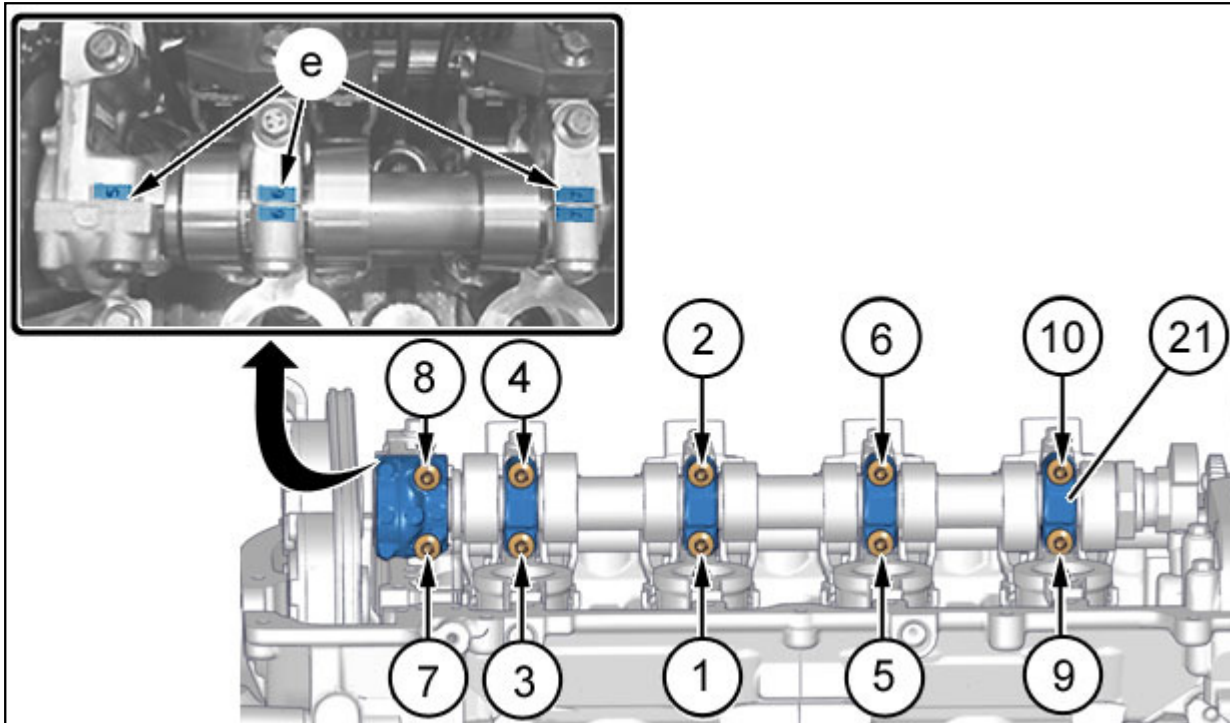


Figure : B1BG206D

CAUTION : Take note of the markings on the camshaft bearings (at "e") ; From 5 to 9.

Lubricate the camshaft bearing caps (21).

CAUTION : Respect the tightening sequence indicated.

Fit : The camshaft bearing caps (21) ; Tighten to the specified torque.

4.5. Refitting the variable lift springs

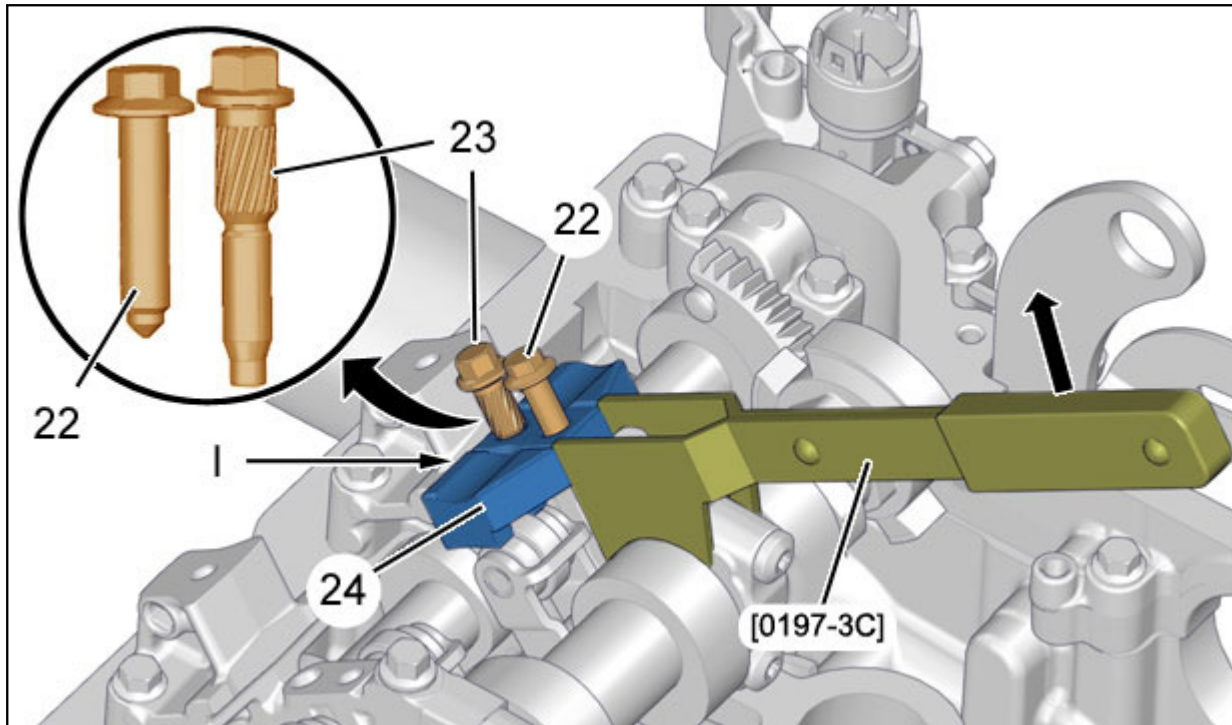


Figure : B1BG207D

CAUTION : Refit the guides (24) in their original positions ; Using tool [0197-3C].

Oil the slides (24).

CAUTION : (*)Observe the order of tightening of the bolts (23), (22).

Fit :

- The guide (24)
- The bolt (23) (*) ; Pre-tighten to the specified torque
- The bolt (22) (*) ; Pre-tighten to the specified torque

Slacken the 2 bolts (23), (22) by 90°.

Fit the tool [0197-3C] : Action the lever upwards.

Retain the guide (24) on its bracket (at "I").

Tighten to the specified torque :

- The bolt (23) (*)
- The bolt (22) (*)

Remove the tool [0197-3C].

Repeat the operation on the other guides (24).

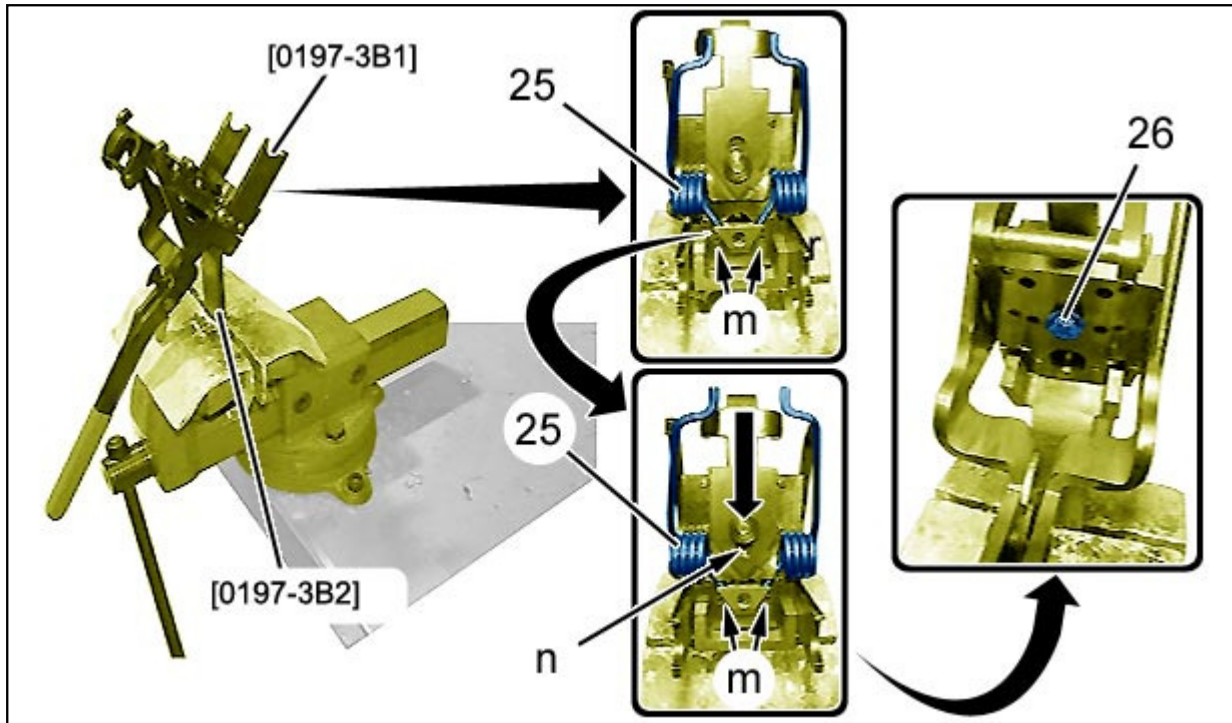


Figure : B1BG208D

Turn over the tool [0197-3B1] on the tool [0197-3B2].
 Fit and centre the spring (25) in its housing against the dowels (at "m").
 Push down the locking lug of the tool [0197-3B1] (at "n").
 Tighten : The bolt (26).
 Check the positioning of the spring (25) on the tool [0197-3B1].

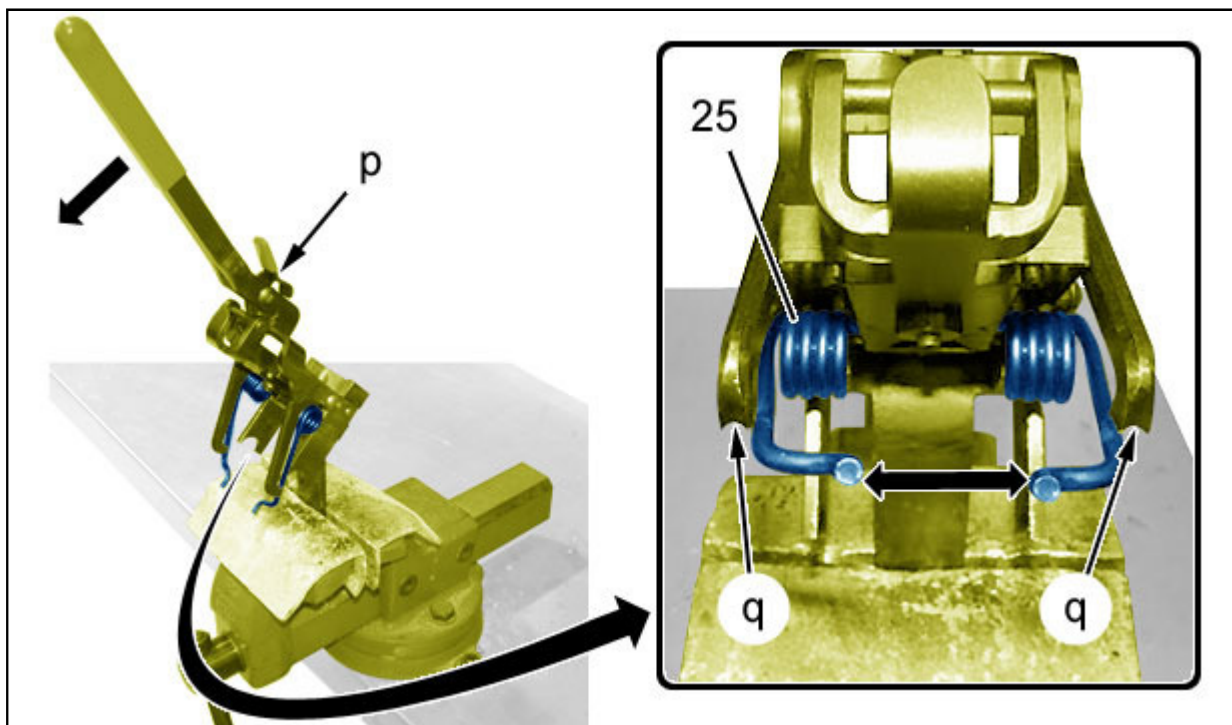


Figure : B1BG20ED

Position the tool [0197-3B1] on the tool [0197-3B2].

Manually move aside the ends of the spring (25), positioning them (at "q") in the grooves in the jaws of the tool [0197-3B1].

Action the lever to compress the spring (25) and lock the tool [0197-3B1] (at "p").

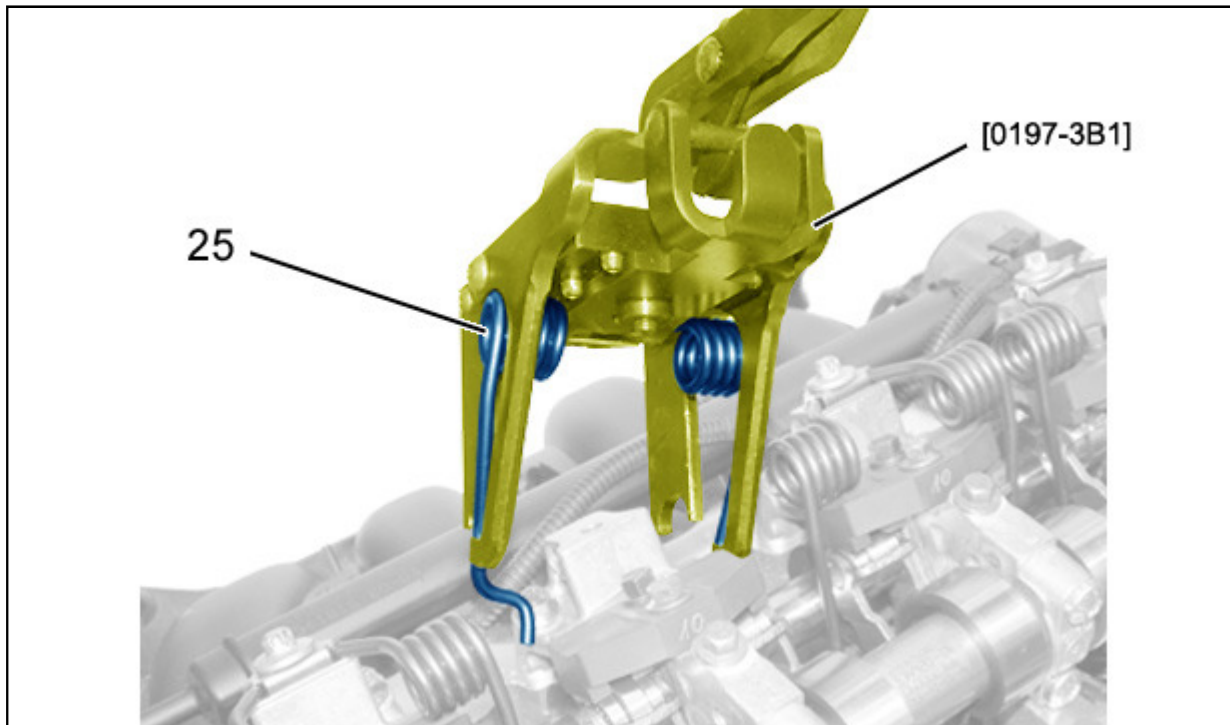


Figure : B1BG20FD

URGENT : Do not activate the latch "p" of the tool [0197-3B1] during handling, risk of injury ; Hold the tool [0197-3B1] by its shaft.

Position the tool [0197-3B1] together with the spring (25).

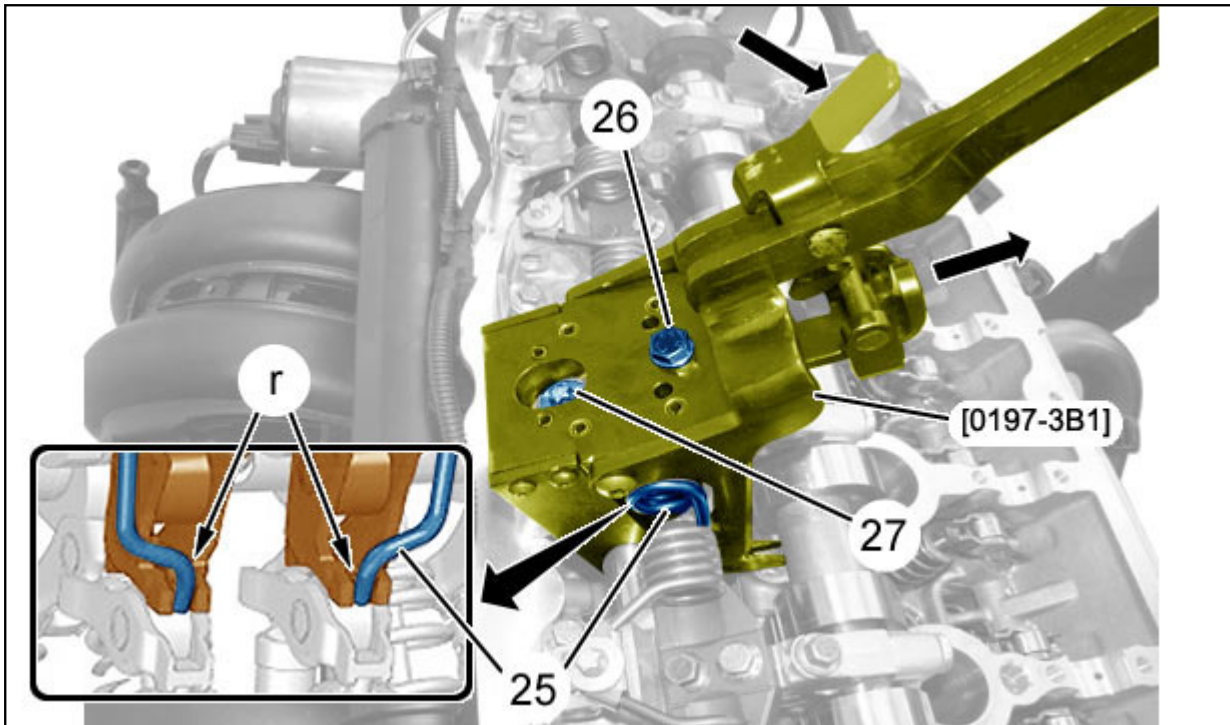


Figure : B1BG20GD

Refit screw (27) ; Tighten to the specified torque.
 Unlock the tools [0197-3B1].

CAUTION : Check the positioning of the extremities of the spring (25) in the notches of the variable lift valve rockers (15) (at "r").

Slacken the bolt (26).
 Pull the locking lug on the tool [0197-3B1].
 Remove the tool [0197-3B1].
 Repeat the operation on the other springs (25).

4.6. Refitting the exhaust camshaft

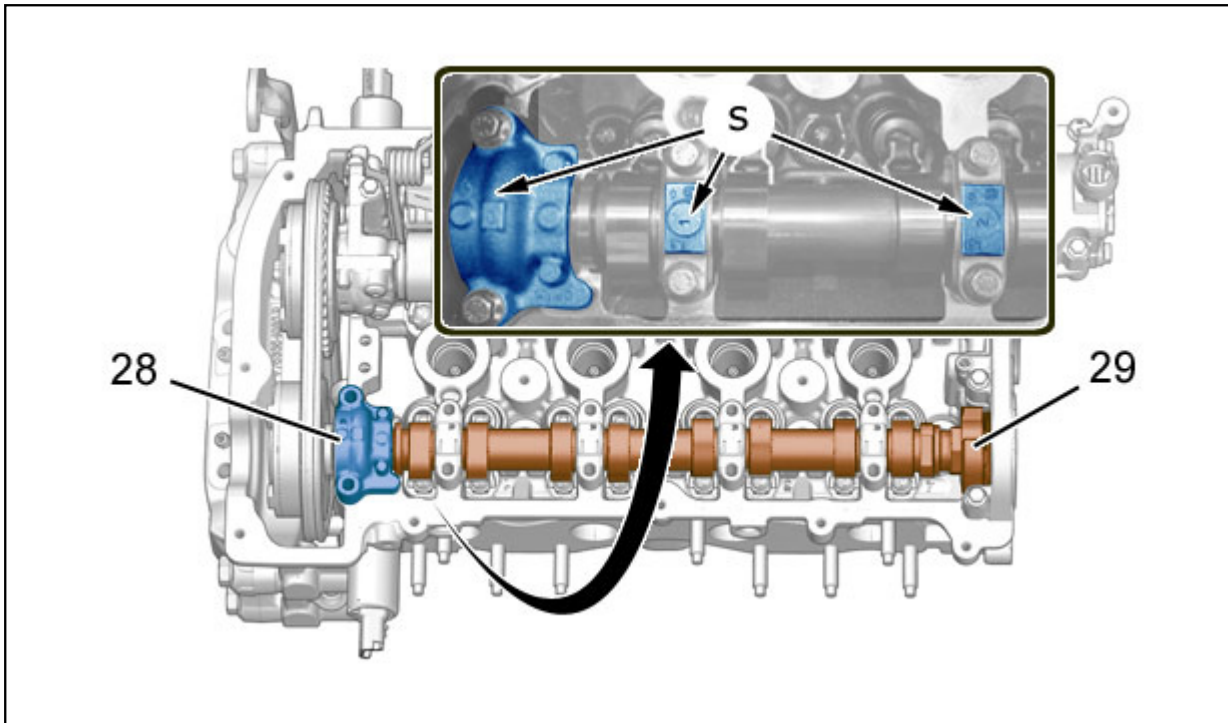


Figure : B1BG20HD

CAUTION : Take note of the markings on the camshaft bearings (at "s") ; From 0 to 4.

Clear the oil from the threads receiving the camshaft bearing cap fixing bolts.

Oil the camshaft bearings (28) (With clean engine oil).

Fit :

- The exhaust camshaft (29)
- The camshaft bearing caps (28)

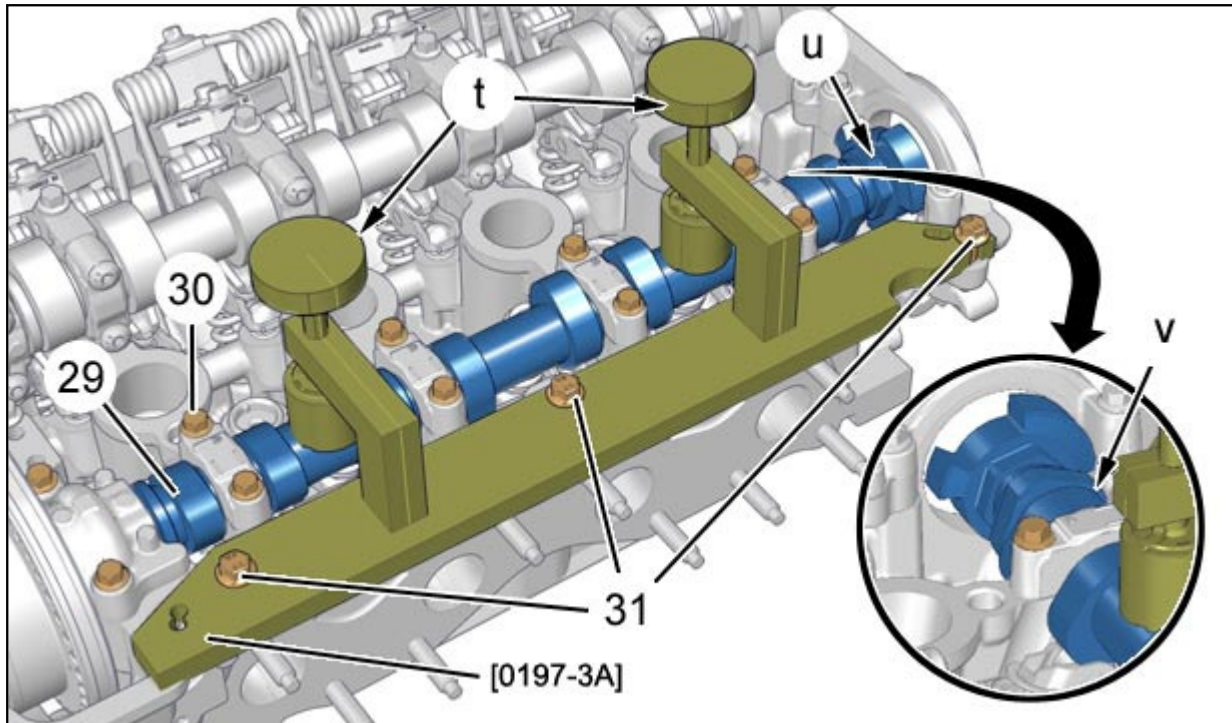


Figure : B1BG20ID

CAUTION : Do not refit the bearings without the tool [0197-3A] ; Risk of destruction of the camshaft bearings and bearing threads.

N.B. : Slacken the controls "t" on the tool [0197-3A].

CAUTION : Turn the camshaft (29) clockwise by around 30° (at "u") ; The upper surface of the cam "v" should be inclined by around 30°.

Fit :

- The tool [0197-3A]
- The bolts (31)

Tighten the controls "t" to retain the exhaust camshaft in its housing (29).
Refit the bolts (30) ; Tighten to the specified torque.

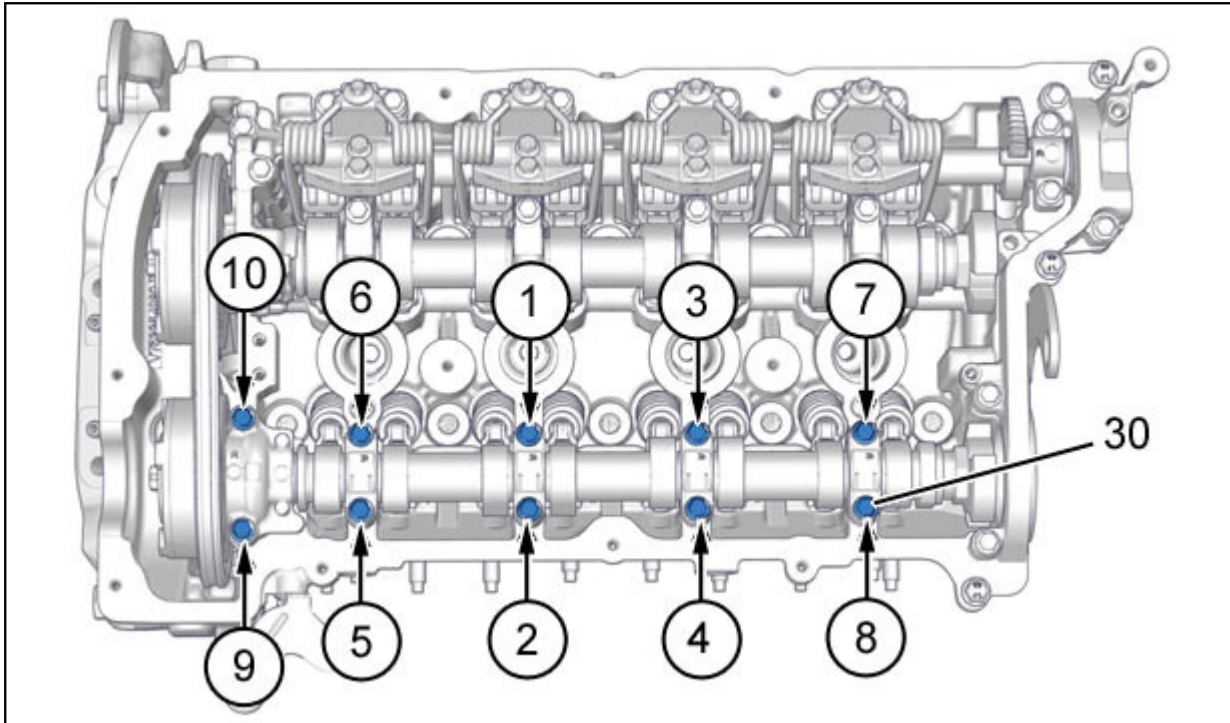


Figure : B1BG20JD

CAUTION : Respect the tightening sequence indicated.

Slacken the controls "t" on the tool [0197-3A].

Remove :

- The bolts (31)
- The tool [0197-3A]

5. Refit the cylinder head

5.1. Setting the valve timing

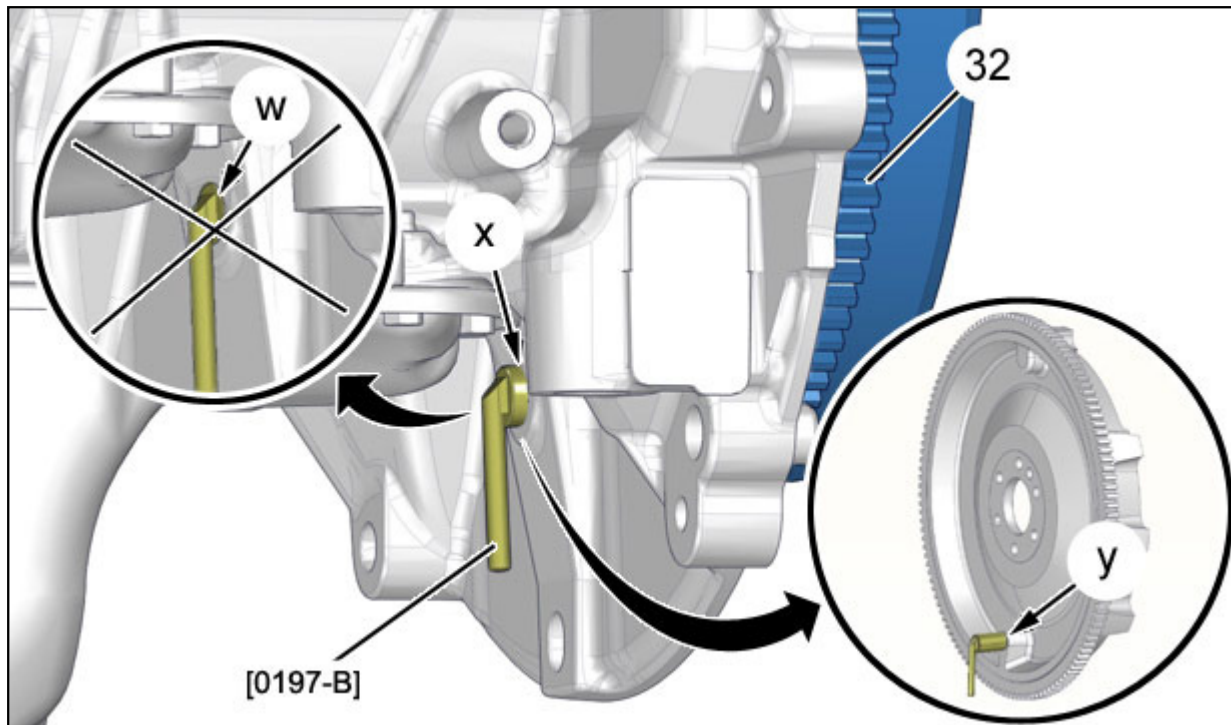


Figure : B1BG20KD

CAUTION : If the rod goes all the way into its recess (at "w"), the flywheel is not pegged (at "y") : Repeat the operation for setting the timing.

Position the crankshaft setting pin [0197-B] in the hole "x" located on the crankshaft main bearing cap casing .
 Turn the engine flywheel (32) to the pegging position (at "y").
 Peg the engine flywheel ; Using the pin [0197-B].
 Check that the engine is pegged, by trying to rotate the engine flywheel in the 2 directions.

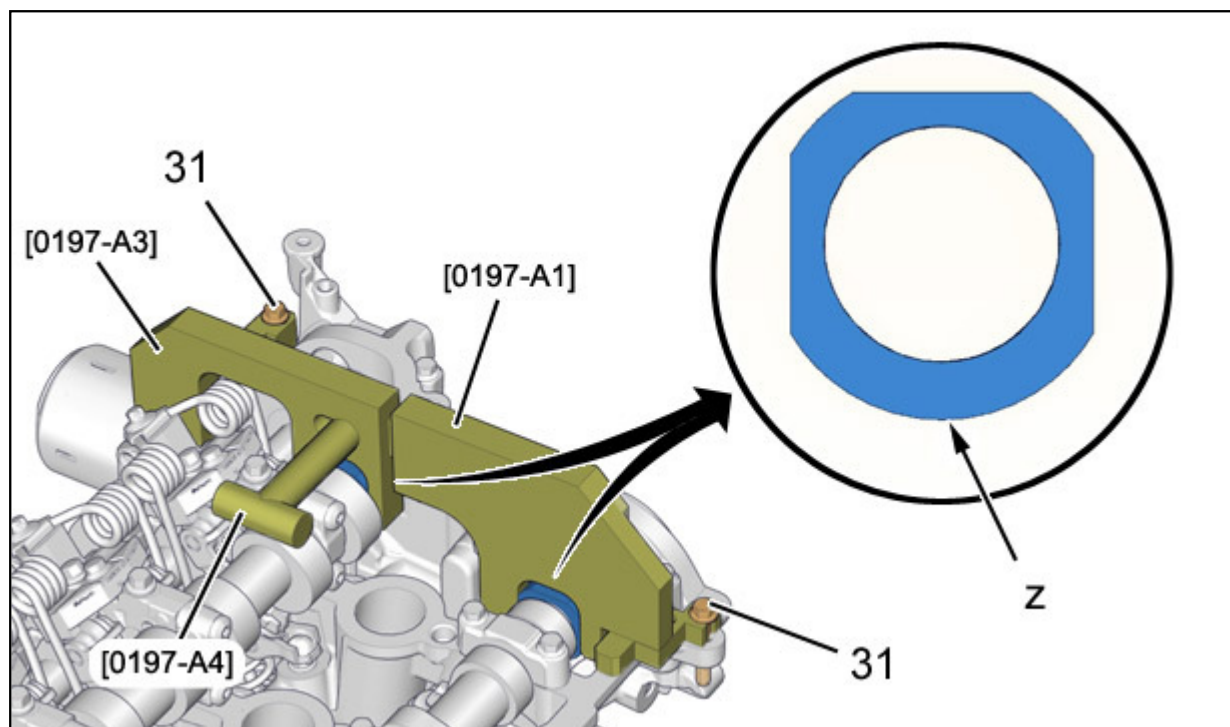


Figure : B1BG20LD

CAUTION : Always refit the cylinder head, camshafts and crankshaft in the setting position, tools in place.

Position :

- The camshaft immobilisation tool [0197-A1] (Exhaust side)
- The camshaft immobilisation tool [0197-A3] (Inlet side)

CAUTION : The rounded contour of the pegging zone on the camshafts must be oriented downwards (at "z"), the 3 other flat zones receiving the setting tool.

N.B. : To facilitate assembling of the setting tools, rotate the camshafts slightly (clockwise and anti-clockwise) (at "j", "u") ; Using a 27 mm combination spanner.

Fix :

- The tool [0197-A1] ; With the bolt (31)
- The tool [0197-A3] ; With the bolt (31)

CAUTION : The camshaft setting tools must be very firmly lodged on the cylinder head seal face; no lifting of the tools should be possible.

Assemble the camshaft immobilisation tools [0197-A1], [0197-A3] ; With the bolt [0197-A4].

5.2. Refitting the oil non-return valves

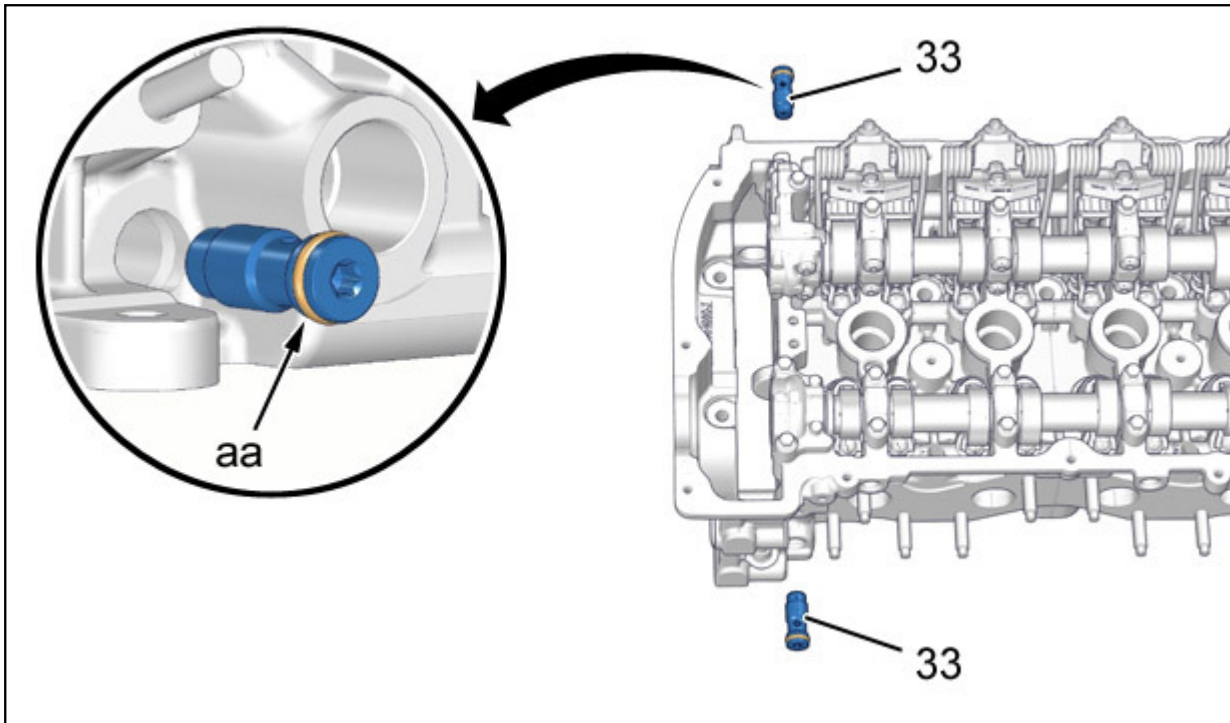


Figure : B1BG20MD

Refit the oil non-return valves (33).

N.B. : Replace the O-ring seals (at "aa") on the oil non-return valves.

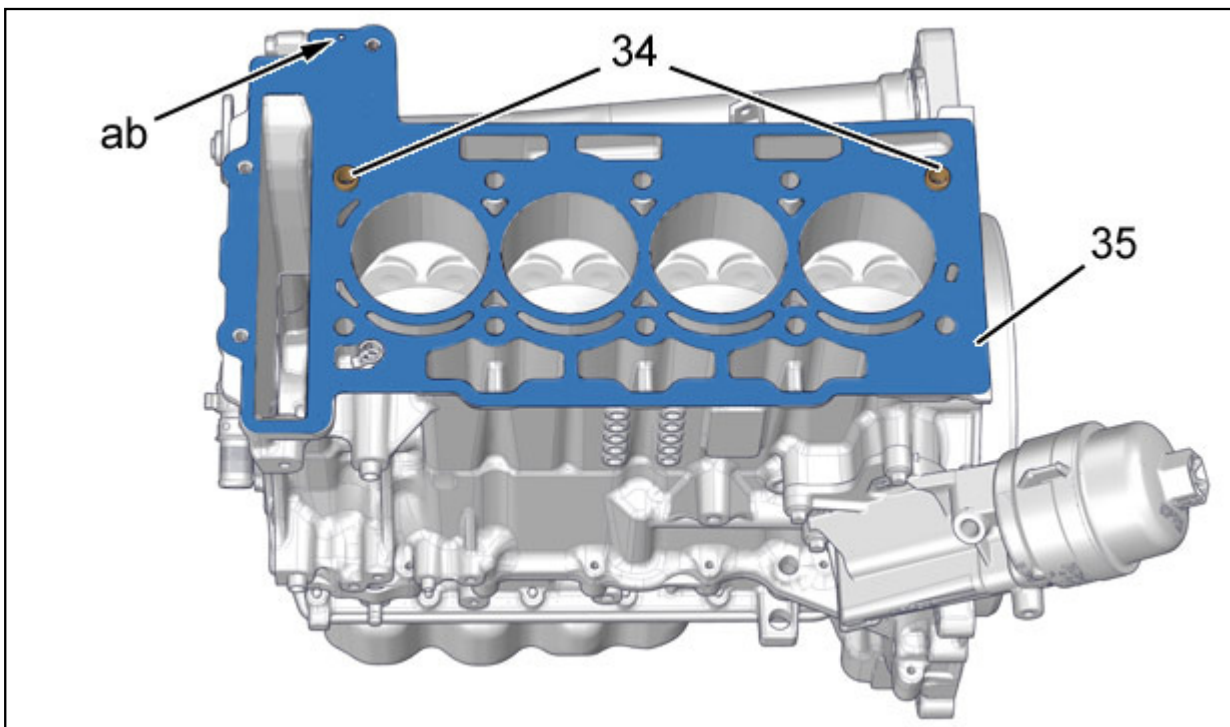


Figure : B1BG20ND

CAUTION : When the crankshaft is pegged, the pistons are at mid-stroke.

Check the presence of the centralising bushes (34).

Fit :

- The new cylinder head gasket (35) (Engine identification (at "ab"))
- The cylinder head

CAUTION : The cylinder head is refitted with new bolts and washers .

CAUTION : Fit the cylinder head bolts coated with MOLYKOTE G RAPID PLUS E3 on the threads and under the bolt heads.

5.3. Refitting the cylinder head bolts

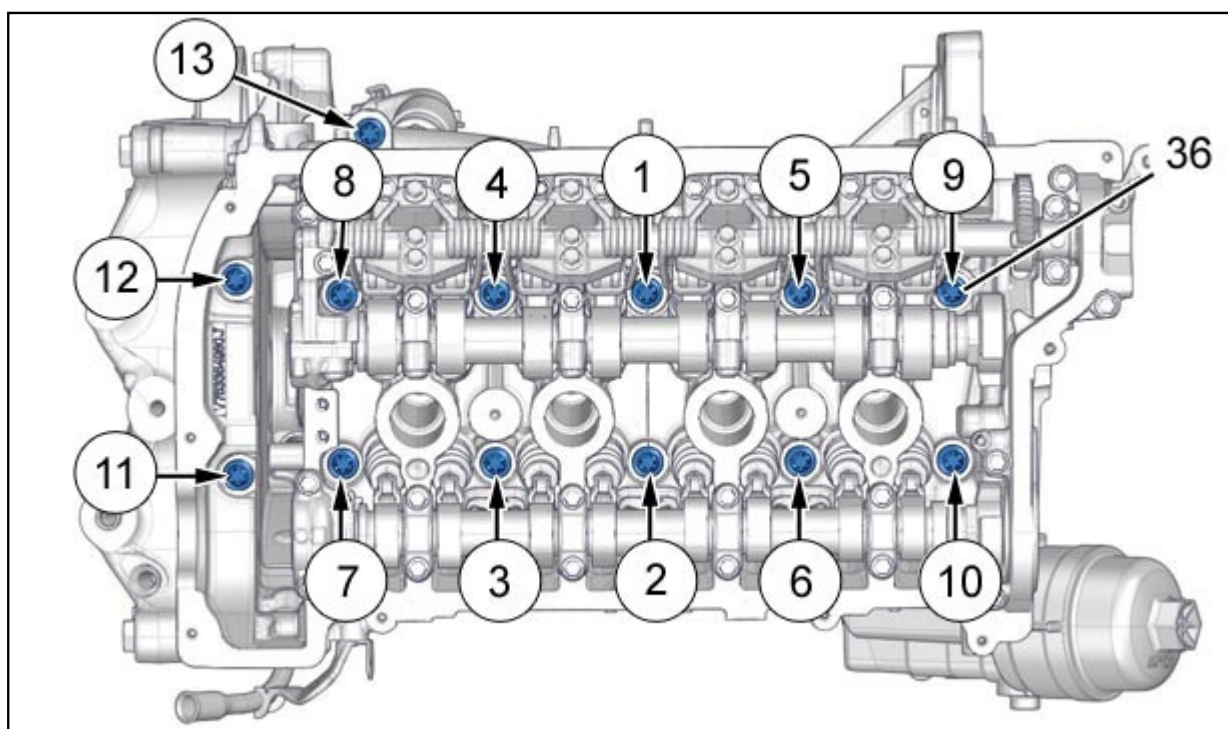


Figure : B1BG200D

CAUTION : The cylinder head bolts numbered 11,12,13 have different lengths.

Fit :

- The cylinder head bolts (36) (In the order from 1 to 10)
- The cylinder head bolts (36) (In the order from 11 to 13)

6. Refitting of the timing

6.1. Refitting the timing chain assembly

N.B. : If re-using the timing chain, refer to the engine top dismantling procedure for measuring the wear on the timing chain assembly.

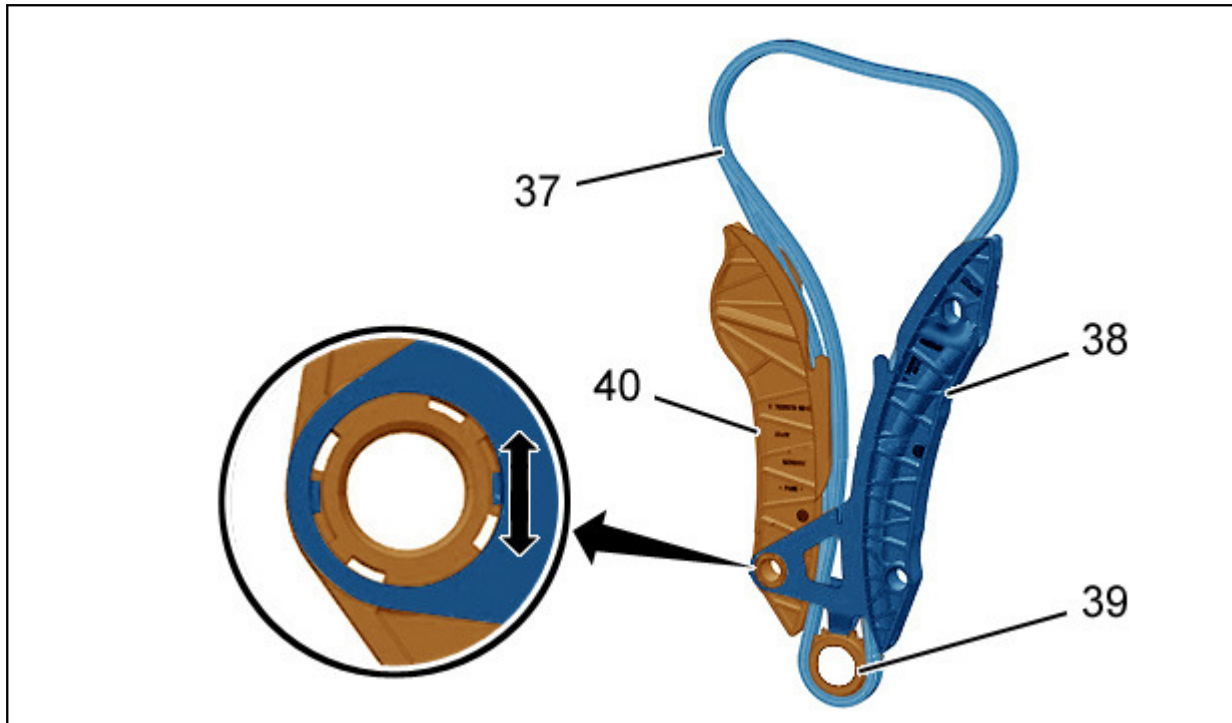


Figure : B1BG20PD

Assemble the chain (37), the chain guides (38), (40), the crankshaft pinion (39).

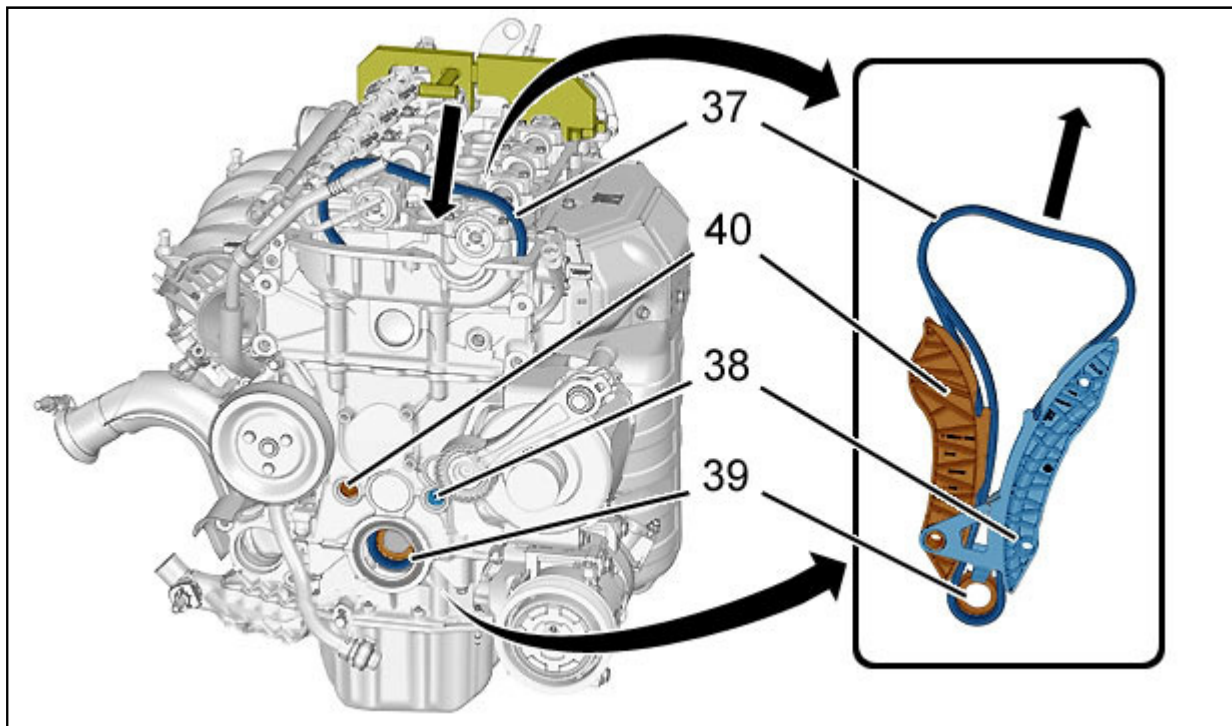


Figure : B1BG20QD

Refit the timing chain assembly (37) (Following the arrow) :

- The crankshaft gear (39)
- The fixed guide (38)

- The tensioner guide (40)

Position the tool [0197-E] for holding the timing chain (37).

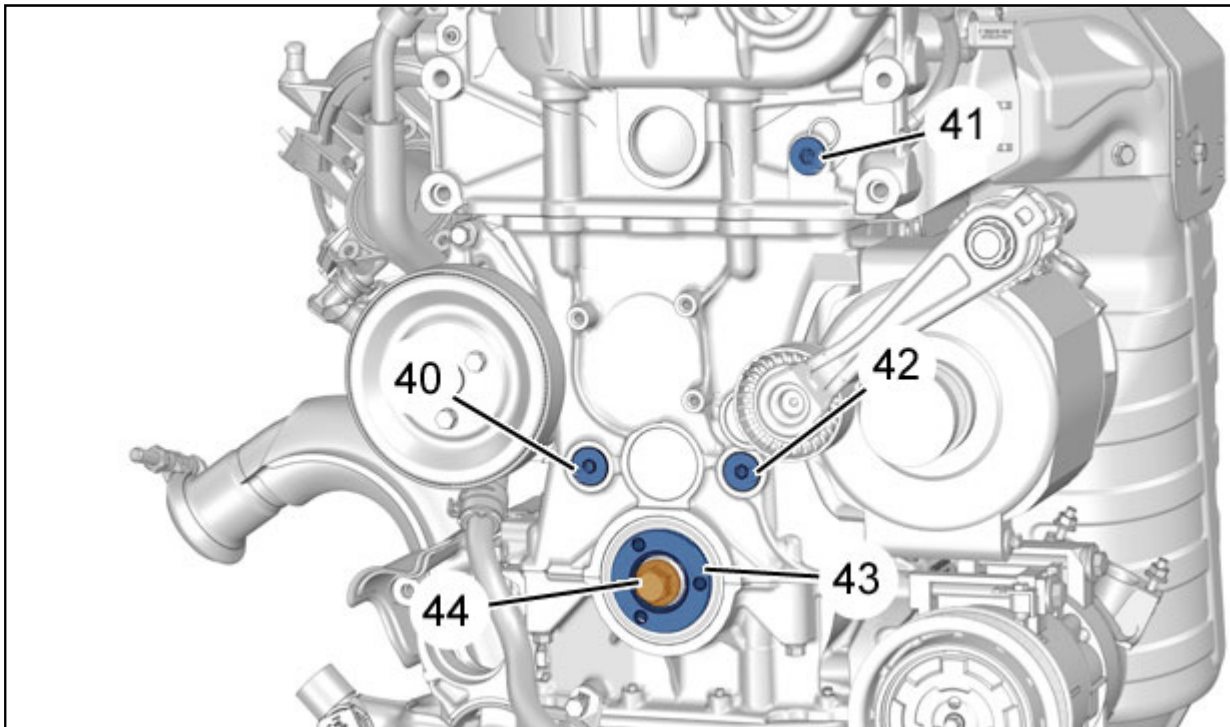


Figure : B1BG20SD

Refit without tightening :

- The crankshaft hub (43)
- The new bolt (44)

Refit and torque tighten :

- The bolt (40)
- The bolt (41)
- The bolt (42)

N.B. : Do not lubricate the O-ring seals on bolts (40), (41), (42).

6.2. Positioning the dummy timing chain tensioner

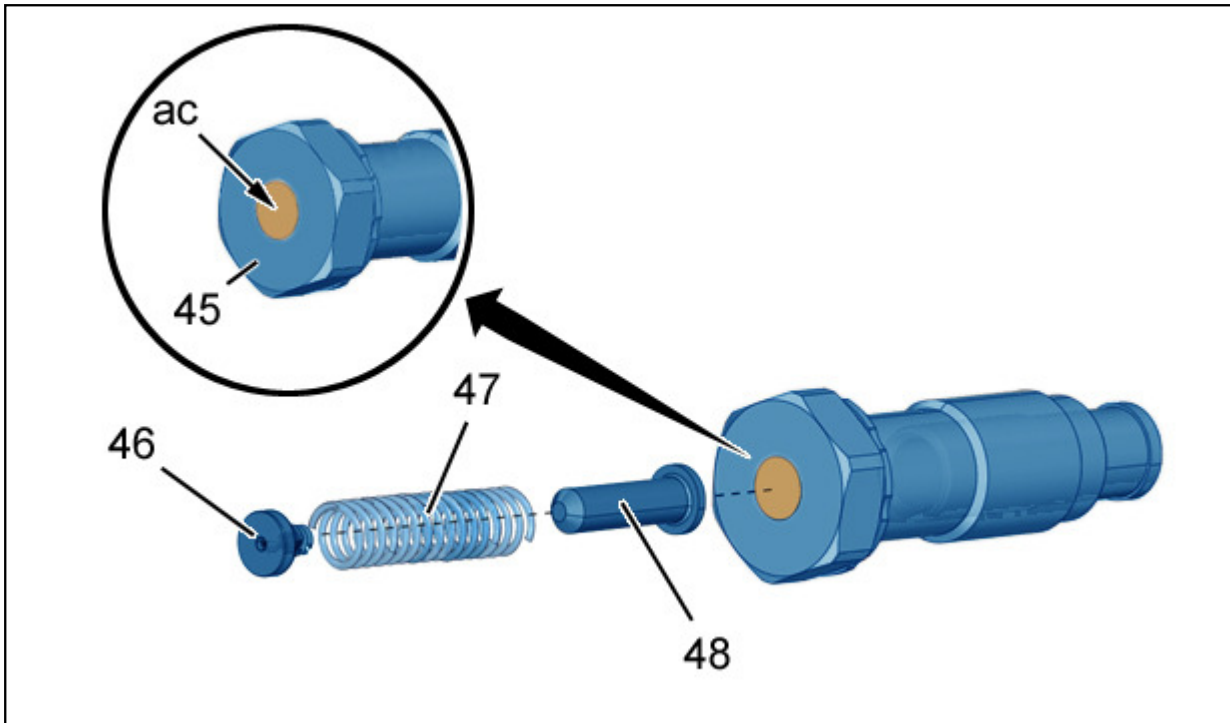


Figure : B1BG20TD

CAUTION : It is essential to keep to the approved method for fitting the dummy chain tensioner ; Do not weld the piston on the tensioner ; Risk of overtensioning the timing chain.

Drill the old timing chain tensioner (45) to the diameter 10,75 mm (at "ac").

N.B. : Release the ball valve (46) as necessary ; Using a pin drift.

Remove :

- The ball valve (46)
- The spring (47)
- The valve guide (48)

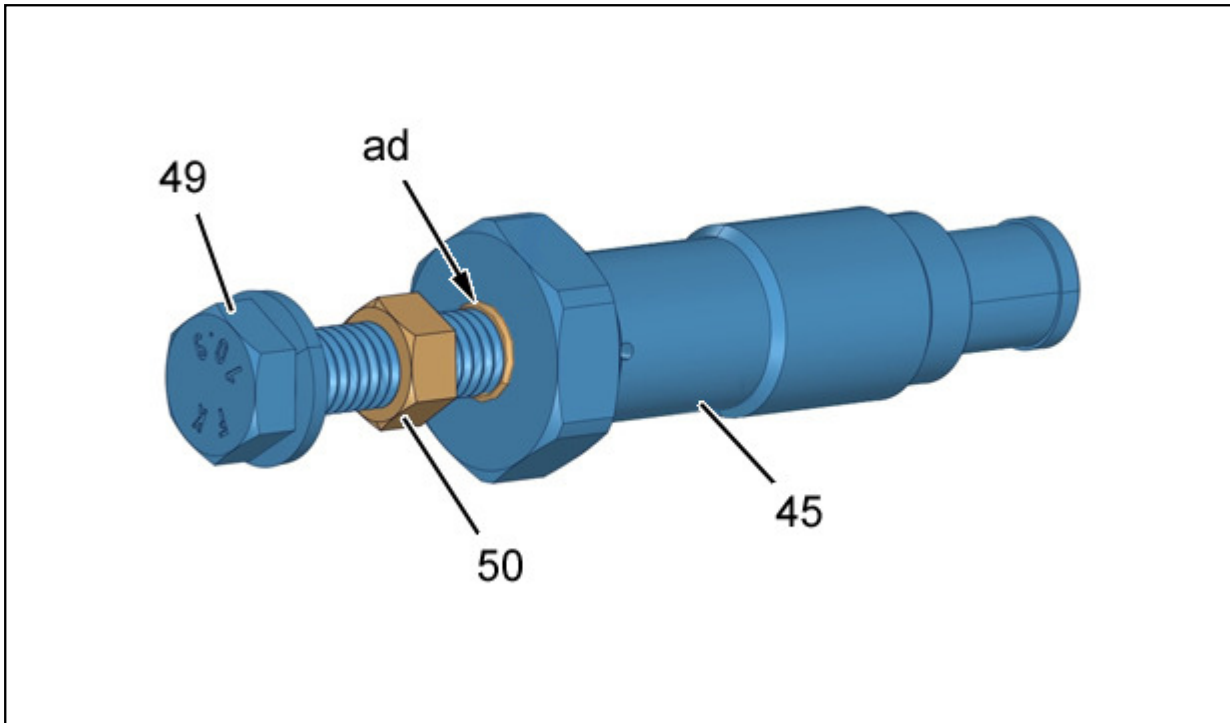


Figure : B1BG20UD

CAUTION : Thoroughly clean the body of the chain tensioner (45) of any signs of swarf.

Fit a separate thread of the "helicoil" type, diameter M10x150 (at "ad").

Do up :

- One nut M10 (50) on one bolt, or a screw or a threaded rod (49) diameter M10x150, length 100 mm
- The assembly (49), (50) onto the body of the tensioner (45)

6.3. Tightening the timing

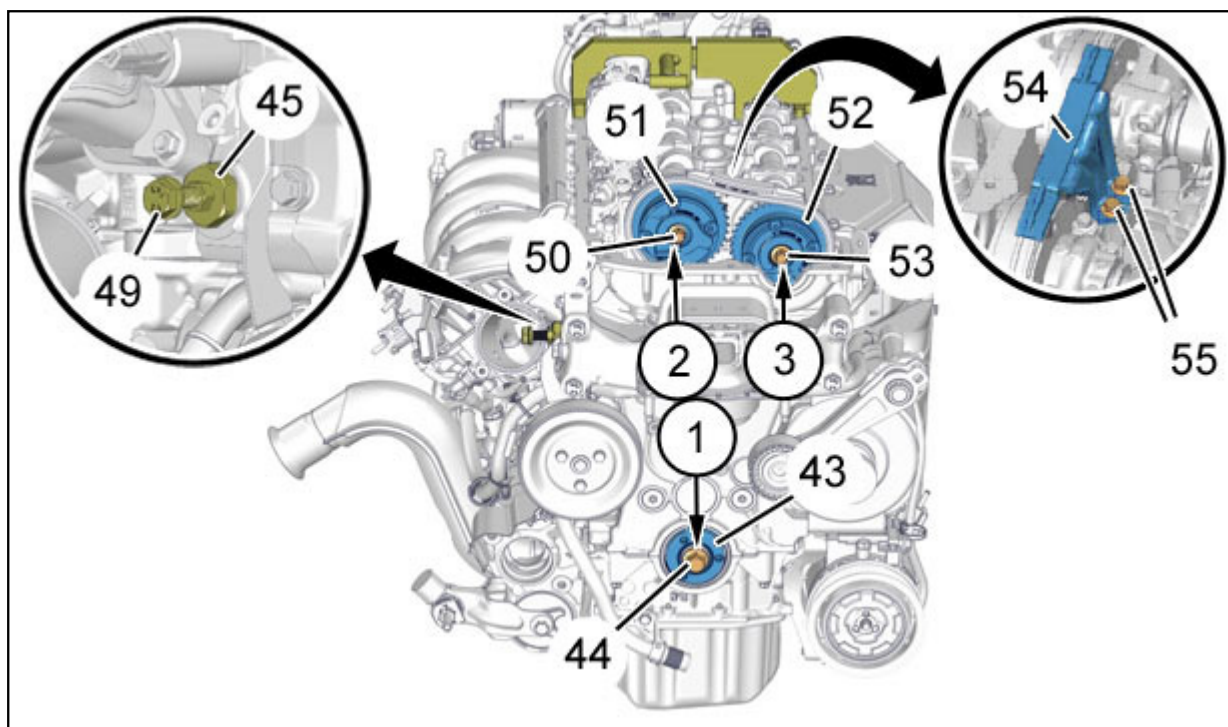


Figure : B1BG20VD

CAUTION : Replace the crankshaft pulley hub fixing bolt (44) ; Degrease the contact face of the hub (43) on the timing pinion (39) before tightening the bolt (44).

CAUTION : Replace the camshaft pulley fixing bolts (51), (52) ; Degrease the contact faces of the pulleys on the camshafts before tightening the bolts (50), (53).

Remove the tool [0197-E] holding the timing chain (37).

Fit :

- The inlet camshaft pinion (51) ; Fit the chain on the pinion (51)
- The securing bolt (50)
- The exhaust camshaft gear (52) ; Fit the chain on the pinion (52)
- The securing bolt (53)
- The upper chain guide (54)
- The 2 bolts (55)

Tighten the dummy timing chain tensioner (45) (Without a seal).

Tighten the bolt (49) of the dummy timing chain tensioner until there is contact with the tensioner guide (40) in order to prevent it from coming back ; Tightening torque 0,06 m.daN, or hand-tighten (without a spanner) as much as possible.

CAUTION : (*)Respect the tightening sequence indicated.

Tighten to the specified torque :

- The bolt (44) (New) (*)
- The bolt (50) (New) (*)
- The bolt (53) (New) (*)

CAUTION : The timing chain may jump a tooth while you are removing the dummy chain tensioner, if the tools pegging the camshafts [0197-A1], [0197-A3] have been taken away.

Remove the dummy timing chain tensioner .

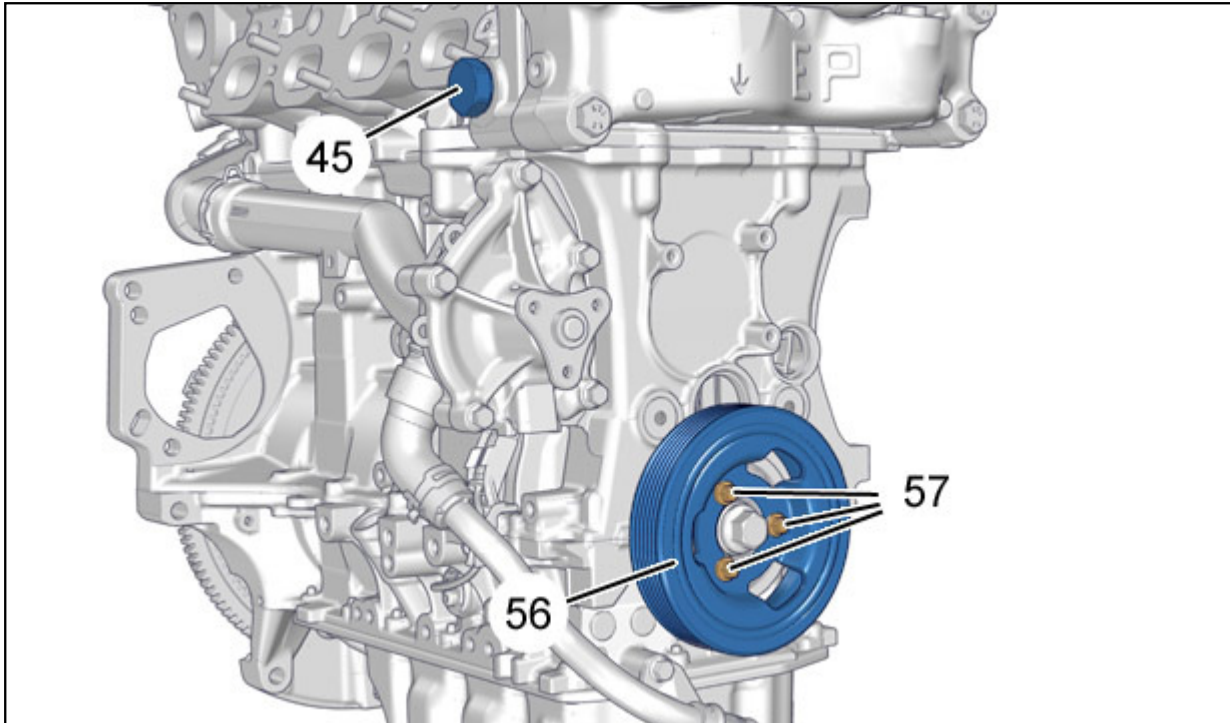


Figure : B1BG20WD

CAUTION : If the chain tensioner shows signs of a tight spot or seizing ; Replace : The chain tensioner (45).

Refit the timing chain tensioner (45).

N.B. : Replace the seal of the timing chain tensioner (45).

Replace the ring seal on the crankshaft hub.

Fit :

- The crankshaft pulley (56)
- The bolts (57)

Remove :

- The tool [0197-A4]
- The tool [0197-A1]
- The tool [0197-A3]
- The tool [0197-B]

7. Assembling the cylinder head

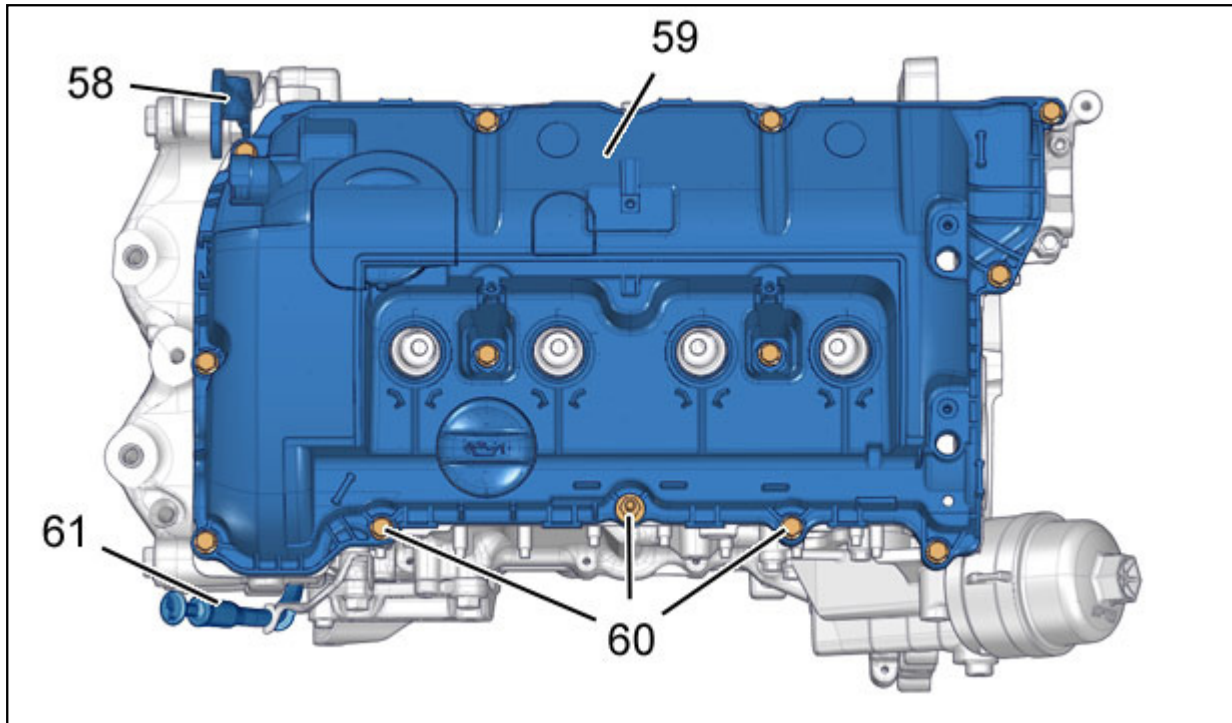


Figure : B1BG20XD

Remove :

- The cylinder head cover (59)
- The bolts (60)
- The lifting eye (58)
- The oil gauge well (61)
- **The engine from the support** ⓘ