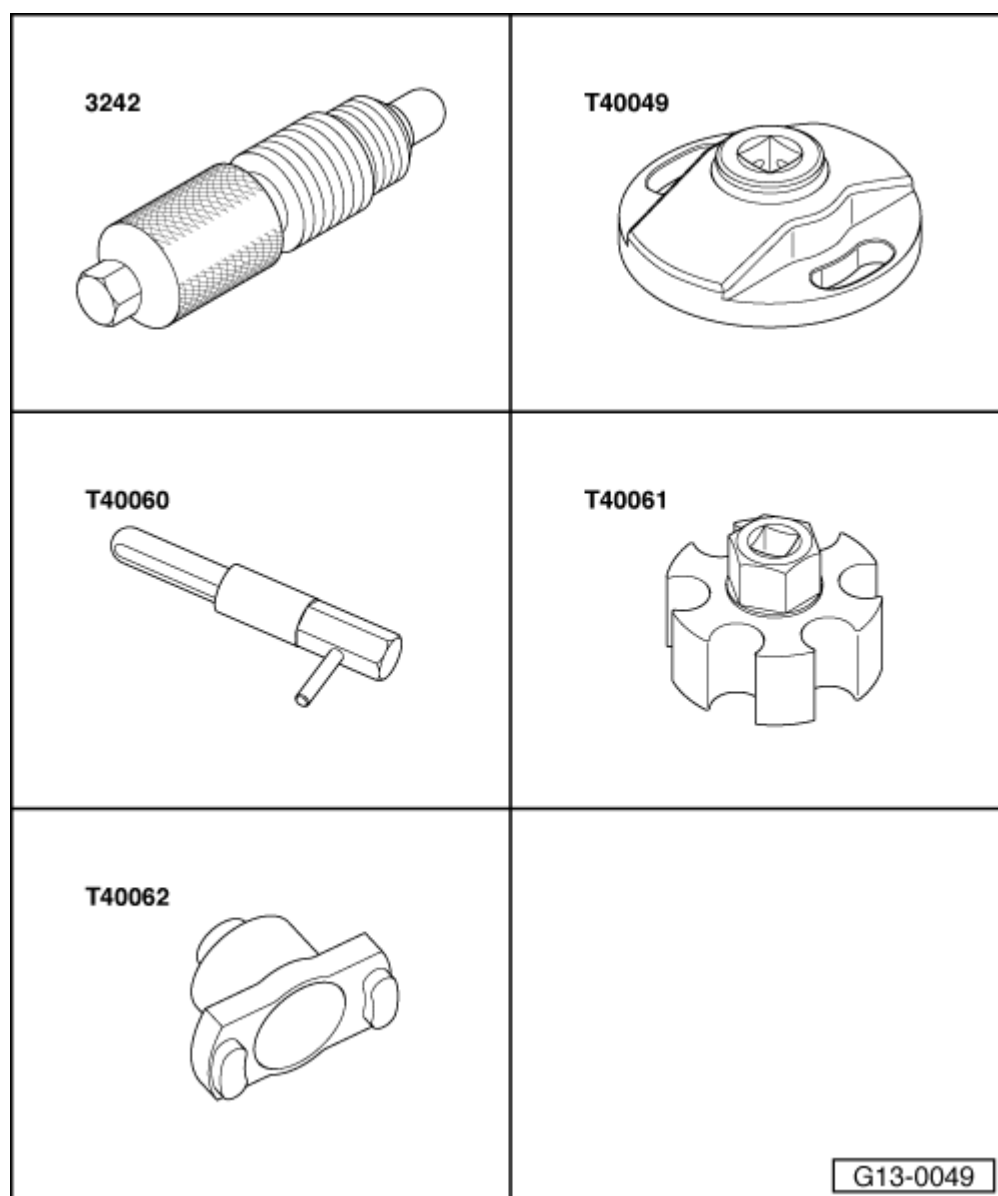


Removing and installing camshaft timing chains



Special tools and workshop equipment required

- ♦ Locking pin -3242-
- ♦ Special wrench -T40049-
- ♦ 2x Adjustment pin -T40060-
- ♦ Adapter -T40061-
- ♦ Adapter -T40062-
- ♦ Drill bit 3.3 mm Ø (2x)

Removing

- Gearbox removed →Rep. gr.34 or →Rep. gr.37.



Caution

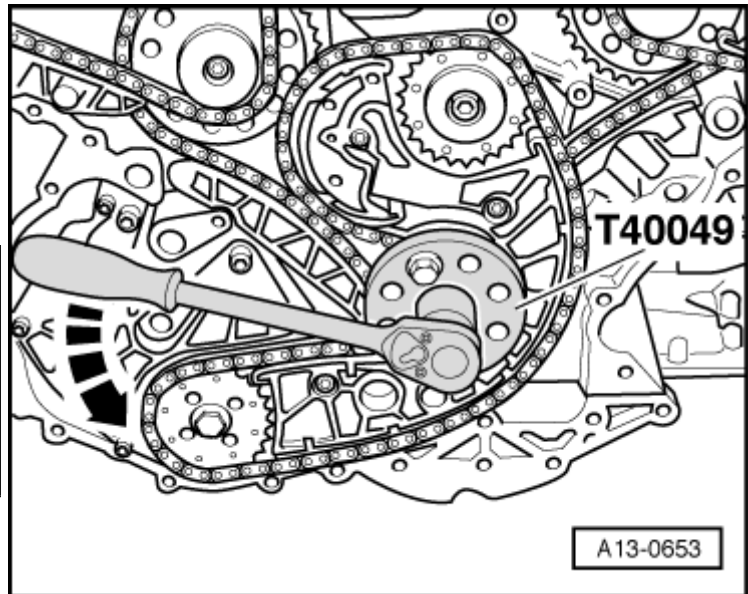
The crankshaft and camshafts must only be turned with the chain drive mechanism fully installed. Otherwise the valves may strike the pistons, causing damage to valves and piston crowns.

- Remove dual-mass flywheel on vehicles with manual gearbox → **Chapter**.
- Remove flywheel on vehicles with multitronic gearbox → **Chapter**.
- Remove drive plate on vehicles with automatic gearbox → **Chapter**.
- Remove timing chain covers → **Chapter**.
- Attach special wrench -T40049- to rear of crankshaft: on vehicles with automatic gearbox secure wrench with two old drive plate bolts; on vehicles with manual gearbox or multitronic gearbox use two bolts M10x19 to secure wrench.



Caution

Do not use bolts for dual-mass flywheel or flywheel to secure wrench -T40049-; these bolts are too long and can damage the camshaft timing chains when they are screwed in.



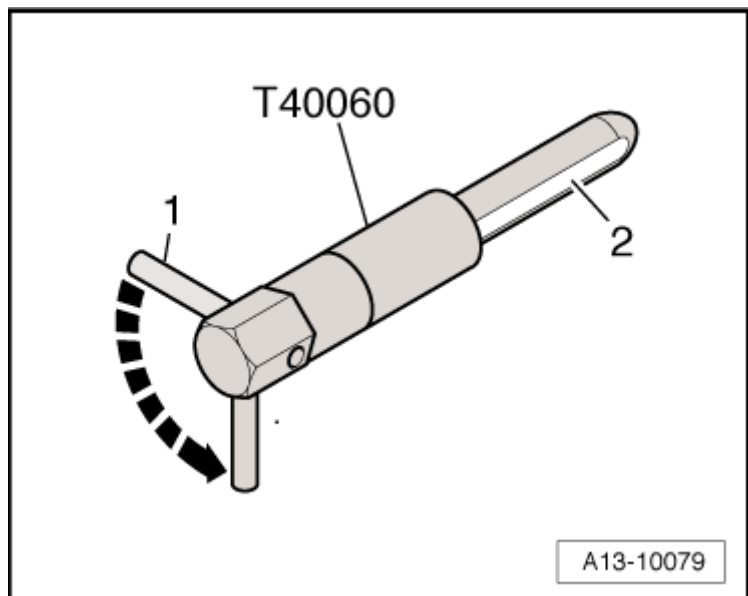
Note

Disregard -arrow-.



Note

- ♦ The adjustment pin -T40060- has a flat -2- which makes it easier to insert when the locating bores in the camshaft and cylinder head are not exactly in line.
- ♦ The adjustment pin is inserted initially so that the side pin -1- is perpendicular to the imaginary line between the adjustment pin and the centre of the camshaft.
- ♦ To obtain the correct TDC position, the side pin -1- must then be turned 90° -arrow- so it is in line with the imaginary line between the adjustment pin and the centre of the camshaft.

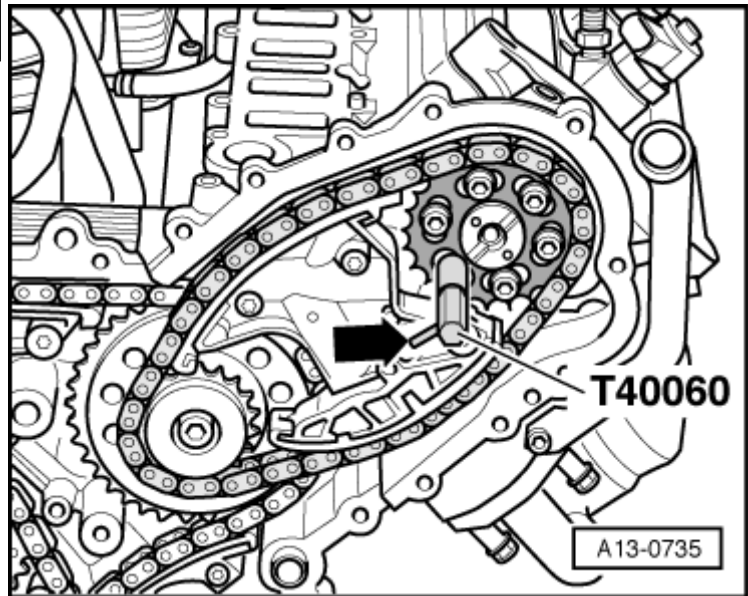


Caution

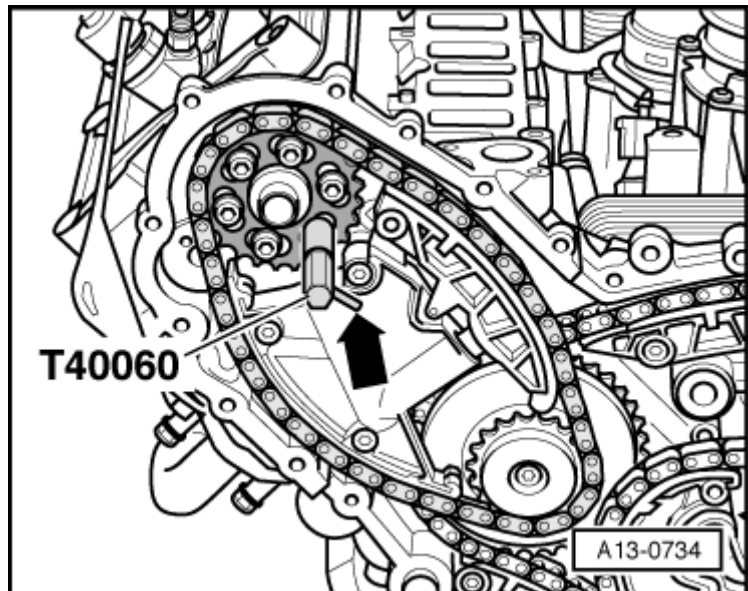
Do not rotate crankshaft in opposite direction of engine rotation.

- Turn crankshaft in normal direction of rotation to TDC position:
- It should be possible to lock camshafts with adjustment pin -T40060-.
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

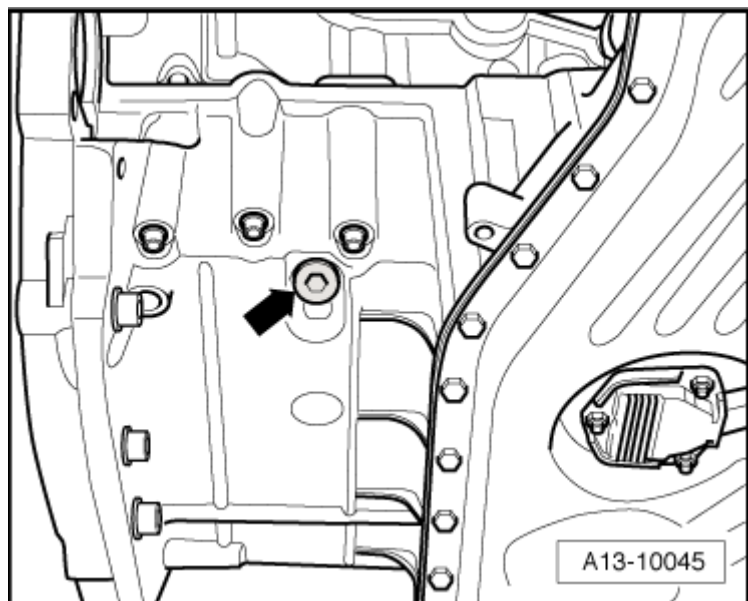
Cylinder bank 1 (right-side):



Cylinder bank 2 (left-side):

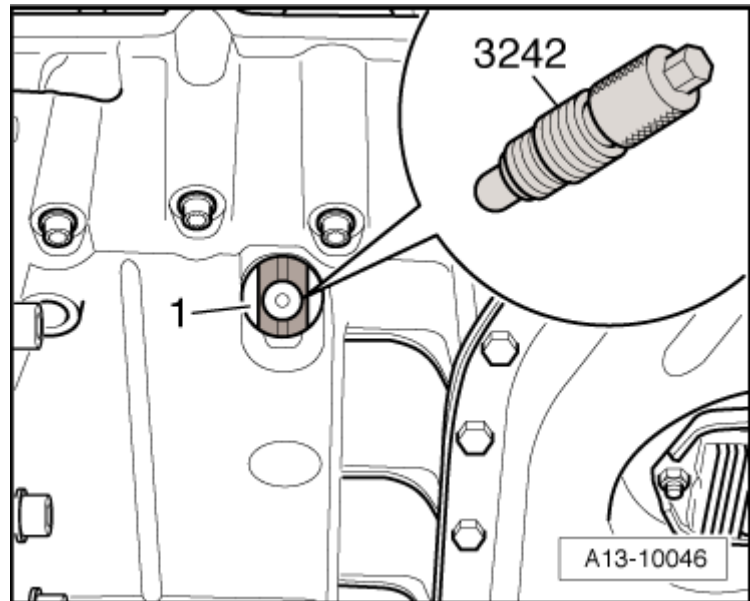


- Unscrew plug -arrow- from sump (top section).

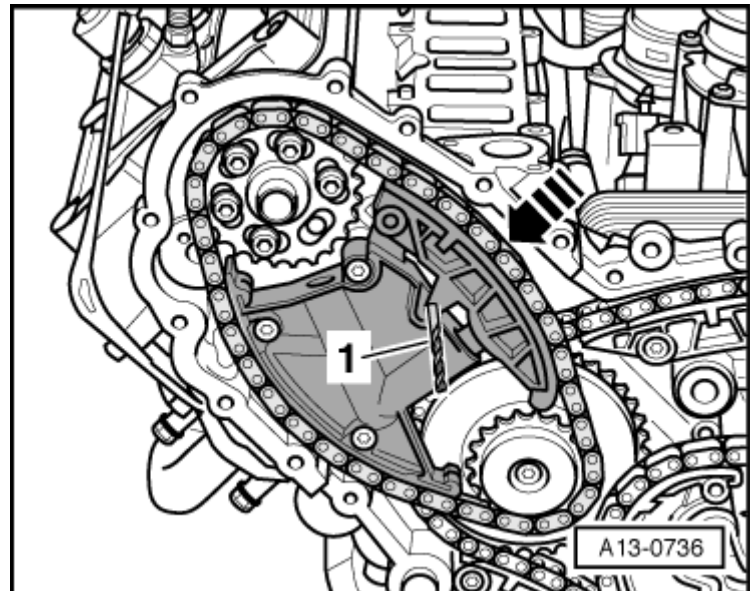


- Screw locking pin -3242- into bore (20 Nm); if necessary, turn crankshaft -1-

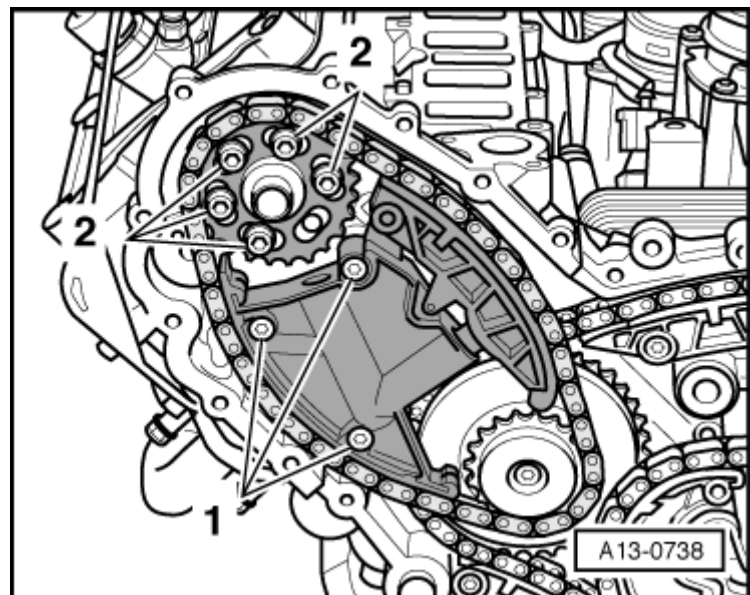
backwards and forwards slightly to fully centralise locking pin.



- Wrap insulating tape around tip and shaft of 3.3 mm Ø drill bit to avoid cuts.
- Press guide rail of chain tensioner for timing chain (left-side) in direction of - arrow- and lock chain tensioner by inserting 3.3 mm Ø drill bit -item 1-.
- Mark running direction of timing chain (left-side) with paint.
- Remove adjustment pin -T40060- from both camshafts.

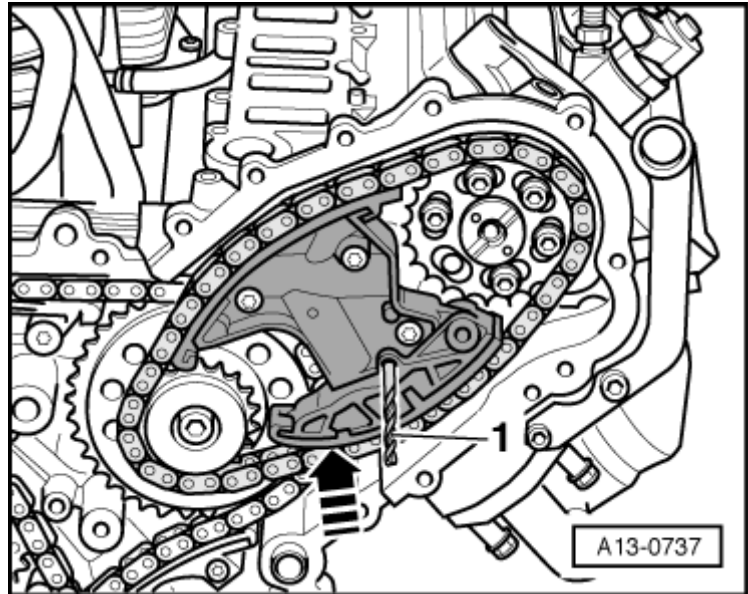


- Unscrew bolts -1- from chain tensioner and -2- from camshaft sprocket.
- Take off camshaft sprocket, chain tensioner and timing chain (left-side).

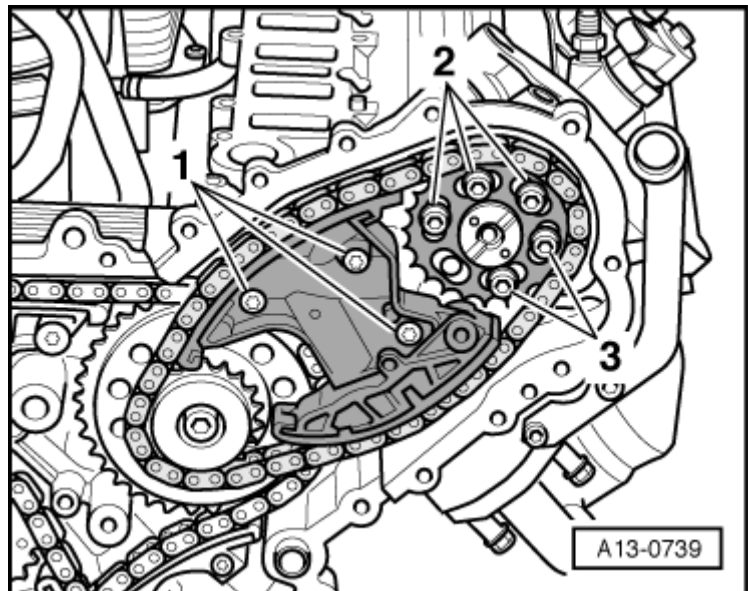


- Wrap insulating tape around tip and shaft of 3.3 mm Ø drill bit to avoid cuts.

- Press guide rail of chain tensioner for timing chain (right-side) in direction of arrow- and lock chain tensioner by inserting 3.3 mm Ø drill bit -item 1-.
- Mark running direction of timing chain (right-side) with paint.



- Remove bolts -1- for chain tensioner and bolts -2- and -3- for camshaft chain sprocket.
- Take off camshaft sprocket, chain tensioner and timing chain (right-side).



Installing

- Crankshaft -1- locked in TDC position with locking pin -3242-.
- Drive chain for valve gear installed
→ [Chapter](#)



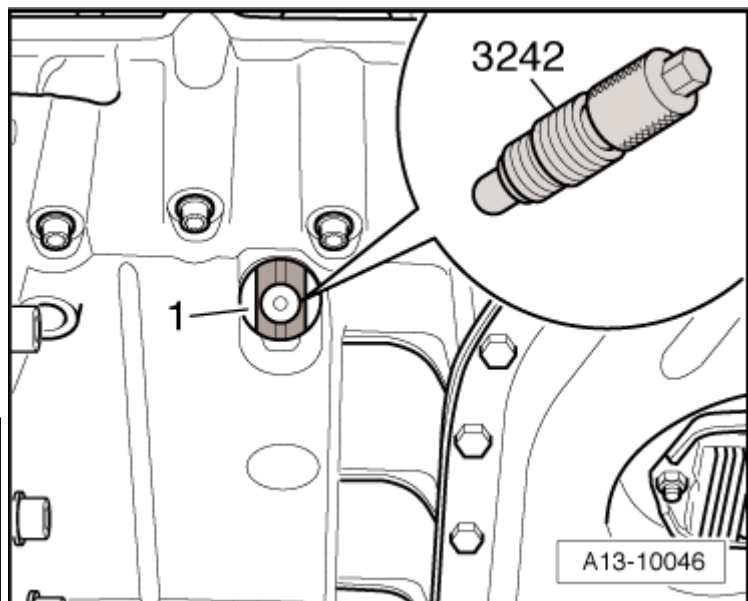
Note

- ♦ Renew seal.
- ♦ Renew the bolts tightened with specified tightening angle.



Caution

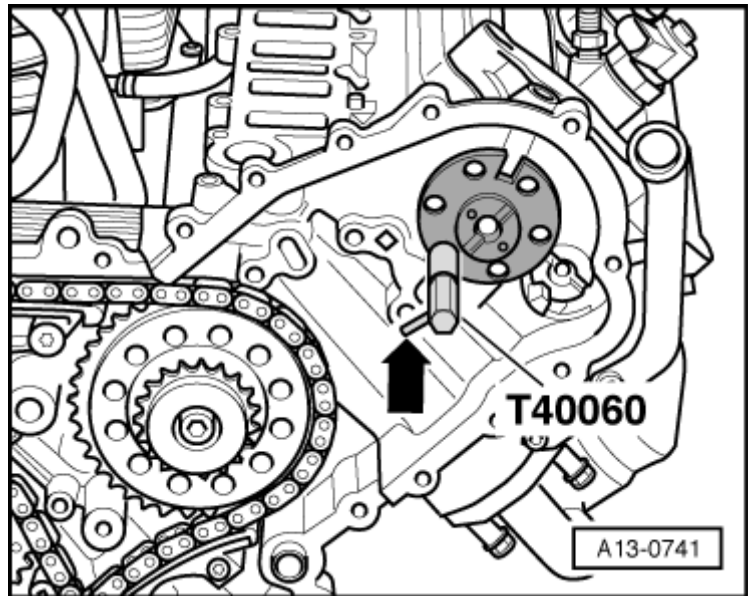
The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise, there is a risk of damage to valves and piston crowns.



Check that camshafts on both cylinder heads are positioned at TDC.

- It should be possible to lock camshafts with adjustment pin -T40060-.
- The side pin -arrow- in each adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder bank 1 (right-side):

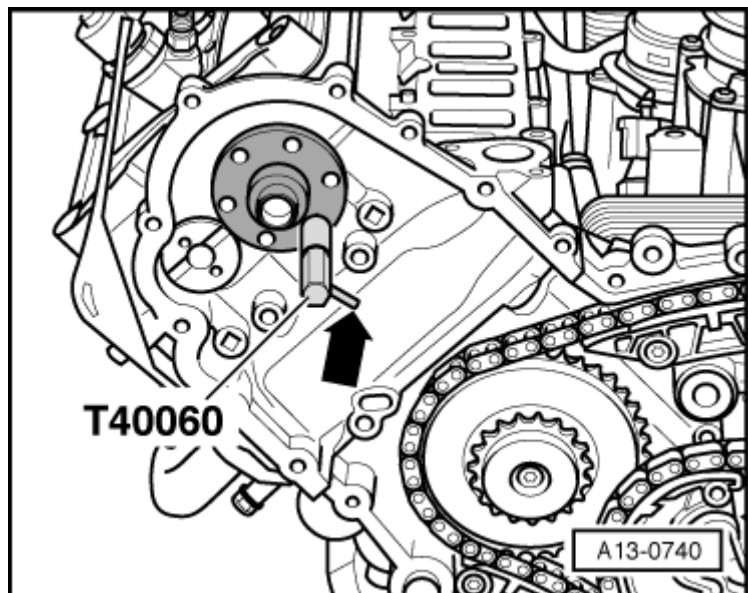


Cylinder bank 2 (left-side):

- Remove adjustment pin -T40060- from both camshafts.



Note

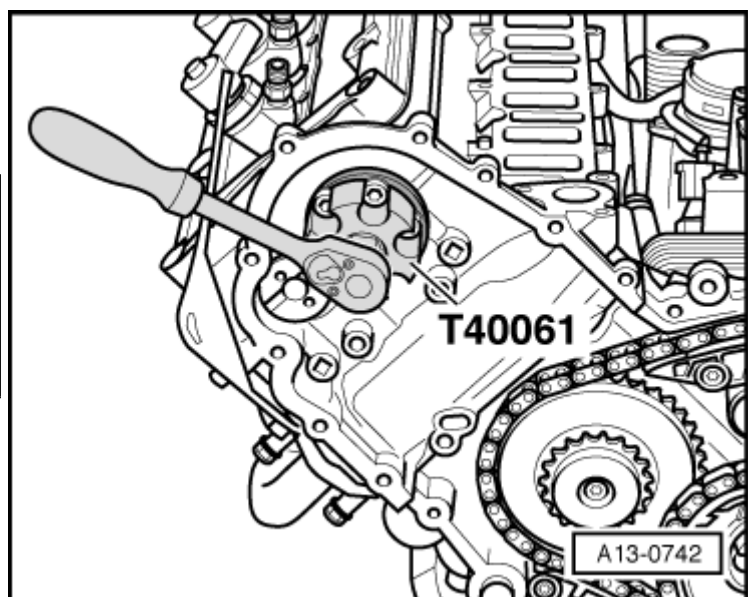


If the adjustment pins cannot be inserted in the camshafts, the camshafts can be turned slightly using adapter -T40061-. To do so, screw securing bolts for camshaft sprocket into camshaft.



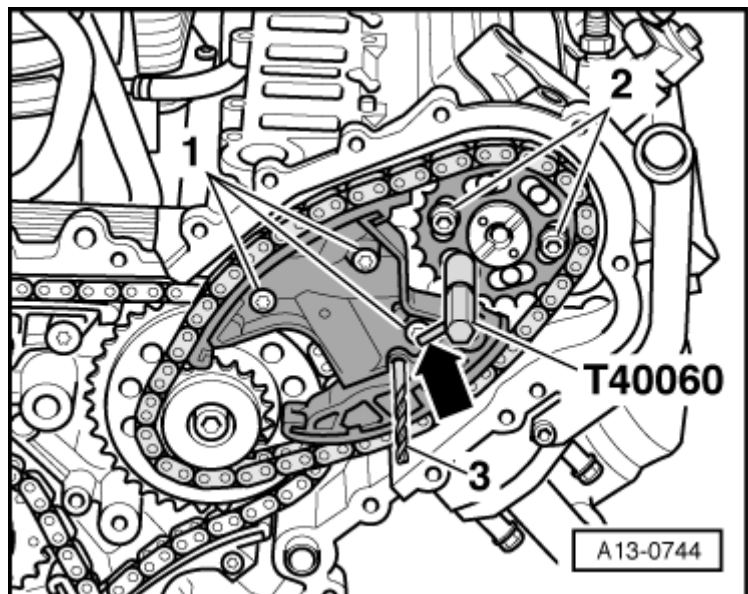
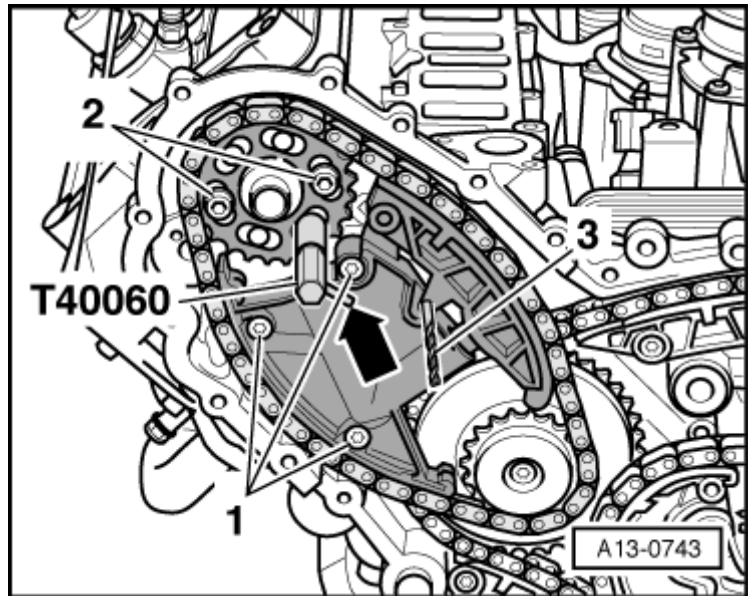
Caution

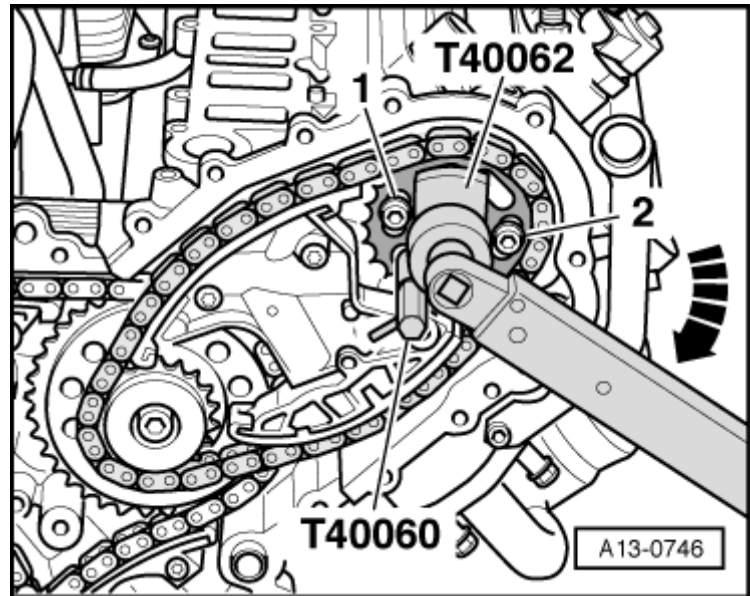
The crankshaft must not be at TDC at any cylinder when the camshafts are turned. Otherwise, there is a risk of damage to valves and piston crowns.



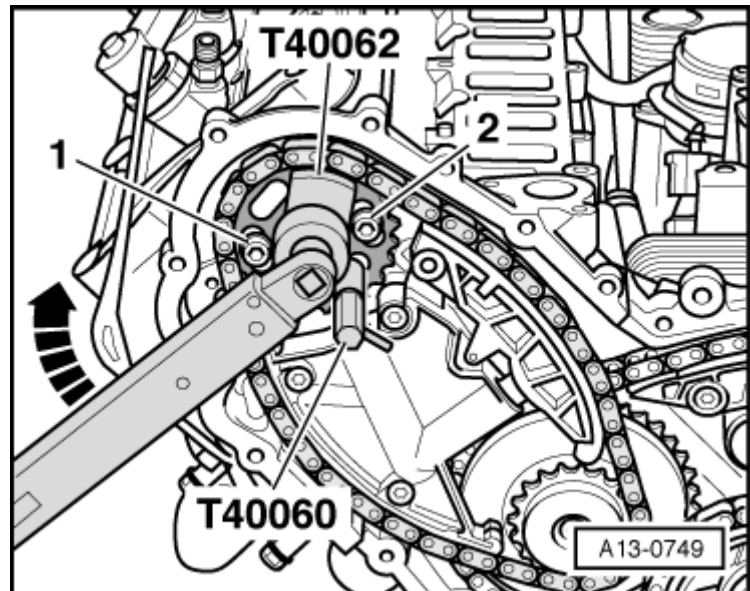
- Install timing chain (left-side) with camshaft sprocket and chain tensioner.

- The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.
- Tighten bolts -1- for chain tensioner.
- Screw in two bolts -2- for sprocket, but do not tighten bolts.
- It should just be possible to turn the sprocket on the camshaft without axial movement.
- Lock camshaft (left-side) with adjustment pin -T40060-.
- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.
- Pull drill bit -3- from locating hole, this releases the chain tensioner (left-side).
- Install timing chain (right-side) with camshaft sprocket and chain tensioner.
- The elongated holes in the sprocket must be aligned centrally over the tapped holes in the camshaft.
- Tighten bolts -1- for chain tensioner.
- Screw in two bolts -2- for sprocket, but do not tighten bolts.
- It should just be possible to turn the sprocket on the camshaft without axial movement.
- Lock camshaft (right-side) with adjustment pin -T40060-.
- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.
- Pull drill bit -3- out of locating hole; this releases the chain tensioner (right-side).
- Using a torque wrench and adapter -T40062-, apply a torque of 30 Nm to camshaft sprocket (right-side) in the direction indicated (-arrow-). Maintain this torque for the following step.
- Tighten bolts -1- and -2-.
- Take off adapter -T40062- and pull out adjustment pin -T40060-.
- Tighten remaining bolts for sprocket (right-side).

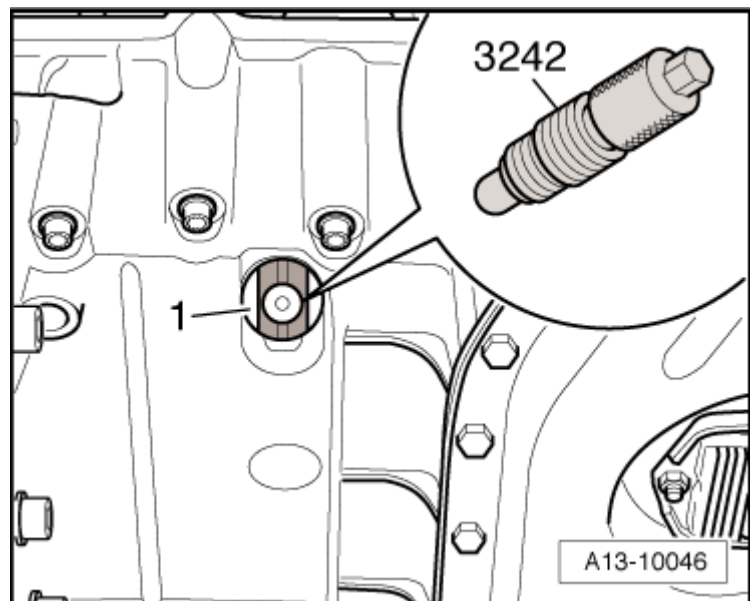




- Using a torque wrench and adapter -T40062-, apply a torque of 15 Nm to camshaft sprocket (left-side) in the direction indicated (-arrow-). Maintain this torque for the following step.
- Tighten bolts -1- and -2-.
- Take off adapter -T40062- and pull out adjustment pin -T40060-.
- Tighten remaining bolts for sprocket (left-side).



- Remove locking pin -3242-.



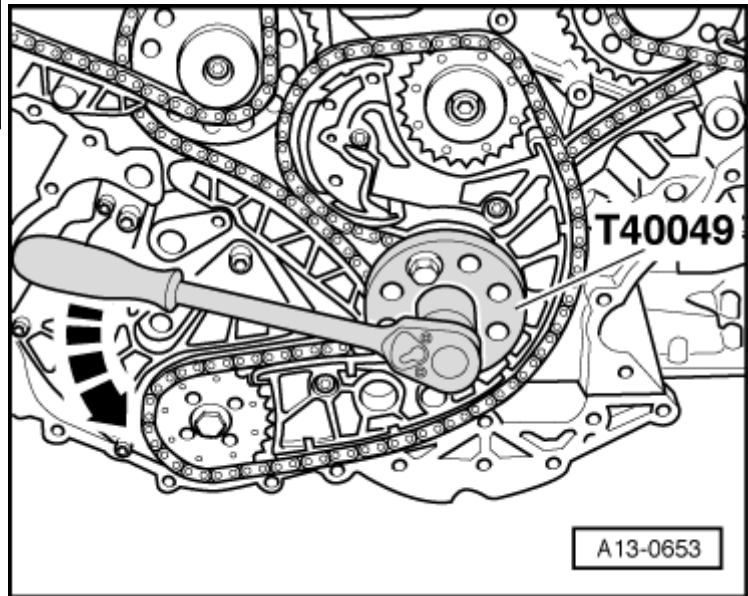
Checking valve timing



Caution

Do not rotate crankshaft in opposite direction of engine rotation.

Using special wrench - 40049- turn crankshaft two rotations in normal direction of rotation -arrow- until crankshaft is stopped again.

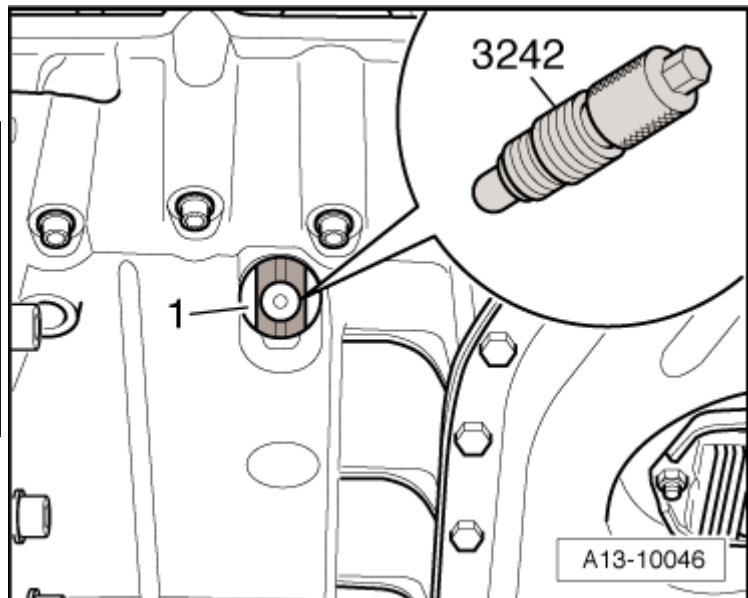


While turning in this direction, lock crankshaft -1- with locking pin -3242-. Tighten locking pin to 20 Nm.



Caution

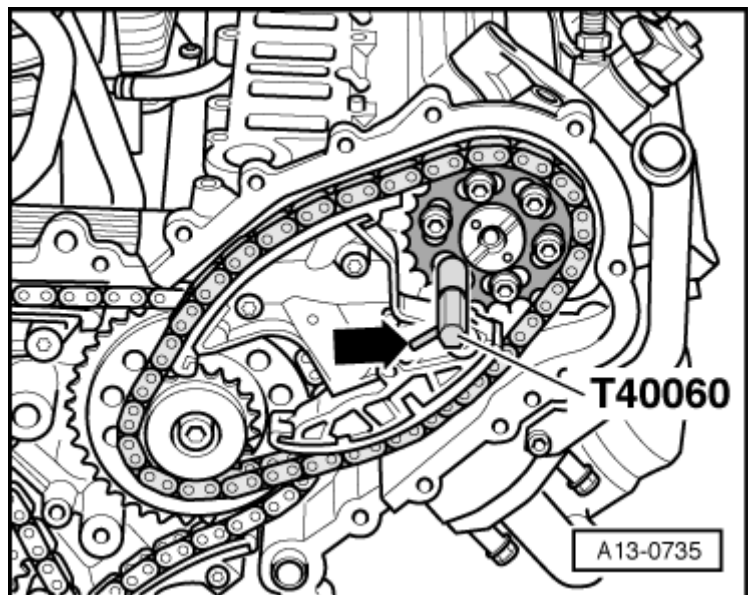
If crankshaft has been turned past „TDC“ position, turn crankshaft two further rotations until it is again positioned just before „TDC“. Then turn further in the same direction and lock crankshaft with locking pin -3242-.



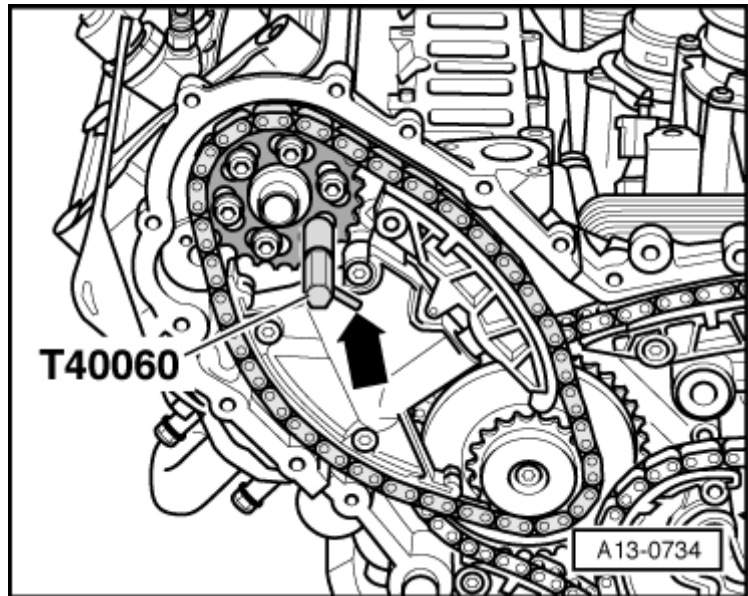
Check that it is now possible to lock the camshafts with adjustment pin - 40060 -.

- The side in -arrow- in each adjustment pin - 40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.

Cylinder an 1 right-side :



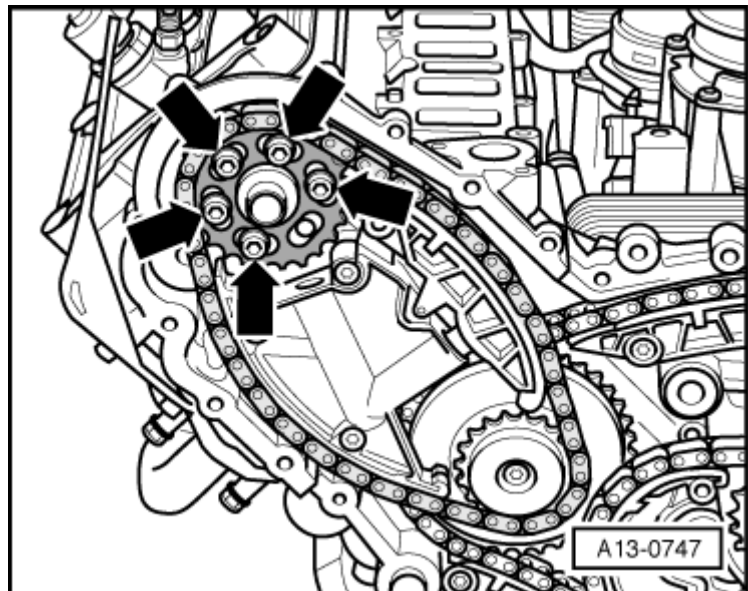
Cylinder an 2 left-side :



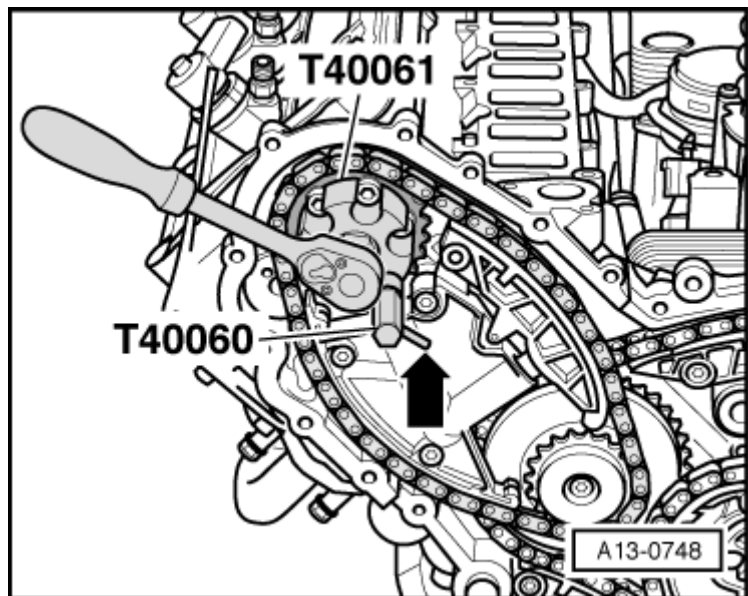
Adjusting valve timing

If the adjustment pin cannot be inserted in one of the camshafts:

- Loosen all bolts -arrows- on the relevant sprocket approx. 1 turn.



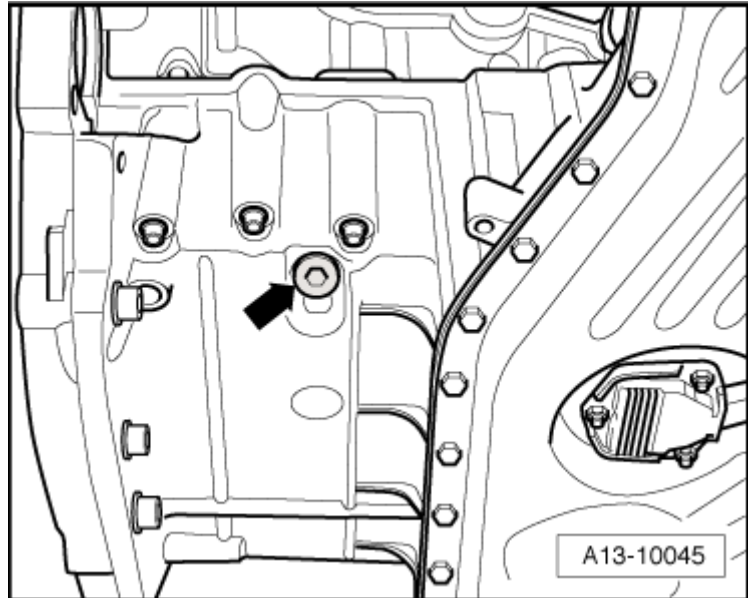
- Apply adapter -T40061- to the heads of the loosened bolts.
- Turn camshaft slightly backwards and forwards with adapter -T40061- until adjustment pin -T40060- can be inserted.
- The side pin -arrow- on the adjustment pin -T40060- must be in line with the imaginary line between the adjustment pin and the centre of the camshaft.
- With adapter -T40061- and adjustment pin -T40060- still in position, tighten bolts on sprocket to approx: 5 Nm.
- Remove adjustment pin -T40060- and adapter -T40061-.
- Tighten bolts on sprocket to final torque.



- Repeat this procedure on the other cylinder bank if necessary.
- Remove locking pin -3242-.
- Check valve timing once again
→ **Anchor**.

Remaining installation steps are carried out in reverse sequence; note the following:

- Screw plug -arrow- for TDC mark into top section of sump with a new seal.
- Install timing chain covers → .
- Install dual-mass flywheel on vehicles with manual gearbox → **Chapter**.
- Install flywheel on vehicles with multitronic gearbox → **Chapter**.
- Install drive plate on vehicles with automatic gearbox → **Chapter**.
- Fill up with engine oil and check oil level → .



Tightening torques

Component	Nm
Chain tensioner to cylinder head	5 + 90° ¹⁾²⁾
Camshaft sprocket to camshaft	23
Screw plug in top section of sump	35
<ul style="list-style-type: none"> • ¹⁾ Renew bolts. • ²⁾ 90° = one quarter turn. 	