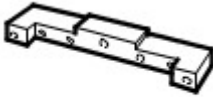





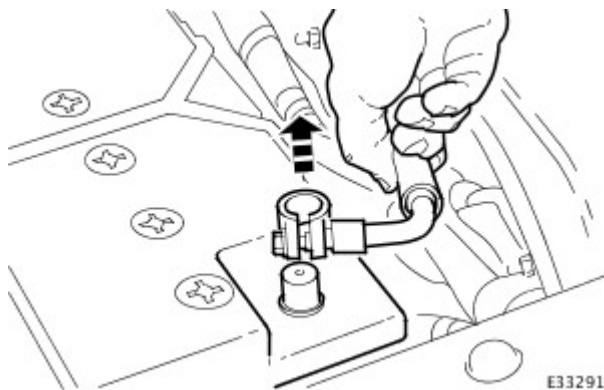
Engine - Secondary Timing Chain LH

In-vehicle Repair

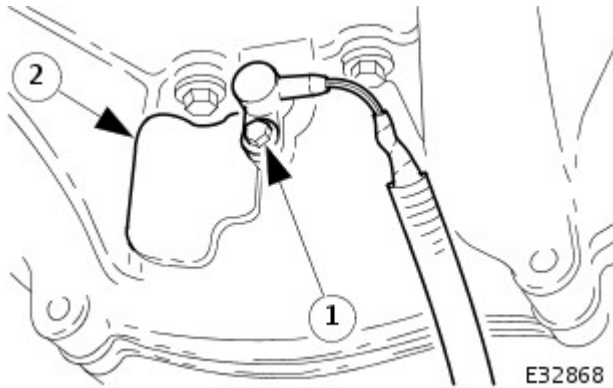
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
 - Remove the battery cover.



4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the Variable Valve Timing Bush Carrier Assembly. Refer to Operation 12.65.52 in this Section
6. Raise the vehicle on a ramp.
7. Remove the crankshaft position sensor.



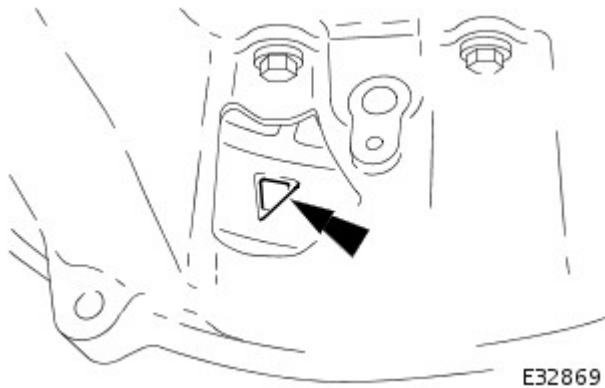
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

8. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

9. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.

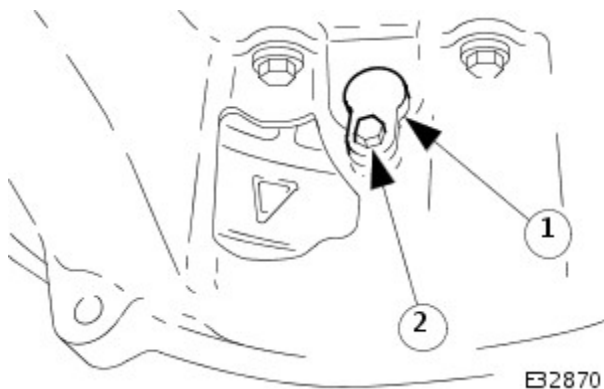


10. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

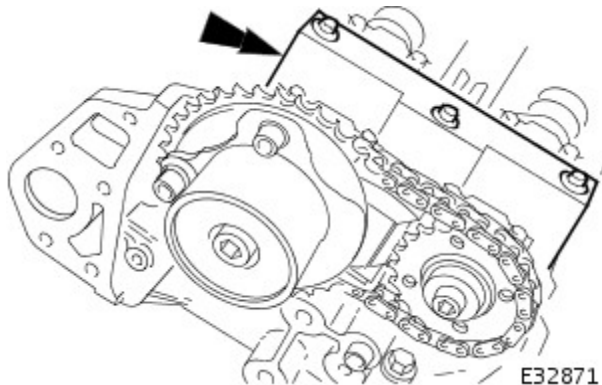
2. Fit and tighten the bolt to secure the setting peg.



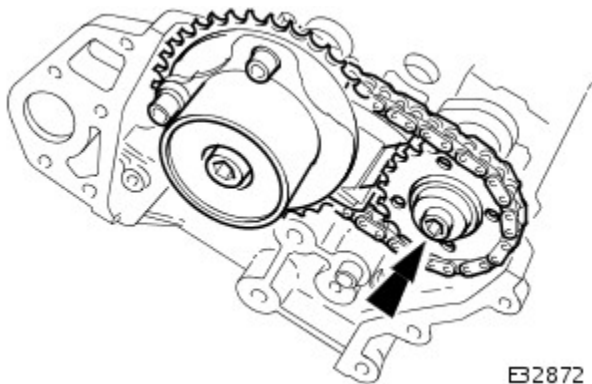
11. Remove the damper securing bolt from the crankshaft.

12. Lower the vehicle on the ramp.

13. Fit the camshaft locking tool 303 - 530 to the B-Bank camshafts, aligning the shafts slightly as necessary.



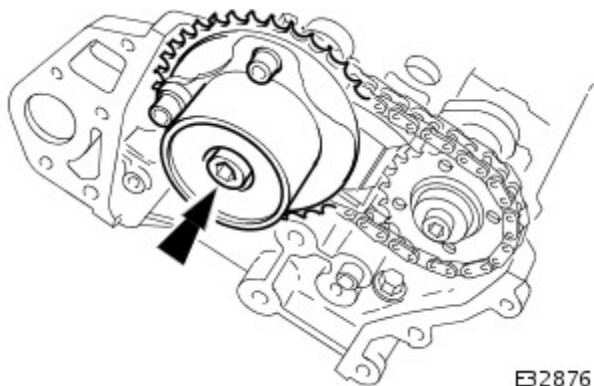
14. Loosen the bolt which secures the sprocket to the exhaust camshaft.



E32872

15. Loosen the bolt which secures the VVT unit.

- Do not tamper with the three bolts which secure the VVT mechanism to the sprockets. It is sealed at the factory to the correct valve timing specification for the engine and is supplied only as a complete unit.

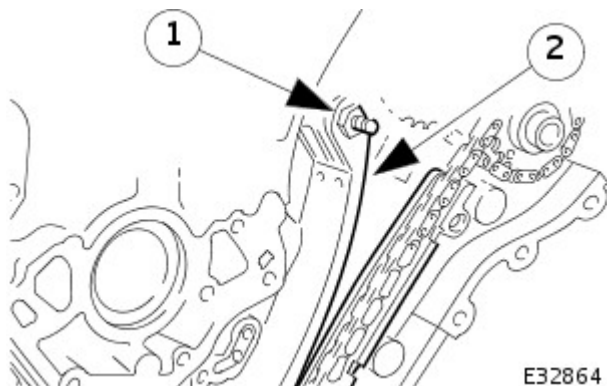


E32876

16. Remove the primary chain tensioner. Refer to operation 12.65.55, in this Section.

17. Remove the primary chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.



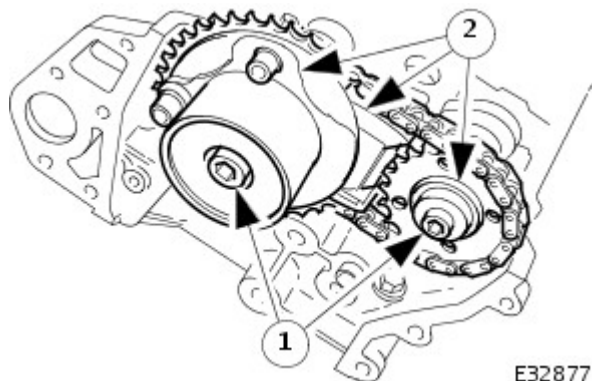
E32864

18. Reposition the VVT unit along the cam journal to allow the chain to clear the head casting.

- Disconnect the primary chain from the VVT unit and reposition it against the crankshaft sprocket.

19. Remove the VVT unit.

1. Remove the securing bolt from the VVT unit and the exhaust cam sprocket.
2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

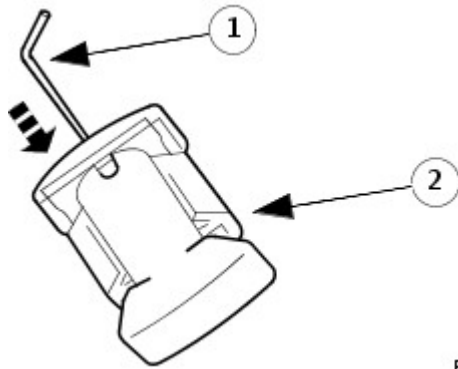


E32877

- Remove the secondary chain from the VVT unit and the sprocket.

20. Clean and inspect all relevant components.

Installation

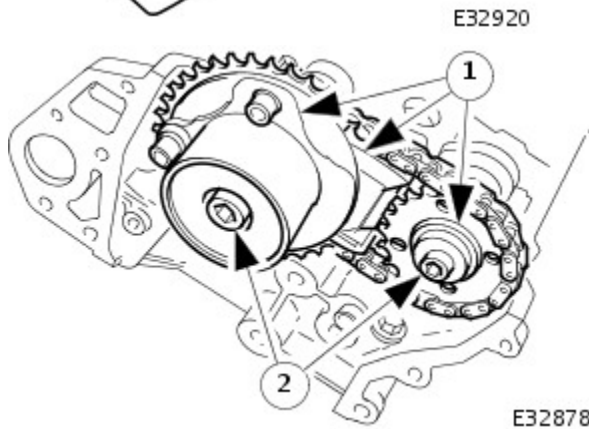


1. Push the tensioner piston (secondary chain) into the body to provide clearance for fitting.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.

2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.



2. Fit the VVT unit to the engine.

- Assemble the VVT unit, the exhaust camshaft sprocket and the secondary chain, in preparation for fitting to the engine.

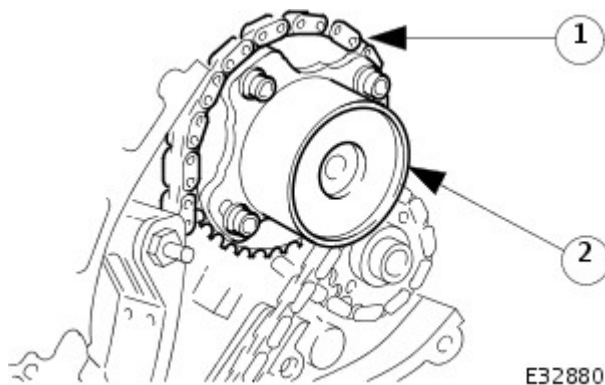
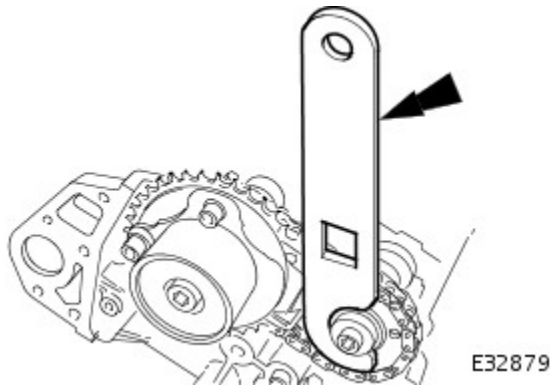
1. Fit the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.

2. Fit, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts. Allow the VVT unit sufficient space to fit the primary chain, in a later operation.

3. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.

- Remove the tool.



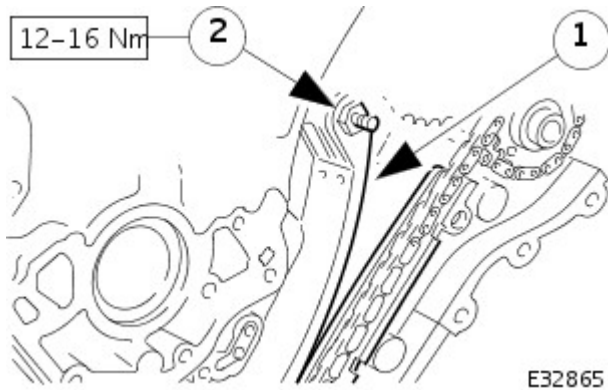
4. Refit the primary timing chain.

1. Lift the primary chain and position it over the VVT unit sprocket (the VVT unit must be pulled forward to clear the cylinder head casting). There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.

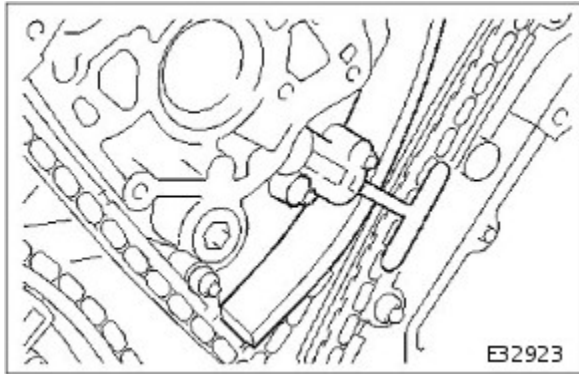
2. Slide the VVT unit fully on to the camshaft.

5. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.

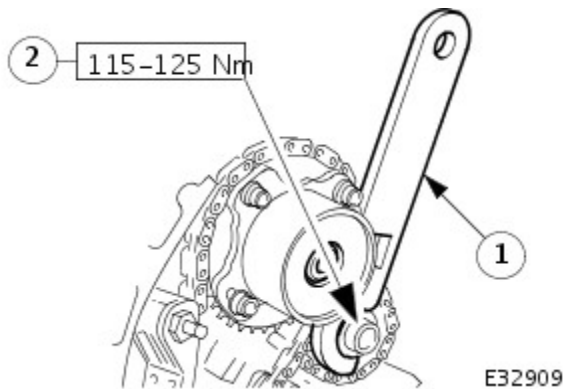


2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.



6. Refit the primary chain tensioner assembly. Refer to Operation 12.65.55 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

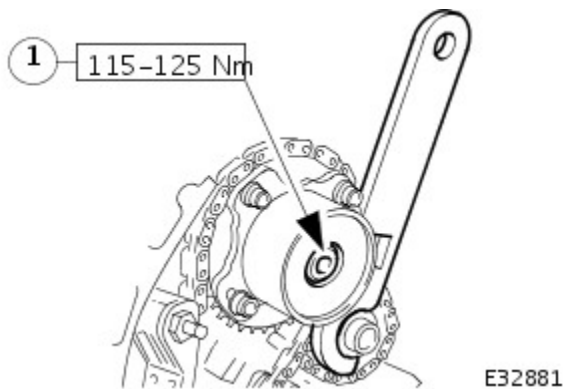


7. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



8. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

- Remove the chain tensioning tool and the wedge(s).

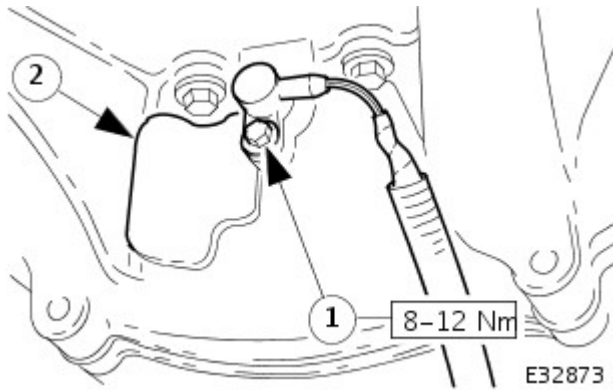
9. Remove the camshaft locking tool 303 - 530.

10. Raise the vehicle on the ramp.

11. Remove the crankshaft setting tool 303 - 531.

12. Refit the crankshaft position sensor.

1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.

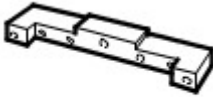





2. Refit the access grommet to the housing.

13. Lower the ramp.
 14. Refit the B-Bank VVT Bush Carrier Assembly. Refer to operation 12.65.52 in this Section.
 15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.
 16. Move the engine compartment cover from the service position and connect the gas struts.
 17. Remove the paint protection sheets and close the cover.
 18. Connect the battery and fit the battery cover.
- Refer to the Battery Reconnection Procedure 86.15.15.

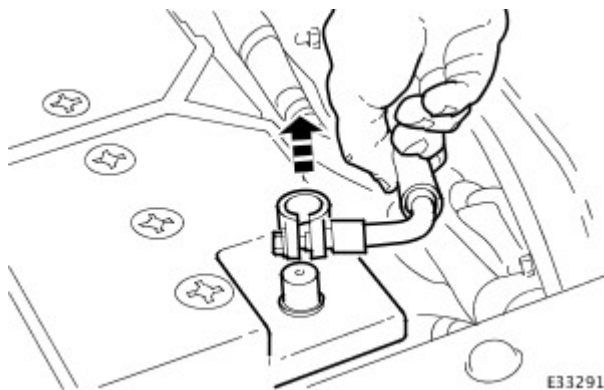
Engine - Secondary Timing Chain RH

In-vehicle Repair

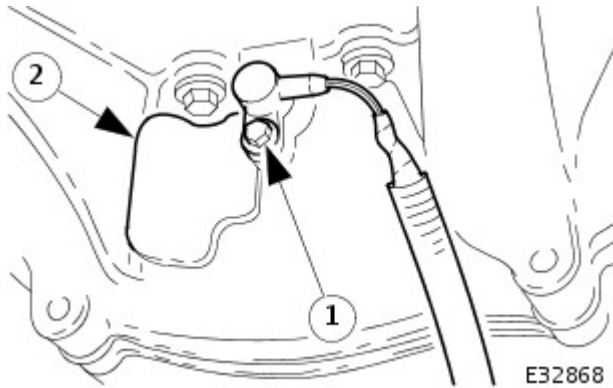
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
 - Remove the battery cover.



4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the Variable Valve Timing Bush Carrier Assembly. Refer to Operation 12.65.51 in this Section
6. Raise the vehicle on a ramp.
7. Remove the crankshaft position sensor.



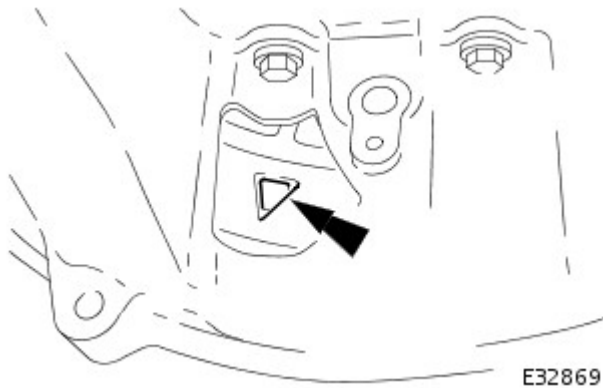
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

8. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

9. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.

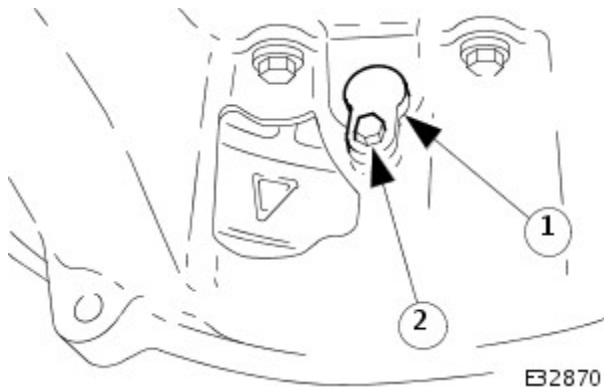


10. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

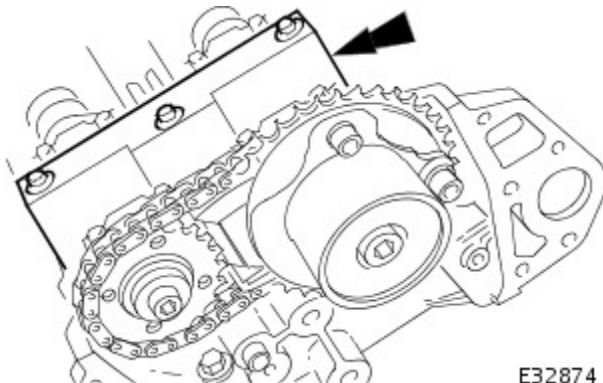
2. Fit and tighten the bolt to secure the setting peg.



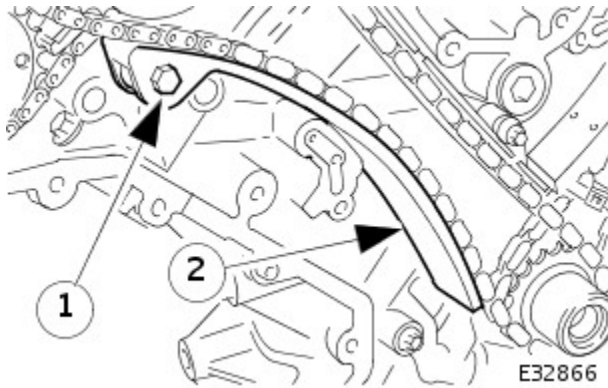
11. Remove the damper securing bolt from the crankshaft.

12. Lower the vehicle on the ramp.

13. Fit the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.



14. Remove the primary chain tensioner. Refer to operation 12.65.54, in this Section



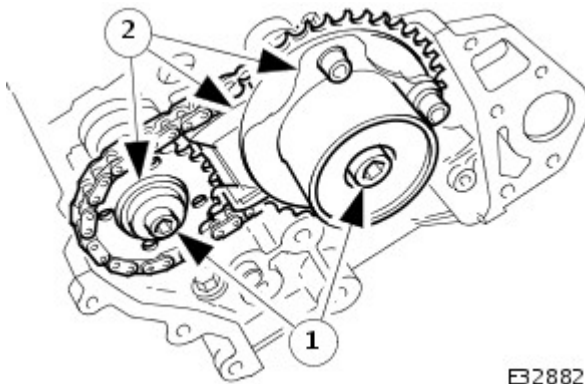
15. Remove the primary chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

16. Disconnect the primary chain from the VVT unit and the crankshaft sprocket, and remove it completely.

17. Do not tamper with the three bolts which secure the VVT mechanism to the sprockets. It is sealed at the factory to the correct valve timing specification for the engine and is supplied only as a complete unit.

18. Remove the VVT unit.



1. Remove the securing bolt from both the VVT unit and the exhaust cam sprocket.

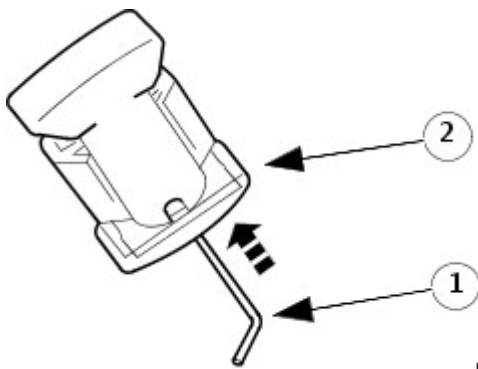
2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

- Remove the secondary chain from the VVT unit and the sprocket.

19. Clean and inspect all relevant components.

Installation

1. Push the tensioner piston (secondary chain) into the body to provide clearance for fitting.



1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

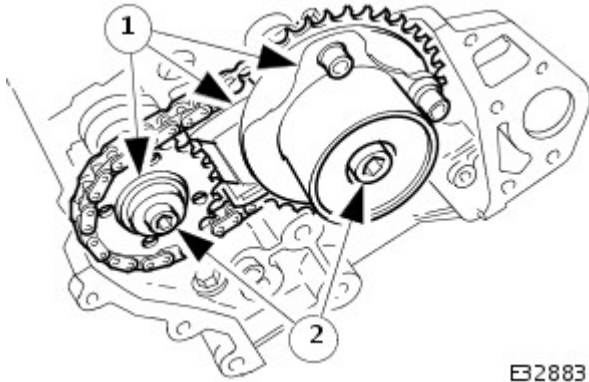
- Remove the wire.

2. Fit the VVT unit to the engine.

- Assemble the VVT unit, the exhaust camshaft sprocket and the secondary chain, in preparation for fitting to the engine.

1. Fit the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.

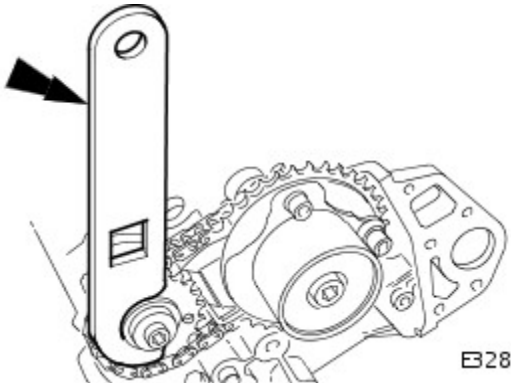
2. Fit, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts.



E32883

3. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

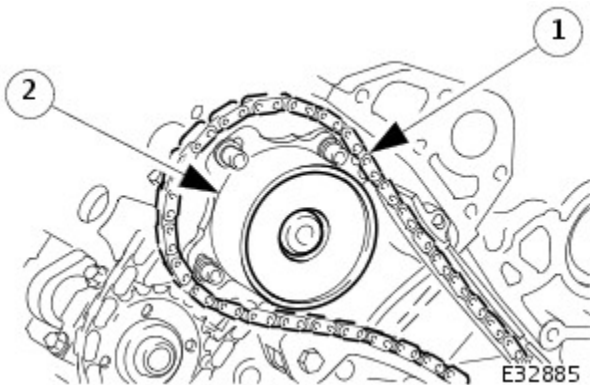
- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



E32884

4. Refit the primary timing chain.

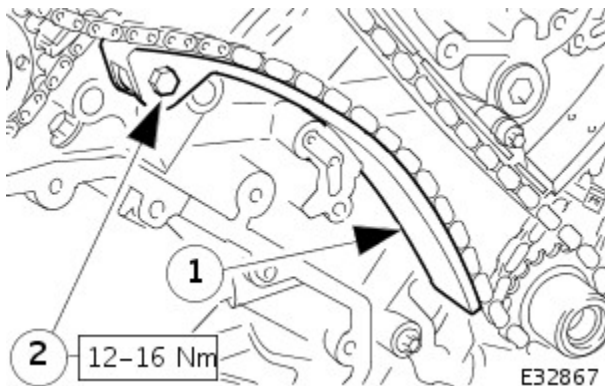
1. Fit the primary chain to position over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain.
2. The VVT unit must not be rotated on the camshaft



E32885

5. Fit the primary chain tensioner blade.

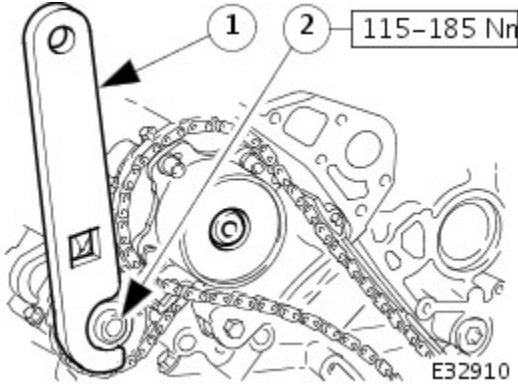
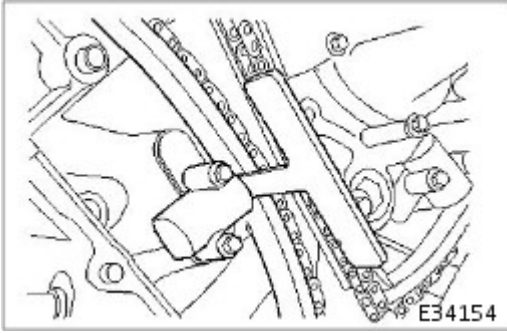
1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.



E32867

6. Refit the primary chain tensioner assembly. Refer to Operation 12.65.54 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

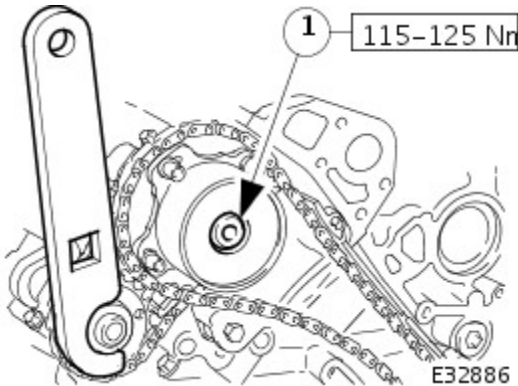


7. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



8. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

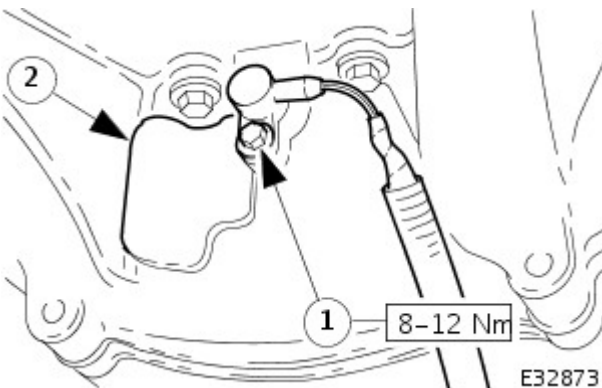
- Remove the chain tensioning tool and the wedge(s).

9. Remove the camshaft locking tool 303 - 530.

10. Raise the vehicle on the ramp.

11. Remove the crankshaft setting tool 303 - 531.

12. Refit the crankshaft position sensor.



1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.

2. Refit the access grommet to the housing.

13. Lower the ramp.

14. Refit the A-Bank VVT Bush Carrier Assembly. Refer to operation 12.65.51 in this Section.

15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

- 16.** Move the engine compartment cover from the service position and connect the gas struts.
- 17.** Remove the paint protection sheets and close the cover.
- 18.** Connect the battery and fit the battery cover.
 - Refer to the Battery Reconnection Procedure 86.15.15.