

Published : Apr 20, 2004

Camshafts LH (12.13.21)

Special Service Tools



Crankshaft locking tool
303-645




Camshaft setting/locking tool
303-530



Timing chain tensioning tool
303-532

Removal

1. Disconnect the battery ground cable. For additional information, refer to [Specifications](#) (Section 414-00)
2. Remove the battery tray. For additional information, refer to [Battery Tray \(76.10.30\)](#) (Section 414-01)

3.  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

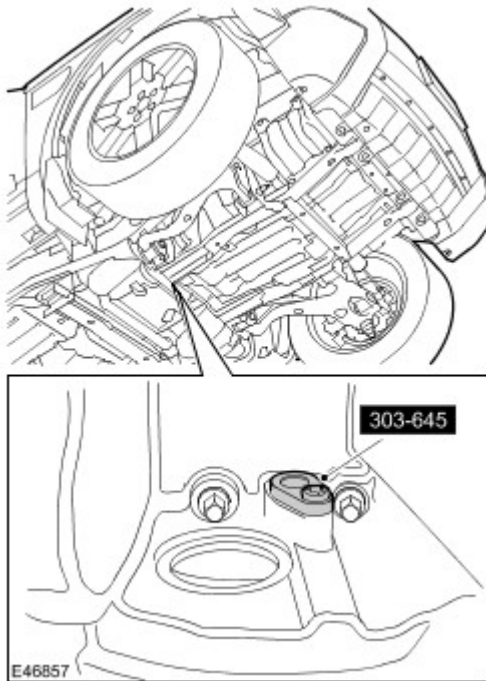
Raise and support the vehicle.

4. Remove the engine front cover. For additional information, refer to [Engine Front Cover \(12.65.01\)](#) (Section 303-01)
5. Remove the crankshaft position (CKP) sensor. For additional information, refer to [Crankshaft Position \(CKP\) Sensor \(18.30.12\)](#) (Section 303-14)

- 6 . Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.

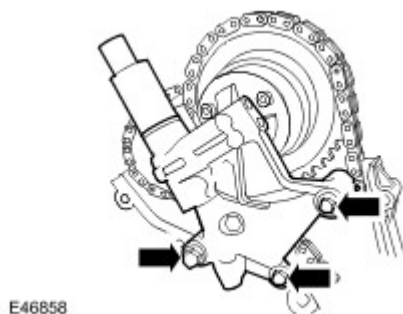
- 7 . **NOTE :**
The engine is now in the SAFE position.
Lock the crankshaft.

- Install the special tool.
- Install the screw.



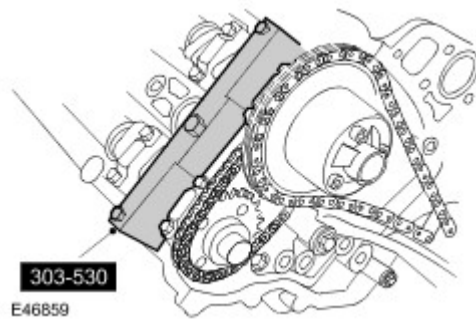
- 8 . Remove the RH variable camshaft timing (VCT) control unit.

- Remove the 3 bolts.
- Remove and discard the O-ring seals.



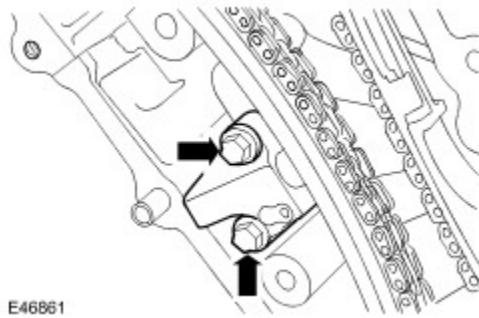
- 9 . Install the special tool to the RH cylinder head.

- Install the 3 bolts.



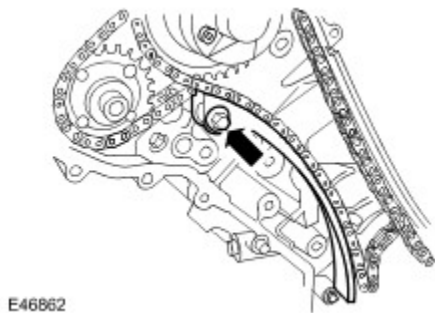
10. Remove the RH primary timing chain tensioner assembly.

▶ Remove the 2 bolts.

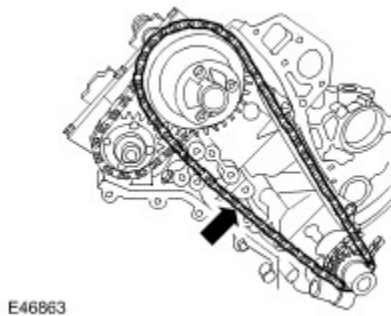


11. Remove the RH primary timing chain tensioner guide.

▶ Remove the bolt.



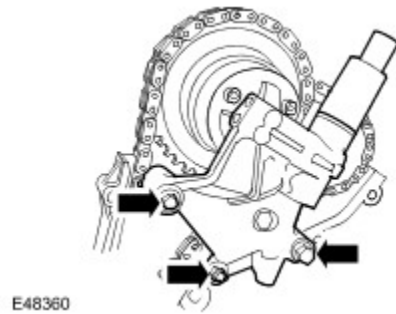
12. Remove the RH primary timing chain.



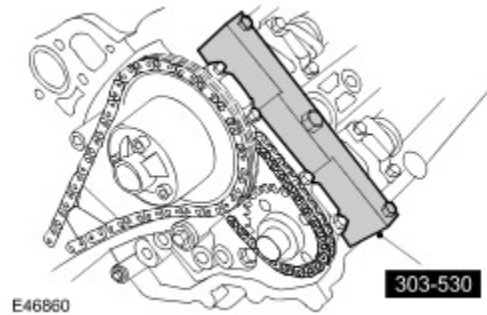
13. Remove the LH variable camshaft timing (VCT) control unit.

▶ Remove the 2 bolts.

- Remove the nut.
- Remove and discard the O-ring seals.



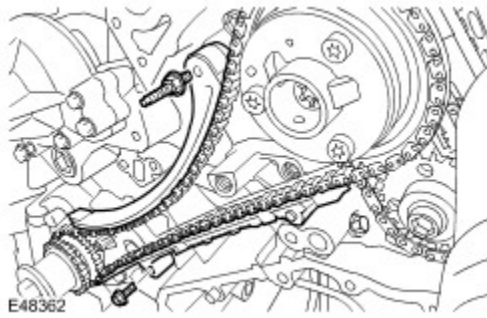
- 14 . Install the special tool to the LH cylinder head.
- Install the 3 bolts.



- 15 . Remove the LH primary timing chain tensioner.
- Remove the 2 bolts.



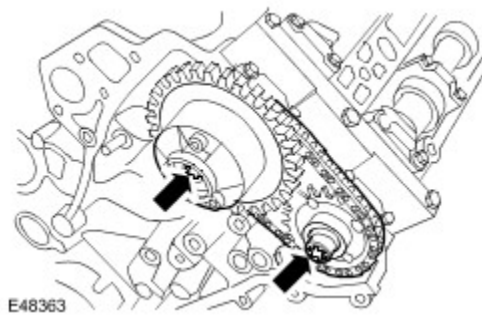
- 16 . Remove the LH upper and lower primary timing chain tensioner guides.
- Remove the stud.
 - Remove the bolt.



17. Remove the LH primary timing chain.

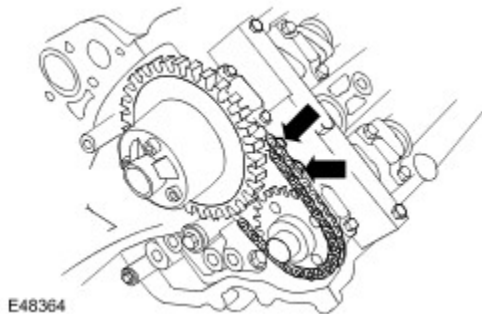
18. Remove the camshaft sprockets.

➤ Remove the 2 bolts.



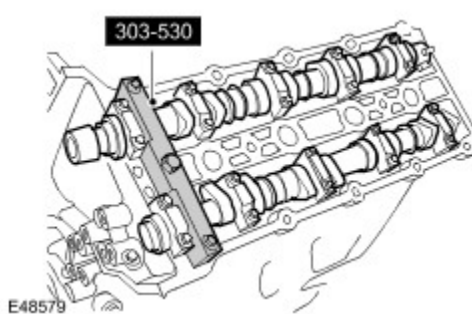
19. Remove the secondary timing chain tensioner and the secondary timing chain.

➤ Remove the 2 bolts.



20. Remove the special tool from the LH cylinder head.

➤ Remove the 3 bolts.



21 .



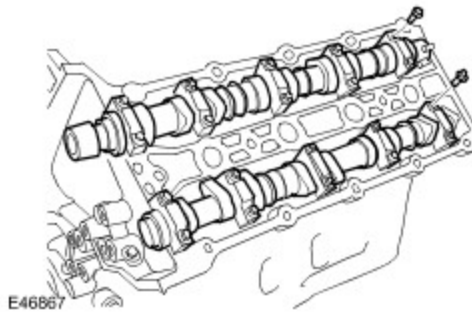
CAUTION: Evenly and progressively, release the camshaft bearing caps.

NOTE :

Remove the camshaft bearing caps. Note their position, orientation and markings, each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

➤ Remove the 20 bolts.



22 .

Remove the camshafts.

Installation

1 .

Check and adjust the valve tappet clearances.

2 .

Replace the valve tappets, with the smallest tappet available.

➤ Apply a light coat of clean engine oil to the replacement valve tappets.

3 .

Install the camshafts.

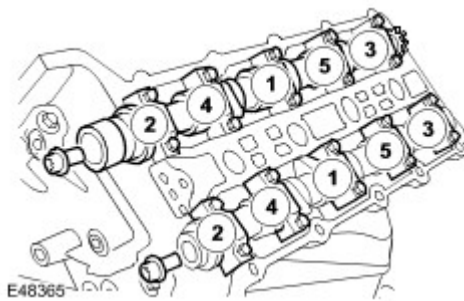
➤ Clean the component mating faces.

➤ Lubricate the journals and camshaft lobes.

4 .

Install the camshaft bearing caps.

➤ Evenly and progressively tighten the bolts in the sequence shown to 10 Nm (7 lb.ft).



5 .

Install the sprocket retaining Torx bolts to the camshafts.

6 .

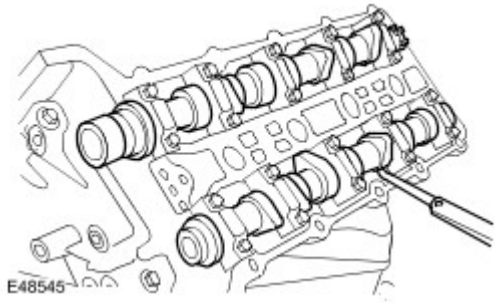


CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

Measure and record the tappet clearances.



Rotate the camshafts using the Torx bolts.



7 .

NOTE :

Remove the camshaft bearing caps evenly and in stages.

NOTE :

Remove the camshaft bearing caps. Note their position, orientation and markings, each is marked with its position (number) and an orientation (arrow).

Remove the camshafts.



Remove the 20 bolts.

8 .

Remove the valve tappets, replace with selected tappets.

9 .

Install the camshafts.



Lubricate the journals and camshaft lobes.



Clean the component mating faces.

10 .

Install the camshaft bearing caps.



Evenly and progressively tighten the bolts in the sequence shown to 10 Nm (7 lb.ft).

11 .



CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

Check valve tappet clearances are correct.



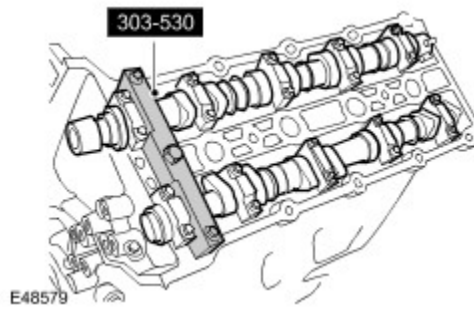
Rotate the camshafts using the Torx bolts.



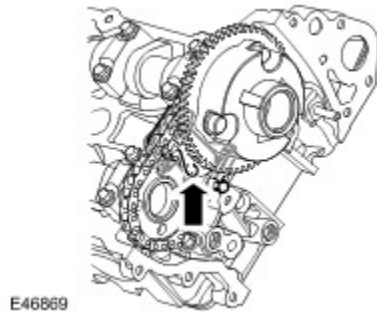
Remove the camshaft Torx bolts after the check is complete.

12 .

Install the special tool to the LH cylinder head.



13. Depress the LH secondary timing chain tensioner piston.
 ➤ Using 1 mm diameter metal rod, retain the chain tensioner piston.

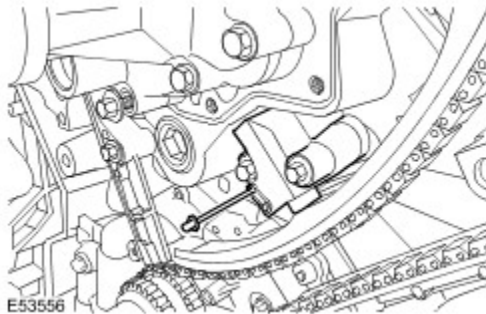


14. Install the LH secondary timing chain tensioner and chain to the camshaft sprockets.
15. Install the LH secondary timing chain tensioner retaining bolts.
 ➤ Tighten the bolts to 12 Nm (9 lb.ft).
16. **NOTE :**
 Lightly tighten the camshaft sprocket Torx bolts, the sprockets **MUST** be free to move.
 Install the LH secondary timing chain and sprockets to the camshafts.
 ➤ Install the sprocket retaining Torx bolts to the camshafts.
17. Tension the secondary timing chain.
 ➤ Remove the retaining rod.
18. Install the LH primary timing chain.
 ➤ Make sure the timing chain slack is on the tensioner side of the timing chain.
19. Install the LH primary chain tensioner guide.
 ➤ Tighten the stud to 12 Nm (9 lb.ft).

20.  **CAUTION:** During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the LH primary chain tensioner.

- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Tighten the bolts to 12 Nm (9 lb.ft).
- Remove the retaining rod.



21 .



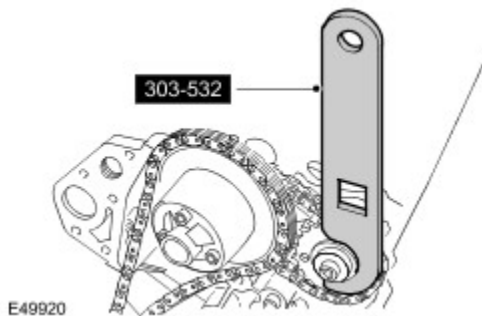
CAUTION: Using the special tool apply force to the tool in an anti-clockwise direction to tension the primary timing chain on its drive side.



CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

Install the special tool to the exhaust camshaft sprocket.

- Tighten the intake camshaft sprocket retaining bolt to 120 Nm (88 lb.ft).
- Tighten the exhaust camshaft retaining bolt to 120 Nm (88 lb.ft).



22 .

Install the LH VCT oil control unit.

- Install the new O-ring seals.
- Tighten the new bolts to 22 Nm (16 lb.ft).
- Tighten the nut to 10 Nm (7 lb.ft).

23 .

Install the RH primary timing chain.

- Make sure the timing chain slack is on the tensioner side of the timing chain.

24 .

Install the RH primary chain tensioner guide.

- Tighten the bolts to 12 Nm (9 lb.ft).

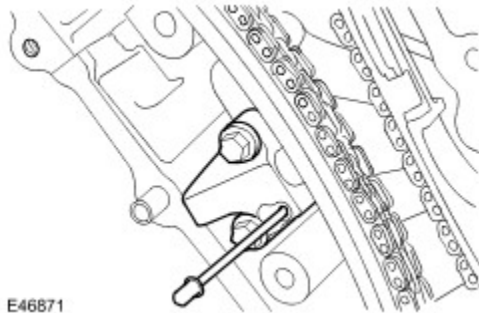
25 .



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the RH primary chain tensioner.

- Using 3 mm diameter metal rod, retain the chain tensioner piston.
- Tighten the bolts to 12 Nm (9 lb.ft).
- Remove the retaining rod.



26 .



CAUTION: Using the special tool apply force to the tool in an anti-clockwise direction to tension the primary timing chain on its drive side.



CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

Install the special tool to the exhaust camshaft sprocket.

- Tighten the intake camshaft sprocket retaining bolt to 120 Nm (88 lb.ft).
- Tighten the exhaust camshaft retaining bolt to 120 Nm (88 lb.ft).

27 .

Install the RH VCT control unit.

- Install the new O-ring seals.
- Tighten the new bolts to 22 Nm (16 lb.ft).

28 .

Remove the special tool from the LH cylinder head.

29 .

Remove the special tool from the RH cylinder head.

30 .

Remove the crankshaft locking tool.

- Remove the screw.

31 .

Install the CKP sensor. For additional information, refer to [Crankshaft Position \(CKP\) Sensor \(18.30.12\)](#) (Section 303-14)

32 .

NOTE :

Before refitting the valve covers, check the valve clearances.

Install the engine front cover. For additional information, refer to [Engine Front Cover \(12.65.01\)](#) (Section 303-01)

- 33 . Install the battery tray. For additional information, refer to [Battery Tray \(76.10.30\)](#) (Section 414-01)