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Camshafts RH (12.13.20)

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 . 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 .

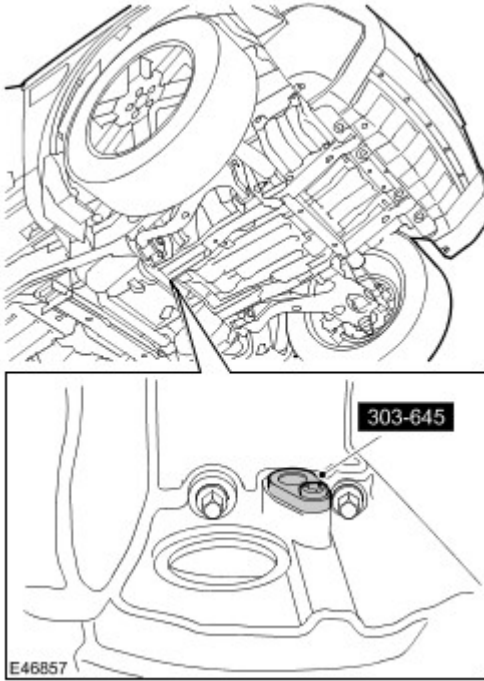
NOTE :

The engine is now in the SAFE position.

Lock the crankshaft.

➤ Install the special tool.

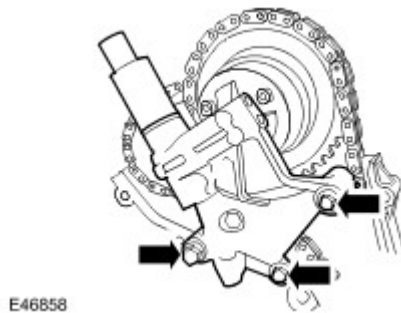
➤ Install the screw.



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

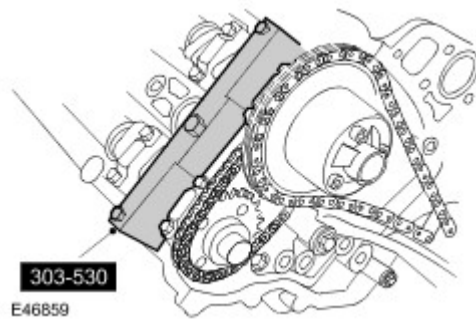
➤ Remove the 3 bolts.

➤ Remove and discard the O-ring seals.



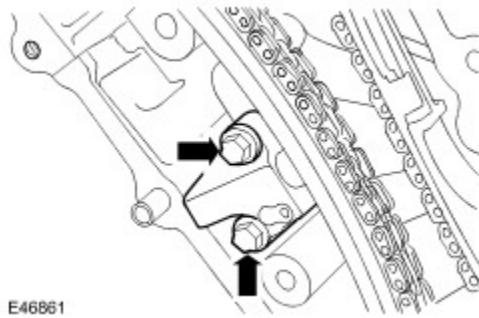
9 . Install the special tool to the RH cylinder head.

➤ Install the 3 bolts.



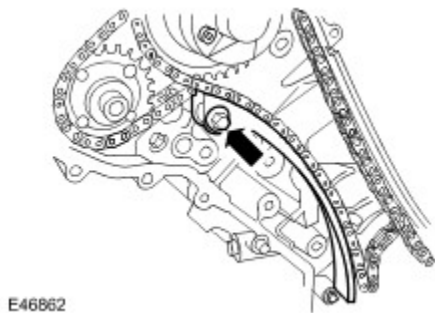
10. Remove the primary timing chain tensioner.

▶ Remove the 2 bolts.

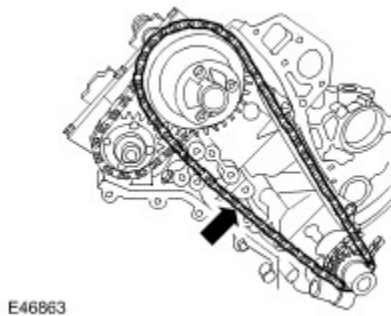


11. Remove the primary timing chain tensioner guide.

▶ Remove the bolt.

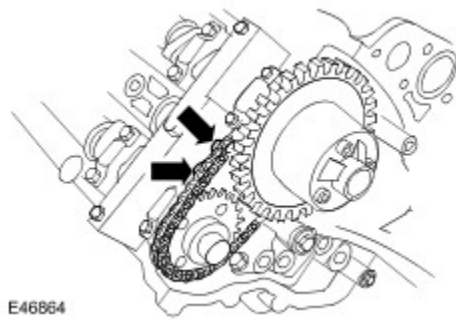


12. Remove the primary timing chain.



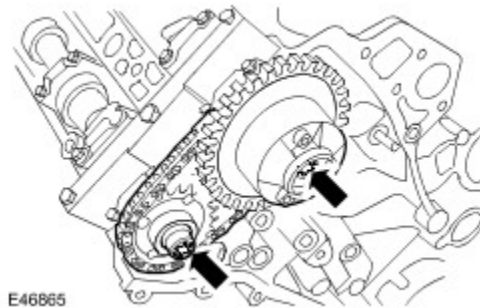
13. Remove the secondary timing chain tensioner and the secondary timing chain.

▶ Remove the 2 retaining bolts



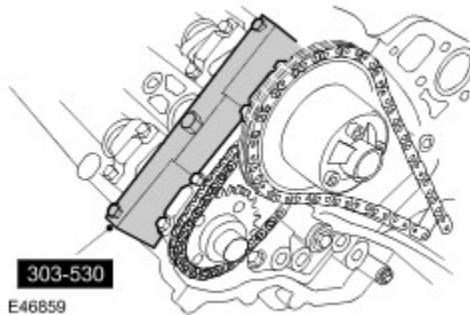
14. Remove the camshaft sprockets.

▶ Remove the 2 bolts.



15. Remove the special tool from the RH cylinder head.

▶ Remove the 3 bolts.



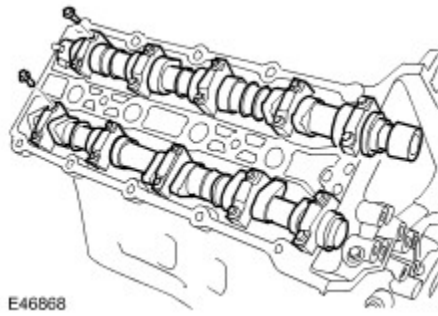
16.  **CAUTION: Evenly and progressively, release the camshaft bearing caps.**

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.

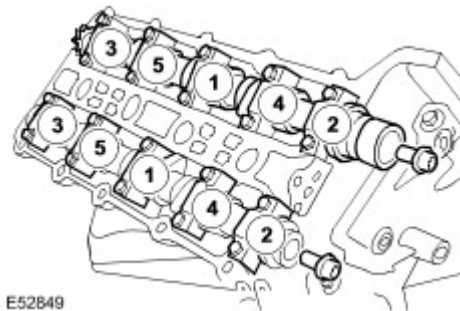
▶ Remove the 20 bolts.




17. 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 .



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 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 .

NOTE :

Apply clean engine oil to the camshaft and bearing surfaces, as follows. To the upper surface in the cylinder head. To the upper face of each bearing surface on each bearing cap. On the cam lobes ONLY, not on the base circle area.

Install the camshafts.

- Clean the component mating faces.

13 .

Install the camshaft bearing caps.

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

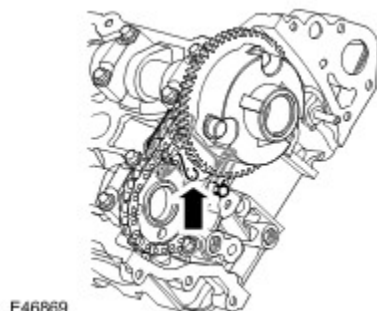
14 .

Install the special tool to the RH cylinder head.

- ▶ Install the 3 bolts.

- 15 . Retain the secondary timing chain piston.

- ▶ Install a metal rod.



- 16 . Install the secondary timing chain tensioner and chain to the camshaft sprockets.

- 17 . **NOTE :**

Lightly tighten the camshaft sprocket Torx bolts, the sprockets **MUST** be free to move.

Install the secondary timing chain and sprockets to the camshafts.

- ▶ Install the sprocket retaining Torx bolts to the camshafts.

- 18 . Install the secondary timing chain tensioner retaining bolts.

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

- 19 . Tension the secondary timing chain.

- ▶ Remove the retaining rod.

- 20 . Install the primary timing chain.

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

- 21 . Install the primary tensioner guide.

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

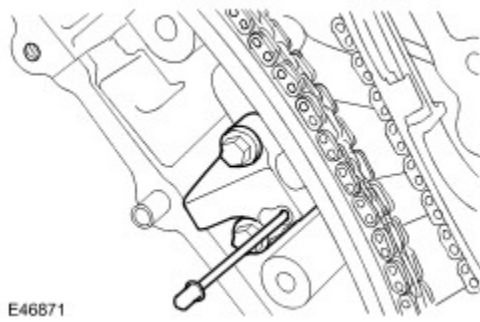
- 22 .



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 primary chain tensioner.

- ▶ Using a metal rod, retain the tensioner piston.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).
- ▶ Release the retaining rod.



23 .



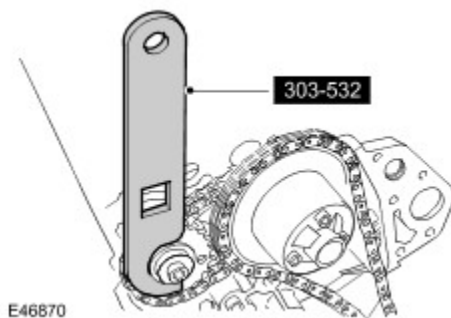
CAUTION: Using the special tool apply force to the tool in an anti-clockwise direction to tension the primary timing chain on its drive side.



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).



24 .

Remove the special tool from the RH cylinder head.

25 .

Install the RH VCT control unit.

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

26 .

Remove the crankshaft locking tool.

- ▶ Remove the screw.

27 .

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

28 .

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)

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