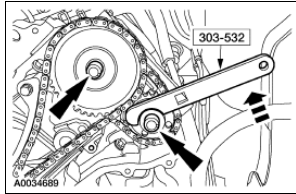
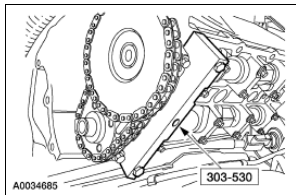


and tighten the camshaft bolts in two stages.

- Stage 1 : Tighten to 20 Nm (15 lb-ft).
- Stage 2 : Tighten an additional 90 degrees.

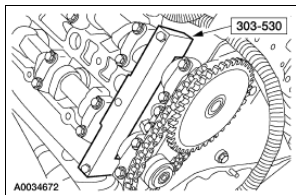


8. Remove the special tool.

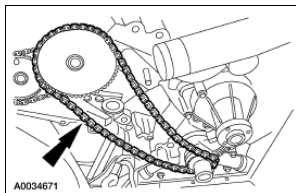


9. Remove the tie strap.

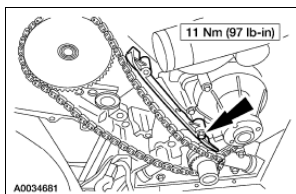
10. Install the special tool on the right cylinder head.



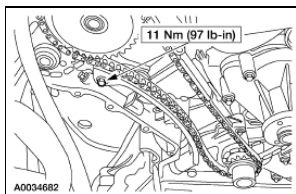
11. Position the RH timing chain over the RH intake camshaft sprocket and over the crankshaft gear.



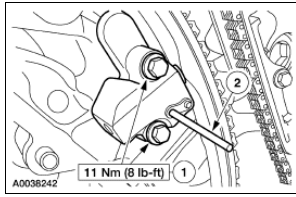
12. Install the RH timing chain guide.



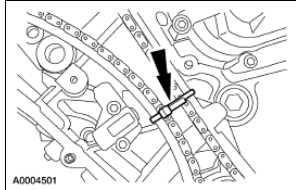
13. Install the RH timing chain tensioner arm.



14. Install the RH timing chain tensioner.
 1. Install the timing chain tensioner and bolts.
 2. Remove the drill rod.



15. Install a tie strap to take up the slack in the timing chain.

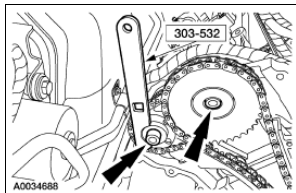


16. **⚠ CAUTION:** The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.

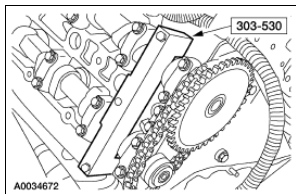
⚠ CAUTION: The flats on the camshaft must contact the flats on the special tool.

Using the special tool, apply 10 Nm (89 lb-in) counterclockwise to the RH exhaust camshaft sprocket and tighten the camshaft sprocket bolts in two stages.

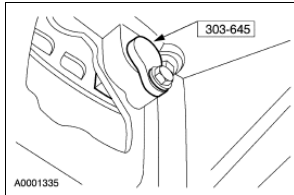
- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten an additional 90 degrees.



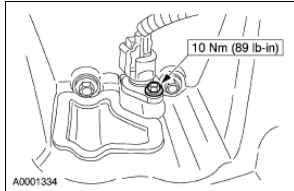
17. Remove the special tool.
 - Remove the tie strap.



18. Raise the vehicle.
19. Remove the special tool.



20. Install the CKP sensor and the torque converter cover.



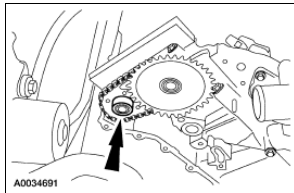
21. Lower the vehicle.

22. Install the engine front cover. For additional information, refer to [Engine Front Cover](#) in this section.

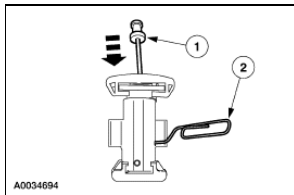
Timing Drive Components Secondary**Removal**

NOTE: The RH secondary timing chains are shown; the LH secondary timing chains are similar.

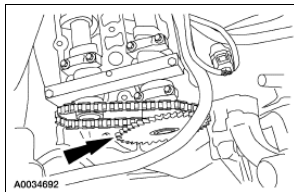
1. Remove the primary timing chains. For additional information, refer to Timing Drive Components Primary in this section.
2. Remove the exhaust sprocket bolt.



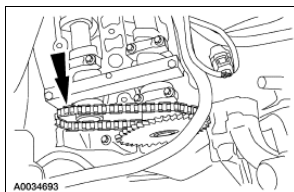
3. Collapse the tensioners.
 1. Insert a thin wire into the check valve and apply hand pressure until the tensioners are fully collapsed.
 2. Install a wire in the side of the tensioner to retain it.



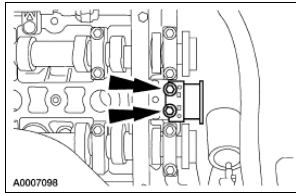
4. Remove the intake sprocket bolt.



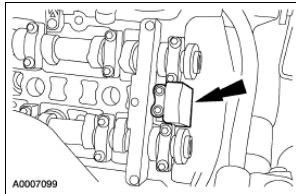
5. Remove the sprockets and chain as an assembly.



6. Remove the secondary timing chain tensioner bolts.

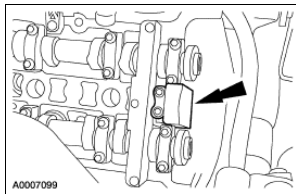


7. Remove the tensioner.

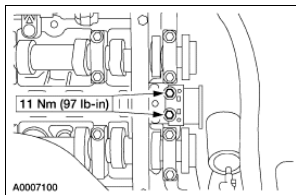


Installation

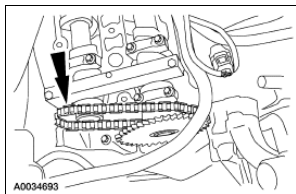
1. Position the tensioner.



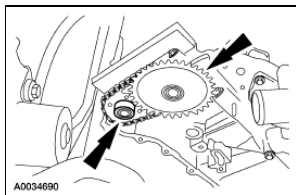
2. Install the timing chain tensioner bolts.



3. Position the intake sprocket, chain and exhaust sprocket on the camshafts as an assembly.

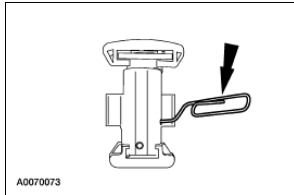


4. Loosely install the intake and exhaust sprocket bolts.



5. Install the primary timing chains. For additional information, refer to Timing Drive Components Primary in this section.

6. Remove the wire retainer from the secondary chain tensioner.



Valve Springs

Special Tool(s)

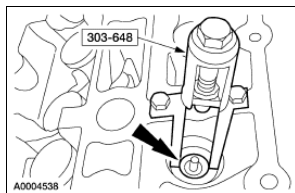
 ST2489-A	Compressor, Valve Spring 303-648
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Removal

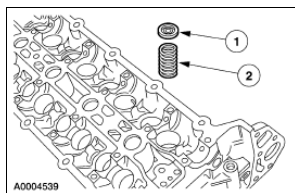
1. Remove the camshaft. For additional information, refer to Camshaft in this section.
2. Position the piston at the top of the stroke on the appropriate cylinder.
3. Remove the spark plug and apply compressed air in the cylinder to hold both valves in position.
4. **⚠ CAUTION:** If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal.

Remove the bucket tappet and shim from the valve.

5. Using the special tool, remove the retainer keys.



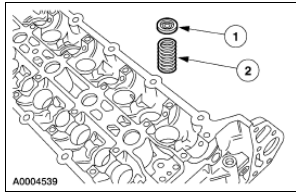
6. Remove the valve springs.
 1. Remove the spring retainers.
 2. Remove the valve springs.



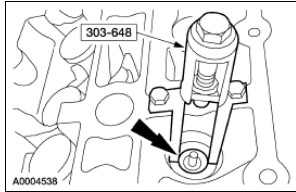
7. Repeat the procedure until all of the valve springs are removed.

Installation

1. Position the valve springs.
 1. Position the spring retainers.
 2. Position the valve springs.



2. Using the special tool, install the retainer keys.



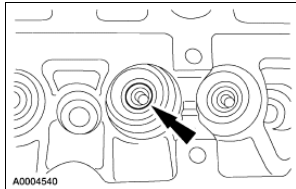
3. Repeat the procedure until all of the valve springs are installed.

4. Install the camshaft. For additional information, refer to Camshaft in this section.

Valve Seals

Removal

1. Remove the valve springs. For additional information, refer to [Valve Springs](#) in this section.
2. Remove the valve stem seals.



Installation

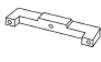
1. **NOTE:** The valve stem seal must be bottomed on the valve seat.

NOTE: Make sure that the garter spring is present in the valve stem seal.

Install the valve stem seals over the valve stems.

2. Install the valve springs. For additional information, refer to [Valve Springs](#) in this section.
-

Camshaft**Special Tool(s)**

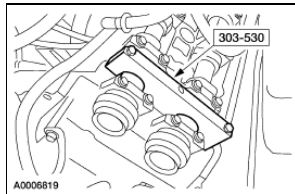
 ST2398-B	Aligner, Camshaft 303-530
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Material

Item	Specification
Super Premium SAE 5W-20 XO-5W20-QSP or equivalent	WSS-M2C153-H

Removal

1. Remove the secondary timing chains. For additional information, refer to [Timing Drive Components, Secondary](#) in this section.
2. Remove the special tool.



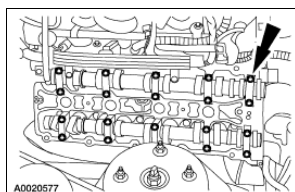
3. **⚠ CAUTION:** Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientations or engine damage may occur.

⚠ CAUTION: Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.

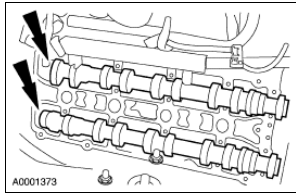
⚠ CAUTION: Record the shim and bucket tappet location. The shim and bucket tappet are positional and if installed in the incorrect location, engine damage may occur.

Remove the RH camshaft bearing caps.

- Remove the bolts.
- Remove the RH camshaft bearing caps.



4. Remove the RH camshafts (6A270 intake and 6A272 exhaust).



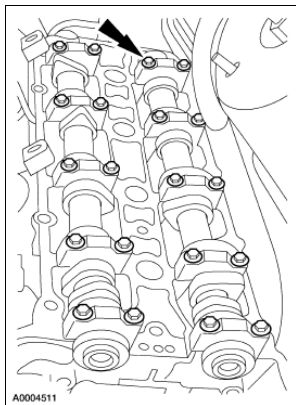
5. **⚠ CAUTION:** Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientations or engine damage may occur.

⚠ CAUTION: Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.

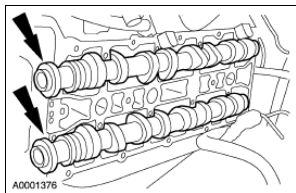
⚠ CAUTION: Record the location of the shims and bucket tappets. The bucket tappets and shims are positional and if installed in the incorrect location, engine damage may occur.

Remove the LH camshaft bearing caps.

- Remove the bolts.
- Remove the LH camshaft bearing caps.



6. Remove the LH camshafts.



Installation

1. **NOTE:** Apply clean engine oil to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

Position the LH camshafts on the camshaft journals.