Subject: Camframe Assembly  
Date: January 2014

Additions, Revisions, or Updates

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2 Removal of the Camframe Assembly

Table 1.

<table>
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<th>Tool Number</th>
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<td>W470589034000</td>
<td>Camshaft Timing Tool - EPA07 DD13*</td>
<td>![Graphic]</td>
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<td>W470589114000</td>
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<td>W470589054000</td>
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<td>DD15 Camshaft Timing Tool - EPA07/EPA10 DD15/16</td>
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<tr>
<td>J-46392 or W904589046300</td>
<td>Engine Barring Tool - DD Platform</td>
<td>![Graphic]</td>
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<tr>
<td>W470589001500</td>
<td>Top Dead Center Locating Pin - DD Platfrom</td>
<td>![Graphic]</td>
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</table>

Remove as follows:

1. Turn engine OFF.
2. Disconnect the battery power to the engine. Refer to OEM procedures.
3. Open the hood.
4. Steam clean the engine.
5. Remove the bumper (if needed). Refer to OEM procedures.
6. Remove fender (if needed). Refer to OEM procedures.
7. Remove the wipers (if needed). Refer to OEM procedures.
8. Remove the rain tray (if needed). Refer to OEM procedures.
9. Remove the rain wiper motor assembly (if needed). Refer to OEM procedures.

10. Drain the fuel system.
   a. For two-filter systems, Refer to section "Draining the Fuel System Using J-48710 Prior to Repairs - Two-Filter System".
   b. For three-filter systems, Refer to section "Draining the Fuel System Using J-48710 Prior to Repairs - Three-Filter System".

11. Remove the turbocharger inlet pipe and hose. Refer to OEM procedures.

12. Remove air filter housing (if needed). Refer to OEM procedures.

13. Unbolt the air compressor intake hose from the air filter mounting brackets and the chassis water manifold mounting bracket.

14. Remove the air filter housing mounting brackets from the top of the valve cover (if needed).

15. Remove the coolant distribution block bracket mounted above the rocker cover (if needed).

16. Unbolt the air compressor inlet pipe from the camframe housing.

17. Unbolt the air compressor inlet pipe from the flywheel housing.

18. Remove the air compressor inlet hose.

19. Unbolt (2) the doser coolant supply line (1) from the camframe housing (3).

20. Remove the high pressure fuel rail feed lines.
    Refer to section "Removal of the High Pressure Fuel Rail Feed Lines - Two-Filter System".
    Refer to section "Removal of the High Pressure Fuel Rail Feed Lines - Three-Filter System".

21. Remove the Pressure Limiting Valve (PLV) banjo bolt.

22. Remove the two 14-pin fuel injector harness connectors (1) from the camframe (2).
23. Remove the high pressure fuel injector lines.
   Refer to section "Removal of the High Pressure Fuel Injector Lines - Two-Filter System".
   Refer to section "Removal of the High Pressure Fuel Injector Lines - Three-Filter System".

24. Disconnect the fuel rail pressure sensor (1) and intake manifold temperature sensor (2).

25. Disconnect the camshaft position sensor (1) from the camshaft housing (2).
26. Unclip all of the electrical wiring harness attaching points on to the camshaft housing.
27. Remove the rocker cover. Refer to section "Removal of the Rocker Cover".
28. Remove the fuel injector wiring harness.
   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System".
   Refer to section "Removal of the Two-Piece Fuel Injector Wiring Harness - Three-Filter System".
29. Using the engine barring tool (J-46392 or W904589046300) rotate the crankshaft to Top Dead Center (TDC) on cylinder No. 1. The TDC dot (3) is between two teeth on the flywheel and aligns with the edge of pointer (2) on the flywheel housing (1).

30. Remove the Crankshaft Position (CKP) sensor (1) from the driver side of the flywheel housing. Refer to section "Removal of the Crankshaft Position Sensor".
31. To accurately locate TDC, install the flywheel housing crankshaft TDC locating pin (W470589001500) into the CKP sensor hole located on the driver side of the flywheel housing.

32. Remove the two rear camframe housing mounting bolts (if applicable).

33. Install the proper camshaft timing tool to verify TDC. See tool list below:
   a. W470589034000 - EPA07 DD13
   b. W470589114000 - EPA07/EPA10 DD13
   c. W470589054000 - EPA07
   d. W470589104000 - EPA07/EPA10 DD15 / DD16

**NOTE:** Loosen the camframe bolts in the correct sequence to prevent damage.

**NOTE:** Do not remove the camframe mounting bolts completely from the assembly.

34. Loosen the overhead lash on the intake, exhaust, and engine brake rockers.
35. Remove the timing tool on the rear of the camframe only.
36. Loosen camframe housing mounting bolts 1 and 2 completely.
37. Install the timing tool on the rear of the camframe.
38. Loosen the remaining bolts by a single turn at a time following the sequence below. Repeat as necessary until the bolts are completely loose.

39. Install four lifting eyes into the rocker cover mounting holes.

**NOTE:** Ensure that no debris fall into the return oil ports on the cylinder head or severe engine damage can occur.

40. Connect a suitable lifting device to the lifting eyes in the cam frame.

**NOTE:** Camframe could stick on the dowel pins.

41. Remove and discard the camframe seal.

**NOTE:** Do not rest the camframe assembly on the camshaft gears or damage can occur.

42. Place the camframe assembly on the bench on its side.
3 Installation of the Camframe Assembly

Install as follows:

NOTE: Do not remove the camshaft timing tool until instructed to do so.

1. Clean the groove on the camframe where the camframe housing seal is positioned.
2. Install a new camframe housing seal into the camshaft housing.

WARNING: PERSONAL INJURY

To avoid injury when removing or installing a heavy engine component, ensure the component is properly supported and securely attached to an adequate lifting device to prevent the component from falling.

3. Clean the camframe assembly sealing surface on the cylinder head.

NOTE: When lowering the camframe assembly onto the cylinder head, it is helpful to rotate the camshafts inward to ensure correct engine timing.

NOTE: Ensure the new camframe seal remains positioned in the groove before the mounting bolts are tightened.

NOTE: The camframe assembly mounting bolts will act as guides to the cylinder head.

4. Using an appropriate lifting device, lower the camframe assembly onto the cylinder head ensuring the camshafts align properly with the camshaft timing tool.
5. Draw down the camframe assembly by turning the mounting bolts gradually across the entire assembly.
6. Verify timing of camshafts.
7. Remove the four camshaft assembly lifting eyes.
8. Remove the timing tool on the rear of the camshaft only.
9. Using the torque sequence shown below, torque the twenty one M10 (3-23) camshaft cap bolts to the following:
1. Torque all bolts to 20 N·m (15 lb·ft).
2. Then torque bolts to 50 to 55 N·m (37 to 40 lb·ft).
10. Torque the M8 bolts (1 and 2) to 30 N·m (22 lb·ft).
11. Remove the camshaft timing tool.
12. Remove the flywheel housing crankshaft TDC locating pin (W470589001500) from the CKP sensor hole.
13. Install the crankshaft position sensor. Refer to section "Installation of the Crankshaft Position Sensor".
14. Adjust the valve lash on the intake, exhaust, and engine brakes.
   a. Refer to section "Valve Lash Adjustments".
   b. Refer to section "Setting the Engine Brake Lash".
15. Install the high pressure fuel injector lines.
    For the three-filter fuel system, Refer to section "Installation of the High Pressure Fuel Injector Lines - Three-Filter System".
    For the two-filter fuel system, Refer to section "Installation of the High Pressure Fuel Injector Lines - Two-Filter System".
16. Install the fuel injector wiring harness.
    Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Two-Filter System".
    Refer to section "Installation of the One-Piece Fuel Injector Wiring Harness - Three-Filter System".
    Refer to section "Installation of the Two-Piece Fuel Injector Wiring Harness - Three-Filter System".
17. Connect the two 14-pin fuel injector harness connectors (1) to the camshaft housing (2).
18. Clean the rocker cover sealing gasket.
19. Install the rocker cover. Refer to section "Installation of the Rocker Cover".
20. Connect the camshaft position sensor (1) on to the camshaft housing (2).

21. Connect the fuel rail pressure sensor (1) and intake manifold temperature sensor (2).
22. Clip all of the electrical wiring harness attaching points on to the camshaft housing.
23. Install the PLV banjo bolt with new sealing washers. Torque to 30 to 32 N·m (22 to 24 lb·ft).

**WARNING: PERSONAL INJURY**
All hardware/components must be installed in the proper locations, and MUST be fastened to the specified torque. Failure to properly torque hardware/components will result in failure of a high pressure fuel feed line, resulting in possible fire and/or personal injury.

**NOTE:** The high pressure fuel rail feed lines, P-clips, vibration dampers, mounting bracket and hardware are one-time use components and MUST be replaced any time they are loosened or removed.

**NOTE:** Engine size/model year specific service kits, containing all of the necessary parts to replace the high pressure fuel rail feed lines have been released. Refer to TS letter 12 TS-9 for the high pressure fuel line kit numbers to repair these engines.

24. Install the high pressure fuel rail feed lines.
   For the DD13 three-filter fuel system, Refer to section "Installation of the DD13 High Pressure Fuel Rail Feed Lines - Three-Filter System".
   For the DD13 two-filter fuel system, Refer to section "Installation of the High Pressure Fuel Rail Feed Lines - Two-Filter System".
   For the DD15/16 three-filter fuel system, Refer to section "Installation of the DD15 and DD16 High Pressure Fuel Rail Feed Lines - Three-Filter System".
   For the DD15/16 two-filter fuel system, Refer to section "Installation of the High Pressure Fuel Rail Feed Lines - Two-Filter System".
25. Install the bolt (2) and the P-clip securing the doser coolant line (1) to the camshaft housing (3). Torque 30 N·m (22 lb·ft).
26. Install the air compressor inlet air line pipe P-clips to the flywheel housing. Torque 30 N·m (22 lb·ft).
27. Install the air compressor inlet air line pipe P-clips to the camframe housing. Torque 30 N·m (22 lb·ft).
28. Install the two air filter housing brackets (2) (if equipped), onto the rocker cover and torque the eight nuts to 20 N·m (14 lb·ft).

29. If removed, install the coolant distribution block bracket. Refer to OEM procedures.
30. If removed, install air cleaner housing. Refer to OEM procedures.
31. Install the turbocharger inlet pipe and hose. Refer to OEM procedures.
32. Install the air compressor inlet air hose to the turbocharger inlet pipe.
33. Prime the fuel system.
   For the three-filter fuel system, Refer to section "Priming the Fuel System Using ESOC 350 Fuel Priming Pump - Three-Filter System".
For the two-filter fuel system, Refer to section "Priming the Fuel System Using ESOC 350 Fuel Priming Pump - Two-Filter System".

34. Reconnect the battery power to the engine. Refer to OEM procedures.
35. Start the engine and inspect for leaks.
36. If removed, install the rain wiper assembly. Refer to OEM procedures.
37. If removed, install the rain tray. Refer to OEM procedures.
38. If removed, install the wipers. Refer to OEM procedures.
39. If removed, install the fenders. Refer to OEM procedures.
40. If removed, install the bumper. Refer to OEM procedures.
41. Close the hood.