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## Service Information Bulletin

SUBJECT	DATE
DD13, DD15, and DD16 Cylinder Head Assembly Removal and Installation	February 2017

### Additions, Revisions, or Updates

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0081	EPA07/10/ GHG14 Heavy Duty	Removal of the DD13 Cylinder Head Assembly	Revised step 19 to add removal of the camshaft housing as an assembly. Revised steps 35 to 39 to use lifting device W470589086200.
		Installation of the DD13 Cylinder Head Assembly	Revised steps 4 and 10 to use lifting device W470589086200. Added bolt graphic to step 11 for head bolt length check. Added note and step 15 to torque cylinder head fuel return fittings. Revised step 28 to add installation of the camshaft housing as an assembly.
		Removal of the DD15 and DD16 Cylinder Head Assembly	Revised steps 27 to 31 to use lifting device W470589086200.
		Installation of the DD15 and DD16 Cylinder Head Assembly	Revised steps 4 and 10 to use lifting device W470589086200. Added bolt graphic to step 12 for head bolt length check. Added note and step 17 to torque cylinder head fuel return fittings.

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0181	Euro IV Heavy Duty	Removal of the DD15 and DD16 Cylinder Head Assembly	Revised steps 27 to 31 to use lifting device W470589086200.
		Installation of the DD15 and DD16 Cylinder Head Assembly	Revised steps 4 and 10 to use lifting device W470589086200. Added bolt graphic to step 12 for head bolt length check. Added note and step 17 to torque cylinder head fuel return fittings.
DDC-SVC-MAN-0190	GHG17 Heavy Duty	Removal of the DD13 Cylinder Head Assembly	Added step 13 to remove the air compressor resonator. Revised step 20 to add removal of the camshaft housing as an assembly. Revised steps 35 to 39 to use lifting device W470589086200.
		Installation of the DD13 Cylinder Head Assembly	Revised steps 4 and 10 to use lifting device W470589086200. Added bolt graphic to step 11 for head bolt length check. Added step 15 to torque cylinder head fuel return fittings. Revised step 27 to add installation of the camshaft housing as an assembly. Added step 37 to install the air compressor resonator.
		Removal of the DD15 and DD16 Cylinder Head Assembly	Added step 11 to remove the air cleaner assembly. Added step 12 to remove the air compressor resonator. Revised steps 27 to 31 to use lifting device W470589086200.
		Installation of the DD15 and DD16 Cylinder Head Assembly	Revised steps 4 and 10 to use lifting device W470589086200. Added bolt graphic to step 12 for head bolt length check. Added step 16 to torque cylinder head fuel return fittings. Added step 29 to install the air compressor resonator. Added step 30 to install the air cleaner assembly.



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## 2 Removal of the DD13 Cylinder Head Assembly



### WARNING: PERSONAL INJURY

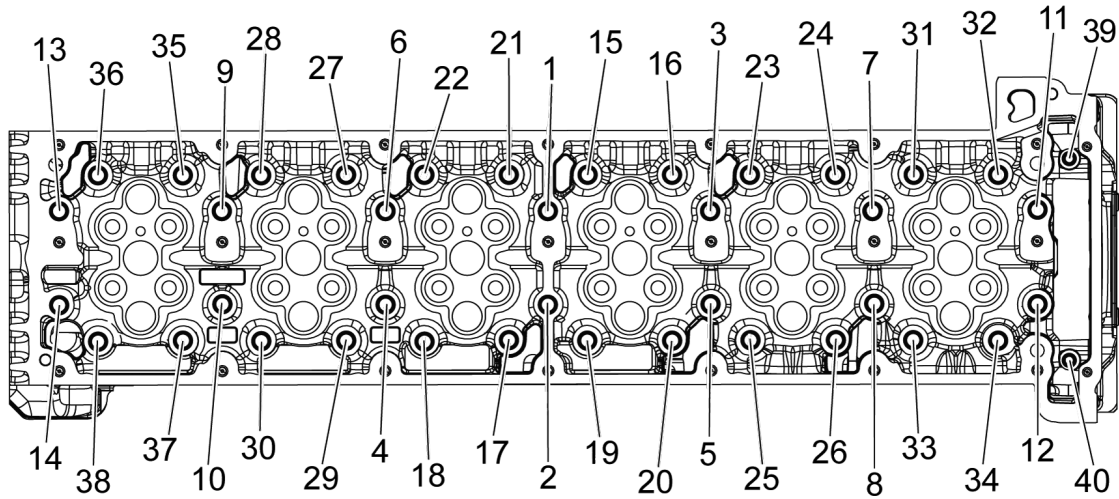
To avoid injury, never remove any engine component while the engine is running.

Remove as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Disconnect the batteries. Refer to OEM procedures.
3. Open the hood.
4. If needed, remove the bumper. Refer to OEM procedures.
5. For a vehicle with a short (less than 120 inches) Bumper-to-Back-of-Cab (BBC), remove the hood. Refer to the OEM procedure.
6. If necessary, remove the side fairings and inner fenders/splash shields for access. Refer to the OEM procedures.
7. If needed, remove the rain tray. Refer to OEM procedures.
8. If needed, remove the windshield wiper linkage. Refer to OEM procedures.
9. Drain the coolant. Refer to section "Cooling System Drain Procedure".
10. Disconnect and remove the ducting from the turbo compressor outlet to the Charge Air Cooler (CAC).
11. Remove the turbocharger compressor outlet elbow.
12. Remove the air cleaner assembly and turbocharger inlet.
13. Disconnect and remove the ducting from the CAC to the intake throttle valve adaptor.
14. Disconnect the coolant level sensor.
15. Disconnect the EGR cooler vent (de-aeration) line from the EGR cooler water manifold assembly.
16. Remove the coolant surge tank. Refer to OEM procedures.
17. For a vehicle with a short BBC, remove the cooling package. Refer to the OEM procedures.
18. For a vehicle with a short BBC, remove the engine cooling fan. Refer to the OEM procedures.
19. Remove the camshaft housing.
  - a. For a vehicle with a short BBC, Refer to section "Removal of the Camshaft Housing".
  - b. For a vehicle with a BBC of 120 inches or more, remove the camshaft housing as an assembly. Refer to section "Removal of the Camshaft Housing Assembly".
20. Remove coolant lines from the Exhaust Gas Recirculation (EGR) cooler water manifold assembly to the fuel doser injector housing.
21. Disconnect the cab heater lines from the water manifold.
22. If equipped, disconnect the DEF system heater lines from the water manifold.
23. Remove the coolant line from the EGR valve actuator to the EGR cooler water manifold.
24. Remove the turbocharger heat shield.
25. Remove the EGR hot pipe and discard the spherical clamps.
26. Disconnect the EGR valve pull rod from the EGR valve actuator.
27. Remove the turbocharger mounting bolts
28. Remove the Coolant Crossover Pipe. Refer to section "Removal of the Coolant Crossover Pipe".
29. Disconnect the Intake Throttle Valve (ITV) electrical harness connector.
30. If the oil dipstick tube is attached to the intake throttle valve bracket, remove the attachment hardware.
31. Remove the two bolts attaching the cold boost pipe to the cold boost pipe support bracket.

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

32. Remove needle, amplifier, and pressure limiting valve (PLV) return lines.  
Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Three-Filter System"  
Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve (PLV) Return Lines – Two-Filter System"
33. Remove the two small cylinder head mounting bolts (39 and 40). See illustration below. For EPA07 DD13 engines, these bolts are located on the outside perimeter of the cylinder head casting at the rear of the engine.



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34. Using the flywheel and main pulley socket tool (J-45390), remove the 38 large mounting bolts securing the cylinder head to the cylinder block.



**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.

35. Position lifting device W470589086200 in place on top of the cylinder head.
36. Install the eight lifting device mounting bolts and torque the bolts to 60 N·m (44 lb·ft).
37. Attach a suitably rated overhead crane or engine hoist to the lifting device.
38. Carefully lift and remove the cylinder head from the cylinder block. The lifting device can be leveled using the screw drive to assist with removal.
39. Place the cylinder head on a suitable surface using caution to avoid damage to the protruding fuel injector tips and No. 5 idler gear.
40. Remove the cylinder head gasket.
41. If the cylinder head must be replaced, Refer to section "DD Platform Cylinder Head Replacement".

### 3 Installation of the DD13 Cylinder Head Assembly

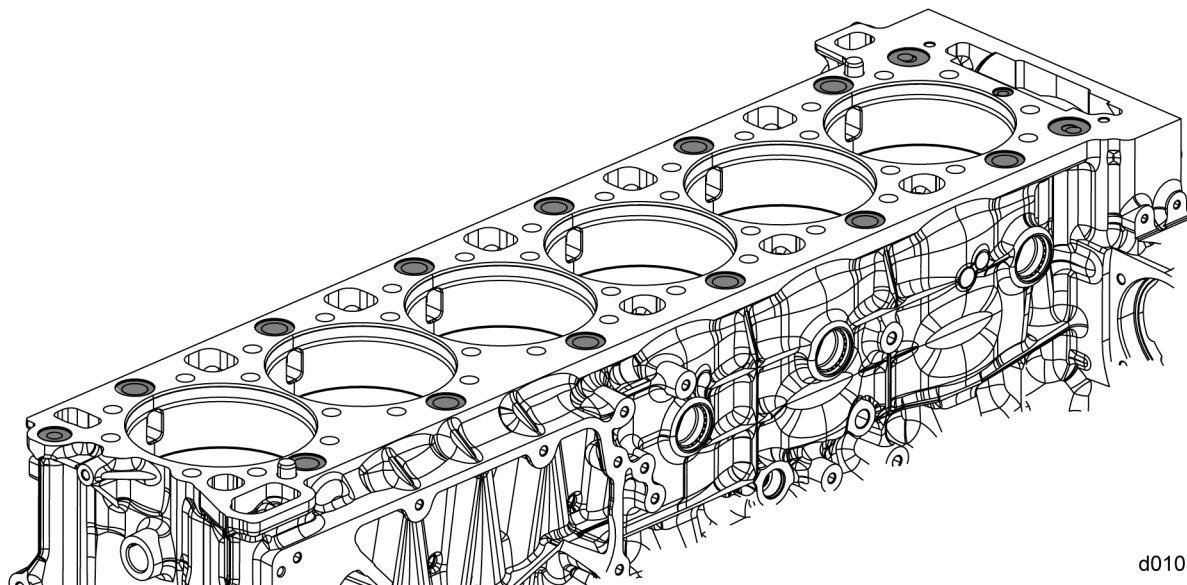
Install as follows:

**NOTICE:** If the coolant grommets on the head gasket have failed, do not proactively replace the cylinder liner seals unless there is evidence of extensive cylinder block erosion around the liners.

**NOTICE:** Do not use any abrasive tools or methods to clean the oil and coolant grommet counter bores or other gasket surfaces of the cylinder head or cylinder block. Foreign material may enter the oil system and cause serious engine damage.

**NOTICE:** Failure to properly clean the oil and coolant grommet counter bores in the cylinder block may result in cylinder head gasket grommet failure.

1. Thoroughly clean the oil and coolant grommet counter bores in the cylinder block with a suitable scraper to remove any foreign material before installing the cylinder head gasket. Counter bores must be clean and dry.
2. Inspect the cylinder head bolt holes in the cylinder block for the presence of oil, water, dirt, rust or damaged threads. Clean and re-tap as necessary.
3. Ensure piston domes and cylinder block deck surfaces are clean, dry and free of oil, water or any other foreign material.



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**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.

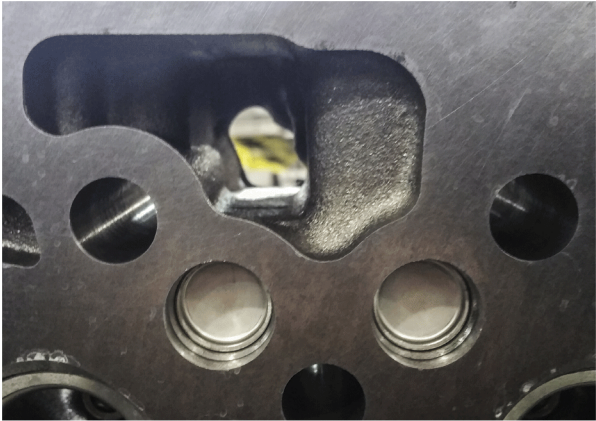
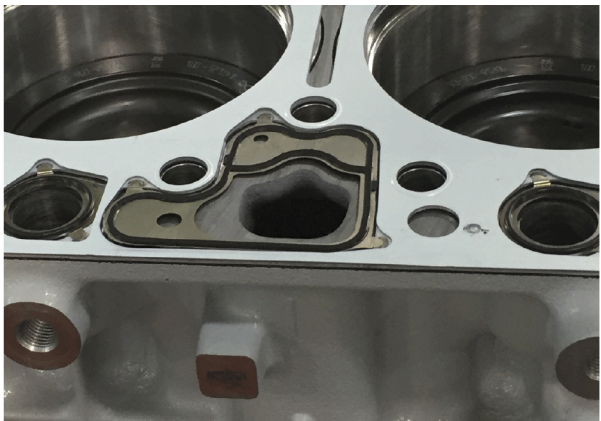
4. If reusing the cylinder head, lift the head using lifting device W470589086200 so it can hang at a 30 to 45 degree angle lengthwise for 10 minutes. The residual oil and coolant will need to drain before the cylinder head can be installed onto the cylinder block. Use caution to avoid damage to the protruding fuel injector tips.

**NOTE:** The area of the cylinder block between the liners is not a sealing surface for the head gasket and will not cause a coolant leak.

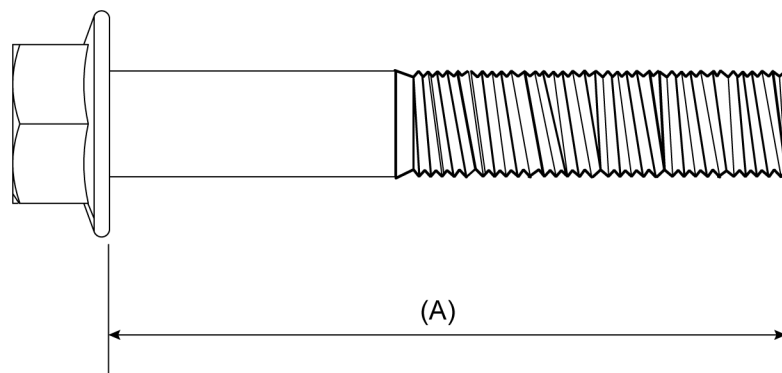
**NOTE:** When measuring liner protrusion, avoid measuring the areas between the liners if there is erosion present.

5. Using liner protrusion tool J-47415-A, measure and record the cylinder liner protrusion for all six cylinders. Minimum allowable liner protrusion is 0.1397 mm (0.0055 in.) and maximum allowable liner protrusion is 0.26924 mm (0.0106 in.). The maximum variation allowed between cylinders is 0.0889 mm (0.0035 in.).
6. If reusing the cylinder head, alternate the head to hang in the opposite direction at the same 30 to 45 degree angle lengthwise for another ten minutes. Use caution to avoid damage to the protruding fuel injector tips.
7. If reusing the cylinder head, clean any oil, water or other foreign material from the cylinder head bolt holes and head gasket surface of the cylinder head.
8. Ensure both head gasket surfaces on the cylinder block and the cylinder head are clean and dry, especially the oil and coolant grommet counter bores.

**Table 1.**

DD13 Cylinder Head Casting Change	
<p><b>NOTICE:</b> Detroit made a cylinder head casting change for DD13 engines to improve cooling in April of 2015 with engine serial number 471927S0336887. The oil drain passages on the exhaust side of the cylinder head were modified. This change also required cup plugs to be installed in the deck of the cylinder head. A new cylinder head gasket was released with the cylinder head change. See illustrations below.</p>	
 <p><b>A</b></p>	 <p><b>B</b></p>
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<p>The new DD13 Cylinder Head (A) is shown on the left and the new DD13 Cylinder Head Gasket (B) is shown on the right.</p>	
<p>When making repairs to a DD13 engine with the new cylinder head design, the correct new cylinder head gasket must be used. The new cylinder head gasket part number is A4710161220. This head gasket can be used on any DD13 engine with carbon scraper ring liners (GHG14 and GHG17).</p>	

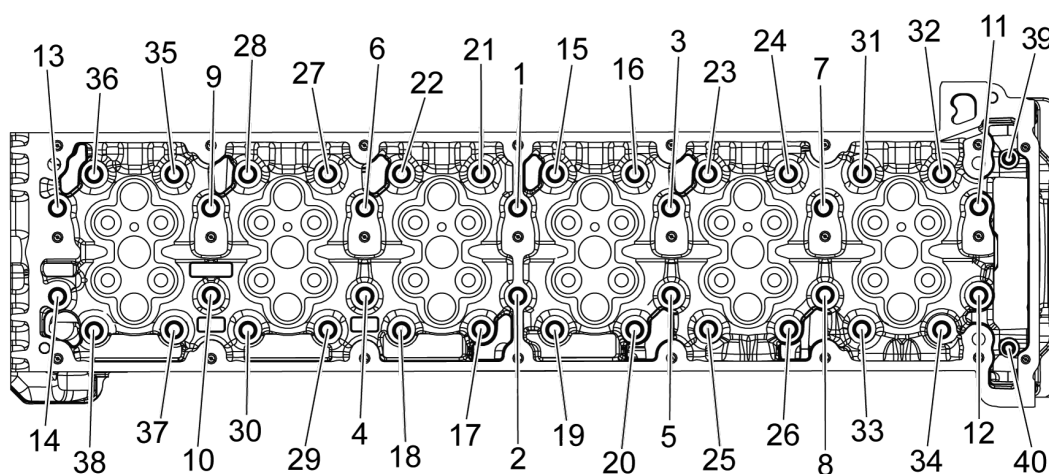
9. Position a new cylinder head gasket onto the cylinder block.
10. Lift the cylinder head into position using lifting device W470589086200. The screw drive on the tool can be used to assist with installation. Lower the cylinder head into place until it is fully seated onto the dowel pins and cylinder block.
11. Measure the 38 large cylinder head mounting bolts for reuse. The maximum shank and thread length is 194 mm (7.638 inches). Refer to dimension “A” as shown below. Replace any bolts outside of this specification.



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**NOTICE:** Do not dip the entire cylinder head mounting bolt in oil as the excessive oil could cause improper torque results or external oil seepage at the head gasket joint.

12. Using a suitable brush, lightly coat the threads and underside of the bolt heads with clean engine oil.
13. Using the flywheel and main pulley socket tool (J-45390), install the 38 large cylinder head mounting bolts and tighten using the torque sequence shown below. Torque bolts (1 through 38) in three steps as follows
  - a. 200 N·m (147 lb·ft).
  - b. 90° torque turn.
  - c. 90° torque turn.



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14. Install and torque the small bolts (39 and 40) to 60 N·m (44 lb·ft). For EPA07 DD13, these bolts are located on the outside perimeter of the cylinder head casting at the rear of the engine.

**NOTE:** EPA07 engines have one M18 and one M16 fuel return fitting. EPA10 and newer engines use M18 only.

15. Torque the needle and amplifier return fittings M18 to 55 to 60 N·m (40 to 44 lb·ft) and M16 to 45-50 N·m (33 to 37 lb·ft).
16. Install the needle, amplifier, and pressure limiting valve (PLV) return lines.  
Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Three-Filter System"  
Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines – Two-Filter System"
17. Install the two bolts attaching the cold boost pipe to the cold boost pipe support bracket. Torque the bolts to 30 N·m (22 lb·ft).
18. Connect the Intake Throttle Valve (ITV) electrical harness connector.
19. Install the Coolant Crossover Pipe. Refer to section "Installation of the Coolant Crossover Pipe".
20. Install the turbocharger mounting bolts. Torque the bolts to 50 N·m (37 lb·ft).
21. Connect the EGR valve actuator pull rod to the EGR valve actuator. Refer to section "Installation of the DD13 Exhaust Gas Recirculation Valve Actuator Pull Rod".
22. Install the EGR hot pipe with two new spherical clamps. Refer to section "Installation of the Exhaust Gas Recirculation Hot Pipe".
23. Install the turbocharger heat shield.
24. Install the coolant line from the EGR valve actuator to the EGR cooler water manifold assembly. Tighten coolant line to 35 N·m (26 lb·ft).
25. If equipped, connect the DEF system heater lines to the water manifold.
26. Connect the cab heater lines to the water manifold.
27. Install the doser injection valve coolant lines to the EGR cooler water manifold assembly
  - a. For the 5mm long thread fitting, torque to 15 N·m (11 lb·ft).
  - b. For the 15mm long thread fitting, torque to 22 N·m (16 lb·ft).
28. Install the camshaft housing.
  - a. For vehicles with a short BBC (Bumper-to-Back-of-Cab), Refer to section "Installation of the Camshaft Housing".
  - b. For a vehicle with a BBC of 120 inches or more, install the camshaft housing as an assembly. Refer to section "Installation of the Camshaft Housing Assembly".
29. If disconnected, reattach oil dipstick tube to intake throttle valve bracket.
30. If removed, install the engine cooling fan. Refer to the OEM procedure.
31. If removed, install the cooling package. Refer to the OEM procedure.
32. Install the coolant surge tank. Refer to the OEM procedure.
33. Connect the EGR cooler vent (de-aeration) line.
34. Connect the coolant level sensor.
35. Install the ducting from the CAC to the intake throttle valve adaptor.
36. Install the turbocharger compressor outlet elbow.
37. Install the ducting from the turbocharger compressor outlet to the CAC.
38. Install the air cleaner assembly and turbocharger inlet. Refer to the OEM procedure.
39. Reconnect the batteries. Refer to the OEM procedure.
40. Prime the fuel system.  
For three-filter systems, Refer to section "Priming the Fuel System - Three-Filter System".  
For two-filter systems,  
Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"  
Refer to section "Priming the Fuel System - KM59 GEN1 - Two-Filter System"
41. Change the engine lubricating oil and oil filter due to possible coolant contamination during repairs.
42. Fill the cooling system. Refer to section "Cooling System Fill Procedure".
43. If removed, install the windshield wiper linkage. Refer to OEM procedures.
44. If removed, install the rain tray. Refer to OEM procedures.
45. If removed, install the hood. Refer to the OEM procedure.
46. If removed, install the inner fenders/splash shields and side fairings. Refer to the OEM procedures.
47. If removed, install the bumper. Refer to OEM procedures.

**NOTICE:** It is normal to see oil seepage or small oil bubbles at the head gasket joint when running the engine after a head gasket replacement. Oil seepage or small oil bubbles should not be present after approximately 805 km (500 mi).



**WARNING: PERSONAL INJURY**

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.



**WARNING: ENGINE EXHAUST**

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

48. Start the engine and check for leaks.

## 4 Removal of the DD15 and DD16 Cylinder Head Assembly

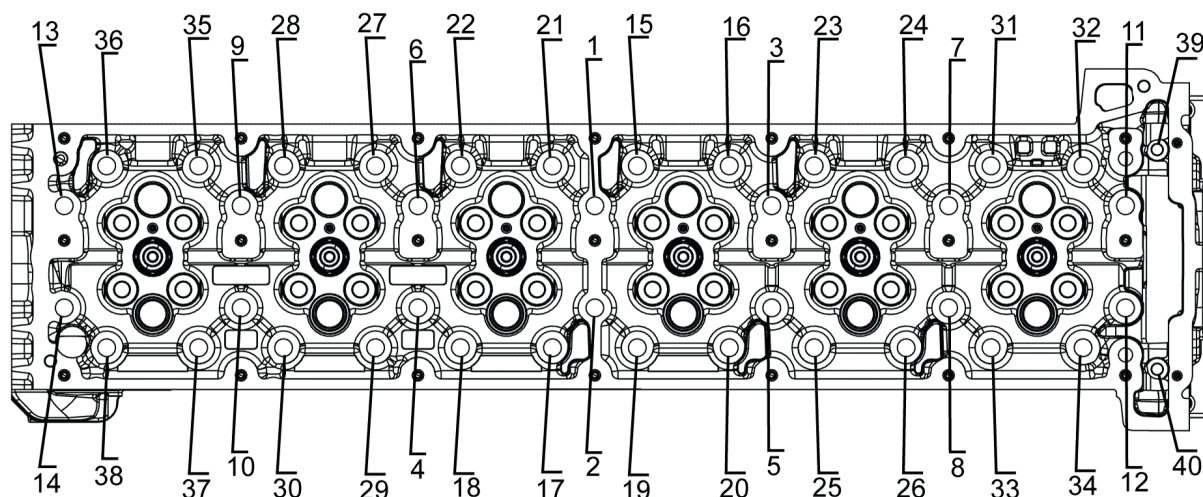
Remove as follows:



### **WARNING: PERSONAL INJURY**

To avoid injury, never remove any engine component while the engine is running.

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Disconnect the batteries. Refer to OEM procedures.
3. Open the hood.
4. If necessary, remove the bumper. Refer to OEM procedures.
5. If necessary, remove the rain tray. Refer to OEM procedures.
6. If necessary, remove the windshield wiper linkage. Refer to OEM procedures.
7. Drain the engine cooling system. Refer to section "Cooling System Drain Procedure".
8. Disconnect the coolant level sensor.
9. Disconnect the EGR cooler vent (de-aeration) line from the EGR cooler.
10. Remove the coolant surge tank. Refer to the OEM procedure.
11. Remove the camshaft housing assembly. Refer to section "Removal of the Camshaft Housing Assembly".
12. Remove coolant lines from the water manifold to the fuel doser injector housing.
13. Disconnect the cab heater lines from the water manifold.
14. If equipped, disconnect the DEF system heater lines from the water manifold.
15. Disconnect the EGR actuator connector and remove the heat shield. Refer to section "Removal of the DD15 and DD16 Delphi<sup>®</sup> Exhaust Gas Recirculation Valve Actuator".
16. Remove the EGR actuator coolant line from the cylinder block.
17. Remove the EGR pull rod from the EGR valve.
18. Remove the turbocharger heat shield.
19. Remove the turbocharger mounting bolts.
20. Remove the Coolant Crossover Pipe. Refer to section "Removal of the Coolant Crossover Pipe".
21. Disconnect the Intake Throttle Valve (ITV) electrical harness connector.
22. Remove the ducting from the CAC to the intake throttle valve adaptor.
23. Remove the two bolts attaching the cold boost pipe to the cold boost pipe support bracket.
24. Disconnect the needle, amplifier, and pressure limiting valve return lines.  
Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve (PLV) Return Lines – Two-Filter System".  
Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Three-Filter System".
25. Remove the two small cylinder head bolts (39 and 40). See illustration below. For EPA07 DD15, these bolts are located on the outside perimeter of the cylinder head casting at the rear of the engine.



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26. Using the flywheel and main pulley socket tool (J-45390), remove the 38 large mounting bolts securing the cylinder head to the cylinder block.



**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.

27. Position the lifting device W470589086200 in place on top of the cylinder head.
28. Install the eight lifting device mounting bolts into the cylinder head and torque the bolts to 60 N·m (44 lb·ft).
29. Attach a suitably rated overhead crane or engine hoist to the lifting device.
30. Carefully lift and remove the cylinder head from the cylinder block. The lifting device can be leveled using the screw drive to assist with removal.
31. Place the cylinder head on a suitable surface using caution to avoid damage to the protruding fuel injector tips and No. 5 idler gear.
32. Remove the cylinder head gasket.
33. If the cylinder head must be replaced, Refer to section "DD Platform Cylinder Head Replacement".

## 5 Installation of the DD15 and DD16 Cylinder Head Assembly

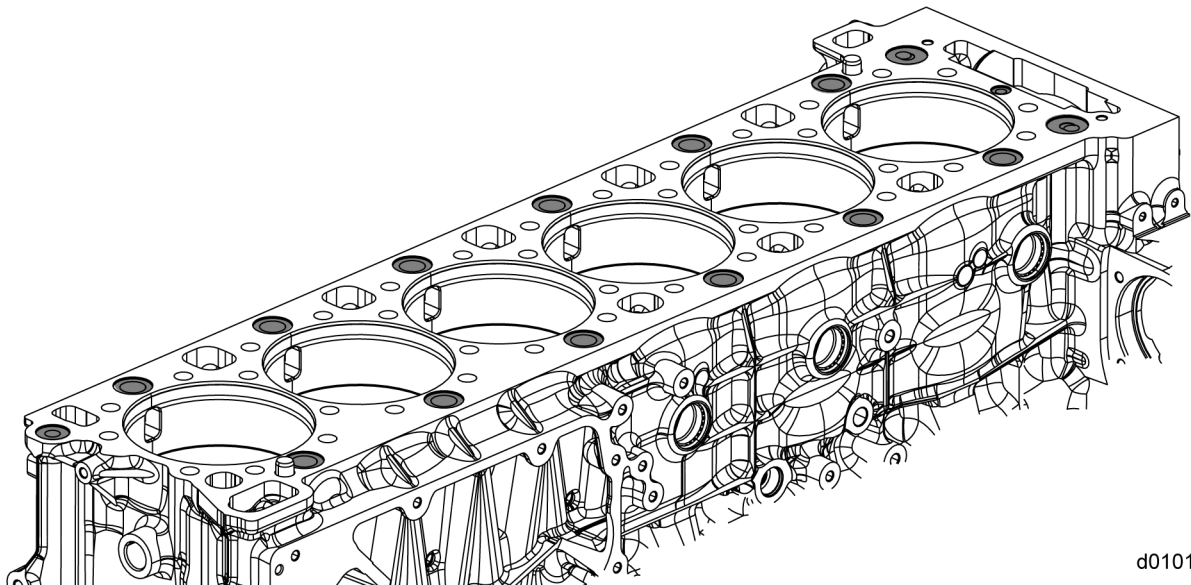
Install as follows:

**NOTICE:** If the coolant grommets on the head gasket have failed, do not proactively replace the cylinder liner seals unless there is evidence of extensive cylinder block erosion around the liners.

**NOTICE:** Do not use any abrasive tools or methods to clean the oil and coolant grommet counter bores or other gasket surfaces of the cylinder head or cylinder block. Foreign material may enter the oil system and cause serious engine damage.

**NOTICE:** Failure to properly clean the oil and coolant grommet counter bores may result in cylinder head gasket grommet failure.

1. Thoroughly clean the oil and coolant grommet counter bores in the cylinder block with a suitable scraper to remove any foreign material before installation of cylinder head gasket. Counter bores must be clean and dry.
2. Inspect the cylinder head bolt holes in the cylinder block for the presence of oil, water, dirt, rust or damaged threads. Clean and re-tap as necessary.
3. Ensure piston domes and cylinder block deck surfaces are clean, dry and free of oil, water or any other foreign material.



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4. If re-using the cylinder head, lift the head using lifting device (W470589086200) so it can hang at a 30 to 45 degree angle lengthwise for 10 minutes. The residual oil and coolant will need to drain before the head can be installed on the engine. Use caution to avoid damage to the protruding fuel injector tips.

**NOTE:** The area of the cylinder block between the liners is not a sealing surface for the head gasket and will not cause a coolant leak.

**NOTE:** When measuring liner protrusion, avoid measuring the areas between the liners if there is erosion present.

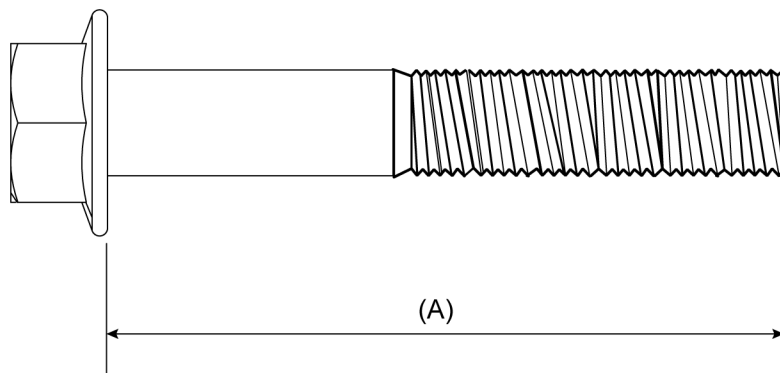
5. Using liner protrusion tool J-47415-A, measure and record the cylinder liner protrusion for all six cylinders. Minimum allowable liner protrusion is 0.1397 mm (0.0055 in.) and maximum allowable liner protrusion is 0.26924 mm (0.0106 in.). The maximum variation allowed between cylinders is 0.0889 mm (0.0035 in.).
6. If re-using the cylinder head, alternate the head to hang in the opposite direction at the same 30 to 45 degree angle lengthwise for another ten minutes. Use caution to avoid damage to the protruding fuel injector tips.
7. If re-using the cylinder head, clean any oil, water or other foreign material from the cylinder head bolt holes and head gasket surface of the cylinder head.
8. Ensure both head gasket surfaces on the cylinder block and the cylinder head are clean and dry, especially the oil and coolant grommet counter bores.
9. Position a new cylinder head gasket onto the cylinder block.



**WARNING: PERSONAL INJURY**

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10. Lift the cylinder head into position using lifting device W470589086200. The screw drive on the tool can be used to assist with installation. Install guide studs (J-35784) through the cylinder head and into the cylinder block. Lower the cylinder head onto the cylinder block.
11. Remove the cylinder head guide studs.
12. Measure the 38 large cylinder head mounting bolts for reuse. The maximum shank and thread length is 194 mm (7.638 inches). Refer to dimension "A" as shown below. Replace any bolts outside of this specification.

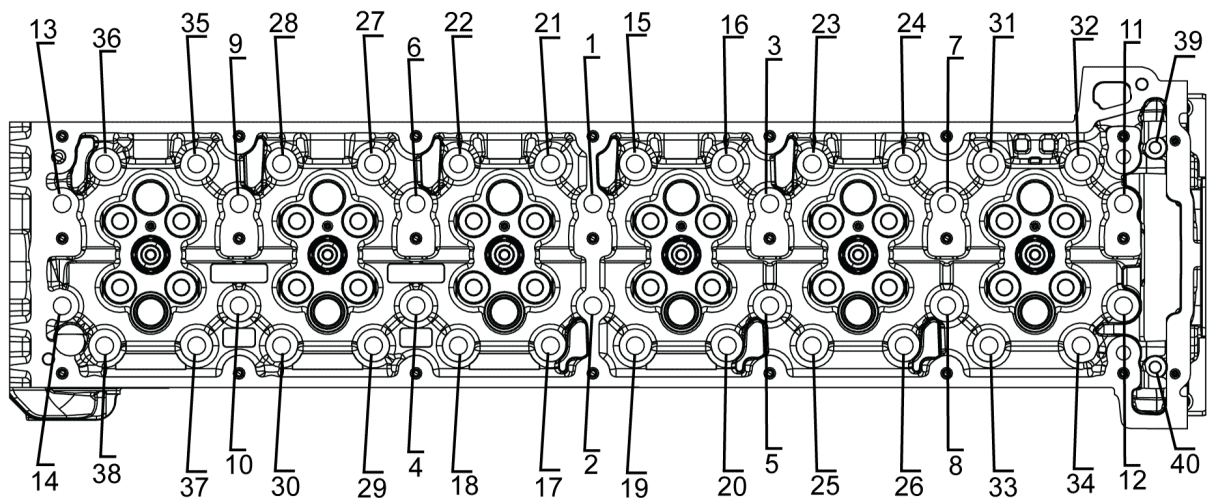


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**NOTICE:** Do not dip the entire cylinder head mounting bolt in oil as the excessive oil could cause improper torque results or external oil seepage at the head gasket joint.

13. Using a suitable brush, lightly coat the threads and underside of the bolt heads with clean engine oil.
14. Install the 40 cylinder head mounting bolts.

15. Using the sequence shown below, torque the 38 large bolts in four steps to:
- 50 N·m (37 lb·ft).
  - 250 N·m (184 lb·ft).
  - 90° torque turn.
  - 90° torque turn.



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16. Torque the small bolts (39 and 40) to 60 N·m (44 lb·ft). For EPA07 DD15, these bolts are located on the outside perimeter of the cylinder head casting at the rear of the engine.

**NOTE:** EPA07 engines have one M18 and one M16 fuel return fitting. EPA10 and newer engines use M18 only.

17. Torque the needle and amplifier return fittings M18 to 55 to 60 N·m (40 to 44 lb·ft) and M16 to 45-50 N·m (33 to 37 lb·ft).
18. Connect the needle, amplifier, and pressure limiting valve return lines.  
Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines – Two-Filter System".  
Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Three-Filter System".
19. Install the two bolts attaching the cold boost pipe to the cold boost pipe support bracket. Torque bolts to 30 N·m (22 lb·ft).
20. Install the ducting from the CAC to the intake throttle valve adaptor.
21. Connect the Intake Throttle Valve (ITV) electrical harness connector.
22. Install the Coolant Crossover Pipe. Refer to section "Installation of the Coolant Crossover Pipe".
23. Install the turbocharger mounting bolts. Torque the bolts to 50 N·m (37 lb·ft).
24. Connect the EGR pull rod to the EGR valve. Install and torque the clamping nuts to 20 N·m (15 lb·ft).
25. Install the EGR actuator coolant supply line.
26. Install the turbocharger heat shield.
27. Connect the EGR actuator connector and install the heat shield. Refer to section "Installation of the DD15 and DD16 Delphi<sup>®</sup> Exhaust Gas Recirculation Valve Actuator".
28. If equipped, connect the DEF system heater lines to the water manifold.
29. Connect the cab heater lines to the water manifold.
30. Install the coolant lines from the water manifold to the fuel doser injector housing.
31. Install the camshaft housing assembly. Refer to section "Installation of the Camshaft Housing Assembly".
32. Install the coolant surge tank. Refer to OEM procedures.
33. Connect the EGR cooler vent (de-aeration) line to the EGR cooler.
34. Connect the coolant level sensor.
35. Prime the fuel system.  
For three-filter systems, Refer to section "Priming the Fuel System - Three-Filter System".

For two-filter systems,

Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"

Refer to section "Priming the Fuel System - KM59 GEN1 - Two-Filter System"

36. Reconnect the batteries. Refer to OEM procedures.
37. Change the engine lubricating oil and oil filter due to possible coolant contamination during repairs.
38. Fill the cooling system. Refer to section "Cooling System Fill Procedure".
39. If removed, install the windshield wiper linkage. Refer to OEM procedures.
40. If removed, install the rain tray. Refer to OEM procedures.
41. If removed, install the bumper. Refer to OEM procedures.

**NOTICE:** It is normal to see oil seepage or small oil bubbles at the head gasket joint when running the engine after a head gasket replacement. Oil seepage or small oil bubbles should not be present after approximately 805 km (500 mi).



**WARNING: PERSONAL INJURY**

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.



**WARNING: ENGINE EXHAUST**

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

42. Start the engine and check for leaks.

## 6 Removal of the DD15 and DD16 Cylinder Head Assembly

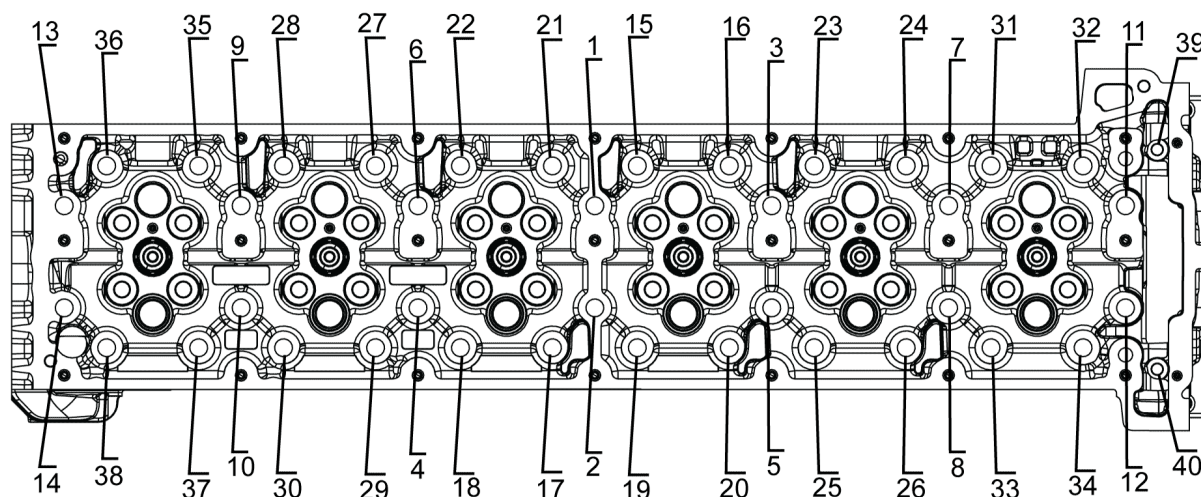
Remove as follows:



### **WARNING: PERSONAL INJURY**

To avoid injury, never remove any engine component while the engine is running.

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Disconnect the batteries. Refer to OEM procedures.
3. Open the hood.
4. If necessary, remove the bumper. Refer to OEM procedures.
5. If necessary, remove the rain tray. Refer to OEM procedures.
6. If necessary, remove the windshield wiper linkage. Refer to OEM procedures.
7. Drain the engine cooling system. Refer to section "Cooling System Drain Procedure".
8. Disconnect the coolant level sensor.
9. Disconnect the EGR cooler vent (de-aeration) line from the EGR cooler.
10. Remove the coolant surge tank. Refer to the OEM procedure.
11. Remove the camshaft housing assembly. Refer to section "Removal of the Camshaft Housing Assembly".
12. Remove coolant lines from the water manifold to the fuel doser injector housing.
13. Disconnect the cab heater lines from the water manifold.
14. If equipped, disconnect the DEF system heater lines from the water manifold.
15. Disconnect the EGR actuator connector and remove the heat shield. Refer to section "Removal of the DD15 and DD16 Delphi © Exhaust Gas Recirculation Valve Actuator".
16. Remove the EGR actuator coolant line from the cylinder block.
17. Remove the EGR pull rod from the EGR valve.
18. Remove the turbocharger heat shield.
19. Remove the turbocharger mounting bolts.
20. Remove the Coolant Crossover Pipe. Refer to section "Removal of the Coolant Crossover Pipe".
21. Disconnect the Intake Throttle Valve (ITV) electrical harness connector.
22. Remove the ducting from the CAC to the intake throttle valve adaptor.
23. Remove the two bolts attaching the cold boost pipe to the cold boost pipe support bracket.
24. Disconnect the needle, amplifier, and pressure limiting valve return lines.  
Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve (PLV) Return Lines – Two-Filter System".  
Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Three-Filter System".
25. Remove the two small cylinder head bolts (39 and 40). See illustration below. For EPA07 DD15, these bolts are located on the outside perimeter of the cylinder head casting at the rear of the engine.



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26. Using the flywheel and main pulley socket tool (J-45390), remove the 38 large mounting bolts securing the cylinder head to the cylinder block.



**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.

27. Position the lifting device W470589086200 in place on top of the cylinder head.
28. Install the eight lifting device mounting bolts into the cylinder head and torque the bolts to 60 N·m (44 lb·ft).
29. Attach a suitably rated overhead crane or engine hoist to the lifting device.
30. Carefully lift and remove the cylinder head from the cylinder block. The lifting device can be leveled using the screw drive to assist with removal.
31. Place the cylinder head on a suitable surface using caution to avoid damage to the protruding fuel injector tips and No. 5 idler gear.
32. Remove the cylinder head gasket.
33. If the cylinder head must be replaced, Refer to section "DD Platform Cylinder Head Replacement".

## 7 Installation of the DD15 and DD16 Cylinder Head Assembly

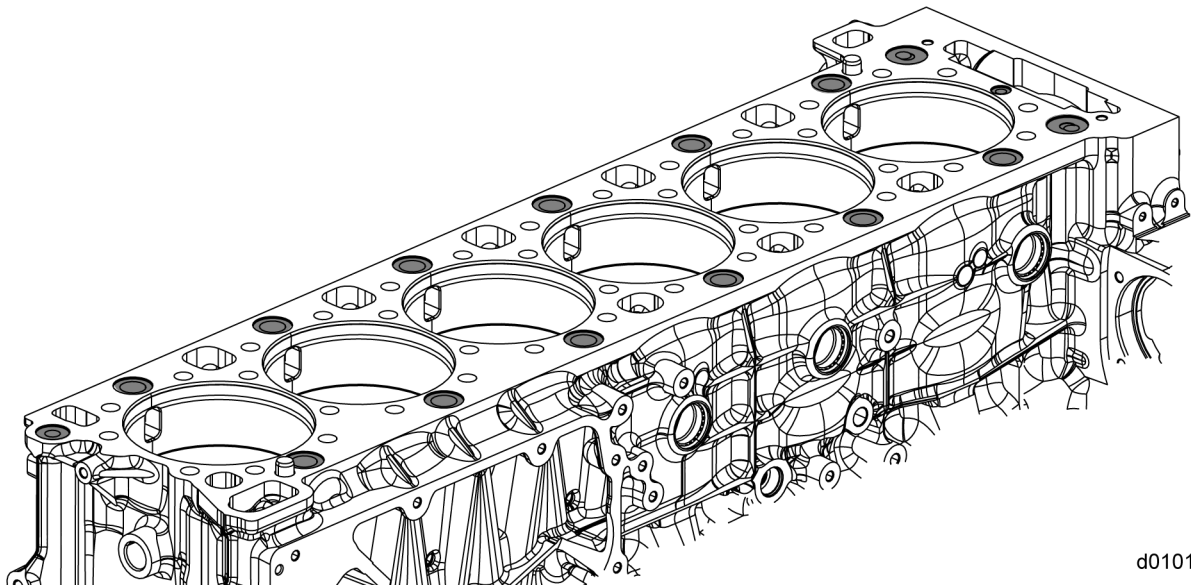
Install as follows:

**NOTICE:** If the coolant grommets on the head gasket have failed, do not proactively replace the cylinder liner seals unless there is evidence of extensive cylinder block erosion around the liners.

**NOTICE:** Do not use any abrasive tools or methods to clean the oil and coolant grommet counter bores or other gasket surfaces of the cylinder head or cylinder block. Foreign material may enter the oil system and cause serious engine damage.

**NOTICE:** Failure to properly clean the oil and coolant grommet counter bores may result in cylinder head gasket grommet failure.

1. Thoroughly clean the oil and coolant grommet counter bores in the cylinder block with a suitable scraper to remove any foreign material before installation of cylinder head gasket. Counter bores must be clean and dry.
2. Inspect the cylinder head bolt holes in the cylinder block for the presence of oil, water, dirt, rust or damaged threads. Clean and re-tap as necessary.
3. Ensure piston domes and cylinder block deck surfaces are clean, dry and free of oil, water or any other foreign material.



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### **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.

4. If re-using the cylinder head, lift the head using lifting device (W470589086200) so it can hang at a 30 to 45 degree angle lengthwise for 10 minutes. The residual oil and coolant will need to drain before the head can be installed on the engine. Use caution to avoid damage to the protruding fuel injector tips.

**NOTE:** The area of the cylinder block between the liners is not a sealing surface for the head gasket and will not cause a coolant leak.

**NOTE:** When measuring liner protrusion, avoid measuring the areas between the liners if there is erosion present.

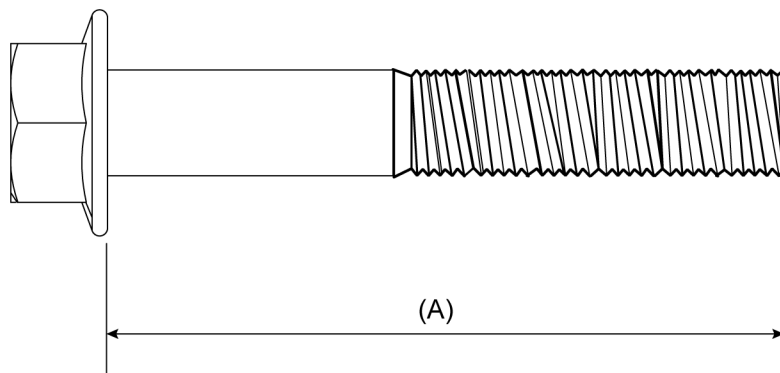
5. Using liner protrusion tool J-47415-A, measure and record the cylinder liner protrusion for all six cylinders. Minimum allowable liner protrusion is 0.1397 mm (0.0055 in.) and maximum allowable liner protrusion is 0.26924 mm (0.0106 in.). The maximum variation allowed between cylinders is 0.0889 mm (0.0035 in.).
6. If re-using the cylinder head, alternate the head to hang in the opposite direction at the same 30 to 45 degree angle lengthwise for another ten minutes. Use caution to avoid damage to the protruding fuel injector tips.
7. If re-using the cylinder head, clean any oil, water or other foreign material from the cylinder head bolt holes and head gasket surface of the cylinder head.
8. Ensure both head gasket surfaces on the cylinder block and the cylinder head are clean and dry, especially the oil and coolant grommet counter bores.
9. Position a new cylinder head gasket onto the cylinder block.



**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.

10. Lift the cylinder head into position using lifting device W470589086200. The screw drive on the tool can be used to assist with installation. Install guide studs (J-35784) through the cylinder head and into the cylinder block. Lower the cylinder head onto the cylinder block.
11. Remove the cylinder head guide studs.
12. Measure the 38 large cylinder head mounting bolts for reuse. The maximum shank and thread length is 194 mm (7.638 inches). Refer to dimension "A" as shown below. Replace any bolts outside of this specification.

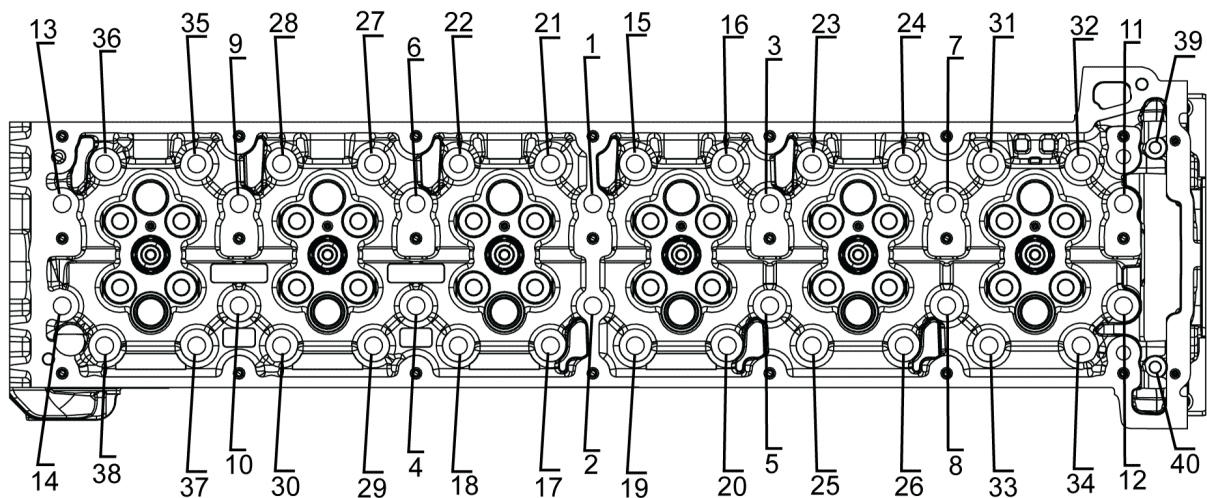


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**NOTICE:** Do not dip the entire cylinder head mounting bolt in oil as the excessive oil could cause improper torque results or external oil seepage at the head gasket joint.

13. Using a suitable brush, lightly coat the threads and underside of the bolt heads with clean engine oil.
14. Install the 40 cylinder head mounting bolts.

15. Using the sequence shown below, torque the 38 large bolts in four steps to:
- 50 N·m (37 lb·ft).
  - 250 N·m (184 lb·ft).
  - 90° torque turn.
  - 90° torque turn.



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16. Torque the small bolts (39 and 40) to 60 N·m (44 lb·ft). For EPA07 DD15, these bolts are located on the outside perimeter of the cylinder head casting at the rear of the engine.

**NOTE:** EPA07 engines have one M18 and one M16 fuel return fitting. EPA10 and newer engines use M18 only.

17. Torque the needle and amplifier return fittings M18 to 55 to 60 N·m (40 to 44 lb·ft) and M16 to 45-50 N·m (33 to 37 lb·ft).
18. Connect the needle, amplifier, and pressure limiting valve return lines.  
Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines – Two-Filter System".  
Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Three-Filter System".
19. Install the two bolts attaching the cold boost pipe to the cold boost pipe support bracket. Torque bolts to 30 N·m (22 lb·ft).
20. Install the ducting from the CAC to the intake throttle valve adaptor.
21. Connect the Intake Throttle Valve (ITV) electrical harness connector.
22. Install the Coolant Crossover Pipe. Refer to section "Installation of the Coolant Crossover Pipe".
23. Install the turbocharger mounting bolts. Torque the bolts to 50 N·m (37 lb·ft).
24. Connect the EGR pull rod to the EGR valve. Install and torque the clamping nuts to 20 N·m (15 lb·ft).
25. Install the EGR actuator coolant supply line.
26. Install the turbocharger heat shield.
27. Connect the EGR actuator connector and install the heat shield. Refer to section "Installation of the DD15 and DD16 Delphi<sup>®</sup> Exhaust Gas Recirculation Valve Actuator".
28. If equipped, connect the DEF system heater lines to the water manifold.
29. Connect the cab heater lines to the water manifold.
30. Install the coolant lines from the water manifold to the fuel doser injector housing.
31. Install the camshaft housing assembly. Refer to section "Installation of the Camshaft Housing Assembly".
32. Install the coolant surge tank. Refer to OEM procedures.
33. Connect the EGR cooler vent (de-aeration) line to the EGR cooler.
34. Connect the coolant level sensor.
35. Prime the fuel system.  
For three-filter systems, Refer to section "Priming the Fuel System - Three-Filter System".

For two-filter systems,

Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"

Refer to section "Priming the Fuel System - KM59 GEN1 - Two-Filter System"

36. Reconnect the batteries. Refer to OEM procedures.
37. Change the engine lubricating oil and oil filter due to possible coolant contamination during repairs.
38. Fill the cooling system. Refer to section "Cooling System Fill Procedure".
39. If removed, install the windshield wiper linkage. Refer to OEM procedures.
40. If removed, install the rain tray. Refer to OEM procedures.
41. If removed, install the bumper. Refer to OEM procedures.

**NOTICE:** It is normal to see oil seepage or small oil bubbles at the head gasket joint when running the engine after a head gasket replacement. Oil seepage or small oil bubbles should not be present after approximately 805 km (500 mi).



**WARNING: PERSONAL INJURY**

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.



**WARNING: ENGINE EXHAUST**

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

42. Start the engine and check for leaks.

## 8 Removal of the DD13 Cylinder Head Assembly

Remove as follows:



### **WARNING: PERSONAL INJURY**

To avoid injury, never remove any engine component while the engine is running.



### **WARNING: PERSONAL INJURY**

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.



### **CAUTION: ELECTRICAL SHOCK**

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

2. Disconnect the batteries. Refer to Original Equipment Manufacturer (OEM) procedures.
3. Open the hood.
4. If needed, remove the bumper. Refer to OEM procedures.
5. For a vehicle with a short (less than 120 inches) Bumper-to-Back-of-Cab (BBC), remove the hood. Refer to the OEM procedure.
6. If necessary, remove the side fairings and inner fenders/splash shields for access. Refer to the OEM procedures.
7. If needed, remove the rain tray. Refer to OEM procedures.
8. If needed, remove the windshield wiper linkage. Refer to OEM procedures.

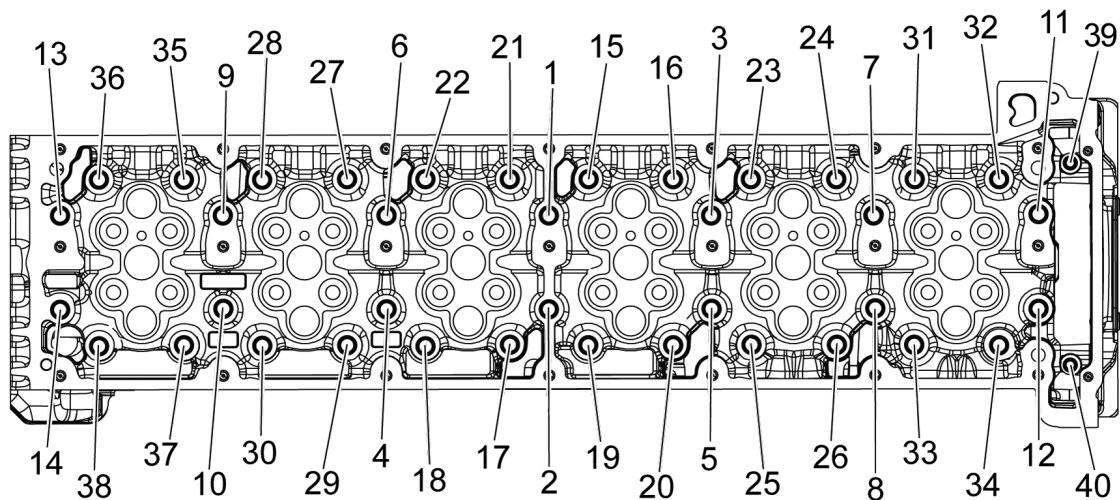
**NOTICE:** The engine coolant can be reused if it is not contaminated and has been properly maintained.

9. Drain the cooling system. Refer to section "Cooling System Drain Procedure".
10. Disconnect and remove the ducting from the turbo compressor outlet to the Charge Air Cooler (CAC).
11. Remove the turbocharger compressor outlet elbow.
12. Remove the air cleaner assembly and turbocharger inlet. Refer to the OEM procedure.
13. For the New Cascadia, remove the air compressor resonator. Refer to the OEM procedures.
14. Disconnect and remove the ducting from the CAC to the cold boost pipe.
15. Disconnect the coolant level sensor connection.
16. Disconnect the EGR cooler vent (deaeration) line from the EGR cooler water manifold assembly.
17. Remove the coolant surge tank. Refer to the OEM procedure.
18. For a vehicle with a short BBC, remove the cooling package. Refer to the OEM procedures.
19. For a vehicle with a short BBC, remove the engine cooling fan. Refer to the OEM procedures.
20. Remove the camshaft housing.
  - a. For a vehicle with a short BBC, Refer to section "Removal of the Camshaft Housing".
  - b. For a vehicle with a BBC of 120 inches or more, remove the camshaft housing as an assembly. Refer to section "Removal of the Camshaft Housing Assembly".
21. Remove the coolant lines from the Exhaust Gas Recirculation (EGR) cooler water manifold assembly to the fuel doser injector housing.
22. Disconnect the cab heater lines from the water manifold.
23. Disconnect the DEF system coolant lines from the water manifold.
24. Remove the coolant line from the EGR valve actuator to the water manifold.
25. Remove the turbocharger heat shield and EGR valve heat shield.
26. Remove the EGR hot pipe and discard the spherical clamps.

27. Disconnect the EGR valve pull rod from the EGR valve actuator.
28. Remove the turbocharger mounting bolts.
29. Remove the coolant crossover pipe. Refer to section "Removal of the Coolant Crossover Pipe".
30. If the oil dipstick tube is attached to the cold boost pipe, remove the attachment hardware.
31. Remove the two bolts attaching the cold boost pipe to the cold boost pipe support bracket.

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

32. Remove needle, amplifier, and pressure limiting valve (PLV) return lines. Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Two-Filter System".
33. Remove the two small cylinder head mounting bolts (39 and 40). See illustration below.



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34. Using the flywheel socket tool (J-45390), remove the 38 large mounting bolts securing the cylinder head to the cylinder block.



**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.

35. Position the lifting device W470589086200 in place on top of the cylinder head.
36. Install the eight lifting device mounting bolts into the cylinder head and torque the bolts to 60 N·m (44 lb·ft).
37. Attach a suitably rated overhead crane or engine hoist to the lifting device.
38. Carefully lift and remove the cylinder head from the cylinder block. The lifting device can be leveled using the screw drive to assist with removal.
39. Place the cylinder head on a suitable surface using caution to avoid damage to the protruding fuel injector tips and No. 5 idler gear.
40. Remove the cylinder head gasket.
41. If the cylinder head must be replaced, Refer to section "DD Platform Cylinder Head Replacement".

## 9 Installation of the DD13 Cylinder Head Assembly

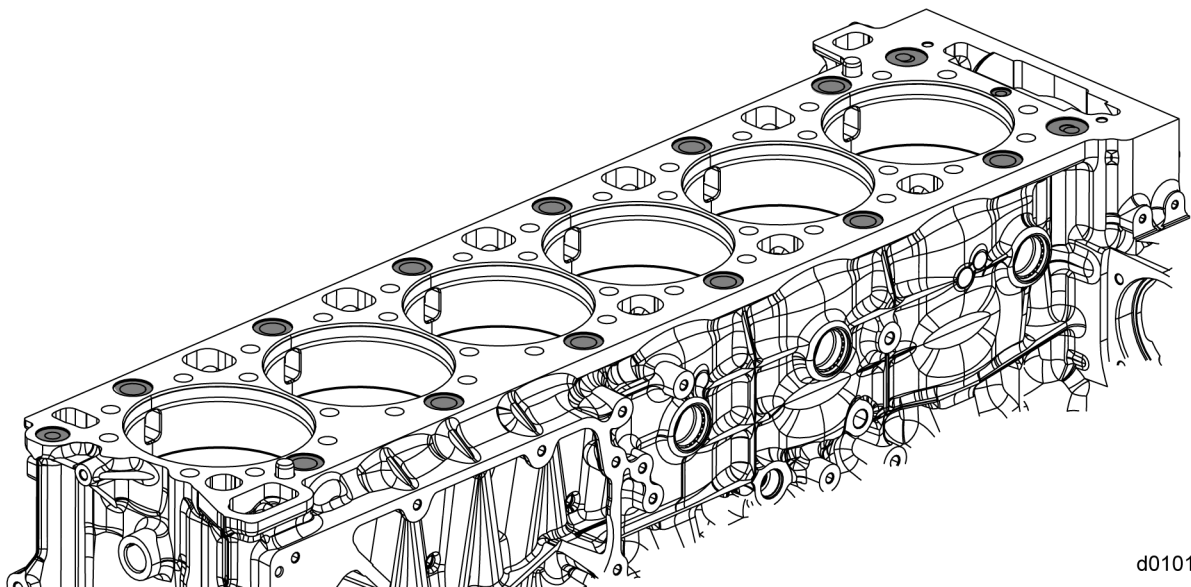
Install as follows:

**NOTICE:** If the coolant grommets on the head gasket have failed, do not proactively replace the cylinder liner seals unless there is evidence of extensive cylinder block erosion around the liners.

**NOTICE:** Do not use any abrasive tools or methods to clean the oil and coolant grommet counter bores or other gasket surfaces of the cylinder head or cylinder block. Foreign material may enter the oil system and cause serious engine damage.

**NOTICE:** Failure to properly clean the oil and coolant grommet counter bores in the cylinder block may result in cylinder head gasket grommet failure.

1. Thoroughly clean the oil and coolant grommet counter bores in the cylinder block with a suitable scraper to remove any foreign material before installing the cylinder head gasket. Counter bores must be clean and dry.
2. Inspect the cylinder head bolt holes in the cylinder block for the presence of oil, water, dirt, rust or damaged threads. Clean and re-tap as necessary.
3. Ensure piston domes and cylinder block fire deck surfaces are clean, dry, and free of oil, water or any other foreign material.



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### **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.


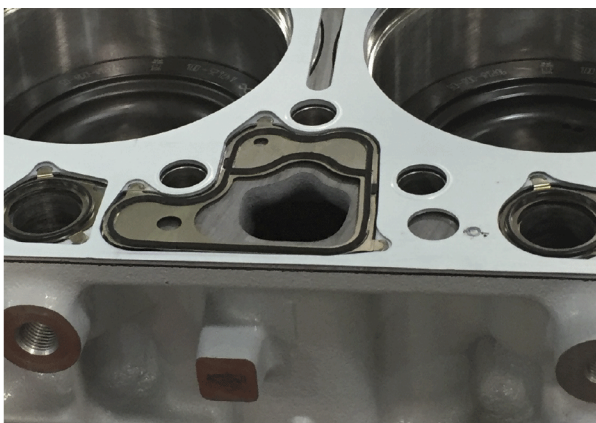
4. If reusing the cylinder head, lift the head using lifting device W470589086200 so it can hang at a 30 to 45 degree angle lengthwise for 10 minutes. The residual oil and coolant will need to drain before the cylinder head can be installed onto the cylinder block. Use caution to avoid damage to the protruding fuel injector tips and No. 5 idler gear.

**NOTE:** The area of the cylinder block between the liners is not a sealing surface for the head gasket and will not cause a coolant leak unless the erosion reaches the upper liner O-ring.

**NOTE:** When measuring liner protrusion, avoid measuring the areas between the liners if there is erosion present.

5. Using liner protrusion tool J-47415-A, measure and record the cylinder liner protrusion for all six cylinders. Minimum allowable liner protrusion is 0.1397 mm (0.0055 in.) and maximum allowable liner protrusion is 0.26924 mm (0.0106 in.). The maximum variation allowed between cylinders is 0.0889 mm (0.0035 in.).
6. If reusing the cylinder head, alternate the head to hang in the opposite direction at the same 30 to 45 degree angle lengthwise for another ten minutes. Use caution to avoid damage to the protruding fuel injector tips and No. 5 idler gear.
7. If reusing the cylinder head, clean any oil, water or other foreign material from the cylinder head bolt holes and head gasket surface of the cylinder head. A scraper can be used to remove any residual gasket material.
8. Ensure both head gasket surfaces on the cylinder block and the cylinder head are clean and dry, especially the oil and coolant grommet counter bores.

**Table 2.**

DD13 Cylinder Head Casting Change	
<p><b>NOTICE:</b> Detroit made a cylinder head casting change for DD13 engines to improve cooling in April of 2015 with engine serial number 471927S0336887. The oil drain passages on the exhaust side of the cylinder head were modified. This change also required cup plugs to be installed in the deck of the cylinder head. A new cylinder head gasket was released with the cylinder head change. See illustrations below.</p>	
 <p><b>A</b></p>	 <p><b>B</b></p>
d010190	
<p>The new DD13 Cylinder Head (A) is shown on the left and the new DD13 Cylinder Head Gasket (B) is shown on the right.</p>	
<p>When making repairs to a DD13 engine with the new cylinder head design, the correct new cylinder head gasket must be used. The new cylinder head gasket part number is A4710161220. This head gasket can be used on any DD13 engine with carbon scraper ring liners (GHG14 and GHG17).</p>	

9. Position a new cylinder head gasket onto the cylinder block.

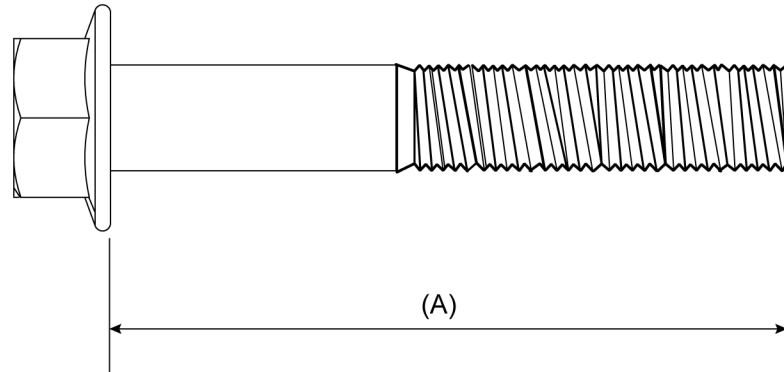


**WARNING: PERSONAL INJURY**

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.

10. Lift the cylinder head into position using lifting device W470589086200. The screw device on the lifting device can be used to assist with installation. Lower the cylinder head into place until it is fully seated onto the dowel pins and cylinder block.

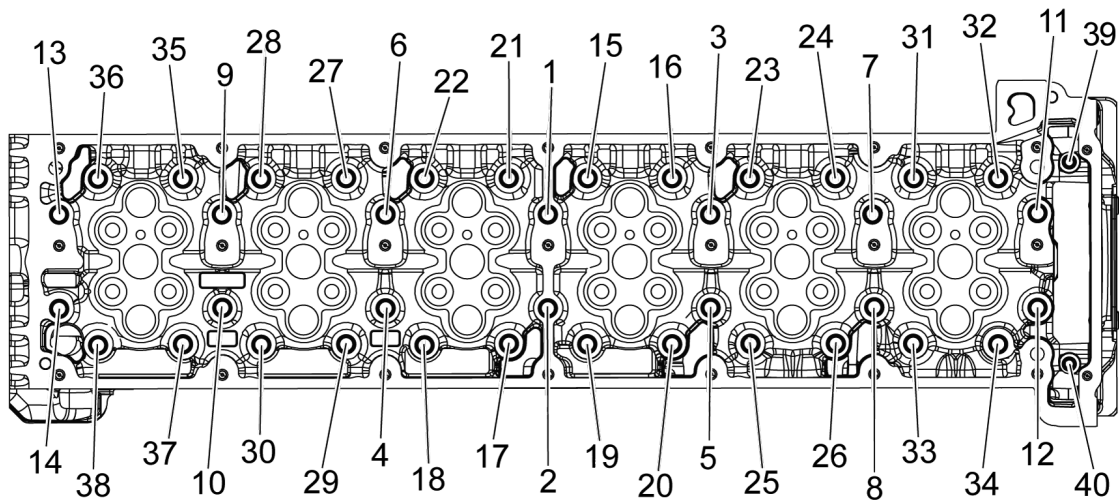
11. Measure the 38 large cylinder head mounting bolts for reuse. The maximum shank and thread length is 194 mm (7.638 inches). Refer to dimension "A" as shown below. Replace any bolts outside of this specification.



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**NOTICE:** Do not dip the entire cylinder head mounting bolt in oil as the excessive oil could cause improper torque results or external oil seepage at the head gasket joint.

12. Using a suitable brush, lightly coat the threads and underside of the bolt heads with clean engine oil.
13. Using the flywheel socket tool (J-45390), install the 38 large cylinder head mounting bolts and tighten using the torque sequence shown. Torque bolts (1 through 38) in three steps as follows:
  - 200 N·m (147 lb·ft).
  - 90° torque turn.
  - 90° torque turn.



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14. Install and torque the small bolts (39 and 40) to 60 N·m (44 lb·ft).
15. Torque the needle and amplifier return fittings M18 to 55 to 60 N·m (40 to 44 lb·ft).
16. Install the needle, amplifier, and Pressure Limiting Valve (PLV) return lines. Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Two-Filter System".
17. Install the two bolts attaching the cold boost pipe to the cold boost pipe support bracket. Torque the bolts to 30 N·m (22 lb·ft).
18. Install the coolant crossover pipe. Refer to section "Installation of the Coolant Crossover Pipe".
19. Install the turbocharger mounting bolts. Torque the bolts to 50 N·m (37 lb·ft).
20. Connect the EGR valve actuator pull rod to the EGR valve actuator. Refer to section "Installation of the DD13 and DD15 Exhaust Gas Recirculation Valve Actuator Pull Rod".
21. Install the EGR hot pipe with two new spherical clamps. Refer to section "Installation of the Exhaust Gas Recirculation Hot Pipe".
22. Install the turbocharger heat shield and EGR valve heat shield.
23. Install the coolant line from the EGR valve actuator to the EGR cooler water manifold assembly. Tighten coolant line to 35 N·m (26 lb·ft).
24. Connect the DEF system coolant lines to the water manifold
25. Connect the cab heater lines to the water manifold.
26. Install the doser injection valve coolant lines to the EGR cooler water manifold assembly.
  - For the 5mm long thread fitting, torque to 15 N·m (11 lb·ft).
  - For the 15mm long thread fitting, torque to 22 N·m (16 lb·ft).
27. Install the camshaft housing.
  - a. For vehicles with a short BBC (Bumper-to-Back-of Cab), Refer to section "Installation of the Camshaft Housing".
  - b. For a vehicle with a BBC of 120 inches or more, install the camshaft housing as an assembly. Refer to section "Installation of the Camshaft Housing Assembly"
28. If disconnected, reattach oil dipstick tube to the cold boost pipe.
29. If removed, install the engine cooling fan. Refer to the OEM procedure.
30. If removed, install the cooling package. Refer to the OEM procedure.
31. Install the coolant surge tank. Refer to the OEM procedure.
32. Connect the EGR cooler vent (deaeration) line.
33. Connect the coolant level sensor.
34. Install the ducting from the CAC to the cold boost pipe.
35. Install the turbocharger compressor outlet elbow.
36. Install the ducting from the turbocharger compressor outlet to the CAC.
37. For New Cascadia, install the air compressor resonator. Refer to the OEM procedures.
38. Install the air cleaner assembly and turbocharger inlet. Refer to the OEM procedure.
39. Reconnect the batteries. Refer to the OEM procedure.
40. Prime the fuel system.  
Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"  
Refer to section "Priming the Fuel System - KM59 GEN1 - Two-Filter System"

**NOTICE:** Be sure to change the oil and oil filter, in the correct sequence, so all of the contaminated lube oil and any oil filter debris is drained from the oil pan. Change the oil filter first, and then drain the lube oil.

41. Change the engine lubricating oil and oil filter due to possible coolant contamination during repairs.
42. Fill the cooling system. Refer to section "Cooling System Fill Procedure".
43. If removed, install the windshield wiper linkage. Refer to OEM procedures.
44. If removed, install the rain tray. Refer to OEM procedures.
45. If removed, install the hood. Refer to the OEM procedure.
46. If removed, install the inner fenders/splash shields and side fairings. Refer to the OEM procedures.
47. If removed, install the bumper. Refer to OEM procedures.



**WARNING: PERSONAL INJURY**

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.



**WARNING: ENGINE EXHAUST**

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

**NOTICE:** It is normal to see oil seepage or small oil bubbles at the head gasket joint when running the engine after a head gasket replacement. Oil seepage or small oil bubbles should not be present after approximately 805 km (500 mi).

48. Start the engine and check for leaks.

## 10 Removal of the DD15 and DD16 Cylinder Head Assembly

Remove as follows:



### **WARNING: PERSONAL INJURY**

To avoid injury, never remove any engine component while the engine is running.



### **WARNING: PERSONAL INJURY**

To avoid injury from hot surfaces, wear protective gloves, or allow engine to cool before removing any component.

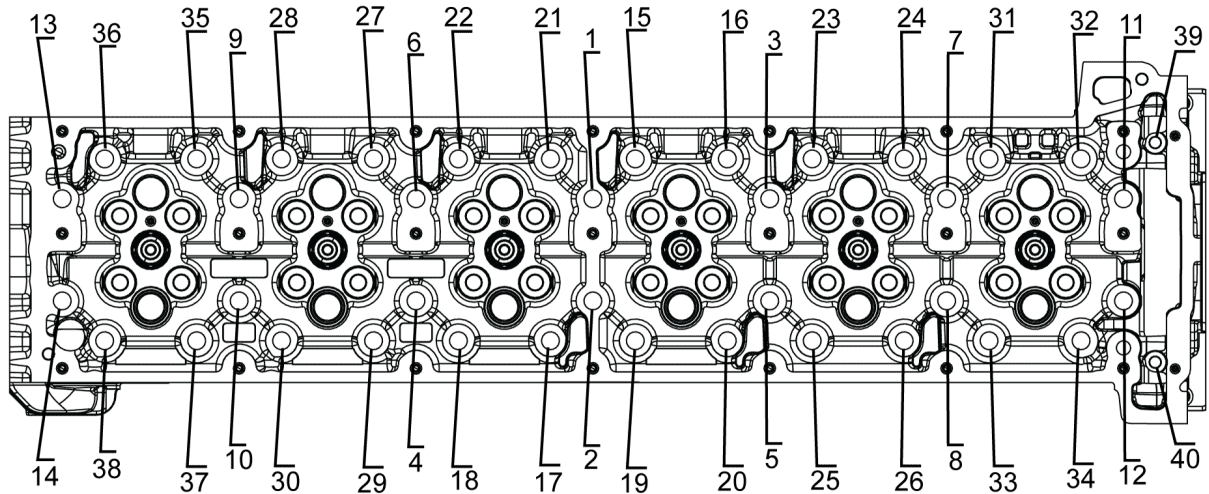
1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.



### **CAUTION: ELECTRICAL SHOCK**

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

2. Disconnect the batteries. Refer to Original Equipment Manufacturer (OEM) procedures.
3. Open the hood.
4. If necessary, remove the bumper. Refer to OEM procedures.
5. If necessary, remove the rain tray. Refer to OEM procedures.
6. If necessary, remove the windshield wiper linkage. Refer to OEM procedures.
7. Drain the cooling system. Refer to section "Cooling System Drain Procedure".
8. Disconnect the coolant level sensor connection.
9. Disconnect the EGR cooler vent (deaeration) line from the EGR cooler.
10. Remove the coolant surge tank. Refer to the OEM procedure.
11. Remove the air cleaner assembly and turbocharger inlet. Refer to the OEM procedures.
12. For New Cascadia, remove the air compressor resonator. Refer to the OEM procedures.
13. Remove the camshaft housing assembly. Refer to section "Removal of the Camshaft Housing Assembly".
14. Remove the coolant lines from the water manifold to the fuel doser injector housing.
15. Disconnect the cab heater lines from the water manifold.
16. Disconnect the DEF system coolant lines from the water manifold.
17. Remove the EGR actuator coolant line from the water manifold.
18. Remove the EGR pull rod from the EGR valve.
19. Remove the turbocharger heat shield and EGR valve heat shield.
20. Remove the turbocharger mounting bolts.
21. Remove the coolant crossover pipe. Refer to section "Removal of the Coolant Crossover Pipe".
22. Remove the ducting from the CAC to the cold boost pipe.
23. Remove the two bolts attaching the cold boost pipe to the cold boost pipe support bracket.
24. Remove needle, amplifier, and pressure limiting valve (PLV) return lines. Refer to section "Removal of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Two-Filter System".
25. Remove the two small cylinder head bolts (39 and 40). See illustration below.



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26. Using the flywheel socket tool (J-45390), remove the 38 large mounting bolts securing the cylinder head to the cylinder block.



**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.

27. Position the lifting device W470589086200 in place on top of the cylinder head.
28. Install the eight lifting device mounting bolts into the cylinder head and torque the bolts to 60 N·m (44 lb·ft).
29. Attach a suitably rated overhead crane or engine hoist to the lifting device.
30. Carefully lift and remove the cylinder head from the cylinder block. The lifting device can be leveled using the screw drive to assist with removal.
31. Place the cylinder head on a suitable surface using spacers to avoid damage to the protruding fuel injector tips and No. 5 idler gear.
32. Remove the cylinder head gasket.
33. If the cylinder head must be replaced, Refer to section "DD Platform Cylinder Head Replacement".

## 11 Installation of the DD15 and DD16 Cylinder Head Assembly

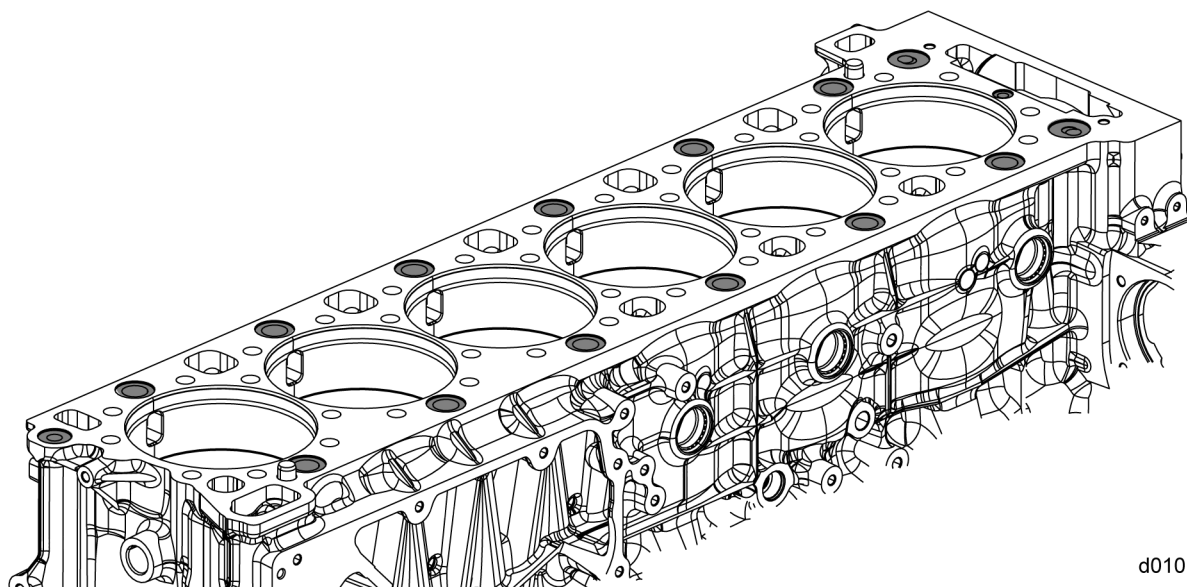
Install as follows:

**NOTICE:** If the coolant grommets on the head gasket have failed, do not proactively replace the cylinder liner seals unless there is evidence of extensive cylinder block erosion around the liners.

**NOTICE:** Do not use any abrasive tools or methods to clean the oil and coolant grommet counter bores or other gasket surfaces of the cylinder head or cylinder block. Foreign material may enter the oil system and cause serious engine damage.

**NOTICE:** Failure to properly clean the oil and coolant grommet counter bores may result in cylinder head gasket grommet failure.

1. Thoroughly clean the oil and coolant grommet counter bores in the cylinder block with a suitable scraper to remove any foreign material before installation of cylinder head gasket. Counter bores must be clean and dry.
2. Inspect the cylinder head bolt holes in the cylinder block for the presence of oil, water, dirt, rust or damaged threads. Clean and re-tap as necessary.
3. Ensure piston domes and cylinder block deck surfaces are clean, dry, and free of oil, water or any other foreign material.



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### **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.

4. If reusing the cylinder head, lift the head using lifting device W470589086200 so it can hang at a 30 to 45 degree angle lengthwise for 10 minutes. The residual oil and coolant will need to drain before the head can be installed on the engine. Use caution to avoid damage to the protruding fuel injector tips and No. 5 idler gear.

**NOTE:** The area of the cylinder block between the liners is not a sealing surface for the head gasket and will not cause a coolant leak unless the erosion reaches the upper liner O-ring.

**NOTE:** When measuring liner protrusion, avoid measuring the areas between the liners if there is erosion present.

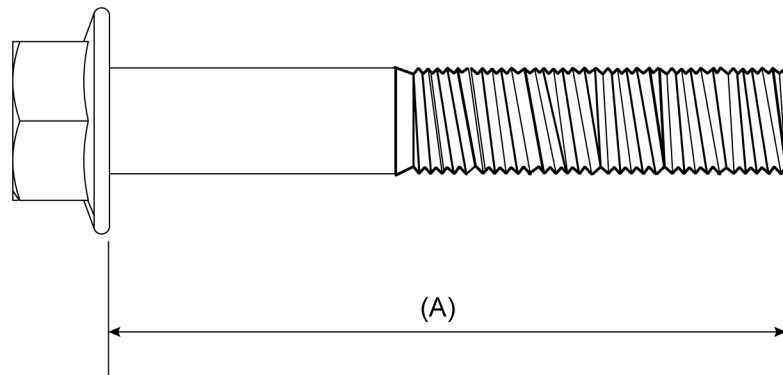
5. Using liner protrusion tool J-47415-A, measure and record the cylinder liner protrusion for all six cylinders. Minimum allowable liner protrusion is 0.1397 mm (0.0055 in.) and maximum allowable liner protrusion is 0.26924 mm (0.0106 in.). The maximum variation allowed between cylinders is 0.0889 mm (0.0035 in.).
6. If reusing the cylinder head, alternate the head to hang in the opposite direction at the same 30 to 45 degree angle lengthwise for another ten minutes. Use caution to avoid damage to the protruding fuel injector tips and the No. 5 idler gear.
7. If reusing the cylinder head, clean any oil, water or other foreign material from the cylinder head bolt holes and head gasket surface of the cylinder head. A scraper can be used to remove any residual gasket material.
8. Ensure both head gasket surfaces on the cylinder block and the cylinder head are clean and dry, especially the oil and coolant grommet counter bores.
9. Position a new cylinder head gasket onto the cylinder block.



**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.

10. Lift the cylinder head into position using lifting device W470589086200. The screw drive on the tool can be used to assist with installation. Install guide studs J-35784 through the cylinder head and into the cylinder block. Lower the cylinder head onto the cylinder block.
11. Remove the cylinder head guide studs.
12. Measure the 38 large cylinder head mounting bolts for reuse. The maximum shank and thread length is 194 mm (7.638 inches). Refer to dimension “A” as shown below. Replace any bolts outside of this specification.

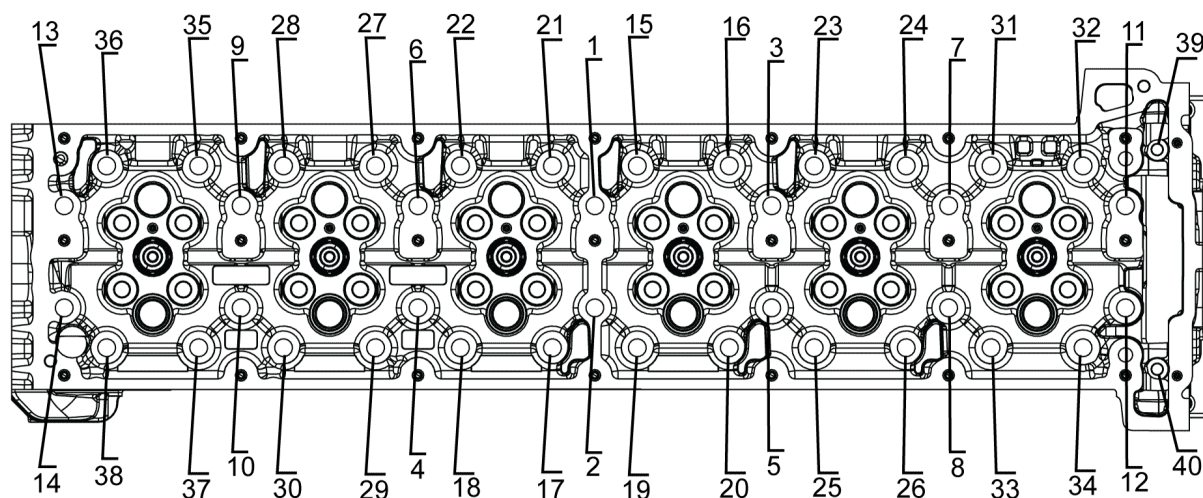


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**NOTICE:** Do not dip the entire cylinder head mounting bolt in oil as the excessive oil could cause improper torque results or external oil seepage at the head gasket joint.

13. Using a suitable brush, lightly coat the threads and underside of the bolt heads with clean engine oil.

14. Using the sequence shown below, install and torque the 38 large cylinder head mounting bolts in four steps to:
- 50 N·m (37 lb·ft).
  - 250 N·m (184 lb·ft).
  - 90° torque turn.
  - 90° torque turn.



d010117

15. Install and torque the small bolts (39 and 40) at the rear to 60 N·m (44 lb·ft).
16. Torque the needle and amplifier return fittings M18 to 55 to 60 N·m (40 to 44 lb·ft).
17. Connect the needle, amplifier, and pressure limiting valve return lines. Refer to section "Installation of the Needle, Amplifier, and Pressure Limiting Valve Return Lines - Two-Filter System".
18. Install the two bolts attaching the cold boost pipe to the cold boost pipe support bracket. Torque bolts to 30 N·m (22 lb·ft).
19. Install the ducting from the CAC to the cold boost pipe.
20. Install the coolant crossover pipe. Refer to section "Installation of the Coolant Crossover Pipe".
21. Install the turbocharger mounting bolts. Torque the bolts to 50 N·m (37 lb·ft).
22. Connect the EGR pull rod to the EGR valve. Install and torque the clamping nuts to 20 N·m (15 lb·ft).
23. Install the EGR actuator coolant supply line.
24. Install the turbocharger heat shield and EGR valve heat shield.
25. Connect the DEF system coolant lines to the water manifold.
26. Connect the cab heater lines to the water manifold.
27. Install the coolant lines from the water manifold to the fuel doser injector housing.
28. Install the camshaft housing assembly. Refer to section "Installation of the Camshaft Housing Assembly".
29. For New Cascadia, install the air compressor resonator. Refer to the OEM procedures.
30. Install the air cleaner assembly and inlet to the turbocharger. Refer to the OEM procedures.
31. Install the coolant surge tank. Refer to OEM procedures.
32. Connect the EGR cooler vent (deaeration) line to the EGR cooler.
33. Connect the coolant level sensor.
34. Prime the fuel system.  
Refer to section "Priming the Fuel System - KM63 GEN2 - Two-Filter System"  
Refer to section "Priming the Fuel System - KM59 GEN1 - Two-Filter System"
35. Reconnect the batteries. Refer to OEM procedures.

**NOTICE:** Be sure to change the oil and oil filter in the correct sequence, so all of the contaminated lube oil and any oil filter debris is drained from the oil pan. Change the oil filter first, and then drain the lube oil.

36. Change the engine lubricating oil and oil filter due to possible coolant contamination during repairs.
37. Fill the cooling system. Refer to section "Cooling System Fill Procedure".
38. If removed, install the windshield wiper linkage. Refer to OEM procedures.

39. If removed, install the rain tray. Refer to OEM procedures.
40. If removed, install the bumper. Refer to OEM procedures.

**NOTICE:** It is normal to see oil seepage or small oil bubbles at the head gasket joint when running the engine after a head gasket replacement. Oil seepage or small oil bubbles should not be present after approximately 805 km (500 mi).



**WARNING: PERSONAL INJURY**

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.



**WARNING: ENGINE EXHAUST**

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

41. Start the engine and check for leaks.