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Service Information Bulletin

SUBJECT	DATE
Symptom Diagnostics - Oil Leaks	January 2017

Additions, Revisions, or Updates

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0191	GHG17 DD Platform HD	Engine Oil Leaks	These are new sections.
DDC-SVC-MAN-0084	EPA07/10/ GHG14 DD Platform	Engine Oil Leaks	



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2 Engine Oil Leaks

NOTE: Detroit™ and the Department of Transportation (DOT) define an external fluid leak as a condition where fluids are pooling or leaking onto the ground.



Figure 1. Example of an Oil Leak - Very Wet with Evidence That Fluid Leaks onto the Ground



d180092

Figure 2. Example of a Seep - Residue Accumulation on the Surface But Remains on that Surface and Does Not Drip onto the Ground

NOTE: Block porosity is an immediate issue and does not happen over time. If there was a block porosity concern present, the porosity issue would be evident when the engine is new.

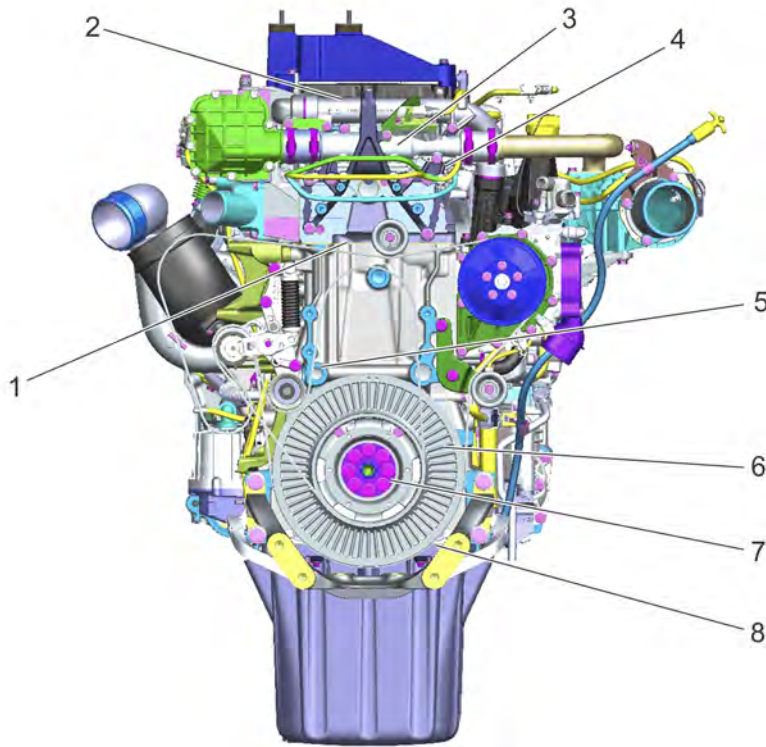
Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Was an oil change recently performed on this vehicle?
 - a. Yes; check to make sure that the oil filter and drain plug were properly installed and clean any oil presence spilled from the previous service interval.
 - b. No; Go to step 3.
3. Is oil pooling or leaking onto the ground?
 - a. Yes; Go to step 4.
 - b. No; no leaks are present, release the vehicle. Refer to 12WO-2. (<http://www.ddcsn.com/cps/rde/xchg/ddcsn/hs/5525.htm>)
4. Check vehicle repair history. Are there any recent repairs that could have resulted in oil spills on the engine that would appear as an oil leak?
 - a. Yes; examine the oil spill area of the engine to make sure it is not being perceived as an oil leak.
 - b. No; Go to step 5.

NOTE: Isolating the exact location can be difficult due to fan blast and road grime that can cause the leaking oil to migrate. Oil leaks tend to move in a downward and rearward direction. Look for the highest point of any oil trace.

5. Inspect the entire vehicle for signs of leaks; note any leaks that could be confused for an engine oil leak. Was the source of the leak identified as being caused by the engine?
 - a. Yes; Go to step 6.
 - b. No; identify the non-engine component causing the leak and refer to the component OEM literature for additional information on troubleshooting/repair of the oil leak.

6. Visually inspect the rocker cover gasket, starting at the left front of the engine and continuing down the left side toward the rear of the engine. Is there an external oil leak coming from the rocker cover gasket?
 - a. Yes; replace the rocker cover gasket. Refer to section "Removal of the Rocker Cover".
 - b. No; Go to step 7.
7. Visually inspect the Camshaft Position (CMP) sensor for sign of external oil leaks. Is there an external oil leak coming from the CMP sensor?
 - a. Yes; replace the O-ring on the CMP sensor. Refer to section "Removal of the Camshaft Position Sensor".
 - b. No; Go to step 8.
8. Visually inspect the camshaft housing seal, starting at the front left and continuing down the left side to the rear. Pay special attention to the rear corner, as leaks are hard to see in this area. Are there any external oil leaks coming from the cam frame housing seal?
 - a. Yes; replace the cam housing seal. Refer to section "Removal of the Camshaft Housing Assembly".
 - b. No; Go to step 9.
9. Visually inspect the cylinder head gasket (1), starting at the left front of the engine and continuing down the left side to the rear of the engine. Keep in mind that the oil supply ports are at the front and the rear of the block. Are there any external oil leaks coming from the cylinder head gasket?
 - a. Yes; remove the cylinder head and inspect the head gasket oil supply and return seals for damage. Refer to section "Removal of the DD13 Cylinder Head Assembly"
Refer to section "Removal of the DD15 and DD16 Cylinder Head Assembly"
Repair as necessary.
 - b. No; Go to step 10.



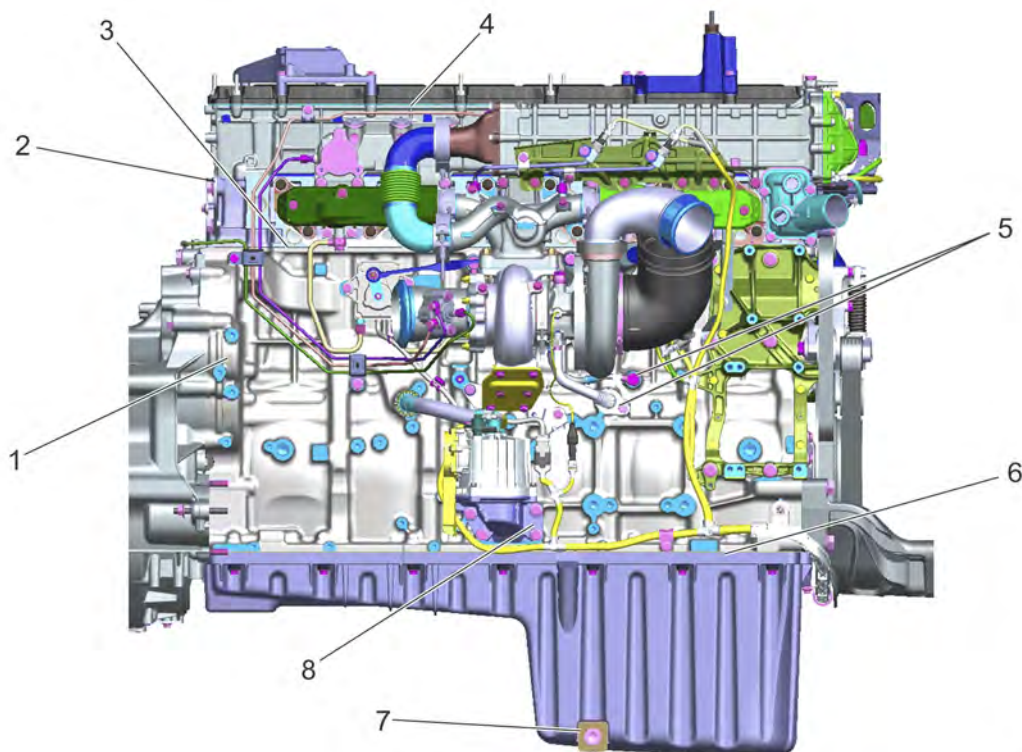
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- | | |
|-------------------------------------------------------|-------------------------------------|
| 1. Cylinder Head Gasket | 5. Oil Gallery Cup Plugs |
| 2. Rocker Cover Gasket | 6. Front Cover Seal (behind damper) |
| 3. Camshaft Housing Cup Plugs (behind crossover pipe) | 7. Crankshaft Seal (behind damper) |
| 4. Camshaft Housing Seal | 8. Oil Pan Gasket |

Figure 3. Front of Engine (steps 10 - 13)

10. Is oil leaking from the front of the engine?
 - a. Yes; Go to step 11.

- b. No; Go to step 14.
- 11. Visually inspect the camshaft housing cup plugs (behind the crossover pipe) (3). Are there any external leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 12.
- 12. Visually inspect the oil gallery cup plugs (5) in the cylinder block. Are there any external leaks present?
 - a. Yes, repair as necessary.
 - b. No; Go to step 13.
- 13. Looking behind the damper, inspect for a leaking front cover seal (6) or a leaking crankshaft seal (7). Is either seal leaking?
 - a. Yes; repair as necessary.
 - b. No; Go to step 39.
- 14. Is oil leaking from the right side of the engine?



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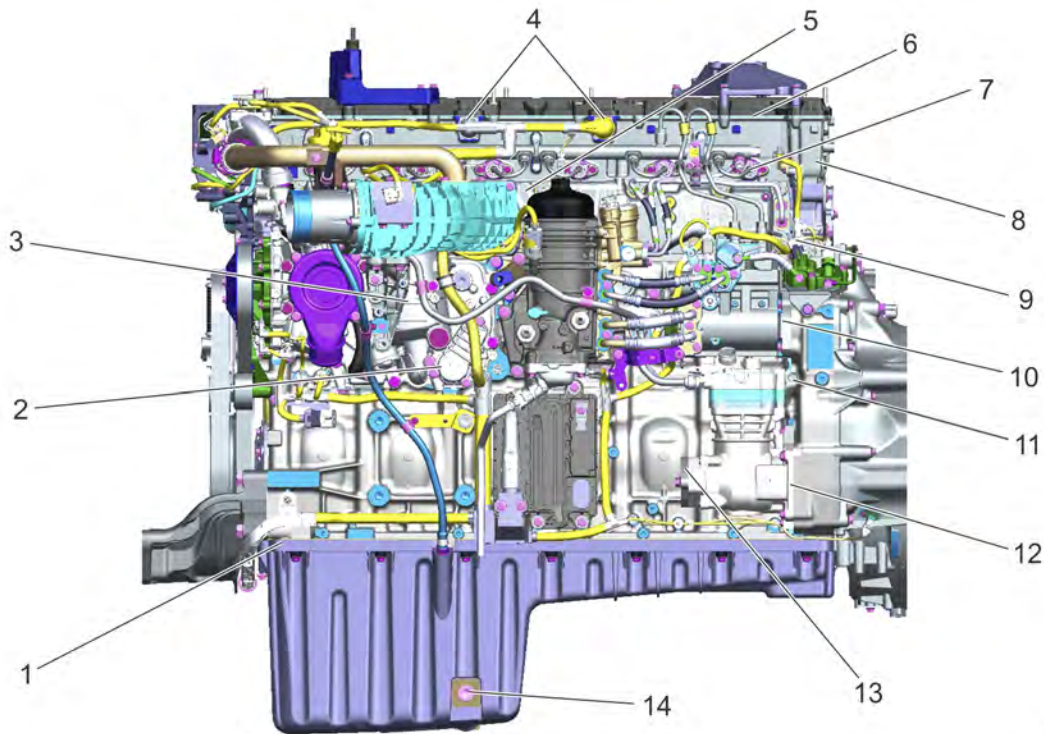
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|--------------------------------|---------------------------------------------|
| 1. Cylinder Head Gasket | 5. Oil Pan Gasket |
| 2. Rocker Cover Gasket | 6. Right Oil Drain Plug |
| 3. Turbo Oil Supply and Return | 7. Cylinder Block Cover Plate (if equipped) |
| 4. Crankcase Breather and Tube | 8. Camshaft Housing Seal |

Figure 4. Right Side (steps 14 - 20)

- a. Yes; Go to step 15.
- b. No; Go to step 21.
- 15. Inspect the right side oil drain plug (6). Is there an oil leak present at the oil drain plug?
 - a. Yes; repair as necessary.
 - b. No; Go to step 16.
- 16. Inspect the crankcase breather (4). Check for leaks at the inlet and outlet tubes, fittings, mounting surface to the cylinder block, and the housing-to-cap seal. Are there any external oil leaks present?
 - a. Yes; repair as necessary, Go to step 18.
 - b. No; Go to step 17.

NOTE: An internally leaking crankcase breather will leak at a rate of at least three drips of oil every five minutes. If a leak is found at a slower rate than three drips every five minutes the source of the drip is not internal to the crankcase breather.

17. Wipe the crankcase breather clean. Place a blank card under the crankcase breather assembly to visualize any leaks. An internal leaking crankcase breather will leak at a rate of at least three drips of oil every five minutes. Are there any oil leaks present of more than three drips of oil in a five-minute time span?
 - a. Yes; Go to step 18.
 - b. No; Go to step 19.
18. Measure the crankcase pressure. Refer to section "Crankcase Pressure Test". Does the engine have high crankcase pressure?
 - a. Yes; repair as necessary.
 - b. No; replace the crankcase breather. Refer to section "Removal of the Crankcase Breather Assembly".
19. Is oil leaking at the boost pipe?
 - a. Yes; inspect for loose clamps, seeping, worn or damaged boost pipe and for a dirty air filter. Then Go to step 20.
 - b. No; Go to step 20.
20. Inspect the turbocharger assembly and related parts.
 Refer to section "Inspection of the DD13 and DD15 Turbocharger"
 Refer to section "Inspection of the DD16 Turbocharger"
 Check for leaks at the inlet and outlet pipes, oil supply and drain lines, speed sensor, speed sensor O-ring, sealing surface between the turbocharger assembly and the engine block. Are there any external oil leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 39.
21. Is oil leaking from the left side of the engine?

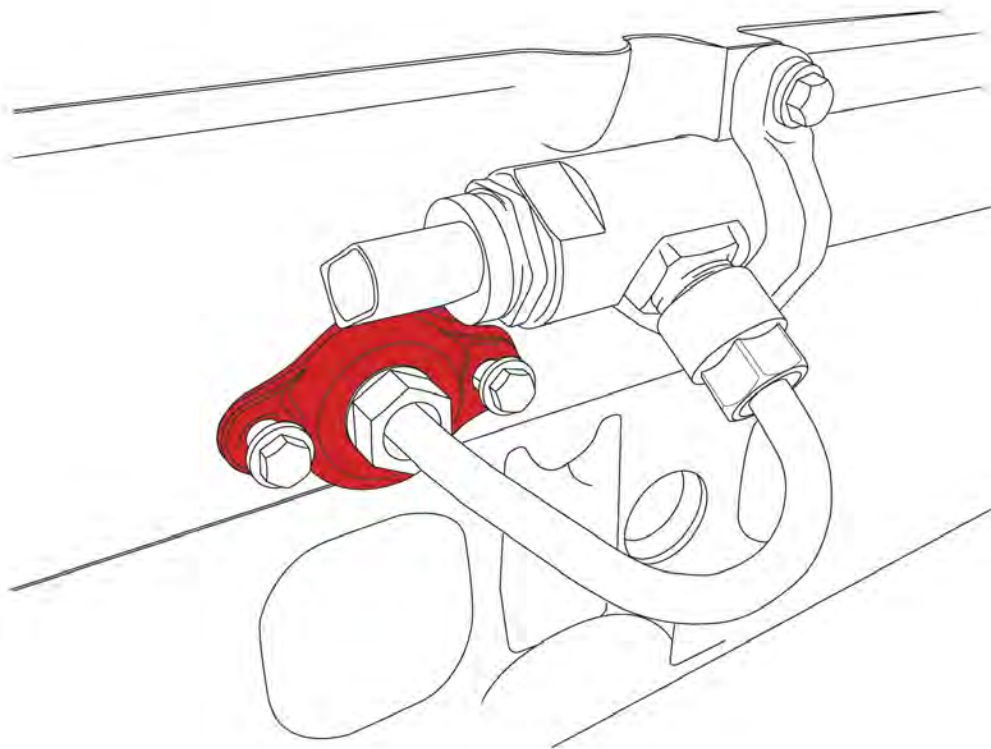


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1. Injector Harness Grommets
2. Camshaft Housing Seal
3. Rocker Cover Gasket
4. High Pressure Transfer Line Seals
5. Cam Position Sensor O-ring
6. Cylinder Head Gasket
7. High Pressure Pump Mounting Seal
8. Oil Gallery Cup Plug between High Pressure Pump and Air Compressor
9. Air Compressor Mounting Seal
10. Power Steering Pump Mounting Gasket
11. Left Oil Pan Plug
12. Oil Pan Gasket
13. Oil Thermostat Cover Plate Seal
14. Oil Coolant Module (see 13TS-10)

Figure 5. Left Side (steps 21 - 33)

- a. Yes; Go to step 22.
 - b. No; Go to step 34.
22. Inspect the left side oil pan plug (11). Is there an oil leak present at the oil pan plug?
 - a. Yes; repair as necessary.
 - b. No; Go to step 23.
 23. Visually inspect the oil pressure and oil temperature sensors for signs of external oil leaks. Leaks can be present at the sensors or O-rings. Is there an external oil leak coming from either sensor?
 - a. Yes; repair as necessary.
 - b. No; Go to step 24.
 24. Visually inspect the injector harness grommets (1). Are there any external leaks present?
 - a. Yes; replace the injector harness grommets.
 - b. No; Go to step 25.
 25. Visually inspect the high pressure fuel injector line seals for each cylinder. Are any of the high pressure fuel injector line seals leaking?

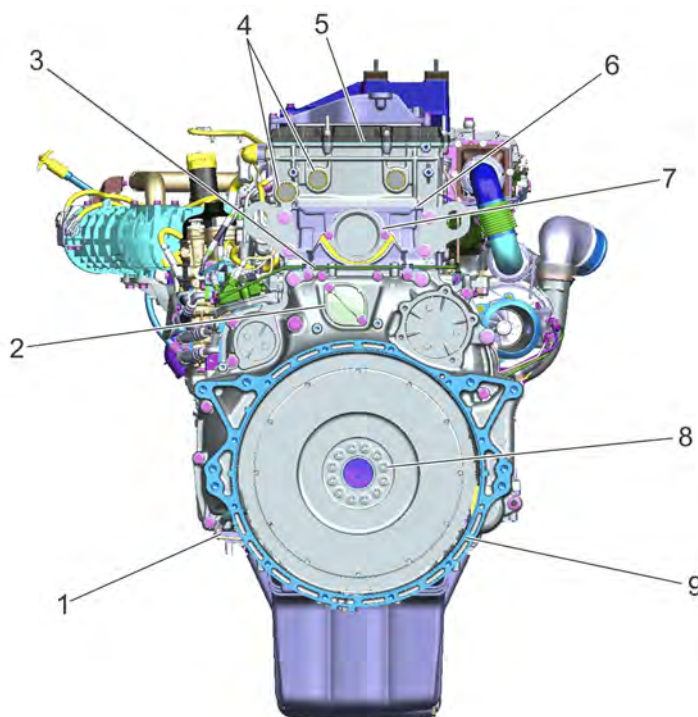


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- a. Yes; replace the high pressure fuel line injector line seal(s) that are leaking.
- b. No; Go to step 26.

NOTE: When inspecting the oil coolant module, consider that oil might be spilled around the filler neck and oil filter cap area during service intervals. These spills can sometimes lead to misdiagnosis.

26. Inspect the oil coolant module. Check for leaks at the oil fill neck, oil filter cap, oil thermostat cover, plugs, and around the sealing surface between the oil coolant module and the engine block. Are there any external oil leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 27.
27. Inspect the oil dipstick tube. Are there any external oil leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 28.
28. Check for leaks at the High Pressure Fuel Pump (HPFP) (7). Are there any external oil leaks at the HPFP weep hole or where the HPFP mates to the engine block?
 - a. Yes; Go to step 29.
 - b. No; Go to step 30.
29. Remove the HPFP and inspect its camshaft seal. Is damage present?
 - a. Yes; install a new HPFP and mounting O-ring.
 - b. No; install a new mounting O-ring and reinstall the HPFP.
30. Inspect the cylinder block oil gallery cup plug, located two inches under the high pressure fuel pump (8). Is there an external oil leak at the cup plug?
 - a. Yes; replace the cup plug. Refer to section "Replacement of the Oil Gallery Cup below the High Pressure Fuel Pump".
 - b. No; Go to step 31.
31. Inspect the air compressor assembly; check for oil leaks at the compressor's cup plug. Are there any external oil leaks present?
 - a. Yes; replace the air compressor.
 - b. No; Go to step 32.
32. Inspect the air compressor flange where it mates to the engine block. Is there an external oil leak present?
 - a. Yes; remove the air compressor, clean the area, replace the O-ring, and reinstall the air compressor.
 - b. No; Go to step 33.
33. Inspect the seal between the rear of the air compressor and the power steering pump. Is there an external oil leak present?
 - a. Yes; remove the power steering pump, replace the seal, and reinstall the power steering pump.
 - b. No; Go to step 39.
34. Visually inspect the camshaft housing cup plugs (1). Is there an external oil leak present?



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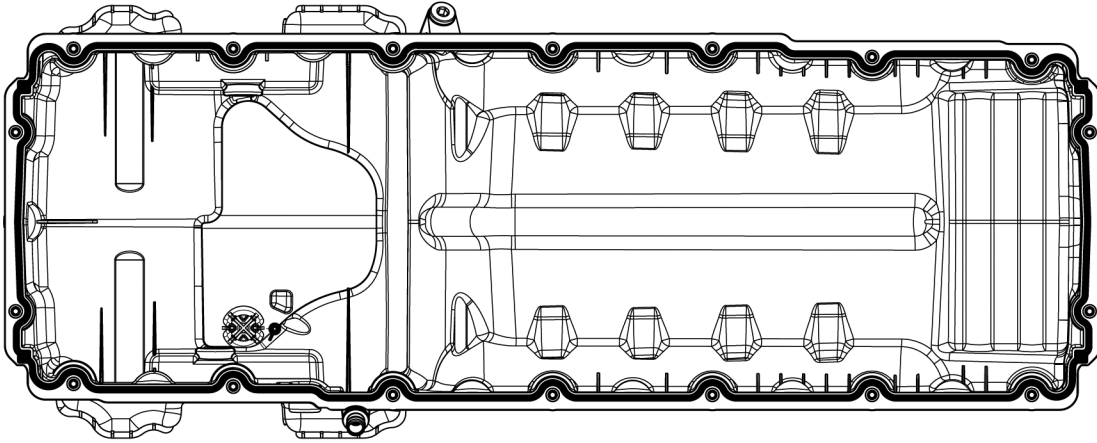
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| 1. Camshaft Housing Cup Plugs | 6. Flywheel Housing Gasket |
| 2. Rocker Cover Gasket | 7. Oil Pan Gasket |
| 3. Camshaft Housing Seal | 8. Access Plate for #3 Idler |
| 4. Access Plate for #5 Idler | 9. Cylinder Head Gasket |
| 5. Rear Crank Seal (behind flywheel) | |

Figure 6. Back of Engine (steps 34 to 38)

- a. Yes; repair as necessary.
 - b. No; Go to step 35.
35. Visually inspect the camshaft housing seal (3). Is there an external oil leak present?
 - a. Yes; replace the cam housing seal. Refer to section "Removal of the Camshaft Housing Assembly".
 - b. No; Go to step 36.
 36. Visually inspect the access plate for #5 idler (4). Is there an external oil leak present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 37.
 37. Visually inspect the access plate for #3 idler (8). Is there an external oil leak present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 38.
 38. Visually inspect the flywheel housing for leaks (6). Is there a leak on the lower 6 inches of the flywheel housing?
 - a. Yes; Go to step 39.
 - b. No; the oil leak is generated by either the flywheel housing gasket or the rear crankshaft seal. Inspect and repair as necessary.

NOTE: For oil pan gasket warranty submissions, you may choose to use the image below to mark the location of the leak on the oil pan gasket. When replacing an oil pan gasket, Refer to section "Installation of the Oil Pan".

39. Inspect the oil pan starting at the front of the engine working towards the rear of the engine. Is there an external oil leak present?



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- a. Yes; repair as necessary.
- b. No; Refer to section "Engine Oil Leaks - Oil Developer Method".

3 Engine Oil Leaks

NOTE: Detroit™ and the Department of Transportation (DOT) define an external fluid leak as a condition where fluids are pooling or leaking onto the ground.



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Figure 7. Example of an Oil Leak - Very Wet with Evidence that Fluid Leaks onto the Ground



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Figure 8. Example of a Seep - Residue Accumulation on the Surface but Remains on that Surface and Does Not Drip onto the Ground

NOTE: Block porosity is an immediate issue and does not happen over time. If there were a block porosity concern present, the porosity issue would be evident with a new engine.

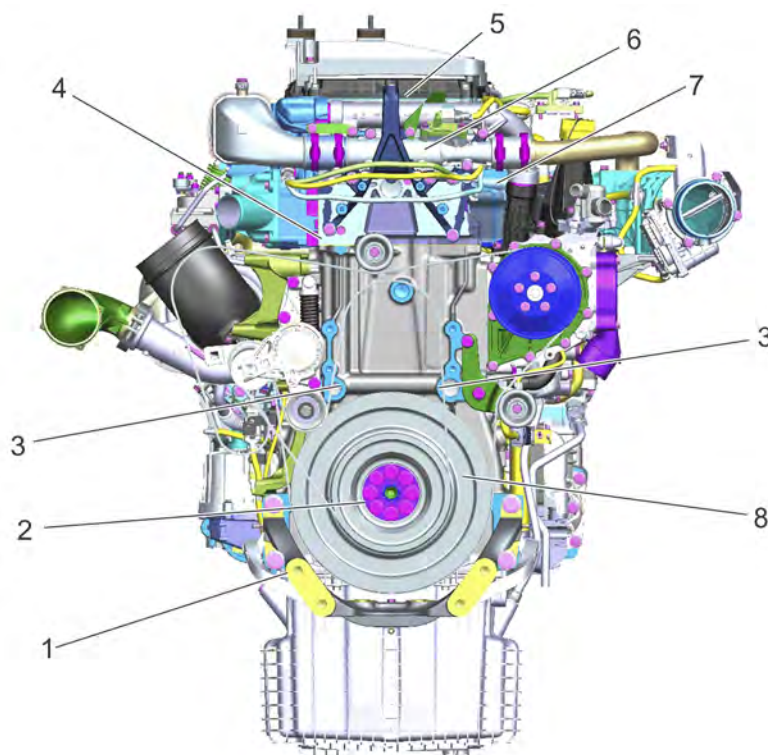
Check as follows:

1. Shut off the engine, apply the parking brake, chock the wheels, and perform any other applicable safety steps.
2. Was an oil change recently performed on this vehicle?
 - a. Yes; check to make sure that the oil filter and drain plug were properly installed and clean any oil presence spilled from the previous service interval.
 - b. No; Go to step 3.
3. Is oil pooling or leaking onto the ground?
 - a. Yes; Go to step 4.
 - b. No; no leaks are present, release the vehicle. Refer to 12WO-2. (<http://www.ddcsn.com/cps/rde/xchg/ddcsn/hs/5525.htm>)
4. Check vehicle repair history. Are there any recent repairs that could have resulted in oil spills on the engine that would appear as an oil leak?
 - a. Yes; examine the oil spill area of the engine to make sure it is not being perceived as an oil leak.
 - b. No; Go to step 5.

NOTE: Isolating the exact location can be difficult due to fan blast and road grime that can cause the leaking oil to migrate. Oil leaks tend to move in a downward and rearward direction. Look for the highest point of any oil trace.

5. Inspect the entire vehicle for signs of leaks; note any leaks that may be confused for an engine oil leak. Was the source of the leak identified as being caused by the engine?
 - a. Yes; Go to step 6.
 - b. No; Identify the non-engine component causing the leak and refer to the component OEM literature for additional information on troubleshooting/repair of the oil leak.

6. Visually inspect the rocker cover gasket starting at the left front of the engine and continue down the left side to the rear of the engine. Is there an external oil leak coming from the rocker cover gasket?
 - a. Yes; replace the rocker cover gasket. Refer to section "Removal of the Rocker Cover".
 - b. No; Go to step 7.
7. Visually inspect the Camshaft Position (CMP) sensor for sign of external oil leaks. Is there an external oil leak coming from the CMP sensor?
 - a. Yes; replace the O-ring on the CMP. Refer to section "Removal of the Camshaft Position Sensor".
 - b. No; Go to step 8.
8. Visually inspect the camshaft housing seal, starting at the front left and continuing down the left side to the rear. Pay special attention to the rear corner; leaks are hard to see in this area. Are there any external oil leaks coming from the cam frame housing seal?
 - a. Yes; replace the cam housing seal. Refer to section "Removal of the Camshaft Housing Assembly".
 - b. No; Go to step 9.
9. Visually inspect the cylinder head gasket, starting at the left front of the engine and continuing down the left side to the rear of the engine. Keep in mind that the oil supply ports are at the front and the rear of the cylinder block. Are there any external oil leaks coming from the cylinder head gasket?
 - a. Yes; remove the cylinder head and inspect the head gasket oil supply and return seals for damage. Refer to section "Removal of the DD13 Cylinder Head Assembly"
Refer to section "Removal of the DD15 and DD16 Cylinder Head Assembly"
Repair as necessary.
 - b. No; Go to step 10.
10. Is oil leaking from the front of the engine?



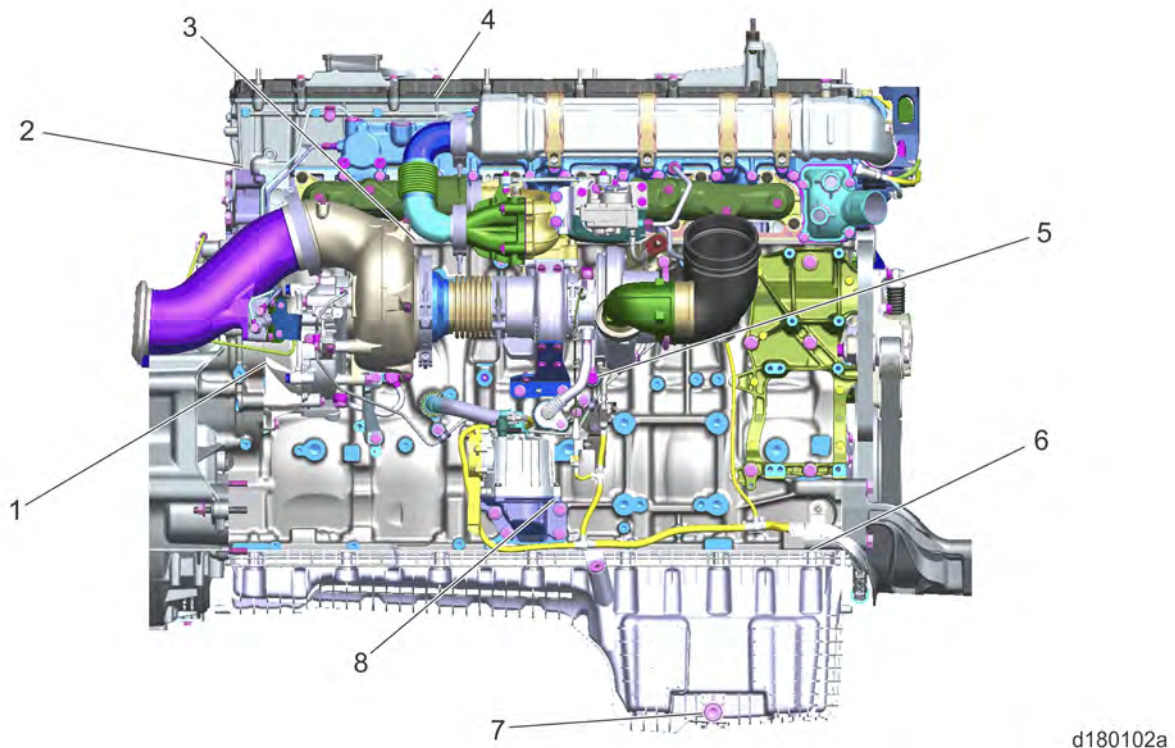
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|-------------------------------------------------------|-------------------------------------|
| 1. Cylinder Head Gasket | 5. Oil Gallery Cup Plugs |
| 2. Rocker Cover Gasket | 6. Front Cover Seal (behind damper) |
| 3. Camshaft Housing Cup Plugs (behind crossover pipe) | 7. Crankshaft Seal (behind damper) |
| 4. Camshaft Housing Seal | 8. Oil Pan Gasket |

Figure 9. Front of Engine (steps 10 to 13)

- a. Yes; Go to step 11.

- b. No; Go to step 14.
- 11. Visually inspect the camshaft housing cup plugs (behind the crossover pipe) (3). Are there any external leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 12.
- 12. Visually inspect the oil gallery cup plugs (5) in the cylinder block. Is there any external leaks present?
 - a. Yes, repair as necessary.
 - b. No; Go to step 13.
- 13. Looking behind the damper inspect for a leaking front cover seal (6) or a leaking crankshaft seal (7). Is either seal leaking?
 - a. Yes; repair as necessary.
 - b. No; Go to step 43.
- 14. Is oil leaking from the right side of the engine?



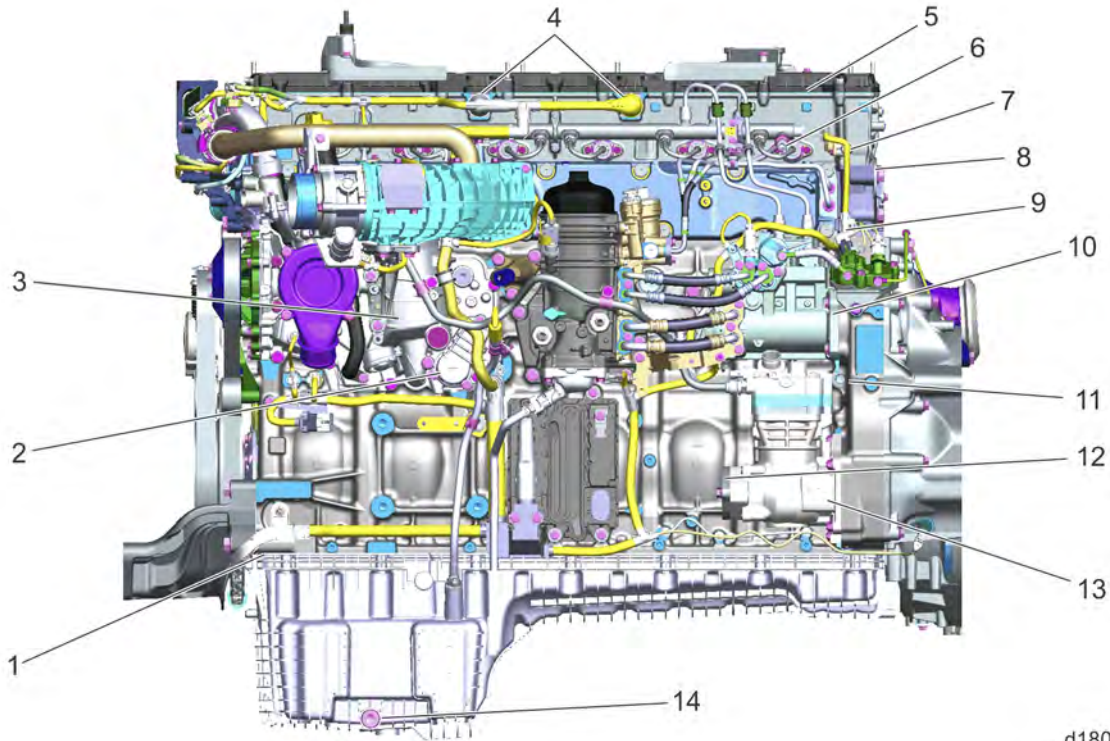
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|--------------------------------|---------------------------------------------|
| 1. Cylinder Head Gasket | 5. Oil Pan Gasket |
| 2. Rocker Cover Gasket | 6. Right Oil Drain Plug |
| 3. Turbo Oil Supply and Return | 7. Cylinder Block Cover Plate (if equipped) |
| 4. Crankcase Breather and Tube | 8. Camshaft Housing Seal |

Figure 10. Right Side (steps 14 to 23)

- a. Yes; Go to step 15.
- b. No; Go to step 24.
- 15. Inspect the right side oil drain plug (6). Is there an oil leak present at the oil drain plug?
 - a. Yes; repair as necessary.
 - b. No; Go to step 16.
- 16. Inspect the crankcase breather (4). Check for leaks at the inlet and outlet tubes, fittings, the mounting surface to the cylinder block, and the housing to cap seal. Are there any external oil leaks present?
 - a. Yes; repair as necessary, Go to step 18.
 - b. No; Go to step 17.

NOTE: An internally leaking crankcase breather will leak at a rate of at least three drips of oil every five minutes. If a leak is found at a slower rate than three drips every five minutes, the source of the drip is not internal to the crankcase breather.

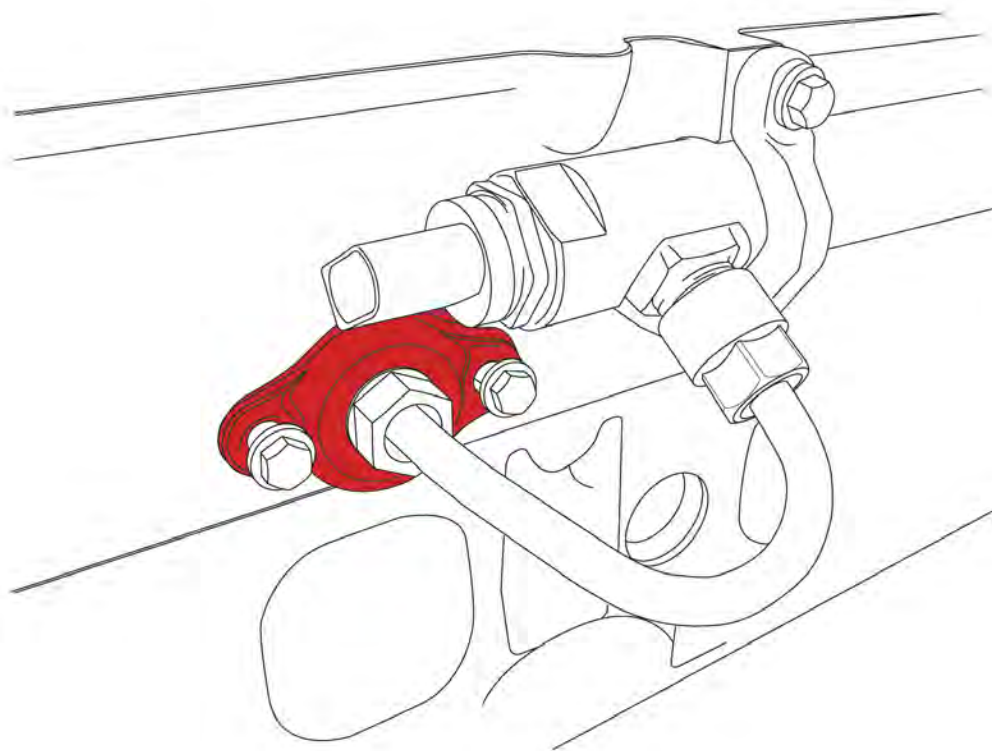
17. Wipe the crankcase breather clean. Place a blank card under the crankcase breather assembly to visualize any leaks. An internal leaking crankcase breather will leak at a rate of at least three drips of oil every five minutes. Are there any external oil leaks present of more than three drips of oil in a five-minute time span?
 - a. Yes; Go to step 18.
 - b. No; Go to step 19.
18. Measure the crankcase pressure. Refer to section "Crankcase Pressure Test". Does the engine have high crankcase pressure?
 - a. Yes; repair as necessary.
 - b. No; replace the crankcase breather. Refer to section "Removal of the Crankcase Breather".
19. Is oil leaking at the boost pipe?
 - a. Yes; inspect for loose clamps, seeping, worn or damaged boost pipe, and for a dirty air filter. Then go to step 20
 - b. No; Go to step 20.
20. Is this vehicle equipped with an Axial Power Turbine (APT)?
 - a. Yes; Go to step 21.
 - b. No; Go to step 23.
21. Remove the APT heat shield.
22. Inspect the APT and related parts for leaks. Inspect around the oil supply and drain lines, between the APT and the APT gearbox sealing surface, and around the sealing surface of the APT gearbox and the cylinder block. Are there any external oil leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 23.
23. Inspect the turbocharger assembly and related parts.
Refer to section "Inspection of the DD13 Turbocharger"
Refer to section "Inspection of the DD15 and DD16 Turbocharger"
Check for leaks at the inlet and outlet pipes, oil supply and drain lines, the speed sensor, speed sensor O-ring, and around the sealing surface between the turbocharger assembly and the exhaust manifold. Are there any external oil leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 43.
24. Is oil leaking from the left side of the engine?



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| <ul style="list-style-type: none"> 1. Injector Harness Grommets 2. Camshaft Housing Seal 3. Rocker Cover Gasket 4. High Pressure Transfer Line Seals 5. Cam Position Sensor O-ring 6. Cylinder Head Gasket 7. High Pressure Pump Mounting Seal | <ul style="list-style-type: none"> 8. Oil Gallery Cup Plug between High Pressure Pump and Air Compressor 9. Air Compressor Mounting Seal 10. Power Steering Pump Mounting Gasket 11. Left Oil Pan Plug 12. Oil Pan Gasket 13. Oil Thermostat Cover Plate Seal 14. Oil Coolant Module (see 13TS-10) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 11. Left Side (steps 24 to 37)

- a. Yes; Go to step 25.
 - b. No; Go to step 38.
25. Inspect the left side oil pan plug (11). Is there an oil leak present at the oil pan plug?
- a. Yes; repair as necessary.
 - b. No; Go to step 26.
26. Visually inspect the oil pressure and oil temperature sensors for sign of external oil leaks. Leaks can be present at the sensors or O-rings. Is there an external oil leak coming from either sensor?
- a. Yes; repair as necessary.
 - b. No; Go to step 27.
27. Visually inspect the injector harness grommets (1). Are there any external leaks present?
- a. Yes; replace the injector harness grommets.
 - b. No; Go to step 28.
28. Visually inspect the high pressure fuel injector line seals for each cylinder. Are any of the high pressure fuel injector line seals leaking?



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- a. Yes; replace the high pressure fuel line injector line seal(s) that are leaking.
- b. No; Go to step 29.

NOTE: When inspecting the oil coolant module, consider that oil is sometimes spilled around the filler neck and oil filter cap area during service intervals. These spills can sometimes lead to misdiagnosis.

29. Inspect the oil coolant module. Check for leaks at the oil fill neck, oil filter cap, the oil thermostat cover, the plugs, and around the sealing surface between the oil coolant module and the cylinder block. Are there any external oil leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 30.
30. Inspect the oil dipstick tube. Are there any external oil leaks present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 31.
31. Check for leaks at the High Pressure Fuel Pump (HPFP). Are there any external oil leaks at the HPFP weep hole or where the HPFP (8) mates to the engine block?
 - a. Yes; Go to step 32.
 - b. No; Go to step 34.

NOTE: HPFP built with the old production cam seal should not be replaced due to groove camshafts. The new service seal changes the seal point on the HPFP camshaft away from the possible groove point. The new service seal was put into production starting with ESN 201835 on three-filter systems and starting with ESN 205055 on two-filter systems.

32. Remove the HPFP. Use the graphics below to establish which type of HPFP cam seal is installed. Is the pump equipped with an old production camshaft oil seal?

Table 1.

Old Production Seal	
	
1. Steel Ring	d180110

Table 2.


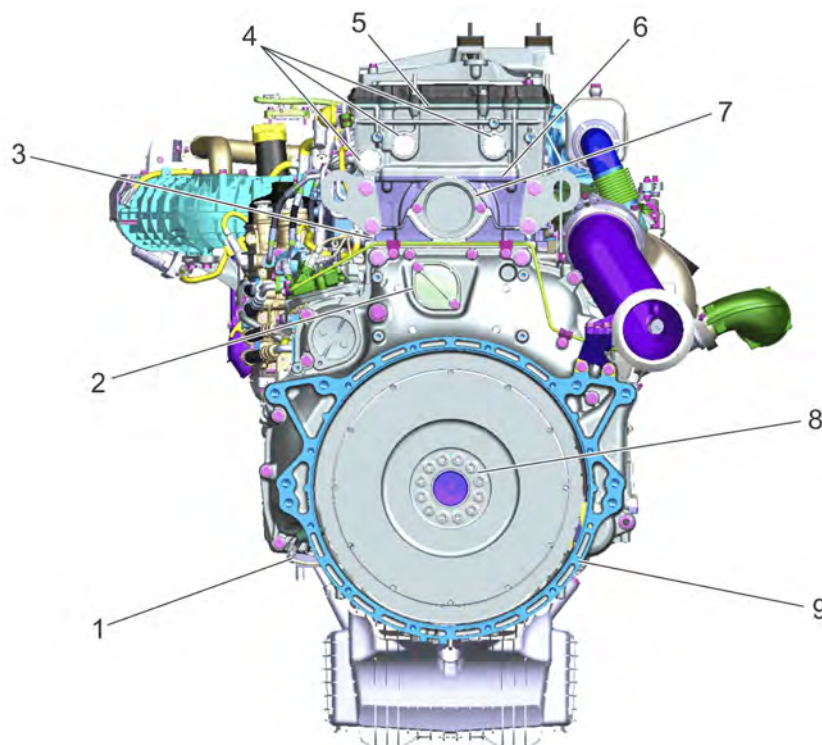
New Service Seal
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Table 3.

- a. Yes; replace the HPFP camshaft seal, the O-ring, and reinstall the HPFP.
 - b. No; Go to step 33.
33. Visually inspect the HPFP camshaft seal. Is damage present?
- a. Yes; install a new HPFP and mounting O-ring.
 - b. No; install a new mounting O-ring and reinstall the HPFP.
34. Inspect the cylinder block oil gallery cup plug located two inches under the HPFP. Is there an external oil leak at the cup plug?
- a. Yes; replace the cup plug. Refer to section "Replacement of the Oil Gallery Cup below the High Pressure Fuel Pump".
 - b. No; Go to step 35.
35. Inspect the air compressor assembly; check for oil leaks at the compressor's cup plug. Are there any external oil leaks present?
- a. Yes; replace the air compressor.
 - b. No; Go to step 36.
36. Inspect the air compressor flange where it mates to the cylinder block. Is there an external oil leak present?
- a. Yes; remove the air compressor, clean the area, replace the O-ring, and reinstall the air compressor.
 - b. No; Go to step 37.
37. Inspect the seal between the air compressor and the power steering pump. Is there an external oil leak present?
- a. Yes; remove the power steering pump, replace the seal, and reinstall the power steering pump.
 - b. No; Go to step 43.
38. Visually inspect the camshaft housing cup plugs (1). Is there an external oil leak present?



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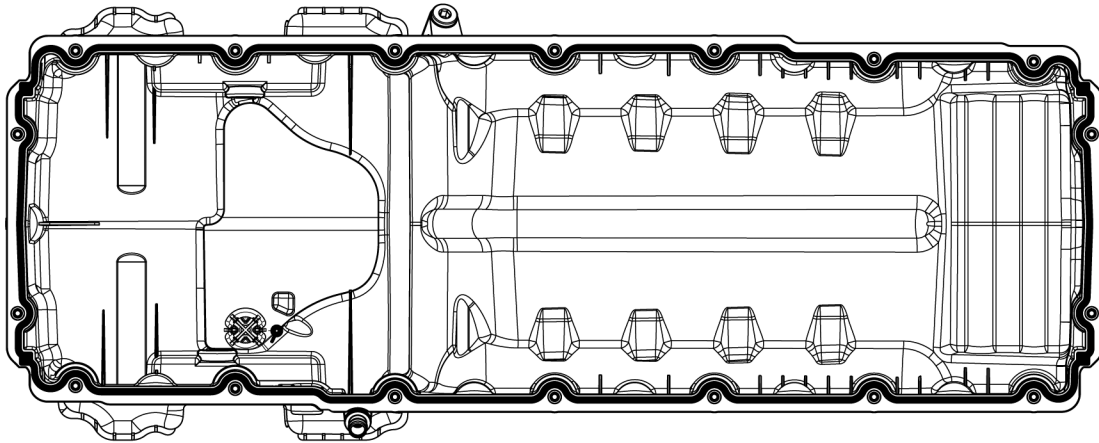
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| 1. Camshaft Housing Cup Plugs | 6. Flywheel Housing Gasket |
| 2. Rocker Cover Gasket | 7. Oil Pan Gasket |
| 3. Camshaft Housing Seal | 8. Access Plate for #3 Idler |
| 4. Access Plate for #5 Idler | 9. Cylinder Head Gasket |
| 5. Rear Crank Seal (behind flywheel) | |

Figure 12. Back of Engine (steps 38 to 42)

- a. Yes; repair as necessary.
 - b. No; Go to step 39.
39. Visually inspect the camshaft housing seal (3). Is there an external oil leak present?
 - a. Yes; replace the cam housing seal. Refer to section "Removal of the Camshaft Housing Assembly".
 - b. No; Go to step 40.
 40. Visually inspect the access plate for #5 idler (4). Is there an external oil leak present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 41.
 41. Visually inspect the access plate for #3 idler (8). Is there an external oil leak present?
 - a. Yes; repair as necessary.
 - b. No; Go to step 42.
 42. Visually inspect the flywheel housing for leaks (6). Is there a leak on the lower 6 inches of the flywheel housing?
 - a. Yes; Go to step 43.
 - b. No; the oil leak is generated by either the flywheel housing gasket or the rear crank seal. Inspect and repair as necessary.

NOTE: For oil pan gasket warranty submissions, use the image below to mark the location of the leak on the oil pan gasket. When replacing an oil pan gasket, refer to "Installation of the Oil Pan

43. Inspect the oil pan starting at the front of the engine working towards the rear of the engine (7). Is there an external oil leak present?



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- a. Yes; repair as necessary.
- b. No; Refer to section "Engine Oil Leaks - Oil Developer Method".