



Service Repair Manual

Models

350-A L, 350 and 350 L
Excavator

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Product: EXCAVATOR

Model: 350-A L EXCAVATOR 9FL

Configuration: 350 & 350 L Excavators 9FL00001-UP (MACHINE) POWERED BY 3306 Engine

Disassembly and Assembly 3304B and 3306B Engines for Caterpillar Built Machines

Media Number -SEN5598-09

Publication Date -01/01/2013

Date Updated -25/01/2013

i07489822

Cylinder Head - Install

SMCS - 1100-012

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: When the cylinder head is removed, a new spacer plate gasket must be installed. Refer to Disassembly and Assembly, "Spacer Plate - Remove and Install".

1. Ensure that the surface of the cylinder head is clean and dry. Install a new dry cylinder head gasket onto the cylinder block.

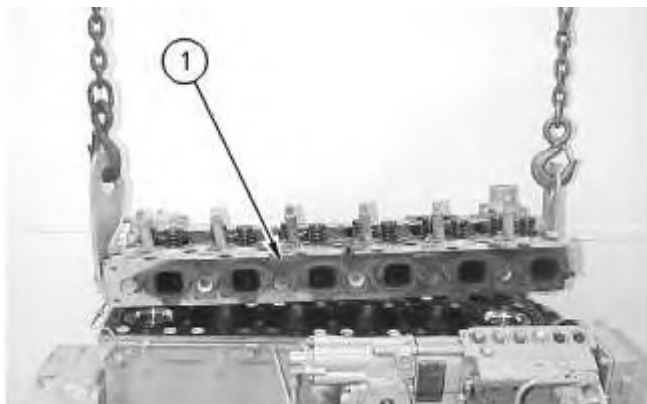


Illustration 1

g00541495

2. Fasten the proper lifting device to cylinder head (1). Put cylinder head (1) in position on the cylinder block. Remove the lifting device after cylinder head (1) is positioned.

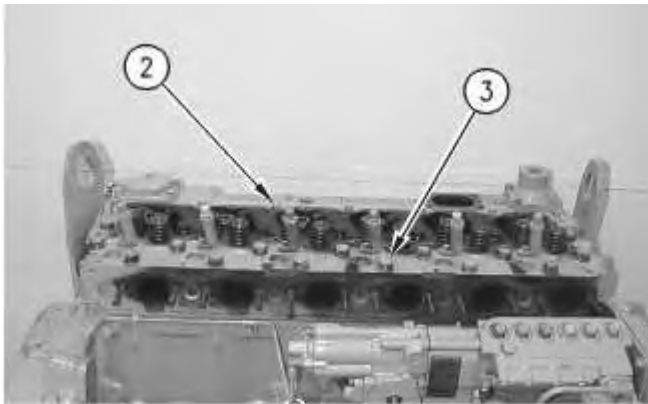


Illustration 2

g00541497

3. Apply clean engine oil to the threads and the washer faces of cylinder head bolts (2) and (3). Install cylinder head bolts (2) and (3). Tighten the cylinder head bolts finger tight.

Note: Do not tighten the cylinder head bolts at this time.



Illustration 3

g00511493

4. Install pushrods (4). Make sure that the pushrods are installed in the original location and that the pushrods are seated correctly in the valve lifters.
5. Loosen the adjusting screws on rocker arms (5) for valve clearance. This will prevent a bent valve or a broken pushrod during installation.
6. Install a new O-ring seal in the rear rocker arm support.
7. Apply clean engine oil to all the rocker shaft bolts except bolt (25). Refer to illustration 5.
8. Put rocker shaft assembly (5) in position on the cylinder head. Make sure that the dowels in the rocker shaft supports are aligned with the dowel holes in the cylinder head.
9. Ensure that the rocker arms are aligned with the pushrods and install the rocker shaft mounting bolts. Tighten the rocker shaft mounting bolts finger tight.

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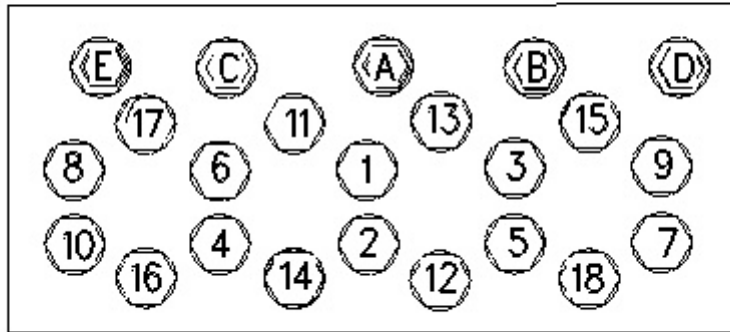
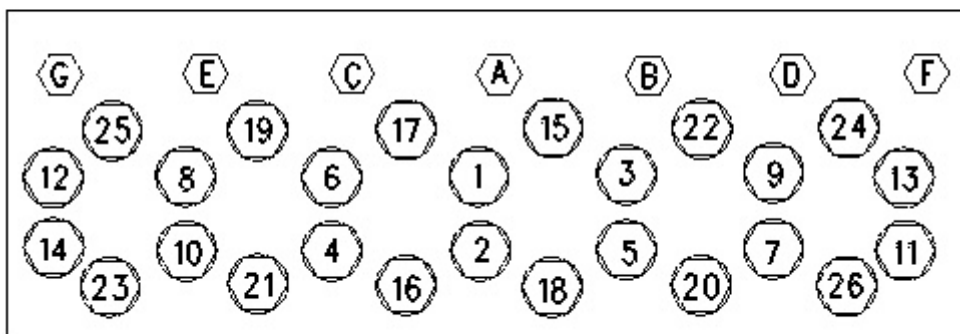


Illustration 4
3304B torque sequence

g00602759

10. Tighten the cylinder head bolts by hand, as follows:
 - a. Tighten all the bolts (1 through 18) in the numerical sequence to a torque of $150 \pm 15 \text{ N}\cdot\text{m}$ ($115 \pm 12 \text{ lb ft}$).
 - b. Tighten all the bolts (1 through 18) again in the numerical sequence to a torque of $250 \pm 17 \text{ N}\cdot\text{m}$ ($185 \pm 13 \text{ lb ft}$).
 - c. Tighten all the bolts (1 through 18) again in the numerical sequence to a final torque of $250 \pm 17 \text{ N}\cdot\text{m}$ ($185 \pm 13 \text{ lb ft}$).
 - d. Tighten all the remaining bolts (A through E) to a torque of $43 \pm 7 \text{ N}\cdot\text{m}$ ($32 \pm 5 \text{ lb ft}$).
-



11. Tighten the cylinder head bolts by hand, as follows:
 - a. Tighten all the bolts (1 through 26) in the numerical sequence to a torque of $150 \pm 15 \text{ N}\cdot\text{m}$ ($115 \pm 12 \text{ lb ft}$).
 - b. Tighten all the bolts (1 through 26) in the numerical sequence to a torque of $250 \pm 17 \text{ N}\cdot\text{m}$ ($185 \pm 13 \text{ lb ft}$).
 - c. Tighten all the bolts (1 through 26) again in the numerical sequence to a final torque of $250 \pm 17 \text{ N}\cdot\text{m}$ ($185 \pm 13 \text{ lb ft}$).
 - d. Tighten all the remaining bolts (A through G) to a torque of $43 \pm 7 \text{ N}\cdot\text{m}$ ($32 \pm 5 \text{ lb ft}$).
12. Adjust the inlet valve lash to 0.38 mm (.015 inch) and the exhaust valve lash to 0.64 mm (.025 inch). Tighten the locknuts for the adjusting screws to a torque of $29 \pm 7 \text{ N}\cdot\text{m}$ ($22 \pm 5 \text{ lb ft}$). Refer to the Testing and Adjusting, "Air Inlet and Exhaust System" topic for additional information on valve lash adjustments.

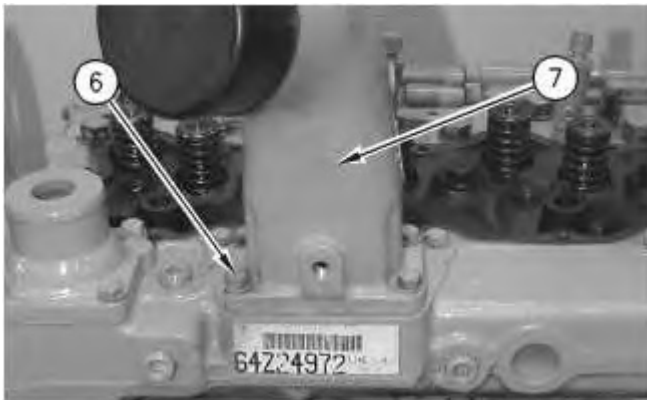


Illustration 6

g00511911

13. Put the gasket and air inlet pipe (7) in position on the cylinder head. Install four bolts (6) to fasten air inlet pipe (7) to the cylinder head.

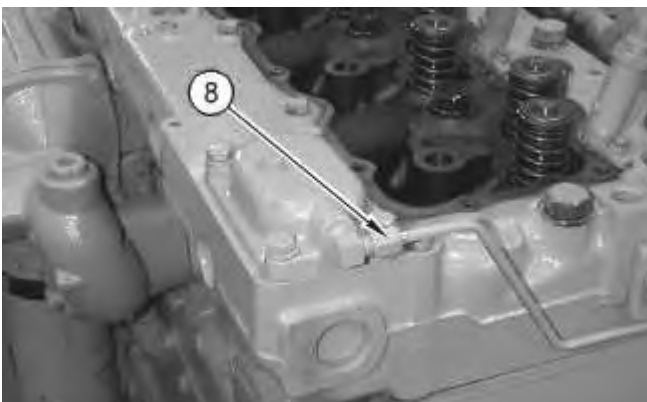


Illustration 7

g00541522

14. Connect tube (8) to the inlet manifold.

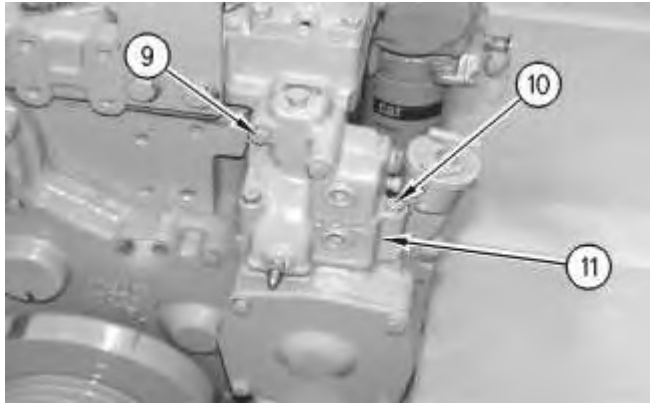


Illustration 8

g00541524

15. Put the gaskets and water pump elbow (11) in position on the engine. Install two bolts (9) that fasten water pump elbow (11) to the cylinder head. Install two bolts (10) that fasten water pump elbow (11) to the water pump.

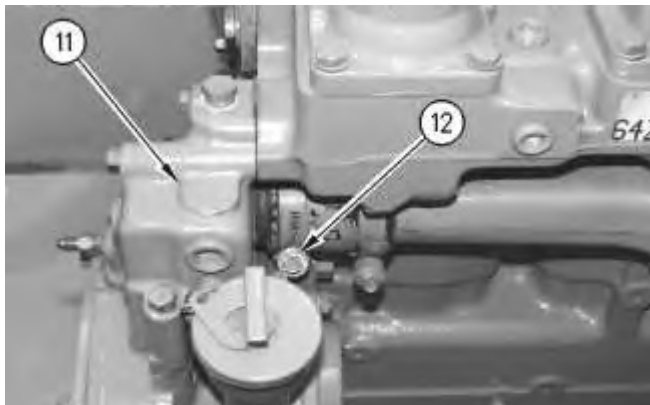


Illustration 9

g00541527

16. Tighten hose clamp (12).

End By:

- a. Install the valve mechanism cover. Refer to Disassembly and Assembly, "Valve Mechanism Cover - Remove and Install".
- b. Install the exhaust manifold. Refer to Disassembly and Assembly, "Exhaust Manifold - Remove and Install".
- c. Install the fuel injection lines. Refer to Disassembly and Assembly, "Fuel Injection Lines - Remove and Install".

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Product: EXCAVATOR

Model: 350-A L EXCAVATOR 9FL

Configuration: 350 & 350 L Excavators 9FL00001-UP (MACHINE) POWERED BY 3306 Engine

Disassembly and Assembly 3304B and 3306B Engines for Caterpillar Built Machines

Media Number -SEN5598-09

Publication Date -01/01/2013

Date Updated -25/01/2013

i01045029

Spacer Plate - Remove and Install

SMCS - 1221-010

Removal Procedure

Start By:

- A. Remove the cylinder head. Refer to Disassembly and Assembly, "Cylinder Head - Remove".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

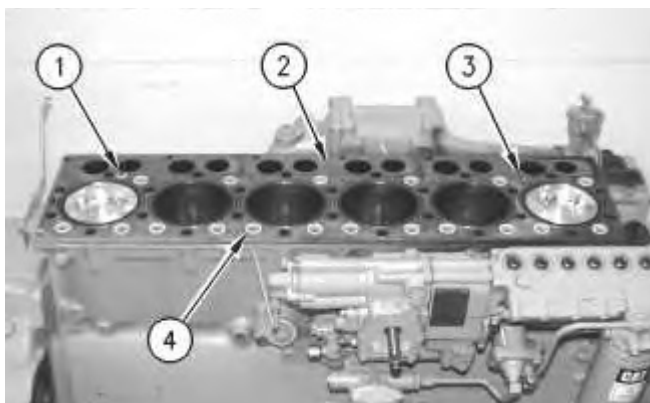


Illustration 1

g00540847

1. Remove O-ring seal (1), water seals (3) and water directors (4) from spacer plate (2) .

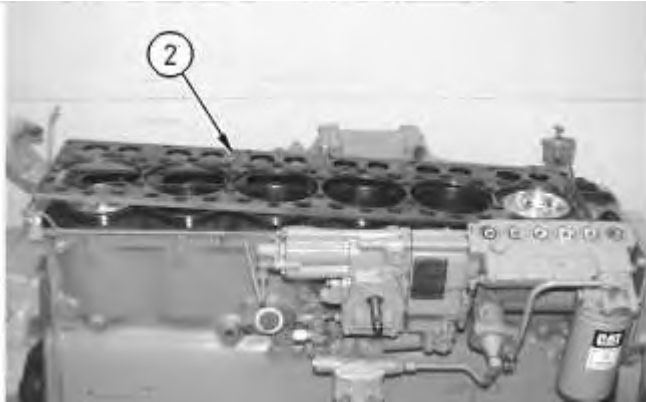


Illustration 2

g00540857

NOTICE

Do not damage the dowels as the spacer plate is removed.

2. Remove spacer plate (2) from the cylinder head.

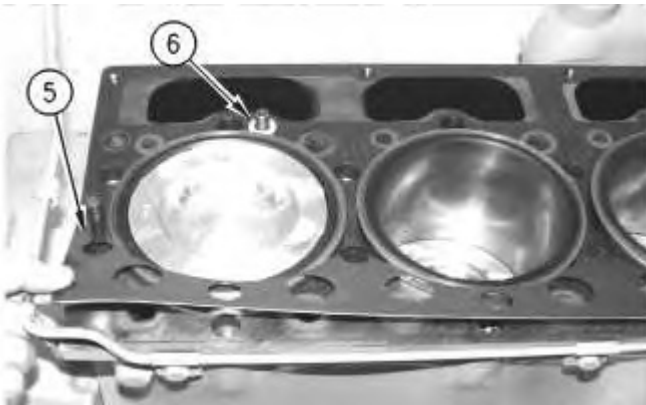


Illustration 3

g00540895

3. Remove O-ring seal (6) and spacer plate gasket (5) from the cylinder head.

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Thoroughly clean the mating surfaces between the spacer plate and the cylinder block.

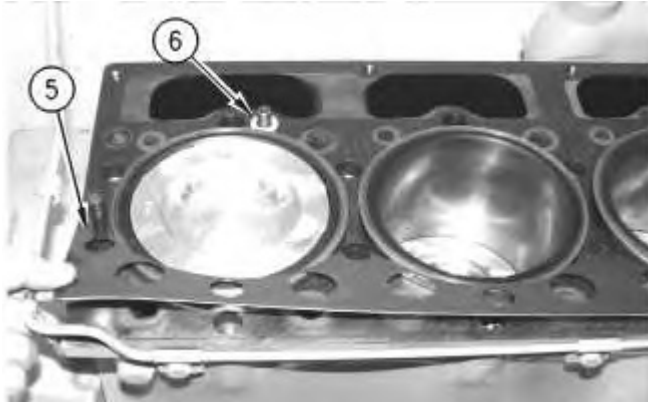


Illustration 4

g00540895

2. Install new spacer plate gasket (5) and new O-ring seal (6) .

Note: If the dowels in the cylinder block have been removed for any reason, the overall height of the installation is 16.0 ± 5.0 mm ($.63 \pm .20$ inch).

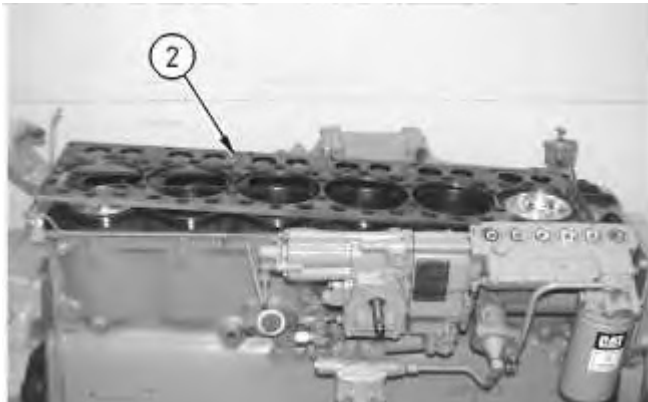


Illustration 5

g00540857

Note: Both surfaces of the spacer plate, spacer plate gasket and the top of the cylinder block must be clean and dry. Do not use any gasket adhesive or other substances on these surfaces.

3. Install spacer plate (2) on the cylinder head.

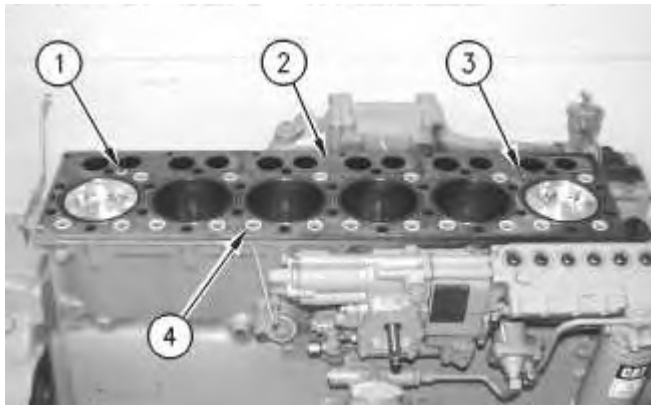


Illustration 6

g00540847

4. Install a new O-ring seal (1). Install new water seals (3). Install new water directors (4) .
5. Check the cylinder liner projection. Refer to Disassembly and Assembly, "Cylinder Liner - Install".

End By: Install the cylinder head. Refer to Disassembly and Assembly, "Cylinder Head - Install".

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Product: EXCAVATOR

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Configuration: 350 & 350 L Excavators 9FL00001-UP (MACHINE) POWERED BY 3306 Engine

Disassembly and Assembly 3304B and 3306B Engines for Caterpillar Built Machines

Media Number -SEN5598-09

Publication Date -01/01/2013

Date Updated -25/01/2013

i00943364

Water Directors - Remove and Install

SMCS - 1115-010

Removal Procedure

Start By:

- A. Remove the spacer plate. Refer to Disassembly and Assembly, "Spacer Plate - Remove and Install".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

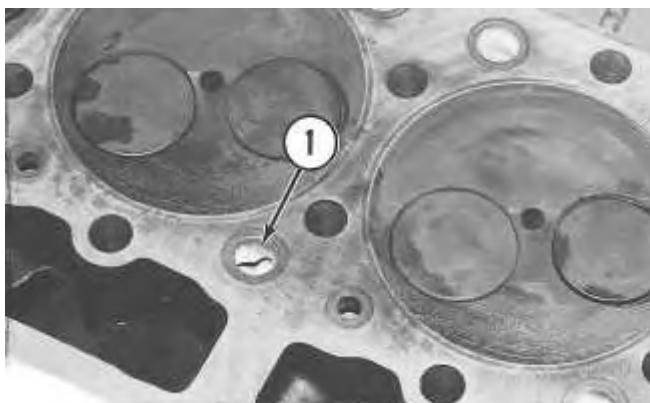


Illustration 1

g00481082

1. Remove water directors (1) from the cylinder head.

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Thoroughly clean the cylinder head before assembly.

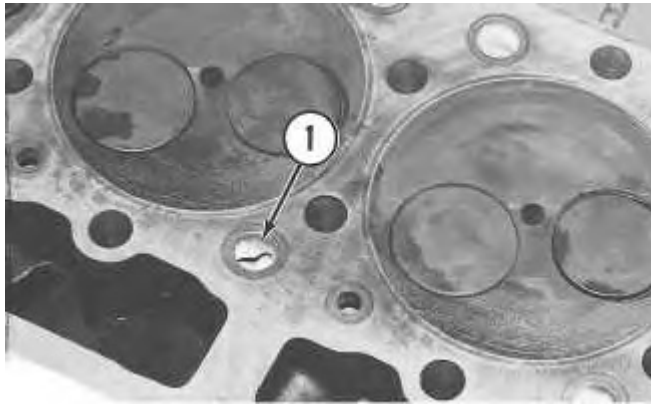


Illustration 2

g00481082

2. Install new water director (1) into the cylinder head. Align the notch in water director (1) with the "V" mark on the cylinder head.
3. Install water director (1) to a depth of 0.8 ± 0.6 mm (0.031 ± 0.023 inch) below the surface of the cylinder head.

End By: Install the spacer plate. Refer to Disassembly and Assembly, "Spacer Plate - Remove and Install".

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**Disassembly and Assembly
3304B and 3306B Engines for Caterpillar Built Machines**

Media Number -SEN5598-09

Publication Date -01/01/2013

Date Updated -25/01/2013

i01042782

Lifter Group - Remove and Install

SMCS - 1209-010

Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	1U-7262	Telescoping Magnet	1

Start By:

- A. Remove the spacer plate. Refer to Disassembly and Assembly, "Spacer Plate - Remove and Install".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

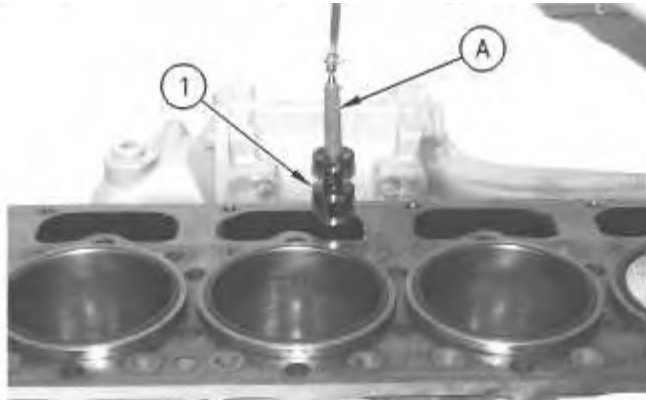


Illustration 1

g00538891

1. Use Tool (A) to remove valve lifter (1), as shown. Put identification marks on the valve lifters for installation purposes.
2. Repeat Step 1 for the remainder of the valve lifters.
3. Check the diameter of the valve lifters. The diameter of a new valve lifter must be 33.285 ± 0.015 mm (1.3105 ± 0.0005 inch). The diameter of the bore in the cylinder block for a new valve lifter must be 33.388 ± 0.050 mm (1.3145 ± 0.0020 inch). The maximum permissible clearance between the valve lifter and the valve lifter bore in the cylinder block must be 0.30 mm (0.012 inch).

Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	1U-7262	Telescoping Magnet	1

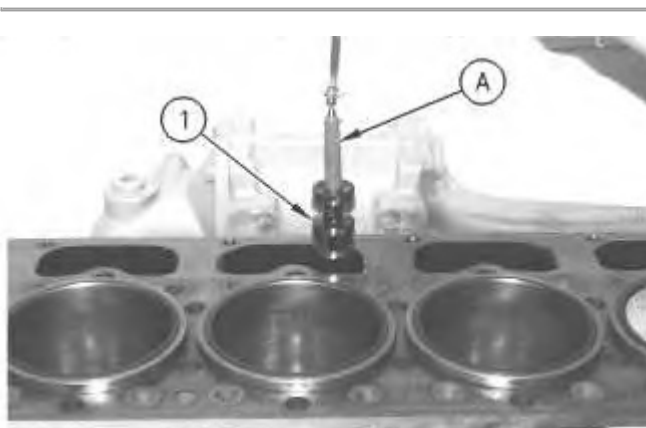


Illustration 2

g00538891

1. Put **8T-2998** Lubricant on valve lifter (1) prior to installation. Install valve lifter (1) with Tool (A) in the original location in the cylinder block.
2. Repeat Step 1 for the remainder of the valve lifters.

End By: Install the spacer plate. Refer to Disassembly and Assembly, "Spacer Plate - Remove and Install".

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Product: EXCAVATOR

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Configuration: 350 & 350 L Excavators 9FL00001-UP (MACHINE) POWERED BY 3306 Engine

Disassembly and Assembly 3304B and 3306B Engines for Caterpillar Built Machines

Media Number -SEN5598-09

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Date Updated -25/01/2013

i01037991

Camshaft - Remove and Install

SMCS - 1210-010

Removal Procedure

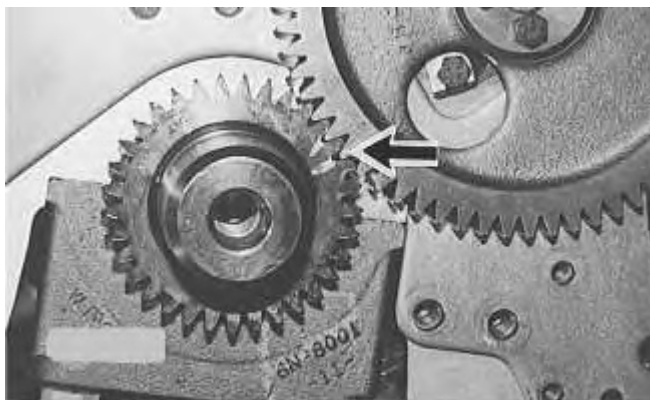
Start By:

- A. Remove the valve lifters. Refer to Disassembly and Assembly, "Lifter Group - Remove and Install".
- B. Remove the timing gear cover. Refer to Disassembly and Assembly, "Front Housing - Remove".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.



1. Turn the crankshaft to top center compression stroke for the No. 1 piston. The "C" mark on the crankshaft gear will be aligned with the "C" mark on the camshaft gear.

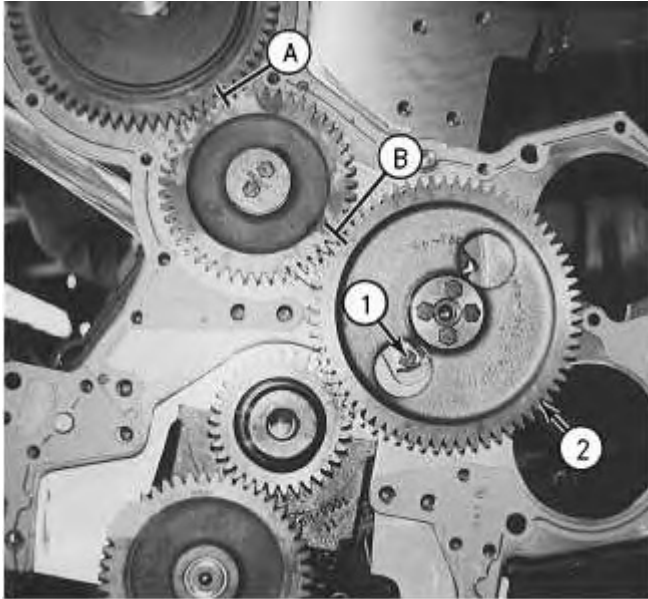


Illustration 2

Note: Put a mark on the teeth of the fuel injection pump drive gear and the idler gear at location (A). This will help to keep the engine timing correct during the removal and the installation of the camshaft. Put a mark on the teeth of the idler gear and camshaft gear (2) at location (B). When the camshaft is installed, the engine timing will be correct when the mark at location (A) is aligned with the mark at location (B) and the "C" mark on the crankshaft gear is aligned with the "C" mark on the camshaft gear.

2. Remove the bolts, the lock and washer (1) .

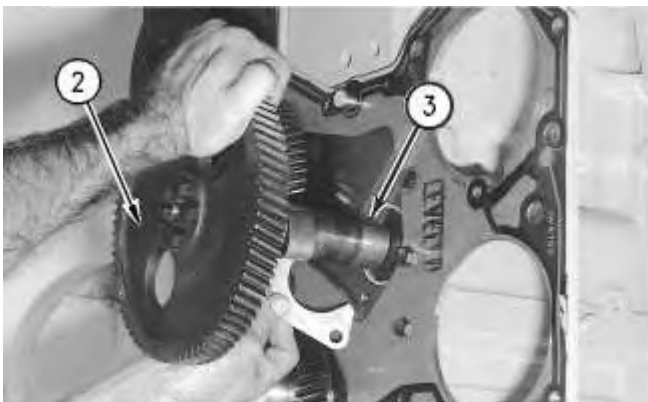


Illustration 3

NOTICE

Do not damage the lobes or the bearings when the camshaft is removed.

3. Carefully remove camshaft (3) from the engine.
4. If necessary, remove the bolts that hold camshaft drive gear (2) to the camshaft and remove the gear.

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

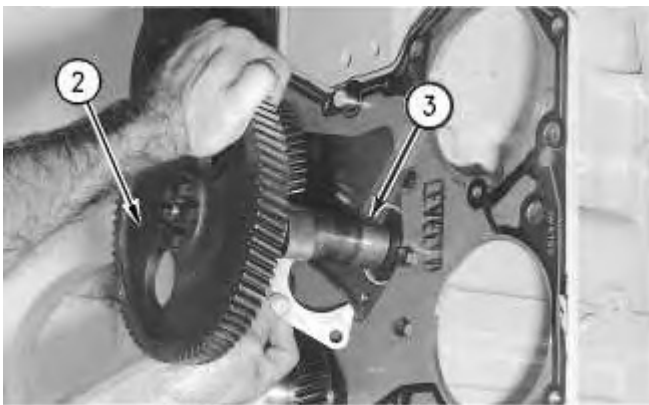


Illustration 4

g00535590

1. Put camshaft drive gear (2) in position on the end of camshaft (3). Install the bolts that hold camshaft drive gear (2) to camshaft (3). Tighten the bolts to a torque of 55 ± 7 N·m (41 ± 5 lb ft).

NOTICE

Do not damage the lobes or the bearings when the camshaft is installed.

- Put **8T-2998** Camshaft Lubricant on the camshaft lobes only and put clean engine oil on the bearing journals.

Note: During the installation of camshaft (3), rotate the camshaft in both directions in order to prevent binding in the camshaft bearing bores.

- Carefully install camshaft (3) into the engine.

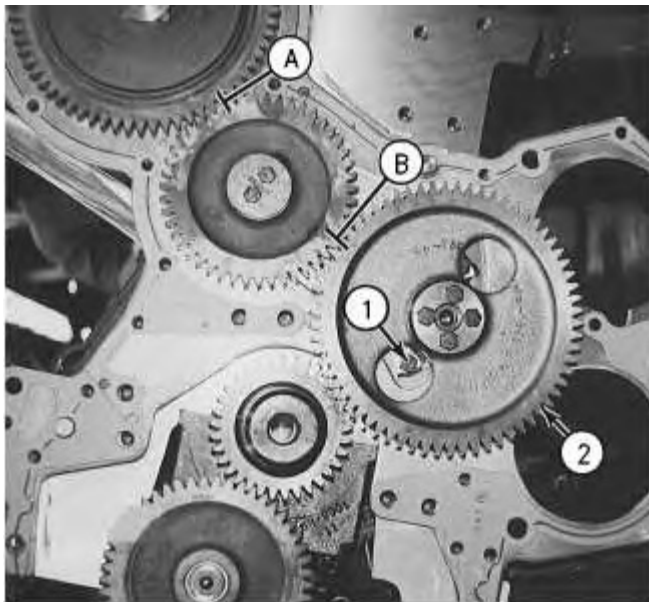


Illustration 5

g00476743

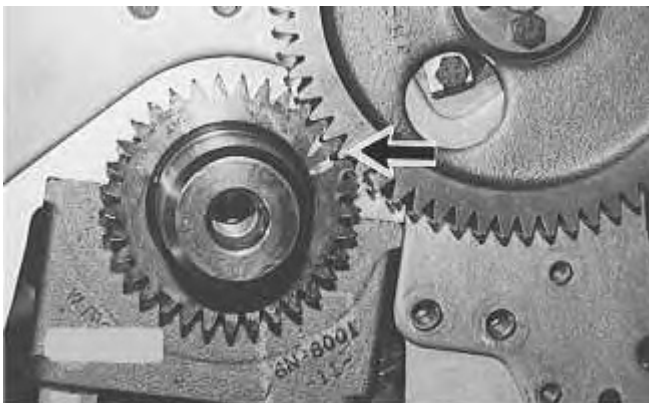


Illustration 6

g00476744

- Make sure that the mark on the teeth of the fuel injection pump drive gear and the idler gear are in alignment at location (A). Make sure that the mark on the teeth of the idler gear and camshaft gear (2) are in alignment at location (B). Align the "C" marks on the crankshaft gear and camshaft gear (2). When all of the timing marks are in alignment the engine timing is correct.

5. Install washer (1), the lock and the two bolts that hold the camshaft in position in the engine.

End By:

- a. Install the valve lifters. Refer to Disassembly and Assembly, "Lifter Group - Remove and Install".
- b. Install the timing gear cover. Refer to Disassembly and Assembly, "Front Housing - Install".

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Product: EXCAVATOR

Model: 350-A L EXCAVATOR 9FL

Configuration: 350 & 350 L Excavators 9FL00001-UP (MACHINE) POWERED BY 3306 Engine

**Disassembly and Assembly
3304B and 3306B Engines for Caterpillar Built Machines**

Media Number -SEN5598-09

Publication Date -01/01/2013

Date Updated -25/01/2013

i02473351

Camshaft Bearings - Remove and Install

SMCS - 1211-010

Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	8S-2241	Camshaft Bearing Tool Group	1
	8H-0684	Ratchet Wrench	1

Start By:

- A. Remove the Flywheel Housing. Refer to Disassembly and Assembly, "Flywheel Housing - Remove and Install".
- B. Remove the Oil Pan Plate. Refer to Disassembly and Assembly, "Oil Pan Plate - Remove and Install".
- C. Remove the Camshaft. Refer to Disassembly and Assembly, "Camshaft - Remove and Install".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

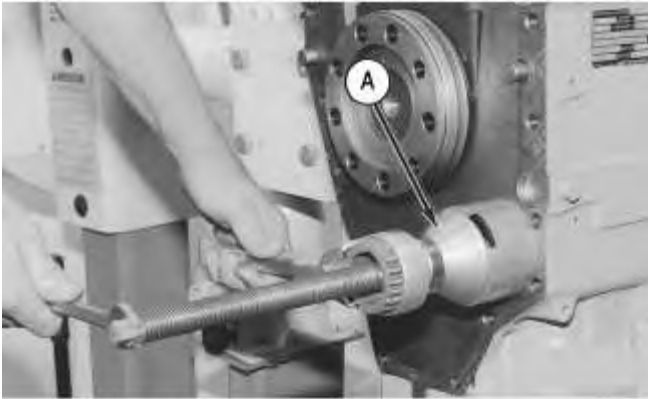


Illustration 1

g00478567

1. Use Tool (A) to remove the camshaft bearing from the cylinder block. Start with the front bearings and work to the rear bearing.

Installation Procedure

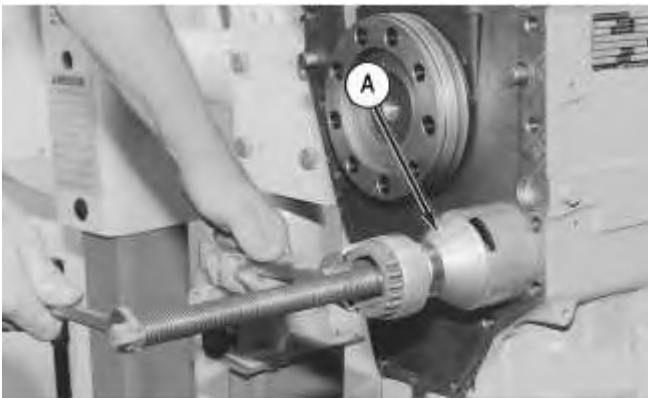
Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	8S-2241	Camshaft Bearing Tool Group	1
	8H-0684	Ratchet Wrench	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.



1. Use Tool (A) to install the camshaft bearings in the 3304B and 3306B cylinder block.

Note: The camshaft bearings in the 3304B have pressure lubrication. The intermediate camshaft bearings and the rear camshaft bearings in the 3306B have splash lubrication.

2. Install the camshaft bearings in the 3304B cylinder block, as follows:

(a) Install the front bearing to a depth of 0.57 ± 0.5 mm (0.022 ± 0.02 inch). Ensure that the oil holes are in a horizontal position and that the camshaft bearing joint is at the top of the engine. The camshaft bearing joint can not be more than 15° degrees from vertical in either direction.

(b) Install the center bearing to a depth of 303.2 ± 0.5 mm (11.94 ± 0.02 inch). Ensure that the oil holes in the camshaft bearing are in alignment with the oil holes in the cylinder block.

(c) Install the rear bearing to a depth of 604.9 ± 0.5 mm (23.81 ± 0.02 inch). Ensure that the oil holes in the camshaft bearing are in alignment with the oil holes in the cylinder block.

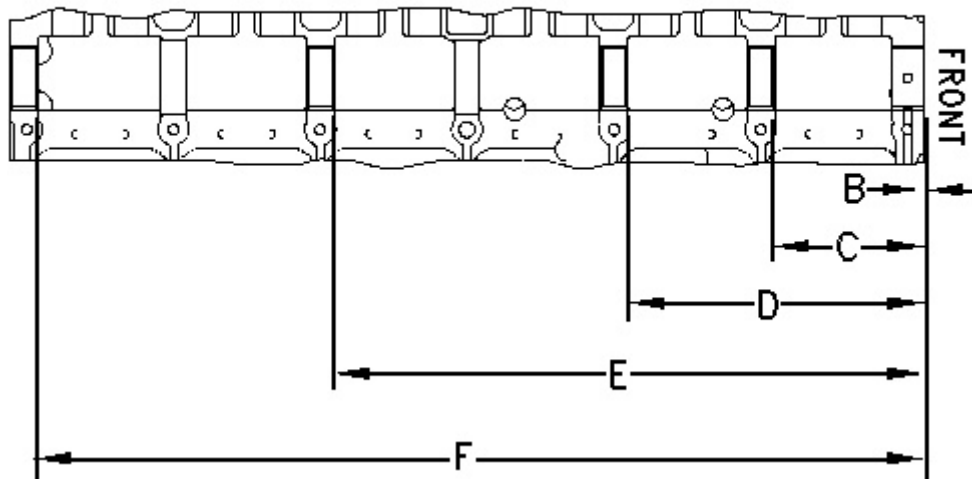


Illustration 3

1. Install the camshaft bearings in the 3306B cylinder block, as follows:
2. Install front bearing (B) to a depth of 0.5 ± 0.5 mm ($.02 \pm .02$ inch). Ensure that the oil holes are in a horizontal position and that the camshaft bearing joint is at the top of the engine. The camshaft bearing joint cannot be more than 15 degrees from the vertical position in either direction.
3. Install the remainder of the bearings. Install the bearings to the dimensions that are given from the front face of the cylinder block: (C) 154.0 ± 0.5 mm ($6.06 \pm .02$ inch), (D) $303.2 \pm$



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0.5 mm (11.94 ± .02 inch), (E) 601.7 ± 0.5 mm (23.69 ± .02 inch) and (F) 903.4 ± 0.5 mm (35.57 ± .02 inch).

End By:

- a. Install the camshaft. Refer to Disassembly and Assembly, "Camshaft - Remove and Install".
- b. Install the oil pan plate. Refer to Disassembly and Assembly, "Engine Oil Pan Plate - Remove and Install".
- c. Install the flywheel housing. Refer to Disassembly and Assembly, "Flywheel Housing - Remove and Install".

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