

Product: WHEEL LOADER

Model: 990 II WHEEL LOADER 4FR

Configuration: 990 Series II Wheel Loader 4FR00001-UP (MACHINE) POWERED BY 3412 Engine

## Disassembly and Assembly 3408E and 3412E Engines for Caterpillar Built Machines

Media Number -REN2336-06

Publication Date -01/08/2018

Date Updated -10/08/2018

i01105362

# HEUI Fluid Manifold - Remove and Install

SMCS - 1126-010

## Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	138-7573	Link Bracket	2

### Start By:

- Remove the injection actuation pressure sensor. Refer to Disassembly and Assembly, "Injection Actuation Pressure Sensor - Remove and Install".
- Remove the unit injector sleeves. Refer to Disassembly and Assembly, "Unit Injector Sleeve - Remove".
- Remove the rocker arm and shaft. Refer to Disassembly and Assembly, "Rocker Arm and Shaft - Remove".
- Remove the valve mechanism cover base. Refer to Disassembly and Assembly, "Valve Mechanism Cover Base - Remove and Install".
- Remove the aftercooler. Refer to Disassembly and Assembly, "Aftercooler - Remove".

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## NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers

**before opening any compartment or disassembling any component containing fluids.**

**Refer to Special Publication, NENG2500, "Caterpillar Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Caterpillar products.**

**Dispose of all fluids according to local regulations and mandates.**

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### **NOTICE**

**Keep all parts clean from contaminants.**

**Contaminants may cause rapid wear and shortened component life.**

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### **NOTICE**

**The cylinder head must be removed and a new spacer plate gasket must be installed anytime the HEUI Fluid Manifold has been removed. Refer to Disassembly and Assembly, "Cylinder Head - Install" in this module.**

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Illustration 1

g00570914

Typical example

1. Remove hose (1) from the front of the HEUI Fluid Manifold.
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-

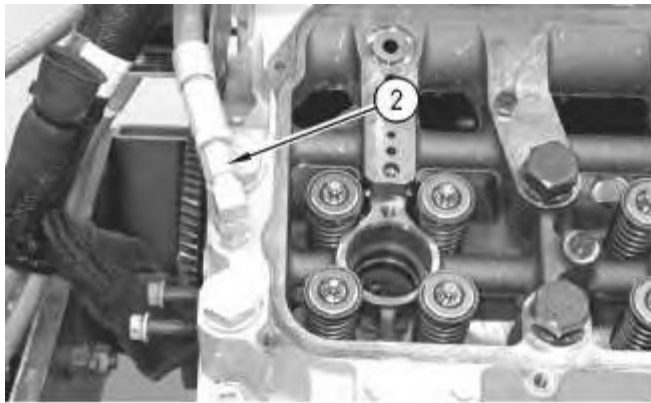


Illustration 2  
Typical example

g00570923

2. Remove hose (2) from the rear of the HEUI Fluid Manifold.



Illustration 3  
Typical example

g00582732

3. Remove tube assembly (3).

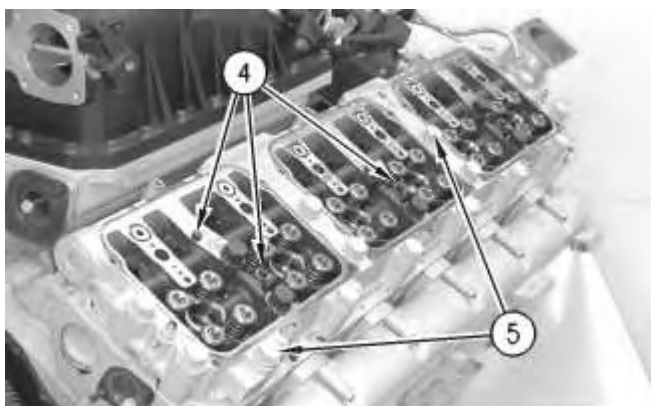


Illustration 4  
Typical example

g00570979

4. Remove cylinder head bolts (5) and the washers. Remove HEUI Fluid Manifold bolts (4).

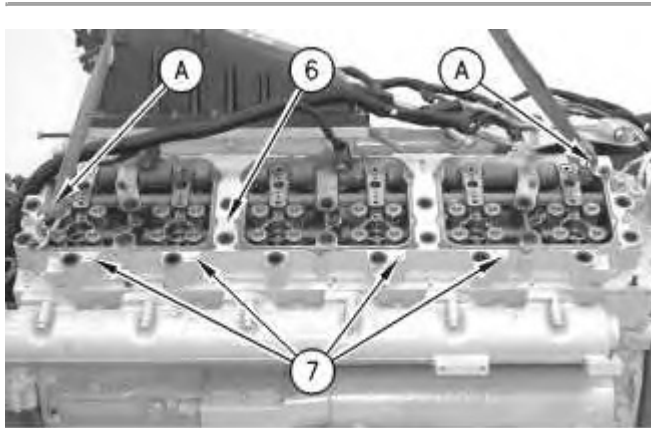


Illustration 5

g00582745

Typical example

5. Install Tool (A) and a hoist on the HEUI Fluid Manifold. Remove HEUI Fluid Manifold bolts (7). Remove HEUI Fluid Manifold (6).

The weight of the HEUI Fluid Manifold for the 3412E is 60 kg (131 lb).

The weight of the HEUI Fluid Manifold for the 3408E is 39 kg (86 lb).

## Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	138-7573	Link Bracket	2

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### NOTICE

**Keep all parts clean from contaminants.**

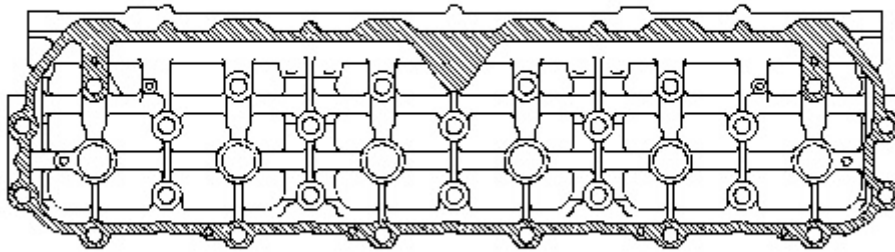
**Contaminants may cause rapid wear and shortened component life.**

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### NOTICE

**The cylinder head must be removed and a new spacer plate gasket must be installed anytime the HEUI Fluid Manifold has been removed. Refer to Disassembly and Assembly, "Cylinder Head - Install" in this module.**

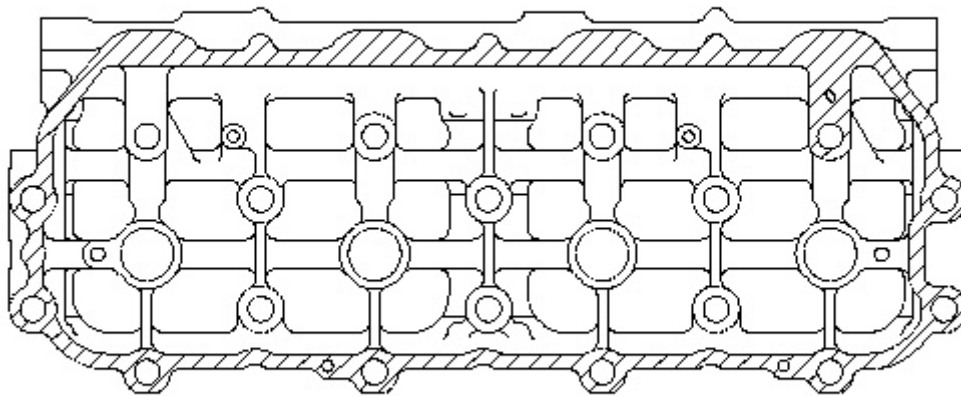
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Illustration 6  
HEUI fluid manifold for 3412E

g00570607



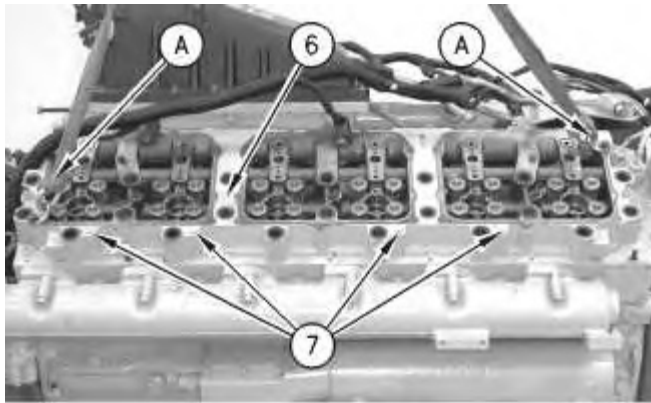
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Illustration 7  
HEUI fluid manifold for 3408E

g00582780

**Note:** The bottom face of the HEUI Fluid Manifold and the top face of the cylinder head must be free of any contaminants during assembly.

1. Apply **8C-8422** Sealant in the shaded area of the HEUI Fluid Manifold. The **8C-8422** Sealant is applied to the bottom portion of the HEUI Fluid Manifold. The **8C-8422** Sealant is permitted on the entire face of the HEUI Fluid Manifold.
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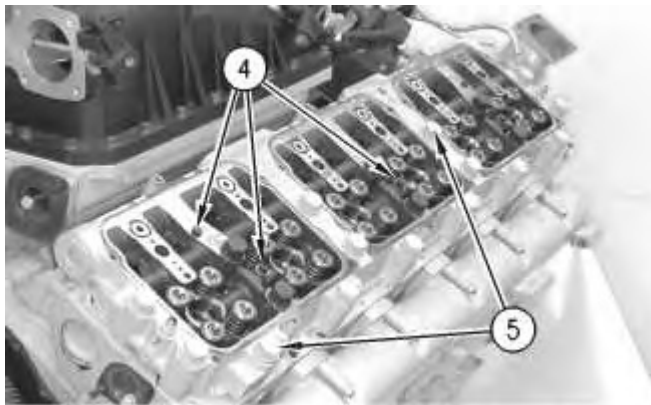


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Illustration 8  
Typical example

g00582745

2. Install Tool (A) and a hoist on the HEUI Fluid Manifold. Install HEUI Fluid Manifold (6).  
The weight of the HEUI Fluid Manifold for the 3412E is 60 kg (131 lb).  
The weight of the HEUI Fluid Manifold for the 3408E is 39 kg (86 lb).



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Illustration 9  
Typical example

g00570979

3. Install HEUI Fluid Manifold bolts (4) and (7).
  4. Put clean engine oil on bolts (5) for the cylinder head. Install cylinder head bolts (5).
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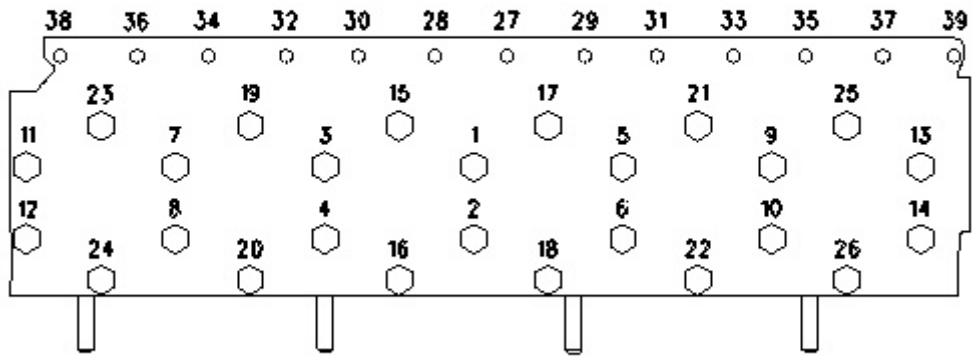


Illustration 10

g00570761

Tightening sequence for 3412E

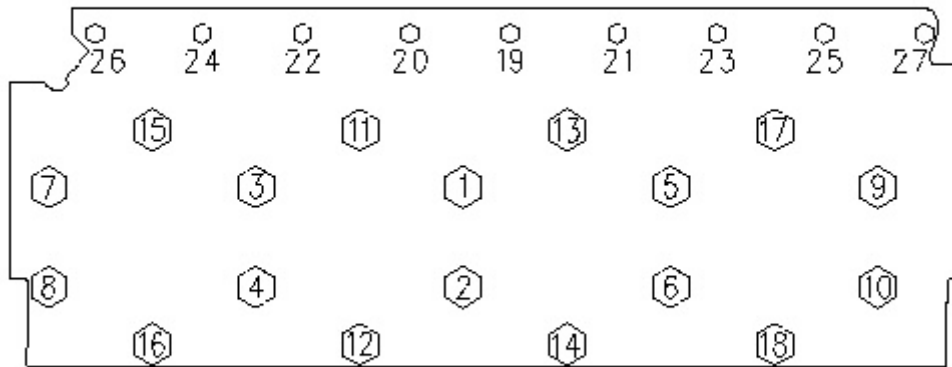


Illustration 11

g00582808

Tightening sequence for 3408E

5. Tighten bolts (5) in the following step sequence:

In a numerical sequence, tighten the bolts 1 through 26 for the 3412E.

In a numerical sequence, tighten the bolts 1 through 18 for the 3408E.

- a. In a numerical sequence, tighten the bolts to a torque of  $270 \pm 15 \text{ N}\cdot\text{m}$  ( $200 \pm 11 \text{ lb ft}$ ).

- b. In a numerical sequence, tighten the bolts to a torque of  $450 \pm 15 \text{ N}\cdot\text{m}$  ( $330 \pm 11 \text{ lb ft}$ ).
- c. In a numerical sequence, again tighten the bolts to a torque of  $450 \pm 15 \text{ N}\cdot\text{m}$  ( $330 \pm 11 \text{ lb ft}$ ).

6. Tighten the upper row of nuts that are on the cylinder head in the following sequence.

In a numerical sequence, tighten nuts 27 through 39 for the 3412E to a torque of  $45 \pm 7 \text{ N}\cdot\text{m}$  ( $33 \pm 5 \text{ lb ft}$ ).

In a numerical sequence, tighten nuts 19 through 27 for the 3408E to a torque of  $45 \pm 7 \text{ N}\cdot\text{m}$  ( $33 \pm 5 \text{ lb ft}$ ).

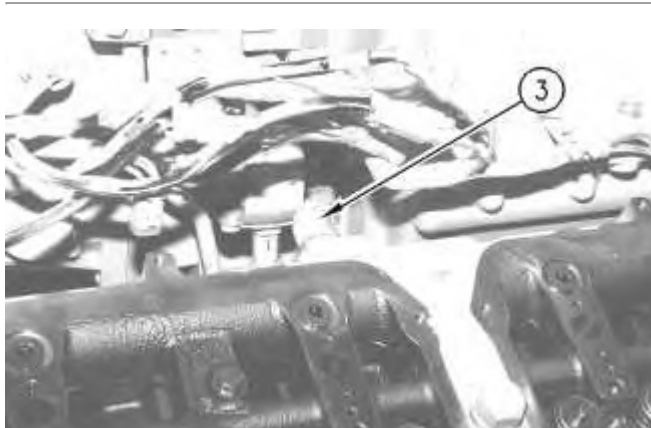


Illustration 12  
Typical example

g00582732

7. Install tube assembly (3).

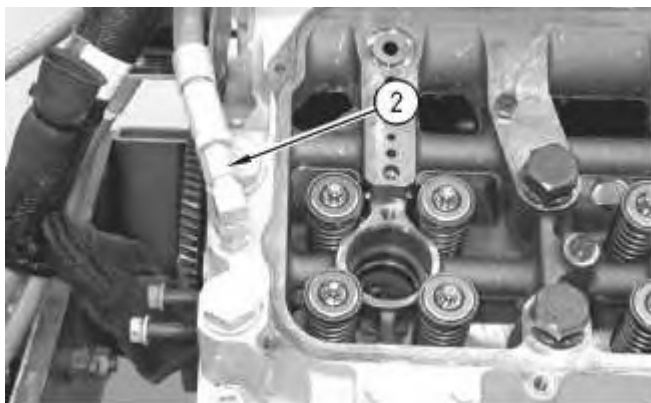


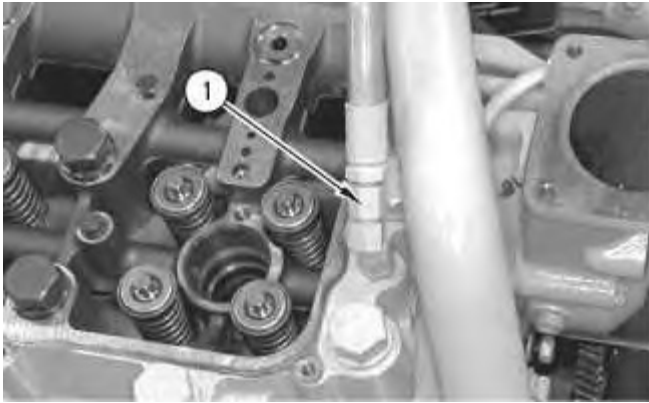
Illustration 13  
Typical example

g00570923

8. Install hose (2) on the rear of the HEUI Fluid Manifold.

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Illustration 14  
Typical example

g00570914

9. Install hose (1) on the front of the HEUI Fluid Manifold.

**End By:**

- a. Install the valve mechanism cover base. Refer to Disassembly and Assembly, "Valve Mechanism Cover Base - Remove and Install".
  - b. Install the rocker arm and shaft. Refer to Disassembly and Assembly, "Rocker Arm and Shaft - Install".
  - c. Install the unit injector sleeves. Refer to Disassembly and Assembly, "Unit Injector Sleeve - Install".
  - d. Install the injection actuation pressure sensor. Refer to Disassembly and Assembly, "Injection Actuation Pressure Sensor - Remove and Install".
  - e. Install the aftercooler. Refer to Disassembly and Assembly, "Aftercooler - Install".
-

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## Disassembly and Assembly 3408E and 3412E Engines for Caterpillar Built Machines

Media Number -REN2336-06

Publication Date -01/08/2018

Date Updated -10/08/2018

i01105933

# Cylinder Head - Remove

SMCS - 1100-011

## Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	5P-8700	Lifting Bracket	2

### Start By:

- a. Remove the HEUI fluid manifold. Refer to Disassembly and Assembly, "HEUI Fluid Manifold - Remove and Install".
- b. Remove the exhaust manifold. Refer to Disassembly and Assembly, "Exhaust Manifold - Remove and Install".

---

### NOTICE

**Keep all parts clean from contaminants.**

**Contaminants may cause rapid wear and shortened component life.**

---

### NOTICE

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of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

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Dispose of all fluids according to local regulations and mandates.

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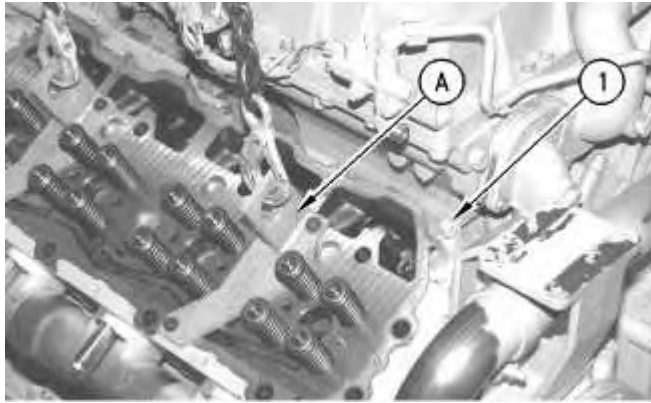


Illustration 1

g00583128

Typical example

1. Install Tool (A) on the cylinder head. Remove nuts (1) that hold the cylinder head to the block.

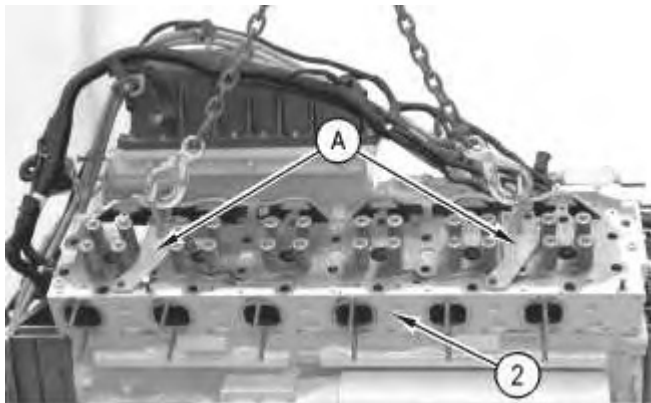


Illustration 2

g00583122

Typical example

2. Remove cylinder head (2).

The weight of the cylinder head for the 3412E is 172 kg (380 lb).

The weight of the cylinder head for the 3408E is 90 kg (200 lb).

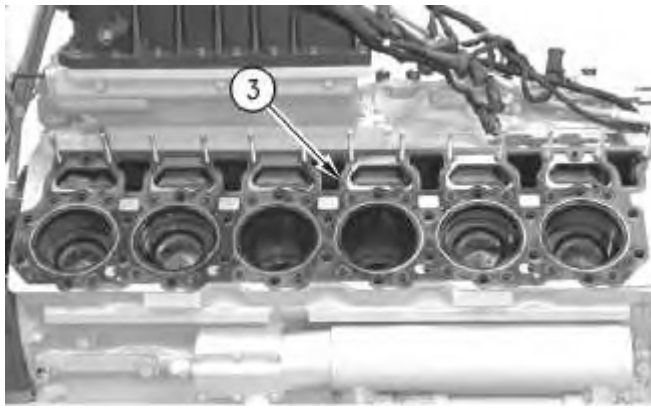


Illustration 3  
Typical example

g00583124

3. Remove cylinder head gasket (3).

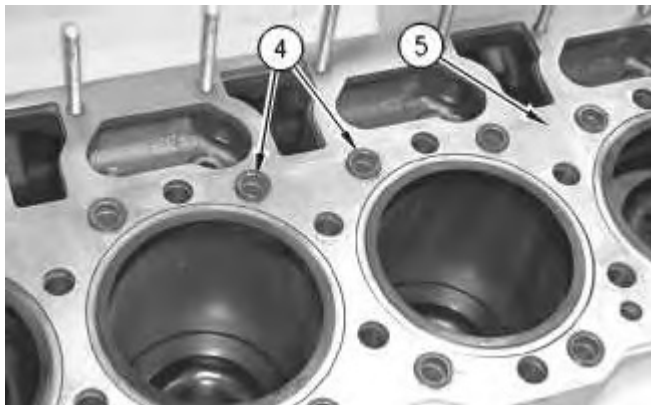


Illustration 4  
Typical example

g00583123

4. Remove coolant ferrules (4) from the spacer plate.
5. Remove spacer plate (5) from the cylinder block.

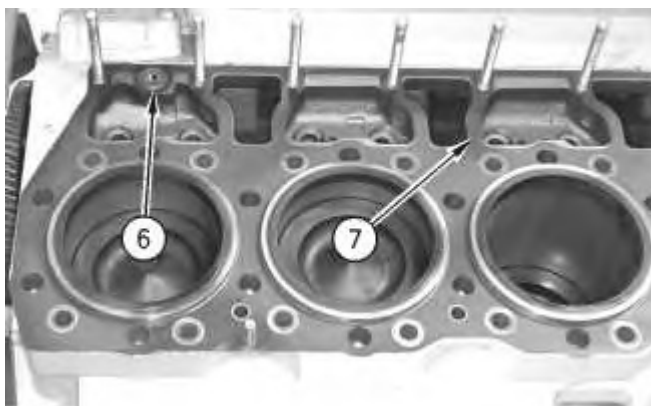


Illustration 5

g00583125

Typical example

6. Remove two O-ring seals (6) and gasket (7) from the cylinder block.
-

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## Disassembly and Assembly 3408E and 3412E Engines for Caterpillar Built Machines

Media Number -REN2336-06

Publication Date -01/08/2018

Date Updated -10/08/2018

i01105988

# Cylinder Head - Install

SMCS - 1100-012

## Installation Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	5P-8700	Lifting Bracket	1

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### NOTICE

**Keep all parts clean from contaminants.**

**Contaminants may cause rapid wear and shortened component life.**

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**Note:** Thoroughly clean the spacer plate and the bottom surface of the cylinder head. A new spacer plate gasket must be installed when the cylinder head is removed. A new cylinder head gasket must be installed when the cylinder head is removed.

**Note:** Check the condition of the O-rings. If the O-rings are worn or damaged, use new parts for replacement.

**Note:** Put a thin film of clean engine oil on the seals and the O-ring seals prior to installation.

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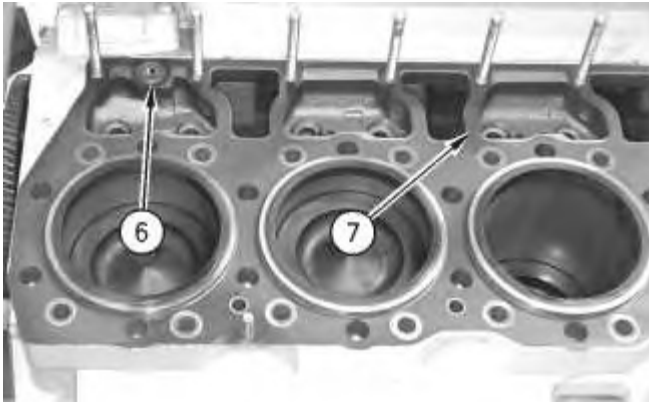


Illustration 1  
Typical example

g00583125

1. Install two O-ring seals (6) and spacer plate gasket (7) on the cylinder block.

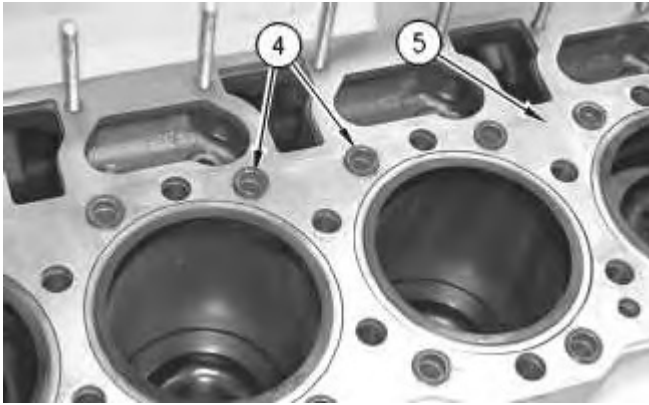


Illustration 2  
Typical example

g00583123

2. Install spacer plate (5) on the cylinder block.
3. Install coolant ferrules (4) in the spacer plate.

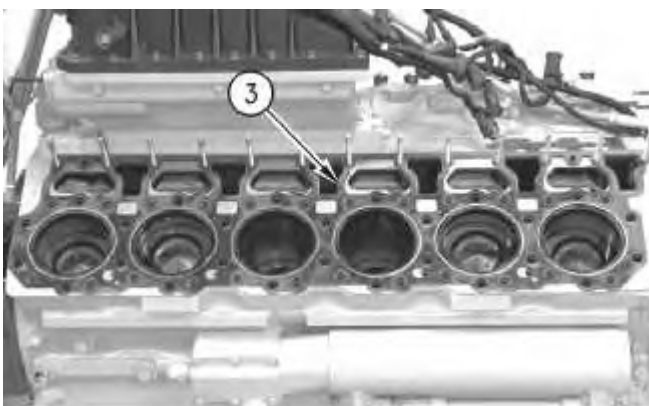


Illustration 3  
Typical example

g00583124

4. Install cylinder head gasket (3).

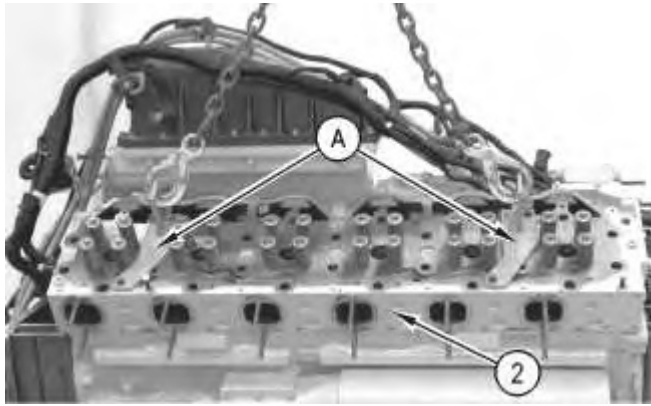


Illustration 4

g00583122

Typical example

5. Install Tool (A) and a hoist on the cylinder head. Install cylinder head (2).

The weight of the cylinder head for the 3412E is 172 kg (380 lb).

The weight of the cylinder head for the 3408E is 90 kg (200 lb).

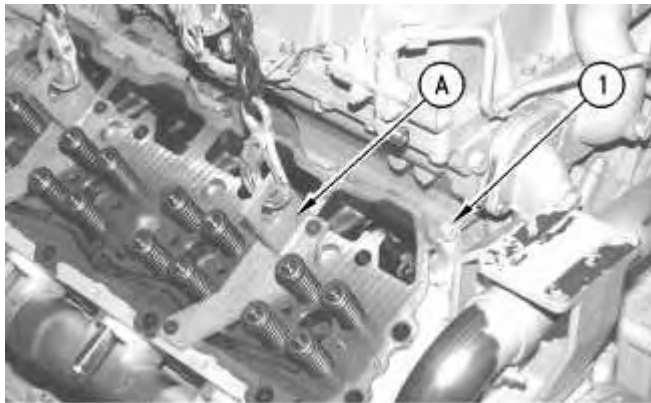


Illustration 5

g00583128

Typical example

6. Install nuts (1) for the cylinder head finger tight. Remove Tool (A).

**End By:**

- a. Install the HEUI fluid manifold. Refer to Disassembly and Assembly, "HEUI Fluid Manifold - Remove and Install".
  - b. Install the exhaust manifold. Refer to Disassembly and Assembly, "Exhaust Manifold - Remove and Install".
-



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## Disassembly and Assembly 3408E and 3412E Engines for Caterpillar Built Machines

Media Number -REN2336-06

Publication Date -01/08/2018

Date Updated -10/08/2018

i05933135

# Lifter Group - Remove and Install

SMCS - 1209-010

## Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	5P-7433	Valve Lifter Tool Group	1

### Start By:

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

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### NOTICE

**Keep all parts clean from contaminants.**

**Contaminants may cause rapid wear and shortened component life.**

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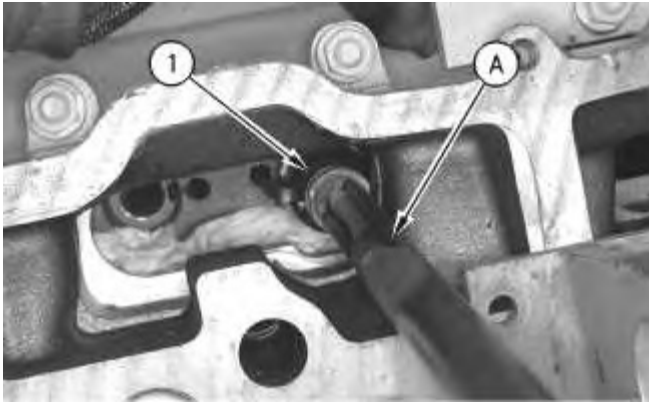


Illustration 1

g00571490

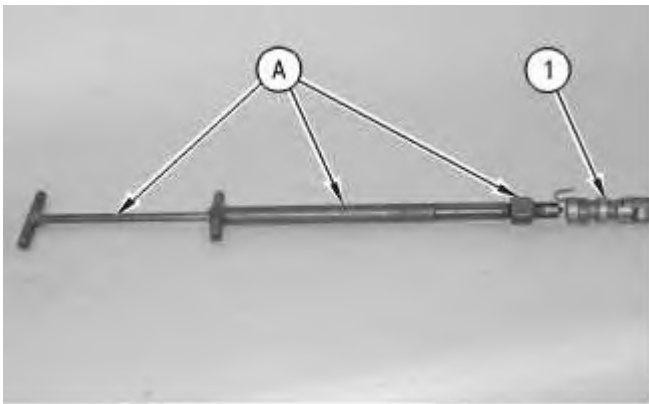


Illustration 2

g00571491

1. Install Tooling (A) in lifter assembly (1) .
2. Remove lifter assembly (1) from the lifter bore.

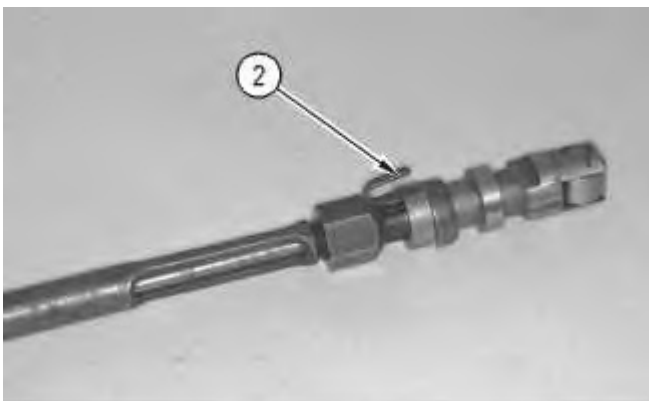


Illustration 3

g00571492

3. Remove lifter guide spring (2) from the lifter assembly.

# Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	5P-7433	Valve Lifter Tool Group	1

**Note:** Install new valve lifter guide springs on the valve lifter when the valve lifters are removed from the engine.

**Note:** Apply clean engine oil to the ball socket for the pushrod and the bore for the valve lifter assembly.



Illustration 4

g00571513

1. Make an alignment of the new lifter guide spring (2) in Tooling (A) .

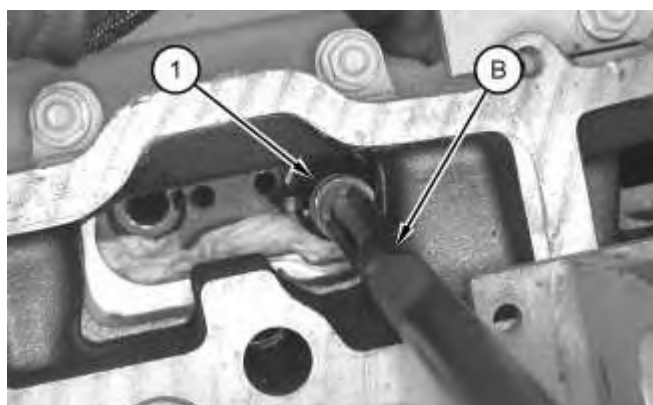


Illustration 5

g01104989

2. Install lifter assembly (1) in the cylinder block with Tooling (A) .

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

---

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## Disassembly and Assembly 3408E and 3412E Engines for Caterpillar Built Machines

Media Number -REN2336-06

Publication Date -01/08/2018

Date Updated -10/08/2018

i01605594

## Camshaft - Remove

SMCS - 1210-011

## Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	8S-1378	Stud Remover And Resetter Tool	1
B	9S-9082	Engine Turning Tool	1
C	1B-9575	Bolt	2
C	9M-1974	Hard Washer	2
D	1P-0510	Driver Gp	1
E	5P-0944	Dowel Puller Gp	1
F	1P-2321	Combination Puller	1
F	9S-9153	Puller Jaw	3

### Start By:

- a. Remove the front housing. Refer to Disassembly and Assembly, "Housing (Front) Remove".
- b. Remove the lifter group. Refer to Disassembly and Assembly, "Lifter Group - Remove and Install".

## Engines Without a Camshaft Rear Gear

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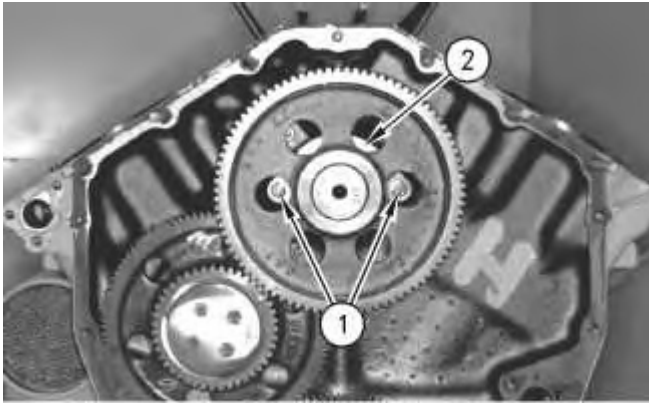


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Illustration 1

g00572090

1. Rotate the engine until the timing marks “V” on the camshaft drive gear and the idler gear are aligned.

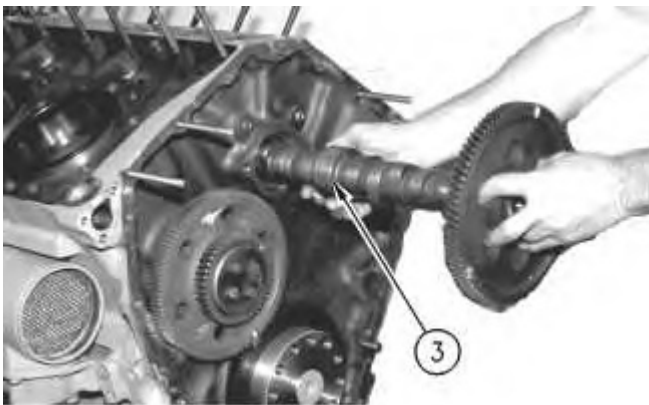


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Illustration 2

g00832971

2. Remove two bolts (1) and plate (2) from the camshaft.



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Illustration 3

g00832973

3. Remove camshaft (3) from the cylinder block.
-

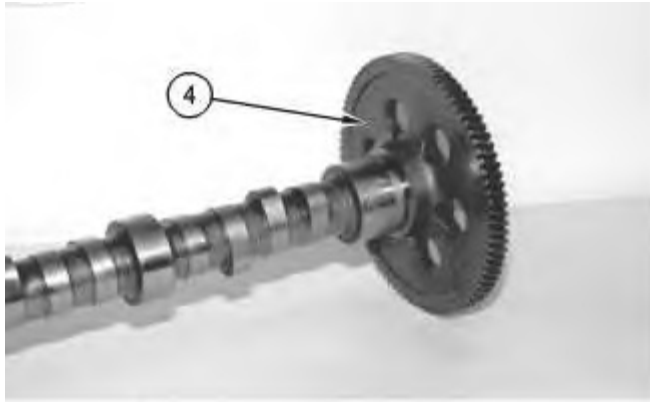


Illustration 4

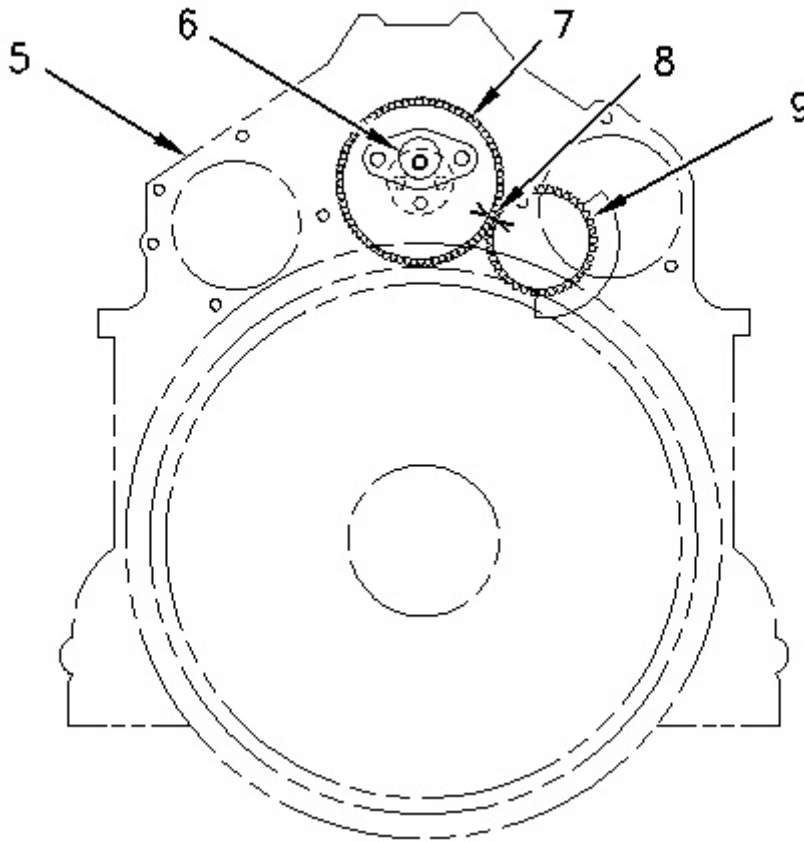
g00832975

4. If necessary, remove camshaft drive gear (4) with Tool (D) and press.

## Engines With a Camshaft Rear Gear

**Note:** All 3408E Engines have a balancer gear that is located in the flywheel housing. The balancer gear is driven by the crankshaft or the camshaft. The balancer gear has a timing mark. This timing mark must be aligned with the timing mark of the gear that drives the balancer gear. If there is access to the rear camshaft gear through the flywheel housing, the rear camshaft gear may be removed without removing the flywheel housing. If the balancer gear is driven by the crankshaft, the camshaft rear gear can be removed and installed without regarding the timing. If the balancer gear is driven by the camshaft rear gear, the timing marks on the camshaft rear gear and the balancer gear must be aligned when the camshaft rear gear is installed. Refer to Disassembly and Assembly, "Balancer Group - Remove" and Disassembly and Assembly, "Balancer Group - Install". **3412 Engines do not have a balancer gear.** A dowel in the rear of the camshaft positions the rear camshaft gear on the camshaft. The rear camshaft gear is secured to the camshaft with four bolts.

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Illustration 5

g00832150

- (5) Flywheel housing
- (6) Hole for turbocharger oil drain
- (7) Camshaft rear gear
- (8) Timing marks
- (9) Balancer gear

1. The procedure that follows is for flywheel housings that have a hole for the turbocharger oil drain. Access to the camshaft rear gear may be in several possible locations. The access will depend on the flywheel housing. Covers may need to be removed. The turbocharger oil drain line may need to be removed. If there is no possible access, the flywheel housing will need to be removed. Refer to Disassembly and Assembly, "Flywheel Housing - Remove and Install". Refer to "The Flywheel Housing Has Been Removed" in this section.

**Note: If the balancer gear is driven by the camshaft rear gear, the timing marks on the camshaft rear gear and the balancer gear must be aligned.** If the balancer gear is driven by the crankshaft, the camshaft rear gear can be removed without regarding the timing.

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