

Document Title: Cylinder block, disassembly and assembly	Function Group: 212	Information Type: Service Information	Date: 2014/3/31
Profile: CEX, EW55B [GB]			

Cylinder block, disassembly and assembly

Op nbr 00000

Disassemble in the order of the numbers in the illustration.

1. Perform steps 1 to 12 in the cylinder head disassembly procedure.
2. Perform steps 1 to 12 in the gear train disassembly procedure.
3. Remove the oil pan. (service point 1)
4. Remove the lubricating oil suction pipe.
5. Remove the piston with rod. (service point 2)
6. Remove the mounting flange. (service point 3)
7. Remove the bearing metal caps. (service point 4)
8. Remove the crankshaft. (service point 5)
9. Remove the tappets.
10. Remove the pistons and rings. (service point 6)
11. Remove the oil seal from the mounting flange. (service point 7)
For assembly, reverse the procedure.

Service points

Point 1 Oil pan

Disassembly :

- Sealant is applied to the oil pan mounting surface on the block. Carefully operate so as not to damage or distort the bonding surface.

Reassembly :

- Apply sealant (Part No. 977770-01212) before reassembly.

Point 2 Piston with rod

Disassembly :

- Measure the connecting rod side gap.
Standard : 0.20 ~ 0.40 mm (0.0079 ~ 0.0157 inch)
- Carefully remove the carbon deposit on top of the cylinder so as not to damage the inner side of the cylinder.

- Set the piston at the BDC (Bottom Dead Center) position and remove the connecting rod cap. Then set the piston at the TDC (Top Dead Center) position, and push the connecting rod big end with the wooden shaft of a hammer. Proceed carefully so as not to cause the cylinder block to catch the rod big end. Set the rod caps and crankpin metals in their correct combinations.

Reassembly :

- Apply oil especially carefully to the sliding contact surfaces of the pistons, rods and rings.
- Use the piston insertion tool to insert each piston with rod in the cylinder block and install the bearing metal cap.
 - Tightening torque (Rod screw): 53.93 ~ 58.83 N m (5.5 ~ 6 kgf m) (39.7 ~ 152.4 lbf ft) (lubrication oil applied)

Point 3 Mounting flange

Disassembly :

- Place the engine on a stable base with the cylinder block upper surface facing down, and remove the mounting flange carefully so as not to damage the combustion surface.

Reassembly :

- Apply sealant (Part No. 977770-01212) and install the mounting flange by matching the two dowel pins. After assembly, raise the engine with its mounting flange on the bottom side.



Risk of personal injury. Very heavy object.

Unforeseen injury may arise due to falling or slipping when raising or reversing the engine. Carefully operate so as not to lose balance.

Point 4 Journal bearing cap

Disassembly :

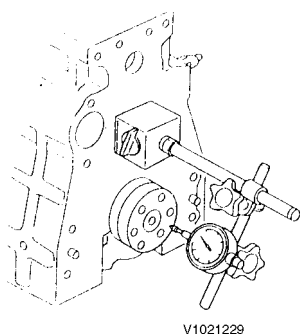


Figure 2

Measurement (1), crankshaft side gap

- Before removing the journal bearing, measure the crankshaft side gap. Measure it in either method because there are the next two methods. Standard : 0.11 ~ 0.21 mm (0.0043 ~ 0.0083 inch)
 1. Install a dial gauge on the cylinder block, and move a crankshaft in front and back, and measure the side gap as shown in the left figure.

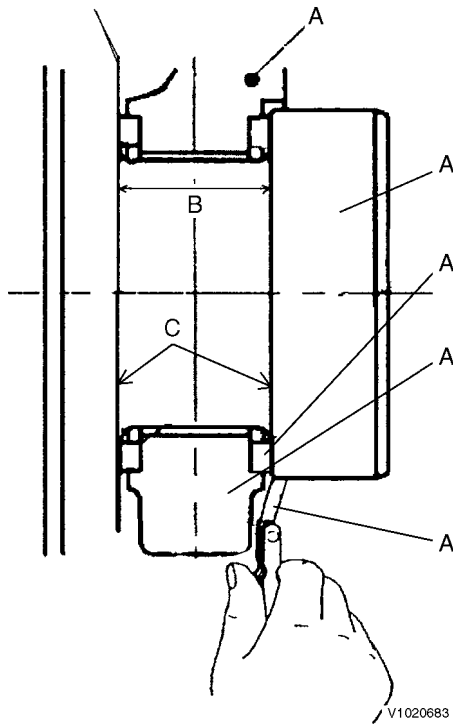


Figure 3
Measurement (2), crankshaft side gap

- A. Cylinder block
- B. Standard width
- C. Thrust face

2. Put a thickness gauge in the clearance between thrust metal and crankshaft directly, and measure it.

Crankshaft side gap, unit: mm (inch)

	Standard	Limit
Crankshaft side gap	0.13 ~ 0.23 (0.0051 ~ 0.0091)	0.28 (0.0110)

Reassembly :

- If the side gap exceeds the standard, replace the thrust metal with an oversize one.

Standard thickness, unit: mm (inch)

0.25 Oversize	129900-02370 (Upper) 129900-02360 (Lower)
Standard thickness, mm (inch)	2.055 ~ 2.105 (0.0809 ~ 0.0829)

Disassembly :

- Remove the bearing caps, cap side bearings, and thrust metals. Place each thrust metal with identification of the position and direction.

Reassembly :

- Carefully install each thrust metal so that the grooved one is positioned away from the cap.
- Do not confuse the upper and lower main bearing metals. The upper main bearing metal (block side) has an oil hole, and the lower one does not. The "wheel and arrow" marks on the cap shall face the flywheel.
- Bearing cap mounting screw tightening torque: 107.87 ~ 117.68 N m (11 ~ 12 kgf m) (79.4 ~ 86.6 lbf ft) (lubrication oil applied)

Point 5 Crankshaft

Disassembly :

- Remove the crankshaft. Remove each main bearing metal upper (block side) and pair it with the metal cap side lower metal.

WARNING

The parts are heavy. Take appropriate safety precautions.

Carefully prevent damage to the bearing or finger injury when removing the crankshaft because it is heavy.

Point 6 Piston pin and rings

Disassembly :

- Use the piston ring replacer, remove the piston rings.
- Remove the circlip and remove the piston pin by pushing it out.

Reassembly :

- Install each piston ring on the piston, with the punched manufacturer's mark facing upward.

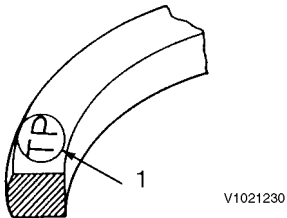


Figure 4
Piston ring

1. Make the punched manufacture's mark face upward
- The piston ring joints shall be staggered at by 120° intervals. Do not position the top ring joint vertical to the piston pin. The coil expander joint shall be opposite to the oil ring joint.

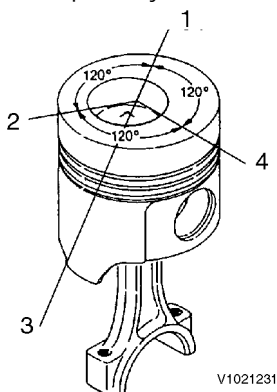
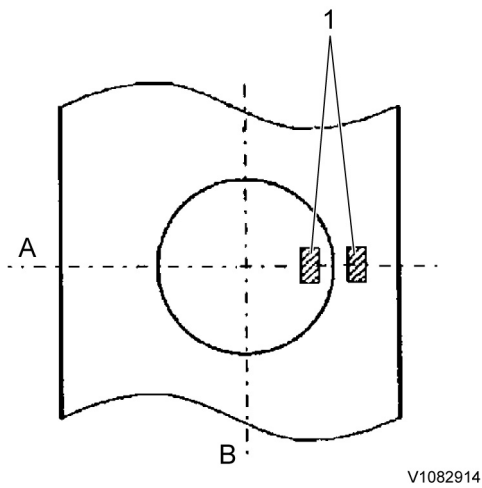


Figure 5
Ring joints

1. Oil ring joint
 2. Second ring joint
 3. Expander joint
 4. Top ring joint
- When installing the piston pin to the rod and piston, the punched match mark on the big end of the connecting rod shall be opposite to the size mark on the piston top.



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Figure 6
Assembly direction of connecting rod and piston

1. Engraved mark
- A. Camshaft side
- B. Flywheel side

- Install the piston in the cylinder block with the punched mark on the big end of the rod on the nozzle side. (The embossed mark at the connecting rod I-beam section shall be on the flywheel side.)

Point 7 Oil seal

Reassembly :

- Replace the oil seal with a new one whenever disassembled. Apply lithium grease at the time of assembly.

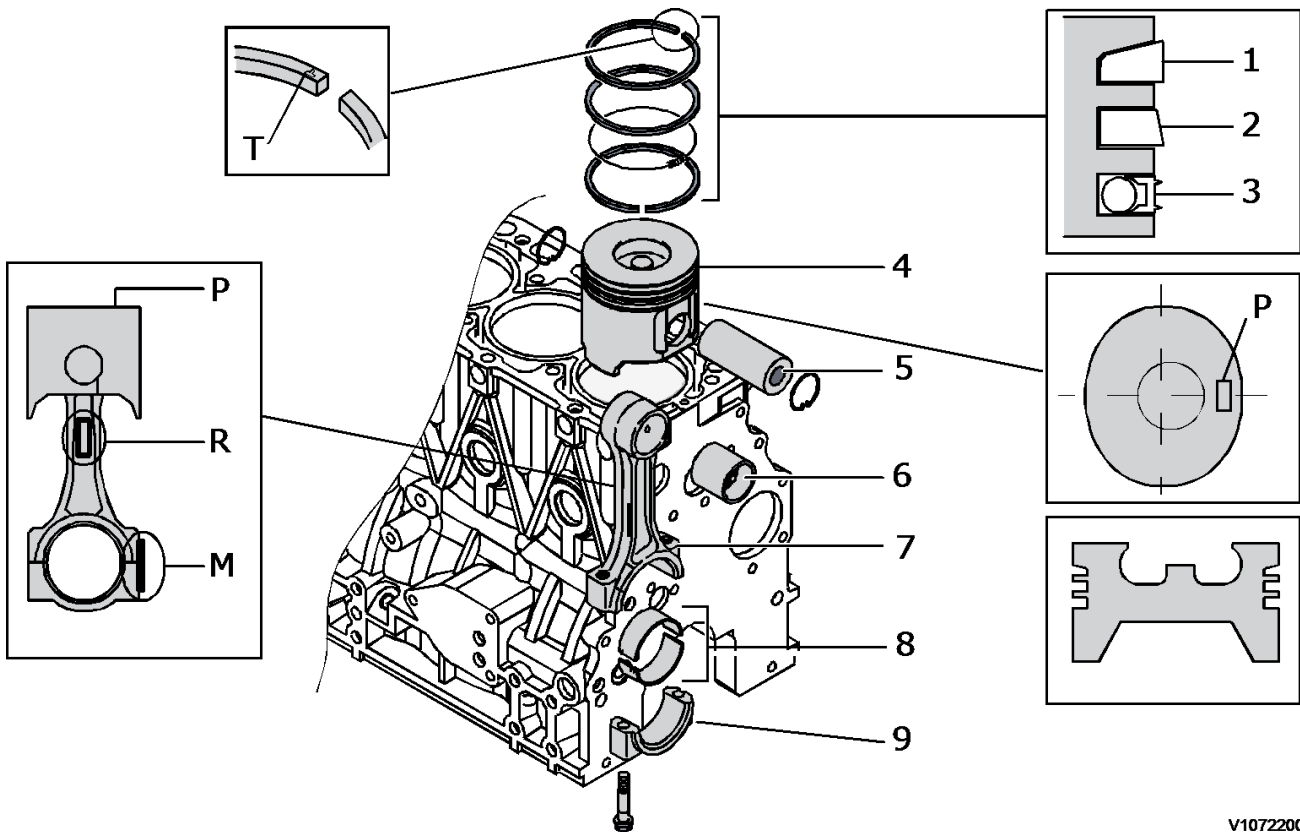
Document Title: Pistons, description	Function Group: 213	Information Type: Service Information	Date: 2014/3/31
Profile: CEX, EW55B [GB]			

Pistons, description

The engine has a three ring piston (top ring, second ring and oil ring). Each ring has a T marking on one side to identify the top of the ring. When mounting the piston rings, the joints have to be mounted with an offset of 120°. The top ring joint has to be opposite the piston working side.

The P mark on the top of the piston indicates the mounting position. This mark faces towards the nozzle side. The R mark on the connecting rod faces towards the flywheel side. The M mark on the big end of the connecting rod should also face the nozzle side.

Due to the direct injection system, the combustion chamber of the piston is shaped to achieve good combustion of the injected fuel. The chamber is placed eccentrically towards the nozzle.



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Figure 1
Piston assembly components

- | | | |
|---------------------------------|-----------------------|------------------------|
| 1. Top ring (upper piston ring) | 4. Piston | 7. Connecting rod |
| 2. Second piston ring | 5. Piston pin | 8. Knuckle pin bearing |
| 3. Oil scraper ring | 6. Piston pin bushing | 9. Bearing cap |

Document Title: Valves, adjusting	Function Group: 214	Information Type: Service Information	Date: 2014/3/31
Profile: CEX, EW55B [GB]			

Valves, adjusting

Op nbr 214-012

The 4-valve cylinder head operates two valves with a single rocker arm by employing a valve bridge between the two valves. Clearance between the valve bridge and valves must be set before adjusting the clearance between the rocker arm and valve bridge.

NOTICE

Valve adjustment with the engine running is not allowed since the valves may strike the piston, causing severe damage.

1. Place the machine in the service position B, See [091 Service positions](#).
2. Open the engine hood
3. Remove clamp mounting screw (1).

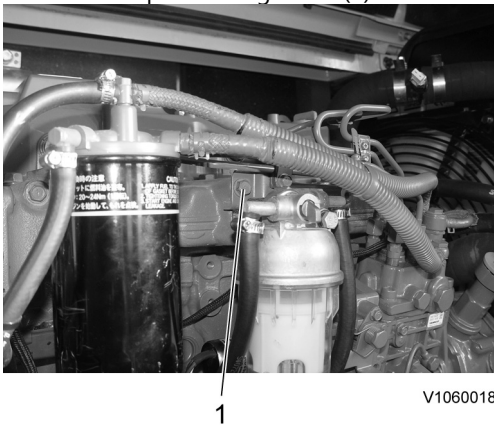


Figure 1

4. Loosen nuts (1), (2) of the delivery pipes and then remove the delivery pipes.

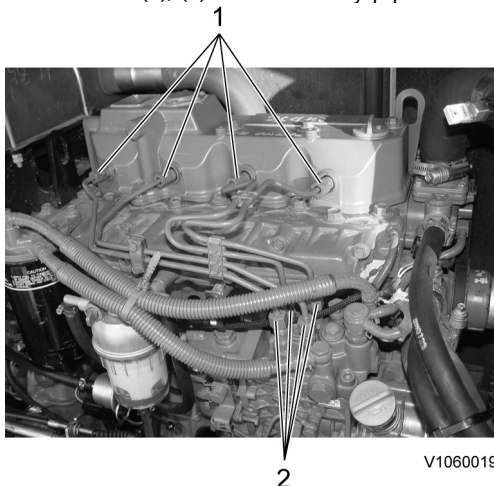


Figure 2

5. Remove 4 rubber seals.

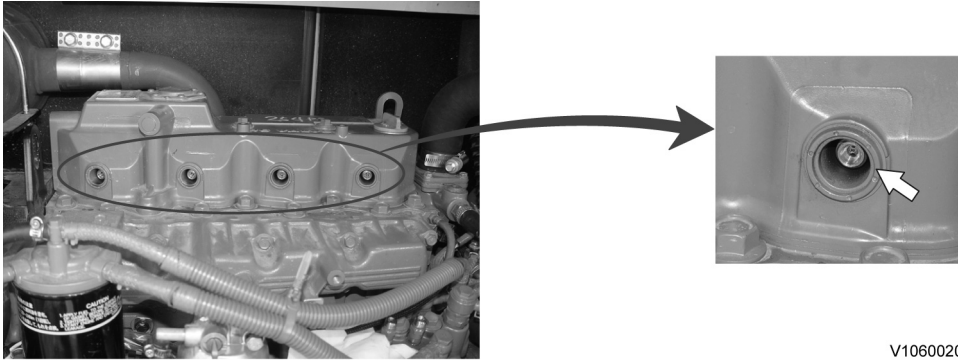


Figure 3

6. Remove 4 mounting screws of the engine rocker arm cover.

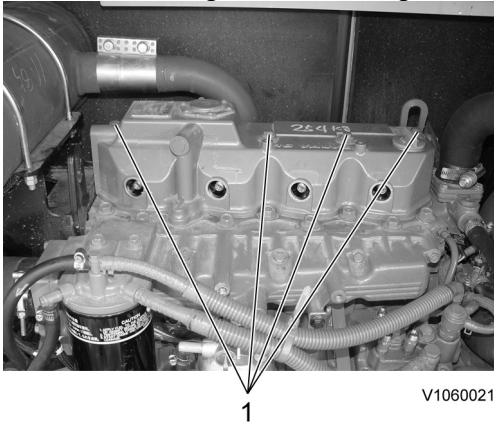


Figure 4

7. Remove the engine rocker arm cover.



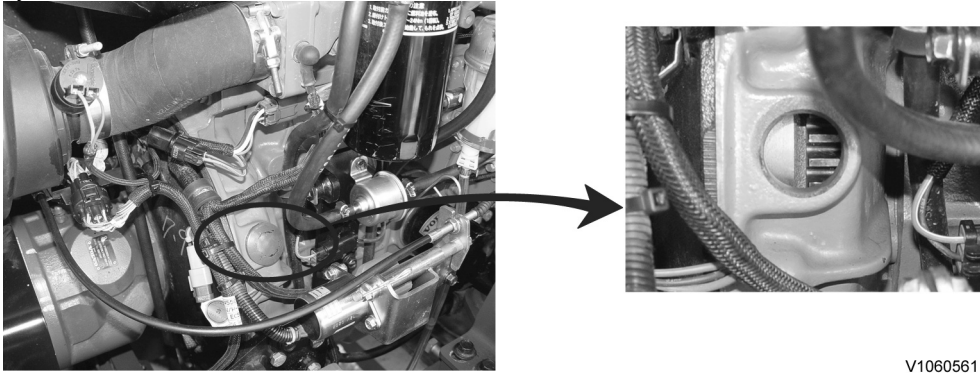
Figure 5

NOTE!

If adjusting each cylinder individually, the cylinder to be adjusted first does not have to be the No. 1 cylinder. Select and adjust the cylinder where the piston is nearest to the top dead center after turning, and make adjustment for other cylinders in the order of firing by turning the crankshaft 180° each time.

8. Remove the rubber plug and rotate the crankshaft clockwise as seen from the coolant pump end, to bring No.1

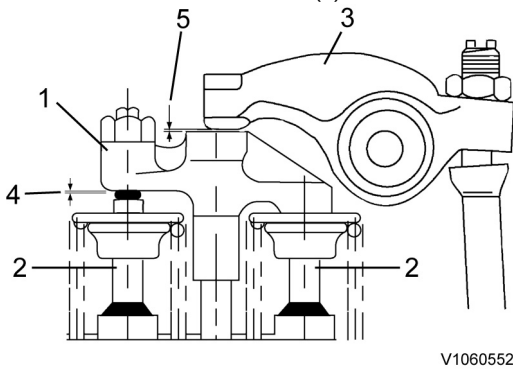
piston to TDC on the compression stroke while watching the rocker arm motion and the timing grid on the flywheel. (Position where both the intake and exhaust valves are closed.)



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Figure 6

9. Make sure there is clearance (5) between valve bridge (1) and rocker arm (3).



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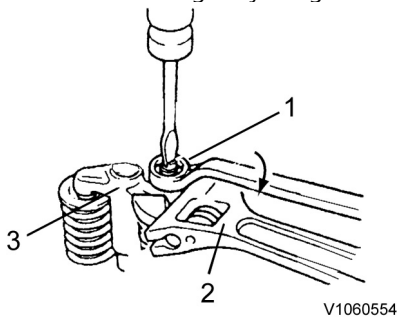
Figure 7

1. Valve bridge
2. Valves
3. Rocker arm
4. Clearance between the valve bridge and valves
5. Clearance between the valve bridge and the rocker arm

NOTE!

Do not loosen or tighten the valve adjusting screw lock nut without holding the valve bridge. Always hold the valve bridge using a wrench to prevent bending of the valve stems.

10. Loosen valve bridge adjusting screw lock nut (1) while holding bridge (3) with a wrench (2).



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Figure 8

1. Valve bridge adjusting screw lock nut
2. Wrench

3. Bridge

11. To assure the valve bridge contacts the rear valve, apply light, downward finger pressure (4) on valve bridge (3) and loosen valve bridge adjusting screw (1) until there is visible clearance between the adjusting screw and the front valve.
12. To assure the valve bridge has equal contact with the front and rear valves, apply light downward pressure (4) on valve bridge (3), adjust valve bridge adjusting screw (1), so there is "zero" clearance between the adjusting screw and the front valve.

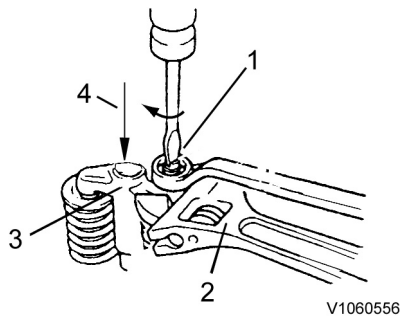


Figure 9

1. Valve bridge adjusting screw
2. Wrench
3. Bridge

13. Tighten lock nut (1), while holding the valve bridge with a wrench. Verify that the valve clearance (2) is zero.

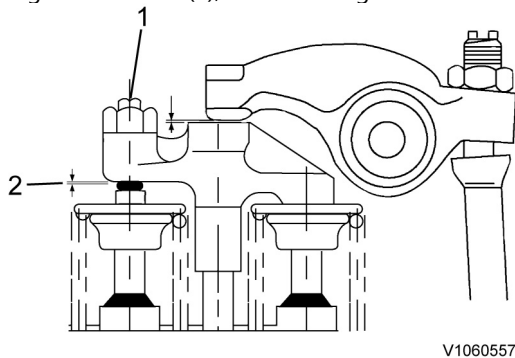


Figure 10

1. Valve bridge adjusting screw
2. Valve clearance

NOTE!

There is a tendency for the clearance to decrease slightly when the lock nut is tightened. It is suggested that the initial clearance adjustment is made slightly on the "loose" side before tightening the lock nut.

14. To adjust the actual valve clearance between the rocker arm and the valve bridge, insert a feeler gauge (1) of the correct thickness between rocker arm (2) and valve bridge (3). Record the results and use this value as an indication of wear.

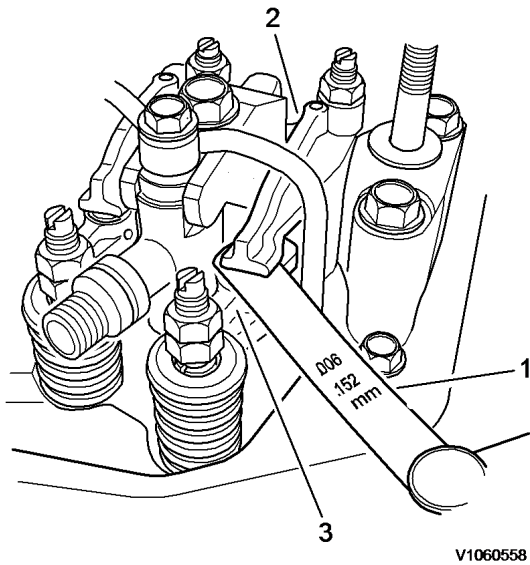


Figure 11

1. Feeler gauge
2. Rocker arm
3. Valve bridge

15. If adjustment is required, proceed to the next step.

16. Loosen valve adjusting screw lock nut (5) and valve adjusting screw (4) on rocker arm (3) and check clearance gap (2) for evidence of dirt or wear.

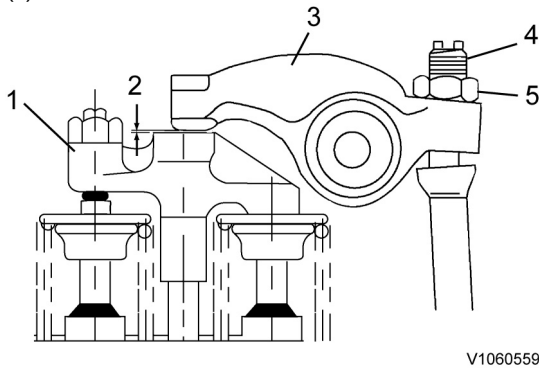


Figure 12

1. Valve bridge
2. Valve clearance gap
3. Rocker arm
4. Valve adjusting screw
5. Valve adjusting screw lock nut

17. Adjust valve clearance (2) by turning adjusting screw (4) until there is a slight "drag" on the feeler gauge when sliding it between the rocker arm and the valve bridge.

18. Hold adjusting screw (4) while tightening the valve adjusting screw lock nut (5). Recheck the clearance.

19. Apply oil to the contact surface between the adjusting screw and push rod.

20. Rotate the crankshaft to measure and adjust the set of valves. Continue until all valves are measured and adjusted.

21. Restore the machine to the operating condition.

NOTE!

Use only new bronze washers, O-rings and seals.

Document Title: Engine timing gear, description	Function Group: 215	Information Type: Service Information	Date: 2014/3/31
Profile: CEX, EW55B [GB]			

Engine timing gear, description

The engine is controlled by timing gears. The timing gears are on the front of the engine in the timing case. The camshaft gear and the injector pump gear are driven by the crankshaft gear via an intermediate pulley.

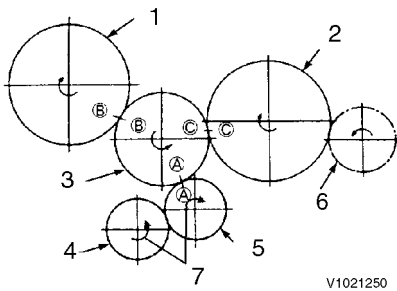


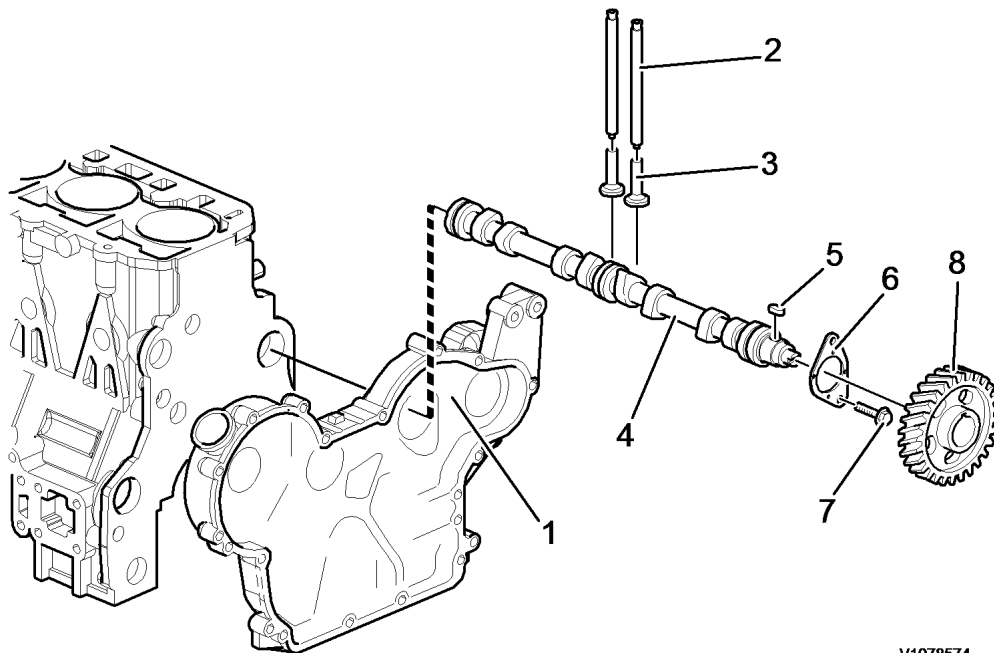
Figure 1

1. Fuel injection pump gear
2. Camshaft gear
3. Idler gear
4. Lubrication oil pump gear
5. Crankshaft gear
6. PTO (Power Take-Off, optional)
7. Direction of rotation

Document Title: Camshaft, description	Function Group: 215	Information Type: Service Information	Date: 2014/3/31
Profile: CEX, EW55B [GB]			

Camshaft, description

The function of the camshaft is to control the flow of intake air and exhaust gasses in the combustion chambers of the engine. Tappets work off the lobes of the camshaft and drive the push rods to operate the valves. There are six tappets in this engine. Springs on the valves return them to their closed position. The camshaft is mounted on four bearing journals.



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Figure 1
Camshaft and components

1. Gear case
2. Push rod
3. Tappet
4. Camshaft
5. Camshaft gear key
6. Camshaft end plate
7. Screw
8. Camshaft gear

Document Title: Gear train and camshaft, disassembly and assembly	Function Group: 215	Information Type: Service Information	Date: 2014/3/31
Profile: CEX, EW55B [GB]			

Gear train and camshaft, disassembly and assembly

Op nbr 00000

Disassemble in the order of the numbers in the illustration.

1. Perform steps 1 to 12 of the cylinder head disassembly procedure.
2. Remove the coolant pump.
3. Remove the crankshaft pulley. (service point 1)
4. Remove the gear case cover. (service point 2)
5. Remove the fuel injection pump. (service point 3)
6. Remove the idle gear assembly. (service point 4)
7. Remove the PTO (Power Take-Off) drive gear. (service point 5)
8. Remove the PTO (Power Take-Off) lubrication pipe.
9. Remove the starting motor.
10. Remove the flywheel. (service point 6)
11. Remove the camshaft assembly. (service point 7)
12. Remove the gear case. (service point 8)
13. Remove the seal from the gear case cover. (service point 9)

For assembly, reverse the procedure.

Service point

Point 1

Disassembly :

- Remove the crankshaft pulley using a gear puller after removing the crankshaft pulley set screw. When removing the pulley using the gear puller, use a pad and carefully operate so as not to damage the thread. Set the gear puller securely to prevent the pulley from being damaged.

Reassembly :

- Apply lithium grease to the oil seal lips. For the oil seal with double lips dust seal, further slightly apply engine oil on the lips so as not to damage them.
- Clean by wiping off any oil on both taper surface using detergent.

- Be sure to use the crankshaft pulley installing tool so as not to damage the oil seal lips.
 - When installing the crankshaft pulley, apply lube oil to the set screw to tighten and carefully assemble so as not to damage the oil seal.
- Tightening torque : 107.87 ~ 127.48 N m (11 ~ 13 kgf m) (79.4 ~ 93.9 lbf ft)

Point 2

Reassembly :

- When installing the gear case cover, do not forget to install the two reinforcing screws at the center.

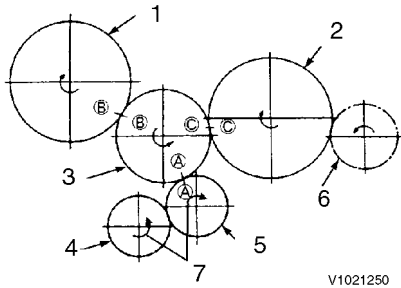


Figure 1
Gear train

1. Fuel injection pump drive gear
2. Camshaft gear
3. Idle gear
4. Lubrication oil pump gear
5. Crankshaft gear
6. PTO (Power Take-Off) gear
7. Direction of rotation

- Measure the backlash of each gear.

Gear train measurement, unit : mm (inch)

	Standard	Limit
Crankshaft gear, camshaft gear, fuel injection pump gear, idle gear, PTO (Power Take-Off) gear	0.08 ~ 0.14 (0.0031 ~ 0.0055)	0.16 (0.0063)
Lubricating oil pump gear	0.09 ~ 0.15 (0.0035 ~ 0.0059)	0.17 (0.0067)

- Apply sealant and install the gear case cover by correctly positioning the two dowel pins.

Point 3

Disassembly :

- Remove the fuel injection pump drive gear mounting nut, remove the gear using the gear puller, and remove the fuel injection pump. Do not forget to remove the stay on the rear side. When extracting the gear using the gear puller, use a pad at the shaft and carefully operate so as not to damage the thread.

Reassembly :

- Drive gear nut tightening torque: 112.77 ~ 122.58 N m (11.5 ~ 12.5 kgf m) (83 ~ 90 lbf ft)

Point 4

Reassembly :

- Assemble crankshaft gear A, fuel injection pump drive gear B and camshaft gear C at the same time by aligning with idle gear A, B and C marks.
- Install the idle gear shaft with the oil hole facing upward.

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