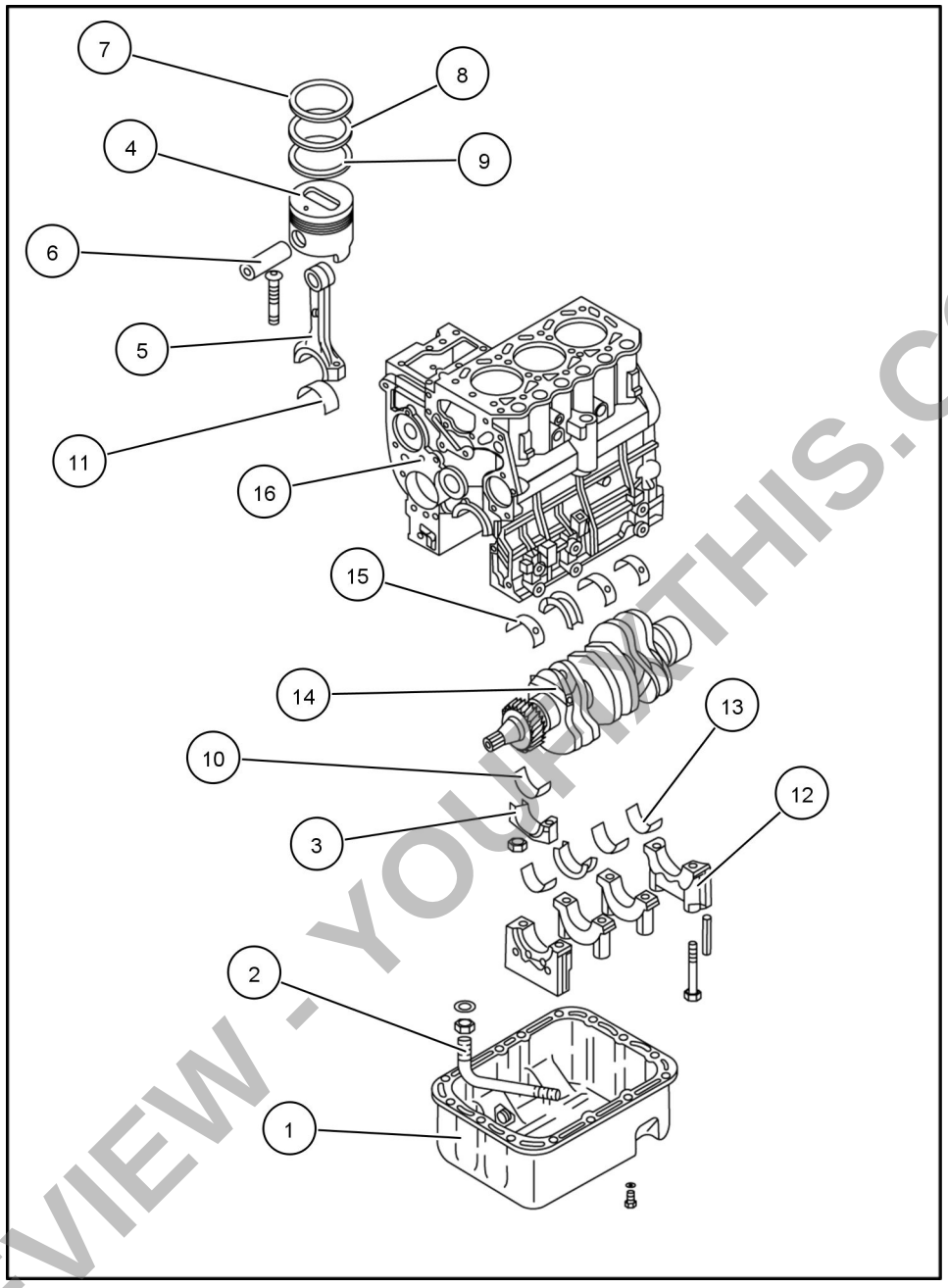
Engine - Exploded view



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(1) Oil pan
(2) Oil pickup tube
(3) Connecting rod cap
(4) Piston
(5) Connecting rod
(6) Piston pin
(7) No. 1 compression ring
(8) No. 2 compression ring
(9) Oil ring
(10) Lower connecting rod bearing
(11) Upper connecting rod bearing
(12) Main bearing cap
(13) Lower main bearing
(14) Crankshaft
(15) Upper main bearing
(16) Cylinder block

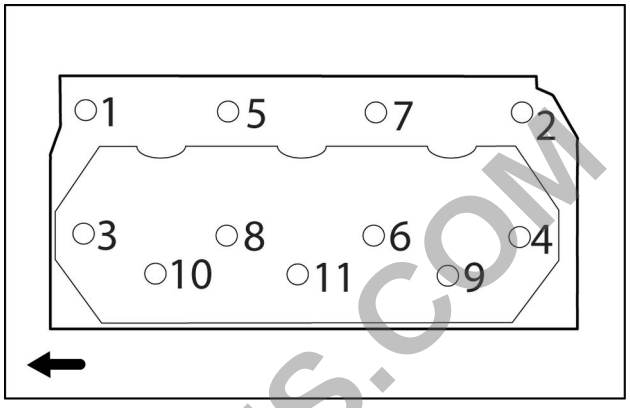
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Cylinder head - Remove

NOTE: *If there is a cylinder head problem, check the bolts for tightness with a torque wrench before removing the cylinder head bolts.*

1. Loosen cylinder head bolts in the numerical order as shown.
2. Remove the cylinder head bolts.



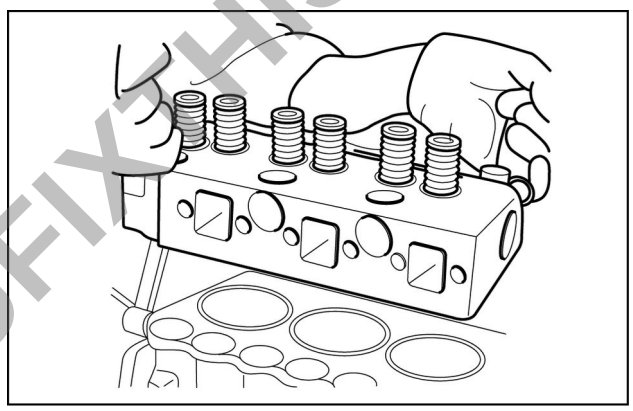
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3. Remove the cylinder head assembly by lifting it up.

NOTE: *If the cylinder head assembly cannot be removed due to crimping of the cylinder head gasket, tap the thick area on the side of the cylinder head using a plastic hammer to give a shock.*

4. Remove the gasket from the cylinder head.

NOTICE: *When removing the cylinder head gasket, be careful not to damage the cylinder head or block deck by using tools such as a screwdriver for scraping.*



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Engine - Problem solving

OPERATION

In most cases, the engine should be overhauled when the compression pressure of the engine becomes low. An increase in engine oil consumption and blow-by gas are also considered to evaluate the engine condition. Besides, such symptoms as a decrease in output, increase in fuel consumption, decrease in oil pressure, difficulty of engine starting and increase in noise are also considered for judging the overhaul timing, although those symptoms are often affected by other causes, and are not always effective to judge the overhaul timing. Decreased compression pressure shows a variety of symptoms and engine conditions, thus making it difficult to accurately determine when the engine needs an overhaul. The engine can exhibit these conditions in various combinations. Some of these problems are directly caused by worn engine parts, while others are not. Phenomena described in items **(2)** and **(6)** will result from improper fuel injection volume, fuel injection timing, worn plunger, faulty nozzles and also faulty conditions of electrical devices such as battery and starter. The most valid reason to overhaul an engine is a decrease in compression pressure due to worn cylinder liners and pistons, as described in item **(4)**. In addition to this item, it is reasonable to take other problems into consideration for making the total judgement.

TROUBLESHOOTING

The following shows typical problems caused by reduced compression pressure.

1. Decreased output power
2. Increased fuel consumption
3. Increased engine oil consumption
4. Increased blow-by gas through the breather due to worn cylinder liners and piston rings (Visually check the blow-by amount)
5. Increased gas leakage due to poor seating of inlet and exhaust valves
6. Difficulty in starting
7. Increased noise from engine parts
8. Abnormal exhaust color after warm-up operation

NOTE: *Refer to* ***Engine - Check (10.001)*** *for the proper procedure to check cylinder compression.*

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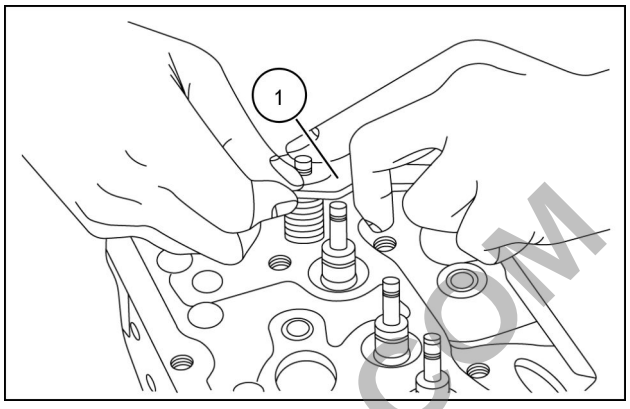
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Valves - Remove

1. Use an appropriate tool **(1)** to compress the valve spring and remove the valve keepers.
2. Remove the retainer, valve spring and valve.

NOTE: *Put match marks for easy identification of the installing position if the valve is to be reused. When reassembling, do not change the combination of the valve and valve seat.*



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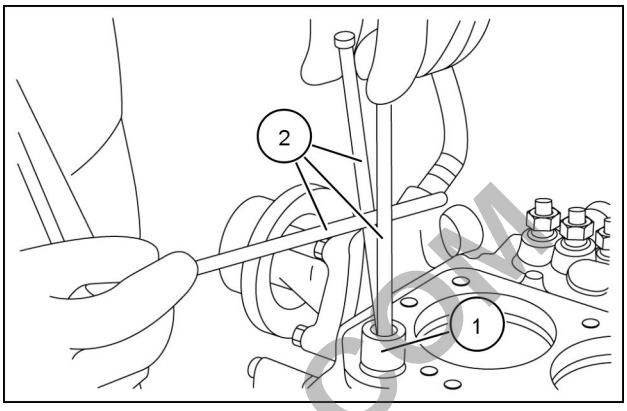
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Camshaft Tappets - Remove

1. Remove the tappet **(1)** from the cylinder block using the push rods **(2)**.

NOTE: *If the camshaft is removed before the tappet, the tappet will fall in the oil pan.*



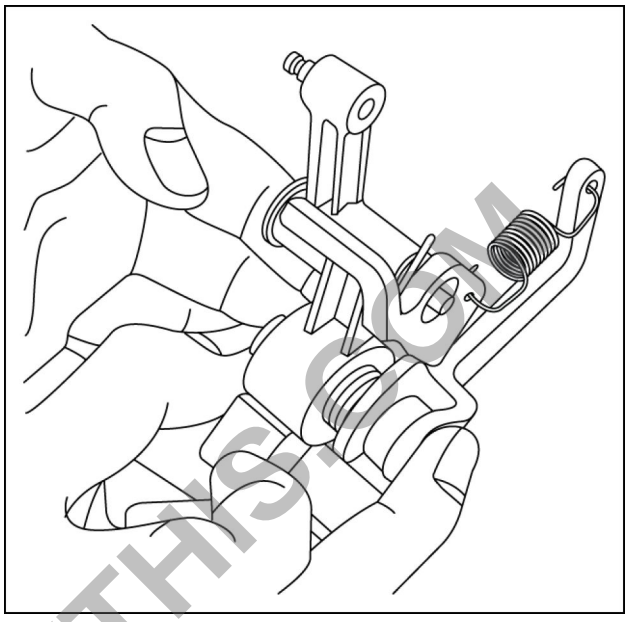
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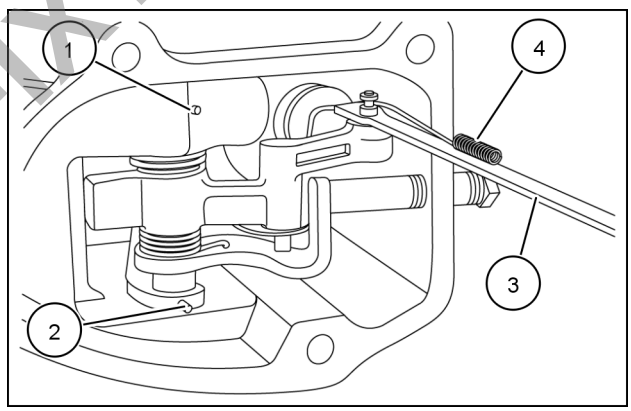
Governor - Assemble

1. Install the levers first.



93101351 1

2. Install the O-ring onto the governor shaft.
3. Insert the governor shaft into the governor case, and combine it with the levers.
4. Hold the grooved pin **(1)** and the spring pin **(2)** in place, and knock them in with a soft hammer.
5. Install the tie-rod **(3)** and the tie-rod spring **(4)**.
6. Install the tire rod cover.



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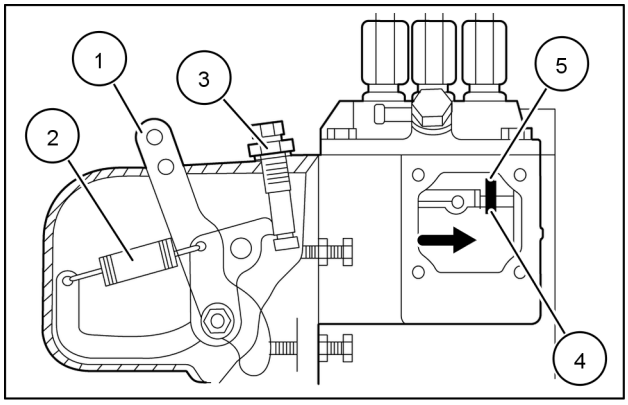
7. Adjust the low and high idle speeds of engine. Refer to **Governor - Adjust (10.220)** for the proper procedure.

NOTE: *Stop the engine for installation and adjustment of the torque spring set.*

8. Remove the tie-rod cover.
9. Pull the speed control lever **(1)** to the high idle speed position and hold it.
10. Pull the tie-rod in the direction of the arrow until a slight resistance is felt.

NOTE: *This is the initial resistance by the governor spring **(2)**. Do not pull the tie-rod further to try to overcome the resistance.*

11. While holding the tie-rod in this position, screw in the torque spring set **(3)** until the notched line on the control rack **(4)** is aligned with that on the pump body **(5)**.

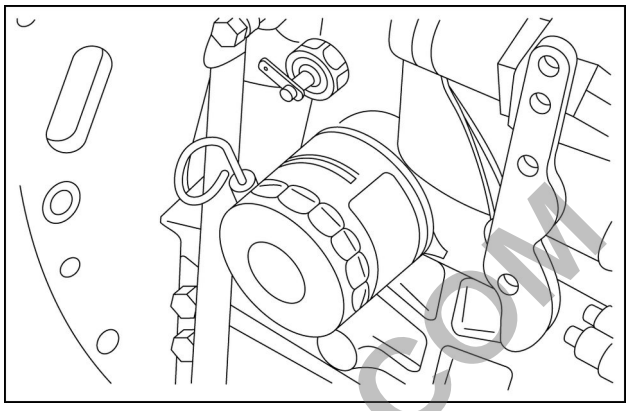


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Engine oil filter - Remove

1. Place a drip pan under the oil filter.
2. Remove the oil filter using a filter wrench.



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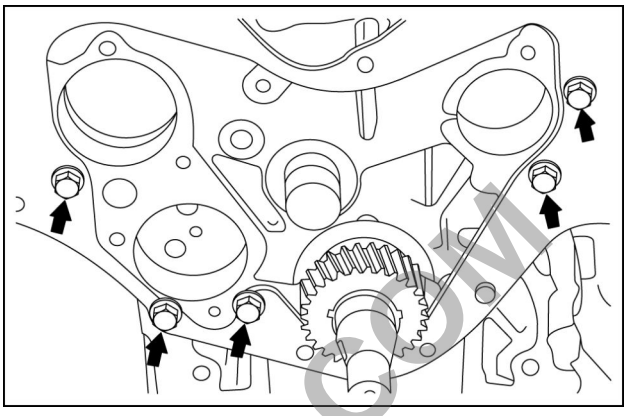
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Engine block cover Front - Remove

1. Remove the front plate bolts.
2. Remove the front plate from the crankcase.

NOTE: *If it is difficult to remove the front plate, lightly tap it with a plastic hammer.*



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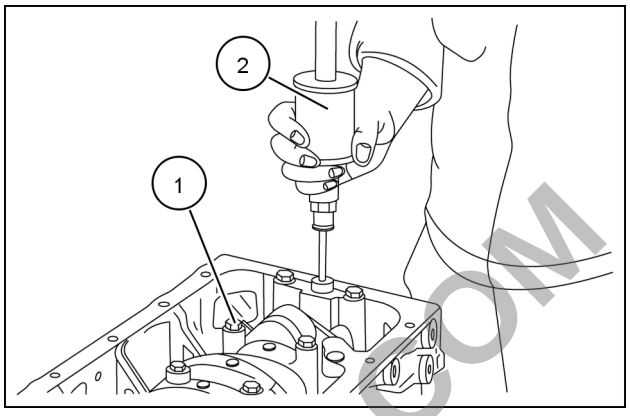
Crankshaft - Remove

1. Remove the main bearing cap bolts **(1)**.

NOTICE: *Be careful not to damage the main bearings.*

2. Remove the main bearing cap together with the lower main bearing.
3. Use a slide hammer **(2)** to remove the main bearing caps on the front and rear ends.

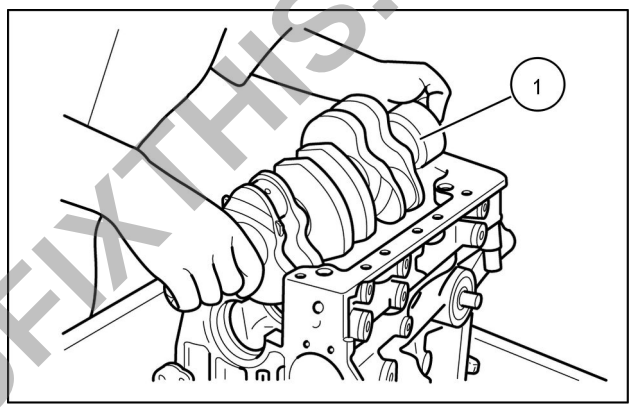
NOTE: *Mark each main bearing for its cylinder number.*



93101242 1

4. Slowly lift the crankshaft **(1)** straight up.
5. Arrange the bearings in the order of disassembly so that their original positions are restored when re-assembling.

NOTE: *Mark the bearings for their cylinder numbers.*



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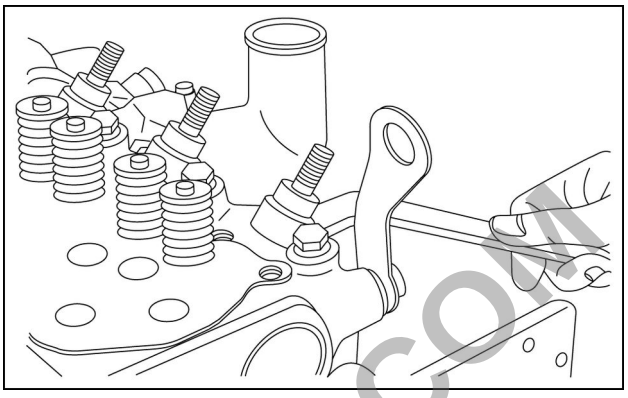
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Fuel injectors - Remove

1. Using a wrench, loosen the nozzle, and remove the fuel injection nozzle and holder bracket.

NOTE: *Using a wire or screwdriver remove the holder gasket.*



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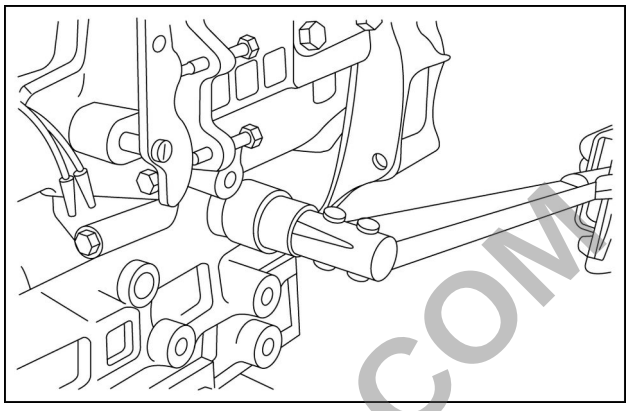
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Engine oil filter Bypass valve - Remove

1. Unscrew the bypass valve from the engine block.

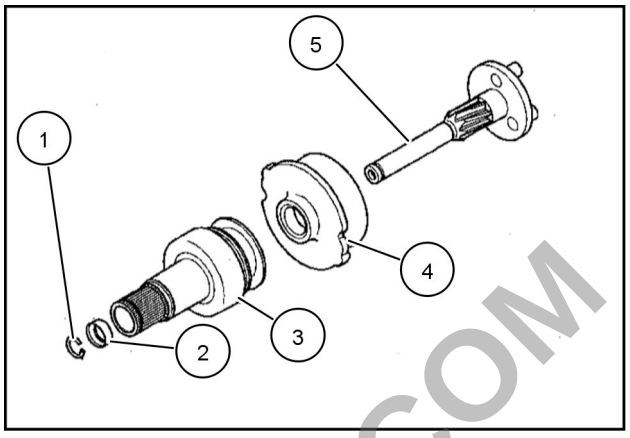


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15. Remove the stopper ring **(1)** and then the stopper **(2)**.
16. Separate the overrunning clutch **(3)**, internal gear **(4)** and gear shaft **(5)**.



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