POWER SOLUTIONS INTERNATIONAL

13L & 13L TURBO SERVICE MANUAL

PSI ENERGY

7610036-2

A Product by Power Solutions International
Wood Dale, IL

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Note: Engine accessory and component locations may differ from those presented in the images within this manual based on various applications and package manufacturers using this engine.

REVISION CONTROL INFORMATION

Revision Level	Release Date	Change Description (s)
1	7/02/2021	Initial Release
2	9/11/2024	Revised formatting, new cover, updated Valve Train Intake and exhaust valve callout p.46
3		
4		
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Purpose

This manual is intended to inform customers on how to assemble and disassemble the 13 Liter engine. This document will be provided to customer so they can incorporate thisinformation into their manuals and service documents.

Maintenance Providers

Maintenance and repair services may be performed by you or any qualified engine service provider thatyou choose. However, your engine warranty does not cover damage or failure caused by improper maintenance or repairs.

Owner’s Manual & Maintenance Records Storage & Use

Store this Owner’s Manual and Maintenance Records in a safe, visible place by your engine. The maintenance log must be updated whenever your engine is serviced. If repairs are being done under warranty should be sure to follow proper warranty procedures.

Table of Contents

Disassembly & Assembly of Engine

1.1 Safety Precautions

Please strictly comply with instructions in this manual to disassemble and assemble the engine safely and properly.

Environmental Protection Measures

Please comply with relevant laws and regulations on environmental protection when handling oil and hydrocarbon waste. For further instructions please contact your local officials.

Notes for Disassembly and Assembly of Engine

Failure in complying with safety regulations and basic safety practices causes most engine-related accidents. Proper training is required for all engine operators and maintenance personnel. Any violation of instructions in this manual may result in serious injury or death.

Note: Before proceeding with any maintenance or repair operation, place a sign clearly stating “Maintenance in Progress, Do Not Use” on the engine starter switch.

Take the following precautions before using a lockout tool and beginning maintenance or repair:

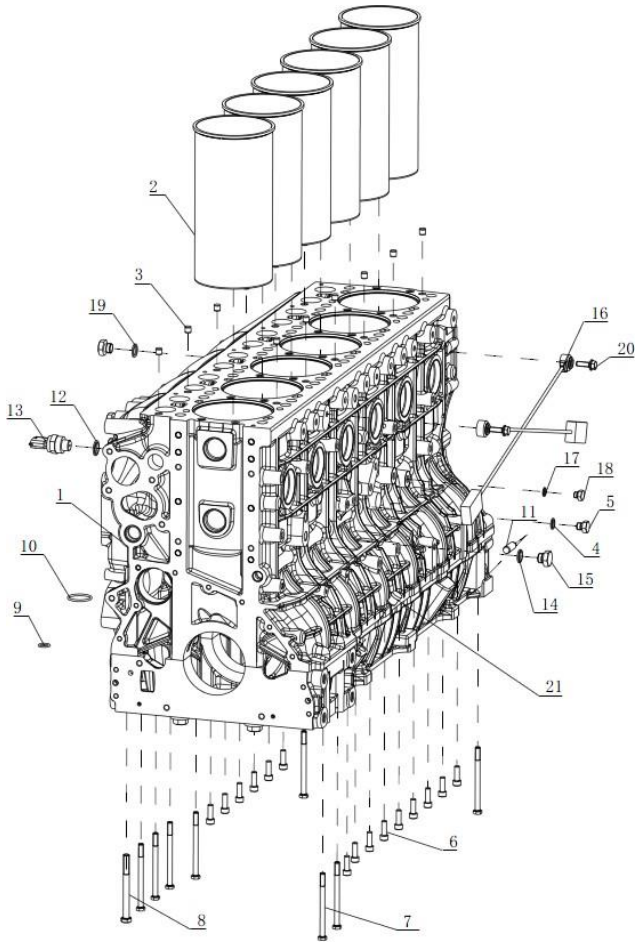
- Ensure the maintenance site and surrounding area is clean and suitable for safe operation.
- Remove any rings, necklaces, watches, or other jewelry and wear appropriate close-fit work clothes before entering the maintenance site.
- Wear relevant protective devices (goggles, gloves, shoes, masks, work clothes, helmet, etc.) that are in good condition prior to entering the maintenance site.
- Do not use any defective, worn, broken, or inappropriate tools.

NOTICE: THE ENGINE MUST BE COMPLETELY SHUT DOWN PRIOR TO MAINTENANCE

Engine block assembly

2.1 Disassembly and assembly of engine block assembly

2.1.1 Exploded view of engine block assembly



1. Engine block
2. Cylinder liner
3. Pin
4. Gasket
5. Hex head bolt
6. Hexagon socket head cap screws
7. Hex head bolt
8. Hex head bolt
9. O seal ring
10. O seal ring
11. Pin
12. Gasket
13. Pressure temperature sensor
14. Gasket
15. Hex head plug
16. Knock sensor
17. Gasket
18. Hexhead plug
19. Gasket
20. Hex flange bolts
21. Oil dip tube plug

Fig. 2- 1 Exploded view of engine block assembly

2.1.2 Preparation before disassembly

1. Equipment conditions: Socket wrench, copper hammer and so on
2. Preparation before disassembly: Remove gearbox and clutch, remove flywheel, flywheel, housing, gear housing and oil pan.

2.1.3 Dismantling

1. Remove the crankcase around the bolt.
2. Remove the main bearing bolts.
3. Remove the seal.
4. Remove the main oil duct plug.
5. Remove cylinder liner.

2.1.4 Assembling

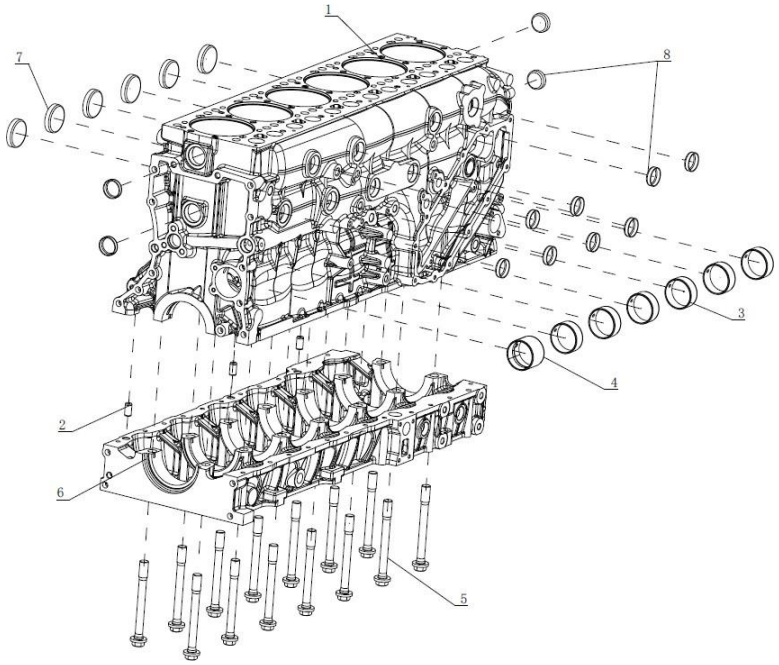
Assembling steps are contrary to disassembling ones.

2.1.5 Service Key point

1. Assembling: Crankcase around the tight bolt tightening torque were：8.8 bolts, tightening torque of 22 N·m ~ 29 N·m; 10.9 bolts, tightening torque 29 N·m ~ 35 N·m;
2. Assembling: cylinder liner should be carefully checked before assembly, to see if there arecracks and clean cylinder liner, the use of special tooling into the cylinder bore, press the outer surface of the front cylinder coating molybdenum powder, cylinder liner protruding amount（0.05~0.10）mm.
3. Check the body of the processing surface, the processing surface should be no glitches, oil, bump and so on, with Whetstone, sandpaper towels, etc. removed.
4. Check the body of the oil, waterways, cavities and other places without iron, burrs, flash, etc.,with air gun, iron brush to remove clean.
5. Requires no sealing surface sealing.

2.2 Steps to Assemble and disassemble Engine Block Module

2.2.1 Exploded View of Engine Block Module



1. Cylinder block
2. Internal thread cylindrical pin
3. Camshaft bushings
4. Rear camshaft bushing
5. Main bearing bolts
6. Crankcase
7. Bowl plug
8. Bowl plug

Fig. 2- 2 Exploded View of Engine Block Module

2.2.2 Preparation before disassembly

1. Equipment conditions: Socket wrench, copper hammer and so on
2. Preparation before disassembly: Remove gearbox and clutch, remove flywheel, flywheel housing, gear housing and oil pan

2.2.3 Dismantling

1. Disassemble the internal thread cylinder pin.
2. Remove camshaft bushings.
3. Remove the main bearing bolts and crankcase bolts.
4. Remove the crankcase.

2.2.4 Assembling

Cylinder pre-assembly and assembly steps and cylinder block pre-assembly and disassemblysteps.

2.2.5 Service Key point

1. Disassembly: Use special tools to disassemble the camshaft bushing, pay attention to protect the other bushing during disassembly.
2. Assembly: Before assembly, carefully check the inner surface of the camshaft bush for scratches, replace if necessary. Camshaft bushing oil hole alignment body camshaft bottom hole oil hole.
3. Assembly: clean the crankcase before assembly plane, the crankcase on the plane to be coated sealant.
4. Assembly: The main bearing bolts are symmetrically fastened in the order shown in Figure 2-3, first tighten by pneumatic wrench, next tighten to the torque of 80Nm, then tighten to 140Nm, after this tighten bolts in the specified sequence by 90°, last tighten by 60° to finish assembly. Before assembly in the crankcase bearing surface and the main bearing bolt threaded parts brushing clean lubricant.

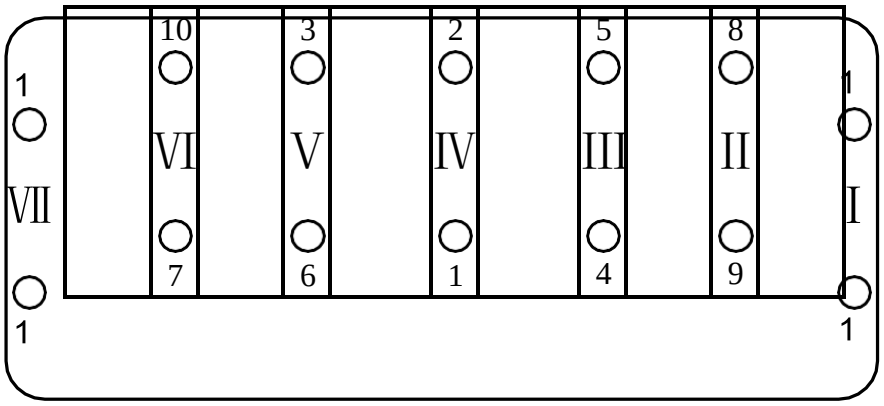
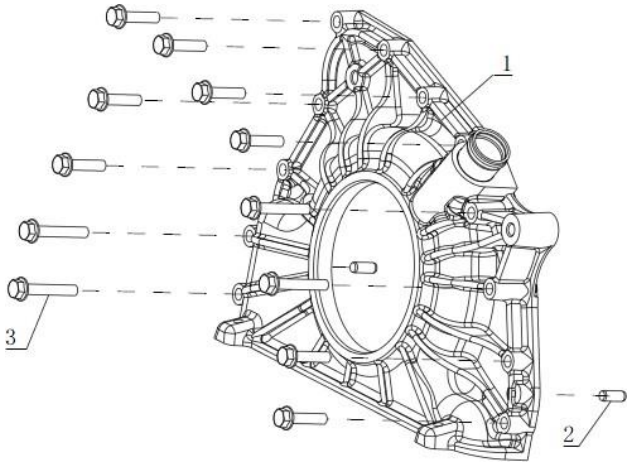


Figure 2-3 Main bearing bolt tightening order

2.3 Front cover disassembly and assembly

2.3.1 Exploded view of front cover



1 front cover 2 Pin 3 Hex flange bolts

Figure 2-4 Exploded view of front cover

2.3.2 Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Preparation before disassembly: Remove the front attachment

2.3.3 Dismantling

1. Remove the front cover fastening bolt.
2. Remove the front cover.
3. Remove the front cover seal.

2.3.4 Assembling

The front cover assembly procedure is the opposite of the front cover removal procedure.

2.3.5 Service Key point

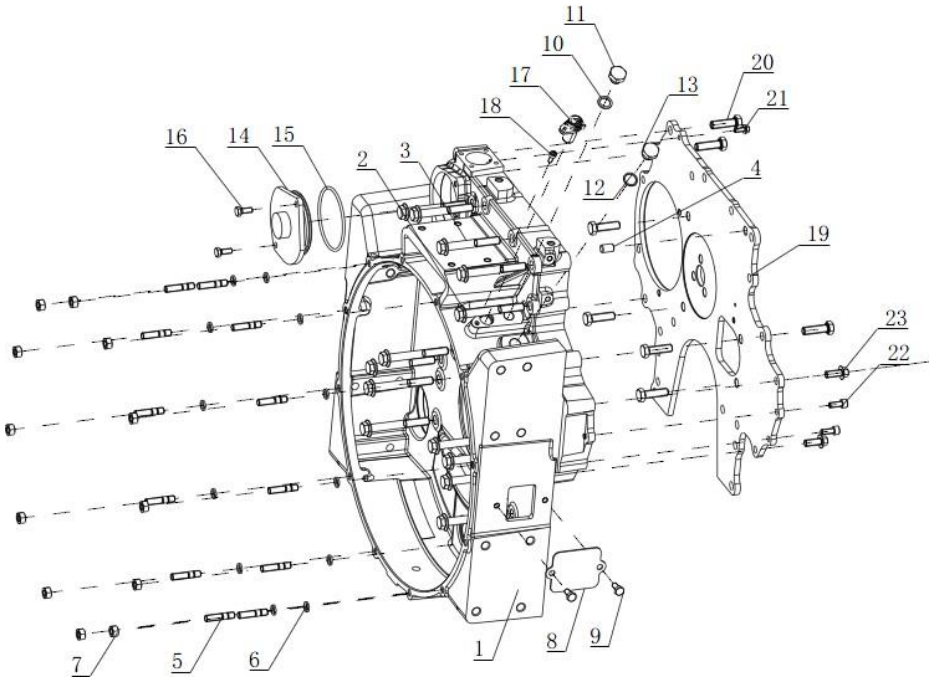
1. After the front cover is removed, it should be placed in a clean environment. Before assembly, it is necessary to check whether the inside of the front cover has greater dirt to ensure the front cover is tidy.

2. Before assembling the front cover, apply the sealant on the bonding surface of the body, and the glue line should be continuous.

   Check the seal for damage, if damaged need to be replaced with new parts. When assembled, the seal must be pressed fully into the front cover groove.

2.4 Assembly and disassembly of flywheel housing

2.4.1 Exploded view of flywheel housing



1. Flywheel shell
2. Hexagon flange bolts to increase the series
3. Hex flange bolts to increase the series
4. Cylindrical pins
5. Studs
6. Spring washers
7. Hexagon nut
8. Observation hole cover
9. Hexagon head bolt
10. Gasket
11. Hex head screw
12. Washer
13. Hexagon socket head cap
14. Hydraulic pump cover
15. O-ring rubber seal
16. Hex head bolt
17. Speed sensor
18. Hexagon head Screw
19. Flywheel shell connector plate
20. Hex head bolt
21. Hex flange bolts to increase the series
22. Hex socket head cap screws
23. Hex flange bolts

Figure 2-5 Exploded view of flywheel housing

2.4.2 Preparation before disassembly

1. Equipment conditions: Socket wrench

2. Preparation before disassembly: Remove transmission and clutch, remove flywheel.

2.4.3 Dismantling

1. Remove the hydraulic pump cover fastening bolt and remove the hydraulic cover.

2. Remove the observation hole cover fastening bolt, remove the observation hole cover.
3. Remove the flywheel housing stud along the outside.
4. Remove the flywheel housing fastening bolt according to the diagonal loosening sequence.
5. Remove the flywheel housing, cylinder pin and rear oil seal.

2.4.4 Assembling

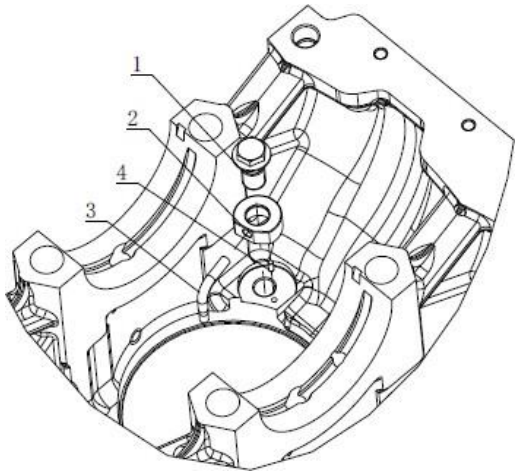
The flywheel housing assembly step is the opposite of the flywheel housing removal step.

2.4.5 Service Key point

1. The flywheel housing bolts are pre-glued, symmetrically tightened, oiled on the bolt flange before assembly, and the flywheel housing bolts are reusable twice.
2. During installation, a uniform sealant should be applied on the joint surface of the cylinder block and the flywheel housing, and the application of glue should be continuous and uniform. Hoisting the flywheel shell to prevent knock bumps.
3. Flywheel housing bolt in the thread and pressure surface with lubricating oil, into the threaded hole diagonal bolt. Tightening torque is 110N.m~140N.m

2.5 Assembly and disassembly of piston nozzle

2.5.1 Exploded view of piston nozzle



1. Hollow bolt
2. Nozzle body
3. Piston nozzle
4. Cylindrical pin

Figure 2-6 Piston cooling nozzle disassembly

2.5.2 Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Preparation before disassembly: Remove the crankcase, crankshaft, and other components.

2.5.3 Dismantling

1. Remove the hollow bolt.
2. Remove the nozzle assembly.
3. Remove the cylinder pin.

2.5.4 Assembling

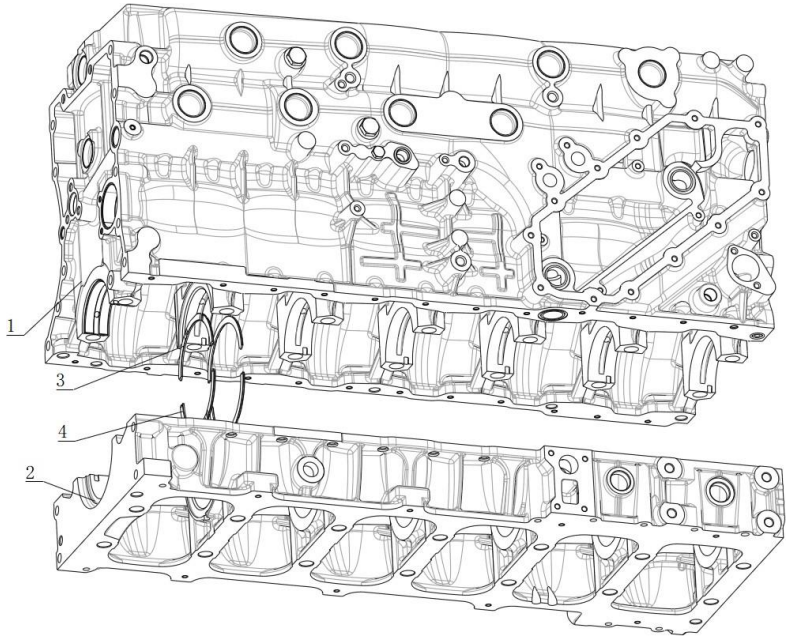
The order of assembly is the opposite of the disassembly sequence.

2.5.5 Service Key point

1. Hollow bolt tightening torque (20 ~ 30) N m.
2. Before assembly, check if the dowel pin is defective and replace if necessary. Align the locating pin with the body pin hole and tap the nozzle body with a copper hammer so that the locating pin is completely inserted into the body pin hole.

2.6 Assembly and disassembly of thrust plates

2.6.1 Exploded view



1. Cylinder block
2. Crankcase
3. Upper thrust plate
4. Lower thrust plate

Figure 2-7 Thrust piece dismantling map

2.6.2 Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Preparation before disassembly: Remove the crankcase, crankshaft, and other components.

2.6.3 Dismantling

1. Remove the crankcase.
2. Remove the crankshaft.
3. Remove thrust plate.

2.6.4 Assembling

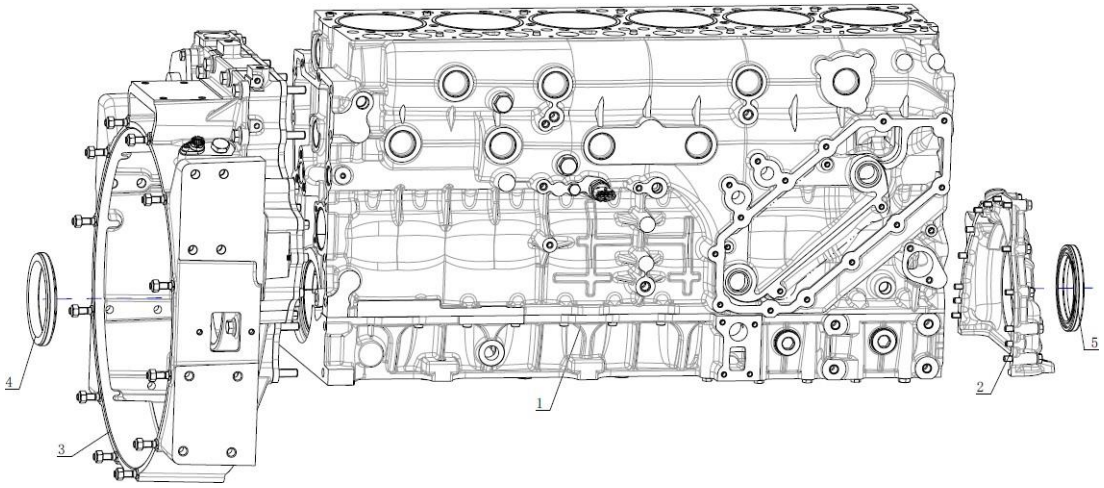
1. Assemble the crankshaft.
2. Fit thrust plate (no ears).
3. Fit thrust plate.

2.6.5 Service Key point

Thrust piece to be used in pairs. Assembly, the first crankshaft into the body, the installation of thrust washer (no ears), the thrust washer coated grease, attached to the crankcase, together withthe crankcase assembly. Throttle washer side points to crank arm side.

2.7 Assembly and disassembly of oil seal

2.7.1 Exploded view



1. Body combination group
2. Front cover
3. Flywheel housing
4. Rear oil seal
5. Front oil seal

Figure 2-8 Oil seal dismantling map

2.7.2 Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Preparation before disassembly: Remove the crankcase, flywheel housing

2.7.3 Dismantling

1. Remove the front cover.
2. Remove the front oil seal.
3. Remove the flywheel housing.
4. Remove the rear oil seal.

2.7.4 Assembling

1. Assemble the front cover.
2. Assemble the front oil seal.
3. Assembled flywheel housing.
4. Assemble the rear oil seal.

2.7.5 Service Key point

1. Oil seal is no longer used after disassembly.
2. Oil seal assembly before cleaning holes and oil seals, do not allow dirt. Oil seal assembly using special tools, the oil seal into the smooth. Before assembly, oil seals and press tools need to be lubricated.

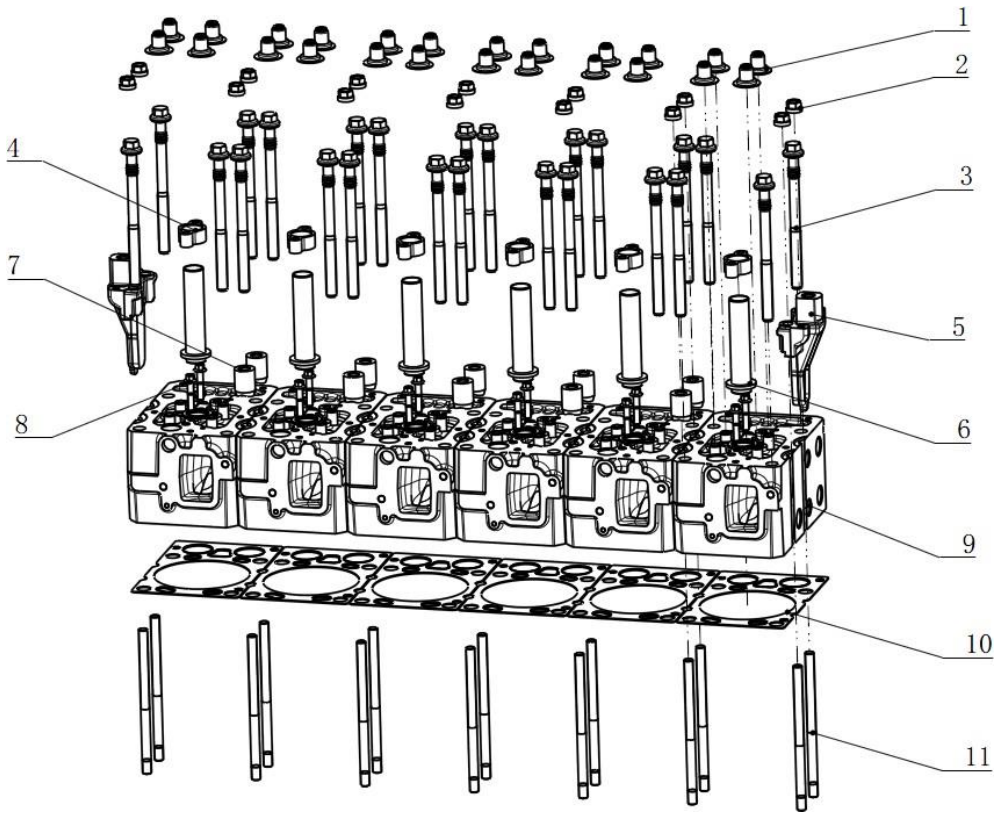
3 Cylinder Head Group

3.1 Cylinder Heads Assembly and Disassembly

3.1.1 Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Preparation before disassembly: Remove the cylinder head cover, intake pipe, exhaust pipe.

3.1.2 Exploded view



1. Valve Gland
2. Shoulder Nut
3. Cylinder Head Bolt
4. Ignition Coil Bushing Plate
5. Ring Clamping Block
6. Ignition Coil Bushing
7. Clamping Block 8-Bolt
8. Cylinder Head Sub-Assembly
9. Cylinder Head Gasket
10. Bolt

Figure 3-1 Exploded view of cylinder head

3.1.3 Cylinder Heads Disassembly Procedure

1. Loosen and remove the eyebolts on both ends of the engine.

2. Loosen the cylinder head bolt and nut, and remove the clamping block, clamping block has three structures: one is mounted between the two cylinder head cylindrical clamping block, mounted on a bolt; the second Kinds for the assembly of the engine at both ends, only mounted on a cylinder head clamping block, mounted on the two bolts above, you can install the rings block; the third is installed on both ends of the engine, only installed in a cylinder Cover the clamping block, mounted on a bolt ;
3. Loosen the cylinder head main bolt and remove the main bolt and place it in place.
4. Remove the ignition coil bushing, release the ignition coil bushing mounting plate bolts, remove the ignition coil bushing, remove the O-ring.
5. Remove the cylinder head and place the removed cylinder head on the board to avoid
6. wearing the combustion chamber upper surface and other sealing surfaces. If you need to remove more than one-cylinder head cylinder head number marked on the cylinder for subsequent analysis of the problem.
7. Remove the cylinder head gasket, if the removal of multiple cylinder head gasket needs to indicate the cylinder head cylinder serial number for subsequent analysis of the problem.
8. If the cylinder head bolt needs to be replaced or needs to be checked, remove the cylinder head bolt.
9. Demolition of rocker seat, into the exhaust valve and other gas institutions.
10. To check or replace the valve stem gland, remove the valve stem gland, use a special tool to remove the valve stem gland, or clamp the outer sidewall of the valve stem gland with a pair of pliers, and rotate to extract the lower valve stem Gland, valve stem gland removed after dismantling cannot be used repeatedly.

3.1.4 Cylinder Heads Assembly Procedure

1. Assemble cylinder head bolt.

1) Cylinder head bolt allows the use of 3 times, after 3 times, please replace the new parts.
2) Installed in the first row of the oil cooler cap assembly side of the cylinder head bolt screwed into the end (short thread end) coated with anaerobic thread locking agent 262.

3. Clean the threaded hole on the cylinder body.
4. Tighten the bolts, tightening torque: (20+10) N·m.

2. Assemble cylinder head gasket.

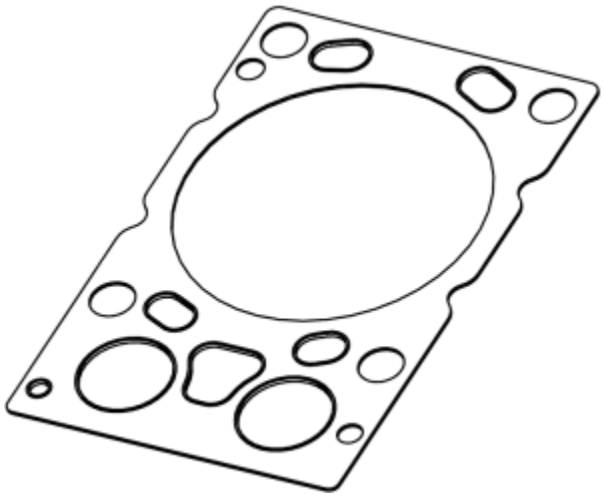


Figure 3-2 Cylinder head gasket

1) Cylinder head gasket can only be used once, in case of repair, you must replace the newparts.
2) Wipe cylinder liner wall, and coated with clean oil, clean the plane body, and then put thecylinder head gasket in accordance with the corresponding pin hole.
3) Check the cylinder head gasket on each hole and the cylinder on the hole alignment,check the cylinder head gasket assembly is correct.

3. Assembly valve stem gland

1) Valve stem gland only allowed to use once, in case of repair must be replaced by new parts.
2) Check the valve stem seal sleeve without defects, the valve stem seal sleeve spring is intact.
3) In the valve guide to install valve stem seal sleeve.
4) In the valve stem seal sleeve lip lubricants.
5) Valve stem seal sleeve assembly tools and rubber hammer smashed valve stem gland.

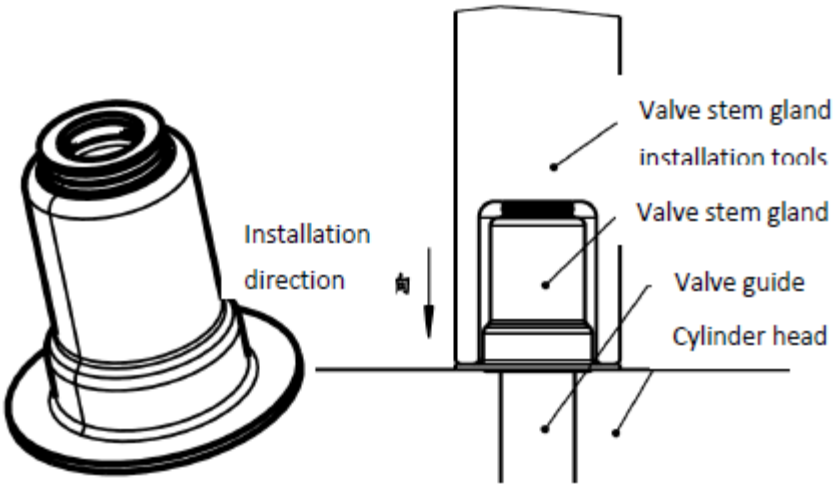


Figure 3-3 Valve stems gland and its installation and installation

4. Assemble the cylinder head

1) Carefully clean the cylinder head, to ensure that no dust, debris, sand and other dirt, andthen wipe the cylinder head plane.
2) Check the cylinder head airway, waterways no foreign body, check the cylinder withoutforeign matter, cylinder head gasket and cylinder head plane cleaning.
3) Cylinder head bolt fastening before the cylinder head with pin - surface positioning.
4) Assembly cylinder head.

5. Assemble the clamping block

1) Wipe the clamping block.
2) Clamp block in the support surface coated with clean oil, according to the disassembly position in turn mounted on the cylinder head, oiled to the right amount to prevent the flowof lubricant into the gap between the cylinder head;
3) Clamp clamping folder to allow the direction of the groove and cylinder head gap betweenthe same direction.
4) Hand cylinder head bolt nut screwed into the cylinder head bolt.

6. Assemble cylinder head bolts

1) Cylinder head bolts allow 3 times.

2) In order, align the cylinder head with the cylinder head and cylinder head bolt and clampingblock with appropriate amount of clean lubricant on the thread and shoulder pressure surface of the main cylinder head bolt and shoulder nut.
3) Tighten the main bolts in the specified sequence to the torque of 60±6Nm.
4) Tighten the nuts of auxiliary bolts in the specified sequence to the torque of 25±3Nm.
5) Tighten the nuts of auxiliary bolts in the specified sequence by 120º±5º. Then makemarks on the nuts.
6) Tighten the main bolts in the specified sequence by 120º±5º. Then make marks on thebolts.
7) Tighten the nuts of auxiliary bolts in the specified sequence by another 120º±5º
8) Tighten the main bolts in the specified sequence by another 120º±5º
9) Tightening sequence of cylinder head bolts is shown in Figure 4-16. Tighten the auxiliarybolts (studs) numbered M12 × 1.5 for numbers 1 to 14; and tighten the main bolts numbered 15 to 38.

NOTE:

- The engine MUST be barred over three complete rotations before starting theengine once new cylinder heads are installed.

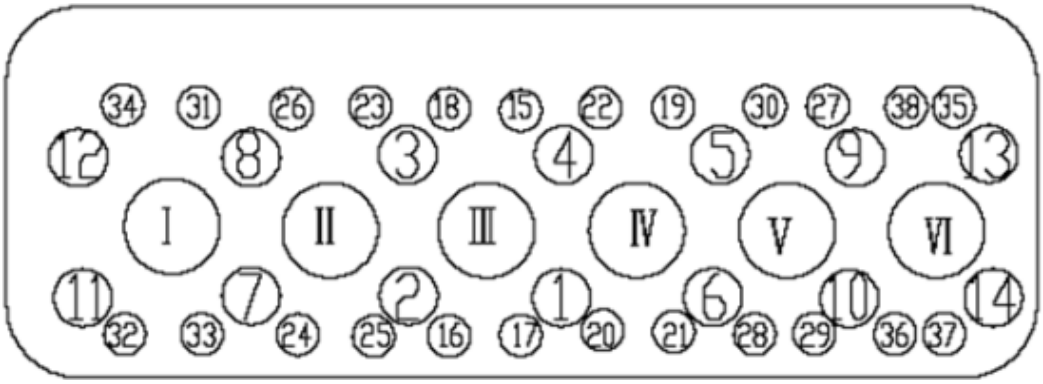


Figure 3-4 Fan side flywheel side

2. Assemble the ignition coil bushing

O-ring coated Ke Bang 680 plastic, and placed in the cylinder head gasket groove, into the ignition coil bushing, and ignition coil bushing pressure plate to suppress ignition coil bushing,tighten the mounting screws.

3.1.5 Cylinder head inspection and maintenance

1. Before removing the cylinder head cover first check cylinder head and body joints with no water leakage, oil leakage, air leaks and other abnormal phenomena. If any such problems, replace the new cylinder head gasket to see if the problem is solved, the cylinder head gasketdisassembly method, see this section.
2. Check the cylinder head appearance, fine check cylinder discoloration and cracks, if cracksare found, the color inspection
3. Before disassembly, check whether there is any oil leakage in the oil inlet pipe and check whether the oil inlet pipe itself is cracked, worn or corroded. If there is a crack, you need to change the oil into the oil pipe. Analysis of the corrosion affecting reliability is needed Cause and replace the new lubricant into the tubing. If the oil leakage appears in the hollow bolt, youneed to replace the hollow bolts, combination ferrules, tighten, and then check for oil leakage.
4. Before disassembly and disassembly of the valve, check the valve sinking amount, the valve sinking amount is the vertical distance from the bottom surface of the valve cylinder to the bottom of the cylinder head, and the difference between the valve sinking amount measurement value and the valve sinking amount requirement value can indirectly reflect thevalve and valve seat Wear level. You can use the depth micrometer to measure the amount ofvalve depression, as shown in Figure 4-13：

Figure 3-5 Depth micrometer

Refer to Table 3-3 for the required value of valve sinking. If the amount of valve sinking exceeds the allowable range, the cylinder head needs to be replaced to ensure the reliability of the gas generator. If the valve does not sink more than the allowable value, remove the valvecheck valve and valve seat sealing surface, check valve and valve seat sealing surface for obvious wear and tear and abnormal damage.

Table 3-3 Valve Depression Requirements

	Valve Depression Requirements（mm）
Intake	-0.2~0.2
exhaust	-0.22~0.22

5. After disassembling the valve body, check the condition of the cylinder head into the exhaust port to see if there is any water leakage. If there is any such problem, it should be washed and shaded. To confirm the problem position, you need to replace the new cylinder head.
6. Clean the cylinder head, focus on cleaning the surface of the combustion chamber, seat, intake and exhaust valves, inlet and outlet channels, remove the surface area of carbon and viscose, and check the surface condition.
7. Check the diameter of the valve guide tube, valve guide tube valve inner diameter of the contact surface with the valve movement, if the valve guide tube diameter due to wear exceeds the allowable value, it will affect the valve guide effect to reduce the reliability of the engine work. Measuring the diameter of the valve guide can be measured using an ID micrometer, as shown in Figure 4-14. The allowable range of valve guide diameter is: (9.0 ~ 9.015) mm, the cylinder head needs to be replaced if the allowable range is exceeded to ensure the reliability of engine operation.

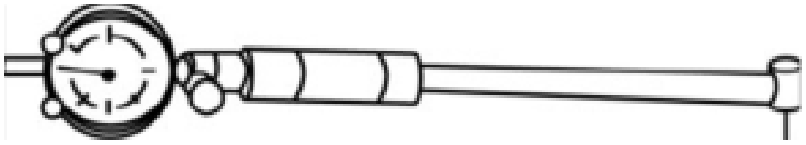


Figure 3-6 Micrometer inside diameter

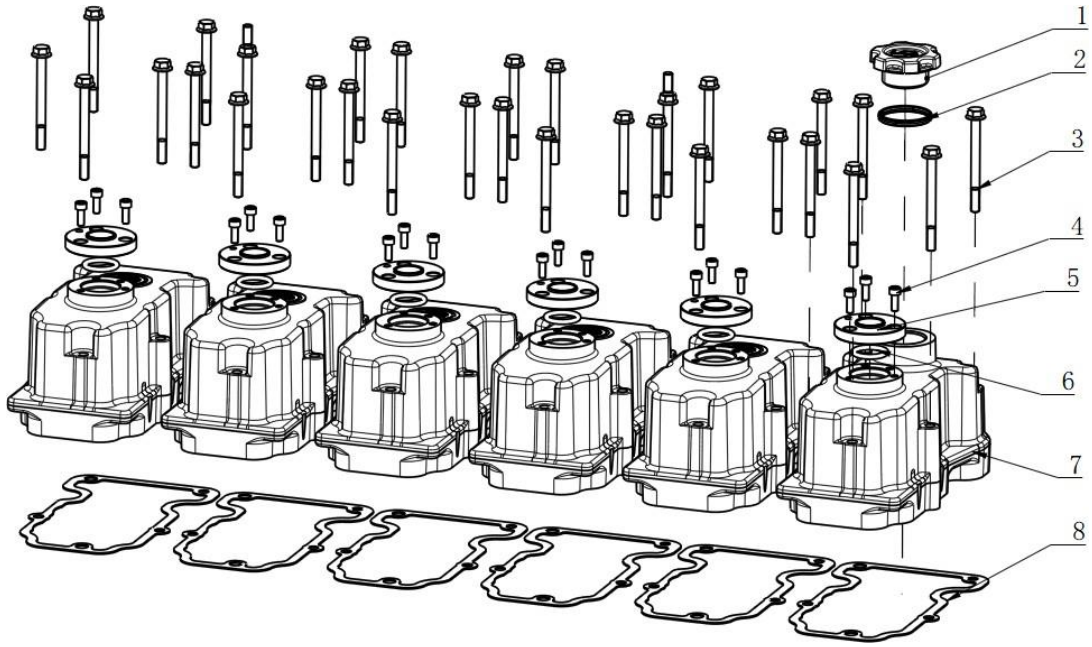
1. Remove the cylinder head gasket and check for visible damage to the cylinder head gasketand analyze the cause.
2. Before disassembling, check the valve stem seal rubber sleeve mouth for any damage, springfailure and other anomalies.

3.2 Disassembly and assembly of cylinder head cover

3.2.1Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Preparation before disassembly: Remove the pipe clamps and brackets that are bolted usingthe cylinder head cover bolts.

3.2.2Exploded view of cylinder head cover



1. Plus Oil Cap
2. Ring
3. Hex Flange Bolts
4. Hexagonal Head Cap Screws
5. Cover
6. Rubber Seal
7. Cylinder Head Cover
8. Cylinder Head Cover Gasket

Figure 3-7 Exploded view of cylinder head cover

3.2.3Cylinder head cover removal procedure

1. Loosen the cover mounting bolt, remove the O-ring, and remove the cover.
2. Loosen the filler cap, remove the seal.
3. Loosen the cylinder head cover bolts and remove the bolts and washers.
4. Remove cylinder head cover and cylinder head cover gasket vertically.

3.2.4Cylinder head cover assembly steps

1. Before installing the cylinder head cover gasket Check the new cylinder head gasket does notmanufacture and use defects and damage.
2. Wipe the upper surface of the cylinder head, followed by proper assembly of the cylinderhead gasket.
3. Clean the cylinder head cover, followed by the correct installation of the cylinder head.
4. Install the cylinder head cover bolts, tighten, tighten the torque（10～15）N·m.
5. Put the O-ring in the groove, lower the cover and screw in the cover mounting bolt.
6. Install the seal ring and the filler cap onto the cylinder head cover in turn.

3.2.5Cylinder head cover inspection and maintenance

Key Point 1:

Assembly

Cylinder head cover shims should only be used once, when replacement, new parts should bereplaced.

Key Point 2:

Inspection

1）Check the cylinder head cover itself for cracks and other damage, if there is a crack, you needto replace the new cylinder head cover.

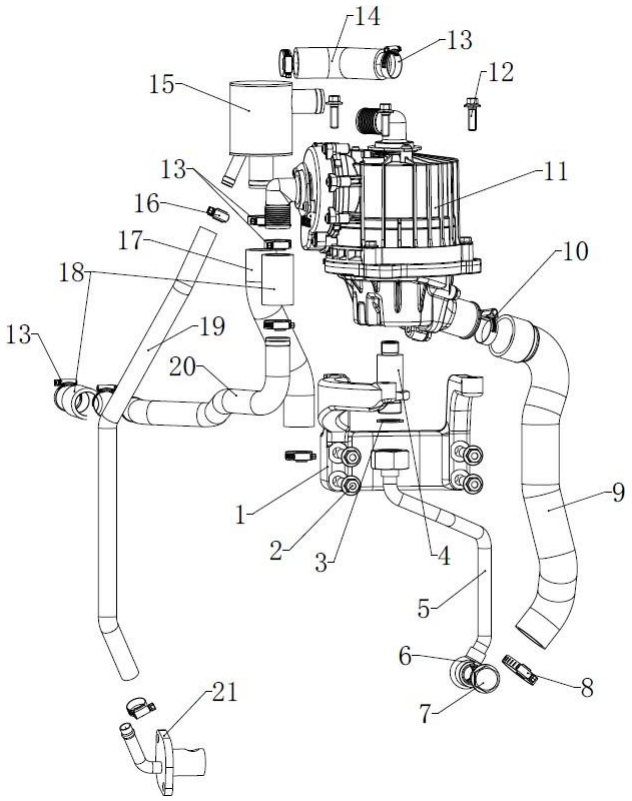
2）Leakage of oil at cylinder head gasket should be checked for cylinder head gasket failure andreplacement of new cylinder head gasket.

3.3 Oil and gas separator dismantling and assembly

3.3.1 Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Preparation before disassembly: Remove the radiator, cylinder generator and its bracket

3.3.2 Oil and gas separator assembly disassembly diagram



1 Oil and Gas Separator Bracket	13 Clamp
2 Hexagonal Flange Bolts	14 Intake Pipe
3 Combination Gasket	15 Oil and Gas Pre-Separator
4 Screw Structure	16 Card Hoop
8 Clamp	17 Intake Pipe
9 Oil Return Pipe	18 Connection Hose
10 Clamp	19 Return Pipe
11 Oil and Gas Separator	20 Exhaust Pipe
12 Hex Flange Bolt	21 Oil Separator Return Pipe

Figure 3-8 Oil and gas separator dismantling map

3.3.3 Oil and gas separator removal steps

1. Disassemble the inlet pipe 17, the outlet pipe 20, the pre-oil separator 15 of the oil-gas separator, the clamp of the inlet pipe 14, and remove the hoses.
2. Remove the oil and gas separator back to the oil pipe 19, return pipe clamp 9, the hose removed.
3. Remove the oil and gas separator and the oil separator gas pipe, return pipe fixed clamp, the hose access.
4. Remove the oil and gas separator drive oil inlet pipe 5 fixing nut and hollow bolt, remove the inlet pipe.
5. Remove the oil and gas separator fixing bolts 12, remove the oil and gas separator.
6. Remove the oil and gas separator bracket fixing bolt 2, Remove the oil and gas separator bracket.

3.3.4 Oil and gas separator inspection and maintenance

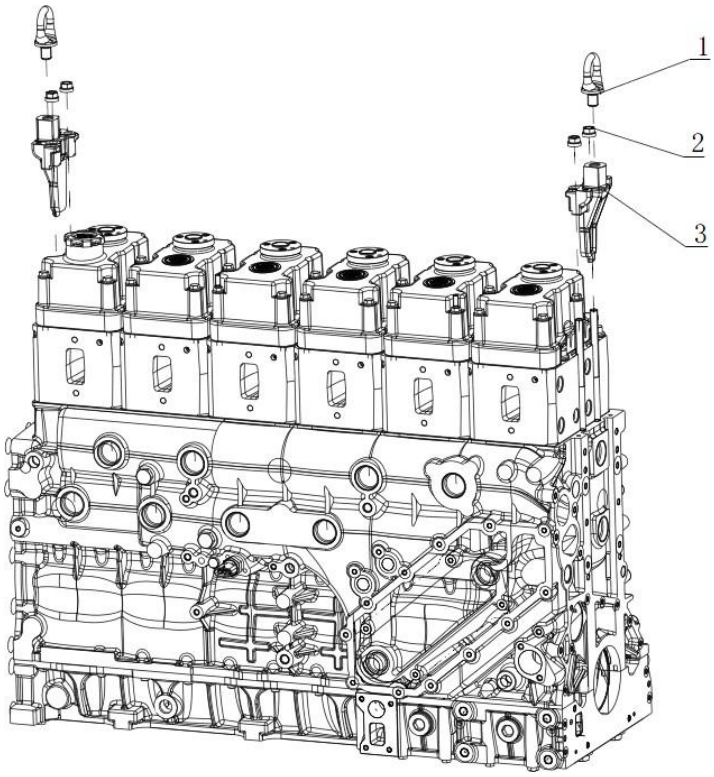
1. Check the appearance of the various components to see if there are any broken parts, cracks, etc., and the failure modes of the hose hardened and cracked. If there is the above problem, replace the corresponding parts.
2. You can check whether the oil separator is smooth by inflating the inlet pipe of the pre-separator. If the air flow is not smooth, you can pass the large pressure air to the pipe joints of the separator to eliminate the impurities in the oil separator. Clean up and clear. If you do this, the pre-splitter is still not clear, and you will need to replace the new pre-splitter.
3. You can check whether the oil separator is smooth by inflating the inlet pipe of the oil
4. separator. If the air flow is not smooth, you need to replace the new oil separator.

3.3.5 Oil and gas separator assembly steps

In contrast to the assembly and disassembly steps of the oil and gas separator, make sure that thepositions of the hoses and the connectors are correct according to Figure 4-16. At the same time,pay attention to ensure the rotation angle when the hoses are installed, and the fixed position is consistent with the engine.

3.4 Lifting Lugs Assembly and Disassembly

3.4.1 Lifting Lugs Exploded View



1- Rings
2- Shoulder Nut
3- Rings Clamping Block

Figure 3-9 Lifting Lugs Exploded View

3.4.2 Lifting Lugs Disassembly Procedure

Loosen and remove the lifting lugs.

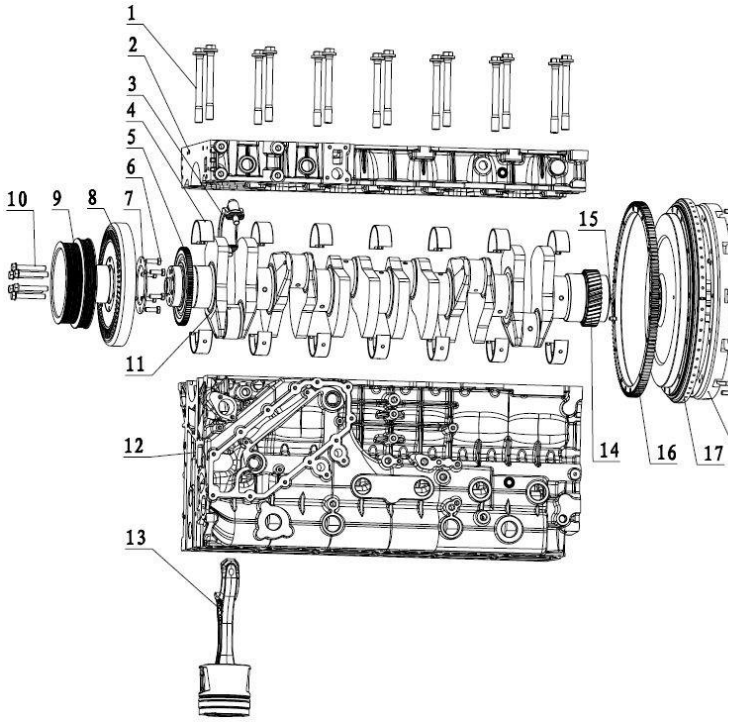
3.4.3 Lifting Lugs Assembly Procedure

Check the lifting lugs and standoffs for any damaged threads. Replace either if damage is found. Tighten the lugs after installing them.

4 Crank-rod mechanism

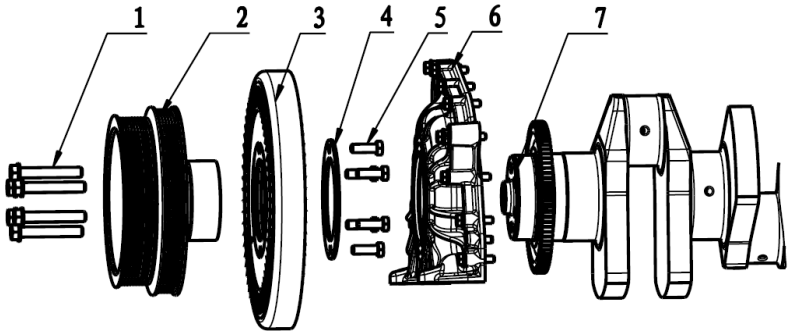
4.1 Shock absorber, crankshaft pulley disassembly and installation

4.1.1 Exploded view



1. Main bearing bolts
2. Crankcase
3. Connecting rod cover
4. Main bearing assembly
5. Oil pump gear
6. Shock absorbers bolts
7. Gasket
8. Torsional vibration damper
9. Crankshaft pulley
10. Hex head bolt
11. Crankshaft
12. cylinder block
13. Piston rod combination group
14. Crankshaft timing gear
15. Pin
16. Flywheel gear ring
17. Flywheel
18. Flywheel connecting ring
19. Flywheel bolts
20. Hex head bolt

Figure 4-1 Exploded view of crank-rod mechanism



1. Pulley bolt
2. Crankshaft pulley
3. Shock absorber
4. Gasket
5. Shock absorbers bolts
6. Front cover
7. Crankshaft

Figure 4-2 Shock absorbers, crankshaft pulley dismantling map

4.1.2Preparation before disassembly

1. Equipment conditions: torque wrench
2. Preparation before disassembly: Removed fan, belt, tensioner and other parts

4.1.3Dismantling

1. Unscrew the pulley bolt (1) and remove the pulley assembly.
2. Unscrew the shock absorber bolts (5), separate the crankshaft pulley (2), shock absorber (3), washer (4).

4.1.4Inspection

1. Check the shock absorber bump, deformation and so on.
2. Check the pulley is damaged, the bolt to crush if there is crush.
3. Check pulleys bolts for damage.

4.1.5Installation

The reverse order of disassembly

4.1.6Service Key point Key Point：

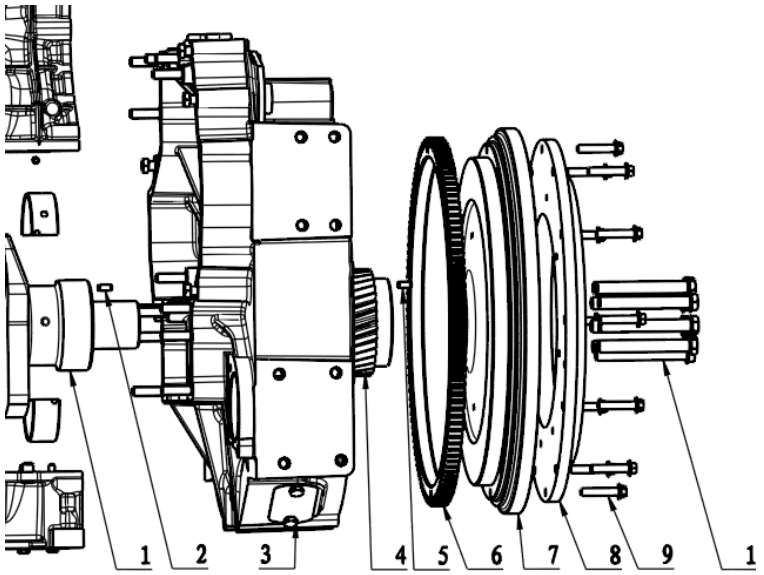
Assembly

Apply a clean lubricant to the bolt threads and to the support surface prior to assembly.

Bolt symmetrical tightening. Shock absorber bolts M10-10.9 bolts, tightening torque (60 ~ 70) N·m; crankshaft pulley bolts M12 × 1.5-10.9 special bolts, pre-tightening 45 N·m, and then turn135 °.

4.2 Flywheel, flywheel gear ring, flywheel connection plate removal and installation

4.2.1Exploded view



1. Crankshaft
2. Pin
3. Flywheel shell
4. Crankshaft timing gear
5. Pin
6. Ring gear
7. Flywheel
8. connection plate
9. Connecting bolt
10. Flywheel bolts

Figure 4-3 Exploded view

4.2.2Preparation before disassembly

1. Equipment conditions: torque wrench, oil seal press equipment
2. Disassembly Preparation: The generator and other components have been removed

4.2.3Dismantling

The opposite of the installation sequence

4.2.4Inspection

1. Flywheel bolts, connecting bolts with or without thread damage.
2. Flywheel, connecting plate surface with or without crushing.
3. Flywheel ring without damage.

4.2.5Installation

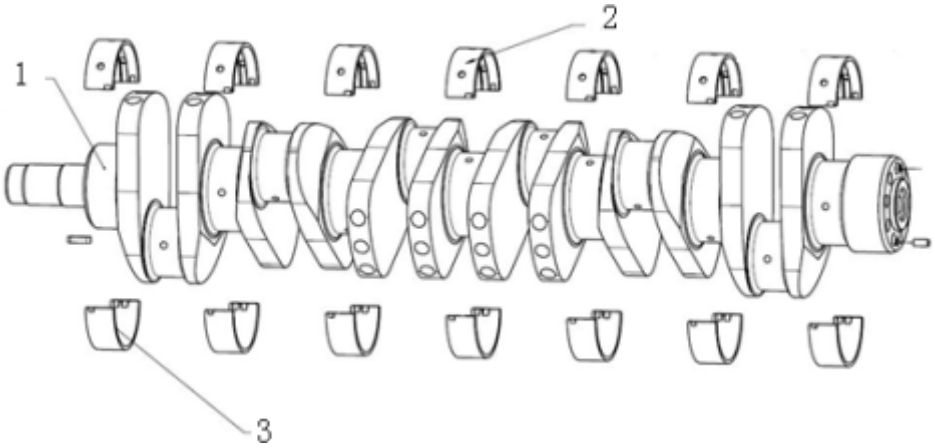
1. Fit the ring gear (6) and the flywheel coupling plate (8) to the flywheel (7) and tighten the connecting bolt (9) diagonally.
2. Insert the cylindrical pin (2) at the rear end of the crankshaft (1), install the crankshaft rear oil on the crankshaft gear (4), and press the rear oil seal into the rear oil seal.
3. Punch the cylinder pin (5) onto the crankshaft timing gear (4).
4. After inserting the flywheel guide rod in the crankshaft bolt hole, install the flywheel assembly and tighten the flywheel bolt diagonally (10).

4.2.6Maintenance points

1. Lubricate the bolt thread and pressure surface.
2. The flywheel bolts are special bolts M16 × 1.5. After the flywheel bolts are installed diagonally, the torque is 105 (0, + 20) Nm, then rotate two 90 °

4.3 Crankshaft bearing disassembly and assembly

4.3.1Exploded view



1. Crankshaft
2. Main Bearing on The Tile
3. Main Bearing on The Tile

Figure 4-4 Exploded view

4.3.2Preparation before disassembly

1. Equipment conditions: no special tooling, to be prepared to mark the marker
2. Disassembly Preparation: Remove the front and rear pulley and flywheel combination group,remove the crankcase, the cylinder block is fixed to the rotating bracket, the crankshaft hanging.

4.3.3Dismantling

Push the bearing bush from the side by hand and mark the disassembled bearing bushcorresponding to the seat hole of the body and the crankcase.

4.3.4Installation

1. First, the main bearing bush and the bottom hole cleaning, wipe clean.

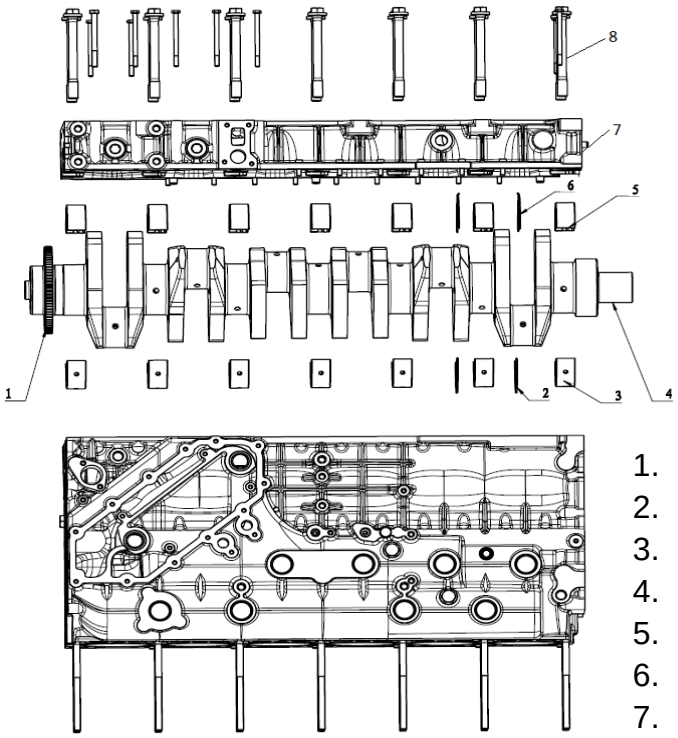
2. If there is no new bearing, the assembly should be loaded into the body (upper tile) and the crankcase (lower tile) in the order of the time when the original bearing was removed, pay attention to distinguish the upper and lower tiles and the upper tile with the oil groove;, Install directly. Pay attention to the lip alignment during installation and coated with a small amount of oil.

4.3.5Maintenance points

1. Clean the bearing, check the bearing wear.
2. Check whether there is bearing metal flaking, positioning lip damage and lateral cracks.

4.4 Crankshaft removal and installation

4.4.1Exploded view



1. Oil pump gear
2. Upper thrust plate
3. Main bearing lower shell
4. Crankshaft
5. Main bearing upper shell
6. Lower thrust plate
7. Crankcase
8. Main bearing bolts

Figure 4-5 Exploded view

4.4.2Preparation before disassembly

1. Equipment conditions: torque wrench, driving, air gun, towel
2. Disassembly Preparation: Remove the oil pan, piston rod, flywheel, pulley and so on

4.1.1Dismantling

1. With the engine crankcase (7) facing up, remove the main bearing bolts (8) and place them to lift the crankcase (7).
2. Lift the crankshaft (4), remove the front and rear thrust washers (2, 6); place the crankshaft on the bracket (if placed too long, the crankshaft should be placed vertically).

4.1.2Inspection

1. Crankshaft main journal, connecting rod neck fillet whether there is a crack; crankshaft and bearing joint inspection; check to clear the oil passage, whether there is a crack and other anomaly.
2. Check the main journal, connecting rod neck presence or absence of line-shaped grinding, metal flaking and cracks.
3. Check the crankshaft and seal with the wear and tear.
4. Check the main bearing bolt thread failure.
5. Crankshaft flange bolt holes for cracks.
6. Crankshaft journal wear, crankshaft bending, distortion.

4.1.3Installation

1. Hang the crankshaft (4) on the support. Avoid knock bumps.
2. Insert a cylindrical pin in the rear pin hole of the crankshaft (4).
3. The oil pump gear is hot mounted on the crankshaft and supplied to the assembly. To ensure the good work of the oil pump gear, it is recommended to replace the crankshaft assembly when replacing. In the case of special circumstances need to be replaced oil pump gear, be sure to pay attention to gear heating temperature and placement distance: heating oil pump gear (1) to (190 ~ 200) ℃, and then push it into the front of the crankshaft (4). Ensure that the gear outer end to the crankshaft front end of the size (26.5 ± 0.3) mm (special tooling required).
4. Check the crankshaft with or without knock bumps, if necessary, remove or replace. Purge the oil chamber with compressed air to make the oil passage clean and open.
5. Remove the oil from the underside of the cylinder block with detergent and wipe with a towel.

   5-1, Should ensure that the cylinder block with a clean and burr-free.
6. Clean with a detergent and wipe the bottom hole of the cylinder main bearing with a towel, then press the main bearing on the tile (3) into the bottom hole.
7. Lifting the crankshaft parts, blowing clean the oil passage with compressed air and wipe the spindle journals and connecting rod journals with a towel, and then gently into the cylinder block, so that the main journal fell into the bearing.

   7-1 , before loading the crankshaft, the inner surface of the main bearing tile (3) coated withlubricating oil.

   7-2 , carefully check before cranking the crankshaft bump each friction bump, if necessary, to be cleared.

   7-3 , lifting knock is not allowed to bump injury.

   7-4 , before loading the oil hole should be determined, the friction pair be cleaned.
8. Insert the top thrust plate (2), noting that the thrust plate groove faces outward (toward the crankshaft). Thrust piece before loading with the bearing cap surface coated with lubricating oil.
9. Spindle neck clean lubricant.
10. Plane under the plane of the cylinder glue, glue line to ensure continuous and uniform. Based on ensuring smooth oil seal and no distortion, put the O-ring flatly into the groove of the lubricating oil seal in the lower plane of the cylinder block.
11. Insert the main bearing (5) and the lower thrust plate (6) into the crankcase (7) with the oil groove facing the crankshaft to assemble the crankcase (7).
12. Apply clean lubricating oil to the bolt bearing surface of the crankcase (7) and to the threaded part of the main bearing bolt (8), loosen the main bearing bolt (8), and then pre-tighten all main bearing bolts as follows:

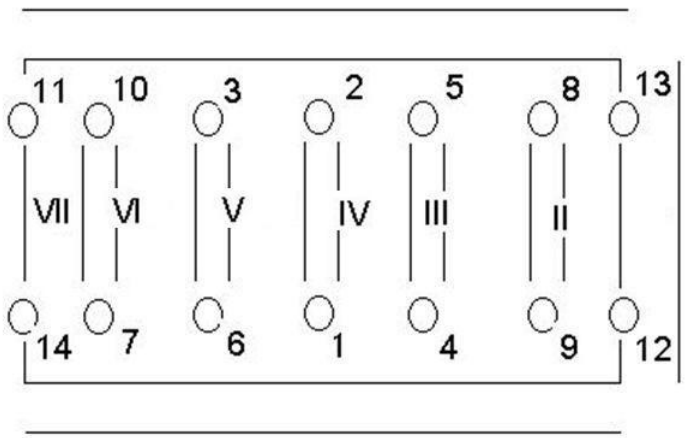
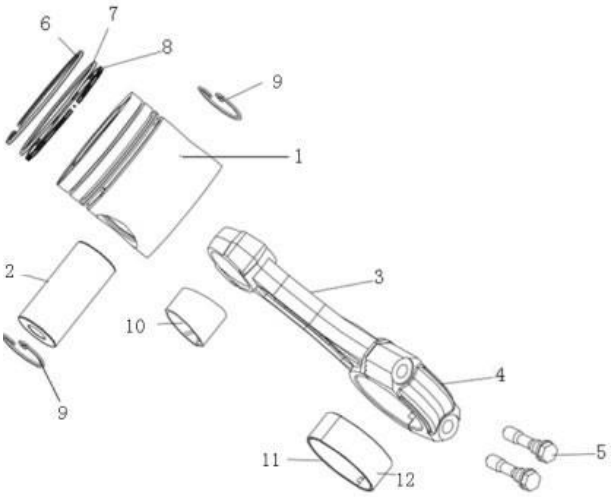


Figure 4-6 Main bearing bolt tightening order

13. The first time with a low torque pneumatic wrench tighten; the second reached 80 N·m; the third reached 140 N·m; the fourth order of 90 ° and finally turn 60° to finish assembly.
14. Measuring crankshaft axial clearance, qualified axial clearance (0.052-0.255) mm.

4.5 Piston rod group disassembly and assembly

4.5.1Exploded view



1. Piston
2. Piston Pin
3. Link Body
4. Link Cover
5. Connecting Rod Bolt
6. Trapezoidal Barrel Surface Ring
7. Torsion Cone Ring
8. Steel Band Oil Ring
9. Piston Pin Ring
10. Connecting Rod Bushings
11. Connecting Rod on The Tile
12. Connecting Rod Under the Tile

Figure 4-7 Exploded view

4.5.2Preparation before disassembly

1. Equipment conditions: socket wrenches, pneumatic wrenches, wooden hammer, and hole ring clamp.
2. Disassembly Preparation: Fixed cylinder block and tilt, with a pneumatic wrench to unscrew the connecting rod bolts, remove the cover.

4.5.3Dismantling

1. Check before demolition: Check the connecting rod axial backlash, check the connecting rod bolt tightening torque.
2. Place the engine tilted side, the piston disc to be disassembled to bottom dead center, remove the connecting rod bolt and connecting rod cover.
3. Turn the car to the top dead center, with a wooden hammer to knock out the piston, careful operation to avoid the connecting rod big end block cylinder.
4. Remove the remaining piston assembly and connecting rod assembly in the same manner. The piston, connecting rod bolts, connecting rod cover number, respectively, in order.

5. Use the retaining ring pliers carefully remove the retaining rings on both sides of the piston and push the piston pin out to remove the connecting rod body. The piston pin, connecting rod number, respectively, in order.
6. Use piston ring installation forceps to disassemble one ring, two rings and oil rings, respectively, and mark them separately.
7. Remove the connecting rod up and down the tile, and respectively numbered on the back, in order.

4.5.4Installation

The same machine connecting rod and piston are in the same quality group; connecting rod bodyand connecting rod cover must be paired.

1. Use the hole retaining ring pliers to install a hole with a circlip into the piston retaining ring groove and turn the retaining ring to ensure full loading. The angular face of the retaining ring should be inward, and the retaining ring opening should be offset 30 ° from the centerline of the piston. As shown in Figure 4-8.

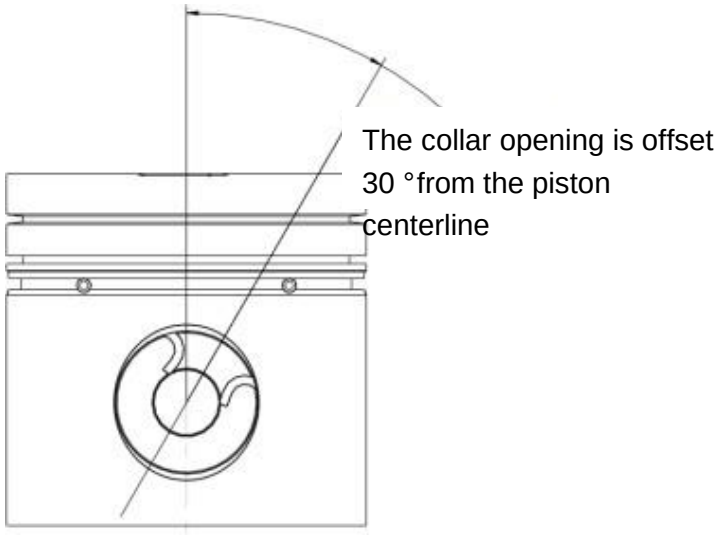


Figure 4-8 Piston pin retainer ring assembly diagram

2. Insert the small end of the connecting rod into the inner cavity of the piston and align the small end of the connecting rod with the pin hole of the piston. Then insert the piston pin and finally insert the other end of the piston pin into the ring. Connecting rod small hole and piston pin before assembly appropriate amount of clean lubricant and pay attention to the connecting rod oblique cutout direction and the piston cooling oil inlet hole in the same direction.
3. The installed piston rod components arranged in order according to the cylinder number, and then the piston ring installation clamp oil ring, the second gas ring, the first gas ring in turn into the piston ring groove. Piston ring "TOP" surface should be up, and the ring in the ring groove should be flexible rotation.
4. Wipe the cylinder wall, crank and piston rod components, and in the movement of the Deputy coated clean oil.
5. Adjust the direction of the opening of each ring: the first ring opening mounted on the centerline of the piston pin offset 30 ° position, the second ring opening and the first ring

opening position offset by 120 °, oil ring openings were in the first and second the air ring openings are staggered by 120 ° and at the perpendicular bisector of the centerline of the piston pin. As shown in Figure 4-9

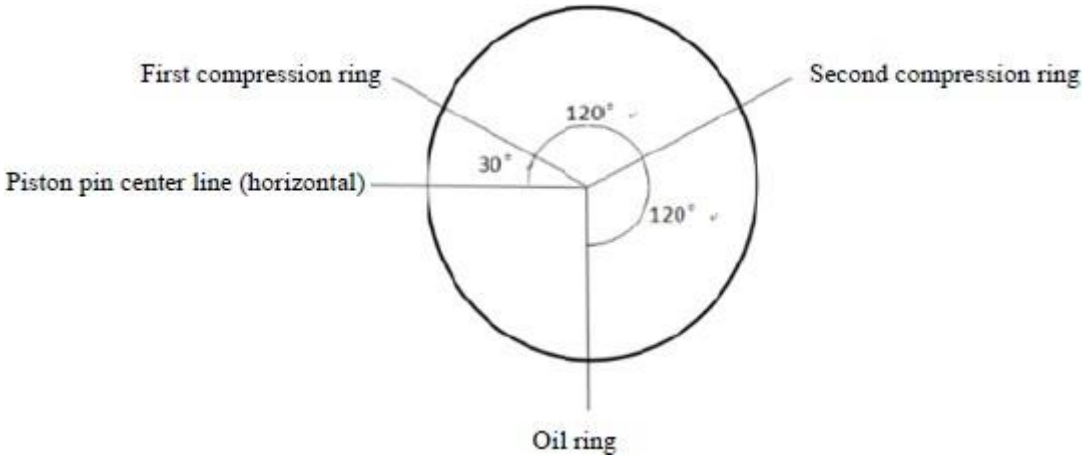


Figure 4-9 Piston ring assembly opening angle diagram

6. Turn the engine so that the 1, 6 cylinder is near the bottom dead center, put in the 1, 6-cylinder piston rod and loosen the connecting rod bolts. Piston fuel injection gap and the body is located on the same side of the piston cooling nozzle, the piston cylinder times the same number of cylinder, connecting rod cover and connecting rod body paired with connecting rod bolts before loading clean lubricating oil;
7. Tighten the connecting rod bolt:

   Hand Tighten: Tighten first and then symmetrically with a torque of 115N • m, with a final rotation of 90 ° ± 5 °. The same method to install the remaining cylinder.

   Automatic wrench tightens first screwed and then use 80N.m torque symmetrical tightening, the last turn 153 ° ± 5 °. The same method to install the remaining cylinder.

   Connecting rod bolts are not allowed to be reused, after tightening in place, lacquered.

4.5.5Maintenance points

1. Check the piston combustion chamber throat, piston pin seat and other places for cracks; check the piston skirt, head pull cylinder phenomenon; check the piston pin hole wear and tear is normal.
2. Check the piston ring in the piston ring groove is stuck phenomenon.
3. Check the piston ring cylindrical wear is abnormal; check the piston ring upper and lower face wear is abnormal.

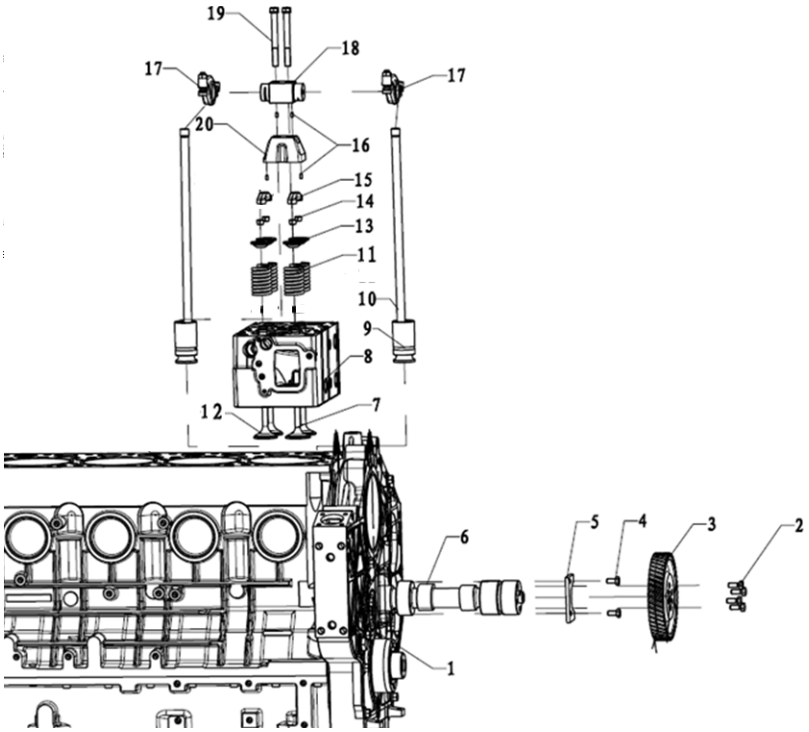
4. Check the piston pin cylindrical wear is abnormal.
5. Check the connecting rod big bottom hole, shaft, and small head hole for cracks; check the connecting rod bushing alloy layer is
6. No wear normal or whether there is flaking, etc..; check the connecting rod side wear is abnormal, check the connecting rod bending.
7. Check the bearing rod wear, the alloy layer whether tile, peeling, slippage and so on.

5 Valve train

5.1 Disassembly and assembly of Valve train

5.1.1Exploded view

Valve bodies are generally divided into valve group, valve drive group. Valve groups include valves, valve springs, valve seats, valve lock clamps and so on. Valve drive groups include camshafts, tappets, putters, rocker arm, rocker shaft and so on. As shown in Figure 5-1.



1. Gear Chamber
2. Hex Head Bolt
3. Camshaft Timing Gear
4. Hexagon Head Bolt
5. Throttle
6. Camshaft Assembly
7. Exhaust Valve
8. Cylinder Head
9. Valve Lifter
10. Putter
11. Valve Spring
12. Intake Valve
13. Valve Spring Seat
14. Valve Lock Clamps
15. Valve Bridge
16. Pin
17. Rocker
18. Arm Assembly
19. Rocker Shaft Assembly
20. Hex Head Bolt
21. Rocker Bracket

Figure 5-1 Exploded view

5.1.2Dismantling

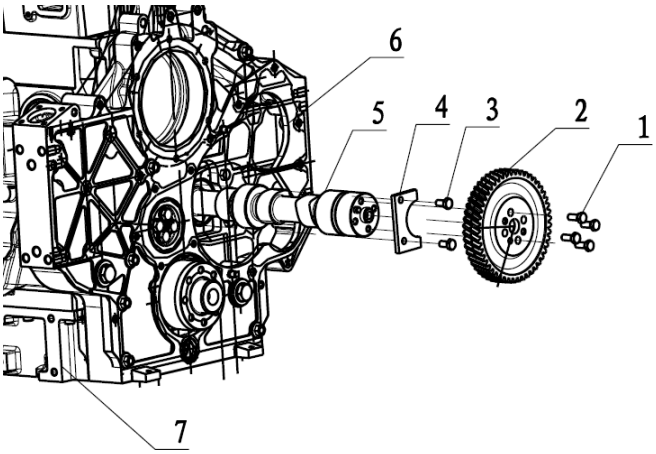
1. Remove the rocker arm and rocker arm, see rocker and rocker arm disassembly steps.
2. Remove the exhaust valve, see the valve removal step.
3. Demolition tappet and putter, see tappet and putter removal steps.
4. Remove the camshaft and camshaft timing gear, see the camshaft and camshaft timing gear removal steps.

5.1.3Installation

1. Assembly camshaft and camshaft timing gear, see camshaft and camshaft timing gear assembly steps.
2. Tappet assembly and putter, see Push rod and putter assembly steps
3. Assembly into the exhaust valve, see the intake and exhaust valve assembly steps.
4. Assembly rocker and rocker shaft, see rocker and rocker shaft assembly steps.

5.2 Camshaft disassembly and assembly

5.2.1Exploded view



1. Hex bolt
2. Camshaft timing gear
3. Hex head bolt
4. Thrust washer
5. Camshaft assembly
6. Gear chamber
7. Body

Figure 5-2 Exploded view

5.2.2Preparation before disassembly

1. Equipment conditions: dial indicator, torque wrench, lube oil and lubricants, towels, camshaft guide tools.
2. Disassembly Preparation: Disassembly is carried out on the assembly bench. After the disassembly of the flywheel housing is completed, remove the camshaft and camshaft timing gears.

5.2.3Dismantling

1. Turn the crankshaft to check whether the camshaft assembly (5) and the timing gear (2) are flexible and without block.
2. Check with a dial indicator whether there is axial movement of the camshaft before.
3. Check timing gear teeth (2) side clearance.
4. On the engine mounting and dismounting workbench, turn the crankshaft so that the cam uranium timing gear is at the top dead center of the first cylinder. Check whether the camshaft timing gear fixed hexagon head bolt (1) is loose or not. Remove the camshaft timing gear hex head bolt (1) and remove the timing gear (2).

5. Remove the camshaft thrust plate hex head bolt (3), remove the thrust plate (4), remove the camshaft assembly (5).

5.2.4Installation

After disassembly, check the camshaft assembly (5) and the timing gear (2). If wear occurs orthere is a large deviation in other parameters, repair or replacement of a new camshaft is required.

1. Use a towel to clean the camshaft hole, and check the camshaft hole for bump injury, with oil in the camshaft bushing round the right amount of lubricant. If found bump camshaft hole bump, do not allow the repair to use.
2. Put the camshaft guide tool and the camshaft lubrication sleeve into the camshaft hole, wipe the camshaft and check for bump injury, align the cylinder at the tail of the tooling to the cylinder of the camshaft head, and then insert the camshaft Assembly (5) into the camshaft hole, camshaft installation is complete, remove the camshaft guide tool and camshaft sleeve. Be careful to injure the camshaft bushing when penetrating the camshaft.
3. Install the camshaft thrust washer (4), apply clean lubricating oil on both sides of the camshaft thrust washer (4), turn the camshaft, the camshaft should rotate flexible, Tighten.
4. Grinding the rear end of the cylinder block, oiled, and wiped clean, with a smooth surface, clean, the crankshaft rear end into the cylindrical pin flywheel housing plate and tighten the four fastening bolts.
5. Apply special glue to connecting plate, glue line should be continuous and even.
6. Tighten the camshaft thrust plate and timing gear to the camshaft by bolts.

5.2.5Maintenance points

Point 1:

Check

Check the contact with the tappet cam surface for wear, check whether the main journal biting, wear, and tear.

Check whether the timing gear fastening hexagon head bolt is bent and deformed, whether the camshaft timing gear is punctured or has serious wear on the tooth surface.

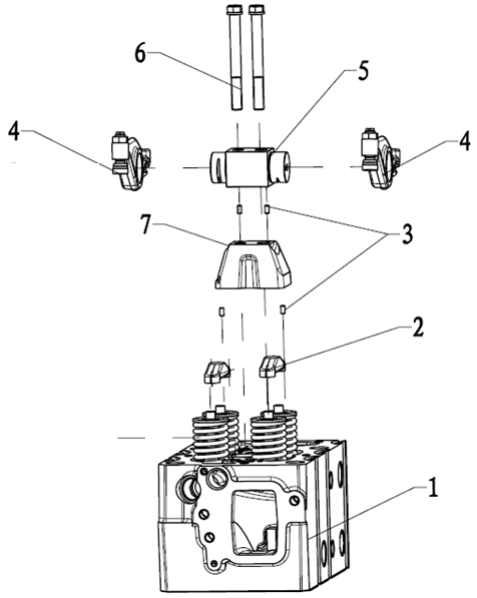
Point 2:

Assembly

1. If it is found bump camshaft bump, do not allow repair use.
2. Be careful to injure the camshaft bushing when penetrating the camshaft.
3. Thrust washer bolt 242 thread sealant, tighten

5.3 Rocker and rocker shaft removal and installation

5.3.1 Exploded view



1. Cylinder head
2. Valve bridge
3. Cylindrical pin
4. Rocker arm assembly
5. Rocker arm assembly
6. Hexhead bolt
7. Rocker bracket

Figure 5-3 Exploded view

5.3.2 Preparation before disassembly

1. Equipment conditions: torque wrenches, wrenches, oilers and lubricants.
2. Disassembly Preparation: The engine is fixed in the demolition of the pedestal, rocker cover removal is complete, the rocker and rocker shaft removal.

5.3.3 Dismantling

1. Turn the crankshaft to see if the rocker arm is rotating flexibly.
2. Measure the valve clearance, check the valve clearance change.
3. Loosen the hexagon head bolts (6) if the rocker is not rotating properly or the valve clearance is greatly changed, then gently remove the rocker arm assembly (5), rocker arm assembly (4) and rocker bracket), Well marked, so as not to confuse each cylinder rocker.

5.3.4 Installation

4. Insert the cylindrical pin into the pin hole in the plane under the rocker arm shaft, hit the pin in the end, and there is no crack in the pin.
5. Assemble the rocker arm bracket (7) with the rocker arm shaft assembly (5), the rocker arm bracket (7) and the rocker arm shaft assembly (5) should be tightly combined, and apply a small amount to the rocker arm shaft assembly After the lubricant is installed on the rocker arm assembly (4), the rocker arm assembly (4) is rotated flexibly, and two hexagonal head bolts are inserted on the rocker arm shaft assembly (5)
6. Fill valve push rod, see the valve push rod assembly process, the valve into the exhaust valve respectively (2).
7. Install the rocker arm assembly (4) and pre-tighten, align the pin hole on the lower side of the rocker arm bracket with the locating pin on the plane on the cylinder head, and fully seat the rocker arm ball pin in the hole of the valve push rod.
8. Tighten the rocker shaft assembly bolt (6).

5.3.5 Check and adjust valve clearance.

1. Catch a cylinder on the dead center, that is, the flywheel engraved line and flywheel shell line alignment, to determine a cylinder compression top dead center.
2. Adjust the intake valve clearance of 1, 2 and 4 cylinders, exhaust valve clearance of 1, 3 and 5 cylinders; intake valve clearance (0.5) mm; exhaust valve clearance (0.8) mm. Intake and exhaust valve adjustment nut tightening torque (45 ± 5) N · m, on the flywheel shell fixed device and fastening the outer two hex nuts, turning to the six-cylinder top dead center.
3. Adjust the intake valves of cylinders 3, 5 and 6 and the exhaust valve clearance of cylinders 2, 4 and 6. 6-cylinder piston in the top dead center position. Intake valve clearance (0.5) mm; Exhaust valve clearance (0.8) mm.
4. Check the cylinder with a cold phase gas phase, the intake valve before the top dead center (19 ± 5) °, the exhaust valve closed only after the point (21 ± 5) °, the intake valve closing dead center (33 ± 5) °, exhaust valve to open before the deadline (49 ± 5) °.

5.3.6 Maintenance points

Point 1: Check after demolition

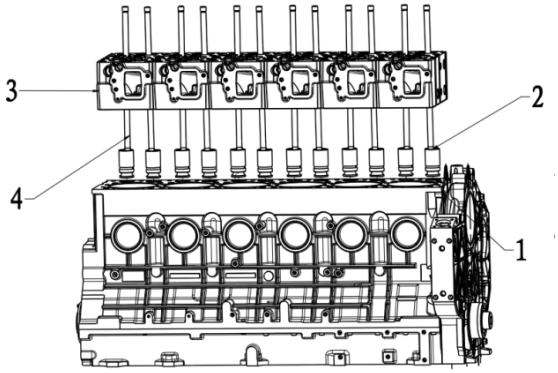
1) The rocker clean, observe the appearance of the rocker, whether there are cracks and otherdefects.
2) Check the rocker arm bore for wear and abrasion, measuring its diameter.
3) Check whether the ball pin and rocker arm are worn.
4) Check whether the smooth flow of oil.
5) Rocker arm hole diameter measurement and rocker shaft diameter, with the calculation ofclearance.
6) Check the rocker shaft combination group is worn, rocker arm holder is intact withoutcracks, no wear.

Point 2: Assembly

Install the rocker arm assembly (4) with a small amount of lubricating oil on the rocker arm shaft. The rocker arm assembly (4) is rotated flexibly. Insert the two hex head bolts (6) into therocker arm shaft assembly (5).

5.4 Tappet and putter removal and installation

5.4.1 Exploded view



1. Body
2. Tappet
3. Cylinder Head
4. Putter

Figure 5-4 Exploded view

5.4.2 Preparation before disassembly

1. Equipment conditions: tappet installation tools, lubricants.
2. Disassembly Preparation: After the cylinder head cover is disassembled, loosen the rocker shaft assembly to fix the hex head bolt, and then remove the push rod (4). After the cylinder head is disassembled, remove the tappet (2).

5.4.3 Dismantling

1. After the unloading of the rocker arm and the rocker arm is completed, the push rod (4) is directly removed and put in order.
2. Cylinder head unloading (see cylinder head unloading step) after the completion, remove the tappet (2), and then placed.

5.4.4Installation

1. Check tappet (2) and putter (4) for any problem, if any problem is updated. Before assembling tappet (2), it must be purged with compressed air and check whether the oil hole is smooth.
2. The valve tappet (2) the outer surface of the cylinder and the bottom clean oil, oil evenly.
3. Use the tappet installation tool to install the tappet to the tappet hole, the tappet and the tappet hole may not bump in the installation process.
4. Cylinder head assembly (see the cylinder head assembly steps), after blowing with compressed air push rod, and check the oil hole is smooth.
5. The push rod (4) coated with clean oil, must ensure that the ball and the concave enough lubricant.
6. Put the putter (4), putter (4) spherical face down.

5.4.5Maintenance points

Point 1:

Disassembled inspection

1) The putter and tappet clean.
2) Check the tappet oil path is smooth.
3) Check whether the pushrod is bent, the degree of wear on the outer surface.
4) Check the pusher ball and the recess is worn.
5) Check the tappet surface, the bottom is worn.
6) Check tappet internal recess is worn.

Point 2:

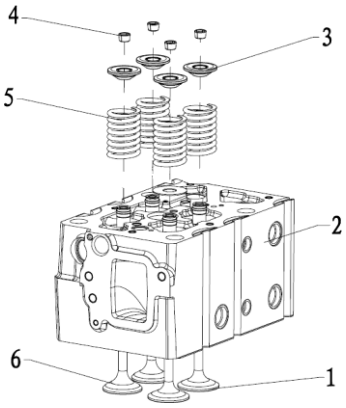
Assembly

The valve tappet (2) the outer surface of the cylinder and the bottom of the clean oil, oil evenly.

The push rod (4) coated with clean oil, you must ensure that the ball and the Au have enough lubricant.

5.5 Valve removal and installation

5.5.1Exploded view



1. Intake valve
2. Cylinder head
3. Valve spring seat
4. Valve lock clamp
5. Valve spring
6. Exhaust valve

Figure 5-5 Exploded view

5.5.2 Preparation before disassembly

1. Equipment conditions: valve spring compressor or valve top pliers or other valve spring tool depress
2. Preparation before disassembly: Rocker arm shaft removal is complete, remove the cylinder head from the body, and then remove the valve.

5.5.3 Dismantling

1. Depress the valve spring seat (3) with the valve spring compressor or valve top pliers or other tools, remove the valve lock clamp (4) and remove the valve spring seat (3) and the valve spring (5).
2. Remove the intake and exhaust valve (1) (6) from the valve seat.

5.5.4Installation

1. If the valve is worn or carbon soot serious sintering and other undesirable phenomena, the need for valve replacement.
2. The molybdenum disulfide paste evenly coated on the exhaust valve stem, and then into the exhaust valve (1) (6) into the cylinder head to ensure that the intake and exhaust valve sliding in the catheter without block;
3. Plane into the cylinder head on the plane into the positioning pin, each cylinder head on the three, asked to hit in the end.
4. Put the valve stem protective sleeve on the inlet and exhaust valve guide pipe, and then assemble the valve rod sealing sleeve; before the assembly, you must check the valve rod sealing sleeve internal spring is intact.
5. Valve spring (5).
6. loading valve spring seat, depress the valve spring (5), the valve lock clip (4).
7. After the valve lock clip is loaded, the rubber hammer is tapped into the exhaust valve so as to be seated. If the valve seat is not seated or the valve spring is seated (3), the cause should be excluded.

5.5.5Maintenance points

Point 1:

Check after demolition

1) Check the valve stem and valve rod end wear.
2) Check valve cone is worn or damaged.
3) Check the valve cone and valve surface arc whether there is coke wear phenomenon.

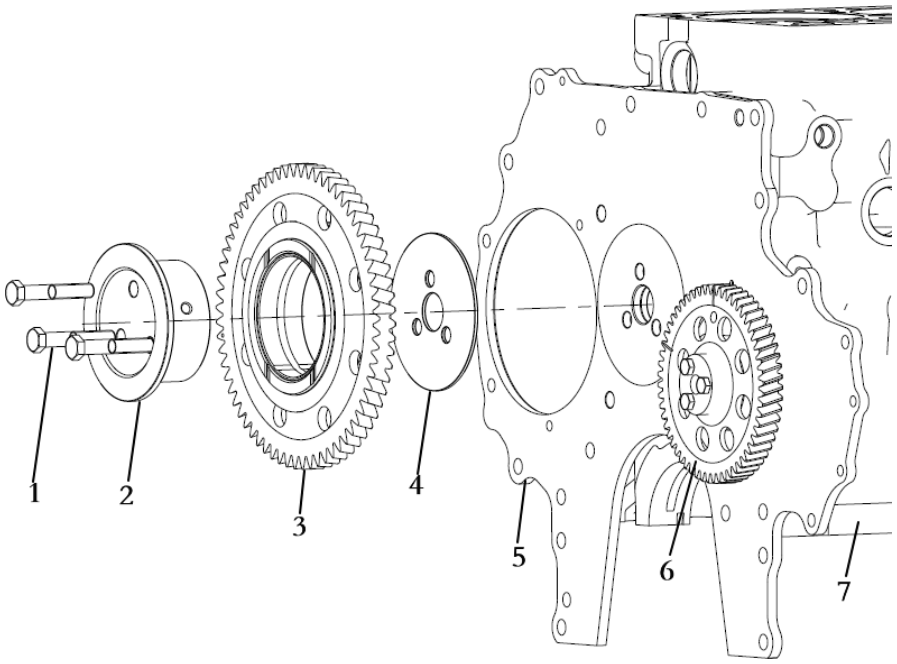
Point 2:

Assembly

1) To ensure that the intake and exhaust valve sliding in the catheter without block.
2) Before assembly, check the valve stem gland internal spring is intact.

5.6 Intermediate gear disassembly and assembly

5.6.1Exploded view



1. Hexagon head bolt
2. Intermediate gear shaft
3. Intermediate gear assembly
4. Idler baffle
5. Flywheel housing connecting plate
6. Camshaft timing gear
7. Body

Figure 5-6 Exploded view

5.6.2Preparation before disassembly

1. Equipment conditions: pneumatic wrenches, torque wrenches, lube oil and lubricants, towels.
2. Disassembly Preparation: Remove the flywheel housing, crankshaft timing gear, fuel pump gear.

5.6.3Dismantling

1. Loosen the hex head bolt (1) and remove the two hexagon head bolts (1) below the bottom.
2. Remove the remaining hexagon head bolt (1) from the intermediate gear shaft (2), the intermediate gear assembly (3) and the idler shield (4).

5.6.4Installation

1. Finish the installation of flywheel shell connecting plate (5) and camshaft timing gear (6).
2. Assemble the intermediate gear shaft (2), intermediate gear assembly (3) and idler pulley cover (4) together to the flywheel housing connecting plate (5) while loading the three hexagon head bolts) and tighten.

5.6.5Maintenance points

Point 1: Check the mounting bolt mark before disassembly to confirm whether the bolt is rotating or not.

Point 2: Check the mounting bolt thread before assembly is good, the gear shaft bolt bearing surface is crushed.

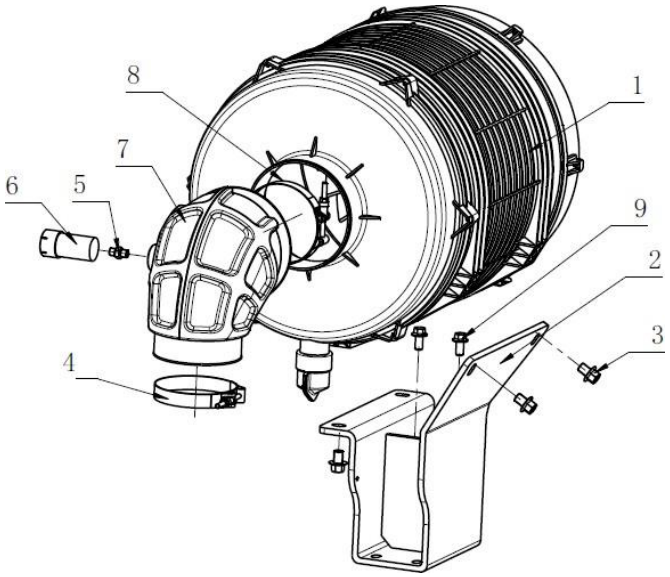
Point 3: Check whether each tooth flaking tooth surface, broken teeth.

Point 4: There is abnormal wear between the middle gear shaft and middle gear bushing. Whether each oil hole is dirty and clogged with foreign matter.

6 Intake and Exhaust System

6.1 Air filter combination group dismantling and assembly

6.1.1Exploded view



1	Air Filter	6	Pressure Sensor
2	Air Filter Bracket	7	Intake Manifold
3	Hexagonal Flange Bolt	8	Clamp
4	Clamp	9	Hexagonal Flange Bolt
5	Adapter		

Figure 6-1 Exploded view

6.1.2Preparation before disassembly

1. Equipment conditions: pneumatic wrench, sleeve
2. Disassembly Preparation: Remove the other peripherals installed on the air filter.

6.1.3Dismantling

The disassembly sequence is the opposite of the installation sequence.

6.1.4Installation

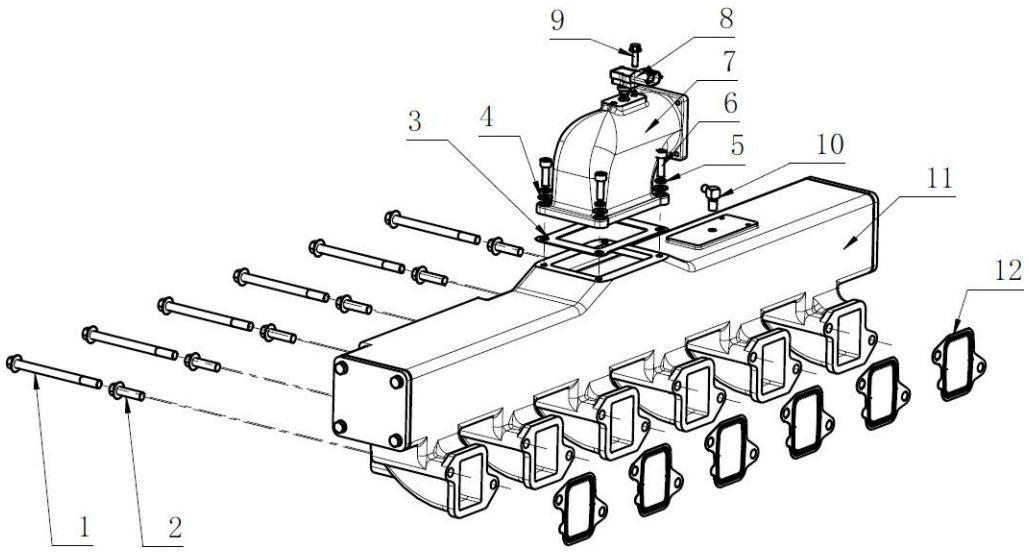
1. Secure the air cleaner (1) to the air cleaner bracket (2) with hexagonal flange bolts (3) and tighten it with a wrench.
2. Secure the air cleaner bracket and air cleaner to the flywheel housing with hexagonal flange bolts (9) and tighten them with a wrench.
3. Connect the air cleaner to intake manifold (7) with clamp (8) and tighten it with wrench.

6.1.5Air filter during maintenance and precautions:

1. The air filter cartridge must be regularly cleaned and inspected. When cleaning the air filter element, gently tap the end face of the filter element on the flat plate and blow it back out of the filter element with compressed air for maintenance. No oil, water cleaning.
2. If equipped with filter plugging alarm, when the light is on, the filter must be cleaned in time.
3. In strict accordance with the provisions of the maintenance manual replacement air filter cartridge.
4. Regular cleaning bag do not make the dust accumulation in the dust too much.
5. In the dusty area, according to the circumstances should be cleaning the filter and replace the filter cycle time.
6. After the filter maintenance, attention should be paid to the correct installation, do not omit parts, not knock the empty filter housing flat, or cannot remove the filter for maintenance and replacement, and the dust bag should be vertical downward.

6.2 Intake pipe combination group disassembly and assembly

6.2.1Exploded view



1. Hexagonal Flange Bolts
2. Hexagonal Flange Bolts
3. Gasket
4. Flat Washers
5. Spring Washers
6. Hexagonal Head Cap Screws
7. Mixed Intake Manifold
8. Pressure And Temperature Sensors
9. Hexagonal Flange Bolts
10. Connector
11. Intake Manifold Assembly
12. Intake Manifold Gasket

Figure 6-2 Exploded view

6.2.2Preparation before disassembly

Equipment conditions: pneumatic wrench, sleeve.

6.2.3Dismantling

Disassembly steps in contrast to the assembly procedure, recommended tightening torques for intake pipe bolts are 23 N·m.

6.2.4Installation

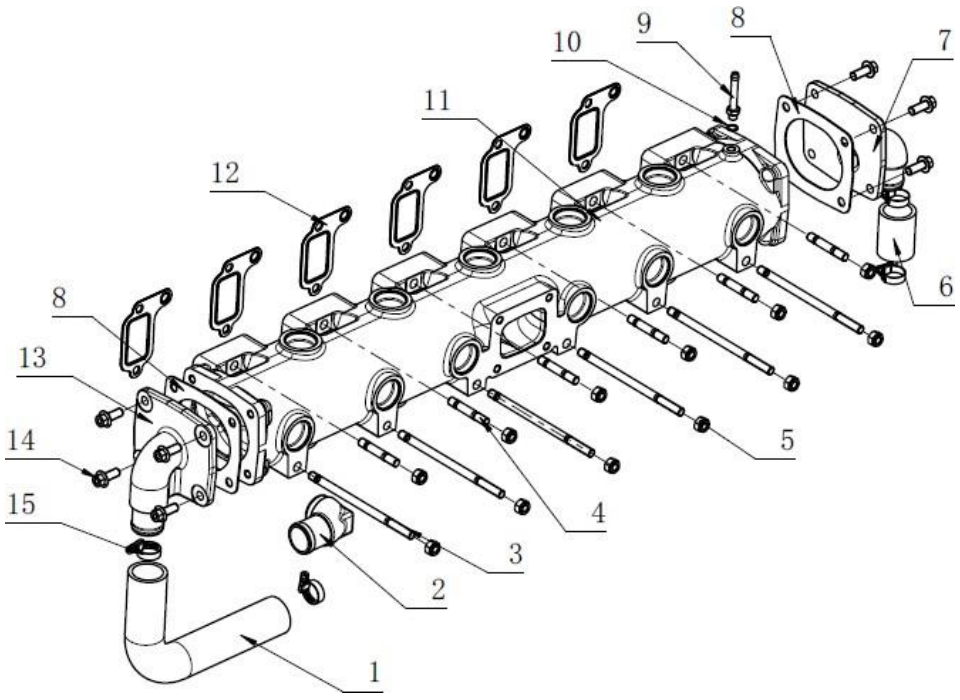
1. Install the temperature and pressure transducer (8) to the mixing inlet connector (7) with the flange bolt (9) and tighten it with a wrench.
2. Install the spring washers (5) through the hexagon socket head cap screws (6). The flat washers (4) will mix the intake manifold and the gasket (3) to the intake manifold assembly (11).
3. Install the intake pipe assembly to the cylinder head with hexagonal flange bolts (1) and (2). Torque bolts to 23 N·m.
4. Assembly and disassembly steps on the contrary, intake pipe bolts recommended tightening torque.

6.2.5Maintenance points

1. Check the intake manifold for cracks, deformation, and other damage, if you need to replace the new intake manifold.
2. Disassemble the intake manifold gasket, mix the intake manifold gasket, and check the gasket for visible damage and analyze the cause, regardless of whether the gasket is defective or not, if the disassembly is required to replace the new gasket.
3. Check the temperature of the pressure sensor burnout, short circuit, etc., if you need to be replaced.

6.3 Exhaust pipe disassembly and assembly

6.3.1Exploded view



1. Coolant Connection Hose
2. Water Pipe Fittings
3. Studs
4. Studs
5. Hex Nuts
6. Coolant Connection Hose
7. Cover Plate
8. Gasket
9. Pipe Joints
10. Gasket
11. Exhaust Pipe Total Into
12. Exhaust Pipe Gasket
13. Cover Plate
14. Hexagonal Flange Nut

Figure 6-3 Exploded view

6.3.2Preparation before disassembly

1. Equipment conditions: pneumatic wrench, sleeve.
2. Prepare for disassembly: Disassemble and disassemble the peripheral parts around the group.

6.3.3Dismantling

The disassembly sequence is the opposite of the installation sequence.

6.3.4Installation

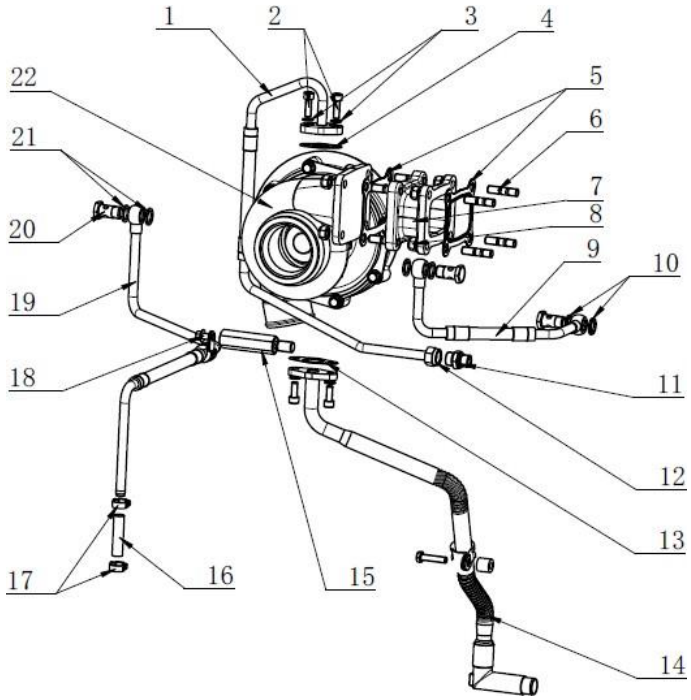
1. Fit cover plate (7), cover plate (13) and gasket (8) to exhaust pipe assembly (11) with hexagonal flange bolts (14).
2. Fit the water jacket exhaust pipe and exhaust pipe gasket (12) to the cylinder head with stud bolts (3) and (4) and hex nut (5).
3. Using a rubber mallet, tap the hose connector (2) into the machine body and connect the cover.
4. (13) with the hose connector through the clamp (15) and the coolant connection hose (1). Tighten with a wrench.
5. Connect the cover (7) to the water return port on the pump with the clamp (15) and the coolant connection hose (4) and tighten with a wrench.
6. Fit the fitting (9) through the gasket (10) to the exhaust pipe and tighten with a wrench.

6.3.5Maintenance points

1. Check the exhaust pipe for cracks and other damage, whether the flange deformation, if any, you need to replace the new exhaust pipe.
2. Check the exhaust pipe flange for signs of leaks, if any, replace the new exhaust pipe gasket.
3. Disassemble the gaskets on both sides of the exhaust gaskets and exhaust pipes, and check the gaskets for visible damage and analyze the causes, regardless of the exhaust gaskets, as long as the disassembly requires replacement of new gaskets.
4. Exhaust pipe installation should be careful not to scratch the exhaust pipe connector surface.
5. Exhaust pipe bolt coated with anti-bite molybdenum disulfide; exhaust pipe bolts can be reused up to twice.
6. Exhaust system bolts, nuts are made of heat-resistant steel, do not use ordinary bolts and nuts instead.

6.4 Turbocharger dismantling and assembly

6.4.1Exploded view



1 The Supercharger into The Pipe Assembly
2 The Hexagonal Head Cap Screws
3 The Waveform Elastic Washers
4 Supercharger Back to The Gasket's Gasket
5 Supercharger Gasket; Pad
8 Hexagon Nut
9 Supercharger Inlet Pipe Assembly
10 Combination Gasket
11 Double Pipe Joint
12 Connecting Nut
13 Supercharger Return Pipe Gasket
14 Supercharger Back Oil Pipe Assembly
15 Support Block
16 Coolant Connection Hose
17 Clamp
18 Hexagonal Flange Bolt
19 Supercharger Return Pipe Assembly
20 Hollow Bolt
21 Seal Gasket
22 Turbine Turbocharger

Figure 6-4 Exploded view

6.4.2Preparation before disassembly

1. Equipment conditions: rubber hammer, pneumatic wrench, sleeve
2. Preparation before disassembly: Remove the supercharger combination group around the other peripheral pieces.

6.4.3Dismantling

Disassembly steps are the opposite of assembly steps.

6.4.4Installation

1. Assemble the turbocharger (22), booster gasket (5) and spacer (7) with the studs (6) and hex nuts (8) and tighten them with a wrench.
2. Assemble the supercharger and supercharger pre-assembled block to the exhaust pipe with stud bolt (6) and hex nut (8) and tighten with wrench.
3. Assemble the supercharger inlet pipe assembly (9) to the supercharger with the hollow bolt (20) and the gasket (21) and the other end to the body and tighten with a wrench.
4. Assemble the supercharger return pipe assembly (19) to the supercharger with hollow bolts and ferrules and the other end to the return fitting with hose (17) and clamp (16).
5. Assemble the supercharger inlet pipe assembly (1) to the supercharger through the corrugated washer (3) through the hexagon socket head cap screw (2) and connect the other end with the body through the double pipe joint (11) Tighten the wrench.
6. Assemble the supercharger return pipe assembly (14) to the supercharger with a hexagon socket head cap screw, tighten with a wrench and the other end with a rubber hammer into the body oil return port.

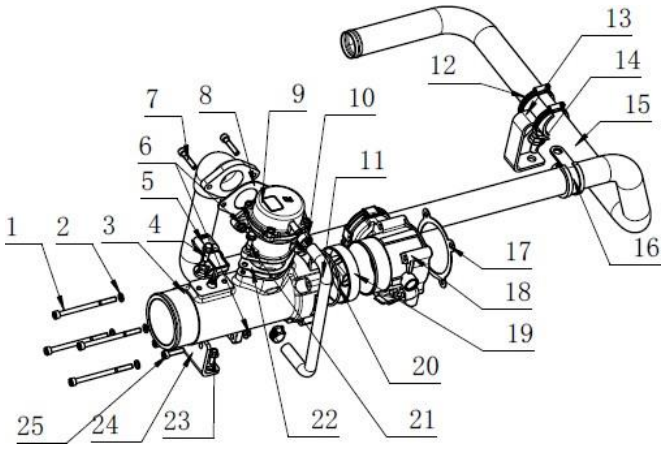
6.4.5Maintenance points

1. Check the turbocharger and engine pipe connections have loose signs, and promptly ruled out.
2. Check supercharger leaks, oil spill, water leakage, and promptly ruled out.
3. Check the supercharger fastening screws are loose and promptly ruled out.
4. Check the air filter, if the dust is too much, should be promptly cleaned
5. Turbocharger disassembly, if you cannot rule out failure or do not have disassembly conditions, should be submitted to the production or maintenance department.
6. Remove the fastening screw on the compressor scroll, gently rock the compressor scroll around the impeller, and beat the shell evenly with the rubber hammer. Do not allow the shell to hit the impeller blades, nor loosen the shaft nuts.
7. Wipe off the impeller channel with gasoline, grease on the housing cavity.
8. When reinstalling the compressor scroll case, tighten the fastening screws as required and tighten the torque 15N.m.
9. Disassemble the supercharger gasket and check for any visible damage to the supercharger gasket and analyze the cause, regardless of whether the supercharger gasket is defective or not, if disassembly requires replacement of new gasket.

If you need to disassemble the shaft components, please find a professional or commissioned bythe manufacturer for disassembly.

6.5 Mixed intake system with the disassembly and assembly of the group

6.5.1Exploded view



1. Hexagon Socket Head Cap Screws
2. Wave Spring Washers
3. Mixed Intake Manifold
4. Hex Flange Bolts
5. Temperature And Pressure Sensors
6. Hex Nuts
7. Hexagon Socket Head Cap Screws
8. Gaskets
9. Through Valve
10. Clamp
11. Hose
12. Clamp
13. Fixing Bracket
14. Hex Flange Bolts
15. Tube
16. Clamp
17. Gaskets
18. Electronic Throttle
19. Washer
20. O-Ring
21. Hex Flange Bolts
22. Hex Flange Bolts
23. Hexagon Socket Head Cap Screws
24. Hex Flange Bolts
25. Fixing Bracket

Figure 6-5 Exploded view

6.5.2Preparation before disassembly

1. Equipment conditions: wrench, sleeve.
2. Preparation before disassembly: Remove other peripherals installed on the hybrid intake manifold assembly.

6.5.3Dismantling

The disassembly sequence is the opposite of the installation sequence.

6.5.4Installation

1. Fit the temperature and pressure transducer (5) to the mixing inlet manifold (3) with the hex head bolt (4) and tighten with a wrench.
2. Assemble the inlet bypass valve (9) and gasket (8) to the mixing inlet manifold with a hexagonal flange bolt and tighten with a wrench.
3. Install washer (19) and O-ring seal (17) on electronic throttle inlet.
4. Fit the mixed intake manifold, gasket, and electronic throttle to the intake elbow using the hexagon socket head cap screws (1) through the wave spring washers (2) and tighten them with a wrench.
5. Loosen the bracket (24) with the hexagonal socket head cap screw (25) and the hexagonal flange nut (23) onto the mixing inlet pipe and assemble the bracket with the hexagonal head flange bolt (23) Use a wrench to tighten, and then use a wrench to fasten the other end.
6. Connect the intake bypass valve balancing pipe to the corresponding pipe joint on the intake pipe through the clamp (9) and hose (11) and tighten with the wrench.
7. Fit the pipe clamp (16) to the cylinder head cover with the cylinder head cover bolts and tighten them with a wrench.
8. Assemble the bracket (13) to the flywheel housing with a hexagonal flange bolt (14) and tighten with a wrench.
9. Fix the tube (15) to the bracket (13) by the clamp 12.

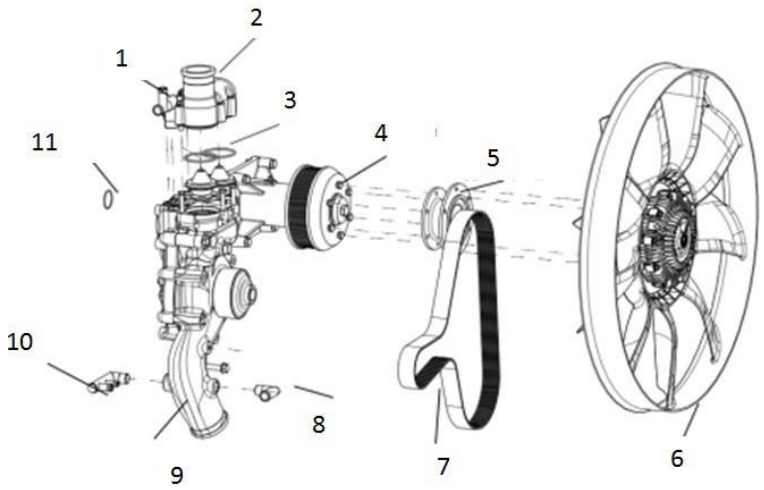
6.5.5Maintenance points

1. Check the mixed intake manifold, intake bypass valve take over, hoses and other pipe body cracks, deformation and other damage, if any, you need to be replaced.
2. Disassemble the mixture inlet gaskets and check for any visible damage to the gaskets and analyze the cause, regardless of whether the gasket is defective or not if disassembly requires replacement of new gaskets.
3. Check the pressure and temperature sensors for burnout, short circuit and so on, if there is need to be replaced.

7 Cooling system

7.1 Cooling system disassembly and assembly

7.1.1Exploded view



1. Heater connector
2. Thermostat cover
3. Seal
4. Fan tray
5. Fan drive shaft
6. Fan
7. Belt
8. Heater connector
9. Pump
10. Heater connector
11. Seal

Figure 7-1 Exploded view

7.1.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: None.

7.1.3Dismantling

1. Remove the fan and fan tray.
2. Remove the belt and tension pulley.
3. Remove the pump.
4. Remove the thermostat.

7.1.4Installation

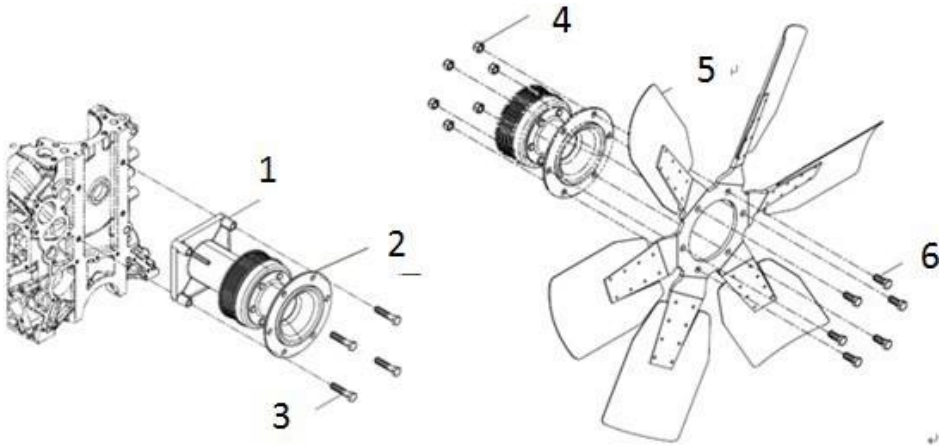
The reverse order of disassembly.

7.1.5Installation

1. Assembly: Tightening torque according to standard.
2. Assembly: Before the assembly should be carefully checked to see if there are cracks and clean the various components.
3. Requires no sealing surface sealing.

7.2 Fan dismantling and assembly

7.2.1Exploded view



1. Fan bracket
2. Fan drive shaft
3. Hex flange bolt
4. Nut
5. Fan
6. Hex head bolt

Figure 7-2 Exploded view

7.2.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: Remove the belt.

7.2.3Dismantling

1. Remove the 4 bolts securing the fan tray.
2. Remove the six bolts and nuts that secure the fan shaft.

7.2.4Installation

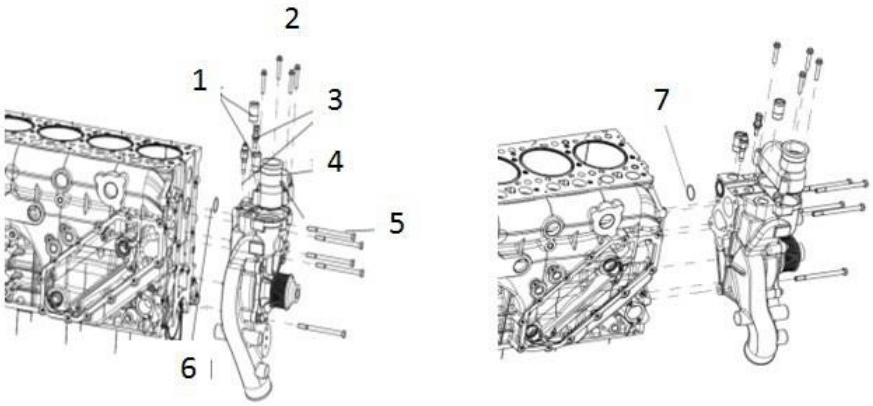
1. Loosen the fan drive shaft with the six hexagon head bolts on the fan bracket and tighten.
2. Loosen the fan on the fan drive shaft with 4 bolts and tighten.

7.2.5Maintenance points

1. Check the fan blades for cracks and other damage, rotation is smooth, if you need to replace the fan.
2. Check fan drive shaft for cracks. Need to check the drive shaft failure and replace the drive shaft.

7.3 Pump disassembly and assembly

7.3.1Exploded view



1. Hose connector
2. Hex flange bolts
3. Temperature sensor
4. Thermostat cover
5. Hex flangebolts 6.O-type seals
6. O-ring

Figure 7-3 Exploded view

7.3.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: Remove the belt, fan, out of the water pipe

7.3.3Dismantling

Remove the 5 bolts Remove the pump, remove the 4 bolts Remove the thermostat cover.

7.3.4Installation

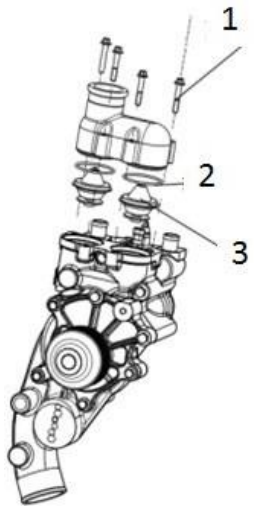
1. Polishing the front of the cylinder block and the back surface of the pump cover and wipe the glue. The combination of pump back cover and cylinder block coated with 518 plane sealants.
2. Insert the corresponding O-ring on the coupling surface of the pump back cover.
3. Install pump assembly and tighten with bolts. Pre-installed pump to check whether the rotation of the pump is flexible.

7.3.5Maintenance points

Check whether the pump is running flexible, seals are damaged, if necessary to replace the newpieces.

7.4 Thermostat dismantling and assembly

7.4.1Exploded view



1. Hex Flange Bolt
2. O-Ring
3. Thermostat Cover

Figure 7-4 Exploded view

7.4.2Preparation before disassembly

1. Equipment conditions: Socket wrench.
2. Disassembly Preparation: Remove the belt, fan, out of the water pipe, water pump.

7.4.3Dismantling

Remove hexagonal flange bolts and remove thermostat.

7.4.4Installation

First unscrew the thermostat cover, the thermostat into the pump, and then placed in 2

O-ring fitted thermostat cover and tightened.

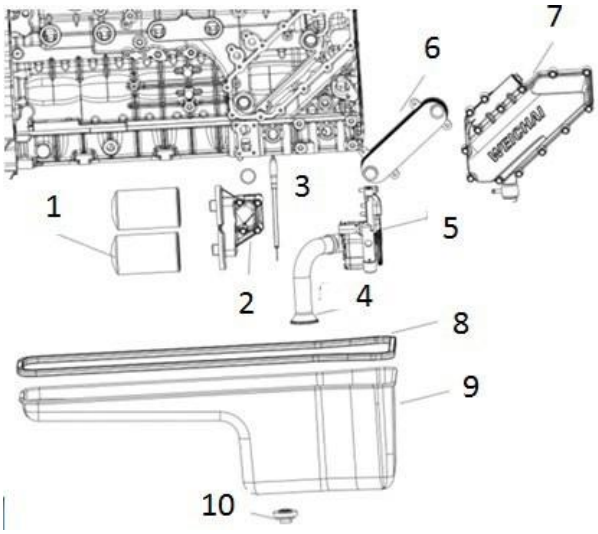
7.4.5Maintenance points

Check thermostat and seal for damage, if damaged, you need to replace the new one.

8 Lubrication system

8.1 Lubrication system dismantling and assembly

8.1.1Exploded view



1. Oil Filter
2. Oil Cooler Cover
3. Oil Gauge
4. Set Filter
5. Oil Pump
6. Oil Cooler
7. OilCooler Cover
8. Oil Pan Seal
9. Oil Pan
10. Put Oil plug

Figure 8-1 Exploded view

8.1.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: None

8.1.3Dismantling

1. Remove the oil sump and dipstick, drain the oil plug, and see the body group disassembly instructions.
2. Remove the filter.
3. Disassemble the oil pump.
4. Remove the oil cooler cover.
5. Remove the oil cooler.
6. Remove the oil filter.
7. Remove the oil filter seat.

8.1.4Installation

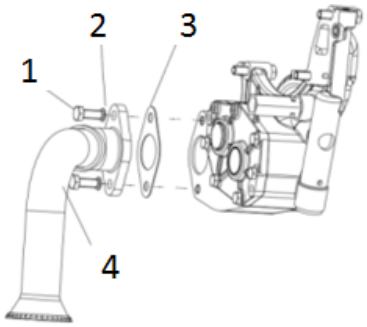
The installation steps are the opposite of the disassembly steps.

8.1.5Maintenance points

1. Assembly: Tightening torque according to standard.
2. Assembly: Before the assembly should be carefully checked to see if there are cracks and clean the various components.
3. Requires no sealing surface sealing.

8.2 Oil filter dismantling and assembly

8.2.1Exploded view



1. Hex head bolt
2. Flange
3. Gasket
4. Set filter

Figure 8-2 Exploded view

8.2.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: Remove the oil pan

8.2.3Dismantling

Loosen the two hexagonal bolts on the strainer and remove the strainer and strainer washers.

8.2.4Installation

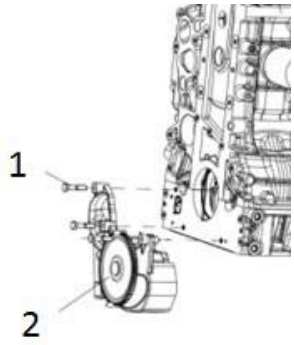
1. Before assembly, check the collector filter and collector filter gasket to ensure that there are no defects and damages in manufacture and use.
2. Pre-installed weld to be checked whether there is a crack or leak welding, set filter assembly.
3. Set the filter thread of the fastening bolt 242 sealant, separated by a wave washer screwed hex bolts and tighten.

8.2.5Maintenance points

1. Check the filter for cracks and other damage, the cavity is smooth, if you need to replace the filter set.
2. If the filter gasket oil leakage phenomenon. Need to check the filter gasket failure and replace the filter gasket.

8.3 Oil pump disassembly and assembly

8.3.1Exploded view



1. Hex head bolt
2. Oil pump

Figure 8-3 Exploded view

8.3.2Preparation before disassembly

1. Equipment conditions: Socket wrench.
2. Disassembly Preparation: Remove the oil pan, oil filter.

8.3.3Dismantling

1. Loosen and remove the hex head bolt.
2. Remove the oil pump.

8.3.4Installation

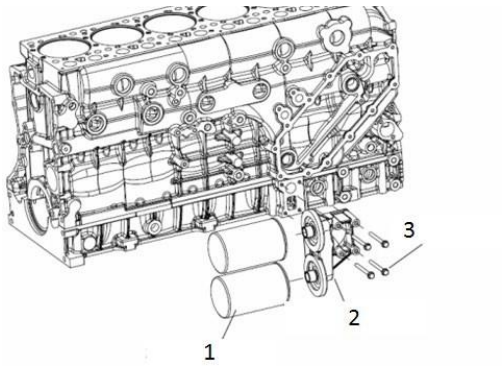
1. Before assembling, check the oil pump and hexagonal bolts to ensure that there are no defects and damages in manufacture and use.
2. Clean the crankcase and the combination of the oil pump.
3. Install the hex head bolt and tighten it.

8.3.5Maintenance points

1. Check the oil pump for cracks and other damage, check the oil pump drive gear is flexible.
2. If the rotation is not flexible or there is a need to replace the broken oil pump.

8.4 Oil filter, oil filter seat disassembly and assembly

8.4.1Exploded view



1. Oil filter
2. Oil filter seat
3. Hex flange bolts

Figure 8-4 Exploded view

8.4.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: None

8.4.3Dismantling

Remove the oil filter with a special tooling; loosen the 4 bolts that fit the oil filter seat and remove the oil filter seat.

8.4.4Installation

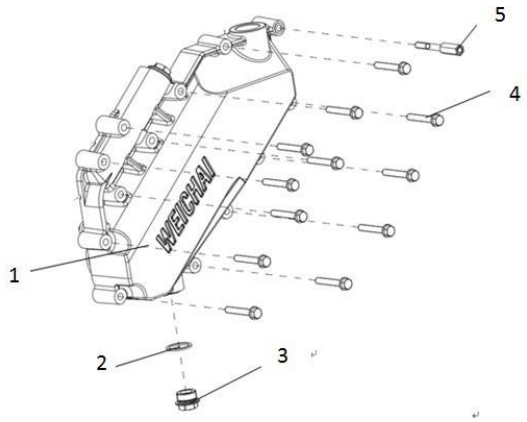
1. Grind oil filter seat and the body of the joint surface, and use compressed air to purge the lumen
2. Remove the spin-on oil filter core, loosely mounted on the oil filter seat.

8.4.5Maintenance points

1. Check whether the filter bump, oil filter and oil filter with the oil spill, if there is need to be replaced.
2. Check whether the bolt thread is deformed, if it is elongated, it needs to be replaced.

8.5 Oil cooler cap disassembly and assembly

8.5.1Exploded view



1. Oil cooler cover
2. Washer
3. Plug
4. Hex flange bolt
5. Support block

Figure 8-5 Exploded view

8.5.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: None

8.5.3Dismantling

Before disassembly, let go of the engine coolant, followed by loosening the bolts on the oil cooler cover, plug, and remove the oil cooler cover and O-ring.

8.5.4Installation

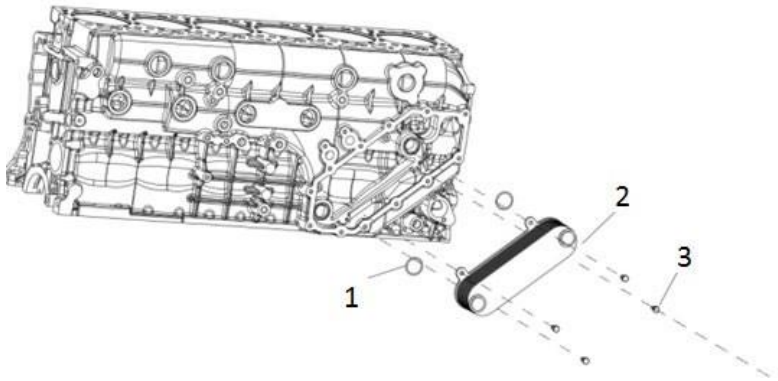
1. Before installing the oil cooler cover, check the oil cooler cover seal and the oil cooler cover to ensure that no defects and damages are created and used.
2. Clean the oil cooler cover and the fuselage joint surface, install the oil cooler cover.
3. Install the oil cooler cover bolts and tighten.
4. Install the gasket to seal and tighten the screw plug.

8.5.5Maintenance points

1. Check the oil cooler cover itself for cracks and other damage, if there is a crack you need to replace the oil cooler cover.
2. Check the oil cooler lid seal for damage, if leakage phenomenon, you need to check the failure of the seal, while replacing the new seal.

8.6 Oil cooler disassembly and assembly

8.6.1Exploded view



1. O-ring
2. Oil cooler
3. Hex bolts

Figure 8-6 Exploded view

8.6.2Preparation before disassembly

1. Equipment conditions: Socket wrench
2. Disassembly Preparation: Remove the oil cooler cover

8.6.3Dismantling

Before disassembling, let go of the coolant in the engine, and then turn off the oil cooler bolts, remove the oil cooler and O-ring.

8.6.4Installation

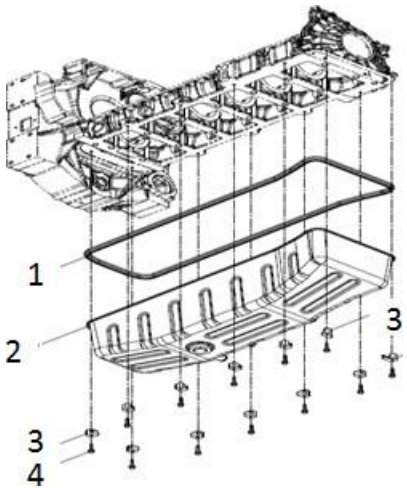
1. Before installing the oil cooler, check the oil cooler seal and the oil cooler to ensure that no defects and damage are created and used.
2. Clean the oil cooler and fuselage junction, install the oil cooler.
3. Install the oil cooler screw and tighten.

8.6.5Maintenance points

1. Check the oil cooler itself for cracks and other damage, if there is a crack you need to replace the oil cooler.
2. Check the oil cooler seal is damaged, if leakage phenomenon, you need to view the failure of the seal, while replacing the new seal.

8.7 Oil pan disassembly and assembly

8.7.1Exploded view



1. Gasket
2. Oil pan
3. Support block
4. Hex flange bolt

Figure 8-7 Exploded view

8.7.2Preparation before disassembly

1. Equipment conditions: Socket wrenches, special tooling
2. Disassembly Preparation: None

8.7.3Dismantling

1. Turn the engine, the oil pan up.
2. Remove the oil pan fastening bolt.
3. Remove the oil pan support block.
4. Remove the oil pan and gasket.
5. Remove the magnetic plug and the composite gasket.

8.7.4Installation

The installation steps are the opposite of the dismantling steps.

8.7.5Maintenance points

1. Disassembly: The oil pan should be cleaned before disassembly. Place the oil container on the oil pan under the oil drain plug, loosen the oil plug with a screwdriver, and drain the oil.
2. Assembly: Tighten the oil pan fastening bolts in the sequence shown in Figure 8.8,

Tightening torque is 22 N·m ~ 29 N·m.

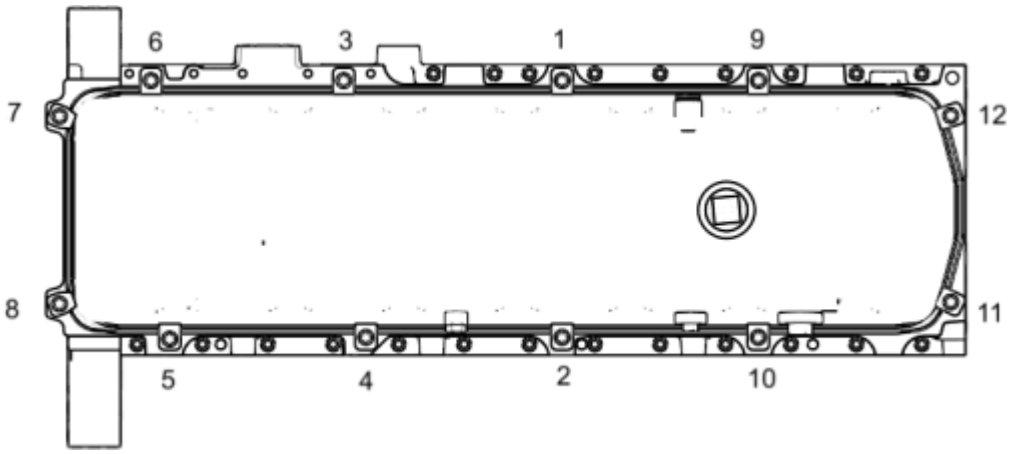


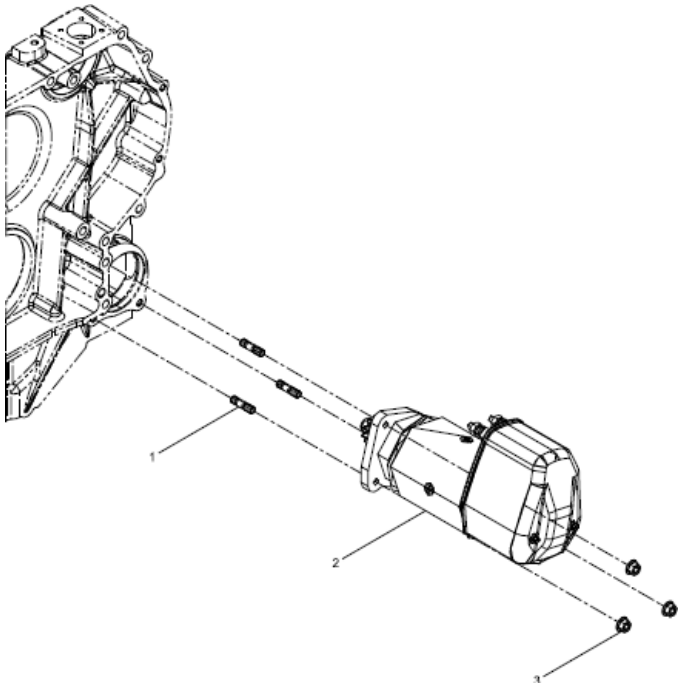
Figure 8-8 tighten the oil pan fastening bolts

9 Start the system

9.1 Startup system disassembly and assembly

9.1.1Exploded view

Starting system consists of a starter and a fixed starter stud, nut composition.



1. Stud
2. Starter
3. Nut

Figure 9-1 Exploded view

9.1.2Dismantling

1. Remove the starter.
2. Remove the ring gear.

9.1.3Installation

The starting system assembly procedure is the opposite of the starting system disassembly procedure.

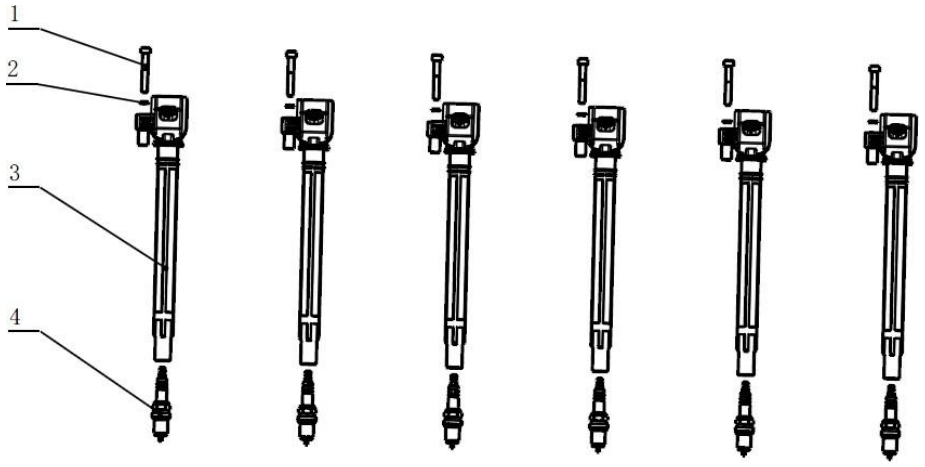
9.1.4Maintenance points

Check starter gear for damage, if damaged should be replaced.

10 Gas system

10.1 Ignition system disassembly and assembly

10.1.1 Exploded view



1. Hexagon socket head cap screw
2. Gasket
3. Ignition coil
4. Spark plug

Figure 10-1 Exploded view

10.1.2 Preparation before disassembly

Equipment conditions: Spark plug special wrench, sleeve.

10.1.3 Dismantling

1. Remove the ignition coil mounting screw.
2. Pull out the ignition coil along the axis, the ignition coil cannot withstand the lateral force.
3. Use a special spark plug to remove the wrench and remove the spark plug.

Figure 10-2 Spark plug special wrench

10.1.4 Installation

1. Tighten spark plug with professional spark plug wrench, tightening torque (25-28) N·m.
2. Assemble the ignition coil, push it down vertically in assembly, do not push and pull laterally.
3. Fix the ignition coil with M6 hexagon socket head cap screw and tighten the torque (8-10) N·m.

10.1.5 Maintenance points

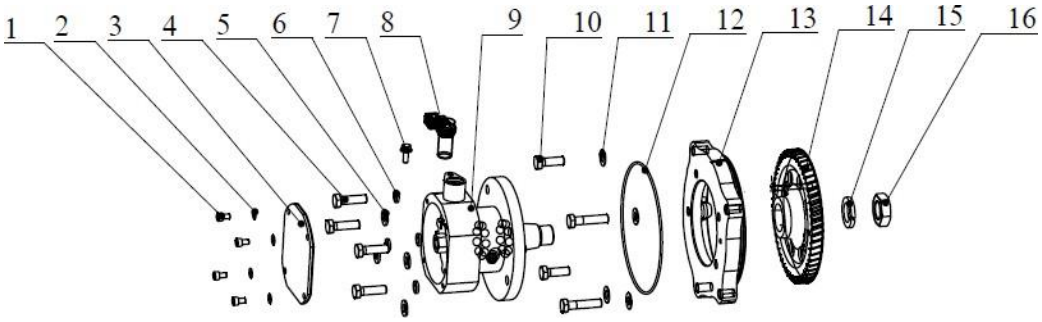
1. The normal spark plug head is gray or gray, if the spark plug head electrode damage or melting failure, to be replaced with a new spark plug.
2. Adjust the spark plug gap with a feeler gauge, the gap range is (0.45-0.5) mm, the gap between each cylinder should be the same, if necessary, replace.

   Note: If the spark plug gap is too large: first plug into the gap, gently wrench with a small wrench corner of the side electrode; if the spark gap is too small: the first vise to slowly adjustthe gap, then plug into the feeler, gently tap the corner of the side electrode with a small wrench. Adjust the gap to ensure that the side electrode and the center electrode end parallel.
3. Check the spark plug head thread is intact, if necessary, replaced.
4. Check the ignition coil rubber cover is aging or damaged, if necessary, replaced.

   Note: remove the rubber sleeve along the axial edge of the drawing, bending prohibited.

10.2 Signal generator disassembly and assembly

10.2.1 Exploded view



1. Hexagon socket head cap screw
2. Flat washer
3. Cover plate
4. Bolt
5. Washer
6. spring washer
7. Hexagonal flange bolt
8. Speed sensor
9. Signal generator
10. Bolt
11. Washer
12. O-ring
13. Fuel injection pump flange
14. Timing gear
15. Spring washer
16. Nut

Figure 10-3 Exploded view

10.2.2 Preparation before disassembly

Equipment conditions: pneumatic wrench, sleeve.

10.2.3 Dismantling

1. Remove the pump mounting flange bolts, the signal generator and fuel pump flange overall removal.
2. Remove the timing gear fixing nut and separate the timing gear from the signal generator.
3. Remove the signal generator fixing bolt and separate the signal generator from the fuel pump flange.
4. Remove the hexagon flange bolt of the speed sensor and separate the speed sensor from the signal generator.

10.2.4 Installation

1. Install the signal generator on the fuel pump flange, tighten with M10 bolts, tightening torque (40-50) N·m;
2. Assemble the O-ring rubber to the pump flange

3. Install the timing gear on the signal generator, tighten with M20 hex nut, tightening torque (200-220) N·m.
4. Install the speed sensor on the signal generator, tighten the M6 hex flange bolts, tightening torque (8-10) N·m.
5. Remove the signal generator side cover, adjust the signal generator gear plate: adjust the first cylinder piston compression top dead center position, adjust the signal generator gear plate, so that the TDC scale line alignment with the speed sensor centerline.

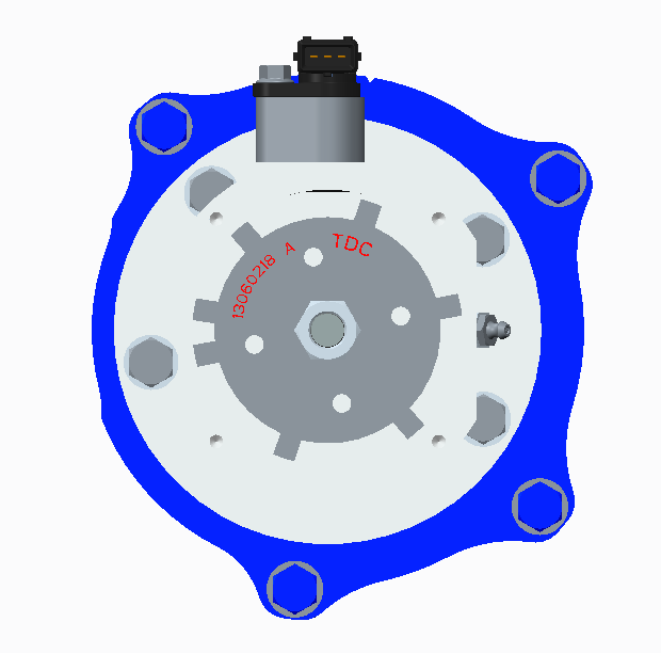


Figure 10-4 Slotted signal generator tooth plate diagram

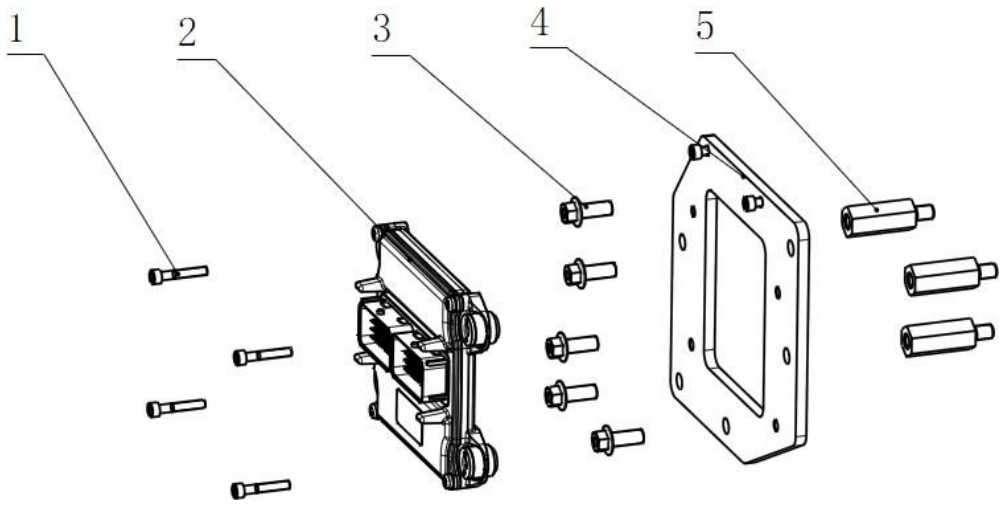
6. Install the cover and tighten the hexagon socket head cap screws M6, tightening torque (8-10) N·m.

10.2.5 Maintenance points

1. Check the signal generator shaft thread is damaged.
2. Check the nut is tightened, the signal generator gear adjustment is correct.
3. Check the O-ring is damaged, if necessary, replace.
4. Check the speed sensor head is damaged if there is foreign body, if necessary, replaced.
5. Check the clearance between the speed sensor and the gear unit of signal generator, it should be (0.5-1.5) mm.

10.3 Electronic control module disassembly and assembly

10.3.1 Exploded view



1. Hexagon socket head cap screw
2. ECU
3. Hexagonal Flange Bolt
4. ECU Bracket
5. Support Screw

Figure 10-5 Exploded view

10.3.2 Preparation before disassembly

Equipment conditions: pneumatic wrench, sleeve.

10.3.3 Dismantling

1. Then disassemble the hexagon socket head cap screws on the ECU.
2. Remove the ECU.
3. Remove the hexagon flange bolts on the ECU bracket in turn.
4. Remove the ECU bracket.

10.3.4 Installation

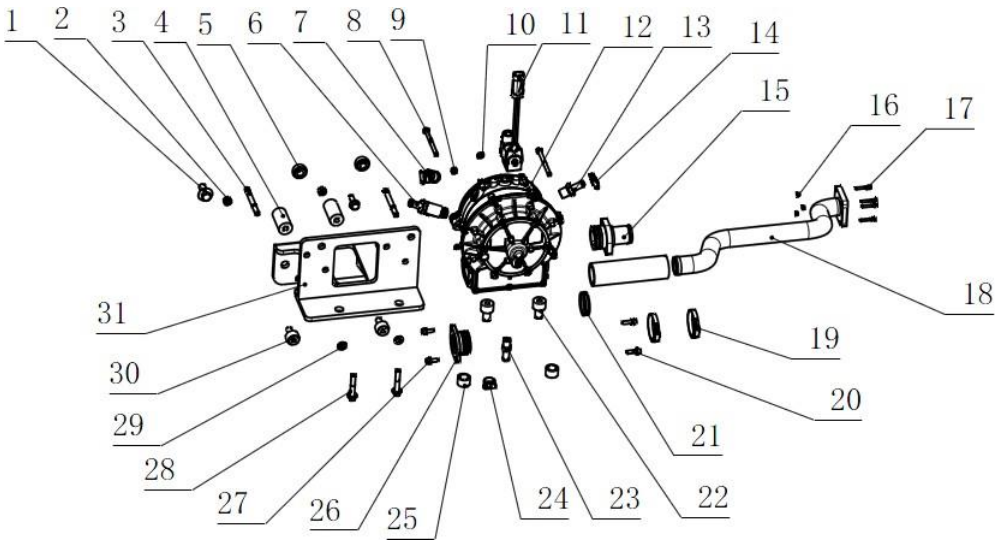
The assembly procedure is the opposite of the disassembly procedure.

10.3.5 Maintenance points

1. Check if the internal pins of the ECU electrical socket end are abnormal. If there is a failure mode such as pin rusting, bending, breaking, missing, etc., replace the ECU.
2. Check the ECU electrical socket (plastic parts) for damage, if the locking and sealing parts damaged, need to replace the ECU.

10.4 LPG supply system dismantling and assembly

10.4.1 Exploded view



1. Hexagonal Flange Bolt
2. Nut
3. Stud Bolt
4. Support Block
5. Shock Absorption Pad
6. Tee Adapter
7. Clamp
8. Bolt
9. Gasket
10. Nut
11. LPG Electromagnetic Shut-Off Valve
12. LPG Evaporator
13. Water Pipe Joint
14. Clamp
15. Pipe Joint
16. Nut
17. Bolt
18. Gas Pipe
19. Clamp
20. Hexagon Socket Head Cap Screw
21. O-Ring
22. Sensitive Cushion
23. Pipe Joint
24. Clamp
25. Sensor Cushion
26. Pipe Joint
27. Bolt
28. Flat Washer
29. Damping Pad
30. LPG Evaporator Bracket

Figure 10-6 Exploded view

10.4.2 Preparation before disassembly

1. Equipment conditions: pneumatic wrench, sleeve.
2. Preparation before disassembly: Remove other peripherals installed on the LPG supply system.

10.4.3 Dismantling

1. Remove the clamp between the LPG evaporator and the gas pipe and fix the bolt on the flange end of the gas pipe to remove the gas pipe assembly and hose.
2. Remove LPG evaporator inlet and outlet fittings clamp, pull out the inlet pipe and outlet pipe.
3. Remove the connecting bolt and cushion between the LPG evaporator and the LPG evaporator bracket and remove the LPG evaporator assembly.
4. Remove the bolts of the LPG evaporator fixing bracket and remove the fixing bracket.
5. Disassemble the LPG evaporator electromagnetic cut-off valve.
6. Remove the water and air connections on the LPG evaporator.

10.4.4 Installation

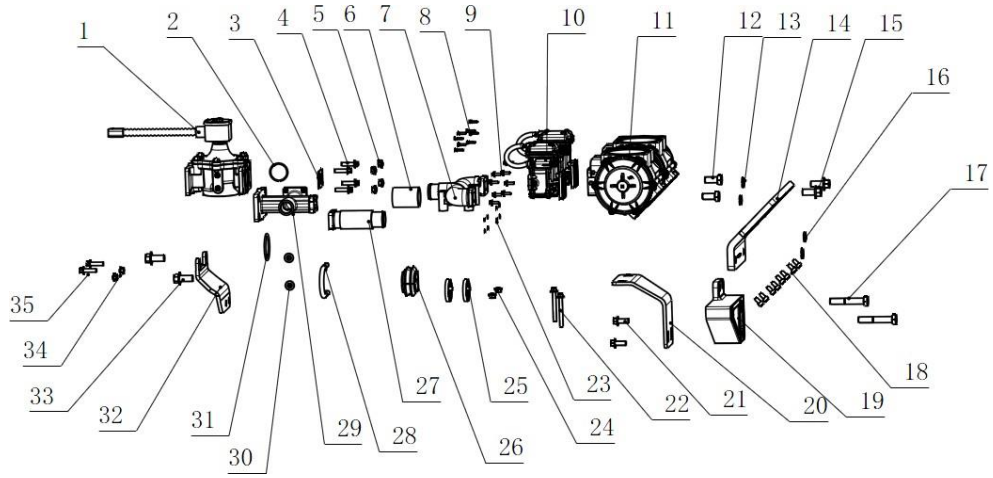
The assembly procedure is the opposite of the disassembly procedure.

10.4.5 Maintenance points

1. After disassembly and installation, you need to replace the gasket, O-type rubber ring before installation.
2. Check the joints, clamps are fastened well.
3. Check LPG evaporator balance pipe is connected to the mixer.
4. Use the leak test liquid to check the gas connections to ensure no leaks.
5. Check the waterway interface to ensure no water leakage.
6. Check the gas pipe for cracks and other damage, the flange is deformed, etc., there is the need to replace the gas pipe

10.5 NG gas supply system dismantling and assembly

10.5.1 Exploded view



1. Solenoid Valve
2. O-Ring
3. Gasket
4. Hexagonal Flange Bolts
5. Hexagonal Flange Nuts
6. Hose
7. Gas Pipe
8. Hexagonal Flange Bolt
9. EPR Valve
10. Mixer
11. Bolt
12. Spring Washer
13. Mixer Holder
14. Hexagonal Flange Bolt
15. Spring Washer
16. Bolt Socket Head Cap Screw
17. Hexadecimal Cap Screw
18. Transition Bracket
19. EPR Valve Bracket
20. Hex Flange Bolt
21. Hex Flange Bolt
22. Flat Washer
23. Hex Flange Nut
24. Clamp
25. Damping Pad
26. Gas Pipe
27. U-Shaped Bolt
28. Gas Pipe Joint
29. Hexagonal Flange Nut
30. O-Ring
31. Electromagnetic Valve Bracket
32. Hex Flange Bolt
33. Hexagonal Flange Nut
34. Hexagonal Flange Bolt

Figure 10-7 NG Exploded view

10.5.2 Preparation before disassembly

1. Equipment conditions: pneumatic wrench, sleeve
2. Preparation before disassembly: Remove other peripherals installed on the NG gas supply system.

10.5.3 Dismantling

1. Remove the fixing bolts of the solenoid valve bracket and remove the fixing bracket.
2. Remove the solenoid valve and the gas pipe connector end of the connection bolts, remove the solenoid valve.
3. Remove the bolt between the gas pipe joint and the gas pipe and remove the gas pipe joint.
4. Remove the U-bolt fixing nut, remove the U-bolt and cushion.
5. Remove the fixing bolt between gas pipe and EPR valve.

6. Remove the clamp at both ends of the hose, remove the gas pipe and hose.
7. Remove the bolts on the EPR valve fixing bracket and remove the bracket.
8. Remove the fixing bolt between EPR valve and gas pipe and remove the gas pipe.
9. Remove the fixing bolts between the EPR valve and the mixer and remove the EPR valve.
10. Remove the fixing bolt between the mixer and the bracket and remove the mixer.
11. Remove the fixing bolts between the mixer bracket and the transition bracket and remove the mixer bracket.
12. Remove the fixing bolt between the transition bracket and the flywheel housing and remove the transition bracket.

10.5.4 Installation

The assembly procedure is the opposite of the disassembly procedure.

10.5.5 Maintenance points

1. After disassembly and installation, you need to replace the gasket, O-type rubber ring before installation.
2. Check the joints, clamps are fastened well.
3. Check if NG inlet pressure is at 2.5 kPa.
4. Use the leak test liquid to check the gas connections to ensure no leaks.
5. Check the gas pipe for cracks and other damage, the flange is deformed, etc., there is the need to replace the gas pipe.

11 APPENDIX A

Appendix A: Tolerance Clearance for Main Parts of Gas Engine (Reference value)

#	Items		Theoretical value (mm)
1	Main bearing clearance		0.063～0.138
2	Connecting rod bearing clearance		0.05～0.125
3	Crankshaft axial clearance		0.052～0.255
4	Connecting rod planar axial clearance		0.15～0.35
5	Clearance between the connecting rod small end bushing andpiston pin		0.04～0.06
6	Clearance between piston pin hole and piston pin		0.011～0.023
7	Clearance between valve stem and intake valve guide pipe		0.025～0.054
8	Clearance between valve stem and exhaust valve guide pipe		0.041~0.074
8	Piston ring's gap in coldstate	The first (top) ring	0.35～0.5
		The second ring	0.5～0.7
		Oil ring	0.2～0.7
9	Piston ring end face gap incold state	The first (top) ring	0.11~0.16
		The second ring	0.06～0.1
		Oil ring	0.03～0.17
10	Plane values of valve bottom recess cylinder head		0.05～0.10
11	Plane values of cylinder liner top above the engine body		0.05～0.10
12	Camshaft axial clearance		0.15～0.35
13	Camshaft bearing clearance		0.04～0.12
14	Clearance between valve tappet and tappet hole		0.025～0.089
17	Valve clearance (coldstate)	Intake (mm)	0.5
		Exhaust (mm)	0.8
18	Clearance between rocker arm and rocker arm shaft		0.012～0.066
19	Gear backlash between timing gear and the intermediate gear		0.015～0.033

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