

Operation and Maintenance Manual for WP10 Series Four-valve Diesel Engine (China IV, V)



Weichai Power Co., Ltd.



WP10 Series Four-valve Diesel Engine (China IV, V)

Special Notice

- Before operating the diesel engine, please always read this Operation and Maintenance Manual carefully, and follow the technical operation and maintenance practices therein strictly.
- As the diesel engine has been tested strictly according to the related test specification, it is prohibited to increase the engine power by changing the ECU data without permission, otherwise, the warranty service commitments of Weichai will be invalid.
- The ECU, common-rail fuel pump and injector are of precision components, it is prohibited to disassemble at will; otherwise, the warranty service commitments of Weichai will be invalid.
- The turbocharger rotor shaft is of precision and high speed rotation component, it is prohibited to disassemble or impact with hard objects; otherwise, the warranty service commitments of Weichai will be invalid.
- For the important bolts of diesel engine (such as main bearing bolt and connecting rod bolt), there are strict requirements on tightening torque and rotating angle, it is prohibited to unscrew or dismantle at will. The connecting rod bolt can be used only one time. Otherwise, the warranty service commitments of Weichai will be invalid.
- The diesel engine should use the oil and fuel specified in this Operation and Maintenance Manual and they should be filtered with special clean filters in filling (the fuel should also be deposited for 72h before being added). Check the coolant and oil level every time before starting the engine.
- It is prohibited to run the diesel engine without air filter to avoid the unfiltered air from entering the cylinders directly.
- For the new diesel engine, 50h test run shall be performed before normal using.
- After the engine is started in cold state, please run it at idle speed for a while (do not run it at idle speed for a long time) and then increase the engine speed slowly. After running under heavy load, do not stop the engine immediately (except in special cases), you should run the engine at low speed for 5~10 minutes before stopping.
- Please check the coolant periodically and replace it if necessary. It is prohibited to use cold water or low-grade coolant.
- Inspection and repair of the electrical system components of diesel engine should be carried out by professional technicians.
- Inspection and repair of the electronic control system components of diesel engine should be carried out by professional technicians of Weichai Service Station.
- In general, the oil seal period of diesel engine is one year, please check and take necessary measures if exceeded.
- The key components (such as turbocharger, injection pump, injector, ECU, exhaust after-treatment system and EGR system) related to engine emission should be replaced with that of the same model of same manufacturer. Otherwise, Weichai will not bear any responsibility for the diesel engine damage caused due to not using the specified spare parts.

Foreword

This series diesel engine is of high-speed diesel engine developed and manufactured by Weichai Power Co., Ltd. This series has a compact structure, reliable operation, excellent performance, low fuel consumption and meets the requirements of international emission standards. The engine is quick to start, simple to operate and easy to maintain.

This manual covers the basic information for the use and maintenance of the diesel engine. To gain optimum performance and properly maintain the engine, please understand the diesel engine structure in detail, and learn to master the maintenance and use methods.

With the continual launch of new products in this series, notification of changes will be made via our website; please visit <http://www.weichai.com> for the latest product information.

June 2017

图示标记说明 Description of the illustration marks

	拆卸(组合件) Dismounting (assembly parts)		涂润滑油 Oil coating
	装配(组合件) Fitting (assembly parts)		专用工具, 如 S K……, KUKKO, …… , TS……W Special tools, such as K--- ---, KUKKO, --- ---, TS--- --- W
	打记号 (分解前打上, 重新装配时注意对正) Marking (do before disassemble, adjust when assemble)		注意装配方向 Pay attention to assembly direction
	注入—充满(如润滑油、冷却水等) Filling— full charge (such as lubricating oil, cooling water etc.)		放气 Deflating
	排出(例如润滑油、冷却水等) Draining off (lubricating oil or cooling water)		松开(例如: 夹紧装置的松开) Unloosing (such as unloose clamping equipment)
	(防松—粘固)涂液态密封剂 (loose-proof -fixed) Coat fluid sealant		夹紧(例如: 夹紧装置的夹固) Clamping (such as: reinforcing clamp equipment)
	防止人身事故(危险场合标记) Accident preventing (marks for dangerous occasion)		检测—调整 (例如: 拧紧力矩, 尺寸, 压力, 间隙等) Inspecting -adjusting (such as tightening torque, dimension pressure and clearance)
	每次装配都要更换 Replacement when re-assembly		检查 Inspecting

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1. Product overview

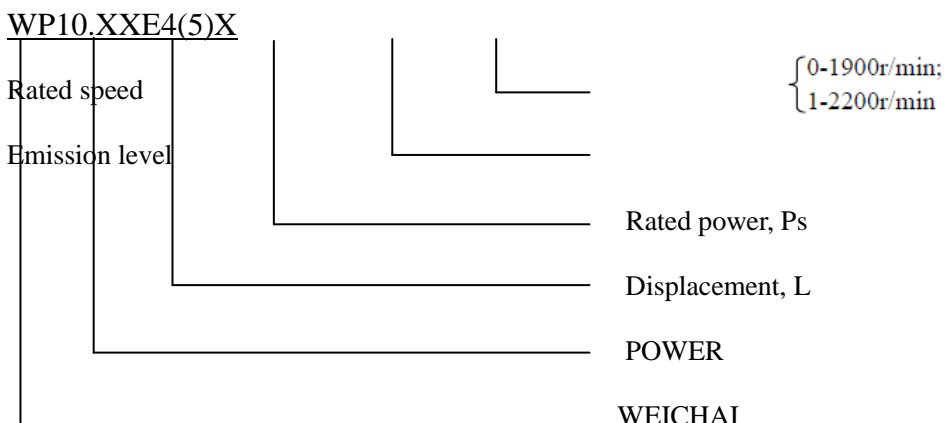
1.1 Power and speed of the diesel engine

The power range of WP10 series diesel engine (China IV, V) is 175-247kW, the rated speed is 1900r/min.

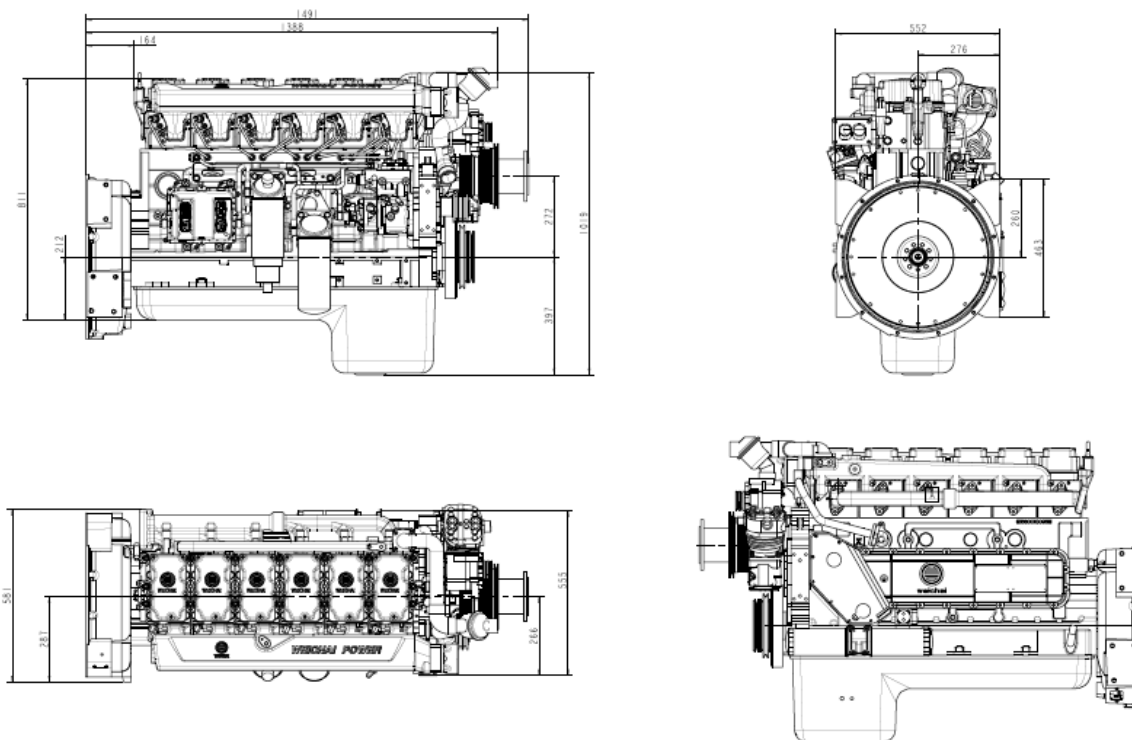
1.2 Main structural features of the diesel engine

- One cylinder one head, reliable in working and convenient in dismantling.
- Left side arranged common rail system is adopted (viewed from the free end of the diesel engine) for easy vehicle layout.
- Frame main bearing structure, high strength cylinder block, ensuring the high reliability and long service life of the whole engine.
- Middle or rear arranged turbocharger, with small change of overall dimensions of various models.
- Front designed gear train, with impact structure and lower noise
- All series of products are of inline six-cylinder structure with good interchangeability, convenient for vehicle matching.
- Equipped with high pressure common rail system and SCR after-treatment system.

1.3 Meaning of the diesel engine model



1.4 Outline drawings of WP10 series China IV/V diesel engine



2. Technology and performance parameters of the diesel engine

2.1 Main technical parameters of the diesel engine

Table 2-1 Main technical parameters

Engine type	Liquid cooled, 4-stroke, DI, turbocharged and inter-cooled, with EVB
Bore/stroke (mm)	126/130
Displacement (L)	9.726
Compression ratio	17:1
Firing order	1-5-3-6-2-4
Fuel system	Electronic controlled high pressure common rail
Catalytic converter	Urea-SCR system
Cold state valve clearance (mm)	Intake valve: 0.4; exhaust valve: 0.6; EVB system: 0.4
Valve timing (valve clearance: intake 0.4, exhaust 0.6)	Intake valve open: 20° before TDC; Intake valve close: 34° after BDC; Exhaust valve open: 49° before BDC; Exhaust valve close: 21° after TDC



Thermostat opening temperature (°C)		83	
Starting type		Electric starter	
Lubricating mode		Pressure lubrication	
Oil capacity (L)		24	
Cooling mode		Water cooling forced circulation	
Oil pressure (kPa)		350~550	
Oil pressure at idling speed (kPa)		≥100	
Permissible longitudinal inclination (°)	Front/rear	Long time: 10/10	Short time: 30/30
Permissible sidewise inclination (°)	Exhaust manifold side/injection pump side	Long time: 45/5	Short time: 45/30
Crankshaft rotation (view from free end)		Clockwise	

2.2 Main performance parameters of the diesel engine

Table 2-2 Main performance parameters

	Unit	WP10 diesel engine(China IV, V)			
		WP10.240	WP10.270	WP10.300	WP10.336
Engine model		WP10.240	WP10.270	WP10.300	WP10.336
Engine type	-	Liquid cooled, 4-stroke, DI, turbocharged and inter-cooled, with EVB and SCR			
Displacement	L	9.726			
Bore × stroke	mm	126×130			
Number of cylinders	-	6			
Valves per cylinder		4			
Fuel injection equipment		Electronic controlled high pressure common rail			
Rated power	kW	175	199	221	247
Rated speed	r/min	1900			
Max torque	Nm	1150	1270	1390	1500
Speed at max torque	r/min	1200~1500			
Emission level	-	China IV/V			
Fuel consumption at rated power	g/kWh	≤210			
Min fuel consumption at full load	g/kWh	195			



Cold starting (without starting aid)	°C	-10
White smoke emission	Opacity	≤15% after idling for 20s
Cold starting (with starting aid)	°C	-30
Noise at 1m away from the engine	dB(A)	<104
B ₁₀ lifetime	km	800,000



3. Fuel, Lubricating Oil, Coolant, Diesel Exhaust Fluid and Auxiliary Material of the Diesel Engine

3.1 Fuel

In summer: 0# diesel fuel (GB252) should be used.

In winter: Select the fuel of proper grade according to the ambient temperature.

3.2 Lubricating oil

For Weichai Power China IV Series and China V series Diesel Engines, grade CI-4 should be used. Special oil for Weichai Power should be used refers to table 3-1.

Table3-1 Specification for Weichai Power special oil selection

Type	Product class		Packaging capacity	Applicable engine models
Oil for diesel engine	CI-4	10w/30 15w/40 20w/50	4L,18L,170kg	China IV series diesel engines: WP4, WP5, WP6, WP7, WP10, WP12, WP13,etc.

For Viscosity selection for Weichai Power special oil refers to table 3-2.

Table 3-2 Relation table between viscosity and applicable ambient temperature

SAE Viscosity grade	Applicable ambient temperature (°C)
0W-20	-35-20
5W-30	-30-30
10W-30	-25-30
15W-40	-20-40
20W-50	-15-50

Attention:

- 1) Before starting the diesel engine, check the oil level in the oil sump firstly.
- 2) Don't inspect the oil level when the diesel engine is running.
- 3) Oils with different manufacturers or different grades are not allowed for mixing with Weichai Power special oil.

Table13-3 Oil filling capacity and filter element number for all series of Weichai engines



Engine series	Oil filling capacity (L)	Filter numbers				
		Diesel engine			Gas engine	
		Oil filter	Fuel filter		Oil filter	Gas filter
			Coarse filter	Fine filter		
WP10	22~26	2	1	1	2	1

Note:

- 1) The oil filling capacity in this table is only for reference, for the actual filling, take the oil dipstick as the standard.
- 2) If fuel system protector or fuel filter with water separator is equipped, its element should be replaced together with the fuel filter.

3.3 Lubrication of tensioner

The tensioner shall be lubricated with general lithium base grease for automobile (Refer to national standard GB/T5671-1995).

3.4 Diesel engine coolant

The diesel engine cooling system shall be filled with pure coolant. The function of coolant is to prevent freezing under cold weather and to prevent boiling under high temperature. Furthermore, the coolant contains rust-inhibiting and anticorrosion additives, which can offer special protection to the water tank and engine cooling chamber, and avoid cylinder liner cavitation and cooling system corrosion.

The Weichai Power special coolants with freezing points of -25°C, -35°C and -40°C are available. Please choose the coolant based on the local ambient temperatures in such manner that the freezing point of coolant should be 10°C lower than the local air temperature.

Table 3-4 Weichai Power special coolants for heavy-duty engine

Type	Designation	Packing
Heavy-duty engine coolant	HEC-II-25	4kg, 10kg
	HEC-II-35	
	HEC-II-40	

Notice: 1) Check the coolant regularly to prevent corrosion damage. Replace the coolant if necessary.

2) Never use water or low-grade coolant.

3.5 Diesel Exhaust Fluid

The substandard diesel exhaust fluid(DEF) will easily lead to poisoning failure of SCR catalyst or lower reduction efficiency(For instance, the out-of-limit of phosphorus, sodium, potassium and calcium contents in the DEF will easily lead to poisoning of catalyst and if the concentration of DEF is unqualified, it will easily lead to excessive leakage of NH₃ or lower reduction efficiency of NO_x) and excessive emission and malfunction indicator lamp warning. So, the quality and the performance of DEF shall meet the requirements specified in standard ISO 22241. See table 3-5 for details.

Table 3-5 DEF specifications as per ISO 22241

Items	Unit	Minimum	Maximum
Urea content	% by weight	31.8	33.2
Density at 20°C	kg/m ³	1,087	1,093
Refracting index at 20°C	-	1.3814	1.3843
Alkalinity as NH ₃	%	-	0.2
Biuret	%	-	0.3
Aldehyde	mg/kg	-	5
Insolubles	mg/kg	-	20
Phosphate (PO ₄)	mg/kg	-	0.5
Calcium	mg/kg	-	0.5
Iron	mg/kg	-	0.5
Copper	mg/kg	-	0.2
Zinc	mg/kg	-	0.2
Chromium	mg/kg	-	0.2
Nickel	mg/kg	-	0.2
Aluminium	mg/kg	-	0.5
Magnesium	mg/kg	-	0.5
Sodium	mg/kg	-	0.5
Potassium	mg/kg	-	0.5

3.6 Auxiliary materials

Table 3-6 Auxiliary materials and applications



No.	Name	Color	Function and application
1	Molykote Pulver (fine molybdenum powder)	Black	Applied on flat and smooth metal surfaces to prevent seizing For instance: Applied onto outer surface of cylinder liner
2	Molykote G-N plus (Molybdenum disulfide, oil solution)	Dark grey	Achieve lubrication function before lubricating oil pressure is built up For instance: Applied onto intake valve stem

Table 3-7 Application of sealant for diesel engine

Grade	Major application	Application part	Supplements
Loctite 242	Applied onto the threads to prevent looseness due to vibration, with moderate strength.	Flywheel housing bolt Camshaft thrust plate bolt Camshaft timing gear bolt Intermediate idler gear bolt Front end cover bolt Oil filter head bolt Oil cooler bolt Screw plug of engine oil cooler regulator valve Bolt of oil pump return pipe fixing device Air compressor shaft end thread Strainer bolt Bolt of sensor and harness fixing device	Alternatively, DriLoc204 thread-locking adhesive can be used for pre-coating
Loctite262	Applied onto the external threads for locking, sealing, preventing vibration from causing looseness	Cylinder head secondary bolt	
Loctite271	Locking and tightening	Bowl-shape plug for oil hole	
Loctite277	For sealing between core and hole	Other bowl-shape plugs	
Loctite270	For sealing of cylinder head top surface	Push rod tube - cylinder head	



<p>Loctite518 (upgraded product based on 510)</p>	<p>Applied on shining metal surface for sealing</p>	<p>Mating faces of cylinder block and crankcase Cylinder block front end face and the front end cover Connecting plate between cylinder block rear end face and flywheel housing Mating faces of oil filter seat and crankcase Water pump rear cover and cylinder block front end face Flywheel housing connecting plate and flywheel housing Mating face between cylinder block and engine oil cooler Mating face between cylinder block and oil filler port cover plate</p>	
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4. Use and Operation of the Diesel Engine

4.1 Diesel engine unsealing

After opening the engine packing case, please check the engine appearance for damage and loose connection before carrying out the following operations:

- 1) Wipe away the rust proof coat or anti-corrosion agent on the surfaces of exposed components.
- 2) Drain the sealing oil from the fuel filter and fuel system components (it is allowed to run the engine with load only when the sealing oil is used up and the normal diesel fuel has been supplied).

Notice: The oil seal is only effective for one year, and when the time is up, please get your engine inspected and take necessary remedies.

- 3) Rotate the flywheel and spray solvent into the intake pipe until the oil sealing oil in the cylinder is completely removed.
- 4) Spray solvent into the turbocharger intake/exhaust ports until the oil sealing oil is completely removed.
- 5) Add lubricating oil of specified grade to the oil pan as required. If the oil containing running-in accelerant is filled in the oil pan before delivery, it is suggested that the oil should be drained off after running for 2,000km (or 50h) and then fill with new oil.
- 6) Base on the agreement between Weichai and user, if the coolant is already filled according to the user's requirement before delivery, please check the coolant performance when unpacking. If the antifreezing capability is suitable for -30°C or -35°C, the PH value is 7~8 (neutral), the total hardness number is 5-15°d [9-15°f (hardness)], the coolant can be used. Otherwise, drain the coolant and add new coolant which contains antifreeze additives.

4.2 Hoisting of diesel engine

When hoisting the engine, keep the engine crankshaft centerline in horizontal state, and never hoist the engine obliquely or at one side (as shown in figure 4-1).

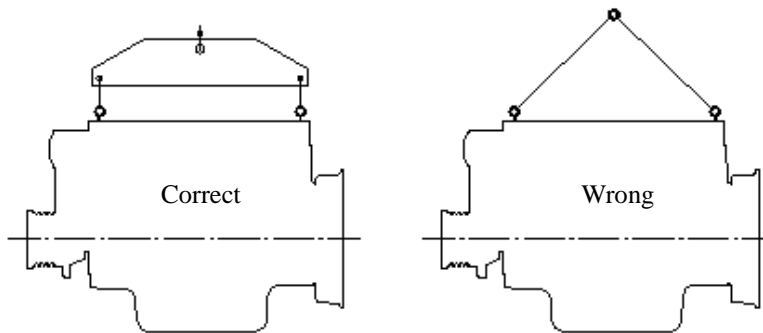


Figure 4-1 Diesel engine hoisting

4.3 Installation of the diesel engine

When installing, it should be ensure that the centerline of diesel engine crankshaft is concentric with the axis of input shaft of driving device (gear box, alternator etc.) and elastic coupling should be used to ensure that there is no additional axial foron the crankshaft caused by the installation.

4.4 Preparations for Diesel Engine Starting

1) Check coolant level

Check the coolant level through the glass window of expansion tank, and add coolant from the filler port if necessary. When the engine is still hot, before open the filler cap with relief valve and bleed button, please always press down the bleed button first to release the hot air. It is prohibited to add a large amount of coolant when the engine is relative hot; otherwise, the related parts of diesel engine may get damaged due to sudden excessive temperature change. The coolant (water) should be added via the filler port until it overflows.

Start the engine, and when the engine is running (at 1000 r/min), continue to add coolant till the liquid level is stable, and then close the filler cap.

2) Check fuel level

If the engine has been installed on the vehicle, please turn on the power supply switch, and check fuel level through the fuel meter or check the fuel tank directly.

3) Check engine oil level

The engine oil level shall be located at between the upper and lower markings of the oil dipstick. If necessary, add engine oil from the filler port.

4) Check liquid level in DEF tank

Generally, the DEF consumption accounts for 3~5% of the fuel consumption (by volume). Check the liquid level of DEF frequently based on the use condition. Please maintain the liquid level at 30~80% of full level and timely add if necessary.

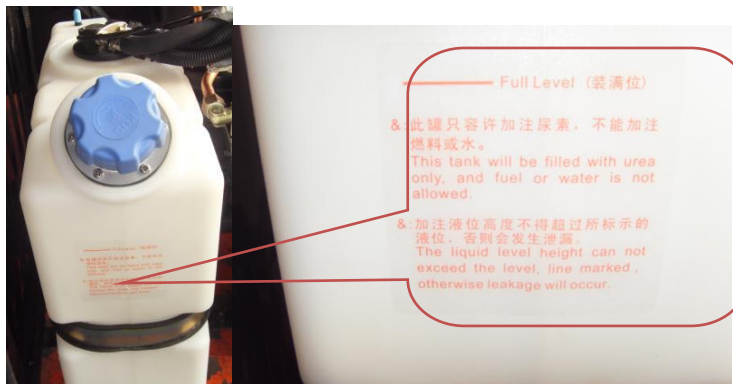


Figure 4-2 Urea Level Identification on Urea Tank

4) Check all accessories of the diesel engine for reliable connections.

5) Check the starting system for normal wiring and check and ensure that the battery is charged sufficiently. Then open the fuel tank valve, loosen the bleeding screw on primary fuel filter, and operate the manual pump on the fuel filter to remove the air inside the fuel system.

4.5 Diesel Engine Starting

1) Turn the power switch, ignition key to the starting position, and move the gear lever to the neutral gear position before starting the engine.

2) Depress the clutch pedal and throttle pedal, and turn the ignition key to start the engine. If the engine fails to be started within 5~10 seconds for the first attempt, start it again one minute later. If the engine still fails to be started after three attempts, stop the attempt and find out and solve the malfunction before retry. After the engine is started, check the readings of meters. The engine oil pressure meter shall immediately indicate a pressure. For the cold engine, you should run it at idle speed for a while (no more than 10 minutes).

3) It is recommended to use the starting aid in case of engine startup at lower temperature. Under the action of relay, the electronic heating flange begins to work and then heats the incoming air, allowing a smooth startup of the engine at -30°C.

4.6 Diesel Engine Running

1) After the engine is started, run it at idle speed for a few minutes and then increase the speed to (1,000~1,200) r/min and add part load. Only when the water outlet temperature is higher than 60°C and the oil temperature is higher than 50°C, can you operate the engine with full load. It is recommended to increase the load and speed gradually, and avoid sudden loading or unloading as possible.

2) In the running-in period (about 60h or 3,000km) of diesel engine, the engine can only be run with load below

the moderate.

3) Speed down timely when driving on a slope road. Long term work under large torque condition, small load and low rotating speed are not recommend, for which may lead to excessive oil consumption.

4) In normal use, you can run the diesel engine continuously at rated power and rated speed. But if the running speed is 105% or 110% of the rated speed, it can be allowed to run for 20 minutes only. After the diesel engine is unloaded, it is required to run the engine at idle speed for (1~2) minutes before shutdown.

5) Check the following parameters in operation:

- a. Oil pressure in main oil passage: (350~550) kPa;
- b. Oil temperature in oil pan: $\leq 110^{\circ}\text{C}$;
- c. Coolant outlet temperature: $(80+5)^{\circ}\text{C}$, no more than 95°C ;
- d. Exhaust temperature after turbine: $< 600^{\circ}\text{C}$;
- e. Intake temperature after intercooler: $(50\sim 55)^{\circ}\text{C}$.

6) Check the color of exhaust gas to estimate the working performance of fuel injector and the operating load; if the color is abnormal (i.e., serious black or white smoke), stop the engine for troubleshooting.

Notice: Check the diesel engine for water, air and oil/fuel leakages during operation; and if any, stop the engine for troubleshooting.

7) The operator should acknowledge the following features of the engine:

- a. The fuel consumption is relatively low at max torque, and increases along with the rotation speed rise.
- b. The torque reaches its peak value within the medium speed range (1,200 - 1,500 r/min);
- c. The engine power increases along with the speed, and reaches its rated value at rated speed.

8) Precautions for engine running under cold environments:

- a. Fuel: Choose the diesel fuel of proper grade according to the ambient temperature in winter.
- b. Lubricating oil: Choose the lubricating oil with proper viscosity based on the season.
- c. Coolant: The cooling system should be filled with coolant (containing antifreezing additives) of proper grade according to the ambient temperature.
- d. Startup: Use starting aid when necessary in winter. After starting the engine, the running speed and load of diesel engine can be increased only after the oil pressure and water temperature become normal.
- e. Battery: Before the cold season comes, make sure to check the electrolyte level, viscosity and unit voltage of the battery; and if the diesel engine is not used for a long time and the ambient temperature is very low, it is recommended to remove the battery and keep it in a warm room.
- f. Shutdown: To stop the engine in cold weathers, unload the engine first, and run it at idle speed for (1~2) minutes, and wait for a while until the water temperature and oil temperature lower down; the coolant with

antifreeze should not be drained out after shutdown. However, if the coolant contains no antifreeze additive, make sure to drain off the coolant from the engine block, oil cooler cover, radiator and water pipes to prevent the engine from being frost cracked.

5. Regular Inspection and Technical Maintenance of the Diesel Engine

5.1 Routine Maintenance of the Diesel Engine

- a. Check the liquid level and temperature of coolant

Check the coolant level through the sight hole on the expansion tank, and if it is insufficient, open the filler port cap to add coolant. As shown in figure 5-1 and 5-2.

Notice: Before opening the filler cap, press down the air bleeding button to avoid personalby the hot coolant while the engine is hot.

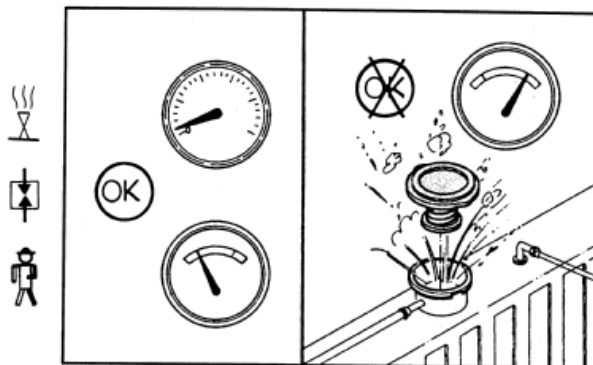


Figure5-1Coolant filler port cover

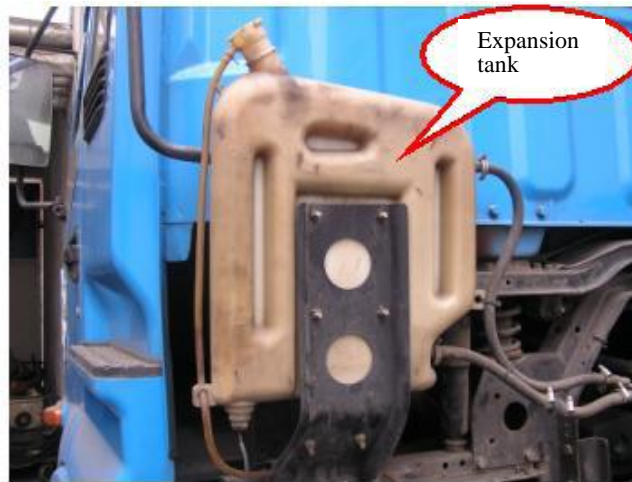


Figure 5-2 Expansion tank

b. Check the oil level

Check the oil level with oil dipstick. When the oil level is below the lower mark or above the upper mark, it is not allowed to start the diesel engine.

When checking the oil level, stop the engine and wait for at least 5 minutes, enabling the oil to flow back to the oil pan. The oil capacity difference between the upper mark and lower mark is about 3L. As shown in figure 5-3.

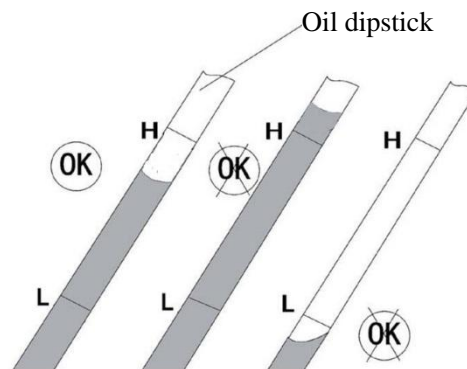


Figure 5-3 Oil dipstick

c. Check fuel level

d. Check for leakages

Check the external surface of diesel engine for water, air/gas and oil/fuel leakage.

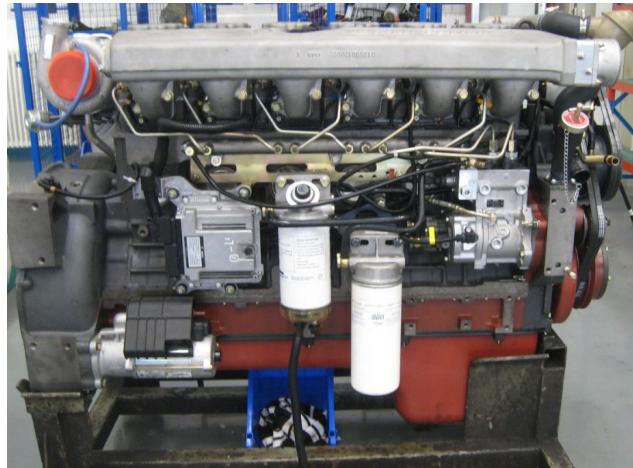


Figure 5-4 Diesel engine

e. Check the liquid level in DEF tank

The liquid level should be maintained in between 30% to 80% of total urea tank volume.

f. Check the fan

Visually check fan blade deformation and damage and check the connecting bolts for tightness (Figure 5-5).



Figure 5-5

g. Check the belt

The belt is automatically tensioned by the tensioner. Check the tension of belt by pressing the belt with hand.

h. Check the exhaust color

The normal color of exhaust gas is light grey. Do troubleshooting if the color has changed. See figure 5-6.



Figure 5-6

- h. Check the running sound of diesel engine.
- i. Check the speed and vibration of diesel engine.

5.2 Periodic maintenance items

◆ Replace the engine oil

Place an oil recycling container under the engine, unscrew the drain plug at the bottom of oil pan (figure 5-7), drain off the oil completely, and then screw in the drain plug again.

Open the oil filler cap, add fresh new oil through the filler port, the oil should be filtered by a strainer when filling; check the oil level through the scale mark of oil dipstick, tighten the filler port cap finally. See figure 5-8

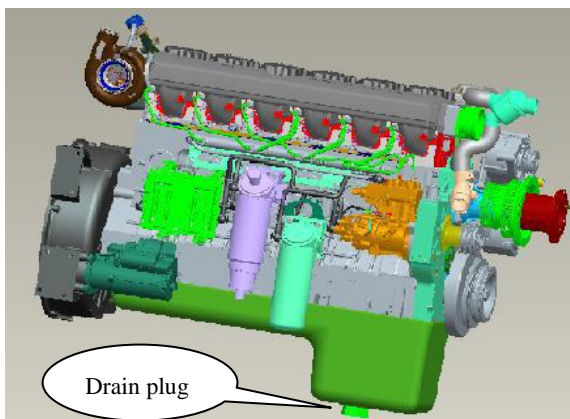


Figure 5-7



Figure 5-8

Notice: Set the vessel containing waste oil in specified place for recycling.

◆ Replace the oil filter or filter element (figure 5-9)

- a. Remove the old oil filter;
- b. Fill the new filter with clean oil;
- c. Apply lubricating oil on the sealing gasket before installing the new oil filter;
- d. After the sealing gasket touches the filter seat, tighten 3/4 to 1 more turns to seal tight;

e. Start the engine to check for oil leakage.

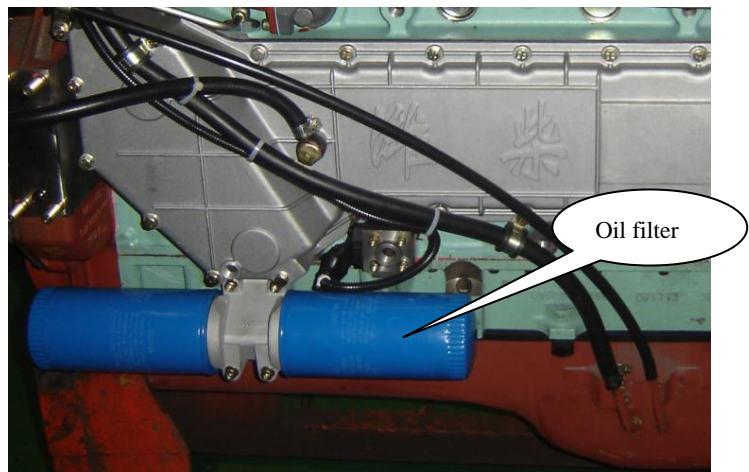


Figure 5-9

◆ Check and adjust intake/exhaust valve clearance

Check and adjust intake/exhaust valve clearance as follows:

- a. With the diesel engine in cold state, turn the flywheel with a bar (along with the running direction of diesel engine crankshaft) to make the pistons of No. 1 cylinder and No. 6 cylinder to TDC, when the notch groove on flywheel should be aligned with the pointer on the inspection window cover plate.
- b. Remove the valve rocker arm cover from the cylinder head, and determine if the No. 1 cylinder or No. 6 cylinder is in the compression stroke (as indicated by the existence of clearance between the intake/exhaust valve and the rocker arm under the compression stroke).
- c. Use a feeler gauge to check the clearance between the upper plane of valve bridge and rocker arm. For WP10 diesel engine, the intake valve clearance and exhaust valve clearance should be 0.4mm and 0.6mm respectively. Please rotate the adjusting screw on the rocker arm to achieve proper valve clearance. See figure 5-10.

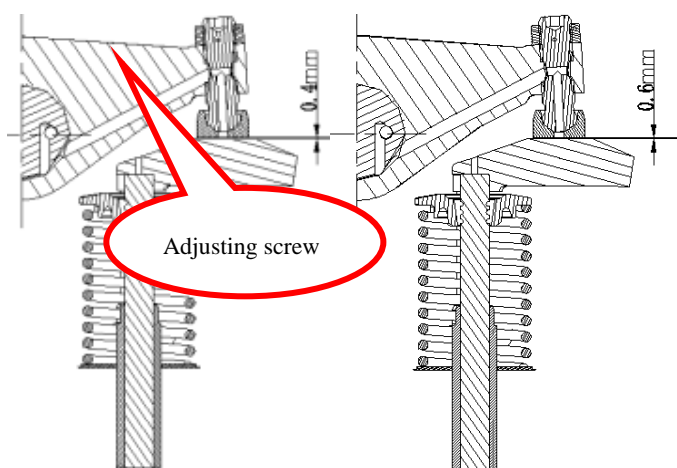


Figure 5-10 Cold state valve clearance: intake valve, 0.4mm; exhaust valve, 0.6mm

d. After the checking of the No. 1 or No. 6 cylinder, turn the flywheel by another 360°, ensuring that the No. 6 cylinder or No. 1 cylinder is in working stroke, and then adjust the remaining valves (see table 5-1).

Table 5-1 Adjustment of valve clearances

	No. 1 cylinder	No. 2 cylinder	No. 3 cylinder	No. 4 cylinder	No. 5 cylinder	No. 6 cylinder
No. 1 cylinder, compression stroke	Intake/exhaust valves	Intake valve	Exhaust valve	Intake valve	Exhaust valve	Non-adjustable
No. 6 cylinder, compression stroke	Non-adjustable	Exhaust valve	Intake valve	Exhaust valve	Intake valve	Intake/exhaust valve

Adjustment of exhaust valve with EVB:

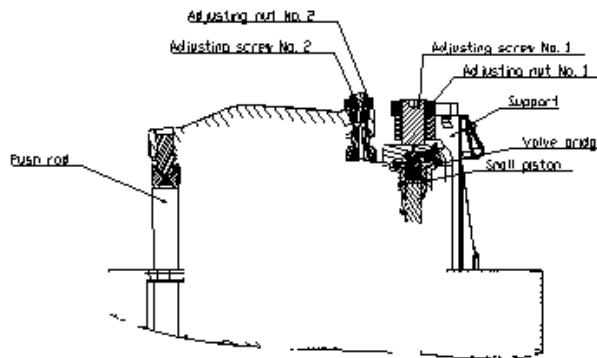


Figure 5-11 Adjustment of exhaust valve and EVB clearances

With the piston at TDC of compression stroke;

Loose nut 1;

Adjust the screw 1 till the clearance between the screw and the valve bridge is “0”;

Loose nut 2;

Adjust the screw 2 and set a feeler gauge (0.6mm) in between the screw 2 and the valve bridge;

Adjust the screw 2 to make the feeler gauge being clamped by the small piston;

Adjust the valve clearance 0.6mm, turn the adjusting screw till the feeler gauge being clamped and then lock the nut;

Adjust the screw 1 and set a feeler gauge (0.4mm) in between the valve bridge and the screw 1;

Adjust the screw 1 to make the feeler gauge being clamped by the small piston and then lock the nut;

Check the valve clearance and make adjustment if necessary.

◆ Replace the fuel filter element (figure 5-12)

Replace the fuel filter element as follows:

- a. Remove the used fuel filter element, if the water collector installed on the primary filter can be reused, please

remove the collector.

- b. Apply lubricating oil to the sealing port.
- c. Screw the fuel filter with hands until the sealing port comes into contact with the mating port.
- d. Continue to screw the new fuel filter until it is securely installed (about 3/4 turn).
- e. Remove the air in the fuel system.
- f. Conduct the leakage test.

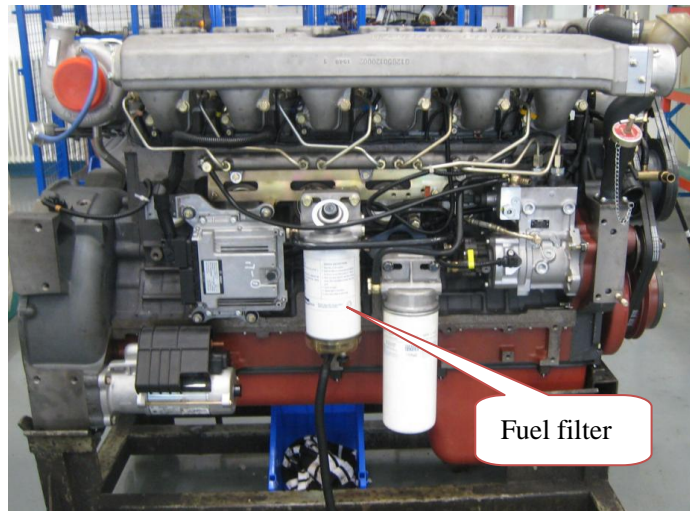


Figure 5-12

Notice: After replacing the primary spin-on filter or reinstalling fuel pipe, remove the air in the primary filter (see figure 5-13).

- ① Stop the engine.
- ② Dismantle the bleeding screw on the primary fuel filter.
- ③ Pumping fuel with hand pump until only fuel comes out.
- ④ Retighten the bleeding screw.

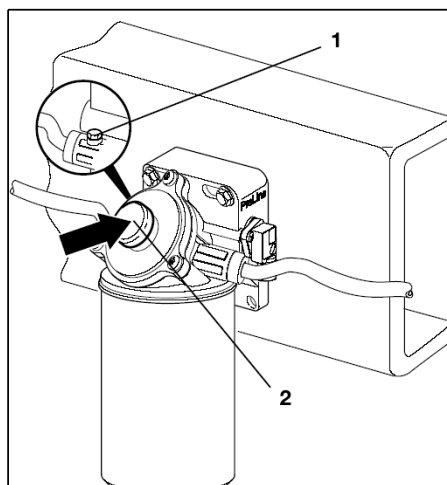


Figure 5-13 Air removal from the primary fuel filter

Drain off the water in water collector of filter (figure 5-14):

(Notice: Drain the water timely when the water collector is full or the spin-on filter is replaced)

- ① Open the drain plug 2 at the bottom of water collector 1 to drain the water out.
- ② Retighten the drain plug.

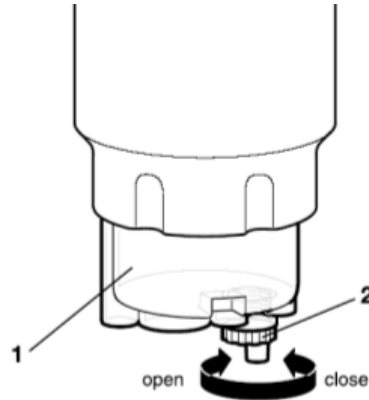


Figure 5-14

Steps for replacing water collector (see figure 5-15):

- a. Stop the engine.
- b. Drain off the water from water collector.
- c. Remove the water collector.
- d. Apply lubricating oil to the seal ring of new collector.
- e. Install the water collector by hand and tighten up with tool.
- f. Check the water collector for damage before it is being used in a new filter.
- g. Install the water collector with a torque wrench (tightening torque: 20Nm).

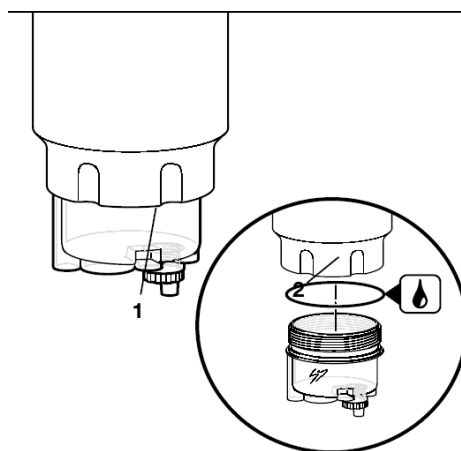


Figure 5-15

◆ Check the intake system (figure 5-16)

Check the intake hose for cracks due to aging, and check the clamp for loosening. When necessary, tighten or replace the related parts to ensure the tightness of intake system.

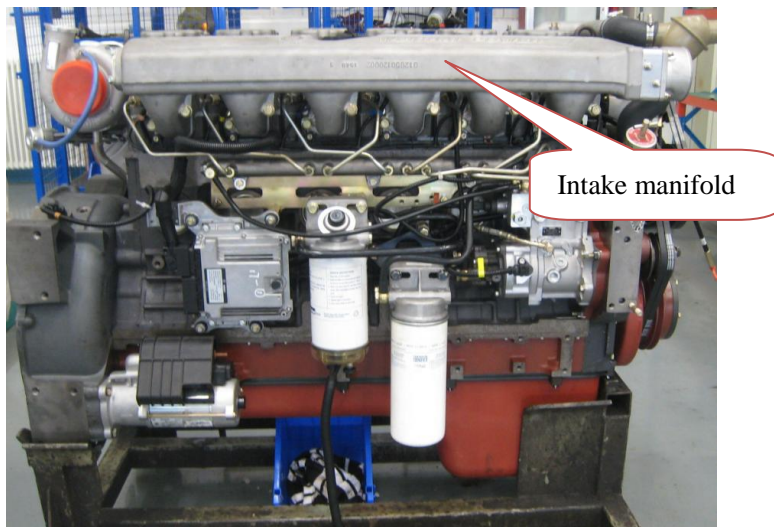
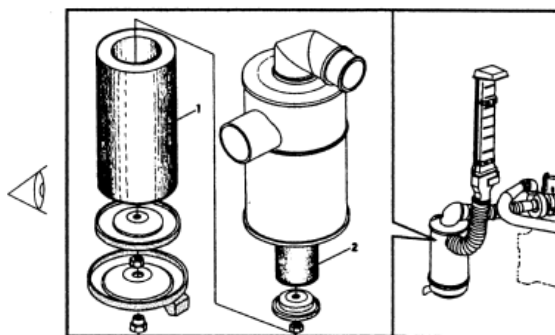


Figure 5-16 Intake system

◆ Check the air filter element



1.纸质主滤芯 Paper filtering element
2.毛毡安全滤芯 Blanketry safety filtering element

Figure 5-17 Air filter element checking

The maximum allowable intake resistance of the diesel engine is 7kPa. Please check the maximum intake resistance only when the diesel engine is running at rated speed and full load. If the intake resistance reaches the maximum permissible limit, please clean or replace the filter element timely as per the manufacturer’s instructions.

Notice: It’s absolutely prohibited to run the engine without the air filter; otherwise, dust and foreign matters may get into the cylinder of diesel engine to cause early wear of diesel engine.

Dismantle the filter element from the air filter, and tap the end face of filter element or blow with compressed air (from inside out) to remove the dust.

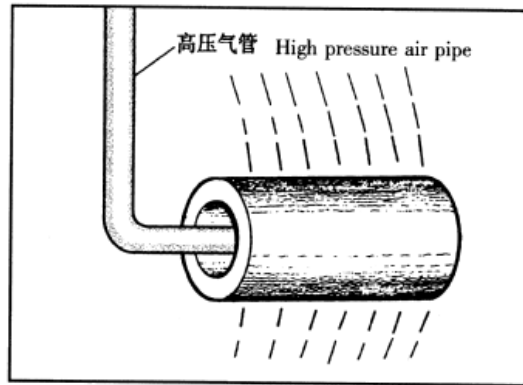


Figure 5-18 Filter element cleaning

Notice: 1) Do not damage the filter paper; 2) Do not clean the filter paper with water or oil; 3) Do not knock the filter element forcibly.

- Check urea dosing pump filter element

At the time of maintenance, it's necessary to remove the filter element of urea dosing pump and thoroughly clean with water before installation. Do not slap or knock the filter element forcibly.

- Check the urea nozzle gasket

At each replacement or disassembly of urea nozzle, it's necessary to check the urea nozzle gasket. In event of damage or deformation, replace the gasket.






- Clean the urea tank and urea tank filter element



At the time of maintenance, it's necessary to check the cleanliness of urea tank and filter element and clean them if necessary.

- ◆ Maintenance of urea dosing pump

The urea dosing pump filter element of the DeNOx 2.2 system or DeNOx6-5 system shall be replaced every 3 years or 100,000 km. For the harsh application environments, the DEF will be seriously polluted, so the filter element shall be replaced according to the actual situation. Before replacement, clean the outer surface of the urea dosing pump, and prevent the filter element area from being polluted in the installation. The filter cover shall be tightened with the torque of (20+5) Nm. The replacement of the filter element of DeNOx 2.2 or DeNOx6-5 is shown in table 5-2 and table 5-3 respectively.

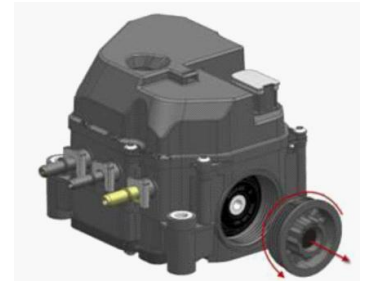
Table 5-2

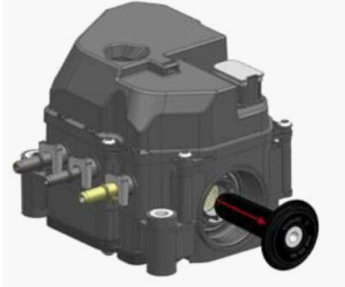
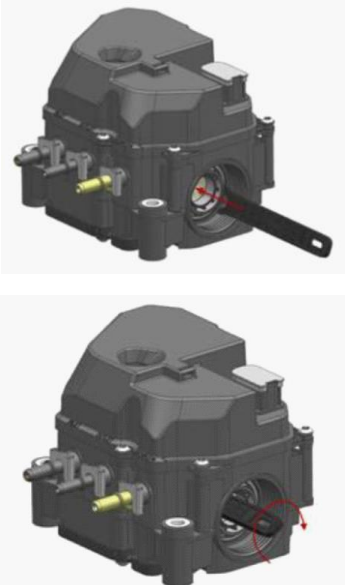
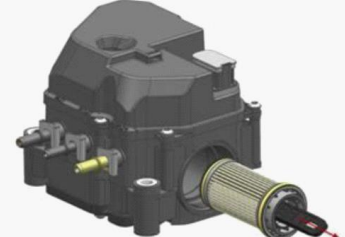

<p>1</p>	<p>Unscrew the filter cover with the wrench of 27mm (DIN3124/ISO2725-1)</p>	
<p>2</p>	<p>Remove the balancing unit</p>	
<p>3</p>	<p>Check the color of the filter element: if it is gray, use the gray end of special tool; if it is black, use the black end. Stretch the proper end of tool into the filter element until you hear a clicking sound, indicating that the tool has been installed in place.</p>	
<p>4</p>	<p>Draw out the filter element (use the slot of special tool and other tools if necessary).</p>	
<p>5</p>	<p>Clean the outer surface of the filter element cover with water.</p>	

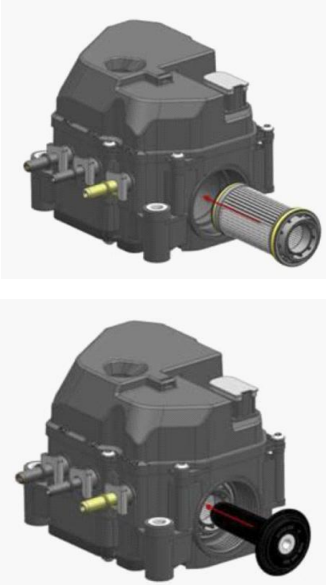

<p>6</p>	<p>Lubricate the O-rings at both ends and install the HCF filter element. (it is recommended to use MobilVelocite No.6, other lubricating oil may lead to O-ring failure)</p>	
<p>7</p>	<p>Tighten the filter cover with the torque of 20+5Nm, and the size of wrench is 27mm (DIN3124/ISO2715-1).</p>	

When fixing the urea dosing pump harness, the distance between the first fixing point and the connector shall be less than 200mm, and the fixing point and the fixed part shall be on the same vibration source.

Table 5-3

<p>1</p>	<p>Unscrew the filter cover with the wrench of 27mm (DIN3124/ISO2725-1)</p>	
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<p>2</p>	<p>Remove the balancing unit.</p>	
<p>3</p>	<p>Stretch the proper end of tool into the filter element and rotate the tool clockwise until you hear a clicking sound, indicating that the tool has been installed in place.</p>	
<p>4</p>	<p>Draw out the filter element (use the slot of special tool and other tools if necessary).</p>	
<p>5</p>	<p>Clean the outer surface of the filter element chamber threads with water.</p>	

<p>6</p>	<p>Lubricate the O-rings at both ends and install the HCF filter element. (it is recommended to use MobilVelocite No.6, other lubricating oil may cause the O-ring failure)</p>	
<p>7</p>	<p>Tighten the filter cover with the torque of 20+5Nm, and the size of wrench is 27mm (DIN3124/ISO2715-1).</p>	

When fixing the urea dosing pump harness, the distance between the first fixing point and the connector shall be less than 200mm, and the fixing point and the fixed part shall be on the same vibration source.

5.3 Maintenance of Diesel Engine for Long-term Storage

5.3.1 Clean the diesel engine

5.3.2 Protection of diesel engine before storage

- 1) After warm up of the diesel engine, discharge the engine oil, clean the oil filter, and add rust resisting oil to the oil pan.
- 2) Drain the diesel fuel out of the fuel system, and fill it with anti-rust oil to protect the fuel line.
- 3) Discharge the cooling water from cooling system, and fill the cooling system with cooling water containing rust inhibitor.
- 4) Start the engine and run it at idle speed for (15~25) minutes.
- 5) Discharge all the engine oil, fuel, coolant and DEF.
- 6) Take protective measures for other positions.

5.3.3 Protection during storage



Use cap or plastic cloth to seal oil, air and water inlets and outlets; use VCI film to cover the whole diesel engine.

Note: Outer packing is needed for transportation.

5.4 Regular inspection and maintenance of diesel engine

Table 5-4 Using conditions of matched vehicles

(WG I)	(WG II)
Working under severe conditions (extremely cold or hot; dusty; short distance transport; working on construction site and city buses, municipal engineering vehicles, snow sweeper vehicles or fire trucks) or annual mileage is less than 20,000 km or annual working time is less than 600h.	Various commercial vehicles that annual mileage is more than 20,000 km.

Table 5-5 Maintenance interval

Items	Using conditions	Mileage (time)	WG I	WG II
	First mandatory maintenance		3,000km (or 50h)	A
Routine maintenance		10,000km (or 200h)	B	C
		30,000 km (or 400h)		B
	For WG II using conditions, it should replace the oil filter element in the Weichai designated service center every 10,000km (or 200h).			

Note: “A” - First mandatory maintenance: replace the oil, oil filter element;

“B” - Routine maintenance: Replace the oil, oil filter element, primary and secondary fuel filter elements;

“C” – Replace the oil filter element only.

Table 5-6 Specification of diesel engine maintenance

Maintenance items	First mandatory maintenance	Routine maintenance
Replace oil filter or filter element	●	Every time when changing the oil
Check and adjust the valve clearance	●	●
Check coolant amount and add if necessary	●	●
Tighten the clamps for cooling system pipeline	●	
Tighten air intake pipe, hose and flange fitting	●	●
Check the maintenance indicating light or indicator of air filter		●



Clean the dust cup of air filter (excluding the auto dust-removal type)		●
Clean the air filter main element	When the indicator is lit	
Replace the air filter main element	Please refer to the related regulations in the instruction manual	
Replace the air filter safety element	After the main element has been cleaned for 5 times	
Check and tighten the belt	●	●
Check turbocharger bearing clearance		Every 160,000km
Check and adjust clutch stroke	●	●
Check urea dosing pump filter element	●	●
Check urea spray nozzle gasket	Every time when mounting the spray nozzle after disassembly	
Clean urea tank and its filter element	●	●
Note: The symbol “●” indicates that maintenance is required.		

6. Common Faults and Troubleshooting

WP10 series China IV/V diesel engines are designed and manufactured under strict quality management system and each delivered diesel engine has passed the specified tests. As the diesel engine is of precision machinery, and the long-term guarantee of its functionality is closely related to the normal maintenances. The causes leading to earlier failure of diesel engine are generally as follows:

- (1) Operation against the regulations, and improper management and use;
- (2) Failure to fulfill maintenance as required, or even repair instead of maintenance;
- (3) Poorly manufactured parts, especially the counterfeit products procured due to temptation of cheap prices, which will greatly shorten the service life of diesel engine;
- (4) Inappropriate or unqualified fuel and oil are used.

6.1 Fault Diagnostic Method

Generally, the common diagnostic methods for diesel engine faults are as follows:

- (1) Observation method: Judge the fault situation by observing its features such as exhaust smoke color of diesel engine (figure 6-1).
- (2) Listening diagnosis method: Judge the location, feature and extent of fault by listening the abnormal noise of diesel engine (figure 6-2).



Figure 6-1 Figure 6-2

(3) Cylinder deactivation method: Generally, cut off the fuel supply to the suspect malfunctioned cylinder, and compare the working condition of the diesel engine before and after stopping fuel supply to narrow down the scope for further determination of the fault location or causes.

(4) Comparison method: Replace a certain assembly or component to determine whether there is failure.

Notice:

(1) The cause of diesel engine fault shall be determined carefully. Before the causes are basically found, do not disassemble the diesel engine at will. Or it will not only eliminate the fault, but also lead to more serious fault due to improper assembly after disassembly.

(2) Inspection and maintenance on critical components (such as injection pump, ECU, common rail and turbocharger) shall be performed by Weichai designated service stations.

6.2 Common Faults and Troubleshooting

6.2.1 Failure in diesel engine starting

(1) The starter motor does not work

The starter motor of WP10 series China IV/V diesel engines are controlled by ECU. Under normal working conditions, the ECU produces an output current to drive the starter relay. When the relay is activated, the battery drives the starter motor to start the engine. In case of start failure, you should mainly check the neutral gear.

Factors to be checked: correlation between neutral gear switch, starter relay, battery and off-vehicle shutdown switch and related parts.

- ◆ Check whether the gear shift is at neutral position.

Before starting, check whether the gear shift is at neutral gear position.

- ◆ Check the position of off-vehicle shutdown switch (which should be at OFF position).

The off-vehicle shutdown switch is of inching switch and capable of automatic reset. Check this switch for normal functioning.

If the switch cannot reset automatically, check whether it is at ON position.

- ◆ Check the neutral switch and its wiring to ensure they are under sound conditions, and try to perform emergency starting (press down and hold the ignition switch for more than 5s).

For the engine of which the starter motor is controlled with ECU, when starting, the ECU determines whether the gear shift is placed at neutral position based on the signal from the neutral switch. When the neutral switch or its wiring is damaged, no neutral position signal will be received by ECU, and the starter motor will not work.

- ◆ Check whether the battery voltage is too low to drive the starter motor.

Normally, the battery voltage is 24V. If the voltage is too low, the starter motor cannot be driven to work. Actual "battery voltage" can be measured with voltage range of the or with the fault diagnostic device.

- ◆ Check whether the starter relay and its wiring are under sound conditions.

Check the surface of the wiring terminals for excessive oxide, and check the wiring terminal bolt for looseness or fracture.

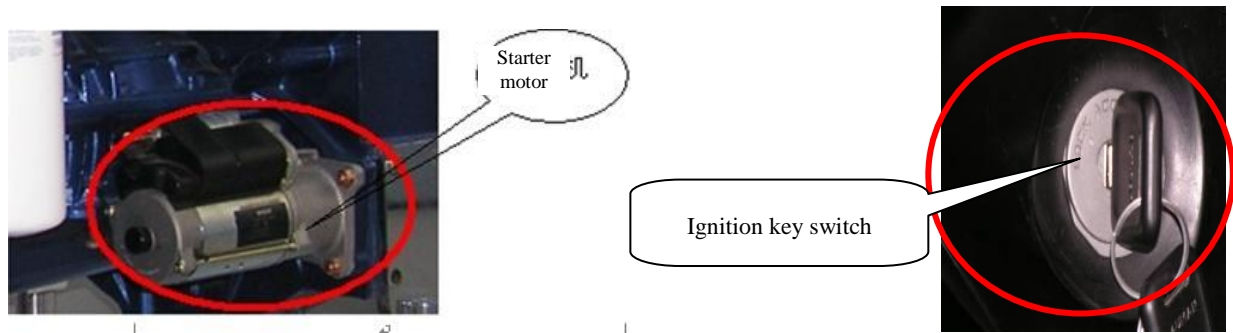
- ◆ Check whether the starter motor has been burnt.

Check with whether the starter relay is functioning properly.

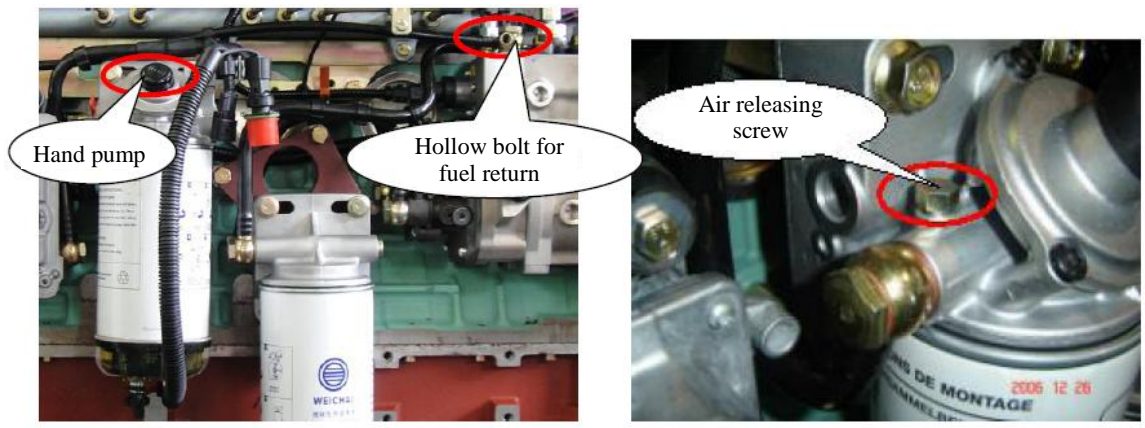
- ◆ Check whether the ignition switch and starting switch are damaged.

Turn the ignition key to "ON" position, and check whether the panel lamp becomes on;

Turn the ignition key to starting position, and check whether the starter motor is working (with other causes having been excluded).



(2) Common rail pressure build up failure (the starter motor can properly function, but the engine cannot be started)



◆ Check if the fuel level in the fuel tank is too low.

Special attention must be paid to this cause although it tends to be overlooked.

◆ Check if the hand pump is functioning properly.

Operate the hand pump with hand to check the working condition.

◆ Check whether there is air in the low pressure fuel line, and remove the air if any (Leakage of the low pressure fuel line is sometimes not noticeable, so careful inspection is required).

Air removal method: it is mainly to remove the air in the primary fuel filter. Loosen the bleed screw on the primary fuel filter, and manually operate the hand pump on the primary filter until fuel flows out continually from the bleed screw.

If the diesel engine still fails to be started after the air in low pressure fuel line is removed, there might be air in high pressure fuel line. Remove the air in the high pressure fuel line.

Air removal method: loosen the high pressure fuel line of a cylinder, and drive the diesel engine to run with the starter motor until fuel flows out continually from the high pressure fuel line. (It is recommended not to frequently

dismantle the high pressure fuel line joint.)

- ◆ Check whether there is leakage in the high pressure fuel line.

The leakage of high pressure fuel line is quite easy to be noticed. Check whether the joint nut of the high pressure fuel line is loose, and tighten it if necessary.

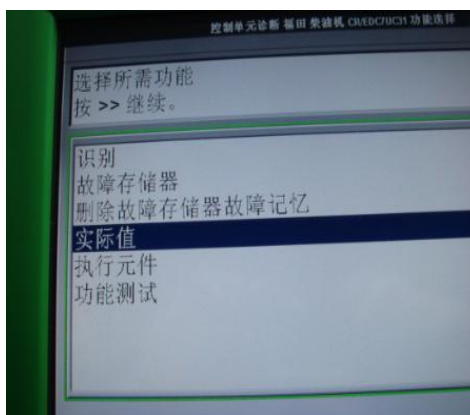
- ◆ Check if the fuel line and the fuel filter are blocked. It is recommended to replace the fuel filter element timely.

Inspection method: loosen the bolt at outlet of secondary fuel filter, drive the diesel engine to run with the starter motor. If only a small amount of fuel flows out, it means that the filter element is blocked, please replace the filter element.

- ◆ Check if the initial voltage value of the common rail pressure sensor is around 500mV, or check if the common rail pressure is set to be 30-50MPa.

Measuring method:

Enter the operating interface of the fault diagnosis instrument, select “actual value”, and click “next”.



Then all “actual values” will be displayed, and among them, select “accumulator pressure sensor voltage” and “rated fuel rail pressure”.



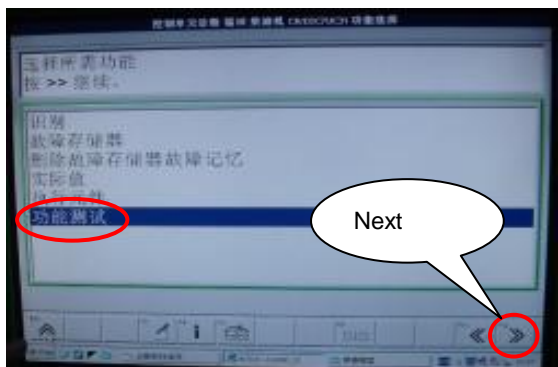
If any abnormal condition occurs, first check the connector, and if it is OK, then the common rail pressure sensor may be damaged.

If no testing equipment is available, disconnect the connector of the common rail pressure sensor, and try to start the engine (the engine will come into “Limp Home” mode after starting).

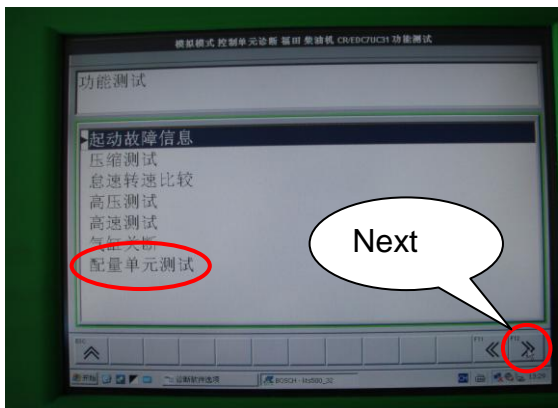
◆ Check the flow metering unit, disconnect the connector of the flow metering unit, and try starting again.

- ① First, visually check the hardware for noticeable damage and check the connector for reliable connection;
- ② Perform Meter-unit test with fault diagnosis apparatus.

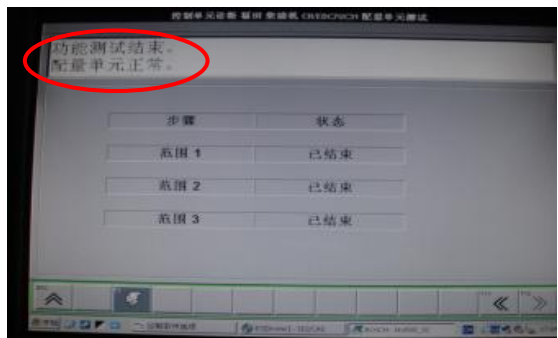
Go to operating interface of fault diagnosis apparatus, select “functional test” and click “next”;



Go to sub-interface of functional test, select “Meter-unit test”, and click “next”;



At this time, the test condition interface appears, and the operator will confirm that the conditions are OK, click “next”, and start the test;

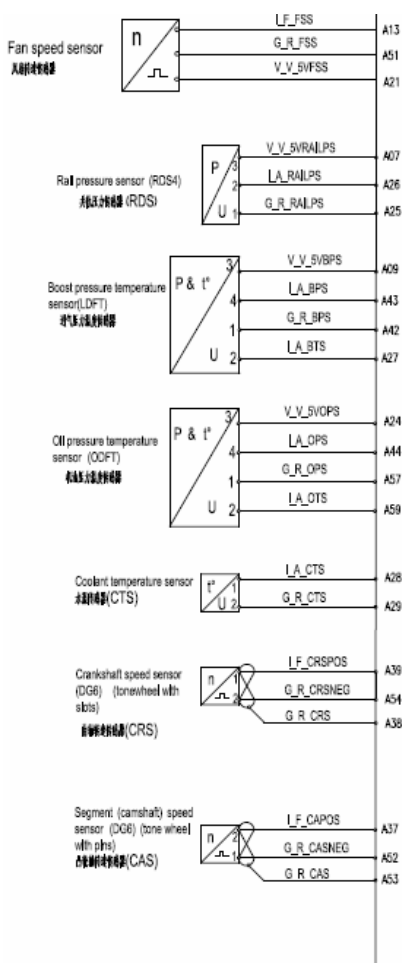
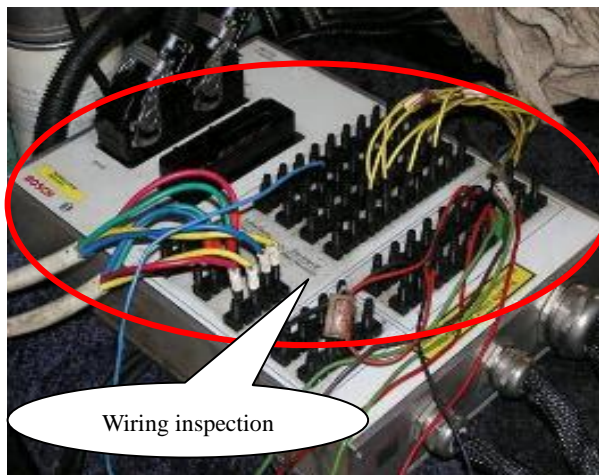


At the end of test, it will display if the flow metering unit is normal.

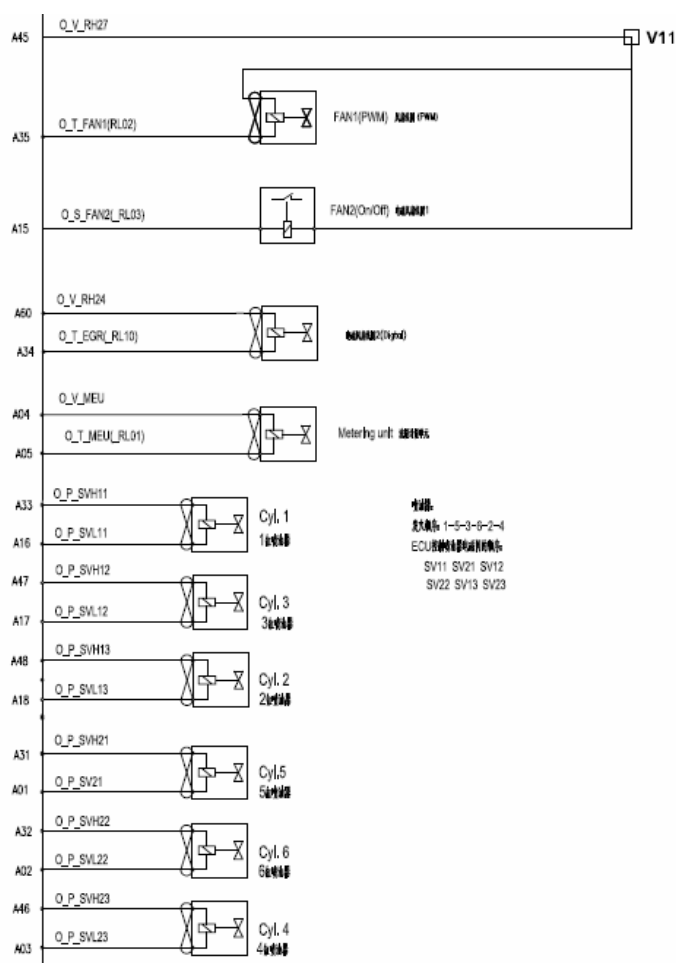
(3) Poor connection of injector harness, sensor harness or vehicle harness connector, or the harness is open circuit

or short circuit

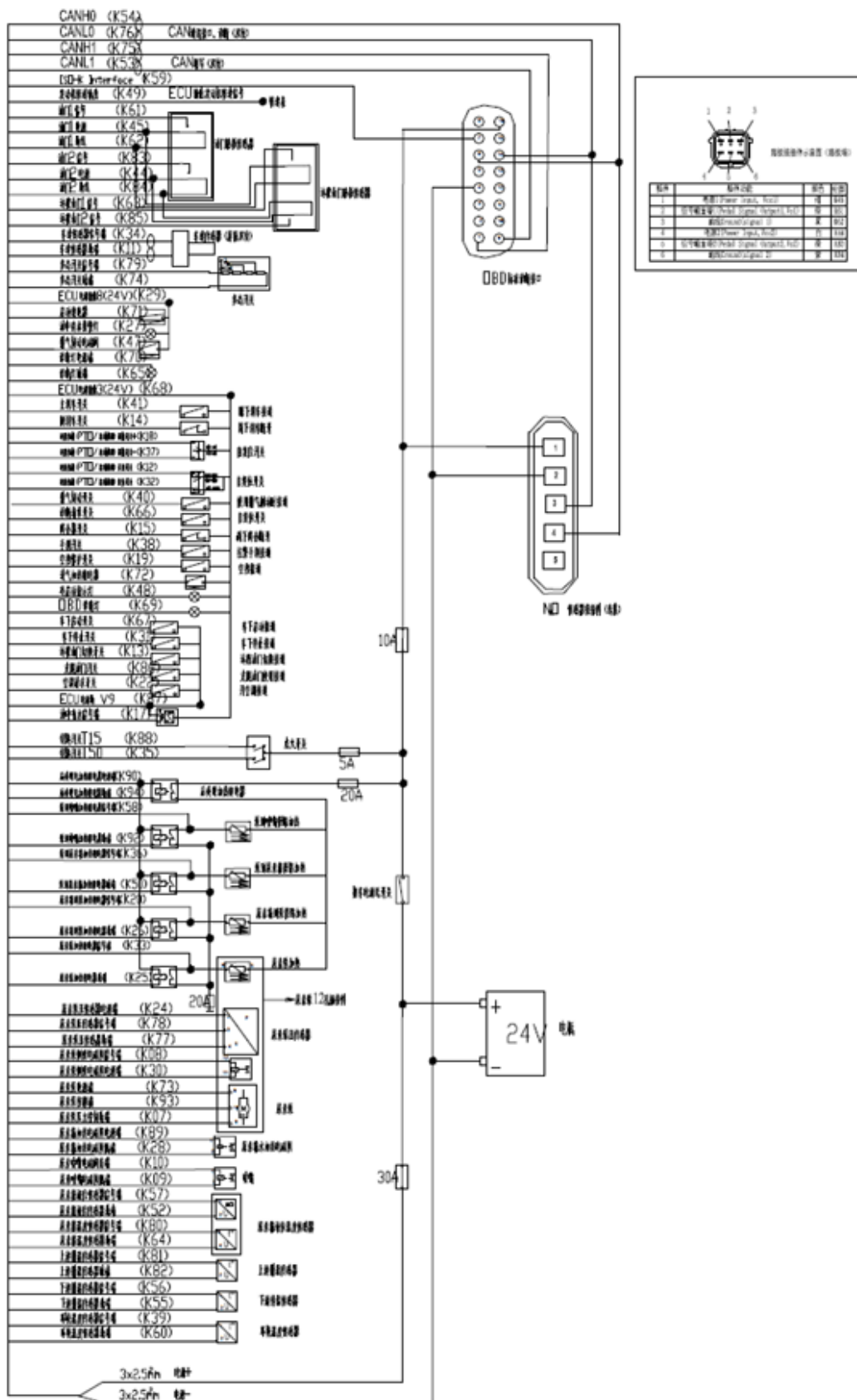
- ◆ Check the installation of the connector, and check circuit continuity with the multimeter (“wiring inspection tester” is recommended) according to pin definition on the circuit diagram.



Circuit connection diagram of engine manufacturer



Weichai EDC17 vehicle wiring harness connection diagram



(4) Crankshaft and camshaft signals lost

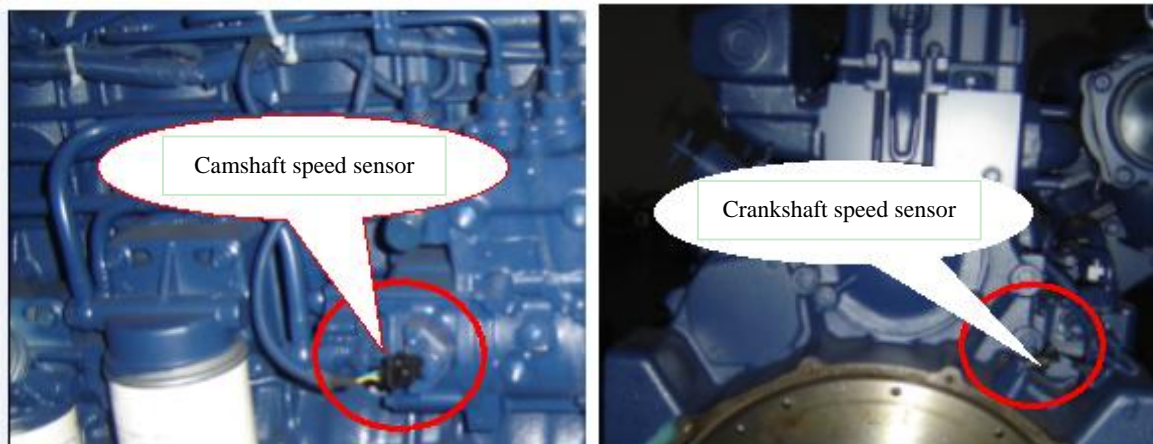
The diesel engine is provided with two speed sensors, which are mounted on the outsides of flywheel housing and high pressure fuel pump respectively, and they serve as crankshaft position sensor and cylinder identification sensor respectively. The fuel injection timing of electronic control engine depends on these sensors. Both signals will be lost when the diesel engine fails to start.

◆ Possible causes for loss of both signals

- (1) The sensor is damaged, or the harness is short-circuited or open-circuited;
- (2) The sensor is not fastened, causing too large or too small clearance ($1\pm 0.5\text{mm}$ in general) between the sensor and the sensing tooth.

Troubleshooting: check the sensor and harness for damage and reliable connection.

- ◆ To ensure signal synchronization, the reassembly of high pressure fuel pump and flywheel must be performed in strict accordance with related process documents.



6.2.2 The engine is hard to start

Causes and troubleshooting:

- ◆ The diesel engine has not been running for a long time: Insert the fuel return pipe to below the fuel level.
- ◆ There is air in the low pressure fuel line: Remove the air.
- ◆ Too weak crankshaft speed and camshaft speed signals, and too long synchronization judgment time: Find the causes and make adjustment.
- ◆ Too low ambient temperature and failure of pre-heating device: Check the heating flange wiring, or replace the pre-heating device.
- ◆ Poor diesel fuel or oil quality: Replace as required.
- ◆ Starter or flywheel gear with teeth collision: Replace the starter motor and flywheel ring gear.
- ◆ Piston ring or cylinder liner worn or valve seal not tight: Replace piston ring, cylinder liner, or valve seat

and valve.

- ◆ EVB butterfly valve is stuck at close state, causing the exhaust to be blocked: Replace the butterfly valve

6.2.3 Engine power is insufficient

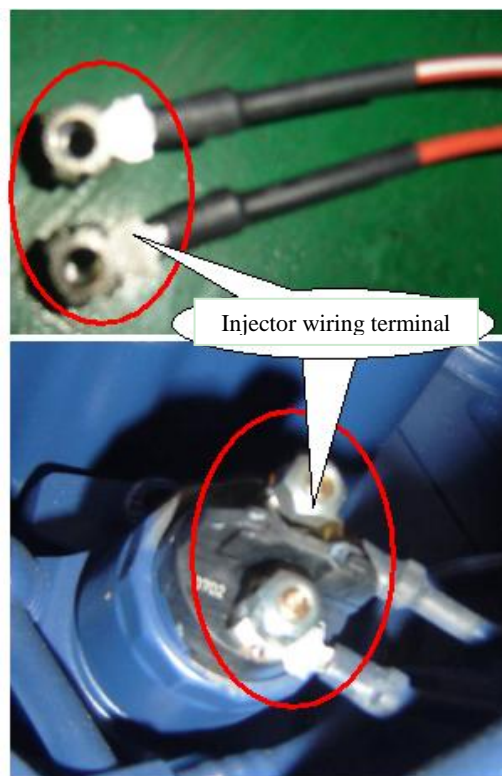
Limp home: A running mode of engine under malfunctioned state. The engine malfunction is detected, but the ECU will not stop the engine immediately. Instead, it will restrain the engine power in such manner that the engine speed can only be increased to 1,500r/min, so that the driver can drive the vehicle to the nearest service station for repair.

(1) Fuel injector fault

In general, fuel injector fault includes mechanical fault and wiring fault.

Mechanical fault: needle valve is stuck. The needle valve is seized in the injector due to excessive dirt in the fuel or water ingress corrosion (Caution: ECU may not report this fault).

Wiring fault: the harness is disconnected or directly contact with the cylinder head and shorted to ground due to vibration, wearing and other causes. ECU will report this fault.



(2) Water, engine oil and inlet air temperatures are too high

When the temperature of water, engine oil or inlet air is too high, ECU will enable the overheat protection function to limit the power of diesel engine.

Prior to troubleshooting, first eliminate distortion of response from the sensor and instrument.

◆ Causes and remedies for excessively high water temperature

- ① The water level in the tank is too low: Check for leakage, and add water if necessary;
- ② Fan rotate at low speed or does not rotate: Check the fan drive unit;
- ③ Water tank is blocked: Check the water tank, and clean or repair if necessary;
- ④ Water pump belt is loose: Adjust the tension as required;
- ⑤ Water pump gasket is damaged and water pump impeller is worn: Check, repair or replace;
- ⑥ Thermostat fault: Replace;
- ⑦ Water pipe seal damaged: Check the water pipe, joint, gasket, etc., and replace any damaged part.

◆ Causes for excessively high engine oil temperature and troubleshooting

- ① Low oil level in oil pan: Check the oil level and oil leakage, repair and add oil;
- ② Water temperature is high: Check the cause for high water temperatures, and eliminate it;
- ③ Oil cooler blocked: Check and clean.

◆ Causes for excessively high intake temperature and troubleshooting

Check the heattransferperformanceof intercooler.

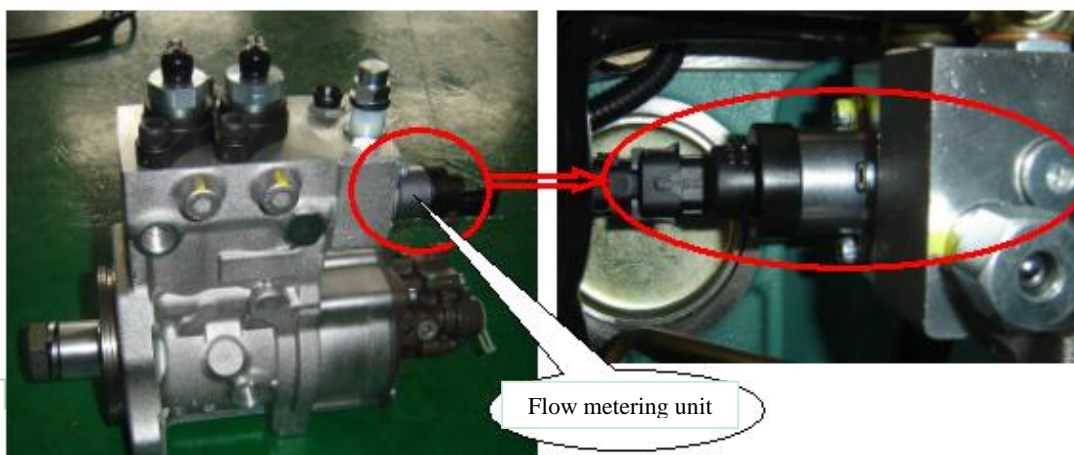
(3) Synchronization signal fault

When this fault occurs, generally it is that the signal of one sensor is failure.

Read the flash code with flash code light, find the specific cause against the flash code table, and eliminate it.

(4) Flow metering unit fault

The flow metering unit is the actuator to control the common rail pressure, and it is mounted on the high pressure fuel pump. In case of metering unit failure, the high pressure fuel pump will supply fuel to the common rail pipe at the maximum capacity. At this time, the pressure relief valve on the common rail pipe will open, and the diesel engine gives out clicking noise. The same occurs in case of fault to the rail pressure sensor.



- ◆ Troubleshooting: Inspect and repair the wiring, and determine if the fault occurs to the flow metering unit or common rail pressure sensor, and inform the office for troubleshooting.

(5) Abnormal fluctuation of common rail pressure due to leakage in fuel line

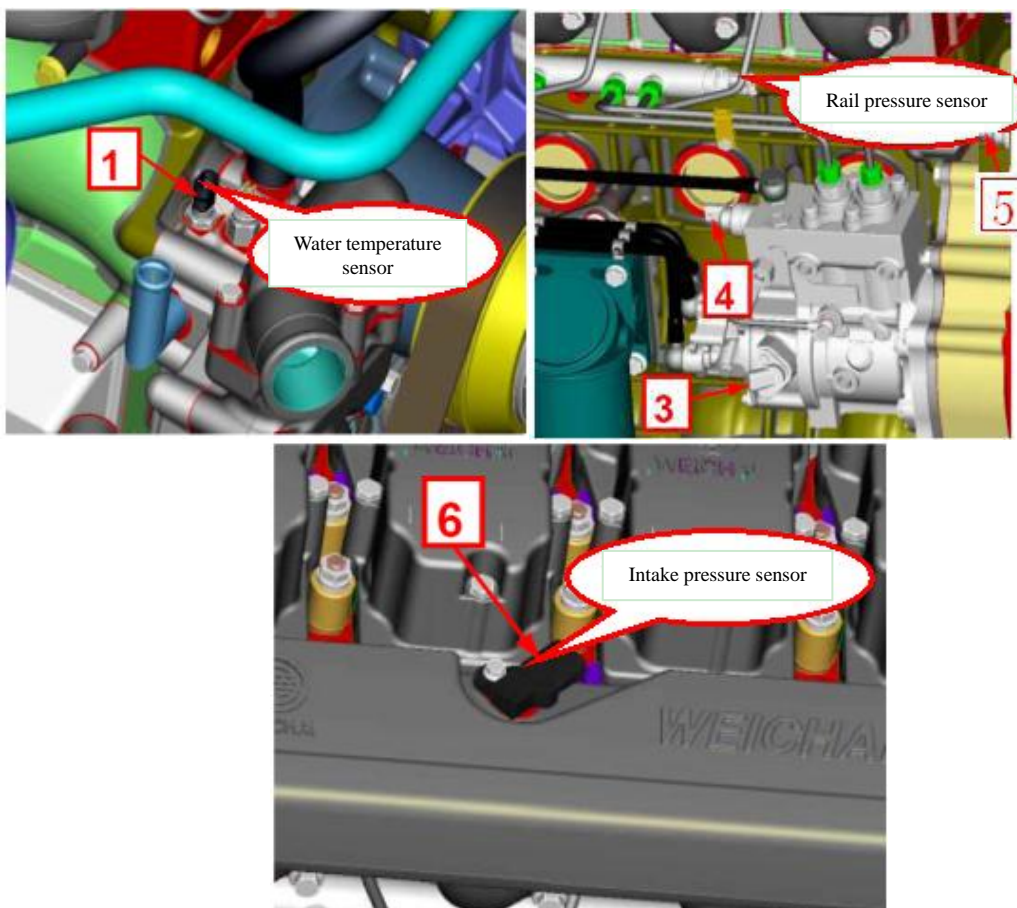
In the vehicle running, the speed will appear unstable.

- ◆ Troubleshooting:

First, cut off the power for one minute and then restart. If the fault still exists, check and repair the sealing of the fuel line.

(6) Sensor fault

ECU will estimate the inlet air volume through the intake pressure sensor (mounted on the intake manifold), and heat load of the engine is estimated with water temperature sensor (mounted on water pump), and the fuel pressure in the common rail is tested with the rail pressure sensor (mounted on the common rail pipe).



- ◆ Troubleshooting

Check the intake temperature and pressure sensors, water temperature sensor and rail pressure sensor, and ensure that the connectors are connected firmly.

Caution: In event of fault 1, 3, 4, 5 or 6, the diesel engine will enter the “Limp Home” mode.

6.2.4 Engine always running at speed of 1,000r/min

The accelerator is failure at this time: the ECU will judge the load through the signal coming from the pedal potentiometer, and when the pedal malfunctions, the ECU will control the diesel engine to automatically return to the idling speed (1,000r/min) for safety.

- ◆ Electronic throttle pedal wire loosed or wrong connected

Check and reconnect the throttle wiring.

- ◆ There is water in connector of electronic throttle pedal

Drying the connector and then start the engine again.



Notice: Replace the throttle pedal with same model.

6.2.5 Unstable idle speed of engine

- ◆ Causes and troubleshooting for unstable idling speed of engine:
 - ① Malfunction of fuel injector: Check the fuel injectors and harnesses of all cylinders.
 - ② For the complete vehicle equipped with speed sensor, there is speed signal input when parking: Check the speedometer and speed sensor signal and wiring.
 - ③ Poor fuel quality, containing water or wax: Clean fuel system and replace fuel filter.
 - ④ There is air in low pressure fuel pipeline: Check air-tightness of fuel pipes and connectors and remove the air.
 - ⑤ Unstable atomization of fuel injector nozzle: Check and repair.

Notice: It's a normal function of ECU that the idling speed will increase due to low water temperature.

If there is additional load (for instance, the air conditioner is turned on), the idling speed will increase by about 100r/min.

6.2.6 Malfunction of SCR exhaust after treatment system

- ◆ Normal DEF injection cannot be achieved

If the SCR system does not work when the engine is working normally, please check whether the connectors of DEF pump, spray nozzle and sensor are installed reliably. Check whether the DEF connecting pipes and joints are bent, loose or broken.

Check the fluid level in the urea tank and add timely. If the DEF is poor in quality containing excessive impurities, please check the cleanliness of the urea tank and clean the tank if necessary. Check the contamination state of the DEF pump filter element and clean or replace the filter element if necessary. Check the contamination state near the spray nozzle holes. If the nozzle hole is blocked, clean or replace the spray nozzle.

If the engine is working in cold weather conditions, it is normal that the DEF cannot be sprayed normally because the DEF has not yet been unfrozen. If it cannot be unfrozen for a long time, there may be a malfunction in the heating function and you should contact the local service station for troubleshooting.

◆ Exhaust backpressure of engine increased

In the event of serious black smoke or increased fuel consumption during running of the engine, please check for urea crystals or stones in the exhaust pipe. If the environment temperature is too low or the DEF spray nozzle is poor atomization, it will probably lead to obvious urea crystallization on the inner wall of pipe. Heat preservation measures for the exhaust pipe should be performed as required. Please check the blockage of spray nozzle and check the catalyst carrier in the SCR tank for damage and timely contact the service station for troubleshooting.



Appendix: Power correction factor

Air pressure 气压 kPa	Temperature 温度 °C		10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
	110	110	110	0.97322	0.97487	0.97650	0.97813	0.97975	0.98136	0.98297	0.98456	0.98615	0.98773	0.98930	0.99086	0.99242	0.99397	0.99551
108	108	108	0.97572	0.97737	0.97902	0.98065	0.98227	0.98389	0.98550	0.98710	0.98869	0.99027	0.99185	0.99341	0.99497	0.99652	0.99807	0.99960
106	106	106	0.97828	0.97993	0.98158	0.98322	0.98485	0.98647	0.98808	0.98968	0.99128	0.99286	0.99444	0.99602	0.99758	0.99914	1.00068	1.00222
104	104	104	0.98089	0.98255	0.98420	0.98584	0.98748	0.98910	0.99072	0.99232	0.99392	0.99552	0.99710	0.99868	1.00024	1.00180	1.00336	1.00490
102	102	102	0.98356	0.98523	0.98688	0.98853	0.99016	0.99179	0.99341	0.99503	0.99663	0.99823	0.99981	1.00139	1.00297	1.00453	1.00609	1.00764
100	100	100	0.98629	0.98796	0.98962	0.99127	0.99291	0.99455	0.99617	0.99779	0.99940	1.00100	1.00259	1.00417	1.00575	1.00732	1.00888	1.01043
98	98	98	0.98909	0.99076	0.99242	0.99408	0.99573	0.99736	0.99899	1.00061	1.00223	1.00383	1.00543	1.00702	1.00860	1.01017	1.01174	1.01330
96	96	96	0.99195	0.99362	0.99529	0.99695	0.99860	1.00025	1.00188	1.00351	1.00513	1.00673	1.00834	1.00993	1.01151	1.01309	1.01466	1.01622
94	94	94	0.99487	0.99656	0.99823	0.99990	1.00155	1.00320	1.00484	1.00647	1.00809	1.00971	1.01131	1.01291	1.01450	1.01608	1.01766	1.01922
92	92	92	0.99787	0.99956	1.00124	1.00291	1.00457	1.00622	1.00787	1.00950	1.01113	1.01275	1.01436	1.01596	1.01756	1.01915	1.02073	1.02230
90	90	90	1.00095	1.00264	1.00433	1.00600	1.00767	1.00933	1.01097	1.01262	1.01425	1.01587	1.01749	1.01910	1.02070	1.02229	1.02387	1.02545
88	88	88	1.00410	1.00580	1.00749	1.00917	1.01084	1.01251	1.01416	1.01581	1.01744	1.01907	1.02069	1.02231	1.02391	1.02551	1.02710	1.02868
86	86	86	1.00734	1.00904	1.01074	1.01242	1.01410	1.01577	1.01743	1.01908	1.02072	1.02236	1.02398	1.02560	1.02721	1.02881	1.03041	1.03200
84	84	84	1.01066	1.01237	1.01407	1.01577	1.01745	1.01912	1.02079	1.02244	1.02409	1.02573	1.02736	1.02899	1.03060	1.03221	1.03381	1.03540
82	82	82	1.01408	1.01579	1.01750	1.01920	1.02089	1.02257	1.02424	1.02590	1.02755	1.02920	1.03084	1.03246	1.03409	1.03570	1.03730	1.03890
80	80	80	1.01759	1.01931	1.02102	1.02273	1.02442	1.02611	1.02778	1.02945	1.03111	1.03276	1.03441	1.03604	1.03767	1.03928	1.04089	1.04250

1. The temperature in this table is that of intake air, and the air pressure (not equal to atmospheric pressure) is that of dry intake air.
2. This table only suitable for the temperature range of 10-40°C, and air pressure range of 80-110kPa. In order to make actual air inlet status meets the above conditions, the engine test should be carried out in proper time by adopting suitable measures.
3. $P_{e0} = a_d * P_e$ (P_{e0} is corrected power, P_e is measured power, a_d is correction factor)

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