



WEICHAI POWER



Common Rail WP5 Series Diesel Engine

SPECIAL ATTENTIONS

- Before the technician manipulates the engine, please seriously read the maintenance manual. Strictly follow the maintenance manual regulating each process, each operation.
- Note that: Diesel engine before leaving factory has been rigorously tested according to regulations, it is not allowed to arbitrarily edit ECU black box data or increase machine capacity. Otherwise, Weichai Company will refuse warranty.
- Turbo-spindle is a high-speed rotating device, so during the operation, it's prohibited any mobile objects (such as hands, tools, cotton, etc.) approaching turbo loading doors, avoiding the risk of harm to people and machines. For Turbo-spindle assemblies, except for professional turbo repairer or Weichai authorized professional warranty points, it is not allowed to arbitrarily install and remove it.
- Important bolts have a limited number of uses (For example, bolts of connecting rod can be used once), must not be used beyond the specified number of times.
- Diesel engines use lubricating oil or fuel oil which are compulsorily be in accordance with the maintenance warranty book, and through the fine filtering regime, fuel oil after 72 hours of use or more must be filtered out sediment; Every time before starting the machine, make sure the amount of coolant and lubricant are in accordance with the regulations.
- It's strictly forbidden to operate Diesel engines in the absence of air filter, to prevent air.
- When using a new machine, run the engine at the idle speed for 50 hours.
- After the engine has been cold-started, slowly increase the revolution, do not increase suddenly, nor should the engine operate in a guarantee state for too long (guarantee time should not exceed 3 minutes); After the machine operates continuously at high intensity, do not immediately turn off (except in special cases), but gradually reduce the revolution from 5-10 minutes before turning off.
- If operating at low temperature environment below 0°C, at the same time the engine does not use antifreeze solution, the water in the water tank and the engine should be discharged completely.
- Inspection and maintenance of components of the air-electrical system must be done by a skilled specialist.
- Inspection and maintenance of air-electrical system components must be performed by Weichai's warranty station.
- To prevent rust, before the engine is left factory, it will be covered with oil. Normally, this oil coating has a duration of 1 year, if more than 1 year, it is necessary to inspect and take measures.
- Replacement of important components affecting emissions quality (Turbo, high pressure pump, injector, ECU, SCR system, EGR system) should ensure that components for replacement must be the same line and of the same manufacturer with the replaced ones, otherwise, Weichai are not responsible for any consequence.

PREFACE

This is a series of high-speed machines developed and researched by Weichai Dynamics Company. It has a compact design, stable operation, strong driving force, economical operation, meeting technical requirements, with the advantages of fast start-up, simple operation and convenient maintenance, especially meeting international emission standards.

This manual includes items to be paid attention to, maintenance methods, periodic adjustment tests and common diagnostic problems of WP5 series. In the compilation process, our criteria are of being comprehensive, simple and easy to understand. The purpose of pointing out the machinery problem diagnostic is an extremely meticulous item, which requires certain knowledge and experience. In the period of not aware the key reason of problem, it should not remove the engine arbitrarily, otherwise it will not only handle the problem, but also lead to more serious problems in the installation process. Especially maintenance and repair of the electronic control system, important components such as turbo must have specialized equipment, so in case of the absence of experience, customers should not arbitrarily assemble and disassemble it for adjustment.

The maintenance manual will contain contents which may not be promptly updated, customers (or car manufacturers) should visit the website <http://www.weichai.com> for the updated information.

You are welcomed to provide feedback for improvement of our product line.

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CHAPTER I. INSTRUCTIONS FOR USING THE MACHINE

1.1 Appearance

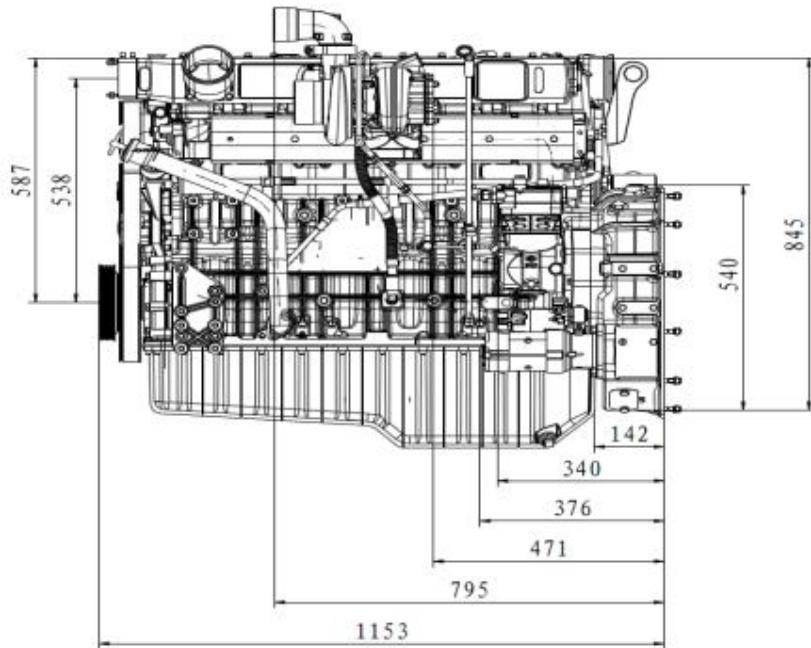


Figure 1-1 Appearance of WP5 series Euro IV-standard electronic oil pump diesel engine

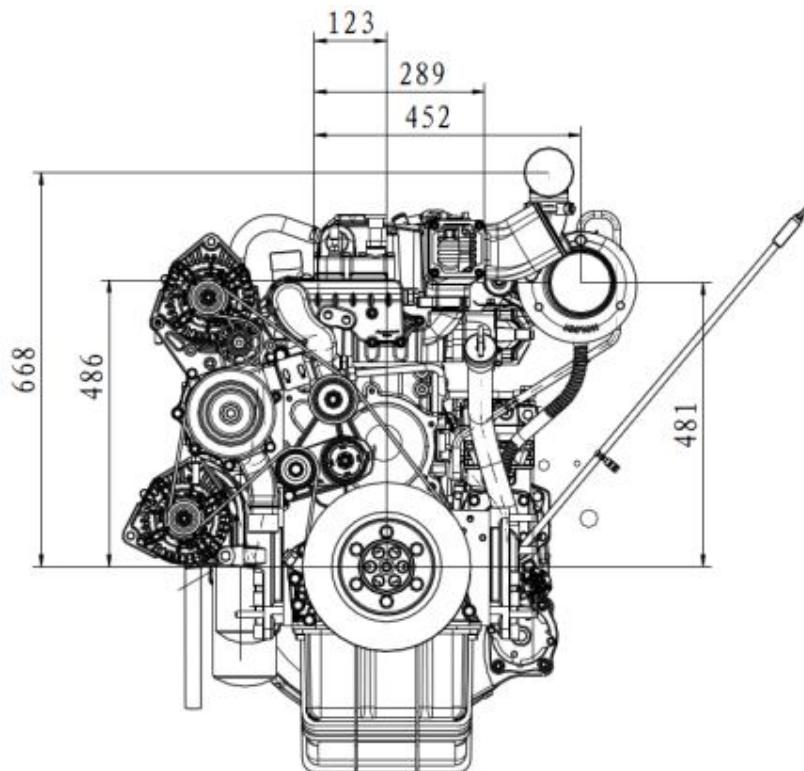


Figure 1-2 Front side of WP5 Euro IV-standard electronic oil pump diesel engine

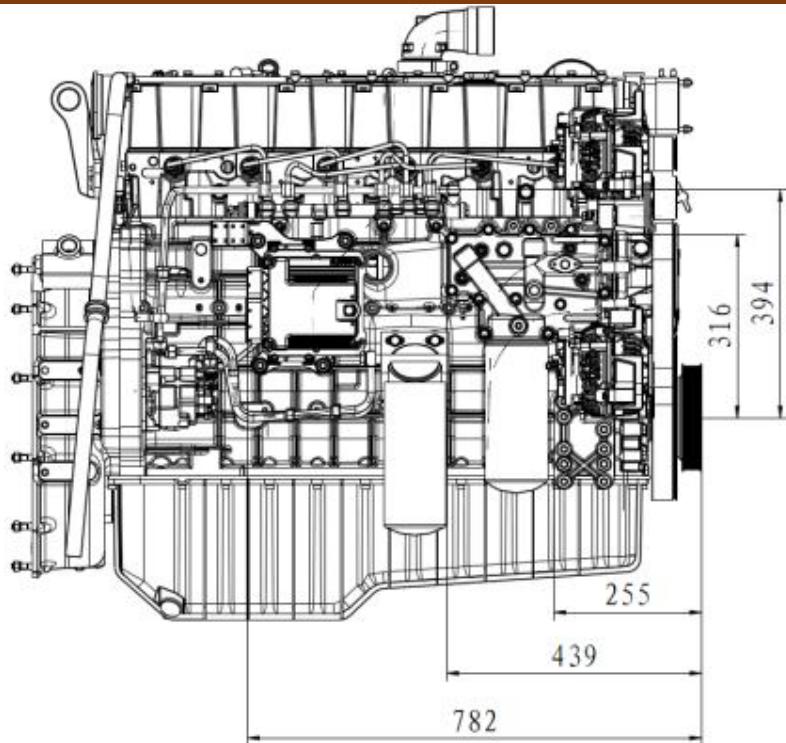


Figure 1-3 Side view of WP5 Euro IV-standard electronic oil pump diesel engine

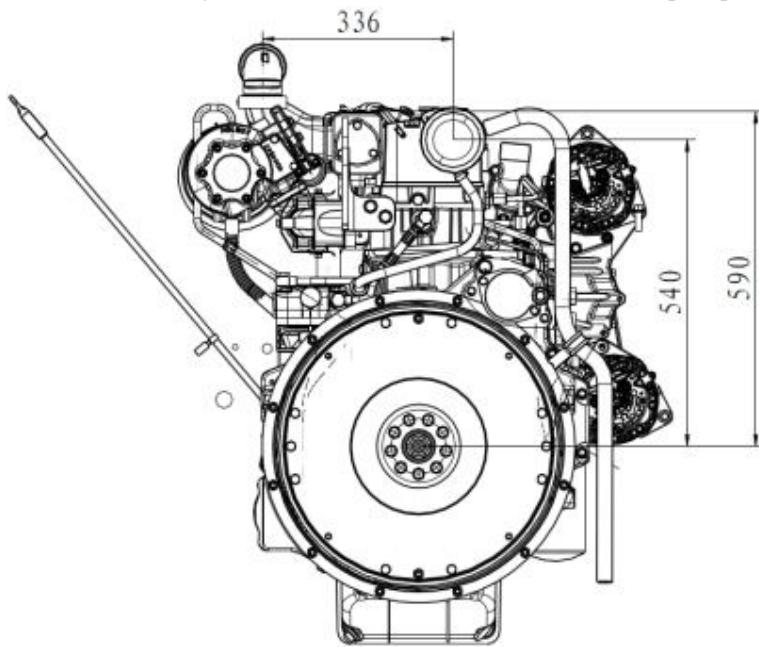


Figure 1-4 Backside of WP5 Euro IV-standard electronic oil pump diesel engine

1.2 The meaning of engine code

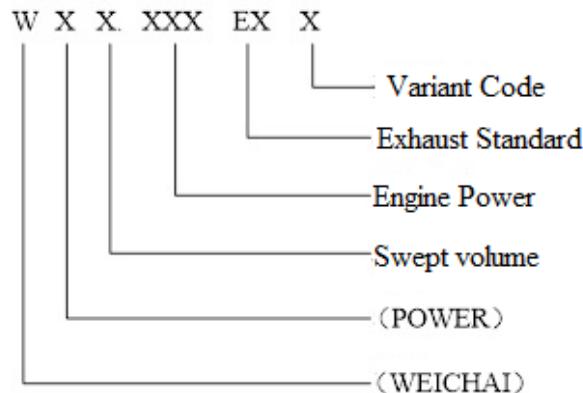


Figure 1-5. The meaning of engine code

1.3 Basic parameters

Table 1: Parameter of WP5 Euro IV-standard electronic oil pump diesel engine

Engine	Unit	WP5.160E4 0	WP5.180E40	WP5.200E40	WP5.220E40
Type of engine		4 phase inline, electronic injection, cooling by water			
Type of intake manifold		Turbocharger			
Cylinder diameter / journey	mm×mm	108×136			
Volume	L	4.98			
Capacity/revolution	kW/r/min	117/2300	132/2300	147/2300	162/2300
Lowest fuel consumption	g/kW·h	≤ 195			
Maximum torque at revolution	n·m/revolution/min	900/1200~1700	1000/1200~1700	1100/1200~1700	1160/1200~1700
Largest idling revolution	Revolution/min	2300 ± 50			
Guaranty	Revolution/min	600 ± 50			
Noise level	dB (A)	≤ 118			
Weight	kg	600			

1.4 Things to know when using a new engine

When using new engine for 60 hours (or 3000km), do not operate the engine with a load exceeding 75% of the standard.

Regulation on the first oil change cycle:

For engine operating for 1 year not exceeding 20,000 km, the first oil change is at 1000 ~ 1500km;

For engine operating for 1-year exceeding 20,000 km, the first oil change is at 1500 ~ 2000km
Perform maintenance according to the regulations in the instruction manual.

1.5 When hoisting engine

In the process of hoisting the engine, it is necessary to maintain the balance axis, not tilting or only hoist one end. When hoisting and lowering engine, it must be done very slowly (refer to figure 1-5).

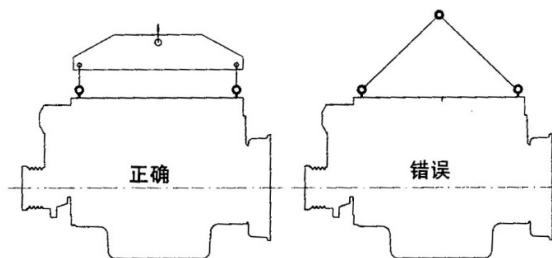


Figure 1-6 Drawings of how to install the engine hoist

1.6 When opening the engine container

When opening the engine container, first check the attached list of component tally, check appearance whether the engine is collided or the connections have phenomenon of being loosen, then proceed to the followings:

- (1) Clean the surface of anti-rust and anti-corrosion layer of components outside the engine;
- (2) Remove fuel oil filter and inhibiting oil in fuel oil components system (It may be necessary not to remove inhibiting oil but start up immediately, provided that the amount of inhibiting oil must be consumed fully, diesel oil must normally be provided already to run load).

But note that, protective oil is usually used for 1 year, if more than 1 year, it should check and apply additional measures.

- (3) Move the flywheel while spraying the solution into the intake manifold, until the cylinder is on the oil layer then stop.

- (4) Spray the solution into the Turbo intake manifold until it has reached enough one layer of oil.

Based on the agreement between the factory and the user, the oil must be added according to the regulations for the oil pan which has not been poured into the oil when leaving factory. For oil pan filled oils when leaving factory, and accelerated machines at the idle speed, it can be run 2000km (or operated for 50 hours), then remove old oil to replace new oil.

According to the agreement between the factory and customers, when leaving factory, if requested by customers, the engine can be filled with the cooling oil. When opening the container, check the coolant feature. If the antifreeze ability meets the temperature of -30°C or -35°C, the pH is 7-8 (neutral), the hardness is between 5-15 ° d (9 ~ 15 ° f (hardness)), these antifreezes can be used, if not meet the requirements, discharge them and refill antifreeze and cooling oil.

1.7 Preparation before starting the engine

- (1) Check the coolant level

If the engine is installed on the vehicle or on a rack, it is always possible to check the coolant level through the glass hole water tank at any time. If the water level is not enough, it is possible to

open the lid and supplement. When opening the lid to add water with pressure relief valve and air relief button, if the engine is in a hot state, it is required to press the air relief button to open the lid. It is important to remember that when the engine is relatively hot, if we add cooling water at this time, there will be thermal shock that affects the parts involved. Start the engine and operate at 1000 rpm, add cooling water to a stable level and finally close the lid.

(2) Check fuel oil level

If the engine is installed in the vehicle, the electric key should be opened, we can base on the dashboard to check the current fuel level, or directly check the fuel oil tank.

(3) Check the lubricant level

The guaranteed oil level is between the upper limit and lower limit of the oil level gauge, it is required to add oil via the supplementary oil filling hole.

(4) Check appearance of engine, the safety level of the joints, eliminate abnormal phenomena, check whether the electric line system is normally started, the battery is full of electricity, then open the fuel oil tank valve, loosen bleeder screws on the fuel pre-filter, press the hand pump on the fuel pre-filter to remove air in the fuel system.

1.8 Start the engine

- ◆ Close the battery, open the electric key, put the gear stick into position 0, start the engine
- ◆ Press clutch pedal, turn the key to start engine, if failing to start the machine within 5 ~ 10s, it is recommended to wait for one minute to repeat this process. If repeating 3 times but not working, stop doing it. Wait for the exclusion cause before proceeding to restart the machine. When starting the machine, it is necessary to observe the indicators on the clock table, the oil pressure meter must show the parameters, be careful not to let the machine rewind high when starting cold, so run guarantee for 30s to check oil pressure and water temperature.
- ◆ In the low temperature environment, it's required to have auxiliary equipment to start engine, through the relay to heat the working flange, thereby carry out the start-up work at a favorable environment of -30 degrees C.

1.9 Operate machine

- ◆ After starting up, run guarantee for 3 minutes, then increase revolution up to 1000 ~ 1200rpm, then add part of the load, only when the water temperature reaches 60 degrees C, the viscosity temperature reaches 50 degrees C, then it is allowed to transfer to the state of the full load, improve the load and implement revolution gradually, avoid sudden increase or decrease.
- ◆ Machine operating for 60h (running 3000km) should run the medium load, do not pull the car.
- ◆ When going up a slope, it is necessary to decelerate in time, when in a large torque state, it is not recommended to operate slowly, nor should it operate too little load, with low revolution. Because it is easy to appear oil leakage and other incidents.
- ◆ When operating the machine in a normal state, it is possible to operate continuously at rated power, rated revolution, but if the rated revolution is at 105% and the rated capacity is at 110%, it should only be operated for 20 minutes. After lowering the load, run guarantee for 1 ~ 2 minutes and then turn off.
- ◆ The following parameters should be checked during operation:
Pressure of main lubricating oil hose 350kPa ~ 600kPa

Temperature of oil at the oil pan $\leq 115^{\circ}\text{C}$

Temperature of cooling solution at the outlet: $80\sim 93^{\circ}\text{C}$

Air temperature in Turbo exhaust assemble: $\leq 600^{\circ}\text{C}$

Check the color of emission, check the working status of the injector and the working process at idling state, if there is too much black or white gas, stop the machine to check.

Be sure to check whether there is water leakage, air leakage, oil leakage, etc. when operate the machine. If detected, it should stop to check.

◆ Machine operators need to understand the following features of the machine:

A. In the maximum torque state, the fuel consumption is relatively low, the increasing revolution means increasing fuel consumption

B. At the average revolution (1200 revolutions / minute ~ 1700 revolutions / minute), torque reaches the optimum level;

C. According to the increase in machine capacity, the revolution increases correspondingly, when the revolution reaches the rated level, the engine capacity also reaches the rated power.;

◆ **Attention when operating the machine in winter**

Fuel oil: Base on the winter environment when the temperature is not the same to choose the appropriate fuel grade;

Lubricating Oil: Base on the seasons to choose different lubricant oil;

Cooling water: Add anti-freeze solution, based on the environment to select the different grade and ratio;

Start-up: in winter, it requires the use of auxiliary equipment, after starting, wait for the ideal oil pressure and water temperature and then operate with load.

Before using the battery in the winter environment, it must check the level of electrolytes in the battery, adhesion and voltage unit. If the engine has not been used for a long time, remove the battery and leave it in a warmer place such as in a closed room

Turn-off: In cold winter environment, when disconnecting, it's required reduce the load down then run guarantee for about 1 ~ 2 minutes. Wait for the water temperature, viscosity lower, then you can turn off the engine and stop the vehicle. Note that after disconnecting the machine, if the cooling water is supplemented with anti-freezing solution, it is not allowed to discharge the water. If the cooling solution is not supplemented with anti-freezing solution, it is compulsory to remove the cap of the oil cooler housing on the engine block., remove heat sink, remove water inlet and water relief valves, bowl plugs. Discharge completely to prevent machine from being frozen and broken.

CHAPTER 2: IODESTAR OF ENGINE MAINTENANCE

2.1 Diesel engines using fuel oil, lubricating oil, coolant and auxiliary solutions

2.1.1 Fuel oil

In Summer: Diesel No. 0 (GB252)

In Winter: Winter: Normally use light oil No.-10 (GB252). But if the temperature is below -20, use -20 grade Diesel oil, when the temperature is -30, use -35 grade oil.

All fuel oil grades must meet national standards GB17691-2005, annex C - regulation C.6 (revised after June 2008)

2.1.2 Lubricant

Euro2 Weichai engine uses CF-4 diesel, Euro3 engine uses CH-4 grade, Euro4 engine uses CI-4 diesel, Euro5 engine uses CJ-4 grade. Gas engine uses oil specialized for gas engine. For specific details, refer to table 2.1.

Table 2.1 Rules for selecting dedicated lubricants for Weichai engines

Type	Lubricant type	Packing	Adaptable to the model
Diesel engine lubricant	CF-4	10W/30 15W-40 20W-50	4L, 18L, 170kg
	CH-4	10W/30 15W-40 20W-50	4L, 18L, 170kg
	CI-4	10W/30 15W-40 20W-50	4L, 18L, 170kg
	CJ-4	10W/30 15W-40 20W-50	4L, 18L, 170kg

Reference to base on environmental temperature for selecting adhesion of weichai engine oil

Table 2-2 Table of correspondence between adhesion and environmental temperature

SAE oil grade	Appropriate ambient temperature (°C)
0W-20	-35-20
5W-30	-30-30
10W-30	-25-30
15W-40	-20-40
20W-50	-15-45

Notes:

- (1) Before operating the machine, check the oil level in the oil pan.
- (2) Do not check the oil when the machine is in working.
- (3) Do not use Weichai dedicated lubricant with oil manufactured by other companies.

For the amount of lubricant and the number of filter cores used for Weichai machines, refer to Table 2-3.

Table 2-3: Amount of Lubricating oil for WeiChai engine models and number of filter cores

Type of engine	Amount of lubricant (L)	Number of filters				
		Diesel engine			Gas engine	
		Oil filter	Diesel filter	Pre-filter	Fine filter	Oil filter
WP4	9~12		1	1	1	1
WP5	13~16	1	1	1	1	1
WP6	16~24	1	1	1	1	1
WP7	20~28	1	1	1	1	1
WP10	22~26	2	1	1	2	1
WP12	25~28	2	1	1	2	1
WP13	25~28	2	1	1	2	1

Notes:

- (1) Carefully check the amount of oil to be added, in fact take the oil level gauge as a standard.
- (2) If the vehicle is installed an integrated filter or water filter, when replacing diesel filter, replace the integrated filter or water filter core.

2.1.3 Lubricant

Refer to standard GB5671-85 for the choice of lubricant used for vehicles lubricating tightener.

2.1.4 Coolant

Weichai dedicated cooling water in the coagulating point is selected -25, -35-40 degrees as standard. Base on the local environmental conditions to select the appropriate type, the principle is to choose the type lower 10 degrees than the local ambient temperature, refer to Table 2-4 for details.

Table 2-4 Selection of cooling water for heavy load engine

Type	Code	Packing
Cooling water for heavy load engine	HEC- II -25 HEC- II -35 HEC- II -40	4kg, 10kg

Notes:

- (1) Periodically check the coolant, avoid rusting, replace it in time.
- (2) Use of poor-quality coolant for the machine is prohibited.

2.1.5 Urea solution

Using unsuitable Urea solution easily causes SCE catalytic system ineffective or poorly effective (eg, in Urea, there are S, Na, Ca, K or other chemical elements exceeding the content, because Catalytic system being affected, Urea concentration is not up to standard, causes NH3 leakage or incompletely reconstituted NOx. It leads emissions exceeding limit, the warning lights will sign on, so using Urea with quality and feature meeting ISO 22241. Refer to the table 2-5 for details. Should buy it from a reliable supply to supplement Urea.

Table 2-5 Urea Ingredients (According to ISO 22241)

Ingredients	Unit	Min limit	Max limit
Urea ratio	%	31.8	33.2
Density at 20 °C	kg/m ³	1087	1093
Refractive index at 20°C	-	1.3814	1.3843
Amino ratio	%	-	0.2
Biuret ratio	%	-	0.3
Aldehyde	mg/kg	-	5
Insoluble substance	mg/kg	-	20
Phosphorus	mg/kg	-	0.5
Calcium	mg/kg	-	0.5
Fe	mg/kg	-	0.5
Cu	mg/kg	-	0.2
Zinc	mg/kg	-	0.2
Chromium	mg/kg	-	0.2
Nikel	mg/kg	-	0.2
Aluminum	mg/kg	-	0.5
Maggie	mg/kg	-	0.5
Sodium	mg/kg	-	0.5
Potassium	mg/kg	-	0.5

2.1.6 Auxiliary substances

Table 2-6 Auxiliaries for Diesel engines

No.	Name	Color	Application
1	Molykotte Pulver	Black	Apply on metal surfaces to prevent two surfaces from adhering to each other Example: Apply on the outer surface of the cylinder
2	Molykotte G.u.plus	Gray	Before lubricating oil, pressure is established, it also has a lubricating effect Example: Apply on the intake valve stem, etc.

Table 2-7 List of sealants used for diesel engines

Brand	Uses	Location of use	Additional instructions
Sealant 242	Apply on the surface of the thread, to prevent from being loosen, medium-range tightening force is required	Bolts of camshaft cotter-pin Bolts of Camshaft air distribution gear Bolts of interlocked intermediate pulleys Bolts of shaft end of the air compressor Bolts of pressure relief valve of main oil line Bolts of Filter assembly Bolts fixing the command wires and sensors	For selection, Driloc204 can be applied on the thread as a pre-lubricating step
Sealant 277	Use to ensure tightness between core and hole	Air-Compressor output when connecting to curved tube Machine face cover, Elbows connecting the hydraulic pipes	
Sealant 962	Dedicated to bowl plugs	The bowl plugs on the engine	
Sealant 510	Apply on metal surfaces with surface sealing effect	The rear part of the engine block (gear type) oil pump is combined with the front part of the engine block	
Sealant 620	Use to fix the combined surface of the cylinder	Install crankshaft and crankshaft gear	
Dedicated silicon	Apply on metal surfaces with surface sealing effect	(Rotary shaft) oil pump combined with the front part of the engine block	

2.2 Daily maintenance and repair

2.2.1 Daily maintenance

- ◆ Check the coolant level, the oil level, the fuel level, the position to add lubricating oil, then add for full amount;
- ◆ Check whether oil or water is leaking;
- ◆ Check whether joints are firmly;
- ◆ Check whether Propeller, belt is too tight or too loose;
- ◆ Oil pressure of the machine;
- ◆ Water temperature of the machine;
- ◆ Whether temperature, exhaust gas color, sound, vibration, or revolution are stable or not.

2.2.2 Daily maintenance

(1) Check the coolant level, water temperature.

Observing holes can use to identify excess or lack of water, can open additional water when below standard level.

Attention:

Before opening the supplementary lid, it's required to press the air discharge button, to avoid the case of opening the lid when engine is in hot, the hot air of the cooling water causes unsafe for workers.

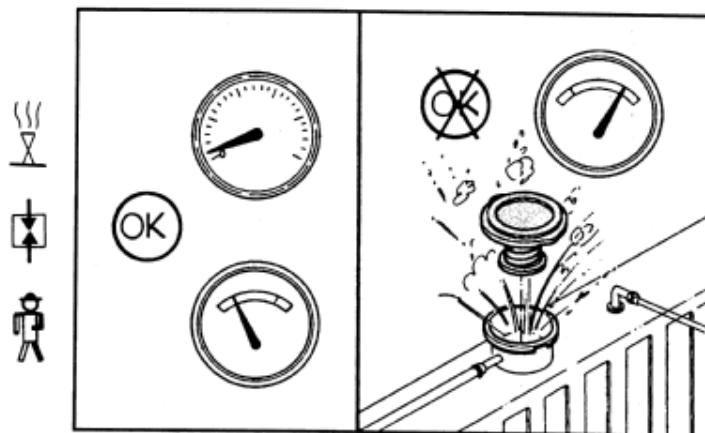


Figure 2-1 Press the air release button



Figure 2-2 Secondary water tank

(2) Check the oil level

If the oil level is below the lower limit or higher than the upper limit of the oil level gauge, do not start the machine.

After machine stops operating at least for 5 minutes, conduct to add oil, the waiting time is to wait for oil from the lubricating lines back to the oil pan.

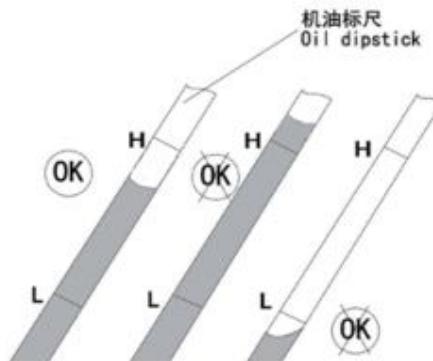


Figure 2-3: Explanation of symbols on lubricant gauge

(3) Check fuel oil level, as shown in figure



Figure 2-4: Fuel level gauge

(4) Check 3 possible leaks

The whole engine has no leakage of water, gas and oil.

(5) Check the propeller

Visually check whether the rotor has an abnormal or not, the bolts are connected firmly or not.

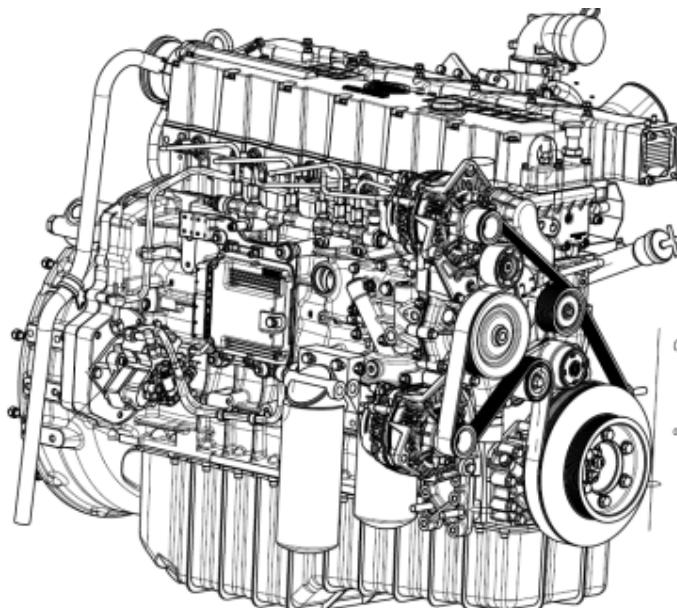


Figure 2-5 Check 3 possible leaks

(6) Check the belt

The belt through the tightener to automatically tighten the it, users can press the belt to feel

tightness.

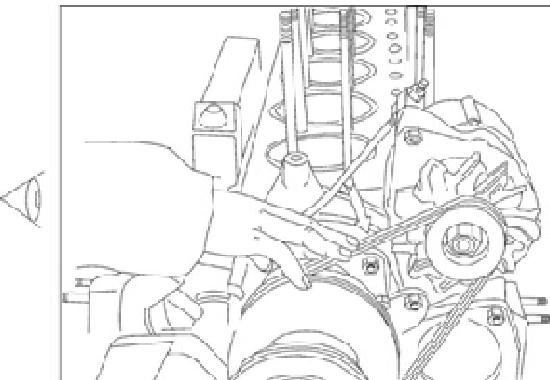


Figure 2-6. Check the belt

- (7) Check whether emissions color is normal

The normal color of exhaust gas is light gray. If color changes, check the cause and handle it.



Figure 2-7. Check the emission

- (8) Check whether sound is normal or not.

- (9) Check the revolution whether the vibration is normal or not

2.3 Content of maintenance and maintenance level

In addition to the daily maintenance contents, some contents should also be added:

- (1) Replace lubricating oil, as figure 2-8.

A. Turn the bolts at the oil pan to discharge completely oil, then turn them firmly again.

B. Open the lid to replenish the oil, and observe the oil level gauge, until the oil level reaches the required level then close the lid.

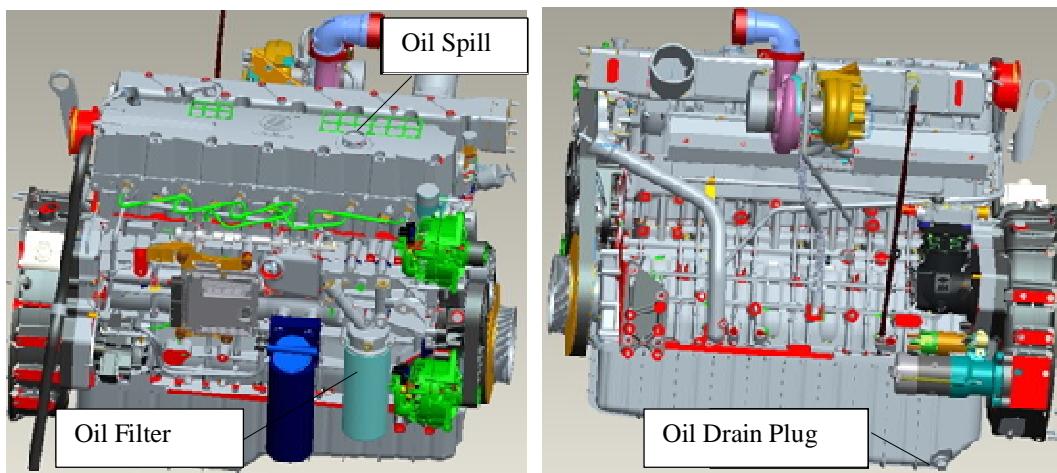


Figure 2-8 Location of oil spill, oil discharge, oil filter

(2) Replace filters or fliting core

When replacing the filter, perform the following steps:

- Remove the old filter;
- Fill the new filter with clean oil
- Before installing new oil filter, oil must be applied on the rubber gasket.
- After the gasket contacts the base, tighten the bolt $\frac{3}{4}$ ring to 1 ring.
- Start the machine, check whether there has oil leakage

(3) Check, adjust the thermal clearance of exhaust valve,

Adjustment steps are as follows:

- In the cold state, machine number 1.6 to the upper dead compression point (upward).

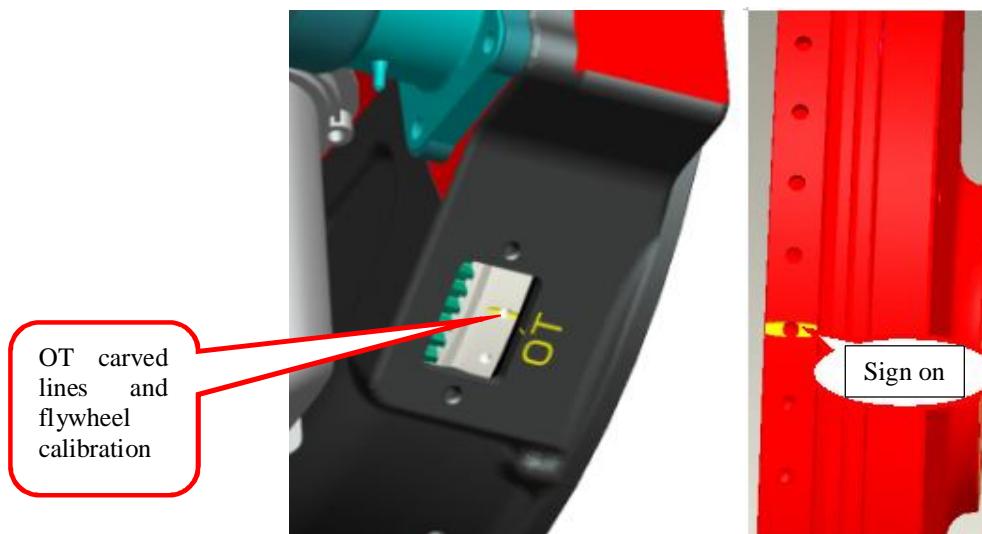


Figure 2-9 Sign on the flywheel

- Remove the cap of the rocker on the cylinder head cover, judge whether the number 1 or 6 is in the compression stage (in this state, the cylinder's discharge and intake valves also have clearances).



Figure 2-10 Adjust the valve clearance

Use a feeler gauge to adjust the thermal clearance, if it is too small or too big, adjust the rocker to reach the required gap (according to table 2-8).

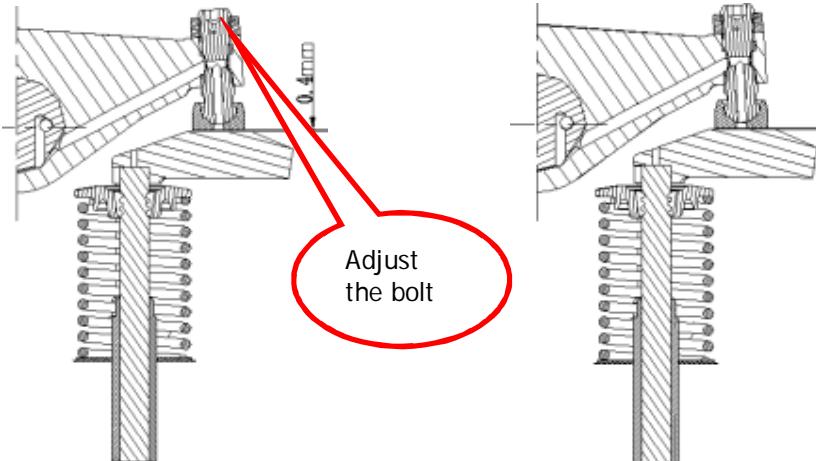


Figure 2-11 0.3mm intake valve clearance

Figure 2-12 0.5mm exhaust valve clearance

D. Checking engine No. 1 or 6, turn gear for engine at 360 degree, makes the engine No. 6 or 1 in the combustion cycle, check to adjust the remaining valve

Figure 2-8 Explosive compression states of cycles

	Engine No. 1	Engine No. 2	Engine No. 3	Engine No. 4	Engine No. 5	Engine No. 6
combustion compression process of engine 1	Exhaust valve	Intake valve	Exhaust valve	Intake valve	Exhaust valve	Not adjustable
combustion compression process of engine 6	Not adjustable	Exhaust valve	Intake valve	Exhaust valve	Intake valve	Intake exhaust valve

(4) Replace the filter core as shown in figure

When removing the filter core, manipulate the steps as below:

A. Remove the combustive fuel filter core, if the filter assembly is still in use, replace the water separating cup only

B. Lubricate the contact surface

C. Use your hand to turn the filter surface to match the filter cup face

D. Continue to use your hand to tighten it until it feels firm.

E. Discharge the air until the air bubbles are gone

F. Then proceed to discharge pressure test

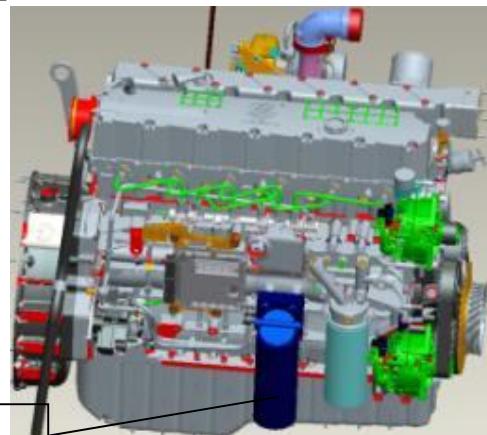


Figure 2-13 Fuel filter

(5) Check the intake air system

Carry out to check the air intake pipe whether it is aging, cracking, the hose clamp is loose. Tightening or replacement is required to ensure that the air intake system is close.

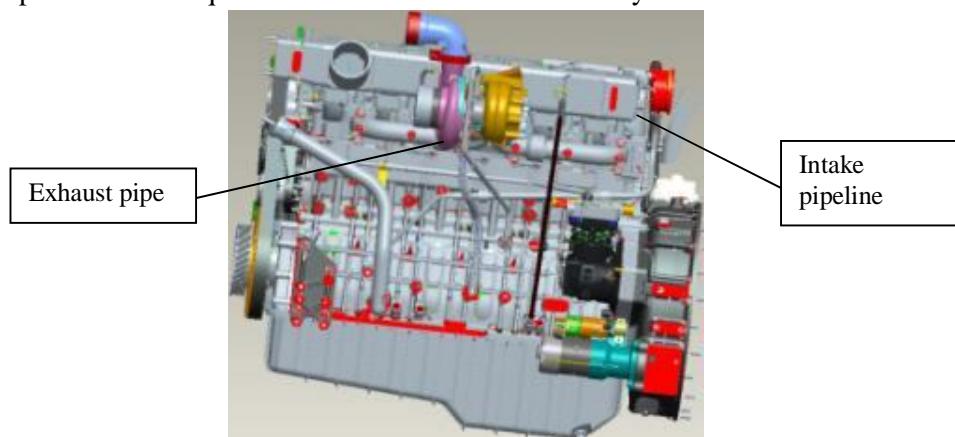


Figure 2-14 Intake and exhaust pipe

(6) Check the air filter assembly

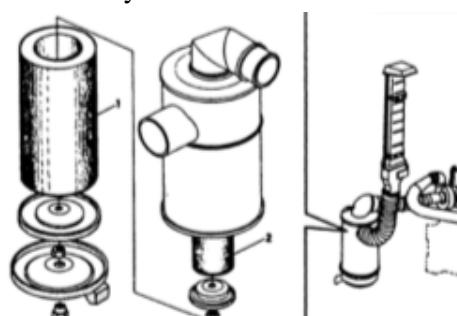


Figure 2-15: Air filter

1. Main filter core is made of papers; 2. Safety filter core is made of wool carpet.

The permissible air-resistance pressure level of the air filter assembly is 7Kpa, when the engine operates at the nominal evaluation or is in full load operation state to check the air resistance pressure. When the resistive pressure reaches the allowed limit, it is recommended to replace the filter core according to regulation of the manufacturer.

Attention:

It is not allowed to operate the engine without using the air filter, otherwise, the air including dust and impurities will come into the combustion chamber, lead to premature wear.

From the air filter assembly, remove the filter core, gently tap the filter frame to remove dust, and also use an air compressor to blow the filter core (spraying from the inside to outside).

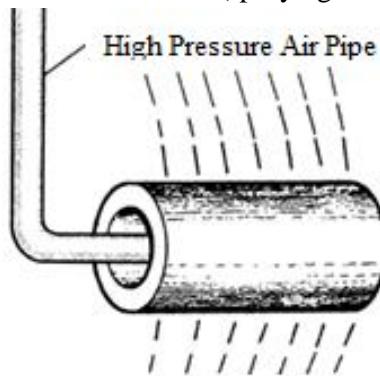


Figure 2-16 Cleaning filter core

Attention:

Do not make the filter core puncture;

Do not use water or oil to clean the filter core;

Do not use excessive force to tap or knock the filter core.

(7) Check the Urea pump filter core

For each maintenance, it is necessary to remove the urea pump filter core to check and use the water to clean it and then install it again without using excessive force to tap or knock the filter core.

Attention:

Each time you replace or remove the Urea nozzle, check the state of the Urea nozzle, if it is damaged or deformed, you need to replace the washer of Urea nozzle.

(8) Clean Urea tank and Urea tank filter core

When performing maintenance, it's required to check the hygiene of the filter core and the Urea tank, if necessary, it's required to carry out cleaning.

2.4 Maintenance in case where the engine is inactive for a long time

1. Clean the engine;

2. Protection work;

(1) After running idle speed to heat the engine, discharge the oil, clean the filter core, add anti-rust oil

(3) Discharge fuel oil, add anti-rust oil mixture;

(4) Discharge water, add anti-rust coolant solution;

Start the engine and run idling for 15 ~ 25 minutes at the same time;

(5) Discharge all oil, fuel oil, coolant;

(6) Carry out cleaning of places that are likely to rust over time.

3. Protection measures when the engine is inactive for a long time:

Use suitable objects or cloths to seal the inlet and outlet of oil, gas, and water. Use a specialized anti-rust membrane to cover the whole engine.

4. If it's must be transported, add additional packaging.

5. Protective oil

The protective oil layer has a shelf life of 1 year, if it is found that after 1 year, it is necessary to apply a new layer, specifically as below:

(1) When applying the protective oil layer, it must be done in a clean medium. Before applying it, you need to clean the parts, to not have rust, stains and dust.

(2) Base on the specific requirements to select methods of seepage, spraying, and sweeping to apply the protective liner.

(3) Oil seal position: turbo exhaust outlet, air compressor intake, air intake head. Air intake injector as shown in Figure 2-17

① When the primer oil is applied to the exhaust intake air system: When the engine is operating or using the turning gear equipment to rotary engine, use injector of oil pump JB1 to spray JB-1 into the position of the intake air inlet, at least 15 seconds;

② Apply oil layer for turbo: When the engine is in a static state or in progress of turning gear, use the JB-1 device to spray the air intake injector turbo for at least 5 seconds;

③ Apply oil layer for air compressors: When the engine is in a static state or in progress of turning gear, use the JB-1 device to spray the air intake injector turbo for at least 5 seconds;



Figure 2-17: Shape of compressed air injector

CHAPTER 3: TYPICAL PROBLEMS OF ENGINE AND HOW TO HANDLE

WP5 is a strict quality assurance engine in the management, design, manufacturing and manufacturing systems. Each machine before being leaving factory is tested. At the same time, diesel engines are a form of high precision equipment. In order to ensure the working performance of the engine, the maintenance work is an important factor that can not to be missed. Leading to the phenomenon of loss of efficiency early compared to life expectancy, there are several reasons as below:

- (1) Operations are not in accordance with standard guidelines, improper use management;
- (2) Do not maintain maintenance according to guidelines, even only repair when damaged but not conduct maintenance;
- (3) Replace fabricated parts which are not guaranteed, especially for short-term benefits, replace the counterfeit and poor-quality parts leading to shorten the service life;
- (4) Use fuel oil and lubricating oil with grade that is not suitable with manufacturer recommendations.

3.1 Methods of diagnosing troubles

Methods for diagnosing the common troubles of engine:

- (1) Observation method: By observing an engine discharging or typical troubles to judge the incident, as shown in Figure 3-1.
- (2) Listening method: Base on the abnormal sound of the engine, relying on hearing to judge the problem and the level and nature of the trouble location, as shown in Figure 3-2.



Figure 3-1: Observation for Judgment.



Figure 3-2: Listening for judgment.

- (3) Method of stopping each machine: Stop the operation of each engine, thanks to stopping each machine to make judgments, normally when suspecting any engine does not spray oil, compare the efficiency status work of each engine, proceed to find the location of the trouble, the cause and narrow the scope to find out the problem
- (4) Comparison method: For each assembly of the assy components or single components, replace them to ensure the elimination of that trouble.

Attention:

1. Judging the trouble is a meticulous task, when we do not certain the reason, we should not remove them in an arbitrary way, it not only cannot eliminate the previous trouble but also leads to the serious trouble due to improper re-installation after disassembly.
2. With high-pressure pumps, turbocharger and important components: maintenance and

repair must be done by using specialized tools, by certain experienced technicians. So when not meeting the conditions and experience, customer should not arbitrarily proceed to remove and adjust.

3.2 Judge the trouble and how to treat it

3.2.1 The engine is difficult to be started up

The cause of the trouble	Measure of treatment
1. Fuel pump or oil hydraulic pipe is clogged.	Check to remove impurities, check the cleanliness of fuel oil
2. Fuel oil hydraulic pipe contained air	Discharge air, check the tightness of the joints, conduct repairs
3. High pressure pump is in trouble	Check whether piston is loose, oil drain valve, repair or replace components
4. Injector is in trouble	Check the injector
5. Air distribution or oil feeder pipe is broken or leaking	Check and adjust
6. High pressure oil pipe is broken or leaking	Repair high pressure oil pipes or replace broken parts.
7. Compression pressure of cylinder is not enough	Check tightness of valve gaskets, tightness of cylinder gaskets, whether piston is worn and handle and replace broken parts.
8. Water temperature is too high	Add boot support device

3.2.2 The engine is started up for a while but stalled after that

The cause of the trouble	Measure of treatment
1. Fuel filter is clogged	Remove the filter assembly, clean and remove dirt and water. replace filter core if necessary
2. Air penetrates fuel oil pipeline system	Check whether the joints, bleeder bolts are tightened firmly, remove air residues due to long-term storage
3. Fuel pump is inactivating	Check and clean piston of fuel pump, valves, clean and repair.

4. Poor quality oil, mixed with water	Replace high quality oils
5. Speed of guarantee revolution is too low	Adjust the idling speed revolution

3.2.3 Weak engine

The cause of the trouble	Measure of treatment
1. The intake manifold is clogged (the air filter is clogged)	Check air filter, intake manifold, clean or replace filter
2. Obstructive exhaust air pressure is too high	Check whether valves, exhaust manifold pipe is clogged or not. Adjust or repair.
3. Turbocharge system has not enough pressure	Check, handle leaks of pipe joints
4. Turbocharger is working abnormally	Replace the assy turbocharger
4.1 Air compressors and turbocharger compressor propeller are dirty	Clean or replace with new ones
4.2 The ball bearing of rotary shaft is loose	Replace with new one
4.3 Propeller, rear clearance air compressor is accumulated of soot, oil dust	Clean propeller and related parts
5. Intercooler is broken, leaking gas	Repair or replace with new one
6. Fuel oil pipe is clogged or leaking	Check whether oil pipes and joints are tightly? Clean filter and fuel pipeline or replace with new one
7. Poor quality oil	Clean oil tanks, filter components and oil pipes. Replace high quality oil.
8. High pressure pump or speeder is seriously broken	Repair or replace with new one
9. Oil pump has smoke or propeller membrane is broken	Repair or replace with new one
10. Intake manifold is restricted by smoke, air leakage	Replace with new one
11. Spraying without porosity	Check and adjust spray oil pressure, clean

12. Time for air distribution or oil spray is not correct	Adjust valve clearance and early injection
13. Speeder adjusts blade speed too low	Check and adjust
14. The oil is excessive in the oil pan	Check the oil level gauge and remove excess oil
15. Cylinder gasket is leaking air	Check the compression pressure when the vehicle is hot, replace the broken cylinder head gasket
Piston is cracked, worn out, bushing clearance is too big	Replace components or overhaul engine
Piston, cylinder is cracked or worn out	Replace with new one

3.2.4 Fuel consumption is too big

The cause of the trouble	Measure of treatment
1. Intake manifold is clogged	Check and clean the air filter, the intake manifold pipeline
2. Obstructive exhaust air pressure is too high	Check and clean exhaust air pipe and dynamics valve
3. Poor quality oil	Clean oil pipes, filter parts, replace high quality oil
4. Oil pipe is blocked	Check and repair
5. Oil intake pipe is leaked	Check and repair
6. Weak injection pump	Check, adjust and repair or replace
7. Time for air distribution or oil feeding is not correct	Regulation: adjust valve clearance and early injection
8. Cylinder gasket is leaked	Check compressive pressure, replace cylinder gaskets
9. The bushing clearance is too large; the engine needs to be overhauled	Check and overhaul
10. Piston is expanded	Replace
11. Pressure of air compressing turbocharge system is low	Check and handle the case of leaking pipes and joints
12. Turbocharge is not working normally	Replace turbocharge
13. Oil cooler housing is broken or leaking air	Repair or replace with new oil cooler housing

3.2.5 The exhaust gas is black

The cause of the trouble	Measure of treatment
1. Obstructive pressure of intake manifold or exhaust manifold pipeline is large	Check and clean filters, intake manifold pipeline, exhaust pipes and dynamic valves.

2. Poor quality fuel oil	Clean oil tanks, filter components and oil pipes, replace with high quality oil
3. Time for air distribution or oil feeding is not correct	Adjust valve clearance and oil supply angle according to regulations
4. Injector has poor porosity	Check, adjust and repair or replace filters
5. The amount of oil spray is too large	Check and adjust (conducted by experts)
6. Pressure of air compression turbocharge system is low	Check and handle the case of leaking pipes and joints
7. Turbocharge is not working normally	Check and replace with new one
8. Oil cooler housing is broken or	Replace with new one or repair
9. Equipment to limit smoke phenomenon is not effective properly	Readjust

3.2.6 Exhaust gas is white-green

The cause of the trouble	Measure of treatment
1. Poor quality fuel oil, mixed with water	Replace fuel oil
2. The coolant temperature is too low	Check if the thermostatic valve is working or not, replace it if necessary
3. Time for air distribution or oil feeding is not correct	Check and adjust
4. Injector spays with poor porosity	Check and repair
5. Low compression pressure, incompletely combusted and piston is expanded	Check piston ring, cylinder, cylinder gasket and repair
6. Piston ring and cylinder run idling speed poorly	Continue running at idle speed
7. Piston ring mouth is slack	Adjust or reinstall
8. Piston ring is ineffective	Replace with new one
9. The clearance between the piston cylinder is too large	Repair, replace with new one
10. Turbo gaskets are worn	Check, replace with new one
11. Retaining catch of turbo ball is worn	Check, replace with new one
12. Turbo oil return hose is blocked	Clean or repair

3.2.7 Turbo intake air pipe, intake air pipe is accumulated with oil

The cause of the trouble	Measure of treatment
1. Turbo gasket is ineffective	Repair or adjust turbo
2. The oil-gas separation mechanism is ineffective	Adjust or replace
3. Lubricating oil in the oil pan is too much	Check and remove oil to reach the specified level

3.2.8 The revolution is unstable

The cause of the trouble	Measure of treatment
1. Poor quality fuel oil, mixed with water or scammed	Replace with new fuel oil

2. Oil hydraulic pipe is leaking air	Check oil pipe joints to ensure air tightness and discharge air.
3. Speeder of spring hammer has the phenomenon of working abnormally	Check and adjust
4. pumping oil unevenly	Check and adjust (done by experts)
5. The porosity of injector is unstable	Check and repair
6. Turbo is shaken	Check and clean compressed air pipe, remove impurities, clean coal charcoal in exhaust gas
7. Turbo ball bearings is damaged	Replace turbo

3.2.9 Oil pressure is too low

The cause of the trouble	Measure of treatment
1. The oil in the oil pan is lower than the oil gauge or lack of oil.	Add oil according to regulations
2. Trouble in pressure reducing valve of main oil line	Check valves, clean and fix
3. The filter assembly, oil line, connector, washers are clogged and cracked	Check and clean compressed air pipelines, remove dirt, remove soot of turbo exhaust pipeline
4. Oil grades are not correct as required.	Replace oil in accordance with regulations, use appropriate oil grade.
5. Oil pump pipe is leaked	Check the oil pipeline, connectors, repair or replace
6. Cooling system with high water temperature, high oil temperature	Check cooling system
7. The resistance from the filter is too large	Replace with the new filter core
8. Oil cooling is clogged	Check and clean
9. The main oil pipeline is blocked	Check and clean
10. Clearance of bushing is too big or bushing is broken	Check and replace
11. Parts of components are worn out, need overhaul	Check the engine in working and overhaul

3.2.10 Water temperature is too high

The cause of the trouble	Measure of treatment
1. The water level in the tank is too low	Check for any leaks, add water
2. The water tank is stuck	Check the water tank, clean and repair
3. Water pump belt is loose	Adjust the tightening force as specified
4. Water pump washer is broken; the impeller is worn out	Check, repair or replace with new one
5. Thermostatic valve is broken	Replace
6. Water pipe is broken, leaking air	Check water line, connector, washer, replace damaged part
7. The oil pan has less or lack of oil	Check oil level and leakage location, repair and add oil

3.2.11 Components are quickly worn out

The cause of the trouble	Measure of treatment
1. Filter quality is not standard, or damaged	Check and replace with the appropriate type
2. The intake manifold system is too short	Check gas pipes, washers, joints, repair and replace
3. The oil level in the oil pan is less or lack	Check oil level, leak location, repair and add oil.
4. Oil pipeline is clogged	Clean oil pipeline
5. Lubricant oil grade is unsuitable	Replace oil according to regulations
6. Piston ring is worn out	Replace broken components
7. Cylinder, piston are worn out early, cylinder is scratched	Remove piston to check cylinder, repair or replace
8. Oil filter is not be replaced promptly	Replace as required
9. Parts of parts are worn seriously, need overhaul	Check the number of km, determine the overhaul
10. The mechanical shaft and the interlock shaft are not concentric	Check installation and repair racks
11. Use unsatisfactory oil quality.	Select the specified oil type.

3.2.12 The noise is too loud

The cause of the trouble	Measure of treatment
1. Poor quality fuel oil	Replace fuel
2. The coolant temperature is too low	Check if the thermostatic valve is working or not, replace it if necessary
3. Time for air distribution or oil feeding is not correct	Check and repair, adjust
4. Injector spays with poor porosity	Check and repair, adjust
5. Oil pump with too large flow	Check and adjust (done by experts)
6. Shock absorber is worn out	Check whether it is broken. Check the connecting bolts, replace broken components
7. Valves are leaking air or adjust the clearance improperly	Remove valves to check, adjust
8. Gear clearance is large or gears are broken	Check for replacement of broken components
9. Cylinder, piston are worn out or cylinder is scratched	Check for repair or replacement
10. The push rod is bent or broken	Replace with new one
11. Piston rings are broken or worn	Check for replacement of broken components

3.2.13 The engine starts but is inactive

The cause of the trouble	Measure of treatment
1. Voltage of battery is not enough	Check and charge the battery, replace battery
2. Conductor contacts poorly	Clean the conductor, tighten the contact head
3. Fuse is broken	Replace fuse
4. Carbon brush contacts poorly	Clean contact surfaces of carbon brush, replace carbon brushes
5. The engine itself starts short-circuited	Check motor, replaces the assy

3.2.14 The engine starts but is inactive

The cause of the trouble	Measure of treatment
1. Battery voltage is low	Charge or replace batteries
2. Shaft bushing is worn	Replace the bushing assy
3. Carbon brush contacts poorly	Clean metal carbon brushes or replace new carbon brushes
4. Manifold is dirty	Clean the manifold, polish or replace the manifold assy
5. The weld point is loose	Re-weld
6. The switch operates poorly	Check and repair
7. The clutch is worn out, causing igniting with a sliding phenomenon	Adjust the clutch or replace the clutch assy

3.2.15 Engine starts weakly

The cause of the trouble	Measure of treatment
1. The power cord is broken, short-circuited, loose contact point	Check and repair generator and conductor of line meters, repair
2. Rotor winding, Stator winding wires are short-circuited	Repair or replace with the new generator assy
3. The rectifier is broken	Replace with new rectifier assy
4. Insulation paper is broken; the conductor is broken	Repair
5. The rectifier adjusts the voltage too low	Repair
6. The contact point is melting	Repair or replace with new assy

3.2.16 The generator fails to generate electricity

The cause of the trouble	Measure of treatment
1. The power cord is broken, short-circuited, loose contact point	Repair
2. Rotor winding, Stator winding wires are short-circuited	Repair or replace with the new generator assy
3. The generator belt is loose	Check and adjust the belt
4. The rectifying tube of generator is damaged; the battery is poorly exposed	Replace
5. The rectifier adjusts the voltage too low	Adjust
6. The magnetic field of the voltage control coil or resistance of the connecting wire is broken	Repair or replace with new one
7. Electrolyte of battery is low or old battery	Add electrolytes or replace batteries

3.2.17 The generator charges electricity in an unstable manner

The cause of the trouble	Measure of treatment
1. Rotor winding, Stator winding wires are short-circuited	Repair or replace with new one
2. Carbon brush contacts poorly	Repair
3. The contact wire is loose	Repair
4. Voltage controller is broken	Repair
5. Voltage adjustment is not suitable	Check and adjust

3.2.18 The generator charges too much

The cause of the trouble	Measure of treatment
1. The battery itself is short-circuited	Repair or replace with new one
2. Voltage controller is too high	Repair and adjust
3. Voltage controller is electric leakage	Repair
4. Contact of the voltage controller is inactivating, polluted, voltage coil or earth resistor is broken	Repair or replace with new one

3.2.19 The generator has an unusual sound

The cause of the trouble	Measure of treatment
1. Unreasonable installation of generator	Repair
2. Bearings are broken	Replace bearings
3. Rotor wires are exposed to stator wires	Repair or replace with new one
4. Rectifier is short-circuited	Replace with new one
5. The stator winding is short-circuited	Repair or replace with new one

3.3 Screening and diagnosing troubleshooting problems after SCR

3.3.1 Analysis of troubles of SCR parts

3.3.1.1 Trouble of Urea pump

- a) Urea pumps cannot set pressure

Phenomenon: The MIL lamp lights the Urea pump operates for a while and stops working, urea is not consumed

There may be the following reason:

- (1) Urea pipe is leaking;
- (2) Urea inlet pipe is leaking
- (3) Urea return pipe is connected in reverse
- (4) Urea inlet pipe is severely twisted.

Treatment:

Check whether 2 ends of Urea intake pipe are connected firmly, intake pipe and return pipe is connected improperly.

- b) Urea pump temperature is not normal

Phenomenon: Mil lamp lights, the difference between temperature and environment is large, the post-discharge treatment system does not work normally.

There may be the following reasons:

- (1) Urea pump source is open;
- (2) Urea pump Controller is open;

Treatment:

Check the status of the Urea pump's needle pin, check whether the connector of the Urea pump connector is exposed or not.

- c) Pressure of urea spraying decreases

Phenomenon: Mil lamp lights, Urea pump works for a while and then stops, does not spray Urea, post-discharge treatment assembly cannot work.

There may be the following reasons:

- (1) Urea pipe pressure has a clogging phenomenon

Treatment:

Remove urea pipe, use water to clean, solve the problem by re-fitting the pipe to initial position

- d) The high-voltage circuit of the modulating valves with the reversible direction is open.

Phenomenon: Incident lamp and Mil lamp light, Urea is not consumable.

Problem explanation: The reversible direction valve will be controlled by EDC17, its effect is to prevent residual Urea residual flow in the pipeline, whenever the engine is turned off, the directional valve will work for 90s, to remove the residue of urea on the pipe to the tank. With this phenomenon, it is common to report many errors, and in the same time, in a connection jack this phenomenon appears relatively common, such as the position pin is loose, or jack is leaking the water.

There may be the following reason:

- (1) Location pins are loose
- (2) The jack is leaking water
- (3) Error of Command wire correlation

Treatment:

- (1) Check the urea pump connecting jack
- (2) Check whether the any of jack pin is loose and poor contact
- e) Error of Urea pressure setting in SCR

Phenomenon: after operating the vehicle for a few minutes to a few dozen minutes, the Mil lamp lights, it will report the trouble 441 (The error of setting the pressure of Urea in SCR), Urea is not consumed.

Explanation: Before spraying Urea, the pressure of Urea is set to 9Bar, through the pressure sensor in the Urea pump to measure. When the engine operates, the Urea pump will set pressure, if the pressure still does not reach 9Bar, it will report the trouble.

With this problem, there are usually several causes: the amount of urea is too small, the urea pipe is connected reversely, the intake pipe is blocked or leaked, the pressure is leaked, rarely problem related to the urea pump.

There may be the following reasons:

- (1) Amount of Urea is too small
- (2) Urea pipe is reversely connected, intake pipe is blocked or leaked
- (3) Pressure is leaked
- (4) Rarely trouble related to Urea pump

Treatment

- (1) Check Urea level
- (2) Check whether Urea pipe is connected wrong
- (3) Check the intake pipe is twisted and connected wrong
- (4) Check the intake pipe for leak marks
- (5) After checking and finding no problem, check if the pipe is clogged

3.3.1.2 Urea tank

Urea tank mainly includes: Tank case, assy temperature sensor, sensor which is easy to encounter problems, common are: non-standard alarm, abnormal display temperature, incident lamp lights and alarms errors of level sensor, temperature. The cause of this problem has several causes: broken sensor, poor connection and correlation error from the command line. Sometimes Weichai level sensor with inadequate requirements (such as customers arbitrarily equipped with urea tanks without notifying weichai) is also easy to lead temperature sensor error.

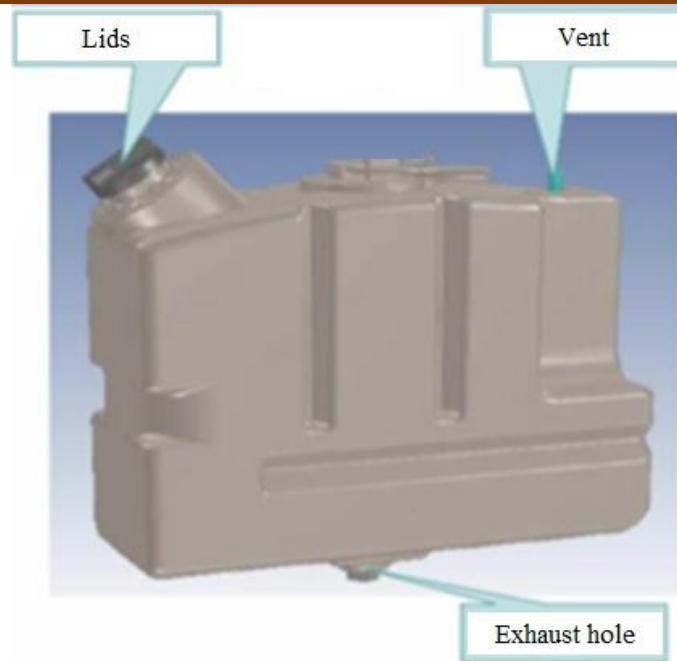


Figure 3-3: Urea tank

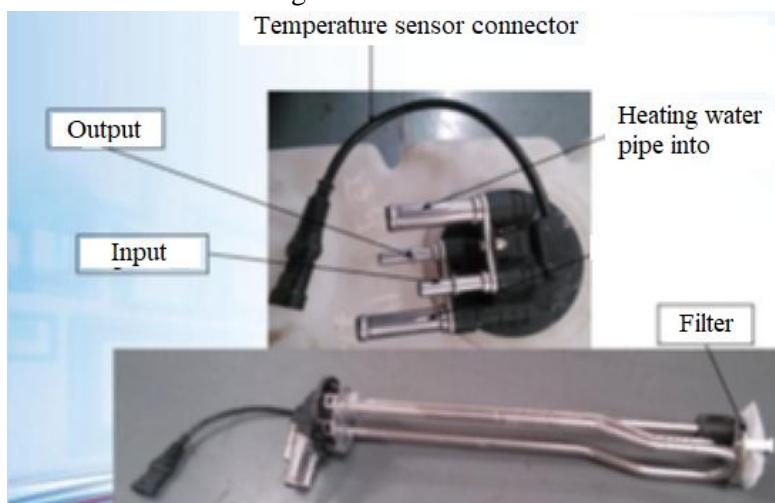


Figure 3-4 Urea tank connection

a) The voltage alarms level of the Urea sensor exceeds the limit

Phenomenon: Mil lamp lights and flashes error 445 (Voltage alarms urea level sensor exceeds limit) device displays incorrect urea level, explanation of problem: If this phenomenon does not occur before leaving the factory but after the engine operates for a while: it's usually due to the poor contact sensor command line or open. Check if the pin contact connector of needle 1 (ECU K57 pin) is open, short circuited to the power. If it is not able to fix it, conduct to check whether another needle pin has a problem.

There may be the following reason

- (1) The sensor signal wiring connector and the total command line are poorly exposed
- (2) Open command wire or poor contact
- (3) K57 and the source is short-circuited
- (4) Sensor failure, sensor parameters do not match Weichai requirements.

Practical solution method

- (1) Check from simple to complex, check high incident frequency to contact connection
 - (2) Remove plug to check the pins
 - (3) Fix firmly
- b) Temperature, urea level is abnormal

Phenomenon: Display Urea level inaccuracy (flow is small, but display 10%) Urea temperature with ambient temperature is a big difference but does not report correlation error.

Incident explanation: this type of incident is usually caused by a sensor with an incompatible index of Weichai, or a car that has replaced another Urea barrel, but the sensor in the Urea tank and the original sensor of the vehicle when it is shipped in a similar manner. likes, parameters are different, resulting in inconsistent data, improperly display.

Reason:

- (1) Customer replaces Urea tank, not in sync with vehicle;
- (2) When turning air distribution for vehicle, Urea tank is equipped without notifying Weichai to reset the parameter;
- (3) The correlation command line of the sensor fails, resulting in a variable parameter (this phenomenon is rare) but does not report correlation errors.

Treatment

- (1) Check the sensor, confirm whether it is compatible or not
- (2) Check if Urea tank is different in manufacturers;
- (3) Level indicator, urea temperature is abnormal.

Phenomena:

The Urea level and Urea temperatures are not accurate, although the level of Urea is very low, the meter alarms 100%. Specialized equipment of Weichai measures ambient temperature of 21 °C, but the temperature of the Urea tank is up to 42 °C, it's clearly not suitable. There are no other problems of the Urea level sensor.

Problem explanation: This type of problem is usually due to the Urea tank and Weichai designated product is not compatible. However, there are special cases such as the resistor power cord is too large, the resistor in the ECU is too large or due to another electrical components malfunction.

Reason:

- (1) Used Urea tank is not compatible with Weichai designated products.
- (2) The correlation conductor of resistive sensor is too large
- (3) Resistor on both ends of ECU and sensor is too large

Treatment:

- (1) Check Urea tank sensor, confirm whether Urea tank is the Weichai designated type;
- (2) Check whether Urea tank is normal, check whether the sensor wire is in good contact, check if the resistance index is normal;
- (3) Check Resistance between ECU and Urea tank temperature sensor in pins K57-K52-K80-K64;
- (4) If the resistor in the pin is 3,675kΩ, then this is a new ECU, it should be checked whether the data set in ECU is suitable for use status..

3.3.1.3 Heating assembly

The freezing temperature of Urea is at -11.5 degrees, when the system works in a low

temperature environment, the Urea is frozen, leading to the system being unable to work normally, so it is necessary to defrost the urea, use water to cool the circulating engine to defrost. Urea heating cooling water cycle is as shown in figure.

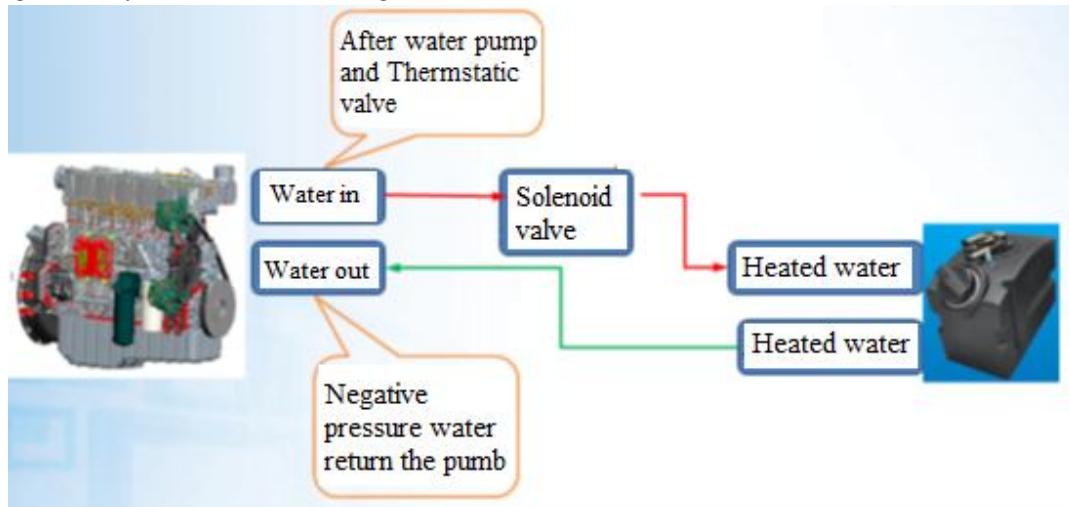


Figure 3-5 Urea heating circulation

Heating systems include water or electric heating, in which electric heating uses relatively lots of relay (wire resistance heating has 5 relays, which pumps to the tank, pumps to the nozzle, from tank to pump, Urea pump, main heating relay) multiple conductors, multiple wire resistor heating, so many problems will occur. Mainly wire resistance heating is not broken, not open, short-circuited.

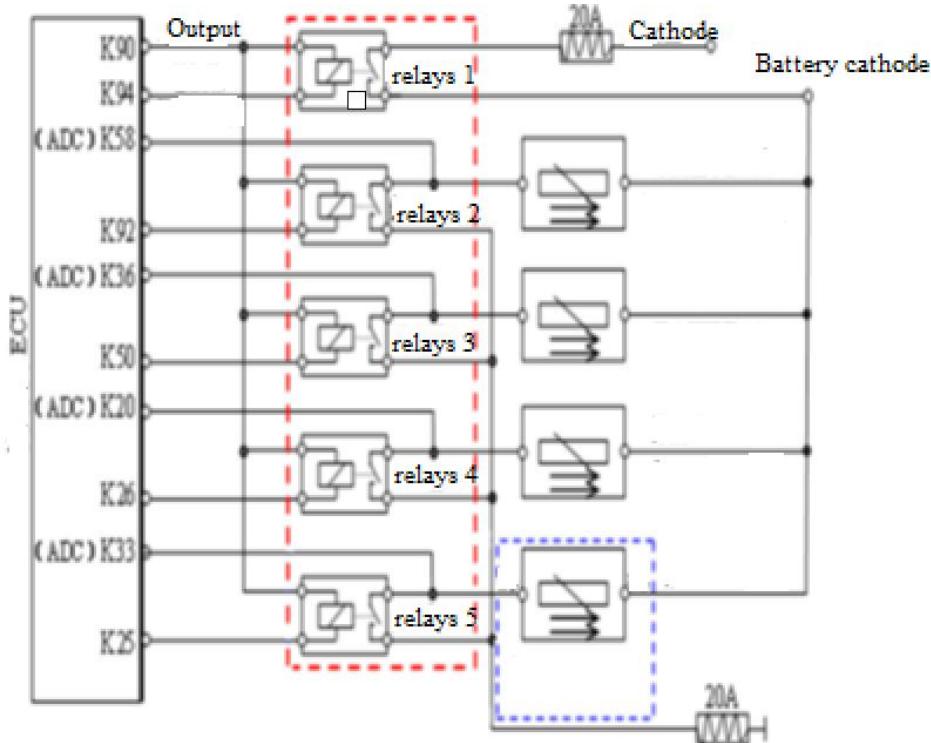


Figure 3-6 Electrical diagram of the heating system

Check Trouble 1: firstly, close relay 1 (K94: 0V) other relays maintain the stopping state

(Restraint to the pin voltage to the K90 is at 24V) In normal state K58, K36, K20, K33 has voltage about 24V. If any electrical voltage is measured abnormal voltage, there will be a correlation warning " idling wire resistance heating " or "short-circuit wire resistance heating" and other errors. It is necessary to check whether the resistance heating of the wire K58, K36, K20, K33 is open, short-circuited or not. For the relay trouble, check: ECU can check whether relays are installed correctly, if the relay is missing, broken or faulty wiring, it will report the problem " any heating relay is open circuited, short circuited, now you need to check the correlation relay, conductors and jacks. Common water heating problems include: water-heating solenoid valves, contact jacks, solenoid valves for water heating with mechanical problems such as abrasion and jamming can also lead to inefficient heating of the Urea, the too low temperature of Urea also leads to Urea heating to work continuously, too high temperature urea, steaming urea leading to emission not meeting standard, heating pipe is screwed, clogged, leaked or unfirms connector can also resulting in heating ineffective.

a) **Overheating of the Urea tank**

Phenomenon: After the vehicle has been operating for 1 time, the MIL lamp lights, alarms error 446 (Urea Overheating).

Problem explanation: Urea through the cooling the heating engine controlled by EDC17 for the solenoid valve heating. Because Urea will evaporate at 75 degrees c, the Urea tank temperature should not be too large. If the heating temperature of the solenoid valve does not turn off normally, the cooling water of the heating motor will continuously indicate this problem. Other incidents that lead to high urea temperatures will also report errors like this.

Reasons:

- (1) The solenoid valve is stuck, in a continuous open state;
- (2) Temperature sensor trouble.

Treatment

- (1) Check actual temperature of Urea tank, confirm the accuracy of the Urea temperature sensor.
- (2) Check the Urea tank heating solenoid valve, check the Close-Open status.

b) **The heating relay of the Urea pipe is open**

Phenomenon: Incident lamp, MIL lamp light and alarm the main Urea heating relay, Urea piping heating relay, Urea pump heating relay is exposed.

Physical problem: Relay 1 means Urea heating relay, relays 2 3 4 are Urea conduit heating relay, relay 5 is Urea pump heating one, if one of the above relays is missing or broken wire, it will report the above trouble.

Reasons:

- (1) Lack of relay installed;
- (2) Error of Relay conduit, jacks.

Treatment:

- (1) Check the status of 5 relays;
- (2) Carefully install each relay position.

c) **The resistance of Urea conduit heating wire is open**

Phenomenon: Incident lamp, Mil lamp light and warn resistance for Urea conduit heating wire, resistance of Urea pump heating wire is open circuited.

Physical problem: If Urea conduit, Urea pump only connects heating relay without connecting

wire resistance heating or wire resistance does not follow the instruction, ECu can also check this error.

Reasons:

- (1) Forget connecting wire resistance heater;
- (2) K58 K36 K20 K33 does not wiring according to the electrical diagram or being open circuit;
- (3) Other connection links do not follow the electrical diagram of instructions.

Treatment:

- (1) Check whether the resistor is installed
- (2) wire resistor is correctly connected, ensure K58 K36 K20 K33 is correctly connected.

3.3.1.4 Urea nozzle

The structure of the nozzle is simple, so the problem of Urea nozzles is often quite typical, mainly by solenoid valve of nozzles, connections, wires that form open circuits, short circuits. The solenoid valve coil is burned, it's possible to make judgments through resistance measurement.

Mechanical problems of nozzles. May be due to the addition of poor-quality urea, or aging nozzles, making nozzles worn out (usually there will be high consumption of urea phenomenon). Because the urea is crystallized or has an object that enters, causing a blockage or other cause leading to deformed or broken nozzles. Above errors affect Urea spray and engine exhaust gas are limited to operation, limiting torque.

a) **High voltage at the source circuit of Urea nozzle is short circuit.**

Phenomenon: Error lamp, MIL lamp is on and alarm error 453 (High voltage at the source circuit of Urea nozzle is short circuit) Physical problem: Solenoid valve of urea nozzle has 2 pins K09 and K10, correspondingly to code 2,1. K10 indicates the high voltage of the power supply circuit of solenoid valve, K09 is the low voltage power circuit, this problem is that K10 pin is short circuit, check K10 pin and conductor.

Reason:

- (1) The problem of connecting pins, leading to K10 short circuit with the power;
- (2) K10 conduit correlation problem leads to short circuit with external source.

Treatment:

- (1) Check the nozzle head whether it is broken or short-circuited;
- (2) Take the voltage for pin K10;
- (3) Check the wiring plugs on the vehicle assy.

b) **Consuming a lot of Urea**

Phenomenon: Customer gives feedback on high urea consumption, higher than fuel oil ratio of 1/20, there are no other correlation incidents.

Physical problems: If no problem is reported, it is possible to judge that the conductor of the system, electrical components operate normally.

Possible reasons are: Urea pipe is leaked, Urea pump is leaked, Urea tank is leaked, the urea nozzle is worn out, leading to Urea nozzle leaking.

Reason:

- (1) Conduits and correlated electrical components have Urea leakage phenomenon;
- (2) The nozzle is worn out, leading to an increase in Urea spraying.

Treatment:

- (1) Check the Urea tank, Urea pump, Urea conductor has a leak or no phenomenon;
- (2) If Urea is not leaked, start the vehicle, operate the vehicle to maintain at high capacity so that exhaust gas reaches urea injection pressure, about 200 degrees Celsius, OEL to check whether pressure of pump has reached to pressure of 9 bar;
- (3) Do not turn off the engine, maintain the engine in guarantee state;
- (4) Unplug the Urea nozzle from the exhaust pipe, observe whether the nozzles are leaked.

3.3.1.5 Trouble in SCR conversion efficiency and exhaust pipes

The internal SCR tank structure has a catalytic and transforming component, if there is a direct problem that leads to an unqualified exhaust gas, the ECU will limit the engine operation such as torque limit etc. Note there are type as below:

The catalyst is ineffective due to the impact of SCR tank or covered by other contaminants (such as black smoke soot). As a result, efficiency of the catalytic reconstitution decreases, leading to substandard emissions, torque limits. engine;

SCR is clogged, SCR is deformed or other causes also lead to obstruction, creating high pressure backflow exhaust, then occurs black smoke, engine is vibrating, weak engine etc. and emissions will also affect the exhaust pipe such as being corroded, because urea solution is also corrosive, so we choose the materials to make SCR as stainless steel, with smooth inner surface, to minimize conjunctive welds.

If the exhaust pipe does not meet the above requirements, it is likely that Urea spray will still have residues, be worn out and damage the exhaust pipe.

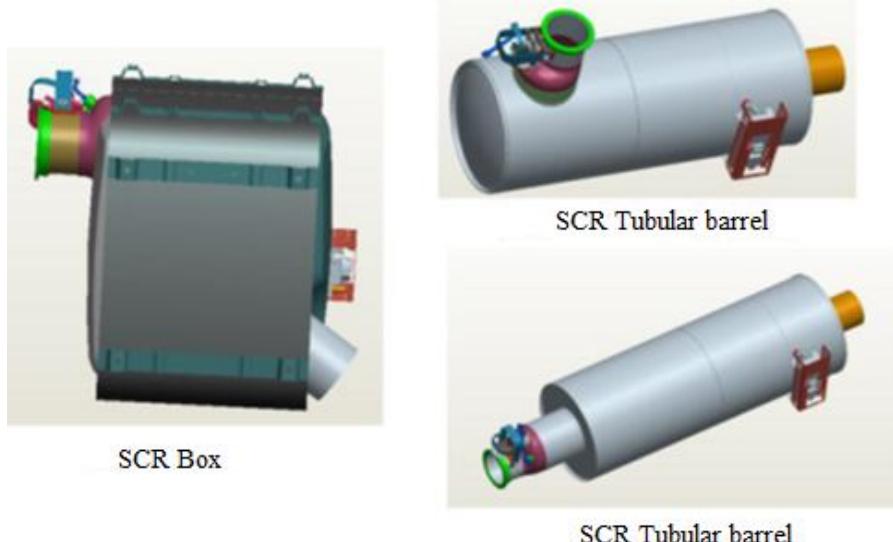


Figure 3-7 SCR tank

a) The exhaust pipe is rusty, corrosive

Phenomenon: Exhaust pipe for more than 1 month has corrosion and damage phenomenon, replacing the exhaust pipe still has the above phenomenon.

Physical breakdown: Urea is corrosive, so the urea nozzle in the rear part of the exhaust pipe needs to be processed as required: the material is not rust, smooth surface, and does not allow welds traces, minimizes joints.

If not meet the above requirements, it is very easy to lead to urea residue, causing exhaust pipes rusted.

Reason:

- (1) Poor Quality of anti-rust materials;
- (2) Material surface is not smooth, leading to precipitation of urea;
- (3) Internal weld traces;
- (4) Too many conjunctive joints.

Treatment:

- (1) Check that the exhaust pipe meets machining requirements;
- (2) Check the exhaust pipe whether quality of material is of common type, processed poorly;
- (3) If it fails to meet the requirements, you need to change the standard type.

a) SCR tank has average conversion efficiency below limit value 1 (limit value 2)

Phenomenon: Incident lamp, MIL lamp light, Urea spraying is normally without correlation phenomenon.

Physical problem:

The above two incidents show that the emission has too large NOx concentration, surpassing the E4 standard, if not handled promptly, it will lead to limited engine operation.

Reason:

- (1) Original engine itself has air exhaust with poor quality, the front assembly of the rear treatment from Turbo extract exhaust gas with too poorly quality;
- (2) SCR is poor in quality, leading to poor metabolism;
- (3) Spray error is too large, actual injection volume compared to setting value is too small;
- (4) Poor oil quality.

Treatment:

- (1) First check, judge whether the original engine is guaranteed, there is black smoke phenomenon;
- (2) Check oil quality;
- (3) Check whether Urea spray is clogged, leaking, non-standard flow injection;
- (4) Check whether SCR tank is precipitated, wrapped by soot, or not.

3.3.1.6 Trouble in Urea path

Post-SCR processing has 3 segments including Urea conductor, easy to appear 3 types of problems: blocked, leaked or twisted wires.

The reason why the conductor is clogged is normally due to urea precipitation or poor-quality urea, which influences the setting of spray pressure, leading to substandard emissions.

The leakage of conductor is caused by 2 types of reason, the jack ends of conductor are not of right type, not closed, so leaking, pipe is aging or damage leading to leakage.

The screwed path does not establish spray pressure, which also leads to unqualified quality emissions.

a) SCR fails to set injection pressure

Phenomenon: Incident lamp, MIL lamp light, NOx surpasses target, Urea does not spray normally.

Physical problems: When the thermal exhaust reaches the lowest spraying pressure, the Urea pump will conduct spraying, and at the same time check all conductors and Urea pumps, nozzles to see whether it is leaking or clogged. If for a long time the injection pressure does not reach 9 bar,

ECU will judge Urea is leaked and report the type of problem, SCR stops working.

Reasons:

- (1) Wrong connection of Urea conductor, or the conductor is leakage
- (2) Urea pressure pipe is leaked
- (3) Trouble of Urea pump.

Treatment method

- (1) Check that the conductor has a wrong connection, leakage, twist
- (2) Check that the pressure conductor is leaking
- (3) Check that the conductors are screwed and the connectors are not tight.

b) The previous use of SCR does not discharge cleanly

Phenomenon: Unlock electric key T15, incident lamp flashes code 447 (previous operating is not rinsed clearly by circulation), previously there was no such problem.

Mechanic incident: prevent Urea residuals and precipitation leading to blockage and lead to Urea pump broken, require operators not to turn off completely for 90 second when disconnecting engine, so Urea pump can continue working, recover Urea to Urea tank. If the operator misses this step, it will lead to the problem.

Reason:

- (1) The driver violates the above principle

Practical solution method

- (1) Explore driving operation to ensure principle of 90s.
- (2) Driver turns off the engine, skip stage of 90s
- (3) Restart the engine, then turn off the engine in accordance with the principle of 90s and then turn off the engine completely.

3.3.1.7 Trouble of SCR correlation sensor

The sensor here has 2 types of pre-catalytic air-thermal sensors, environmental temperature sensors and NOx sensors.

Environmental temperature and pre-catalytic air-thermal sensors: mainly have 2 types of trouble, there is one type as signal sensor voltage is higher than the limit or lower than the permissible limit / the higher voltage is due to the conductor, the jacks is open or short circuit. Lower voltage is commonly due to conductor or contact jack is short-circuited. Another type is of display temperature is not standard, now it is necessary to check whether the sensor is installed in the right position, suitable, or damaged. When there is an environmental temperature problem, it will affect the heating function for urea, forming a precipitate, leading to congestion, when the pre-treatment sensor is damaged, causing the urea spray controller ineffective, the exhaust is not reached.

In short, if it is not timely to fix the problem, it will lead to limitation of the engine when operating.

NOx sensor: When this sensor fails, the concentration of Hydrogen is too high, exceeding AT101, it will indicate the indicator to EDC17, but also releases the AT101 trouble, usually due to the conductor, the NOx sensor has 4 connectors, distinguish as positive, negative wires, grounding wire and high CAN, check four ends whether voltage is normal, open or short-circuited, ensure wire, contact, we can also take into account the case where the NOx sensor is broken, try replacing the new sensor.

a) Voltage signal of pre-SCR catalytic exhaust air temperature sensor exceeds the limit

Phenomenon: Incident lamp flashes code, reporting problem, causing EOL to check that the display temperature is not correct and changed.

Physical problem: Correlated conductor sensor. Contact jacks lead to open circuits, when checking this problem, EOL checks the temperature will be the default value.

Reason:

- (1) Conductor, connection of sensor is open circuited;
- (2) Sensor is aging, damaged;
- (3) The ECU plug-in conductor is broken, resulting in an open circuit.

Practical solution method

- (1) Check the pre-treatment exhaust air sensor connector plug;
- (2) Check the conductor has standard adjustment;

b) The temperature signal is not reliable

Phenomenon: the vehicle operates for a time, the warning light is on, the light flashes with error 235 (the ambient temperature signal is not reliable).

Physical problem: When measuring the current ambient temperature, if the ECU checks that the temperature is not appropriate, for example, too high or too low, it will report this problem.

This problem is usually caused by improper position sensor installation (such as installation in the engine compartment, too close to the radiating area, the sensor gives abnormal resistance, the sensor itself is abnormal).

Reason:

- (1) Install the wrong position sensor
- (2) Resistance of conductor is too large
- (3) The ambient temperature sensor is broken.

Practical solution method

- (1) Check whether the sensor mounting position is suitable;
- (2) Check whether the sensor position is close to the radiant area;
- (3) As required, choose the appropriate mounting position

c) CAN receive the AT101 signal beyond the time limit

Phenomenon: The code lamp is on; the MIL lamp indicates error 421 (CAN receives the AT101 signal beyond the time limit).

Physical problem: The NOx sensor measures too high NOx concentration, constantly measuring results, through the CAN to alarm signal to the ECU, if the ECU fails to receive data from AT101, it will report this error.

Reason:

- (1) NOx sensor failed, resulting in AT101 not transferring data;
- (2) Sensor NOx is broken;
- (3) CAN wire data network is broken.

Practical solution method:

Check the voltage of 4 pins (1 2 3 4) to distinguish the voltage as 24V, 0V, 2.2V, 2.8V.

Judge whether errors exist, such as an open circuit, short circuit, etc.



NOx sensor code	Needle pin voltage
1	Voltage (+) 24V
2	Voltage (-) 0V
3	CAN wire of total information – Low
4	CAN wire of total information - High

Figure 3-8 NOx sensor assy

3.3.1.8 Conclusion

SCR systems do not work normally, in some cases:

- 1) Urea conductors have leak, precipitate, congestion;
- 2) Conductor of connectors is loose, leaked but not leaked Urea;
- 3) Injecting wires and returning wires are reversely connected;
- 4) Conductor of Urea pump is short, interruption of contact;
- 5) SCR system is unreasonably arranged, leading to conductors clogged or penetrated water;
- 6) Exhaust air temperature sensor has not been connected or loss of contact;
- 7) Urea temperature sensor is abnormal or SCR does not work;
- 8) The ECU or ECU conductor has a problem; the contact is poor;
- 9) Wire resistance heating is burned, alarming the OL correlative heating;
- 10) Urea nozzles, exhaust air sensors, Urea-level sensor for malfunction.

3.3.2 Diagnose and handle the problem of post-treatment emissions treatment assembly

3.3.2.1 Classification of troubles

- Type 1: Urea pressure fails to be established
- Type 2: Low urea consumption
- Type 3: OBD limits the torque and cannot remove the error code
- Type 4: MIL lamp
- Type 5: heating Urea but not spraying
- Type 6: Low NOx conversion efficiency
- Type 7: NOx conversion efficiency without Urea spraying
- Type 8: The measurement value of NOx is incorrect
- Type 9: Odor of ammonia
- Type 10: Urea Precipitate
- Type 11: Other incidents

3.3.2.2 Handle the troubles

- 1) Urea pressure fails to be established

Step 1: Based on the error code, determine the location of the trouble, the key point of the function setting up the Urea injection pressure and the related components such as: nozzle, navigation valve, Urea pump, heating relay, resistance wire heating, exhaust air temperature sensor, Urea tank temperature sensor and so on

Step 2: If the temperature is low, based on the error code to check the Urea heater to ensure the heating function is normal.

Step 3: From step 1, the correlation error information is obtained, if fails to reach the injection pressure, only correlation errors, check the nozzle, directional reverse valve, Urea pump, heating relay, wire resistance heating, exhaust air temperature sensor, Urea tank temperature sensor and other parts with conductors. Possibility of the other part due to the pressure of the urea spray setting, the turbocharger releases the air exhaust pre- processing assembly at temperature of 180 °C.

Step 4: Turn off and restart, if the system still fails to set up the urea injection pressure, it is necessary to take into account the case where the conductor connecting parts are reversely connected, check it.

Step 5: It is recommended that from step 1 to obtain correlation trouble information, if the problem is related to setting up the injection pressure but there is no correlation trouble, then it is possible to see that parts are normal, check Urea pipe assembly, if no leak or congestion is detected, the system has tried to set the injection pressure but failed.

Step 6: Turn off and restart, if the system still tries to set the injection pressure but fails, take into account the case where the conductor connecting parts are reversely connected, check it.

Step 7: The quality of the feedback signal also leads to the system failing to set up pressure, such signal alarms Urea level, Urea pump temperature, Urea temperature.

Step 8: it's required to check installation data.

2) Low urea consumption

Step 1: Based on the error code, determine the location of the trouble, the key point of the function setting up the Urea injection pressure and the related components such as: nozzle, navigation valve, Urea pump, heating relay, resistance wire heating, exhaust air temperature sensor, Urea tank temperature sensor and so on

Step 2 If the temperature is low, based on the error code to check the Urea heater to ensure the heating function is normal.

Step 3. Check that the setting of Urea injection pressure is normal, if it fails, refer to the first type of trouble to check.

Step 4: If the pressure is successfully set, check the nozzle, remove the nozzle to see if it's normal. If the mechanical detail nozzles are stuck, the fault reading system will not read.

Step 5: Check the recent vehicle operation status, if the vehicle operates for a long time but in a low load state leading to low exhaust temperature, Urea will not spray (lower than 200 degrees).

Step 6: Check the connection standard between parts.

Step 7: It's required to check installation data.

3) OBD limits the torque and cannot delete the error code

Step 1: Based on the error code obtained, determine the location of trouble and key location of attention to limiting the torque of OBD and cannot delete the error code, specifically referred to Annex A.

Step 2: Based on step 1, compare with table 1, determine the problem that leads to limiting the torque of OBD and cannot delete the error code.

Step 3: It's required to check installation data.

Step 4: Refer to the guideline for conducting step-by-step screening.

4) MIL lamp

Step 1: Based on the error code obtained, determine the location of the trouble, the key of attention to the MIL lamp and other related parts malfunction.

Step 2: Based on step 1, compare with table 1, identify the problem that led to the MIL lamp lights.

Step 3: Check the MIL lamp and conductors, determine the MIL lamp to work normally.

Step 4: It's required to check installation data.

Step 5: Refer to the guideline for conducting step-by-step screening.

5) Urea heating but not spraying

Step 1: Based on the error code obtained, determine the trouble location, key attention to Urea heating and thermal sensor with correlation problem.

Step 2: Based on step 1, it is necessary to check the ambient temperature sensor and conductor, determine the sensor to work normally.

Step 3: Based on step 1, it is necessary to check Urea heating relay, solenoid valve and related conductors.

Step 4: Based on step 1, it is necessary to check Urea resistance heater and conductor, the Urea pipeline heater.

Step 5: If the Urea pump error is reported, turn off and restart, if the problem still exists, replace the Urea pump.

Step 6: It's required to check installation data.

Step 7: Refer to the instruction manual for step-by-step screening

6) Low NOx conversion efficiency

Step 1: Based on the error code obtained, determine the trouble location, the key attention is to the low performance NOx conversion trouble.

Step 2: from the result of step 1, check:

a) Check the NOx sensor and exhaust pipe, if measuring a relatively large NOx indicator, it will lead to a conversion failure.

b) Check Urea spray, if the amount of urea spray is low, it will result in NOx sensor giving big signal leading to low efficiency conversion.

c) Check the nozzle, if it's fault of the nozzle (mechanical details are jammed, the system cannot check the mechanical error) less urea flow also leads to this problem;

d) Check Urea injection pressure, Urea path is leaked, leading to low pressure, spraying less, so leading to the above problem;

e) Check Urea solution, if Urea quality is not guaranteed (low concentration, mixed with impurities), it also leads to this problem;

f) Check whether Urea is precipitated, if the precipitation within SCR, it also leads to reduced conversion efficiency;

g) Check the engine and SCR tank, if it detects the machine and SCR is too aging, it also leads to the above problem;

h) Check the relative environmental factors, if the temperature is low, the temperature sensor fails, if the vehicle operates in a harsh environment, it also leads to this problem;

Step 3: It's required to check the installation data, if it's in the specific conditions, unreasonable requirement of spray will report an error.

7) NOx conversion efficiency without Urea spraying

Step 1: Based on the error code obtained, determine the trouble location, the key attention is to the low performance NOx conversion;

Step 2: Check the NOx sensor, confirm the NOx sensor to work normally, the ECU can read the measured value of NOx and NOx sensor in status 1.

Step 3: Check Urea spray conditions, including SCR state to control injection flow, spray pressure of 9bar and temperature of 200 degrees or more, Urea spray confirmation.

Step 4: Check Urea spray status, confirm Urea is spraying.

Step 5: Check the environment, normal conductor environmental pressure sensor, confirm 2 sensors normally working, besides the environment pressure is more than 900hPa, the ambient temperature is higher than 2 degrees C.

Step 6: confirm that the engine is working in a suitable environment, such as an air discharge machine with a temperature of 300 degrees, a discharge air flow is greater than 500kg / h.

Step 7: It's required to check the installation data, if the engine operates in an inappropriate state, it also leads to the transformation being affected.

8) The measurement value of NOx is incorrect

Step 1: Based on the error code obtained, determine the trouble location, the key attention is to the NOx trouble.

Step 2: Check the NOx sensor and exhaust temperature, confirm the exhaust pipe is not leaked and install the NOx sensor correctly, check the SCR distribution rules.

Step 3: Check the NOx sensor conductor, confirm the information exchange, the power supply is normal.

Step 4: Check the reverse pressure of the exhaust gas, the reverse pressure of exhaust air affects the NOx sensor and its index then affects the NOx measurement.

Step 5: Check rate of NO and NO2 in the exhaust, if NO2 is large, the NOx index will be large

Step 6: It is necessary to check the installation data to confirm that the NOx signal is returned correctly.

9) Odor of ammoniac

Step 1: Based on the error code obtained, determine the trouble location, the key attention is to Urea spray incident and correlation incident. Includes: revolution sensor, injector, intake manifold, temperature sensor, exhaust air temperature sensor, nozzles, Urea spray pressure sensor

Step 2: Check the revolution sensor and conductor, the revolution signal is one of the bases of calculating Urea flow.

Step 3: Check the injector, if the spray flow is less than the spray installation data, it will lead to a relatively large difference in urea injection flow.

Step 4: Check pressure of intake manifold, temperature sensor and conductor, flow of intake manifold is also the basis for setting up Urea spray control.

Step 5: Check the exhaust temperature sensor and conductor, exhaust air temperature is also the basis for setting up Urea spray control.

Step 6: Check Urea spray pressure sensor and conductor, if the measured signal of Urea injection pressure is different highly in pressure, it also leads to the adjustment of Urea spray, thereby leading to high injection flow.

Step 7: Check the nozzles and conductors, if the Urea nozzle is stuck in the open state, the amount of urea spray is also large.

Step 8: It's required to check the installed data, confirm the emissions quality machine in the

original form, the flow of intake manifold is enough to ensure the standard.

10) Urea Precipitate

Step 1: Based on the error code, determine the error location, the key attention is to the conversion of NOx and correlated NOx signals.

Step 2: Large flow of urea, also causes crystallization, specifically refer to the 9th trouble to check the method and processing step.

Step 3: Check the design of exhaust pipes and materials.

Step 4: Check the design of spray nozzle base and material.

Step 5: Check the nozzle to see if the technical requirements are guaranteed.

Step 6: It's necessary to check the installed data, confirm the air quality machine in the original form, the flow of intake manifold is enough to ensure the standard.

CHAPTER 4. INSTALLATION AND REMOVING OF MACHINE

4.1 Overview

When Installing and removing the machine, please strictly follow the manual. At the same time pay attention to and identify dangerous warning symbols when operating, ensure safety, avoid unintended incidents.

4.1.1 Hazard symbol

This symbol is recognized by the world as a warning symbol, in this manual, this symbol is used to emphasize important related information, ensure users capture the dangerous nature to avoid committing. Not paying attention will likely lead to loss of property and people etc.

We often see this symbol as a warning, in this manual, warning information will be based on the level of danger to warn (minor injury, serious injury or life-threatening).



This warning represents a potentially dangerous situation, if not preventable, which can lead to serious injury, life-threatening or property loss.

This warning represents a potentially dangerous situation, if it is not preventable, it can lead to serious injury, affecting life or property loss, this symbol is also true to warn of dangerous operations.



This symbol provides information for users to pay attention to, to interpret how the operation is accurate, along with reference to this book also cannot prevent all forms of danger, only one understands correctly the items to be notices for right support.

This manual cannot disseminate all situations arising in the use process, if the user uses in the sequence and method within the scope of manual, please make sure the above operation does not bring potential dangers to people, 3rd person and equipment.

4.1.2 Safety symbol

Picto	Definition
	Wear hand protection
	Wear ear protection
	Wear eye protection
	Wear head protection
	Wear foot protection
	Wear a protective mask
	Wear overalls
	Avoid naked flames
	Do not smoke
	Do not use a mobile phone
	Danger: battery acid
	Danger: live cables, electrical risk
	Highly inflammable product
	Keep away from hanging loads
	Keep an extinguisher close by

During use, there may be many unforeseen dangerous incidents. Therefore, this manual cannot produce all the potential dangers. Therefore, it is recommended that users comply with the safety order so as not to result in loss of life and property.

4.1.3 Installation and Removing tools

Picto	Definition
	2.5mm hexagonal wrench
	5 mm hexagonal wrench
	8mm socket
	Flat screwdriver
	Special tool
	10mm flat hexagonal wrench

If using methods and tools outside the scope of this manual, users must ensure their own safety, avoid hurting themselves and others, and ensure the method of use and maintenance does not cause harm and safety.

4.1.4 Health care items

Here are the safety protection items for users:

- (1) Avoid repeated contact with used lubricating oils.
- (2) Wear protective clothing and gloves when handling.
- (3) Absolutely do not put lubricating oil-attached clothes in the pockets of clothes and pants.
- (4) Avoid allowing lubricating oil to stain clothes, especially underwear.
- (5) Wash protective clothing, remove oil-stained clothes and shoes that cannot be washed thoroughly,
- (6) If you are injured or formed a wound, immediately choose a way to treat the wound
- (7) Prior to working, you should apply protection plaster layer, when it is dirty, it can be easily cleaned.
- (8) Use soap and warm water with a brush to remove dirt in interstitial hands and nail. In the process of washing, if losing the natural oil layer that the body secretes, it is possible to get goat (sheep) fur oil to replenish the skin layer.
- (9) Do not use gasoline, kerosene, fuel oil, etc. to wash your hands.
- (10) If skin irritation is felt, see the hospital immediately.
- (11) If possible, in the process before transferring parts, remove the oil layer.
- (12) It is dangerous to eyes, wear protective glasses, and easily to remove for sanitation when needed.
- (13) Do not let the oil fall on the ground when repairing the machine. If leakage of hydrocarbons or other chemicals, it must be isolated from the above area.
- (14) The mixture of hydrocarbons, ethylene, etc. when transported, recovered, stored must comply with the regulations of the host country and relevant agencies.

4.1.5 Environmental protection items

Concerning waste oil and hydrocarbon mixture, it must be treated, recommended to comply with the environmental protection sanctions, details can refer to the relevant guidelines.

4.1.6 Items to be noted when Installing & removing the machine

Diesel engines during operation and maintenance have problems related mostly due to not strictly following the instructions and attention. So users need to be aware of the potential risks. The operation skills need to be trained.

If you violate the guidelines set out in this manual, it is very likely to lead to serious, even life-threatening incidents. Weichai Power cannot synthesize all potential risks that may occur during operation, and this manual is not the final manual without omissions.

To proceed with maintenance work, it is recommended to have a sign "Prohibited to use" at the machine's power switch.

Before using the tools, it is necessary to set out situations that may arise to prevent it.

Warranty station and garage must ensure that the required environmental factor is suitable for operation.

Ensure the repair area is clean.

Before proceeding, it is recommended to remove jewelry, necklaces, rings, watches, wear appropriate work clothes.

Before doing so, check the protective equipment (glasses, gloves, shoes, masks, clothes, etc. and their expiry date.

The use of tools with errors or incompatibilities is strictly prohibited.

The machine must be turned off during maintenance and repair.

4.2 Engine body cluster (engine block)

4.2.1 Definition

The engine body cluster includes cylinder components, flywheel housing, oil crank bottom, cylinder head cover, main shaft bearings, piston coolers, pins. Structure figure as shown below.

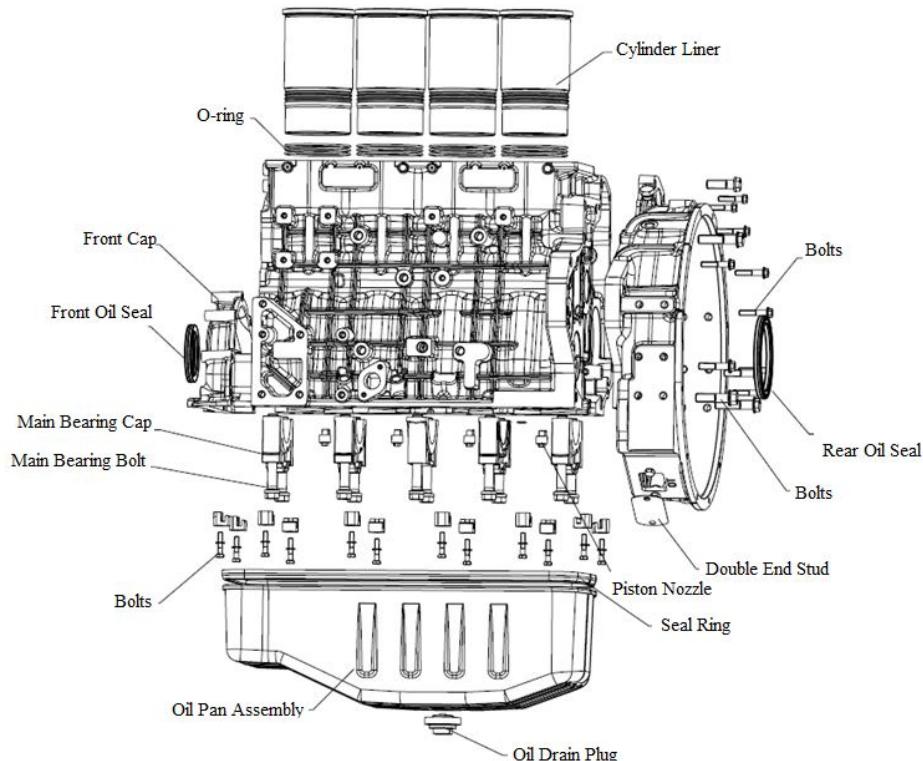


Figure 4-1 Structure of the body cluster

4.2.2 Installation and Removing of oil crankcase bottom

Assembly orders

1. Use the adhesive glue applied to the contact surface of oil crankcase bottom, the adhesive glue must be uniform, not screwed or missing.
2. Use Hexagon bolts and flat gaskets to mount the bottom of the overall crankcase to the cylinder (before Installation, check any obstacles in the cylinder core, based on the rotation of flywheels to turn 360-degree machine, check if there is collision between weight of the mechanical shaft and gear pump, if there is collision, it has to be treated immediately, with the bolts fixing at the crankcase bottom, tighten 1 force of 29-35 Nm)

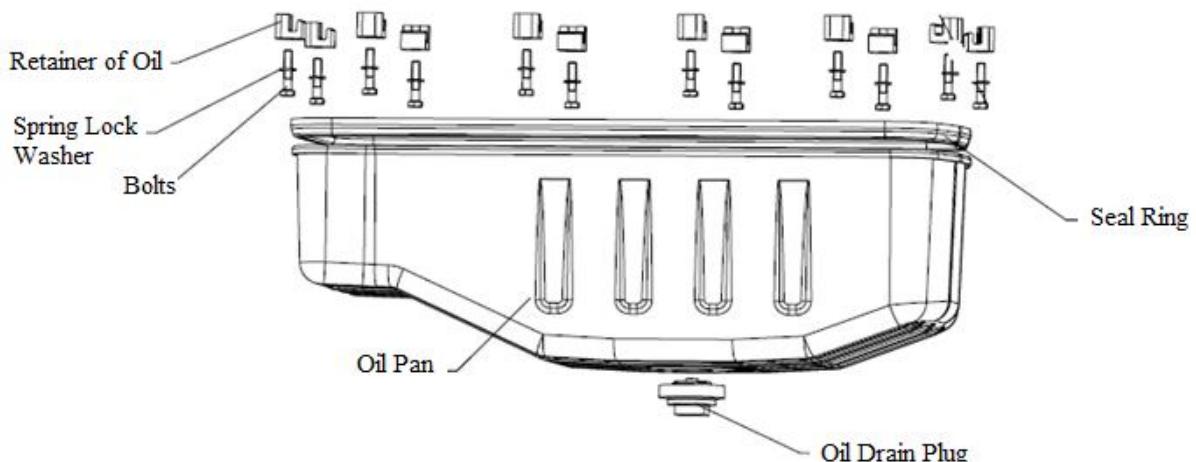


Figure 4-2 Figure of crankcase bottom

Check

1. Check if the bottom of the crankcase bottom is clean and smooth.
2. Check is the contact surface between the crankcase bottom and the cylinder is clean, free of dirty waste.
3. Check the falling status of the gasket.
4. Check if the bolts have been tightened with force of 29 ~ 35N.m
5. Check is the cylinder core has an obstacle
6. Check if there is any latency when turning the machine for timely treatment.

Disassembly order

The sequence of Installation is reversed with the Removing sequence.

Notes

1. Gaskets can only be used once, when removing the crankcase, the new gasket must be replaced.
2. Firstly, stressing in the process of tightening bolts, the stressing process must follow the principle of symmetry from the middle to the two sides. Then tighten again with a force of 29-35 N.m.

4.2.3 Installation and Removing of flywheel crankcase

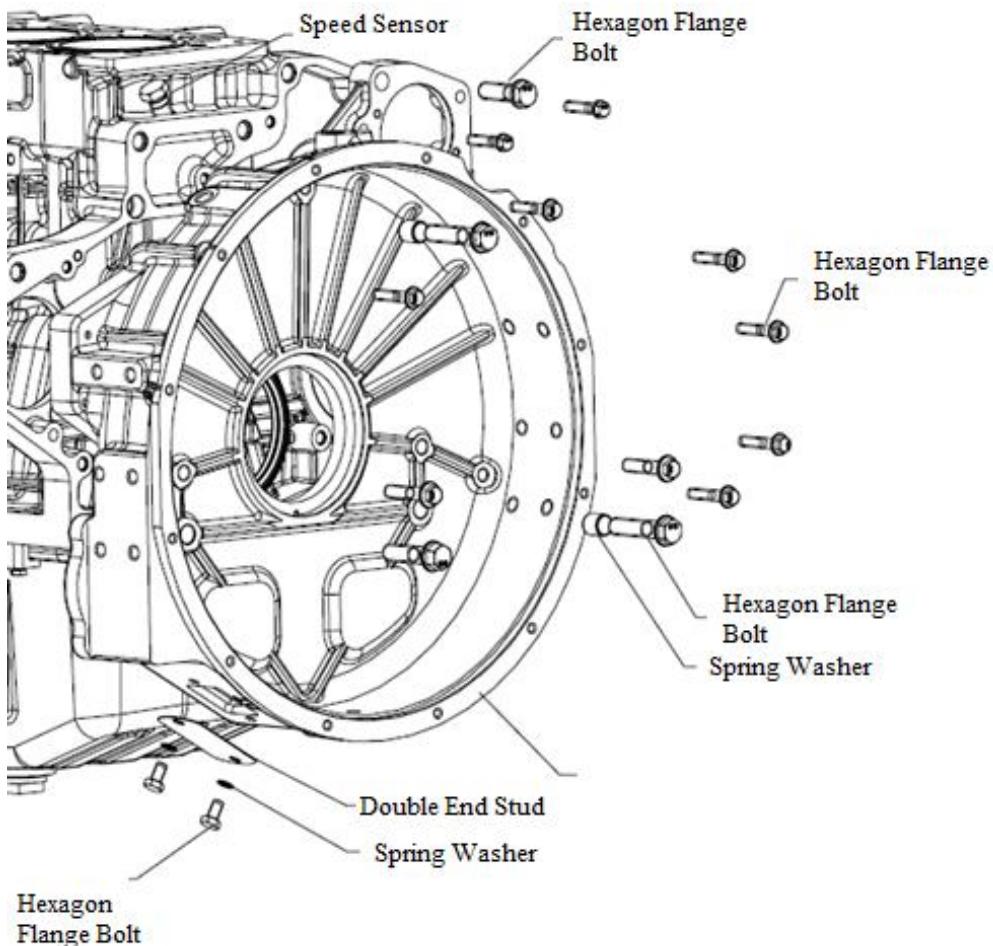


Figure 4-3 Figure of Flywheel housing

Installation order

1. In the post-cylinder cluster, it is inserted into the positioning unit (the positioning unit does not have marginal edge).
2. Polish the contact surface between the cylinder and the flywheel crankcase, clean the oil, then apply 510 glue, glue sugar without interruption.
3. Crane fitted with flywheel crankcase (flywheel Bolt and bearing surface must be applied with cleaning oil layer).

Process of tightening flywheel bolts:

Bolt M10: Firstly, tighten a force of 26-36 N.m, secondly tighten a force of 64-90 N.m

Bolt M12: Firstly, tighten a force of 44-54 N.m; secondly tighten a force of 110-135 N.m

Bolt M16: Firstly, tighten a force of 108-132 N.m, secondly tighten a force of 270-330 N.m

Flywheel bolts can be used twice, when tightening, use sealed oil paint.

Removing order

The sequence of Installation is reversed with the Removing sequence.

Notes

1. If there is a glue on the contact surface between the cylinder and the flywheel crankcase, carefully remove it to avoid scratching the contact surface, and use detergent to clean the glue.
2. When Installing the flywheel bolts, pay attention to lubricating oil, bolts can be used twice.

Table 4-1 Tightening force of flywheel bolts

Bolt specification	Tightening force (add lubricating oil) N.m
M10	64~90
M12	110~135
M16	270~330

4.2.4 Installation and removing of oil seal

Installation order

Put the seal on the bonnet with the crankshaft front end of the outer diameter area (the seal must be applied with oil, clean, round, not twisted)

Removing order

Use tools to Install the oil seal of the crankshaft

Notes:

1. During Removing, do not scratch the crankshaft.
2. After removing it, replace the oil seal.

4.2.5 Installation and Removing of pins

Installation order

Use special tools to put the pins in (Before Installing, remember to apply lubricating oils on the two fronts of the pins)

Removing order

Use the tools to remove the pin

Notes:

1. During the Removing process, it is necessary to be careful, meticulous, avoid scratching the overall crankshaft.
2. Ghip must not be used twice, after removing it, replace it with a new one.

4.2.6 Installation and Removing of main shaft cover and bolts

Installation order

1. Clean the lower shaft bush and the main shaft cover, and press the lower shaft bush into the main shaft cover, then install the brake.
2. Align the Locating pin, insert the main shaft cover onto the engine block.
3. On the bearing surface of the main shaft ball bearing bolt and the main shaft ball bearing bolt thread, the lubricating oil must be cleaned.
4. Gently tighten the main ball bearing bolt
5. Rotate the crankshaft so that the force is oriented to the radial gap of crankshaft (flexible rotating shaft, no latency)
6. Install a brake, clean the semi-circular portion, do not let the obstacles and apply the appropriate grease layer in the groove.
7. Main bearing bolt tightening technique: Firstly, use wrench to tighten, secondly tighten with a force of 145N.m, thirdly create a torsion force of 60 °, finally tightening the force to 310-420 N.m
8. After tightening the main shaft bolt, check the return force of the crankshaft and the crankshaft gap, the gap reaches 0.120 - 0.289 mm.

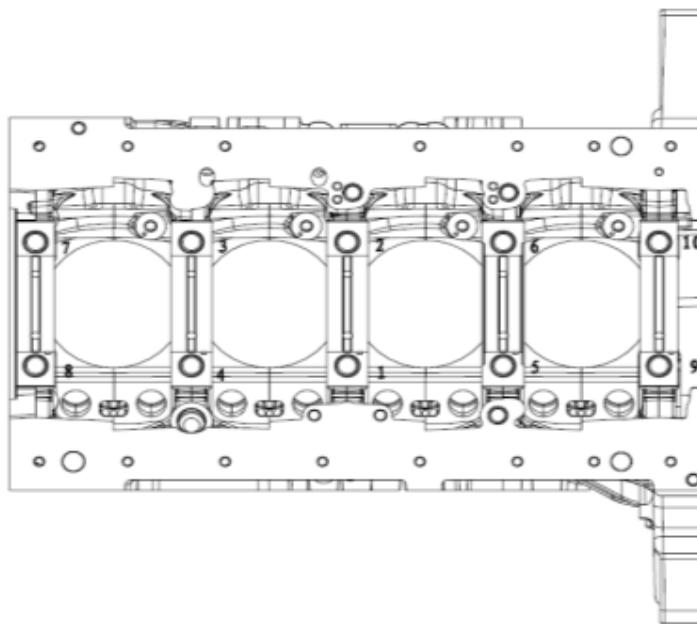


Figure 4-4 Steps of tightening the main shaft bolts

Removing order

The sequence of Installation is reversed with the Removing sequence.

Notes

1. Check the lower shaft bush, brake and main shaft cover, make sure the surface is clean, not collided causing scratches.
2. Insert the brake into the groove, the oil line will face to the side of the crankshaft, avoiding incorrect Installation.
3. Tighten the main shaft bolts according to the instruction picture.

4.2.7 Installation and Removing of piston injector

Installation order

1. Use Locating pin to adjust the position of the injector, use an empty bolt to separate the gasket and then install the injector cluster onto the engine block.
2. Use wrench force to tighten the empty bolt.

Removing order

The sequence of Installation is reversed with the Removing sequence.

Notes

1. Check whether the injector is clear, ensure that the injector core is not blocked, otherwise replace the new injector.
2. Check if the contact surface between the injector and the engine block has scratches and collisions, it is necessary to repair or replace it.

4.2.8 Installation and Removing of cylinder

Installation order

1. Install 3 O-shaped gaskets on 3 grooves on the engine block, the upper side of the rubber gasket is placed on the upper part of the cylinder, the groove position is processed.
2. Put the cylinder and gasket into a specialized installation tool, then slowly bring the whole clusters into the engine block.

Removing order

The sequence of Installation is reversed with the Removing sequence.

Notes

1. Before Installing O-gasket and O-rubber gasket, check whether the gasket is broken or damaged.
2. When pressing on the cylinder, do it slowly, if there is a jam, it is necessary to remove for checking, do not press it with too much force, causing damage to the cylinder.
3. Overhang of cylinder 0.03-0.08mm, Install according to instructions.
4. After replacing the cylinder, check whether there is a leak.

4.2.9 Cylinder head cover

The cylinder head cover is located on the upper part of the cylinder, the rim of the cylinder, the machine gasket, the piston peak and the segment are combined to form the combustion chamber. Associated with cylinder head cover also has air intake cluster, air discharge cluster, cover, water-oil separator, cylinder head cover bolts, gaskets, crane hook, load fuel system and mixing mechanism cluster (gas - oil).

4.2.9.1 Installation and Removing of cylinder head cover

4.2.9.1.1 Figure of cylinder head cover Installation

The cylinder head cluster includes: cover, cylinder cover, water outlet pipe, water-oil separator, hanging panel are 5 large components, the above components are installed with each other as shown in Figure 4-5 below:

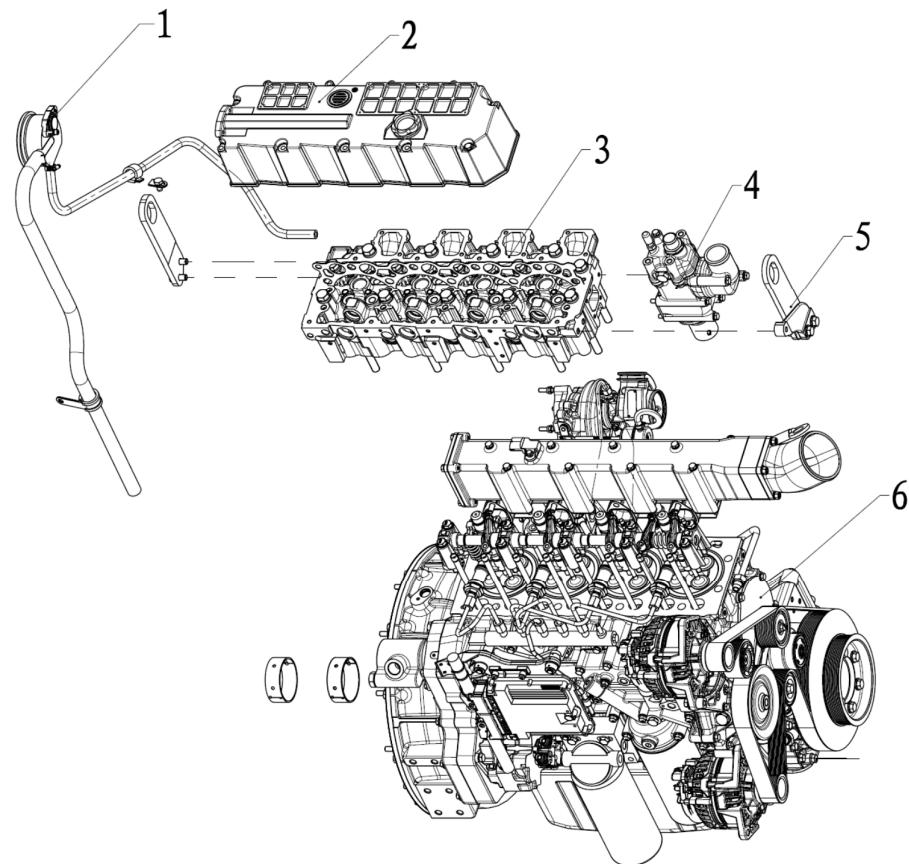


Figure 4-5 Removing of cylinder head cluster

Pos.	Denomination
1	Oil-gas Separator
2	Cylinder Head Cover
3	Cylinder Head
4	Water Outlet Pipe
5	Engine Hanger Plate
6	Diesel Engine

4.2.9.1.2 Installation and Removing of cylinder head cover

Sequence as follows:

- (1) Remove the exhaust air cluster, refer to the instructions for removing the exhaust air system;
- (2) Remove the intake air cluster, refer to the instructions for removing the intake air system;
- (3) Remove the water-oil dehydration cluster;
- (4) Remove the crane hook;
- (5) Remove the water return line;
- (6) Remove high-pressure oil line, high-pressure connection mechanism, high-pressure connector nut, fuel oil return line, refer to instructions for removing fuel line system;
- (7) Remove the cover cluster;
- (8) Remove the injector control wire, specifically refer to the manual;
- (9) Remove the rocker arm cluster and push rod, valve bridge, refer to the manual;
- (10) Remove the injector molding plate, and the injector, specifically refer to the manual;
- (11) After Completely removing the cylinder head cover, remove the gasket;
- (12) Remove the valve spring, load valve spring, valve clamps and valve, and refer to the manual;
- (13) Remove valve gasket;

4.2.9.1.3 Steps of installing the machine cover

The sequence of Installation is reversed with the Removing sequence.

4.2.9.2 Installation and removing of oil-water separator and filter cluster

4.2.9.2.1 Figure of oil-water separator and filter cluster

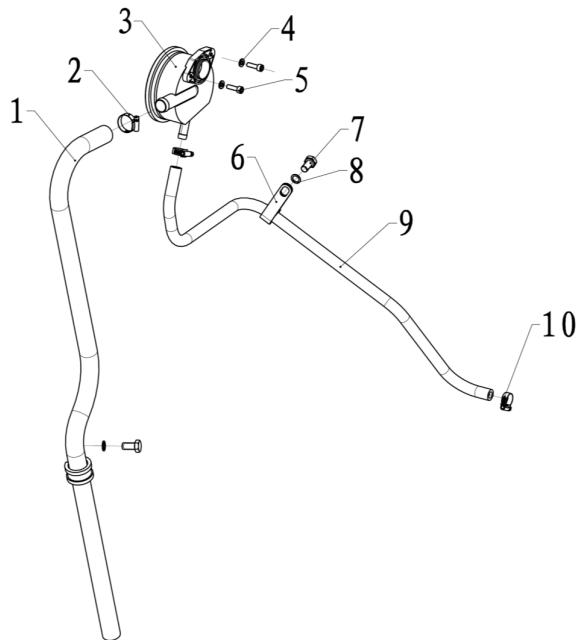


Figure 4-6 Figure of oil-water separator and filter cluster

Pos .	Denomination	Pos .	Denomination
1	Oil-gas Separator Air-outlet Pipe	6	Pipe Clamp Assembly
2	Clamp	7	Wave Spring Washer
3	Oil-gas Separator	8	Bolt
4	Wave Spring Washer	9	Oil-gas Separator Oil-outlet Pipe
5	Bolt	10	Clamp

4.2.9.2.2 Steps of removing the oil-water separator and filter cluster

- (1) Remove the jack of air outlet line of oil-water separator and filter cluster.
- (2) Remove the jack of oil return line of oil-water separator and filter cluster.
- (3) Remove the fixing bolts between the oil-water separator and filter cluster and the bracket.
- (4) If you want to remove separately, refer to table 4-6 to remove.

4.2.9.2.3 Check and maintain the oil-water separator and filter cluster

- (1) Check the air intake line of the oil-water separator and filter cluster to see if the pipe is aging, cracked, or deformed, if any, then proceed to replace.
 - (1) Check the discharge line of the oil-water separator and filter cluster to see if the pipe is aging, cracked, or deformed if any, then replace.
 - (2) Check that the outer cover of the oil -water separator and filter cluster is cracked and leaked, if any, it should be replaced.
 - (3) Check if oil filter - the gasket is aging or deformed, fails to work, if any, it should replace the corresponding parts.

- (4) It is possible to use compressor when the pressure is not over 5kpa to check if this separator and filter cluster has air leak, if it is leaked, replace it.

4.2.9.2.4 Steps of installing oil-water separator and filter cluster

(1) The Steps of installing oil-water separator and filter cluster is in reverse with the removing order. It is necessary to clearly distinguish each pipeline, wires, connector and in the process of installation, ensure the technical connection of the connection points must be tight and not leaky. Avoid using too strong force to damage the connector, must use the clamp to fix the rubber ring, avoid warping and causing oil leakage or gas leakage.

- (2) Before installing the oil-water separator and filter cluster, clean around.

4.2.9.3 Installation and removing of machine crane plate

4.2.9.3.1 Figure of machine hanger

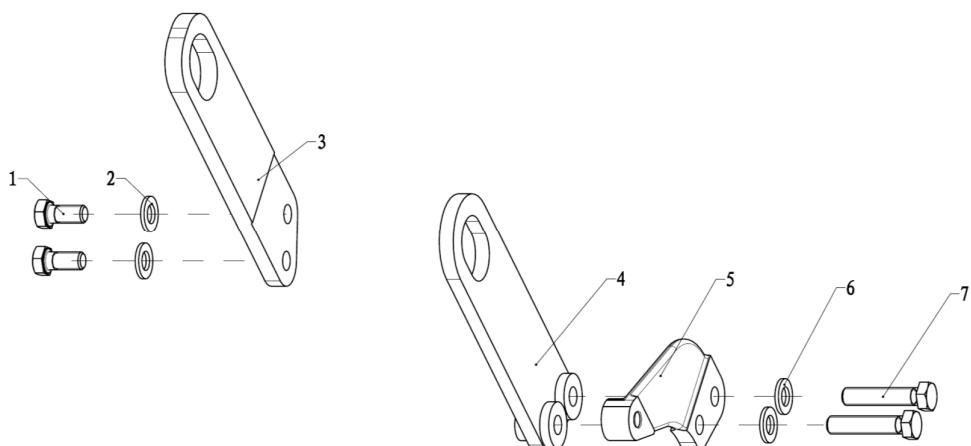


Figure 4-7 Figure of installing the engine hanger assemblies

Pos.	Denomination
1	Bolt
2	Wave Spring Washer
3	Hanger Plate
4	Hanger Plate
5	generator bracket
6	Wave Spring Washer
7	Bolt

4.2.9.3.2 Operation steps for machine hanger

(1) Loosen the Bolt M12x87 of the front fixing cluster of the machine, remove the front hanger plate of the machine.

(2) Loosen the Bolt M12x25 of the rear fixing cluster of the machine, remove the rear hanger plate of the machine.

4.2.9.3.3 Check and maintain the machine crane hanger

(1) Check the quality of hangers, check if it is cracked or deformed. Especially the front hanger plate, before removing, it is necessary to check if it is deformed, if any, it is advisable to measure the gap between the hanger plate and the exhaust pipe, if the gap is less than 4mm, it must be replaced.

(2) In the process of hanger craning, it should be noted that the hanger is bent or deformed or not.

(3) Check if the hanger fixing bolts are ineffective, if they are damaged, replace the new bolts.

4.2.9.3.4 Steps of installing the machine crane hanger

(1) Fix the M12 Hexagon flange bolts at the 2 in the front and rear of the machine, tighten with a force of 120N.m.

(2) Position and how to tighten the bolt are as shown in Figure 4-7.

4.2.9.4 Installation and removing of water discharge pipe

4.2.9.4.1 Structure figure of drain line

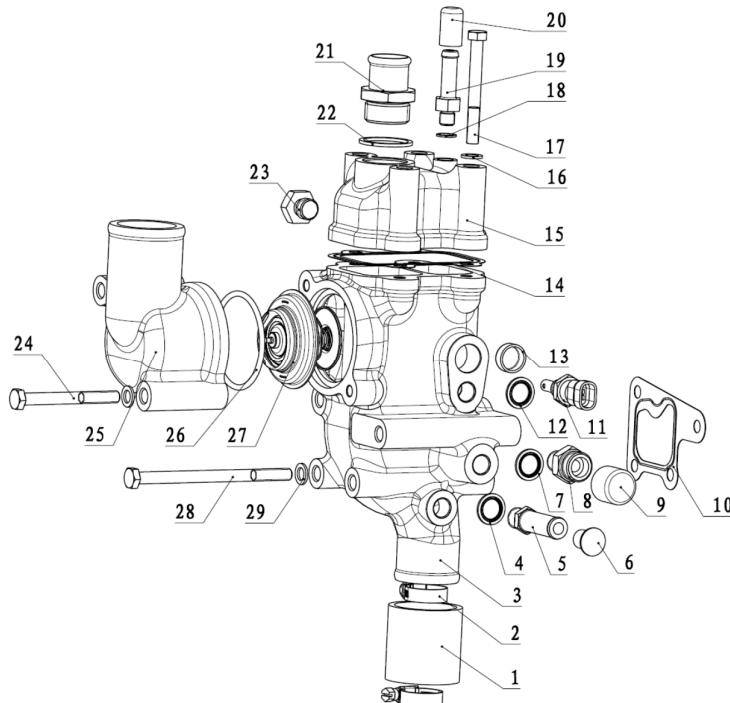


Figure 4-8 Structure figure of water discharge pipe

Pos	Denomination	Pos.	Denomination
1	Coolant Connecting Rubber	16	Wave Spring Washer
2	Clamp	17	Hexagon Head Bolt
3	Water Outlet Pipe	18	Sealing Washer
4	Sealing Washer	19	Air Prevent Joint
5	Pipe Joint	20	Cover
6	Cover	21	Air Compressor Intake
7	Sealing Washer	22	Sealing Washer
8	Pipe Joint	23	Hexagon Screw Plug
9	Oil Connector Cap	24	Hexagon Head Bolt
10	Water Outlet Pipe Gasket	25	Thermostat Cover
11	Temperature Sensor	26	Seal Ring
12	Sealing Washer	27	Internal Thermostat
13	Bowl Plug	28	Hexagon Head Bolt
14	Water Outlet Pipe Cover	29	Wave Spring Washer
15	Water Outlet Pipe Cover		

4.2.9.4.2 Steps of removing the drain line

1. Loosen the link belt between the drain line and the total machine radiator.
2. Loosen the link belt between the discharge line and the expansion tank.
3. Loosen the link belt between the drain line and the hot wind line.
4. Loosen the link belt between the drain line and water pump.
5. Remove the water return line of air compressor and drain line.
6. Remove the sensor and sensor wire on the drain line.
7. Remove the 4 bolts M8x45 on the drain line.
8. Remove the exhaust pipe cluster
9. If you have to remove more, refer to Figure 4-8.

4.2.9.4.3 Check and maintain the drain line

1. Before removing it, check if the drain line has leak, scratch and rust. If there are scratches, replace the exhaust pipe, with rust incidents, it is necessary to analyze the cause and then replace the new pipe.
2. Check if the connector has scratches or rust, if necessary, replace the new connector.
3. If water leaks outside the connectors, it is possible to replace the connector and then tighten it, check if it is still present.
4. When replacing the connector, must clean the gasket surface on the exhaust pipe, make sure there is no dry glue, no scratches.

4.2.9.4.4 Steps of installing the exhaust pipe

Installation order and things to note:

- (1) The drain line gasket can only be used once, when maintaining and repairing, it needs to be replaced.
- (2) The contact surface between the drain line and the gasket must be clean and free from scratches and roughness.
- (3) Drain line after cleaning should be installed on the cylinder cap, tightened by bolts.
- (4) Check if the rubber pipe has a scratch or aging. If yes, replace it.
- (5) Make sure the pipe is in place and then use the clamp to tighten it.
- (6) When replacing the connector, apply the glue, then tighten the connector to the exhaust pipe or press the exhaust line.

4.2.9.5 Installation and removing overall machine cover

4.2.9.5.1 Figure of overall machine cover

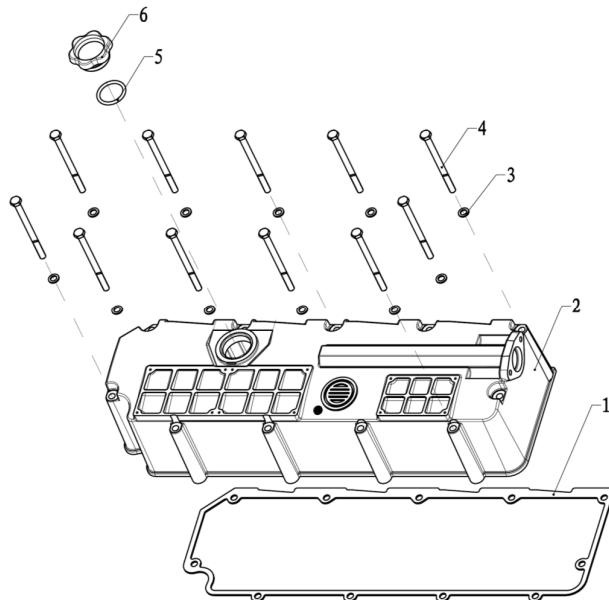


Figure 4-9 Overall machine cover

Pos.	Denomination
1	Cylinder head cover gasket
2	Cylinder head cover
3	Wave spring washer
4	Bolt
5	O-Ring
6	Screw Block

4.2.9.5.2 Steps of removing the machine cover

(1) Step by step to remove the bolt system, lift the machine cover in a direction that is perpendicular to the ground, lift the machine gasket from the groove.

(2) If you want to remove more, you can check the machine cover cluster and relatively install and remove to proceed to removing according to Figure 4-9.

4.2.9.5.3 Check and maintain the machine cover

1. Before removing the machine cover, check if there is the oil leak surrounding. If there is leakage, check the relevant parts.
2. Before removing, check if the cover is cracked and broken, if necessary, replace the new cover.
3. Before removing, check if the lubricating oil inlet has leakage phenomenon or not, if any, check the relevant parts.
4. Check if there is oil leakage at the block gasket. If there is oil leakage, it is necessary to check whether the joint surface between the gasket is leaked or not, check if the problem belongs to the gasket or the machine cover and replace it.
5. Check the lubricating oil pouring inlet, if there is a trace of oil, check is the thread cover is tight or not, if not tight, it should be replaced with a lubricating oil pouring inlet or machine cover.

6. Check if the contact surface between the cylinder head and the oil-water separator has oil leakage, if any, it is necessary to check if the outer gasket surface of the cylinder head is scratched or not, if any, replace the cylinder head cover. If the oil-gas separator gasket is ineffective, it must be replaced with a new one.

4.2.9.5.4 Steps of installing overall machine

(1) The cylinder head cover gasket is only used once, it must be replaced when repairing or maintaining. Before installing the cylinder head cover gasket, ensure the gasket is new, not damaged or defective.

(2) Clean the cover surface, install the gasket correctly.

(3) Clean the cover of the machine face, install the overall machine cover to match the cylinder head cover.

(4) Insert bolts, tighten.

(5) Clean the lubricating oil pouring inlet, tighten the lubricating oil pouring inlet.

4.2.9.6 Installation and removing of cylinder head cover

4.2.9.6.1 Figure of cylinder head cover

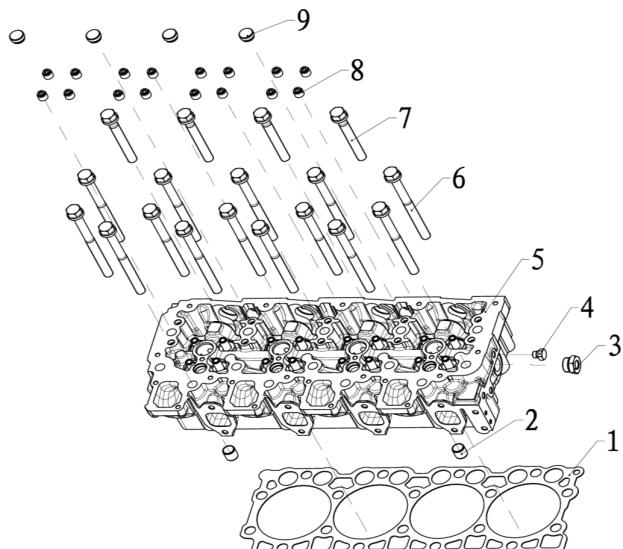


Figure 4-10 Structure diagram and installation position of the cylinder head cover components

Pos.	Denomination
1	Cylinder Head Gasket
2	Orientation
3	Hexagon Screw Plug
4	Hexagon Screw Plug
5	Cylinder Head Subassembly
6	Long Bolt
7	Short Bolt
8	Valve Stem Seal
9	Parallel Pin

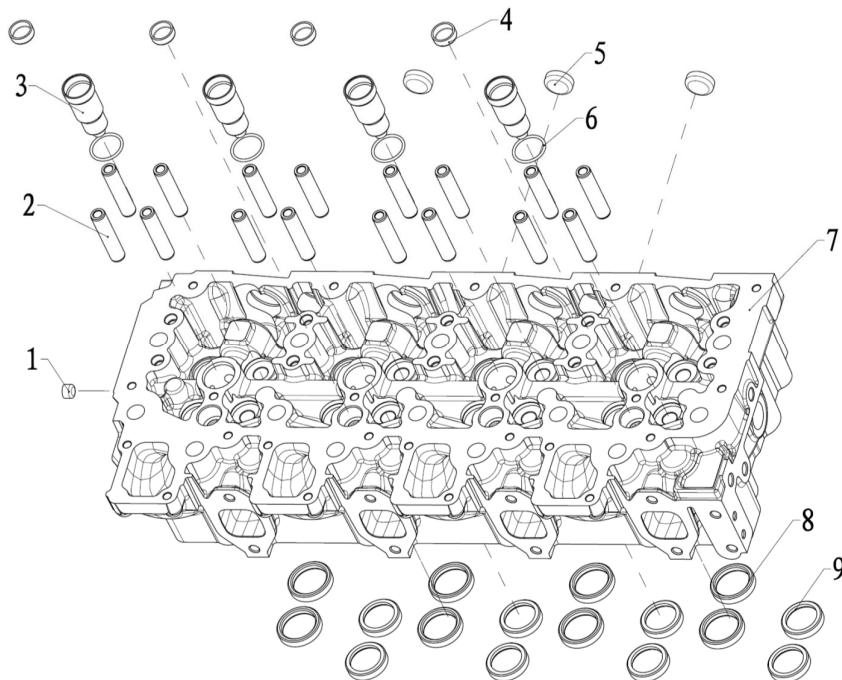


Figure 4-11 Overall cylinder cover cluster

Pos .	Denomination
1	lebes Plug
2	Valve Guide
3	Injector Sleeve
4	lebes Plug
5	lebes Plug
6	O-Ring
7	Cylinder Head
8	Intake Valve Seat
9	Exhaust Valve Seat

4.2.9.6.2 Steps of removing the cylinder head cover

- (1) Before removing the cylinder cover, it is necessary to ensure the entire air distribution system such as the rocker, the push rod has been removed completely beforehand.
- (2) Before removing the cylinder cover, it is also necessary to ensure that the injector is removed beforehand, to avoid pressing or compressing the injector.
- (3) Ensure that before removing the fuel system, remove the high-pressure link part otherwise it is not possible to remove the cylinder bolt.
- (4) Then step by step to loosen the entire bolts. WP5 has all 18 bolts, including 14 long bolts and 4 short bolts. All bolts must be removed before craning the cylinder head cover.
- (5) The cylinder cover after removing must be placed on the paper, nylon to avoid the damaged surface.
- (6) after removing, protect the upper part of engine block to prevent impurities from entering the combustion chamber.
- (7) Remove the cylinder head cover gasket.

(8) Remove the inlet and exhaust valve, refer to disassembly of the relevant installation and removing sequence.

(9) Remove valve gasket.

(10) The overall cylinder head cover and sequence of installing and removing refer to figure 4-10 and 4-11.

4.2.9.6.3 Check and maintain the cylinder cover

(1) Cylinder cover

Before removing the cylinder head cover, check if it has water, oil, or gas leaks or abnormal markings, to have accurate positioning diagnostics, problem analysis.

Clean the cylinder cover, the combustion chamber, inlet and exhaust valve rack, the inlet and exhaust line, eliminate surface with soot and adhesive, check surface.

① Check appearance

Thoroughly check the color of the cylinder head cover, color change, crack if any, then proceed to check.

② opening and closing gap of valve.

The opening and closing distance are the gap of valve and the cylinder head cover surface, this distance can show the degree of abrasion of the valve rack, a specialized mm distance meter can be used, as shown in Figure 4-12.:



figure 4-12 Specialized mm distance meter

Table of gap range refer to Table 5-3. If the range is within the allowable range, ensure the stability of the operating machine, if the value is outside the range, it is necessary to check the abrasion level of valve and valve rack.

Table 4-2 Value of gap range

Valve	Gap (mm)
Intake valve	0.88~1.04
Exhaust valve	0.96~1.03

③ Inner diameter of valve guide

This size, if the amount of abrasion is beyond the allowable limit, it will reduce the stability of the machine, use specialized tools to measure the diameter value in the valve guide. The allowable inner diameter is 7.6 ~ 7.69 mm. Exceeding this limit should be replaced to ensure stable operation.

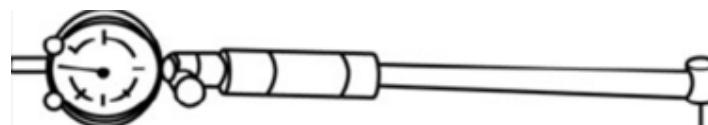


Figure 4-13: Ruler for inner diameter

(2) Cylinder head cover gasket

If the cylinder head cover is leaked with air, water, and oil, check and replace the gasket.

To remove and analyze the cause, after remove it, it is necessary to replace a new one.

(3) Mushroom valve foot gasket

It is necessary to ensure that the position of mushroom valve foot gaskets must have lubricating oil, and at the same time the mushroom valve foot must also have lubricating oil, avoid the case that this mushroom valve foot and abrasion guide are dry and stick together, before removing, it is necessary to check if the mushroom valve foot gaskets are separated from the position, after removing, see if the quality is still perfect, there are no cracks, aging. Check for elasticity or deformation, if seriously, it must be replaced.

(4) Other holes on the cylinder head cover need sealing gasket

Check if the conductor passes through the lot on the cylinder head cover has a scratch, if any, it will make the hole of the conductor being leaked, need to replace the cylinder head cover.

Check the position of the high-pressure link hole, if there are scratches, it will make the high-pressure link hole being oil-leaked and also need to replace the cylinder head cap.

4.2.9.6.4 Steps of installing cylinder head cover

(1) Mushroom valve foot gasket

Figures and steps of installing Mushroom valve foot gasket are shown in 4-14

- ① The mushroom valve foot gasket is only used once, if it is repaired, it must be replaced.
- ② Check if the gasket has any defect to ensure elasticity.
- ③ Install gaskets on the valve guide line
- ④ At the contact point of the gasket and the position of placing the gasket needs to apply the lubricating oil.
- ⑤ When installing gaskets, use specialized tools such as rubber hammer to press the gasket in place.

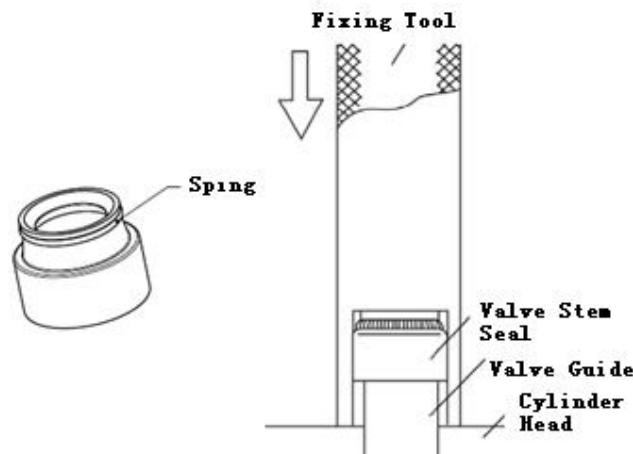


Figure 4-14 Gasket and how to install the gasket

(2) Install the cylinder head cover gasket

- ① This gasket is only used once, if the repair is required, it must be replaced as shown in Figure 4-15.
- ② Clean the inner surface of the cylinder head cover, apply the lubricating oil layer, clean the surface then follow the corresponding hole to press gasket on the surface of the cover.
- ③ Check once again if the positions are installed correctly or not.

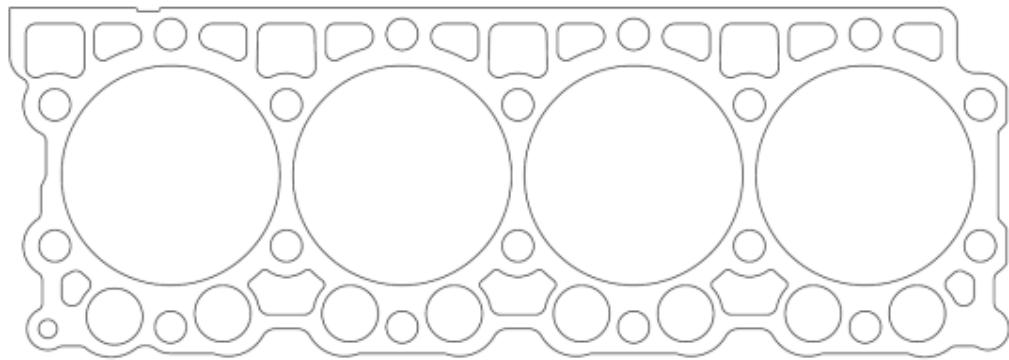


Figure 4-15 Cylinder head cover gasket

(3) Installation of cylinder head cover

- ① Strictly clean and install the cylinder cover, make sure there are no dust, mites, sand and clean the contact surface of engine block.
- ② Check the combustion chamber to confirm that there is no obstacle, the contact surfaces must be clean.
- ③ Before fixing the bolts, the cylinder head cover is equipped with Locating Pin.
- ④ Installation

(4) Tightening the bolts

1. The cylinder head cover bolt has 2 types: long and short, see Figure 4-16.



a. Long b. Short

Figure 4-16 Figures of long and short bolts

This bolt is used 3 times in a recirculation cycle, sequence of tightening the bolt is as shown in Figure 4-17.

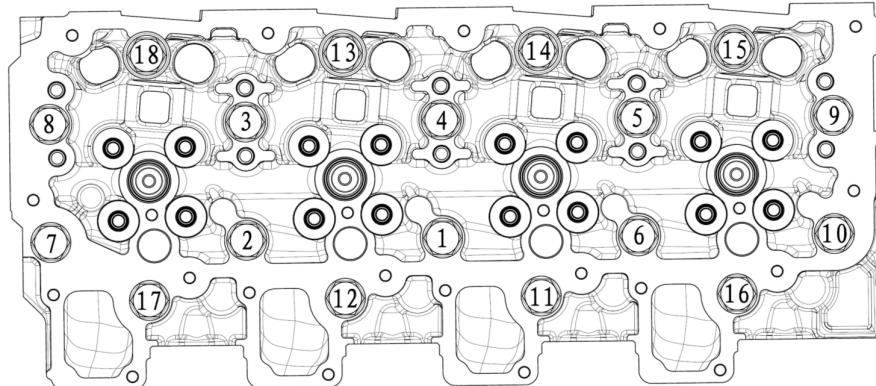


Figure 4-17 Sequence of tightening the bolts.

2. By sequentially, put the cylinder head cover on the symmetrical position, at the position of the bolt thread and the bearing surface to tighten on the lubricant layer, then tighten 5 times.

3. In the first time, use the power wrench tool as shown in Figure 4-18.



Figure 4-18 Power wrench

4. In 2nd time, tighten with a force of 75-90 N.m
5. In 3rd time, tighten with an angle of 70°
6. In 4th time, tighten with an angle of 70°
7. In 5th time, tighten with an angle of 70°

Finally check if the torque has reached 240-340N.m. If not, replace the other bolt and tighten it 5 times as above.

4.3 Counterweight structure and transmission bar

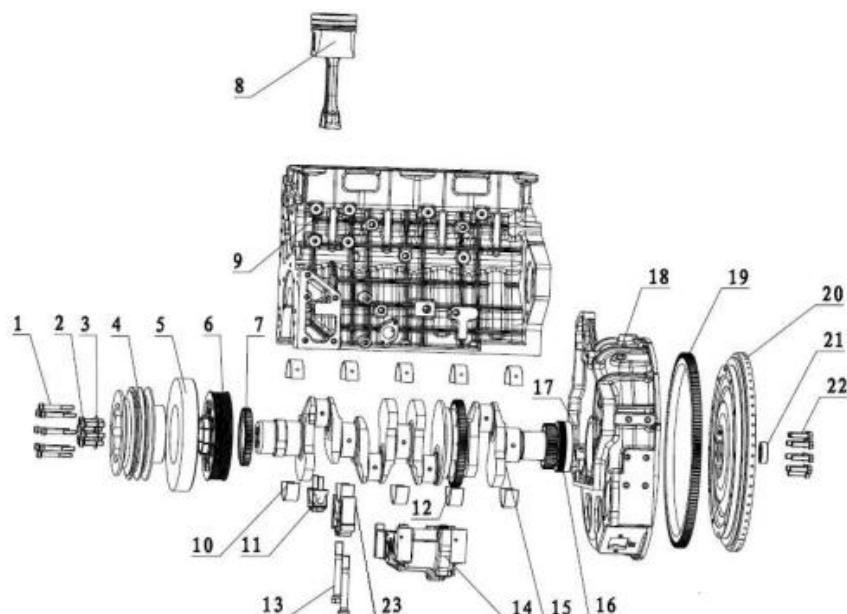


Figure 4-19 Figure of Counterweight and connecting rod structures WP5

Pos.	Denomination	Pos.	Denomination
1	Shock Absorber Bolt	13	Main Bearing Bolt
2	Pulley Bolt	14	Mass Balancing System of II
3	Plate Of Pulley	15	Flywheel Ring Gear
4	Crankshaft Pulley	16	Crankshaft Timing Gear
5	Torsional Vibration Damper	17	Locating Pin
6	Crankshaft Pulley	18	Flywheel Housing
7	Oil Pump Gear	19	Flywheel Ring Gear
8	Piston and Connecting Rod	20	Flywheel
9	Cylinder Block	21	Deep Groove Ball Bearing
10	Main Bearing Set	22	Flywheel Bolt
11	Connecting Rod Big End	23	Main Bearing Cap
12	Balance Ring Gear		

4.3.1 Flywheel crankshaft cluster

4.3.1.1 Concept of crankshaft cluster - flywheel

The flywheel crankshaft cluster consists of main parts including crankshaft, flywheel, crankshaft gear, lubricating oil pump gear, flywheel gear ring, flywheel bolt, muffler, shock absorber bolt, belt roller, roller bolts. In particular, the lubricating oil pump gear, flywheel gear ring, flywheel gear ring has heating on the crankshaft, the rivet blocks at the end of the crankshaft oil hole. When maintenance, it cannot be removed directly from the crankshaft, these parts combine with the crankshaft to form the crankshaft cluster. Crankshaft gear type can be changed according to engine type, there may also be engine type without crankshaft gear. For example, is shown in Figure 4-2.

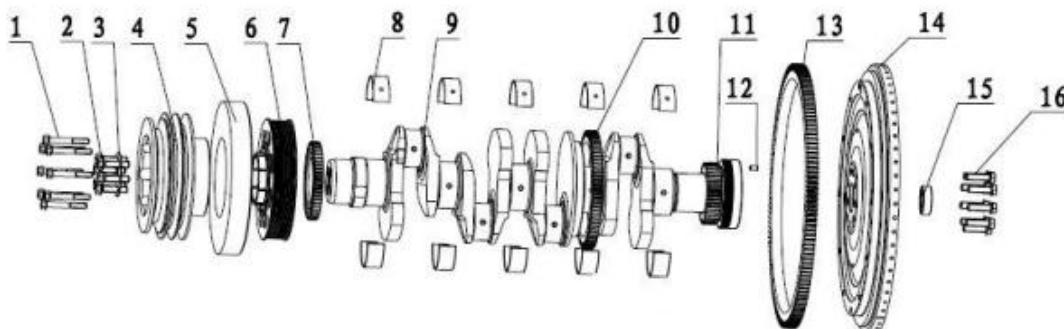


Figure 4-20 Crankshaft – flywheel cluster WP5

Pos.	Denomination	Pos.	Denomination
1	Shock Absorber Bolt	9	Crankshaft
2	Pulley Bolt	10	Balance Ring Gear
3	Plate Of Pulley	11	Crankshaft Timing Gear
4	Crankshaft Pulley	12	Locating Pin
5	Torsional Vibration Damper	13	Flywheel Ring Gear
6	Crankshaft Pulley	14	Flywheel
7	Oil Pump Gear	15	Deep Groove Ball Bearing
8	Main Bearing Set	16	Flywheel Bolt

The main function of the flywheel crankshaft cluster is to make the forward movement of the piston into a movement of the crankshaft. At the same time, through the flywheel, turning into torque, flywheels also store energy, overcome the resistance of the unsuccessful journey, making the engine operate stably. This part is of large load, high speed rotation, is a central part of the engine, so when carrying out maintenance, it must be very careful.

- a. Do not collide, scratch the contact surface.
- b. Keep contact surface clean, not stick to lubricating oil, rust.
- c. Tighten bolts in accordance with torque and tightening sequence.
- d. Impact on the shock absorber is capable of making it ineffective.

4.3.1.2 Installation and removing of crankshaft

Removing order

1. Rotate for the main shaft bearing of the machine upwards, check whether it is numbered, if not, number sequentially.
2. In order, remove the 2 ends and then the middle part of the main shaft cover.

3. Remove crankshaft, brake in the front and rear, flywheel bearings. Withdraw the seal. Lift the crankshaft onto the rack (if for a long time, the crankshaft must be placed perpendicular to the position)

4. Remove components to be grouped and neatly placed.

Checking

1. Check if the components are perfect.

2. Check if the neck of the crankshaft, the neck of connecting rod, or the oil line have scratches.

If yes, replace the crankshaft.

3. Checking the abrasion of the neck of crankshaft, connecting rod, bending phenomenon.

Based on the level of consideration to replace the crankshaft.

4. Check if the neck of crankshaft, connecting rod, oil seal and pin have sign of abrasion, peeling off or color change or not. If yes, depending on the level of consideration, it is necessary to replace the crankshaft.

5. Clean the bush, check the abrasion status of bush, peeling, sealing. Based on the level of consideration to replace the bush. Suggest to replace the bush promptly to protect the crankshaft.

6. Check if the main shaft bolts, the flywheel bolts are perfect, deformed or not.

7. Check if the contact surface of the bolts and bolts are closed, not crushed.

Installation order

1. Clean the hole at the bottom of the block, insert the bush into the hole under the engine block.

(1) Check the status before pressing the bush, reuse is not permitted;

(2) The shaft bush need to apply lubricating oil layer, oil hole must match, if deviation is from 1/5 ~ 1/4 or more, it is forbidden to install the bush, the outer surface of bush matches the shaft bush edge on the block

(3) Clean obstacles produced in the process of installing the bush.

2. Apply lubricating oil to the bush surface.

3. Use the oil to clean the cylinder surface and crankshaft cover, requires the contact surface of cylinder and shaft cover not to have oil residue.

4. The crankshaft uses an air compressor to clean the oil line, use a clean towel to wipe the neck of the shaft and connecting rod, then let the crankshaft fit into the block, the whole process requires no collision. etc.

(1) Before craning, carefully check whether the crankshaft is damaged by collision, it is necessary to clean it;

(2) Collisions are strictly prohibited when craning;

(3) After lowering, apply lubricating oil to the main shaft;

5. Clean the brake, insert into the brake groove between the crankshaft and the cylinder, the oil groove of the outward-facing brake (contact with crankshaft)

6. Clean the shaft bush, insert the shaft bush in position and install the corresponding brake.

(1) The brake under the oil groove is outward (contact with crankshaft)

(2) Before installing the bush, check the surface, not scratching or impacting

(3) The bottom brake should be applied with a grease layer

(4) Clean the bush part if there is dirt etc.

7. Install the main bearings on the engine block

8. Apply lubricating oil to the contact surfaces of the main shaft bearings and bolts

9. Fit bolts of main shaft bearings
10. Rotate crankshaft, feel axial clearance, require flexible crankshaft rotation, no delay.
11. Tighten bolts of main shaft bearings in the correct order.

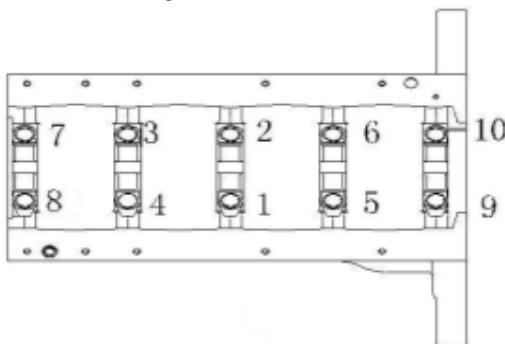


Figure 4-21 Sequence of tightening bolt of the main shaft bearings

(1) The first time, use tightening wrench, the second time use the 145 N.m force wrench, the third time 60 ° tightening, finally tighten a force of 310-420 N.m

(2) Main shaft bearings can be used twice.

12. When tightening the bolt of the main shaft bearing, check the torque of the return crankshaft and the axial clearance.

(1) Axial clearance is within 0.120-0.289mm.

4.3.1.3 Installation and removing of flywheel

Installation order

1. Install gear ring on flywheel

2. In the flywheel shaft, close the bearing deep into the shaft

(1) Before installing bearings, clean the outer surface of the bearing and apply lithium grease.

3. The inside of the flywheel should be rust-proof

4. Use hexagonal bolts to install flywheel components on the flywheel flange.

(1) Apply lubricating oil to bolt thread and bolt bearing parts

5. Tighten flywheel bolts

(1) first time, tighten an angle with force of 35-40N.m torque, second time use a tightening force of 120N.m or more. The bolt is used twice.

(2) After tightening the bolts in place, use special paint to mark, the sealing direction must be uniform.

4.3.1.4 Installation and removing of pulley (pully)

Installation order

1. Install shock absorber unit on pulley. Tightening bolts a force of 80-100 N.m.

2. Close the locating pin to the head of the crankshaft

3. Use the hexagon bolts to attach the belt wheel to the mechanical shaft, then tighten the bolts.

(1) Bolt force torque: 110-145N.m

(2) After tightening the bolt, seal it with a special paint.

4.3.2 Structure of transmission rod - Piston

The transmission rod – piston cluster consists of piston, connecting rod, segment, piston pin, piston brake, connecting rod bush. Components and quantities and categories depend on the

structure and feature requirements of the engine. Figure 4-22 describes the piston- transmission rod structure. The main function of the piston- transmission rod cluster is to transmit the burst pressure of the gas to the crankshaft, making the crankshaft rotate.

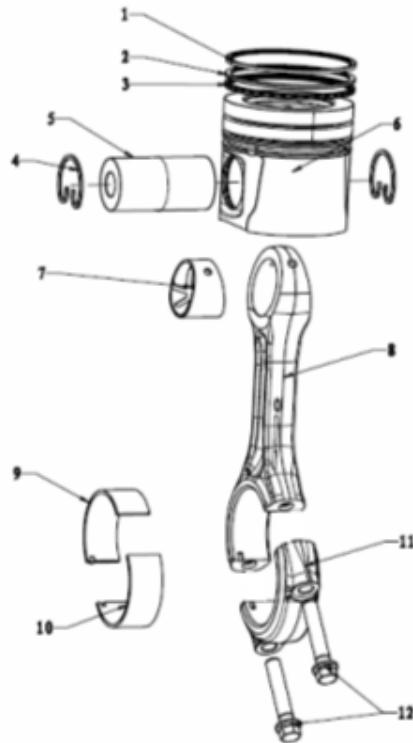


Figure 4-22 piston- transmission rod structure

Pos.	Denomination	Pos.	Denomination
1	First piston ring	7	Con-rod bush
2	Second piston ring	8	Con-rod body
3	Oil ring	9	Con-rod upper body
4	Piston pin barrel	10	Con-rod lower body
5	Piston pin	11	Con-rod cover
6	Piston	12	Con-rod bolt

4.3.2.1 Installation and removing of piston- transmission rod structure

Check before removing

- 1) Check the Axial rib clearance of the transmission rod
- 2) Check the torque of tightening force.

Removing order

- 1) Put the engine tilted to one side, turning the machine to the piston position at the bottom dead point, removing the bolts and cover of transmission rod.

- 2) Turn the machine to the upper dead point, use a wooden head hammer to knock on the piston, gently do so to prevent the bar from getting stuck in the cylinder.

- 3) Similar operation with other pistons, in order.

Analysis of piston-transmission rod cluster

- 1) Use the nipper to open the slot gently, remove the 2-pin elastic pin, pull out the piston pin, remove the rod assembly. Numbering piston pins, transmission rods, arranged in order.

- 2) Use specialized pliers to remove the segment and in turn arrange them in order
Check after removing
 - 1) Check the 2 half rods, the small half fitted with the piston is not allowed to have burrs and collision and check the other half of the bush fitting around the oil line without traces or deformation
 - 2) On the connecting joint of the transmission rod is numbered with position of the transmission rod, the piston peak oriented to the flywheel cluster is numbered with the subordinate piston number.
 - 3) Check the surface and inside of the piston, the segment surface, the piston pin surface without burrs, oil stains and collisions to damage the surface.
 - 4) Piston on the same machine have the same weight, the rod on one machine also has the same weight.
 - 5) Number size of piston (Roman number I, II) and cylinder number (Roman number I, II) must be identical.
 - 6) The order number of installing the connecting rod and the connecting rod cover must be identical.
 - 7) The letter marking the weight of the rod on the same machine must be identical.
- Installation of piston-transmission rod cluster and technical requirements:
- 1) Use a brake to insert on the brake groove of a piston side, turn the brake to ensure that the brake is inserted into the correct position. The top corner of the brake is inward. The open position of piston is upwards.
 - 2) Insert the small end on the upper half of the rod into the piston core, insert the hole in the transmission rod and the hole on the piston to match each other, then insert the piston battery, then insert the piston block pin. Apply 1 layer of lubricating oil.

Direction to install the connecting rod as shown in Figure 4-5:

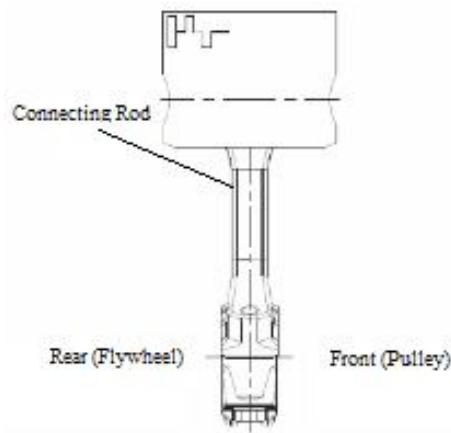


Figure 4-23 Instructions to installation of transmission rod

- 3) Sequentially arrange parts of piston and transmission rod according to the cylinder order, then use pliers dedicated to install the oil segment, segment 2, segment 1 turn into segment groove. The word "TOP" marks on segment facing upwards, segment in the groove has flexible movement.
- 4) Clean the cylinder core, mechanical shaft and piston -rod together with the auxiliary positions involved in the machine motion then apply 1 layer of lubricating oil to those positions.
- 5) Deflect the 1st segment compared to the pin center line an angle of 30 degrees, Deflect the

2nd segment with an angle of 120 degrees, the 3rd segment and oil segment is deflected to the 1st and 2nd segment an angle of 120 degrees, at the same time perpendicular to the center line of the piston. As shown in Figure 4-24.

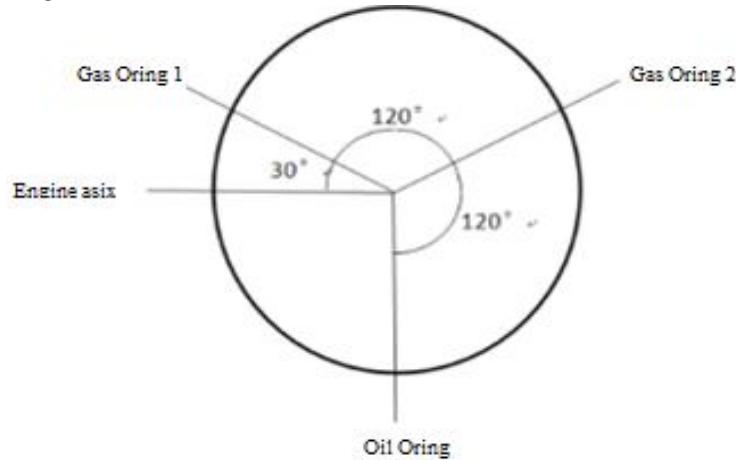


Figure 4-24 Position of opening the piston pin

- 6) Turning the machine at 1 and 6 to the bottom dead points, attaching the piston-connecting rod parts and mounting the bolts at the same time. The plane separates the rod towards the left side of the cylinder (the side of the viscous solder). The piston order corresponds to the cylinder order, the transmission rod surface and the transmission rod are paired, and before inserting the bolt, apply lubricating oil.
- 7) Tighten the rod bolts: Clean the bolt holes before operating, not to store residue, in first time, tighten a force 70 ± 2 Nm, then tighten a force $60^\circ \pm 5^\circ$, do the same with cylinder.

Check after installation

- 1) Turning the machine to feel the manual axial clearance, the gap size of $0.15\text{mm} \sim 0.35\text{mm}$.
- 2) Smooth turning without delay.

Specialized tools

- 1) pliers to open the groove - piston pin brake
- 2) pliers to install piston - remove or install segment.



Figure 4-25 Specialized plier

- 3) Guide pipe - Piston
- 4) Leaf-shaped ruler – Measure the opening and closing gap of segment when installing.

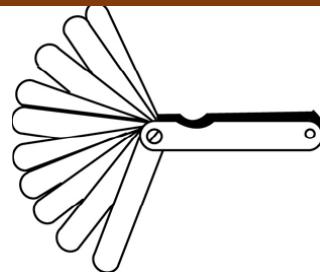


Figure 4-26 Leaf-shaped ruler

4.4 Air distribution structure

4.4.1 Installation and removing of air distribution structure

4.4.1.1 Figure of installing the air distribution structure

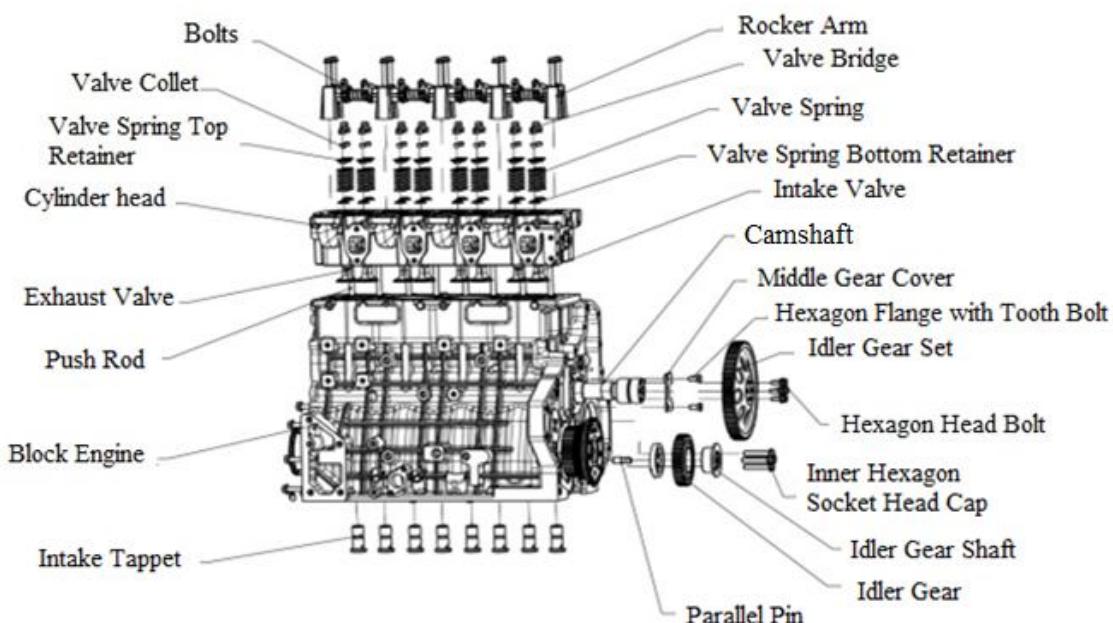


Figure 4-27 Air distribution structure

4.4.1.2 Steps of removing the air distribution structure

- 1) Remove the rocker and rocker shaft, specifically refer to the steps of removing the rocker and rocker shaft;
- 2) Remove the intake and exhaust valve, specifically refer to the steps of installing and removing valve;
- 3) Remove the lever-jack and push rod, specifically refer to the correlation steps;
- 4) Remove idle gears, details refer to steps of removing idle gears;
- 5) Remove camshaft and camshaft mixing gear, specifically refer to the correlation steps.

4.4.1.3 Steps of installing the air distribution structure

- 1) Install camshaft and camshaft mixing gear, specifically refer to correlation steps;
- 2) Install idle gears, details refer to the steps of installing idle gears;
- 3) Install the lever-jack, push rod, specifically refer to the correlation steps;
- 4) Install intake and exhaust valve, specifically refer to the correlation steps;
- 5) Install the rocker and rocker shaft, specifically refer to the correlation steps.

4.4.2 Installation and removing of camshaft

4.4.2.1 Figure of installing the camshaft

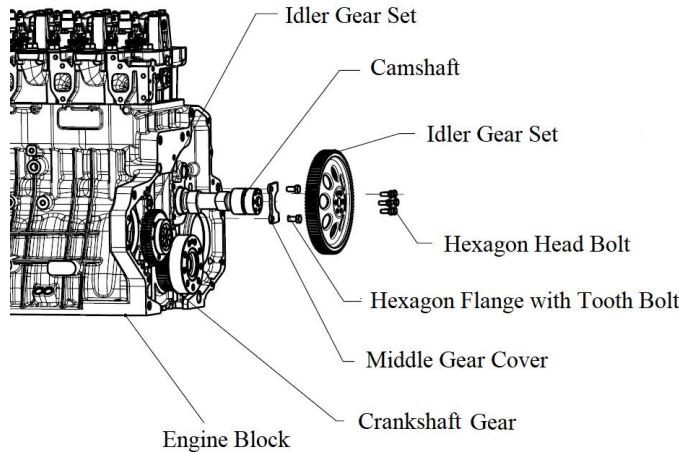


Figure 4-28 Figure of camshaft cluster

4.4.2.2 Steps of removing the camshaft

- ① Turn the camshafts, check flexibility of camshafts and air distribution gear;
- ② Use a specialized ruler to compare the axial deflection of the current and previous states;
- ③ Check the gap between camshaft and gear;
- ④ When installing the engine on the rack, the mechanical shaft causes the gears to co-ordinate the air of the engine No. 1 on the dead point, check the loose of hexagon bolts fixing the camshaft? in turn remove each bolt, air distribution gear of the camshaft
- ⑤ Remove the hexagon bolts brake on the camshaft, remove the brake. Gently remove the camshaft, avoid scratching.

4.4.2.3 Check and maintain the camshaft

- ① Check the abrasion of camshaft surface exposed to the push rod, check the jam and abrasion of the neck of the crankshaft;
- ② Check the bending of bolts fixing the camshaft air distribution gears, if there is a phenomenon in appearance, the quality, it should be handled.

4.4.2.4 Steps of installing the camshaft

1. After removing and checking the camshaft and air distribution gears, if abrasion appears or other parameters are too big, it is necessary to maintain or replace the camshaft.
2. Clean the camshaft hole, check whether the camshaft bush fails, do not repair and use, and apply 1 layer of lubricating oil;
3. Clean the camshaft, check whether the camshaft is defective or broken, when it is necessary to repair, then use a specialized tool to install a camshaft into the camshaft hole,
4. thread
5. Use Bowl Plug Fi 60, apply 277 glue layers, use specialized tools pressed into holes, after installation is complete, use the cloths to wipe off the excess glue, clean around the bowl plug border.
6. Measure camshaft axial clearance;
7. Fit the gears, use 242 glue applied on the bolts thread, and also use the tool to tighten the bolt of camshaft gear, the pin on the camshaft gear and the locate the camshaft to match each other, mark the matching symbol on the camshaft gear and on crankshaft gears (this

time marks on the crankshaft gear located between the mark on the camshaft gear)

8. Tighten camshaft gear bolts, a force $32 \sim 36$ N.m, after tightening to point, use special paint to mark, edge gap between camshaft gear and crankshaft is $0.11 \sim 0.22$ mm.

4.4.3 Installation and removing of rocker and rocker shaft

4.4.3.1 Figure of installing rocker and rocker shaft

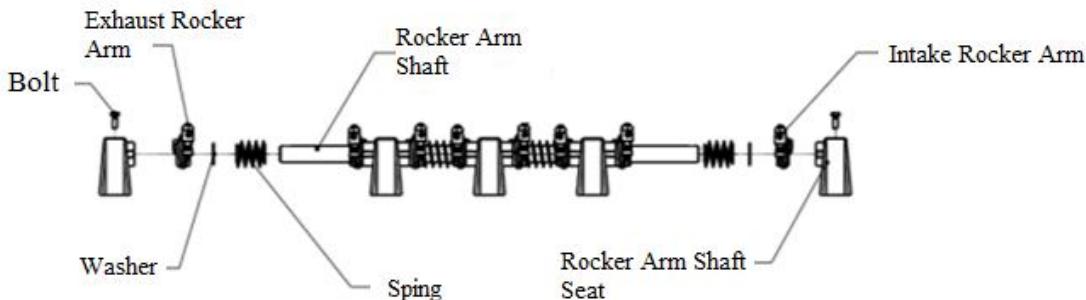


Figure 4-29 Installation of rocker and rocker shaft

4.4.3.2 Steps of removing rocker and rocker shaft

- ① Turn the crankshaft, observe the flexible movement of the rocker.
- ② Check the thermal gap of the rocker.
- ③ If the rocker is not flexible or the thermal gap is too large, loosen the bolt, then disassemble the shaft cluster. Loosen the hexagon bolts fixing the rocker rack, remove rack, load-discharge rocker, gasket and rocker spring.

4.4.3.3 Check and maintain the rocker and rocker shaft

- ① Clean the stork, observe the appearance to find defects or cracks;
- ② Check if the rocker hole is abrasive or damaged, check the diameter;
- ③ Check if the bridge pin and rocker pins are worn out;
- ④ Check the smoothness of the rocker shaft and lubricating oil line;
- ⑤ Measure the diameter of the rocker hole and the diameter of the rocker shaft, calculate the contact gap;
- ⑥ Check is the gasket of the rocker, the rocker shaft, the hole inside the stork rack is worn out.

4.4.3.4 Steps of installing rocker and rocker shaft

- ① Check whether the components are clean, impacted, scratched, rusty;
- ② After installing the push rod and valve bridge, check carefully the steps to install the push rod and the lever-jack, valve. Use the bolts to fix the bearer stand and the rocker rack, then temporarily mount the rocker rack on the cylinder head cover.
- ③ Tighten the bolts of the rocker rack, tightening force is $60 \sim 77$ N.m, after tightening to the point, use special paint to mark.

Check and adjust the intake valve gap

- ① Rotate the crankshaft to move the rear flywheel for the machine 1 at the position of the upper dead point.
- ② Then in turn adjust the valve gap of 1-2-3-6 rocker from the head of the machine, adjust the bolts with a force of $25 \sim 25$ N.m, intake valve gap of 0.30 ± 0.03 mm (cool), discharge 0.50 ± 0.03 mm (cool)
- ③ Rotate the crankshaft 360 degrees, adjust the remaining rocker
- ④ Check the machine 1, the intake valve when open and the discharge valve when closing,

giving the leaf-shaped ruler, the intake valve has the dead point with the angle of $17 \pm 4^\circ$ and the discharge valve with the dead point above $14^\circ \pm 4^\circ$

4.4.4 Installation and removing of lever-jack and push rod

4.4.4.1 Figure of installing lever-jack and push rod.

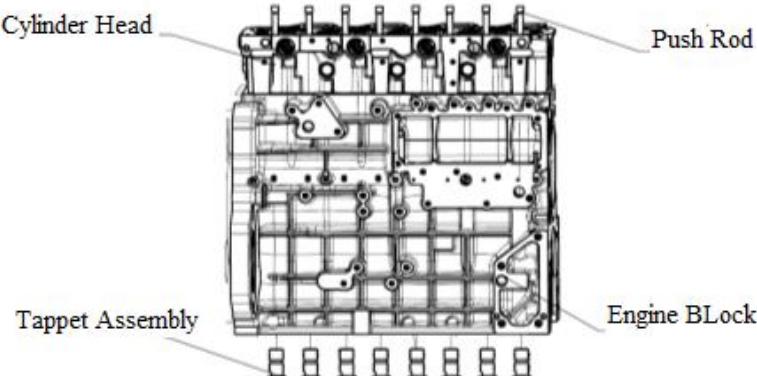


Figure 4-30 Installation of lever-jack and push rod

4.4.4.2 Steps of removing the lever-jack and push rod

- ① After removing the rocker and rocker shaft, it is possible to directly take the push rod, arranged in order;
- ② After removing the cylinder head cap, disassemble the lever-jack, arranged in order.

4.4.4.3 Check and maintain the lever-jack and push rod

- ① Clean up the lever-jack and push rod;
- ② Check if the oil line of push rod of intake air, exhaust air is smooth;
- ③ Check if the push rod is bent, the surface is abrasive;
- ④ Check if the spherical push rod end is worn;
- ⑤ Check if the surface of the lever-jack, the roller is abrasive;
- ⑥ Check if the lever-jack core is abrasive.

4.4.4.4 Steps of installing the lever-jack and push rod

- ① Check if the lever-jack and push rod are abnormal or not? If yes, it is necessary to replace it, and use the air compressor to blow thoroughly before installation to ensure that the paths are smooth;
- ② Valve, the lever-jack must be cleaned and apply lubricating oil, taking care to apply the oil evenly;
- ③ From the side of the engine block, gently put the lever-jack in position, so that the lever-jack and the push rod move freely, but give a sense of uniform. Insert the camshaft, refer to the steps of installing camshaft
- ④ the rocker is installed temporarily on the cylinder head cover, check whether the push rod is clean, the welding point has good effect
- ⑤ Apply the lubricating oil to the push rod to make sure the two ends of the bridge have enough lubricating oil
- ⑥ Insert the push rod, push the push rod through the cylinder head cover into the position of the lever-jack.

4.4.5 Installation and removing of valve

4.4.5.1 Figure of removing valve

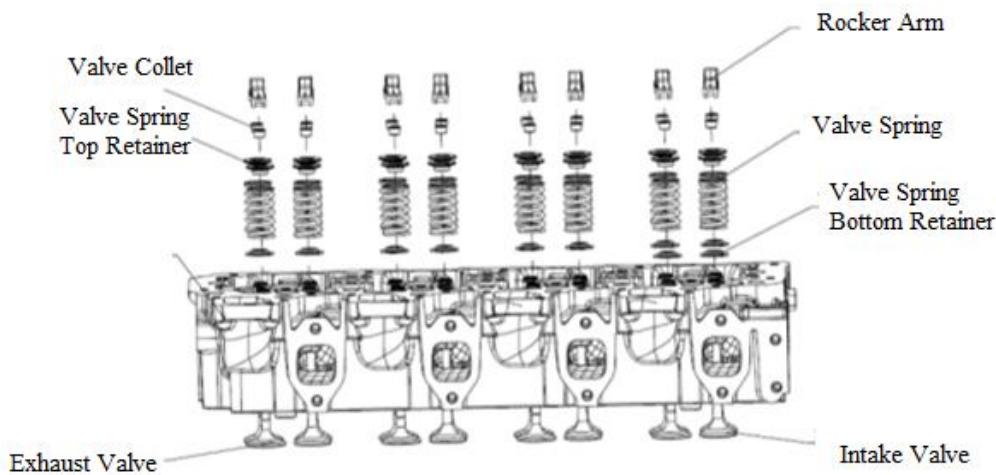


Figure 4-31 removing valve

4.4.5.2 Steps of removing valve

- ① Remove the valve bridge, use a spring or use a pliers to push the valve or other specialized equipment to press the spring, remove the valve lock, remove the spring rack and valve springs;
- ② Remove the valve from the rack.

4.4.5.3 Check and maintain valve

- ① Check if the valve and the valve end are abrasive;
- ② Check if the valve foot surface is abrasive or defective;
- ③ Check if the valve foot surface is cumulated with soot;
- ④ Check if the upper valve surface is abrasive? Exposure to valve has abrasion traces?

4.4.5.4 Steps of installing the valve

If valve is abrasive or cumulated with soot, burnt and faces other abnormal phenomena, it is necessary to replace the valve.

- ① Apply molybdenum disulfide (MoS) evenly to the bodies of the load and discharge valve, then install the valve on the cylinder head cover, making sure that the valve moves in the cover smoothly without getting stuck;
- ② Turn the cylinder head cover, install the discharge valve spring rack in turn, make sure the spring is in place, and on the valve pipe is equipped with the block gasket for the valve body.

Note: Before installing, check if the spring inside the valve gasket is good.

- ③ Install valve springs and rack on valve springs;
- ④ Install the valve clamps, apply pressure on the parts;
- ⑤ Install the valve bridge, open the direction on the valve bridge to the side of the discharge valve.

4.4.6 Installation and removing of intermediate gear

4.4.6.1 Figure of peeling off the gear chamber when installing

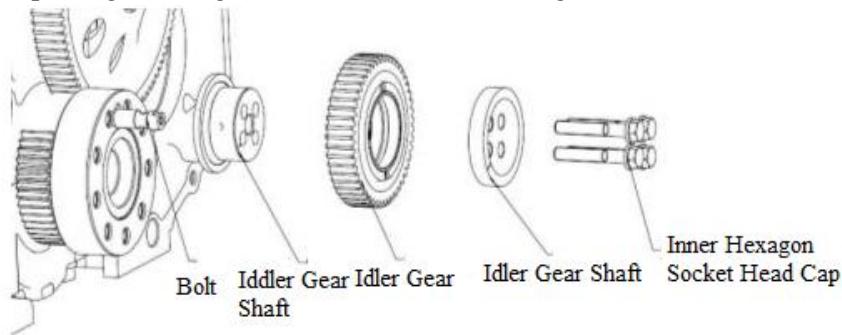


Figure 4-32 Structure of intermediate gear

4.4.6.2 Steps of removing the intermediate gear

- 1) Ensure the numbered bolts are installed to make sure the bolts are driven or not.
- 2) Remove 4 hexagonal M10 bolts on intermediate gears, remove the gasket.
- 3) Use 1 M6 bolt to tighten the gear with the shaft to pull out the shaft, taking care to avoid idle gear dropping, overall idle gear and intermediate roller to remove the whole cluster.
- 4) Borrow M6 bolts together with intermediate gears to form a stand for 3 knobs to separate, then rotate slightly to separate 2 half gear.

4.4.6.3 Check and maintain the intermediate gear

- 1) Check if the bolt thread is in good condition
- 2) Check if the gear and gear joint are peeled off, broken, the bearing surface of the bolts is broken, the thread hole of the vent hole of the gears are deformed
- 3) Check if between balanced gear shaft and intermediate gear shaft bush is abnormal. Check if every oil vent hole has any obstruction.
- 4) Whether the bearing screw is broken, the oil hole on the intermediate gear is blocked.

4.4.6.4 Steps of installing the intermediate gear

- 1) Insert the intermediate roller into the intermediate gear cluster, then let the intermediate gear shaft goes through the overall gear cluster into the gear chamber, then also add the washer and tighten with the lubricating oil bolt, Tighten the bolts so that the gear cluster is a monolithic cluster.
- 2) Tighten intermediate gear bolts with a force 60 ± 5 N.m, transmit an angle of $90^\circ \pm 5^\circ$, finally tighten a force 80-100 N.m. After bolts are tightened in place, use specialized paint to seal, bolts are reused 3 times.

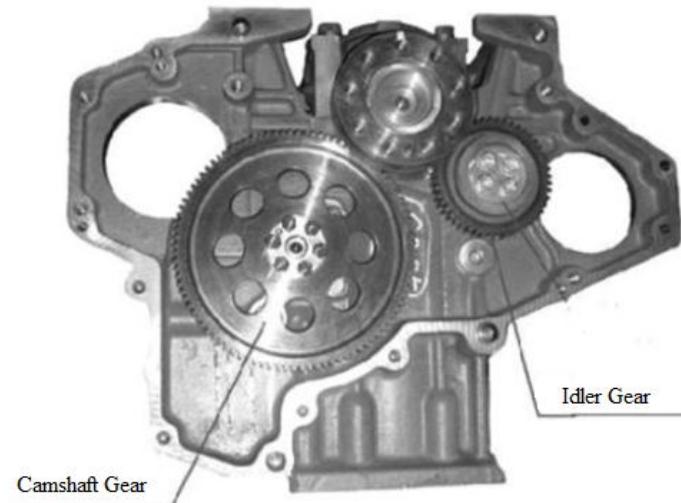


Figure 4-33 Installation of intermediate gear

- (1) The camshaft gear brake hole must match the locating latch on the camshaft;
- (2) Mark on camshaft and mark on crankshaft gear to be symmetrical, then mark on crankshaft gear in middle position of mark on camshaft intermediate gear, see Figure 4-33.

4.5 Suction neck system

4.5.1 Installation and removing of suction neck pipe

4.5.1.1 Structure figure of suction neck

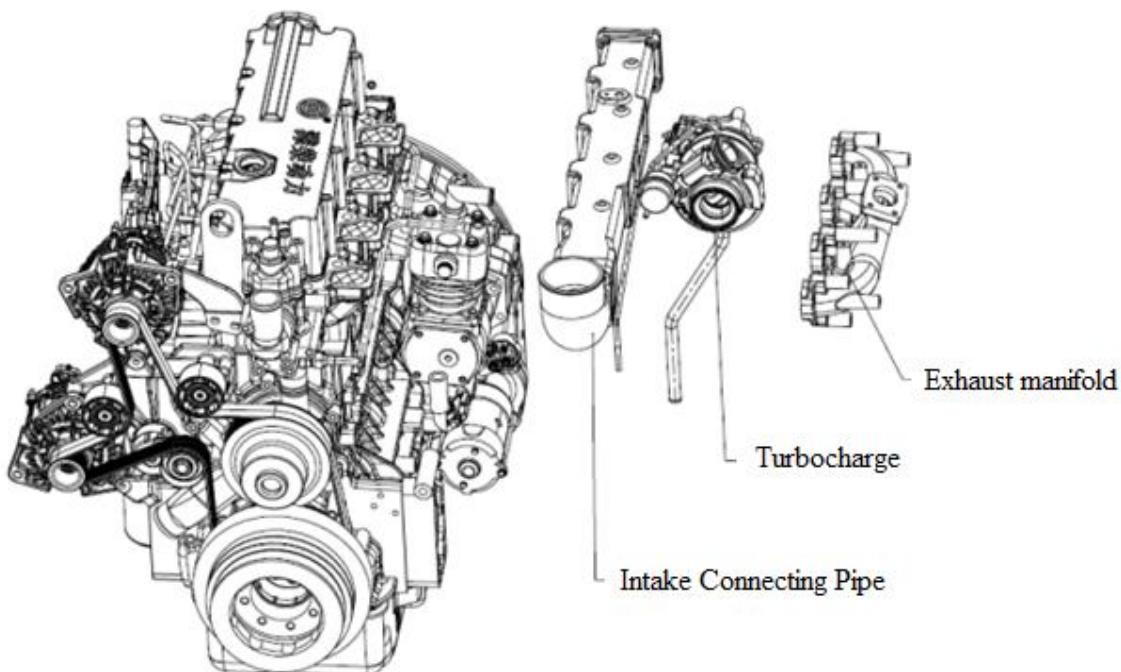


Figure 4-34 Structure of suction neck

4.5.1.2 Steps of removing the suction neck

- 1) Loosen the filter fixing bolts and remove the filter and connector.
- 2) Loosen her and connect the airway, remove the turbo exhaust connector.
- 3) Loosen bolts fixed turbocharger oil line, remove oil pipe and gaskets;
- 4) Loosen bolts fixing the tube after the exhaust gas, remove the turbo.

5) Remove the insulated bolts, the insulation cover, loosen the fixing bolts, remove the exhaust pipe and the gaskets, see Figure 4.5.3 for details.

6) Remove bolts fixing the exhaust pipe in turn, remove the exhaust pipe and gasket, see Figure 4.5.2 for details, check, maintain and install.

4.5.1.3 Steps of installing the suction neck system

The order is reverse with the removing steps.

4.5.2 Installation and removing of the suction neck pipe

4.5.2.1 Figure of installing the suction neck

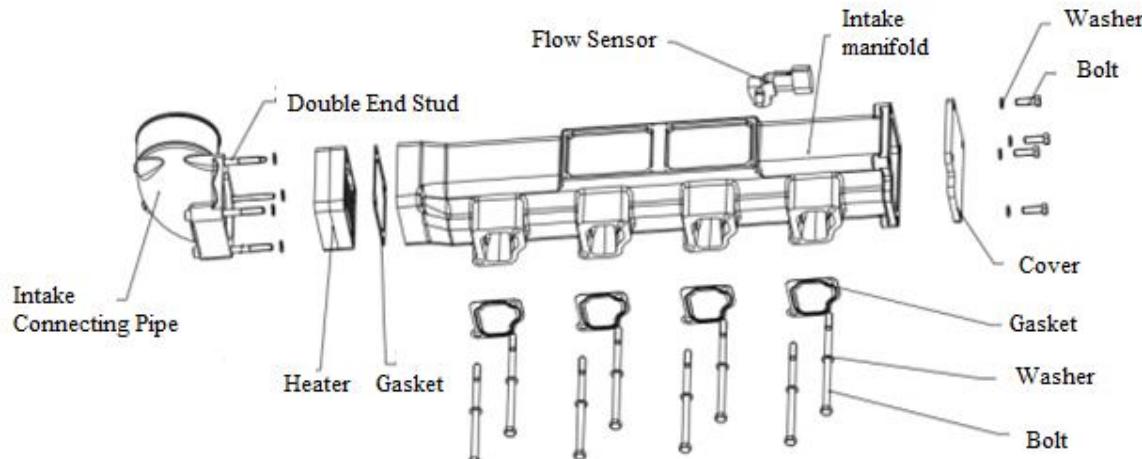


Figure 4-35 Installation of suction neck

4.5.2.2 Steps of removing the air intake pipe

- 1) Loosen hexagonal bolts, remove the air intake pipe;
- 2) Loosen hexagonal bolts, remove heating elements and gaskets.
- 3) Loosen bolts of the air intake pipe, remove pipes and gaskets.

4.5.2.3 Check and maintain the air intake pipe

- 1) Check if the pipe is faulty or defective, if yes, replace a new one.
- 2) Check if the gaskets of pipes are deformed, cracked, defective ... if yes, replace them.

4.5.2.4 Steps of installing the air exhaust pipe

The sequence of installation is reverse with the removing sequence.

4.5.3 Installation and removing of the exhaust neck pipe

4.5.3.1 Figure of installing the exhaust neck pipe

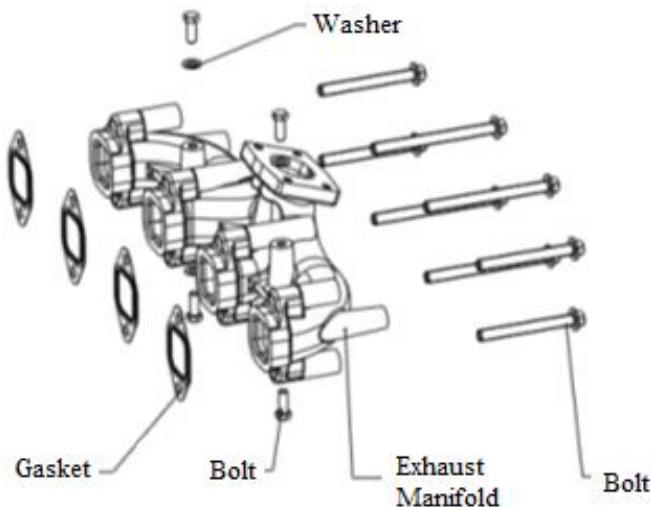


Figure 4-36 Installation of exhaust neck pipe

4.5.3.2 Steps of removing the air exhaust pipe

- 1) In turn, loosen the bolts of insulation cover of exhaust neck pipe, remove the insulation cover.
- 2) Sequentially remove the bolts fixing the exhaust neck pipe, disassemble the exhaust neck pipe and the gasket.

4.5.3.3 Check and maintain the air exhaust pipe

- 1) Check if the air exhaust pipe is cracked or damaged, the flange is deformed. If needed, it is possible to replace.
- 2) Check the leak at the flange, if necessary, replace the new air exhaust block gasket.
- 3) Check if the exhaust gasket is deformed, broken, defective, if yes, replace it.

4.5.3.4 Steps of installing the air exhaust pipe

The sequence of installation is reversed with the removing sequence, be careful when installing the machine:

The exhaust pipe bolt is applied with anti-jamming substance, tightening force is 65 ~ 80N.m the exhaust pipe bolt can be reused at most 2 times.

4.5.4 Installation and removing of turbo

4.5.4.1 Structure figure of turbo

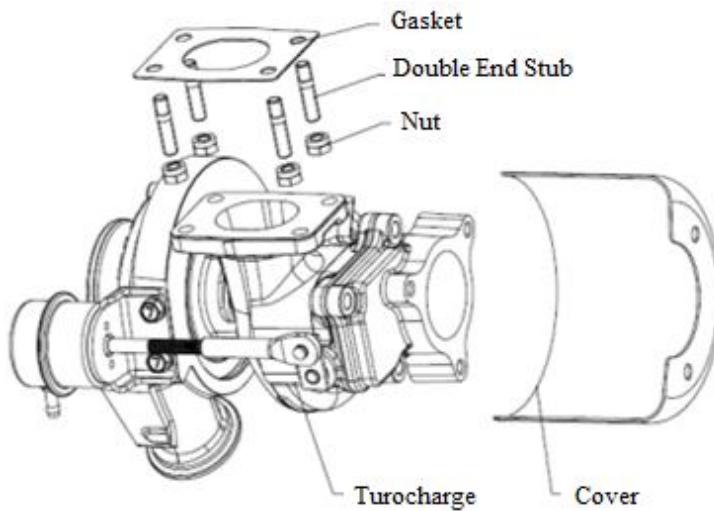


Figure 4-37 Structure of Turbo

4.5.4.2 Steps of removing the turbo

In reverse with the steps of installation

4.5.4.3 Check and maintain the turbo

1. Check the status of the rotation shaft

Use the hand to gently remove the compressor impeller, turn the shaft to see if there is a normal, if it is very quick to stop, it is clear that the impeller shaft bush is not normal, or the impeller part with the fixed part has the phenomenon of jamming, after analyzing the cause, screening the incident.

2. Check the rotation shaft

Use a specialized ruler to check the compressor head, press to the axial direction with the hand, rotate the shaft, measure the result and compare the difference as shown in Figure 4-38. The force is in the range of 0.088mm ~ 0.118mm to meet the requirement, if the above value is exceeded, it is possible that the shaft brake or brake are worn, need to analyze the cause, eliminate the problem.

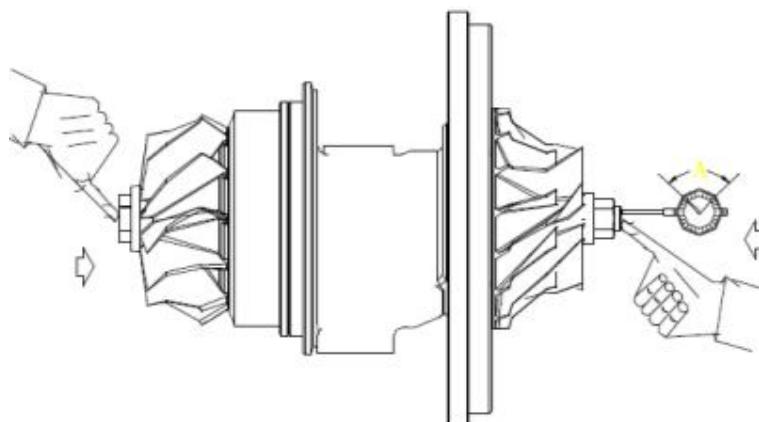


Figure 4-38 Check the rotation shaft

3. Check the axial gap of the compressor impeller

Use the hand to press the axial impeller or pull the impeller outwardly, use the leaf-shaped ruler to measure the gap between the compression impeller and the smallest and largest air compressor impeller cover as shown in Figure 4-39, if the value is within 0.4mm. ~ 0.8mm, it is

normal, if it exceeds this value, check the shaft, eliminate the problem.

Note: When measuring, the turbo must be in a cool state.

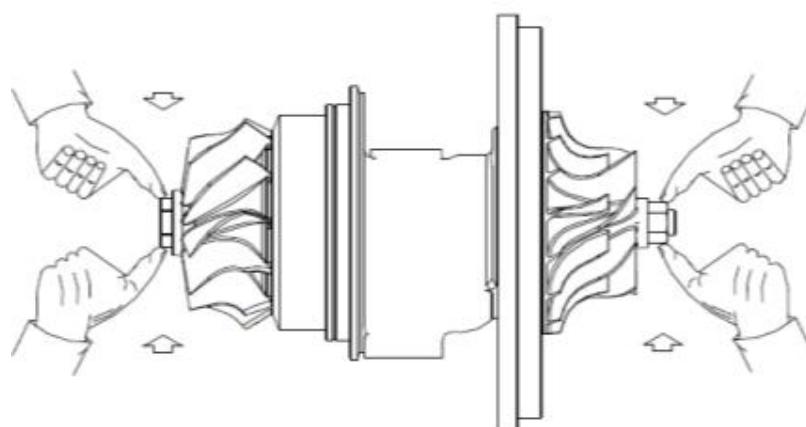


figure 4-39 Check the compressor impeller

Daily maintenance:

1. Check if the turbo and the connection part of the exhaust air are loose or not for timely processing.
2. Check if the turbo has gas or oil leak for timely processing.
3. Check turbo tightening bolts and promptly screen for loose positions
4. Check the air filter, if there is dust, clean the blower.

4.5.4.4 Steps of installing the turbo

1. Mounting on the flange with turbo exhaust gaskets.
2. Install the return oil pipe and oil pipe bolt on the overall turbo. The torque of return oil bolt is controlled at about 22 ~ 29 N.m.
3. Flange between the exhaust pipe and turbo has loose, loosen the screw at 2 sides and tighten the brae screw to avoid loose bolts
5. Apply a layer of lubricating oil, clean the oil inlet oil line, and wipe out the oil spills.
6. Install the turbo oil line connected by washer, tighten the tightening screw to take the box and then tighten, tightening force from 22 ~ 29N.m, ensure that turbo swing is not stuck.
7. Install the elbow pipe
8. Fit the turbo oil return pipe with the hose, use the pipe clamp to tighten, use the pipe clamp to tighten the 2 sides.
9. Both turbo gaskets are only used once, must be replaced when repairing.

4.6 Fuel oil system

4.6.1 Installation and removing of fuel oil system

4.6.1.1 Structure figure of fuel oil system

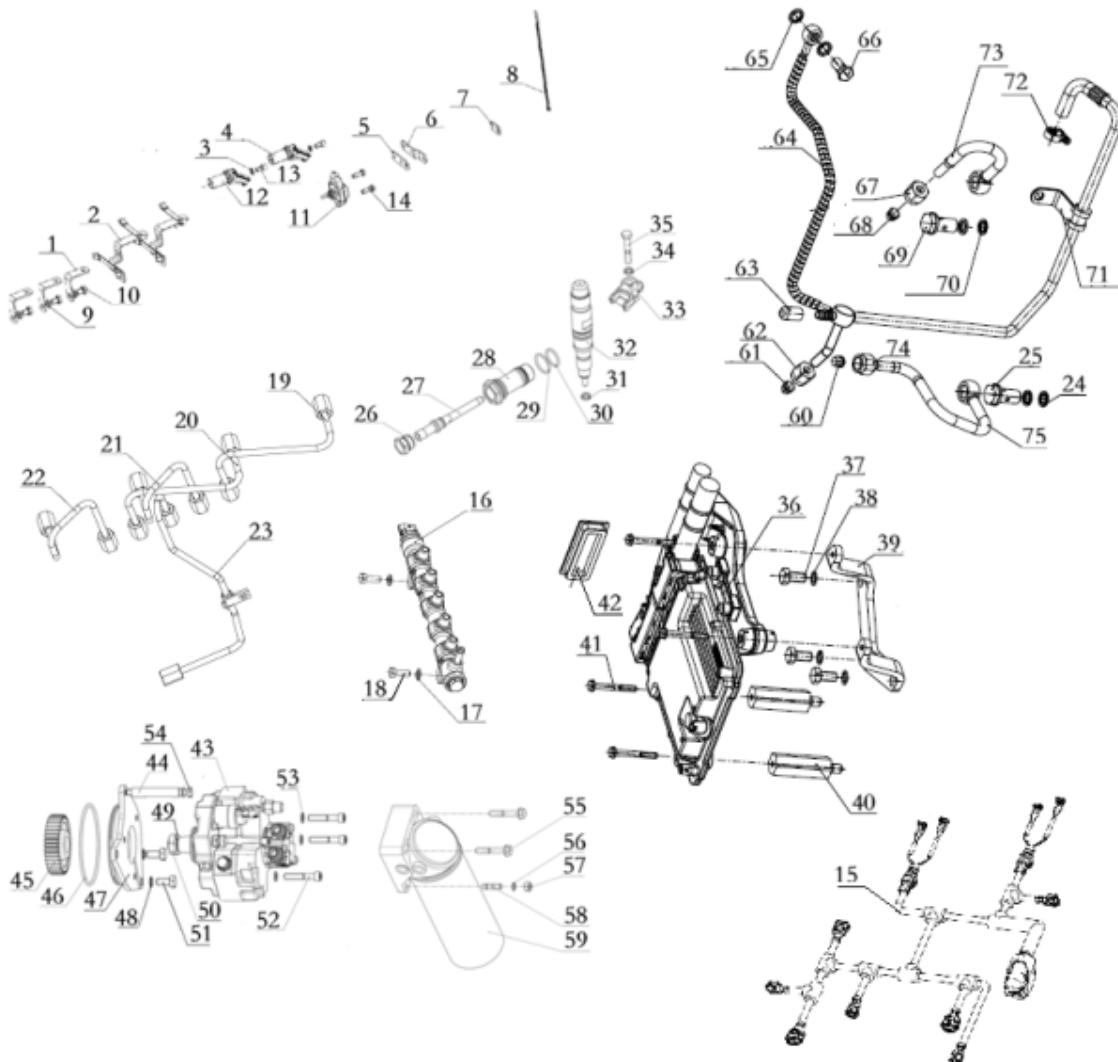


Figure 4-40 Structure figure of fuel oil system

1. Wire frame 01; 2. Wire frame 02; 3. Gasket; 4. Speed sensor; 5. Wire frame 03; 6. Wire frame 04; 7. Wire frame 05; 8. Drawstring; 9. Gasket; 10. Hexagonal bolts; 11. Lubricant pressure & temperature sensor; 12. Speed sensor; 13. Hexagonal oil screw; 14. Hexagon flange bolts; 15. Fixed drawstring; 16. Common rail; 17. Gasket; 18. Hexagonal bolts; 19. 1 Cylinder high pressure oil pipe; 20. 2 Cylinder high pressure oil pipe; 21. 3 Cylinder high pressure oil pipe; 22. 4 Cylinder high pressure oil pipe; 23. High pressure oil pipe; 24. Synthetic gasket; 25. Empty bolt; 26. Screw nut; 27. High voltage connection; 28. Connector; 29. O ring; 30. O ring; 31. Filler; 32. Fuel injector; 33. Pipe clamp; 34. Filler; 35. Hexagonal bolts; 36. ECU; 37. Hexagonal bolts; 38. Filler; 39. ECU frame; 40. Screw; 41. Hexagonal flange bolts; 42. ECU cover; 43. Fuel injector; 44. filler; 45. Fuel injection & pump gear; 46. O-ring; 47. Flange; 48. Gasket; 49. Ring; 50. Lock nut; 51. Hexagonal head bolt; 52. Hexagonal head cover screw; 53. Socket Hexagonal head screw; 54.

Hexagonal head bolt; 55. Hexagonal flange bolts; 56. Filler; 57. Screw nut; **58. Double End Stub**; 59. Filter; 60. Ferrule; 61. Ferrule; 62. Ferrule of floating pipe; 63. Cover; 64. Installation of fuel return pipe; 65. Combination gasket; 66. Empty bolt; 67. Pipe joint of ferrule; 68. Ferrule; 69. Empty bolt; 70. Combined sealing gasket; 71. Pipe clamp; 72. Clamp; **73. Fuel filter (fine filter)**; 74. Pipe joint of ferrule; **75. Pipe mounting clamp**.

4.6.1.2 Steps of removing the fuel oil system

- 1) Remove the wiring system, command wire
- 2) Remove ECU
- 3) Remove the low-pressure oil pipe
- 4) Remove the filter
- 5) Remove the high-pressure oil pipe
- 6) Remove the common rail bar
- 7) Remove the high-pressure pump
- 8) Remove the injector

4.6.1.3 Installation of fuel oil system

In reverse with the removing sequence of fuel oil system.

4.6.2 Installation and removing of the oil injection pump

4.6.2.1 Structure figure of oil injection pump

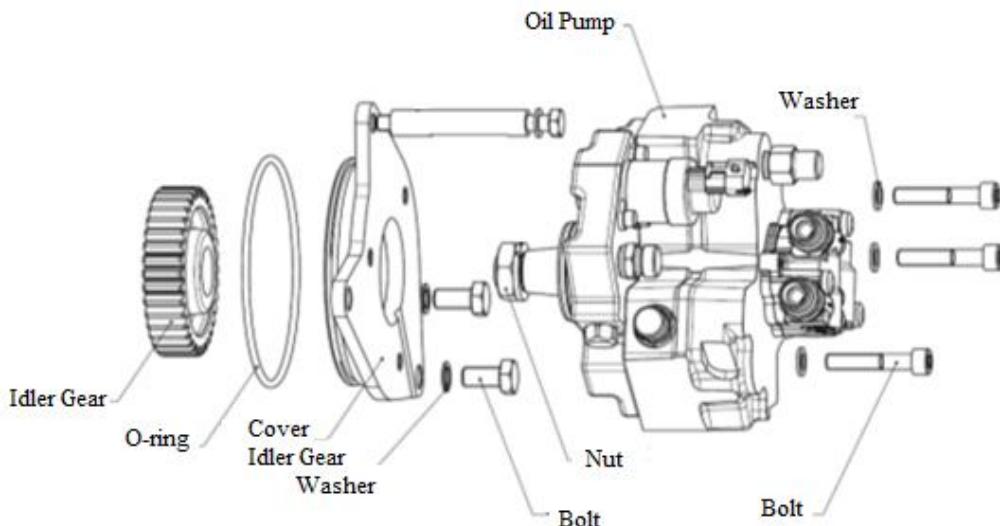


Figure 4-41 Structure of oil injection pump

4.6.2.2 Steps of removing the oil injection pump

- 1) Remove the hexagon bolts between the pump contact flange and the gear compartment.
- 2) From the machine, remove the oil pump and gear cluster.
- 3) Remove the oil pump brake screw and the high-pressure pump gear.
- 4) Remove bolts connecting the pump and flange.
- 5) Remove the pump flange.

4.6.2.3 Check and maintain the oil injection pump

1. Check if the bold thread of the front oil pump cluster is broken or not
2. Check if the flow control component jack is broken, the needle pin is rusty, resulting in

inactivity

3. Check if the high - low pressure oil outlet is broken, has any obstacle.

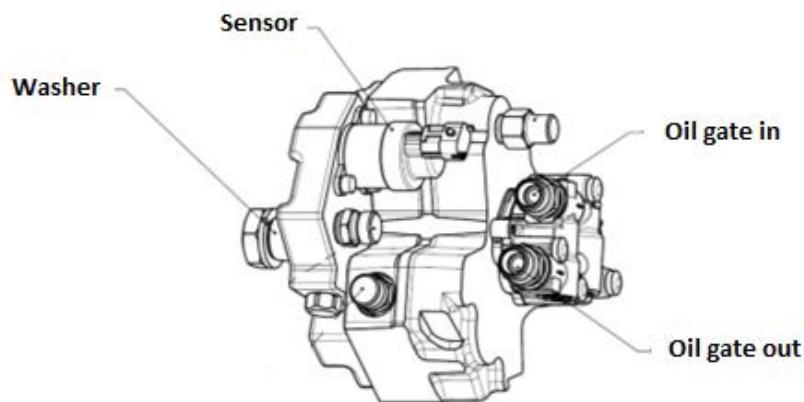


Figure 4-42 Check the oil injection pump

4.6.2.4 Steps of installing the oil injection pump

- 1) Install oil pump flange cluster and oil pumps, apply small amount of lubricating oil on rubber gaskets.
- 2) Install the hexagon M8 bolt between the flange and the oil pump, fixed by a tightening force of 30 ± 5 N.m.
- 3) Install gear pump, tighten the gear pump by standard screw M18 × 1.5, tighten with force of 105 ± 5 N.m to fix it.
- 4) Install and fix the oil pump cluster with hexagon bolts, O-ring gasket, pay attention to apply oil layer when installing, do not press the gasket too much, gently press the gasket along the locating latch, avoid damaging causing oil leakage.

4.6.3 Installation and removing of high-pressure pump pipe

4.6.3.1 Figure of installing the high-pressure pump pipe

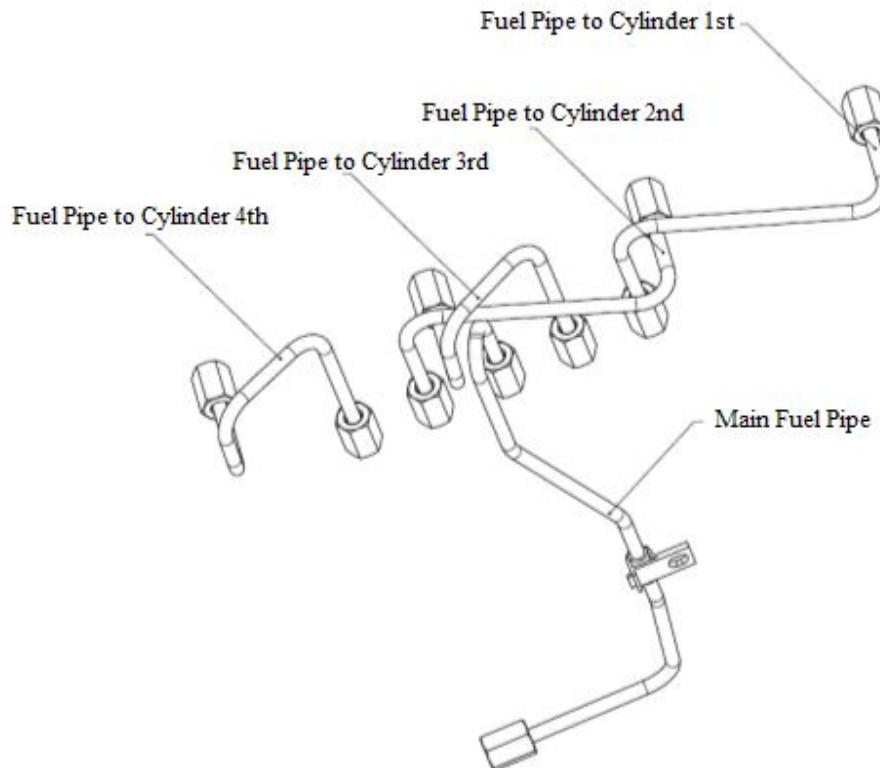


Figure 4-43 High pressure pump pipe

4.6.3.2 Steps of removing the high-pressure pump pipe

- 1) Remove high pressure oil pipe fixing rack.
- 2) Remove high pressure seal pipe.

4.6.3.3 Check and maintain high pressure oil pipe

1. Check if 2 ends of high-pressure oil pipe that are deformed, damaged when pressing or not
2. Check if the high-pressure oil lines have any obstacle.

4.6.3.4 Steps of installing the high-pressure pump pipe

In reverse with the removing sequence.

Note: Bolt for tightening high pressure pipe at the end of the injector section is 35 ~ 45N.m, in the high-pressure bar section, the oil pump section is 35 ~ 45N..m

4.6.4 Installation and removing of injector

4.6.4.1 Structure figure of injector

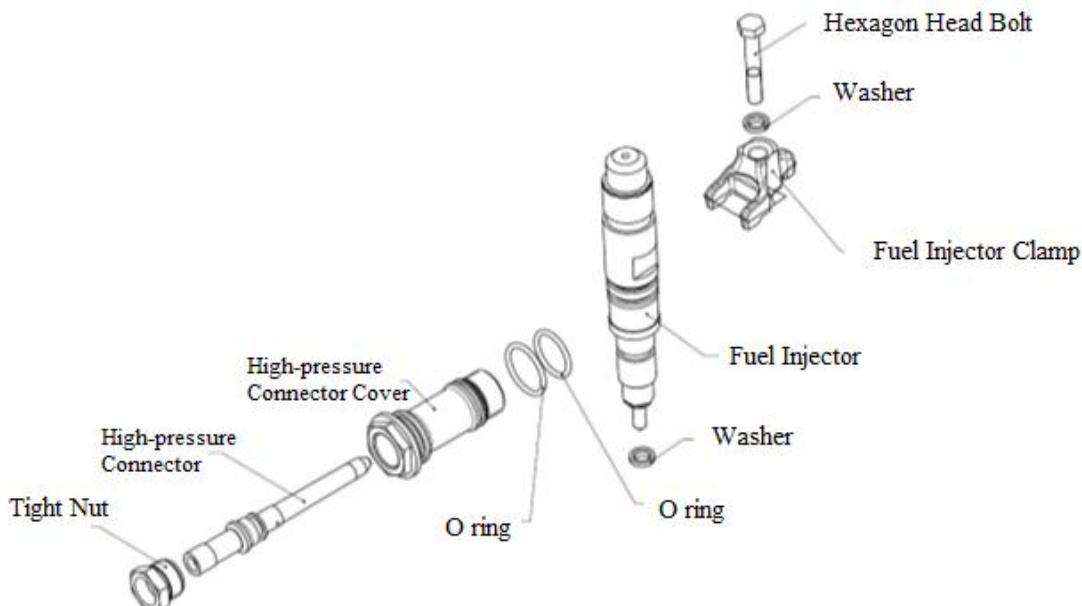


Figure 4-44 Figure of peeling off the injector

4.6.4.2 Steps of removing the injector

- 1) Bolt for fixing the injector on the pressing plate is hexagon bolt.
- 2) Loosen the high-pressure connector tightened with the screw, remove connecting joint of the high-pressure pipe
- 3) Use a specialized tool to remove the injector, check if the gasket head needs to be removed or not.

4.6.4.3 Check and maintain the injector

Replacement of injectors must be carried out by BOSCH's professional warranty station.

The injector is printed with stamp:

Location of injector end: electromagnetic valve

Print Rules: Row 1: Line of injectors, like WPCRIN2.

Row 2: Code WEICHAI like 610800080073

Row 3: Code BOSCH like 0445B29850

Notes:

The injectors with different codes must be used wrongly, the injector is suitable with National Standard III and IV must be used wrongly.

4.6.4.4 Steps of installing the injector

Sequence of installing injectors and high-voltage connectors:

O-rings of injectors and high-pressure joints, annular rings on the nut, thread of the high-pressure joint and the contact surface between the screw nut and the joint must be lubricated, all covers need to be cleaned before installing. (Note: Because BOSCH has lubricated the O-ring surface of injectors and high-pressure joints, it is not necessary to apply oil when installing.)

- 1) When inserting the injector into the combustion chamber cavity, tighten with a force 3N.m.
- 2) Loosen the injector clamp bolt, place the above bolt to impact on the injector with a force 0kN at the axial direction.

- 3) Turn the upper ring on the cylinder head and tighten the torque (60 ~ 90) N.m.
- 4) Screw high-pressure joints (nuts) with torque (15 ~ 20) N.m
- 5) Tighten the injector clamp bolts with 8 N.m + 90 °.
- 6) Use force 50-60N.m to tighten the high-pressure connector (screw).
- 7) High-voltage connector, O-ring gasket is only used once.

4.6.5 Installation and removing of Common rail

4.6.5.1 Structure figure of common rail – high pressure bar

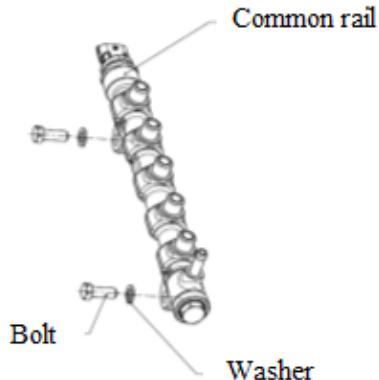


Figure 4-45 Structure of high-pressure bar

4.6.5.2 Steps of removing the Common rail bars

- 1) Remove 3 bolts fixing the common rail bar.
- 2) Remove the common rail.

4.6.5.3 Check and maintain the Common rail

- 1) Check the common rail sensor plug jack, if leaky or bent, replace the common rail.
- 2) Check if the high-pressure, low-pressure pipe head has any obstacle? If damaged, replace the Common rail.

4.6.5.4 Steps of installing the common rail bar

In reverse with the removing sequence

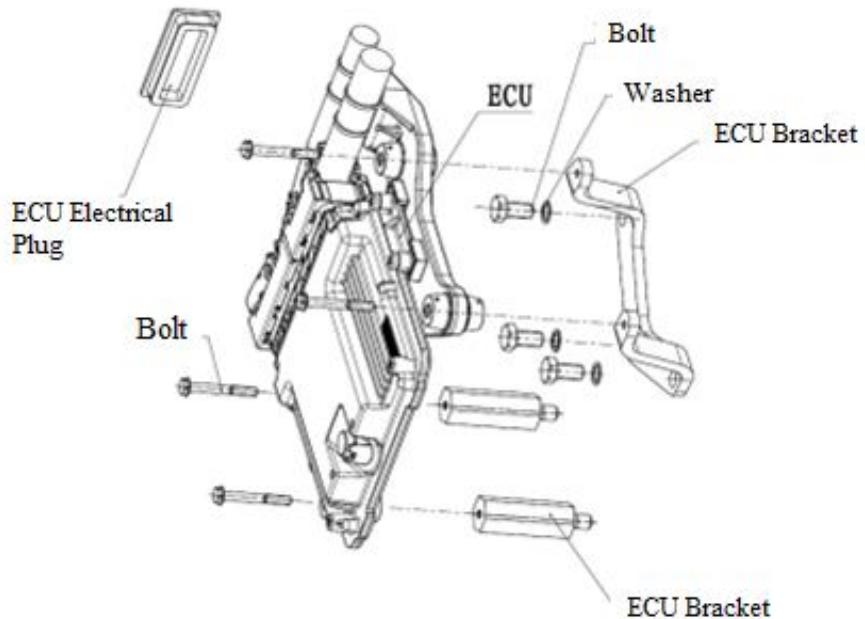
4.6.6 Installation and removing of ECU**4.6.6.1 Structure figure of ECU**

Figure 4-46 Structure of ECU

4.6.6.2 Steps of removing the ECU

- 1) Remove 4 bolts fixing the ECU.
- 2) Remove ECU.
- 3) Remove the upper rack of ECU and lower bolts

4.6.6.3 Check and maintain the ECU

- 1) Check if the ECU, the internal plug jack is abnormal, if the plug pin is rusty, bent, losing pins, then replace the ECU
- 2) Check the ECU plug jack (plastic), if it is damaged, or not locked closely, replace the ECU.

4.6.6.4 Steps of installing the ECU

In reverse with the removing order.

4.6.7 Installation and removing the fuel oil filter

4.6.7.1 Structure figure of fuel oil filter

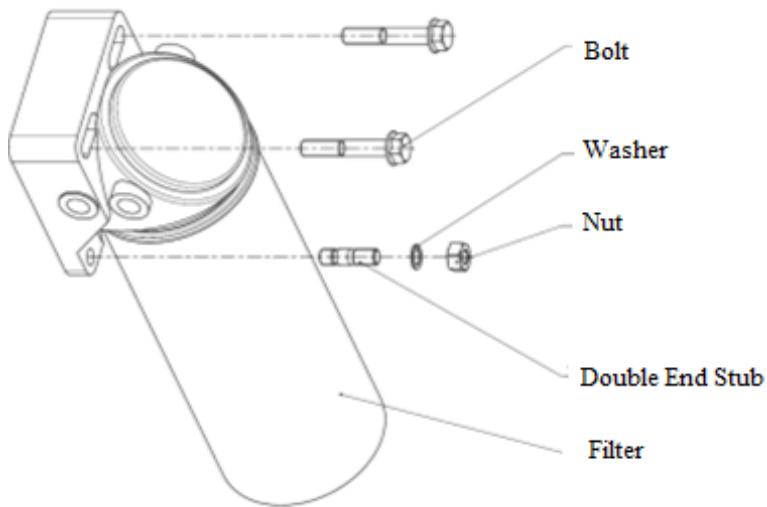


Figure 4-47 Structure of fuel oil filter

4.6.7.2 Steps of removing the fuel oil filter

- 1) Remove 2 bolts and 1 screw fixing the fuel oil filter.
- 2) Remove fuel oil filter.

4.6.7.3 Check and maintain the fuel oil filter

Filter replacement must follow the maintenance regulations, when replacing the filter core, the following order should be followed:

- (1) Remove the old filter core;
- (2) Lubricate the closed filler;
- (3) Turn the fuel filter by hand until the ring comes into contact with the connection point;
- (4) Use a specialized tool to tighten the filter (about $\frac{3}{4}$ round)
- (5) discharge air until air bubbles no longer appear;
- (6) Check whether there is a leak.

4.6.7.4 Steps of installing the fuel oil filter

In reverse with the removing order.

4.6.8 Installation and removing of the low-pressure oil line.

4.6.8.1 Structure figure of low-pressure oil line

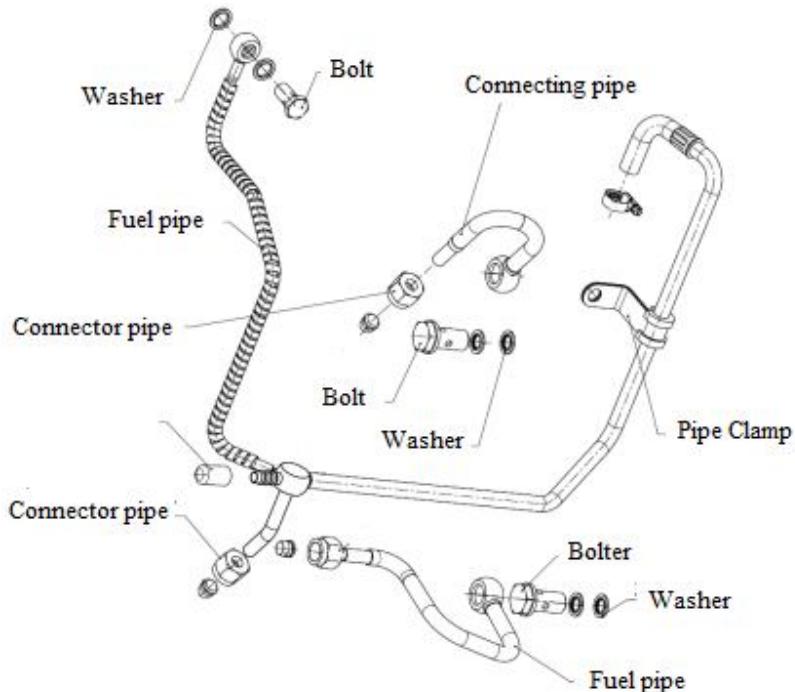


Figure 4-48 Structure of low-pressure oil line

4.6.8.2 Steps of removing the low-pressure oil line

- 1) Remove bolts and pipe clamps fixing the pipe clips.
- 2) Loosen the empty bolts and the ends of the sleeve of the oil pipe end.
- 3) Remove each low-pressure pipe one by one.

4.6.8.3 check and maintain the low-pressure pipe

- 1) Check if the gasket and pipe clamps are damaged.
- 2) Check if the pipe is worn and impacted.

4.6.8.4 Steps of installing the low-pressure oil line

In reverse with the removing order

4.7 Cooling system

4.7.1 Definition of cooling system

The function of the cooling system is to ensure that the engine works under proper temperature conditions. Forced recirculation cooling is best guaranteed for continuous operation, WP5 engine cooling system as shown in Figure 4-49.

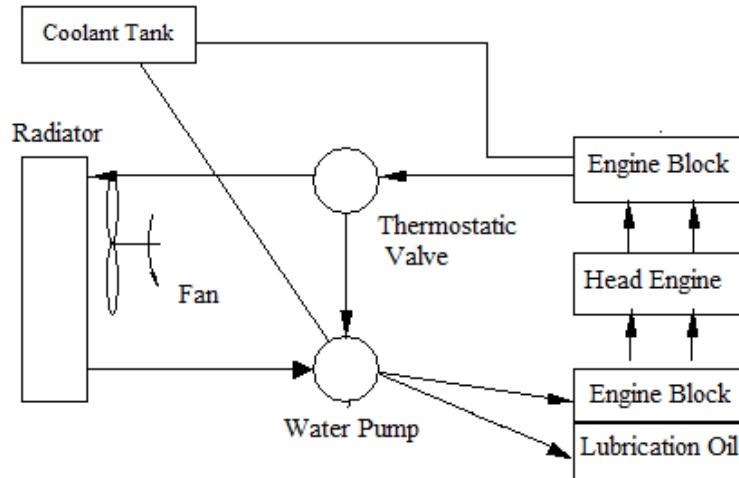


Figure 4-49 Diagram of WP5 cooling system

4.7.2 Figure of cooling system

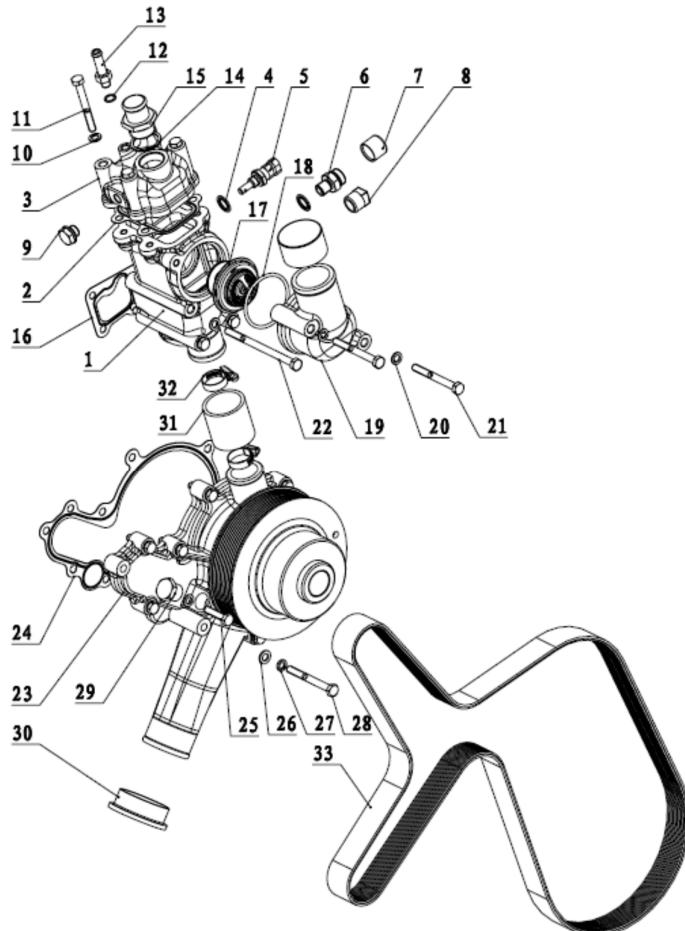


Figure 4-50 Cooling system

No.	In English	No.	In English
1	Water outlet pipe	18	Seal ring
2	Water outlet pipe cover gasket	19	Thermostat cover
3	Water outlet pipe cover	20	Wave spring washer
4	Sealing washer	21	Hexagon head bolt
5	Temperature sensor	22	Hexagon head bolt
6	Pipe joint	23	Water pump
7	Oil connector cap	24	Water pump gasket
8	Square taper screw plug	25	Hexagon head bolt
9	Hexagon screw plug	26	Plain washer
10	Wave spring washer	27	Spring washer
11	Hexagon head bolt	28	Hexagon head bolt
12	Sealing washer	29	Cover
13	Air prevent joint	30	Cover
14	Sealing washer	31	Coolant connecting rubber pipe
15	Air compressor intake joint	32	Clamp
16	Water outlet pipe gasket	33	10PK poly V belt
17	Internal thermostat		

4.7.3 Preparation work before removing and things to note:

b1: Preparing tools

- (1) 13mm socket wrench
- (2) Copper hammer
- (3) 17x19 open wrench
- (4) Steam clamping handle
- (5) Force measurement wrench

b2: Things to note before removing

- (1) Before removing, it is necessary to remove the automatic belt rigging screw

4.7.4 Steps of removing the cooling system

- (1) Remove the belt stretcher
- (2) Remove the belt, details refer to the steps of removing it.
- (3) Remove generators, generator racks, mechanical shaft belts, shock absorber unit. For details, see Figure 4.3 for counterweight and connecting rod structures and Figure 4.10 for overall vehicle components.
- (4) Remove thermostatic valves, details refer to the relevant documentation.
- (5) Remove the water pump, details refer to the relevant steps.

4.7.4.1 Removing the belts

Use a wrench to tighten the screw of rigging screw belt, making the belt rotate the rigging screw, so that the 2 holes on the shaft of the rigging screw are symmetrical, and install the round cylindrical pin, so as the rigging screw cannot return to the original position, and can remove the

10-groove belt.

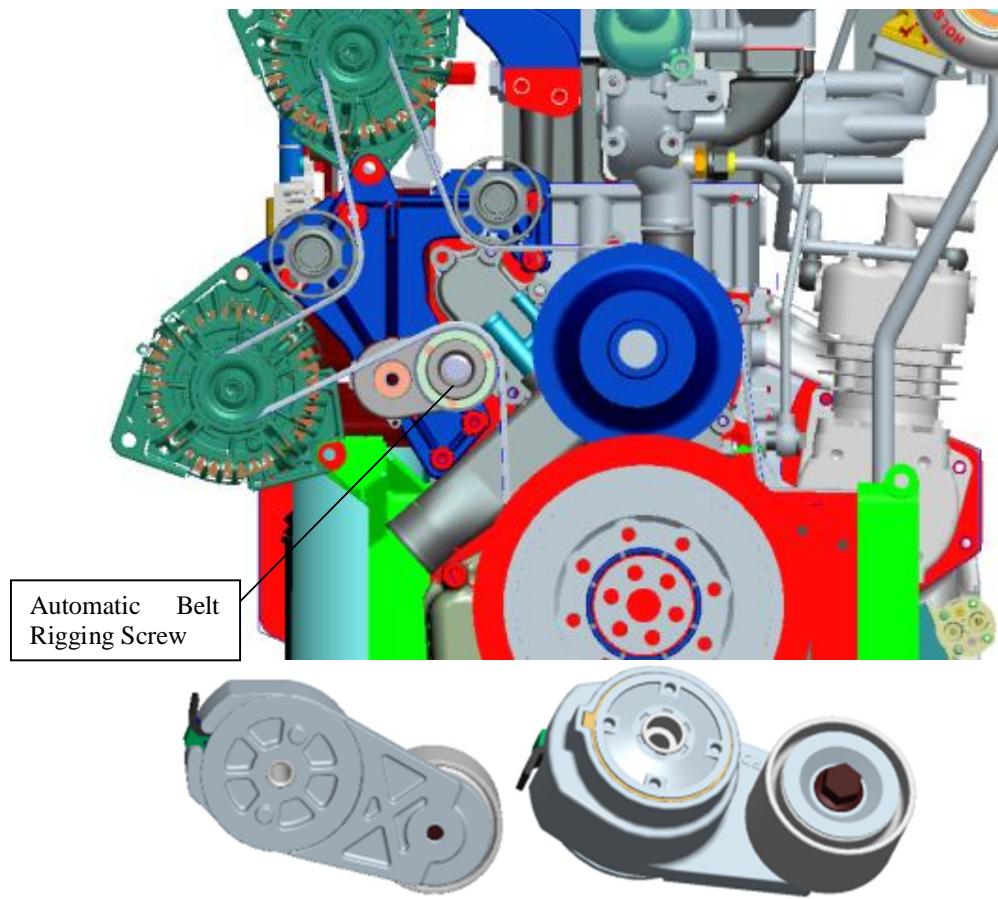


Figure 4-51 Removing belt

Installation steps

Refer to 4.3: connecting rod and crankshaft claw structure 4.10: explanation to the installation system, after installing the generator rack, automatic rigging screw, intermediate roller, water pump, and then the steps of removing the belt is in reverse order, install the round cylindrical pin, belt, automatic rigging screw.

4.7.4.2 Installation and removing of water pump

Steps of removing the pump

WP5 series of water pumps are installed in the front of the machine, water inlet and outlet are arranged at the side of the exhaust gas cylinder, the water line in the upper return cavity, the water line in the lower return cavity. The water outlet is connected by double thermostat valves, 2 thermostatic valves are arranged inside the water outlet, compact structure. The thermostat valve has 2 outputs, 1 line through the water tank, 1 line through the water pump inlet to form a small cycle. When the temperature of the cooling water is at 83 °C, open the valve, when the temperature reaches 92 °C, fully open. At this time, all the cooling water after passing through the cooled radiator will be pumped with water into the engine block. But when the cooling water temperature is lower than 83 °C, the thermostat valve will not perform the above steps, the cooling water is directly pushed into the way into the water pump, causing the temperature of the machine to increase rapidly, when the hot state is reached, to avoid low temperature abrasion, extend machine

life.

Steps

- ① Remove 10 V-shaped belts according to steps of belt replacement
- ② Use a wrench to remove the belt rigging screw
- ③ Use a wrench to remove the belt tension handle.
- ④ Use a wrench to remove 8 bolts fixing water pump on the engine block.

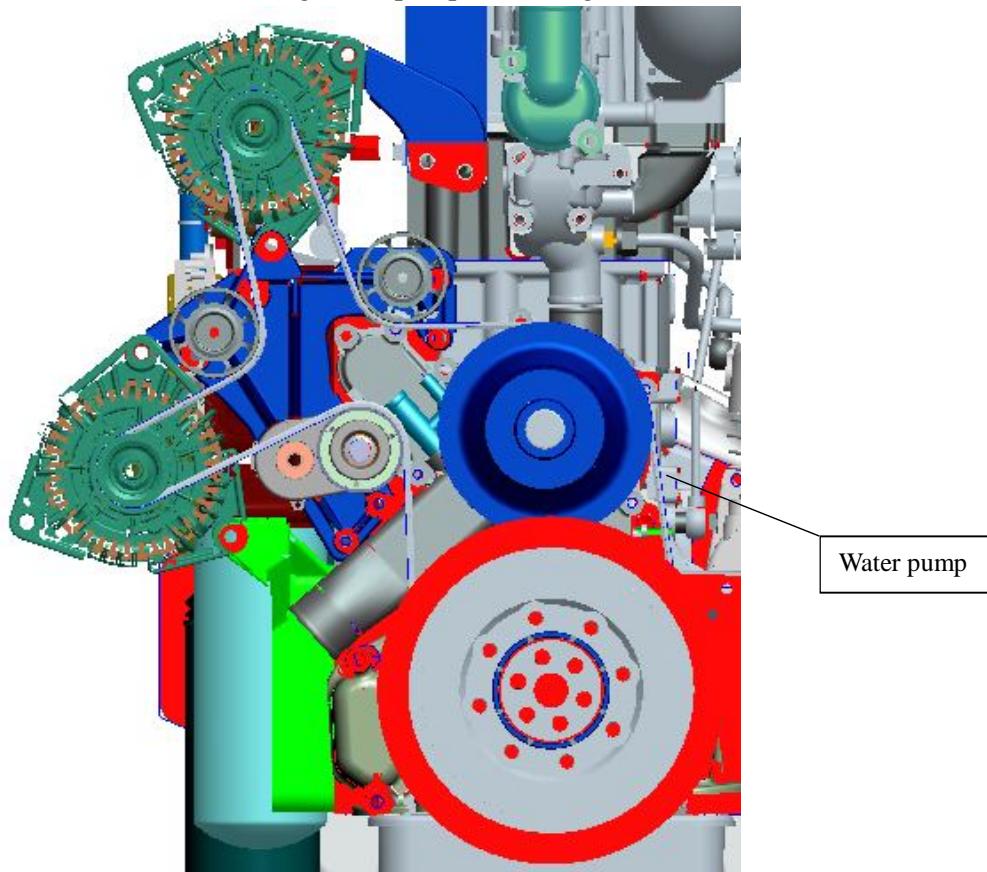


Figure 4-52 Water pump

Installation steps

- (1) Clean the contact surface of the engine block with the water pump
- (2) Install gaskets, install the overall pump, fix it with bolts.

4.7.4.3 Installation and removing of thermostat valves

Steps of removing

- (1) Remove the soft pipe with the water outlet and the 2 clamps connected to the thermostat valve
- (2) Remove the thermostat valve cap, remove the thermostat valve.
- (3) Remove the drain pipe.

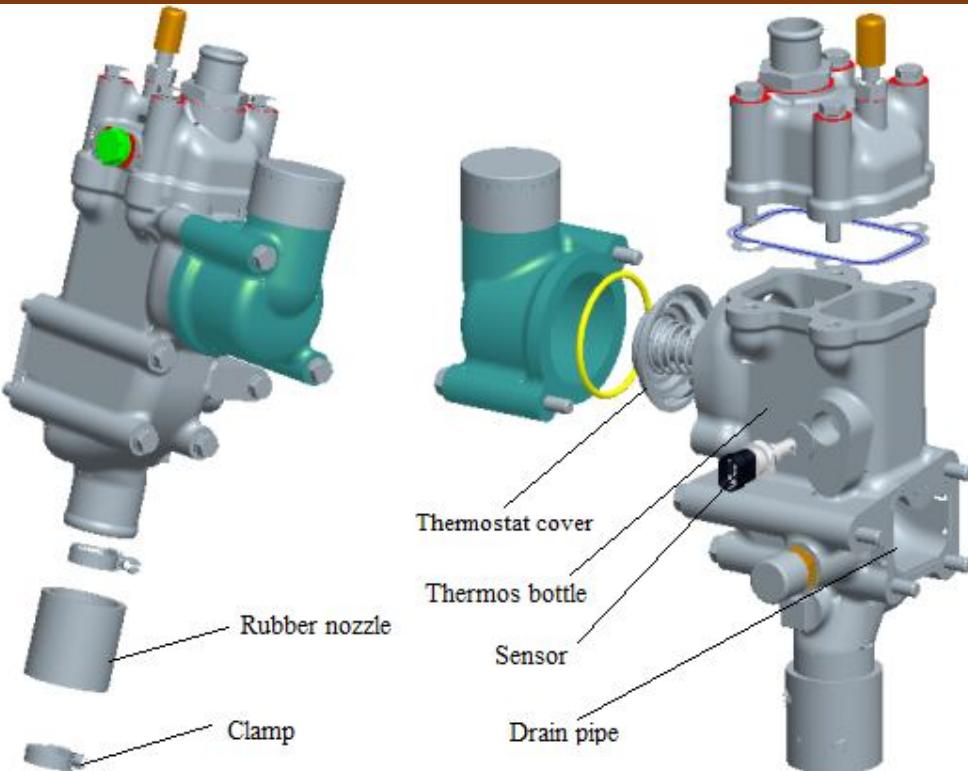


Figure 4-53 Thermostatic Assembly

Installation steps

- (1) Check whether the processing surface of water outlet has burr or not;
- (2) After applying the glue to the pipe connector, insert it into the outlet.
- (3) Regulate the thermostat valve, put into the outlet;
- (4) Thermostat valve cap is mounted on water outlet;
- (5) Install rubber gaskets.

Temperature table when the thermostat valve is open

Partial opening	Full opening
83°C	92°C
71°C	82°C
76°C	88°C

4.7.5 Notes for expansion water tank

This is a part installed by the factory which installs the overall vehicle, not with a diesel engine. The performance and capacity of the cooling system depends very much on whether or not the part has pressure or air bubbles. These two properties are greatly influenced by the expansion water tank. Specific effects are as follows:

- ◆ Cooling water will expand when absorbing heat.
- ◆ Cooling water flows from the vent duct and airways, and also distributes with the air in the system.
- ◆ Store a certain amount of coolant to compensate if leaks.
- ◆ Stabilize pressure and regulate pressure of cooling system.
- ◆ Convenient to check the cooling oil level and additional level.

The pre-installed cooling system of WP5 engine series must have an independent or semi-independent expansion tank. The pressure inside the tank is maintained at 50kPa, the installation position is at least higher than the diesel engine and the 400mm radiator, placed at a high position in the water circulation cooling system. If necessary, the design should also include the addition of a partition, to avoid strong shaking when accelerating, decelerating or steering.

The expansion tank capacity is greater than or equal to 15% of the total amount of cooling oil added to the cooling system, and the amount of gas is about 7% -12% of the additional amount. This shows that, for the first time of adding cooling oil, at most only add an amount equal to 60% of the tank capacity, the remaining 40% provides cooling oil for water tank.

4.7.6 Things to note for impeller

Basic WP5 engine uses an annular plastic impeller, when driving, using a silicone oil switch (sticky drive). According to customer requirements, hard drive can be made. Not only save fuel, more importantly ensure good machine state, obvious advantages for vehicle operation and machine life.

4.8 Lubricating system

4.8.1 Definition

The function of lubrication system is to reduce friction, cleaning, cooling and anti-rust. Used lubricants must comply with company regulations. The universal oil is better for the cold start function, a preferred use. Universal viscosity like 15W40 can be used within the specified temperature range. For sudden low temperature environments, it is possible to use a pre-heating method or a suitable oil change.

Notes:

WP5 series does not allow the use of lubricants of CE, CD, CC, CB, CA. Each change of oil must change the oil filter.

WP5 series are mainly for pressure lubrication, oil pump through multi-level filter, oil suction from the bottom of crank, through the oil line in the engine block to go to the filter - cooling cluster, go through the oil pipeline system to lubrication position. Most of the oil comes to the main bearings through the oil hole on the crankshaft. The inside of the cylinder and piston pins are lubricated by the oil injection needle. Air distribution, turbo, air compressor, intermediate gear bearings are equally lubricated through oil line and oil grooves. The piston peak adopts a cooling injector to inject the oil to coolant oil bottle. The oil through oil generation part is cooled with cooling water. The pressure of the circulating system is adjusted via pressure relief valve and bypass valve. Details are shown in Figure 4-54.

When starting the engine, the oil temperature is low, so it is relatively sticky, the oil pressure is immediately high, however as the operating time goes on, the oil temperature is high, the pressure will be reduced, when the machine operates at relief condition, water temperature is from 80 ~ 93 degrees C, normal oil pressure is 350kPa ~ 660kPa.

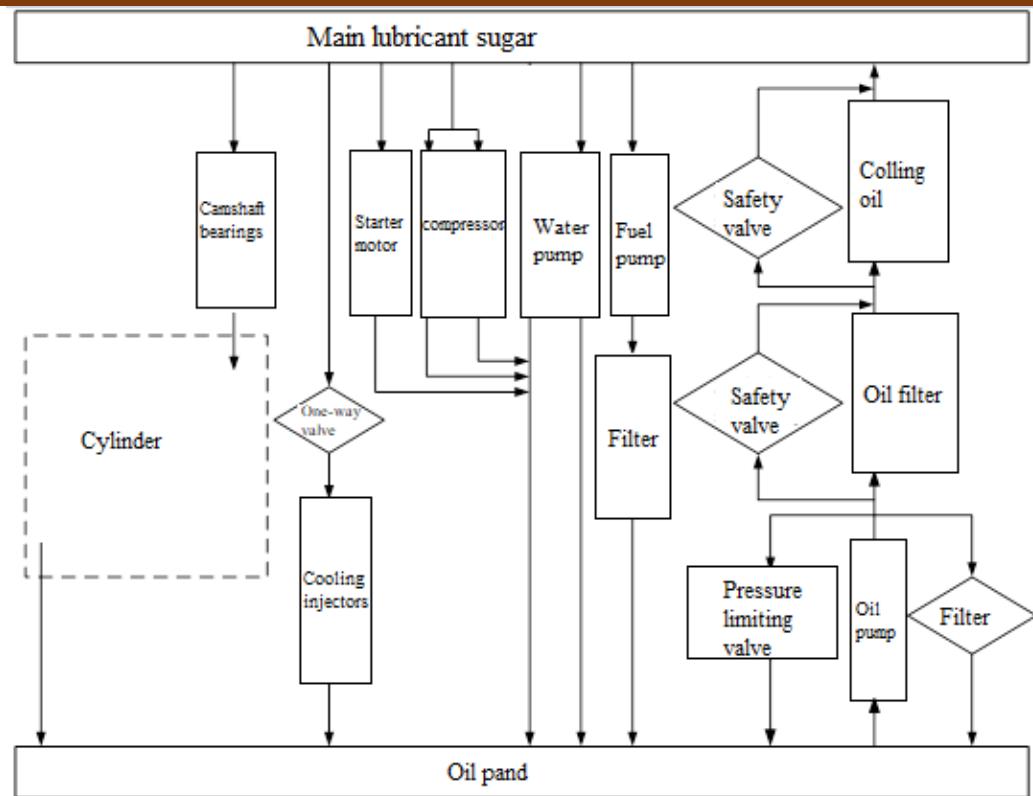
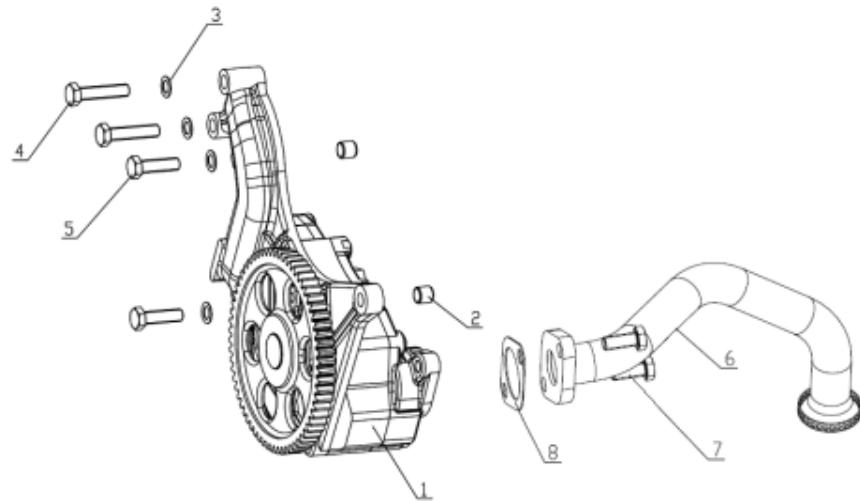
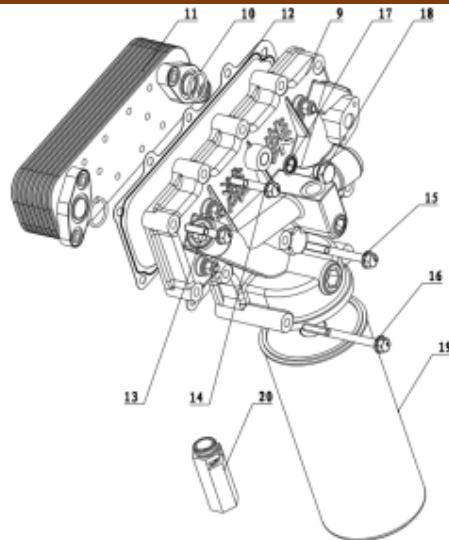


Figure 4-54 Operation diagram of WP5 oil line

4.8.2 Structure figure of lubricating system





4-55 Structure of lubricating system

No	English	No	English
1	Lubricating oil pump	11	Oil cooler
2	Dowel pin	12	Oil cooler cap gasket
3	Wave spring washer	13	Hexagon flange bolt
4	Hexagon head screw	14	Hexagon flange bolt
5	Hexagon head screw	15	Hexagon flange bolt
6	Oil suction strainer assembly	16	Hexagon head bolt
7	Hexagon head screw	17	Sealing washer
8	Oil suction strainer gasket	18	Hexagon screw plug
9	Oil cooler cap	19	Oil filter
10	O-ring	20	Valve of main oil gallery

4.8.3 Installation and removing of oil pump

1. 16mm socket wrench

Loosen 4 M10 fixing bolts on the oil pump, remove the oil pump.

Clean the contact surface between the pump and the engine block.

2. 16mm socket wrench

First install 2 locating bushes on the engine block, then install an oil pump so that the oil pump is in contact with the engine block, then tighten 4 M10 fixing bolts on the oil pump.

Note: Use specialized 242 glue to apply to the bolts thread before tightening.

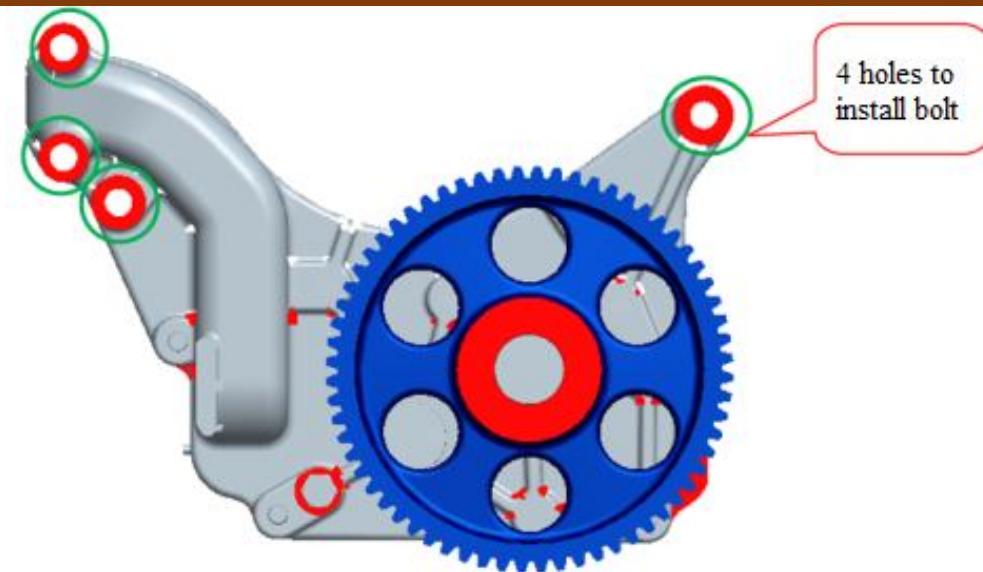


Figure 4-56 Oil pump

4.8.4 Installation of oil filter cluster

① 16mm socket wrench

Loosen two fixing bolts on the overall filter cluster, then remove the overall filter cluster and the filter cluster gasket.

Clean the contact surface between the overall filter cluster and the oil pump.

② 16mm socket wrench

Install a new overall filter cluster and filter gasket, then tighten two M10 fixing bolts on the overall filter cluster.

Note: Use specialized 242 glue to apply to the bolts thread before tightening.

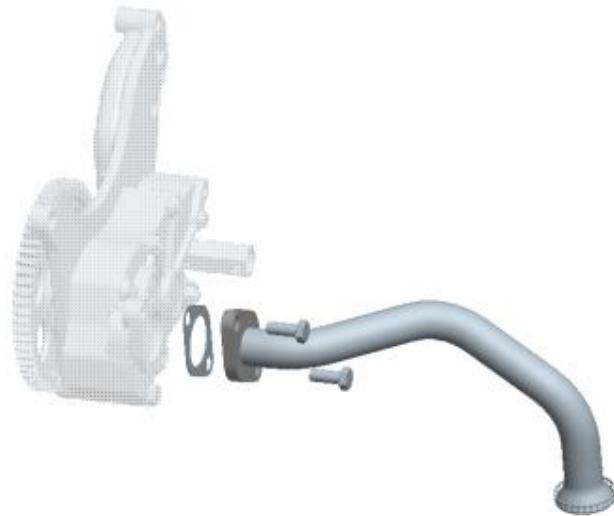


Figure 4-57 Overall filter cluster

4.8.4 Installing and removing of overall oil cooler housing

① 13mm socket wrench

Loosen M8 bolts 1 round on the oil cooler housing cap, then remove the overall cooler housing and the cap gasket (before removing, let all the cooling oil flow out).

Clean the contact surface between the overall oil cooler housing and the engine body.

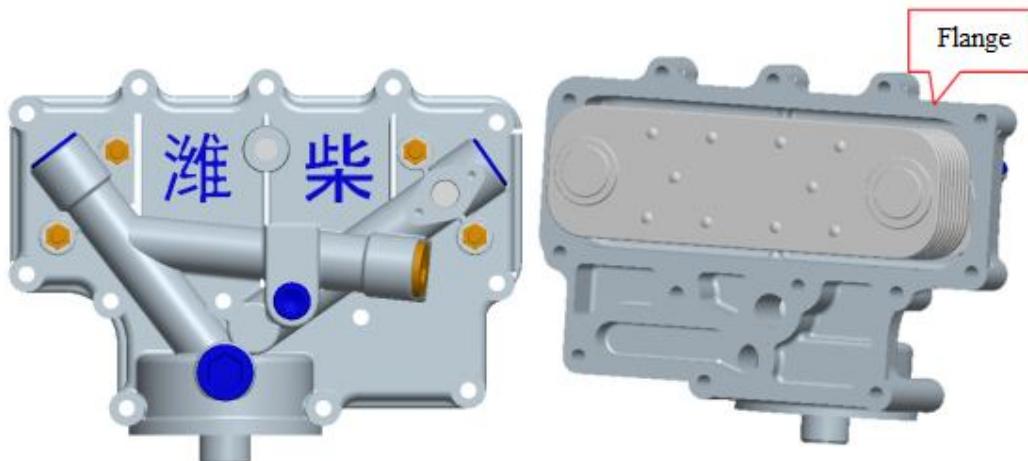


Figure 4-58 Front side and back side of overall oil cooler housing

②13mm socket wrench

Install a new oil cooler housing and oil cooler housing cap spring gasket, then tighten M8 fixing bolts on the oil cooler housing cap.

Note: Use specialized 242 glue to apply to the bolts thread before tightening.

4.8.5 Installation and removing of oil filter.

1. Specialized tools: Remove old oil filter

2. Add clean oil to the new filter

3. Brush: Apply the oil to the gaskets.

4. Use a plier to install on the stand

5. Specialized tools

Use a specialized tool to tighten $\frac{3}{4}$ to 1 round.

6. Start the engine to check if there is oil leakage.



Figure 4-59 Specialized tools for installation of oil filter

4.8.6 Installation and removing of limiting valve of the main oil line

①27mm open wrench

Remove limiting valve of the overall main oil line; clean the contact surface on the engine block and the limiting valve of the overall main oil line.

② Brush

Using a specialized 242 glue to apply to the limiting valve of the overall main oil line.

③27mm open wrench

Install a new limiting valve of the overall main oil line and tighten.

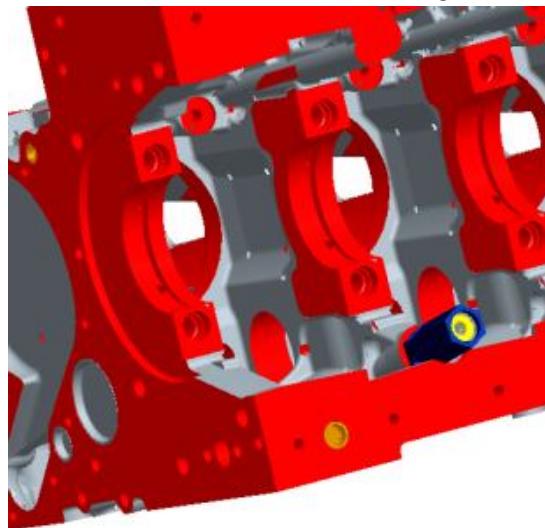


Figure 4-60 Limiting valve of the overall main oil line

4.9 Startup system

4.9.1 Installation and removing of startup system

4.9.1.1 Structure figure of startup system

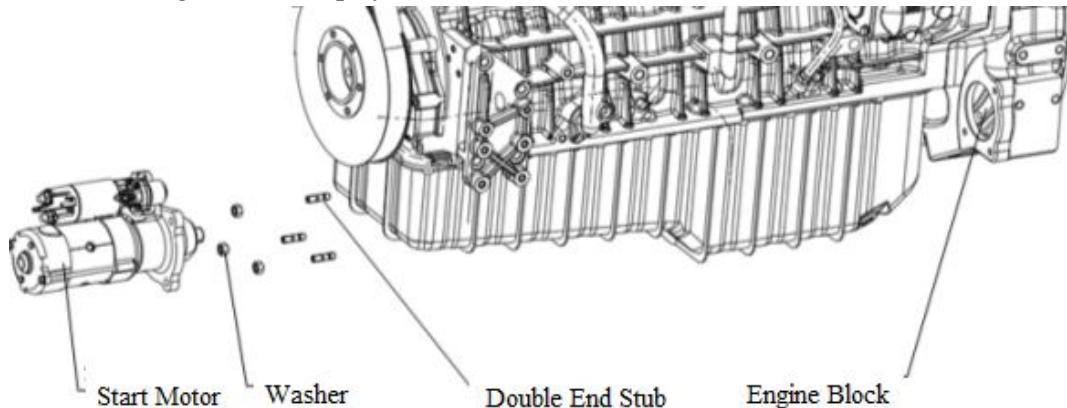


Figure 4-61 Startup system

4.9.1.2 Steps of removing the startup system

- 1) Remove the starter machine
- 2) Remove the gear ring, refer to the flywheel crankshaft section.

4.9.1.3 Steps of installing the startup system

In reverse with the installation steps

4.9.2 Installation and removing of starter

4.9.2.1 Diagram of installation of starter

See the diagram of installation of starter.

4.9.2.2 Steps of removing the starter

- (1) Remove the hexagon bolts;
- (2) Use two hands to tightly hold the starter, turn the starter gear to remove the starter from

the machine;

- (3) Remove the 2-head bolt.

4.9.2.3 Check and maintain the starter

Check if the starter gear is broken, if yes, it should be replaced.

4.9.2.4 Steps of installing the starter

In reverse with the removing steps.

4.10 Accessories system of overall vehicle

The system of accessories of overall vehicle includes generator, air compressor, and navigation pumps.

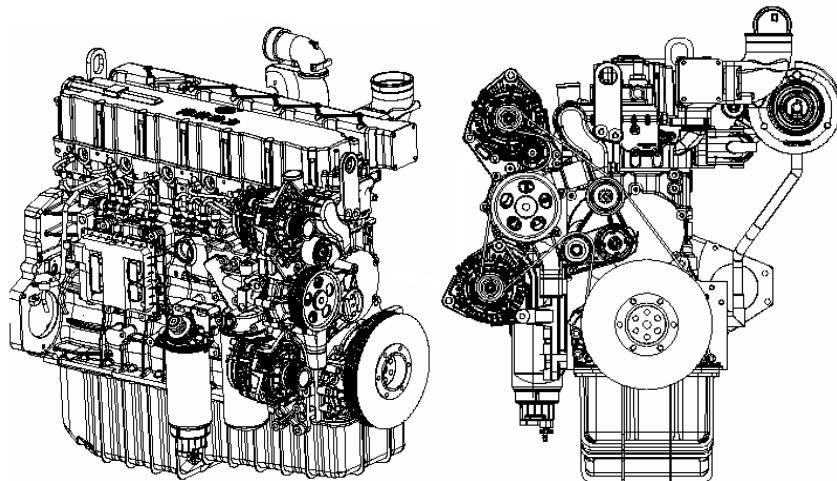


Figure 4-62 Accessories system

4.10.1 Installation and removing of generator

Steps of removing

- (1) Loosen belt tensioner, V-belt

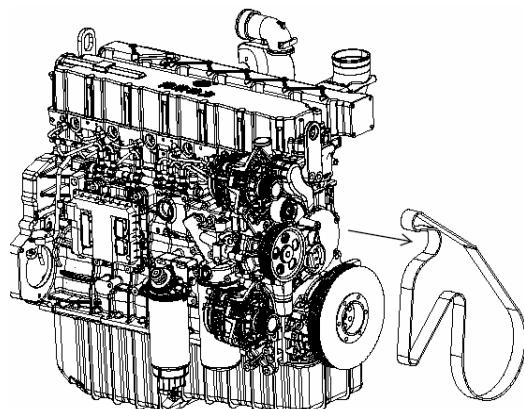


Figure 4-63 Removing the belt tensioner

- (2) Remove the fixed bolts on the generator rack, lift up the upper part.

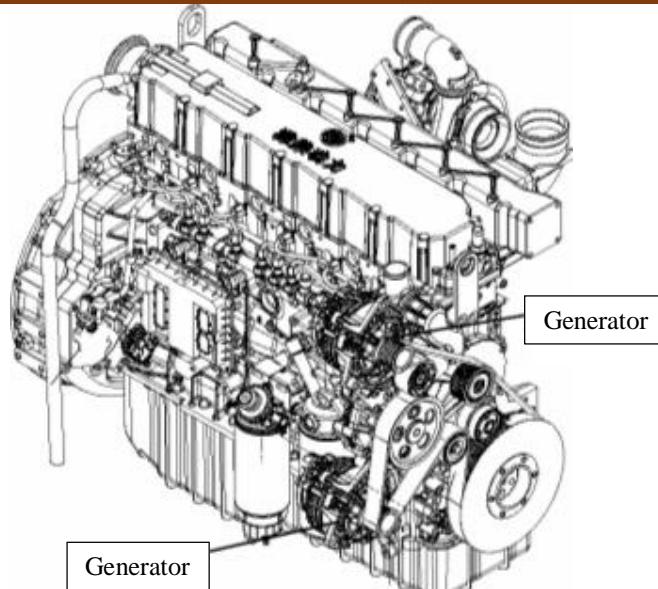


Figure 4-64 Removing the generator

Notes:

Repair of generators must be done by experts. When installing, it is necessary to check insulation gaskets, technical assurance need to be replaced if having damage. The anode of generator must not short-circuit in the cover, otherwise, it is strictly forbidden to install the generator on the vehicle to avoid an unreasonable incident.

Steps of installation

- (1) Install the generator on the rack, use the bolts to fix on the rack and tighten it.
- (2) Remove the multi-groove belt
- (3) Take advantage of the rigging screw of the generator to tension the generator belt, as shown in Figure 4-42.

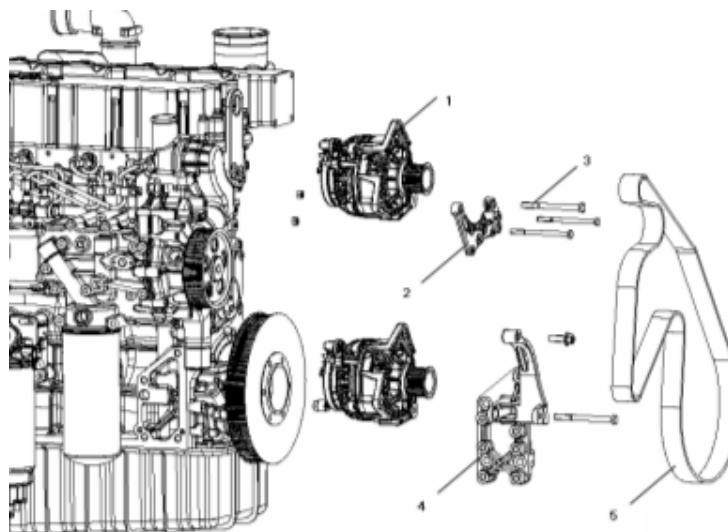


Figure 4-65 Installation of generator

1. Generator; 2. Stand; 3. bolt; 4. Rack on the engine; 5. Belt

4.10.1.1 Maintenance, Diagnosis of Generator Incidents

When customers come for maintenance, it should be judged whether it is certain that the problem is from the generator, the test tool is the test lamp, the test procedure as shown in Figure 4-43.

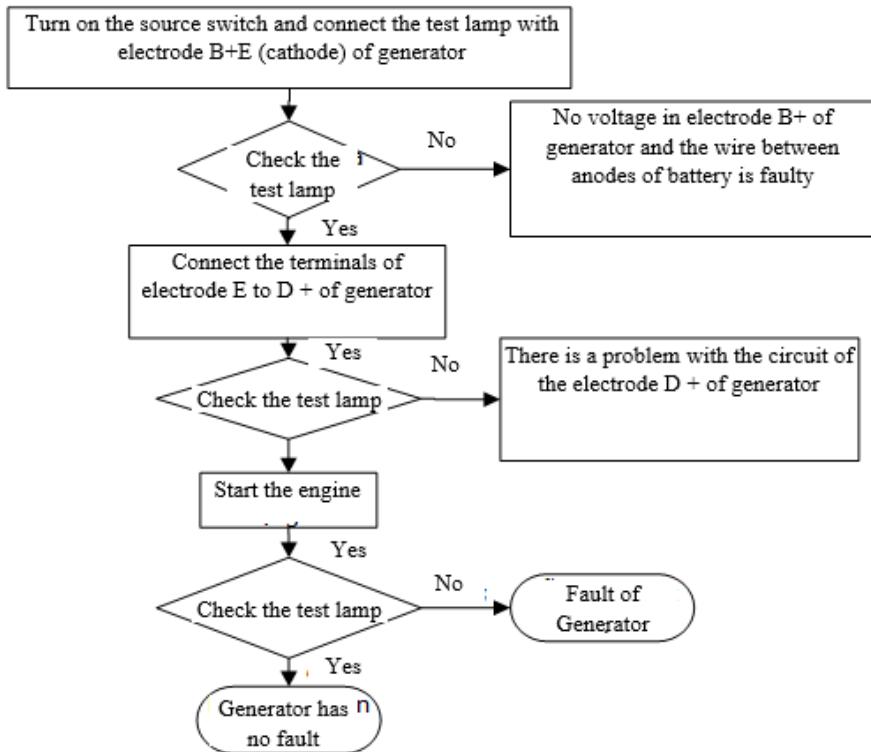


Figure 4-66. Diagnosis of Generator Incidents.

4.10.2 Installation and removing of air compressor

Steps of removing

- (1) Remove air intake pipe, water inlet line, water drain pipe, oil intake line;
- (2) Remove the 3 bolts on the flange, remove the compressor, and remove the O-shaped gasket and operate as shown in Figure 4-67.

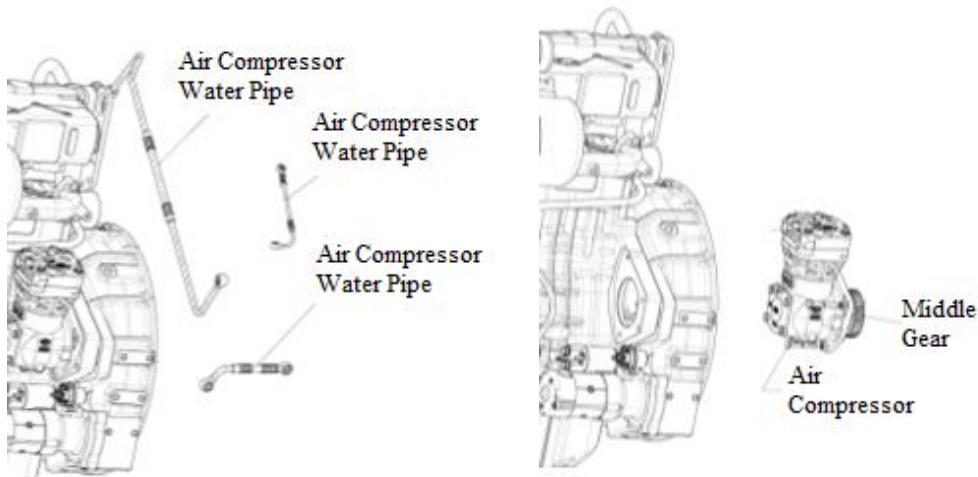


Figure 4-67 Air compressor and steps of removing

Steps of installing the air compressor

- (1) First place the O-ring on the air compressor groove, so that the axial center of the compressor shaft is symmetrically concentric to the gear on the engine, gently push the compressor

to make sure the gears fit together. The flange of the compressor with the engine fits together on the same side, use 3 M10 fixed bolts, then use the 13mm spanner, or the wrench to tighten.

(2) Install water inlet line, water outlet line (including vise), oil inlet line, oil intake line of air compressor, use vise for tightening, operation as shown in Figure 4-45.

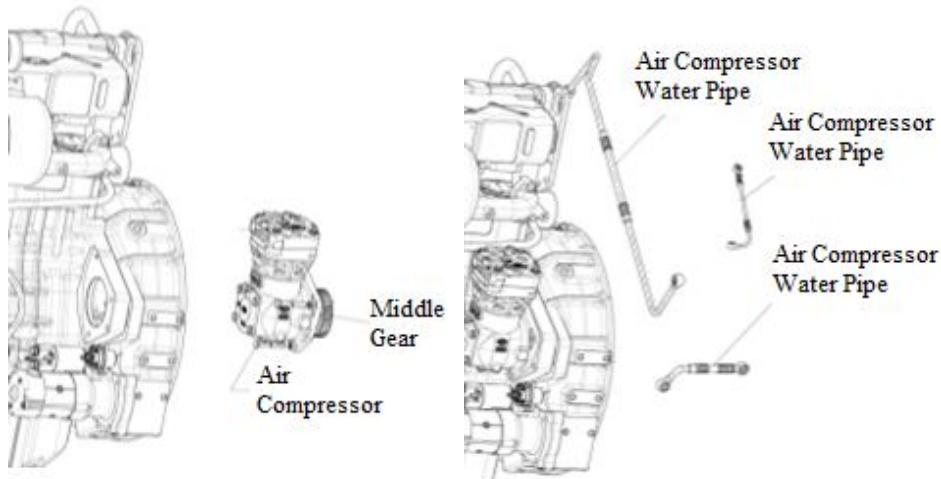


Figure 4-68 Installation of air compressors and pipes

4.10.3 Installation and removing of navigation pump

4.10.3.1 Figure of navigation pump

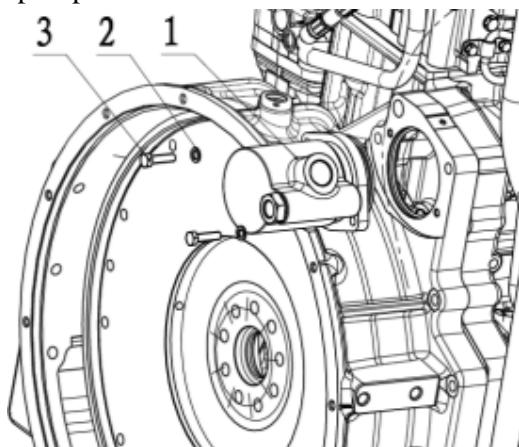


Figure 4-69 Figure of navigation pump

1. navigation pump; 2. spring seal ring (2 pcs); 3. hexagon bolt (2 pcs)

4.10.3.2 Steps of removing the navigation pump

Using 13mm wrench to loosen the bolts, remove bolts and spring seal ring, use rubber hammer to lightly knock pump housing (do not use hard tool to knock), gently remove navigation pump.

- (1) Remove oil inlet line, oil outlet line for navigation pump.
- (2) Remove the bolts fixing pump and spring seal ring, and then remove the pump. Operation as shown in Figure 4-47.

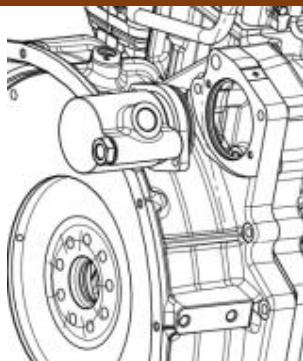


Figure 4-70 Removing the navigation pump

4.10.3.3 Check and maintain the navigation pump

The navigation pump usually has 3 typical problems: Oil leakage, slow navigation, loud noise. In addition, there is an issue of tightened gear of the pump, broken pump shaft, and overheating pump cover.

4.11 Processing system after emissions

4.11.1 Urea pump

4.11.1.1 Structure of urea pump

The urea pump is in charge of increasing the pressure of the solution, bringing the solution from the urea tank to the nozzle, and brings the excess urea back to the urea tank, maintaining the system pressure to 9bar. After the machine stops working, Urea is sucked back to the tank, avoiding the remaining urea on the path that affects the system. Figure 4-48 is appearance of the DeNox2.2 system structure of Bosch.

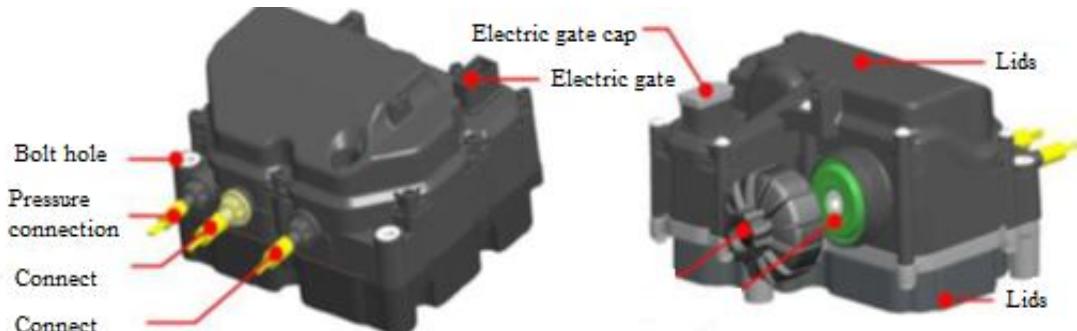


Figure 4-71 Structure of the Urea pump system

Urea pump has 3 connectors, which are distinguished as urea input connector, urea return connector, and pressure connector. Supply urea from tanks to nozzles. The connector ensures SAE J2044 standard, table 4-5 is standard for 3 connectors.

table 4-5 Specification and definition of Urea connector

Name	Specification	Description
urea input connector	SAE J2044 3/8"	Input, for Urea suction
urea return connector	SAE J2044 3/8"	Output, for Urea return
Urea pressure connector	SAE J2044 5/16"	Output, for Urea pressure

During the installation of the Urea pipe, make sure the connector and the pipe are suitable, if the connector is wrong, the system cannot work.

The Urea pump has a replaceable filter level, preventing impurities in urea, ($f_i > 30\mu\text{m}$)

entering the injecting, filtering relief valve and accessories must be replaced periodically.

The front of the Urea pump has to wait for the connector of electrical components, for the DCU / ECU to connect and control the use.

4.11.1.2 Installation of Urea pump

Urea pump requires a very high level of hygiene, as shown in Figure 4-72, the protective plastic caps are only removed when installing.

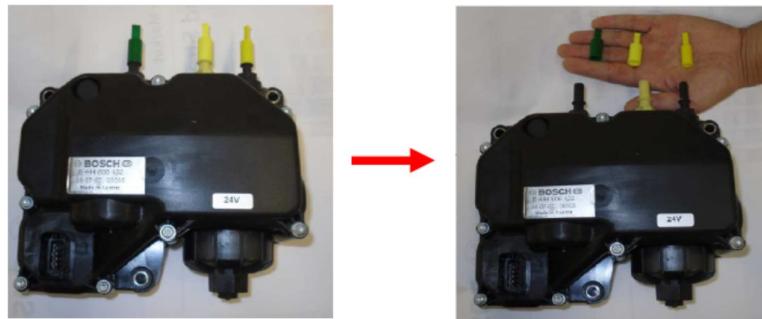


Figure 4-72 Before installing, remove the protective cap

In order to ensure a highly efficient system, Urea pump needs to be installed correctly on the overall vehicle, selecting the integrated Urea tank is designated by Weichai, allowing the installation of Urea pumps directly on the appropriate reciprocal position, meeting the installation requirements of urea pump.

For non-integrated Urea tanks, installation of Urea pumps must meet the requirements of Figure 4-73, such as front elevation, side elevation, allowing the installation of urea pumps in the range of 315° ~ 0° ~ 450, beyond the above range, the system can not work, in the side elevation, the installation direction is parallel to the gravity direction, allowing the Urea pump to be installed within 315° ~ 0° ~ 450 range, if it exceeds this range, the Urea during the pumping process will have residues on the duct.

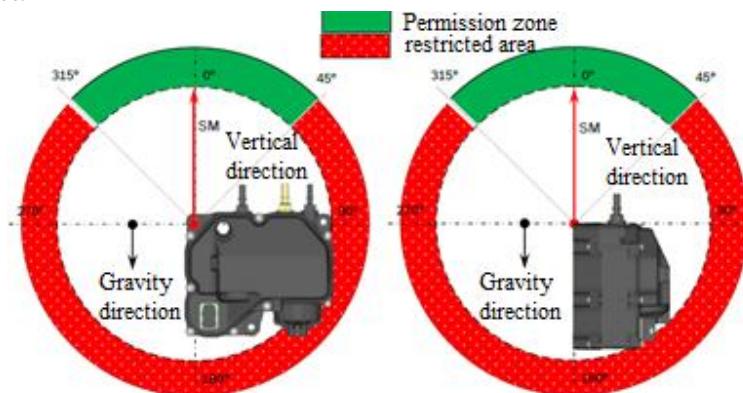


Figure 4-73 Instructions to installing Urea pump in front elevation (left) side elevation (right).

On Urea pump, there are 3 installation holes, installing bolts of 90mm length, it is advisable to use anti-vibration gaskets, contact surface should have vibration pressure at 260N / mm², bolt tightening force of 19N.m ±20%.

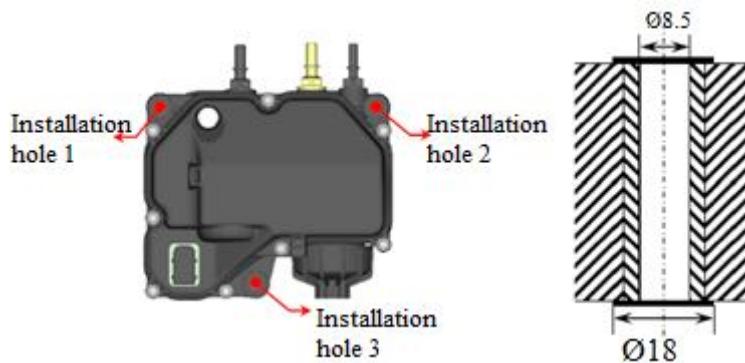


Figure 4-74 Positions of Urea pump installation holes and sizes

4.11.1.3 Maintenance of Urea pump

DeNox2.2 system uses filtered Urea pump every 3 years or replace at every 100k km, if the environment is harsh, then we can shorten the replacement time. Before replacing, it is necessary to conduct surface cleaning, and at the same time, strictly comply with the environmental hygiene requirements during installation. Twist the cap with a force of 20Nm + 5Nm, table 4-6: steps of replacing Urea pump filter.

Table 4-6 Steps of replacing Urea pump filter

1	Twist the filter cap, use the 27mm wrench	
2	Remove the balance structure	
3	Observe the color of the filter, if it is a gray color, use a gray-recording device, if it is black, use a black-recording device. The correct device is inserted into the core of the filter, until a click is heard, indicating that the device has been put into place.	

4	Remove the filter, when necessary, use a support tool to remove the filter from the groove.	
5	Use water to clean outside the filter cover.	
6	HCF filter two-side lubrication is O-gasket, (recommended using MobilVelocite No.6), use of other lubricating oil can lead to loss of lubrication effect.	
7	Tighten the filter cap, use force 20 + 5Nm, use 27mm wrench.	

Fix the Urea pump control command line, require a distance from fixed point to connector <200mm, select a fixed point along with other fixed accessories on the same vibration source.

4.11.2 Urea pump nozzle

4.11.2.1 Structure of Urea nozzle

Urea nozzle with the effect of increasing pressure into the after-discharge cluster, Figure 5-77

is appearance of urea nozzle, in which 1 end is for Urea leading and 2 ends for Urea cooling, the standard of connectors must meet SAE J2044 standard, Urea 5/16 " pipe connector standard, is similar to Urea pressure pipe.

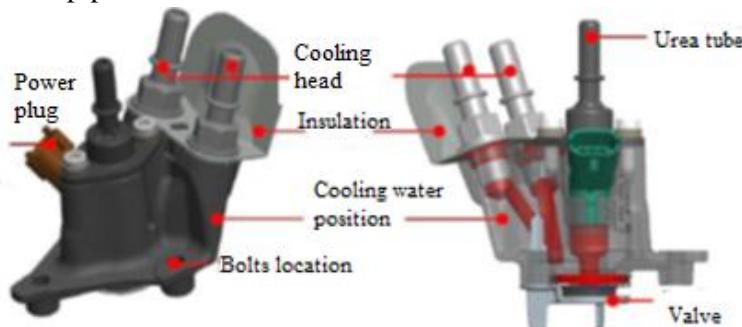


Figure 4-75 Structure of Urea nozzle

Two standard cooling ends of urea pump are 3/8 ", the cooling water will be led to cool and will have the input and the circulating end, to avoid the high urea temperature, which will make Urea useless, cooling water pipe connectors are not divided into the input - the output and can be mixed, the location of taking cooling water for cooling the urea nozzle can refer to the location of water taking and circulation of Urea tank heating cooling.

4.11.2.2 Installation of Urea nozzle

Requirement for cleaning the urea nozzle is high, as in Figure 4-76, the protective cap is removed before installing a new one.

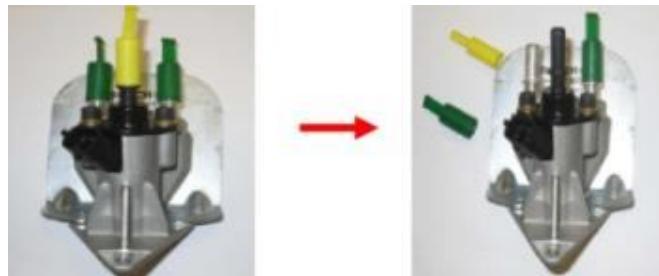


Figure 4-76 the protective cap is removed before installing a new one

In order to ensure a high-performance working system, the position of the nozzle installation must be accurate on the overall vehicle, using Weichai's integrated SCR equipment including silencer, which can be directly fitted on the Urea nozzle on the SCR contactor in the appropriate reciprocal position.

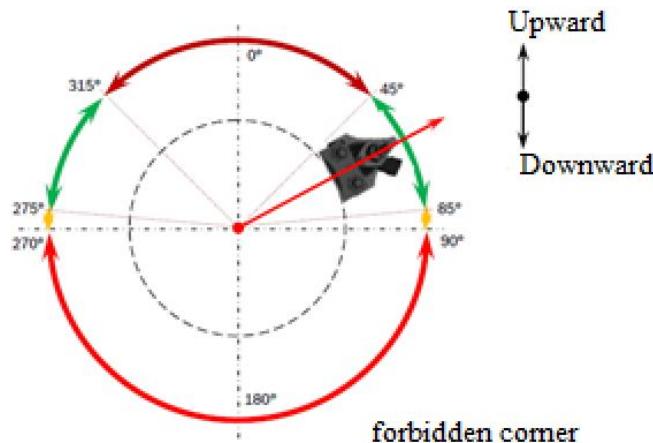


Figure 4-77 Installation of urea nozzles on straight pipes

For non-integrated SCR type silencer, installed Urea nozzle should meet Figure 3-3, optimal angle 45 ~ 85 degrees and 275-315 degrees. If the drain pipe is designed to meet the requirement on avoiding urea and soot in the exhaust gas in order not to accumulate on the pipeline, it is recommended to use 85 ~ 90 degree and 270 ~ 275 degree position. The position of 315 ~ 45 degrees is not recommended. There will be a phenomenon of overheating nozzles, 85 ~ 275 degrees is a strictly prohibited range, there is a phenomenon of precipitated Urea and blocked soot.

Installing the nozzle position on the drain pipe can be installed on straight or curved pipes. In the position of the straight drain pipe, install with an angle of 30 degrees, with the curved drain pipe, refer to figure 4-78 (right), so it should be installed in the sub-position, the urea injected in will follow the curve to inject straightly to treat the exhaust gas, It is possible to install a 3 ~ 5 degree angle with the curve, to compensate when the discharge process has deviations.

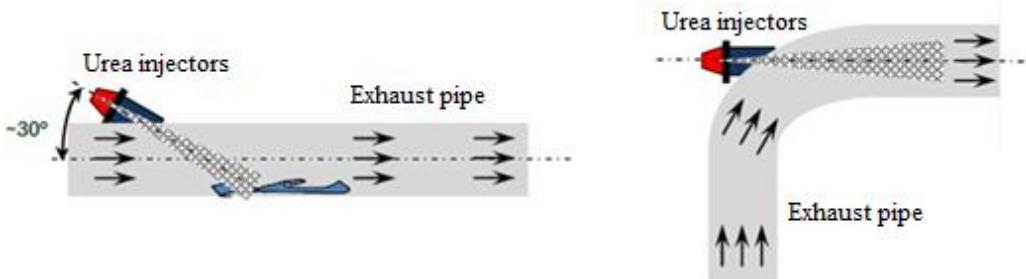


Figure 4-78 Diagram of the installing angle of urea nozzle on direct drain pipe (left) and curved drain pipe (right)

The nozzle is correctly inserted in the order as shown in Figure 4-79, so fix hole # 1 then to hole # 2 3, contact surface (screw face, and gasket) with the smallest diameter 12mm, maximum contact pressure 180N / mm², recommended tightening force of 8 ± 2Nm (friction coefficient 1fa 0.14) screw length 20mm.

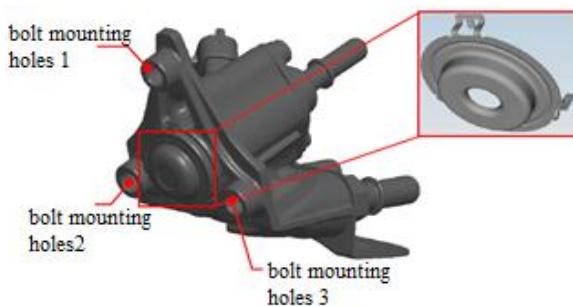


Figure 4-79 Sequence of installing the nozzle

Under the nozzle base is 1 block gasket used 1 time, so every time it is removed, it must be replaced, Figure 4-80 is the process of replacing this gasket. When replacing, do not use sharp objects to move along the border to push the gasket out, so use a clamp to push 3 points on the round gasket and pick up the gaskets, clean the surface, but avoid hitting the urea injector, then install the new gasket to the injector base.

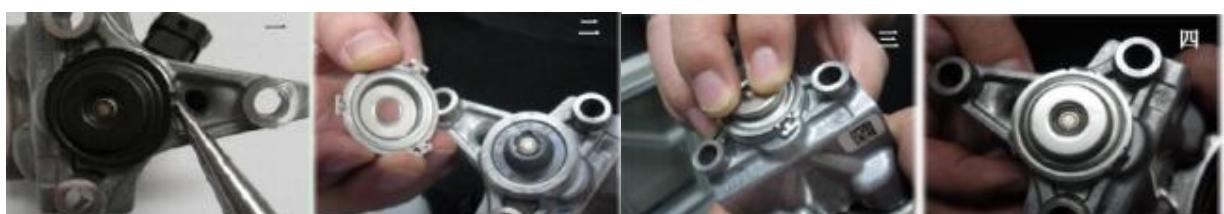


Figure 4-80 Process of replacing the gasket

Fix the nozzle control head conductor, the first fixing point to the nozzle is less than 100mm, the position of the conductor must ensure the same vibrating surface with the nozzles.

4.11.3 Urea tank

4.11.3.1 Appearance of Urea tank

Urea containers are used to contain urea solution, weichai integrated tank will be equipped with urea pump on the tank, Figure 4-81 is Weichai integrated Urea tank.

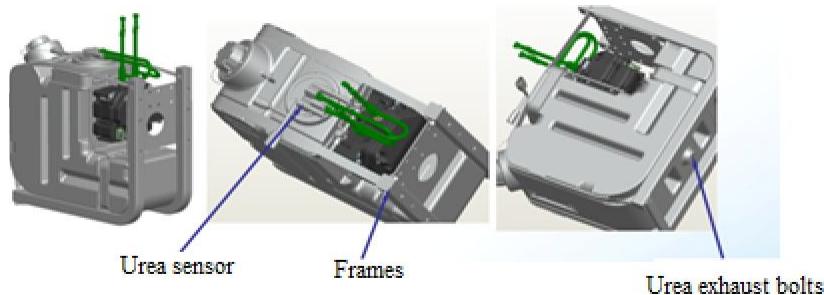


Figure 4-81 integrated Urea tank

Temperature sensor, appearance of structural urea level as shown in Figure 4-82, in which specifications of urea path connectors are as shown in Table 4-8.

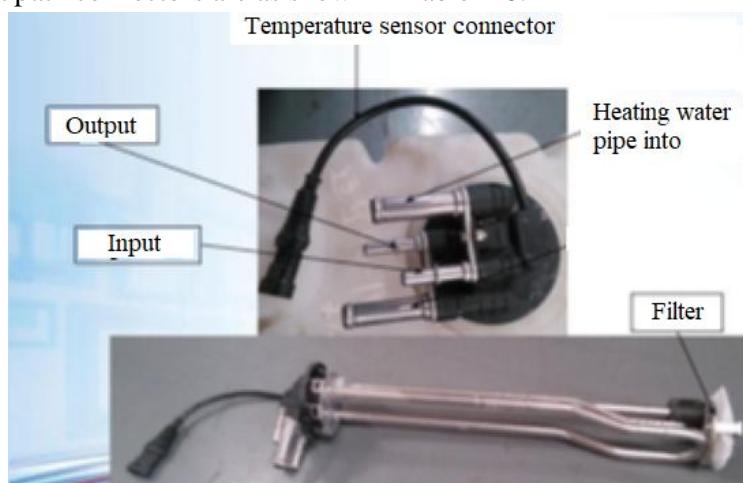


Figure 4-82 urea temperature sensor

Table 4-8 Specification of urea path connectors

Name	Specification	Description
Urea outlet pipe connector	SAE J2044 3/8"	Output, for Urea suction
Urea return connector	SAE J2044 5/16"	Input, for Urea return
Heating input	Outer diameter 14, inner diameter 10	Heating input connection
Heating output	Outer diameter 14, inner diameter 10	Heating output connection

4.11.3.2 Installation of Urea tank

Before installing the Urea tank, check the temperature sensor plugs and urea level. Figure 4-83 should protect these plugs. Avoid dirty impurities into the path, making the system unable to work.



Figure 4-83 temperature sensor plug

When installing urea tanks on vehicles, it is advisable to install away from radiant location, avoid the urea tank from being affected by engine, gearbox, catalytic treatment after SCR, drain pipes and making the urea degraded in long time.

Urea solution freezes at -11.5, when the system is in a low temperature environment, the urea is frozen, resulting in the system being unable to operate, so it should be frozen for urea, use Cooling water when cooling the engine proceeds to defrost.

The heating water system for defrosting is as shown in Figure 4-84

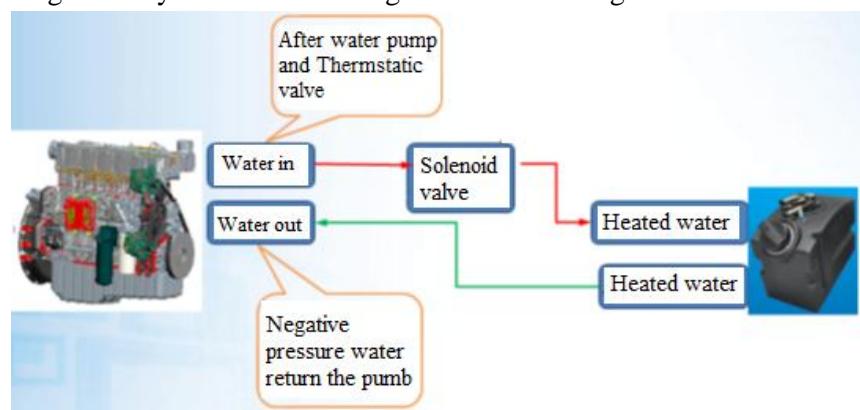


Figure 4-84 The heating water system for defrosting

4.11.3.3 Maintenance of Urea tank

- (1) When the urea tank is full, it will signal 100%, when urea is consumed at 20%, it is necessary to add more urea;
- (2) Every year upon maintenance of the engine, clean the bottom of the urea tank, discharge the sediment;
- (3) Check regularly, detect white crystallization phenomenon in gas valve or urea inlet, use water to clean, use a wet towel to dry, if detected blocked valve, should clean the valve or replace.
- (4) Replace the Urea filter every 2-3 year
- (5) Regularly check the connection points and the connector to see the status.

4.11.4 Urea pipe system

Before installing the urea pipe, ensure that the two ends are well protected, as shown in Figure 4-85, to prevent objects from entering the pipeline, affecting the work process of the system.



Figure 4-85 Check and ensure safety conditions before installation

When installing the Urea pipe, ensure proper connection, avoid wrong connection, leading to the inactive working, selection of the components must be compatible with each other, Table 4-8 specifications of compatible components.

Table 4-8 specifications of compatible components

Name	Diameter/mm	Connecting specifications	Description	Description
Urea suction pipe	Outer diameter 8, inner diameter 6	SAE J2044 3/8"	3/8 straight pipe to curved	Straight tank Curved pump
Urea pressure pipe	Outer diameter 8, inner diameter 7	SAE J2044 5/16"	5/16 straight pipe to curved	Straight pump Curved injector
Urea return pipe	Outer diameter 8, inner diameter 7	SAE J2044 5/16"	3/8 curved pipe	Straight tank
		SAE J2044 3/8"	5/16 straight	Curved pump

When installing urea pipeline, it should not be twisted or bent, if the pipe is seriously bent, the system cannot work, Figure 4-86.



Figure 4-86 The Urea pipe is seriously bent

4.11.5 SCR tank

SCR tank is divided into 2 types, box type and round cylindrical type, in which the cylindrical type has 2 types, 1 is the inlet on the flank and outlet at the back side, 1 type is inlet in the front and outlet at the back as shown in Figure 4-87, appearance of overall SCR.

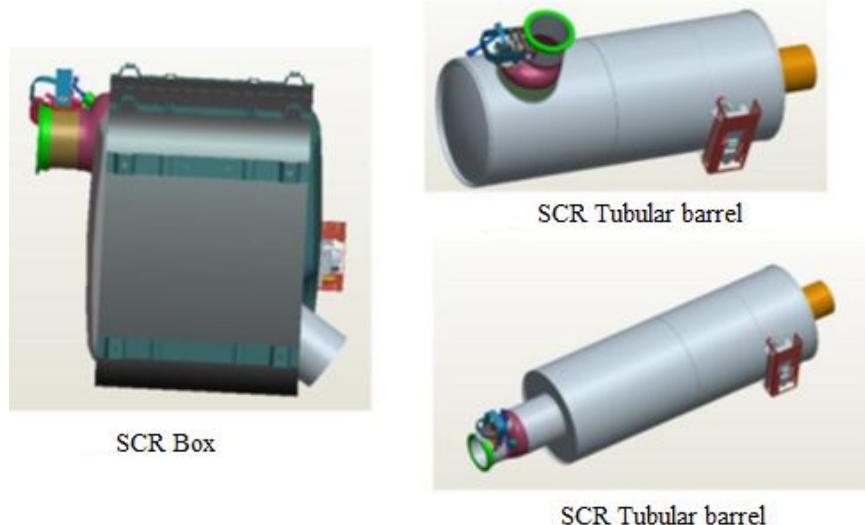


Figure 4-87. appearance of overall SCR

SCR integrates nozzles, exhaust gas sensors and NOX sensors, in order to avoid collision during movement, which make sensors and nozzles unable to work, distinguish and design protection structure for NOx sensors. as shown in Figure 4-88.

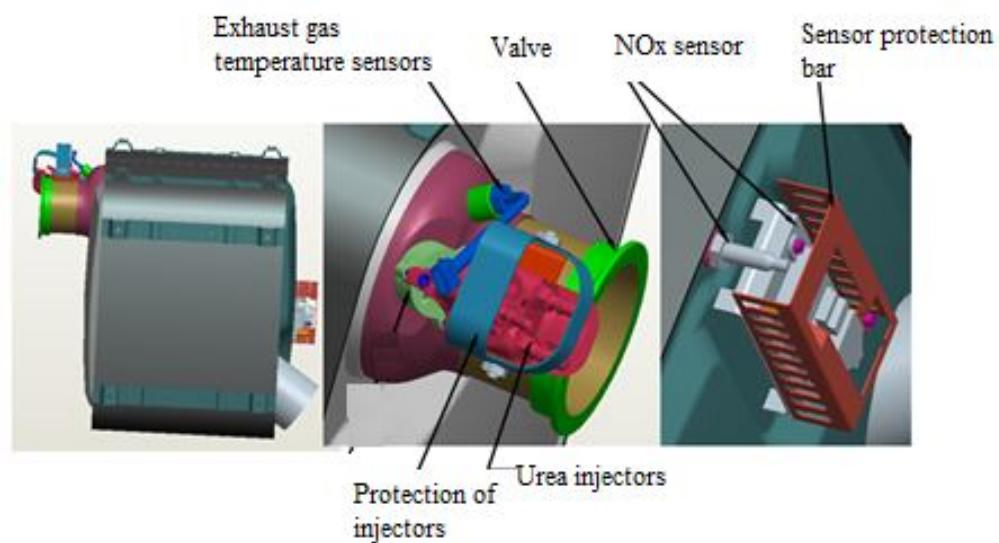


Figure 4-88 Overall SCR

4.11.6 Sensor

DeNox2.2 system, in addition to temperature sensors, urea level sensors integrated on SCR tank, there also have exhaust gas temperature sensor, NOx sensor and environmental temperature sensor.

Install the exhaust gas temperature sensor and NOx sensor perpendicular to the exhaust gas

flow, before installing the sensor, waiting for the space to meet enough for sensor installation, NOx sensor when installing with the tightening force of 50N.m, the command line should avoid high temperature area, sensor tightening force $45\text{Nm} \pm 5\text{Nm}$.

The installation location of the environmental temperature sensor needs to find a location that reflects visually the surrounding temperature, avoiding the overheating position, leading to an incorrect signal.

The NOx sensor is located at the end of SCR processing (drain pipe), the direction of installing the sensor is perpendicular to the drain pipe in the range of -80 degrees ~ 80 degrees, as shown in Figure 4-89, installing the NOx sensor.

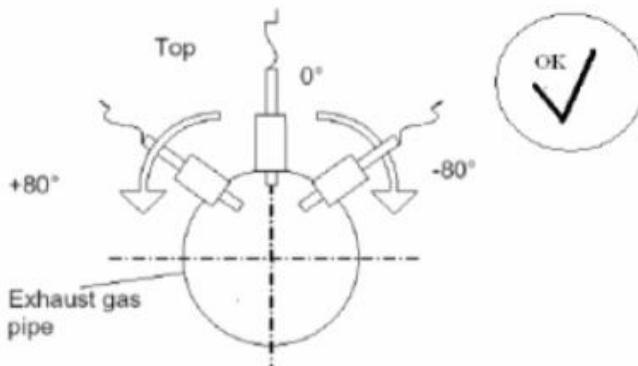


Figure 4-89 Installation of NOx sensor

Avoid the conductor shaking due to vehicle vibration during operation, leading to loose and broken plug jacks, leading to poor contact, signal transmission interruption, leading to abnormal working of system, with excess fixed conductor, when fixed, the conductor must not bend too large, otherwise for a long time, the conductor is broken, it is necessary to fix the wire $L1 > 10\text{mm}$, curve $L2 > 50\text{mm}$, angle $\alpha 45^\circ \sim 135^\circ$, specific parameters refer to Figure 4-90.

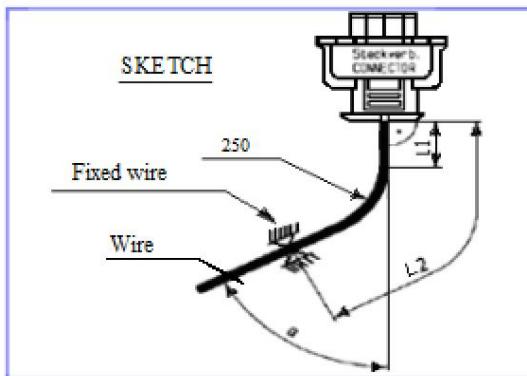


Figure 4-90 Parameters refer to conductor - sensor

When installing and fixing conductor, note that:

- (1) Make sure the command line connecting to the jack has no obstruction, ensuring dark contact, insulating.
- (2) When arranging a command line on overall vehicle, protection measures should be taken, keep away from locations with sharp structures, avoid to operate for long periods resulting in corrosion, short circuits etc.
- (3) Requires the combination of male-female jacks to be in good contact, to avoid the case of being connected but the internal contact pins in bad contact leading to unnecessary problems. At the same time, ensure stable conductor, sequential arrangement and fixed roll forming.

(4) At the jack position, make sure that the conductor is not bent, twisted, and the jack is not affected by oil - water - mixtures etc. if the metal is exposed from the protective rubber part then it is necessary to cover up to avoid short circuit.

Figure 4-91: exhaust gas temperature sensor conductor and NOx sensor are arranged and fixed together.



Figure 4-91 Standard way of conductor arrangement

4.11.7 Urea solution

Urea solution (Diesel engine exhaust treatment) referred to as DEF, in DeNox 2.2 system using the international standard with 32.5% Urea, the main components refer to table 4-9, refer to standards DIN70070/ISO22241 for more information.

table 4-9 Components of Urea solution

Name	Unit	Smallest value	Own value	Largest value
Urea	%	31.8	32.5	33.3
Ammonia	%	—	—	0.2
Biuret	%	—	—	0.3
Insoluble substance	mg/kg	—	—	20
Phosphate (PO ₄)	mg/kg	—	—	0.5
Ca	mg/kg	—	—	0.5
Fe	mg/kg	—	—	0.5
Cu	mg/kg	—	—	0.2
Zn	mg/kg	—	—	0.2
Cr	mg/kg	—	—	0.2
Al	mg/kg	—	—	0.5
Ni	mg/kg	—	—	0.2
Mg	mg/kg	—	—	0.5
Na	mg/kg	—	—	0.5
K	mg/kg	—	—	0.5

Physical properties of urea solution:

Soluble substance CO (NH₂)

Molar mass 60.06g/mol

Concentration 32.5%

Density 1090.0kg/m³

Alkalinity 9.0~9.5 Light alkaline

High corrosion properties

Colorless, mild taste

Refraction 1.3829

Frozen point -11.5°C (Concentration and frozen point refer to table 4-2)

Boiling point 103°C

Stickiness (25°C) 1.4mPa.s

Thermal conductivity (25°C) 0.570W/m.K

Heat rate (heat capacity 25°C) 340kJ/kg.K

Degree of surface expansion (20°C) 65mN/m

The solution should be stored in a closed, shady, cool place, away from oxygen solutions, when adding urea solution, if poured directly, it is easy to spread to surrounding area, leading to environmental pollution, it is recommended to use specialized tools to pour.



DEF is corrosive, in the process of pouring solution, use water to wash if touching skin or face, if pain appear, comes to see a doctor. If swallowed, do not vomit, see a doctor immediately.

4.11.8 Check and use DeNox system

According to E4 OBD standard requirements, when Urea left in the box is less than 10%, the warning light on the dashboard will be bright, whenever it needs to be added in time.

Urea solution needs to be purchased at a reliable address, currently the Urea supply market is not really formal. Avoid the case the machine is limited in operation due to unassured urea; the device is limited in operation due to lack of urea; it is possible to reserve 1 suitable amount. Avoid using other solutions to pour into Urea tank, metal impurities will affect the system, shorten life etc.

When starting the engine, when the machine operates to the revolution and the appropriate exhaust temperature DeNox2.2 system will start working, after the engine stops working, the system will switch to the reverse suction cycle, eliminate all residual urea on the pipeline, it is recommended not to disconnect the system immediately.

DeNox2.2 of system after closing the entire cycle, in the environment -40 ~ 25 degrees, stop the machine for 4 months without removing for maintenance, in case of high temperature, this maintenance period will be shortened, but in this time, it is not advisable to disconnect from electricity, so to avoid putting urea in the pump and the injector evaporating, it is recommended that when stopping the vehicle, filling the Urea to avoid reducing the urea in the pipe to be evaporated.

Time to stop the vehicle is over the recommended time, before re-operating the system, it should run idle speed, ensure normal start, steps are as follows:

1. Fill the tank with Urea
2. Replace the filter in the Urea pump
3. Start DeNox 2.2 system.

If the system is abnormal, turn off the Role Server stop system in DCU / ECU (stop time),

based on the situation to handle. Reboot the system, if the system still cannot boot, contact the warranty department.

In the process of using, need a professional error reader, warranty stations are equipped with this device.



When operating, if the MIL light is on, control the vehicle to the warranty station for repair.

In the absence of an error reader, diagnose by appearance status, the indicator light on the Urea dashboard is bright, it shows that the remaining amount of urea in the tank is not more than 10%, it is time to add more amount, additional methods refer to section 4.12.3.3

If it is necessary to replace or remove Urea nozzle, it is required to let the engine stop operating after 1 hour, the exhaust pipe is lowered to the temperature, then proceed with the work. Installation process refer to section 4.12.2.2, simultaneously note that the sealing gasket in the nozzle base is used one time, it must be replaced after each time of removing.

Vehicles operating for 3 years or every 100k km need to replace the Urea pump filter, the process of replacement refers to section 4.12.1.3.

Appendix A Error code table

Description	Blink code	P-Code	Correlated components	The problems	Causes	Solution
The grounded oil spray capacitance 2 is short-circuited	151	P062D	Fuel-injector 1-2-3	Fuel-injector or 1-2-3 do not work, affecting engine performance	The conductor of the grounded fuel-injector is short-circuited	Check the conductor, draw the conductor of fuel-injector 1-2-3 to measure the grounding resistance if the value is greater than $1M\Omega$ indicating the normal conductor
The grounded oil spray capacitance 2 is short-circuited	151	P062E	Fuel-injector 4-5-6	Fuel-injector or 4-5-6 do not work, affecting engine performance	The conductor of the grounded fuel-injector is short-circuited	Check the conductor, draw the conductor of fuel-injector 1-2-3 to measure the grounding resistance if the value is greater than $1M\Omega$ indicating the normal conductor
The grounded oil spray capacitance 1 is short-circuited to check error	426	P1581	Fuel-injector 1-2-3	Fuel-injector or 1-2-3 do not work, affecting engine performance	The conductor of the grounded fuel-injector is short-circuited	Check the conductor, draw the conductor of fuel-injector 4-5-6 to measure the grounding resistance if the value is greater than $1M\Omega$ indicating the normal conductor
The grounded oil spray capacitance 2 is short-circuited to check error	426	P1582	Fuel-injector 4-5-6	Fuel-injector or 4-5-6 do not work, affecting engine performance	The conductor of the grounded fuel-injector is short-circuited	Check the conductor, draw the conductor of fuel-injector 4-5-6 to measure the grounding resistance if the value is greater than $1M\Omega$ indicating the normal conductor
Error of opening PRV valve (actually the valve is not open)	136	P0088	High-low pressure oil lines and correlated components	Engine capacity is limited	High-low pressure oil lines and correlated components have problems	Check if the transforming valve is leaking

Oil pump works continuously in the largest spray state	136	P0088	High-low pressure oil lines and correlated components	Engine capacity is limited	High-low pressure oil lines and correlated components have problems	1. Check high - low pressure oil lines 2. Check components, control flow 3. Check fuel-injector 4, check common rail pressure sensor
When closing the cooling fins of the loading air line, the voltage signal is high	323	P2609	Shutter heats the loading air	Unusually heating the loading air	1. Shutter heating the loading air works abnormally 2. Shutter heating the loading air works abnormally	1、 Check the shutter heating the loading air with a value of about 0.4Ω 2、 Check the shutter heating the loading air and the source circuit of correlated conductor
When closing the cooling fins of the loading air line, the voltage signal is low	323	P2609	Shutter heats the loading air	Unusually heating the loading air	1. Shutter heating the loading air works abnormally 2. Shutter heating the loading air works abnormally	1、 Check the shutter heating the loading air with a value of about 0.4Ω 2、 Check the shutter heating the loading air and the source circuit of correlated conductor
When opening the cooling fins of the loading air line, the voltage signal is high	323	P2609	Shutter heats the loading air	Unusually heating the loading air	1. Shutter heating the loading air works abnormally 2. Shutter heating the loading air works abnormally	1、 Check the shutter heating the loading air with a value of about 0.4Ω 2、 Check the shutter heating the loading air and the source circuit of correlated conductor
When opening the cooling fins of the loading air line, the voltage signal	323	P2609	Shutter heats the loading air	Unusually heating the loading air	1. Shutter heating the loading air works abnormally 2. Shutter	1、 Check the shutter heating the loading air with a value of about 0.4Ω 2、 Check the shutter heating the loading air and the source circuit of correlated conductor

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is low					heating the loading air works abnormally	
The shutter of loading air continuously opens	322	P2609	Shutter heats the loading air, control relay	Heating the loading air does not work, the conductor is burned	1. Check the flange connecting the loading air heater 2. The flange heating the loading air of the conductor is short-circuited	1. Check the flange connection 2. Check that the flange heating conductor has a cut or short circuit.
When cold start, the temperature 0 is unreliable	481	P1000	Water temperature sensor	The cold start does not work	Problem with water temperature sensor	Check sensor conductors, check footpads A28, A29, check footpads A28 for 5V ground voltage? Replace the sensor, normally the sensor value of resistor is about several KΩ
When cold start, the temperature 1 is unreliable	481	P1001	Input temperature sensor	The cold start does not work	Problem with input temperature sensor	Check sensor conductors, check footpads K81, K82, check footpads K81 for 5V ground voltage? Replace the sensor, normally the sensor value of resistor is about several hundred Ω
When cold start, the temperature 2 is unreliable	481	P1002	Input temperature sensor	The cold start does not work	Problem with input temperature sensor	Check the temperature sensor of the loading air, measure the footpads A27, A42, A09, A43. Check the footpads A09, A27 for 5V ground voltage Replace the sensor, measure the voltage of the footpads 1-2 R 2KΩ
When cold start, many temperature signals are unreliable	481	P1005	Water temperature, the loading air temperature sensor, exhaust .	The cold start does not work	Water temperature, input exhaust temperature, temperature sensor	Check the loading air temperature, input exhaust temperature and water temperature sensor Replace input temperature sensor, exhaust, water temperature

The source executive component 0 is short-circuited	114	P0659	Indicat or light and loading air heater, starter motor and cuppo solenoi d valve	Related lights and solenoid valves do not work	Footpads K68, K29 and A45 is the ECU output voltage, not directly connected to the vehicle's power source	Check K68, K29, A45 when the power switch is off, is there a 24V power supply? If so, replace the electric lines of overall car
The source executive component 1 is short-circuited	115	P2671	Relate the solenoi d valve and light, no need to pay attention to after treatment	Related components do not work	K94、K92、K50、K25、K26 input source of overall car	Check K94、K92、K50、K25、K26 open circuit of 3.5V voltage, otherwise check other conductors
The source executive component 2 is short-circuited	116	P2686	Urea pump conductor	Urea pumps cannot set pump pressure	K93 has an input voltage from overall car	Draw Urea pump connector, measure the footpad K93 0 ~ 25mV voltage, otherwise, check the footpad K93 with related conductors
The ground executive component 0 is short-circuited	114	P0658	The loading air heater and indicator lights, starter relay or cuppo solenoi d valve	Related lights and solenoid valves do not work	Footpad K68-K29-A45 output ECU power supply, do not connect directly into the battery of the overall car	Check the footpads K68, K29 A45 voltage when power off is 24V, if so, change the electric lines of overall car
The ground executive component 1 is short-circuited	115	P2670	Lights and solenoi d valves connect the overall	Related components do not work	K94、K92、K50、K25、K26 input voltage of overall car	Check K94、K92、K50、K25、K26 open circuit of 3.5V voltage, otherwise check related conductors

			car, no need to pay attention to after treatment			
The ground executive component 1 is short-circuited	116	P2685	Urea pump conductor	Urea pumps cannot set pump pressure	K93 has the vehicle's input voltage	Draw Urea pump connector, measure the footpad K93 0 ~ 25mV voltage, otherwise, check the footpad K93 with related conductors
Battery voltage is high	124	P0563	Generators and batteries	ECU is broken, the engine cannot start	The voltage is too high	Check the battery Check generator Check ECU
Battery voltage is low	124	P0562	Generators and batteries	ECU does not work, the engine stops working	The voltage is too low	Check the battery Check generator Check ECU
Signal of battery voltage is too high	124	P0563	Generators and batteries	ECU is broken, the engine cannot start	Signal of voltage is too high	Check the battery Check generator Check ECU
Signal of battery voltage is too low	124	P0562	Generators and batteries	ECU does not work, the engine stops working	Signal of voltage is too low	Check the battery Check generator Check ECU
The main - secondary brake signal is not the same	223	P0504	Brakes and brake conductors	Can't judge the brakes, cannot perform stroke control, Preferential braking function is ineffective	The conductors of the main – secondary brake switch have trouble, the main - secondary brake signal is synchronized	Check the secondary brake (step on the main brake pedal K41 24V voltage, the secondary brake pedal K14 0V and check whether two brake pedals have synchronous) check the conductors of plug pin K41, K14
Brake signal has problem	223	P0571	Error message CAN	Error of brake signal from the master CAN	Corrective conductor or brake switch have trouble	Check the secondary brake (step on the main brake pedal K41 24V voltage, the secondary brake pedal K14 0V and check whether two brake pedals have

						synchronous) check the conductors of plug pin K41, K14
Point contact A of master CAN conductor has problem	411	U0073	ECU/ Nox sensor	Master CAN conductor cannot work	The CAN module in ECU fails, the contact NOx sensor is not good	Check whether the ground master CAN conductor (K54 / K76) and correlation problems are short-circuited or broken (grounded K54 2.7V, grounded K76 2.5V)
Point contact A of master CAN conductor has problem	411	U0073	ECU/ Nox sensor	In Bus OFF state, other point contacts do not exchange data with point contact A	The CAN module in ECU fails, the contact NOx sensor is not good	Check the Nox sensor connector
Cooling water temperature in static state is not reliable	242	P0116	Cooling water temperature	Engine is limited operation, Save the error code	Water temperature sensor error	Check engine temperature sensor, conductor to replace water temperature sensor
Cooling water temperature in dynamic state is not reliable	242	P0116				
Cooling water temperature of signal from master CAN conductor has problem	241	U0116	Master CAN conductor	Do not measure water temperature, Save error code	Error from the master CAN conductor having no information or error information	Check sent information and address attached content
Initial voltage of cooling water temperature sensor is higher than the limit	241	P0118	Cooling water temperature sensor	Engine is limited operation; the MIL light is on	The connection conductor has problem	Check water temperature sensor and connecting conductors
Initial voltage of cooling water temperature sensor is lower than the limit	241	P0117				
The temperature of the cooling	242	P0116		Error from engine water	When starting, the water	

water is not reliable (allowable error is higher than the limit)				temperature	temperature does not reach the setting value	
The switch signal is not reliable (Do not change the signal when the car is operating)	222	P0704	Clutch signal	Cut the cone without exiting the stroke control mode, after 3 times of operating stroke control, warning light is on	The contraction of switch is not good	Check switches and conductors
Error signal of the switch from master CAN conductor	222	U1400		Cut the cone without exiting the stroke control mode, after 3 times of operating stroke control, warning light is on	Address receiving data and content has problem	Check CAN control
OBD torque limit fails to activate	511	P1007	Torque Limit Structure	Engine is limited operation	Multi-stage torque control structure is activated, not displayed correctly	Leading to the problem is that the torque limit is removed
Error from the combination switch of the stroke monitoring control	341	P0575	Multi-function switch	Car does not set stroke control, save error codes	Stroke control switch, hold two buttons simultaneously	Check the status of switches and conductors
Battery voltage is too high	124	P0563	Battery	The plug pin's source of the entire diagnostic actuator is closed Save the error code	The battery has an electrical leak or the contact wire is not good	Replace the battery / Replace the conductor
Battery voltage is too low	124	P0562				

Cuppo signal is not reliable	342	P1500	Cuppo solenoid valve	Cuppo has no effect, save the error code	Problems from cuppo solenoid valve, cuppo conductor	Check the cuppo power line, replace the cuppo solenoid valve
The engine stop switch in the engine compartment is not reliable	343	P2536	The engine stop switch in the engine compartment	The engine stop switch in the engine compartment does not work, Save the error code	The engine stop switch in the engine compartment is pressed for too long	Check if the switch is stuck, the conductor is short-circuited
The engine stop switch in the engine compartment is not reliable	343	P2536	The engine stop switch in the engine compartment	The engine stop switch in the engine compartment does not work, Save the error code	The engine stop switch in the engine compartment is pressed for too long	Check if the switch is stuck, the conductor is short-circuited
EEP deletes the error	117	P062F	Data storage structure of ECU	Problem from ECU, Save the error	Internal ECU error	Disconnect and restart, replace ECU
EEP reads the error	117	P062F		Read the error data, use another value instead, save the error code		
EEP enters the error	117	P062F		Problems from ECU, Save the error code		
The engine proposes to disconnect the machine leading to oil spraying	512	P1008	Fuel-injector, engine shutdown system	Engine stall, problems of light		
Engine of revolution is high	513	P0219	Control mechanism of revolution	Engine is limited operation, Save the error code	The engine revolution is higher than the allowable limit	Disconnect and restart
Activate	514	P1009				

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protection mode						
Output revolution without load	344	P100A	The output jewel's revolution	Through the connect jewel does not receive the revolution, save the error code	The output jewel connection line is short-circuited, broken circuit	Reconnect the conductor
The output revolution temperature is too high	344	P100B				
The source output is short-circuited	344	P100C				
The ground output is short-circuited	344	P100D				
Environmental pressure signal from CAN conductor is faulty	232	U1401	Sensor of environmental pressure signal (Internal ECU)	Flash light fails, operating in highland environment, so the engine is weak, smoke is black	Internal ECU pressure sensor fails	Replace ECU
The voltage of Environmental pressure signal sensor from CAN conductor is higher than the limit	232	P2229				
The voltage of Environmental pressure signal sensor from CAN conductor is lower than the limit	232	P2228				
Environment temperature sensor has an unreliable signal	235	P0071	Environment temperature sensor	Post-processing system unusually work, save the error code	Environment temperature sensor and flow sensor take the difference value too large	Check the environment temperature sensor
Voltage of environment temperature sensor is higher than the limit	235	P0073		The environment temperature is not collected, the MIL	The source and ground power line are short-circuited	Check the environment temperature sensor
Voltage of	235	P0072				

environment temperature sensor is lower than the limit				light is on		
Camshaft sensor signal error	123	P0341	Camshaft revolution sensor	Difficult start, weak engine, MIL light is on	Camshaft revolution sensor is broken	Check the revolution sensor conductor of the camshaft
Error of defective camshaft sensor signal	123	P0340			Camshaft revolution sensor is broken, the conductor is short-circuited	Replace the camshaft revolution sensor, check the conductor
Camshaft signal is deviated from camshaft sensor	123	P0340			Crankshaft and camshaft install wrongly	Replace camshaft sensor
Camshaft sensor signal error	122	P0336	The sensor of crankshaft revolution	Difficult start, weak engine	Install sensor of crankshaft revolution incorrectly, conductor lost link, flywheel processing has problems	Check the sensor of the crankshaft, conductor, flywheel processing
Defective camshaft sensor signal	122	P0335			Install the cuppo solenoid valve incorrectly	Check the conductor
Cuppo solenoid valve without load	311	P0475	Cuppo solenoid valve	Cuppo is ineffective, after 3 times of operation, Incident light is on	The solenoid valve is broken	Replace the solenoid valve
Solenoid valve has high temperature	311	P0475			The cuppo conductor is short-circuited	Check the cuppo conductor
The source cuppo solenoid valve is short-circuited	311	P0478			The cuppo conductor is short-circuited	
The ground cuppo solenoid valve is short-circuited	311	P0477				
Cuppo solenoid valve has unreliable status	311	P0476	The cuppo solenoid valve	Cuppo lost its effect	Check if the impulse of the solenoid valve is standard	Check the K29 / K47 solenoid valve connection Check that the cuppo solenoid valve is broken
Cuppo solenoid valve has error status	311	P0475	The cuppo solenoid valve	Cuppo lost its effect	Check if the impulse of the cuppo solenoid valve	Check the K29 / K47 solenoid valve connection Check that the cuppo solenoid valve is broken

					is standard	
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Solenoid valve of paddle 1 does not load	312	P0480	Electro magnetic fan	The coil of the Electromagnetic Fan 1 does not work	The connection of Electromagnetic Fan 1's relay is not good	Check the Electromagnetic Fan Check that the conductor is normal Check if the fan is broken
Solenoid valve of paddle 2 does not load	312	P0480	Electro magnetic fan	The coil of the Electromagnetic Fan 2 does not work	The connection of Electromagnetic Fan 2's relay is not good	Check the Electromagnetic Fan Check that the conductor is normal Check if the fan is broken
Solenoid valve of paddle 1 has high temperature	312	P0480	Electro magnetic fan	The coil of the Electromagnetic Fan 1 does not work	The relay of the Electromagnetic Fan is broken or the resistor is too small	Check if the electromagnetic fan relay is broken Check the relay's indicator of the electromagnetic fan (R) is suitable Check that the two relay controllers are short-circuited
Solenoid valve of paddle 2 has high temperature	312	P0480	Electro magnetic fan	The coil of the Electromagnetic Fan 2 does not work	The relay of the Electromagnetic Fan is broken or the resistor is too small	Check if the electromagnetic fan relay is broken Check the relay's indicator of the electromagnetic fan (R) is suitable Check that the two relay controllers are short-circuited
The source solenoid valve of paddle 1 is short-circuited	312	P0692	Electro magnetic fan	The coil of the Electromagnetic Fan 1 does not work	The coil 1 of the source control head is short-circuited	Remove the coil 1, check the voltage of the plug is 0 Check if the Electromagnetic Fan is broken
The source solenoid valve of paddle 2 is short-circuited	312	P0692	Electro magnetic fan	The coil of the Electromagnetic Fan 2 does not work	The coil 2 of the source control head is short-circuited	Remove the coil 2, check the voltage of the plug is 0 Check if the Electromagnetic Fan is broken
The ground solenoid valve of paddle 1 is short-circuited	312	P0691	Electro magnetic fan	The coil of the Electromagnetic Fan 1 does not work	The coil 1 of the source control head is short-circuited	Remove the coil 1, check the end of the conductor and land with extremely large resistors

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The ground solenoid valve of paddle 2 is short-circuited	31 2	P0691	Electro magnetic fan	The coil of the Electromagnetic Fan 2 does not work	The coil 2 of the source control head is short-circuited	Remove the coil 2, check the end of the conductor and land with extremely large resistors
PWM fan power does not load	31 2	P0481	Electrically controlled silicon oil fan	Fan does not work	Electrically controlled silicon oil fan with solenoid valve has an open circuit	Check fan switch Check conductor and connector Check that the fan switch is broken
PWM fan source has high temperature	31 2	P0481	Electrically controlled silicon oil fan	Fan does not work	The coil of electronically controlled fan is broken	Check 24V relay, if not broken, replace the new switch for the fan
The source PWM fan is short-circuited	31 2	P0694	Electrically controlled silicon oil fan	Fan does not work	Electromagnetic signals PWN of the high-voltage end of the fan with the ground is short-circuited	Check fan switch Check conductor and connector Check that the fan switch is broken
The ground PWM fan is short-circuited	31 2	P0693	Electrically controlled silicon oil fan	Fan does not work	Electromagnetic signals PWN of the high-voltage end of the fan with the ground is short-circuited	Check fan switch Check conductor and connector Check that the fan switch is broken
The time between the two signals of the paddle's rotation is too long	31 6	P0480	Electrically controlled silicon oil fan	Fan does not work	The distance between two impulse signals of the fan is too short	Check that in the normal state, the fan switch is turned on Check that the sensor fan switch is broken
Fan rotation speed is higher than the set value	31 6	P0495	Electrically controlled silicon oil fan	Fan's revolution is not correct	The sensor is broken or data is not suitable	Check the fan's revolution sensor Check if the fan with crankshaft revolution has too large gear ratios Check the data

Fan rotation speed is lower than the set value	31 6	P0494	Electronically controlled silicon oil fan	Fan's revolution is not correct	The sensor is broken or data is not suitable	Check the fan's revolution sensor Check if the fan with crankshaft revolution has too large gear ratios 3、检查数据。Check the data
The sensor voltage in oil with water is higher than the limit	21 4	P2267	Raw filter or integrated filter assembly (oil pump, sediment removal, water filter)	Save the error code	Have not installed sensor	Note: Sensor error in oil with water using simulation signal, there is no error in the immediate future
The sensor voltage in oil with water is lower than the limit	21 4	P2266	Raw filter or integrated filter assembly (oil pump, sediment removal, water filter)	Save the error code	The ground signal sensor conductor is short-circuited	Note: Sensor error in oil with water using simulation signal, there is no error in the immediate future
There is too much water in oil	21 1	P2269	Raw filter or integrated filter assembly (oil pump, sediment removal, water filter)	The oil in the engine has too high water	The cup containing the raw water is too much	Remove the water from the raw filter
More numbers of CAN wires have faulty input signal	22 7	U1402	MORE signal	Save the error code	The master CAN conductor collects the data in MORE number state incorrectly	This error is currently unavailable, if it appears it needs to turn off the program

The light heating the loading air has no load	33 2	P0381	Heating the loading air	The indicating light of heating the loading air does not work	Light are not installed or the conductors are open	Check if the light is broken, the conductor is connected to ECU (K68 / K48)
The light heating the loading air is too hot	33 2	P0381	Heating the loading air	The indicating light of heating the loading air does not work	Light parameters are inconsistent or conductors have problem	The resistance index of the light is suitable
The source light heating the loading air is short circuited	33 2	P0381	Heating the loading air	The indicating light of heating the loading air does not work	The conductor of the light has a problem	Check that the signal of K48 footpad for the source is short circuited
The ground light heating the loading air is short circuited	33 2	P0381	Heating the loading air	The indicating light of heating the loading air does not work	The conductor of the light has a problem	Check that the signal of K48 footpad for the ground is short circuited
Heating the loading air has no load	32 1	P0110	Relay of heating the loading air	Heating the loading air is ineffective	Relay of heating the loading air is not installed or the conductors are open	1 Check if the heating relay when loading, with ECU (K68/ K72) are connected; 2. Is the role broken?
Heating the loading air is too hot	32 1	P0110	Relay of heating the loading air	Heating the loading air is ineffective	Relay of heating the loading air are inconsistent or the conductors have a problem	Check that the index of the heating relay is appropriate
Heating the loading air for the source is short circuited	32 1	P0113	Relay of heating the loading air	Heating the loading air is ineffective	Relay of heating the loading air and conductors have problem	Check that the heating relay of the control head K72 for the source has a short circuit
Heating the loading air for the ground is short	32 1	P0112	Relay of heating the loading	Heating the loading air is ineffective	Conductors of the relay of heating the loading air have problem	Check that the heating relay of the control head K72 for the ground has a short circuit

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circuited			air			
The number of sprays exceeds the control circuit limit	32 4	P100E	ECU	Incident light is on	The ECU power supply voltage is too low	Check battery and supply, Check the generator
The number of sprays exceeds the limit of high-pressure pumps	32 4	P100F	Common rail high pressure pump	Incident light is on	High pressure pump flow is too large, positive deviation exceeds 50Mpa	Check that the flow control components are broken
The number of sprays exceeds the system limit	32 4	P1010	ECU	Incident light is on	The number of sprays exceeds 5 times	Check standard data
The number of sprays exceeds the system limit	32 4	P1011	ECU	Incident light is on	The number of sprays exceeds 5 times	Check standard data
The pressure of common rail is lower than the set value	27 6	P0087	ECU/ Fuel-injector	Incident light is on	The pressure of common rail is below the lower limit value	Check the spray nozzle, replace the ECU
The capacitance of oil spray 1 is short-circuited	15 1	P062D	Fuel-injector	Incident light is on	Conductors of the fuel-injector 1-2-3 are short-circuited	Check if the conductors of fuel-injector 1-2-3 are working Check that the pillar of the conductor is loose
The capacitance of oil spray 2 is short-circuited	15 1	P062E	Fuel-injector	Incident light is on continuously	Conductors of the fuel-injector 4-5-6 are short-circuited	Check if the conductors of fuel-injector 4-5-6 are working Check that the pillar of the conductor is loose
Error of dedicated chip for oil spray control	15 3	P062B	ECU	Engine stall	Internal ECU CY33x chip fails	Replace ECU
The circuit of the fuel-injector 1 is open	14 1	P0201	Fuel-injector	The OBD light is on continuously, the engine does not work	The connection of the conductor of engine 1 is not good	Check that the pillar of the conductor of the engine 1 is fixed Check the connector A33, A16 with ECU is good

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The circuit of the fuel-injector 2 is open	14 2	P0205	Fuel-inj ector	The OBD light is on continuously, the engine does not work	The connection of the conductor of engine 2 is not good	Check that the pillar of the conductor of the engine 2 is fixed Check the connector A48, A18 with ECU is good
The circuit of the fuel-injector 3 is open	14 3	P0203	Fuel-inj ector	The OBD light is on continuously, the engine does not work	The connection of the conductor of engine 3 is not good	Check that the pillar of the conductor of the engine 3 is fixed Check the connector A47, A17 with ECU is good
The circuit of the fuel-injector 4 is open	14 4	P0206	Fuel-inj ector	The OBD light is on continuously, the engine does not work	The connection of the conductor of engine 4 is not good	Check that the pillar of the conductor of the engine 4 is fixed Check the connector A46, A03 with ECU is good
The circuit of the fuel-injector 5 is open	14 5	P0202	Fuel-inj ector	The OBD light is on continuously, the engine does not work	The connection of the conductor of engine 5 is not good	Check that the pillar of the conductor of the engine 5 is fixed Check the connector A31, A01 with ECU is good
The circuit of the fuel-injector 6 is open	14 6	P0204	Fuel-inj ector	The OBD light is on continuously, the engine does not work	The connection of the conductor of engine 6 is not good	Check that the pillar of the conductor of the engine 6 is fixed Check the connector A32, A02 with ECU is good
The circuit of the fuel-injector 1 is short circuited	14 1	P0262	Fuel-inj ector	The OBD light is on continuously, the engine does not work	Check the correlation of the fuel-injector of the high-low voltage ends with short circuit	Check the correlation conductor of the fuel-injector
The circuit of the fuel-injector 2 is short circuited	14 2	P0274	Fuel-inj ector	The OBD light is on continuously, the engine does not work	Check the source fuel-injector with short circuit	
The circuit of the fuel-injector 3 is short circuited	14 3	P0268	Fuel-inj ector	The OBD light is on continuously, the engine does not work		
The circuit of the fuel-injector	14 4	P0277	Fuel-inj ector	The OBD light is on continuously		

4 is short circuited				y, the engine does not work		
The circuit of the fuel-injector 5 is short circuited	14 5	P0265	Fuel-injector	The OBD light is on continuously, the engine does not work		
The circuit of the fuel-injector 6 is short circuited	14 6	P0271	Fuel-injector	The OBD light is on continuously, the engine does not work		
The circuit of the fuel-injector 1 with low and high voltage is short-circuited	14 1	P0261	Fuel-injector	The OBD light is on continuously, the engine does not work		
The circuit of the fuel-injector 2 with low and high voltage is short-circuited	14 2	P0273	Fuel-injector	The OBD light is on continuously, the engine does not work	Check the correlation of the fuel-injector of the high-low voltage ends with short circuit	Check the correlation conductor of the fuel-injector
The circuit of the fuel-injector 3 with low and high voltage is short-circuited	14 3	P0267	Fuel-injector	The OBD light is on continuously, the engine does not work		
The circuit of the fuel-injector 4 with low and high voltage is short-circuited	14 4	P0276	Fuel-injector	The OBD light is on continuously, the engine does not work		
The circuit of the fuel-injector 5 with low	14 5	P0264	Fuel-injector	The OBD light is on continuously, the		

and high voltage is short-circuited				engine does not work		
The circuit of the fuel-injector 6 with low and high voltage is short-circuited	14 6	P0270	Fuel-injector	The OBD light is on continuously, the engine does not work		
Voltage of PTO switch exceeds the limit	34 5	P251C	Fuel saving switch	Save the error code The connection of fuel-saving switch is not good		Remove and check the switch, check ECU, Footpads K79 with 5V voltage Check footpads K79, K74 and the switch in the status of serial footpad?
The connection of ECU and flow control components is not good	13 3	P0251	Flow control components	Light alarming errors is on continuously, engine is limited operation The connection of flow control components' conductor is not good		Check that flow control components are fixed, sure
Component circuit for flow control is open	13 3	P0251	Flow control components	Light alarming errors is on continuously, engine is limited operation The connection of flow control components' conductor is not good		Plug surely flow control components Check if the conductor is broken
Flow control components are too hot	13 3	P0252	Flow control components	Light alarming errors is on continuously, engine is limited operation The flow control component is broken		Replace flow control components
The high voltage of flow control components for soured is short-circuited	13 3	P0254	Flow control components	Light alarming errors is on continuously, engine is limited operation A04 high voltage exceeds the battery voltage		Check if the A04 conductor has good connection, disconnect the Flow Control Component, the voltage is 24V
The high voltage of flow control	13 3	P0253	Flow control compon	Light alarming errors is on A04 voltage for the ground is short		Check if the A04 conductor has good connection, disconnect

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components for ground is short-circuited			ents	continuousl y, engine is limited operation	circuited	the Flow Control Component, the voltage is 24V
The power circuit of the low voltage power flow control component for the source is short-circuited	13 3	P0254	Flow control components	Light alarming errors is on continuousl y, engine is limited operation	A04 voltage for the source is short circuited	Disconnect the Flow Control Components, measure the voltage A05, U =3.5V
The power circuit of the low voltage power flow control component for the ground is short-circuited	13 3	P0253	Flow control components	Light alarming errors is on continuousl y, engine is limited operation	The ground A04 is short circuit	Disconnect the Flow Control Components, measure the voltage A05, U =3.5V
The line of components controls the high voltage feedback flow is higher than the limit	13 3	P0254	Flow control components	Light alarming errors is on continuousl y, engine is limited operation	Flow control components have not good connectors	Disconnect the Flow Control Components, measure the voltage A05, U =3.5V, A04 U=24V
The line of components controls the low voltage feedback flow is lower than the limit	13 3	P0253	Flow control components, Valves limiting common rail bars, common rail, oil galleries	Engine is limited operation	Transforming valve is open, oil galleries are broken	Check if the transforming valve is normal Check the oil galleries
MIL light has no load	33 1	P0650	OBD light	OBD light does not work	1. The MIL light is broken	Check if the MIL light is normal Disconnect the

					or the connection is not good 2. Single control	diagnostic MIL light
MIL light is too hot	33 1	P0650	OBD light	OBD light does not work	The OBD incident light control circuit is overloaded	Check OBD indicator lights and conductors
MIL light for the source is short-circuited	33 1	P0650	OBD light	OBD light does not work	Control circuit of OBD incident light for the source is short circuited	Use meter to check that MIL light is connected to the source Remove the connector and reinstall it
MIL light for the ground is short-circuited	33 1	P0650	OBD light	OBD light does not work	Control circuit of OBD incident light for the ground is short circuited	Use meter to check that MIL light is connected to the source Remove the connector and reinstall it
Voltage of PTO switch is lower than limit (multi-status switch)	34 5	P251B	Multi-status switches and conductor, connectors	Multi-status switches cannot be applied	Check fuses, conductor 2 and connectors Check switches	Check that the power supply is normal Check that the switch resistor is normal
Error of control data conversion	26 2	P060B	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Error of the digital data conversion ratio coefficient	26 2	P060B	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Error of the digital data conversion ratio coefficient	26 2	P060B	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 2	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange	26	P060C	ECU	The engine is not	Error of ECU hardware	Replace the new ECU

between CPU and monitoring module fails	2			working properly		
Error of saving ECU data	26 2	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data	26	P060C	ECU	The engine	Error of ECU	Replace the new ECU

exchange between CPU and monitoring module fails	3			is not working properly	hardware	
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Data exchange between CPU and monitoring module fails	26 3	P060C	ECU	The engine is not working properly	Error of ECU hardware	Replace the new ECU
Voltage signals of 2 accelerating agents are not the same	26 4	P1012	Accelerating agent, conductor, ECU	Aperture of accelerating agent loses its effect	Incident of accelerating agent, incident of internal ECU	<ol style="list-style-type: none"> Check the APP1 and APP2 accelerating agent with twice the voltage Replace the accelerating agent Check that the accelerating agent and conductor are short circuited, broken. Replace ECU
Revolution signals are not reliable	26 4	P1013	Unreliable revolution signal	Incident light is on continuously		
Power supply time for the fuel-injector is not reliable	26 4	P1014	ECU/fuel-injector	Incident light is on continuously	Error of ECU hardware	<ol style="list-style-type: none"> Disconnect the power of the overall car more than 30 seconds Replace ECU
Early spray angle is not reliable	26 4	P1015		Incident light is on continuously		
When OverRun supplies power, the time exceeds the setting	26 1	P101A	ECU	Incident light is on continuously	Error of ECU hardware	<ol style="list-style-type: none"> Disconnect the power of the overall car more than 30 seconds Replace ECU

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When OverRun supplies power to the fuel-injector, the time exceeds the allowed limit	26 1	P101A	ECU	Incident light is on continuousl y	Error of ECU hardware	1. Disconnect the power of the overall car more than 30 seconds 2. Replace ECU
Error of common rail pressure	26 4	P101C	Common rail sensors, high pressure pumps, flow control components, high-low-pressure oil galleries	Effect of operation overall car or engine operation limit	Correlation incidents as above	Check the correlation components as above
Accelerating agents from 2 voltage sources are not the same	26 4	P1045	Remote accelerating agents, conductors, ECU	Acceleratin g agents speeding up remotely loss its effect	Incident of accelerating agent, incident of internal ECU	1. Check the APP1 and APP2 accelerating agent with twice the voltage 2. Replace the accelerating agent 3. Check that the accelerating agent and conductor are short circuited, broken. 4. Replace ECU
Power supply module 1 has a voltage exceeding the limit	26 5	P1600	ECU, Battery, generator	ECU cannot work normally, affecting operation	Supply 1 has too high supply voltage	1. Check the APP1 and APP2 accelerating agent with twice the voltage 2. Replace the accelerating agent 3. Check that the accelerating agent and conductor are short circuited, broken. 4. Replace ECU
Power supply module 1 has a low voltage below the limit	26 5	P1601	ECU, Battery, generator	ECU cannot work normally, affecting operation	Supply 1 has too low supply voltage	1. Check the APP1 and APP2 accelerating agent with twice the voltage 2. Replace the

						accelerating agent 3. Check that the accelerating agent and conductor are short circuited, broken. 4. Replace ECU
The ECU suppling the Relay opens too soon	12 5	P068A	ECU	Save the error code	Electrical component relays in ECU work abnormally	Check ECU Replace ECU
The main relay cannot be disconnected	12 5	P068B	ECU	Save the error code	Electrical component relays in ECU work abnormally	Check ECU Replace ECU
The signal of oil pressure has problem	24 3	P0524	Oil pressure sensor is digitized	After 3 times of periodic operation, error code light is on, the engine is limited operation	The lubricating oil pressure is low	WEICHAI does not use a digital type lubricating oil pressure sensor, in this program the problem is turned off
The signal of oil pressure is not reliable	24 3	P0521	Oil pressure sensor is digitized	After 3 times of periodic operation, error code light is on, the engine is limited operation	Engine shutdown, lubricating oil pressure still exists	WEICHAI does not use a digital type lubricating oil pressure sensor, in this program the problem is turned off
Oil pressure exceeds the upper limit	24 3	P0523	Oil pressure sensor value is emulati on	Save the error code, the engine is limited operation	The lubricating oil pressure is high	1. Use the error reader to check the lubricating oil pressure that exceeds the allowable value WP10 & WP12 : 7800hPa WP7 : 10000hPa 2. Replace the lubricating oil sensor 3. Check that the lubricating oil pump, the pressure relief valve of oil galleries is broken

Oil pressure is below the lower limit	24 3	P0524	Oil pressure sensor value is emulation	Save the error code, the engine is limited operation	The lubricating oil pressure is too low	1. Use the error reader to check the lubricating oil pressure that exceeds the allowable value 1600hPa 2. Replace the lubricating oil sensor 3. Check that the lubricating oil pump, the pressure relief valve of oil galleries is broken
						Reinstall the program, turn off the above problem
The lubricating oil pressure signal has problem from CAN conductor	24 3	P0520	Oil pressure sensor value is emulation	Save the error code, the engine is limited operation	Turn off the above problem in the program, the actual lubricating oil pressure signal through the sensor is transmitted to ECU	
The oil pressure voltage signal exceeds the limit	24 3	P0523	Oil pressure sensor value is emulation	Save the error code, after 3 times of periodic operation, error code light is on	Footpad A44 has U> 4.5V voltage	1. Footpad A44 is not well connected to the sensor 2. Footpad voltage A44> 5V, power cord is short circuited
The voltage signal of the oil pressure is below the limit	24 3	P0522	Oil pressure sensor value is emulation	Save the error code, after 3 times of periodic operation, error code light is on	Voltage of the footpad A44 <215mV	Footpad A44 for the ground is short circuited
Oil temperature signal is too high	24 4	P0196	The lubricating oil temperature sensor	Save the error code	The lubricating oil temperature exceeds the allowable level of 125 degrees	1. Check the actual lubricating oil temperature is too high? 2. Replace the lubricating oil temperature sensor
Error of oil temperature signal from master CAN conductor	24 4	U1403	The lubricating oil temperature	Save the error code	From CAN conductor, there is lubricating oil temperature =	ECU does not receive the lubricating oil temperature signal from CAN, reinstall the program, turn off

			sensor		0	this problem
The voltage signal of the oil temperature sensor exceeds the limit	24 4	P0198	The lubricating oil temperature sensor	Save the error code, after 3 times of periodic operation, error code light is on	Footpad A59 have voltage U>4.97V	Check that footpad A59 is well connected to the connection sensor. Footpad A59 have voltage U> 5V. power cord is short circuited
The voltage signal of the oil temperature sensor is below the limit	24 4	P0197	The lubricating oil temperature sensor	Save the error code	Footpad A59 have voltage below 144mV	Footpad A50 for the ground is short circuited
The lubricating oil temperature signal is not reliable	24 4	P0196	The lubricating oil temperature sensor	Save the error code	Compare the value of the lubricating oil temperature to other temperatures is exceeded	Check that the temperature of lubricating oil, water, and loading air are normal Based on each step of checking the correlation sensor
The flow of oil being transformed is not monotonous	24 5	P1031	ECU standard data	Save the error code	Standard data is not monotonous	Contact the governing agency to check the data, fix it and reset the data
The input pressure signal of the exhaust exceeds the limit	23 1	P006D	The input loading air pressure	Save the error code	When stopping the car, the loading air pressure is greater than the atmospheric pressure 200hpa	Check the atmospheric pressure value, if the error is too large, replace the ECU 2. Check the loading air pressure with the atmospheric environment, if the error is too large, replace the sensor
The input pressure signal of the exhaust is lower than the limit	23 1	P006D	The input loading air pressure	Save the error code	When stopping the car, the loading air pressure is greater than the atmospheric pressure 200hpa	Check the atmospheric pressure value, if the error is too large, replace the ECU 2. Check the loading air pressure with the atmospheric environment, if the error is too large, replace the sensor
The voltage signal of the	23	P0238	The input	Save the error code	The footpad A43 has	The footpad of A43 is not well connected to

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input pressure sensor when loading is too high	1		loading air pressure		voltage >4.92 V	the sensor The footpad A43 has voltage U> 5V, power cord is short circuited
The voltage signal of the input pressure sensor when loading is lower than the limit	23 1	P0237	The input loading air pressure	Save the error code	The footpad A43 has voltage <202mV	The footpad A43 for the ground is short circuited
Open the transforming valve	13 4	P0089	The oil galleries	The flash is always on	The common rail pressure exceeds the allowable limit, the number of times exceeds 50 times	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
The common rail pressure is too large, leading to the transforming valve opening	13 7	P0089	The oil galleries	The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
Common rail vibrations lead to open transforming valve	13 8	P0089	The oil galleries	The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
Open transforming valve	13 5	P0089	The oil galleries	Error code light is on continuously The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
When the transforming valve opens, oil flow balance has problem	13 6	P1036	The oil galleries	Error code light is on continuously The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
The average	13	P1037	The oil	Error code		

pressure exceeds the allowed range	6		galleries	light is on continuously The engine is limited operation		
When the transforming valve opens, the time reaches the limit	13 6	P0089	The oil galleries	Error code light is on continuously The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
The ECU supplying power to monitor the module has problem	11 1	P060C	ECU	Error code light is on continuously	Internal incident ECU	Replace ECU
Structure of common rail control with positive deviation exceeds the limit	25 1	P0251	The oil galleries	Error code light is on continuously The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
The flow of high-pressure pumps exceeds the limit - there is leakage	25 2	P0251	The oil galleries	Error code light is on continuously The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
The flow of the pump is small, resulting in common rail pressure control structure with negative deviation higher than the limit of phase 1	25 5	P0251	The oil galleries	Error code light is on continuously The engine is limited operation	The common rail pressure exceeds the allowable limit	Check that the oil galleries are twisted, curved Check flow control components Check common rail pressure sensors
The flow of the pump is small, resulting in common rail	25 3	P0251				

pressure control structure with negative deviation higher than the limit of phase 2						
The common rail pressure is below the limit	25 6	P0087	High-low oil pressure galleries	Difficult start, operating limit, open transforming valve, large amount of leaked oil return, high oil return temperature	The pressure of the loading air is heavily blocked, the oil galleries enters with air leak, the oil return galleries have high resistance	Check the oil galleries of the engine, if necessary, replace filter and oil galleries
Common rail pressure exceeds the limit of phase 1	27 1	P0088	Components to control the flow and conductor	The engine is limited operation	Flow control is open, the conductor improperly installs, resulting in flow control without source, flow and being blocked	Check the vent, flow control components and conductors
Common rail pressure exceeds the limit of phase 2	27 2	P0088	Components to control the flow and conductor	The engine is limited operation	Flow control is open, the conductor improperly installs, resulting in flow control without source, flow and being blocked	Check the vent, flow control components and conductors
When overrun, the parameter setting for flow high-pressure pump is higher than the limit	27 3	P1050	High pressure pump oil galleries, fuel-injector, transforming valve	The engine is limited operation	Fuel-injector, transforming valve are not closed	Check the oil galleries (high- and low-pressure oil galleries)

High pressure pump flow exceeds the limit	27 4	P0251	High pressure pump oil galleries, fuel-injector, transforming valve	The engine is limited operation	Fuel-injector, transforming valve are not closed	Check the oil galleries (high- and low-pressure oil galleries)
The common rail pressure exceeds the limit	27 5	P0194	The common rail transforming valve, low pressure oil galleries	The pressure reducing valve open frequently or open for a long time causing the valve to fail	Low pressure oil galleries are not smooth (including up-flow and return flow)	Replace the oil galleries
The common rail pressure with positive deviation exceeds the upper limit	13 2	P0191	High-low pressure oil galleries	Difficult start, operating limit, open transforming valve, large amount of leaked oil return, high oil return temperature	Flow control components are always open, because the conductor has wrong connection, the component has no power supply, no flow, the hole is blocked	Check the conductor, check non-flow hole
The common rail pressure with negative deviation is below than the lower limit	13 2	P0191	High-low pressure oil galleries	Difficult start, operating limit, open transforming valve, large amount of leaked oil return, high oil return temperature	The pressure of the loading air is heavily blocked, the oil galleries enters with air leak, the oil return galleries have high resistance	Check the oil galleries of the engine, if necessary, replace filter and oil galleries
The common rail pressure exceeds the threshold	13 6	P0088	High-low pressure oil	Operating limit	Pressure limiting valve or outlet valve is broken, the	Check valve, outlet valve, oil return galleries

			galleries		oil return galleries is blocked	
Voltage signal of common rail sensor exceeds the threshold	13 1	P0193	Common rail sensors and conductors	Operating limit	Sensors of common pressure are broken; the conductor is broken or the connection is wrong	Check common rail pressure sensors, conductors
Voltage signal of common rail sensor is lower than threshold	13 1	P0192	Common rail sensors and conductors	Operating limit	Sensors of common pressure are broken; the conductor is broken or the connection is wrong	Check common rail pressure sensors, conductors
The adjustment of Urea spray flow has problem	43 4	P203B				
PTO switch has a signal error from CAN conductor	34 5	U1404	Multi-function switches and conductors	Multi-function switch status is incorrect	The fuel-saving switch status sends data to the ECU control structure incorrectly	Check the control structure
Voltage of accelerating agent 1 is higher than the threshold	22 1	P0123	The accelerating agent	Operating limit	The accelerating agent or the conductor of the accelerating agent is broken	Check the accelerating agent, the conductors of connector or replace the new accelerating agent
Voltage of accelerating agent 2 is higher than the threshold	22 1	P0223	The accelerating agent	Operating limit	The accelerating agent or the conductor of the accelerating agent is broken	Check the accelerating agent, the conductors of connector or replace the new accelerating agent
Voltage of remote accelerating agent 1 is higher than	22 9	P1501	The remote accelerating agent	When using the remote accelerating agent, the engine is in	The accelerating agent or the conductor of the	Check the accelerating agent, the conductors of connector or replace the new accelerating agent

the threshold				the operating limit state	accelerating agent is broken	
Voltage of remote accelerating agent 2 is higher than the threshold	22 9	P1502	The remote accelerating agent	When using the remote accelerating agent, the engine is in the operating limit state	The accelerating agent or the conductor of the accelerating agent is broken	Check the accelerating agent, the conductors of connector or replace the new accelerating agent
Voltage of accelerating agent 1 is lower than the threshold	22 1	P0122	The accelerating agent	Operating limit	The accelerating agent or the conductor of the accelerating agent is broken	Check the accelerating agent, the conductors of connector or replace the new accelerating agent
Voltage of accelerating agent 2 is lower than the threshold	22 1	P0222	The accelerating agent	Operating limit	The accelerating agent or the conductor of the accelerating agent is broken	Check the accelerating agent, the conductors of connector or replace the new accelerating agent
Voltage of remote accelerating agent 1 is lower than the threshold	22 9	P1503	The remote accelerating agent	When using the remote accelerating agent, the engine is in the operating limit state	The accelerating agent or the conductor of the accelerating agent is broken	Check the accelerating agent, the conductors of connector or replace the new accelerating agent
Voltage of remote accelerating agent 2 is lower than the threshold	22 9	P1504	The remote accelerating agent	When using the remote accelerating agent, the engine is in the operating limit state	The accelerating agent or the conductor of the accelerating agent is broken	Check the accelerating agent, the conductors of connector or replace the new accelerating agent
Sensor voltage of Urea level exceeds the threshold	44 5	P203D	Urea level sensor		The conductors and connectors of Urea level sensor are broken	Check sensors, conductors and connectors
Sensor voltage of Urea level is lower than the threshold	44 5	P203C	Urea level sensor		The conductors and connectors of Urea level sensor are broken	Check sensors, conductors and connectors

1 power sensor fails	11 2	P0643	Sensor power supply module in ECU	The engine is weak There is black smoke	Error of ECU or fan revolution sensor, 2 accelerating agent sensors, lubricating oil temperature sensor, temperature sensor, the loading air pressure have error, short circuit with the car's electrical system or the ground	Check the sensor conductor Footpad ECU have normal voltage
2 power sensor fails	11 2	P0653	Sensor power supply module in ECU	The engine is weak There is black smoke	1 accelerating agent, lubricating oil temperature sensor, supply sensor have error, short circuit with the car's electrical system or the ground	Check the sensor conductor Footpad ECU have normal voltage
3 power sensor fails	11 2	P0699	Sensor power supply module in ECU	The engine is weak There is black smoke	Common rail pressure sensors or the Dnox module supplying for the source of the overall car is short-circuited or for the ground of the overall car is short-circuited	Check the sensor conductor Footpad ECU have normal voltage
Circuit source of starter motor has no load	12 1	P0615	Starter motor relay and conductor	The engine cannot start	The conductor of starter motor relay or connector is wrong or the starter motor relay is broken	Check relays and conductors
Source circuit of the	12 1	P0615	Starter motor	The engine cannot start	The conductor of starter motor	Check relays and conductors

starter motor has high temperature			relay and conductor		relay or connector is wrong or the starter motor relay is broken	
The source of the starter motor relay is short-circuited	12 1	P0617	Starter motor relay and conductor	The engine cannot start	The conductor of starter motor relay is broken or incorrectly connected	Check relays and conductors
The ground of the starter motor relay is short-circuited	12 1	P0616	Starter motor relay and conductor	The engine cannot start	The conductor of starter motor relay is broken or incorrectly connected Check if the role has capacitor and conductive power?	Check relays and conductors
The source circuit of the diagnostic light has no load	33 3	P1604	Diagnostic lights and conductors	The display function of the diagnostic light does not work	The conductor of diagnostic light is open or incorrectly connected, or the light is broken	Check the diagnostic light and the light conductor
The source circuit of the diagnostic light has a very high temperature	33 3	P1605	Diagnostic lights and conductors	Stop supplying power to the diagnostic light	The conductor of diagnostic light is open or incorrectly connected, or the light is broken	Check the diagnostic light and the light conductor
The source circuit of the diagnostic light for the source is short-circuited	33 3	P1606	The conductor of diagnostic light	The display function of the diagnostic light does not work	The conductor of diagnostic light is open or incorrectly connected	Check the diagnostic light and the light conductor
The ground source circuit of the diagnostic light is short-circuited	33 3	P1607	The conductor of diagnostic light	The display function of the diagnostic light does not work	The conductor of diagnostic light is open or incorrectly connected	Check the diagnostic light and the light conductor
Accelerating	22	P2135	Acceler	Operating	The	Check the voltage of

agent 1, Accelerating agent 2 have the voltage difference between the accelerating agent too large	1		ating agent	limit	accelerating agent or connector of the conductor is broken	the conductor or replace the new accelerating agent
Accelerating agent 1, Accelerating agent 2 have the unreliable voltage difference between the two accelerating agents and guaranty switch signal	22 1	P2135	Accelerating agent 1-2	The engine operates at 1000 rpm, the accelerating agent loses its effect, saves the error code, activates the error code light.	Use a single module accelerating agent, low-revolution of voltage signal of the accelerating agent has a big difference	Check that the accelerating agent is normal, otherwise, replace the accelerating agent Check that the conductor related to the accelerating agent, connector is short-circuited, broken. Check that the conductor related to the accelerating agent is disturbed by another conductor
Accelerating agent 1, Accelerating agent 2 have the voltage difference between the accelerating agent too large	22 9	P1505	Remote accelerating agent 1-2	The engine operates at 1000 rpm, the accelerating agent loses its effect, saves the error code, activates the error code light.	Remote accelerating agent 1 have voltage reaching the standard value. The difference with the voltage of the remote accelerating agent 2 is greater than 0.18 V	Check that the accelerating agent is normal, otherwise, replace the accelerating agent Check that the conductor related to the accelerating agent, connector is short-circuited, broken. Check that the conductor related to the accelerating agent is disturbed by another conductor
Error of T50 switch	34 5	P2530	T50 switch	Save the error code, activate the error code light.	The time of disconnection is more than 20s	Check that the T50 switch has a normal connection Check that the accelerating agent, belt, T50 switch have short-circuited with external power

When loading after cooling, notification temperature signal from CAN has problem	23 3	P0099	Master CAN conductor	The value of the latest of loading air temperature after turbo cooling or default value that affects combustion, may even appear black or weak smoke etc. Save the error code, activate the error code light.	Loss of temperature signal when loading after turbo cooling from master CAN conductor	Use multimeter to check CAN voltage signal, normal state is CANH 2.8V, CANL 2.3V. If it is unusual, check that the CAN conductor or the conductor is short-circuited, disconnected or disturbed by another conductor
Voltage of the temperature sensor of the loading air after the cooling exceeds the threshold	23 3	P0098	Temperature sensor when loading after cooling	The value of the latest of loading air temperature after turbo cooling or default value that affects combustion, may even appear black or weak smoke etc. Save the error code, activate the error code light.	Voltage signal of temperature sensor when loading after Turbo cooling is higher than 4,978V	Use multimeter to check CAN voltage signal, normal state is CANH 2.8V, CANL 2.3V. If it is unusual, check that the CAN conductor or the conductor is short-circuited, disconnected or disturbed by another conductor

Voltage of the temperature sensor of the loading air after the cooling is lower than the threshold	23 3	P0097	Temperature sensor when loading after cooling	The value of the latest of loading air temperature after turbo cooling or default value that affects combustion, may even appear black or weak smoke etc. Save the error code, activate the error code light.	Voltage signal of temperature sensor when loading after Turbo cooling is lower than 0.137V	Use multimeter to check CAN voltage signal, normal state is CANH 2.8V, CANL 2.3V. If it is unusual, check that the CAN conductor or the conductor is short-circuited, disconnected or disturbed by another conductor
The temperature of the loading air after cooling is not reliable	23 3	P0096	Temperature sensor when loading after cooling	The value of the latest of loading air temperature after turbo cooling or default value that affects combustion, may even appear black or weak smoke etc. Save the error code, activate the error code light.	The temperature sensor of the loading air after turbo cooling continuously 2 times has a temperature difference of more than 40 degrees Celsius	Use multimeter to check CAN voltage signal, normal state is CANH 2.8V, CANL 2.3V. If it is unusual, check that the CAN conductor or the conductor is short-circuited, disconnected or disturbed by another conductor
The temperature sensor voltage in ecru exceeds the threshold	11 9	P0669	Temperature sensor in ECU	Internal ECU receives the last normal or default value	Voltage signal of ECU internal temperature sensor is higher than 2.847V	Replace ECU
The temperature sensor	11 9	P0668	Temperature sensor	Internal ECU receives the	Voltage signal of ECU internal	Replace ECU

voltage in eCU is lower than the threshold			in ECU	last normal or default value	temperature sensor is lower than 0.7034V	
The input temperature sensor of the valve exceeds the threshold	23 6	P0113	Input temperature sensor of the loading air	The value of the latest of loading air temperature after turbo cooling or default value that affects combustion, may even appear black or weak smoke etc. Save the error code, activate the error code light.	The voltage signal of the input loading air temperature sensor is higher than 3.2V	Check that the input loading air temperature sensor is normal, use the multimeter to check that the temperature sensor of the input loading air is short-circuited to the peripheral source, check that the relevant conductor, connector is broken, resulting in short circuit or open circuit
The voltage of the input temperature sensor of valve is lower than the threshold	23 6	P0112	Input temperature sensor of the loading air valve	The value of the latest of loading air temperature after turbo cooling or default value that affects combustion, may even appear black or weak smoke etc. Save the error code, activate the error code light.	Voltage signal of the input loading air temperature sensor is lower than 0.2V	Check that the temperature sensor resistance of the input loading air is normal, use the multimeter to check the sensor footpad to the chassis, guess if it is short-circuited, normal $R>1 M\Omega$, check that the correlation conductor, connector is broken or short circuited

The output temperature sensor of SCR catalytic transmitting the CAN signals has problem	44 8	U0113	Master CAN conductor	The output SCR catalyst takes the nearest normal temperature index or default value	Loss of output temperature signal of SCR catalyst from master CAN conductor	Use multimeter to check CAN voltage signal, normal state is CANH 2.8V, CANL 2.3V. If it is unusual, check that the CAN conductor or the conductor is short-circuited, disconnected or disturbed by another conductor
The output temperature sensor voltage of SCR catalyst exceeds the threshold	44 8	P0428	Temperature sensor of outlet exhaust of discharge pipe	The output SCR catalyst takes the nearest normal temperature index or default value	The voltage signal of the temperature sensor of the output loading air is higher than 3.3V	Check if the input temperature sensor is normal, normal temperature $R = 180\Omega$, Use the multimeter to measure the voltage of K55 and K56 footpads. Guess whether the external power supply is short-circuited with the correlated conductor, connector is broken or short-circuited with the external power supply.
The output temperature sensor voltage of SCR catalyst is lower than the threshold	44 8	P0427	Temperature sensor of exhaust of discharge pipe	The output SCR catalyst takes the nearest normal temperature index or default value	Voltage signal of the output loading air temperature sensor is lower than 0.2V	Check if the input temperature sensor is normal, normal temperature $R = 180\Omega$, Use the multimeter to measure the voltage of K55 and K56 footpads to the cabin, normal resistance $> 1M\Omega$, check that the correlated conductor and connector are broken or short-circuited
The input temperature sensor of SCR catalyst transferring the CAN news has problem	44 8	U0113	CAN signal	The output SCR catalyst takes the nearest normal temperature index or	Loss of output temperature signal of SCR catalyst from master CAN conductor	Use multimeter to check CAN voltage signal, normal state is CANH 2.8V, CANL 2.3V. If it is unusual, check that the CAN conductor or the conductor is

				default value, save the error code, activate the error code light and OBD light.		short-circuited, disconnected or disturbed by another conductor
The input temperature sensor voltage of SCR catalyst is higher than the threshold	44 8	P042D	Temperature sensor of exhaust of discharge pipe	The output SCR catalyst takes the nearest normal temperature index or default value, save the error code, activate the error code light and OBD light.	Voltage signal of the input loading air temperature sensor is higher than 4.7V	Check if the input temperature sensor is normal, normal temperature R = 180ohm, Use the multimeter to measure the voltage of K55 and K56 footpads. Guess whether the external power supply is short-circuited with the correlated conductor, connector are broken or short-circuited with the external power supply.
The input temperature sensor voltage of SCR catalyst is lower than the threshold	44 8	P042C	Temperature sensor of exhaust of discharge pipe	The output SCR catalyst takes the nearest normal temperature index or default value, save the error code, activate the error code light and OBD light.	Voltage signal of the input loading air temperature sensor is lower than 0.3V	Check if the input temperature sensor is normal, normal temperature R = 180ohm, Use the multimeter to measure the voltage of K81 and K82 footpads to the cabin, normal resistance > 1Mohm, check that the correlated conductor and connector are broken or short-circuited
Urea level is low	44 5	P203F	Urea barrel, Urea level sensor	The output SCR catalyst takes the nearest normal temperature index or default value, save the error	Urea level sensor failure, low Urea level	Check the Urea level to supplement timely Check that the actual level with the reported level is correct, if there is a big error, check the urea level sensor to see if the float is normal

				code, activate the error code light and OBD light.		
Urea SCR spray nozzle is higher than the threshold	45 3	P2049	Urea spray nozzle	Urea spray nozzle is easily damaged, amount of urea spray is higher than the allowable level, save the error code, activate the error code light and OBD light.	The spray nozzle is too higher than the allowable limit	Check that the Urea spray nozzles work normally Check that the electromagnetic valve of the Urea spray nozzle is short circuited or broken Normal R = 13 Ohm
Urea SCR spray nozzles are too hot	45 3	P3009	Power supply module of Urea spray nozzles	The ECU disconnects the power supply to the Urea spray nozzle the Urea spray nozzle does not work, amount of urea spray is higher than the allowable level, save the error code, activate the error code light and OBD light.	Power supply module of internal circuit ECU is too hot	Disconnect the ECU cooling source, make sure the ECU installs in the cool location and good heat dissipation. If this error occurs, replace ECU
Power circuit of Urea SCR spray nozzles for the source is short circuited	45 3	P2049	Urea spray nozzle	Urea spray nozzles do not work, the amount of urea spray is too higher than the	K09 footpad with low voltage and the source circuit of the Urea spray nozzle for the source is short	Use the meter to measure the resistance of K09 footpad, check if the conductor and connector are broken, resulting in a short circuit to the external source

				allowable level, save the error code, activate the error code light and OBD light.	circuited	
High voltage of Power circuit of Urea SCR spray for the source is short circuited	45 3	P2049	Urea spray nozzle	Urea spray nozzles do not work, the amount of urea spray is too higher than the allowable level, save the error code, activate the error code light and OBD light.	Footpad K10 high voltage power circuit with spray nozzle has short circuit with source or open circuit	Use the meter to measure the resistance of K10 footpad, check if the conductor and connector are broken, resulting in a short circuit to the external source, check if the footpad is connected to the spray nozzle and guess that the circuit is open
High voltage of Power circuit of Urea SCR spray for the ground is short circuited	45 3	P2048	Urea spray nozzle	Urea spray nozzles do not work, the amount of urea spray is too higher than the allowable level, save the error code, activate the error code light and OBD light.	Footpad K09 low voltage power circuit with spray nozzle has short circuit with source or open circuit	Use the meter to measure the resistance of K09 footpad to the cabin > 1Mohm, if you do not check for broken conductor or connector, it will cause a short circuit to the ground, check if the footpad is connected to the spray nozzle and guess that the circuit is open
Power circuit of High-pressure Urea SCR spray nozzles is short circuited	45 3	P2047	Urea spray nozzle	Urea spray nozzles do not work, the amount of urea spray is too higher than the allowable level, save the error	Footpad K10 high voltage power circuit with spray nozzle has short circuit with source or open circuit	Use the meter to measure the resistance of K10 footpad to the cabin > 1Mohm, if you do not check for broken conductor or connector, it will cause a short circuit to the ground, check if the footpad is connected to the spray

				code, activate the error code light and OBD light.		nozzle and guess that the circuit is open
Transmission speed signal of master CAN has problem	22 4	U1405	Maser CAN conductor	Car speed ECU takes the default value 0	Loss of car speed signal from master CAN conductor	Use multimeter to check CAN voltage signal, normal state is CANH 2.8V, CANL 2.3V. If it is unusual, check that the CAN conductor or the conductor is short-circuited, disconnected or disturbed by another conductor
Car speed exceeds the limit	22 4	P0279	Speed sensor or car speed module	Car speed ECU takes the default value 0 Save the error code	Speed exceeds 170km / h	Verify that the car speed exceeds 170km / h. If this is not correct, check that the speed sensor is correctly installed Check that the speed sensor is disturbed by conductor or other parts, affecting the signal that leads to an error
Voltage signal of car speed sensor is unreliable	22 4	P2162	Speed sensor or car speed module	Car speed ECU takes the default value 0 Save the error code	Signals of linear vehicle speed have maximum voltage <4.7V or Signals of linear vehicle speed have minimum voltage > 4.36V	Check that the speed sensor is correctly installed, resulting in low voltage difference or the lowest voltage slightly higher Check that the speed sensor is disturbed by conductor or other parts, affecting the signal that leads to an error
The revolution and torque of the engine with the car speed are not uniform	22 4	P0501	Speed sensor or car speed module	Car speed ECU takes the default value 0 Save the error code	When the engine of revolution >50 00rpm, torque > 300Nm, the speed of the car <10km/h (currently, the revolution	Check that the speed sensor is correctly installed, resulting in low voltage difference or the lowest voltage slightly higher Check that the speed sensor is disturbed by conductor or other parts, affecting the

					limit is less than 5000rpm, normally the engine cannot reach this revolution)	signal that leads to an error
Voltage of car speed sensor exceeds the threshold	22 4	P0503	Speed sensor	Car speed ECU takes the default value 0 Save the error code	The engine operates for a certain time, the revolution sensor of the linear voltage signal is higher than 12V	Check that the speed sensor is correctly installed Check that the speed sensor is disturbed by conductor or other parts, resulting in a voltage that tends to be large or unstable
Voltage of car speed sensor is lower than the threshold	22 4	P0502	Speed sensor	Car speed ECU takes the default value 0 Save the error code	The engine operates for a certain time, the revolution sensor of the linear voltage signal is lower than the limit (currently set = 0, so this error does not appear)	Check that the speed sensor is correctly installed Check that the speed sensor is disturbed by conductor or other parts, resulting in a voltage that tends to be large or unstable
Pulse amplitude signal of car speed sensor exceeds the limit	22 5	P2158	Speed sensor or car speed module	Car speed ECU takes the default value 0 Save the error code	The engine operates for a certain time, the car speed signal has a pulse amplitude higher than 5000ms	Check that the sensor of ground conductor connects correctly, affecting the speed signal of the car Check that the sensor installs correctly, resulting in a relatively weak voltage signal Check the speed sensor, speed meter is disturbed by conductor and other devices resulting in pulse voltage loss
Pulse amplitude signal of car speed sensor is lower than the limit	22 5	P2160	Speed sensor or car speed module	Car speed ECU takes the default value 0 Save the error code	The engine operates for a certain time, the car speed signal has a pulse amplitude lower than	Check that the speed sensor is correctly installed Check that the speed sensor is disturbed by conductor or other parts, resulting in the signal of

					400ms	high-frequency speed being changed Check that the speed meter work normally
The signal cycle of the car speed sensor is lower than the threshold	22 5	P2161	Speed sensor or car speed module	Car speed ECU takes the default value 0 Save the error code	The engine operates for a certain time, the signal of car speed with a pulse cycle is smaller than the smallest one (currently the minimum cycle standard is 0, so there will be no problem)	Check that the speed sensor is correctly installed Check that the speed sensor is disturbed by conductor or other parts, resulting in the signal of high-frequency speed being changed Check that the speed meter work normally
Warning light circuit is open	33 6	P1613	Code flash light	ECU supplies power and error code flash light is not on, press the switch to suggest that the light has problem, save the error code	Footpad of the error code flash light has no load	Check that the footpad K70, K65's conductor, fusible link and connector work correctly, resulting in LED lights and filament lamps work
Warning light circuit is too hot	33 6	P1614	Power supply module of the error code flash light in internal ECU	ECU disconnects the power supply module of error code flash light. The light stops working Save the error code	The power supply module of the error code flash light in ECU is too hot	Disconnect the ECU cooling source, make sure the ECU installs in the cool location and good heat dissipation. If this error occurs, replace ECU
Warning light circuit for the source is short circuit	33 6	P1615	Code flash light	No problem exists, the error code flash light is on. Save the error code	The plug pin conductor of the error code flash light is short-circuited to the external power supply	Use the meter to measure the plug pin voltage of the error code flash light Check that the conductor, connector are broken resulting in a short circuit of the

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Engine

						external power supply
Warning light circuit for the ground is short circuit	33 6	P1616	Code flash light	ECU supplies power and error code flash light is not on, press the switch to suggest that the light has problem, save the error code	The plug pin conductor of the error code flash light is short-circuited to the external source	Use the meter to measure the voltage from plug pin to the car Average resistor $R > 1M$ ohm. If you do not check for broken conductor or connector, it will cause a short circuit to the ground
The actual average conversion efficiency of SCR is low	43 0	P0420	Exhaust control module	OBD limits the torque, does not allow to delete the error code	Exhaust exceeds 5 or 7, the original engine is poorly discharged, SCR transfers not well, Urea flow error is too large, standard data has problem	Replace parts related to engine exhaust (mainly fuel system) replace SCR catalysts or re-activate SCR tanks (spray nozzles, urea pumps). Replace components of Urea spray system, change fuel oil well, check standard data
The actual average conversion efficiency of SCR is lower than threshold 1, exhaust exceeds the threshold 5	43 1	P0420	Exhaust control module	Do not allow code deletion	Exhaust exceeds 5, the original engine is poorly discharged, SCR transfers not well, Urea flow error is too large, standard data has problem	; Replace parts related to engine exhaust (mainly fuel system) replace SCR catalysts or re-activate SCR tanks (spray nozzles, urea pumps). Replace components of Urea spray system, change fuel oil well, check standard data
The actual average conversion efficiency of SCR is lower than threshold 2, exhaust exceeds the threshold 7	43 2	P0420	Exhaust control module	OBD limits the torque, does not allow to delete the error code	Exhaust exceeds 7, the original engine is poorly discharged, SCR transfers not well, Urea flow error is too large, standard data has problem	Replace parts related to engine exhaust (mainly fuel system) replace SCR catalysts or re-activate SCR tanks (spray nozzles, urea pumps). Replace components of Urea spray system, change fuel oil well, check standard data

The value reaching the SCR output NOx sensor signal is not reliable	42 1	P2214	Exhaust control module	After 50h OBD limits torque, do not allow to delete the error code	Nox sensor signals are slow to respond, the sensor has problem, the sensor installs incorrectly, the discharge pipe is blocked, the standard data has problem	Replace Nox sensor, install Nox tcb according to regulations, check and filter the blocked exhaust line, check standard data
Do not spray Urea	43 6	P3042	Exhaust control module	After 50h OBD limits torque, do not allow to delete the error code	Problem of electrical components of spray nozzle, the spray nozzle has closed state ECU hardware problem	Check the spray nozzle, if necessary, replace the spray nozzle, replace the ECU
Return urea flow is not reliable	44 1	P3050	Return urea line	Detmode does not set, spray urea	Return urea line must not leak pressure	Check the return urea line and the connector with the clear line
Error of reducing urea spray pressure	44 1	P3053	Urea pump pressure line	Detmode does not set, spray urea	Pressure lines must not leak pressure	Check that the pressure pipe, the connector are blocked
Error of Urea SCR spray pressure	44 1	P3054	Urea pump and solution line	Detmode does not set, spray urea	The pressure is unstable	Check that the pressure pipe, the connector are blocked
The temperature in the ECU exceeds the limit	11 9	P0669	ECU	Close SCR system, urea does not spray	ECU temperature is too high	Check the types of overheating causes

Urea flow of the previous operation is not sprayed thoroughly	44 7	P3015	Solution line	Operation system does not affect	Bibulous process is not completely thorough	Reverse suction process completes
Control the Urea SCR spray flow, Urea spray pressure is too high	44 2	P3039	Solution line	After 50h of operating limit, the system exceeds the pressure	There is a blockage phenomenon	Check the solution pipe
Control the Urea SCR spray flow, Urea spray pressure is too low	44 3	P3056	Solution line	The system pressure is low, leading to no spraying of urea, immediately operating limit	There is a blockage phenomenon	Check the solution pipe
After pumping, Urea SCR was frozen, the urea spray pressure is too high	44 2	P3039	Urea pump and solution pipe	The system pressure is low, leading to no spraying of urea	There is a blockage phenomenon	Check the solution pipe
Error of setting up Urea SCR spray pressure	44 1	P3040	Urea pump and solution pipe	Pressure setting fails, SCR system stops working, after 50h of operating limit	Exist leakage, no urea	Check the solution pipe
Error of lowering Urea SCR pressure	44 1	P3049	Urea pump and solution pipe	The pressure fails to discharge, the SCR system stop working, after 50h of operating	The urea fails to defrost	Continue defrosting

				limit		
After lowering the pressure, Urea SCR pressure is not lower than the limit	44 1	P3041	Urea pump and solution pipe	The pressure does not drop to the target value, the SCR system stops working	Error of reverse valve or pipe blockage	Check valves in the opposite direction and pipes
Urea barrel heating is too high	44 6	P2043	Urea barrel	Do not spray urea, the temperature is too high, transfer to the non-pressure control state	Urea barrel temperature > upper limit	Stop cooling - heating
The number of times of supplementing Urea has not been timely exceeded the number of times allowed	43 8	P2068	Urea	The amount of urea is low	The sensor of urea barrel is lower than the limit	Add urea, ensure urea level is not lower than the allowable incident value
Urea level sensor voltage exceeds the limit	44 5	P203D	Urea level sensor	After 50 h, limit the torque	The connector has poor or broken contact or short-circuit power source, the voltage is higher than the upper limit	Replace of connector of the same conductor Replace the sensor Check if the upper limit voltage has a correct setting
Urea level sensor voltage is lower than the threshold	44 5	P203C	Urea level sensor	After 50 h, limit the torque	The sensor connector is short circuited to the ground, initial voltage sensor is lower than the power limit voltage	Replace of connector of the same conductor Replace the sensor Check if the upper limit voltage has a correct setting

The heating structure of SCR Urea pump has faulty pulse time	45 5	P3029	Urea SCR pump heating engine	Cannot heat	The Urea SCR pump heating time between two pulse signals is greater than the upper limit and the lower limit	Regulate the pulse time between two signals, make it is larger than the upper limit and smaller than the lower limit
The temperature of Urea SCR pump has pulse time that is not effective	45 5	P3029	Urea SCR pump heating engine	Cannot heat	Heating temperature of urea pump is not within the effective range	Ensure proper temperature source
Module to measure SCR Urea pump loses its effect	45 4	P3038	Module to measure Urea pump temperature in SCR	The temperature of the Urea pump cannot be measured	Components for measuring the temperature are ineffective, the number of starter motor times exceeds the limit, and still do not have the standard temperature	Replace Urea pump
Urea SCR pumps receiving a PWM cycle do not work	45 4	P2062	SCR urea pump	The signal cannot be measured	The cycle of receiving PWM of the SCR urea pump is outside the range of 150ms ~ 250ms	Check or replace Urea pump
The temperature pulse time of SCR urea pump has problem	45 6	P3029	SCR urea pump	Immediately limit the torque, the signal cannot be measured	The temperature pulse signal of the urea pump is inside the fault range	Check or replace Urea pump
The temperature pulse time of SCR urea pump losses the effect	45 6	P3029	The temperature pulse time of SCR	Immediately limit the torque, the signal cannot be measured	Pulse signal of Urea Pump within range is not effective	Check or replace Urea pump

			urea pump losses the effect			
Urea SCR pumps receiving a PWM cycle does not work	45 4	P2062	SCR urea pump	The signal cannot be measured		Check or replace Urea pump
Temperature of Urea barrel has CAN signal error	44 6	P205A	Temperature sensor of Urea barrel	Unable to read the temperature data of Urea barrel	Com_tUTnkT cannot collect 0x7FFF data.	Check ECU, replace the sensor
Temperature sensor of high voltage Urea barrel exceeds the threshold	44 6	P205D	Temperature sensor of Urea barrel	The sensor is broken, the temperature cannot be measured	Loose or broken connection, temperature sensor voltage of SCR barrel	Tighten the connector or replace the sensor
Temperature sensor of low voltage Urea barrel is below the threshold	44 6	P205C	Temperature sensor of Urea barrel	The sensor is short circuited, temperature cannot be measured	Loose or broken connection, temperature sensor voltage of barrel is lower than the limit	Check that the sensor connector is short circuited, replace the sensor
Urea heating error	43 3	P3025	Urea heating has problem	SCR heating system stops working, urea spray system stops working	only if one of the three heating pipes cannot be heated, at this time, the temperature of the urea barrel is too low to heat, to avoid the urea pipe being frozen, it should be warned and immediately	If this error occurs, normally the car attaches the error from other heating, check the heating lines in addition, it is also possible to have the problem of temperature sensor of urea barrel conductor, after resolving the problem, restart the car, delete the error

					stop the SCR system. At this time, you should observe the temperature sensor of the urea barrel to see if the conductor is normal.	
Temperature sensor of high voltage Urea barrel exceeds the threshold	44 6	P205B	Temperature sensor of Urea barrel	The temperature is too high	Signal temperature of urea barrel is higher than the limit	Check that the equipment for urea barrel, temperature between urea barrel and environment are reasonable
Temperature sensor of low voltage Urea barrel is below the threshold	44 6	P205B	Temperature sensor of Urea barrel	The temperature is too low	Signal temperature of urea barrel is lower than the limit	Check that the equipment for urea barrel, temperature between urea barrel and environment are reasonable
Urea conduit (Pump to barrel) heating conductor resistance has non-trust feedback signals	46 1	P3069	Urea pump (pump to barrel) heating the conductor resistance	Cannot heat	Urea pump (pump to barrel) heating the conductor resistance for voltage feedback	Check that the Urea return heating line of conductor resistance, the K36 and K50 footpads are broken and voltage feedback has existed abnormally
Urea conduit (Pump to barrel) heating conductor resistance has open circuit	46 1	P3070	Urea pump (pump to barrel) heating the conductor resistance	Cannot heat	Urea line (Pump to barrel) heating conductor resistance is slightly high	Check that the Urea return heating line of conductor resistance, the K36 and K50 footpads are broken and voltage feedback has existed abnormally

Urea conduit (Pump to barrel) heating conductor resistance for the ground is short circuited or open	46 1	P3071	Urea pump (pump to barrel) heating the conductor or resistance	Cannot heat	Urea line (Pump to barrel) heating conductor resistance for the ground	Check that the Urea return heating line of conductor resistance, the K36 and K50 footpads are broken and voltage feedback has existed abnormally
Urea conduit (Pump to barrel) has heating relay circuit that is open	46 1	P3021	Urea pump (pump to barrel) Heating relay	Cannot heat	Urea line (Pump to barrel) heating conductor relay is broken, open	Check that the heating relays of Urea return line, the K50 of the conductor is broken, the return of the voltage has an abnormal existence, it is required to check the ECU footpad
Urea conduit (Pump to barrel) has heating relay circuit that is too hot	46 1	P3072	Urea pump (pump to barrel) Heating relay	Disconnect the heating relay Cannot heat	The temperature of Urea line (Pump to barrel) heating relay is too high	Check that the heating relays of Urea return line, the K50 of the conductor is broken, the return of the voltage has an abnormal existence, it is required to check the ECU footpad
Urea conduit (Pump to barrel) has electrically heating relay circuit for the source that is short circuited	46 1	P3023	Urea pump (pump to barrel) Heating relay	Cannot heat	Urea line (Pump to barrel) heating relay is short circuited to the source	Check that the heating relay footpad of the urea return line are broken or not? Voltage feedback has an abnormal existence
Urea conduit (Pump to barrel) has the ground heating relay that is short-circuited	46 1	P3022	Urea pump (pump to barrel) Heating relay	Cannot heat	Urea line (Pump to barrel) has the ground heating relay	Check that the heating relays of Urea return line, K26 footpad have abnormal voltage and voltage feedback. It is necessary to check if the ECU footpad has short circuit or disconnection.

Urea conduit (Pump to barrel) heating the resistance of conductor that has non-trust feedback signal	46 2	P3073	Urea line (Pump to barrel) relay heating resistance conductor	Cannot heat	Urea line (Pump to barrel) heating the resistor of voltage conductor in & central.	Check that the conductor resistance of the Urea pressure line, K58 and K92 footpads have abnormal voltage and voltage feedback.
Urea conduit (pump to spray nozzle) has heating circuit of conductor resistance that is open	46 2	P3074	Urea line (Pump to barrel) relay heating resistance conductor	Cannot heat	Urea line (pump to spray nozzle) has interrupted resistance heating relay of conductor	Check that the conductor resistance of the Urea pressure line, K58 and K92 footpads have abnormal voltage and voltage feedback.
Urea conduit (pump to spray nozzle) heating the conductor resistance for the ground is short-circuited or open	46 2	P3075	Urea line (Pump to barrel) relay heating resistance conductor	Cannot heat	Urea line (pump to spray nozzle) having resistance heating relay of conductor that is short circuited to ground	Check that the conductor resistance of the Urea pressure line, K58 and K92 footpads have abnormal voltage and voltage feedback.
Urea conduit (pump to spray nozzle) has heating relay that is open	46 2	P3024	Urea line (pump to spray nozzle) heating relay	Cannot heat, SCR system does not work	Urea line (pump to spray nozzle) having resistance heating relay of conductor that is interrupted	Check that the conductor resistance of the Urea pressure line, K58 and K92 footpads have abnormal voltage and voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.

Urea conduit (pump to spray nozzle) has heating relay that is too hot	46 2	P3076	Urea line (pump to spray nozzle) heating relay	Disconnect the heating relay Cannot heat	Urea line (pump to spray nozzle) having resistance heating relay of conductor that has high temperature	Check that the conductor resistance of the Urea pressure line, K58 and K92 footpads have abnormal voltage and voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea conduit (pump to spray nozzle) has heating relay for the source that is short-circuited	46 2	P3027	Urea line (pump to spray nozzle) heating relay	Cannot heat, SCR system does not work	Urea line (pump to spray nozzle) having resistance heating relay of the connection wire that is short circuited to source	Check that the conductor resistance of the Urea pressure line, K58 and K92 footpads have abnormal voltage and voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea conduit (pump to spray nozzle) has heating relay for the ground that is short-circuited	46 2	P3026	Urea line (pump to spray nozzle) heating relay	Cannot heat, SCR system does not work	Urea line (pump to spray nozzle) having resistance heating relay of conductor that connects to the ground	Check that the conductor resistance of the Urea pressure line, K58 and K92 footpads have abnormal voltage and voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
The main relay heating urea, the load for the source are short circuited	46 3	P3077	The main relay heating urea	Cannot heat	The main relay heating urea, the load are short circuited with source	Check that the main heating relay, K94, K90 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
The main relay heating	46 3	P3043	The main	Cannot heat	The main relay	Check that the main heating relay, K94, K90

urea is open			relay heating urea		heating urea, the load of the conductor is broken	footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
The main relay heating urea is too hot	46 3	P3044	The main relay heating urea	Cannot heat	The main relay heating urea, the source circuit has too high temperature	Check that the main heating relay, K94, K90 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
The main relay heating urea for the source is short circuited	46 3	P3045	The main relay heating urea	Cannot heat	The main relay heating urea is short circuited with source	Check that the main heating relay, K94, K90 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
The main relay heating urea for the ground is short circuited	46 3	P3046	The main relay heating urea	Cannot heat	The main relay heating urea	Check that the main heating relay, K94, K90 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea line (barrel to pump) heating the conductor resistor has non-trust feedback	46 4	P3078	Urea line (barrel to pump) heating the conductor resistor	Cannot heat	Urea line (barrel to pump) heating the conductor resistor to the feedback voltage	Check the Urea resistance heating line of conductor, K20, K26 footpads have abnormal voltage signal, voltage feedback.
Urea line (barrel to pump) heating the conductor resistor has open circuit	46 4	P3079	Urea line (barrel to pump) heating the conductor resistor	Cannot heat	Urea line (barrel to pump) heating the conductor resistor that has open conductor	Check the Urea resistance heating line of conductor, K20, K26 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.

Urea line (barrel to pump) heating the conductor resistor for the ground is short circuited or opened	46 4	P3080	Urea line (barrel to pump) heating the conductor resistor	Cannot heat	Urea line (barrel to pump) heating the conductor resistor that has the ground short circuited conductor	Check the Urea resistance heating line of conductor, K20, K26 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea line (barrel to pump) having circuit heating relay that has open circuit	46 4	P3028	Urea line (barrel to pump) heating relay	Cannot heat	Urea line (barrel to pump) heating the conductor resistor that has interrupted conductor	Check that the heating relay footpad of the return urea line is broken or not? Voltage feedback is abnormal. It is necessary to check whether the ECU footpad has short circuit to ground or disconnection.
Urea line (barrel to pump) having circuit heating relay that is too hot	46 4	P3081	Urea line (barrel to pump) heating relay	Cannot heat	Urea line (barrel to pump) heating the conductor resistor that has the high temperature	Check that the heating relay footpad of the return urea line is broken or not? Voltage feedback is abnormal. It is necessary to check whether the ECU footpad has short circuit to ground or disconnection.
Urea line (barrel to pump) has the short-circuited source heating relay	46 4	P3032	Urea line (barrel to pump) heating relay	Cannot heat	Urea line (barrel to pump) has the short-circuited source heating relay	Check that the heating relay footpad of the return urea line is broken or not? Voltage feedback is abnormal.
Urea line (barrel to pump) has the short-circuited ground heating relay	46 4	P3031	Urea line (barrel to pump) heating relay	Cannot heat	Urea line (barrel to pump) has the short-circuited ground heating relay	Check that the heating relay footpad of the return urea line is broken or not? Voltage feedback is abnormal. It is necessary to check whether the ECU footpad has short circuit to ground or disconnection.
Heating the conductor resistance of Urea pump	46 5	P3082	Heating conductor resistor	Cannot heat	The diagnostic load relays are	Check the Urea resistance heating line of conductor, K33, K25 footpads have abnormal voltage signal,

has non-trust feedback			ce		ineffective , the resistance of the heating conductor of the Urea pump has feedback voltage	voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Heating the conductor resistance of Urea pump has open circuit	46 5	P3083	Heating conductor resistance	Cannot heat	Heating the urea pump with the resistance of the broken conductor	Check the Urea resistance heating line of conductor, K33, K25 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Heating the conductor resistance of urea pump for the ground is short circuited or opened	46 5	P3084	Heating conductor resistance	Cannot heat	Heating the conductor resistance of urea pump for the ground is short circuited	Check the Urea resistance heating line of conductor, K33, K25 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Relay heating the urea pump has open circuit	46 5	P3033	Urea pump heating relay	Cannot heat	Relay heating the K25 urea pump is interrupted	Check the Urea resistance heating line of conductor, K90, K25 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Relay heating the urea pump is too hot	46 5	P3085	Urea pump heating relay	Cannot heat	Relay heating the urea pump has the high temperature	Check the Urea resistance heating line of conductor, K90, K25 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.

Relay heating the urea pump for the source is short-circuited	46 5	P3037	Urea pump heating relay	Cannot heat	Relay heating the urea pump having K25 footpad for the source is short circuited	Check the Urea resistance heating line of conductor, K90, K25 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Relay heating the urea pump for the ground is short-circuited	46 5	P3036	Urea pump heating relay	Cannot heat	Relay heating the urea pump having K25 footpad for the ground is short circuited	Check the Urea resistance heating line of conductor, K90, K25 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea barrel heating solenoid valve has open circuit	46 6	P3016	Solenoid valve heating Urea barrel	Urea barrel cannot heat	Heating the urea barrel having the solenoid valve conductor K28/K89 is broken	Check the Urea resistance heating line of conductor, K89, K28 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea barrel heating solenoid valve is too hot	46 6	P3018	Solenoid valve heating Urea barrel	Urea barrel cannot heat	Electric heating valve from Urea barrel has too high temperature	Check the Urea resistance heating line of conductor, K89, K28 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea barrel heating solenoid valve for the source is short-circuited	46 6	P3020	Solenoid valve heating Urea barrel	Urea barrel cannot heat	Electric heating valve from Urea barrel has K28 footpad for the source that is short circuited	Check the Urea resistance heating line of conductor, K89, K28 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
Urea barrel heating	46 6	P3019	Solenoid valve	Urea barrel cannot heat	Electric heating	Check the Urea resistance heating line of conductor,

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Engine

solenoid valve for the ground is short-circuited			heating Urea barrel		valve from Urea barrel has K28 footpad for the ground that is short circuited	K89, K28 footpads have abnormal voltage signal, voltage feedback. It is necessary to check if the ECU footpad has short circuit to ground or disconnection.
The urea pump engine has a revolution error	45 1	P3001	Urea pump engine	After 50 h, limit the torque	Urea pump engine fails	Check or replace Urea pump
The urea pump engine has a long-time revolution error	45 1	P3086	Urea pump engine	After 50 h, limit the torque	Urea pump engine fails	Check or replace Urea pump
Urea pump engine losses effect	45 1	P3002	Urea pump engine	Immediately limit the torque	Measure the temperature of urea pump engine and then do not move to activate urea pump state	Check or replace Urea pump
Source circuit of the urea pump is open	45 1	P3006	Source circuit of the urea pump engine	Immediately limit the torque	Source circuit of the urea pump engine has an open conductor	Check or replace Urea pump
Source circuit of the urea pump is too hot	45 1	P3003	Source circuit of the urea pump engine	Immediately limit the torque	Source circuit of the urea pump engine has a high temperature	Cooling and Check or replace Urea pumps

Source circuit of the urea pump for the source is short-circuited	45 1	P3004	Source circuit of the urea pump engine	Immediately limit the torque	Source circuit of the urea pump engine for source is short circuited	Check or replace Urea pump
Source circuit of the urea pump for the ground is short-circuited	45 1	P3005	Source circuit of the urea pump engine	Immediately limit the torque	Source circuit of the urea pump engine for ground is short circuited	Check or replace Urea pump
Urea pump pressure exceeds the threshold	45 1	P3007	Urea pump pressure sensor	Immediately limit the torque	The line is broken, the spray nozzle is broken, the pressure is higher than SCR	Check that the line and spray nozzle are blocked
Pressure of urea pump is below the allowed level	45 1	P3007	Urea pump pressure sensor	Immediately limit the torque	The line is broken, the spray nozzle is broken, the pressure is higher than SCR	Check that the line and spray nozzle are blocked
Urea pump pressure with CAN transmission signal has problem	45 1	P204E	Urea pump pressure sensor	Could not collect the signal Do not allow spraying	Pressure of Urea pump has signal from CAN	Check pump signal to ECU, check connection
The voltage of the Urea pump pressure sensor is higher than the threshold	45 1	P204D	Urea pump pressure sensor	Immediately limit the torque	Urea pump pressure sensor is higher than the threshold	Check Urea pump pressure sensor (K24 K78 K77 footpads) that the conductor has good contact
The voltage of the Urea pump	45 1	P204C	Urea pump pressure	Immediately limit the torque	Short-circuit pressure	Check that K78 is short circuited for the ground

pressure sensor is below the threshold		e sensor		sensor of Urea pump Voltage under the limit		
Voltage of valve changing direction of urea is open	45 2	P3047	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea and High voltage conductor are broken	Replace urea pump
Voltage of valve changing direction of urea is hot	45 2	P3048	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea and High-voltage conductor have too high temperature	Replace urea pump
High voltage of Valve changing direction of urea for the source is short circuited	45 2	P3049	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea and High-voltage conductor for the ground are short circuited	Replace urea pump
Voltage of valve changing direction of urea for the ground is short circuited	45 2	P3050	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea and High-voltage conductor for the ground are short	Replace urea pump

					circuited	
High voltage of Valve changing direction of urea is open	45 2	P3010	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea and the conductor are broken	Replace urea pump
High voltage of Valve changing direction of urea is too hot	45 2	P3011	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea that has a high temperature	Check or replace Urea pump
High voltage of Valve changing direction of urea for the source is short circuited	45 2	P3013	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea for the source that is short circuited	Replace urea pump
High voltage of Valve changing direction of urea for the ground is short circuited	45 2	P3012	Valve changing direction of urea	Cannot set Urea pressure	Valve changing direction of urea for the ground that is short circuited	Replace urea pump
CAN receiving AT1O1 data of long amplitude has problem	42 1	U0113	Nox sensor	Effect of NOx accuracy	Noise signal or Nox Sensor error	Check the conductor and supply or replace Nox Sensor
Error of CAN receiving AT1O1 data is out of time	42 1	U0113	Nox sensor	Do not measure Nox signal indicator , after 50h OBD limits torque, does not allow to delete error code	NOx sensor has problem, the connection of conductor is incorrect	Check the conductor and supply or replace Nox Sensor

Appendix B Mechanical gap of the engine components
 (Reference value)

No.	Item	Reference value (mm)	
1	Gap of the main bearing	0.065~0.013	
2	Gap of connecting rod axis	0.042~0.104	
3	Gap of axial crankshaft	0.12~0.289	
4	Gap of axial connecting rod plane	0.15~0.35	
5	Gap of piston pin and bush of small head of the connecting rod	0.04~0.061	
6	Gap of the camshaft crankshaft and the gear axis	0.11~0.22	
7	Working gap of the piston aperture in the cold state		
	Recess 1	0.30~0.45	
	Recess 2	0.7~0.9	
	Recess of oil piston ring	0.25~0.45	
8	Working gap of piston peak in cold state		
	Recess 1	0.06~0.10	
	Recess 2	0.04~0.08	
	Oil recess		
9	Direction conduit gap of valve with the loading valve body	0.017~0.042	
	Direction conduit gap of valve with the exhaust valve body	0.03~0.055	
10	The concave surface of the valve connects to the piston peak plane	Loading air	0.88~1.04
		Exhaust air	0.96~1.03
11	Gap of camshaft gear with the oil pump gear	0.11~0.22	
12	The cylinder is higher than the engine block plane	0.03~0.08	
13	Direction gap of camshaft axis	0.1~0.3	
14	Gap of camshaft bearing	0.04~0.116	
15	Gap of rod and hole of rod	0.02~0.074	

16	Edge gap of crankshaft gear with intermediate gear	0.11~0.22
17	Gap of rocker with rocker axis	0.02~0.062
18	Edge gap of compressor gear with intermediate gear	0.11~0.22
19	Edge gap of camshaft gear with booster pump gear	0.067~0.292
20	Edge gap of lubricating oil pump gear with lubricating oil pump (crankshaft)	0.059~0.238 (Gear-type lubricating oil pump)
		0.056~0.264 (Screw-type lubricating oil pump)
21	Edge gap of gear ring and active balance structure 2	0.087~0.220
22	Adjusting EVB gap (cold state)	0.32~0.38
<p>Note: If the intermediate gear is a shortened gear, there is no need to measure the edge gap between the intermediate gear and air compressor gear, other items refer to the same</p>		

Appendix C: Basic limits of Diesel engine's main wear (Reference value)

Location	Wear limit (mm)	Gap limit (mm)
Gap 2 of the piston ring head 1	1.70	-
Height of piston ring 1	0.10	-
Gap 2 of the piston ring head 2	1.50	-
Height of piston ring 2	0.10	-
Gap of oil piston ring mouth	1.50	-
Height of oil piston ring	0.15	-
Outer diameter of piston skirt	0.25	0.60
Inner diameter of the cylinder	0.50	
Outer diameter of piston pins	0.04	0.10
Inner diameter of piston pins	0.08	
Inner diameter of bush of small head of the connecting rod	0.08	
Outer diameter of camshaft journal	0.06	0.10
Inner diameter of camshaft bush	0.06	
Height of cam	2.00	-
Outer diameter	0.05	-
Outer diameter of crankshaft connecting rod journal	0.12	0.15
Inner diameter of connecting rod - engine torque	0.10	
Outer diameter of connecting rod - engine torque	0.08	0.15
Inner diameter of the main bearing	0.10	
The thickness of the bearing brake	0.40	-
The deflection of the loading valve	0.04*d(1)	
Jointing ring of the loading valve	0.75	
The loading valve seat	0.75	
The deflection of exhaust valve	0.04*d(1)	
Jointing ring of the exhaust valve	0.85	
The exhaust valve seat	0.85	
Inner diameter of direction conduit of the loading valve	0.06	0.1
Outer diameter of push rod	0.06	
Inner diameter of direction conduit of the exhaust valve	0.06	0.1
Outer diameter of exhaust valve body	0.06	
Inner diameter of rocker bush	0.10	0.12
Outer diameter of rocker bush	0.05	



DIWA.5

Maintenance Manual

2015-12-07
150.00024718en, Protection class 0: open

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This document describes the state of design of the product at the time of the editorial deadline on 2015-12-07

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Document revision history

Revision no.	Author	Date	Reason for revision / Contents of revision
8.0	kasg	2015-12-07	Document completely revised

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1 User information

1.1 Target groups

This manual is intended for service staff members.

The service staff members must have read, understood and must follow this manual. We would like to point out that Voith Turbo does not assume any liability for damage or malfunctions resulting from non-observance of the manual.

1.2 Symbols and signs

This manual uses symbols and signs which will help you to find information quickly. Please read the explanations of the symbols in the following section.

Please pay special attention to the safety information contained in this manual.

Symbols used in the text

Text type	Symbol	Function
Action instruction, 1st level	⇒	Prompts an action
Action instruction, several steps	1. 2.	Denotes a step in a sequence of actions.
List	•	Indicates individual elements of the list
Highlighting	■	Identifies important comments
Cross-reference	→	Refers the reader to another chapter or document
Note	i	For useful additional information on proper handling of the product only.

Safety information

Safety information is classified as follows:

**DANGER**

DANGER indicates an imminent threat to a person's life or health. Failure to observe this note will result in death or most serious injury.

**WARNING**

WARNING indicates a potentially hazardous situation to a person's life and health. Failure to observe this note could result in death or most serious injury.

**CAUTION**

CAUTION indicates a potential threat to a person's health. Failure to observe this note may result in minor injury.

NOTICE

NOTICE indicates potentially imminent damage to property. Failure to observe this note may result in damage to the product or to other objects.

2 Safety

2.1 Safety information on DIWA transmissions

2.1.1 General

For operation, maintenance and repair of the transmission, the local regulations for safety and for the prevention of accidents are binding in all cases.

These regulations may, for example, apply to the handling of hazardous materials, the provision and wearing of personal protective equipment or motor vehicle regulations.

Anyone operating the transmission or performing installation, repair or maintenance work must acquaint himself/herself with the warning notes and precautions described in this document.

Anyone who operates the transmission or who carries out installation, repair or maintenance work, has to make sure that his/her personal safety or the safety of other people is ensured.

2.1.2 State of the art

This transmission has been designed and manufactured according to the latest design standard and approved safety regulations. Nevertheless, risks to life and limb of people or impairment of the transmission or other tangible assets can arise during installation, repair or maintenance if:

- the transmission is used improperly,
- the transmission is operated, maintained or repaired by untrained personnel,
- the transmission is modified or rebuilt improperly, and/or
- the safety information is not observed.

2.1.3 Proper use

The DIWA transmission is designed to be used as an automatic transmission in buses.

Any other application is considered improper use. Voith Turbo GmbH & Co. KG does not assume any liability for improper use. The risk is borne solely by the user.

It is imperative that the guidelines for proper and correct use of the transmission be observed by the personnel responsible, especially by the staff involved in operation and servicing.

2.1.4 Conditions for use

Only operate the transmission:

- in perfect technical condition,
- in accordance with its intended use,
- with respect to the safety instructions and the dangers involved, and in compliance with the technical manual and other technical documents

Faults that impair safety must be eliminated immediately.

2.1.5 Qualification of personnel

Work on the transmission must be carried out by trained, instructed personnel only who are authorized by the operator. The legal age must be observed.

Maintenance and repair work requires special knowledge and training (e.g. Voith diagnostics and repair training course) and may only be carried out by qualified personnel.

Personnel currently being qualified, instructed, trained on the job or undergoing general training may work on the transmission only under the permanent supervision of a person assigned to this purpose.

2.1.6 Responsibilities

The responsibilities of the personnel working on the transmission must be clearly defined and complied with.

Only personnel explicitly ordered, authorized and trained for this purpose are allowed to work on the transmission.

Work on the chassis, braking or steering systems must be carried out by trained personnel only.

2.1.7 Unsafe instructions

The personnel working on the transmission must refuse to carry out unsafe instructions by third parties.

2.1.8 Lifting appliances

Only use suitable and technically perfect lifting gear and load-carrying devices with sufficient carrying capacity.

When replacing transmissions, assemblies or individual parts, they have to be carefully attached to the lifting gear and secured so that they do not pose any risk.

Never stand or work under suspended loads.

2.1.9 Risk of burns

The oil can become very hot - in extreme cases up to 130°C.

Improper handling may cause burns to the skin.

Therefore, let the transmission cool down to approx. 60°C before changing the oil.

2.1.10 Risk of accidents caused by oil

Oil escaping from pipes, seals or O-rings which have been improperly installed or are leaking after prolonged running time can cause accidents.

The oil in pipes and conduits as well as in the converter can be under high pressure.

Switch off the driving engine before performing any maintenance work or repairs.

2.1.11 Spare parts

Only use original spare parts for repairs, since only they can guarantee that the transmission complies with the road safety regulations and the technical state on delivery.

When replacing parts, it is essential to observe the notes and information provided in the spare parts catalog.

Original spare parts are designed specifically for Voith transmissions. We would like to point out that original spare parts which are not supplied by Voith are not tested or approved by Voith. The installation and/or use of non-original spare parts may negatively impact the specified technical features of the transmission, and thus impair safety.

In case of any damage due to the use of non-original spare parts, Voith does not assume any liability.

2.1.12 Work performed on the transmission

Before maintenance or control work on the installed transmission and during installation or removal of the transmission, the engine of the bus must be secured against starting.

Before maintenance or control work on the installed transmission and during installation or removal of the transmission, the bus must be secured in such a way that it cannot be put into motion, neither intentionally nor unintentionally, and that it cannot start moving automatically (slope!).

It is essential to perform the specified service work at regular intervals, on time and with the intended fuels and fluids.

Perform the service work in accordance with Voith provisions, e.g. the customer service information describing improvements and modifications to the transmission in such a way that no parts and tools are damaged.

Work on the transmission requires appropriate service-station equipment.

After working on the transmission, check all transmission oil lines for leaks, loose connections, chafing, and damage. Immediately eliminate any defects.

After working on the transmission, check all joints for leaks.

During work on the transmission, tighten all loosened screwed connections to the tightening torques specified in the technical documents on the transmission.

Following work on installed transmissions, close the maintenance flap and secure against unauthorized opening, e.g. by passengers.

2.1.13 Cleaning the transmission

Before cleaning the transmission with water or steam jet (high-pressure cleaner) or other cleaning agents, seal any openings into which no water, steam or cleaning agent could enter for reasons of safety and functioning.

Do not directly expose oil hose lines lying outside to the jet of the high-pressure cleaner.

After cleaning, completely remove all covers/adhesives.

2.1.14 Conversion or modification of the transmission

Modification, conversion or extension of the transmission must not be carried out without permission from Voith Turbo & Co. KG.

2.1.15 Disposal

Fluids and auxiliary substances (e.g. used oil) as well as disassembled parts must be disposed of in a safe and environmentally-sound manner.

Observe local regulations and laws on environmental protection and the disposal of hazardous materials.

2.1.16 Towing

Shift the transmission to idle position (N button).

Unplug the connecting cable between control and transmission from the controller.

If the transmission is damaged, remove the universal joint shaft or stub shaft of the rear axle.

If there is no transmission damage, the bus can also be towed by means of the universal joint shaft:

- Maximum permissible distance: 10 km
- Max. permissible speed: 30 km/h

For transmissions with angle drives it is in any case necessary to remove the universal joint shaft or stub shaft of the rear axle.

If this is not possible, please contact Voith customer service.

3 Servicing

3.1 Maintenance schedule

3.1.1 Checking the oil level

- Monthly

3.1.2 Changing the oil and oil filter

After every 60,000 km or after 2 years, whichever occurs first, with the following requirement:

- Transmission oil in accordance with the list of approved oils for oil change intervals up to 60,000 km, document number H55.6335xx.

After every 120,000 km or after 3 years, whichever occurs first, with the following requirement:

- Transmission oil in accordance with the list of approved oils for oil change intervals up to 120,000 km and 180,000 km, document number H55.6336xx, **with oil in Chapter 1.1 of the list of approved oils.**

After every 180,000 km or after 3 years, whichever occurs first, with the following requirements:

- Initial filling and refilling with transmission oil in accordance with the list of approved oils for oil change intervals up to 120,000 km and 180,000 km, document number H55.6336xx, **with oil in Chapter 1.3 of the list of approved oils.**

3.1.3 General limitations

- Oil change intervals do not apply if internal transmission protection functions are activated.
- Voith reserves the right to adjust the oil change intervals stated above in certain cases, depending on the usage conditions.
- As a basic requirement for the applicability of the specified oil change intervals, the cooling system of the vehicle must be regularly maintained and fully functional.

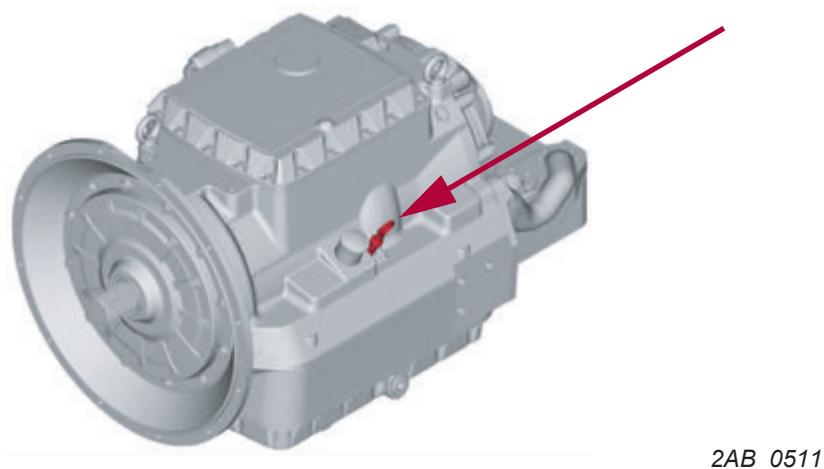
3.1.4 Extension of the oil change intervals for old vehicles

In order to increase the oil change intervals for existing vehicles to 180,000 km, adhere to the following procedures:

- Oil change with Shell Spirax S6 ATF VM PLUS
- Renewed oil change with Shell Spirax ATF VM PLUS after the previously shortened interval has elapsed
- From the second oil change with Shell Spirax S6 ATF VM PLUS, the interval can be extended to 180,000 km in compliance with → Page 3-1, Chapter 3.1.3

3.2 Position of the oil dipstick

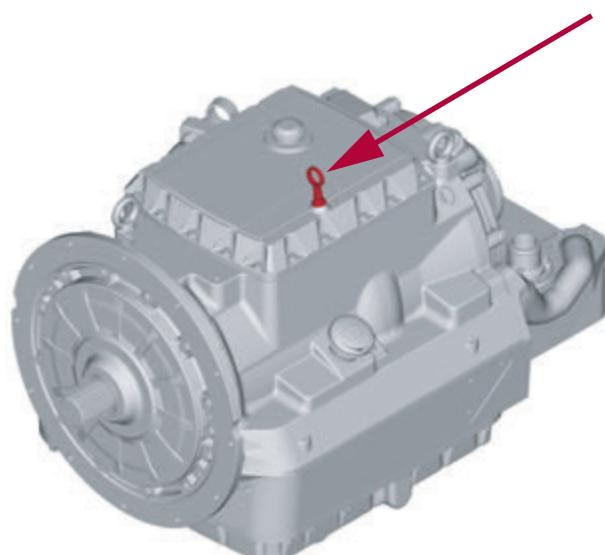
3.2.1 Oil dipstick on the side



2AB_0511

Fig. 3-1 Oil dipstick on the side

3.2.2 Oil dipstick on top



2AB_0512

Fig. 3-2 Oil dipstick on top

3.3 Checking the oil level

1. Place the vehicle in a horizontal position.
2. Apply the parking brake.
3. Press the N key.

NOTICE

Transmission damage due to missing oil

If the engine is started when the transmission has not yet been filled with oil, e.g. after transmission repair, severe damage to the transmission may result.

- ⇒ After transmission repair, only check the oil level when the engine is not running.
- ⇒ If there is insufficient oil in the transmission, refill some oil (→ Page 3-12, Chapter 3.7).

Notice

Measurement conditions

In order to determine the correct value under operating conditions, check the oil level with the engine running and at operating temperature (at least 60°C).

The cooling water temperature indicator in the vehicle can be used to determine the transmission oil temperature because the transmission oil and cooling water temperature are almost identical.

1. Start the engine.
2. Let the engine run in idle.
 - If the transmission oil temperature is below 60°C:
3. Let the engine warm up to operating temperature.



2AB_0513

Fig. 3-3 Oil dipstick

4. Pull out the oil dipstick.
5. Clean the oil dipstick.
 - The oil dipstick can be located to the side of or on top of the transmission.
6. Insert the oil dipstick briefly and remove.
7. Read the oil level.
 - The oil level must be in the range between the "min" and "max" markings of the oil dipstick.
 - The difference in the amount between the two markings is approx. 2.5 l.
8. If there is insufficient oil in the transmission, refill with the corresponding amount of oil ([→ Page 3-12, Chapter 3.7](#)).
9. If there is too much oil in the transmission, drain the corresponding amount of oil ([→ Page 3-6, Chapter 3.4](#)).

3.4 Draining the transmission oil



WARNING

Risk of scalding due to hot oil

Direct contact of the hot transmission oil with the skin can cause severe scalding injuries.

⇒ Take appropriate safety precautions when handling hot oil.

1. Shut off the engine.
2. Check the transmission oil temperature.
3. If the transmission oil temperature is below 60°C, warm up the engine to operating temperature.



Notice

Only drain the oil at operating temperature (at least 60°C). Otherwise, too much oil will remain in the transmission.

The cooling water temperature indicator in the vehicle can be used to determine the transmission oil temperature because the transmission oil and cooling water temperature are almost identical.

NOTICE

Environmental hazard due to oil

Used oil must not enter the environment.

- ⇒ Collect the oil in an appropriate container.
⇒ Dispose of any oil in accordance with local regulations.

3.4.1 Draining the transmission oil from the oil pan



Fig. 3-4 Oil pan drain plug

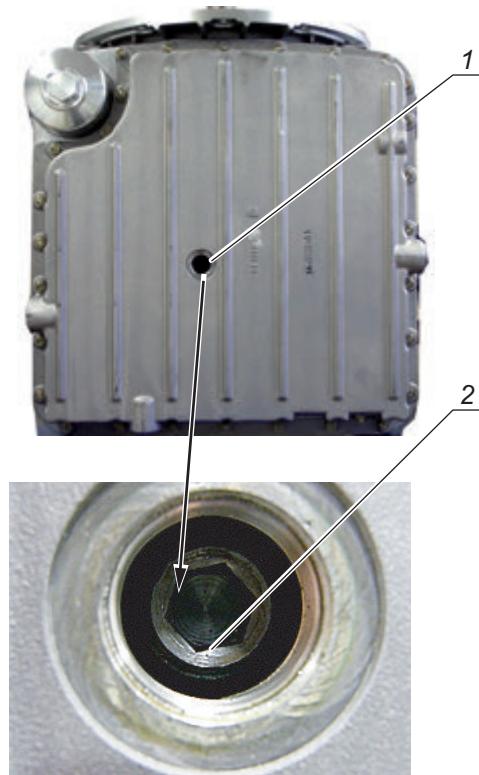
1 Oil pan drain plug

1. Loosen and remove the drain plug of the oil pan (1).
 - Use a hexagon socket wrench, size 12.
2. Drain the transmission oil.

3.4.2 Draining the transmission oil from the converter

Notice

The drain plug for the converter oil (2) is accessible through the oil pan drain hole (1)



2AC_0141

Fig. 3-5 Converter drain plug

1 Oil drain hole of the oil pan **2** Converter drain plug

1. Loosen and remove the drain plug for the oil in the converter (2).
 - Use a hexagon socket wrench, size 12.
2. Remove 14 x 20 copper sealing ring.
3. Drain the converter oil.

3.4.3 Closing the oil drain hole

1. Screw in the converter drain plug (2) with a new copper sealing ring 14x20 placed underneath.
 - Use a hexagon socket wrench, size 12.
2. Tighten the drain plug.
 - Tightening torque 50 Nm.
3. Screw in the oil pan drain plug (1) with a new copper sealing ring 26x34 placed underneath.
4. Tighten the drain plug.
 - Tightening torque 100 Nm.

3.5 Draining the transmission oil with the Flush Module

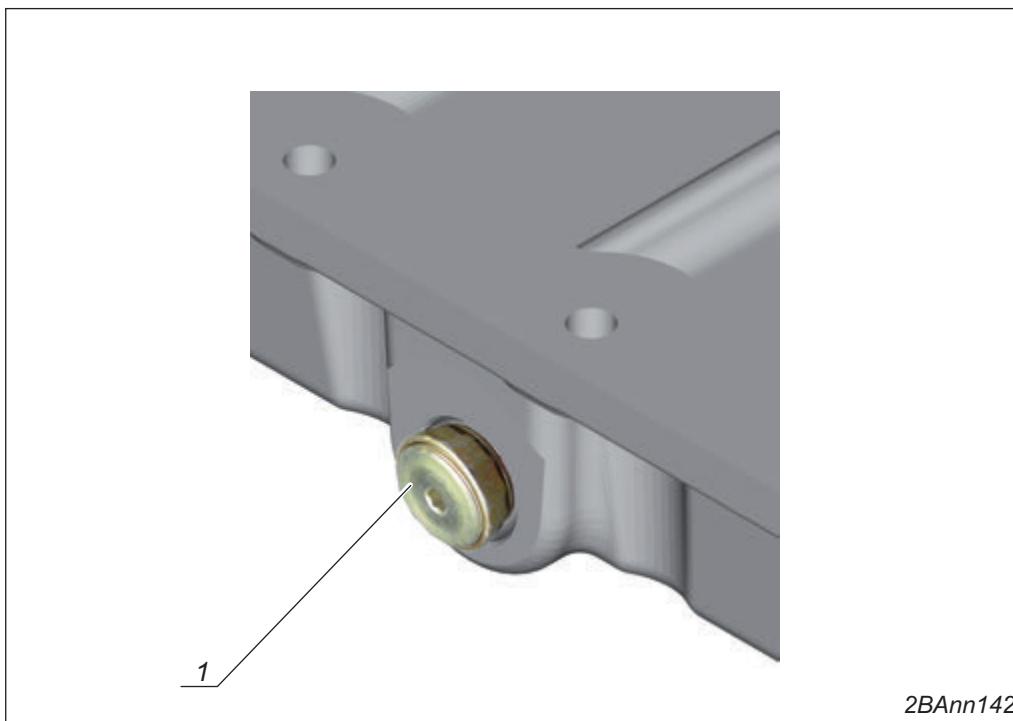


Fig. 3-6 Quick-drain valve on the oil pan

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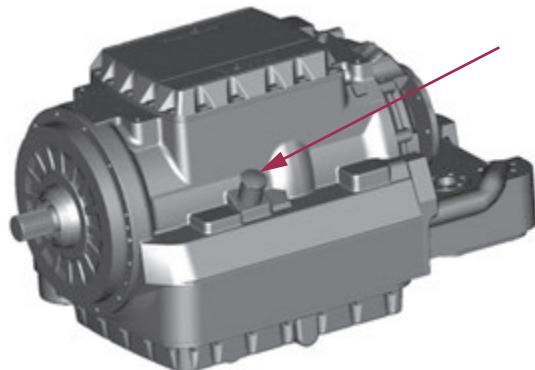
If there is a quick-drain valve (1) on the oil pan, drain the oil in the converter into the oil pan using the Flush Module while emptying the oil pan.

With the Flush Module, the oil in the converter can be drained into the oil pan at the touch of a button without having to unscrew the converter drain plug ([→ Flush Module operating instructions 150.003836xx](#)).

To drain the transmission oil using the quick-drain valve, see the documentation of the system manufacturer VIVA SYSTÈME.

3.6 Position of the oil filler neck

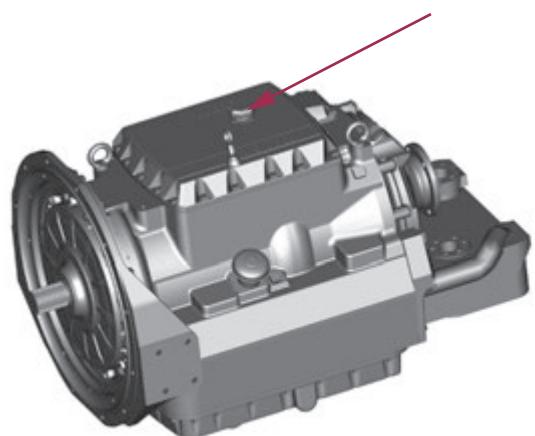
3.6.1 Oil filler neck on the side



2AB_0514

Fig. 3-7 Oil filler neck on the side

3.6.2 Oil filler neck on top



2AB_0515

Fig. 3-8 Oil filler neck on top

3.7 Fill the transmission with oil

NOTICE

Transmission damage due to incorrect oil level

Too little oil can lead to transmission malfunctioning and damage (disk damage).

Too much oil can cause the fuel consumption to increase, the transmission to overheat and oil to escape at the breather.

⇒ It is imperative to check the transmission oil level **before** starting the engine for the first time after the transmission has been installed.

⇒ Fill ATF oil into transmission.

- The oil filling orifice can be located to the side of or on top of the transmission.

Oil quantity

- For an oil change: 24 - 25 l.
- For new filling, e.g. after a transmission repair, approx. 31 l.
- No additional oil filling required for ex-works oil filling.
- After operating the transmission for a short time, check the oil level again (→ Page 3-4, Chapter 3.3) and correct if necessary.
The oil level must be between the "min." and "max." marks of the oil dipstick.

Oil quality

Only fill the transmission with oil types that are specified in the current version of the Voith H55.6335.. and H55.6336.. lists of approved oils.

⇒ After filling the oil, inspect the oil level and check the transmission for leaks.

3.8 Changing the oil filter



WARNING

Risk of scalding due to hot oil

When unscrewing the oil filter cap, some transmission oil leaks out, which can be very hot.

Direct contact of the hot transmission oil with the skin can cause severe scalding injuries.

⇒ Take appropriate safety precautions when handling hot oil.

NOTICE

Environmental hazard due to oil

Used oil must not enter the environment.

⇒ Collect the oil in an appropriate container.

⇒ Dispose of any oil in accordance with local regulations.

Notice

For changing the oil filter, the transmission oil does not have to be drained.





2AB_0516

Fig. 3-9 Oil filter cover

- ⇒ Unscrew the oil filter cover (socket wrench, size 36).
- ⇒ Remove the soiled oil filter..

**Notice**

Soiling of the oil filter

If the used oil filter is extremely dirty, this indicates excessive wear of transmission components.

In this case, the transmission should be examined by a Voith service technician.

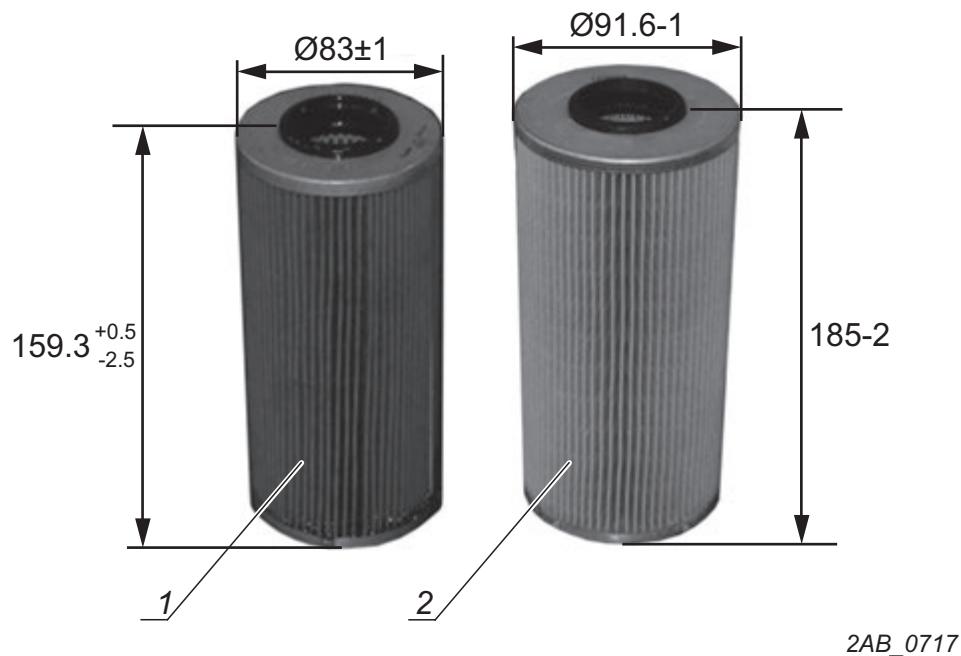
NOTICE

Wrong oil filter

It is possible to mount an oil filter for a DIWA.3E transmission in a DIWA.5/6 transmission. Both housings have the same fitting for accommodating the oil filter.

- ⇒ Ensure that the oil filter for the DIWA.5/6 is mounted.

- If a DIWA.3E filter is mounted in a DIWA.5/6 transmission:
 - there will be no longer be any filter effect.
 - a pressure loss might occur in the transmission.
- The material number for the maintenance kit with DIWA.5/6 oil filter is 151.003837xx



2AB_0717

Fig. 3-10 Difference between the DIWA.3E and DIWA.5/6 oil filters

1 DIWA.3E oil filter

2 DIWA.5/6 oil filter

1. Mount the new oil filter.
2. Mount a new O-ring.
3. Screw on the oil filter cover.
4. Tighten the oil filter cover (socket wrench, size 36).
 - Tightening torque 25 Nm.

3.9 Oil hose lines

- For the DIWA.5, oil hose lines are only installed for applications with special models (e.g. angle drive).

3.9.1 General instructions

1. Check regularly every three months.
2. When replacing, use only Voith original parts.

Soiling due to street dust and humidity and loads due to road salt in the winter can have a negative impact on the life span.

Voith recommends a usage of not longer than 6 years (starting from production, according to DIN 20066). The storage time should not exceed 2 years.

3.9.2 Cleaning

NOTICE

Possible damage caused by inappropriate cleaning methods

Oil hose lines can be damaged.

- ⇒ Do not use high-pressure cleaners on oil hose lines.
- ⇒ Do not use chemical additives.

3.9.3 Criteria for replacement

- Damage of the outer layer
- Brittleness of the outer layer
- Leakage
- Damage / deformation of the fitting
- Loosening of the hose from the fitting
- Corrosion at fitting that impairs function and firmness
- Exceeding the maximum storage and usage time

3.10 Cooling water quality

NOTICE

Damage to the heat exchanger due to unsuitable antifreeze and corrosion inhibitors.

The heat exchanger can corrode and become leaky.

⇒ Only use cooling water with a quality that meets the following specifications.

3.10.1 Water quality requirements

- No floating particles (especially with CU content) in the water
- Pure, entirely demineralized water
- pH value 6.5 to 8 at 20°C
- Chloride content max. 75 mg/l
- Sulfate content max. 50 mg/l
- Water hardness 3 to 10 °dH
- Nitrate content max. 50 mg/l
- Nitrite content max. 0 mg/l
- Drinking water is suitable in most cases

3.10.2 Mixing ratio

- Water ≤ 64%
 - Antifreeze ≥ 35%
 - Corrosion preventive 1%
- ⇒ Use ethylene glycol-based antifreeze.

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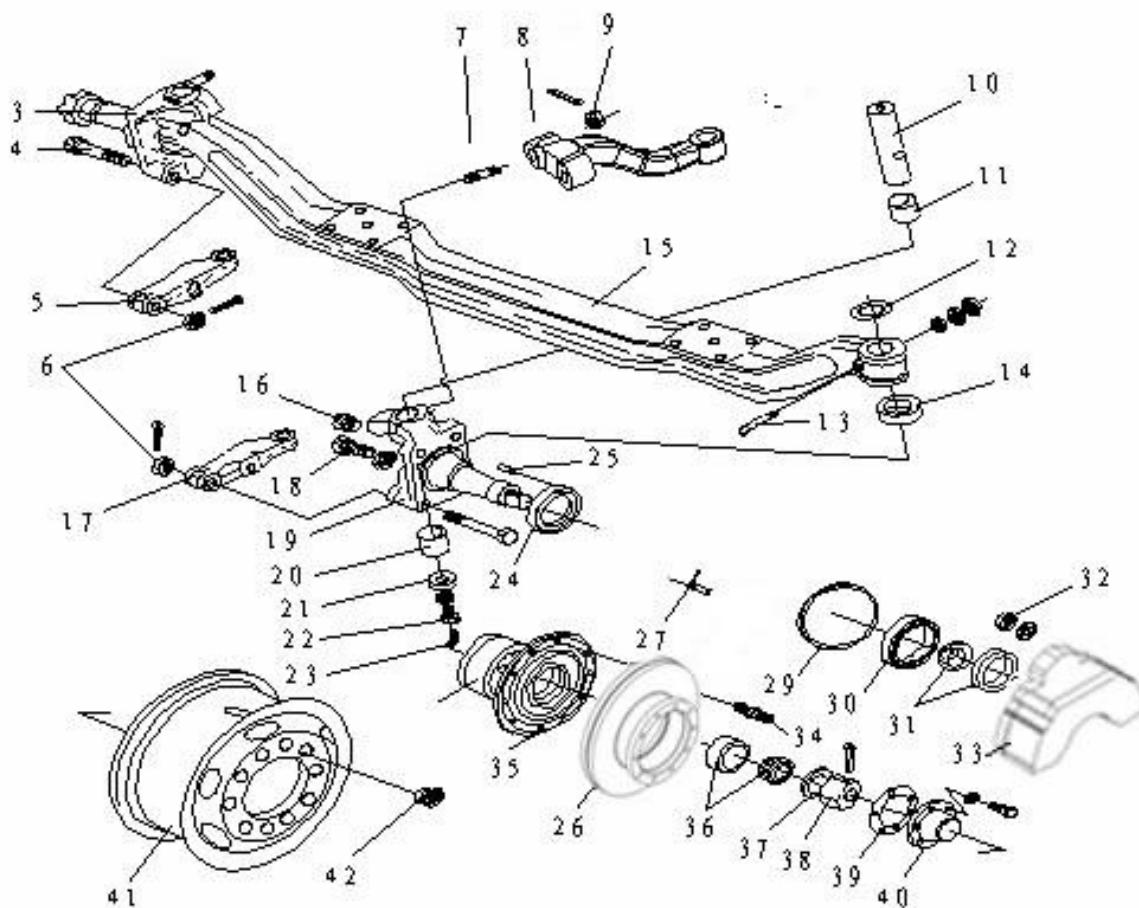
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Engineered Reliability

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PART 1: CONSTRUCTION**1. General construction***Figure 1-1. General construction of the front axle.*

No.	Name of the component	No.	Name of the component	No.	Name of the component
3	Right shunt articulation	16	Oil thrust bolts	30	Total of oil seal of front hub
4	Bolt	17	Left shunt bar	31	Total of oil seal in the hub
5	Right shunt bar	18	Steering angle limit bolts	32	Nuts
6	Milled nut	19	Left shunt articulation	33	Front shoe brake
7	Stud bolt	20	Below rubber	34	Bolts of left/right disc wheel

No.	Name of the component	No.	Name of the component	No.	Name of the component
8	Bumper pitman arm	21	Sealing plug	35	Hub assemble of axle
9	Milled nut	22	Bolts	36	Ball-bearing outside hub
10	Main pintle of shunt articulation	23	Lubricant fitting	37	Side plate
11	Upper rubber	24	Carrying ring of front oil thrusting plate	38	Milled nut
12	Side plate of shunt articulation	25	Round cylindrical pin	39	Sealing washer
13	Lock plug	26	Front brake disc	40	Hub cover
14	Thrust ball-bearing	27	Sensor ABS	41	Total of front cylinder
15	Front axle	29	Ring gear ABS	42	Disc rawlplug

2. Construction of horizontal bumper

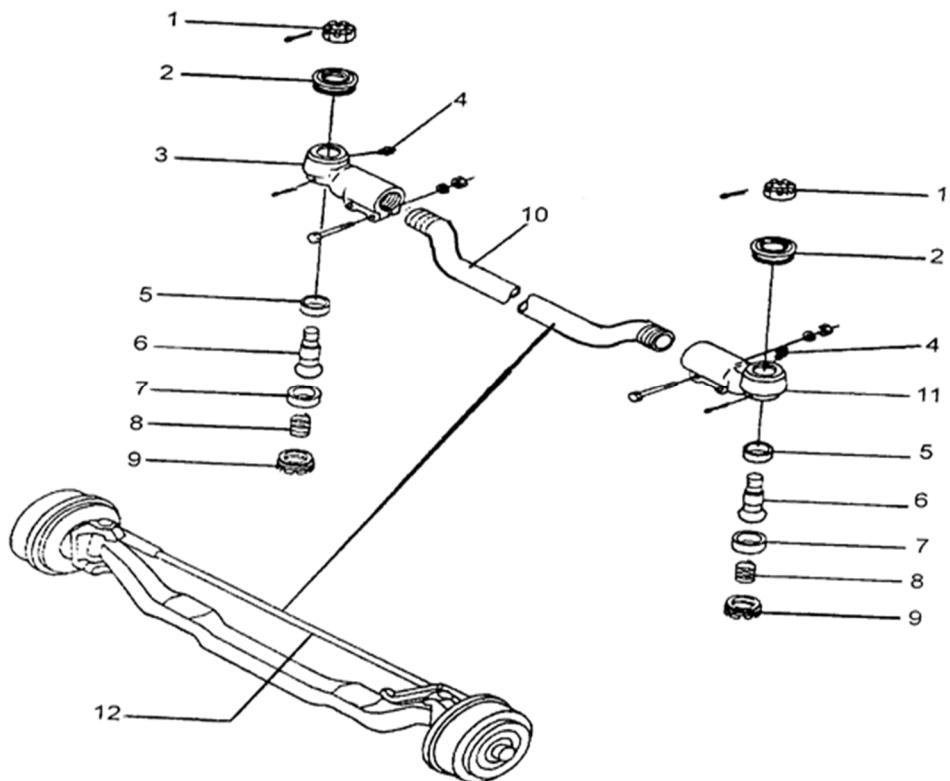


Figure 1-2. Construction of horizontal shunt brake.

No.	Name of the component	No.	Name of the component	No.	Name of the component
1	Milled nut	5	Upper cover	9	Sealing plug
2	Total of shaft sleeve	6	Tie rod pin	10	Horizontal spar
3	Total of right tie rod head	7	Below cover	11	Total of left tie rod head
4	Lubricant fitting	8	Cylindrical springs	12	Total of horizontal bumper

3. Construction of disc brake

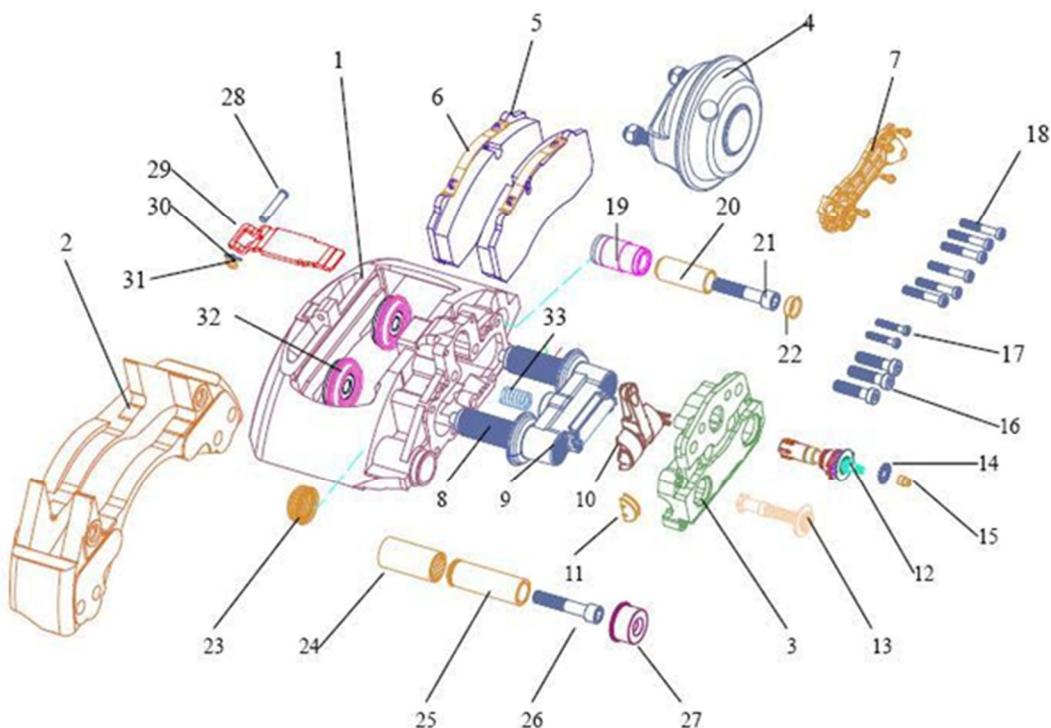


Figure 1-3. Construction of disc brake.

No.	Name of the component	No.	Name of the component	No.	Name of the component
1	Left right front shoe brake	12	Total of controller	23	Cover of king rod
2	Cover of shoe brake	13	Total of passive self-regulation mechanism	24	Copper washer
3	Manhole cover of left right front shoe brake	14	Active connecting wheel	25	King rod
4	Left right cacuum power booster	15	Momen protection plate	26	Long king rod bolts
5	Brake pads	16	Bolts I	27	Cover
6	Spring of brake pad	17	Bolts II	28	Lock shalf
7	Shaft sleeve of automatic controller	18	Bolts III	29	Sheathing sheet of brake pad
8	Controller	19	Total of shell	30	Plug
9	Rigging screw base	20	Short plug	31	Washer
10	Bearing bar	21	Bolts of short plug	32	Stirrup
11	Rubber sealing plug	22	Short plug cover	33	Return spring

4. Construction of the hub assemble of the disc brake

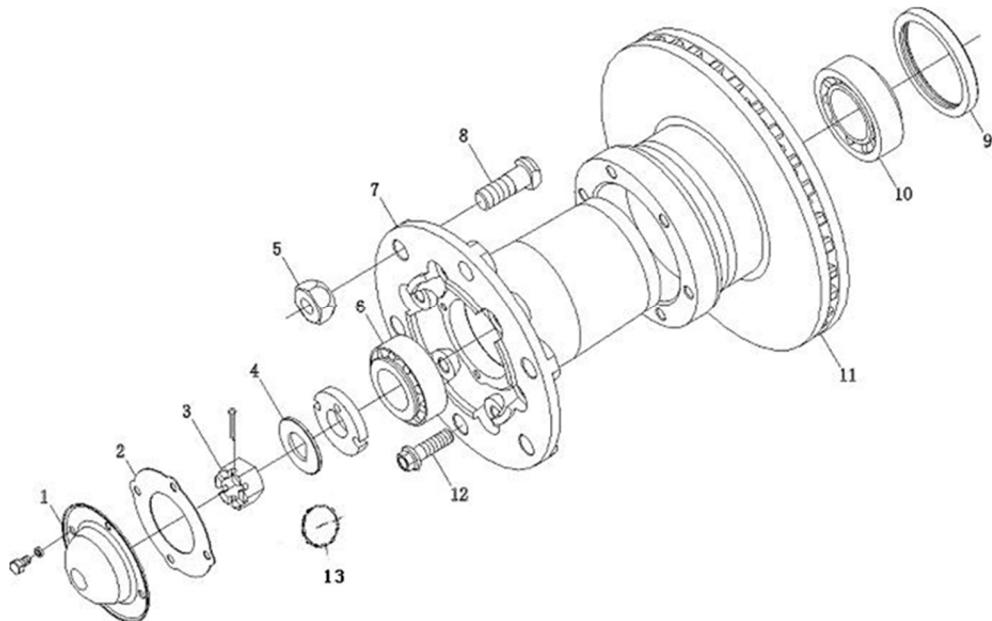


Figure 1-4. Construction of disc brake hub.

No.	Name of the component	No.	Name of the component
1	Cowl of the front burner	8	Disc bolts
2	Waterproof washer	9	Total of oil seal of front hub
3	Bolt nut of slot	10	Inner ball-bearing
4	Abrasion reducing plate	11	Brake disc
5	Bolt nut of disc	12	Bolts tightening brake disc
6	Outer ball-bearing	13	Thread sensing front axle
7	Hub		

PART 2: OPERATION AND MAINTENANCE

1. New front axle operation

- 1.1. Before putting it into use, it is necessary to add lubricating oil to the reducer and add the oil fully to the lubricant fitting on the axle.
- 1.2. After using the new axle, it is necessary to pass the running-in of 1500km and adjust the brake gap. Checking the tightness of the bolts, nuts (except the adhesive bolts).

2. Maintenance of axles

- 2.1. Each time operating 2000km: need to add oil into lubricant fitting.
- 2.2. Each time operating 8000-10000km: check the tightening status of brake bases, loose status of hub ball bearings, abrasion status of brake pads. If the brake pads wear out of the limit or concave, it is necessary to renew, check the quality of the gear oil in the axle cover. If it is deformed or too loose, replace the new oil. Check the loose status of the tie rod in the horizontal bumper, check the tightening status of wheel disc bolts .
- 2.3. Checking the brake pads adjustment handle jack: each time operating 2000km, turn the hexagonal head of the handle jack to adjust the brake gap counterclockwise and measure the torque (repeat measurement 3 times). If the torque value is less than 18N.m, it means that the handle jack to adjust the brake pad's gap has been damaged and needs to be replaced promptly.
- 2.4. Each time operating 20000-25000km: need to replace oil for the ball-bearing.
- 2.5. Failure to periodically check the vehicle means refusal of warranty from the supplier.

➤ Some notes with the axle:

- 1) Prohibit the use of excessive load according to the vehicle axle design.
- 2) Prohibit the use of the axle with errors.
- 3) Prohibit arbitrarily removing the defective axle.
- 4) Prohibit changing the structures or specifications of the axle.

PART 3: CHECK, ADJUSTMENT AND REPAIR

1. Removal process

1.1. Removing the horizontal bumper

- 1) Removing the cotter key on the nut connecting the tie rod head with the shunt bar.
- 2) Removing the horizontal bumper.
- 3) Removing the bolt connecting the head and the horizontal bumper bar.
- 4) Removing the tie rod assemble.
- 5) Removing the cotter key in the tie rod assemble, removing the slot bolt and other components (removal process as shown in Figure 5-1).

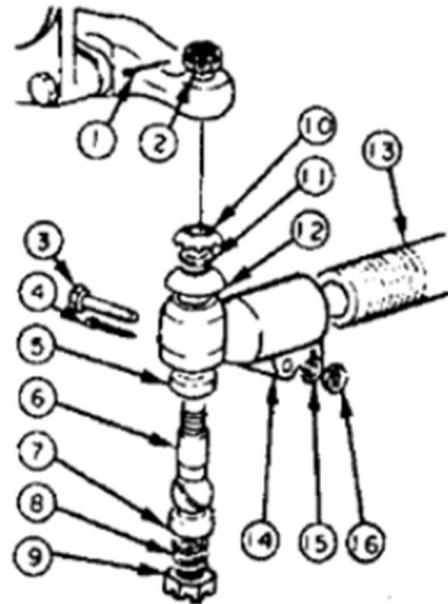


Figure 3-1. Removal process

1.2. Removing the cacuum power booster and front brake bar

- 1) Pulling out the cotter key on the plug connecting the cacuum power booster, pulling out the plug connecting the cacuum power booster and brake bar, removing the cacuum power booster and cacuum power booster base (Figure 3-2).
- 2) Removing the washer, bolts connecting between positioned bracket and brake bar (Figure 3-3).
- 3) Removing the washer and bolts positioned on the camshaft (Figure 3-4).
- 4) Using the 12 spanner to remove the bolts on the brake bar counterclockwise (due to the large tightening force, there will be a clattering sound). Then, removing the brake bar (Figure 3-5).

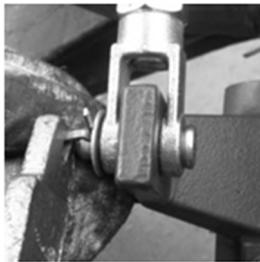


Figure 3-2



Figure 3-3



Figure 3-4



Figure 3-5

1.3. Removing the total of hub and removing the front hub

1) Removing shoe brake

- Removing the cacuum power booster (Figure 3-6).
- Removing the bolts connecting the shunt articulation and shoe brake (Figure 3-7).



Figure 3-6

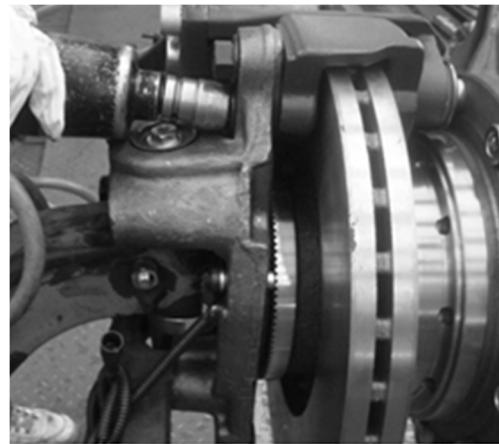


Figure 3-7

2) Removing the axle hub assemble

- Removing the cover of the ball bearing cowl (Figure 3-8).
- Removing washers, rivets, cotter keys, etc. (Figure 3-9).
- Removing the outer ball-bearing of the hub (Figure 3-10).
- Removing the hub and total of shoe brake, removing the inner ball-bearing (Figure 3-11).

➤ **Note: The cylinder is very heavy so it takes 2 people to work together to ensure safety.**

- Using the hoist to hoist ball-bearing and brackets.



Figure 3-8

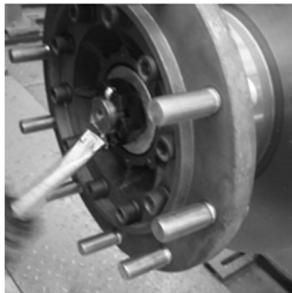


Figure 3-9

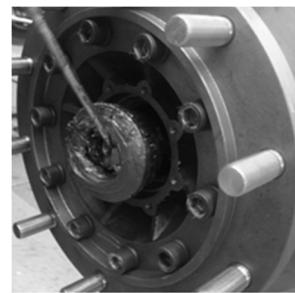


Figure 3-10

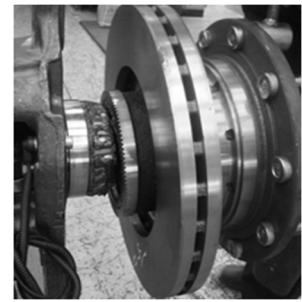


Figure 3-11

3) Removing other parts

- Loosening the bolts connecting hubs with brake discs .
- Removing the total of oil seal of the hub.

➤ **Note: Normally, the removed oil seal will not be reused.**

- Then, finding the missing position on the hub and removing the 2 ball bearings.
- Removing the ABS washer.

1.4. Removing the shunt articulation and swivel axis

- 1) Removing the brake bar (Figure 3-12).
- 2) Removing the sealing plugs and other components on the main pintle.
- 3) Loosening the nut positioning the swivel axis with the axle beam until the outside of the bolt nut is equal to the outside of the axle beam (Figure 3-13).

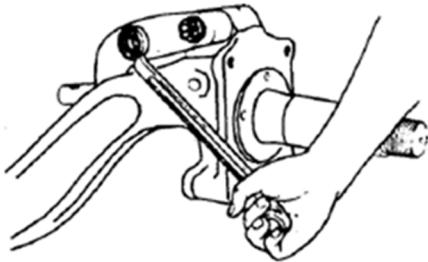


Figure 3-12.

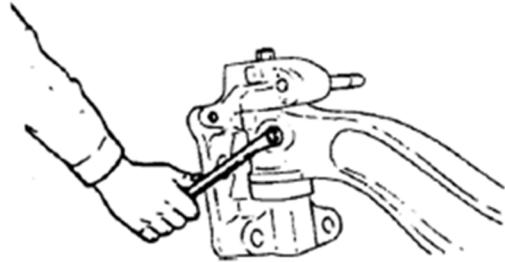


Figure 3-13.

- 4) Using a copper hammer to beat the nut, loosening the swivel axis position plug.
- 5) Removing the nut and the swivel axis position plug.
- 6) Using copper hammers and copper sticks to remove the swivel axis (Figure 3-14).
- 7) Removing the shunt articulations and the washers (Figure 3-15& 3-16).

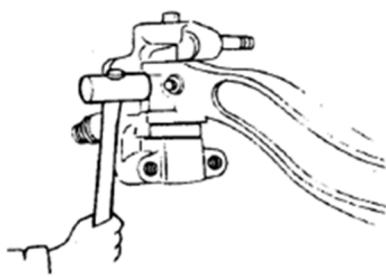


Figure 3-14.

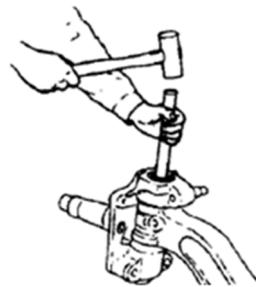


Figure 3-15.

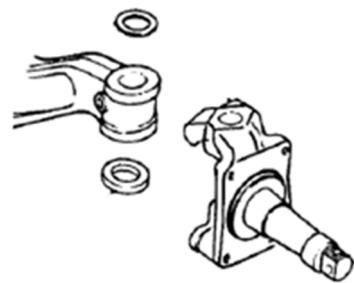


Figure 3-16.

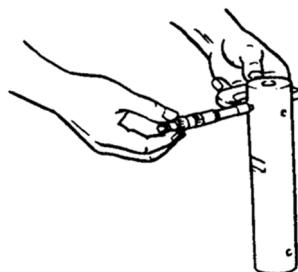
2. Check and sanitation

2.1. Check

Before cleaning the components, it is necessary to use a check tool. Based on the repair requirement that determine whether the component can continue to be repaired. Damaged components need to be repaired or replaced as required. If one of the two components interconnected is severely damaged, the gap between the two pieces is too large, according to the actual situation to replace one of the two components. The check method is as follows:

2.1.1. The main plug and shunt articulation

- a) Checking the outer diameter of the swivel axis, if the outer diameter is smaller than the limit, renew it (Figure 3-17).



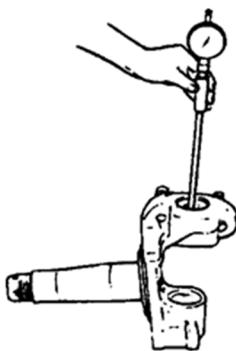
The right size: $\varnothing 52$

Wear limit: $\varnothing 51.9$

Tool: caliper

Figure 3-17.

- b) At some different points, the outer diameter of the swivel axis and the inner diameter of the bushing are of medium diameter. When the difference in average diameter is greater than the wear limit, it is necessary to replace the swivel axis or bushing (Figure 3-18).



Repair standard: 0.01~0.10mm

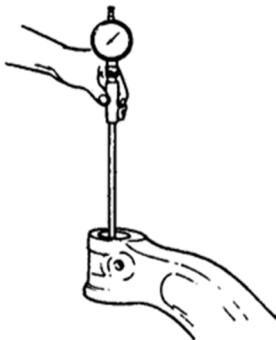
Wear limit: 0.20mm

Tool: caliper

Figure 3-18.

2.1.2. Main swivel axis bush of front axle

On the plane perpendicular to the front axle, measure the inner diameter of the bushing at several locations. If the gap between the swivel axis and the bushing is greater than the wear limit, or if the bushing is misaligned, repairing, increasing the swivel axis's diameter (Figure 3-19).



Repair standard: 0-0.04mm

Wear limit: 0.15mm

Tool: caliper

Figure 3-19.

2.1.3. Curved and twisted deformation of the front axle

- Putting the front axle on the repair table, using installation surface of the air suspension base to make the standard surface.
- Using a rope to hang a heavy object so that the 2 ends of the thread enter the 2 holes of the swivel axis, checking whether the straight line connecting the center of the hole at the position installing air suspension base coincides to the rope, if it does not coincide, it means that the axle must be bent front or back. Checking the height of symmetrical positions on the axle to the rope, if the height does not match, it means that the axle has been deformed up and down (Figure 3-20).

- c) Looking from both sides, check whether the position of the two swivel axes coincides. At the same time, checking whether the two planes at the installing position of the air suspension coincide. If two swivel axes do not coincide with each other or the two planes at the installing position of the air suspension do not coincide (forming a vertical tilt angle of the axle), the axle is twisted (Figure 3-21).

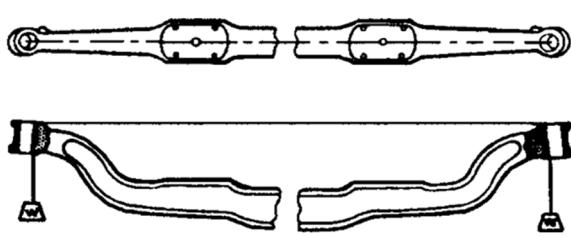


Figure 3-20.

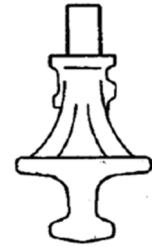
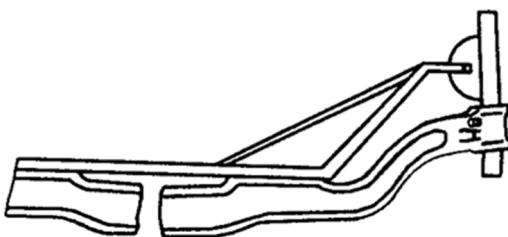


Figure 3-21.

2.1.4. Camber angle of swivel axis

Using a dedicated protractor and center plug to check as shown below. In the position of installing the air suspension base, placing the protractor so that the line in the protractor is parallel to the swivel axis, reading the number on the protractor. If the number on the protractor is not the same as the standard, the Camber angle is wrong or the swivel axis bushing is worn (Figure 3-22).



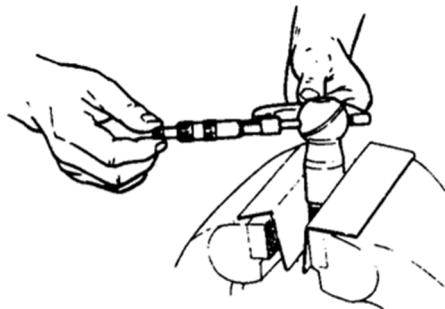
Standard camber angle: $7^\circ \pm 10'$

Tool: Protractor

Figure 3-22.

2.1.5. The tie rod head plug of horizontal bumper

If the tie rod head plug of horizontal bumper is loose or unusually worn, it is necessary to replace (Figure 3-23).



Wear limit: 37.5mm

Tool: caliper

Figure 3-23.

2.1.6 Front brake disc

a) Checking the thickness of brake pads and brake discs

A= disc brake thickness (completely new status), 45mm.

B= Disc brake thickness (after use) if $\leq 37\text{mm}$, need to be replaced.

C= 30mm brake pads thickness.

D= 9mm base plate thickness.

E= wear limit of friction plate. Limit 2mm.

F= wear limit of friction plate = thickness of base plate + minimum thickness of shims. 11mm.

Note:

- If the disc brake thickness is $\leq 39\text{mm}$, it is necessary to replace the brake disc, 37mm is the minimum thickness limit allowed.
- The brake pads are burnt, worn unevenly or stucked the lubricant, it must be replaced immediately.
- Replacing brake pads on the axle at the same time, it is not allowed to replace one side of the axle.

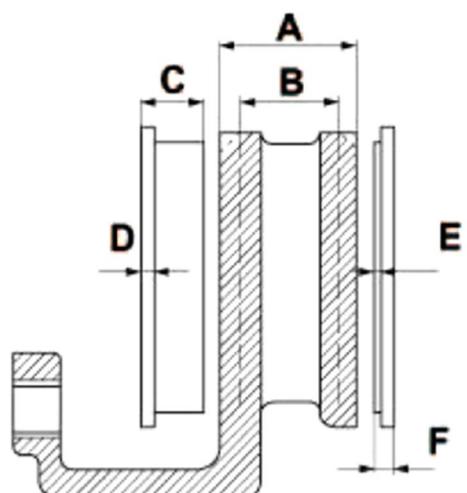


Figure 3-24

b) Checking the roughness of the brake disc surface (Figure 3-25).

a: Friction surface.

A1: Small scratches are acceptable.

B1: Scratches with depth or width less than 1.5mm are acceptable.

C1: Evenness below 1.5mm is acceptable.

D1: Scratches acrossing the surface are not acceptable.

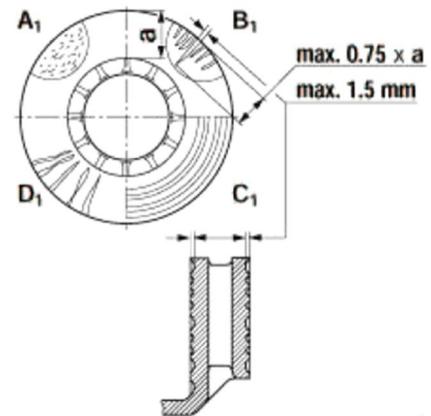


Figure 3-25

c) Hub

- Inner and outer ball-bearing are not worn.
- Whether the ball-bearing base is worn.

d) Checking whether the brake shoe slips normally.

Using the hand force (without the use of assistive devices) to push the shoe brake, if the shoe brake slips along the guide pin and the itinerary is greater than 30mm, then it is normal, otherwise it is necessary to change the short plug, long plug, etc. and related parts.

e) Checking the gap of brake pads and brake discs.

Pushing the shoe brake assemble inward, using the appropriate tool to separate from the push plate. Then measuring the distance of the base plate and push plate, the distance is within 0.7-1.2mm.

On the principle of maintenance and redundancy: every parts has a limit for repair or abrasion, it is necessary to renew it before the parts are damaged or abraded to the allowable limit..

All parts need to be through visual observation and infrared inspection. If abnormal signs are detected, conduct repair or replace as required.

After removing all rubber parts such as O-washer, oil seals, etc., it is necessary to check whether you can continue to use it.

Unusual cases			
Uneven adrasion	1 side adrasion	Deformation	Bent
Crack	Scratch	Discoloration	Rust
No matching	There are strange voices (ball bearings)	Weak or ineffective (springs)	Metamorphosis (brake pads)

2.2. Sanitation

Components can stick with oil or dust. Therefore, cleaning components is indispensable. Usually sanitation measures include washing with steam, gasoline, acid or alkaline solutions, neutral solutions, etc. In the process of cleaning may arise situations that the parts are damaged, so during the cleaning process should be carefully checked.

a) Metal

- Gasoline: gasoline for mud does not have permeability or solubility, it should be considered when using gasoline to clean metal surfaces, using a brush or other tool to remove mud, and then wash twice.
- Alkali: using alkaline solution to handle cast iron or cast steel surface. If the material is made from an alloy, do not use alkaline solution to handle.

b) Rubber components: Can not use fossil oil, can use alcohol to clean, can also use clean cloth to wipe.

c) Anti-rust: After cleaning the oil on the surface of the component, adding clean oil to prevent rust.

3. Assembling and adjusting

The front axle assembly procedure is opposite to the removal process, but pay attention to the tightening force..

3.1. Assembling the front axle

3.1.1. Assembling the shunt articulation and swivel axis

- 1) Adding the oil into the thrust ball-bearing.

- 2) Temporarily assembling the shunt articulation, washer, thrust ball-bearing (Figure 3-26).

Note: Thrust ball-bearings of small parts need to be facing towards the front axle.

- 3) Measuring the distance from the shunt articulation to the front axle, selecting the appropriate washer, ensuring the gap from 0.05-0.15mm (Figure 3-27).

Note: Washer can only use 1 piece, there are a total of 8 types of washer: 2.1-2.8mm.

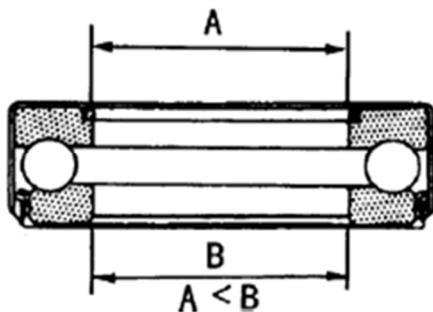


Figure 3-26.

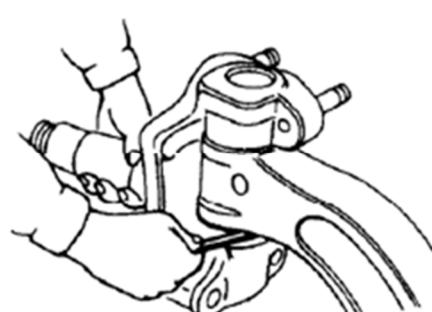


Figure 3-27.

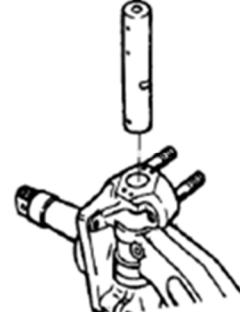


Figure 3-28.

- 4) Adding a thin layer of lubricant on the swivel axis.
- 5) Installing the swivel axis, adjusting the position (Figure 3-28).
- 6) Installing positioning plug and assemble of washer, nut (Figure 3-29).
- 7) Using a measure of the pull force at the free end of the shunt articulation (Figure 3-30).
- 8) Installing limited bolts (Figure 3-31).

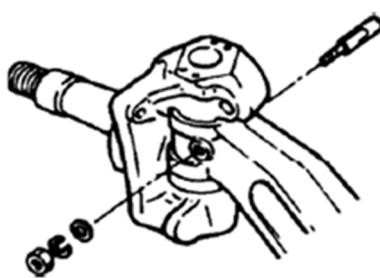


Figure 3-29.

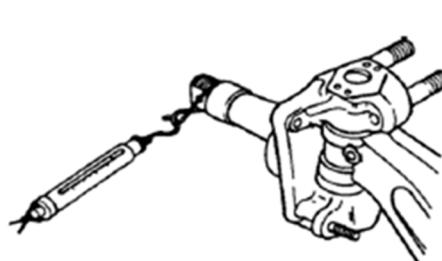


Figure 3-30.

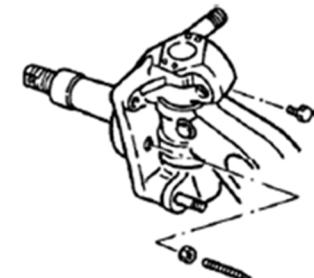


Figure 3-31.

- 9) Installing oil thrust seal and other parts under the swivel axis.
- 10) Installing the nut and the cotter key into place.

3.1.2. Installing the total of vertical steering pitman arm, bearing, cacuum power booster

- 1) First, installing the stud bolt. After that, installing the bumper pitman arm. Finally, installing the milled nut and cotter key.
- 2) Installing cacuum power booster base on the shunt articulation, installing the washers and nuts.
- 3) Installing cacuum power booster on the base.

3.1.3. Installing the brake assemble and hub

- 1) Installing the oil seal on the shunt articulation.
- 2) Installing the inner ball-bearing on the shunt articulation.
- 3) Adding the lubricant on the empty position in the hub.
- 4) Installing the brake assemble and hub.
- 5) Installing the brake assemble and hub on the shunt articulation.
- 6) Using specialized tools to install ball bearings.
- 7) Adjusting the tightening force.

3.1.4. Installing automatic brake bar

- 1) Adding the lubricant to the camshaft, installing the brake bar on the camshaft. Making sure the direction of the brake bar is in the right direction. Tightening the nut in a clockwise direction, so that the brake bar fits into the U-head of the cacuum power booster. Adding the lubricant to the round lock, installing the nut and cotter key.
- 2) Pushing the brake bar in the direction of the upward arrow until it cannot be pushed anymore. The goal is to ensure the gap of the brake pads and brake discs is consistent with the design. Then installing the positioning base to the camshaft outer cover, on the positioning base, install the washer, position and tightening the bolts (via U-shaped bolts and stud bolts, tightening force is 20-30N.m) .
- 3) Installing the washer, nut on the camshaft. Checking the handle jack position to adjust the gap of the brake pads that is within a certain gap, requiring a gap of 0.5-1 mm. If the deviation is larger, removing the brake bar and readjusting the camshaft until it is satisfactory, and finally locking the cotter key.

- 4) Using the 12 spanner to tighten the nut on the brake bar clockwise until it cannot be tightened anymore. At this time, the brake discs and brake pads are contact. Then twisting it back 270° (due to the large tightening force, there will be a clattering sound). The goal is to ensure the axle can operate and not be rubbed. Requirement for gap is from 0.5-0.8mm.

3.1.5. Adjusting the toe-in of the front wheel.

- 1) First, loosening the fixed positions on the horizontal bumper.
- 2) Turning the horizontal spar that the toe-in of the wheel is from 0-2mm .
- 3) Tightening the fixed position while the deflection angle is not more than 4°.

3.1.6. Adjusting the ABS system

When installing the ABS sensor to the sensor base, make sure that the sensor is left out of the base. After installing, the lubricant oil on the ABS sensor should be cleaned if available.

3.2. Table of tightening force

Bolt-nut	Value (N.m)	Bolt-nut	Value (N.m)
Nut connecting between the head and horizontal track rod	25-40	Nuts of handle bar	350-450
Cowl nut of swivel axis	60-80	Nuts of brake pad's base	160-210
Steering angle bolts	80-100	Bolts of brake bar sheathing sheet	140-180
2-head bolts	100-140	Bolts, brackets of brace	20-30
Bumper nuts	280-350	Adjustment nuts	180-220
	100-140	Nuts of tie rod head	250-310
Cacuum power booster adjustment bolts	140-180	Nuts of binding screw clamp	70-80

4. Common problems

Problem	Reason	Solution
Ball bearing is	Rotation force of ball bearing is large	Readjusting

hardened	Lack of oil or wrong type of oil	Pumping extra oil or changing oil
	Dirt sticks to ball-bearings	Cleaning and pumping oil
Problem	Reason	Solution
Braking force is not enough	Camshaft is not flexible	Checking the camshaft, if necessary, replacing the camshaft, checking the ball-bearings for lack of oil
	The cacuum power booster is not enough itinerary	Adjusting itinerary
	The brake pads are too hot or deformed	Replacing the brake pad
	The brake pad contact is not enough	Adjusting the contact position
Braking force is not enough	The cylinder sticks to the water	When running, lightly brake, discharge the water.
	There is oil between the cylinder and brake pads	Cleaning oil and replacing brake pad
Brakes made a sound	Brake pads are worn	Replacing brake pad
	The brake pad surface is hard and metamorphosed	Replacing brake pad
	The hub is worn unevenly or the installation is uncertain	Adjusting the hub, tightening the bolt
	The base of the friction plate on the brake pads and friction pads are not tight	Tightening the bolt
	The brake pad bases are loose	Tightening the bolt
	The ball-bearing shalf of the burner is worn	Replacing the new ball-bearing
	The hub is deformed	Replacing the hub
Wheel is worn	The camshaft has no oil or brake arm is not returned	Repairing damaged parts
	Brake bases or return springs of the cacuum power booster are damaged.	Renewing
Driving heavily,	The position of the toe-in angle is not correct (wrong camber angle)	Readjusting

the front axle may be damaged	Gap of the swivel axis and bush is large	Readjusting the gap
	Reverse installation of thrust ball-bearing	Reinstalling
	Lack of slippery	Adding oil
	Tie rod is too hard or too loose	Checking the oil of tie rod
The guide wheel is vibrated	Ball-bearing is worn	Replacing ball-bearing
	Gap of the swivel axis and bush is large	Checking the parts or renewing
	Swivel joint is deformed	Replacing swivel joint
	The wheel position is not correct	Checking and repositioning
The vehicle is deflected to the left or right	The wheel position is not correct	Checking and repositioning
	The front axle is curved	Adjusting or changing axle
	Brake is loose	Referring to the brake system
	Wheel bolts are loose	Re-checking the tightening force according to the standard
Tire is worn unevenly or quickly	The wheel position is not correct	Checking and repositioning
	Ball-bearing is damaged or bolt is loose	Changing the ball-bearing, re-checking the tightening force
	The steering tie rod head is too tight or too loose	Re-checking, if necessary, renewing

5. The components are easily damaged

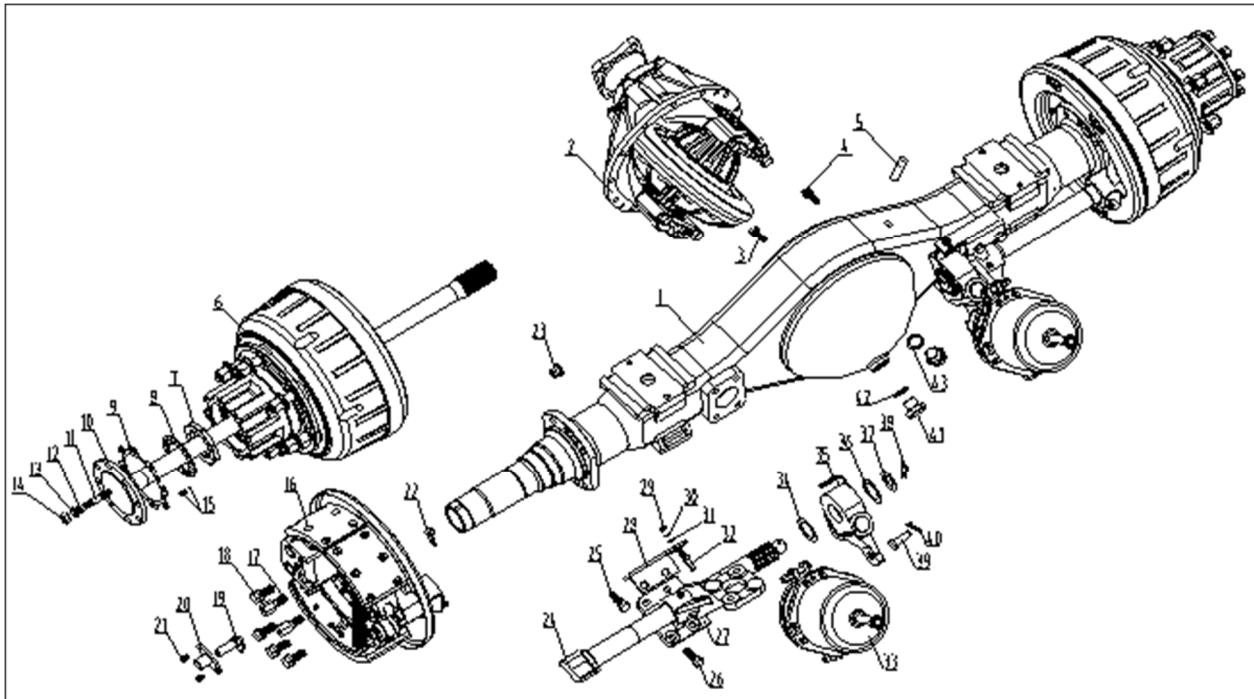
No.	Name	Quantity
1	Brake pads	8
2	Rivet – Brake pads	80
3	Ball-bearing inside the hub	2
4	Ball-bearing outside the hub	2
5	Thrust ball-bearing	2
6	Oil seal	2
7	Washer	2
8	Front brake	2
9	Shaft sleeve and base of brake plate	8

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PART 1: CONSTRUCTION

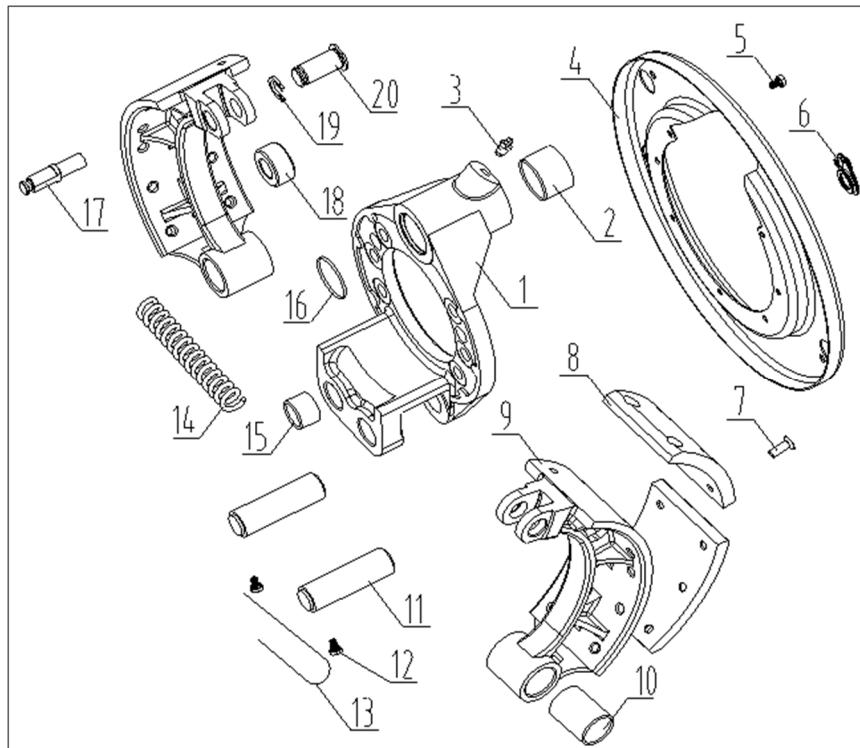
1. General construction



No.	Name of the component	No.	Name of the component	No.	Name of the component
1	Axle sleeve	16	Back brake assemble	31	Washer
2	Axle core	17	Bolt- side plate and ABS	32	Fixed adjustment axle
3	Stud fixed the axle core	18	Hexagonal bolts	33	Right/ left locker brake chamber
	Nuts		Lock washer	34	Camshaft adjustment washer
	Lock washer	19	Sensor ABS	35	Brake pad's gap adjustment handle jack
4	Bolts	20	Fixed base ABS	36	Adjustment washer
	Lock washer	21	Hexagonal bolts	37	Washer outside

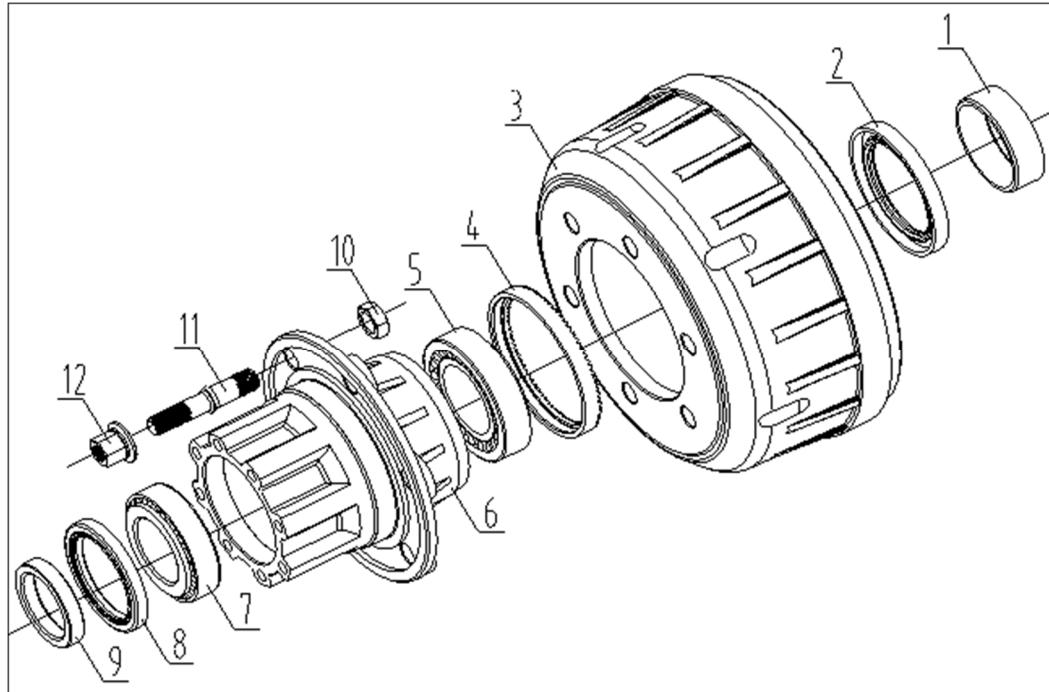
5	Breather plug		Lock washer	38	Split key
6	Left rear-hub and drum	22	Single catch	39	Piston pin
	Right rear-hub and drum		Hexagonal bolts		Washer
7	Nut to adjust the ball bearing of the hub	23	Vehicle speed sensor cowl	40	Split key
8	Lock washer	24	Right/ left camshaft	41	Plug to close the oil hole
9	Half-shaft paper washer	25	Hexagonal bolts	42	Sealing pad of sealing plug
10	Half-shaft		Lock washer	43	Oil discharge plug
11	Half-shaft bolts	26	Hexagonal bolts		Adjustment of washer
12	Cone cowl of half-shaft bolts		Lock washer		
13	Lock washer	27	Right/left back base of locker		
14	Hexagonal nuts	28	Right/left base of fixed adjustment handle jack		
15	Hexagonal bolts	29	Nuts		
	Lock washer	30	Lock washer		

2. Brake assemble



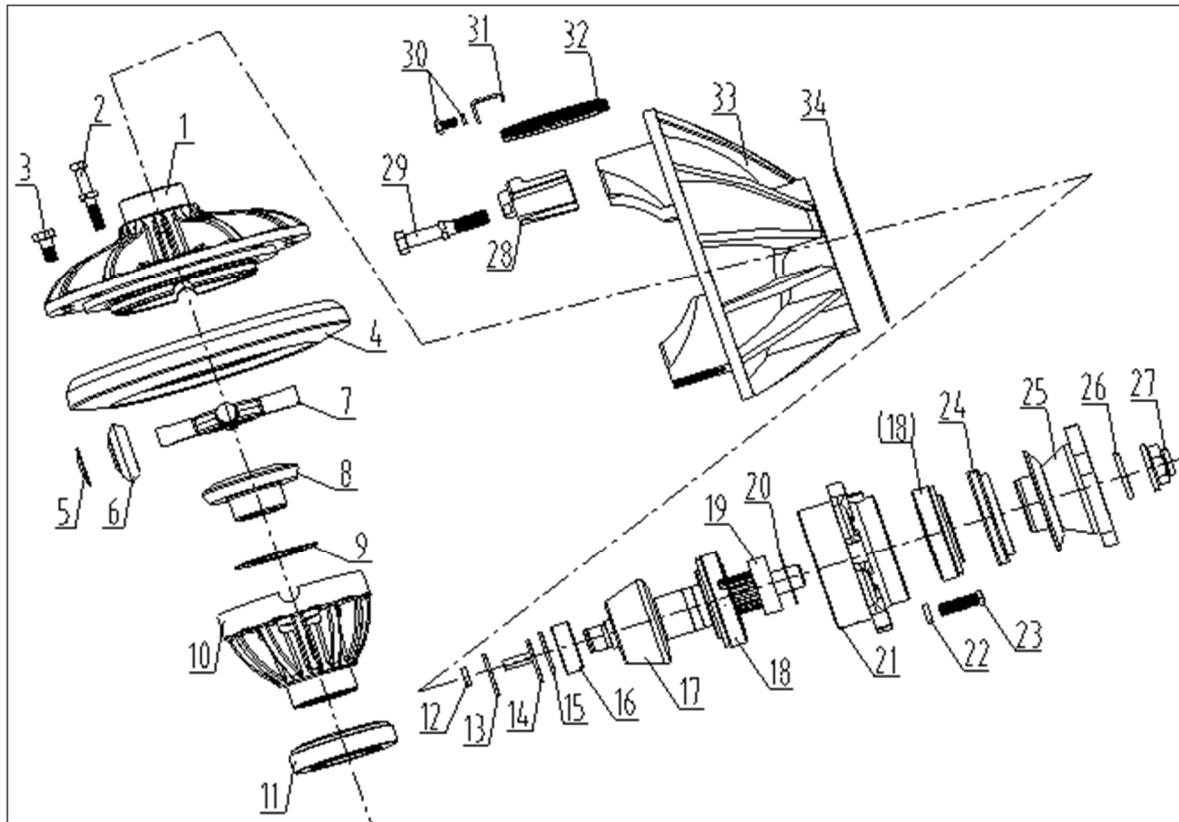
No.	Name of the component	No.	Name of the component
1	Base plate of back shoe brake	11	Axle of brake pads
2	Bushing- Base plate of back shoe brake	12	Brake pad fixed scre
3	Lubricant fitting	13	Lock cord
4	Dust shields cowl for rear brakes	14	Retun spring
5	Hexagonal bolt	15	Bushing of brake lining
	Lock washer	16	Seal ring
6	Dust-proof observation hole sealing plug	17	Return pin
7	Rivet		Nut
8	Rear brake friction plate	18	Ball-bearing
9	Brake lining	19	Lock washer
10	Bushing of brake lining	20	Ball-bearing

3. Hub and drum assemble



No.	Name of the component	No.	Name of the component
1	Inner oil seal base	8	Outer oil seal of the hub
2	Inner oil seal of the rear hub	9	Rear oil seal base
3	Rear drum	10	Drum fixed nut
4	Convolution ABS	11	Rear left wheel bolts
5	Bearing cone		Rear right wheel bolts
6	Hub	12	Left inner nut of the right rear wheel
7	Bearing cone		Right outer nut of the right rear wheel

4. Different assamble



No.	Name of the component	No.	Name of the component	No.	Name of the component
1	Left cover of the differential	13	Thrust strip	27	Driving gear nut
2	Hexagonal bolt	14	Thrust strip	28	Ball-bearing cover
	Lock washer	15	Clamp	29	Hexagonal bolt
3	Bolt	16	Ball-bearing for guiding the driving gear		Lock washer
4	Driven gear	17	Driving gear	30	Bolt
5	Washer of epicyclic gear	18	Ball-bearing of driving gear		Lock washer
6	Epicyclic gear	19	Thrust bearing of driving ball - bearing	31	Left/right adjustment locknut

7	Cross axis	20	Driving gear ball- bearing adjustment washer	32	Different adjustment nut
8	Half-shaft gear	21	Ball-bearing base	33	Different assamble cover
9	Washer of half-shaft gear	22	Lock washer	34	Driving gear adjustment washer
10	Left cover of differential	23	Hexagonal bolt		
11	Difference ball-bearing	24	Oil seal of driving gear		
12	Hexagonal nut	25	Flange		
	Lock washer	26	Driving gear fixed cowl		

PART 2: OPERATION AND MAINTENANCE

1. Using new axles

- 1.1. Before putting it into use, it is necessary to add lubricating oil to the reducer and add the oil fully to the lubricant fitting on the axle.
- 1.2. After using the new axle, it is necessary to pass the running-in of 1500km and adjust the brake gap. Checking the tightness of the bolts, nuts (except the adhesive bolts).

2. Maintenance of axles

- 2.1. Regular cleaning of mud and dirt, dust on axle vents.
- 2.2. Regularly check the oil discharge plug and filler opening, if leakage is detected, tighten it or replace the gasket, sealing gasket.
- 2.3. Each time operating 2000km: need to add oil into lubricant fitting, clean the vent button, check tighten the half-shaft bolts, check the gear oil height in the axle cover.
- 2.4. Each time operating 8000-10000km: check the tightening status of brake bases, loose status of hub ball bearings, abrasion status of brake pads. If the brake pads wear out of the limit or concave, it is necessary to renew, check the quality of the gear oil in the axle cover. If it is deformed or too loose, replace the new oil

➤**Note: Replace oil for the first 8000km.**

- 2.5. Checking the brake pads adjustment handle jack: turn the hexagonal head of the handle jack to adjust the counterclockwise brake gap and measure the torque (repeat measurement 3 times). If the torque value is less than 18N.m, it means that the handle jack to adjust the brake pad's gap has been damaged and needs to be replaced promptly.

PART 3: CHECK, ADJUSTMENT AND REPAIR

1. Removal process

The back axle assembly is made up of 3 parts: axle cover, brake assemble, axle core (differential). The process of removing the axle in principle follows the following steps:

- 1) Discharging oil of gear.
- 2) Removing the drive axle connecting to the back axle.
- 3) Removing horizontal half-shaft.
- 4) Removing the axle core (difference).
- 5) Removing the connection between the locker brake chamber pipelines.
- 6) Removing the drum and hub assemble.
- 7) Removing the brake assemble.
- 8) Removing the axle cover.

Note:

- Before removing, measure the gaps of the gears.
- When removing the differential: before removing the ball-bearing cover, mark on the ball-bearing cover to avoid incorrectly reassembling.

- 1) Removing axle cover and brake assemble

- 1) Fixing axle.
- 2) Using wrench to remove the half-shaft bolts.
- 3) Gently pulling out the half-shaft, at the same time, through the oil seal of splined, slowly turning the half-shaft to avoid damage to the oil seal. If the half-shaft is difficult to turn, it is possible to use a hammer to lightly tap the middle part of the half-shaft end, until the half-shaft is loose as shown in Figure 3-1.
- 4) Using the screwdriver to remove the 3 screws, removing the cover plate.
- 5) Using specialized tools to open the bolts as shown in Figure 3-2.

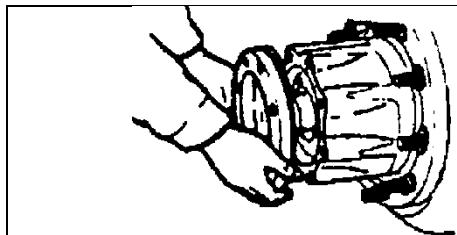


Figure 3-1

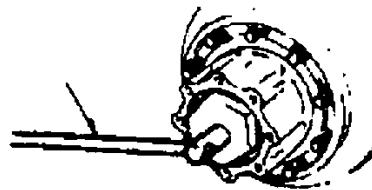


Figure 3-2

➤ **Note:** Before removing the bolts, it is necessary to mark to avoid incorrectly reassembling.

6) Turning the cylinder slightly, and using the hoist to pull out, lightly tapping the cylinder to loosen the inner ball-bearing. When the ball-bearing is loose, proceed to remove the cylinder. At this time paying attention to the weight of the large constituent, carefully injured. Also making sure the ball-bearings are not damaged.

❖ **Note:** Steps 1 to 6 are cylinder removal procedures.

7) Using a dedicated tool to remove the return spring.

➤ **Note:** Before removing any steel wire or wire, fix 2 brake pads (Figure 3-3).

8) Removing the brake pad.

a) Removing steel wire and screws (Figure 3-4).

b) Removing the brake pad plug and taking the brake pads down (Figure 3-5).

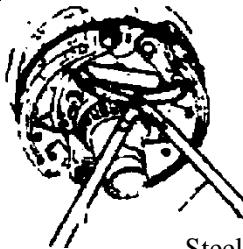


Figure 3-3

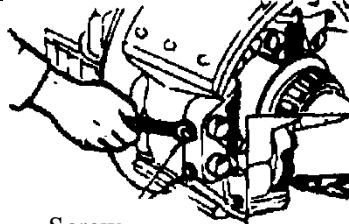


Figure 3-4

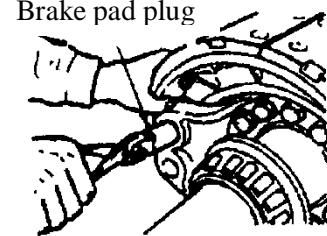
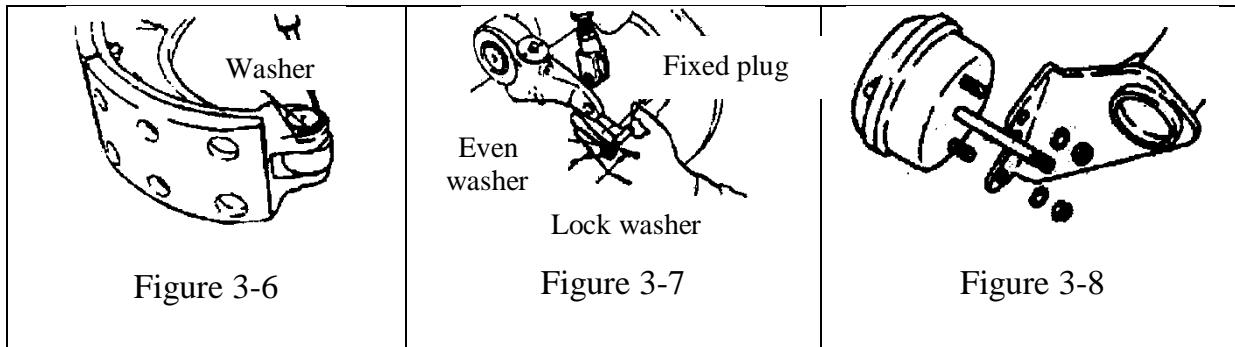


Figure 3-5

9) Removing the washer (Figure 3-6).

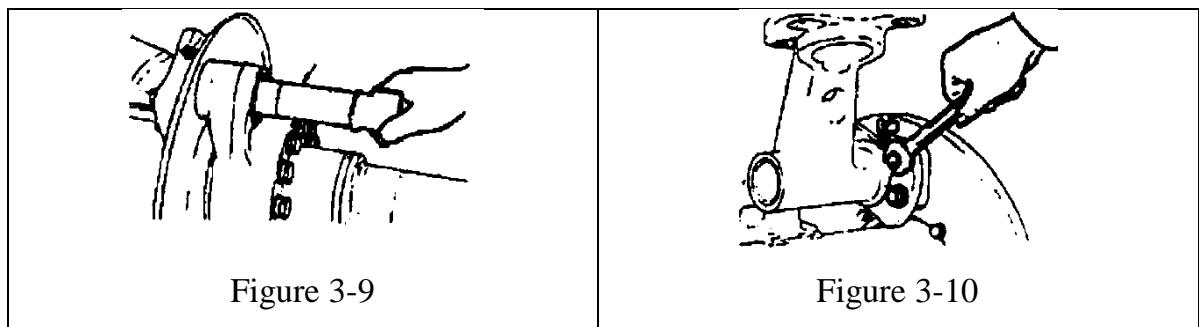
10) Removing the fixed plug, even washer, lock washer (Figure 3-7).

11) Removing the bolt nut and steam pipe, removing the cacuum power booster on the mounting foot (Figure 3-8).



- 12) Removing the brake pad's gap adjustment handle jack.
- 13) Removing the camshaft (Figure 3-9).

➤ **Note: if removing the camshaft, it is necessary to mark to avoid incorrectly reassembling**
- 14) Removing the cacuum power booster's support base (Figure 3-10).
- 15) Removing the shaft sleeve.



- 2) Removing the axle core
 - 1) Before removing it, it is necessary to mark the gap of the axle core
 - 2) Removing the keeper.
 - 3) Marking in the axle cover and ball-bearing axle
 - 4) Loosening the bolt of the ball-bearing cover.
 - 5) Removing the ball-bearing cover and bolts.
 - 6) Removing the differential.
 - 7) Removing the driving gear and O-rings.
- 3) Removing the differential
 - 1) Removing the right cover of the differential (Figures 3-11 and 3-12).

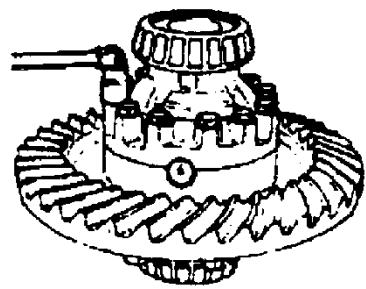


Figure 3-11

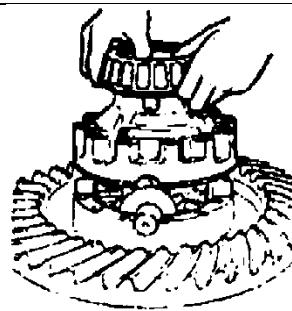


Figure 3-12

2) Removing the washer and half-shaft gear.

3) Measuring and noting the gaps of the gears (Figure 3-14).

➤ **Note: Before measuring, tighten the cross axis.**

4) Removing the cross axis, then removing the anti-pad and epicyclic gear (Figure 3-15).

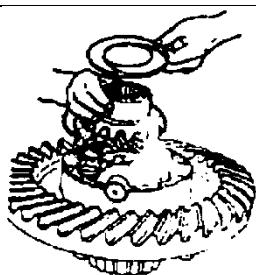


Figure 3-13

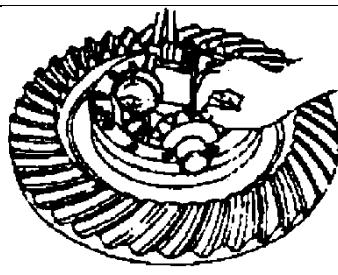


Figure 3-14

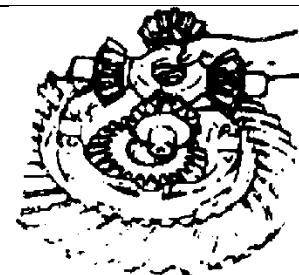


Figure 3-15

5) Removing the half-shaft and washer (Figure 3-16)

6) Removing driven gears in the difference cover (Figure 3-17)

7) Removing the ball- bearing in the differential (Figure 3-18)

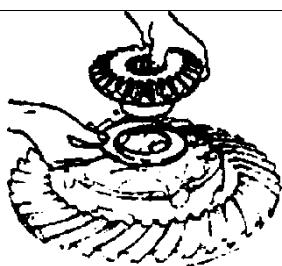


Figure 3-16

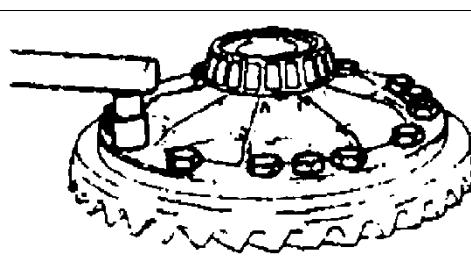


Figure 3-17

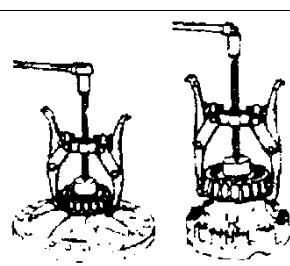


Figure 3-18

4) Removing the brake pad's gap adjustment handle jack

- 1) Releasing the brake, removing the cotter key on the cacuum power booster so that the brake pad's gap adjustment handle jack is not connected to the cacuum power booster.
- 2) Removing the nut fixing the brake pad's gap adjustment handle jack.
- 3) Removing the fixing pin and washer in the camshaft position.
- 4) Using the torque spanner to tighten the bolts on the brake pad's gap adjustment handle jack counterclockwise and removing the brake pad's gap adjustment handle jack.

2. Check and sanitation

1) Check

Before cleaning the components, it is necessary to use a check tool. Based on the repair requirement that determine whether the component can continue to be repaired. Damaged components need to be repaired or replaced as required. If one of the two components interconnected is severely damaged, the gap between the two pieces is too large, according to the actual situation to replace one of the two components.

On the principle of maintenance and redundancy: every part has a limit for repair or abrasion, it is necessary to renew it before the parts are damaged or abraded to the allowable limit.

All parts need to be through visual observation and infrared inspection. If abnormal signs are detected, conduct repair or replace as required.

After removing all rubber parts such as washer, oil seals, etc., it is necessary to check whether you can continue to use it.

Unusual cases:

- Abrasion and uneven adrasion.
- Rust.
- Bend, deformation.
- Scratch.
- Getting broken, cracked.

- Loss of effect or weakness.
- Metamorphosis.
- The position of contact is not tight.
- There are strange voices (ball bearings, etc.).
- Discoloration.

2) Sanitation

Components sometimes stick with oil. Therefore, cleaning components is indispensable. Usually sanitation measures include washing with gasoline, acid or alkaline solutions, neutral solutions, etc.

a) Metal

- 1) Gasoline: unlike other methods, gasoline for mud does not have permeability or solubility unless the component surface is machined correctly. If not, use a brush or other tool to remove mud, and then wash twice.
- 2) Alkali: using alkaline solution to handle cast iron or cast steel surface, the result is very good. If the material is made from an alloy, do not use alkaline solution to handle.
- b) Rubber components: Can not use fossil oil, can use alcohol to clean, can also use clean cloth to wipe.
- c) Anti-rust: After cleaning the oil on the surface of the component, adding clean oil to prevent rust.

3. Assembling and adjusting

The back axle assembly procedure is opposite to the removal process, but pay attention to the tightening force.

3.1. Table of tightening force

Bolt-nut	Value (N.m)	Bolt-nut	Value (N.m)
Bolt discharging lubricating oil of axle	130-150	Bolt checking lubricating oil of axle	130-150
Back shoe brake plate	180-220	Back locker brake chamber bolt	100-140
Large bolts on driving	220-250	Bolts of ball-bearing	60-80

gears		base	
Large bolts on driven gears	120-145	Bolts of difference cover	55-75
Bolts of ball-bearing	120-150	Bolts of dust stop plate	20~30
Bolts of half-shaft	75-95	Bolts connecting axle cover and reducer	65-80
Bolts of the cacuum power booster base	120-130	Adjustment bolt nut	200-250
Bolts connecting combustion head and cylinder	300-250		

3.2. Location using sealant glue

Location	Types of glue
Bolts of driven gear	Dri-Loc204 Priming glue
Bolts of difference cover	
Bolts of axle cover and reducer	Vibra-Seal503 Priming glue
Location of axle flange	HZ-1 Waterproof glue RTV oil resistance

3.3. Adjustment of axle

3.3.1. Adjustment of brake pad's gap

- 1) Adding oil on the camshaft, assembling the the brake pad's gap adjustment handle jack to the camshaft, ensuring the direction of the camshaft is in the direction of the cacuum power booster. Tightening the bolts to the handle jack clockwise, to let the handle jack in the U-slot of the cacuum power booster.
- 2) Pushing the brake pad's gap adjustment handle jack in the direction of the arrow until it cannot be pushed anymore, the purpose is to ensure the gap of the brake pads and cylinder is in accordance with the design. Then installing the positioning base on the camshaft outer cover, on the

positioning base, installing the washer, locating the position and tightening the bolt (using the U tree on pat, the force is not less than 20N.m).

- 3) Installing the washer, the nut on the camshaft, checking the position of the brake pad's gap adjustment handle jack that are within a certain gap, requiring a gap of 0.5-1 mm. If the deviation is larger, adjust the camshaft until it meets the requirements, finally locking the cotter key.
- 4) Using the Sw17 spanner to turn the hexagonal head of the brake arm clockwise until it stops, at which time the brake pads and cylinders are in contact. Then measuring the rotation counterclockwise 1-2 times so that the distance between the brake pads and cylinders is 0.6mm. At this time the axle can operate and not be rubbed.

3.3.2. Adjustment of wheel ball-bearings

- 1) Removing the lock plugs, using specialized spanner to tighten the boly nut, tighten force is 200-250N.m.
- 2) Turning the cylinder 2-3 round, leaving the ball bearing in place.
- 3) Turning the bolt nut to adjust the opposite 1/6-1/4 round, turning additionally the cylinder 2-3 times.Using the gauge to measure the pull force, the pull force is within 30-50N (if not yet, readjust)
- 4) Installing the lock plug, both sides use 2 hexagonal bolt nuts (Q151B0616) and washer rod (Q40306) to tighten, the tightening force is from 9-11N.m, making the anti-release seal.
- 5) Finally installing the oil shield oil seal.

3.4. Repair standard

Name	Standard	Limit of repair	Limit of abrasion
Gap of epicyclic gear and cross axis in the axle core	0.10-0.14 mm		0.3 mm
Gap of the convex of the half-shalf and difference cover	0.21-0.31 mm		0.60 mm
Gap of the driving gear and the driven gear	0.15-0.25 mm	0.60 mm	
Gap of half-shalf and epicyclic gear	0.25-0.35 mm	0.5 mm	

Diameter in the cylinder		330 mm	332 mm
Degree of change of the cylinder's diameter	0-0.1 mm	0.2 mm	
Thickness of brake pads		12-13mm	8.5mm
Gap of the cylinder and the brake pad	0.6mm		
the cacuum power booster's itinerary	24mm	45mm	
Gap of the camshalf	0.40-0.46mm		0.7mm
Gap of the brake pad shalf and rubber	0.16-0.26mm		0.56mm
Tightening force of main ball bearing shaft	2.5-3.5kg		
Force of differential's base	9.6-15.8kg		
Rotation force of ball bearing	30-50N		
Rotation force of the reducer	5.5-7.5kg		

PART 4: COMMON PROBLEMS

Problem	Reason	Solution
Noise	Gap of the differential's gear is not enough	Replacing the washer or gear
	Gap of the driving and driven gear is large	
	Rotation force of driving gear is small	Readjusting
	Half-shaft, epicyclic gear, cross axis have worn or damaged washer	Repairing or replacing broken parts
	Lack of lubricating oil	Adding lubricating oil
Oil leakage	Oil seal is loose, damaged and worn	Replacing oil seal
	Bolts of the reducer are loose	Tightening according to the standard
	Sealant glue is damaged	Shooting glue again
	Pat bolts of ball-bearing are loose	Tightening according to the standard
	Lubricating oil discharge bolts are loose or damaged	Tightening according to the standard or replacing
	Overload causes axle deformation	Repairing or replacing the axle cover
	The air vent is not blocked or damaged	Cleaning or renewing
Ball-bearing is hardened	Rotation force of ball-bearing is large	Readjusting
	Lack of oil or wrong type of oil	Pumping extra oil or changing oil
	Dirt sticks to ball-bearings	Cleaning and pumping oil
	Because the sealant oil seal is broken, it leads to water penetration	Replacing oil seal
Braking force is not enough	Camshaft is not flexible	Checking the camshaft, if necessary, replacing the camshaft, checking the ball-bearings for lack of oil
	The cacuum power booster is not enough itinerary	Adjusting itinerary
Braking force is not enough	The brake pads are too hot or deformed	Replacing the brake pad
	The brake pad contact is not enough	Adjusting the contact position
	The cylinder sticks to the water	When running, lightly brake, discharge the water.
	There is oil between the cylinder and brake pads	Cleaning oil and replacing brake pad
	Braking steam is not enough	Checking the steam pipe
	The fork adjusting the gap of the brake pads is ineffective	Readjusting or replacing

Problem	Reason	Solution
Brakes made a sound	Brake pads are worn	Replacing brake pad
	The brake pads are hard and metamorphosed	Replacing brake pad
	The cylinder is worn unevenly or the installation is uncertain	Adjusting the cylinder, tightening the bolt
	The base of the friction plate on the brake pads and friction pads are not tight	Tightening the bolt
	The brake pad bases of the bolts are loose	Tightening the bolt
	The ball-bearing shaft of the burner is worn	Replacing the new ball-bearing
Unstable brakes	The cylinder is deformed	Adjusting or replacing the cylinder
	The cylinder installation is not correct	Tightening the bolt
	Return spring is broken	Renewing the spring
	The friction plate with oil or metamorphism	Cleaning or renewing
Wheel is worn	Brake base are damaged	Renewing
	The camshaft has no oil or the brake pad's gap adjustment handle jack is not returned	Repairing damaged parts
	Brake bases or return springs of the cacuum power booster are damaged.	Renewing

PART 5: THE COMPONENTS ARE EASILY DAMAGED

No.	Name	Quantity
1	Total oil seal inside the burner	2
2	Half-shaft	2
3	Total oil seal outside the burner	2
4	Back brake pad	8
5	Rivet fixing the friction plate	48
6	Back cylinder	2
7	Oil seal – discs gear	1
8	Sealant oil seal	2
9	Bolts of back disc	20
10	Ball-bearing guiding for disc gear	1
11	Left cacuum power booster	1
12	Right cacuum power booster	1
13	Ball-bearing of disc gear	2
14	Ball-bearing of differential	2
15	Ball-bearing inside the back wheel burners	2
16	Ball-bearing outside the back wheel burners	2
17	Oil shield of lubricant oil discharge bolts	2



Operation & Repair & Maintenance Manual

—Propeller Shaft System

BUS MODEL: THACO MEADOW 85SE

Bus propeller shaft is characterized as with high torque and large swing angle. The nominal dynamic torque is 4000 N.m, maximum torque can be 14,000 N.m. Maximum swing angle can be 25°.

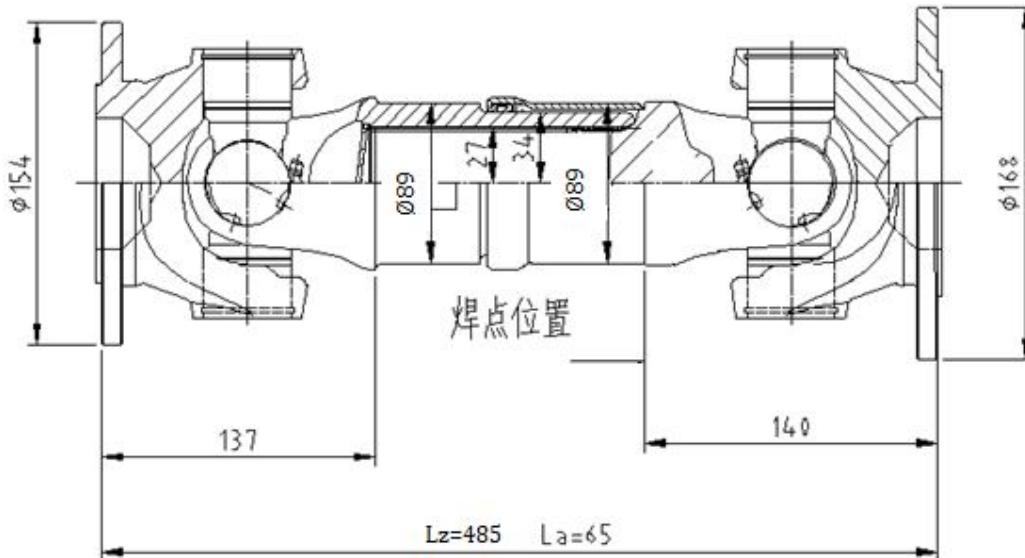


Figure 1. The structure of propeller shaft

I. Disassembling the propeller shaft.

Before disassembling the propeller shaft, securely wedge the front and rear wheel with seat pads. Firstly disassemble the flange connecting propeller shaft and rear axle, then take down the flange connecting with the transmission. Before dismantling the propeller shaft, mark the position facing the propeller shaft expanding cover and spline shaft in order to avoid making mistakes during reassembling and ensure dynamic balance accuracy.

1. Disassembling of spider needle bearing

Firstly disassemble retainer ring (or locking piece and cover plate) of needle bearing, take out the the needle bearing assembly. Pay attention not to let the assembly fall apart.

2. Disassembling the spline shaft and expanding cover

Hold the fork of universal shaft in the spline shaft sleeve, unscrew oil seal cover, take out the oil seal and washer then pull out the spline shaft.

Use light oil and metal wire brush to clean off greasy dirt on the non-machined surface, then use base solution to clean metal parts. Rubber parts should be cleaned by alcohol, then blower to dry.

II. Inspection of propeller shaft parts.

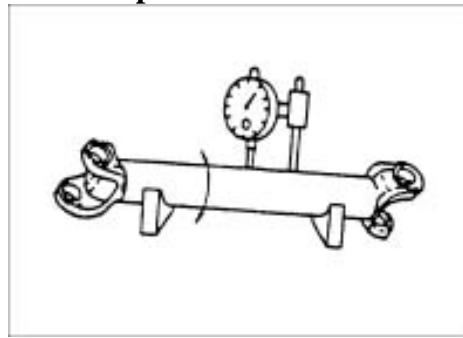


Figure 2. Inspection of propeller

1. Lay two ends of the propeller shaft on a V-shaped iron, measure the amount of its radial run-out.

Service standard: 0.75 mm

Use limit: 1.50 mm

If the run-out exceeds tolerance, the shaft should be adjusted or replaced.

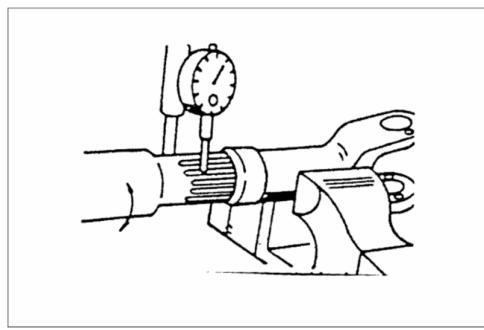


Figure 2. Check shaft and sleeve

2. Insert the spline shaft into its sleeve, check the clearance between them.

Service standard: 0.025 mm

Wear standard: 0.400 mm

The shaft shall be replaced if the clearance is larger than required.

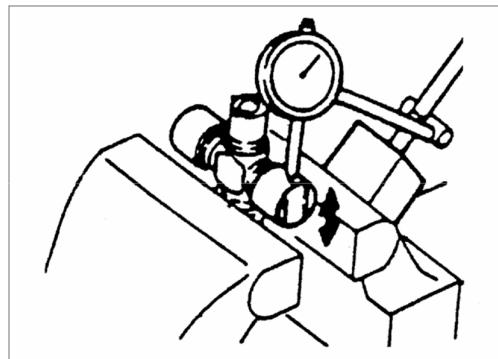


Figure 3. Check needle bearing

3. Put the needle bearing on the universal joint spider, push the bearing vertically, check the it's play.

Service standard: 0.02 mm

Wear standard: 0.15 mm

The bearing or spider should be replaced if the clearance exceeds tolerance.

III. Assembling of propeller shaft parts.

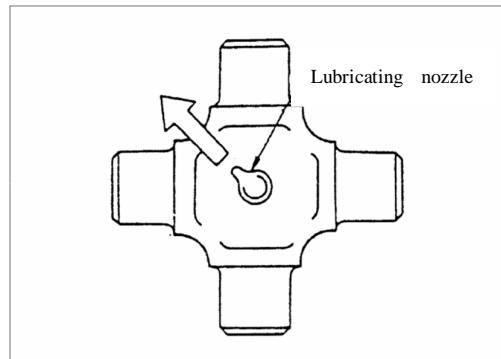


Figure 4. Assembly lubricating nozzle

1. Install the lubricating nozzle on the universal joint spider as shown in the figure below.

Then install the dustproof cover.

Hold the spline shaft with a vice and install the spider, apply lubricant grease to the needle bearing firstly.

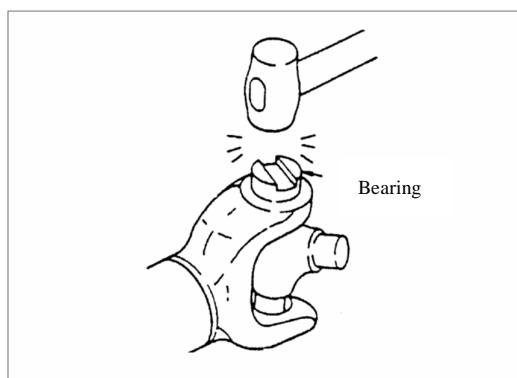


Figure 5. Assembly needle bearing

2. Use a copper hammer to knock on the bearing when it is assembled. Install the retainer ring (or cover plate and locking piece). Install flange yoke. The spider and flange yoke shall be install onto the splined sleeve with the same method.

Insert the splined sleeve according to the mark made when the spline shaft is dismantled.

Finally, put on the oil seal and dustproof cover. Connect the propeller shaft assembly with transmission output shaft , tighten the bolt of propeller shaft with a torque of 125-145 N.m. Connect the propeller shaft assembly with input flange of rear axle, tighten the bolt of propeller shaft with a torque of 180-220 N.m.

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PREFACE

This maintenance manual provides customers with the necessary information to carry out maintenance, inspection and safe use of air suspension on Bus.

The specifications, codes and number of details mentioned in this maintenance manual are only in accordance with the standard configuration of the air suspension system of Komman Company. If not identical to the standard installation configuration, please contact the manufacturer. Please proceed with maintenance and use of the product according to the requirements set out in this maintenance manual so that customers can use the product “effectively and safely”.

PART 1: OPERATING

The air suspension system has outstanding features, providing reliability when used and without problems when used on long distances. When minor incidents such as leaking gas pipes or damaged air bags occur, the pressure protection valve in the pipeline can still maintain the pressure to brake the car, moreover, the washers inside the spring will now have the function of becoming a support rubber washer, the car can still move at a slow speed to the nearest warranty station to perform repairs.

Accurate use will minimize and avoid other unintended incidents to the air suspension system.

1. No overload allowed.
2. The pressure supplied to the air suspension system is maintained in the range of 6.0 bar (if exceeding 6.0 bar, the pressure maintaining valve will operate and the maximum allowable pressure for air control system is 7.0 bar).
3. The position on the air suspension system does not need to use lubricating oil, especially prohibit the use of lubricants in rubber parts.
4. Maintenance of products according to regulations (see part 2, maintenance).

PART 2: MAINTENANCE

The manufacturer will provide quality warranty services for products that has manufactured and supplied (from the date of sale).

Product's name	Maintenance time	Number of Km	Note
Main details	2 years	200000	Apply on condition comes first
Buffer, air bag	1 year	100000	
Backing	1 year	80000	
Types of valves	1 year	50000	
Vulnerable details	Only applicable for damaged details		

During the warranty period, if product quality is problematic, customers are free of providing, maintaining and replacing components by authorized showrooms dealer stores of Komman company.

➤ Tasks include:

- Provide information or documentation on instructions for maintenance, repair and assembly of products.
- Provide components that need to be replaced, with shipping.

➤ Responsibilities of the person installing the product

- Installation based on standards and guidelines.
- Ensure accuracy and safety when operating.
- Notify the owner and provide documents so that the customer can maintain and use it exactly as required by the product.

➤ Limitation of warranty

The company will not be responsible for cases when sharing Komman's suspension system with components that have not been approved by Komman, or use other replacement parts from other manufacturers that have not been verified by Komman.

1. Daily maintenance items

- 1.1. Check every day or before using the car.
- 1.2. Content to check includes:

- 1.2.1. Visually check the amount of air supplied in the gas tank.
- 1.2.2. The height of the suspension system is normal, the system does not leak.

The simple check method is: when receiving a car from the manufacturer, stop the car on a flat road surface, measure 4 points from the center of the wheel to the point on the vehicle chassis, determine the fixed distance and record 4 values. Every time you check, just stop the car at a flat surface, measuring and checking these 4 values without any change means that the height of the suspension system is still normal and the system does not leak.

- 1.3. If the check fails, fix and correct the problem if necessary.

2. Periodic safety check

- 2.1. Periodic safety check can be based on maintenance time, distance of 1500-2000km or based on regulations on safety check time to proceed.
- 2.2. When checking, it is necessary to stop the car in a clean and flat place, it is best to park the car at a repair station with an inspection tunnel, fix the brakes on the vehicle (below is a description of the types of maintenance checks).
- 2.3. Safety check items:
 - 2.3.1. All components are tightened and not loosened. Bolts, nuts are not loose, dirty, rusted and damaged, abrasive.
 - 2.3.2. The pressure must not exceed 6.0 Mpa, the air must be fully loaded, the air suspension must be firmly placed at the same height and check whether the air suspension is abrasive, damaged or inflated, the gap range must be 25mm or more.
 - 2.3.3. Check whether the buffers are leaking oil and working normally.

The easy way to check the buffers for normal operation is: after moving, the buffer generate heat proves that the buffer works normally.

➤ **Note: The buffer may cause burns to the hands**

- 2.3.4. All components and welds are not cracked.

3. Level 2 maintenance

- 3.1. After traveling 8000km or relying on the level 2 maintenance period to conduct maintenance, repair and check once.

3.2. Content of level 2 maintenance

- 3.2.1. Check suspension system and the tightening of bolts and nuts; when necessary, replace nuts or washers
- 3.2.2. Spring check like section 2.3.2
- 3.2.3. Buffer check like section 2.3.3
- 3.2.4. Drain the water in the compressed air tank
- 3.2.5. Check and repair the height of the control valve
- 3.2.6. Check the height of the suspension system in accordance with the design value, the error should not exceed $\pm 5\text{mm}$. When necessary, adjust the height of the control valve to adjust the height of the suspension system.

4. Level 3 maintenance

- 4.1. Rely on the road of 80,000km or 1 year, level 3 maintenance carries out maintenance and repair of the suspension system.
- 4.2. Content of level 3 maintenance: In addition to the level 2 maintenance items, strengthen checking whether the components of the suspension system are loosened, abrasive, cracked, damaged to promptly repair and replace.

PART 3: INCIDENT ANALYSIS

Although Komman air suspension is of good quality, safe to use and avoids problems when used in long distance, it is also impossible to avoid incidents caused by the adjustment process or maintenance process. To help customers to "judge and solve" problems when repairing and save up to the maximum time and repair costs. Below is a list of possible incidents and situations that may occur and the causes of the air suspension problem.

1. Incident of the buffer

1.1. Leakages

- The height of the suspended frame is not suitable, too high or too low.
- Incorrect installation of buffers, reverse installation or installation position of the leaf spring on buffer is not correct.
- The buffer is not correct.
- The gap around the buffers is not enough.

1.2. The washer for installing buffers is prolonged or pulled apart, buffers are pulled apart.

- Suspended frame is too high.
- Incorrectly installate the buffers, the installation position of the leaf spring on the buffers is too high.
- The buffer is not correct.

1.3. The bushing of buffer is damaged

- The heigh of suspended frame is too high or too low.
- Incorrectly installate the buffers, installation of bolts are not tightened or loose.
- The buffer is not correct.
- Normal abrasion.

1.4. The buffer is bent

- The buffer is not correct.
 - Incorrectly installate the buffers, the position of the leaf spring installed on the buffers is too low.
 - The air tank is not correct.

Note: Buffer is easily damaged, the warranty period is 1 year or 80,000 km. In cases where no cause is found, if there is no repeated damage in a short period of time, it is considered normal.

2. Incident of air tank

2.1. The air tank has collapsed (no air supply).

- The air pressure in the tank is low.
- Pressure protection valve is disabled or the pipe is dirty.
- The air control pipes are leaked or blocked.
- The valve determining the height is disabled or the connecting end of the connecting bars is loosened.

2.2. The air bag is abraded

- The gap around the air tank is not 25mm.
- The welds of the chassis adjustment bar with the leaf spring is open or the damaged rubber bush slips the suspension frame, causing friction between the wheel and air bag.
- Caused by the damaged buffersm, the pipe is loose plus the airbag friction.
- Outside the plunger on the bottom washer of the air tank is attached by sand and glass fragments.

2.3. The air tank is protruding

- The height of suspended frame is low, the air tank works with low pressure for a long time.
- The valve determining the height is disabled or the connecting end of the connecting bars is loosened.
- The air tank is not correct (too high).
- The supply pressure is too low, the vehicle is overloaded.

2.4. The air tank cover is swollen

- The buffer is invalid, damaged or improper.
- The valve determining the height does not work.
- The height of suspended frame is too high, the tank works for a long time in conditions exceeding the normal pressure

2.5. The air tank is not correct (too low)

- The connection between the airbag with the upper half edge or the plunger is cracked and leaked or gas leakage is at the location of bolts and nuts.
- Supply pressure is too high, severe overload.
- The disabled buffers cause damage or improper product, the air bag is stretched too long.
- The washers are eccentric in contact, corroding the position between the airbag and the cover or piston.

2.6. The air tank is skewed, the washer is eccentric in contact

- Incorrectly installing the air tank, spring is tilted vertically.
- Incorrectly installing the air tank, spring is tilted horizontally.
- The welds of the chassis adjustment bar with the leaf spring is open or the damaged rubber bush of reverse bar slips the suspension frame.

2.7. The air bag is cracked

- Using lubricating oil for air bags reduces the age of use.
- Normal depreciation.

2.8. Reducing elasticity, increasing hardness

- The air in the air tank has not escaped out all the time, more water is deposited in the air tank.

Note: If using normally, the age of use of the air tank is usually 3-5 years

3. Incidents of height adjustment valve

3.1. Vehicle is tilted

- The valve determining the height is adjusted incorrectly, if the height of the suspension system on the back axle significantly different from the design value, the vehicle will tilt vertically, if the height difference between the suspension system of the two adjustment axes is too large, the vehicle will be tilted horizontally.
- Any fault of each valve determining the height or fault of blocked pipes can cause control errors for that airbag.

3.2. The connecting bar is pulled apart, crank adjusting valve turns backwards.

- Incorrectly installing the valve.

- The height of the connecting bar is not correct.

3.3. Valve reacts slowly

- Supply pressure is too low.
- The valves determining the height or pipes are dirty, deformed.
- The water in the air bag has not escaped out all the time, in cold weather days, it will happen freezing in pipes or valves.
- The diameter of the pipe and the connecting end is too small.

4. Incidents of structural details with the suspension system

4.1. The wheel is unusually deflected, abraded

- Incorrectly locating the front and back axles.
- The weld is open on the adjusting bar of the chassis with the leaf spring, the bolt locking the axle is loose.
- The bolt for installing backing is loose. The rubber bush of the backing is abraded or damaged

4.2. Vehicle moves unstable, the movement is difficult

- The bolt of the chassis or the connecting bolt is loose.
- The fixed bolt for installation of axles is loose.
- The weld is open on the adjusting bar of the chassis with the leaf spring, the rubber bush is abraded or damaged (the bolt for installing backing is loose), the suspended frame is slipped

5. Incidents of rubber bush

5.1. The rubber bush is broken

- Serious overloading.
- The adherence between rubber and metal is not good or vulcanization of rubber is not guaranteed (belongs to product quality problem).
- Using lubricating oil reduces the age of the product.

PART 4: INSTALLATION, ADJUSTMENT AND REPAIR**1. Installation and adjustment**

1.1. Quality control methods and parameters for installation and adjustment of air suspension systems

1.1.1. The deviation of the front axle center line (in the direction from top to bottom) is not greater than 5/1000mm. The deviation of the front axle center line comparing with the center line of the chassis (in the direction from left to right) is not greater than 5mm.

a) Adjustment method

Use the method of adding and reducing the gasket at the position of connection of the front leaf spring with the leaf spring or adding and reducing the gasket by adjusting the distance between the two ends of the backing with the leaf spring.

b) Check method

- Taking 2 holes to install bolts on the front axle, and find 2 symmetrical holes on the left and right beams of the chassis, measuring the deviation of the 2 symmetrical holes connecting the bolts to the left and right beams.
- Each length is required to be about 1000mm, the deviation of the symmetrical line does not exceed 5mm.

1.1.2. The deviation of the back axle center line (in the direction from top to bottom) is not greater than 5 / 1000mm. The deviation of the back axle center line comparing with the center line of the chassis (in the direction from left to right) is not greater than 5mm.

a) Adjustment method :

Use the method of adding and reducing the gasket at the position of connection of the V-shaped gasket with the V-shaped backing or adjusting horizontal backing (bottom) and 2 ends of leaf spring.

b) Check method

- Taking 2 holes to install bolt on the back axle, and find 2 positions of symmetrical holes on the left and right beams of the chassis, measuring the deviation of the 2 symmetrical holes connecting the bolts to the left and right beams of the chassis.

- Each length is required to be about 1000mm, the deviation of the symmetrical line does not exceed 5mm.

1.1.3. The deviation of the symmetrical line between the two axles must not be greater than 5mm

Check method

- Stopping the vehicle on a flat, hard ground.
- At the center position of the front and back axle tires, using perpendicular to straighten to the ground and marking the sign.
- Making the vehicle move, the difference between the two marked points is not greater than 10mm.

1.1.4. The height when assembling airbags is: $H \pm 5\text{mm}$ (the height when assembling the front and back buffers is: $H \pm 5\text{mm}$)

- a) Adjustment method: adjusting the valve to control the height of the front and back of the suspension system.
- b) Check method: taking the bottom of the air bag as standard, measuring the distance H from the bottom of the air bag to the surface of the airbag, according to the requirements of the air bag height, the deviation should not exceed $\pm 5\text{mm}$.

1.1.5. When sufficient air is supplied to the air tank, there is still over 25mm gap around.

➤ **Note: The load impacting on the front air tank is not heavy, the low pressure is only enough to support the suspension system's height, it seems that the amount of air is insufficient, even if it is flat, this phenomenon is completely normal.**

2. Repair

2.1. Preparation: When repairing, it is necessary to stop the car in a clean and flat place, it is best to repair at repair tunnel, fix the brake, block the tire. Based on the content to be repaired, use the appropriate lever-jack or elevator to increase the height of the chassis and remove the tire.

2.2. Buffer replacement

2.2.1. Removing upper and lower bolts, taking out buffers.

2.2.2. Replacing new buffers, sufficient tightening of bolts force.

2.2.3. After traveling a certain distance, check whether the buffers are working normally.

➤ **Note: The buffer and air tank should be based on the construction of the suspension system to select the appropriate use. It is absolutely necessary to replace the buffer properly, otherwise it will reduce the function and age of the suspension system, which can easily damage the suspension system.**

2.3. Replacing the air tank

2.3.1. Using the lever-jack or elevator to increase the height of the chassis to 90mm.

2.3.2. Removing the nut at the connecting position between the tie rod of valve adjusting height and the tie rod bearer, then lower the tie rod to the bottom to discharge the air inside for 2 front air tanks or 4 back air tanks.

2.3.3. Removing damaged air tank.

2.3.4. Installing the new air tank. 2 ends of the air tank is attached to the exit of the upper bearing plate and the plunger of the air bag, tightening the air bag at the contact position.

2.3.5. Reinstalling the removed nuts as above.

2.3.6. Taking the lever-jack or elevator.

2.3.7. Starting the machine causes the pressure in the system to reach the value of turning off the pressure machine, checking whether the system has an air leak (maximum permissible pressure is 7.0 bar).

2.4. Checking, maintaining, adjusting and replacing height adjustment valves.

2.4.1. Check height adjustment valves

Using this method to check the status of the height control valve, determining whether the device is disabled to eliminate waste replacement, the check method is as follows:

- a) The air supplied to the system must be greater than 6.0 Bar.
- b) Loosening the nut connecting between the tie rod of the height adjustment valve and the tie rod bearer.
- c) Lifting the tie rod of the height adjustment valve in the vertical direction upwards, stopping for 10 seconds, if the air supplied to the air tank is sufficient, the vehicle will be lifted high.

- d) The tie rod of the height adjustment valve is in the middle, at which point the valve will stop supplying air to the air bag and the air bag cannot discharge air.
- e) Lowering the tie rod of the height adjustment valve, stopping for 10 seconds. The air tank discharges air, the vehicle automatically lowers.
- f) The tie rod of the height adjustment valve is in the middle, at which point the valve will stop supplying air to the air bag and the air bag cannot discharge air.

2.4.2. Height adjustment valve maintenance

- a) Regular visual check of the gaps around the valve, the tie rod of the height adjustment valve and the bearer are not hindered in the operating range of the axle.
- b) Periodically maintaining the air supply system, removing impurities in the air pipeline, strictly prohibiting the use of the grease to lubricate the valve.
- c) Periodically discharging the air in the air tank. In cold weather conditions, drying recommendations to prevent damage to the valve due to freezing water.

2.4.3. Valve adjustment

- a) During maintenance and repair of the vehicle, if the height H of the suspended frame is greater than $\pm 5\text{mm}$, after eliminating all causes, if it is confirmed that due to the height adjustment valve, it is recommended to adjust the valve and the bearer connecting the tie rod of the height adjustment valve.
- b) Order and method of adjusting height adjustment valve:
 - Removing the nut between the tie rod of the height adjustment valve and the bearer (for the back axle, carry out 2 valves at the same time).
 - Lifting the tie rod of the height adjustment valve in the vertical direction upwards, if the pressure is sufficient, the air tank will have enough air and lift the vehicle.
 - Place the bearing plate (one on each side of the vehicle) with the appropriate height below the chassis (based on the measured height of the suspended frame), then lowering the tie rod of the height adjustment valve to discharge the air inside the air tank and making the chassis slowly contact the bearing plate.
 - Continuously lowering the tie rod of the height adjustment valve, stopping for 10-15 seconds and taking the tie rod to the middle position, then checking whether the

suspended frame has the value $H \pm 1.5\text{mm}$. If not, it must be operated again from the beginning, using the method of adjusting the height of the bearing plate or adding the lower washer.

- Adjusting the length of the tie rod of the height adjustment valve so that the position of the air tank is in the most balanced position, then tightening the connecting nuts between the tie rod and the bearer to 33-38Nm.
- Supplying air to the system with the pressure greater than 6.0 Bar, removing the bearing plate under the chassis then checking all the air tanks that the amount of air supplied must have correct height of the bearer and ensuring the system does not leak air.

2.4.4. Height control valve replacement

- a) Put the lifting jack or bearing base into position under the chassis, at this time the height of the suspended frame is at the correct level
- b) Removing the connecting nut between the tie rod of the height adjustment valve and the bearer (for the back axle, carry out 2 valves at the same time). Lowering the tie rod of the height adjustment valve, discharging the air in the air bag
- c) Removing the ends connecting between the valves and the air pipe and removing the air pipe, then removing the height adjustment valve.
- d) Reinstalling the new height adjustment valve in reverse with the removal steps.
- e) Adjusting the length of the tie rod of the height adjustment valve so that the position of the air tank is in the most balanced position, then tightening the connecting nut between the tie rod and the bearer to 33-38N.m.
- f) Removing the lift jacks or bearing bases.
- g) With an air supply greater than 6.0 Bar, checking whether the system has an air leak, whether the air tank has correct height of the suspended frame, if not, tightening the nut. If the height of the suspended frame is incorrect, refer to section 2.4.3 adjusting the height adjustment valve

2.5. Backing replacement

- 2.5.1. Put the lifting jack or bearing base into position under the chassis, at this time the height of the suspended frame is at the correct level

2.5.2. Removing the damaged backing

2.5.3. Installing new backing according to the standard of tightening force below.

- a) It is recommended to measure the difference between the length of the old backing and the new backing (the distance bearing center between the front and back backings), determined when installing the new backing, the distance between the leaf spring and the backing is not increased, change the washer.
- b) Installing the appropriate thickness washer on the surface of the leaf spring, then assemble the new backing, temporarily tightening the components so that there is no gap, then check whether the positioning axis is correct, then tightening according to the specified tightening force.

2.6. Replacing the rubber cladding stabilizer bar

2.6.1. Removing the rubber face panel

2.6.2. Removing the rubber cladding old stabilizer bar

2.6.3. Cleaning the position of the connection on the stabilizer bar

2.6.4. Checking for damage, if a crack in the stabilizer bar is detected, performing a new replacement.

2.6.5. Installing the rubber cladding new stabilizer bar in reverse with the removal steps

➤ **Note: The stabilizer bar cannot be repaired when there are cracks but only replaced with new stabilizer bar**

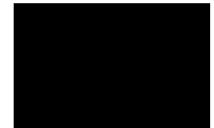
3. Tightening moment table

Installing position		Specificatio n of bolts	Tighteni ng force of phosphat e bolt (N.m)	Tighteni ng force of galvanize d (N.m)	Tighteni ng force of bolts (N.m)
Air tank, fork, valve, rubber,	Air tank	Self-tight hexagonal bolts	M12	/	100
		Lock nut	M18×1.5	230	/
					300

etc. and parts which are easily damaged		Thin lock nut	M18×1.5	130	/	150
		I hexagonal nut	M18×1.5	210	/	270
		Bolt (without nut)	M18×1.5	230	/	300
	Load valves and accessories	Hexagonal nut level 8.8	M6	/	10	8
			M8	/	25	20
	Buffer	Belong to NCC	M16×1.5	90		
		Lock nut	M16×1.5	230	/	290
			M20×1.5	400	/	500
			M24×1.5	560	/	700
			M30×1.5	780	/	950
	Strut frame	Thin nut	M16×1.5	120	/	140
			M20×1.5	200	/	270
		Bolt (without nut)	M14×1.5	/	250	190
		Common self-locking nut	M14×1.5	/	250	190
		Lock nut	M20×1.5	400	/	500
			M22×1.5	500	/	600
Connecting details	Base of air tank, backing, backing pat, buffer pat, etc.	Common nuts	M10	/	80	60
			M12	/	140	110
			M14×1.5	/	250	190
	Lock nut	M16×1.5	230	/	290	
		M18×1.5 (X2.0)	360	/	420	

			M20×1.5	460	/	600	
			M22×1.5	640	/	800	
			M24×2	850	/	1000	
			M27×2	1100	/	1200	
			M30×2	1100	/	1200	
Backing	Slotted nut	M24×2	260				
		M33×2	400				
Bolt (without nut)			M12	/	140	110	
Bolt (without nut)			M14	/	200	170	
Bolt (without nut)			M16×1.5	230	/	290	
Bolt (without nut)			M18×1.5	360	/	420	
Bolt (without nut)			X2.0)				
Bolt (without nut)			M20×1.5 (X2.0)	460	/	600	
Note:							
1) According to the tightening force standard, if the bolts have nuts, following the tightening force of the nuts, otherwise apply the bolt without nut. 2) With nuts, tightening at the end of the nut, tightening force takes standard plus 20%.							

CLUTCH (CL)



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1. CLUTCH

D395 clutch is a kind of dry type helical spring friction clutch. Pressing force is generated by compression coiled springs arranged on the circumference. In order to reduce the thermal deformation loss of springs as far as possible, springs are made of heat proof material through special process and additionally, the springs and pressure plate contact each other on a narrow convex surface. Therefore, thermal transmission is reduced quite.

Thermal vibration caused by unstable power output is intrinsic for an internal combustion engine. Therefore, noise due to resonance of power train gears will be generated under some running conditions at certain engine speed. D395 clutch driven disc is provided with torsional vibration absorber, which may eliminate or reduct to a great extent such resonance so as to mitigate the impact and reduct the noise, thus lengthening the service life of power train components, improving the driving comfort and enabling smooth start of.

D395 clutch can transfer the maximum engine torque reliably. It can engage easily and smoothly and disengage completely. It also has the ability to absorb vibration and impact and to reduce noise. It is a kind of ideal clutch for heavy duty vehicle.

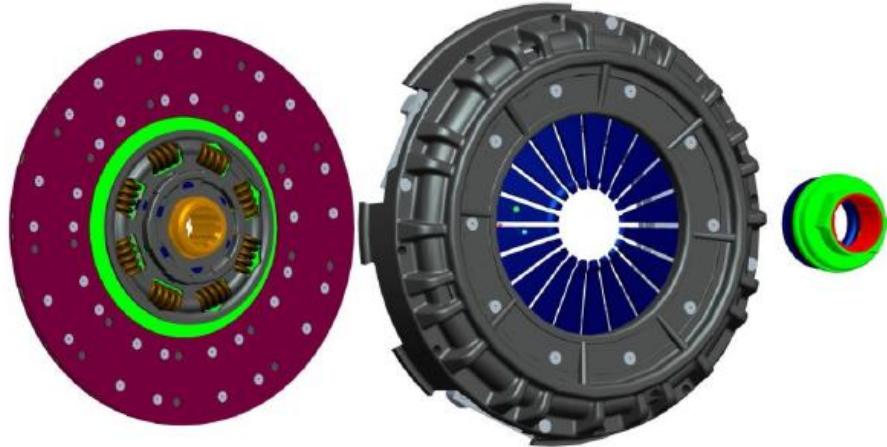


Figure 1. Clutch

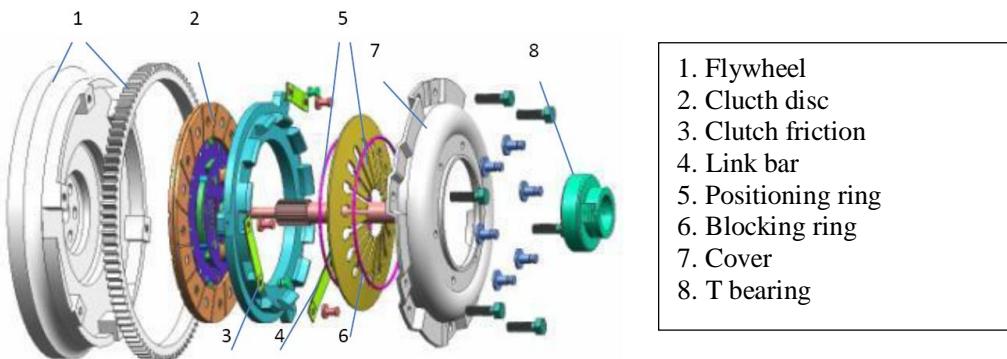


Figure 2. Assembly clutch

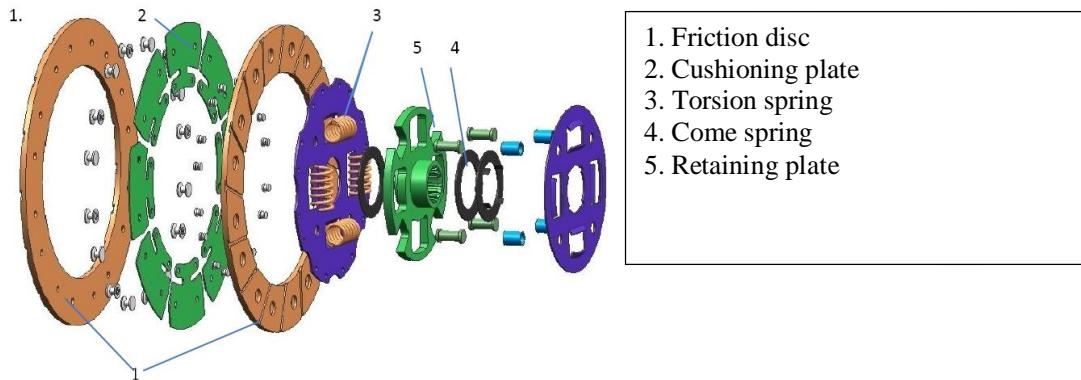


Figure 3. Clutch disc creation

As shown in the figure, D395 clutch is provided with conventional pressure plate and torsion springs are arranged on the circumference of the driven disc. It consists of clutch pressure disc, driven disc (clutch friction disc), pressure disc cover, clutch spring, diaphragm, housing and release bearing, clutch shifter and shifter shaft mounted on the transmission disconnection slider, etc. The pressure plate is connected with the pressure plate cover through diaphragm. Clutch springs are arranged on the circumference between the pressure plate cover and the pressure plate. After the pressure plate assembly is connected with the flywheel, the pressure plate holds down the driven friction disc tightly onto the end surface of flywheel so as to transfer the torque. The magnitude of torque to be transferred depends on the total compression force of clutch springs. When the clutch pedal is pressed, the release bearing is forced by the link gear and clutch shifter to force down the release lever so that the pressure plate shaft is made move backwards to allow the clutch to separate completely. The clutch should be able to disengage completely and engage.

Clutch pressure plate cover is made of grey cast iron and the characteristics of push type clutch. Cast housing to allow higher clamp load, higher heat capacity to allow high temperature, reliable diaphragm spring, well release.

Pressure plate is a key part of clutch. On the non-machining surface of pressure plate, wide angle 6 spring damper with friction device.

The working surface of pressure plate can be polished and the maximum polishing amount is 1 mm. A spacer with corresponding thickness should be added on the clutch spring seat when the polishing amount of pressure plate exceeds 0.5.

Wavy spring plate strap is mounted between the clutch driven disc lining and the driven steel strap, and has the function of damping to allow smooth engagement of clutch. A torsional vibration absorber is equipped on the driven disk. Pre-absorber is installed between the inner hubs of driven disc mainly to eliminate the torsional vibration during idling of engine. A main absorber is mounted between the outer hub and driven steel strap and consists of tangentially arranged helical spring and antifriction.

In order to prevent direct contact of release bearing with release lever (diaphragm) and thereby to prevent release lever wearing, a withdrawal collar is hitched by spring at the end of the release lever (diaphragm). In case of disengagement, the release bearing will press directly on the withdrawal collar so as to push the release lever (diaphragm) to disengage the.

Basic parameters of D395:

Type: D395 clutch.

Adjusting height of release lever: 70 ± 2.6 mm

Pressing force of pressure plate: 11000 ± 1500 N

Max disengaging force: 3800 N

Disengaging stroke of pressure plate: $10 + 2$ mm

Mass of pressure plate assembly: 27 kg

Max allowable speed: 2800 rpm
Mass of driven disc: 5.0 kg
Thickness of driven disc 10 ± 0.3 mm
Min thickness of driven disc: 7.0 ± 0.3 mm
Thickness of single friction lining: 3.5 mm
Allowable wear of single friction lining: 1.5 mm
Allowable side face runout of driven disc: 0.5 mm.

2. DISASSEMBLY AND ASSEMBLY OF

a. Inspect the flywheel

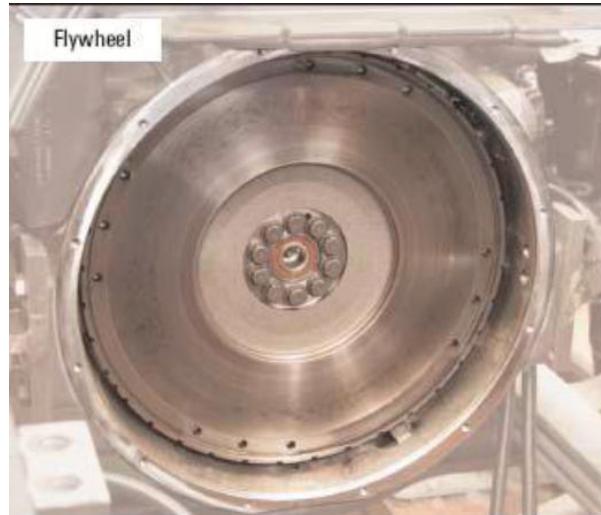


Figure 4. Inspect the flywheel

Inspect flywheel for flatness and any damage.

Inspect damaged threads.

Inspect the e.g facing damage at O.D.

Inspect the pilot bearing for free, easy rotation.

Keep bent axle, flywheel housing around away from oil or any other dirt.

Remove any dirt, grease or oil from the flywheel.

b. Inspect the cover.



Figure 5. Inspect the cover

Inspect cover for damage.

Inspect the straps for any damage.

Inspect the diaphragm finger for deformation or any damage.

Lack of rivit.

Remove any dirt, grease or oil from the cover.

c. Inspect the clutch disk.



Figure 6. Inspect the clutch disk

Inspect disk for damage due to dropping.

Inspect the disk for deformation.

Lack of rivit .

Keep dirt, oil ,grease away from clutch. Check disk spline and transmission input shaft spline for any damage and make sure that the disk can move easily on the shaft.

d. Inspect the releaser



Figure 7. Inspect releaser for oil leak

Inspect releaser for oil leak.

Inspect releaser for easy rotation.

Don't clean releaser with water, that will cause releaser failure.

Inspect transmission input shaft guide quill, release fork and diaphragm finger for any damage.

2. The clutch has been adjusted properly before delivery, so generally no adjustment is required during use. If adjustment is actually needed, it must be done by means of the adjusting nut on a special technical appliance, preventing pressure disc from tilting. The cambered surfaces on the end faces of the six release levers must contact the withdrawal collar. Runout of withdrawal collar end face should not exceed 0.4mm.

3. In order to ensure smooth operation of clutch, the pressure plate assembly and driven disc assembly has be balanced before delivery. No parts should be dismounted randomly in use. When the clutch has to be disassembled for repair purpose, a mark can be done at first. After repair is done, assemble it as per the original mark and balance it again.

4. When mounting or dismounting the clutch onto or from the engine, the bolts or nut to fix the clutch on the flywheel must be tightened or unscrewed alternately in a diagonal manner.

5. When installing the clutch, the driven disc spline and spline of transmission shaft 1 should be properly lubricated by heat resistant and overpressure resistant lubricating grease in such a way that the driven disc can move freely on the spline of transmission shaft 1. Excessive lubrication will make the friction lining be stained with oil, causing clutch slip, so take care to prevent.

6. During installation, take care not to damage the driven disc spline. Prevent the driven disc axial movement from being obstructed, causing inability to release.

7. Disengagement stroke of clutch must meet the requirement. Excessive engagement stroke may cause the release lever to contact the driven disc, very dangerous. Too small engagement stroke may result in incomplete disengagement of clutch.

8. When the clutch is in the engaged state, a clearance of 2 to 3 mm should be kept between the release bearing and diaphragm so that pressure plate can still press on the friction lining without interference in case of wearing of friction lining. Thus, engine torque can be transferred reliably.

9. The release bearing must be able to slide freely on the bushing of transmission shaft 1. Therefore, make sure the sliding plane is lubricated sufficiently and the bushing is positioned accurately.

10. The driven disc assembly should be replaced in time when the friction lining has been worn to the operating limit so as to prevent clutch slip, which may score the surfaces of pressure plate and fly wheel.

11. D395 clutch housing is made of grey cast iron, so during handling, place it carefully and never throw it randomly. Never hold and lift up the withdraw collar so as not to cause deformation of torsion spring.

12. It should be used correctly. Prevent clutch slip due to improper operations such as (a) starting at high throttle and high gear; (b) when changing into a high gear, pressing the accelerator pedal hard before the vehicle speed is high enough; (c) starting continuously the vehicle on a slope for many times; and (d) pressing down the accelerator pedal and pressing the clutch pedal halfway, trying to rush by force in case of wheel slip or sticking on the muddy road, etc. This will generate high temperature on the clutch due to continuous hard friction, causing pressure spring resilience to fade due to overheat, hence resulting in slip and if seriously, friction lining burning out, pressure plate deformation or even heat crack, which may bring forward serious aftermath.

13. In order to ensure coaxiality of clutch friction lining with flywheel and facilitate smooth thrusting in, clutch centering pin had better be used in installation of pressure plate assembly. The clutch centering pin is actually a transmission shaft 1. For installation, pass the centering pin through the driven disc and insert it into flywheel center bearing hole. After fixing the pressure plate assembly and flywheel, withdraw the centering pin (as shown in the figure).

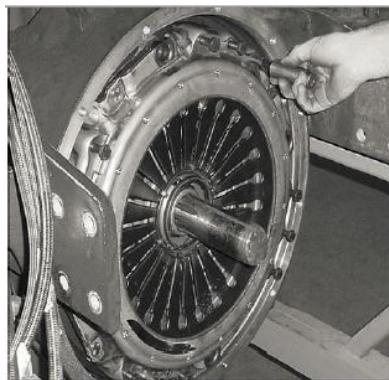


Figure 8. Installation of Pressure Plate (Using a Centering Pin)

14. When the driven disc is to be replaced, use a calliper to measure the free thickness of driven disc friction lining, which should be made not exceed 10.3 mm. Otherwise, incomplete disengagement of clutch may happen after installation.

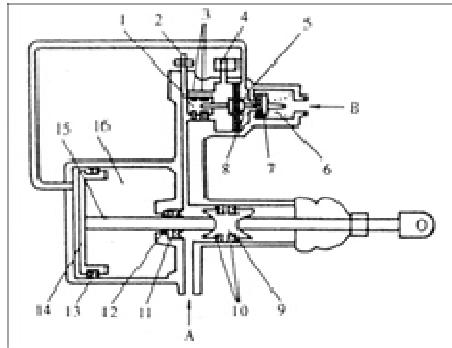


Figure 9. Schematic Diagram of Clutch Booster Structure

1. Control piston; 2. Bleeding screw; 3. Gasket; 4. Exhaust port; 5. Diaphragm assembly; 6. Spring; 7. Poppet valve; 8. Spring; 9. Hydraulic cylinder piston; 10. Gasket; 11. Gasket; 12. Oil seal; 13. Gasket; 14 Power Piston; 15. Push rod; 16. Spring; A – Oil inlet; B – Air inlet

CONTROL MECHANISM OF CLUTCH

Clutch control system of large buses is the hydraulic controlled, air-boosting remote control system. It consists of clutch pedal, clutch control master cylinder and clutch air-boosting hydraulic control cylinder.

When the clutch pedal is pressed down, the pressure oil from clutch master cylinder flows through oil inlet A (as shown in the figure) and then is divided into two branches. One of the branches forces the hydraulic cylinder piston 9 to move rightwards and the other branch is applied on the control piston 1, which forces the push rod of diaphragm assembly 5 to move rightwards so as to push the poppet valve 7 open. At this moment, the compressed air in the air reservoir enters into power cylinder through air passage from air inlet A and is applied on the power piston 14, thus forcing the power piston 14 and push rod 15 to move rightwards. This way, boosting is provided.

When the clutch pedal is released, the oil pressure reduces. The control piston 1 moves leftwards. The poppet valve 7 shut down the air source. The air in the power cylinder is discharged from the exhaust port 4 through the center hole of diaphragm assembly 5. The push rod 15 returns to its original position with the function of spring 16.

After installation of a new master cylinder and a boosting cylinder, or maintenance of the master cylinder and the boosting cylinder, air should be discharged from the hydraulic control system. Otherwise, the boosting cylinder cannot operate normally and the clutch cannot be released completely. An air bleed screw is provided on the boosting cylinder. First of all, fill up the oil tank attached on the master cylinder with automatic transmission oil (or hydraulic oil). Then press down the clutch pedal several times. Finally, press down to the end and hold the pedal. Loosen the air bleed screw on the boosting cylinder. Oil with air will be discharged. When discharging is finished, tighten the air bleed screw and press the pedal repeatedly again to discharge air. Repeat the above discharging procedure several times until pure oil is discharged from the air bleed screw. Then tighten the air bleed screw. Air discharging is finished.

3. CLUTCH FAILURES AND REMOVAL

Failure	Cause	Removal method
Clutch slipping	<ul style="list-style-type: none"> 1. The pressure spring is worn and too flexible, or resilience fades due to thermal deformation 2. There is oil stain on the friction surface 3. Clutch is overheated and friction lining is burnt out 4. Friction lining is worn excessively 5. No clearance is available between the release bearing and withdrawal collar 6. Driven disc or pressure plate warps or deforms 7. For a hydraulically controlled clutch, the pedal stroke is getting higher and higher during use 8. Improper operation. 	<ul style="list-style-type: none"> 1. Replace the pressure plate assembly. 2. Check and eliminate the source of oil stain. Remove the oil stain from friction surface or replace the driven disc. 3. Replace the driven disc 4. When wear limit is reached, replace the driven disc. Never rivet the friction lining randomly. 5. Adjust the clearance to 2 to 3 mm 6. Replace the driven disc or pressure plate assembly 7. Check and adjust the stroke of master cylinder push rod or boosting cylinder push rod. Clear the oil passage. Make sure that the boosting cylinder push rod can return to the original position agilely. 8. Operate correctly.
Incomplete disengagement of clutch	<ul style="list-style-type: none"> 1. The adjusting position of release lever has changed and the pressure disc is inclined. 2. Driven disc or pressure plate warps or deforms. 3. Axial movement of driven disc is unsmooth. 4. Friction lining is affected with damp and hence is adhered on the flywheel. Clutch of a new vehicle can not be released due to long time non-use. 5. Transmission shaft 1 is not aligned with crankshaft. 6. Free travel of pedal is excessive and clutch cannot be completely disengaged. 7. For hydraulically operated clutch, oil passage system is short of oil or oil pressure is insufficient or there is air in it. 	<ul style="list-style-type: none"> 1. Adjust it according to the requirement. 2. Replace the driven disc or pressure plate assembly. 3. Repair the injured spline fit set. Remove the dirt and rust and apply oil on it. 4. Treat the friction lining. Replace the driven disc in case of serious adherence. 5. Check if they have been assembled as per the requirement. 6. Adjust the free travel of pedal and check the disengagement stroke of clutch. 7. Check and correct the sealing of the oil passage system and fill the oil or discharge the air from oil passage system completely.

Vibration of clutch	<p>1. The adjusting position of release lever has changed.</p> <p>2. Driven disc warps, deflects and deforms.</p> <p>3. Difference in thickness of driven disc is too great. Friction lining surface is unsmooth and contact surface is uneven.</p> <p>4. Spring is broken, deflects or is thermal deformed, causing uneven pressure of pressure plate.</p> <p>5. Release bearing does not contact normally.</p> <p>6. Other causes such as:</p> <ul style="list-style-type: none"> (a) The fixing screws of pressure plate housing and flywheel are loose; (b) Shock prevention warm glue of the engine legs is damaged or the fixing screws are loose; (c) The fixing screws of transmission and flywheel housing are loose; (d) The newly replaced drive shaft oil seal is too tight; (e) Dragging of foot brake or hand brake. 	<p>1. Adjust it as per the requirement.</p> <p>2. Replace the driven disc.</p> <p>3. Replace the driven disc.</p> <p>4. Replace the pressure plate assembly</p> <p>5. Check the release bearing and release yoke for normal operation. Replace it if necessary.</p> <p>6. Find out the cause and shoot the trouble.</p>
Non-returning of boosting cylinder	The gaskets of boosting cylinder hydraulic piston, control piston or air boosting piston are seized, causing the piston unable to return rapidly.	Disassemble and check the boosting cylinder and replace the gaskets.
Non-act of boosting cylinder	<p>1. Air exists in the hydraulic control system.</p> <p>2. It is short of oil</p> <p>3. Gasket of master cylinder piston is damaged</p>	<p>1. Discharge air.</p> <p>2. Replenish oil.</p> <p>3. Replace the gasket.</p>
Oil discharged from boosting cylinder air exhaust port	The gasket between boosting cylinder and hydraulic cylinder is damaged.	Disassemble and check the boosting cylinder and replace the oil-air separation gasket.
Air leakage from boosting cylinder air exhaust port	The air boosting poppet valve of boosting cylinder is not sealed tightly	Replace the air boosting poppet valve
Heavy clutch pedal	<p>1. Air boosting cylinder does not operate.</p> <p>2. Air pressure is too low.</p>	<p>1. Examine and repair the air boosting cylinder.</p> <p>2. Check and find out the cause of low pressure.</p>

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1. Summary

Principle of operation:

When you rotate the hand wheel from left to right, the moment will transfer to the valve cover, the twisted bar is connected to the active axle via the control device. At the same time, the tire resistance will be transferred back to the drop arm, through the structure of the ball screw to the twisted bar. After that, the twisted bar is deformed and the valve cover on the active axle rotates a certain angle compared to the valve slot. The pressure from the power steering pump goes to the top or bottom of the piston to push the piston up and down. Finally, the actuator pulls the tire back to the right or left by the drop arm.

This specification is only suitable for SB brand Power Steering Gearbox. Illustrations and symbols on the specification make it easy to find the location of parts and names.

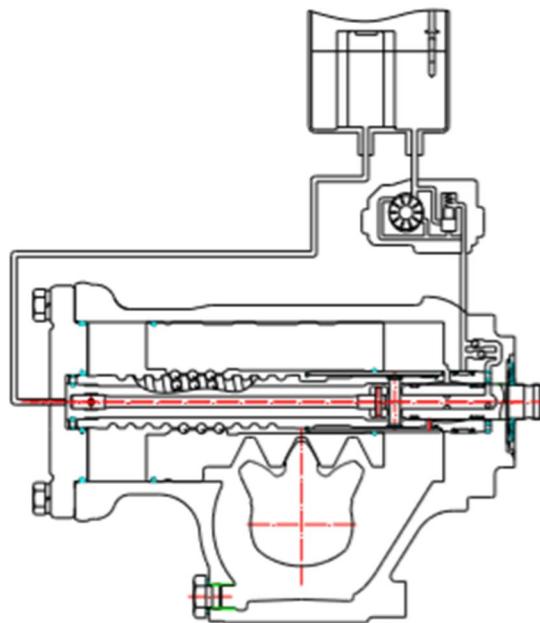


Figure 1. Operation principle

2. Operation and maintenance

➤ Note:

- 1) When the hand wheel turns to the maximum position and stops immediately, the stop time must not exceed 10 seconds.

- 2) If it is difficult to control the hand wheel, please stop and check the vehicle. If the Power Steering Gearbox is difficult to drive (for example, power steering pump problem), the vehicle can be controlled by increasing the force of the driver's impact on the hand wheel by hand but cannot work for long time.
- 3) The steering oil and oil filter element should be replaced when the vehicle runs about 5,000 km and after every 25,000 km depending on the user's usage.
- 4) Steering system and steering oil tank must be added to N32 or similar products. This oil is usually high intensity, good viscosity. At a temperature of 50°C, the viscosity is about $27 \times 10^6 \text{ m}^2 / \text{S}$. Please do not choose poor quality oil or mix with other oil. How to add oil should follow the technical characteristics of the Power Steering Gearbox.
- 5) The power steering pump and the steering oil tank must be placed as close as possible, the oil bottom must be higher than the entry of the oil pump.
- 6) If you are not sure about the operating principle of the steering system, let the technicians and professional repairmen check and adjust.

2.1. Checking the oil tank

- 1) Starting the engine in a flat place and let the engine spin slowly. Then, driving the hand wheel clockwise or counterclockwise. If the oil has air bubbles (air bell) or white oil appears inside the oil tank, the new oil must be changed or air is discharged because if the oil has air bubbles or is emulsified, it means the oil has mixed with air.
- 2) If the properties of oil are constant and there is no air in the oil. If only a slightly higher oil level is needed, a leak problem may occur, please check and repair this part. Then, add oil to the designated location.

2.2. Performing air discharge step on the hydraulic system

- 1) Turn the hand wheel all the way from left to right and vice versa a few times to add more oil to the tank.
- 2) When the lubricating oil is stable (does not change the oil level and no air bubbles). Restarting the engine, turn the hand wheel all the way from left to right and vice versa a few times. If no bubbles appear, it is done.

2.3. Steps to change lubricating oil

- 1) Using a shim to hold the front tire.
- 2) Opening the cover of the oil tank, installing the air exhaust pipe.
- 3) Restarting the engine (less than 10 seconds) to discharge air bubbles in the oil pump and oil tank.
- 4) Turning off the device, turning the hand wheel all the way from left to right and vice versa a few times and discharging air bubbles from the system.
- 5) Cleaning oil tank and oil filter.
- 6) Cleaning oil pump, safety valve, butterfly throttle-valve and oil pipe.
- 7) After completing the above 6 steps, adding new oil with the filter until the new oil flow spills out of the filter's mouth.
- 8) Installing and tightening the filter. Then, discharging the air.

2.4. Adjusting limit valve

- 1) Before installing the Power Steering Gearbox, loosening the nut to the end of the bolt.
- 2) Starting the engine, turning the hand wheel from left to right. After that, twisting the limit valve and adjusting the bolts, fixing the nut; turning the hand wheel from right to left and repeat in the next step.
- 3) Note: when the position of the bolts in the front axle is changed, the corresponding bolts on the steering system must be adjusted, or the function of the limited valve will be lost and damage the steering system.

3. Guessing error and maintaining

When there are some steering system problems, please do not rush to collapse and repair the steering wheel. In fact, the steering wheel is the last check, there are a few other parts that should be checked first:

- 1) Checking hand wheel, tires
- 2) Checking whether the oil level of the tank is normal.
- 3) Checking whether the oil pipe is properly installed. If not, correcting or replacing it.
- 4) Checking whether the front tire is fixed and is loose.

TABLE OF GUESSING ERROR AND REPAIRING

Cases	Reason	Solution
Difficult to drive	<p>1. Too little oil in the tank or oil level is lower than the required level.</p> <p>2. Roan sealing of oil pumps is not good.</p> <p>3. The oil pipe is blocked because there is too much sediment in the oil filter; the old pump is damaged</p> <p>4. The oil pump is damaged and contains lead.</p> <p>5. Safety valve, spring are damaged.</p> <p>6. The sealing ring of the Power Steering Gearbox and damper is damaged.</p>	<p>1. Checking whether oil leaks and repairing. Then, if there is no problem, filling the tank with oil.</p> <p>2. Renewing roan sealing of oil pumps and discharging the air.</p> <p>3. Sealing the connector or replacing the connector or new sealing ring.</p> <p>4. Cleaning oil pipes and oil filters.</p> <p>5. Renewing.</p> <p>6. Replacing damaged parts and renewing sealing ring.</p>
Unusually turn the hand wheel	<p>1. Pressure from power steering pump is low. Air from hydraulic pipes leaks.</p> <p>2. The exhaust pipe is blocked.</p> <p>3. Steering control valve or cylinder is locked.</p> <p>4. Place of control valve is not suitable</p>	<p>1. Checking the safety valve, renewing it if necessary. Keeping the leaked place safely. Then discharging the air.</p> <p>2. Replacing the exhaust pipe.</p> <p>3. Maintenance.</p> <p>4. Maintenance.</p>
The hand wheel works in the wrong direction(should check on 2 sides)	<p>1. The lubricating oil is dusty so the control valve cannot work properly.</p> <p>2. The core of the steering control valve is in the central position but the joint is not identical to the slot of the valve body.</p> <p>3. The flow of oil pump or high pressure oil pipes is not well</p>	<p>1. Cleaning steering system and changing lubricating oil.</p> <p>2. Adjusting the control valve to the central position or renewing the control valve.</p> <p>3. Checking butterfly throttle-valve or high pressure oil pipe.</p>

	arranged.	
Hardness is not the same when driving to the right or left.	<ol style="list-style-type: none"> 1. The core of the steering control valve is in the central position but the joint is not identical to the slot of the valve body. 2. There is dust on the control valve, so the resistance from right and left is different. 3. Some sealing parts in a certain hole has been damaged. 4. Damaged oil pipelines lead to no good adjustment. 	<ol style="list-style-type: none"> 1. Adjusting the control valve to the central position or renewing the control valve. 2. Cleaning the control valve. 3. Renewing the sealing parts. 4. Checking where the leak is and repairing it. Adjusting again.
The hand wheel is shaken when turning.	<ol style="list-style-type: none"> 1. Low oil level. 2. Air leakage on hydraulic oil spring leads to reduction of the oil pump's pressure. 3. Oil pump is blocked. 	<ol style="list-style-type: none"> 1. Adding new oil and finding where the leak is. 2. Maintaining the leaked place to discharge the air. Checking whether the oil pump belt is slippery, whether the oil pump safety valve is adjustable, renewing the oil pump if necessary. 3. Checking the control valve.
There is noise when turning the hand wheel.	<ol style="list-style-type: none"> 1. The oil level in the tank is too low, so the air easily enters. 2. Air leakage on hydraulic oil spring leads to reduction of the oil pump's pressure. 3. Oil filter is blocked or there is too much dust in the hydraulic oil spring. 4. The connector of the oil pipe is loose or damaged. 5. The oil pump is broken. 	<ol style="list-style-type: none"> 1. Checking where the leak is and repairing it, adding oil and discharging air. 2. Repairing the leaked location. Then discharging the air. 3. Cleaning dust and pumping the oil. 4. Fixing the connector or renewing the oil pipe. 5. Renewing.
There is noise when turning the hand wheel	<ol style="list-style-type: none"> 5. The function of the steering control valve is not good. 	<ol style="list-style-type: none"> 5. Maintaining.

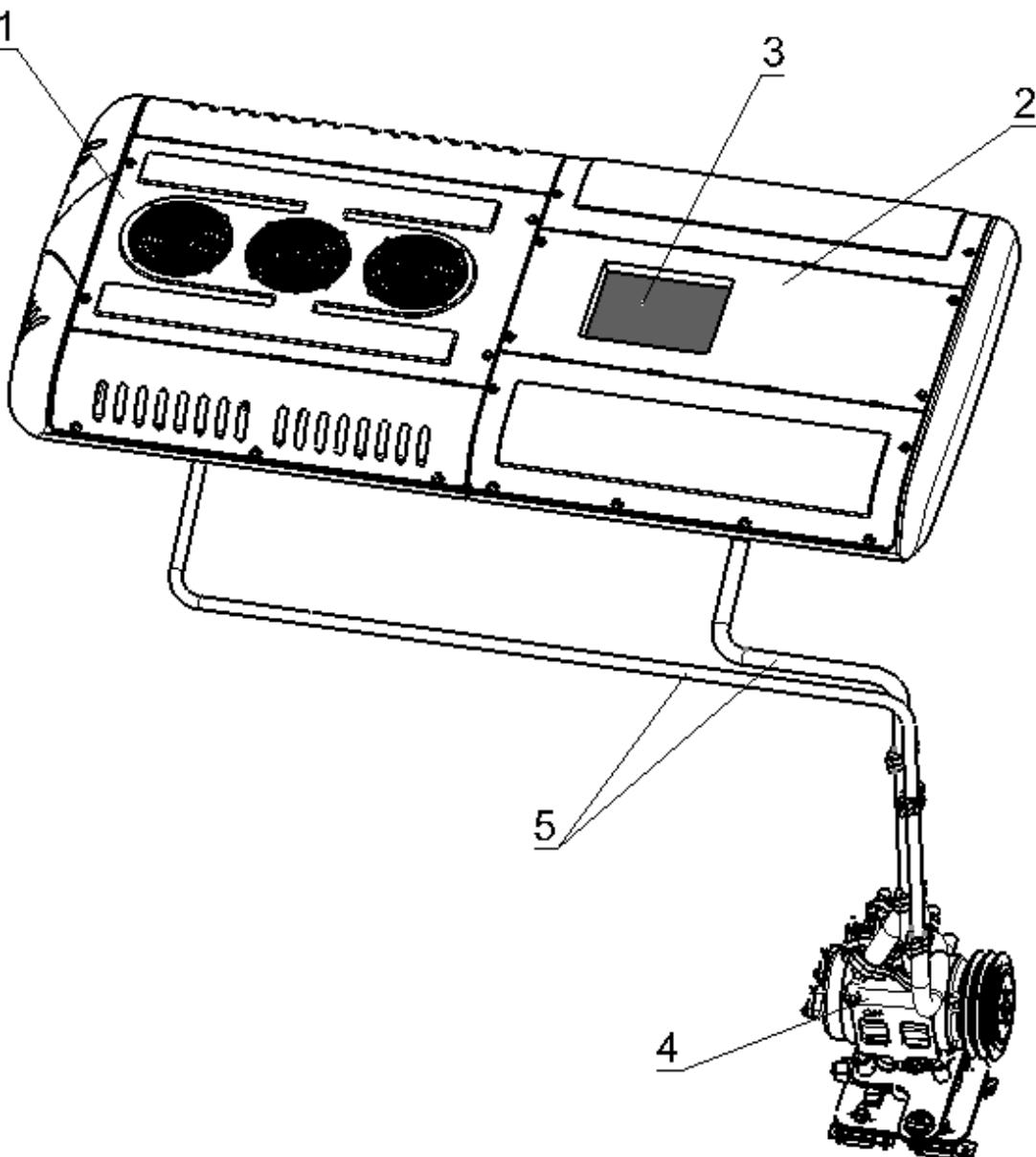
There are air bubbles in the tank, the oil level or output pressure of oil pump is too low.	1. There is air or leakage in the steering system.	1. Checking for leaks in the system and repair, if the oil level is not low, but there is air bubbles in the pipeline, moving it away from the vehicle, checking the cover, screwing and repairing it.
Heavy hand wheel	1. Oil level is low. 2. Oil flow of oil pump is too high.	1. Please adding steering power oil as required. 2. Please checking the pressure of the pump and repairing it.
Oil pressure from the pump is low.	1. Control valve does not work. 2. Pressure circuit or oil pump Stator is uneven. 3. Broken oil distributes on shell and oil pump stator. 4. The impeller installs incorrectly. 5. The impeller is blocked in the groove of the oil pump roto. 6. A small amount of broken oil distributes in the shell.	1. Cleaning dirt. 2. Flattening. 3. Replacing damaged parts and cleaning it. 4. Reinstalling properly. 5. Cleaning. 6. Renewing the parts.

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PART 1: TECHNICAL SPECIFICATIONS OF AIR CONDITIONING SYSTEM

Size of evaporator (L x W x H)	1350 mm x 1640 mm x 185 mm
Cooling capacity	20000 kcal/h
Weight of evaporator	48 Kg
Size of condenser (L x W x H)	1350 mm x 1561 mm x 185 mm
Wind flow	3500m ³ /h
Weight of condenser	78 Kg
Cold gas compressor	TM-43
Compressor capacity	425 cc/rev
Weight of Compressor	13.5 Kg

PART 2: DESCRIBING THE AIR CONDITIONING SYSTEM

- 1. Condenser
- 2. Evaporator
- 3. Control

- 4. Gas compressor
- 5. Gas pipe

PART 3: MAINTENANCE, GUESSING AND REPAIR OF ERRORS**1. Maintenance****1.1. Warning for drivers**

- When the air conditioner warning light appears on the dashboard, you need to turn off the air conditioning system. If the operation continues, the magnetic clutch may be damaged by the clutch from continuously closed and disconnected.
- Turning on the air conditioner when the engine just starts, sudden acceleration may result in compressor failure.
- Following the instructions below to avoid accidents during air conditioning repairs.
 - ✓ Using ladders and ladders must be firmly fixed when using.
 - ✓ Wearing protective shoes to avoid slipping.
 - ✓ Making sure to disconnect the start switch when working in the engine compartment.

1.2. Air filter check

Check of the air filter is a very important step, it needs to be cleaned every week. To clean the air filter with compressed air, blow the air in the opposite direction to the air flow when the air conditioner operates. Then removing dirt with warm water or neutral detergent. Drying before reinstalling.

1.3. Belt check

- 1) Checking belt is also a very important check step.



Figure 1. Waring appears

- 2) Checking belt tension every week, and adjusting to a reasonable tension.

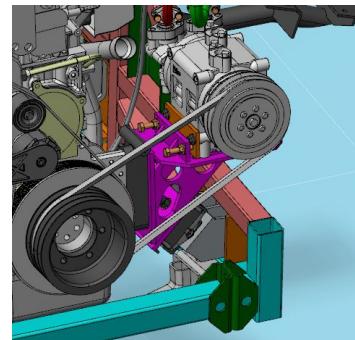


Figure 2. Belt check

- 3) If the tension is outside the standard, loosen bolt and nut (figure 4) counterclockwise, adjust bolt (figure 5) clockwise to standard tension, lock nut and bolt (figure 6) clockwise.

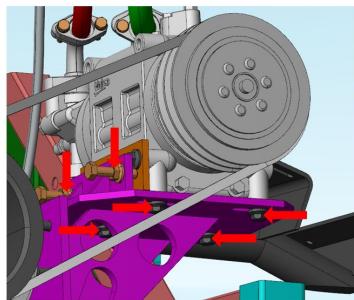


Figure 4

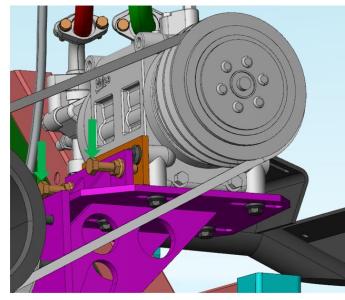


Figure 5

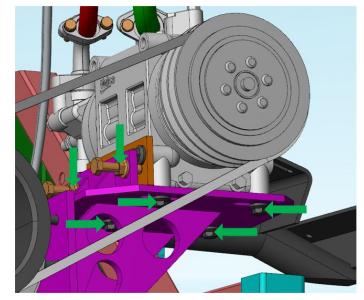


Figure 6

1.4. Magnetic clutch check

- 1) Checking the magnetic clutch.
- 2) Checking the operation of the magnetic clutch from turning on and off the compressor's close switch. If the magnetic clutch does not work properly, checking the electric control part.



Figure 7: Check clutch

- 3) Checking the gap of the magnetic clutch with a leaf ruler (0.5 mm).

1.5. Compressor lubricating oil check

- 1) Compressor oil is very important, it affects the smooth operation of the air conditioning system.
- 2) Checking the color and capacity of the lubricating oil monthly through the eye to check compressor check.

Reasonable oil level is 1/2 ~ 2/3 of the glass height.



Figure 8:Oil check

- 3) Adding oil if missing and don't forget to check the oil when replacing any details.
- 4) If the amount of oil is too much, it will reduce the heat exchange capacity. If the amount of oil is too small, it will reduce lubrication.
- 5) Through the color of the lubricating oil can guess the damage:

- ✓ If the oil is black, the compressor needs to be checked because the color can be changed by carbonization.
- ✓ If the oil is silver, the steering knuckle parts of the compressor's connecting rod may have become worn out, checking the compressor
- ✓ If the oil is milky, water may have mixed in the gas. These cases usually occur due to maintenance and repair errors, or when vacuum is not good.
- ✓ It is necessary to avoid working on the gas line operating on rainy days.

1.6. Check of the gas filter and the amount of gas



*Figure 9: Position more oil
and repairing.*

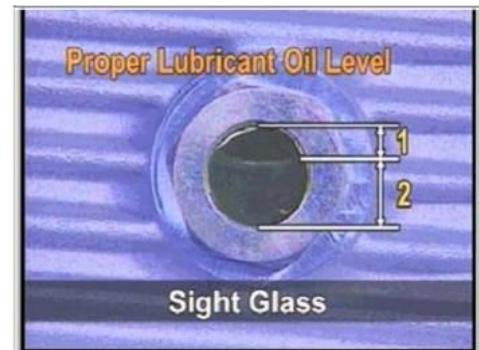


Figure 10. Oil level

- 1) When the gas line is contaminated, the filter may be blocked. Check the filter block by using the hand to feel the difference in temperature between the inlet pipe and the outlet pipe. If not blocked, the temperature will be equal at both ends of the filter.
- 2) If there is a temperature difference, it is necessary to replace the filter. You should check the gas filter every month.
- 3) Inadequate cold refrigerant gas will affect cooling capacity. Checking the amount of gas every week.
- 4) Checking the amount of gas through the check eye after turning on the air conditioner for 5 minutes.
- 5) When enough cold refrigerant gas, do not see bubbles in the check eye.
- 6) If you see a bubble, it means lack of gas.

1.7. Note when checking air conditioner

- 1) When the ambient temperature is low, bubbles can appear despite enough cold refrigerant gas. Therefore, checking the amount of cold refrigerant gas when the ambient temperature is over 20°C.

- 2) When the tachometer changes rapidly, bubbles can also appear despite enough cold



Figure 11. Gas filter

- 7) If there are many large bubbles, it means that there is a lot of gas.



Figure 12. Check eye

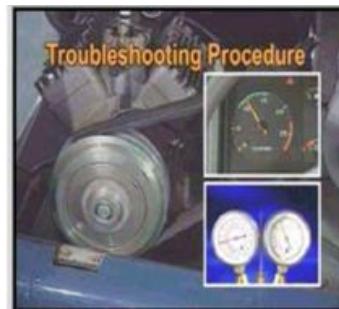


Figure 12. Check gas

refrigerant gas. Please maintain the speed of 1,100 revolutions / minute when conducting the check.

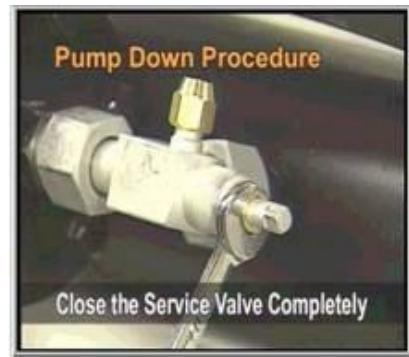
3) After a long period of operation, the amount of cold refrigerant gas may be lacking because there is a very small leak in the system, so need to add cold refrigerant gas. However, after adding the gas, the air conditioning system quickly lacks gas again, which means that the system has been seriously leaked, needing to find leaks and repairing.

4) Gas leakages will be damp due to cold refrigerant gas and clinging oil , so it can be checked with the naked eye.

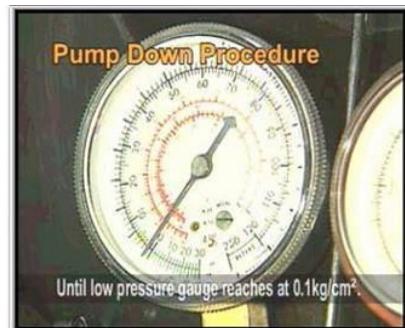


Figure 13. Gas leakage

- 5) When checking gas leakage, first check the connectors and welds.
- 6) When damage occurs on the low-pressure assembly, the gas accumulation is very helpful.
- 7) Gas accumulation means moving all cold refrigerant gas on low pressure place to high pressure place. At this time, it is possible to carry out repair or replacement of the compressor, evaporator, butterfly throttle-valve, filter, low pressure pipeline without discharging gas.
- 8) The process of gas accumulation according to the following steps:
- ✓ Attaching the gas meter to the air conditioning system.
 - ✓ Fully closing the gas valve on the roof to block the gas line.
 - ✓ Starting the engine and turn on the air conditioner close button, when the red warning light appears on the control panel and low-pressure side pressure drops below 0.6 kg / cm², the compressor stops working due to magnetic clutches from interrupts.

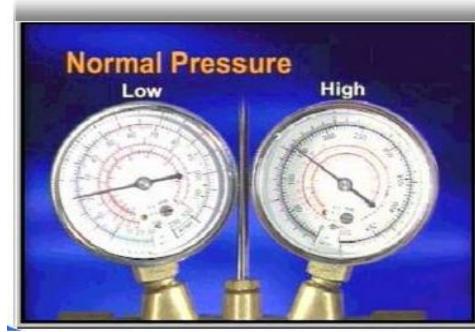
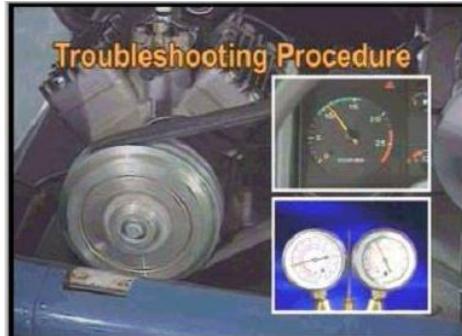


- ✓ Just then, turning off the engine and completely closing the high-pressure close valve on the output of the compressor.
 - ✓ At this time, the gas has been transferred and kept on the high-pressure line, be careful to observe the pressure gauge of the low pressure part. If this pressure gauge moves up gradually, it means that the accumulation process fails or you need to tighten the gas close valve.
 - ✓ And although the meter is below $0.6 \text{ kg} / \text{cm}^2$, you should remove the low pressure pipeline to prevent strong pressure discharge (including oil) because there is still a small amount of gas remaining.
 - ✓ After finishing the work, use a vacuum pump to empty the air in the low pressure line and check for leakage. Opening the gas close valve at the compressor and on the roof.
- 9) When performing maintenance and repair of the air conditioning system, attention must be paid to the following issues:
- ✓ Using nitrogen gas to check the seal will avoid moisture entering the system, but should not exceed $15\text{kg} / \text{cm}^2$ of nitrogen gas.
 - ✓ If over $15\text{kg} / \text{cm}^2$ is loaded, it will cause an explosion.
 - ✓ When refueling, maintain the tachometer of 1,100 revolutions / minute and add gas through the low pressure side charging connection.
 - ✓ If the refueling procedure is carried out incorrectly, it can cause serious damage to the compressors.
 - ✓ Do not adjust the butterfly throttle-valve. In fact, adjusting the butterfly throttle-valve when



you see poor air conditioning is wrong. We need to find the exact cause for this case.

- ✓ Do not change metal tubes or flexible tube. This change can result in reduced cooling capacity due to cold gas flow barrier and can cause cracking.

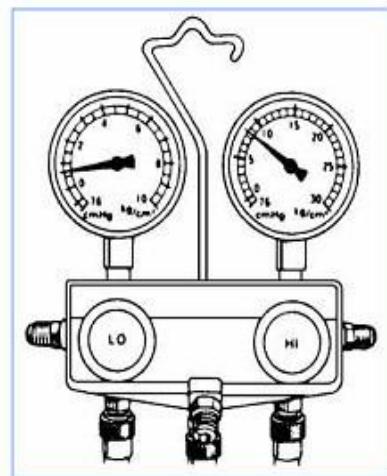


- 10) When the warning light is on, or when the cooling capacity is unsatisfactory, use the gas meter to check.

➤ **Check process:**

- Attaching the meter to the gas charging port on the low and high pressure parts.
 - Starting the engine and turning on the air conditioner to fan at the highest wind level.
 - Running air conditioner for more than 5 minutes at 1,100 revolutions/ minute, then reading the indicator shown on the meter .
- ✓ When the ambient temperature is **25°C**, the pressure is **normal** if the high pressure is about **8 ~ 18kg / cm²** and the low pressure is about **1.5 ~ 3kg / cm²**.
 - ✓ However, normal pressure may change depending on the ambient temperature and humidity.
 - ✓ If the ambient temperature is high, low pressure is almost unchanged but high pressure slightly increases.
 - ✓ If the ambient temperature is low, low pressure is almost unchanged but high pressure slightly drops.

2. Troubleshooting of air conditioning system



2.1. The damage of the electrical part

INCIDENT	REASON	TROUBLE SHOOTING	NOTE
Air conditioner does not work.	<ul style="list-style-type: none"> - 3A fuse (in the fuse box) is exploded. - The main fuse of the air conditioner is broken. 	Replacement	After replacing if the fuse continues to explode, check the mass touch.
Operation of the condenser fan is wrong	<ul style="list-style-type: none"> - The electric wire is broken. - Error of thermostat. 	<ul style="list-style-type: none"> - Re-connection - Relacement 	Air conditioning fuse board or thermostat
Compressor does not work (turning condenser fan).	<ul style="list-style-type: none"> - 3A fuse (in the fuse box) is exploded. - The electric wire is broken. - Error from electric solenoid of magnetic clutch. 	<ul style="list-style-type: none"> - Relacement - Re-connection - Relacement 	Checking the magnetic clutch gap (0.5mm). Making sure the power lines are good for mass.
Fan of condenser does not run.	<ul style="list-style-type: none"> - 20A fuse (in the fuse box) is exploded. - The electric wire is broken. 	<ul style="list-style-type: none"> - Relacement - Re-connection 	After replacing if the fuse continues to explode, check the mass touch.
The warning light is always on when the A/C operates.	The electric wire of the high / low pressure switch touches the mass of the chassis	Repair	Checking the operation of the compressor and condenser fan
Other incidents.	<ul style="list-style-type: none"> - Relay error. - Touching the mass or breaking the electric wire - Fuse explodes. 	<ul style="list-style-type: none"> Repair or Relacement 	If the relay fails, replace it with a backup relay in the fuse box

2.2. The damage caused by part's errors

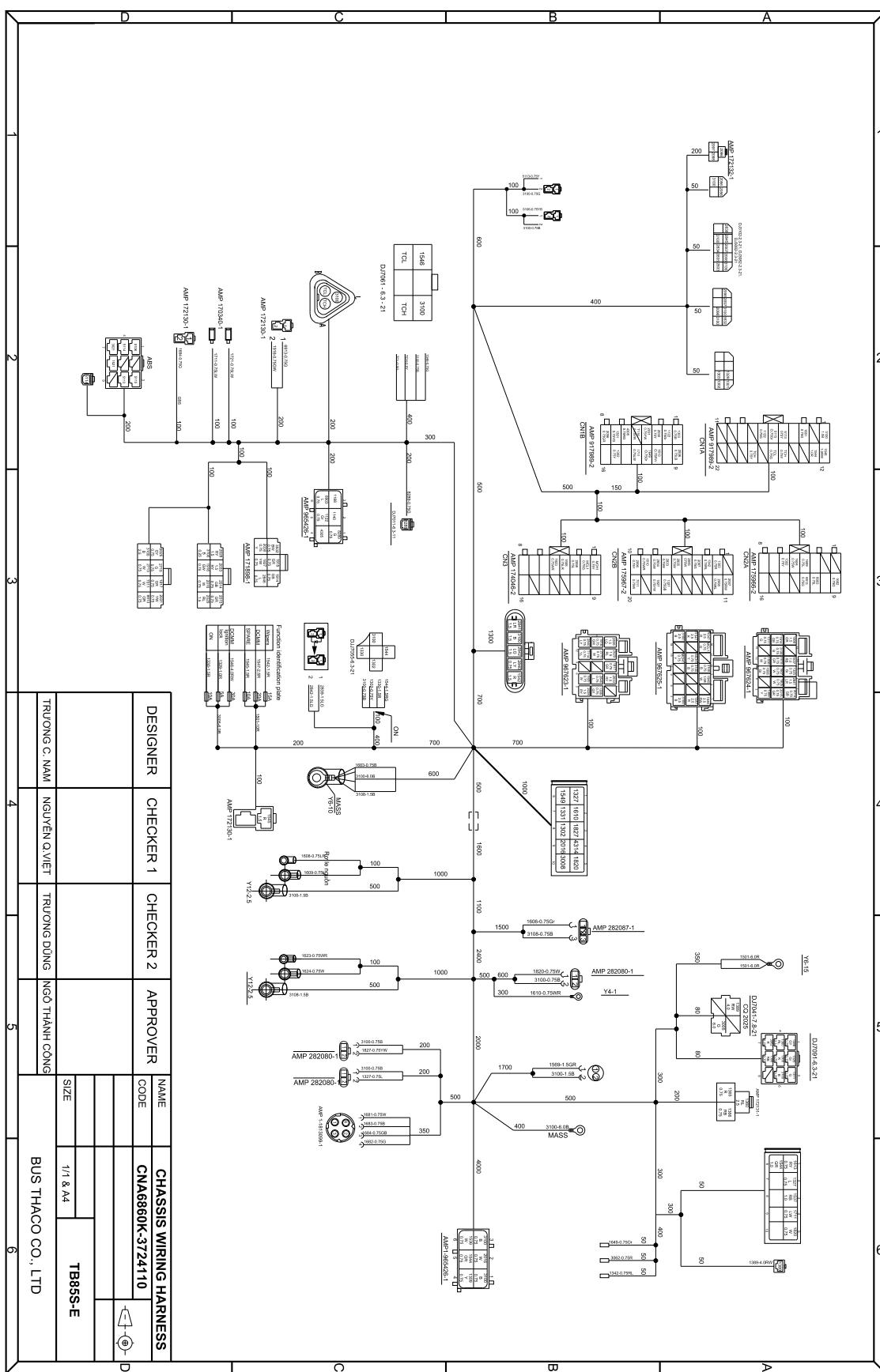
INCIDENT	REASON	TROUBLE SHOOTING	NOTE
High-high pressure	1. Condenser is dirty or blocked 2. Overcharge gas 3. Gas filter is blocked 4. There is air in the system 5. Error of condenser fan	1. Cleaning by compressed air 2. Discharging gas 3. Replacing filter particles 4. Cleaning air 5. Replacement	Observing gas charging meter and gas check eye
High-low pressure	Loading lack of gas	Adding gas	If the gas check eye does not see bubble, which means that there is excess gas
Low-high pressure	1. The heat-sensing ball of the butterfly throttle-valve is poorly insulated and the contact is not good 2. Van luppe of the compressor is broken	1. Tightening contact and insulation points.	Normal pressure: High pressure: 8 ~ 18 kg / cm ² Low pressure: 1.5 ~ 3 kg / cm ²
Low-low pressure	1. Loading lack of gas 2. Pipes, filters and butterfly throttle-valves are blocked. 3. Open the wind in the evaporator 4. Wind filter is dirty 5. There is moisture in the	1. Checking the gas leakage and adding 2. Repair/ placement 3. Closing up 4. Washing wind filter net 5. Cleaning air 6. Replacing the butterfly throttle-valve	When the gas filter is blocked, the inlet and outlet temperatures are diffrent. Gas pressure for gas leak check is

	system 6. Butterfly throttle-valve is damaged		not higher than 1.8 times normal pressure
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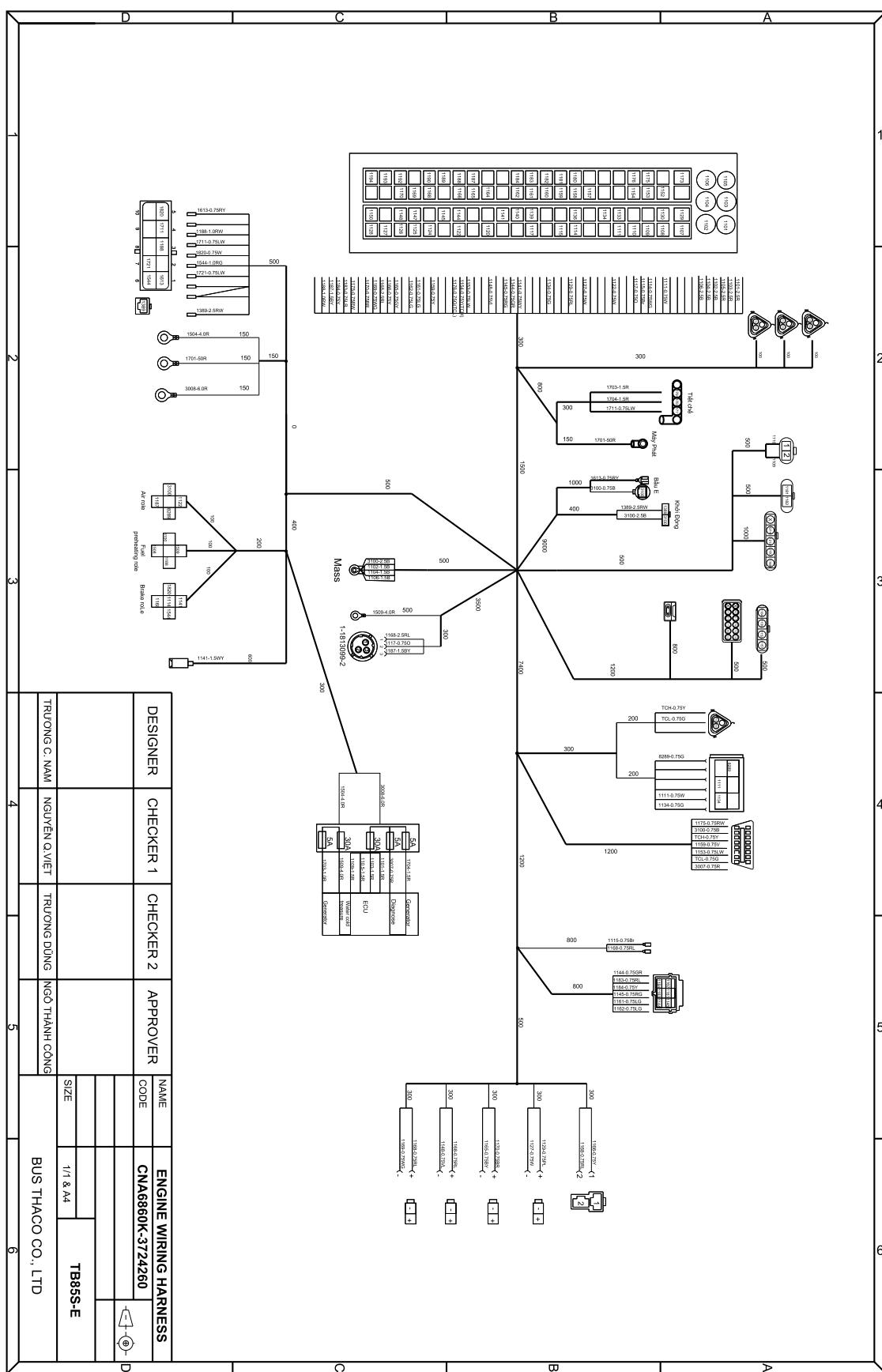
3. Other incidents

INCIDENT	REASON	TROUBLE SHOOTING
There is abnormal vibration or noise	1. Bolts and nuts are loosed 2. The belt is too tight 3. The belt is too loose 4. The intermediate puli suffer from dry lubricant oil 5. The intermediate puli ball and clutch is worn out a lot 6. The bearer is broken 7. The buffer rubber is aging	1. Tightening 2. Adjustment 3. Adjustment 4. Greasing 5. Replacement 6. Replacement 7. Replacement

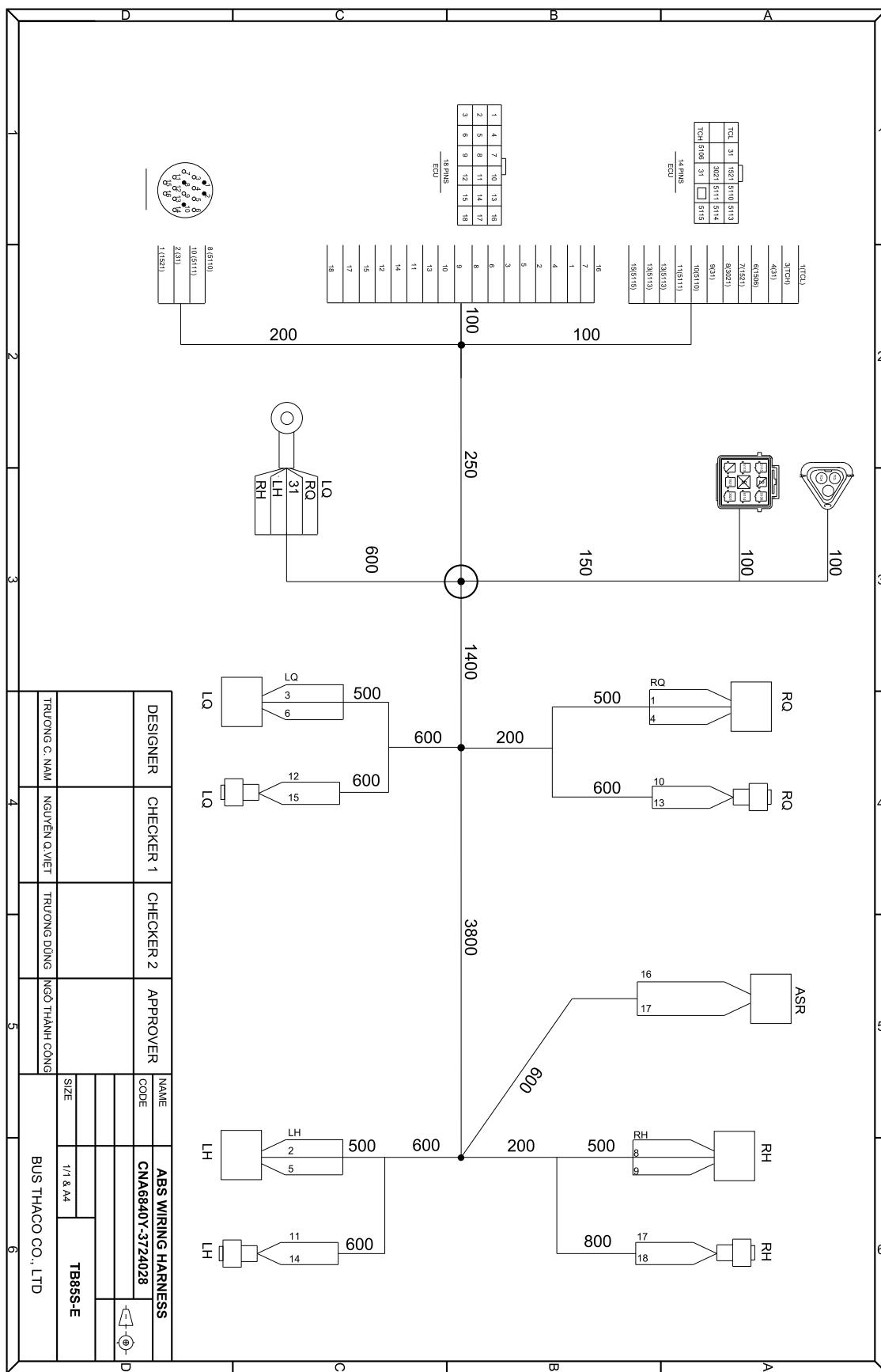
CHASSIS WIRING HARNESS



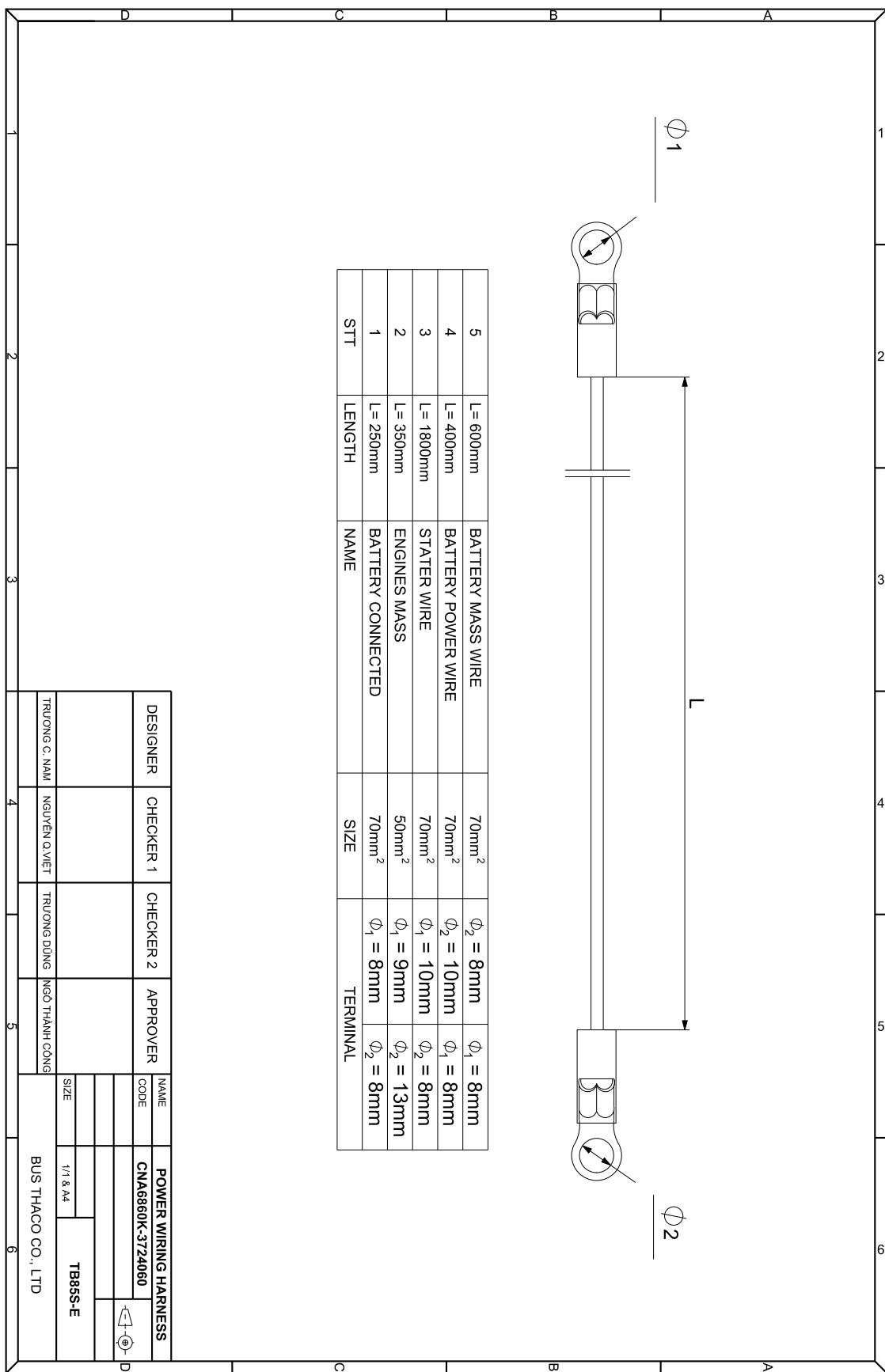
ENGINE WIRING HARNESS



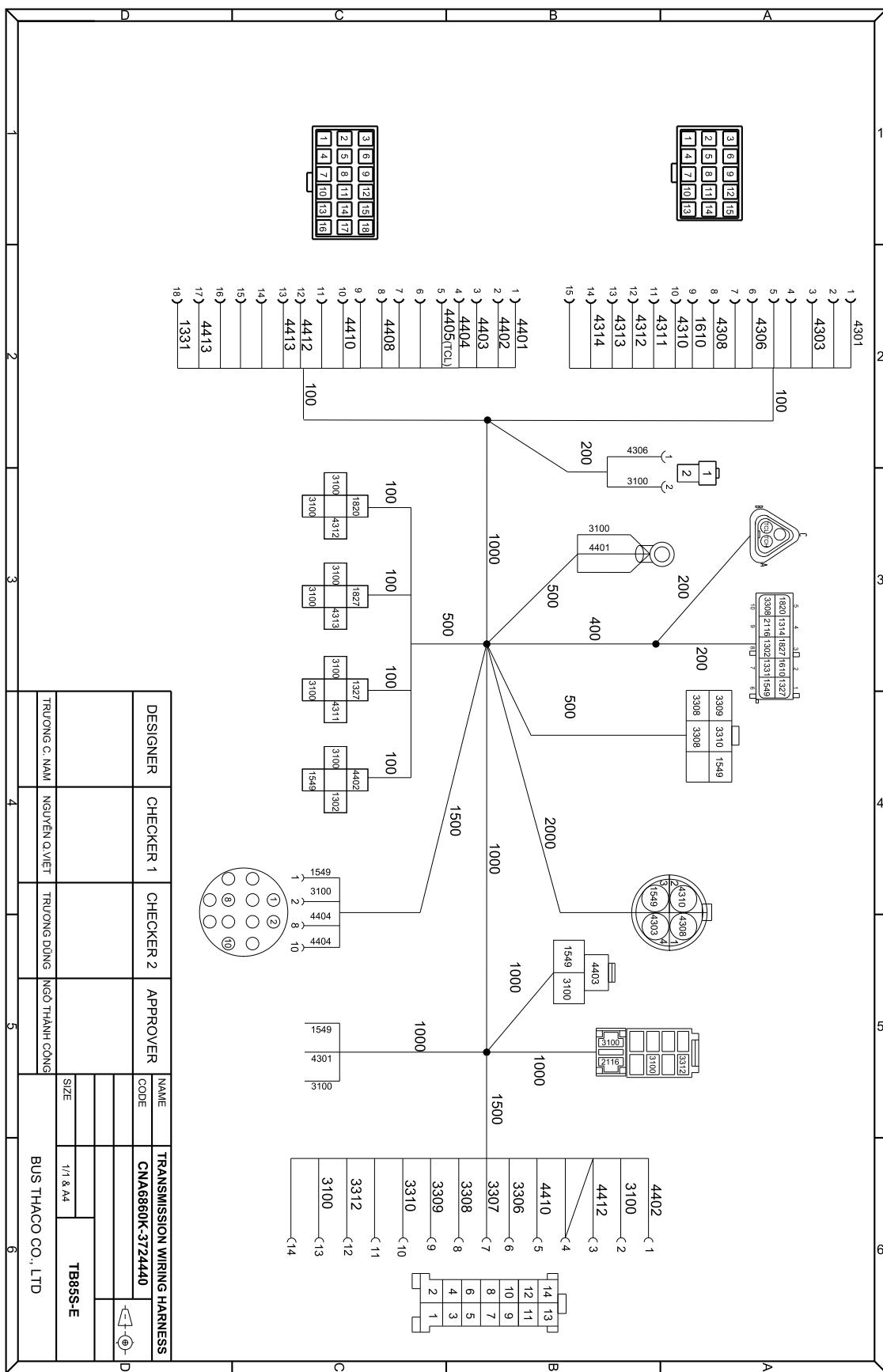
ABS WIRING HARNESS



POWER WIRING HARNESS



TRANSMISSION WIRING HARNESS



POWER BOX CQ2025

