SDEC POWER

E SERIES
POWER GENERATION ENGINES

G-DRIVE
POWERPACK
Power Generation Specification

OPERATION & MAINTENANCE MANUAL

Power Output Range
280kW – 495kW

STAGE II EMISSION COMPLIANT
FOR USE IN THE FOLLOWING TERRITORIES ASIA MIDDLE EAST AND AFRICA

Z SERIES DIESEL ENGINE

MODELS	MAX ENGINE OUTPUT		RATED GENERATOR OUTPUT	
	Prime kW	Standby kW	Prime kVA	Standby kVA
6ETAA11.8-G22 (1500 rpm)	280	308	313	350
6ETAA11.8-G22 (1800 rpm)	307	338	350	375
6ETAA11.8-G21 (1500 rpm)	307	338	350	375
6ETAA11.8-G21 (1800 rpm)	307	338	350	375
6ETAA12.8-G21 (1500 rpm)	368	405	400	440
6ETAA12.8-G21 (1800 rpm)	368	405	400	440
6ETAA12.8-G31 (1500 rpm)	401	441	450	500
6ETAA12.8-G31 (1800 rpm)	-	-	-	-
6ETAA12.8-G310 (1500 rpm)	450	495	500	550
6ETAA12.8-G310 (1800 rpm)	-	-	-	-

Generator outputs calculated using nett engine power at 0.8 power factor, at an altitude below 1000 m.a,s,l, and 40-degree Celsius ambient temperature.
Refer to outputs and ratings table for exact site conditions.

CAUTION

To minimize the possibility of personal injury and property damage and to reduce the likelihood of diesel engine performance degradation and premature wear or failure, please strictly adhere to the safety instructions and operating procedures outlined in this manual, especially the warnings and precautions.

The warnings in this manual must be strictly followed; failure to do so may result in burns, amputation, disability, suffocation, other personal injury, or death. The precautions are reminders to operators to use correct methods to avoid damage to diesel engine components or deterioration of engine performance. These warnings and precautions are not exhaustive and Shanghai Diesel Engine Co., Ltd. cannot and should not provide for all potentially dangerous consequences of violating these safety instructions and operating procedures.

PRODUCT REPAIR, TECHNICAL CONSULTATION, COMPLAINTS & SUGGESTIONS

For product repair, technical consultation, complaints and suggestions, please contact the Shanghai "Easy+People" call centre. We provide fast, professional, and sincere service 24/7, 365 days a year. National toll-free service hotline: **400-820-5656.**

For Product Repair Request

Please be sure to provide the following information:

- Diesel engine model
- Diesel engine order number
- Diesel engine serial number
- Equipment purchase date
- A detailed description of the fault
- Contact person's address and telephone number.

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1. INTRODUCTION

1.1 To Users and Operators

Thank you for choosing Shanghai Diesel Engine Co., Ltd.'s diesel engine products!
The E-series diesel engines are available in 11.8L and 12.8L displacements. They are newly developed six-cylinder, high-power, four-valve diesel engines from our company. The E-series diesel engines offer strong power, low fuel consumption, and emissions that meet relevant national regulations and standards, making them ideal power sources for mid-to-high-end automobiles and industrial equipment.

This manual mainly describes the technical specifications, usage and maintenance precautions for the basic model of this series of diesel engines to help users familiarize themselves with the product and use and maintain it correctly. Users should carefully read the relevant contents and requirements in this manual before using the diesel engine. Due to continuous improvements in product performance and structure, the technical specifications and illustrations listed in this manual may differ slightly from the actual product you are using. Our company will continuously supplement and improve these in future editions without further notification to users. Please note that for any questions regarding the use and maintenance of this product, please contact Shanghai Diesel's "Easy+Human" call center (400-820-5656) for technical consultation or guidance.

Shanghai Diesel Engine Co., Ltd. (Shanghai Diesel) products utilize the latest technology and high-quality components. For maintenance and repair, it is recommended to use Shanghai Diesel brand service parts. Shanghai Diesel's authorized service stations are located throughout China, providing repair services and spare parts supply; service personnel are professionally trained.

If the diesel engine is transferred or sold, this instruction manual should be transferred to the new user along with the engine.

1.2 Notice to Users Regarding Product Quality Reports

To facilitate our company's understanding and analysis of product quality issues and their causes and to promptly improve product quality and better serve our users, please provide the following information when reporting product quality problems:

1. Time and location of the malfunction
2. Diesel engine serial number, model, order number, shipping date and exact recipient's address
3. Diesel engine operating conditions, cumulative operating time (hours or kilometers), operating status (power, speed), fuel and oil grades used
4. Characteristics of the driven equipment (model, power consumption, structural features, etc.)
5. Description of the malfunction
6. Any parts or components requiring compensation or repair should be sent to or brought to our company along with a record or description of the damage process for analysis. If users find numerous problems or particularly serious issues, they should preserve the site and promptly inform us and our company will send personnel to jointly analyse the problem.

The handling of diesel engine quality problems will be in accordance with the relevant provisions of the Quality Warranty Manual.

1.3 After-Sales Service Commitment

To ensure excellent after-sales service and minimize losses for users due to product quality issues, Shanghai Diesel Engine Co., Ltd. has established a 24-hour repair and handling system.

Users nationwide can call 400-820-5656 to receive timely and professional consultation and after-sales service from Shanghai Diesel Engine Co., Ltd.

1.4 Safety Precautions

Before using or performing regular maintenance on the engine, carefully read and understand all safety precautions and warnings.

The appearance of this symbol in the maintenance section of this manual indicates a potential danger that could cause personal injury or death, or serious damage to the engine. However, this danger can be avoided by paying attention and taking necessary measures. We cannot anticipate all potential hazards that may occur; therefore, users are advised to always be mindful of safety.

The following safety precautions and warnings must be followed, otherwise personal injury may occur.

- Ensure safe operation place and always be aware of potential dangers.
- Always remain vigilant when operating the engine.
- Stop working immediately if you feel unwell or mentally unwell.
- Do not smoke while operating the engine.
- Do not smoke while refuelling, as fuel vapours are flammable.
- Do not smoke while checking the battery electrolyte level, as the electrolyte releases flammable gases.
- Do not wear loose clothing or remove all jewellery when working around the engine or its drive unit. Wear protective eyewear, work clothes, a safety helmet, or other protective equipment if necessary.
- To prevent fires during operation, the generator set must be kept at least 1 meter away from buildings and other equipment.
- Engine exhaust contains carbon monoxide and other harmful components. Operating in poorly ventilated areas poses a risk of exhaust poisoning. If the engine is operating indoors, exhaust gases must be vented outdoors and ensure there are no leaks at exhaust pipe connections.
- Do not remove protective devices or heat shields from exhaust system components; do not remove protective covers from exposed rotating parts, as this could cause injury.
- Do not place flammable materials such as fuel, lubricating oil, and coolant, or dangerous items such as explosives, around the engine. This poses a risk of fire or explosion.
- Wipe up any spilled fuel, lubricating oil, or coolant. Fuel, engine oil, or coolant can ignite and cause a fire. Store oily or coolant-soaked cloths in fireproof containers and never place them on the engine.
- Remove dust, dirt, and foreign objects from the engine and surrounding area. This can also cause fires or engine overheating.
- Before starting the engine, ensure that no one is around it and that there are no tools or other objects on the engine. Never start the engine if a "Do Not Start" warning sign is displayed on the ignition switch or other equipment.
- If a fuel, lubricating oil, or exhaust leak is detected, take immediate measures to stop the leak. Fuel or lubricating oil splashing onto hot engine components, or exhaust encountering flammable materials, can cause a fire or resulting in personal injury or engine damage.
- Never inspect engine leaks by hand. High-temperature, high-pressure fuel, lubricating oil, and coolant can cause injury. Exercise extreme caution when checking for leaks in high-pressure fuel lines, as fuel under high pressure can penetrate the skin and cause personal injury or death. Use a thick plate to check for fuel leaks. If a leak is found, avoid direct contact with the sprayed fuel.
- When testing fuel, lubricating oil, coolant, or battery electrolyte, if lighting is required, explosion-proof lighting equipment must be used to avoid the risk of ignition and explosion.
- Never smoke or use open flames when handling or working near any components related to the fuel system. Fuel vapours may ignite, causing damage to parts or personal injury.
- Never perform maintenance on any parts of the fuel system while the engine is running.
- Diesel fuel flows from the injection pump to the injectors under extremely high pressure through high-pressure fuel lines. Therefore, never loosen any high-pressure fuel lines while the engine is running. Failure to comply with this warning can result in severe burns.
- When the engine is to be out of service for an extended period or requires maintenance, disconnect the engine and battery connection wires. If using an air starter, disconnect the air connection line to prevent accidental engine starting. A "Do Not Operate" sign must be displayed in the control room or at the control area. When disconnecting the battery terminals, always start from the (-) terminal side. When installing, always start from the (+) terminal side.
- Do not use tools or other metal objects to contact the two battery terminals. Do not short-circuit the positive and negative terminals of the battery, as this poses a risk of fire and explosion.

- Battery terminal connections must be secure. Loose terminals may cause arcing due to poor contact, posing a risk of explosion. Damaged cables and wires can cause fires. Inspect and replace any damaged cables or wires before reconnecting.
- Do not use open flames or perform welding near the battery. Flammable hydrogen and oxygen are produced inside the battery; using an open flame near the battery poses a risk of ignition and explosion. Stop using the battery when the electrolyte level is below the minimum level line. Improper use of electrolyte can cause blindness or burns.
- If the engine is running indoors, a fire extinguisher should be readily available and in a usable condition. Users should be familiar with how to use a fire extinguisher. First-aid kits should be placed in designated locations for immediate use in case of emergency. Fire and accident response procedures should be established, including contact information and locations for emergency services. Carbon tetrachloride fire extinguishers must not be used, as they release toxic gases and their liquid can damage the insulation of electrical wires.
- When adding or changing coolant or battery fluid, avoid contact between coolant and electrolyte and skin and eyes. If contact occurs, wash skin with soap and water immediately. If contact occurs, flush eyes with plenty of water for 15 minutes and seek immediate medical attention.
- When adding coolant, take care to prevent steam burns. Cool the engine first. Only when the coolant temperature is below 50°C should the filler cap (pressure cap) on the radiator be slowly loosened to depressurize the cooling system before adding coolant. The coolant temperature is very high immediately after engine shutdown. Opening the end cap may result in scalding from steam or hot water. Always tighten the filler cap after checking the coolant level, adding coolant, or changing coolant.
- When the engine is running, the intake and exhaust systems are very hot. Do not touch hot components such as the exhaust pipe, exhaust tailpipe, turbocharger, intercooler intake pipe, or expansion tank. The coolant temperature is very high during engine operation; do not open the radiator filler cap. Opening the radiator filler cap may result in scalding from steam or hot water.
- If the fan belt breaks, stop the engine immediately. Otherwise, the engine will overheat, and coolant in the expansion tank will steam out, posing a scalding risk.
- Do not handle lubricating oil directly with your hands when draining lubricating oil or changing the oil filter. Hot lubricating oil or components can burn your skin.
- Before disassembling or loosening any pipes, fasteners, interfaces, or related components, release the pressure in the systems to which these components belong, such as the air system, cooling system, lubrication system, or fuel system. Otherwise, high-pressure fuel, lubricating oil, and coolant can cause injury.
- Do not approach rotating parts while the engine is running. Do not place objects that could easily be caught in rotating parts around them. Getting caught in rotating parts, such as your body or tools, can result in serious personal injury.
- Always stop the engine before adjusting its drive system. Getting caught in rotating parts can cause a serious accident.
- Use proper engine cranking techniques. Do not crank the engine crankshaft using the fan area, as this can cause serious personal injury or damage to the fan blades.
- When working on parts of the engine that are inaccessible by hand, do not stand on the engine or brace your feet on parts on the side of the engine. Stand on a stable and reliable work platform and be careful not to slip and fall. Do not use parts boxes or toolboxes as work platforms. Improper work methods can damage engine parts and cause personal injury.
- Used lubricating oil may contain carcinogenic components and can cause regenerative toxicity. Avoid inhaling lubricating oil vapours or prolonged contact with them. Dispose of waste oil using appropriate, safe, and reliable methods.
- To prevent suffocation or frostbite, protective clothing must be worn, and the process must be carried out in a well-ventilated environment when disconnecting air conditioning refrigerant (Freon) piping. To protect the environment, the refrigeration system must be emptied or refilled using specialized equipment to prevent Freon from releasing into the atmosphere. Refrigerant should be recovered and recycled.
- To protect the environment, when replacing lubricating oil and oil filters, fuel filters, or coolant, the discharged lubricating oil or coolant and the replaced oil or fuel filters, must not be disposed of indiscriminately but in accordance with relevant environmental protection regulations. Discarded batteries should also be disposed of in accordance with relevant environmental protection regulations.

1.5 Precautions for Use and Maintenance

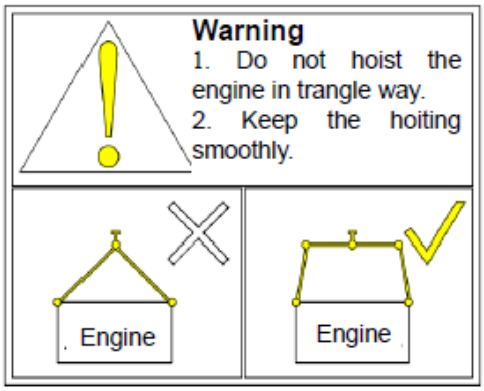
Before using and performing regular maintenance on the engine, carefully read and understand all engine use and maintenance precautions and warnings. The following precautions and warnings must be followed, otherwise engine malfunction or damage may occur.

- Carefully read this manual and strictly follow the operating procedures and maintenance protocols specified herein.
- Strictly adhere to the provisions of this manual for daily maintenance and Level 4 maintenance and keep regular maintenance records.
- Use the appropriate fuel, lubricating oil, and coolant as specified in this manual.
- The engine cooling system should use the coolant or antifreeze specified in this manual in all climates.
- Before starting the engine, check that the coolant, lubricating oil, and fuel levels are sufficient.
- Always start the engine under no-load conditions.
- New or overhauled engines must undergo a 60-hour break-in period before use.
- Do not operate the engine without an air filter (except for marine engines) to prevent premature engine wear.
- If the engine is operating indoors, always maintain good ventilation in the engine room. Insufficient air intake into the engine will cause engine temperature to rise, output power to decrease, and performance to degrade. If necessary, engine room ventilation equipment must be provided.
- During engine operation, its operating status and the readings of all instruments should be frequently observed. If any abnormality is detected or an emergency occurs, emergency shutdown measures should be taken, and the fault should be rectified to prevent engine moving parts from seizing due to overheating caused by insufficient coolant or low lubricating oil pressure.
- When the coolant temperature is below 60℃, high-speed, high-load operation of the engine is strictly prohibited.
- Overloading of the engine is strictly prohibited.
- If the engine overheats and must be shut down, do not immediately add coolant after shutdown, otherwise it will damage components such as the cylinder head.
- After an abnormal engine shutdown, it must not be restarted immediately. When the engine is shut down while an abnormal alarm is sounding, the cause of the fault must be identified and rectified before restarting. Continuing to operate without addressing the fault may lead to more serious accidents.
- When the engine lubricating oil pressure drops abnormally for some reason, the engine should be stopped immediately, and all parts of the lubrication system should be inspected to confirm the cause of the fault. Continuing to operate under low oil pressure can cause accidents such as engine bearing burnout.
- When starting a newly repaired engine, be prepared to cut off the air supply. If runaway occurs after starting the engine, immediately stop the engine by cutting off the air supply.
- Avoid welding on engines or equipment equipped with electronic devices. If welding is necessary, disconnect the power supply to the equipment and disconnect the electronic equipment from the wiring harness before welding. Never plug or unplug wiring harnesses while the power is on. Do not arbitrarily plug or unplug wiring harnesses; if necessary, disconnect the power first to avoid malfunction.
- The engine should be stopped when checking belt tension and other drive devices.
- Do not use a pry bar to remove or install the drive belt from the pulley, as this may damage the reinforcing fibres inside the belt. Disassembly and installation should be done manually.
- If the drive belt is contaminated with lubricating oil, fuel, or other harmful liquids, it must be replaced and the source of contamination eliminated. Do not use solvents to clean the belt.
- When storing or transporting drive belts, ensure their bending diameter is not less than 25 mm and do not hang them on hooks.
- All surfaces of the drive belt pulleys must be smooth to extend belt life. Therefore, before installing the belt, ensure the pulley surface is free of rough surfaces or burrs and rotates freely.
- Batteries have a limited lifespan and must be replaced at a certain time.
- If the thermostat malfunctions, replace it promptly and do not remove it unnecessarily.
- To maintain normal engine performance, there are fuel injection quantity seals and speed control seals on the fuel control linkage. Using the engine after these seals are broken will void the warranty if malfunctions occur. Breaking the seals will result in the following malfunctions: increased slippage and wear in the fuel injection pump, leading to melting and damage; a sharp increase in fuel and lubricant consumption; imbalance between fuel injection quantity and the governor; performance degradation; and serious accidents such as overspeeding.
- Do not use seawater to directly cool the engine.

- Do not directly spray water to clean fuel injection pumps with electronic speed governors.
- Prevent rainwater from entering through the exhaust or intake manifold. Do not wash the engine while it is running. Cleaning agents (water) may be drawn into the engine. If water enters the combustion chamber, the engine may be damaged by water pressure during startup, potentially causing a serious accident.
- Do not arbitrarily change the engine's purpose or usage. Doing so may easily lead to damage to the engine and/or equipment and may also cause personal injury. Unauthorized engine modifications will not be covered under warranty, even within the warranty period.

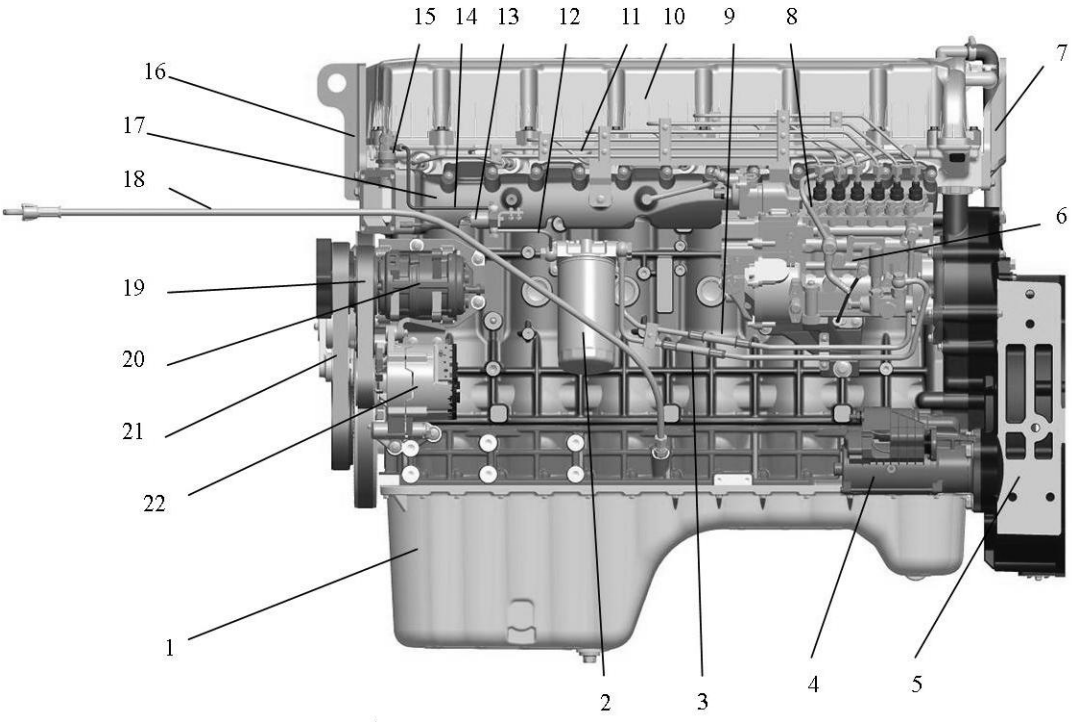
1.6 Warning Marks on Diesel Engine

The following warning signs are present on diesel engines and must be strictly observed, otherwise personal injury and engine damage may occur.



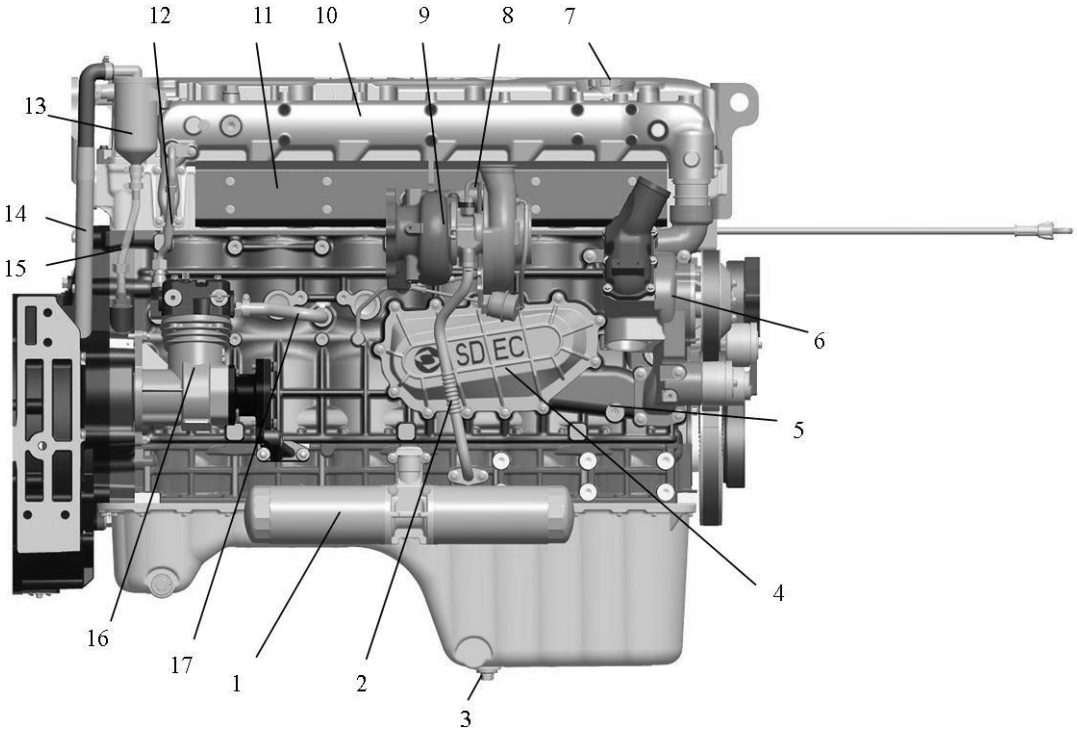
2. DIESEL ENGINE OVERVIEW

2.1 Diesel Engine External Appearance



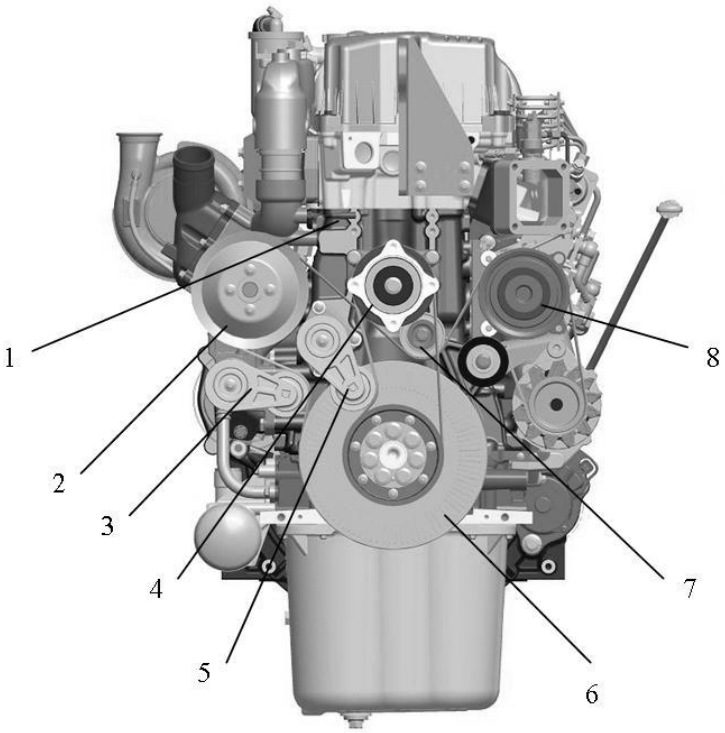
Diesel Engine Intake Side

1	Oil Pan
2	Fuel Filter
3	Fuel Filter Inlet Pipe
4	Starter Motor
5	Flywheel Housing
6	Fuel Injection Pump
7	Rear Lifting Ring
8	Injector Return Pipe
9	Fuel Injection Pump Inlet Pipe
10	Cylinder Head Cover
11	High-Pressure Fuel Pipe
12	Solenoid Valve Inlet Pipe
13	Fuel Solenoid Valve
14	Fuel Solenoid Valve Outlet Pipe
15	Flame Preheat Plug
16	Front Lifting Ring
17	Intake Manifold
18	Oil Dipstick
19	Multi-V Belt
20	Air Conditioning Compressor
21	Drive Belt
22	Charging Alternator

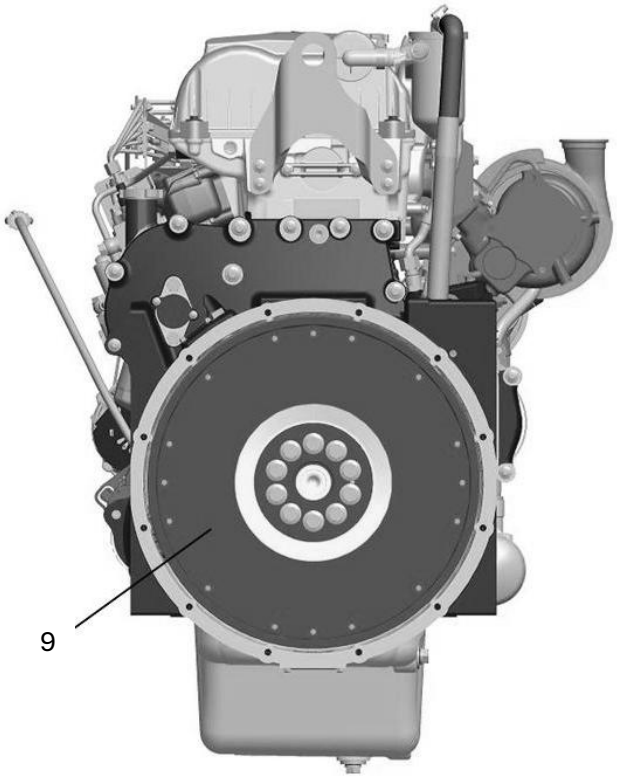


Diesel Engine Exhaust Side

1	Oil Filter
2	Turbocharger Return Oil Pipe
3	Oil Pan Drain Plug
4	Oil Cooler
5	Water Drain Plug
6	Water Pump Assembly
7	Oil Filler Cap
8	Turbocharger Inlet Pipe
9	Turbocharger
10	Main Water Return Pipe
11	Exhaust Manifold and Heat Shield
12	Air Compressor Water Outlet Pipe
13	Oil Separator
14	Oil Separator Outlet Pipe
15	Oil Separator Return Oil Pipe
16	Air Compressor
17	Air Compressor Water Inlet Pipe



Diesel Engine Front End

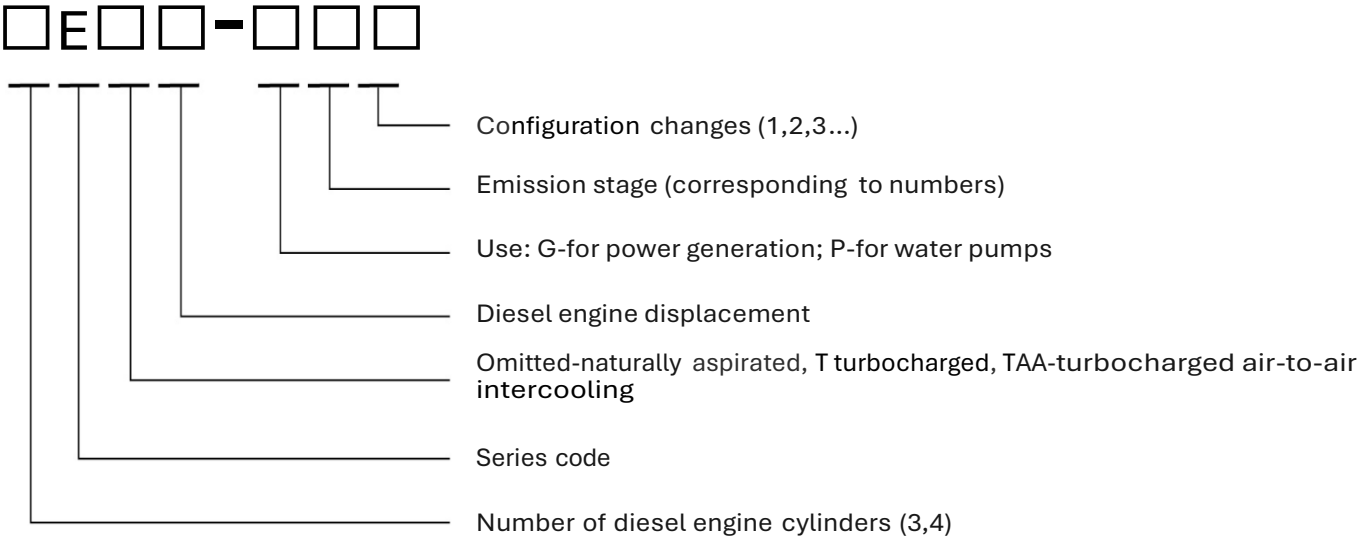


Diesel Engine Rear End

1	Water Temperature Sensor
2	Water Pump Pulley
3	Tensioner Pulley
4	Fan Pulley
5	Drive Belt Tensioner Pulley
6	Vibration Damper
7	Idler Pulley
8	Air Conditioning Compressor Pulley
9	Flywheel

2.2 Diesel Engine Model Identification

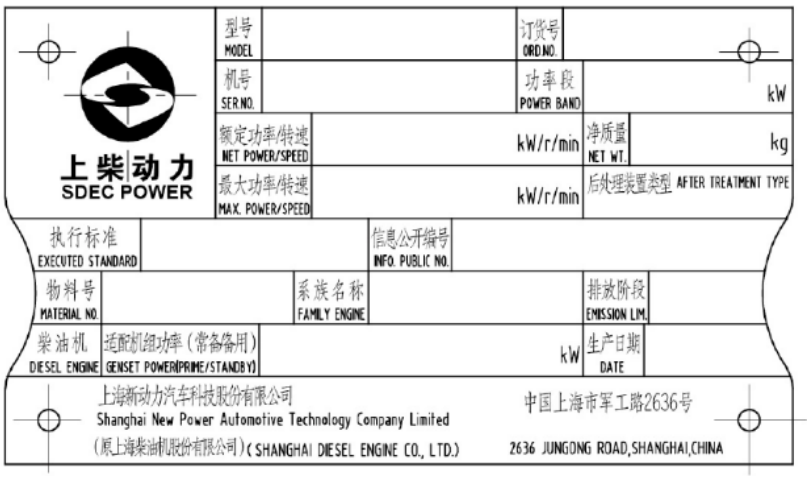
The diesel engine model designation indicates the following meanings:



e.g.
6ETAA11.8-G22 represents E series 6-cylinder total displacement 11.8L turbocharged air-to-air intercooled Stage III (non-road) emission standards, the first configuration of power station diesel engines.
6ETAA12.8-G31 represents E series 6-cylinder total displacement 12.8L turbocharged air-to-air intercooled Stage III (non-road) emission standards, the first configuration of power station diesel engines.

2.3 Diesel Engine Nameplate

The diesel engine nameplate displays the main technical data and information of the diesel engine you purchased: model, order number, engine number, manufacturing date, rated power, and rated speed. It is the primary basis for users to purchase repair parts and for our company to provide after-sales technical services. We hope users will record this information and data in the working log of your diesel engine or the equipment it is paired with. Providing this information promptly when contacting repair services or reporting quality issues will help in correctly resolving the problems you report. Please protect the nameplate from damage. The nameplate is located on the side of the diesel engine cylinder head cover (intake side).



Note: Users may not replace the diesel engine nameplate without our company's permission!

2.4 Diesel Engine Technical Specifications

2.4.1 Basic Parameters

Engine		6ETAA11.8-G22	6ETAA11.8-G21	6ETAA12.8-G21	6ETAA12.8-G31	6ETAA12.8-G310
Total piston displacement/L		11.8	11.8	12.8	12.8	12.8
Type		In-line, four-stroke, water-cooled				
Bore/mm		128		130		
Stroke/mm		153		161		
Number of Cylinders		6				
Number of valves of each cylinder		2	4			
Firing order (Viewed from the free end)		1-5-3-6-2-4				
Aspiration		Turbocharged with intercooler				
Fuel system		Mechanical fuel injection pump				
Crankshaft rotation (facing flywheel)		Counterclockwise				
Starting mode		Electric				
Dry weight/kg*		1164				
Dimensions (basic model) **	Length/mm	1787		1856		1787
	Width/mm	918		1000		
	Height/mm	1304		1354		1287

*Dry weight, as defined by DIN 70020, excludes the starter, alternator, air compressor, steering pump, clutch, and oil/water components within the diesel engine, but includes the flywheel and flywheel housing.

** Dimensions are for the basic diesel engine model only; different models may vary slightly.

2.4.1 Main Technical Parameters

Specification		Model				
		6ETAA11.8-G22	6ETAA11.8-G21	6ETAA12.8-G21	6ETAA12.8-G31	6ETAA12.8-G310
Lubricating system						
Oil pressure @	idle speed (min allowable), kPa	70				
	rated speed (min. allowable), kPa	350				
Oil pan capacity, L (dipstick “high”-“low”)		41-33			36-31	
System capacity, L*		36				

Cooling system			
Thermostat	Opening temperature, ℃	85	
	Full-opening temperature, ℃	95	
	Lift, mm	9	
The pressure of pressure cap (for water temperature of 95 ℃ in the upper tank), kPa		50~70 for plain,90 for highland	
System capacity, L		28	
Intake and exhaust system			
Max allowable intake resistance (rated condition, with dry air filter), kPa		6	
Max allowable exhaust temperature, ℃		550	
Fuel system			
Max inlet resistance of the fuel transfer pump, kPa		13.5	
Max pressure of the fuel transfer pump outlet, kPa	at small flow	100	
	at large flow	300	
Max resistance of fuel return piping, kPa		22(with check valve) / 9(without chevk valve)	
Low pressure of the fuel injection pump, MPa	at small flow	≤50	
	at large flow	≤135	
Fuel inlet flow temperature,℃		-20~50	
Performance of mechanical governor		RQVK	
Min stabilized speed at low idle, r/min		Refer to the nameplate of specific engine	
Speed regulation ratio	Variable speed type	≤15%	
Cold start			
Lowest starting temperature °C		-15 (without aid)	
		-30 (with aid)	
Electrical system			
Min. recommended battery capacity**		180	
24V system ：			
Cold starting current @ -18℃, A		950	
Starting motor			
Voltage, V		24	
Power, kW		7.5	9
Alternator			
Voltage, V		28	
Current, A		55	

* This value refers only to the volume of this diesel engine system.

** For applications with high starting requirements, the battery capacity should be appropriately increased.

3. DIESEL ENGINE USE

Proper use of the diesel engine not only ensures its normal operation and good performance but also extends its lifespan and reduces operating costs. Use the correct fuel, engine oil, and coolant, and follow the correct operating procedures as required in this section.

3.1 Fuel

The fuel specifications used in this diesel engine should conform to the GB 19147 standard. The diesel fuel grade should be determined based on the ambient temperature of the operating environment. In cold winter, low-freezing-point diesel fuel should be used, and vice versa in summer. The recommended fuel grade for the region is based on the GB 19147 standard. Users can also select according to the recommendations in the table below: for example, when the ambient temperature is -27℃, -35 diesel fuel should be used.

Relationship between diesel grade and applicable minimum temperature

Diesel grade	0 #	-10 #	-20 #	-35 #
Cetane number	≥49	≥49	≥46	≥45
Freezing point (°C)	≤0	≤-10	-20	-35
Minimum applicable temperature (diesel engine operating ambient temperature °C)	Above 4°C	Above -5°C	Above -14°C	Above -29°C

△**Note**: Diesel fuel must be kept highly clean and free from dust, impurities, or water contamination.

3.2 Engine Oil

To ensure the normal operation and long service life of the diesel engine and to improve its emissions, please use Shanghai Diesel Engine Co., Ltd.'s dedicated CH-4 grade or higher lubricating oil. If Shanghai Diesel Engine Co., Ltd.'s dedicated engine oil is unavailable, lubricating oil meeting the requirements of the American Petroleum Institute (API) CH-4 grade or higher may be used.

The relationship between engine oil viscosity and suitable ambient temperature is as follows:

Engine oil viscosity grade	Suitable operating temperature	
	Minimum	Maximum
0W-20	-50°C	40°C
0W-40	-40°C	30°C
5W-20	-40°C	40°C
5W-40	-30°C	30°C
10W-30	-30°C	40°C
10W-40	-30°C	60°C
15W-40	-20°C	40°C
20W-50	-10°C	50°C

△**Note**: Engine oil must be kept clean and free from dust, impurities, or water contamination.
△**Note**: Different brands of engine oil should not be mixed. If there are significant changes in ambient temperature, and a different brand of engine oil is required, the entire oil and oil filter should be replaced.

3.3 Coolant

To ensure the normal operation and service life of the diesel engine, a coolant with antifreeze and anti-corrosion properties must be used under all climatic conditions. This coolant features antifreeze, anti-corrosion, good thermal conductivity, good stability, and environmentally friendly.

3.4 Diesel Engine Starting

Before using a diesel engine, select appropriate specifications of engine oil, fuel, and coolant based on the specific operating environment and conditions. Before starting, perform the following tasks:

- Conduct a comprehensive inspection of the diesel engine and starting system, addressing any problems promptly.
- Check that the oil pressure gauge, oil temperature gauge, coolant temperature gauge, warning lights, and other instruments are functioning correctly.
- Check that the air filter maintenance indicator shows a red plunger.

Note: Never start a diesel engine without an air filter (paper filter element) (except for marine diesel engines) to prevent premature engine wear.

- Check that the fuel pre-filter maintenance indicator has turned red.
- Check that the engine oil level is within the specified range. When a diesel engine is first put into use or after a major overhaul, add an appropriate amount of clean engine oil to the turbocharger inlet.
- Check that the coolant level is within the specified range.
- Check that the electrolyte level is within the specified range.
- When a diesel engine is first put into use, after a major overhaul, after being out of service for several days, or after the fuel filter has just been replaced, air may be present in the fuel system. It is necessary to bleed the fuel system by pumping fuel. See Section 4.3 for details on bleeding the fuel system.
- Check that the electric starter circuit is in normal working order.
- All safety devices must be properly installed.
- Check that the accelerator pedal operates smoothly.

3.4.1 Standard Starting Procedure

- Disconnect the diesel engine from the transmission or place the gearbox in neutral.
- Engage all mechanical controls.
- Insert the ignition key and turn the switch from the OFF position to the ON position to connect the electronic controller and other electrical components. If there is intake preheating, the indicator light will illuminate; if there is no intake preheating, the indicator light will not illuminate.
- If there is intake preheating, wait for the intake preheater indicator light to go out before turning the switch from the ON position to the START position. For vehicle diesel engines, the accelerator pedal must be pressed during starting.

Note: To prevent damage to the starter motor, the starting time should not exceed 15 seconds, and there should be a 2-minute interval between two starts.

Each starting time is generally 2 to 3 seconds. If three consecutive starts fail, contact Shangchai "Easy+Ren" (400-820-5656).

- After the diesel engine starts successfully, the switch will automatically return from the START position to the ON position.

Note: The diesel engine oil pressure gauge must display a reading within 15 seconds of a successful start. If the oil pressure is not indicated within 15 seconds, stop the engine immediately to prevent damage.

- Then, refer to Chapter 5, "Troubleshooting Guide," to identify and resolve the problem.
- After starting a hot diesel engine, gradually increase the speed and load after idling for 1 to 3 minutes.
- After starting a cold diesel engine, gradually increase the speed after idling for 3 to 5 minutes to ensure adequate lubrication of all bearings and stable oil pressure.
- Loading should only begin gradually after the oil pressure has stabilized.
- When the diesel engine is idling, check that all instruments are functioning correctly.

Caution: Do not accelerate the diesel engine immediately after starting.

Caution: Do not allow the diesel engine to idle for too long, as this will damage it. During idling, the combustion chamber temperature is low, resulting in incomplete fuel combustion, carbon buildup in the

cylinder, clogging of the injector nozzles, and piston ring and valve sticking, ultimately leading to decreased engine performance.

Caution: When using a jumper cable to start the diesel engine, always connect the cables in parallel: positive to positive, negative to negative. When using an external power source to start the diesel engine, turn the circuit breaker to the "OFF" position. Remove the key before connecting the jumper cable to prevent accidental starting.

3.4.2 Low-Temperature Starting

Diesel engines are capable of starting smoothly at temperatures above -15°C without any preheating measures. However, to ensure rapid and smooth starting of the diesel engine in low winter temperatures and to maintain a stable engine speed and improve smoke emission, an intake air heating device is recommended.

There are two types of heating devices: resistance wire heating devices and flame heating devices.

1) Resistance wire heating device: Composed of an electric heater, electronic controller, temperature sensor, indicator lights, etc., its operation is controlled by the electronic controller.
2) Flame heating device: Composed of a glow plug, solenoid valve, fuel inlet pipe, electronic controller, temperature sensor, indicator lights, etc., its operation is controlled by the electronic controller.

The electronic controller determines whether to activate the intake air heating based on the ambient temperature. Intake air heating is divided into two stages: intake air preheating before starting and intake air heating after starting. Starting the diesel engine is generally not allowed during the preheating process; if starting occurs, preheating will stop, and starting can only proceed after preheating is complete.

- Before starting, insert the ignition key and turn it from the OFF position to the ON position to activate the preheating auxiliary device circuit. The indicator light will illuminate, and intake air preheating will begin. Once intake air preheating is complete, the preheating light will flash, indicating that the diesel engine is ready to start.
- After the preheating light goes out, turn the ignition key from the ON position to the START position to start the diesel engine. After successful starting, the switch will automatically return to the ON position.
- Intake air heating (stage 2 heating) will begin after starting, and the timing is controlled by the electronic controller. During this period, the preheating light will not illuminate.

Other procedures after starting should follow the guidelines in Section 3.4.1, "Regular Starting Procedure".

Note: If no starting operation is performed within 30 seconds after the indicator light begins flashing, or if starting fails, the electronic controller will automatically disconnect the preheating circuit, solenoid valve circuit, and indicator light circuit, entering a delay protection state. To start again, return the ignition key to the OFF position, wait 5 seconds, and then repeat the above process.

3.4.3 Starting the Diesel Engine After a Long Period of Parking or Oil Change

After each oil change or after a parking period exceeding 30 days, before starting the diesel engine, always check that the oil level is within the dipstick marks and pump oil into the fuel system to bleed the system. See Section 4.3 for specific procedures. Then, start the diesel engine using the standard starting procedure or the low temperature starting procedure.

3.5 Diesel Engine Operation

Precautions for Diesel Engine Operation:

- Regularly monitor oil pressure and coolant temperature. If any abnormalities are observed, stop the engine and inspect it.
- When the diesel engine begins to overheat (coolant temperature alarm sounds), reduce the engine speed or shift to a lower gear to reduce the load, or both simultaneously, until the coolant temperature returns to the normal operating range. Otherwise, refer to Chapter 5, "Troubleshooting Guide," to identify and resolve the problem. If necessary, contact the Shanghai Diesel Engine Co., Ltd. "Easy+People" call center (400-820-5656).

- When operating a diesel engine in very cold environments, the correct engine oil, fuel, and coolant must be used. Most diesel engine malfunctions are preceded by obvious signs. Changes in the engine's sound, performance, and appearance can indicate the need for maintenance or repair. Timely maintenance or repair is crucial to prevent serious malfunctions. If necessary, contact the Shanghai Diesel Engine Co., Ltd.'s "Easy+People" call centre for technical guidance or professional repair services.

Typical signs of diesel engine malfunction:

- Diesel engine stalls
- Abnormal engine vibration
- Abnormal engine sound.
- Sudden changes in diesel engine coolant temperature and oil pressure
- Diesel engine emitting black smoke
- Insufficient power
- Increased oil consumption
- Increased fuel consumption
- Three leaks (oil, fuel, and coolant leaks)

3.6 Diesel Engine Shutdown

3.6.1 Normal Shutdown

After prolonged high-speed, high-load operation, the diesel engine should be gradually unloaded and its speed reduced before shutdown. It should be allowed to idle for 3-5 minutes to allow for even cooling and a significant drop in turbocharger speed before shutdown, protecting the diesel engine and turbocharger. The "acceleration-switching-coasting in neutral" method is strictly prohibited. After the diesel engine stops, turn the switch from the ON to the OFF position and remove the ignition key.

If the diesel engine needs to be shut down for a period of time, proper storage is required. See Chapter 6, "Storage After Diesel Engine Shutdown," for details.

3.6.2 Emergency Shutdown

In emergency or special circumstances, an emergency shutdown can be performed to avoid serious accidents involving the diesel engine. Simply pull the emergency stop handle manually to achieve this.

3.7 Break-in of New or Overhauled Diesel Engines

New or overhauled diesel engines must undergo a 60-hour break-in period and oil change before being put into full-load operation. This process improves the working condition of moving parts, enhances reliability, and extends service life. The break-in plan should be tailored to the engine's intended use and load type. Generally, the engine speed and load should be gradually increased in stages as the break-in period progresses. During the entire break-in period, the load should be 50%–80% of the rated power, and the speed should not exceed 80% of the rated speed.

During the break-in period and the subsequent normal operating period, diesel engines should not be idled or run at low load for extended periods. Continuous idling should not exceed 10 minutes to avoid premature wear due to carbon buildup or to prevent performance degradation.

4. DIESEL ENGINE MAINTENANCE

4.1 Diesel Engine Maintenance Plan

The table below shows the maintenance cycle and maintenance content for this series of diesel engines. Users should perform regular maintenance according to the provisions of this table. If the diesel engine is frequently operated in ambient temperatures below -18℃ or above 38℃, or in dusty environments or with frequent shutdowns, the maintenance cycle should be appropriately shortened.

Maintenance content	Daily	Every 10,000km or 250h or 3 months	Every 20,000km or 500h or 6 months	Every 40,000km or 1,000h or 12 months	Every 80,000km or 2,000h or 2 years
Checking engine periphery	●	●	●	●	●
Checking fuel tank	●	●	●	●	●
Checking air filter service indicator	●	●	●	●	●
Checking primary fuel filter service indicator	●	●	●	●	●
Checking oil level	●	●	●	●	●
Checking coolant level	●	●	●	●	●
Checking electrolyte level	●	●	●	●	●
Checking drive belt *	●	●	●	●	●
Checking cooling fan	●	●	●	●	●
Checking intake system		●	●	●	●
Changing lubricating oil, oil filter and oil centrifugal filtration **			●	●	●
Changing fuel filter (including primary filter) ***			●	●	●
Priming fuel system			●	●	●
Checking intercooler and its lines			●	●	●
Check/adjusting valve clearance				●	●
Checking belt tensioner ****				●	●
Checking fan bearing					●
Checking turbocharger					●
Checking vibration damper					●
Checking air compressor					●
Changing coolant and cleaning cooling system					●

* The belt must be replaced immediately if cracks or other defects affecting its use appear on the belt surface.
** For models equipped with an oil rotor filter, the replacement interval for the engine oil, oil filter, and rotor filter is 30,000 kilometers (9 months or 750 hours).
*** When the fuel contains a high amount of impurities, the replacement interval for the fuel pre-filter should be appropriately shortened.
**** The tensioner pulley needs to be replaced if it becomes stuck or rotates sluggishly.
Note:
1) For engines equipped with an air filter pre-filter, the pre-filter needs maintenance every 50 hours of diesel engine operation. Maintenance requirements are detailed in 4.3.27.
2) Marine diesel engine air filters do not have maintenance indicators. The air filter element should be cleaned according to 4.3.26 whenever the engine oil and oil filter are changed.

Note: The maintenance intervals in this table are specified in kilometers, hours, or months, whichever comes first.

4.2 Diesel Engine Maintenance Records

Users should maintain regular maintenance records. Users can refer to the "Maintenance Record" format provided below to create their own maintenance record book.

Maintenance records

Diesel engine number: _____ Diesel engine model/order number: _____

Username: _____ Device name/number: _____

Date	Hour or time interval	Maintenance contents	Maintainers	Remarks

4.3 Diesel Engine Maintenance Contents and Methods

4.3.1 Diesel Engine Peripheral Inspection

Perform a peripheral inspection of the diesel engine daily before starting it. The inspection includes:

- Checking for debris such as rags, scrap wires, pipe clamps, and screws accumulated on the diesel engine and radiator, ensuring the engine is clean and tidy.
- Checking all joints and mating surfaces of the fuel system, cooling system and lubrication system for leaks.
- Checking the fan connection and safety guard for safety and reliability.
- Checking the tightness of accessories.
- Checking electrical wiring connections for looseness and ensuring the wires are intact.
- Checking the drive belt for damage.

4.3.2 Fuel Tank Inspection

Check the fuel level in the fuel tank daily.

4.3.3 Air Filter Maintenance Indicator Inspection

Check the maintenance indicator on the air filter daily. If the inspection window displays red, it indicates that the air filter's intake resistance exceeds the specified value, and the filter element needs to be replaced. See section 4.3.25 for filter element replacement requirements and procedures. After replacing the filter element, the button on the end of the maintenance indicator must be pressed to reset it.

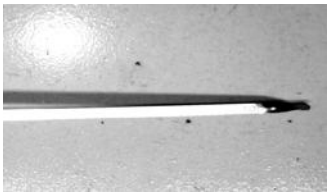
Note: Never start the diesel engine without an air filter (except for marine engines). Doing so will easily cause premature wear of the diesel engine.

4.3.4 Check the Fuel Pre-filter Maintenance Indicator

Check the fuel pre-filter maintenance indicator daily. When the accumulated impurities in the pre-filter reach a certain level, causing difficulty in pumping fuel, the maintenance indicator on the filter will turn red, reminding the user to replace the fuel pre-filter. If the indicator does not turn red after 250 hours of use, it must still be replaced according to maintenance regulations. The fuel pre-filter is also a screw-in type; the replacement procedure is the same as for the fuel fine filter.

4.3.5 Check Engine Oil Level

The engine oil level should be checked daily before starting the diesel engine or when it is stopped (at least 10 minutes after stopping) to allow sufficient time for the oil to flow back to the oil pan. The oil level should be between the lower mark (low oil level) and the upper mark (high oil level) on the dipstick. If the oil level is low, add oil. The difference between the upper and lower marks on the dipstick is approximately 6 liters for an SC10E (10L) engine and approximately 8 liters for an SC12E (12L) engine.



Caution: Never run the diesel engine with the oil level below the low oil level, as this will lead to decreased engine performance or even damage to the engine.

4.3.6 Check Coolant Level

Warning: When the diesel engine is running, the coolant temperature is high and under pressure, which can easily cause burns. Wait until the diesel engine is stopped and the coolant temperature has dropped below 50°C, then slowly loosen the pressure cap to release the pressure before checking or adding coolant.
Warning: The rust inhibitor in the coolant contains alkali. Avoid contact with skin and eyes to prevent injury.

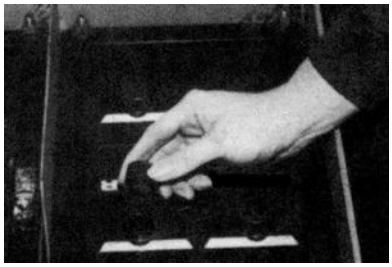
Non-Automotive Diesel Engines:
(1) Daily, before starting the engine or after stopping the engine, once the coolant temperature has dropped below 50°C, slowly unscrew the pressure cap (filler cap) on the radiator or expansion tank to release the cooling system pressure.
(2) Check the coolant level through the filler neck or level check port. It should be within the upper and lower marks or meet the equipment manufacturer's specifications.
(3) Add coolant as needed. Add coolant up to near the upper mark or meet the equipment manufacturer's specifications.

Note: Add coolant slowly to prevent air lock.

4.3.7 Checking the Electrolyte Level

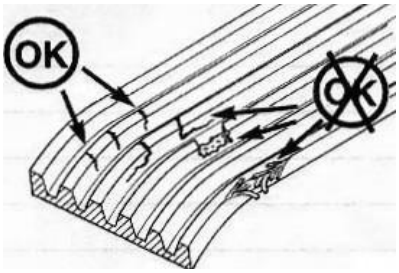
Some batteries are not maintenance-free and require checking the electrolyte level.

(1) Before starting the diesel engine each day, remove the filler cap and check the electrolyte level. It should be at the bottom of the filler neck. If the level is insufficient, add electrolyte as needed.



4.3.8 Inspect the Drive Belt

Visually inspect the drive belt daily. Check for crisscrossing cracks. Transverse cracks along the belt width are permissible, but longitudinal (along the belt length) and transverse through-cracks are not allowed. Replace the belt if it is worn or shows material peeling.



4.3.9 Inspect the Cooling Fan

Visually inspect the fan daily for cracks and other defects. Ensure the fan is securely installed. Tighten bolts or replace a damaged fan if necessary.

WARNING: Damaged fan blades can cause serious injuries. Never drag or pry the fan and never use the fan to rotate the diesel engine crankshaft.

4.3.10 Inspect the Intake System

Inspect the intake hose for cracks or perforations and check for loose clamps. Replace any malfunctioning intake hoses. Tighten loose clamp screws to ensure the intake system is leak-free.

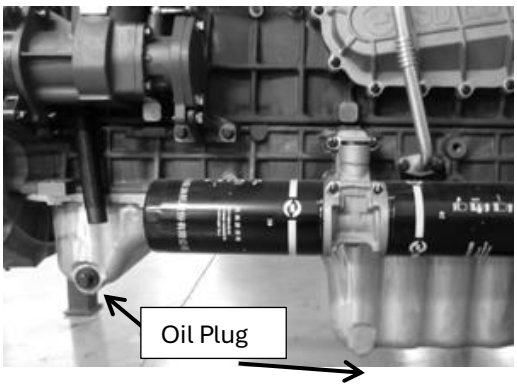
4.3.11 Changing Engine Oil and Oil Filter

Warning: Exercise caution when changing engine oil and oil filter. Contact with hot engine oil and diesel engine surfaces can cause burns.

(1) Stop the diesel engine when the coolant temperature reaches 60°C. Remove the drain plug from the oil pan, discard the gasket, and drain the engine oil completely.

Note: Some oil pans have two drain plugs, one at the bottom of the large oil sump and one on the side of the small oil sump.

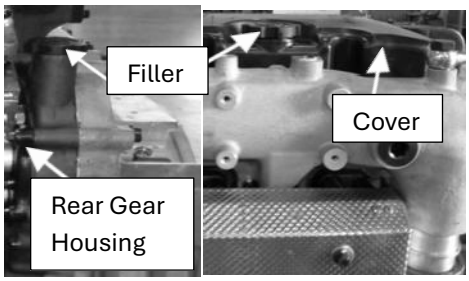
Caution: Do not drain the engine oil when the diesel engine is cold. When cold, impurities suspended in the oil have settled at the bottom of the oil pan and adhered to the inner surface of the oil pan, preventing them from being drained with the oil. When the oil is warm, the impurities are suspended in the oil, making it easier to drain them.



(2) Clean the drain plug mounting surface, replace the gasket, install the drain plug, and tighten the plug to 80 N·m.
(3) Clean the outer surface of the oil filter, remove the oil filter with tools, and discard it.
(4) Clean the sealing surface of the filter housing, ensuring no old O-rings remain.
(5) Before installing a new oil filter, inject clean engine oil through the eight small holes around the filter, filling the filter cavity completely, with the oil level 3-15mm below the bottom of the threaded hole. Apply a thin layer of petroleum jelly or clean engine oil to the sealing surface of the sealing ring to form a lubricating film.

Note: Do not inject engine oil through the centre hole of the filter.

(6) Tighten the filter by hand until the sealing ring contacts the filter seat mounting surface, then tighten with a tool to 38-42 N·m.
(7) Open the filler cap and add clean engine oil to the diesel engine until it is close to the mark on the dipstick (high oil level mark).



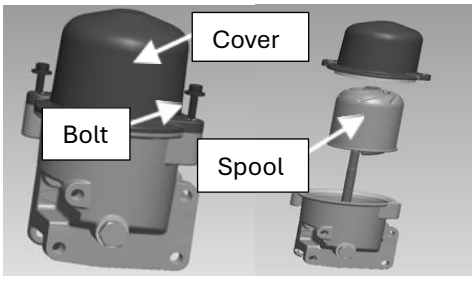
(8) Start the diesel engine and let it idle. Check the oil filter and drain plug for leaks.
(9) Stop the engine and wait approximately 10 minutes to allow the oil sufficient time to drain back into the oil pan. Then check the oil level. If necessary, add oil until it is close to the mark on the dipstick (high oil level mark).

Install the filler cap, tightening it by hand.

4.3.12 Replacing the Rotor of the Rotor Oil Filter (if equipped)

If a rotor filter is installed, the rotor filter rotor must be replaced simultaneously when replacing the oil filter. The replacement method is as follows:

(1) Stop the engine and ensure the rotor filter is completely stopped before operation.
(2) When the diesel engine has cooled to a temperature that is not hot to the touch, use a tool to loosen the two locking bolts under the rotor filter cover and remove the filter cover. Carefully check the O-ring seal on the cover; replace it immediately if damaged.
(3) Lift the rotor upwards along the vertical axis of the rotor filter to drain the oil inside. Then disassemble the rotor vertically upwards along the vertical axis. Take care not to damage the rotor bearings during disassembly.



(4) Install the new rotor into the central shaft and check that the rotor can rotate freely.
(5) Install the O-ring seal, then install the cover and tighten the bolts.

(6) Start the diesel engine, make sure the rotor filter work, and then check all joints.

4.3.13 Replacing the Fuel Filter

(1) Clean the outer surface of the fuel filter, remove it with tools, and discard it.
(2) Clean the area around the fuel filter housing and the sealing surface of the housing, ensuring no old O-rings remain.
(3) Before installing the new fuel filter, inject clean fuel through the eight small holes around the filter, filling the filter cavity completely, with the fuel level 3-15mm below the bottom of the threaded hole. Apply a thin layer of petroleum jelly or clean engine oil to the sealing surface of the O-ring to form a lubricating film.
(4) Manually rotate the filter until the O-ring contacts the mounting surface of the filter housing, then tighten it with tools to 38-42 N·m.

4.3.14 Replacing the Primary Fuel Filter

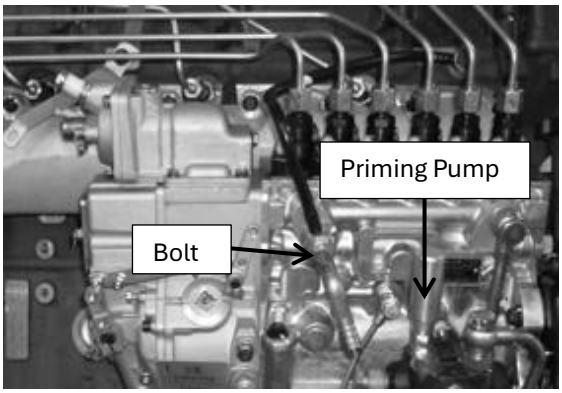
The primary fuel filter is also a spin-on type, and its replacement procedure is the same as that for the "4.3.13 Replacing the fuel filter". First, remove the water cup, and then replace the filter.

4.3.15 Fuel System Bleeding

When a new diesel engine is put into use, or after the engine has been idle for several days, or after the fuel filter (fine filter or coarse filter) has just been replaced, air may be present in the fuel system. The following steps are required to bleed the air:

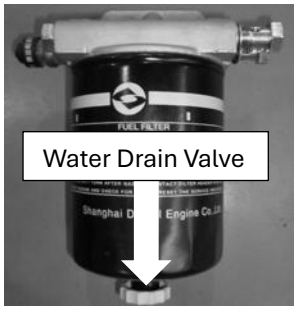
(1) Loosen the bolt of the fuel return pipe.
(2) Repeatedly press the hand pump on the fuel pump to bleed the air until no air bubbles are visible in the diesel fuel flowing from the return pipe
(3) Tighten the bolt.

Note: Failure to refuel promptly can lead to air entering the fuel system.



4.3.16 Draining Water from the Fuel Coarse Filter

The coarse filter has an oil-water separation function. When the water level in the coarse filter's water reservoir reaches a certain height, the water level sensor sends a signal to the water level indicator light in the cab or on the control panel, reminding the driver or operator to drain the water in time. The water level indicator turns red, indicating that drainage is needed. Loosen the drain valve to remove water and sediment until clean fuel flows out, then close the valve tightly. Do not tighten it forcefully; it should feel tight to the touch.



4.3.17 Inspect the Intercooler and its Piping

Visually inspect the intercooler's inlet and outlet chambers for cracks, perforations, or other damage. Inspect the inlet and outlet pipes for cracks, detached welds, or other damage. If any are found, replace them. Inspect the connecting hoses of the intercooler's inlet and outlet pipes and water inlet and outlet pipes (water-to-air cooling) for cracks or perforations, and for loose clamps. If any are found, replace the hoses and tighten the clamps.

4.3.18 Checking and Adjusting Valve Clearance

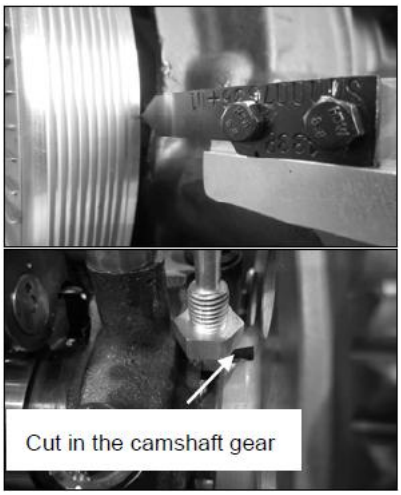
For new diesel engines and diesel engines put into use after major overhaul, the first valve clearance check should be performed during the first maintenance to promptly adjust and correct any initial changes in clearance. During subsequent normal operation, checks and adjustments should be made according to the maintenance plan.

Valve clearance checks should be performed after the diesel engine has stopped running and the coolant temperature has dropped below 60°C.

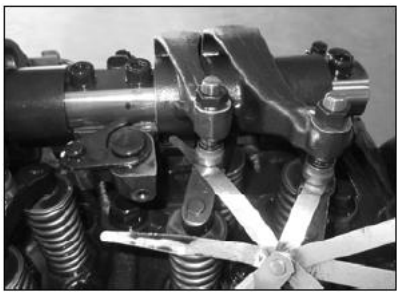
(1) Loosen the cylinder head cover bolts and remove the cover.
(2) Rotate the crankshaft using a cranking tool to bring the diesel engine to the top dead centre (TDC) position of the piston in cylinder 1.

Note: When the pointer is aligned with the 0 mark on the damper and the camshaft gear notch is facing upwards, this indicates the top dead center of the piston in cylinder 1.

Camshaft gear notch



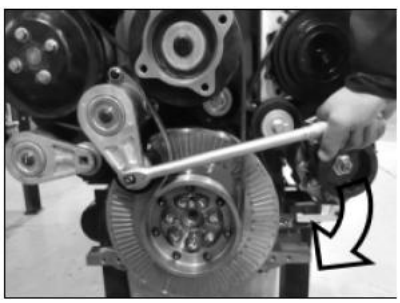
(3) Use a valve wrench to check the intake valve clearance of cylinders 1, 2, and 4, and the exhaust valve clearance of cylinders 1, 3, and 5. Note: When checking the clearance with a clearance shim, the correct valve clearance is indicated by slight resistance when the shim moves between the top surface of the valve bridge and the rocker arm.



(4) If the clearance does not meet the requirements, loosen the lock nut of the valve clearance adjusting screw on the rocker arm and adjust it to the specified value.
(5) Tighten the lock nut to 40 N·m and recheck the valve clearance. The clearance value should not change. Valve clearance: Intake valve... 0.40±0.08 mm Exhaust valve... 0.65±0.08 mm
(6) Mark the damper, then rotate the crankshaft one full turn (360°) and adjust the remaining intake and exhaust valve clearances using the same steps.
(7) Install the cylinder head cover and check if the cover seal is intact. If damaged, replace it with a new one. Tighten the cover bolts to 18 Nm.

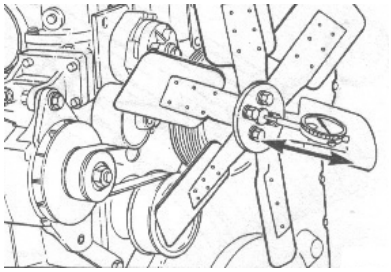
4.3.19 Inspect the Belt Tensioner

(1) Rotate the tensioner clockwise to remove the drive belt. Rotate the tensioner pulley to check for jamming or radial/axial movement, thus determining if the tensioner bearing surface is scratched or worn; swing the tensioner arm to check if its spring is functioning properly.
(2) Install the drive belt, then visually inspect and adjust to ensure the belt centre is cantered on each pulley.



4.3.20 Inspect the Fan Bearing

Rotate the belt tensioner clockwise to remove the drive belt. Manually rotate the fan pulley to check for any abnormalities in the shaft bearing. There should be no vibration or excessive axial movement when rotating the fan. Replace the fan bearing housing if necessary.



4.3.21 Inspect the Turbocharger

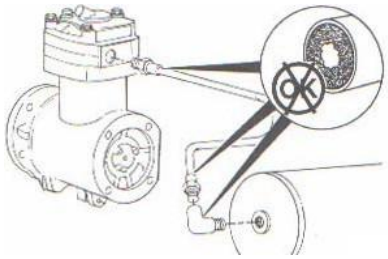
Visually inspect the turbocharger turbine blades and compressor blades for damage or cracks. Gently press the blades with your fingers to check if they contact the turbine housing or compressor housing. Check the turbocharger shaft for any jamming. If any of these problems are found, the turbocharger needs to be replaced.

4.3.22 Inspect the Vibration Damper

Check the vibration damper for leaks of damping fluid (silicone oil) and for surface collapse; check the thickness of the vibration damper to determine if it is deformed. If any of the above problems occur, the vibration damper needs to be replaced.

4.3.23 Inspect the Air Compressor

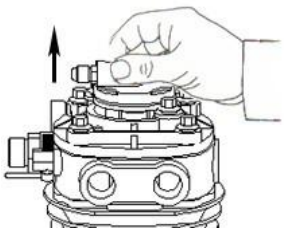
Warning: The air in the air system is under pressure. Before disassembling any parts from the air compressor, the pressure in the air system must be released to prevent personal injury.



Inspect the Air Compressor Outlet Pipe

Inspect the pipes and fittings for carbon buildup. Depending on the severity of the carbon buildup, clean or replace them as needed.

Check the air compressor intake unloading valve. Carefully inspect the unloading valve for carbon buildup. If severe carbon buildup is found, remove and clean it thoroughly. Also inspect the air compressor cylinder head and inlet/exhaust valve components, replacing any parts as necessary.



4.3.24 Coolant Replacement and Cooling System Cleaning

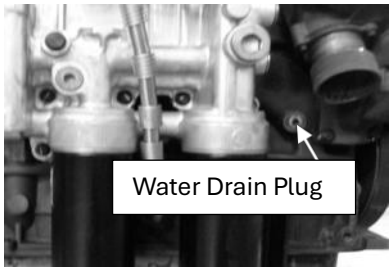
To ensure the cooling and corrosion prevention effects of the diesel engine coolant, the coolant must be replaced, and the cooling system cleaned every 80,000 kilometres, every 2,000 hours, or every 2 years (whichever comes first).

Warning: At operating temperature, the diesel engine coolant is hot and pressurized; the steam can cause personal injury. Only after the diesel engine has stopped working and the coolant temperature has dropped below 50°C should the pressure cap on the radiator (fill cap) be slowly loosened to release the cooling system pressure.

Warning: The rust inhibitor in the coolant contains alkali; avoid contact with skin and eyes to prevent personal injury.

(1) After the diesel engine has stopped and the coolant temperature has dropped to 50°C, slowly loosen the pressure cap on the radiator to release the cooling system pressure, then remove the pressure cap. Open the drain valve on the radiator to drain the coolant from the radiator.

(2) Loosen and remove the drain plug on the diesel engine to drain the coolant from the diesel engine cooling system. Loosen the drain valve on the air compressor to drain the coolant from the air compressor.
(3) Clean the cooling system using the following steps:



Install and tighten all drain valves and drain plugs. Add a sodium carbonate solution (or a commercially available mixture of sodium carbonate and water) to the cooling system through the radiator filler neck.
Note: Use 0.5 kg of sodium carbonate for every 23 L of water. Do not use cleaning agents containing corrosive agents, as this will damage aluminium parts.
Note: During the filling process, air must be expelled from the cooling water chamber. Add the cleaning fluid slowly to prevent air lock. Add the cleaning fluid to the bottom of the radiator filler neck and wait 3-5 minutes to allow the air to be fully expelled.

Start the diesel engine and run it for 5 minutes after the cleaning fluid temperature reaches above 80°C. Then stop the engine and drain the cleaning fluid from the cooling system.
Note: During the entire cooling system cleaning process, do not install the pressure cap and run the diesel engine without the cap.

Inject clean water into the cooling system.
Note: When injecting clean water, inject slowly to prevent air lock. Add water to the bottom of the radiator filler neck and wait 3-5 minutes to allow air to escape.

Start the diesel engine and run it for 5 minutes after the water temperature reaches above 80℃. Then stop the engine and drain all the clean water from the cooling system.
Note: If the drained water is still dirty, repeat the above steps to clean the cooling system again until the drained water is clean.

After cleaning, tighten the drain valve on the radiator. Install the drain plug on the diesel engine. Apply Loctite 515 sealant to the circumference of the plug and tighten it to 25 N·m.
Add coolant. The total coolant volume is shown in “2.4.1 Main Technical Parameters”

Note: The volume values in the table refer only to the volume of this diesel engine system. The actual amount added should be based on the equipment data.

Note: When adding coolant, pour it in slowly to prevent air lock. The coolant should be added to the bottom of the radiator filler neck or meet the requirements of the vehicle or equipment manufacturer. Wait 3-5 minutes to allow the air to be fully expelled.

Install the pressure cap, start the diesel engine, and continue until the coolant temperature reaches 80℃. Then stop the engine and check for leaks in the cooling system.
After stopping the engine, wait for the coolant temperature to drop below 50℃, then slowly open the pressure cap and check the coolant level again. If necessary, add an appropriate amount of coolant.

4.3.25 Replacing the Air Filter Element (Paper Filter Element)

(1) Blow away the dust adhering to the housing with compressed air.
(2) Remove the air filter cover and filter element, discarding the filter element.
(3) Cover the air filter housing with a clean cover leading to the compressor inlet to prevent dust from entering the intake system.
(4) Blow away the inside of the air filter housing with compressed air.
(5) Check that the new filter element is intact and remove the cover at the compressor inlet.
(6) Install the new filter element, ensuring a reliable seal at both ends of the air filter; install the air filter cover.

Note: After replacing the air filter element, ensure a reliable seal at both ends of the air filter to prevent air leakage.

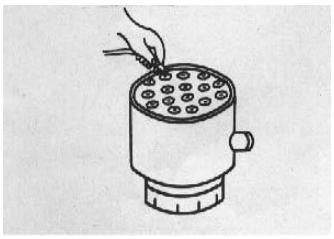
4.3.26 Cleaning the Air Filter Element (Non-Paper Filter Element)

(1) Blow away the dust adhering to the housing with compressed air.
(2) Remove the air filter cover and remove the filter element.
(3) Soak the filter element in a warm, neutral cleaning solution to remove oil and dirt. Do not use a brush. Dry the filter element after cleaning. If using a non-neutral cleaning solution, rinse it off with clean water.
(4) After cleaning, check the filter element for damage.
(5) Install the filter element and ensure a reliable seal at both ends of the air filter. Install the air filter cover.

Note: After maintaining the air filter element, ensure a reliable seal at both ends of the air filter to prevent air leakage.

4.3.27 Maintaining the Air Filter Coarse Filter

(1) Remove the air filter coarse filter (upper body).
(2) Use compressed air to blow away dust from the cyclone tube and the housing.
(3) Install the coarse filter.



5. DIESEL ENGINE TROUBLESHOOTING GUIDE

The table below lists some simple and typical failure modes of diesel engines, their possible causes, and troubleshooting steps. If any of these symptoms appear during diesel engine operation, the user should take appropriate measures to resolve the issue; otherwise, it may lead to a serious accident. Users can troubleshoot simple faults themselves. For complex faults, if needed, users can contact the Shanghai Diesel Engine Co., Ltd. "Easy+People" call centre (400-820-5656) for assistance, technical guidance, or professional repair services.

No	Fault mode	No	Fault mode
1	Alternator refuses to charge or fails to charge enough	16	Diesel knock
2	Starting motor fault	17	Excessive noise
3	Engine is difficult to start or will not start	18	Black smoke
4	Engine starts, but will not keep running	19	White smoke
5	Liable misfire or unsteady speed	20	Blue smoke
6	Liable misfire at low speed	21	Fuel consumption too much
7	Engine cannot reach rated speed under load	22	Coolant temperature above normal - gradual overheat
8	Engine power output low	23	Coolant temperature above normal - sudden overheat
9	Rough running and misfiring	24	Coolant temperature below normal
10	Unexpected engine halt or misfire in deceleration	25	Coolant contamination
11	Poor acceleration	26	Oil consumption too much
12	Engine will not stop	27	Oil pressure too high
13	Unsteady idle speed and engine hunting	28	Oil pressure too low
14	Rough running at idle speed	29	Oil contamination
15	Excessive vibration		

Fault mode 1： Alternator refuses to charge or fails to charge enough

Possible cause	Correction
The instrument or indicator light failure	Check and replace the instrument or indicator light
The battery connector(s) is loose or eroded	Clean and tighten the battery connector(s)
The drive belt slip or failure of the belt tensioner	Check and replace the belt and check the spring performance of the tensioner
Poor terminal contact of the alternator	Tighten all terminal connects of the alternator

Fault mode 2： Starting system fault

Possible cause	Correction
The terminals and connectors of the starting circuit and/or the battery are loose, open or eroded	Clean and tighten all the terminals and the connectors
Insufficient battery output	Adopt a battery with sufficient output or add some more batteries in parallel

Starting motor fault	Check the starting motor

Fault mode 3：Engine is difficult to start or will not start

Possible cause	Correction
Improper starting method	Refer to the operating instruction manual of the vehicle or the equipment for proper starting method
The time for engine start up is 2-3 seconds	It is normal and needs no adjustment
The drive system is engaged	Disengage the drive system
Too low starting speed (minimum starting speed is 100 rpm)	Check battery for voltage and check starting motor for looseness or eroded connection
Insufficient fuel in the tank	Add fuel
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes and relevant parts if necessary and then prime the system
The connectors of low-pressure fuel pipeline is loose	Check the low-pressure fuel pipeline and tighten all the connectors
The fuel filter or fuel suction pipe is blocked	Replace the fuel filter or fuel suction pipe
Fuel arises solidification because of cold weather	Choose proper fuel specified in this manual based on the ambient condition
There is no fuel in the fuel injection pump	Check the fuel transfer pump
The resistance of the intake system exceeds the specified value	Check the intake system and replace the air filter element if necessary
The resistance of the exhaust system fails to meet the requirements	Check the exhaust system
The crankshaft rotation is restricted	Barring the crankshaft and check for restriction.
Injection pump timing is not correct	Check and adjust injection pump timing.
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 4：Engine starts, but will not keep running

Possible cause	Correction
The engine is engaged with the drive system	Disengage the engine with the drive system
Fuel arises solidification because of cold weather	Choose proper fuel specified in this manual based on the ambient condition
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes and relevant parts if necessary and then prime the system
The fuel filter or fuel suction pipe is blocked	Replace the fuel filter or fuel suction pipe
The resistance of intake system exceeds the specified value	Check the intake system and replace the air filter element if necessary
The resistance of exhaust system fails to meet the requirements	Check the exhaust system
Fuel fails to meet required specification or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 5：Liable misfire or unsteady speed

Possible cause	Correction
Fuel level in the fuel tank too low	Add fuel
Air in fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Fuel pressure too low	Check the fuel tank for fuel level, check the pipe between the tank and the fuel transfer pump for leakage, serious deformation, bent or plug and for air
Leakage at high-pressure fuel pipe connectors	Tighten the connectors and make replacement if required
Injection pump timing is not correct	Check and adjust injection timing
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 6：Liable misfire at low speed

Possible cause	Correction
Fuel level is low in the tank	Add fuel
Air in the low-pressure fuel pipeline	Check the low-pressure fuel pipeline for air source. Tighten or replace joints or pipes if necessary and then prime the system

Fault mode 7：Engine cannot reach rated speed with load

Possible cause	Correction
The load is too heavy	Reduce the load or shift to lower gear
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Fault of the tachometer or speed sensor	Check the tachometer and speed sensor, and make replacement when necessary
The resistance of fuel inlet is great	Check the fuel filter and fuel suction pipe and replace the fuel filter if necessary
Fault of the turbocharger	Check the boost pressure
Leakage in the intake system	Check the connection of intake manifold, intake pipe, intercooler, its pipeline for looseness or leakage
The resistance of intake system exceeds the specified value	Check the intake system resistance and replace the air filter element if necessary
Fuel fails to meet required specification or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 8：Engine power output low

Possible cause	Correction
Inquire the driver or operator	Obtain all the information related to the problem
Overloaded operation	Reduce the load to allowed range
The engine runs on the plateau beyond the specification	Run the engine on the specified plateau. Engine power decreases with increase of altitude
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Oil level is too high	Check and lower oil level to the specified range
The accelerator pedal doesn't arrive at the bottom	Check accelerator pedal for restriction
Accessories load is too big	Check the cooling fan for abnormal operation and vehicle braking for friction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Fuel inlet temperature is high	Add fuel into the fuel tank

The fuel supply is blocked	Check the fuel inlet resistance and replace the fuel filter (first stage) and fuel filter (second state) if necessary
Leakage of the exhaust manifold or turbocharger	Check the exhaust manifold and boost pressure to find and eliminate the source of leakage
The resistance of exhaust system fails to meet the requirements	Check the exhaust system resistance
The resistance of intake system exceeds the specified value	Check the intake system resistance and replace the air filter element if necessary
Leakage in the intake system	Check the connection of intake manifold, intake pipe, intercooler, its pipeline for looseness or leakage
Fault of the turbocharger	Check the boost pressure
Fuel is not proper or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue
Incorrect injection pump timing	Check and adjust injection timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 9：Rough running and misfiring

Possible cause	Correction
Only happens at idle speed	Refer to the fault mode “Rough running at idle” for correction
Low running temperature	Refer to the fault mode “Coolant temperature below normal”
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 10：Unexpected engine halt or misfire in deceleration

Possible cause	Correction
Causes related to the protective system of the vehicle or equipment	Contact the manufacturer of the vehicle or equipment
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
The fuel has been contaminated	Replace it with clean and qualified fuel

Fault mode 11：Poor acceleration

Possible cause	Correction
Inquire the driver or operator	Obtain all the information relevant to the problem
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Overload of accessories	Check the cooling fan, air conditioner and the vehicle braking system for too much resistance and reduce the load of the accessories
The accelerator pedal movement is restricted	Check the pedal for restriction
Leakage of the intake system	Check the intake manifold, intake pipe, intercooler and its pipelines for leakage
The intake system or exhaust system is blocked	Check the resistances of intake and exhaust systems.
Injection pump timing is not correct	Check and adjust injection pump timing.
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 12：Engine will not stop

Possible cause	Correction
Electric key switch fault	Refer to the manual of vehicle or equipment manufacturer for instruction
The engine inhales fuel mist	Check the intake manifold and separate the source of fuel mist
External power supply	Check and make sure there is no external power supply being connected to the power supply circuit of the vehicle or equipment
Oil leak in the turbocharger due to poor seal	Check the compressor outlet and intake pipe for oil trace

Fault mode 13：Unsteady idle speed and engine hunting

Possible cause	Correction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system

Fault mode 14：Rough running at idle speed

Possible cause	Correction
Engine temperature is too low	Warm up the engine
The load at idle speed is too heavy (more than 50 horsepower)	Reduce the load at idle speed
Leakage of the intercooler or its pipeline	Check intercooler and its pipeline for leaks
Leakage of the intake manifold or pipeline	Check the intake manifold or pipeline for leaks
Engine support problem	Check the engine support and cushion
Alternator fault	Disconnect the alternator to check the problem
Valve clearance error (s)	Check and adjust valve clearance
Engine support problem	Check the supporter and cushion pad of the engine

Fault mode 15：Excessive vibration

Possible cause	Correction
The engine runs unsteadily	Refer to fault mode “Rough running or misfire”
Pulley or vibrator bolts or nuts loose	Check and tighten loose bolts or nuts
Fan blade not in balance	Loosen or remove fan belts and operate engine for a short time at the r/min that the vibration was present. If vibration is not present any more, make a replacement of the fan assembly
Damage of fan or accessories	Check, and replace relevant parts if required
The vibration damper is broken	Check/replace the damper
Engine support problem	Check the supporter and cushion pad of the engine for problem. Make replacement if necessary

Fault mode 16：Diesel knock

Possible cause	Correction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Poor quality fuel	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue
Injection pump timing is not correct	Check and adjust injection timing

Fault mode 17：Excessive noise

Possible cause	Correction
Noise from drive belt due to poor tension or heavy load	Check the belt drive system and ensure all pulleys running
Leakage of intake system and exhaust system	Check the intake and exhaust systems for leakage. Tighten the loose components and replace the related parts if necessary
Noise from the turbocharger	Check the blades of compressor or turbine for their contact with their housings
Incorrect injection pump timing	Check and adjust injection timing
Too big valve clearance	Check and adjust valve clearance

Fault mode18：Black smoke

Possible cause	Correction
The engine is overloaded	Set to lower gear or reduce equipment load
Intake system resistance exceeds the specified value	Check the intake system for resistance and replace the air filter element if necessary
Incorrect injection pump timing	Check and adjust injection timing
Intake/exhaust valve clearance error	Check and adjust the valve clearance
Fuel is not proper or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 19：White smoke

Possible cause	Correction
The engine is in cold state	Warm the diesel engine
Water in fuel	Check the first stage fuel filter for fuel and water separate function. Replace it if required
Injection pump timing is not correct	Check and adjust injection timing
Fuel is not correct or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 20：Blue smoke

Possible cause	Correction
A big gap between piston and liner channeling oil Into the combustion chamber due to the engine running long time at low load (below 40% of full load)	Increase engine load and make proper engine load match
Too much oil in the oil pan	Adjust oil level to be within the specified range
Oil leak in the turbocharger due to poor seal	Check the compressor outlet and intake pipe for oil trace

Fault mode 21：Fuel consumption too much

Possible cause	Correction
Something related to driving technique	Check driver's operation for gear shift, deceleration and idle speed
Display error of the odometer	Adjust or replace the odometer
The drive system cannot match the engine	Check the transmission gears and make sure that the components of the engine and drive system are correct
Leakage of fuel	Check the fuel system pipeline for leakage and tighten connectors if loosened
The resistance of intake or exhaust is too great	Check the intake and exhaust systems, especially the air filter and exhaust muffler
Oil level is too high	Check and adjust the oil level
Injection pump timing is not correct	Check and adjust injection timing
Poor seal of intake valve or exhaust valve	Check and adjust valve clearance
Fuel is not correct or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 22：Coolant temperature above normal -- gradual overheat

Possible cause	Correction
Overload operation	Reduce the load
Coolant level is too low	Check the coolant level and engine external for leakage, eliminating the leakage and adding the coolant to be within the specified range
Oil level is too high or too low	Check oil level and adjust it to be within the specified range
The radiator core is broken or blocked	Check the radiator core and repair or replace it if necessary
The coolant pipe is collapsed and there is leakage	Check the pipe and replace it if necessary
The drive belt is loose	Check the drive belt and replace it if necessary
Fault of the pressure cap of radiator and pressure calibration is too low	Check the function of the pressure cap
Fault of the thermometer or temperature sensor	Check the thermometer and sensor, and make replacement when necessary
Air in the cooling system	Check the connector at water pump inlet for leakage

Fault mode 23：Coolant temperature above normal—sudden overheat

Possible cause	Correction
Coolant level is too low	Check coolant level and engine external for leakage, eliminating the leakage and adding the coolant to be within the specified range
Coolant system hose(s) is collapsed and there is leakage	Check the hose(s) and replace it if necessary
The drive belt is broken	Check the drive belt and replace it if necessary
Fault of the coolant thermometer	Check the coolant thermometer and replace it if necessary

Fault mode 24：Coolant temperature below normal

Possible cause	Correction
The radiator shutter is blocked at the maximum opening	Check the radiator shutter and replace it if necessary
Too much cold air flows though the radiator	Visually check the fan and fan clutch (if equipped) for operation
Running in low ambient temperature	Take measures to increase intake air temperature
Fault of the coolant thermometer	Check the coolant thermometer and replace it if necessary

Fault mode 25：Coolant contamination

Possible cause	Correction
Improper coolant	Choose the coolant specified in this manual
Coolant change interval too long	Change coolant at the specified time

Fault mode 26：Oil consumption too much

Possible cause	Correction
The engine runs at idle speed for too long time	Shorten the time of the engine running at idle
The oil level is too high	Check the oil level and make adjustment if necessary
External oil leakage of the engine	Check the external pipeline, sealing gasket and crankshaft seals for leakage and replace the damaged components
The oil in the turbocharger leaks into the intake system or exhaust system	Check the compressor inlet, air intake pipe and turbine outlet for oil trace
Big blow-by push oil in crankcase to the crankcase ventilation device	Check the crankcase ventilation device for oil trace on its periphery
Air compressor pumps oil	Check the air compressor outlet for oil trace
Oil is not correct	Check the oil for its specification. Use correct oil and change the oil and oil filter

Fault mode 27：Oil pressure too high

Possible cause	Correction
The operating temperature of the engine is too low and the oil viscosity is high	Refer to the fault mode “Coolant temperature below normal”
Fault of the oil pressure meter or pressure sensor	Check the pressure meter and sensor, and make replacement when necessary
The lubricating oil fails to meet the requirements	Use the lubricating oil specified in this manual and replace the oil filter

Fault mode 28：Oil pressure too low

Possible cause	Correction
Oil level is too low	Check oil level and adjust it to the specified range
Leakage of the oil pipeline	Check the oil pipeline and eliminate the leakage
Oil temperature is higher than the specified value	Refer to the fault mode “Coolant temperature above normal”
Fault of the oil pressure meter or pressure sensor	Check the pressure meter and sensor, and make replacement when necessary
Water in lubricating oil	Check the oil filler cover or the oil dipstick for their missing. Replace the oil if required
The oil filter is blocked	Replace the oil and oil filter
The lubricating oil fails to meet the requirements and the oil viscosity is too low	Check the oil specification and replace the oil and oil filter if necessary
Hydraulic oil in the lubricating oil	Check for hydraulic oil leak, replace the oil and oil filter if required

Fault mode 29：Oil contamination

Possible cause	Correction
Cold running of the engine leads to fuel in lubricating oil	Check if the engine runs at idle for a too long time. Shorten idle running time

6. ENGINE STORAGE

6.1 Short Time Storage

If the diesel engine needs to be shut down for a period of time (1 to 3 months), it is necessary to clean it and take necessary oil sealing measures to prevent rusting.

6.1.1 Before Storage

(1) Clean the surface of the diesel engine, check for visible dirt, oil stains, rust, water stains, etc., and then dry it with compressed air; use a brush to evenly apply rust-preventive oil to all machined metal surfaces of the diesel engine (i.e., unpainted machined surfaces); note that rust-preventive oil should not be applied to rubber parts, plastic parts, or fibre fabric parts, or come into contact with rust-preventive oil.

Note: Certain rust prevention measures must be taken for the surface of the accessory drive pulley.

For external engine storage, it is recommended to use FD615 dehydrating rust-preventive oil or rust-preventive oil that meets the following performance requirements.

Item		Requirement
Appearance		Brown in even
Moisture		None
Drop point		≥55
Freezing resistance		Qualified
Oil stability（ml）		≤2
Salt test	Steel sheet	≥14
	Cast iron sheet	≥7
Humid heat test	Steel sheet	≥30
	Cast iron sheet	≥14
Lamination test（7 days）	Steel sheet	Qualified
Corrosion test（14 days）	Steel sheet	Qualified
	Cast iron sheet	Qualified

(2) Disconnect the battery cables, clean the terminals, apply a thin layer of grease, and charge the battery.
(3) Loosen the drive belt.
(4) Seal or wrap all exposed air, water, or oil pipe openings with moisture-proof paper, vapor phase rust-preventive paper, or polyethylene plastic film tape. The entire air filter should also be sealed or wrapped with moisture-proof paper.
(5) Cover the diesel engine with a plastic cover or similar covering and place it in a well-ventilated, dry room.

6.1.2 Storage Period

Charge the battery monthly. Check the battery fluid level, add fluid as needed, and then charge. Rotate the crankshaft 3-4 times monthly using a cranking tool.

6.1.3 Use After Unsealing

When starting, remove the fuel injection pump and send it to a service station designated by the diesel company for adjustment; remove the cover and wrapping, and connect the pipeline; install the fuel injection pump to pump oil and vent the fuel system; connect the battery cable and tighten the drive belt; check the levels of lubricating oil and coolant, and add an appropriate amount of clean engine oil to the turbocharger inlet; use a crankshaft turning tool to rotate the crankshaft 3-5 times. Refer to Section 3.4 for diesel engine starting and start the diesel engine using the correct method.

6.2 Long-Term Storage

If the diesel engine has been out of use for more than 3 months, it needs to be sealed.

6.2.1 Before Sealing

(1) After the last use of the diesel engine, drain all the lubricating oil from the diesel engine, including the oil in the oil filter, while it is still hot. Since the coolant has rust-preventing properties, it does not need to be drained. Add the specified amount of sealing oil to the crankcase, start the diesel engine to idle speed, run for 1-1.5 minutes, then stop the engine and drain the sealing oil from the oil pan. The sealing oil inside the engine is dehydrated CF-4 lubricating oil.
(2) For cleaning, rust prevention, and other sealing requirements of the diesel engine's external surface, refer to Section 6.1.1, items 1, 2, 3, 4, and 5. A label should be attached to the diesel engine indicating that it is out of oil and should not be used.

6.2.2 During the Storage

Refer to 6.1.2 for storage

6.2.3 Use After Unpacking

When starting, remove the fuel injection pump and take it to a service station designated by the diesel company for adjustment; remove the diesel engine cover and wrappings, and connect the pipelines; install the fuel injection pump and pump oil and bleed the fuel system; connect the battery cables and tighten the drive belt; add clean engine oil, adding an appropriate amount of clean engine oil to the turbocharger inlet; check the engine oil level and coolant level; use a crankshaft turning tool to rotate the crankshaft 3-5 times. Refer to Section 3.4 for diesel engine starting and start the diesel engine using the correct method. If the storage period exceeds 2 years, the coolant must be replaced and the cooling system cleaned.

NOTES

NOTES

MANUFACTURER DETAILS

HEADQUARTERS & FACTORY

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