



SDEC POWER

12VK SERIES

POWER
GENERATION ENGINES



G-DRIVE POWERPACK

Power Generation Specification

OPERATION AND MAINTENANCE MANUAL

Power Output Range

1280kW – 2035W

STAGE III EMISSION COMPLIANT

FOR USE IN THE FOLLOWING TERRITORIES. ASIA, MIDDLE EAST AND AFRICA.

H SERIES DIESEL ENGINE

MODELS	MAX ENGINE OUTPUT		RATED GENERATOR OUTPUT	
	Prime kW	Standby kW	Prime kVA	Standby kVA
12KTA58-G36 (1500 rpm)	1280	1410	1375	1500
12KTA58-G36 (1800 rpm)	-	-	-	-
12KTA58-G35 (1500 rpm)	1420	1560	1563	1688
12KTA58-G35 (1800 rpm)	-	-	-	-
12KTA58-G34 (1500 rpm)	1560	1720	1687	1875
12KTA58-G34 (1800 rpm)	-	-	-	-
12KTA58-G33 (1500 rpm)	1720	1890	1875	2062
12KTA58-G33 (1800 rpm)	-	-	-	-
12KTA58-G32 (1500 rpm)	1850	2035	2000	2250
12KTA58-G32 (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 the outputs and ratings tables for exact site conditions.

ADMONITION

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 New Energy Automotive Technology 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 AND SUGGESTIONS

For product repairs, technical consultations, complaints, and suggestions, please contact the Shanghai "Easy People" call centre. We provide fast, professional, and sincere service 24/7, 365 hours a day. National toll-free service hotline: 400-820-5656.

When reporting a product for repair, please be sure to provide the following information:

- Diesel engine model
- Diesel engine order number
- Diesel engine serial number
- Equipment purchase date
- Detailed fault description
- Contact person's address and phone number

TABLE OF CONTENTS

1. Introduction	4
1.1. To User and Operator.....	4
1.2. Scope.....	4
1.3. Notice Regarding User Feedback on Product Quality.....	4
1.4. Product After-sales Service Commitment.....	4
1.5. Safety Precautions	4
1.6. Precautions for Use	6
1.7. Warning Markings on Diesel Engines	8
2. Diesel Engine Overview	8
2.1. Diesel Engine Outline Drawing.....	8
2.2. Diesel Engine Model Identification	10
2.3. Diesel Engine Nameplate	10
2.4. Diesel Engine Technical Specifications.....	11
3. Diesel Engine Installation and Connection.....	13
3.1. Installation Instructions	13
3.2. Diesel Engine Unpacking and Hoisting	13
3.3. Diesel Engine Installation	14
3.4. Diesel Engine Outline Installation Diagram	16
4. Diesel Engine Use	17
4.1. Diesel Fuel	17
4.2. Engine Oil.....	17
4.3. Coolant.....	18
4.4. Power Matching	18
4.5. Diesel Engine Starting	18
4.6. Diesel Engine Operation	19
4.7. Diesel Engine Shutdown	20
4.8. Break-in Period for New or Overhauled Diesel Engines	20
5. Diesel Engine Maintenance.....	20
5.1. Diesel Engine Maintenance Plan	20
5.2. Diesel Engine Maintenance Record.....	22
5.3. Diesel Engine Maintenance Contents and Methods	22
6. Precautions for Using Electrical Control Systems	31
6.1. Precautions for Using Electronically Controlled Diesel Engines	31
6.2. ECU	31
7. Diesel Engine Troubleshooting Guide.....	31
7.1. Overview	31
7.2. Diesel Engine Troubleshooting.....	32
7.3. Fault Codes and Flash Codes	38
8. Storage After Diesel Engine Shutdown	44
8.1. Short-term Shutdown and Preservation.....	44
8.2. Long time storage	45

1. INTRODUCTION

1.1 To User and Operator

Thank you for choosing Shanghai New Energy Automotive Technology Co., Ltd.'s diesel engine products!

The 12VK electronically controlled diesel engine is a brand-new model developed by our company to meet the demand for high-power diesel engines in the power plant market. The 12VK electronically controlled diesel engine boasts strong power, low fuel consumption, and high reliability, making it an ideal power source for power plant units.

This manual mainly describes the technical specifications, usage, and maintenance precautions of the basic model of this diesel engine 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 this. For any questions regarding the use and maintenance of this product, please contact the Shanghai New Energy Automotive Technology Co., Ltd. "Easy Human" call center (400-820-5656) for technical consultation or guidance.

Shanghai New Energy Automotive Technology Co., Ltd. (hereinafter referred to as "the Company") uses the latest technology and high-quality components in its products. For maintenance and repair, we recommend using our company's brand service parts. Our authorized service stations are located throughout the country, providing repair services and spare parts supply. Our 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 Scope

This manual is suitable for the use and maintenance of electronically controlled diesel engines for 12VK power stations.

1.3 Notice to Users Regarding Product Quality Feedback

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, we kindly request that users specify the following 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 address.
- 3) Diesel engine operating conditions, cumulative operating time (hours), operating status (power, speed), and 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 analyze the problem.

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

1.4 1.4 Product After-Sales Service Commitment

To ensure excellent after-sales service and minimize losses for users due to product quality issues, our company has established a 24-hour repair service system. Users nationwide can call 400-820-5656 to receive timely professional consultation and after-sales service.

1.5 Safety Precautions

Before using and performing regular maintenance on the engine, carefully read and understand all safety precautions and warnings. The following safety precautions and warnings must be followed; otherwise personal injury may result.

- Ensure safety around the operating area and always be aware of potential hazards.
- Always remain vigilant when operating the engine. If you feel unwell or mentally unwell, stop working.
- Do not smoke while operating the engine.
- Do not smoke while adding fuel, as fuel vapors are flammable.

- Do not smoke while checking the electrolyte battery level, as the electrolyte releases flammable gases.
- Do not wear loose clothing and remove all jewelry when working around the engine or its drive unit. Wear safety glasses, work clothes, a safety helmet, or other protective equipment if necessary.
- To prevent fire during operation, the generator set must be kept at least 1 meter away from buildings and other equipment when in use.
- Engine exhaust contains harmful components such as carbon monoxide. Operating in poorly ventilated areas poses a risk of exhaust poisoning. If the engine is running indoors, exhaust gases must be vented outdoors, and all exhaust pipe connections must be leak-free.
- Do not remove exhaust system components with protective devices or heat shields; do not remove protective covers from exposed rotating parts, as this could cause injury.
- Do not place flammable materials such as fuel, lubricating oil, or coolant, or explosives, near the engine. This poses a risk of fire or explosion.
- Wipe up any spilled fuel, lubricating oil, or coolant. These substances can ignite and cause a fire. Store oily or coolant-soaked cloths in fireproof containers; never place them on the engine.
- Remove dust, dirt, and foreign objects from the engine and its surrounding area. These can cause fires or overheating engine.
- 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 when a "Do Not Start" warning sign is displayed on the starter switch or other switches.
- If a fuel, lubricant, or exhaust leak is discovered, take immediate measures to stop the leak. Fuel or lubricant splashing onto hot engine components, or exhaust coming into contact with flammable materials, can cause a fire, resulting in personal injury or engine damage.
- Never check for engine leaks by hand. High-temperature, high-pressure fuel, lubricant, 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 injury or death. Use a thick plate to check for fuel leaks and avoid direct contact with sprayed fuel if a leak is found.
- When testing fuel, lubricant, coolant, or battery electrolyte, explosion-proof lighting equipment must be used if illumination is required 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 vapors may ignite, causing damage to parts or personal injury.
- Do not perform any 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 will result in severe burns.
- The common rail fuel system generates high voltage during engine operation. Do not touch the fuel injection pump solenoid valve wires or components, or the injector solenoid valve wires or components, while the engine is running. Failure to comply with this warning will result in severe electric shock.
- When the engine is to be out of service for an extended period or requires maintenance, disconnect the engine from the battery 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, it always starts with the negative (-) terminal side. When installing, it always starts from the positive (+) 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.
- The battery terminal connections must be secure. Loose terminals can cause sparking 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. The battery produces flammable hydrogen and oxygen; using an open flame near it can cause an 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, keep a fire extinguisher readily available and in working order. Be familiar with how to use a fire extinguisher. First-aid kits should be placed in designated locations for immediate use. Fire and accident response procedures should be established, including contact information and locations for emergency services. Do not use carbon tetrachloride fire extinguishers, as they release toxic gases and their liquid can damage the insulation of electrical wires.
- When adding or replacing coolant or battery fluid, avoid contact between coolant or electrolyte and skin and eyes. If contact occurs, wash skin with soap and water immediately. If in eyes, flush 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 can you slowly loosen the radiator filler cap (pressure cap) to depressurize the cooling system before

adding coolant. The coolant temperature is very high immediately after engine shutdown; opening the cap may result in scalding from steam or hot water. After checking the coolant level, adding coolant, or replacing coolant, ensure the filler cap is tightened.

- When the engine is running, the intake and exhaust systems are hot. Do not touch hot components such as the exhaust pipe, exhaust tailpipe, turbocharger, intercooler intake pipe, and expansion tank. The coolant temperature is very high when the engine is running; do not open the radiator filler cap. If the radiator cap is opened, steam or hot water may spray out, posing a risk of burns.
- If the fan belt breaks, stop the engine immediately. Otherwise, the engine will overheat, causing the coolant in the radiator to steam out, posing a risk of burns.
- Do not handle the lubricating oil directly with your hands when draining lubricating oil or replacing the oil filter. Hot lubricating oil or parts 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 be caught in rotating parts around them. Getting caught in rotating parts can result in serious personal injury.
- Always stop the engine before adjusting its drive mechanism. Getting caught in rotating parts can cause a serious accident.
- Use proper engine cranking techniques. Never crank the engine crankshaft using the fan area, as this can cause serious personal injury or damage to the fan blades.
- All cranking tools used during maintenance must be removed after use. Leaving cranking tools plugged into the engine can damage the engine and cause personal injury.
- When working on engine parts that are inaccessible by hand, do not stand on the engine or brace your feet on side components. Stand on a stable and reliable work platform, taking care to avoid slipping and falling. Do not use parts boxes or toolboxes as substitutes. 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 vapors or prolonged contact with them. Dispose of waste oil using appropriate and safe methods.
- To prevent suffocation or frostbite, always wear protective clothing and perform the disconnection of air conditioning refrigerant (Freon) lines in a well-ventilated area. To protect the environment, refrigeration systems 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, oil-gas separators, fuel filters, or coolant, the discharged lubricating oil or coolant, and the replaced lubricating oil filters, oil-gas separators, 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.

1.6 Precautions for use

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

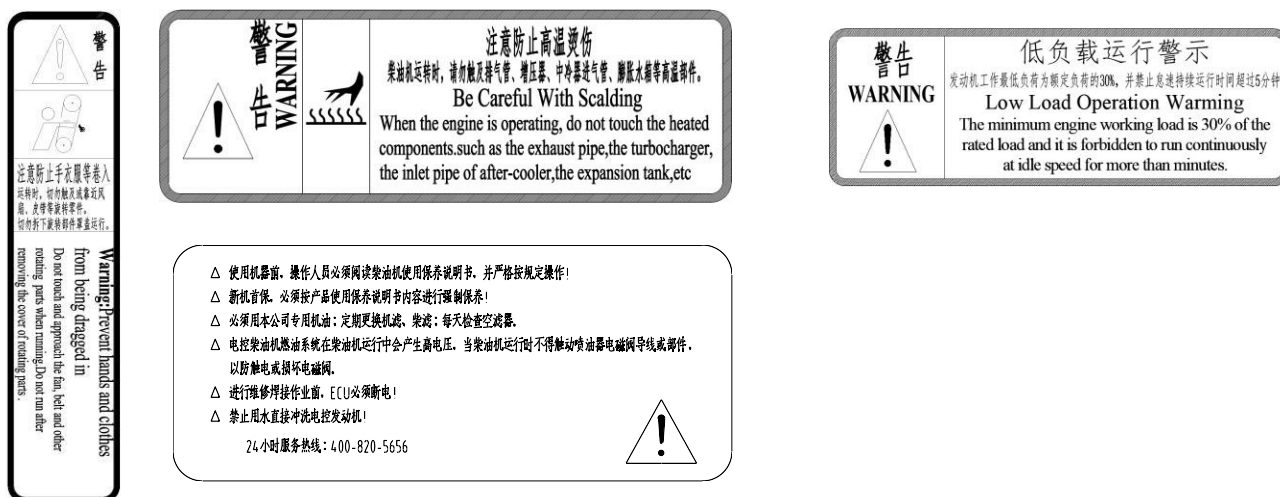
- Carefully read this manual and strictly follow the operating procedures and maintenance protocols specified herein.
- Strictly follow the provisions of this manual for daily maintenance and Level 4 maintenance and keep regular maintenance records.
- Use the appropriate fuel, lubricating oil, and coolant as specified in this manual.
- The engine cooling system should use the coolant specified in this manual in all climates.
- Do not mix different types of lubricating oil when adding it.
- Before starting the engine, always 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 to prevent premature engine wear.
- The generator set requires dedicated personnel to be on duty during operation.
- If the engine is running indoors, the engine room should always be well-ventilated. Insufficient air intake will cause the 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 abnormalities are found 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 ambient temperature is below freezing, before starting the diesel engine, check the vent pipe of the oil-gas separator for ice, sludge, bends, or blockages. If any are found, remove them before starting the diesel engine according to the normal procedure. During diesel engine operation, the vent pipe of the oil-gas separator should be checked regularly to ensure it remains unobstructed.
- When the coolant temperature is below 60°C, high-speed, high-load operation of the engine is strictly prohibited.
- Overloading the engine is strictly prohibited.
- If the engine overheats and must be shut down, do not immediately add coolant after shutdown, as this will damage components such as the cylinder head.
- If the engine shuts down abnormally, do not restart it immediately. If the engine stops while issuing an abnormal alarm, 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.
- If the engine's lubricating oil pressure drops abnormally for any reason, stop the engine immediately and inspect all parts of the lubrication system to identify the cause of the fault. Continuing to operate under low oil pressure can cause accidents such as engine bearing burnout. All bolts and plugs with washers must have their washers replaced with new ones after disassembly; they must not be reused.
- When starting a newly repaired engine, be prepared to disconnect the ECU power supply. Disconnect the power immediately if any abnormality occurs.
- The common rail fuel system generates high voltage during engine operation. Do not touch the fuel injection pump solenoid valve wires or components while the engine is running, as this may damage the solenoid valve.
- The ECU, common rail, high-pressure fuel pump, and injectors are precision components. User self-repair is strictly prohibited. Otherwise, our company will not provide any related service guarantees. Repairs to any components of the electronic control system must be performed by our company's professional service personnel.
- Avoid welding on engines or equipment containing electronic equipment. If welding is necessary, disconnect the power supply and disconnect the electronic equipment from the wiring harness before welding. Never plug or unplug wiring harnesses while the power is on. Cover the slots of ECU, sensors, and other electronic equipment with protective covers to prevent welding particles and sparks from entering. Do not touch the metal pins of the ECU or other electronic equipment slots with your hands. The ground wire of the welding machine should be as close as possible to the welding point to prevent welding current from passing through the ECU and other electronic components, thus protecting them from damage.
- Do not arbitrarily plug or unplug wiring harnesses. If plugging or unplugging is necessary, the power must be disconnected first to prevent damage to the ECU and other components from live operation.
- Do not connect jumper cables for starting or battery charging to the control circuits of the electronic control system. Doing so will damage the electrical components of the electronic control system.
- The engine should be stopped when checking belt tension and other drive components.
- Do not use a pry bar to remove or install the drive belt from the pulleys, 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 the drive belt, ensure its bending diameter is not less than 25 mm and do not hang it 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 period.
- Replace the thermostat promptly if it malfunctions; do not remove it unnecessarily.
- Do not spray water directly onto the engine for cleaning, as this may damage electronic equipment.

- Prevent rainwater from entering through the exhaust or intake manifold. Do not clean the engine while it is running. Cleaning agents (water) may be drawn into the engine. If water enters the engine's combustion chamber, the water pressure during engine start-up could cause internal damage and lead to a serious accident.
- Do not arbitrarily change the engine's purpose or scope of use; otherwise, it may easily lead to damage to the engine and/or equipment and may also cause personal injury. Unauthorized modifications to the engine will void the warranty, even within the warranty period.
- The engine will be disposed of in accordance with national and local regulations after it is scrapped.

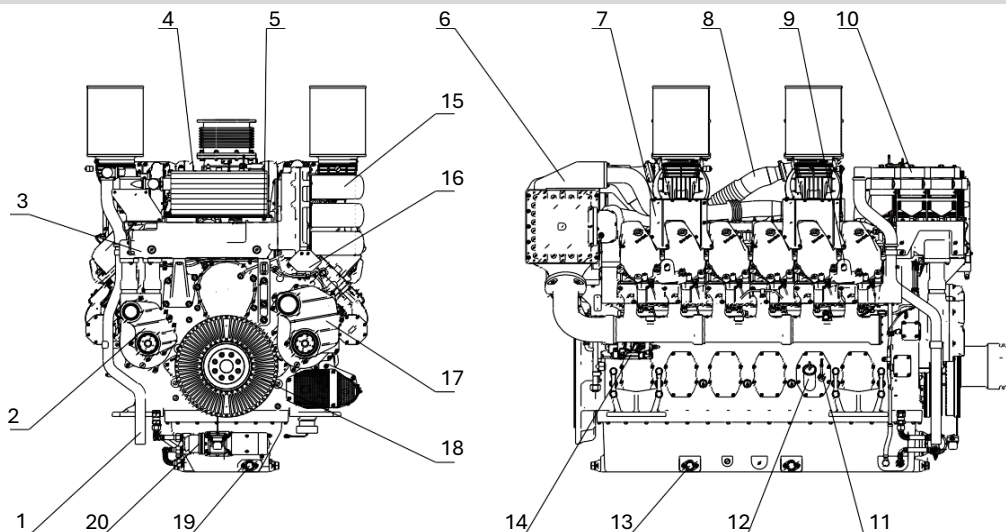
1.7 Warning Markings on Diesel Engines

The following warning signs are present on diesel engines and must be strictly observed; failure to comply may result in personal injury and engine damage.



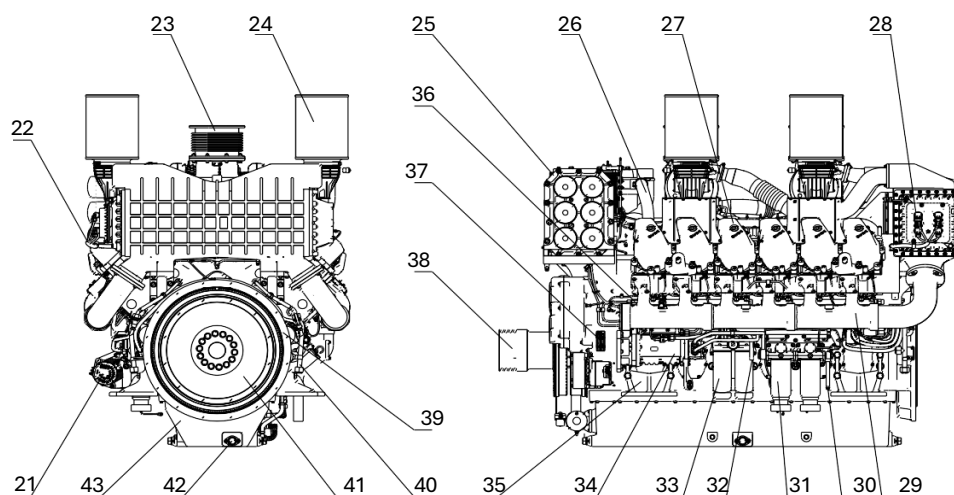
2. OVERVIEW OF DIESEL ENGINES

2.1 Engine Outline Diagrams



Diesel Engine Front End

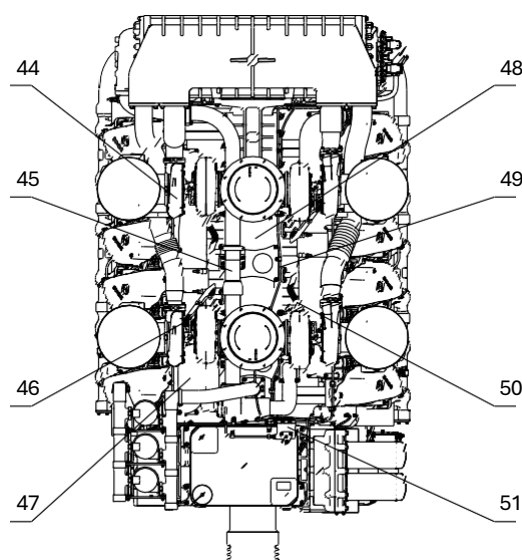
Diesel Engine Side B



Diesel Engine Rear End

Diesel Engine A

1	Oil-gas separator outlet pipe	2	Low temperature water pump	3	Oil cooler housing
4	Oil cooler	5	Oil cooler drain plug	6	Intercooler
7	Intake bend bracket	8	Compressor outlet pipe	9	Engine lifting ring
10	Oil-gas separator	11	Oil dipstick	12	Oil filler cap
13	Oil drain plug	14	Starter	15	Oil filter
16	Oil receiving tray	17	High temperature water pump	18	Shock absorbers
19	Oil drain plug	20	Electric pre-supply oil pump	21	Alternator
22	Engine wiring harness	23	Waveform expansion joint	24	Air filter
25	Oil filter housing	26	Oil-gas separator inlet pipe	27	Cylinder head cover
28	ECU	29	Intake manifold	30	Fuel inlet
31	Electric fuel pre-filter	32	Fuel return port	33	Fuel filter
34	High-pressure oil pump	35	Engine support	36	Common rail
37	Nameplate	38	Matching pulley	39	Flywheel housing
40	Water drainpipe	41	Flywheel	42	Oil drain plug
43	Oil pan	44	Turbocharger	45	Intercooler water pipes



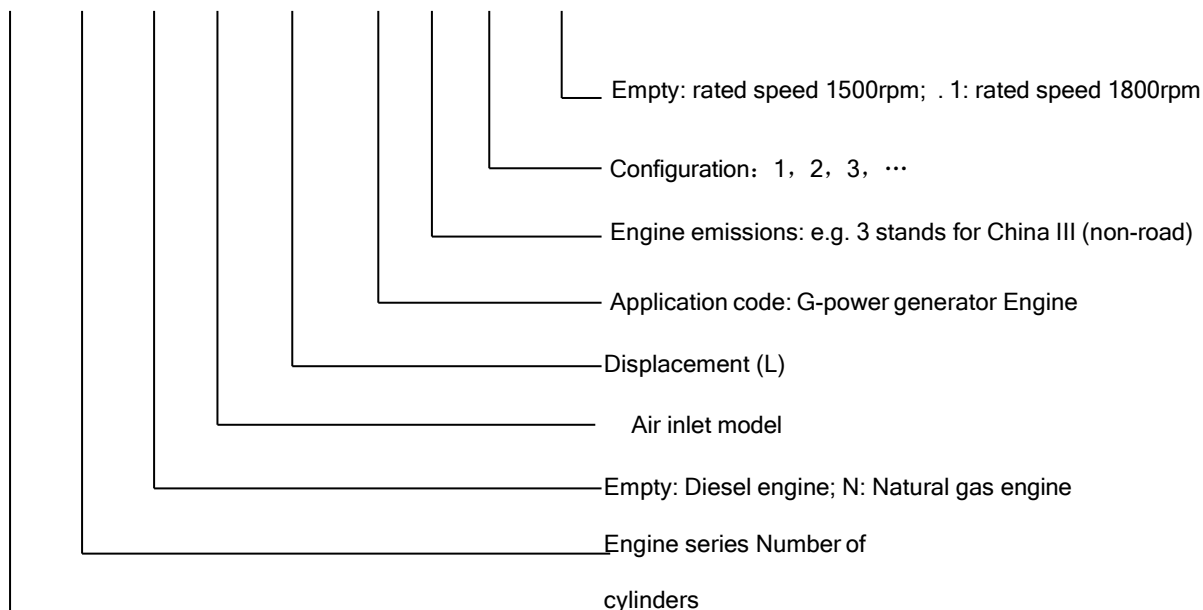
Diesel Engine Top

46	Turbocharger inlet pipe	47	Exhaust pipe	48	Camshaft cover plate
49	Intercooler degassing pipe	50	Turbocharger return pipe	51	Degassing pipe connector

2.2 Diesel Engine Model Identification

12VK Diesel Engine Model Designation Method:

□ □ □ □ □ - G □ □ .1



Note: Air inlet mode is divided into three type: T means Turbo, TA means Turbo with water-air intercooler and TAA means Turbo with air-air intercooler.

For example: 12KTA58-G31 represents SDEC POWER K series twelve cylinder 58-liter water-air intercooler turbo NO.1 spec diesel engine for power station compliant with China III (rated speed: 1500rpm).

2.3 Diesel Engine Nameplate

The diesel engine nameplate displays the main technical data and information of the diesel engine you purchased: engine model, order number, serial number, production date, rated power, and rated speed. This information 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 are reporting. Please protect the nameplate from damage. The nameplate is located on the diesel engine gear chamber.

Nameplate for diesel engine used in power plants:

 上柴动力 SDEC POWER	型号 MODEL	机号 SER. NO.	排放阶段 EMISSION LIM.
	订货号 ORD. NO.	后处理装置类型 AFTER TREATMENT TYPE	
	功率段 POWER BAND	额定功率/转速 RATED POWER/SPEED	kW/r/min
	系族名称 FAMILY ENGINE	最大功率/转速 MAX POWER/SPEED	kW/r/min
柴油机 DIESEL ENGINE	适配机组功率 (常用/备用) GENSET POWER (PRIME/STANDBY)	kW	生产日期 DATE
执行标准 EXECUTED STANDARD	信息公开编号 INFO. PUBLIC NO.	净质量 NET WT.	kg
上海新动力汽车科技股份有限公司 (原上海柴油机股份有限公司) Shanghai New Power Automotive Technology Company Limited (SHANGHAI DIESEL ENGINE CO., LTD.) 中国上海市军工路2636号 2636 JUNGONG ROAD, SHANGHAI, CHINA			

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

2.4 Diesel Engine Technical Specifications

2.4.1 Main Technical Specifications and Performance Parameters

Engine model		12KTA58-G31
Type		V type, twelve -cylinder, water-cooled, four-stroke, direct injection,
Aspiration		Turbocharged and intercooled (water-air)
Bore (mm)		170
Stroke (mm)		210
Displacement (L)		57.2
Compression ratio		18: 1
Fuel system		High-pressure common-rail fuel system
Starting temperature/°C		≥-10
Starting time (s)		≤10
Crankshaft rotation (facing flywheel)		Counterclockwise
Firing order		A1-B5-A5-B3-A3-B6-A6-B2-A2-B4-A4-B1
Min. fuel consumption (g/kWh)		188 (economy model)
Rated	Power (kW)	2,010
	Speed (r/min)	1,500
Max. power	Power (kW)	2,210
	Speed (r/min)	1,500
Oil to fuel ratio (%)		≤0.3
Starting mode		Electrical
Net weight (kg)		7,770(excluding accessories not on the engine)
Dimensions	Length (mm)	2,762
	Width (mm)	1,582
	Height (mm)	2,193

- The performance parameters in the table above are those of the diesel engine under standard environmental conditions. Standard environmental conditions refer to: ambient temperature 25°C, relative humidity 30%, and atmospheric pressure 100 kPa.
- The external dimensions are only those of the basic diesel engine model; different engine models may have different external dimensions.
- For the definition of each cylinder, please refer to section 5.3.12, "Checking and Adjusting Valve Clearance".

2.4.2 Main Technical Parameters

Exhaust temperature (before turbine) (°C)		≤700
Oil temperature in oil pan (°C)	Max. allowable	115
Oil pressure in main gallery (MPa)	@ rated speed	0.40 - 0.60
	@ idle(900rpm)	≥0.25
Oil pan capacity (L) (Oil dipstick “high-low”)		275 – 195
High temperature coolant system outlet temperature (°C)		≤99
High temperature coolant system thermostat	@Opening temperature (°C)	77±2
	@Full open temperature (°C)	90
Low temperature coolant system thermostat	@Opening temperature (°C)	40±2
	@Full open temperature (°C)	52
Engine cooling system capacity (L)	High temperature coolant system	119
	Low temperature coolant system	56
High temperature water pump total dynamic head /m		30.5
Low temperature water pump total dynamic head /m		20
Governor performance	Min. stable idle speed without load /(r/min)	900
	Stable governing rate/%	≤3
	Transit governing rate/%	≤10
	Stable speed recovering time/s	≤3
Battery	Min. recommended battery capacity, Ah *	≥200 (2parallel and 2 series)
	Battery current of at -18°C for cold starting, CCA	750 – 1200
	Voltage (V)	24
Starting motor	Voltage(V)	24
	Power (kW)	8.5
Alternator	Voltage (V)	28
	Current (A)	55
	Rated power (kW)	1.5

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

3. DIESEL ENGINE INSTALLATION AND CONNECTION

3.1 Installation Instructions

- Before installing the diesel engine, installers must carefully read all accompanying documents and materials and familiarize themselves with the engine's structure and installation requirements.
- Installers must be experienced mechanical and electrical technicians.
- If the diesel engine being installed differs significantly from the manufacturer's specifications, installation must be carried out under the guidance of qualified professionals.
- Objects exceeding 20kg must be lifted and moved using lifting equipment. Before lifting, check the condition of the lifting rings and slings.

3.2 Diesel Engine Unpacking and Hoisting

3.2.1 Diesel Engine Disassembly

Before unpacking the diesel engine, take care not to damage its parts. After unpacking, check that all exposed oil, water, and gas pipes are properly sealed, and prevent foreign objects from falling into any pipes. Verify that all accompanying documents and spare parts are complete according to the diesel engine packing list.

3.2.2 Lifting of Diesel Engine and Precautions

There are four lifting rings on both sides of the cylinder head of the diesel engine, capable of supporting the entire weight of the engine. The lifting device for the diesel engine is only for lifting diesel engines and is not permitted for lifting generator sets.

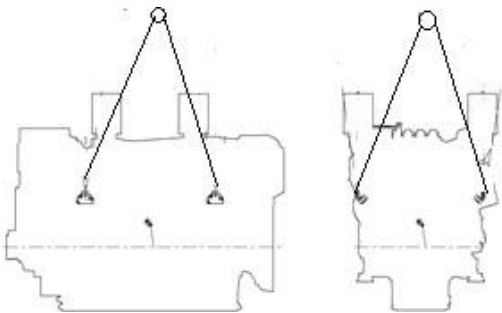
When lifting, the four lifting points must be vertical, taking care to avoid damaging diesel engine components. Use appropriate lifting equipment during hoisting but be careful not to let the load chain press against thin-walled parts or instrument components (and minimize bending moments on the lifting rings).

Lift smoothly, keeping the diesel engine basically horizontal.

There are four mounting brackets on both sides of the diesel engine block. During handling and hoisting, the diesel engine should be placed on a dedicated base or stable pads to prevent the oil pan from directly bearing the weight of the diesel engine.

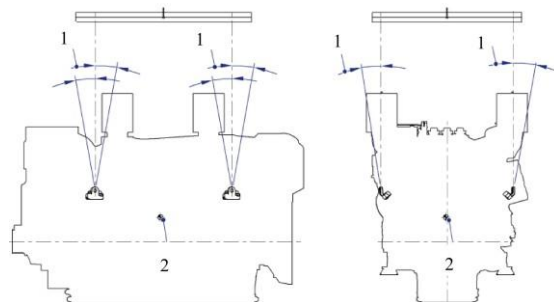
Warning: Overloading during lifting carries a risk of injury or death. Do not stand under the lifted item during lifting operations, as this may result in injury or even death. Place the diesel engine on the ground before leaving the work site. Do not place the diesel engine within the swing radius of the crane.

Incorrect



- Maximum permissible diagonal pull 10°
- Engine centre of gravity

Correct



3.3 Diesel Engine Installation

3.3.1 Diesel Engine Installation

When installing a diesel engine, sufficient space should be left around it for operation and maintenance.

3.3.2 Prevent Stress

To prevent stress caused by chassis deformation from acting on the diesel engine and to reduce the spread of vibration sources, vibration damping pads must be installed between the diesel engine and the chassis. The chassis must have sufficient rigidity and good flatness, with a flatness of less than or equal to 0.2 mm. The clearance between the diesel engine mount and the chassis should be eliminated by scraping or other methods. The distance from the diesel engine mounting bracket to the centreline of the diesel engine crankshaft varies depending on the diesel engine model.

3.3.3 Power Output of Diesel Engine

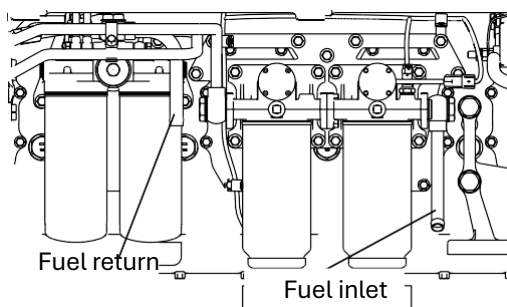
The diesel engine drives the equipment by outputting power from the flywheel. This diesel engine is suitable for use with a single-bearing generator. The diesel engine outputs power through the flywheel connected to the generator's steel plates, and the flywheel housing is fixedly connected to the generator end cover. After assembling the generator, the crankshaft axial clearance should be checked to ensure that the crankshaft is not under mechanical load.

Note: The diesel engine must not be started under load. Therefore, a clutch device should be installed between the diesel engine and the load device that cannot operate under no-load conditions.

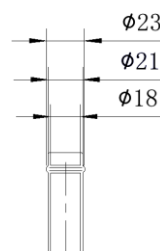
It is forbidden to directly install a pulley on the flywheel for lateral dragging of the driven equipment, as this can easily damage the crankshaft and main bearings. If lateral dragging is required, a modified diesel engine suitable for lateral drag should be selected, or a power transmission transition device adapted for lateral drag should be used. Do not allow the diesel engine crankshaft and main bearings to directly bear lateral forces.

3.3.4 External Connection of Fuel Line

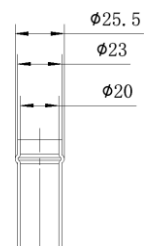
The locations of the diesel engine fuel tank inlet and fuel return connector are shown in the figure. The fuel inlet connector hinge bolt is M27×2 mm, and the fuel return connector hinge bolt is also M27×2 mm. The recommended inner diameter of the fuel inlet pipe is ≥ 21 mm, and the recommended inner diameter of the fuel return pipe is ≥ 23 mm. The fuel lines should be able to withstand sufficient vacuum without damage or denting. The dimensions of the fuel inlet and return connectors are shown in the figure.



Fuel inlet pipe joint



Fuel return pipe joint



The fuel tank should be large enough to hold enough fuel for at least 8 hours of diesel engine operation. The fuel tank should ensure the minimum fuel level is no lower than 1 meter below the centre of the fuel pump, and the fuel inlet must be at least 50 mm above the bottom of the fuel tank. It is recommended to install a coarse filter at the fuel inlet to prevent sediment from being drawn in and clogging the fuel lines. For easy cleaning, a vent valve at the bottom of the fuel tank is recommended. The fuel tank should not be placed near heat sources (such as the exhaust pipe) or electrical equipment.

3.3.5 Exhaust System Installation

The external exhaust pipe is made of steel and must be flexibly connected to the diesel engine turbocharger. The inner diameter of the external exhaust pipe should be larger than the expansion joint, and excessive bending should be avoided. The external exhaust pipe should be fixed with a bracket (or hanger) to prevent vibration, and its weight should not be applied to the diesel engine expansion joint. Expansion joints are not allowed to eliminate alignment errors between pipes.

Note: After the exhaust system is installed, the diesel engine back pressure must not exceed 9 kPa, otherwise it will affect the diesel engine performance!

The exhaust system must prevent rainwater, debris, etc., from entering the diesel engine. Because the exhaust pipe surface temperature is high when the diesel engine is operating, the exhaust pipe should be installed away from flammable materials.

Note: To prevent fires, burns, and other accidents, please install heat insulation measures on the surface of the external exhaust pipe!

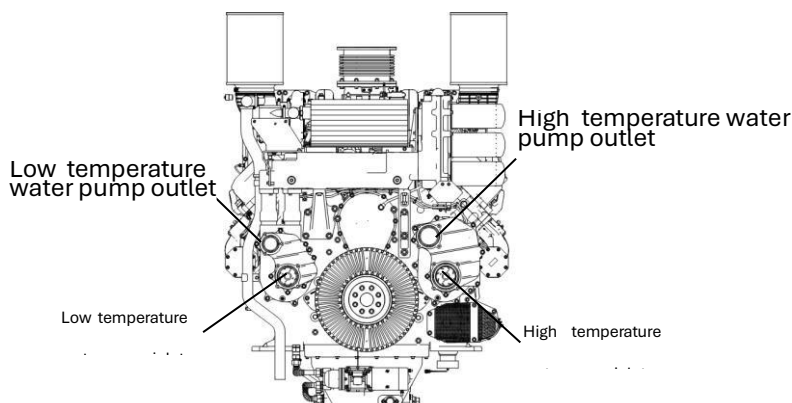
When multiple diesel engines are installed together using a single main external exhaust pipe, several problems may arise: When several diesel engines are not operating simultaneously, condensate from the exhaust will enter the non-operating diesel engines, easily damaging engine components. Therefore,

Note: Each diesel engine should use an independent exhaust system!

If an exhaust muffler needs to be added to the exhaust system, it should be selected and installed appropriately to minimize the increase in exhaust system back pressure caused by the muffler installation.

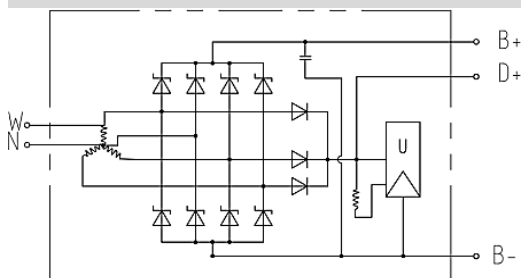
3.3.6 Cooling System

For engines that come with a radiator pre-installed at the factory, the radiator's heat dissipation area and protective cover are already rationally designed, and users do not need to make any other modifications. If the engine does not come with a radiator, a radiator that is compatible with the engine must be selected; otherwise, optimal performance will not be achieved.

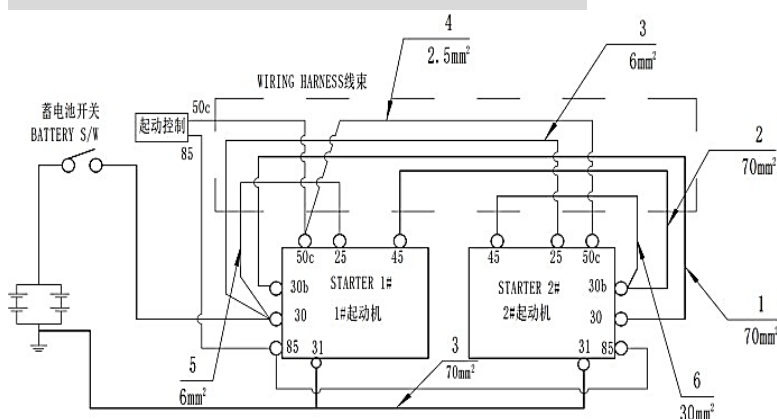


3.3.7 Starting System

Alternator Circuit Diagram



Starter External Wiring Diagram



备注： 双线制
OUT SUPPLY

Technical drawings of the 4D56 engine showing front, side, and detail views with dimensions.

Front View (Top Left): Shows the engine from the front. Dimensions include a total width of 2162.4 and a cylinder block width of 1781.5. The label "Cylinder block front side" is present.

Front View (Top Right): Shows the engine from the front with a total width of 1582.4. The cylinder block width is 1400.9. The total height is 2193.1. The crankshaft diameter is $\phi 117.5$. The main bearing diameter is $\phi 141.35$. The label "Cylinder block front side" is present.

Side View (Bottom Left): Shows the engine from the side. Dimensions include a total width of 1582.4 and a cylinder block width of 1400.9. The total height is 2193.1. The crankshaft diameter is $\phi 117.5$. The main bearing diameter is $\phi 141.35$. The label "Cylinder block front side" is present.

Detail View (Bottom Right): Shows the crankshaft and main bearing details. Dimensions include a total width of 1582.4 and a cylinder block width of 1400.9. The total height is 2193.1. The crankshaft diameter is $\phi 117.5$. The main bearing diameter is $\phi 141.35$. The label "Cylinder block front side" is present.

4. DIESEL ENGINE USE

Proper use of diesel engines not only ensures their normal operation and good performance but also extends their lifespan and reduces operating costs. Follow the requirements of this chapter to use the correct fuel, engine oil, and coolant, and adhere to the correct operating procedures.

4.1 Diesel Fuel

The fuel specifications used in this series of diesel engines should conform to the national standard GB 19147. The diesel fuel grade should be selected according to the ambient temperature. In low-temperature winter environments, low-pour-point diesel fuel should be used, and vice versa in summer. The diesel fuel grade selection can be based on the recommendations in GB 19147, or users can choose according to the recommendations in the table below: for example, when the ambient temperature is -5°C, -10 diesel fuel should be selected.

Relationship between diesel grade and applicable minimum temperature

Fuel designation	0#	-10#	-20#	-35#
Cetane value	≥49	≥49	≥46	≥45
Solid point/°C	≤0	≤-10	-20	-35
Minimum applicable temperature (engine working 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.

4.2 Engine Oil

To ensure the normal operation and long lifespan of diesel engines and to improve diesel engine emissions, we recommend using our company's proprietary CF-4 grade or higher lubricating oil. Please select the appropriate viscosity grade of engine oil according to the local ambient temperature. Under normal ambient temperatures, use 15W-40 viscosity grade engine oil. The relationship between engine oil viscosity grade and applicable ambient temperature is as follows:

Viscosity grade	Applicable Ambient temperature/°C	Viscosity grade	Applicable Ambient temperature/°C
0W	-35~-15	10W-50	-25~50
0W-20	-35~20	15W-30	-20~30
0W-30	-35~30	15W-40	-20~40
0W-40	-35~40	15W-50	-20~50
5W	-30~-10	20W-30	-15~30
5W-20	-30~20	20W-40	-15~40
5W-30	-30~30	20W-50	-15~50
5W-40	-30~40	20	-10~20
5W-50	-30~50	30	-5~30
10W-30	-25~30	40	5~40
10W-40	-25~40	50	15~50

Note: For the viscosity grade of lubricating oil in the table, the smaller the number before W, the better the low temperature performance of oil; the larger the number after W, the greater the viscosity of oil; Refer to GB 11122 for the detailed viscosity-temperature performance requirements of lubricating oil.

4.3 Coolant

To ensure the normal operation and long lifespan of your diesel engine, please use an organic (antifreeze) coolant in all climates. We recommend our company's proprietary coolant, which features antifreeze, corrosion resistance, good thermal conductivity, high stability, and environmental friendliness. Please select a coolant with a freezing point approximately 10°C lower than your local ambient temperature.

Part No.	Freezing point/°C	Boiling point/°C	Package specification/L
F/LQY-45	-45	≥108.5	10
Y/1511000109	-35	≥107.5	4
Y/1511000110	-35	≥107.5	10
Y/1511000107	-25	≥106.5	4
Y/1511000108	-25	≥106.5	10

4.4 Matching the Power of Diesel Engines with that of Working Machinery

When selecting a diesel engine, users should not only consider the power required by the machinery being used, but also the load rate of the machinery, such as whether it is used intermittently or continuously. Simultaneously, the operating economy of the machinery must be considered; that is, the working characteristics of the load and the characteristics of the diesel engine must be reasonably matched. Therefore, the correct calibration of the diesel engine power and the reasonable matching of the diesel engine with the characteristics of the machinery are prerequisites for ensuring the reliable, economical, and long service life of the diesel engine. Otherwise, the diesel engine may be overloaded and cause unnecessary malfunctions; or the load power may be too small, and the diesel engine power cannot be fully utilized, which is not only uneconomical but also prone to problems such as oil leakage.

4.5 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:

- 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 to prevent premature engine wear.

- Check that the engine oil level is within the specified range.
- Check that the coolant level is within the specified range.
- Check that the electrolyte level is within the specified range. (7) When a diesel engine is first put into use, has been idle for several days, or has recently had its fuel filter replaced, there may be air in the fuel system. It is necessary to pump air from the fuel system. See section 5.3 for details on pumping air from the fuel system.

Note: Some models are equipped with an electric fuel pre-filter. It starts working when the ignition switch is turned ON. The electric pump runs for 3 minutes to remove air, and then automatically stops after 3 minutes.

- Check if the electric starter circuit is in normal condition.
- Check if the wiring of the electric starter system is correct. Ensure the battery is fully charged.
- All safety devices must be installed correctly.
- Before starting a diesel engine, drain the fuel from the engine.
- For new engines or diesel engines that have been idle for more than 5 days, rotate the crankshaft 3-5 times using a crankshaft turning tool before starting.

4.5.1 Standard Start-up Procedure

The 12VK power station's electrically controlled diesel engine can be started smoothly in ambient temperatures not lower than -10°C, using the following method:

- Disconnect the diesel engine from the transmission.
- Ensure all mechanical control devices are in the operating position.
- Start the pre-supply oil pump to bring the main oil pressure in the diesel engine's oil passage to 100 kPa.

Note: The diesel engine can only be started after the main oil pressure in the oil passage reaches 100 kPa.

Note: The electric pre-supply oil pump should not operate continuously for more than 120 seconds, and the interval between each start must be greater than 5 minutes.

- Press the start button to start the diesel engine. Release the button immediately after hearing a continuous popping sound from the engine. For specific starting operation modes, please refer to the generator set or the generator set control panel's user and maintenance manual.

Note: The diesel engine must be started under no-load.

Note: The diesel engine starting time should not exceed 10 seconds, and the interval between each start must be greater than 2 minutes.

- If three consecutive starts fail, contact Shanghai's "Easy+ Personnel" (400-820-5656).
- The diesel engine oil pressure gauge must display a reading within 15 seconds of a successful start. If it does not indicate oil pressure within 15 seconds, stop the engine immediately to prevent damage. Then, refer to Chapter 7, "Troubleshooting Guide," to identify and resolve the problem.
- After starting a hot diesel engine, allow it to idle for 3-5 minutes before gradually increasing the load.
- After starting a cold diesel engine, allow it to idle for 5-10 minutes to warm it up. During this time, check all instruments for proper functioning, inspect the engine and external piping for leaks, listen to the engine and turbocharger, and observe the exhaust smoke colour. If any abnormalities are found, stop the engine immediately and inspect it. Gradually increase the load only after the engine has finished warming up.

Note: Especially after starting at low temperatures, increases in speed and/or load should be made as slowly as possible to ensure adequate lubrication of bearings and stable oil pressure.

Note: Immediate acceleration after starting the diesel engine is strictly prohibited.

Note: Prolonged idling time is not permitted and can damage the engine. Idling results in low combustion chamber temperatures, incomplete fuel combustion, carbon buildup in the cylinder, injector nozzle blockage, piston ring and valve sticking, and decreased engine performance.

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

4.5.2 Low Temperature Start-up

Low-temperature starting refers to starting the engine at an ambient temperature below -10°C. During starting, users should adopt appropriate low-temperature starting assistance measures based on the actual ambient temperature. Then, start the diesel engine according to the standard starting procedure. Common low temperature starting assistance measures include:

- Preheating the engine oil and coolant to 40–50°C.
- Using a user-provided low-temperature starting device.
- Raising the ambient temperature of the engine room.
- Selecting diesel fuel, engine oil, and coolant suitable for low temperatures.
- Insulating the battery or using a larger capacity or higher discharge rate battery (a special low-temperature battery).

4.5.3 Starting the Engine After a Long Period of Parking or an Oil Change

Whenever starting a diesel engine after an oil change or after a period of inactivity exceeding 30 days, the lubrication system must be filled with oil first. An electric pre-fill oil pump can be used to establish oil pressure. Perform the following starting preparations, then start the diesel engine according to the normal starting procedure or cold start procedure:

- Check the oil level.
- Check the battery voltage.
- Pump fuel into the fuel system to bleed the system; see section 5.3 for specific procedures.

For diesel engines normally stored for emergency use, to facilitate rapid starting in case of emergency, they should be started every 3–5 days during the storage period until the coolant and oil temperatures reach above 60°C.

4.6 Diesel Engine Operation

Precautions for Diesel Engine Operation:

- Regularly monitor oil pressure, coolant temperature, and malfunction indicator lights. If any abnormalities are observed, stop the engine and inspect it. Oil Pressure: 250 kPa at idle (minimum allowable) / 400 kPa at rated speed (minimum allowable) / 600 kPa at rated speed (maximum allowable).

Coolant Temperature: The coolant outlet temperature of the diesel engine's high-temperature cooling system should be ≤99°C.

- If the diesel engine temperature is too high (water temperature alarm sounds), reduce the engine speed or load, or both, until the engine temperature returns to its normal operating range. Otherwise, refer to Chapter 7, "Troubleshooting Guide," for repair.

- During operation, especially during sudden load reduction, prevent the diesel engine speed from suddenly increasing beyond the specified value (commonly known as runaway). If this occurs, immediately take emergency shutdown measures and then investigate the cause.

Note: Over speeding of the diesel engine can cause serious damage.

- Maximum power continuous operation time should not exceed 1 hour. After operation, the engine should be switched to a lower load for at least 30 minutes. The total operating time at maximum power should not exceed 10% of the specified overhaul period.
- When running in the no-load position, the diesel engine speed should preferably not exceed the minimum no-load stable speed, and the continuous no-load operation time should not exceed 1 hour.
- Continuous operation under low load (below 30%) should not exceed 1 hour. Carbon buildup in the cylinders can easily cause poor combustion. Additionally, after approximately 1 hour of low-load operation, apply a load of 30% or higher for at least 5 minutes to prevent carbon buildup.
- Except in emergencies, the diesel engine speed (or load) should not be suddenly increased or decreased; increases or decreases in speed (or load) should be slow and gentle.

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 damage. If necessary, contact the Shanghai Diesel Engine Co., Ltd.'s "Easy People" call centre for technical guidance or professional repair services.

Typical Signs of Impending Diesel Engine Failure:

- Engine stalling; Abnormal engine vibration.
- Unusual engine sound.
- Sudden changes in coolant temperature and oil pressure.
- Black smoke from the engine; Insufficient power.
- Increased oil consumption; Increased fuel consumption.
- Three leaks (oil, fuel, coolant leakage).

4.7 Diesel Engine Shutdown

4.7.1 Normal Parking

After a diesel engine has been running at high speed and high load for an extended period, the load should be gradually reduced and the engine speed lowered before shutdown. The engine should then idle for 6 minutes to allow for even cooling and a significant drop in turbocharger speed before shutting down, thus protecting both the engine and the turbocharger. After shutdown, close the fuel tank.

If the diesel engine needs to be shut down for a period, proper storage procedures must be followed. See Chapter 8, "Storage After Diesel Engine Shutdown," for details.

4.7.2 Emergency Stop

The emergency stop button should only be used in emergency or special circumstances. The emergency stop button is usually located on the generator set control panel. Do not start the engine after using the emergency stop button until the problem that caused the emergency stop has been resolved. Do not operate the engine for at least 15 minutes after an emergency stop.

4.8 Break-in Period for New or Overhauled Diesel Engines

New or overhauled diesel engines must undergo a 60-hour break-in period before being put into full-load operation. This break-in period is crucial for improving the working condition of moving parts and enhancing the engine's reliability and lifespan. The specific 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. For diesel engines operating at constant speed in power plants, break-in at the rated speed is permitted. However, the no-load or low-load operation time during the initial break-in phase should not be too long. During the break-in period and the subsequent normal operating period, diesel engines should not be idled or operated at low load for extended periods. Continuous idling time should not exceed 10 minutes to avoid premature wear due to carbon buildup or to prevent performance degradation. After each replacement of cylinder liners, pistons, piston rings, connecting rod bearings, main bearings, and/or crankshaft, a short-term break-in period should be performed according to the above-mentioned break-in conditions.

5. DIESEL ENGINE MAINTENANCE

5.1 Diesel Engine Maintenance Plan

The table below shows the maintenance schedule and procedures for this series of diesel engines. Users should perform regular maintenance according to the specifications in this table. If the diesel engine frequently operates in ambient temperatures below -18°C or above 38°C, or in dusty environments, the maintenance schedule should be shortened accordingly.

Maintenance tasks	Daily	First maintenance 250 hours	Every 250 h or 3 months
Checking engine periphery	●	●	●
Checking fuel tank	●	●	●
Checking air filter service indicator	●	●	●
Checking oil level in engine	●	●	●
Checking coolant level	●	●	●
Checking electrolyte level	●	●	●
Checking drive belt *	●	●	●
Checking cooling fan	●	●	●
Excluding water and sediment in first fuel filter	●	●	●
Checking engine wire harness			●
Checking intake system			●
Changing engine oil and oil filter		●	Every 500 h or 12 months
Checking and adjusting valve clearance		First 1,000 h, then every 2,000 h or 9 years	
Changing fuel filter (first and second stages)	Every 1,000 h or 2 years		
Priming fuel system	Every 1,000 h or 2 years		
Checking intercooler and its line	Every 500 h or 6 months		
Checking belt tensioner	Every 500 h or 6 months		
Changing drive belt	Every 2,000 h or 12 months		
Changing AC pre-supply oil pump sealing washer	Every 12 months		
Checking turbocharger	Every 2,000 h or 2 years		
Checking vibration damper	Every 2,000 h or 2 years		
Changing coolant and cleaning cooling system	Every 4,000 h or 2 years		
• The belt must be replaced when it has crack or defect(s) that affects its use. • The first change of oil and oil filter should be made at the first maintenance 250 h; After the first maintenance, later oil and oil filter changing should be done every 500 h or 12 months. • The first check and adjustment of valve clearance should be made when the engine runs to 1,000 h; After the first inspection and adjustment, check and adjust the valve clearance every 2,000 h or 9 years. • The replacement period of the fuel filter(first and second stages) should be shortened properly when it contains a certain number of foreign particulates and causes difficulty to pump fuel. • Only need to prime the low-pressure fuel pipeline when changing fuel filter (first and second stages) during maintenance. • The belt tensioner must be replaced when its pulley doesn't rotate freely. • Use SNAT's special organic coolant (anti-freezing type).			
Note: It is required to crack the crankshaft several turns when the engine is first put into use or is out of service for a quite long time.			
The maintenance interval in this table is in hours, months, or years whichever comes first.			

5.2 Diesel Engine Maintenance Record

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

Maintenance Record				
Engine serial number_____ Engine model & order No._____				
User_____ Equipment description & serial No. _____				
Date	Hour or Interval	Maintenance	Operator	Remark

5.3 Diesel Engine Maintenance Contents and Methods

5.3.1 Inspect the Exterior of the Diesel Engine

Before starting the diesel engine each day, a preliminary inspection of the diesel engine's exterior should be performed, including the following:

- Check the diesel engine and radiator for any accumulated debris such as rags, scrap wires, pipe clamps, and screws, ensuring the engine is clean and tidy.
- Check the joints and seals of the fuel system, cooling system, and lubrication system for leaks.
- Check the fan and safety guard for safety and reliability.
- Check the tightness of accessories.
- Check electrical wiring connections for looseness and ensure the wires are intact.
- Check the drive belt for damage.
- Check the hoses for cracks or perforations.
- Check the clamps for looseness.

5.3.2 Check the Fuel Tank

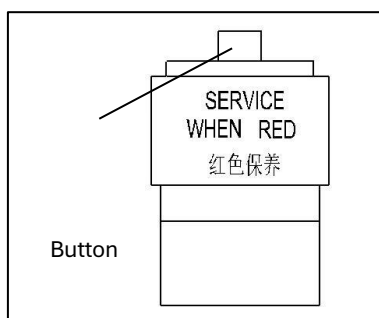
Check the fuel level in the fuel tank daily.

5.3.3 Check the Air Filter Maintenance Indicator.

Check the maintenance indicator on the air filter daily. If the inspection window shows red, it indicates that the air filter's intake resistance exceeds the specified value, and the filter element needs to be replaced. See section 5.3.22 for filter element replacement requirements and procedures. After replacing the filter element, you must press the button on top of the maintenance indicator to reset it. If the air filter has a label, please refer to the label for maintenance or replacement instructions.

Note: After replacing the air filter element, ensure that both ends of the air filter are reliably sealed to prevent air leakage.

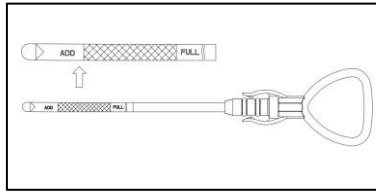
Note: Never operate the diesel engine without an air filter. Doing so will easily cause premature wear of the diesel engine.



5.3.4 Check the Engine Oil Level

Check the engine oil level daily before starting the diesel engine or after it has stopped (at least 20 minutes after stopping to allow sufficient time for the oil to drain back into the pan). The oil level should be between the high (FULL) and low (ADD) marks on the dipstick. If the oil level is low, add oil to near the high mark.

Note: Never run the diesel engine with the oil level below the low mark. Doing so will degrade engine performance and may even damage the engine. However, the oil level must not exceed the upper mark.



5.3.5 Check the Coolant Level

Check the diesel engine coolant level daily before starting or when the engine is stopped.

Warning: When the diesel engine is running, the coolant temperature is high and under pressure, which can easily cause burns. Only check or add coolant after the engine has stopped and the coolant temperature has dropped below 50°C.

Warning: The coolant contains alkaline rust inhibitors; avoid contact with skin and eyes to prevent injury.

- Before starting or after stopping the diesel 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.
- Remove the pressure cap and 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.
- Add coolant if necessary.
- Add to near the upper mark or meet the equipment manufacturer's specifications.

Note: Add coolant slowly to prevent air lock.

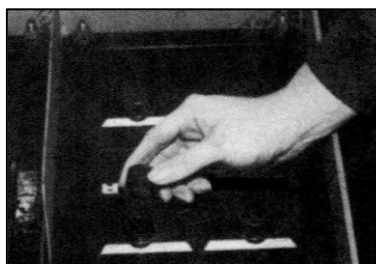
5.3.6 Check the Electrolyte Level

Some batteries are not maintenance-free, and their lifespan needs to be monitored. Refer to the instructions on the battery for details. Replace the battery promptly when its lifespan expires.

Some batteries require the addition of special electrolyte or distilled water; therefore, the electrolyte level needs to be checked.

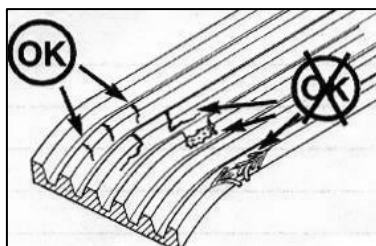
- Remove the filler cap daily and check the electrolyte level. The electrolyte level should be at the bottom of the filler neck. If the level is low, add electrolyte as required.
- Replace the filler cap.

Note: Do not use drinking water instead. Drinking water contains various trace elements that can adversely affect the battery.



5.3.7 Inspect the Transmission Belt

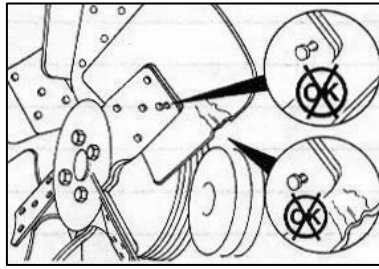
Visually inspect the drive belt daily. Check for crisscrossing cracks. Transverse cracks along the width of the belt are permissible. However, longitudinal (along the length of the belt) and transverse through cracks are not allowed. Replace the belt if it is worn or shows signs of material peeling.



5.3.8 Check the Cooling Fan

Visually inspect the fan daily for cracks, loose rivets, loose blades, and bent blades. Ensure the fan is securely installed. Tighten bolts or replace damaged fans if necessary.

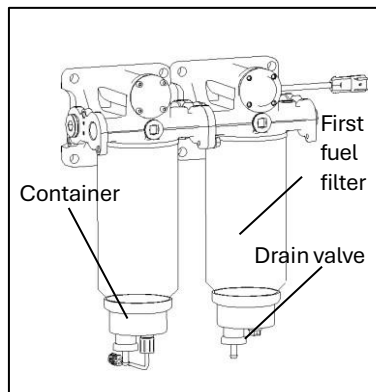
Warning: Damaged fan blades can cause serious injury. Never drag or pry the fan and never use the fan to rotate the diesel engine crankshaft.



5.3.9 Remove Water and Sediment from the Fuel Filter.

The fuel pre-filter has an oil-water separation function. It is essential to stop the machine and drain the water. To drain, loosen the drain valve to expel water and sediment until clean fuel flows out, then tighten the valve. Do not overtighten; a firm feel is sufficient.

- Fuel pre-filter with water level sensor: When the water level in the fuel pre-filter's water reservoir reaches a certain height, the water level sensor sends a signal to the water level indicator light in the driver's cab, reminding the driver to drain the water in time.
- Fuel pre-filter without water level sensor: Check the water cup below the fuel pre-filter daily for any water accumulation. If water is present, drain it.



5.3.10 Inspect the Diesel Engine Wiring Harness

Check the condition of the electrical control system wiring and visually inspect the wiring harness for signs of breakage, looseness, wear, exposure, or burning.

5.3.11 Inspect the Intake System

Check the intake hose for cracks or perforations, and ensure the clamps and bolts are secure. Replace the intake hose if it is malfunctioning. Tighten the clamp screws if the clamps are loose, and tighten the bolts if they are loose, to ensure the intake system is leak-free.

5.3.12 Check and Adjust Valve Clearance

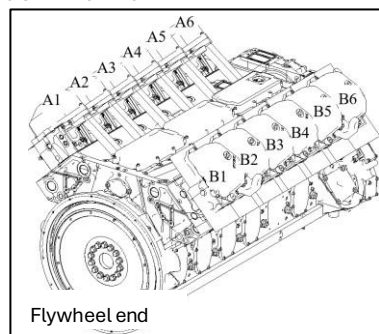
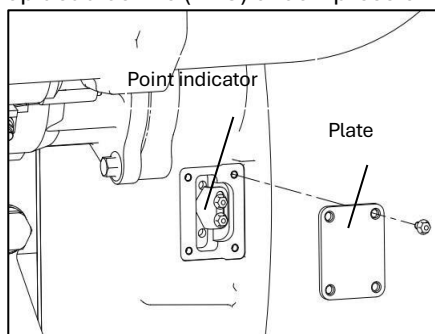
For new diesel engines and those put into service after a major overhaul, the first valve clearance check should be performed within the first 1000 hours of use to promptly adjust and correct any initial changes in valve clearance. During subsequent normal operation, checks and adjustments should be performed according to the maintenance schedule.

Only qualified professional service personnel should perform valve clearance maintenance. For complete clearance check and adjustment procedures, please contact Shanghai Diesel Engine Co., Ltd.'s "Easy Ren" service (400-820-5656) or consult your local service station. Improper operation will reduce diesel engine efficiency and shorten the lifespan of diesel engine components.

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

- Remove the cylinder head cover and related parts.

- Use a crankshaft turning tool to rotate the flywheel counterclockwise (facing the flywheel end) until the piston of cylinder A1 or A6 of the diesel engine is at top dead centre (TDC) of compression. Remove the flywheel housing inspection port cover and observe the pointer position. When the pointer aligns with the "0" mark on the flywheel, it indicates the top dead centre (TDC) of compression for cylinder A1 or A6.



- Check whether the rocker arm of cylinder A1 can be rocked. If it can, it means that the piston of cylinder A1 is at the top dead centre of compression. If it cannot, it means that the piston of cylinder A6 is at the top dead centre of compression.

When the piston of cylinder A1 is at top dead centre during compression, use a micrometre (thickness gauge) to check the intake and exhaust valve clearances for the following cylinder numbers.

Cylinder	A1	A2	A3	A4	A5	B1	B3	B4	B5	B6
Valve	intake\exhaust	intake	exhaust	intake	exhaust	intake	exhaust	intake	intake\exhaust	exhaust

When the piston of No. A6 cylinder is at the TDC on compression stroke, check with a feeler gauge the intake or (and) exhaust valve clearances of the following list cylinder.

Cylinder	A2	A3	A4	A5	A6	B1	B2	B3	B4	B6
Valve	exhaust	intake	exhaust	intake	intake\exhaust	exhaust	intake\exhaust	intake	exhaust	intake

Note: The clearance is correct when some resistance is felt at which the feeler gauge is slipped between a valve bridge and a rocker arm.

- If a valve clearance fails to meet the requirement, loosen the adjusting screw locknut on the corresponding rocker arm, adjust the clearance to the specified value and tighten the locknut to $140 \pm 7 \text{ N} \cdot \text{m}$. Check the valve clearance again and it should not change.

Valve clearance:

Intake $0.45 \pm 0.05 \text{ mm}$

Exhaust..... $0.80 \pm 0.05 \text{ mm}$

Mark a sign on the damper and rotate the crankshaft for a circle (360°). Follow the same steps to adjust the rest intake and exhaust valve clearance

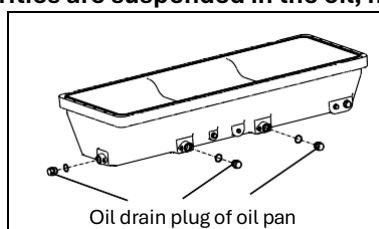
- Install the valve cover. Check the valve cover seal and gasket and replace them if necessary. Tighten the cover bolts diagonally and alternately in two times with a tightening torque of $45 \pm 4 \text{ N} \cdot \text{m}$.
- Install other components.

5.3.13 Change the 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.

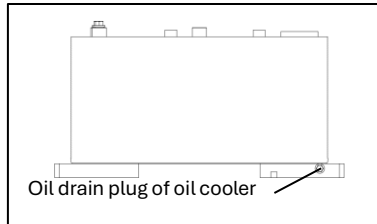
- Stop the diesel engine when the coolant temperature reaches 60°C . Remove the drain plug from the oil pan, discard the gasket, and drain all the engine oil.

Note: 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, 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.

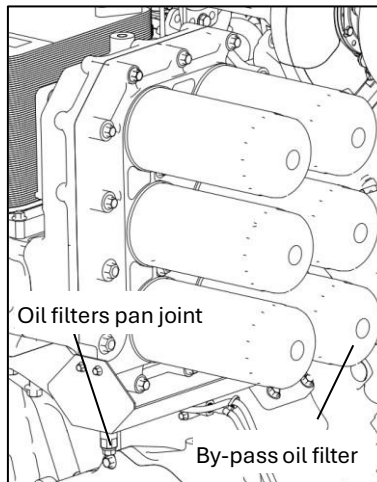


- When the diesel engine reaches its first 250 hours of operation, during the first maintenance, the oil in the oil cooler must be changed. Remove the drain plug from the oil cooler, discard the gasket, and drain all the oil from the oil cooler.

Note: The oil change in the oil cooler is only performed during the first 250-hour maintenance; it does not need to be changed again during subsequent regular maintenance.



- Clean the drain plug mounting surface, use a new gasket, and install the drain plug. The tightening torque for the oil pan drain plug is 150 ± 15 N·m, and the tightening torque for the oil cooler drain plug is 22 ± 3 N·m.
- There is an oil tray below the oil filter. Before removing the oil filter, remove the plug at the oil tray interface and install a hose to guide the waste oil to a suitable container. Clean the outer surface of the oil filter, use the filter wrench shown in the figure to remove the oil filter and discard it. This model of diesel engine has 6 oil filters, all of which must be replaced simultaneously.
- Clean the sealing surface of the filter seat, ensuring no old O-rings remain. Use a new gasket and install the plug at the oil tray interface.



- Before installing a new oil filter, apply a thin layer of petroleum jelly or clean engine oil to the sealing surface of the sealing ring to form a lubricating film. Because the filter is horizontally mounted, do not fill the filter cavity with oil before installation. The oil filter in the lower right corner is a bypass filter, different from the other five; pay attention during installation.
- Tighten the filter by hand until the sealing ring contacts the filter housing mounting surface, then use the filter wrench shown in the diagram to tighten it to 75 N·m. Place a thin cloth between the tool and the filter during use to prevent the tool from scratching the filter surface.
- Open the filler cap and inject clean engine oil into the diesel engine.



- At the first 250-hour service, after draining the oil from the oil cooler, it is recommended to add 288L of engine oil. At this point, the oil level in the oil pan will be higher than the mark on the dipstick. However, after the diesel engine is started and running, some oil will enter and remain in the oil cooler. The oil level in the oil pan will return to normal.

after the engine is stopped. At the scheduled 500-hour or 12-month (whichever comes first) service, add engine oil to near the mark on the dipstick (high oil level mark).

Oil pan capacity (L) (Oil dipstick “high - low”)	275–195
Recommended oil filling volume for the first maintenance 250h(L)	288

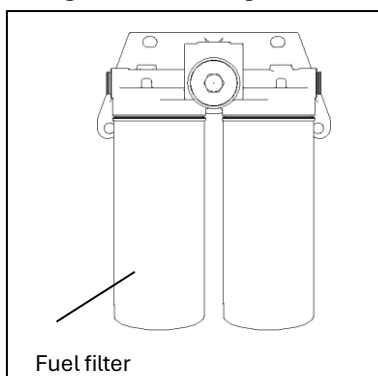
- Start the pre-supply oil pump to fill the oil filter and oil cooler with oil and bring the oil pressure in the main oil passage of the diesel engine to 100 kPa. Note that the continuous operation time of the electric pre-supply oil pump should not exceed 120 seconds, and the interval between each start must be greater than 5 minutes. Then, following the normal starting procedure in 4.5.1, start the diesel engine and let it idle, checking for leaks in the oil filter and drain plug.
- Stop the engine and wait approximately 20 minutes to allow the oil sufficient time to flow back to the oil pan, then check the oil level. If necessary, add oil to near the mark on the dipstick (high oil level mark).
- Install the filler cap.

5.3.14 Replace the Fuel Filter (Fine Filter)

- Stop the engine.

Note: Do not replace the fuel filter element while the diesel engine is running.

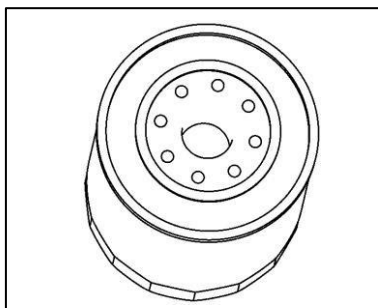
- Clean the outer surface of the fuel filter element, remove the fuel filter with tools, and discard it.
- Clean the area around the fuel filter housing and the sealing surface of the housing, ensuring no old O-rings remain.



- Before installing a new fuel filter, inject clean fuel through the eight small holes around the filter to fill the filter cavity, with the fuel level 3–15 mm below the bottom of the threaded hole. Apply a thin layer of petroleum jelly or clean engine oil to the O-ring seal surface to form a lubricating film.

Note: Do not inject fuel through the hole in the centre of the filter.

- Manually rotate the filter until the seal contacts the filter mounting surface, then tighten it with a tool by 45 ± 5 N·m or 3/4 to 1 turn.



5.3.15 Replace the Fuel Filter (Coarse Filter)

The fuel pre-filter is also a screw-in type, and its replacement procedure is the same as that for the fuel fine filter. First, remove the water cup, then replace the filter.

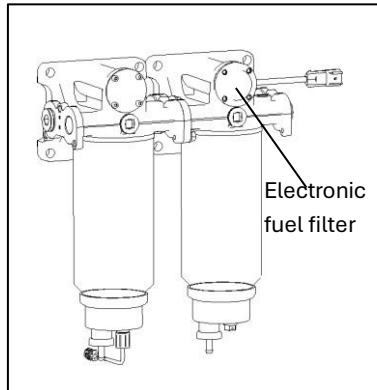
5.3.16 Fuel System Pump Venting

After replacing the fuel filter (fine filter, coarse filter) on a diesel engine, air will enter the fuel system. The following steps are required to bleed the low-pressure fuel line:

- Bleeding the Low-Pressure Fuel Line

- For models equipped with an electric fuel coarse filter, start operating the electric pump when the ignition switch is in the ON position. The electric pump will run for 3 minutes to bleed the air and will automatically stop after 3 minutes.

Note: If fuel is not added in time, causing air to enter the fuel system, or if other factors cause air in the low-pressure fuel system, the air must be bled.

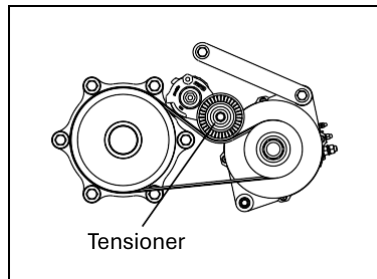


5.3.17 Inspect the Intercooler and its Piping.

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 between the intercooler's inlet and outlet pipes and the inlet and outlet water pipes for breaks or perforations, and for loose clamps. If any are found, replace the hoses and tighten the clamps.

5.3.18 Inspect the Transmission Belt Tensioner.

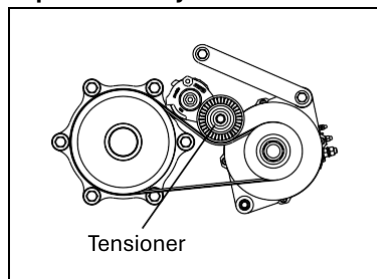
- Remove the protective cover, rotate the tensioner counterclockwise, and remove the drive belt. Rotate the tensioner pulley to check for jamming or radial/axial movement, thus determining if the tensioner bearing surface is scratched or worn; swing the tensioner arm to check if its spring is functioning properly.
- Install the drive belt, then visually inspect and adjust to ensure the belt centre is centred on each pulley.
- Install the protective cover.



5.3.19 Replace the Transmission Belt

- Remove the protective cover, rotate the tensioner counterclockwise, remove the drive belt, replace it with a new belt, and reinstall the protective cover.

Note: After replacing the belt, visually inspect and adjust it to ensure the belt centre is centred on each pulley.



5.3.20 Replace the Seals of the AC Pre-supply Oil Pump.

Disconnect the power supply to the AC pre-supply oil pump, replace the gasket at the AC pre-supply oil pump line or joint, install a new gasket and tighten to the specified torque. Start the electric pre-supply oil pump and check for leaks.

5.3.21 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.

5.3.22 Inspect the Vibration Dampers

Check the shock absorbers for leaks of damping fluid (silicone oil) and for any surface sagging. Inspect the thickness of the shock absorbers to determine if they are deformed. If any of these problems occur, the shock absorbers need to be replaced.

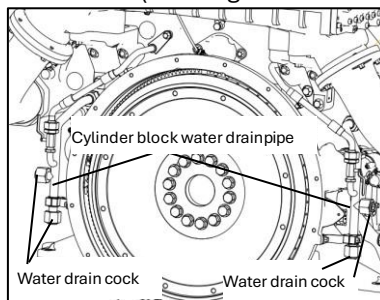
5.3.23 Replace the Coolant and Clean the Cooling System.

To ensure the cooling and corrosion prevention effects of the diesel engine coolant, the coolant must be replaced, and the cooling system cleaned every 4000 hours or 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 be slowly loosened to release the cooling system pressure.

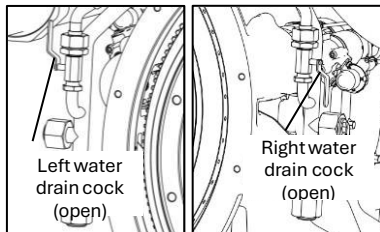
Warning: The coolant contains alkaline rust inhibitors; avoid contact with skin and eyes to prevent personal injury.

- 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 (both high and low temperature cooling systems must be drained).

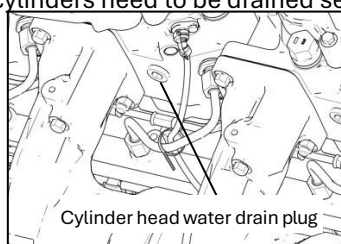


- Loosen the drain plug on the engine block drain hose of the diesel engine (use a wrench to hold the corresponding hexagonal head of the hose to prevent bending), loosen the drain valve (the drain valve handle is open when vertical; it is closed when horizontal and pointing towards the front of the engine); loosen the drain plug on the high-temperature water pump. Drain all the coolant from the diesel engine's high-temperature cooling system.

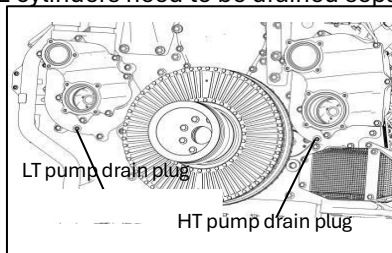
Note: Except for releasing the coolant, the drain valve on the engine block drain hose should be normally closed, especially when the engine is running.



- Loosen the drain plug on the diesel engine cylinder head to drain the high-temperature system coolant remaining in the diesel engine cylinder head (all 12 cylinders need to be drained separately).



- Loosen the drain plug on the diesel engine cylinder head to drain the high-temperature system coolant remaining in the diesel engine cylinder head (all 12 cylinders need to be drained separately).



- Clean the cooling system according to the following steps:
- Install and tighten all drain valves, drain switches, 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 corrosive cleaning agents, as this will damage aluminium parts.

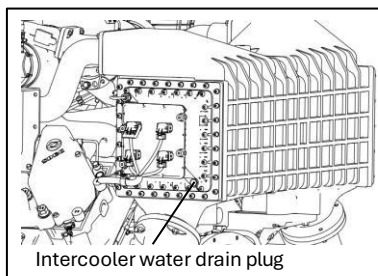
Note: During the filling process, air must be expelled from the coolant chamber, and the solution should be added slowly to prevent air lock. The solution should be added to the bottom of the radiator filler neck. Wait 3-5 minutes to allow air to be fully expelled.

- Start the diesel engine and run it for 5 minutes after the cleaning solution temperature reaches above 80°C. Then stop the engine and drain the cleaning solution from the cooling system.

Note: Do not install the pressure cap during the entire cooling system cleaning process and run the diesel engine without the cap on.

- Add clean water to the cooling system. Δ Note: When adding clean water, pour it in slowly to prevent air lock. Add water to the bottom of the radiator filler neck and wait 3-5 minutes to allow air to be expelled.
- Start the diesel engine and run it for 5 minutes after the water temperature reaches above 80°C. Then stop the engine and drain all the 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 all drain valves on the radiator and drain switches on the diesel engine (the drain switch handle on the engine block drainpipe should be horizontal and pointing towards the front of the engine to be in the closed position). Use new washers. Tighten the drain plug on the engine block drain pipe of the diesel engine to 50 N·m (when tightening, use a wrench to hold the corresponding hexagonal head of the pipe to prevent the pipe from bending), tighten the drain plug on the cylinder head of the diesel engine to 75 N·m, tighten the drain plug on the intercooler of the diesel engine to 25 N·m, and tighten the drain plugs on the high and low temperature water pumps of the diesel engine to 35 N·m. Before installing the drain plug on the diesel engine, apply Loctite 567 or Tianshan 1567F sealant to the threads of the plug.

Add coolant:

The engine coolant capacity/ L	High temperature cooling system	119
	Low temperature cooling system	56

Note: The total amount of coolant added to the entire cooling system should be based on the equipment manufacturer's specifications.

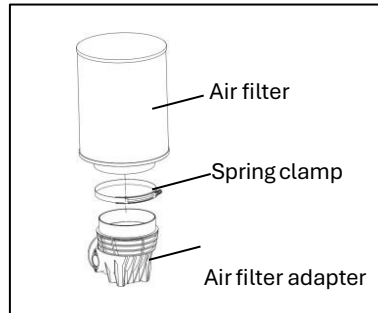
Note: When adding coolant, pour it in slowly to prevent air lock. Add coolant to the bottom of the radiator filler neck or as required by the equipment manufacturer and wait 3-5 minutes to allow air to escape.

- Install the pressure cap, start the diesel engine, and continue until the coolant temperature reaches 80°C. 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°C, then open the pressure cap and recheck the coolant level. If necessary, add an appropriate amount of coolant.

5.3.24 Replace the Air Filter

- Loosen the air filter spring clamp.
- Remove the air filter and discard it.
- Ensure there are no obstructions in the air filter connection pipe and clean it.
- Install a new air filter and tighten the spring clamp to a torque of $8 \pm 1 \text{ N}\cdot\text{m}$.

Note: Never start the diesel engine without an air filter to prevent premature engine wear.



6. PRECAUTIONS FOR USING THE ELECTRICAL CONTROL SYSTEM

6.1 Precautions for Using Electronically Controlled Diesel Engines

- **Collision:** During unpacking, transportation, and installation, users should prevent collisions with the sensors and wiring harness connectors on the diesel engine. These parts are made of plastic or high-pressure seals and are easily damaged.
- **Cleaning:** During diesel engine cleaning, users must not rinse the sensors and wiring harness connectors with water and especially must not spray them directly with a high-pressure water gun. This can easily cause internal short circuits, burning out the sensors and ECU.
- **Fuel System Exhaust:** See 5.3.16
- **Moisture, Water, Oil, and Heat Protection:** During wiring harness installation, users should place the connectors in a dry, waterproof, oil-proof, and heat-proof location. Prevent moisture and foreign objects from entering, which could create a source of ignition, leading to short circuits and burnout.
- **Welding Prevention:** When using electric welding, gas welding, or other welding methods on the engine, users must disconnect the ECU from the power supply or remove the ECU to prevent excessive current from burning out the ECU and sensors.
- **Connection Check:** Users must check the connections of the ECU, sensors, and wiring harness terminals to prevent foreign objects from entering the terminals; prevent loose connections by checking that the terminals are securely connected; prevent short circuits by avoiding short circuits between wiring harness terminals and between wiring harness terminals and ground. Ensure equipment and personal safety.
- **Prevention of Mis operation:** When the diesel engine is running, prevent sudden disconnection of the battery. Any malfunction must be checked by stopping the engine and disconnecting the power.

6.2 ECU

- Before performing welding operations on the engine, the ECU connector harness must be disconnected.
- When connecting the ECU power cable to the battery, always verify the battery's positive and negative terminals to ensure correct connection and avoid damaging the electronic control unit (ECU).
- Always disconnect the ECU power supply before plugging or unplugging the ECU connector; otherwise, related ECU components may be damaged.
- When plugging or unplugging the ECU connector, ensure proper insertion and removal. Loose insertions, forced insertions, or improper removal can damage the ECU pins.
- The ECU requires a stable power supply. For the alternator on the engine, never use inferior products. Inferior alternators can generate abnormal voltages when the battery fails, causing fatal damage to the ECU.
- During engine assembly, if it is necessary to perform power-on tests on other electrical components of the engine, the ECU connector harness must be disconnected; otherwise, there is a risk of damaging the ECU.

- If the ECU is in a wet environment for a short period of time, you must ensure that the wiring harness connectors are securely connected to prevent water from flowing into the controller through the connector ends.

7. DIESEL ENGINE TROUBLESHOOTING GUIDE

7.1 Overview

- When a diesel engine malfunctions, the operator should remain calm and meticulous, promptly analyzing the characteristics of the fault and determining its cause. Generally, the following principles should be followed:
- When abnormal phenomena occur during diesel engine operation, a comprehensive assessment using "visual inspection, listening, touching, and smelling" can be used to determine which part or system is malfunctioning. "Visual inspection": Observe the readings of various instruments, the colour of the exhaust smoke, and changes in coolant temperature and oil pressure. "Listening": Use a thin metal rod or a wooden-handled screwdriver as a "stethoscope" to touch the corresponding parts of the diesel engine's exterior, listening for the sounds produced and their changes. "Touching": Use your fingers to check the working condition of parts such as the valve train and the vibration of the diesel engine. "Smelling": Use your sense of smell to detect any abnormal odours from the diesel engine.
- When a diesel engine suddenly malfunctions or the cause of the malfunction has been determined, and the malfunction will affect the normal operation of the diesel engine, it should be stopped immediately for inspection. For malfunctions where the cause cannot be immediately identified, the diesel engine can be run at low speed under no-load first, and then the cause can be observed and analysed to avoid more serious accidents. 3) When a major fault is diagnosed or the diesel engine suddenly stops on its own, it should be disassembled, inspected, and repaired immediately.
- The causes and troubleshooting methods for each fault, especially major ones, should be recorded for future reference.
- The common diesel engine faults and troubleshooting methods listed in this chapter are for operator reference only. In actual work, operators should flexibly apply these methods based on specific local conditions and practical experience to identify the internal and external causes of the fault and address them promptly.

7.2 Troubleshooting Diesel Engines

The table below lists some typical fault modes in diesel engine use. The subsequent fault table lists the fault characteristics, possible causes, and troubleshooting methods. Users can troubleshoot simple faults themselves. For complex faults, please 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	Engine will not start	8	Oil pressure too low
2	Engine power output low	9	Oil pressure too high
3	Abnormal noise and vibration	10	Oil consumption too much
4	Fuel consumption too much	11	Coolant temperature above normal
5	Black smoke	12	Coolant temperature below normal
6	White smoke	13	Unsteady idle speed
7	Blue smoke	14	Engine cannot reach rated speed with load

1. Diesel Engine cannot Start

	Cause	Correction
Step 1	Insufficient fuel in the fuel tank Fuel waxing due to cold weather	Add fuel Select the appropriate fuel specified in this manual according to the operating environment.
Step 2	The electronic control unit (ECU) is not powered	Check the connection between the electronic control unit (ECU) and the wiring harness.
Step 3	The starting speed is too low	Check the battery voltage and inspect the starter motor and wiring connections for looseness or corrosion.
Step 4	Error codes are displayed	Contact Shanghai "Easy+People" Call Center
Step 5	Camshaft sensor and crankshaft sensor signal errors	Have a professional technician inspect the camshaft sensor, crankshaft sensor, signal disk, and wiring harness, and replace them if necessary.
Step 6	Air in the fuel system Loose low-pressure fuel line connector	Inspect the source of the leak. If necessary, tighten the fuel connectors and fuel line clamps, or replace the fuel

	Clogged fuel filter or fuel suction line	connectors and fuel lines. Then pump fuel into the fuel system to bleed the system. Inspect the low-pressure fuel lines and tighten all low-pressure line connectors. Replace the fuel filter or fuel suction line.
Step 7	Signal error occurs for rail pressure sensor	Have a professional technician inspect the common rail conduit and wiring harness and replace them if necessary.
Step 8	Injector malfunctions: Injector assembly seized Electronic injector solenoid valve damaged, not working, or not receiving power.	Have a professional mechanic inspect the fuel injectors and wiring harness and replace them if necessary.
Step 9	Fuel injection pump malfunctions: The fuel injection pump solenoid valve is damaged and not working or not energized. The fuel delivery pump is faulty and does not supply fuel. The plunger assembly is seized.	Have a professional mechanic inspect the fuel injection pump and wiring harness and replace them if necessary.
Step 10	Insufficient cylinder compression pressure: Excessive wear of piston rings or cylinder liners Incorrect valve clearance or valve leakage Leakage at the cylinder head-to-block mating surface	Replace piston rings; replace cylinder liners as needed for wear. Check and adjust valve clearance; check the sealing of valve springs, valve guides, and valve seats; repair and grind if sealing is poor; check if valve tappet fixing bolts are loose. Tighten cylinder head bolts to the specified torque or replace cylinder head gaskets.
Step 11	An internal mechanical fault in the diesel engine prevented the crankshaft from rotating.	If the crankshaft still cannot turn after disconnecting the driven equipment, it should be manually rotated to check whether the crankshaft or connecting rod bearings are seized, the piston is stuck, or the camshaft timing gear is incorrectly installed.

2. Insufficient Diesel Engine Power

	Cause	Correction
Step 1	Diesel engine overload exceeds the specified value	Reduce the load to bring it within the specified range
Step 2	Fuel specifications do not meet usage requirements or fuel quality is poor	Use the fuel specified in this manual
Step 3	Error codes are displayed.	Contact Shanghai "Easy+People" Call Center
Step 4	Camshaft sensor or crankshaft sensor signal error	Have a professional technician inspect the camshaft sensor, crankshaft sensor, signal disk, and wiring harness, and replace them if necessary.
Step 5	Rail pressure sensor signal error	Have a professional technician inspect the common rail conduit and wiring harness and replace them if necessary.
Step 6	Intake pressure temperature sensor or coolant temperature sensor signal error	Have a professional technician inspect the intake air pressure and temperature sensor, coolant temperature sensor, and wiring harness, and replace them if necessary.
Step 7	Air in the low-pressure fuel system Clogged fuel filter or fuel suction line	Inspect the source of the leak. If necessary, tighten the fuel connector and fuel line clamps, or replace the fuel connector and fuel line. Then pump fuel into the low-pressure fuel system to bleed the system. Replace the fuel filter or fuel suction pipe.
Step 8	Intake system leakage	Check the intake manifold, intercooler, and their piping connections for looseness or leaks.

	Intake system resistance exceeds specified value	Check the intake system resistance; replace the air filter element if necessary.
Step 9	Exhaust leakage from the exhaust manifold or turbocharger Exhaust system resistance does not meet specifications.	Check the exhaust pipe and booster pressure and eliminate the source of leakage. Check the exhaust system resistance, and contact the Shanghai Diesel Engine Co., Ltd. "Easy+Human" call centre if necessary.
Step 10	Fault on turbocharger	Check the turbocharger; if necessary, contact the Shanghai "Easy+Human" call centre.
Step 11	Ambient temperature is too high Engine oil and coolant temperatures are very high, and exhaust temperature is also greatly increased.	If the ambient temperature is too high, improve ventilation and temporarily strengthen cooling measures. Inspect the oil cooler and radiator, remove scale; check if the diameter of relevant pipes is too small.
Step 12	Poor contact of the solenoid valve in the electronic fuel injector Air leakage from the injector hole in the cylinder head or damage to its copper gasket	Have a professional technician inspect the electronic fuel injector and wiring harness and replace them if necessary. Disassemble and inspect the components and replace any damaged parts.
Step 13	Fuel injection pump failure: Insufficient fuel supply from the fuel pump Wear of the plunger assembly	Have a professional mechanic inspect the fuel injection pump and wiring harness and replace them if necessary.
Step 14	Insufficient cylinder compression pressure: Excessive wear of piston rings or cylinder liners Incorrect valve clearance or valve leakage Leakage at the cylinder head-to-block mating surface	Replace piston rings; replace cylinder liners as needed based on wear. Check and adjust valve clearance; check the sealing of valve springs, valve guides, and valve seats; repair and grind any poor seals; check valve tappet fixing bolts for looseness. Tighten cylinder head bolts to the specified torque or replace cylinder head gaskets.

3. The Diesel Engine Makes Abnormal Noises or Vibrates Excessively During Operation

	Cause	Correction
Step 1	Loose bolts or nuts securing the drive pulley or shock absorber Damaged fan or accessories Damaged shock absorber	Tighten bolts or nuts Inspect/replace faulty parts Inspect/replace shock absorbers
Step 2	Insufficient belt tension or excessive load	Check the tensioner pulley's operation and replace it if necessary; check that all pulleys rotate freely
Step 3	Fuel specifications not meeting usage requirements or poor fuel quality	Use the fuel specified in this manual
Step 4	Air enters the fuel system	Check for leaks in the fuel suction line and pump fuel into the fuel system to bleed the system.
Step 5	Intake and exhaust leaks	Check the intake and exhaust systems for leaks, tighten any loose parts, and replace any parts if necessary
Step 6	Noise from the turbocharger	Check if the impeller and turbine are in contact with the casing
Step 7	Excessive clearance between intake and exhaust valves Damaged valve springs	Inspect and adjust valve clearance Replace damaged valve springs
Step 8	Clearance between piston pin and small end bushing of connecting rod is too big	Replace the piston or, depending on wear, the cylinder liner
Step 9	Too big gear backlash due to tooth wear	Check the backlash and replace the gears, if necessary, due to wear

4. Excessive Fuel Consumption

	Cause	Correction
--	--------------	-------------------

Step 1	Fuel specifications not meeting usage requirements or poor fuel quality	Use the fuel specified in this manual.
Step 2	Fuel gauge malfunction	Check the fuel gauge and replace it if necessary
Step 3	Excessive intake or exhaust resistance	Inspect the intake and exhaust systems, especially the air filter and exhaust muffler. If necessary, contact the Shanghai "Easy+Human" call center.
Step 4	Fuel leak	Check the fuel system lines for leaks; tighten any loose connections.
Step 5	Poor sealing of intake or exhaust valves	Check and adjust valve clearance
Step 6	Incorrect matching between drive system and diesel engine	Check the drive system and confirm that the diesel engine and drive system parts are correct

5. The Diesel Engine is Emitting Black Smoke

	Cause	Correction
Step 1	Diesel engine overload exceeds the specified value	Reduce the load to bring it within the specified range
Step 2	Fuel specifications not meeting usage requirements or poor fuel quality	Use the fuel specified in this manual
Step 3	Error codes are displayed	Contact Shanghai "Easy+People" Call Centre
Step 4	Intake pressure and temperature sensor signal error	Check the intake pressure and temperature sensor and wiring harness and replace them if necessary
Step 5	Coolant temperature sensor signal error	Check the coolant temperature sensor and wiring harness and replace them if necessary
Step 6	Intake system resistance exceeds specified value	Check the intake system resistance and replace the air filter element if necessary
Step 7	Poor contact of the solenoid valve in the electronic fuel injector	Have a professional technician inspect the electronic fuel injectors and wiring harness, and replace them if necessary
Step 8	Incorrect valve clearance or poor valve sealing can lead to valve leakage and deteriorated combustion.	Adjust valve clearance, inspect sealing cone surface, and eliminate defects.

6. The Diesel Engine is Emitting White Smoke

	Cause	Correction
Step 1	The diesel engine is in a cold state	Warm up the diesel engine
Step 2	Water in the fuel system	Inspect the fuel-water separator and replace it if necessary Also drain any water from the fuel system
Step 3	Fuel that does not meet usage requirements or poor quality	Use the fuel specified in this manual
Step 4	Error codes are displayed	Contact Shanghai "Easy+People" Call Centre
Step 5	Poor contact of the solenoid valve in the electronic fuel injector	Have a professional technician inspect the electronic fuel injectors and wiring harness, and replace them if necessary
Step 6	Cylinder head crack allowed coolant to enter the cylinder	Check for condensation in the exhaust; replace the cylinder head if necessary

7. The Diesel Engine is Emitting Blue Smoke

	Cause	Correction
Step 1	Air filter clogged, air intake obstructed	Replace the air filter element according to 5.3.
Step 2	Too much engine oil in the oil pan	Add engine oil according to the marks on the dipstick, but do not exceed the high oil level mark.
Step 3	The turbocharger oil seal is damaged, allowing engine oil to enter the intake manifold and subsequently the cylinders	Check the intake manifold for engine oil; if necessary, inspect or replace the turbocharger.

Step 4	Damaged valve stem seals caused engine oil to leak into the combustion chamber	Replace the damaged valve stem seal
Step 5	Excessive clearance between the valve and the guide causes engine oil to be drawn into the combustion chamber	Repair cylinder head, replace guide pipes; replace valves
Step 6	Piston rings may be stuck or excessively worn, resulting in insufficient elasticity; the piston rings may also be installed with the chamfered direction reversed, allowing engine oil to enter the combustion chamber	Disassemble and inspect the piston rings, and replace them if necessary
Step 7	Prolonged operation under low load (below 40% of rated power) results in a larger clearance between the piston and cylinder liner, making it easier for engine oil to enter the combustion chamber	Increase the load appropriately; select appropriate power when matching components.

8. Low Oil Pressure

	Cause	Correction
Step 1	Engine oil temperature higher than specified value	See the fault diagnosis "Coolant temperature higher than normal"
Step 2	Error codes are displayed	Contact Shanghai "Easy+People" Call Centre
Step 3	Low engine oil level	Check the engine oil level and adjust it to the specified range
Step 4	Oil pressure gauge malfunction Oil pressure sensor malfunction	Check the oil pressure gauge and replace it if necessary. Check the oil pressure sensor and wiring harness and replace them if necessary.
Step 5	Engine oil dilution Engine oil specifications do not meet requirements; viscosity is too low	Investigate the cause and change the engine oil. Check the engine oil specification and replace the engine oil and oil filter if necessary.
Step 6	Oil cooler malfunction	Inspect the oil cooler and replace it if necessary
Step 7	Oil filter clog	Change the engine oil and oil filter
Step 8	Oil line leak	Check the oil lines and eliminate the source of the leak
Step 9	Oil pump damaged or jammed due to improper assembly	Reinstall the oil pump, and replace it if necessary
Step 10	Severe oil leakage is observed at the crankshaft bearing, crankshaft front and rear oil seals, camshaft bearing, connecting rod bearing, and/or rocker arm shaft and rocker arm.	Inspect the wear of each bearing; replace the corresponding parts if the wear value exceeds the specified range

9. Oil Pressure too High

	Cause	Correction
Step 1	Error codes are displayed	Contact Shanghai "Easy+People" Call Centre
Step 2	Oil pressure gauge malfunction Oil pressure sensor malfunction	Check the oil pressure gauge and replace it if necessary Check the oil pressure sensor and wiring harness and replace them if necessary
Step 3	The diesel engine is operating at too low a temperature, and the engine oil viscosity is too high	Warm up the diesel engine
Step 4	Lubricating oil specifications do not meet requirements	Replace the lubricating oil as specified in the cost manual, and replace the oil filter

10. Excessive Engine Oil Consumption

	Cause	Correction
Step 1	Diesel engine external oil leak	Check the external piping, gaskets, oil seals, etc. of the diesel engine for leaks, and replace any damaged parts
Step 2	Idle time is too long	Shorten idling time

Step 3	Oil specifications do not meet requirements	Check the engine oil specification. Use the correct specification engine oil and change the engine oil and oil filter
Step 4	The crankcase pressure is too high, forcing engine oil out of the oil-gas separator	Check for traces of oil around the oil-gas separator; if necessary, contact the Shanghai "Easy+Human" call centre
Step 5	Turbocharger oil leaking into the intake or exhaust system	Check the compressor inlet, air connection pipe, and turbine outlet for oil
Step 6	Piston rings that are stuck or excessively worn, or cylinder liners that are excessively worn, allow engine oil to enter the combustion chamber and combustible gas to enter the crankcase	Replace piston rings, and replace cylinder liners if necessary
Step 7	Damaged valve stem seal Excessive clearance between valve and guide	Replace the damaged valve stem seals. Repair the cylinder head, replace the guide pipes; replace the valves.

11. Coolant Temperature is Higher than Normal

	Cause	Correction
Step 1	Diesel engine overload exceeds the specified value	Reduce the load to bring it within the specified range
Step 2	Low coolant level	Check the coolant level and for leaks, fix the leaks, and add coolant to the specified level
Step 3	Radiator fins clogged or damaged	Inspect the radiator fins and repair or replace them if necessary
Step 4	Coolant hose collapsed and leaked	Inspect the hose and replace it if necessary
Step 5	The water pump or fan speed does not meet the requirements	Check the water pump's operation; replace if necessary. Adjust the fan drive belt tension to the specified requirements; replace if necessary
Step 6	Water pump failure	Inspect the water pump and replace it if necessary
Step 7	Thermostat malfunction	Check the thermostat and replace it if necessary
Step 8	Engine oil level too high or too low	Check the engine oil level and adjust it to the specified range
Step 9	Radiator pressure cap malfunction, low pressure calibration	Check the pressure cap function; if necessary, contact Shanghai's "Easy+Human" call centre
Step 10	Coolant temperature gauge malfunction Coolant temperature sensor malfunction	Check the coolant temperature gauge and replace it if necessary. Check the coolant sensor and wiring harness and replace them if necessary.

12. Coolant Temperature is Lower than Normal

	Cause	Correction
Step 1	The radiator louvers are stuck at their maximum opening	Inspect the blinds and replace them if necessary
Step 2	Too much cold air flowing through the radiator	Visually inspect the fan's operation; contact Shanghai if necessary "Easy+People" Call Centre
Step 3	Low ambient temperature and low operating load	Increase the load appropriately
Step 4	Coolant temperature gauge malfunction Coolant temperature sensor malfunction	Check the coolant temperature gauge and replace it if necessary. Check the coolant sensor and wiring harness and replace them if necessary.
Step 5	Thermostat is not flexible or damaged	Replace the thermostat

13. Unstable Diesel Engine Idling Speed

	Cause	Correction
Step 1	Error codes are displayed	Contact Shanghai "Easy+People" Call Centre

Step 2	Diesel engine temperature too low	Heat up the diesel engine
Step 3	Camshaft sensor or crankshaft sensor signal error	Have a professional technician inspect the camshaft sensor, crankshaft sensor, signal disc, and wiring harness, and replace them if necessary
Step 4	Air in the low-pressure fuel system Clogged fuel filter or fuel suction line	Inspect the low-pressure lines, eliminate the source of leaks, and tighten or replace joints and low-pressure fuel lines if necessary. Then pump fuel into the low-pressure fuel system to bleed the system. Replace the fuel filter or fuel suction line.
Step 5	Poor contact of the solenoid valve in the electronic fuel injector Air leakage from the injector hole in the cylinder head or damage to its copper gasket	Have a professional technician inspect the electronic fuel injector and wiring harness and replace them if necessary. Disassemble and inspect the components and replace any damaged parts.
Step 6	Shock absorber damage	Check/replace shock absorbers
Step 7	Intake system leakage Intake system resistance exceeds specified value	Check the intake manifold, intercooler, and their piping connections for looseness or leaks. Check the intake system resistance; replace the air filter element if necessary.
Step 8	Diesel engine support problem	Check diesel engine mounts and shock absorbers
Step 9	Incorrect valve clearance or valve leakage	Check and adjust valve clearance; check the sealing of valve springs, valve guides, and valve seats; repair and resurface any poor seals; check valve tappet retaining bolts for looseness
Step 10	ECU malfunction	Have a professional mechanic inspect the ECU and wiring harness, and replace them if necessary

14. The Diesel Engine cannot Reach its Rated Speed Under Load

	Cause	Correction
Step 1	Diesel engine overload exceeds the specified value	Reduce the load to bring it within the specified range
Step 2	Tachometer malfunction	Check the tachometer and wiring harness, and replace them if necessary
Step 3	High fuel inlet resistance	Inspect the fuel filter and fuel intake line; replace the filter if necessary
Step 4	Intake system leakage Intake system resistance exceeds specified value	Check the intake manifold, intercooler, and their piping connections for looseness or leaks. Check the intake system resistance; replace the air filter element if necessary
Step 5	Turbocharger failure	Have a professional repairman inspect the turbocharger; if necessary, contact the Shanghai Diesel Engine Co., Ltd. "Easy+Human" call centre

7.3 Fault Codes and Flash Codes

No.	Fault Description	P-Code	FTB	SPN	FMI
1	5V sensor 1 supply voltage too high	P0641	A3	3509	3
2	5V sensor 1 supply voltage too low	P0641	A2	3509	4
3	5V sensor 2 supply voltage too high	P0651	A3	3510	3
4	5V sensor 2 supply voltage too low	P0651	A2	3510	4
5	5V sensor 3 supply voltage too high	P06B2	0	3511	3
6	5V sensor 3 supply voltage too low	P06B1	0	3511	4
7	5V sensor 4 supply voltage too high	P06B5	0	3512	3

8	5V sensor 4 supply voltage too low	P06B4	0	3512	4
9	The voltage signal of the crank-case pressure sensor is above the upper limit	P1122	F0	516357	19
10	The voltage signal of the crankcase pressure sensor is below the lower limit	P1122	F1	516357	20
11	The main relay 0 inside the ECU is short circuited to the power supply	P0658	11	1485	4
12	Fuel injection control module 1 short circuit to power failure	P062D	F0	2797	19
13	Fuel injection control module 1 short circuit to ground fault	P062D	F1	2797	6
14	Fuel injection control module 2 short circuit to power failure	P062E	F0	2798	19
15	Fuel injection control module 2 short circuit to ground fault	P062E	F1	2798	6
16	Fuel injection control module 3 short circuit to power failure	P062D	F4	2797	20
17	Fuel injection control module 3 short circuit to ground fault	P062D	F5	2797	21
18	Fuel injection control module 4 short circuit to power failure	P062D	F6	2797	22
19	Fuel injection control module 4 short circuit to ground fault	P062D	F7	2797	23
20	Injection control module 5 short circuit to power failure	P062E	F2	2798	20
21	Fuel injection control module 5 short circuit to ground fault	P062E	F3	2798	21
22	Fuel injection control module 6 short circuit to power failure	P062E	F4	2798	22
23	Fuel injection control module 6 short circuit to ground fault	P062E	F5	2798	23
24	The physical range of the internal battery voltage signal of the ECU is too high	P0563	85	114	3
25	The physical range of the internal battery voltage signal of the ECU is too low	P0562	84	114	4
26	Abnormal camshaft signal	P0341	29	4201	2
27	Cooling water temperature above upper limit	P0115	85	110	0
28	The voltage of the intercooler inlet water temperature sensor is higher than the upper limit value	P2182	12	110	21
29	The voltage of the intercooler inlet water temperature sensor is lower than the lower limit value	P2182	11	110	22
30	Cooling water temperature sensor voltage above upper limit value	P0118	12	110	3
31	Cooling water temperature sensor voltage below lower limit value	P0117	11	110	4
32	Abnormal crankshaft signal	P0336	29	4203	2
33	The low end of the first cylinder injector is short circuited to the power supply	P0262	12	651	19
34	Short circuit to ground at the low end of the first cylinder injector	P0262	11	651	6
35	Open circuit in the drive circuit of the first cylinder injector	P0201	13	651	5
36	Short circuit to power at the low end of the 11th cylinder injector	P0211	12	661	19
37	Short circuit to ground at the low end of the 11th cylinder injector	P0211	11	661	6
38	Open circuit in the driver circuit of the 11th cylinder injector	P0211	13	661	5
39	Short circuit to power at the low end of the 12th cylinder fuel injector	P0212	12	662	19

40	Short circuit to ground at the low end of the 12th cylinder fuel injector	P0212	11	662	6
41	Open circuit in the driver circuit of the 12th cylinder fuel injector	P0212	13	662	5
42	The low end of the second cylinder injector is short circuited to the power supply	P0274	12	653	19
43	The low end of the second cylinder injector is short circuited to ground	P0274	11	653	6
44	Open circuit in the driver circuit of the second cylinder fuel injector	P0205	13	653	5
45	Short circuit to power at the low end of the third cylinder fuel injector	P0268	12	654	19
46	Short circuit to ground at the low end of the third cylinder fuel injector	P0268	11	654	6
47	Open circuit in the driving circuit of the third cylinder fuel injector	P0203	13	654	5
48	The low end of the fourth cylinder injector is short circuited to the power supply	P0277	12	652	19
49	The low end of the fourth cylinder injector is short circuited to ground	P0277	11	652	6
50	Open circuit in the drive circuit of the fourth cylinder fuel injector	P0206	13	652	5
51	The low end of the 5th cylinder injector is short circuited to the power supply	P0265	12	655	19
52	Short circuit to ground at the low end of the 5th cylinder injector	P0265	11	655	6
53	Open circuit in the driving circuit of the 5th cylinder injector	P0202	13	655	5
54	The low end of the 6th cylinder injector is short circuited to the power supply	P0271	12	656	19
55	The low end of the 6th cylinder injector is short circuited to ground	P0271	11	656	6
56	Open circuit in the driving circuit of the 6th cylinder fuel injector	P0204	13	656	5
57	The low end of the 7th cylinder injector is short circuited to the power supply	P0280	12	657	19
58	Short circuit to ground at the low end of the 7th cylinder fuel injector	P0280	11	657	6
59	Open circuit in the driving circuit of the 7th cylinder fuel injector	P0280	13	657	5
60	Short circuit to power at the low end of the 8th cylinder injector	P0208	12	658	19
61	Short circuit to ground at the low end of the 8th cylinder injector	P0208	11	658	6
62	Open circuit in the driving circuit of the 8th cylinder injector	P0208	13	658	5
63	Short circuit to power at the low end of the 9th cylinder fuel injector	P0209	12	659	19
64	Short circuit to ground at the low end of the 9th cylinder fuel injector	P0209	11	659	6
65	Open circuit in the driving circuit of the 9th cylinder fuel injector	P0209	13	659	5
66	Short circuit to power at the low end of the 10th cylinder fuel injector	P0210	12	660	19
67	Short circuit to ground at the low end of the 10th cylinder fuel injector	P0210	11	660	6
68	Open circuit in the driver circuit of the 10th cylinder injector	P0210	13	660	5

69	DCDC voltage too high	P062B	F6	1436	3
70	DCDC voltage too low	P062B	F7	1436	4
71	ECU internal temperature too high_ Level 2	P0666	85	516146	15
72	ECU internal temperature too high_ Level 1	P0666	F0	516146	16
73	ECU internal temperature sensor voltage signal above upper limit	P0666	22	516146	3
74	ECU internal temperature sensor voltage signal below upper limit	P0666	21	516146	4
75	ECU's EEPROM erase failed	P1705	4	629	21
76	ECU's EEPROM reading failed	P1703	4	629	19
77	ECU's EEPROM Write failed	P1704	4	629	20
78	Engine overspeed indication	P0219	0	1769	11
79	Atmospheric pressure sensor voltage above upper limit value	P2226	17	108	15
80	Atmospheric pressure sensor voltage below lower limit value	P2226	16	108	17
81	Camshaft signal interference or signal loss fault	P1027	F0	516287	2
82	No camshaft signal detected	P1027	F1	516287	12
83	Excessive deviation between camshaft signal and crankshaft signal	P1027	F2	4203	14
84	Crankshaft signal interference or signal loss fault	P1028	F0	516288	2
85	No crankshaft signal detected	P1028	F1	516288	12
86	Water detection fault in fuel filter	P2264	1	516156	4
87	Fuel pressure below lower limit	P018A	84	135	1
88	Fuel pressure sensor voltage signal above upper limit	P018A	17	135	3
89	Fuel pressure sensor voltage signal below lower limit	P018A	16	135	4
90	Fuel temperature too high	P0168	85	174	0
91	Fuel temperature sensor voltage signal above upper limit	P0168	12	174	3
92	Fuel temperature sensor voltage signal below lower limit	P0168	11	174	4
93	Ignition sequence cylinder 1 injector drive circuit malfunction - low to high short circuit fault	P0261	11	1413	4
94	Ignition sequence cylinder 2 injector drive circuit malfunction - low to high short circuit fault	P0273	11	1415	4
95	Ignition sequence cylinder 11 injector drive circuit fault - low to high short circuit fault	P0211	F1	1423	4
96	Ignition sequence cylinder 12 injector drive circuit malfunction - low to high short circuit fault	P0212	F1	1424	4
97	Ignition sequence cylinder 13 injector drive circuit malfunction - low to high short circuit fault	P1113	F1	1425	4
98	Ignition sequence cylinder 14 injector drive circuit malfunction - low to high short circuit fault	P1114	F1	1426	4
99	Ignition sequence cylinder 15 injector drive circuit malfunction - low to high short circuit fault	P1115	F1	1427	4
100	Ignition sequence cylinder 16 injector drive circuit malfunction - low to high short circuit fault	P1116	F1	1428	4

101	Ignition sequence cylinder 17 injector drive circuit malfunction - low to high short circuit fault	P1117	F1	1429	4
102	Ignition sequence cylinder 18 injector drive circuit fault - low to high short circuit fault	P1118	F1	1430	4
103	Ignition sequence cylinder 19 injector drive circuit malfunction - low to high short circuit fault	P1119	F1	1431	4
104	Ignition sequence cylinder 20 injector drive circuit malfunction - low to high short circuit fault	P1120	F1	1432	4
105	Ignition sequence cylinder 3 injector drive circuit fault - low to high short circuit fault	P0267	11	1416	4
106	Ignition sequence cylinder 4 injector drive circuit fault - low to high short circuit fault	P0276	11	1414	4
107	Ignition sequence cylinder 5 injector drive circuit malfunction - low to high short circuit fault	P0264	11	1417	4
108	Ignition sequence cylinder 6 injector drive circuit malfunction - low to high short circuit fault	P0270	11	1418	4
109	Ignition sequence cylinder 7 injector drive circuit malfunction - low to high short circuit fault	P0280	F1	1419	4
110	Ignition sequence cylinder 8 injector drive circuit fault - low to high short circuit fault	P0208	F1	1420	4
111	Ignition sequence cylinder 9 injector drive circuit malfunction - low to high short circuit fault	P0209	F1	1421	4
112	Ignition sequence cylinder 10 injector drive circuit malfunction - low to high short circuit fault	P0210	F1	1422	4
113	B-side manifold pressure sensor voltage signal above upper limit	P0105	F2	102	19
114	B-side manifold pressure sensor voltage signal below lower limit	P0105	F3	102	20
115	The voltage signal of B-side manifold temperature sensor 1 exceeds the upper limit	P0110	F2	1131	19
116	The voltage signal of B-side manifold temperature sensor 1 exceeds the lower limit	P0110	F3	1131	20
117	A-side manifold pressure sensor voltage signal above upper limit	P0105	17	102	3
118	A-side manifold pressure sensor voltage signal below lower limit	P0105	16	102	4
119	Excessive intake temperature	P0110	85	1131	0
120	The voltage signal of the A-side manifold temperature sensor exceeds the upper limit	P0110	17	1131	3
121	The voltage signal of the A-side manifold temperature sensor exceeds the lower limit	P0110	16	1131	4
122	Open circuit in the driving circuit of the high-pressure oil pump oil metering unit (MeUn)	P0251	13	1442	11
123	High end short circuit to power in the driving circuit of the high-pressure oil pump oil metering unit	P0254	12	1442	15
124	High pressure oil pump oil metering unit drive circuit low end short circuit to power fault	P0253	F0	1442	17
125	High end short circuit to ground fault in the driving circuit of the high-pressure oil pump oil metering unit	P0254	11	1442	16
126	High pressure oil pump oil metering unit drive circuit low end short circuit to ground fault	P0253	F1	1442	18
127	High end to low end short circuit fault in the driving circuit of the high-pressure oil pump oil metering unit	P0251	1	1442	12
128	Internal software and hardware low-level monitoring error (MoC)	P060B	F0	516185	19

	of electronic control unit (ECU)				
129	Internal software and hardware low-level monitoring error (MoC) of electronic control unit (ECU)	P060B	0	516185	20
130	Internal software and hardware low-level monitoring error (MoC) of electronic control unit (ECU)	P060B	F1	516186	19
131	Internal software and hardware low-level monitoring error (MoF) of electronic control unit (ECU)	P060D	0	516187	19
132	Internal software and hardware low-level monitoring error (MoF) of electronic control unit (ECU)	P1045	0	516188	19
133	Internal software and hardware low-level monitoring error (MoF) of electronic control unit (ECU)	P1046	0	516189	19
134	Internal software and hardware low-level monitoring error (MoF) of electronic control unit (ECU)	P1047	0	516190	19
135	Internal software and hardware low-level monitoring error (MoF) of electronic control unit (ECU)	P1048	0	516191	19
136	Internal software and hardware low-level monitoring error (MoF) of electronic control unit (ECU)	P1049	0	516192	19
137	Motor failure	P1050	F0	8292	20
138	Short circuit to power at motor drive end (CAN)	P1050	12	8292	19
139	Short circuit to ground at motor drive end (CAN)	P1050	11	8292	6
140	Main relay open circuit or short circuit to ground	P1052	F0	818	5
141	Main relay open circuit or short circuit to ground	P1052	F1	818	2
142	Main relay stuck	P1052	4	818	19
143	Missing camshaft signal	P0340	31	4201	12
144	Missing crankshaft signal	P0335	31	4203	12
145	Oil pressure too high	P0523	85	100	15
146	Oil pressure too low	P0524	84	100	17
147	Oil pressure sensor voltage signal above upper limit	P0523	12	100	3
148	Oil pressure sensor voltage signal below lower limit	P0522	11	100	4
149	Oil temperature too high	P0195	85	175	16
150	Oil temperature sensor voltage signal above upper limit	P0198	12	175	3
151	Oil temperature sensor voltage signal below lower limit	P0197	11	175	4
152	(Rail pressure) pressure control valve (PCV) drive circuit open circuit	P009B	13	5448	5
153	(Rail pressure) Pressure control valve (PCV) drive end high end and short circuit to power supply	P009B	F0	5448	20
154	(Rail pressure) Pressure control valve (PCV) drive end low end and short circuit to power supply	P009B	F1	5448	21
155	(Rail pressure) Pressure control valve (PCV) drive end high end short circuit to power supply	P009B	F2	5448	22
156	(Rail pressure) Pressure control valve (PCV) drive end low end short circuit to power supply	P009B	F3	5448	23
157	(Rail pressure) Pressure control valve (PCV) driver circuit high to low short circuit fault	P009B	F4	5448	24

158	The voltage signal of the A-side rail pressure sensor is above the upper limit	P0193	12	157	3
159	The voltage signal of the A-side rail pressure sensor is below the lower limit	P0192	11	157	4
160	The voltage signal of the B-side rail pressure sensor is above the upper limit	P0193	F0	157	19
161	The voltage signal of the B-side rail pressure sensor is below the lower limit	P0192	F1	157	20
162	Sensor power supply module 1 malfunction	P1074	F0	516241	11
163	Sensor power supply module 1 high voltage fault	P1074	F1	516241	3
164	Sensor power supply module 1 short circuit to ground fault	P1074	F2	516241	6
165	Sensor power supply module 1 low voltage fault	P1074	F3	516241	4
166	Sensor power supply module 2 malfunction	P1075	F0	516242	11
167	Sensor power supply module 2 high voltage fault	P1075	F1	516242	3
168	Sensor power supply module 2 low voltage fault	P1075	F2	516242	6
169	Sensor power supply module 3 malfunction	P1075	F3	516243	11
170	ECU software reset	P1080	F0	516250	11
171	ECU software reset	P1080	F1	516251	11
172	The voltage signal of the crankcase pressure sensor is above the upper limit	P1122	F0	516357	19
173	The voltage signal of the crankcase pressure sensor is below the lower limit	P1122	F1	516357	20
174	Oil pump control relay open circuit	P1123	13	516358	5
175	Oil pump control relay low end short circuit to power	P1123	12	516358	19
176	Oil pump control relay low end short circuit to ground	P1123	11	516358	6
177	Oil pump control relay high end short circuit to power	P1123	F0	516358	20
178	Oil pump control relay high end short circuit to ground	P1123	F1	516358	21
179	Short circuit on the high and low ends of the oil pump control relay	P1123	F2	516358	22
180	Excessive crankcase pressure	P1122	85	516357	16
181	Low crankcase pressure	P1122	84	516357	18
182	The water inlet temperature of the intercooler exceeds the limit value	P2182	85	110	16
183	Excessive oil pressure difference (pre filter oil pressure - main oil gallery oil pressure)	P1124	F0	516359	19

8. STORE AFTER DIESEL ENGINE SHUTDOWN

8.1 Short-term shutdown preservation

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

8.1.1 Before Sealing

- Clean the diesel engine surface thoroughly, checking for any visible dirt, oil, rust, water stains, etc., and then dry it with compressed air. Apply rust-preventive oil evenly to all machined metal surfaces of the diesel engine (i.e.,

unpainted machined surfaces) using a brush. Note that rust-preventive oil should not be applied to rubber parts, plastic parts, or fabric parts, or meet rust-preventive oil.

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

For external sealing of the diesel engine, FD615 dehydrating rust-preventive oil or rust-preventive oil meeting the following performance requirements is recommended.

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

- Disconnect the battery cables, clean the terminals, apply a thin layer of grease, and charge the battery. (3) Loosen the drive belt.
- 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.
- Cover the diesel engine with a plastic cover or similar covering. Place the diesel engine in a well-ventilated, dry, and cool indoor environment.

8.1.2 During Storage

Charge the battery monthly. For batteries that are not maintenance-free, check the electrolyte level and add appropriate top-up fluid or distilled water, if necessary, then charge. Rotate the crankshaft 3-4 times monthly using a

8.1.3 Use After Opening

When starting, remove the covers and wrappings, connect the pipelines, and pump oil to the fuel system to bleed the fuel system; connect the battery cables and tension the drive belt; check the lubricating oil and coolant levels, and add an appropriate amount of clean engine oil that meets the specifications to the turbocharger inlet; an electric pre-supply oil pump can be used to establish oil pressure; use a crankshaft turning tool to rotate the crankshaft 3-5 times. Refer to Section 4.5 Diesel Engine Starting and start the diesel engine using the correct method.

8.2 Long-term Shutdown and Storage

Diesel engines that have been out of service for more than 3 months need to be sealed. The oil seal period for diesel engines is 1 year; any engine that has been out of service for more than 1 year needs to be resealed.

8.2.1 Before Sealing

After the last use of the diesel engine, drain all the lubricating oil from the engine while it is still hot, including the oil in the oil filter. 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 it for 1–1.5 minutes, then stop the engine and drain the sealing oil from the oil pan. The sealing oil inside the diesel engine is CF-4 grade lubricating oil. For cleaning, rust prevention, and other sealing requirements for the diesel engine's external surface, refer to Sections 1, 2, 3, 4, and 5 of 8.1.1. Attach a label to the diesel engine indicating that it is out of oil and should not be used.

8.2.2 During Storage

See 8.1.2.

8.2.3 Use After Opening

When starting, remove the diesel engine cover and wrappings, pump oil into the fuel system to bleed the fuel system, connect the pipes and battery cables, and tension the drive belt; add clean engine oil that meets the specifications to the diesel engine, and add an appropriate amount of engine oil to the turbocharger inlet; check the oil level and coolant level; an electric pre-supply oil pump can be used to establish oil pressure; use a crankshaft turning tool to rotate the crankshaft 3-5 times. Refer to Section 4.5 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. Due to long storage time, the rubber hoses on the diesel engine may age; all rubber hoses must be inspected before use, and any cracked or aged hoses must be replaced.

NOTES

NOTES

MANUFACTURER DETAILS

HEADQUARTERS & FACTORY



SDEC POWER

Shanghai New Power Automotive Technology Company Limited.

No.2636 Jungong Road, Yangpu District, Shanghai, China 200438

Engine	Spare parts	Service
+86 21 60652308	+86 21 60652314	+86 21 60652369
motor@sdecie.com	spare@sdecie.com	sc_fw@sdec.com.cn
www.sdecie.com		

DEALER INFORMATION

CONTACT DETAILS



Vert Energy Africa (Pty) Ltd

28A Cnr. Avalon & Private Roads, Westlake View Ext 12, Modderfontein, Johannesburg, Gauteng, South Africa

General Enquiries

+27 (0)11 453 9669

info@vertgroup.co.za

www.vertgroup.co.za

O&OE

All information in the document is substantially correct at the time of printing but may be subsequently altered by the company.