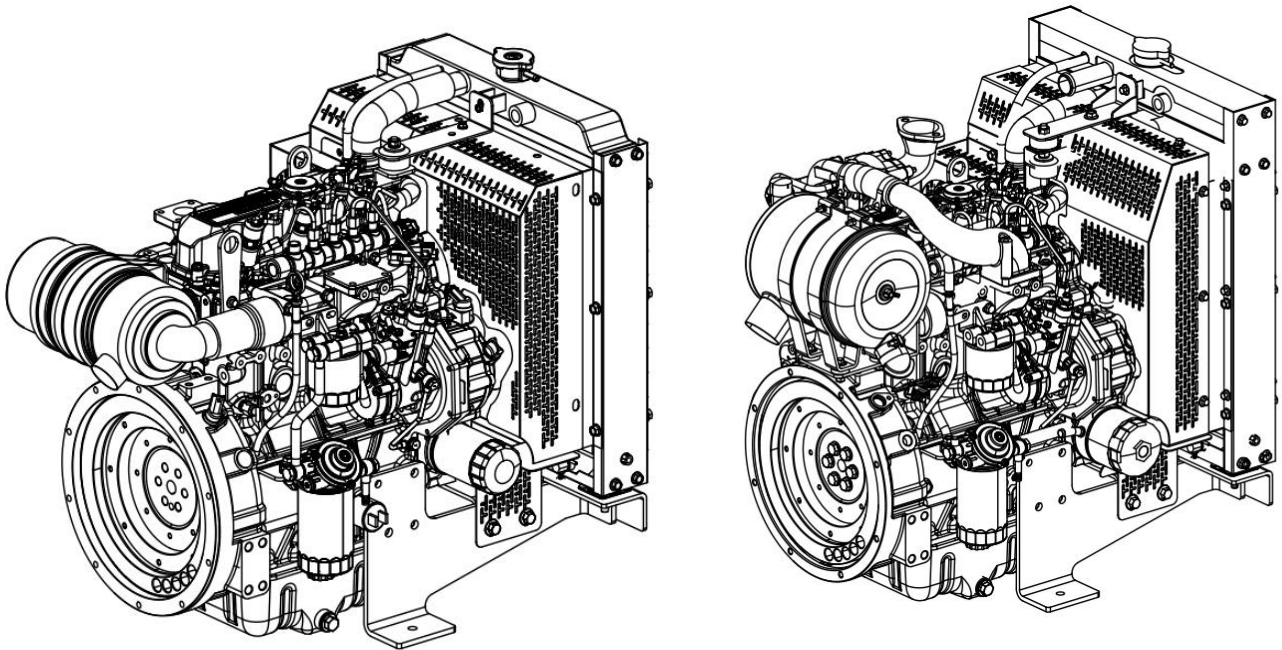


3M18,3M18T Series Engine

Operation and Maintenance Manual

Please read the instruction manual carefully before use



Raywin Powertrain Technology Co., Ltd

Preface

The 3M18 and 3M18T series diesel engines are jointly developed by Raywin Powertrain Technology Co., Ltd. and internationally renowned engine R&D institutions along with expert teams. They adopt two-valve, naturally aspirated or turbocharged technologies, as well as high-pressure common rail or mechanical fuel injection systems. These engines offer excellent reliability, fuel economy, and power performance, and meet the diverse application requirements of customers in agriculture & forestry, construction, horticulture, power generation, industrial, and marine markets.

This manual introduces the basic knowledge of operation and maintenance for the 3M18 and 3M18T series diesel engines, as well as methods for diagnosing and resolving some common faults, for your reference. To enable these engines to serve you better and give full play to their capabilities, please familiarize yourself thoroughly with the engine's structure and master the proper maintenance and operating procedures. If you conscientiously perform maintenance work in accordance with the specified requirements, the service life of the engine will be significantly extended.

As the range of variants and improvements for the 3M18 and 3M18T series continues to expand, it may not be possible to notify users of every modification. We therefore ask for your attention and understanding in this regard.

All rights of interpretation of this manual belong to Raywin Powertrain Technology Co., Ltd.

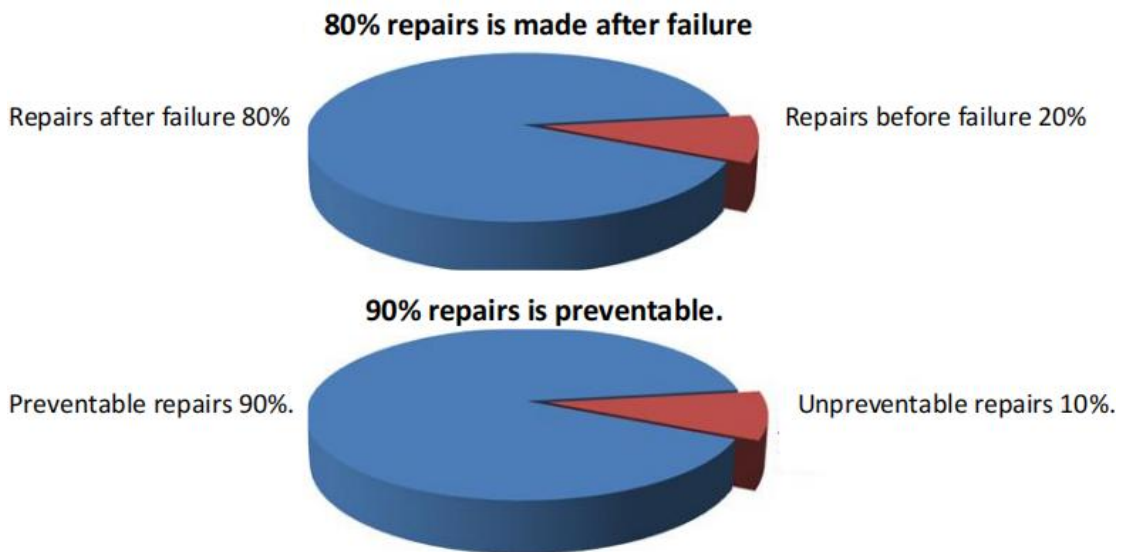
Catalogue

1. Introduction	4
2. Overview	8
2.1 General Application	8
2.2 G-Drive Application	13
2.3 Agricultural, Construction & Marine Power Business Segment	18
3. Diesel Engine Fuels, Oils, Coolant, and Auxiliaries	18
3.1 Fuel	19
3.2 Oil	19
3.3 Coolant	21
Caution	21
3.4 Battery selection	25
4. Use and Maintenance of Diesel Engines	25
4.1 Use of Diesel Engines	25
4.2 Maintenance of Diesel Engines	30
5. Instructions for Daily Maintenance of Diesel Engines	32
5.1 Inspect the coolant level of the cooling system	33
5.2 Fan	35
5.3 Fuel Filter	35
5.4 Oil Level Check	36
5.5 Inspect drive belt	37
5.6 Air filter	38
5.7 Valve train	38
6. Common Faults and Troubleshooting Methods for Diesel Engines	39
6.1 Troubleshooting Methods for Diesel Engine Starting Failure	41
6.2 Hard starting	45
6.3 Low Power	46
6.4 Abnormal noise during diesel engine operation	53
6.5 Exhaust emitting black smoke	55
6.6 Exhaust emitting white smoke or blue smoke	58
6.7 Oil pressure is abnormal	63
6.8 Oil consumption is high	66
6.9 Coolant outlet temperature is too high	67
6.10 Typical Turbocharger Failures and Remedies	68
6.11 Diesel engine stalls unexpectedly	69
6.12 Electrical system abnormality	73
6.13 Diesel engine shaking	74
6.14 Diesel engine idle instability	78
6.16 Warning light stays on continuously	82

1.Introduction

To users and operators:

Relevant survey results indicate that:



Preventive maintenance is simple and costs very little. Please follow the recommended maintenance specifications given in the Maintenance section of this manual, and keep regular records of preventive maintenance activities.

Use the fuel, engine oil, and coolant specified in this manual correctly. For diesel engines equipped with an aftertreatment system, mixing engine oil and fuel is strictly prohibited.

Attention

When welding on the engine or generator frame, disconnect the positive and negative battery cables from the battery, and remove all connectors from the ECU following the power disconnection procedure, in order to prevent damage to the ECU during welding. Under no circumstances should the ECU be connected or disconnected while powered. Additionally, welding must not be performed on the diesel engine itself or on components mounted on the engine, otherwise the engine or its components may be damaged.

Symbol Legend: The symbols used in this manual are intended to help you understand the meaning of various instructions. When a symbol appears below, it conveys the specific meaning described as follows:•



Warning—Failure to follow these instructions may result in serious personal injury or major property damage.



Caution—Failure to follow these instructions may cause minor personal injury or damage to parts, assemblies, or the diesel engine.

Illustration Note:Some illustrations in this manual are schematic and may differ from the actual diesel engine or parts you are using.

General Safety Rules



Warning

Improper procedures, carelessness, or failure to observe warning instructions may cause burns, cuts, amputations, suffocation, or other personal injuries, and may even result in death.

Before performing any maintenance or service, carefully read and understand all safety measures and warnings. The following content contains general safety practices that must be observed to ensure personal safety. Specific safety measures will be included in the detailed procedural steps.

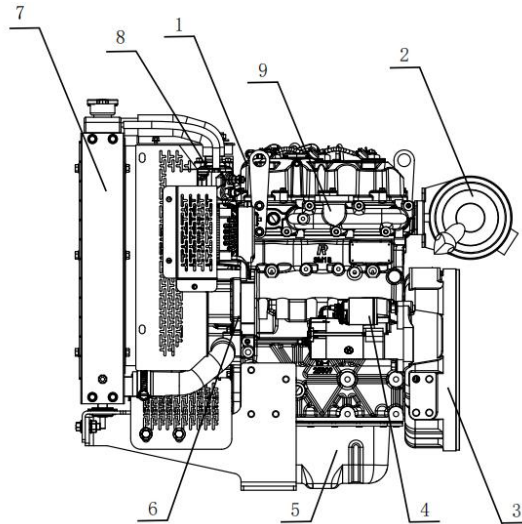
- ◆ Maintenance work area should be dry, well-lit, and well-ventilated, free of clutter, loose tools, parts, ignition sources, and other hazardous materials. Be aware of any potential hazards.
- ◆ Never touch rotating parts, as they may cause cuts, amputations, or even loss of life.
- ◆ Do not attempt to turn the crankshaft by moving or prying the fan. Doing so may cause serious personal injury, property damage, or damage to the fan blades, resulting in premature fan failure.
- ◆ If the engine has been running and the coolant is hot, allow the engine to cool gradually before slowly loosening the filler cap to release pressure from the cooling system. Otherwise, scalding or other injuries may occur.
- ◆ Corrosion inhibitors (components in coolant additives and engine oil) contain alkali. Do not allow these substances to contact your eyes. Avoid prolonged or repeated skin contact. Do not swallow. If contact occurs, immediately wash skin with soap and water. If they enter the eyes, rinse immediately with plenty of water for at least fifteen minutes and seek medical attention promptly. Keep out of reach of children.
- ◆ To reduce the risk of burns, avoid contact with hot components, exhaust piping, hot fluids in lines, and the engine compartment immediately after the engine stops.
- ◆ When replacing fasteners, always use those with the same part number (or equivalent). If replacement is necessary, do not use lower-quality fasteners.
- ◆ Avoid inhaling engine oil vapors, swallowing oil, or prolonged contact with used engine oil.
- ◆ Do not connect jumper start cables or battery charging cables to any ignition or governor control wires. This may cause electrical damage to the ignition system or governor.
- ◆ Always tighten fasteners and fuel connections according to technical

- specifications. Over-tightening or under-tightening may cause leaks.
- ◆ Because the smell of leaking fuel may fade over time, always test for fuel leaks using the method indicated in the manual.
 - ◆ Coolant is toxic. If it is no longer usable, dispose of it in accordance with local environmental regulations.

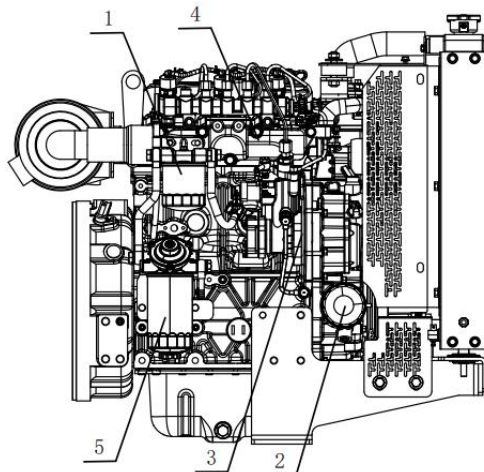
2.Overview

2.1 General Application

2.1.1 Schematic of the engine(Natural Aspirate)

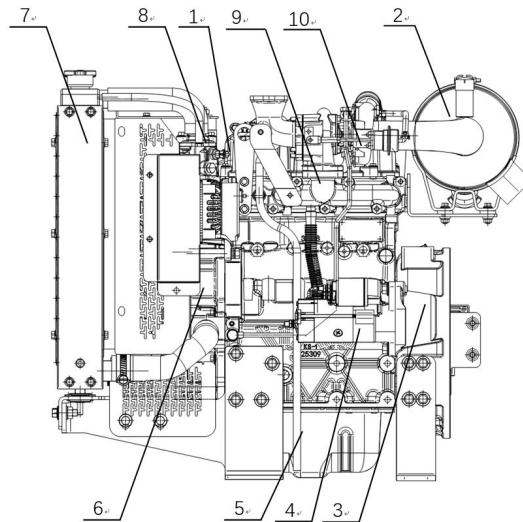


- 1.Cylinder head cover 2. Air filter 3.Flywheel 4.Starter 5.Oil Pan
6.Gear Chamber 7.Radiator 8.Thermostat 9.Exhaust Pipe

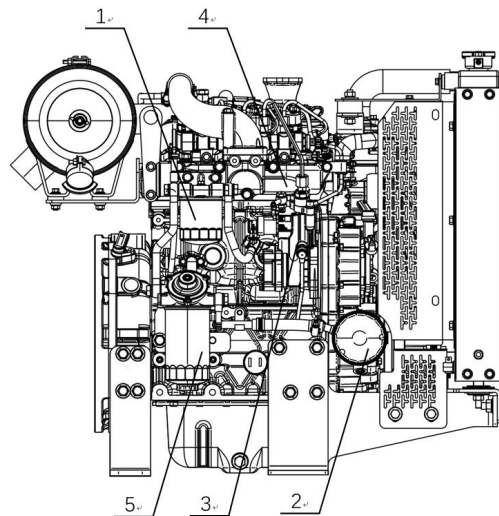


- 1.Fuel Filter 2.Oil filter 3.Fuel Pump 4.Intake Pipe 5.Fuel Pre-filter

2.1.2 Schematic of the engine (Turbocharge Aspirate)



- 1.Cylinder Head Cover 2. Air Filter 3.Flywheel House 4.Starter 5.Oil Pan
6.Gear Chamber 7.Radiator 8. Thermostat 9. Exhaust Pipe 10.Turbocharger



- 1.Fuel Filter 2.Oil Filter 3.Fuel Pump 4.Intake Pipe 5.Fuel Filter

2.1.3 Model Code Composition

Product models are expressed using Arabic numerals and uppercase letters. Their composition is illustrated as follows:

Examples: 3M1800/N, 3M18T00/N:

3——3 Cylinders

M——Model code

18——1.8 Litter

T——Turbocharger

2.1.4 Main Applications and Scope of Use

The 3M18 and 3M18T series diesel engines are widely used in agriculture & forestry, construction, horticulture, power generation, industrial, marine, water pump, and other applications.

They are suitable for ambient temperatures ranging from $-30\text{ }^{\circ}\text{C}$ to $45\text{ }^{\circ}\text{C}$. Operation in flooded conditions or fire environments is prohibited.

When the ambient temperature is below $-30\text{ }^{\circ}\text{C}$ or above $45\text{ }^{\circ}\text{C}$, or when the altitude exceeds 2000 m (for naturally aspirated engines, altitude exceeding 2000 m), users should consult the Technical Service Department of Raywin Powertrain Technology Co., Ltd. to take appropriate measures or use corresponding specialized diesel engines, so as to ensure normal engine operation.

2.1.5 Technical Data Sheet

Table 2—1 3M18 Series Engine Main Technical Data Sheet

NO	Project	Main Specification					
		3M1800/N	3M1801/N	3M1802/N	3M1803/N	3M1804/N	3M1805/N
1	Engine Model	3M1800/N	3M1801/N	3M1802/N	3M1803/N	3M1804/N	3M1805/N
2	Type	Vertical, In-line, 3 cylinder, Water cooling					
3	Aspirate Type	Natural Aspirate					
4	Fuel Injection Model	DI					
5	Cylinder NO.-Bore×Stroke	3-87×103					
6	Valve per cylinder	2					
7	Displace (L)	1.8					
8	Compress Ratio	19:1					
9	Dimension (L×W×H)mm	867×547×764 (With Radiator, Air filter)					
10	Dry Weight	180kg: Bare Engine (Without Radiator, Air filter) 220kg (With Radiator, Air filter)					
11	Lubricating Model	Pressure-splash lubrication					
12	Cooling System	Forced water-cooled closed-loop system					
13	Start Type	Electrical Start					
14	Governor Type	ECU					
15	Fuel System	HPCR					
16	Oil capacity L	6					
17	Fire Order	1—2—3					
18	Crankshaft rotation	CCW					

19	Rated Power(kW)/Speed(r/min)		28/3000	28/2700	26/2400	25/2200	23/2000	21/1800
20	Max Torque/Speed (N.m/rpm)		110/1800					
21	Min. Fuel Consumption(g/kW·h)		≤230					
22	Oil consumption (g/(kW·h))		≤0.2					
23	Speed Drop (%)		8%					
24	Alternator		14V 40A					
25	Starter		12V 1.8kW					
26	Fuel type		Summer: GB 252-2000 premium grade or first-grade light diesel fuel No. 0 or No. 10. Winter: GB 252-2000 premium grade or first-grade light diesel fuel No. 0, No. -10, No. -20, or No. -35.					
27	Oil Type		Recommend CF-4					
28	Applicable Altitude		Recommend ≤ 2000m					
29	Maximum allowable intake restriction kPa		5					
30	Maximum allowable exhaust back pressure kPa		10					
31	Smoke opacity at rated condition		≤2					
32	Voltage System V		12					
33	Emission Level		/					
34	Noise Limit (1m)		≤90dB (A)					
35	Fuel pipe interface (mm)	Inlet fuel pipe outside diameter	Φ10					
		Return fuel pipe outside diameter	Φ8					

Table 2—2 3M18T Series Engine Main Technical Data Sheet

No	Project	Main Specification					
1	Engine Model	3M18T00/N	3M18T01/N	3M18T02/N	3M18T03/N	3M18T04/N	3M18T05/N
2	Type	Vertical, In-line, 3 cylinder, Water cooling					
3	Aspirate Type	Natural Aspirate					
4	Fuel Injection Model	DI					

5	Cylinder NO.-Bore×Stroke	3-87×103					
6	Valve per cylinder	2					
7	Displace (L)	1.8					
8	Compress Ratio	18:1					
9	Dimension (L×W×H)mm	896×547×764(With Radiator,Air filter)					
10	Dry Weight	190kg Bare Engine(Without Radiator,Air filter) 230kg(With Radiator,Air filter)					
11	Lubricating Model	Pressure-splash lubrication					
12	Cooling System	Forced water-cooled closed-loop system					
13	Start Type	Electrical Start					
14	Governor Type	ECU					
15	Fuel System	HPCR					
16	Oil capacity L	6					
17	Fire Order	1—2—3					
18	Crankshaft rotation	CCW					
19	Rated Power(kW)/Speed(r/min)	36.8/3000	36.8/2700	36/2400	32/2200	32/2000	28/1800
20	Max Torque/Speed (N.m/rpm)	150/1800~2000					
21	Min. Fuel Consumption(g/kW·h)	≤225					
22	Oil consumption (g/ (kW·h))	≤0.2					
23	Speed Drop (%)	8%					
24	Alternator	14V 40A					
25	Starter	12V 1.8kW					
26	Fuel type	Summer: GB 252-2000 premium grade or first-grade light diesel fuel No. 0 or No. 10. Winter: GB 252-2000 premium grade or first-grade light diesel fuel No. 0, No. -10, No. -20, or No. -35.					
27	Oil Type	Recommend CF-4					
28	Applicable Altitude	Recommend ≤ 2000m					
29	Maximum allowable intake restriction kPa	5					
30	Maximum allowable exhaust back pressure kPa	10					
31	Smoke opacity at rated condition	≤2					
32	Voltage System V	12					

33	Emission Level		/
34	Noise Limit (1m)		≤90dB (A)
35	Fuel pipe interface (mm)	Inlet fuel pipe outside diameter	Φ10
		Return fuel pipe outside diameter	Φ8

2.2 G-Drive Application

The 3M18 and 3M18T series diesel engines are used for power generation, covering speeds of 1500 rpm and 1800 rpm and a wide range of power outputs.

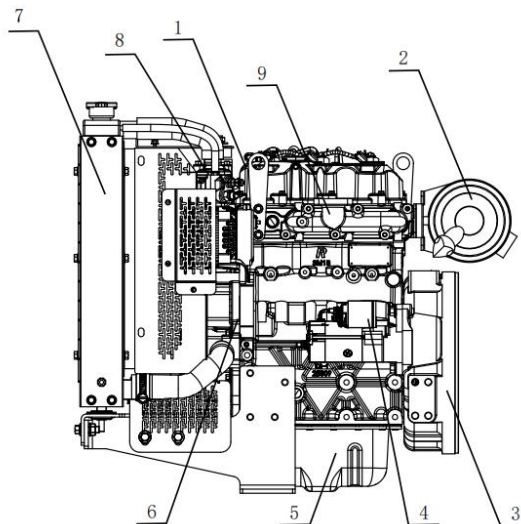
2.2.1 Model Code Composition

Product models are expressed using Arabic numerals and uppercase letters. Their composition is illustrated as follows:

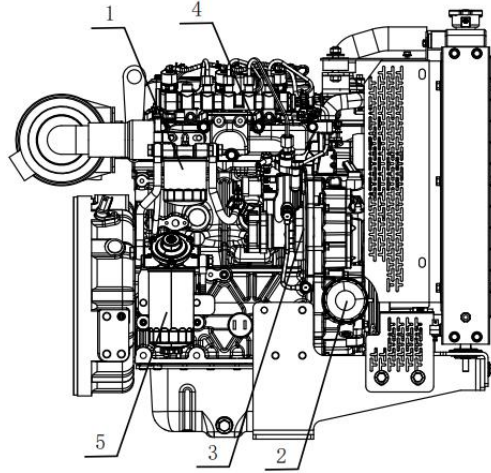
Examples: 3M18G0/N、3M18TG0/N

3—3 Cylinders	M—Model code	18—1.8 Litter
T—Turbocharge	G—G-Drive	0—Family Code
/N—No Emission		

2.2.2 Schematic of the engine(Natural Aspirate)

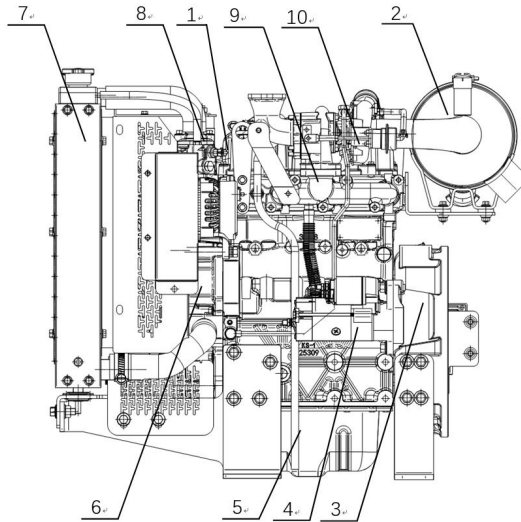


-
- 1.Cylinder Head Cover 2. Air Filter 3.Flywheel House 4.Starter 5.Oil Pan
6.Gear Chamber 7.Radiator 8. Thermostat 9.Exhaust Pipe

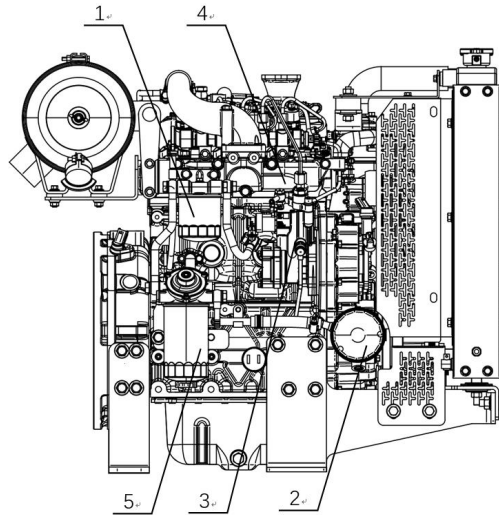


- 1.Fuel Filter 2.Oil Filter 3.Fuel Pump 4.Intake Pipe 5.Fuel Pre-filter

2.2.3 Schematic of the engine(Turbocharge Aspirate)



- 1.Cylinder Head Cover 2. Air Filter 3.Flywheel House 4.Starter 5.Oil Pan
6.Gear Chamber 7.Radiator 8.Thermostat 9.Exhaust Pipe 10.Turbocharge



1. Fuel Filter 2.Oil Filter 3.Fuel Pump 4.Intake Pipe 5.Fuel Pre-filter

2.2.4 Technical Data Sheet

Table 2—3 3M18G0/N Series Engine Main Technical Data Sheet

No.	Project	Main Specification						
		3M18G0	3M18G1	3M18G2	3M18G3	3M18G4	3M18G5	3M18G6
1	Engine Model	/N	/N	/N	/N	/N	/N	/N
2	Type	Vertical, In-line, 3 cylinders, Water cooling						
3	Aspirate Type	Natural Aspirate						
4	Fuel Injection Model	DI						
5	Cylinder NO.-Bore×Stroke	3-87×103						
6	Valve per cylinder	2						
7	Displace (L)	1.8						
8	Compress Ratio	19:1						
9	Dimension (L×W×H)mm	867×547×764(With radiator,Air filter)						
10	Dry Weight	180kg Bare Engine(Without radiator,Air filter) 220kg(With radiator,Air filter)						
11	Lubricating Model	Pressure-splash lubrication						
12	Cooling System	Forced water-cooled closed-loop system						
13	Start Type	Electrical Start						
14	Governor Type	ECU						
15	Fuel System	HPCR						
16	Oil capacity L	6						
17	Fire Order	1—2—3						
18	Crankshaft rotation	CCW						
19	Rated Power(kW)/Speed(r/min)	28/3000	16/1500	18/1800	14/1500	16/1800	12/1500	14/1800
20	Rated Power(kW)/Speed(r/min)	100/1500						
21	Max Torque/Speed (N.m/rpm)	≤230						

22	Min. Fuel Consumption(g/kW ·h)		≤0.2
23	Speed drop %		1%
24	Relative speed droop range (%)		≥5.5%
25	Relative speed raise range (%)		≥2.5
26	Steady-state speed fluctuation rate (%)		≤1.5
27	Speed recovery time (s)		≤3
28	Maximum allowable exhaust back pressure kPa		5
29	Smoke opacity at rated condition		10
30	Alternator		14V 40A
31	Starter		12V 1.8kW
32	Fuel Type		Summer: GB 252-2000 premium grade or first-grade light diesel fuel No. 0 or No. 10. Winter: GB 252-2000 premium grade or first-grade light diesel fuel No. 0, No. -10, No. -20, or No. -35.
33	Oil Type		Recommend CF-4
34	Applicable Altitude		Recommend ≤ 2000m
35	Smoke opacity at rated condition		≤2
36	System Voltage V		12
37	Emission Level		/
38	Noise Limit (1m)		≤86dB (A)
39	Fuel pipe interface(m m)	Inlet fuel pipe outside diameter	Φ10
		Return fuel pipe outside diameter	Φ8

Table 2—4 3M18TG Series Engine Main Technical Data

No.	Project	Main Specification							
		3M18T G0/N	3M18T G1/N	3M18T G2/N	3M18T G3/N	3M18T G4/N	3M18T G5/N	3M18T G6/N	3M18T G7/N
1	Engine Model								
2	Type	Vertical,In-line,3 cylinders,Water cooling							
3	Aspirate Type	Natural Aspirate							
4	Fuel Injection Model	DI							
5	Cylinder NO.-Bore×Stroke	3-87×103							
6	Valve per cylinder	2							
7	Displace (L)	1.8							
8	Compress Ratio	19:1							
9	Dimension (L×W×H)mm	896×547×764(With radiator,air filter)							

10	Dry Weight		190kg (Without radiator,air filter) 230kg(With radiator,air filter)							
11	Lubricating Model		Pressure-splash lubrication							
12	Cooling System		Forced water-cooled closed-loop system							
13	Start Type		Electrical Start							
14	Governor Type		ECU							
15	Fuel System		HPCR							
16	Oil capacity L		6							
17	Fire Order		1—2—3							
18	Crankshaft rotation		CCW							
19	Rated Power(kW)/Speed(r/min)		28/1500	36.8/3000	32/1800	23/1500	25/1800	19/1500	21/1800	18.5/1500
20	Rated Power(kW)/Speed(r/min)		170/1500							
21	Max Torque/Speed (N.m/rpm)		≤225							
22	Min. Fuel Consumption(g/kW ·h)		≤0.2							
23	Speed drop %		1%							
24	Relative speed droop range (%)		≥5.5%							
25	Relative speed raise range (%)		≥2.5							
26	Steady-state speed fluctuation rate (%)		≤1.5							
27	Speed recovery time (s)		≤3							
28	Maximum allowable exhaust back pressure kPa		5							
29	Smoke opacity at rated condition		10							
30	Alternator		14V 40A							
31	Starter		12V 1.8kW							
32	Fuel Type		Summer: GB 252-2000 premium grade or first-grade light diesel fuel No. 0 or No. 10. Winter: GB 252-2000 premium grade or first-grade light diesel fuel No. 0, No. -10, No. -20, or No. -35.							
33	Oil Type		Recommend CF-4							
34	Applicable Altitude		Recommend ≤ 2000m							
35	Smoke opacity at rated condition		≤2							
36	System Voltage V		12							
37	Emission Level		/							
38	Noise Limit (1m)		≤86dB (A)							
39	Fuel pipe interface	Inlet fuel pipe outside diameter	Φ10							

	(mm)	Return fuel pipe outside diameter	Φ8
--	------	--------------------------------------	----

2.3 Agricultural, Construction & Marine Power Business

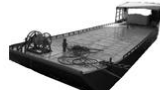
Segment

The 3M18 and 3M18T series diesel engines have a wide range of applications and are suitable for agricultural machinery, construction equipment, and marine vessels. They provide high-quality, reliable power for harvesters, tractors, pickers, excavators, fishing boats, yachts, and other farm machinery, construction equipment, and vessels.

2.3.1 Application examples



船用辅机



船用主机



灯 塔



空压机



拖拉机



收割机



割草车



高空作业车



挖掘机



压路机



滑移装载机



叉车

3. Diesel Engine Fuels, Oils, Coolant, and Auxiliaries

3.1 Fuel

The quality and composition of the fuel are critical. Poor-quality fuel can reduce engine performance and durability.

To achieve higher reliability and lower fuel consumption with the diesel engine, the use of diesel fuel is recommended:

The diesel fuel should meet the technical specifications below:

Comply with the national standards or international standards of the country/region of use. For more details regarding fuel standards, please refer to the relevant national technical regulations of the applicable country.

Users must select the appropriate grade of clean diesel according to the ambient temperature of their operating environment, as listed in the table below.

Table 3-1

Fuel Type	Ambient temperature
0#	$\geq 4^{\circ}\text{C}$
-10#	$\geq -5^{\circ}\text{C}$
-20#	$\geq -14^{\circ}\text{C}$
-35#	$\geq -29^{\circ}\text{C}$
-50#	$\geq -44^{\circ}\text{C}$



Warning!

Do not mix gasoline, alcohol, or alcohol-gasoline blends into diesel fuel. Doing so may cause an explosion.



Caution

Because the tolerances in the diesel fuel injection system are extremely precise, it is essential to keep the fuel clean and free from dirt or water. If water or dirt is present in the fuel system, it may cause serious damage to the fuel pump and injectors.

Raywin Powertrain Technology Co., Ltd. requires users to use

3.2 Oil

The components of the 3M18 and 3M18T series diesel engines are manufactured to very high precision; therefore, the requirements for engine oil selection are also stringent. It is mandatory to use diesel engine oil of CF-4 grade or higher. We recommend using the dedicated oil CF-4 15W-40, which has a quality level of CF-4 and a viscosity grade of 15W-40.

When selecting engine oil, choose the appropriate grade according to local

season and ambient temperature. Pay special attention to two key specifications: the oil quality level (performance level) and the viscosity grade. Refer to the table below for selection guidelines:

Table 3-2

Commonly used quality level	CF-4	CH-4	CI-4	CI-4+	CJ
Applicable emission stage	/	/	/	/	EU Stage V

Table 3-3

Type	Mineral oil based					Synthetic oil based	
Viscosity grade	30	20W-50	15W-50	10W-40	5W-50	5W-50	10W-40
	40	20W-40	15W-40	10W-30	5W-30	5W-30	10W-30
Ambient temperature range (°C)	10~50	-15~30	-20~50	-25~30	-30~30	-35~40	-30~40

Engine Oil Requirements

The engine requires a normal operating oil pressure of 0.3 – 0.6 MPa, and during idle running the oil pressure must not be lower than 0.1 MPa.

Raywin Powertrain Technology (Chongqing) Co., Ltd. specifies the use of multigrade viscosity oil for its diesel engines. This is because multigrade oils cover a wider temperature range, ensuring suitable viscosity when:

- Ambient temperatures vary significantly between morning and evening;
- Engine operating temperature changes considerably;
- The engine operates across regions with different temperatures; or
- It is used over an extended seasonal period.

Another important factor is that single-grade oil consumption is approximately 30 % higher than that of multigrade oil.

The oil grade reflects the level of additives in the oil. For heavy-duty diesel engines, protection is mainly provided by these additives. Since additives gradually deplete over time, an oil of sufficient grade must be selected to ensure reliable protection throughout the oil change interval.

After replacing parts on 3M1800/N and 3M18T00/N series diesel engines, add oil as necessary. After refilling the engine with oil, run the engine for 2 minutes, then stop for 15 minutes. Check the oil level in the oil pan; the level should be between the midpoint of the upper and lower marks and the upper mark on the dipstick (maximum oil pan capacity: 6 L).

Use only Raywin-specified dedicated oil or oil meeting Euro V emission requirements. For this model, the recommended Raywin dedicated oil is as follows:

Table 3-4

Name	Model	Packaging specification	Application range
Euro V engine dedicated oil	CF-4/SL		Suitable for diesel engines compliant with Euro V emissions
	10W-30	4L	
	CF-4/SL	16L	
	15W-40	18L	
	CF-4/SL	170Kg	
	20W-50		

Note: A higher-grade oil may be used to replace a lower-grade oil. The oil-to-fuel ratio must comply with the applicable national or international standards.

Other rules:

- When the total base number (TBN) of the engine oil drops to 1.0, the engine oil must be changed. TBN (mgKOH/g); test method: JIS K-2501-5.2-2 (HCl) or ASTM D4739 (HCl).
- Standard engine oil maintenance interval: 250 hours or 12 months.
- Do not add any additives to the engine oil.
- Do not mix different types (brands) of engine oil.

3.3 Coolant

Caution

When the ambient temperature in winter drops below 0 °C, and there is no insulation measure while the engine is stopped, the water in the cooling system will freeze. Water expands in volume when it freezes, which may cause cracking of cooling system components such as the engine block, radiator, cylinder head, and water pump. Therefore, antifreeze must be added to the cooling system.

To extend the service life of the diesel engine, it is recommended to use the dedicated antifreeze specified by Raywin Powertrain Technology Co., Ltd.

Note: Freshwater is not suitable as engine coolant, because its thermal conductivity is very poor. This can result in insufficient cooling and lead to damage of internal engine components.

Water quality required for preparing engine coolant:

When conditions permit, purchase the antifreeze specified by Raywin Powertrain Technology Co., Ltd. If the specified product is unavailable, it is permissible to prepare the coolant by mixing ethylene glycol with soft water that meets the requirements in the table above. The relationship between boiling point and freezing point of this type of antifreeze is shown in the table below:

Table 3-5

Boiling point and freezing point		
Ethylene glycol volume ratio	Freezing point	Boiling point
	°C	°C
40	-24	106
50	-35	108
60	-52	111

Note: Pressurizing the cooling system can increase its boiling point. A radiator pressure cap helps maintain system pressure. To ensure good water quality, it is recommended to use Raywin- specified or internationally renowned brands and grades of antifreeze.

3.3.1 Specified Antifreeze Brands, Grades and Selection

Table 3-6

Name	Model	Packaging specification	Freezing Point	Minimum applicable ambient temperature
Hanhu	CJ-4—8	4kg	-8°C	2
	CJ-4—25		-25°C	-15
	CJ-4—30		-30°C	-20
	CJ-4—35		-35°C	-25
	CJ-4—40		-40°C	-30
	CJ-4—45		-45°C	-35
	CJ-9—8	9kg	-8°C	2
	CJ-9—25		-25°C	-15
	CJ-9—30		-30°C	-20
	CJ-9—35		-35°C	-25
	CJ-9—40		-40°C	-30
	CJ-9—45		-45°C	-35
	CJ-10—8	10kg	-8°C	2
	CJ-10—25		-25°C	-15
	CJ-10—30		-30°C	-20
	CJ-10—35		-35°C	-25
	CJ-10—40		-40°C	-30
	CJ-10—45		-45°C	-35
	CJ-18—8	18kg	-8°C	2
	CJ-18—25		-25°C	-15
CJ-18—30	-30°C		-20	
CJ-18—35	-35°C		-25	
CJ-18—40	-40°C		-30	
CJ-18—45	-45°C		-35	
CJ-200—8	200kg	-8°C	2	

	CJ-200—25		-25°C	-15
	CJ-200—30		-30°C	-20
	CJ-200—35		-35°C	-25
	CJ-200—40		-40°C	-30
	CJ-200—45		-45°C	-35

Generally, select a coolant whose freezing point is about 10 °C lower than the minimum temperature of the region where the diesel engine operates.

Example: If the minimum temperature in Beijing is assumed to be –15 °C, choose a coolant with a grade of –25 °C (i.e., a freezing point of –25 °C).

3.3.2 Important notes for antifreeze application

- a. Before adding antifreeze, first flush the engine cooling system with clean water. If possible, use softened water or deionized water for flushing.
- b. Check the antifreeze level and the sealing condition of the cooling system.
 - For engines without an overflow tank, do not fill to the brim; fill to approximately 95 % of the capacity.
 - For engines with an overflow tank, fill to the specified level mark first, start the engine and run for a few minutes, then continue adding antifreeze until the level reaches the required height.
- c. Do not mix antifreeze from different manufacturers or of different types for diesel engines. Mixing may reduce the performance of the antifreeze and could even cause engine damage.
- d. If the level falls below the specified mark, replenish to the required level. The replenished antifreeze must be from the same manufacturer and same grade as originally used.
- e. Ethylene glycol is toxic; if it comes into contact with skin, rinse immediately with plenty of water. Ethylene glycol is flammable—do not perform welding or use open flames near an engine with antifreeze leakage. The boiling point of ethylene glycol is 197.4 °C, so water in the antifreeze evaporates easily. After prolonged use, top up with water as needed.

3.3.3 Regular antifreeze replacement

Antifreeze Replacement Intervals and Technical Requirements

- a. For light-duty antifreeze / inorganic salt type antifreeze, the replacement interval is 24 months.
- b. For heavy-duty antifreeze / organic acid type antifreeze, the replacement interval is 36 months.
- c. The technical requirements for both light-duty antifreeze / inorganic salt type and heavy-duty antifreeze / organic acid type must comply with the relevant

standards of the petrochemical industry or the requirements specified in Q/YC 908 Diesel Engine Coolant Technical Conditions issued by Raywin Powertrain Technology (Chongqing) Co., Ltd.

3.3.4 Coolant level check

 **Warning!**

Do not open the radiator pressure cap on a hot engine. Wait until the coolant temperature drops below 50 °C before opening the pressure cap; otherwise, high-temperature coolant or steam may spray out and cause personal injury.

 **Warning!**

Coolant is toxic — keep it out of reach of children and pets. If it is no longer to be used, dispose of it in accordance with local environmental regulations.

 **Warning!**

Do not use corrosive cleaners in the cooling system; otherwise, aluminum components may be damaged.

 **Caution**

Do not use sealant additives to fix cooling system leaks. Doing so may cause blockages in the cooling system and restrict coolant flow, leading to engine overheating. The coolant level must be checked daily.

 **Caution**

Do not add cold coolant to a hot engine; otherwise, engine castings may be damaged. Wait until the engine temperature drops below 50 °C before adding coolant.

The supplemental coolant added to the engine must be mixed with antifreeze, auxiliary coolant additive, and water in the correct proportions to avoid engine damage.

3.4 Battery selection

In winter, especially in plateau, high-altitude, and severely cold regions where the temperature is below -15°C , the discharge capacity of the battery decreases significantly. To ensure and improve the diesel engine's cold start performance, a low-temperature battery of the same capacity should be used or replaced.

Selection examples are shown in the table below:

Table 3-7

General regions		Plateau and high-altitude/cold regions	
Battery Capacity(Ah)	Cold Start Current(A)	Battery Capacity(Ah)	Cold Start Current(A)
≥ 120 (165)	570	≥ 180 (195)	622
Note	In plateau regions (where frequent engine starting and high electrical loads occur), it is advisable to select a battery with a capacity equal to or greater than the value shown in parentheses.		

4. Use and Maintenance of Diesel Engines

4.1 Use of Diesel Engines

4.1.1 Before Start

1. Check the oil level in the oil pan to ensure sufficient oil for lubrication. If the level is low, top up to the position indicated on the dipstick. When adding oil, verify that the oil grade is suitable for the ambient temperature.
2. Check the coolant in the radiator to ensure normal cooling. When adding coolant, verify that the coolant grade is suitable for the ambient temperature.
3. Bleed air from the fuel lines and drain water from the diesel filter.
4. Check the fuel tank; if the fuel level is low, refill with fuel. When refueling, verify that the fuel grade is suitable for the ambient temperature.
5. Check the electrical system: ensure all wiring connections and switch terminals are secure and reliable; check that the battery electrolyte level is adequate and top up if necessary.
6. Check the belts: the tension should be appropriate. If a belt is too loose, it may slip, causing the water pump and fan to operate improperly, resulting in poor cooling, high engine water temperature, and possible overheating. If a belt is too tight, excessive force will act on the pulley shaft, shortening belt life.

4.1.2 Start

 **Warning!**

Do not operate the diesel engine in an environment where combustible gases are present or may be present. These gases can be drawn into the engine through the intake system, causing the engine to accelerate and overspeed, which may result in fire, explosion, or property damage.

Please note that the engine manufacturer cannot know how you operate the diesel engine. Diesel engine users and operators bear full responsibility for the safe operation of the engine under adverse conditions.

 **Caution**

After completing the pre-start preparations and confirming that all requirements are met, the diesel engine may be started (in cold weather, the engine must be preheated before starting).

When starting the engine, the continuous cranking time must not exceed 10 seconds; the interval between restart attempts should be no less than 1 minute.

If the engine fails to start after three consecutive attempts, the cause must be identified and the fault rectified before attempting to start again.

 **Caution**

After starting, check the oil pressure:

At idle speed, the oil pressure must not be lower than 0.1 MPa. If the low-oil-pressure warning lamp does not go off within 15 seconds, or if the instrument indicates no oil pressure, shut down the engine immediately to prevent damage.

Check that the water pump is operating properly and confirm that coolant has entered the engine water jacket and is circulating. Ensure there are no “three leaks” (oil, coolant, or fuel leaks), no abnormal noises, and that all gauges are functioning correctly. If any abnormality is found, stop the engine immediately for inspection and troubleshooting; if necessary, send the engine for repair.

Cold Start: In low-temperature environments, the starting procedure is the same as under normal conditions. If preheating is available during starting, wait until the preheat indicator flashes or goes out before cranking the engine.

Starting Procedure after Prolonged Shutdown or Oil Change.

Follow the normal starting steps given in this section. If the ECU detects that the oil pressure has not reached the minimum cranking oil pressure, the engine will not start. After prolonged shutdown or an oil change, starting the engine may take a longer time.

4.1.3 Operation

After starting the diesel engine, allow it to warm up in no-load condition first at low speed, then at medium speed.

Loading at full load and high speed is permitted only when the engine coolant temperature exceeds 60 °C and the oil temperature exceeds 45 °C.

Observe the following points during operation:

Caution

Do not run the engine at idle for an extended period. Prolonged idle running may reduce diesel engine performance. During idling, the oil pressure must not fall below 0.1 MPa.

Frequently observe the instrument readings while the engine is running, and ensure that oil pressure, oil temperature, and coolant outlet temperature remain within their normal ranges.

If an instrument alarm is activated, or if the engine produces abnormal noise and/or vibration, stop the engine as soon as it is safe to do so and carry out an inspection.

Check the seals for oil, air, and water. If any leakage is found, eliminate it immediately.

Caution

A new diesel engine or an engine after major overhaul must not be operated at high speed or under heavy load from the outset.

During the initial 40 hours of operation, the engine should be run at reduced power, with the load limited to no more than 65 % of its rated capacity, in order to ensure proper break-in.

4.1.4 Engine Shutdown

The diesel engine should avoid rapid shutdown and immediate stopping.

Before shutting down, run the engine at low speed for 3–5 minutes to allow it to cool down, then let it idle for 2–3 minutes so that all moving parts receive adequate lubrication. After that, stop the engine and turn off the ignition.

In addition, when the ambient temperature is below 5 °C, if the coolant cannot be guaranteed to prevent freezing, drain the coolant promptly to avoid damage to components caused by freezing.

When the temperature is below –30 °C, remove the battery and move it to a warm room for insulation; otherwise, starting may become difficult.

4.1.5 Daily Operation

Compared with traditional mechanical fuel systems, the electronically controlled pump system has stricter requirements for fuel cleanliness.

- Only fill with proper clean fuel from authorized sources.
- Do not allow the filled fuel to become contaminated.
- When it is necessary to disconnect or install fuel lines, keep your hands and tools clean to avoid contaminating the fuel lines.

The engine fault indicator is located on the control panel. Under fault-free conditions, the indicator should flash once at the instant the engine is powered on, and then remain off. When a fault is detected by the engine electronic control system, the fault indicator will illuminate and display the corresponding fault message.

When a fault occurs:

1. Turn off the ignition switch immediately.
2. Carefully inspect the engine's fuel system, air system, and electrical system for obvious signs of fuel leakage, air leakage, or disconnected wiring harness connectors.

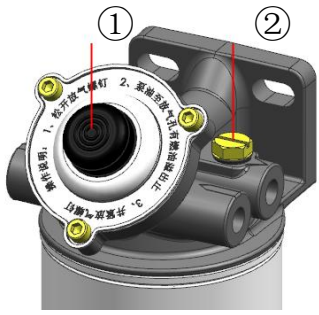
As a general principle, if the fault indicator illuminates and the user finds obvious faults in the fuel, air, or electrical systems, the user may resolve them independently.

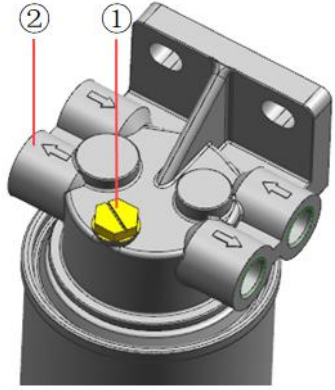
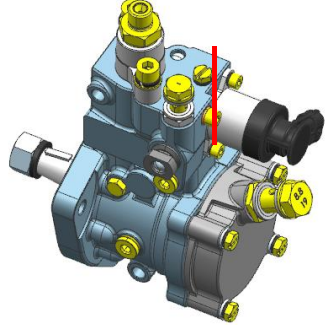

4.1.6 Fuel line bleeding

During engine operation, no air must be present in the fuel supply system lines; otherwise, the engine may fail to start or may stall after starting, potentially damaging the fuel pump.

Therefore, bleeding should be performed before starting the engine (especially on a new machine or after refilling with fuel).

Note: If the diesel pre-filter incorporates an integrated electric feed pump, this bleeding process is not required.

Step	Figure
<p>1) Bleed the pre-filter:</p> <p>① Loosen the bleed screw (②) on the pre-filter.</p> <p>② Press the hand pump (①) on the pre-filter repeatedly until a steady stream of bubble-free fuel flows from the bleed screw (②).</p> <p>③ Tighten the bleed screw (②) securely.</p> <p>Note: If the pre-filter is completely empty, this bleeding process may take a relatively long time.</p>	

<p>2) Bleed the fine filter:</p> <p>① Loosen the bleed screw (①) on the fine filter (if there is no bleed screw, loosen the outlet connector (②) of the fine filter instead).</p> <p>② Press the hand pump on the pre- filter repeatedly until a steady stream of bubble- free fuel flows from the bleed screw (or from the fine filter outlet).</p> <p>③ Tighten the bleed screw (①) (or the outlet connector (②)) securely.</p> <p>Note: The outlet port of the fine filter is normally marked with an arrow indicating the direction of fuel flow; the connector attached to the fuel line is the one that should be loosened.</p>	
<p>3) Bleed the fuel injection pump:</p> <p>① Loosen the bleed screw (①) on the fuel injection pump.</p> <p>② Press the hand pump on the pre- filter repeatedly until a steady stream of bubble- free fuel flows from the bleed screw (①).</p> <p>③ Tighten the bleed screw (①) securely.</p>	
<p>4) Continue pressing the hand pump (①) on the pre- filter to allow more fuel to flow continuously into the fuel injection pump.</p>	
<p>5) After starting the engine, it is recommended to run the engine at idle for 2–3 minutes, then at 60 %–80 % of the rated speed for 3–5 minutes, in order to fully bleed air from the fuel system.</p>	

4.1.7 Store

- Before long-term storage, perform maintenance on the diesel engine, repair any damaged components, and clean it thoroughly to keep the engine in good condition.
- The machine must be parked indoors in a dry location. If outdoor parking is unavoidable, remove the battery and store it indoors; cover the machine with a protective cover.
- When the storage ambient temperature is below 5 °C or the storage period exceeds two months, drain the coolant from the engine to prevent freezing damage to components or internal corrosion. First, allow the engine and radiator to cool sufficiently (temperature below 50 °C), then open the pressure cap on the radiator, loosen the drain valve on the oil cooler, and drain all water. Afterward, tighten the pressure cap and the drain valve securely.
- When the temperature is below –30 °C, remove the battery and move it to a warm room for insulation; otherwise, starting may become difficult.
- Replace the engine oil. New oil is normally neutral and will not corrode the engine's metal components.
- It is recommended to start the diesel engine once a month during storage and run it for a short period so that lubricated parts re-establish an oil film and prevent rust.
- Note: Before starting, refill the coolant; after stopping, drain the coolant completely.

4.2 Maintenance of Diesel Engines

The diesel engine must undergo its first maintenance in accordance with the requirements specified in the user warranty/maintenance manual, and the maintenance details shall be recorded promptly.

During operation, the engine shall also undergo routine maintenance as specified below. Daily maintenance shall be carried out by the user, while other levels of maintenance shall be performed by qualified professional maintenance personnel.

The air cleaner is a critical component for ensuring that the engine draws in clean air. Regularly check the sealing condition of the intake system and maintain or replace the air cleaner as needed, to prevent early wear of the engine.

4.2.1 Break-in

The new diesel engine requires a running-in period (first 50 hours) to further

improve the fit performance of various moving parts and ensure the operational reliability and service life of the engine. During the running-in period, the following points should be noted:

- (1) After starting, the diesel engine should run at medium or low speed for at least 5 minutes to warm up.
- (2) After starting, do not increase the load sharply; instead, increase it gradually.
- (3) The diesel engine should not idle or operate at full load for more than 5 minutes.
- (4) Frequently check the oil pressure gauge and water temperature gauge to ensure the engine is operating under normal conditions.

For a newly overhauled diesel engine, a running-in period is also necessary (which can refer to the running-in procedure for a new engine) to ensure proper matching of all friction pairs. After the running-in period, the engine oil and the oil filter element should be replaced. Running-in by idling is not allowed, as it may lead to premature wear.

4.2.2 Maintenance of Diesel Engines

Proper, timely, and careful maintenance can ensure the long-term good operation of the diesel engine, prevent failures, reduce wear, and extend its service life. Users should perform maintenance on the diesel engine according to the contents listed in this chapter, which are categorized as follows:

4.2.2.1 The maintenance intervals shall be as specified in the table below:

Note: Under harsh operating conditions (such as ambient temperatures below -20°C or above 35°C , or high-dust environments such as deserts, mines, construction sites, coal yards, etc.), the engine oil replacement interval must be shortened.

Engine Maintenance Schedule												
Project	Maintenance interval											
	50hrs	100hrs	250hrs	400hrs	500hrs	1 or 2 month	3 month	800hrs	1500hrs	3000hrs	2years	
Check the fuel line connections and drain	☆											
※Replace oil	★ First		☆									
Check the electrolyte level in the battery		☆										
Check the tension and condition of the fan		☆										
Check the radiator hoses and hose clamps		☆										
※Replace oil Filter	★ First		☆									
Check the intake pipe			☆									
Replace fuel Filter			☆									
Clean air Filter			☆									
Clean fuel tank					☆							
Replace fan belt								☆				
※Check the battery and charge it		☆				☆						
Replace air filter element					☆							
Inspect valve clearance								☆				
※Inspect injector									☆			
Inspect turbocharge(If equip)										☆		
Replace the intake pipe rubber hose												☆
Replace the battery as determined by its												☆
Replace the radiator hoses and hose clamps												☆
Replace the fuel hoses and clamps												☆
Replace the coolant (LLC) in the cooling												☆
Inspect the marine sea water pump impeller								☆				☆
Replace the marine sea water pump impeller											☆	☆
Replace the marine zinc anode												☆
Clean the inside of the water jacket and									☆			☆
Note: After the first 50 hours of operation, the engine oil and oil filter must be replaced.												

5. Instructions for Daily Maintenance of Diesel Engines

A proper maintenance routine begins with a daily assessment of the condition of the diesel engine and its systems. Before starting the engine, check the engine oil level and coolant level, and look for the following conditions:

- Leakage
- Loose or damaged components
- Whether the belts are worn or damaged
- Any changes in the appearance of the diesel engine
- Presence of fuel odor

At the same time, check whether any warning lights are on; if so, identify the cause. If it is a historical fault, it may be cleared.

This section provides instructions for the daily maintenance of certain systems and components of the diesel engine.

5.1 Inspect the coolant level of the cooling system

Check the coolant level



Warning

Do not open the radiator pressure cap when the diesel engine is hot. Wait until the coolant temperature drops below 50 °C before opening the pressure cap; otherwise, high-temperature coolant or steam may spray out and cause personal injury.



Warning

The coolant is toxic—keep children and pets away from it. If it is no longer to be used, dispose of it in accordance with local environmental regulations.



Warning

Do not use corrosive cleaning agents in the cooling system, as they may damage aluminum components.



Caution

Do not use sealants to fix leaks in the cooling system. This can cause blockages in the system and restrict coolant flow, leading to diesel engine overheating.

The coolant level must be checked daily.

△ Caution

Do not add cold coolant to a hot diesel engine. Doing so may damage the engine castings. Wait until the engine temperature drops below 50 °C before adding coolant.

The supplementary coolant added to the diesel engine must be mixed with antifreeze, supplemental coolant additive, and water in the correct proportions to avoid damaging the engine.

Fill the coolant to the bottom of the filler neck of the radiator or expansion tank.

5.2 Fan

The cooling fan should be visually inspected daily. Check for cracks, loose rivets, bent or loose blades. Inspect the fan to ensure it is securely mounted. If necessary, tighten the bolts.



Do not rotate the diesel engine by pulling or prying the fan. Doing so may damage the fan blades, cause fan failure, and result in personal injury or property damage. Use an accessory drive shaft or crankshaft turning tool to rotate the crankshaft.



Do not attempt to straighten bent fan blades or continue using a damaged fan. Bent or damaged fan blades will not function properly and may cause personal injury or property damage.

5.3 Fuel Filter



Drain the water from the fuel filter (pre-filter) into a container and dispose of it in accordance with local environmental regulations.

Raywin Engine (Chongqing) Co., Ltd. requires that a fuel filter (pre-filter and fine filter) or fuel-water separator be installed in the fuel supply system. Drain the water and sediment from the fuel filter (pre-filter) or fuel-water separator daily.



拧松放水阀，将水放尽，然后拧紧放水阀

图 5-1 燃油滤清器放水示意图



When closing the drain valve, do not overtighten it, as excessive tightening may damage the threads.

5.4 Oil Level Check

Check the engine oil level before each start-up.

△ Caution

Do not operate the diesel engine when the engine oil level is below the lower mark or above the upper mark on the dipstick, as this will reduce engine performance and may cause damage to the engine.

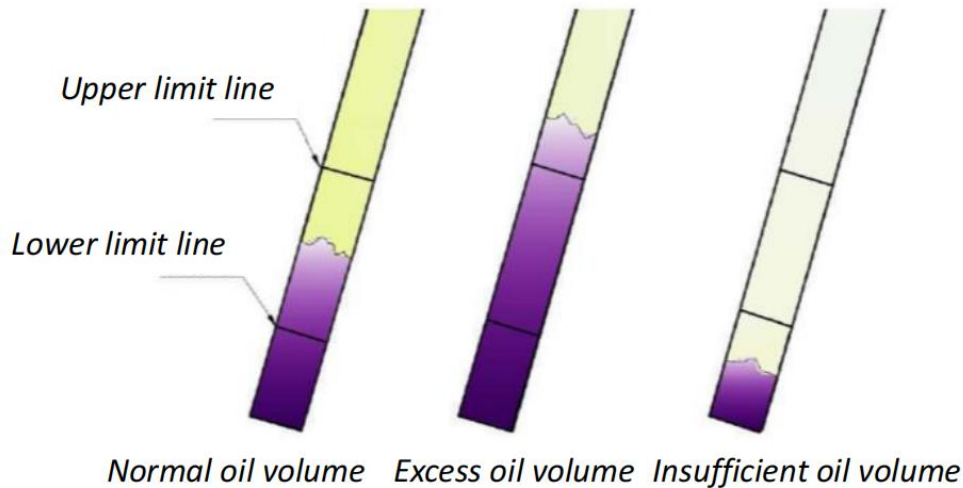


Fig. 5-2 Illustration of Engine Oil Fill Levels on Dipstick

An accurate reading can only be obtained when the diesel engine is shut down. Wait at least 15 minutes after the engine stops before checking the engine oil level. This allows the oil to drain back into the oil pan.

! Warning!

Used engine oil is carcinogenic and may cause reproductive harm. Avoid inhaling oil vapors, swallowing, or prolonged skin contact with used oil. If it is no longer to be used, dispose of it in accordance with local environmental regulations.

! Warning!

To reduce the risk of personal injury, avoid direct skin contact with hot engine oil.

5.5 Inspect drive belt

The belt tension should neither be too loose nor too tight. If too loose, it will reduce transmission efficiency, causing the water pump, fan, and alternator to run at insufficient speeds, which affects cooling performance. At the same time, vibration caused by excessive looseness leads to unnecessary wear of the belt and pulleys. If too tight, it will shorten the service life of the belt, bearings, and other related parts.

Belt deflection check: As shown in Figure 5-3, apply a vertical force of approximately 98 N toward the inside of the belt between the two pulleys. The belt is considered to have proper tension if it deflects inward by (9–14) mm.

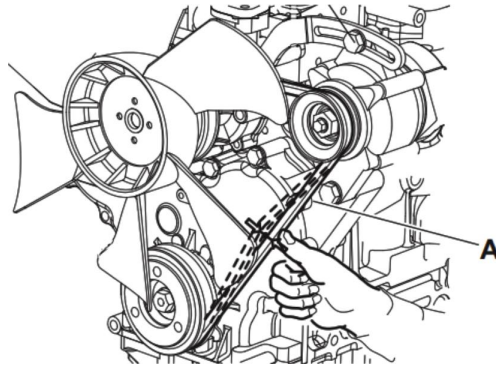


Fig.5-3 Drive belt inspect drawing

During maintenance, use a sonic-type tension gauge or mechanical tension gauge to measure belt tension. The belt tension shall meet the following requirements:

In V-belt drive systems, the preload of a single V-belt shall comply with the values given in the table below. Belts that have accumulated running time exceeding 10 minutes should be treated as used belts.

Note: Manual maintenance is not required for multi-ribbed belts with automatic tensioning mechanisms.

Table 5-1 Belt Inspection Standard Values

V belt Model	Preload Value of Single V-Belt (N)	
	New	Old
AV13,SPA	400±50	300±50
AV17,SPB	600±50	500±50
AV22,SPC	800±50	650±50

5.6 Air filter

The user can judge the blockage condition of the air cleaner by observing the air restriction indicator installed on the intake pipe behind the air cleaner. When the indicator window on the air restriction indicator changes from green (normal condition) to red, it means the intake resistance of the filter has exceeded the specified limit and the filter needs to be cleaned or replaced.

△ Caution

It is strictly prohibited to operate the diesel engine without an air cleaner or with a failed air cleaner. The intake air must be pre-filtered to prevent dust and impurities from entering the engine, which could cause premature wear.



Fig.5-4 Air filter

5.7 Valve train

To ensure the diesel engine operates normally, the user should regularly inspect and adjust the valve clearance as required. In the cold state, the intake valve clearance is 0.2 ± 0.05 mm, and the exhaust valve clearance is also 0.2 ± 0.05 mm.

Method for inspecting and adjusting valve clearance:

- (1) Rotate the crankshaft to bring the No. 1 cylinder to top dead center (TDC) of the compression stroke. At this position, you can inspect and adjust valves No. 1, 2, 4, and 5.
- (2) Then rotate the crankshaft another 360° , and inspect and adjust valves No. 3 and 6.

Valve clearance is adjusted by turning the valve adjusting screw:

- First, loosen the lock nut.
- Use a screwdriver to turn the adjusting screw in or out as needed.
- Check the clearance between the rocker arm and the valve with a feeler gauge.
- Once the clearance meets the specification, tighten the lock nut securely.

6.Common Faults and Troubleshooting Methods for Diesel Engines

Note: This manual describes some typical diesel engine operating problems, their causes, and corresponding solutions.



Warning: Performing diagnostic and troubleshooting procedures not covered in this chapter may result in equipment damage, personal injury, or even death. All diagnostic and troubleshooting work must be carried out by trained technicians. For diagnostic and troubleshooting steps or symptoms not listed in this chapter, please contact an authorized Raywin service station.

When performing fault diagnosis, please follow these recommendations:

- ※ Carefully analyze the problem before taking action;
- ※ Start with the easiest and most obvious areas;
- ※ Identify and eliminate the root cause of the problem.

To detect faults promptly, protect the diesel engine, and especially to significantly reduce repair time and improve engine availability, the ECUs (Electronic Control Units) of Raywin Engine (Chongqing) Co., Ltd.'s 3M1800/N and 3M18T00/N electronically controlled diesel engines are equipped with self-diagnosis functions. The ECU can judge faults by monitoring electrical signals in the electronic control system, and is capable of diagnosing most electronic control components as well as a small number of mechanical component faults.

Once the ECU detects a fault in the diesel engine's electronic control system, it generates corresponding fault code information and stores it in the ECU memory. In the after-sales market, fault codes stored in the ECU are usually read out using a dedicated diagnostic instrument or via the vehicle's fault indicator lamp (flash codes). Reading fault flash codes to obtain fault information is currently the most widely applicable method, mainly used to temporarily acquire fault information when professional after-sales personnel are unavailable. This method is simple to operate, convenient and practical, and allows both reading and clearing of fault information.

In the era of electronically controlled diesel engines, we recommend that drivers

learn and master this method as a basic skill. (Engines equipped with DB-pump fuel systems do not have these functions.)

1. Fault Indicator Lamp Description

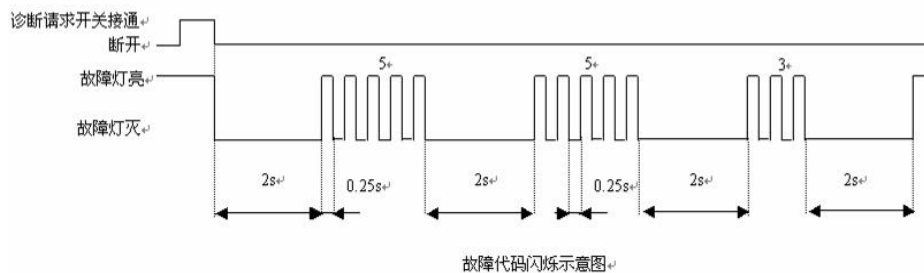
- The fault indicator lamp is located on the instrument panel.
- The color is generally red (refer to the vehicle owner's manual for specifics).
- During power-on self-test, the fault indicator lamp illuminates constantly for 2 seconds, then goes off.
- It lights up when a fault occurs in the electronic fuel injection system.
- For general (minor) faults, the fault indicator lamp stays on continuously.
- For serious faults, the fault indicator lamp flashes.
- After the fault disappears, the fault indicator lamp turns off automatically.

2. Fault Flash Code Reading Method

Method for Reading Fault Flash Codes via the Fault Indicator Lamp:

- Turn the ignition switch to the ON position.
- Can be performed in both standby and running conditions.
- Press and release the diagnostic request switch to activate the fault flash codes.
- Each operation will flash one fault code; repeat the process in sequence to read all fault codes.
- Fault flash codes include historical faults and current faults.
- After clearing the fault codes, reading again will display only the current faults.

For example, when using the method described above to read the warning lamp circuit fault stored in the ECU memory via the fault indicator lamp, and the fault flash code is 553, the flashing pattern of the fault indicator lamp is as follows:



3. Method for Clearing Historical Fault Codes

In practical applications, the historical fault codes stored in the ECU memory can be conveniently deleted using the diagnostic request switch. The specific procedure is as follows:

- Press the diagnostic request switch.
- Turn the ignition switch to the OFF position and keep it there for more than 18 seconds until the ECU is completely powered down.
- Turn the ignition switch to the ON position to power up the ECU.

Approximately 6 seconds (within the range of 4 - 8 seconds) after the ECU powers up, release the diagnostic request switch. This completes the clearing process.

6.1 Troubleshooting Methods for Diesel Engine Starting Failure

Root Cause	Troubleshooting method
<p>Fuel quality does not meet requirements:</p> <ol style="list-style-type: none"> 1.Using fuel of an incorrect grade/specification; 2.Excessive impurities in the fuel; 3.Excessive water content in the fuel. <p>If it meets the requirements, proceed to Step 1.</p>	<p>Replace the fuel with qualified (meeting specifications) fuel, and clean the fuel system.</p>
<p>Electronic fuel injection system fails to power up</p>	<p>Check the wiring harness and fuses of the electronic fuel injection (EFI) system, the main power switch, and especially the ignition switch. A practical and quick method to determine this fault is as follows:</p> <ul style="list-style-type: none"> ●During power- on self- test, the fault indicator lamp does not illuminate. ●The diagnostic tool cannot establish communication with the ECU. ●The throttle power supply wire in the throttle connector lacks the 5 V reference voltage.
<p>Battery voltage is insufficient</p>	<p>Replace the battery or charge it.</p>



If it meets the requirements, proceed to Step 3.

Starter cant start

.....

1. Check the vehicle gear position to confirm it is in neutral.
2. Inspect the neutral switch and its wiring for integrity; try using emergency start (keep the start request switch engaged for more than 5 seconds) and observe whether the starter motor operates.
3. Check the start request switch, start control relay, and their wiring.
4. Verify that the under- vehicle shutdown switch is in the OFF (open) position.
5. Inspect the starter motor.

If it meets the requirements, proceed to Step 4.

There are fault codes stored in the ECU memory:

1. Fault codes can be read using a diagnostic instrument.
2. Fault information of the electronic control system can be read through the CAN dashboard.

.....

1. Based on the fault code information, inspect and repair the relevant components or systems.
2. After repairs, use a diagnostic instrument to clear the historical fault information, then run the engine sufficiently to confirm that there are no fault code messages stored in the ECU memory.

If it meets the requirements, proceed to Step 5.

Unable to establish working timing:

1. During the starting process,

.....

1. Check whether the crankshaft/camshaft signal sensors are intact and undamaged.
2. Inspect the crankshaft/camshaft

<p>the diagnostic instrument detects no change in engine speed.</p> <p>2.Both crankshaft and camshaft signals are lost.</p> <p>3.Oscilloscope shows incorrect installation phase.</p>		<p>connectors and wiring for integrity and damage.</p> <p>3.Check whether the crankshaft reluctor ring is damaged or contaminated (inspect through the sensor signal hole).</p> <p>4.Check whether the camshaft reluctor ring is damaged or contaminated (inspect through the sensor signal hole).</p> <p>5.Verify the installation gap of the wiring for the crankshaft position sensor and camshaft phase sensor (typically 1 ± 0.5 mm).</p> <p>6.If any disassembly/reassembly of components such as the reluctor rings was performed during maintenance, check that the timing phase assembly is correct.</p>
---	--	--

If it meets the requirements, proceed to Step 6.

<p>Low-pressure fuel circuit fault</p>	<p>.....</p>	<p>1.Ensure there is sufficient diesel fuel in the tank.</p> <p>2.Bleed air from the low-pressure fuel circuit.</p> <p>3.Check the tightening condition of pipes and fittings, and verify that hoses and connectors are not crushed, damaged, or of incorrect diameter.</p> <p>4.Inspect the fuel filter for clogging or damage.</p> <p>5.Check whether the fuel tank ventilation device is blocked or contaminated (open the fuel tank cap and listen for the fuel draw sound).</p> <p>6.Verify that the inlet and return lines of</p>
--	--------------	---

		<p>the fuel pump and filter are not connected in reverse.</p>
<p>If it meets the requirements, proceed to Step 7.</p>		
<p>Rail pressure relief valve opens or leaks</p>	<p>.....</p>	<p>Repair the pressure relief valve of the common rail pipe, or directly replace the high- pressure common rail pipe.</p>
<p>If it meets the requirements, proceed to Step 8.</p>		
<p>Injector Fault</p>	<p>.....</p>	<ol style="list-style-type: none"> 1. Check the injector connectors and their wiring. 2. Inspect whether the indentation on the sealing surface at the connection between the high- pressure pipe and the injector is regular. 3. Check the injector return fuel quantity. 4. Remove the injector and inspect whether there are signs of fuel spraying at the front end of the injector. 5. Clean or replace the injector, replace with clean fuel, and conduct a thorough road test.
<p>If it meets the requirements, proceed to Step 9.</p>		
<p>High- pressure fuel pump fault:</p> <ol style="list-style-type: none"> 1. Blockage in the internal fuel passages of the high- pressure fuel pump. 2. Wear of the plungers inside the high- pressure fuel pump. 3. Blockage, contamination, or 	<p>.....</p>	<p>Clean or replace the high- pressure fuel pump, replace with clean fuel, and conduct a thorough road test.</p> <p>Under normal circumstances, if the rail pressure cannot reach 200 bar during the starting process and the common rail pressure remains unchanged, it can be determined that the high- pressure fuel pump is blocked. If the rail pressure</p>

<p>sticking of the relief valve in the high-pressure fuel pump.</p>	<p>shows significant changes, the injector faults should be investigated first.</p>
<p>If it meets the requirements, proceed to Step 10.</p>	
<p>Cylinder air tightness and compression performance faults:</p> <ol style="list-style-type: none"> 1. Insufficient compression pressure. 2. Excessive wear of piston rings. 3. Valve leakage (air leakage from valves). 	<p>Replace the piston rings; install cylinder liners if necessary depending on the condition.</p> <p>Check whether the valve adjusting screws are functioning properly, and inspect the sealing of the valve springs, valve guides, and valve seats; if sealing is inadequate, grind the valve seats. Tighten, clean, or replace as needed.</p> <p>Remove carbon deposits from the combustion chamber.</p> <p>Check for bent crankshaft connecting rods or other related issues.</p>
<p>If it meets the requirements, proceed to Step 11.</p>	
<p>Other mechanical component faults</p>	<p>Check the fuel/oil circuits.</p> <p>Inspect the intake/exhaust passages.</p> <p>Check whether the filters are clogged, etc.</p>

6.2 Hard starting

Root Cause	Troubleshooting method
<p>Insufficient preheating:</p> <ol style="list-style-type: none"> 1. Under extremely cold operating conditions, starting before the cold start indicator lamp 	<p>Check whether the preheating circuit is properly connected.</p> <p>Check whether the resistance level of the preheating grid is normal.</p> <p>Check whether the battery capacity is</p>

<p>stops blinking or goes off.</p> <p>2.Multimeter or diagnostic instrument shows abnormal voltage fluctuation of the battery during the preheating process.</p>		<p>sufficient.</p>
--	--	--------------------

If it meets the requirements, proceed to Step 1.

<p>Other reason</p>	<p>.....</p>	<p>Refer to the troubleshooting procedure for engine starting failure</p>
---------------------	--------------	---

6.3 Low Power

Root Cause

<p>Fuel quality does not meet requirements:</p> <p>1.Use of fuel with an incorrect grade/specification.</p> <p>2.Excessive impurities in the fuel.</p> <p>3.Excessive water content in the fuel.</p>
--

Troubleshooting method

<p>Replace the fuel with qualified (specification- compliant) fuel, and clean the fuel system.</p>
--

If it meets the requirements, proceed to Step 1.

<p>There are fault codes stored in the ECU memory:</p> <p>1.Fault codes can be read using a diagnostic instrument.</p> <p>2.Electronic control system</p>	<p>.....</p>	<p>1.If the fault code information clearly indicates a specific electronic control component, inspect and repair the corresponding sensor or actuator and any associated wiring faults.</p> <p>2.If rail pressure – related fault codes are retrieved, prioritize troubleshooting</p>
---	--------------	---

fault information can be read through the CAN dashboard.

fuel system – related faults according to the following steps.

3. After repairs, use a diagnostic instrument to clear the historical fault information, then run the engine sufficiently to confirm that no fault codes remain stored in the ECU memory.

If it meets the requirements, proceed to Step 2.

Camshaft sensor and its wiring fault (for models equipped with a camshaft sensor)

1. Check the camshaft sensor connector and wiring.
2. Check whether the installation gap between the camshaft sensor and the reluctor ring (signal disc) is correct.
3. Check whether the camshaft sensor is dirty or damaged.

If it meets the requirements, proceed to Step 3.

Turbocharger pressure/temperature sensor and its wiring fault

1. Check the connector and wiring of the turbocharge pressure/temperature sensor.
 2. Check whether the boost pressure/temperature sensor is dirty or damaged.
- If there is a short-circuit fault in the sensor reference voltage 1, also check whether the power supply wires of the oil pressure/temperature sensor and the boost pressure/temperature sensor are shorted.

If it meets the

requirements, proceed to Step 4.

Rail pressure sensor and its wiring fault

.....

Check the connector and wiring of the rail pressure sensor.

Check whether the rail pressure sensor is dirty or damaged.

If it meets the requirements, proceed to Step 5.

Water temperature sensor

.....

1.Check the connector and wiring of the coolant temperature sensor.

2.Check whether the coolant temperature sensor is dirty or damaged.

If it meets the requirements, proceed to Step 6.

Low- pressure fuel circuit fault

.....

1.Ensure there is sufficient diesel fuel in the tank.

2.Bleed air from the low- pressure fuel circuit.

3.Check the tightening condition of pipes and fittings, and verify that hoses and connectors are not crushed, damaged, or of incorrect diameter.

4.Inspect the fuel filter for clogging or damage.

5.Check whether the fuel tank ventilation device is blocked or contaminated (open the fuel tank cap and listen for the fuel draw sound).

6.Verify that the inlet and return lines of the fuel pump and filter are not connected in reverse.

		7. Check whether the gear pump of the fuel pump is faulty.
<p>If it meets the requirements, proceed to Step 7.</p>		
<p>Rail pressure relief valve opens or leaks:</p> <p>Start the engine; a temperature rise can be felt by hand on the return line of the relief valve, or by disconnecting the return line fitting, leakage from the relief valve can be observed.</p>	<p>.....</p>	<p>When the rail pressure relief valve opens or leaks, repair the pressure relief valve of the common rail pipe, or directly replace the high- pressure common rail pipe.</p>
<p>If it meets the requirements, proceed to Step 8.</p>		
<p>Intake system blockage or leakage</p>	<p>.....</p>	<p>Check the air filter and intake pipe, and clean or replace the air filter element.</p>
<p>If it meets the requirements, proceed to Step 9.</p>		
<p>Excessive exhaust back pressure</p>	<p>.....</p>	<ol style="list-style-type: none"> 1. Check the valve timing and adjust it if necessary; clean the exhaust pipe. 2. Inspect and clean the exhaust pipe and muffler assembly.
<p>If it meets the requirements, proceed to Step 10.</p>		
<p>Turbocharge system issue</p>	<p>.....</p>	<ol style="list-style-type: none"> 1. Check and eliminate any leaks at pipelines and connections. 2. Rotate the turbocharger shaft to confirm whether the shaft is seized or stuck.

If it meets the requirements, proceed to Step 11.

Fuel line leakage or blockage

.....

Check the sealing condition of the fuel pipes and joints, inspect the fuel filter for clogging, and replace the spin-on filter. Also check the sealing of the injector(s).

If it meets the requirements, proceed to Step 12.

Engine overheating – coolant temperature too high

.....

Check/repair the radiator and thermostat, and check the tension of the fan belt.

If it meets the requirements, proceed to Step 13.

Injectors issue

-
1. Check the injector connector and its wiring.
 2. Check whether the indentation on the sealing surface at the connection between the high-pressure pipe and the injector is regular.
 3. Check the injector return fuel quantity.
 4. Check whether there are signs of fuel spray at the front end of the injector.
 5. Check whether the thickness of the injector gasket is correct.
 6. Clean or replace the injector, replace with clean fuel, and conduct a full road test.

If it meets the requirements, proceed to Step 14.

High-pressure fuel pump fault:

.....

Clean or replace the high-pressure fuel pump, replace with clean fuel, and perform

<ol style="list-style-type: none"> 1. Blockage in the internal oil passages of the high-pressure fuel pump. 2. Wear of the plungers in the high-pressure fuel pump. 3. Blockage, contamination, or seizure of the relief valve in the high-pressure fuel pump. 		<p>a full road test.</p> <p>Under normal circumstances, if the rail pressure cannot reach 200 bar during the starting process and there is no change in common rail pressure, the high-pressure fuel pump can be determined to be blocked. If the rail pressure shows significant changes, the injector faults should be investigated first.</p>
---	--	--

If it meets the requirements, proceed to Step 15.

<p>Cylinder airtightness and compression performance fault:</p> <ol style="list-style-type: none"> 1. Insufficient compression pressure. 2. Excessive wear of piston rings. 3. Valve leakage. 	<p>.....</p>	<ol style="list-style-type: none"> 1. Replace the piston rings, and install cylinder liners if necessary. 2. Check whether the valve adjusting screws are functioning properly, and inspect the sealing of the valve springs, valve guides, and valve seats; if the seal is poor, grind the valve seat. 3. Tighten, clean, or replace as required. 4. Check whether the in-cylinder brake is faulty. 5. Remove carbon deposits from the combustion chamber. 6. Check for bent crankshaft or connecting rod, etc.
--	--------------	--

If it meets the requirements, proceed to Step 16.

<p>Interference from other control modules on the</p>		<p>Alternately disconnect other control modules on the CAN network until</p>
---	--	--

CAN network with the control functions of the engine ECU

communication or function is restored.

If it meets the requirements, proceed to Step 17.

Excessive auxiliary power consumption of the vehicle

.....

Check whether the vehicle brakes are dragging, whether the transmission has a fault, and whether the cooling fan's duty cycle time and the engine's drivetrain are operating normally.

If it meets the requirements, proceed to Step 18.

Internal engine damage

.....

Analyze the engine oil and inspect the oil filter to identify possible damaged components.

6.4 Abnormal noise during diesel engine operation

Based on the location of the abnormal noise, the fault can be pinpointed and troubleshooting steps adjusted accordingly, so as to quickly eliminate the problem. It is important to distinguish between collision sounds from rotating parts, interference or rubbing noises caused by vibration, and resonance sounds.

Sounds from rotating parts are generally regular in pattern. Resonance sounds, however, may disappear or intensify as engine speed changes.

Root Cause	Troubleshooting method
<p>Fault codes stored in the ECU memory:</p> <ol style="list-style-type: none"> 1. Fault codes can be read using a diagnostic tool. 2. Fault information of the electronic control system can be read via the CAN instrument panel. 	<p>If the fault code information clearly points to a specific electronic control component, inspect and repair the corresponding sensor or actuator and its wiring faults.</p> <p>If rail pressure-related fault codes are retrieved, focus on checking fuel system-related faults according to the subsequent steps.</p> <p>After repairs, use a diagnostic tool to clear historical fault information, then run the engine sufficiently to confirm that no fault codes remain stored in the ECU memory.</p>
<p>If it meets the requirements, proceed to Step 1.</p>	
<p>Crankshaft sensor and its wiring fault (for models equipped with a crankshaft sensor)</p>	<ol style="list-style-type: none"> 1. Check the crankshaft sensor connector and its wiring. 2. Check whether the installation clearance between the crankshaft sensor and the signal wheel is correct. 3. Check whether the crankshaft sensor is dirty or damaged.
<p>If it meets the requirements, proceed to Step 2.</p>	
<p>Camshaft sensor and its wiring fault</p>	<ol style="list-style-type: none"> 1. Check the camshaft sensor connector and its wiring.

		<ol style="list-style-type: none"> 2. Check whether the installation clearance between the camshaft sensor and the signal wheel is correct. 3. Check whether the camshaft sensor is dirty or damaged.
--	--	---

If it meets the requirements, proceed to Step 3.

Abnormal noise at idle	<ol style="list-style-type: none"> 1. Check whether there is air in the fuel line. 2. Excessive return fuel quantity from the injectors. 3. Water accumulation in the fuel filter causing poor fuel supply.
------------------------	-------	--

If it meets the requirements, proceed to Step 4.

Acceleration produces a whistling sound or exhaust noise.	<ol style="list-style-type: none"> 1. Check whether the air filter is clean; if it is clogged, replace the air filter. 2. Check whether the intake and exhaust pipes are securely connected and free of leaks; if there is a leak, it must be repaired. 3. Check whether the turbocharger piping connections are secure, clean, and sealed, and whether there are any cracks in the turbocharger pipes; if cracked, clean or replace them. 4. Turbocharger bearing damage, causing rotating parts to contact the housing; surge occurs due to excessively high operating altitude.
---	-------	--

If it meets the requirements, proceed to Step 5.

Mechanical noise / abnormal noise during load acceleration	<ol style="list-style-type: none"> 1. Check whether the engine timing marks are correctly aligned. 2. Check whether the valve timing is
--	-------	---

		<p>correct; if not, adjust it.</p> <p>3. Inspect the engine valve springs for abnormalities; if broken, arrange for replacement.</p> <p>4. Severe wear of the camshaft or rocker shaft.</p> <p>5. Verify the cylinder head gasket seal; if there is a leak, replace it.</p> <p>6. Check whether the breather is emitting smoke to determine if the piston rings are faulty and need replacement.</p> <p>7. Excessive piston clearance.</p> <p>8. Wear of the timing mechanism.</p> <p>9. Check the piston connecting rods for abnormalities.</p>
--	--	--

6.5 Exhaust emitting black smoke

Root Cause		Troubleshooting method
<p>Fuel quality does not meet requirements:</p> <ol style="list-style-type: none"> 1. Use of incorrect grade/fuel type. 2. Excessive impurities in the fuel. 3. Excessive water content in the fuel. 	<p>.....</p>	<p>Replace with fuel of qualified quality and clean the fuel system.</p>
<p>If it meets the requirements, proceed to Step 1.</p>		
<p>There are fault codes stored in the ECU memory:</p> <ol style="list-style-type: none"> 1. Fault codes can be read using a diagnostic tool. 2. Fault information of the 	<p>.....</p>	<ol style="list-style-type: none"> 1. If the fault code information clearly indicates a specific electronic control component, inspect and repair the corresponding sensor or actuator as well as any wiring faults.

<p>electronic control system can be read via the CAN instrument cluster.</p>		<p>2.If rail pressure–related fault codes are detected, focus on investigating fuel system–related faults according to the subsequent steps.</p> <p>3. After repairs, use a diagnostic tool to clear the historical fault information, then run the engine sufficiently to confirm that no fault codes remain stored in the ECU memory.</p>
<p>If it meets the requirements, proceed to Step 2.</p>		
<p>Turbocharge pressure/temperature sensor or its circuit fault</p>	<p>.....</p>	<p>Check the boost pressure/temperature sensor and its wiring on the intake pipe; the intake pressure signal value can be monitored with a diagnostic tool to see if it is lower than the actual value.</p>
<p>If it meets the requirements, proceed to Step 3.</p>		
<p>Coolant temperature sensor or its circuit fault</p>	<p>.....</p>	<p>Check the coolant temperature sensor and its wiring; the coolant temperature signal value can be monitored with a diagnostic tool to see if it is lower than the actual value. If necessary, unplug the coolant temperature sensor connector, start the engine, and compare the readings.</p>
<p>If it meets the requirements, proceed to Step 4.</p>		
<p>Rail pressure sensor or its circuit fault</p>	<p>.....</p>	<p>Check the rail pressure sensor and its wiring.</p>
<p>If it meets the requirements, proceed to Step 5.</p>		
<p>Intake system restriction exceeds technical specifications</p>	<p>.....</p>	<p>Check whether the intake system is blocked. If necessary, clean or replace the air filter and intake pipe.</p>

If it meets the requirements,
proceed to Step 6.

Air intake system or
exhaust system leakage

.....

Check whether there is air leakage in the
intake system and exhaust system.

If it meets the requirements,
proceed to Step 7.

Intercooler blockage or
leakage (for models
equipped with an
intercooler)

.....

Check whether the intercooler is blocked or
leaking.

If it meets the requirements,
proceed to Step 8.

Exhaust system restriction
exceeds technical
specifications

.....

Check whether the exhaust system is
blocked.

If it meets the requirements,
proceed to Step 9.

Muffler is
crushed/deformed or
blocked.

.....

Replace the muffler.

If it meets the requirements,
proceed to Step 10.

Injector Issue

.....

1. Check the injector connector and its wiring.
2. Check whether the indentation on the sealing surface at the connection between the high-pressure line and the injector is regular.
3. Check the injector return fuel quantity.
4. Check whether there is any sign of fuel leakage at the front end of the injector.
5. Check whether the thickness of the injector gasket is correct.
6. Clean or replace the injector, replace with

		clean fuel, and conduct a sufficient road test.
If it meets the requirements, proceed to Step 11.		
Valve leakage or abnormal valve clearance	.....	Check and adjust valve sealing.
If it meets the requirements, proceed to Step 12.		
Insufficient turbocharge system pressure.	.....	Check and eliminate leaks in lines and connections.
If it meets the requirements, proceed to Step 13.		
Turbocharger malfunction.	.....	Turbocharger cannot rotate or is seized; check and replace the assembly.
If it meets the requirements, proceed to Step 14.		
Internal engine damage.	.....	Analyze the engine oil and inspect the oil filter to identify possible damaged components.

6.6 Exhaust emitting white smoke or blue smoke

The machine may sometimes emit white smoke after a cold start, but this phenomenon will disappear as the operating time increases and the water temperature rises. This is normal behavior and not a fault.

Root Cause		Troubleshooting method
Fuel quality does not meet requirements: 1. Use of incorrect grade of fuel; 2. Excessive impurities in the fuel; 3. Excessive water content in the fuel.	.....	Replace the fuel with qualified (meeting specifications) fuel and clean the fuel system.
If it meets the requirements,		

proceed to Step 1.

Fault codes stored in the ECU memory:

- 1.Fault codes can be read using a diagnostic tool;
- 2.Fault information of the electronic control system can be read through the CAN instrument.

.....

- 1.If the fault code information clearly points to a specific electronic control component, inspect and repair the corresponding sensor or actuator and its wiring faults;
- 2.If rail pressure-related fault codes or fault flash code information are detected, focus on troubleshooting fuel system-related faults according to the subsequent steps;
- 3.After repairs, use a diagnostic tool to clear historical fault information, then run the engine sufficiently to confirm that there are no fault codes stored in the ECU memory.

If it meets the requirements, proceed to Step 2.

Fault in the turbocharge pressure/temperature sensor or its circuit

.....

Check the turbocharge pressure/temperature sensor on the intake manifold and its wiring; you can monitor the intake pressure signal value via the diagnostic tool to see if it is lower than the actual value.

If it meets the requirements, proceed to Step 3.

Coolant temperature sensor or its circuit fault

.....

Check the coolant temperature sensor and its wiring; you can monitor the coolant temperature signal value via the diagnostic tool to see if it is lower than the actual value; if necessary, unplug the coolant temperature sensor connector, start the engine, and compare the readings.

If it meets the requirements,
proceed to Step 4.

Engine operating at low
temperatures

.....

1. Check the radiator shutter (or radiator blinds);
2. Check the thermostat operating temperature and replace it if necessary.

If it meets the requirements,
proceed to Step 5.

Ambient temperature is too
low, requiring auxiliary
preheating for starting, or
the preheating grid has
failed

.....

Check whether the preheating grid is
functioning properly.

If it meets the requirements,
proceed to Step 6.

Low-pressure fuel system
fault

.....

1. Ensure there is sufficient diesel fuel in the tank.
2. Bleed air from the low-pressure fuel system.
3. Check the tightening condition of pipes and connectors, and inspect hoses and connectors for crushing, damage, or incorrect diameter size.
4. Check whether the primary filter and secondary (main) filter are clogged or damaged.
5. Check whether the fuel tank ventilation device is blocked or contaminated (open the fuel tank cap and check for the sound of fuel being drawn).
6. Check whether the fuel pump inlet and return lines are connected in reverse.
7. Check whether the fuel pump's gear

		pump is faulty.
<p>If it meets the requirements, proceed to Step 7.</p>		
<p>Clogged air filter leads to increased intake resistance in the cylinders, restricted airflow, creating a certain negative pressure that draws lubricating oil into the combustion chamber</p>	.....	<p>Check whether the air filter is clogged (or blocked).</p>
<p>If it meets the requirements, proceed to Step 8.</p>		
<p>Excessive oil level in the oil pan</p>	.....	<p>Check whether the oil level in the oil pan exceeds the upper limit.</p>
<p>If it meets the requirements, proceed to Step 9.</p>		
<p>Worn turbocharger seal ring</p>	.....	<p>Inspect and replace.</p>
<p>If it meets the requirements, proceed to Step 10.</p>		
<p>Worn turbocharger thrust bearing</p>	.....	<p>Inspect and replace.</p>
<p>If it meets the requirements, proceed to Step 11.</p>		
<p>Blocked turbocharger oil return line</p>	.....	<p>Clean and repair</p>
<p>If it meets the requirements, proceed to Step 12.</p>		
<p>Injector fault</p>	.....	<ol style="list-style-type: none"> 1. Check the injector connector and its wiring. 2. Check whether the indentation on the sealing surface at the connection between the high- pressure line and the injector is regular/even. 3. Check the injector return fuel quantity.

	<p>4. Check whether there are signs of fuel spray at the front end of the injector.</p> <p>5. Check whether the thickness of the injector gasket is correct.</p> <p>6. Clean or replace the injector, replace with clean fuel, and perform a full road test.</p> <p>7. Check whether the injector protrusion height is correct.</p>
--	---

If it meets the requirements, proceed to Step 13.

Valve leakage or abnormal valve clearance	Check and adjust valve sealing performance.
---	---

If it meets the requirements, proceed to Step 14.

Coolant leakage into the combustion chamber	Check for coolant leakage.
---	----------------------------

If it meets the requirements, proceed to Step 15.

Severe wear of cylinder liner, piston, and piston rings with excessive clearance, causing lubricating oil to flow upward into the combustion chamber and burn	Check the condition of the cylinder liner(s), piston(s), and piston ring(s).
---	--

If it meets the requirements, proceed to Step 16.

Excessive clearance between valve and guide, leading to large amounts of lubricating oil being drawn into the combustion chamber and burned	Replace worn valves and valve guides.
---	---------------------------------------

If it meets the requirements,

proceed to Step 17.

Low compression pressure and incomplete combustion

.....

Check piston rings and cylinder head gasket; replace as necessary.

If it meets the requirements, proceed to Step 18.

Incorrect installation direction of piston rings, or ring gaps not staggered

.....

Inspect and reassemble.

If it meets the requirements, proceed to Step 19.

Long-term operation under low load

.....

Operate at the appropriate working speed and load.

If it meets the requirements, proceed to Step 20.

Internal damage to the engine

.....

Analyze the engine oil and inspect the oil filter to identify possible damaged components.

6.7 Oil pressure is abnormal

6.7.1 Oil pressure is low

Root Cause

Fault codes stored in the ECU memory:

1. Fault codes can be read using a diagnostic tool.
2. Fault information of the electronic control system can be read through the CAN instrument.

.....

Troubleshooting method

1. If the fault code information clearly points to a specific electronic control component, inspect and repair the corresponding sensor or actuator and its wiring faults.
2. After repairs, use a diagnostic tool to clear the historical fault information, then run the engine sufficiently to confirm that there are no fault codes stored in the ECU memory.

If it meets the requirements, proceed to Step 1.

<p>Whether the oil filter element is improperly installed</p>		<p>Remove the oil filter element, then reinstall it.</p>
<p>If it meets the requirements, proceed to Step 2.</p>		
<p>Oil pressure gauge or oil pressure/temperature sensor is faulty, or its mounting position is incorrect</p>	<p>.....</p>	<p>Check whether the oil pressure gauge or oil pressure/temperature sensor and its circuit are functioning properly, and verify that they are installed in the correct position.</p>
<p>If it meets the requirements, proceed to Step 3.</p>		
<p>Lubricating oil has thinned out, or inappropriate lubricating oil is used</p>	<p>.....</p>	<p>Select the appropriate lubricating oil as specified, analyze the oil, and identify possible damaged components.</p>
<p>If it meets the requirements, proceed to Step 4.</p>		
<p>Pressure regulating valve of the lubricating oil filter is malfunctioning or improperly adjusted</p>	<p>.....</p>	<p>Repair.</p>
<p>If it meets the requirements, proceed to Step 5.</p>		
<p>Lubricating oil filter is clogged</p>	<p>.....</p>	<p>Replace the spin-on oil filter element.</p>
<p>If it meets the requirements, proceed to Step 6.</p>		
<p>Crack in the lubricating oil pump's inlet pipe</p>	<p>.....</p>	<p>Repair or replace.</p>
<p>If it meets the requirements, proceed to Step 7.</p>		
<p>Loose mounting bolt of the lubricating oil pump's inlet pipe</p>	<p>.....</p>	<p>Tighten to the specified torque.</p>
<p>If it meets the requirements, proceed to Step 8.</p>		

Worn lubricating oil pump rotor or excessive assembly clearance	.....	Replace the lubricating oil pump.
If it meets the requirements, proceed to Step 9.		
Excessive bearing clearance	.....	Inspect and replace.

6.7.2 Oil pressure is high

Root Cause		Troubleshooting method
<p>Fault codes stored in the ECU memory:</p> <ol style="list-style-type: none"> 1.Fault codes can be read using a diagnostic tool. 2.Fault information of the electronic control system can be read through the CAN instrument.	.....	<ol style="list-style-type: none"> 1.If the fault code information clearly points to a specific electronic control component, inspect and repair the corresponding sensor or actuator and its wiring faults. 2.After repairs, use a diagnostic tool to clear the historical fault information, then run the engine sufficiently to confirm that there are no fault codes stored in the ECU memory.
If it meets the requirements, proceed to Step 1.		
The oil pressure gauge or oil pressure/temperature sensor is faulty, or its mounting position is incorrect.	.....	Check whether the oil pressure gauge or oil pressure/temperature sensor and its circuit are functioning properly, and verify that they are installed in the correct position.
If it meets the requirements, proceed to Step 2.		
Ambient temperature is too low, causing the viscosity of the lubricating oil to increase.	.....	Use the lubricating oil of the specified grade; after starting the engine, run it at low speed initially, and check only after the oil temperature has reached normal.

If it meets the requirements,
proceed to Step 3.

The relief valve is clogged
(or blocked).

.....

Inspect and clean.

6.8 Oil consumption is high

Root Cause

Troubleshooting method

External lubricating oil
pipeline is leaking

.....

Inspect and repair

If it meets the requirements,
proceed to Step 1.

Engine is overloaded

.....

1.Reduce the load.
2.Confirm whether the intake system is
abnormal, as a blockage can cause the
engine to be overloaded.

If it meets the requirements,
proceed to Step 2.

Inappropriate grade of
lubricating oil is used

.....

Select according to regulations.

If it meets the requirements,
proceed to Step 3.

Dipstick is incorrectly
calibrated

.....

Calibrate the dipstick or replace it.

If it meets the requirements,
proceed to Step 4.

Breather is clogged

.....

Replace the breather.

If it meets the requirements,
proceed to Step 5.

Clogged air filter causes
turbocharger oil leakage

.....

Check whether the air filter is clogged, and
confirm that the turbocharger shaft rotates
normally without seizing.

If it meets the requirements,
proceed to Step 6.

Excessive wear of valve

.....

Inspect and replace.

<p>guide and failure of valve stem seal.</p>		
<p>If it meets the requirements, proceed to Step 7.</p>		
<p>Piston ring seized or excessively worn.</p>	<p>.....</p>	<p>Inspect, repair, and replace if necessary.</p>
<p>If it meets the requirements, proceed to Step 8.</p>		
<p>Excessive wear of cylinder liner.</p>	<p>.....</p>	<p>After boring the cylinder, fit piston rings of the machined size, or install a reconditioned cylinder liner.</p>

6.9 Coolant outlet temperature is too high

Root Cause		Troubleshooting method
<p>Insufficient coolant level, and improper/insufficient coolant flow rate</p>	<p>.....</p>	<p>Check whether the coolant level is sufficient; add coolant if insufficient.</p>
<p>If it meets the requirements, proceed to Step 1.</p>		
<p>Whether the belt is too loose</p>	<p>.....</p>	<p>Adjust</p>
<p>If it meets the requirements, proceed to Step 2.</p>		
<p>Water temperature gauge is damaged, and water temperature sender (sensor) is malfunctioning</p>	<p>.....</p>	<p>Check whether the actual temperature matches the temperature indicated on the gauge; if not, replace the temperature sender (sensor) or water temperature gauge.</p>
<p>If it meets the requirements, proceed to Step 3.</p>		
<p>Expansion tank has poor sealing</p>	<p>.....</p>	<p>Air leakage from the expansion tank prevents pressure buildup, reducing the boiling point of the coolant.</p>
<p>If it meets the requirements, proceed to Step 4.</p>		

Water pump is leaking	.....	Carry out repairs promptly
If it meets the requirements, proceed to Step 5.		
Thermostat is malfunctioning or damaged	.....	Inspect and replace
If it meets the requirements, proceed to Step 6.		
Cylinder head gasket is blown	.....	Inspect and replace
If it meets the requirements, proceed to Step 7.		
Issues caused by modified/aftermarket lower radiator or fan	.....	Rematch according to the specified requirements

6.10 Typical Turbocharger Failures and Remedies

Root Cause		Troubleshooting method
Intake system blockage	.....	Check the ducting between the air filter and the compressor, the outlet of the compressor and the intake pipe, as well as the intake pipe; clean and ensure they are unobstructed.
If it meets the requirements, proceed to Step 1.		
Intake system leak	.....	Inspect the ducts between the air filter and the compressor, between the compressor outlet and the intake pipe, and at the connection between the intake pipe and the engine for any leaks. If necessary, tighten the fastening bolts or replace gaskets and other components.
If it meets the requirements, proceed to Step 2.		
Exhaust system blockage	.....	Repair or replace relevant parts as needed.

If it meets the requirements,
proceed to Step 3.

Exhaust system leak

.....

Check the connections between the exhaust pipe and the engine, between the turbine inlet and the exhaust pipe, between the turbine housing and the center housing, and from the turbine outlet to the exhaust pipe. If any leaks are found, replace the sealing gaskets and tighten the fastening bolts.

If it meets the requirements,
proceed to Step 4.

Compressor rotor contacting the compressor housing or turbine housing

.....

Replace

If it meets the requirements,
proceed to Step 5.

Oil leakage from the inlet and return oil lines

.....

Replace

6.11 Diesel engine stalls unexpectedly

Root Cause

Fuel quality does not meet requirements:
1.Incorrect grade of fuel is used;
2.Excessive impurities in the fuel;
3.Excessive water content in the fuel.

.....

Troubleshooting method

Replace with fuel that meets required quality standards.

If it meets the requirements,
proceed to Step 1.

Fault codes are stored in the ECU memory:
1.Fault codes can be

.....

1.If the fault code information clearly points to a specific electronic control component, inspect and repair the

<p>retrieved using a diagnostic scanner;</p> <p>2. Electronic control system fault messages can be accessed through the CAN-based instrument cluster.</p>		<p>corresponding sensor or actuator and check for faults in its wiring.</p> <p>2. If rail pressure-related fault codes are detected, focus on troubleshooting fuel system-related faults according to the subsequent steps.</p> <p>3. After repairs, use a diagnostic tool to clear historical fault codes, then run the engine under load for sufficient time to confirm that no fault codes remain stored in the ECU memory.</p>
---	--	--

If it meets the requirements, proceed to Step 2.

<p>Low-pressure fuel line fault</p>	<p>.....</p>	<ol style="list-style-type: none"> 1. Ensure there is sufficient diesel fuel in the fuel tank. 2. Bleed air from the low-pressure fuel system. 3. Check the tightening condition of pipes and connectors, and inspect hoses and fittings for signs of crushing, damage, or incorrect diameter. 4. Check whether the primary and secondary fuel filters are clogged or damaged. 5. Check if the fuel tank venting system is blocked or contaminated (open the fuel cap and listen for the sound of air being drawn in). 6. Verify that the fuel pump's inlet and return lines are connected correctly (not reversed). 7. Check for faults in the fuel pump's gear-driven supply pump.
-------------------------------------	--------------	---

If it meets the requirements,

proceed to Step 3.

The battery voltage supplying power to the ECU is too low, interrupted, or open (circuit).

.....

Check the battery terminals, fuses, and related circuits.

If it meets the requirements, proceed to Step 4.

A fault has occurred in the ignition switch circuit.

Inspect the vehicle's ignition switch circuit.

If it meets the requirements, proceed to Step 5.

Crankshaft sensor and its circuit fault

.....

1. Check the crankshaft sensor connector and wiring.
2. Check whether the air gap between the crankshaft sensor and the reluctor wheel (signal disc) is correct.
3. Inspect the crankshaft sensor for dirt or damage.

If it meets the requirements, proceed to Step 6.

Camshaft sensor and its circuit fault

.....

1. Check the camshaft sensor connector and wiring.
2. Check whether the air gap between the camshaft sensor and the reluctor wheel (signal disc) is correct.
3. Inspect the camshaft sensor for dirt or damage.

If it meets the requirements, proceed to Step 7.

Injector fault

.....

1. Check the injector connector and its wiring.
2. Inspect the sealing surface indentation at the connection between the high-pressure

	<p>line and the injector to ensure it is uniform/regular.</p> <ol style="list-style-type: none"> 3. Check the injector return fuel quantity. 4. Inspect the tip of the injector for signs of fuel leakage or spray. 5. Verify that the thickness of the injector gasket is correct. 6. Clean or replace the injector, refill with clean fuel, and conduct a thorough road test. 7. Check that the injector protrusion height is correct.
--	---

If it meets the requirements, proceed to Step 8.

<p>High-pressure fuel pump fault:</p> <ol style="list-style-type: none"> 1. Internal fuel passages of the high-pressure fuel pump are blocked; 2. Plunger wear inside the high-pressure fuel pump; 	<p>Clean or replace the high-pressure fuel pump, refill with clean fuel, and conduct a thorough road test.</p> <p>Under normal circumstances, if the rail pressure fails to reach 200 bar during cranking and there is no change in common rail pressure, the high-pressure pump can be determined to be blocked.</p> <p>If the rail pressure shows significant variation, the injector faults should be diagnosed first.</p>
--	---

If it meets the requirements, proceed to Step 9.

<p>Poor flow in the engine lubrication oil circuit results in bearing burnout.</p>	<p>If the engine suddenly stops while the coolant temperature remains normal, this situation is most likely due to internal mechanical failure. The oil pan should be removed for inspection and repair, and the corresponding damaged parts should be replaced.</p>
--	--

If it meets the requirements,

proceed to Step 10.

Engine overheating leading to cylinder scoring is generally caused by coolant loss or excessively high coolant temperature.

.....

First, allow the engine to cool down naturally (never add cold water or rinse it with cold water). Then try to turn the crankshaft by hand; if there is no jamming, coolant may be added and the engine started.
If the crankshaft cannot be turned, disassemble the engine for inspection, carry out repairs, and replace any damaged components.

If it meets the requirements, proceed to Step 11.

The engine ECU has malfunctioned.

.....

Replace the ECU controller.

If it meets the requirements, proceed to Step 12.

Internal damage has occurred in the engine.

.....

Analyze the engine oil and inspect the oil filter to identify potential damaged components.

6.12 Electrical system abnormality

Root Cause

alternator fails to charge.

.....

Troubleshooting method

1. Verify proper and secure wiring connections, and check circuits for any signs of open or short conditions.
2. Test the alternator for output voltage. If no charge is produced, replace the charging generator.

If it meets the requirements, proceed to Step 1.

The starter motor is not functioning properly.

.....

1. Check whether the battery is sufficiently charged; if not, recharge it promptly or replace it.

		<p>2. Check that the wiring connections are correct and secure, and inspect the wiring for open circuits or short circuits.</p> <p>3. Check whether the starter carbon brushes are making proper contact with the commutator, and verify that the starter motor is functioning normally. If the starter is faulty, repair or replace it.</p>
--	--	--

If it meets the requirements, proceed to Step 2.

<p>Instruments and sensors are malfunctioning.</p>	<p>.....</p>	<p>1. Check that the wiring connections are correct and secure; inspect the wiring for open circuits or short circuits.</p> <p>2. Check whether the instruments and sensors are functioning normally; if any abnormalities are found, replace them.</p>
--	--------------	---

If it meets the requirements, proceed to Step 3.

<p>The heater is not working.</p>	<p>.....</p>	<p>1. Check that the wiring connections are correct and secure; inspect the wiring for open circuits or short circuits.</p> <p>2. Check whether the heater generates heat; if it does not produce heat, replace the heater.</p>
-----------------------------------	--------------	---

6.13 Diesel engine shaking

Root Cause		Troubleshooting method
<p>Fault codes are stored in the ECU memory:</p> <p>1. Fault codes can be read using a diagnostic tool.</p> <p>2. Electronic control system fault information can be displayed via the</p>	<p>.....</p>	<p>1. If the fault code information clearly points to a specific electronic control component, inspect and repair the corresponding sensor or actuator and check for faults in its wiring.</p> <p>2. If rail pressure-related fault codes are detected, focus on troubleshooting fuel</p>

<p>CAN instrument panel.</p>		<p>system-related faults according to the subsequent steps.</p> <p>3.After repairs, use a diagnostic tool to clear the historical fault codes, then run the engine sufficiently to confirm that no fault codes remain stored in the ECU memory.</p>
<p>If it meets the requirements, proceed to Step 1.</p>		
<p>Ignition switch circuit malfunction.</p>	<p>.....</p>	<p>Check whether the engine ignition switch circuit has poor contact.</p>
<p>If it meets the requirements, proceed to Step 2.</p>		
<p>Abnormal or interrupted battery voltage supplied to the ECU.</p>	<p>.....</p>	<p>Check whether the battery terminals and related circuits have poor contact</p>
<p>If it meets the requirements, proceed to Step 3.</p>		
<p>Crankshaft sensor and its circuit fault.</p>	<p>.....</p>	<ol style="list-style-type: none"> 1.Check the crankshaft sensor connector and wiring. 2.Check whether the air gap between the crankshaft sensor and the reluctor wheel (signal disc) is correct. 3.Inspect the crankshaft sensor for dirt or damage.
<p>If it meets the requirements, proceed to Step 4.</p>		
<p>Camshaft sensor and its circuit fault.</p>	<p>.....</p>	<ol style="list-style-type: none"> 1.Check the camshaft sensor connector and wiring. 2.Check whether the air gap between the camshaft sensor and the reluctor wheel (signal disc) is correct. 3.Inspect the camshaft sensor for dirt or damage.

If it meets the requirements,
proceed to Step 5.

Turbocharge
pressure/temperature sensor
or its circuit fault.

.....

Check the boost pressure/temperature sensor on the intake manifold and its wiring; use a diagnostic tool to monitor the intake pressure signal value and see if it is lower than the actual value.

If it meets the requirements,
proceed to Step 6.

Coolant temperature sensor
or its circuit fault.

.....

Check the coolant temperature sensor and its wiring; use a diagnostic tool to monitor the coolant temperature signal value and see if it is lower than the actual value. If necessary, unplug the coolant temperature sensor connector, start the engine, and compare the readings.

If it meets the requirements,
proceed to Step 7.

Loose engine mounting
bolts, damaged vibration
isolators, or misalignment
with the powertrain.

.....

Tighten the bolts, replace the vibration isolators, and realign the engine (re-establish proper alignment with the powertrain).

If it meets the requirements,
proceed to Step 8.

Low-pressure fuel system
fault.

.....

- 1.Ensure there is sufficient diesel fuel in the fuel tank.
- 2.Bleed air from the low-pressure fuel system.
- 3.Check the tightening condition of pipes and connectors, and inspect hoses and fittings for signs of crushing, damage, or incorrect diameter.
- 4.Check whether the primary (coarse) filter and secondary (fine) filter are clogged or

	<p>damaged.</p> <p>5. Check if the fuel tank venting system is blocked or contaminated (open the fuel cap and listen for the sound of air being drawn in).</p> <p>6. Verify that the fuel pump's inlet and return lines are connected correctly (not reversed).</p> <p>7. Check for faults in the fuel pump's gear-type supply (feed) pump.</p>
--	---

If it meets the requirements, proceed to Step 9.

<p>Injector fault.</p>	<p>.....</p> <ol style="list-style-type: none"> 1. Check the injector connector and its wiring. 2. Inspect the sealing surface indentation at the connection between the high-pressure line and the injector to ensure it is uniform/regular. 3. Check the injector return fuel quantity. 4. Inspect the tip of the injector for signs of fuel leakage or spray. 5. Verify that the thickness of the injector gasket is correct. 6. Clean or replace the injector, refill with clean fuel, and conduct a thorough road test. 7. Check that the injector protrusion height is correct.
------------------------	--

If it meets the requirements, proceed to Step 10.

<p>Intake system blockage or leakage.</p>	<p>.....</p> <p>Check the air filter, intake piping, etc., for blockages or leaks.</p>
---	--

If it meets the requirements, proceed to Step 11.

<p>Turbocharger damage or</p>	<p>.....</p> <p>Replace the turbocharger; check its</p>
-------------------------------	---

surge.		operating condition and inspect the intake piping for blockages.
If it meets the requirements, proceed to Step 12.		
Driven accessory failure.	.....	Check the fan, alternator, air conditioning compressor, and their drive belts and brackets for interference, damage, or other issues.
If it meets the requirements, proceed to Step 13.		
Engine ECU malfunction	.....	Replace the ECU controller.
If it meets the requirements, proceed to Step 14.		
Internal engine damage.	.....	Analyze the engine oil and inspect the oil filter to identify potential damaged components.

6.14 Diesel engine idle instability

Root Cause		Troubleshooting method
<p>Fault codes are stored in the ECU memory:</p> <ol style="list-style-type: none"> 1. Fault codes can be read using a diagnostic tool. 2. Electronic control system fault information can be displayed via the CAN instrument panel.	.....	<ol style="list-style-type: none"> 1. If the fault code information clearly points to a specific electronic control component, inspect and repair the corresponding sensor or actuator and check for faults in its wiring. 2. If rail pressure-related fault codes are detected, focus on troubleshooting fuel system-related faults according to the subsequent steps. 3. After repairs, use a diagnostic tool to clear the historical fault codes, then run the engine sufficiently to confirm that no fault codes remain stored in the ECU memory.
If it meets the requirements, proceed to Step 1.		

<p>Crankshaft sensor and its circuit fault</p>	<p>.....</p>	<ol style="list-style-type: none"> 1. Check the crankshaft sensor connector and wiring. 2. Check whether the air gap between the crankshaft sensor and the reluctor wheel (signal disc) is correct. 3. Inspect the crankshaft sensor for dirt or damage.
--	--------------	---

If it meets the requirements, proceed to Step 2.

<p>Camshaft sensor and its circuit fault</p>	<p>.....</p>	<ol style="list-style-type: none"> 1. Check the camshaft sensor connector and wiring. 2. Check whether the air gap between the camshaft sensor and the reluctor wheel (signal disc) is correct. 3. Inspect the camshaft sensor for dirt or damage.
--	--------------	---

If it meets the requirements, proceed to Step 3.

<p>Low- pressure fuel system fault</p>	<p>.....</p>	<ol style="list-style-type: none"> 1. Ensure there is sufficient diesel fuel in the fuel tank. 2. Bleed air from the low- pressure fuel system. 3. Check the tightening condition of pipes and connectors, and inspect hoses and fittings for signs of crushing, damage, or incorrect diameter. 4. Check whether the primary (coarse) filter and secondary (fine) filter are clogged or damaged. 5. Check if the fuel tank venting system is blocked or contaminated (open the fuel cap and listen for the sound of air being drawn in). 6. Verify that the fuel pump's inlet and
--	--------------	---

		<p>return lines are connected correctly (not reversed).</p> <p>7. Check for faults in the fuel pump's gear-type supply (feed) pump.</p>
<p>If it meets the requirements, proceed to Step 4.</p>	<p>Injector fault</p> <p>.....</p>	<ol style="list-style-type: none"> 1. Check the injector connector and its wiring. 2. Inspect the sealing surface indentation at the connection between the high-pressure line and the injector to ensure it is uniform/regular. 3. Check the injector return fuel quantity. 4. Inspect the tip of the injector for signs of fuel leakage or spray. 5. Verify that the thickness of the injector gasket is correct. 6. Clean or replace the injector, refill with clean fuel, and conduct a thorough road test. 7. Check that the injector protrusion height is correct.
<p>If it meets the requirements, proceed to Step 5.</p>	<p>Clutch malfunction or improper operation</p>	<ol style="list-style-type: none"> 1. Check whether the clutch is operating normally.
<p>If it meets the requirements, proceed to Step 6.</p>	<p>Damaged shock absorber</p>	<p>Inspect the shock absorber.</p>
<p>If it meets the requirements, proceed to Step 7.</p>	<p>Speed sensor and its circuit fault</p>	<p>Check the vehicle speed sensor and its circuit.</p>
<p>If it meets the requirements,</p>		

proceed to Step 8.

Intake system blockage or leakage

.....

Check the air filter, intake piping, etc., for blockages or leaks.

If it meets the requirements, proceed to Step 9.

Valve leakage or incorrect valve clearance

.....

Inspect and adjust valve sealing performance.

If it meets the requirements, proceed to Step 10.

Engine ECU malfunction

.....

Replace the ECU controller.

If it meets the requirements, proceed to Step 11.

Internal engine damage

.....

Analyze the engine oil and inspect the oil filter to identify potential damaged components.

6.15 Oil dilution

Root Cause

Injector sealing issue

.....

Troubleshooting method

1. Leakage caused by damage to the sealing sleeve in the injector mounting hole.
2. Internal leakage of the injector within the cylinder head.

If it meets the requirements, proceed to Step 1.

Cylinder head crack

.....

Check the cylinder head for any cracked areas.

If it meets the requirements, proceed to Step 2.

Oil cooler crack

.....

Check the oil cooler for any cracked areas.

If it meets the requirements, proceed to Step 3.

Oil pump sealing problem

.....

Inspect the oil pump seal.

6.16 Warning light stays on continuously.

Root Cause	Troubleshooting method
<p>System warning light / Malfunction indicator lamp (MIL) does not perform self-check when ignition is turned on.</p> <p>.....</p>	<p>Check whether the system warning light / malfunction indicator lamp (MIL) wiring is correct and whether there is a short circuit.</p>
<p>If it meets the requirements, proceed to Step 1.</p> <p>Fault codes are stored in the ECU memory:</p> <ol style="list-style-type: none"> 1. Fault codes can be read using a diagnostic tool. 2. Electronic control system fault information can be displayed via the CAN instrument panel. <p>.....</p>	<ol style="list-style-type: none"> 1.If the fault code information clearly points to a specific electronic control component, inspect and repair the corresponding sensor or actuator and check for faults in its wiring. 2.If rail pressure-related fault codes are detected, focus on troubleshooting fuel system-related faults according to the subsequent steps. 3.After repairs, use a diagnostic tool to clear the historical fault codes, then run the engine sufficiently to confirm that no fault codes remain stored in the ECU memory.

Appendix: List of Diesel Engine Wear Parts

No.	Part Name	QTY	Units	Component importance level
1	Gear case cover gasket	1	assembly	C
2	Cylinder head gasket	1	component	A
3	Cylinder head cover gasket	1	component	C
4	Piston ring	1	assembly	A
5	Injector	4	component	A
6	Exhaust pipe gasket assembly	1	component	C

7	Intake manifold gasket	1	component	C
8	Oil pan gasket	1	component	C
9	Fuel filter	1	component	B
10	Thermostat	1	component	C
11	Rear crankshaft oil seal	1	component	C
12	Front crankshaft oil seal	1	component	C
13	Belt	1	component	C
14	Oil filter	1	component	B
15	Cooler cover gasket	1	component	C
16	Water pump gasket	1	component	C

Raywin Powertrain Technology Co., Ltd

Tel: +86-(0)23-85557257

Email: info@raywin.cc

**Add: NO.99,Jiujiang Road,Shuangfu District,Jiangjin
District,Chongqing,China.**