



AGG201806
June 2018

Operation and Maintenance Manual

Diesel Engine

AS6500

Caution

Be sure to read this instruction manual carefully and strictly observe the safety and operation instructions herein, especially the warnings and cautions, so as to reduce the possibilities of personnel injury, property loss, engine performance deterioration, premature wear or damage.

Warnings in this manual must be observed strictly. Failure to do so can cause burns, amputation, mutilation, asphyxiation and other personal injury or death. Cautions are provided for the user to operate the engine in a proper way, so as to avoid damage to engine parts and engine performance deterioration. Warnings and cautions in this manual are not complete because AGG Power has no possibility and is not able to foresee all potential risks resulted from the failure to follow the safety cautions and operation instructions.

Repair, Technical Consultation, Complaint and Suggestion

For engine repair, technical consultation, complaints or suggestions, please contact AGG Power's after-sale service center: info@aggpower.co.uk.

Please provide the following information for product repair:

- The model of diesel engine

- The order number of diesel engine

- The serial number of diesel engine

- The date of equipment procurement

- The detailed description of fault

- The address and phone number of contact person

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1 Introduction

1.1 To User and Operator

Thank you for purchasing a product of AGG Power!

The AS6500 series diesel engine, available in two displacements of 4L and 7L, is a medium-power four-valve diesel engine with four or six cylinders that is newly developed by AGG Power. Featuring strong power and low fuel consumption and with the emissions conforming to relevant national regulations, The AS6500 series diesel engine is a perfect power for middle-and high-end vehicles, construction machinery, generation sets and marine applications.

This manual mainly covers technical specifications, operation and maintenance instruction, with an aim to familiarize you with the engine, as well as the proper operation and maintenance thereof. Before using the engine, read carefully the relevant contents and requirements in this manual. Due to the continuous improvement of performance and structure of the engine, the technical specifications and illustrations of the engine in this manual may be slightly different from those of the engine you have, please note that we will provide the supplement and perfection in the later editions without notice. In case of any question during your engine operation and maintenance, please never hesitate to contact AGG Power's after-sale service center info@aggpower.co.uk for technical advice or guidance.

AGG Power has adopted the latest technology and high-quality parts for the engine. The genuine AGG Power service parts are recommended to be used for repair and maintenance. Please contact AGG Power's after-sale service center info@aggpower.co.uk for service parts.

Since this manual ensures proper engine operation and maintenance, it should be given to the new owner when the engine is traded or sold.

1.2 Notices for Engine Quality Feedback

To better our service, please provide following information when you make feedback about quality issues, whereby, we can understand and analyze the quality issues and the root causes thereof, and make the improvement in time:

- 1) When and where fault occurred;
- 2) Engine serial number, model, order number, delivery date and the detailed address of consignee;
- 3) Service conditions, cumulative operation time (in hours or kilometers), operating conditions (power, speed) and the grade of fuel and engine oil that were used;
- 4) The characteristics of the driven equipment (model, power consumption and structural feature, etc.)
- 5) The description of faults;
- 6) Parts or components claimed for compensation or repair should be mailed or sent in person to AGG Power headquarter with the damage process record or description for facilitating analysis. If there are several problems or a very serious problem, please leave the site as it was and inform us promptly, and then AGG Power will send staff for a joint analysis. Quality issues should be settled based on the relevant provisions in the quality warranty manual.

1.3 Safety Instructions

- Do not wear a loose garment or any jewelry when working around the engine or its driven equipment. If necessary, wear safety goggles, work clothes, safety helmet or other protective items.
- All the exposed rotating parts should be provided with guards with firm installation to prevent personal injury.
- The workroom of the engine should be well ventilated with waste gas exhausted outside.
- No flammable liquid is allowed to be around the engine.
- Take all tools, wires, other odds and ends away from the engine prior to starting.
- Make sure to shutdown the engine before any adjustment is performed to it and its driven equipment.
- Smoking is not allowed during fuel filling, otherwise, fuel steam can cause fire easily.
- Smoking is also not allowed when checking electrolyte level because electrolyte will release flammable gas.

- Contact between electrolyte and skin or eyes must be prevented when replenishing it for the battery, because electrolyte is an acid. In case of skin contact, please flush the contacted part with soap and clean water; in case of eyes contact, flush your eyes for 15 minutes with clean water and seek for medical treatment immediately.
- Cool the engine first when filling coolant to avoid being hurt by coolant steam. Open the pressure cap only when the coolant is lower than 50°C, and then slowly loosen the cap to release the pressure of coolant.
- Wipe up lubricating oil, fuel, Coolant or other liquids overflowed. Put oily rags into a fire-protection container, but not leave it on the engine.
- Before starting the engine after being repaired, make sure to be ready to cut air supply. In case of any abnormal, cut air supply to stop the engine immediately.
- Do not rotate the engine with the fan, otherwise severe personal injury or damage to fan blades can be caused.
- Do not touch by hand the intake and exhaust system components such as the exhaust manifold, turbocharger, intercooler air inlet pipe, expand tank because they are in high temperature when the engine is in operation.
- Release the pressure in the air system, lubricating system, cooling system or fuel system prior to dismantling or loosening any pipelines, permanent joints, connectors or relevant of these systems. Do not use your hand to check leakage, otherwise high pressure and high temperature fuel, lubricating oil and coolant can cause personal injury.
- If the engine will not be used for a long time or is under repair, separate it from the battery to prevent an unexpected start-up. Meanwhile, place a sign STOP in the operation room or on the controller.
- Used engine oil may contain carcinogenic substance which can result in reproductive toxicity, therefore, inhalation of or longtime exposure to oil steam should be avoided. Waste oil should be disposed in proper, safe and reliable manner.
- To prevent choke or cold injury, removal of air-conditioning refrigerant (Freon) pipeline should be conducted in well ventilated environment with protective clothing worn. For environment protection, the refrigerating system should be emptied or filled using dedicated equipment so as to prevent diffusion of Freon into atmosphere. Refrigerant should be recovered and recycled.

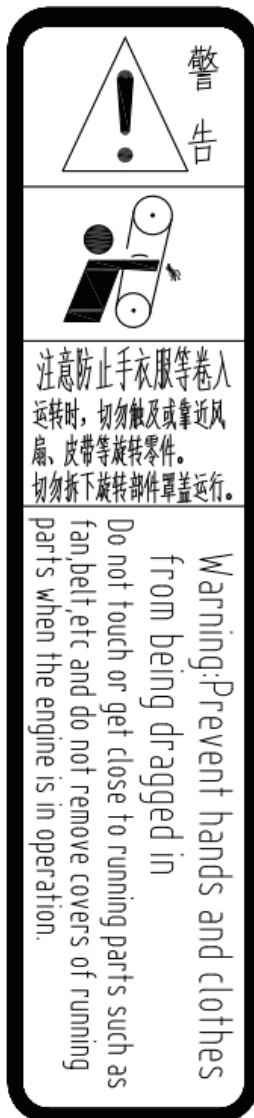
1.4 Engine Operation Instructions

- Read this manual carefully, and be in strict accordance with operation instructions and maintenance procedure specified in this manual.
- Conduct daily and 4-level maintenance as specified in this manual, and keep the records of scheduled maintenance.
- Use the proper fuel, lubricating oil and coolant specified in this manual.
- 60 hours' running-in must be conducted for a new or overhauled engine. Please refer to Section 3.7 for the running-in requirements.
- Do not run the engine without air filter, or early engine wear will be caused. Marine application is exceptional.
- The cooling system of the engine should adopt the coolant specified in this manual at any kind of climate.
- When filling lubricating oil, it is not allowed to use the mixture of oil of different specifications.
- Preparations should be well done before starting the engine. Be sure to remember that the engine must be started without load.
- Check if coolant, lubricating oil and fuel are enough before starting the engine. It is not allowed to start the engine with lack of diesel fuel in the fuel tank. The fuel tank should be replenished; or it will cause damage to the high pressure fuel pump.
- Observe the engine operation and all the instrument readings. In case of critical situation, an emergency stop should be performed to prevent the seizure of moving parts caused by low oil pressure or overheating due to lack of coolant.
- Do not run the engine at high load and high speed when the coolant temperature is blow 60°C.
- The belt tension and the other drive devices can only be inspected when the engine is in stop.
- Malfunction thermostat should be replaced in time but the use of thermostat cannot be omitted.

- Do not remove the lead seals on the engine to make adjustment without permission. If necessary, send the relevant components to a professional service location for repair or/and adjustment.

1.5 Warning Signs on the Engine

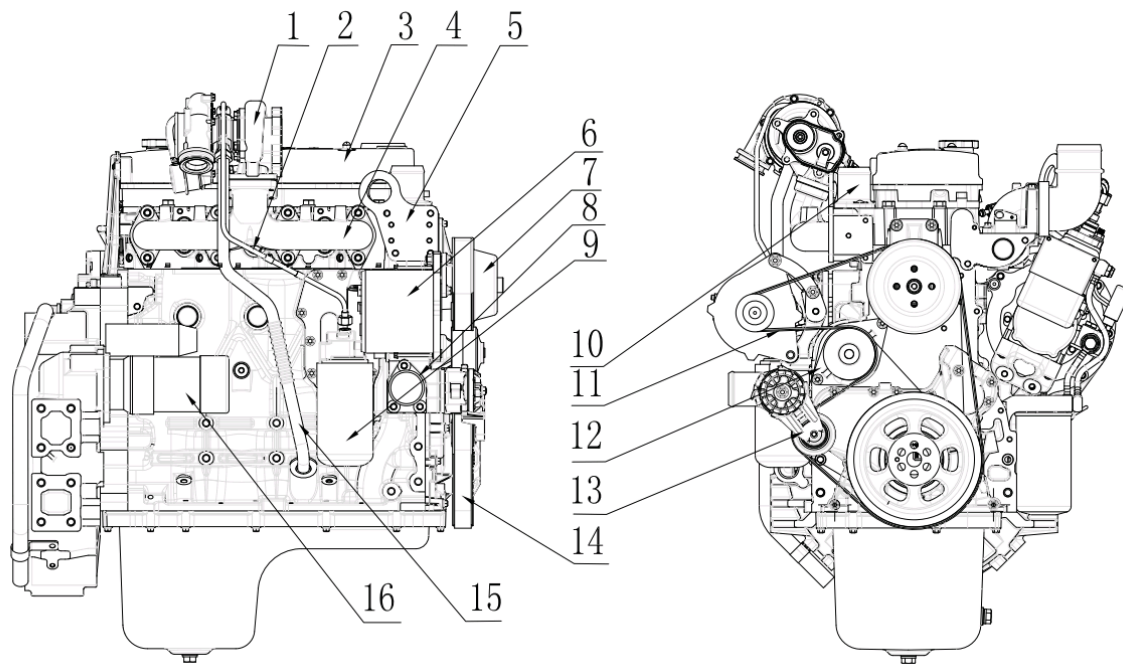
There are warning signs as below on the engine. They must be strictly observed to avoid personal injury or engine damage.



2 About the Engine

2.1 Engine Outline Diagrams

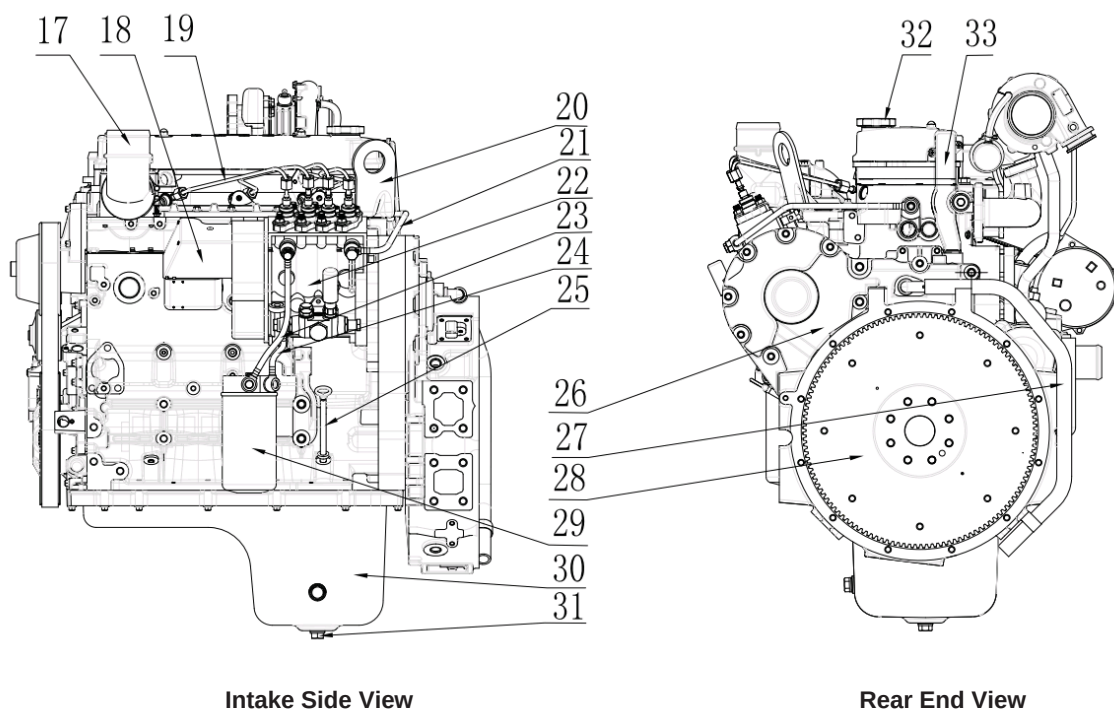
2.1.1 SC4H diesel engine (4L)



Exhaust Side View

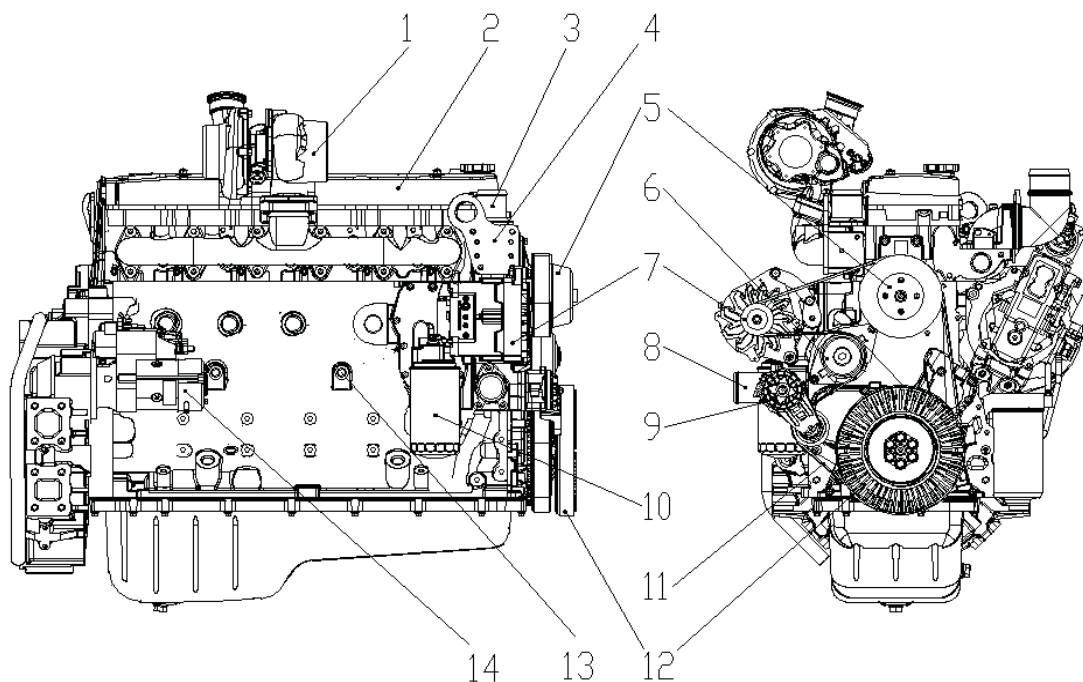
Front End View

- | | | |
|-------------------------------|-------------------------------|---------------------------------|
| 1 Turbocharger | 2 Turbocharger oil inlet pipe | 3 Valve cover |
| 4 Exhaust manifold | 5 Front engine lifting plate | 6 Alternator |
| 7 Fan pulley | 8 Engine coolant inlet pipe | 9 Oil filter |
| 10 Engine coolant outlet pipe | 11 Fan Belt | 12 Water pump |
| 13 Belt tensioner | 14 Crankshaft pulley | 15 Turbocharger oil return pipe |
| 16 Starting Motor | | |



- | | | |
|--|---|----------------------------|
| 17 Air inlet elbow | 18 Governor (mechanical or electronic) | 19 High-pressure fuel pipe |
| 20 Engine rear lifting plate | 21 Fuel return pipe | 22 Fuel injection pump |
| 23 Fuel injection pump fuel inlet pipe | 24 Fuel filter inlet pipe | 25 Oil dipstick |
| 26 Flywheel housing | 27 Outlet pipe of crankcase ventilation | 28 Flywheel |
| 29 Fuel filter | 30 Oil pan | 31 Oil drain plug |
| 32 Oil filler | 33 Engine ventilation pipe | |

2.1.2 SC7H diesel engine (7L)



Exhaust Side View

Front End View

1 Turbocharger

2 Valve cover

3 Engine coolant outlet pipe

4 Front engine lifting plate

5 Fan bearing housing

6 Water pump

7 Alternator

8 Engine coolant inlet pipe

9 Tensioner

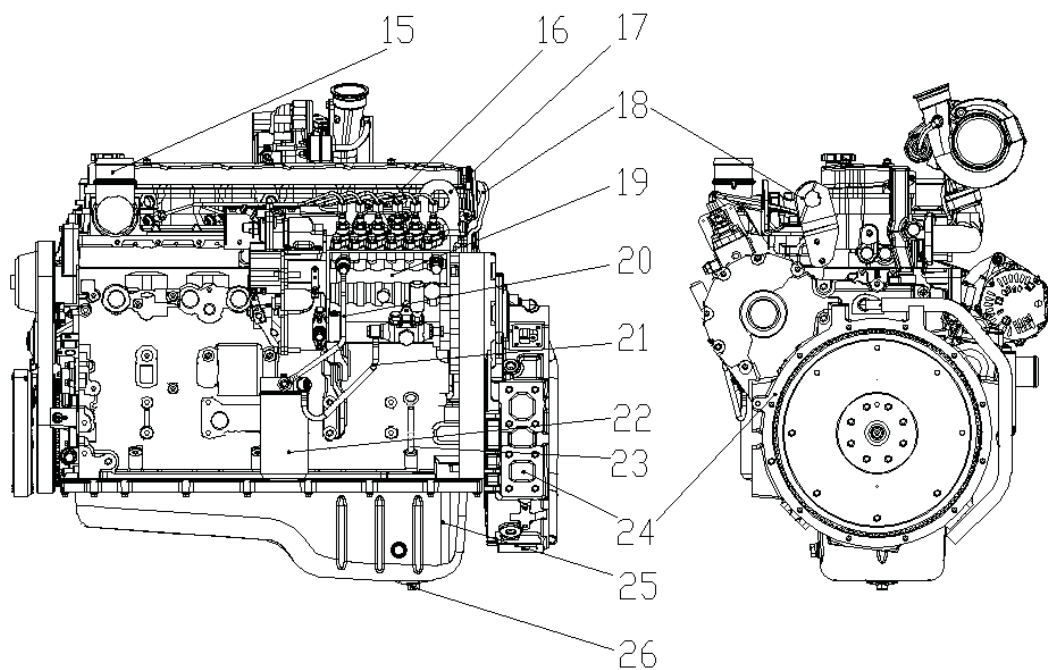
10 Oil filter

11 Fan belt

12 Vibration damper

13 Water drain plug

14 Starting motor

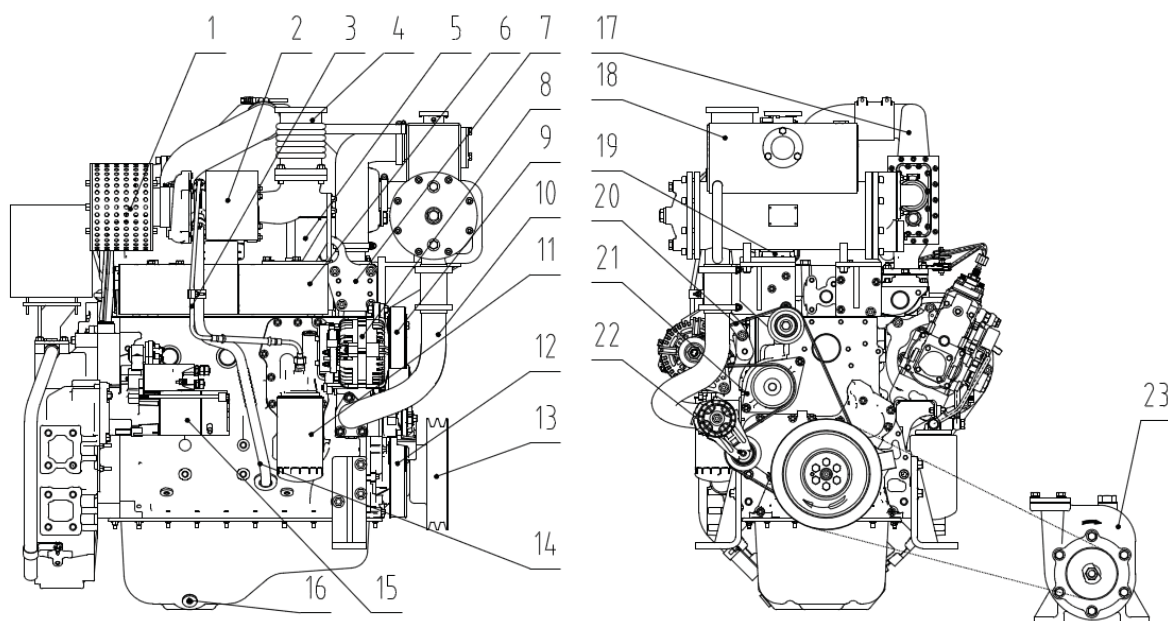


Intake Side View

Rear End View

- | | | |
|---|--|-------------------------------|
| 15 Intake pipe | 16 High pressure fuel pipe | 17 Right engine lifting plate |
| 18 Rear engine lifting plate (optional) | 19 Fuel injection pump (mechanical or electronic governor) | |
| 20 Fuel injection pump fuel inlet pipe | 21 Fuel filter inlet pipe | 22 Fuel filter |
| 23 Oil dipstick | 24 Flywheel housing | 25 Oil pan |
| 26 Oil drain plug | | |

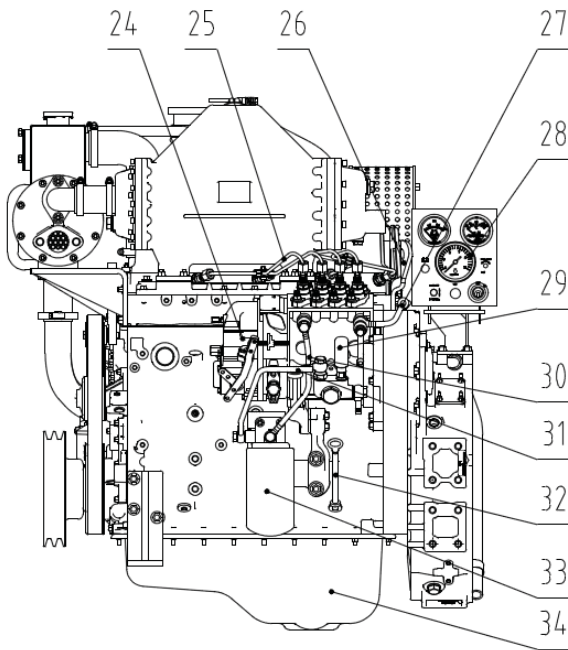
2.1.3 SC4H diesel engine for marine auxiliaries (4L)



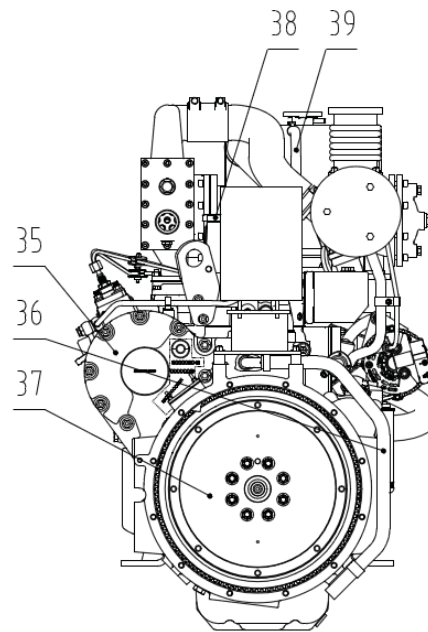
Exhaust Side View

Front End View

- | | | |
|-------------------------------|---------------------------------|-------------------------------|
| 1 Air filter | 2 Turbocharger | 3 Turbocharger oil inlet pipe |
| 4 Expansible pipe | 5 Valve cover | 6 Exhaust manifold |
| 7 Engine front lifting plate | 8 Alternator | 9 Drive pulley |
| 10 Engine coolant inlet pipe | 11 Oil filter | 12 Crankshaft pulley |
| 13 Drive pulley | 14 Turbocharger oil return pipe | 15 Starting motor |
| 16 Oil drain plug | 17 Intercooler | 18 Heat exchanger |
| 19 Engine coolant outlet pipe | 20 Drive belt | 21 Water pump |
| 22 Belt tensioner | 23 Raw water pump | |



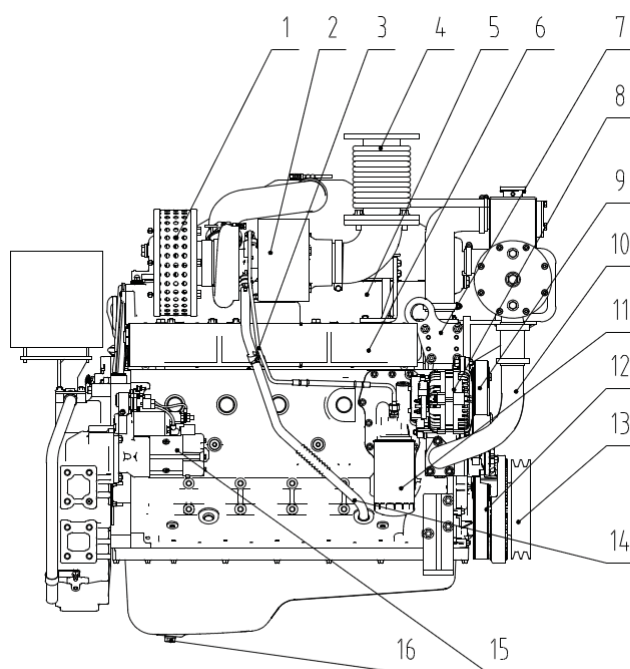
Intake Side View



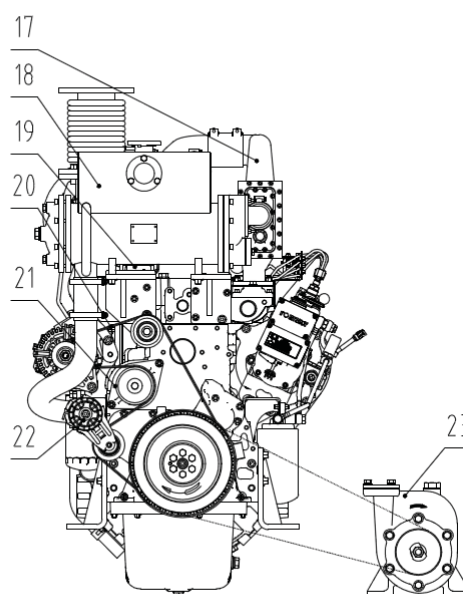
Rear End View

24 Governor (mechanical or electronic)	25 High-pressure fuel pipe	26 Engine rear lifting plate
27 Fuel return pipe	28 Instrument pan box	29 Fuel injection pump
30 Fuel pump fuel inlet pipe	31 Fuel filter inlet pipe	32 Oil dipstick
33 Fuel filter	34 Oil pan	35 Flywheel housing
36 Oil separator gas outlet pipe	37 Flywheel	38 Oil filler cap
39 Oil separator gas inlet pipe		

2.1.4 SC4H diesel engine for marine auxiliaries (7L)

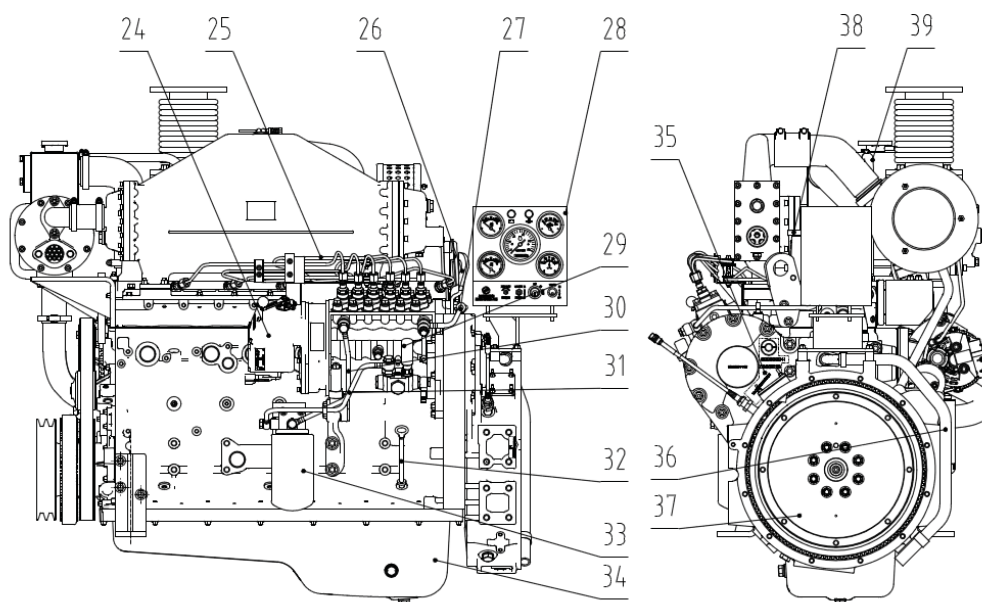


Exhaust Side View



Front End View

- | | | |
|-------------------------------|---------------------------------|-------------------------------|
| 1 Air filter | 2 Turbocharger | 3 Turbocharger oil inlet pipe |
| 4 Expansible pipe | 5 Valve cover | 6 Exhaust manifold |
| 7 Engine front lifting plate | 8 Alternator | 9 Drive pulley |
| 10 Engine coolant inlet pipe | 11 Oil filter | 12 Crankshaft pulley |
| 13 Drive pulley | 14 Turbocharger oil return pipe | 15 Starting motor |
| 16 Oil drain plug | 17 Intercooler | 18 Heat exchanger |
| 19 Engine coolant outlet pipe | 20 Drive belt | 21 Water pump |
| 22 Belt tensioner | 23 Raw water pump | |



Intake Side View

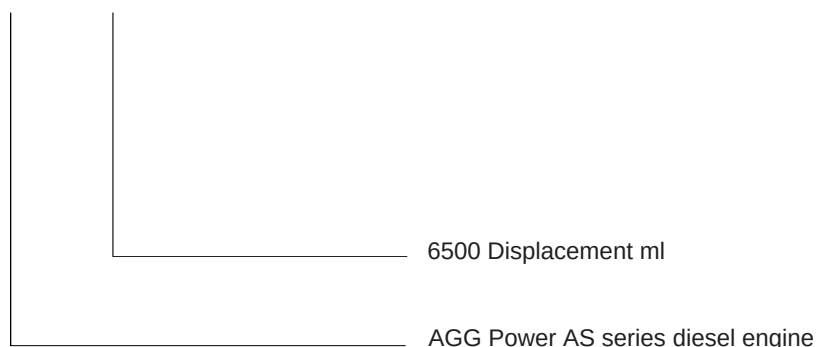
Rear End View

- | | | |
|--|----------------------------|------------------------------|
| 24 Governor (mechanical or electronic) | 25 High-pressure fuel pipe | 26 Engine rear lifting plate |
| 27 Fuel return pipe | 28 Instrument pan box | 29 Fuel injection pump |
| 30 Fuel pump fuel inlet pipe | 31 Fuel filter inlet pipe | 32 Oil dipstick |
| 33 Fuel filter | 34 Oil pan | 35 Flywheel housing |
| 36 Oil separator gas outlet pipe | 37 Flywheel | 38 Oil filler cap |
| 39 Oil separator gas inlet pipe | | |

2.2 Engine Model Identification

The model name represents the meanings as follows:

AS 6500



For example: AS6500 stands for AGG Power AS series diesel engine with displacement of 6500 ml.

2.3 Engine Nameplate

The diesel engine nameplate indicates the main technical data and information: engine model, order number, serial number, date of manufacture, rated power and rated speed, which are the major basis for you to purchase service parts and for AGG Power to conduct after-sale technical service. We hope you to put the information and data into the daily record of work of your engine or equipment for later repair and reflection of quality problems. This is helpful to the correct settlement of your problems. The nameplate locates at the top of the cylinder head cover. Protect it from being damaged.



Note: Do not change the nameplate without our permission!

2.4 Specifications and Parameters

2.4.1 AS6500-H3671

Engine Speed r/min	Type of Operation	Engine Power kW	Generator Power kVA
1500	Prime Power	128	137.5
1500	Standby Power	141	150
1800	Prime Power	136	150
1800	Standby Power	150	165

- The engine performance is as per GB/T2820
- Ratings are based on GB/T1147.1.
- Prime Power:
 - There is no time limit in the case of variable load operation.
 - In any 250hours of continuous operation period, the variable load of average work load less than 70% of the prime power.
 - The operation time in the situation of 100%prime power no more than 500 hours. Permit 10%overload running 1hours in any 12 hours of continuous operation period.
 - The overload 10% power running time of every year no more than 25 hours.
- Standby Power:
 - The annual total standby power load should be less than80% and the average running time shall be less than 200 hours.
 - Among them the standby power point should be no more than 25 hours a year.

Specifications	
Engine Model	AS6500
Engine Type	In-line,4 strokes, 4 valves, water-cooled , Turbo charged with aftercooler
Combustion type	Direct injection
Cylinder Type	Dry liner
Number of cylinders	6
Bore × stroke	105× 124mm
Displacement	6.5 L
Compression ratio	16: 1
Firing order	1-5-3-6-2-4
Injection timing	10.5°BTDC
Dry weight	Approx. 600kg
Dimension (L×W×H)	1330 ×789×1079 mm
Rotation	SAE NO.3
Fly wheel housing	SAE NO.11.5 (tooth number of gear:127)

Mechanism	
Type	Over head valve
Number of valve	Intake 2, exhaust 2 per cylinder
Valve lashes at cold	Intake 0.25mm Exhaust 0.50mm

Valve Timing		
	Opening	Close
Intake valve	20.9° BTDC	44.9° ABDC
Exhaust valve	51.7° BBDC	11.7° ATDC

Fuel Consumption		
Power	L/h (1500r/min)	L/h (1800r/min)
25%	9.2	10.7
50%	16.2	17.9
75%	23.0	25.2
100%	30.5	33.1
110%	34.0	36.7

Fuel System	
Injection pump	Longkou in-line “P” type
Governor	RSV
Feed pump	Mechanical type
Injection nozzle	Multi hole type
Opening pressure	250 kg/cm2
Fuel filter	Full flow, cartridge type
Used fuel	Diesel fuel oil

Lubrication System	
Lub. Method	Fully forced pressure feed type
Oil pump	Gear type driven by crankshaft
Oil filter	Full flow, cartridge type
Oil pan capacity	High level 17.5 liters Low level 15 liters
Angularity limit	Front down 25 deg Front up 35 deg Side to side 35 deg
Lub. Oil	Refer to Operation Manual

Cooling System

Cooling method	Fresh water forced circulation
Water capacity (engine only)	6.8 liters
Lid Min. pressure	70kPa
Water pump	Centrifugal type driven by belt
Water pump Capacity	129L/min (1500r/min) 155L/min (1800r/min)
The maximum temp. of coolant in prime/ Standby power	104/100
	Wax-pellet type
Thermostat	Opening temp. 82°C Full open temp. 95°C
Cooling fan	Blower type, plastic 620 mm diameter, 10blades Power consumption 5kw
Cooling air flow	4.0 m³/s

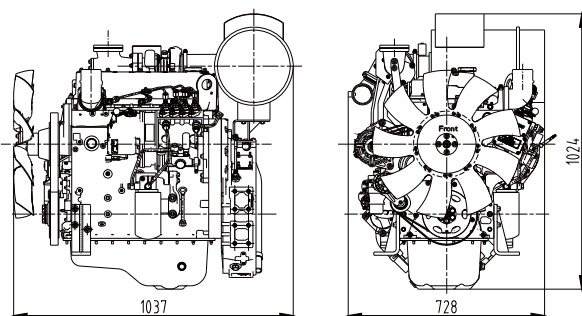
Electrical System

Charging generator	28V×55A
Voltage regulator	Built-in type IC regulator
Starting motor	24V×6kW
Starting motor	24V
Battery Capacity	150 AH

Engineering Data

Heat rejection to coolant	12.9kcal/sec (1500r/min) 13.7kcal/sec (1800r/min)
Heat rejection to intercooler	8.0kcal/sec (1500r/min) 8.5kcal/sec (1500r/min)
Air flow	9.4m³/min (1500r/min) 12.3m³/min (1800r/min)
Exhaust gas flow	22.2m³/min (1500r/min) 28.9m³/min (1800r/min)
Exhaust gas temp	600 °C
Max. permissible restrictions	3 kPa initial
Intake system	6 kPa final (need charge filter element)
Exhaust system	6 kPa max
Max. permissible altitude	2000 m
Intercooler permissible restrictions	8 kPa

Dimension



2.4.2 AS6500-H3672

Engine Speed r/min	Type of Operation	Engine Power kW	Generator Power kVA
1500	Prime Power	140	150
1500	Standby Power	155	165
1800	Prime Power	150	160
1800	Standby Power	165	176

- The engine performance is as per GB/T2820
- Ratings are based on GB/T1147.1.
- Prime Power:
-There is no time limit in the case of variable load operation.
In any 250hours of continuous operation period,
the variable load of average work load less than
70%of the prime power.
The operation time in the situation of 100%prime power
no more than 500 hours. Permit 10%overload running
1hours in any 12 hours of continuous operation period.
The overload 10% power running time of every year no
more than 25 hours.
- Standby Power:
-The annual total standby power load should be less than80%
and the average running time shall be less than 200 hours.
Among them the standby power point should be no more
than 25 hours a year.

Specifications	
Engine Model	AS6500
Engine Type	In-line,4 strokes, 4 valves, water-cooled , Turbo charged with aftercooler
Combustion type	Direct injection
Cylinder Type	Dry liner
Number of cylinders	4
Bore × stroke	105× 124mm
Displacement	6.5 L
Compression ratio	16 : 1
Firing order	1-5-3-6-2-4
Injection timing	10.5° BTDC
Dry weight	Approx. 600kg
Dimension (L×W×H)	1330×789×1079 mm
Rotation	SAE NO.3
Fly wheel housing	SAE NO.11.5 (tooth number of gear:127)

Mechanism	
Type	Over head valve
Number of valve	Intake 2, exhaust 2 per cylinder
Valve lashes at cold	Intake 0.25mm Exhaust 0.50mm

Valve Timing		
	Opening	Close
Intake valve	20.9° BTDC	44.9° ABDC
Exhaust valve	51.7° BBDC	11.7° ATDC

Fuel Consumption		
Power	L/h (1500r/min)	L/h (1800r/min)
25%	9.9	11.3
50%	17.6	19.6
75%	25.2	27.9
100%	33.1	36.3
110%	36.8	40.4

Fuel System	
Injection pump	Longkou in-line "P" type
Governor	RSV
Feed pump	Mechanical type
Injection nozzle	Multi hole type
Opening pressure	250 kg/cm2
Fuel filter	Full flow, cartridge type
Used fuel	Diesel fuel oil

Lubrication System	
Lub. Method	Fully forced pressure feed type
Oil pump	Gear type driven by crankshaft
Oil filter	Full flow, cartridge type
Oil pan capacity	High level 17.5 liters Low level 15 liters
Angularity limit	Front down 25 deg Front up 35 deg Side to side 35 deg
Lub. Oil	Refer to Operation Manual

Cooling System

Cooling method	Fresh water forced circulation
Water capacity (engine only)	6.8 liters
Lid Min. pressure	70kPa
Water pump	Centrifugal type driven by belt
Water pump Capacity	129L/min (1500r/min) 155L/min (1800r/min)
The maximum temp. of coolant in prime/ Standby power	104/100
Thermostat	Wax-pellet type Opening temp. 82°C Full open temp. 95°C
Cooling fan	Blower type, plastic 600 mm diameter, 10 blades Power consumption 5kw
Cooling air flow	4.0 m ³ /s

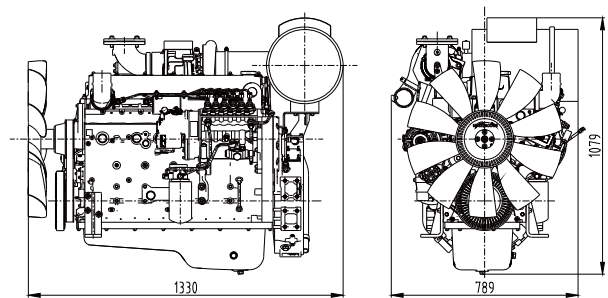
Electrical System

Charging generator	28V×55A
Voltage regulator	Built-in type IC regulator
Starting motor	24V×6kW
Starting motor	24V
Battery Capacity	150 AH

Engineering Data

Heat rejection to coolant	14.1kcal/sec (1500r/min) 15.1kcal/sec (1800r/min)
Heat rejection to intercooler	8.8kcal/sec (1500r/min) 9.4kcal/sec (1800r/min)
Air flow	10.5m ³ /min (1500r/min) 13.5m ³ /min (1800r/min)
Exhaust gas flow	24.8m ³ /min (1500r/min) 31.7m ³ /min (1800r/min)
Exhaust gas temp	600 °C
Max. permissible restrictions	3 kPa initial
Intake system	6 kPa final (need charge filter element)
Exhaust system	6 kPa max
Max. permissible altitude	2000 m
Intercooler permissible restrictions	8 kPa

Dimension



2.4.2 AS6500-H3672

Engine Speed r/min	Type of Operation	Engine Power kW	Generator Power kVA
1500	Prime Power	168	187.5
1500	Standby Power	185	205
1800	Prime Power	180	200
1800	Standby Power	198	220

- The engine performance is as per GB/T2820
- Ratings are based on GB/T1147.1.
- Prime Power:
 - There is no time limit in the case of variable load operation.
 - In any 250hours of continuous operation period, the variable load of average work load less than 70% of the prime power.
 - The operation time in the situation of 100%prime power no more than 500 hours. Permit 10%overload running 1hours in any 12 hours of continuous operation period.
 - The overload 10% power running time of every year no more than 25 hours.
- Standby Power:
 - The annual total standby power load should be less than80% and the average running time shall be less than 200 hours.
 - Among them the standby power point should be no more than 25 hours a year.

Specifications	
Engine Model	AS6500
Engine Type	In-line, 4 strokes, 4 valves, water-cooled , Turbo charged with aftercooler
Combustion type	Direct injection
Cylinder Type	Dry liner
Number of cylinders	6
Bore × stroke	105× 124mm
Displacement	6.5 L
Compression ratio	16 : 1
Firing order	1-5-3-6-2-4
Injection timing	10.5° BTDC
Dry weight	Approx. 600kg
Dimension (L×W×H)	1330 ×789×1079 mm
Rotation	SAE NO.3
Fly wheel housing	SAE NO.11.5 (tooth number of gear:127)

Mechanism	
Type	Over head valve
Number of valve	Intake 2, exhaust 2 per cylinder
Valve lashes at cold	Intake 0.25mm Exhaust 0.50mm

Valve Timing		
	Opening	Close
Intake valve	20.9° BTDC	44.9° ABDC
Exhaust valve	51.7° BBDC	11.7° ATDC

Fuel Consumption		
Power	L/h (1500r/min)	L/h (1800r/min)
25%	11.4	12.6
50%	20.5	22.2
75%	29.5	32.0
100%	39.7	43.4
110%	44.4	48.4

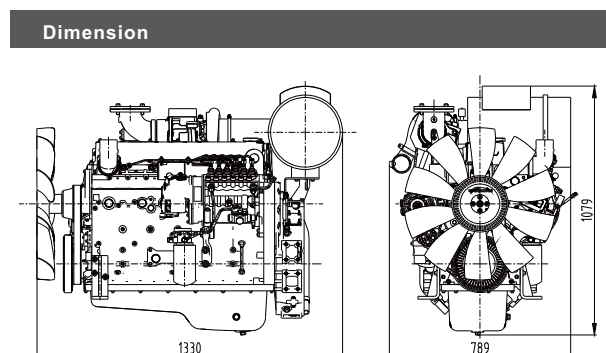
Fuel System	
Injection pump	Longkou in-line "P" type
Governor	RSV
Feed pump	Mechanical type
Injection nozzle	Multi hole type
Opening pressure	250 kg/cm ²
Fuel filter	Full flow, cartridge type
Used fuel	Diesel fuel oil

Lubrication System	
Oil pump	Gear type driven by crankshaft
Oil filter	Full flow, cartridge type
Oil pan capacity	High level 17.5 liters Low level 15liters Front down 25 deg
Angularity limit	Front up 35 deg Side to side 35 deg
Lub. Oil	Refer to Operation Manual

Cooling System	
Cooling method	Fresh water forced circulation
Water capacity (engine only)	9.6liters
Lid Min. pressure	70kPa
Water pump	Centrifugal type driven by belt
Water pump Capacity	129L/min (1500r/min) 155L/min (1800r/min)
The maximum temp. of coolant in prime/ Standby power	104/100
Thermostat	Wax–pellet type Opening temp. 82°C Full open temp. 95°C
Cooling fan	Blower type, plastic 660 mm diameter, 10 blades Power consumption 6kw
Cooling air flow	4.5 m ³ /s

Electrical System	
Charging generator	28V×55A
Voltage regulator	Built-in type IC regulator
Starting motor	24V×6kW
Starting motor	24V
Battery Capacity	150 AH

Engineering Data	
Heat rejection to coolant	15.1kcal/sec (1500r/min) 16.9kcal/sec (1800r/min) 18.1kcal/sec (1800r/min)
Heat rejection to intercooler	10.6kcal/sec (1500r/min) 11.3kcal/sec (1800r/min)
Air flow	11.9m ³ /min (1500r/min) 14.7m ³ /min (1800r/min)
Exhaust gas flow	28.1m ³ /min (1500r/min) 34.8m ³ /min (1800r/min)
Exhaust gas temp	600 °C
Max. permissible restrictions	3 kPa initial
Intake system	6 kPa final (need charge filter element)
Exhaust system	6 kPa max
Max. permissible altitude	2000 m
Intercooler permissible restrictions	8 kPa



3 Engine Operation

Proper use of your engine can not only keep it in normal working order and good performance, but also can extend its service life and reduce its use cost. Adopt proper fuel, oil and coolant, as well as the correct operation steps stipulated in this section.

3.1 Fuel

The specifications of the fuel used for the engine should be in accordance with the standards GB 19147. Proper fuel designation should be chosen for the engine according to ambient temperature. In cold winter, fuel with low-freezing-point should be adopted, while contrary in summer. You may choose the right fuel according to the standards GB 19147, or refer to the table below: e.g. for ambient temperature of above -27°C, fuel with the designation of -35# should be used.

Relationship between diesel fuel grades and applicable minimum temperatures

Designation of fuel	0#	-10#	-20#	-35#
Cetane value	≥49	≥49	≥46	≥45
Solid point/°C	≤0	≤-10	-20	-35
Minimum applicable temperature (engine working temperature)/°C	Above 4°C	Above -5°C	Above -14°C	Above -29°C

△Caution: Fuel must be kept at the highest level of cleanness and not polluted by dust, impurities or water.

3.2 Lubricating Oil

AGG-designated special lubricating oil of grade CF-4 and above is strongly recommended for this engine in order to ensure its normal operation and long service life and improve its emissions. If the above engine oil is not available, oil of CF-4 grade or above meeting the requirements of American Petroleum Institute (API) can serve as an alternative. Choose the oil viscosity under the expected highest working temperature by using the data in the column of maximum ambient temperature in the table below.

Operating temperature range for engine oil (GB 11122-2006)

Viscosity grades of AGG-designated engine oil of CF-4	Ambient temperature	
	Minimum	Maximum
0W-40	-50°C	40°C
5W-20	-40°C	30°C
5W-40	-40°C	40°C
10W-30	-30°C	30°C
10W-40	-30°C	40°C
10W-60	-30°C	60°C
15W-40	-20°C	40°C
20W-50	-10°C	50°C

△Caution: Engine oil must be kept clean and free from dust, impurities or water.

△Caution: Do not use the mixture of oil of different specifications.

3.3 Coolant

In order to ensure the normal operation and long service life of the engine, use coolant with functions of anti-freeze, anti-rust and anti-corrosion at any weather condition.

3.4 Engine Power Output

Engine power output for driving the equipment is taken from flywheel. When using coupling to connect the equipment, the centerline of the equipment should be in alignment with the centerline of the crankshaft. If using an elastic coupling, the misalignment shall not be greater than $\phi 0.30\text{mm}$. If using a rigid coupling, the misalignment shall not be greater than $\phi 0.10\text{mm}$.

△Caution: The engine should not be started with load. So there should be a kind of clutch device between the engine and driven equipment.

A certain power can be taken from the front crankshaft of the engine. But the output power for transverse driving with a belt directly on the front crankshaft pulley should not exceed 11 kW. The amount of power from front engine end is subject to the limitation of bending moment that changes with power delivery location and pulley shape. It is therefore required to get an approval from AGG Power for a transverse power delivery arrangement at the front end.

It is forbidden to directly install a pulley on the flywheel to drive equipment transversely by belt because such operation can easily damage the crankshaft and main bearings. If it is required to have a transverse driving, use an engine or an additional device that is suitable for transverse driving. Do not let the crankshaft and main bearings sustain transverse forces directly.

3.5 Engine Start

Before using the engine, choose proper lubricating oil, fuel and coolant according to local ambient conditions. Besides, the following work should be done before starting:

- Make a surround inspection of the engine and its starting system, and solve problems in time if any.
- Check oil pressure and temperature gauges, coolant temperature gauge, warning lights and other instruments for normality.
- Check the service indicator of the air filter for appearance of red piston.

△Caution: Do not to start the engine without an air filter to avoid early engine wear. Marine engine is exceptional.

- Check the service indicator of the primary fuel filter for appearance in red.
- Check the oil level for being within the specified range. Add proper amount of clean oil into the turbocharger oil inlet port when the engine is first put into use or after being overhauled.
- Check the coolant level for being within the specified range.
- Check the electrolyte level for being within the specified range.
- When the engine is first put into use, or overhauled, or out of service for some days, or its fuel filter has just been replaced, there can be air in the fuel system. It is required to prime the fuel system with the priming pump. Refer to Section 4.3 for specific priming operation.

- Check the electric starting wires for normality.
- All the safety devices must be installed in place.
- Check the accelerator pedal or lever for free movement.

3.5.1 Normal starting procedure

- Disengage the engine from the drive system, or put transmission into the “neutral” position if equipped.
- Put the mechanical operating devices into the “running” position.
- Insert electric key and turn the switch from the OFF position to the ON position to electrify intake air heating device and other electrical devices. The pre-heating indicator light flashes on when intake air pre-heating proceeds and it doesn't flash when no pre-heating happens.
- If pre-heating happens, wait until the pre-heating indicator light goes out and then turn the switch from the ON position to the START position to start the engine. For vehicle application, it is required to step on the accelerator pedal when starting.

△Caution: Starting time should be no more than 15 seconds and there should be a two-minute interval before the next starting so as to prevent the damage to starting motor.

Each starting usually lasts 2 -3 seconds.

- The switch goes back to the ON position from the START position automatically after starting up.

△Caution: The oil pressure gauge should show reading within 15 seconds after the engine has successfully been started; otherwise, stop the engine immediately to prevent damage to the engine and find the causes and remove the fault according to Section 5 Troubleshooting Guidelines.

- Started up from a hot state, the engine should run at idle for 1-3 minutes before being accelerated and loaded gradually.
- Started up from a cold state, the engine should run at idle for 3-5 minutes. Increase the engine speed slowly to have every bearing adequately lubricated and oil pressure stable. Gradually accelerate and load the engine after oil pressure is stable.
- Check the instruments for operational conditions in engine idle running.

△Caution: Do not accelerate and load the engine immediately after it is started up.

△Caution: Do not idle the engine for a long period of time or it can cause problems to the engine. When an engine idles, the temperature in combustion chamber is low and combustion is not complete. It can cause carbon deposit in cylinder that results in blocking of orifice of fuel injector, as well as the seizures of piston rings and valve, thus leading to engine performance deterioration.

△Caution: If the engine is start by a jumper cable, parallel connection of the cable should be adopted by connecting the positive pole to the positive terminal and the negative pole to the negative terminal. If the engine is start by external power supply, the circuit breaker should be set to the OFF position. Take out the key to prevent accidental activation before connection of jumper cable.

3.5.2 Cold starting

The engine has the ability to start successfully without any pre-warming aid if the temperature is above -15℃. It is, however, recommended to use an intake air heating device (electric heating device) in order to get a fast and smooth start as well as for keeping speed stable and improving the smoke after starting up.

Electric heating device consists of electric heater, electronic controller, temperature sensor and indicator light. Its work is governed by the electronic controller.

The electronic controller governs intake air heating action according to ambient temperature. The heating is divided into two stages: heating intake air before engine start (pre-heating) and heating intake air after engine start (after-heating). Generally, it is not allowed to start engine during the first stage of heating (pre-heating). Once the engine is started, the pre-heating will automatically stop. Start the engine after the pre-heating is over.

- Insert the electric key and turn the switch from the OFF position to the ON position to electrify the electronic controller. Pre-heating intake air starts and the indicator light flashes on. Intake air heating ends and the indicator light flickers. The engine is ready to start.
- Turn the switch from the ON position to the START position to start the engine after the indicator light goes out. The switch turns back to the ON position automatically after the engine has started up.
- After-heating begins and its duration is governed by the electronic controller. The indicator light does not flash in the process.

Refer to Normal Starting Procedure for other engine starting instructions.

Note: If startup does not happen or the engine has not been started up within 30 seconds after the indicator light starts flickering, the electronic controller will automatically disconnect the circuits of glow plug, solenoid and indicator light, entering delay protection. If another startup is initiated, turn the electric key back to the OFF position, and wait for 5 seconds before repeating the above process.

3.5.3 Starting after a long-time stop or replacement of lubricating oil

If the engine hasn't been used for more than 30 days or its engine oil has just been replaced, it is necessary to check the oil level for being within the range of the level marks in the dipstick before starting, and prime the fuel system. Refer to Section 4.3 Priming Fuel System for specific operation.

3.6 Engine Operation

Cautions for operation of the engine:

- Pay frequent attention to oil pressure and coolant temperature. In case of any abnormality, stop the engine immediately for inspection.
- When engine overheating starts to happen that is indicated by the coolant temperature alarming, reduce engine speed or reduce load or take the both actions until the coolant temperature falls down into the normal range; otherwise, find the cause and remove the fault as per Section 5 Troubleshooting Guidelines.
- When driving down a steep slope, the transmission gear and brake should be used simultaneously to control the vehicle speed and engine speed; when driving up a steep slope, a proper gear must be chosen to prevent the vehicle from rushing on the slope.

△Caution: Over-speed running will cause serious damage to the engine.

- Proper lubricating oil, fuel and coolant must be used for the engine when it runs in an extremely cold area.

There are significant signs before the faults of an engine occur, such as changes in performance, sound, or engine appearance. Listening and observing will help to detect in advance or predict some problems of the engine that will occur later, with which the proper measures can be taken in time to eliminate such problems as can lead to a serious engine failure.

Typical engine fault signs:

- Engine misfires
- Engine vibrates abnormally
- Engine sounds abnormal
- Engine coolant temperature and oil pressure change abruptly
- Engine produces black smoke
- Engine power output is insufficient
- Engine oil consumption is too much
- Fuel consumption is too much
- There is leakage of oil, fuel or/and coolant

3.7 Engine Shutdown

3.7.1 Normal shutdown

If the engine has just worked at a high speed and heavy load for a long time, reduce its load and speed gradually and run it at idle for 3-5 minutes before stopping it to let the engine cool down evenly and let turbocharger speed fall considerably so as to protect the engine and turbocharger. Turn the switch from the ON position to the OFF position and take out the electric key after the engine has been stopped.

If the engine will not be used for a period of time (6 months at most), keep it properly. Refer to Section 6 for engine storage.

3.7.2 Emergency shutdown

Under an emergency or special condition, make an emergency stop to avoid serious engine failure. Manually pulling of the emergency stop handle can achieve an emergency shutdown.

3.8 Running-In of A New or Overhauled Engine

When the engine is first put into use or after being overhauled, run the engine for 60 hours (about 2,000 km) in running-in condition and change its oil thereafter before running it in full load condition so as to improve its moving parts working condition and its reliability and service life.

The way of running-in varies from one engine application and loading manner to another. In principle, engine speed and load in running-in process will be increased gradually with the running-in going on. Load should be 50%-80% of its full load, and speed should not exceed 80% of its rated speed.

Do not run an engine at idle or with low load for a long-time either in running-in period or normal working period thereafter. Continuous running at idle should not be longer than 10 minutes to avoid early wear due to carbon deposit or engine performance being affected.

4 Engine Maintenance

4.1 Maintenance Schedule

The following table gives maintenance period and tasks. Make regular maintenance based on this table. If the engine frequently operates at the ambient temperature below -18°C or above 38°C, or in dusty environment or under a stop-and-go condition, the maintenance period should be shortened properly.

Maintenance Schedule

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

* The Belt must be replaced when it has crack or defect(s) that affects its use.

** The replacement period of the primary fuel filter should be shorten properly when it contains a certain amount of foreign particulates and causes difficulty to pump fuel.

*** The belt tensioner must be replaced when its pulley doesn't spin freely.

Note 1) If a primary air filter is equipped, clean it every 50 hours' operation. Refer to Section 4.3.26 for cleaning requirement and procedure.

2) For marine application engine, clean air filter element when changing oil and oil filter. Refer to section 4.3.25 for cleaning requirement and procedure.

Note: The maintenance interval in this table is in kilometers, hours or months, whichever comes first.

4.2 Maintenance Record

Make a regular maintenance record. You may make your own maintenance log by referring to the format of Maintenance Record below.

[illegible]

4.3 Tasks and Methods of Engine Maintenance

4.3.1 Checking engine periphery

Check the periphery of the engine each time before starting:

- Check if the engine is in clean state and free from useless things on it.
- Check the joints and connections of the fuel system, cooling system and lubricating system for leakage.
- Check if the fan and its safety guard are fastened in place.
- Check the fastening condition of the accessories.
- Check the electrical circuits and the wire for intact.
- Check the drive belt for intact.

4.3.2 Checking fuel tank

Check the fuel level in the fuel tank daily.

4.3.3 Checking air filter service indicator

Check the maintenance indicator of the air filter every day. If the viewing window shows red piston, it represents that the intake resistance of the air filter exceeds the specified value, and the filter element requires to be replaced. Refer to Section 4.3.24 for the requirement and procedure of the replacement. Press the button on the top of the service indicator for reposition after the replacement.

△Caution: Do not operate the engine without an air filter, and failure to do so would easily cause early engine wear. Marine application is exceptional.



4.3.4 Checking primary fuel filter service indicator

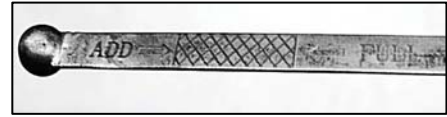
The primary fuel filter has a service indicator. It turns red when the filter has accumulated a certain amount of foreign particulates that will cause it difficulty for the fuel transfer pump to pump fuel. Check the service indicator daily and replace the filter when the indicator appears red. The filter must be replaced even if the indicator does not appear red after being used for 500 hours. The filter is a spin-on type one like the fuel filter. Refer to “Replacing fuel filter” for the replacement procedure.



4.3.5 Checking oil level

Check the oil level daily before starting the engine or the engine is in stop (at least 5 minutes after being stopped) to provide enough time for oil to flow back to the oil pan. The oil level should be between the marks ADD and FULL. If oil is not enough, supplement it. The oil volume difference between the low level ADD and the high level FULL is about 2 L for 4L engine and 2.5 L for 7L engine.

△Caution: Do not run the engine when the oil level is below the mark ADD, otherwise it can result in poor engine performance, or even damage to the engine.

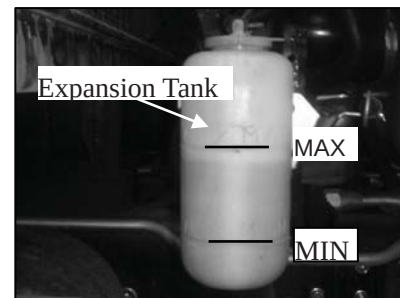


4.3.6 Checking coolant level

▲Warning: Avoid skin or eye contact with coolant to prevent personal injury.

For vehicle application

Check coolant level daily. It should remain between the marks MAX (high level) and MIN (low level) in the expansion tank, and make supplement if necessary. Coolant should be added near the upper mark (MAX). Before adding, wait until the coolant temperature drops to below 50°C and slowly loosen the cap to release the system pressure.



▲Warning: At operating temperature, engine coolant is hot and under pressure, and the coolant steam can cause personal injury. Do not remove the pressure cap on the radiator until the engine stops and coolant temperature drops below 50°C. Slowly loosen the cap to release the cooling system before making supplement.

△Caution: Coolant should be added slowly to avoid air block.

For non- vehicle application

- (1) Slowly loosen the pressure cap on the radiator to release pressure before starting the engine or until coolant temperature goes below 50°C after stopping the engine.
- (2) Remove the pressure cap and check coolant level from the filler or inspection port. The coolant level should remain between the marks in the radiator or expansion tank, or meet the requirement of equipment manufacturer.
- (3) Add if necessary. Coolant should be added near the upper mark or meet the requirement of equipment manufacturer.

▲Warning: At operating temperature, engine coolant is hot and under pressure, and the steam can cause personal injury. Do not remove the pressure cap on the radiator until the engine stops and coolant temperature drops below 50°C. Slowly loosen the cap to release the cooling system before checking coolant level or making supplement.

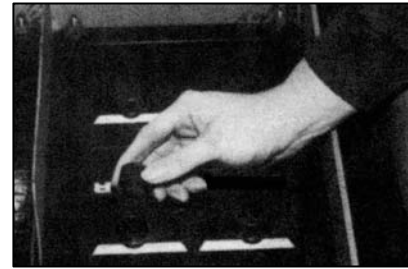
△Caution: Coolant should be added slowly to avoid air block.

4.3.7 Checking electrolyte level

Batteries that are not maintenance-free need electrolyte level checking.

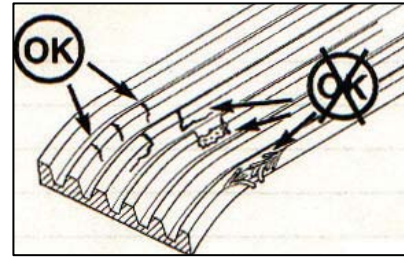
(1) Check the electrolyte level before starting the engine. Remove the filler cap and check the electrolyte level. It should be at the bottom of the filler port. If necessary, make supplement as per requirement.

(2) Install the cap.



4.3.8 Checking drive belt

Perform visual check on the drive belt everyday for any intersecting cracks. Transverse cracks along the width direction of the belt are acceptable, while longitudinal cracks (along the length direction) that intersect with transverse cracks are not allowed. If any wear or abrasion occurs on the belt, replace it.



4.3.9 Checking cooling fan

Perform visual check on the cooling fan for flaw or any other defect. The fan should be installed reliably. Tighten the fastening bolts (55-65 N·m) or replace the damaged fan if necessary.

▲Warning: Damaged fan blades can cause serious personal injury. Do not pull or pry the fan, and never rotate the engine crankshaft with the fan.

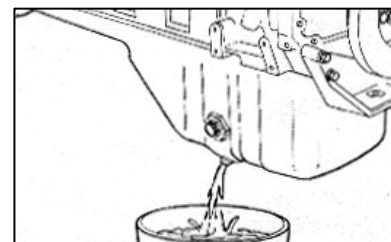
4.3.10 Checking intake system

Check the intake hoses for any crack, as well as perforation, and clamps for looseness. Replace the hose(s) if any fault is found, and tighten clamp screw(s) if looseness is found to ensure leak-proof of the intake system.

4.3.11 Changing lubricating oil and oil filter

▲Warning: Be careful when changing lubricating oil and oil filter because skin contact with the hot engine oil or hot engine surface can cause scald.

(1) Don't stop the engine until the temperature of coolant reaches 60°C, then remove the oil drain plug, scrap the gasket and drain the engine oil.



△Caution: Do not drain engine oil when the engine is in cold-state at which foreign particles has deposited and attached to the bottom of an oil pan, and will not drain with oil. When engine oil is warm, foreign particles suspend in it and can easily drain with engine oil.

(2) Clean the installation surface of the oil drain plug on the oil pan. Fit the drain plug with a new gasket and tighten it by 56-64 N·m.

(3) Clean the outside surface of the oil filter. Remove the oil filter with tool and scrap it.

(4) Clean the sealing surface of the filter head, and there should be no old O-ring left.



(5) Before installing a new oil filter, fill it with clean oil from 8 peripheral holes. The oil level should be 3-15mm below the threaded hole. Apply a light film of clean engine oil to the O-ring on the new filter to form a lubricating film.

△Caution: Do not add oil from the central hole of the filter.



(6) Turn the filter by hand until the O-ring touches the sealing surface of the filter head, and further tighten it to 40-45 N·m or 3/4 to one of a turn with tool.

(7) Open the filler cap, and fill the engine with clean engine oil until the oil level is near the mark FULL in the oil dipstick.

Engine lubricating system capacity	
13.4 L (SC4H)	20.5 L (SC7H)

(8) Start the engine and keep it running at idle, and then check the oil filter and drain plug for oil leaks.

(9) Shut off the engine, wait for about 5 minutes to provide enough time for the oil to flow into the oil pan, and check the oil level. If required, add engine oil until it is near the mark FULL (high level) in the oil dipstick.

(10) Install the filler cap and tighten it until you feel suitable.

4.3.12 Changing fuel filter

(1) Clean the outside surface of the fuel filter. Remove the filter with tool and scrap it.

(2) Clean the filter head and its sealing surface. There should be no old O-ring left.



(3) Before installing a new fuel filter, fill it with clean fuel from 8 peripheral holes. The fuel level should be 3-15 mm below the threaded hole. Apply a light film of Vaseline or clean lubricating oil to the O-ring on the new fuel filter to form a lubricant film.

△Caution: Do not add fuel from the central hole of the filter.



(4) Screw the filter by hand until the O-ring touches the sealing surface of the filter head, and further tighten it to 40-45 N·m or 3/4 to one turn with tool.

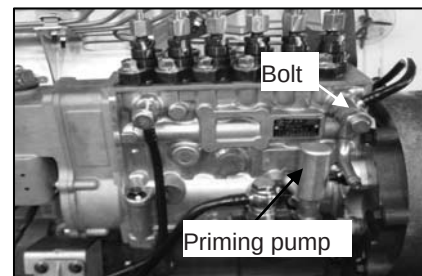
4.3.13 Changing primary fuel filter

The primary fuel filter is also spin-on type. Refer to “Changing fuel filter” for the procedure. First remove the water container on the filter and then remove the filter.

4.3.14 Priming fuel system

If the engine is first put into use, or after being overhauled, or has been out of use for a long time, or fuel filter (including the primary fuel filter) is changed, there can be air in the fuel system. It is required to prime the fuel system as per following steps:

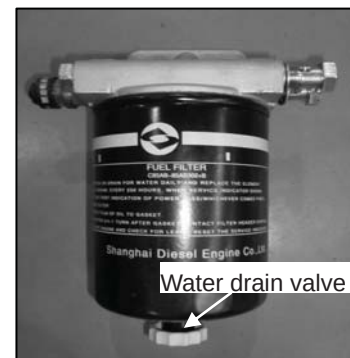
- (1) Loosen the breeze bolt on the fuel return pipe or on the first stage fuel filter.
- (2) Prime the priming pump until there is no bubble visible in the fuel that outflows from the bolt.
- (3) Tighten the bolt.



△Caution: Priming the fuel system is required if air enters the fuel pipeline due to untimely fuel supplement or there is air in the fuel system due to other reasons.

4.3.15 Draining water in primary fuel filter

The primary fuel filter has a function of water and fuel separation. When water level in the water container of the filter reaches a certain level, the water-level sensor will send a signal to the water-level indicator, reminding the drive or operator to drain the water timely. Loosen the water drain valve about three and half turn to drain the water and sediment until clean fuel outflows. Then tighten the valve until you feel suitable. Don't over-tighten it.



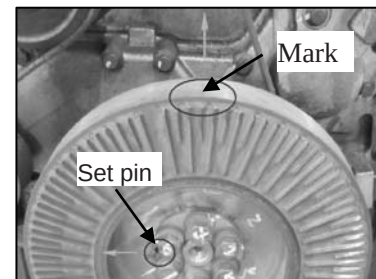
4.3.16 Checking and adjusting valve clearance

When doing the first maintenance for a new or overhauled engine, conduct valve-clearance checking to timely regulate and correct the initial changes of the valve clearances. Later valve clearance checking and regulating should be based on the maintenance plan if the engine operates normally.

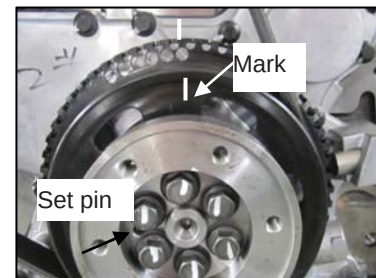
Valve clearance checking should be conducted after the engine has stopped and the coolant temperature fallen below 60°C.

- (1) Remove the valve cover and scrap the cover seal.
- (2) Rotate the engine anticlockwise with barring tool and make the piston of No. 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) position at the top dead center.

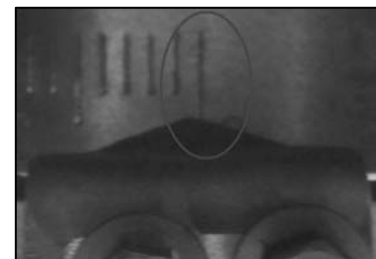
Note: When the set pin is on the left side or the mark in the vibration damper is in alignment with the mark in the gear housing cover, the piston of No 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) is at the top dead center.



Note: When the set pin is on the left side or the mark in the pulley is in alignment with the mark in the gear housing cover, the piston of No 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) is at the top dead center.



Note: When the point indicator on the flywheel housing points at the mark 0 in the flywheel, the piston of No 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) is at the top dead center.



(3) Looking for TDC on compression stroke: if the rocker arm of the No. 1 cylinder can be swayed, the piston of No. 1 cylinder is at the top dead center on compression stroke. If not, the piston of No. 4 cylinder (SC4H) or the piston of No. 6 cylinder (SC7H) is at the top dead center on compression stroke.

(4) When the piston of No. 1 cylinder is at the top dead center on compression stroke, check the following valve clearances with feeler gauge. for the SC4H engine (4- cylinder): check the intake valve clearances of No. 1 and No. 2 cylinders as well as the exhaust valve clearances of No. 1 and No. 3 cylinders; for the SC7H engine (6- cylinder): check the intake valve clearances of No. 1, No. 2 and No. 4 cylinders as well as the exhaust valve clearances of No. 1, No. 3 and No. 5 cylinders.

When the piston of No. 4 cylinder (SC4H) is at the top dead center on compression stroke, check with feeler gauge the intake valve clearances of No. 3 and 4 cylinders, as well as the exhaust valve clearances of No. 2 and 4 cylinders.

When the piston of No. 6 cylinder (SC7H) is at the top dead center on compression stroke, check with feeler gauge the intake valve clearances of No. 3, No. 5 and No. 6 cylinders as well as the exhaust valve clearances of No. 2, No. 4 and No. 6 cylinders.

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



(5) If a valve clearance fails to meet the requirement, loosen the adjusting screw locknut on the corresponding rocker arm, adjust the clearance to the specified value and tighten the locknut to 39-47 N·m. Check the valve clearance again and it should not change.

Valve clearance

Intake: 0.25 ± 0.08 mm; exhaust: 0.50 ± 0.08 mm.

(6) Mark a sign on the damper or fan adaptor plate, and rotate the crankshaft for a circle (360°). Follow the same steps to adjust the other intake and exhaust valve clearances.

(7) Install the valve cover with a new cover seal. Tighten the cover bolts to 22-26 N·m

4.3.17 Checking intercooler and its lines

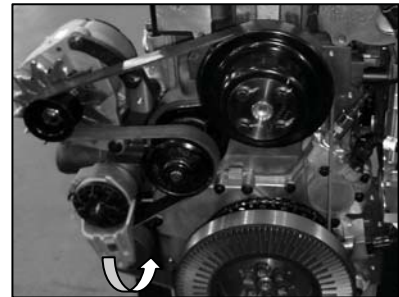
Perform visual check on the air inlet and outlet chambers of the intercooler for crack, perforation or other damages, and of the air inlet and outlet pipes of the intercooler for sealing-off and other damages. Replace the intercooler if necessary.

Perform visual check on the hoses of air inlet and outlet pipes and water inlet and outlet pipes (water-to-air cooler) for crack and check the clamps for looseness. Replace the hose(s) if any fault is found, and tighten clamp screws if looseness is found.

4.3.18 Checking belt tensioner

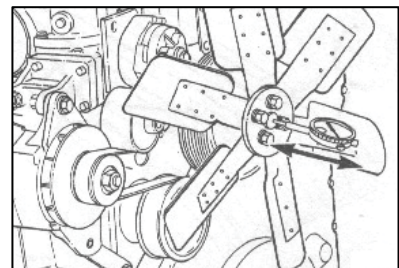
(1) Rotate the belt tensioner anticlockwise, and remove the drive belt. Turn the tensioner pulley to check it for seizure or radial/axial movement, by which to determine if there is scratch or wear on the bearing surface of the tensioner pulley. Swing the tensioner arm to check if the spring performs well.

(2) Install the drive belt and make a visual inspection after the installation to make sure that the belt center line is in alignment with the center lines of the pulleys.



4.3.19 Checking fan bearing

Rotate the belt tensioner anticlockwise and remove the drive belt. Turn the fan to check the fan bearing for normality. When rotating the fan, there should be no vibration or excessive axial movement. Replace the fan hub if necessary.



4.3.20 Checking turbocharger

Perform visual check on turbine and compressor blades of the turbocharger for damage, crack, or contact with their housings when a light finger pressure applied on them. And check the turbocharger shaft for not being free spinning.

In case that any of the above problems occur, the turbocharger should be replaced.

.4.3.21 Checking vibration damper

Viscous damper

Check the vibration damper for damping fluid (silicon fluid) leak and surface dents. Also examine the thickness of damper to confirm if the damper has become deformed. In case that any of the above problems occur, the damper should be replaced.

Rubber damper

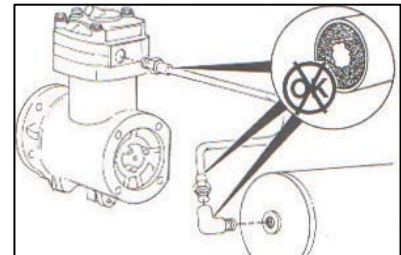
Check the vibration damper for rubber ring aging problem or movement between of inner and outer rings. In case that any of the above problems occur, the damper should be replaced.

4.3.22 Checking air compressor

▲Warning: Air pressure should be released from the air system before removing parts from the air compressor to avoid personal injury.

Air outlet pipe

Check the air outlet pipe and joints for carbon deposit. Clean or replace relevant parts based on the deposit.



4.3.23 Changing coolant and cleaning cooling system

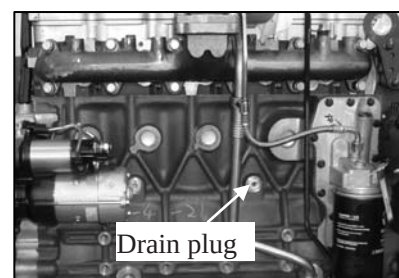
In order to ensure the engine coolant to be good in cooling and anticorrosion, changing of coolant and cleaning of cooling system are required every 80,000 km, 2,000 hours or 2 years, whichever comes.

▲Warning: At operating temperature, engine coolant is hot and under pressure, and coolant steam can cause personal injury. Do not remove the pressure cap on the radiator until the engine stops and coolant temperature goes below 50°C. Slowly unscrew the pressure cap to release the cooling system pressure.

▲Warning: The anti-rust additive in the coolant contains alkali, so avoid skin and eye contact to prevent personal injury.

(1) Stop the engine and wait until the temperature of coolant falls to below 50°C. Slowly unscrew the pressure cap to release pressure and remove the cap. Loosen the drain cock on the radiator to completely drain the coolant in the radiator.

(2) Remove the water drain plug on the engine, scrap the O-ring and completely drain the coolant in the cooling system. Loosen the water drain cock on the air compressor and completely drain the coolant in it.



(3) Clean the cooling system according to the following steps.

(a) Install and screw up all the drain cocks and plug, and add the sodium carbonate solution (or the mixture of sodium carbonate and water that is available in market) into the cooling system from the coolant filler.

△Caution: Each 23 L of water should be mixed with 0.5 kg sodium carbonate. Do not use caustic cleaner, or it will do harm to aluminum parts.

△Purge the air in the coolant system while adding the cleaning fluid. Pour the cleaning fluid slowly to avoid air block. The cleaning fluid should be added up to the bottom of the filler in the radiator and wait for about 3-5 minutes for a full purge of air.

(b) Start the engine and keep it running for 5 minutes after the cleaning fluid temperature has gone up to above 80°C, then stop the engine and completely drain the cleaning fluid in the cooling system.

△Caution: During the whole cleaning process the pressure cap should not be on and the engine runs without the cap on.

(c) Add clean water into the cooling system

△Caution: Pour clean water slowly to avoid air block. Clean water should be added up to the bottom of the filler in the radiator and wait for about 3-5 minutes for a full purge of air.

(d) Start the engine and keep it running for 5 minutes after the water temperature has gone up to above 80°C, then stop the engine and completely drain the clean water in the cooling system.

△Caution: If the discharged water is still dirty, clean the cooling system again according to the above steps until discharged water becomes clean.

(4) After cleaning, tighten all water drain cocks on the radiator and air compressor and use a new O-ring and tighten the plug on the engine to 45 N·m.

(5) Add coolant. Fill the cooling system with the specified coolant, and the total engine cooling system volume is as follows:

Engine cooling capacity			
SC4H		SC7H	
6.8 L	13.3 L (marine application)	9.6 L	16.1 L (marine application)

△Caution: Engine coolant capacity listed above refers to the coolant volume in the engine cooling system. The actual amount should refer to the vehicle or equipment data.

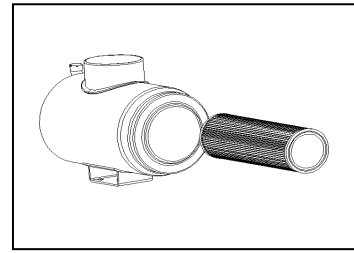
△Caution: Add coolant slowly to avoid air block. Coolant should be added up to the bottom of the filler in the radiator or meet the requirement of vehicle or equipment manufacturer. Wait for about 3-5 minutes for a full purge of air.

(6) Install the pressure cap on the radiator, start and run the engine until coolant temperature goes up to 80°C, then stop the engine and check the cooling system for leakage.

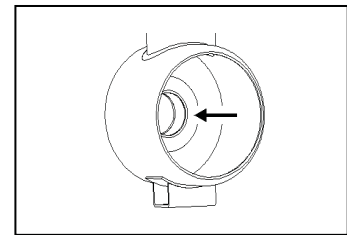
(7) Stop the engine and wait until the coolant temperature falls to below 50°C. Then open the pressure cap and recheck the coolant level. Supplement properly, if necessary.

4.3.24 Replacing air filter element (paper element)

- (1) Blow off dirt on the filter with pressured air.
- (2) Remove the filter cover, remove and scrap the element.



Cover the compressor inlet from inside the air filter body with clean stuff to prevent dirt from entering the intake system.



Clean the inside of the filter body. Check the new filter element for any defects and remove the covering stuff from the compressor inlet. Install the new element and make sure a sound seal at both ends. Install the air filter cover and the service indicator.

△Caution: Be sure that both end faces of the air filter are reliably sealed without leakage after the air filter element has been changed.

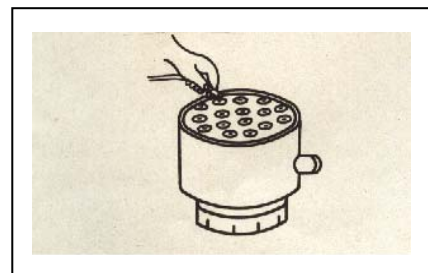
4.3.25 Cleaning air filter element (non-paper element)

Remove the air filter cover and the element. Dip the element in warm neutral cleaning liquid to remove oily dirt on it. Do not use brush for cleaning. Dry the element after cleaning. Flushing afterward with clean water is necessary when non-neutral cleaning liquid is used. Check the element for any damage after cleaning. Install the element and make sure a sound seal at both ends. Install the cover.

△Caution: Be sure that both end faces of the air filter are reliably sealed without leakage after the air filter element has been changed.

4.3.26 Servicing primary air filter

- (1) Remove the upper part of the air filter (primary air filter)
- (2) Blow off the dust in the tubes and on the housing with pressure air.
- (3) Reinstall the filter.



5 Troubleshooting Guidelines

Some simple typical diesel engine fault modes, possible causes and troubleshooting steps are listed in the tables below. If any one of modes occurs in engine operation, it is required to eliminate it by taking appropriate measures. Otherwise, it would lead to severe engine failure. For simple engine faults, you can locate and eliminate them on your own. For complex faults, contact AGG Power's after-sale service center for technical guidance.

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

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

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

Fault mode 2: Starting system fault

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

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

Possible cause	Correction
Improper starting method	Refer to the operating instruction manual of the vehicle or the equipment for proper starting method
The time for engine start up is 2-3 seconds	It is normal and needs no adjustment
The drive system is engaged	Disengage the drive system
Too low starting speed (minimum starting speed is 100 rpm)	Check battery for voltage and check starting motor for looseness or eroded connection
Insufficient fuel in the tank	Add fuel
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes and relevant parts if necessary and then prime the system
The connectors of low-pressure fuel pipeline is loose	Check the low-pressure fuel pipeline and tighten all the connectors
The fuel filter or fuel suction pipe is blocked	Replace the fuel filter or fuel suction pipe
Fuel arises solidification because of cold weather	Choose proper fuel specified in this manual based on the ambient condition
There is no fuel in the fuel injection pump	Check the fuel transfer pump
The resistance of the intake system exceeds the specified value	Check the intake system and replace the air filter element if necessary
The resistance of the exhaust system fails to meet the requirements	Check the exhaust system
The crankshaft rotation is restricted	Barring the crankshaft and check for restriction.
Injection pump timing is not correct	Check and adjust injection pump timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

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

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

Fault mode 5: Liable misfire or unsteady speed

Possible cause	Correction
Fuel level in the fuel tank too low	Add fuel
Air in fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Fuel pressure too low	Check the fuel tank for fuel level, check the pipe between the tank and the fuel transfer pump for leakage, serious deformation, bent or plug and for air
Leakage at high-pressure fuel pipe connectors	Tighten the connectors and make replacement if required
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 6: Liable misfire at low speed

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

Fault mode 7: Engine cannot reach rated speed with load

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

Fault mode 8: Engine power output low

Possible cause	Correction
Inquire the driver or operator	Obtain all the information related to the problem
Overloaded operation	Reduce the load to allowed range
The engine runs on the plateau beyond the specification	Run the engine on the specified plateau. Engine power decreases with increase of altitude
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Oil level is too high	Check and lower oil level to the specified range
The accelerator pedal or throttle lever doesn't arrive at the full position	Check accelerator pedal or throttle lever for restriction
Accessories load is too big	Check the cooling fan for abnormal operation and vehicle braking for friction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Fuel inlet temperature is high	Add fuel into the fuel tank
The fuel supply is blocked	Check the fuel inlet resistance and replace the fuel filter (first stage) and fuel filter (second state) if necessary
Leakage of the exhaust manifold or turbocharger	Check the exhaust manifold and boost pressure to find and eliminate the source of leakage
The resistance of exhaust system fails to meet the requirements	Check the exhaust system resistance
The resistance of intake system exceeds the specified value	Check the intake system resistance and replace the air filter element if necessary
Leakage in the intake system	Check the connection of intake manifold, intake pipe, intercooler, its pipeline for looseness or leakage
Fault of the turbocharger	Check the boost pressure
Fuel is not proper or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue
Incorrect injection pump timing	Check and adjust injection timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 9: Rough running and misfiring

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

Fault mode 10: Unexpected engine halt or misfire in deceleration

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

Fault mode 11: Poor acceleration

Possible cause	Correction
Inquire the driver or operator	Obtain all the information relevant to the problem
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Overload of accessories	Check the cooling fan, air conditioner and the vehicle braking system for too much resistance and reduce the load of the accessories
The accelerator pedal or throttle lever movement is restricted	Check the pedal or f throttle lever or restriction
Leakage of the intake system	Check the intake manifold, intake pipe, intercooler and its pipelines for leakage
The intake system or exhaust system is blocked	Check the resistances of intake and exhaust systems.
Injection pump timing is not correct	Check and adjust injection pump timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 12: Engine will not stop

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

Fault mode 13: Unsteady idle speed and engine hunting

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

Fault mode 14: Rough running at idle speed

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

Fault mode 15: Excessive vibration

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

Fault mode 16: Diesel knock

Possible cause	Correction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Poor quality fuel	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure

Fault mode 17: Excessive noise

Possible cause	Correction
Noise from drive belt due to poor tension or heavy load	Check the belt drive system and ensure all pulleys running
Leakage of intake system and exhaust system	Check the intake and exhaust systems for leakage. Tighten the loose components and replace the related parts if necessary
Noise from the turbocharger	Check the blades of compressor or turbine for their contact with their housings
Incorrect injection pump timing	Check and adjust injection timing. Refer to 5.2 for the procedure
Too big valve clearance	Check and adjust valve clearance

Fault mode18: Black smoke

Possible cause	Correction
The engine is overloaded	Set to lower gear or reduce equipment load
Intake system resistance exceeds the specified value	Check the intake system for resistance and replace the air filter element if necessary
Incorrect injection pump timing	Check and adjust injection timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error	Check and adjust the valve clearance
Fuel is not proper or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 19: White smoke

Possible cause	Correction
The engine is in cold state	Warm the diesel engine
Water in fuel	Check the first stage fuel filter for fuel and water separate function. Replace it if required
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure
Fuel is not correct or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 20: Blue smoke

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

Fault mode 21: Fuel consumption too much

Possible cause	Correction
Something related to driving technique	Check driver's operation for gear shift, deceleration and idle speed
Display error of the odometer	Adjust or replace the odometer
The drive system cannot match the engine	Check the transmission gears and make sure that the components of the engine and drive system are correct
Leakage of fuel	Check the fuel system pipeline for leakage and tighten connectors if loosened
The resistance of intake or exhaust is too great	Check the intake and exhaust systems, especially the air filter and exhaust muffler.
Oil level is too high	Check and adjust the oil level
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure
Poor seal of intake valve or exhaust valve	Check and adjust valve clearance
Fuel is not correct or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

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

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

Fault mode 23: Coolant temperature above normal—sudden overheat

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

Fault mode 24: Coolant temperature below normal

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

Fault mode 25: Coolant contamination

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

Fault mode 26: Oil consumption too much

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

Fault mode 27: Oil pressure too high

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

Fault mode 28: Oil pressure too low

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

Fault mode 29: Oil contamination

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

6 Engine Storage

6.1 Short time storage

If the engine is to be out of service for a period of time (1 to 3 months), measures of cleaning and necessary oil seal should be taken for rust protection.

6.1.1 Before storage

(1) Clean the engine surface and check for any dirt, or oil stain or water stain and rust. Dry the engine with compressed air. Apply anti-rust oil to the unpainted machining surfaces of the engine with a brush and keep the parts of rubber, plastic and fiber free from the anti-rust oil.

△Caution: The surfaces of the front drive pulleys must be kept from rust.

The anti-rust oil requirement for outside engine is as follows:

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

(2) Disconnect the battery, clean terminals and apply a light film of grease. Charge the battery.

(3) Let the drive belt in loose.

(4) Seal all ports of air, fuel, oil and coolant, as well as the air filter with damp-proof material or plastic one.

(5) Cover the engine with plastic cover or similar stuff and place the engine in a dry area with good ventilation.

6.1.2 During the storage

Charge the battery every month. Check the battery electrolyte level before charging. Crank the crankshaft three to four turns every month with barring tool.

6.1.3 After storage

When putting the engine into use, remove the fuel pump and send it to the authorized service provider for adjustment. Remove the engine cover and all port seals. Install the fuel pump and prime the fuel system. Connect battery and install the belt. Check lubricating oil and coolant levels, and add proper amount of clean lubricating oil into the turbocharger from its oil inlet. Crank the engine three to five circles with barring tool. Then follow the starting procedure in Section 3.4 to start the engine.

6.2 Long time storage

6.2.1 Before storage

If the engine is to be out of service for a long time (more than 3 months), proper storage of the engine is required.

(1) On last engine operation, drain the lubricating oil in the engine and oil filter after the engine has stopped and cooled down to warm state. It is not necessary to drain coolant because it is anti-rust. Add qualified anti-rust oil (dewatered CF 15W-40 oil) into the engine, start the engine to idle for 1-1.5 minutes and stop it, then drain the anti-rust oil.

(2) Refer to Article 1, 2, 3, 4 and 5 in Section 6.1.1 Short Time Storage for cleaning, preventing rust and other requirements. And put a tag which reads "The engine does not contain oil and do not use it."

6.2.2 During the storage

Refer to 6.1.2 for storage.

6.2.3 After storage

When putting the engine into use, remove the fuel pump and send it to the authorized service provider for adjustment. Remove the engine cover and all port covers, and connect necessary lines. Install the fuel pump and prime the fuel system. Connect battery and install the belt. Fill the engine and oil filter with clean lubricating oil and add proper amount of clean lubricating oil into turbocharger from its oil inlet. Check oil and coolant levels, and crank the engine three to five circles with a barring tool. Then follow the starting procedures in Section 3.4 to start the engine. If the engine is stored for over 2 years, its coolant should be changed and its cooling system should be cleaned.



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