



AGG201806
June 2018

Operation and Maintenance Manual

Diesel Engine

AS8900

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, 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 failures 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 the diesel engine

The order number of the diesel engine

The serial number of the diesel engine

The date of the equipment procurement

The detailed description of the fault

The address and phone number of contact person

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1 Introduction

1.1 To Users and Operators

The AS8900 Series Diesel Engine is direct injection and has power ranging from 100 kW to 235 kW, most models of which are turbocharged or turbocharged and intercooled. With its emissions meeting relevant Chinese emission regulations, the AS8900 Series Engine can provide ideal power for construction machineries, agricultural tractors, marine application (marine engine and auxiliary equipment), generator sets and other industrial applications.

Containing technical specification, structure, operation, adjustment, maintenance, trouble-shooting, replacement and repair, this manual aims to help users and operators get familiar with the engine and operate it properly.

For any questions regarding operation and maintenance, please contact your local service office, or dealers or distributors authorized by AGG Power or call our service center to inquire or get technical instruction.

Use appropriate fuel, lubricant and coolant according to relevant requirements of this manual.

Operate and maintain the engine according to relevant requirements of this manual and keep regular maintenance record.

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 Important Information for Safety

Operator should read and know all safety cautions and warnings before maintenance or repair of engine.

The sign in this manual represents potential dangers that may cause personal injury or death. However, these



dangers can be prevented, if one pays close attention and adopt necessary measures. Please take caution at anytime, for it is impossible for us to predict all possible dangers.



Be sure to operate in safe surroundings and keep caution at any time.



Be sure to wear protective glasses and shoes during operation.



Be sure to wear working clothes during operation and do not wear loose or broken clothes.



Be sure to disconnect the wiring of battery, or the lines of air starting motor if applicable before repair in order to prevent accidental start, and put a sign of “Stop” in operation room or at control.



Do not pry fan to crank the engine. This kind of abnormal operation will cause serious personal injury or damage to the fan blades.



Be sure to cool down the engine before slowly loosening coolant-fill cover to relieve cooling system pressure when the engine is operating or coolant is hot.



Firstly relieve the pressures of the compressed air, fuel, lubricating and cooling systems before removing or loosening any pipes, connectors and relevant components. Do not check leakage by hand, for high-pressure fuel or lube oil will do personal injury.

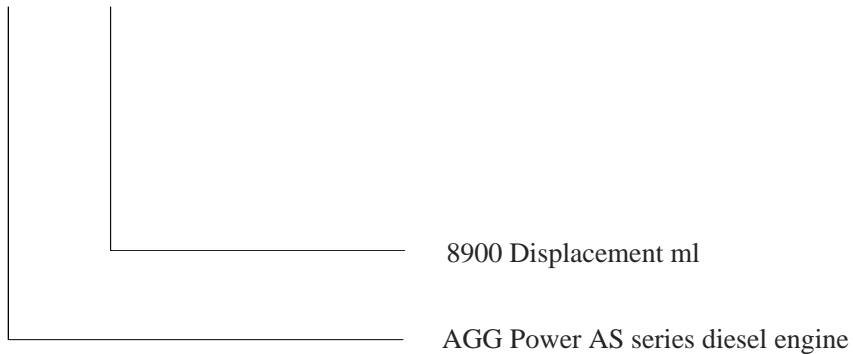


Do not spray antiseptic into eyes or drink it, for it consists of strong alkali. Please clean it with soap and water promptly in case of splashing on skin.

1.3 Engine Model Identification

The model name represents the meanings as follows:

AS 8900



For example: AS8900 stands for AGG Power AS series diesel engine with displacement of 8900 ml.

1.4 Engine Nameplate

The engine nameplate indicates main technical specifications and parameters of the engine you have purchased. It is a major basis with which you can buy service parts and request for customer service from our company.

Note: The engine nameplate varies a little from one application to another and it is either on the side of intake manifold or on the side of gear housing.



Note: Without our permission, user cannot replace the nameplate.

2 Main Engine Technical Specifications and Parameters

2.1 AS8900-DBL3675

Engine Speed r/min	Type of Operation	Engine Power kW	Generator Power kVA
1500	Prime Power	185	200
1500	Standby Power	204	220
1800	Prime Power	205	227.5
1800	Standby Power	226	250

- 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
1 hours 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	AS8900
Engine Type	In-line,4 strokes, 4 valves, water-cooled , Turbo charged with aftercooler
Combustion type	Direct injection
Cylinder Type	Wet liner
Number of cylinders	6
Bore × stroke	114× 144mm
Displacement	8.82 L
Compression ratio	18: 1
Firing order	1-5-3-6-2-4
Injection timing	7.5°BTDC
Dry weight	Approx. 740kg
Dimension (L×W×H)	1422 ×762×1186 mm
Rotation	SAE NO.2
Fly wheel housing	SAE NO.11.5 (tooth number of gear:125)

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%	13.4	15.7
50%	22.8	26.2
75%	32.8	37.4
100%	44.1	50.9
110%	49.6	57.2

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

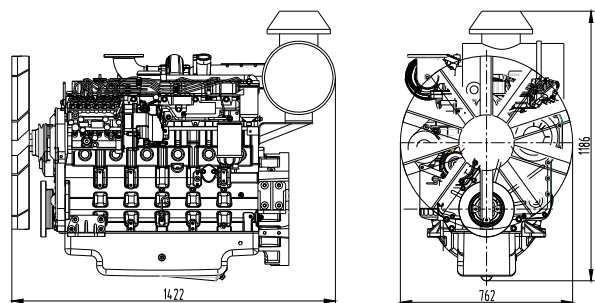
Lubrication System	
Lub. Method	Fully forced pressure feed type
Oil pump	Gear type driven by crankshaft
Oil filter	Full flow, cartridge type
Oil pan capacity	High level 19 liters Low level 15 liters
Angularity limit	Front down 25 deg Front up 35 deg Side to side 35 deg
Lub. Oil	Refer to Operation Manual

Cooling System	
Cooling method	Fresh water forced circulation
Water capacity (engine only)	12 liters
Lid Min. pressure	70kPa
Water pump	Centrifugal type driven by belt
Water pump Capacity	200L/min (1500r/min)
	240L/min (1800r/min)
Thermostat	Wax–pellet type
	Opening temp. 82°C
	Full open temp. 95°C
Cooling fan	Blower type, plastic
	762 mm diameter, 10blades
	Power consumption 5kw
Cooling air flow	6.2m ³ /s

Electrical System	
Charging generator	24V×55A
Voltage regulator	Built-in type 1C regulator
Starting motor	24V×4.5kW
Starting motor	24V
Battery Capacity	120 AH

Engineering Data	
Heat rejection to coolant	18.6kcal/sec (1500r/min)
	20.6kcal/sec (1800r/min)
Heat rejection to intercooler	11.6 m3/min (1500r/min)
	12.9 m3/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

Dimension



2.2 AS8900-DBL3677

Engine Speed r/min	Type of Operation	Engine Power kW	Generator Power kVA
1500	Prime Power	220	230
1500	Standby Power	242	253
1800	Prime Power	235	250
1800	Standby Power	259	275

- 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
1 hours 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	AS8900
Engine Type	In-line,4 strokes, 4 valves, water-cooled , Turbo charged with aftercooler
Combustion type	Direct injection
Cylinder Type	Wet liner
Number of cylinders	6
Bore × stroke	114× 144mm
Displacement	8.82 L
Compression ratio	16.5 : 1
Firing order	1-5-3-6-2-4
Injection timing	8.5°BTDC
Dry weight	Approx. 900kg
Dimension (L×W×H)	1493 ×792×1309 mm
Rotation	SAE NO.2
Fly wheel housing	SAE NO.11.5 (tooth number of gear:125)

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%	13.4	15.7
50%	22.8	26.2
75%	32.8	37.4
100%	44.1	50.9
110%	49.6	57.2

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 25 liters Low level 22 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)	12 liters
Lid Min. pressure	70kPa
Water pump	Centrifugal type driven by belt
Water pump Capacity	200L/min (1500r/min) 240L/min (1800r/min)
Thermostat	Wax-pellet type Opening temp. 82°C Full open temp. 95°C
Cooling fan	Blower type, plastic 762 mm diameter, 10 blades Power consumption 6kw
Cooling air flow	6.2m ³ /s

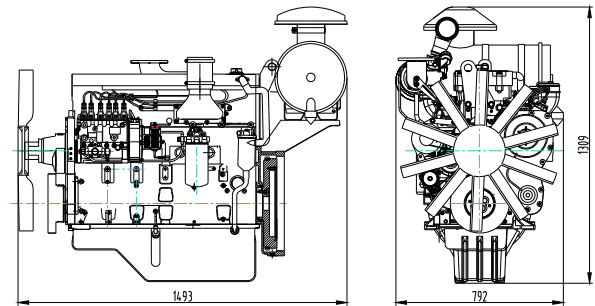
Electrical System

Charging generator	28V×55A
Voltage regulator	Built-in type IC regulator
Starting motor	24V×7.5kW
Starting motor	24V
Battery Capacity	180 AH

Engineering Data

Heat rejection to coolant	22.1kcal/sec (1500r/min) 23.6kcal/sec (1800r/min)
Heat rejection to intercooler	13.8m ³ /min (1500r/min) 14.8m 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

Dimension



2.3 AS8900-DBL3678

Engine Speed r/min	Type of Operation	Engine Power kW	Generator Power kVA
1500	Prime Power	230	250
1500	Standby Power	253	275
1800	Prime Power	255	275
1800	Standby Power	282	303

- 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	AS8900
Engine Type	In-line,4 strokes, 4 valves, water-cooled , Turbo charged with aftercooler
Combustion type	Direct injection
Cylinder Type	Wet liner
Number of cylinders	6
Bore × stroke	114× 144mm
Displacement	8.82 L
Compression ratio	16.5 : 1
Firing order	1-5-3-6-2-4
Injection timing	8.5°BTDC
Dry weight	Approx. 900kg
Dimension (L×W×H)	1493 ×792×1309mm
Rotation	SAE NO.2
Fly wheel housing	SAE NO.11.5 (tooth number of gear:125)

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%	15.9	18.9
50%	27.7	32.3
75%	40.7	46.1
100%	55.1	63.1
110%	61.3	70.3

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 25 liters Low level 25 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)	12 liters
Lid Min. pressure	70kPa
Water pump	Centrifugal type driven by belt
Water pump Capacity	200L/min (1500r/min) 240L/min (1800r/min)
Thermostat	Wax-pellet type Opening temp. 82°C Full open temp. 95°C
Cooling fan	Blower type, plastic 762 mm diameter, 10 blades Power consumption 6kw
Cooling air flow	6.2 m ³ /s

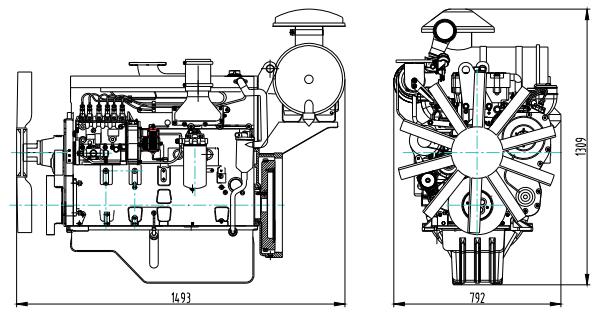
Electrical System

Charging generator	28V×55A
Voltage regulator	Built-in type IC regulator
Starting motor	24V×7.5kW
Starting motor	24V
Battery Capacity	180 AH

Engineering Data

Heat rejection to coolant	23.1kcal/sec (1500r/min) 25.6kcal/sec (1800r/min)
Heat rejection to intercooler	14.5m ³ /min (1500r/min) 16.0m 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

Dimension



2.4 AS8900-DBL3847

Engine Speed r/min	Type of Operation	Engine Power kW	Generator Power kVA
1500	Prime Power	208	180
1500	Standby Power	228	200
1800	Prime Power	228	200
1800	Standby Power	250	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	AS8900
Engine Type	In-line, 4 strokes, 4 valves, water-cooled , Turbo charged with aftercooler
Combustion type	Direct injection
Cylinder Type	Wet liner
Number of cylinders	6
Bore × stroke	114× 144mm
Displacement	8.82 L
Compression ratio	18 : 1
Firing order	1-5-9-6-2-4
Injection timing	7.5°BTDC
Dry weight	Approx. 740kg
Dimension (L×W×H)	1422×762×1186 mm
Rotation	SAE NO.2
Fly wheel housing	SAE NO.11.5 (tooth number of gear:125)

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%	15.1	17.5
50%	25.7	29.1
75%	36.8	41.6
100%	49.6	56.6
110%	55.5	63.3

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 19 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)	12 liters
Lid Min. pressure	70kPa
Water pump	Centrifugal type driven by belt
Water pump Capacity	200L/min (1500r/min) 240L/min (1800r/min)
Thermostat	Wax-pellet type Opening temp. 82°C Full open temp. 95°C
Cooling fan	Blower type, plastic 762 mm diameter, 10 blades Power consumption 6kw
Cooling air flow	6.2m ³ /s

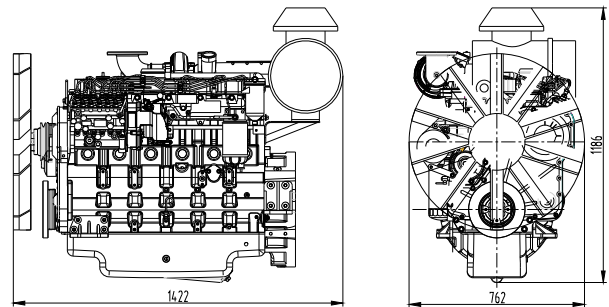
Electrical System

Charging generator	24V×55A
Voltage regulator	Built-in type IC regulator
Starting motor	24V×4.5kW
Starting motor	24V
Battery Capacity	120 AH

Engineering Data

Heat rejection to coolant	20.9kcal/sec (1500r/min) 22.1kcal/sec (1800r/min)
Heat rejection to intercooler	13.1 m3/min (1500r/min) 14.3 m3/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

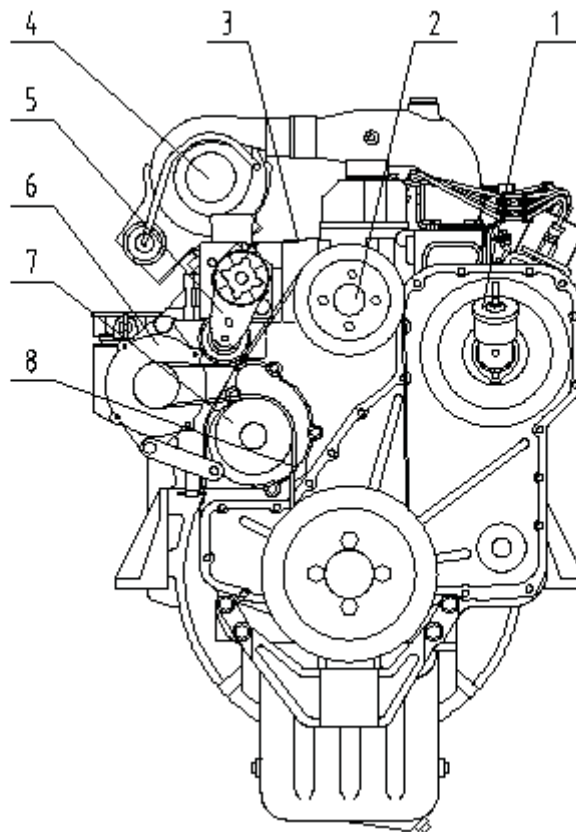
Dimension



3 Engine Structure

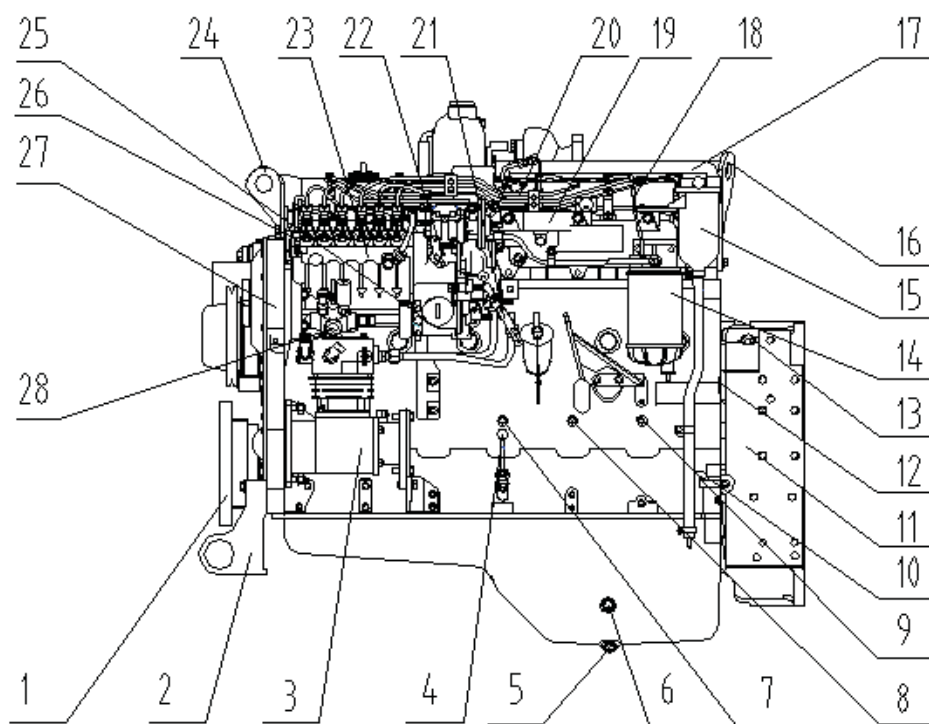
3.1 Engine outlines

Engine outlines vary from one engine model to another. The outlines provided here are only for your reference.



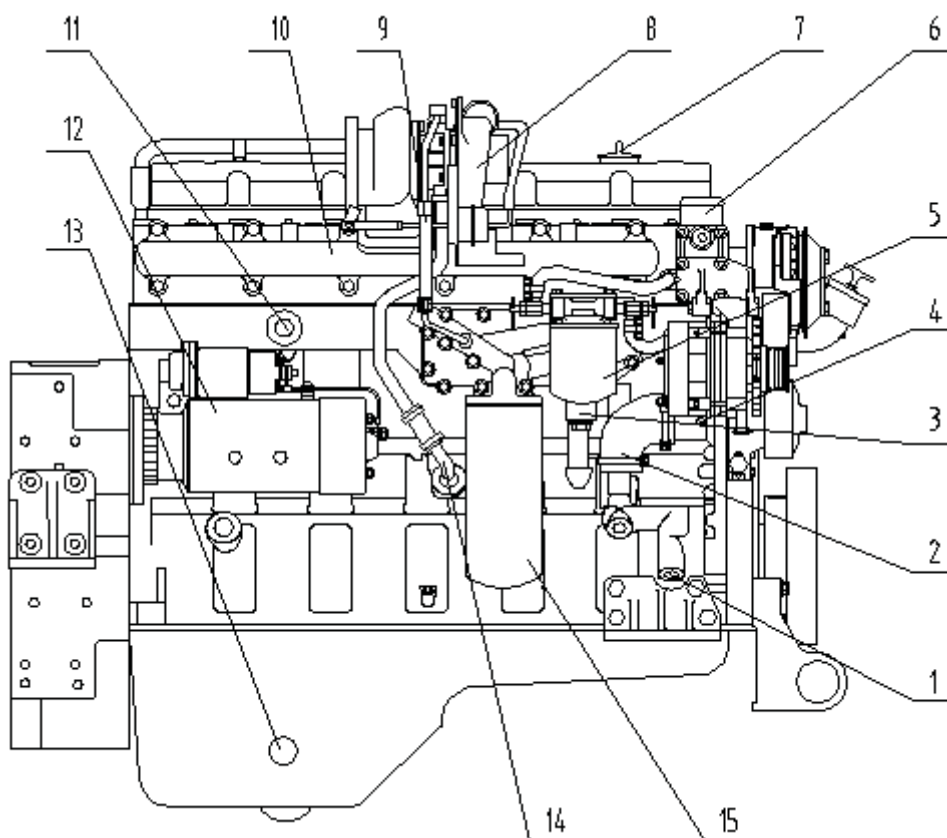
Front View

- | | | | |
|--------------|---------------|----------------------|--------------------|
| 1.Oil fill | 2. Fan pulley | 3. Z1/2 (warm water) | 4.Compressor inlet |
| 5. Tensioner | 6. Alternator | 7. Water pump | 8. Drive belt |



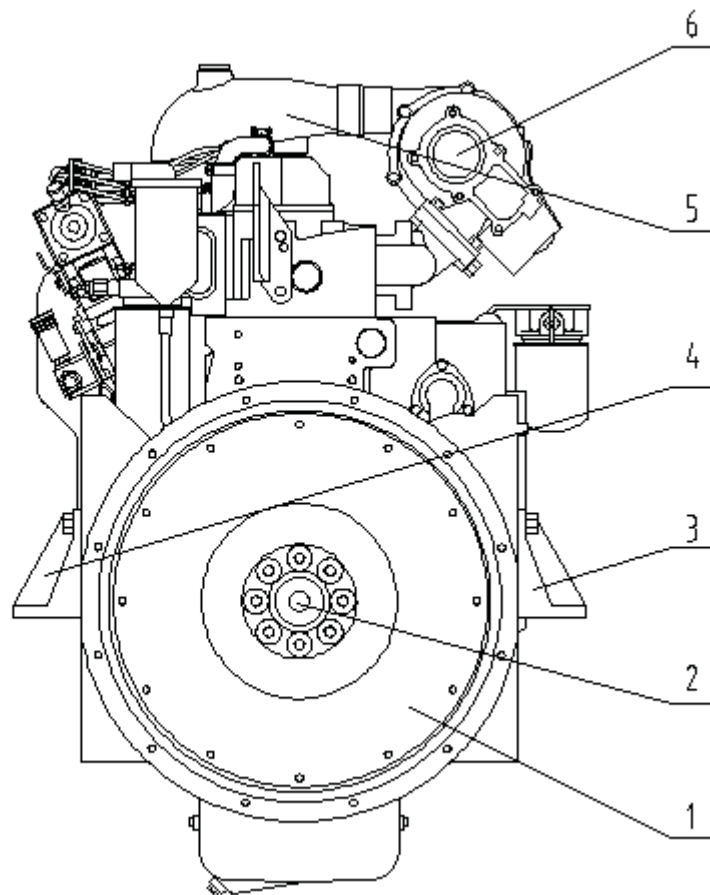
Left Side View

- | | | | |
|---------------------------------|---|----------------------------|-------------------------------|
| 1. Vibration damper | 2. Front engine support | 3. Air compressor | 4. Oil dipstick |
| 5. M18×1.5 (Oil drain) | 6. M16×1.5 Oil (oil temperature sensor) | 7. Z1/8 (oil pressure) | |
| 8. Z1/8 (oil pressure warning) | 9. Z1/8 (oil pressure sensor) | 10. Flywheel pointer | |
| 11. Flywheel housing | 12. Port for barring engine | 13. M18×1.5 (speed sensor) | 14. Fuel filter |
| 15. Blow-by valve | 16. Rear lifting eye | 17. Blow-by valve pipe | 18. Injector fuel return pipe |
| 19. Intake manifold | 20. High pressure fuel pipes | 21. Speed regulating lever | |
| 22. Shut down lever | 23. Fuel pump | 24. Front lifting eye | 25. Fuel pump timing pin |
| 26. Fuel pump fuel return joint | 27. Gear housing | 28. Fuel transfer pump | |



Right Side View

- | | | |
|---|----------------------------------|----------------------------------|
| 1. Max. oil pressure limiting valve of oil pump | 2. Water inlet elbow | 3. Oil pressure regulating valve |
| 4. Water temperature sensor for cold start | 5. Water filter | 6. Coolant outlet pipe |
| 7. Oil fill | 8. Turbocharger | 9. Turbocharger oil inlet tube |
| 10. Exhaust manifold | 11. hole for Coolant heater | 12. Starting motor |
| 13. M22x1.5 (electrical heater) | 14. Turbocharger oil return tube | 15. Oil filter |

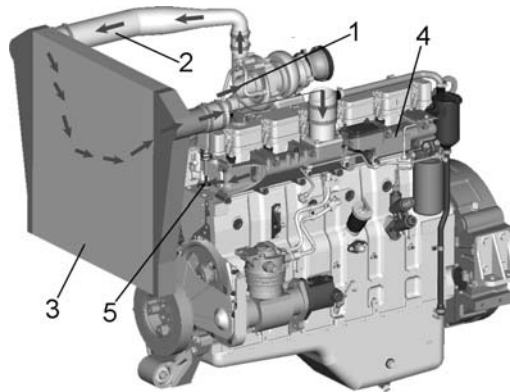


Rear View

1. Flywheel 2. Bearing 3. Rear right engine support 4. Rear left engine support
5. Compressor outlet tube 6. Turbine outlet

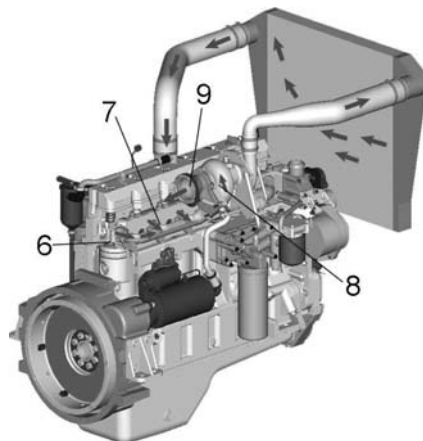
3.2 Intake and exhaust system and components

Air is sucked from the air filter through the intake manifold into the combustion chamber and then mixed with fuel spray injected by the fuel injectors. Power is produced with the movement of the pistons pushed by thermal force generated from the combustion of mixture. For turbocharged engine model, the compressor of turbocharger is placed between the air filter and the intake manifold; while for turbocharged and charge air intercooled model, the intercooler is placed between the compressor and the intake manifold. Exhaust gas from the combustion chamber emits into air through the exhaust manifold and the muffler.



Intake System

1. Compressor inlet 2. Intercooler air inlet 3. Intercooler 4. Intake manifold 5. Intake valve



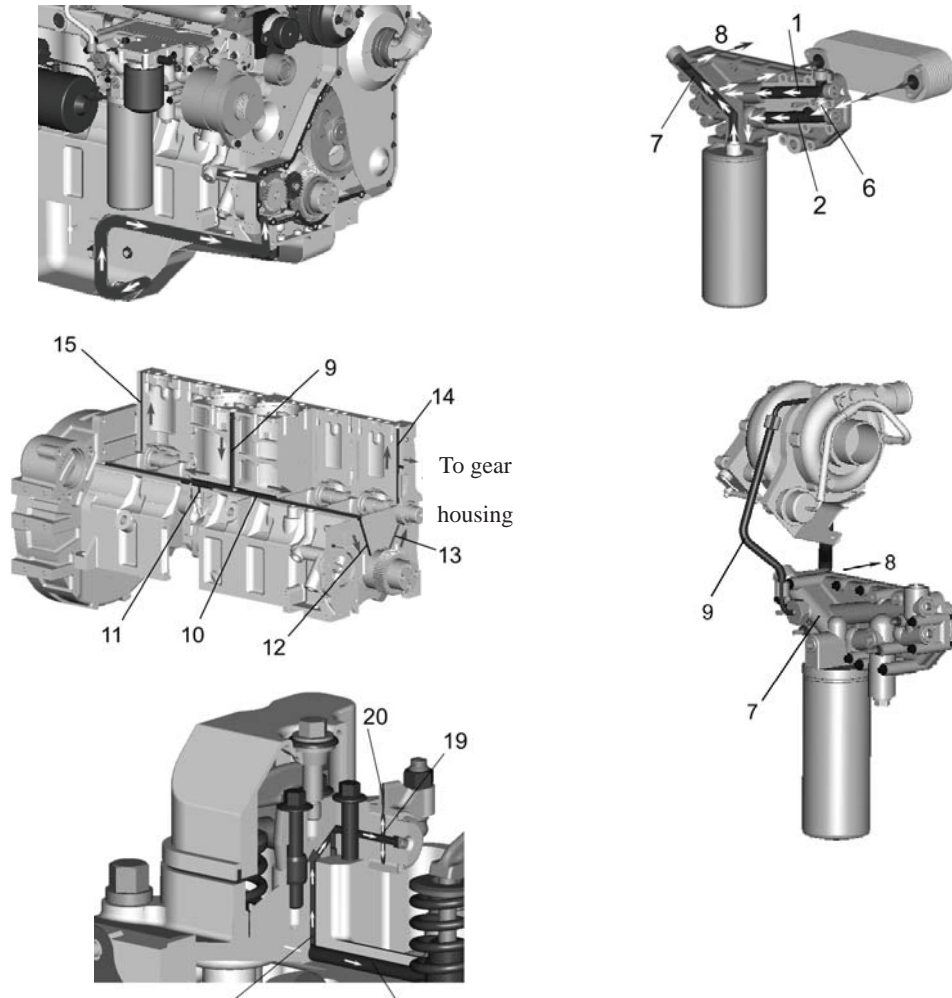
Exhaust System

6. Exhaust valve 7. Exhaust manifold 8. Double-inlet turbocharger housing 9. Turbine outlet

Intake and Exhaust System Flow Chart

3.3 Lubricating System and Components

Pumped by the rotor oil pump from the oil pan through the oil suction pipe, cooled by the oil cooler, and cleaned by the oil filter, oil goes to parts like the crankshaft, camshaft, piston, con-rod, cylinder head, gear etc. to lubricate, cool and clean them, and then recircles to the oil pan.

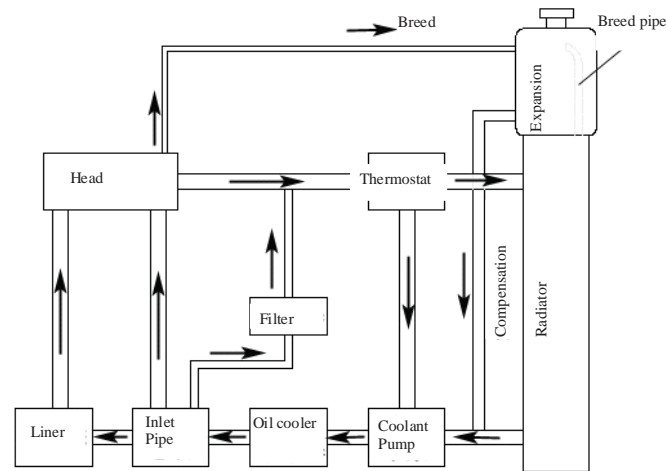


- | | | | |
|--|---|------------------|------------------------------|
| 1. Oil cooler inlet passage | 2. Oil filter inlet passage | 6. By-pass valve | 7. Oil filter outlet passage |
| 8. From filter to oil gallery | 9. From filter to block and turbocharger | 10. Oil gallery | 11. Cooling jet |
| 12. From oil gallery to main bearings | 13. To camshaft bushing | | |
| 14. First to oil passage in gear housing and then to fuel injection pump | 15. To cylinder head | | |
| 19. To rocker arm bushings | 20. To push rod bowls and valve tips along the backs of rocker arms | | |

Lubricating System Flow Chart

3.4 Cooling System and Components

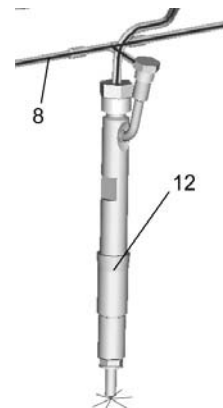
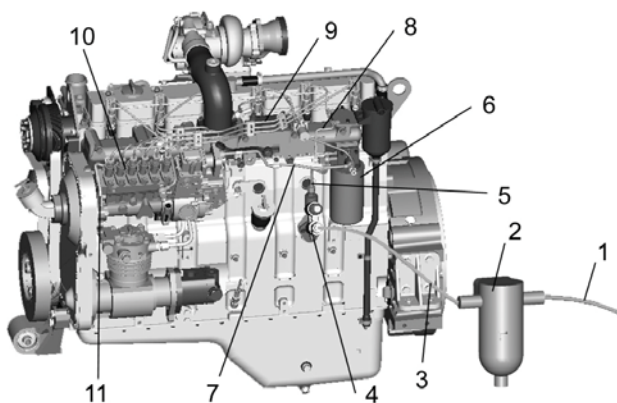
The function of the cooling system is to remove part of heat from the engine and its component. The rest heat is taken into air in form of exhaust gas and radiation.



Cooling System Flow Chart

3.5 Fuel System

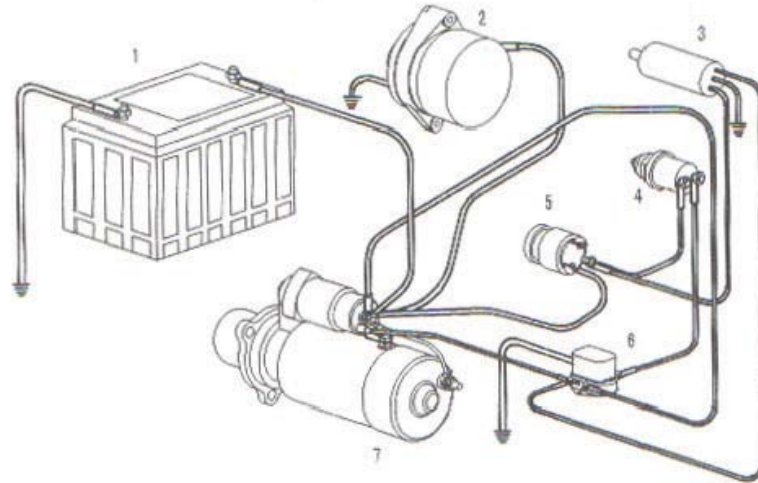
The fuel system consists of the fuel tank, pre-filter with fuel/water separator or strain, fuel transfer pump, fuel filter, fuel supply pipes, fuel injection pump, fuel return pipe of the fuel injector, injector high-pressure fuel pipes, fuel return pipe of the fuel injection pump, etc.



- 1.From tank to suction pipe 2.Pre-filter (or fuel/water separator) 3.Fuel transfer pump inlet pipe
- 4.Fuel transfer pump 5.Fuel transfer outlet pipe 6.Fuel filter 7.Fuel injection pump inlet pipe
- 8.Injector fuel return pipe 9.High-pressure fuel pipe 10.Fuel injection pump
11. Fuel return pipe of fuel injection pump 12.Injector

3.6 Electrical System

The basic elements of the electric system are starting motor and alternator. Some engine models have fuel shutoff solenoid and intake air heating device, which are regarded as part of an electrical system.



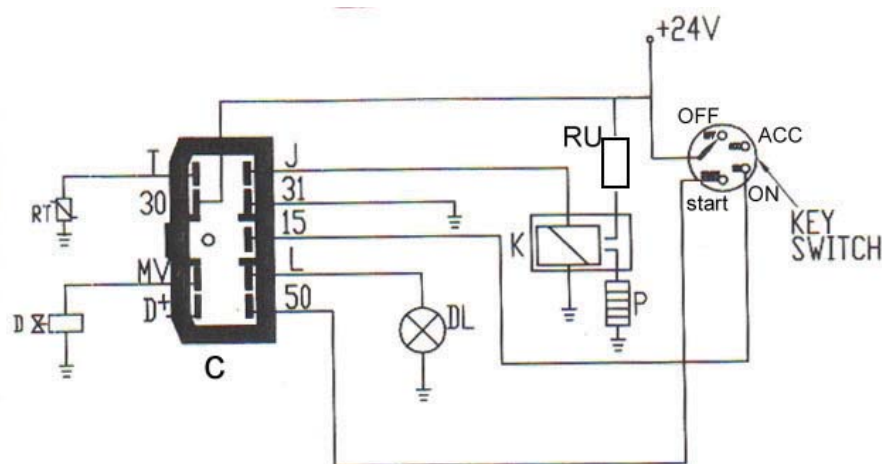
- 1.Battery 2.Alternator 3.Fuel shutoff solenoid 4.Start button
5.Switch key 6.Starting relay 7.Starting motor

3.7 Intake air heating device

The AS8900 Series Engine can start at temperature as low as -15°C without cold starting aid. Usually, an intake air heating device is recommended for helping engine start easily and smoothly when ambient temperature goes below -10°C .

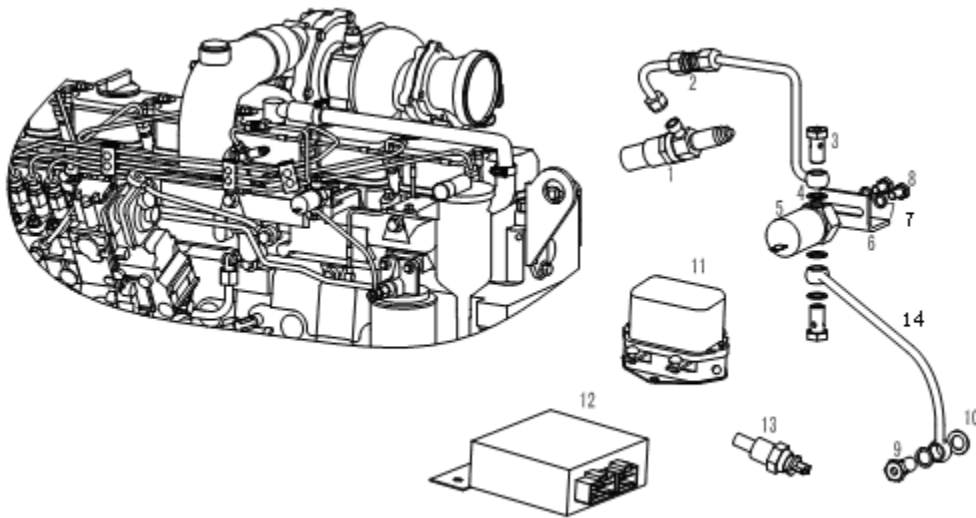
The device consists of the glow plug, solenoid, fuel inlet pipe, electronic control, relay, temperature sensor and indicating lamp.

⚠ Warning: Never use ether for the heating device.



- | | | |
|--------------------|--------------|---|
| P—Glow plug | D—Solenoid | RT—Water temperature sensor |
| DL—Indicating lamp | K—Relay | D ⁺ —D ⁺ terminal of alternator |
| RU—Fuse | C—Controller | |

Intake Air Heating Device Wiring Diagram

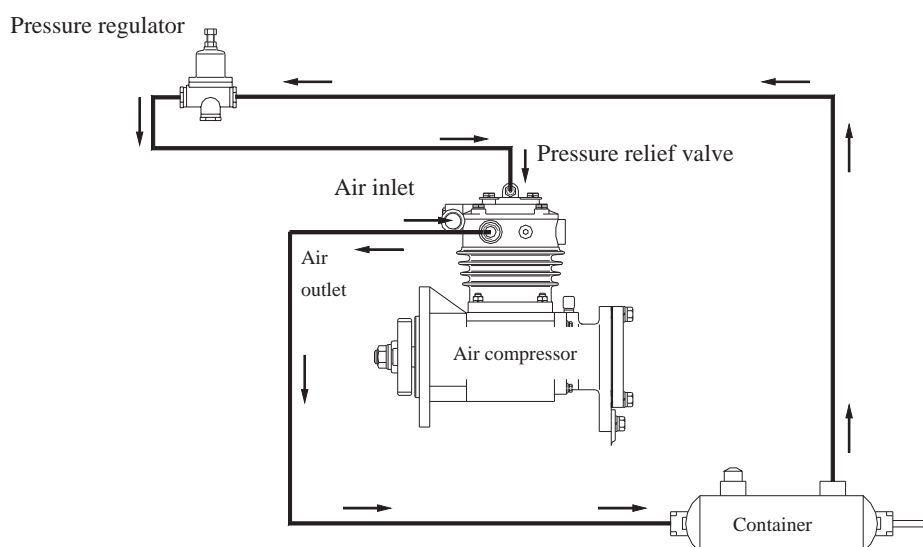


- 1.Glow plug 2.Solenoid outlet pipe 3.Benjo bolt 4.Copper washer 5.Solenoid
 6.Solenoid bracket 7.Spring washer 8.Bolt 9.Banjo bolt 10. Copper washer
 11. Solenoid relay 12.Controller 13.Water temperature sensor 14.Fuel inlet pipe

3.8 Compressed Air System

The compressed air system usually consists of the gear driven air compressor, pressure regulator, compressed air container and piping.

The AS8900 Series Engine employs single-cylinder air compressor, and some engine models don't use air compressor. Only a few engine models use double-cylinder air compressor. Controlled by the pressure regulator and pressure relief valve, the air compressor can operate continuously with and without load.



4 Use of Engine

Before using the engine, choose lube oil, fuel and coolant with proper specifications according to specific environment and condition. The specifications of the lube oil, fuel and coolant used should comply with the stipulations in this chapter.

4.1 Start of Engine

Perform daily maintenance before starting the engine. Refer to Chapter 5 for the maintenance.

4.1.1 Normal start

For routine engine start, pay attention to the followings:

- Disconnect the engine from the drive system.
- Set the fuel shutoff solenoid, electrical switch and mechanical controller at running position.
- For engine equipped with variable speed governor, set the throttle at around 700 rpm slightly higher than idle speed.

△Caution: To avoid damages of the starting motor, the start time shall be less than -15 seconds when ambient temperature is -15°C and above, less than 30 seconds when ambient temperature is below -15°C.

The interval of two startups shall be at least 2 mines (for the electrical starting motor only).

- The pressure gauge should display the engine oil pressure within 15 seconds after the engine is started. If it is not so, shut down the engine to prevent it from damage. Then check the oil level.
- Run the engine at idle speed after it being started. If starting the engine from its hot state, run it at idle for 1-3 minutes before accelerating and loading gradually. If starting the engine from its cold state, run it at idle for 3-5 minutes and then increase its speed slowly to have every bearing adequately lubricated and oil pressure stable. Gradually accelerate and load the engine after oil pressure is stable.

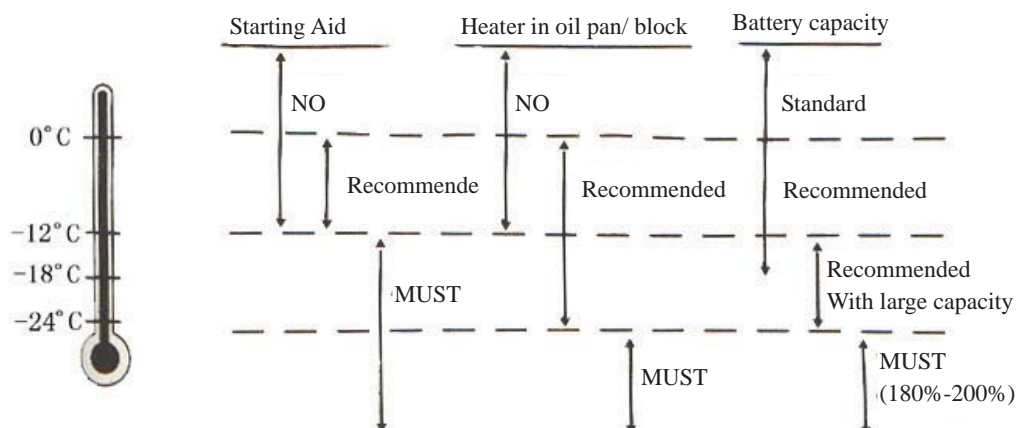
△Caution: Do not accelerate and load the engine immediately after it has been started up.

△Caution: Do not idle the engine for too long time, otherwise the engine will be damaged. During idling, the temperature in the combustion chamber is too low to have a complete combustion, which will result in build-up of carbon, congesting injection nozzles, and making piston rings, as well as intake and exhaust valves seized.

△Caution: If the temperature of coolant is lower than 60°C, fuel will also take away the lube oil on the surface of the cylinder liner and dilute the oil in the oil pan, thus preventing all moving components from getting proper lubrication.

4.1.2 Cold starting

Refer to the diagram below for the necessity of cold starting Aid.



The AS8900 series engine is equipped with the intake air heating device for start in cold weather. The device consists of the glow plug, solenoid, fuel inlet pipe, electronic controller, temperature sensor, indicating lamp, etc. Controlled by the electronic controller, the heater only works when the temperature of engine coolant is lower than 0°C.


- Before start, insert the electric key and turn it from “OFF” position to “ON” position. Connect the circuit of the heater and there comes the indicating lamp, indicating the glow plug heats up.


- After indicating lamp starts to flash (about 50 seconds), turn the electric key from “ON” position to “START” position to start the engine.

△Caution: If startup does not carry out or the engine fails to start within 30 seconds after indicating lamp starts to flash, the controller will automatically disconnect the circuits of heater, solenoid and indicating lamp, and provides delay protection. If another startup is needed, turn the electric key back to “OFF” position, and wait for 5 seconds before repeating the same process as above.

- Other instructions are the same as the routine start in Chapter 4.1.1.

△Caution: Making a cold start with starting liquid even equipped with metering device will speed up wear of cylinder liners and piston rings.

 **Warning: It is not allowed to use the starting liquid near open fire, heater or flame ejector. Do not breathe in starting liquid fumes. Using excessive starting liquid will damage engine.**

 **Warning: It is not allowed to use volatile fuel as auxiliary means for cold start in underground mines or tunnels.**

4.1.3 Start of engine that is not in use for a long time or after lube oil replacement

For starting engine after lube oil replacement or not in use for more than 30 days, it is required to fill up the lubricating system first.

- Shut off the throttle or disconnect the fuel shutoff solenoid (some engines with the solenoid) to prevent the engine from ignition and startup.

- Use the starting motor to crank the camshaft until the oil pressure meter displays pressure.

- Open the fuel throttle or connect the fuel shutoff solenoid.

- Discharge the air in the fuel system according to the instruction in Chapter 5.6.2.

- Start the engine as per Chapter 4.1.1 (normal start) or chapter 4.1.2 (cold start).

4.2 Engine Operation

- For new engine or engine after overhaul, running-in should be carried out before full-load operation. Refer to Chapter 6 for running-in operation.

- Full throttle running at speed lower than the peak torque speed should not exceed 1 minute.

- During engine operation, check oil pressure and coolant temperature regularly. Refer to Chapter 2 for the engine specifications and parameters. If operating parameters do not meet the requirements, stop and check the engine to find out the cause and make repairs where necessary.

△Caution: Continuous operation with coolant temperature below 60°C or above 100°C will cause

damage to the engine.

- In case that the engine starts to be overheated, reduce engine speed or load or reduce both until the temperature recircles to normal operating range.
- Most malfunctions give early warnings. Observe the performance of the engine, listen to engine sound, or check whether the engine exhibits any of the followings that indicate necessity for repair:
 - engine misfire
 - Poor smoke
 - excessive vibration
 - power declination
 - abnormal noise
 - oil consumption increase
 - abrupt change in oil pressure or oil temperature
 - fuel consumption increase
- Prevent engine from over speed.

△Caution: Over speed running (speed higher than the maximal idle speed) will cause damage to the engine.

4.3 Shutdown of Engine

- After full-load operation and before shutdown, gradually reduce the engine speed and load, and run the engine for 3~5 minutes at the idle to let turbocharger speed fall considerably and let the engine cool down gradually and evenly so as to protect the turbocharger and engine.
- Unless necessary, it is not allowed to make an abrupt shutdown during a high-load operation, otherwise overheating will cause severe malfunction.

4.4 Handling of engine malfunction

This chapter mainly introduces the typical engine malfunction. For any of the following malfunction appearing, check and investigate timely, and take necessary steps to remove it, otherwise severe malfunction will occur to the engine. If necessary, contact your near AGG Power offices, or service agencies authorized by AGG Power for technical instruction or professional service.

- Engine can not rotate or rotates slowly
- Engine is hard to start or fails to start, but with exhaust smoke present
- Engine rotates, but does not start up, no smoke from exhaust
- Engine starts, but does not keep running
- Engine fails to stop
- Unstable engine warm speed
- Engine surges at idle speed
- Too low lube oil pressure
- Too high lube oil pressure

- Too much lube oil consumption
- Too high coolant temperature – engine overheated gradually
- Too high coolant temperature – engine overheated suddenly
- Too much coolant consumption
- Too low coolant temperature
- Contaminated coolant
- Contaminated lube oil
- Fuel or lube oil presents in exhaust manifold
- Black smoke during engine running with load
- White smoke during engine warm-up
- Engine fails to reach rated speed when loaded
- Insufficient engine power
- Engine misfire
- Fuel knock
- Too much fuel consumption
- Intensive engine vibration
- Intensive engine noise
- Alternator- no charge or low charge
- Excessive blow-by
- Excessive air compressor noise
- Slow rise of air compressor pressure
- No air pressure from air compressor
- Malfunction of cold starting device

4.5 Diesel fuel



Warning: Mixing of gasoline or alcohol with diesel is prohibited. Such mixture will cause explosion.

The quality of diesel fuel used for this series diesel engine should no less than the requirement of national standard GB 252 (general diesel Fuel). Main fuel specifications specified in the standard are as follows.

Main Specifications of General Diesel Fuel (GB 252)

Item Designation	16 Cetane number	Distillation temperature ℃			Motion viscosity (20℃)	Steel corrosion (50℃ , 3h) class	Moisture % (v/v)	Acid mg KOH/ 100mL	Ash % (m/m)	Mechanical impurity	Solid Point ℃	Cold Filter Point ℃	Flash Point (closed)	
	≥	50% ≤	90% ≤	95% ≤	mm ² /s	≤	≤	≤	≤	%	≤	≤	≥	
5	45	300	355	365	3~8	1	Trace	7	0.01	None	8	12	55	
0											0	4		
-10											-10	-5		
-20											-20	-14		
-35												-35	-29	45
-50												-50	-44	

Choose diesel fuel according to engine operation environment. Use fuel with high solid point for warm area, and fuel with low solid point for cold area. You may take the recommendations in the table below, for

example, for ambient temperature -27°C, Designation -35 fuel should be used.

Relationship between diesel fuel designations and applicable minimum temperatures

Fuel designation	5#	10#	0#	-10#	-20#	-35#	-50#
Cetane number	≥45	≥45	≥45	≥45	≥45	≥45	≥45
Solid point/°C	8	4	0	≤-10	≤-20	-35	-50
Minimum applicable temperature (engine working temperature)/°C	Above 12°C	Above 8°C	Above 4°C	Above -5°C	Above -14°C	Above -29°C	Above -44°C

△Caution: It is extremely important to keep diesel fuel clean as well as free from impurities and water, for the fuel system has precise parts with tight tolerances. Water and impurities in fuel system will cause severe damage to the high pressure fuel pump and the injection nozzles. Diesel fuel should have sufficient sedimentation or be filtered with silk cloth before being used.

4.6 Lubricating Oil

The function of lubricating oil for diesel engine includes lubrication, cooling, heat transfer, flushing, anti-rust and anti-corrosion.

1) Specifications

To have good lubrication at high temperature while improving cold start and reducing oil consumption, lube oil of CF-4 grade with multi-grade viscosity is recommended for the AS8900 series engine. Relationship between oil viscosity grades and applicable ambient temperatures is as follows:

Viscosity grade	Applicable Ambient temperature		Viscosity grade	Applicable Ambient temperature	
	Minimum	Maximum		Minimum	Maximum
0W-20	-50°C	30°C	10W-40*	-30°C	40°C
0W-30	-50°C	30°C	10W-50	-30°C	50°C
0W-40	-50°C	40°C	10W-60	-30°C	60°C
0W-50	-50°C	50°C	15W-40	-20°C	40°C
5W-20	-40°C	30°C	15W-40*	-20°C	50°C
5W-30	-40°C	30°C	20W-50*	-10°C	50°C
5W-40	-40°C	40°C	20W-60	-10°C	60°C
5W-40*	-40°C	50°C	25W-60	-5°C	60°C
10W-30*	-30°C	30°C			

*The dedicated lube oil provided by AGG Power for the AS8900 series engine.

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

△Caution: Choose lube oil with proper viscosity according to ambient temperature.

Lube oil of CF-4 15W-40 is recommended for most areas and lube oil of CF-4 10W-40 for the areas where ambient temperatures are below -15°C.

Having very good cold starting quality, lube oil of CF-4 5W-50 is recommended for the engines being operated in freezing cold areas with ambient temperatures below -23°C all the time and not being provided with warm protection after each operation.

△Caution: Although it is easy for starting engine, low viscosity oil facilities wear. Continuous use of it will shorten engine service life; which shall be avoided or limited.

△Caution: Use of lube oil with bad quality will cause much high oil consumption, early wear, or even piston scuffing.

△Caution: To ensure good lube oil performance during engine operation, the dedicated lube oil provided by AGG Power for the AS8900 series engine is recommended.

2) Lube oil degradation and change interval

After being used for certain time, lube oil goes to degradation due to its oxygenation at high temperature and its contamination by dust, clay, metal particle, by-product of combustion and fuel. This affects its lubricating and cooling function. So lube oil change should be done periodically. Refer to the maintenance sheet and replace the oil and oil filter timely.

△Caution: Do not postpone lube oil change interval. Prolonged change interval will shorten the engine lifetime due to corrosion, carbon deposit and wear.

4.7 Coolant

Proper coolant is required in order to ensure normal operations of the cooling system and the engine itself when it is running.

Anti-freezing liquid

Featuring anti-freezing and raising coolant boiling point, anti-freezing liquid is mandated for the engine as coolant for any climate.

Adjusting the ratio of water and ethylene glycol can give antifreezes of different ice points, i.e. freezing points. In general, the ice point of selected antifreeze shall be about 10°C lower than the lowest temperature of the area where the engine is used. Mixture of water and glycol by 50% to 50% is recommended for most climates. Relation of volume ratio and freezing point of ethylene glycol and water as follows:

Ratio of ethyleneglycol and water	10:90	20:80	30:70	40:60	50:50	55:45	60:40	65:35
Freezing point, °C	-3.8	-7.5	-14.1	-22	-32	-42	-55	-64

Since ordinary antifreeze liquid doesn't have anti-corrosion and anti-rust function, it is recommended to use AGG- designated special organic coolant (anti-freezing type) for any climate. The coolant is proved to be of antifreeze, anticorrosion, good thermal conductivity, performance stability, and environmental friendliness.

Name	Part No.	Freezing point/°C	Boiling point/°C
AGG-designated special organic coolant	F/LQY-45	-45	108

△Caution: Anti-freezing liquid must be replaced every 6,000 hours or 2 years, whichever comes first.

Drain up anti-freezing liquid to remove harmful chemical deposit and fill new one.

DCA4 Additive

Being helpful to preventing cooling system from cavity, corrosion, chemical deposit, and retraining as well as removing babble, DCA4 additive is required if ordinary antifreeze liquid is adopted for the engine. Ordinary antifreeze liquid has no corrosion preventive function. DCA4 additive is optional for this series engine. DCA4 chemical additive and concentration test package are available from the after-service net of AGG Power.

△Caution: Do not touch testing paper with hand. Keep eyes, skin and clothes free from DCA4 additive. Checking the content of DCA4 additive should be carried out at a bright place and keep testing paper and container free from dirt.

The content of DCA4 additive in coolant is specified as follows: 0.264 units DCA4 per liter of coolant; no more than 0.528 units per liter and no less than 0.132 units per liter. One unit DCA4 additive weights 22.68 g. For example, a coolant filter with 12 units of solid DCA4 additive is required for a cooling system of 30-liter coolant. Such cooling system has 0.4 units DCA4 additive per one liter coolant.

To maintain proper DCA4 additive concentration, a coolant filter with proper solid DCA4 additive is required.

△Caution: When using coolant filter and powdered DCA4 additive, total amount of DCA4 additive in coolant should not exceed the specified value: 0.528 unit/L.

Water filter

Coolant filter has two functions: one for holding a certain amount of DCA4 additive to maintain coolant with specified DCA4 content, the other for filtering impurity in coolant. Therefore, it is required to change coolant filter periodically.

△Caution: Replacement of coolant filter is required every 250 hours or 3 months, whichever comes first.

DCA4 Additive concentration check


DCA4 water filter should be replaced at specified time to ensure the proper concentration of DCA4 in coolant, or check DCA4 additive content regularly.

DCA4 Additive Concentration Checking Method

Use DCA4 checking kit to check the DCA4 additive content of coolant. The method is as follows:

- (1) Take the plastic cup from the kit and fill it with coolant from the engine and check it. It is more accurate to measure when the coolant is a little warm. Checking DCA4 additive content of new coolant should be done only after the coolant is used for more than two hours in engine operation.
- (2) Take a test paper from a sealed bag in the kit and dip the top of test into the coolant in the cup for 5 seconds, take and compare it with standard color card, and then determine the content of DCA4 additive in measured coolant through comparison.
- (3) Clean up the cup and seal the test paper bag and put it in a dark dry place for future use. Usually, have the measurement very half month.

Standard color card steps for maintaining proper DCA4 additive content

Correct content is 6 g DCA4 per 1 liter coolant (6 g/L) and acceptable range is from 3 g/L to 12 g/L. Too and too less content is very harmful to components.		
	Content of DCA4 per coolant	Necessary measures
	<3 g	<ul style="list-style-type: none"> ● Replacement of coolant filter ● Supplement of DCA4 by 3 g per liter of coolant
	3 g	
	6 g	<ul style="list-style-type: none"> ● Replacement of coolant filter
	12 g	<ul style="list-style-type: none"> ● No need for measures
	18 g	<ul style="list-style-type: none"> ● Drainage 50% of coolant into a plastic container for next coolant supplement

5 Maintenance of Engine

5.1 Maintenance Plan

Regular maintenance is required following the requirement below. Maintenance interval should be shorten if the engine frequently works under a temperature lower than -18°C or higher than 38°C, or it works under a dusty environment or under a condition of frequent shutdown.

Maintenance Plan for the AS8900 Series					
Engine	Daily maintenance or 3 months	Every 250 hours, or 3 months	Every 500 hours, or 6 months	Every 1,000 hours, 12 months	Every 2,000 hours, or 2 years
Inspection	-----Replacement-----				
●Oil level	●Oil	●Oil	●Oil	●Oil	●Oil
●Coolant level	●Oil filter	●Oil filter	●Oil filter	●Oil filter	●Oil filter
●Drive belt	●Coolant filter (if used)	●Coolant filter (if used)	●Coolant filter (if used)	●Coolant filter (if used)	●Coolant filter (if used)
●Fan	●Fuel filter (including fuel filter and fuel-water separator)	●Fuel filter (including fuel filter and fuel-water separator)	●Fuel filter (include fuel filter and oil and water separator)	●Fuel filter (include fuel filter and oil-water separator)	●Fuel filter (include fuel filter and oil-water separator)
●Leakage					●Coolant
●Fixing of auxiliaries	-----Adjustment-----				
			●Valve clearance	●Valve clearance	
	-----Check-----				
	●Air filter	●Air filter	●Air filter	●Air filter	●Air filter
	●Air intake system	●Air intake system	●Air intake sys.	●Air intake sys.	●Air intake sys.
	●Intercooler system	●Intercooler system	●Intercooler system	●Intercooler system	●Intercooler system
	●Priming fuel system	●Coolant (DCA4 concentration (if used), anti-freeze fluid concentration)	●Coolant (DCA4 concentration (if used), anti-freeze fluid concentration)	●Coolant (DCA4 concentration (if used), anti-freeze fluid concentration)	●Coolant (DCA4 concentration (if used), anti-freeze fluid concentration)
		●Priming fuel system	●Priming fuel system	●Priming fuel system	●Priming fuel system
			●Fan hub	●Fan hub	●Fan hub
			●Belt tensioner bearing	●Fan bearing	●Fan bearing
			●Belt tension	●Belt tensioner bearing	●Belt tensioner bearing
				●Belt tension	●Belt tension
				●Turbocharger	●Turbocharger
				●Vibration Damper	●Vibration Damper
				●Air compressor	●Air compressor

5.2 Maintenance records

- Make record of regular maintenance
- Refer to the following form to develop your own maintenance record

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5.3 Tools required for maintenance

Basic tools required for maintenance of the engine

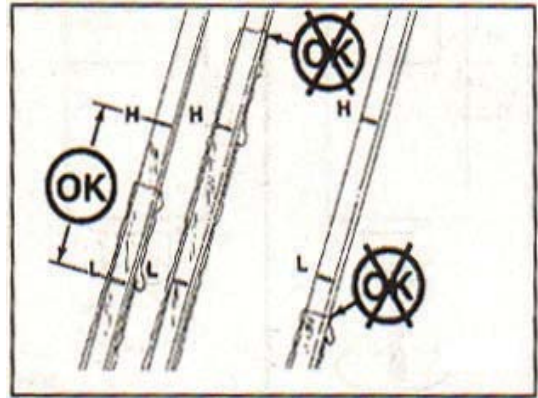
Sleeve	Wrench	Other tools
19 mm	22 mm	Filter wrench(75-80 mm, 90-95 mm, 118-131 mm)
17 mm	19 mm	Torque wrench (80~300N·m)
14 mm	17 mm	Screw driver
	14 mm	Valve lash gage (0.30 mm, 0.50 mm)
	13 mm	DCA4 additive inspection kit
	10 mm	Barring tool

5.4 Daily maintenance

Preventive engine maintenance starts from understanding engine working condition and its systems. Daily check for lube oil and coolant levels, for loosened or damaged parts, worn or damaged belt or any change on the engine is necessary before starting engine.

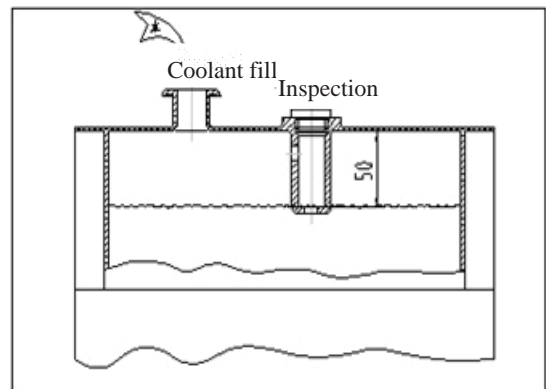
5.4.1 Inspection of lube oil level

Inspection of lube oil level should be made after engine has been stopped for minimum of five minutes to make sure the oil has enough time to flow back to the oil pan. Never run engine when oil level is lower than the mark “L” (low oil level) or higher than “H” (high oil level) on oil dipstick.

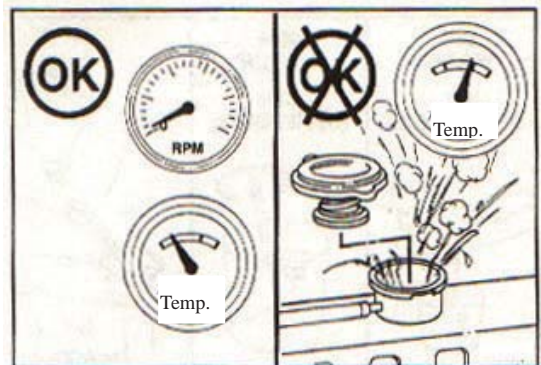


5.4.2 Inspection of coolant level

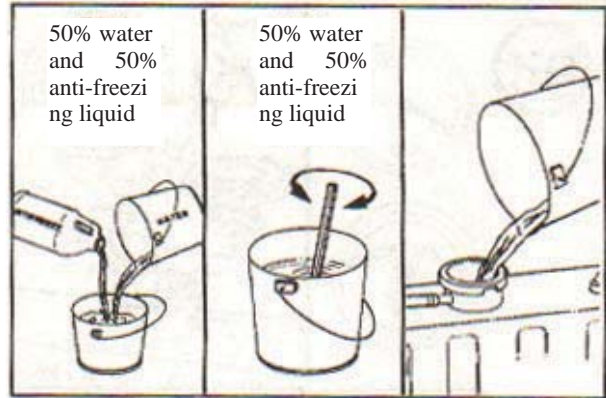
Open coolant-fill cover or inspection port on the radiator or expansion tank to check the coolant level.



Warning: When the temperature of the coolant in the engine drops to below 50°C, open the coolant-fill cover or inspection port on the radiator or expansion tank to check the coolant level. Do not open the cover immediately after the engine has been stopped, or else personal injury can occur due to hot pressured coolant spray or steam. Open slowly to relieve coolant system pressure gradually.

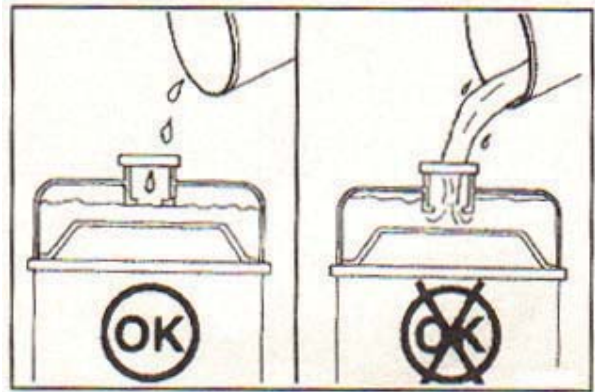


Fill coolant and add additive according to chapt.8. If anti-freezing additive needs adding, it must be mixed with water before being filled in engine. Heat-transfer of anti-freezing additive is different from that of water. Direct filling of the additive instead of pre-mixing will cause over-heat.



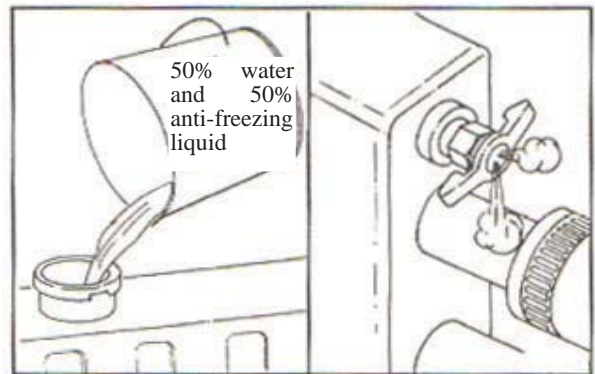
⚠ Warning: When using ordinary anti-freeze liquid without anti-corrosion and anti-rust function for the engine, if no DCA4 additive is in coolant, there occurs cavity erosion to the cylinder liners, which will significantly shorten the lifetime of the liners. In addition, air will be blocked if the engine bleed hole and coolant drain hole rust and become blocked, causing engine overheated.

Fill up the cooling system with coolant to the bottom of the fill port or inspection port in the radiator or expansion tank.



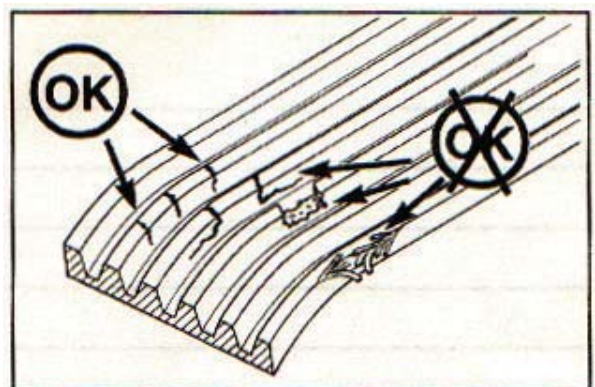
Before filling coolant, open the bleed valve of the intercooler (if any) to discharge the air in the coolant passage.

Fill coolant slowly to prevent air block, and wait for at least 2 or 3 minutes to have a full air discharge.



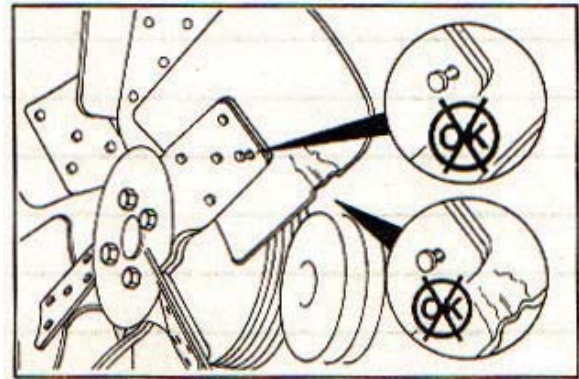
5.4.3 Drive Belt Check

Visually inspect the belt. Check the belt for cross cracks. Transverse cracks that are along but not through belt width are acceptable, while longitudinal cracks and cracks that are through the belt width are not acceptable. Replace the belt if it is worn or its material flake.



5.4.4 Fan Check

Visually inspect the fan on daily basis. Check for any possible problems such as cracks, loosened rivets, loosened or bent blades. Make sure the fan is secured. Fasten the bolts or replace the damaged fan when necessary.



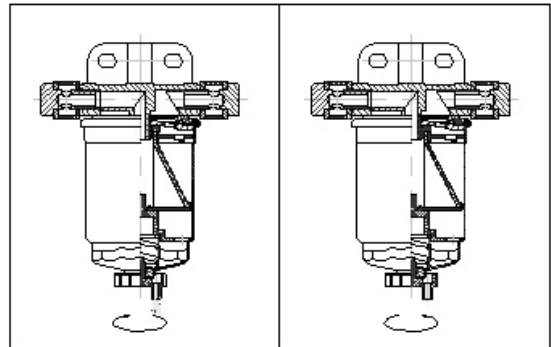
⚠ Warning: The damage of the fan blades can cause severe accidents, such as personal injury. Never tug or pry the fan, nor use the fan to crank the engine.

5.4.5 Remove of water and sediment in fuel-water separator

Drain the water and sediment in the fuel-water separator (if used) every day.

Open the bottom valve on the fuel-water separator to drain the water and sediment until clear fuel is visible. Then close the drain valve.

⚠ Caution: If too much sediment is drained, it is required to replace the fuel-water separator in order to ensure smooth starting of the engine.



5.5 Maintenance every 250 hours or 3 months

The following maintenance is to be done after daily maintenance:

- Replacement of the lube oil and fuel filter
- Replacement of the coolant filter (if used)
- Inspection of the air filter
- Inspection of the air intake system
- Inspection of the intercooler

5.5.1 Replacement of lube oil and filter

The lube oil will become dirty and additive in it will be consumed after a period use. Therefore, it is required to replace lube oil and oil filter regularly to remove the contaminants suspending in oil.

Replacement of lube oil and oil filter

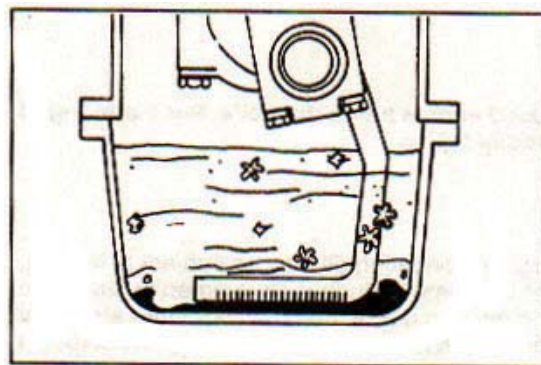
The replacement interval of lube oil and oil filter given in the Maintenance Plan is for engine models of general application. Replacement interval varies from one application to another. The following table gives the recommended maintenance intervals for major applications. For maintenance intervals of the applications that are not included here, refer to those of similar applications.

Application	Replacement interval of lube oil and oil filter	
	Hour	Month
Pavers Cranes Scrapers Bulldozers Backhoes	250	3
Agriculture tractors Combines croppers Irrigation devices Generating sets Air compressors Fire pumps Pleasure boats	250	6
Work boats	250	3

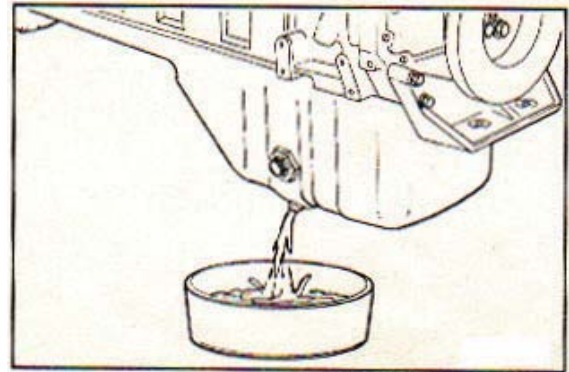
△Caution: Even if the engine is under use, the replacement period of lube oil should by no means be prolonged beyond the above recommended intervals.

Lube oil change

Drain lube oil only when it is hot and the contaminants are floating.

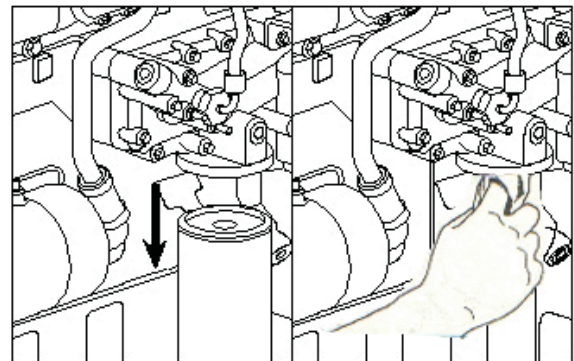


Stop the engine when coolant temperature reaches 60°C, and then remove the oil drain plug.



Replacement of oil filter

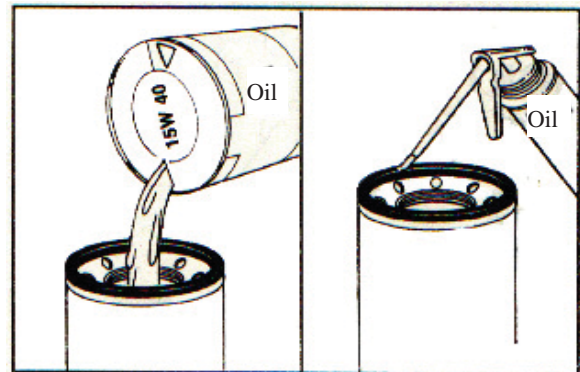
Clean the area around the oil filter head. Remove the filter. Clean the sealing surface of the filter head.



Fill up the filter with clean lube oil before installation. Apply a light film of Vaseline or clean lube oil to the O-ring surface before installing the filter.

Install the filter and turn it by hand until the O-ring contacts the seal surface of the filter head, and further tighten it by 3/4 to one turn with tool.

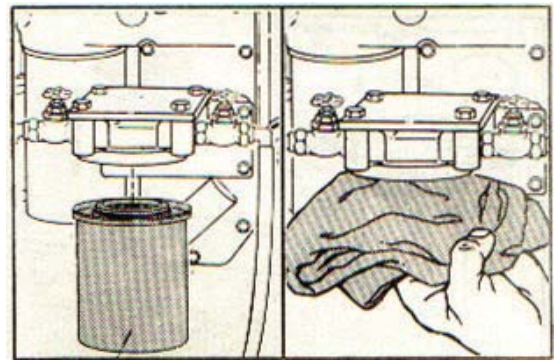
Fill the engine with clean lube oil to proper level.



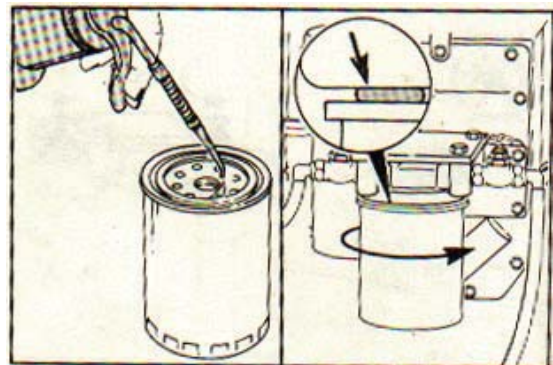
5.5.2 Replacement of coolant filter

⚠ Warning: when the engine is hot, especially after full-load running, the coolant-fill cover cannot be removed immediately because hot vapor will cause severe personal injury. Wait until the coolant temperature drops to below 50°C and then remove the cover. Before replacing the coolant filter, shut the coolant inlet and outlet valves, otherwise hot coolant spray will cause severe body injury.

Remove the coolant filter and clean the seal surface of the filter head.

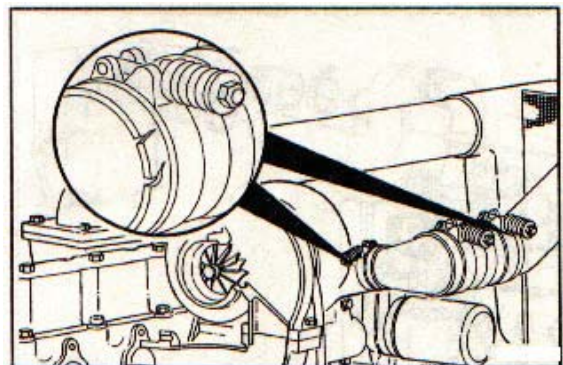


Apply a light film of Vaseline or clean lube oil to the O ring surface before installing the coolant filter. Install the coolant filter according to the instruction provided by the filter manufacturer.



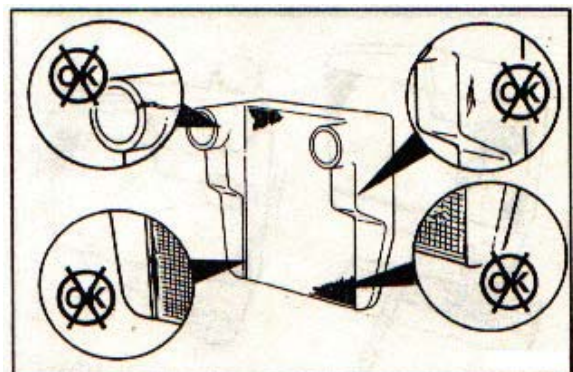
5.5.3 Inspection of air intake system

Inspect the intake piping for cracks or through holes, loose clamps. If any, tighten or replace parts as necessary to make sure the air intake system does not leak.



Inspection and maintenance of intercooler

Visually inspect the air inlet and outlet chambers, tubes and fins of the intercooler for cracks, through holes or damage.



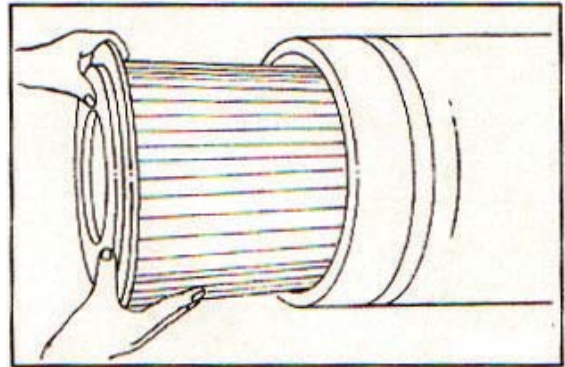
Inspection of air filter

Replace the air filter element when the maximum air intake restriction exceeds following values:

Turbocharged engine or turbocharged with charge air intercooled engine: 6.2 kPa

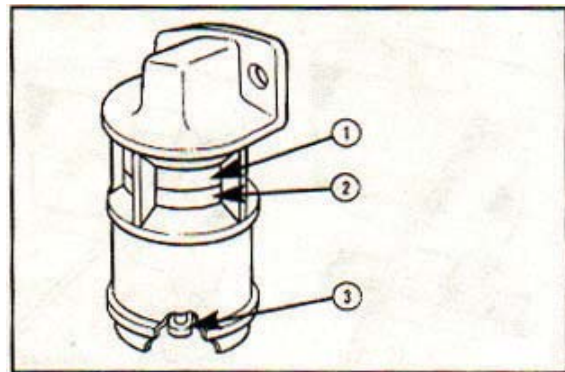
Naturally aspirated engine: 5.0 kPa

△Caution: Check of maximum air intake restriction should be done at the rated condition.



Regularly check the maintenance indicator. If the red mark (2) on the indicator appears, replace the air filter element, then reset the indicator switch by pressing the button at the top.

Warning: It is not allowed to start the engine without an air filter. Air should be filtered before going to the engine to prevent early engine wear.



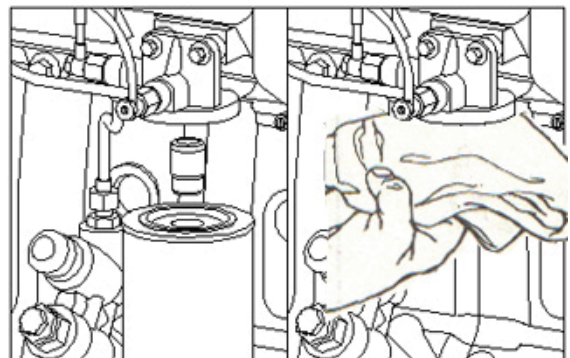
5.6 Maintenance for every 500 hours or 6 months

Following maintenance is to be done after daily maintenance and the previous cycle maintenance.

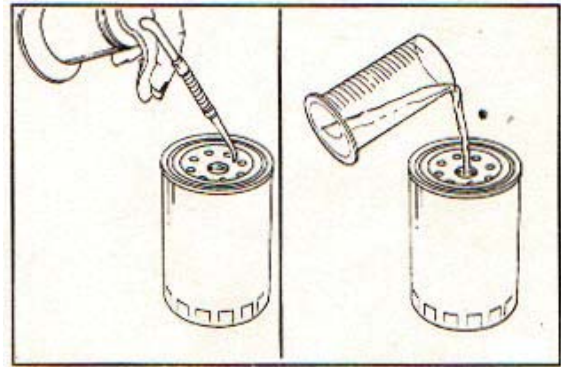
- Replacement of fuel filter
- Bleed of fuel system
- Check of concentration of antifreeze and DCA4 additive

5.6.1 Replacement of fuel filter

Clean the surrounding of the fuel filter head. Remove the filter and clean the seal surface of the filter head.

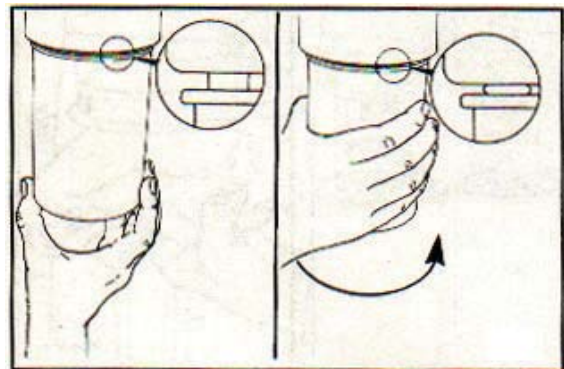


Fill up the new fuel filter with clean lube oil and apply a light film of Vaseline or clean lube oil to the O-ring surface before installing the filter.



Install the filter according to the instruction provided by the filter manufacturer. Or Turn the filter by hand until the O-ring contacts the seal surface of the filter head, and further tighten it by 3/4 to one of a turn with tool.

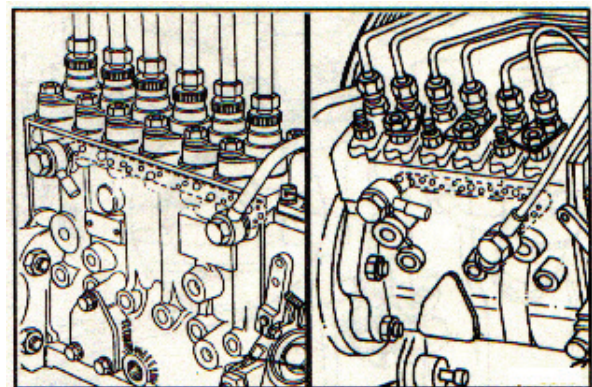
△Caution: In order to avoid fuel leakage, tighten the filter, but over-tightening will damage the filter.



5.6.2 Bleed of Fuel System

If the engine has not been used for a long time or fuel filter is changed, air will enter the fuel system. It is required to prime the fuel system as per following steps:

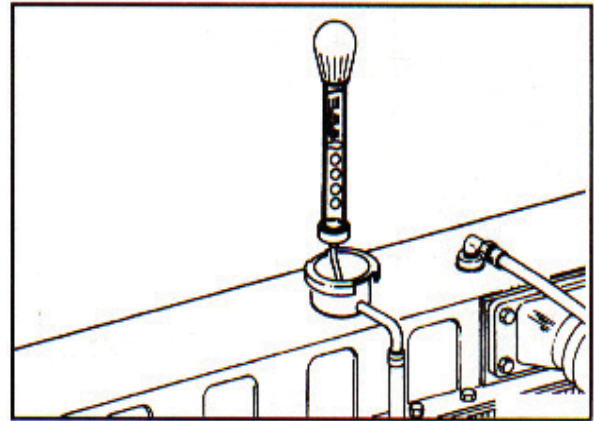
Loosen the bolt of the fuel return pipe of the fuel injection pump. Prime the priming pump until there is no bubble visible in the fuel that outflows from the bolt. Then tighten the bolt.



5.6.3 Check concentrations of anti-freeze fluid and coolant additive

Use ice point apparatus to check anti-freeze fluid concentration. It is necessary to add anti-freeze fluid in coolant under any climatic condition, for it can increase boiling point of the coolant and decrease condensation point meanwhile, so that the operation temperature range of the engine coolant is expanded.

The anti-freeze fluid concentration shall be controlled to make the coolant ice point lower than local min. temperature by about 10°C, refer to Section 4.7 Description for relationship between the volume ratio anti-freeze fluid and



5.7 Maintenance for every 1,000 hours or one year

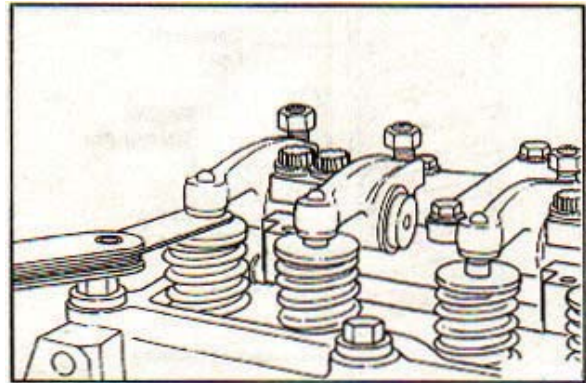
Following maintenance is to be done after daily maintenance and the previous cycle maintenances.

- Valve clearance adjustment
- Belt tension check
- Tensioner bearing check
- Fan check

5.7.1 Valve clearance adjustment Check and adjust valve clearance with feeler gage after the engine stops and cool down to below 60°C.

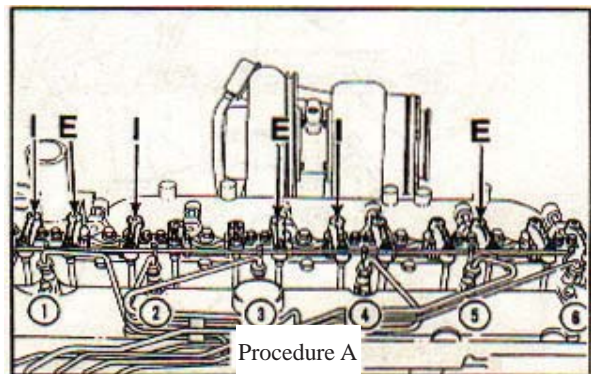
Intake: 0.30 mm;

Exhaust: 0.50 mm.

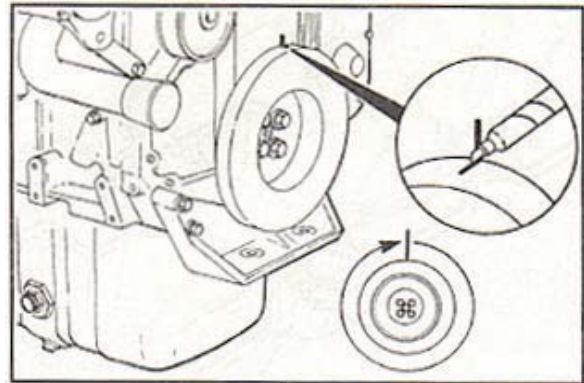


Check and adjust the intake and exhaust valve clearances according to Procedure A when Cylinder 1 is at TDC. “I” stands for intake valves and “E” for exhaust valves.

Recheck the valve clearances after tightening the adjusting nuts. The clearance values shall not change.



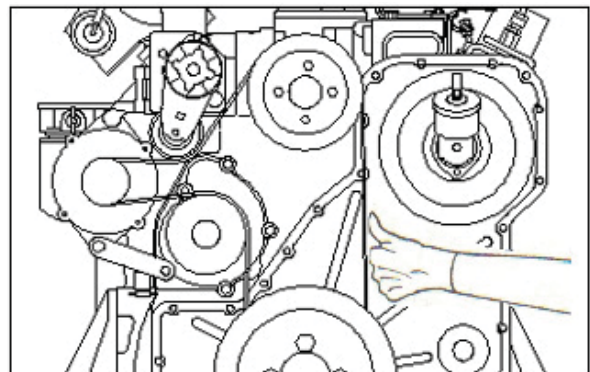
Mark the damper and rotate the crankshaft by 360°.



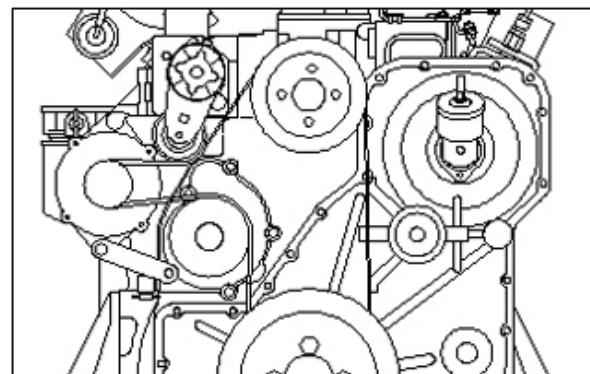
Check and adjust the rest intake and exhaust valve clearances. Recheck the valve clearances after tightening the adjusting nuts. The clearance values shall change.

5.7.2 Belt tension check

Check belt deflection at the maximum span.
The deflection should be no more than 13 mm.

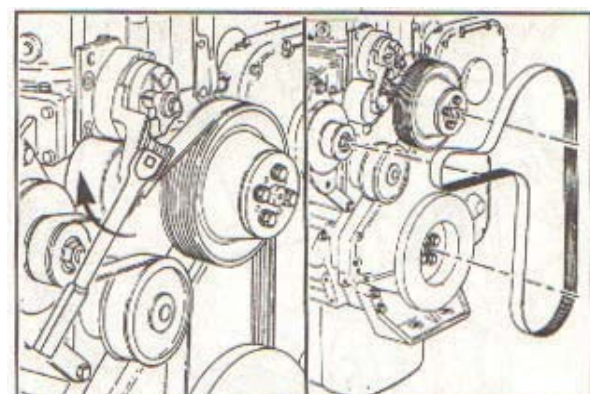


Check tensional force at the maximum span with a tension measurement tool (if available). The force should be 360 - 490 N.

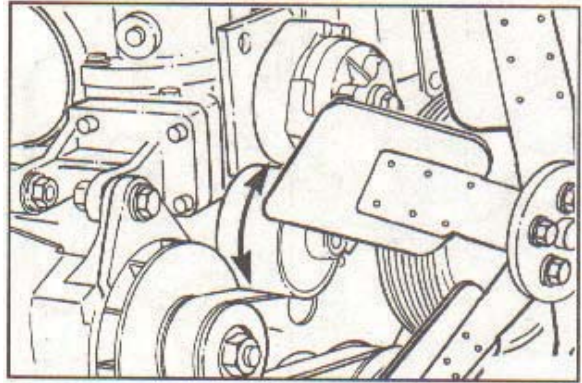


5.7.3 Inspection of belt, tensioner bearing and fan bearing

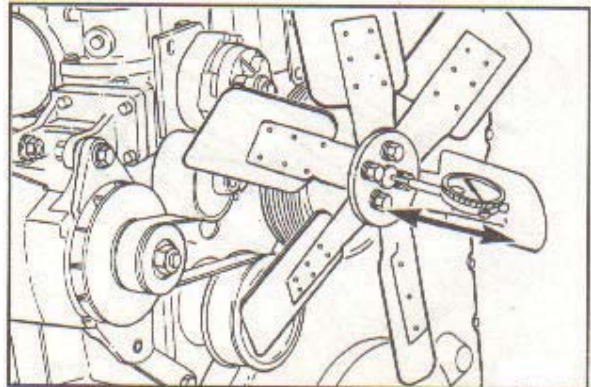
Remove and check the belt for damage



Rotate tensioner and check its bearing for abnormality. The tensioner should rotate freely and should not have excessive movement in axial or/and radial directions.



Rotate the fan and check its bearing for abnormality. The fan should not have vibration or excessive movement in axial direction when rotating.



5.8 Maintenance every 2,000 hours or two years

Following maintenance is to be done after daily maintenance and the previous cycle maintenances.

- Cleaning cooling system and changing coolant
- Checking vibration damper
- Checking air compressor

5.8.1 Coolant System cleaning

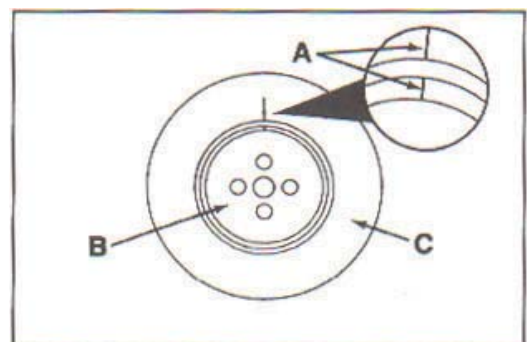
In order to ensure a good cooling efficiency and anti-rust effect, it is required to clean the cooling system regularly. Replace and clean the cooling system once every two years even if using coolant filter and taking regular maintenance, otherwise the intervals of replacement and cleaning should be shortened.

The main element of cleaning liquid is sodium. Fill up the cooling system with cleaning liquid.

△Caution: Use 0.5 kilogram of sodium carbonate for every 23 liters of water.

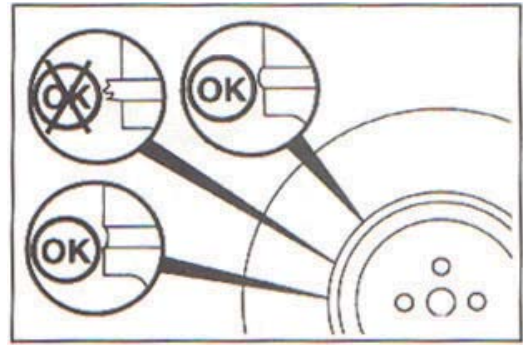
5.8.2 Vibration damper inspection

Check the marks A on inner ring (B) and external ring (C) for misalignment. If the misalignment is more than 1.6 mm, replace the damper.



Inspect the rubber element for deterioration. When rubber scraps appear or the rubber ring is below the metal surface by more than 3.2 mm , replace the damper.

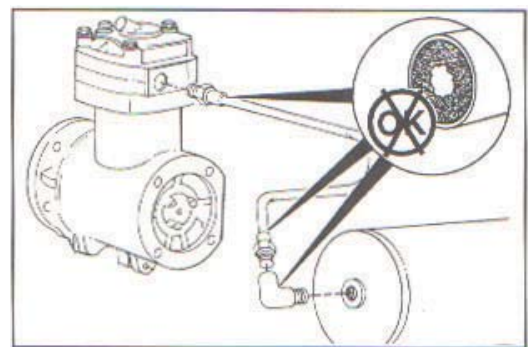
△Caution: Check forward travel of the inner ring against the external ring. Replace the damper if any.



5.8.3 Inspection of air compressor

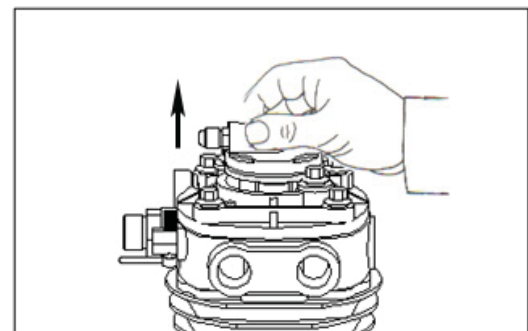
Outlet tube

Check the tube and connector for carbon deposit, and clean or replace relevant parts when necessary.



Intake valve

Carefully check pressure relief valve for carbon deposit, and remove the carbon deposit and clean the valve if necessary. Check air compressor head and intake as well as exhaust valves, and replace relevant parts when necessary.



6 New engine Running-in

Before running a new or overhauled engine in full load condition, run it for 60 hours in running-in condition and change its oil thereafter 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 is usually not longer than 5 minutes to avoid early engine wear due to carbon deposit or engine performance being affected.

7 Engine Storage

7.1 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.

7.1.1 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.

7.1.2 During the storage

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

7.1.3 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 the battery and install the belt. Check lubricating oil and coolant levels, and add proper amount of clean specified 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 4.1 to start the engine.

7.2 Long time storage

7.2.1 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 7.1.1 for cleaning, preventing rust and other requirements. And put a tag which reads “The engine does not contain oil and do not use it.”

7.2.2 During the storage

Refer to 7.1.2.

7.2.3 After storage

When putting the engine into use, remove the engine cover and all port seals, remove the fuel pump and send it to the authorized service provider for adjustment. Then install the fuel pump and prime the fuel system. Connect the battery, install the belt, fill the engine and oil filter with clean specified lubricating oil and add proper amount of the oil into turbocharger from its oil inlet. Check oil and coolant levels, and crank the engine three to five circles with barring tool. Then follow the starting procedures in Section 4.1 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.

8 Information necessary for product quality feedback

In order for us to understand and analyze quality problems and to improve our products, we would request you to provide following information when making feedback:

- 1) Location and date of malfunctions happened;
- 2) Engine serial number, model, order number, date of delivery from AGG Power, detailed receiver address;
- 3) Engine operation condition, accumulated operation time (house), operation status such as power, speed, grades of used fuel and oil;
- 4) Information of driven equipment such as model, required power input, structure feature, etc.;
- 5) The damaged parts that are requested for indemnity or repair are required to be brought or sent to AGG Power or to the dealers or distributors close to your location together with a record or explanation of damage process for analysis. When there happens many or serious problems, please keep the situ from damage and inform AGG Power or your local dealers or distributors authorized by AGG Power to analyze the problem(s) together.

Quality issue(s) will be addressed according to the stipulations in the Product Quality Warranty Manual



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