1.3 Engine Technical Performance Data

Usage type	Forklifts
Model	A490BPG
Type	in-line, water cooled, 4-stroke, direct injection ω_shaped combustion chamber (Ring -like platformcombustion for chamber for A490BPG)
No. of cylinders-bore-stroke (mm)	4-90-100
Total displacement (L)	2.54
Firing order	1-3-4-2
Compression ratio	18.5:1
Rated speed (r/min)	2650
Rated power (kW)	36.8
Max. torque (N•m)	≥148
Max. torque speed (r/min)	1800-1900
Maximum mean effective pressure (k Pa)	≥659.6
Min. fuel consumption at full load (g/kW•h)	≤230
Oil consumption (g/kW•h)	≤1.63
Min. steady idle speed (r/min)	≤750±30
Direction of crank rotation viewed from flywheel end	counterclockwise
Noise dB(A)	≤112
Cooling system	closed cycle, forced water cooling
Lubrication system	pressured and splashed
Starting device	electric motor
Net weight (kg)	≤260
Overall dimension Length X width X height (mm)	751 X 565 X 690

■ Note: The rated power is the power at standard condition that means the atmospheric pressure is $1X10^5$ Pa (750mmHg), ambient temperature is 25°C, relative humidity is 30% without air filter, muffler or cooling fan.

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2.1 Preparation for the First Operation of the Diesel Engine

1). Fill the oil

Generally, there's no oil filled in the engine when it is off the line. Customer should fill the oil by himself before operating the engine. When filling oil, please open the cover of the oil filling port on the cowl of the cylinder head first, take out the oil gauge, then fill the oil and check the oil level with the gauge. Check the oil level again after 3 minutes. Oil capacity: make sure the lubricating oil level in the oil sump should be between the upper mark and lower mark on the oil gauge when the lubricating system is filled with oil.

■ **Note:**

Only clean oil can be filed into engine, make sure no any deposit in the filled oil. Fuel injection pump assembly also needs to be filled with oil. The lubricating oil in the pump case should be between the upper mark and lower mark on the injection pump oil gauge.

2). Fill diesel fuel

Users can choose the corresponding diesel fuel for summer or winter according to the temperatures in their local places. The position of the fuel pipe joint position is on the lower part of the injection pump. Before filling into the engine, the diesel fuel should be keep still for more than 72 hours to clear out the water and impurities.

3). Fill coolant

- Open the cap and the drain cock.
- Fill the coolant to the mark of filler
- Close the drain cock when the coolant flows out.
- Screw on the cap

4). Other preparing work before starting the engine

Check whether all engine mounting fasteners are in good condition and whether the control handles such as throttle, shut down handle and etc. can operate smoothly.

- Revolve the crankshaft several turns to be certain all moving parts can move smoothly.
- Check oil sump and injection pump for the oil level.
- Check whether the radiator is full of cooling water and there is no leakage at the joints.
- Check whether the fuel is sufficient, fuel supply is unblocked and there is no leakage at the joints of fuel pipes. Check if the fuel cock at the fuel tank has been turned open.
- Check whether the battery has been fully charged and all joints between electric equipment is in good condition.
- Check all fixing fasteners for various components (injection pump, fuel supply pump, fuel filter, water pump, fan, generator and its bracket, v-belt of fan, electric starter, oil filter, water radiator, etc.)
- Check all joints between air filter, intake rubber pipe and intake pipe for secure air tightness.
- Check if power take off clutch is released.

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3.1 Maintenance Tools

Hexagon Wrench Spanner Handle

Valve Clearance Gauge

Assembling and Dismantling Tool for Spin-On Filter

3.2 Maintenance Periods

These maintenance periods are suitable for general situations, if maintenance is required for the vehicles (cars, forklifts, tractors and so on) the shorter maintenance period is applied. When the engine operation should meet local regulations, the maintenance periods and procedures should be modified to ensure proper operation.

■ Note: Some maintenance periods should be shortened if the engine is worked in dusty environments or in other rigorous conditions. Engine maintenances are classified as follows:

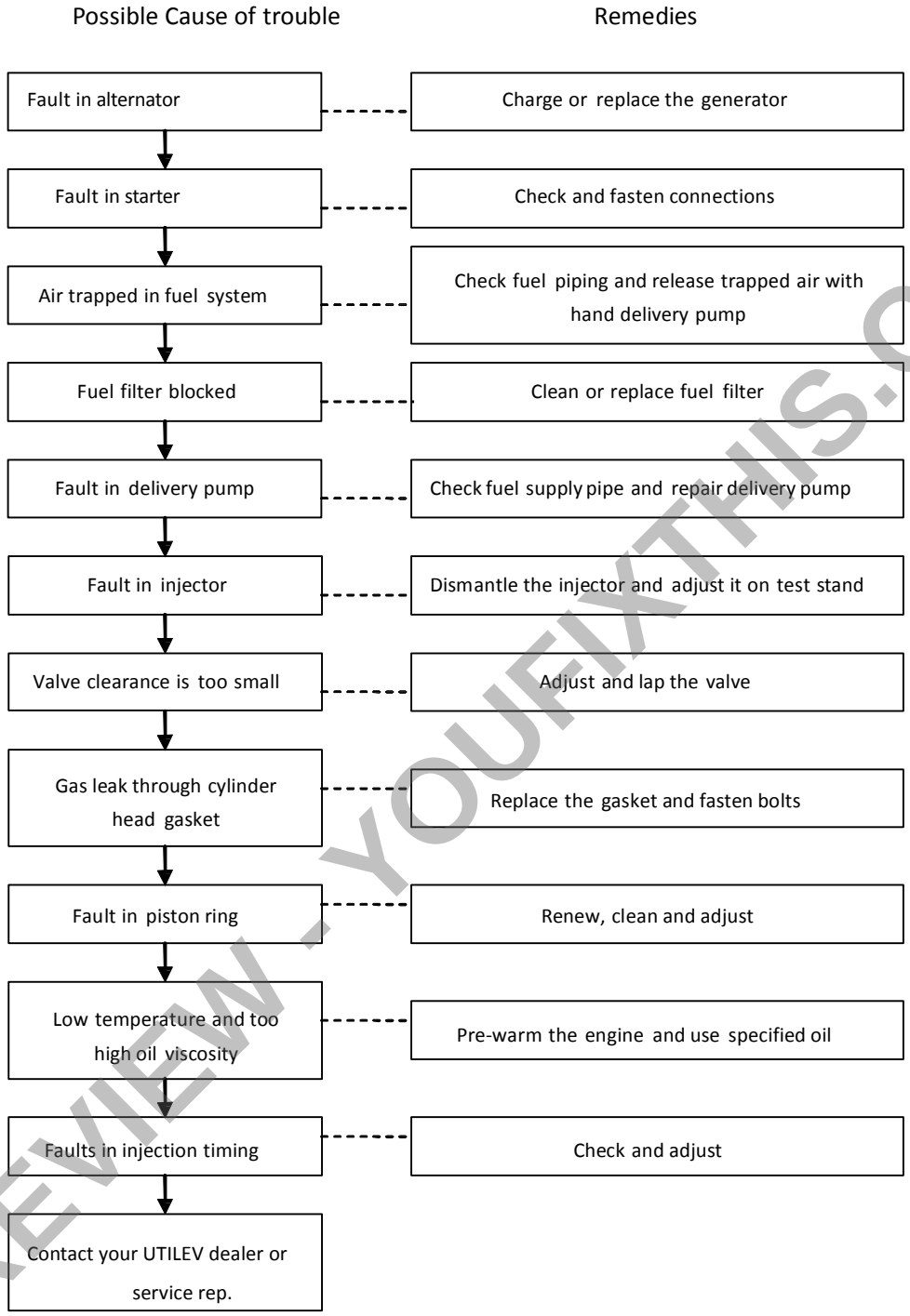
1) Daily Maintenance
2) Grade 1 Maintenance (After 50 Hours or 2500 km)
3) Grade 2 Maintenance (After 250 Hours or 12500 km)
5) Grade 3 Maintenance (After 500 Hours or 25000 km)
4) Grade 4 Maintenance (After 1000 Hours or 50000 km)

Interval	Maintenance Items
Daily Maintenance	1). Check the oil sump, air filter and the oil level in the injection pump. If the oil level rises, find out the cause and deal with it; if the oil is not sufficient enough, fill the oil to the specified value. 2). Check the cooling water level in the water tank and fill it if the cooling water is not sufficient enough. When the temperature goes below 5°C, all cooling water shall be drained out after the enginebeing shutting down (if there is no any antifreeze). 3). Check and fix bolts and nuts to eliminate any leakages phenomena. 4). Use the compressed air to eliminate the dust on the cartridge of air filter when working on the occasions with much dust. 5). Clean the mud, deposited dust and smear outside of the engine. 6). Pay attention to the sound when the engine is running. Watch the exhaust smoke and deal with the caused troubles and abnormal situations.
Grade 1 Maintenance (After 50 Hours or 2500 km)	1). Same as the Daily Maintenance. 2). Clean deposited dust on the cartridge of air filter and dust bin. Renew the oil in the air filter. 3). Check and adjust the tightness of fan belt. 4). Fill the grease lubricant to the water pump bearing (except the shaft-connecting water pump). 5). Check every part of engine and make adjustments if necessary. 6). Start the engine to check its operation condition after finishing the maintenance and deal with the caused troubles and abnormal situations.

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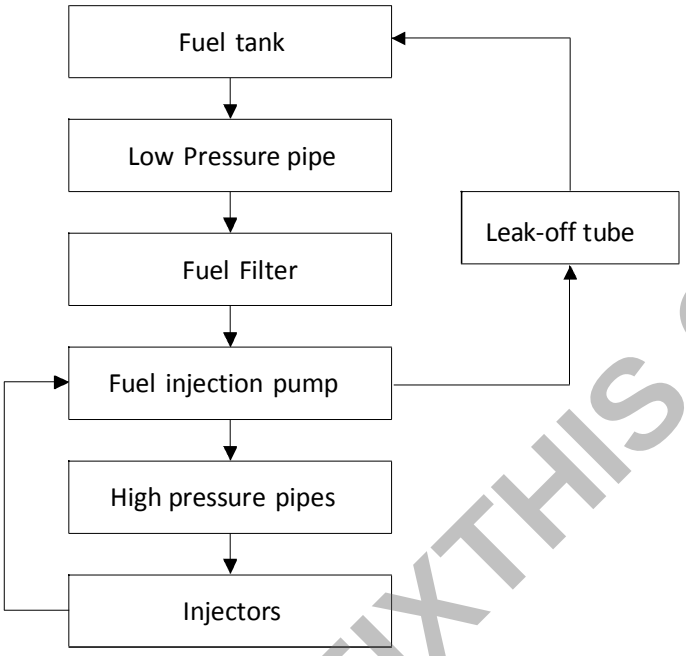
6.1 Engine fails to start



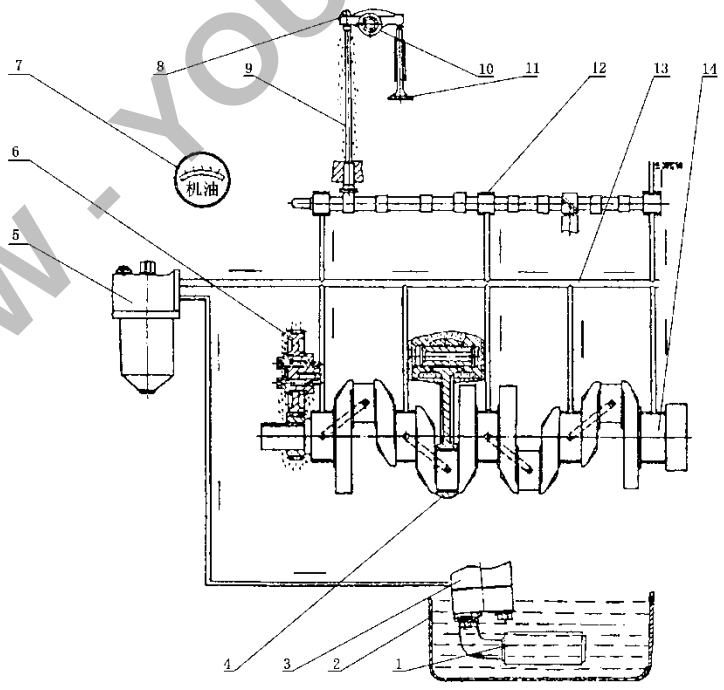
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5.1 Fuel System



5.2 Lubricating System

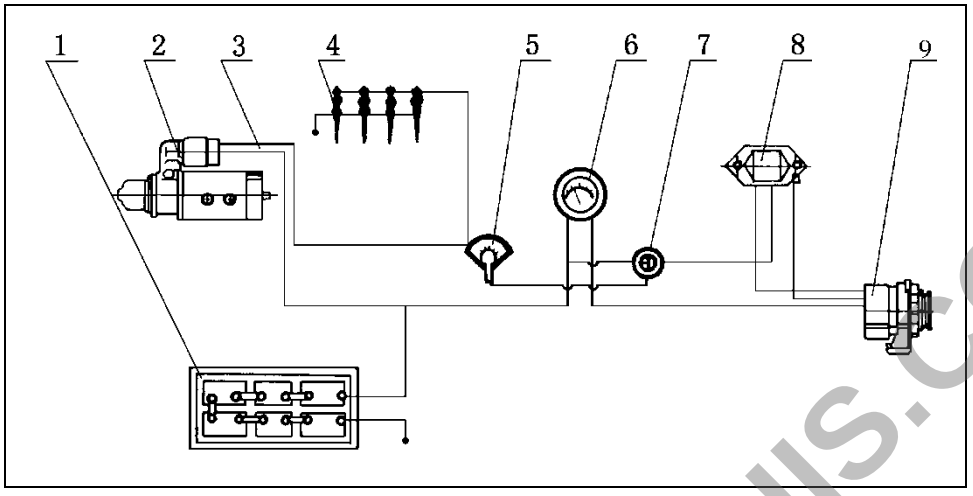


1-Strainer 2-Oil Sump 3-Oil Pump 4-Connecting Rod Bearings 5-Oil Filter
6-Gear Train 7-Oil Pressure Gauge 8-Valve Rocker Arms 9- Push Rods and Tappets
10- Valve Rocker Arm Shaft 11-Valves 12-Camshaft 13-Oil Galleries 14-Crankshaft

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5.5 Electric System



1 -Battery 2 -Starter 3 -Wire 4 -Preheating Plugs 5 -Starting and Preheating Switch 6-Amperemeter 7-Main Switch 8-Regulator 9- Alternator

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1.4 Main Characteristic Data

1. Timing (in terms of crankshaft angle)

Intake valve open: 11°before top dead center.

Intake valve close: 41°after bottom dead center

Exhaust valve open: 49°before bottom dead center.

Exhaust valve close: 11°after top dead center.

Cold valve clearance: intake valve 0.35mm

exhaust valve 0.45mm

2. Injection advance angle: 17±1°CA(A490BPG)

3. Temperature and pressure requirements:

   1). Exhaust temperature:≤550℃ (490B ≤620℃).

   2). Oil temperature: ≤368k (95℃).

   3). Cooling water temperature: 357-368k (85-95℃).

   4). Oil pressure at the main oil gallery: 0.2-0.44Mpa.

4. Tightening torques for the main bolts in (N•m)

Cylinder head bolt: 117.6-137.2.

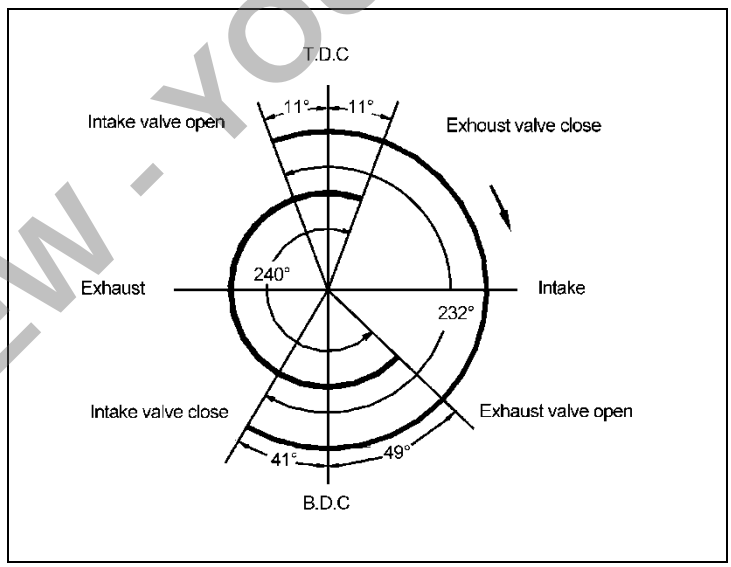
Main bearing bolt: 137.2-156.8 .

Connecting rod bolt: 98.1-117.6.

Flywheel bolt: 98.1-117.6.

Starting claw: 100-120.

5. Oil capacity in the oil sump ≈ 6L.



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2.4 Shutting Down of the Diesel Engine

1). Before shutting down the engine, gradually reduce its load and speed. Run the engine at idle speed until the water temperature cools down to 70° C. Then operate the shut- down lever to shut down the engine.

2). When ambient temperature goes below 5° C in the winter and the water temperature goes below 60°C after shutting down the engine, open the drain cocks on the cylinder block and the radiator to drain the cooling water to avoid freezing and damaging the engine (if anti-freezing fluid has been added, it will not be necessary to do so).

2.5 Precaution during Engine Operation

1). Operation and maintenance of the engine should be done according to the manual.

2). A new engine or an overhauled engine should not work at full load and high speed. It should take a running- in period of 50 hours with light load (≤50% of load) and low Speed (≤2000rpm) before going to its normal operation.

3). Fuel should keep clean. It is recommended to keep the fuel still for one week or more to let the impurities settle down or filter the fuel with silk cloth.

4). Keep a normal water temperature (70°C-95°C). The oil pressure should be 0.2-0.4MPa at medium speed.

5). The engine should be shut down and checked when any abnormal phenomenon happens during the operation.

2.6 Working Media

1). Oil

Use CD grade oil.

Use different oil for different ambient temperature

SAE Grade	Temperature Range	SAE Grade	Temperature Range
20	-10---30°C	5W/30	-40---35°C
30	-10---35°C	10W/30	-30---35°C
40	-5---40°C	15W/40	-20---40°C
5W	-40---10°C	20W/40	-15---40°C
10W	-30---15°C	20/20W	-10---35°C
5W/20	-40---10°C		

2). Diesel Fuel

Customers can choose the light diesel fuel according to the actual ambient temperatures at their local places.

3). Coolant

Special coolant is needed for some vehicles. In that case, use coolant according to the requirement of the vehicles. For general purposes, use cooling water which meets certain requirements.

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