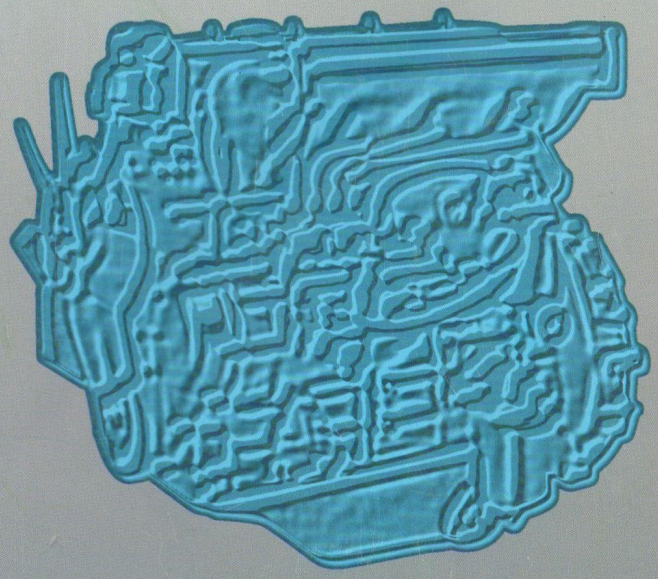
498B

Operation and Maintenance Manual for 498B Series Diesel Engine



ZHEJIANG XINCHAI CO., LTD

1.3 Engine Technical Performance Data

Usage type	Forklifts	Tractors、combine harvesters		
Model	A498BPG	A498BT5	498BT	
Type	in-line, water cooled, 4 -stroke ,direct injection ,ring-like platform combustion chamber			
No. of cylinders - bore - stroke (mm)	4-98-105			
Total displacement (L)	3.168			
Firing order	1-3-4-2			
Compression ratio	18.5:1			
Liner type	dry			
Rated speed (r/min)	2500	2400	2200	2400
Rated power (kW)	45	38	36.8	45
Max. torque (N·m)	≥193	≥189	≥193	≥193
Max. torque speed (r/min)	1675~1875	1600~1800	1450~1650	1600~1800
Maximum mean effective pressure (kPa)	766	756	766	
Min. fuel consumption at full load (g/kW·h)	≤225		≤235	
Oil consumption (g/kW·h)	≤1.0			
Min. steady idle speed (r/min)	750±30			
Direction of crank rotation viewed from flywheel end)	counterclockwise			
Exhaust temperature(°C)	≤550			
Noise dB(A)	≤112	≤111		
Cooling system	closed cycle, forced water cooling			
Lubrication system	pressured and splashed			
Starting device	electric motor			
Net weight (kg)	≤260	Fit for tractors≤330 Fit for combine harvesters≤255		
Overall dimension Length ×width× height (mm)	751×565×700.5	726×550×700.5		

Usage type	Tractors、combine harvesters				
Model	A498BT1		A498BT2	A498BT3	A498BT4
Type	in-line, water cooled, 4 -stroke ,direct injection ,ring-like platform combustion chamber				
No. of cylinders - bore - stroke (mm)	4-98-105				
Total displacement (L)	3.168				
Firing order	1-3-4-2				
Compression ratio	18.5:1				
Liner type	dry				
Rated speed (r/min)	2200	2400			
Rated power (kW)	36.8	36.8	40.5	33.1	35.3
Max. torque (N·m)	≥193	≥186	≥193	≥179	≥186
Max. torque speed (r/min)	1450~1650	1600~1800			
Maximum mean effective pressure (kPa)	766	744	766	723	744
Min. fuel consumption at full load (g/kW·h)	≤225				
Oil consumption (g/kW·h)	≤1.0				
Min. steady idle speed (r/min)	750±30				
Direction of crank rotation viewed from flywheel end)	counterclockwise				
Exhaust temperature(°C)	≤550				
Noise dB(A)	≤111				
Cooling system	closed cycle, forced water cooling				
Lubrication system	pressured and splashed				
Starting device	electric motor				
Net weight (kg)	Fit for tractors≤330 Fit for combine harvesters≤255				
Overall dimension Length *width* height (mm)	726×550×700.5				

Notes:1. A498BPG、A498BT1、A498BT2 have got the certificate of EPA Ⅱ (US Environmental Protection Agency);A498BT1、A498BT3、A498BT4 has got the certificate of E-mark Ⅲ.

2. The rated power is the power at standard condition that means the atmospheric pressure is 1×10^5 Pa (750mmHg),ambient temperature is 25℃, relative humidity is 30% without air filter, muffler or cooling fan.

1.4 Main Characteristic Data

1、Timing (in terms of crankshaft angle)

Intake valve open: 11° before top dead center.

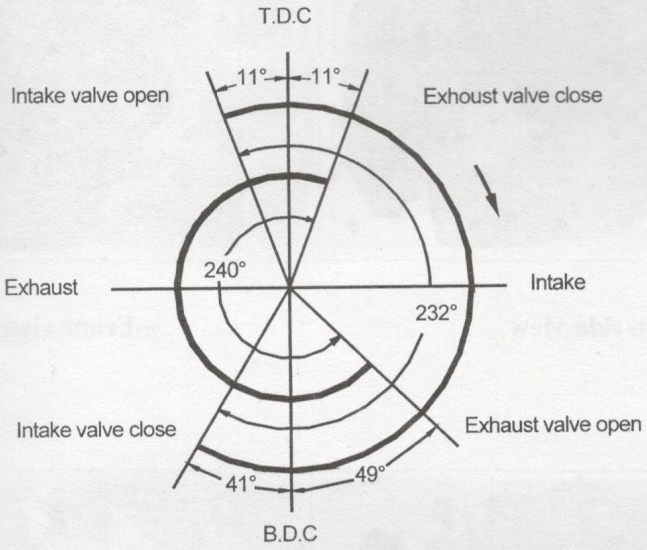
Intake valve close: 41° after bottom dead center

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: 18±1° CA;

9±1° CA(A498BPG、A498BT1、A498BT2、A498BT3、A498BT4).

3、Temperature and pressure requirements:

1)、Exhaust temperature ≤823k (550° C).

2)、Oil temperature: ≤368k (95° C).

3)、Cooing water temperature: 358–368k (85–95° C).

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.

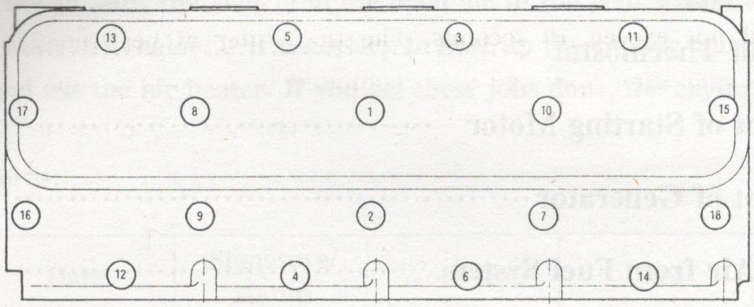
Flywheel bolt: 150–160.

Starting claw: 100–120.

5、Oil capacity in the oil sump≈6L.

4.1 Tightening Sequence of Cylinder Head Bolts

The cylinder head is fixed on the cylinder block with cylinder head bolts. When tightening these bolts, torque wrench should be used and the specified tightening torque value should be reached step by step following the tightening sequence shown in the figure. If the cylinder head has been dismantled and remounted, the engine should be shut down and the cylinder head bolts should be re-tightened to the specified tightening torque as well as the valve clearances should be re-adjusted after the engine is warmed up in its first running



4.2 Checking and Adjustment of Driving Belt

1)、Check the whole belt and renew the broken belt.

2)、Engine should work 15 minutes after the new belt is installed and then check the tightening of belt.

3)、Driving belt should be kept under a certain tension status. Normally when exerting a force of 29~49N at the middle part of the belt a depressed distance not exceeding 10~15mm is recommended. Too tight belt will lead to excessive wear of bearings in generator, fan and water pump. Too loose belt will lead to drop of speeds of accessories. As a consequence, voltage from generator, air flow from fan and/or water flow from water pump will drop and normal function of the engine will be affected.

4)、Adjust tension of belt:

- Loosen two fixing bolts.
- Turn the generator to the right or left to adjust the tension of belt until it reaches an appropriate value.
- Tighten the two bolts.

4.3 Notes about Thermostat

▲ Note: it's prohibited to operate an engine without a thermostat.

When the temperature of the coolant through the thermostat reaches about 70℃, the thermostat valve should open, and it should fully open when the temperature reaches 85℃.

When checking the thermostat, if necessary, thermostat may be put into water and heat it up gradually, and then check the open temperature and fully open temperature of thermostat valve to see whether they are in the range specified above.

4.4 Adjustment of Starting Motor

The voltage of starting motor is 12v, power is 2.5kw. It is electro –magnetically controlled and mechanically driving. When starting an engine, put on the main switch and press down the start push button, and the engine will start to work. If it fails to start, wait till the starting pinion returns to its original position and stands still before trying the second time.

1、 Before using the starting motor, check the engine, starting system circuit and the charging situation of the battery.

2、 Normally, engine can start in just one attempt. The time used to start the engine each time should not exceed 10 seconds. The time interval between 2 consecutive tries should be longer than 1 minute. It´s prohibited to restart the motor while the engine and motor are still moving, otherwise severe crash will happen between pinion and ring gear. After the engine start to work, loose the push button at once and let the pinion return to its original position.

3、 If the engine still fails to start after several attempts, do not try again before the trouble has been got rid of.

4.5 Adjustment of Generator

1、 Don't disconnect the wire from its terminal when the engine is running.

1、 Not be confused with the polarities.

2、 Use compressed air to clean out dust from inside the generator after long time operation.

4.6 Expelling Air from Fuel System

When the engine is working, air can enter the system under the following circumstances:

1、 Drain out fuel from the fuel tank when the engine is still working.

2、 Low pressure fuel pipe or return pipe is broken or a joint hasn´t been tightly fixed.

Once the air enters the fuel system, it should be expelled before the engine begins to work.

Take steps as follows:

1、 Open vent plug of fuel filter, and operate the hand delivery pump till there is no air in the fuel flowing out the vent hole. Tighten the vent plug again.

2、 Open vent plug of injection pump, and operate the hand delivery pump till there is no air in the fuel flowing out the vent plug. Tighten the vent plug again.

4.7 Maintenance of Air Filter

1、 The intake air quality is closely related to the working environment and the size of air filter. If there is too much dust, relevant measurements should be taken.

2、 The maintenance periods should be adjusted according to the actual situation.

3、 Relevant detail clean method and maintenance periods should be taken according to the requirement of the vehicle.

4.8 Draining Out Coolant

▲Note: the coolant should not be drained when the engine is still hot and the system is still pressurized. It´s very dangerous to drain the coolant under high temperature and high pressure.

1、 Make sure that the vehicle or the machine is standing horizontally.

2、 Open the filling cap of the radiator.

3、 Put a container under the drain cock. Open the drain cock by the side of the cylinder block to drain out coolant.

4、 Open the drain plug at the radiator bottom to drain out water in the radiator. If the radiator does not have a drain plug, just dismantle the hose from the bottom of the radiator.

5、 Clean the cooling system with clean water.

4.9 Renew Spin-on Fuel Filter

1、 Clean the surface of the fuel filter.

2、 Loose drain device at the filter bottom. Drain water /fuel into a container.

3、 Dismantle the filter with special spanner shown or some other similar tools.

4、 Threaded adaptor should be tightly fixed with the filter cover. Be sure to keep the inside of filter clean.

5、 Smear the sealing of the new fuel filter with a little clean fuel. Tightly fix the new filter on to the filter cover.

6、 Expel the air in the fuel filter.

4.10 Renew Oil Filter

1、 Put a pan under the oil filter to collect the oil draining out.

2、 Dismantle the oil filter with special spanner or other similar tools. Make sure that the adaptor is tightly fixed in the filter cover.

3、 Clean the filter cover.

3、 Fill clean lubricating oil into the new filter.

4、 Smear the sealing of filter with clean lubricating oil.

5、 When installing the new filter, after turning tight by hand it can be further screwed in by only 3/4 turn. Much care should be taken when using the spanner to avoid damaging the sealing.

6、 Make sure there is lubricating oil in the oil sump.

7、 Operate the engine and check if there is leakage from the filter. After the engine stops for a while, check the oil level with the oil gauge, fill more lubricating oil if necessary.

4.11 Adjustment of Valve Clearances

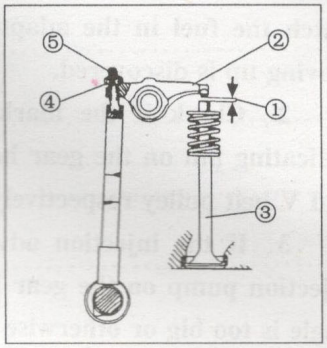
After repairing or technical maintenance, valve clearances of the engine should be checked and adjusted.

The method of adjusting valve clearances is as follows:

1、Take off the cylinder head cover, check and fasten the bolts which hold the rocker bracket.

2、Turn round the crankshaft until the first piston is at its top dead center when the mark at the observing window on the flywheel housing is just in line with the "0"mark on the flywheel, or the indicating pin on the gear housing cover is just pointing to the "0" mark on the V belt pulley.

3、Measure the intake and exhaust valve clearances of the first cylinder with a feeler gauge. Adjust them to 0.35mm and 0.45mm respectively in cold state. Then turn the crankshaft for 180° CA to adjust the other cylinders' valve clearances.



Adjustment done as follows:

- Take off the cylinder head cover
- Shut down the engine and wait for 30 minutes before adjusting valve clearances.
  Oil temperature should be below 80 ℃.
- Using the feeler gauge to check the valve clearances between ② and ③.

Adjust the valve clearances in following steps:

1、Loosen nut ④

2、Turn bolt⑤ with a screwdriver and tighten nut ④ to get correct valve clearances.

3、Check and adjust other valve clearances.

4、Install cylinder head cover

Adjust the valves marked ¥ in the table.

Cylinder Number	1		2		3		4	
Valve	Exhaust	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust	Intake
Rocker Number	1	2	3	4	5	6	7	8
Compression TDC of No.1 Cylinder	¥	¥		¥	¥			

Cylinder Number	1		2		3		4	
Valve	Exhaust	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust	Intake
Rocker Number	1	2	3	4	5	6	7	8
Compressing TDC of No.4 Cylinder			¥			¥	¥	¥

4.12 Adjustment of Injection Timing

In order to get the lowest fuel consumption rate and good performance, it's necessary to adjust the injection timing.

The method of adjusting injection timing is as follows:

1、Release the air trapped in the fuel system. Repeatedly turn the crankshaft to and fro to fill up the injection pump with fuel. Dismantle No.1 high pressure pipe. Blow away the fuel in the delivery valve adapter. Slowly turn round the crankshaft clockwise and watch the fuel in the adaptor. Stop the crankshaft as soon as the first sign of the fuel moving up is discovered.

2、Check if the mark at the observing window on the flywheel housing or the indicating pin on the gear housing cover points to the right timing marks on the flywheel and V belt pulley respectively.

3、If the injection advancing angle is not right, loose three M8 nuts that fix the injection pump on the gear housing. Turn the injection pump off the cylinder block if the angle is too big or otherwise if too small.

4.13 Adjustment of Injector

The test and adjustment of injector should be done on the test stand. The purpose is to adjust the injector pressure and watch the atomization quality and deal with the troubles.

The steps for the adjustment of injector:

1)Push the handle of the hand pump to raise the fuel pressure to 18MPa; Gradually push the handle to further raise to 20.3 to 20.8MPa; watch the nozzle tip to see if there is any fuel leakage or dripping. Check, wash, or lap the nozzle precision couple if necessary.

2)Take down injector screw cap, tighten or loosen adjusting screw to get the injector pressure to 20.3–20.8Mpa. Fix the screw cap and check again.

3)Watch the atomization quality. Do the atomization test at a speed of every 1 second each. The fuel atomization should be fine and even. No splashed fuel should be seen and uneven or deflected spray is not allowed. Clear cut sound should be heard when the injection stops. Generally, abnormal injection is caused by sluggish movement of the nozzle needle valve, fuel dripping is caused by damaging of sealing surfaces, branching of spray is caused by carbon deposit at nozzle tip or thermal deformation.

4.14 Adjustment of Injection Pump

Injection pump has been checked and adjusted before being released off the line. If there is need to re–adjust, it should be done on a special testing machine by a professional mechanic.