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CHAPTER ONE

ENGINE TECHNICAL DATA

AND SPECIFICATION

1.1 ENGINE TECHNICAL DATA AND SPECIFICATION

Model		LJ276M/LJ276MT-2	
Type		Two Cylinder, four Stroke, Water cooled In-line, Inclined Installation, Hemispherical Combustion Chamber	
Valve Train		Overhead Camshaft, Chain Transmission	
Bore×Stroke		76×71mm	
Total Displacement		644ml	
Compression Ratio		8.4 : 1	
Maximum Power /Speed		20.6 / 4500KW/(r/min)	
Rated Power/Speed 标定功率/转速（净功率）		17/4500KW/(r/min)	
Maximum Torque/Speed		44/2700~3300N.m(r/min)	
Minimum Specific Fuel Consumption At Full Load		≧329g/(KW. h)	
Idling Speed		900±50r/min	
Direction of rotation		Counter Clockwise(Look from power output)	
Overall Dimension (length×width×height)		LJ276M	LJ276MT-2
		795 × 540 × 435mm	670 × 550 × 525mm
Net Weigh Of Engine		LJ276M	LJ276MT-2
		86 kg	91kg
Inlet Valve Clearance(hot)		0.15mm	
Exhaust Valve Clearance(hot)		0.25mm	
VALVE TIMING	Intake Valve Opens	23° BTDC	
	Intake Valve Closes	53° ABDC	
	Exhaust Valve Opens	53° BBDC	

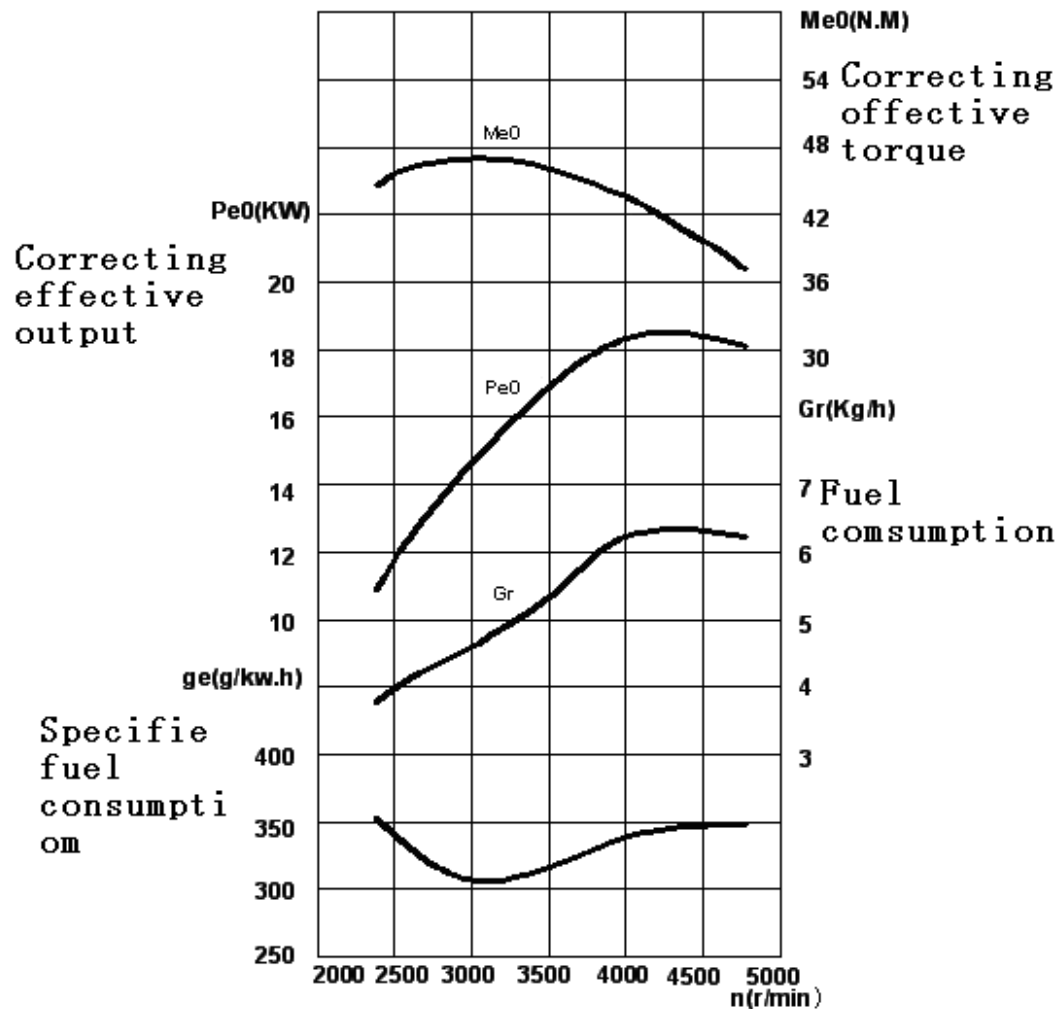
	Exhaust Valve Closes		23° ATDC	
Starting Mode			Electromagnetic drive,	
Crankcase Ventilation			Unidirectional clutch	
			Closed	
LUBRICATION SYSTEM	Oil		Use SE15W/40 petrol engine oil if Ambient Temperature is Above 0 °C; Use SE15W/40 petrol engine oil if Ambient Temperature is Below 0 °C;	
	Lubricating Mode		Pressurized And Splash	
	Type Of Oil Pump		Cycloid Rotor Pump	
	Type Of Oil Filter		Screwed joint J0706	
	Oil Capacity(with filter)		2.9L	
	Oil Pressure		0.245Mpa ~ 0.440Mpa (3000r/min)	
COOLING SYSTEM	Mode Of Cooling		Forced Water-Cooling	
	Cooling Water Capacity		1.4L	
	Type Of Water Pump		Centrifugal	
	Thermostat		Wax-Type	
	Type Of Fan Belt		AV10×840	
	Water Temperature		75~95℃	
	Type Of Air Filter		ModelQK1706 — 00,Paper Element	
FUEL SYSTEM	Type of Fuel Pump (electromotion)		JB12D—II, 12V	
	CARBUREROR	Model	BJH101E、CSH101E	
		Type	Double Venturi tube , Single Chamber, Balancing Float Chamber Flat Absorb	
		Type Of Choke Valve	Manual	
ELECTRICAL SYSTE M	Ignition system	Firing		By battery
		Ignition Timing		6±2° BTDC 900r/min
		Firing Order		1—2
		Ignition Coil		Model DQ130, 12V
		Distributor	Model	FDW261

			Type	Magnetic pulse igniter without contact piece
			Ignition Advance	Centrifugal, Vacuum
		SPARK PLUG	Model	F6T 、E6TC
			Bolt Diameter	M14×1.25
			Electrode Gap	0.7±0.1mm
	ALTERNATOR	Model and Type		JF132、JF138A, Silicon Rectified Alternator
		Power Output		14V—30A (Used With Voltage Regulator)
	STARTING MOTOR	Model		QD112A, QD115
		Power Output		12V—0.8KW
	Battery			Model 6—QA-36S
POWER TRAIN SYSTEM	Clutch	Type		Single Disc, Diaphragm Spring. Dry
		Operating Mode		Forced
		Dimension Of Frictional Disc(Outer Dia.×Inner Dia.×Thickness		160×110×7.8
	TRANSMISSION	Type		Normally-engaged helical gears, synchronous at full speed
		Mode of operation		Floor shift
		Crankshaft to Transmission main shaft (Normally Engaged drive ratio)		1.6
		Transmission main shaft to Lay shaft	First Gear	2.413 (30/14)
			Second Gear	1.318 (29/22)
			Third Gear	0.862 (25/29)
			Fourth Gear	Nothing

			Reverse Gear	2.25 (27/12)	
		Speed ratio		LJ276M	LJ276MT-2
			First Gear	3.429	4
			Second Gear	2.109	2.8
			Third Gear	1.379	1.8
			Fourth Gear	1.000	1.0257
			Reverse Gear	3.600	3.363
		Mileage Counter		14/3	13/3
		Lubricant		GL—4	
		Lubricant Capacity		0.7L	1.5L
	Spline Data Of The Output Shaft	Normal modulus Mm		0.75	1.0
		Tooth Number Z		18	22
		Normal Tooth Pressure angle		20°	20°
		Normal Tooth Stand-off		+0.8	+0.8
		Measure Normal Line w/k		8.412	
		Measure Span M		20.874	

1.2 Petrol Engine External Characteristic Curve

The Petrol Engine External Characteristic Curve refer to fig1-1



CHAPTER TWO

ENGINE OPERATION

2.1 POINTS FOR ATTENTION IN ENGINE OPERATION

- Make adjustments and carry out maintenance in accordance with the maintenance methods and rules in this book.
- Check bonding of earth of battery. Negative terminal of battery is connected to the earth for model LJ276M engine
- When operating new engines, carry out running in accordance with the specification below. Don't accelerate or overload suddenly .

- d. Keep water temperature within 75~95°C. At medium speeds normal oil pressure should not be less than 245Kpa (2.5kgf/cm²).
- e. Use RQ—70 or RON—90 or above petrol as fuel. When detonation happens, adjust distributor so that ignition timing is retarded properly. It is not allowed to run engine under detonation.
- f. If abnormal phenomena happen during running, turn off engine and check it without delay.
- g. When draining water from cooling system, to avoid being scalded, don't open drain plug before water temperature drops.

2.2 RUNNING IN OF NEW ENGINE

The service life of engines depends greatly on their initial operating states. When a new engine is installed in a vehicle,

The vehicle must be driven for 2500 km in accordance with running in specification. The proposed running in specification is as follows:

Mileage km	Load	Speed
0~250	No load	Engine Speed Not Over 1600r/min
250~1000	50% of Rated Load	Engine Speed Not Over 2200r/min
1000~1500	75% of Rated Load	Engine Speed Not Over 2800r/min
1500~2500	Rated Load	Increase Speed Gradually To Maximum Speed In The Operating Gears.

2.3 STARTING, RUNNING AND TURNING OFF ENGINE

2.3.1 PREPARATIONS BEFORE STARTING

Do the following before starting engine

- a. Check water level in radiator and reservoir tank, tightening of water pipe connections and tensioning of fan belt.
- b. Check level of Lubricating oil in oil pan.
- c. Check fuel quantity in fuel tank and soundness of fuel supply line and connections. eliminate any leakage.
- d. Check level of electrolyte in battery.
- e. Check tightening of connections for battery, alternator, fuel pump, distributor, spark plug, regulator, ignition coils and other electric components.

2.3.2 PROCEDURE FOR STARTING ENGINE

- A. Set gearshift level to idling position.
- B. Move carburetor choke valve near to close position. Then slightly open throttle valve with starting lever so that rich mixture is obtained.
- C. Step down clutch pedal.
- D. Turn ignition switch to start position. Starting time should not be over 5 seconds.
The interval between two adjacent starts should not be less than 20 seconds.
- E. After starting engine, release ignition switch immediately so that it goes back to ignition position automatically. At the same time open choke valve partially. With the increase of

engine temperature, open choke valve gradually until its fully open position.

2.3.3 STARTING ENGINE AT THE ATMOSPHERIC TEMPERATURE OF LOWER THAN -5°C

When starting engine at low temperature, in addition to above mentioned checks SE10W/30 OE engine oil for winter use and antifreeze coolant should be used. And engine should be warmed up.

Steps For Engine Warming Up:

- A. If Antifreeze coolant is not used. Feed hot water of above 90°C into engine.**
- B. Feed oil of 80°C~90°C into engine .The oil should be that which has been drained from engine previously. Draining of oil should be done immediately after engine turn off so that oil is not contaminated.**

Rotate crankshaft of warmed up engine by hand several turns so that cylinders suck in small amount of fuel. Start engine and run it at idling speed for 2~3minutes. Then run engine from Low load until normal working load .Don't warm up engine at high speed.

2.3.4 RUNNING ENGINE

- A. Running in of an engine in a vehicle must be carried out in accordance with running in specification. Don't start or accelerate engine suddenly at high speed. Avoid overloading engine after running in.**
- B. It is prohibited to run engine when there is no oil pressure, Oil pressure if too low, abnormal noises take place, engine is overheated and abnormal vibration happens.**

2.3.5 TURNING OFF ENGINE

It is prohibited to turn off engine at high speed and high load. Before running off engine, Load must be removed. Then run engine at low speed for 3~5 minutes and turn off ignition switch. In icy season, if antifreeze coolant and cylinder block immediately after turning off engine.

THAPTER TERE

STRUCTURAL CHARCAITERISTICS AND ADDEMBLY REQUIREMENTS OF ENGINE

3.1 CYLINDERHEAD ASSEMBLY

Cylinder head is made of high strength aluminum alloy. The shape of combustion chamber is hemispherical. Intake and exhaust runners are distributed on two sides. The overhead camshaft of value train has very good suitability by three bearing in the cylinder head and driven by timing chain. There are the advantages of being stable in transmission, compact in structure and low

noise.

Rocker arm is made of high strength aluminum alloy with inlaid alloy resists very high temperature. A sealing unit is used for value stem so that engine oil can not enter combustion chamber phase angle between the No.1 cylinder and the No.2 cylinder is 360 degrees crank angle.

A. Point for installing timing chain

Rotate crankshaft to TDC position before installing timing chain. Then align marks on timing sprocket of crankshaft and camshaft sprocket with the white and bright chain element respectively. Now the locating pin in camshaft should be right at the top position (refer to fig.3-1)

B. Locating TDC

Rotate crankshaft to make pistons in two cylinders go to their TDC positions in turn. Now the center mark on boss of crankshaft pulley should align with the boss of timing chain cover. Remove cylinder head cover if the locating pin in camshaft sprocket is at the position shown in fig.3-2. the piston in No.1 cylinder is at the position of compression stroke. If locating pin is at opposite position the piston in No.2 cylinder is at TDC position of compression stroke.

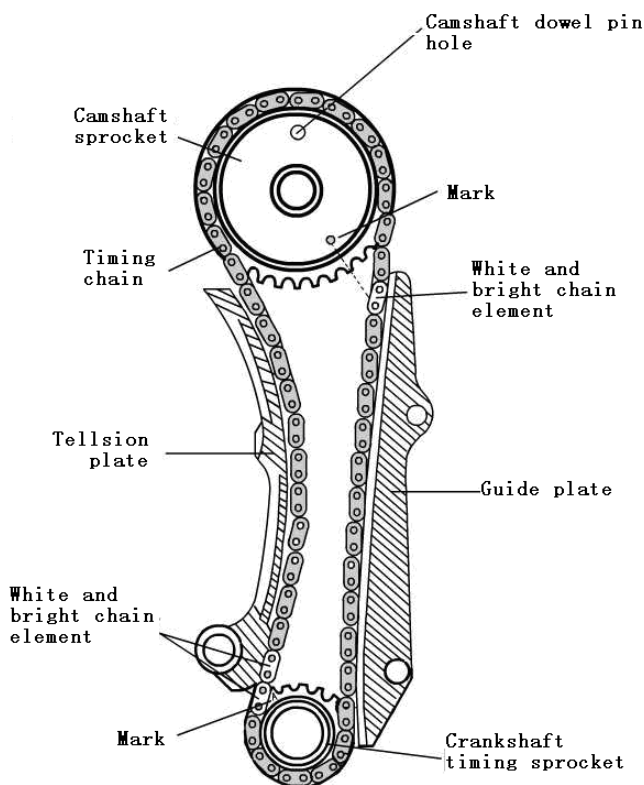


Fig. 3-1 Alignment of timing chain marks

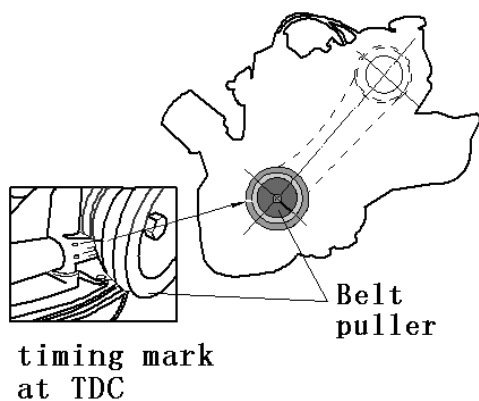


Fig.3-2

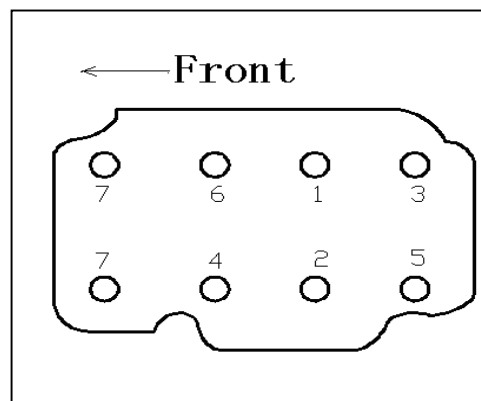


Fig.3-3

C. Tightening and removing cylinder head bolts. The tightening order for cylinder head bolts is shown in fig.3-3.tighten bolts uniformly in three steps. Unfasten are remove bolts in reverse order.

IGHTENING TORQUE

requirement	NO.1~NO.6 Bolts	NO.7Bolt
Tightening torque	68.6~73.3N • m(Cold) (7~7.5kgf • m)	4.9~6.86N • m (0.5~0.7kgf.m)
	75.8~83.4N • m(Hot)(8~8.5kgf • m)	

3.2 CYLINDERBLOCK ASSEMBLY AND BALANCE CHAIN

Cylinder block is made of alloy cast iron, which has high strength and is wear-resistant .In order to make operation of engine stable and to reduce vibration. Advanced balancing mechanism is adopted .The balancing mechanism consists of counter weights and balancing. Shaft which are located on two sides of crankshaft respectively .balancing shaft is driven by a chain.

On top surface of the cylinder block marked with cylinder matching group number. at bottom marked with main bearing hole matching group number refer to fig.3-4 3-5

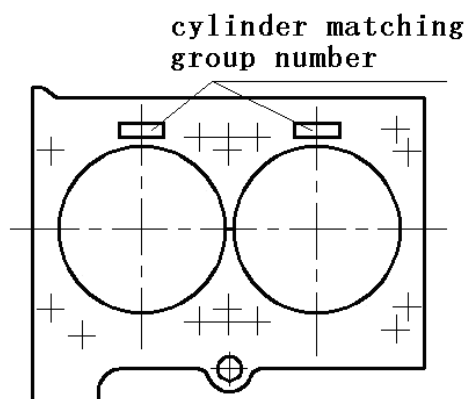


Fig.3-4

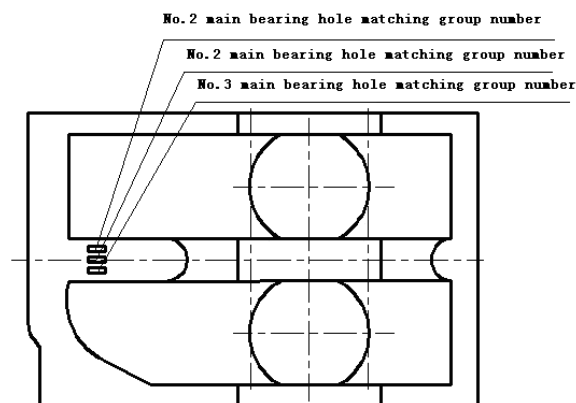


Fig.3-5

Requirement of matching group is in the table below.

Cylinder matching group	
Group number and mark	Cylinder diameter $\phi 76^{+0.003}_0$
1	≥ 0 $< +0.01$
2	$\geq +0.01$ $< +0.02$
3	$\geq +0.02$ $\leq +0.03$

Main bearing hole matching group	
Group number and mark	Cylinder diameter $\phi 47^{+0.024}_0$
1	≥ 0 $\leq +0.008$
2	$> +0.008$ $\leq +0.016$
3	$> +0.016$ $\leq +0.024$

Main points for installing balance chain

A. Rotate crankshaft to BDC position

B. Mark direction of counter weight on balancing shaft to be the same as that of counterweight on crankshaft (fig.3—6)。

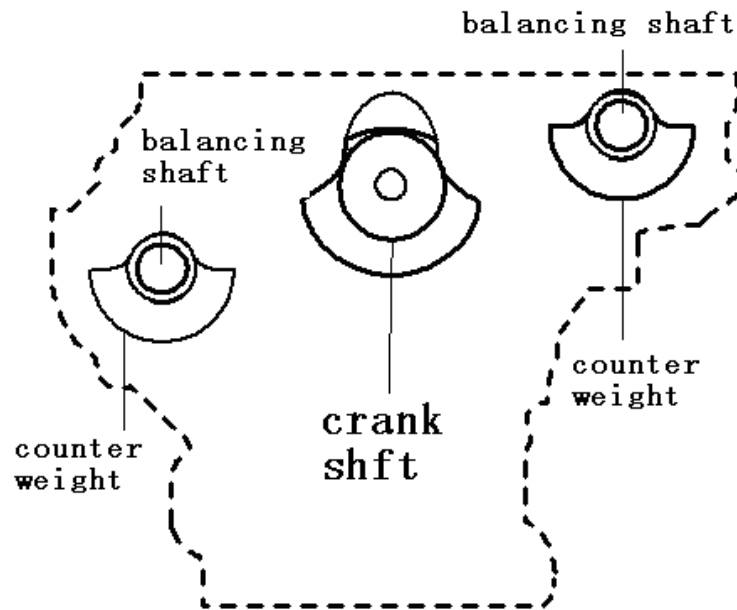


Fig.3-6 The position of counter weights and balancing shaft

C. Align the marks (white and bright chain elements) on two balancing shaft sprockets (grooves) respectively (fig.3—7)

Then install crankshaft sprocket and two balancing shaft sprocket with balance chain on crankshaft and balancing shaft.

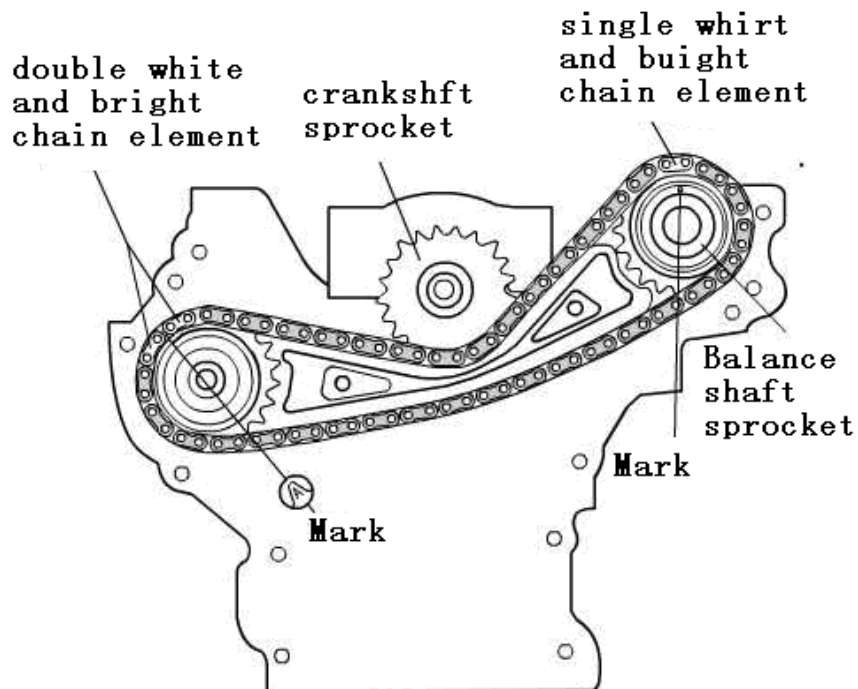


Fig.3-7 Alignment of balancing chain marks

3.3 Crankshaft and main shaft bearing

3.3.1 Crankshaft

Crankshaft is made of ductile iron .On No.1 and No.4 crank, -each mark with connecting group number, refer to fig.3-8.At the front end of the crankshaft fitted with balancing shaft drive pulley, timing chain and belt pulley ,each used for drive balancing shaft , camshaft , water pump ,alternator, the fly wheel with toothed ring fitted at the end of the crankshaft.

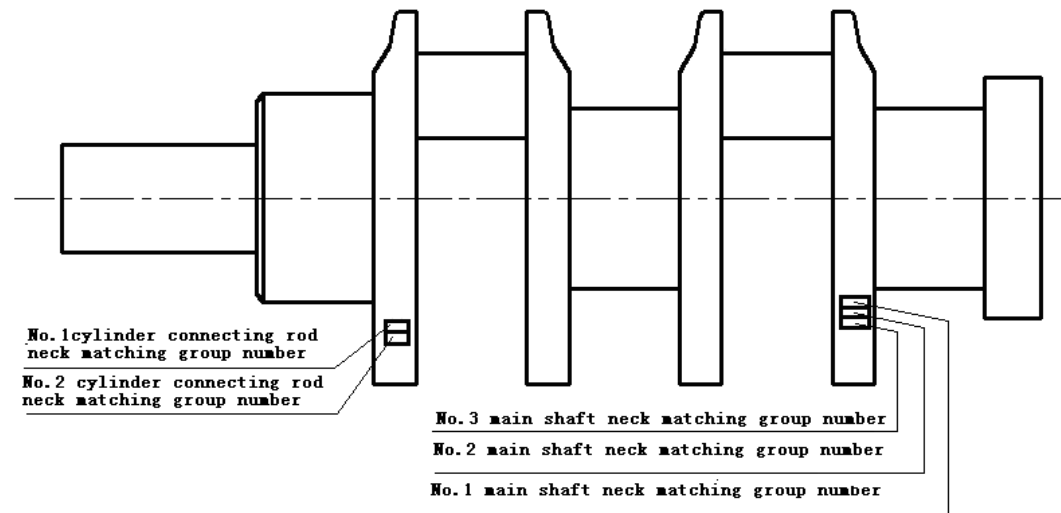


Fig.3-8 Connecting rod neck, main shaft neck matching group number

Connecting rod neck and main shaft neck matching group number is in the table below:

Connecting rod neck matching group

Group and mark	Connecting rod neck dimension($\Phi 40^{0}_{-0.024}$)
1	$\geq -0.024 \leq -0.016$
2	$> -0.016 \leq -0.008$
3	$> -0.008 \leq 0$

Main shaft neck matching group

Group and mark	Main shaft neck dimension ($\Phi 43^{0}_{-0.024}$)
1	$\geq -0.024 \leq -0.016$
2	$> -0.016 \leq -0.008$
3	$> -0.008 \leq 0$

3.3.2 Main shaft bearing

Main shaft bearing grouping according to the dimension of centre thickness see the table below:

Main shaft bearing matching group

Group and mark	Identifying Color	Centre thickness($2^{+0.006}_{-0.014}$)
1	Yellow	$\geq -0.014 \leq -0.010$
2	Green	$> -0.010 \leq -0.006$
3	Brown	$> -0.006 \leq -0.002$
4	Black	$> -0.002 \leq +0.002$
5	Blue	$> +0.002 \leq +0.006$

When fitting in order to ensure the bearing clearance it needed to matching on group ,the matching relation is in the table blow.

Main bearing matching relation

Main bearing matching group number		Main shaft neck matching group number		
		1	2	3
Main bearing hole matching group number	4	3	2	1
	5	4	3	2
	6	5	4	3

Note: (1) Main bearing matching group number=main bearing hole matching group number-main shaft neck matching group number

(2) Upper and lower bearing should be fitted with the same group bearing set.

3.4 PISTON AND CONNECTING ROD ASSEMBLY

Piston is made of special aluminum alloy. There are two gas rings and one oil ring on each piston. The surfaces of the first gas ring and oil ring are chromium plated. The second gas ring is slightly conical and serves to proof gas and form lubricating oil zone (when piston is going upwards) and scrape oil (when piston is going downwards). The combined oil ring consists of an upper scrape ring, a lower scrape ring and a compound ring in the middle. The oil ring has radial and axial sealing function and can prevent lubricating oil enter combustion chamber.

Piston pin is pressed into the hole of connecting rod with interference. In order to prevent knocking, the hole of piston pin deviates 1mm from supporting and compressing direction.

Main points for installing piston assembly.

A. Piston and connecting rod assembly matching group

① Requirement of matching group of the piston skirt diameter is in the table below:

Piston skirt diameter matching group		
Group and mark	Skirt dimension ($\Phi 76^{0}_{-0.03}$)	
1	≥ -0.030	≤ -0.020
2	> -0.020	≤ -0.010
3	> -0.010	≤ 0

② Requirement of piston matching relation is in the table below:

Piston matching relation			
	Matching group		
Engine block	1	2	3
piston	1	2	3

③ Requirement of piston pin boss hole matching group is in the table below:

Piston pin boss hole matching group		
Group and mark	hole dimension ($\Phi 18^{+0.008}_{-0.001}$)	
A	≥ -0.001	$\leq +0.002$
B	$> +0.002$	$\leq +0.005$
C	$> +0.005$	$\leq +0.008$

④ Requirement of piston pin external diameter matching group is in the table below:

Piston pin external diameter matching group		
group	mark (colored at	Piston pin external diameter ($\Phi 18^{0}_{-0.009}$)

	internal hole)	
A	Red	≥ -0.009 ≤ -0.006
B	Yellow	> -0.006 ≤ -0.003
C	Blue	> -0.003 ≤ 0

⑤ Requirement of connecting rod small end matching group is in the table below:

Connecting rod small end matching group

Group and mark	Connecting rod small end diameter ($\Phi 18^{+0.020}_{-0.047}$)	
A	≥ -0.047	≤ -0.038
B	> -0.038	≤ -0.029
C	> -0.029	≤ -0.020

⑥ Requirement of connecting rod bearing matching group is in the table below:

Piston pin matching relation

	Matching group number		
Connecting rod small end	A	B	C
Piston pin	A	B	C
Piston pin boss hole	A	B	C

⑦ Requirement of connecting rod big end matching group is in the table below:

Group and mark	Connecting rod big end dimension ($\Phi 43_0^{+0.024}$)	
4	≥ 0	$\leq +0.008$
5	$> +0.008$	$\leq +0.016$
6	$> +0.016$	$\leq +0.024$

⑧ Requirement of connecting rod bearing matching group is in the table below:

Connecting rod bearing matching group

Group and mark	Identifying color	Center thickness ($1.5^{+0.006}_{-0.014}$)	
1	Yellow	≥ -0.014	$\leq +0.010$
2	Green	> -0.010	≤ -0.006
3	Brown	> -0.006	≤ -0.002
4	Blake	> -0.002	$\leq +0.002$
5	Blue	$> +0.002$	$\leq +0.006$

⑨ connecting rod matching relation is in the table below:

Connecting rod matching relation

connecting rod matching group		Connecting rod neck group number		
		1	2	3
Connecting rod big end group number	4	3	2	1
	5	4	3	2
	6	5	4	3

Note:(1)Connecting rod bearing matching group number=connecting rod big end

- matching group number-connecting rod neck matching group number.
- (2) Upper and lower connecting rod should be fitted with the same group bearing.

- B.** When installing two gas ring and the combined oil ring into grooves of piston. Stagger their opening (fig.3-9). The marked surface of the first and second rings should face piston head
- C.** Main points for installing piston and connecting rod assembly. There are fitting marks on piston head and connecting rod shank. Sure that the mark s are in the same direction (refer to fig.3-10). Be careful to avoid mistakes.
- D.** When installing piston and connecting rod assembly into cylinders. The marked surfaces of the connecting rod and piston must face the front of engine (fig.3-10).

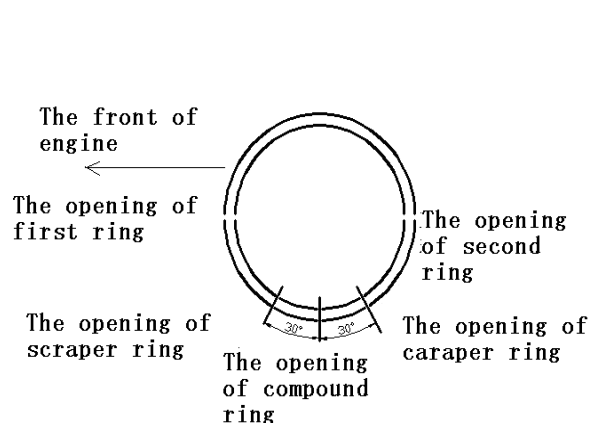


Fig.3-8 Relative position of piston rings

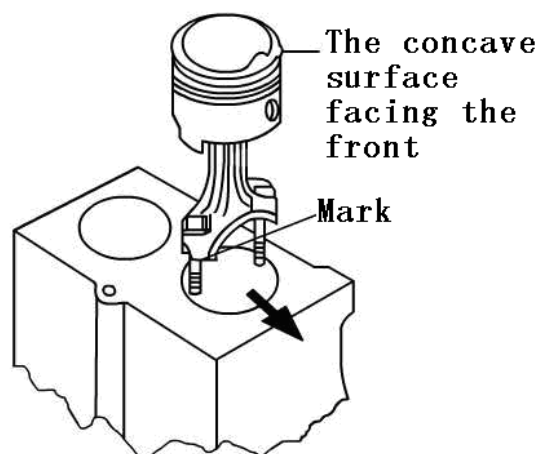


Fig.3-9 the direction of piston and connecting rod in cylinder

3.5 DISTRIBUTOR ASSEMBLY

Distributor is driven by a special bevel gear on crankshaft. The shaft end drives oil pump. Obviously, the installation angle of distributor decides ignition timing. The steps for distributor installation is as follows:

- A.** Rotate crankshaft to TDC position. Then use a screwdriver to turn the groove in shaft end of oil pump (refer to fig.3-11).
- B.** Align the mark on distributor shaft with that on the housing refer to fig.3-12
- C.** Align the flat tongue face on distributor shaft with the groove on shaft end of oil pump.
Slowly install the distributor into timing chain cover until its shaft inserts into the groove on oil pump.
- D.** Tighten locknuts on the distributor housing and check ignition timing (refer to chapter 4. ignition system maintenance).

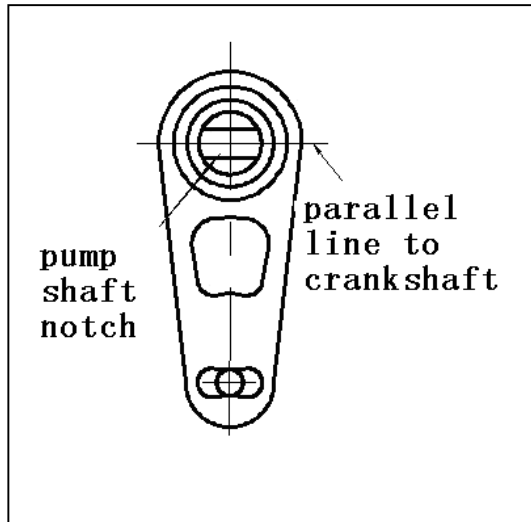


Fig.3-10 The position of groove in oil pump shaft

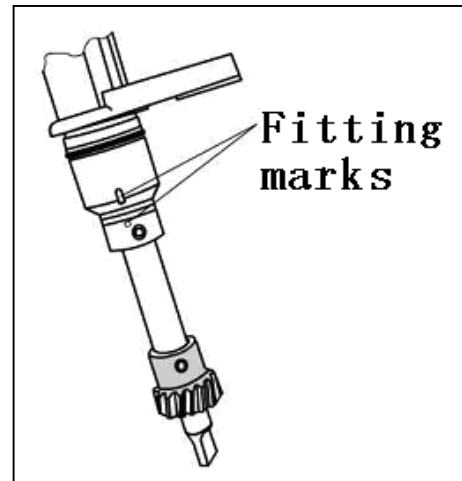


Fig.3-11 The direction of piston and connecting rod in cylinder

3.6 CARBURETOR ASSEMBLY

In order to achieve good power performance and economy with low exhaust gas pollution. Engine is equipped with a meticulously designed and adjusted carburetor. It has a sliding valve which serves to prevent mixture to be too rich during decelerating and reduce CO and HC content in exhaust gas. The air equilibrating chamber which is connected to float chamber serves to avoid fuel vapor overflow and to avoid negative effects caused by clogged air filter. In addition the P32Q-1 carburetor also has a start /high speed/idling speed mechanism, which serves to have a good cooperation between choke value and throttle value under starting and idling speed operating conditions to make engine run at higher idling speed to reduce warming up time.

3.7 LUBRICATION SYSTEM

Oil pump is installed in oil pan under timing chain cover. The screw fitting oil filter and main oil gallery are distributed in timing chain cover. The chain is lubricated by spraying of oil from nozzle. Forced and splash lubrication system is used for engine. Oil filter is convenient in use and easy in replacement with a one-assembly structure. Oil pressure is indicated by an oil pressure switch. When oil pressure is under specified value, The indicator is on.

3.8 COOLING SYSTEM

Engine is cooled by pressurized circulating water. A centrifugal water pump and a nylon fan with blades of different lengths are adopted. Results of food radiation, small power loss and small noise for fan are achieved.

The opening temperature of the paraffin thermostat is at 75° C

3.9 ELECTRICAL SYSTEM

A. Alternator: silicon rectified high speed alternator. its negative terminal is connected to

the earth.

B. Starting motor: electromagnetic drive unidirectional clutch

C. Distributor: contact type, with rechargeable indicator.

D. Regulator: contact type, with rechargeable indicator.

The electrical diagram of engine is shown in fig.3-13 Alternator is driven by crankshaft pulley through fan belt. It is necessary to adjust tensioning of fan belt in accordance with specification (refer to chapter 4. cooling system maintenance).

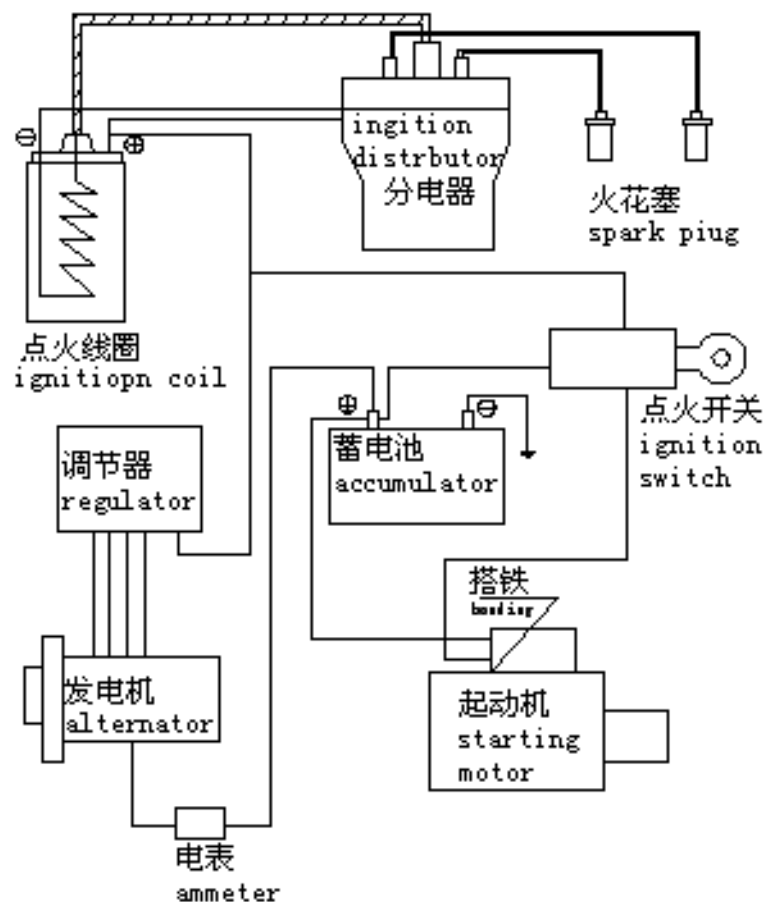
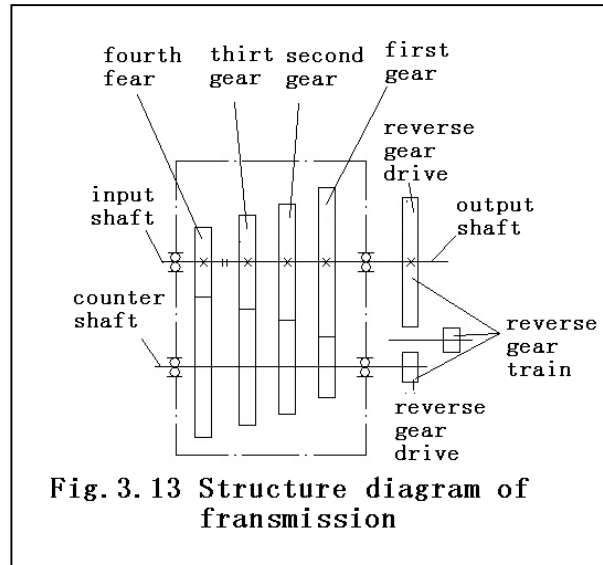


Fig.3-12 The electrical diagram of engine

3.10 CLURCH ASSEMBLY AND TRANSMISSION ASSEMBLY

Clutch disc is of single dry frictional disc. Diaphragm spring plate is of normally-pressurized drive type. Transmission with synchronizer has four forward gears and one reverse gear. All fears of the forward speeds are normally-engaged helical fears. Which have the advantage of stable in transmission, Low noise and transmitted torque.

The structure diagram of transmission is shown in fig 3-13.



3.11 ENGINE LEAKAGE PREVENTION

In order to overcome leakage of oil, gas, water. The jointing surfaces and the surfaces for oil seals have been properly designed and sealants are applied to main jointing surfaces. Place which must be applied with sealants are shown in fig.3-15, 3-16, 3-17.

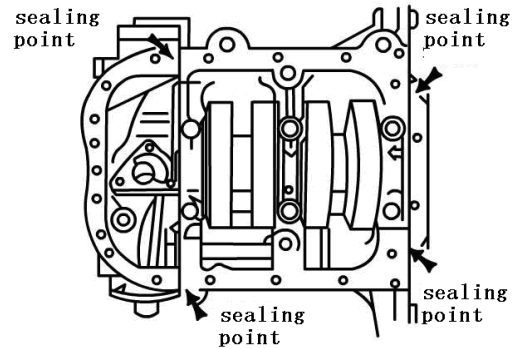


Fig.3-15 The jointing surface between oil pan and cylinder block

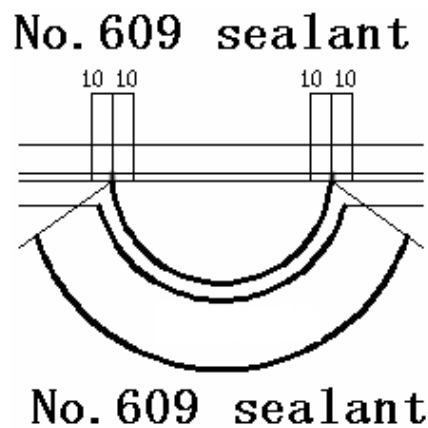


Fig.3-16 The front and rear seal sealing surfaces of cylinder head cover

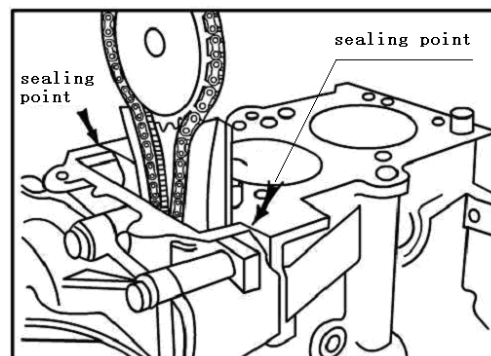


Fig.3-17 The jointing surface between cylinder block and timing chain cover

CHAPTER 4

ENGINE MAINTENANCE

4.1 ENGINE MAINTENANCE CYCLE

4.1.1 DAILY MAINTENANCE

- A. Check the levels of fuel, Cooling water and oil. Replenish if necessary.**
- B. Check jointing surfaces for leakage of oil and water.**
- C. Check high-tension cables for looseness.**
- D. Check electrolyte level in battery.**
Refill distilled water if the level is not high enough.
- E. Carefully listen to the sound of engine running at idling speed after starting. Observe the functioning of different instruments.**

4.1.2 MAINTENANCE AFTER FIRST 1000KM

- A. Carry out the maintenance mentioned in daily maintenance.**
- B. Check the tightening of bolts between engines and bracket and exhaust manifold between engine and air filter.**
- C. Check the tightening of cylinder head bolts. If there is looseness, retighten in accordance with the order in the instruction.**
- D. check valve clearances, Adjust if necessary.**
- E. Check the tensioning of fan belt. Adjust if necessary**
- F. Check idling speed and ignition timing.**
- G. Check gravity of electrolyte in battery or voltage of battery.**
- H. Check connections of alternator, Regulator., Ignition coils and spark plug for looseness.**
- I. Check and adjust the free travel of clutch pedal.**

4.1.3 MAINTENANCE AFTER RORST 2500 KM

- A. Carry out the maintenance mentioned in daily maintenance..**
- B. Check the wear and tensioning of fan belt. Replace or adjust if necessary**
- C. Clean the electrodes of spark plug. Adjust electrode gap if necessary.**
- D. Replace the paper element of air filter..**
- E. Change oil of engine and replace oil filter .**
- F Start engine and check for any abnormal noises from power train under no load.**
- G. Operate clutch. Clutching off should be complete and clutching on should be smooth
It should be smooth to shift gears of transmission .**
- H. Replace lubricating oil of transmission.**

4.1.4 MAINTENANCE ECERY 5000 KM

- A. Carry out the maintenance in point 4.1.3(refill lubricating oil instead of replacing lubricating oil.)**
- B. Clean fuel tank, fuel line and carburetor barrel..**
- C. Check battery for cracks or leakages of electricity..**
- D. Check functioning of regulator.**

4.1.5 MAINTENANCE EVERY 10000 KM

- A. Carry out the maintenance in point 4.1.4**

- B. Replace air filter element.**
- C. Replace oil filter and change engine oil.**
- D. Remove cylinder head and clean carbon deposit on the surface of combustion chamber and on piston head. Clean the dirt inside intake and exhaust system.**
- E. Remove and clean alternator and starting motor. Replace the grease in their bearings.**
- F. Check the functioning of throttle operating wire and carburetor shaft.**
- G Check the contamination of lubrication oil in transmission. Replace if necessary.**
- H. Replace the antifreeze coolant in the cooling system.**

4.2 PONINTS OF ATTENTION FOR ENGINE MAINTENANCE

4.2.1 LUBRICATION SYSTEM MAINTENANCE

A. Measurement of oil level.

The quantity of oil in oil pan is measured by a dipstick on the right side of engine. To check the oil level, turn off engine and wait until oil surface is quiet (about after 5 minutes),take out the dipstick and remove oil trace with a clean cloth .then insert the dipstick and take out again. The oil level must be between the upper and lower lines (refer to fig.4-1)

B. Changing oil

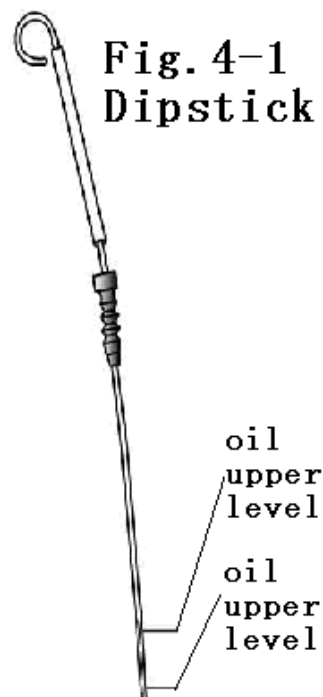
Proper selection and change of oil in accordance with the maintenance cycle are very important to ensure good operation and service life of engine. Users should select oils in accordance with instruction strictly. Don't mix and use oils of different brands.

Before replacing oil, drain oil from oil pan when engine is hot. If there are large amount of impurities inside oil pan, the engine lubrication system must be cleaned with light spindle oil, Kerosene or petrol are prohibited to be used for cleaning. Filling 3 liters of light spindle oil through oil filler port, Start engine with starting motor to idling speed for 2~3 times for one minute a time, drain spindle oil quickly and fill oil into engine in accordance with specification.

Every time after change of oil .run engine at idle speed for 3~5 minutes to ensure that lubrication system obtains enough oil .

Replace transmission lubricating oil when lubricating oil is still warm. Open drain plug on the hole of hexagon-headed bolt on the right side of the housing until oil goes up to lower edge of the hole.

C. For lubricating distributor cam and breaker contacts. drip 1~2 drops of oil on felt periodically.



**Fig. 4-1
Dipstick**

4.2.2 COOLING SYSTEM MAINTENANCE

A. To ensure normal operation of

engine. There must be enough coolant. Therefore, it is necessary to check coolant and replenish clean soft water every time before going out with a vehicle. It is prohibited to use hard alkaline water with many minerals. In winter, antifreeze must be used. Generally speaking, the freezing point of the selected antifreeze must be 5°C lower than the lowest temperature of the area where engine is used. If antifreeze is not

used, drain cooling water from radiator and cylinder block after turn off of engine without delay.

B. It is necessary to check tensioning of fan belt regularly.

Adjust tensioning if necessary (refer to fig4-2). The appearance of fan must be good. The excessively worn belt must be replaced without delay.

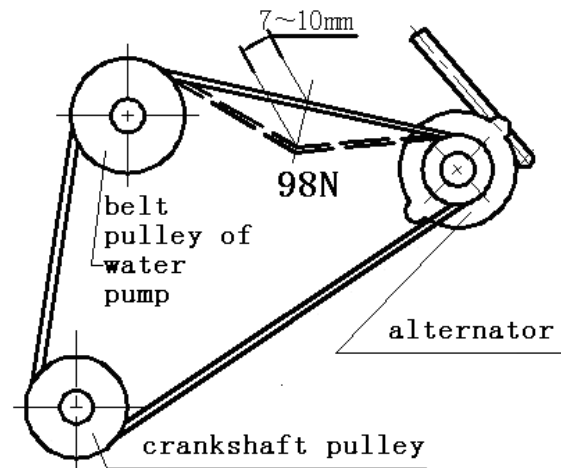


Fig. 4-2 Adjustment of tensioning of fan belt

4.2.3 FUEL SYSTEM MAINTENANCE

A. The air filter element must be replaced regularly in accordance with maintenance instruction and road conditions.

B. The carburetor has been adjusted pre-delivery and adjustments are not necessary .It is prohibited to turn the screw which marked with paint. Turning this screw arbitrarily will make the transient performances economy and exhaust at idle speed deteriorate.

The idle speed of LJ276M engine is 900±50r/min. When adjusting idle speed .the water temperature. Of engine must be 75~95°C. Check if ignition advance angle is an follows: Turn the idle adjusting screw and speed adjusting screw (refer to fig4-3) alternatively to make engine run at a speed a bit higher than idle speed. Then

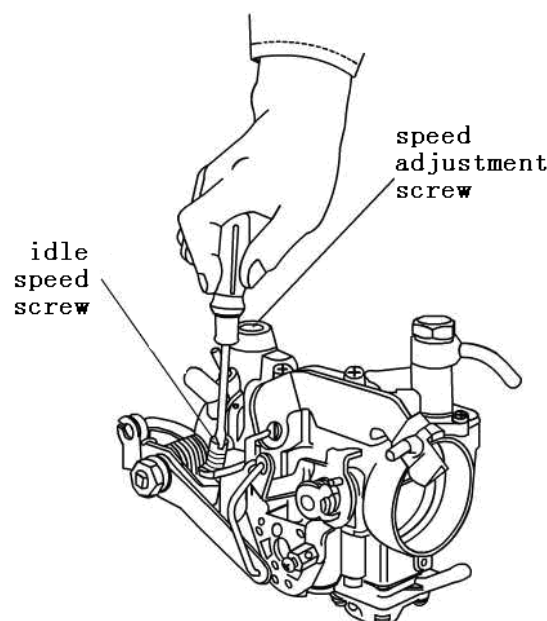
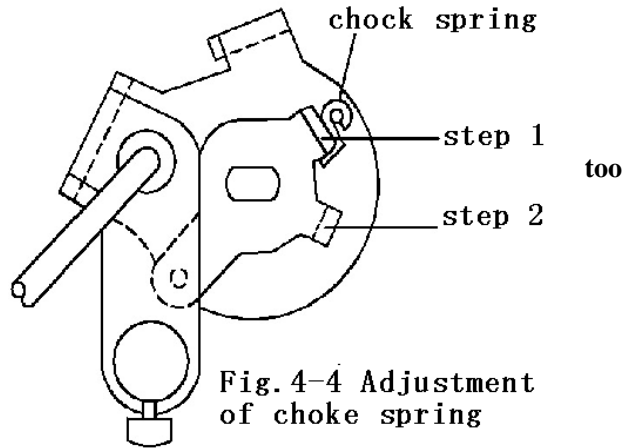


Fig. 4-3 adjustment screw of carburetor

turning idle adjusting screw until the engine speed is lower than idle speed and turn back for 1/4 turns.

- C. The fuel level in the float chamber must be within the $\Phi 3$ circle in the centre of fuel mirror. When the fuel level is too high or low, it can be regulated by changing the thickness of the spaces of float needle valve seat.



- D. The position of choke valve spring in order to facilitate starting when ambient temperature is below -15°C , the mixture must be richer. For this purpose. The hook up position of the choke valve spring on the rocker must be changed from step1 to step2(fig.4-4).

4.2.4 IGNITION SYSTEM MAINTENANCE

4.2.4.1

The ignition timing has been adjusted prp-delivery and is happens during operation due to change of ignition timing and readjustment is necessary, carry out adjustments as follows:

- Turn crankshaft to set the piston of No.1 cylinder at TDC position of compression stroke.
- Open distributor cover and observe the position of rotor head make the end with notch of contact set face forward (fig.4-5)
- Turn crankshaft again and check the cross firing moment across breaker contact points. When cross firing happens, The angle on the timing chain cover facing the boss mark of crankshaft is ignition timing.
- If ignition timing is not within $6 \pm 2^{\circ}\text{C}$ loosen the locknuts for distributor housing and adjust it by swinging the housing .swinging anticlockwise increases ignition advance angle, while swinging clockwise reduces it(fig.4-6)

4.2.2.4.2 The type of spark plug is F6T. The surfaces of insulator and electrode must be clean and free from carbon deposit. The electrode gap is $0.7 \pm 0.1\text{mm}$. Within the end face of enter electrode, the gap valve must be more or less the same. It is possible to adjust the electrode gap by moving ground electrode.

When installing and removing spark plug, care must be taken to prevent the screw hole in cylinder head from damage. Replace spark plug if it is faulty.

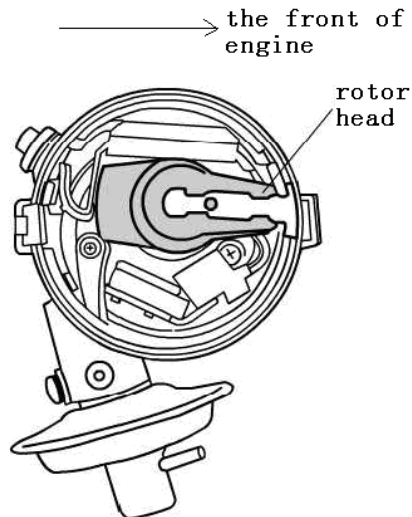


Fig. 4-5 The position of rotor head when the piston in No.1 cylinder is at TDC compression stroke

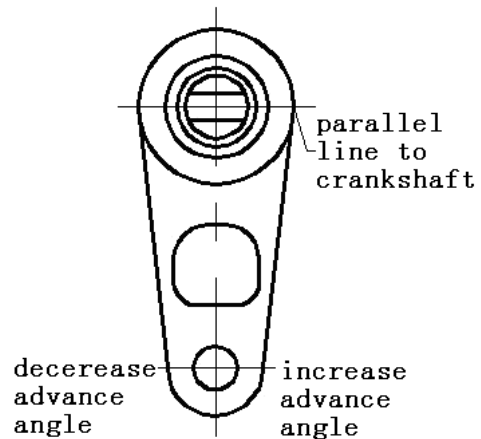


Fig. 4-6 Adjustment of ignition advance angle

4.2.5 SEALING AND UNSEALING ENGINE

When engine will not be used for a long time it must be sealed. After having been stored for a long time, engine must be unsealed before starting.

SEALING:

- A. before sealing, drain all cooling water from cylinder block and wipe the outer surfaces of engine with petrol.
- B. Rotate crankshaft to BDC Position and remove spark plug .Fill 15 gram of SE10W/30 or SE15W/40 car oil into each cylinder. Rotate crankshaft for 5~8 turns and install spark plug.
- C. Apply HDJ—2 special antirust grease to the surfaces of electrical contacts, connects, unplated metal surfaces and surfaces without paint
- D. Loosen fan belt
- E. Seal the water ports, carburetor inlet and tachometer bushing with paraffin paper or plugs.

UNSEALING:

- A. Clear the water ports, carburetor inlet and tachometer bushing with paraffin paper or plugs.
- B. Remove spark plug and race engine. Drain as completely as possible sealing oil from cylinders.
- C. Adjust and retighten fan belt in accordance with specification.
- D. Refill oil.
- E. Refill coolant
- F. Unseal all sealed ports.

CHAPTER FIVE

ENGINE MAIN TROUBLES AND REMEDIES

TROUBLES		CAUSE	REMEDY	REMARKS
1. Engine starting difficulty	a. Starter does not work	<ul style="list-style-type: none"> • Battery pole connecting loosen or electric insufficient • Electric circuit breakaway • Starter damaged 	Tighten or charge Repair Check or Repair	
	b. Spark plug does not firing or Firing Weakness	<ul style="list-style-type: none"> • Ignition coil damaged • Spark plug burned out or isolator damaged • Spark plug carbon deposit or wrong gap • High voltage cable damaged or wrong gap • Low voltage circuit damaged or poor connecting • Capacitor damaged • Distributor cover or firing head damaged • wrong ignition 	Replace Replace Clean Carbon deposit or adjust gap Replace cable or tighten connecter Replace or tighten Replace Replace Adjust	
	c. Fuel supply system problems	<ul style="list-style-type: none"> • Fuel pump does not work • Fuel pipeline blocked or damaged • Carburetor blocked , fuel pressure in the float chamber is too low or wrong adjustment • Mixture too rich or too poor 	Repair or replace Repair or replace Clean or readjust Adjust chock valve and fuel valve	
	d. Cylinder Compression pressure insufficient	<ul style="list-style-type: none"> • Cylinder gasket damaged • Wrong valve clearance • Leakage through valve and valve seat • leakage through intake manifold • Piston ring or cylinder over worn 	Replace Readjust Repair Repair Replace	

2. Lack of power	<ul style="list-style-type: none"> • cylinder compression pressure insufficient • Fuel supply insufficient • Spark plug firing weakness • Wrong adjustment of fuel valve and carburetor • Exhaust blocked 	<p>Done as item 1-d</p> <p>Done as item 1-c</p> <p>Done as item 1-b</p> <p>Readjust</p> <p>Check exhaust system and clear carbon deposit</p>	
3.Over heat	<ul style="list-style-type: none"> • Fn belt loosen or water pump damaged • Insufficient of cooling Liquid or water pipeline blocked • Thermostat does not open • Too much carbon deposit in combustion chamber • Oil too much insufficient or poor • Ignition timing too late or too early • Clutch slipping 	<p>Adjust belt or replace water pump</p> <p>Replenish cooling Liquid or clean water pipeline</p> <p>Replace</p> <p>Clean carbon deposit</p> <p>Adjust oil level</p> <p>Readjust</p> <p>Repair or replace</p>	
4.Carburetor firing back	<ul style="list-style-type: none"> • Ignition timing too late • Over heat • Mixture gas too poor A. Carburetor jet blocked B. Insufficient of fuel supply • Valve leakage • High voltage cable damage 	<p>Adjust</p> <p>Done as item 3</p> <p>Clean</p> <p>Done as item 1-c</p> <p>Adjust clearance or lap the valve</p> <p>Replace</p>	
5.Knocking noise from inside	<ul style="list-style-type: none"> • Ignition timing too early • Too much carbon deposit in combustion chamber • Main bearing connecting rod hearing over worn • Cylinder-piston-piston pin over worn • Piston ring and ring edge over worn • Valve clearance too big. • Balance chain was long-drawn 	<p>Adjust</p> <p>Clean</p> <p>Replace or repair</p> <p>Replace or repair</p> <p>Replace</p> <p>Adjust</p> <p>Replace</p>	
6. Oil consumption excessive	<ul style="list-style-type: none"> • Valve seal worn or damage • The spring of the piston scraper ring reduce or piston ring openings do not stagger • Cylinder worn • Over heat or crankshaft case breathing blocked 	<p>Replace</p> <p>Replace or adjust</p> <p>Repair</p> <p>Reduce heating or clean the orifices</p>	

7.Oil pressure too low		<ul style="list-style-type: none"> • Too much or too less oil • Oil temperature too high • Oil too poor • Oil pipe leakage • Oil filter blocked • Oil pressure meter problem 	Replenish or drain out the oil Check cooling system Replace Repair or replace Clean or replace Replace	
8.Echaust manifold firing back		<ul style="list-style-type: none"> • Fuel level too high in the carburetor float chamber • Exhaust valve leakage • Firing too late 	Drain out the unnecessary fuel and adjust fuel level in the float chamber Lap the valve Adjust ignition angle	
9.Without idle speed		<ul style="list-style-type: none"> • Carburetor valve open too big • Carburetor idle speed jet out of function • Inlet pipe leakage • Spark plug carbon deposit or wrong gap • Ignition timing too early • Fuel supply blocked 	Adjust Adjust or replace Tighten or replace Clean or adjust Adjust Clean	
10. Generator problems	A. Generator does not work	<ul style="list-style-type: none"> • Stator coil or rotor coil breakaway short circuit or bonding • Rectifier tube burned out, breakaway or short circuit. • Pole isolator damaged wire breakaway 	Replace or repair Replace or repair Replace or repair	
	B. Lack of power	<ul style="list-style-type: none"> • Rectifier damaged • Brush contact not good sliding ring oily 	Replace Clear oily	
	C. Abnormal noise	<ul style="list-style-type: none"> • Bearing over loosed distribute noise • Rotor knock with stator • Rectifier short circuit • stator coil short circuit 	Replace or fill grease adjust Replace Replace Replace	
11 Clutch	Clutch slip	<ul style="list-style-type: none"> • Clutch lining oily • Clutch lining worn serious. 	Remove ,clean Replace	

h pro ble m	Clutch vibration and noise	<ul style="list-style-type: none"> • Release bearing moving inefficient or worn • No.1 shaft bearing moving inefficient or worn • Clutch pin hub loosen • pressure plate and spring loosen • Clutch pressure plate crack • Clutch pressure plate crack 	Clean, fill grease or replace Replace Repair Replace or repair Replace Replace	
	Shift easy to slipping	<ul style="list-style-type: none"> • Pressure on locating spring too weak • Locating ball damaged • Synchronism sleeve and engage gear worn 	Replace Replace Replace	
12. Tra ns mis sio n pro ble m	Shaft change difficulty	<ul style="list-style-type: none"> • Synchronizer ring worn • Synchronizer hub worn 	Replace Replace	
	Abnormal noise	<ul style="list-style-type: none"> • Needle bearing or ball bearing damage • Gear worn serious or damage 	Replace Replace	

APPENDIX A

Fit clearances of main components

No	Description	Type of fit	Clearance (mm)	Remarks
1	Connecting rod neck and connecting rod bearing hole	Matching clearance	0.026~0.066	
2	Connecting rod big end side clearance	Shaft direction Clearance	0.08~0.24	
3	First piston ring and cylinder	Gap	0.25~0.45	
4	Second piston ring and cylinder	Gap	0.2~0.4	
5	Piston scraper ring and cylinder	Gap	0.3~0.5	
6	Crankshaft thrust bearing and main shaft neck gap	Shaft direction Clearance	0.05~0.166	
7	Balance shaft and bearing hole	Clearance	0.06~0.106	
8	Cam shaft neck and bearing hole	Clearance	0.050~0.091	
9	Cam shaft direction clearance	Shaft direction clearance	0.09~0.24	
10	Exhaust valve seat and cylinder head	Interference	0.112~0.153	
11	Intake valve seat and cylinder head	Interference	0.112~0.153	
12	Exhaust valve and guide	Clearance	0.04~0.07	
13	Intake valve and valve guide	Clearance	0.025~0.035	
14	Rocker arm shaft and rocker arm hole	Clearance	0.016~0.054	
15	Oil pump external rotor and inner rotor	Clearance	0.05~0.12	
16	Oil pump rotor and oil pump housing end surface	Clearance	0.02~0.065	
17	Oil pump external rotor and	Clearance	0.08~0.158	
18	Piston pin and connecting rod small end	Matching clearance	0.029~0.041	
19	Piston pin and piston smooth pin hole	Matching clearance	0.005~0.011	
20	Piston skirt and cylinder	Matching clearance	0.02~0.04	

21	Crankshaft neck and shaft bearing	Matching clearance	0.020~0.044	
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APPENDIX B

TIGHTENING TORQUE

Description		Torque N • m(kg • m)	Remarks
Cylinder head Bolt		68.6~73.5(7~7.5) 78.5~83.4(8~8.5)	Cold Hot
Camshaft Bearing Cap		24.5~29.4(2.5~3)	
Camshaft Sprocket		58.8~78.5(6~8)	
Main Bearing Cap		58.8~68.6(6~7)	
Timing Chain Cover (Including water pump)		14.7~19.6(1.5~2)	
Sprocket Tensioner		49.0~58.8(5~6)	
Crankshaft pulley		49.0~58.8(5~6)	
Flywheel		40.0~45.0(4.1~4.6)	
Counterweight		24.5~29.4(2.5~3)	
Balancing sprocket		17.7~21.6(1.8~2.2)	
Con. Rod Cover		34.3~39.2(3.5~4)	
Oil Pan plug		34.3~44.1(3.5~4.5)	
Oil filter		20~25(2.1~2.6)	
Spark Plug		10.8~12.7(1.1~1.3)	
Transmission Assembly(M12)		26.4~39.2(2.7~4.0)	
Transmission level plug		39.2~49(4~5)	
Transmission Drain Plug		39.2~49(4~5)	
cooling fan		4.9~7.8(0.5~0.8)	
Spark plug		19.6~29.4(2~3)	
Other bolts	M5	3.9~5.9(0.4~0.6)	
	M6	9.8~7.8(0.8~1.0)	
	M8	14.7~21.6(1.5~2.2)	

APPENDIX C

SEALING SURFACES AND SEALIANT

DESCRIPTION	Position of painting	SEALANT
Oil Pan Gasket	The surfaces jointing cylinder block	609sealant
Cylinder head Gasket	The Surfaces Jointing t. The Circumference of Cylinder block Top Surface And Timing Chain Cover Top Surface.	Ditto
Front And Rear Semi-circle Oil Seals Of Cylinder head	The Area With A Width Of 10mm on each side of Top Surfaces Of semicircle Oil Seals And The Area With A Width Of 10mm Jointing Cylinder head Top Surfaced	Ditto
	The Curved Surfaces Of Semi-Circle Oil Seal	Ditto