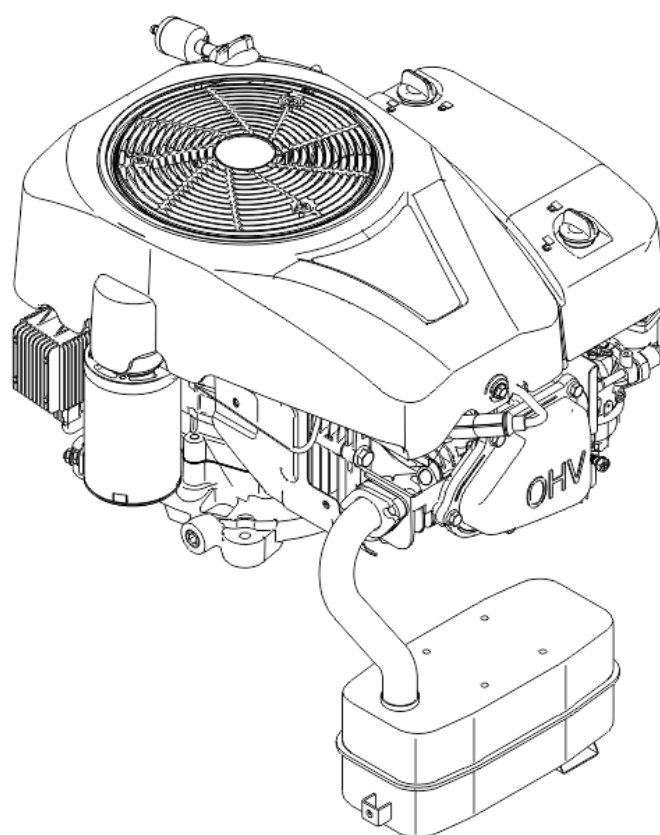




RV550

Service Manual



Chongqing RATO Technology Co., Ltd.

This Manual covers specifications that shall be followed in the process of regular maintenance and service and troubleshooting of general-purpose gasoline engine products.


Make sure the product's maintenance staff can refer to this Manual at any time.


This Manual describes correct methods to service this equipment. The Company does not undertake any liability for any personal casualty and equipment damage caused due to ignoring these rules.


Note:


The copyright of this Manual belongs to the Company, it is not allowed to reproduce it without written consent of the Company, and corresponding responsibility will be taken for violation.

Safety Warnings

It's very important to keep you and other's safety. Please carefully read the extremely important safety warnings that we have described in the Service Manual and on the engine. There is the symbol  and one of three kinds of tips (Danger, Warning, Caution) in front of each safety warning. Details are as follows:

-  WARNING** Failed to follow instructions, extremely serious injury or death will be caused.

-  WARNING** Failed to follow instructions, very serious injury or death may be caused.

-  CAUTION** Failed to follow instructions, the injury may be caused.

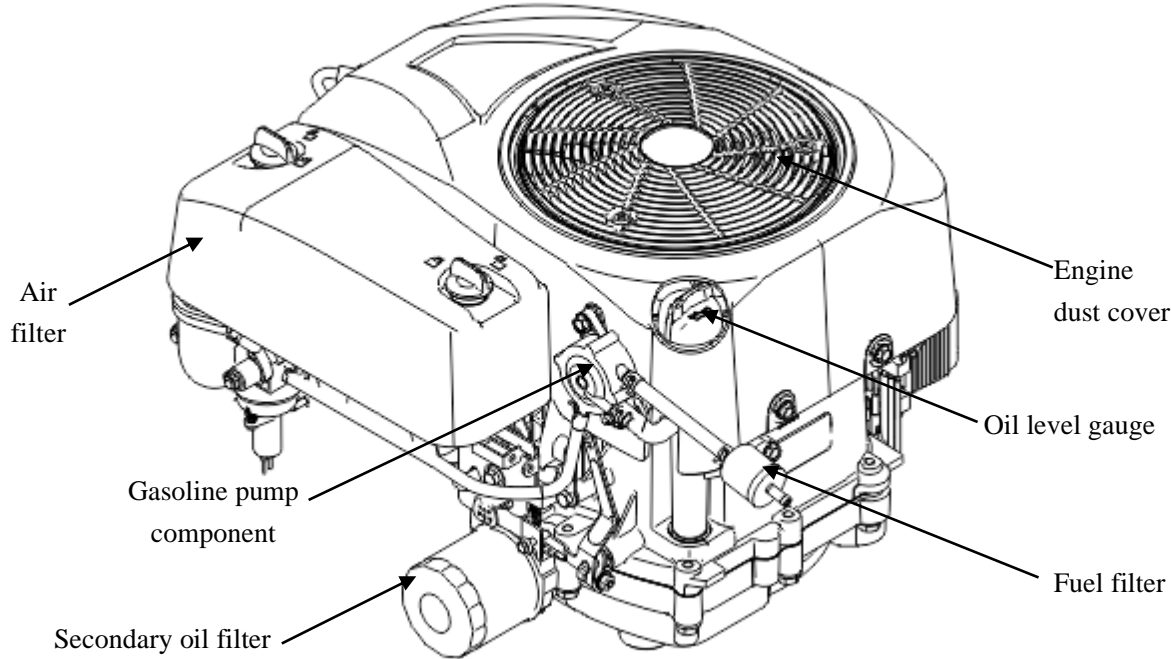
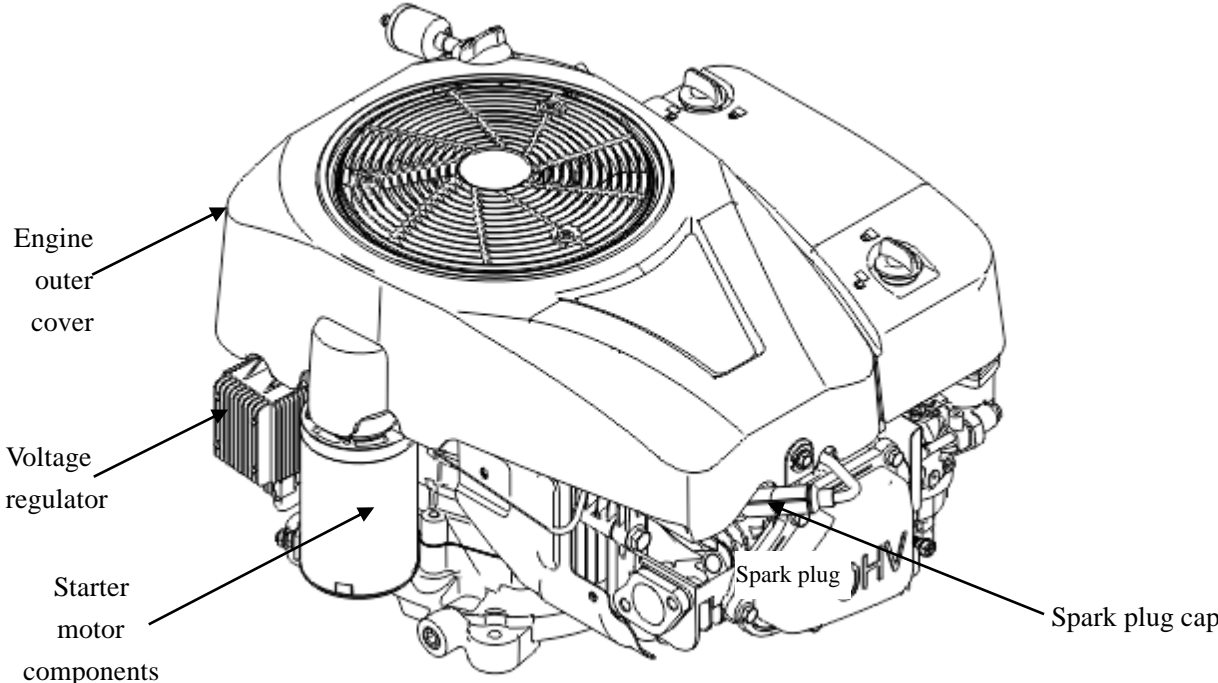
- NOTE** Failed to follow instructions, your gasoline engine and other properties may be damaged.

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Part I Introduction

1-1 Components of general-gasoline engine



1-2 Parameters

Model	RV550D
Specification parameters	
Length*width*height	480*406*315 (mm) (no muffler)
Net weight	32 kg
Type of gasoline engine	Horizontal single-cylinder, four-stroke, overhead valve (OHV)
Air displacement	547 cm ³
Cylinder diameter x stroke	94.5 mm × 78 mm
Theoretical maximum power	12.2 kW/3,600 r/min
Recommended service power	8.8 kw/2,700 r/min
Maximum torque	36.2 N·m/2,500 r/min
Fuel consumption	≥ 374 g/kW·h
Cooling system	Forced air cooling
Ignition system	Inductance type
Power output mode	Vertical axis output

1-3 Maintenance

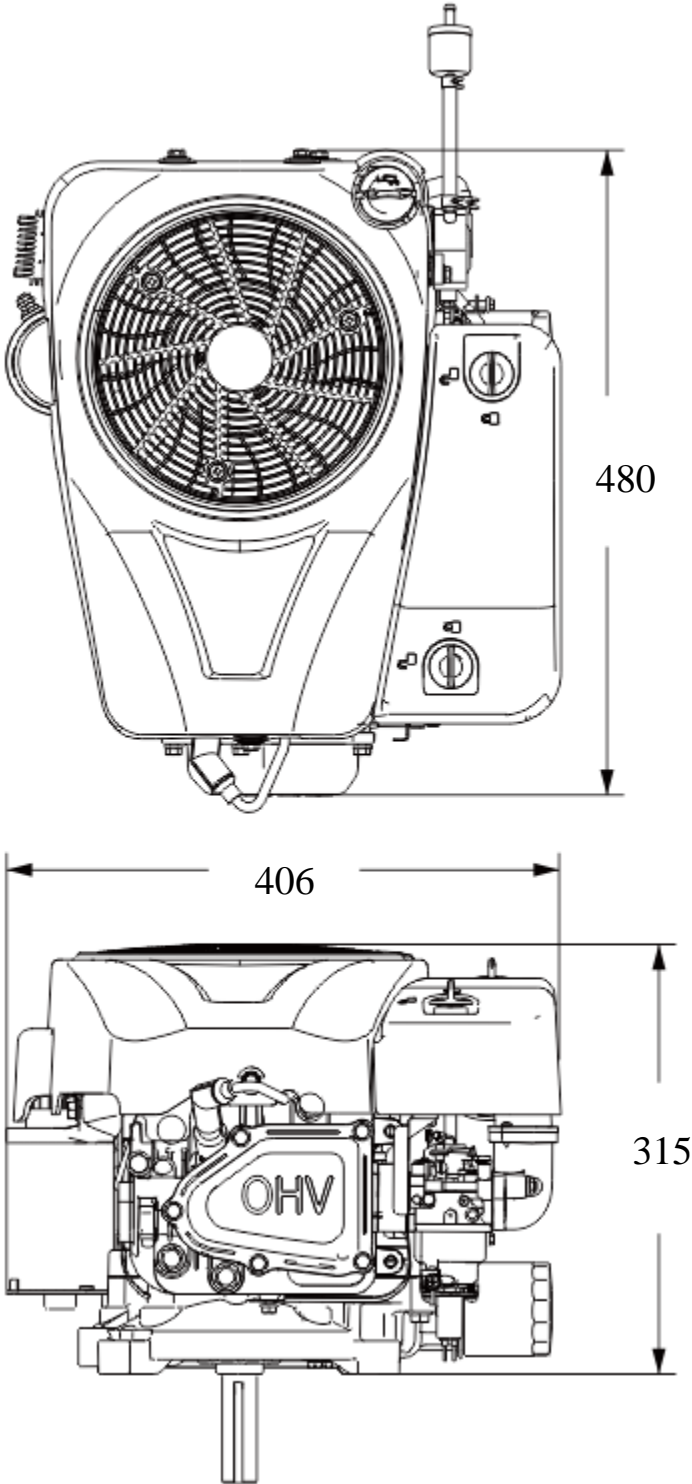
limit Unit: mm

Parts	Item	Standard	Service limit
Gasoline engine	Maximum speed without load	3,000 ± 100 rpm	-
	Idle speed	1,900 ± 100 rpm	-
	Cylinder pressure	≥ 1.05 Mpa/1,400 rpm	-
Cylinder	Cylinder inner diameter	94.5	94.665
Cylinder head	Warping	--	--
Piston	Outer diameter of piston skirt	94.46-94.47	94.36
	Piston-cylinder clearance	0.03-0.055	0.12
	Inner diameter of piston pinhole	20.002-20.008	20.052
	Outer diameter of piston pin	19.992-19.998	19.9
	Piston-piston pin hole clearance	0.007-0.024	0.5
Piston ring	Piston ring side gap: Ring 2	0.02-0.07	0.135
Connecting	Inner diameter of small end	20.005-20.016	20.052

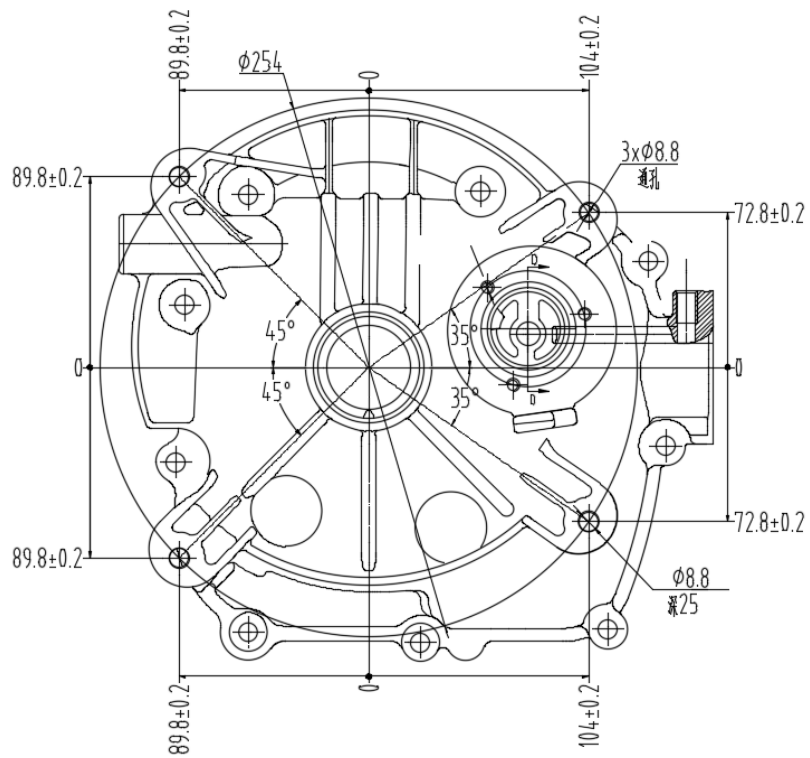
rod	Inner diameter of big end		38.010-38.022	38.066
	Big-end oil-film clearance		0.030-0.055	0.12
	Clearance of big end side		0.1-0.75	1.8
Crankshaft	Outer diameter of crankshaft		37.967-37.98	37.92
Air valve	Valve clearance	Intake	0.15-0.20	0.5
		Exhaust	0.15-0.20	0.5
	Outer diameter of valve stem	Intake	6.563-6.575	6.418
		Exhaust	6.548-6.56	6.375
	Inner diameter of Conduit	Intake/Exhaust	6.60-6.615	6.662
	Width of valve seat		1	2.2
	Free length of spring		39.5	38
Camshaft	Camshaft height	Intake	31.5	31.3
		Exhaust	31.5	31.3
	Outer diameter of camshaft		14.966-14.984	14.916
Crankcase cover	Inner diameter of camshaft carrier		15.0	15.2
Spark plug	Clearance		0.6-0.8	-
Spark plug cap	Resistance		8 k Ω -12 k Ω	-
Ignition coil	Air gap (at the flywheel)		0.3~0.6 mm	-

Part II Dimension and Torque

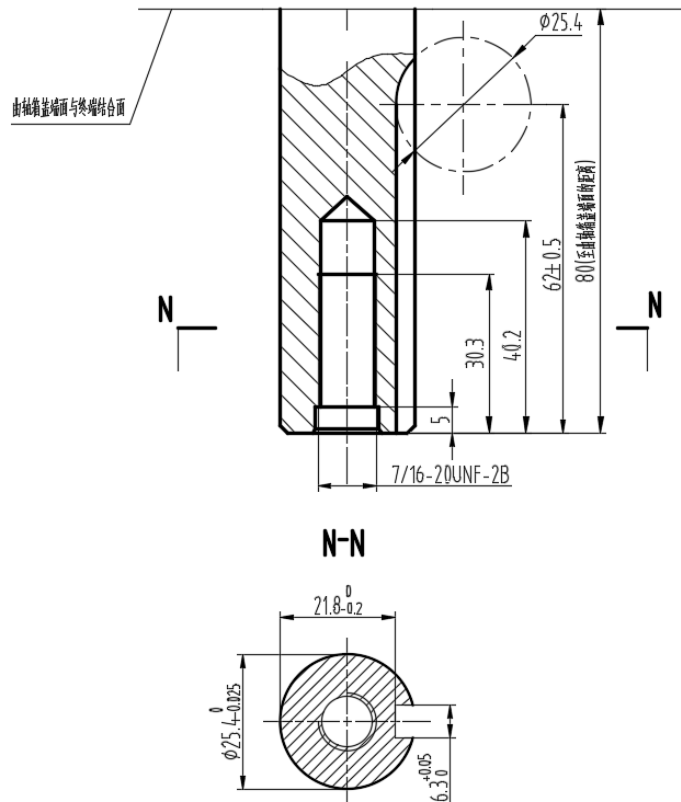
2-1 Dimensions of general-purpose gasoline engine



2-2 Locations of mounting holes



2-3 PTO installation drawing



2-4 Torque parameters

Fastening position	Fastening part	Torque (N·m)
Oil drain plug	3/8-18NPTF	20 ± 2
Connecting rod bolt	M8 × 38	16 ± 1.5
Mounting bolt of governor gear	M6 × 14	10 ± 2
Closure bolt (special bolt)	M8 × 45	24 ± 2
Assembly of spark plug	M14 - 1.25	22 ± 2
Rocker arm shaft bolt	M8 × 1.25	24 ± 2
Valve locking nut	M6 × 0.75	10 ± 1
Cylinder head cover mounting bolt	M6 × 16	10 ± 2
Mounting bolt of breathing tank cover plate	M6 × 16	6 ± 1
Assembly of cylinder head	M10 × 60	45 ± 3
Assembly of cylinder head	M8 × 50	24 ± 2
Breathing plate combination	M4 × 10	1.5 ± 0.5
Starter motor components	M8 × 55	24 ± 2
Charging coil combination	M5 × 25	7 ± 1
Flywheel nut (cast iron flywheel)	M16 × 1.5	160 ± 10
Ignition coil mounting bolt	M6 × 25	10 ± 2
Air filter intake pipe	M6	10 ± 2
Mounting nut of governor bracket	M6	7 ± 1
Muffler components	M8	24 ± 2

Note: refer to the standard torque for the bolt, screw and nut without special provisions.

2-5 Standard torque parameters

Fastening part	Thread specification	Torque (N·m)
Bolts and nuts	5 mm bolt and nut	4.5-6
	6 mm bolt and nut	8-12
	8 mm bolt and nut	18-25
	10 mm bolt and nut	29-34
	12 mm bolt and nut	49-59
	4 mm screw	1.5-2.6
	5 mm screw	3.5-5
	6 mm screw	7-11
	5 mm flange bolt	3.6-6.9
	6 mm screw	7-11
	5 mm flange bolt	3.6-6.9
	6 mm flange bolt	10-14
	8 mm flange bolt	20-26
	10 mm flange bolt	35-45

Part III Maintenance

3-1 Maintenance list

Maintenance period Item		Every time	1st month or 10 hours at the first time	Every 3 months or 20 hours	Every 6 months or 50 hours	Every year or 100 hours
Gasoline engine oil	Check-fill	√				
	Replace		√		√	
Air filter element	Check	√				
	Clean			√		
	Replace				√	
Spark plug	Clean-adjust				√*	
Spark arrester	Clean				√	
Valve clearance**	Check-adjust					√
Fuel pipe	Check	Every two years (please replace it if necessary)				
Cylinder head and piston	Clear carbon deposits**	Every 200 hours;				
*The item shall be replaced if necessary; **These items shall be maintained by the dealer authorized by our company, unless the user has proper tools and maintenance capability.						

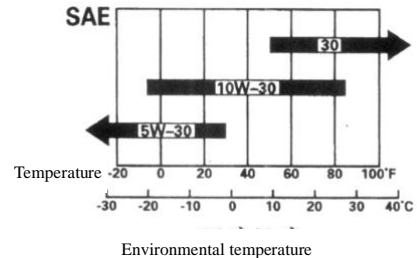
NOTICE

- The oil shall be replaced every 10 h if it is frequently operated under high temperature or high load.
- The air filter element shall be cleaned every 10 h if it is frequently operated in dusty or harsh environment; the air filter element shall be replaced every 25 h if necessary.
- The maintenance shall be carried out on the basis of first come for the spot inspection period and time.
- If the maintenance interval has expired, the maintenance shall be carried out according to the above table as soon as possible.

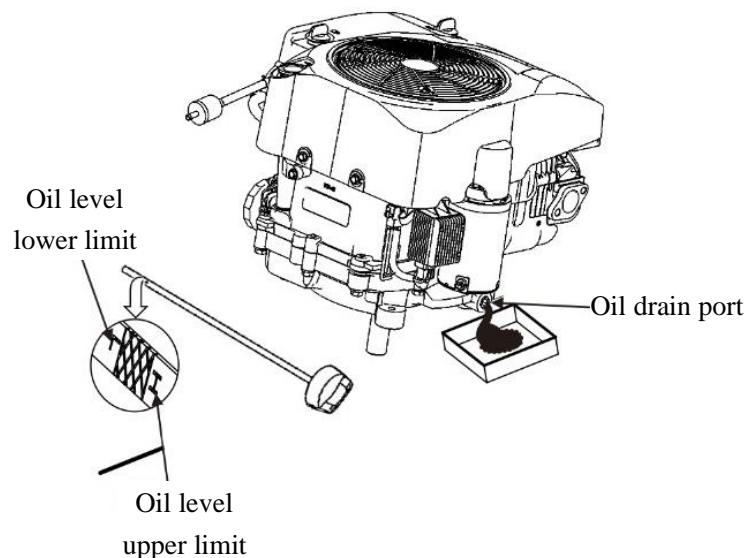
3-2 Oil

NOTICE

- **The gasoline engine oil is the main factor affecting the performance and service life of gasoline engine. It is recommended not to use the oil including additives and two-stroke engine oil, or the service life of the gasoline engine will be shortened due to their insufficient lubricating property.**
- **The engine shall be powered off and placed on a horizontal level during the inspection of the oil.**
- **Oil capacity: RV550 1.5L**



SAE10W-40 is the recommended general-purpose oil at common temperatures; the oil with other stickiness could be used when the temperature in your area is within the range shown in the chart.



Inspection steps:

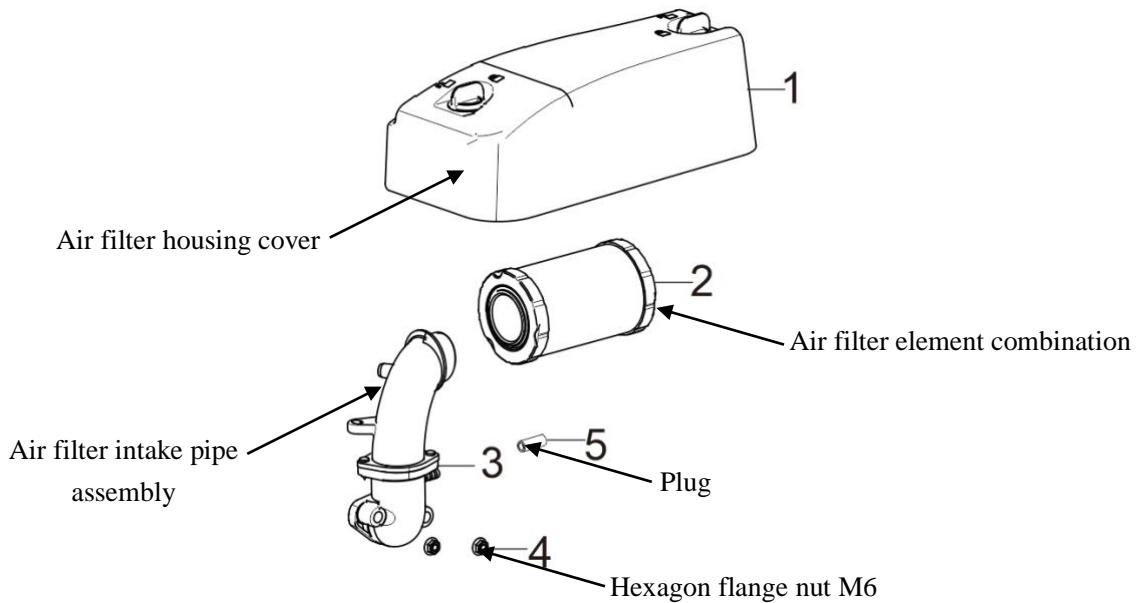
- Remove the oil level gauge and wipe off the oil.
- Insert the oil level gauge into the filling inlet, don't twist it, check the oil level.
- The oil level is low if no oil is on the oil level gauge, fill the recommended oil to 2/3 of the grid mark of the oil level gauge.
- Reinstall the oil level gauge.

Replacement of oil:

NOTICE

- **There is harmful substance in the waste oil, if the skin contact with the waste oil for a long time, it may lead to skin cancer. Clean your hands thoroughly with soap and water as soon as possible after contact with the waste oil.**
 - **In discharging, the waste oil shall be drained into a container, no pollution shall be made to the environment.**
- a) Screw out the oil level gauge.
b) Tilt the gasoline engine to make the oil be drained from the oil hole.

3-3 Air filter



The gasoline engine's air filter shall be cleaned every 20 h or 3 months, and the air filter element shall be replaced every 50 h. (Cleaning times shall be added in harsh environment, and replacement shall be made if necessary)

- Remove the air filter housing cover and take out the filter element.
- Replace damaged filter element.
- Clean the filter element before reuse

Cleaning of filter element:

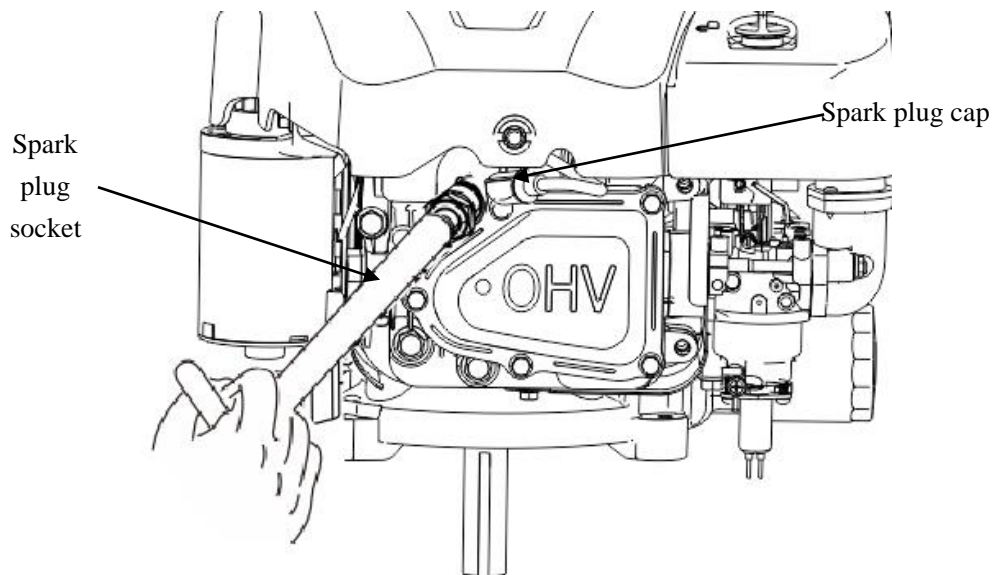
Foam filter element	Clean the filter element with solvent and dry it.
	Impregnate the filter element into oil and squeeze out the excess oil. The filter element shall be oily, but there shall be no dropping oil.

Paper filter element	Blast compressed air from inside or slightly knock it to remove the dust. It shall be replaced in case of very dirty.
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- Be careful not to let dust enter the carburetor when wiping off the air filter cover
- Reinstall the filter element into the housing and place the housing cover on.

3-4 Spark plug

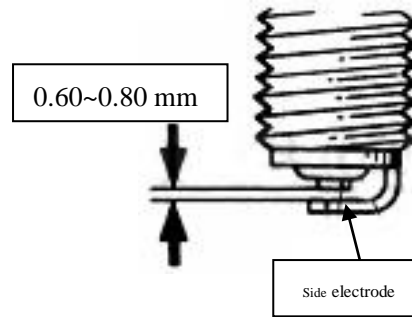
- Remove the spark plug cap and clean the debris around the spark plug.
- Disassemble the spark plug with special socket and handle of the spark plug.



- Check the spark plug visually, if there is obvious wear or damaged insulator, it shall be replaced with a new one; if it is still operable, clean it with wire brush.



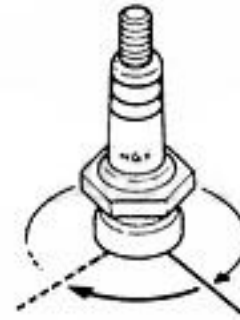
- Measure the spark plug clearance with feeler gauge, the proper clearance shall be 0.60-0.80 mm; if adjustment is required, tap (when the clearance is large) it or gently pry up the electrode with a straight screwdriver (the gap is too small).



e) In order to prevent disorderly thread, screw in the spark plug with hand, tighten it with special socket, and then tightly press the washer.

f) If a new spark plug is installed, an additional 1/2 turn shall be tightened after pressing the washer.

g) If a used spark plug is reinstalled, an additional 1/8~1/4 turn shall be tightened after pressing the washer.

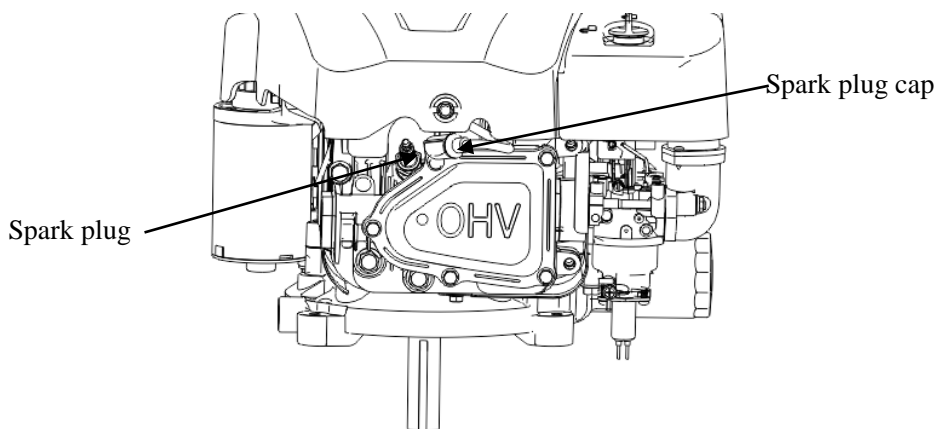


Spark plug torque value: 22 ± 2 N·m

Spark plug model: F6RTC

NOTICE

The spark plug must be tightened properly, or it may be extremely hot and damages the gasoline engine. The recommended spark plug or its equivalent products shall be used, incorrect calorific value range of spark plug will cause damage to the gasoline engine.

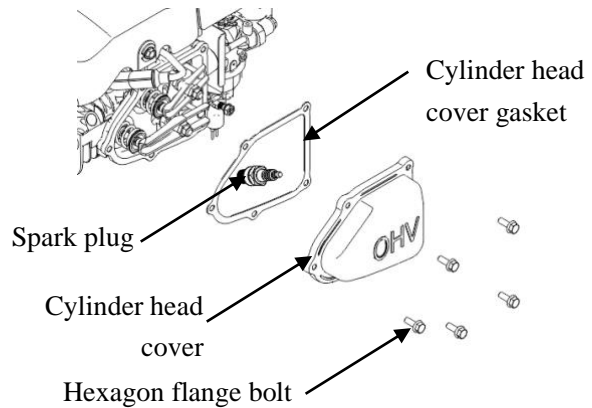


3-5 Adjustment of valve clearance

NOTICE

The valve clearance must be measured when the gasoline engine is cold.

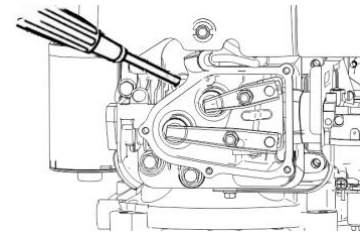
- a) Remove the bolts (M6×16), cylinder head cover, gasket, spark plug cap and spark plug in turns



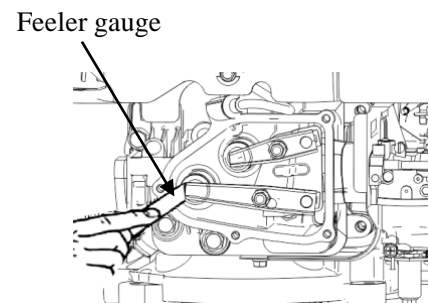
NOTICE

The oil will overflow after removing the cylinder cover, wipe off the spilled oil.

- b) Rotate the crankshaft slightly to make the piston be at the top dead center of the compression stroke, be careful the false timing, (insert the screwdriver into the spark plug hole to detect the height of the plug)



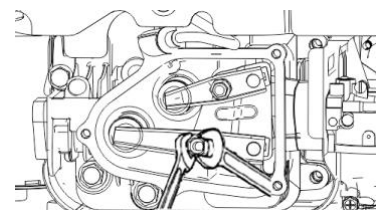
- c) Loosen the valve lock with 10 mm wrench, the spacing between the valve lock top surface and the valve adjusting nut top surface shall be about 3 mm



- d) Put the 0.15 mm feeler gauge at the location shown in the drawing

- e) Tighten the valve lock with 14 mm wrench or loosen the valve adjusting nut until there is a resistance when moving the feeler gauge

- f) Fix the 14 mm wrench, tighten the valve



lock with 10 mm wrench

Locking torque: about 8 N·m~12 N·m

g) Take out the 10 mm and 14 mm wrenches, measure the air valve clearance with the feeler gauge slightly; if the clearance is too large or small, repeat the steps c~f;

h) Adjust the valve clearance of another air valve with the same method;

i) Power on the engine, observe whether the valve rocker is operated normally; if it is abnormal, it indicates that the top dead center is false timing, turn the engine to true timing and repeat the above steps.

j) Mount new gasket to make it tightly connect with the cylinder head.

k) Install the cylinder head cover, tighten 4 bolts according to specified torques.

Torque values: 10 ± 2 N·m

Standard value of valve clearance	
Intake valve	0.10-0.15 mm
Exhaust valve	0.15-0.20 mm
Adjusting nut	Valve clearance
Tighten	Decrease
Loosen	Increase

NOTICE

Excessive gap: Late opening of intake and exhaust valves shortens the intake and exhaust time, reduces the valve opening height, changes normal valve timing and decreases the gasoline engine's power due to insufficient air intake and incomplete air exhaust; additionally, it also increases the impact of valve system parts and accelerates the wear.

Excessive little clearance: After the gasoline engine is operated, the part is heated and expanded to push the valve open and make the valve close loosely, which will cause air leakage, power reduction, and serious carbon deposition or burning on the sealing surface of the valve, and even the valve strikes the piston.

3-6 Governor

Governor adjustment:

The machine speed under mower status has been adjusted before delivery, no adjustment shall

be done when using.

Part IV Disassembly and Maintenance

4-1 Troubleshooting

4-1-1 Start difficulty

Phenomenon		Cause		Remedy	
Normal cylinder compression	Normal spark of spark plug	Abnormal fuel system	Impeded fuel flow or no fuel flow	There is no fuel in fuel tank	Refuel
				Clogged venthole of fuel tank cap	Dredge
				Main measuring hole is improperly adjusted or blocked	Re-adjust or clean, blow through
				Float needle hole is blocked	Remove needle valve for repairing, cleaning and blowing through
				The floater is stuck or damaged	Repair the floater
			Unobstructed fuel flow	Fuel is too dirty or deteriorated	Replace fuel
				There is water in fuel	Replace fuel
				There is excessive fuel in the cylinder	Drain the fuel, and wipe and dry spark plug electrode
	Normal fuel supply system	Spark of HV wire is normal	Spark plug is poor	Electrode is dirty with carbon deposit	Remove the dirt and carbon deposit
				Insulator is damaged, electrode is severe ablated	Replace the spark plug
				Electrode gap is incorrect	Adjust electrode gap
		HV wire has no spark	Spark plug is normal	HV line is damaged	Replace the HV line
				Ignition coil is damaged	Replace the ignition coil
				Magnet is demagnetized	Replace the flywheel
			The clearance between ignition coil and flywheel is abnormal	Adjust the clearance between ignition coil and flywheel	
Phenomenon		Cause		Remedy	
Cylinder compression is poor	Normal fuel supply system	Normal spark of spark plug	Piston ring wear exceeds the limit	Replace complete set of new ring	
			Piston ring is broken	Replace complete set of new ring	
			Piston ring is stuck	Clear carbon deposit	
			The spark plug is not provided with sealing gasket or is not tightened	Mount the gasket and tighten it	
			Air leakage of joint face between the cylinder body and cylinder head	Check the flatness of joint face of cylinder pad and cylinder body and cylinder head	
				And tighten cylinder cover bolts according to specified torque and sequence	

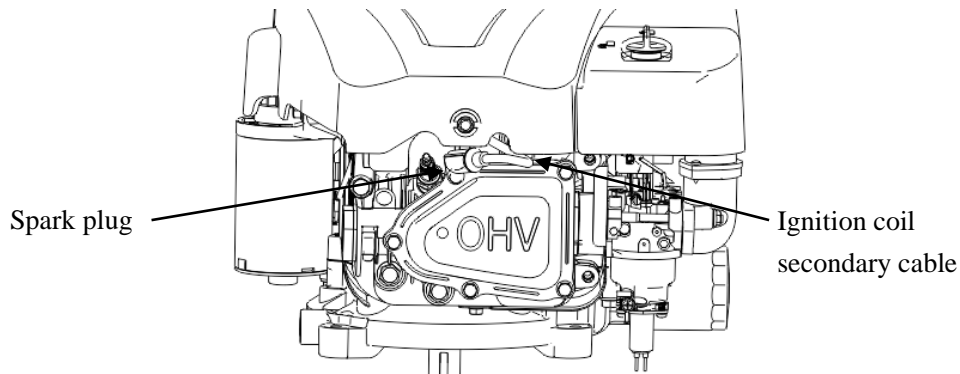
			Valve leakage	Check valve clearance and valve tightness, repair when necessary
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If gasoline engine is still unable to be started, please send it to authorized dealer of the Company for overhaul.

● **Spark detection**

▲ WARNING

- **Ensure that there is no spilled fuel outside the gasoline engine and the spark plug is not soaked by fuel.**
- **In order to prevent fire, keep sparks away from spark plug mounting hole.**
- **When doing testing to the spark plug, it is strictly prohibited to hold the spark plug with wet hand.**



- When operating, put the fuel switch in the "OFF" position, and drain off the fuel in the carburetor.
- Remove the spark plug cap and spark plug.
- Pull the starter handle to release unburned gas out of the cylinder.
- Assemble spark plug cap.
- Ground the negative electrode (threaded part) of spark plug via the cylinder head, pull the starter handle to observe the spark condition.

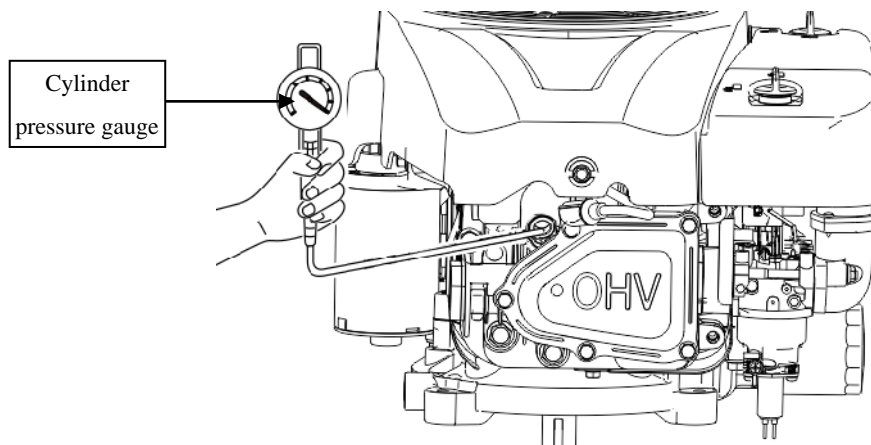
4-1-2 Underpowered

Phenomenon	Cause		Remedy
When raising the throttle, the speed increases slowly, and the speed decreases or the engine shuts down	Fuel supply system	There is air in oil way or oil way blockage	Exhaust and dredge oil way
		Needle valve hole and the main hole are blocked in the carburetor	Clean, and blow through
		Fuel tank switch is clogged	Clean and replace damaged part

when it is serious		Combustion-chamber deposit	Clear carbon deposit
		Carbon deposit in the muffler and exhaust pipe	Clear carbon deposit
		Blockage of air filter	Clean filter element
		Leakage of air intake system	Repair or replace
	Poor compression	Wear of piston, cylinder and piston ring	Replace worn parts
		Valve clearance is excessive (excessive little)	Readjust
		Valve seal is not sealed tightly	Repair

● **Cylinder pressure inspection**

Please send to the authorized dealer of the Company for repair.



4-1-3 Unstable speed

Phenomenon	Cause	Remedy
There is knocking noise in gasoline engine	Excessive wear of piston, cylinder and piston ring	Replace worn parts
	Excessive wear of piston pin and pin hole	Replace the piston or piston pin
	Excessive wear of small end of connecting rod	Replace the connecting rod
Deflagration	Gasoline engine overheating	Find the cause and eliminate
	Combustion-chamber deposit	Clear carbon deposit
	Unqualified gasoline	Replace qualified gasoline
Misfire of gasoline engine	There is water in float chamber	Clean the float chamber
	Electrode clearance of spark plug is improper	Adjust electrode gap
	Ignition coil failure, etc.	Check and replace damaged parts

4-1-4 Unable to Ignite

Phenomenon	Cause		Remedy
Unable to Ignite	Fuel supply system	Fuel used up	Refuel
		Carburetor is clogged	Check oil way and dredge it
		Fuel leakage of float chamber	Repair float needle valve
		Needle valve is stuck	Disassemble the float chamber, and remedy the trouble
	Ignition system	Spark plug is broken through with carbon deposit and short circuit	Replace the spark plug
		The side electrode of the spark plug fell off	Replace the spark plug, and remove fallen object
		Falling-off of HV line	Re-welding
		Breakdown and short circuit of ignition coil	Replace the ignition coil
		Shutdown line is placed on the body	Find short circuit point and re-insulate
	Other	Severe cylinder scraping, falling-off of the valve	Repair and replace damaged parts

4-1-5 Overheating of general-purpose gasoline engine

Phenomenon	Cause	Remedy
Gasoline engine overheating	Insufficient oil	Fill sufficient oil
	Exhaust port is blocked	Clean exhaust port
	Leakage of air deflector	Repair damaged place
	Sundries blockage in the middle of cooling fins	Clean cooling fins
	Deformation of connecting rod causes the wears of the piston and cylinder liner edge	Replace the connecting rod
	Wears of cylinder, piston and piston ring causes air leakage between cylinder and crankcase	Replace worn parts
	Gasoline engine governor is improperly adjusted, causing the speed to be too high	Re-adjust the governor

4-1-6 Abnormal sound

Phenomenon	Cause	Remedy
Knocking noise	Wear of piston, cylinder and piston ring	Replace worn parts
	Wears of piston, cylinder and piston ring	Replace worn parts
	Piston ring is broken	Replace piston ring
Produce metal knocking sound during deflagration	Excessive carbon deposit in combustion chamber	Clear carbon deposit
	Fuel label is incorrect	Replace fuel
	Gasoline engine overheating	Find the cause and eliminate
Other	The valve clearance is improperly adjusted	Re-adjust the valve clearance
	Loose connection between flywheel and crankshaft	Reinstall

4-2 Pre-maintenance Preparations

4-2-1 Safety factors

▲ WARNING

Failure of observing the following precautions will cause the void of warranty commitment provided with gasoline engine, and it may damage the gasoline engine or cause personal injury. Therefore, before operating gasoline engine, the user shall pay special attention to following points:

- 1) Strictly carry out the matching according to power shown on the nameplate. It is strictly forbidden to operate under overload and over-speed condition or low load and low speed for a long term.
- 2) Apply fuel and oil with code designation, which must be fully precipitated and filtered before use. Refueling appliance shall be maintained clean, and the oil shall be replaced regularly.
- 3) Check the tightness of fastening bolts of the gasoline engine regularly, and tighten them in time.
- 4) Replace the air filter element every 50 h.
- 5) This engine is air-cooled gasoline engine, so the debris and dirt on cooling fins, air

deflector and other components shall be removed in time to ensure normal cooling of the gasoline engine.

6) The operator shall be familiar with the working principle and structure of the gasoline engine, and understand how to operate emergency shut-down and all control components. Adhere to regular maintenance and service, and eliminate the fault found in time, and prohibit continuous operation of gasoline engine after the failure.

7) When operating, please make sure that the gasoline engine shall be at least one meter away from the building and other equipment, and maintain good ventilation. Do not place flammable materials (such as gasoline and matches) nearby the gasoline engine or close to running gasoline engine to avoid fire.

8) Refuel at a well-ventilated place. The engine shall be shut down when refueling. Do not smoke or make naked flame or spark in the place where gasoline engine is fueled or in fuel storage site.

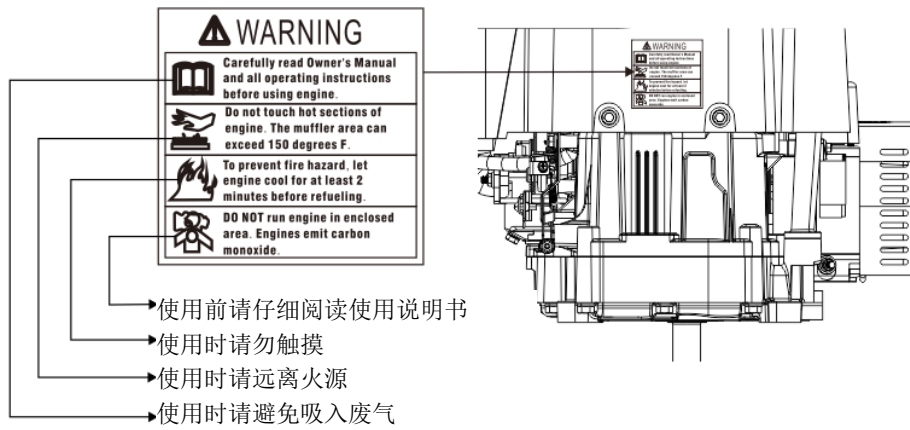
9) Do not overfill the fuel tank to cause overflowing of fuel. If there is fuel spilling, it must be thoroughly removed, and gasoline engine shall not be started until spilled fuel is volatilized.

10) Do not operate the gasoline engine in a confined place or poorly ventilated place.

11) When the gasoline engine is running and within a period of time after it is shut down, it is strictly forbidden to touch the muffler to avoid scalding. In order to avoid getting burnt or fire, the gasoline engine shall not be handled or stored until it cools down.

12) Safety warning label

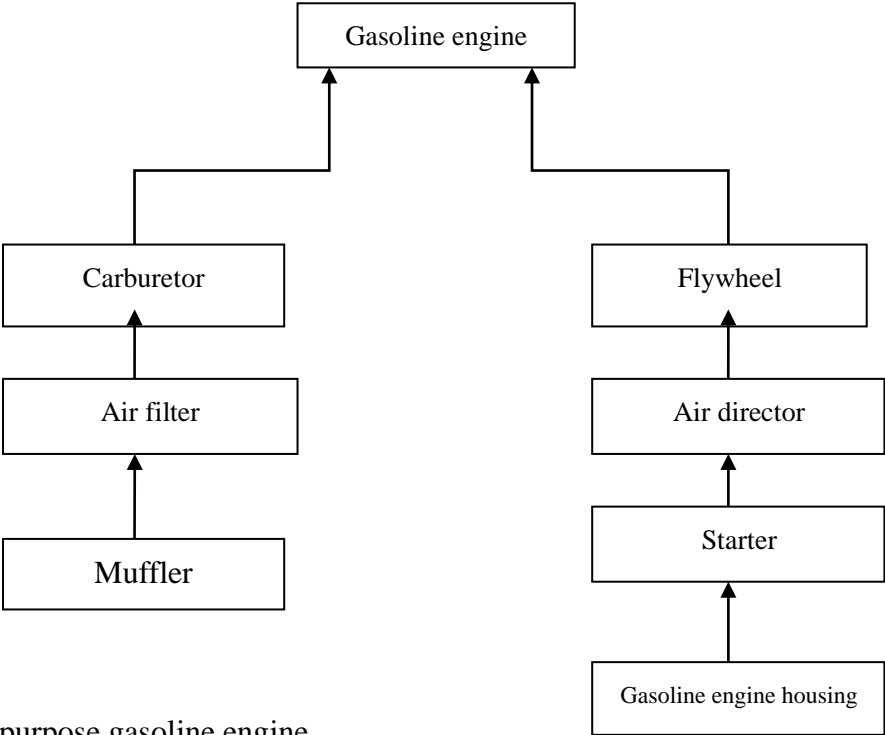
Please read the warning label carefully before operating the engine; our company will not be liable for the personal injury or equipment damage caused by ignoring the warning label.



4-2-2 Special tools

Tool name	Application location·Remarks
(I) Float height gauge	Correction of intake and exhaust valve seat surface
(II) Valve guide replacer	Correction of intake and exhaust valve seat surface
(III) Outer seat ring assembler	Disassembly of flywheel
(IV) Assembler handle	
(V) Inner seat ring assembler	
(VI) Diamond grinder 45°	
(VII) Diamond grinder 32°	
(VIII) Flywheel puller	
(IX) Bearing puller	
(X) Valve guide reamer	

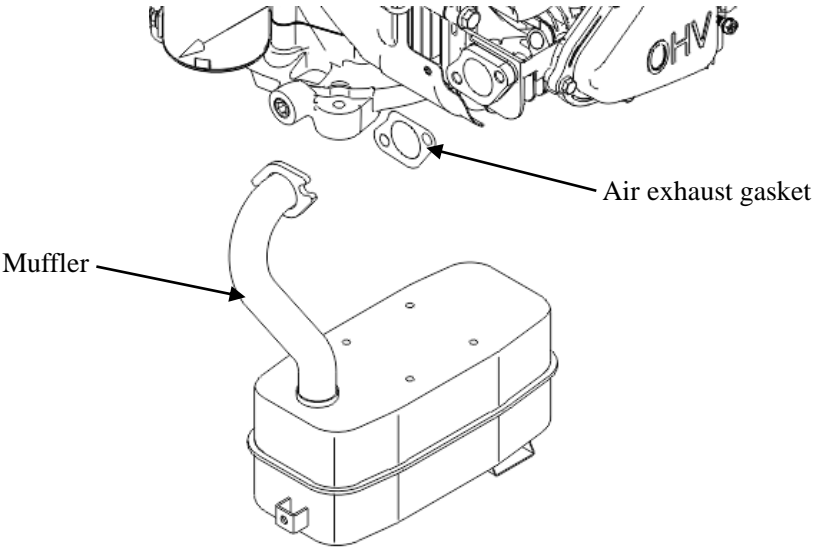
4-3 Disassembly chart



4-4 general-purpose gasoline engine

4-4-1 Muffler

a) Disassembly/assembly



Disassemble the muffler according to the above drawing

In the process of long-term using, the muffler will produce the carbon deposit which causes a serious impact on the exhaust system. In order to make the exhaust system work better, we often need to remove the carbon deposit of the muffler.

When removing the carbon deposit inside the muffler, it is allowed to slightly knock with hammer and blow away with compressed air.

If the muffler has water droplets and is seriously corroded, which increases the exhaust noise, it shall be replaced with a new one.

NOTICE Don't clean it with iron wire, or the sound proofing material might fall off, which will reduce the silencing performance.

The muffler sealing gasket can't be reused.

▲ WARNING

- **The muffler will get heat, please put this gasoline engine at a place that the passersby and children can't accessible.**
- During the operation of the gasoline engine, any combustible good shall not be placed near the exhaust port.

▲ WARNING

Don't smoke or use open fire near the combustible solvent.

b) Cleaning/installation

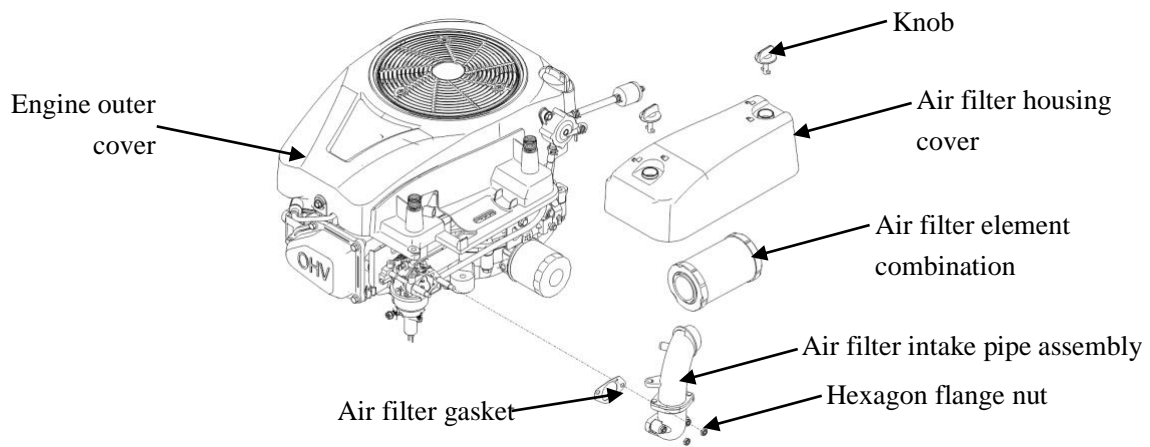
- Inspect whether there is any crack or oil leak of oil pipe.
- Fill fuel into suitable container.

c) Installation precautions

- Whether the fuel filter screen is clogged or damaged;
- Whether fuel hose is aged or broken;
- If there is any problem, it shall be replaced in time and then assembled.

4-4-2 Air filter

a) Disassembly/assembly



b) Installation precautions

- Inspect the air filter gasket for damage before assembling,
- Pay attention to the installation direction, looking from the air filter side.
- Confirm the deterioration and damage condition of flue gas leading before assembling, and replace it if necessary.

NOTICE

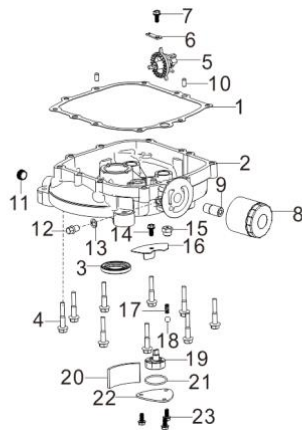
- **Do not clean foam filter element with gasoline, acidic, alkaline or organic solvents.**
- **Do not pull and wring the sponge forcefully as this will damage it.**

▲ WARNING

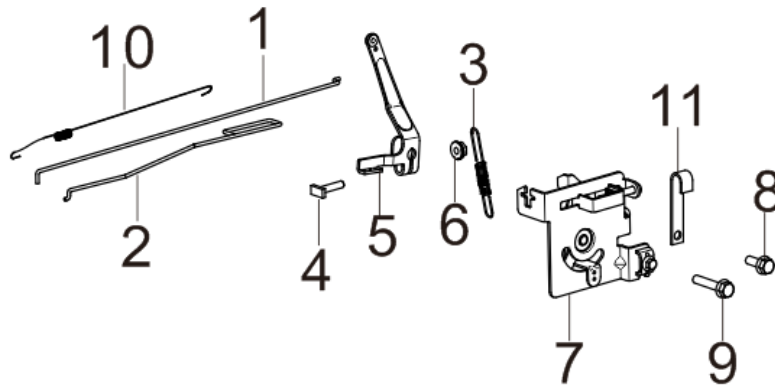
Be sure not to start the gasoline engine before the air filter is mounted, which will cause the gasoline engine to wear out quickly.

4-4-3 Governor

Disassembly/assembly



Serial number	Part name	Serial number	Part name
1	Crankcase gasket	13	Flat washer
2	Crankcase cover assembly	14	Hexagon flange bolt
3	Oil seal	15	Pressure relief bolt
4	Hexagon flange bolt	16	Screen cover
5	Speed control gear components	17	Pressure relief valve spring
6	Speed regulating core shaft press plate	18	Steel ball
7	Hexagon flange bolt	19	Oil pump component
8	Secondary oil filter	20	Oil screen
9	Oil filter mounting tube	21	Rubber o-ring
10	Location pin	22	Oil pump cover
11	Oil drain plug	23	Hexagon flange bolt
12	Oil drain plug		



Serial number	Part name	Serial number	Part name
1	Speed regulating pull rod	7	Throttle control combination
2	Choke lever	8	Hexagon flange bolt M6 * 16
3	Governor spring	9	Hexagon flange bolt M6 * 30
4	Fixing bolt of speed regulating bracket	10	Throttle return spring
5	Speed regulating support assembly	11	Clamp
6	Hexagon flange nut M6		

4-4-4 Carburetor

NOTICE

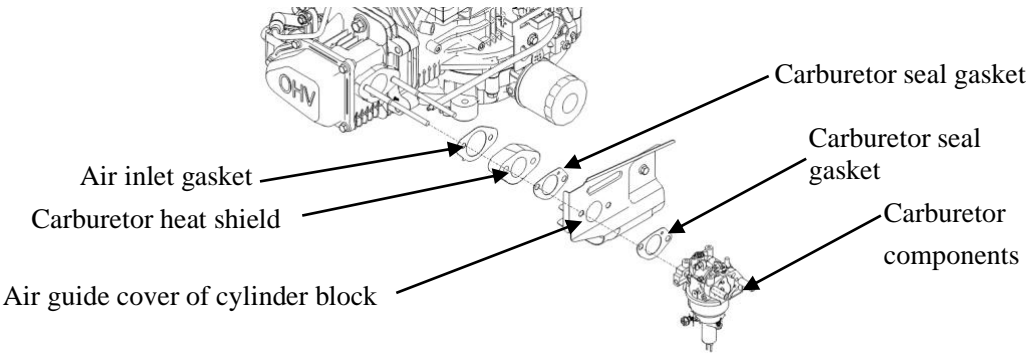
At high altitude areas, standardized carburetor will cause thick mixed gas, drop the output power and increase the fuel consumption rate for the gasoline engine. Gasoline engine used at high altitude area can be improved by installing small-diameter main metering jet of the carburetor and re-adjusting adjustment screw of idle mixing ratio. If you often use the gasoline engine at the region of above 1,000 m, you can go to authorized dealer of the Company to change the main metering jet and adjust the carburetor. Otherwise, the gasoline engine shall be used by reducing power.

Even if being equipped with proper carburetor, every 300 m's rise in ASL will reduce the power of the gasoline engine by about 3.5%. This reduction will be greater if it is not equipped with proper carburetor.

If a carburetor applicable to high ASL application is equipped to a gasoline engine for low ASL application, too thin mixed gas will cause the power reduction of gasoline

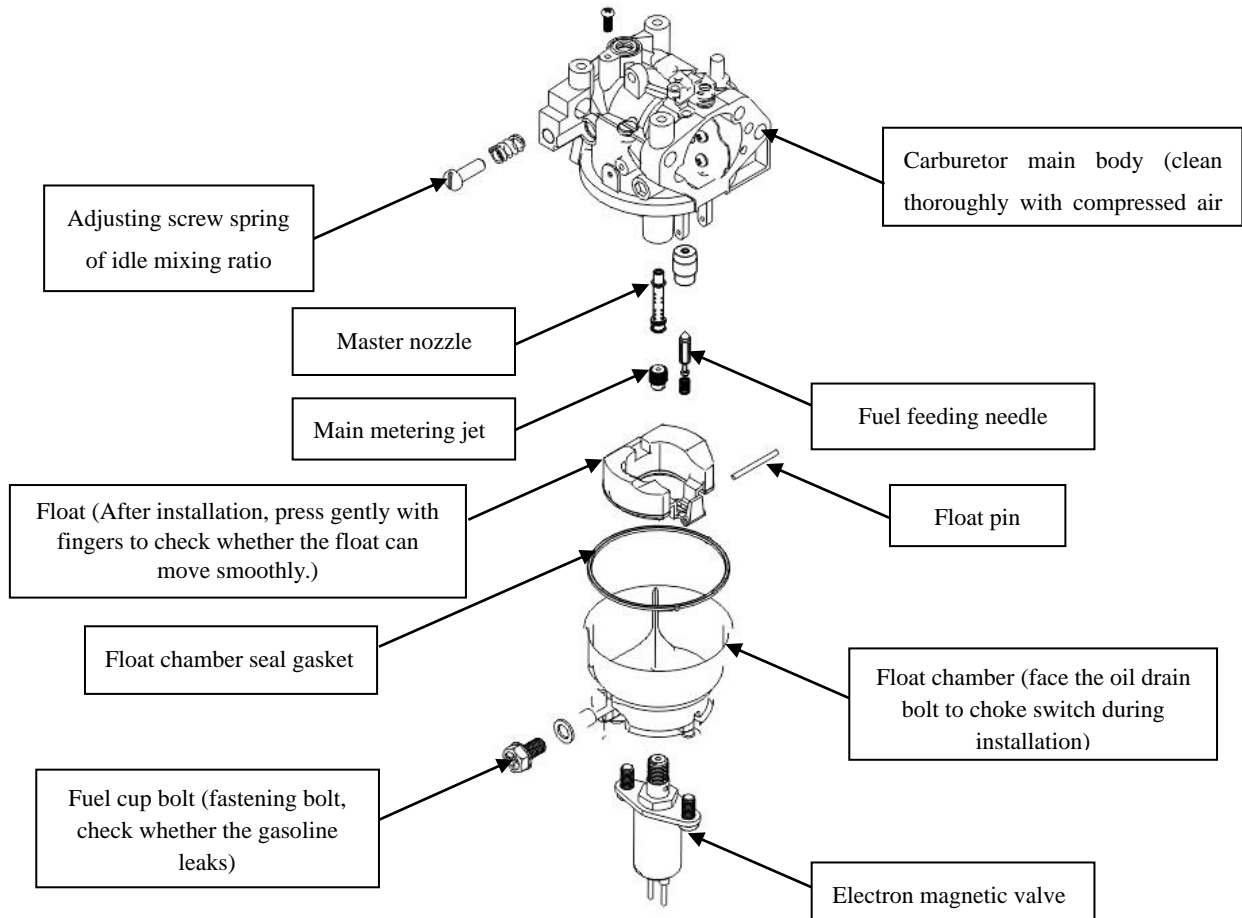
engine, overheating and even cause more serious damage.

The gasoline is fed into the carburetor from the fuel tank and fuel filter. The fuel filter can filter out impurities mixed in the gasoline and oxides in the fuel tank. If the quality is defective, some impurities will enter the carburetor through the fuel filter. In addition, gasoline contains components capable of forming gelatinous substance, which will condense gelatinous substance after a long time of deposition to attach to components of the carburetor (such as main metering jet), oil way and the surface of float chamber. Air is fed into the carburetor by way of air filter. Based on the consideration that intake resistance shall not be too great and other factors, filter device shall not be too dense, hence some tiny impurities in air will still enter the carburetor via the air filter.



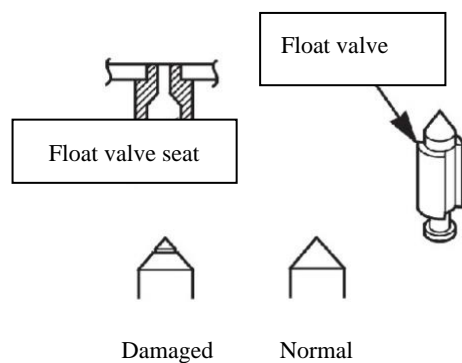
The carburetor shall be cleaned on a clean site. Clean the external surface of the carburetor, and clean the internal parts with special carburetor cleaner or industrial gasoline. Pay attention to clean gasoline gel besides impurities on surface of the parts. The cleaned part shall be blown with compressed air, and shall not be wiped with cloth or paper to avoid secondary pollution. It is forbidden to poke through clogged hole by hard object such as steel wire, to prevent hole diameter from changing to cause the change of carburetor performance, but it shall be washed off with gasoline or compressed air.

a) Disassembly and assembly of carburetor:

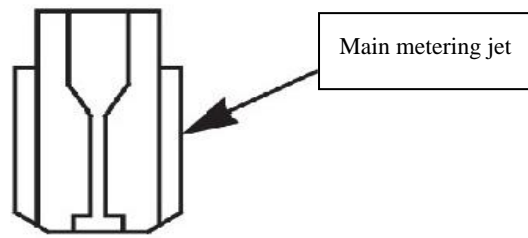


NOTICE

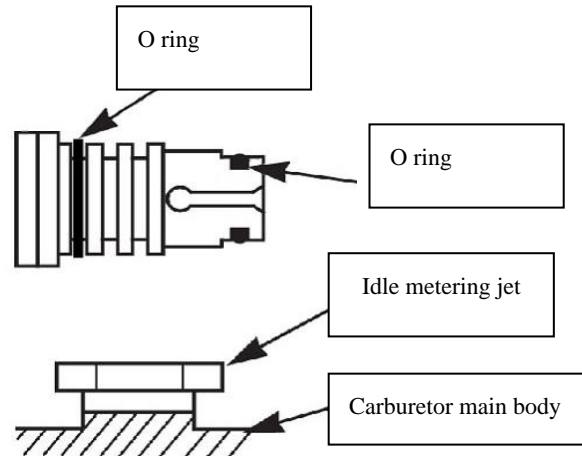
- **Before assembling the carburetor, the fuel drain bolt must be unscrewed to drain off the fuel inside.**
- **No Open Flames.**



- Before assembly, check the wear of fuel feeding needle valve, fuel feeding needle valve seat and fuel feeding needle valve spring



- Clean thoroughly with compressed air before assembling.
- Clean thoroughly with compressed air before assembling, lightly lubricate the O ring
- so that it can be easily installed into the carburetor

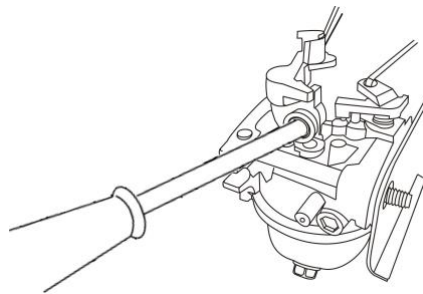


b) After cleaning the carburetor, restore the mixing ratio adjusting screw. Disassemble it only when repairing the carburetor.

d) Carburetor idle speed adjustment

- Start the gasoline engine and warm up to normal operating temperature.
- Adjust idle speed adjusting screw to achieve specified idle speed.

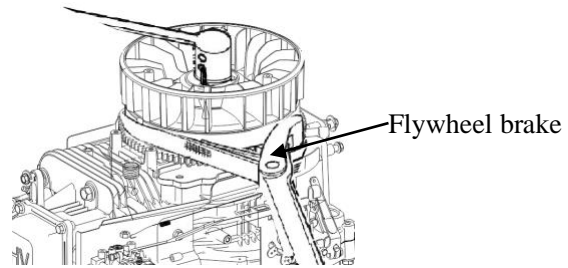
Specified idle speed: 1800 rpm ~ 2000 rpm



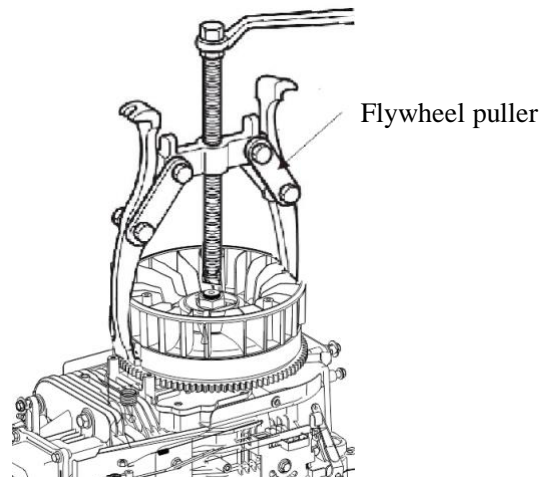
4-4-5 Flywheel

① Disassembly:

a) Clamp the flywheel by flywheel brake available in the market, remove flywheel brake (M16).



b) Disassemble the flywheel by flywheel puller available in the market



NOTICE

The flywheel shall not be hit by hammer

- **The magnet steel on the flywheel shall be evaded when placing the puller.**

② Assembly

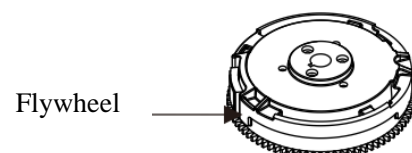
a) Before assembling, clean dirt, oil, grease and other foreign substances on the crankcase and tapering part of the flywheel. Make sure that magnetic steel part of the flywheel is not stuck with gaskets or other foreign substances;

- b) Assemble the key into crankshaft keyway
c) Assemble the flywheel on the crankshaft

NOTICE

It is possible that the flywheel may push semicircular key out of the keyway, which shall be confirmed after the assembly.

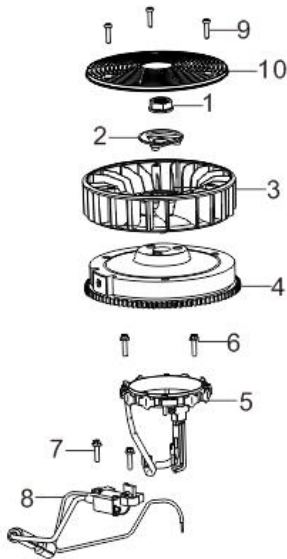
Flywheel (cast iron)



d) Align four holes on rear side of the flywheel through four holes on the flywheel.

Torque: 160 ± 10 N.m

Ignition coil



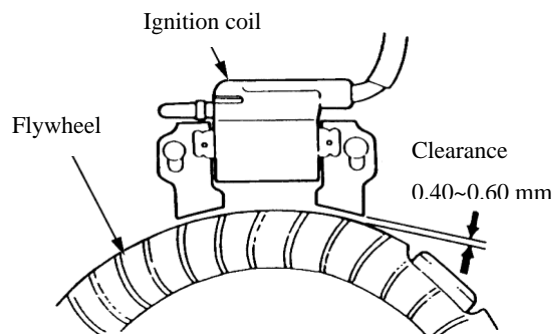
Serial number	Part name
1	Flywheel nut
2	Impeller gasket
3	Impeller
4	Flywheel assembly
5	Charging coil combination
6	Hexagon flange bolt M5 * 25
7	Hexagon flange bolt M6 * 25
8	Ignition coil
9	Cross recessed pan head tapping screw
10	Engine dust cover

a) Disassembly: Air filter; carburetor; starter assembly

b) Use a thickness gauge to measure the gap between ignition coil and flywheel

c) Adjustment: Gap between ignition coil and flywheel

d) Adjustment steps: Loosen the bolts, adjust clearance by moving the ignition coil up and down, and tighten the bolts

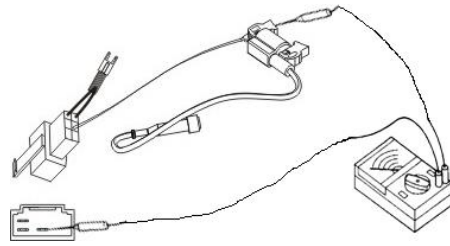


4-4-6 Ignition coil detection

(Primary side)

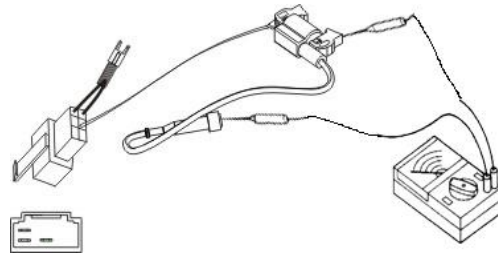
Make contact between tester terminal and wire terminal and coil core, to measure the resistance value of coil primary.

The resistance of primary coil: 1.0-1.5 Ω
(recommended value)



(Secondary side)

Remove the cap of spark plug, to connect one end of the tester to HV harness, and make contact between the other end and coil core, to measure resistance value on the secondary side of the coil.

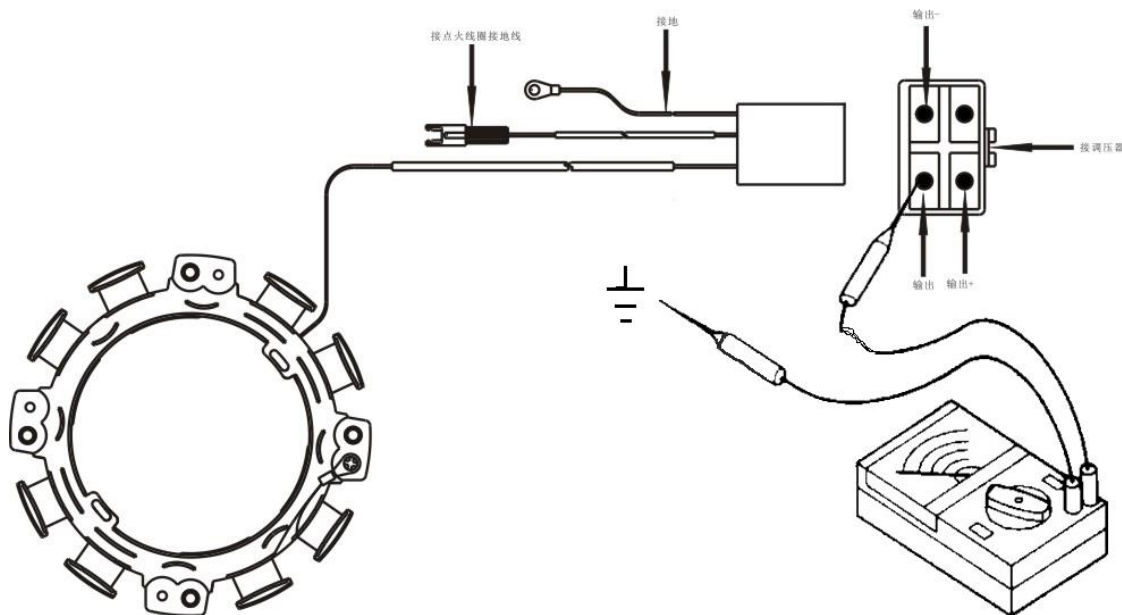


The resistance value of secondary coil: 5-7 k Ω
(recommended value)

4-4-7 Charging coil detection

Test the continuity of each pair of wires

The insulation resistance of each wire shall be ≥ 10 m Ω

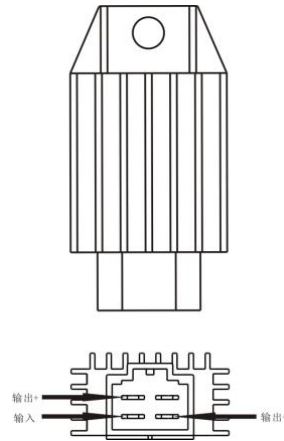


4-4-8 Voltage regulating rectifier

Test the continuity of each pair of wires

The insulation resistance of each line shall be

$\geq 20 \text{ m}\Omega$



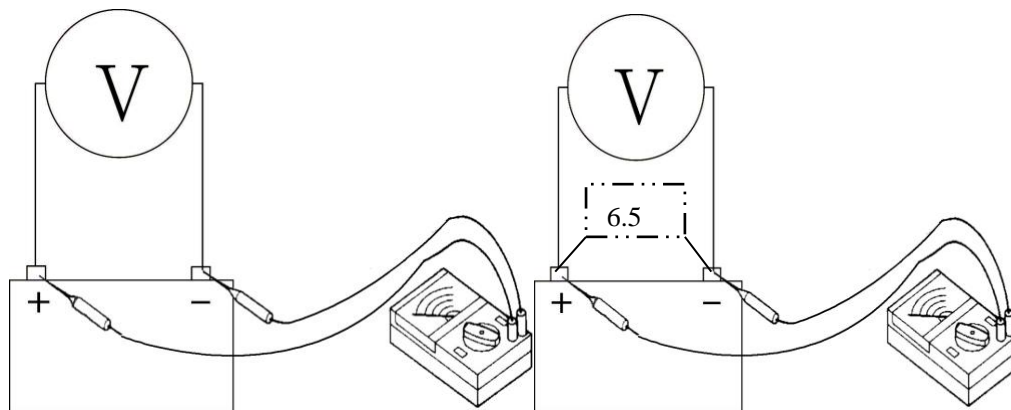
⚠ WARNING

After confirming that the parts are not damaged through above inspections, connect all wiring harnesses and detect the output voltage. As the detection requires starting the engine, this operation will be dangerous. Non-professional personnel are not allowed to do the detection.

No load detection:

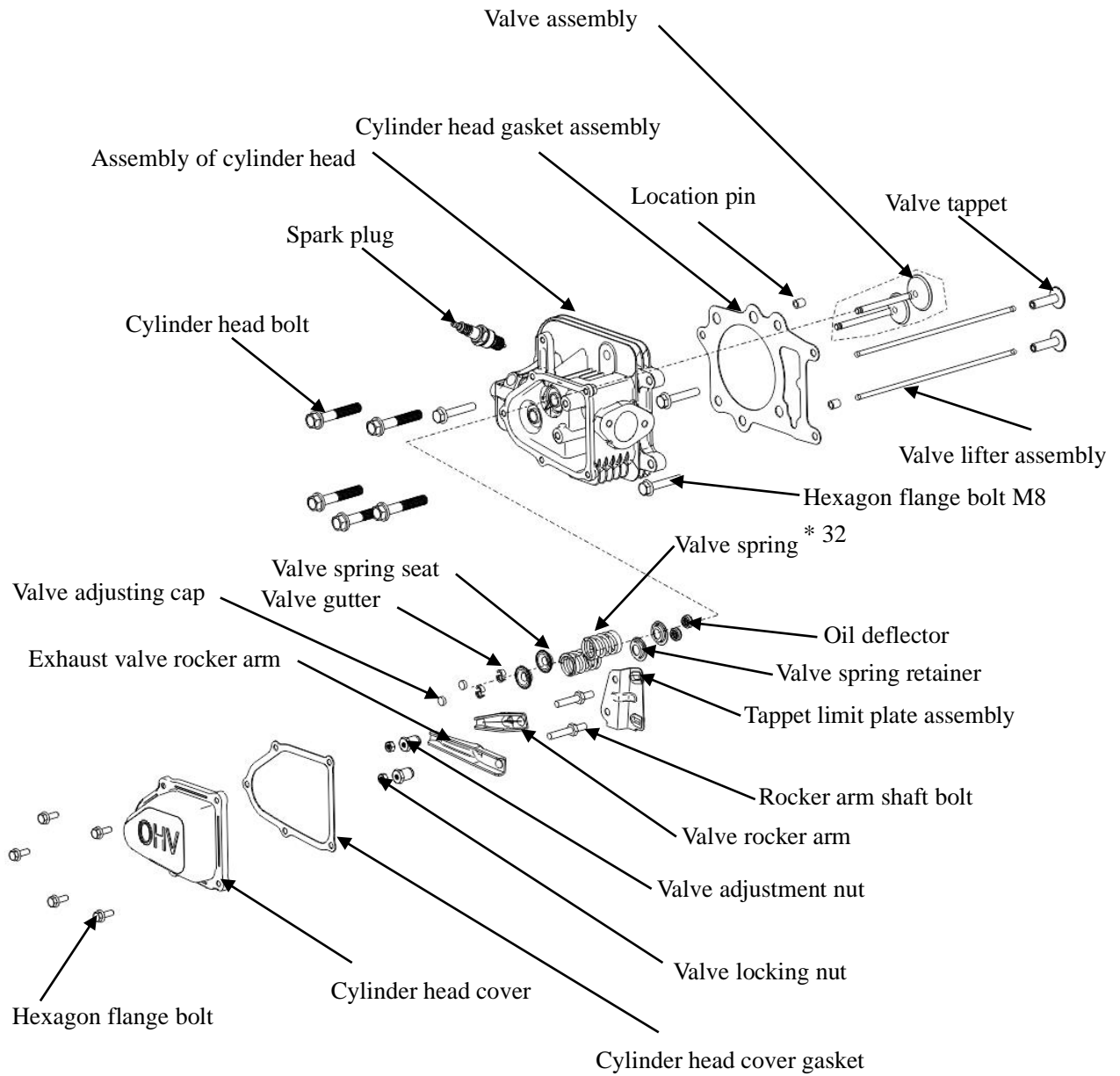
Charging coil (output line and grounding)	Voltage regulator (input line and output -)
$\cong 36 \text{ V}$	$14.4 \pm 0.5 \text{ V}$

Load detection with battery:



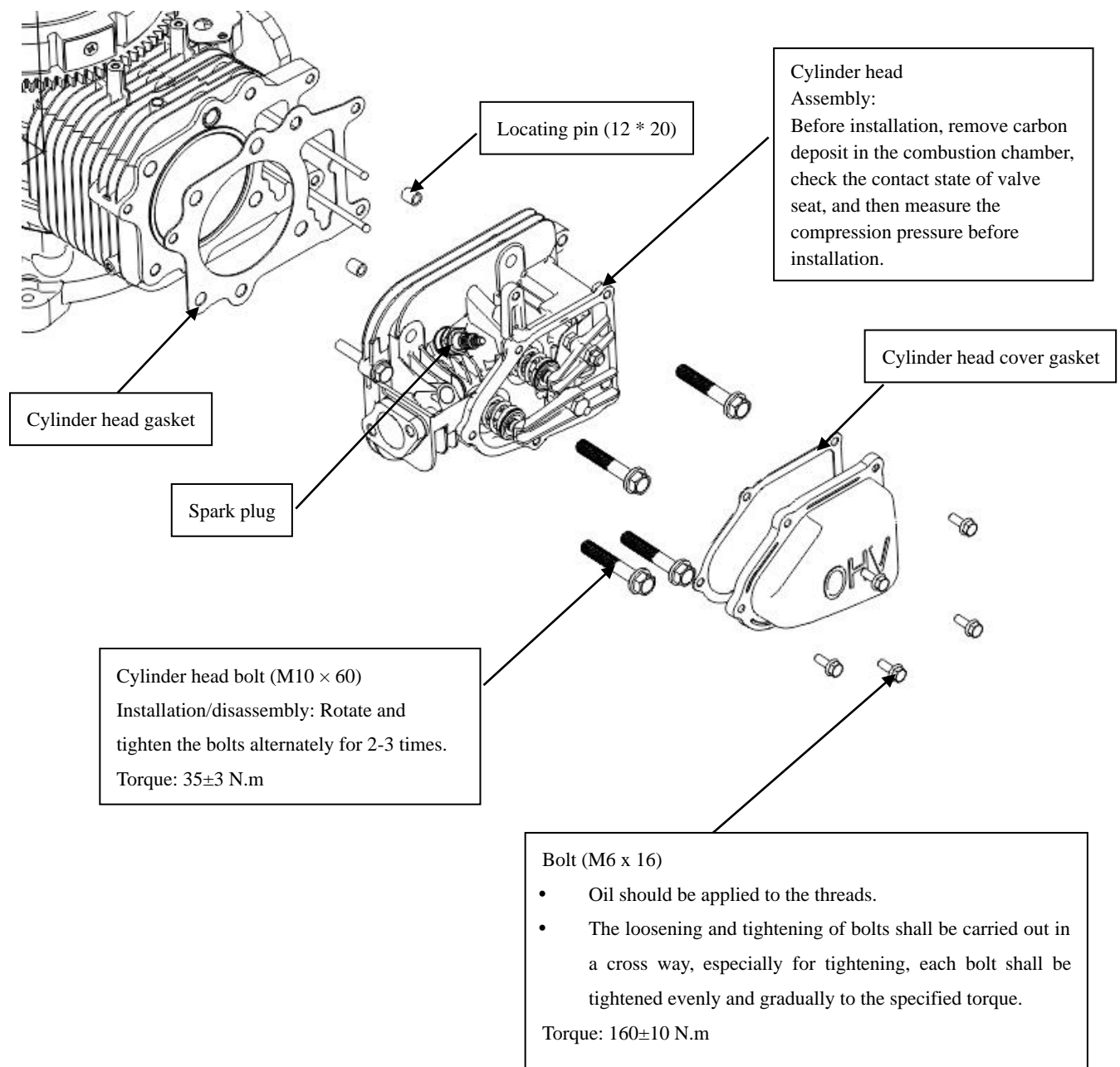
No load voltage (with battery)	With load (180W needs to be added in the figure above, and the battery voltage $\geq 13 \text{ V}$)
$14.4 \pm 0.5 \text{ V}$	12-14 V

4-4-9 Cylinder head/valve

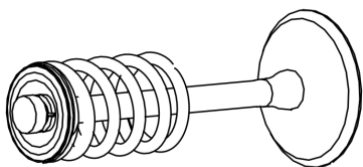


1) Disassembly\installation

- ① Remove the muffler
- ② Remove the air filter
- ③ Remove the starting system and air guide cover
- ④ Remove the carburetor and heat insulation pad



Valve spring retainer:

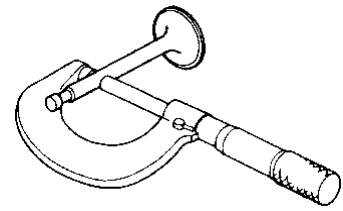


Coat clean engine oil evenly on the valve stem before assembly of inlet/exhaust valve; Pay attention to press the valve spring seat and lock clamp in place when installing inlet/exhaust valve.

If the cylinder head is installed on the cylinder, the spring seat ring may fall into the cylinder, which should be noted.

2) Inspection/maintenance/adjustment:

① **OD of valve stem**



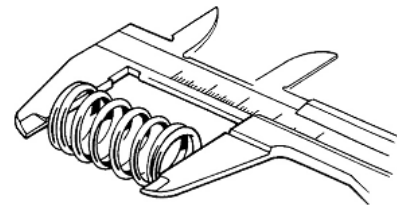
Use a micrometer to check the outer diameter of valve stem. If the diameter is lower than standard or exceeds the maintenance limit, or the valve surface has visible ablation or cracks, replace it with a new valve.

Standard		Maintenance limit	
Inlet: 6.563-6.575 mm	Exhaust: 6.548-6.56 mm	6.418 mm	6.375 mm

② **Free length of valve spring**

Measure free length of valve spring.

If it is below the standard or exceeds service limits, replace the spring.

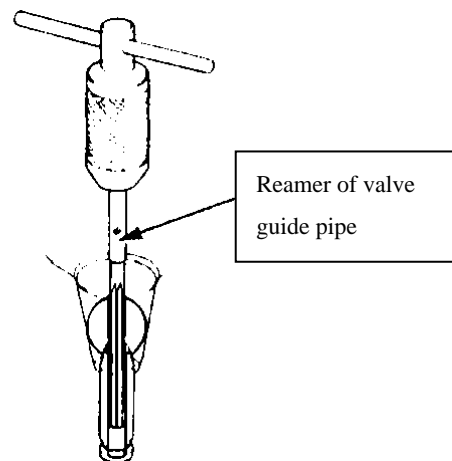


Standard	Maintenance limit
39.5 mm	38 mm

③ **Valve guide**

Inspection:

a) Check if inner surface of valve guide is smooth, being free of scratches and scuffing; the fitting between valve guide and valve seat is solid.



b) Before measuring the ID of the valve guide pipe, remove carbon deposit inside valve guide pipe by valve guide reamer.

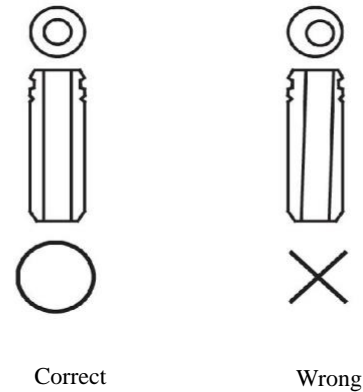
If the ID of valve guide pipe is below the standard or exceeds the maintenance limit, replace cylinder head.

Standard	Maintenance limit
6.6-6.615 mm	6.662 mm

Reamer:

When reaming precisely valve guide with a reamer, be sure to be at room temperature to get good result.

- a) Apply a layer of cutting grease to the valve reamer and valve guide.
- b) Screw into the reamer clockwise until the reamer is fully screwed into the air valve guide pipe.
- c) Continue to rotate clockwise to pull out the valve reamer from the valve guide.

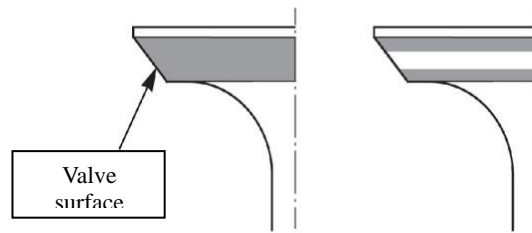


Tool: valve guide reamer

- d) Thoroughly remove dirt and debris from cylinder cover.
- e) Inspect the hole of valve guide pipe, which shall be in the center of valve guide pipe and shall be straight and unobstructed, and insert the valve to inspect whether the action is smooth. If not, the valve guide may have been bent during assembly. If it is bent or damaged, replace the valve.
- f) Check the clearance between valve stem and the guide.
- g) Clearance between the valve stem and the valve guide pipe: Subtract OD of valve stem from corresponding ID of valve guide pipe to obtain the clearance between valve guide pipe and valve stem.
- h) If the clearance between valve stem and valve guide exceeds maintenance limit, replace a new guide, to judge if the clearance can be within maintenance limit. If so, replace valve guide and stick valve guide. Re-trim valve seat when replacing the valve guide pipe.

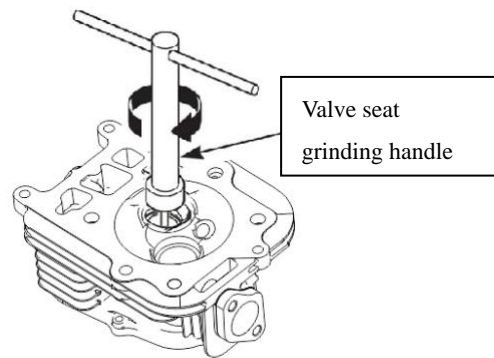
④ **Valve seat:**

a) Thoroughly remove carbon deposit out of combustion chamber and valve seat, and apply a thin layer of red lead powder on the surface of valve, or other adhesive color paints easy to be wiped.



b) Insert the valve and press the valve with effort a few times, but do not rotate the valve on the valve seat. If the valve seat is stained with paint, it indicates that it is in close contact with the valve; otherwise, it fails to contact. This indicates that the valve and the valve seat are not concentric.

c) Grind the valve seat by 45° grinder to create a smooth valve seat being concentric with the valve guide, rotate it clockwise and not it is not allowed to rotate counterclockwise. Keep grinding till the valve can be lifted from seat.



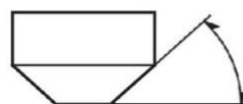
Tools:

Valve grinder



Intake valve: 20°

Exhaust valve: 45°

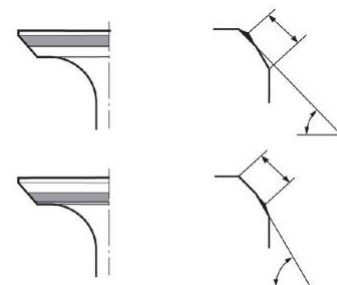


Intake valve: 20°

Exhaust valve: 45°

Use 32° and -45° grinders to reduce and adjust the valve seat, to make it be in contact with middle part of valve cone face. Grind top edge of valve seat by 32° grinder (contacting too high).

d) Grind bottom edge of the valve by 45° grinder (contacting too low). Make sure that the width of

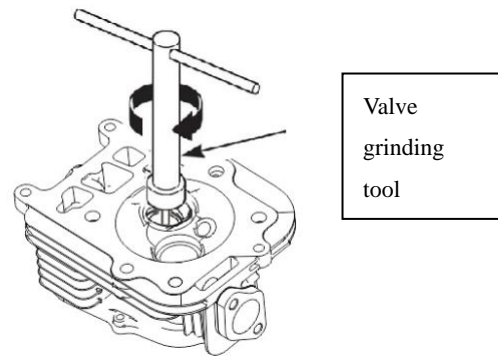


valve seat completed is within specified range.

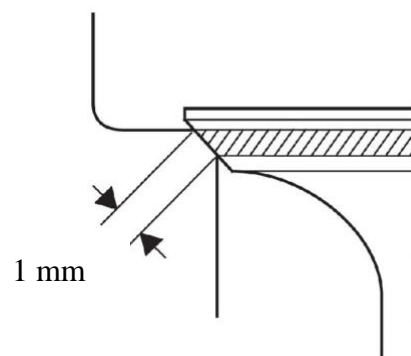
Standard	Maintenance limit
1 mm	2.2 mm

e) Slightly grind with by 45° grinder to remove any burr on the edge of valve seat.

f) After reshaping the valve seat, check the width of valve seat. Use only the colorant on valve cone face, to insert the valve and press the valve several times with effort, but ensure that the valve does not rotate on the valve seat. The surface of valve seat is evenly dyed with colorant as shown in the figure, which shows that complete cycle of the valve seat is in good contact with tapered face of the valve.

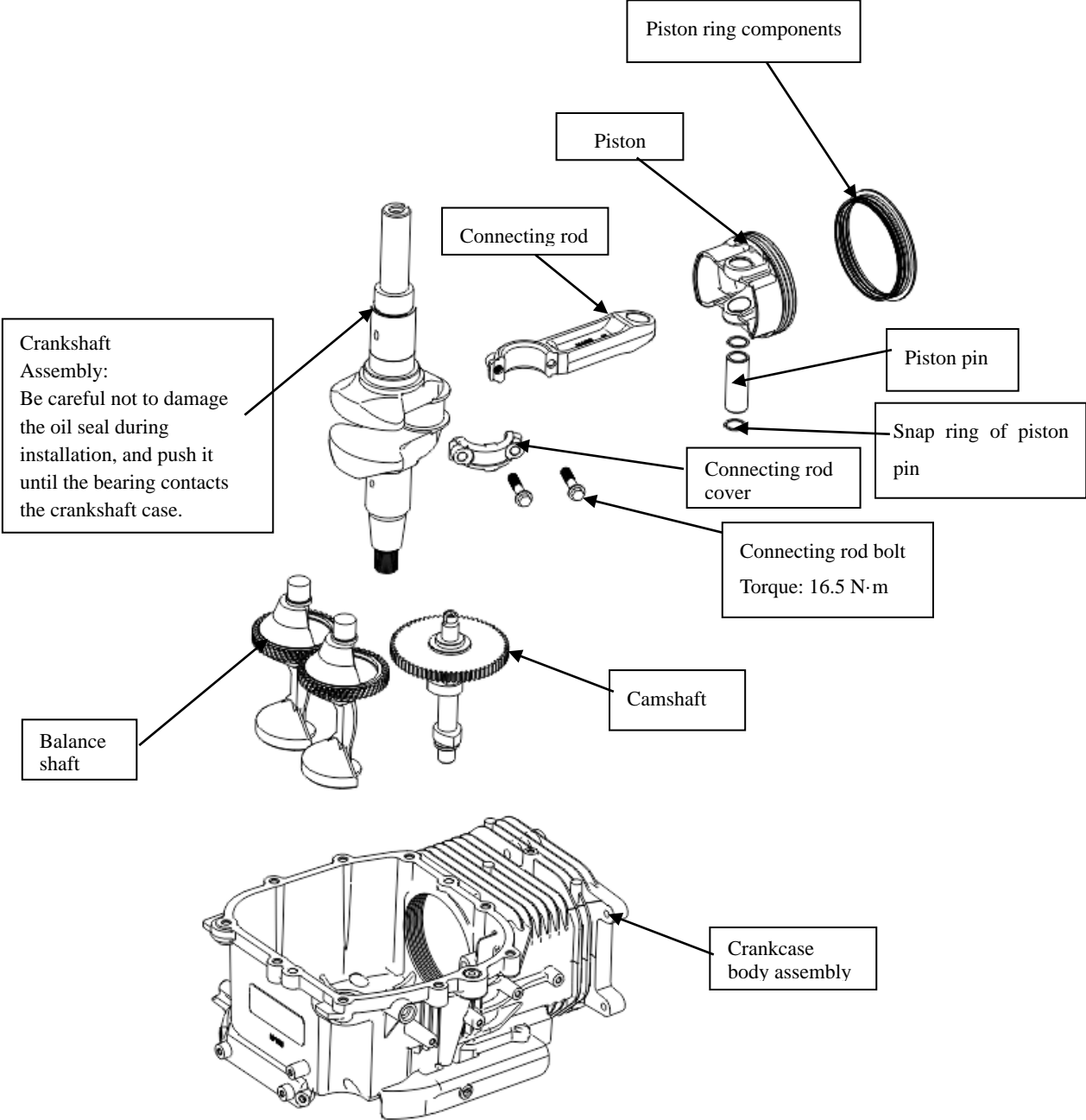


g) Apply abrasive to valve seat surface, rotate valve grinding tool to grind the valve seat.



h) Check valve clearance after the assembly.

4-4-10 Crankshaft/Piston

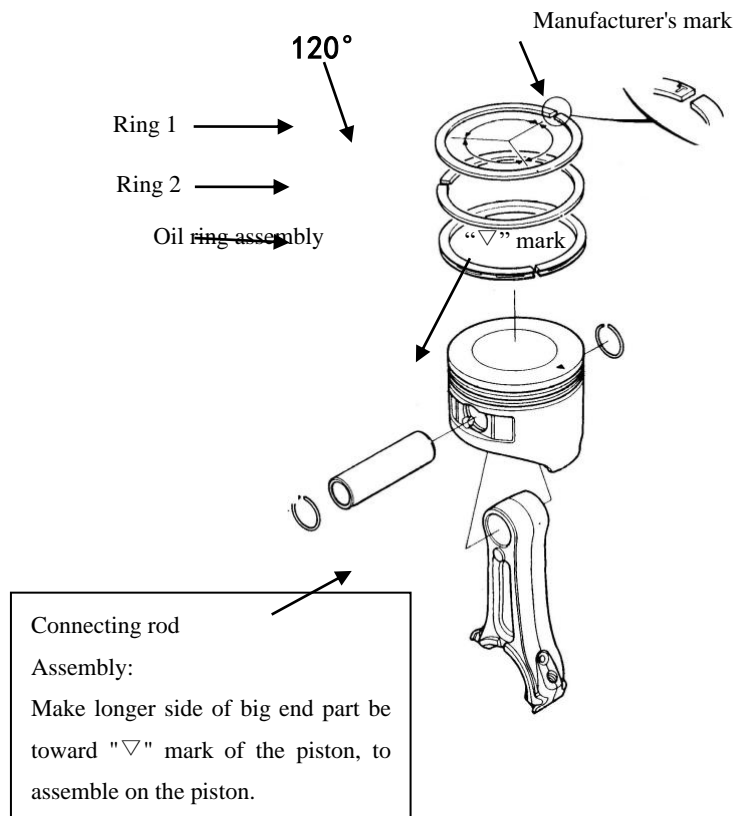


① Disassembly:

a) Piston

- Make manufacturer's mark face up when assembling. Be careful not to confuse the first ring with the second ring.
- Make sure that piston ring moves freely after assembling.

Make openings of various piston rings keep away from the direction of piston pin and scatter by 120 °.

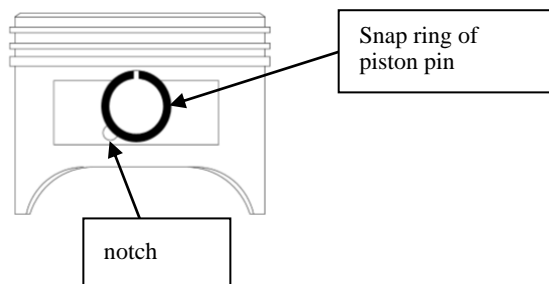


② Assembly:

a) Snap ring of piston pin

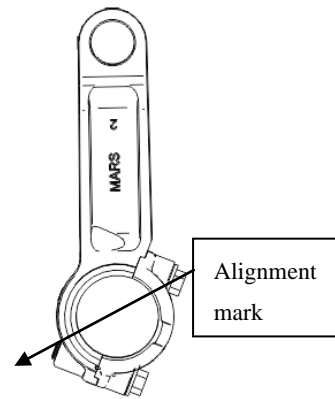
Jack the front end at the piston groove, to clamp the other end with a nose plier, and mount it in the groove while turning.

Make the opening of snap ring be away from the notch of piston.



b) Connecting rod cover

Align connecting rod with the edge of the connecting rod cover when installing.



c) Oil seal:

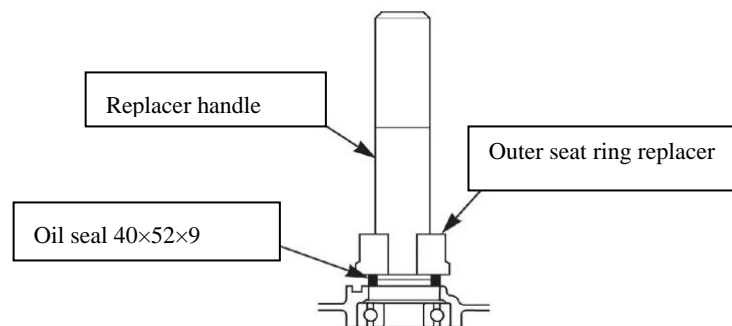
- Apply lubricant to the edge of oil seal.
- Assemble oil seal into crankcase body by below tools.

Tools:

Replacer handle

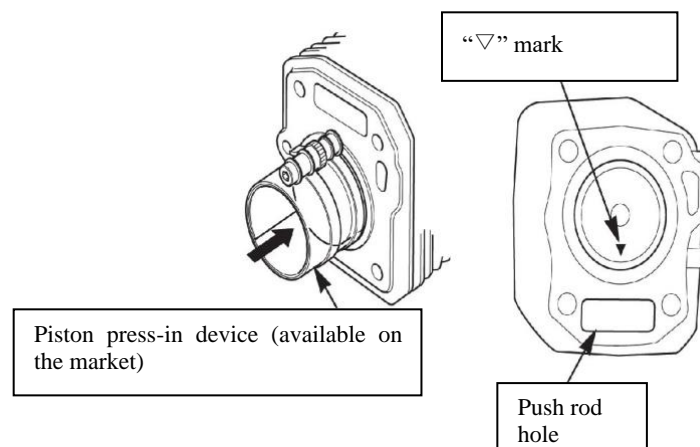
Outer seat ring replace

- After assembling, apply special lubricating oil to the oil seal.



d) Piston:

- Lubricate the piston and cylinder block with oil.
- When installing, put the mark on the top of the piston towards the side of the push rod hole.

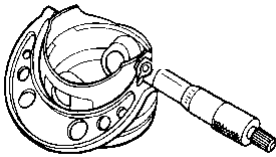


③ Piston inspection

Inspect the contact between the piston and cylinder, ring groove defect, top ablation and cracking, etc. If it is seriously damaged, such as broken, it shall be replaced.

Remove carbon deposits

Carbon deposit is accumulated on the top of piston and the edge of upper part of the cylinder. Carbon deposits shall be cleared up before the inspection. Soak the carbon deposit with kerosene first, and then remove it with a blunt scraper or metal brush.



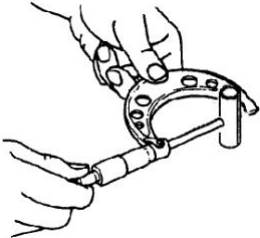
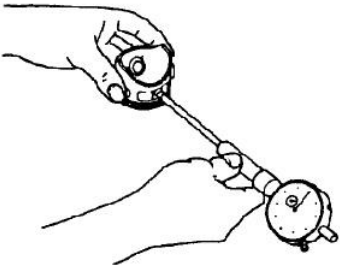
a) O.D. of piston skirt

Measure the O.D. of the piston skirt by O.D. micrometer, to replace it if it exceeds the service limit.

Standard	Service limit
94.46-94.47 mm	94.36 mm

b) The clearance between piston pin hole and piston pin

Use the inside micrometer and the outside micrometer to measure the inner diameter of the piston pin seat hole and the outer diameter of the piston pin respectively. And then calculate its clearance value based on measured result.



Standard	Service limit
0.002-0.008 mm	0.008 mm

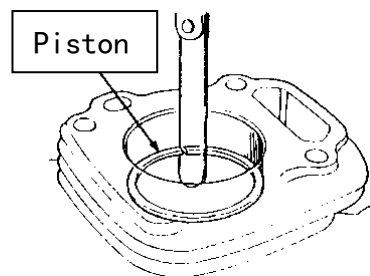
d) Clearance of piston ring side

When inspecting, place each ring in its respective piston ring groove. Piston rings shall rotate freely, to be neither loose nor sluggish. Then measure by insert a thickness gauge into the gap between upper and lower planes of the ring and slot.

Standard	Service limit
0.02-0.07 mm	0.07 mm

e) Closed gap of piston ring

Put piston ring horizontally into the cylinder, push the ring to working position with piston head, and then measure its opening clearance by thickness gauge. This clearance shall be neither too great, nor too small. Too great clearance may make that cylinder sealing performance gets bad, too small will cause the piston ring to be stuck in the cylinder due to thermal expansion during operation, causing that the piston ring is broken or even "cylinder scraping". Ring opening clearance is small, the opening can be filed by thin flat file. It shall be placed into the cylinder for inspection while filing, until the clearance is proper.



Standard	Service limit
0-0.06 mm	0.06 mm

④ Inspection of connecting rod

When connecting rod is bent or twisted, or there is serious groove in big end hole or small end hole, or there is a crack on one side, it shall be scrapped and replaced with new ones.



a) Test the diameter of small end

If it is below the criterion or exceeds the maintenance limit, replace the connecting rod.

Standard	Service limit
20.011-20.022 mm	20.022 mm

b) Test the diameter of big end

If it is below the criterion or exceeds the maintenance limit, replace the connecting rod.



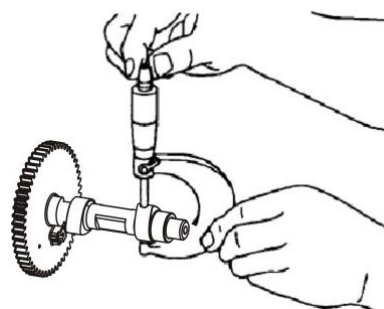
Standard	Service limit
38.010-38.022 mm	38.066 mm

⑤ Inspection of camshaft

The camshaft is main driving part of valve train of gasoline engine, which controls intake and exhaust valves to open or close.

Its structural feature is: On the shaft, there are the cam and supporting journal meeting the requirements for controlling air intake and exhaust. When the cam is working, it bears the periodic impact load, and the cam working surface and the tappet have intense friction, which is easy to wear or scratch. Therefore, the cam is required to have wear resistance and good lubricity.

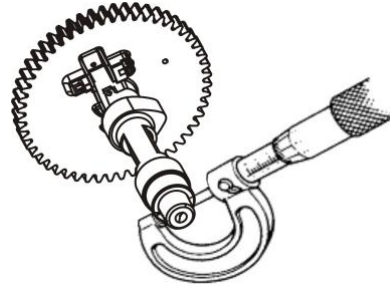
- Visually inspect cam surface and cam height for damage, and the camshaft and bearing for being loose or worn, and if so, replace the whole group.
- Inspect the height dimension of the cam. When the dimension of cam height is less than the service limit, replace the



camshaft.

Standard	Maintenance limit
19 mm (inlet)/19 mm (exhaust)	18.9116 mm (inlet)/18.9116 mm (exhaust)

- Inspect the outer diameter of the cam.
When it is less than the service limit, replace the camshaft.



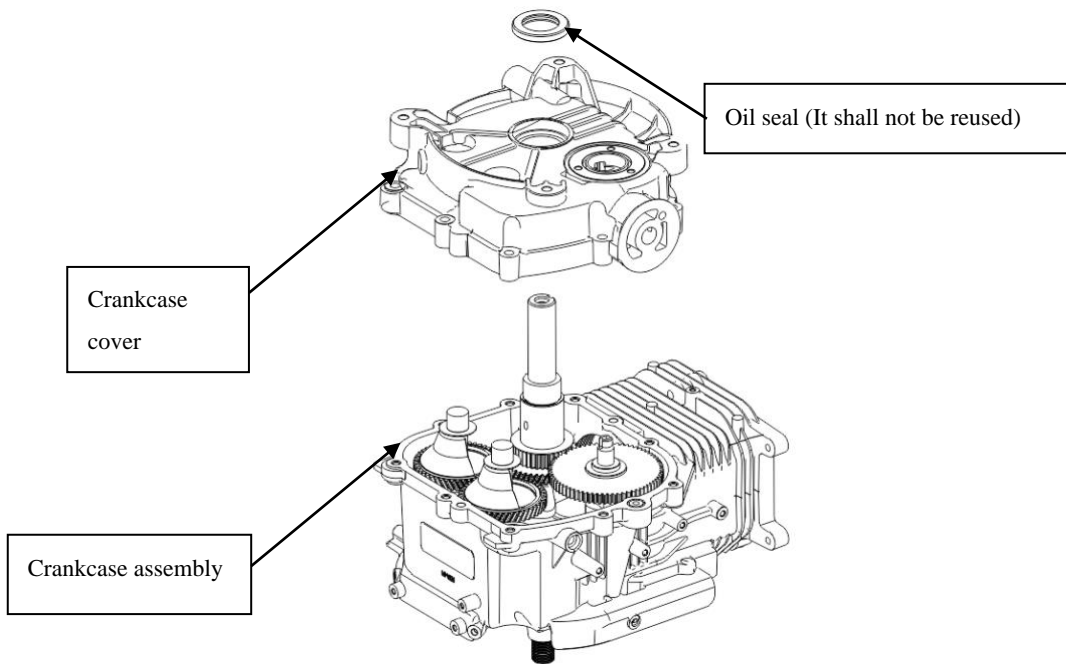
Standard	Maintenance limit
14.966-14.984 mm	14.916 mm

Analysis on causes of camshaft wear and its impact on the performance of whole gasoline engine:

The main cause for abnormal camshaft wear of the camshaft is poor lubrication, Factors such as low oil viscosity, many impurities and small circulating oil volume is unable to form complete oil film on the camshaft surface, to cause it to be in a state of high-speed dry friction, resulting in serious wear on the cam surface. The second is assembly accuracy of the camshaft. When matching clearance between camshaft journal and camshaft seat or bearing is out of tolerance, rotation accuracy of the camshaft will decrease, and the contact with related parts will generate deviation plane t cause abnormal wear.

⑥ Timing gear

- a) Inspect meshing clearance of the timing gear, which shall align marks of gears on both sides.



The main damage of timing gear is the wear of gear tooth, tooth face peeling or roughness, gear deflection, gear tooth breakage, etc. Due to the wear of gear teeth, the greater the meshing gap, the greater the noise.

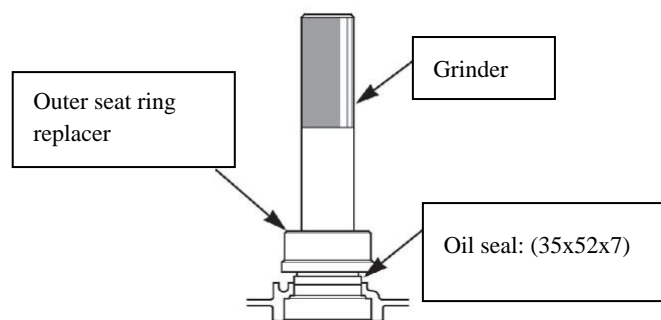
If gear face of timing tooth is bruised or damaged or rupture angle, it shall be replaced with a new one for any case.

NOTICE When replacing new parts, it is better to replace the whole part to ensure that there is a more consistent meshing surface.

b) Assembly:

Oil seal:

- Apply lubricating oil around new oil seal.
- Assemble oil seal into crankcase cover by special tool.
- After assembling, apply special lubricating oil to the oil seal.



c) Inspect:

ID of camshaft handle

Standard	Maintenance limit
15 mm	15.2 mm

4-5 Electrical schematic diagram

