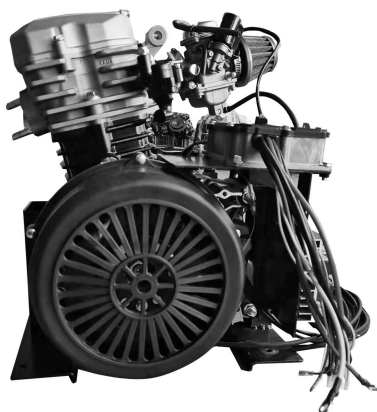


SOFTCAR

- ◆ **To correctly operate your generator are for your own safety, be sure to read this manual carefully.**
- ◆ **If you have problem about your extended range generator, please contact with the authorized dealer.**

➤ **OWNER'S MANUAL**



Water Cooled Extended Range Generator
7kW/9kW/20kW For Hybrid Power

PREFACE

According to the latest technology, our company has independently developed four stroke water-cooled single cylinder, V-type double cylinder and in-line four cylinder extended range generators. The extended range generator adopts permanent magnet motor, which has the characteristics of advanced design, compact structure, reliable performance, convenient maintenance, economical use, automatic speed regulation, automatic start and automatic flameout. As an ideal power supply, it is widely used in hybrid vehicles, ATV, UTV, hybrid ships, off grid solar hybrid power generation systems and other fields.

This manual provides the operation and maintenance information of 7kW / 8kW /20kW water-cooled gasoline / CNG extended range generator. Please read carefully before operation. In order to prolong the service life, users should operate and maintain in strict accordance with the provisions of this manual.

An extended range generator that automatically starts and automatically shuts down according to the remaining capacity and load state of the battery. For example, when the remaining capacity of the battery is less than 40%, the extended range generator automatically starts to drive the load, and the remaining power charges the battery. When the remaining capacity of the battery is higher than 95%, the generator will automatically shut down and the battery will drive the load. Cycle after cycle to maximize efficiency.

Before purchase, please inform us of the battery capacity, voltage, BMS, battery type and load power, because the charging or endurance control procedures of lead-acid battery, lithium iron phosphate battery and polymer lithium battery are different. Please also tell us your purpose, because the GCU (generator controller unit) of the extended range generator varies according to the purpose.

This manual shall be regarded as a permanent part of the extended scope generator and shall be retained in this manual if resold.

All materials and diagrams in this manual conform to the latest products at the time of publication. Due to revisions and other changes, the information described in this manual may be slightly different from the actual state. This manual is subject to change without notice.

The copyright of this manual belongs to the company, and no group or individual may reprint or copy it.

Pay special attention to statements preceded by the following words:

- failure to properly follow these precautions may result in property damage and serious injury!
- please read all labels and user manuals before operating this generator.
- the generator produces carbon monoxide, a toxic, colorless and tasteless gas that can cause death or serious injury. Using generators indoors can quickly lead to death.
- the generator should be used outdoors. The generator shall be used only outdoors, away from the garage and open windows, and protected from rain and snow.
- check for fuel / gas spills or leaks.
- be sure to stop the engine before refueling.
- always keep any source of ignition away from the fuel tank or gas system.
- do not mix the extended range generator with different types of batteries! Because the charging control program is different for different battery types.
- do not use the extended range generator for different vehicles, because the logic of different vehicle controllers is different.

⚠ WARNING

“WARNING” indicates a strong possibility of severe personal injury or loss of life if instructions are not followed.

⚠ CAUTION

“CAUTION” Indicates a possibility of personal injury or equipment damage if instructions are not followed.

NOTE: Gives helpful information.

If a problem should arise, or if you have any questions about the generator, consult an authorized dealer.

⚠ WARNING

- Our generators are designed to give safe and dependable service if operated according to instructions.
- Read and understand the Owner's Manual before operating the generator.
- Failure to do so could result in personal injury or equipment damage.

- Illustrations may vary depending on the update.

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1. SAFETY INSTRUCTIONS

⚠ DANGER

Using a generator indoors can kill you in a few minutes!

The engine exhaust of this extended range generator contains carbon monoxide, which can cause coma or death!

1) OPERATOR SAFETY

⚠ WARNING

- ◆ before starting the engine, be sure to check the oil, fuel and air filter.
- ◆ properly clean and maintain the equipment.
- ◆ operate the generator according to safe and reliable operating instructions.
- ◆ please read all labels and user manual before operating the generator. Otherwise, personal injury or equipment damage may be caused.
- ◆ do not operate the generator in an enclosed area to avoid injury caused by toxic carbon monoxide emission.
- ◆ be careful not to touch the exhaust system, compressor pump or discharge pipe due to danger or burns during operation.
- ◆ pay attention to the warning label. The engine exhaust system becomes hot during operation and remains hot immediately after the engine stops.
- ◆ gasoline or natural gas is a highly flammable and explosive liquid. When the engine is stopped, add oil in a well ventilated area.
- ◆ using gasoline containing more than 10% ethanol may damage the engine and fuel system and invalidate the manufacturer's warranty.
- ◆ keep away from cigarettes, open flames, smoke and sparks when refueling the generator or replacing natural gas.
- ◆ during operation, place the generator at least 3 feet away from the building or other equipment.
- ◆ run the generator on a horizontal plane. Tilting the generator can cause fuel spillage.
- ◆ know how to stop the generator quickly and the operation of all control devices. Do not allow anyone to operate the generator without proper instructions.
- ◆ keep away from children, pets and machines with rotating parts during operation
- ◆ do not operate the generator in rain and snow
- ◆ do not let any moisture contact the generator
- ◆ do not touch the spark plug when the engine is running or shortly after the engine is stopped.

2) ELECTRIC SAFETY

WARNING

Before starting the extended range generator:

- ◆ ensure that everything works normally. Faulty equipment or power cord may cause electric shock.
- ◆ if the equipment starts to operate abnormally, please turn off the generator immediately. Then disconnect the device and investigate the problem.
- ◆ ensure that the electrical rating of the equipment does not exceed that of the generator. If the power level of the equipment is between the maximum output power and operating power of the generator, the service time of the generator shall not exceed 30 minutes.
- ◆ when you use the power grid to charge the battery, please stop the extended range generator.
- ◆ please correctly connect the positive harness, negative harness and other functional harnesses of the battery and the extended range generator.

3) MAINTENANCE SAFETY

WARNING

- ◆ After any maintenance is performed, wash immediately using soap and clean water because repeated exposure to lubricant may cause skin irritation.
- ◆ Do not clean the filter element with flammable liquids like gasoline because an explosion may occur.
- ◆ Turn off the engine before performing any maintenance. Otherwise it can cause severe personal injury or death.
- ◆ Allow the generator set to cool down before performing any maintenance.
- ◆ Always wear safety glasses when cleaning the generator set with chemical cleaner.
- ◆ Do not clean the generator set with a pressure washer because it can cause damage to the generator set.
- ◆ When working with batteries, ventilate the area, use safety glasses, do not smoke. Always disconnect the negative first and reconnect it last.
- ◆ Use rubber gloves when coming into contact with engine oil.
- ◆ Always stop the generator set before removing the oil filler cap.
- ◆ Only qualified maintenance personnel with knowledge of fuels, electricity, and machinery hazards should perform maintenance procedures.
- ◆ Lubricate all exposed metal parts regularly. check chapter 7.1 for maintenance schedule.

4) OTHER SAFETY TIPS

WARNING

- ◆ in order to avoid inhaling toxic carbon monoxide in waste gas, if the generator set operates in a partially

enclosed space, sufficient ventilation shall be provided.

- ◆ if the generator set is stored outdoors, check all electrical components on the control panel before each use.

Moisture can damage the generator and may cause electric shock.

- ◆ the generator will vibrate during normal use. Regularly check whether the generator and its connected extension line and power line are damaged due to vibration. Repair or replace damaged items as necessary. Do not use plugs or wires with signs of damage, such as broken or broken insulation or damaged blades.

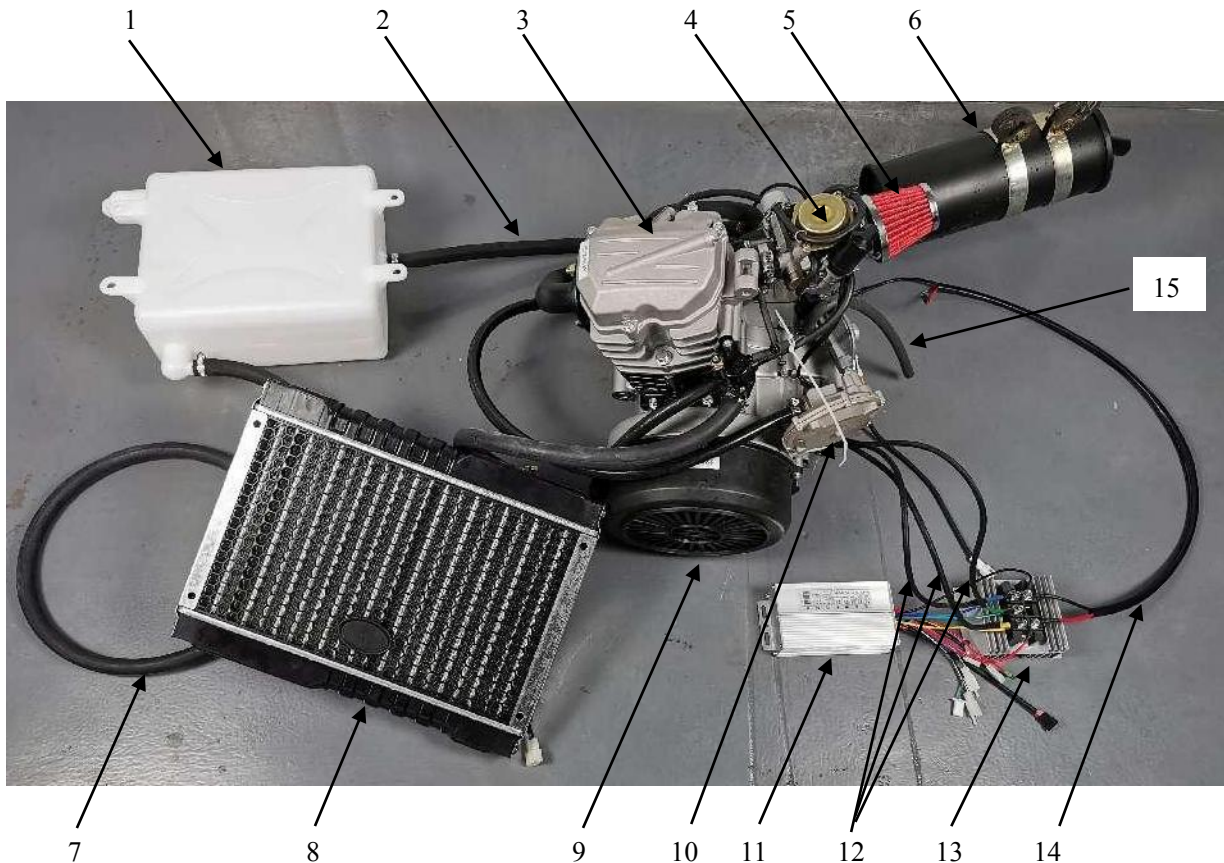
- ◆ if you begin to feel sick, dizzy or weak after the generator is running, please transfer to fresh air immediately.

Go to the doctor. You may have carbon monoxide poisoning.

2. LEARN ABOUT YOUR GENERATOR

This section will show you how to identify key parts of your generator. Going over the terminology below will make sure we're on the same page.

(1) COMPONENT IDENTIFICATION



1 Water tank

2 Inlet pipe

3 engine

4 Carburetor

5 Air filter

6 Muffler

7 Return pipe

8 Radiator and fan

The fan is facing the engine to obtain better cooling effect.

9 Permanent magnet generator

10 Gas inlet valve(Secondary pressure reducing valve)

11 Controller

12 Three phase output cable

Connected to rectifier input, regardless of phase sequence.

13 Rectifier bridge

14 Battery connection cable

15 Exhaust pipe of box

(2) CONTROL FUNCTIONS

Power.SW



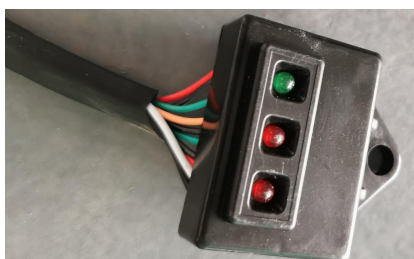
- ◆ After connecting the power (battery) cable, press “ I ” to start the generator. After releasing, it will automatically rebound to “0”.
- ◆ “0” means automatic. When the battery voltage is detected to be lower than preset voltage value in the automatic mode, the generator will start automatically, Automatic flameout when the battery is full.
- ◆ Press “ II ” to turn off the engine. After pressing “ II ”, the generator cannot start automatically and the remote control cannot start!

(3) BATTERY POSITIVE TERMINAL



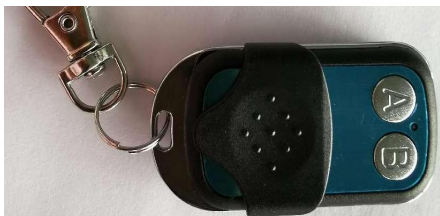
- ◆ Connect the positive pole of the battery through the red cable. Remember, don't connect it wrong! Otherwise, it will lead to serious consequences..

(4) DESCRIPTION OF WARNING INDICATOR



- ◆ The green light is always on, it means that it is powered on and normal
- ◆ The fast flashing green light indicates that the control system is resetting
- ◆ The red light is always on or flashing, it indicates a fault

(5) REMOTE CONTROLLER DESCRIPTION



- ◆ press button A to start the extended range generator
- ◆ press button B to stop the engine
- ◆ remote control battery model: CR2032

(6) INTAKE SYSTEM

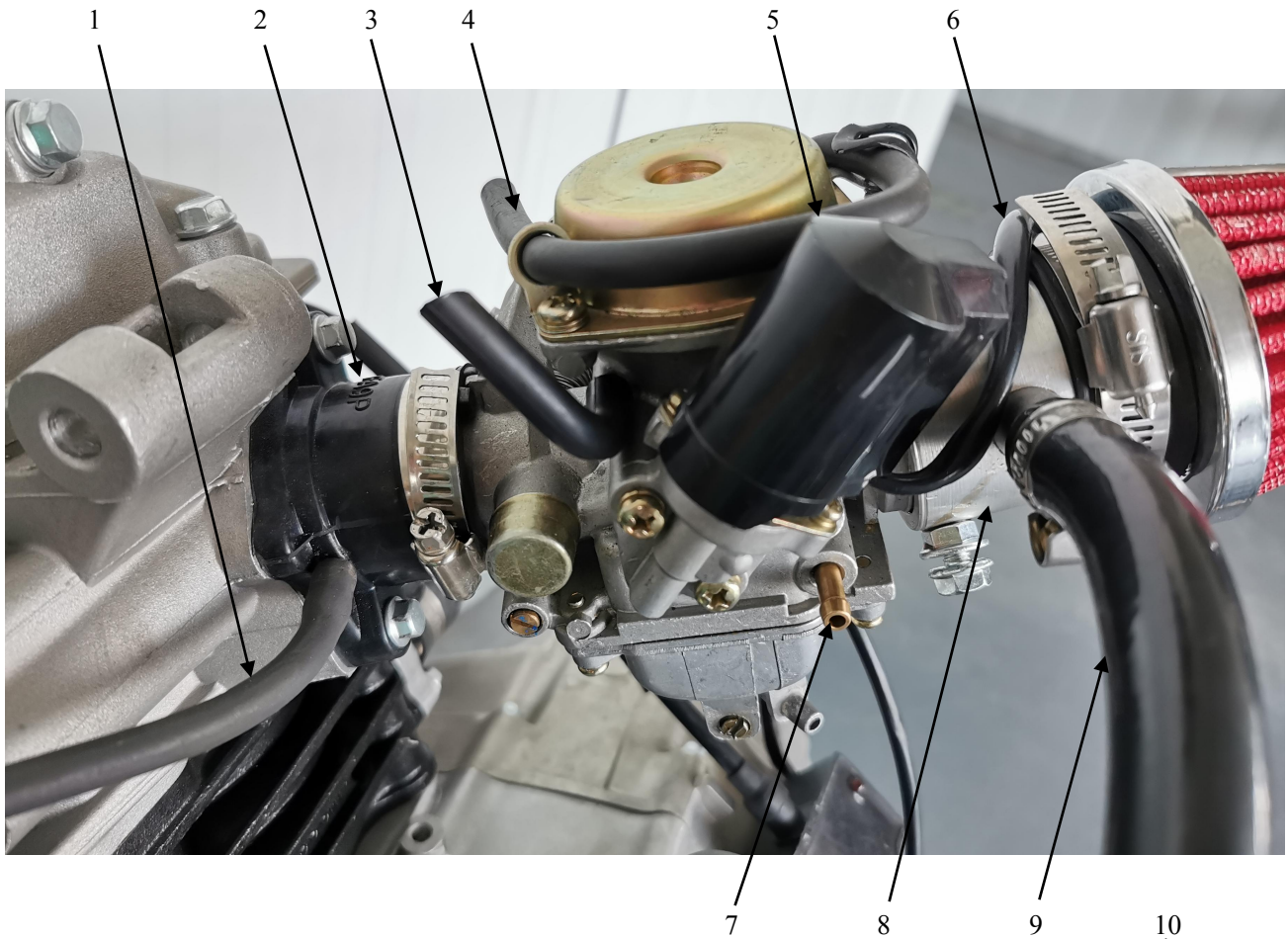


- ◆ For the primary pressure reducing valve, the acceptable pressure value is 0.2 MPa to 1 MPa.
- ◆ The flow of the primary pressure reducing valve is 180000btu per hour.



- ◆ Secondary pressure reducing valve (stable pressure value)

(7) CARBURETOR AND ACCESSORIES

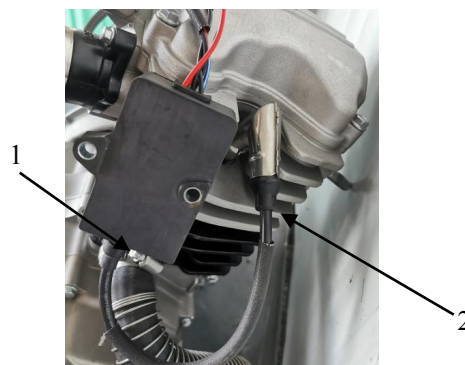


- 1-Gas make-up pipe
- 2-Intake manifold
- 3-Exhaust pipe
- 4-Overflow pipe
- 5-Heater
- 6-Heater harness
- 7-Gasoline inlet
- 8-Gas intake adapter
- 9-Main gas intake pipe
- 10-Throttle control motor



(8) IGNITION SYSTEM

- 1-Igniter
- 2-Spark plug



3. PARAMETERS OF EXTENDED RANGE GENERATOR

Generator model	YD6000P	YD8000P	YD10KP	YD25KP
Engine type	Single cylinder, four stroke			Double cylinder
Cooling system	Water-cooled			
Displacement (ml)	200	250	300	800
Size (mm×mm×mm)	358×355×420	358×355×450	370×355×470	450×440×480
Net weight (kg)	28	30.5	32	65
Maximum generating power (kw/rpm)	5.0/4500	7.0/4500	10/4500	25.0/4500
Speed regulation system	Automatic speed regulation			
Compression ratio	9.5:1		11	10.3:1
Bore and stroke (mm×mm)	63×62	70×65	70×61.2	91×61.5
Ignition system	DC-CDI			
lubrication system	Splash pressure lubrication			
Fuel consumption rate (g/kW.h)	≤354	≤354	≤354	≤354
Starting system	Auto start/Remote start			
Rated Voltage(V)-Current	72V/96V/144V			144V
Suitable battery type	lead-acid battery, Lithium iron phosphate battery, lithium ion battery.			
Applicable battery capacity	lead-acid battery 20kWh~30kWh			Lithium iron phosphate / lithium ion battery 20kWh-50kWh
	Lithium iron phosphate/lithium ion battery 8kWh-30kWh			
Reference vehicle weight	450kg-800kg.			700-1500kg
Vehicle control unit	Optional or Customizable			
CANBUS/485	Customizable			
Electron injection	Customizable			

❖ For applicable of electric vehicle models, please refer to the selection manual.

4. USE AND MAINTENANCE

(1) THE CHOOSING OF LUBRICATING OIL

◆ Confirm the quality level, according to the displacement of the engine, choose the related engine oil. Usually, the bigger the displacement is, the higher level the lubricating oil is. No matter which type it is, we can not choose it only based on price and choose a poor-quality engine oil which will cause the engine's malfunction and shorten the engine's life.

◆ Choose the proper viscosity level, we choose the viscosity of lubricating oil according to different areas and temperature. Four-stroke engine usually choose 10W/30SF (winter) and 15W/40SF (summer) lubricating oil.

◆ Do not tilt the generator when adding engine oil. This could result in overfilling and damage to the engine.

◆ Use high quality 4-stroke engine oil, certified to meet or exceed API standard SG、SF、SAE ratings with strong detergents. Using non-detergent or 2-stroke oil could shorten the engine's working life.

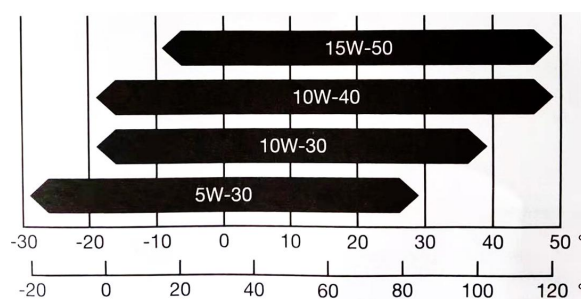
◆ Do not mix different engine oils.

◆ Handle and store the engine oil with care, avoid getting dirt or dust into the engine oil.

◆ Before the engine oil falls below the safety margin, the low oil alert system will automatically shut off the engine.

The low oil light will turn on .

Effective Viscosity Range of engine oils

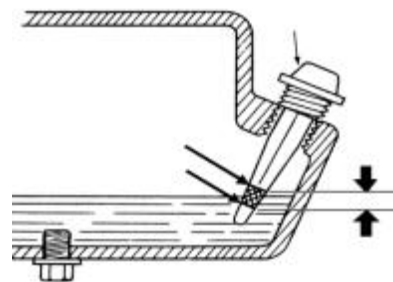


(2) CHECK OF OIL LEVEL

◆ Place the extended range generator flat and check the engine oil level. Please refer to pic for inspection.



oil level

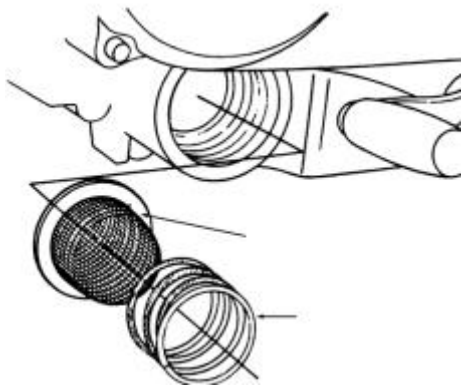


(3) THE RUNNING-IN OF THE ENGINE

- 1) There is no overload during the first 1000km running in.
- 2) During running in, the engine speed shall not exceed 4500r / min; The speed of 125 and above engines shall not exceed 4500r / min. After the running in period, the maximum speed of the engine shall not exceed 7500r / min.
- 3) During running in (within 1000km), replace the engine lubricating oil every 500km. Note: new lubricating oil must be completely replaced, because the mixing of new oil and old oil will accelerate the wear of the engine. After running in, maintenance is required to make up for the initial slight wear, which will significantly prolong the service life of the engine. Please establish and maintain files according to the requirements of the company. The records of maintenance items, brand of engine oil, oil capacity, time and operators will be used as a reference for us to diagnose engine faults in the future.
- 4) During running in or normal operation, the load power shall not be greater than the maximum power of extended range generator.

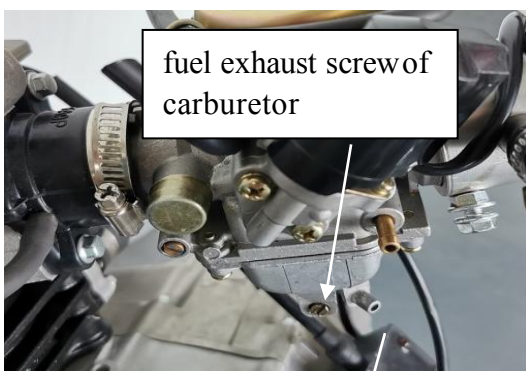
(4) CLEANING OF OIL FILTER SCREEN

- 1) The appearance of engine should be regularly checked and the dirt shall be regularly cleansed.
- 2) Take out the oil filter net and put it in clean kerosene or diesel to cleanse.
- 3) Take off the oil filter cover of the engine oil , put the oil filter in clean kerosene or diesel to cleanse.



(5) MAINTENANCE OF THE CARBURETOR

When the vehicle is parked for a long time, the fuel version must drain the remaining fuel in the carburetor and replenish new fuel. For the gas version, press the black button of the secondary pressure reducing valve. When a problem with the carburetor is found, it must be repaired in a special workshop.

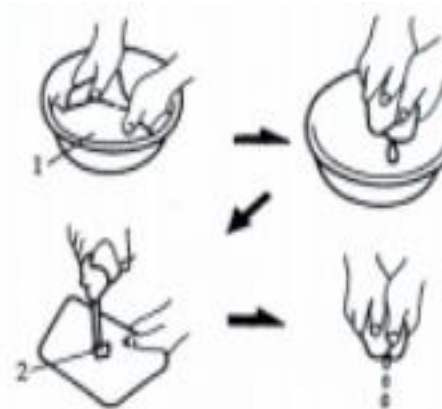
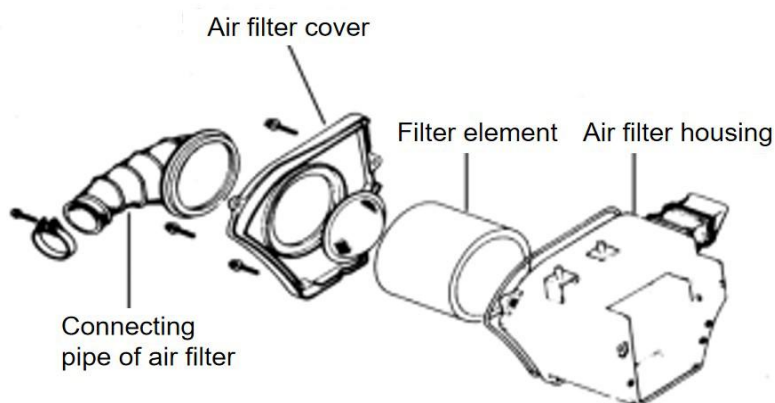


(6) MAINTENANCE OF AIR FILTER

After driven for a certain distance, many dirts and foreign matter are cumulated within the housing of air filter, and the surface of filter element also adhere many dirts which will block the hole of filter element and cause decrease of air input and over strong mixed gas, leading to increasing fuel consumption, burn of oil, blue smog and driving weakness. Therefore, under normal circumstance, the filter element shall be cleansed regularly. On urban clean pavement, it is suggested that maintenance shall be conducted every 3 months or after 5000km's driving; on suburban pavement or areas with much dust in the wind, it is suggested that maintenance shall be conducted every months or 3000km's driving. Different materials of filter element lead to different ways of maintenance.

1) MAINTENANCE OF FOAMED PLASTIC FILTER ELEMENT

- a. Disassemble the air filter
- b. Dismantle the air filter and take the filter element out. Replace the damaged one in time. You can also maintain in special maintenance shop if conditions permit.
- c. Put the foamed plastic filter element into the kerosene or diesel to pinch and clean in order to cleanse the dust and dirts
- d. Extrude the kerosene or diesel within the foam. Note: don't use hands to twist and screw, or it will break the filter element.
- e. If the filtering element cannot separate from support frame, it can be soaked into cleaner and keep shaking, then spin-dry.
- f. Soak the cleansed foam into the engine oil, and extrude the engine oil or spin-dry. When it is with a little oil, it can be installed and utilized.



2) MAINTENANCE OF PAPERY FILTER ELEMENT

- a. Disassemble the air filter.
- b. Dismantle the air filter and take the filter element out. Replace the damaged in time. You can also maintain in special maintenance shop if conditions permit.

- c. Remove the surface dust with hairbrush.
- d. Gently beat or blow with compressed air in order to remove the dust.
- e. The assembly and installation of air filter shall be proceeded in an opposite sequence from the disassembly. Special attention should be paid to seal at assembly and installation. The poorly-sealed air filter is the most important cause for severe malfunction of engines.

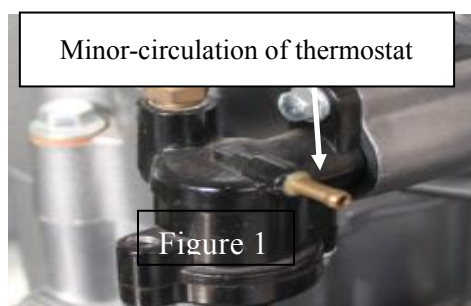


(7) WATER COOLING SYSTEM

First uncover the cover of vehicle tank, remove minor-circulating water pipe at the thermostat.

Add cooling water at the cover of the tank, and observe if minor-circulating water outflows normally. The air in water circulation is not completely drained if minor-circulating water doesn't outflow when added water overflows from the cover of the tank. The pipe bend between the secondary kettle and the tank is required to be tightly clenched at the moment, blow towards the opening of water tank on tank cover mouth, loosen the pipe bend between the secondary kettle and the tank when temperature gas-saving minor circulation flows, continue to add cooling water inside the opening of the tank until the water at the thermostat completely flow linearly (Figure 2) and no air bubble generates at the opening of the tank; restart the engine, check if there is a pressure at the water outflow of minor-circulation. Confirm if the water is circulated, connect the minor-circulating water pipe at the thermostat when the water is circulated, and secure it with the clamp spring, and continue to add water to the tank until the water fill out.

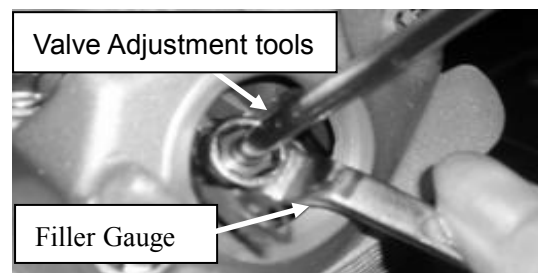
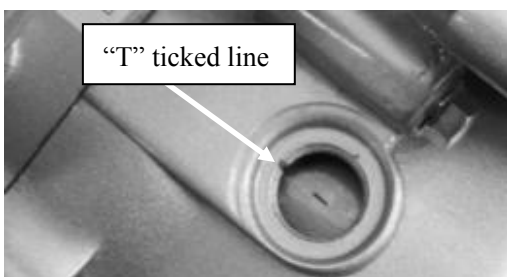
Daily check and confirm of the water of minor circulation is circulated, and it is required to check if the water is normally circulated at minor circulating water pipe of the thermostat when the water is supplemented and added each time, the rotational speed should be controlled under 4000rpm when the engine is at neutral position, and the pressure exists at minor- circulating pipe of the thermostat and outflows in bundle form, and it will be better when the flow speed is faster.



(8) ADJUSTMENT ON VALVE CLEARANCE

Excessively large valve clearance will cause the noise of valve, and excessively small valve clearance will cause declining power of the engine and result in the damage of the valve, the valve clearance should be checked in accordance with specified traveled distance, and the valve clearance should be adjusted in accordance with following procedures.

- 1) Remove the valve-chamber cover and hole cover
- 2) Rotate the rotor of magnetor with socket spanner to have the piston arrive at the upper dead center of compression travel (rotate the rotor of magnetor until “T” ticked line on the motor coincides with the marking on the right crankcase cover).



- 3) Insert the filler gauge with standard size into the position between the end of valve spindle and adjusting screw on the rocker, and the clearance of the inlet valve and the exhaust valve ranges between 0.03 and 0.05mm
- 4) Special tools should be applied to adjust the valve clearance within specified scope if it is within above mentioned scope.
- 5) Re-mount the valve-chamber cover and hole cover.

Notes: The valve clearance should be checked and adjusted at cooling state of the engine, and the inlet exhaust valve should be adjusted on upper dead center of compression travel.

The methods of mounting and adjustment of valve mechanism with similar form are basically similar. It should be noted that there are lots of structure types of chain-based gazogene and their adjustment and regulations are completely different, specific structure should be followed, and corresponding instruction should be followed to conduct assembly and adjustment.

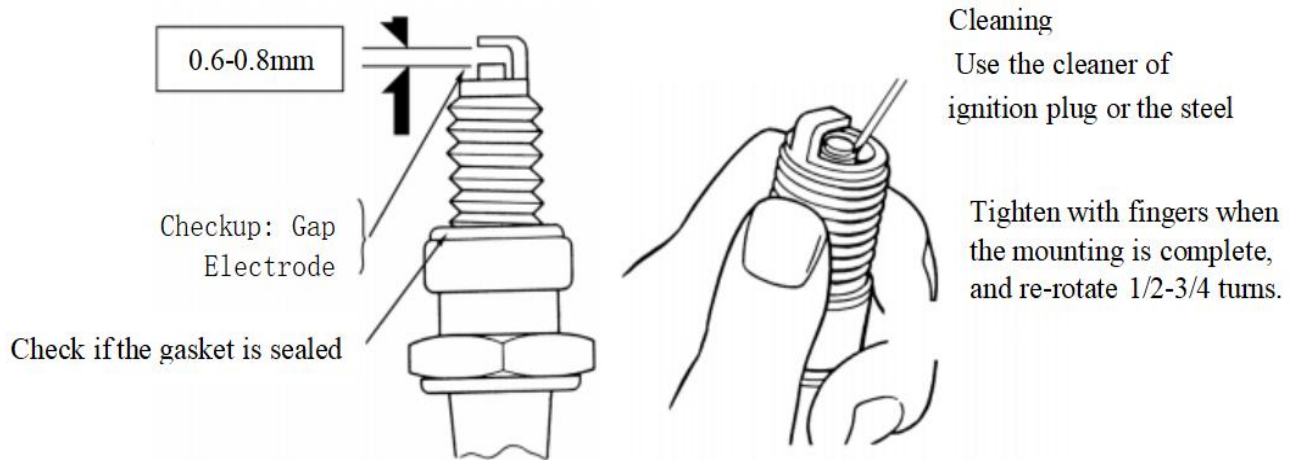
The valve clearance of fuel and gas dual fuel is the same. the inlet valve and the exhaust valve ranges between 0.03 and 0.05mm

The valve clearance of natural gas, the inlet valve and the exhaust valve ranges between 0.03 and 0.07mm

(9) INSPECTION ON IGNITION PLUG

- 1) Remove the ignition plug
- 2) Remove deposited carbon of the ignition plug with the metal wire or a needle, adjust the gap of the ignition plug to range between 0.6mm and 0.8mm.

- 3) Observe the appearance of the ignition plug and the color of the carbide when
- 4) deposited carbon is removed. It can be determined if standard ignition plug is suitable. The ignition plug should be replaced with hot plug if standard ignition plug is susceptible to damp, and cooling plug should be replaced with when the standard ignition plug is overheated (the porcelain pole goes white .)



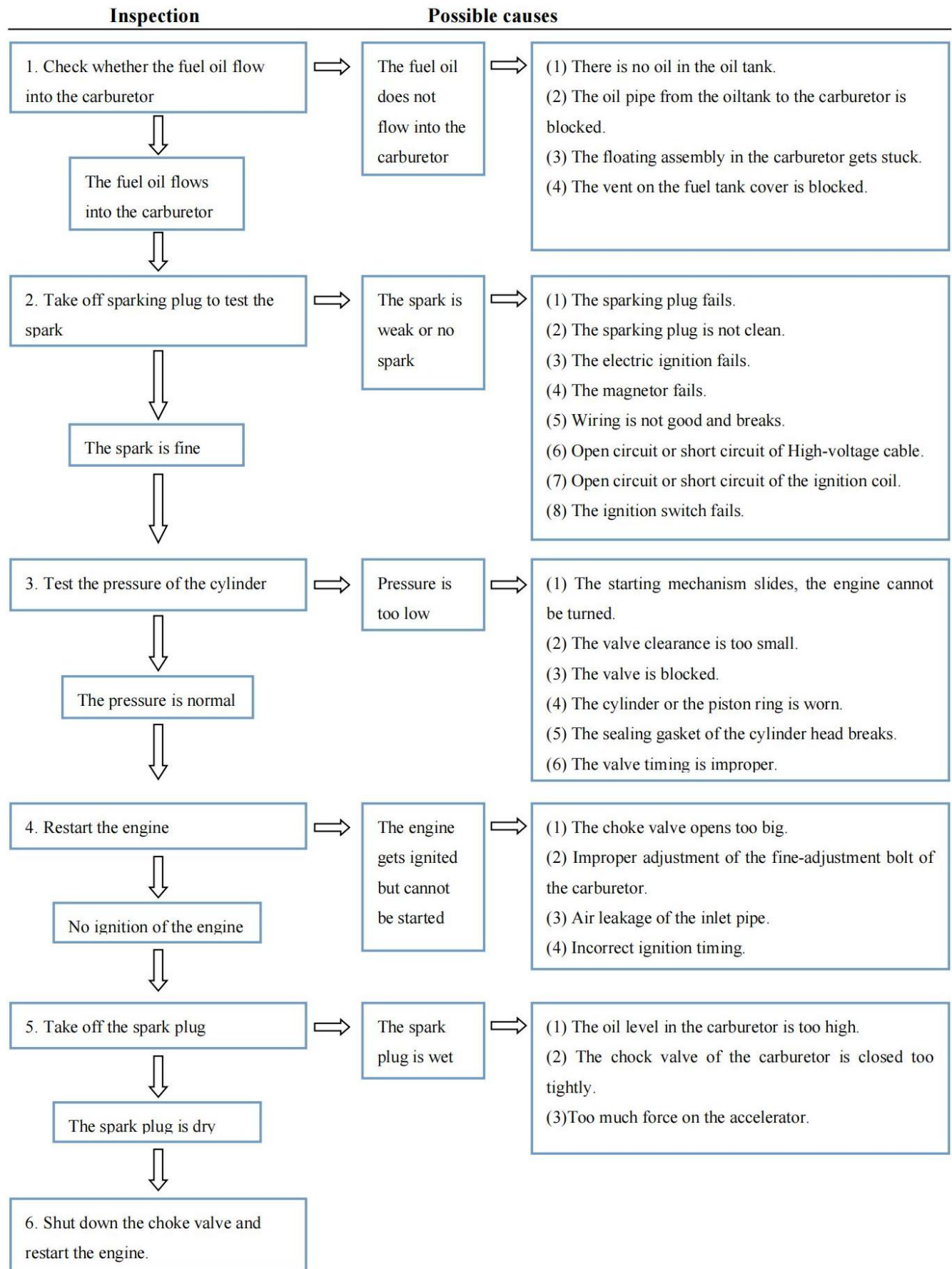
5. MAINTENANCE SCHEDULE

Maintenance Period Item	First 1000km	3000km	5000km	6000km
Cylinder Head, Cylinder Nut	Check	Check	Check	Check
Air Filter	Clean every 1000km		Replace	Replace
Tensioner	New car, and adjust every 1000km			
Valve Clearance	Check	Adjust	Adjust	Adjust
Fuel Filter	Clean	Clean	Clean	Clean
Spark Plug	Check	Check	Check	Replace
Engine Oil	every 1000km in running-in period		Replace	Replace
Oil Filter	Clean	Replace	Replace	Replace
Oil Filter Screen	Clean	Clean	Clean	Replace
Carburetor	Check	Clean	Clean	Clean
Clutch	Check	Check	Check	Check

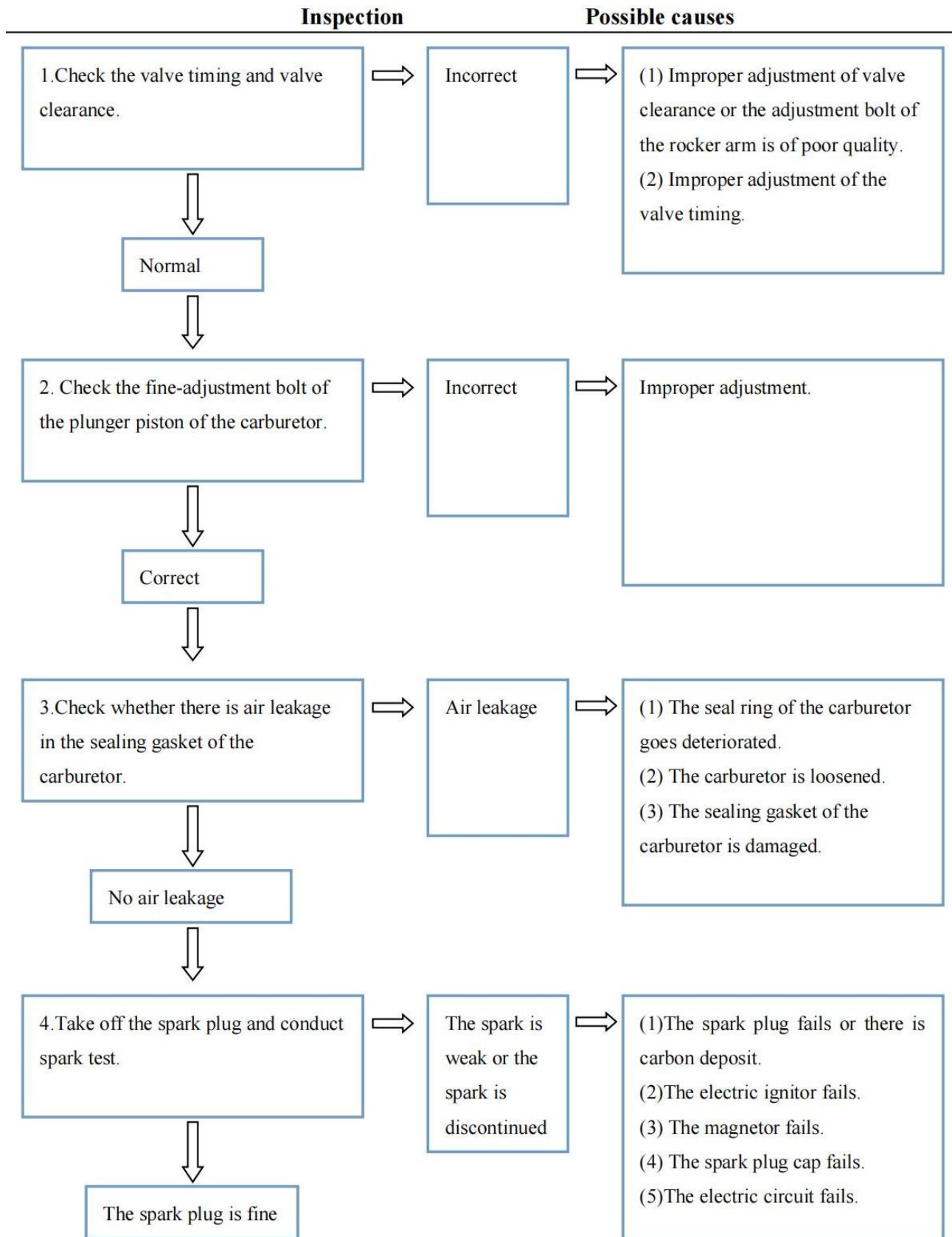
Note: Service more frequently when used in more severe conditions.

6. TROUBLESHOOTING

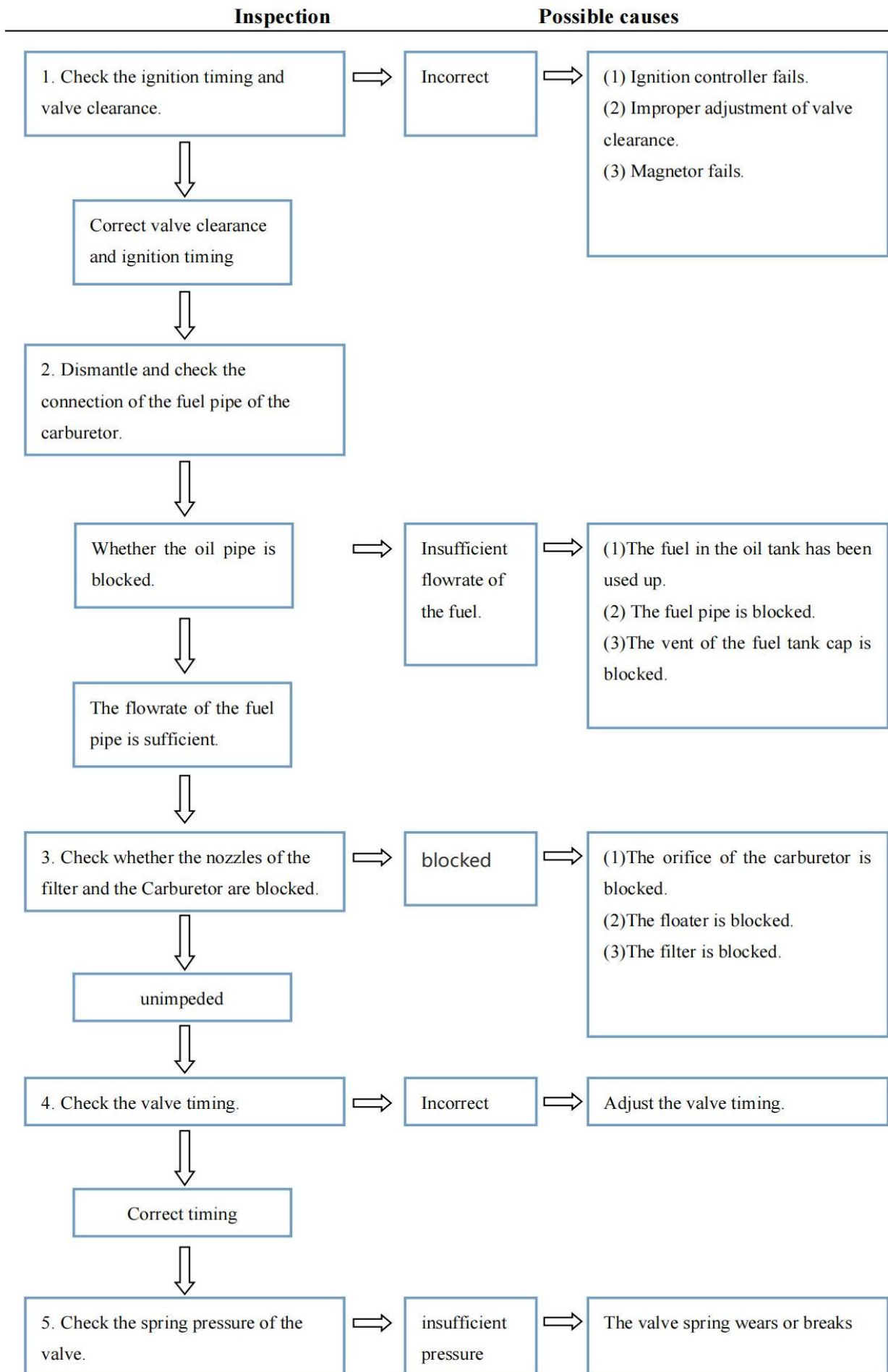
6.1 THE ENGINE CANNOT BE STARTED OR IS DIFFICULT TO BE STARTED





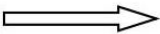
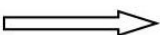
6.2 POOR PERFORMANCE OF THE ENGINE AT LOW SPEED OR IDLE SPEED



6.3 POOR PERFORMANCE OF THE ENGINE AT HIGH SPEED



6.4 ABNORMAL NOISE OF THE ENGINE

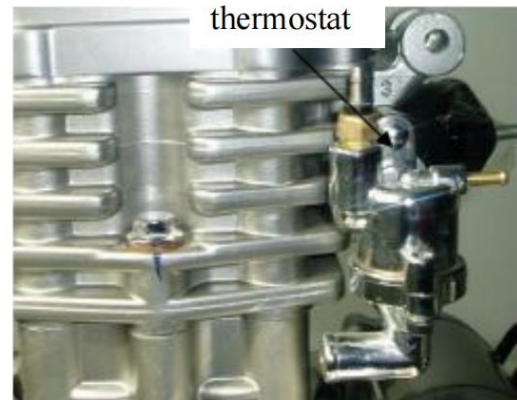
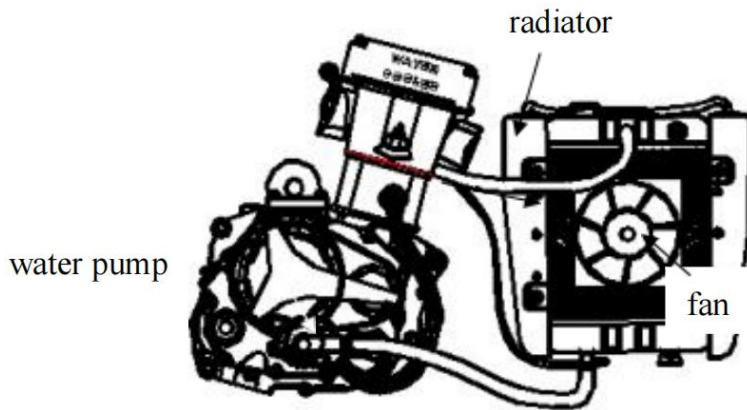
Inspection	Possible causes
1. Abnormal noises from the valve	 <ul style="list-style-type: none">(1) Valve clearance is too big Abnormal noises from the valve.(2) Valve is worn.
2. Abnormal noises from the cylinder	 <ul style="list-style-type: none">(1) Piston and cylinder block are worn.(2) Piston pin and the small end hole of the connection rod are worn.(3) The Crank pin and the connecting rod big end are worn.
3. Abnormal noises from the timing chain	 <ul style="list-style-type: none">(1) The camshaft is worn.(2) The timing driven sprocket is worn.(3) The timing chain stretches.(4) The automatic tensioner of the timing chain fails or the guide pulley is worn.
4. Abnormal noises from driving gear and driven gear	 <ul style="list-style-type: none">(1) The machining precision of the gears are insufficient.(2) The teeth of the gear are worn.(3) The fit clearance between the driving gear and driven gear is too small or too big.

6.5 WATER COOLING SYSTEM

If the engine's water cooling system breaks down, it will cause under cooling or overheat of the engine, which will affect the engine's normal operation. Therefore, the engine's liquid cooling system shall be maintained regularly and failures that are found shall be eliminated.

- (1) The choosing of cooling liquid shall be consistent with the local temperature and environmental conditions. The freezing point of cooling liquid shall be lower than local ambient temperature. However, the cooling liquid shall not be replaced by tap water or hard water, because cooling liquid is of the functions such as cooling, antiscaling, rust prevention and increasing of boiling point while tap water and hard water are only able to cool down without other functions. The engine which uses tap water or hard water for cooling in a long period of time is hard to dissipate heat due to scale depositing on waterway, which will lead to overheating.
- (2) After the cooling liquid is used for a period, it will discolor and deteriorate, leading to poor cooling effect, then it should be replaced in time. Open the draining bolt and tank cover after the engine cools down, drain the cooling liquid in the pipeline (blow one end with compressed air), then install the draining bolt. The water tank and pipeline shall be fully filled with cooling liquid. After the proper arrangement of tank and water pipe, take out the minor-cycle water pipe of the thermostat, fill the cooling liquid slowly until the liquid level does not decrease any longer (or fill the cooling liquid in the closed system), then close the tank cover. The steps of the replacement of cooling liquid in auxiliary water tank should be like this: add the cooling liquid in auxiliary tank first, and fill cooling liquid between the marking lines on the container, which can ensure the thermally expanded cooling liquid is able to flow into the auxiliary tank when the engine is overheated and that flow back to tank after cooling.
- (3) The bearing of water pump shall be well lubricated in order to reduce the wearing. If the bearing is severely worn, it should be replaced in time. The parts of the water pump shall be sealed reliably; it should be fixed in time if leakage appears. At the same time, the incrustation in the waterway shall be cleansed regularly.
- (4) The pipeline of water cooling system shall be unimpeded without any leakage. The water pipe connection shall be secure and reliable that no leakage is allowed. The water pipe shall be smoothly transited that no bending or deformation is allowed. Cooling fins shall be intact. The dust and dirt on cooling fins shall be cleansed regularly in order to keep good heat dissipation. The damaged parts of pipes and cooling fins shall be fixed or replaced in time.
- (5) The blade's assembly direction and assembly angle of fans shall be correct. The blades if deformed shall be corrected and replaced if necessary.

- (6) The thermostat plays a very important role in maintaining the engine's running and lessening wearing. It shall not be dismantled at liberty. The inspection of thermostat shall be processed in hot water over 72°C (it can be processed in water at its boiling point if no thermometer) and check whether the valve is open. If the valve is not open, it should be replaced, otherwise the cooling liquid can not be major cycled.



- (7) When the engine is on the cooled state, open the tank cover to check if the cooling liquid becomes less. If it becomes a lot less, it means leakage happens, and further inspection is necessary for inner leakage or out leakage.
- (8) We can judge if there is inner leakage within liquid-cooled engine by the color of engine oil. If leakage flows into engine oil, the engine oil would emulsify and deteriorate and discolor, and turn white. Then, the engine shall be dismantled and the parts, such as water pump, cylinder head, cylinder gasket, cylinder body and right cover, relevant to water lane shall be inspected with more attention.
- (9) Through direct observation on the hole under the right cove, water pump, tank, auxiliary tank, shell of thermostat, water pipe and its joints, we can judge if there is out leakage.
- (10) The overheated illusion of liquid-cooled engines. Users have misunderstandings over the liquid-cooled engines that they use hands to touch the cylinders block and cylinder end and feel it overheated, but the actual temperature is about 120°C which is not high. If we use thermometer or multimeter with temperature sensor test the temperature of cooled liquid, it differs greatly from the indicated temperature, which means resistance of temperature sensor is not consistent with the engine's instruments.
- (11) The truth of liquid-cooled engines' overheat. At first, we should confirm if plenty of cooled liquid in tank flows into auxiliary tank. If so, the engine is possible to go boiling. However, following effective measures should be taken to confirm whether it is overheated.
- A. Check the unimpededness of water pipe: parts of water pipe deflect severely; the incrustation causes blocking.
- B. Check the punch of cylinder gasket: open the tank cover, if the opening of tank burst out a large number of

cooled liquid in high speed, it means minor leakage between the combustor and waterway. Besides the phenomenon above, take off the ignition plug and activate the engine, if the cooled liquid burst out to the opening of ignition plug, it means there is severe leakage between combustor and water lane. Then, disassemble the engine to check whether the bolt torque reaches the specified value, whether the cylinder is concave (it is generally concave), whether the flatness of cylinder head is concave, whether the cylinder gasket degums or cracks, and whether the seal line of cylinder body and cylinder head damages or has any dirt attached.

(12) The input power supply of the water cooling system is 12V DC.

7. TRANSPORTATION & STORAGE

7.1 TRANSPORTING THE EXTENDED RANGE GENERATOR

- (1) Before transportation on the road, drain the carburetor fuel (gasoline version) of the extended range generator to avoid danger caused by fuel residue.
- (2) Draw out the lubricating oil in the crankcase to avoid the lubricating oil entering the combustion chamber due to bumping or inversion.
- (3) The extended range generator shall be transported with a support frame or packing box to avoid damage to the extended range generator.

7.2 STORAGE

- (1) Before storing the generator set for an extended period:
- (2) Ensure that the storage area is free of excess humidity and dust.
- (3) Drain the fuel tank and the carburetor.
- (4) To prevent corrosion, coat screws and exposed metal with anti-rust oil at least twice per year.

8. REFERENCE INFORMATION ABOUT BATTERIES

- When the battery has BMS, the GCU of the extended range generator will communicate with the BMS, and the GCU will judge whether to start and close automatically according to the residual capacity fed back by the BMS.
- If the battery pack does not have BMS, the GCU of the extended range generator will decide whether to start or close automatically according to the voltage value (residual capacity) fed back by the battery pack. This situation is called blind charging.

◆ Lead acid battery

1. Stage charging of lead-acid battery

1.1 In the constant current charging stage, the charging current of the charger remains constant, the charged power increases rapidly, and the battery voltage rises;

1.2 In the constant voltage charging stage, the charging voltage of the charger remains constant, the charged power continues to increase, the battery voltage rises slowly and the charging current decreases;

1.3 When the battery is full, the charging current drops below the floating charge conversion current, and the charging voltage drops to the floating charge voltage;

1.4 In the floating charge stage, the charging voltage of the charger is maintained at the floating charge voltage.

2. Composition of lead-acid battery

The nominal voltage of a single cell lead-acid battery is 2.0V, which can discharge to 1.5V and charge to 2.4V; In application, six single cell lead-acid batteries are often connected in series to form a nominal 12V lead-acid battery, as well as 24V, 36V, 48V, 60V, 72V, 96V, etc.

3. Relationship between residual capacity and voltage of lead-acid battery (reference value).

12V nominal voltage battery pack						
Feedback voltage	11.58V	11.75V	11.9V	12.2V	12.5V	14.4V
Remaining capacity	20%	30%	40%	60%	90%	100%/Floating charge
24V nominal voltage battery pack						
Feedback voltage	23.16V	23.5V	23.8V	24.4V	25V	28.8V
Remaining capacity	20%	30%	40%	60%	90%	100%/Floating charge
48V nominal voltage battery pack						
Feedback voltage	46.32V	47V	47.6V	48.8V	50V	57.6V
Remaining capacity	20%	30%	40%	60%	90%	100%/Floating charge

60V nominal voltage battery pack						
Feedback voltage	57.9V	58.75V	59.5V	61V	62.5V	72V
Remaining capacity	20%	30%	40%	60%	90%	100%/Floating charge
72V nominal voltage battery pack						
Feedback voltage	69.84V	70.5V	71.4V	73.2V	75V	86.4V
Remaining capacity	20%	30%	40%	60%	90%	100%/Floating charge
96V nominal voltage battery pack						
Feedback voltage	92.64V	94V	95.2V	97.6V	100V	115.2V
Remaining capacity	20%	30%	40%	60%	90%	100%/Floating charge

◆ Lithium iron phosphate battery

1. Charging stage of lithium battery

1.1 Trickle charging is used to precharge the fully discharged lithium-ion battery unit (restorative charging).

1.2 Constant current charging, When the lithium battery voltage rises above the trickle charging threshold, increase the charging current for constant current charging.

1.3 Constant voltage charging, When the voltage of lithium-ion battery rises to the maximum voltage, the constant current charging ends and the constant voltage charging stage begins. According to the saturation degree of the cell, the charging current decreases slowly from the maximum value as the charging process continues.

1.4 charge termination

2. Composition of lead-acid battery

In general, the nominal voltage of single lithium iron phosphate battery is 3.2V, which can be discharged to 2.8V and charged to 3.6V; In applications, multiple lithium iron phosphate batteries are usually connected in series to form a nominal 12V lithium iron phosphate battery, as well as 24V, 36V, 48V, 60V, 72V, 96V, etc.

It is very important to determine how many single cells your battery pack is composed of.

3. Relationship between residual capacity and voltage of lithium iron phosphate battery (reference value)

12V battery pack(4 series single cell)						
Feedback voltage	12.4V	13.04V	13.2V	13.36V	13.68V	14.4V
Remaining capacity	10%	20%	30%	70%	100%	Terminate charging
24V battery pack(8 series single cell)						
Feedback voltage	24.8V	26V	26.4V	26.72V	27.36V	28.8V
Remaining capacity	10%	20%	30%	70%	100%	Terminate charging

48V battery pack(15 series single cell)						
Feedback voltage	46.5V	48.9V	49.5V	50.1V	51.3V	54V
Remaining capacity	10%	20%	30%	70%	100%	Terminate charging
60V battery pack(19 series single cell)						
Feedback voltage	58.9V	61.94V	62.7V	63.46V	64.98V	68.4V
Remaining capacity	10%	20%	30%	70%	100%	Terminate charging
72V battery pack(23 series single cell)						
Feedback voltage	71.3V	74.98V	75.9V	76.82V	78.66V	82.8V
Remaining capacity	10%	20%	30%	70%	100%	Terminate charging
96V battery pack(30 series single cell)						
Feedback voltage	93V	97.8V	99V	100.2V	102.6V	108V
Remaining capacity	10%	20%	30%	70%	100%	Terminate charging
144V battery pack(45 series single cell)						
Feedback voltage	139.5V	146.7V	148.5V	150.3V	153.9V	162V
Remaining capacity	10%	20%	30%	70%	100%	Terminate charging

◆ Lithium ion battery

1. The charging process of lithium ion battery is consistent with that of lithium iron phosphate battery.
2. In general, the nominal voltage of lithium-ion battery is 3.7V, and the maximum charging is 4.2V; In application, multiple lithium-ion batteries are connected in series to form a nominal 24V lithium iron phosphate battery, as well as 36V, 48V, 60V, 72V, 96V, etc.
3. Relationship between residual capacity and voltage of lithium ion battery(reference value)

48V battery pack(13 series single cell)						
Feedback voltage	47.84V	48.62V	49.27V	50.31V	52.78V	54.6V
Remaining capacity	10%	20%	40%	60%	90%	Terminate charging
60V battery pack(16 series single cell)						
Feedback voltage	58.88V	59.84V	60.64V	61.92V	64.96V	67.2V
Remaining capacity	10%	20%	40%	60%	90%	Terminate charging
72V battery pack(20 series single cell)						
Feedback voltage	73.6V	74.8V	75.8V	77.4V	81.2V	84V
Remaining capacity	10%	20%	40%	60%	90%	Terminate charging

96V battery pack(26 series single cell)						
Feedback voltage	95.68V	97.24V	98.02V	100.62V	105.56V	109.2V
Remaining capacity	10%	20%	40%	60%	90%	Terminate charging
144V battery pack(39 series single cell)						
Feedback voltage	143.52V	145.86V	147.81V	150.93V	158.34V	163.8V
Remaining capacity	10%	20%	40%	60%	90%	Terminate charging

- ❖ The above parameters are based on standard status. Cell material, quality and the external environment will affect the relationship between the battery voltage and the residual capacity.
- ❖ Before purchasing extended range generator, please confirm the relationship parameters between residual capacity and discharge voltage with your battery supplier.

9. MODEL SELECTION RECOMMENDATION

Conditions for long endurance of extended range hybrid vehicle:

Electric range (km): A

Max driving speed(km/h): B

Extended range generator power(kW): C

Battery capacity(kWh): D

Amplification factor: 1.2

Assuming that the range of an electric vehicle is 200km (A), the maximum speed is 140km / h (B), and the battery capacity is 24kwh (D), the power of the extended range generator is greater than or equal to 20.2kw (C).

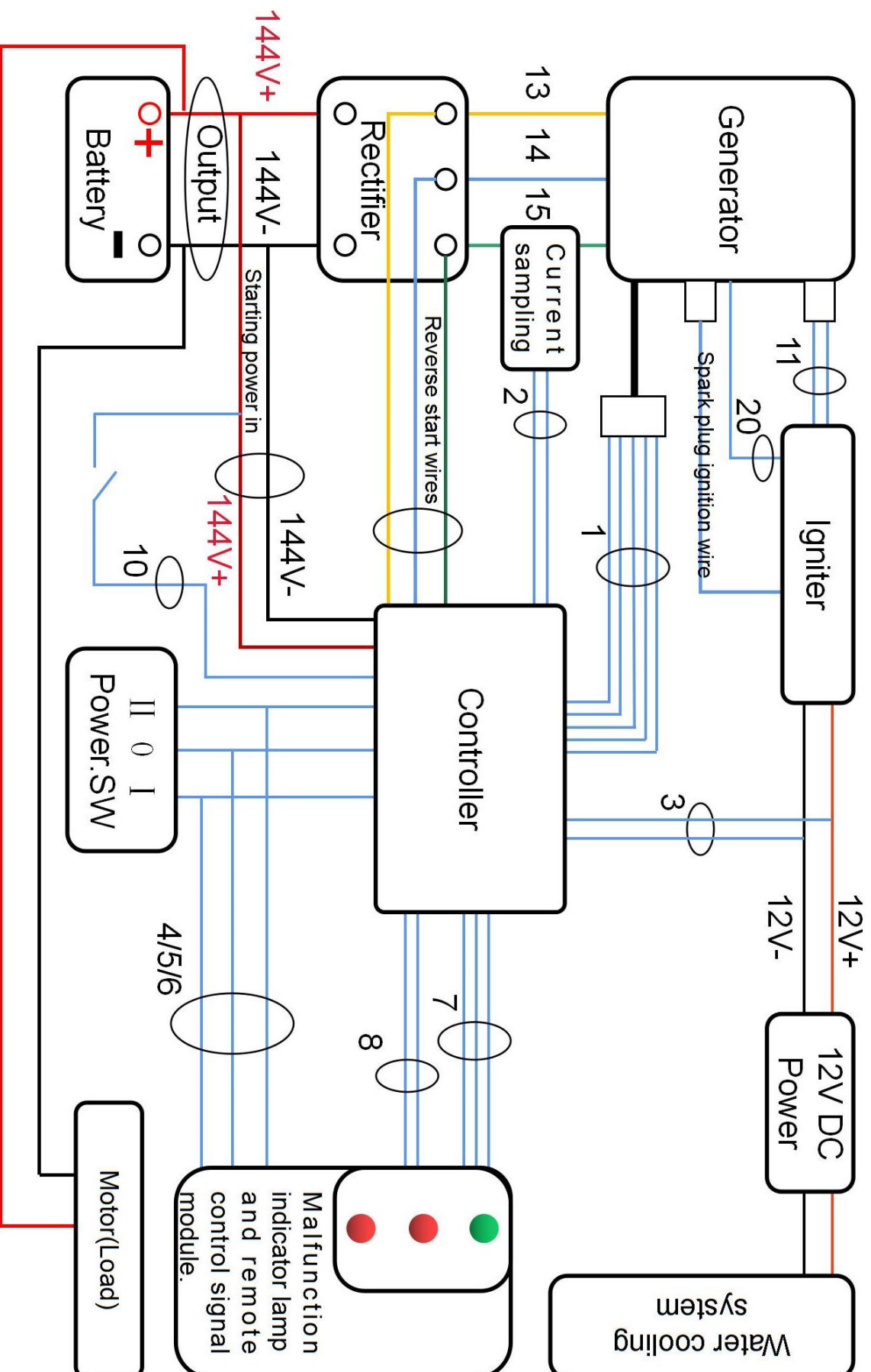
Computational formula:

$$(A \div B) \times C \geq 1.2D$$

Vehicle weight	Motor power	Volt	Battery	Mileage	Max speed	Battery drive	Model selection
0.72T	20kW	96V 144V	13.8kWh	120km	80km/h	1.5h	YD10KP
0.88T	25kW	144V	17.8kWh	200km	100km/h	2h	(YD8000P) YD10KP
1.12T	36kW	144V	31kWh	300km	100km/h	3.0h	YD10KP
1.48T	120kW	144V 320V	28kWh	200km	160km/h	1.2h	YD25KP
1.75T	120kW	144V 320V	20kWh	120km	150km/h	0.8h	YD25KP
1.91T	150kW	320V	31kWh	150km	160km/h	0.9h	YD55KP
2.31T	400kW	320V	35kWh	180km	220km/h	0.8h	YD75KP

- Since there are many models of electric vehicles and other vehicles, please consult the sales engineer or calculate the power demand of the extended range generator according to the formula.

Wiring diagram of 144v extended range generator



10. CIRCUIT AND FUNCTION DESCRIPTION

WIRES AND FUNCTION DESCRIPTION

Number	Name	Describe	Remarks
1	Throttle motor control wires (Hall)	The controller controls the stepping motor to automatically adjust the engine speed and output power according to the load.	
2	Current sampling wires	Collect the current signal and feed it back to the controller. The current annunciator can be used in any one of the three-phase wires.	
3	Ignition power control wires	Control the ignition of the engine	
4	Start control wires	1) Power.SW ◆After connecting the power (battery) cable, press“ I ” to start the generator. After releasing, it will automatically rebound to “0”.	If there is 485 / CANBUS communication protocol, the operation can be completed on the vehicle control panel.
5		◆“0” means automatic. When the battery voltage is detected to be lower than preset voltage value in the automatic mode, the generator will start automatically, Automatic flameout when the battery is full.	
6		◆Press “ II ” to turn off the engine. After pressing “ II ”, the generator cannot start automatically and the remote control cannot start!	
7	Operation indicator wires	2) Remote controller. ◆ press button A to start the extended range generator. ◆press button B to stop the engine.	
8	Signal module power wires	◆ The green light is always on, it means that it is powered on and normal ◆ The fast flashing green light indicates that the control system is resetting ◆ The red light is always on or flashing, it indicates a fault.	
10	Positive pole of switch lock	Power supply of remote control signal module.	
11	Heater wires	It needs a switch to connect with the positive pole of the battery. For example, when you leave the vehicle and remove the key, the generator will not start automatically.	

Number	Name	Describe	Remarks
13	Three phase output cable of extended range generator	It can be connected to the input of rectifier bridge in any sequence, but the wires needs to correspond to the color of reverse start wires.	
14			
15			
20	Ground wire of igniter		
*	Starting power in	The power battery provides input DC power for the start-up of the extended range generator.	
*	Reverse start wires	Extended range generator starting wires	
*	Output wires	144v positive and 144v negative output cables. Please connect the positive and negative poles of the battery and motor correctly.	