POWERHOUSE®

POWERHOUSE POWER PRODUCTS

PH2100PRi SHOP MANUAL

Coast Distribution
April, 2011

Preface

This manual covers the construction, function and servicing procedure of the *POWERHOUSE*® PH2100PRi generator, certificated by CARB.

Careful observance of these instructions will result in better, safe service work.

CONTENTS

1. SPECIFICATIONS

1.1 SPECIFICATIONS

Dimensions and weights

Model	PH2100PRI
Overall Length	22 in. (559mm)
Overall Width	11 in. (279mm)
Overall Height	19 in. (482mm)
Net Weight, with battery	73 lbs. (33kg)

Engine

Model	152F
Type	4-stroke,OVH, single cylinder, Gasoline engine
Displacement	125cc
Bore x stroke	52.4X57.8 mm
Maximum horsepower	4.35 Hp
Compression ratio	9.2:1
Cooling system	Forced air-cooled
Ignition system	Electronic
Spark plug	A7RTC
Carburetor	Float type, Horizontal, butterfly valve type
Air cleaner	Semi-dry type
Governor	Electronic control type
Lubrication system	Pump
Lube oil	SAE 15W-40 (SF/SG grade or greater)
Oil capacity	15.6 fl oz (460 ml)
Starting system	Recoil starter / Electric / Remote
Stopping system	Primary circuit ground
Fuel used	Automotive unleaded gasoline

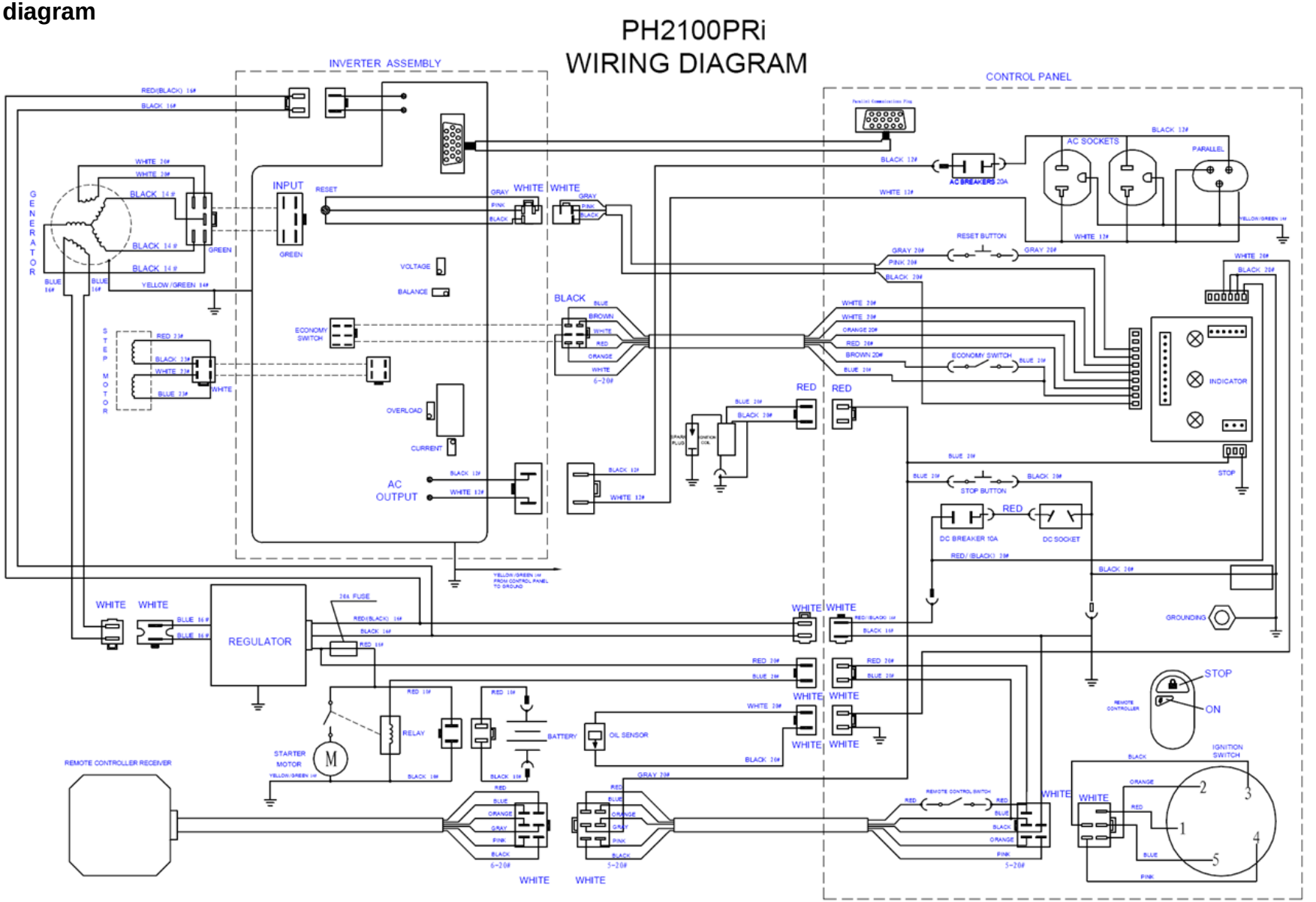
Alternator

Alternator type	Multi pole rotation type
Alternator structure	Self-ventilation drip-proof type
Excitation	Self-excitation (Magnet type)
Phase	Single phase
Rotating direction	Clockwise (Viewed from the generator)
Frequency regulation	AC-DC-AC conversion (Inverter type)

1.2 CHARACTERISTICS

Model	PH2100PRi
Maximum output AC	2.1KVA
Rated output AC	2.0KVA
Rated output DC	100W
Rated frequency	60HZ
Rated voltage AC	120V
Rated voltage DC	12V
Rated current AC	16.7A
Rated current DC	8.3A
Power factor	1.0cosφ
Voltage variation rate Momentary Average Average time	10%max. 1.5%max. 3 sec. max.
Voltage stability	±1%
Frequency variation rate Momentary Average Average time	1%max. 1%max. 1 sec. max.
Frequency stability	±0.1%
Insulation resistance	10MΩmin.
AC circuit protector	20A
DC circuit protector	10A
Fuel tank capacity	1.3 gal (4.9L)
Continuous running time at Rated load ~ 1/4 load	3.0 ~ 7.5 hours
Noise level (Zero load to full load)	56~63 dB (A)/7m

1.3 Wiring diagram



2 Service Information

2.1 The importance of proper servicing

Proper servicing is essential to the safety of the operator and the reliability of the engine. Any error or oversight made by the technician while servicing can easily result in faulty operation, damage to the engine or injury to the operator.

- Improper servicing can cause an unsafe condition that can lead to serious injury or death.
- Follow the procedures and precautions in this shop manual carefully.
- Some of the most important precautions are given below. However, we cannot warn you of every conceivable hazard that can arise in performing maintenance or repairs. Only you can decide whether you should perform a given task.
- Failure to follow maintenance instructions and precautions can cause you to be seriously hurt or killed. Follow the procedures and precautions in this shop manual carefully.

2.2 Important safety precautions

Be sure you have a clear understanding of all basic shop safety practices and that you are wearing appropriate clothing and safety equipment. When performing maintenance or repairs, be especially careful of the following:

- Read the instructions before you begin, and be sure you have the tools and skills required to perform the tasks safely.
- Be sure that the engine is off before you begin any maintenance or repairs. This will reduce the possibility of several hazards:
  - **a.)** Exhaust gas contains poisonous carbon monoxide. Never run the generator in an enclosed area.
  - **b.)** Be sure there is adequate ventilation whenever you run the engine.
  - **c.)** The muffler becomes very hot during operation and remains hot for several minutes after stopping the engine.
  - **d.)** Let the engine cool before you touch it.
  - **e.)** Keep away from moving parts while the generator is running.
- Do not run the engine unless the instruction tells you to do so. Even then, keep your hands, fingers, and clothing away.
- Gasoline is extremely flammable and explosive under certain conditions. To reduce the possibility of a fire or explosion, use caution when working around gasoline, use only a nonflammable solvent, not gasoline, to clean parts. Keep all cigarettes, sparks, and flames away from all fuel-related parts.

2.3 Service rules

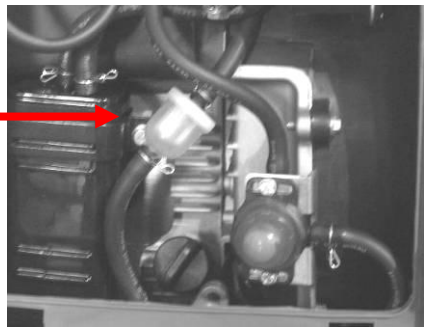
1. Use genuine *POWERHOUSE*® or *POWERHOUSE*®-recommended parts and lubricants or their equivalents. Parts that do not meet *POWERHOUSE*® design specifications may damage the engine.
2. Always install new gaskets, O-rings, etc. when reassembling.
3. When tightening bolts or nuts, begin with larger-diameter or inner bolts first and tighten to the specified torque diagonally, unless a particular sequence is specified.
4. Clean parts in cleaning solvent upon disassembly. Lubricate any sliding surfaces before reassembly.
5. After reassembly, check all parts for proper installation and operation.
6. Many screws used in this machine are self-tapping. Be aware that cross-threading or over tightening these screws will strip the threads and ruin the hole.
7. Use only metric tools when servicing this engine. Metric bolts, nuts and screws are not interchangeable with non metric fasteners. The use of incorrect tools and fasteners will damage the engine.
8. Follow the instructions represented by these symbols when they are used.

Electric precautions

1. Hold the connector body to disconnect the connector. Do not disconnect by pulling the wire harness. To disconnect the locking connector, be sure to unlock first, and then disconnect.
2. Check the connector terminals for bent, excessive extrusion, missing terminal, or other abnormalities before connecting the connector.
3. To connect, insert the connector as full as it goes. If the connector is a locking type, be sure that it is locked securely.
4. Check the connector cover for breakage and check whether the connector female terminal is open excessively. Then, connect the connector securely. Check the connector terminal for rust. Remove the rust using an emery paper or equivalent material before connecting the connector.
5. Set the harness clips in the specified places of the frame securely, and clamp the wire harnesses.
6. Clamp the wire harnesses securely so that they do not interfere with the rotating parts, moving parts and the hot parts.
7. Route and connect the wire harnesses properly. Be sure that the harnesses are not loose, twisted or pulled tight.
8. Route the wire harnesses properly so that they do not contact with the shape edges and corners, and the end of the bolts and screws on the body.
9. If a wire harness contacts the end of the bolts/screws or sharp edges and corners, protect the contact part of the harness with a tube or by winding with an electrician’s insulating tape. If the wire harness has a grommet, set the grommet securely.
10. Take care not to pinch the wire harnesses during installation of a part. If a wire harness has the damaged insulation, repair by winding with the electrician’s insulating tape.
11. Read the tester manufacture’s operation instructions carefully before operation with tester. Follow the instructions of the Service Manual. Be sure that the battery built in a tester is fully charged and check the meter before inspection using the tester.

2.4 Serial number location

The serial number can be found stamped on the engine block above the oil dipstick. It is visible when the maintenance panel is removed.



2.5 Engine maintenance standards

Part	Item		Standard(mm)	Service limit
Engine	Maximum speed without load		5000±100rpm	—
Cylinder	Sleeve I.D.		52.400-52.420mm (2.0630”~2.0638”	52.505mm (2.0671”)
Piston	Skirt O.D		52.360-52.380mm (2.061”~2.062”)	52.25mm (2.057”)
	Pin bore I.D.		15.002-15.008mm (0.5907”~0.5908	15.05mm (0.5925”)
Piston pin	O.D		14.994-15.000mm (0.5903”~0.5905”)	14.95mm (0.588”)
Piston ring	1st ring	Height h	0.97-0.99mm (0.0381”~0.0389”)	0.87mm (0.0342”)
		Ring side clearance	0.02-0.06mm (0.0008”~0.0024”)	0.15mm (0.0059”)
		Ring end clearance	0.15-0.25mm (0.0059”~0.0098”)	1.0mm (0.039”)
		Width t	1.90-2.10mm (0.0748”~0.0826”)	1.80mm (0.0590”)
	2nd ring	Height h	0.97-0.99mm (0.0381”~0.0389”)	0.87mm (0.0342”)
		Ring side clearance	0.02-0.06mm (0.0008”~0.0024”)	0.15mm (0.0059”)
		Ring end clearance	0.15-0.25mm (0.0059”~0.0098”)	1.0mm (0.039”)
		Width t	2.0-2.3mm (0.0787”~0.0905”)	1.8mm (0.0590”)
	Oil ring	Height h	1.85-1.96mm (0.0728”~0.0771”)	1.75mm (0.0688”)
		Ring side clearance	0.03-0.18mm (0.001”~0.007”)	0.24mm (0.009”)
		Ring end clearance	0.20-0.50mm (0.0078”~0.0196”)	1.0mm (0.039”)

		Width t	2.05-2.35mm (0.0807”~0.0925”)	1.9mm (0.0748”)
Part	**Item**		**Standard(mm)**	**Service limit**
Connecting rod	Small end I.D		15.006－15.017mm (0.590”~0.591”)	15.08mm (0.594”)
Valves	Valve clearance	IN	0.10±0.02mm (0.0039” ± 0.0008”)	---
		EX	0.15±0.02mm (0.0059” ± 0.0008”)	---
	Stem O.D.	IN	4.975-4.99mm (0.1958”~0.1964”)	4.92mm (0.1937”)
		EX	4.955—4.970mm (0.1950”~0.1951”)	4.90mm (0.193”)
	Guide I.D.	IN/EX	5.000—5.030mm (0.197”~0.198”)	5.06mm (0.199”)
	Seat width	IN/EX	1.0mm (0.039”)	2.0mm (0.079”)
Valve spring	Free length	Outer spring	35.5mm (1.397”)	33.8mm (1.330”)
		Inner spring	32.8mm (1.291”)	31.1mm (1.224”)
Cam wheel	Cam height		29.026-29.086mm (1.143”~1.145”)	28.5mm (1.104”)
Carburetor	Main jet		0.75mm (0.030”)	—
	Float height		12mm (0.472”)	—
	Pilot screw opening (Fixed)		N/A	—
Spark plug	Gap		0.6—0.7mm (0.024”~0.028”)	—
Ignition coil	Resistance	Primary side	0.045-0.070Ω	—
		Second side	5-8k Ω	—

2.6 Motor

Part	Item	Wire color	Standard(Ω)
			120V
DC winding	Resistance	blue－blue	0.045~0.070 Ω
Sub winding	Resistance	white－white	0.100~0.160 Ω
Main winding	Resistance	black－black－black	0.250~0.350 Ω

2.7 Torque values

Item	Specification	Tightening torque	
		Lbs-ft	N·m
Connection rod bolt		N/A	N/A
Spark plug	M10*1*13	9.6~11	13~15
Crankcase cover	M6*75	7.4-8.9	10-12
Flywheel nut	M12*1.25	51.8-59.2	70-80
Standard torque	M5 Bolt, nut	3.7~5.2	5-7
	M6 Blot, nut	6~7.4	8-10
	M8 Bolt, nut	13.3~16.2	18-22

Note: Use standard torque values for fasteners that are not listed in this table.

3. Trouble shooting

3.1 General symptoms and possible causes

Engine does not start or is hard starting	Fuel filter clogged	Replace
	Fuel tank tube clogged	Clean
	Fuel valve clogged	Clean
	Carburetor faulty	clean
	Check valve / Choke pod	Inspect
	Ignition coil faulty	Inspect
	Spark plug faulty	Inspect
	Spark plug cap looses	Fix it securely
	Low oil sensor faulty	Inspect
	Ignition module	Inspect
	Ignition winding faulty	Inspect
	Throttle opening fault	Set in fully close or half close position
Engine speed does not stabilize, too high or too low	Carburetor faulty	Disassemble and clean
	Economy switch	Inspect
	Throttle control motor (step motor) faulty	Inspect
	Inverter unit faulty	Inspect and replace
	Valve clearance misadjusted	Readjust

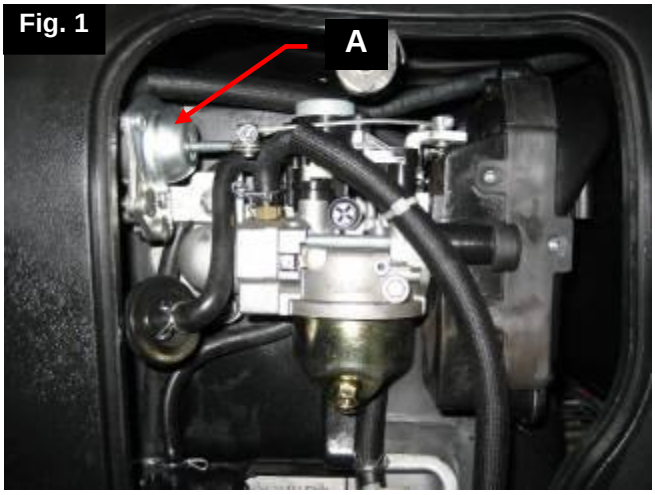
3.2 Difficult cold starting

The choke on the PH2100PRi operates automatically. When the unit is off, the choke will return to the closed position. In some cases, the choke may close too slowly or open too fast. Both conditions can cause difficulty starting the unit. Read below to see if one or both conditions are present.

What to check:

1. Remove the maintenance cover to view the choke system (fig. 1-A).
2. Make sure that there is sufficient fuel in the tank and the fuel valve is open. If the unit has been sitting for some time or has been run out of fuel, it may be necessary to pump the primer bulb several times to fill the fuel filter, ensuring fuel is getting to the carburetor.
3. While cranking the engine over using the ignition key (Not the remote), watch the choke lever (fig. 2-A). The lever should begin to move to the left (Open) position as it is being pulled by the vacuum from the engine.

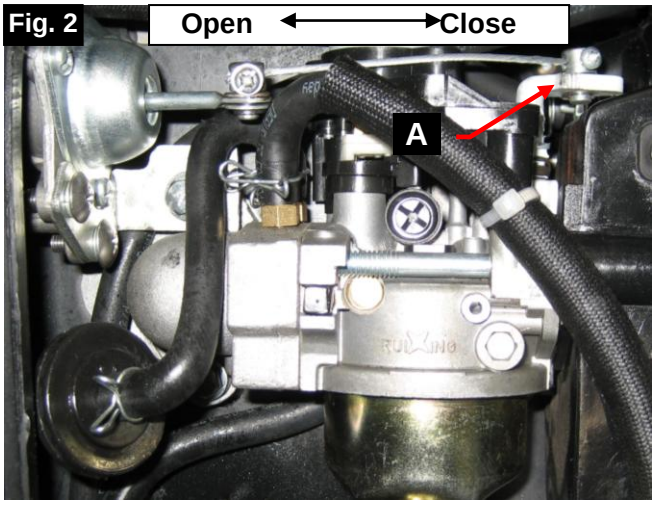
Fig. 1



Choke opens too fast:

1. If the choke is being pulled open to fast, there will not be enough fuel drawn in to the intake manifold to start the engine. If after four starting attempts the unit fails to start, try holding the choke closed while cranking. If the unit now starts, shut the key off and allow the generator to cool down for several minutes. If after sitting for several minutes the unit is still hard to start without holding the choke closed, the check valve will need to be inspected. Air should flow easily in one direction only (Away from the choke pod). If air flows easily in both directions, replace the check valve.

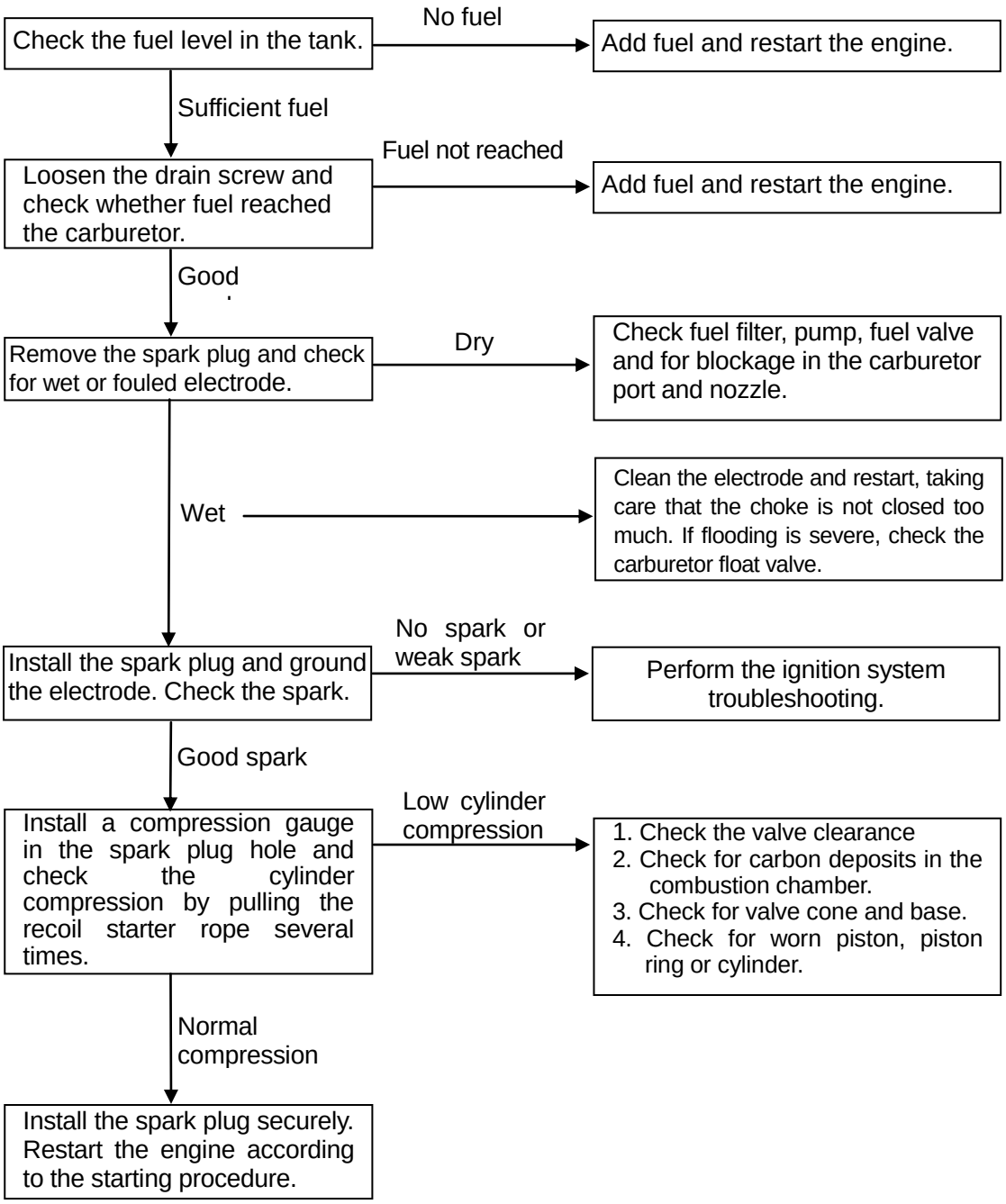
Fig. 2



Choke closes too slowly:

1. If the choke opens properly but does not return to the closed position over an extended period of time, restarting can be difficult. The choke should normally return to the closed position in 2 seconds or less. If the choke stays open for more than 5 seconds, the check valve will need to be replaced.

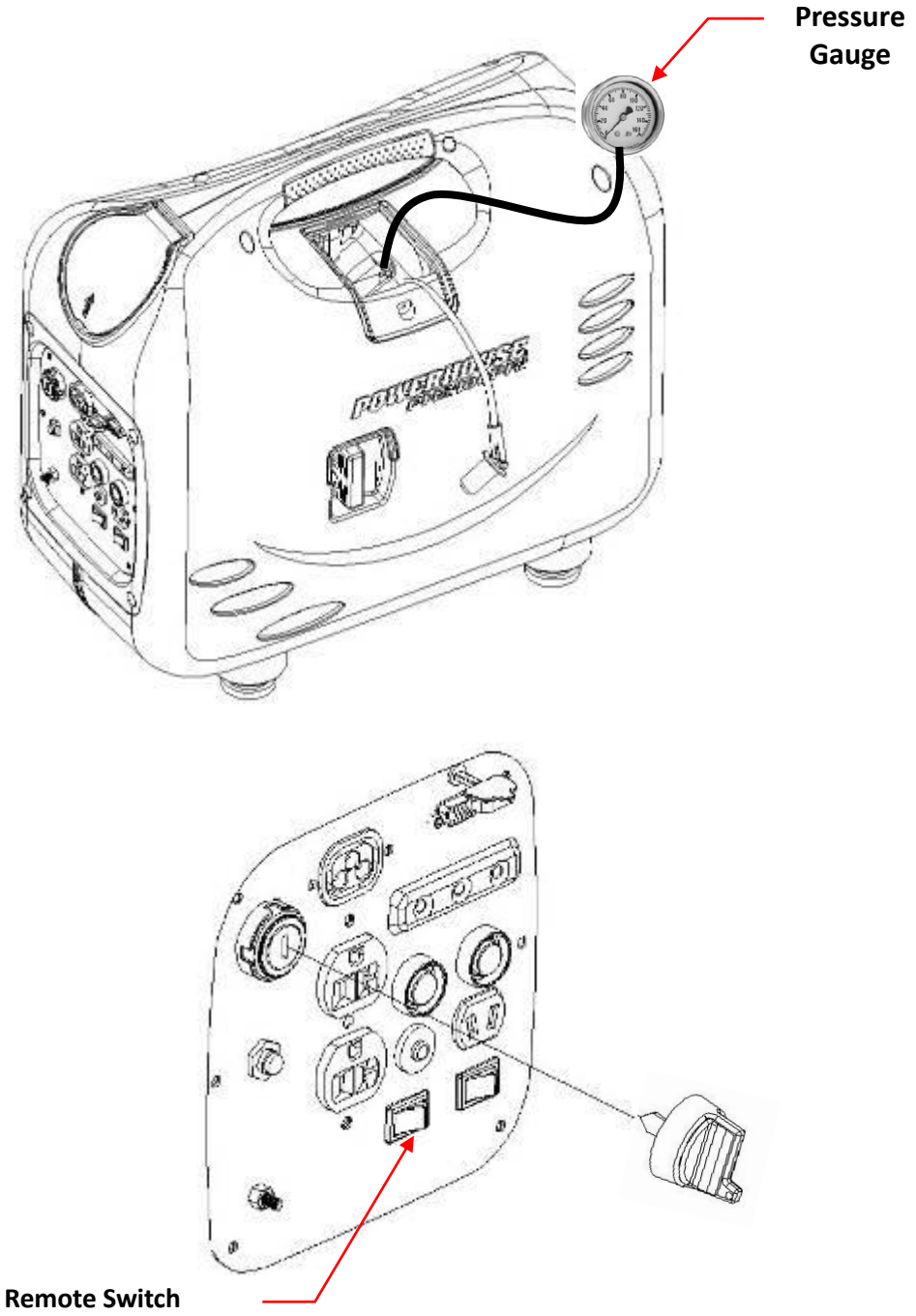
3.3 Hard starting



3.3 Cylinder compression check

1. Remove the spark plug cap and spark plug.
2. Install a compression gauge in the spark plug hole.
3. Put the remote switch is on the OFF position.
4. Turn the ignition switch to the start position and measure the cylinder compression.

Cylinder compression	65 psi (0.45Mpa) 800rpm



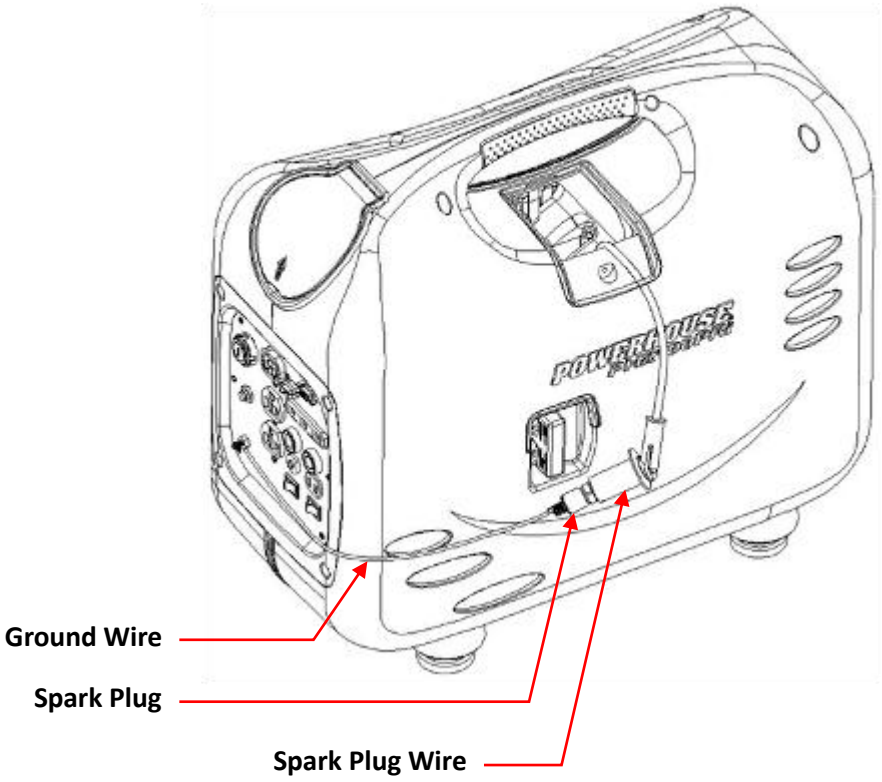
3.4 Ignition system

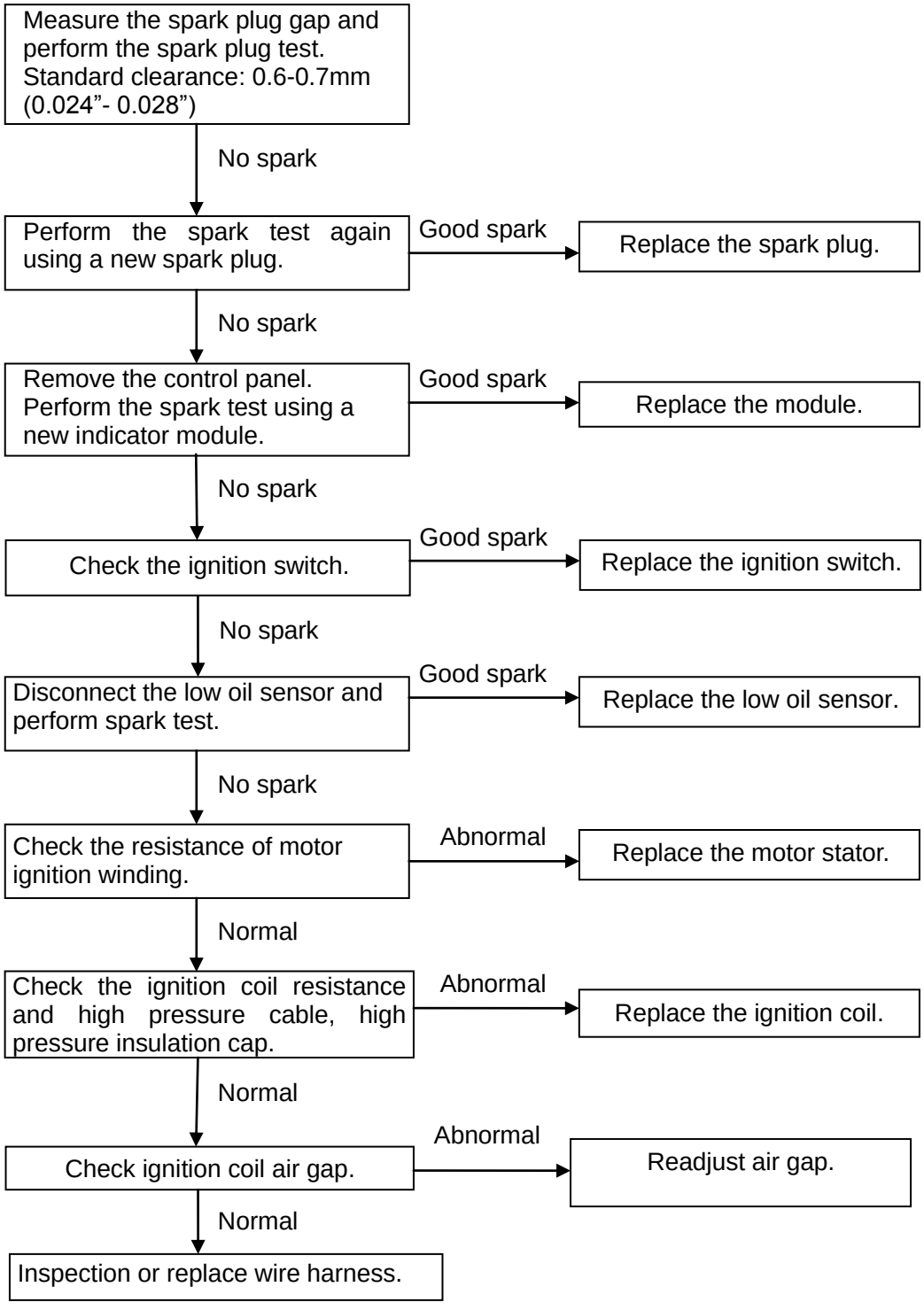
- Fill oil to the correct level.
- Use **A7RTC** or equivalent spark plug.
- Spark plug inspection

Warning

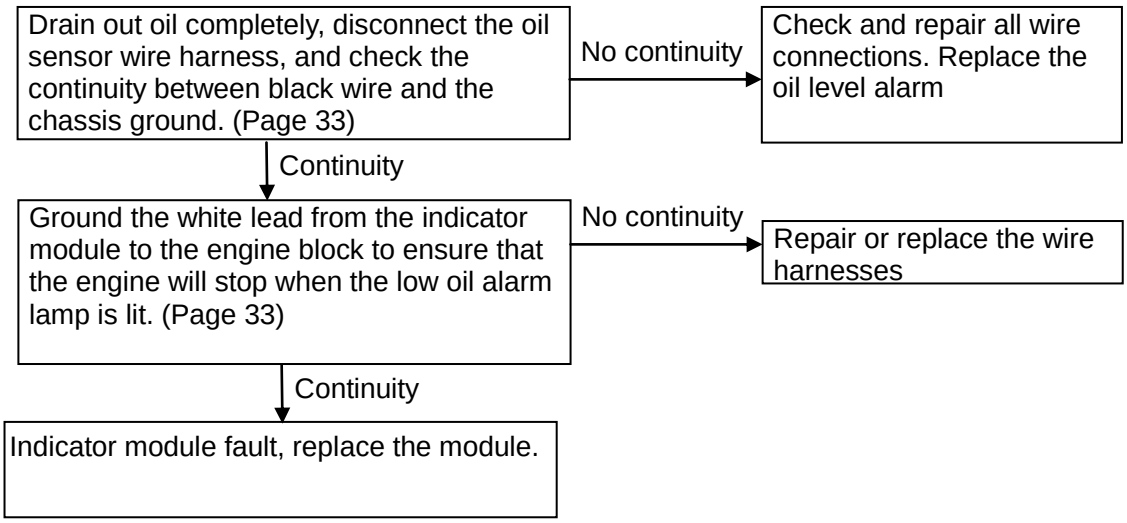
- Don’t pull the recoil starter or turn the ignition switch to start while touching the high tension wire.
- Turn off the fuel valve.
- Pull the recoil starter several times to release the unburned gas in the cylinder with the engine switch OFF.

1. Remove spark plug.
2. Install spark plug cap.
3. Set the ignition switch to the “ON” position. Ground the negative (—) electrode (i.e. threaded part) of the spark plug against with a ground wire against the engine block, and pull the recoil starter rope to check the spark plug.

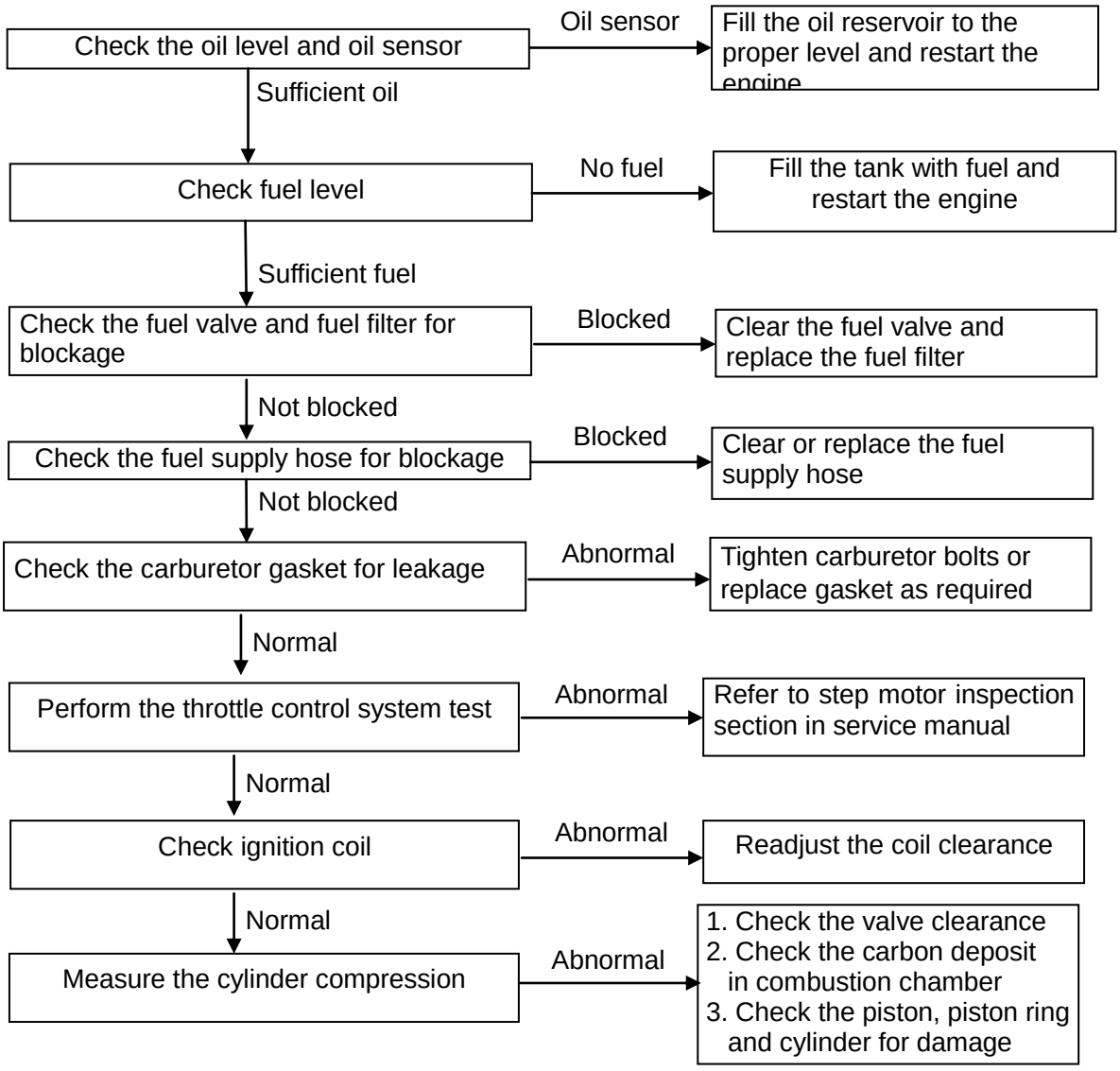



Measure the spark plug gap and perform the spark plug test. Standard clearance: 0.6-0.7mm (0.024”- 0.028”)
No spark
Perform the spark test again using a new spark plug.
Good spark
Replace the spark plug.
No spark
Remove the control panel. Perform the spark test using a new indicator module.
Good spark
Replace the module.
No spark
Check the ignition switch.
Good spark
Replace the ignition switch.
No spark
Disconnect the low oil sensor and perform spark test.
Good spark
Replace the low oil sensor.
No spark
Check the resistance of motor ignition winding.
Abnormal
Replace the motor stator.
Normal
Check the ignition coil resistance and high pressure cable, high pressure insulation cap.
Abnormal
Replace the ignition coil.
Normal
Check ignition coil air gap.
Abnormal
Readjust air gap.
Normal
Inspection or replace wire harness.

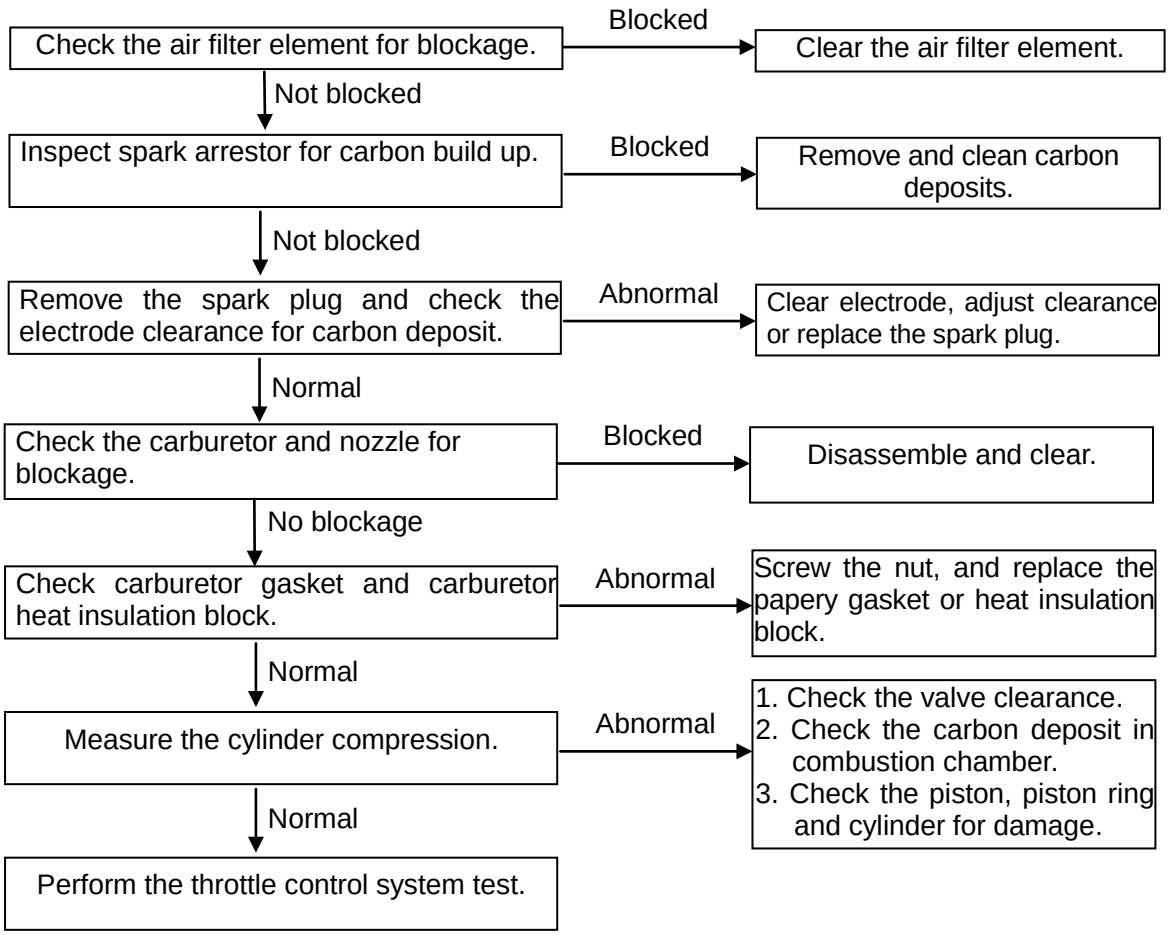
3.5 Engine oil level is low, but engine does not stop.



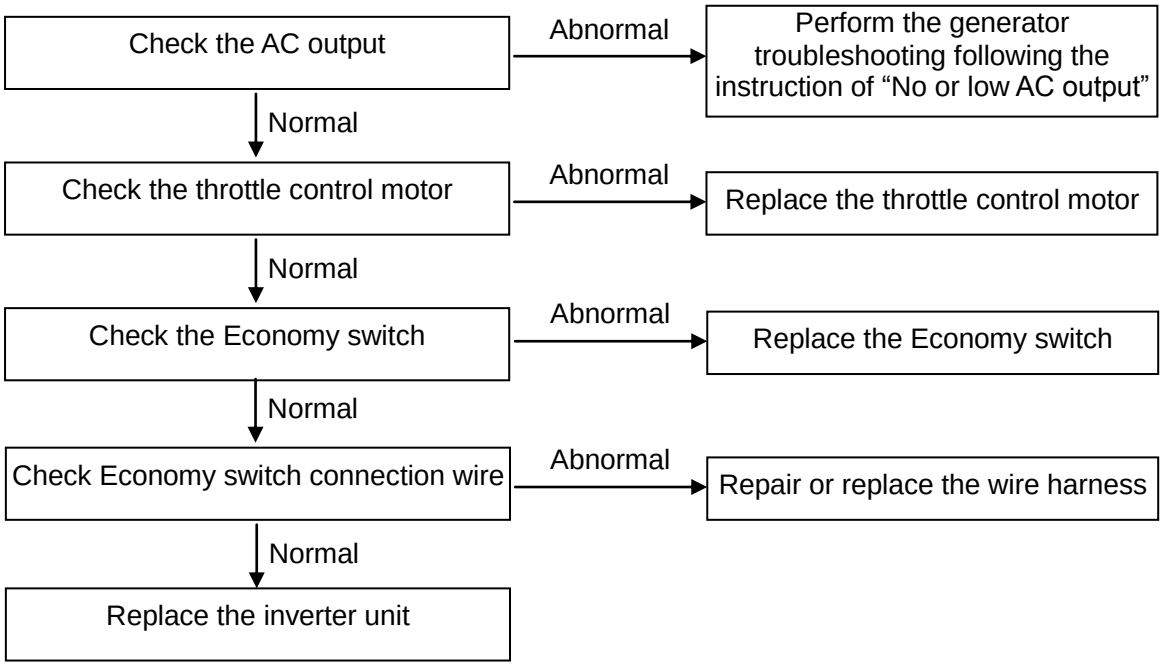
3.6 Engine stops running (Throttle is in the correct position)



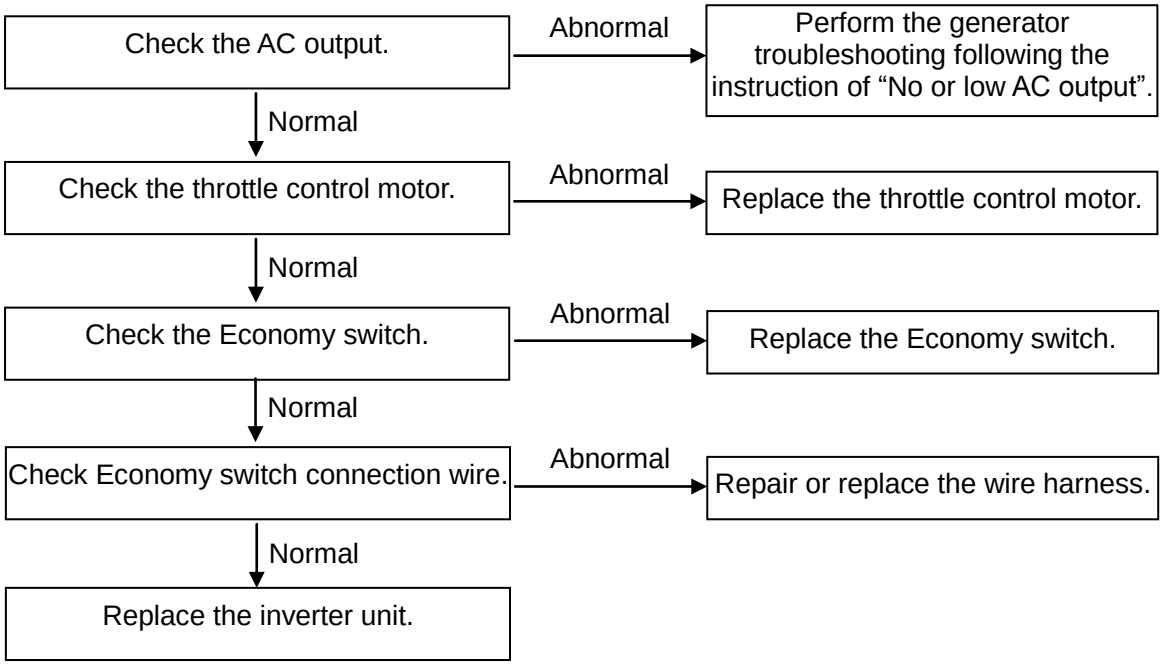
3.7 Engine speed can't increase or unstable (choke is at the correct position)



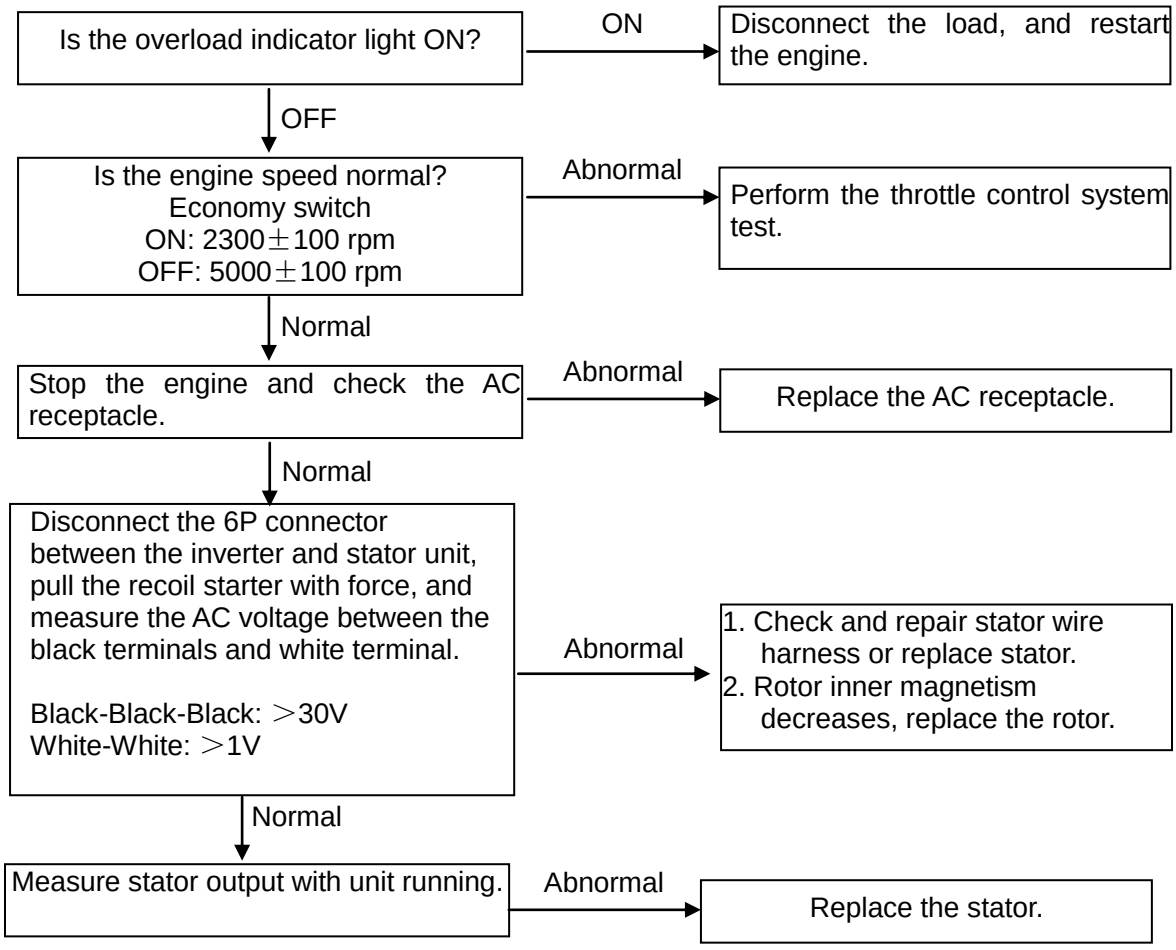
3.8 Engine speed too high or too low



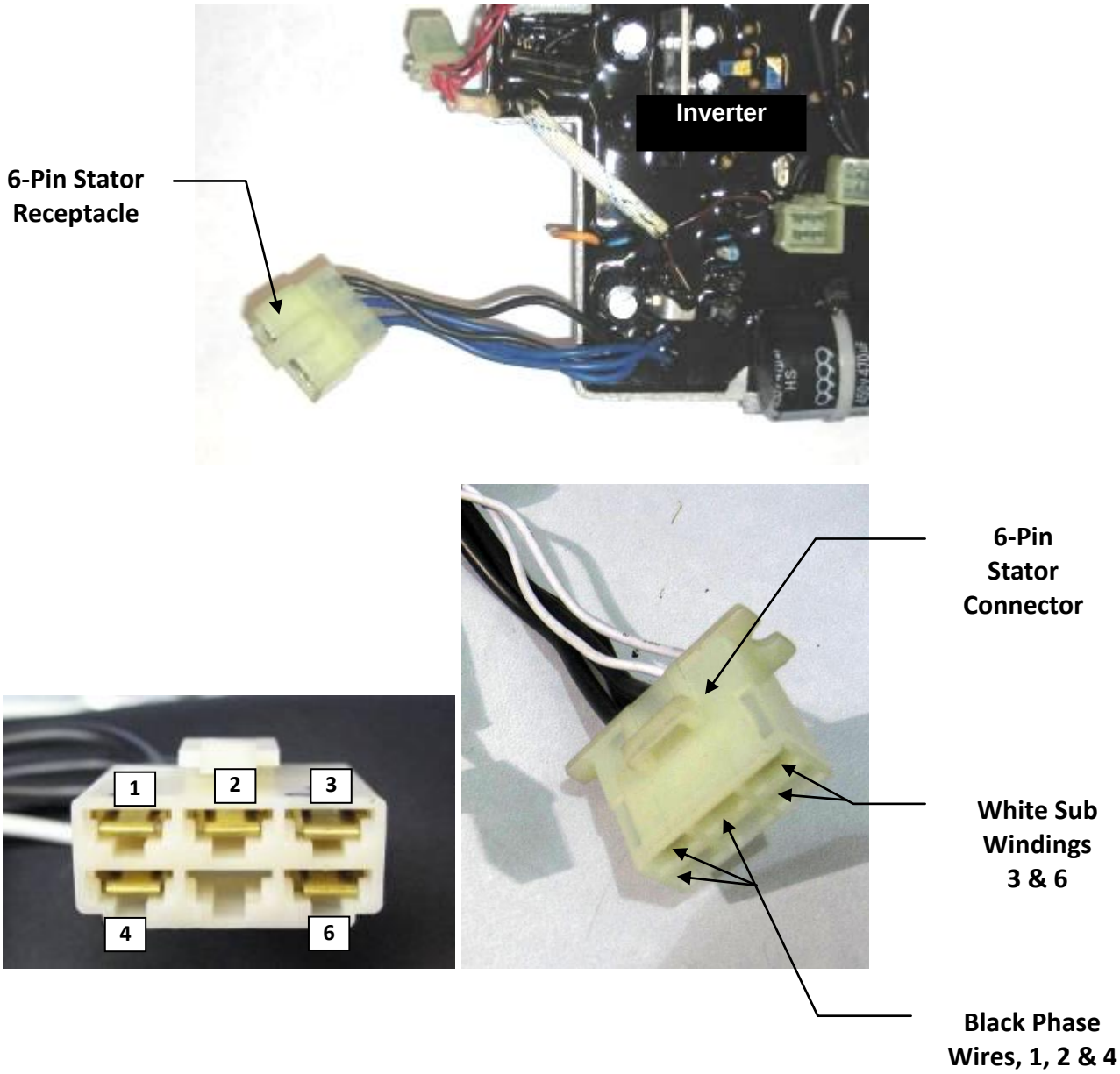
3.9 Engine speed doesn't increase with economy system "ON" and a load connected.



3.10 No or low AC output.

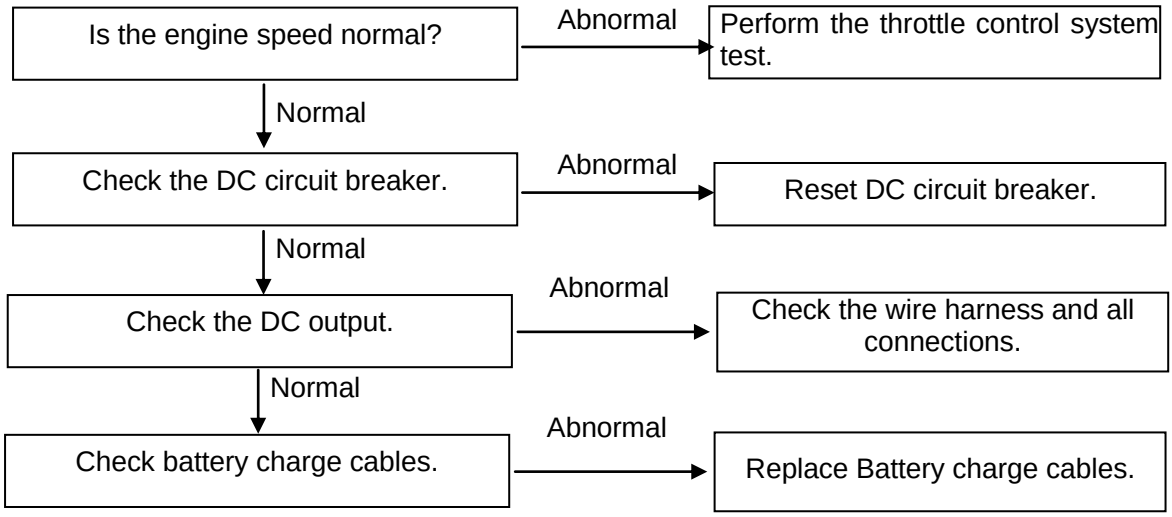


3.11 Measuring stator output voltage while running.

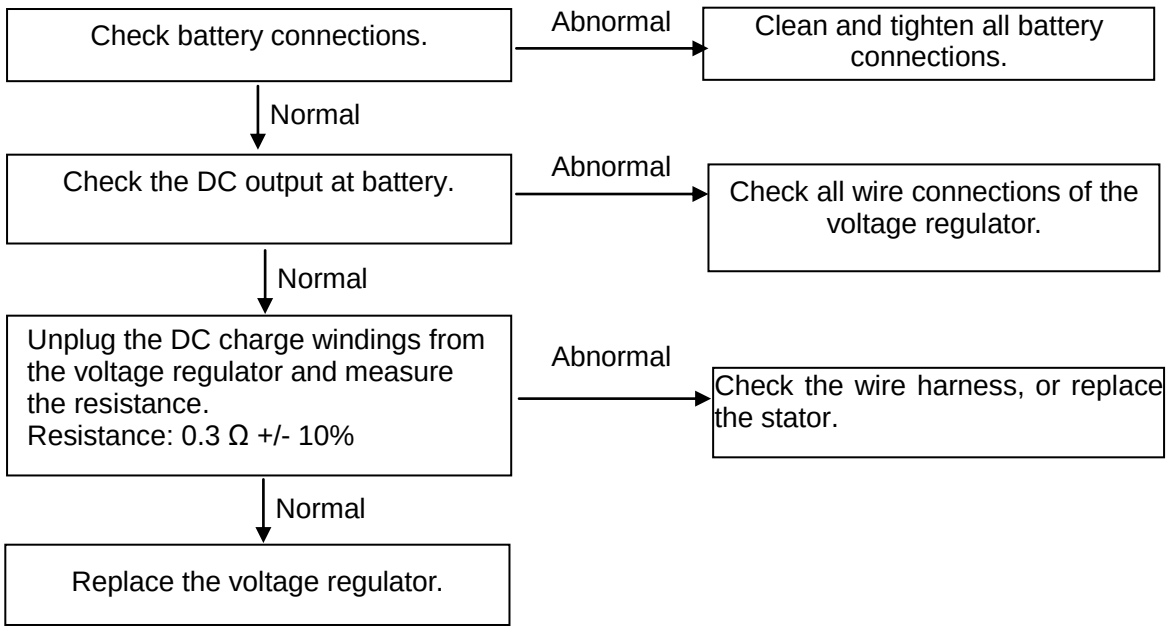


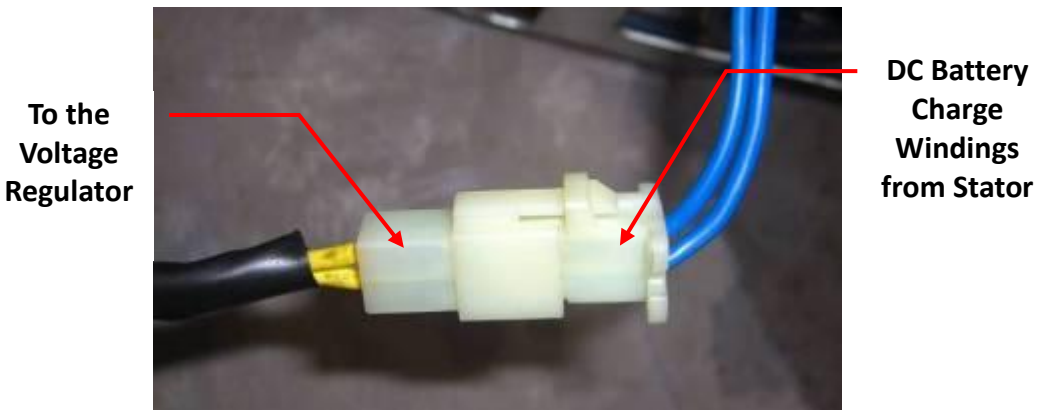
1. Unplug the connector from the inverter and start the engine, check voltage between pins 1 & 4, between pins 2 & 4, and between pins 1 & 2. **Note, the engine will be running at a high RPM.**
2. They should be approximately 300vac at each test with the engine running at high speed. If one or more of the three tests fail, the problem is either a damaged wire harness or a defective alternator. If the wire harness is the problem, look for and repair the damage.
3. If the alternator is the problem, the stator will need to be replaced. If all three tests are OK, the problem is likely the inverter.

3.12 No DC output at receptacle.

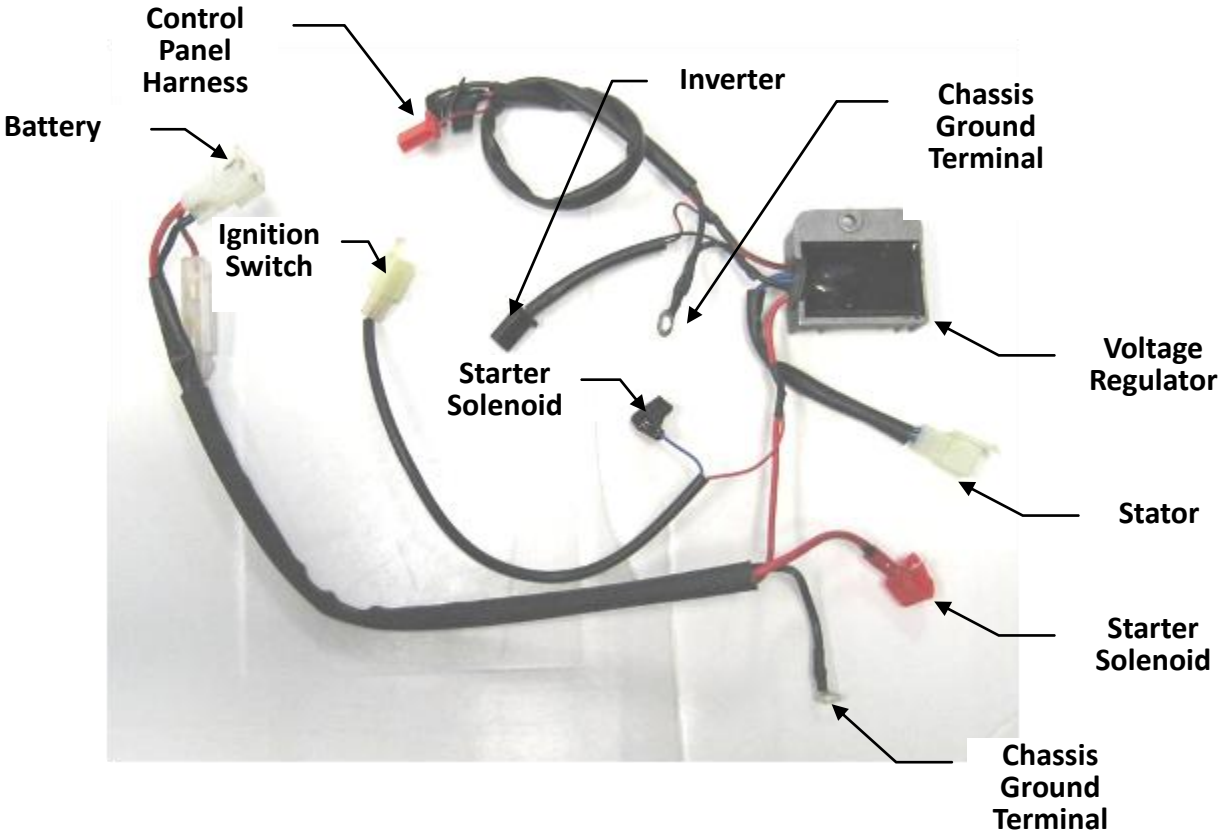


3.13 Battery will not charge.

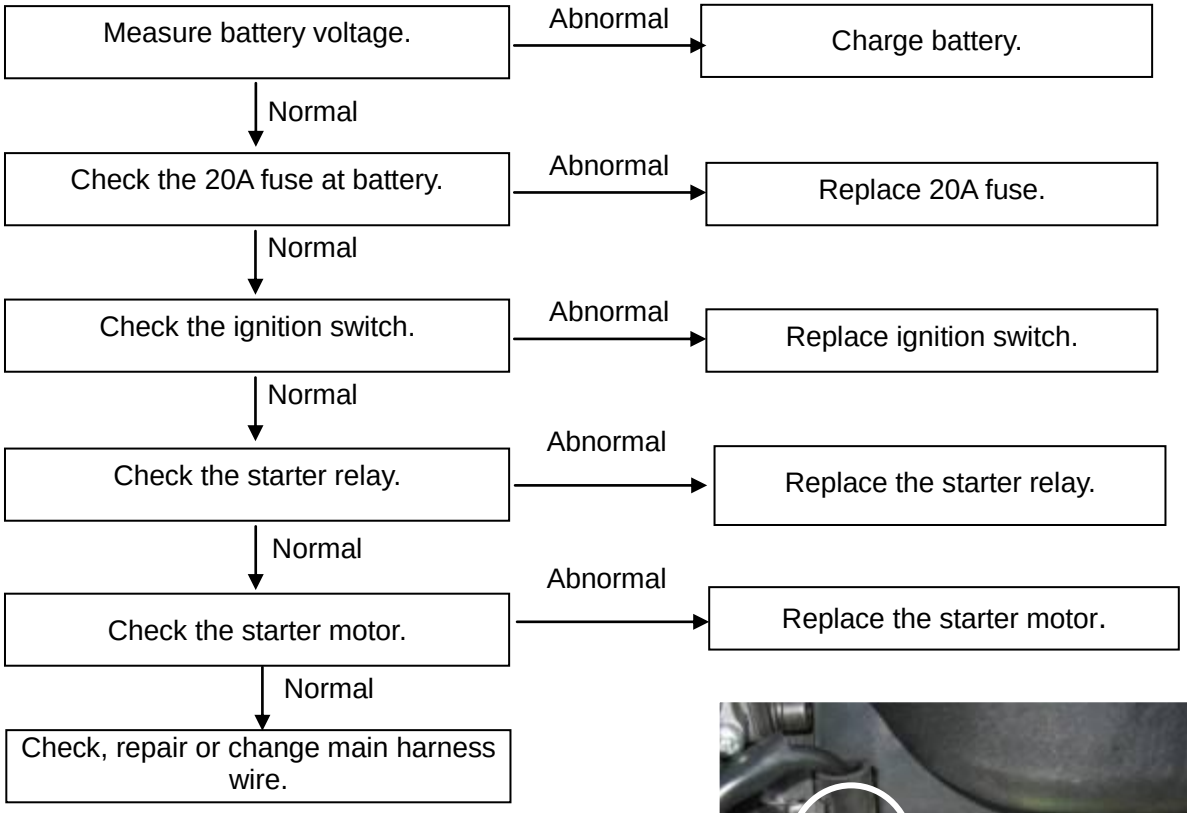


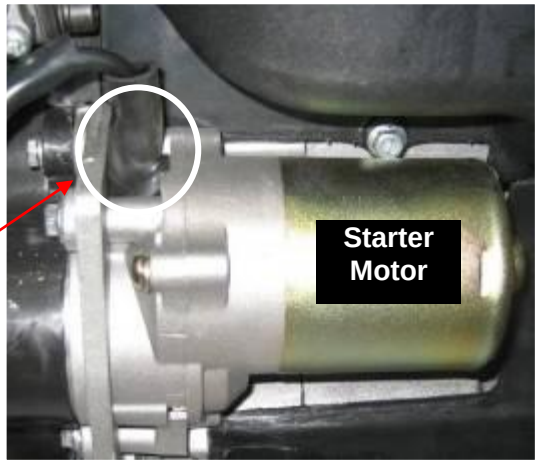


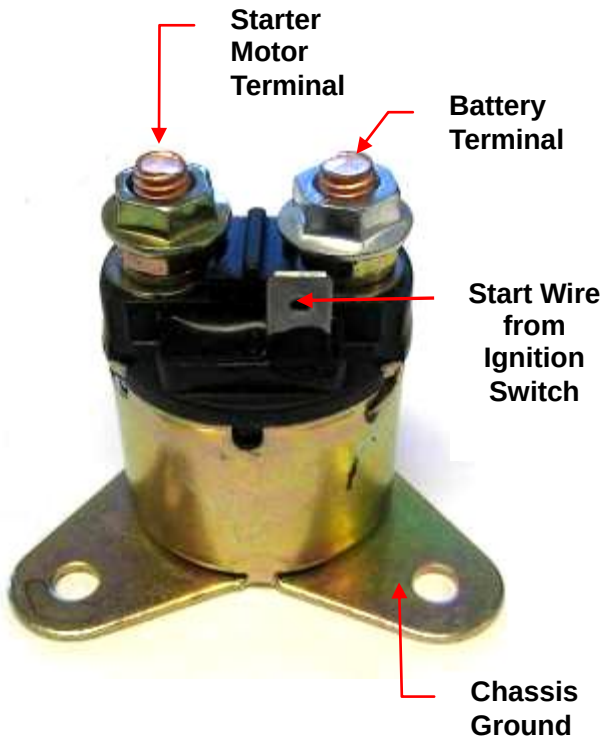
3.14 Voltage regulator

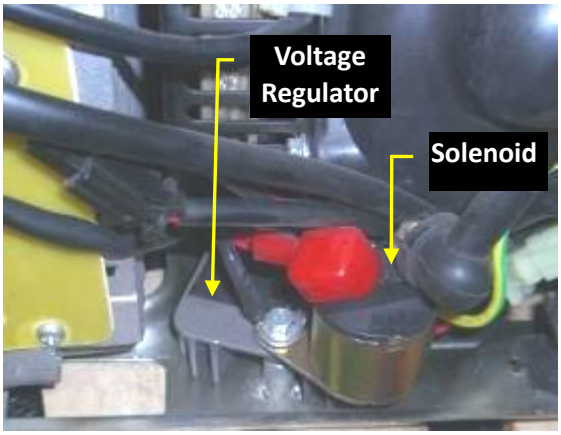


3.15 Starter motor doesn't run.

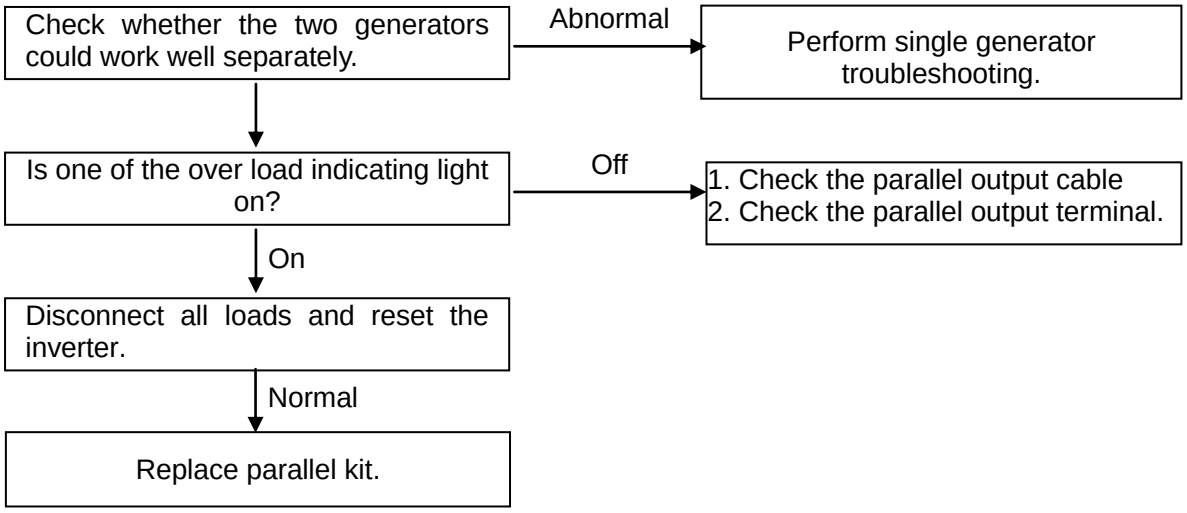








3.16 No output when operating in Parallel:



NOTE

- Turn “OFF” both generators and disconnect all the electrical devices from the generators.
- Plug the cables from the parallel kit into each of the units.
- Start both generators and confirm that both green "RUN" lights are illuminated. **Note, the Economy Switch automatically turns off when running in parallel.**
- Two separate PH2100PRi models can run in parallel to increase the total output to a maximum load of 4200 W (Rated output, 5200 W).
- You can also run a PH2700PRi and a PH2100PRi in parallel. The maximum output will be 4200 W (Rated output, 4000 W).

CAUTION

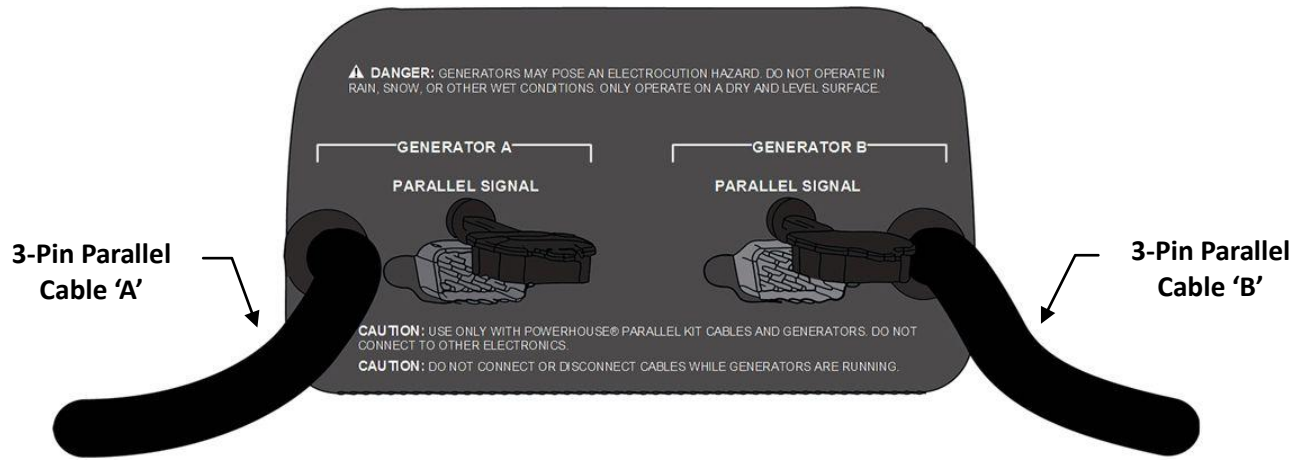
- **Never Connect or Disconnect the parallel kit cables from the generators while running. Doing so will cause permanent damage not covered under warranty.**
- The required output of the electrical appliance cannot exceed the rated output of parallel generators.
- The special parallel cables for the PH2100PRi and PH2700PRi is only applicable to the parallel operation of two POWERHOUSE® generators.
- This kit cannot be used for paralleling three or more generators or running two different brands of generators.
- **ONLY the POWERHOUSE® Dual Generator Parallel Kit and cables may be connected to the parallel signal port. DO NOT CONNECT TO OTHER ELECTRONICS OR USE OTHER CABLES. Permanent damage not covered by the warranty will occur.**

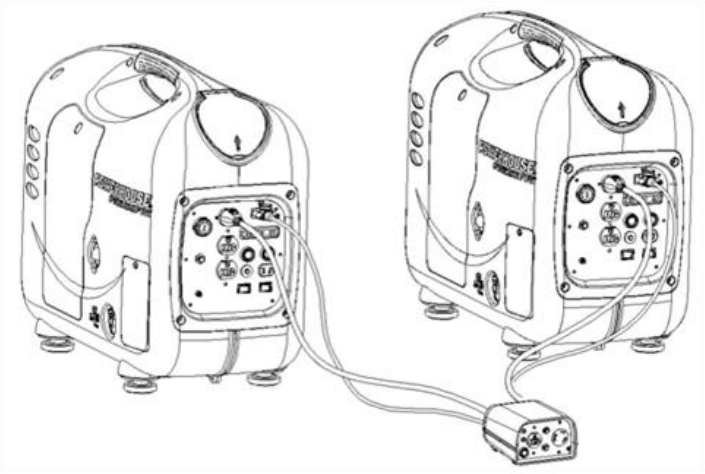
3.17 Parallel operating procedure:

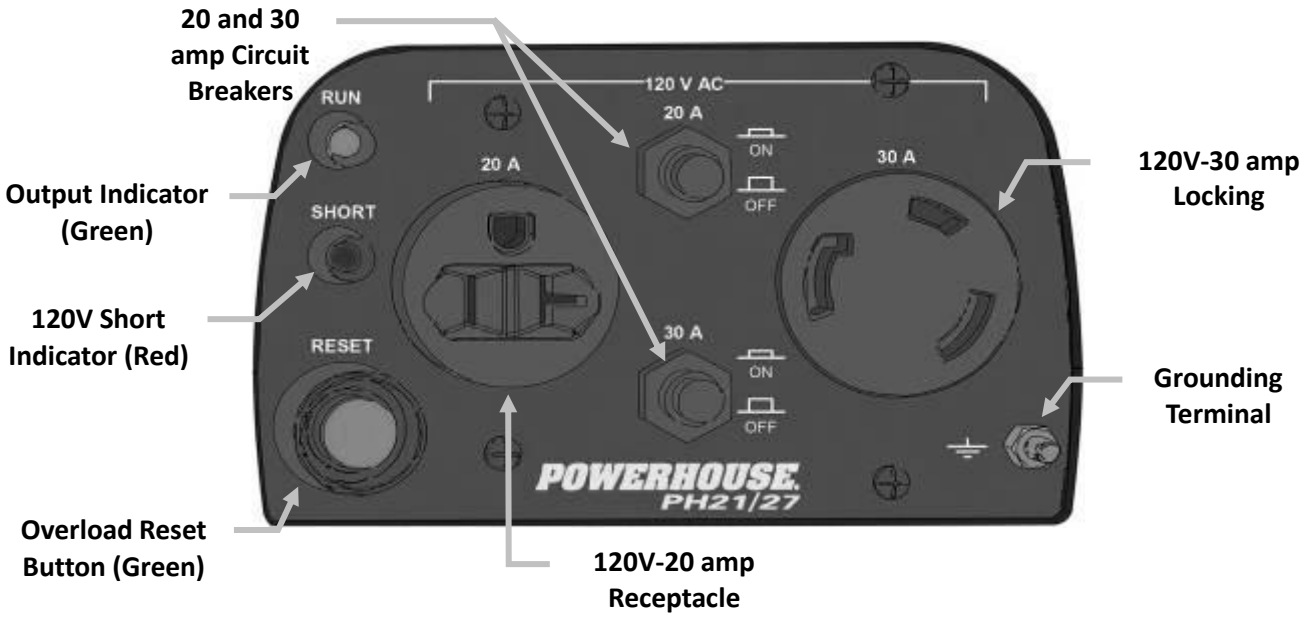
1. Prepare two POWERHOUSE® generators for operation.
2. Connect the 15-pin signal cable between the parallel kit and each generator and secure with the thumb screws.
3. Connect the 3-pin parallel cable from the parallel kit into each generator making sure that the cables for generator ‘A’ and generator ‘B’ are not switched.
4. Start both generators and confirm that both green "RUN" lights are illuminated on the generators and on the front panel of the parallel kit.
5. The Economy Switch may be used as long as the Economy switch setting of both generators is the same.
6. The starting procedure is the same as the normal starting procedure.
7. Securely plug the electrical appliance plug into either or both of the parallel receptacles and switch on the electrical appliance.

⚠ CAUTION

- The required output of the electrical appliance cannot exceed the rated output of the generators. The special parallel cable for the PH2100PRI and PH2700PRi is only applicable to the parallel operation of two POWERHOUSE generators. **It cannot be used for paralleling three or more generators or running two different brands of generators.**
- Be sure to only use parallel output cable for parallel operation.
- **Don't disconnect the parallel output cable during parallel operation.**







WARNING

- **To prevent electrical shock from faulty appliances, the parallel kit should be grounded. Connect a length of heavy cable between the parallel ground terminal and an external ground source.**

1. During normal operating conditions, the output indicator lights (Green) will remain illuminated.
2. If the generators are overloaded (in excess of 4200W when using two PH2100PRi units) the overload indicator light (red) will flash slowly on only one generator. The indicator lights on the other unit and the parallel kit will all be off.
3. At this time, there will be no electrical output from the parallel panel and the connected appliance or load will be shut off.
4. Remove all electrical loads from the generators and/or parallel kit and then determine and correct the cause of the overload.
5. To reset the overload condition (Red light), press and release the (Green) overload reset button on the parallel panel. The (Green) indicator lights should be illuminated on both generators and on the parallel panel within 15 seconds.

3.18 Troubleshooting Parallel Operation:

Problem	Condition	Cause	Correction
Flashing overload light.	The red overload light on one of the generators is flashing slowly. There are no indicator lights on the other generator or parallel panel. There is no AC output from either of the generators or parallel panel. Both engines are running at a slow idle.	The load (Wattage) has exceeded the capacity of one or both generators.	Remove all loads from the parallel panel and the generators and press the green reset button on the parallel panel. The green indicator light on both generators and the parallel kit should come on within 15 seconds. If the reset is pushed without correcting the cause for the overload, the system will try to reset briefly but the units will again shut down. Repeatedly pressing the reset button without correcting the overload condition may cause permanent damage to the generators and/or parallel kit.
Short indicator light on the parallel panel	The red (Short) indicator light on the parallel panel is on. The indicator lights on both generators are all off. There is no AC output from either of the generators or parallel panel. Both engines are running at a slow idle.	The hot and neutral output wires between the parallel kit and appliances are shorted, or there is a short in the appliance.	Remove all loads from the parallel panel and the generators and check the appliances for shorts. Repair or replace shorted appliances as needed. Press the green reset button on the parallel panel. The green indicator light on both generators and the parallel kit should come on within 15 seconds. Repeatedly pressing the reset button without correcting the short circuit may cause permanent damage to the generators and/or parallel kit.

3.19 Troubleshooting Parallel Operation (Cont.)

Problem	Condition	Cause	Correction
No indicator lights (Red or Green)	There is no AC output from either of the generators or parallel panel. Both engines are running at a slow idle.	Loose or disconnected power cord between the parallel kit and parallel power socket on the generator.	Remove all loads from the parallel panel and the generators. Reconnect or plug in the power cord from the parallel kit to the power socket on the generator. The green indicator light should come back on in approximately 15 seconds. If not, press the green reset button on the parallel panel.
No AC output from parallel panel	The green light on both generators and parallel panel are on. The generators are running at high idle.	An excessive load is connected to either the 30A or 20A receptacle on the parallel panel.	Remove or reduce excessive loads. Reset circuit breakers.

4. Maintenance schedule

4.1 Maintenance schedule

Item	Maintenance Procedure	Regular Service period (1). Perform at every indicated month or operating hour interval, whichever occurs first.				
		Each Use	First Month Or 4-6 HRS	Every 3 Months or 50 HRS	Every 6 Months Or 100 HRS	Every Year Or 300 HRS
Engine Oil	Check	O				
	Change		O		O	
Air cleaner	Check	O				
	Clean			O (2)		
Spark Plug	Clean - adjust				O	
Spark Arrester	Clean				O	
Fuel Filter	Check	O				
	Replace					O (2)
Valve clearance	Check - adjust					O (3)
Fuel tank & strainer	Clean					O (2)
Fuel line	Check	Every 2-years (Replace as necessary) (3)				

Note:

(1) For commercial use, operation hours are determined by proper maintenance.

(2) Service more frequently when operating in dusty areas, every 10 hrs or every day.

(3) Service by POWERHOUSE authorized agency, unless correct tools or professional specialist is available. Do service according to the manual.

4.2 Checking the oil level.

Stop the engine and check the oil level, be sure to put the engine on a flat floor when checking.

1. Loosen the screw of the maintenance cover and remove the cover.
2. Remove the oil filler cap and check for the oil level.
3. If the oil level is low, add to the edge of the oil filler port.

4.3 Changing oil

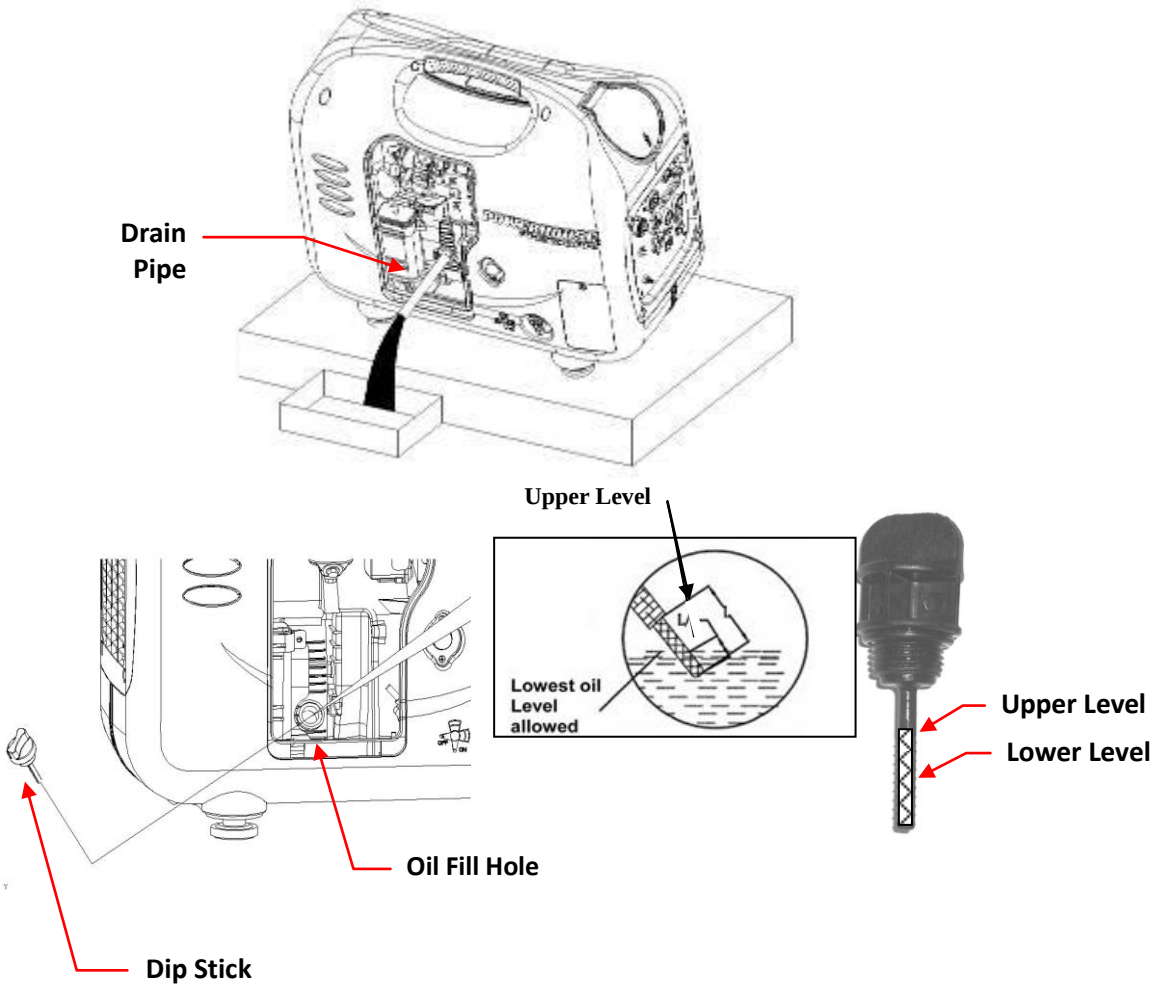
Drain the oil while the engine is still warm to assure rapid and complete draining.

⚠ CAUTION

- Make sure to turn the engine switch and fuel lever OFF before draining.

1. Loosen the panel screw and remove the maintenance cover.
2. Remove the oil filler cap.
3. Install the oil drain pipe.
4. Drain dirty oil into a container thoroughly.
5. Refill with the recommended oil, and check the oil level.
6. Reinstall the access panel and tighten the screws securely.

Engine oil capacity: 15.6 oz (460 ml)



NOTE

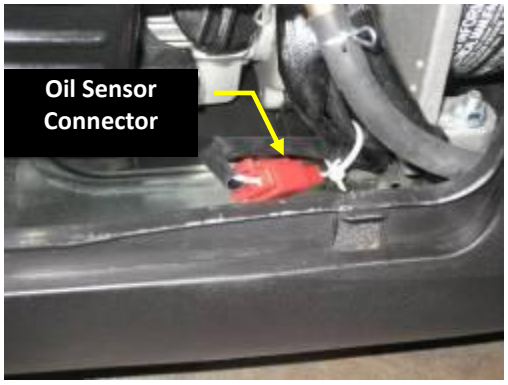
- Please dispose of used motor oil in a manner that is compatible with the environment and local disposal regulations. Do not throw it in the trash or pour it on the ground.

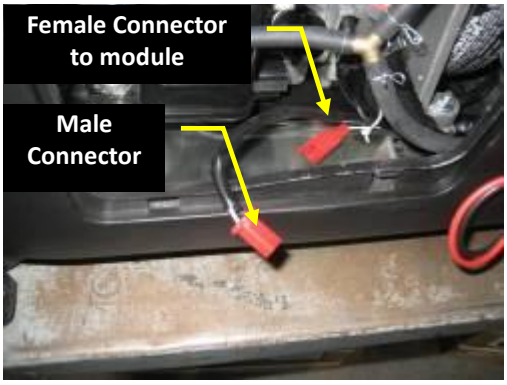
4.4 Checking for the low oil sensor

1. Remove the maintenance cover and locate the oil sensor lead which is below and too the right of the dipstick.
2. Disconnect the low oil sensor when the engine is running.
3. Ground the white lead (Female connector) from the indicator module to the engine block, to ensure that the engine will stop when the low oil alarm lamp is lit.
4. After insuring that the engine oil is at the proper level, test the continuity between the (Male connector) from the oil sensor and the case of the engine. No continuity indicates a normal condition.
5. Continuity between the oil sensor lead and engine when the oil is drained from the engine indicates a normal condition.

WARNING

- No continuity with the oil drained would indicate a faulty oil sensor or damaged wire that must be repaired or replaced. Failure to do so can lead to permanent damage if the engine runs low on oil.



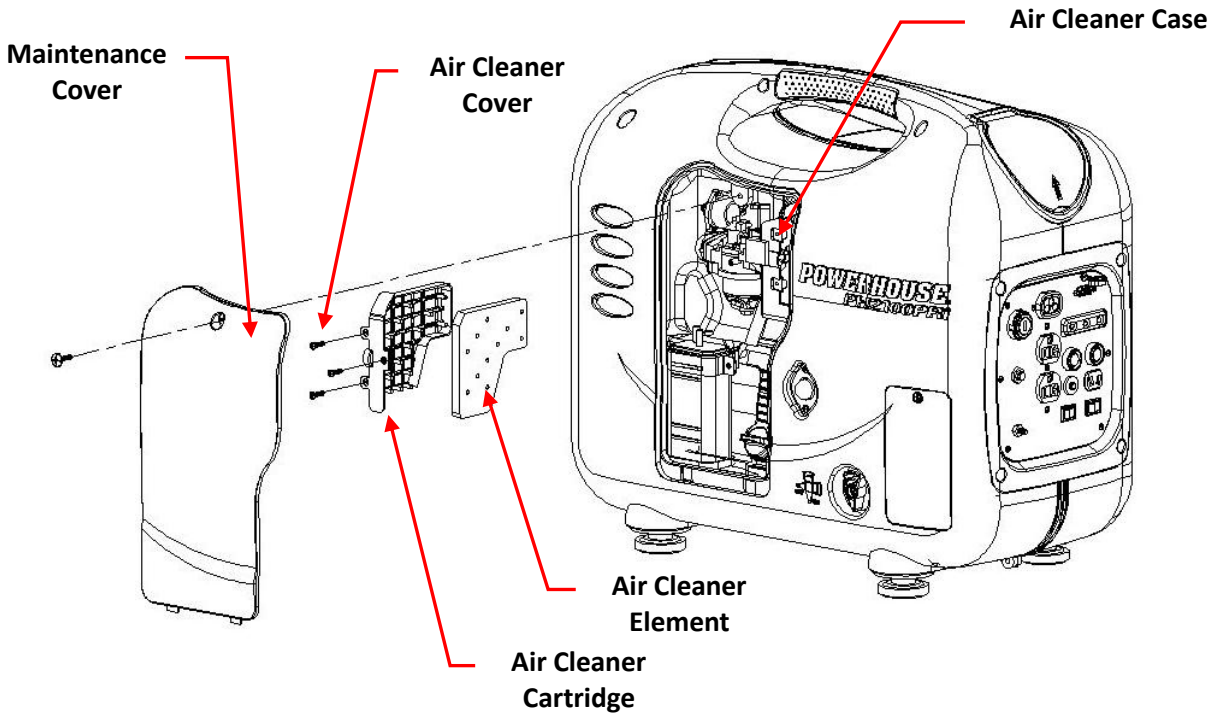


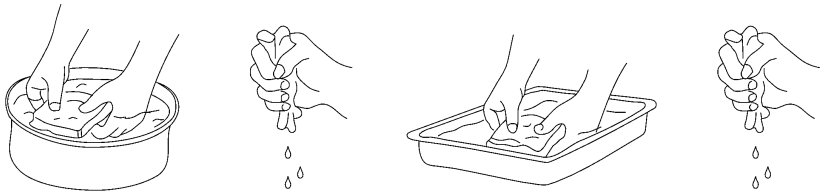
Check Continuity between the Male connector from the Oil sensor Lead and Ground

4.5 Air Filter

Inspection/Cleaning:

1. Loosen the panel screw and remove the side maintenance panel.
2. Remove the three air filter retaining screws. Remove the air cleaner cover and check the element. Clean or replace the element if necessary.
3. Wash the element in a non-flammable or high flash point solvent and dry it thoroughly.
4. Soak element in clean engine oil and squeeze out the excess oil.
5. Reinstall the air cleaner element and the air cleaner cover. Tighten the cover screws securely.
6. Reinstall the maintenance panel and tighten the screw securely.





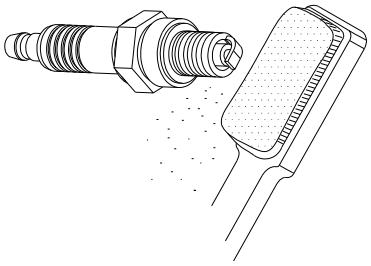
CAUTION

- A dirty air cleaner will restrict air flow to the carburetor, reducing engine performance. If the engine is operated in dusty areas, clean the air cleaner more often than specified in the Maintenance Schedule.
- Never run the engine without an element or the filter is damaged, as it will do great harm to the engine.

4.6 Spark plug

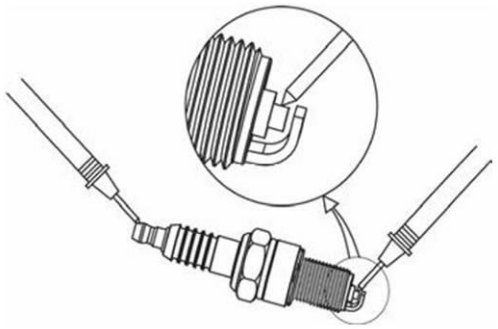
Inspection/Cleaning:

1. Remove the spark plug cap and remove the spark plug.
2. Remove carbon or other deposits with a plug cleaner or stiff ire brush. Check the sealing washer for damage.



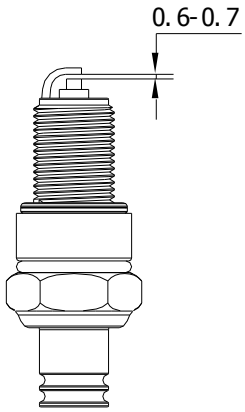
3. Measure the plug resistance; replace the spark plug if the measurement is not within the value shown.

Spark plug resistance	3~9KΩ



4. Measure the plug gap with a wire-type feeler gauge. Adjust by bending the side electrode

Spark plug clearance	0.6~0.7mm (0.024”~0.028”)
Standard spark plug	A7RTC



5. Install the plug finger tight to seat the washer, and then tighten with a plug wrench.
   Torque valve is 9.6~11 lbs-ft (13~15 Nm)

4.7 Valve clearance

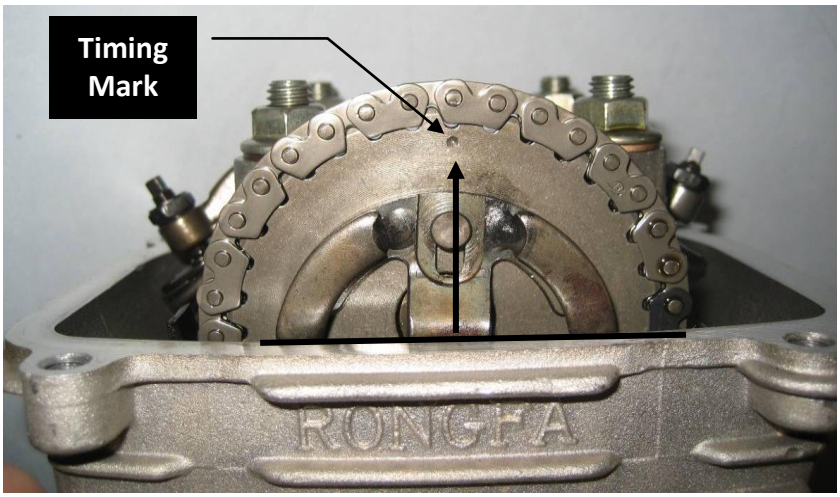
CAUTION

- Valve clearance inspection and adjustment must be performed with the engine cold.

Inspection/Adjustment:

1. Disconnect the battery.
2. Drain all fuel from the tank and carburetor.
3. Remove front and rear panels.
4. Remove the left and right covers.
5. Remove fuel tank.
6. Remove the carburetor assembly.
7. Remove the starter motor.
8. Remove the carbon canister.
9. Remove front and back engine covers.
10. Remove muffler.

11. Turn the rotor to set the piston at top dead center of the compression stroke.
    The timing mark of camshaft should be vertical to the cylinder head seal, check whether the inlet and exhaust valve are closed.



Insert a feeler gauge between the rocker arm and the valve and measure the valve clearance.

Valve clearance	IN	0.10+/- 0.002mm (0.0039” ± 0.0008”)
	EX	0.15 +/- 0.002mm (0.0059” ± 0.0008”)

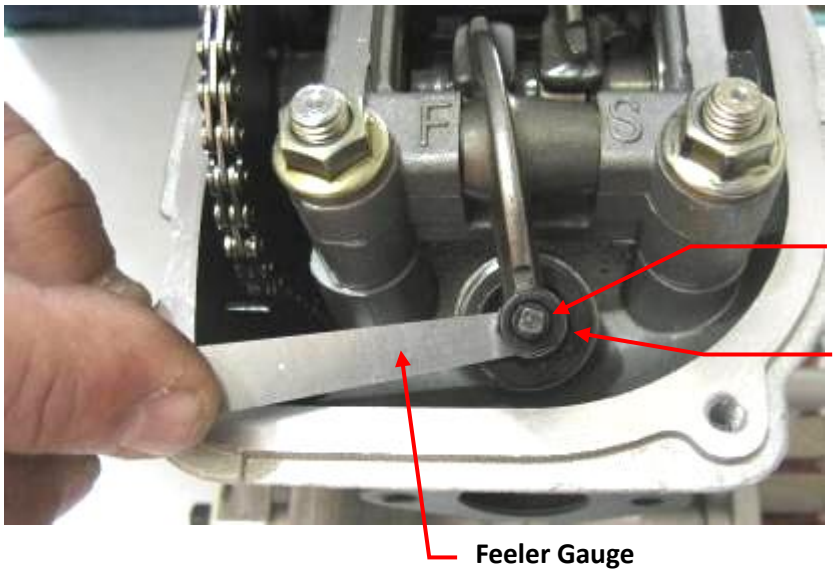
12. If adjustment is necessary, proceed as follows.

a. Loosen the adjusting screw lock nut and adjust the valve clearance by turning the adjusting screw in or out.

b. Secure the adjusting screw with a socket wrench and tighten the lock nut to the specified torque.

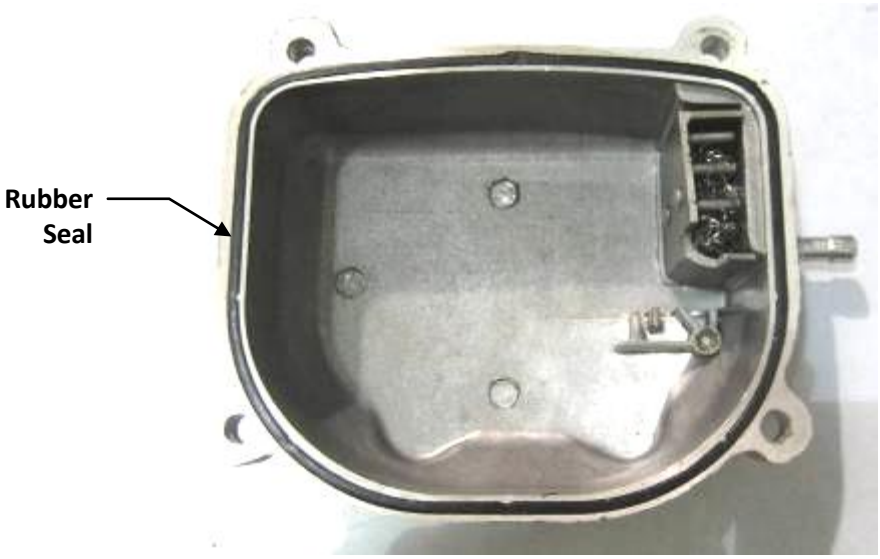
c. After tightening the lock nut, check the valve clearance again.

13. Clean the cylinder block and cylinder head cover.



14. Replace the rubber seal.

15. Install the removed parts in the reverse order of removal.



4.8 Fuel tank

CAUTION

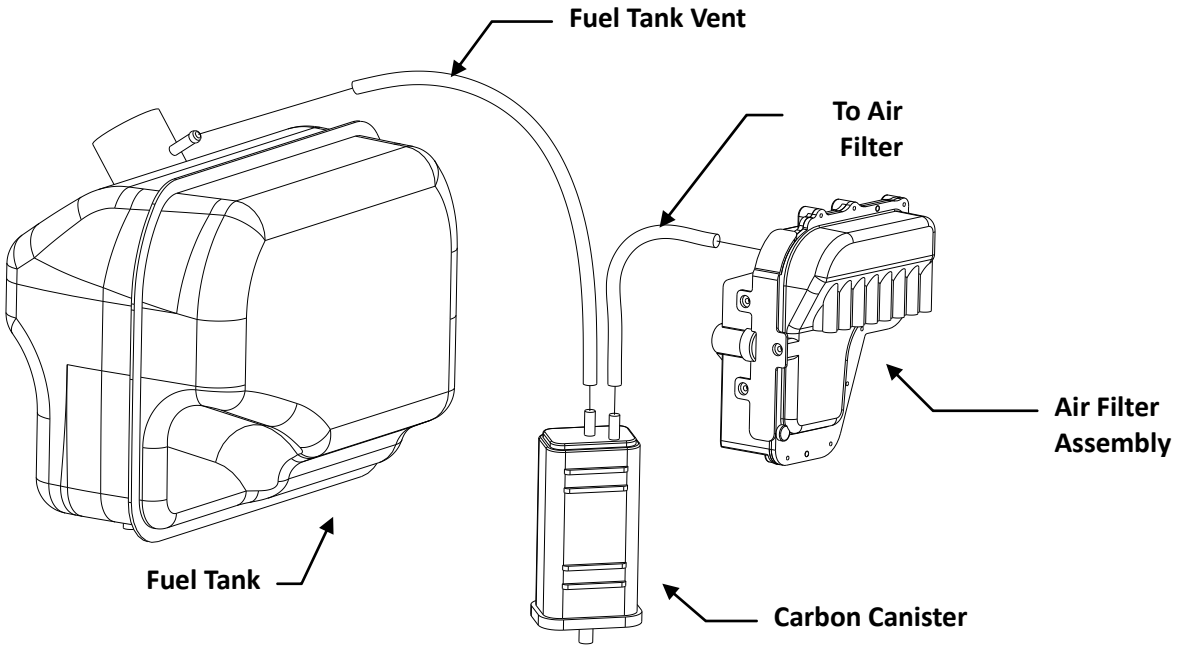
- Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel. Keep heat, sparks, and flame away. Wipe up spills immediately.

Cleaning:

1. Disconnect the battery.
2. Drain all fuel from the tank and carburetor.
3. Remove front and rear panels.
4. Remove the left covers.
5. Remove all hoses from tank and clean it with cleaning solvent and allow the fuel tank to dry thoroughly.
6. After cleaning reconnect all hoses.
7. Install the removed parts in the reverse order of removal.

Fill the fuel tank with gasoline and check the fuel hoses for gasoline leaks.

4.9 Evaporation Control

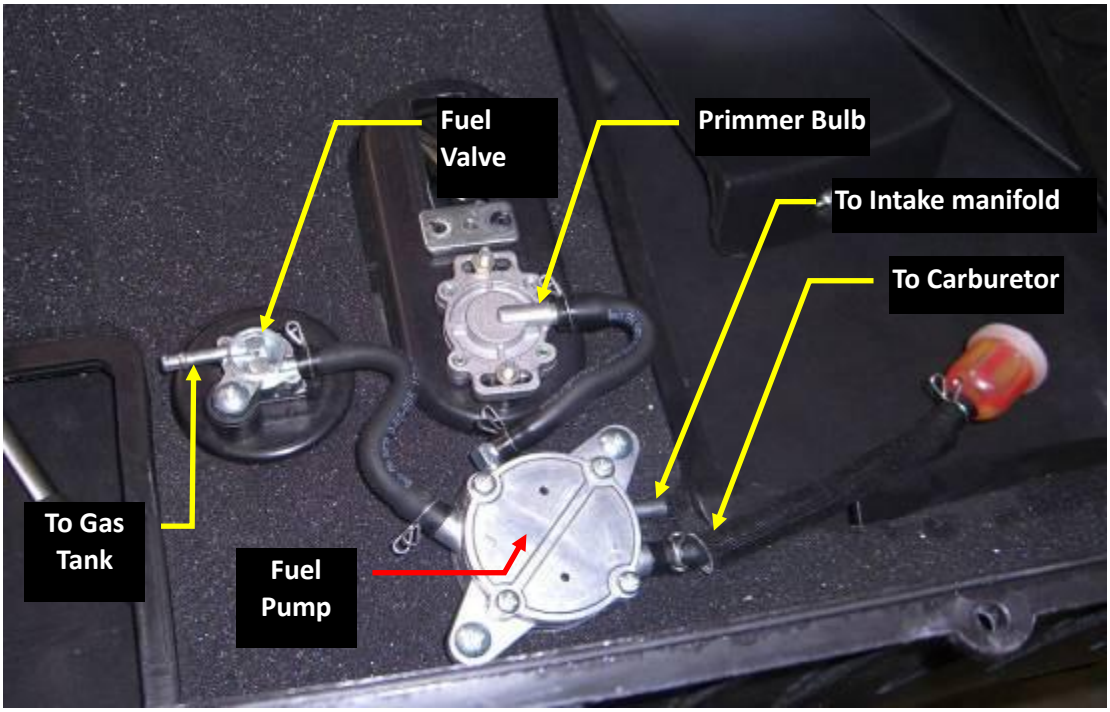


4.10 Fuel pump, primer bulb

CAUTION

- Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel. Keep heat, sparks, and flame away. Wipe up spills immediately.

1. Disconnect the battery.
2. Remove front and rear panel.
3. Remove the left cover.
4. Drain all fuel from the tank and carburetor.
5. Check the fuel tubing for deterioration, cracks and gas leaks. If there is any abnormality in the fuel tubing, replace it.
6. Check the primer bulb and diaphragm tube for deterioration, crack or gas leaks. If there is any abnormality in the primer bulb or diaphragm tube, replace it.
7. Check to see whether water or foreign material has accumulated in the fuel pump.
8. If there is water or foreign material accumulated in the pump, replace the fuel pump.
9. Check the fuel valve and make sure there is no obstruction when open. Clean or replace as required.
10. After reassembly check all hoses and connections for fuel leaks.

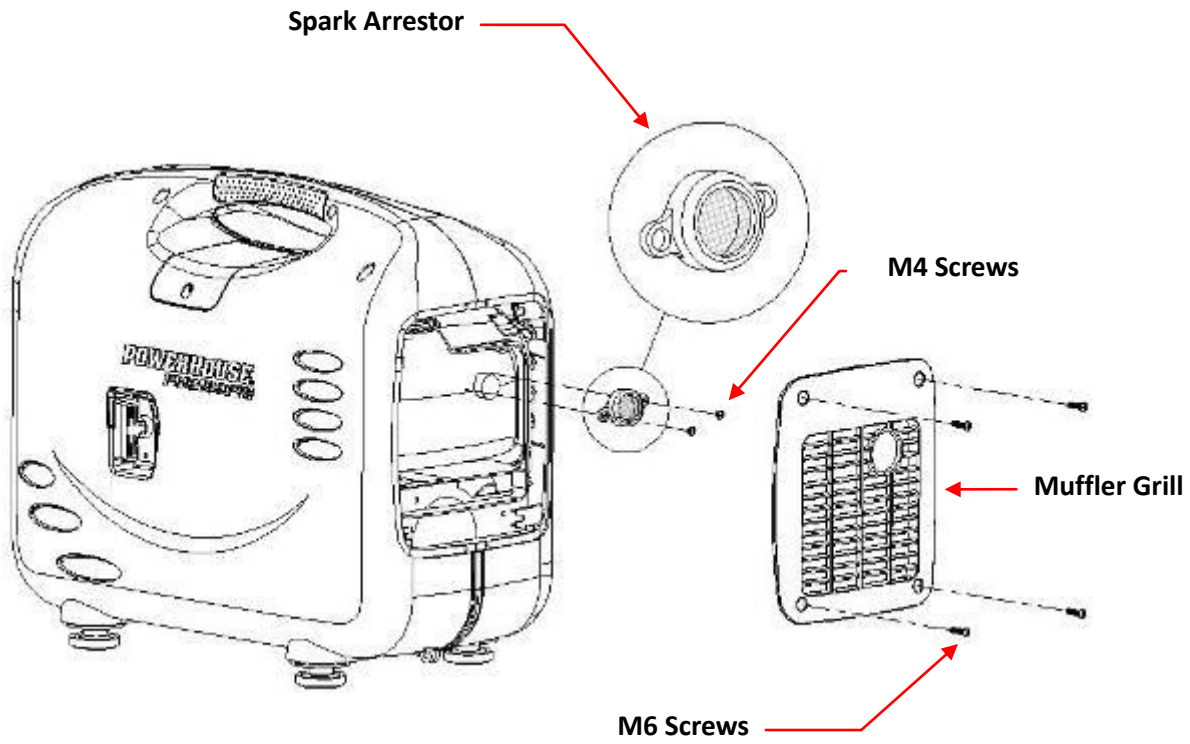


5 Muffler system

5.1 Spark arrestor

CAUTION ▪ Do the performance after engine has cooled completely.

1. Remove the four M6 screws and remove the muffler grill.
2. Remove the two M4 screws holding the spark arrester to the muffler.
3. Use a stiff wire brush to remove carbon deposits from the spark arrester screen.
4. Inspect the screen for holes, and replace it if necessary.



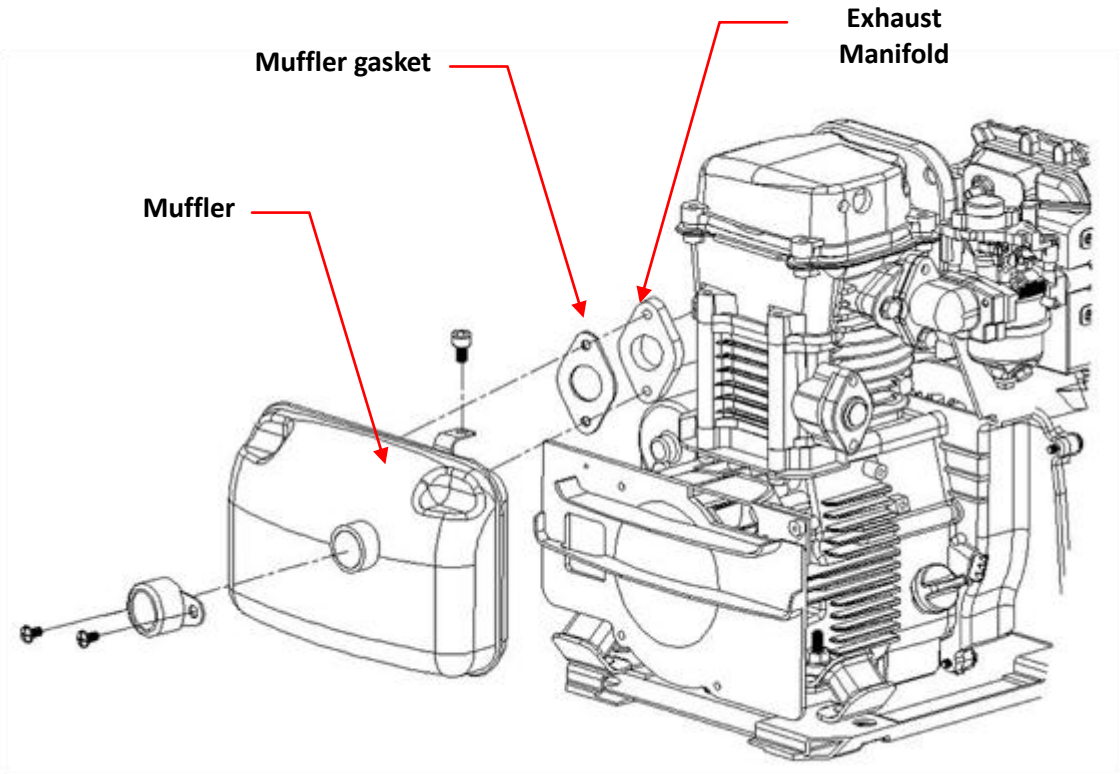
CAUTION

- Muffler removal/installation must be performed with the engine cold.

5.2 Muffler

Disassembly/Reassembly

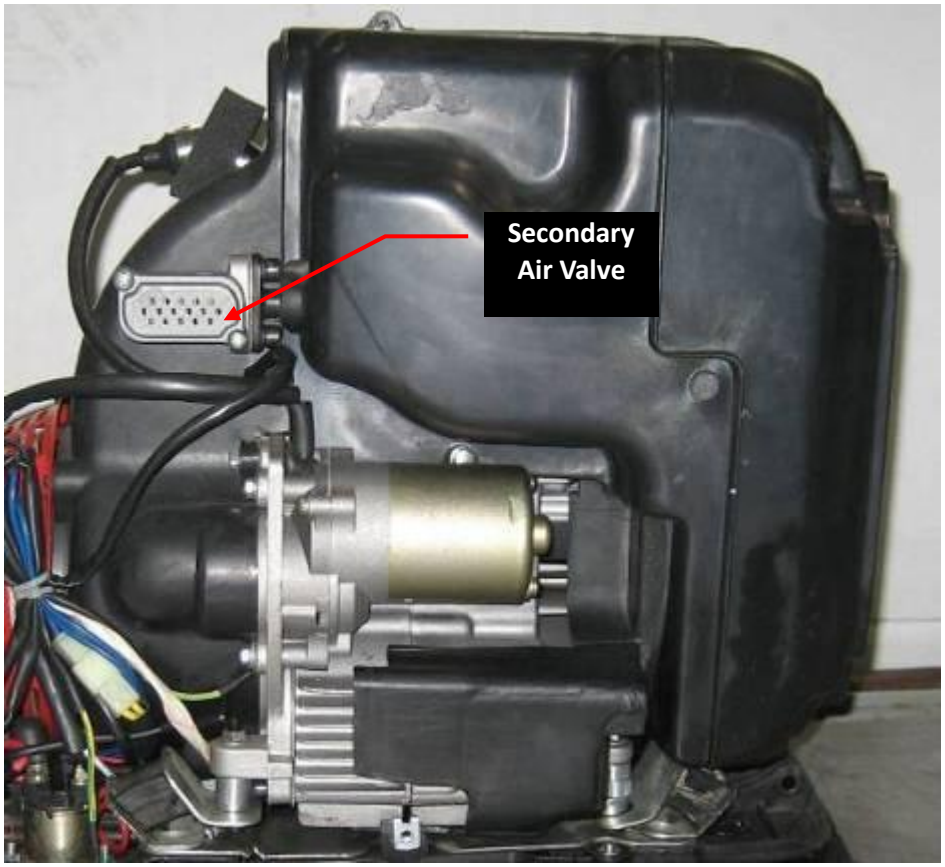
1. Disconnect the battery.
2. Drain all fuel from the tank and carburetor.
3. Remove front and rear panel.
4. Remove the left and right cover
5. Remove fuel tank.
6. Remove the carburetor assembly.
7. Remove the carbon canister.
8. Remove the starter motor.
9. Remove front and back engine covers.



5.3 Exhaust tube, secondary air valve

Disassembly/Reassembly

1. Disconnect the battery.
2. Remove front and rear panel.
3. Remove right cover



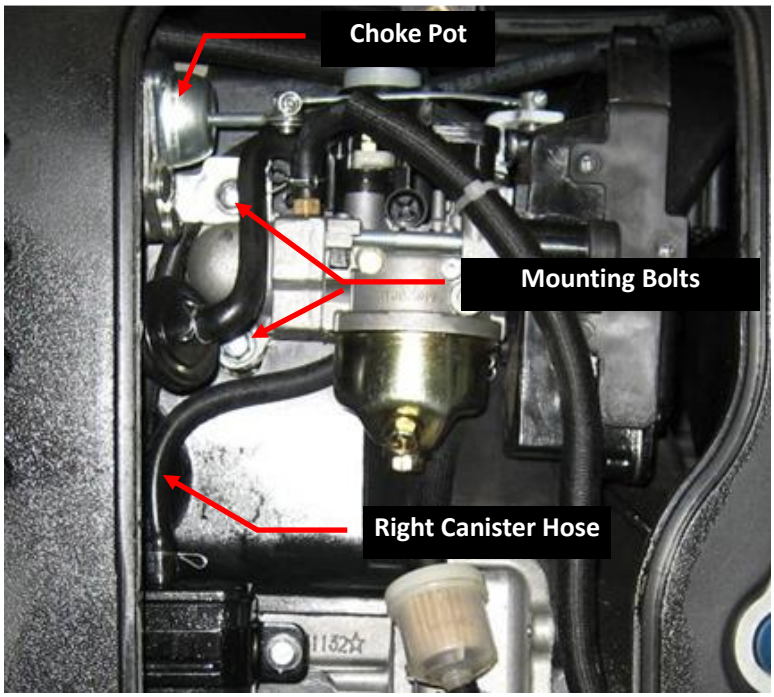
6. Carburetor

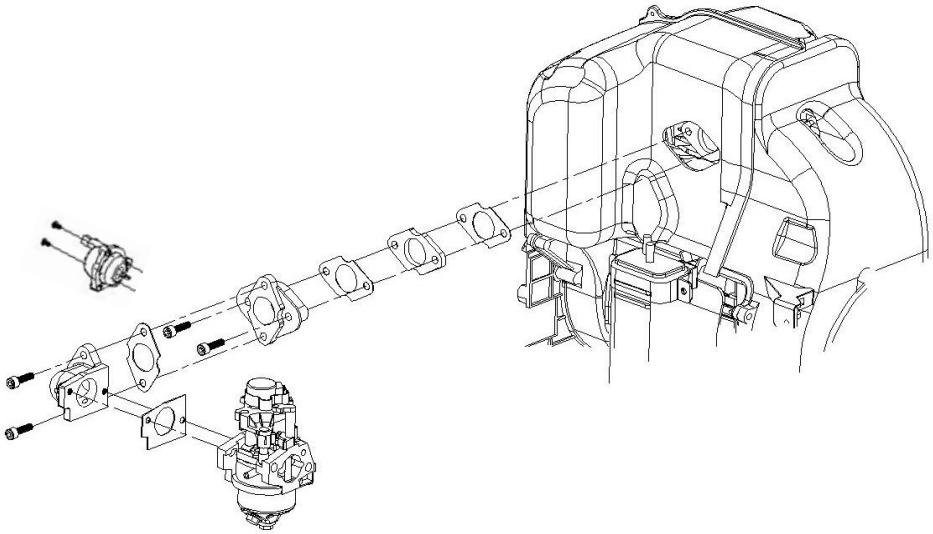
6.1 Disassembly/Installation of Carburetor

⚠ CAUTION

- Turn fuel lever to the “OFF” position.
- Keep heat, flame and sparks away.

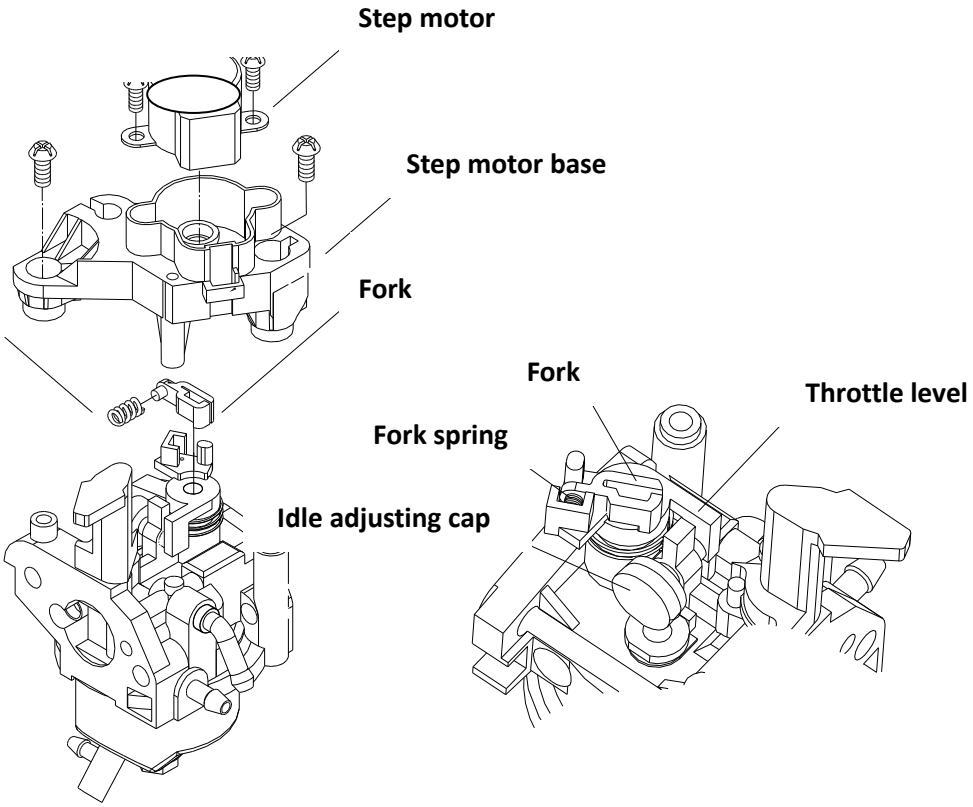
1. Disconnect battery.
2. Remove maintenance panel.
3. Disconnect the right vent hose from the carbon canister.
4. Drain fuel from carburetor.
5. Remove two carburetor mounting bolts.
6. Remove the carburetor, choke and air filter as an assembly being very careful not to pull on the step motor wires.



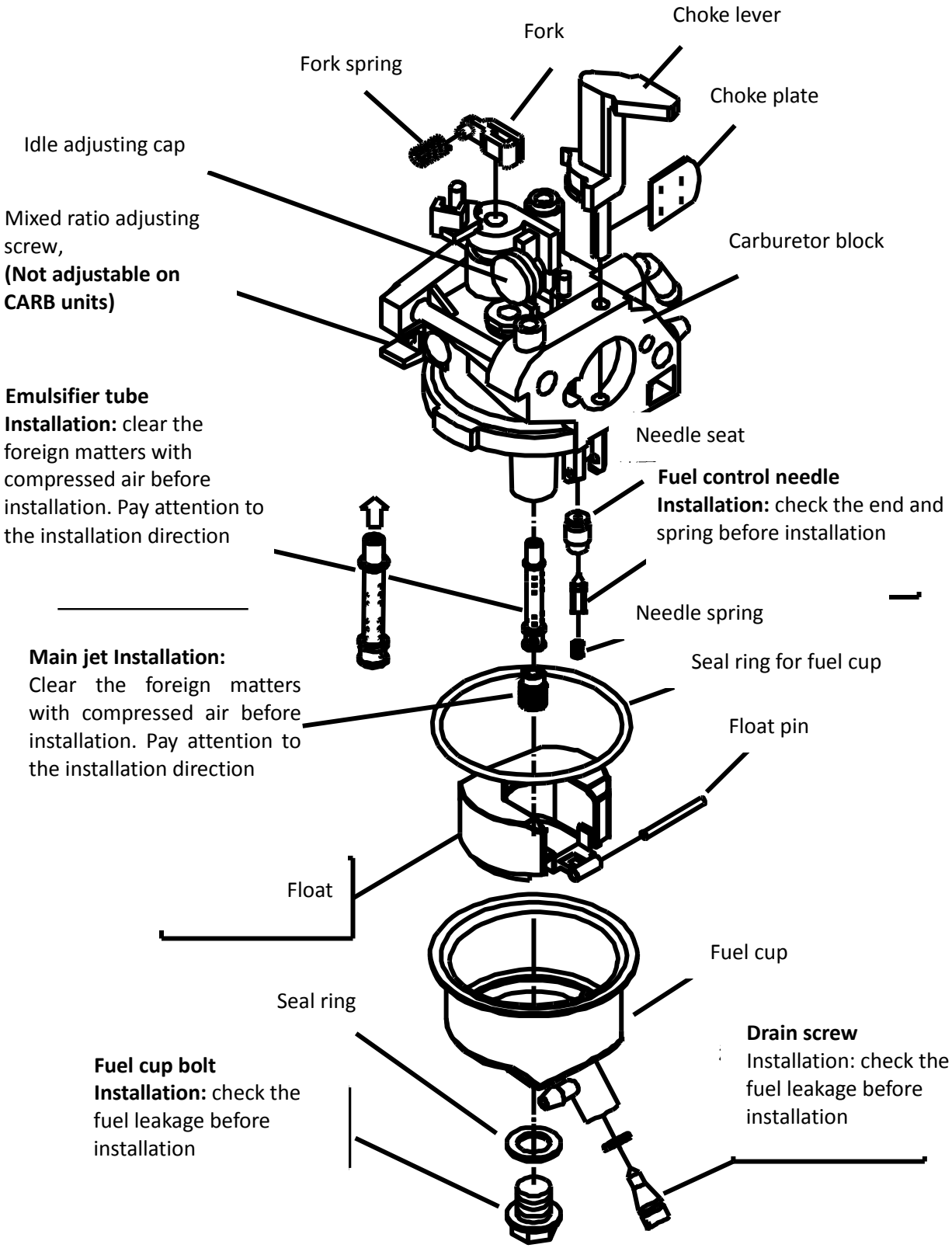


6.2 Disassembly/Installation of Step motor

Fork spring Disassembly:
Carefully remove the spring and fork from the throttle lever.

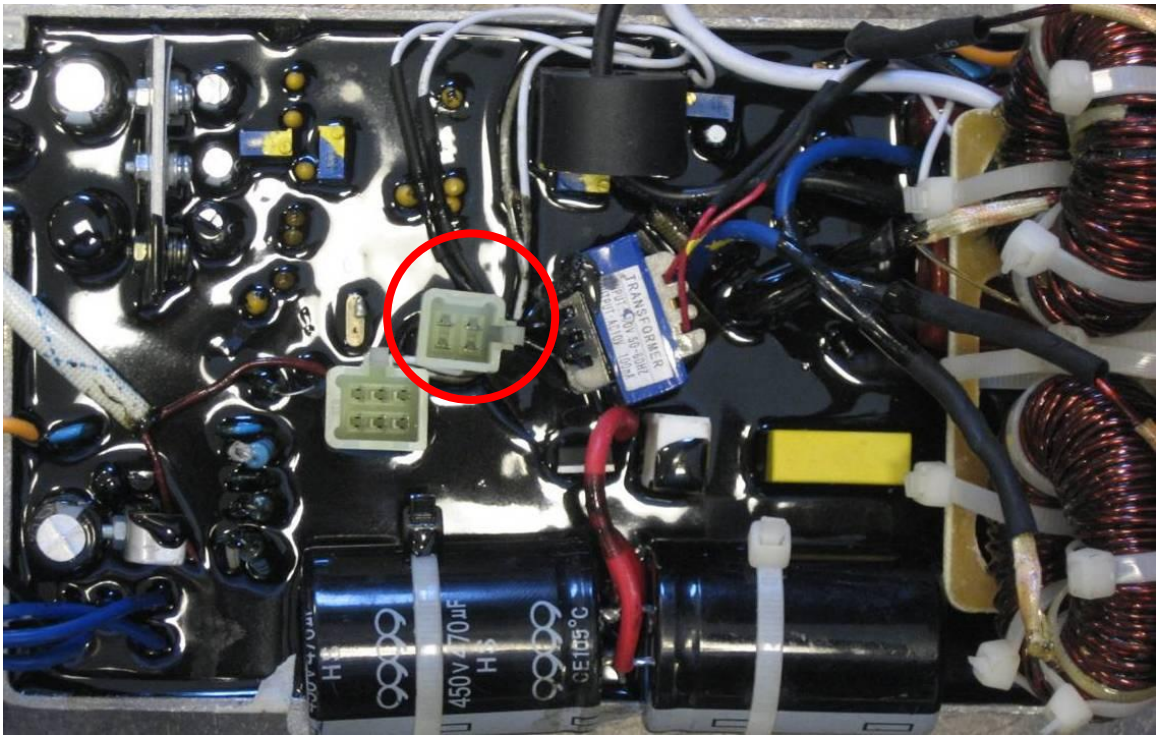


6.3 Disassembly/Installation of Carburetor



6.4 Step motor

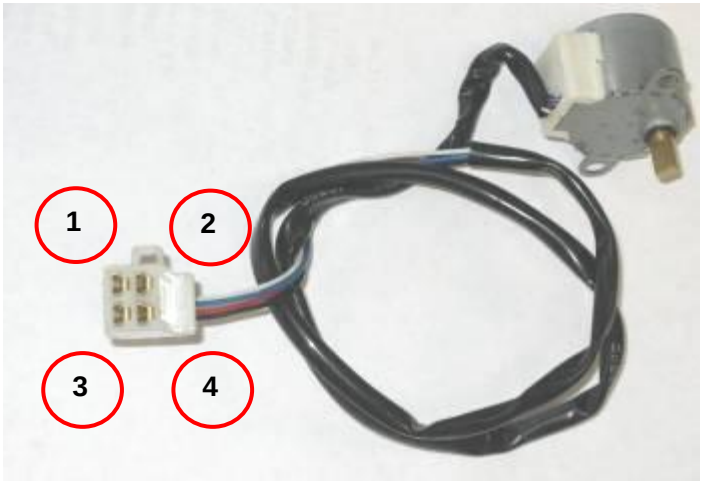
Make sure to check the step motor connection on the inverter for any debris, damaged or bent pins



Measure the resistance of the step motor lead-out wire.

Replace the step motor if the resistance exceeds the ranges shown below.

Standard resistance	1-blue ~ 2-white：50~55Ω
	3-red ~ 4-black：50~55Ω



6.5 Automatic choke inspection/adjustment.

The choke on the PH2100PRi operates automatically. When the unit is off, the choke will return to the closed position

1. The automatic choke consists of the backpressure check valve and the vacuum pot, figure 1.
2. Items to check if the automatic choke fails to operate.
   - **a.** Check all vacuum hoses for cracks or damage, replace as necessary.
   - **b.** Check the backpressure check valve for leaks or a defective diaphragm.
   - **c.** Check all choke linkage to insure it operates smoothly and that the choke closes and opens fully.
   - **d.** To insure that the choke is closing fully, remove the filter and check the choke. Loosen the set screw and make sure that the butterfly closes completely, then retighten the set screw.
   - **e.** To check the vacuum pot for leaks, disconnect the vacuum hose from the barbed fitting. Move the choke lever to the open position and block off the barbed fitting on the choke pot, figure 2. The choke should stay in the open position as long as the fitting is closed off.

Fig. 1

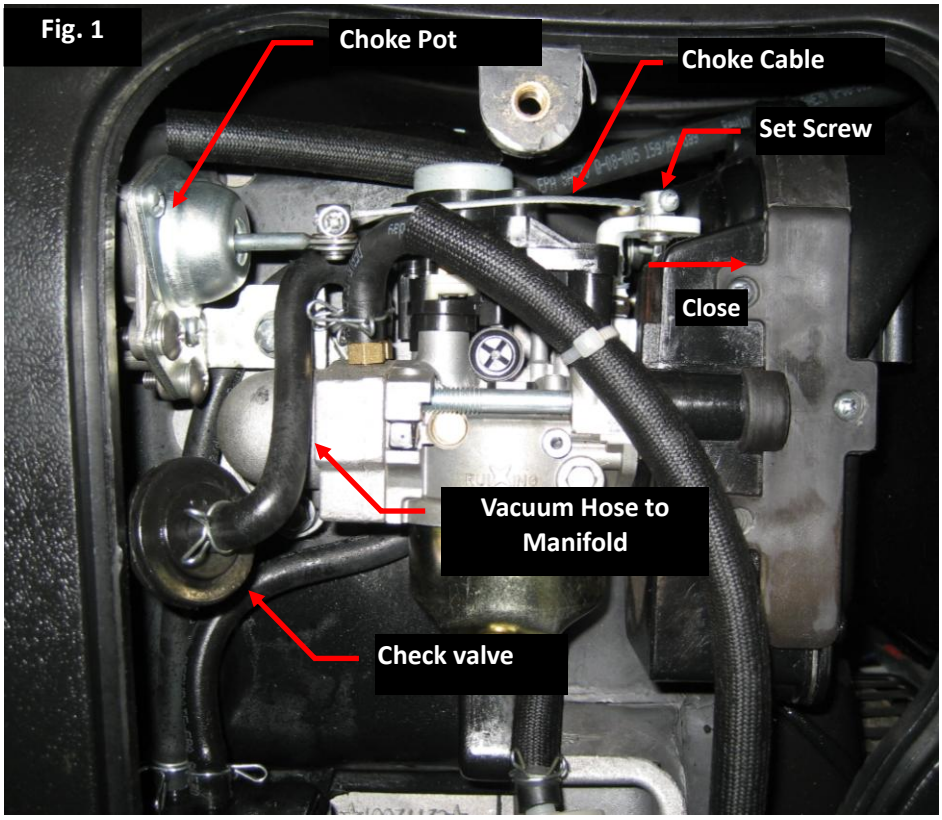
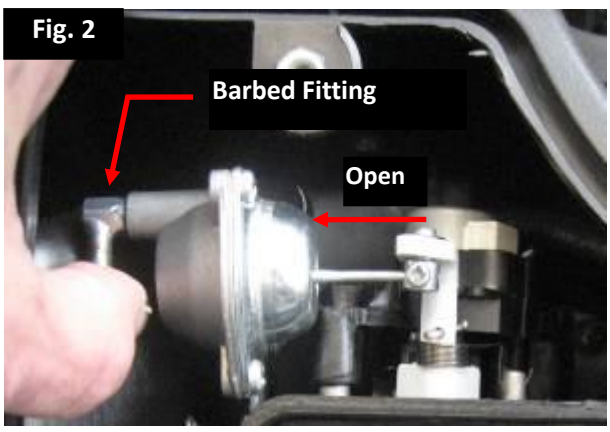


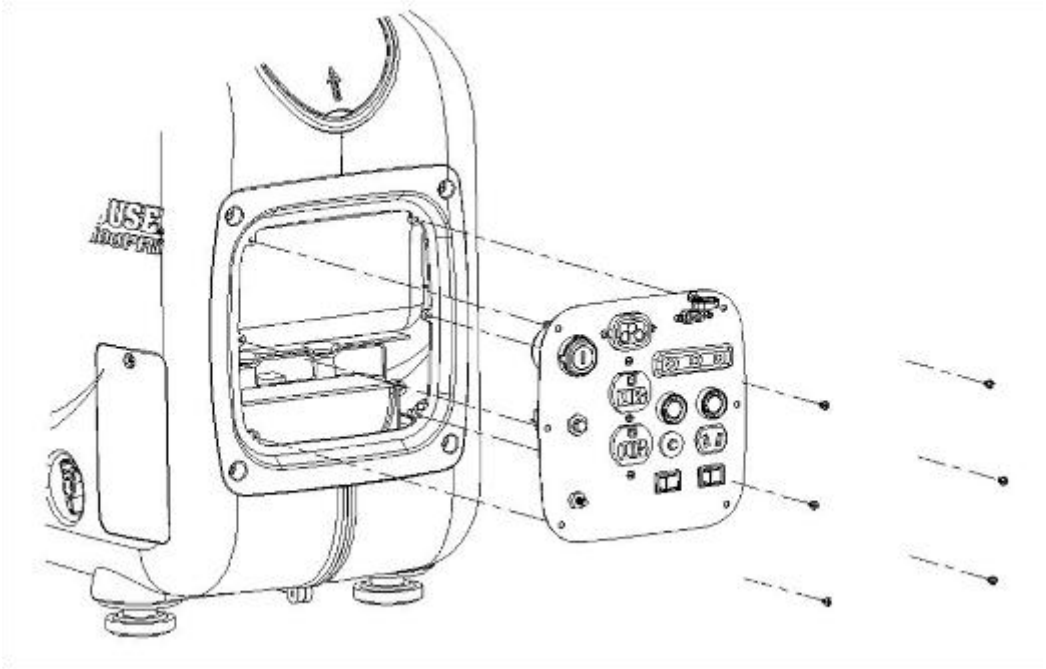
Fig. 2

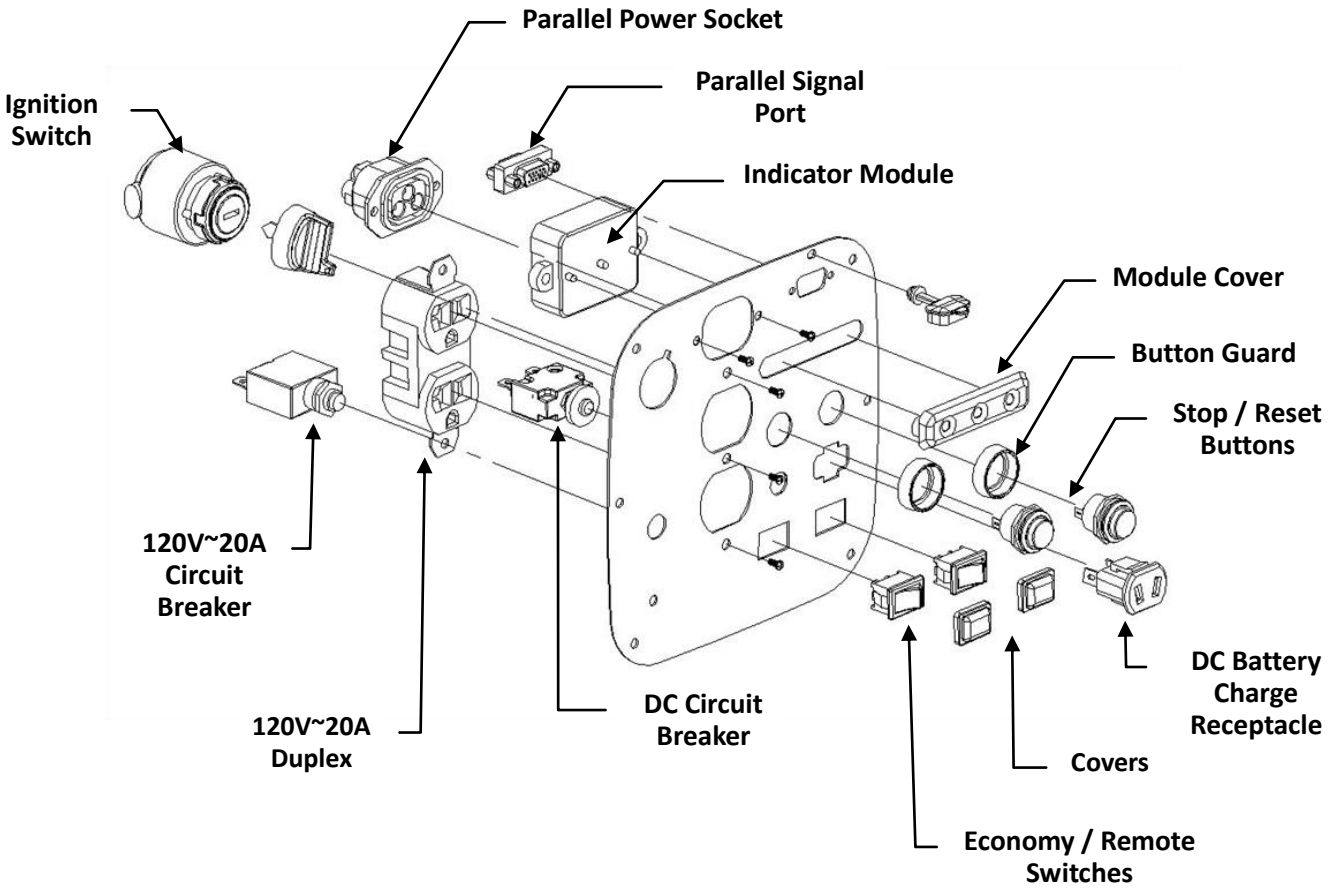


7. Control panel

7.1 Disassembly/Installation

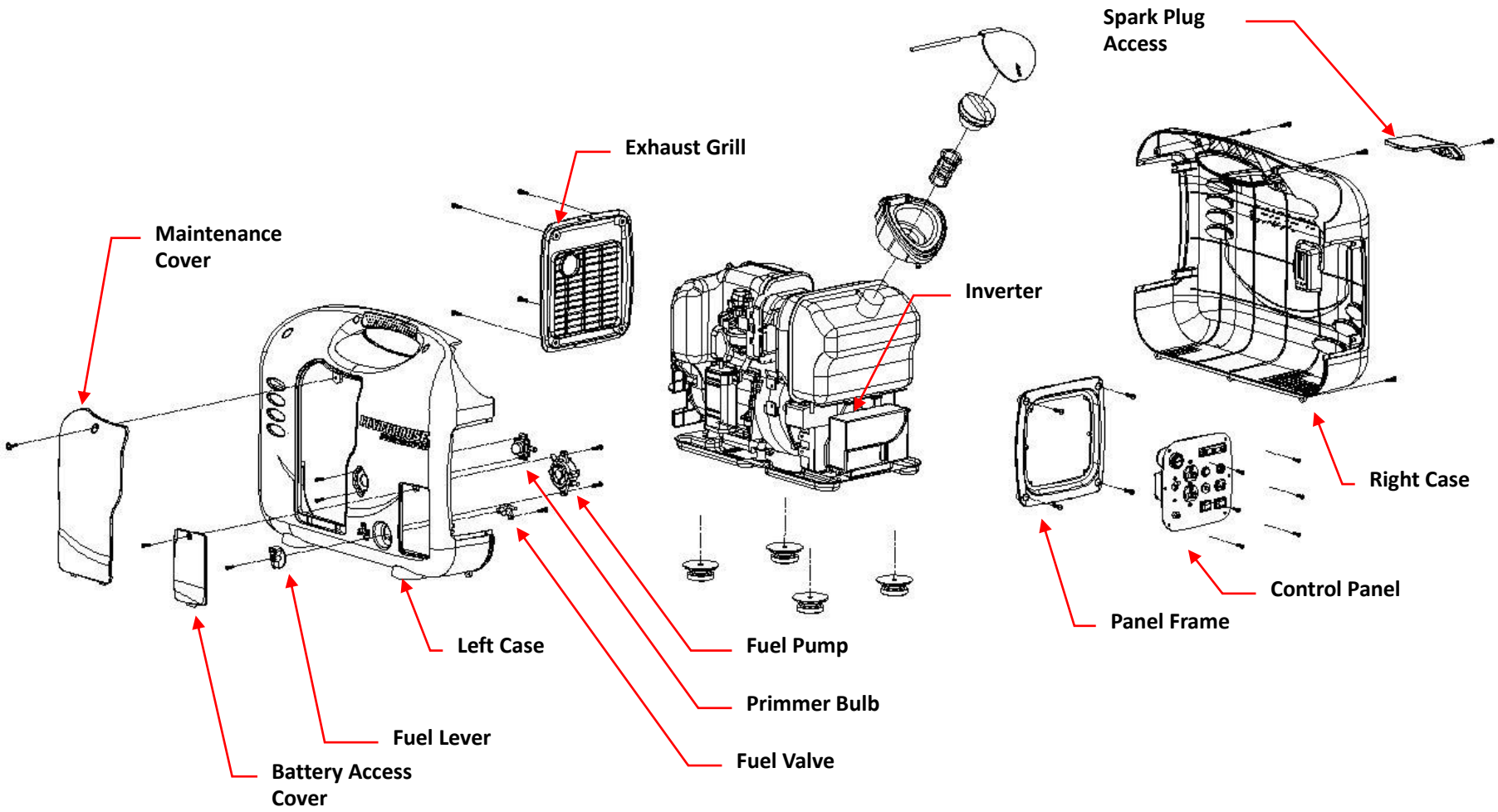
1. Remove six M4 panel screws.





8. Outer generator housing

8.1 Disassembly and installation of housing case



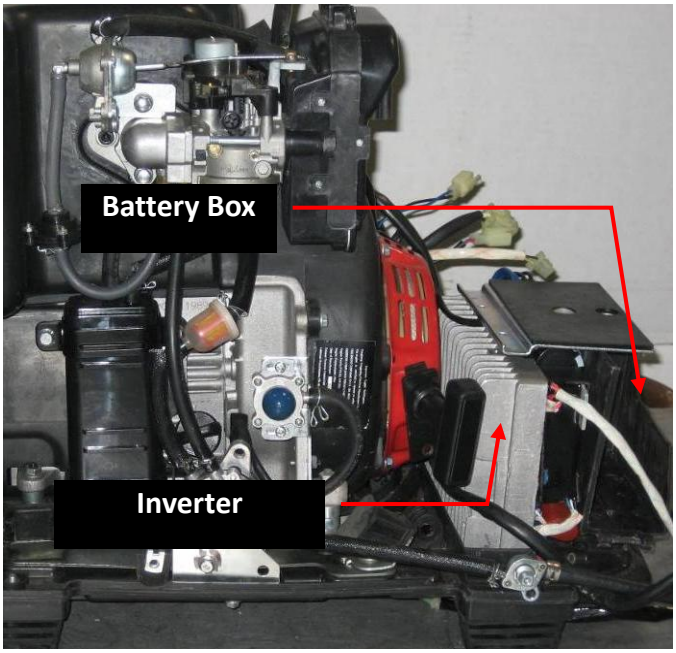
9. Recoil starter / Electric Starter / Ignition coil

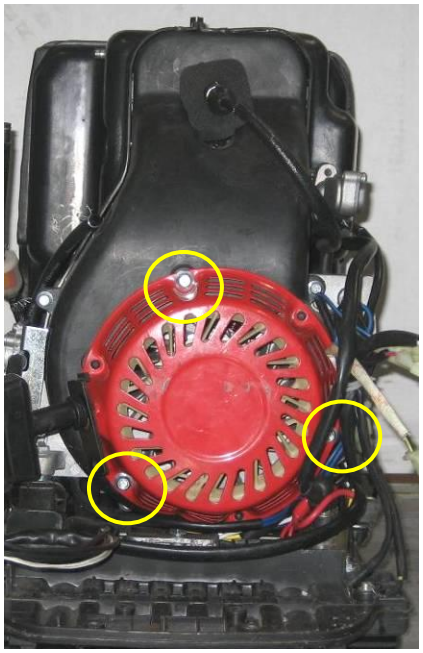
Caution

- ■ Drain all gasoline from the fuel tank before disassembly.
- ■ Keep the unit away from all heat, flame and sparks.

9.1 Recoil starter/Disassembly/Reassembly

1. Disconnect the battery.
2. Remove front and rear panels.
3. Remove the left and right covers.
4. Drain all gasoline from the fuel tank.
5. Remove the fuel tank and the inverter.
6. Remove (3) M6 flange bolts and the recoil starter.
7. Reinstall the inverter side covers and end panels.

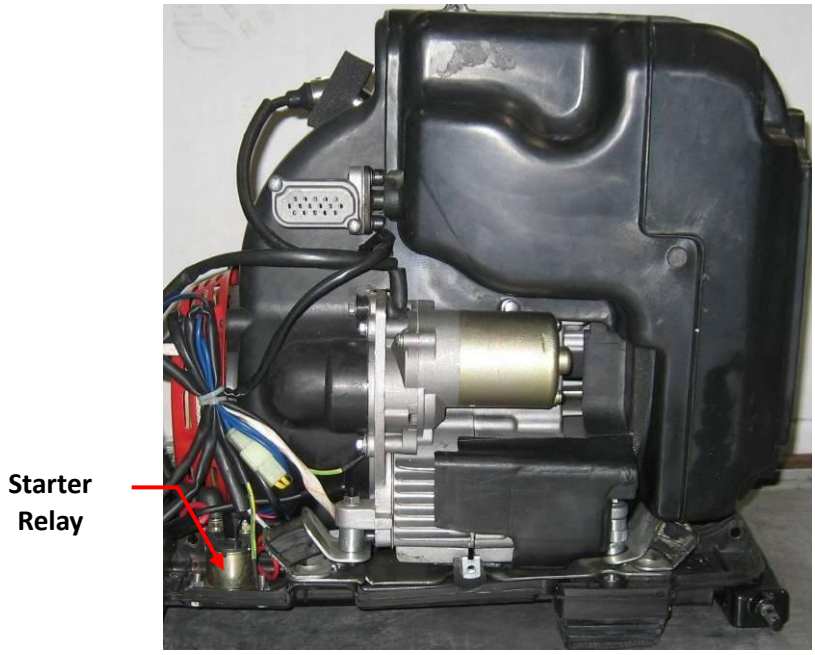


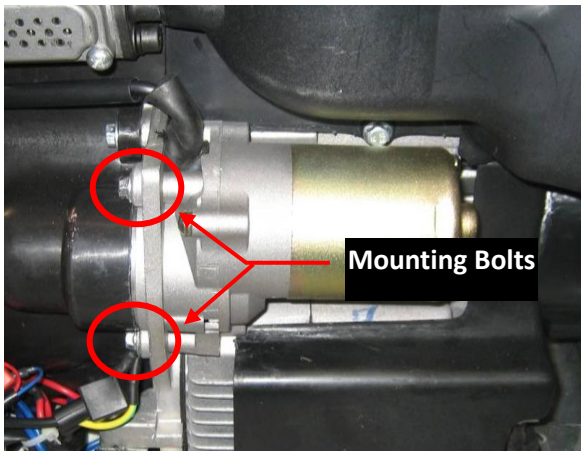


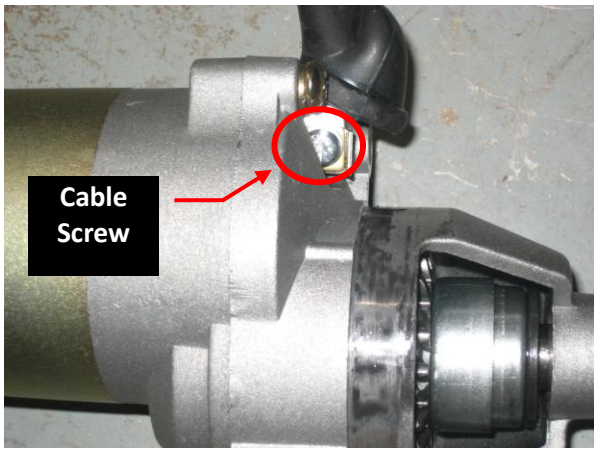
9.2 Starter motor

● Disassembly

1. Disconnect the battery.
2. Remove front and rear panels.
3. Remove the left and right covers
4. Using and 8mm socket remove 2-mounting bolt.
5. Remove the starter and the cable.







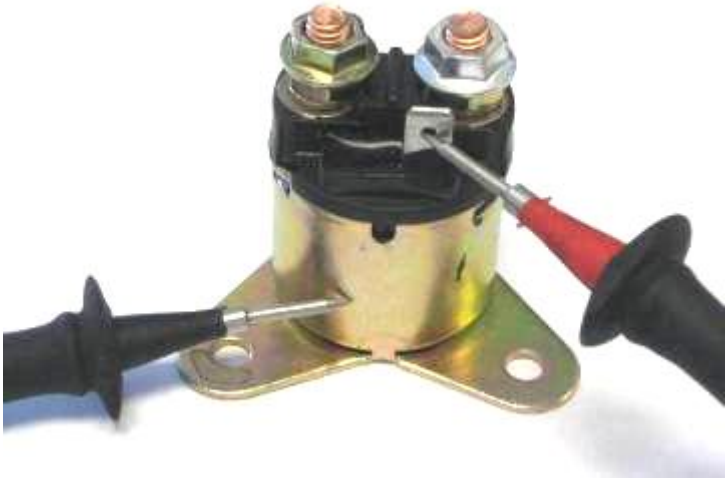
9.3 Starter solenoid

1. Using a volt ohm meter, check the resistances of the electromagnetic coil of the starter relay by connecting the red positive lead to the ¼" spade and the black negative lead to the metal body of the relay.

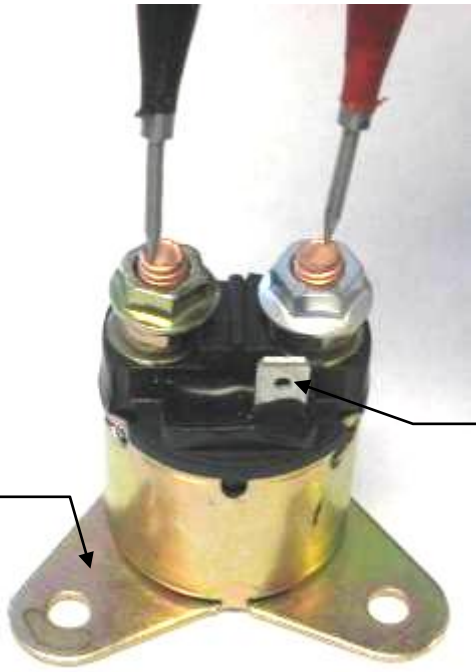
Resistance	4.6-6.0 Ω

2. Check the function of the start relay by connecting 12 volts + to the ¼" spade terminal and 12 volts negative to the metal base or body. There should be a clicking sound as the relay is activated. While the relay remains activated, use the volt ohm meter check continuity between the two lugs. If there is no continuity the relay is defective.
3. **Note, there must only be continuity between the battery and the starter terminals when the relay is activated.**

Checking Resistance



Checking Continuity

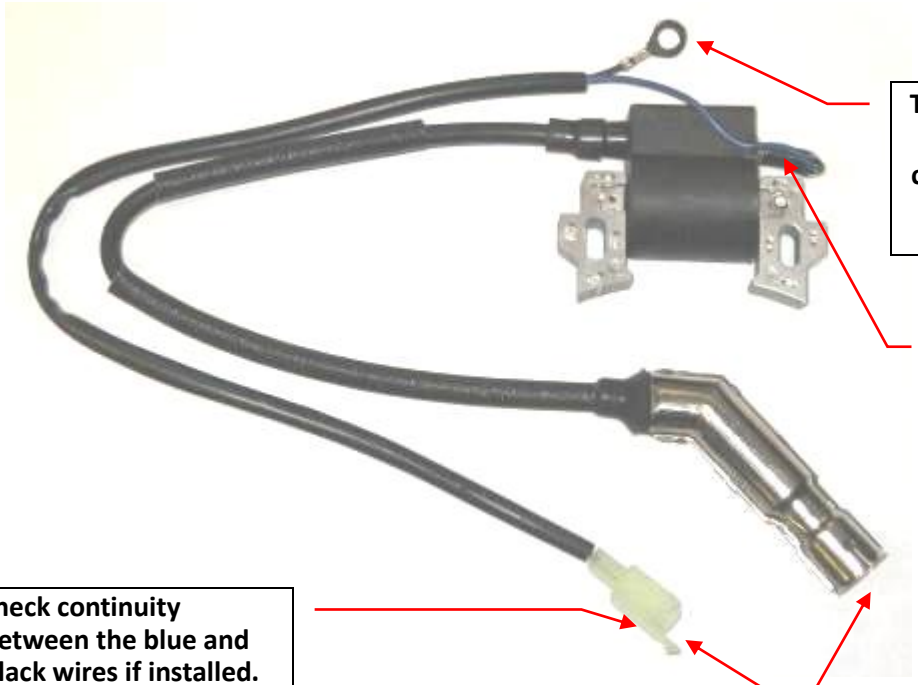


9.3 Ignition coil

Inspection

1. Remove the control panel and locate the 2-pin primary coil plug with a Blue and Black wire and unplug it from the control panel.
2. Attach the two leads of tester to the Blue and Black wires and measure the primary resistance of the ignition coil.
3. If there is no resistance, check for continuity between the black wire and chassis ground. If there is no continuity repair or correct as necessary.
4. Replace the coil if there is no resistance or the value is outside of the values shown.

Primary resistance	0.045-0.070 Ω



5. To check the secondary resistance, attach one lead of the tester to the black wire of the primary plug of the ignition coil and the other lead to the spark plug cap.
6. If there is no resistance remove the spark plug cap and check the lead itself.
7. Replace the spark plug cap or coil if there is no resistance or the value is outside of the values shown.

Secondary resistance	5-8 k Ω

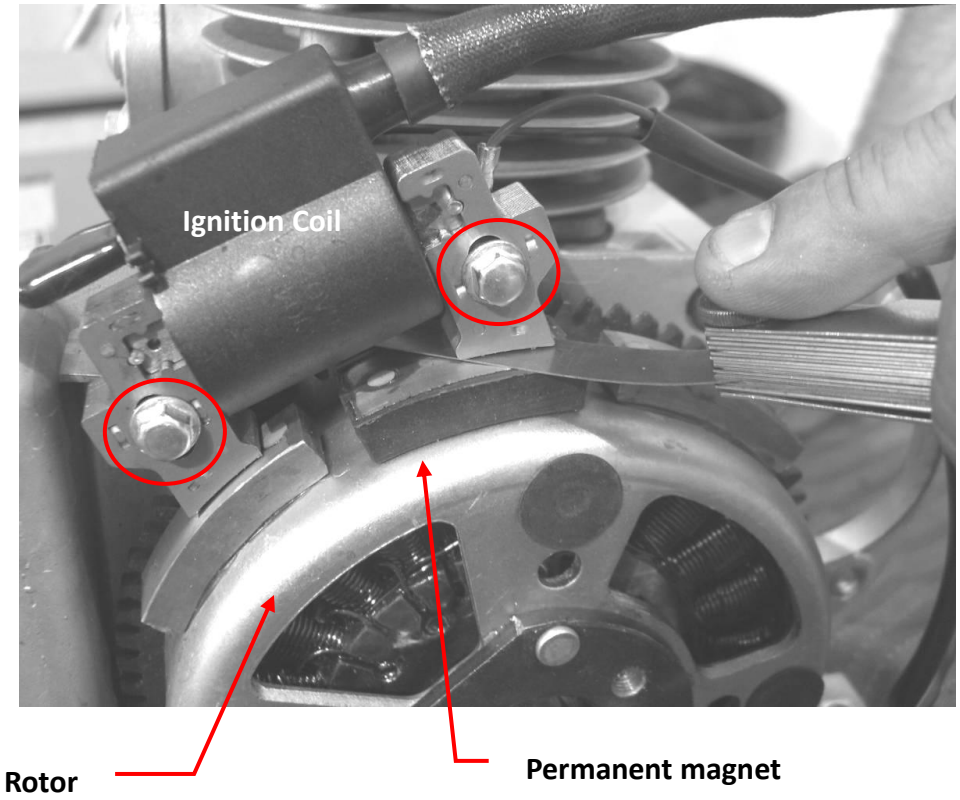
9.4 Ignition coil/Disassembly

1. Disconnect the battery.
2. Remove front and rear panel.
3. Remove the left and right cover
4. Remove the fuel tank and the inverter.
5. Remove the inlet fan cover.

9.5 Adjustment

1. Adjust the clearance between the ignition coil and the outer magnet trigger of the rotor.
2. Loosen the ignition coil bolts and Insert a feeler gauge between the ignition coil and the permanent magnet of the rotor, (Both sides need to be adjusted equally) and retighten the bolts.
3. Rotate the rotor to make sure there is interference with the flyweights.

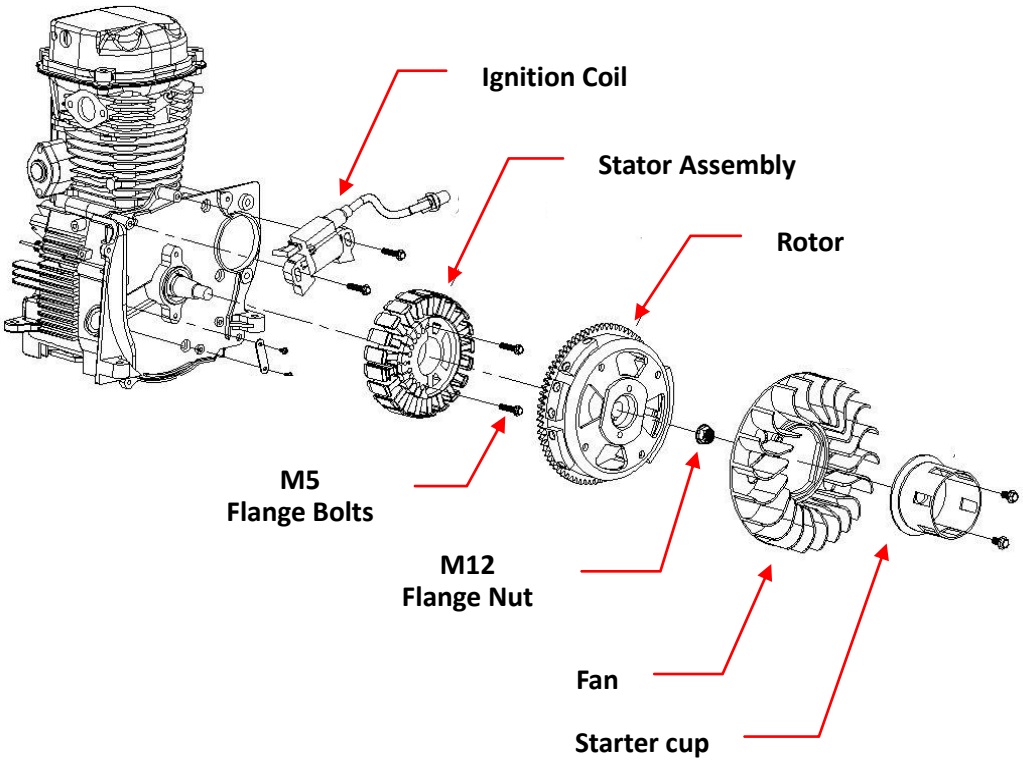
Ignition coil gap	0.5~0.75mm



10. Rotor/Stator disassembly / reassembly

10.1 Disassembly/Reassembly

1. Remove the following parts:
   - — Front cover, control panel.
   - — Rear cover.
   - — Right/left side covers.
   - — Fuel tank.
   - — Battery box.
   - — Inverter.
   - — Fan cover
   - — Starter cup and fan
   - — M12 flange nut
   - — Ignition coil
   - — Rotor
   - — M5 Stator bolts
   - — Stator



10.2 Stator Inspection

(1) DC charging winding

Measure the resistance between the two blue terminals.

Resistance	Blue-Blue
	0.045~0.070 Ω

(3) Sub winding

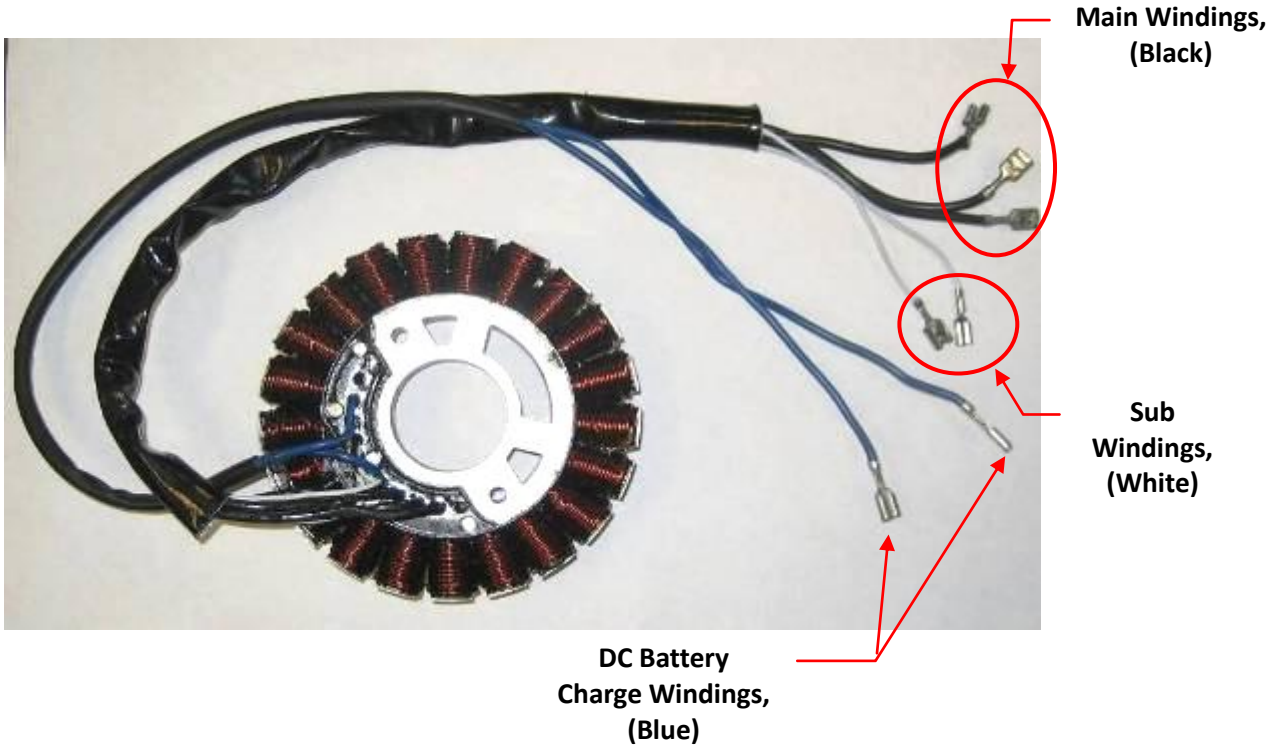
Measure the resistance between the two sub winding terminals.

Resistance	White-White
	0.100~0.160 Ω

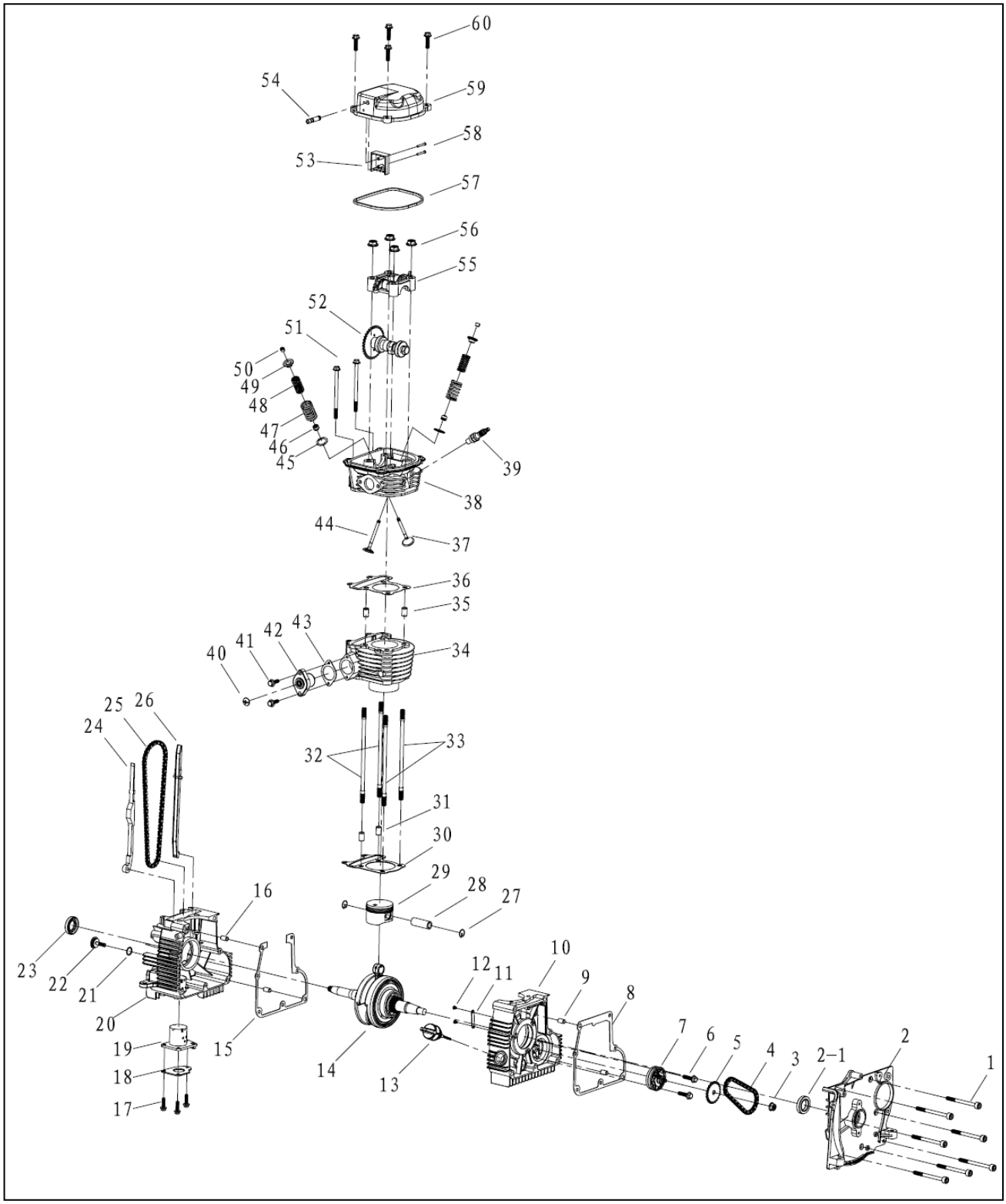
(4) Main winding

Measure the resistance between each of the main winding terminals.

Resistance	Black-Black-Black
	0.250~0.350 Ω



11. Exploded engine view



152 Engine				
Item No.	**Description**	**Mfg No**	**Stock No.**	**Qty**
1	M6 x 75 hex screw	03050611		7
2	Front engine cover	76115		1
2-1	Front seal	040906-07	69700	1
3	M8 nut	03060115	69709	1
4	Chain for oil pump	09070116	69710	1
5	Chain wheel for oil pump	09070117	69712	1
6	M6 x 25 bolt	03050241	69349	1
7	Oil pump	09070115	69714	2
8	Crankcase gasket	09070164	69694	1
9	Crank case bushing	04030265		1
10	Front crankcase	76113		2
11	Oil passage cover	09010342		1
12	M3 x 5 roundhead screw	03050802	69796	1
13	Oil dipstick	68150	69309	2
13-1	O'-Ring, dipstick	9070202	69437	1
14	Crankshaft	09070126		1
15	Crankcase gasket	09070164		1
16	Crankcase bushing	04030265		1
17	M5 x12 bolt	03050221	69351	2
18	O'-Ring, Low oil sensor	09070147		3
19	Low oil sensor	71046	69328	1
20	Rear crankcase	76114		1
21	"O" style sealing ring	09070129-31	69706	1
22	Tie bar bolt	03050313	69715	1
23	Rear oil seal	040906-07		1
24	Timing chain guide, tensioner	09070111	69701	1
25	Timing chain	09070112	69701	1
26	Timing chain guide	09070109	69705	1
27	Retainer ring	09070139	69708	1
28	Locating pin for piston	09070102		2

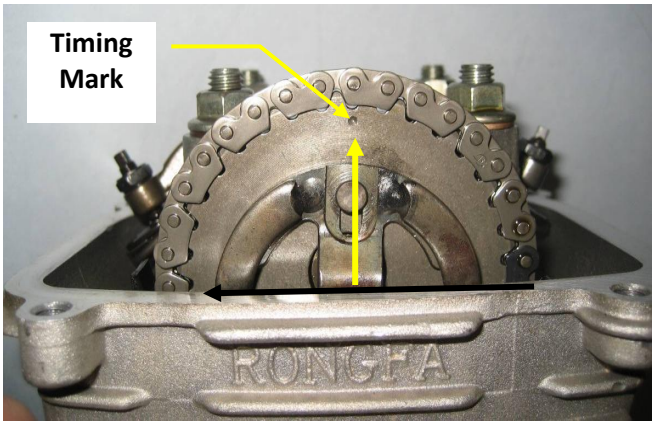
152 Engine				
Item No.	**Description**	**Mfg No**	**Stock No.**	**Qty**
29	Piston	09070101		1
30	Cylinder gasket	09070165	69695	1
31	Locating bushing, head	04030264		2
32	M8 x 195 threaded stud	03050603		2
33	M8 x 185 threaded stud	03050601		2
34	Cylinder sleeve	09070105		1
35	Locating bushing, head	04030264		2
36	Head gasket	09070107	69685	1
37	Intake valve	09070122	69683	1
38	Cylinder head	09070106	69684	1
39	Spark plug, A7RTC	09080114	69412	1
40	M6 X 5 roundhead bolt	03050327	69686	1
41	M6 x 20 bolt	03050223	69352	2
42	Tensioner	09070113	69688	1
43	Gasket, tensioner	09070114	69690	1
44	Exhaust valve	09070123	69670	1
45	Washer	09070121	69674	1
46	Valve seal	09070118	69675	1
47 & 48	Valve spring Kit, 2100 & 2700	09070120	69677	2
49	Valve seat retainer	09070119	69681	2
50	Lock catch for valve	09070125	69682	4
51	M6 x 100 bolt	03050226		2
52	Camshaft	09070128	69669	1
55	Rocker subassembly	09070133	69644	1
56	M8 nut	03060115	69709	4
57	Valve cover gasket	09070110	69667	1
53, 54, 58 & 59	Valve cover/PCV Assy.	77050	Need	1
60	M6 x 25 bolt	03050241	69349	4

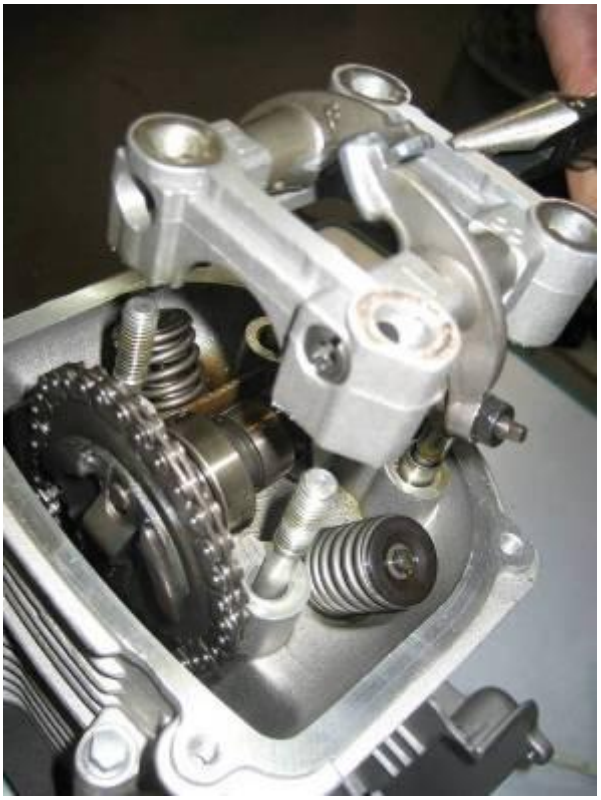
12. Valve cover/ Rocker arm

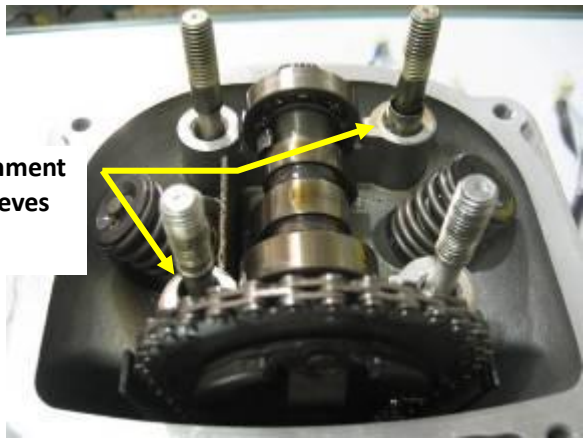
12.1 Disassembly/ Reassembly

Remove the four bolts and valve cover.

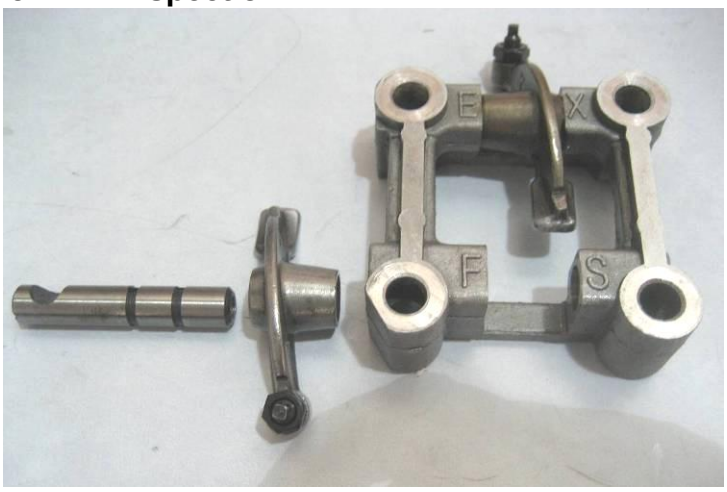
1. Turn the rotor to set the piston at top dead center of the compression stroke.
2. The timing mark of camshaft should be vertical to the cylinder head seal, check whether the inlet and exhaust valve are closed.
3. Remove 4- rocker arm nuts and washers and carefully remove the rocker arm assembly







12.2 Rocker Arm Inspection



● **Rocker arm outer diameter**

Standard	Service limit
9.96—9.97mm (0.392-0.393”)	9.953mm (0.391”)

● **Rocker arm inner diameter of inlet/exhaust valve**

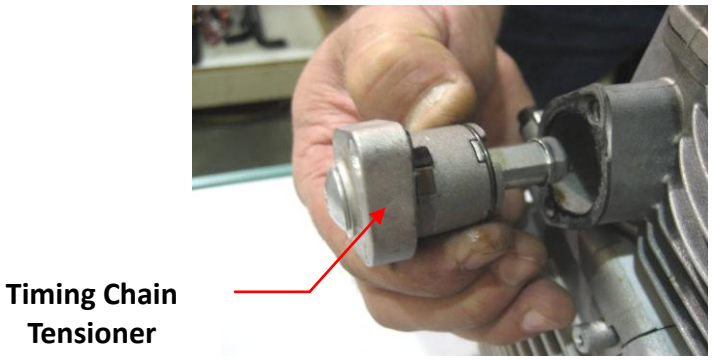
Standard	Service limit
10.000-10.015mm (0.3936-0.3942”)	10.040mm (0.3952”)

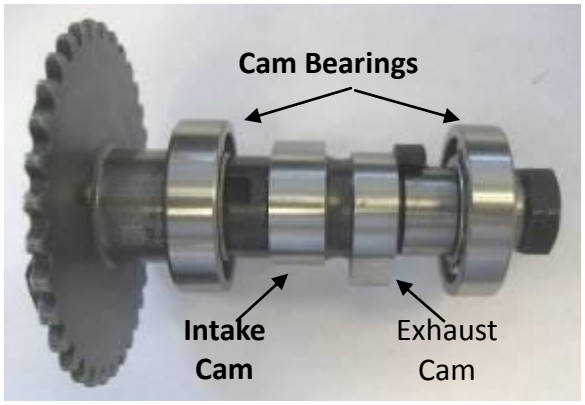
12.3 Cam and cylinder head removal / Reassembly

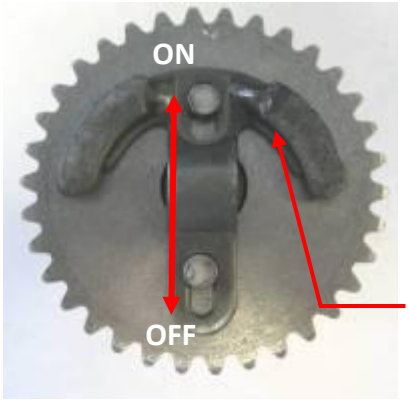
1. Turn the rotor to set the piston at top dead center of the compression stroke.
2. The timing mark of camshaft should be vertical to the cylinder head seal. Make sure the inlet and exhaust valve are closed.
3. Remove the timing chain tensioner.
4. Secure the timing chain with safety wire to prevent it from falling into the crank case.
5. Lift and remove the cam assembly from the head.
6. Carefully inspect the cam lobes, bearings and decompression operation.

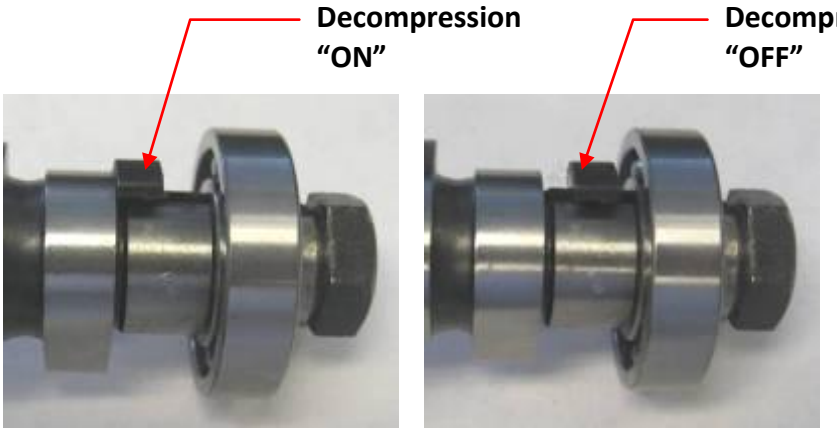
● **Cam height**

Standard	Service limit
29.026-29.086 mm (1.143-1.145”)	29.15 mm (1.104”)

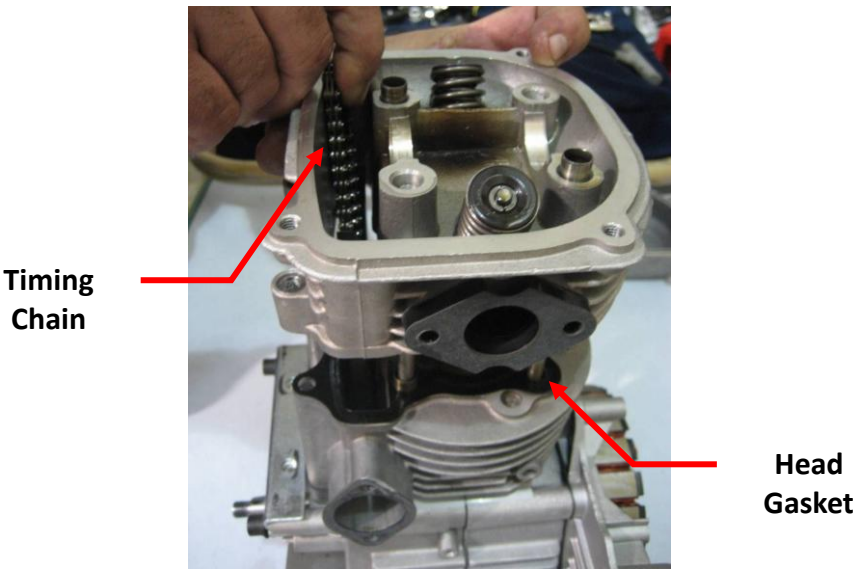








7. While holding the safety wire that is attached to the timing chain, carefully remove the cylinder head and gasket.

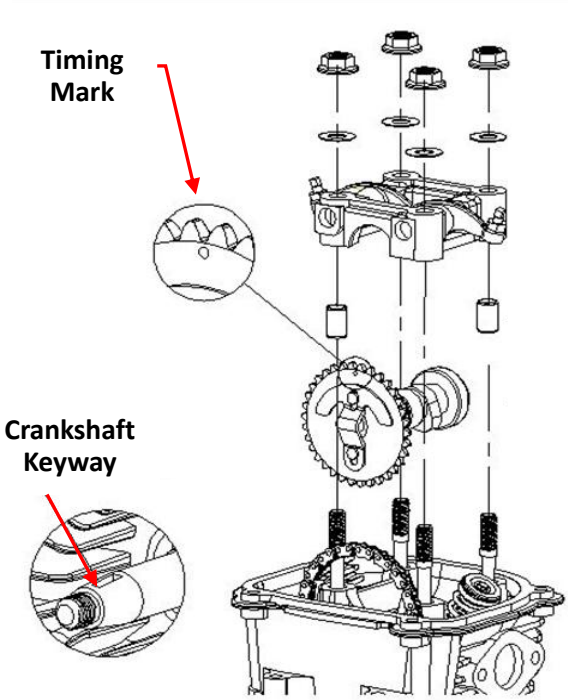


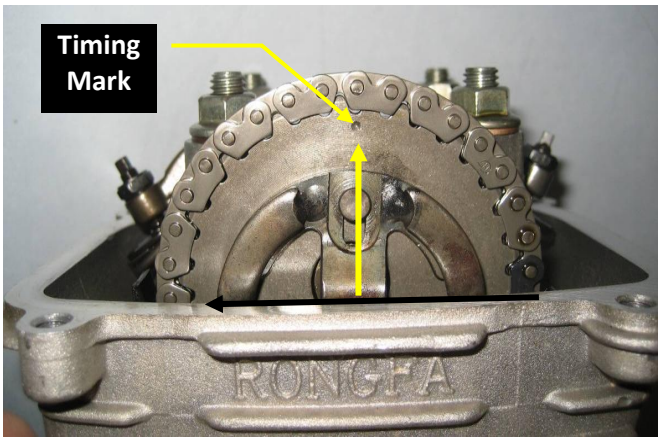
Reassembly:

8. Replace the head gasket.
9. Follow the reverse procedure to reassemble.

Caution

- Make sure that the piston is at top dead center which can also be confirmed by locating the crank shaft keyway in the vertical (Upright) position.
- Install the chain onto the cam gear making sure that the timing mark is straight up before installing the rocker arm assembly.





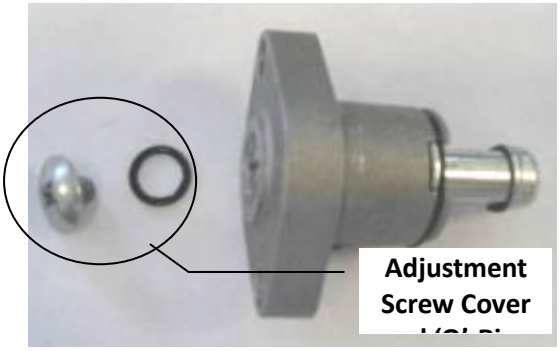
Reinstalling the timing chain tensioner:

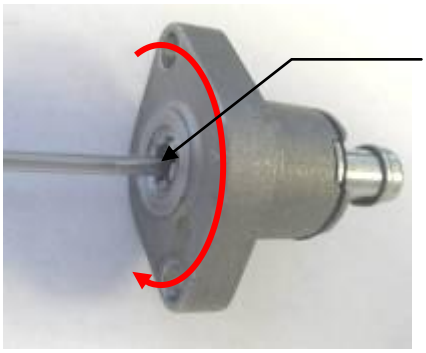
10. Remove the adjustment cover screw and 'O'-ring.

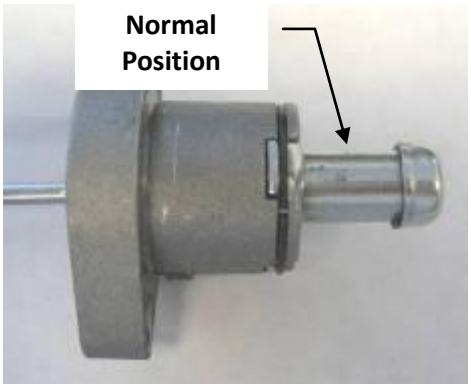
11. Replace gasket.

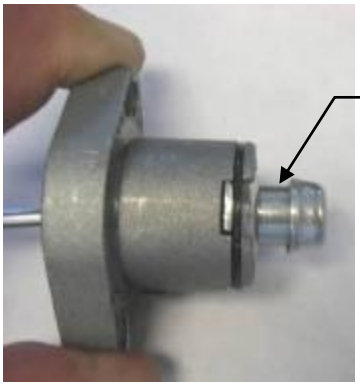
12. Using a small flat blade screw driver rotate the spring loaded adjustment screw clockwise to retract the plunger.

13. Constant clockwise tension must be applied to the center screw until the tensioner is flush with the gasket before it is released.





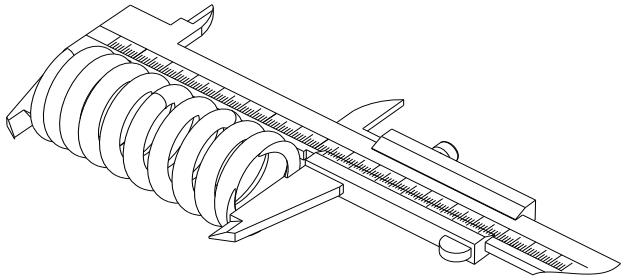




12.4 Inspection, valves and valve springs

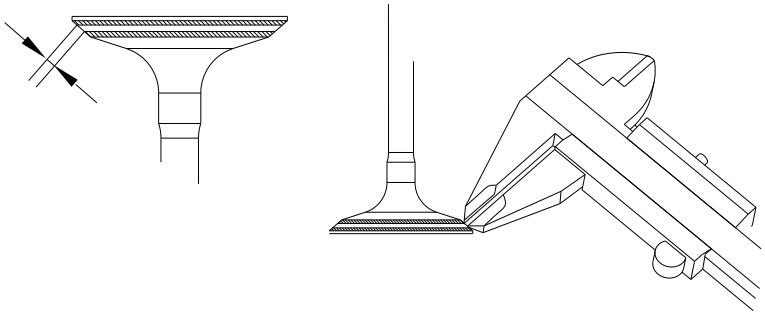
● Free length of valve spring

Spring	Standard	Service limit
Small	35.5mm (1.397”)	31.1mm (1.224”)
Large	32.8mm (1.291”)	33.8mm (1.330”)



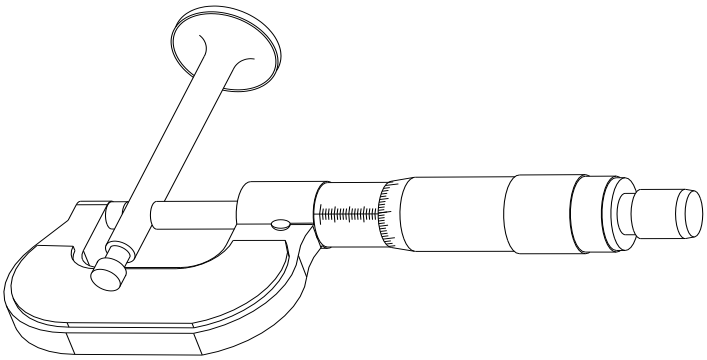
● Valve seat width

Standard	Service limit
1.0mm (0.039”)	2.0mm (0.079”)



● Valve stem outer diameter

	Standard	Service limit
Intake valve	4.975 - 4.99mm (0.1958-0.1964”)	4.92mm (0.1937”)
Exhaust valve	4.955 - 4.970mm (0.1950-0.1951”)	4.90mm (0.193”)



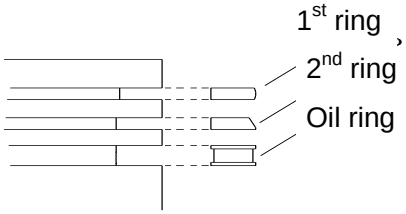
● Valve guide inner diameter

	Standard	Service limit
Inlet/Exhaust valve	5.000-5.030mm (0.197-0.198”)	5.060mm (0.199”)

12.5 Piston/Connection rod

Assembly of piston ring

Caution

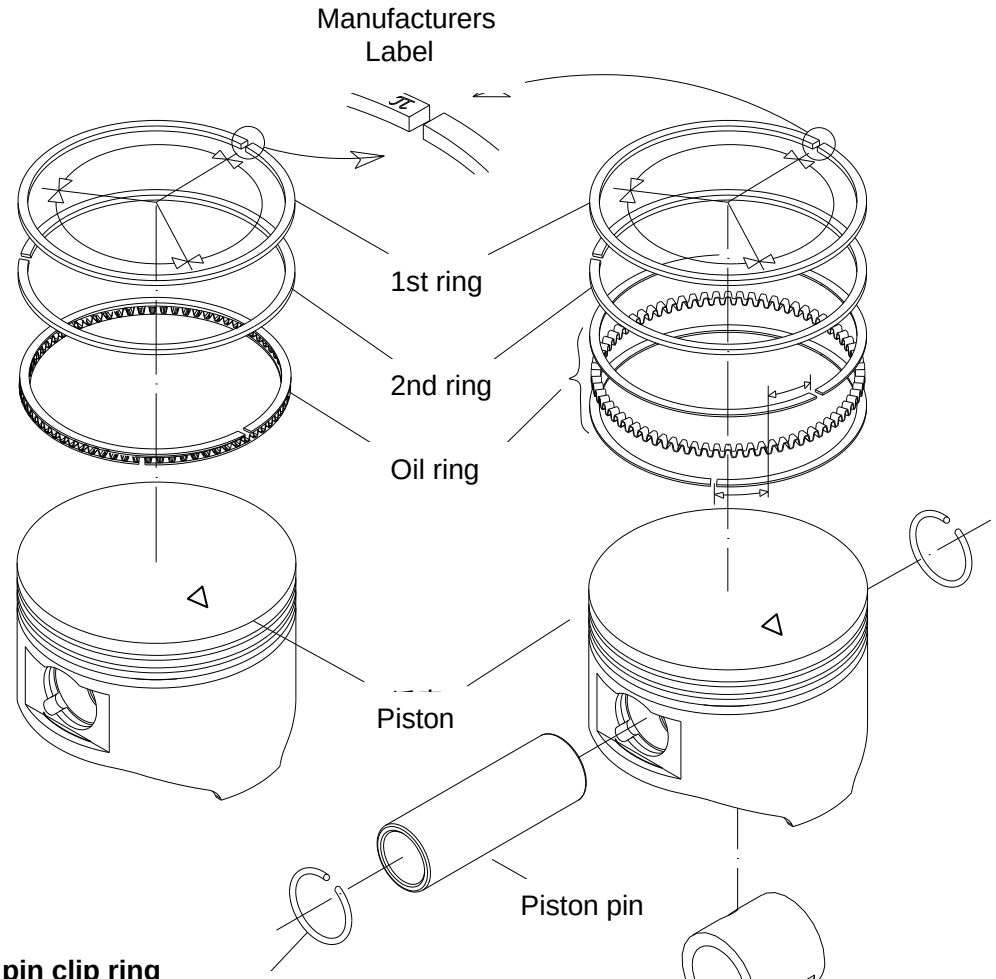


● Make sure the rings are installed with the manufacturer's label up.

● Make sure the 1st ring and 2nd ring are not interchanged.

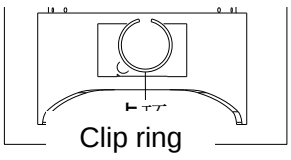
● Make sure the piston rings are free to move after installation.

● Stagger each piston ring gap 120° from each of the other rings.



Piston pin clip ring

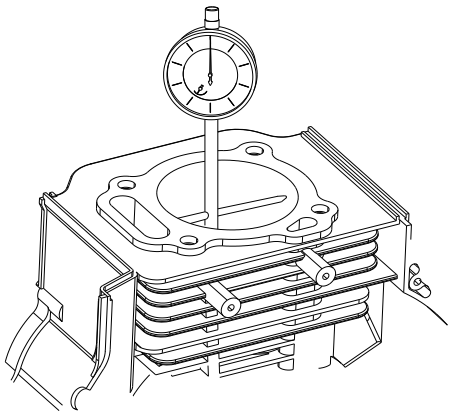
Installation: set the front end in the piston groove, and clamp the other end. Install the ring clip by revolving. Make sure that the gap of the ring clip is not in line with the groove in the piston pin hole.



Connection rod Installation: The larger side of the connection rod must be aligned with the △ label on the piston.

● **Cylinder inner diameter**

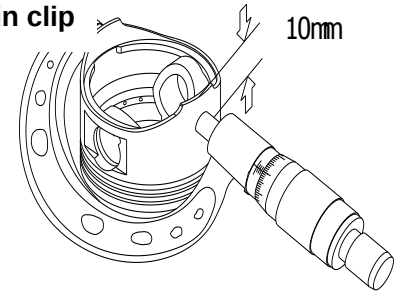
Standard	Service limit
52.4000-52.420mm (2.0630-2.0638”)	52.505mm (2.0671”)



● **Piston skirt outer diameter**

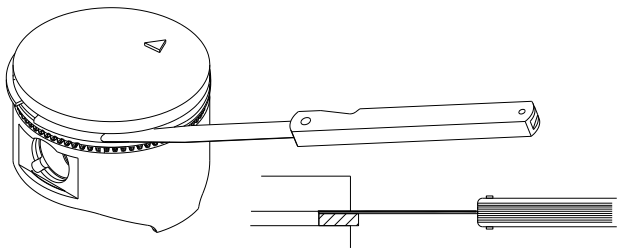
Standard	Service limit
52.360-52.380mm (2.061-2.062”)	52.25mm (2.057”)

Piston pin clip



● **Side clearance of piston ring**

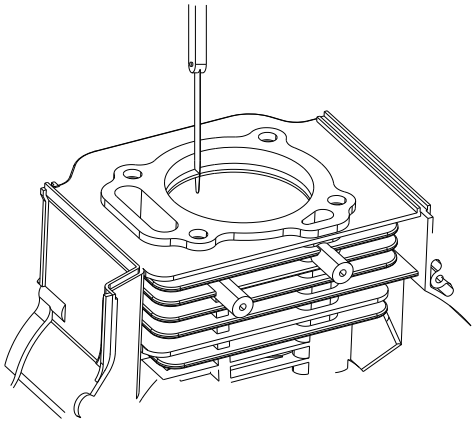
	Standard	Service limit
1st and 2nd Ring	0.02-0.06mm (0.0008-0.0024”)	0.15mm (0.0059”)
Oil Ring	0.03-0.18mm (0.001-0.007”)	0.24mm (0.009”)



● **Piston ring end clearance**

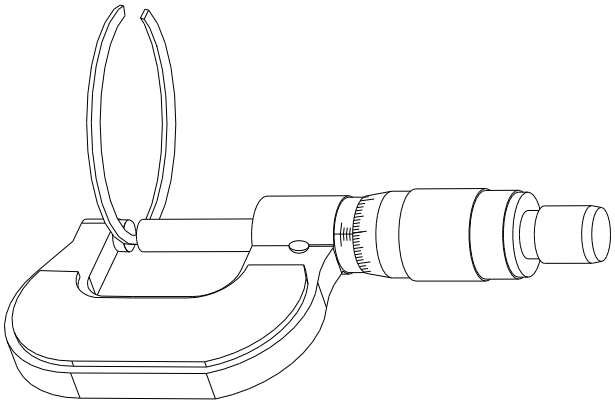
Locate the piston ring into cylinder with piston top, and measure the piston end clearance.

	Standard	Service limit
1st and 2nd Ring	0.15-0.25mm (0.0059-0.0098”)	1.0mm (0.039”)
Oil Rings	0.20-0.50mm (0.0078-0.0196”)	1.0mm (0.039”)



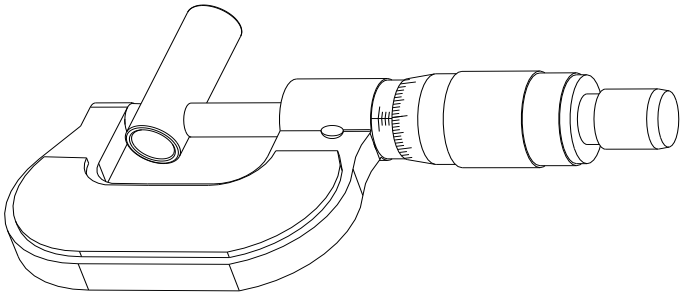
● **Piston ring height**

	Standard	Service limit
1st and 2nd Ring	0.97-0.99mm (0.0381-0.0389”)	0.87mm (0.0342”)
Oil Rings	1.85-1.96mm (0.0728-0.0771”)	1.75mm (0.0688”)



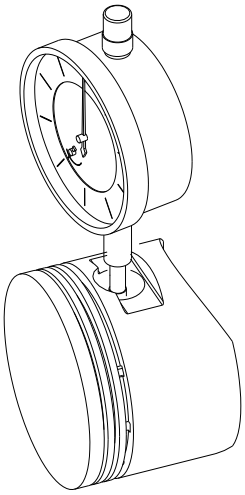
● **Piston pin outer diameter**

Standard	Service limit
14.994-15.008mm (0.5903-0.5905”)	14.95mm (0.5925”)



● **Piston pin hole inner diameter**

Standard	Service limit
15.002-15.008mm (0.5907-0.5908”)	15.05mm (0.5925”)



● **Connection rod small end inner diameter**

Standard	Service limit
15.006-15.017mm (0.590-0.5991”)	15.08mm (0.594”)