# *WORKSHOP MANUAL*

# *Engine: K 700 H – K 800 H (183 cc)*

Emak®

our **power**, your **passion**

# SAFETY PRECAUTIONS

**Thoroughly read this MANUAL before operating and servicing the generator set. Safe operation and top performance can only be attained when equipment is operated and maintained properly. The following symbols, found throughout this manual, alert you to potentially dangerous conditions to operators, service personnel and equipment.**

DANGER ***This symbol alerts you to an immediate hazard that will result in severe personal injury or death.***

WARNING ***This symbol alerts you to a hazard or unsafe practice that can result in severe personal injury or death.***

CAUTION ***This symbol alerts you to a hazard or unsafe practice that can result in personal injury or damage to property.***

Fuel, exhaust, and moving parts present hazards against which precautions must be taken to prevent severe personal injury or death.

## Be Careful when Fueling

- As gasoline is flammable, fueling the engine must be performed in a well-ventilated outdoor place after the engine is stopped.
- No smoking is allowed during fueling, keep flames and sparks away.
- Never start the engine before the place with spilled gasoline has not dried.

## Hot Exhaust

- Muffler temperature is very high during engine's running, and even remains hot after engine has been stopped for a while. Be careful not to touch a hot muffler. Stop the engine indoors, then cool the engine indoors, and start maintenance after cooling.
- In order to avoid fire, the engine shall be kept at least 1 m from any wall or any other equipment when it is working. Flammables shall all the more be kept far away from the engine.

## Carbon Monoxide

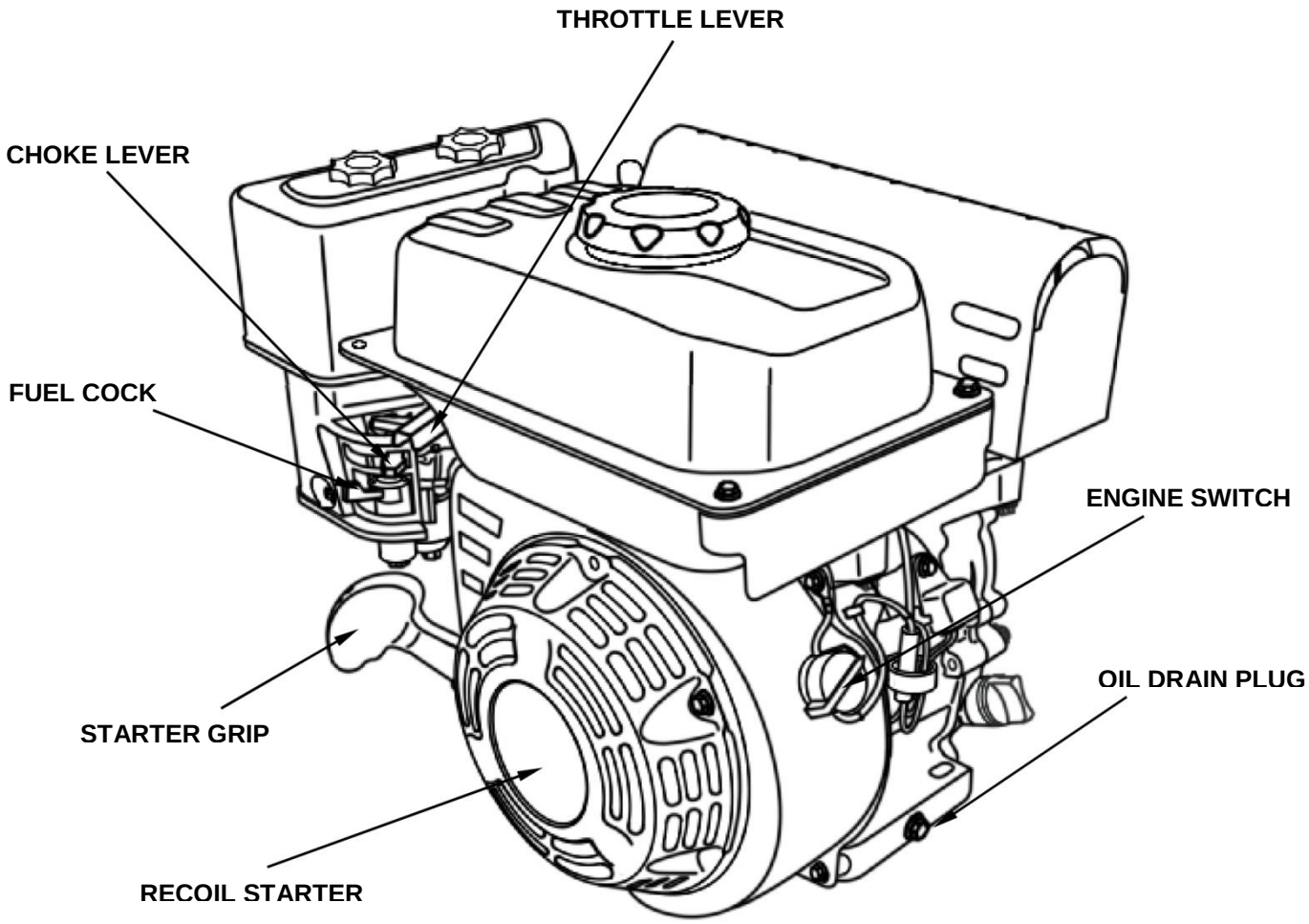
- The exhaust contains poisonous carbon monoxide. Avoid inhale the exhaust.
- Never run the engine indoors.
- Never run the engine in a closed garage or any other closed space.

## General Precautions

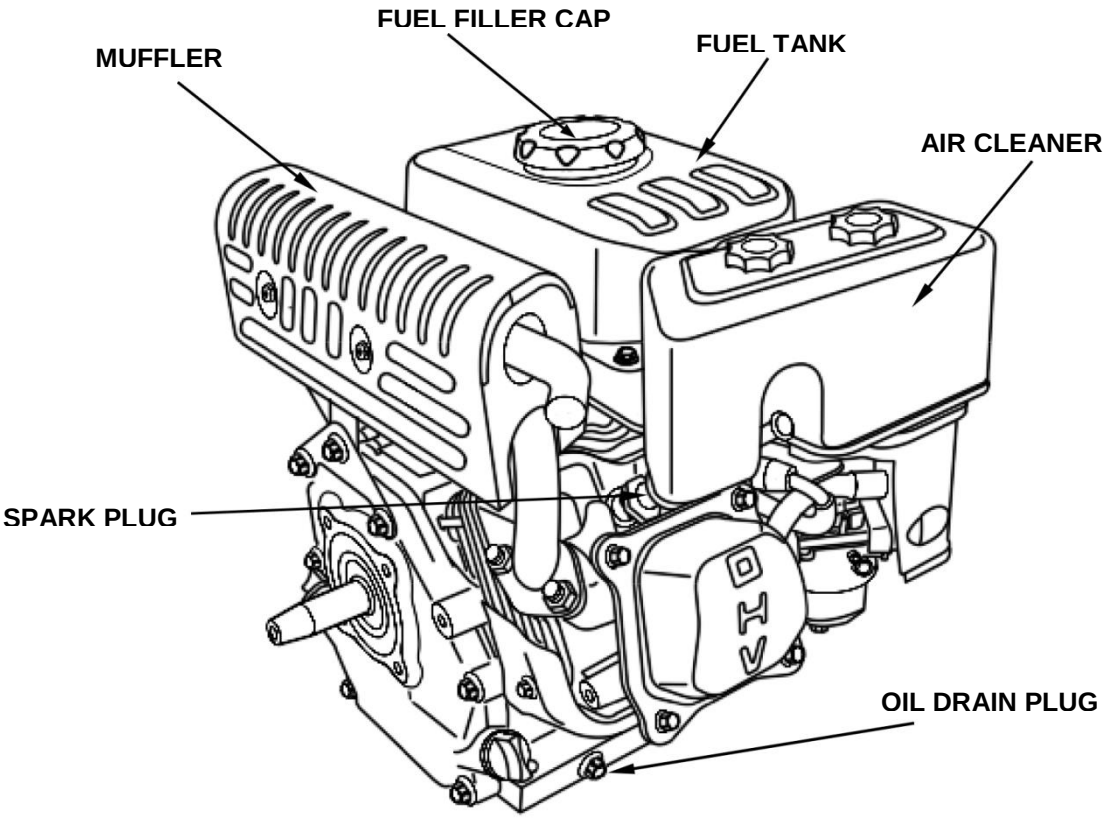
- Thoroughly read this MANUAL, get familiar with all the operating mechanisms and the correct methods for using and maintaining the engine, and master the operation method for stopping the engine and quickly declutching.
- Don't operate the engine when you are tired, sick or have drunk any alcoholic beverage, or you may be seriously injured.
- Children, persons who haven't read this Manual, or haven't be trained are prohibited from using the engine.
- Never repair the machine at will without mastering the method for repairing the engine.
- Don't modify the machine or change its structure at will; once the machine loses balance, it is very likely to cause damage or injury accidents.

# 1. Parameters

## 1.1 Engine Structure




***Fuel cock:*** a switch in the fuel line to control the fuel flow in the fuel line.
***Recoil starter:*** serves to start the engine
***Choke lever:*** closes the choke before engine's cold starting, and the carburetor will deliver a very rich mixture to let the engine be easily startable. When the engine has warmed up, the choke lever shall be fully opened.
***Engine switch:*** before starting the engine, the switch shall be put in the ON position; if you put the switch in the OFF position the engine will be shut down
***Throttle lever:*** serves to adjust the engine speed, so as to obtain the power and speed you want.

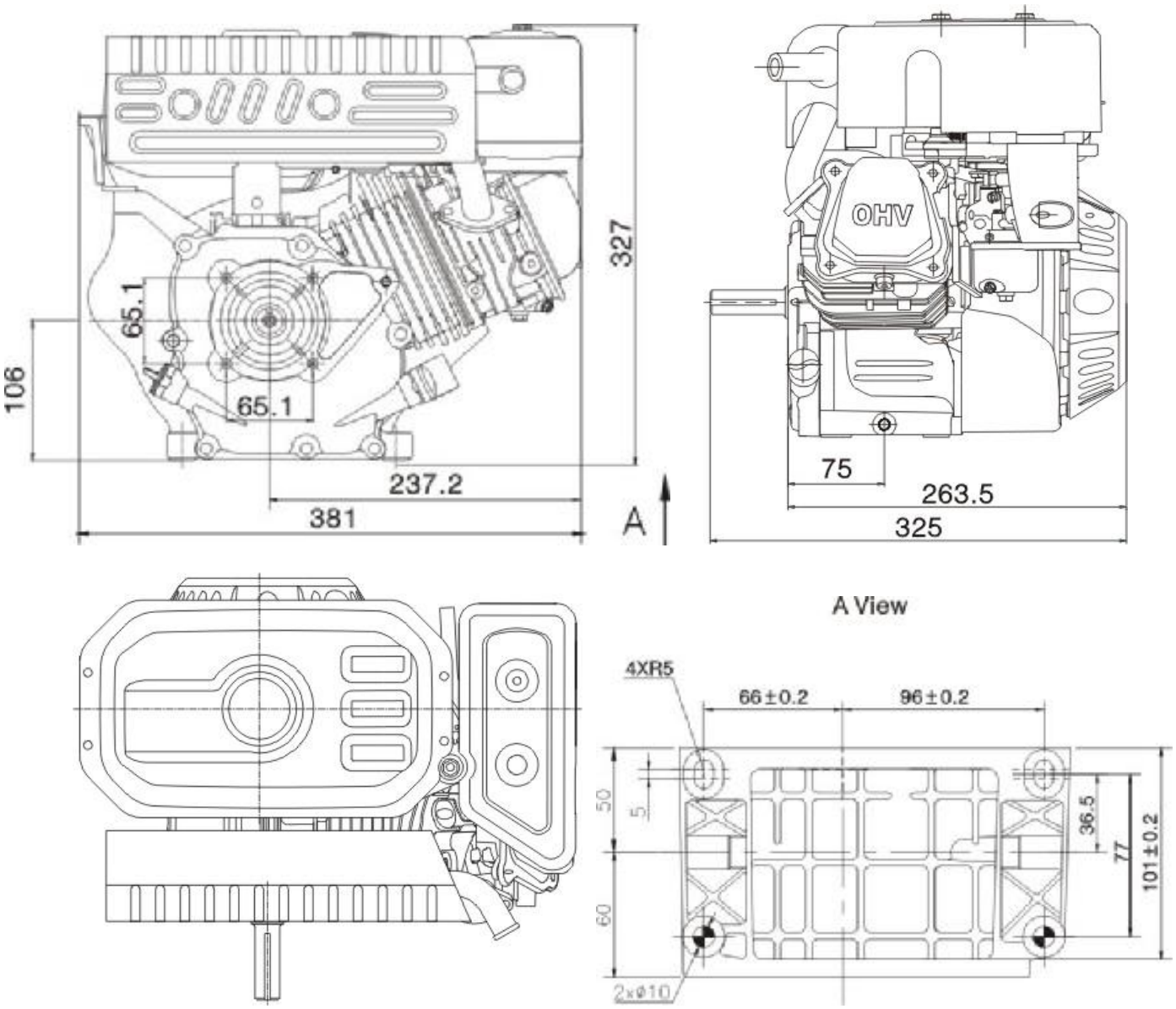



***Air cleaner:*** protects the engine through removing dust and other impurities in the air.
***Spark plug:*** delivers the high voltage of the ignition coil into the engine's combustion chamber, and produces sparks by electric discharge between electrodes, to ignite the fuel-air mixture.
***Muffler:*** prevents the engine noise from traveling, so as to lower noise of the exhaust system.
***Fuel tank cap:*** when loosened, fuel can be added into the fuel tank; when tightened, fuel can be sealed in the fuel tank.
***Fuel tank:*** stores the fuel and delivers fuel to the carburetor.
***Oil drain plug:*** when loosened, all engine oil in the engine can be drained off so that engine oil can be change.

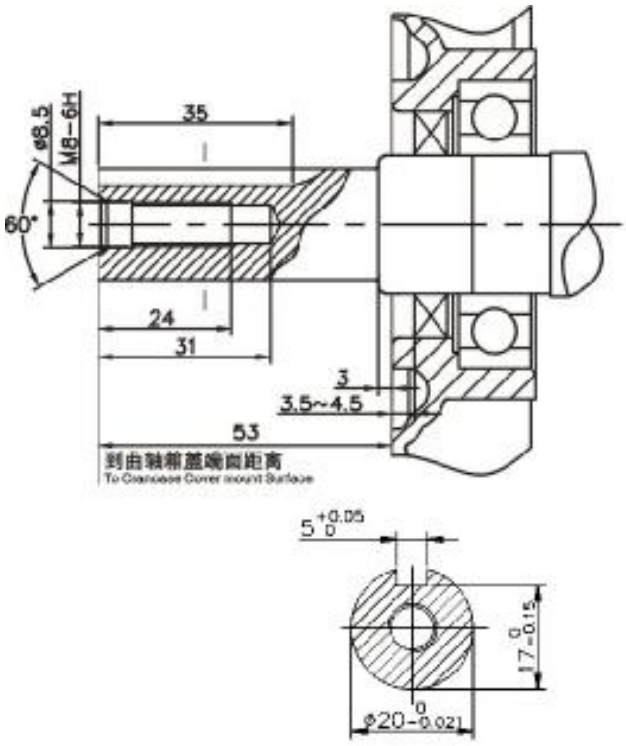
## 1.2 Product Technical Parameters

| Model | K700H – K800H |
|---|---|
| Type | Single cylinder, 4-Stroke, Forced Air Cooling, OHV 25° |
| Displacement (cc) | 183 cc |
| Cylinder bore × Stroke (mm) | 65×55 |
| Net power (KW / 3600 rpm) | 4 |
| Net torque (Nm / rpm) | 10.8 / 2500 |
| Idle speed (rpm) | 1800 ±150 |
| Compression ratio | 8.5 : 1 |
| Output rotation | Counter clockwise close (from P.T.O. side) |
| Noise (≤ 7m) | ≤ 70 dB(A) |
| Igniting mode | Transistorized magneto Ignition |
| Starting mode | Recoil / Electric |
| Carburetor | Butterfly |
| Lubrication system | Splash lubrication |
| Governor system | Centrifugal mass type |
| Air cleaner | Semi-dry, dual element |
| Oil capacity | 0.6 L |
| Fuel tank capacity | 3.0 L |
| Net weight (kg) | 16/18 |
| Dimensions (L×W×H) (mm) | 381 × 325 × 327 |

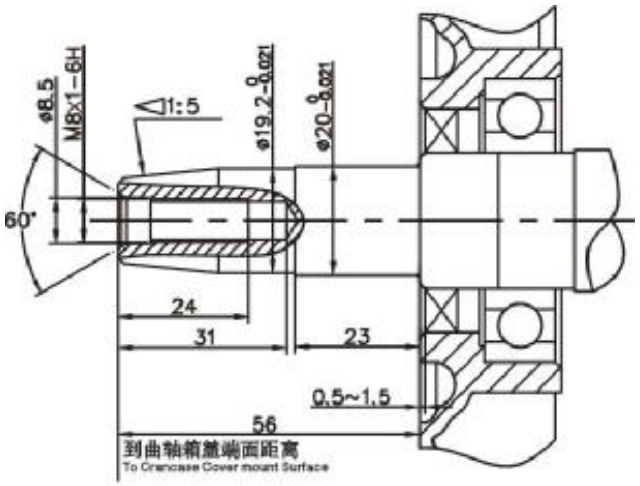
## 1.3 Drawings of Mounting Dimensions



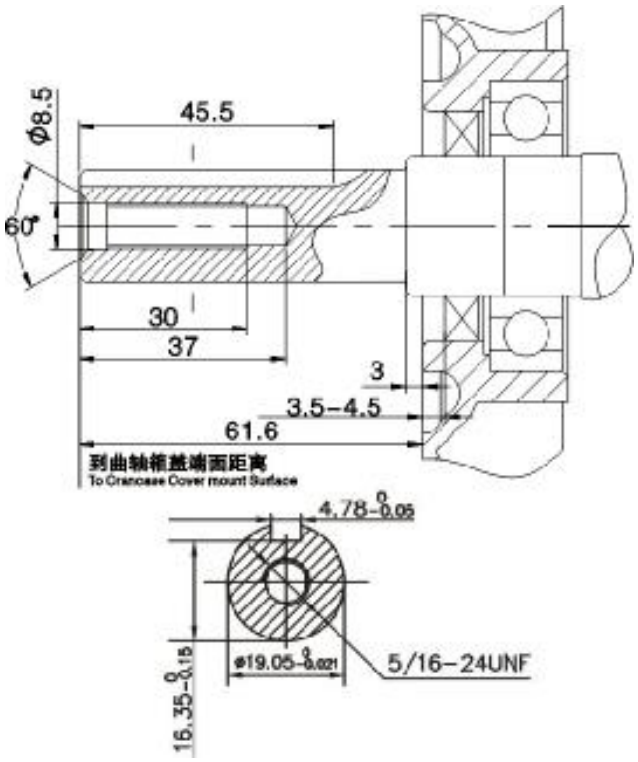
## 1.4 Drawings of PTO Dimensions



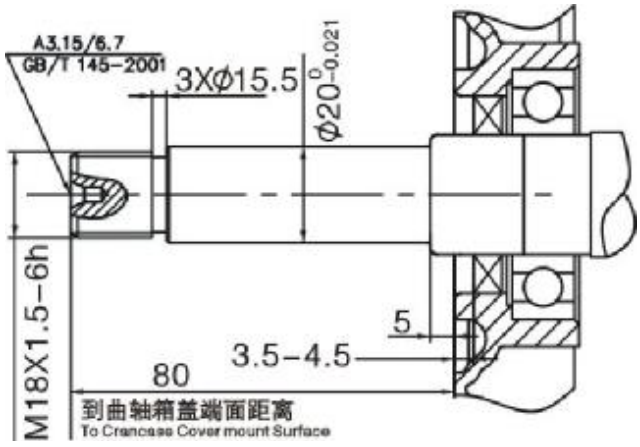

Type A



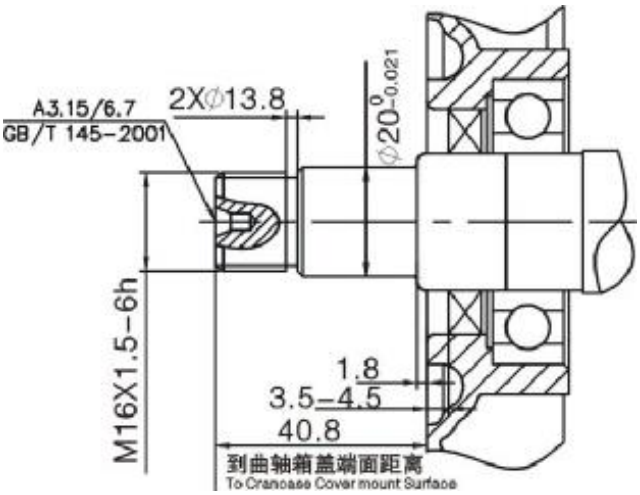

Type C



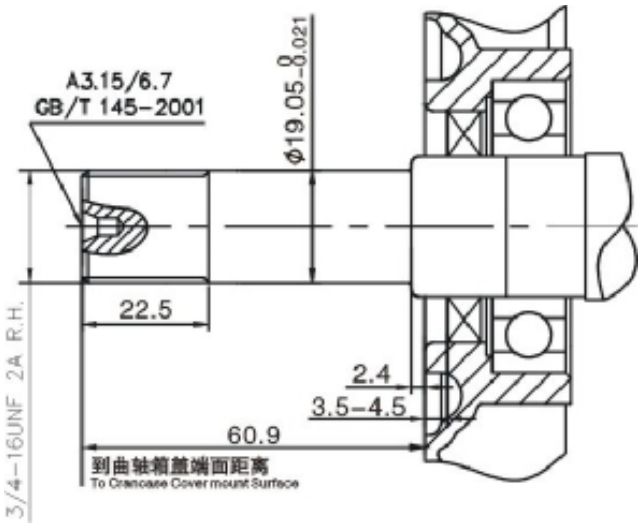

Type R



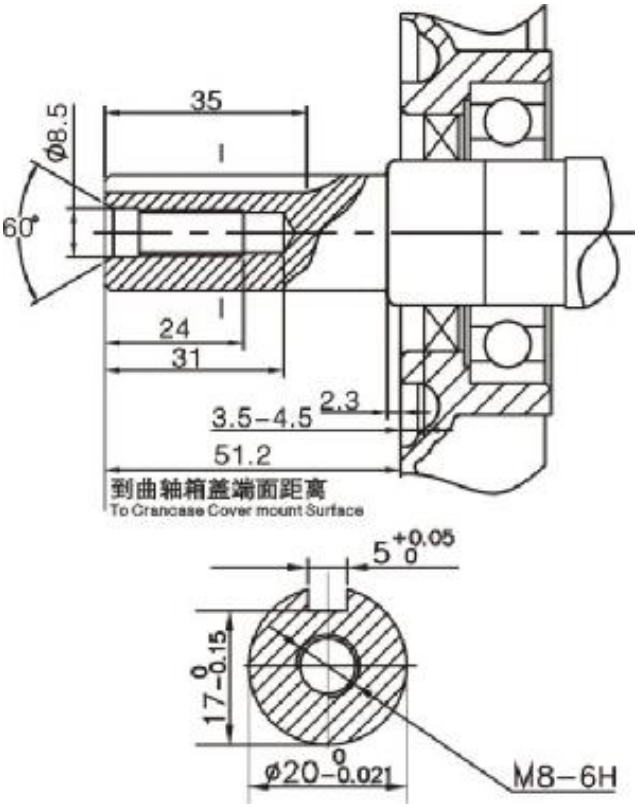

Type D



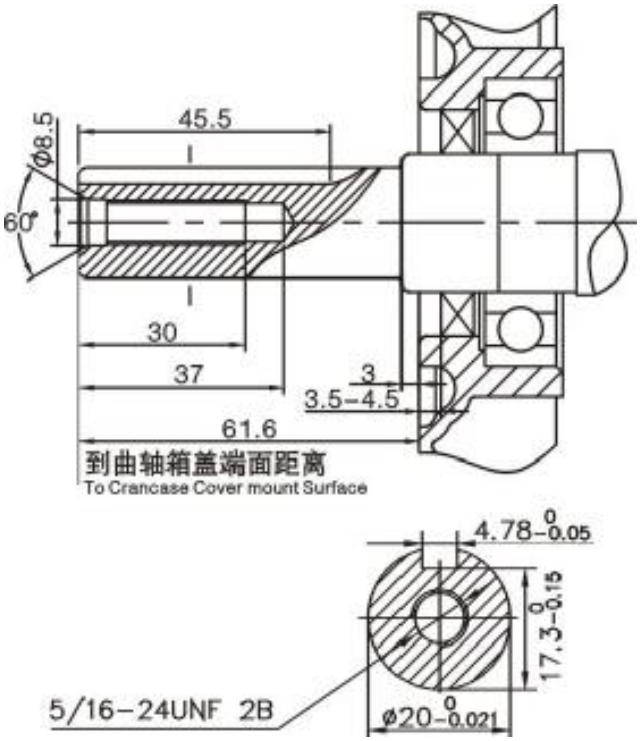

Type E




Type S




Type U



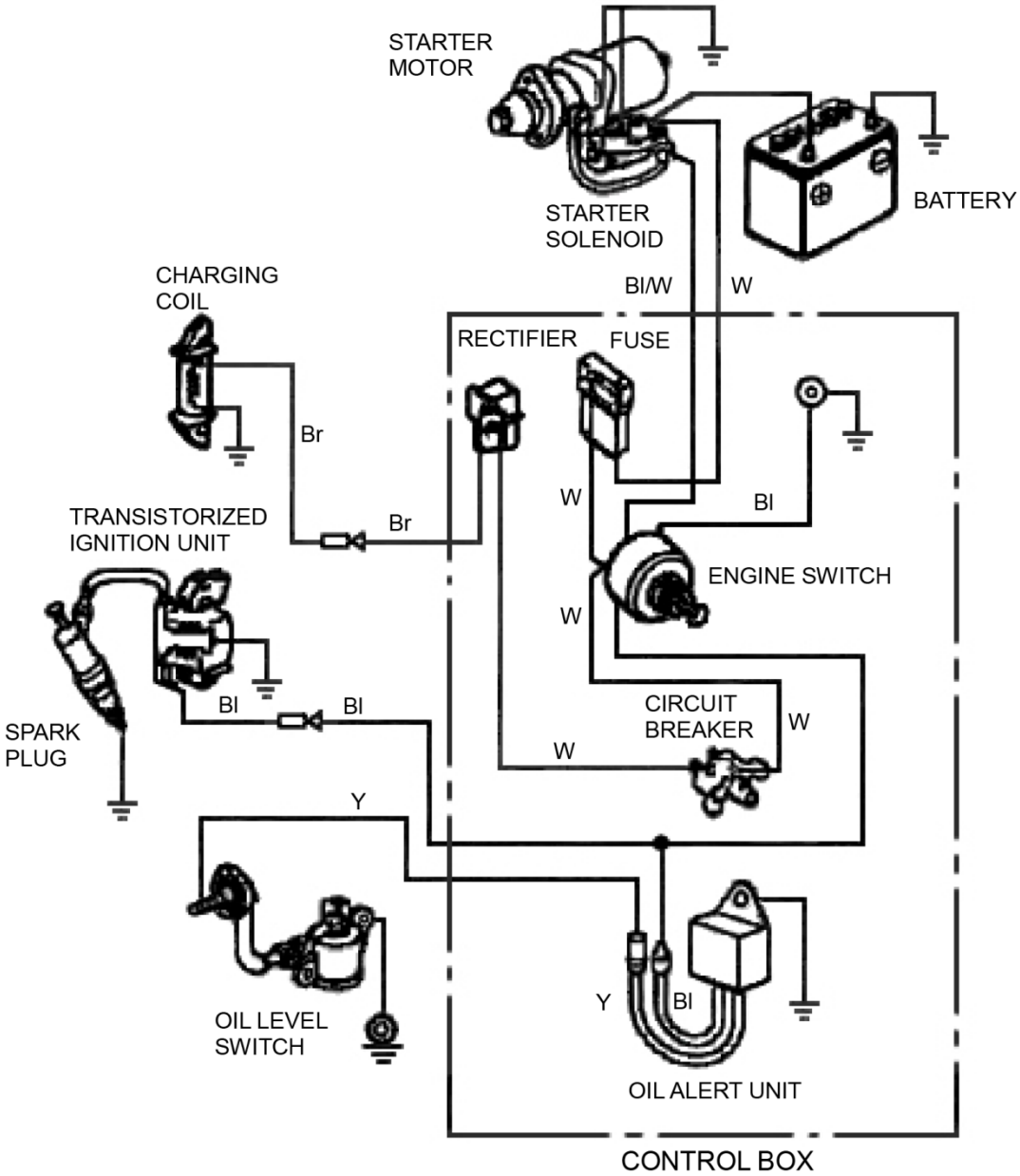

Type A22

## 1.5 Diagram of Electrical Wiring

ENGINE SWITCH

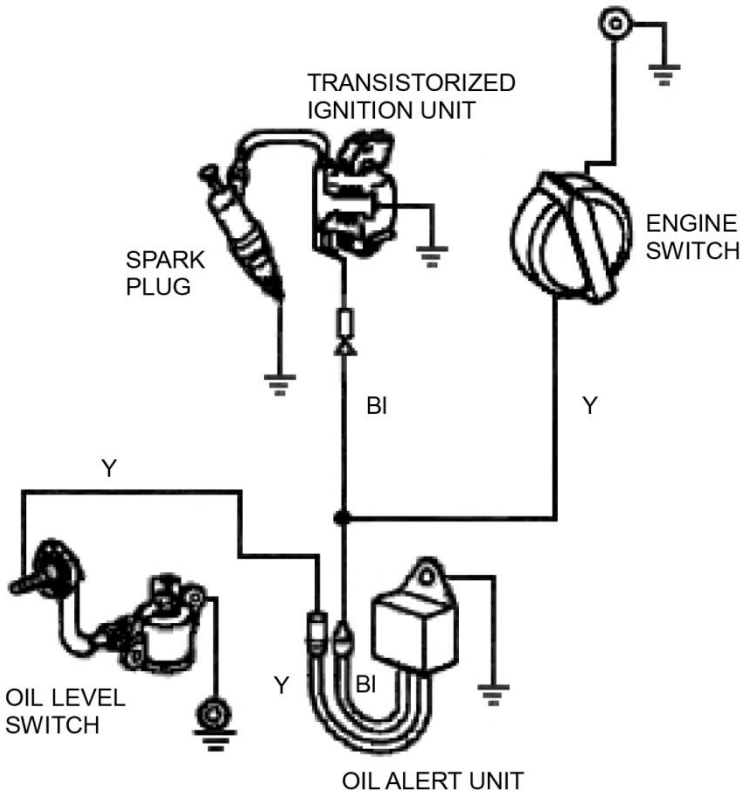
| | IG | E | ST | BAT |
|---|---|---|---|---|
| OFF | O | O | | |
| ON | | | | |
| START | | | O | O |

| | | | |
|---|---|---|---|
| Bl | BLACK | Br | BROWN |
| Y | YELLOW | R | RED |
| W | WHITE | G | GREEN |



## Engine Type with Oil Alert and Without Electric Starting

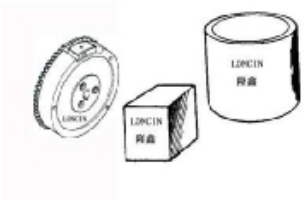
| | |
|---|---|
| Bl | BLACK |
| Y | YELLOW |
| G | GREEN |



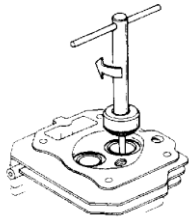
# 2. Service information

## 2.1 Precautions for Maintenance

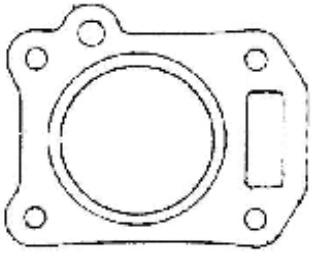
1. Parts, oil and grease must be genuine Efco and Oleo-mac products or products designated by Efco and Oleo-mac. Parts not meeting Efco and Oleo-mac's design specifications may damage the device or engine.



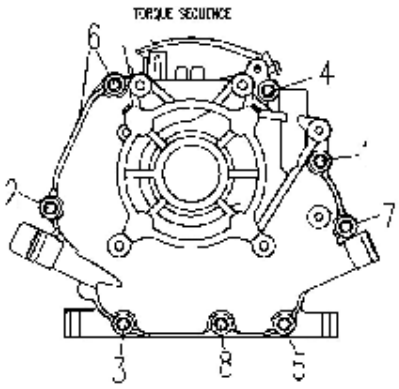
2. Work to be done with special tools must be done with such tools and corresponding devices.



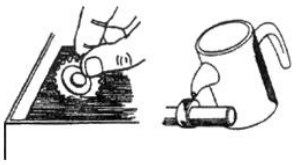
3. Gaskets, washers, O-rings and oil seals must be replaced after disassembly.



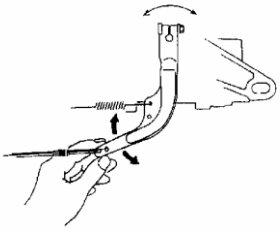
4. When screwing bolts, nuts or screws, tighten from the ones of larger diameters and on inner side to the ones of smaller diameters and on the outer side, and tighten in a crisscross pattern to the specified torque diagonally.



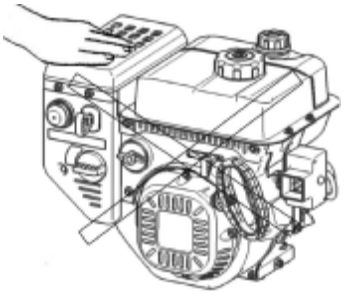

5. Clean parts in cleaning solvent upon disassembly. Lubricate any sliding surfaces before reassembly.



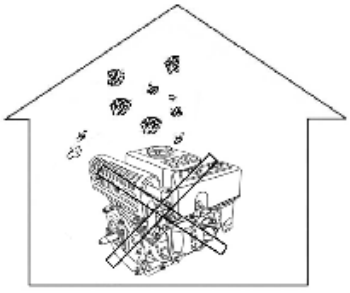
6. After reassembly, check all parts for proper installation and operation.



7. Don't maintain unless the engine is stopped and has cooled, otherwise, bun can happen when engine is hot.



8. If you want to perform a test run of the engine in the work area after maintenance, take care to ensure adequate ventilation in the area, and never smoke or light a fire near fuel, grease or other inflammable materials.



Follow the instructions represented by these symbols when maintaining:


: Used oil


: Used special tool

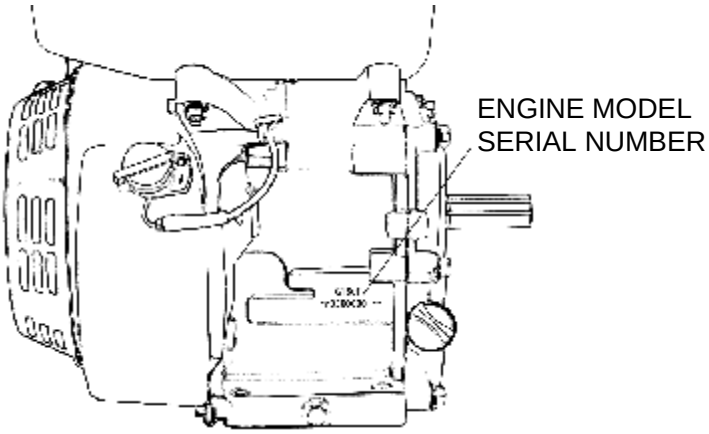

: Used grease

○×○ (○)：Indicates flange bolt model, length and quantity.

P. ：Indicates pages

## 2.2 Serial number location

The serial number is stamped on the crankcase, as shown on the following drawing when inquiring about engine or ordering parts in order to get correct parts for the unit being serviced by Efco or Oleo-Mac.



## 2.3 Maintenance standards

| Part | Item | Standard | Service limit |
|---|---|---|---|
| | | K700H – K800H | K700H – K800H |
| Engine | Compression pressure (kg/cm$^2$) * | 6.5 ~ 8.5 | — |
| Cylinder | Cylinder bore | 65 | 65.165 |
| Piston | Skirt outside diameter | 64.985 | 64.845 |
| | Piston-to-cylinder clearance | 0.015 ~ 0.005 | 0.12 |
| | Piston pin bore inside diameter | 17.002 ~ 17.008 | 17.12 |
| | Piston pin – to – piston pin bore clearance | 0.002 ~ 0.014 | 0.06 |
| Piston pin | Outside diameter | 13.0 | 12.954 |
| Piston ring | Side clearance (top/second) | 0.015 ~ 0.045 | 0.15 |
| | End gap (top/second) | 0.20 ~ 0.40 | 1.0 |
| | Width (top) | 0.15 ~ 0.35 | 1.0 |
| | Width (second) | 1.5 | 1.37 |
| | Width (oil ring) | 2.5 | 2.37 |
| Connecting rod | Small end inside diameter | 13.005 | 13.07 |
| | Big end inside diameter | 30.22 | 30.246 |
| | Big end oil diameter | 0.04 ~ 0.063 | 0.12 |
| | Big end side clearance | 0.1 ~ 0.7 | 1.1 |
| Crankshaft | Crack pin outside diameter | 30.16 | 30.1 |
| Valve | Clearance(cold) (intake) | 0.15 + 0.02 | — |
| | Clearance(cold) (exhaust) | 0.20 + 0.02 | — |
| | Stem diameter (intake) | 5.48 | 5.318 |
| | Stem diameter (exhaust) | 5.44 | 5.275 |
| Valve guide | Inside diameter (intake, exhaust) | 5.50 | 5.572 |
| | Stem to guide clearance (intake) | 0.02 ~ 0.044 | 0.10 |
| | Stem to guide clearance (exhaust) | 0.06 ~ 0.087 | 0.12 |
| Valve seat | Seat width | 0.8 | 2.0 |
| Valve spring | Free length | 30.5 | 29.5 |
| Cam shaft | Height (intake) | 27.7 | 27.45 |
| | Height (exhaust) | 27.75 | 27.50 |
| | Outside diameter (bearing) | 13.984 | 13.916 |
| Crankcase cover | Camshaft holder internal diameter | 14.0 | 14.048 |
| Spark plug | Gap | 0.7 ~ 0.8 | — |
| Igniter coils | Resistance (primary) | 0.8 ~ 1.0 Ω | — |
| | Resistance (secondary) | 5.9 ~ 7.1 Ω | — |
| | Gap to flywheel | 0.4 ± 0.2 mm | — |

Unspecified unit: mm
* Value at the speed 1400 rpm of the engine.

## 2.4 Fastener Torque Specification

### (1) Torque specification

| Item | Thread specification | Torque range (Nm) |
|---|---|---|
| Connecting rod bolt | M7x1 | 13 ~ 15 |
| Cylinder head bolt | M8×1.25 | 32 ~ 35 |
| Flywheel mounting nut | M14×1.5 | 80 ~ 90 |
| Crankcase cover bolt | M8×1.25 | 27 ~ 30 |
| Oil drain bolt (in crankcase) | M10×1.25 | 20 ~ 25 |
| Air cleaner mounting nut | M6×1 | 8 ~ 12 |
| Pivot adjusting nut | M6×0.75 | 12 ~ 16 |
| Pivot bolt | M8×1.25 | 28 ~ 32 |
| Governor arm nut | M6×1.0 | 9 ~ 13 |
| Starter motor fastening bolt | M6×1.25 | 8 ~ 12 |
| Spark plug | | 27 ~ 30 |

### (2) Standard Torques specification

| Faster | Thread specification | Torque range (Nm) |
|---|---|---|
| Bolt, nut | 5 mm bolt, nut | 4 ~ 7 |
| | 6 mm bolt, nut | 8 ~ 12 |
| | 8 mm bolt, nut | 20 ~ 28 |
| | 10 mm bolt, nut | 35 ~ 40 |
| | 12 mm bolt, nut | 50 ~ 60 |

# 3. Maintenance

## 3.1 Maintenance schedule

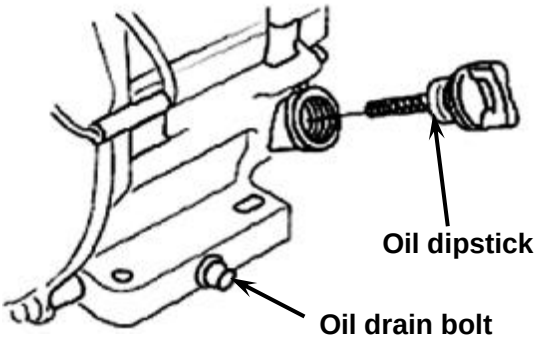
| Maintenance schedule | | Each use | First month or 20 hours | Every 3 months or 50 hours | Every 6 months or 100 hours | Every year or 300 hours |
|---|---|---|---|---|---|---|
| Engine oil | Check level | ● | | | | |
| | Replace | | ● | | ● | |
| Air filter | Check | ● | | | | |
| | Clean | | | ● (1) | | |
| | Replace | | | | | ● |
| Fuel strainer cup | Clean | | | | ● | |
| Battery electrolyte level | Check | ● | | | | |
| Spark plug | Clean | | | | ● | Replace |
| Valve clearance | Readjust | | | | | ● (2) |
| Combustion chamber | Clean | Every 300 hours (2) | | | | |
| Fuel tank and strainer | Clean | Every 2 years (2) | | | | |
| Fuel tube | Replace | Every 2 years (2) | | | | |

(1) Replace paper element only.
(2) Service more frequently when used in a dust area.

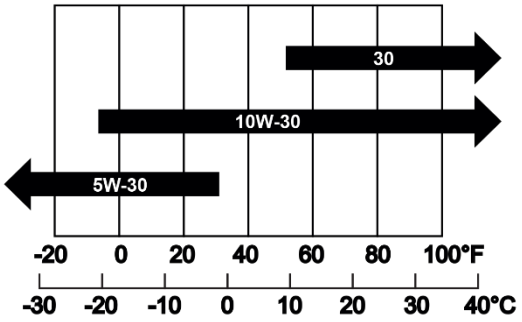
## 3.2 Engine oil

### Note

***Drain the oil while the engine is stopped yet warm to ensure rapid and complete draining.***



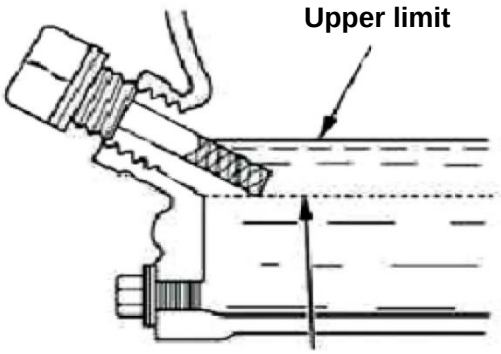

- Oil is the major factor affecting performance and service life. Don't use oil containing additives and 2-stroke engine oil, because they lack sufficient lubricating ability and will shorten the gasoline engine's service life.
- Check the oil level with the engine stopped and on a flat level surface.
- **Oil capacity**: 0.60 L




In order to obtain the best performance of the engine, it is recommended to use special engine oil certified to be OK for Emak engines. SAE 10W-30 is the recommended oil. Other viscosities shown in the chart may be used when the average temperature in your area is within the recommended range.

### Oil level check:

1) Remove the oil cap/dipstick and wipe it clean.
2) Insert the oil dipstick into oil filler neck but do not screw it in, and check oil level.
3) Oil level is too low if there is no oil on the dipstick. Add recommended oil to bring the oil level to the upper limit of the dipstick.
4) Reinstall the cap/ dipstick securely.




### Warning

- ***Used engine oil contains carcinogenic substances. If repeatedly left in contact with the skin for prolonged periods, it may cause skin cancer. Wash your hands thoroughly with soap and water as soon as possible after contact with used engine oil.***
- ***Please dispose of used motor oil and the oil containers in a manner that is friendly to the environment. We suggest you put it in a sealed container and take it to your local recycling center or service station for reclamation. Do not throw it in the trash, or pour it on the ground.***

## 3.3 Air cleaner

**A dirty air filter will restrict fair 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**

**Warning**

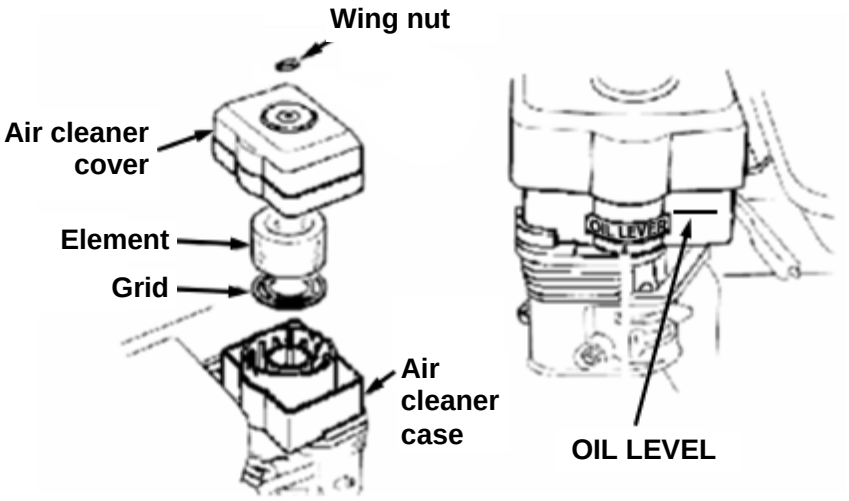
***Washing filter element with gasoline or flammable solvents many cause fire or explosion, please use soapy water or nonflammable solvent.***

**Note**

***Operating the engine without an air filter element or with a damaged air filter will allow dirt to enter the engine, causing rapid engine wear.***

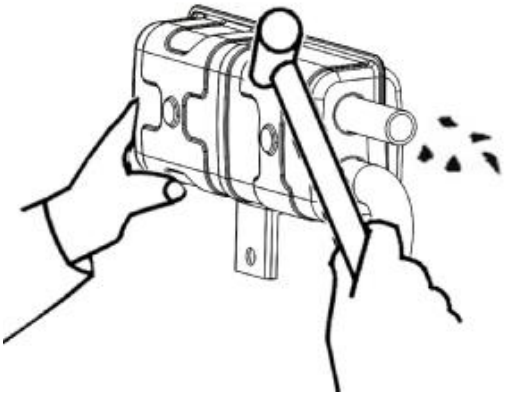
**Oil batch air cleaner**

1) Remove wing nut, air cleaner cover and cap, and take out element.
2) Wash the element in a solution of household detergent and warm water, then rinse thoroughly, or wash in non-flammable or high flash point solvent. Allow the element to dry thoroughly. Soak the air filter element in clean engine oil and squeeze out the excess oil.
3) Rinse air cleaner cover and cap in warm water with detergent and allow them to dry thoroughly.
4) Empty the used oil from the air cleaner case and wash out any accumulated dirt with non-flammable solvent, and dry the case.



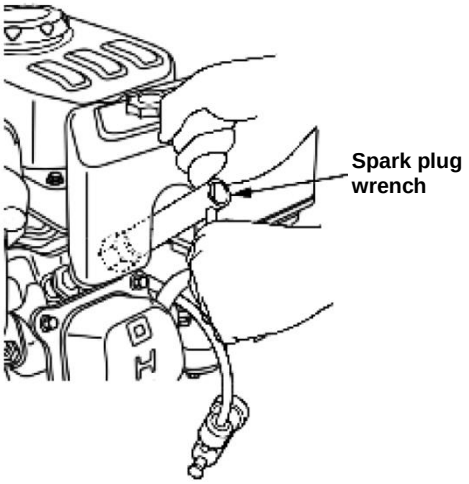

5) Fill the air cleaner case to the OIL LEVEL mark with the same oil that is recommended for the engine. **Oil capacity:** 60 cc.
6) Reinstall the air cleaner parts and tighten the wing nut securely.

### 3.4 Muffler



Long use of the muffler can cause carbon deposit, which will severely affect the exhaust system; in order to let exhaust system work more reliably, we normally need to remove the carbon deposit from the muffler.
Use a hand hammer to gently knock the muffler, and blow it with compressed air to remove the carbon deposit inside it.
If the muffler has water drops in it, and severe erosion, which cause higher exhaust noise, replace it with a new one.
Never use wires to clean, or the acoustic absorbent will be scraped off, and acoustic absorbing performance will be worse.
Never reuse the muffler gasket.

### 3.5 Spark plug

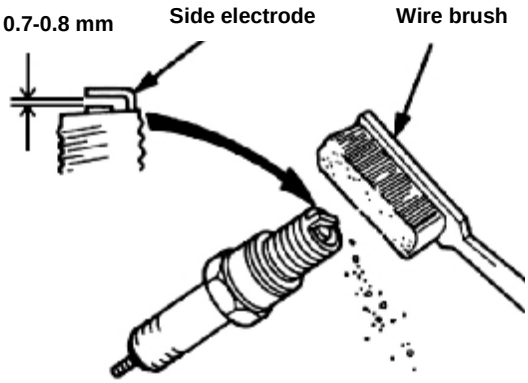



**Recommended type:** F7RTC or a spark plug of an equivalent grade. Replacing the spark plug has the following positive effect: ensuring continuous production of sparks, more reliable starting.

**Caution**

***Spark plugs of a wrong model or incorrect heat range can cause engine damage.***

1. Remove the spark plug cap, and remove the dirt from around the spark plug.
2. Remove the spark plug with a spark plug wrench.
3. Inspect the spark plug for excessively worn electrodes, chips or cracks in the insulator, or excessive deposits. Replace the spark plug if you have any doubts about its condition.
4. Measure the electrode gap with a gap gauge; the correct gap is 0.7 ~ 0.8 mm; if the gap need be adjusted, slightly knock (when the gap is to big), or slightly pry the electrode with a slot type screwdriver (when the gap is too small).
5. Use a spark plug wrench to tighten the spark plug enough to let it press on the washer. If reinstalling a used spark plug, tighten 1/8 to 1/4 of a turn after the spark plug presses on the washer. If installing a new spark plug, tighten 1/2 turn after the spark plug presses on the washer.

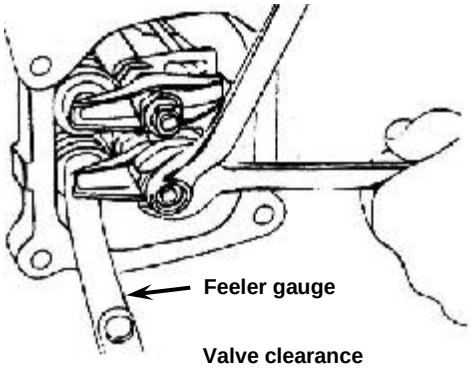



**Caution**

***A loosely installed spark plug can become hot enough to damage the engine. Over tightening a spark plug can damage the threads in the engine.***

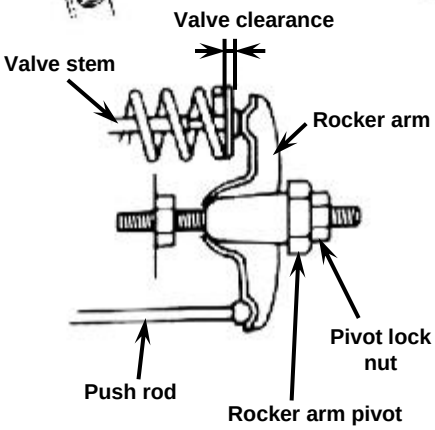
6. Install the spark plug cap on the spark plug.

### 3.6 Valve clearance




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

1. Remove the cylinder head cover, and set the piston at top dead centre of the compression stroke (both valves will be fully closed).
2. Measure the clearance between the rocker arm and the valve stem with a feeler gauge.
   **Intake:** 0.15 ± 0.02 mm
   **Exhaust:** 0.20 ± 0.02 mm
3. To adjust valve clearance, hold the rocker arm pivot and loosen the pivot lock nut.
4. Turn the rocker arm pivot to obtain the specified clearance.
5. Hold the rocker arm pivot and tighten the pivot lock nut.
6. Recheck the clearance and readjust if necessary.
7. Install the cylinder head cover.

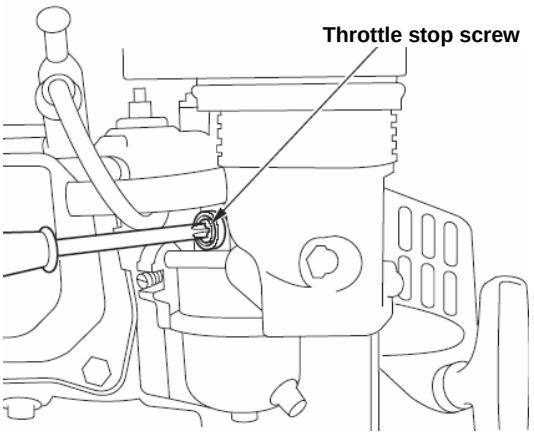



### 3.7 Carburetor

**Idle speed**

1) Start the engine and allow it to warm up for about 10 minutes.
2) Set the throttle lever in the position for lowest speed.
3) Use tools to adjust the throttle stop screw, to bring the idle speed within the range of standard idle speed.

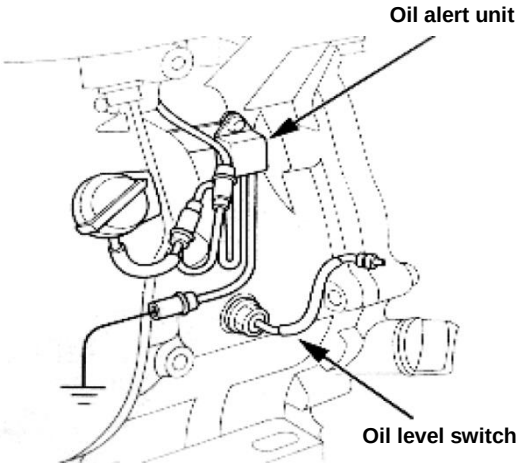
**Standard idle speed**: 1800 ± 150 rpm.




### 3.8 Oil alert system inspection

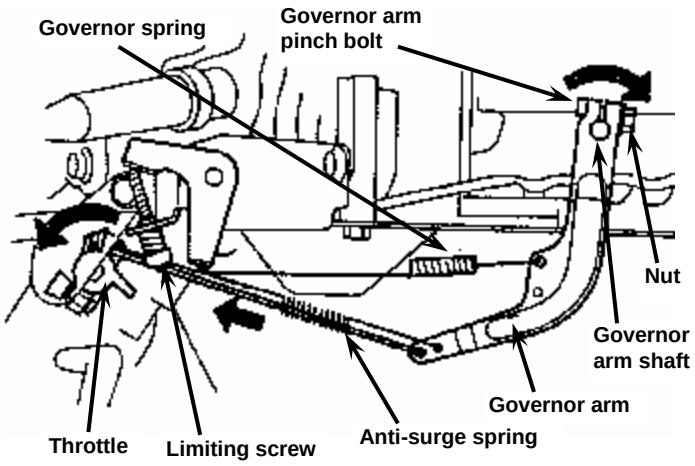
Oil alert system is specially designed to protect engine from damage by insufficient oil in the crankcase. Before the oil level in the crankcase can fall below a safe limit, the oil alert system will automatically shut down the engine (the engine switch will remain in the ON position). The oil alert system shuts down the engine and the engine will not start. If this occurs, first check engine oil level, then check for other faults.

1) With the engine running, disconnect the engine switch's yellow lead and ground it to the engine, the engine should stop.
2) With the engine stopped, engine oil level within the specified range and two leads of oil level switch not disconnected, there should be continuity between the two leads.
3) Then check with engine oil drained off. There should be continuity between leads of oil level switch.



## 3.9 Governor

1) Take down the fuel tank.
2) Loosen the nut on the governor arm pinch bolt.
3) Move the arm until the throttle is completely open, and hold it in that position.
4) Rotate the governor arm shaft as far as it will go in same direction it was just moved by the governor arm, and then tighten the governor arm pinch bolt.
5) Whether check the arm and throttle move smoothing.
6) Install the fuel tank.
7) Start the engine and adjust the limiting screw to produce the standard until the engine warm up to normal operating temperature.

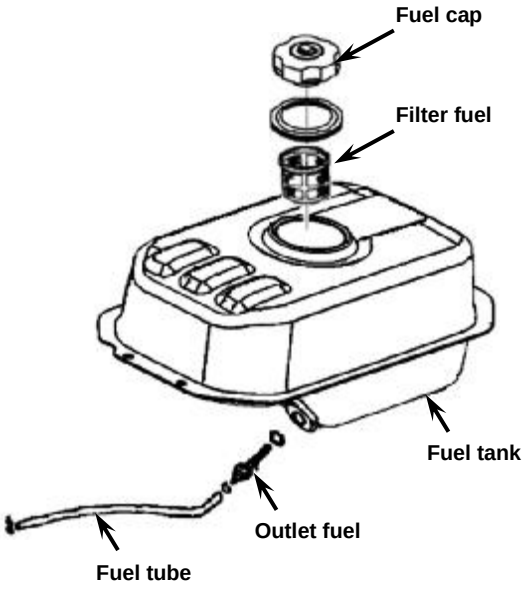



## 3.10 Fuel filter

**Warning**

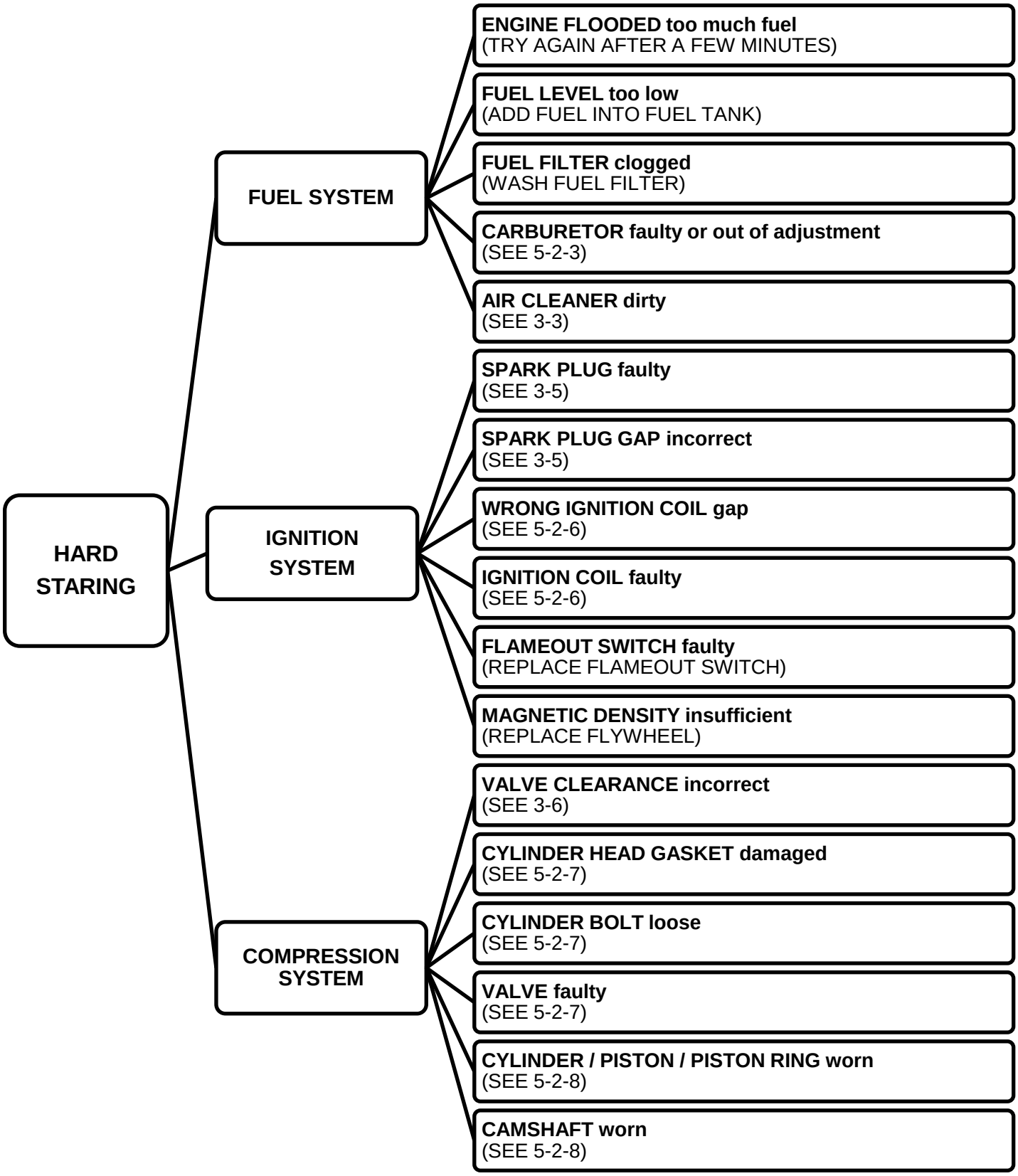
***Gasoline is extremely flammable and explosive. Don't smoke and fire on the working site. Don't allow the gasoline overflowing.***

1) Drain the fuel in the fuel tank thoroughly out and remove the fuel tank.
2) Remove the fuel tube, and remove filter from the fuel tank.
3) Wash the filter with solvent and check strainer if there is damaged, put the O-ring on the filter, reassemble the filter and tighten to specified: 2 Nm.
4) After that, check if there is leaking.

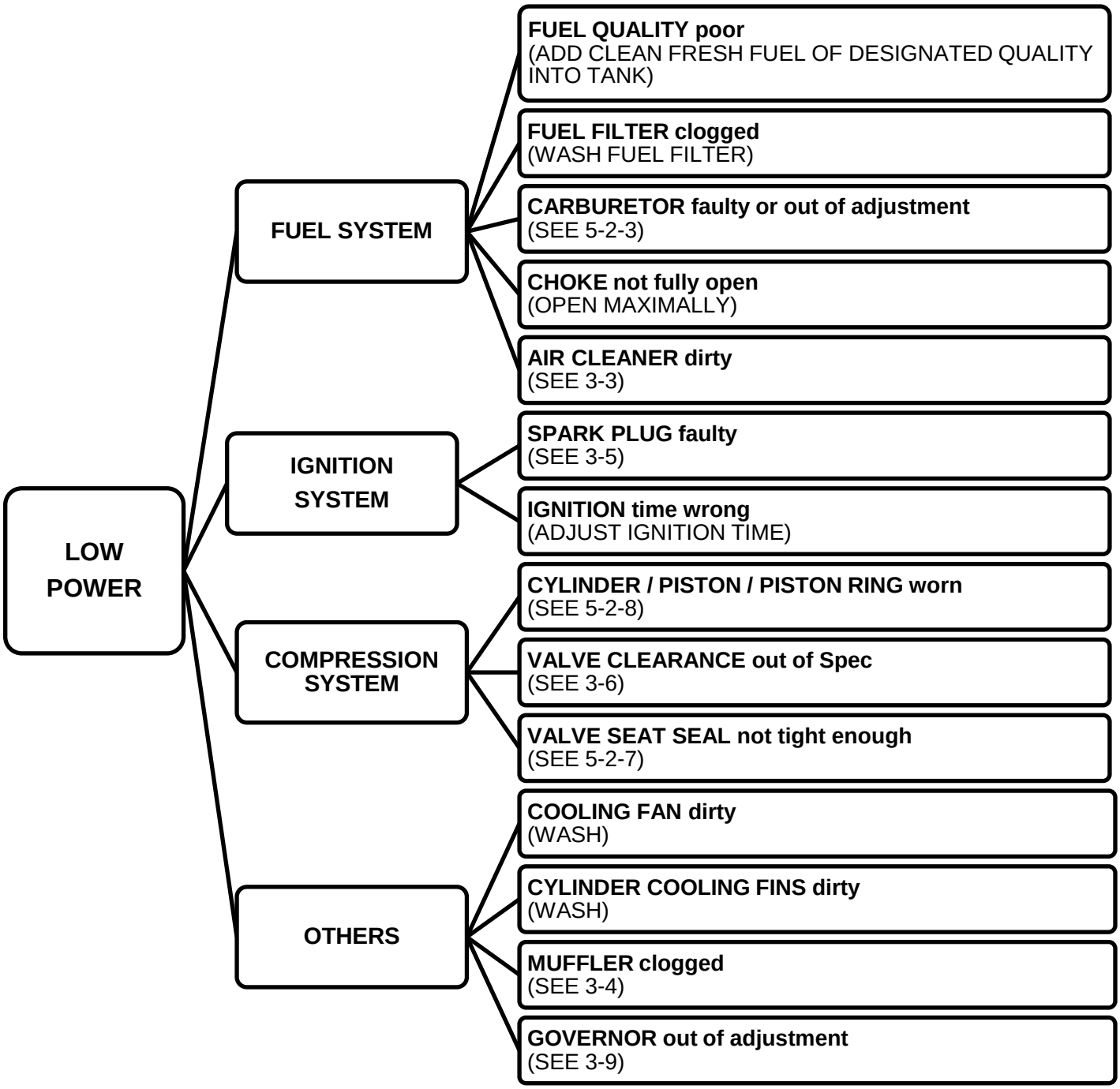


# 4. Troubleshooting

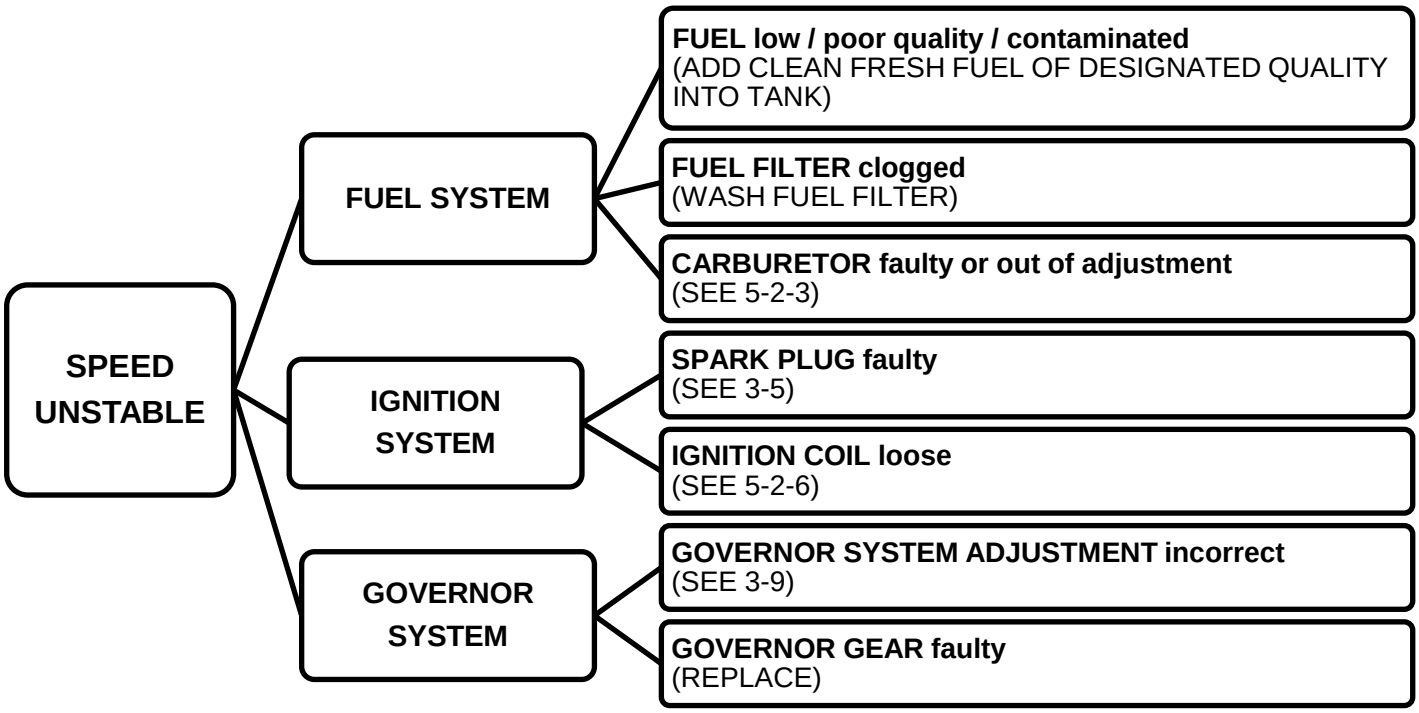
## 4.1 Hard Starting



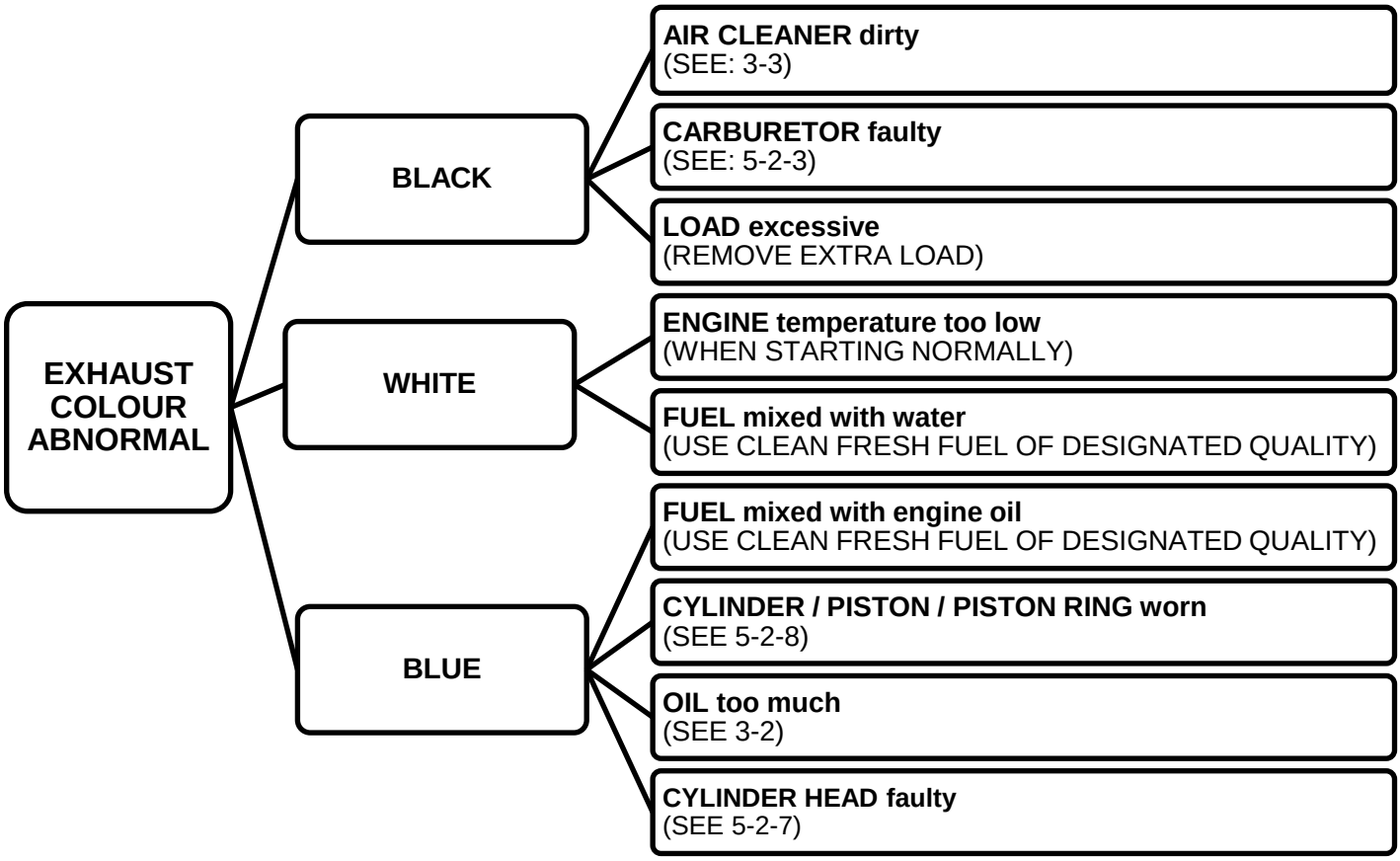
## 4.2 Low Power


LOW POWER
FUEL SYSTEM
FUEL QUALITY poor
(ADD CLEAN FRESH FUEL OF DESIGNATED QUALITY INTO TANK)
FUEL FILTER clogged
(WASH FUEL FILTER)
CARBURETOR faulty or out of adjustment
(SEE 5-2-3)
CHOKE not fully open
(OPEN MAXIMALLY)
AIR CLEANER dirty
(SEE 3-3)
IGNITION SYSTEM
SPARK PLUG faulty
(SEE 3-5)
IGNITION time wrong
(ADJUST IGNITION TIME)
COMPRESSION SYSTEM
CYLINDER / PISTON / PISTON RING worn
(SEE 5-2-8)
VALVE CLEARANCE out of Spec
(SEE 3-6)
VALVE SEAT SEAL not tight enough
(SEE 5-2-7)
OTHERS
COOLING FAN dirty
(WASH)
CYLINDER COOLING FINS dirty
(WASH)
MUFFLER clogged
(SEE 3-4)
GOVERNOR out of adjustment
(SEE 3-9)

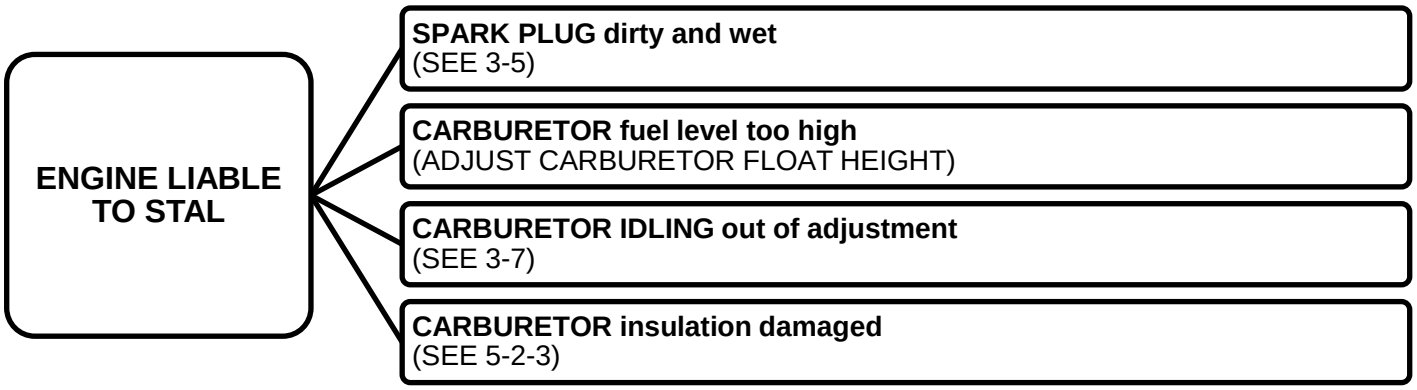
## 4.3 Speed Unstable



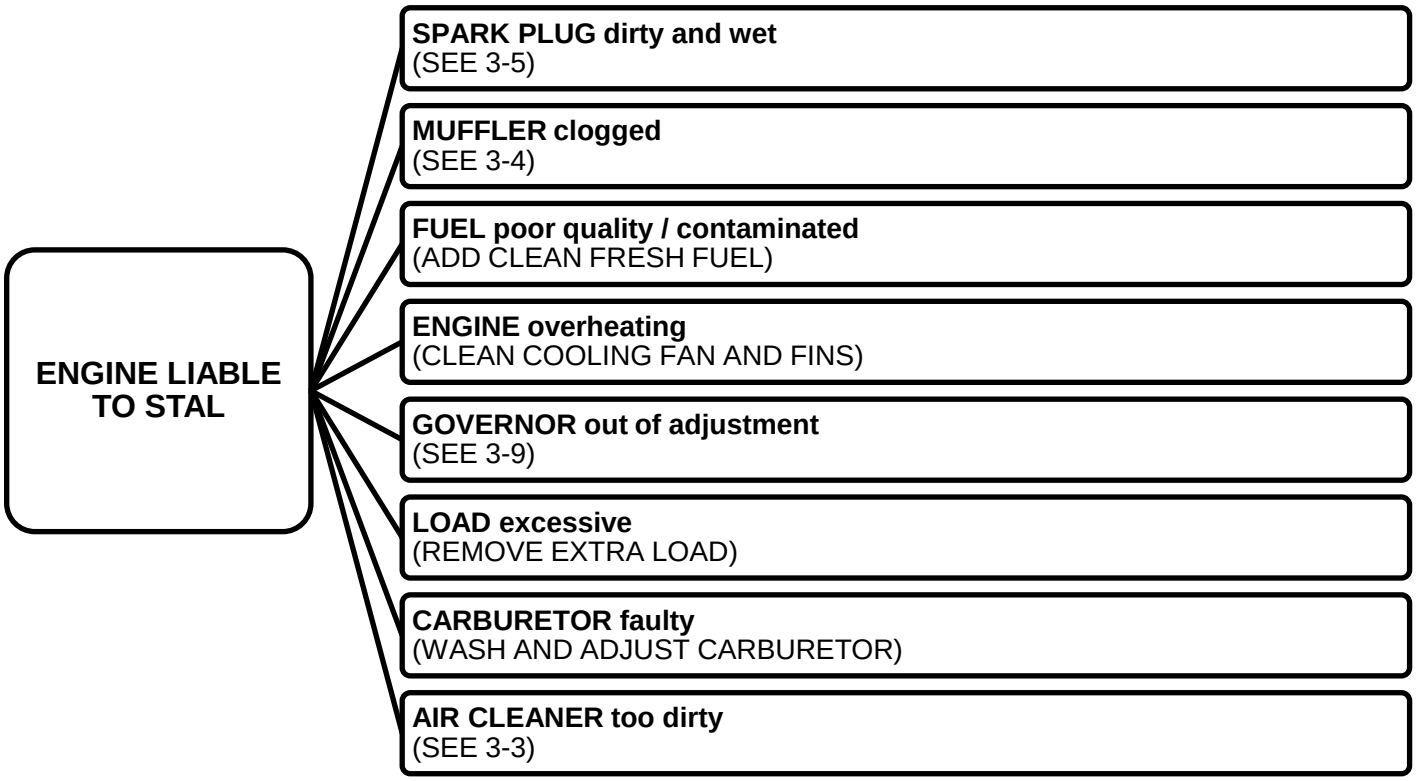

## 4.4 Exhaust Colour Abnormal



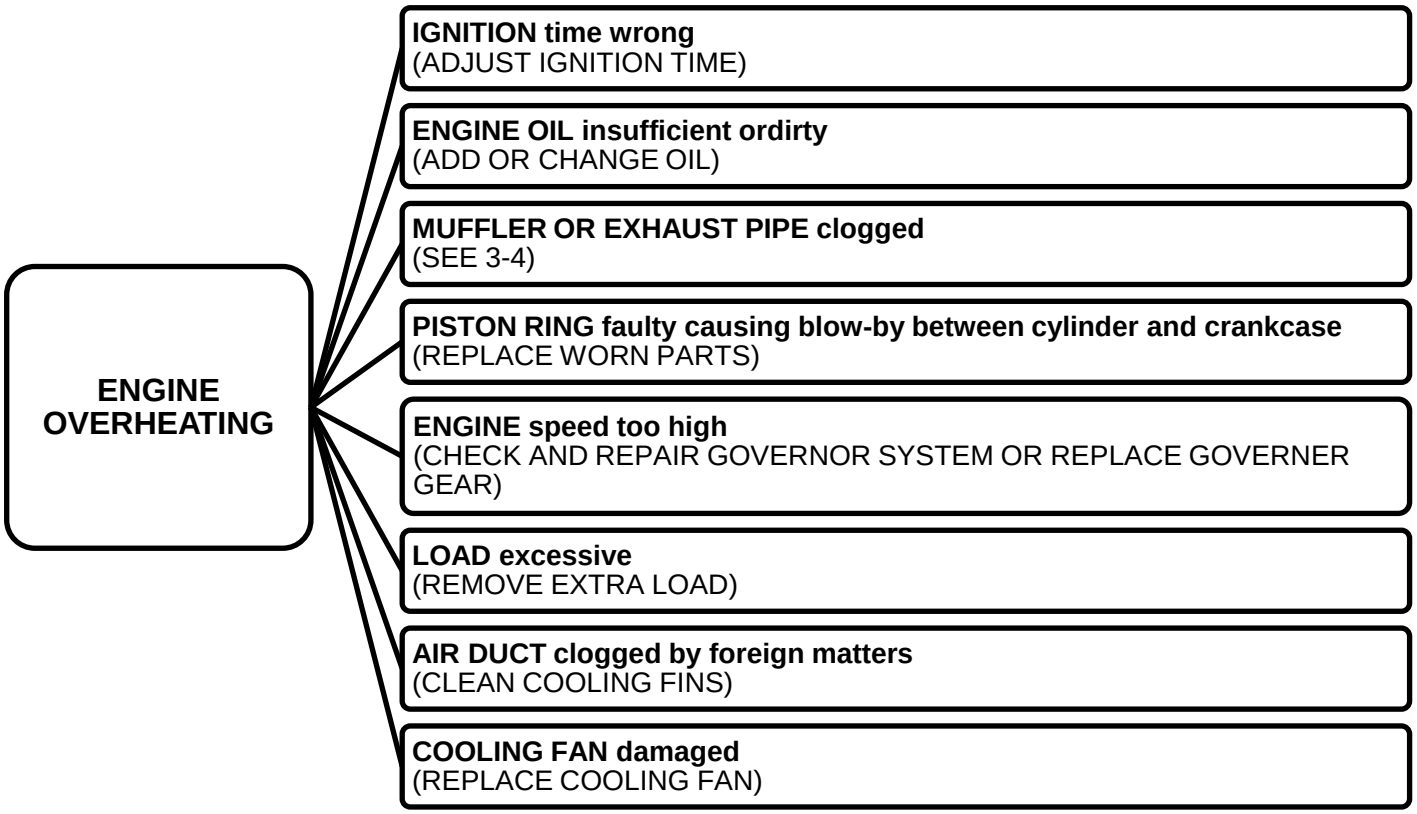
## 4.5 Engine Liable to Stall



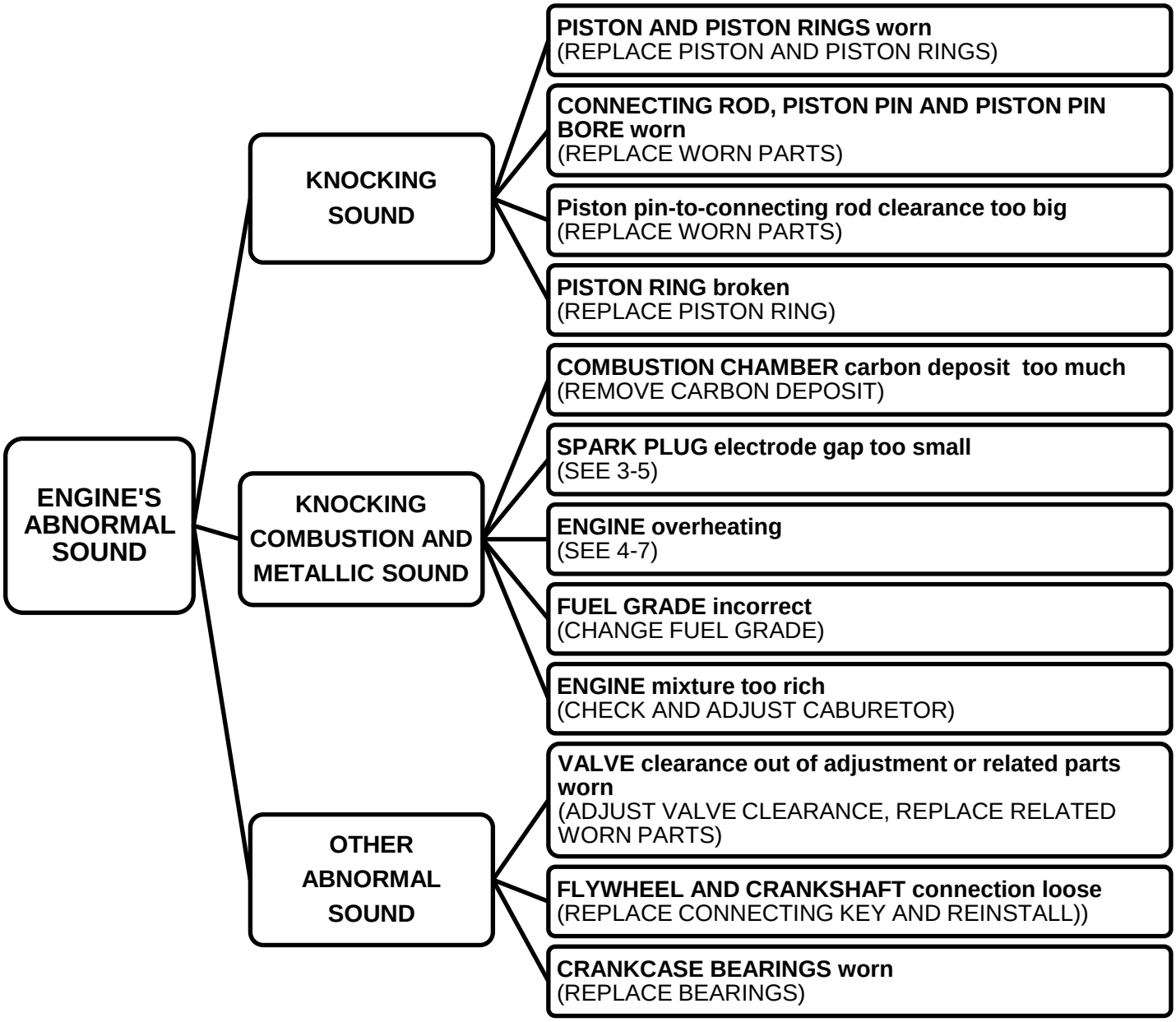

## 4.6 Engine Liable to Stall



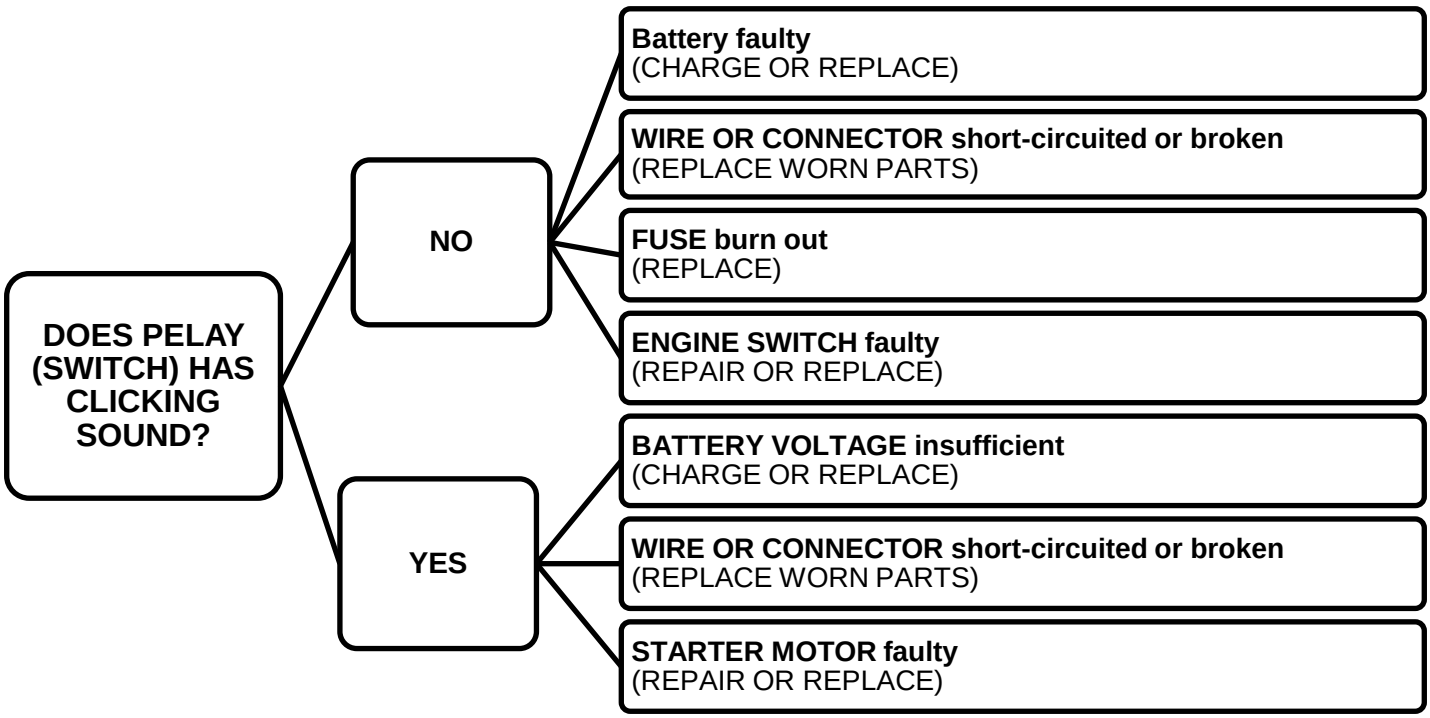
## 4.7 Engine overheating

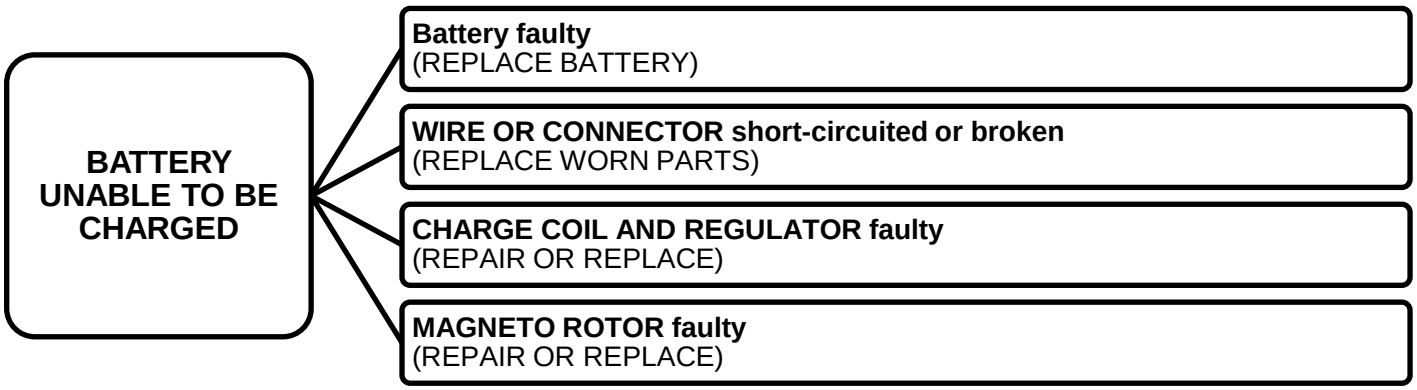


## 4.8 Engine's Abnormal Sound



## 4.9 Electric Starting System Failure

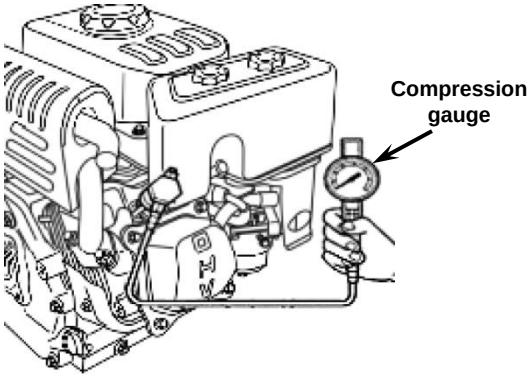


## 4.10 Cylinder Compression Check

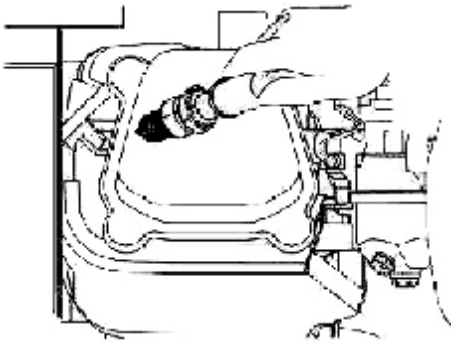
1) Remove spark plug cap and spark plug.
2) Install a compression gauge in the spark plug hole.
3) Install a compression gauge in the spark plug hole, crank the engine several times with the recoil starter and measure cylinder compression

| | |
|---|---|
| Cylinder compression | 6.0 ～ 8.5 kg/cm$^2$ (600rpm) |




## 4.11 Spark Test

1) Remove the spark plug.
2) Install the spark plug into the spark plug cap.
3) Ground the spark plug's (-) electrode (threaded section), pull starter to check if there is spark at the electrode joint.



**Warning**

***Never touch spark plug's terminals by wet hand when testing. If touching the high tension cord by wet hand, starting can produce a high electric voltage, which is very dangerous.***
***Sprinkled fuel can cause fire around the spark plug. First, clean the fuel, then check.***
***When checking, keep far away from the spark plug hole***

# 5. Disassembly and service

## 5.1 Precautions for Disassembly

### 5.1.1. Disassembly

1. Be familiar with the machine's structure and working principles before disassembly, it is the prerequisite of correct disassembly.
2. Try best not to detach the parts that can avoid being detached. Aimless detaching not only increases work load of the repair, but also deteriorates the originally good fitting relation between parts and fitting accuracy, which leaves new hazards of failure.
3. Use suitable removing tools and correct removing methods. Never knock with a big force during removing to avoid parts' deformation and damage. In order to improve repairing efficiency, the special removing tools should be preferred tools.
4. Disassembly work should be carried out step by step from the outside to the inside. Generally disassembly is carried in the order of "Whole machine Assemblies Subassemblies Parts".
5. In order to ensure smooth assembly after repairing, the following requirements should be met during disassembly:

1) Check the marks, and make marks, (such as lines, arrows, and texts marked on some parts). If any part has no mark, make a mark on its non-working surface to help reinstall it correctly.
2) Reasonably put parts based on their categorization. Parts of the same assembly or subassembly should be placed together. Parts liable to deformation or missing, such as the washers, should be place separately.

### 5.1.2. Reassembly

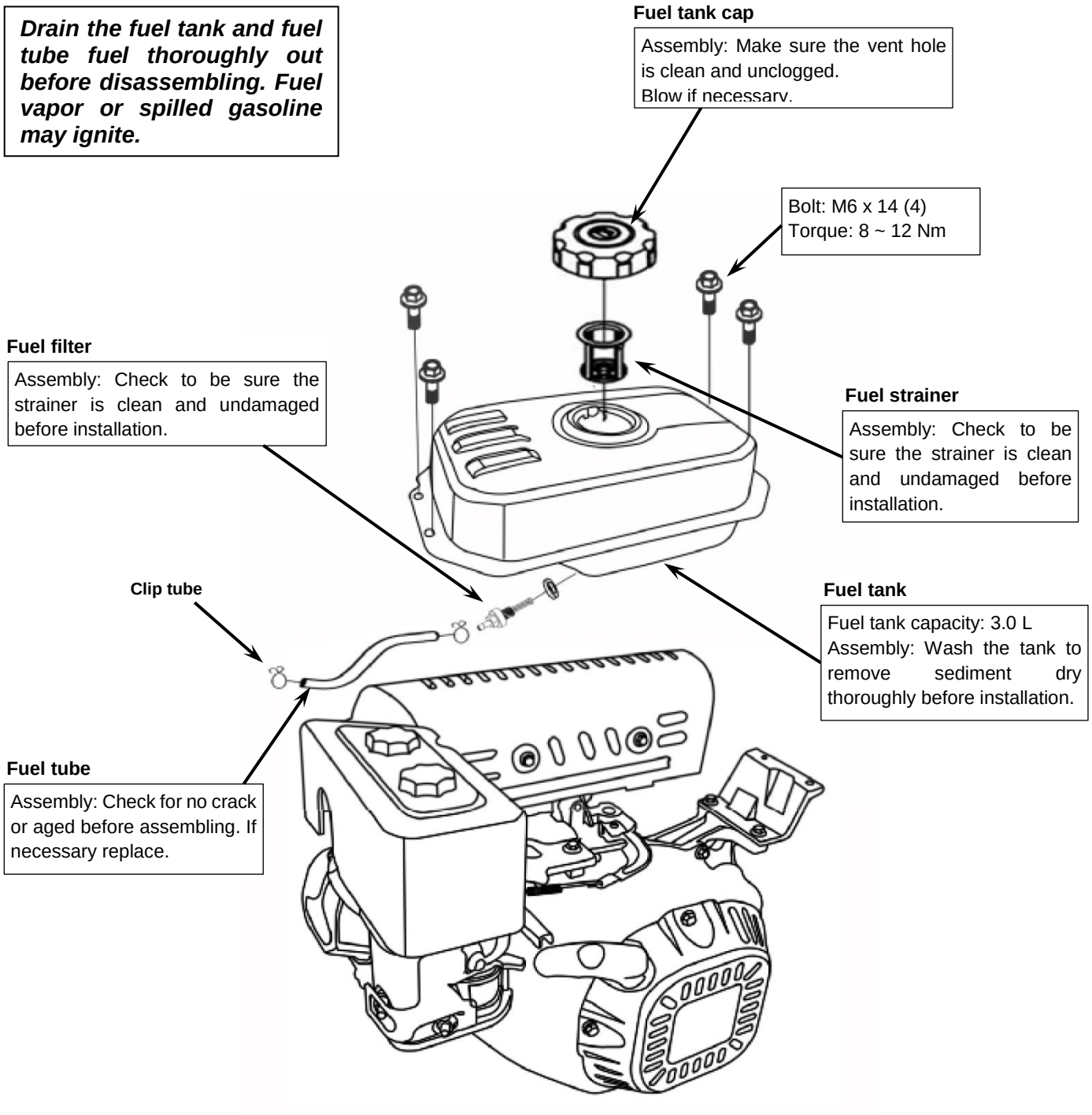
1. The place for assembly should be clean.
2. Prepare suitable assembling tools and devices.
3. Parts must be cleaned thoroughly; dust, dirt, earth, metal filings, carbon deposit, oil sludge and other impurities must be removed from its surface, holes, grooves, oil passage, etc. Compressed, detergent, etc. can be used for cleaning.
4. Carry out assembly in the order contrary to that for disassembly, i.e. in the order of "from inside to outside, from major parts to auxiliary parts" and "parts subassemblies assemblies whole machine".
5. Take care to check the part mark and assembling mark of each part when assembling to avoid missing or wrong installation.
6. When installing fasteners, tighten them in the order of "from the center to sides" and by turning several times in a crisscross pattern. Then use a torque wrench to fasten them to the specified torque values.
7. When assembling, all gaskets should be replaced in a timely manner.
8. Carry out trial run of the machine after the whole machine has been assembled and adjusted, and no fault is found upon check.

## 5.2 Disassembly and Service of Engine

### 5.2.1. Fuel tank

**Warning**

***Drain the fuel tank and fuel tube fuel thoroughly out before disassembling. Fuel vapor or spilled gasoline may ignite.***



### 5.2.2. Air cleaner, Muffler

**Muffler**

Assembly: Install after removing the carbon deposits from the muffler by gently knocking with a plastic hammer.

**Air cleaner cover**

**Exhaust pipe gasket**

**Air cleaner cover**

**Air cleaner grid**

**Air cleaner base**

Disassembly / Assembly:

- Remove and install with the choke lever in ON position and fuel in OFF position.
- Clean the inside with compressed air before installation

### 5.2.3. Air cleaner, Muffler

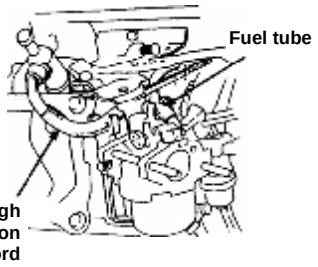
## a Disassembly / Reassembly

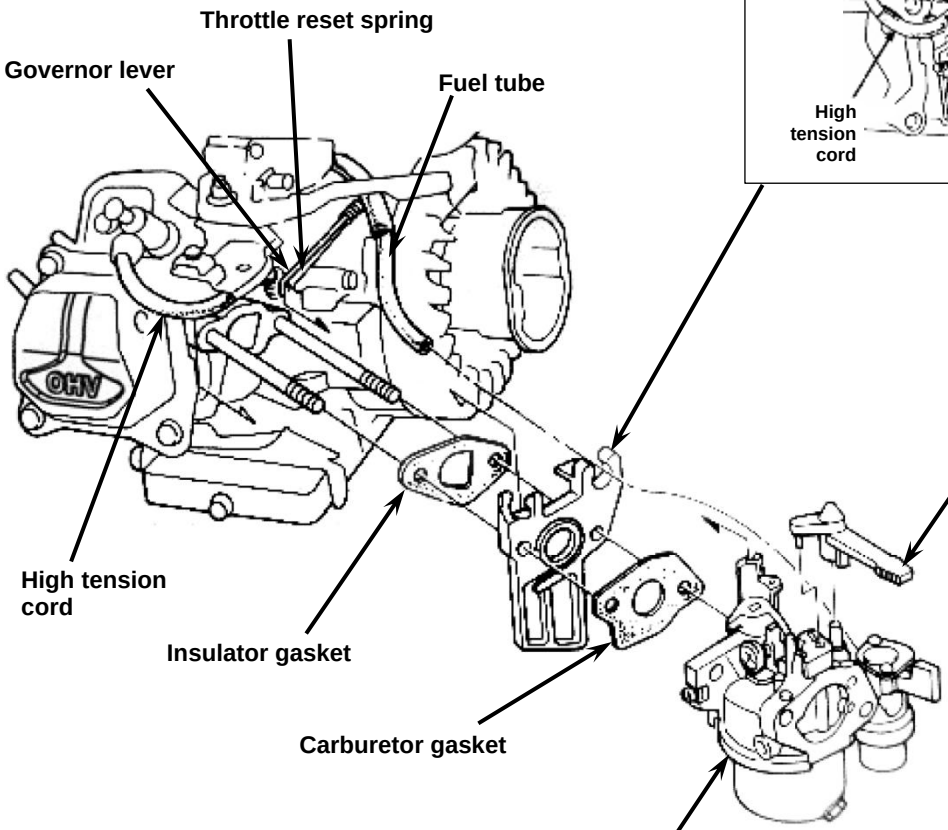
**Warning**

***Loosen the drain bolt and drain the carburetor before disassembling. Fuel vapor or spilled fuel may ignite.***

**Carburetor insulator**

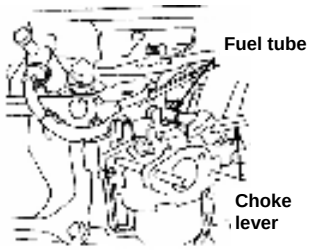
Reassembly: Blow out the passage using compressed air and install, noting the installation directions on inner and outer sides. After installing, securely install high tension cord and fuel tube.




**Choke lever**

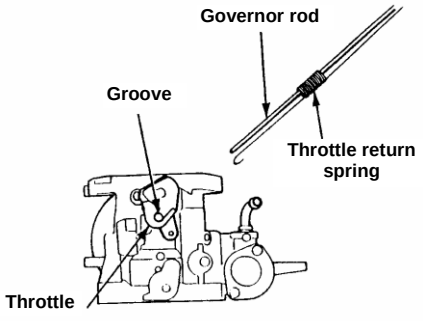
Reassembly: Plug the fuel tube with the choke lever's lug after removing the fuel tube to prevent fuel leakage.




**Choke lever**

Disassembly: Pull the carburetor forward to a point where the groove in the throttle arm lines up with the governor rod, and lift the rod out of the hole on the throttle arm. Unhook the anti-surge spring from the throttle lever. Remove the carburetor from the cylinder head.

Reassemble in the order contrary to the order of disassembly.



## b Disassembly / Reassembly

**Note**

***Clean the carburetor before reassembly.***

**Main nozzle**

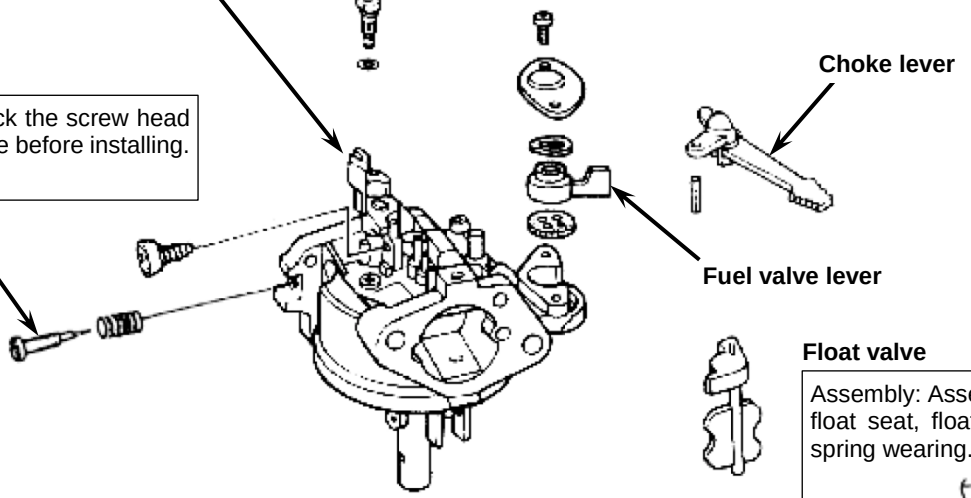
Assembly: Clean with compressed air and lightly lubricate O-ring before assembling.


**Carburetor body**

Reassembly: Check the screw head for wear or damage before installing.

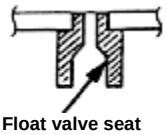
**Pilot screw**

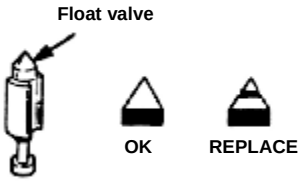
Reassembly: Check the screw head for wear or damage before installing.




**Float valve**

Assembly: Assemble after checking for float seat, float valve and float valve spring wearing.




**Main nozzle**

Reassembly: Clean thoroughly with compressed air before assembly.

**Main jet**

Reassembly: Clean thoroughly with compressed air before assembly.

**Spring Needle Valve**

**Float pin**

**O-ring**

Reassembly: Check whether it is correctly installed in the groove.

**Float**

Reassembly: Check for smooth movement by finger after installation.

**Fuel drain bolt**

Check for fuel leakage after installation.

**Float chamber**

**Set bolt**

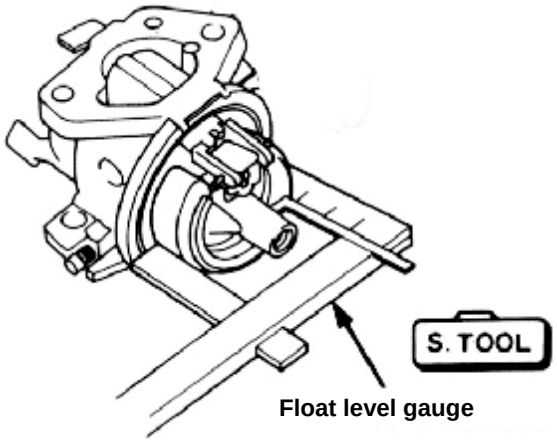
Check for fuel leakage after installation.

### c Disassembly / Reassembly

Place the carburetor as shown on the drawing. Measure the distance between the float top and carburetor body when the float just contacts the float valve.

| | |
|---|---|
| Standard height | 13.7 mm |

If the float height is not within specification, replace float valve and recheck the float height




### Washing carburetor

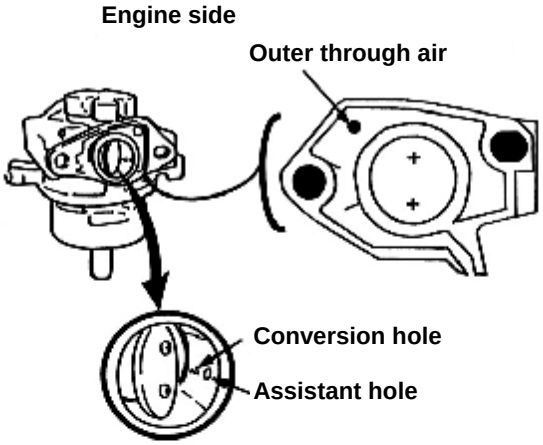
**Warning**

***In order to avoid injury, please wear safety eyeglasses or other eye protector when using compressed air.***

**Attention**

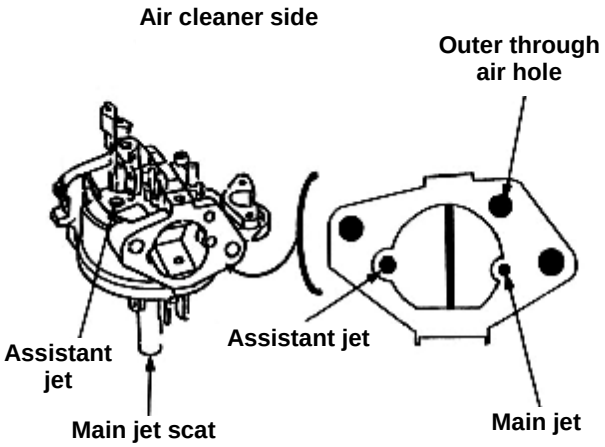
***Some chemical solvent has strong causticity which can damage plastic parts, such as, O-ring, and float valve seat. Please carefully read vessel manual. If you don't affirm, don't use this solvent to wash carburetor. Too maximum air pressure can damage carburetor, please use proper pressure to wash passage and tube mouth.***

1) Use detergent to wash the carburetor.
2) Use low pressure air to clean passage, air hole, assistant screw hole, assistant jet hole, assistant air jet hole, main air jet hole and assistant hole.



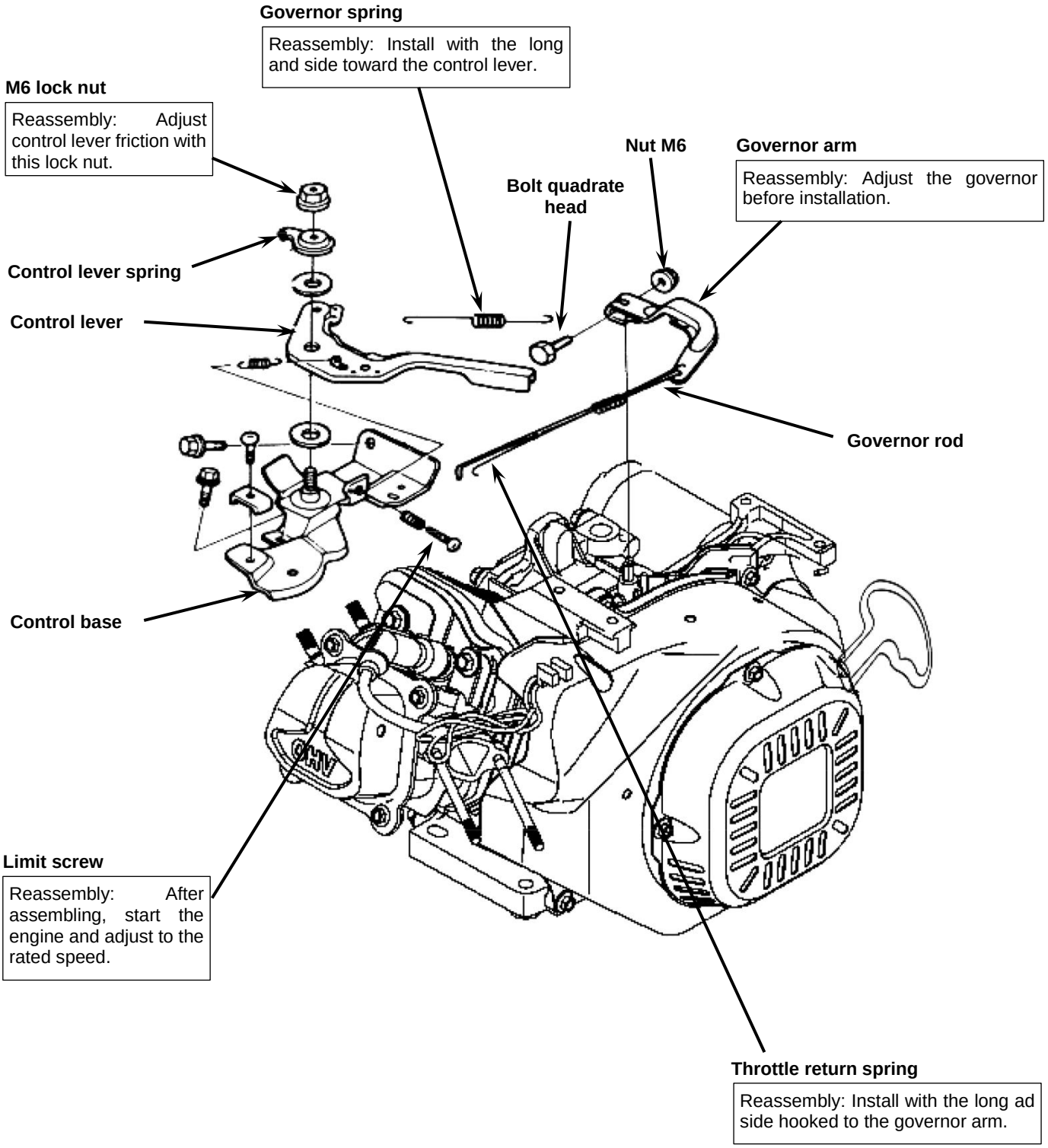

**Note**

***The carburetor has inner through and outer through air holes. For outer through hole, it passes through to carburetor oil cup, as well as inner through air hole is closed. For inner through hole, it passes through to carburetor oil cup, as well as outer through air hole is closed.***



### 5.2.4. Governor System

## a Disassembly / Reassembly

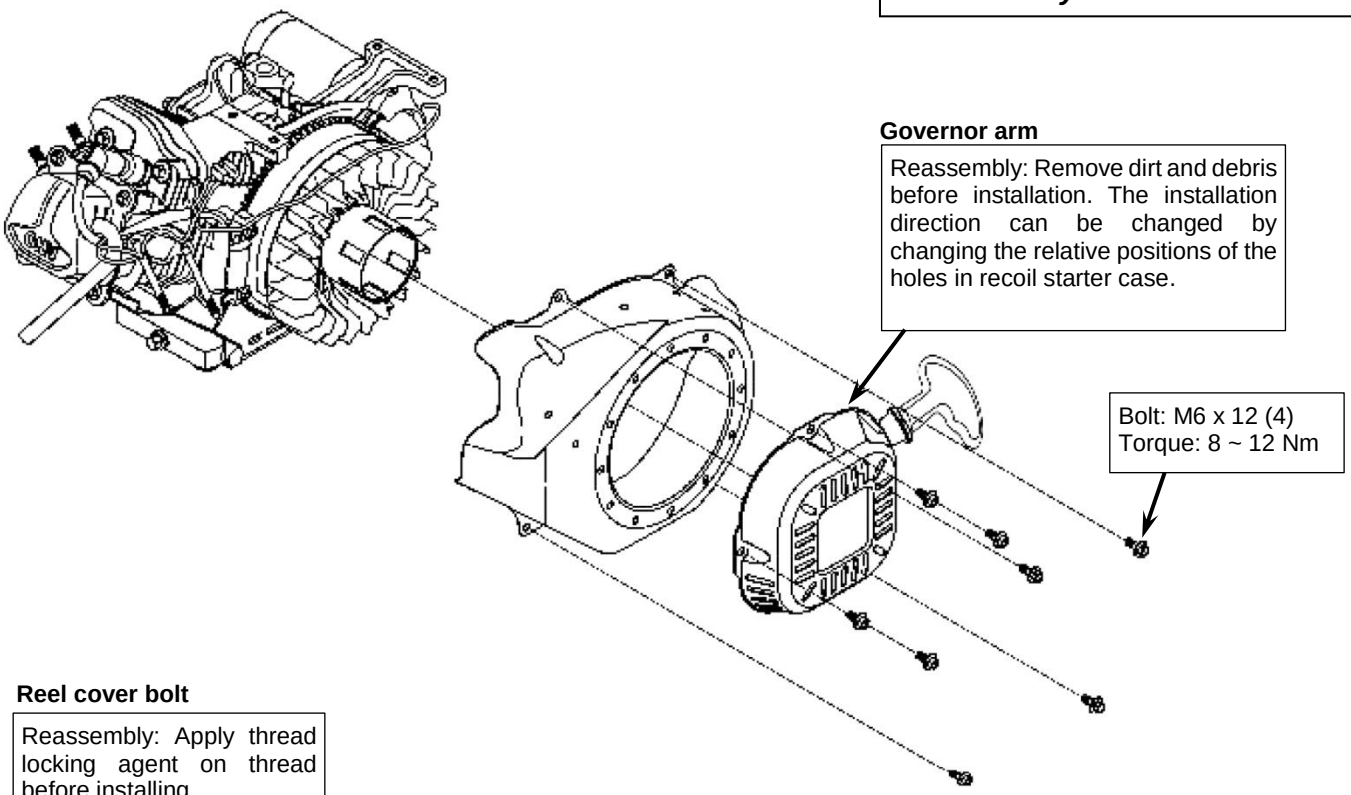


### 5.2.5. Recoil starter

**a Disassembly / Reassembly**

**Warning**

***Wear gloves and eye protectors. Do not let the spring out when disassembly.***



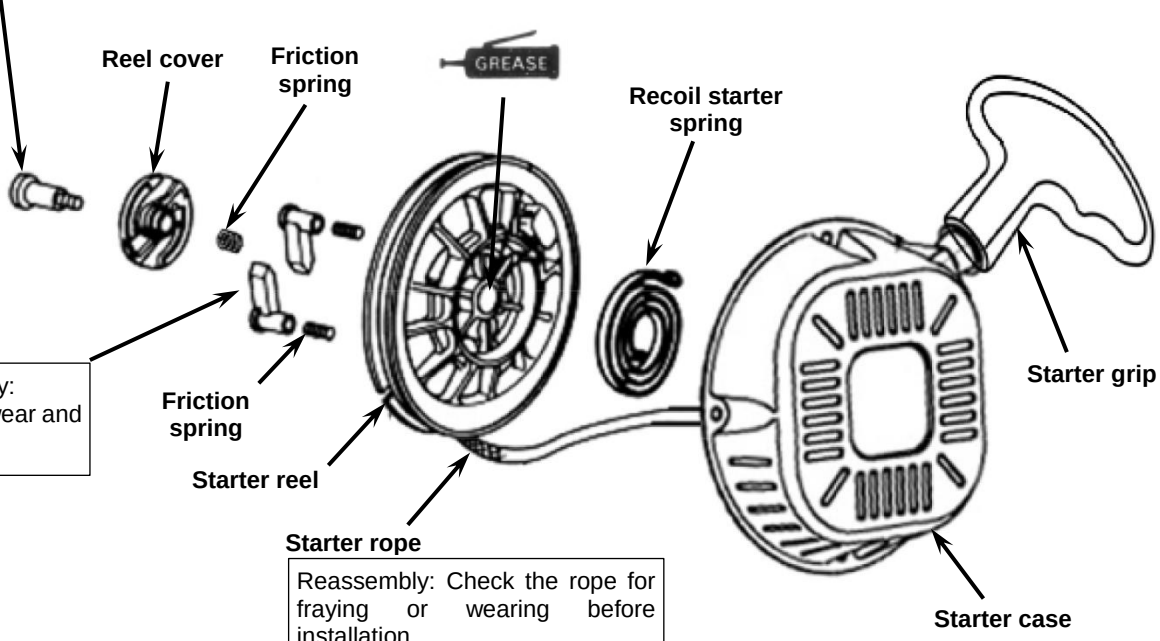
**Governor arm**

Reassembly: Remove dirt and debris before installation. The installation direction can be changed by changing the relative positions of the holes in recoil starter case.

Bolt: M6 x 12 (4)
Torque: 8 ~ 12 Nm

**Reel cover bolt**

Reassembly: Apply thread locking agent on thread before installing.




**Reel cover**

**Friction spring**

**Recoil starter spring**

**Ratchet (2)**

Reassembly: Check for wear and chipping.

**Friction spring**

**Starter reel**

**Starter rope**

Reassembly: Check the rope for fraying or wearing before installation.

**Starter grip**

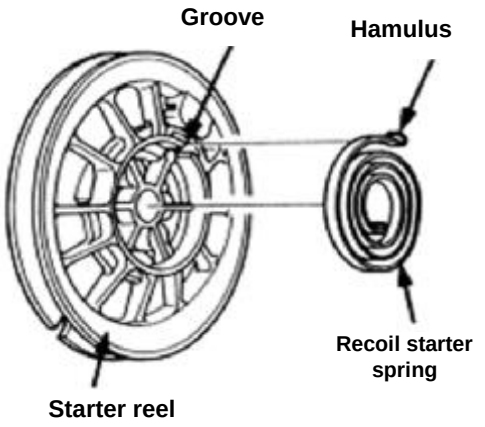
**Starter case**

## b Disassembly / Reassembly

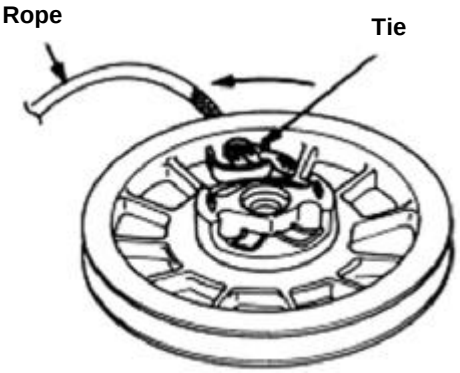
**Warning**

***Wear gloves and eye protectors.***
***Do not let the spring out when disassembly.***

Insert the hook on the outer side of the scroll spring into the hole of the starter.



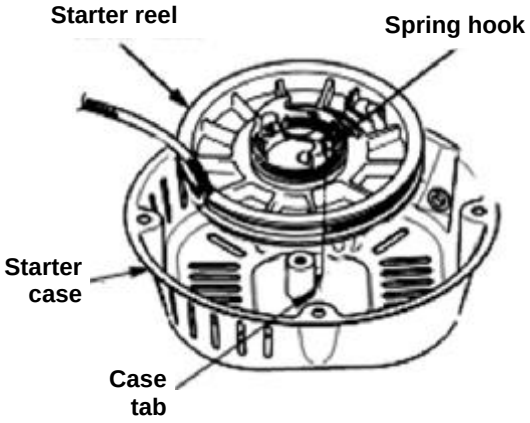

Pass the rope through the hole of the starter wheel and tie the end of rope (shown on drawing), wind the rope onto the reel in the arrowed direction, and remain about 30 cm outside the starter wheel.



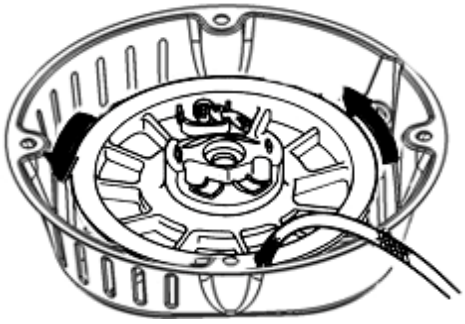

**Note**

***Make sure remaining about 30 cm rope outside the starter wheel***

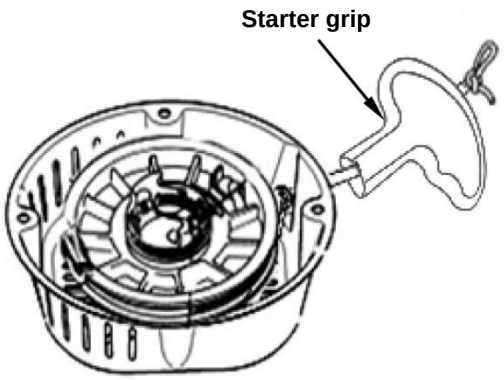
Assemble the starter wheel on the starter reel, insert the hook on the inner side of scroll spring on the convex position of starter dray.




Grasp the starter grip and pre-turn starter wheel two turns as shown as arrow direction.



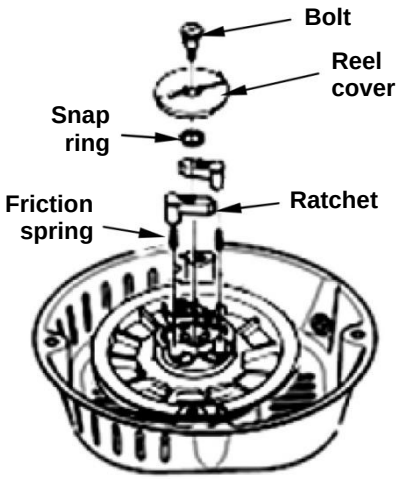
Pass the starter rope through the starter tray, and tie as shown as drawing.



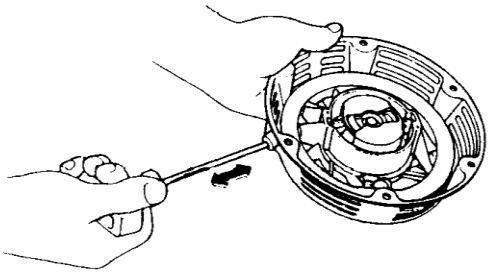

**Warning**

***Don't allow the starter wheel leaving off the starter tray, otherwise, the spring fly out to injure person.***

Assemble the pawl and friction spring together on the starter wheel, tighten the bolt of bolt.




Pull the starter rope several times to make sure if the pawl moves correctly.

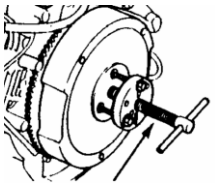


### 5.2.6. Flywheel, ignition coil

## a Disassembly / Reassembly

**Flywheel**

<Starting motor>
- Remove the igniting coil before removing flywheel
- Don't hit the flywheel with a hammer. Remove as shown on the drawing with a special tool.



**Flywheel puller**

Reassembly: Degrease the crankshaft taper face and flywheel hole, then assemble.

**Starting motor type**

Start the motor, and measure motor operation performance, if the operation performance is not within the maintenance, disassemble.

Bolt: M6 x 30 (2)
Torque: 8 ~ 12 Nm

**Woodruff key**

After assembling, check to be sure that the woodruff key is still in its slot on the crankshaft.

Bolt: M6 x 30 (2)
Torque: 8 ~ 12 Nm

**Charging coil**

**M14 hexagon flange nut**

80 ~ 90 Nm (Apply engine oil on the thread.)
Disassembly/reassembly: Insert a screwdriver or another tool into the hole of starter pulley to prevent flywheel from rotating.

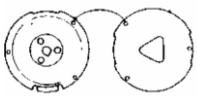
**High-tension cord**

Assembly: Check for cracked or damaged insulation, replace if necessary.

**Ignition coil**

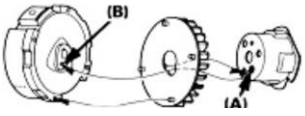
**Cooling fan**

**Caution:** When servicing, take care not to damage the fan blades.
Reassembly: Assemble the fan, aligning the four lugs on the back of the fan with the small holes in the flywheel.



**Starter pulley**

Assemble, aligning the lugs on the starting cup with the small holes in the flywheel centre.

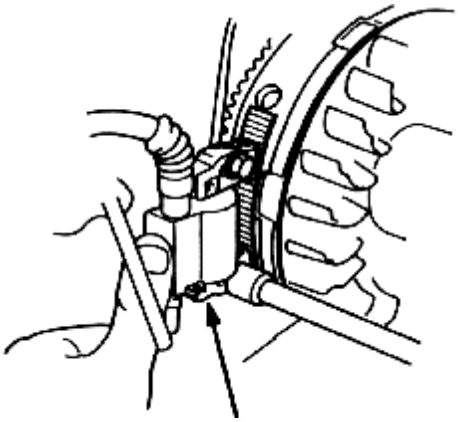


**b Ignition coil gap adjustment**

When reinstalling the ignition coil, adjust the ignition coil gap.

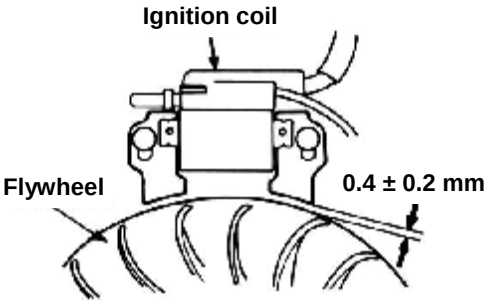
1) Lightly tighten ignition coil mounting bolt.
2) Insert the feeler gauge or a piece of paper of the same thickness between the flywheel and ignition coil as shown.
3) Push the ignition coil against the flywheel by hand and tighten the two bolts.

| | |
|---|---|
| **Ignition coil gap** | 0.4 ± 0.2 mm |




**Note**

***a) Adjust both ends of the ignition coil to the same gap.***
***b) Avoid the magnet section of the flywheel when***



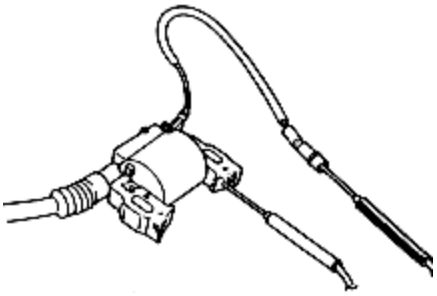

**Inspection**

**Ignition coil:**

<Primary side>

Measure the resistance of the primary coil by attaching one ohmmeter lead to the ignition coil's primary lead while touching the other test lead to the iron core.

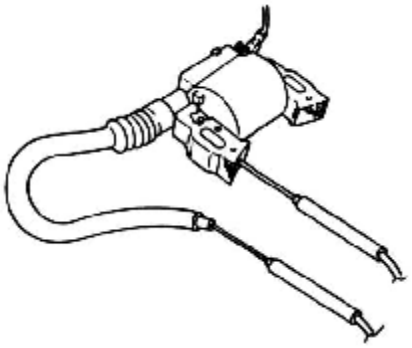
| | |
|---|---|
| **Primary side resistance value** | 0.8 - 1.0 Ω |



<Secondary side>

Measuring the resistance of the secondary side of the coil by removing the spark plug cap and touching one test lead to the spark plug lead wire while touching the other lead to the coil's iron core.

| | |
|---|---|
| **Secondary side resistance value** | 5.9 - 7.1 KΩ |



**Caution**

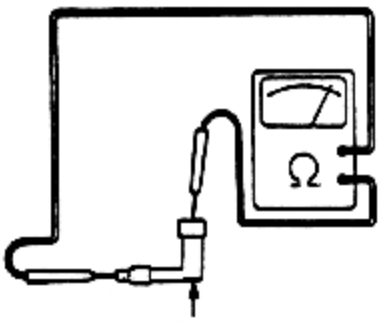
***A false reading will result if the spark plug cap is not removed.***

### c Spark plug cap

Put the tester to contact the two end of the spark plug cap and measure spark plug cap resistance.

| | |
|---|---|
| **Resistance** | 7.5 – 12.5 KΩ |

If the resistance is out of the specification, replace the spark plug.



Spark plug cap

### Adjustment

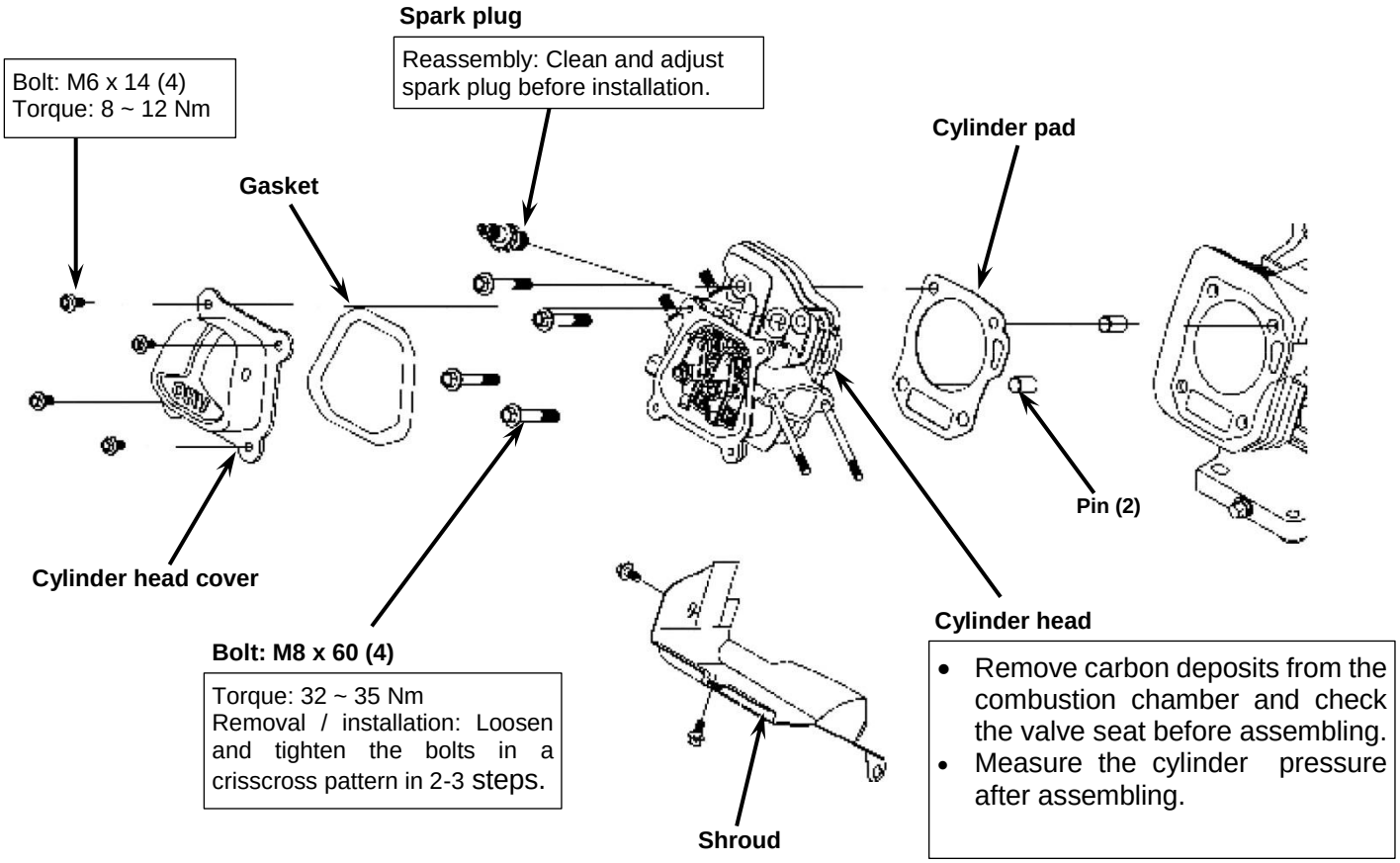
Adjustment is required only when the ignition coil or the flywheel has been removed.

1. Loosen the ignition coil mounting bolts.
2. Insert the thickness gauge or a piece of paper of the proper thickness between the ignition coil and the flywheel, both gaps should be adjusted simultaneously. Avoid the magnet when adjusting the air gap.
3. Push the ignition coil firmly toward the flywheel and tighten the mounting bolts.

| | |
|---|---|
| **Specified clearance** | 0.20-0.60 mm<br>(0.008-0.020 in) |

## 5.2.7. Cylinder head, Valves

### Disassembly / reassembly



## Disassembly / reassembly

**Valve spring retainer (2)**

Disassembly: Push down the spring retainer and move the retainer to the small hole so that the valve stem slips through the small hole.
The exhaust valve retainer has a larger groove than the intake valve retainer so that it can accept the valve rotator.

Caution: don't disassemble the valve spring while the cylinder cover is not removed, or the valve stem will drop into the combustion chamber.

**Exhaust valve**

Reassembly: Check exhaust valve taper face for chipping or excessive carbon deposits before assembling.

**Cylinder head**

**Valve spring (2)**

**Seal guide**

**Valve rotator (2)**

Be sure to assemble. If the engine is operated with the rotator not attached, the valve will drop into cylinder.

**Intake valve**

Assembly: Don't interchange the exhaust and intake valves.

**Push rod (2)**

Assembly: Check the two ends of the push rod for wearing and push rod for straightening. Be sure that two ends of push rod completely seat on the lifter and rocker seat.

**Rod guide plate**

**Adjust nut (2)**

**Lock nut**

Torque: 10 Nm

**Rocker arm (2)**

Assembly: Check the contacting face of rocker with adjust nut and push rod for wearing before assembling.

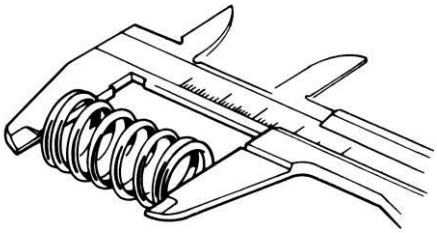
**Valve adjust bolt (2)**

Torque: 10 Nm

### Valve spring free length

Measure the free length of the valve springs.

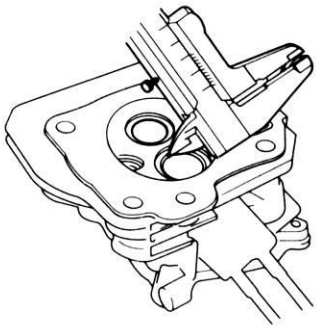
| Standard | Service limit |
|---|---|
| 30.5 mm | 29.5 mm |



Replace the springs if they shorter than the service limit.

**Valve seat width**

Remove carbon deposits from the combustion chamber. Inspection the valve seats for pitting or other damage. Measure the valve seat width.

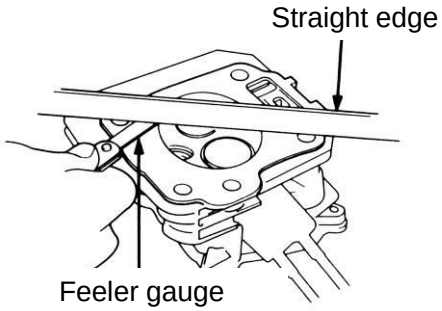


| Standard | Service limit |
|---|---|
| 0,8 mm | 2.0 mm |

If the valve seat width is under the standard, or over the service limit, recondition the valve seat.

**Cylinder head**

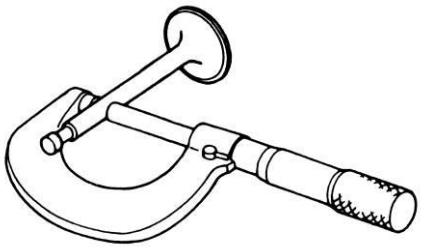
1. Remove carbon deposits from the combustion chamber. Clean off any gasket material from the cylinder head surface.
2. Check the spark plug hole and valve areas for cracks.
3. Check the cylinder head for warpage with a straight edge and a feeler gauge as shown.




| Service limit | 0,10 mm |
|---|---|

**Valve stem OD**

Inspect each valve for face irregularities, bending or abnormal stem wear. Replace the valve if necessary. Measure and record each valve stem OD.

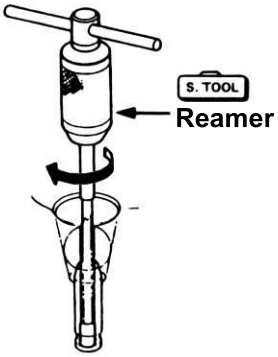


| | Standard | Service limit |
|---|---|---|
| IN. | 5.480 mm | 5.318 mm |
| EX | 5.440 mm | 5.275 mm |

Replace the valves if their OD is smaller than the service limit.

**Valve guide ID**

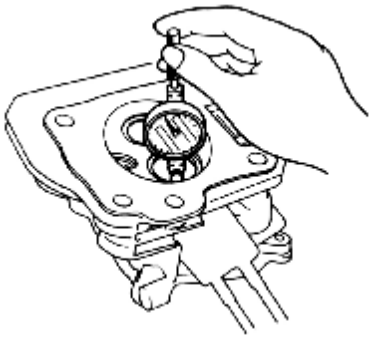
Ream the exhaust valve guide to remove any carbon deposits before measuring. Measure and record each valve guide ID.




| Standard | Service limit |
|---|---|
| 5,500 | 5.572 mm |

### Stem – to - guide clearance

Subtract each valve stem OD from the corresponding guide ID to obtain the guide-to-stem clearance.



| | Standard | Service limit |
|---|---|---|
| IN | 0,02 - 0,044 mm | 0,10 mm |
| EX | 0,06 - 0,087 mm | 0,12 mm |

If the stem-to-guide clearance exceeds the service limit, determine if the new guide with standard dimensions would bring the clearance within tolerance. If so, replace the guide (or cylinder head) as necessary and ream to fit. If the stem-to-guide clearance exceeds the service limit with new guides, replace the valves as well. Recondition the valve seat whenever the valve guide is replaced.

### Cylinder head service

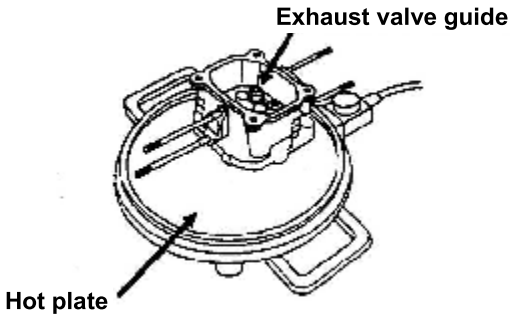
#### Exhaust valve guide replacement

The intake valve guide is not replaceable. If the intake valve guide is worn beyond the service limit, replace the cylinder head.

1. Chill the replacement exhaust valve guide in the freezer section of a refrigerator for about an hour.
2. Use a hot plate or oven to heat the cylinder head evenly to 150℃ (330℉)

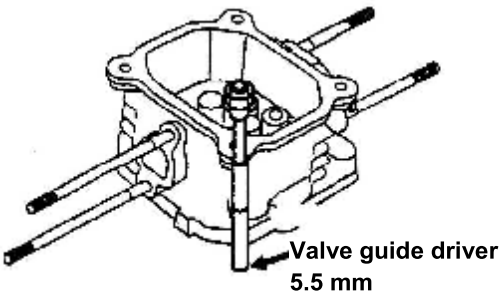
Check the temperature with a temperature indicating stick (available at welding supply stores) or equivalent.

Wear heavy gloves to prevent burns when handling heated cylinder head.




**Note**

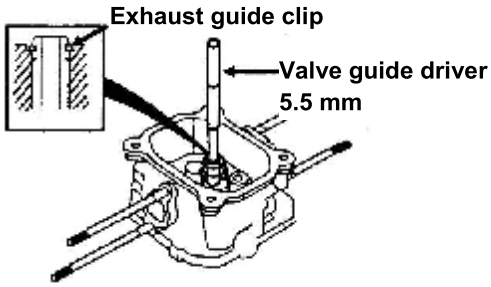
***Do not use a torch to heat the cylinder head; warpage of the cylinder head may result. Do not get the head hotter than 150 °C (330 °F); excessive heat may loosen the valve seats.***




3. Remove the heated cylinder head from the hot plate and support it with wooden blocks. Drive the exhaust valve guide out of the head from the combustion chamber side.

**Note**

***When driving the valve guide out, be careful not to damage the head.***

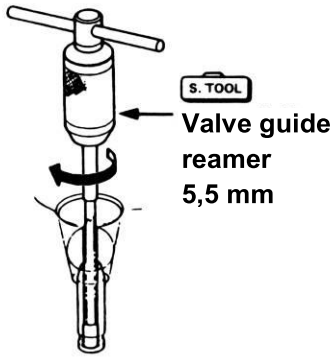


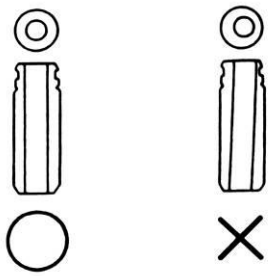

4. Remove the new exhaust valve guide from the refrigerator.
5. Install the new valve guide from the valve spring side of the cylinder head. Drive the valve guide until the clip is fully seated as shown.
6. After installation, inspect the valve guide for damage. Replace the guide if damaged.

**Exhaust valve guide reaming**

For best results, be sure the cylinder head is at room temperature before reaming the exhaust valve guide.

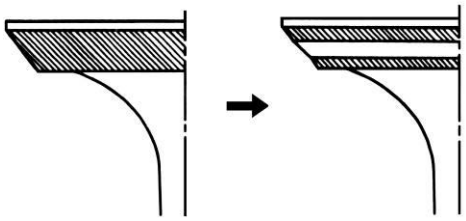
1. Coat the reamer and valve guide with cutting oil.
2. Rotate the reamer clockwise through the valve guide the full length of the reamer.
3. Continue to rotate the reamer clockwise while removing it from the valve guide.
4. Thoroughly clean the cylinder head to remove any cutting residue.
5. Check the valve guide bore; it should be straight, round and centred in the valve guide. Insert the valve and check operation. If the valve does not operate smoothly, the guide may have been bent during installation. Replace the valve guide if it is bent or damaged.
6. Check the valve stem-to-guide clearance.



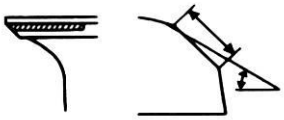



**Valve seat reconditioning**

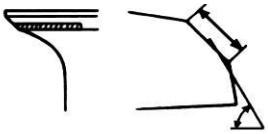
1. Thoroughly clean the combustion chambers and valve seats to remove carbon deposits.
2. Apply a light coat of Prussian Blue or erasable felt-tipped marker ink to the valve faces.
3. Insert the valve, and then lift them and snap them closed against their seats several times. Be sure the valve does not rotate on the seat. The transferred marking compound will show any area of the seat that is not concentric.
4. Using a 45° cutter, remove enough material to produce a smooth and concentric seat. Follow the valve seat cutter manufacturer's instructions.
   ***Turn the cutter clockwise, never counter clockwise. Continue to turn the cutter as you lift it from the valve seat.***
5. Using the 30°~32° and 60° cutter to narrow and adjust the valve seat so that it contacts the middle of the valve face. The 30° ~ 32° cutter removes material from the top edge. The 60° cutter removes material from the bottom edge. Be sure that the width of the finished valve seat is within specification.



**Contact too high**

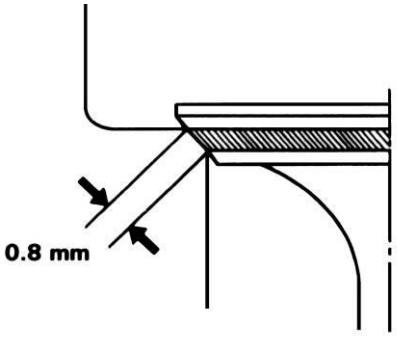


**Contact too low**

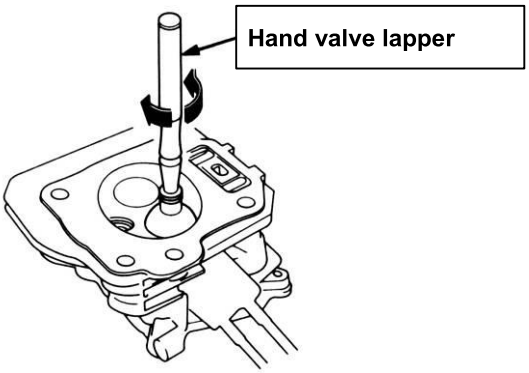


### Valve seat width

| Standard | Service limit |
|---|---|
| 0,8 mm (0.03 in) | 2.0 mm (0.08 in) |




1. Make a light pass with the 45° cutter to remove any possible burrs at the edges of the seat.
2. After resurfacing the seats, inspection for even valve seating.
3. Apply a light coat of Prussian Blue or erasable felt-tipped marker ink to the valve faces.
4. Insert the valves, and then lift them and snap them closed against their seats several times. Be sure the valve does not rotate on the seat. The seating surfacing, as shown by the transferred marking compound, should have good contact all the way around.



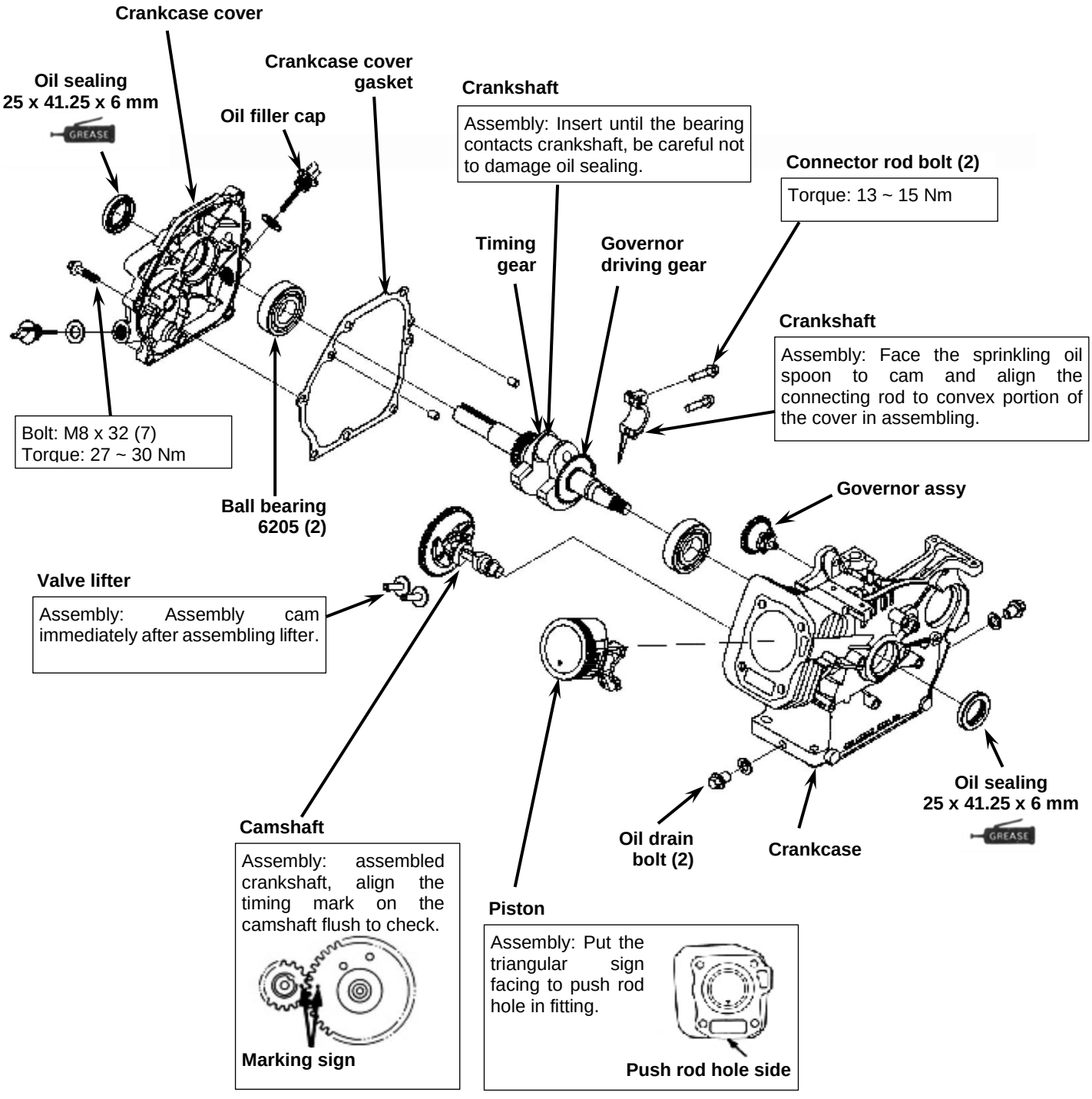

**Note**

***To avoid severe engine damage, be sure to remove all lapping compound from the head before reassembling.***

5. Check the valve clearance after reassembly.

### 5.2.8. Crankcase, camshaft, piston

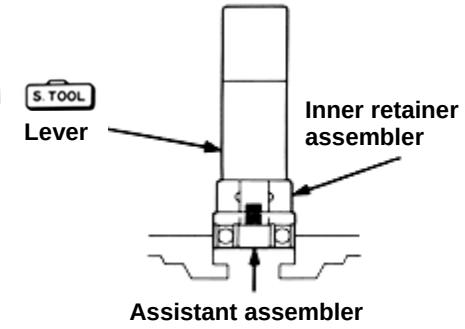
**Disassembly / reassembly**



**Crankshaft bearing**

Assembly：Assemble the bearing in with following the tool after applying engine oil.

Assembly lever 52×55 mm outer retainer assembler Assistant assembler

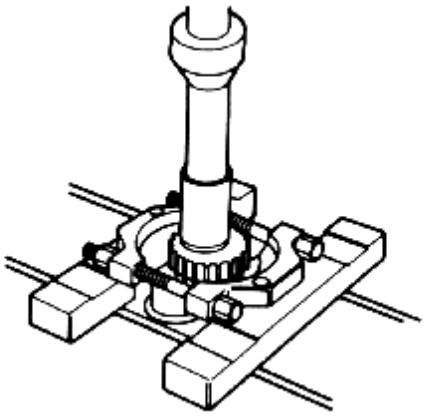



**Gear on the crankshaft**

**Disassembly：**

Mark a line on the crankshaft and a timing gear. Set the commercial available bearing puller plate on the lower part to the governor drive gear and remove the crankshaft and timing gear by manual compressor.

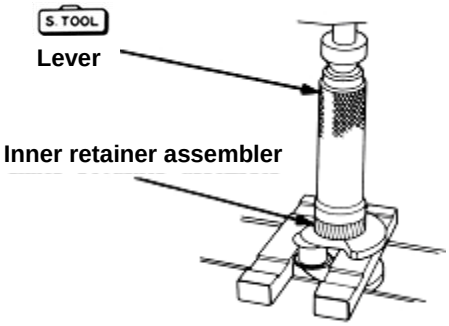
Disassemble the governor drive gear in the same way.



**Assembly：**

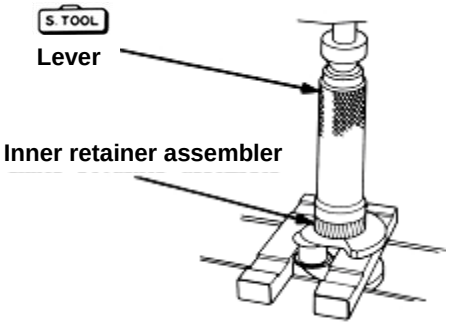
Timing gear

Using the old gear for reference, make a mark at the same position on the new gear. Using a hydraulic press, lever and inner retainer assembler (the special tools shown,), press the timing gear onto the crankshaft after aligning old and new gears mark flush.



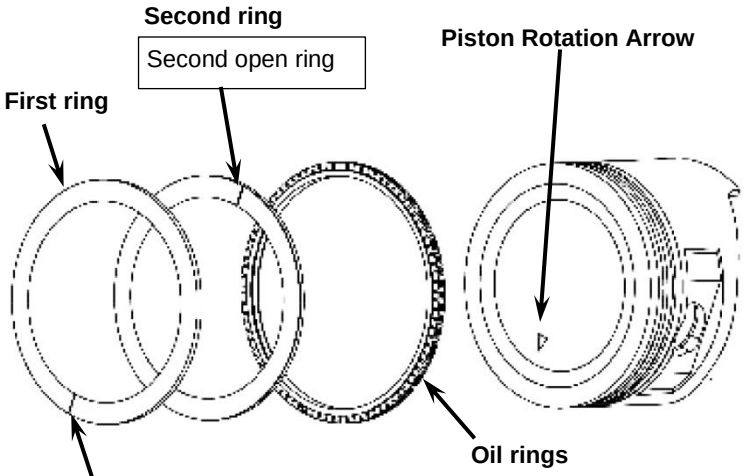

**Governor drive gear**

Use a hydraulic press lever and inner retainer assembler (special tool) to press in a new governor drive gear.



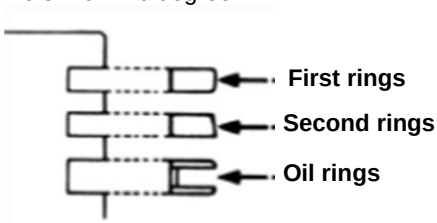
## Piston connecting rod

## Disassembly / reassembly




**Assembly**

- Put the piston ring sign facing up when assembling.
- Don’t wrongly assemble the top ring and the second ring.
- After assembling, be sure the piston can freely move.
- Stagger the open of the piston to piston pin hole with 120 degree.



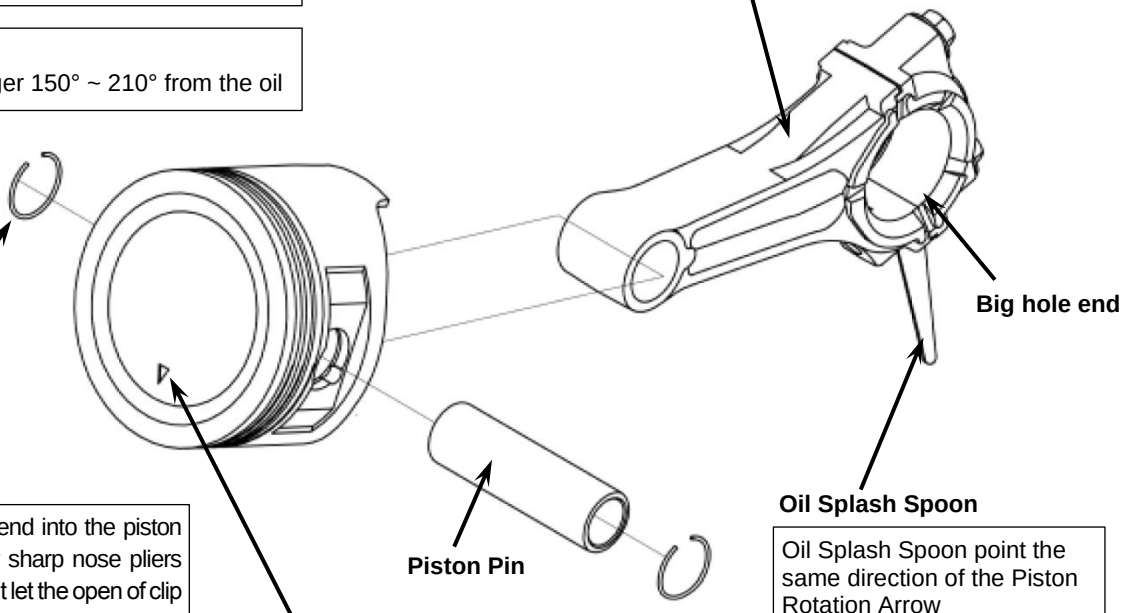

Open of first ring


**Attention:**
First and Second Rings are stagger 150° ~ 210°

**Attention:**
Scrape Rings are stagger 150° ~ 210° from the oil

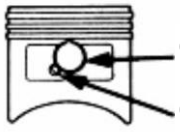
**Connecting Rod**

Assembly: Put the long and of the connecting rod aiming the triangular mark when assembling.




**Piston Pin Clip (2)**

Assembly: Put the one end into the piston slot, clamp other end by sharp nose pliers and revolve into slot. Don’t let the open of clip aiming at the piston pin slot.




**Oil Splash Spoon**

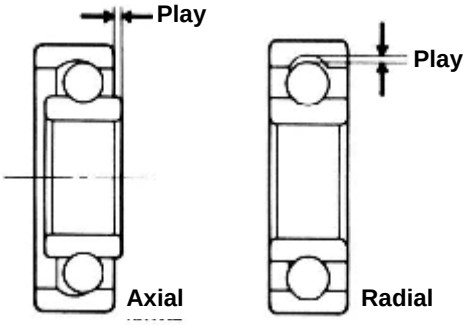
Oil Splash Spoon point the same direction of the Piston Rotation Arrow

**Attention:** Piston Rotation Arrow should point at Valve Lifter

## Inspection

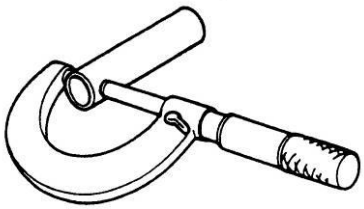
### Crankshaft bearing free play

1) Clean the bearing in solvent and dry it.
2) Spin the bearing by hand and check for play. Replace the bearing if it is noisy or has excessive play.




### Piston pin OD

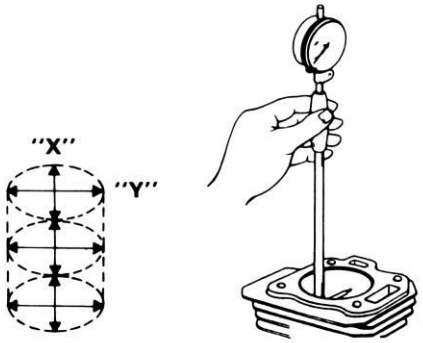
| Model | Standard | Service limit |
|---|---|---|
| **K 700 H – K 800 H** | 13.0 mm | 12.954 mm |



### Cylinder inside diameter

Measure three points on the “X” and “Y” shaft and record cylinder inside diameter “X” (shaft is vertical to crankshaft) and “Y” shaft (parallel to crankshaft).
Take maximum reading as the wearing and tapering of the cylinder.

| Model | Standard | Service limit |
|---|---|---|
| **K 700 H – K 800 H** | 65.0 mm | 65.165 mm |




### Piston inspection

Check the contact between piston and cylinder, defects of ring grooves, ablation and cracks on piston top, etc. replace the piston if presents damages severe.

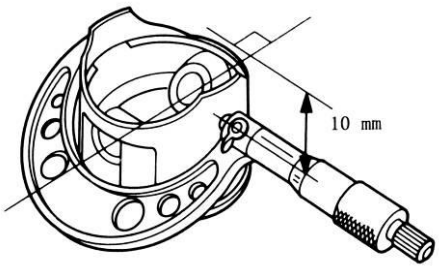
### Removal of carbon deposits

Carbon deposits accumulate on piston top and upper edge of cylinder. Remove carbon deposits completely before inspection. Saturate the carbon deposits with kerosene and then use a blunt scraper or a wire brush to remove carbon deposits.

### Piston skirt outside diameter

Measure and record the piston skirt outside diameter at the 10 mm from piston skirt maximum lower side making 90° to piston pin hole.

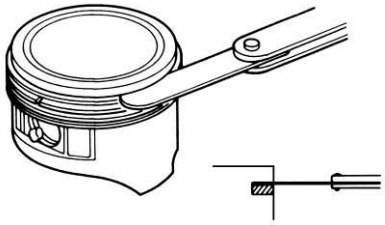
| Model | Standard | Service limit |
|---|---|---|
| **K 700 H – K 800 H** | 64.985 mm | 64.845 mm |



**Piston – to - cylinder clearance**

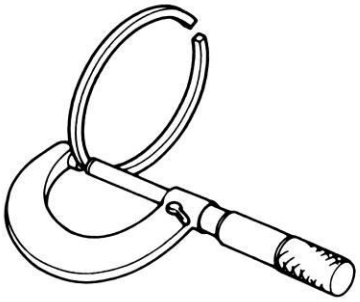
| Standard | Service limit |
|---|---|
| 0.015 ~ 0.050 mm | 0.120 mm |

**Piston ring side clearance**



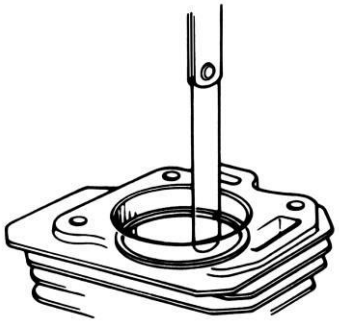
| | Standard | Service limit |
|---|---|---|
| **Top / Second** | 0.015 ~ 0.045 mm | 0.15 mm |

**Piston ring width**



| | Standard | Service limit |
|---|---|---|
| **Top / Second** | 1.5 mm | 1.37 mm |

**Piston ring end gap**



| Standard | Service limit |
|---|---|
| 0.2 mm ~ 0.4 mm | 1.0 mm |

Before measuring end gap, use the piston top to position the ring so it will not be cocked in the cylinder bore

**Piston Pin hole ID**

| Model | Standard | Service limit |
|---|---|---|
| **K 700 H – K 800 H** | 13.002 mm | 13.048 mm |

**Piston Pin hole ID**

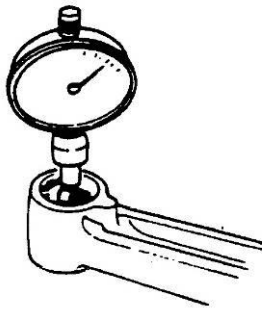
| Standard | Service limit |
|---|---|
| 0.002 mm ~ 0.014 mm | 0.06 mm |

**Inspection of connecting rod**

Replace the connecting rod if it's bent, warped, or its big end cap or the outer race of its small end's shaft sleeve is loose, or any of its end has cracks.

**Connecting rod small end ID**

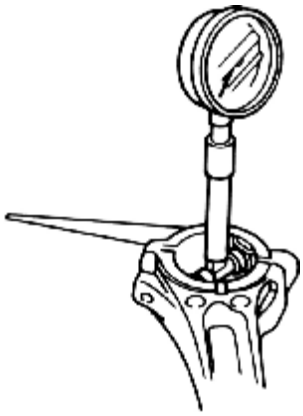
Replace the connecting rod if its small end I.D. is smaller than standard value or is out of service limit.



| Model | Standard | Service limit |
|---|---|---|
| **K 700 H – K 800 H** | 13.005 mm | 13.07 mm |

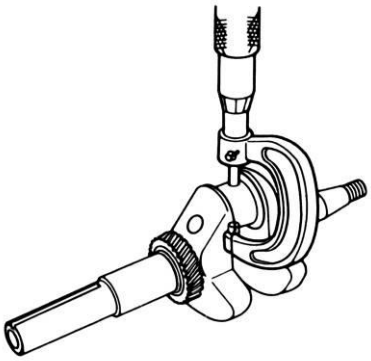
**Crankshaft pin OD**

Replace the connecting if its big end I.D. is smaller than standard value or is out of service limit.



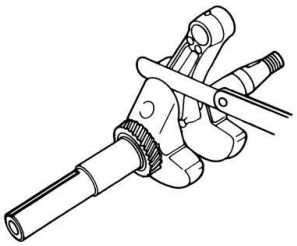
| Standard | Service limit |
|---|---|
| 30.22 mm | 30.246 mm |

**Crankshaft pin OD**



| Standard | Service limit |
|---|---|
| 30.16 mm | 30.1 mm |

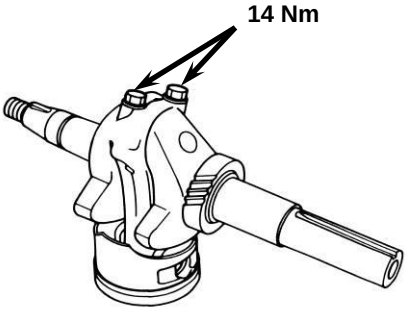
**Crankshaft pin OD**



| Standard | Service limit |
|---|---|
| 0.10 mm ~ 0.70 mm | 1.1 mm |

**Connecting rod big end oil clearance (radial)**

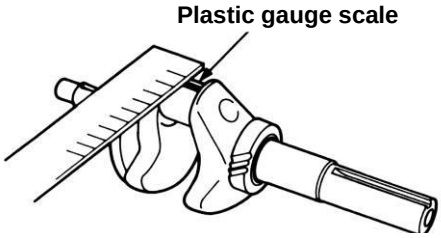
1) Clean all oil from the crankshaft neck journal and inside side.
2) Place a piece of plastic gauge on the crankshaft neck journal, assemble connecting rod, and tighten the bolts to specified torque.




**Bolt torque:** 14 Nm

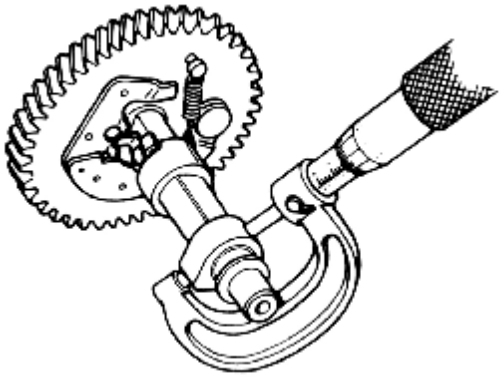
***Do not rotate the crankshaft while the tightening connecting rod bolt.***

3) Remove the connecting rod and measure the plastic gauge.



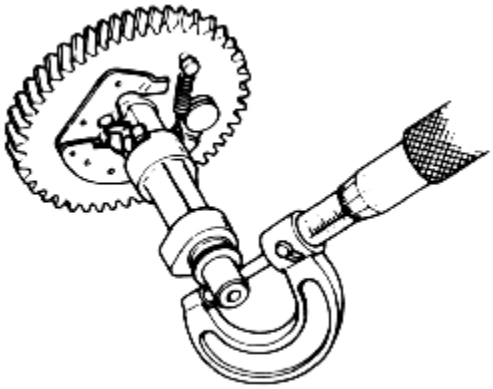

| Standard | Service limit |
|---|---|
| 0.040 mm ~ 0.063 mm | 0.12 mm |

4) If the clearance exceeds the service limit, replace the connecting rod and recheck the clearance. After using new connecting rod, the clearance still exceeds the service limit, lap the neck journal and use a connecting rod lower than standard value.



**Camshaft cam height**

| | Standard | Service limit |
|---|---|---|
| IN | 27.70 mm | Replace under 27.45 mm |
| EX | 27.75 mm | Replace under 27.50 mm |



**Camshaft OD**

| Standard | Service limit |
|---|---|
| 13.984 mm | 13.916 mm |

**Note**

***Note the location of the decompression mechanism, check to be sure it moves freely.***

**Camshaft axletree ID**

| Standard | Service limit |
|---|---|
| 14.0 mm | 14.048 mm |

### 5.2.9. Governor

## Disassembly / reassembly

**Governor nylon gear**

Assembly:
- Check the gear for no worn and damaged before assembling.
- Check if governor flyweight has been assembled before assembling crankshaft.

**Split pin**

Assembly:
- Immediately fit the split pin after assembling governor arm and move the governor arm to against the governor slider.
- Insert the straight side of the split pin into the slot of the governor arm.

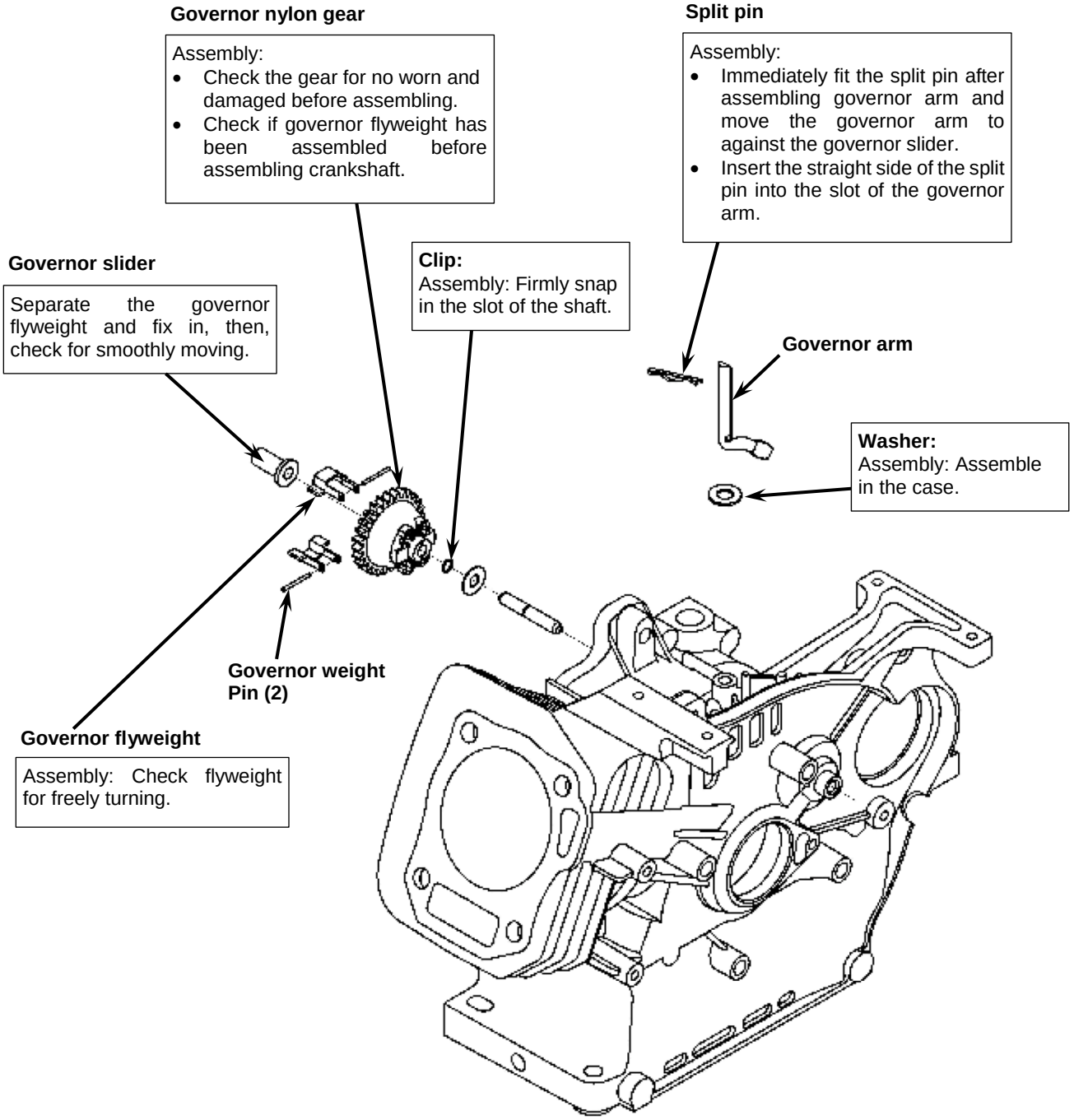
**Governor slider**

Separate the governor flyweight and fix in, then, check for smoothly moving.

**Clip:**
Assembly: Firmly snap in the slot of the shaft.

**Governor arm**

**Washer:**
Assembly: Assemble in the case.



**Governor weight Pin (2)**

**Governor flyweight**

Assembly: Check flyweight for freely turning.

Emak®

our **power**, your **passion**

**Emak S.p.A.**
42011 Bagnolo in Piano (RE) Italy
service@emak.it • www.emak.it