Kawasaki

# KF24-KF34-KF53A-KF68

## 4-stroke air-cooled gasoline engine

# WORKSHOP MANUAL

# INTRODUCTION

Kawasaki 4-stroke gasoline engine models, KF24, KF34, KF53A and KF68 are of the same basic design having the following features in common.

1. Cylinder and crankcase are single unit aluminum die cast construction with cast iron liner.
2. All models in this series, except K53A, have the crankshaft and camshaft supported by heavy duty ball bearing on both PTO end and MAG end.
   KF53A type D has the ball bearing on both ends of crankshaft and has no bearing on camshaft, whereas, type G has a ball bearing on PTO end of the camshaft.
3. Each model is available in two types.
   One is direct coupling type or "D" type which uses an extended crankshaft for driving and the other is "G" type which is 2 to 1 gear reduction model utilizing an extended camshaft for power take off.

Therefore, the procedures for assembly, disassembly and adjustment for all of these models are allmost identical.

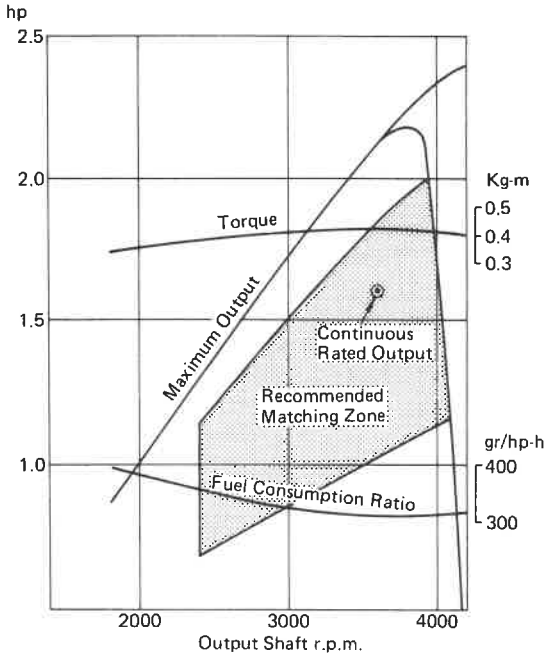
# CONTENTS

# A. GENERAL SPECIFICATIONS

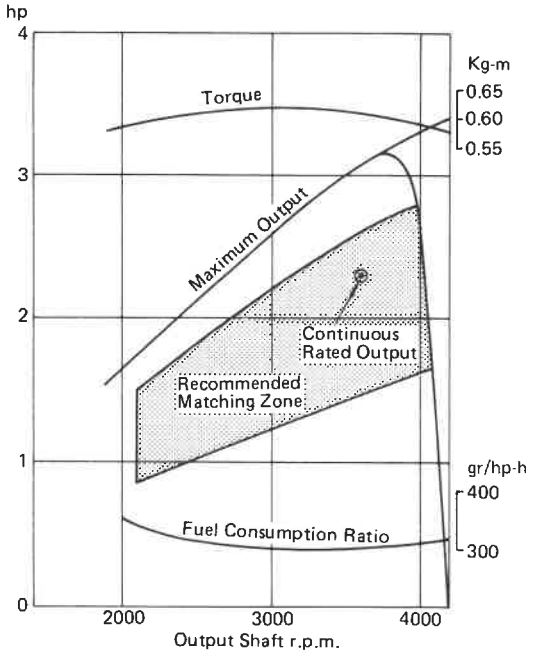
| | KF24D | KF34D | KF53D-A | KF68D |
|---|---|---|---|---|
| Engine type<br>No. of cylinders | Air-cooled, 4-stroke, horizontal shaft, gasoline engine<br>Single cylinder | | | |
| Bore x stroke | 56 x 40 mm | 60 x 47 mm | 66 x 53 mm | 74 x 60 mm |
| Displacement | 98 cc | 132 cc | 181 cc | 258 cc |
| Compression ratio | 6.4 : 1 | 6.4 : 1 | 6.4 : 1 | 6.0 : 1 |
| * Max. output | 2.3 hp/4,200 r.p.m. | 3.4 hp/4,200 r.p.m. | 5.0 hp/4,200 r.p.m. | 7.0 hp/4,000 r.p.m. |
| * Rated output | 1.6 hp/3,600 r.p.m. | 2.3 hp/3,600 r.p.m. | 3.6 hp/3,600 r.p.m. | 5.2 hp/3,600 r.p.m. |
| * Max. torque | 0.42 kg-m/3,600 r.p.m. | 0.62 kg-m/3,000 r.p.m. | 0,94 kg-m/3,000 r.p.m. | 1.35 kg-m/2,800 r.p.m. |
| Fuel consumption | 310 gr/hp-h | 300 gr/ph-h | 280 gr/hp-h | 310 gr/hp-h |
| Ignition type<br>Ignition advance angle<br>Lubrication<br>Carburetor<br>Air cleaner<br>Governor | Flywheel magneto<br>Fixed<br>Splash type<br>Float type with idle mixture adjustment<br>Dry, polyurethane foam element<br>Mechanical type | | | |
| Fuel tank capacity | 1.8 ℓ | 2.6 ℓ | 3.5 ℓ | 5.0 ℓ |
| Cylinder/crankcase<br>Main bearing | One piece aluminum alloy die-casting with cast iron sleeve<br>Ball bearing on each end of crank shaft | | | |
| Crankshaft | One piece steel forging | One piece steel forging | Cast-iron | One piece steel forging |
| Connecting rod<br>Piston<br>Piston ring<br>Intake exhaust valves<br>Valve seat<br>Method of starting<br>Rotating direction | I-beam, aluminum alloy<br>Low expansion aluminum alloy<br>Two compression rings and one oil ring<br>Heat-resisting steel forging. Stellite exhaust valve<br>Cu-Cr-Mo cast iron<br>Recoil starter<br>Counterclockwise viewed from PTO side | | | |
| Dry weight | 9.6 kg | 13 kg | 16 kg | 20.5 kg |

* These values apply to the "D" type engine only. In the case of the "G" type then:
  A) Output (hp) : Same as "D"
  B) r.p.m. : 1/2 of "D" due to reduction
  C) Torque (kg-m) : 2 times "D" due to reduction

## B. PERFORMANCE CURVES




**KF24D**

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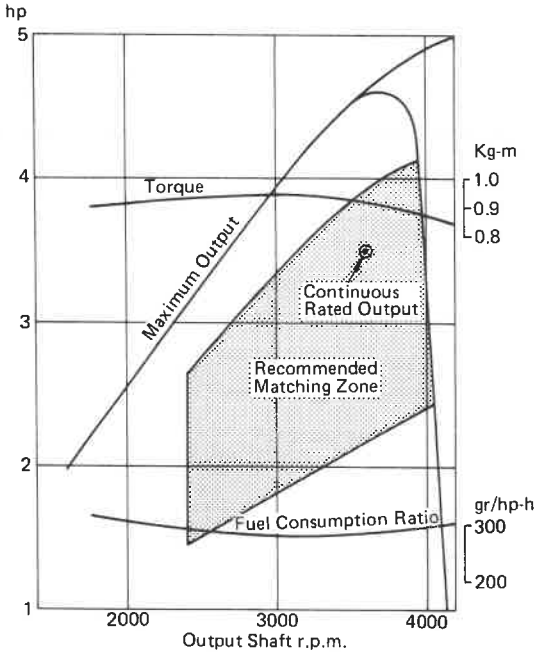


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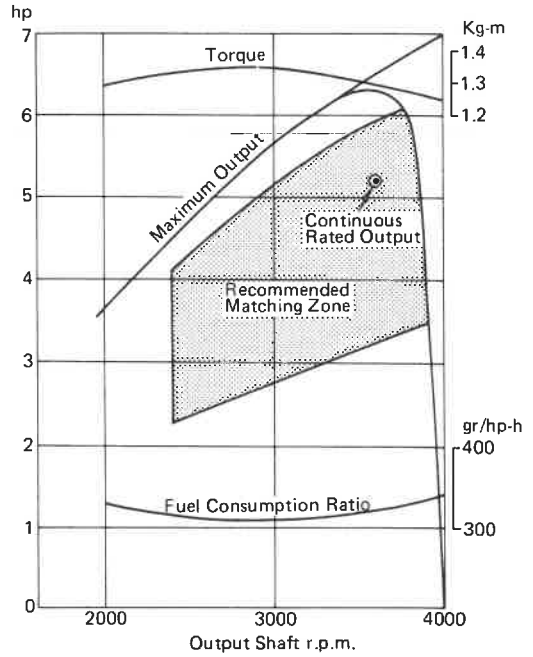
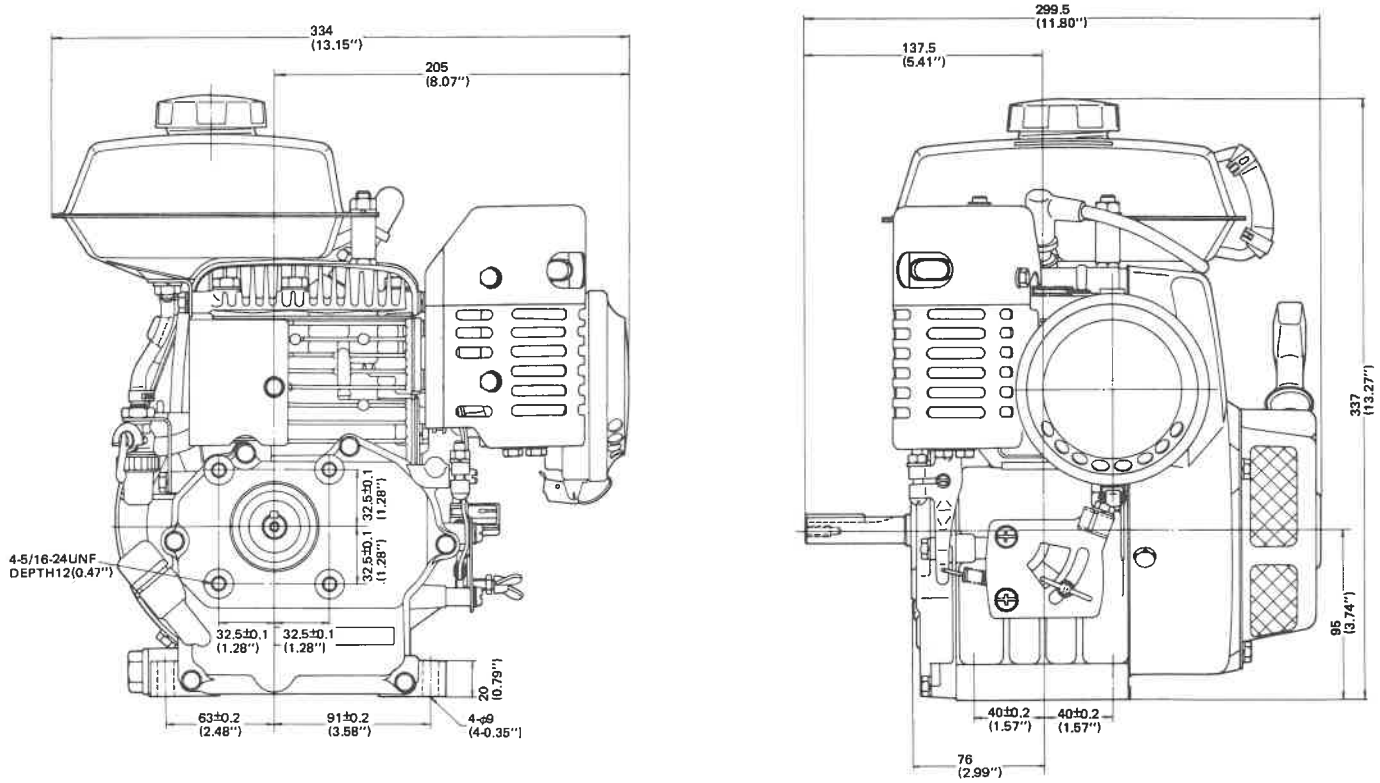



**KF68D**

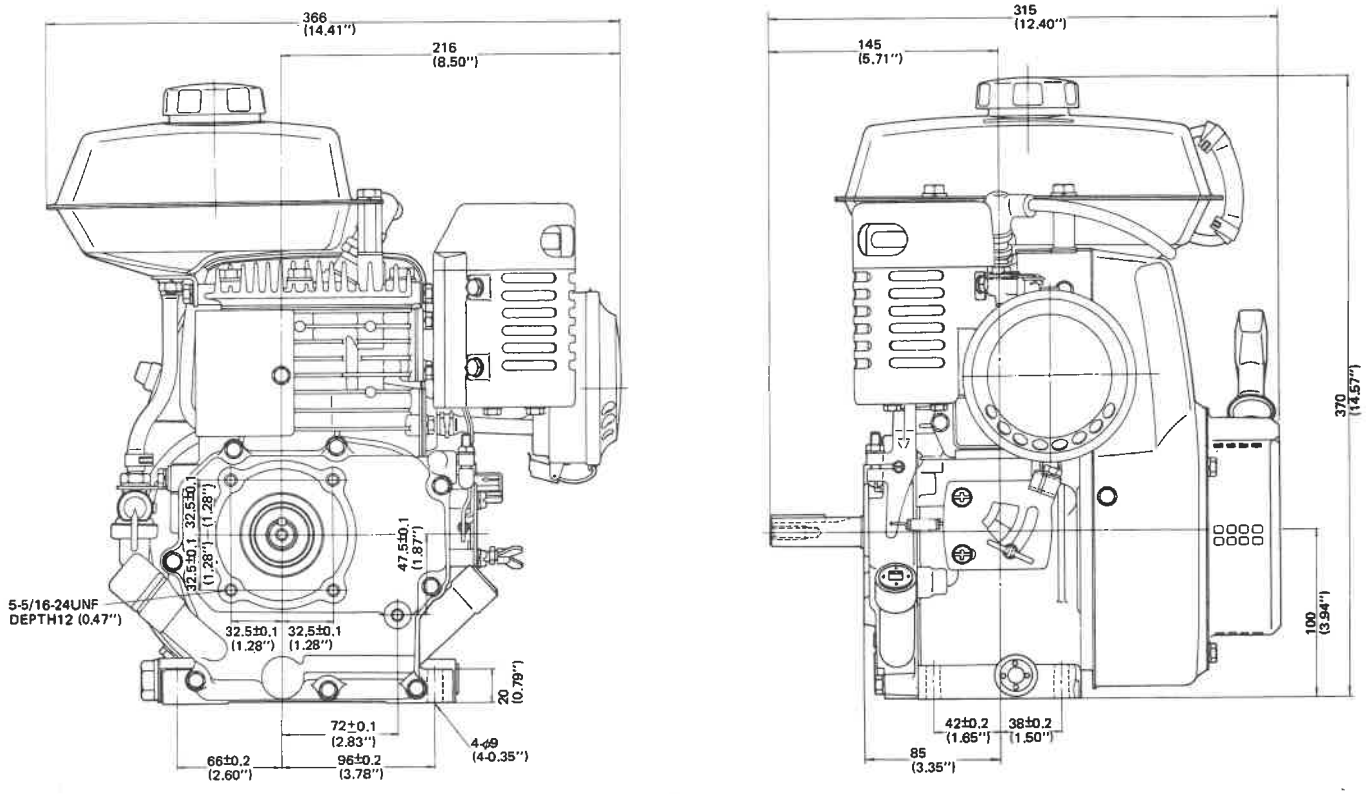
The horsepower ratings shown herein are established in accordance with Society of Automotive Engineers Code J607.
Power curves are corrected to standard conditions of sea level barometer and temperature of 15.6° C (60° F) and are developed from laboratory test engines equipped with standard air cleaner and muffler.
The "Maximum B.H.P." curve represents performance of laboratory test engines. Production engines will develop not less than 95% of the "Maximum B.H.P." when tested after run-in to reduce friction and after cleanout of combustion chamber, with valves, carburetor and ignition system adjusted to laboratory standards. Production engines when shipped, will develop not less than 85% of the "Maximum B.H.P."
Engine power will decrease 3.5% for each 305m (1,000 ft.) above sea level and 1% for each 5.6° C (10° F) above standard temperature of 15.6° C (60° F)

# C. DIMENSIONAL SPECIFICATIONS

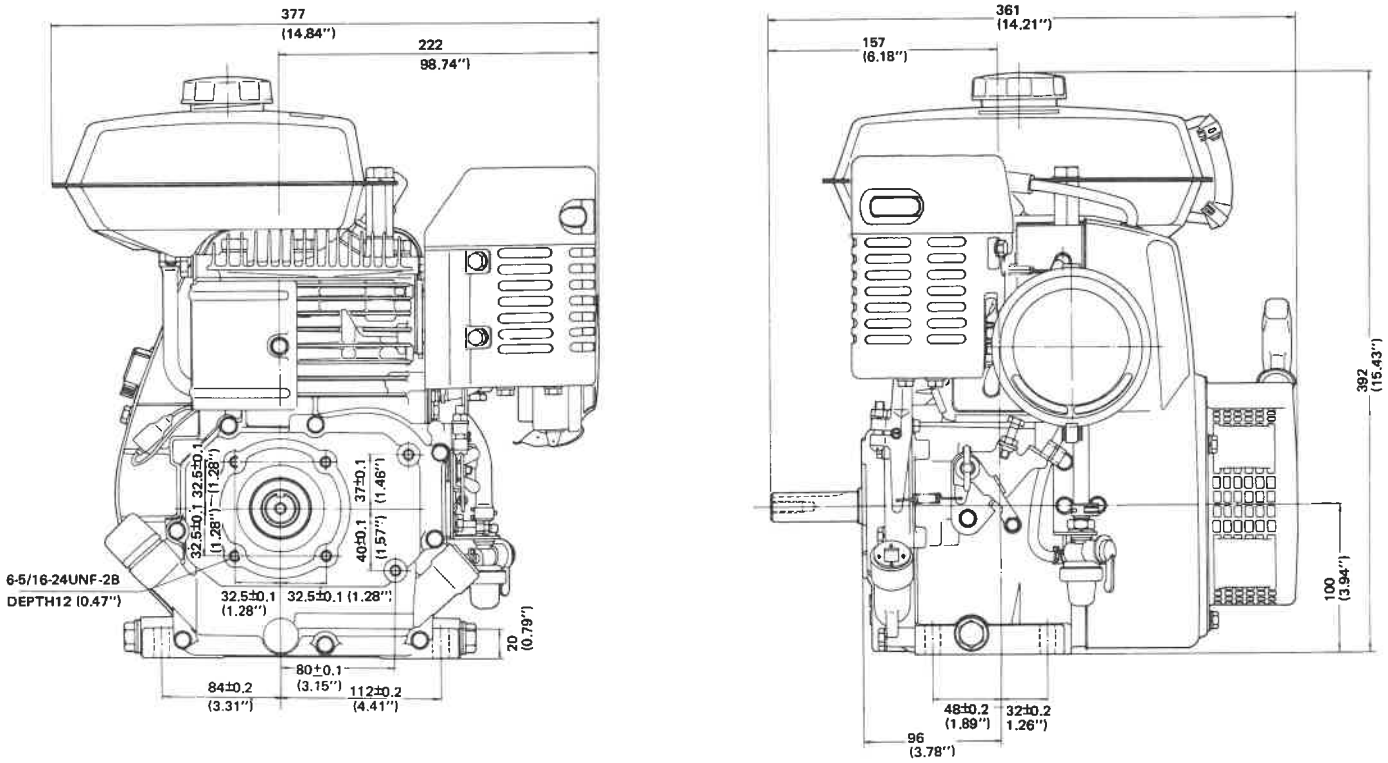
mm (inch)



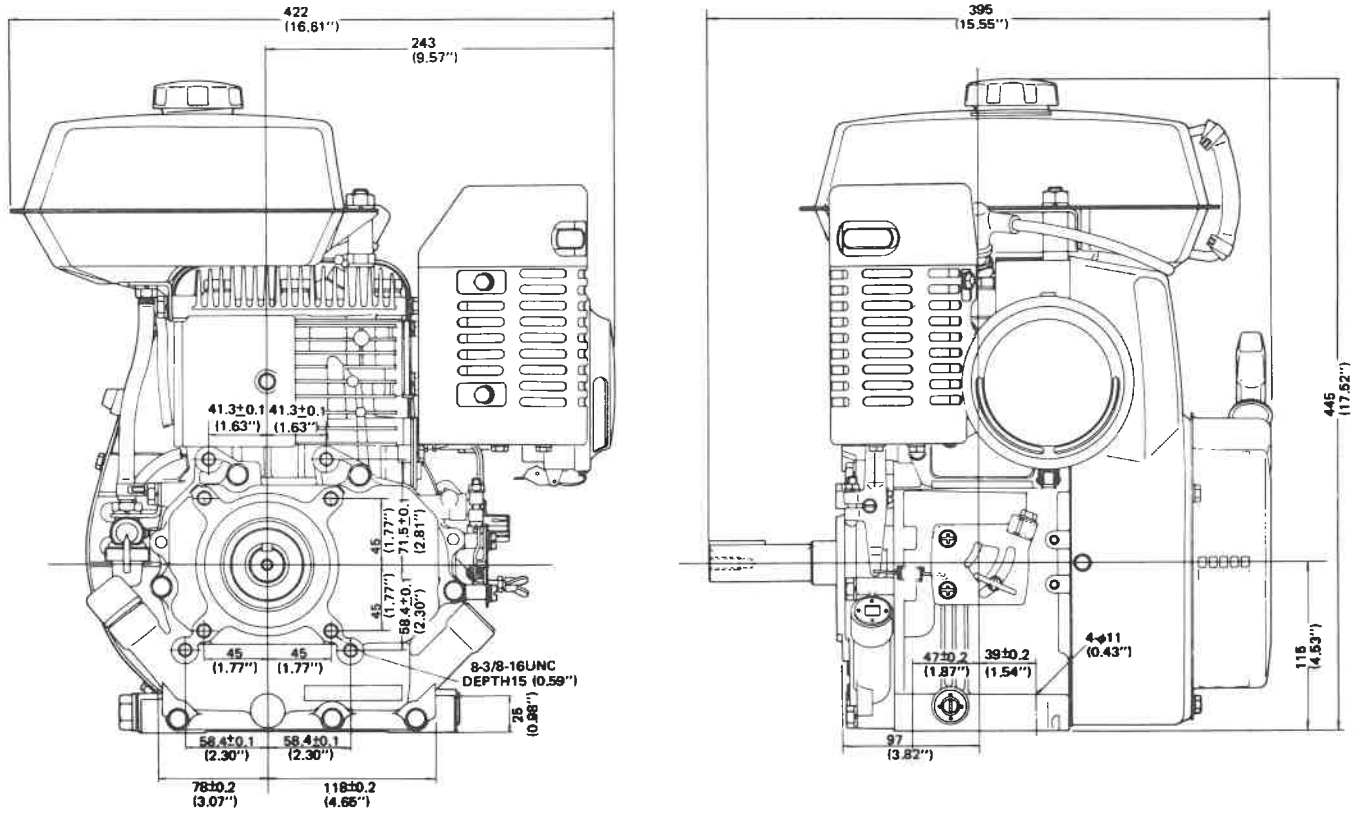

KF24D




KF34D




KF53D-A




KF68D

# D. OPERATION THEORY AND AD-JUSTMENT

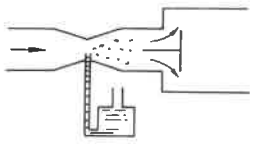
## 1 CARBURETOR

### 1-1 Carburetor Theory of Operation

The carburetor functions to atomize the fuel from the fuel line and feeds it into the cylinder as a combustible mixture.
This is a delicate functional component of high accuracy, and has the same operating principle as a sprayer. (Fig. 001)

a MAIN SYSTEM

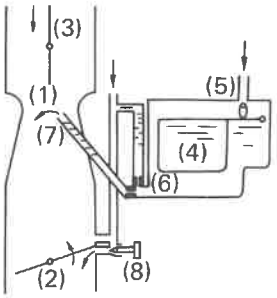
Fuel is caused to be mixed with intake air by the negative pressure in venturi when it is created during the intake stroke of piston, as shown Fig. 001. In this venturi tube, the intake air has high velocity and low static pressure, which causes fuel out of the float chamber. This fuel is atomized to fine particles by intake air of high velocity, and is drawn into the cylinder as a combustible mixture.



(Fig. 001)

b SLOW SYSTEM

In the case of low speed running without load, the horsepower required is very small, and the intake airflow required is also very slow.
The throttle valve (2) is almost closed in this state. As high negative pressure is generated on the back side of the throttle valve, the slow system is designed to suck air into this area. The air causes to draw that is sucked into this area sucks up the gasoline fuel metered precisely by the slow jet (6) and the fuel drawn is mixed with the air to be combustible mixture.
The combustible mixture is controlled by needle valve (8) and delivered into the venturi.
(Fig. 002)




(Fig. 002)

c CHOKE SYSTEM

Choke valve (3) should be closed as a rule for engine starting under low ambient temperature. As a result there is almost no air flows to venturi (1), which causes very high vacuum pressure in the venturi. Fuel is drawn into the venturi at a high rate, and highly combustible air-fuel mixture is produced. (Fig. 002)

d FLOAT SYSTEM

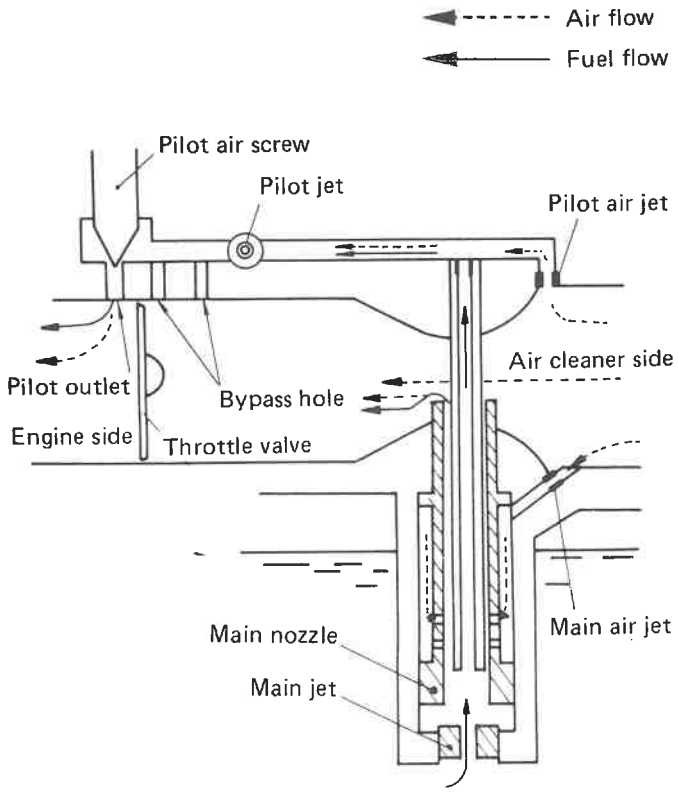
The engine will malfunction unless the fuel level in the float chamber is always kept at a predetermined level. Float (4) is floating in the float chamber, and when the fuel level rises to the fixed level, needle valve (5) closes the fuel inlet as the floating force overcomes fuel line inlet pressure. When the fuel level lowers, on the other hand, the needle valve opens per the atitude of the float and permits fuel to flow into the chamber. Thus the fuel level in the float chamber is always at a predetermined level regardless of the load being applied on engine. (Fig. 002)

### 1-2 Carburetor Structure in Practice

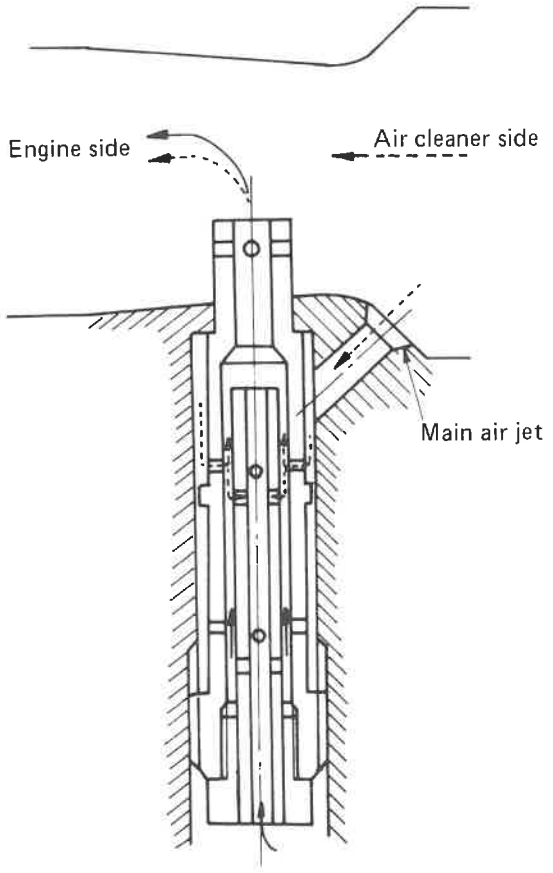
The structure and functions of carburetors used for Kawasaki engines in practice are described below.

a MAIN SYSTEM

The main system functions to supply fuel during medium and high speed running. Fuel is metered by the main jet and is drawn into the main nozzle. At the same time, the air metered by the main air jet is mixed with the fuel through the main nozzle bleed hole, causing it to foam before reaching the venturi. This fuel mixed with air bubbles is again mixed with the air in the venturi which is drawn through the air cleaner and becomes optimum air-fuel mixture.



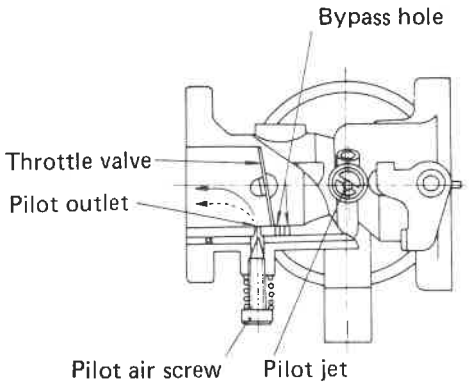

Main system diagram for KF24 (Fig. 003)

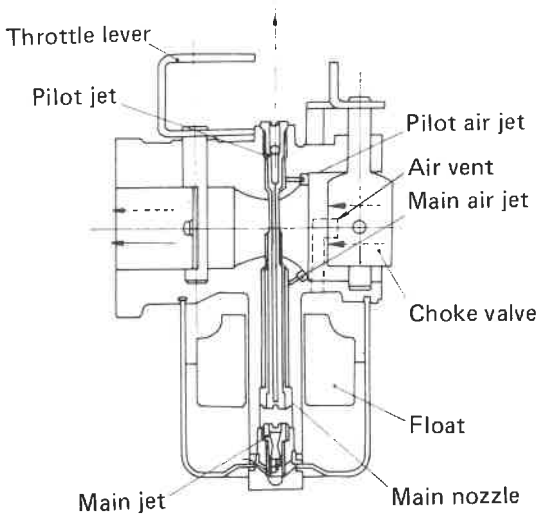



Main system diagram for KF34, 53-A, 68 (Fig. 004)

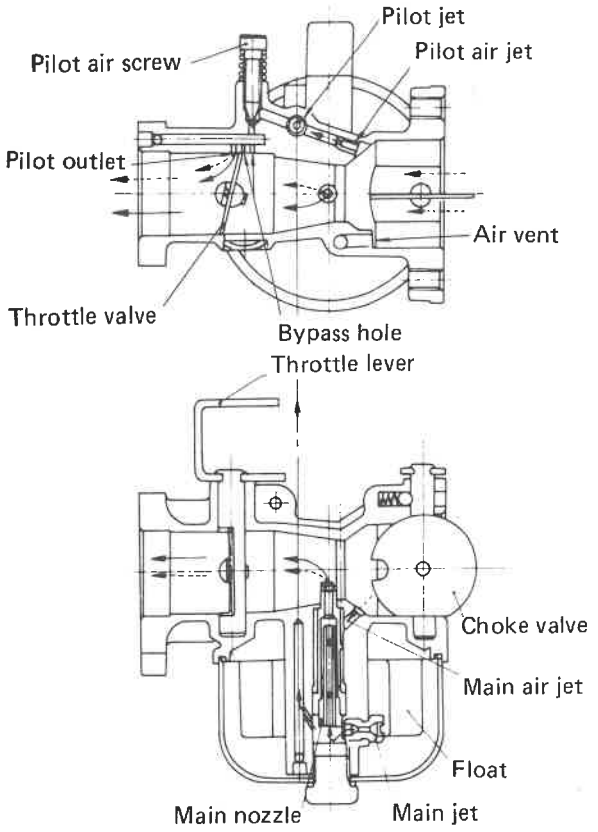
b SLOW SYSTEM

The slow system functions to supply fuel during idling and low speed running. The fuel is metered by the pilot jet and is mixed with the air which was metered by the pilot air jet. The air-fuel mixture is regulated by the pilot air screw (Needle) and is delivered through the pilot outlet and bypass. The fuel during idling is mainly supplied through the pilot outlet, and the engine RPM is adjusted by the throttle stop screw.

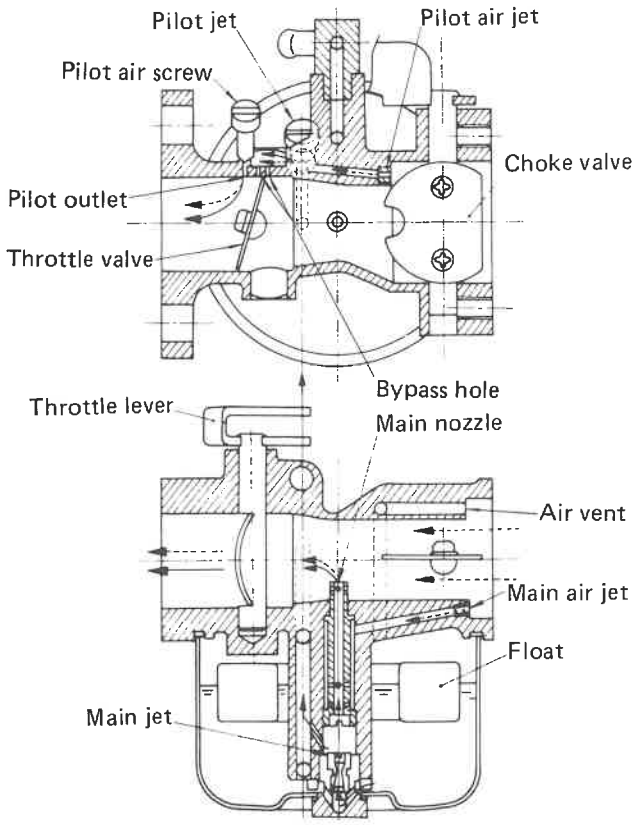



Carburetor for KF24 (Fig. 005)




Carburetor for KF34, 53-A (Fig. 006)




Carburetor for KF68 (Fig. 007)

c CHOKE SYSTEM

The choke system functions to start the engine in cold weather.
When the choke valve is closed, the negative pressure at the main nozzle increses, fuel is drawn out to the main nozzle at a high rate, and starting is facilitated.

d FLOAT SYSTEM

With the float chamber located just below the carburetor body, the float system funcitons to keep the fuel level in the float chamber at a designed level while the engine is running. The fuel enters into the float chamber from the tank through the needle valve (inlet valve). (Fig. 010) The float rises with the fuel up to the designed level and inflow of fuel is obstructed and flow is stopped by the needle activated (by the float).
Thus, fuel level is automatically kept at the predetermined constant level.

## 1-3 Carburetor Adjustment

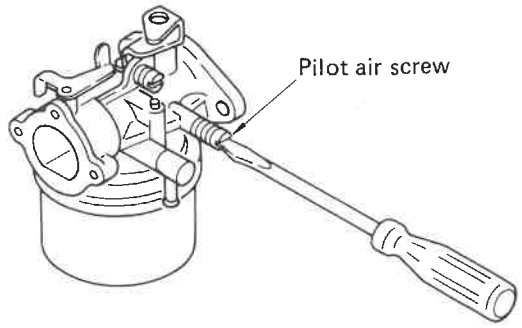
The meaning of carburetor adjustment covers adjustment of gas flow during idling, adjustment of idling speed and adjustment of fuel level in float chamber.

a IDLING ADJUSTMENT

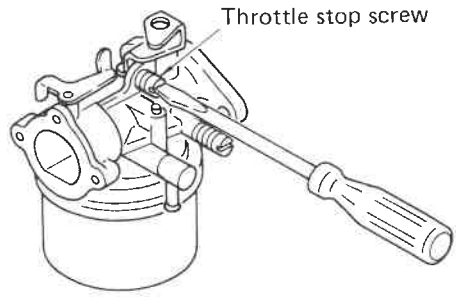
First of all, thoroughly warm up the engine.
① Reduce the engine speed to a level that is immediately before engine stop, by slowly backing off the throttle stop screw using a screwdriver.
② Search the point at which the engine speed get the highest, by slowly turning the pilot air screw in or out using a screwdriver.
③ Perform the work of step ① again.
④ Perform the work of step ② again. The airfuel mixture becomes leaner when the pilot air screw is turned in, and it becomes richer when the screw is turned out.
If rise of engine speed is not observed and if the speed decreases regardless turning of the pilot air screw in the work of step ② after a number of trials, terminate adjustment of gas flow, because the best conditions has been obtained.
⑤ Make adjustment by turning the throttle stop screw so that the idling speed may be kept at the specified level. (Fig. 008) (Fig. 009)

**(Standard value for adjustment)**

| Model | Pilot air screw back-off value | Idling R.P.M. |
|---|---|---|
| KF24 | 1 1/8 turns | 1,300 |
| KF34 | 7/8 turns | 1,200 |
| KF53-A | 6/8 turns | Carburetor 1,200/Governor 1,300 Refer to 5-2,a |
| KF68 | 1 1/8 turns | 1,300 |



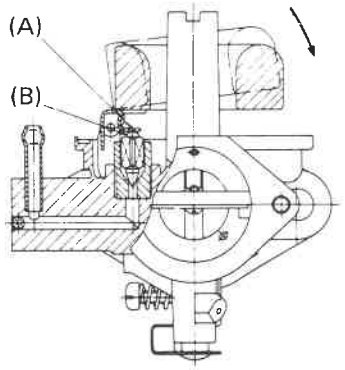

(Fig. 008)




(Fig. 009)

b FUEL LEVEL ADJUSTMENT IN FLOAT CHAMBER

Hold the carburetor, from which the float chamber has been removed, in a inverted position as shown in Fig. 010. Then lower the float in the direction shown by the arrow, and make adjustment by bending float lever (A) so that the float is level at the time when the tip of float lever (A) touches the tip of valve pin (B).




(Fig. 010)

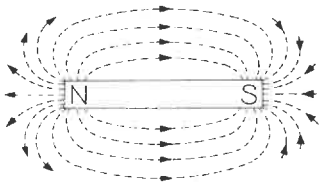
## 2 FLYWHEEL MAGNETO

### 2-1 Magneto Theory of Operation

This system is based on the theory that voltage can generated in circuit when magnetic flux is cut by the relative movement between magnet and circuit (coil), as described below in detail.

a MAGNETIC LINES OF FORCE

Invisible electricity can be expressed in the magnetic flux lines by the curve pattern drawn by iron powder placed on a magnetic field. It is considered that the flow direction of the magnetic flux line is always from "N" pole to "S" pole as a convention for learning magnetic induction and directions are indicated by adding arrow marks to magnetic flux lines as shown.



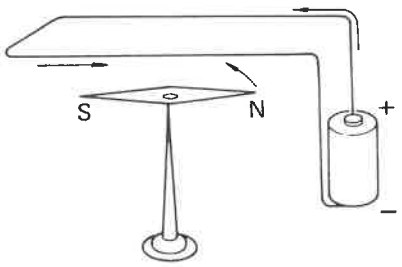

(Fig. 011)

Any region in which a magnetic substance becomes magnetized is said to be a magnetic field.

A simple experimental testing indicates the existence of the magnetic field.

As shown Fig. 12. the needle magnet rotates to get perpendicular to the wire carring electric current which generates magnetic field in the neighbourhood of the magnet.

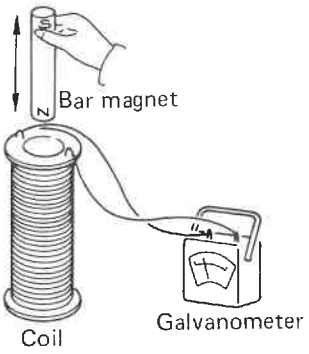
The torque being applied on the magnet is propotional to the magnitude of the current and number of wires in the field.



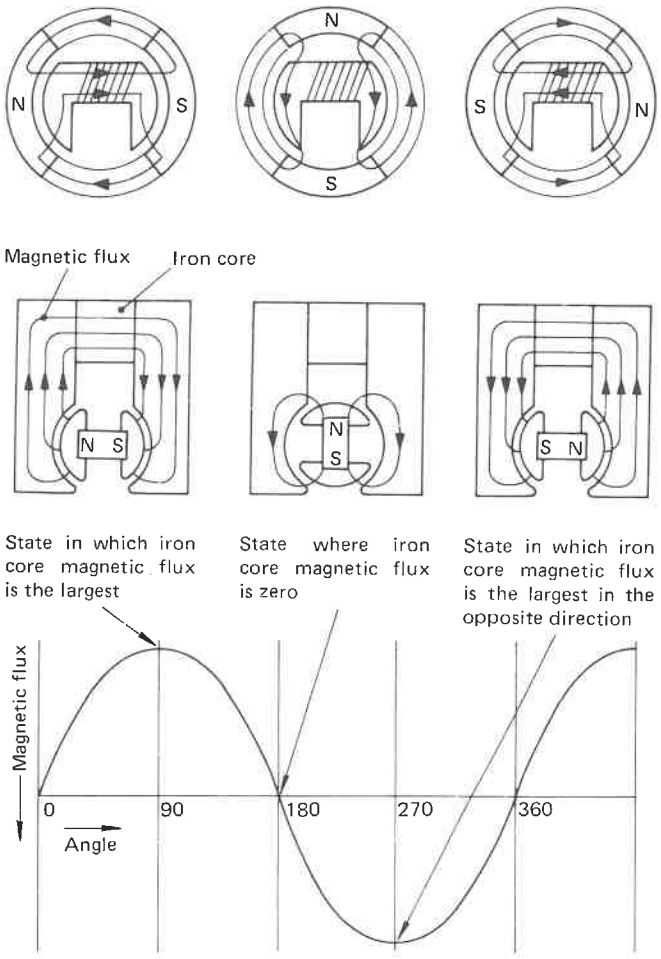

(Fig. 012)

## b MAGNETIC INDUCTION

In 1831, Faraday discovered that when a bar magnet is moved in and out of the center of a coil, electromotive force is generated in the coil and electric current flows through the coil. It is discovery of magnetic induction. The direction of the current observed by the galvanometer is opposite between the case when the bar magnet is moved into the coil and the other case where the bar is moved out of the coil. Electromotive force is generated only when magnetic flux is cut by the electrical circuit (coil). The current observed here is called induced current caused by induced voltage.
The magnitude of the induced electric power is proportional to the magnetic flux changes on coil per unit length of time. In simple expression, "electricity is generated in a coil when the motion of the magnet causes the magnetic flux cut by the coil.




(Fig. 013)



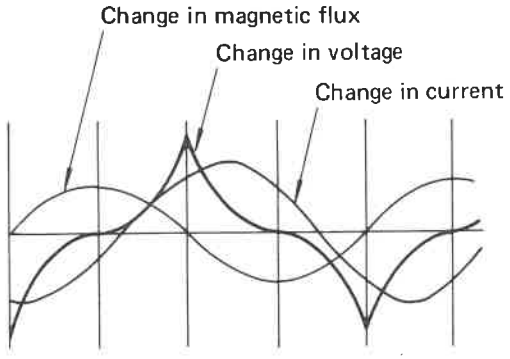

(Fig. 014)

## c CHANGES IN MAGNETIC FLUX AND POWER GENERATION

With such a magnetic circuit shown in Fig. 14, the magnetic flux change per the rotation of the magnet is represented by the curve shown in the lower part of Fig. 14. When a magnet is rotated in the neighbourhood of a coil wound over which magnetic flux passes, induced electromotive force is generated in the coil in accordance with "Faraday's law" as indicated in Fig. 013.
The magnitude of this electromotive force increases in proportion to changes of the magnetic flux per unit length of time.
The voltage induced in this coil changes like the curve of the magnetic flux, as the magnetic flux laways changes in time axis. The electric current generated in such a manner is called alternate current.

## d GENERATION OF HIGH VOLTAGE

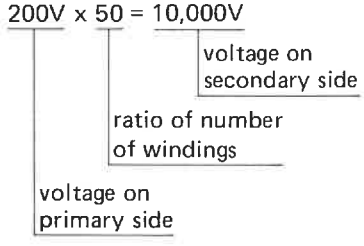
A magneto that generates sparks of high voltage cannot practically be obtained only by increasing the number of windings of the coil or by using a powerful magnet. An ignition coil and a contact breaker are required for obtaining high voltage.
When a magnet is rotated the magnetic flux in the iron core changes as shown in Fig. 015, and a voltage is induced in the primary coil of the ignition coil. When both ends of the primary coil are connected at this time, primary current flows through the primary coil and the iron core becomes an electromagnet, magnetic flux is produced as a result of flow of this primary current, and this magnetic flux is combined with the magnetic flux of the magnet itself. When the point of the contactor breaker is opened in a specified position, the primary current is interrupted, and the magnetic flux caused by the current disappears. In other words, the magnetic flux in the iron core changes drastically within a short period of time.



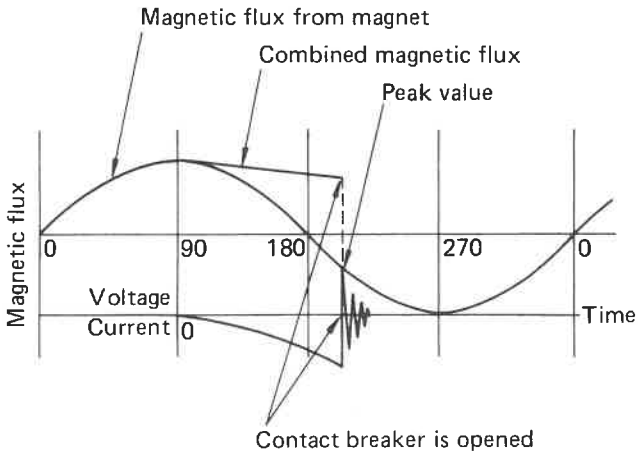

(Fig. 015)

This phenomenon is explained in detail in Fig. 016.
As the magnet rotates, the magnetic flux has the sine waveform shown in Fig. 016.
When the point of the contact breaker is closed in the position where the magnet rotated by 90° and the magnetic flux is of the maximum value, the primary coil is connected, the primary current flows through the coil and gradually increases.
At this occasion, magnetic flux produced by the flow of primary current is combined with the magnetic flux from magnet, and combined magnetic flux has the trend shown in Fig. 016.
When the point of the contact breaker is opened at point (C) when the primary current is sufficiently high, the primary current through the coil is interrupted.
This flux change is drastic enough in short period of time to generate a couple hundred volt in the primary.

A voltage of the similar waveform is generated in the secondary coil wound over the primary. The peak value of the voltage is determined by the ratio of number of windings between the primary coil and the secondary coil.
When the ratio of number of windings is 50 (number of primary coil windinga 200, number of secondary coil windings 10,000), for instance, if the voltage generated in the primary coil is 200V, the voltage generated on the secondary coil is as follows.




It is possible to momentarily break the primary current by the contact breaker point by the assistance of a condenser. Without help of this condenser, an arc over the point gap will cause point damage.
In addition, slow changes of both current and magnetic flux, without the condensor, causes in sufficient voltage rise in secondary for ignition.




(Fig. 016)

## 2-2 Flywheel magneto structure in general

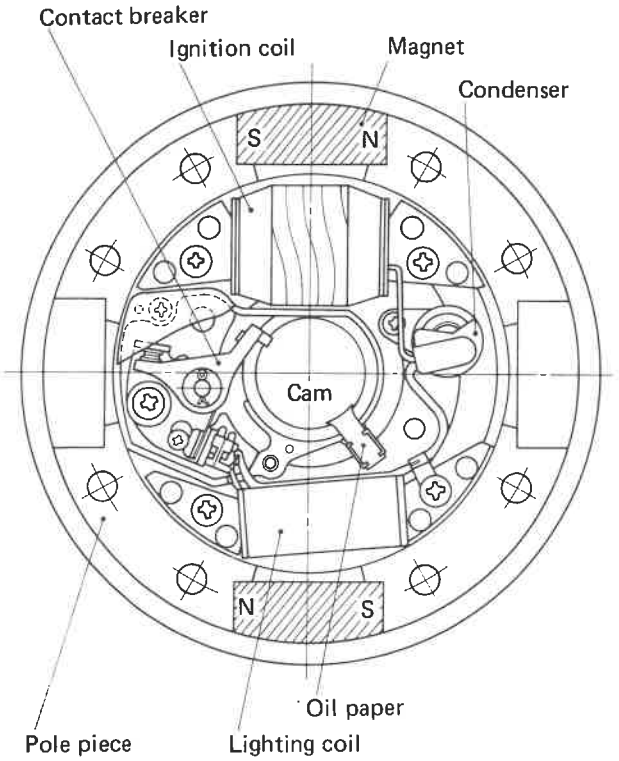
A flywheel magneto can be generally divided into the rotor (magneto can be generally divided into the rotor (magnet and magnetic poles) and stator (ignition coil or power supply coil for inginition coil, contact breaker, condesner, etc.).

### 2-2-1 Rotor (Flywheel)

The rotor is usually called a flywheel. In the case where two or more magnets are used, they are securely installed mechanically or molded on together with plastic or adhered on the flywheel.
The blowerfins for engine cooling is usualy integrated with this flywheel.

### 2-2-2 Stator

Coils wound on laminated iron cores made of silicon steel sheets are mounted to a base made of aluminium alloy or directly to the crankcase, and the contact breaker points, condenser, oil pregnant felt (for lubrication to cam) and so forth are also attached. This unit is called the stator assy.

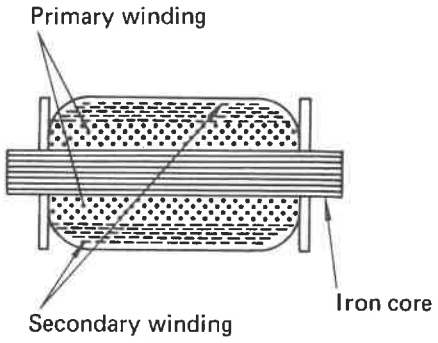



NOTE:
The magneto construction shown above is typical and different in detail from actual magneto used on each model.

(Fig. 017)

a IGNITION COIL

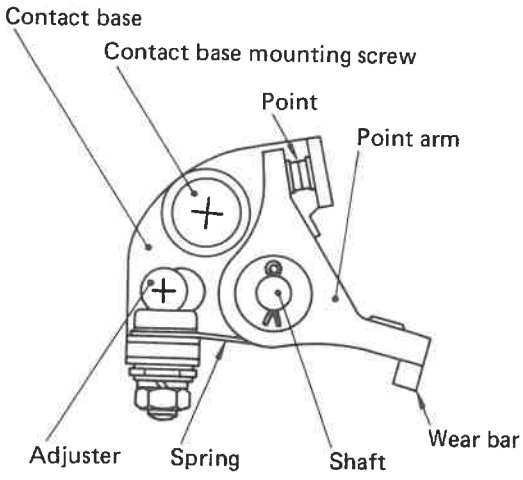
Fig. 018 is a cross sectional view of a typical ignition coil. The primary coil construction consists of 220 ~ 240 turns of 0.4 ~ 0.6 mm diameter wire over the laminated core made of silicon steel sheets with each layer having an insulation treatment.
A secondary coil is then wound over the primary, consisting of 10,000 ~ 21,000 turns of 0.05 ~ 0.07 mm diameter copper wire in the same manner as the primary.
This assembly is then inslation threated by immersing in insulation varnish.
After the immersion, electric drying process is applied in repeated cycles to insure that all the layered section and peripery can adequately withstand the generation of high voltage.
A final coating of polyester or epiforam is applied to futher increase the water resistance of the coil suface.
Recently, it is common to have ignition system where the coils are mounted on crankcase at the outside periphery or the flyhweel.
This is to reduce the coil's exposure to engine heat.




(Fig. 018)

b CONTACT BREAKER

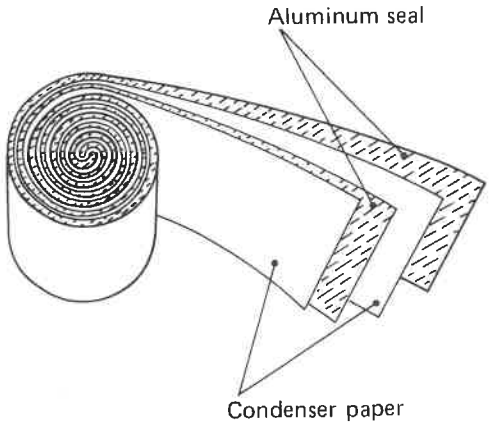
The contact breaker is the component that makes and breaks the primary circuit in conjunction with changes of magnetic flux from rotating magnet and allows proper current to the primary coil.
It is composed of a movable breaker arm connected to the point base, a wear bar, a spring, stationary point etc. so shown Fig. 019.
The point arm is equipped with wear bar made of bakelite or other plastic at one end and with a point tip at another end. It is electrically insulated from the base board and is opened and closed by a cam on the crankshaft.
The point contact tips are made of tungsten which is strong both mechanically and electrically.
But, because of inevitable wear of the point for long range use, the point gap changes accordingly, cuasing ingition timing change. Therefore, this compornent is designed to alow easy point gap adjustment.




(Fig. 019)

c CONDENSOR

Condensor is a component which consists of 2 conductors insulated from each other by dielectric (condensor paper) as shown Fig. 020. Terminals are attached to the conductors and the unit is insulated and hermetically sealed in a case.
The condensor introduces capacitance into circuit, stores electrical energy, blocks direct current and permits the flow of alternate current to a certain digree dependant on it's capacitance and the frequency of the current. Condensor capacitance is expressed in micro-farads ($\mu$F) and the typical capacitance for the magneto is in the range of 0.2 ~ 0.35$\mu$F.




(Fig. 020)

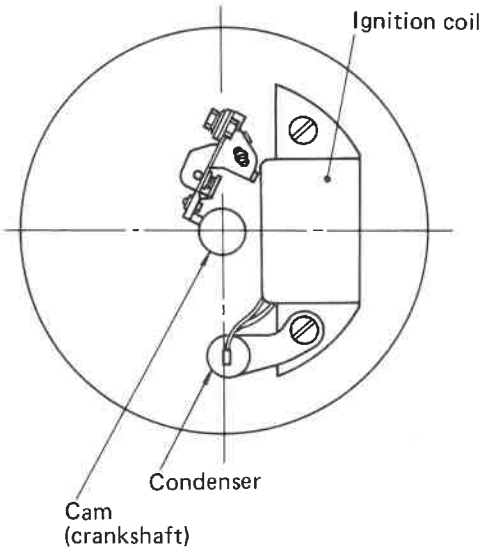
## 2-3 Flywheel Magneto Adjustment

Ignition should occur in the combustion chamber at the optimum crank angle. This relation ship between spark and crank angle is a function of the magneto refered to as ignition timing.
Optimum crank angle is predetermined at the factory and is indicated by marks on the cramkcase and flywheel. These marks are to be aligned and the points of the breaker to be adjusted so they just begin to open at this angle. Another important factor to ignition timing is point gap, which should be set at 0.3 ~ 0.4mm. This gap is important because proper spark angle cannot be produced without the point gap that is correctly adjusted.

a ADJUSTMENT OF IGNITION TIMING IN PRACTICE

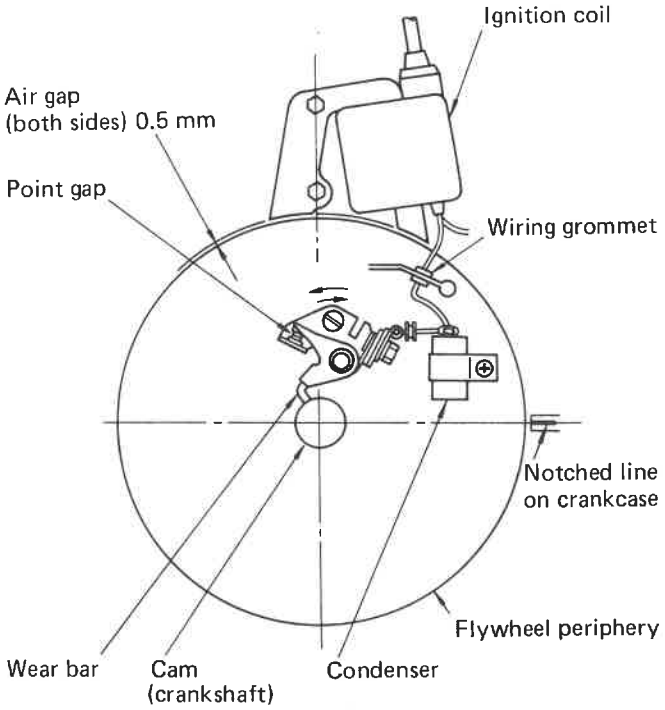
Kawasaki engines of the series ranging from KF24 to KF68 are categorized into two different types by the ignition coil mounting position. That, "internal coil type" (KF24, KF34, KF68) with which the ignition coil is mounted inside of the flywheel, and "external coil type" (KF53-A) with which the ignition coil is mounted outside of the flywheel.

The method of adjustment is the same for both, and adjusting procedures are described below.




Internal coil type

(Fig. 021)




External coil type

(Fig. 022)

Remove the recoil starter and the spiral case, and then remove the flywheel and point cover.

① ADJUSTMENT OF IGNITION TIMING

- First of all, place the crankshaft in the crank angle of the ignition timing specified for each model.
  For this purpose, push the flywheel key into the keyway in the crankshaft. Then, while putting this key through the keyway, temporarily fit the flywheel to the crankshaft. Then, pay attention to the motion of notched line P located along the circumference of the flywheel while slowly turning the flywheel by both hands in the normal direction. Stop turning of the flywheel at the time when notched line P is aligned with the notched line on the engine block side, and keep this alignment. Then remove the flywheel with care from crankshaft keeping those lines aligned.

- Adjust the contact breaker so they just begin to open at this position.
  To do this, loosen the contact breaker screw so that the breaker plate may be moved but tight enough to maintain a slight friction for adjustment.
  Then make adjustment by prying the pry point of the breaker arm with the tip of a screwdriver. Then, firmly tighten the breaker plate.
  It is recommended that a circuit tester be used for correctly determining beginning of opening of the breader point. Set the selector in RX1 position, touch the black lead from the condenser by one test lead and touch the engine body by another test lead, and observe the swing of the pointer (needle) of the tester. The moment at which the pointer swings is the timing of start of opening.

② MAXIMUM POINT GAP CHECK

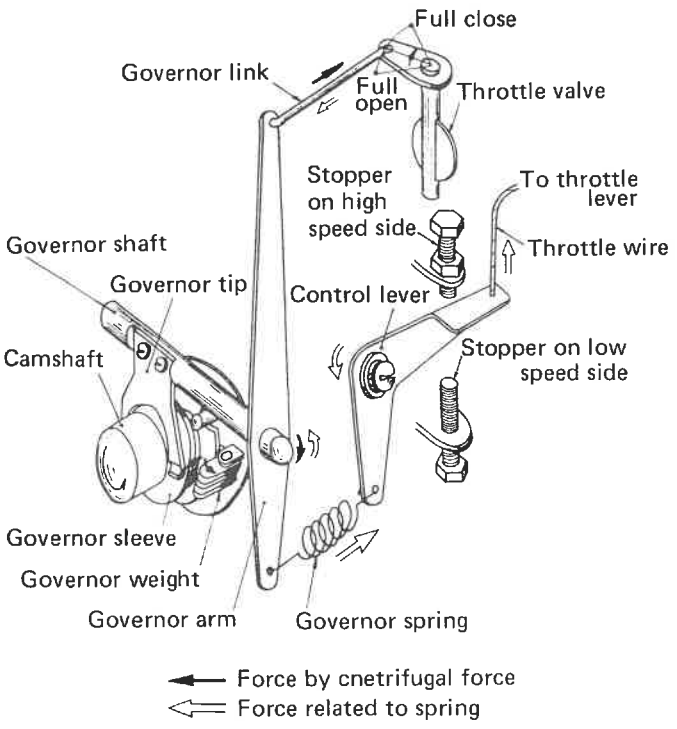
Pay attention to the change in the point gap while slowly turning the crankshaft in normal direction. Stop the crankshaft at the point at which the point gap is the maximum, and measure the gap by using a feeler gauge.
Max. point gap: 0.3 ~ 0.4 mm

## 3 SPEED GOVERNOR

If carburetor throttle valve opening is fixed, the engine R.P.M. is sensitive to the load applied on the engine. The R.P.M. drops as the load increases. In order to keep the engine R.P.M. constant for various load, it is necessary to manually regulate the carburetor throttle valve opening in correspondence to the load. If a job required frequent load variation, it is impossible for the operator to regulate the throttle valve manually.
Therefore, a device which regulates the thottle valve in correspondence to load variation is required. The speed governor is a device having this function. Speed governors are generally available in two types. One is the mechanical type which utilize centrigugal force of a weights attached to a rotating shaft, and the other is a wind pressure type which uses the wind pressure from the engine cooling air. Mechanical type which functions with higher degree of accuracy and is always used for high quality general-purpose engines.
With a speed govenor of the mechanical type, the engine R.P.M. is controlled by the centrifugal force of weights against a spring loaded control arm.
Because of necessity of changing the engine R.P.M. in correspondence to changes in load conditions devices are provided with adjustability of the spring tension. Therefore, a mechanical type speed governor is called an all speed governor. All governors used by Kawasaki on the KF series are the mechanical type.

### 3-1 Governor Theory of Operation

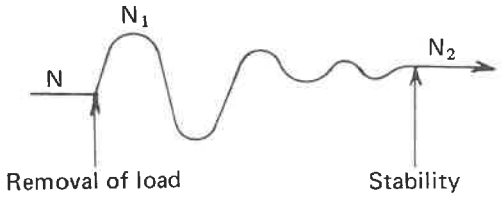
Centrifugal force that corresponds to the engine revolution is applied to the governor weight mounted to the camshaft or the crankshaft.
This force is transmitted to the carburetor throttle valve through governor sleeve, governor tip, governor shaft, governor arm and governor link which acts in the direction to close the throttle valve.
On the other hand, there is a governor spring that acts in the direction to open the throttle valve, and the throttle valve opening is stabilized at the point where the tension of this spring and the centrifugal force of the governor weight are balanced.
The governor spring is connected to the control lever and its tension can be changed by the throttle lever. The range of motion of the control lever is restricted by the stoppers so that the engine revolution will not rise or drop beyong predetermined limits. Therefore, it is possible for the operator to safely run the engine by adjusting the control lever only.
Fig. 023 schematically indicates the structure of an all speed governor. All engine models are equipped with governors of the same operating principle and mechanism.




(Fig. 023)

In the case where the load is suddenly removed from the engine which has been running under a centain load condition, the engine R.P.M. fluctuates as shown in Fig. 24, and becomes stabilized after a certain length of time.

R.P.M. in loaded state ..... N
R.P.M. immediately after removal of load . $N_1$
R.P.M. after stabilized ..... $N_2$




(Fig. 024)

In the case where various revolution values are expressed as indicated above, the efficiency of a speed governor can be expressed by the following values.

Momentary speed fuluctuation (%)

$$= \frac{N_1 - N}{N} \times 100$$

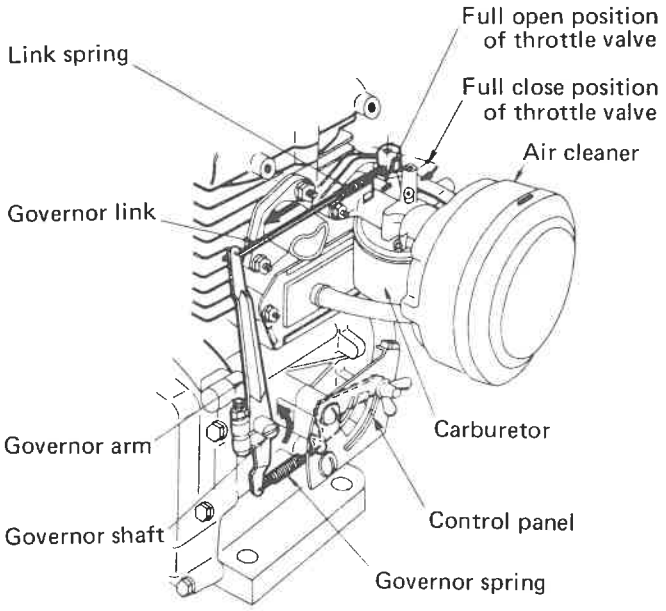
Stabilized speed fluctuation ratio (%)

$$= \frac{N_2 - N}{N} \times 100$$

### 3-2 Adjustment of Speed Governor Mechanism

Whenever the engine was reassembled, adjustment of the governor mechanism is always required. The eigine will not run satisfactory until this adjustment is correctly made.

a Loosen the bolt that holds the governor arm to the governor shaft.
b Push the governor arm end (place where one end of the link is attached) by hand so that the carburetor throttle valve is fully opened.
c Fully turn the governor shaft counterclockwise.
d Tighten the governor arm to the governor shaft while maintaining the state of paragraphs b and c above.




(Fig. 025)

## 4 VALVE CLEARANCE

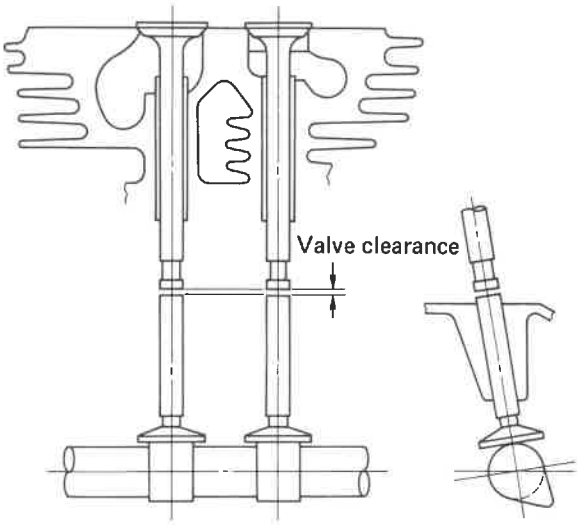
Both the intake and exhaust valves must be firmly seated to the valve seats.

In order to satisfy this requirement, a certain clearance should be maintained between the valve stem end and the tappet while each valve is closed. This is what is called valve clearance.

If there is no valve clearance, the valve may hang open slightly allowing leakage on the compression stroke.

If the valve on the exhaust side leaks sufficient compression is lost and accordingly, difficulty of starting and output drop will occur.

If the valve on the intake side leaks, there is a possibility of problems such as blow-back of combustion gas to the carburetor in addition to the problems stated above.




(Fig. 026)

a MEASUREMENT OF VALVE CLEARANCE

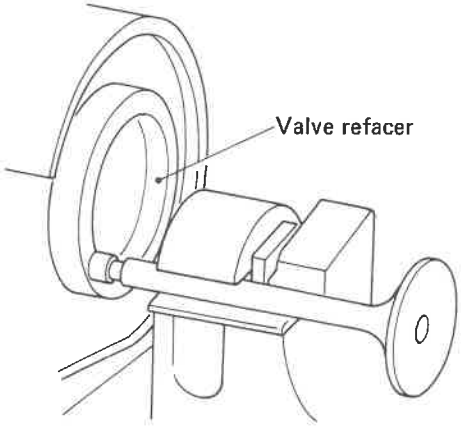
Measure the valve clearance **when the engine is cold** and with the piston located in **at the top dead center of the compression stroke.**

| Model | Intake | Exhaust |
|---|---|---|
| KF24 | 0.22 ± 0.12 mm | 0.22 ± 0.12 mm |
| KF34 | 0.22 ± 0.12 mm | 0.22 ± 0.12 mm |
| KF53-A | 0.15 ± 0.03 mm | 0.22 ± 0.12 mm |
| KF68 | 0.15 ± 0.03 mm | 0.22 ± 0.12 mm |

b ADJUSTMENT OF VALVE CLEARANCE

For the series of Kawasaki engine models KF-24, KF34, KF53-A and KF68, no shims are required for adjustment of valve clearance. However, there is such a trend that, as the engine is used for a long time, wear to valve seats make gradual advancement, and as a result, normal valve clearances which were set at the beginning are reduced.

In such a case, adjust valve clearances to normal values by refacing valve stem ends as shown in Fig. 027.




(Fig. 027)

## 5 REGULATION OF ENGINE R.P.M.

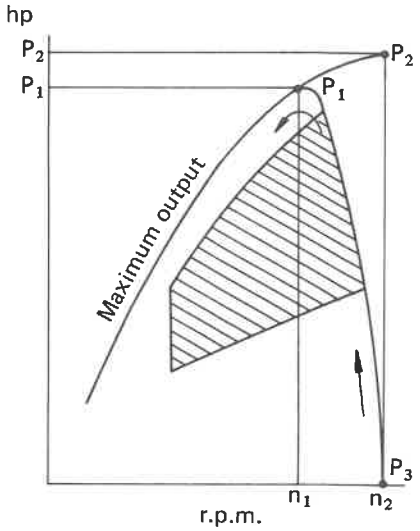
The idle R.P.M. and maximum R.P.M. of engine are important and must be adjusted, so the engine will idle smoothly and not be damaged by over revolution. The adjustment of maximum R.P.M. is particularly important.

In reference to Fig. 028, this graph shows the output characteristics in relationship to maximum R.P.M. under no load and full load. The point $P_3$ indicates max. no load R.P.M. As load is gradually applied to the engine, the governor will sense the decrease in R.P.M. and begin to open the throttle to offset the load until a full open throttle point $P_1$ is reached. The point $P_1$ represents the maximum output available from the engine while under the governor control.

The point $P_2$ indicates maximum output from the engine without governor control.

In matching a specific engine to a product, it is the most important to consider the load that will be applied to the engine.

In other words, engine should be selected so that the matching point with the load required may fall in the shaded zone as shown in Fig. 028.




(Fig. 028)

### 5-1 Models KF24, KF34, KF68

a IDLING ADJUSTMENT

- Loosen the speed control knob and set it at the idle position.
- To obtain the proper idling R.P.M. adjust the throttle stop screw in or out while pushing the throttle lever towards the closed position and making it contact with the stop screw.

(Fig. 029)

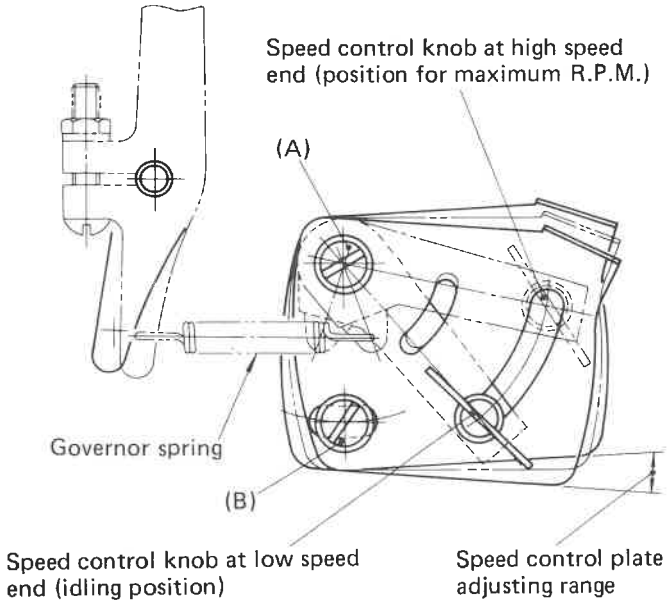
| Model | Idling R.P.M. |
|---|---|
| KF24 | 1300 |
| KF34 | 1200 |
| KF68 | 1300 |

b SETTING OF MAXIMUM R.P.M. (NO LOAD)

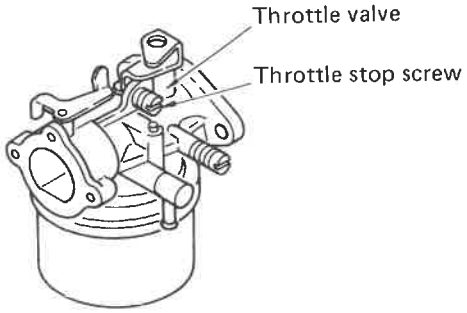
- Set the speed control knob in the position where it was fully turned to the high speed end.
- Adjust the maximum R.P.M. to the specified level by moving the speed control panel around (A) as a center using the oval hole in area (B).

(Fig. 029)

| Model | Maximum R.P.M. |
|---|---|
| KF24 | 4200 |
| KF34 | 4200 |
| KF68 | 4000 |




(Fig. 029)




(Fig. 030)

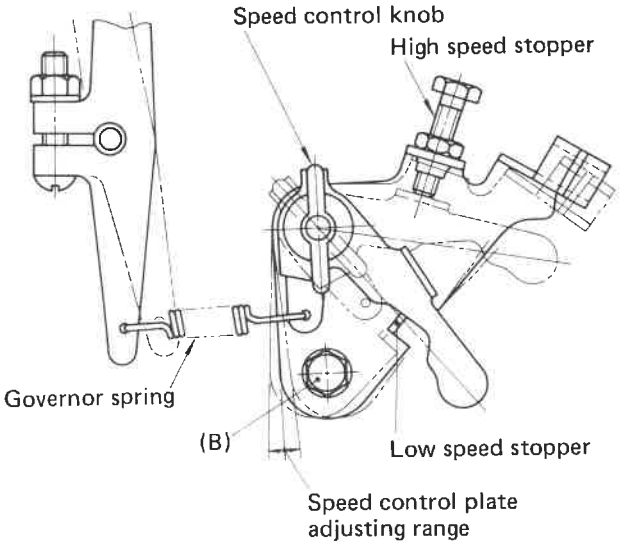
## 5-2 Model KF-53-A

a IDLING ADJUSTMENT

- Move the speed control lever to the idle position.
- Adjust the throttle stop screw in or out while posling the throttle lever towards the closed position and making it contact with the stop screw.
  Carburetor setting-Idling R.P.M.; 1200
- Make ajustment so that the specified idling revolution is obtained, by making use of the oval hole in area (B) of the speed control plate.
  Governor setting-Idling R.P.M.; 1300

b SETTING OF MAXIMUM R.P.M. (NO LOAD)

Adjust the maximum revolution without load to the specified value by means of the high speed stopper. Tighten the stopper in position by the lock nut on completion of adjustment.
Maximum R.P.M.; 4200

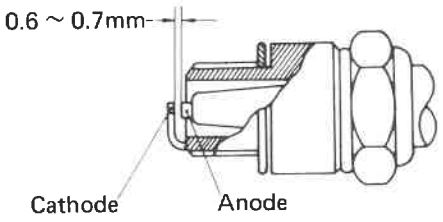



(Fig. 031)

## 6 SPARK PLUG GAP

Carbon contamination around electrodes area can be brushed off and plug gap is to be adjusted to the specified ones listed below as required, bending the tip of cathode.

| Model | Spark plug model | Standard plug gap |
|---|---|---|
| KF24 | NGK B-6HS | 0.6 ~ 0.7 mm |
| KF34 | NGK B-6S | 0.6 ~ 0.7 mm |
| KF53-A | NGK B-6HS | 0.6 ~ 0.7 mm |
| KF68 | NGK B-6S | 0.6 ~ 0.7 mm |




(Fig. 032)

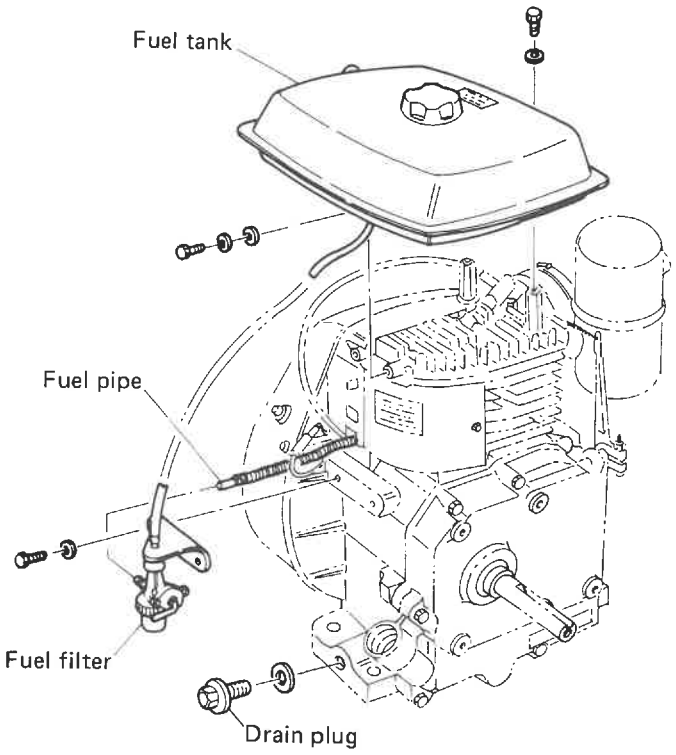
# E. DISASSEMBLY AND ASSEMBLY

## 1 DISASSEMBLY PROCEDURE

### 1-1 Fuel Tank and Fuel Filter

- Drain the engine oil with the drain plug removed.
  **Check for oil detrioration for presence of metal powder in particular.**
- Set the fuel filter lever in "STOP" position, and disconnect the fuel tube from the fuel filter.
- Remove filter bracket bolts, and remove the fuel filter from the crankcase.
  **Check for presence of water in the filter.**
- Remove fuel tank mounting bolts, and remove the fuel tank.
  Tool to be used

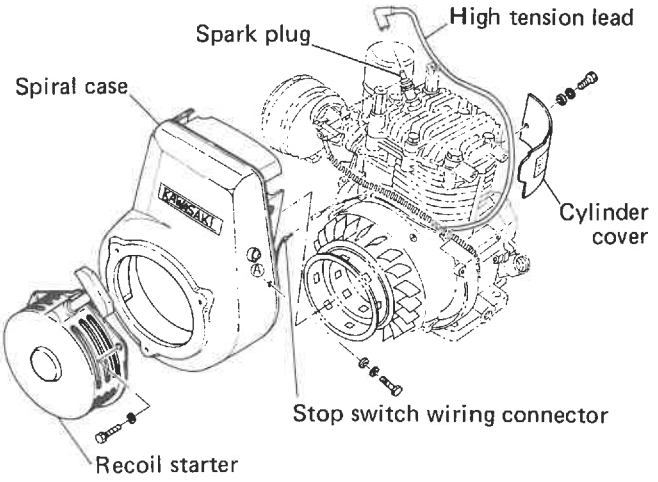
| | |
|---|---|
| KF24, KF34 | 10 socket wrench |
| | 13 socket wrench |
| KF53-A | 13 socket wrench |
| | 14 socket wrench |
| KF68 | 13 socket wrench |
| | 17 socket wrench |




(Fig. 033)

### 1-2 Spiral Case

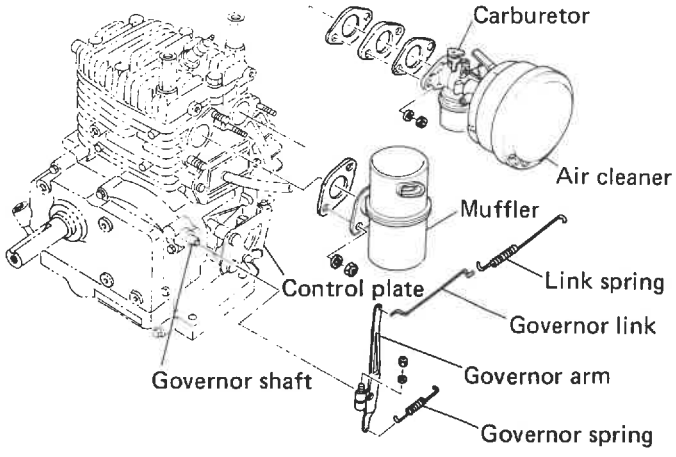
- Remove the recoil starter.
- Disconnect the wiring to the stop switch at the connector.
- Disconnect the high tension cord from the spark plug.
- Remove the spiral case.
- Remove the cylinder cover.
  Tools to be used
  All models ..... 10 socket wrench




(Fig. 034)

### 1-3 Muffler and Carburetor

- Remove muffler's flange nuts, and remove the muffler.
- Remove carburetor's flange nuts, and remove the carburetor.
  **Remove the governor link and link spring connected to carburetor throttle valve at the same time with care to avoid any damage.**
- Loosen the lock nut, and remove the governor arm.
- Remove the speed control plate, if required.
  Tools to be used
  All models ..... Screwdriver
  KF53-A ..... 13 spanner



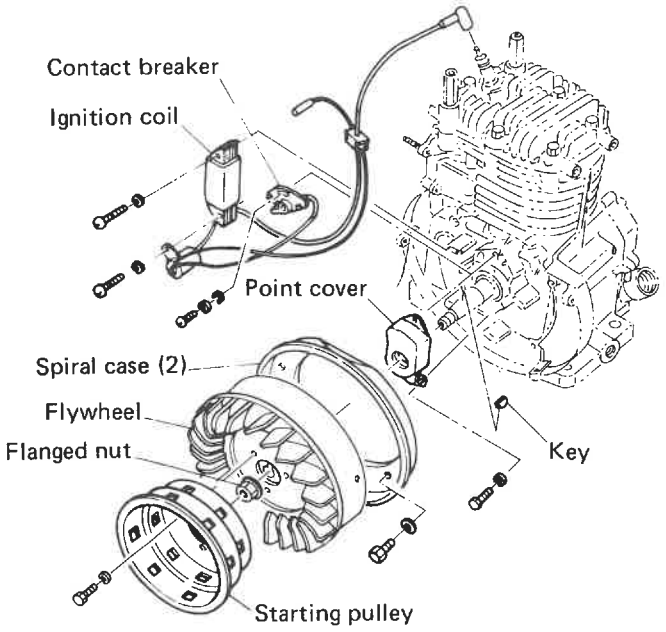

(Fig. 035)

## 1-4 Flywheel

- Equally loosen flywheel mounting bolts at three places.
  **Three bolts together with flanged nut work as a puller. Therefore, do not remove them in this stage.**
- Loosen the flanged nut by turning it clockwise (counterclockwise with G type engine) and remove it together with the flywheel.
  Remove the starting pulley from the flywheel.
- Remove the flywheel key from the keyway on the cranksahft.
- Remove spiral case (2).
- Remove the breaker cover.
- Remove ingnition coil/contact breaker/condenser.
  **Carry out the work carefully to avoid lead wire breakage. Pay particular attention to soledered portions.**

Tools to be used

All models ..... 10 socket wrench
21 socket wrench
Screwdriver
Hammer

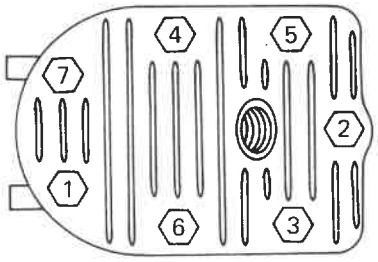



(Fig. 036)

## 1-5 Cylinder Head

- Remove the spark plug from the cylinder head.
- Equally loosen and remove head bolts and long nuts, and remove the cylinder head.
  **It is important to equally loosen bolts and nuts around the cylinder by a minor extent at a time in order not to allow occurrence of deformation to the cylinder head. For example, loosen all bolts and nuts by around 1/4 turn each in the sequence shown below.**

**Equally loosen them again by about 1/2 turn in the second round. Then remove all bolts and nuts.**
**No bolt or nut should be loosened one full turn before others are equally loosened.**

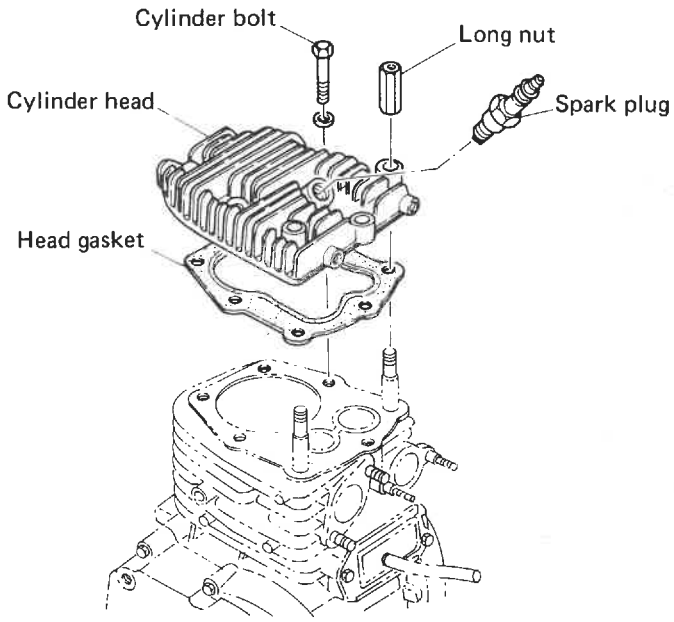



(Fig. 037)

**The above figure indicates the case where tightening is made at seven places, and the procedures are the same even when the number of bolts/nuts is different from that of the above case.**
**Check the removed head gasket for traces of gas leakage.**

Tools to be used

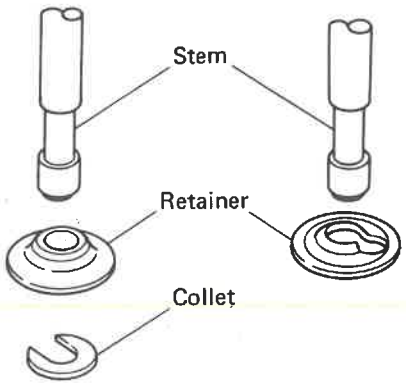
KF24, KF34 ..... 13 socket wrench
KF53-A ..... 14 socket wrench
14 spanner
KF68 ..... 17 socket wrench
17 spanner
All models ..... Plug wrench




(Fig. 038)

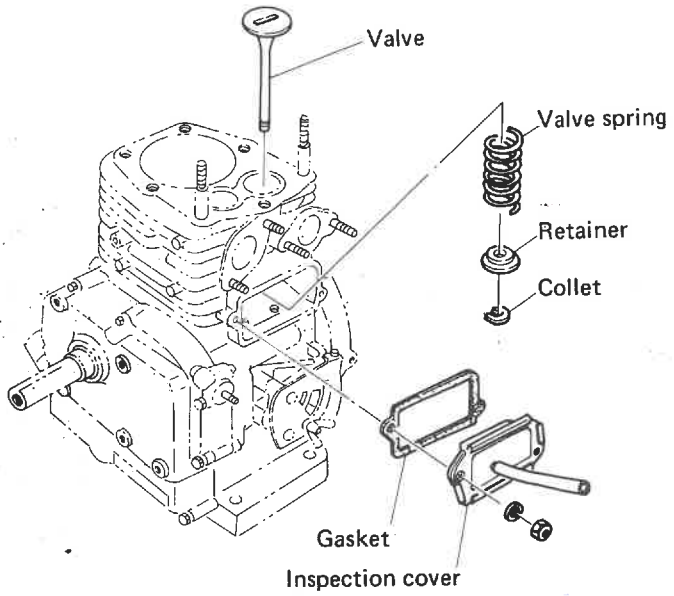
## 1-6 Intake-Exhaust Valves

- Remove the inspection cover.
- Remove spring retainers of intake and exhaust valves using valve spring compressor.
  **Two different methods are used for supporting spring retainers.**




(Fig. 039)

- Extract intake and exhaust valves.
- Remove valve springs.
  **Check contact of each valve with the valve seat.**
  Tools to be used
  All models ..... Valve spring compressor
  Long nose pliers
  10 spanner

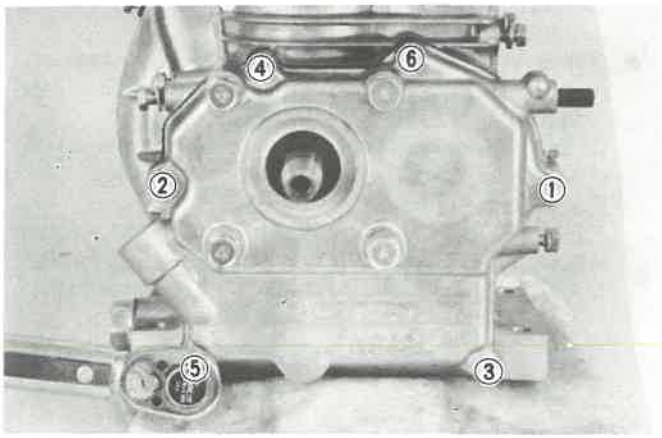



(Fig. 040)

## 1-7 Side Base

- Equally loosen side base mounting bolts by a minor extent at a time, and remove them.

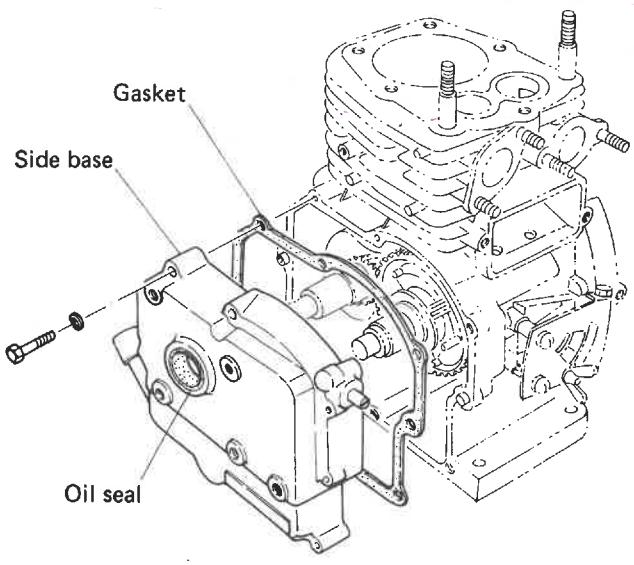
**Do not loosen a specific bolt in a stroke. Equally loosen bolts by a minor extent at a time in the sequence shown below. Otherwise, the side cover may be deformed and oil leakage may occur after reassembly.**




(Fig. 041)

**The above figure indicates the case where tightening is made at six places, and the procedures are the same even when the number of bolts is different from the above.**
**Usually, knock pins for positioning are located at places ① and ②. It is the rule to loosen bolts at these places first as shown above.**

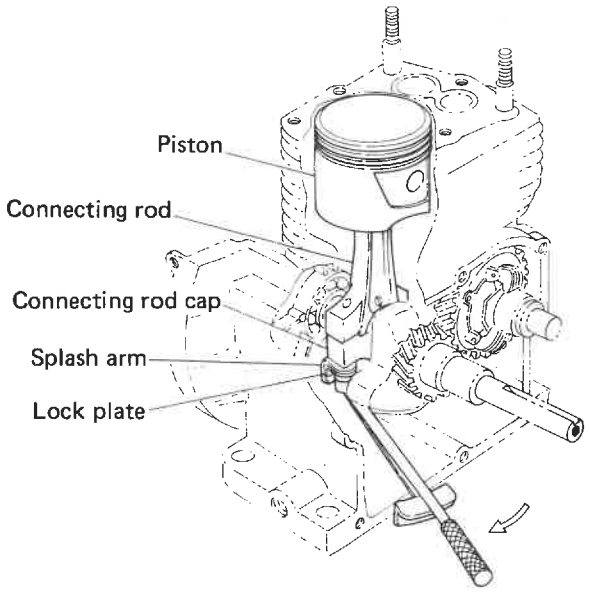
- Carefully separate the side cover from the crankcase by a minor extent at a time, so that its periphery is equally spaced aprt from the crankcase.
  **Remove the side base by lightly tapping its periphery using a wood (or plastic) hammer. Special attention to be paid at this occasion not to damage the oil seal.**
  Tools to be used
  KF24, KF34, KF53-A .... 10 socket wrench
  KF68 ..... 13 socket wrench




(Fig. 042)

### 1-8 Piston/Connecting Rod

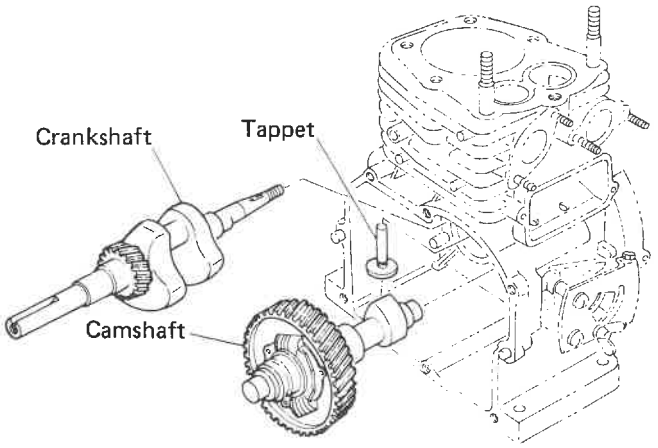
- Straighten tongues of lock plates by using a screwdriver and a hammer.
- Loosen connecting rod bolts and remove the connecting rod cap.
- Extract piston/connecting rod from the cylinder.
- Remove piston rings from piston/connecting rod, if required, and futher remove the snap ring and extract the piston pin.
  **Check wear and other surface conditions of the cylinder bore, piston and piston rings.**
  Tools to be used
  KF24 ..... 10 socket wrench
  KF34, KF53-A ..... 12 socket wrench
  KF68 ..... 13 socket wrench




(Fig. 043)

### 1-9 Crankshaft and Camshaft

- Remove the camshaft.
  **As tappets may drop into the space between the intake cam and the exhaust cam, camshaft extraction work may be obstructed. Therefore, place the engine block sideway or up side down.**
- Extract intake and exhaust tappets.
  **Identify the tappet on the intake side and the tappet on the exhaust side at this time. At the occasion of assembly, the tappet extracted from the intake side should be mounted on the intake side and the tappet extracted from the exhaust side should be mounted on the exhaust side. This is the rule for maintaining suitable valve clearances.**
- Extract the crankshaft.
  Tools to be used
  All models ..... Wood (plastic) hammer




(Fig. 044)

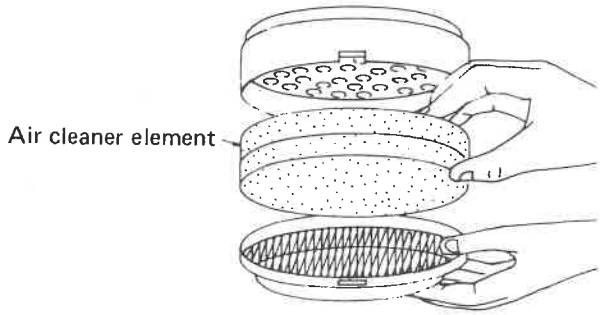
## 2 ASSEMBLY PROCEDURE

Pay particular attention to the following points before starting engine assembly work. Otherwise, the engine may be fatally damaged in the worst case or disassembly may be required once again. The reassembly work, therefore, should be carried out carefully and positively with thorough knowledge related to key points of adjustment.

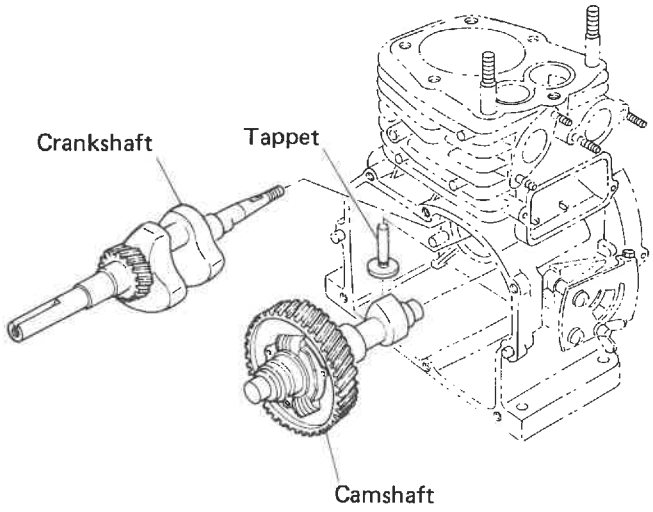
**Points requiring particular attention for engine reassembly work.**

- **Clean all parts using cleaning oil before starting the work. Do not assemble parts if they are contaminated with dust or foreign matters. The interior and bearing portions of cylinder/crankcase, valve guides, valve seats, tappet guides and so forth should be cleaned with particular care.**
- **Damaged or worn parts should not be reused. Be sure to replace them with new genuine parts.**
- **Sufficiently apply fresh lubricating oil to rotating parts prior to assembly. Particularly important points are cylinder inside wall, crankshaft and camshaft bearings, valve guides, tappet guides, crankpins, piston pins, governor sleeve and so forth.**
  **Also apply lubricating oil to connecting rod bolts.**
- **At the occasion of tightening of multitle bolts/nuts for one component, equally tighen them by a minor extent at a time in order that unusual tightening stress will not be applied to it. Furthermore, tightening should be made to the specified torque value.**
- **Before getting into next process, assure that the mounted parts smoothly turn by turning the crankshaft by hand. If turning of the crankshaft lacks smoothness even to a minor extent, check processes worked up to the present process and eliminate the cause for the problem, before making progress to the next process.**

- **It is necessary to carry out assembly while making necessary adjustments, alignments and settings of ignition system, governor system, valve clearance, timing gear mark alignment and carburetor. The engine will not run if these components are carelessby installed.**
- **Air cleaner element can be washed in kerosene and after getting dry, it is to be submerged into 3 : 1 kerosene oil mixture.**
  **The element become ready to be reused after the mixture oil is squeezed out.**



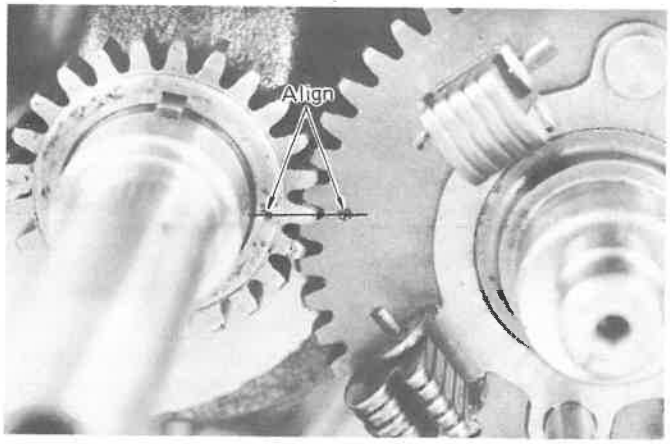

(Fig. 045)




(Fig. 047)

### 2-1 Crankshaft and Camshaft

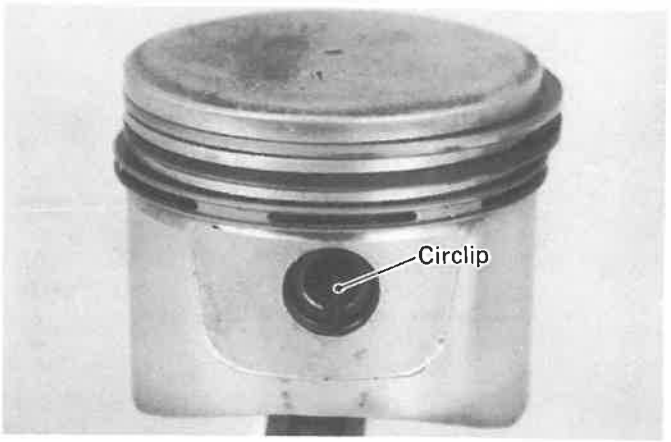
- Mount the crankshaft in the engine block. **Lay the engine sideway. This is to allow the tappets to be installed without falling out.**
- Insert intake and exhaust tappets into guide holes.
  **Insert the tappet which was located on the intake side prior to disassembly into the guide hole on the intake side, and insert the tappet which was located on the exhaust side into the guide hole on the exhaust side. This is the theory which should be observed for maintaining fixed valve clearances.**
- Insert the camshaft into the engine block while meshing its cam gear with the timing gear of the crankshaft so that timing marks on each are matched.
  **This is a very important work with a 4 stroke engine, because the valve timing is determined by this step.**




(Fig. 046)

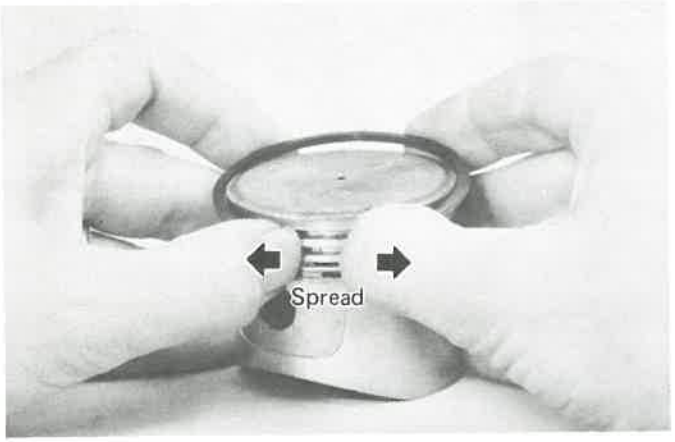
### 2-2 Piston/Connecting Rod

- [If piston and connecting rod have been disassembled]
  Mount the piston to the connecting rod.
  **In the case where engine's running direction is clockwise (counterclockwise) as viewed from the magneto side, mount the piston so that "R" or "D" ("L" or "G") stamp mark on the piston head is located on the side of the connecting rod having " マグネト側 " (Japanese characters meaning "magneto side"). Fit circlips to both ends of the piston pin so that the ends ("Tail") point straight up or down. This is to avoid any chance of circlip falling off due to inertia force to the ends as top and bottom dead centers of the piston when engine is running.**




(Fig. 048)

- Fit piston rings to the piston.
  **First of all, fit the oil ring to the bottom groove. Fit the second ring which has no plating to the second groove, and the fit the plated compression ring to the top groove.**
  **Use of piston ring expander is recommended to avoid any chance of scratching piston which may cause ring stick.**

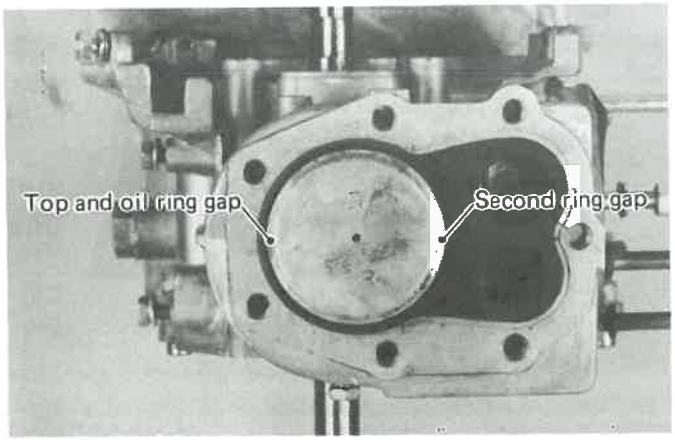



(Fig. 049)

**Fit each ring so that the "manufacturer's mark" located near the open end faces upward.**


(Fig. 050)

- Locate piston rings so that their open end gaps are located as spaced apart by 180° each.
  **The open end gaps of three piston rings should not be aligned. Because compressed gas may leak through the gaps. Furthermore, none of the end gaps should be located in the direction of the piston pin.**

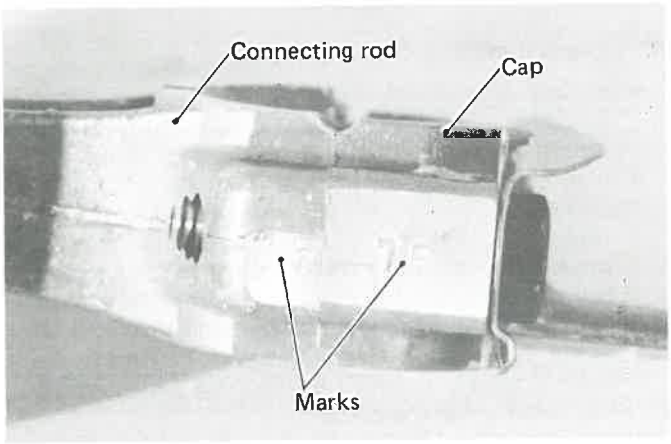



(Fig. 051)

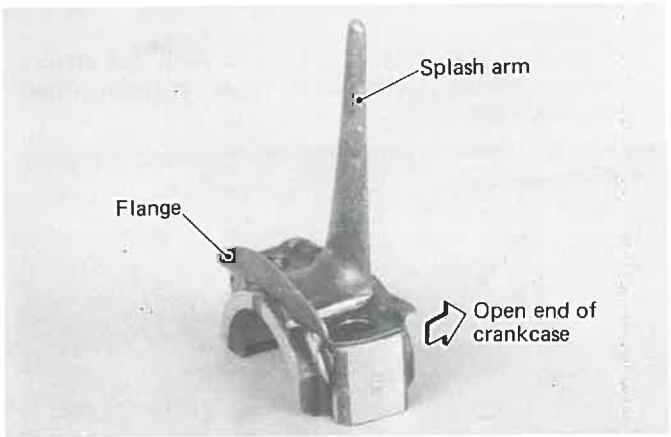
- Insert the piston/connecting rod into the cylinder with the side of the connecting rod having relieved "マグネト側" Japanese characters facing the magneto side.

  **Using a ring compressor insert the piston into the cylinder by a minor extent at a time while positively inserting pistons rings one at a time into the cylinder. Rings may break if the piston is inserted with force by tapping its head.**

  Slowly turn the crankshaft and place the crankpin in the lower position. Then further insert the piston into the cylinder while leading the connecting rod big end to the place above the crankpin.
- Match the match marks on the connecting rod and its cap, and set the connecting rod cap to the connecting rod big end.
- Set the lock plate to the connecting rod so that its bendable tabs face to the open side of the crankcase and the flange of the lock plate points down ward of engine as shown in Fig. 052, 053.




(Fig. 052)




(Fig. 053)

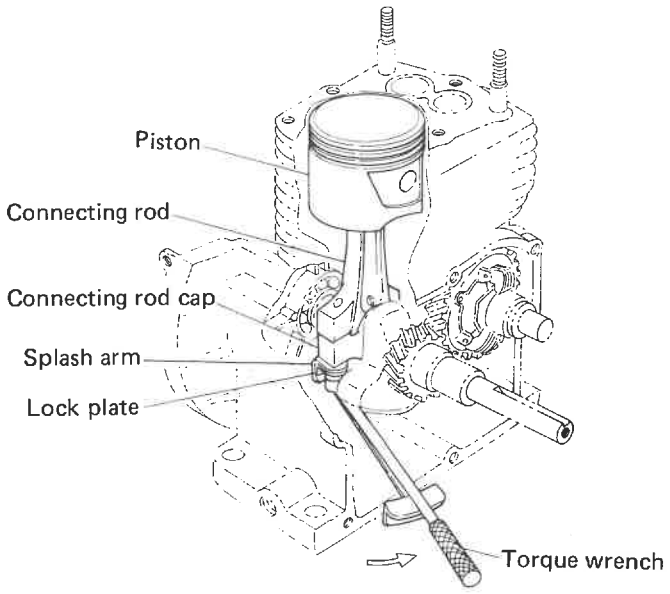
- Fit two connecting rod bolts through lock plates and connecting rod cap, and equally turn them in by fingers.
  Furthermore, tighten them to the specified torque using a torque wrench.

**Apply engine oil to connecting rod bolts in advance. Also when a torque wrench is used, alternately and equally tighten the two connecting rod bolts to a small amount at a time.**

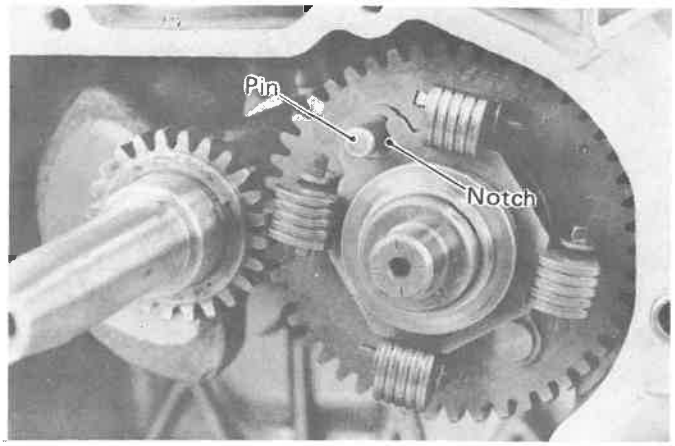
| Model | Specified torque |
|---|---|
| KF24 | 0.9 ~ 1.0 kg-m |
| KF34 | 1.6 ~ 1.7 kg-m |
| KF53-A | 1.7 ~ 1.8 kg-m |
| KF68 | 1.9 ~ 2.0 kg-m |

- Bend the tabs of the lock plate towards the bolt head using pliers.
  Insure that the tabs are securely seated to the bolt heads not rounded.

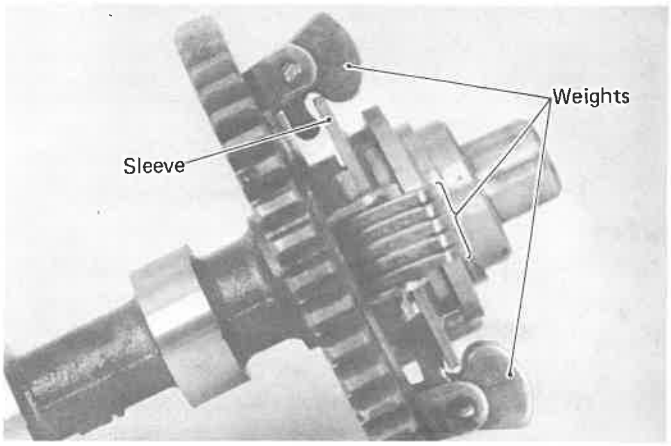
Tools to be used
KF24. . . . . 10 socket wrench
KF34, KF53-A . . . . . 12 socket wrench
KF68. . . . . 13 socket wrench
All models. . . . . Torque wrench




(Fig. 054)




(Fig. 055)



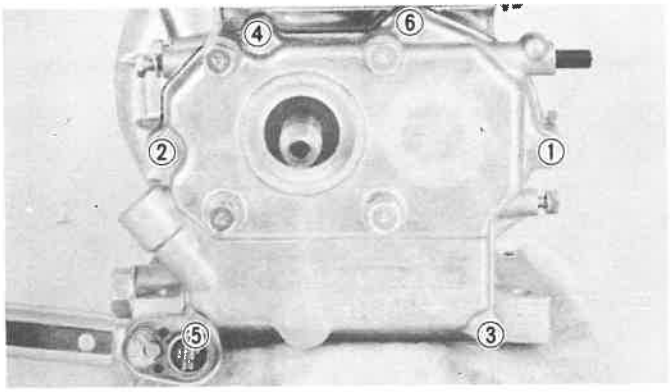

(Fig. 056)

## 2-3 Side Base (Fig. 058)

- [If governor sleeve has been removed from camshaft]
  Fit cam gear's pin into the notch in the sleeve tab, and fit the governor sleeve to the camshaft. Then fit weights to the sleeve edge.
- Assure that the governor shaft and fork are correctly mounted to the side base.
- Place a new gasket on the crankcase to side base mating surfaces.
- Fit the side base to the crankcase carefully, so that the oil seal is not damaged. Pay attention to positioning two knock pins to be located on crankcase.

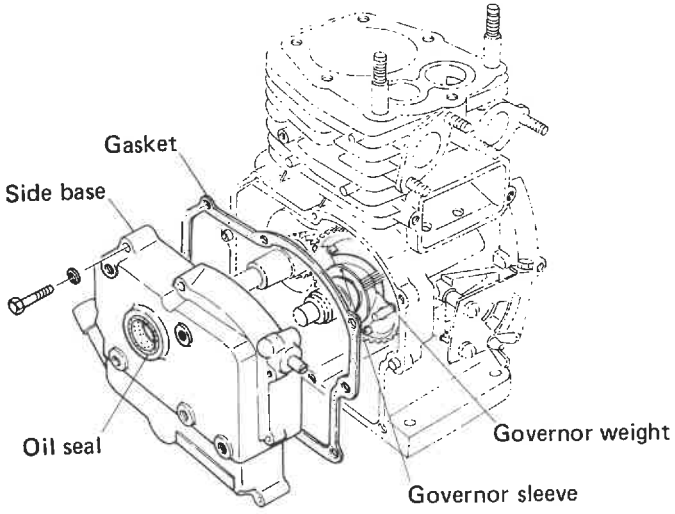
  **Do not drive in the side case with force. Carefully fit it to the crankcase by lightly tapping it with a wood (plastic) hammer so that its periphery is equally fitted.**
- Tighten side base mounting bolts.

  **Equally tighten bolts in the sequence indicated below. Finally tighten them to the specified torque value.**
  **Specified torque: 0.6 kg-m**




(Fig. 057)

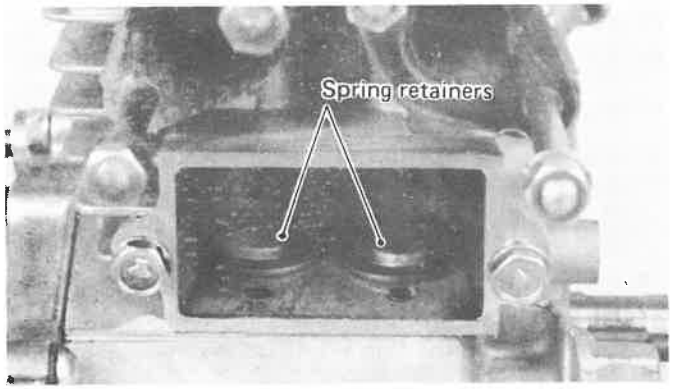
Tools to be used
KF24, KF34, KF53-A. . . . . 10 socket wrench
KF68. . . . . 13 socket wrench
All models. . . . . Torque wrench



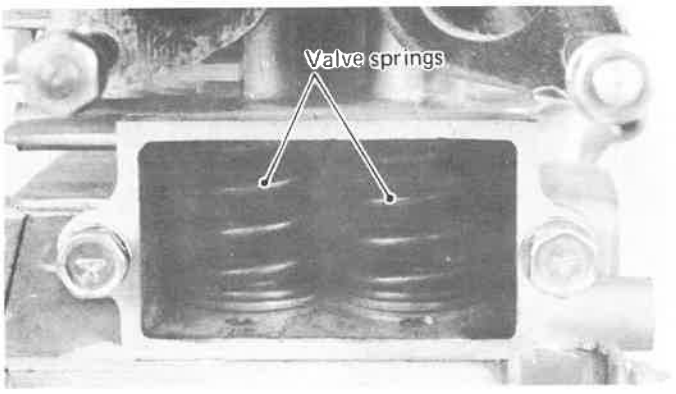

(Fig. 058)

## 2-4 Intake and Exhaust Valves

- Place spring retainers on valve spring chamber floor, aligning to tappet axis.
  Then place valve springs on them.

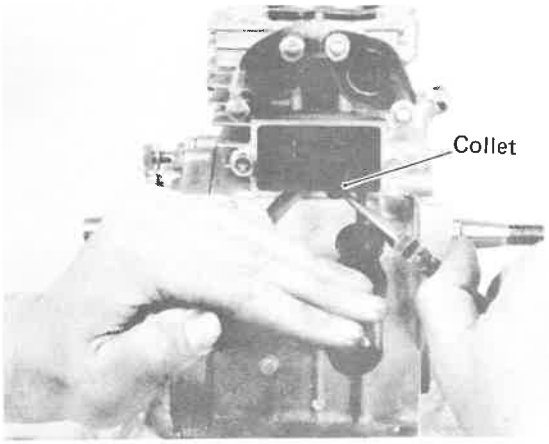



(Fig. 059)

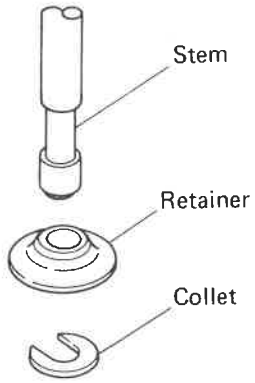



(Fig. 060)

- Fit the intake and exhaust valves into their guide holes.
  **The smaller valve is the exhaust valve.**
- [KF24, KF34, KF68]
  Compress the spring using valve spring compressor. Pinch a collet with long nose pliers and slide it into the collet groove on the valve stem.

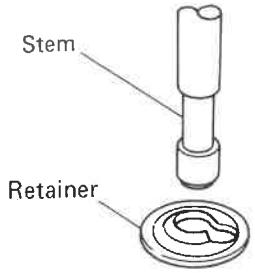



(Fig. 061)



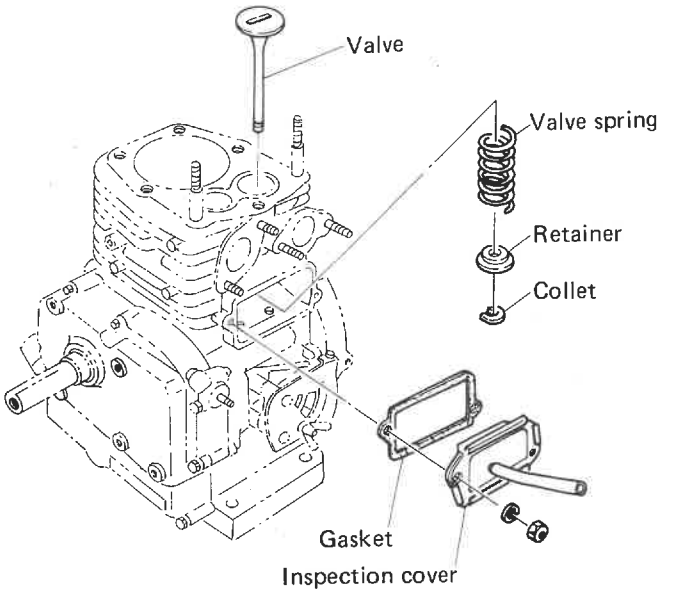

(Fig. 062)

- [KF53-A]
  While pushing up a spring in the manner described above, drop the valve stem through the larger retainer groove.
  Then push in retainer's edge so that the smaller retainer groove comes to the center of the valve stem. Assure that the center of the spring retainer was correctly set in the groove of the valve stem.




(Fig. 063)

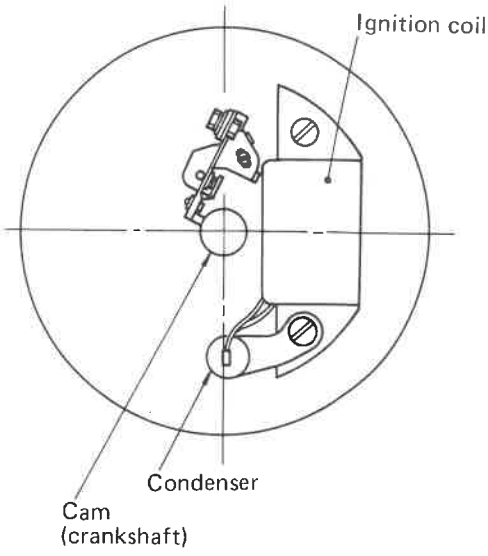
- Check the valve clearance on both intake side and exhaust side.
  Refer to item D. 4 "Valve clearance".
- Mount the inspection cover through a gasket.
  Tools to be used
  All models. . . . . Two screwdrivers
  Long nose pliers
  10 spanner




(Fig. 064)

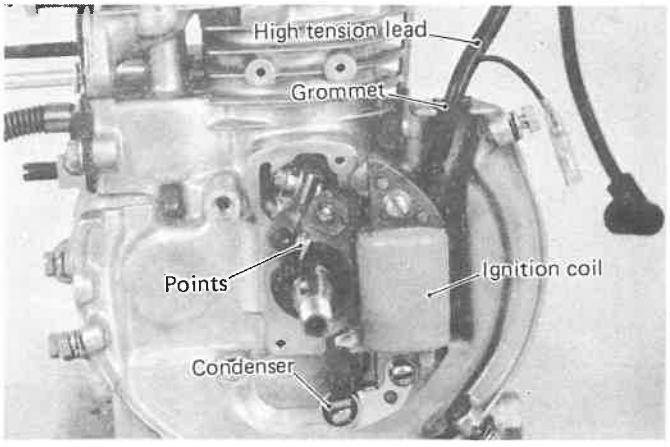
## 2-5 Magneto

- [KF24, KF34, KF68]
  Mount the contact breaker, ignition coil and condenser. Then fit the wiring grommet in the notch of the crankcase.



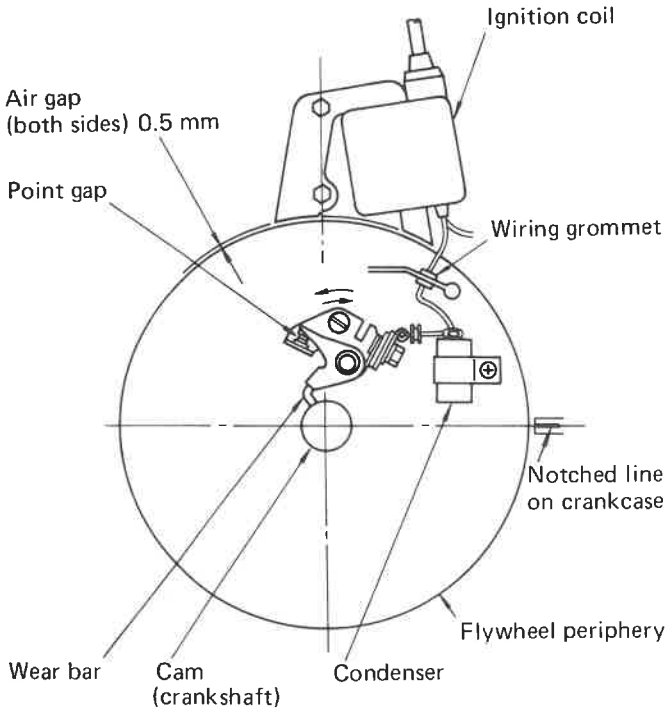

Internal coil type

(Fig. 065)




(Fig. 066)

- [KF53-A]
  Mount the ignition coil to its position outside of the flywheel.
  Then mount the contact breaker and condenser and fit the wiring grommet in crankcase notch in the manner identical to what was described above. Then adjust the air gap between the ignition coil core and flywheel periphery to 0.5mm.



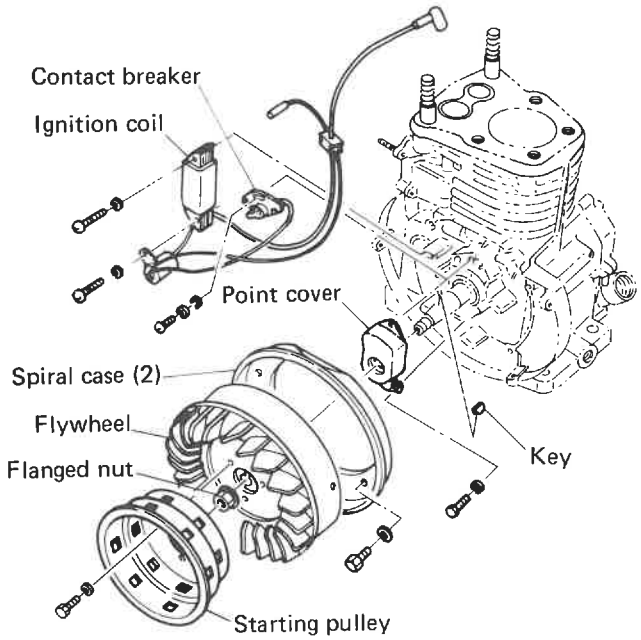

External coil type

(Fig. 067)

- Adjust the ignition timing and the maximum point gap.
  Refer to A. 2-3 "Adjustment of flywheel magneto".
- Mount the breaker cover.
- Mount spiral case (2), except KF24.
- Correctly place the key in the keyway, mount the flywheel and tighten flanged nut by turning it counterclockwise (clockwise with G type).

| Model | Specified torque |
|---|---|
| KF24 | 4.1 ~ 4.5 kg-m |
| KF34, KF53-A, KF68 | 6.0 ~ 6.5 kg-m |

- Mount the starting pulley.
  Tools to be used
  All models. . . . . .Standard tip screwdriver
  Philips tip screwdriver
  Thickness gauge
  Tester
  10 socket wrench
  21 socket wrench
  Torque wrench



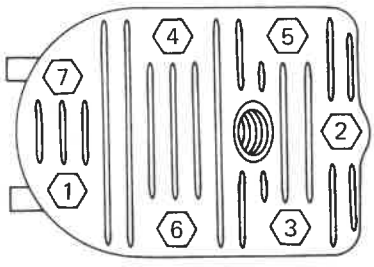

(Fig. 068)

## 2-6 Cylinder Head

- Place the gasket on the cylinder and place the cylinder head on it.
- Then screw in all of long nuts and head bolts by fingers. Then tighten all long nuts and bolts equally to the specified torque using a torque wrench.

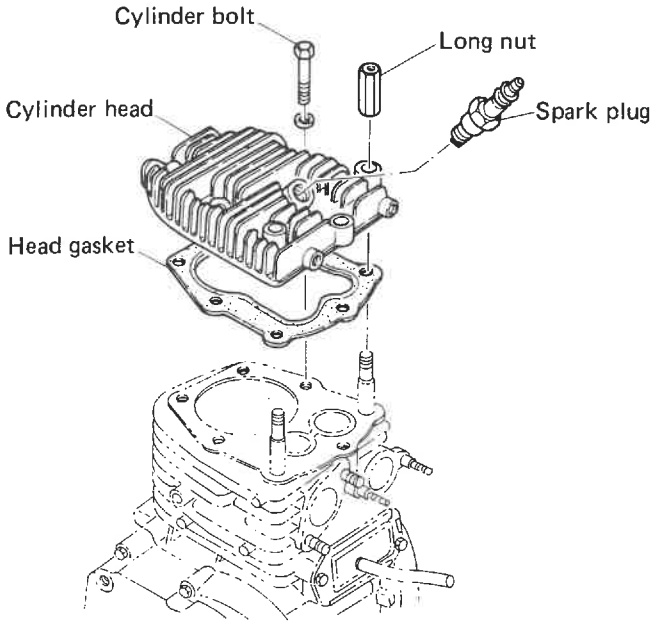
  **In order to prevent deformation to the cylinder head, exercise care to equally tighten all nuts and bolts. For example, tighten them by about 1/4 turn in the first round, tighten them by about 1/2 turn in the second round, and repeat the sequence to tighten all long nuts and head bolts to the specified torque.**
  **Do not fully tighten one bolt only before other nuts or bolts are suitably tightened.**
  **The procedures are the same even when the number of bolts is different from what is indicated above.**

| Model | Specified torque |
|---|---|
| KF24, KF34 | 2.0 ~ 2.2 kg-m |
| KF53-A, KF68 | 2.4 ~ 2.5 kg-m |




(Fig. 069)

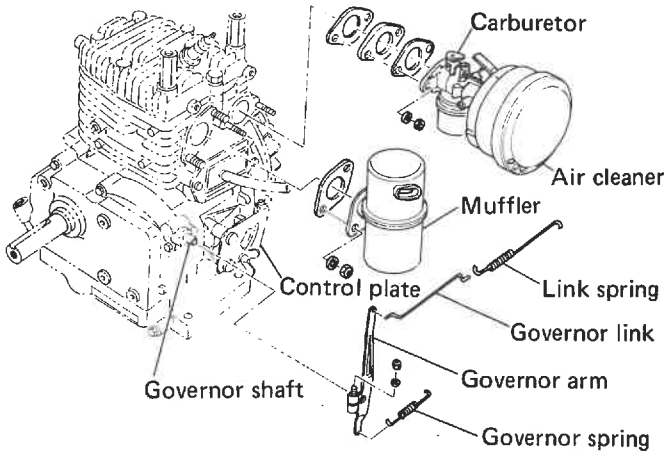
- Mount the spark plug.
  Tolls to be used
  KF24, KF34 . . . . . 13 socket wrench
  KF53-A. . . . . 14 socket wrench
  KF68. . . . . 17 socket wrench
  All models. . . . . Torque wrench
  Plug wrench




(Fig. 070)

## 2-7 Carburetor and Muffler

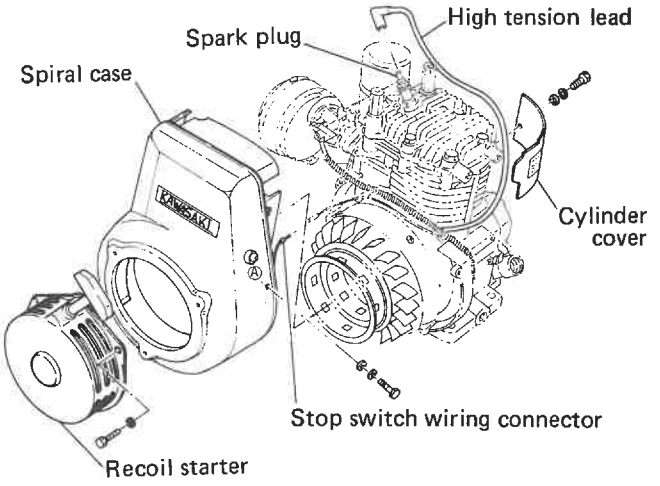
- Mount the governor arm to the governor shaft. Do not tighten it in this stage.
- Mount gasket, insulator and gasket in this order to the flange of carburetor intake hole.
- Hook one end of the governor link and link spring to the small hole located at the tip of the governor arm. Then, with the carburetor held in hand, hook another end of the governor link and link spring to the small hole in the carburetor throttle lever.
- Fit the carburetor to the intake hole and equally tighten two nuts.
- Carry out governor adjustment.
  Refer to item A. 3-2 "ADJUSTMENT OF SPEED GOVERNOR MECHANISM".
- Fit the muffler through a gasket, and equally tighten two flanged nuts.
  Tools to be used
  All models. . . . . 10 spanner
  KF53-A, KF68 . . . . . 13 spanner




(Fig. 071)

## 2-8 Spiral Case

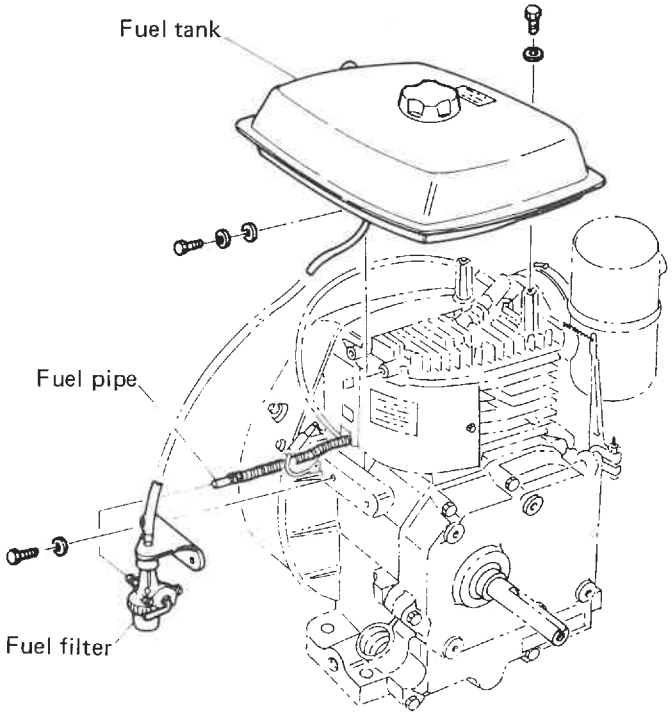
- Mount the spiral case to the crankcase.
- [With a model having fuel filter on opposite side of carburator]
  Connect one end of the fuel tube to the carburetor and arrange the tube line as shown below.
- Mount the cylinder cover.
- Make wiring connection to the stop switch.
- Connect the high tension lead to the spark plug.
- Mount the recoil starter.
  Tools to be used
  All models. . . . . 10 socket wrench




(Fig. 072)

## 2-9 Fuel Tank

- Mount the fuel tank.
- Mount the fuel filter.
- Positively insert the fuel tube to the fuel filter.
  Tools to be used
  All models. . . . . 13 socket wrench
  KF24, KF34 . . . . . 10 socket wrench
  KF53-A. . . . . 14 socket wrench
  KF68. . . . . 17 socket wrench




(Fig. 073)

## 2-10 Engine Oil and Fuel Supply and Trial Running

- Mount the drain plug.
  With a model having drain plug on both carburetor side and counter-carburetor side, both of them should be mounted.
- Supply engine oil in accordance with the instructions given in the Operator's Handbook and fit the oil level gauge.
- Assure that all parts have been correctly assembled together.
- Supply fuel into the fuel tank with reference made to the Operator's Handbook, and then carry out preparation for trial running.
  Tools to be used
  All models..... 13 spanner
  21 spanner
  Contactless tachometer

**Trial running**

- **Start the engine and fully warm it up.**
  **Do not run the just assembled engine at high speeds right away.**
- **Check the gas flow (pilot air screw opening) at low speed without load.**
- **Check setting of maximum no load engine R.P.M.**
- **Check idling setting.**
  **Refer to item D. 1-3. a "LOW SPEED AND IDLING ADJUSTMENT" and item D. 5. "REGULATION OF ENGINE R.P.M."**

## F. SETTING TABLE

| Item \ Model | | KF24 | KF34 | KF53-A | KF68 |
|---|---|---|---|---|---|
| Valve clearance (mm) | Intake | 0.22±0.12 | 0.22±0.12 | (0.15±0.03 | 0.15±0.03 |
| | Exhaust | 0.22±0.12 | 0.22±0.12 | (0.22±0.12 | 0.22±0.12 |
| Ignition timing (BTDC) | | 23±2° fixed | 23±2° fixed | 25±2° fixed | 25±2° fixed |
| Breaker point gap (mm) | | 0.3 ~ 0.5 | 0.3 ~ 0.5 | 0.3 ~ 0.5 | 0.3 ~ 0.5 |
| Spark plug model | | NGK B-6HS | NGK B-6S | NGK B-6HS | NGK B-6S |
| Spark plug gap (mm) | | 0.6 ~ 0.7 | 0.6 ~ 0.7 | 0.6 ~ 0.7 | 0.6 ~ 0.7 |
| At crankshaft R.P.M. | Idling R.P.M. | 1300 | 1200 | Carburetor 1200 Governor 1300 | 1300 |
| | Maximum R.P.M. | 4200 | 4200 | 4200 | 4000 |
| Carburetor | Main jet | #65 | #72.5 | #85 | #87.5 |
| | Pilot air screw | 1 turn out | 7/8 turn out | 6/8 turn out | 1 turn out |
| Tightening torque (kg-m) | Cylinder head bolt | 2.0 ~ 2.2 | 2.0 ~ 2.2 | 2.4 ~ 2.5 | 2.4 ~ 2.5 |
| | Connecting rod bolt | 0.9 ~ 1.0 | 1.6 ~ 1.7 | 1.7 ~ 1.8 | 1.9 ~ 2.0 |
| | Flywheel nut | 4.1 ~ 4.5 | 6.0 ~ 6.5 | 6.0 ~ 6.5 | 6.0 ~ 6.5 |
| | M6 general bolt/nut | 0.6 | 0.6 | 0.6 | 0.6 |
| | M8 general bolt/nut | 1.5 | 1.5 | 1.5 | 1.5 |

# G. CLEARANCE TABLE

(mm)

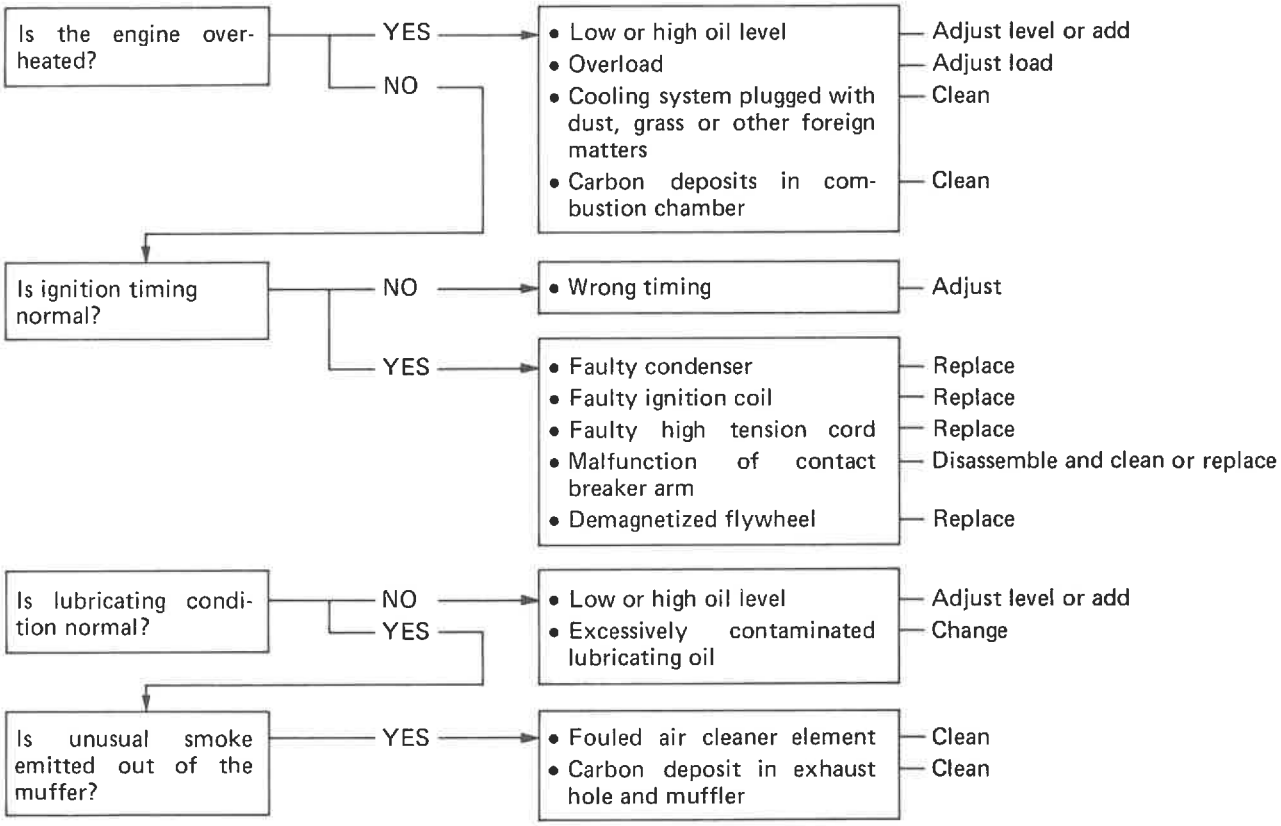
| Item \ Model | | KF24 | | | KF34 | | | KF53-A | | | KF68 | | | Method correction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Nominal size | Standard value | Limit of use | Nominal size | Standard value | Limit of use | Nominal size | Standard value | Limit of use | Nominal size | Standard value | Limit of use | |
| Cylinder bore | | 56 | | -0.15 | 60 | | -0.15 | 66 | | -0.15 | 74 | | -0.15 | Replace |
| Piston to cylinder clearance | | | | 0.25 | | | 0.25 | | | 0.25 | | | 0.25 | Replace |
| Ring groove clearance | Top | 1.96 | | -0.15 | 2.5 | | -0.15 | 2.5 | | -0.15 | 2.5 | | -0.15 | Replace |
| | Second | 1.96 | | -0.15 | 2.5 | | -0.15 | 2.5 | | -0.15 | 2.5 | | -0.15 | Replace |
| | Oil | 3.5 | | -0.15 | 4 | | -0.15 | 4 | | -0.15 | 4 | | -0.15 | Replace |
| Ring end gap | Top | | | 1.0 | | | 1.0 | | | 1.0 | | | 1.0 | Replace |
| | Second | | | 1.0 | | | 1.0 | | | 1.0 | | | 1.0 | Replace |
| | Oil | | | 1.0 | | | 1.0 | | | 1.0 | | | 1.0 | Replace |
| Piston to piston pin fit | | 12 | | 0.05 | 13 | | 0.05 | 15 | | 0.05 | 16.5 | | 0.05 | Replace |
| Connecting rod big end gap | | 22 | | 0.5 | 24 | | 0.5 | 26 | | 0.5 | 27 | | 0.7 | Replace |
| Connecting rod small end to piston pin fit | | 12 | | 0.05 | 13 | | 0.05 | 15 | | 0.05 | 16.5 | | 0.05 | Replace |
| Crankpin outside diameter | | 22.5 | | -0.05 | 24.5 | | -0.05 | 26 | | -0.05 | 28 | | -0.05 | Replace |
| Connecting rod big end to crankpin fit | | | | 0.07 | | | 0.07 | | | 0.07 | | | 0.07 | Replace |
| Ball bearing play | | | | 0.3 | | | 0.3 | | | 0.3 | | | 0.3 | Replace |
| Wear to cam | Base redius | 10 | | -0.5 | 11 | | -0.5 | 13 | | -0.5 | 13.5 | | -0.5 | Replace |
| | Lift | 5.0 | | -0.5 | 5.5 | | -0.5 | 6.72 | | -0.5 | 6.72 | | -0.5 | Replace |
| Valve spring free length | | 30.9 | | 30 | 33 | | 32 | 33 | | 32 | 37.8 | | 36.8 | Replace |
| Valve seat contact width | | 1.0 | | 1.5 | 1.0 | | 1.5 | 1.0 | | 1.5 | 1.0 | | 1.5 | Correct |
| Valve stem to valve guide clearance | Intake | 55 | | 0.12 | 6 | | 0.12 | 7 | | 0.12 | 7.5 | | 0.12 | Replace |
| | Exhaust | 5.5 | | 0.12 | 6 | | 0.12 | 7 | | 0.12 | 7.5 | | 0.12 | Replace |
| Tappet to tappet guide clearance | | 6 | | 0.1 | 6 | | 0.1 | 7 | | 0.1 | 8 | | 0.1 | Replace |
| Camshaft axial play | | | 0.07 ~ 0.40 | | | 0.07~ 0.40 | | | 0.07 ~ 0.40 | | | 0.07 ~ 0.40 | | Adjust |
| Crankshaft axial play | | | 0.07 ~ 0.40 | | | 0.07~ 0.40 | | | 0.07 ~ 0.40 | | | 0.07 ~ 0.40 | | Adjust |
| Carburetor throttle shaft runout | | | | 0.1 | | | 0.1 | | | 0.1 | | | 0.1 | Replace |

# H. TROUBLESHOOTING

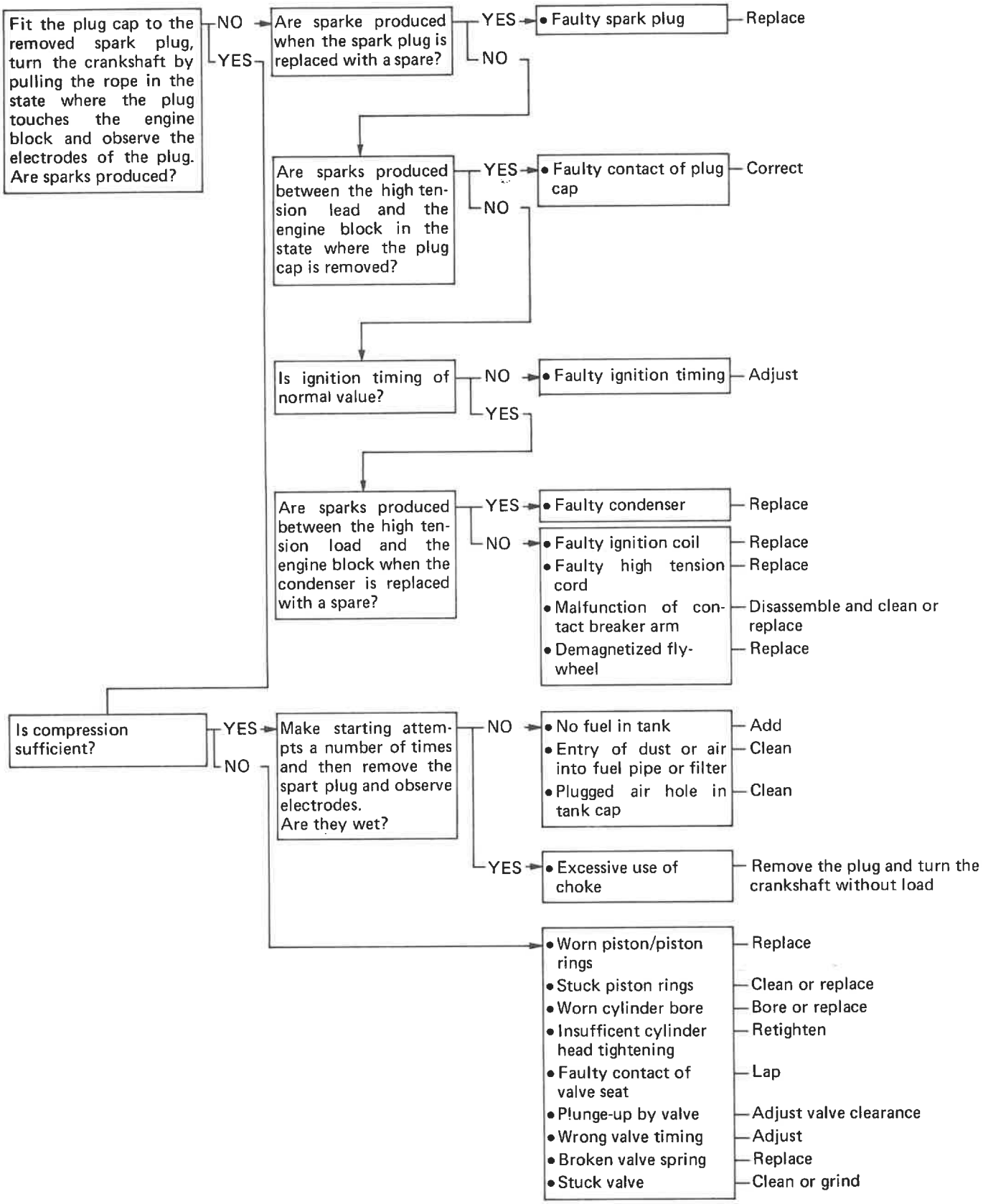
If the engine malfunctions, it is first necessary to check if the way the engine is used is correct. If the engine malfunctions even if engine is used correctly, it is important to systematically carry out troubleshooting starting with simple points.

This chapeter describes typical troubleshooting procedures.
Do not unnecessarily disassemble the carburetor, magneto or engine unless it has been found to be the cause of malfunctioning.

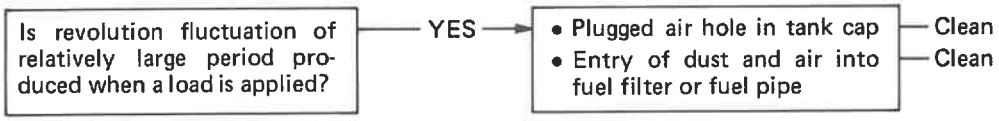
**[ Power Output is Low ]**



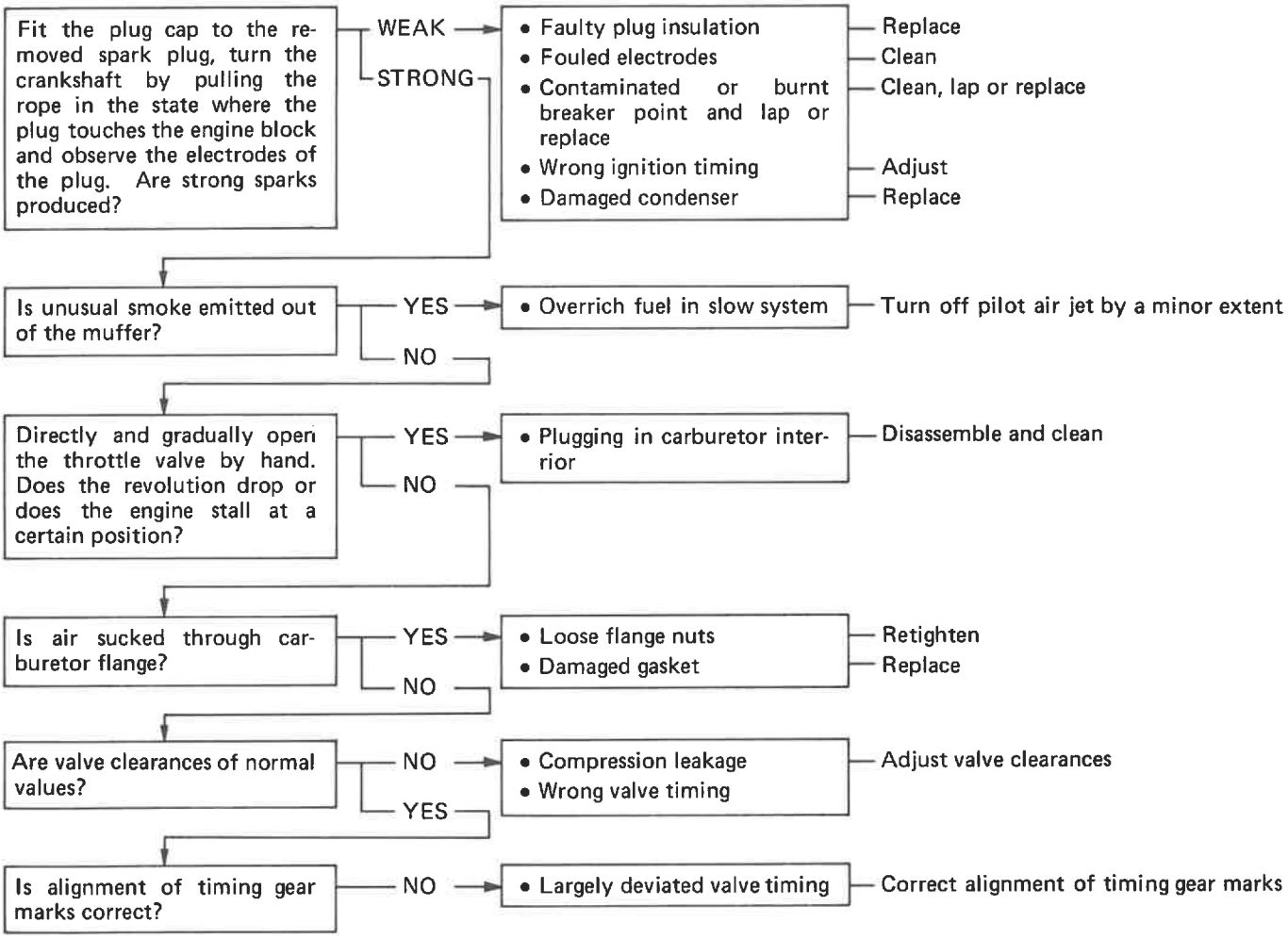
## [ Starting is Hard ]



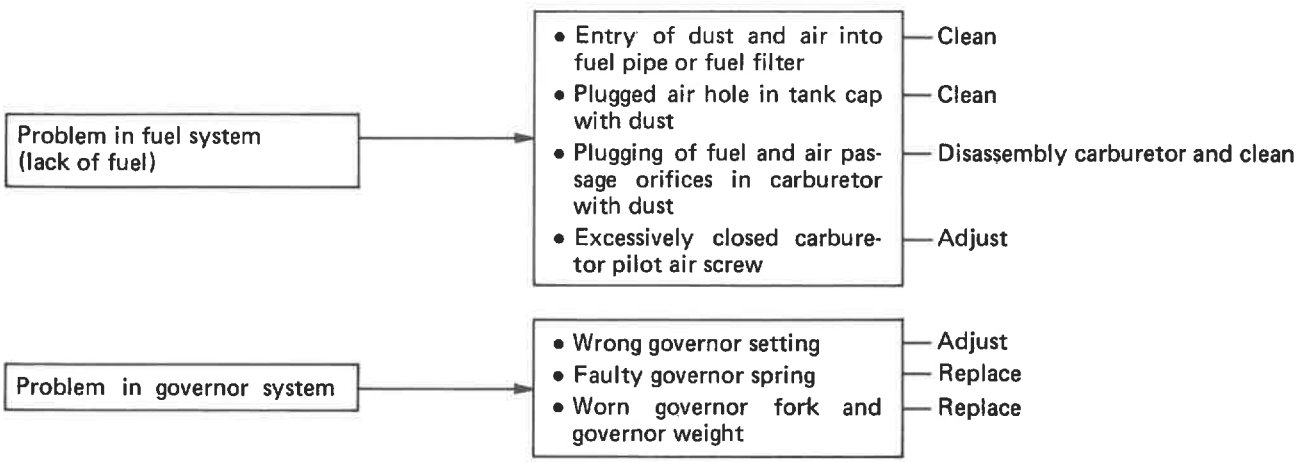
## [ Engine Malfunctions at High Speed ]



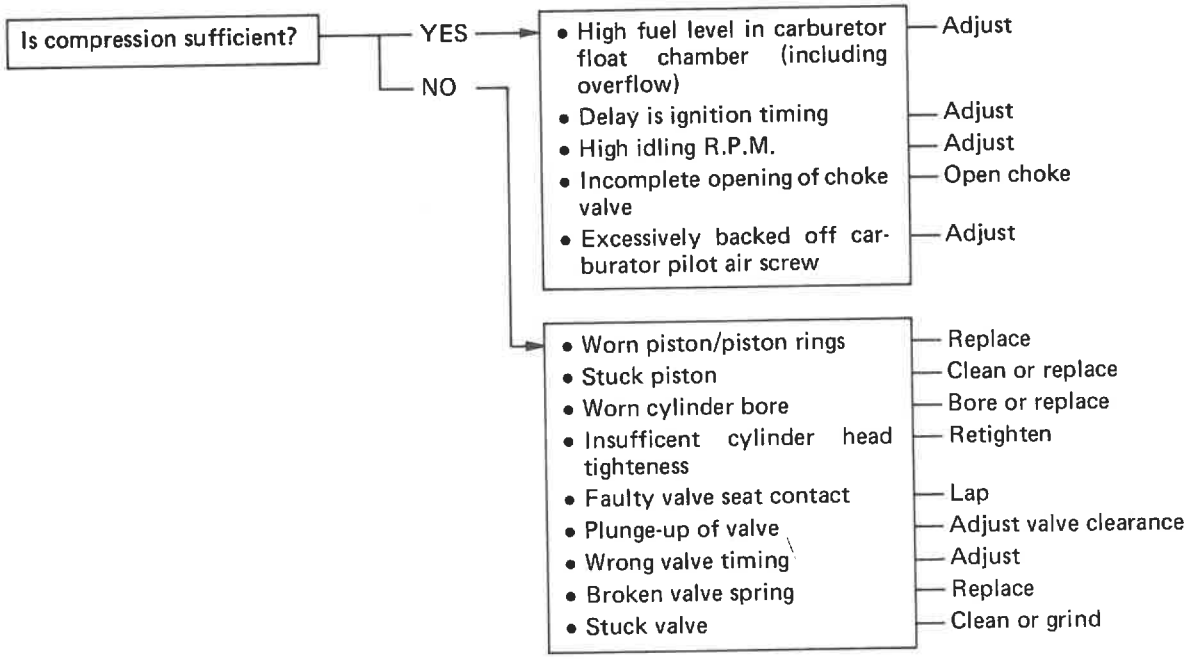

## [ Engine Malfunctions at Low Speed ]



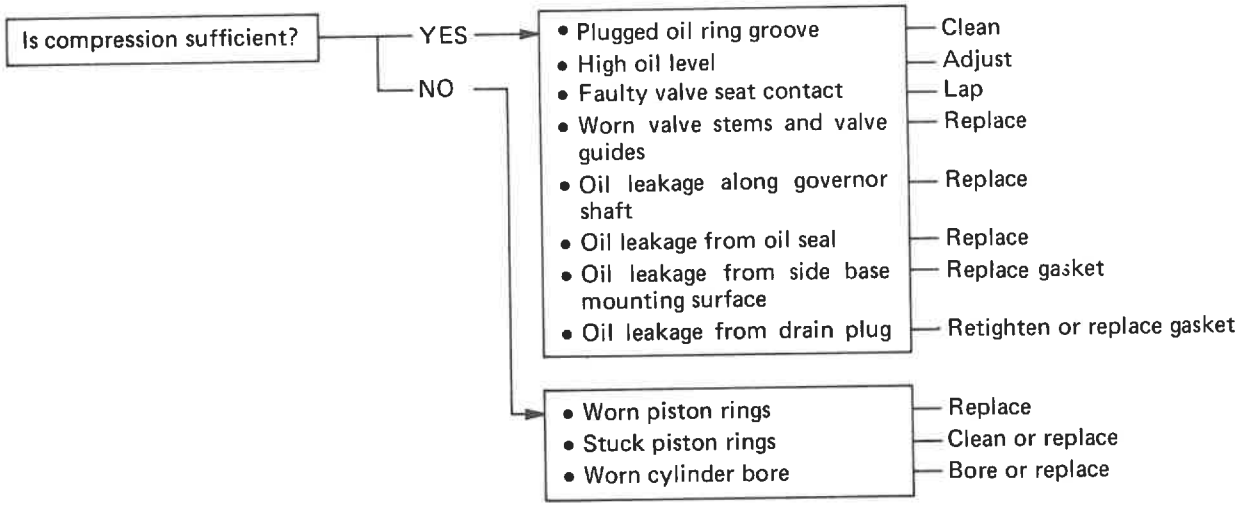

## [ Engine Hunts ]



## [ Fuel Consumption is Excessive ]




## [ Oil Consumption is Excessive ]



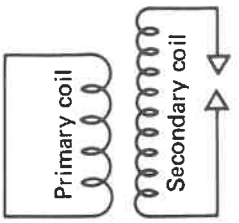
# I. ELECTRONIC IGNITION SYSTEM

## 1. GENERAL

### 1-1 Various Types of Ignition System

The most common ignition system having been used is mechanical type, so called point Breaker System. Recently, various types of electronic ignition system with electronic components such as diode, Transister Thyrister etc. have become more popular because of less maintenance required.

In both cases mentioned above, the theory of generating high voltage on secondary coil either by shutting off current or by sending rush current into the primary of the ignition coil, stays same.



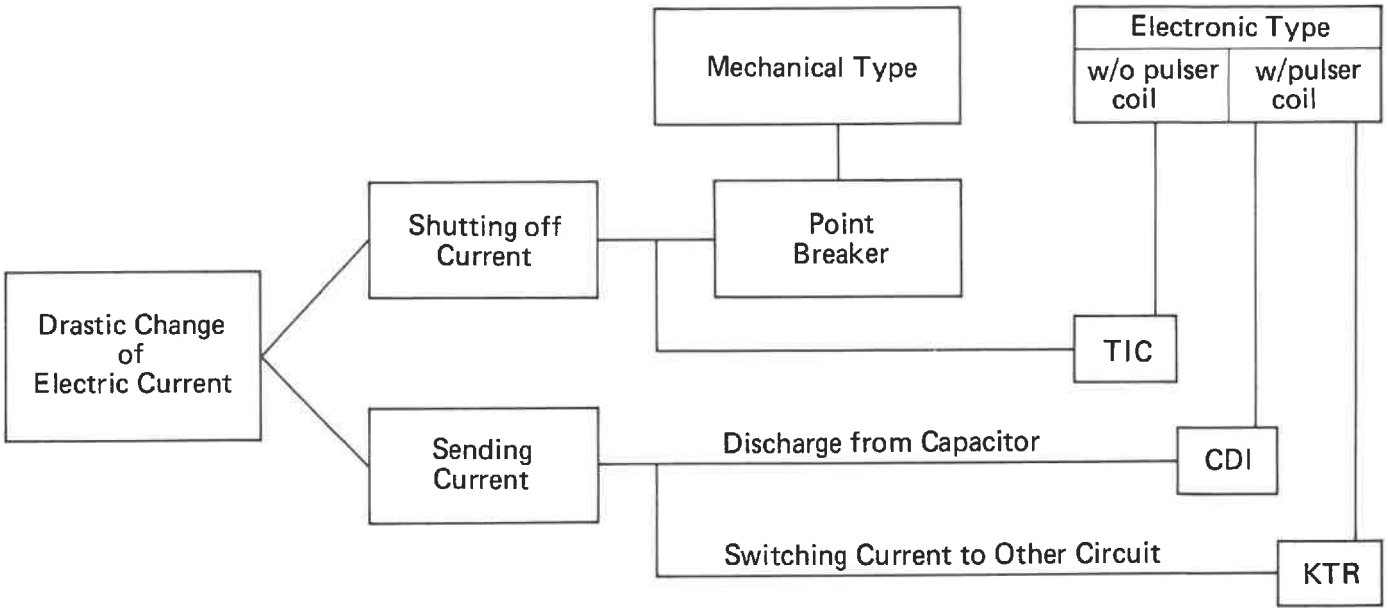
General circuit

(Fig. 074)

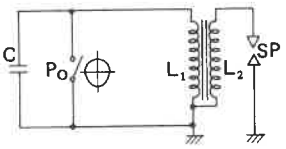
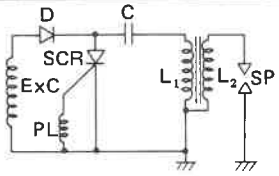
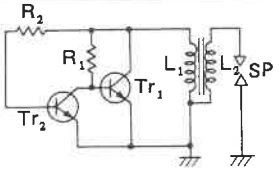
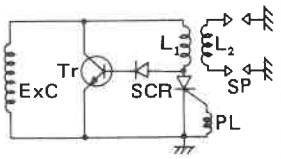
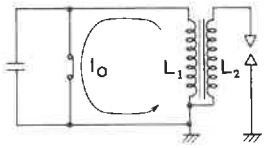
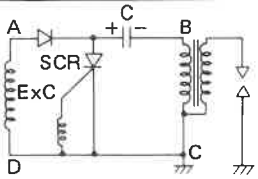
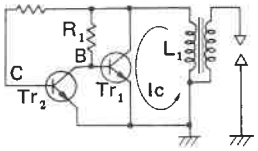
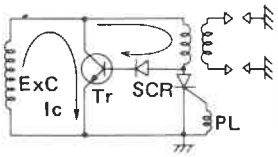
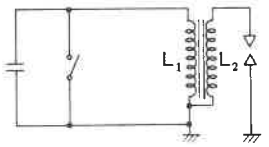
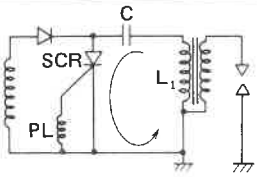
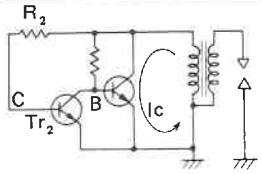
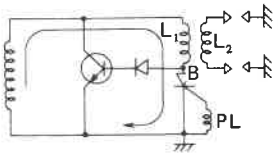
There are some variations of the electronic ignition system, depending on circuits or combination of electronic components.

The classification of ignition systems Kawasaki has been using is explained below.

**[Classification of Ignition System]**



## 1-2 General Circuit and Working Theory

| | Contact breaker type | CDI type | TIC type | KTR type |
|---|---|---|---|---|
| Initial stage |  <br>$L_1$ : Ignition Coil-Primary<br>$L_2$ : Ignition Coil-Secondary<br>Po : Contact Breaker<br>SP : Spark Plug<br>C : Condensor |  <br>$L_1$ : Ignition Coil-Primary<br>$L_2$ : Ignition Coil-Secondary<br>ExC : Exciter Coil<br>PL : Pulser Coil<br>SCR: Thyrister (Silicon-Controlled Rectifire)<br>SP : Spark Plug<br>C : Condensor<br>D : Diode |  <br>$L_1$ : Ignition Coil-Primary<br>$L_2$ : Ignition Coil-Secondary<br>$R_1$ : Control Resister<br>$R_2$ : Control Resister<br>$Tr_1$ : Transistor<br>$Tr_2$ : Transistor<br>SP : Spark Plug |  <br>$L_1$ : Ignition Coil-Primary<br>$L_2$ : Ignition Coil-Secondary<br>ExC : Exciter Coil<br>PL : Pulser Coil<br>Tr : Transistor<br>SCR: Thyrister (Silicon-Controlled Rectifire)<br>SP : Spark Plug |
| Ignition preparatory stage |  <br>The current (Io) due to the voltage induced by $L_1$ is circulating as shown. |  <br>The electric energy induced by the exciter coil (ExC) is accumulated in the condensor. Thru the circuit A-B-C-D. At this stage, SCR does not operate because of low voltage at the gate of SCR. |  <br>The current (Ic) flows Thru $Tr_1$ due to the induced voltage applied on the point of "B" as shown in the circuit above. At this stage, $Tr_2$ does not operate because of low voltage applied on point "C" due to reister $R_2$. |  <br>Tr become active and the current (Ic) flows when the voltage induced by excites coil (ExC) reaches to the base voltage of Transistor (Tr). At this stage, SCR does not operate because of low voltage applied on the gate of the SCR. |
| At the time of ignition |  <br>The contact breaker is opened by mechanical action of cam at desired ignition timing and this opening causes sudden shut off of the current (Io) resulting high voltage generated on secondary coil of ignition which makes spark at spark plug (SP). |  <br>This SCR is turned on at desired ignition timing due to the gate voltage induced by pulser coil (PL), then the energy having been accumulated in condensor (C) makes current flow thru primary coil ($L_1$). This rush current into the primary coil causes high voltage on secondary coil ($L_2$) resulting spark at spark plug (SP). |  <br>At the proper timing of ignition, $Tr_2$ is turned on by high voltage at point "C" which relates to the high voltage induced at $L_1$. As soon as the $Tr_2$ turned on, the base current thru $R_1$ to $Tr_1$ bigins to flow to $Tr_2$ thru $R_2$, thus $Tr_1$ is tured off bcause of voltage drop at the point "B". The sudden current shut-off thru $Tr_1$ creates high enough voltage induced at $L_2$ for proper ignition. |  <br>The SCR gate is triggered open when pulser coil generates voltage at desired ignition timing. Upon SCR turning on, the voltage at the point "B" drops, the lower voltage on transistor base makes the transistor inactive and the current flows thru primary coil ($L_1$) and SCR as shown. This rush current thru the primary causes high voltage induced on secondary coil which provides necessary level of voltage for spark. |
| Employed models | KF24-X FA130<br>KF34-X FA210<br>KF53-A<br>KF68-X<br>KF100-X<br>KF150-X<br>KF200-X | KF24-X<br>KF34-X<br>KF68-X<br>KF82-X<br>KF100-X | FA130<br>KF53-AX | KF200-X<br>KF150-X |

### 1-3 Instructions

- CDI unit or Igniter unit composed with electronic components is to be kept away from excessive heat.
- Special attention should be paid to avoid any misconnection between lead wires from exciter coil, pulser coil, stop switch etc.
  Otherwise, any misconnection may cause the system failed.
  The lead wires to be connected each other have the same color to avoide the mistake.
- Each wire has to be securely connected.
- Use engine kill switch to stop engine.
- Don't disconnect leads from CDI or igniter unit when engine is running.
  The disconnection may cause electronic component failed.
- Don't pull strongly the leads from igniter unit, exciter coil and pulser coil because it may cause wire breakage.

### 1-4 Checking Points

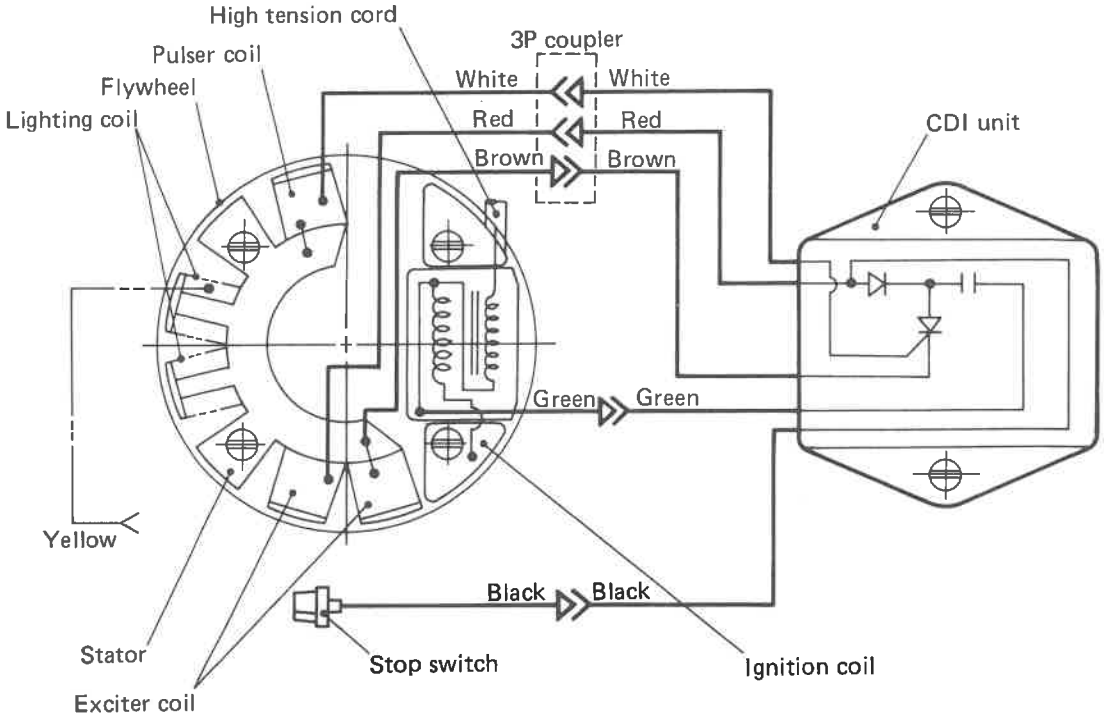
In the case of electronic ignition system such as CDI, TIC which is working electronically, there is no portion to be checked or adjusted mechanically as needed for point breaker system.

The electronic ignition system is mainly checked by using portable circuit tester along with timing light as required. The procedure is shown below.

- Ignition timing check
  Ignition timing is precisely checked at factory level. Therefore, correct timing is obtained without timing check or adjustment when the igniter, the CDI unit, pulser coil are installed correctly.
- Spark check
  The electronic ignition system such as CDI, TIC require minimum crankshaft RPM (200 RPM for CDI, 300 RPM for TIC) to generate spark at spark plug.
  No spark is expected with lower crankshaft RPM than the minimum, because of inadequate voltage generated at the secondary of the ignition coil.
- Resistance Value of Coils
  Standard resistance values of the ignition coils are shown in 2-4, 3-4, and 4-2.
  The values shown indicate medians and are to be used as a guide line because of tolerance of components and the accuracy of the circuit tester.

## 2 CHECKING OF CDI UNIT FOR KF24-X

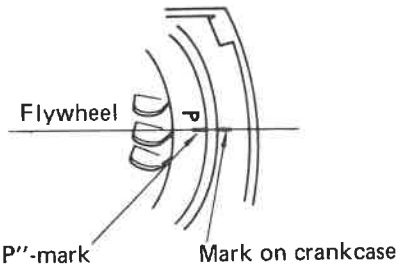
### 2-1 Component and Wiring of CDI Unit




(Fig. 075)

## 2-2 Comfirmation of Ignition Timing (Using Timing Light)

- Start and keep engine running at 3600 R.P.M.
- Clip positive ⊕ terminal of timing light onto insulated cover of high tension cord, and ground negative ⊖ terminal of the timing light to engine body.
- Check whether the mark on the flywheel lines up to the mark on crankcase. (Fig. 076)




(Fig. 076)

| | |
|---|---|
| Ignition timing | BTDC 23 ± 2°/3600 R.P.M. |
| Allowable mis-match of the marks | Within ± 3mm/3600 R.P.M. |

## 2-3 Resistance Value of Coils

| | |
|---|---|
| Exciter Coil | approx. 250Ω |
| Polser Coil | approx. 40Ω |
| Ignition Coil – Primary | approx. 0.7Ω |
| Ignition Coil – Secondary | approx. 6KΩ |

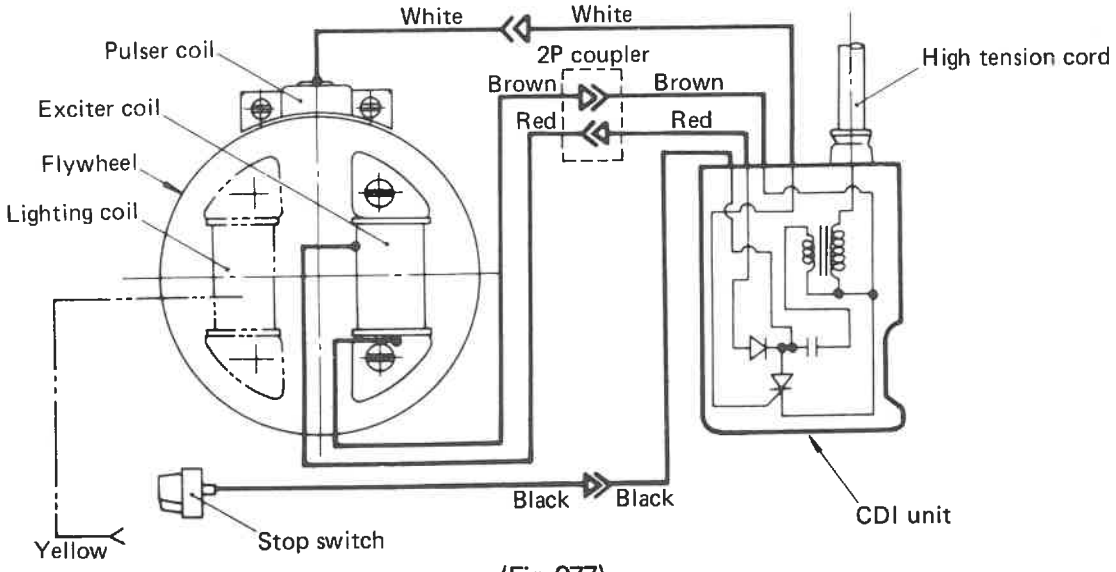
## 2-4 CDI Unit Check Table

| | | To be conected with positive ⊕ terminal of the tester | | | | |
|---|---|---|---|---|---|---|
| | Leading wire | Red | White | Black | Green | Brown |
| To be conected with negative ⊖ terminal of the tester | Red | | Non-conductive | 0 (Ω) | Non-conductive | Non-conductive |
| | White | Conbuctive | | Conductive | Non-conductive | 0 (Ω) |
| | Black | 0 (Ω) | Non-conductive | | Non-conductive | Non-conductive |
| | Green | Conductive | Conductive | Conductive | | Conductive |
| | Brown | Conductive | 0 (Ω) | Conductive | Non-conductive | |

Non-conductive: The tester indicates uifcnite resistance (∞) – no movement of the needle.
Conductive: The tester shows the resistance of couple hundreds to ten-thausands ohms.

## 3 CHECKING OF CDI UNIT FOR KF34-X, KF68-X

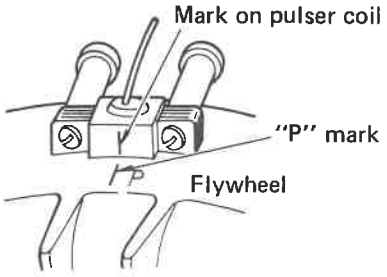
### 3-1 Component and Wiring of CDI Unit




(Fig. 077)

### 3-2 Comfirmation of Ignition Timing (Using Timing Light)

- Start and keep engine running at 3600 R.P.M.
- Clip positive ⊕ teminal of timing light onto insulated cover of high tension cord, and ground negative ⊖ terminal of the timing light to engine body.
- Check whether the mark on the flywheel lines up to the mark on crankcase. (Fig. 078)




(Fig. 078)

| Ignition timing | BTDC 23±2°/3600 R.P.M. |
|---|---|
| Allowable mismatch of the marks | Within ±3mm/3600 R.P.M. |

### 3-3 Resistance Valve of Coils

| Exciter Coil | approx. 480Ω |
|---|---|
| Polser Coil | approx. 70Ω |

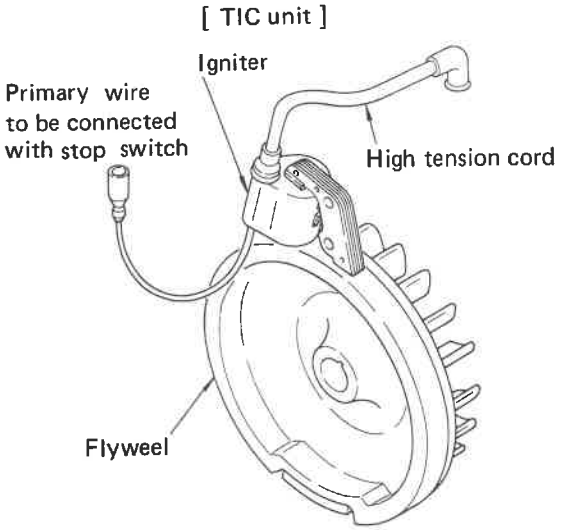
### 3-4 CDI Unit Check Table

| To be connected with negative ⊖ terminal of the tester | To be connected with positive ⊕ terminal of the tester | | | | | |
|---|---|---|---|---|---|---|
| | Leading wire | Red | Black | White | Brown | Black (H) |
| | Red | | Conductive | Needle swing | Needle swing | Needle swing |
| | Black | Needle swing | | Needle swing | Needle swing | Needle swing |
| | White | Conductive | Conductive | | Conductive | Conductive |
| | Brown | Conductive | Conductive | Conductive | | Conductive |
| | Black (H) | Conductive | Conductive | Conductive | Conductive | |

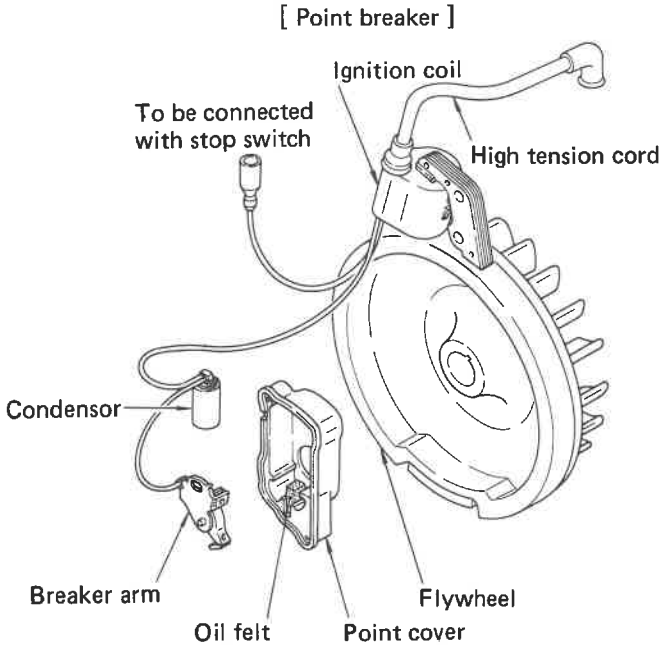
Conductive: The tester shows the resistance of couple hundreds to tenthousands ohms.
Needle swing: Needle swings back to show infinite resistance (∞) immediately after showing low resistance.
(H): High tension cord.

## 4 CHEKING OF TIC UNIT FOR KF53-AX

### 4-1 Components of TIC Unit (Composition Compared with Point Breaker System)




(Fig. 079)




(Fig. 080)

There is neither condensor nor contact breaker in this TIC system. The system is made as one unit called TIC unit (igniter) which consists of ignition coil and electronic circuit with transistors.
Correct timing is obtained when the igniter is installed correctly with the airgap recommended.
Otherwise, no portion is to be adjusted.

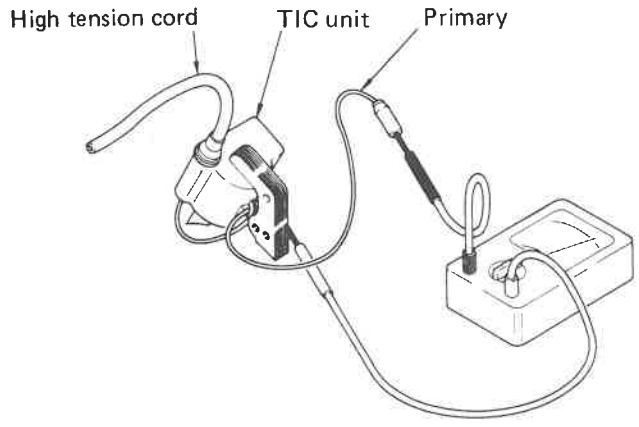
## 4-2 Resistance Value of Coils

There is no way to do conductivity test between wires of this system, whereas the test can be applied on CDI system, because only the lead from primary coil and high tension cord are available from TIC unit (Igniter).
If the test resuslt obtained per the circuit shown in Fig. 092, 093 indicates too high or too low resistance as compared the value shown below, replacement of the unit is recommended because lower value indicates possible insulation faibure of the coil and non-conductirity indicates possible wire breakage in the circuit.

Resistance Value — Ignition Coil

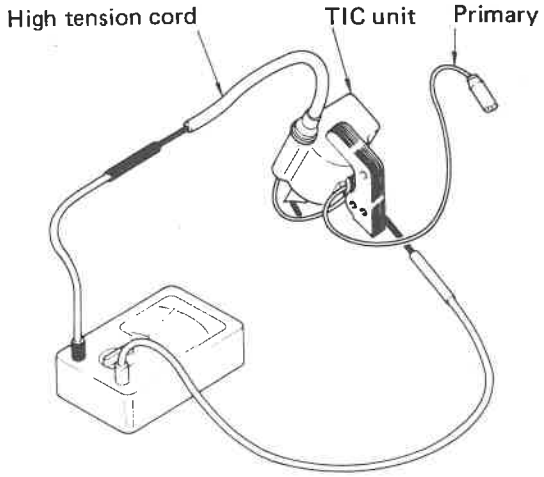
| | |
|---|---|
| Primary Coil | 0.6Ω |
| Secondary Coil | 11.2KΩ |

[Mesurement of primary coil resistance]




(Fig. 081)

[Mesurement of secondary coil resistance]




(Fig. 082)