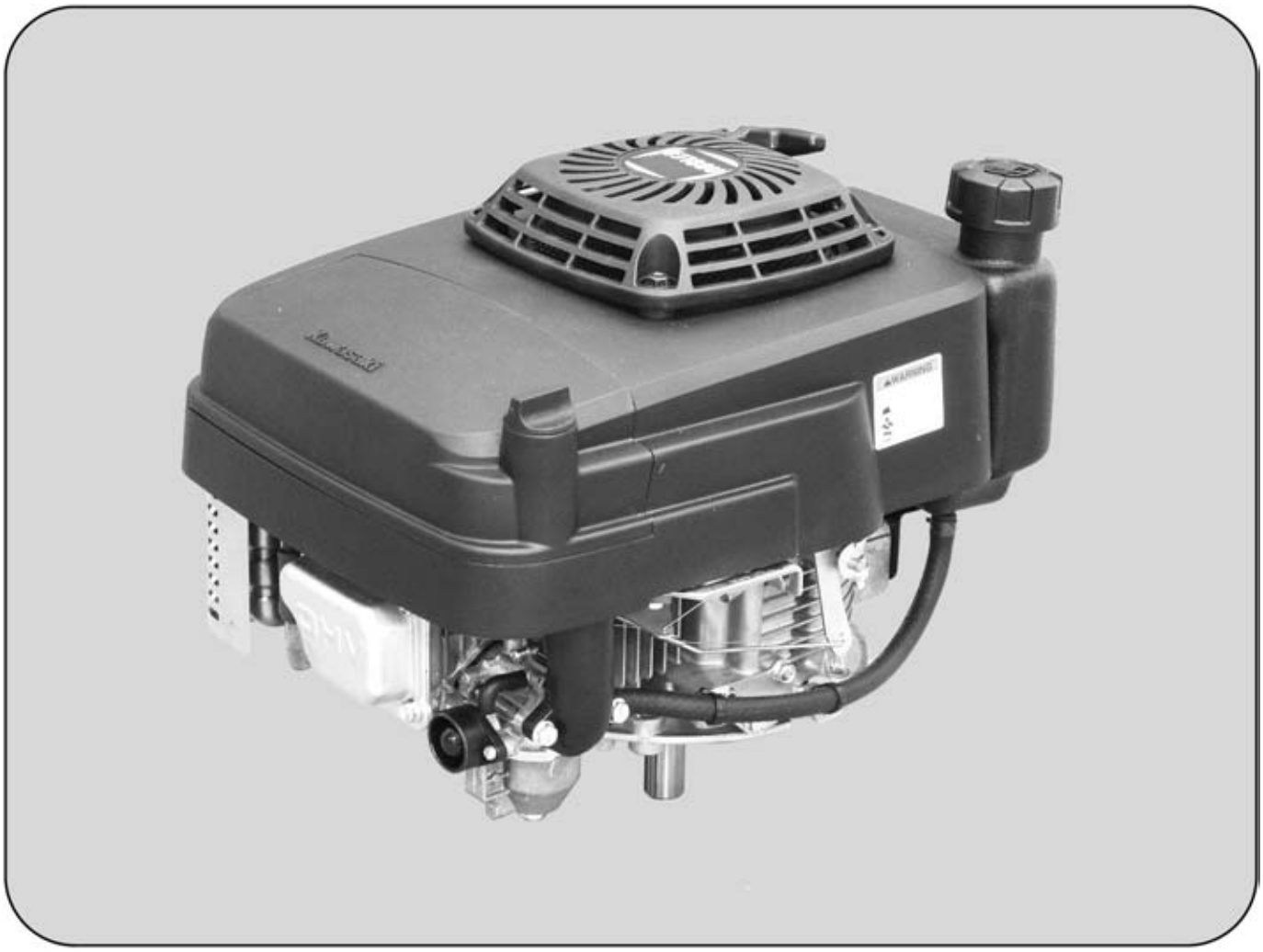
Kawasaki

FJ151V
FJ180V
(Year 2010 ~)



4-Stroke Air-Cooled Gasoline Engine

Service Manual

Quick Reference Guide

This quick reference guide will assist you in locating a desired topic or procedure.

- Bend the pages back to match the black tab of the desired chapter number with the black tab on the edge at each table of contents page.
- Refer to the sectional table of contents for the exact pages to locate the specific topic required.

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FJ151V
FJ180V
(Year 2010 ~)

4-Stroke Air-Cooled Gasoline Engine

Service Manual

First Edition (0) : Aug. 20, 2010

LIST OF ABBREVIATIONS

A	ampere(s)	lb	pound(s)
ABDC	after bottom dead center	m	meter(s)
AC	alternating current	min	minute(s)
ATDC	after top dead center	N	newton(s)
BBDC	before bottom dead center	Pa	pascal(s)
BDC	bottom dead center	PS	horsepower
BTDC	before top dead center	psi	pound(s) per square inch
°C	degree(s) Celsius	r	revolution
DC	direct current	rpm	revolution(s) per minute
F	farad(s)	TDC	top dead center
°F	degree(s) Fahrenheit	TIR	total indicator reading
ft	foot, feet	V	volt(s)
g	gram(s)	W	watt(s)
h	hour(s)	Ω	ohm(s)
L	liter(s)		

EMISSION CONTROL INFORMATION

To protect the environment in which we all live, Kawasaki has incorporated crankcase emission (1) and exhaust emission (2) control systems (EM) in compliance with applicable regulations of the United States Environmental Protection Agency and California Air Resources Board.

1. **Crankcase Emission Control System**

A sealed-type crankcase emission control system is used to eliminate blow-by gases. The blow-by gases are led to the breather chamber through the crankcase. Then, it is led to the air cleaner.

Oil is separated from the gases while passing through the inside of the breather chamber from the crankcase, and then returned back to the bottom of crankcase.

2. **Exhaust Emission Control System**

The exhaust emission control system applied to this engine consists of a carburetor and an ignition system having optimum ignition timing characteristics.

The carburetor has been calibrated to provide lean air/fuel mixture characteristics and optimum fuel economy with a suitable air cleaner and exhaust system.

TAMPERING WITH EMISSION CONTROL SYSTEM PROHIBITED

Federal law and California State law prohibits the following acts or the causing thereof: (1) the removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new engine for the purpose of emission control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the engine after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the acts listed below:
Do not tamper with the original emission related part:

- Carburetor and internal parts
- Spark plug
- Magneto or electronic ignition system
- Fuel filter element
- Air cleaner elements
- Crankcase
- Cylinder head
- Breather chamber and internal parts
- Inlet pipe and tube

Foreword

This manual is designed primarily for use by trained mechanics in a properly equipped shop. However, it contains enough detail and basic information to make it useful to the owner who desires to perform his own basic maintenance and repair work. A basic knowledge of mechanics, the proper use of tools, and workshop procedures must be understood in order to carry out maintenance and repair satisfactorily. Whenever the owner has insufficient experience or doubts as to his ability to do the work, all adjustments, maintenance, and repair should be carried out only by qualified mechanics.

In order to perform the work efficiently and to avoid costly mistakes, read the text, thoroughly familiarize yourself with the procedures before starting work, and then do the work carefully in a clean area. Whenever special tools or equipment are specified, do not use makeshift tools or equipment. Precision measurements can only be made if the proper instruments are used, and the use of substitute tools may adversely affect safe operation.

To get the longest life out of your engine:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki engine parts. Genuine parts provided as spare parts are listed in the Parts Catalog.
- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

How to Use This Manual

In this manual, the product is divided into its major systems and these systems make up the manual's chapters. The Quick Reference Guide shows you all of the product's system and assists in locating their chapters. Each chapter in turn has its own comprehensive Table of Contents.

For example, if you want ignition coil information, use the Quick Reference Guide to locate the Electrical System chapter. Then, use the Table of Contents on the first page of the chapter to find the Ignition coil section.

Whenever you see these WARNING and CAUTION symbols, heed their instructions! Always follow safe operating and maintenance practices.

⚠ WARNING

This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.

CAUTION

This caution symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of equipment.

This manual contains four more symbols (in addition to WARNING and CAUTION) which will help you distinguish different types of information.

NOTE

○ *This note symbol indicates points of particular interest for more efficient and convenient operation.*

- Indicates a procedural step or work to be done.

○ Indicates a procedural sub-step or how to do the work of the procedural step it follows. It also precedes the text of a WARNING, CAUTION, or NOTE.

★ Indicates a conditional step or what action to take based on the results of the test or inspection in the procedural step or sub-step it follows.

In most chapters an exploded view illustration of the system components follows the Table of Contents. In these illustrations you will find the instructions indicating which parts require specified tightening torque, oil, grease or a locking agent during assembly.

General Information

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1-2 GENERAL INFORMATION

Before Servicing

Before starting to service the engine, carefully read the applicable section to eliminate unnecessary work. Photographs, diagrams, notes, cautions, warnings, and detailed descriptions have been included wherever necessary. Nevertheless, even a detailed account has limitations, a certain amount of basic knowledge is required for successful work.

Especially note the following:

(1) Dirt

Before removal and disassembly, clean the engine. Any dirt entering the engine, carburetor, or other parts, will work as an abrasive and shorten the life of engine. For the same reason, before installing a new part, clean off any dust or metal filings.

(2) Tightening Sequence

Generally, when installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit. Then tighten them evenly, in a staggered sequence. This is to avoid distortion of the part and/or causing gas or oil leakage. Conversely when loosening the bolts, nuts, or screws, first loosen all of them by about a quarter of a turn and then remove them. Where there is a tightening sequence indication in this Service Manual, the bolts, nuts, or screws must be tightened in the order and method indicated.

(3) Torque

When torque values are given in this Service Manual, use them. Either too little or too much torque may lead to serious damage. Use a good quality, reliable torque wrench.

(4) Force

Common sense should dictate how much force is necessary in assembly and disassembly. If a part seems especially difficult to remove or install, stop and examine what may be causing the problem. Whenever tapping is necessary, tap lightly using a wooden or plastic-faced mallet. Use an impact driver for screws (particularly for the removal of screws held by a locking agent) in order to avoid damaging the heads.

(5) Edges

Watch for sharp edges, especially during major engine disassembly and assembly. Protect your hands with gloves or a piece of thick cloth when lifting the engine or turning it over.

(6) High-Flash Point Solvent

A high-flash point solvent is recommended to reduce fire danger. A commercial solvent commonly available in North America is Standard solvent (generic name). Always follow manufacturer and container directions regarding the use of any solvent.

(7) Gasket, O-ring

Do not reuse a gasket or O-ring once it has been in service. The mating surfaces around the gasket should be free of foreign material and perfectly smooth to avoid oil or compression leaks.

(8) Liquid Gasket, Non-Permanent Locking Agent

Follow manufacturer's directions for cleaning and preparing surfaces where these compounds will be used. Apply sparingly. Excessive amounts may block engine oil passages and cause serious damage. An example of a non-permanent locking agent commonly available in North America is Loctite Lock'n Seal (Blue).

(9) Press

A part installed using a press or driver, such as a journal, should first be coated with oil on its outer or inner circumference so that it will go into place smoothly.

(10) Ball Bearing

Do not remove a ball bearing unless it is absolutely necessary. Replace any ball bearings that were removed with new ones. Install bearings with the manufacturer and size marks facing out, applying pressure evenly with a suitable driver to the end of the race that contacts the press fit portion, and press it evenly over the base component.

(11) Oil Seal and Grease Seal

Replace any oil or grease seals that were removed with new ones, as removal generally damages seals. When pressing in a seal which has manufacturer's marks, press it in with the marks facing out. Seals should be pressed into place using a suitable driver, which contacts evenly with the side of seal, until the face of the seal is even with the end of the hole.

Before Servicing

(12)Seal Guide

A seal guide is required for certain oil or grease seals during installation to avoid damage to the seal lips. Before a shaft passes through a seal, apply a little oil, preferably high-temperature grease on the lips to reduce rubber to metal friction.

(13)Circlip and Retaining Ring

When installing circlips and retaining rings, take care to compress or expand them only enough to install them and no more. Install the circlip with its chamfered side facing load side as well.

Replace any circlips and retaining rings that were removed with new ones, as removal weakens and deforms them. If old ones are reused, they could become detached while running, leading to a problem.

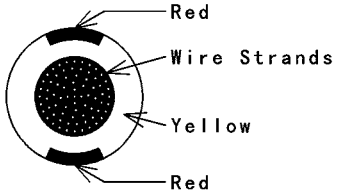
(14)Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the rubbing surfaces have an adequate lubricative film. During assembly, oil or grease (whichever is more suitable) should be applied to any rubbing surface which has lost its lubricative film. Old grease and dirty oil should be cleaned off. Deteriorated grease has lost its lubricative quality and may contain abrasive foreign particles.

Don't use just any oil or grease. Some oils and greases in particular should be used only in certain applications and may be harmful if used in an application for which they are not intended. This manual makes reference to molybdenum disulfide grease (MoS2) in the assembly of certain engine parts. Always check manufacturer recommendations before using such special lubricants.

(15)Electrical Wires

All the electrical wires are either single-color or two-color and, with only a few exceptions, must be connected to wires of the same color. On any of the two-color wires there is a greater amount of one color and a lesser amount of a second color, so a two-color wire is identified by first the primary color and then the secondary color. For example, a yellow wire with thin red stripes is referred to as a "yellow/red" wire; it would be a "red/yellow" wire if the colors were reversed to make red the main color.

Wire(cross-section)	Color Indicated on the Wire	Color Indicated on the Wiring Diagram
	Yellow/Red	Y/R

GB020601WI C

(16)Replacement Parts

When there is a replacement instruction, replace these parts with new ones every time they are removed. There replacement parts will be damaged or lose their original function once removed.

(17)Inspection

When parts have been disassembled, visually inspect these parts for the following conditions or other damage. If there is any doubt as to the condition of them, replace them with new ones.

Abrasion	Crack	Hardening	Warp
Bent	Dent	Scratch	Wear
Color change	Deterioration	Seizure	

(18)Service Data

Service Data terms are defined as follows:

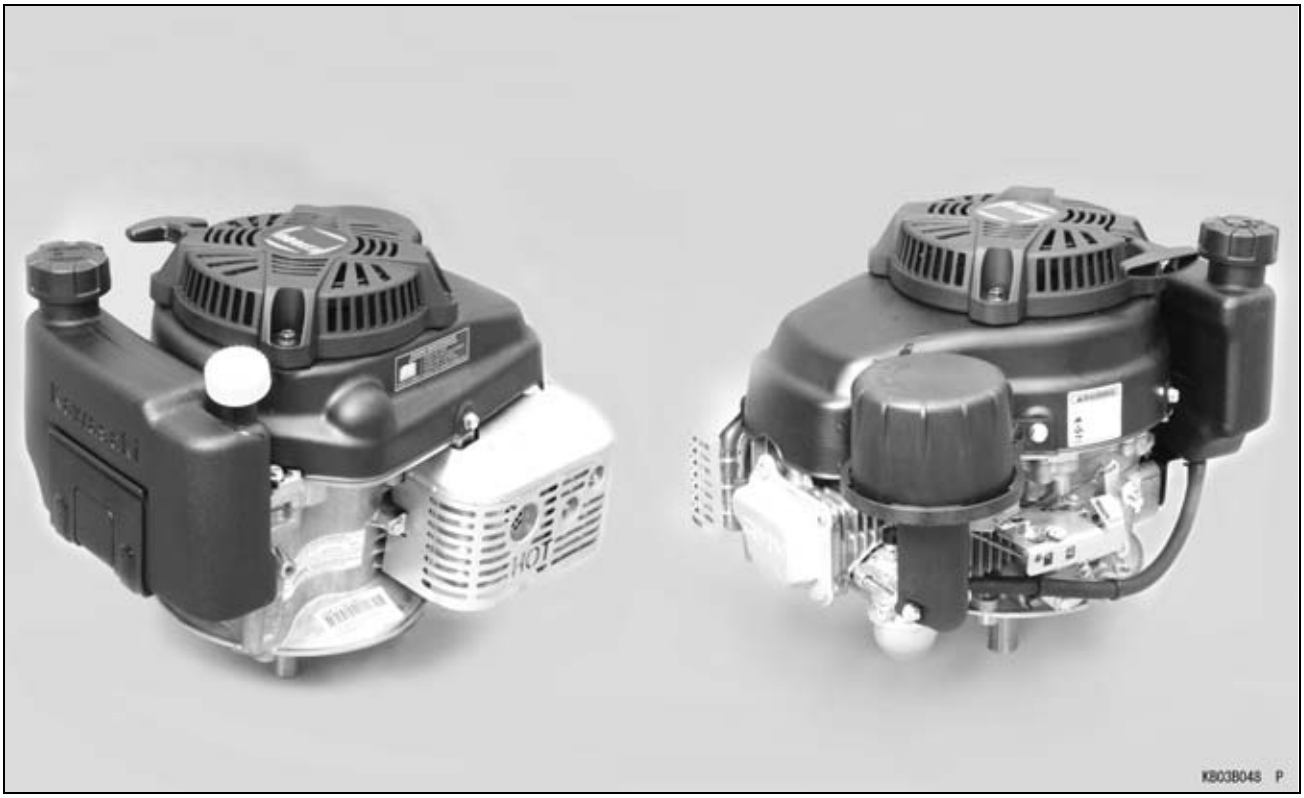
"Standards" show dimensions or performances which brand-new parts or systems have.

"Service Limits" indicate the usable limits. If the measurement shows excessive wear or deteriorated performance, replace the damaged parts.

Model Identification

FJ180V

FJ180V (KAI Model)



Model Application

Year	Model	Beginning Engine Number
2010 ~	FJ151V	FJ151VJ00001 ~
2010 ~	FJ180V	FJ180VJ00001 ~

General Specifications

Item	FJ151V, FJ180V	
	Standard Model	KAI Model
Type	Forced air-cooled, vertical shaft, OHV, 4-stroke gasoline engine	
Bore × Stroke	65 mm × 54 mm (2.56 in. × 2.13 in.)	
Displacement	179 cm³ (10.9 cu in.)	
Direction of Rotation	Counterclockwise facing the PTO shaft	
Compression Release	Automatic compression release	
Low Idle Speed	1 550 rpm (r/min) (Choke Start Model) Not specified (Priming Start Model)	
High Idle Speed	3 300 rpm (r/min) (Choke Start Model) 3 200 rpm (r/min) (Priming Start Model) 2 950 rpm (r/min) (FJ151V Model)	
Ignition System	Flywheel magneto with CDI	
RFI	Per Canada and U.S.A. requirements	
Starting System	Recoil starter	
Spark Plug	NGK BPR5ES	
Carburetor	Float type, fixed main jet	
Air Cleaner	Dual stage element, dry type	
Governor	Flyweight all speed governor	
Lubrication System	Pressure feed by positive displacement pump	
Oil Capacity (when engine is completely dry)	0.65 L (0.69 US qt)	
Cooling System	Forced air cooling by fan	
Dimensions (L × W × H)	393 mm × 317 mm × 286 mm (15.5 in. × 12.5 in. × 11.3 in.)	390 mm × 344 mm × 290 mm (15.4 in. × 13.5 in. × 11.4 in.)
Dry Weight	17.0 kg (37.5 lb)	16.9 kg (37.3 lb)

Specifications are subject to change without notice.

Unit Conversion Table

Prefixes for Units:

Prefix	Symbol	Power
mega	M	× 1 000 000
kilo	k	× 1 000
centi	c	× 0.01
milli	m	× 0.001
micro	μ	× 0.000001

Units of Mass:

kg	×	2.205	=	lb
g	×	0.03527	=	oz

Units of Volume:

L	×	0.2642	=	gal (US)
L	×	0.2200	=	gal (imp)
L	×	1.057	=	qt (US)
L	×	0.8799	=	qt (imp)
L	×	2.113	=	pint (US)
L	×	1.816	=	pint (imp)
mL	×	0.03381	=	oz (US)
mL	×	0.02816	=	oz (imp)
mL	×	0.06102	=	cu in

Units of Force:

N	×	0.1020	=	kg
N	×	0.2248	=	lb
kg	×	9.807	=	N
kg	×	2.205	=	lb

Units of Length:

km	×	0.6214	=	mile
m	×	3.281	=	ft
mm	×	0.03937	=	in

Units of Torque:

N·m	×	0.1020	=	kgf·m
N·m	×	0.7376	=	ft·lb
N·m	×	8.851	=	in·lb
kgf·m	×	9.807	=	N·m
kgf·m	×	7.233	=	ft·lb
kgf·m	×	86.80	=	in·lb

Units of Pressure:

kPa	×	0.01020	=	kgf/cm²
kPa	×	0.1450	=	psi
kPa	×	0.7501	=	cmHg
kgf/cm²	×	98.07	=	kPa
kgf/cm²	×	14.22	=	psi
cmHg	×	1.333	=	kPa

Units of Speed:

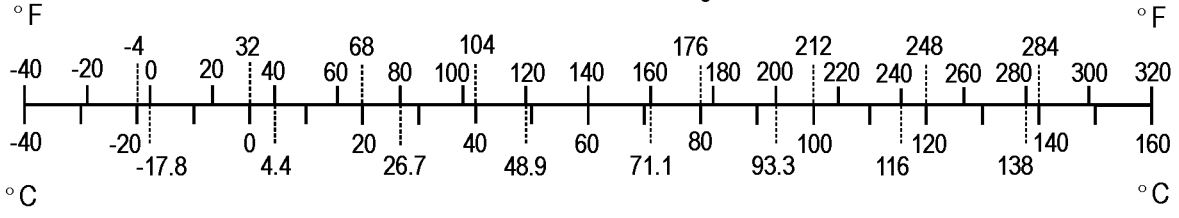
km/h	×	0.6214	=	mph

Units of Power:

kW	×	1.360	=	PS
kW	×	1.341	=	HP
PS	×	0.7355	=	kW
PS	×	0.9863	=	HP

Units of Temperature:

$\frac{9(°C+40)}{5} - 40 = °F$ $\quad\quad$ $\frac{5(°F+40)}{9} - 40 = °C$



Periodic Maintenance

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2-2 PERIODIC MAINTENANCE

Periodic Maintenance Chart

To ensure satisfactory operation over an extended period of time, any engine requires normal maintenance regular intervals. The Periodic Maintenance Chart shows periodic inspection and maintenance items and suitable intervals. The bullet mark (●) designates that the corresponding item should be performed at that interval.

Some adjustments require the use of special tools or other equipment. An electronic tachometer will facilitate setting idle and running speeds.

OPERATION	INTERVAL					
	Daily	First 8 hr.	Every 25 hr.	Every 50 hr.	Every 100 hr.	Every 300 hr.
Check and clean air inlet screen	●					
Check and add engine oil	●					
Check for fuel and oil leakage	●					
Check for loose or lost nuts and screws	●					
Clean air cleaner foam element (1)			●			
Clean air cleaner paper element (1)					●	
Tighten nuts and screws			● (First)		●	
Change engine oil		●		●		
Clean and re-gap spark plug					●	
Change air cleaner paper element (1)						●
Clean dust and dirt from cylinder and cylinder head fins (1)						●
Check and adjust valve clearance ★						●
Clean and lap valve seating surface ★						●
Clean combustion chamber ★						●

(1): Service more frequently under dusty conditions.

★: These items must be performed with the proper tools. See your authorized Kawasaki Engine Dealer for service, unless you have the proper equipment and mechanical proficiency.

Torque and Locking Agent

The following tables list the tightening torque for the major fasteners, and the parts requiring use of a non-permanent locking agent or silicone sealant etc.
Letters used in the "Remarks" column mean:
L : Apply a non-permanent locking agent.
O : Apply engine oil.
S : Follow the specified tightening sequence.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System				
Governor Arm Clamp Nut	7.8	0.80	69 in·lb	
Fuel Tank Cover Bolts	6.9	0.70	61 in·lb	
Fuel Tank Bracket Bolt	6.9	0.70	61 in·lb	
Priming Nut	1.2	0.12	11 in·lb	
Throttle Valve Screw	0.70	0.07	6 in·lb	L
Main Jet	1.1	0.11	9.7 in·lb	
Drain Screw	5.4	0.55	48 in·lb	
Float Chamber Mounting Bolt	9.8	1.0	48 in·lb	
Float Chamber Mounting Bolt (Choke Start Model)	9.8	1.0	39 in·lb	
Cooling System				
Flywheel Bolt	42	4.3	31	
Fuel Tank Cover Bolts	6.9	0.70	61 in·lb	
Engine Top End				
Cylinder Head Bolts (7T)	22	2.2	16	S
Cylinder Head Bolts (7N)	25	2.5	18	S
Cylinder Head Bolts (9N)	26	2.6	19	S
Valve Clearance Lock Screws	6.9	0.70	61 in·lb	
Connecting Rod Big End Cap Bolts	5.9	0.60	52 in·lb	O
Rocker Arm Bolts	28	2.8	20	
Spark Plug	22	2.2	16	
Rocker Cover Mounting Bolts	5.9	0.60	52 in·lb	
Muffler Cover Bolt	6.9	0.70	61 in·lb	
Lubrication System				
Oil Drain Plug	22	2.2	16	
Oil Filter Cover Bolt	6.9	0.70	61 in·lb	
Camshaft/Crankshaft				
Crankcase Cover Bolts	8.8	0.90	78 in·lb	S
Crankcase Cover Bolts (Cylinder side)	5.9	0.60	52 in·lb	S
Connecting Rod Big End Cap Bolts	5.9	0.60	52 in·lb	O
Valve Clearance Lock Screws	6.9	0.70	61 in·lb	
Rocker Arm Bolts	28	2.8	20	
Starter System				
Recoil Starter Mounting Bolts	6.9	0.70	61 in·lb	
Brake Arm Mounting Bolt	9.3	0.95	82 in·lb	
Brake Lever Assembly Mounting Bolt	6.9	0.70	61 in·lb	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Electrical System				
Flywheel Bolt	42	4.3	31	
Spark Plug	22	2.2	16	
Kill Switch Bolt	1.5	0.15	13 in·lb	

The table below, relating tightening torque to thread diameter, lists the basic torque for the bolts and nuts. Use this table only for the bolts and nuts which do not require a specific torque value. All of the values are for use with dry solvent-cleaned threads.

Basic Torque for General Fasteners

Threads Diameter (mm)	Torque		
	N·m	kgf·m	ft·lb
4	2.0	0.20	17 in·lb
5	3.4	0.35	30 in·lb
6	5.9	0.60	52 in·lb
8	15	1.5	11
10	20	2.0	15

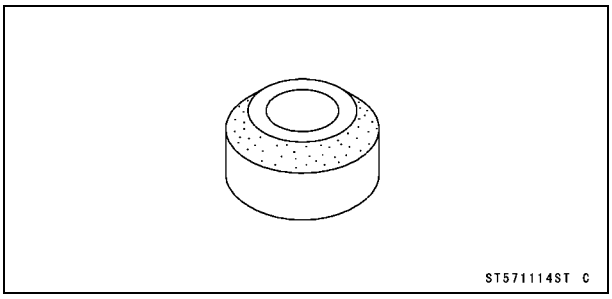
Specifications

Item	Standard
Fuel System	
Idle Speed (1) :	
Low Idle Speed:	
Choke Start Model	1 550 r/min(rpm)
Priming Start Model	Not specified
High Idle Speed:	
Choke Start Model	3 300 r/min (rpm)
Priming Start Model	3 200 r/min (rpm)
FJ151V Model	2 950 r/min (rpm)
Air Cleaner:	
Type	Dual stage filtration system
Cleaner:	
First	Foam element
Second	Paper element
Engine Top End	
Cylinder Head Warp	Service Limit: 0.03 mm (0.001 in.)
Valve Clearance:	
Exhaust	0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)
Inlet	0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)
Valve Seating Surface Angle:	
Exhaust	45°
Inlet	45°
Valve Seating Surface Width:	
Exhaust	0.6 ~ 0.9 mm (0.024 ~ 0.035 in.)
Inlet	0.6 ~ 0.9 mm (0.024 ~ 0.035 in.)
Lubrication System	
Engine Oil:	
Type	SF, SG, SH or SJ class
Viscosity	SAE30, SAE10W-30
Capacity	0.65 L (0.69 US qt)
Level	Operating range (grid area) on dipstick
Electrical System	
Spark Plug Gap	0.75 mm (0.030 in.)

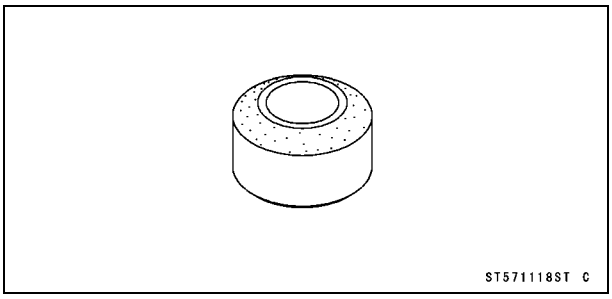
(1) Idle speeds may vary depending on each equipment. Refer to the equipment specification.

Special Tools

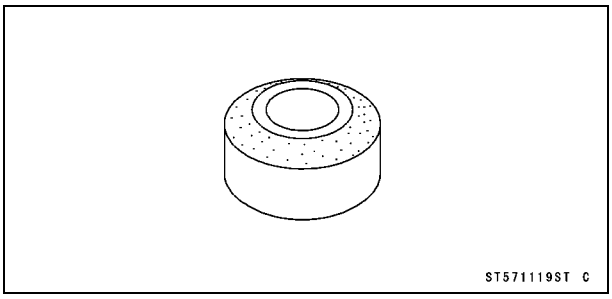
Valve Seat Cutter, 45° - ϕ27.5:
57001-1114



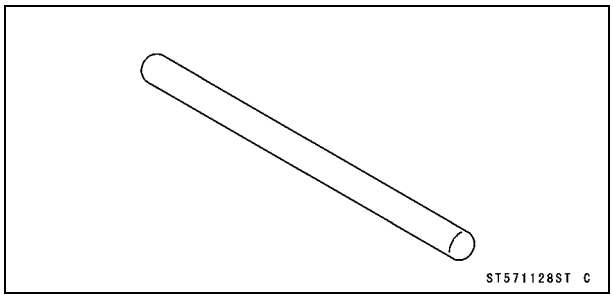
Valve Seat Cutter, 32° - ϕ25:
57001-1118



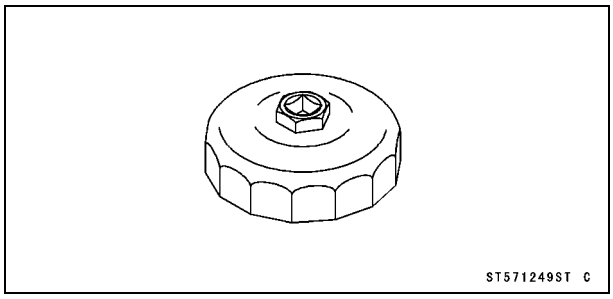
Valve Seat Cutter, 32° - ϕ28:
57001-1119



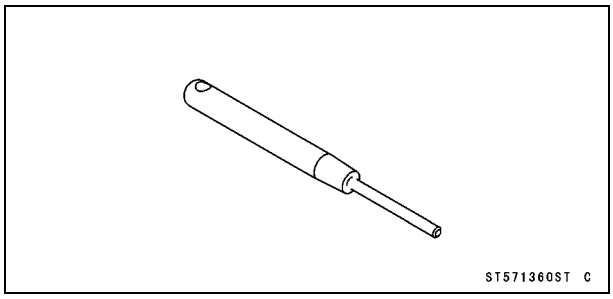
Valve Seat Cutter Holder Bar:
57001-1128



Oil Filter Wrench:
57001-1249



Valve Seat Cutter Holder, ϕ6:
57001-1360



Periodic Maintenance Procedures

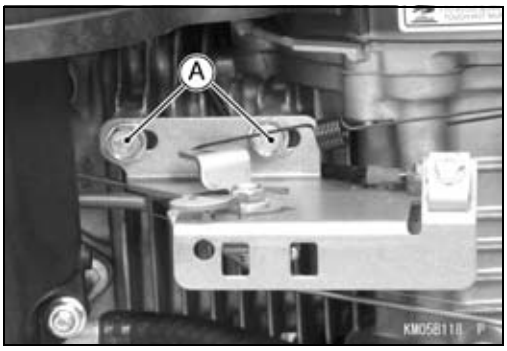
Fuel System

Idle Speed Adjustment (Choke Start Model)

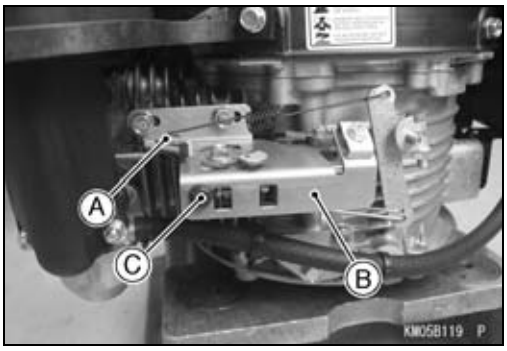
CAUTION
Do not adjust idle speed with the air cleaner removed.

High Idle Speed Adjustment

- Start and warm up the engine without load.
- Tighten the control panel mounting bolts [A] temporarily.



- Move the throttle lever [A] at a dash to the high idle position, align bend part of throttle lever with hole of control panel [B] and insert the 6 mm (0.24 in.) diameter pin or bolt [C] through hole. When installing, fit the bend part of the throttle lever and the 6 mm (0.24 in.) diameter pin or bolt.
- Adjust the idle speed for specified rpm by moving control panel, and tighten the control panel mounting bolts securely.

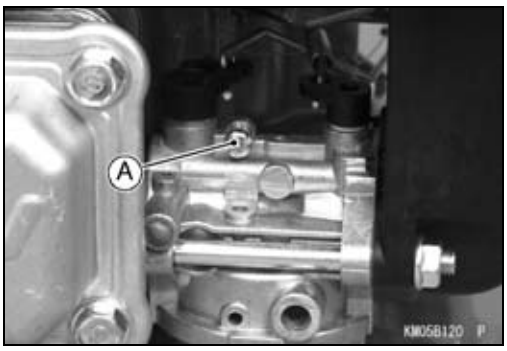


High Idle Speed
3 300 r/min (rpm)
2 950 r/min (rpm) (FJ151V Model)

- Remove the 6 mm (0.24 in.) diameter pin or bolt from the control panel.

Low Idle Speed Adjustment

- Move the throttle lever at a dash to the low idle position.
- Adjust the idle speed set screw [A] on the carburetor to obtain the specified rpm.

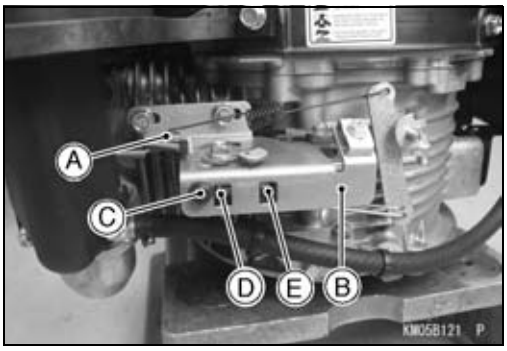


Low Idle Speed
1 550 r/min (rpm)

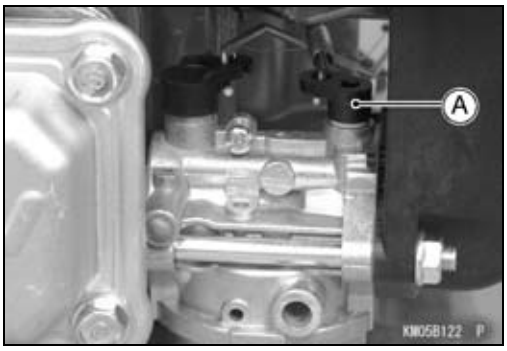
- Stop the engine.

Periodic Maintenance Procedures

Choke Adjustment



- Stop the engine.
- Move the throttle lever [A] at a dash to the high idle position, align bend part of throttle lever with hole of control panel [B] and insert the 6 mm (0.24 in.) diameter pin or bolt [C] through hole. When installing, fit the bend part [D] (carburetor side) of the throttle lever and the 6 mm (0.24 in.) diameter pin or bolt.
- Adjust the clearance (0.5 ~ 1.5 mm, 0.02 ~ 0.06 in.) between the bend part (opposite carburetor side) of the throttle lever and the screw end [E] of the control panel by turning the screw.



- Remove the 6 mm (0.24 in.) diameter pin or bolt from the control panel. After removing, move the choke lever of the control panel and make sure that the position of the choke lever [A] on the carburetor will be the opened or closed positions.

Idle Speed Adjustment (Priming Start Model)

High Idle Speed Adjustment

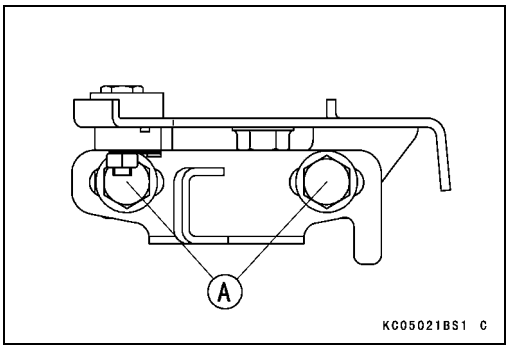
CAUTION

Do not adjust high idle speed with the air cleaner removed.

- Start and warm up the engine thoroughly.

⚠ WARNING

Always keep your hands clear of the moving parts.



- Move the throttle lever at a dash to the high idle position.
- Loosen the control panel mounting bolts [A] enough to move the control panel assembly.
- Carefully move the control panel assembly right or left to obtain the specified high idle speed.

High Idle Speed
3 200 r/min (rpm)

- Tighten the mounting bolts.

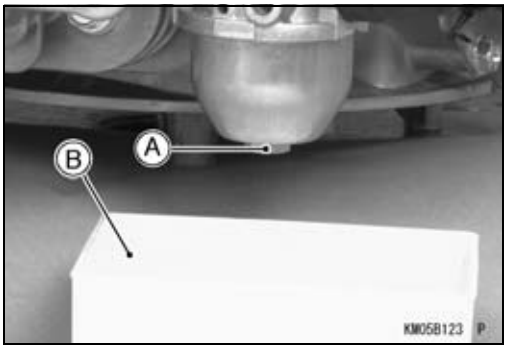
Fuel System Cleanliness Inspection

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the engine switch stop position. Do not smoke. Make sure the area is well-ventilated and free from any source of flame or sparks, this includes any appliance with a pilot light.

Periodic Maintenance Procedures

Choke Start Model

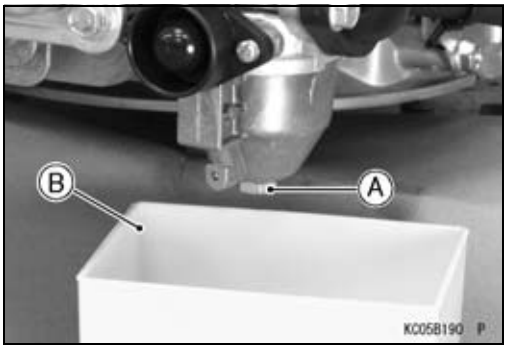


- Place a suitable container [B] under the bolt [A] of the carburetor.
- Loosen the bolt to drain the carburetor and check to see if water or dirt has accumulated in the carburetor.
- Tighten the bolt.

Torque - Float Chamber Mounting Bolt: 4.5 N·m (0.45 kgf·m, 39 in·lb)

- If any water or dirt is found, clean the carburetor and the fuel tank (see Carburetor Cleaning, Fuel Tank Cleaning in the Fuel System chapter).

Priming Start Model



- Place a suitable container [B] under the drain screw [A] of the carburetor.
- Loosen the drain screw to drain the carburetor and check to see if water or dirt has accumulated in the carburetor.
- Tighten the drain screw.

Torque - Drain Screw: 5.4 N·m (0.55 kgf·m, 48 in·lb)

- Install the primer pipe in the tube (see Priming Pump Installation in the Fuel System chapter).
- If any water or dirt is found, clean the carburetor and the fuel tank (see Carburetor Cleaning, Fuel Tank Cleaning in the Fuel System chapter).

Fuel Filter Inspection

- Visually inspect the fuel filter.

★If the filter is clear with no signs of dirt or other contamination, the replacement of the filter is not necessary.

★If the filter is dark or looks dirty, replace it with a new one. Also check the rest of the fuel system for contamination.

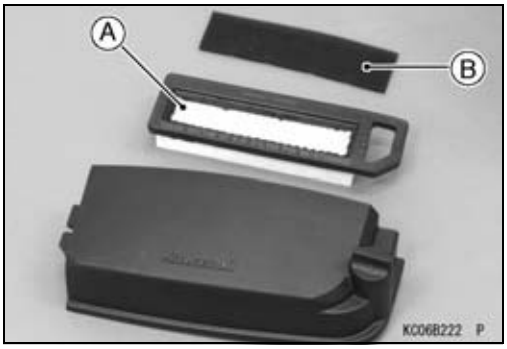
- Check the O-ring at the tank drain for damage. Replace the O-ring with a new one if it is damaged.

Air Cleaner Element Removal

- Remove the nut [A].

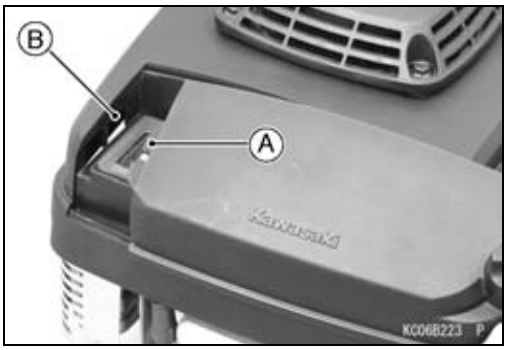
● Remove the air cleaner case [A].

● Remove:
Paper Element [A]
Foam Element [B]



Air Cleaner Element Installation

● Install:
Foam Element
Paper Element
● Install the hollow [A] of the air cleaner case to fit the projection [B] of the air cleaner body.



● Tighten the nut [A].

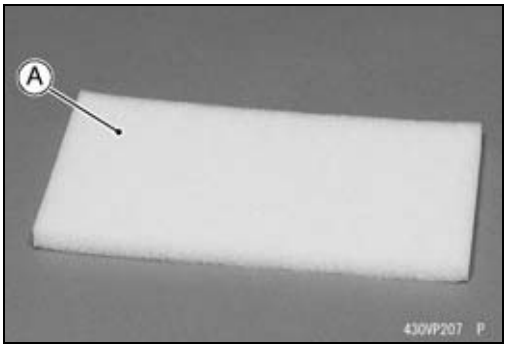
Air Cleaner Element Cleaning and Inspection

NOTE

○*In dusty areas, clean the elements more frequently than the recommended intervals.*

⚠ WARNING

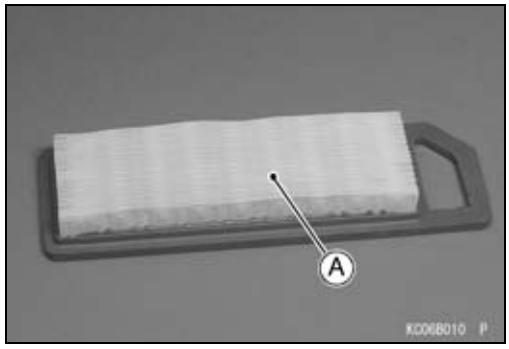
Because of the danger of highly flammable liquids, do not use gasoline or a low-flash point solvent to clean the element.



Periodic Maintenance Procedures

- Remove the paper element and the foam element (see Air Cleaner Element Removal).
- Clean the foam element [A] in a bath of detergent and water, and let the element air-dry thoroughly before installing it.

- Clean the paper element [A] by tapping it gently on a flat surface to remove dust. If the element is very dirty, replace it with a new one.



CAUTION

Do not use compressed air to clean the paper element. Do not oil the paper or foam element.

Air Cleaner Housing (Case and Body) Inspection

- Clean the housing with detergent and water and dry it thoroughly.
- Check the housing for deformation or other damage. Seal the housing well and permit only filtered air to reach the carburetor.

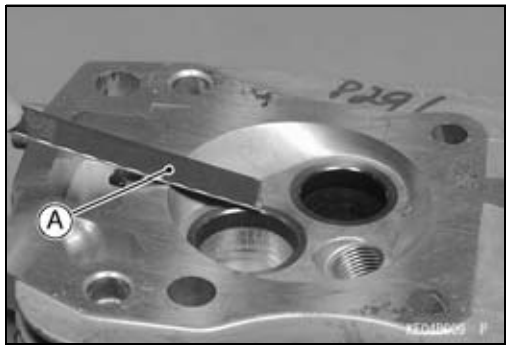
★If the housing is damaged, replace the housing with a new one.

- Check that no foreign material is obstructing the air passage.

Engine Top End

Cylinder Head Cleaning and Inspection

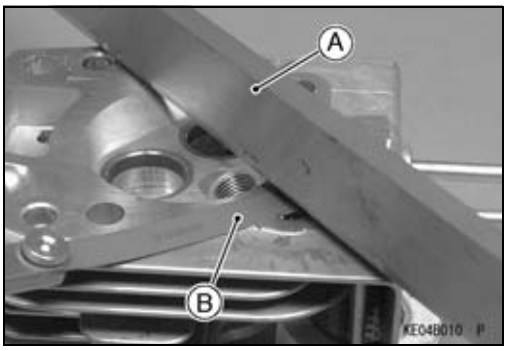
- Remove the cylinder head (see Cylinder Head Assembly Removal in the Engine Top End chapter).
- Scrape the carbon deposits from the cylinder head and the exhaust port with a suitable tool [A].
- To avoid gouging, use scrapers that material will not damage the cylinder head and the exhaust port.
- Clean the cylinder head in a bath of high-flash point solvent and dry it with compressed air.



⚠ WARNING

Clean the cylinder head in a well ventilated area, and take care that there are no sparks or flame anywhere near the working area, this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the cylinder head. A fire or explosion could result.

Periodic Maintenance Procedures



- Lay a straight edge [A] across the mating surface of the head at several different points, and measure the warp by inserting a thickness gauge [B] between the straight edge and the cylinder head.

★If the warp exceeds the service limit, repair the mating surface. Replace the cylinder head with a new one if the mating surface is badly damaged or warped.

Cylinder Head Warp
Service Limit: 0.03 mm (0.001 in.)

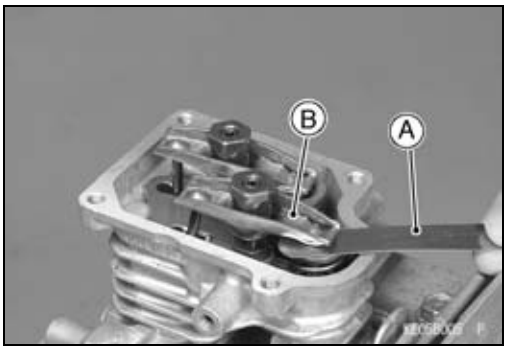
- Check the cylinder head for cracks or other damage.
- Cracks not visible to the eye may be detected by using a metal crack detection system (Visual color check: commonly found at automotive parts tore).
- If a crack is present in the cylinder head, replace it with a new one.
- Inspect the mating surface for burrs and nicks.

Valve Clearance Inspection

NOTE

○*Valve clearance must be checked when the engine is cold (at room temperature).*

- Remove the rocker cover (see Cylinder Head Assembly Removal in the Engine Top End chapter).
- Place the piston at the top dead center (TDC) of the compression stroke end by turning the crankshaft counterclockwise.



- Check the valve clearance.

○Using a thickness gauge [A], measure the valve clearance between the rocker arm [B] and the valve stem end.

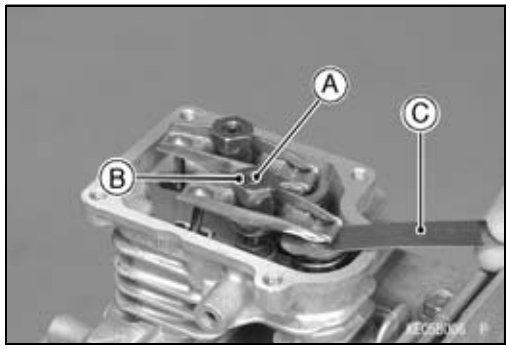
★If the valve clearance is not correct, adjust it.

Valve Clearance
Standard:

Exhaust	**0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)**
Inlet	**0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)**

Periodic Maintenance Procedures

Valve Clearance Adjustment



- Since valve repairs change the valve clearance, adjust the valve clearance to the specification.
- Assemble the cylinder head and install the cylinder head assembly on the block (see Cylinder Head Assembly Installation in the Engine Top End chapter).
- Turn the crankshaft to the proper direction until the piston is at the TDC of the compression stroke end.
- Loosen the lock screws [A] and the valve clearance adjusting nuts [B].
- Insert a 0.10 mm (0.004 in.) thickness gauge [C] between the rocker arm and valve stem, and tighten the adjusting nut until the thickness gauge begins to bind between the rocker arm and valve stem end. Use a sweeping motion with the thickness gauge while making this adjustment.

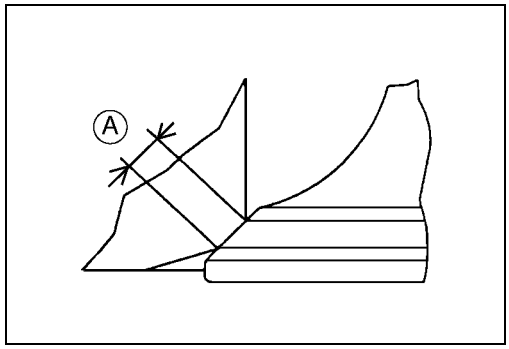
Valve Clearance
Standard:
Exhaust 0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)
Inlet 0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)

- Holding the adjusting nut with a wrench, tighten the lock screw to the specified torque.

Torque - Valve Clearance Lock Screws: 6.9 N·m (0.70 kgf·m, 61 in·lb)

- Do not overtighten the valve clearance lock screws.
- After adjusting the valve clearance, measure the valve clearance again. Readjust the valve clearance if necessary.

Valve Seat Inspection



- Remove the valve (see Valve Mechanism Removal/Installation in the Engine Top End chapter).
- Inspect the valve seats for damage.

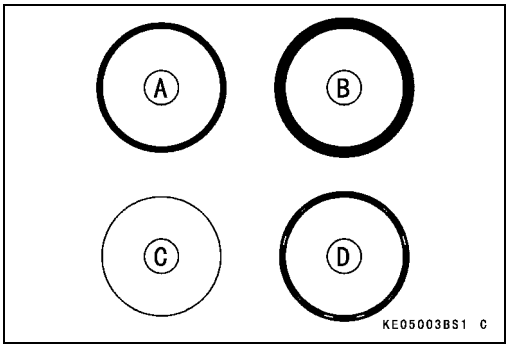
★If the seats are warped or distorted beyond reconditioning, replace the cylinder head with a new one.

- Reface pitted or worn valve seats. Lap the valves to the seats after refacing.
- Coat the valve seat with machinist's dye.
- Push the valve into the guide.
- Rotate the valve against the seat with a lapping tool.
- Pull the valve out, and check the seating pattern on the valve head. It must be the correct width [A] and even all the way around.

Periodic Maintenance Procedures

NOTE

○*The valve stem and guide must be in good condition or this check will not be valid.*



Good [A]
Too Wide [B]
Too Narrow [C]
Uneven [D]

★If the valve seating pattern is not correct, repair the seat.

Valve Seating Surface Width
Standard:

Exhaust	**0.6 ~ 0.9 mm (0.024 ~ 0.035 in.)**
Inlet	**0.6 ~ 0.9 mm (0.024 ~ 0.035 in.)**

Valve Seat Repair

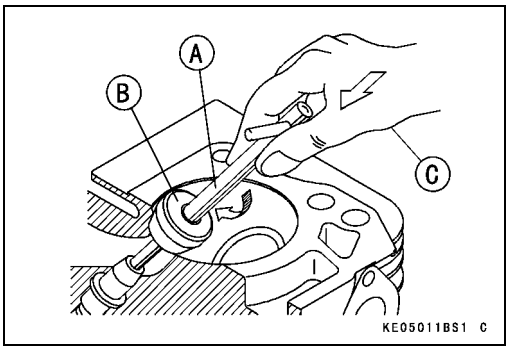
● Follow the manufacturer's instructions for use of valve seat cutters.

Special Tools - Valve Seat Cutter Holder Bar : 57001-1128
Valve Seat Cutter Holder-ϕ6.0 : 57001-1360
Exhaust Valve:
Valve Seat Cutter, 45° - ϕ27.5 : 57001-1114
Valve Seat Cutter, 32° - ϕ25.0 : 57001-1118
Inlet Valve:
Valve Seat Cutter, 45° - ϕ27.5 : 57001-1114
Valve Seat Cutter, 32° - ϕ28.0 : 57001-1119

★If the manufacturer's instructions are not available, use the following procedure.

Seat Cutter Operating Cares:

1. This valve seat cutter is designed only for valve seat repair. Do not use the valve seat cutter for other purposes.
2. Do not drop or hit the valve seat cutter, or the diamond particles may fall off.
3. Be sure to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.



NOTE

○*Do not use a wire brush to remove the metal particles from the cutter. It will take off the diamond particles.*

4. Setting the valve seat cutter holder [A] in position, operate the cutter [B] with one hand [C]. Do not apply too much force to the diamond portion.

NOTE

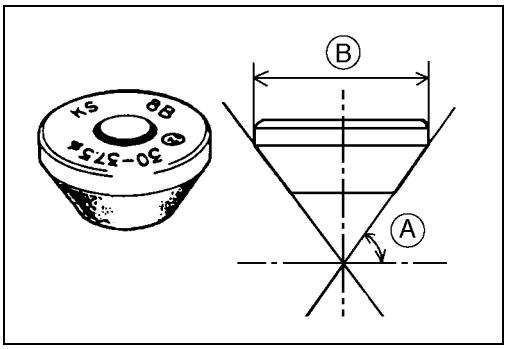
○*Prior to grinding, apply oil to the cutter, and during the operation wash off any ground particles sticking to the cutter with washing oil.*

5. After use, wash the cutter with washing oil and apply a thin layer of engine oil before storing.

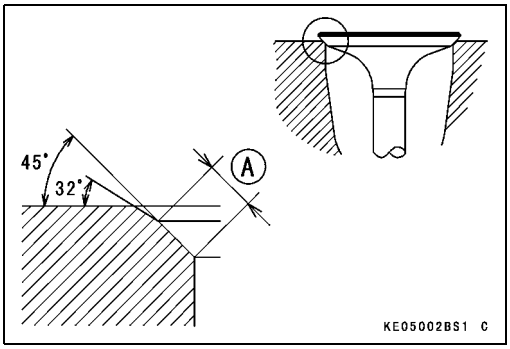
Periodic Maintenance Procedures

Marks Stamped on the Cutter:
The marks stamped on the back of the cutter represent the following.

1	Cutter number, selected from 1 to 12
30°	Cutter angle [A]
37.5	Cutter diameter of cutter [B]
KS8B	Manufactured lot number

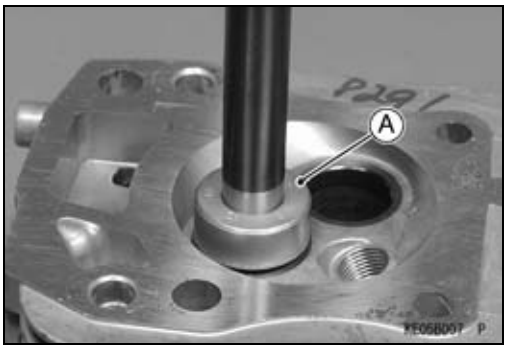


Operating Procedures:
- Clean the seat area carefully.
- Recondition the valve seats with the valve seat cutters (45°, 32°) and lap the valves.
- Check the seats for good contact all the way around with machinist's dye.
- Measure the seat width [A]. If it is more than the standard width, reface the seating surface.
- If the valve seating pattern is not correct, repair the seat.



- Coat the seat with machinist's dye.
- Fit a 45° seat cutter [A] to the holder and slide it into the valve guide.

○Resurface the valve seat with a 45° cutter, removing only enough material to produce a smooth and concentric seat.



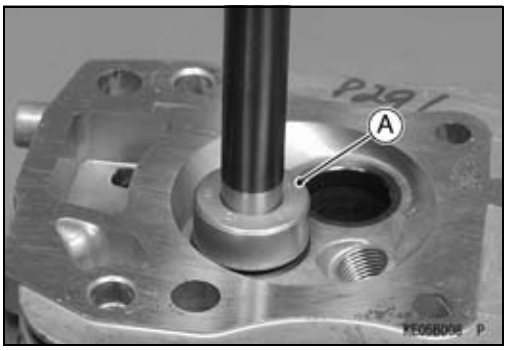
CAUTION

Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced. Do not turn the cutter counterclockwise or drop it against the seat, or it will be dulled.

Periodic Maintenance Procedures

● Use a 32° seat cutter [A] to narrow the seat width to the standard width.

○Turn the seat cutter one turn at a time while pressing down very lightly. Check the seat width after each turn.



CAUTION

The 32° cutter removes the material very quickly. Check the seat width frequently to prevent over grinding.

NOTE

○*Keep the seat width as close as possible to the standard width.*

● Make a light contact on the valve seat with the 45° cutter to remove any possible burrs at the edge of the seat.

● After resurfacing the seat, inspect for even valve seating.

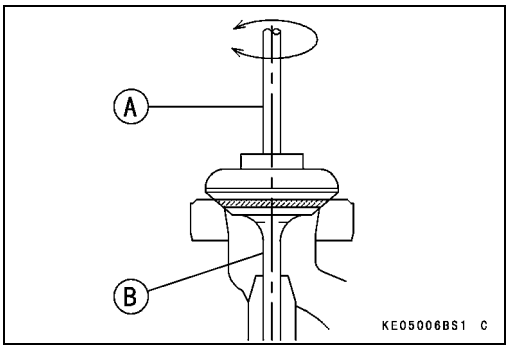
○Apply a machinist's dye to the valve face, insert the valve, and snap it closed against the seat several times. The valve surface should show good contact all the way around. Be sure the valve seat is centered on the valve face. The position of the valve in the seat is evident after lapping the valve.

★If the seat does not make proper contact, lap the valve into seat with a lapper.

● Coat the valve face sparingly with a fine lapping compound.

● Use the lapper [A], to grip the top of the valve [B]. Rotate the valve in a circular motion to lap the valve to the seat.

● Lift the valve slightly from the seat every 8 to 10 strokes, continue lapping operation until a uniform ring appears around entire surface of the valve face.



● When lapping is completed, wash all parts in solvent to remove lapping compound. Dry the parts thoroughly.

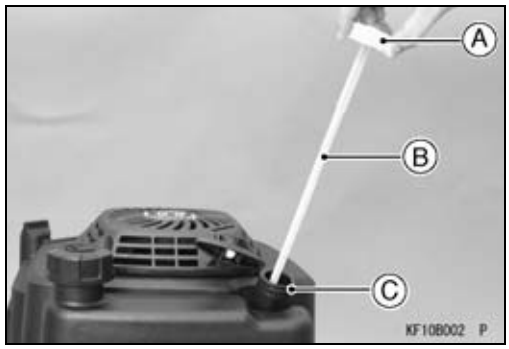
● Note the position of the lapping mark on the valve face. The lapping mark should appear on or near the center of the valve face.

● When the engine is assembled, be sure to adjust the valve clearances (see Valve Clearance Adjustment).

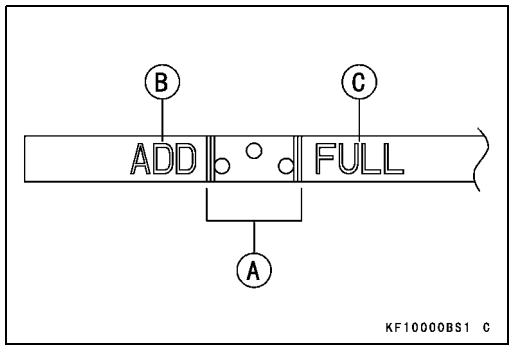
Periodic Maintenance Procedures

Lubrication System

Oil Level Inspection



- Place the engine on a level surface.
- Remove the oil filler cap [A] and wipe its dipstick [B] with a clean cloth.
- Insert the dipstick into the gauge hole [C] without screwing it in, then check the oil level.



- The oil level should be the operating range [A] (grid area) on the dipstick.

★If the oil level is "ADD" range [B], add enough engine oil to bring oil level to the operating range.

CAUTION

Do not add more oil above the operating range. Excess oil will cause a smoking condition.

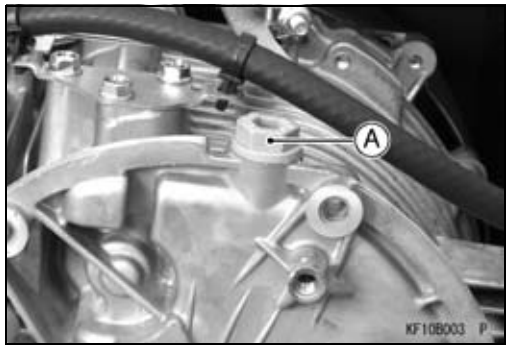
○Use the same type and make of oil that is already in the engine.

NOTE

○*If the engine oil type and make are unknown, use any brand of the specified oil to top up the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.*

★If the oil level is "FULL" range [C], drain the excess oil by loosening the drain plug.

Oil Change



- Change the oil after first 8 hours of operation. Thereafter change oil every 50 hours.
- Start and warm up the engine to drain the oil easily.
- Stop the engine.
- Place the engine on a level surface.
- Place a suitable container under the engine.
- Remove the drain plug [A] and drain the oil.

⚠ WARNING

Be careful of hot oil when drained. It may be hot enough to burn you severely.

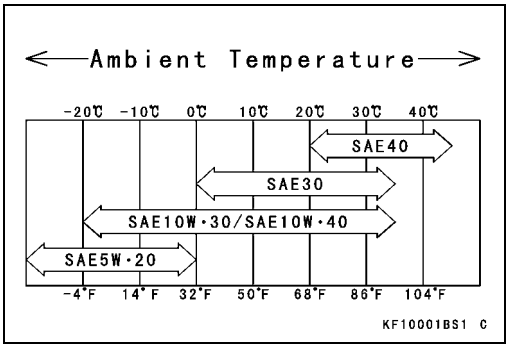
- Tighten the drain plug.

Torque - Oil Drain Plug : 22 N·m (2.2 kgf·m, 16 ft·lb)

Periodic Maintenance Procedures

● Remove the oil filler cap and pour in the specified type and amount of oil.

Engine Oil
Type: SF, SG, SH or SJ Class
Viscosity: SAE30, SAE10W-30
Capacity: 0.65 L (0.69 US qt)

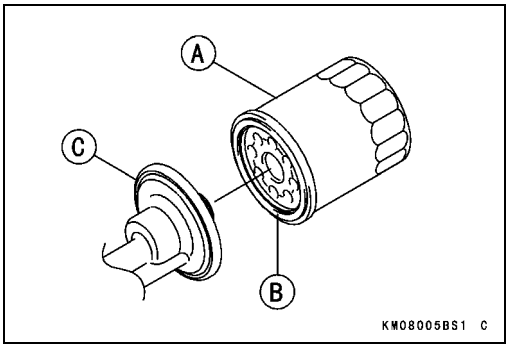


Oil Filter Replacement

● Drain the engine oil (see Oil Change).
● Using a strap wrench or oil filter wrench, remove the oil filter [A].

Special Tool - Oil Filter Wrench: 57001-1249

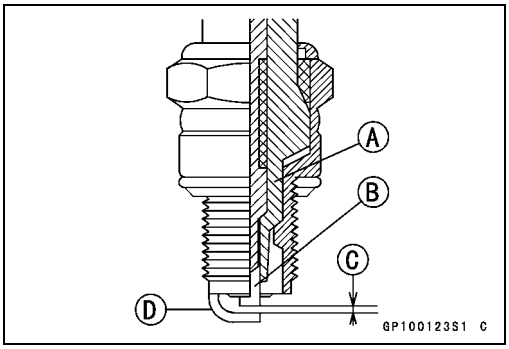
○When unscrewing the oil filter, place a suitable container beneath the oil filter to receive oil from the oil filter and oil passages in the engine. Turn the filter counterclockwise to remove it.
● Replace the oil filter [A] with a new one.
● Apply light film of engine oil to the seal [B].
● Install a oil filter.
○Turn the oil filter until the seal contacts mounting surface [C] of the engine. Then turn the oil filter BY HAND(S) 3/4 turn more.
● Run the engine at slow idle speed 2 minutes. Check for leaks around the engine.
● Stop the engine. Check the oil level (see Oil Level Inspection).



Electrical System

Spark Plug Cleaning and Inspection

● Remove the spark plug (see Spark Plug Removal in the Electrical System chapter).
★If the plug is oily or has carbon build up on it, clean the plug using a high-flash point solvent and a wire brush or other suitable tool.
★If the spark plug electrodes are corroded or damaged, or if the insulator is cracked, replace the plug with a new one. Use the standard spark plug or its equivalent.
Insulator [A]
Center Electrode [B]
Plug Gap [C]
Side Electrode [D]



Spark Plug Gap Inspection

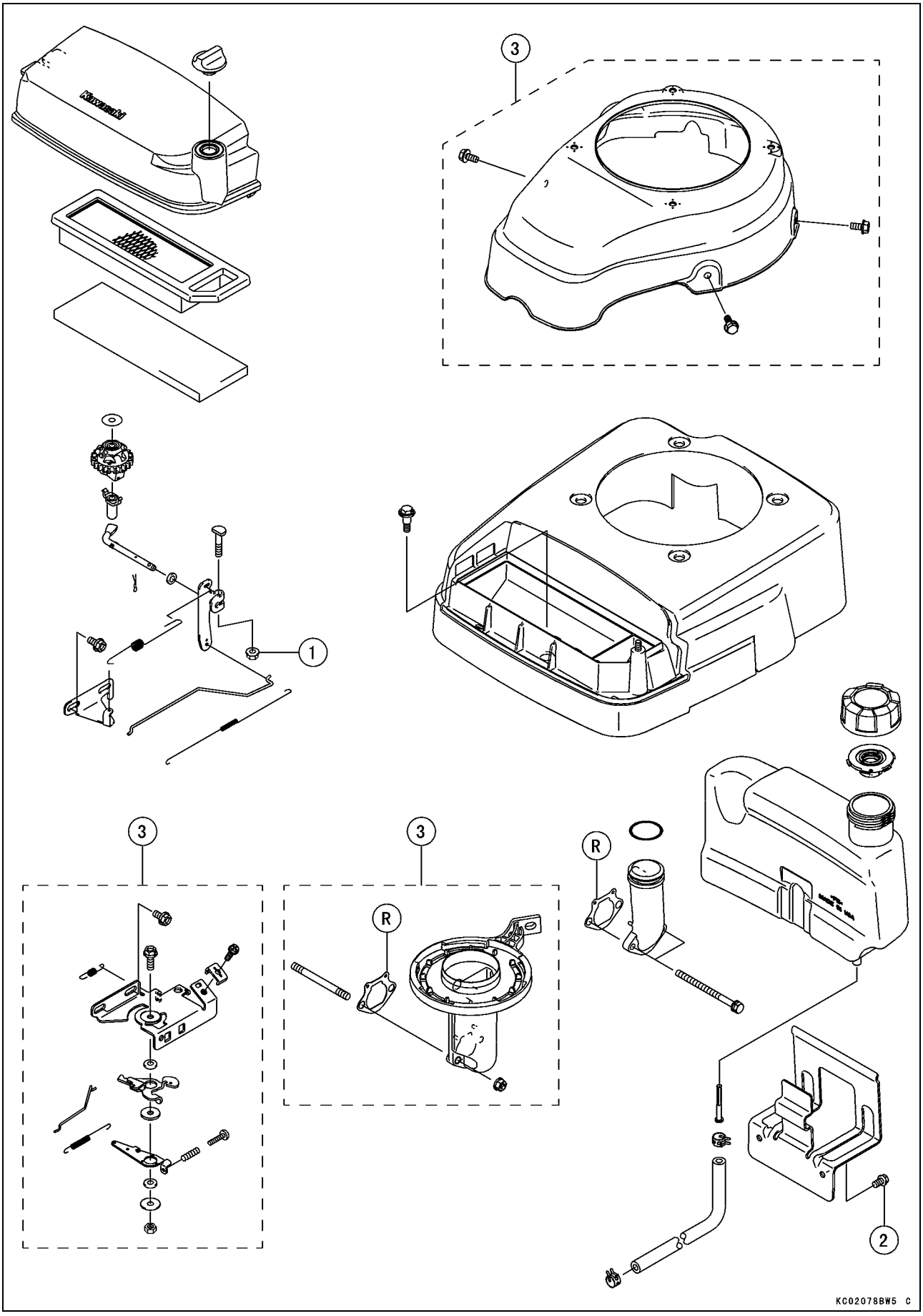
● Measure the gap with a wire-type thickness gauge.
★If the gap is not correct, carefully bend the side electrode with a suitable tool to obtain the correct gap.

Spark Plug Gap
Standard: 0.75 mm (0.030 in.)

Fuel System

Table of Contents

Exploded View

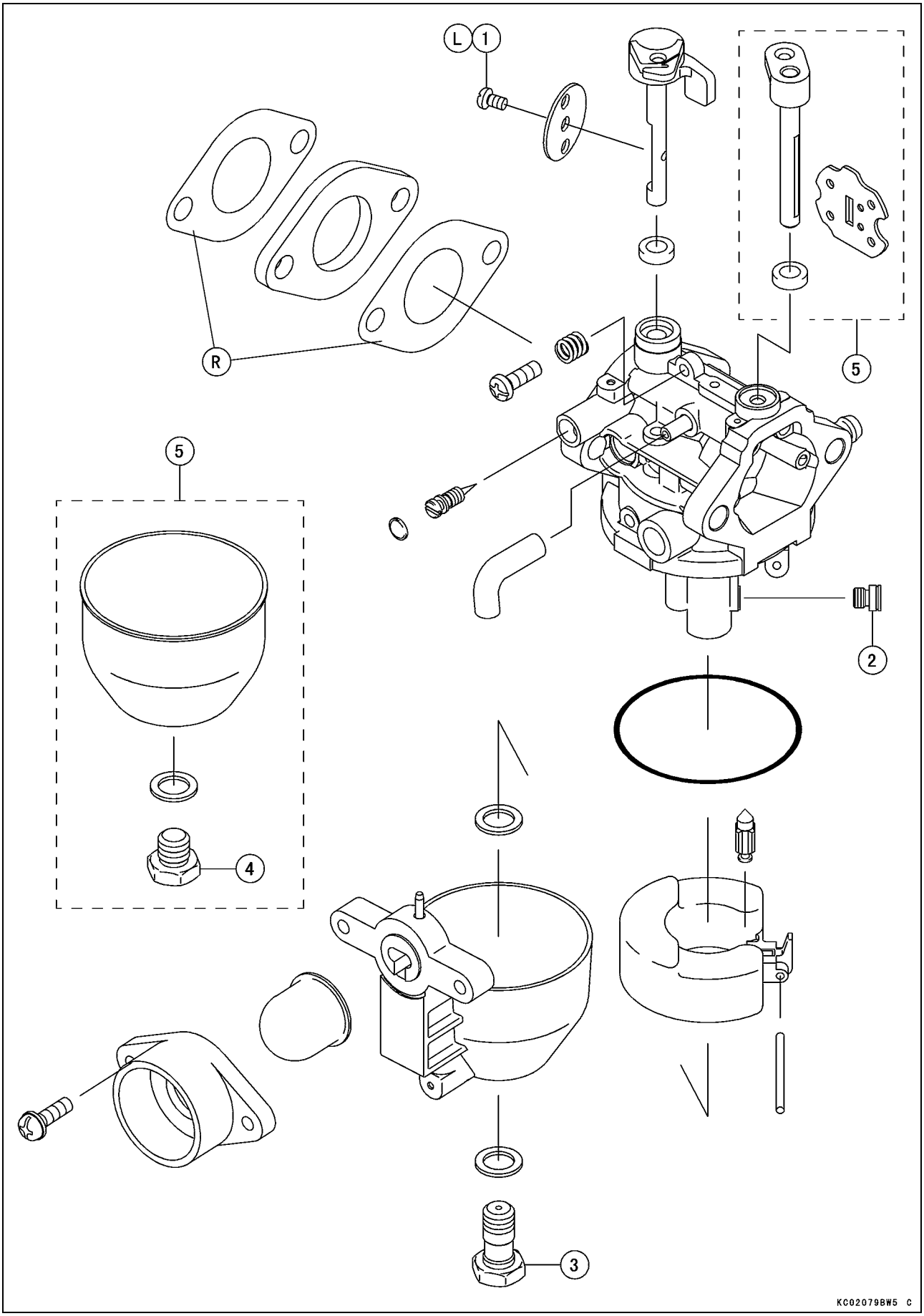


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Governor Arm Clamp Nut	7.8	0.80	69 in·lb	
2	Fuel Tank Bracket Bolt	6.9	0.70	61 in·lb	

3. Choke Start Model
R: Replacement Parts

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Throttle Valve Screw	0.70	0.07	6 in·lb	L
2	Main Jet	1.1	0.11	9.7 in·lb	
3	Float Chamber Mounting Bolt	9.8	1.0	87 in·lb	
4	Float Chamber Mounting Bolt (Choke Start Model)	9.8	1.0	87 in·lb	

5. Choke Start Model
L: Apply a non-permanent locking agent.
R: Replacement Parts

3-6 FUEL SYSTEM

Specifications

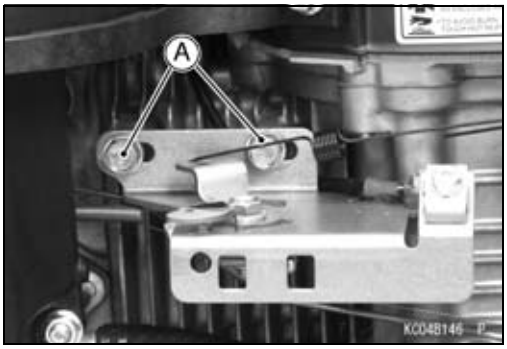
Item	Standard
	FJ151V, FJ180V
Carburetor	
Make/Type	NIKKI 6C1020-671 (Choke Model)
	NIKKI 6C1020-681 (Priming Model)
Throttle Bore Diameter	20 mm (0.79 in.)
Venturi Diameter	14 mm (0.55 in.)
Main Jet (MJ)	#81
Pilot Jet (PJ)	#40
Pilot Air Screw Turns Out (PS)	2 3/4
(Idle mixture screw turns out)	
Float Level	Float parallel to carburetor body
Idle Speed (1):	
Low	1 550 r/min (rpm) (Choke Start Model)
	Not specified (Priming Start Model)
High	3 300 r/min (rpm) (Choke Start Model)
	3 200 r/min (rpm) (Priming Start Model)
Air Cleaner	
Type	Dual stage filtration system
Pre-cleaner	Foam element
Second-stage Cleaner	Paper element
Fuel	
Fuel Requirement	Unleaded regular grade gasoline
Governor	
Type	Flyweight all speed governor

(1) Idle speeds may vary depending on each mounting equipment. Refer to the mounting equipment specification.

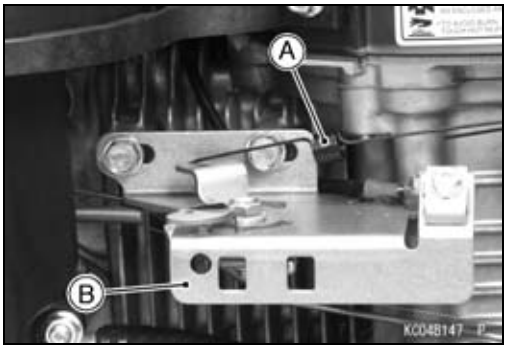
Governor Link Mechanism (Choke Start Model)

Control Panel Assembly Removal

- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal)
  Control Panel Mounting Bolts [A]

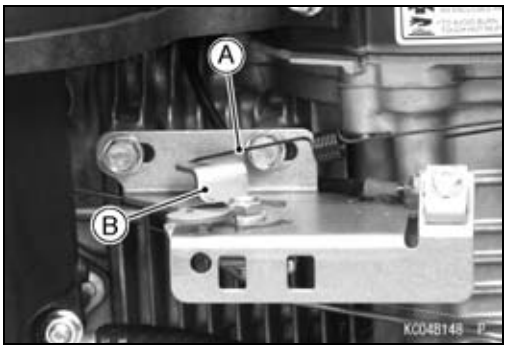


- Remove the control panel [B] unhooking the governor spring [A] end loop at the panel bracket.



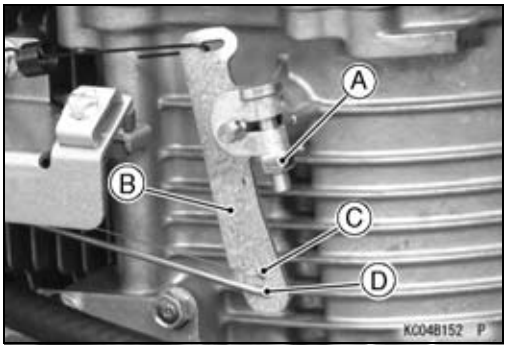
Control Panel Assembly Installation

★If any part is worn or damaged, replace the control panel with a new one.
- Install the control panel.
- Tighten the control panel mounting bolts.
- Hook the governor spring end loop [A] at the panel bracket [B].
- After installation, adjust the idle speed to the specifications (see Idle Speed Adjustment in the Periodic Maintenance chapter).



Governor Arm Removal

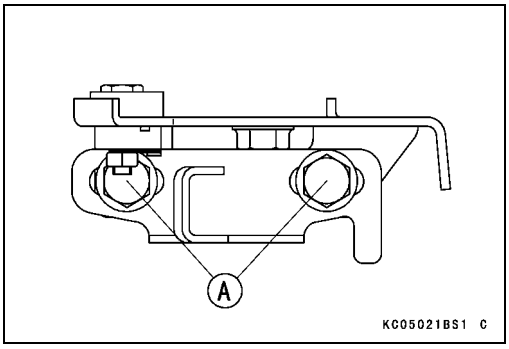
- Remove:
  Control Panel Assembly
- Loosen the clamp nut [A] and take off the governor arm [B].
- Unhook the throttle link rod spring [C] end loop and clear the throttle link rod lower end [D].



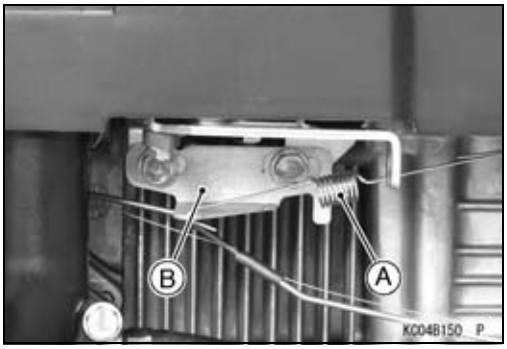
Governor Link Mechanism (Priming Start Model)

Control Panel Assembly Removal

- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal)
  Control Panel Mounting Bolts [A]



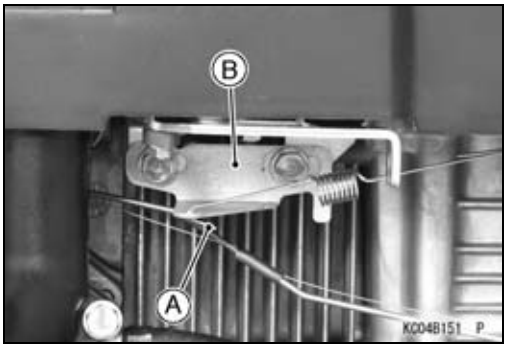
- Remove the control panel [B] unhooking the governor spring [A] end loop at the panel bracket.



Control Panel Assembly Installation

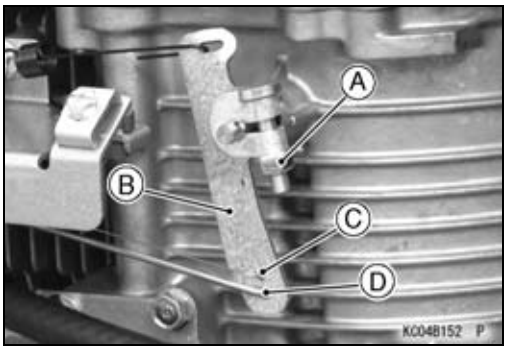
★If any part is worn or damaged, replace the control panel with a new one.

- Install the control panel.
- Tighten the control panel mounting bolts.
- Hook the governor spring end loop [A] at the panel bracket [B].
- After installation, adjust the idle speed to the specifications (see Idle Speed Adjustment in the Periodic Maintenance chapter).



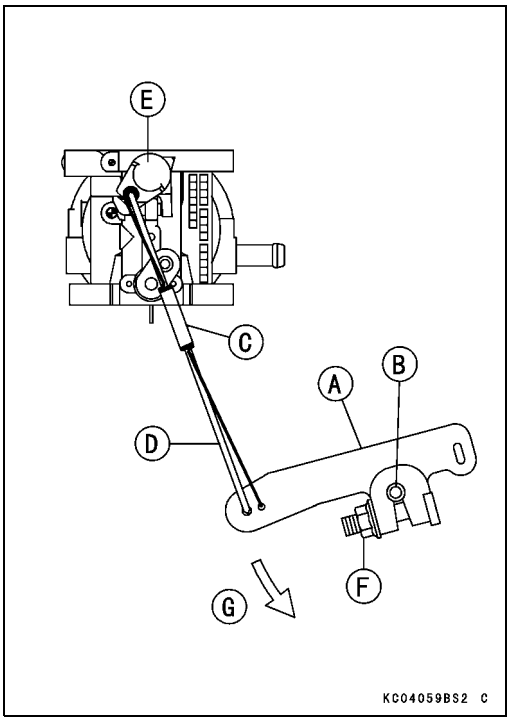
Governor Arm Removal

- Remove:
  Control Panel Assembly
- Loosen the clamp nut [A] and take off the governor arm [B].
- Unhook the throttle link rod spring [C] end loop and clear the throttle link rod lower end [D].



Governor Link Mechanism

Governor Arm Installation



- Install the governor arm [A] onto the governor shaft [B] temporarily.
- Be sure the link spring [C] around the throttle link rod [D] is in place and that it pulls the governor arm and the throttle lever [E] toward each other.
- Loosen the clamp nut [F] on the governor arm enough to move the governor shaft.

○Choke Start Model [H]; install the governor link and spring into the same link hole of the governor arm.

○Priming Start Model [I]; install the governor link and spring into the each link hole of the governor arm.

- Turn the top end of the governor arm counterclockwise [G] to fully open the carburetor throttle valve and hold it there.
- Turn the governor shaft counterclockwise, fully turn the shaft to end of its travel.

○There should be no gap between the governor arm and the snap pin on the governor shaft.

- Tighten the clamp nut.

Torque - Governor Arm Clamp Nut: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install the control panel assembly, and connect the governor arm with the governor spring.

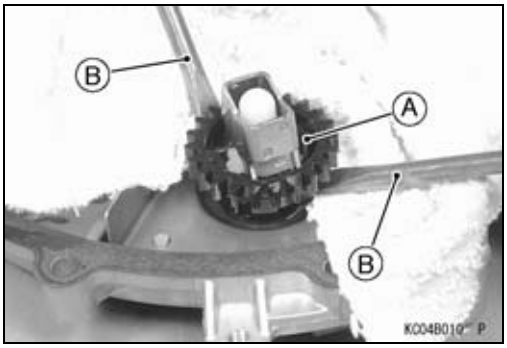
Governor Assembly Inspection and Removal

- Remove the crankcase cover (see Crankcase Cover Removal in the Camshaft/Crankshaft chapter).
- Visually check the governor assembly as built in the crankcase cover for damage or wear.

CAUTION

Do not remove the governor assembly unless the parts are to be replaced. Do not reuse the parts once they are removed.

- When removing the governor gear assembly [A] for replacing, use two screw drivers [B] of an appropriate size.



CAUTION

Protect the gasket-mount surface of the crankcase cover when removing the governor assembly with the screw drivers.

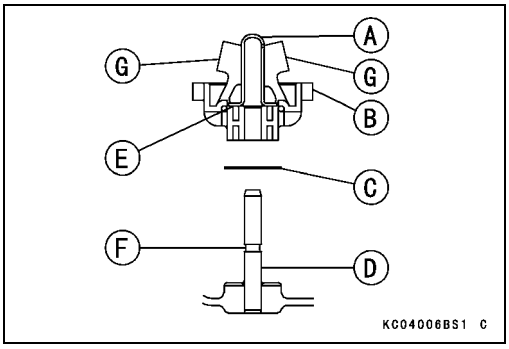
Governor Link Mechanism

Governor Assembly Installation

- Instal the sleeve [A] on the governor assembly [B].

CAUTION

First install the sleeve. The sleeve cannot be installed after the governor gear assembly has been installed.

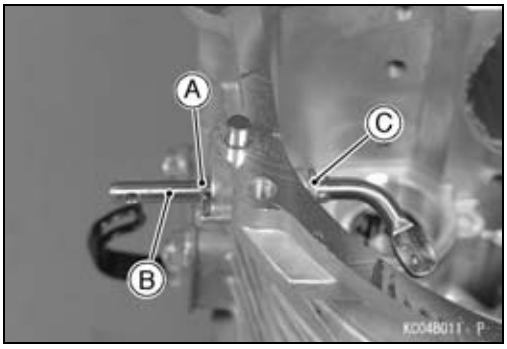


- To install, first place the thrust washer [C] on the boss of the shaft [D]. Then, install the governor assembly (with the sleeve attached) on the shaft so that the step [E] is fitted securely in the groove [F].
- After installing the assembly, turn the governor by hand to make sure that the governor weight [G] and the sleeve move smoothly.

Governor Shaft Removal

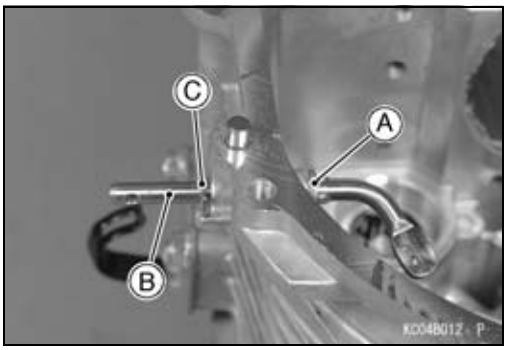
- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal)
  Governor Arm (see Governor Arm Removal)
  Flywheel (see Flywheel Removal in the Electrical System chapter)
  Crankcase Cover (see Crankcase Cover Removal in the Camshaft/Crankshaft chapter)
  Crankshaft (see Crankshaft Removal in the Camshaft/Crankshaft chapter)

- Remove:
  Snap Pin [A]
  Governor Shaft [B]
  Washer [C]



Governor Shaft Installation

- Apply engine oil to the governor shaft.
- Install:
  Washer [A]
  Governor Shaft [B]
  Snap Pin [C]
- Check that the governor shaft moves freely in its operating range.

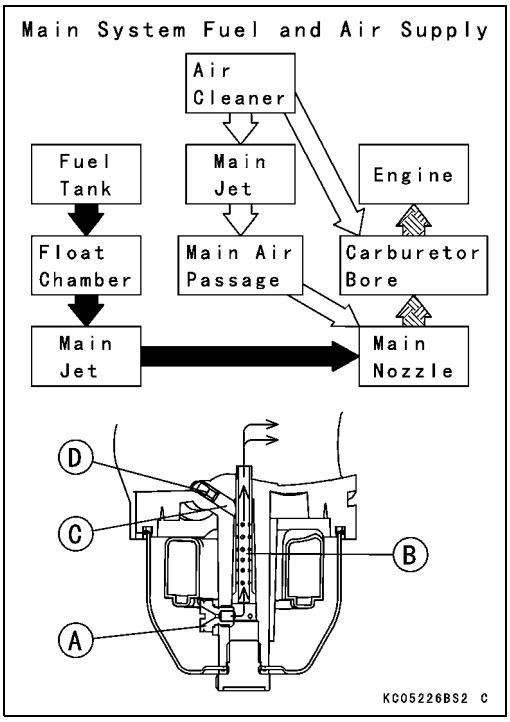


Carburetor

Fuel and Air Flow (Choke Start Model)

The main system of the carburetor consists of the main jet [A], the main nozzle [B], and the main air passage [C] (main air jet [D]). The main system meters fuel to the engine during moderate to high load conditions. Fuel flows through the main jet and into the main nozzle, where it is joined by air from the main air passage (main air jet). The resulting mixture flows out the end of the main nozzle into the carburetor bore, where it is atomized by the high speed air flow, and carried into the engine.

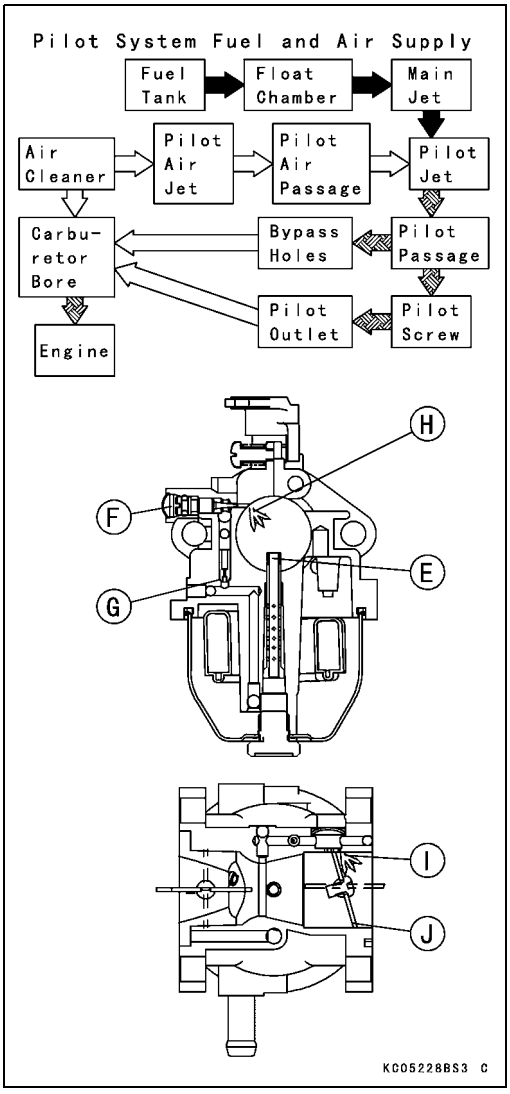
By closing the choke valve, the engine start system of the carburetor reduces the inlet air volume, increases the vacuum pressure in the inlet stroke and flows out the fuel of suitable quantity from the pilot line and the main line of the carburetor.



The pilot system includes the pilot jet [E], the pilot screw [F] (idle mixture screw), the pilot air jet [G], the pilot outlet [H], and the bypass holes [I]. The pilot system meters the fuel/air mixture while the engine is idling and running under a light load. Under these conditions there is very little air flow through the carburetor bore, so little that it is not enough to draw fuel through the main system of the carburetor and atomize it. Instead, the fuel is drawn through the pilot system, since the nearly closed throttle valve [J] causes high speed air flow past the pilot outlet and bypass holes (even at low engine speed).

Fuel flow in the pilot system is metered by the pilot jet. Air for better atomization is admitted via the pilot air jet in the mouth of the carburetor. The fuel/air mixture passes into the bore of the carburetor side stream of the throttle valve through the bypass holes and pilot outlet. While the throttle valve is almost closed, it covers the small bypass holes opening into the bore from the pilot system. As the throttle valve begins to open, it uncovers the bypass holes, allowing more fuel/air mixture to flow. The extra flow is needed because the engine starts to run faster as the throttle is opened. The pilot screw controls the amount of fuel/air mixture allowed through the pilot outlet, but does not meter the bypass holes. A moderate amount of air comes in around the throttle valve at idle, so adjusting the pilot screw changes the fuel/air ratio. Turning the pilot screw (idle mixture screw) out (counterclockwise) enriches the mixture; turning it in (clockwise) leans the mixture.

Main Fuel Flow →
Pilot Fuel Flow ⇒

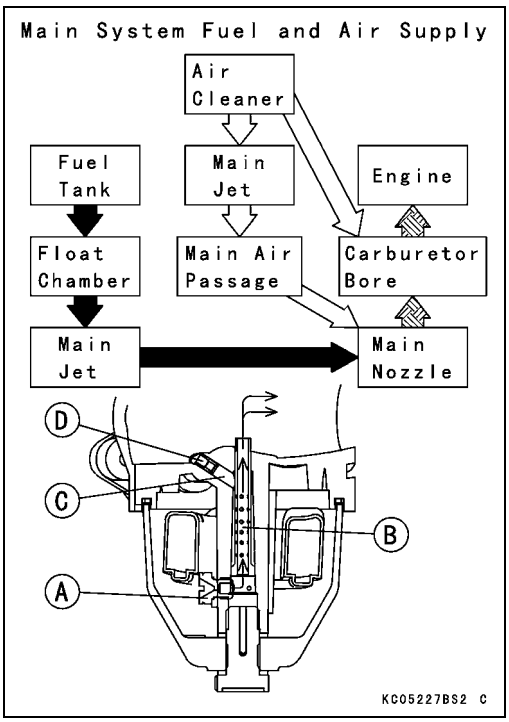


Carburetor

Fuel and Air Flow (Priming Start Model)

The main system of the carburetor consists of the main jet [A], the main nozzle [B], and the main air passage [C] (main air jet [D]). The main system meters fuel to the engine during moderate to high load conditions. Fuel flows through the main jet and into the main nozzle, where it is joined by air from the main air passage (main air jet). The resulting mixture flows out the end of the main nozzle into the carburetor bore, where it is atomized by the high speed air flow, and carried into the engine.

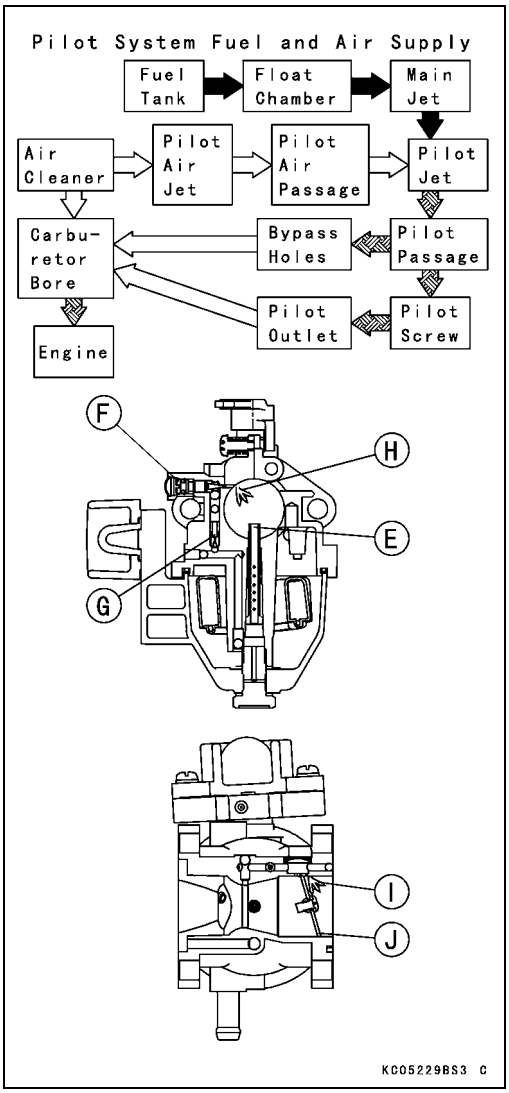
In the engine system of the carburetor, pressurized fuel flows through the main jet by operating the priming pump and the fuel of suitable quantity flows out from the main nozzle.



The pilot system includes the pilot jet [E], the pilot screw [F] (idle mixture screw), the pilot air jet [G], the pilot outlet [H], and the bypass holes [I]. The pilot system meters the fuel/air mixture while the engine is idling and running under a light load. Under these conditions there is very little air flow through the carburetor bore, so little that it is not enough to draw fuel through the main system of the carburetor and atomize it. Instead, the fuel is drawn through the pilot system, since the nearly closed throttle valve [J] causes high speed air flow past the pilot outlet and bypass holes (even at low engine speed).

Fuel flow in the pilot system is metered by the pilot jet. Air for better atomization is admitted via the pilot air jet in the mouth of the carburetor. The fuel/air mixture passes into the bore of the carburetor side stream of the throttle valve through the bypass holes and pilot outlet. While the throttle valve is almost closed, it covers the small bypass holes opening into the bore from the pilot system. As the throttle valve begins to open, it uncovers the bypass holes, allowing more fuel/air mixture to flow. The extra flow is needed because the engine starts to run faster as the throttle is opened. The pilot screw controls the amount of fuel/air mixture allowed through the pilot outlet, but does not meter the bypass holes. A moderate amount of air comes in around the throttle valve at idle, so adjusting the pilot screw changes the fuel/air ratio. Turning the pilot screw (idle mixture screw) out (counterclockwise) enriches the mixture; turning it in (clockwise) leans the mixture.

Main Fuel Flow →
Pilot Fuel Flow ⇒



Idle Speed Adjustment

- Refer to the Idle Speed Adjustment in the Periodic Maintenance chapter.

Carburetor

High Altitude Operation

At high altitude, the standard carburetor air-fuel mixture will be excessively rich. Performance will decrease, and fuel consumption will increase. High altitude performance can be improved by installing a smaller diameter main jet in the carburetor and correct idle speed.

NOTE

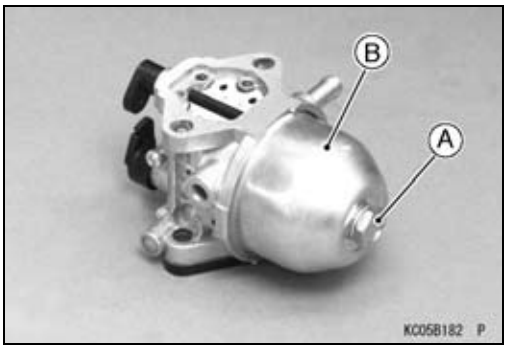
○*The main jet high altitude kits are available for the equipment used in the high altitudes. The main jet numbers are stamped on the ends of the main jets.*

High Altitude Main Jet

Altitude	Main Jet No.
0 ~ 1 000 m (0 ~ 3 300 ft)	#81 (92063-2497)
1 000 ~ 2 000 m (3 300 ~ 6 600 ft)	#79 (92063-2498)
2 000 m (6 600 ft) and higher	#77 (92063-2499)

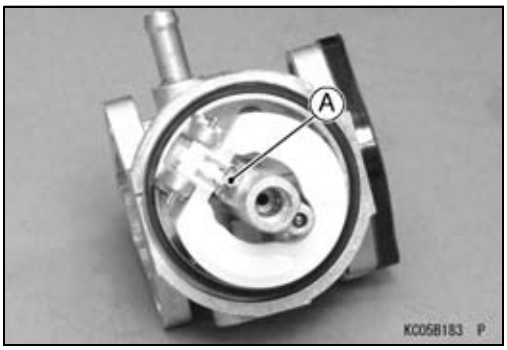
Main Jet Replacement

- Place the engine on a level surface.
- Drain the fuel in the carburetor completely by unscrewing the float chamber mounting bolt [A] at the bottom of the float chamber.
- Remove the carburetor (see Carburetor Removal).
- Unscrew the float chamber mounting bolt [A] and take off the float chamber [B] and the gasket.

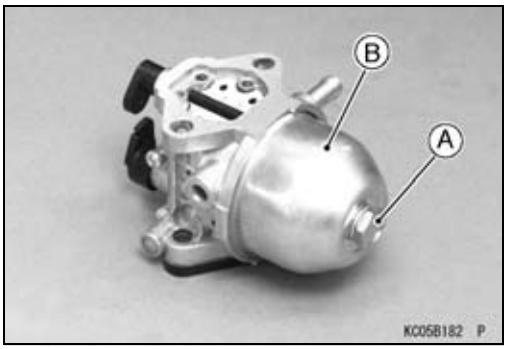


- Using a properly sized blade screw driver, carefully replace the main jet [A] with a new one for altitude expected.
- Tighten the main jet to the specification (see Carburetor Disassembly/Assembly Notes).
- Install the float chamber and the gasket.
- Tighten the float chamber mounting bolt and the drain screw.

Torque - Float Chamber Mounting Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)
Drain Screw: 5.4 N·m (0.55 kgf·m, 48 in·lb)



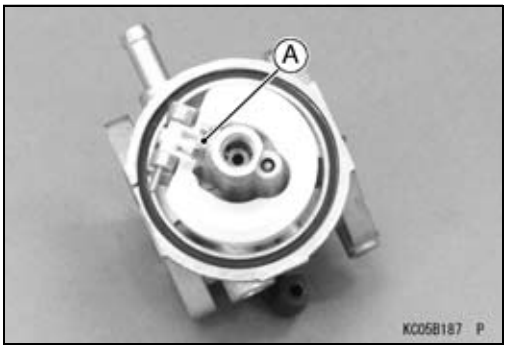
- For Choke Start model; note the following.
- Place the engine on a level surface.
- Drain the fuel in the carburetor completely by unscrewing the float chamber mounting bolt [A] at the bottom of the float chamber.
- Remove the carburetor (see Carburetor Removal).
- Take off the float chamber [B] and the gasket.



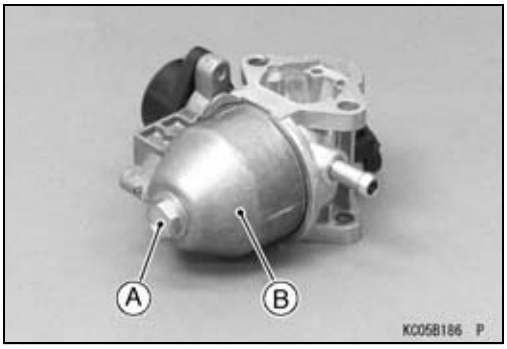
Carburetor

- Using a properly sized blade screw driver, carefully replace the main jet [A] with a new one for expected altitude.
- Tighten the main jet to the specification (see Carburetor Disassembly/Assembly Notes).
- Install the float chamber and the gasket.
- Tighten the float chamber mounting bolt.

Torque - Float Chamber Mounting Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

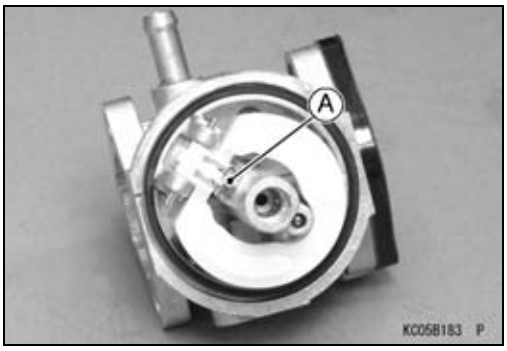


- For Priming Start model; note the following.
- Place the engine on a level surface.
- Remove the tube from the primer pipe.
- Drain the fuel in the carburetor completely by unscrewing the float chamber mounting bolt [A] at the bottom of the float chamber.
- Remove the carburetor (see Carburetor Removal).
- Take off the float chamber [B] and the gasket.



- Using a properly sized blade screw driver, carefully replace the main jet [A] with a new one for expected altitude.
- Tighten the main jet to the specification (see Carburetor Disassembly/Assembly Notes).
- Install the float chamber and the gasket.
- Tighten the float chamber mounting bolt.

Torque - Float Chamber Mounting Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)



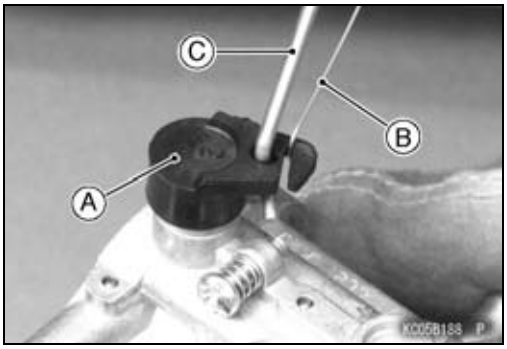
Fuel System Cleanliness Inspection

- Refer to the Fuel System Cleanliness Inspection in the Periodic Maintenance chapter.

Carburetor Removal

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the engine switch stop position. Do not smoke. Make sure the area is well-ventilated and free from any source of flame or sparks, this includes any appliance with a pilot light.



- Place a suitable container beneath the fuel hose.
- Disconnect the fuel hose from the carburetor.
- Drain the fuel in the carburetor completely by unscrewing the drain screw at the bottom of the float chamber.
- Remove the inlet manifold (see Inlet Manifold Removal).
- Remove the carburetor.
- Unhook the throttle link spring [B] and throttle link rod [C] at the throttle shaft lever [A] top end with a long nose pliers.

Carburetor

Carburetor Installation

- Clean the mating surfaces of the carburetor and the inlet manifold, and fit the new gaskets.
- Take care not to bend the throttle during installation. Make sure the link spring around the throttle link rod is in place and that it pulls the governor arm and carburetor throttle shaft lever toward each other.
- Adjust:
  Idle Speed (see Idle Speed Adjustment in the Periodic Maintenance chapter)

Carburetor

Carburetor Disassembly/Assembly

- Refer to the illustration shown for disassembly and assembly.
- There are several passage plugs (ball plugs) in the carburetor body. Do not remove them.
- Before disassembly, mark the outside of throttle valve for assembling them.
- Replace the pilot screw with a new one in accordance with the following procedure if necessary.

○Carefully mark the position of the pilot screw on the carburetor body so that it can be installed and set to its original position later.

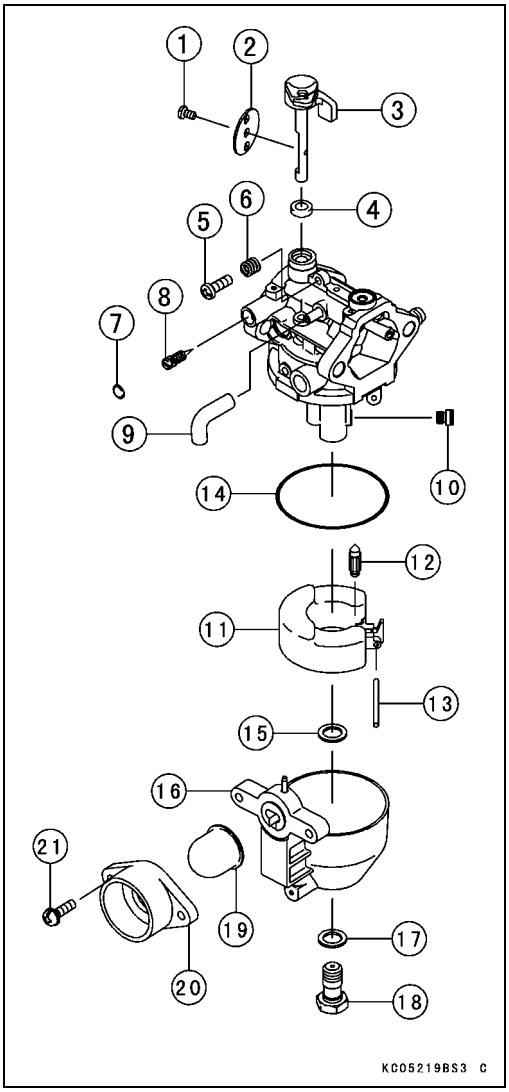
○Turn the pilot screw clockwise and count the number of turns until screw is gently seated in the pilot passage. Record the number of turns needed to closed the screw.

○Turn out the pilot screw to replace it with a new one.

○Install the new pilot screw until the screw is gently seated. Then open the screw the same number of turns as recorded prior to removal.

○Align the pilot screw with the mark on the carburetor body to install, taking care not to turn the pilot screw.

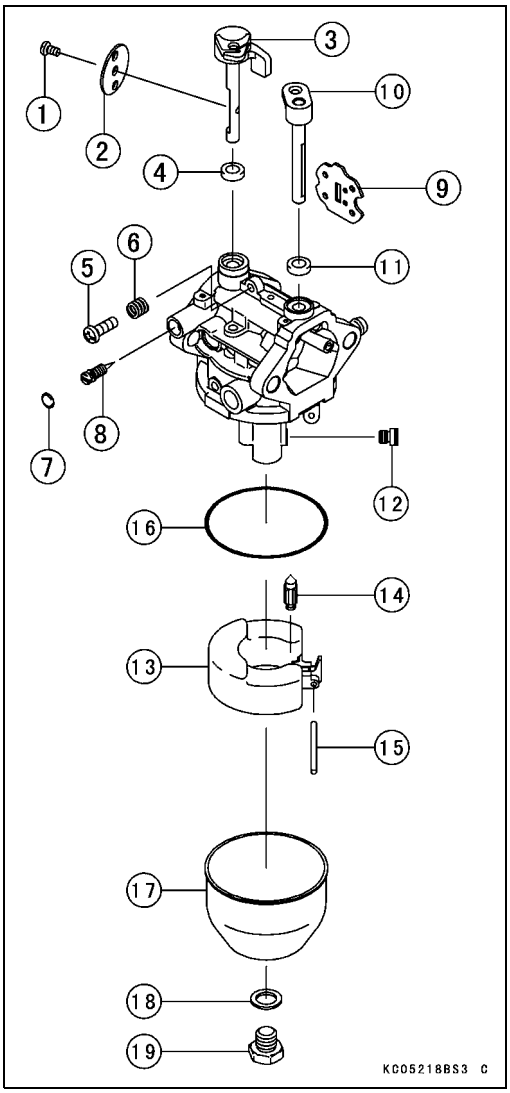
- Install the throttle valve on the shaft as the outside mark of them facing out side.
- Drive the float pin into the carburetor body from the pilot screw side.
- Assemble carburetor parts with recommended tightening torque (see Exploded View).



1. Throttle Valve Screw
2. Throttle Valve
3. Throttle Shaft
4. Seal
5. Screw
6. Spring
7. Plug
8. Needle Jet
9. Hose
10. Main Jet
11. Float
12. Float Valve
13. Float Pin
14. Gasket
15. Gasket
16. Float Chamber
17. Gasket
18. Float Chamber Mounting Bolt
19. Priming Pump
20. Priming Pump Cover
21. Screw

Carburetor

● For Choke Start model
1. Throttle Valve Screw
2. Throttle Valve
3. Throttle Shaft
4. Seal
5. Screw
6. Spring
7. Plug
8. Needle Jet
9. Choke Valve
10. Choke Shaft
11. Seal
12. Main Jet
13. Float
14. Float Valve
15. Float Pin
16. Gasket
17. Float Chamber
18. Gasket
19. Float Chamber Mounting Bolt



Carburetor

Carburetor Cleaning

⚠ WARNING

Clean the carburetor in a well ventilated area, and take care that there is no sparks or flame anywhere near the working area, this includes any appliance with a pilot light. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents to clean the carburetor.

CAUTION

Do not use compressed air on an assembled carburetor, or the float may be crushed by the pressure.
Remove as many rubber or plastic parts as possible from the carburetor before cleaning the carburetor with a cleaning solution. This will prevent to damage or deterioration of the parts.
The carburetor body has plastic parts that cannot be removed. Do not use a strong carburetor cleaning solution which could attack these parts instead, use a mild high-flash point cleaning solution safe for plastic parts.
Do not use wire or any other hard instrument to clean carburetor parts, especially jets, as they may be damaged.

- Disassemble the carburetor (see Carburetor Disassembly/Assembly).
- Immerse all the carburetor metal parts in a carburetor cleaning solution and clean them.
- Rinse the parts in water and dry them with compressed air.
- Do not use rags or paper to dry parts. Lint may plug the hole or passages.
- Blow air through the holes and fuel passages with the compressed air. All holes must be open.
- Assemble the carburetor (see Carburetor Disassembly/Assembly).

Carburetor

Carburetor Inspection

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain. Turn the engine switch stop position. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks this includes any appliance with a pilot light.

- Inspect the carburetor body for damage. Flange sealing surfaces should be smooth and free of burrs and nicks. Replace the gasket with a new one if necessary.
- Turn the throttle shaft to check that the throttle butterfly valve move smoothly.

★If the valve do not move smoothly, replace the carburetor body and/or throttle shaft.

- Check the gasket on the carburetor body.

★If the gasket condition is not good, replace it with a new one.

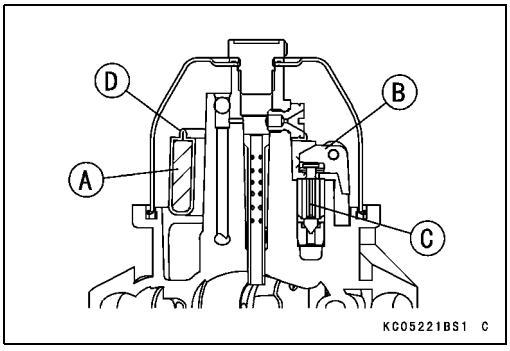
- Check the other parts of the carburetor for wear or damage. Replace the part with a new one if necessary.
- Clean and check the float level as follows.

CAUTION

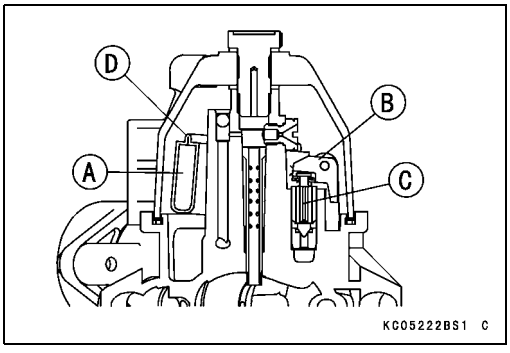
Do not push down on the float during float level checking.

- With the float [A] assembly installed onto the carburetor body, hold the carburetor upside down at eye level. Gently support the float with a finger and bring it down slowly so that the float arm tab [B] touches the float valve [C]. The float lower surface [D] should be parallel with the carburetor body mating surfaces.

★If the float position is not correct, replace the float with a new one.



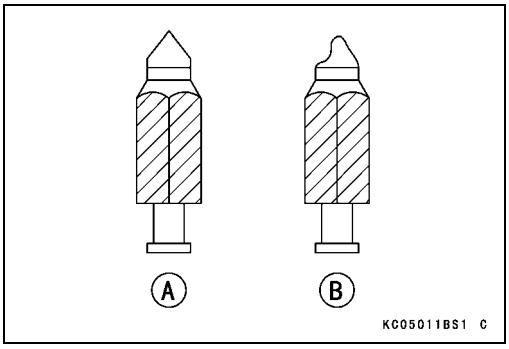
- For Priming model; the float assembly is as shown in the figure.



Carburetor

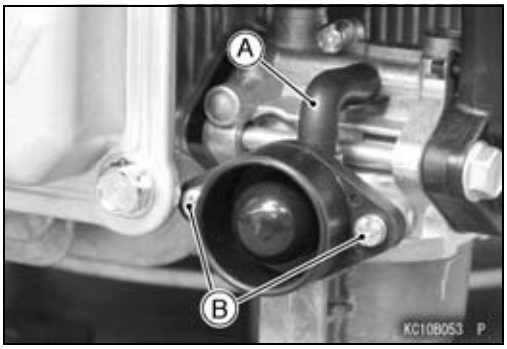
- Inspect the float valve for excessive wear or damage. The tip should be smooth, without any grooves, scratches, or tears. The rod at the other end of the needle should move smoothly when pushed in and released.
  Good [A]
  Bad [B]

★If either the needle or the seat is worn or damaged, replace the float assembly and carburetor body as a set.



Priming Pump

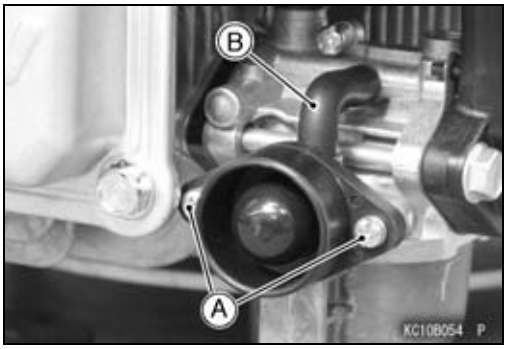
Priming Pump Removal



- Remove the tube [A] from the priming pump.
- Remove the screw [B].
- Remove the priming pump from the inlet manifold.
- Inspect the priming pump for damages.

★If the priming pump is damaged, replace it with a new one.

Priming Pump Installation



- Install the priming pump in the inlet manifold.
- Tighten the screw [A].

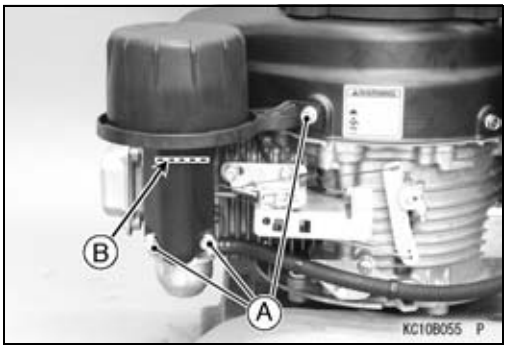
Torque - Priming Screw: 1.2 N·m (0.12 kgf·m, 11 in·lb)

- Install the tube [B] on the priming pump.

Inlet Manifold (Choke Start Model)

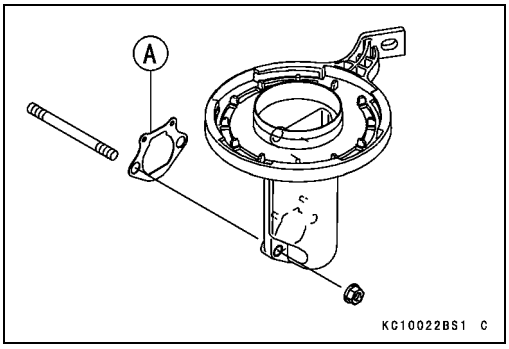
Inlet Manifold Removal

- Unscrew the inlet manifold mounting bolts [A].
- Remove the breather pipe [B] from the inlet manifold.

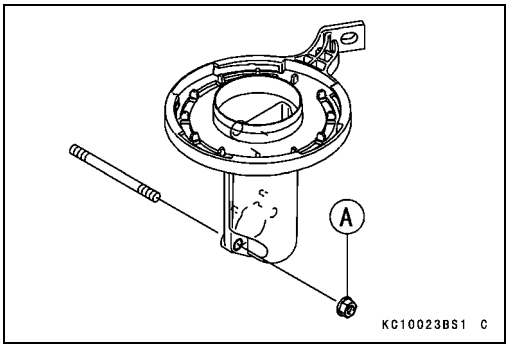


Inlet Manifold Installation

- Clean the mating surface of the carburetor and the inlet manifold.
- Install the new gasket [A] and the inlet manifold.



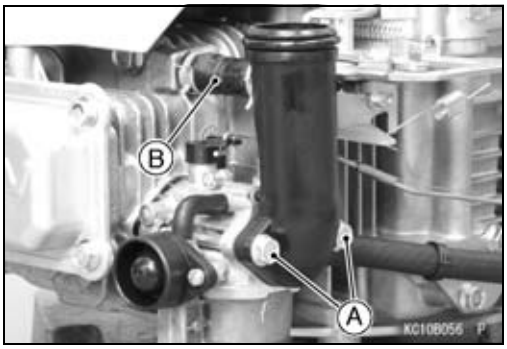
- Tighten the inlet manifold mounting nut [A].
- There should be no clearance between the inlet manifold and the fuel tank.



Inlet Manifold (Priming Start Model)

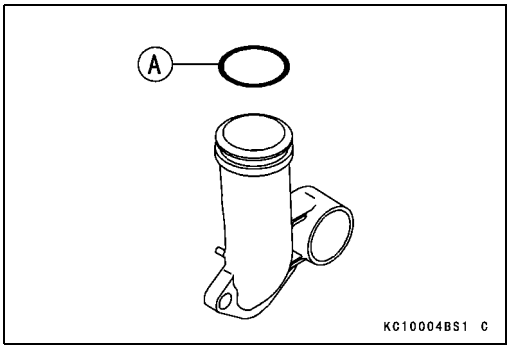
Inlet Manifold Removal

- Unscrew the inlet manifold mounting bolts [A].
- Remove the breather pipe [B] from the inlet manifold.

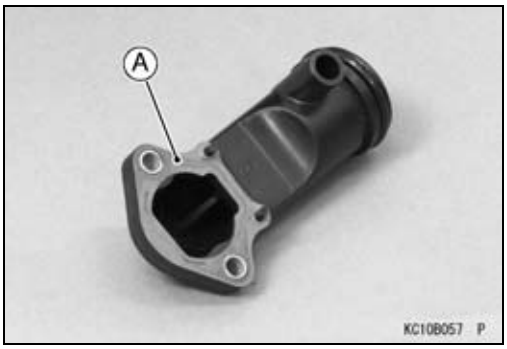


Inlet Manifold Installation

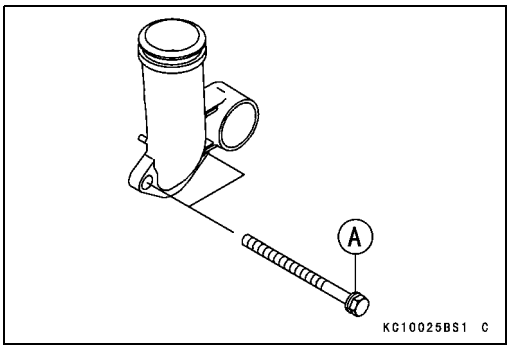
- Replace the O-ring [A] with a new one.
- Clean the mating surface of the carburetor and the inlet manifold.



- Install the new gasket [A] and the inlet manifold.



- Tighten the inlet manifold mounting bolts [A].
- There should be no clearance between the inlet manifold and the fuel tank.



Inlet Manifold

Inlet Manifold Inspection

- Inspect the inlet manifold for cracks.
- Cracks not visible to the eye may be detected by using a metal crack detection system (Visual color check: commonly found at automotive parts store).

★If a crack is present in the inlet manifold, replace it with a new one.

- Inspect the gasket surfaces for burrs and nicks.

Fuel Tank

Fuel Tank Removal

- Place a suitable container beneath the fuel hose.
- Loosen the clamp and remove the fuel hose from the carburetor.
- Loosen the clamp and remove the fuel hose [A] from the tank drain.
- Remove the fuel tank bracket bolts [B].
- Remove the fuel tank [C].

Fuel Tank Installation

- Install the fuel tank.
- When installing the fuel tank, there should be no clearance between the inlet manifold and the fuel tank.

- Install the fuel hose [A] on the fuel tank [B].
- Install the fuel hose on the carburetor.
- Tighten the fuel tank bracket bolts [C].

Torque - Fuel Tank Bracket Bolts: 6.9 N·m (0.70 kgf·m, 61 in·lb)

- Install the removed parts (see appropriate chapters).

Fuel Tank Cleaning

⚠ WARNING

Clean the fuel tank in a well ventilated area, and take care that there is no sparks or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvent to clean the tank.

- Remove the fuel tank (see Fuel Tank Removal).
- Pour the solvent out of the tank.
- Pour some high-flash point solvent into the fuel tank and shake the tank to remove dirt and fuel deposits.
- Dry the fuel tank with compressed air.
- Install the fuel tank (see Fuel Tank Installation).

Fuel Filter

Fuel Filter Inspection

- Refer to the Fuel Filter Inspection in the Periodic Maintenance chapter.

Air Cleaner

Air Cleaner Element Removal

- Refer to the Air Cleaner Element Removal in the Periodic Maintenance chapter.

Air Cleaner Element Installation

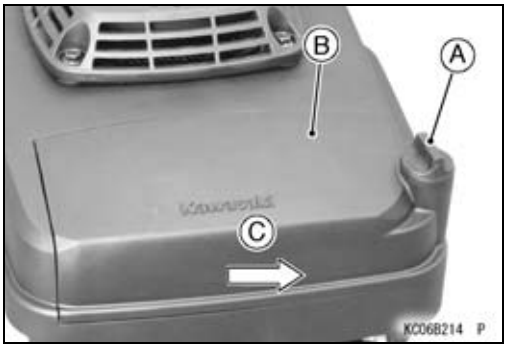
- Refer to the Air Cleaner Element Installation in the Periodic Maintenance chapter.

Air Cleaner Element Cleaning and Inspection

- Refer to the Air Cleaner Element Cleaning and Inspection in the Periodic Maintenance chapter.

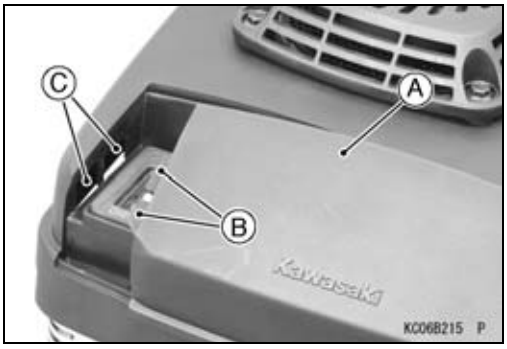
Air Cleaner Body Removal (Priming Model)

- Remove the nut [A].
- Move the direction of the arrow [C] and remove the air cleaner case [B].
- Remove:
  Paper Element
  Foam Element



Air Cleaner Body Installation

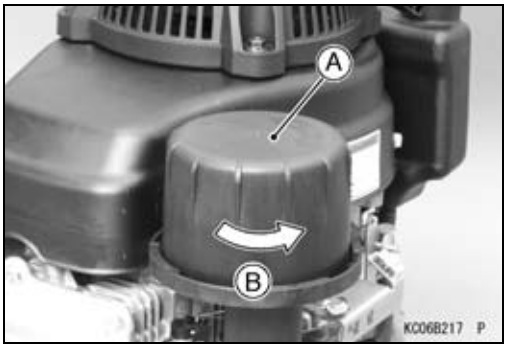
- Install:
  Foam Element
  Paper Element
- Install the projection [B] of the air cleaner case [A] to fit the hollow [C] of the air cleaner body.



- Tighten the nut [A].

Air Cleaner Body Removal (Choke Model)

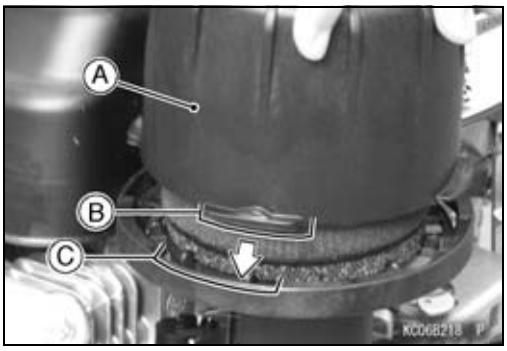
- Turn the air cleaner case [A] in the direction of the arrow [B] and remove the air cleaner case [A].



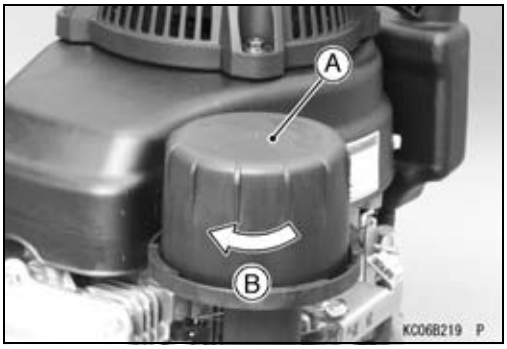
Air Cleaner

Air Cleaner Body Installation

- Install the projection [B] of the air cleaner case [A] to fit the hollow [C] of the air cleaner body.



- Turn the air cleaner case [A] in the direction of the arrow [B].



Air Cleaner Housing (Case and Body) Inspection

- Refer to the Air Cleaner Housing (Case and Body) Inspection in the Periodic Maintenance chapter.

Cooling System

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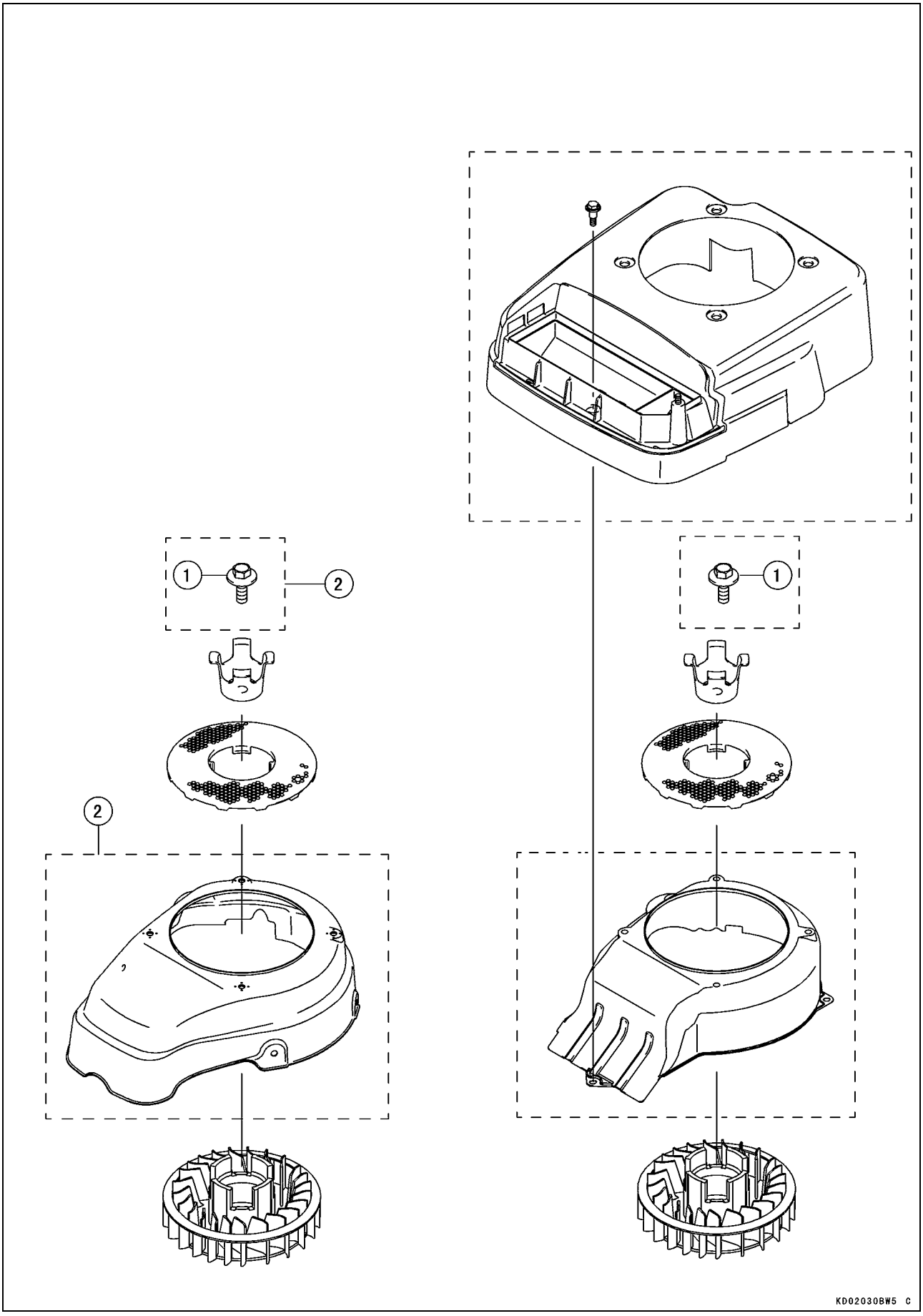
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Flywheel Bolt	42	4.3	31	

2. KAI Model

Cooling Fan

Cooling Fan Removal

- Refer to the Flywheel Removal in the Electrical System chapter.

Cooling Fan Installation

- Refer to the Flywheel Installation in the Electrical System chapter.

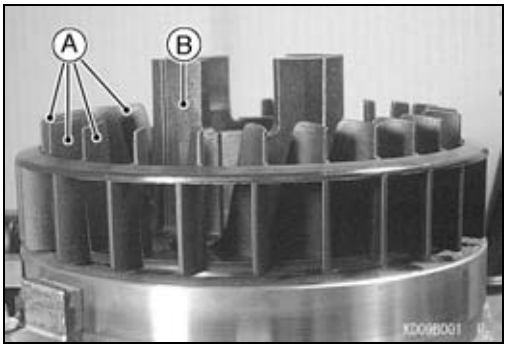
Cooling Fan Inspection

- Visually inspect the blades [A] in the cooling fan [B].

★If they are any cracks, warps or damage, replace the cooling fan.

★If any mud or dust have stuck to the cooling fan, clean it.

- Clean the cooling fan by washing in detergent and water.



CAUTION
Do not clean the cooling fan in oil solvent. It may be damage by oil solvent.

Engine Top End

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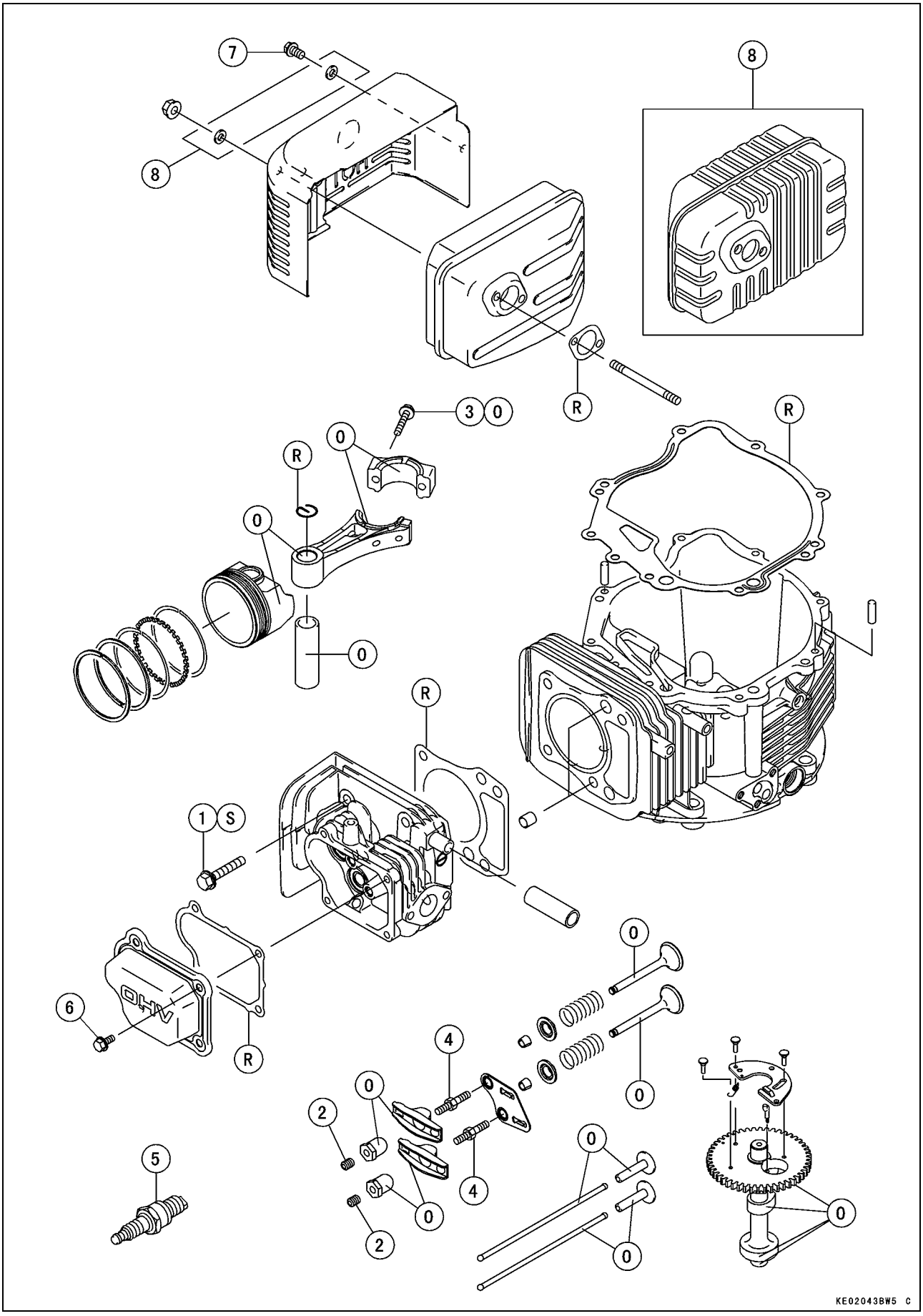
5-2 ENGINE TOP END

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Cylinder Head Bolts (7T)	22	2.2	16	S
	Cylinder Head Bolts (7N)	25	2.5	18	S
	Cylinder Head Bolts (9N)	26	2.6	19	S
2	Valve Clearance Lock Screws	6.9	0.70	61 in·lb	
3	Connecting Rod Big End Cap Bolts	5.9	0.60	52 in·lb	O
4	Rocker Arm Bolts	28	2.8	20	
5	Spark Plug	22	2.2	16	
6	Rocker Cover Mounting Bolts	5.9	0.60	52 in·lb	
7	Muffler Cover Bolt	6.9	0.70	61 in·lb	

8. KAI Model
O: Apply engine oil.
R: Replacement Parts
S: Follow the specified tightening sequence.

Specifications

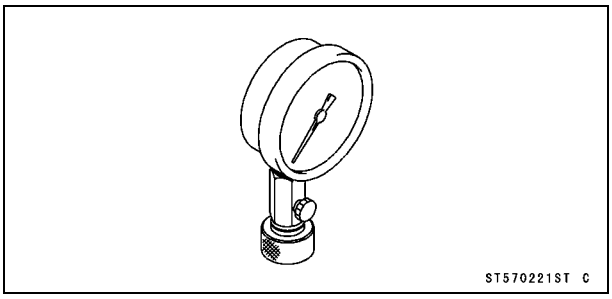
Item	Service Limit
Cylinder Head	
Cylinder Compression	196 kPa (2.0 kgf/cm², 28.4 psi) (MIN)
Cylinder Head Warp	0.03 mm (0.001 in.)
Valves	
Valve Head Thickness:	
Exhaust	0.36 mm (0.014 in.)
Inlet	0.35 mm (0.014 in.)
Valve Stem Runout:	
Exhaust	0.05 mm (0.002 in.)
Inlet	0.05 mm (0.002 in.)
Valve Stem Diameter:	
Exhaust	5.93 mm (0.233 in.)
Inlet	5.93 mm (0.233 in.)
Valve Guide Inside Diameter:	
Exhaust	6.08 mm (0.239 in.)
Inlet	6.08 mm (0.239 in.)
Valve Spring Free Length:	
Exhaust	33.5 mm (1.32 in.)
Inlet	33.5 mm (1.32 in.)
Rocker Arm Push Rod Runout:	
Exhaust	0.5 mm (0.02 in.)
Inlet	0.5 mm (0.02 in.)
Cylinder, Piston	
Piston Diameter	64.79 mm (2.551 in.)
Piston Ring/Groove Clearance:	
Top	0.17 mm (0.007 in.)
Second	0.17 mm (0.007 in.)
Piston Ring Thickness:	
Top	1.40 mm (0.055 in.)
Second	1.40 mm (0.055 in.)
Piston Ring End Gap:	
Top	0.75 mm (0.029 in.)
Second	0.75 mm (0.029 in.)
Oil	1.05 mm (0.041 in.)
Piston Pin Outside Diameter	15.96 mm (0.628 in.)
Piston Pin Hole Inside Diameter	16.08 mm (0.633 in.)
Connecting Rod Small End Inside Diameter	16.06 mm (0.632 in.)
Cylinder Inside Diameter	65.10 mm (2.563 in.)
Cylinder Bore Out Round	0.056 mm (0.0022 in.)

Specifications

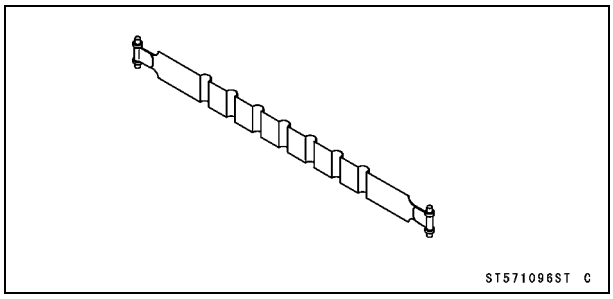
Item	Standard
Valves	
Valve Clearance:	
Exhaust	0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)
Inlet	0.10 ~ 0.15 mm (0.004 ~ 0.006 in.)
Valve Seating Surface Angle:	
Exhaust	45°
Inlet	45°
Valve Seating Surface Width:	
Exhaust	0.6 ~ 0.9 mm (0.024 ~ 0.035 in.)
Inlet	0.6 ~ 0.9 mm (0.024 ~ 0.035 in.)
Valve Guide Inside Diameter:	
Exhaust	6.00 ~ 6.012 mm (0.2362 ~ 0.2367 in.)
Inlet	6.00 ~ 6.012 mm (0.2362 ~ 0.2367 in.)
Exhaust Valve Lift Height by ACR	0.9 mm (0.04 in.)
Cylinder, Piston	
Cylinder Inside Diameter	64.98 ~ 65.00 mm (2.558 ~ 2.559 in.)

Special Tools

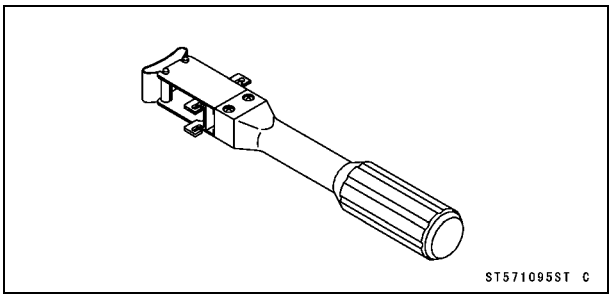
Compression Gauge:
57001-221



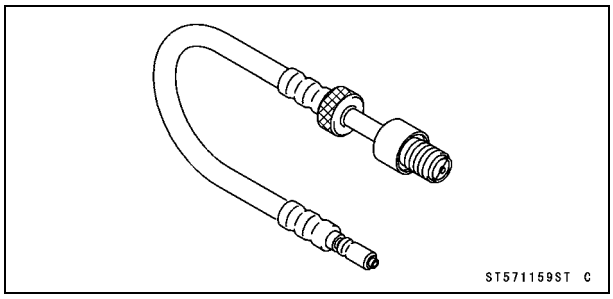
Piston Ring Compression Belt, ϕ55 ~ ϕ67:
57001-1096



Piston Ring Compression:
57001-1095

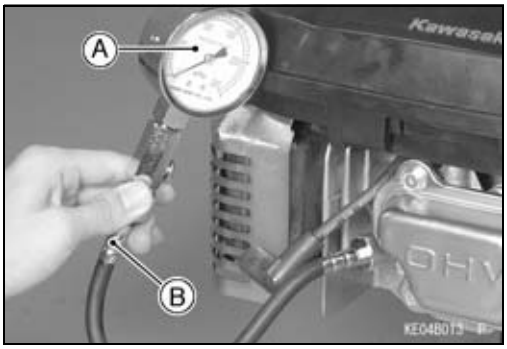


Compression Gauge Adapter M14 × 1.25:
57001-1159



Cylinder Head

Compression Measurement



- Before measuring compression, do the following.

○Thoroughly warm up the engine so that engine oil between the piston and cylinder wall will help seal compression as it does during normal running.

○Stop the engine.

- Disconnect the spark plug cap and remove the spark plug.
- Attach the compression gauge assembly firmly into spark plug hole.

Special Tools - Compression Gauge [A]: 57001-221
Compression Gauge Adapter [B]: 57001 -1159

- Ground the spark plug to the engine.

⚠ WARNING

To avoid fire, do not ground the spark plug in proximity to the plug hole. Keep the plug as far away as possible from the plug hole.

- Opening the throttle fully, run the engine by pulling the recoil starter grip several times until the compression gauge stops rising. Read the highest compression value.

Cylinder Compression
Service Limit: 196 kPa (2.0 kgf/cm², 28.4 psi) (MIN)

★If the compression is higher than the specified value, the piston rings, cylinder and valves are probably in good condition.

★If the compression is too high, check the following.

1. Carbon build-up on the piston crown and cylinder head - clean off any carbon on the piston crown and cylinder head.
2. Cylinder head gasket - use only the proper gasket. The use of a gasket of incorrect thickness will change the compression.
3. Valve guides and piston rings - rapid carbon accumulation in the combustion chamber may be caused by worn valve guides or worn piston oil ring. This may be indicated by white exhaust smoke.
4. Malfunction of ACR (Automatic Compression Release) with the camshaft.

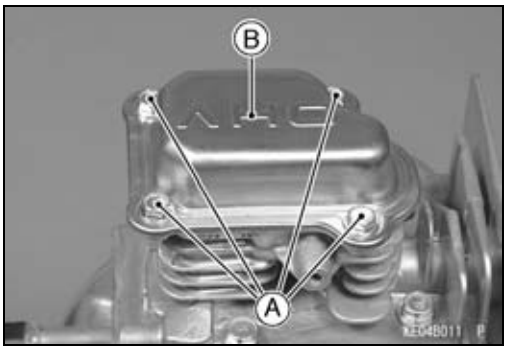
★If the cylinder compression is lower than the (MIN), check the following.

1. Gas leakage around the cylinder head - replace the damaged gasket with a new one and check and check the cylinder head warp.
2. Condition of the valve seating.
3. Valve clearance.
4. Piston/cylinder wear, piston seizure.
5. Piston ring, piston ring groove.

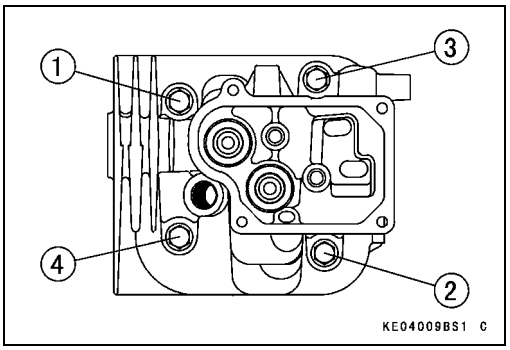
Cylinder Head

Cylinder Head Assembly Removal

- Remove:
  Air Cleaner Elements (see Air Cleaner Element in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
  Muffler (see Muffler Removal)
  Fan Housing (see Flywheel Removal in the Electrical System chapter)
  Inlet Manifold and Carburetor (see Inlet Manifold Removal, Carburetor Removal in the Fuel System chapter)
  Spark Plug (see Spark Plug Removal in the Electrical System chapter)



- Loosen the rocker cover mounting bolts [A] and remove the cover [B] and the gasket.
- When removing the cylinder head, set the piston at the TDC of the compression stroke end.



- Loosen the cylinder head bolts 1/4 turn in the sequence as shown in the figure.

CAUTION

If the above procedure is not followed, the cylinder head may be warped during removal.

- Repeat the sequence until all bolts are removed and lift off the cylinder head assembly.

NOTE

○*Mark the push rods so they can be installed in their original position during assembly.*

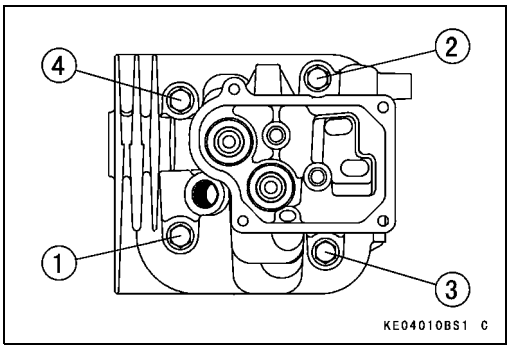
Cylinder Head Assembly Installation

- Clean the mating surfaces of the cylinder head and the cylinder.
- Install the push rods in their original positions on the cylinder (see Push Rod Installation).
- Install the dowel pins.
- Set the piston at the TDC of the compression stroke end.
- Put new gasket and the cylinder head assembly on the cylinder, then align the push rods under the rocker arms.

Cylinder Head

● Tighten the cylinder head bolts following the tightening sequence as shown in the figure.

Torque - Cylinder Head Bolts:
7T: 22 N·m (2.2 kgf·m, 16 ft·lb)
7N: 25 N·m (2.5 kgf·m, 18 ft·lb)
9N: 26 N·m (2.6 kgf·m, 19 ft·lb)



CAUTION

A torque wrench must be used to assure proper torque. Improper tightening of the head bolts may result in warping of the cylinder head.

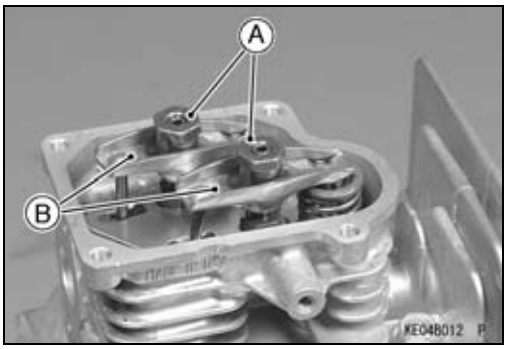
● Check and adjust the valve clearance (see Valve Clearance Inspection, Valve Clearance Adjustment in the Periodic Maintenance chapter).
● Install the gasket and the rocker cover.

Torque - Rocker Cover Mounting Bolts: 5.9 N·m (0.60 kgf·m, 52 in·lb)

● Install the removed parts (see appropriate chapters).

Push Rod Removal

● Set the piston at the TDC of the compression stroke end.
● Remove the rocker cover (see Cylinder Head Assembly Removal).
● Loosen the valve clearance adjusting nuts [A].
● Move the rocker arms [B] to clear the push rod upper ends.
● Pull out the push rods.

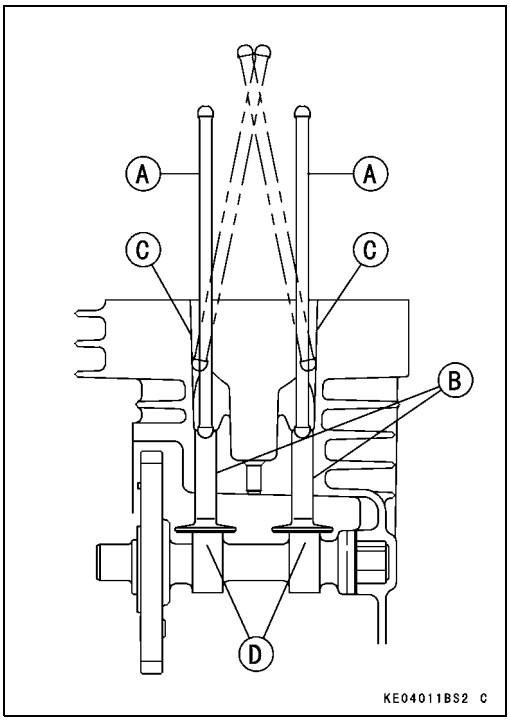


NOTE

○*Mark the push rods so they can be installed in their original positions during assembly.*

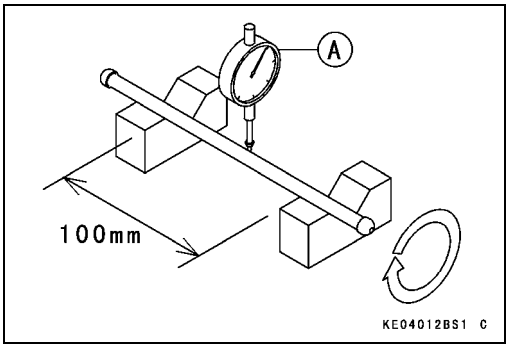
Push Rod Installation

● Set the piston at the TDC of the compression stroke end.
● Install the push rods [A] in their original positions on the cylinder.
○To install the push rod in the correct position on the tappet [B], insert the push rod, so the end of the push rod is sliding down along the inside wall [C] of the crankcase and position the push rod end onto the tappet.
● Check that both inlet and exhaust push rod on cylinder is at lowest position on the cam lobes [D], if not, turn the flywheel clockwise one turn (360°) and reset at the TDC of the compression stroke end.
● Be sure to seat the end of the push rods correctly on the tappets.
● Tighten the valve clearance adjusting nuts (see Valve Clearance Adjustment in the Periodic Maintenance chapter).
● Check and adjust the valve clearance (see Valve Clearance Inspection, Valve Clearance Adjustment in the Periodic Maintenance chapter).



Cylinder Head

Push Rod Inspection

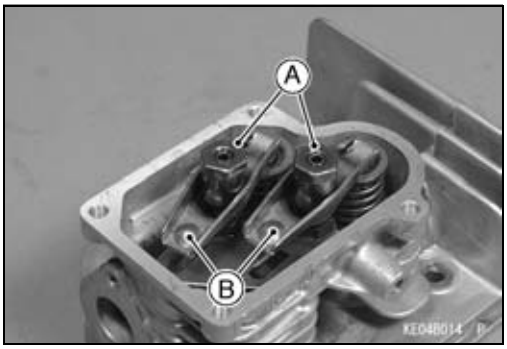


- Place the push rod in V blocks that are as far apart as possible, and set a dial gauge [A] on the rod at the halfway point between the blocks. Turn the rod to measure the runout. The difference between highest and the lowest dial readings is the amount of runout.

★If the runout exceeds the service limit, replace the rod with a new one.

Rocker Arm Push Rod Runout
Service Limit: 0.5 mm (0.02 in.)

Valve Mechanism Removal/Installation

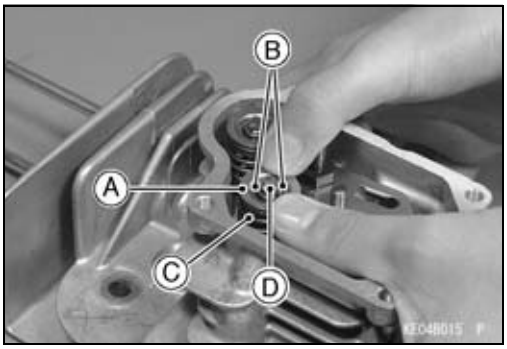


- Remove the cylinder head assembly (see Cylinder Head Assembly Removal).

NOTE

○*When removing the valve mechanism parts, record their position so that they may be reinstalled in their original position during assembly.*

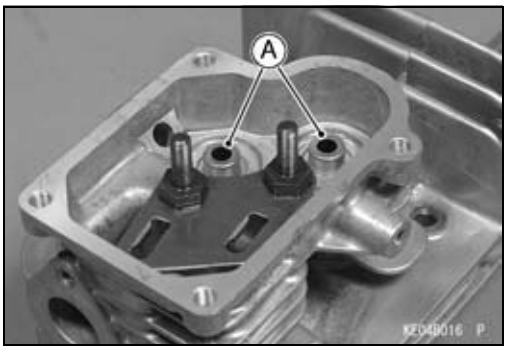
- Remove:
  Valve Clearance Adjusting Nuts [A]
  Rocker Arms [B]



- Support the valve head in the combustion chamber with a suitable block.
- To remove the collets [B], push down the valve retainer [A] with thumbs and remove the collets.
- Remove the spring [C] and valve [D] .

NOTE

○*Valve guide [A] is not replaceable, do not remove it.*



Cylinder Head

- Apply engine oil to the valve stem.
- Install the valve.
- Check to see that the valve moves smoothly up and down in the guide.
- Install the spring and the valve retainer.
- To install the collets, push down the valve retainer with thumbs and install the collets.

○Soak the valve clearance adjusting nuts and rocker arms in the engine oil.

- Install the rocker arms by the valve clearance adjusting nuts.
- Adjust the valve clearance (see Valve Clearance Adjustment in the Periodic Maintenance chapter).

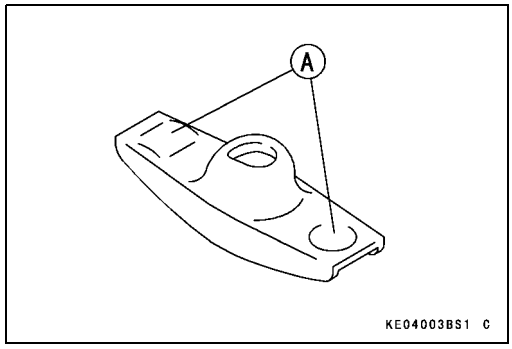
Cleaning and Inspection

- Refer to the Cylinder Head Cleaning and Inspection in the Periodic Maintenance chapter.

Rocker Arm Inspection

- Clean and inspect the rocker arm where it touches the push rod and the valve stem.

★If the contact points [A] are worn or damaged, replace the rocker arm with a new one.



Valves

Valve Clearance Inspection

- Refer to the Valve Clearance Inspection in the Periodic Maintenance chapter.

Valve Clearance Adjustment

- Refer to the Valve Clearance Adjustment in the Periodic Maintenance chapter.

Valve Seat Inspection

- Refer to the Valve Seat Inspection in the Periodic Maintenance chapter.

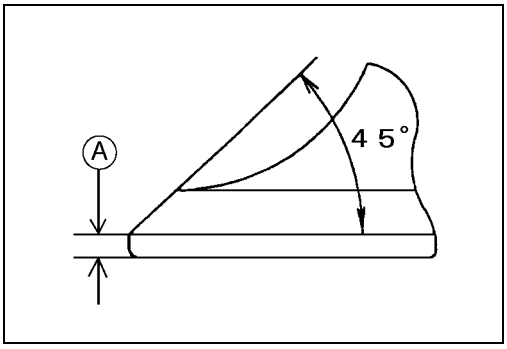
Valve Seat Repair

- Refer to the Valve Seat Repair in the Periodic Maintenance chapter.

Valve Head Thickness

- Remove the valve (see Valve Mechanism Removal/Installation).
- Measure the thickness of the valve head.

★If the valve head thickness (valve margin) [A] is less than the service limit, replace the valve with a new one.



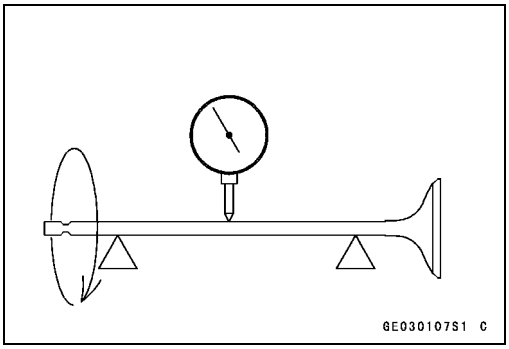
Valve Head Thickness
Service Limit:

Exhaust	**0.36 mm (0.014 in.)**
Inlet	**0.35 mm (0.014 in.)**

Valve Stem Runout

- Support the valve on V blocks at each end of the stem.
- Position a dial gauge perpendicular to the stem.
- Turn the valve and read the value variation on the dial gauge.

★If the stem runout is greater than service limit, replace the valve with a new one.



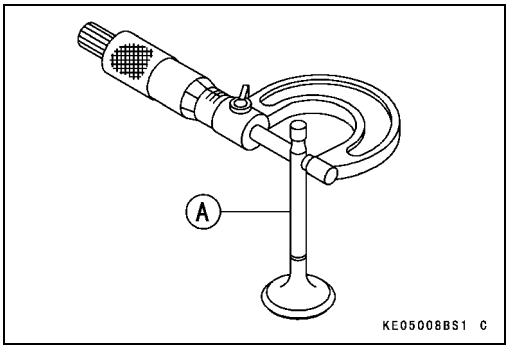
Valve Stem Runout
Service Limit:

Exhaust	**0.05 mm (0.002 in.)**
Inlet	**0.05 mm (0.002 in.)**

Valve Stem Diameter

- Measure the diameter of the valve stem [A] in two directions at right angles, at four different positions on the stem.

★If any single measurement is less than the service limit, replace the valve with a new one.

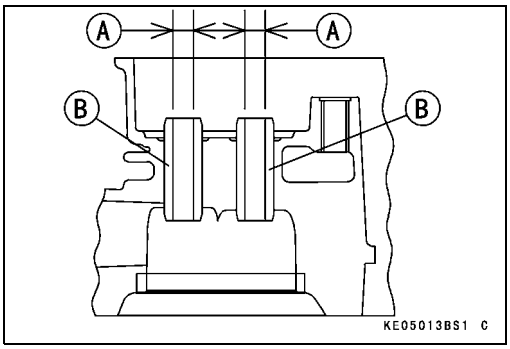


Valve Stem Diameter
Service Limit:

Exhaust	**5.93 mm (0.233 in.)**
Inlet	**5.93 mm (0.233 in.)**

Valves

Valve Guide Inside Diameter



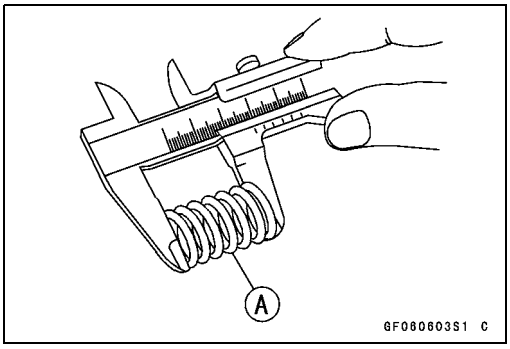
- Use a small bore gauge or a micrometer to measure the inside diameter [A] of the valve guides [B] at three positions down the guide length.

★If the measurement is more than the service limit, replace the cylinder head with a new one.

Valve Guide Inside Diameter
Service Limit:

Exhaust	**6.08 mm (0.239 in.)**
Inlet	**6.08 mm (0.239 in.)**

Valve Spring Inspection



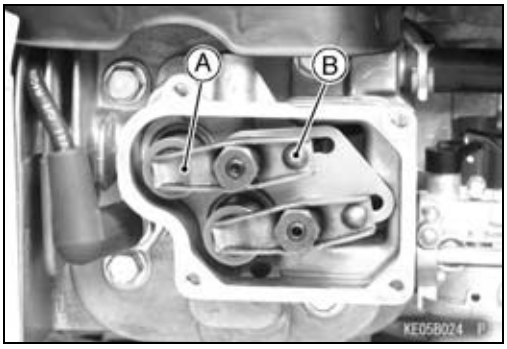
- Inspect the valve spring for pitting, cracks, rusting, and burns. Replace the spring with a new one if necessary.
- Measure the free length [A] of the spring.

★If the measurement is less than the service limit, replace the spring with a new one.

Valve Spring Free Length
Service Limit:

Exhaust	**33.5 mm (1.32 in.)**
Inlet	**33.5 mm (1.32 in.)**

Automatic Compression Release (ACR) Device Inspection



The ACR reduces the compression of the cylinder in order to facilitate the revolution of the crankshaft during the engine starting.

- Remove:
  Rocker Cover (see Cylinder Head Assembly Removal)
  Spark Plug (see Spark Plug Removal in the Electrical System chapter)
- Check if the valves have the specified clearance (see Valve Clearance Inspection in the Periodic Maintenance chapter).
- Slowly turn the crankshaft counterclockwise facing the PTO side and observe the movement of the exhaust valve [A] and the rocker arm [B].

★Immediately after the inlet valve has closed, the rocker arm should push and open the exhaust valve to attain a lift. If the exhaust valve does not lift to the standard height, the ACR on the camshaft is faulty (see Camshaft Inspection in the Camshaft/Crankshaft chapter).

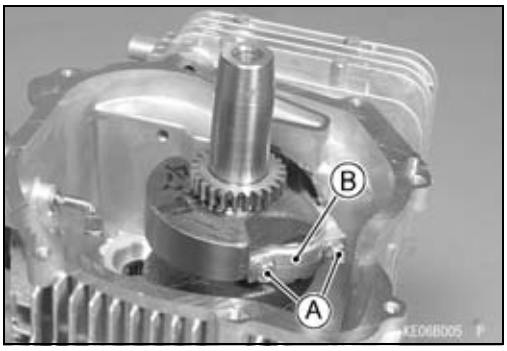
Exhaust Valve Lift Height by ACR
Standard: 0.9 mm (0.04 in.)

Cylinder, Piston

Piston Removal

- Remove:
  Air Cleaner Elements (see Air Cleaner Element in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
  Flywheel (see Flywheel Removal in the Electrical System chapter)

- Remove the crankcase cover (see Crankcase Cover Removal in the Camshaft/Crankshaft chapter).
- Remove the camshaft (see Camshaft Removal in the Camshaft/Crankshaft chapter).
- Turn the crankshaft to expose the connecting rod cap bolts [A].
- Remove the cap bolts and take off the connecting rod cap [B].

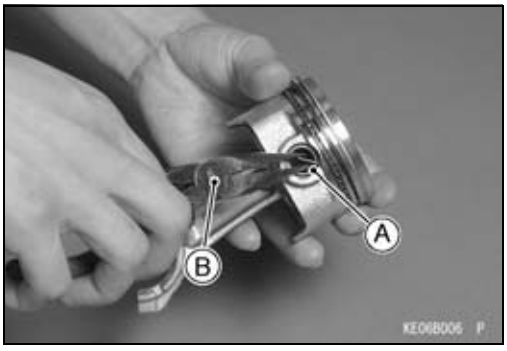


NOTE

○*Record the position of the connecting rod cap for reinstalling the cap.*

- Push the connecting rod end into the cylinder, and pull the piston and the connecting rod out of the cylinder.

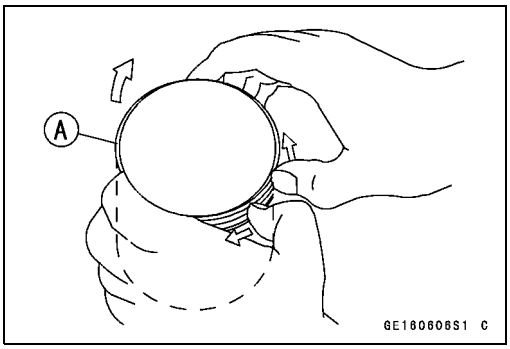
- Remove one of the piston pin snap rings [A] with needle nose pliers [B].



- Remove the piston by pushing the piston pin [A].

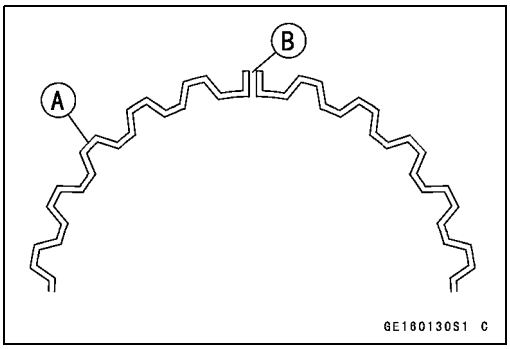
Cylinder, Piston

- Carefully spread the ring opening with your thumbs then push up to the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.

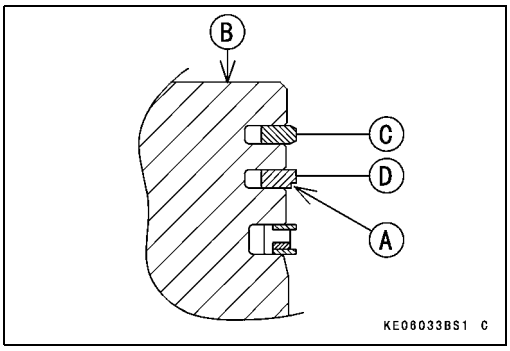


Piston Installation

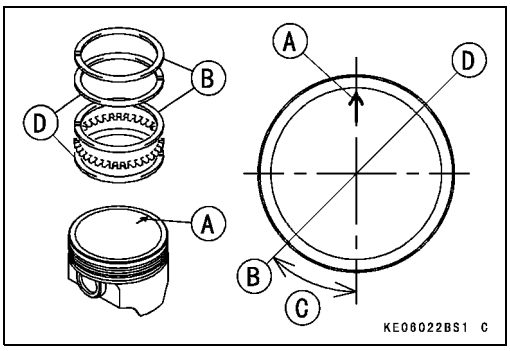
- Install the expander [A] in the piston oil ring groove so that the expander ends [B] touch together, never overlap them.
- Install the upper and lower steel rails. There is no UP or Down to the rails. They can be installed either way.



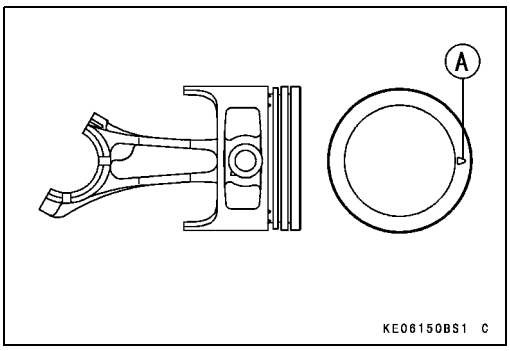
- Do not mix up the top and second ring.
- Install the second ring so that the flat side comes up.
- Install the top ring.
- The rings should turn freely in the grooves.
  Under Cut Style Structure [A]
  Piston Head [B]
  Top Ring [C]
  Second Ring [D]



- Align the piston and rings with the piston ring end gap as shown in the figure.
  Arrow Match Mark [A]
  Top Ring End Gap, Upper Steel Rail End Gap [B]
  45° [C]
  Second Ring End Gap, Lower Steel Rail End Gap [D]

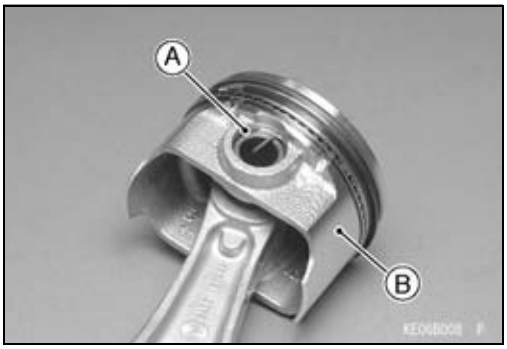


- Apply engine oil to the piston pin.
- Assemble the piston onto the connecting rod as follows: Align the arrow mark [A] on the piston crown as shown in the figure, then insert the piston pin into the piston pin hole.



Cylinder, Piston

● Install the snap ring [A] in the piston [B] as shown in the figure.

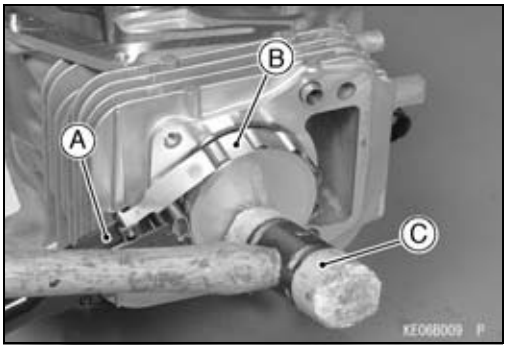


CAUTION

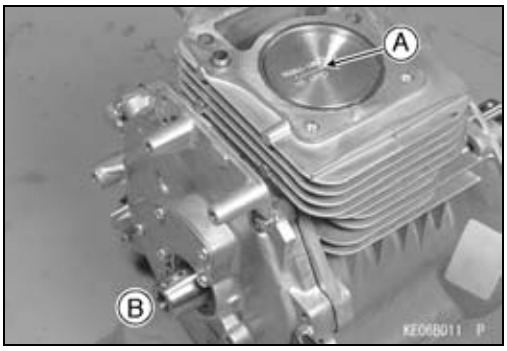
Do not reuse the snap rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.

● Apply engine oil to the piston skirt and the cylinder bore.
★Using the piston ring compressor grip [A] and the belt [B], lightly tap the top of the piston with a plastic mallet [C] to insert the piston and the connecting rod into the cylinder.

Special Tools - Piston Ring Compressor Grip: 57001-1095
Piston Ring Compressor Belt: 57001-1096

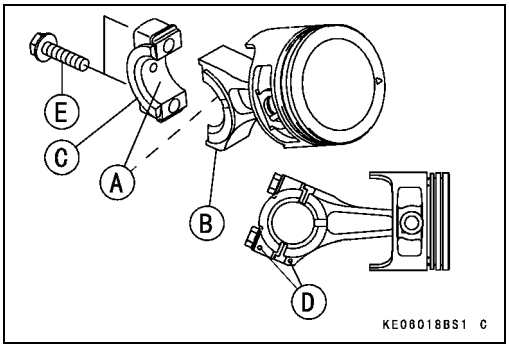


● Insert the piston and the connecting rod so that the arrow mark [A] on the piston crown faces the flywheel side [B].



CAUTION

The connecting rod and the connecting rod big end cap are machined at the factory in the assembled state, so they must be replaced together as a set.



● Apply engine oil to the inner surface [A] of the connecting rod big end [B] and cap [C].
● Set the rod and the cap aligning the mark [D] of the rod to the mark of cap, install the connecting rod big end cap in their original position on the connecting rod big end.
● Apply a small amount of engine oil to the cap bolts [E].
● Tighten the cap bolts.

Torque - Connecting Rod Big End Cap Bolts: 5.9 N·m (0.60 kgf·m, 52 in·lb)

● Install:
Camshaft (see Camshaft Installation in the Camshaft/Crankshaft chapter)
Crankcase Cover (see Crankcase Cover Installation in the Camshaft/Crankshaft chapter)
● Install the removed parts (see appropriate chapters).

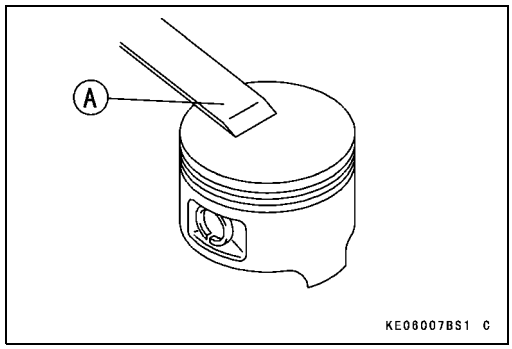
Cylinder, Piston

Piston Cleaning

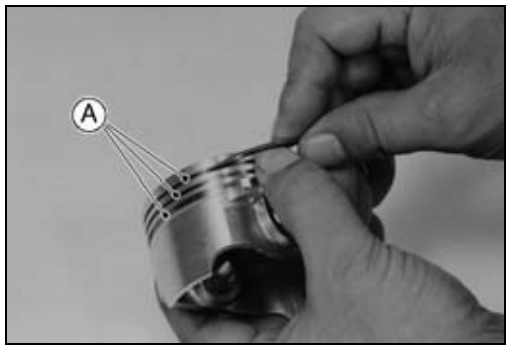
- Remove the piston and piston rings (see Piston Removal).

CAUTION

Never clean the piston head assembled. Carbon particles will fall between the piston and cylinder, and damage the piston and cylinder.



- Scrape the carbon off [A] the piston head.



- Use scraping tools carefully. Do not gouge the piston head. To avoid gouging, use scrapers that material will not damage the piston head.
- Clean the piston ring grooves [A] with a broken piston ring or other suitable tools.

CAUTION

Be careful not to widen the ring grooves. Damaged ring grooves will require piston replacement.

Piston Ring and Ring Groove Wear

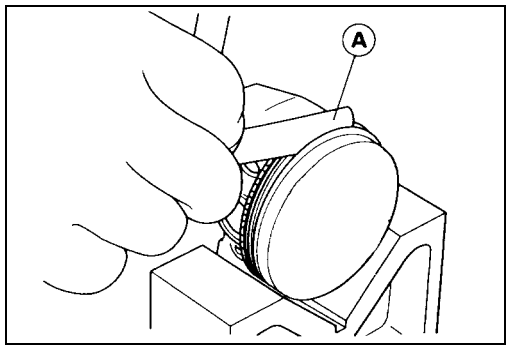
- Clean the piston (see Piston Cleaning).
- Visually inspect the piston rings and ring grooves.

★If the piston rings are worn unevenly or damaged, replace them with new ones.

★If the ring grooves are worn unevenly or damaged, replace both the piston and piston rings with new ones.

- Measure the clearance between the top and the second rings and their grooves using a thickness gauge [A].

★If the piston ring/groove clearance is greater than the service limit, replace the piston with a new one.



Piston Ring/Groove Clearance
Service Limit:

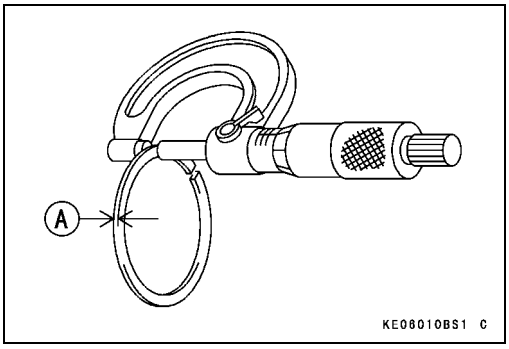
Top	**0.17 mm (0.007 in.)**
Second	**0.17 mm (0.007 in.)**

NOTE

○*The oil ring is a three piece assembled ring. It is difficult to measure the ring groove clearance and thickness. Visually inspect the oil ring, the ring groove clearance and the thickness.*

Cylinder, Piston

● Measure the piston ring thickness [A].
○Use a micrometer to measure the ring thickness at several points around the rings.
★If any of the measurement is less than the service limit, replace the entire set of rings with new ones.



Piston Ring Thickness
Service Limit:

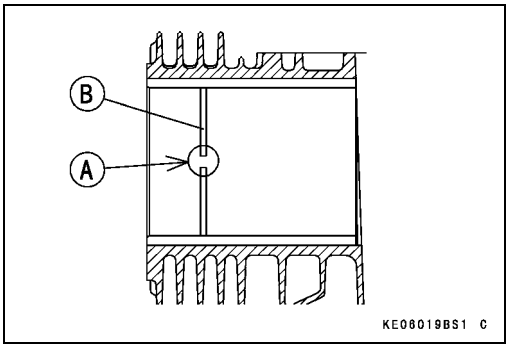
Top	**1.40 mm (0.055 in.)**
Second	**1.40 mm (0.055 in.)**

NOTE

○*When using new rings in a used piston, check if the groove wear is even. The rings should fit perfectly parallel to the groove sides. If not, replace the piston with a new one.*

Piston Ring End Gap

● Remove the piston rings.
● Push each ring (one at a time) in the cylinder bore to a point close to the bottom of the cylinder bore.
○Use the piston to push it in to be sure it is square.
● Measure the gap [A] between the ends of the ring [B] with a thickness gauge.
★If the end gap of any ring is greater than the service limit, replace the entire set of rings with new ones.

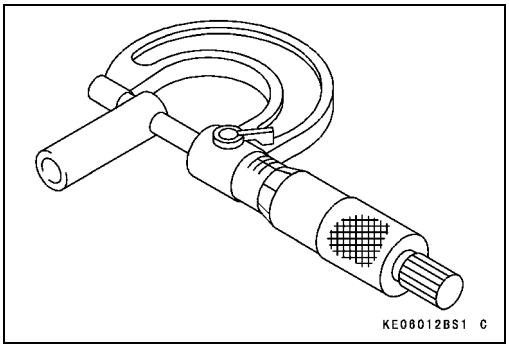


Piston Ring End Gap
Service Limit:

Top	**0.75 mm (0.029 in.)**
Second	**0.75 mm (0.029 in.)**
Oil	**1.05 mm (0.041 in.)**

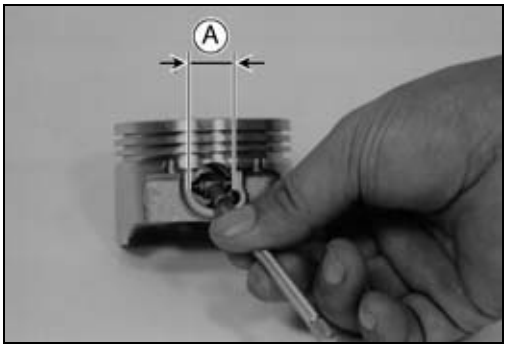
Piston Pin, Piston Pin Hole, and Connecting Rod Wear

● Remove the piston pin.
● Measure the piston pin diameter with a micrometer at several points.
★If the outside diameter is less than service limit, replace the piston pin with a new one.



Piston Pin Outside Diameter
Service Limit: 15.96 mm (0.628 in.)

● Measure the inside diameter [A] of the piston pin hole at several points on both side. Use a dial bore gauge.
★If the inside diameter is greater than the service limit, replace the piston with a new one.

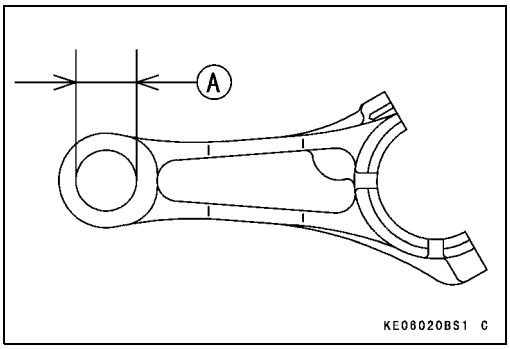


Piston Pin Hole Inside Diameter
Service Limit: 16.08 mm (0.633 in.)

Cylinder, Piston

● Measure the inside diameter [A] of the connecting rod small end at several points. Use a dial bore gauge.
★If the inside diameter is greater than the service limit, replace the connecting rod with a new one.

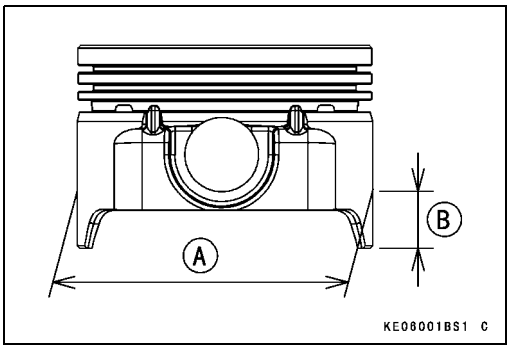
Connecting Rod Small End Inside Diameter
Service Limit: 16.06 mm (0.632 in.)



Piston Diameter

● Measure the outside diameter [A] of the piston 12.5 mm (0.9 in.) up [B] from the bottom of the piston at a right angle to the direction of the piston pin hole.
★If the measured outside diameter is less than the service limit, replace the piston with a new one.

Piston Diameter
Service Limit: 64.79 mm (2.551 in.)

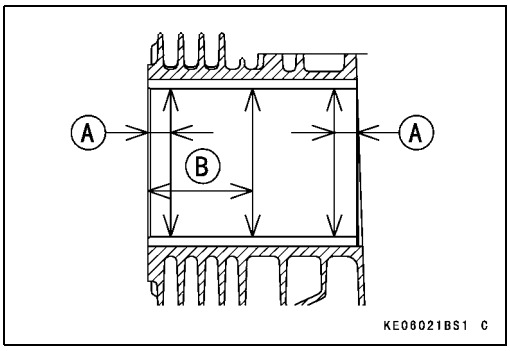


Cylinder Inside Diameter

● Clean and measure the cylinder inside diameter.
○Use a dial bore gauge to measure front-to-back and side -to-side at the points as shown in the figure.
★If any of the cylinder bore measurements is greater than the service limit, replace the cylinder with a new one.
10 mm (0.39 in.) [A]
Middle [B]

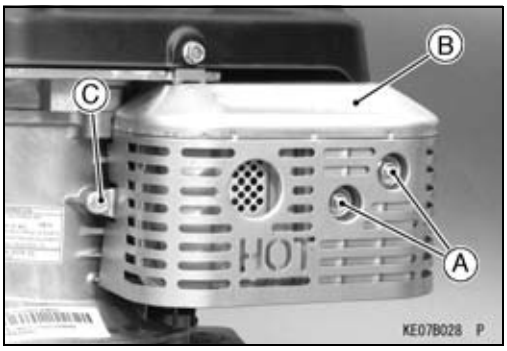
Cylinder Inside Diameter
Standard: 64.98 ~ 65.00 mm (2.558 ~ 2.559 in.)
Service Limit: 65.10 mm (2.563 in.)

Cylinder Bore Out Round
Service Limit: 0.056 mm (0.0022 in.)



Muffler

Muffler Removal



- Remove:
  Muffler Cover Bolt [C]
  Muffler Cover Nuts [A]
  Muffler Cover [B]
  Muffler
- Remove the gasket.
- Do not use unnecessary force on the muffler when removing the muffler assembly, or they could become damaged or distorted.

Muffler Installation

- Clean the gasket surface and install a new gasket each time of the muffler installation.
- Install the muffler.
- Install the muffler cover.
- Tighten the muffler cover nuts and bolt.

Torque - Muffler Cover Bolt: 6.9 N·m (0.70 kgf·m, 61 in·lb)

- After installation, thoroughly warm up the engine, wait until the engine cools down and retighten the nuts and bolt.

Inspection

- Inspect the muffler for dents, cracks, rust and holes.

★If the muffler is damaged, replace the muffler with a new one for best performance and minimum noise.

- Check the muffler for distortion or loose internal components. Loose internal muffler components may result in the exhaust flow restriction and the engine output decrease.

Lubrication System

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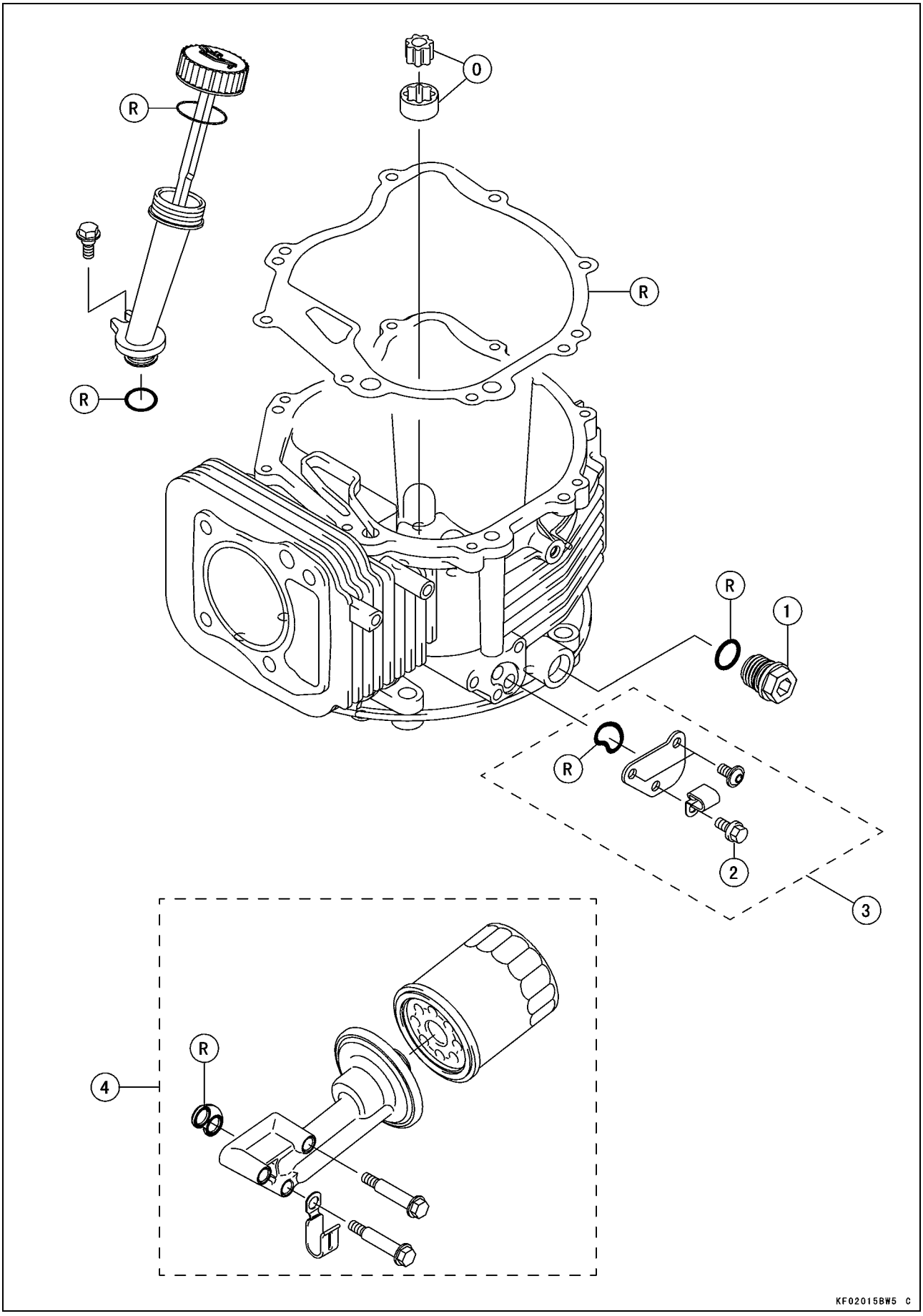
Exploded View



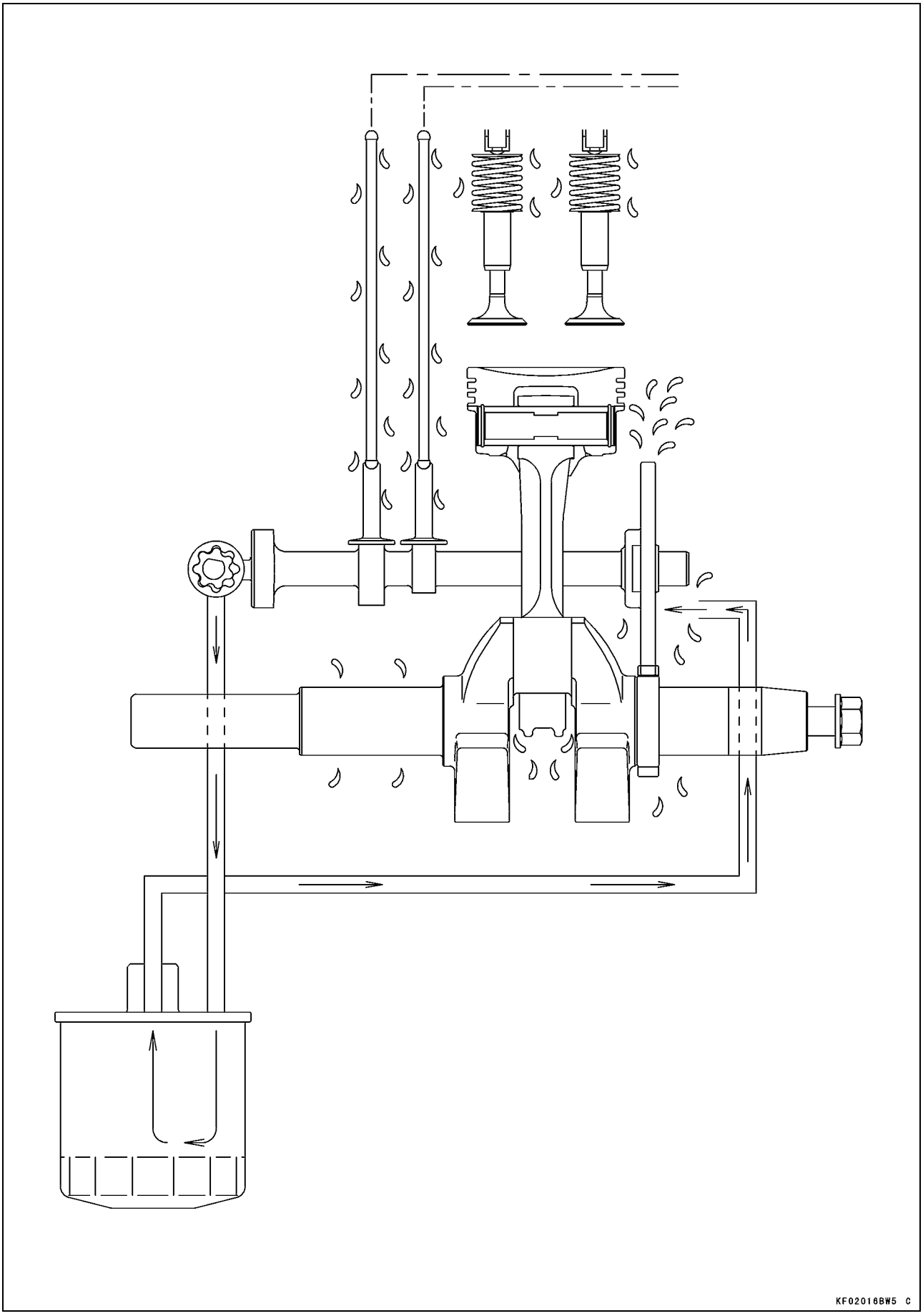
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Drain Plug	22	2.2	16	
2	Oil Filter Cover Bolt	6.9	0.70	61 in·lb	

3. Without Oil Filter Model
4. With Oil Filter Model

O: Apply engine oil.
R: Replacement Parts

Engine Oil Flow Chart



Specifications

Item	Standard
Engine Oil	
Type	SF, SG, SH or SJ class
Viscosity	SAE30, SAE10W-30
Capacity	0.65 L (0.69 US qt)
Level	Operating range (grid area) on dipstick

Item	Service Limit
Oil Pump	
Inner and Outer Rotor Clearance	0.14 mm (0.006 in.)
Outer Rotor Outside Diameter	22.940 mm (0.9031 in.)
Outer Rotor Thickness	11.960 mm (0.4709 in.)
Pump Housing Inside Diameter	23.241 mm (0.915 in.)
Pump Housing Depth	12.220 mm (0.4811 in.)

6-6 LUBRICATION SYSTEM

Engine Oil

CAUTION

Engine operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine seizure and accident. Before starting the engine for the first time, add oil: The engine is shipped dry. Preoil the engine to force all air from the internal oil passages.

- Fill fresh engine oil to the specified level (see Oil Change in the Periodic Maintenance chapter).
- Run the engine at slow speed for 2 minutes.
- Stop the engine and check the oil level.

Oil Level Inspection

- Refer to the Oil Level Inspection in the Periodic Maintenance chapter.

Oil Change

- Refer to the Oil Change in the Periodic Maintenance chapter.

Lubrication System

The oil pump on the camshaft top discharges the oil.

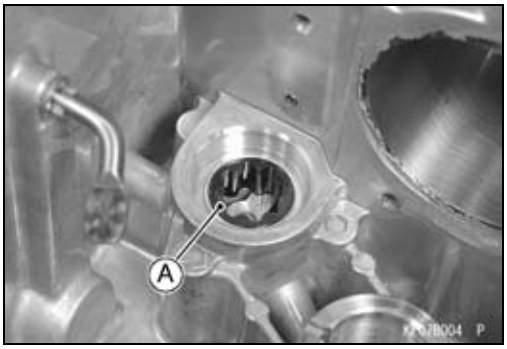
The oil passes the crankcase oil passage, the discharge hole on the crankcase flywheel side, and the camshaft gear side edge. Finally, the oil mist lubricates the connecting rod big end, the small end, the crankshaft and other internal components.

Oil Pump

Oil Pump Removal

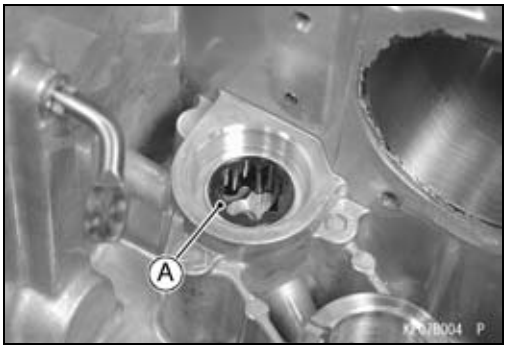
● Remove:
Air Cleaner Elements (see Air Cleaner Element Removal in the Fuel System chapter)
Recoil Starter (see Recoil Stater Removal in the Starter System chapter)
Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
Flywheel (see Flywheel Removal in the Electrical System chapter)
Crankcase Cover (see Crankcase Cover Removal in the Camshaft/Crankshaft chapter)
Camshaft (see Camshaft, Tappet Removal in the Camshaft/Crankshaft chapter)
Connecting Rod (see Connecting Rod Removal in the Camshaft/Crankshaft chapter)
Crankshaft (see Crankshaft Removal in the Camshaft/Crankshaft chapter)

● Remove the oil pump assembly [A].



Oil Pump Installation

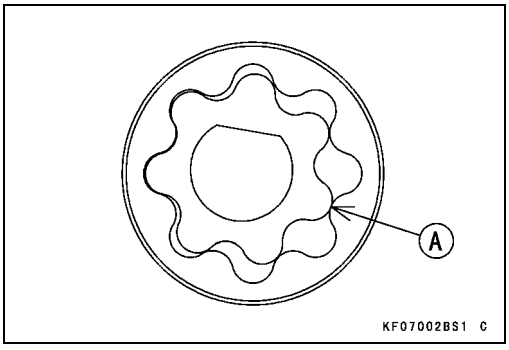
● Fill the rotor housing with engine oil for initial lubrication.
● Install the pump assembly [A] in the crankcase.
● Install the removed parts (see appropriate chapters).



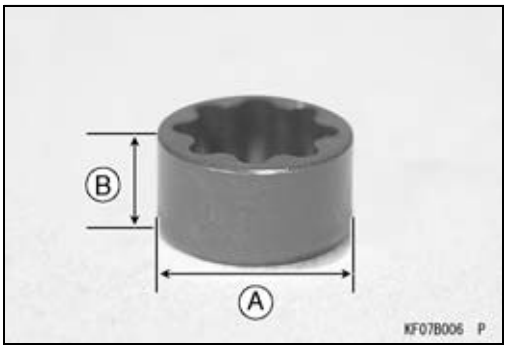
Oil Pump Inspection

● Remove the oil pump (see Oil Pump Removal).
● Visually inspect the outer and inner rotor.
★If there is any damage or uneven wear, replace them with new ones.
○Check the clearance [A] between the inner and outer rotor with a filler gauge. Measure the clearance between the highest point of the inner rotor and the highest point of the outer rotor.
★If the measurement exceed the service limit, replace the rotors as a set with new ones.

Inner and Outer Rotor Clearance
Service Limit: 0.14 mm (0.006 in.)



Oil Pump



- Measure the outside diameter [A] of the outer rotor with a micrometer at several points.

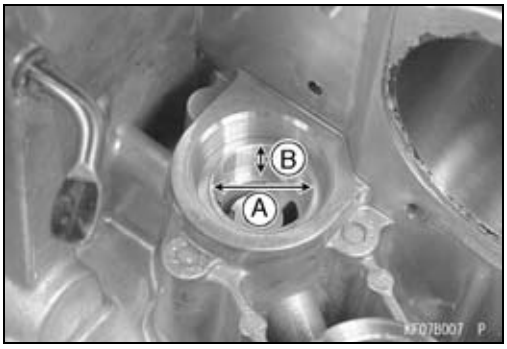
★If the rotor diameter is less than the service limit, replace both the inner and outer rotor with new ones.

Outer Rotor Outside Diameter
Service Limit: 22.940 mm (0.9031 in.)

- Measure the thickness [B] of the outer rotor with a micrometer at several points

★If the rotor thickness is less than the service limit, replace both the inner and outer rotor.

Outer Rotor Thickness
Service Limit: 11.960 mm (0.4709 in.)



- Measure the inside diameter [A] of the pump housing with an inside micrometer at several points.

★If the inside diameter is more than the service limit, replace the crankcase with a new one.

Pump Housing Inside Diameter
Service Limit: 23.241 mm (0.915 in.)

- Measure the depth [B] of the pump housing with a depth micrometer at several points.

★If any of measurement is more than the service limit, replace the crankcase.

Pump Housing Depth
Service Limit: 12.220 mm (0.4811 in.)

Camshaft/Crankshaft

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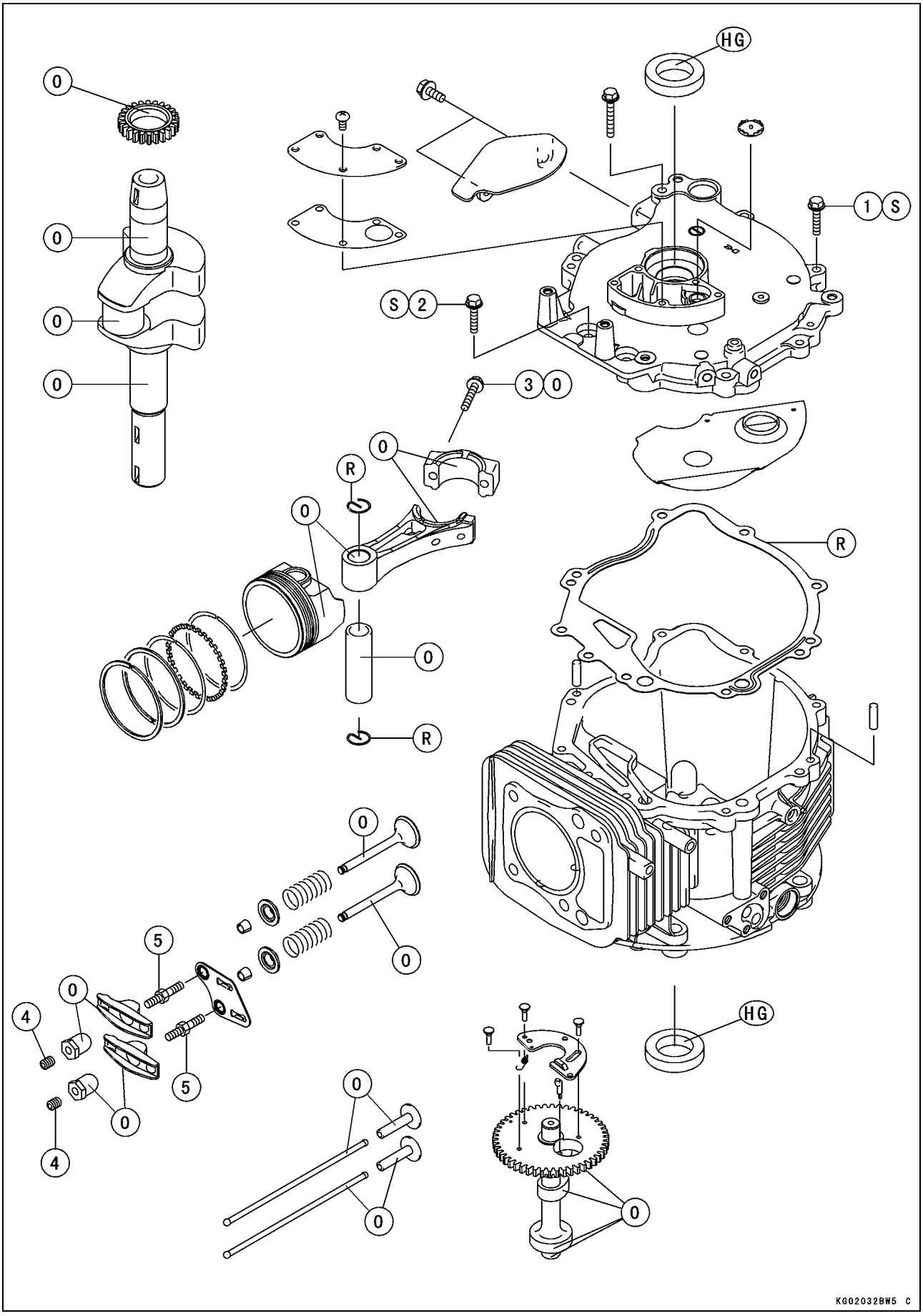
7-2 CAMSHAFT/CRANKSHAFT

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Crankcase Cover Bolts	8.8	0.90	78 in·lb	S
2	Crankcase Cover Bolt (Cylinder Side)	5.9	0.60	52 in·lb	S
3	Connecting Rod Big End Cap Bolts	5.9	0.60	52 in·lb	O
4	Valve Clearance Lock Screws	6.9	0.70	61 in·lb	
5	Rocker Arm Bolts	28	2.8	20	

HG: Apply high-temperature grease.
O: Apply engine oil.
R: Replacement Parts
S: Follow the specified tightening sequence.

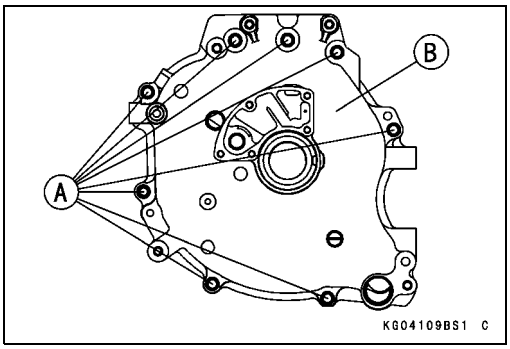
7-4 CAMSHAFT/CRANKSHAFT

Specifications

Item	Service Limit
Camshaft, Tappet	
Cam Lobe Height:	
Exhaust	22.060 mm (0.8685 in.)
Inlet	22.060 mm (0.8685 in.)
Camshaft Journal Diameter:	
PTO Side	7.77 mm (0.3059 in.)
Flywheel Side	13.927 mm (0.5483 in.)
Camshaft Hole Inside Diameter:	
Crankcase Cover	11.060 mm (0.4354 in.)
Crankshaft, Connecting Rod	
Connecting Rod Bend	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Big End Width	23.44 mm (0.92 in.)
Crankpin Width	24.17 mm (0.95 in.)
Connecting Rod Big End Inside Diameter	31.040 mm (1.222 in.)
Crankpin Outside Diameter	30.97 mm (1.219 in.)
Crankshaft Runout	TIR 0.05 mm (0.002 in.)
Crankshaft Journal Diameter:	
PTO Side	27.96 mm (1.101 in.)
Flywheel Side	27.98 mm (1.102 in.)
Crankcase	
PTO Shaft Hole Inside Diameter:	
Crankcase Cover	27.98 mm (1.102 in.)
Crankshaft Journal Metal Inside Diameter:	
Crankcase	27.98 mm (1.102 in.)

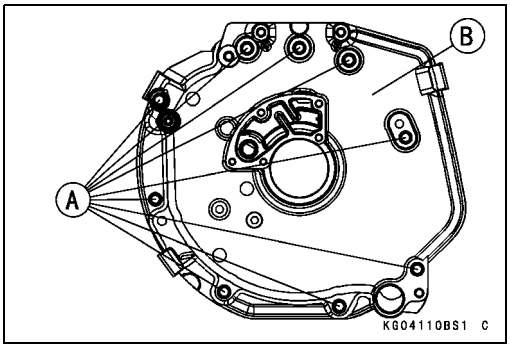
Crankcase

Crankcase Cover Removal



- Drain the oil (see Oil Change in the Lubrication System chapter).
- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
  Flywheel (see Flywheel Removal in the Electrical System chapter)
- Unscrew the mounting bolts [A] and remove the crankcase cover [B] from the crankcase.

- For KAI model; the crankcase cover is as shown in the figure.



○There are two dowel pins on the crankcase mating surface. Using a wooden or plastic mallet, gently tap the crankcase to loosen the crankcase cover.

Crankcase Cover Installation

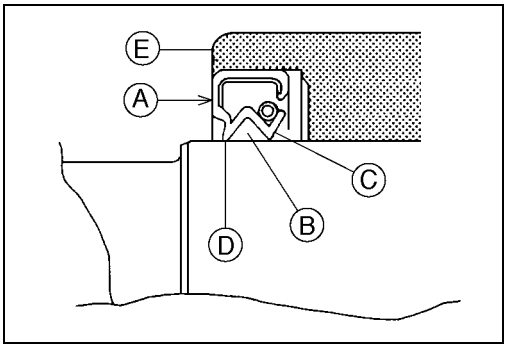
- Remove the old gasket from the mating surfaces of the crankcase and cover.
- Using compressed air, blow out the oil passage in the crankcase cover.
- With a high-flash point solvent, clean off the mating surfaces of the crankcase and the cover, and wipe them dry.

⚠ WARNING

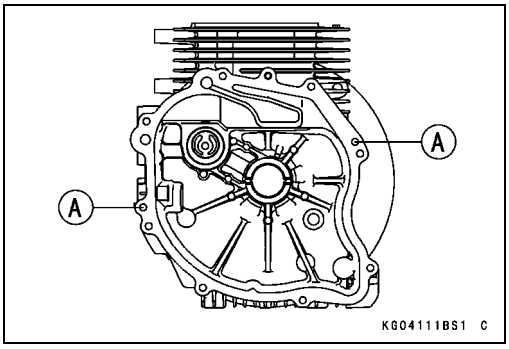
Clean the crankcase and cover in a well ventilated area, and take care that there are no sparks or flame anywhere near the working area, this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean parts. A fire or explosion could result.

Crankcase

● Be sure to replace any oil seal with a new one.
○Install the oil seal so that the marks [A] face out.
○Thoroughly pack high-temperature grease [B] into the space between the seal lip [C] and the dust lip [D]. Press in the new oil seal using a press or suitable tools until it is flush with flange surface [E]. Do not damage the seal lips.



● Check to see that the dowel pins [A] are in place on the crankcase.
● Install the gasket on the crankcase.

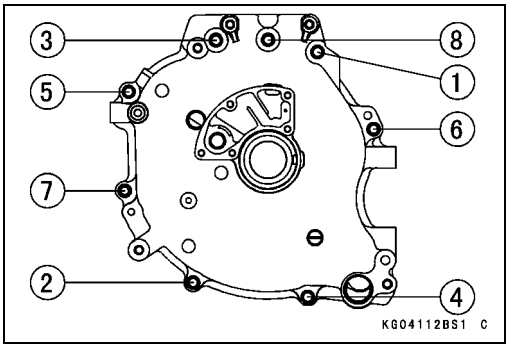


● Install the crankcase cover and tighten the crankcase cover bolts following the tightening sequence as shown in the figure.

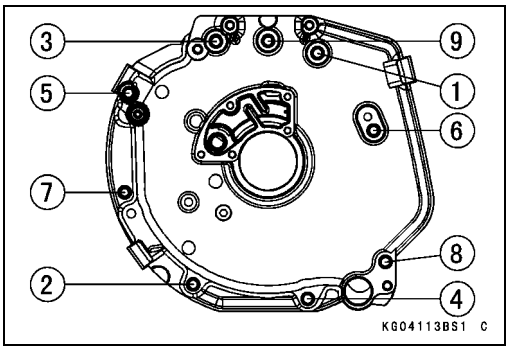
Torque - Crankcase Cover Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Torque - Crankcase Cover Bolt (Cylinder Side): 5.9 N·m (0.60 kgf·m, 52 in·lb)

○Do not turn one bolt down completely before the others, as it may cause the crankcase cover to warp.



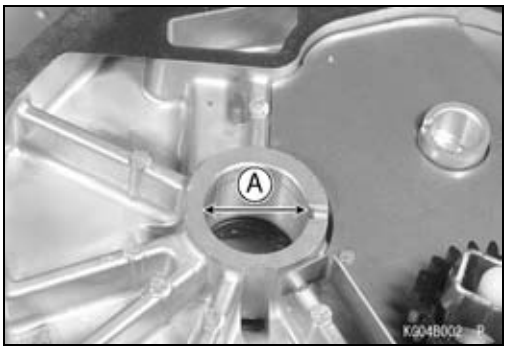
● For KAI model; the tightening sequence is as shown in the figure.



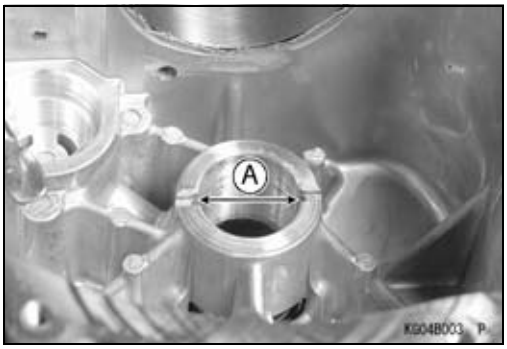
Inspection

● Measure the inside diameter [A] of the PTO shaft hole on the crankcase cover at several points. Replace the crankcase cover with a new one if the inside diameter is more than the service limit.

PTO Shaft Hole Inside Diameter
Service Limit: 27.98 mm (1.102 in.)



Crankcase



- Measure the inside diameter [A] of the crankshaft journal metal on the crankcase at several points. Replace the crankcase with a new one if the inside diameter is greater than the service limit.

Crankshaft Journal Metal Inside Diameter
Service Limit: 27.98 mm (1.102 in.)

Cleaning

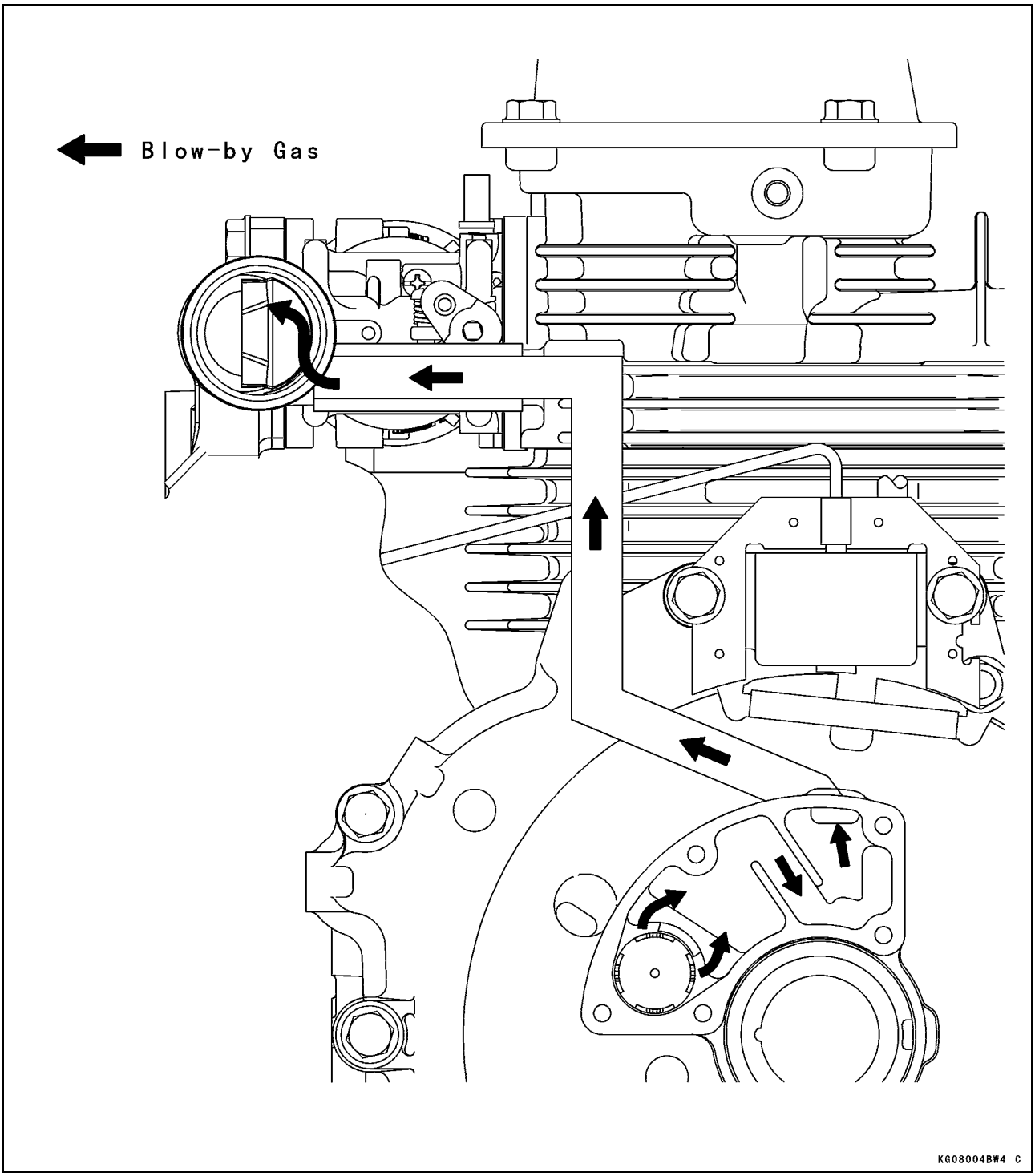
- Remove:
  Camshaft and Tappets (see Camshaft, Tappet Removal)
  Connecting Rod and Piston (see Piston Removal in the Engine Top End chapter)
  Crankshaft (see Crankshaft Removal)
- Clean up the crankcase and the cover with a high-flash point solvent, and blow out any foreign particles that may be in the pockets inside of the crankcase with compressed air.

⚠ WARNING

Clean the crankcase and cover in a well ventilated area, and take care that there is no sparks or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents.

Breather

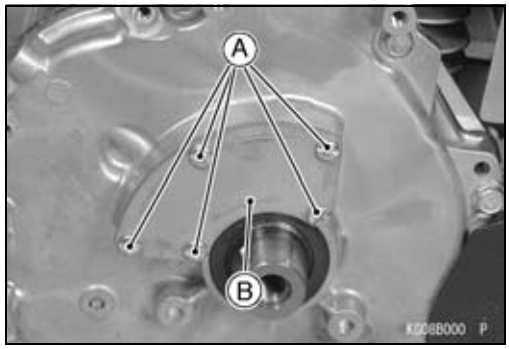
The function of the breather is to create a negative pressure in the crankcase which prevents oil from being forced out of the engine through the piston rings, oil seals or gaskets. Valve controls direction of air flow caused by piston movement so that air flow from inside to outside can pass reed valve but not from outside to inside. Blow-by gas in crankcase passes through valve and expands in valve chamber. The air passes through expands in breather chamber. Then air passes through maze in breather chamber and is vented to inlet pipe, through breather pipe.



Breather

Breather Chamber Cover Removal

- Remove the bolts [A] and the breather chamber cover [B].

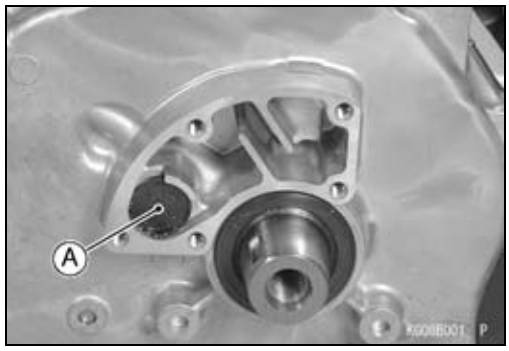


Breather Chamber Cover Installation

- Install a new gasket and the breather chamber cover, and tighten the bolts.

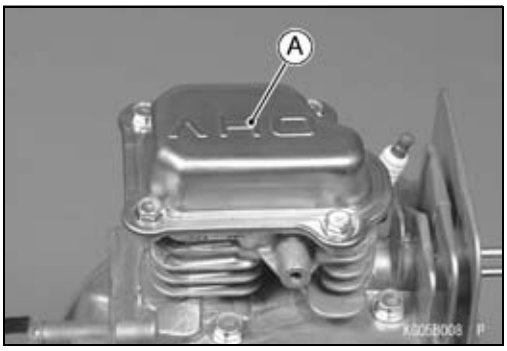
Breather Valve Inspection

- Remove the breather valve [A].
- Inspect the breather valve for breakage, hair crack or distortion, replace it with a new one if necessary.
- Inspect the valve seating surface. The surface should be free of nicks or burrs.
- Be sure the drain hole on the breather chamber does not accumulate with slugs before installing the breather valve.

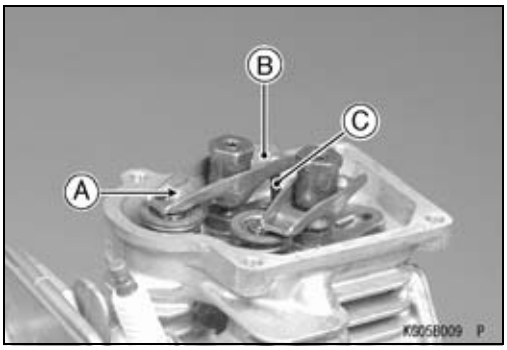


Camshaft, Tappet

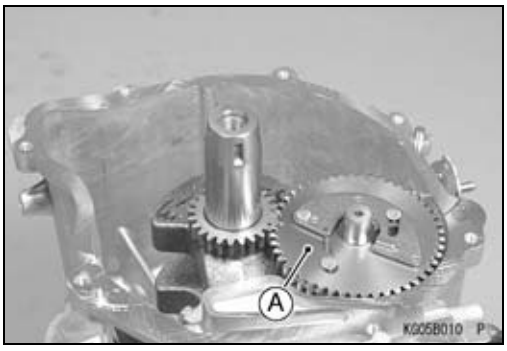
Camshaft, Tappet Removal



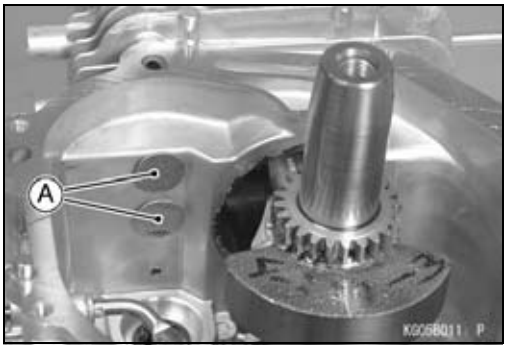
- Drain the oil (see Oil Change in the Lubrication System chapter).
- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
  Flywheel (see Flywheel Removal in the Electrical System chapter)
  Crankcase Cover (see Crankcase Cover Removal)
  Rocker Cover [A]



- Position the piston at the TDC of the compression stroke end.
- Push down [A] the spring side of the rocker arm [B] and move it to clear the push rod [C].
- Remove the push rods and mark them so they can be installed in their original positions during assembly.



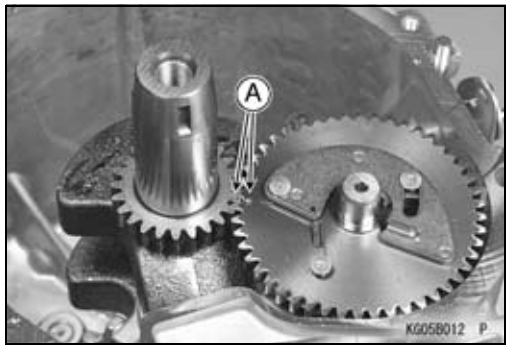
- Place the crankcase with flywheel side toward top side.
- Pull the camshaft [A] out of the crankcase.



- Remove the tappets [A] and mark them so they can be installed in their original positions during assembly.

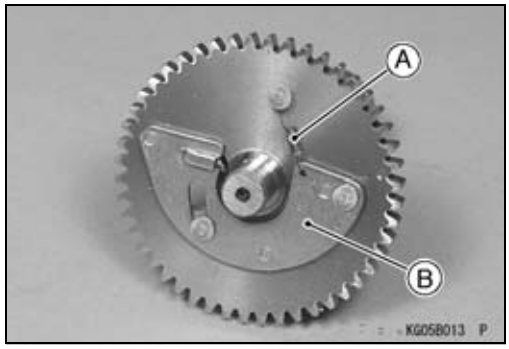
Camshaft, Tappet

Camshaft, Tappet Installation



- Apply engine oil to the following.
  Tappet Journal
  Camshaft Journal
  Cam Lobe Surface
  Camshaft Gear
- Install the tappets in those old positions.
- Align the punch marks [A] on the crankshaft gear and on the camshaft gear.
- Install the push rods (see Push Rod Installation in the Engine Top End chapter).
- Install the rocker arms on the push rods, and install the valve clearance adjusting nuts.
- Adjust the valve clearance (see Valve Clearance Adjustment in the Engine Top End chapter).
- Install the gasket and rocker cover.
- Install the removed parts (see appropriate chapters).

Camshaft Disassembly



- Remove the camshaft (see Camshaft, Tappet Removal).
- Remove:
  Spring [A]

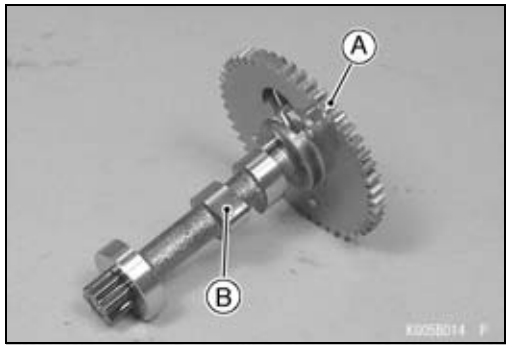
○Do not remove the ACR (automatic compression release) weight [B].

○While shaking the camshaft, ACR weight swings smoothly.

Camshaft Assembly

- Install the spring.
- Install the camshaft (see Camshaft, Tappet Installation).
- After assembling the camshaft, check the following items.

Camshaft Inspection

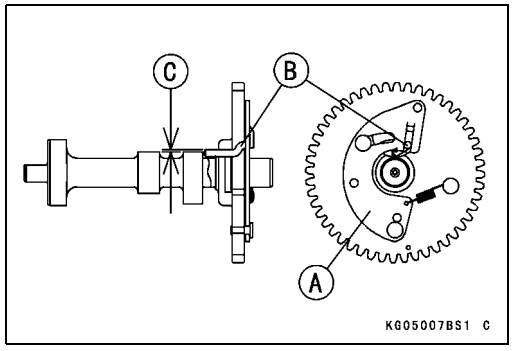


- Check the camshaft gear [A] for pitting, fatigue cracks, burrs or an evidence of improper tooth contact.

★Replace the camshaft with a new one if necessary.

- Check the top of the cam lobes [B] for wear, burrs or uneven contact.

★Replace the camshaft with a new one if necessary.



- Inspect the camshaft to make sure that its ACR (automatic compression reduction) function operates smoothly and does not have any damage or abnormal wear.

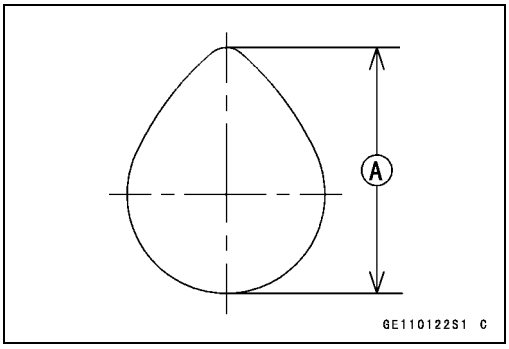
★If ACR parts are worn, replace the ACR with a new one.

★When the weight [A] is closed, if the top of the arm [B] is lower than the base [C], replace the ACR with a new one.

★When the weight is pulled entirely outward with your finger, if the top of the arm is higher than the cam base, replace the ACR with a new one.

Camshaft, Tappet

Camshaft Bearing/Journal Wear

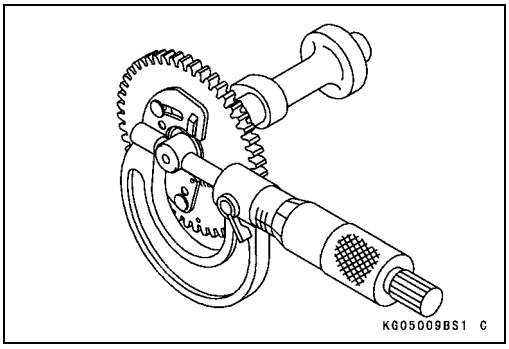


- Measure the height [A] of each cam lobe.

★If the cam height is less than the service limit for either lobe, replace the camshaft with a new one.

Cam Lobe Height
Service Limit:

Exhaust	**22.060 mm (0.8685 in.)**
Inlet	**22.060 mm (0.8685 in.)**

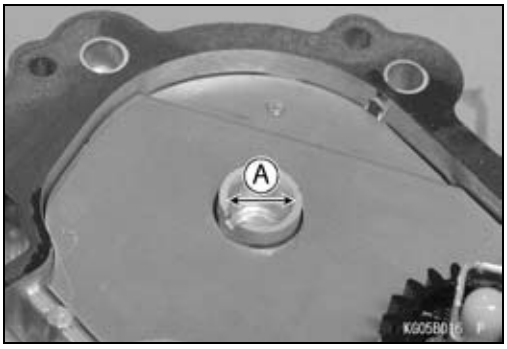


- Measure both camshaft journals at several points around the journal circumference.

★If the journal diameter is less than the service limit, replace the camshaft with a new one.

Camshaft Journal Diameter
Service Limit:

PTO Side	**7.77 mm (0.3059 in.)**
Flywheel Side	**13.927 mm (0.5483 in.)**



- Measure the inside diameter [A] of the camshaft hole on the crankcase cover at several points.

★Replace the crankcase cover with a new one if the inside diameter is more than the service limit.

Camshaft Hole Inside Diameter (Crankcase Cover)
Service Limit: 11.060 mm (0.4354 in.)

Crankshaft, Connecting Rod

Connecting Rod Removal

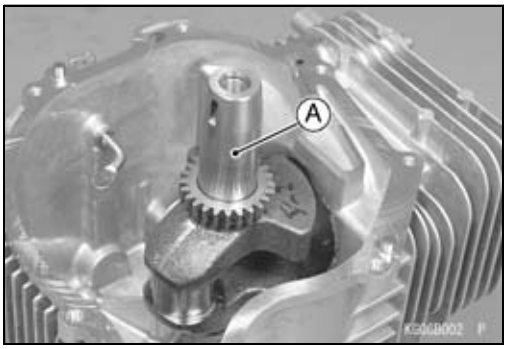
- Remove:
  Piston (see Piston Removal in the Engine Top End chapter)

Connecting Rod Installation

- Install:
  Piston (see Piston Installation in the Engine Top End chapter)

Crankshaft Removal

- Drain the oil (see Oil Change in the Lubrication System chapter).
- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
  Flywheel (see Flywheel Removal in the Electrical System chapter)
  Crankcase Cover (see Crankcase Cover Removal)
  Camshaft (see Camshaft, Tappet Removal)
  Connecting Rod (see Connecting Rod Removal)
- Pull the crankshaft [A] out of the crankcase. Tap gently with a wooden or plastic mallet if necessary to loosen the crankshaft.



Crankshaft Installation

- Clean up the crankshaft and crankcase thoroughly.
- Check that the pivot arm for the governor is installed (see Governor Shaft Installation in the Fuel System chapter).
- Pack some amount of high-temperature grease into the oil seal on the crankcase.
- Apply engine oil journal.
- Install the crankshaft in the crankcase.

Cleaning/Inspection

- After removing, clean the connecting rod and crankshaft with a high-flash point solvent and dry them with compressed air.
- Inspect the teeth of the crankshaft gear for pitting, fatigue cracks, burrs and evidence of improper tooth contact.

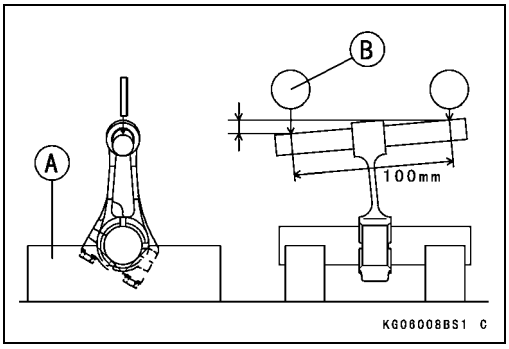
★Replace the gear with a new one if necessary.

- Inspect the crankshaft and connecting rod for wear, scratches, evidence of improper contact or other damages.

★Replace them with new ones if necessary.

Crankshaft, Connecting Rod

Connecting Rod Bend/Twist



● Measure the connecting rod bend.

○Select an arbor of the same diameter of the connecting rod big end, and insert the arbor through the connecting rod big end.

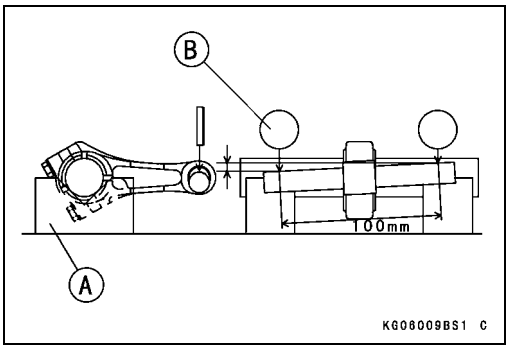
○Select an arbor of the same diameter of the piston pin and at least 100 mm (3.94 in.) long, and insert the arbor through the connecting rod small end.

○On a surface plate, set the big end arbor on V blocks [A].

○With the connecting rod held vertically, use a height gauge to measure the height difference of the small end arbor above the surface plate. Using a dial gauge [B], measure the height at two different positions and the distance of the two positions is 100 mm (3.94 in.). Then determine the connecting rod bent from the measured height differences.

★If the connecting rod bend exceeds the service limit, replace the connecting rod with a new one.

Connecting Rod Bend
Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)



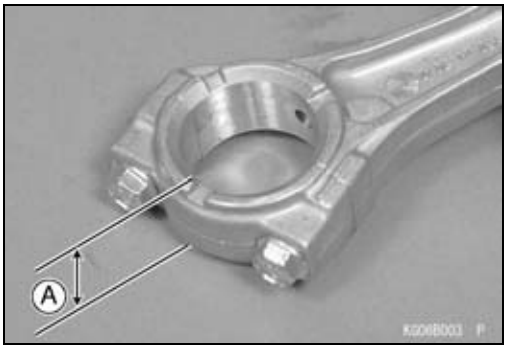
● Measure the connecting rod twist.

○With the big end arbor still on the V blocks [A], hold the connecting rod horizontally and measure the amount that the small end arbor differences. Using a dial gauge [B], measure the height at two different positions and the distance of the two positions is 100 mm (3.94 in.). Then determine the connecting rod twist from the measured height differences.

★If connecting rod twist exceeds the service limit, replace the connecting rod with a new one.

Connecting Rod Twist
Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)

Connecting Rod Big End/Crankpin Width Wear



● Measure the connecting rod big end width [A] with a micrometer or dial caliper.

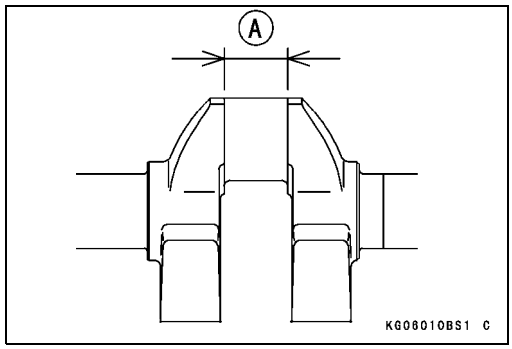
★If the measurement is less than the service limit, replace the connecting rod with a new one.

Connecting Rod Big End Width
Service Limit: 23.44 mm (0.92 in.)

Crankshaft, Connecting Rod

● Measure the crankpin width [A] with a dial caliper.
★If the crankpin width is greater than the service limit, replace the crankshaft with a new one.

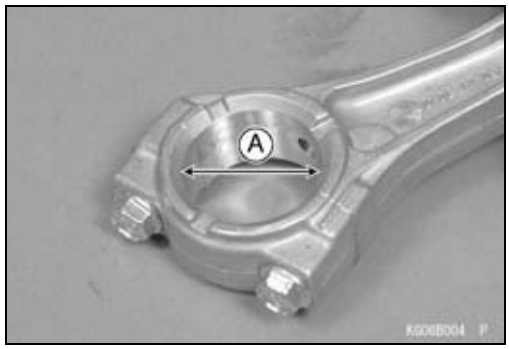
Crankpin Width
Service Limit: 24.17 mm (0.95 in.)



Connecting Rod Big End Bearing/Crankpin Wear

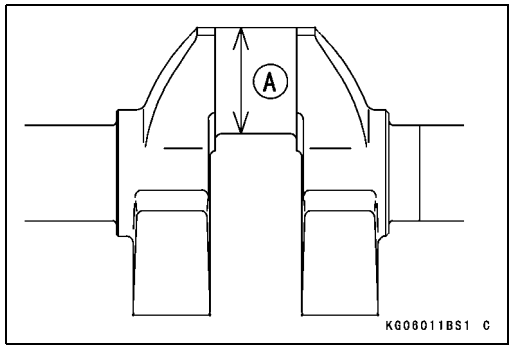
● Apply a thin layer of oil on the threads of the cap bolts.
● Install the cap bolts and tighten the bolts to the specified torque (see Piston Installation in the Engine Top End chapter).
● Measure the big end inside diameter [A] at several points with a telescoping gauge or inside micrometer.
★If the inside diameter is greater than the service limit, replace the connecting rod with a new one.

Connecting Rod Big End Inside Diameter
Service Limit: 31.040 mm (1.222 in.)



● Measure the crankpin outside diameter [A].
○Use a micrometer to measure several points around the crankpin circumference.
★If the crankpin diameter is less than the service limit, replace the crankshaft with a new one.

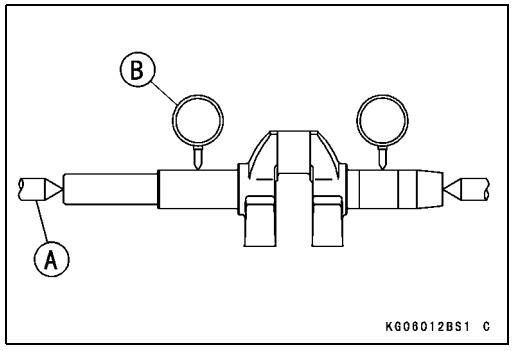
Crankpin Outside Diameter
Service Limit: 30.97 mm (1.219 in.)



Crankshaft Runout

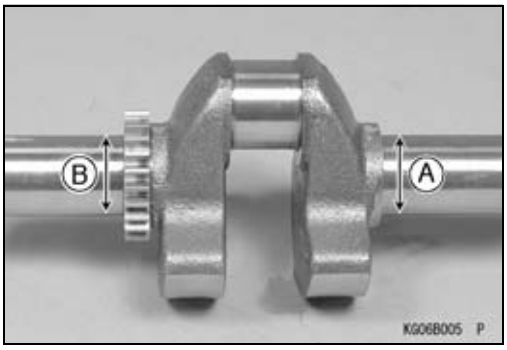
● Measure the crankshaft runout.
○Set the crankshaft in a flywheel alignment jig [A] or on V blocks gauge.
○Set a dial gauge [B] against both journals.
○Turn the crankshaft slowly to measure the runout. The difference between the highest and lowest dial gauge readings (TIR) is the amount of runout.
★If the measurement exceeds the service limit, replace the crankshaft with a new one.

Crankshaft Runout
Service Limit: TIR 0.05 mm (0.002 in.)



Crankshaft, Connecting Rod

Crankshaft Main Journal/Wear



- Measure both journals at several points around the journal circumference.

★If the journal diameter is less than the service limit, replace the crankshaft with a new one.

Crankshaft Journal Diameter
Service Limit:

PTO Side [A]	**27.96 mm (1.101 in.)**
Flywheel Side [B]	**27.98 mm (1.102 in.)**

Starter System

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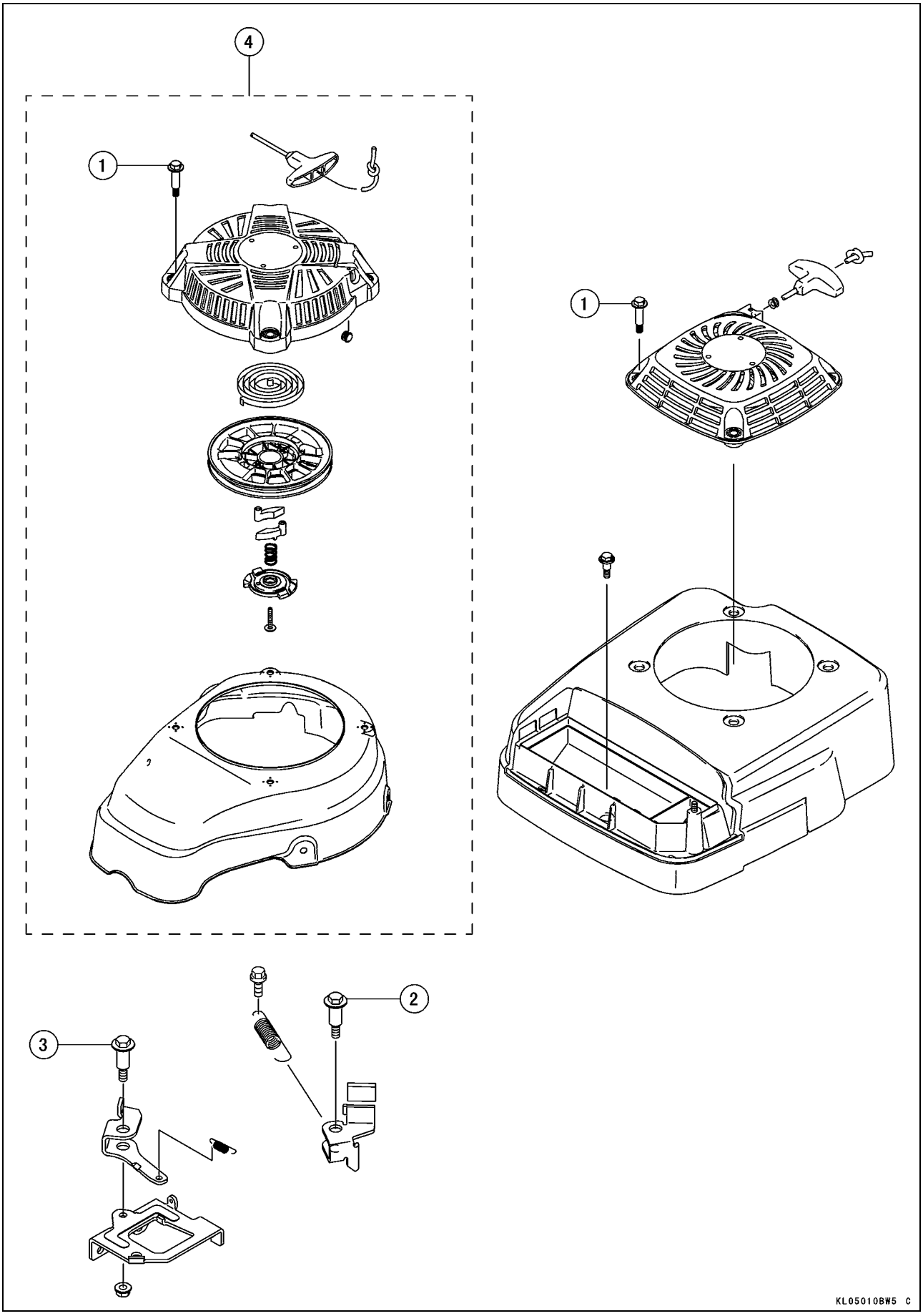
Exploded View



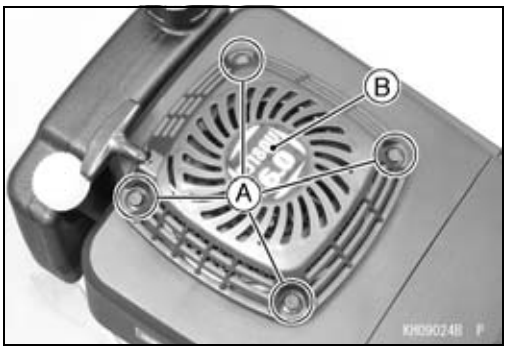
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Recoil Starter Mounting Bolts	6.9	0.70	61 in·lb	
2	Brake Arm Mounting Bolt	9.3	0.95	82 in·lb	
3	Brake Lever Assembly Mounting Bolt	6.9	0.70	61 in·lb	

4. KAI Model

Recoil Starter System

Recoil Starter Removal



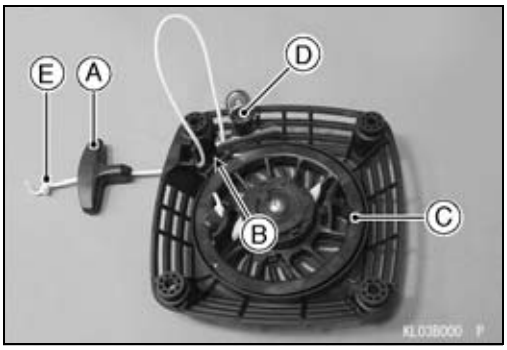
- Remove:
  Recoil Starter Mounting Bolts [A]
  Recoil Starter [B]

Recoil Starter Installation

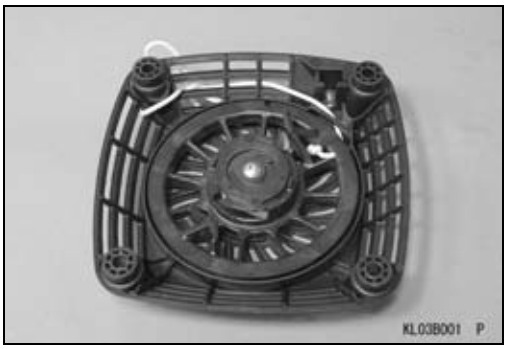
- Install the recoil starter and tighten the mounting bolts.

Torque - Recoil Starter Mounting Bolts: 6.9 N·m (0.70 kgf·m, 61 in·lb)

Rope Guide Removal



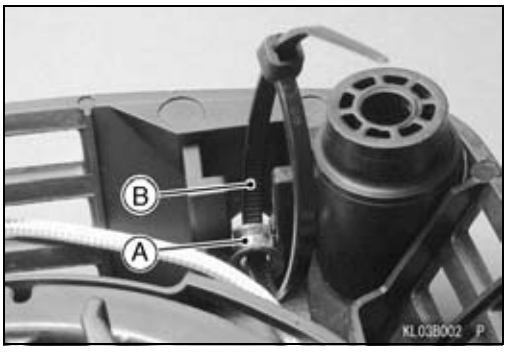
- Remove the recoil starter (see Recoil Starter Removal).
- Draw the rope from the inside [B] of the guide after pulling the starter grip [A] 30 cm (1 ft).
- Clamp the rope with a clip [D] so it can not wind back onto the reel [C].
- Pry the knot [E] out of the starter grip and untie it.
- Remove the starter grip from the rope and remove the rope from the guide.



- Connect the rope to the case so it can not wind back onto the reel.

⚠ WARNING

Wear gloves to avoid injury for the remaining steps.

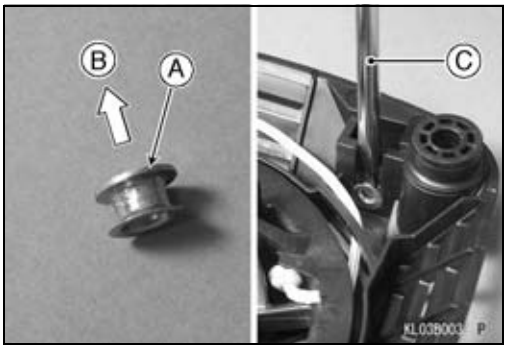


- Put a suitable rope or band [B] through the guide [A].
- Hold the case securely and pull the band with the guide.

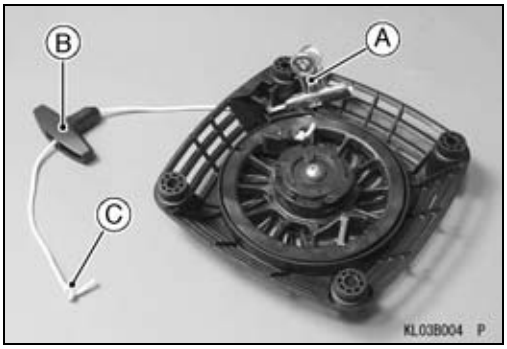
Recoil Starter System

Rope Guide Installation

- Set the guide so that the thick side [A] faces the outside [B], and press it with a suitable tool [C].



- Clamp the rope with the clip [A] so it can not wind back.
- Untie the rope from the case and push it through the guide.
- Install a starter grip [B] and secure it with a knot [C].
- Hold the starter grip, then remove the clip from the rope and put back the grip to the case slowly.

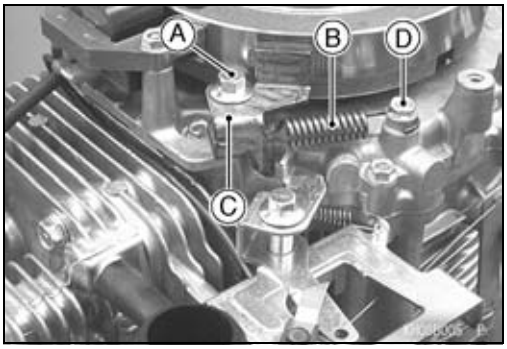


Pad Brake

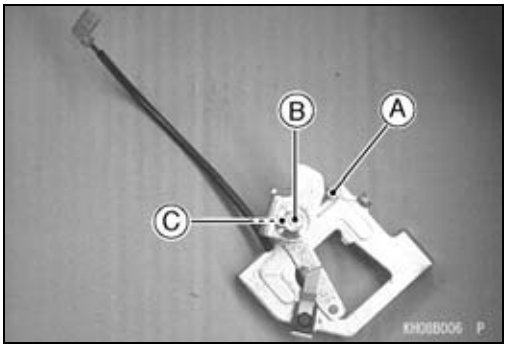
Pad Brake Assembly Removal

- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal)
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
  Pulley (see Flywheel Removal in the Electrical System chapter)
  Fan Housing and Fan (see Flywheel Removal in the Electrical System chapter)

- Remove the brake lever assembly mounting bolt [A].
- Remove the spring [B] from the lever assembly and remove the lever assembly [C].
- Remove the spring and bolt [D].



- Remove the ground lead from the ignition coil.
- Remove the control panel assembly (see Control Panel Assembly Removal in the Fuel System chapter).
- Remove the spring [A] from the brake panel assembly.
- Remove the spring.
- Remove the brake arm mounting bolt [B] and nut [C].
- Remove the brake arm and brake panel.



CAUTION

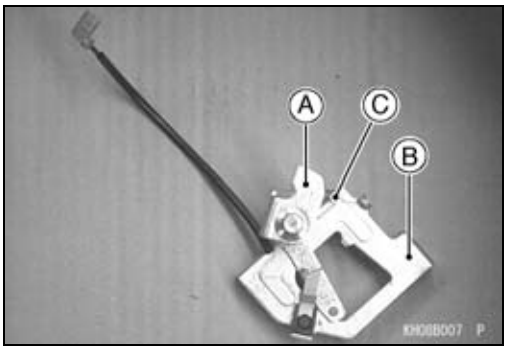
Make sure that pad brake always stop engine within 3 seconds when pad brake is ON. If not, check brake shoe and/or related parts for wear and damage. Replace parts if necessary.

Pad Brake Assembly Installation

- Install the brake arm [A], brake panel [B] and spring [C] as shown in the figure.
- Install the brake arm mounting bolt and nut.

  Torque - Brake Arm Mounting Bolt: 9.3 N·m (0.95 kgf·m, 82 in·lb)

- Install the brake panel assembly and control panel assembly (see Control Panel Assembly Installation in the Fuel System chapter).
- Install the ground lead in the ignition coil (see Ignition Coil Installation in the Electrical System chapter).



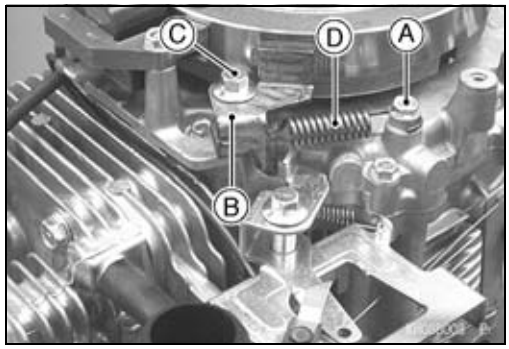
Pad Brake

- Tighten the bolt [A].
- Install the lever assembly [B].
- Tighten the brake lever assembly mounting bolt [C].

Torque - Brake Lever Assembly Mounting Bolt: 6.9 N·m (0.70 kgf·m, 61 in·lb)

○Check the lever assembly moves smoothly after installation.

- Install the spring [D].
- Install the removed parts (see appropriate chapters).
- Adjust the idle speed to the specifications (see Idle Speed Adjustment in the Periodic Maintenance chapter).

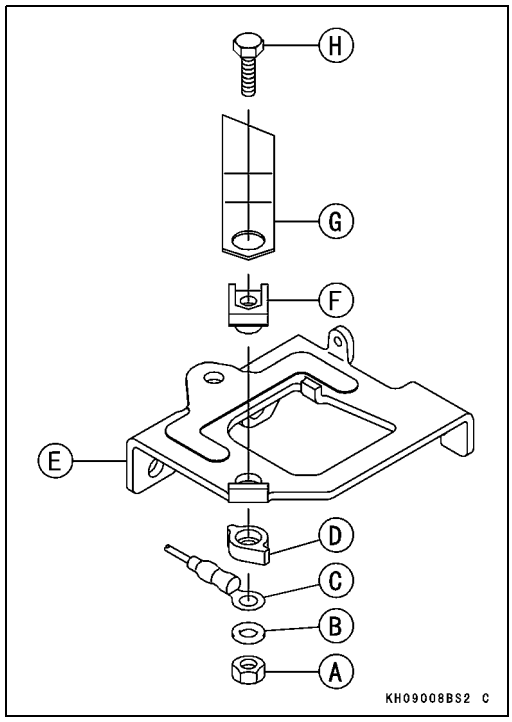


Brake Switch Removal/Installation

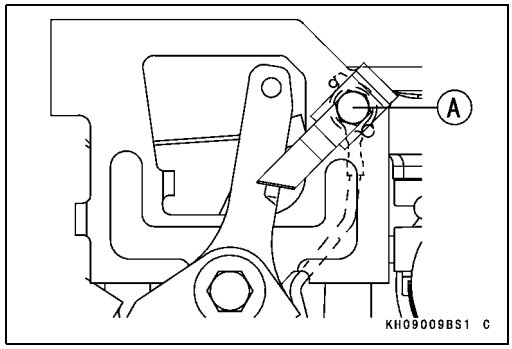
- Refer to the illustration shown for removal and installation.

Nut [A]
Washer [B]
Earth Lead Wire [C]
Cover [D]
Brake Panel Assembly [E]
Insulator [F]
Terminal [G]
Kill Switch Bolt [H]

Torque - Kill Switch Bolt: 1.5 N·m (0.15 kgf·m, 13 in·lb)



- Install the brake switch [A] as shown in the figure.



Electrical System

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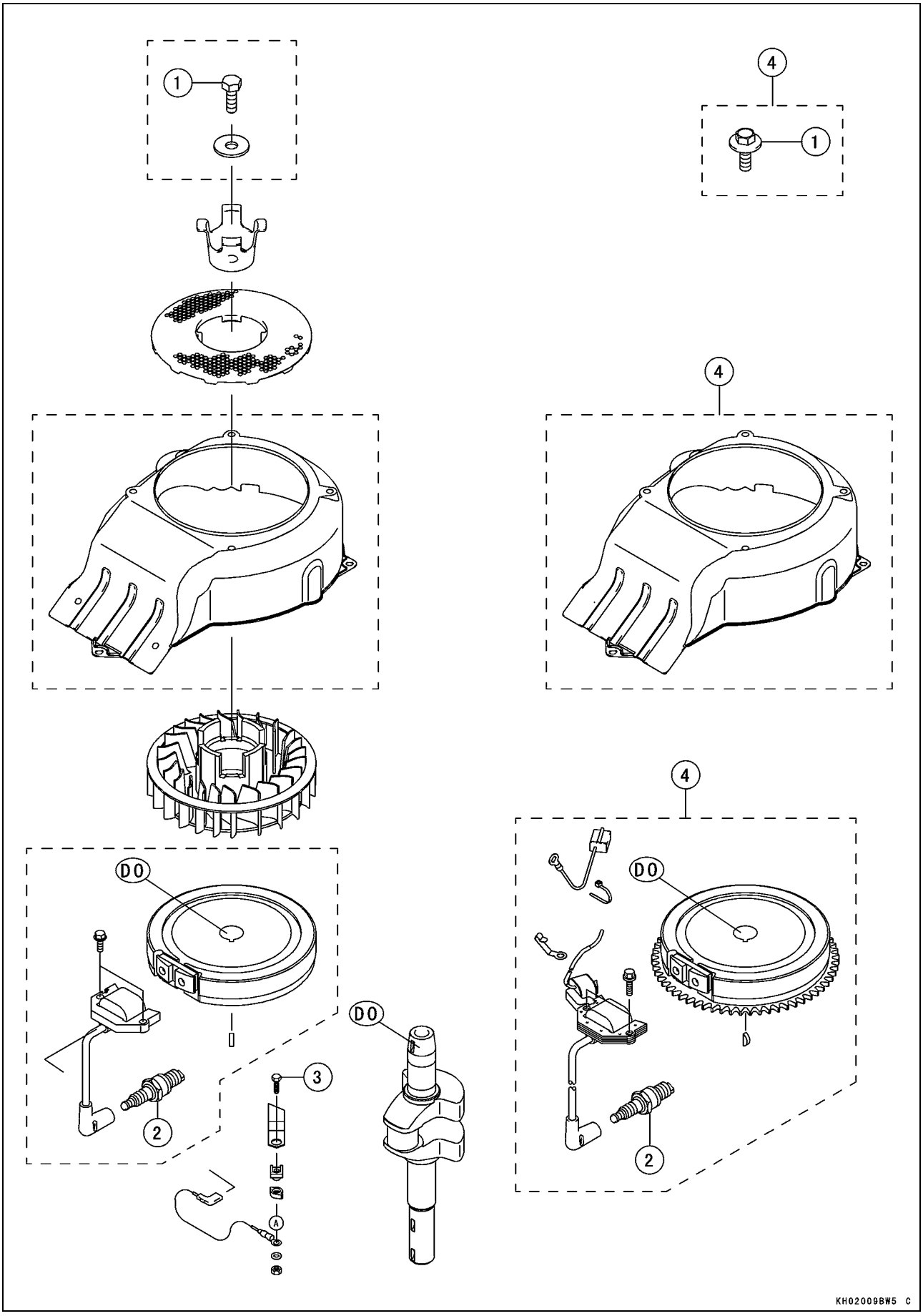
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Flywheel Bolt	42	4.3	31	
2	Spark Plug	22	2.2	16	
3	Kill Switch Bolt	1.5	0.15	13 in·lb	

4. KAI Model

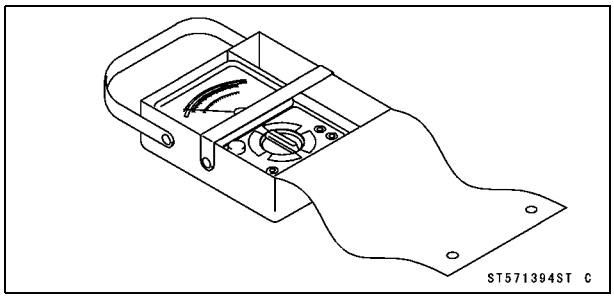
DO: Degrease the taper.

Specifications

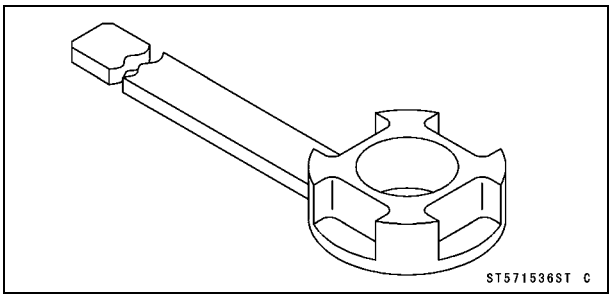
Item	Standard	Service Limit
Ignition System		
Ignition Coil:		
Primary Winding Resistance	in the text	– – –
Secondary Winding Resistance	in the text	– – –
Spark Plug:		
Type	NGK BPR5ES	– – –
Gap	0.75 mm (0.030 in.)	– – –

Special Tools

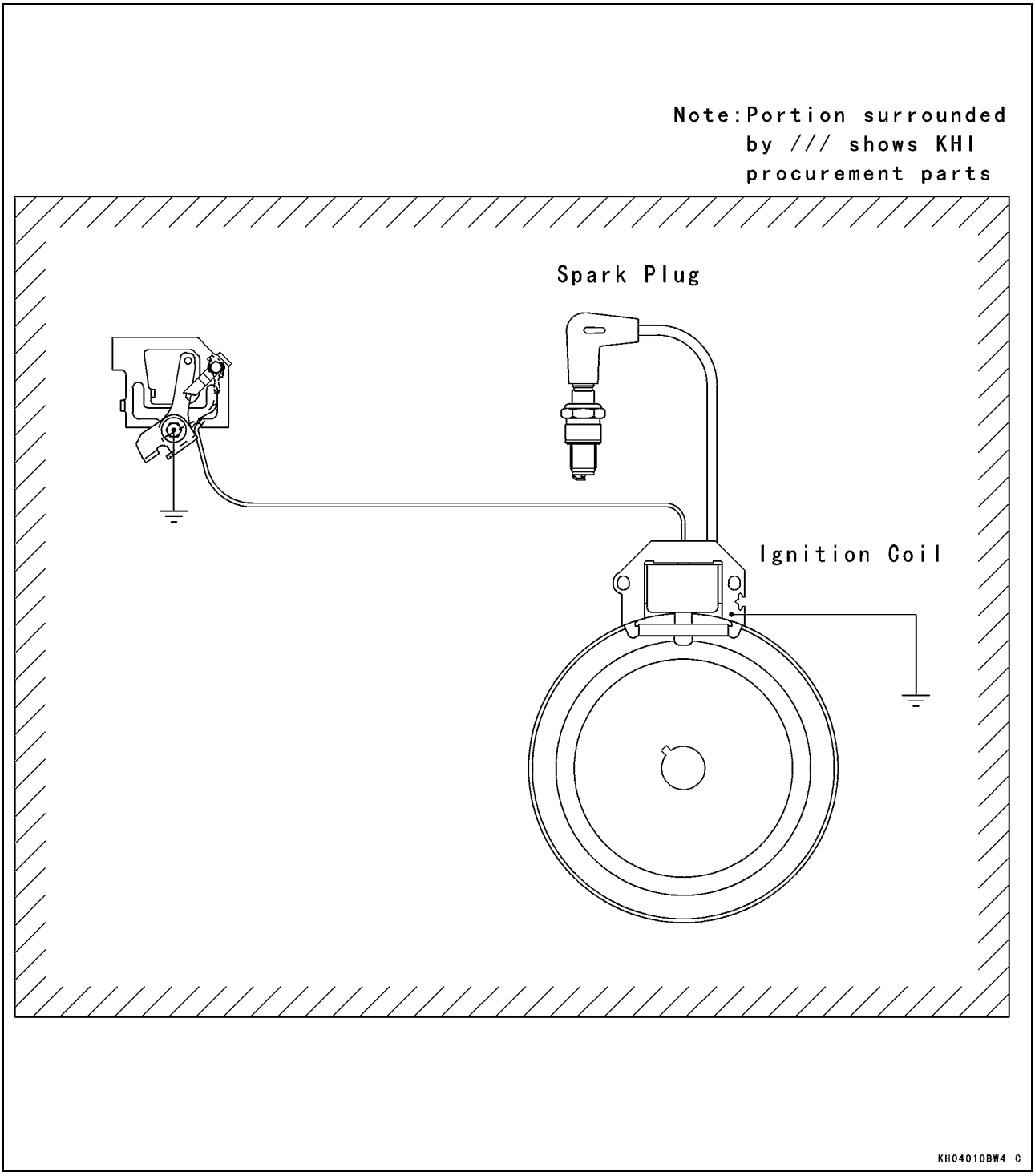
Hand Tester:
57001–1394



Bracket Holder:
57001–1536



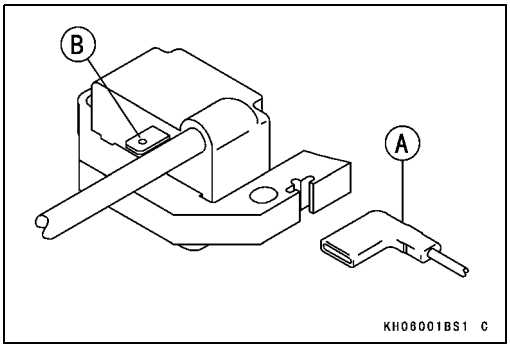
Wiring Diagram



Precautions

There are a number of important precautions that you must follow when servicing electrical systems. Learn and observe all the rules below.

- ○Do not hit the electric parts with a hammer or do not drop the electric parts. These may result in the electric parts damage or breakage.
- ○Troubles may involve one or all items in some cases. Never replace a defective part without determining what CAUSED the failure. If the failure was occurred by another item or some other items, repair and/or replace the item(s). Or the failure may happen again.
- ○Make sure all connectors in the circuit are clean and tight, and examine leads for signs of burning, fraying, etc. Poor leads and bad connections will affect electrical system operation.
- ○Measure the coil and winding resistance when the parts are cold (at room temperature).
- ○Connectors are as shown in the figure.
  Female Connector [A]
  Male Connector [B]

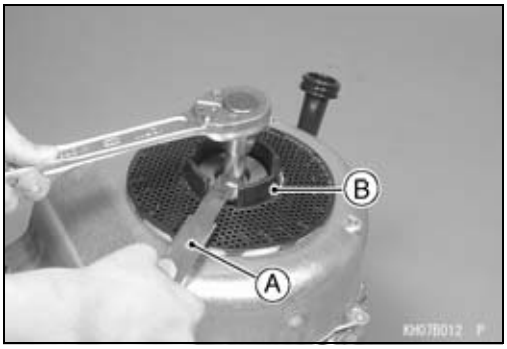


Charging System

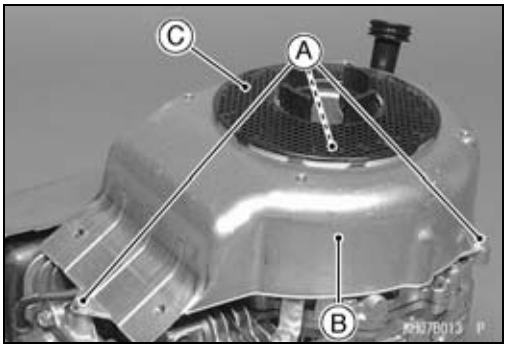
Flywheel Removal

- Remove:
  Air Cleaner Elements (see Air Cleaner Element Removal in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal in the Starter System chapter)
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)

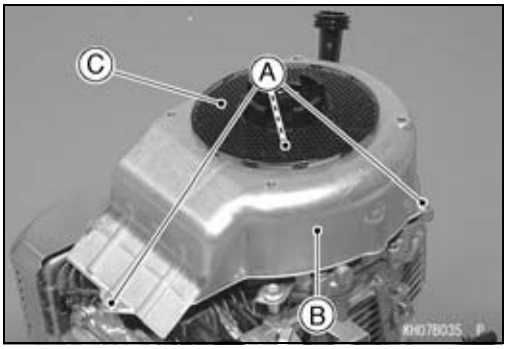
- Hold the pulley [B] with bracket holder [A], remove the flywheel bolt and washer.
  Special Tool - Bracket Holder: 57001-1536
- Remove the pulley.



- Loosen the fan housing bolts [A] and remove the fan housing [B] and screen [C].
- Remove the fan.



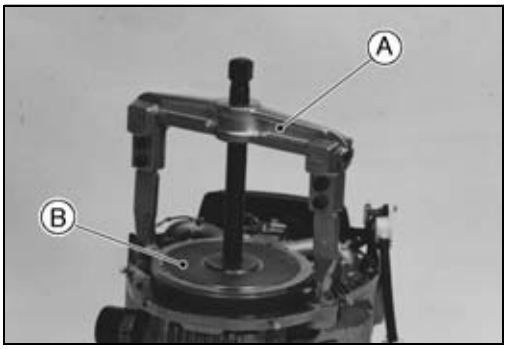
- For KAI model; the fan housing bolts are as shown in the figure.



- Note the following.
- Remove:
  Ignition Coil (see Ignition Coil Removal)
- Remove the pad brake assembly (see Pad Brake Assembly Removal in the Starter System chapter).

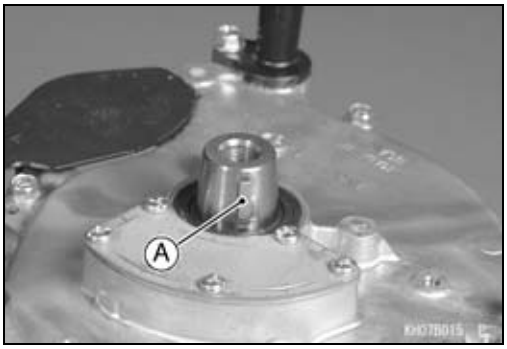
Charging System

● Using a suitable flywheel puller [A], remove the flywheel [B].



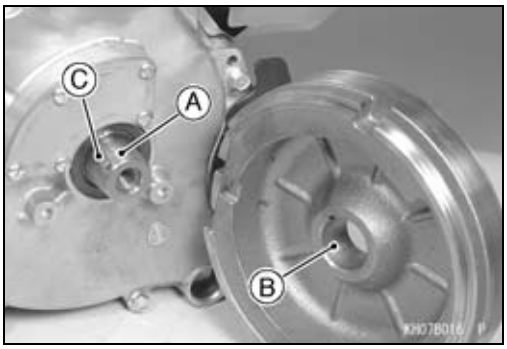
CAUTION
Always use flywheel puller.

● Note the following.
● Remove:
Woodruff Key [A]

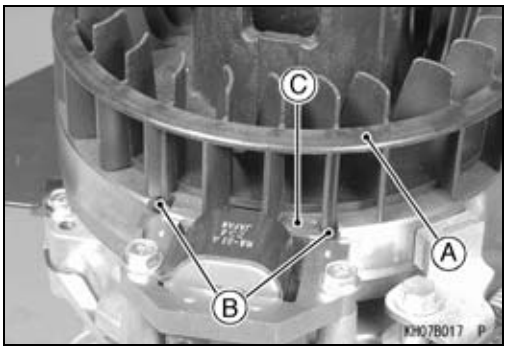


Flywheel Installation

● Note the following.
● Using a cleaning fluid, clean off any oil or dirt on the following portions and dry them with a clean cloth.
Crankshaft Tapered Portion [A]
Flywheel Tapered Portion [B]
○Degrees the flywheel taper, crankshaft taper, before assembring.
● Fit the Woodruff key [C] securely in the slot in the crankshaft before installing the flywheel.
● Install the flywheel onto the crankshaft taper so that the woodruff key fits in the key way in the hub of the flywheel.

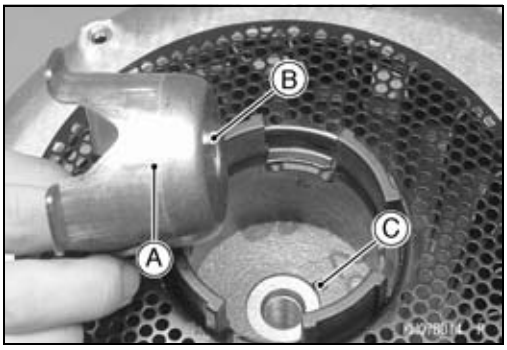


● Note the following.
● Install:
Ignition Coil (see Ignition Coil Installation)
Pad Brake Assembly (see Pad Brake Assembly Installation in the Starter System chapter)
● Install the fan [A] so that two positioning bosses [B] fit around flywheel ignition magnet [C].
● Install the fan housing and tighten the fan housing mounting screws.
● Install the screen to the fan housing.



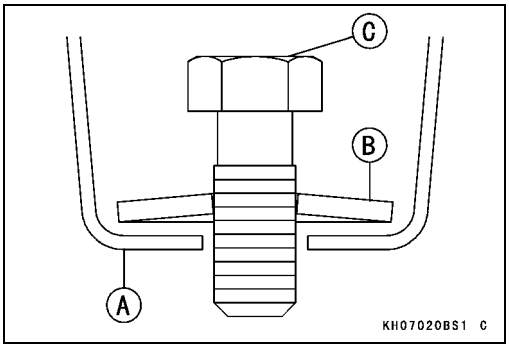
Charging System

- Install the pulley [A] so that the projection [B] fit into the recess [C] of the flywheel.



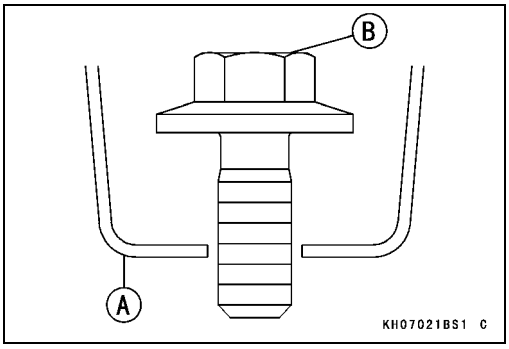
- Install the pulley [A] and washer [B] as shown in the figure.
- Tighten the flywheel bolt [C].

  Torque - Flywheel Bolt: 42 N·m (4.3 kgf·m, 31 ft·lb)
- Install the removed parts (see appropriate chapters).



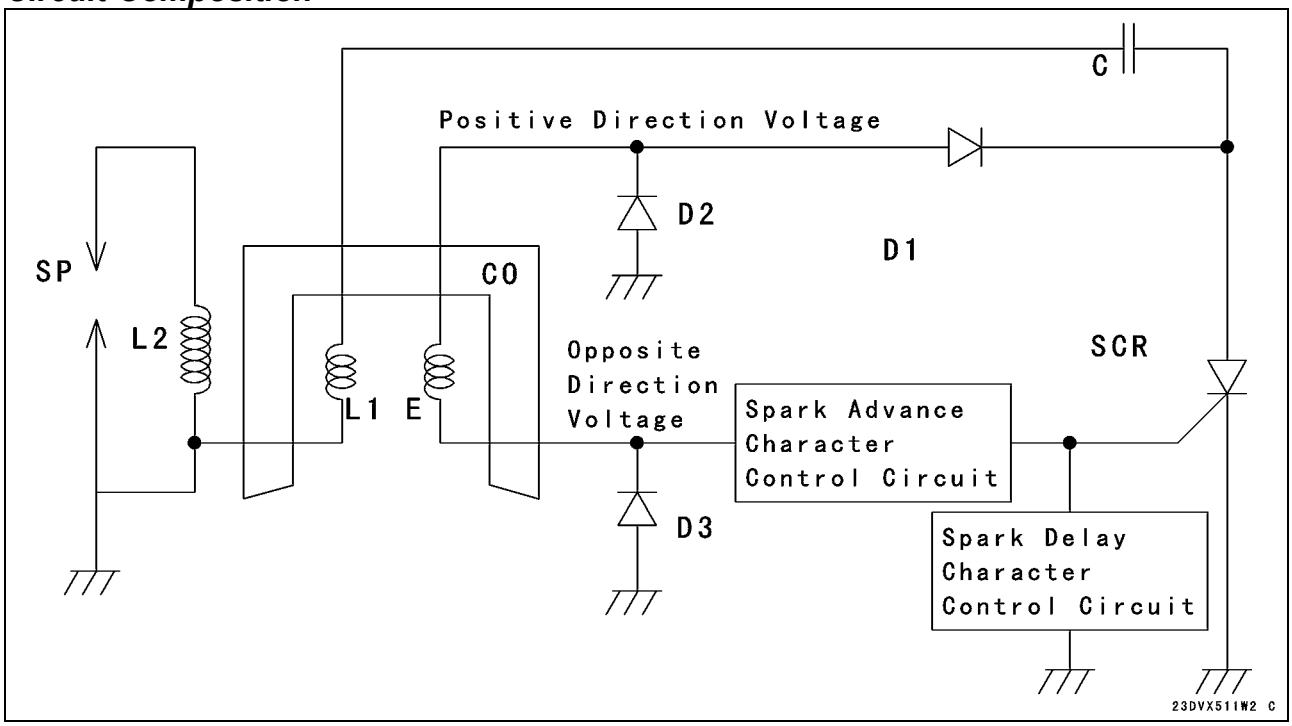
- For Modified model; note the following.
- Install the pulley [A].
- Tighten the flywheel bolt [B].

  Torque - Flywheel Bolt: 42 N·m (4.3 kgf·m, 31 ft·lb)
- Install the removed parts (see appropriate chapters).



Charging System

Circuit Composition



C: Condenser
Co: Ignition Coil Core
D1: Diode
D2: Diode
D3: Diode
E: Exciter Coil
L1: Primary Coil
L2: Secondary Coil
SCR: Thyristor
SP: Spark Plug

Action Principle

(1) Fundamental action

1. Genarated positive direction voltage by rotor rotated in the exciter coil (E) flows the electrical current through the diode (D1), and discharged to the condenser (C).
2. Generated opposite direction current flows to the thyristor (SCR) because voltage had generated in the exciter coil (E) also at the opposite direction.
3. If the voltage of opposite direction reaches to the trigger voltage of the thyristor (SCR), the thyristor (SCR) will be ON state, and voltage is charged by the condenser (C) and discharged rapidly to the primary coil (L1).
4. The primary voltage of several hundreds volt generate by large electrical current flows rapidly to the primary coil (L1), the primary voltage are risen by the secondary coil (L2), and turn into the secondary voltage of several thousands volt, and spark generate to the spark plug (SP) of output side.

(2) Spark advance characteristic

1. If the revolutions number rises, the opposite direction voltage of exciter coil (E) which the trigger position of the thyristor (SCR) changes and spark advance because of voltage wave form will change.
2. Spark advance is controlled by spark advance characteristic control circuit in the figure.

(3) Spark delay characteristic

1. The trigger position of the thyristor (SCR) changes and spark delay by decreasing the voltage wave form applied to the thyristor (SCR) in the revolutions number set up in the spark delay characteristic control circuit in the figure.
2. The start revolutions number of spark delay is controlled by spark delay characteristic control circuit in the figure.

Cautions of Handling and Maintenance

Charging System

(1) Do not near the magnet by the heat of fire.
(2) Ignition timing is not adjustable because it is fixed.
(3) When carry out the spark test, pull the recoil starter knob with strong force. If the flywheel does not turned more than the ignition revolutions, spark does not ignite.

Charging Coil Inspection

- Remove the ignition coil with charging coil (see Ignition Coil Removal).
- Measure the winding resistance as follows:

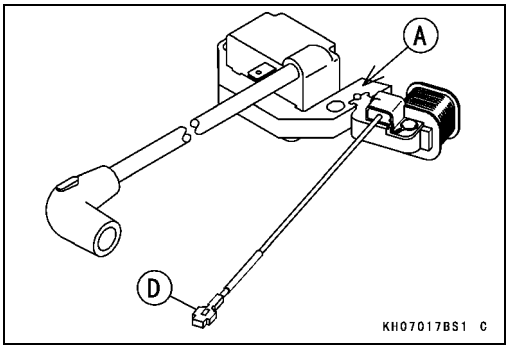
○Set the hand tester to the R × 1 Ω range.

Special Tool - Hand Tester: 57001-1394

○Make the measurements as shown in the table.

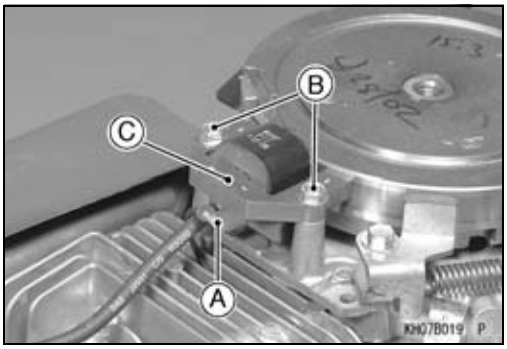
Charging Coil Winding Resistance

+ / –	A	D
A	–	30 ~ 80 Ω
D	∞	–



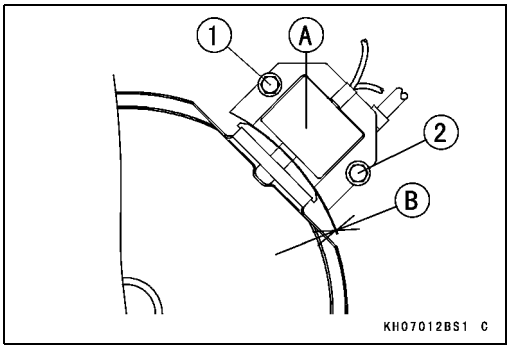
Ignition System

Ignition Coil Removal



- Note the following.
- Remove:
  Fan (see Flywheel Removal)
  Spark Plug Cap
  Ground Lead [A]
  Bolts [B]
  Ignition Coil [C]

Ignition Coil Installation

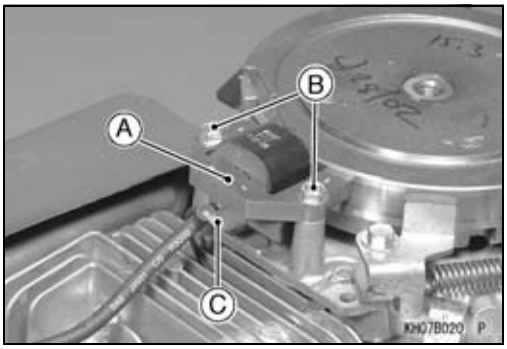


- Note the following.
- Install ignition coil [A] on crankcase and tighten bolt (1) first, then tighten bolt (2). While tightening bolts, adjust the air gap [B] between the leg of ignition coil and the magnet to the specified gap value as shown.

Ignition Coil Air Gap
Standard: 0.2 ~ 0.4 mm (0.008 ~ 0.016 in.)

NOTE

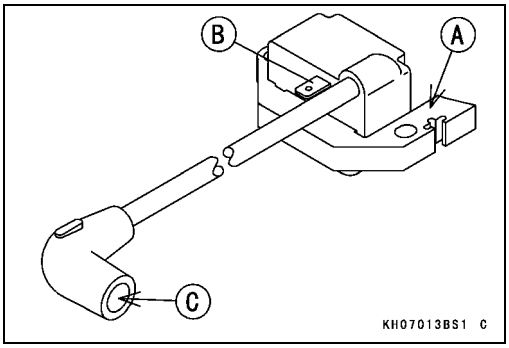
○*Above procedure must be used to insure proper coil air gap is not too large.*



- Note the following.
- Install:
  Ignition Coil [A]
  Bolts [B]
  Ground Lead [C]
- When installing the ground lead, put ground lead between second and third fin.

Ignition System

Ignition Coil Inspection



- Remove the ignition coil (see Ignition Coil Removal).
- Measure the winding resistance as follows.

○Set the hand tester to the R × 1 Ω range to measure the resistance between the terminals "A" and "B", and to the R × 100 Ω range to measure the other resistance.

Special Tool - Hand Tester: 57001-1394

○Make the measurements as shown in the table.

Ignition Coil Winding Resistance

+ / –	A	B	C
A	–	300 ~ 400 Ω	4 ~ 6 kΩ
B	300 ~ 450 Ω	–	4 ~ 6 kΩ
C	4 ~ 6 kΩ	4 ~ 6 kΩ	–

CAUTION

Use only Tester 57001-1394 with new battery at room temperature for this test. A tester other than the Kawasaki Hand Tester should show different readings.
If a megger or a meter with a large-capacity battery is used, the ignition coil will be damaged.

★If the tester does not read as specified, replace the coil.

Spark Plug Removal

- Carefully pull the plug cap from the spark plug.
- Remove the spark plug using a suitable plug wrench.

Spark Plug Installation

- Insert the spark plug vertically into the plug hole with the plug installed in the plug wrench.
- Tighten the plug.

Torque - Spark Plug: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Fit the plug cap securely.
- Pull up the spark plug cap lightly to make sure to install the spark plug cap.

Spark Plug Cleaning and Inspection

- Refer to the Spark Plug Cleaning and Inspection in the Periodic Maintenance chapter.

Spark Plug Gap Inspection

- Refer to the Spark Plug Gap Inspection in the Periodic Maintenance chapter.

Troubleshooting

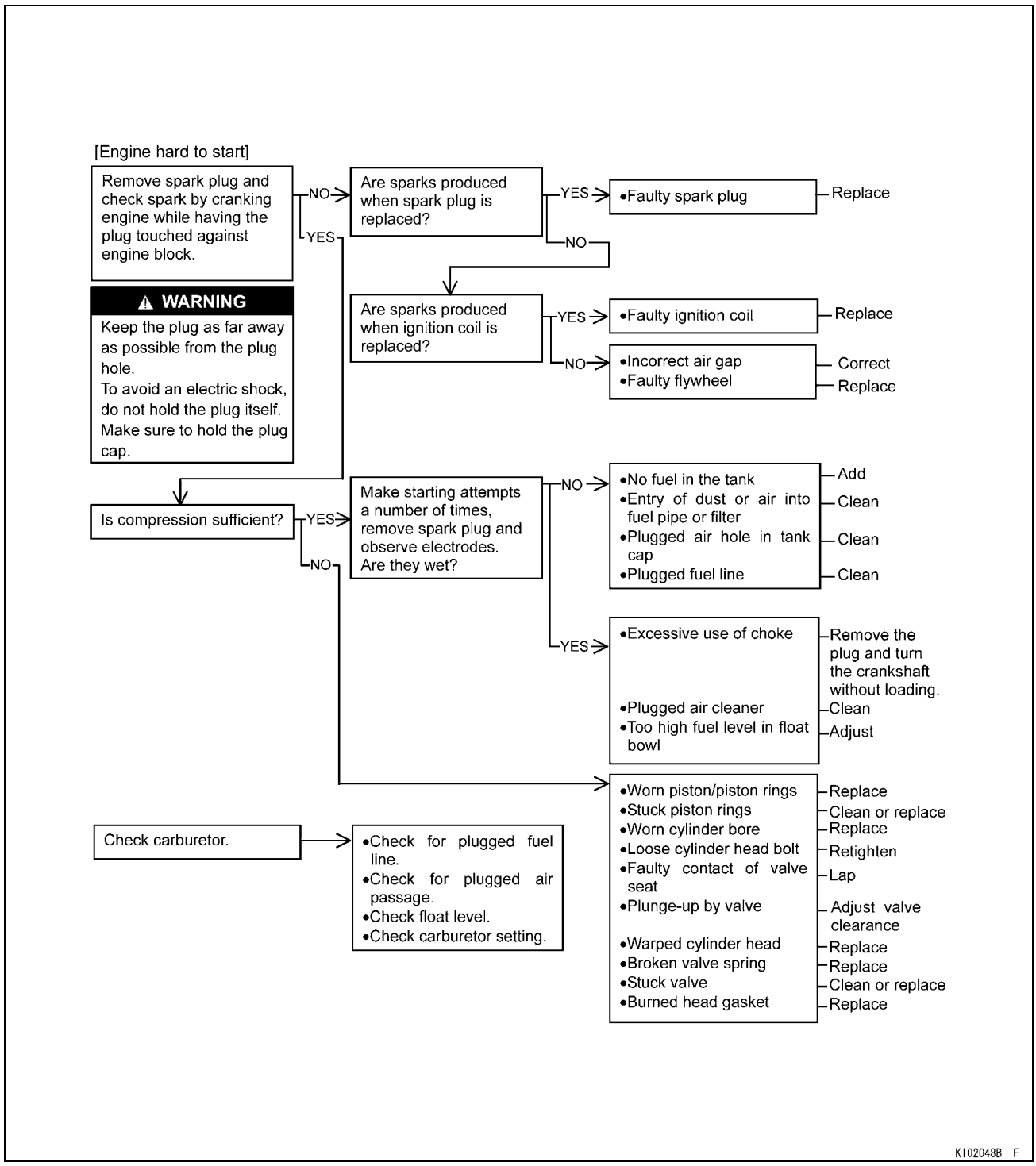
Table of Contents

Engine Troubleshooting Guide

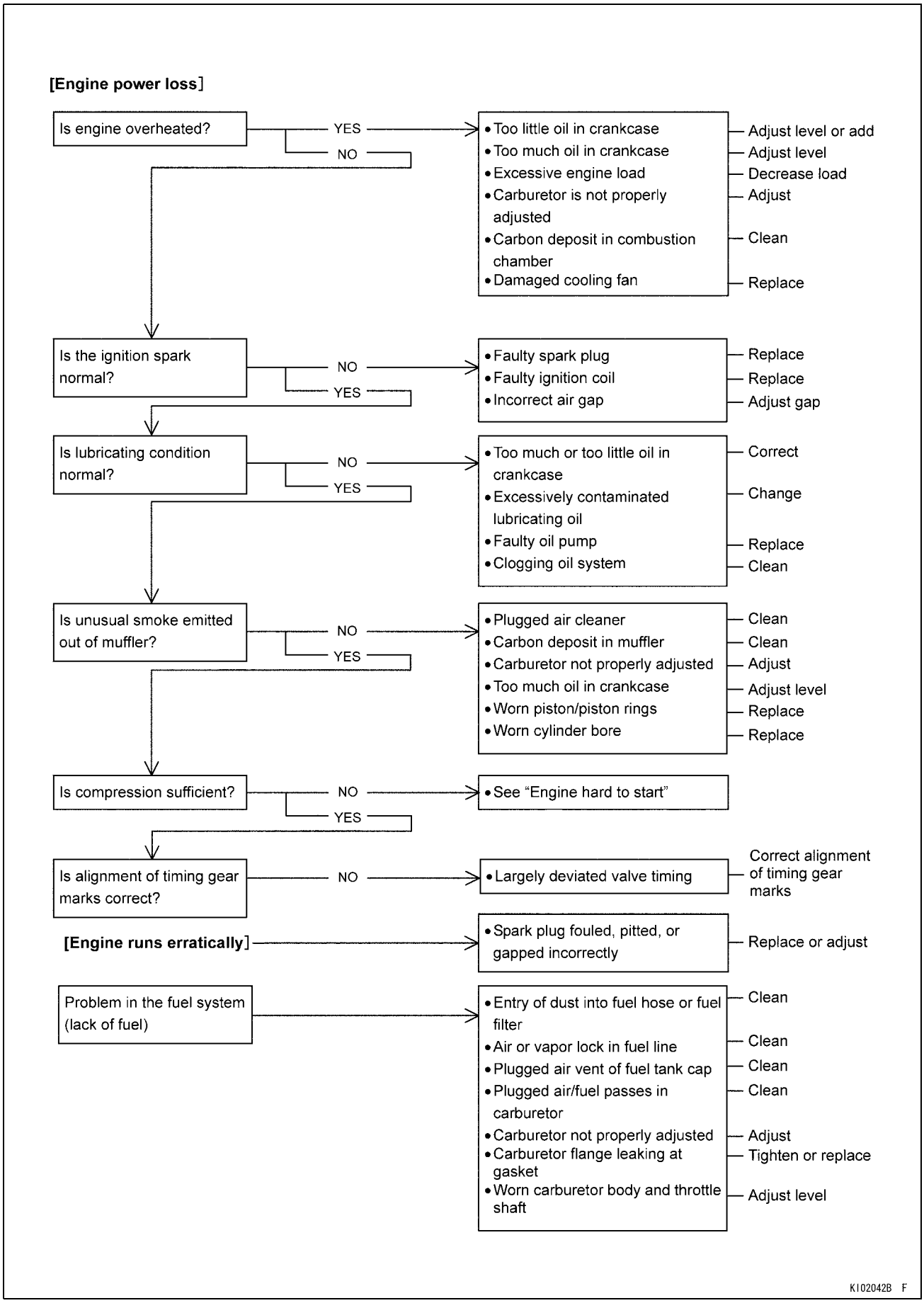
If the engine malfunctions, check if the way the engine is used is correct. If engine malfunctions even if engine is used correctly, systematically carry out troubleshooting starting with simple points.

This chart describes typical troubleshooting procedures.

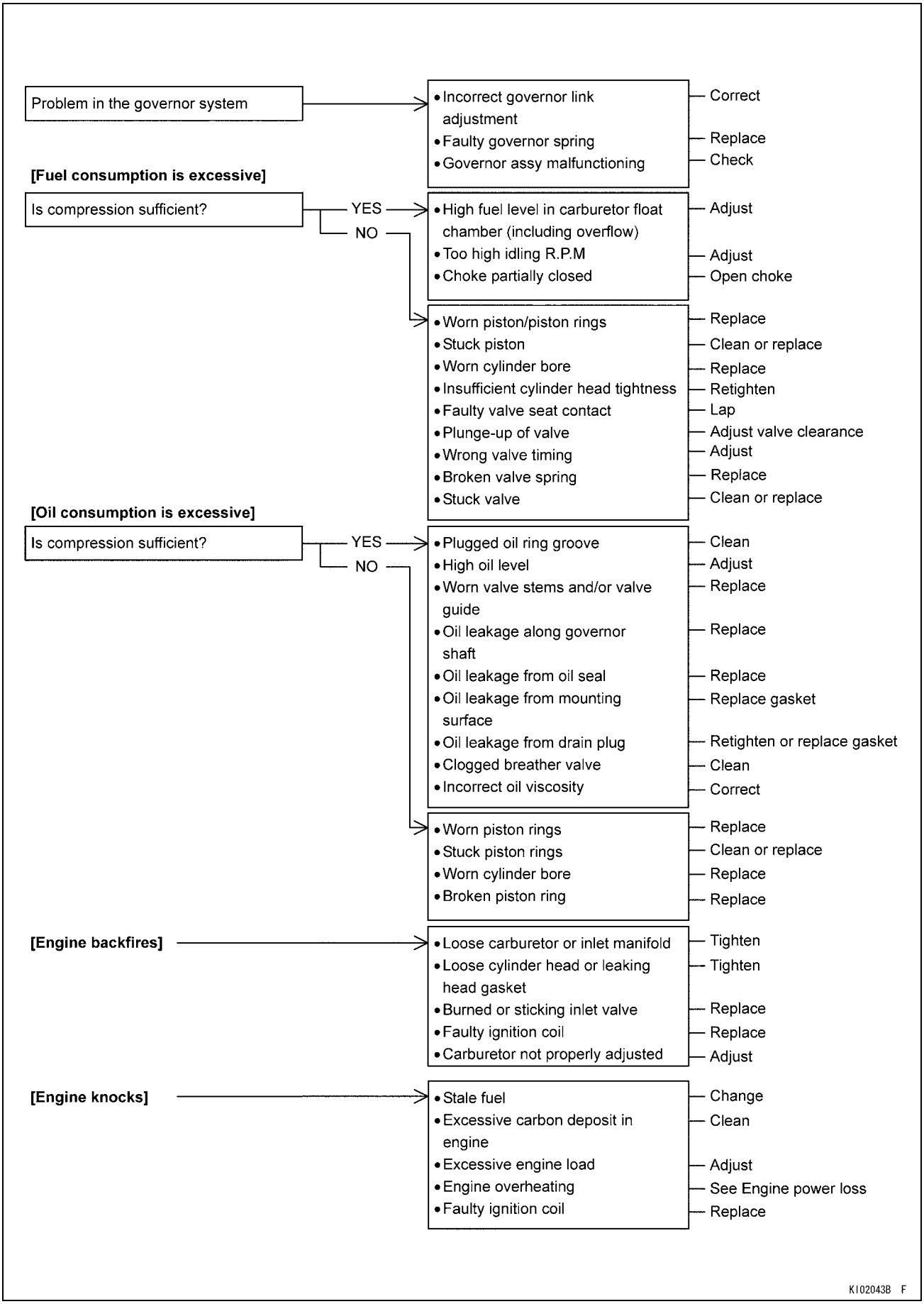
Do not unnecessarily disassemble carburetor, magneto or engine unless it has been found to be the cause of malfunctioning.



Engine Troubleshooting Guide

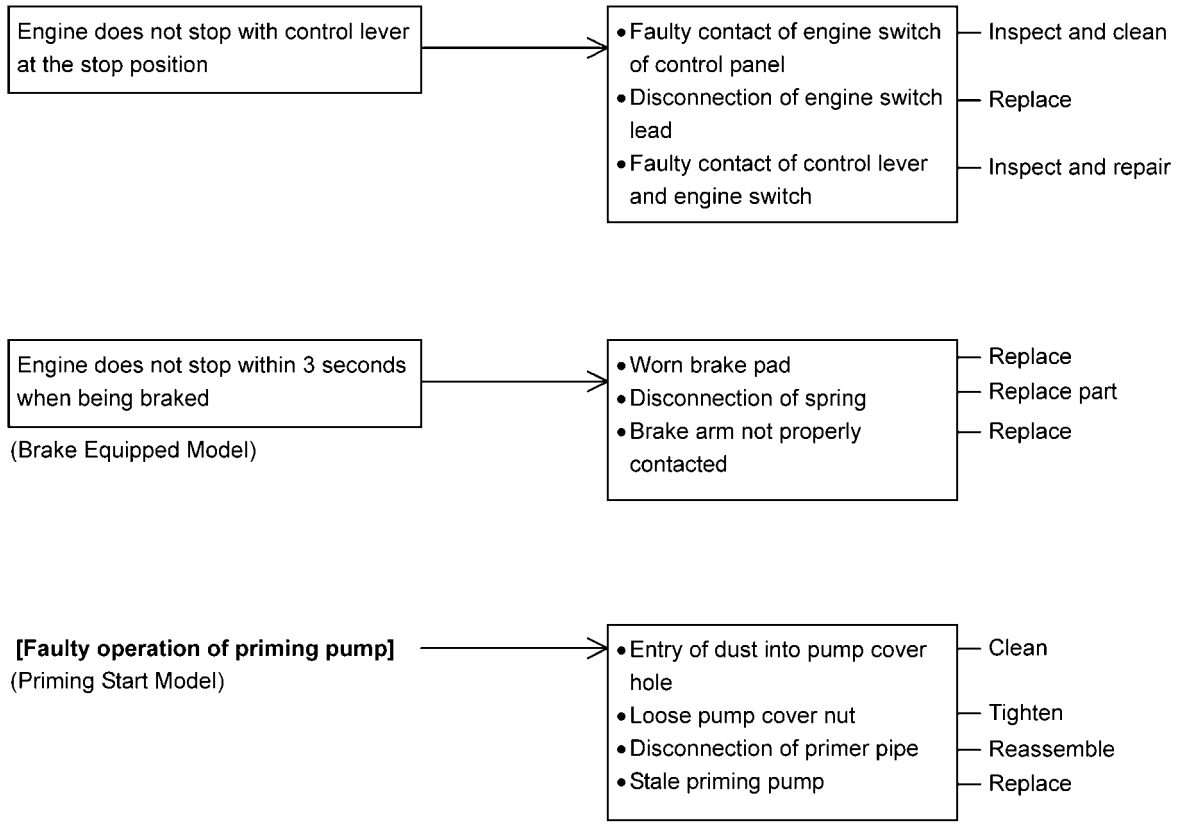


Engine Troubleshooting Guide



Engine Troubleshooting Guide

[Engine hard to stop]



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Kawasaki
KAWASAKI HEAVY INDUSTRIES, LTD.
Motorcycle & Engine Company
Part No.99924-2099-01
Printed in Japan