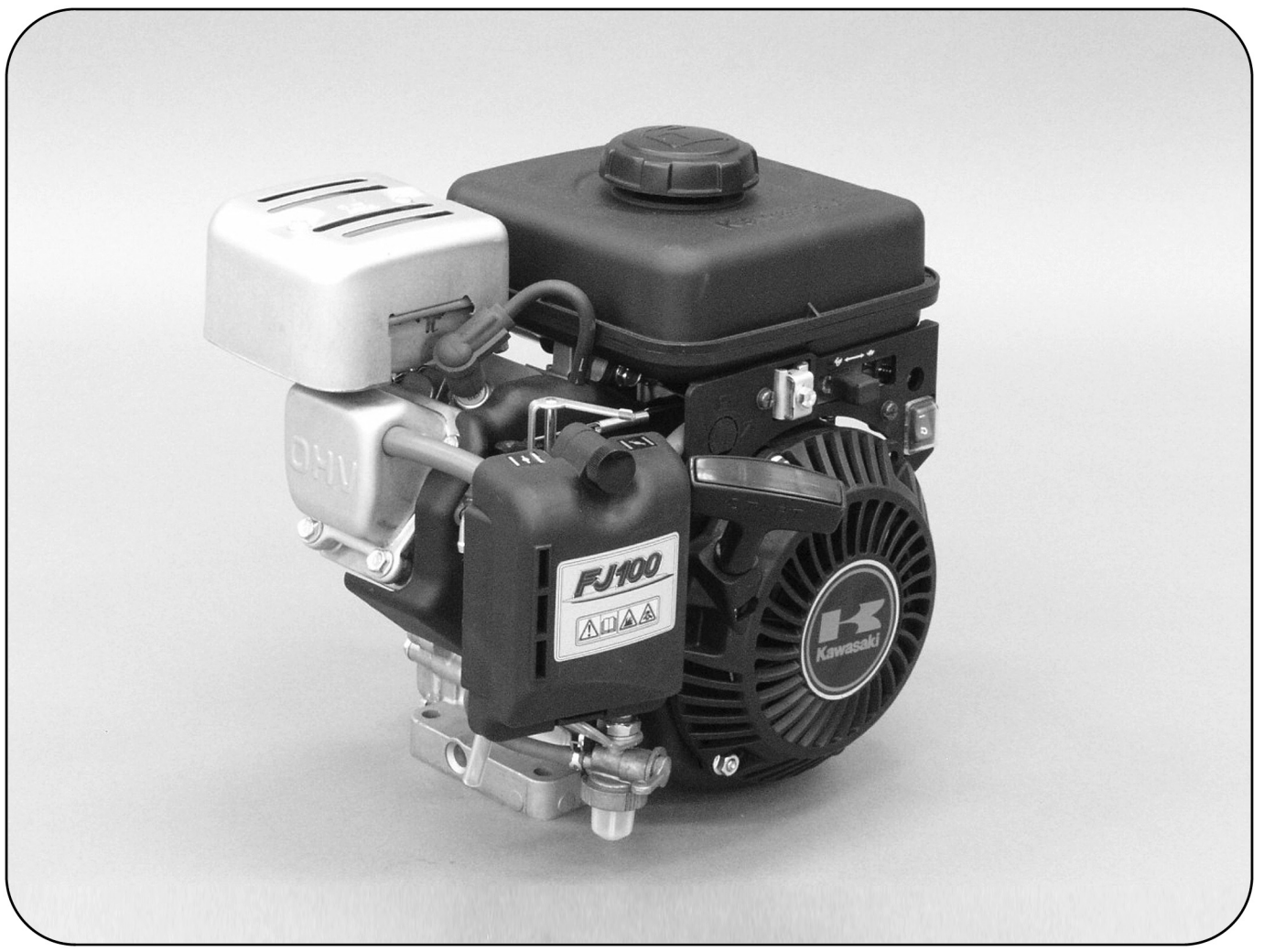
Kawasaki

FJ100D



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.

Kawasaki

FJ100D

4-stroke air-cooled gasoline engine

Service Manual

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First Edition (1) : Feb. 28, 2005 (K)

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)		

Read OWNER'S MANUAL before operating.

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 element
- 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

1

Table of Contents

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 matter 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.

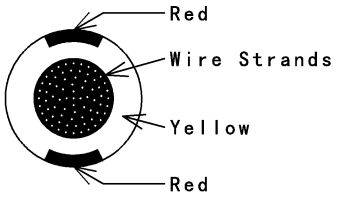
(14)Lubrication

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

GB020601W1 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

General Specifications

Item	FJ100D
Type of engine	Air-cooled, 4-stroke, OHV, single cylinder gasoline engine
Bore × Stroke	56 mm × 40 mm (2.20 in. × 1.57 in.)
Piston displacement	99 cm³ (6.0 cu in.)
Direction of rotation	Counterclockwise facing the PTO shaft
Compression release	Automatic compression release
Low idle speed	1 600 rpm (r/min)
Fast idle speed	4 000 rpm (r/min)
Ignition system	Transistorized-flywheel magneto
RFI	Per Canada and U.S.A. requirements
Starting system	Recoil starter
Spark plug	NGK B6HS/BR6HS
Carburetor	Float, Butterfly Type
Air cleaner	Dual element type
Governor	Flyweight all speed governor
Lubrication system	Splash
Oil capacity (when engine is completely dry)	0.26 ~ 0.46 L (0.27 ~ 0.49 US qt)
Cooling system	Forced air cooling by fan
Dimensions (L × W × H)	279 mm × 304 mm × 303 mm (11.0 in. × 12.0 in. × 11.9 in.)
Dry weight	10.5 kg (23 lb)

Specifications subject to change without notice.

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 below 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 250 hr.
Check or clean 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)					●	
Clean fuel tap				●		
Change engine oil		●		●		
Tighten nuts and screws			●		●	
Clean and re-gap spark plugs					●	
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 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 specific tightening sequence.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System				
Throttle Valve Screw	0.78	0.08	7 in·lb	L
Choke Valve Screw	0.78	0.08	7 in·lb	L
Main Jet	0.54	0.055	5 in·lb	
Pilot Jet	0.54	0.055	5 in·lb	
Float Chamber Mounting Bolt	9.8	1.0	87 in·lb	
Governor Arm Clamp Nut	5.9	0.60	52 in·lb	
Fuel Tank Bolts	8.8	0.90	78 in·lb	
Control Panel Nut	1.5	0.15	13 in·lb	
Fuel Tap Nut	2.5	0.25	22 in·lb	
Cooling System				
Fan Housing Bolts	8.8	0.90	78 in·lb	
Flywheel Bolt	25	2.5	18	
Engine Top End				
Cylinder Head Bolts (Used)	25	2.5	18	S
Cylinder Head Bolts (New)	32	3.3	24	S
Valve Clearance Locknuts	6.9	0.70	61 in·lb	
Connecting Rod Big End Cap Bolts	9.0	0.90	80 in·lb	O
Rocker Arm Bolts	23	2.3	17	
Exhaust Pipe Flange Nuts	23	2.3	17	
Spark Plug	23	2.3	17	
Lubrication System				
Engine Oil Drain Bolt	32	3.3	24	
Camshaft/Crankshaft				
Crankcase Cover Bolts	8.8	0.90	78 in·lb	
Connecting Rod Big End Cap Bolts	9.0	0.90	80 in·lb	O
Rocker Arm Bolts	23	2.3	17	
Electrical System				
Flywheel Bolt	25	2.5	18	
Fan Housing Bolts	8.8	0.90	78 in·lb	
Recoil Starter Mounting Stud Bolts	7.8	0.80	69 in·lb	L
Recoil Starter Mounting Nuts	6.9	0.70	61 in·lb	
Recoil Starter Retainier Screw	3.4	0.35	30 in·lb	
Spark Plug	23	2.3	17	

2-4 PERIODIC MAINTENANCE

Torque and Locking Agent

The table below, relating tightening torque to thread diameter, lists the basic torque for the bolts and nuts. Use this table for only 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	Torque		
(mm)	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

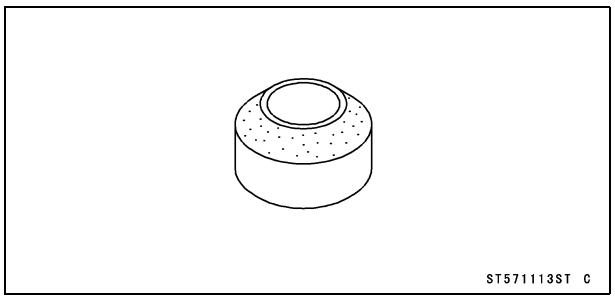
Item	Standard
Fuel System	
Idle Speed (1):	
Low Idle Speed	1 600 rpm (r/min)
High Idle Speed	4 000 rpm (r/min)
Air Cleaner:	
Type	Dual stage filtration system
Cleaner:	
First	Foam element
Second	Paper element
Engine Top End	
Cylinder Head Warp	Service Limit: 0.03 mm (0.001 in.)
Valve Clearance:	
Exhaust	0.12 mm (0.005 in.)
Inlet	0.12 mm (0.005 in.)
Valve Seating Surface Angle:	
Exhaust	45°
Inlet	45°
Valve Seating Surface Width:	
Exhaust	0.5 ~ 1.1 mm (0.02 ~ 0.04 in.)
Inlet	0.5 ~ 1.1 mm (0.02 ~ 0.04 in.)
Lubrication System	
Engine Oil:	
Type	SF, SG, SH or SJ class
Viscosity	SAE 10W-30
Capacity	0.26 ~ 0.46 L (0.27 ~ 0.49 US qt)
Level	Operating range (grid area (between L and H)) on dipstick
Electrical System	
Spark Plug Gap	0.6 ~ 0.7 mm (0.02 ~ 0.03 in.)

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

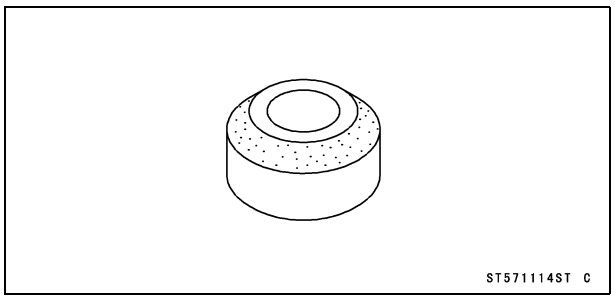
2-6 PERIODIC MAINTENANCE

Special Tools

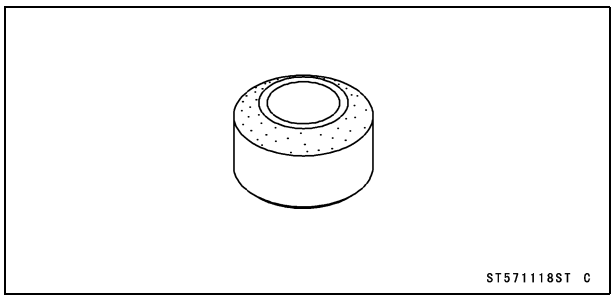
Valve Seat Cutter, 45° - ϕ24.5:
57001-1113



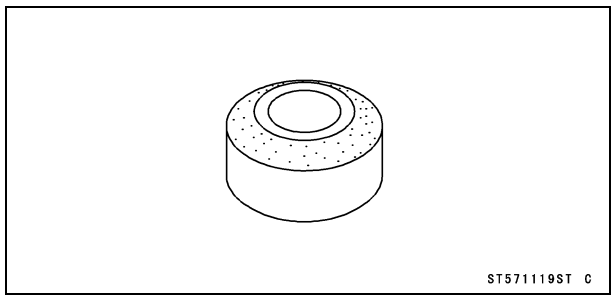
Valve Seat Cutter, 45° - ϕ27.5:
57001-1114



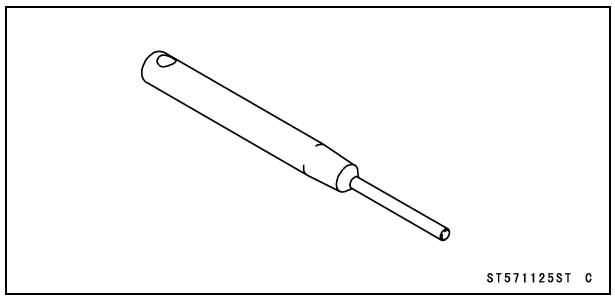
Valve Seat Cutter, 32° - ϕ25:
57001-1118



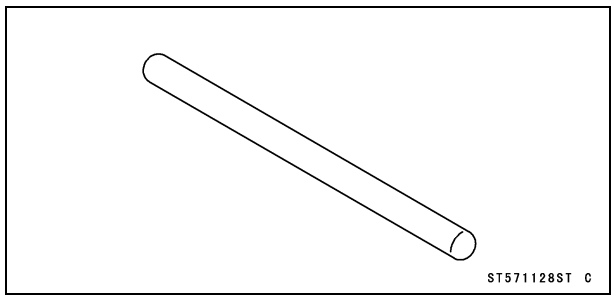
Valve Seat Cutter, 32° - ϕ28:
57001-1119



Valve Seat Cutter Holder, ϕ5.5:
57001-1125



Valve Seat Cutter Holder Bar:
57001-1128



Periodic Maintenance Procedures

Fuel System

Low Idle Speed Adjustment

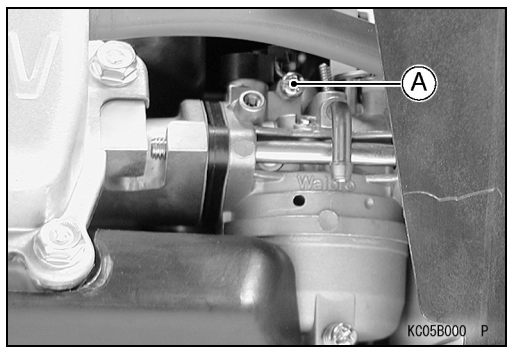
- Disconnect all external loads from the engine.
- Start the engine and warm it up thoroughly.

⚠ WARNING

Always keep your hands clear of the moving parts.

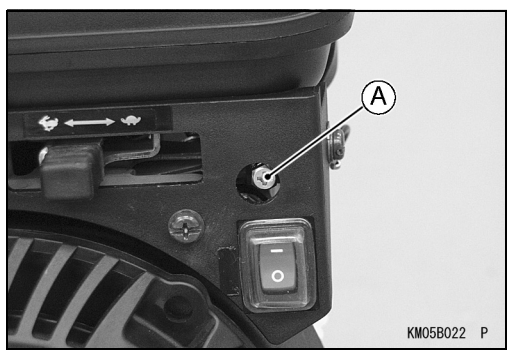
- Move the throttle lever on dash to the idle position, and hold the throttle lever on the carburetor in closed position (turn the governor arm clockwise all the way) and adjust the idle speed screw [A] until the engine idles at specified speed.

Idle Speed (Carburetor Idle rpm)
1 500 rpm (r/min)



- Release the throttle lever and adjust the idle speed set screw [A] on the control plate to obtain the specified governed low idle speed.

Low Idle Speed (Governed Idle rpm)
1 600 rpm (r/min)



High Idle Speed Adjustment

NOTE

○*High idle speed adjustment should be made after the idle speed adjustment is performed.*

CAUTION

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

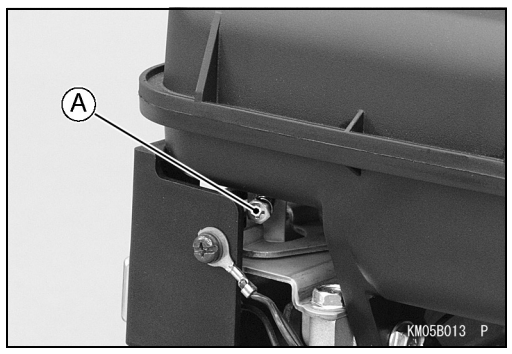
- Start and warm up the engine thoroughly.

⚠ WARNING

Always keep your hands clear of the moving parts.

- Move the throttle lever at a dash to the high idle position and adjust the idle speed set screw [A] to obtain the specified high idle speed.

High Idle Speed
4 000 rpm (r/min)



- Check the idle speed, and readjust the idle speed if necessary.

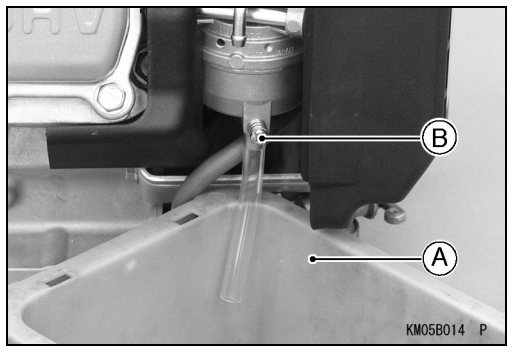
2-8 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Fuel System Cleanliness Inspection

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the engine switch "○" (Stop). 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.



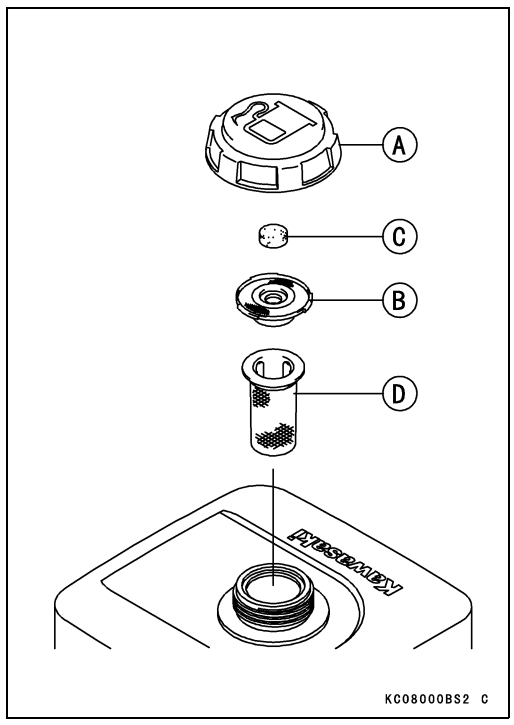
- Close the fuel tap.
- Place a suitable container [A] under the carburetor drain screw [B].
- Loosen the drain screw to drain the carburetor and check to see if water or dirt has accumulated in the carburetor.
- Tighten the drain screw
- If any water or dirt is found, clean the carburetor and fuel tank (see Carburetor Cleaning, Fuel Tank Cleaning in the Fuel System chapter), and check the fuel filter and fuel strainer (see Fuel Filter Inspection, Fuel Strainer Inspection in this chapter).

Fuel Strainer Inspection

- Remove the tank cap [A], the breather gasket [B], the breather [C], and the fuel strainer [D].
- Visually insect the fuel strainer.

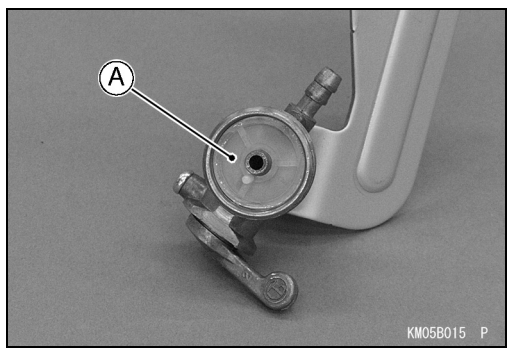
★If the fuel strainer is clear with no signs of dirt or other contamination, it is OK and need not be replaced.

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



Periodic Maintenance Procedures

Fuel Filter Inspection



- Place a suitable container under the drain screw on the carburetor.
- Turn the fuel tap to the ON position, and Loosen the drain screw to drain the carburetor.
- Tighten the drain screw.

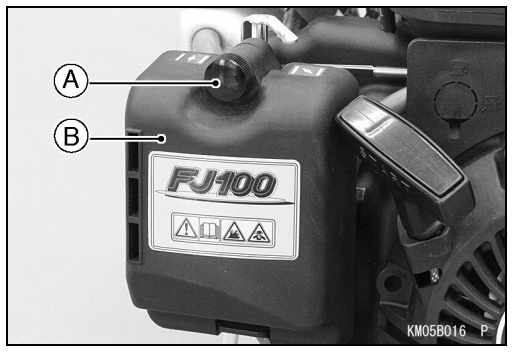
★If any water or dirt is found, clean the carburetor, fuel filter and fuel tank (see Carburetor Cleaning, Fuel Filter Cleaning, Fuel Tank Cleaning in the Fuel System chapter).

- Remove:
  Fuel Tap (see Fuel Tap Removal in the Fuel System chapter)
  Nut, Cup, Gasket and Fuel Filter (see Fuel Filter Cleaning in the Fuel System chapter)
- Visually inspect the fuel filter [A] in the fuel tap.

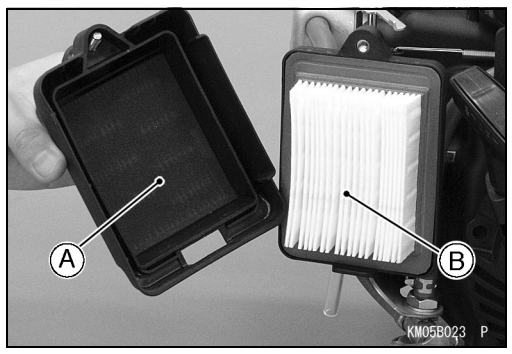
★If the filter is clear with no signs of dirt or other contamination, it is OK and need not be replaced.

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

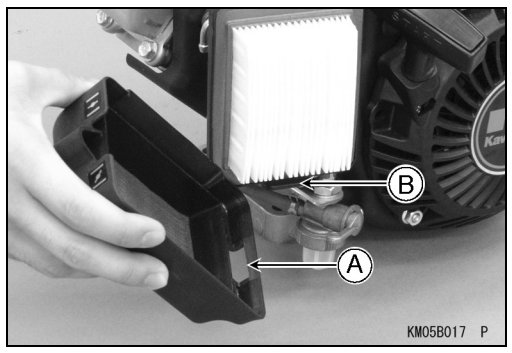
Air Cleaner Element Removal



- Loosen the bolt [A], open the air cleaner case [B].
- Remove:
  Foam Element [A]
  Paper Element [B]



Air Cleaner Element Installation



- Install the paper element correctly on the air cleaner body.
- Install the foam element correctly in the air cleaner case.
- Be sure foam element is in-place in the air cleaner case.
- Install the slot [A] into the hook [B].
- Be sure the hook of air cleaner body are in place in the air cleaner case.
- Tighten the bolt.

2-10 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Air Cleaner Element Cleaning and Inspection

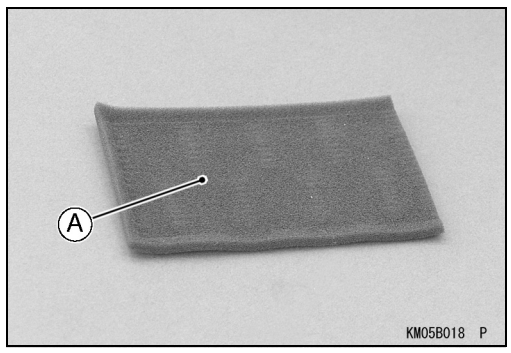
NOTE

○*In dusty areas, the elements should be cleaned 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.

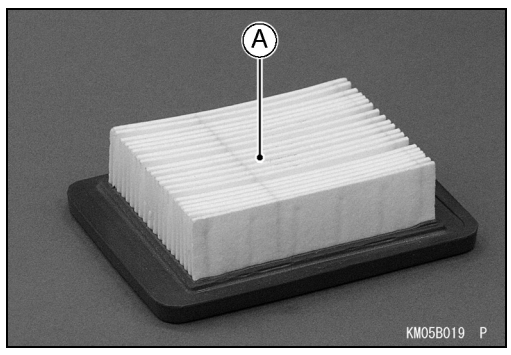
- Remove the foam element and paper element (see Air Cleaner Element Removal in this chapter).
- Clean the foam element [A] in a bath of detergent and water, and let the element air-dry thoroughly.



- 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 and foam element.



Air Cleaner Housing (Case and Body) Inspection

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

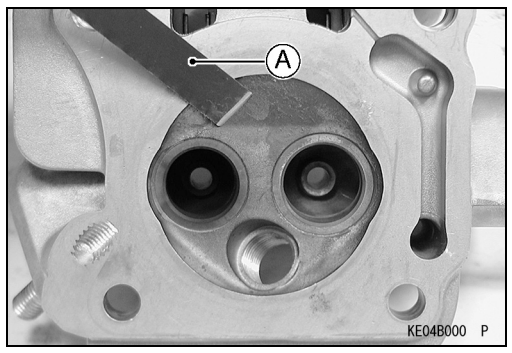
★If the housing is damaged, it must be replaced.

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

Periodic Maintenance Procedures

Engine Top End

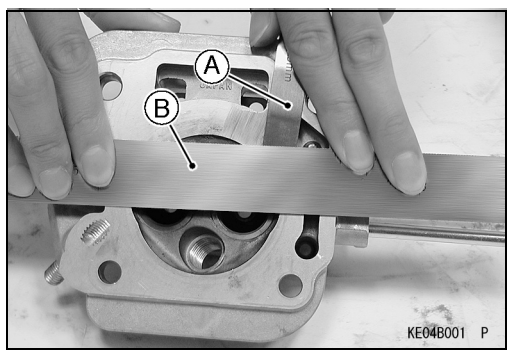
Cylinder Head Cleaning and Inspection



- Remove the cylinder head (see Cylinder Head Assembly Removal in the Engine Top End chapter).
- Scrape the carbon deposits from the head and exhaust port with a suitable tool [A].
- To avoid gouging, use scrapers that are made of a material that will not cause damage.
- Clean the 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.



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

★If warp exceeds the service limit, repair the mating surface. Replace the cylinder head if the mating surface is badly damaged.

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 detached 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.
- 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).*

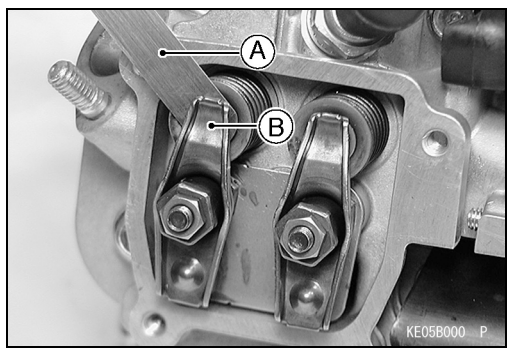
- Remove the rocker cover (see Cylinder Head Assembly Removal in the Engine Top End chapter).
- Place the piston at top dead center (TDC) of the compression stroke turning the crankshaft rotational direction.

Periodic Maintenance Procedures

● Then check the valve clearance.
○Using a thickness gauge [A], measure the valve clearance beween the rocker arm [B] and the valve stem end.
★If the valve clearance is incorrect, adjust it.

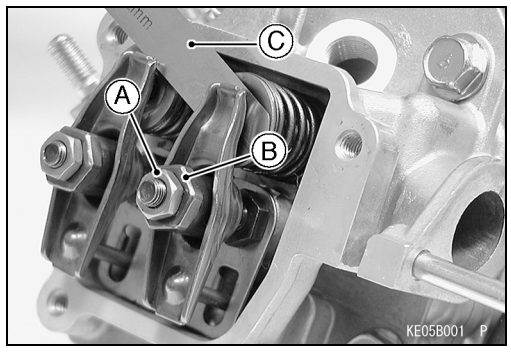
Valve Clearance
Standard:

Exhaust	**0.12 mm (0.005 in.)**
Inlet	**0.12 mm (0.005 in.)**



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 cylinder (see Cylinder Head Assembly Installation in the Engine Top End chapter).
● Turn the crankshaft to the proper direction until the piston is at TDC of the compression stroke (described above).
● Loosen the locknut [A] and valve clearance adjusting nut [B].
● Insert a 0.12 mm (0.005 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	**0.12 mm (0.005 in.)**
Inlet	**0.12 mm (0.005 in.)**

● Holding the adjusting nut with a wrench, tighten the locknut to the specified torque.

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

● Do not overtighten.
● Remeasure any clearance that was adjusted. Readjust if necessary.

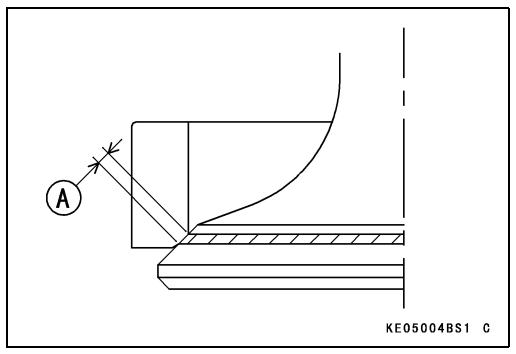
Periodic Maintenance Procedures

Valve Seat Inspection

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

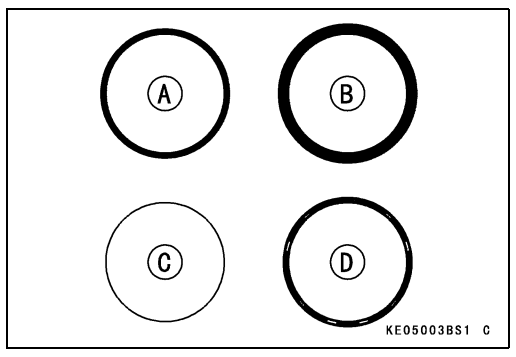
★If the seats are warped or distorted beyond reconditioning, replace the cylinder head.

- Pitted or worn valve seats can be refaced. 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.



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 valve seat.

Valve Seating Surface Width
Standard:

Exhaust	**0.5 ~ 1.1 mm (0.02 ~ 0.04 in.)**
Inlet	**0.5 ~ 1.1 mm (0.02 ~ 0.04 in.)**

Valve Seat Repair

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

Special Tools - Valve Seat Cutter Holder, ϕ5.5: 57001-1125
Valve Seat Cutter Holder Bar: 57001-1128

For Exhaust Valve Seat

Valve Seat Cutter, 45° - ϕ24.5: 57001-1113

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

For Inlet Valve Seat

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

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

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

Periodic Maintenance Procedures

Seat Cutter Operating Cares

1. This valve seat cutter is designed only for valve seat repair. Therefore the cutter must not be used for other purposes.
2. Do not drop or hit the valve seat cutter, or the diamond particles may fall off.
3. Do not fail 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

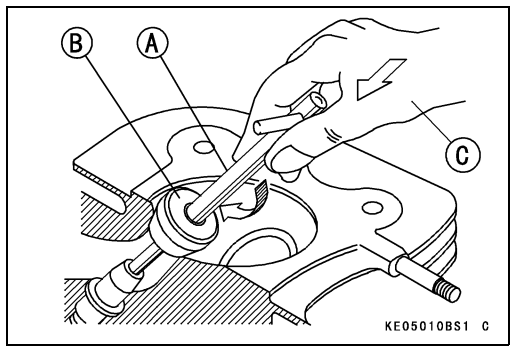
○*Do not use a wire brush to remove the metal particles from the cutter. It will take off the diamond particles.*

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.*

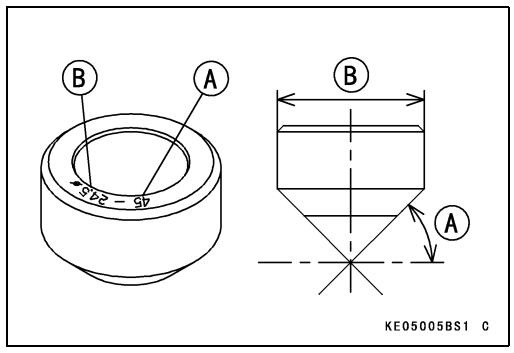
5. After use wash the cutter with washing oil and apply a thin layer of engine oil before storing.



Marks Stamped on the Cutter

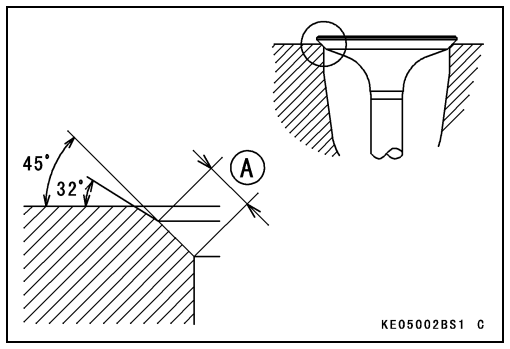
The marks stamped on the back of the cutter represent the following.

45°	Cutter angle [A]
24.5	Cutter diameter of cutter [B]



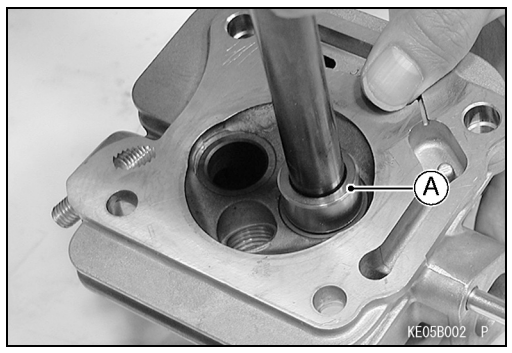
Operating Procedures

- 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 diameter width, the seating surface should be refaced.
- If the valve seating pattern is not correct, repair the seat.



Periodic Maintenance Procedures

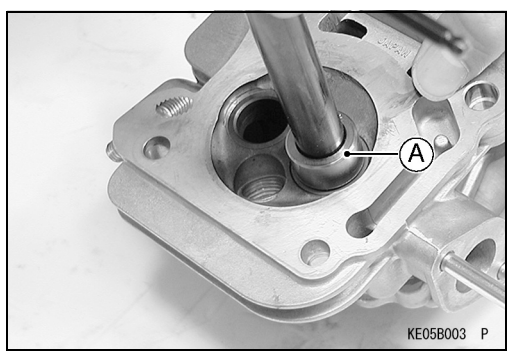
● Coat the seat with machinist's dye.
● Fit a 45° cutter [A] to the holder and slide it into the valve guide.
○Resurface the valve seat with a 45° cutter, removing only enough material to produce a smooth and concentric seat.



CAUTION

Do not grind the valve seat too much. Overgrinding will reduce valve clearance by sinking the valve into the cylinder 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.

● Use a 32° seat cutter [A] to narrow the seat width to the standard diameter width.
○Turn the seat cutter one turn at a time while pressing down very lightly. Check the seat width after each turn.



CAUTION

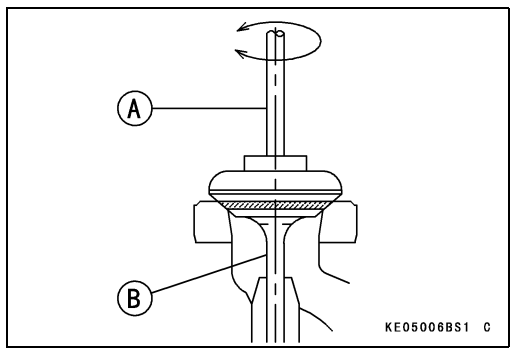
The 32° cutter removes material very quickly. Check the seat width frequently to prevent over grinding.

NOTE

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

● Make a light pass with the 45° cutter to remove any possible burrs at the edge of the valve 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 vacuum cap tool.

● Coat the face of valve sparingly with a fine lapping compound.
● Use the lapping tool [A], to grip 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.



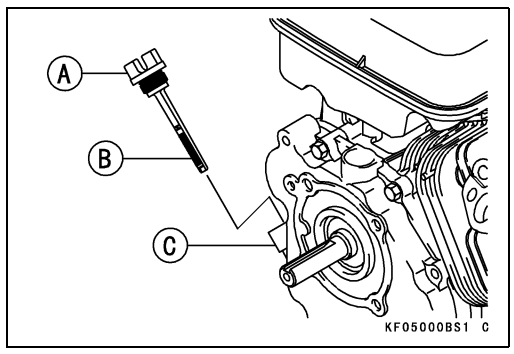
Periodic Maintenance Procedures

- 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 in this chapter).

Lubrication System

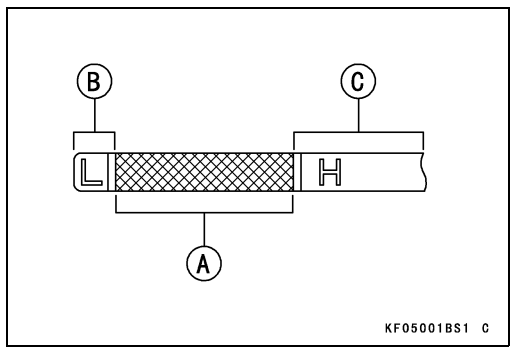
Oil Level Inspection

- 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 gauge hole[C] without screwing it in, then check the oil Level.



- The oil level should be in the range of “H” mark and “L” mark (grid area) [A] on the dipstick.

★If the oil level is “L” range [B] or below, add enough engine oil to bring oil level to the range of “H” mark and “L” mark.



CAUTION

Do not add more oil above the range of “H” mark and “L” mark. Excess oil will cause a smoking condition.

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

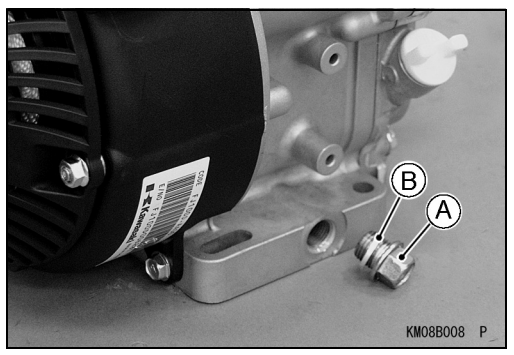
NOTE

○*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 “H” range [C] or above, drain the excess oil by loosening the drain bolt.

Oil Change

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



⚠ WARNING

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

- Check the gasket [B] at the drain bolt for damage. Replace the gasket with a new one.
- Install the drain bolt with the gasket and tighten it.

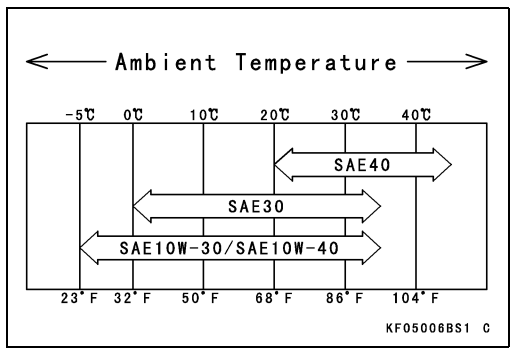
Torque - Engine Oil Drain Bolt: 32 N·m (3.3 kgf·m, 24 ft·lb)

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:	**SAE 10W-30**
Capacity:	**0.26 ~ 0.46 L (0.27 ~ 0.49 US qt)**



Electrical System

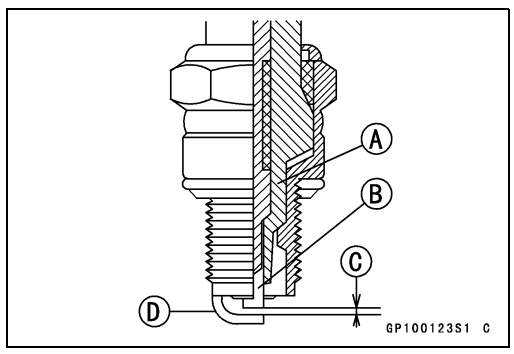
Spark Plug Cleaning and Inspection

● 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. 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 incorrect, carefully bend the side electrode with a suitable tool to obtain the correct gap.

Spark Plug Gap

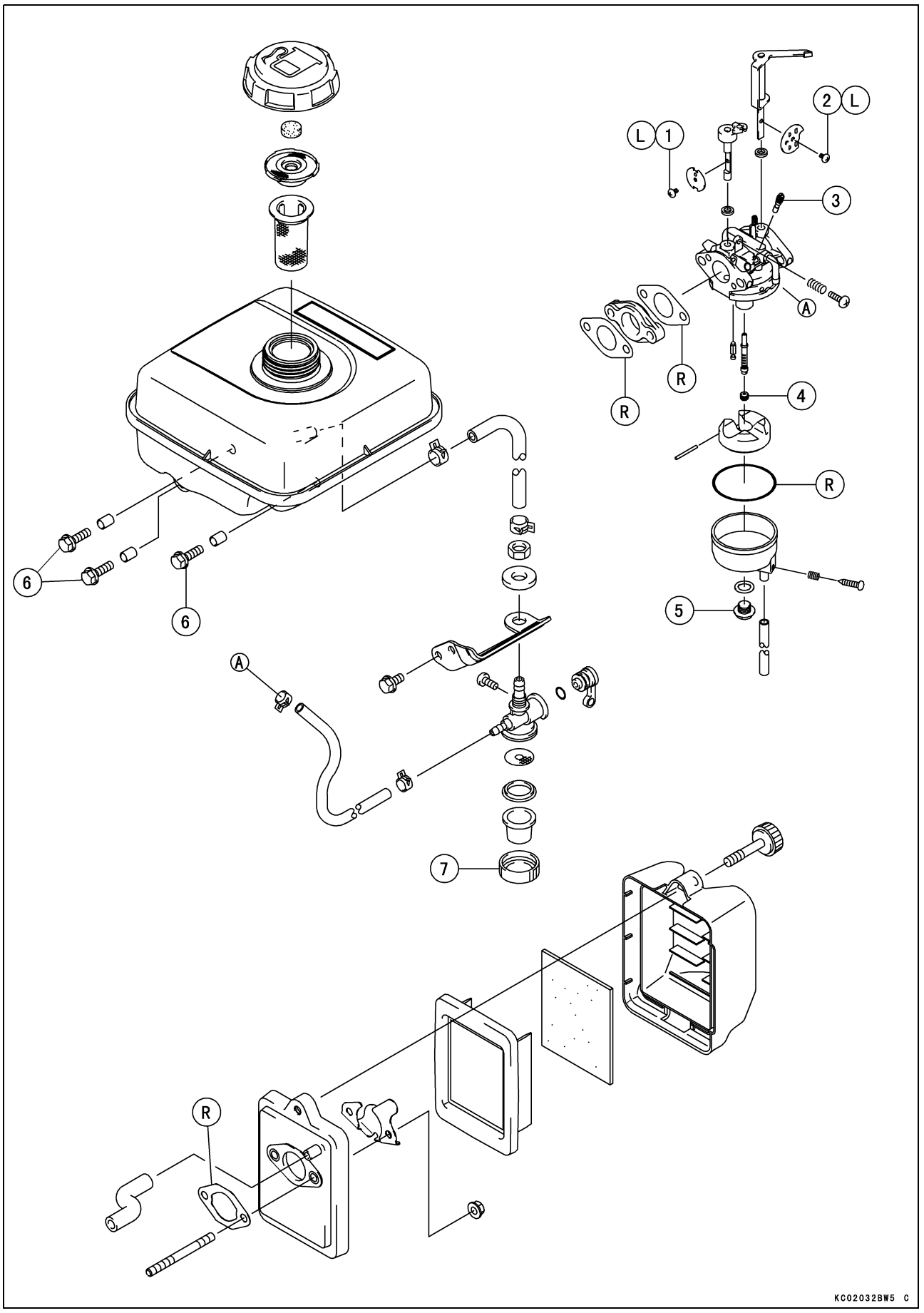
Standard: 0.6 ~ 0.7 mm (0.02 ~ 0.03 in.)

Fuel System

Table of Contents

3-2 FUEL SYSTEM

Exploded View



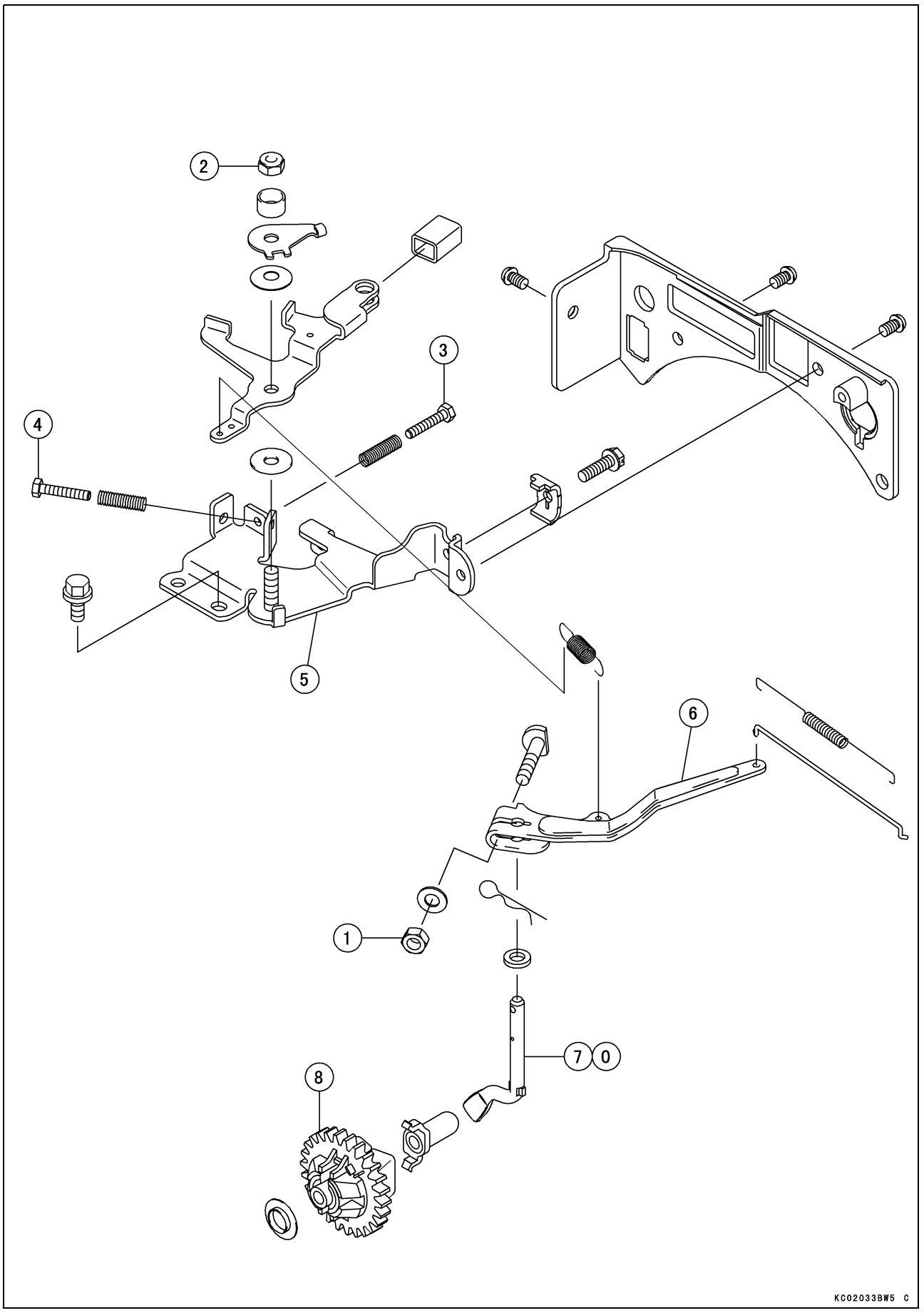
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Throttle Valve Screw	0.78	0.080	7 in·lb	L
2	Choke Valve Screw	0.78	0.080	7 in·lb	L
3	Pilot Jet	0.54	0.055	5 in·lb	
4	Main Jet	0.54	0.055	5 in·lb	
5	Float Chamber Mounting Bolt	9.8	1.0	87 in·lb	
6	Fuel Tank Bolts	8.8	0.90	78 in·lb	
7	Fuel Tap Nut	2.5	0.25	22 in·lb	

L: Apply a non-permanent locking agent.
R: Replacement Parts

3-4 FUEL SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Governor Arm Clamp Nut	5.9	0.60	52 in·lb	
2	Control Panel Nut	1.5	0.15	13 in·lb	

3. Low Idle Speed Screw
4. High Idle Speed Screw
5. Throttle Lever
6. Governor Arm
7. Governor Shaft
8. Governor Assembly

O: Apply engine oil.

3-6 FUEL SYSTEM

Specifications

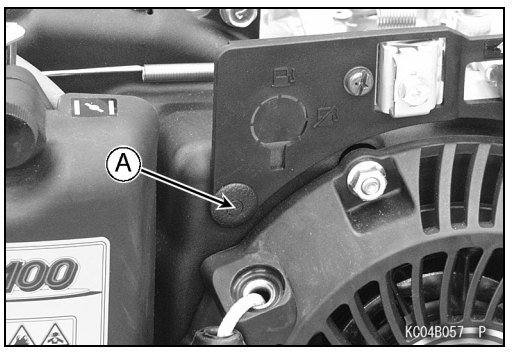
Item	Standard
Carburetor	
Make/Type	Walbro/LMJ
Throttle Bore Diameter	18 mm (0.71 in.)
Venturi Diameter	12 mm (0.47 in.)
Main Jet (MJ)	#54
Pilot Jet (PJ)	#52
Pilot Air Screw Turns Out (PS)	1 7/8 ±1/2
(Idle Mixture Screw Turns Out)	
Float Level	Float parallel to carburetor body
Idle Speed (1)	
Low Idle Speed	1 600 rpm (r/min)
High Idle Speed	4 000 rpm (r/min)
Air Cleaner	
Type	Dual stage filtration system
Cleaner:	
First	Foam element
Second	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.

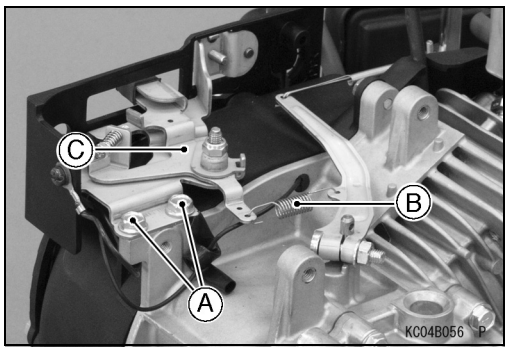
Governor Link Mechanism

Control Panel Assembly Removal

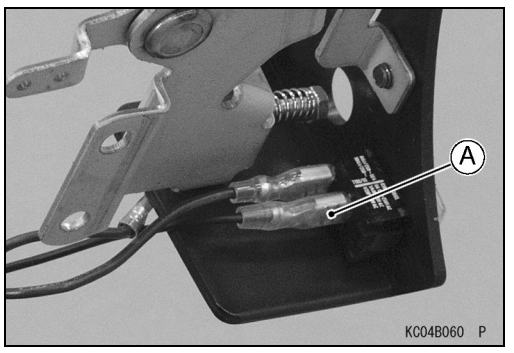
- Push the fastener in the center [A] with a screw driver or a pin-point tool, and remove the fastener.



- Remove:
  Fuel Tank (see Fuel Tank Removal in this chapter)
  Control Panel Assembly Mounting Bolts [A]
- Remove the control panel assembly [C] while unhooking the governor spring [B] end loop at the panel bracket.

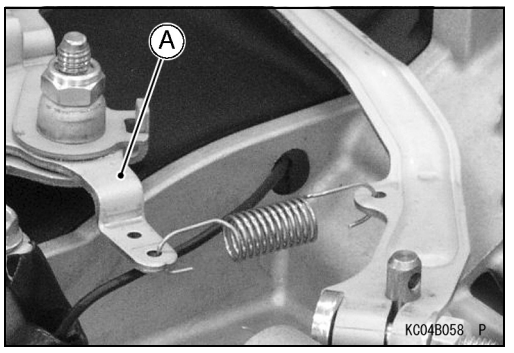


- Remove:
  Harness [A]



Control Panel Assembly Installation

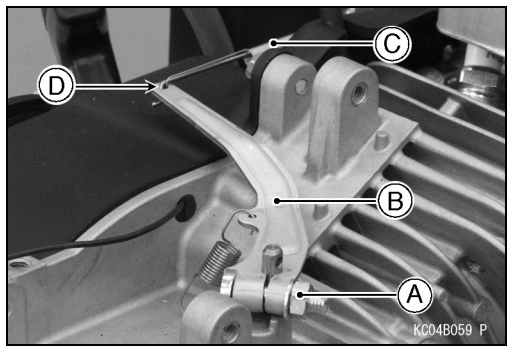
- Before installing the control panel assembly, check to see that the engine speed control lever move smoothly in all directions.
- ★If any part is worn or damaged, replace the control panel assembly.
- Hook the governor spring end loop at the panel bracket [A].
- Install the removed parts (see appropriate chapters).
- After installation, adjust the low idle speed and high idle speed to the specifications (see Low Idle Speed Adjustment, High Idle Speed Adjustment in the Periodic Maintenance chapter).



Governor Link Mechanism

Governor Arm Removal

- Remove:
  Control Panel Assembly (see Control Panel Assembly Removal in this chapter)
- 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].



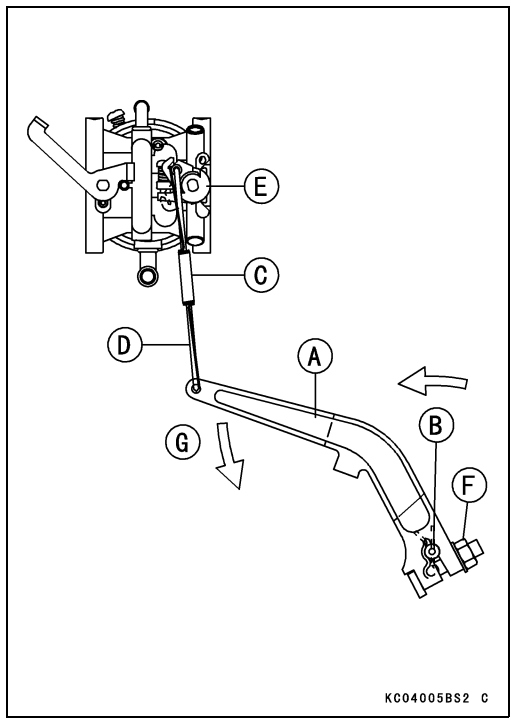
Governor Arm Installation

- 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 throttle lever [E] toward each other.
- Loosen the clamp nut [F] on the governor arm enough to move the governor shaft.
- 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.
- Tighten the clamp nut.

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

Torque - Governor Arm Clamp Nut: 5.9 N·m (0.60 kgf·m, 52 in·lb)

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



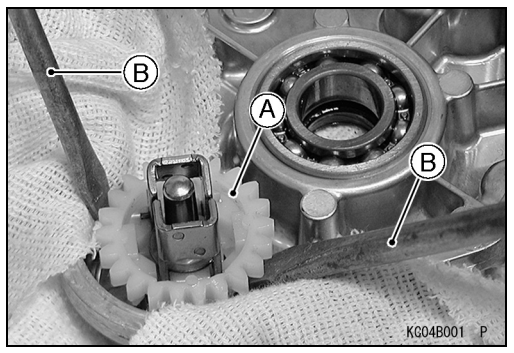
Governor Assembly Removal/Inspection

- 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 gear assembly unless the parts are to be replaced. The parts cannot be reused once they are removed.

- When removing the governor 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

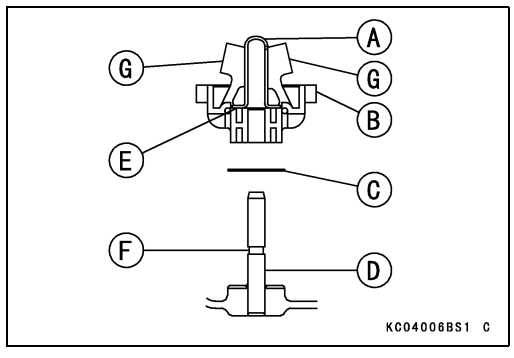
Governor Assembly Installation

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

CAUTION

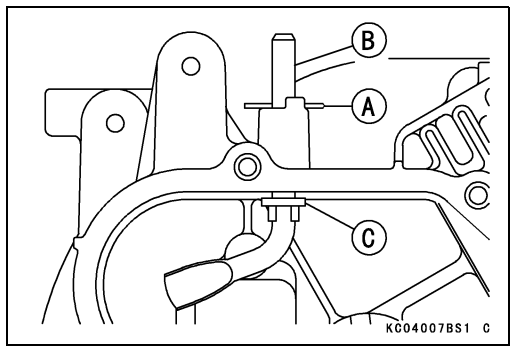
First install the sleeve. The sleeve cannot be installed after the governor gear assembly has been installed.

- 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 step [E] is fitted securely in groove [F].
- After installing the assembly, turn the governor by hand to make sure that the governor weight [G] and the sleeve move smoothly.



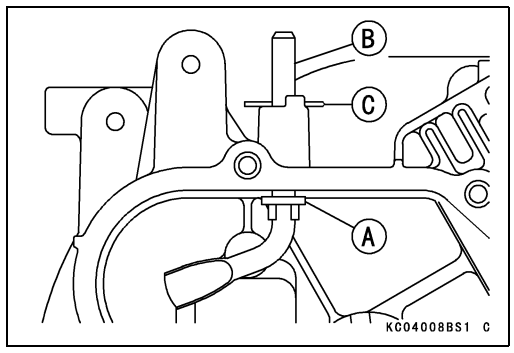
Governor Shaft Removal

- Remove:
  Crankshaft (see Crankshaft Removal in the Camshaft/Crankshaft chapter)
  Governor Arm (see Governor Arm Removal in this chapter)
  Snap Pin [A]
  Governor Shaft [B]
  Washer [C]



Governor Shaft Installation

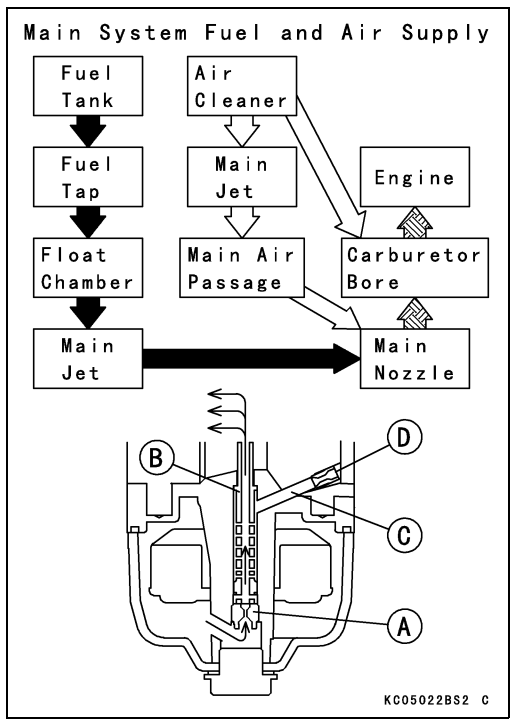
- Apply engine oil to the governor shaft.
- Install:
  Washer [A]
  Governor Shaft [B]
  Snap Pin [C]
- Check that the governor shaft moves smoothly in its operating range.



Carburetor

Fuel and Air Flow

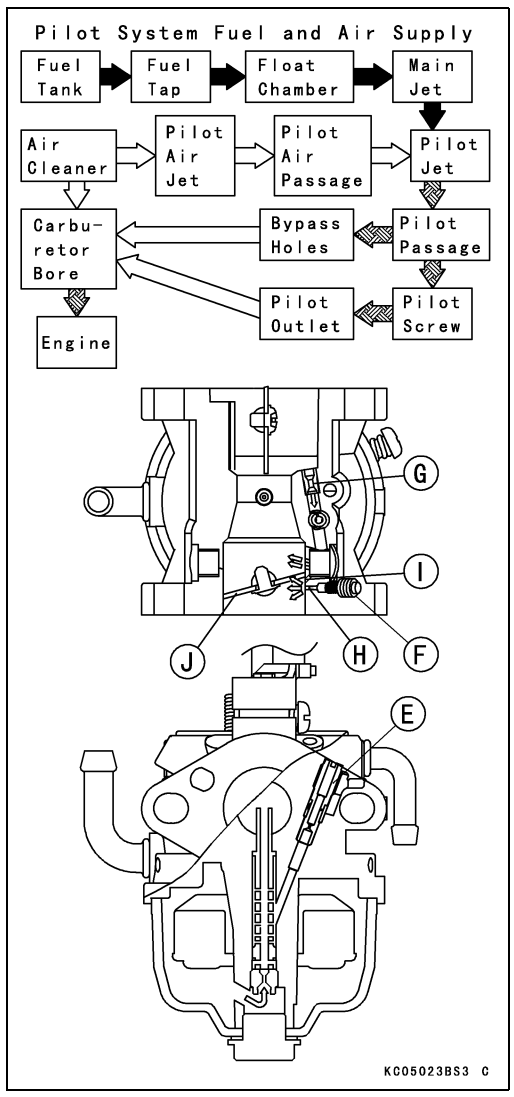
The main system of the carburetor consists of the main jet [A], main nozzle [B], and the main air passage [C] (main air jet [D]). The main system meters fuel to the engine during moderate to heavy load conditions. Fuel flows through the main jet and into the main nozzle, where it is joined by air from 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.



The pilot system includes the pilot jet [E], pilot screw [F] (idle mixture screw), pilot air jet [G], 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

Low Idle Speed Adjustment

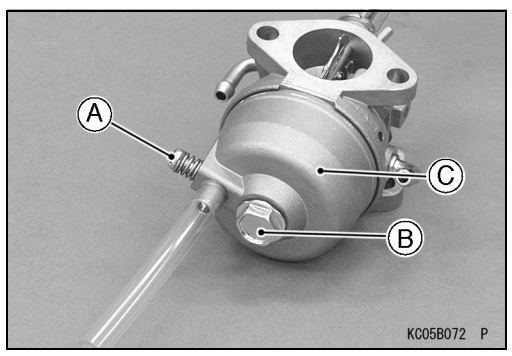
- Refer to the Low Idle Speed Adjustment in the Periodic Maintenance chapter.

High Idle Speed Adjustment

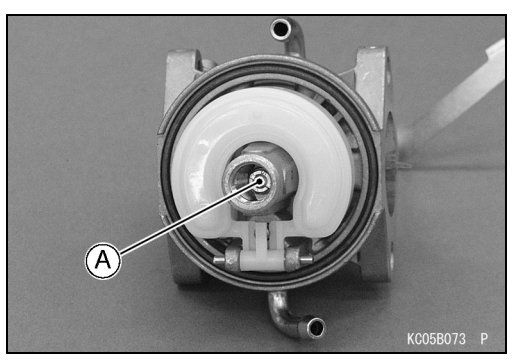
- Refer to the High Idle Speed Adjustment in the Periodic Maintenance chapter.

Main Jet Replacement

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

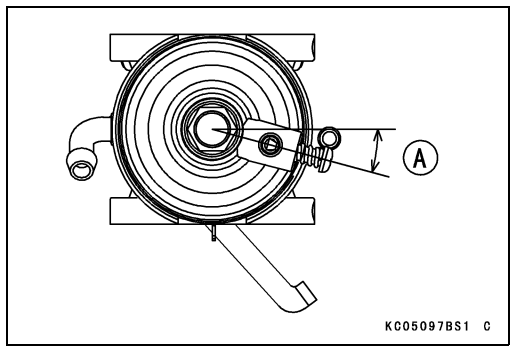


- Using a properly sized blade screw driver, carefully replace the main jet [A] with a new one.
- Tighten the main jet to the specified torque (see Carburetor Disassembly/Assembly in this chapter).



- Install the float chamber and gasket.
- Tighten the float chamber mounting bolt as shown in the figure.
  About 15° [A]

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



Fuel System Cleanliness Inspection

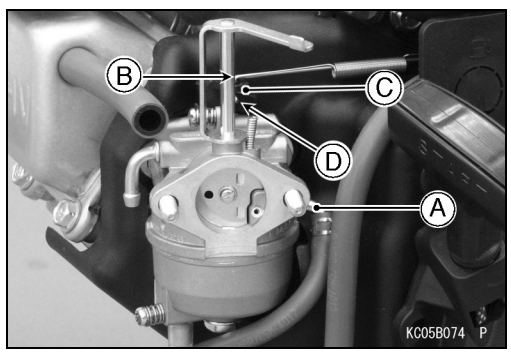
- Refer to the Fuel System Cleanliness Inspection in the Periodic Maintenance chapter.

Carburetor

Carburetor Removal

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the engine switch "○" (Stop). 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.



- Remove:
  Air Cleaner Body (see Air Cleaner Body Removal in this chapter)
- Close the fuel tap.
- Drain the carburetor completely by unscrewing the drain screw at the bottom of the float chamber.
- Disconnect the fuel tube at the fuel inlet joint [A] of the carburetor.
- Unhook the throttle link spring [B] at the throttle shaft lever [C] top end with a long nose pliers.
- Unhook the throttle link rod [D] from the throttle shaft lever.
- Remove the carburetor, gasket and insulator.
- Check the insulator for damage.

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

Carburetor Installation

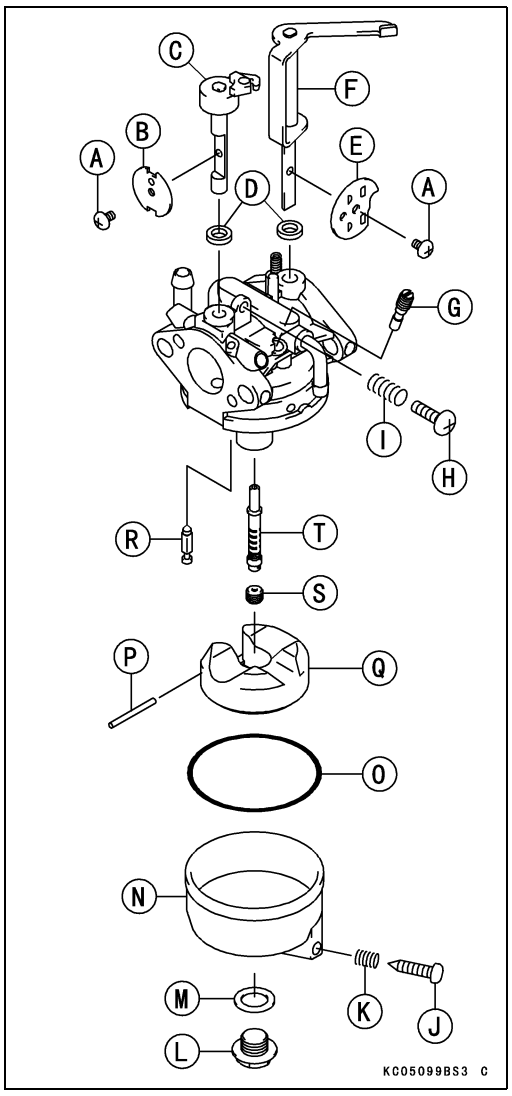
- Clean the mating surfaces of the carburetor, and install the new gaskets.
- Take care not to bend the throttle link rod during installation. Make sure that the link spring around the throttle link rod is in place and that it pulls the governor arm and carburetor throttle shaft lever toward each other.
- Adjust:
  Idle Speed (see Low 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.
- Before disassembly, mark the out side of choke valve and throttle valve for assembling them.
- Install the choke valve and throttle valve on the shaft as the out side mark of them facing out side.
- Drive the float pin into the carburetor body.
- Assemble carburetor parts with recommended tightening torque (see Exploded View in this chapter).

Screw [A]
Throttle Valve [B]
Throttle Shaft [C]
Dust Seal [D]
Choke Valve [E]
Choke Shaft [F]
Pilot Jet [G]
Low Idle Speed Screw [H]
Spring [I]
Drain Screw [J]
Spring [K]
Float Chamber Bolt [L]
Gasket [M]
Float Chamber [N]
Gasket [O]
Float Pin [P]
Float [Q]
Float Valve [R]
Main Jet [S]
Main Nozzle [T]



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 electrical appliance with a pilot light. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point washing to clean the carburetors.

CAUTION

Remove as many rubber or plastic parts from the carburetor as possible before cleaning the carburetor with a washing. 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 washing which could attack these parts; instead, use a mild high-flash point washing 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 in this chapter).
- 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 holes 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 in this chapter).

Carburetor

Carburetor Inspection

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain. Turn the engine switch "○" (Stop). 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.
- Turn the throttle and choke shafts to check that the throttle and choke butterfly valves move smoothly.

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

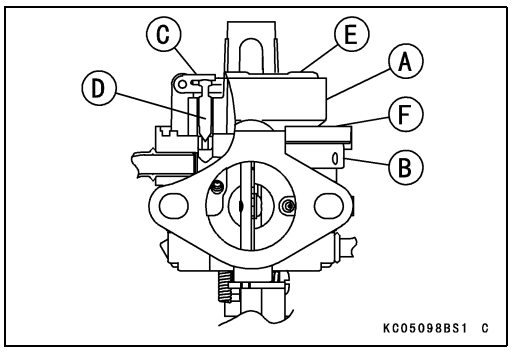
- Replace the gasket on the carburetor body.
- Check the other parts of the carburetor for wear or damage. Replace the part if necessary.
- Clean and check the float level as follows.

CAUTION

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

- With the float [A] assembly installed onto the carburetor body [B], 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 [C] just touches the float valve [D]. The float lower surface [E] should be parallel with the carburetor body mating surfaces [F].

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

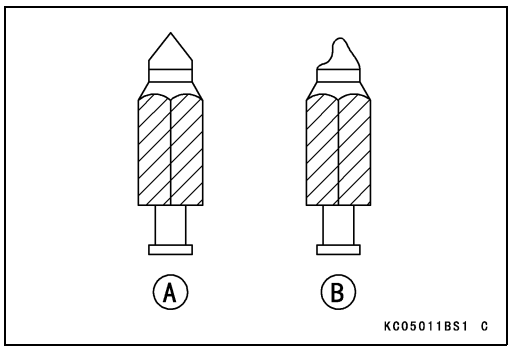


- Inspect the float valve for excessive wear or damage. The tip should be smooth, without any grooves, scratches, or tears. The rod at the other end of the needle should move smoothly when push in and released.

  Good [A]

  Not Good [B]

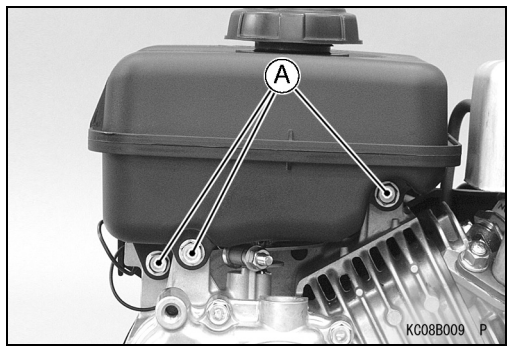
★If either the needle or the seat is worn or damaged, replace the float assembly and carburetor body as a set.



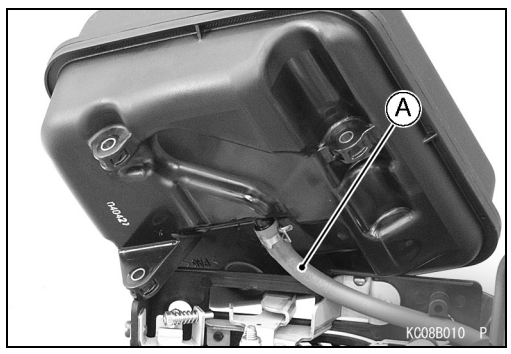
Fuel Tank

Fuel Tank Removal

- Drain the fuel from the fuel system with the fuel tap.
- Remove:
  Fuel Tank Bolts [A]



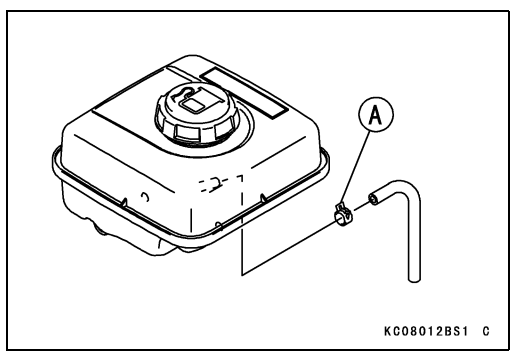
- Pull the fuel hose [A] out of the fuel tank by loosening the clamps, and remove the fuel tank.



Fuel Tank Installation

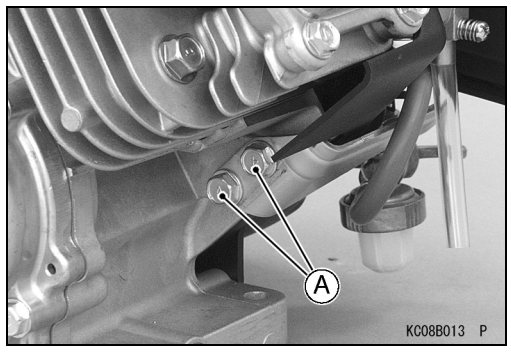
- Connect the fuel hose and fuel tank with the clasp of the clamp [A] as shown in the figure.
- Install the fuel tank with the bolts.

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

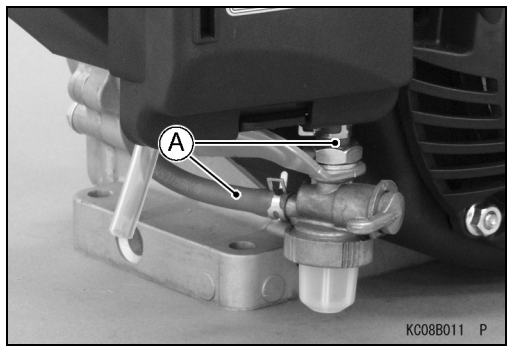


Fuel Tap Removal

- Drain the fuel from the fuel system with the fuel tap.
- Remove the bracket bolts [A].



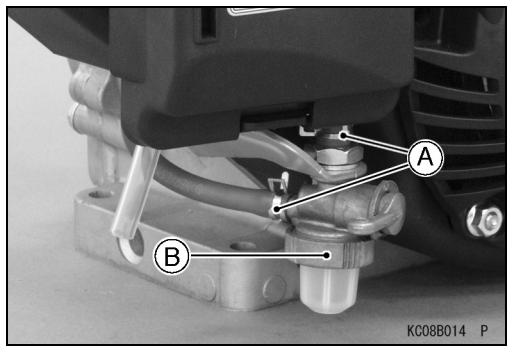
- Take off the fuel hoses [A] by loosening the clamps, and remove the fuel tap.



Fuel Tank

Fuel Tap Installation

- Connect the fuel hose and fuel tap [B] with the clasps of the clamps [A] as shown in the figure.
- Install the bracket, and tighten the bolts.



Fuel Tank and Fuel Tap Cleaning

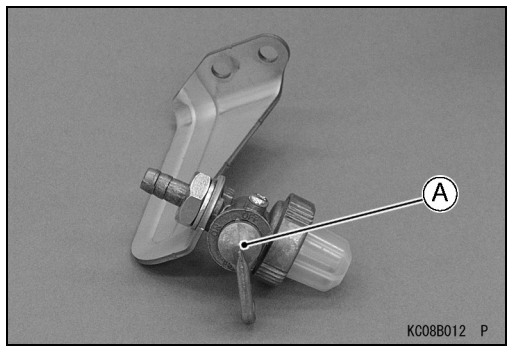
⚠ WARNING

Clean the tank and cock in a well-ventilated area. Do not use gasoline or low-flash point solvent to clean the tank and cock.

- Remove the fuel tank and pour gasoline in a container (see Fuel Tank Removal in this chapter).
- Fill the fuel tank with some high-flash point solvent, and shake the tank to remove dirt and fuel deposits.
- Draw the solvent in the fuel tap by setting the lever of the fuel tap.
- Dry the tank and tap with compressed air.
- Install the fuel tank (see Fuel Tank Installation in this chapter).

Fuel Tap Inspection

- Remove the fuel tap (see Fuel Tap Removal in this chapter).
- Visually check the fuel tap [A].
- Replace the fuel tap with a new one, if there is any damage or degradation.



Fuel Filter

Fuel Filter Inspection

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

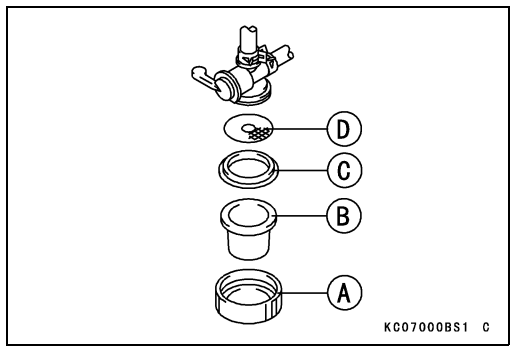
Fuel Filter Cleaning

⚠ WARNING

Clean the fuel filter in a well-ventilated area. Do not use gasoline or low-flash point solvent to clean the filter.

- Remove the fuel tap (see Fuel Tap Removal in this chapter).
- Unscrew the nut [A], and remove the cup [B], gasket [C] and filter [D].
- Clean the fuel filter of high-flash point solvent.
- Install the filter, gasket and cup, and tighten the nut.

Torque - Fuel Tap Nut: 2.5 N·m (0.25 kgf·m, 22 in·lb)



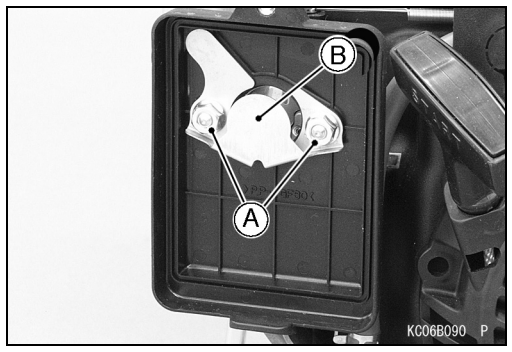
Air Cleaner

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

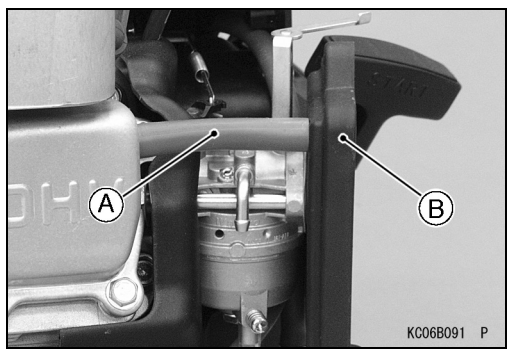
Element Installation
- Refer to the Air Cleaner Element Installation in the Periodic Maintenance chapter.

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

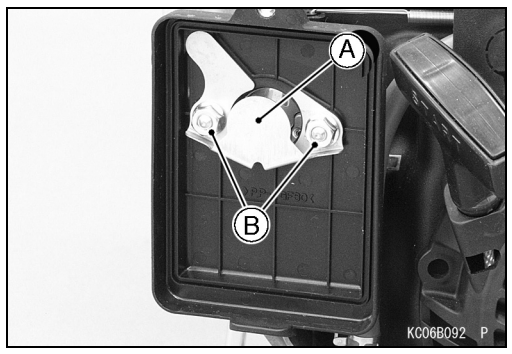
Air Cleaner Body Removal
- Remove the elements (see Air Cleaner Element Removal in the Periodic Maintenance chapter).
- Remove the air cleaner body mounting nuts [A] and plate [B].



- Pull the breather tube [A] off the pipe at the back of the body, and remove the air cleaner body [B] and the gasket.



Air Cleaner Body Installation
- Install the gasket and air cleaner body.
- Install the breather tube from the rocker case to the air cleaner body.
- Install the plate [A], and tighten the air cleaner body mounting nuts [B].
- Install the removed parts (see appropriate chapters).



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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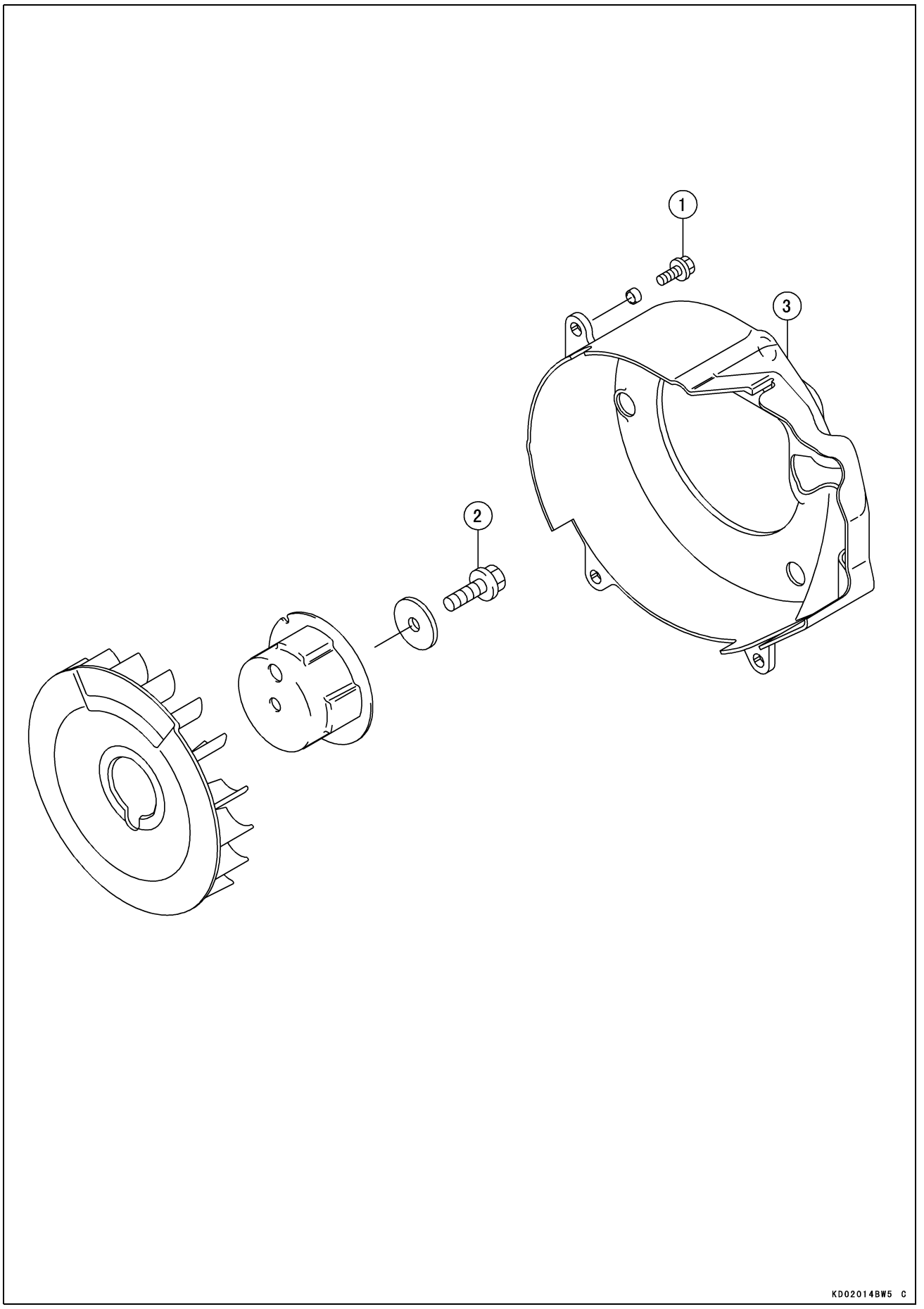
4-2 COOLING SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Fan Housing Bolts	8.8	0.90	78 in·lb	
2	Flywheel Bolt	25	2.5	18	

3. Fan Housing

4-4 COOLING SYSTEM

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.

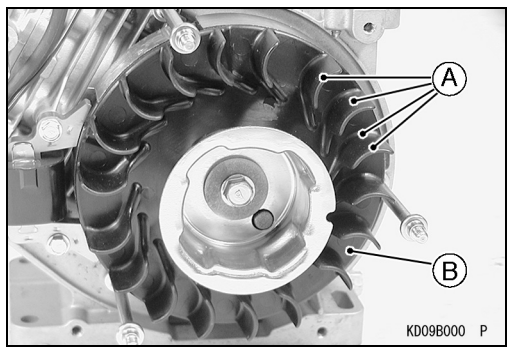
Cooling Fan Inspection

- 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.

- Cooling fan is cleaned by washing in detergent and water.



CAUTION

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

Engine Top End

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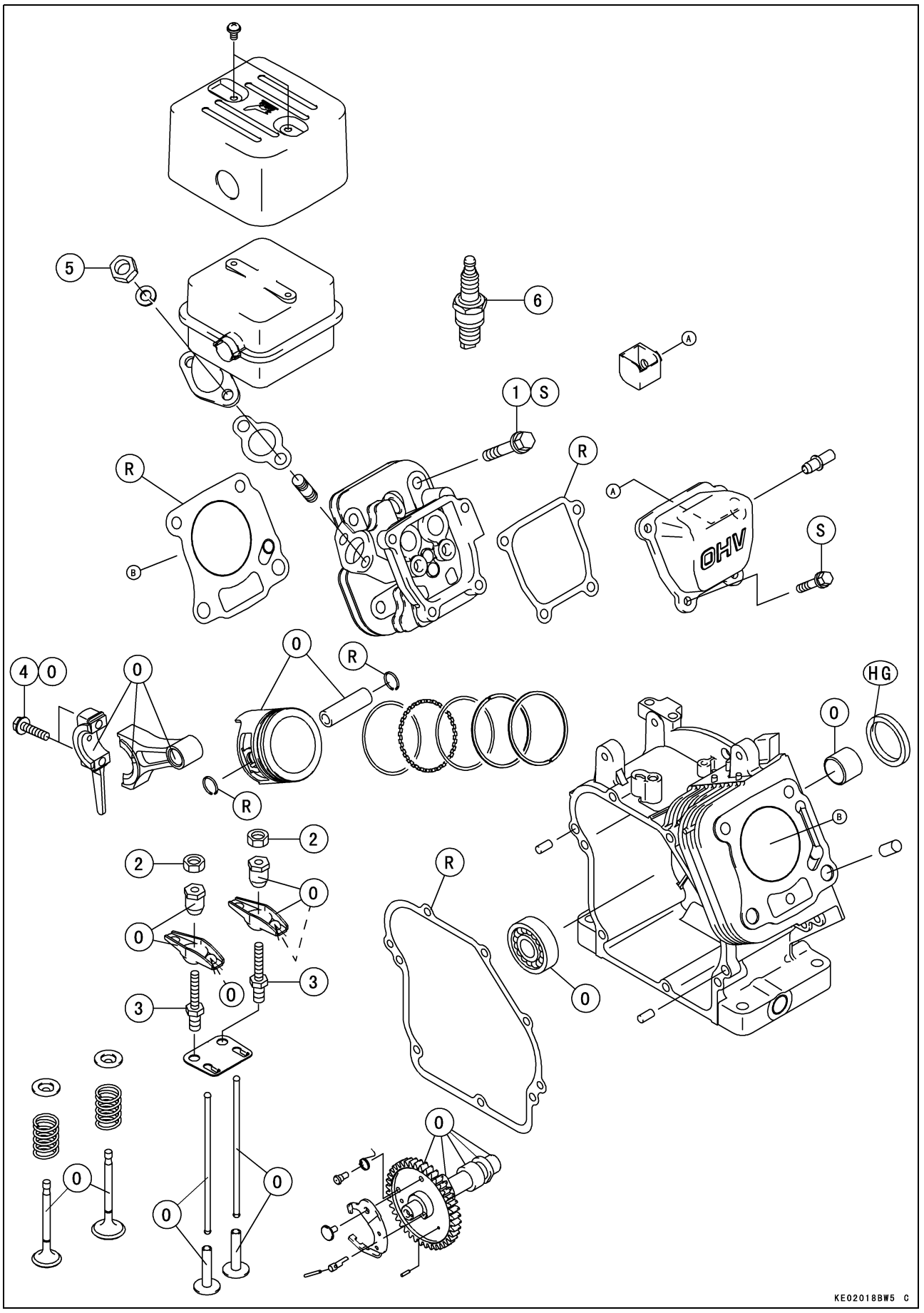
5-2 ENGINE TOP END

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Cylinder Head Bolts (Used)	25	2.5	18	S
	Cylinder Head Bolts (New)	32	3.3	24	S
2	Valve Clearance Locknuts	6.9	0.70	61 in·lb	
3	Rocker Arm Bolts	23	2.3	17	
4	Connecting Rod Big End Cap Bolts	9.0	0.90	80 in·lb	O
5	Exhaust Pipe Flange Nuts	23	2.3	17	
6	Spark Plug	23	2.3	17	

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

5-4 ENGINE TOP END

Specifications

Item	Service Limit
Cylinder Head	
Cylinder Compression	200 kPa (29 psi) (MIN)
Cylinder Head Warp	0.03 mm (0.001 in.)
Valves	
Valve Head Thickness:	
Exhaust	0.50 mm (0.020 in.)
Inlet	0.50 mm (0.020 in.)
Valve Stem Runout:	
Exhaust	TIR 0.05 mm (0.002 in.)
Inlet	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:	
Exhaust	5.43 mm (0.214 in.)
Inlet	5.43 mm (0.214 in.)
Valve Guide Inside Diameter:	
Exhaust	5.58 mm (0.220 in.)
Inlet	5.58 mm (0.220 in.)
Valve Spring Free Length:	
Exhaust	31.3 mm (1.23 in.)
Inlet	31.3 mm (1.23 in.)
Rocker Arm Push Rod Runout:	
Exhaust	TIR 0.5 mm (0.02 in.)
Inlet	TIR 0.5 mm (0.02 in.)
Cylinder, Piston	
Piston Diameter	55.28 mm (2.176 in.)
Piston Ring/Groove Clearance:	
Top	0.07 mm (0.003 in.)
Second	0.07 mm (0.003 in.)
Piston Ring Thickness:	
Top	1.12 mm (0.044 in.)
Second	1.12 mm (0.044 in.)
Piston Ring End Gap:	
Top	0.65 mm (0.026 in.)
Second	0.65 mm (0.026 in.)
Oil	1.00 mm (0.039 in.)
Piston Pin Outside Diameter	12.95 mm (0.510 in.)
Piston Pin Hole Inside Diameter	13.08 mm (0.515 in.)
Connecting Rod Small End Inside Diameter	13.05 mm (0.514 in.)
Cylinder Inside Diameter	56.10 mm (2.209 in.)
Cylinder Bore Out Round	0.056 mm (0.0022 in.)

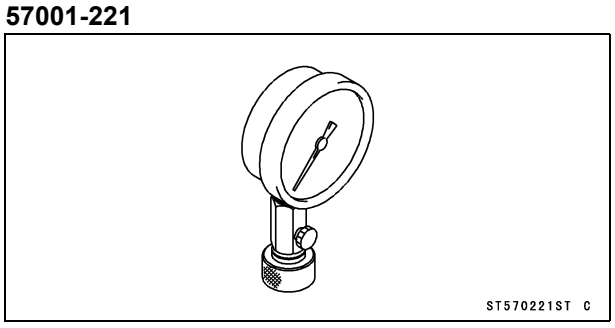
Specifications

Item	Standard
Valves	
Valve Clearance:	
Exhaust	0.12 mm (0.005 in.)
Inlet	0.12 mm (0.005 in.)
Valve Seating Surface Angle:	
Exhaust	45°
Inlet	45°
Valve Seating Surface Width:	
Exhaust	0.5 ~ 1.1 mm (0.02 ~ 0.04 in.)
Inlet	0.5 ~ 1.1 mm (0.02 ~ 0.04 in.)
Valve Guide Inside Diameter:	
Exhaust	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)
Inlet	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)
Exhaust Valve Lift by ACR	1.4 mm (0.055 in.)
Cylinder, Piston	
Cylinder Inside Diameter	55.98 ~ 56.00 mm (2.204 ~ 2.205 in.)

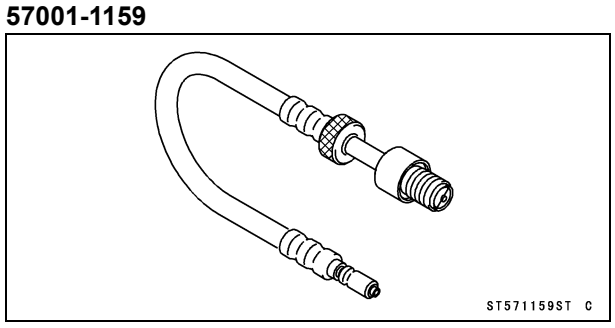
5-6 ENGINE TOP END

Special Tools

Compression Gauge, 20 kgf/cm²:
57001-221



Compression Gauge Adapter, M14 × 1.25:
57001-1159



Cylinder Head

Compression Measurement

● Before measuring compression, do the following.

○Be sure the battery is fully charged.

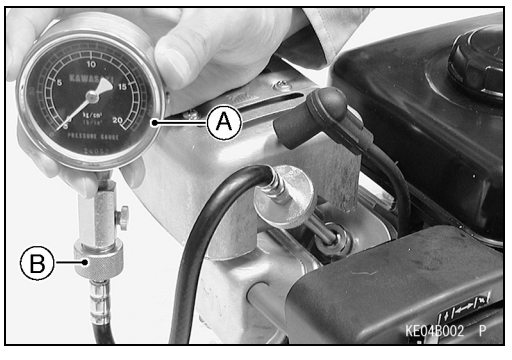
○Thoroughly warm up the engine so that engine oil between the piston and cylinder wall will help seal compression as it does during normal running.

○Stop the engine.

● Disconnect the spark plug cap of the cylinder and remove the spark plug keeping the engine throttle and the choke valve fully open.

● Attach the compression gauge assembly firmly into the plug hole.

Special Tools - Compression Gauge, 20 kgf/cm² [A]: 57001 -221
Compression Gauge Adapter, M14 × 1.25 [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.

● With the throttle fully open, pull the recoil starter grip quickly several times until the compression gauge stops rising; the compression is the highest reading obtainable.

Cylinder Compression
Service Limit: 200 kPa (29 psi) (MIN)

★If the compression is about the specified value, the piston rings, cylinder and valves are 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 and/or worn piston oil rings. This may be indicated by white exhaust smoke.
4. Malfunction of ACR (Automatic Compression Release) with the camshaft.

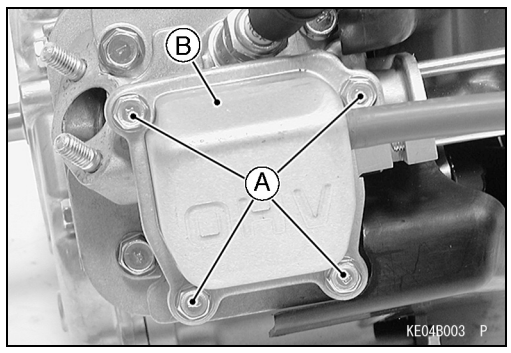
★If cylinder compression is lower than the (MIN), check the following.

1. Gas leakage around the cylinder head - replace the damaged gasket 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

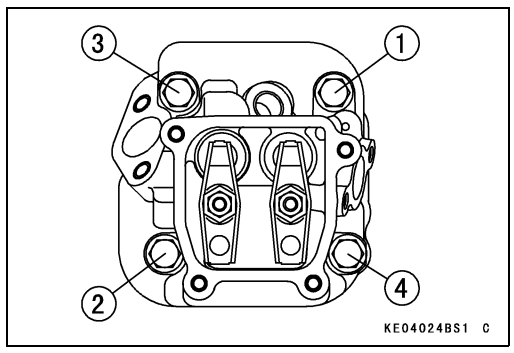
- Remove:
  Fan Housing (see Flywheel Removal in the Electrical System chapter)
  Muffler Assembly (see Muffler Assembly Removal in this chapter)
  Spark Plug (see Spark Plug Removal in the Electrical System chapter)
- Unscrew the rocker cover mounting bolts [A], and remove the cover [B] and gasket.
- When removing the cylinder head, set the piston at TDC of power stroke in.



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

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.*

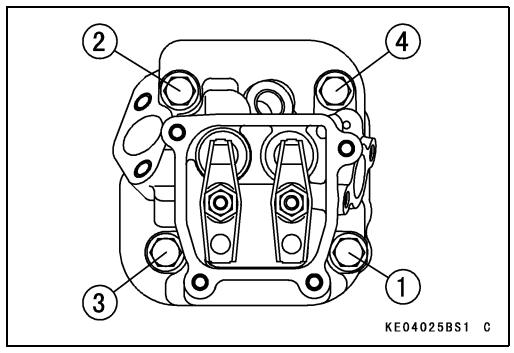
Cylinder Head Assembly Installation

- Clean the mating surfaces of the cylinder head and cylinder.
- Install the push rods in their original positions on the cylinder (see Push Rod Installation in this chapter).
- Install the dowel pins.
- Set the piston at TDC of power stroke in.
- 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.

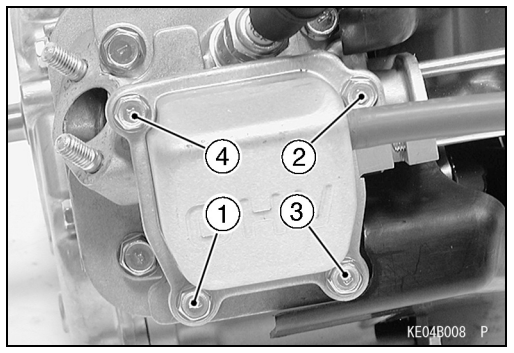
Torque - Cylinder Head Bolts:
Used: 25 N·m (2.5 kgf·m, 18 ft·lb)
New: 32 N·m (3.3 kgf·m, 24 ft·lb)



CAUTION

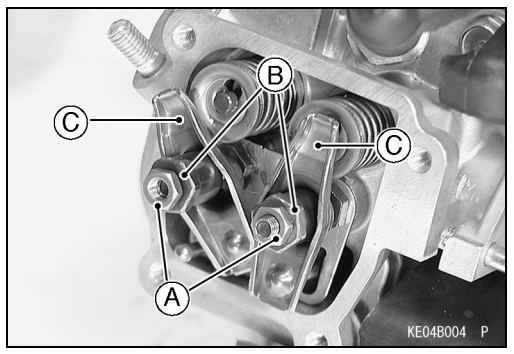
A torque wrench must be used to assure proper torque. Improper tightening of the head bolts can result in warping of the cylinder head.

- Check and adjust the valve clearance (see Valve Clearance Inspection, Adjustment in the Periodic Maintenance chapter).
- Install the gasket and rocker cover.
- Tighten the rocker cover mounting bolts following the tightening sequence as shown in the figure.
- Install the removed parts (see appropriate chapters).



Push Rod Removal

- Set the piston at TDC of power stroke in.
- Remove the rocker cover (see Cylinder Head Assembly Removal in this chapter).
- Loosen the locknuts [A] and valve clearance adjusting nuts [B].
- Move the rocker arms [C] 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 position during assembly.*

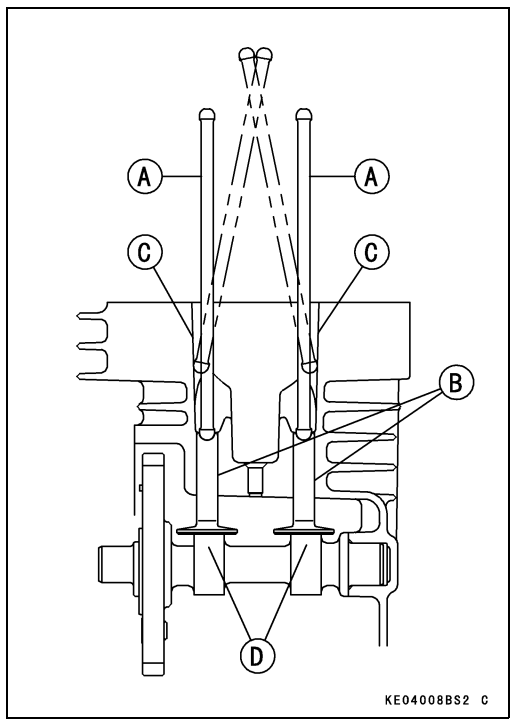
Cylinder Head

Push Rod Installation

- Set the piston at TDC of power stroke in.
- Install the push rods [A] in their original positions on each cylinder.

○To install the push rod in the correct position on the tappet [B], insert the push rod so end of the push rod is sliding down along inside wall [C] of the crankcase and position the push rod end onto the tappet.

- Check that both inlet and exhaust push rods on the cylinder are at lowest position on the cam lobes [D], if not, turn the flywheel clockwise one turn (360°) and reset the piston at TDC of power stroke in.
- Be sure the end of the push rods are correctly seated on the tappets.
- Tighten the valve clearance adjusting nuts and locknuts (see Valve Clearance Adjustment in the Periodic Maintenance chapter).
- Check and adjust the valve clearance (see Valve Clearance Inspection, Adjustment in the Periodic Maintenance chapter).



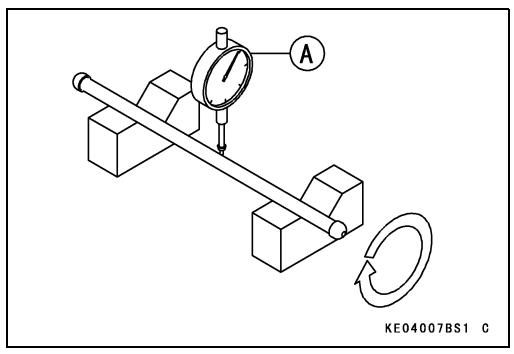
Push Rod Inspection

- Place the rocker arm push rod in V blocks that are as far apart as possible, and set a dial gauge [A] on the rod at a point halfway 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.

Rocker Arm Push Rod Runout
Service Limit:

Exhaust	**TIR 0.5 mm (0.02 in.)**
Inlet	**TIR 0.5 mm (0.02 in.)**



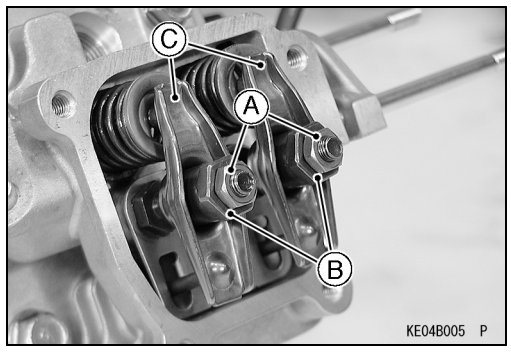
Valve Mechanism Removal/Installation

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

NOTE

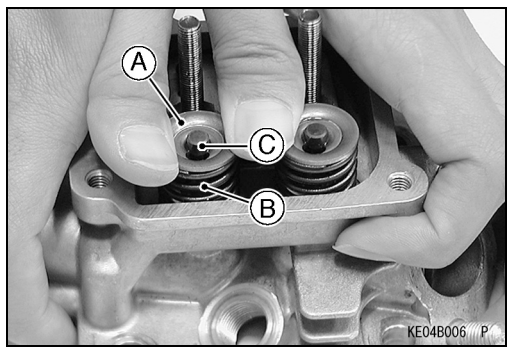
○*When removing the valve mechanism parts, note their position so that they may be reinstalled in their original position during assembly.*

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



Cylinder Head

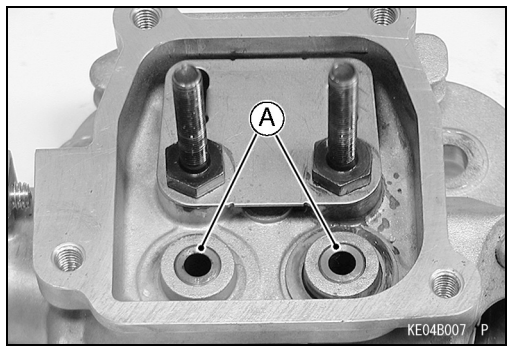
- Support the valve head in the combustion chamber with a suitable block.
- Press the valve retainer [A] with thumbs and move the valve stem end toward the recessed corner of the valve retainer, then pull out the valve retainer.
- Remove the spring [B] and valve [C] .



NOTE

○*Valve guide [A] is not replaceable, do no remove it.*

- Apply engine oil to the valve stem and install the valve.
- Check to see that the valve moves smoothly up and down in the guide.
- Install the spring and the valve retainer.
- Press the valve retainer with thumbs and move the valve stem end toward the recessed part in the center, then install the valve retainer.
- Soak the valve clearance adjusting nuts and rocker arm in the engine oil.
- Install the rocker arm by using the valve clearance adjusting nuts and locknuts.
- Adjust the valve clearance (see Valve Clearance Adjustment in the Periodic Maintenance chapter).



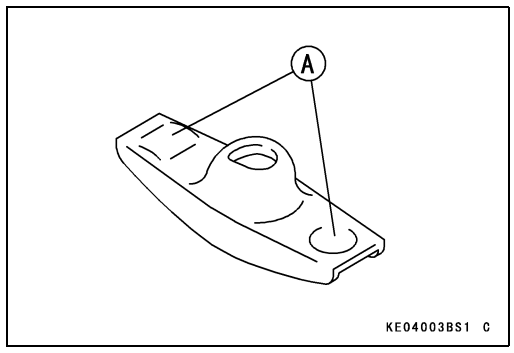
Cleaning and Inspection

- 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 valve stem.

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



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.

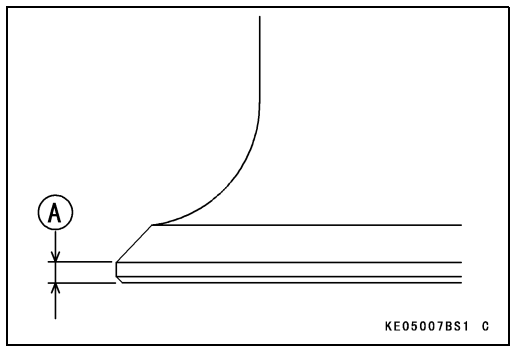
Valve Seat Repair

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

Valve Head Thickness

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

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



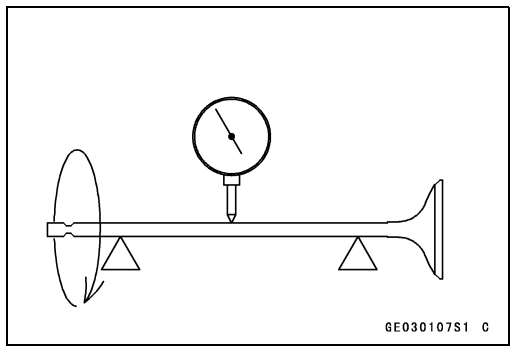
Valve Head Thickness
Service Limit:

Exhaust	**0.50 mm (0.02 in.)**
Inlet	**0.50 mm (0.02 in.)**

Valve Stem Runout

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

★If the stem runout is greater than service limit, replace the valve.



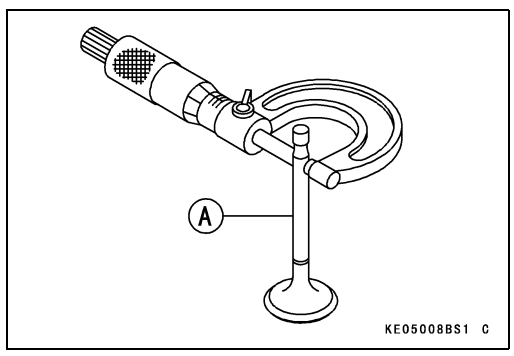
Valve Stem Runout
Service Limit:

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

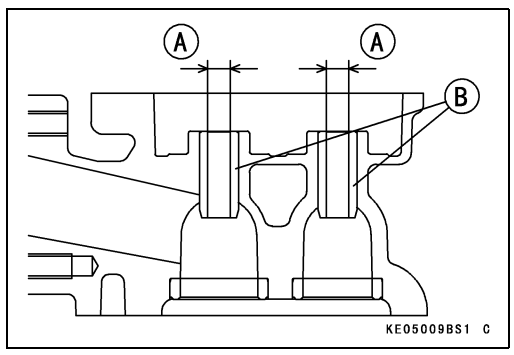


Valve Stem Diameter
Service Limit:

Exhaust	**5.43 mm (0.214 in.)**
Inlet	**5.43 mm (0.214 in.)**

Valves

Valve Guide Inside Diameter

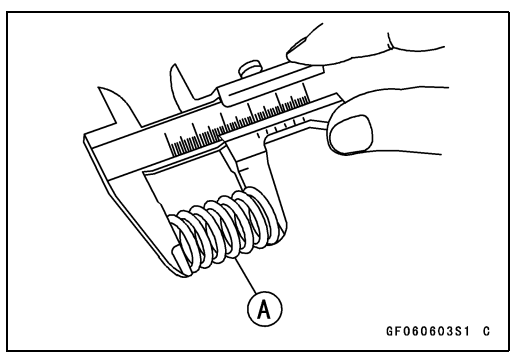


- Use a small bore gauge or a micrometer to measure the inside diameter [A] of the valve guide [B] at three places down the length of the guide.

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

Valve Guide Inside Diameter
Standard:
Exhaust **5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)**
Inlet **5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)**
Service Limit:
Exhaust **5.58 mm (0.220 in.)**
Inlet **5.58 mm (0.220 in.)**

Valve Spring Inspection

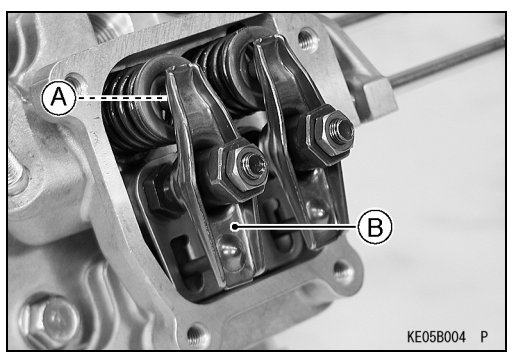


- Inspect the valve spring for pitting, cracks, rusting, and burns. Replace the spring if necessary.
- Measure the free length [A] of the spring.

★If the measurement is less than the service limit, replace the spring.

Valve Spring Free Length
Service Limit:
Exhaust **31.3 mm (1.23 in.)**
Inlet **31.3 mm (1.23 in.)**

ACR (Automatic Compression Release) Inspection



ACR is the equipment which allows some of the compression pressure to escape, making it easy to turn over the crankshaft during starting.

- Remove:
  Rocker Cover (see Cylinder Head Assembly Removal in this chapter)
  Spark Plug (see Spark Plug Removal in the Electrical System chapter)
- Confirm that the valve clearance is the specified valve (see Valve Clearance Inspection in the Periodic Maintenance chapter).
- Observe the movement of the exhaust valve [A] and rocker arm [B] by turning slowly the crankshaft clockwise.

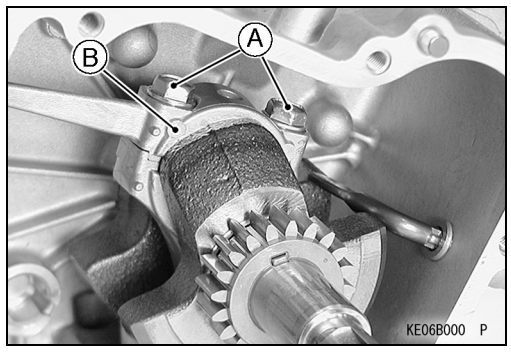
★If the exhaust valve is not pushed up to open by the rockerarm just after the inlet valve closed, ACR with the camshaft is out of order (see Camshaft Inspection in the Camshaft/Crankshaft chapter).

Exhaust Valve Lift by ACR
Standard: 1.4 mm (0.055 in.)

Cylinder, Piston

Piston Removal

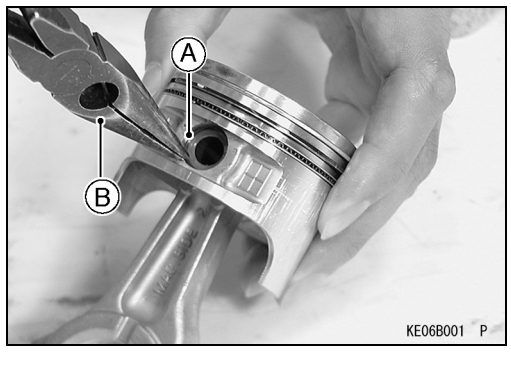
- Remove:
  Cylinder Head Assembly (see Cylinder Head Assembly Removal in this chapter)
  Camshaft (see Camshaft Removal in the Camshaft/Crankshaft chapter)
- Turn the crankshaft to expose the connecting rod cap bolts [A].
- Remove the bolts and take off the connecting rod cap [B].



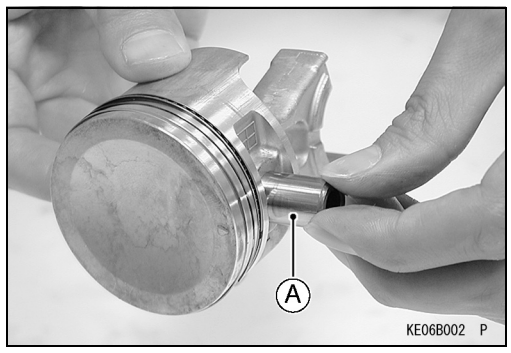
NOTE

○*Note the position of the connecting rod caps for reinstalling the caps.*

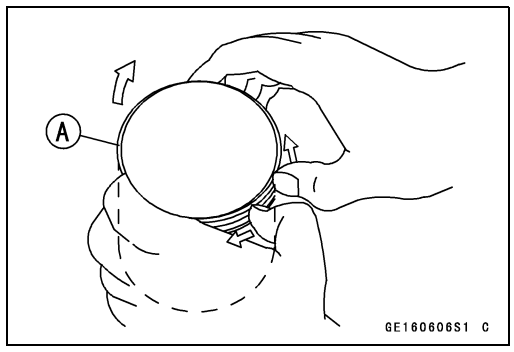
- Push the connecting rod end into the cylinder, and pull the piston and connecting rod out of the cylinder.
- Remove one of the piston pin snap rings [A] with needle nose pliers [B].



- Remove the piston by pushing the piston pin [A] out the side from which the snap ring was removed.



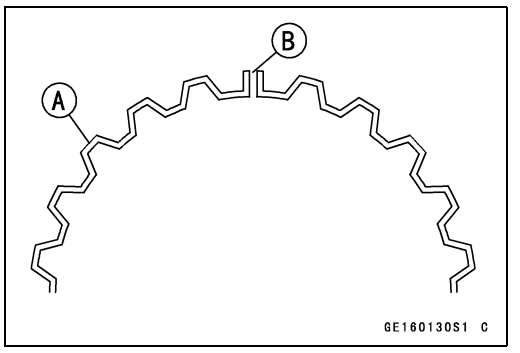
- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.



Cylinder, Piston

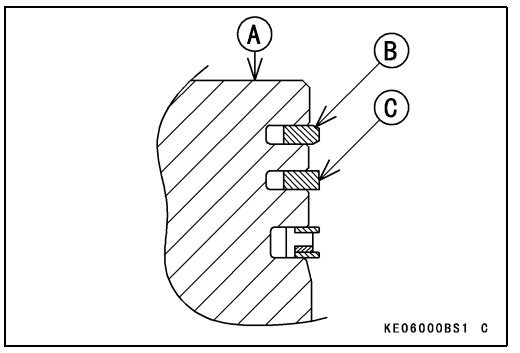
Piston Installation

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



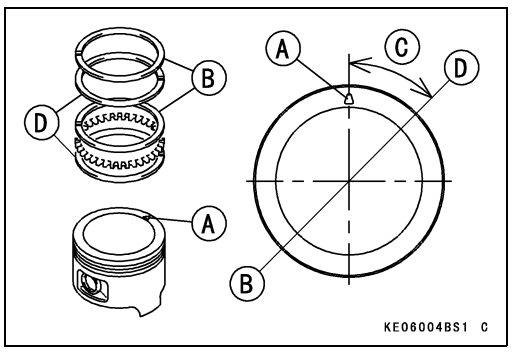
- Do not mix up the top and second rings.
- Install the second ring so that the “R” mark faces up.
- Install the top ring.
- The rings should turn freely in the grooves.

  Piston Head [A]
  Top Ring [B]
  Second Ring [C]

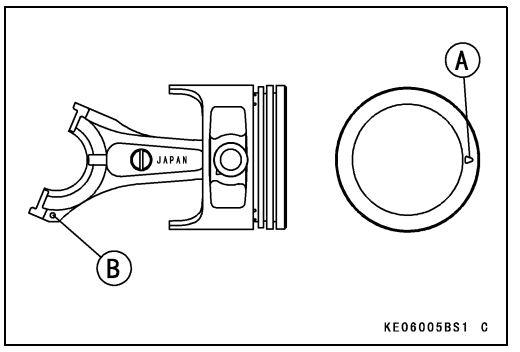


- Align the piston and rings with the piston ring end gap as shown.

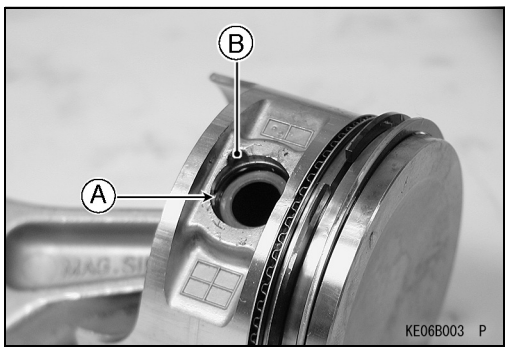
  Arrow Match Marks [A]
  Top ring End Gap, Upper Steel Rail End Gap [B]
  About 45° [C]
  Second Ring End Gap, Lower Steel Rail End Gap [D]



- Apply engine oil to the piston pins.
- Assemble the piston onto the connecting rod as follows. Set the arrow mark [A] on the piston head come reverse side of the mark [B] side of the connecting rod, then insert the piston pin into the piston pin hole.



- When installing a piston pin snap ring, compress it only enough to install it and no more. Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the notch [B] in the edge of the piston pin hole.

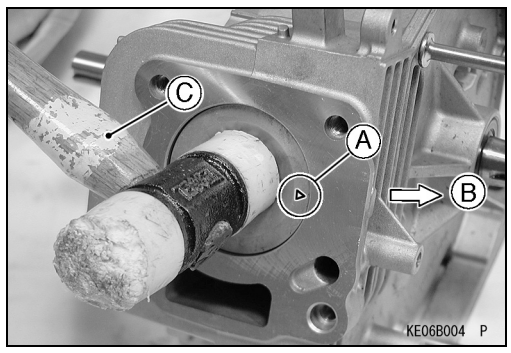


CAUTION

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

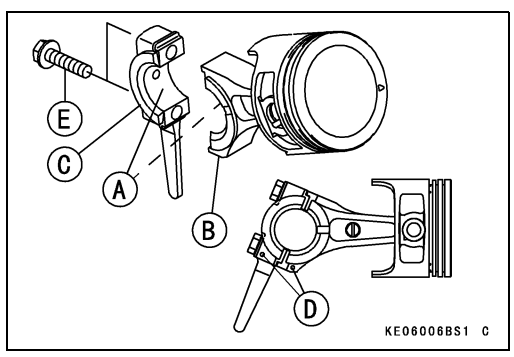
Cylinder, Piston

- Apply engine oil to the piston skirt and the cylinder bore.
- Facing the arrow mark [A] on the top of the piston toward the flywheel side [B], lightly tap the top of the piston with a plastic mallet [C] to insert the piston and connecting rod into the cylinder.



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].
- Install the connecting rod big end cap in their original position on the connecting rod big end by matching the marks [D].
- Apply a small amount of engine oil to the thread and seating surface of the cap bolts [E].
- Tighten the cap bolts.

Torque - Connecting Rod Big End Cap Bolts: 9.0 N·m (0.90 kgf·m, 80 in·lb)

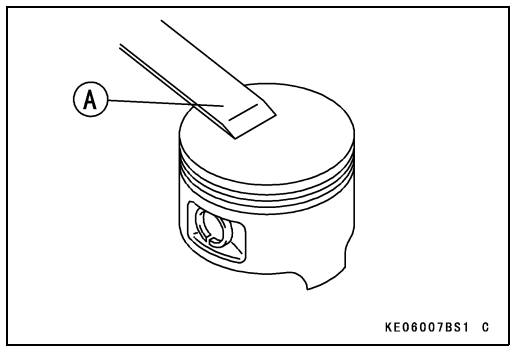
- Install the removed parts (see appropriate chapters).

Piston Cleaning

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

CAUTION

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

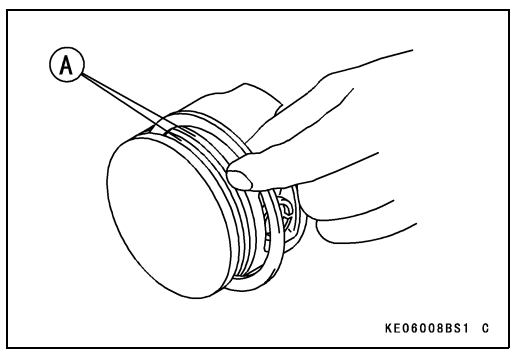


- Scrape the carbon off the piston head.
- Use the scraping tools carefully. Do not gouge the piston head. To avoid gouging, use scrapers [A] that are made of a material that will not cause damage.

- Clean the piston ring grooves [A] with a broken piston ring or other suitable tools.

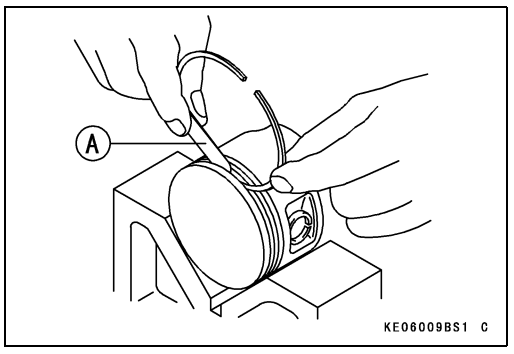
CAUTION

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



Cylinder, Piston

Piston Ring and Ring Groove Wear



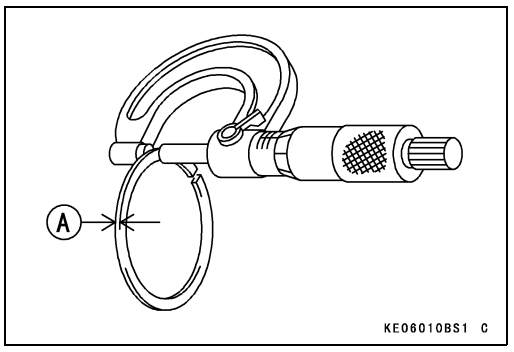
- Clean the piston (see Piston Cleaning in this chapter).
- Visually inspect the piston rings and ring grooves.
- ★If the piston rings are worn unevenly or damaged, replace them.
- ★If the ring grooves are worn unevenly or damaged, replace both the piston and piston rings.
- Measure the clearance between the top and second rings and their grooves using a thickness gauge [A].
- ★If the piston ring/groove clearance is greater than the specified value, replace the piston.

Piston Ring/Groove Clearance
Service Limit:

Top	**0.07 mm (0.003 in.)**
Second	**0.07 mm (0.003 in.)**

NOTE

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



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

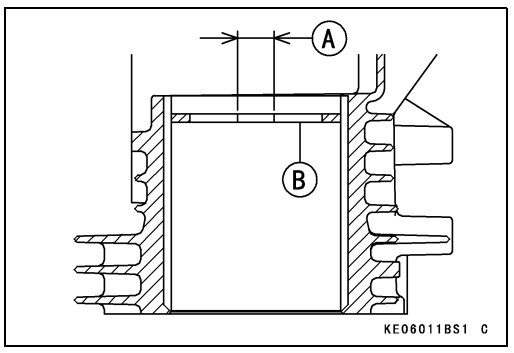
Piston Ring Thickness
Service Limit:

Top	**1.12 mm (0.044 in.)**
Second	**1.12 mm (0.044 in.)**

NOTE

○*When using new rings in a used piston, check for uneven groove wear. The rings should fit perfectly parallel to the groove sides. If not, replace the piston.*

Piston Ring End Gap



- Remove the piston rings (see Piston Removal in this chapter).
- 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.

Piston Ring End Gap
Service Limit:

Top	**0.65 mm (0.026 in.)**
Second	**0.65 mm (0.026 in.)**
Oil	**1.00 mm (0.039 in.)**

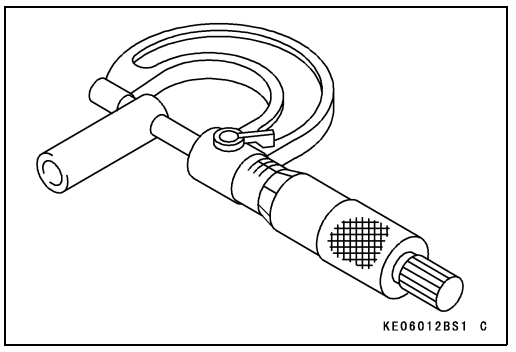
Cylinder, Piston

Piston Pin, Piston Pin Hole, and Connecting Rod Wear

- Remove the piston pin (see Piston Removal in this chapter).
- Measure the diameter of the piston pin with a micrometer at several points.

★If the outside diameter is less than service limit, replace the piston pin.

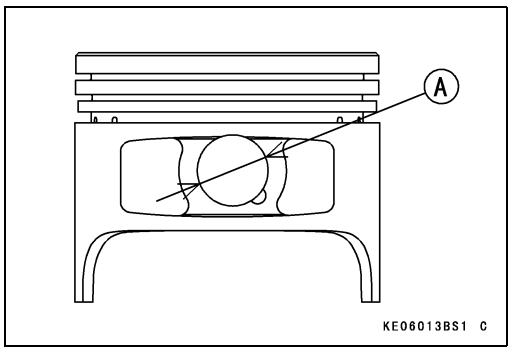
Piston Pin Outside Diameter
Service Limit: 12.95 mm (0.510 in.)



- 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 more than the service limit, replace the piston.

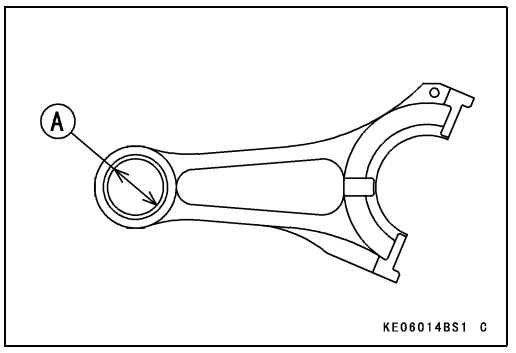
Piston Pin Hole Inside Diameter
Service Limit: 13.08 mm (0.515 in.)



- Measure the inside diameter [A] of the small end of the connecting rod at several points. Use a dial bore gauge.

★If the inside diameter is more than the service limit, replace the connecting rod.

Connecting Rod Small End Inside Diameter
Service Limit: 13.05 mm (0.514 in.)

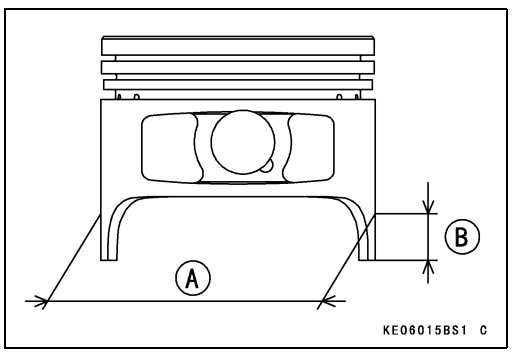


Piston Diameter

- Measure the outside diameter [A] of the piston 10 mm (0.4 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin hole.

★If the measurement is less than the service limit, replace the piston.

Piston Diameter
Service Limit: 55.28 mm (2.176 in.)



Cylinder Inside Diameter

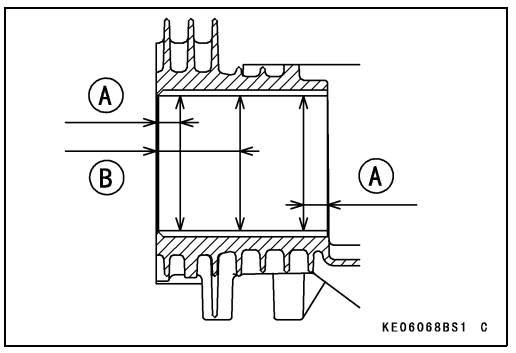
- Clean and measure the cylinder inside diameter.

○Use a dial bore gauge to measure front-to-back and side-to-side at the points as shown in the figure.
10 mm (0.4 in.) [A]
35 mm (1.4 in.) [B]

★If any of the cylinder bore measurements is greater than the service limit, replace the cylinder.

Cylinder Inside Diameter
Standard: 55.98 ~ 56.00 mm (2.204 ~ 2.205 in.)
Service Limit: 56.10 mm (2.209 in.)

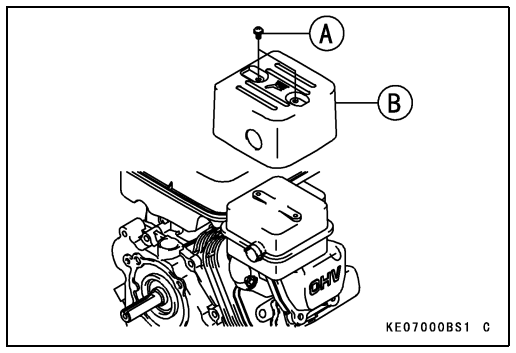
Cylinder Bore Out Round
Service Limit: 0.056 mm (0.0022 in.)



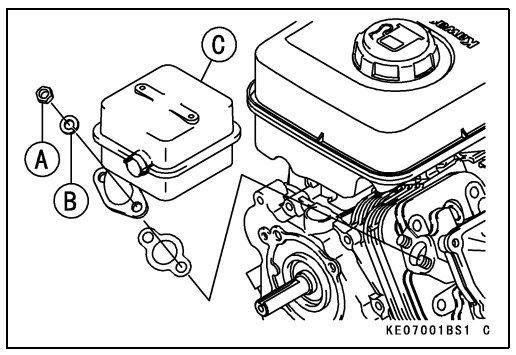
Muffler

Muffler Assembly Removal

- Remove:
  Muffler Cover Screws [A]
  Muffler Cover [B]



- Unscrew the exhaust pipe flange nuts [A], and the spring washers [B] to remove the muffler assembly [C]. Use a penetrating oil if necessary to break threads loose.
- Remove the gasket.
- Do not use unnecessary force when removing the muffler assembly, or they could become damaged or distorted.



Muffler Assembly Installation

- Clean the exhaust pipe flange and the exhaust port gasket surface and install a new gasket each time the muffler installed.
- To prevent mis-threading, finger tight the flange nuts first. Next tighten the hook nut.
- Tighten the nuts.

Torque - Exhaust Pipe Flange Nuts: 23 N·m (2.3 kgf·m, 17 ft·lb)

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

Inspection

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

★If the exhaust pipe or muffler is damaged, it should be replaced for best performance and least noise.

- Check the muffler for distortion and/or loose internal components. Loss of power could develop if loose internal muffler components restrict exhaust flow.
- Check for breaks in the seams and check weld at the junction of the exhaust pipes and muffler.
- Tap the muffler with a plastic hammer to decarbonize.

Lubrication System

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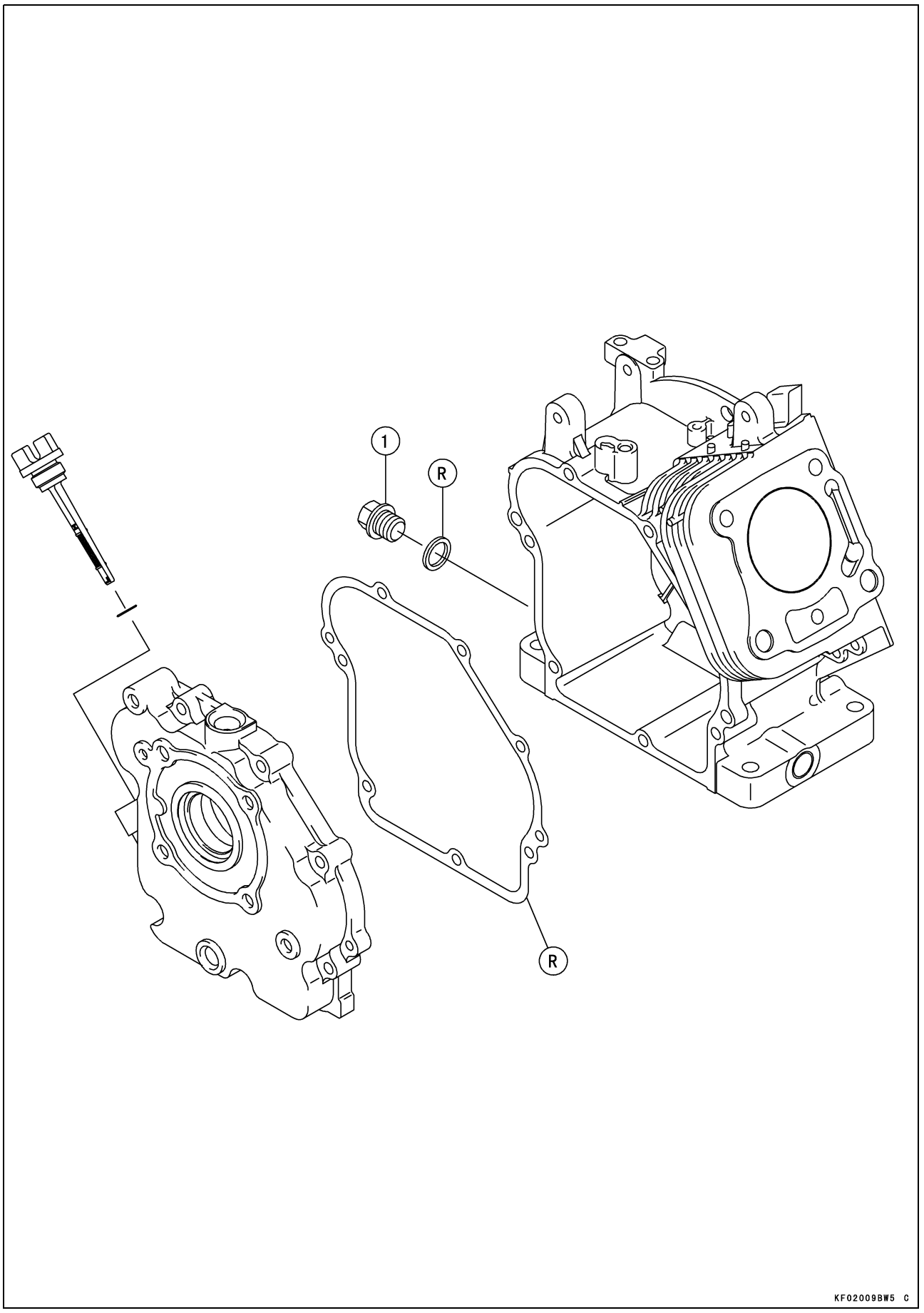
6-2 LUBRICATION SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Oil Drain Bolt	32	3.3	24	

R: Replacement Parts

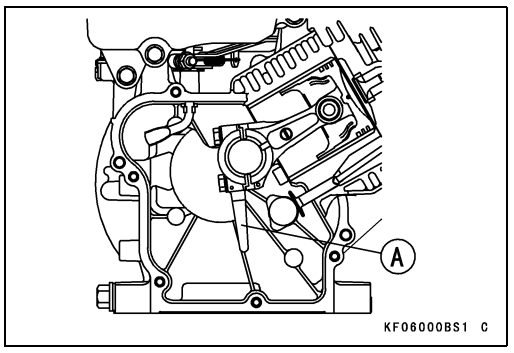
6-4 LUBRICATION SYSTEM

Specifications

Item	Standard
Engine Oil	
Type	SF, SG, SH or SJ class
Viscosity	SAE 10W-30
Capacity	0.26 ~ 0.46 L (0.27 ~ 0.49 US qt)
Level	Operating range (grid area (between L and H)) on dipstick

Lubrication Method

As shown in the right figure the revolution of the crankshaft causes the splash arm [A] that is provided at the big end of the connecting rod to pick up the engine oil from the crankshaft chamber and splash it in a spray form to lubricate the internal parts (forced splashing type).



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. **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 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.

Camshaft/Crankshaft

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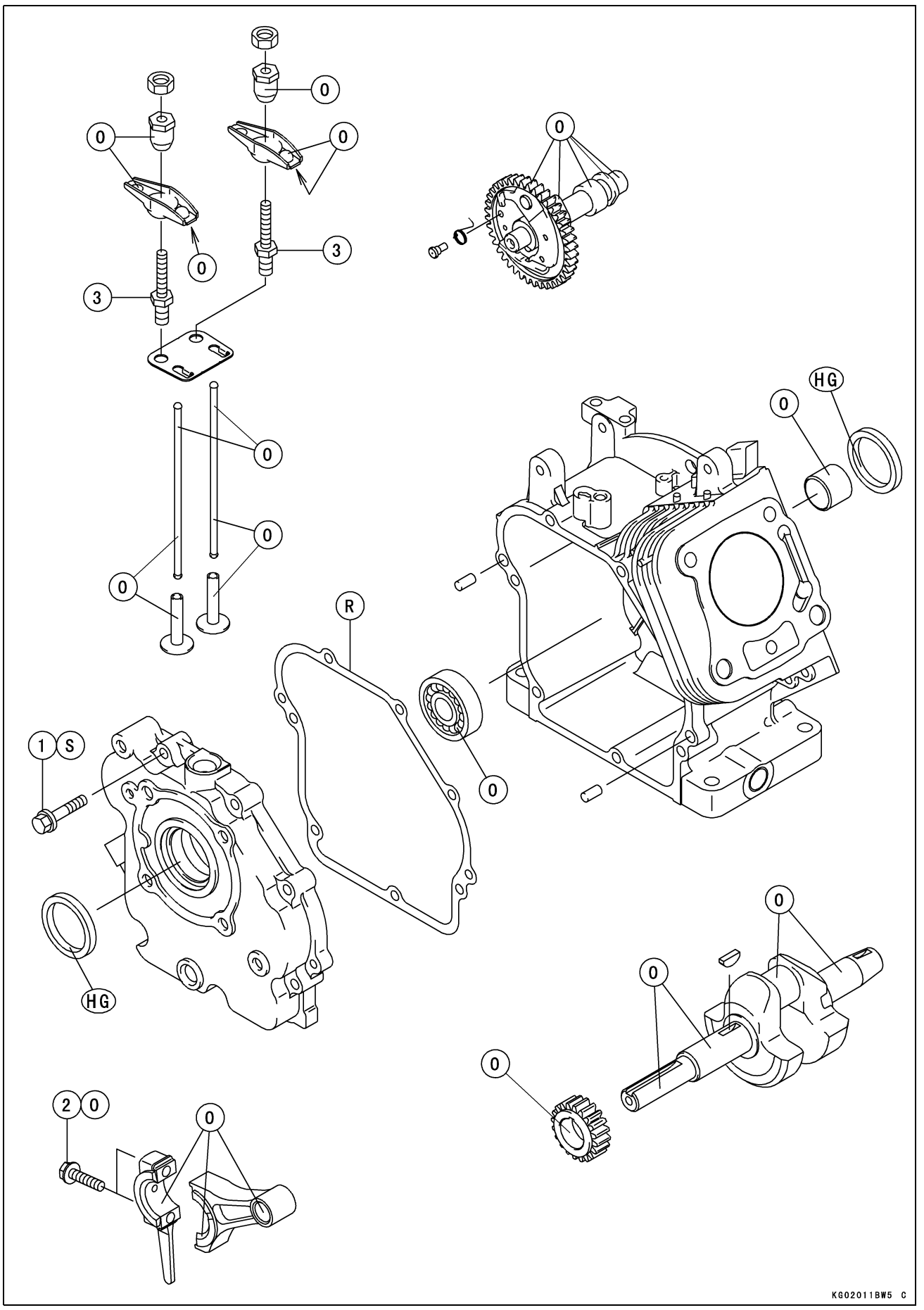
7-2 CAMSHAFT/CRANKSHAFT

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	Connecting Rod Big End Cap Bolts	9.0	0.90	80 in·lb	O
3	Rocker Arm Bolts	23	2.3	17	

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

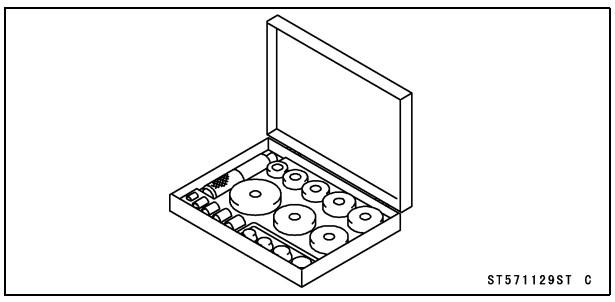
7-4 CAMSHAFT/CRANKSHAFT

Specifications

Item	Service Limit
Camshaft, Tappet	
Cam Lobe Height:	
Exhaust	25.06 mm (0.9866 in.)
Inlet	25.06 mm (0.9866 in.)
Camshaft Journal Diameter:	
PTO Side	11.94 mm (0.4701 in.)
Flywheel Side	13.93 mm (0.5484 in.)
Camshaft Bearing Inside Diameter:	
Crankcase	14.08 mm (0.5543 in.)
Crankcase Cover	12.08 mm (0.4756 in.)
Crankshaft, Connecting Rod	
Connecting Rod Bend	TIR 0.20/100 mm (0.008/3.94 in.)
Connecting Rod Twist	TIR 0.20/100 mm (0.008/3.94 in.)
Connecting Rod Big End Width	19.40 mm (0.764 in.)
Crankpin Width	20.50 mm (0.807 in.)
Connecting Rod Big End Inside Diameter	24.04 mm (0.947 in.)
Crankpin Outside Diameter	23.94 mm (0.943 in.)
Crankshaft Runout	TIR 0.05 mm (0.002 in.)
Crankshaft Journal Diameter:	
PTO Side	19.96 mm (0.786 in.)
Flywheel Side	19.96 mm (0.786 in.)
Crankcase	
Crankshaft Journal Bushing Inside Diameter:	
Crankcase	20.06 mm (0.790 in.)

Special Tool

Bearing Driver Set:
57001-1129



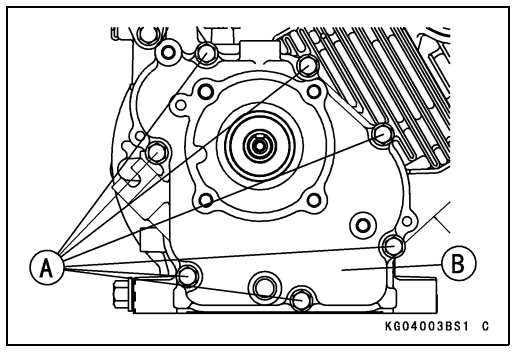
7-6 CAMSHAFT/CRANKSHAFT

Crankcase

Crankcase Cover Removal

- Drain the engine oil (see Oil Change in the Periodic Maintenance chapter).
- Unscrew the mounting bolts [A] and remove the crankcase cover [B] from the crankcase.

○There are two dowel pins on the crankcase mating surface. A wooden or plastic mallet may be used to gently tap loose the crankcase cover.

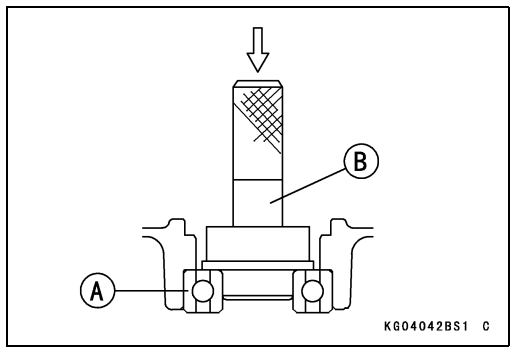


CAUTION

Do not remove the ball bearing or the oil seal unless it is necessary. If removed, replace it with a new one.

- Remove the oil seal with a screw driver.
- Using the bearing driver set [B] push out the ball bearing [A].

Special Tool - Bearing Driver Set: 57001-1129



Crankcase Cover Installation

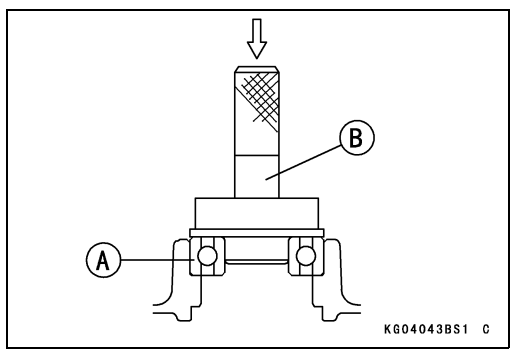
- Scrape off the old gasket from the mating surfaces of the crankcase and the cover.
- With a high-flash point solvent, clean off the mating surfaces of the crankcase and the cover, and wipe dry.

⚠ WARNING

Clean the crankcase 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.

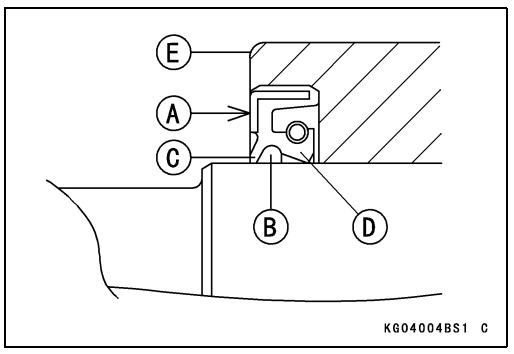
- Clean the bearing housing.
- Apply engine oil to a new ball bearing.
- Using the bearing driver set [B], install the new ball bearing [A] until it stops at the bottom of its housing.

Special Tool - Bearing Driver Set: 57001-1129

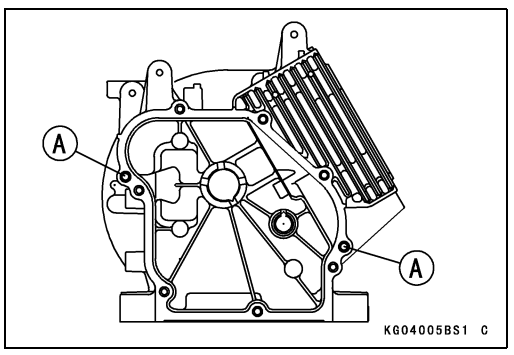


Crankcase

● Be sure to replace any oil seal removed with a new seal.
○Install the oil seal so that the marks [A] face out.
○Thoroughly pack high-temperature grease to 60% volume into the space [B] between the seal lip [D] and dust lip [C]. Press in the new oil seal using a press or suitable tools until it is flush with flange surface [E] or maximum 0.5 mm (0.02 in.) lower than the flange surface. Do not damage the seal lip.



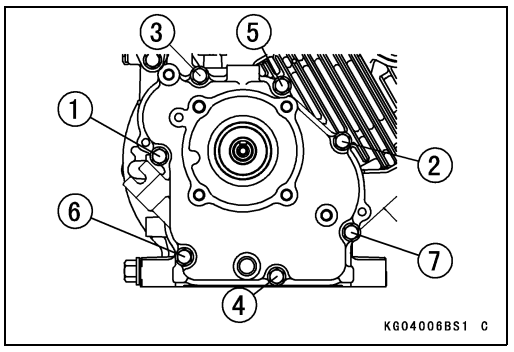
● Check to see that the crankcase dowel pins [A] are in place (5.5 ±0.5 mm (0.21 ±0.02 in.)) on the crankcase.
● Install the new gasket on the crankcase.



● Install the crankcase cover and tighten the crankcase cover bolts following the tightening sequence shown.
○Make sure that the governor gear engages with crankshaft gear properly. After installing, check that the governor shaft moves smoothly.

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

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



Crankcase Cover Cleaning

● Remove:
Crankcase Cover (see Crankcase Cover Removal in this chapter)
● Clean up the crankcase cover with a high-flash point solvent, and blow out any foreign particles that may be in the pockets inside of the cover with compressed air.

⚠ WARNING

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

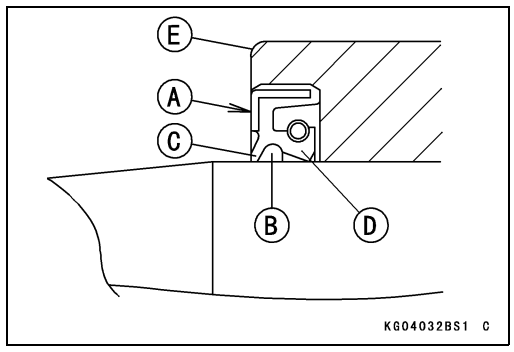
Crankcase Disassembly

● Remove:
Crankcase Cover (see Crankcase Cover Removal in this chapter)
Camshaft and Tappets (see Camshaft, Tappet Removal in this chapter)
Connecting Rod and Piston (see Piston Removal in the Engine Top End chapter)
Crankshaft (see Crankshaft Removal in this chapter)
● Remove the oil seal with a screw driver.

Crankcase

Crankcase Assembly

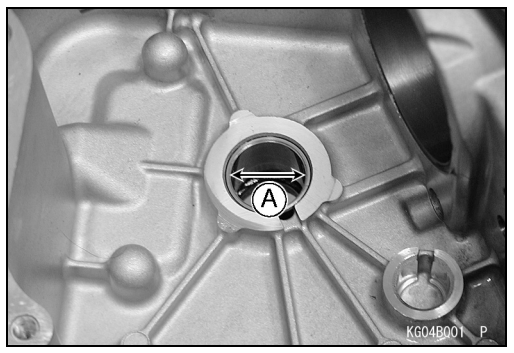
● Be sure to replace any oil seal removed with a new seal.
○Install the oil seal so that the marks [A] face out.
○Thoroughly pack high-temperature grease to 60% volume into the space [B] between the seal lip [D] and dust lip [C]. Press in the new oil seal using a press or suitable tools until it is flush with flange surface [E] or maximum 0.5 mm (0.02 in.) lower than the flange surface. Do not damage the seal lip.



Crankcase Inspection

● Measure the inside diameter [A] of the crankshaft journal bushing on the crankcase at several points. Replace the journal bushing if the inside diameter is more than the service limit.

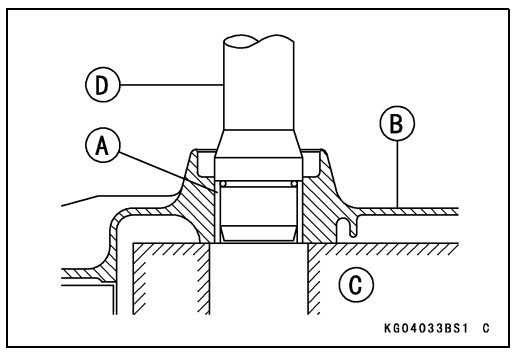
Crankshaft Journal Bushing Inside Diameter
Service Limit: 20.06 mm (0.790 in.)



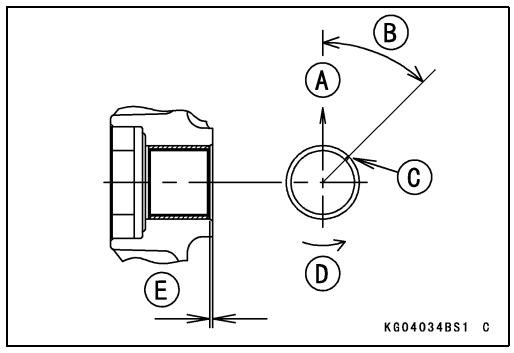
Journal Bushing Replacement

The journal bushing [A] is press fit into the crankcase [B].

● Remove the oil seal on the crankcase (see Crankcase Disassembly in this chapter).
● Place the crankcase on a support block [C] with the oil seal side up.
● Using a bushing tool [D], drive out the journal bushing as shown.



● The journal bushing is to be reinstalled using a bushing tool.
● Coat the journal bushing and flange surface with light film of engine oil, press in the new journal bushing as shown.
Cylinder Direction [A]
30 ~ 60° [B]
Journal Bushing Mating Surface [C]
Rotation Direction [D]
1 ~ 1.5 mm (0.04 ~ 0.06 in.) [E]
● No finish reaming is required.



Crankcase

Crankcase Cleaning

- Remove:
  Camshaft and Tappets (see Camshaft, Tappet Removal in this chapter)
  Connecting Rod and Piston (see Piston Removal in the Engine Top End chapter)
  Crankshaft (see Crankshaft Removal in this chapter)
- Clean up the crankcase 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

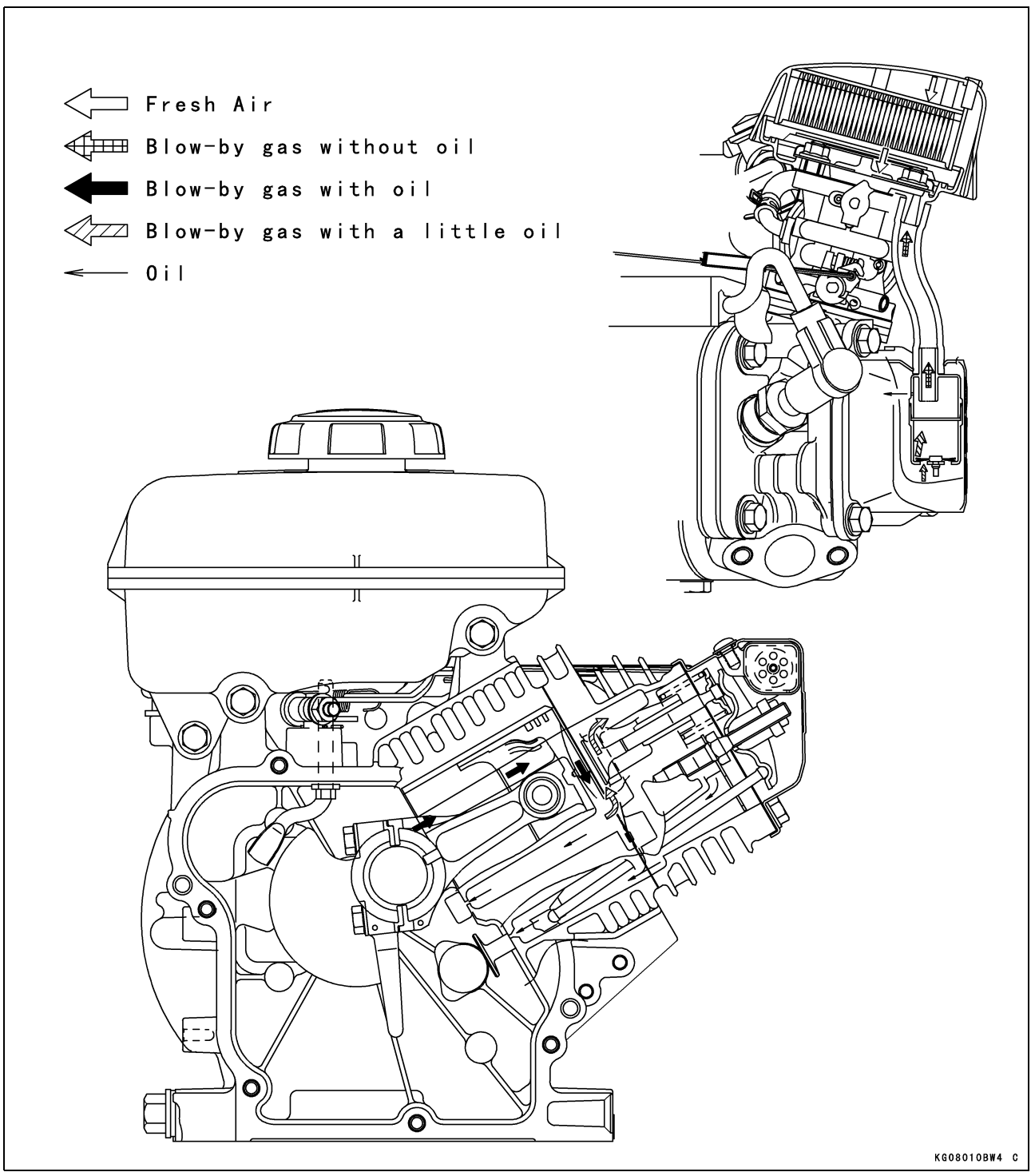
Clean the crankcase in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low -flash point washing.

7-10 CAMSHAFT/CRANKSHAFT

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. A sealed-type crankcase emission control system is used to prevent blow-by gases from emitting in the air. The blow-by gases are drawn into the clean side of the air cleaner through the crankcase and the cylinder head and mixed with the clean air flow, and subsequently comes into the combustion chamber through the carburetor.

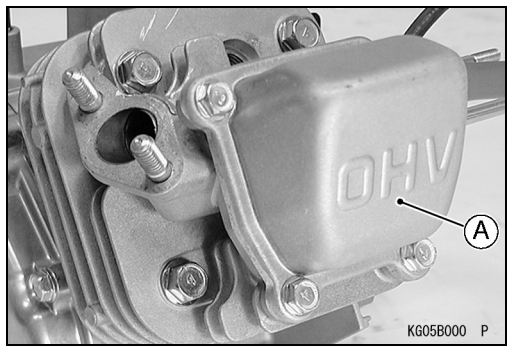
Oil is primarily separated from the gases while passing through the inside of the rocker chamber from the crankcase, and secondly separated from the gases in the breather chamber, and then brought back to the crankcase cover.



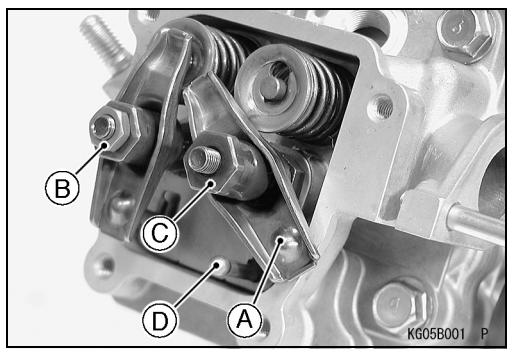
Camshaft, Tappet

Camshaft, Tappet Removal

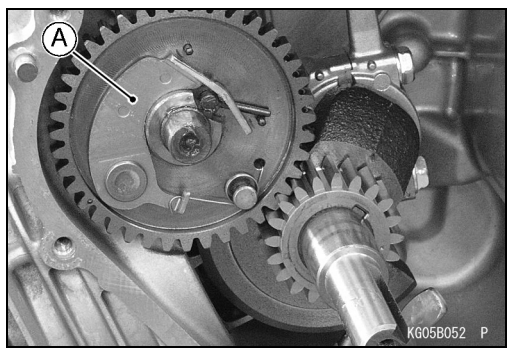
- Drain the engine oil (see Oil Change in the Periodic Maintenance chapter).
- Remove:
  Muffler Assembly (see Muffler Assembly Removal in the Engine Top End chapter)
  Crankcase Cover (see Crankcase Cover Removal in this chapter)
  Rocker Cover [A] (see Cylinder Head Assembly Removal in the Engine Top End chapter)



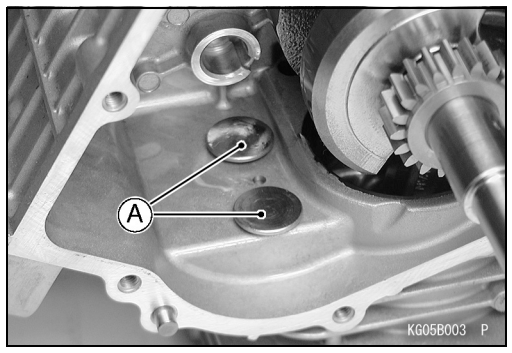
- Position the piston TDC at the end of the compression stroke.
- Remove the locknuts [B] and the valve clearance adjusting nuts [C] which install the rocker arms [A], and pull the rocker arm off the push rods [D].
- Remove the push rods and mark them so they can be installed in their original positions during assembly.



- Pull the camshaft [A] out of the crankcase.

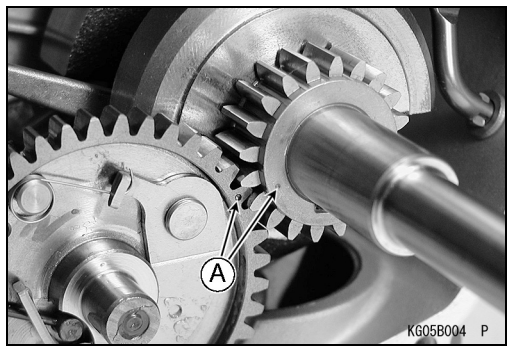


- Remove the tappets [A] and mark them so they can be installed in their original positions during assembly.



Camshaft, Tappet Installation

- Apply engine oil to the following.
  Tappet Journal
  Camshaft Journal
  Cam Lobe Surface
  Camshaft Gear
- Install the tappets in their original positions.
- Align the punch marks [A] on the crankshaft gear and on the camshaft gear.



Camshaft, Tappet

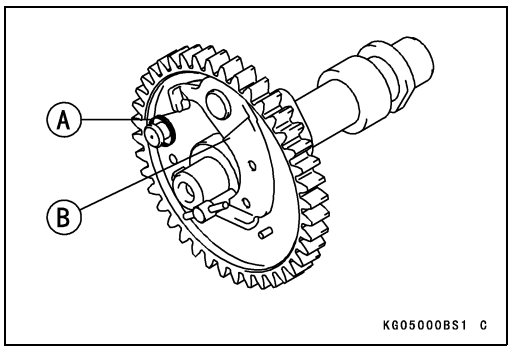
- Install the push rods (see Push Rod Installation in the Engine Top End chapter).
- Mount the rocker arms on the push rods, and install the valve clearance adjusting nuts and locknuts.

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

- Adjust the valve clearance (see Valve Clearance Adjustment in the Periodic Maintenance chapter).
- Install the removed parts (see appropriate chapters).

Camshaft Disassembly

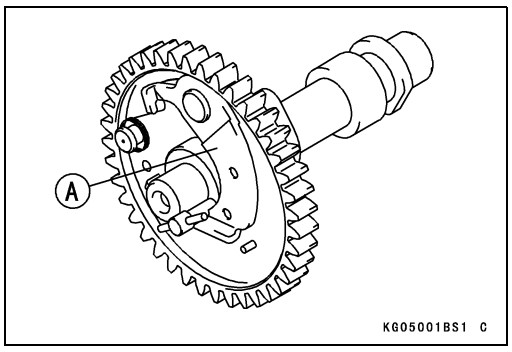
- Remove the camshaft (see Camshaft, Tappet Removal in this chapter).
- Remove:
  Spring [A]
  ACR (Automatic Compression Release) Weight [B]



Camshaft Assembly

- After assembling the camshaft, check the following items.

○While shaking the camshaft, ACR weight [A] swings smoothly.



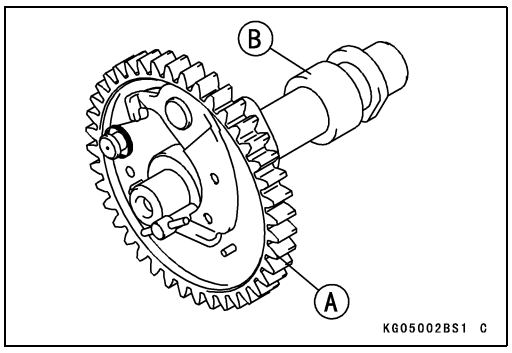
Camshaft Inspection

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

★Replace the shaft if necessary.

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

★Replace the shaft if necessary.

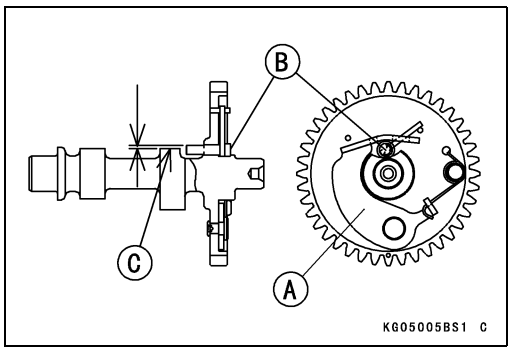


- Inspect the camshaft to make sure that its ACR (Automatic Compression Reduction) function operates smoothly and does not have any damage or abnormal wear.

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

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

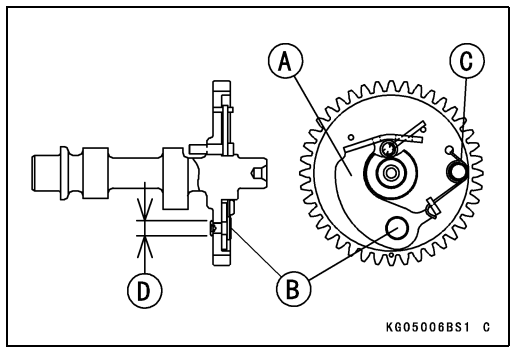
★When weight is pulled entirely outward with your finger, if the top of the shaft is higher than the cam base, replace the ACR with a new one.



Camshaft, Tappet

The ACR Weight Installation

- Align the pin hole of the ACR weight [A] and that of the camshaft gear.
- Insert the pin [B] from the weight side and caulk it on the reverse end.
  Caulking Diameter: ϕ4.4 ~ ϕ4.6 (0.173 ~ 0.181 in.) [D]
- Hook the spring [C] on the weight.
- Check that the weight moves smoothly.



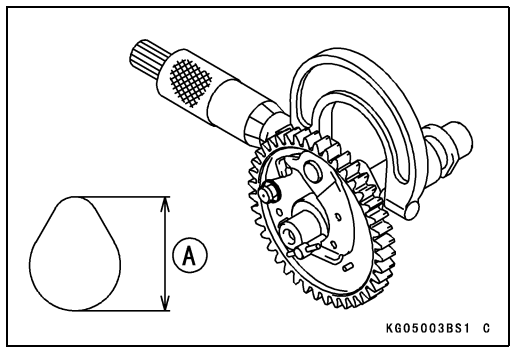
Camshaft Bearing/Journal Wear

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

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

Cam Lobe Height
Service Limit:

Exhaust	**25.06 mm (0.9866 in.)**
Inlet	**25.06 mm (0.9866 in.)**

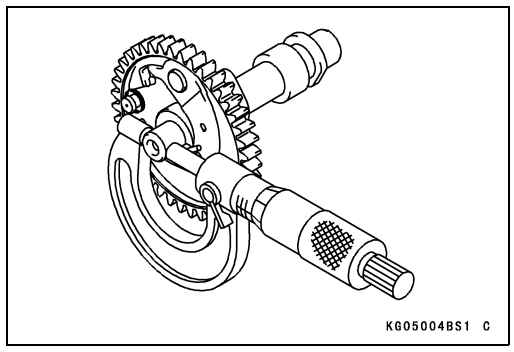


- Measure camshaft journals at several points around the journal circumference.

★If the journal diameter is less than the service limit, replace the camshaft.

Camshaft Journal Diameter
Service Limit:

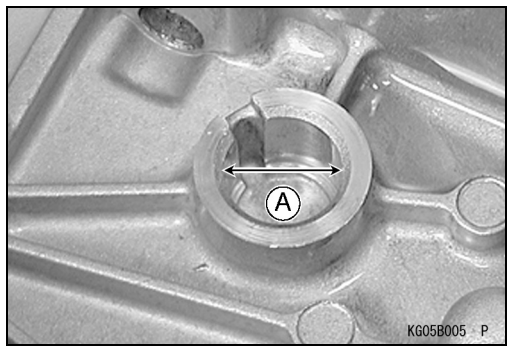
PTO Side	**11.94 mm (0.4701 in.)**
Flywheel Side	**13.93 mm (0.5484 in.)**



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

★Replace the crankcase if the inside diameter is more than the service limit.

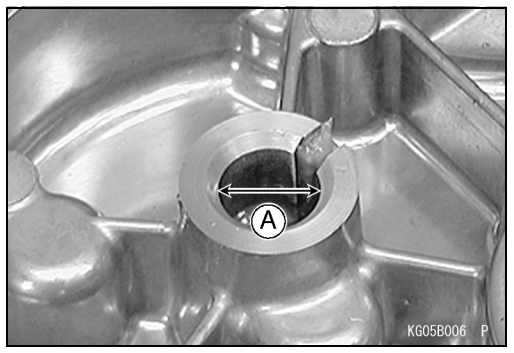
Camshaft Bearing Inside Diameter (Crankcase)
Service Limit: 14.08 mm (0.5543 in.)



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

★Replace the crankcase cover if the inside diameter is more than the service limit.

Camshaft Bearing Inside Diameter (Crankcase Cover)
Service Limit: 12.08 mm (0.4756 in.)



Crankshaft, Connecting Rod

Connecting Rod Removal

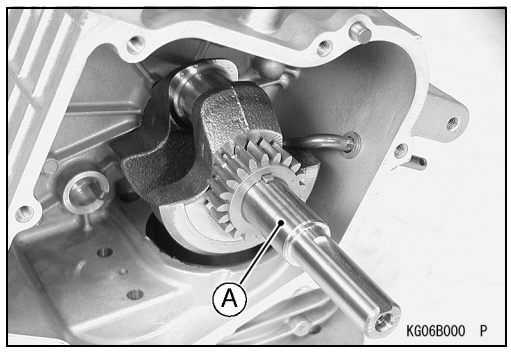
● Remove:
Piston (see Piston Removal in the Engine Top End chapter)

Connecting Rod Installation

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

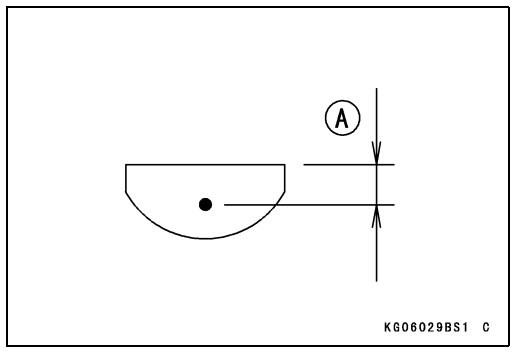
Crankshaft Removal

● Drain the engine oil (see Oil Change in the Periodic Maintenance chapter).
● Remove:
Flywheel (see Flywheel Removal in the Electrical System chapter)
Camshaft and Tappets (see Camshaft, Tappet Removal in this chapter)
Connecting Rod and Piston (see Piston Removal in the Engine Top End chapter)
● 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, especially at the bearing contact surfaces.
● Check the governor shaft 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 to the PTO side, journal crank pin and bearing.
● Put the key in the keyway of the crankshaft.
○When the key is replaced with a new one, punch the new key on one side to fill the clearance between the key and keyway.
3.5 mm (0.14 in.) [A]
● Install the crankshaft gear.
● Insert the crankshaft into the crankcase.
● Install the removed parts (see appropriate chapters).

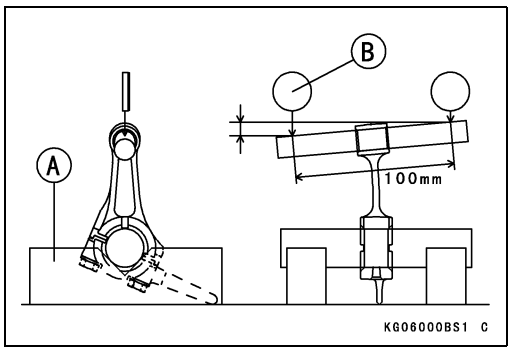


Cleaning/Inspection

● After removing, clean the crankshaft and connecting rod with a high-flash point washing 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 if necessary.
● Inspect the crankshaft and connecting rod especially at the bearing surfaces for wear, scratches, evidence of improper contact or other damages.
★Replace them if necessary.

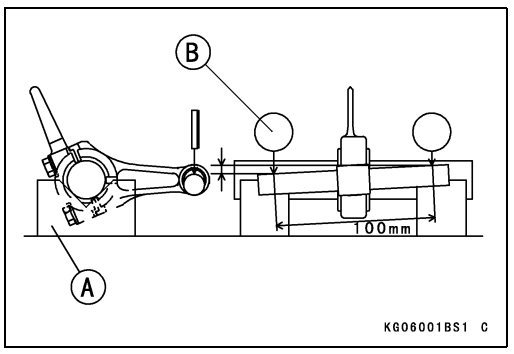
Crankshaft, Connecting Rod

Connecting Rod Bend/Twist



● Measure connecting rod bend.
○Select an arbor of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
○Select an arbor of the same diameter as 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 dial gauge [B] to measure the difference in the height of the small end arbor above the surface plate over a 100 mm (3.94 in.) length to determine the amount of connecting rod bend.
★If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

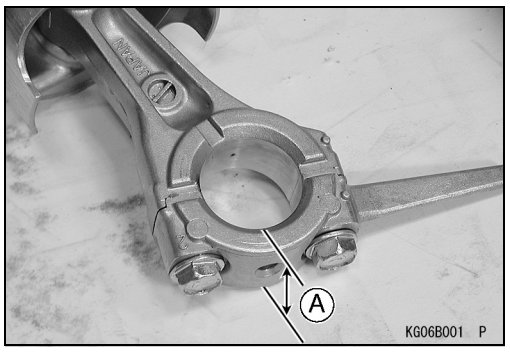
Connecting Rod Bend
Service Limit: TIR 0.20/100 mm (0.008/3.94 in.)



● Measure connection rod twist.
○With the big-end arbor still on the V blocks [A], hold the connection rod horizontally and measure the amount that the small end arbor varies from being parallel with the surface plate over a 100 mm (3.94 in.) length of the arbor to determine the amount of connecting rod twist by using a dial gauge [B].
★If connection rod twist exceeds the service limit, the connecting rod must be replaced.

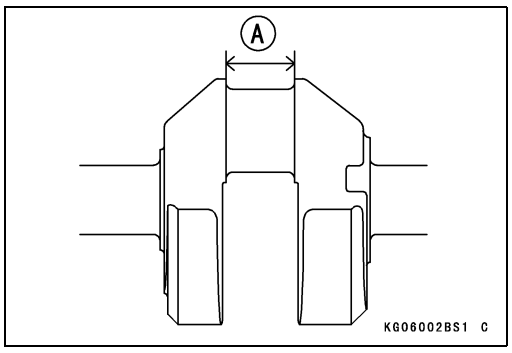
Connecting Rod Twist
Service Limit: TIR 0.20/100 mm (0.008/3.94 in.)

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.

Connecting Rod Big End Width
Service Limit: 19.40 mm (0.764 in.)



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

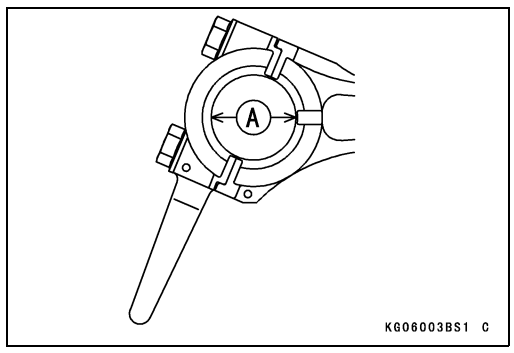
Crankpin Width
Service Limit: 20.50 mm (0.807 in.)

Crankshaft, Connecting Rod

Connecting Rod Big End Bearing/Crankpin Wear

- Apply a thin film of engine oil on the thread 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 inside diameter [A] of big end at several points with a telescoping gauge or inside micrometer.

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

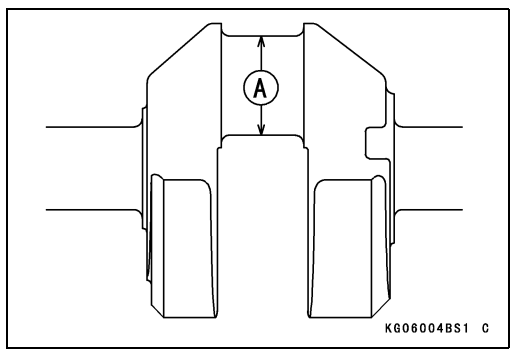


Connecting Rod Big End Inside Diameter
Service Limit: 24.04 mm (0.947 in.)

- 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: 23.94 mm (0.943 in.)

Crankshaft Runout

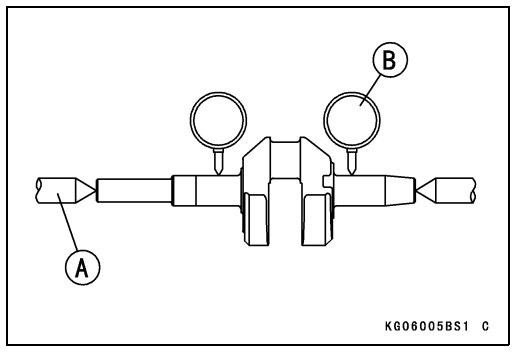
- Measure the crankshaft runout.

○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.

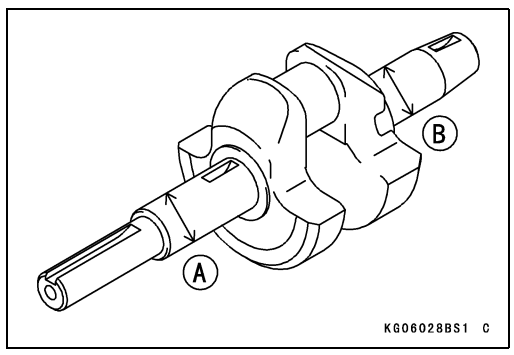


Crankshaft Runout
Service Limit: TIR 0.05 mm (0.002 in.)

Crankshaft Main Journal/Wear

- Measure both main 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]	**19.96 mm (0.786 in.)**
Flywheel Side [B]	**19.96 mm (0.786 in.)**

Electrical System

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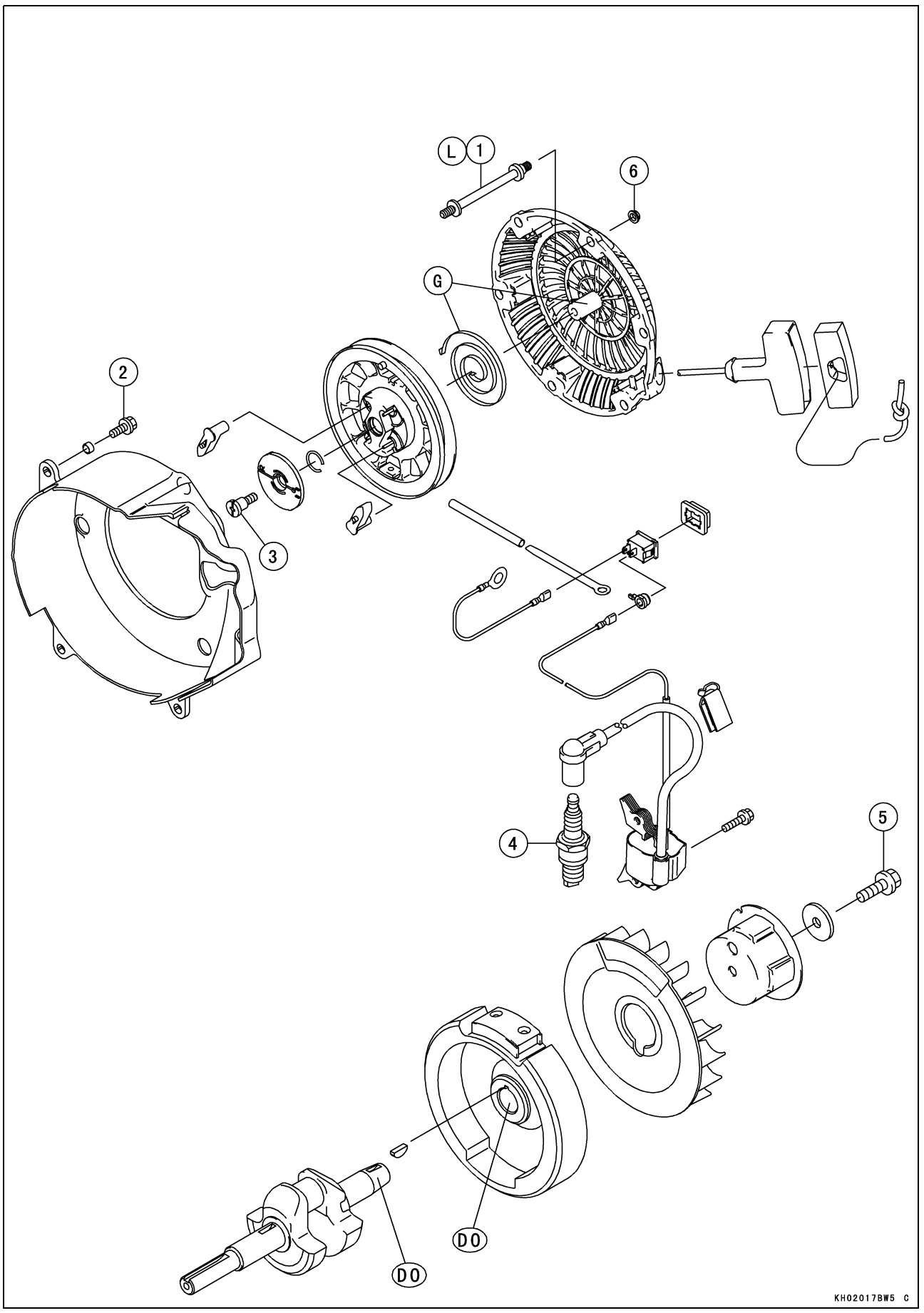
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Recoil Starter Mounting Stud Bolts	7.8	0.80	69 in·lb	L
2	Fan Housing Bolts	8.8	0.90	78 in·lb	
3	Recoil Starter Retainer Screw	3.4	0.35	30 in·lb	
4	Spark Plug	23	2.3	17	
5	Flywheel Bolt	25	2.5	18	
6	Recoil Starter Mounting Nuts	6.9	0.70	61 in·lb	

DO: Treat deoiling on the tapered shaft.
G: Apply grease.
L: Apply a non-permanent locking agent.

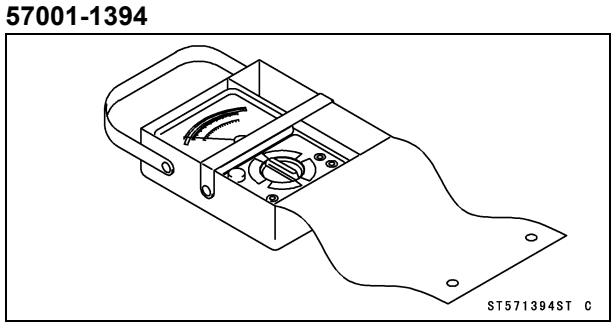
8-4 ELECTRICAL SYSTEM

Specifications

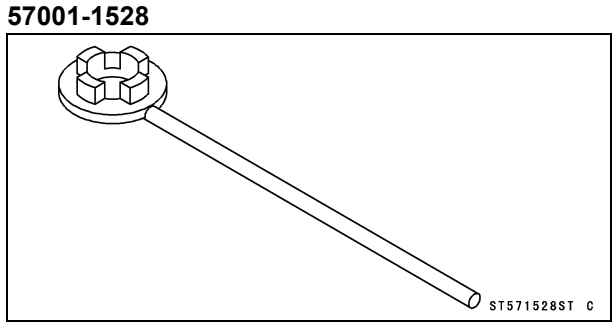
Item	Standard	Service Limit
Ignition System		
Ignition Coil:		
Primary Winding Resistance	About 1.3 Ω	– – –
Secondary Winding Resistance	About 15.5 kΩ	– – –
Spark Plug	NGK B6HS/BR6HS	– – –
Plug Gap	0.6 ~ 0.7 mm (0.02 ~ 0.03 in.)	– – –

Special Tools

Hand Tester:
57001-1394

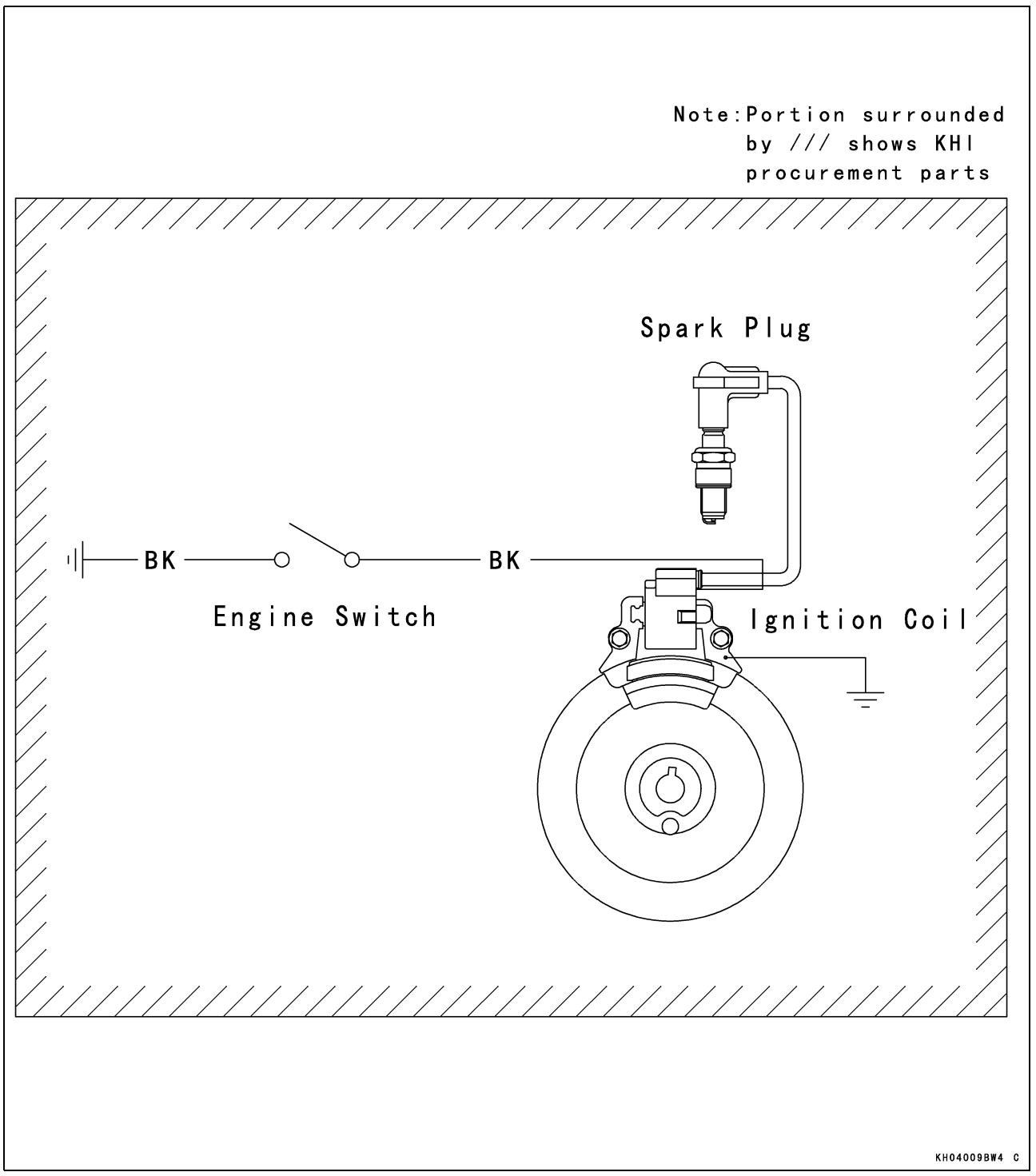


Pulley Holder:
57001-1528



8-6 ELECTRICAL SYSTEM

Wiring Diagram

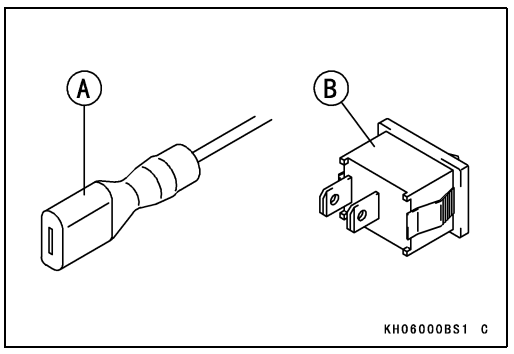


Precautions

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

- The electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock to the parts can damage them.
- Troubles may involve one or in some cases all items. Never replace a defective part without determining what CAUSED the failure. If the failure was brought on by some other item or items, they too must be repaired or replaced, or the replacement part will soon fail again.
- Make sure all connectors in the circuit are clean and tight, and examine wires for signs of burning, fraying, etc. Poor wires and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).

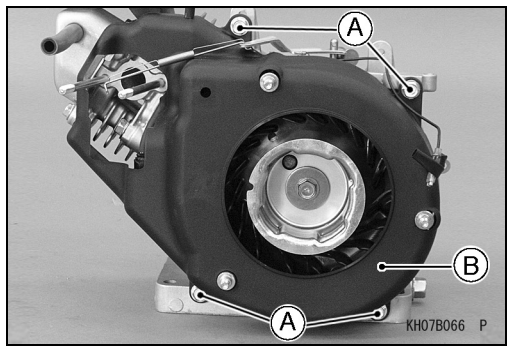
- Electrical Connectors:
  Female Connectors [A]
  Male Connectors [B]



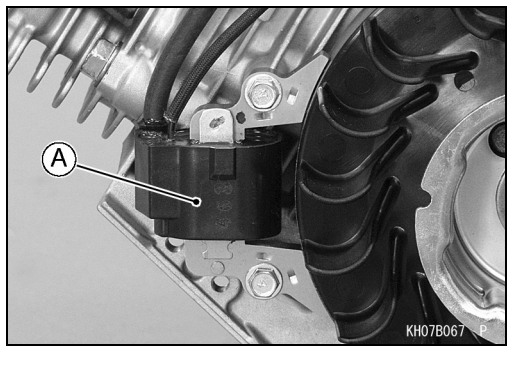
Charging, Ignition System

Flywheel Removal

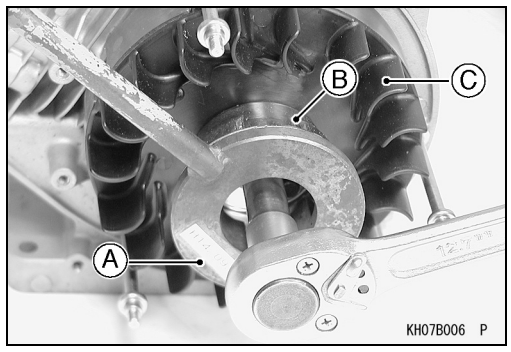
- Remove:
  Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)
  Air Cleaner Body (see Air Cleaner Body Removal in the Fuel System chapter)
  Carburetor (see Carburetor Removal in the Fuel System chapter)
  Recoil Starter (see Recoil Starter Removal in this chapter)
  Control Panel Assembly (see Control Panel Assembly Removal in the Fuel System chapter)
- Loosen the fan housing bolts [A] and remove the fan housing [B].



- Remove:
  Ignition Coil [A] (see Ignition Coil Removal in this chapter)

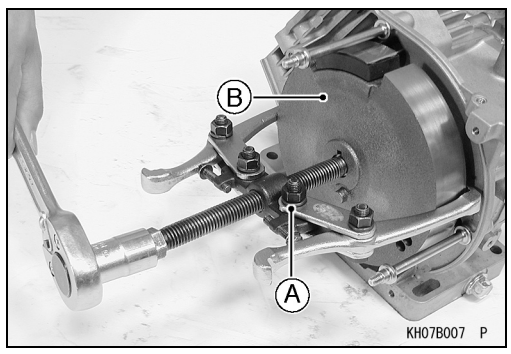


- Using a pulley holder [A] to hold the pulley [B], remove the flywheel bolt and washer, then remove the pulley and fan [C].
  Special Tool - Pulley Holder: 57001-1528



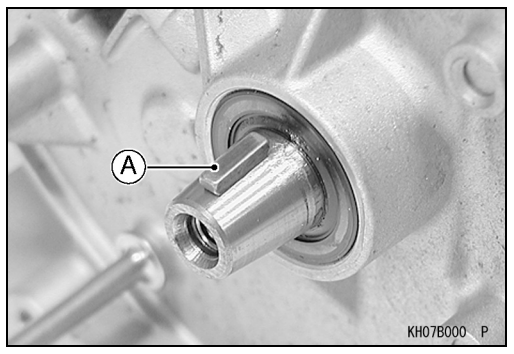
- Using a suitable flywheel puller [A], remove the flywheel [B].

CAUTION
Always use flywheel puller.

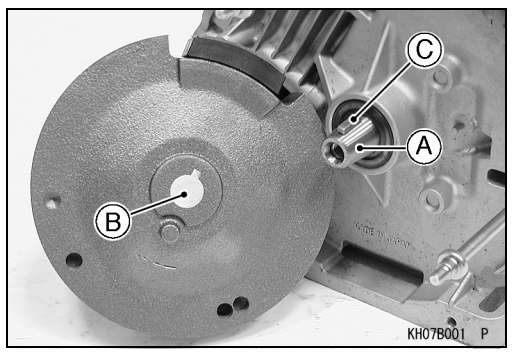


Charging, Ignition System

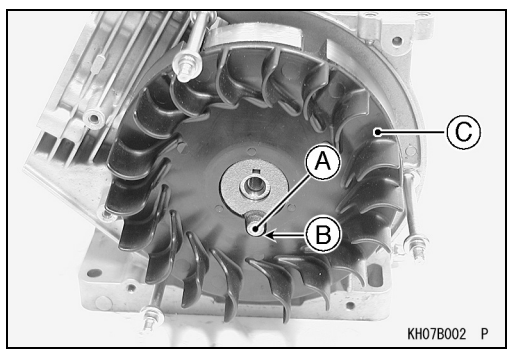
● Remove:
Woodruff Key [A]



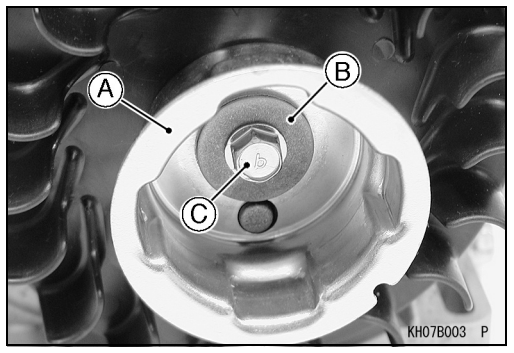
Flywheel Installation
● Using a cleaning fluid, clean off any oil or dirt on the following portions and dry them with a clean cloth.
Crankshaft Tapered Portion [A]
Flywheel Tapered Portion [B]
○Treat deoiling the tapered portion of the flywheel and crankshaft.
● Fit the Woodruff key [C] securely in the 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.



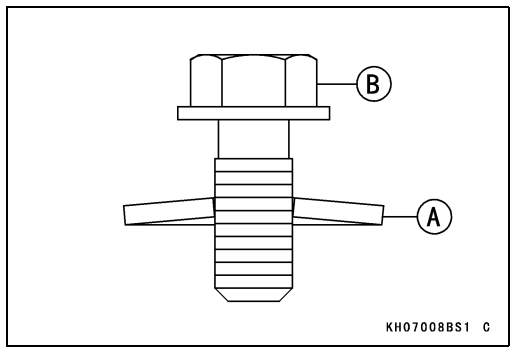
● Install the fan [C] so that the protruded portion [A] of the flywheel inserts into the slot [B] in the fan.



● Install the pulley [A] and the washer [B], and tighten the flywheel bolt [C].
Torque - Flywheel Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)



○Install the washer [A] with its convex surface upward as shown in the figure.
Flywheel Bolt [B]
● Install:
Ignition Coil (see Ignition Coil Installation in this chapter)
● Install the fan housing and tighten the bolts after inserting the collar.
Torque - Fan Housing Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)
● Install the removed parts (see appropriate chapters).



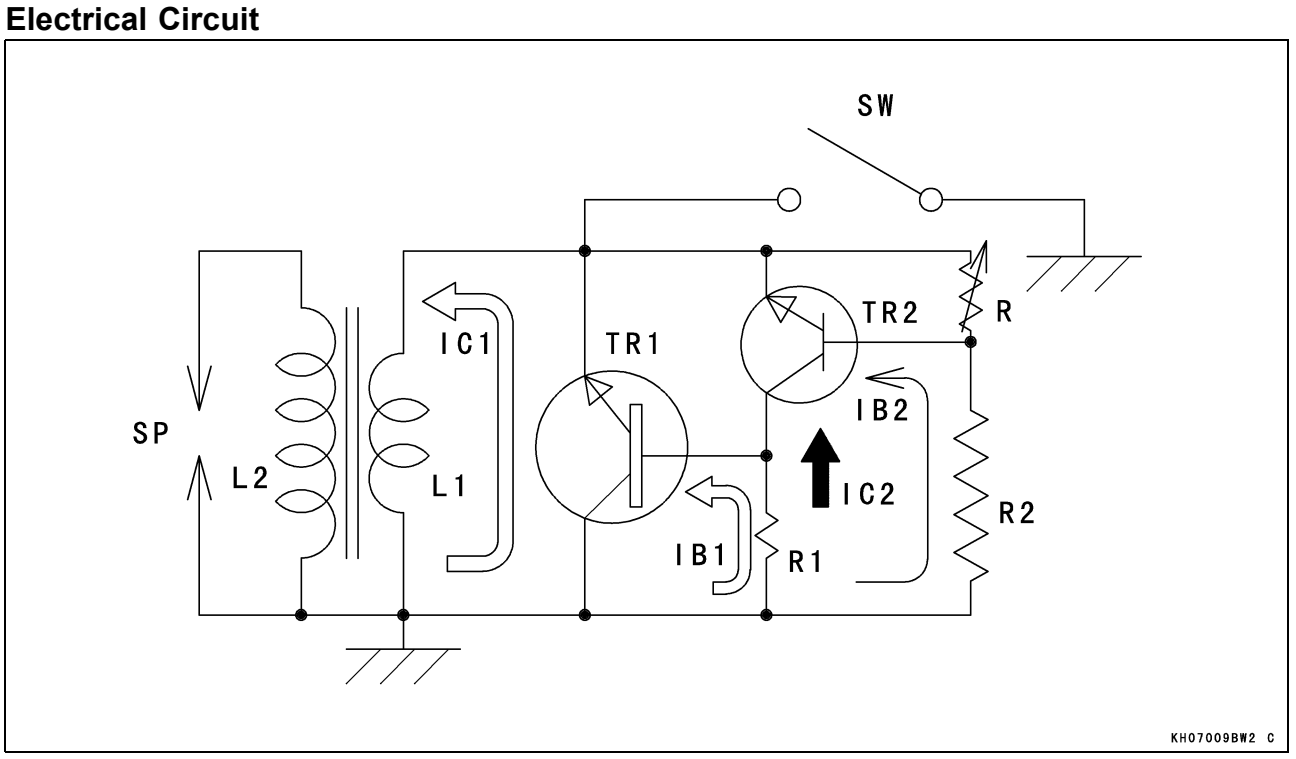
8-10 ELECTRICAL SYSTEM

Charging, Ignition System

The ignition system is the voltage-interruption method which interrupts the primary current conducted by turning the flywheel and generates the high secondary voltage, and therefore this system is basically the same as the traditional system of mechanical contact parts.

As compared with the traditional mechanical parts and condenser, a transistor in the igniter serves as an interrupter of the current. This system is called TIC (Transistor Ignition Control).

Electrical Circuit



L1: Ignition Coil (Primary)
L2: Ignition Coil (Secondary)
R1: Resistance to regulate the base current of TR1
R2: Resistance to regulate the base current of TR2
SP: Spark Plug
SW: Stop Switch
TR1: Power Transistor
TR2: Drive Transistor

Ignition Theory of Operation

1. The revolution of the flywheel generates a voltage in the L1, causing a base current IB1 to flow from TR1. Then, current IC1 that is amplified by TR1 flows to form the primary circuit.
2. The flywheel revolves further and the voltage that is generated in the L1 increases. When the flywheel reaches the position of the ignition timing, the generated voltage overcomes the resistance R2, causing a base current IB2 to flow to transistor TR2. At that instant, the current changes into collector current IC2, which is amplified by transistor TR2.
3. In the meantime, because the internal resistance of TR2 is considerably lower than TR1, IB1 that was flowing through TR1 until then will turn into IC2, thus changing its direction to flow via TR2.
4. In this manner, base current IB1 of TR1 will not momentarily flow, thus causing large current IC1 that was flowing in the L1 until then to stop suddenly.
5. Due to the sudden change in the current in the primary circuit, a high voltage is generated in secondary side L2, causing spark plug to spark.

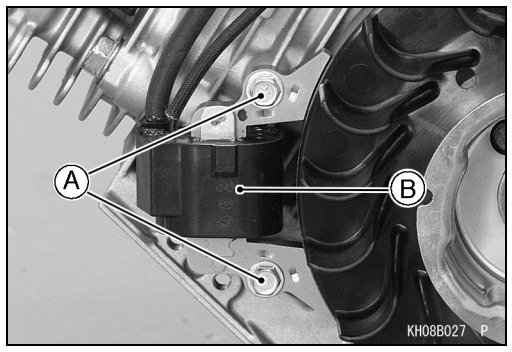
Handling and Maintenance Care

1. Do not bring the Igniter near fire.
2. Ignition timing is fixed and no necessary for adjusting.
3. In case of spark test, pull the recoil starter grip with all your strength to obtain a required speed of the flywheel for sparking.

Charging, Ignition System

Ignition Coil Removal

● Remove:
Fan Housing (see Flywheel Removal in this chapter)
Spark Plug Cap
Bolts [A]
Ignition Coil [B]



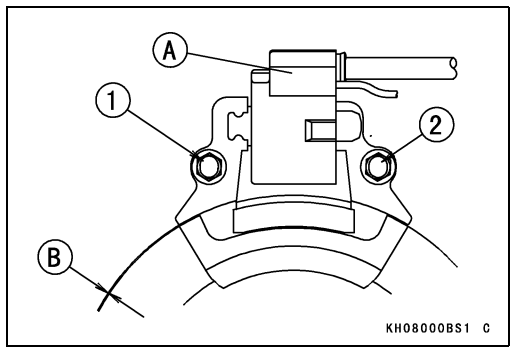
Ignition Coil Installation

● Install ignition coil [A] on the crankcase. 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: 0.25 ~ 0.40 mm (0.010 ~ 0.016 in.)

NOTE

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

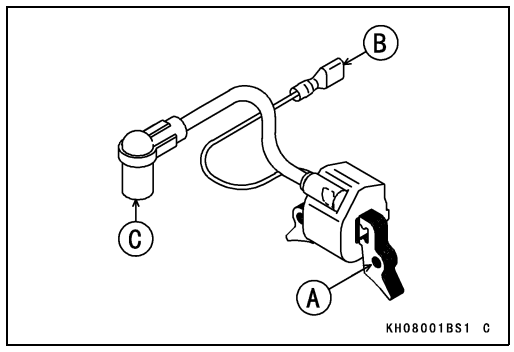


Ignition Coil Inspection

● Remove the ignition coil (see Ignition Coil Removal in this chapter).
● 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 ×1 kΩ range to measure between other two terminals.

Special Tool - Hand Tester: 57001-1394

○Make the measurements shown in the table.



Ignition Coil Winding Resistance

+ / –	A	B	C
A	–	0 ~ 2 Ω	12 ~ 22 kΩ
B	0 ~ 2 Ω	–	12 ~ 22 kΩ
C	12 ~ 22 kΩ	12 ~ 22 kΩ	–

CAUTION

Use only Tester 57001-1394 with new battery at room temperature for this test. A tester other than the Hand Tester may show different readings. If 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.

Charging, Ignition System

Spark Plug Installation

- Screw the spark plug gently into the plug hole with the plug installed in the plug wrench.
- Tighten the plug.

Torque - Spark Plug: 23 N·m (2.3 kgf·m, 17 ft·lb)

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

Spark Plug Cleaning and Inspection

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

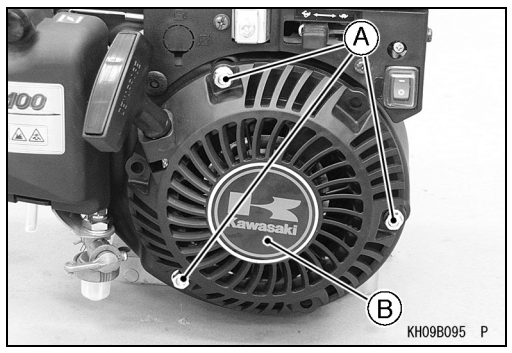
Spark Plug Gap Inspection

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

Starter System

Recoil Starter Removal

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



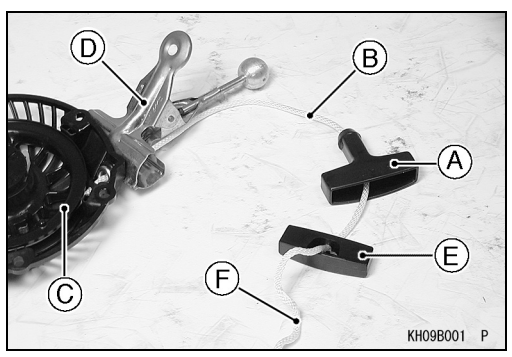
Recoil Starter Installation

- Install the recoil starter and tighten the mounting nuts.

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

Recoil Starter Disassembly

- Remove the recoil starter (see Recoil Starter Removal in this chapter).
- Pull the starter knob [A] out 30 cm (1 ft), and clamp the rope [B] with the clip [D] so it can not wind back onto the reel [C].
- Pry the knot [F] out of the handle and untie it.
- Remove the starter knob and knob cap [E] from the rope.



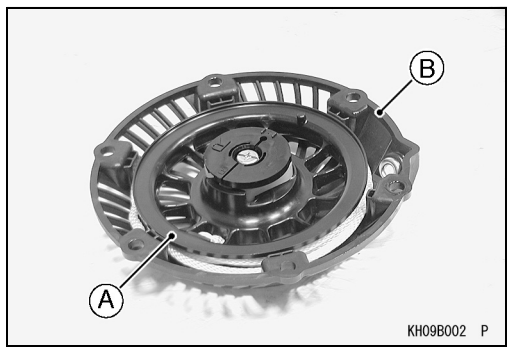
⚠ WARNING

Wear gloves to avoid injury for the remaining steps.

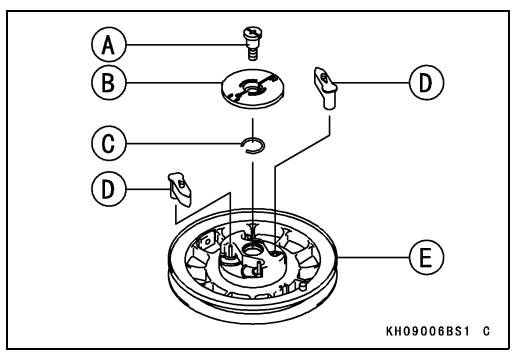
- While carefully holding the reel [A] and case [B], remove the clip.
- Unwind the spring tension slowly.

NOTE

○*Do not wedge the rope between the reel and case.*



- Remove:
  Set Screw [A]
  Ratchet Guide [B]
  Friction Spring [C]
  Ratchets [D]
  Reel [E]



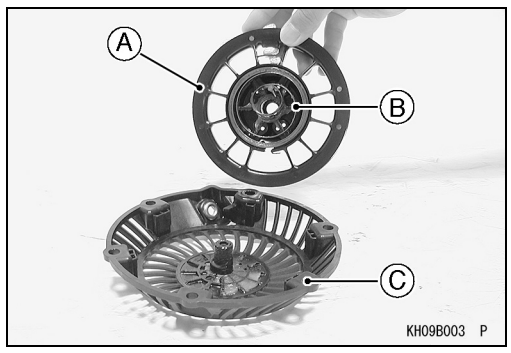
CAUTION

Do not remove the friction spring unless removal is necessary.

Starter System

⚠ WARNING

When removing the reel [A], be careful that the recoil spring [B] under the reel may fly out and cause injury. The spring is under great pressure.



NOTE

○*There should be no spring tension on the reel when removing it. If tension is felt, push the reel back into place and gently "wiggle" it until the reel can be easily removed.*

● Slowly lift the reel straight up out of the case [C].

⚠ WARNING

Be careful that the recoil spring may fly out from the cassette and cause injury. The spring is under great pressure.

● Slowly lift the recoil spring cassette, straight up out of the case or reel.

★If the recoil spring must be removed, hold it with the reel downward in a suitable container and remove the recoil spring by using a suitable tool.

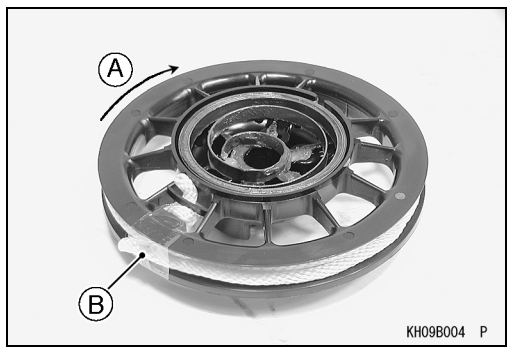
Recoil Starter Assembly

⚠ WARNING

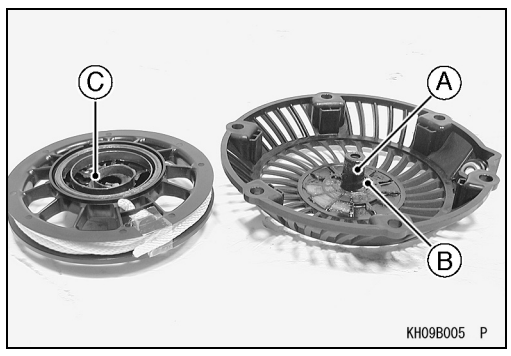
Wear gloves during the recoil spring installation to avoid injury. The recoil spring must be assembled with great pressure.

● Lightly grease the recoil spring.

● Wind the rope clockwise [A] on the reel, and hold the rope end [B] with tape.
● Install the recoil spring on the reel using a suitable tool.

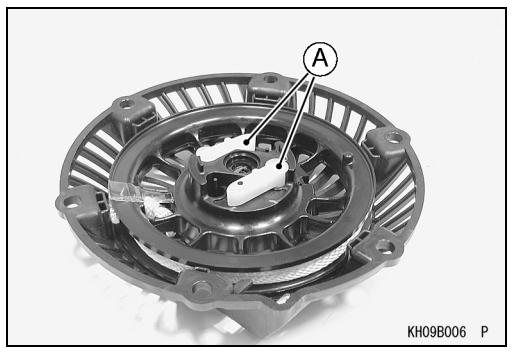


● Lightly grease the shaft [A].
● Put the reel into the case, with the round peg [B] aligned with the spring inner tongue [C].
○At that time engage the recoil spring with the starter case.
● Turn the reel clockwise until you feel the hang hook on the catch.



Starter System

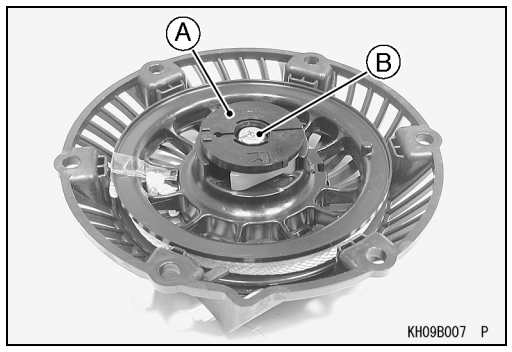
- Install:
  Ratchets [A]



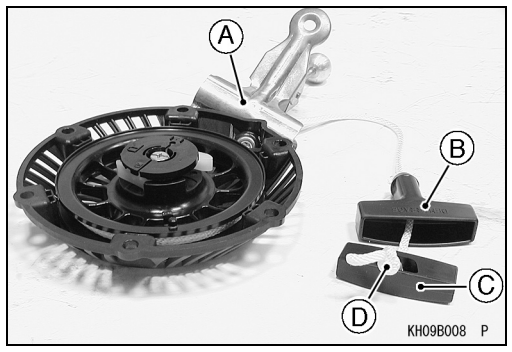
- If the friction spring is removed, install the friction spring on the ratchet guide [A].
- Install the ratchet guide.
- Tighten the screw [B].

  Torque - Recoil Starter Retainer Screw: 3.4 N·m (0.35 kgf·m, 30 in·lb)

- Turn the reel two turns counterclockwise to preload the recoil spring.
- Remove the tape.



- While holding the reel to keep it from unwinding, feed the end of the rope through the hole in the case.
- Clip [A] the rope as shown to hold it.
- Install the starter knob [B] and knob cap [C], and secure it with a knot [D].
- Remove the clip to release the rope.



Troubleshooting

Table of Contents

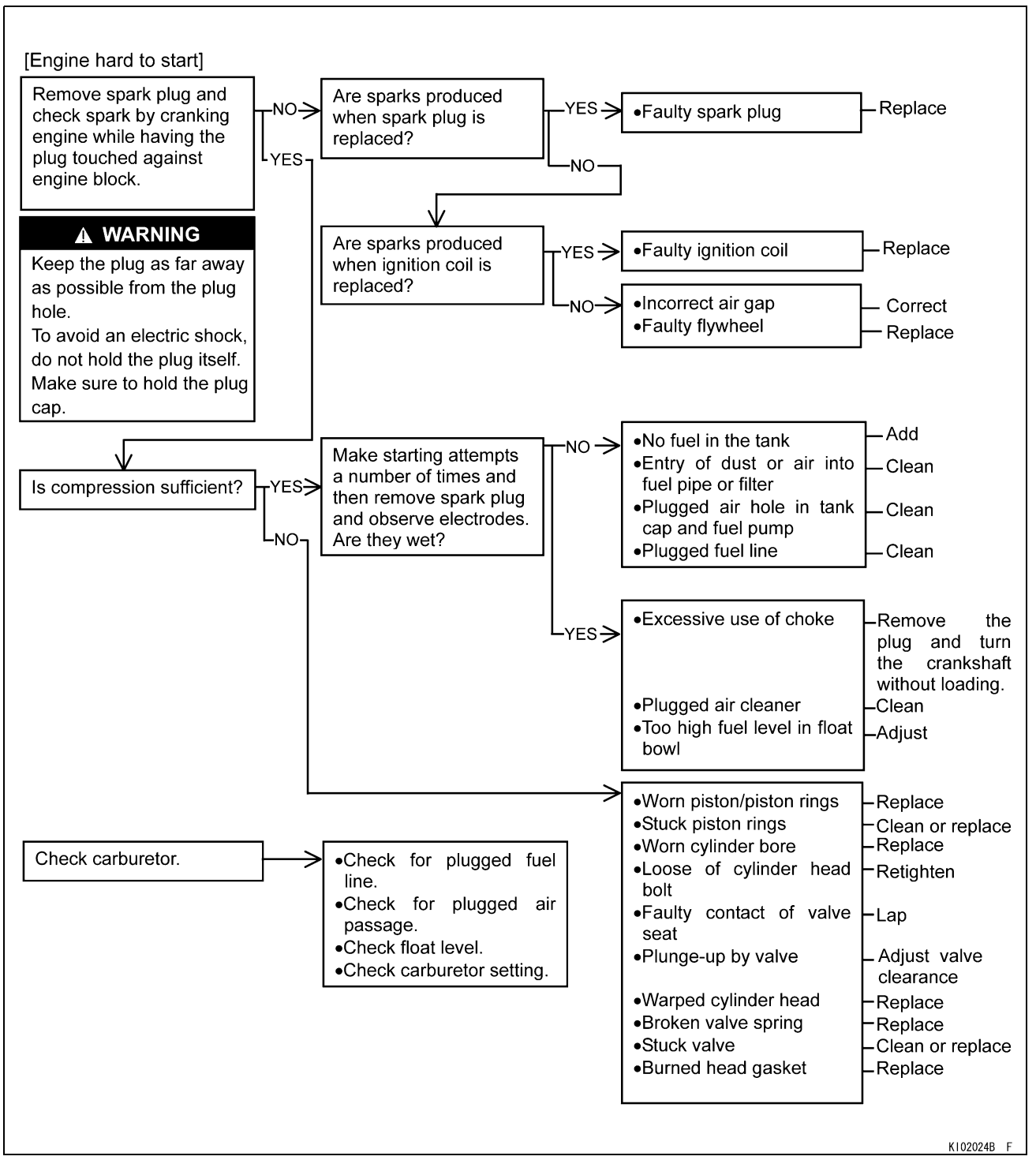
9-2 TROUBLESHOOTING

Engine Troubleshooting Guide

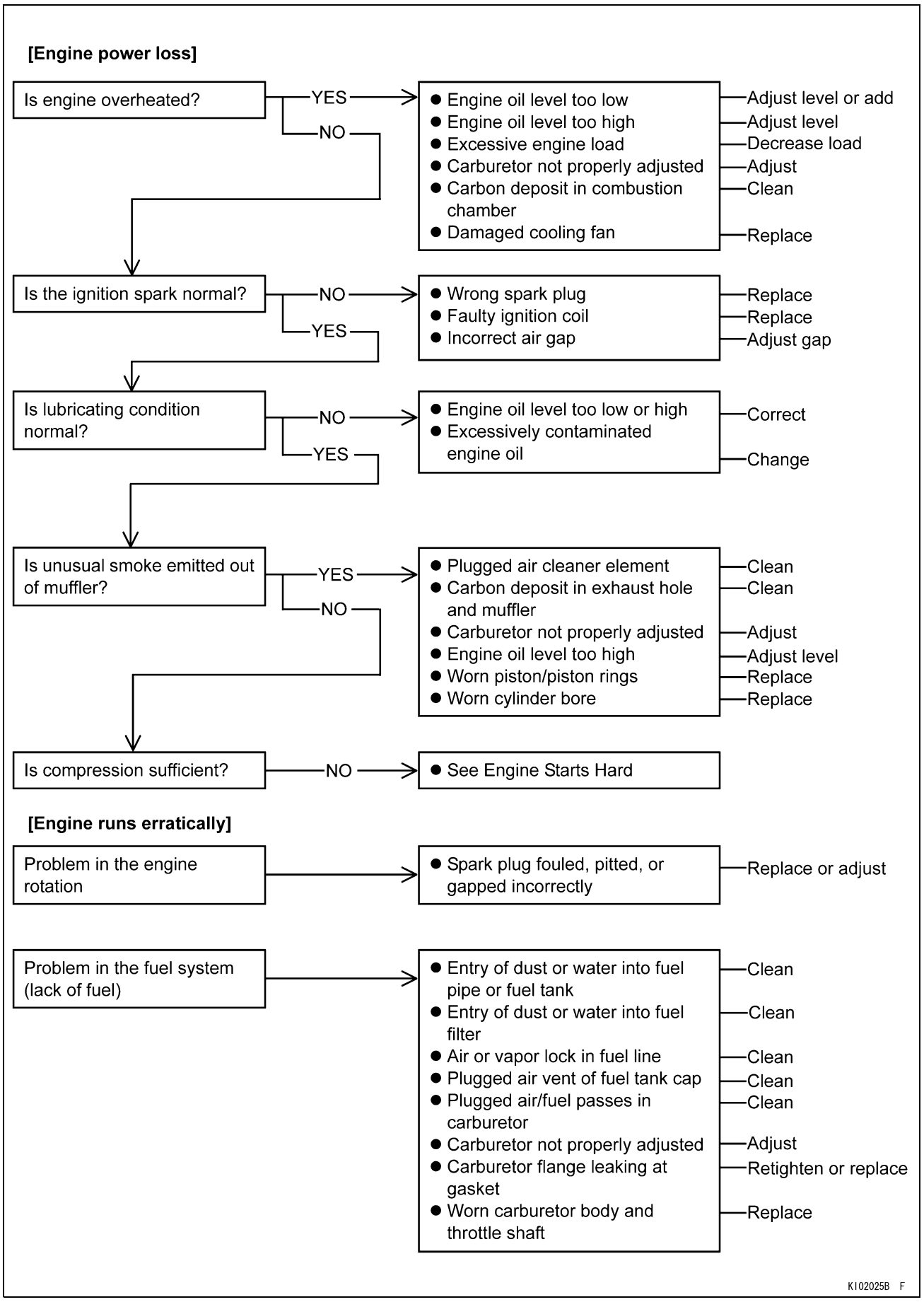
If the engine malfunctions, check if the way the engine is used is correct. If engine malfunctions even if engine is used correctly, systematically carry out troubleshooting starting with simple points.

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.

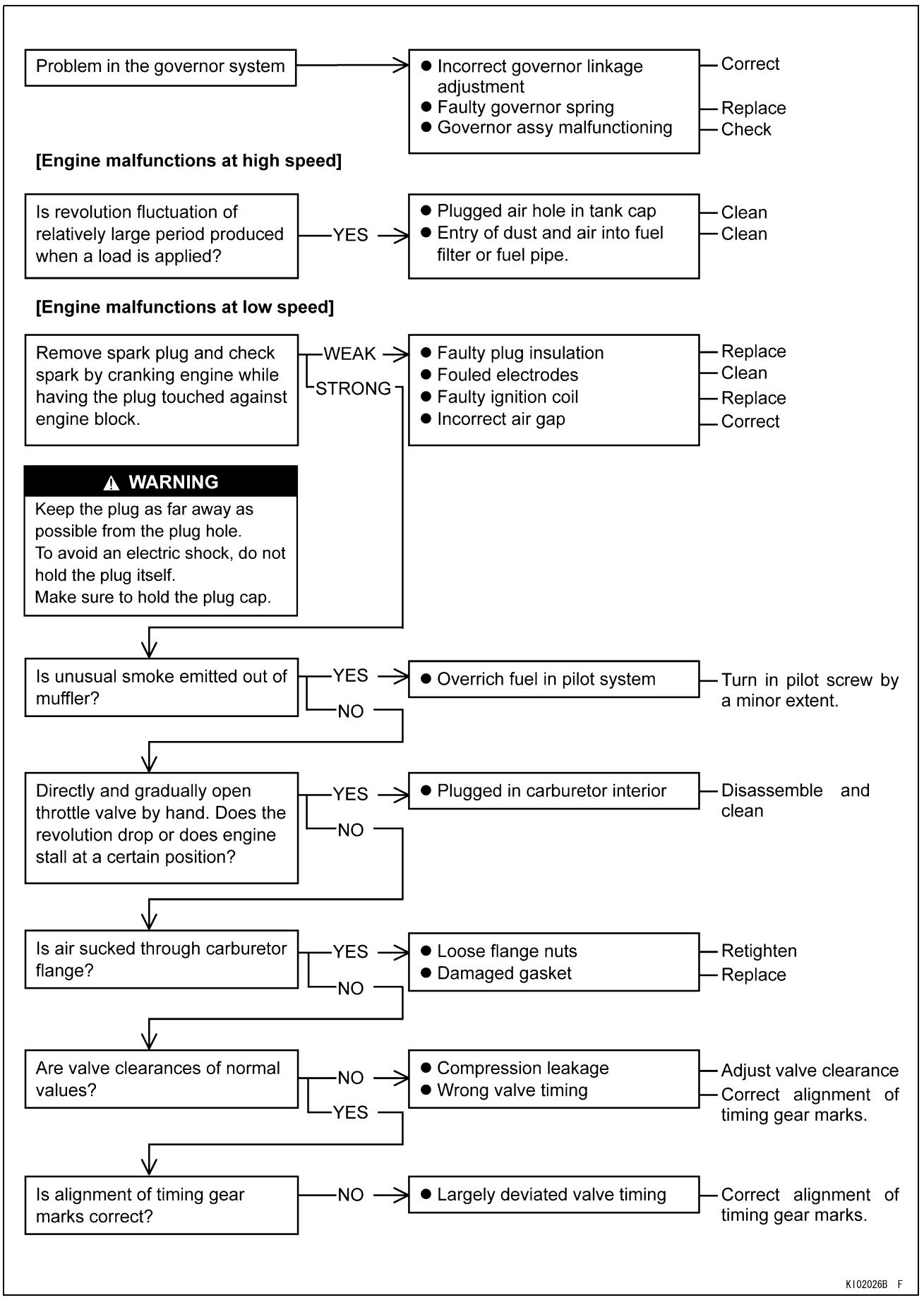


Engine Troubleshooting Guide

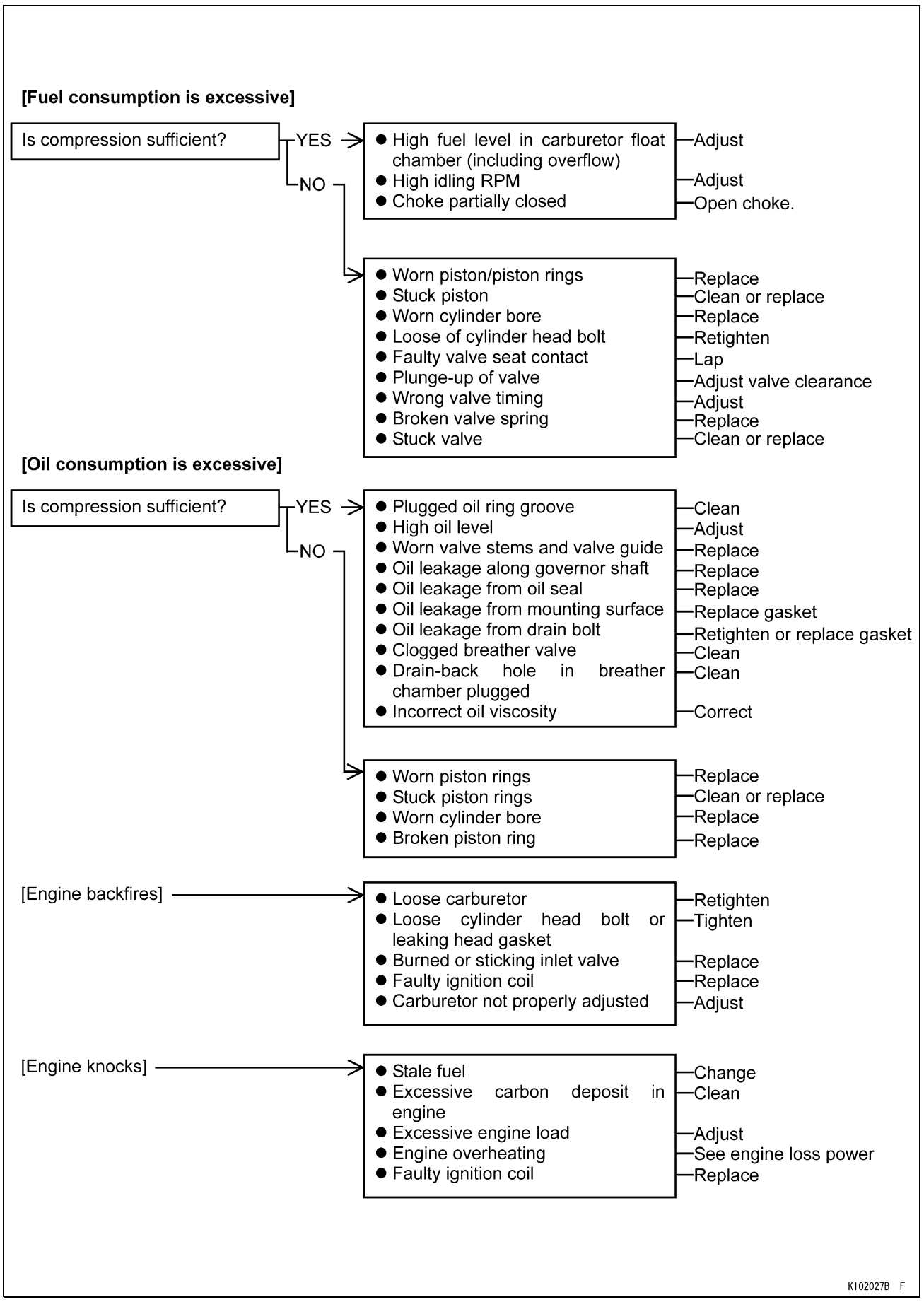


9-4 TROUBLESHOOTING

Engine Troubleshooting Guide



Engine Troubleshooting Guide



KAWASAKI HEAVY INDUSTRIES, LTD.
Consumer Products & Machinery Company

Part No.99924-2070-01

Printed in Japan