



**KLF 250**  
**BAYOU 250**  
**Workhorse 250**



# **All Terrain Vehicle Service Manual**



# Quick Reference Guide

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

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





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# **All Terrain Vehicle Service Manual**

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All information contained in this publication is based on the latest product information available at the time of publication. Illustrations and photographs in this publication are intended for reference use only and may not depict actual model component parts.

## LIST OF ABBREVIATIONS

A	ampere(s)	lb	pounds(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) Celcius	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 in compliance with applicable regulations of the 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 family is engine modifications that consist of a modified 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.

A maintenance free ignition system provides the most favorable ignition timing and helps maintain a thorough combustion process within the engine which contributes to a reduction of exhaust pollutants entering the atmosphere.

The Clean Air Act, which is the Federal law covering motor vehicle pollution, contains what is commonly referred to as the Act's "tampering provisions."

"Sec. 203(a) The following acts and the causing thereof are prohibited...

(3)(A) for any person to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this title prior to its sale and delivery to the ultimate purchaser, or for any manufacturer or dealer knowingly to remove or render inoperative any such device or element of design after such sale and delivery to the ultimate purchaser.

(3)(B) for any person engaged in the business of repairing, servicing, selling, leasing, or trading motor vehicles or motor vehicle engines, or who operates a fleet of motor vehicles knowingly to remove or render inoperative any device or element of design installed on or in a motor vehicle or motor vehicle engine in compliance with regulations under this title following its sale and delivery to the ultimate purchaser..."

### NOTE

○The phrase "remove or render inoperative any device or element of design" has been generally interpreted as follows:

1. Tampering does not include the temporary removal or rendering inoperative of devices or elements of design in order to perform maintenance.
2. Tampering could include:
  - a. Maladjustment of vehicle components such that the emission standards are exceeded.
  - b. Use of replacement parts or accessories which adversely affect the performance or durability of the motorcycle.
  - c. Addition of components or accessories that result in the vehicle exceeding the standards.
  - d. Permanently removing, disconnecting, or rendering inoperative any component or element of design of the emission control systems.

**WE RECOMMEND THAT ALL DEALERS OBSERVE THESE PROVISIONS OF FEDERAL LAW, THE VIOLATION OF WHICH IS PUNISHABLE BY CIVIL PENALTIES NOT EXCEEDING \$10,000 PER VIOLATION.**

**PLEASE DO NOT TAMPER WITH NOISE CONTROL SYSTEM  
(US MODEL only)**

To minimize the noise emissions from this product, Kawasaki has equipped it with effective intake and exhaust silencing systems. They are designed to give optimum performance while maintaining a low noise level. Please do not remove these systems, or alter them in any way which results in an increase in noise level.

# 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 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.

**For the duration of the warranty period,** we recommend that all repairs and scheduled maintenance be performed in accordance with this service manual. Any owner maintenance or repair procedure not performed in accordance with this manual may void the warranty.

To get the longest life out of your vehicle:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki Vehicle parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki vehicles are introduced by the Special Tool Catalog or Manual. 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.

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## How to Use This Manual

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

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



# General Information



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## 1-2 GENERAL INFORMATION

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### Before Servicing

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Before starting to perform an inspection service or carry out a disassembly and reassembly operation on a motorcycle, read the precautions given below. To facilitate actual operations, notes, illustrations, photographs, cautions, and detailed descriptions have been included in each chapter wherever necessary. This section explains the items that require particular attention during the removal and reinstallation or disassembly and reassembly of general parts.

#### **Especially note the following:**

(1) Dirt

Before removal and disassembly, clean the motorcycle. Any dirt entering the engine will shorten the life of the motorcycle. For the same reason, before installing a new part, clean off any dust or metal filings.

(2) Battery Ground

Disconnect the ground (-) wire from the battery before performing any disassembly operations on the motorcycle. This prevents the engine from accidentally turning over while work is being carried out, sparks from being generated while disconnecting the wires from electrical parts, as well as damage to the electrical parts themselves. For reinstallation, first connect the positive wire to the positive (+) terminal of the battery

(3) Installation, Assembly

Generally, installation or assembly is the reverse of removal or disassembly. However, if installation or assembly sequence is given in this Service Manual, follow it. Note parts locations and cable, wire, and hose routing during removal or disassembly so they can be installed or assembled in the same way. It is preferable to mark and record the locations and routing whenever possible.

(4) Tightening Sequence

When installing bolts, nuts, or screws for which a tightening sequence is given in this Service Manual, make sure to follow the sequence. When installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit, thus ensuring that the part has been installed in its proper location. Then, tighten them to the specified torque in the tightening sequence and method indicated. If tightening sequence instructions are not given, tighten them evenly in a cross pattern. Conversely, to remove a part, first loosen all the bolts, nuts, or screws that are retaining the part a 1/4-turn before removing them.

(5) 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.

(6) 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 removing screws held by non-permanent locking agent) in order to avoid damaging the screw heads.

(7) Edges

Watch for sharp edges, as they could cause injury through careless handling, especially during major engine disassembly and assembly. Use a clean piece of thick cloth when lifting the engine or turning it over.

(8) 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.

(9) Gasket, O-ring

Replace a gasket or an O-ring with a new part when disassembling. Remove any foreign matter from the mating surface of the gasket or O-ring to ensure a perfectly smooth surface to prevent oil or compression leaks.

### Before Servicing

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(10) Liquid Gasket, Locking Agent

Clean and prepare surfaces where liquid gasket or non-permanent locking agent will be used. Apply them sparingly. Excessive amount may block engine oil passages and cause serious damage.

(11) Press

When using a press or driver to install a part such as a wheel bearing, apply a small amount of oil to the area where the two parts come in contact to ensure a smooth fit.

(12) Ball Bearing and Needle Bearing

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

(13) Oil Seal and Grease Seal

Replace any oil or grease seals that were removed with new ones, as removal generally damages seals. Oil or grease seals should be pressed into place using a suitable driver, applying a force uniformly to the end of seal until the face of the seal is even with the end of the hole, unless instructed otherwise. When pressing in an oil or grease seal which has manufacturer's marks, press it in with the marks facing out.

(14) Circlip, Retaining Ring, and Cotter Pin

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, retaining rings, and cotter pins that were removed with new ones, as removal weakens and deforms them. If old ones are reused, they could become detached while the motorcycle is driven, leading to a major problem.

(15) Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the sliding surfaces have an adequate lubricative film. During assembly, make sure to apply oil to any sliding surface or bearing that has been cleaned. Old grease or dirty oil could have lost its lubricative quality and may contain foreign particles that act as abrasives; therefore, make sure to wipe it off and apply fresh grease or oil. 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.

(16) Direction of Engine Rotation

To rotate the crankshaft manually, make sure to do so in the direction of positive rotation. Positive rotation is counterclockwise as viewed from the left side of the engine. To carry out proper adjustment, it is furthermore necessary to rotate the engine in the direction of positive rotation as well.

(17) Replacement Parts

When there is a replacement instruction, replace these parts with new ones every time they are removed.

Replacement parts will be damaged or lose their original function once they are removed. Therefore, always replace these parts with new ones every time they are removed. Although the previously mentioned gasket, O-ring, ball bearing, needle bearing, grease seal, oil seal, circlip, and cotter pin have not been so designated in their respective text, they are replacement parts.

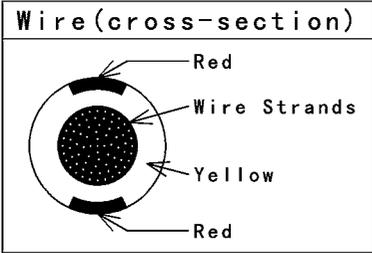
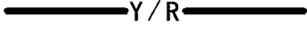
(18) Electrical Wires

All the electrical wires are either one-color or two-color. A two-color wire is identified first by the primary color and then the stripe 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. Unless instructed otherwise, electrical wires must be connected to wires of the same color.

# 1-4 GENERAL INFORMATION

## Before Servicing

### Two-Color Electrical Wire

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

6B020601W1 C

#### (19) 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	

#### (20) Specifications

Specification 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

KLF250-A1 Left Side View



KLF250-A1 Right Side View



# 1-6 GENERAL INFORMATION

## General Specifications

Item	KLF250-A1 ~ A3
<b>Dimensions</b> Overall Length Overall Width Overall Height Wheelbase Ground Clearance Seat Height Dry Mass Curb Mass:                      Front Rear Fuel Tank Capacity	1 780 mm (70.08 in.) 1 120 mm (44.09 in.), (US) (CA) 1 020 mm (40.16 in.) 1 040 mm (40.94 in.) 1 115 mm (43.90 in.) 155 mm (6.10 in.) 730 mm (28.74 in.) 185 kg (408 lb), (US) 183 kg (404 lb), (CA) 183.5 kg (405 lb) 89 kg (196 lb), (US) (CA) 88.5 (195 lb) 106 kg (234 lb), (US) 104.5 kg (230 lb), (CA) 105 kg (232 lb) 10 L (2.6 US gal)
<b>Performance</b> Minimum Turning Radius	2.7 m (8.86 ft)
<b>Engine</b> Type Cooling System Bore and Stroke Displacement Compression Ratio Maximum Horsepower Maximum Torque Carburetion System Starting System Ignition System Timing Advance Ignition Timing Spark Plug Valve Timing: Inlet:                      Open Close Duration Exhaust:                Open Close Duration Lubrication System Engine Oil:                      Type Viscosity Capacity	4-stroke, SOHC, 1-cylinder Air-cooled 69.0 × 61.0 mm (2.72 × 2.40 in.) 228 mL (13.9 cu in.) 8.9 12.5 kW (17 PS) @7 000 r/min (rpm), (US) – 17.9 N·m (1.83 kgf·m, 13.24 ft·lb) @5 500 r/min (rpm) Carburetor, MIKUNI VM24SS Electric starter & Recoil starter CDI Electronically advanced From 10° BTDC @1 800 r/min (rpm) to 35° BTDC @4 600 r/min (rpm) NGK DR8ES 35° BTDC 57° ABDC 272° 54° BBDC 26° ATDC 260° Forced lubrication (wet sump) API SF or SG API SH or SJ with JASO MA SAE 10W-40 2.0 L (2.11 US qt)

**General Specifications**

Item	KLF250-A1 ~ A3
<b>Drive Train</b>	
Primary Reduction System:	
Type	Gear
Reduction Ratio	3.450 (69/20)
Clutch Type	Wet multi disc and centrifugal
Transmission:	
Type	5-speed plus reverse, constant mesh, return shift
Gear Ratio:	
1st	2.923 (38/13)
2nd	1.684 (32/19)
3rd	1.173 (27/23)
4th	0.923 (24/26)
5th	0.785 (22/28)
Reverse	3.115 (27/13 × 33/22)
Final Drive System:	
Type	Shaft
Reduction Ratio	4.680 (18/15 × 39/10)
Overall Drive Ratio (@Top Gear)	12.686
Final Gear Case Oil:	
Type	Hypoid gear oil SAE90 (above 5°C, 41°F) or SAE80 (below 5°C, 41°F)
Capacity	0.2 L (0.21 US qt)
<b>Frame</b>	
Type	Double tubular
Caster (Rake Angle)	4.0°
Camber	3.0°
King Pin Angle	10°
Trail	17 mm (0.67 in.)
Tread:	
Front	764 mm (30.08 in.)
Rear	776 mm (30.55 in.)
Front Tire:	
Type	Tubeless
Size	AT21 × 8 - 9
Rear Tire:	
Type	Tubeless
Size	AT22 × 10 - 10
Suspension:	
Front:	
Type	Independent swing axle
Wheel Travel	115 mm (4.53 in.)
Rear:	
Type	Torque tube-link
Wheel Travel	125 mm (4.92 in.)

## 1-8 GENERAL INFORMATION

### General Specifications

Item	KLF250-A1 ~ A3
Brake type:	
Front	Drum (Mechanical)
Rear	Drum (Mechanical)
<b>Electrical Equipment</b>	
Battery	12 V 14 Ah, (US) 12 V 11 Ah
Headlight:	
Type	Semi-sealed beam
Bulb	12 V 25/25 W × 2
Tail/brake light	12 V 8/27 W × 2
Alternator:	
Type	Three - phase AC
Rated Output	13 A, 14 V @8 000 r/min (rpm)

Specifications are subject to change without notice, and may not apply to every country.

(CA): Canada Model

(US): U.S.A. Model

**Unit Conversion Table**

**Prefixes for Units:**

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

**Units of Mass:**

kg	×	2.205	=	lb
g	×	0.03527	=	oz

**Units of Volume:**

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

**Units of Force:**

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

**Units of Length:**

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

**Units of Torque:**

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

**Units of Pressure:**

kPa	×	0.01020	=	kg/cm <sup>2</sup>
kPa	×	0.1450	=	psi
kPa	×	0.7501	=	cmHg
kg/cm <sup>2</sup>	×	98.07	=	kPa
kg/cm <sup>2</sup>	×	14.22	=	psi
cm Hg	×	1.333	=	kPa

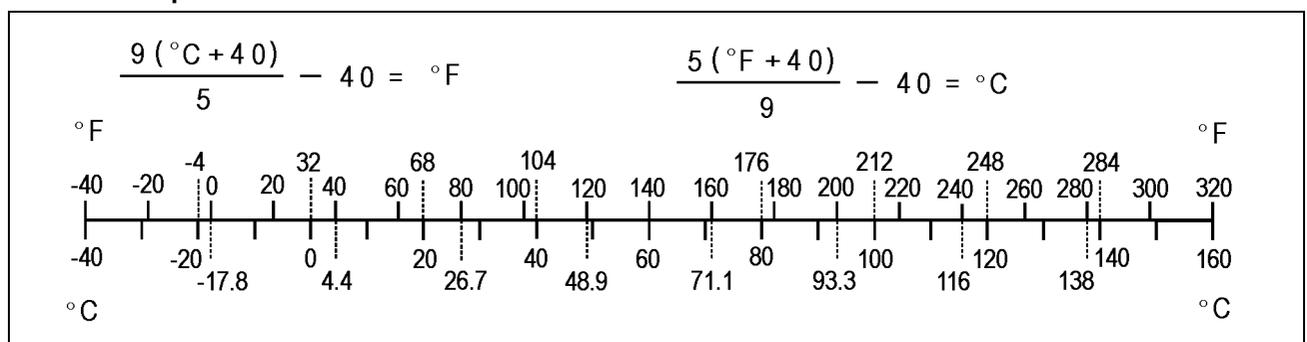
**Units of Speed:**

km/h	×	0.6214	=	mph
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**Units of Power:**

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

**Units of Temperature:**





# Periodic Maintenance

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## 2-2 PERIODIC MAINTENANCE

### Periodic Maintenance Chart

The scheduled maintenance must be done in accordance with this chart to keep the vehicle in good running condition. **The initial maintenance is vitally important and must not be neglected.**

OPERATION	FREQUENCY	First Service	Regular Service			
		After 10 hrs. or 100 km (60 mi) of use	Every 10 days or 200 km (120 mi) of use	Every 30 days or 600 km (360 mi) of use	Every 90 days or 1 700 km (1 100 mi) of use	Every year of use
<b>ENGINE</b>						
Air cleaner - service*	•	•				
Throttle lever play - inspect	•	•				
Valve clearance - inspect	•			•		
Fuel system cleanliness - inspect*	•			•		
Engine oil - change*	•			•		
Oil filter - replace*	•			•		
Clutch adjustment*	•	•				
Spark plug - clean and gap	•			•		
Spark arrester - clean						•
Fuel hoses and connections - inspect				•		
Fuel hose - replace		4 years				
<b>CHASSIS</b>						
Joint boots - inspect*	•	•				
Rear brake pedal and lever adjustment - inspect*	•	•				
Cables adjustment*	•	•				
Bolts and nuts - tighten	•	•				
Brake wear - inspect*	•	•				
Brake light switch - inspect*	•			•		
Battery - inspect	•			•		
Steering - inspect	•				•	
Tire wear - inspect*				•		
Final gear case oil - change	•					•
General lubrication*				•		

\*: Service more frequently when operated in mud, dust, or other harsh riding conditions.

•: Clean, adjust, lubricate, torque, or replace parts as necessary.

**Torque and Locking Agent**

The following tables list the tightening torque for the major fasteners, and the parts requiring use of a non-permanent locking agent or liquid gasket.

Letters used in the “Remarks” column mean:

L: Apply a non-permanent locking agent to the threads.

MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

S: Tighten the fasteners following the specified sequence.

St: Stake the fasteners to prevent loosening.

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 dia. (mm)	Torque		
	N·m	kgf·m	ft·lb
5	3.4 ~ 4.9	0.35 ~ 0.50	30 ~ 43 in·lb
6	5.9 ~ 7.8	0.60 ~ 0.80	52 ~ 69 in·lb
8	14 ~ 19	1.4 ~ 1.9	10.0 ~ 13.5
10	25 ~ 34	2.6 ~ 3.5	19.0 ~ 25
12	44 ~ 61	4.5 ~ 6.2	33 ~ 45
14	73 ~ 98	7.4 ~ 10.0	54 ~ 72
16	115 ~ 155	11.5 ~ 16.0	83 ~ 115
18	165 ~ 225	17.0 ~ 23.0	125 ~ 165
20	225 ~ 325	23 ~ 33	165 ~ 240

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
<b>Fuel Sytem</b>				
Carburetor Holder Bolts	11	1.1	95 in·lb	L
Throttle Lever Bolt	5.9	0.6	52 in·lb	
<b>Engine Top End</b>				
Cylinder Head Bolts (M10), first torque	13	1.3	113 in·lb	L(1), MO, S
Cylinder Head Bolts (M10), final torque	34	3.5	25	S
Cylinder Head Bolts (M6), first torque	5.9	0.6	52 in·lb	MO, S
Cylinder Head Bolts (M6), final torque	9.8	1.0	87 in·lb	S
Valve Adjusting Cap Bolts	8.8	0.9	78 in·lb	
Retaining Bolt	4.4	0.45	39 in·lb	
Compression Releasing Lever Bolt	8.8	0.9	78 in·lb	
Camshaft Sprocket Bolt	34	3.5	25	MO
Rear Camshaft Chain Guide Bolt	9.8	1.0	87 in·lb	
Camshaft Chain Tensioner Mounting Bolts	8.8	0.9	78 in·lb	
Valve Adjusting Screw Locknuts	12	1.2	104 in·lb	
Rocker Shaft Retainer Screws	4.4	0.45	39 in·lb	
Camshaft Chain Guard Screws	4.4	0.45	39 in·lb	
<b>Engine Right Side</b>				
Right Engine Cover Bolts	8.8	0.9	78 in·lb	

## 2-4 PERIODIC MAINTENANCE

### Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Clutch Spring Bolts	12	1.2	104 in·lb	
Primary Clutch Hub Nut	127	13	94	MO
Secondary Clutch Hub Nut	78	8.0	58	MO
Balancer Drive Gear Nut	83	8.5	61	MO
Balancer Gear Nut	118	12	87	MO
Clutch Adjusting Screw Locknut	11	1.1	95 in·lb	
<b>Recoil Starter</b>				
Recoil Starter Mounting Bolts	8.8	0.9	78 in·lb	
Recoil Starter Flange Nut	12	1.2	104 in·lb	
<b>Engine Lubrication System</b>				
Oil Pipe Banjo Bolts	15	1.5	11	
Oil Pump Screws	4.4	0.45	39 in·lb	
Engine Drain Plug	29	3.0	22	
Oil Filter Cover Bolts	8.8	0.9	78 in·lb	
Relief Valve	15	1.5	11	L
<b>Engine Removal/Installation</b>				
Engine Bracket Bolts and Nuts	26	2.7	20	
Engine Mounting Nuts (M10)	39	4.0	29	
Engine Mounting Nut (M8)	29	3.0	22	
<b>Crankshaft/Transmission</b>				
Engine Drain Plug	29	3.0	22	
Crankcase Bolts	8.8	0.9	78 in·lb	
Clutch Release Cam Pin	25	2.5	18	L
Return Spring Pin	25	2.5	18	L
Output Shaft Bearing Position Plate Screws	8.8	0.9	78 in·lb	L
Relief Valve	15	1.5	11	L
Bearing Stopper Screws	9.8	1.0	87 in·lb	
Positioning Lever Bolt	8.8	0.9	78 in·lb	
Neutral and Reverse Switch Screws	–	–	–	L
Shift Drum Pin Plate Bolt	12	1.2	104 in·lb	
<b>Wheels/Tires</b>				
Wheel Nuts	34	3.5	25	S
Rear Axle Nut	147	15	108	
<b>Final Drive</b>				
Output Bevel Gear Case Bolts (M8)	25	2.5	18	L (1)
Output Bevel Gear Case Bolts (M6)	8.8	0.9	78 in·lb	
Oil Seal Housing Nuts	25	2.5	18	
Drive Gear Nut	118	12	87	MO
Cam Damper Mounting Nut	78	8.0	58	MO
Driven Gear Shaft Nut	147	15	108	L
Bearing Retainer	108	11	80	L
Pinion Gear Nut	69	7.0	51	St
Propeller Shaft Housing Nuts	25	2.5	18	

## PERIODIC MAINTENANCE 2-5

### Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Final Gear Case Drain Bolt	20	2.0	14	L
Speedometer Plug	20	2.0	14	
Final Gear Case Filler Cap	15	1.5	11	
Ring Gear Cover Bolts	25	2.5	18	
Axle Shaft Pipe Bolts	20	2.0	14	
Oil Level Inspection Bolt	7.8	0.8	69 in·lb	
<b>Brakes</b>				
Front Axle Nut	34	3.5	25	L
Rear Axle Nut	147	15	108	
Front Brake Panel Bolts	25	2.5	18	
Rear Brake Panel Bolts	29	3.0	22	
Rear Brake Drum Drain Bolts	29	3.0	22	
<b>Suspension</b>				
Front Suspension Arm Pivot Bolts	88	9.0	65	
Rear Suspension Arm Pivot Bolts and Nuts	34	3.5	25	
Shock Absorber Mounting Bolts and Nuts	34	3.5	25	
Steering Knuckle Pivot Nuts	39	4.0	29	
<b>Steering</b>				
Steering Stem Clamp Allen Bolts	26	2.7	20	S
Stem Bottom End Nut	29	3.0	22	
Tie-rod End Nuts	41	4.2	30	
Tie-rod Adjusting Sleeve Locknuts	26	2.7	20	
Steering Knuckle Arm Pivot Nuts	39	4.0	29	
Handlebar Holder Bolts	20	2.0	14	
<b>Frame</b>				
Rear Carrier Bolts	20	2.0	14	
<b>Electrical System</b>				
Alternator Cover Bolts	8.8	0.9	78 in·lb	L
Spark Plug	14	1.4	10	
Starter Motor Clutch Bolts	34	3.5	25	
Ignition Switch Nut	2.9	0.3	26 in·lb	
Alternator Rotor Bolt	59	6.0	43	
Starter Motor Mounting Bolts	8.8	0.9	78 in·lb	
Starter Motor Terminal Nut	4.9	0.5	43 in·lb	
Starter Motor Terminal Locknut	6.9	0.7	61 in·lb	
Starter Motor Bolts	3.4	0.3	30 in·lb	

## 2-6 PERIODIC MAINTENANCE

### Specifications

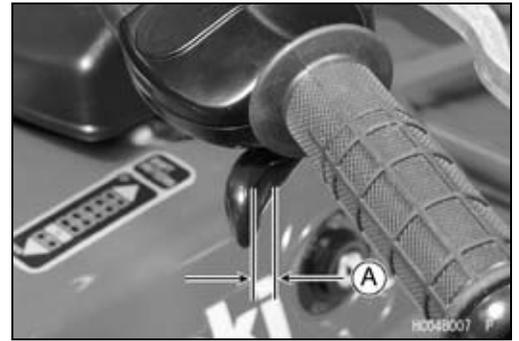
Item	Standard	Service Limit
<b>Fuel System</b>		
Throttle Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	---
Idle Speed	1 300 ~ 1 400 r/min (rpm)	---
Air Cleaner Element Oil	High-quality foam air filter oil	---
<b>Engine Top End</b>		
Valve Clearance:		
Exhaust	0.18 ~ 0.23 mm (0.0071 ~ 0.0091 in.)	---
Inlet	0.15 ~ 0.20 mm (0.0059 ~ 0.0079 in.)	---
<b>Engine Lubrication System</b>		
Engine Oil:		
Type	API SF or SG API SH or SJ with JASO MA	---
Viscosity	SAE10W40	---
Capacity	2.0 L (2.11 US qt) (When filter is not removed)	---
	2.1 L (2.22 US qt) (When filter is removed)	---
	2.75 L (2.91 US qt) (When engine is completely dry)	---
<b>Wheels/Tires</b>		
Tire Tread Depth:		
Front	---	4 mm (0.16 in.)
Rear	---	4 mm (0.16 in.)
Standard Tire:		
Front	AT 21 X 8-9 Dunlop, KT856, Tubeless	---
Rear	AT 22 x 10-10 Dunlop, KT857, Tubeless	---
<b>Final Drive</b>		
Final Gear Case:		
Gear Case Oil:		
Type	API GL-5 Hypoid gear oil	---
Viscosity	SAE90 (above 5°C, 41°F) SAE80 (below 5°C, 41°F)	---
Capacity	0.2 L (0.21 US qt)	---
<b>Brakes</b>		
Front Brake Lever Free Play	1 ~ 2 mm (0.04 ~ 0.08 in.)	---
Rear (Parking) Brake Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	---
Brake Pedal Free Play	25 ~ 35 mm (1.0 ~ 1.4 in.)	---
Cam Lever angle	80 ~ 90°	---
<b>Electrical System</b>		
Spark Plug Gap	0.6 ~ 0.7 mm (0.024 ~ 0.028 in.)	---
Rear Brake Light Switch Timing	On after 10 mm (0.4 in.) of pedal travel	---

**Periodic Maintenance Procedures**

**Fuel System**

*Throttle Lever Free Play Inspection*

- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by the return spring.
- ★ If the throttle lever does not return properly, check the throttle cable routing, lever free play, and cable damage. Then lubricate the throttle cable.
- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.
- ★ If the idle speed increases, check the throttle lever free play and the cable routing.
- Stop the engine and check the throttle lever free play [A].
- ★ If the free play is not within the specified range, adjust the cable.

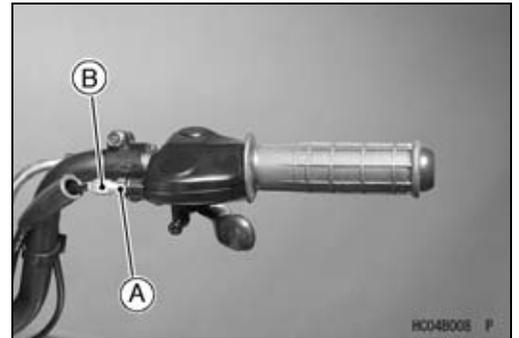


**Throttle Lever Free Play**

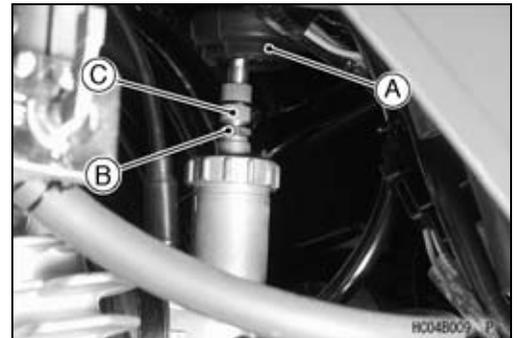
**Standard: 2 ~ 3 mm (0.08 ~ 0.12 in.)**

*Throttle Lever Free Play Adjustment*

- Slide the rubber cover off the adjuster at the throttle case.
- Loosen the locknut [A] and turn the throttle cable upper adjuster [B] until the cable has proper amount of play.
- Tighten the locknut and reinstall the rubber cover.



- ★ If the free play cannot be adjusted by using the upper cable adjuster, pull up the rubber cover [A] at the carburetor.
- ★ Loosen the locknut [B] and turn the throttle cable lower adjuster [C] to obtain the specified free play.
- ★ Tighten the locknut and reinstall the rubber cover.



## 2-8 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

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#### *Fuel System Cleanliness Inspection*

#### **WARNING**

**Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. 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.**

- Turn the fuel tap to the OFF position.
- Run the lower end of the carburetor drain hose to a suitable container.
- Turn out the carburetor drain plug a few turns and drain the fuel system.
- Check to see if water or dirt comes out.
- Tighten the drain plug.
- ★ If any water or dirt appears during the above inspection, clean the fuel system (carburetor, tank, fuel hose).

#### *Air Cleaner Element Cleaning and Inspection*

#### **NOTE**

- *In dusty areas, the element should be cleaned more frequently than the recommended interval.*
- *After riding through rain or muddy terrains, the element should be cleaned immediately.*
- *Since repeated cleaning opens the pores of the element, replace it with a new one in accordance with the Periodic Maintenance Chart.*
- *Also, if there is a break in the element material or any other damage to the element, replace the element with a new one.*

#### **WARNING**

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

- Remove the air cleaner element (see Air Cleaner Element Removal).
- Clean the element in a bath of high-flash point solvent using a soft bristle brush.

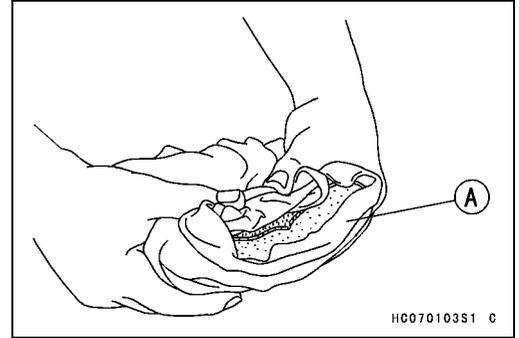
**Periodic Maintenance Procedures**

- Squeeze it dry in a clean towel [A]. Do not wring the element or blow it dry; the element can be damaged.
- Inspect the element for damage.
- ★ If it is torn, punctured, or hardened, replace it.

**NOTE**

○ *Replace the element after cleaning it five times or if it is damaged.*

- After cleaning, saturate the element with a high-quality foam-air-filter oil, squeeze out the excess oil, then wrap it in a clean rag and squeeze it as dry as possible. Be careful not to tear the element.



**Air Cleaner Draining**

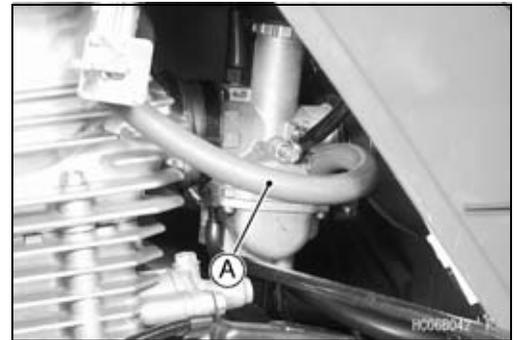
Two drain tubes [A] are connected to the bottom of the air cleaner housing to drain water or oil accumulated in the housing.

- Squeeze open the two drain tubes to expel dust and/or water accumulated inside.



**Fuel Hose and Connection Check**

- Turn the fuel tap to the OFF position.
- Check the fuel hose [A].
- ★ If the fuel hose is frayed, cranked, or bulged, replace the fuel hose.
- Check that the hose is securely connected and clamps are tightened.
- ★ If the fuel hose has been sharply bent or kinked, replace the fuel hose.
- ★ If the clamps are loosened or damaged, replace the clamps.
- When installing the fuel hose, avoid sharp bending, kinking, flattening or twisting, and route the fuel hose with a minimum of bending so that the fuel flow will not be obstructed.



**Fuel Hose Replacement**

**WARNING**

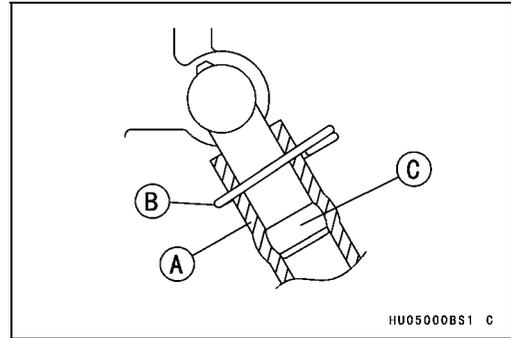
**Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.**

- Turn the fuel tap to the OFF position.
- Remove:
  - Clamps
  - Fuel Hose

## 2-10 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Fit the fuel hose [A] onto the pipe fully and install the clamps [B] beyond the raised rib [C].



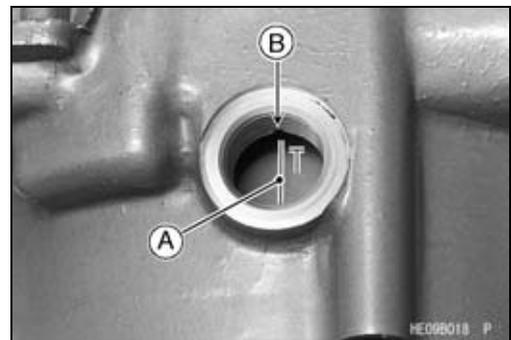
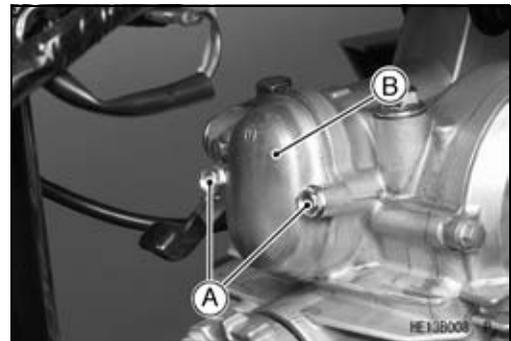
### Engine Top End

#### Valve Clearance Inspection

#### NOTE

○ Check the valve clearance only when the engine is cold (at room temperature).

- Remove:
  - Front Fender (see Frame chapter)
  - Bolts [A] and Valve Adjusting Caps [B]
- Remove:
  - Recoil Starter (see Recoil Starter chapter)
  - Timing Inspection Plug
- Turn the crankshaft counterclockwise with a wrench on the alternator rotor bolt until the "T" mark [A] on the alternator rotor aligns with the slot [B], as shown.
- Measure the clearance of each valve between the end of the valve stem and the adjusting screw on the rocker arm with a thickness gauge [A].
- ★ If the valve clearance is not correct, adjust it.



#### Valve Clearance (when cold)

Exhaust: 0.18 ~ 0.23 mm (0.0071 ~ 0.0091 in.)

Inlet: 0.15 ~ 0.20 mm (0.0059 ~ 0.0079 in.)

#### Spark Arrester Cleaning

#### WARNING

To avoid burns, wear gloves while cleaning the spark arrester. Since the engine must be run during this procedure, the muffler will become hot.

## Periodic Maintenance Procedures

- Remove the drain plug [A] on the muffler.
- In an open area away from combustible materials, start the engine with the transmission in neutral.
- Raise and lower engine speed while tapping on the muffler with a rubber mallet until carbon particles are purged from the muffler.

### WARNING

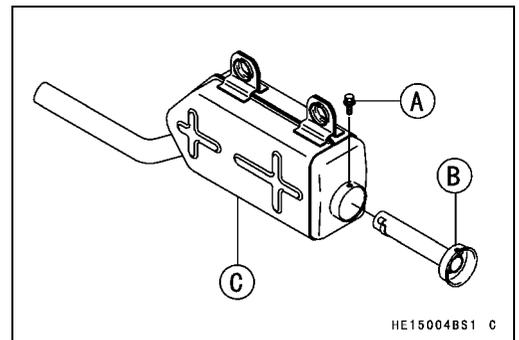
**Do not run the engine in a closed area. Exhaust gases contain carbon monoxide; a colorless, odorless, poisonous gas. Breathing exhaust gas leads to carbon monoxide poisoning, asphyxiation, and death.**

- Stop the engine.
- Remove:
  - Bolt [A]
  - Spark Arrester [B]
  - Muffler [C]
- Scrape carbon deposits off the spark arrester and slide it back into the muffler.

### WARNING

**Never run the engine with the spark arrester removed near combustible materials. Hot carbon particles may start a fire.**

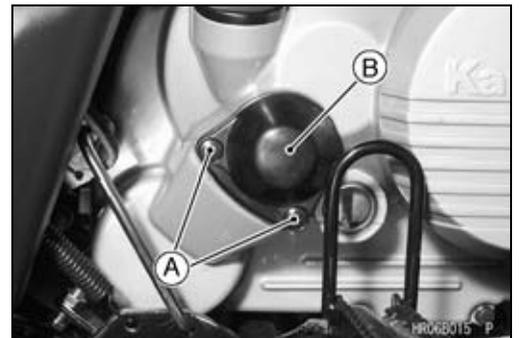
- Install the drain plug.



## Clutches

### Clutch Adjustment

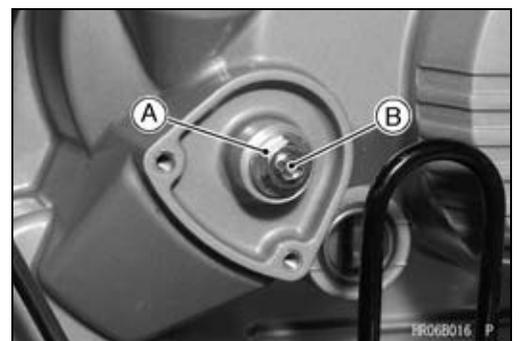
- Remove:
  - Screws [A]
  - Adjusting Screw Cover [B]



- Loosen the locknut [A].
- Turn the adjusting screw [B] clockwise until it becomes hard to turn.
- Turn the adjusting screw counterclockwise until it becomes hard to turn.
- Tighten the locknut without changing the adjusting screw position.

**Torque - Clutch Adjustment Locknut: 11 N·m (1.1 kgf·m, 95 in·lb)**

- Install the adjusting screw cover.



## 2-12 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Engine Lubrication System

##### Engine Oil Change

- Support the vehicle so that it is level side to side and front to back after warming up the engine.
- Remove the engine drain plug [A] to drain the oil.
- The oil in the filter can be drained by removing the filter (see Oil Filter Change).
- ★ Replace the drain plug gasket with a new one if it is damaged.
- Tighten:
  - Torque - Engine Drain Plug : 29 N·m (3.0 kgf·m, 22 ft·lb)
- Pour in the specified type and amount of oil.

##### Engine Oil

Type: API SF or SG  
API SH or SJ with JASO MA

Viscosity: SAE 10W-40

Amount: 2.0 L (2.11 US qt)  
(When filter is not removed)  
2.1 L (2.22 US qt)  
(When filter is removed)  
2.75 L (2.91 US qt)  
(When engine is completely dry)

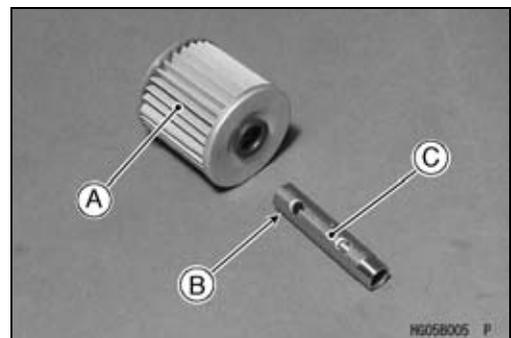
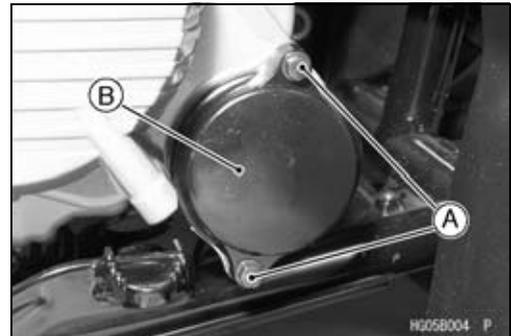
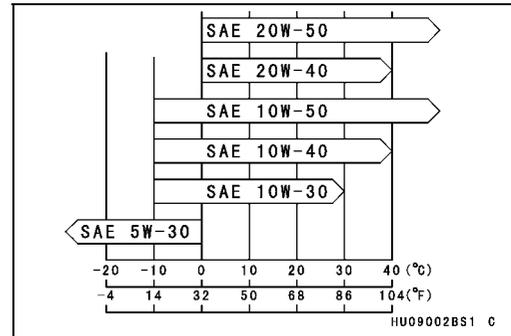
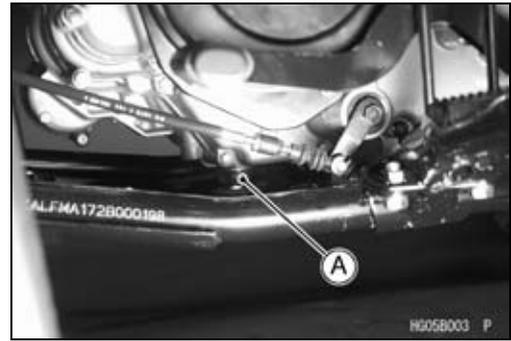
##### NOTE

○ Depending on the atmospheric temperature of your riding area, the engine oil viscosity should be changed according to the chart.

##### Oil Filter Change

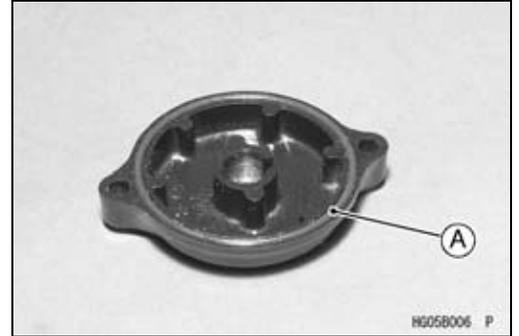
- Drain the engine oil.
- Remove:
  - Oil Filter Cover Bolts [A]
  - Oil Filter Cover [B]

- Replace the filter [A] with a new one.
- When installing the oil filter, be careful of the following.
- The large end of mounting pin [B] goes in first.



**Periodic Maintenance Procedures**

- Apply grease to the O-ring [A] in the cover.
- Tighten:
  - Torque - Oil Filter Cover Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**
- Pour in the specified type and amount of oil.



**Wheels/Tires**

*Tire Inspection*

- Examine the tire for damage and wear.
- ★ If the tire is cut or cracked, replace it.
- Lumps or high spots on the tread or sidewalls indicate internal damage requiring tire replacement.
- Remove any foreign objects from the tread. After removal, check for leaks with a soap and water solution.
- Measure the tread depth at the center of the tread with a depth gauge. Since the tire may wear unevenly, take measurements at several places.
- ★ If any measurements are less than the service limit, replace the tire.

**Tire Tread Depth**

**Service Limit:**

- Front:                    4 mm (0.16 in.)**
- Rear:                     4 mm (0.16 in.)**

**Standard Tire**

- Front:    AT 21 x 8 - 9 DUNLOP KT856 Tubeless**
- Rear:     AT 22 x 10 - 10 DUNLOP KT857 Tubeless**

## 2-14 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Final Drive

##### Final Gear Case Oil Change

- Warm up the oil by running the vehicle so that the oil will pick up any sediment and drain easily. Then stop the vehicle.
- Park the vehicle so that it is level, both side-to-side and front-to-rear.
- Place an oil pan beneath the final gear case and remove the drain plug [A].

#### CAUTION

**When draining or filling the final gear case, be careful that no oil gets on the tire or rim because oil will deteriorate the tire. Clean off any oil that inadvertently gets on them with a high-flash point solvent.**

- After the oil has completely drained out, install the drain plug with a new aluminum gasket.

**Torque - Final Gear Case Drain Plug : 20 N·m (2.0 kgf·m, 14 ft·lb)**

- Unscrew the oil level inspection bolt.
- Pour the oil into the case until the oil comes out of the bolt hole.

##### Final Gear Case Oil

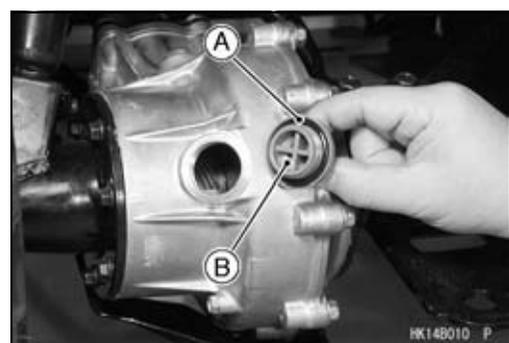
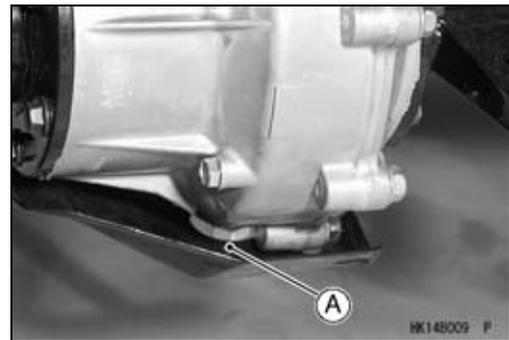
Type:	API "GL-5" Hypoid gear oil
Viscosity:	SAE90 (above 5°, 41°F) SAE80 (below 5°, 41°F)
Capacity	0.2 L (0.21 US qt)

#### NOTE

○ "GL-5" indicates a quality and additive rating. "GL-6" rated hypoid gear oils can also be used.

- Be sure the O-ring [A] is in place and tighten the filler cap [B].

**Torque - Final Gear Case Filler Cap : 15 N·m (1.5 kgf·m, 11 ft·lb)**



##### Propeller Shaft Joint Boot Inspection

- Visually inspect the rear propeller shaft joint boot [A] in accordance with the Periodic Maintenance Chart or if the shaft is noisy during operation.
- ★ If the joint boot is torn, worn, or deteriorated, replace the joint boot and check the propeller shaft (see Propeller Shaft Inspection in Final Drive chapter).

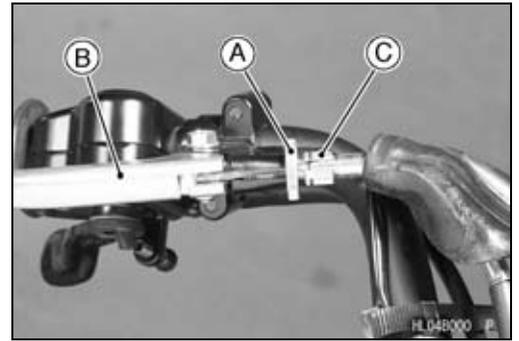


**Periodic Maintenance Procedures**

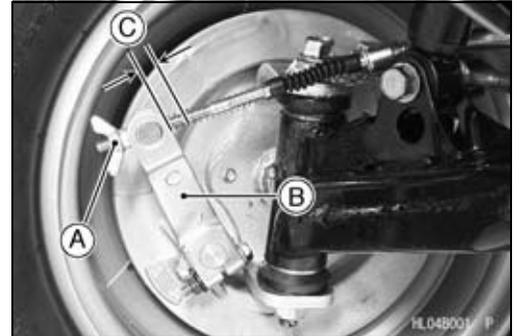
**Brakes**

*Front Brake Adjustment*

- Loosen the locknut [A] at the brake lever [B] and turn in the adjuster [C] as far as it will go to make the brake lever loose.



- Turn each adjuster [A] at both lower ends of the cable so that each brake cam lever [B] will have 2 ~ 3 mm (0.08 ~ 0.12 in.) [C] of free play.

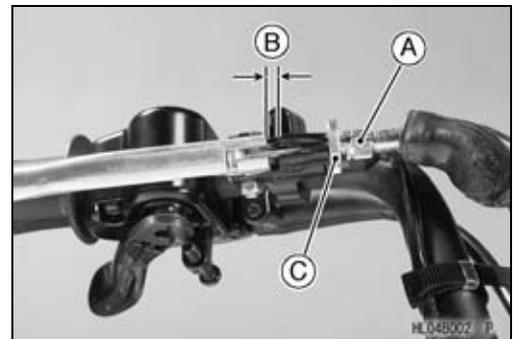


- Turn the adjuster [A] at the brake lever until the brake lever has the specified amount of free play [B].

**Front Brake Lever Free Play**

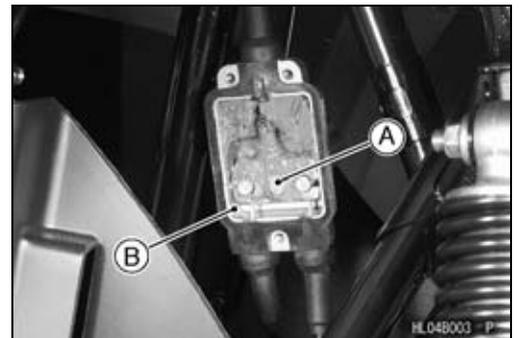
**Standard:** 1 ~ 2 mm (0.04 ~ 0.08 in.)

- Tighten the locknut [C].



**NOTE**

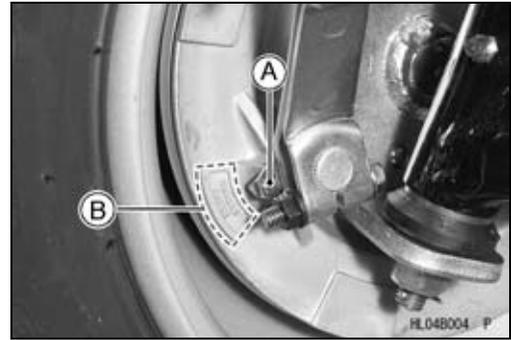
- Once the adjustment has been made following the above procedures, ordinarily adjust the free play by using the adjusters at both lower ends of the cable.
- Make sure that the equalizer [A] is lifted parallel to the bottom of the case [B] when brake lever is pulled in to prevent the brakes from pulling to either side.



## 2-16 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Check that the brake lining wear indicator [A] points within the USABLE RANGE [B] when the brake is fully applied.
- ★ If does not, replace the brake shoes.

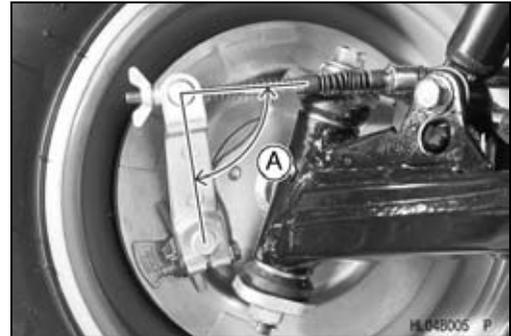


- Check the cam lever angle [A] when the brake is fully applied.

#### Cam Lever Angle

Standard: 80 ~ 90°

- ★ If the cam lever angle is not within the specified range, adjust it (see Cam Lever Angle Adjustment).



#### WARNING

Since a cam lever angle greater than 90° reduces braking effectiveness, cam lever angle adjustment should not be neglected. Reduced braking effectiveness could lead to a crash.

#### Rear (Parking) Brake Lever Free Play Inspection

- Check the rear (parking) brake lever free play [A].
- Pull the rear brake lever lightly until the brake is applied.
- ★ If the play is incorrect, adjust it.

#### Rear (Parking) Brake Lever Free Play

Standard: 2 ~ 3 mm (0.08 ~ 0.12 in.)

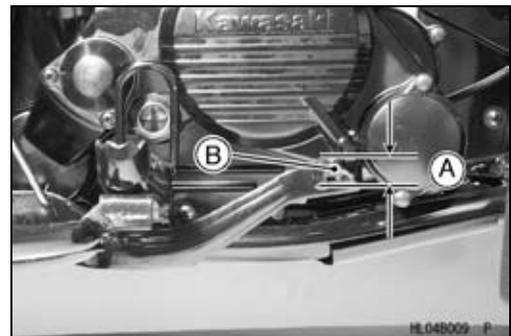


#### Brake Pedal Free Play Inspection

- Check the brake pedal free play [A].
- Depress the brake pedal [B] lightly by hand until the brake is applied.
- ★ If the free play is incorrect, adjust it.

#### Brake Pedal Free Play

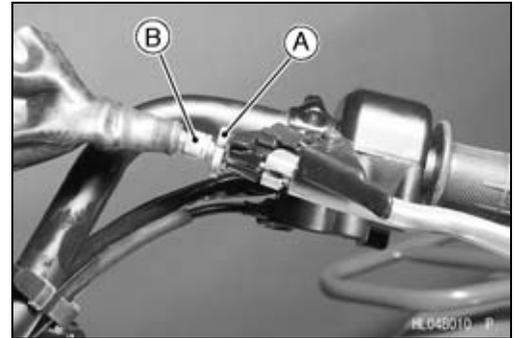
Standard: 25 ~ 35 mm (1.0 ~ 1.4 in.)



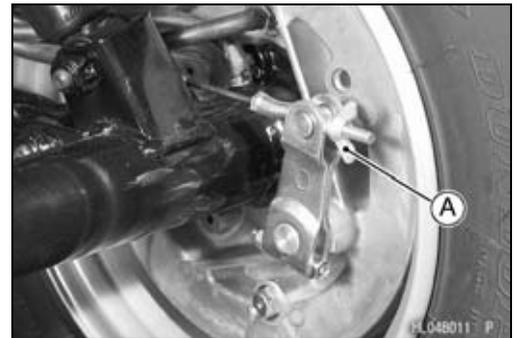
**Periodic Maintenance Procedures**

*Rear (Parking) Brake Lever and Pedal Free Play Adjustment*

- Loosen the locknut [A] and turn in the adjuster [B] at the rear brake (parking) lever as far as it will go.



- Turn in or out the adjuster [A] at the rear end of the brake cable so that the brake pedal will have 25 ~ 35 mm (1.0 ~ 1.4 in.) of free play before the brake starts to take hold.

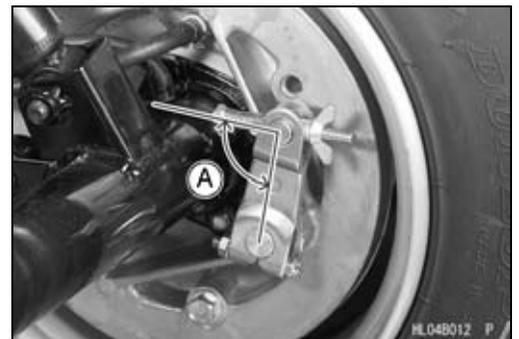


- Turn out the adjuster at the rear brake lever until brake lever has 2 ~ 3 mm (0.08 ~ 0.12 in.) of free play. Tighten the locknut.
- Check the cam lever angle [A] when the brake is fully applied.

**Cam Lever Angle**

Standard: 80 ~ 90°

- ★ If the cam lever angle is not within the range specified, adjust it (see Cam Lever Angle Adjustment).



**WARNING**

Since a cam lever angle greater than 90° reduces braking effectiveness, cam lever angle adjustment should not be neglected. Reduced braking effectiveness could lead to a crash.

## 2-18 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Steering

##### *Steering Inspection*

- Turn the handlebar left and right, and check the steering action.
- ★ If the steering action is not smooth, or if the steering binds or catches before the stop, lubricate the steering stem bearing.

#### NOTE

○ *The cables and wires will have some effect on the steering action which must be taken into account.*

- Check the steering action again.
- ★ If steering stem bearing lubrication does not remedy the problem, inspect the steering stem for straightness, steering stem clamps, and tie-rod bearings.
- ★ If you feel looseness, or if the steering rattles as it turns, check the tightness of the steering bolts and nuts.
- Tighten loose bolts and nuts to the specified torque (see Exploded View), and check the steering action again.
- ★ If the steering action does not change by tightening the bolts and nuts, inspect the steering stem clamps, steering stem bearings, tie-rod bearings, and steering knuckle joints.

#### Electrical System

##### *Battery Inspection*

- Refer to the Electrolyte Level Inspection in the Electrical System chapter.
- Refer to the Electrolyte Specific Gravity Inspection in the Electrical System chapter.
- Refer to the Ordinary Charging in the Electrical System chapter.

##### *Spark Plug Cleaning / Inspection*

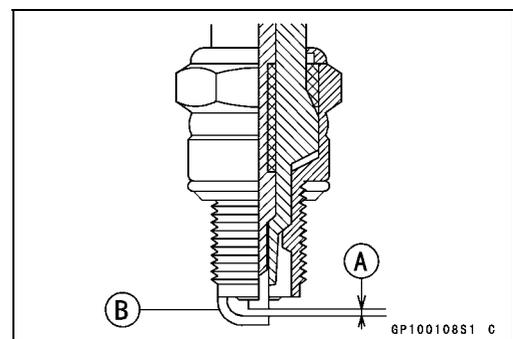
- Clean the spark plug, preferably in a sandblasting device, and then clean off any abrasive particles. The plug may also be cleaned using a wire brush or other suitable tool.
- ★ If the spark plug electrodes are corroded or damaged, or if the insulator is cracked, replace the plug. Use the standard spark plug or its equivalent.

##### *Spark Plug Gap Inspection*

- Measure the gap [A] with a wire-type thickness gauge.
- ★ If the gap is incorrect, carefully bend the side electrode [B] with a suitable tool to obtain the correct gap.

##### **Spark Plug Gap**

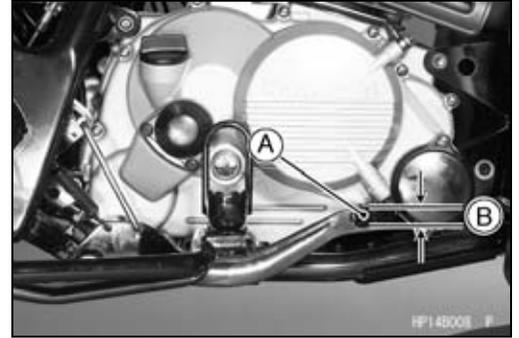
**0.6 ~ 0.7 mm (0.024 ~ 0.028 in.)**



**Periodic Maintenance Procedures**

*Brake Light Switch Adjustment*

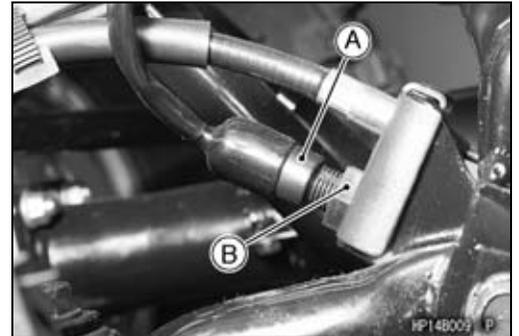
- Check the operation of the brake light switch by depressing the brake pedal [A]. The brake light should go on after about 10 mm (0.4 in..) of pedal travel [B].



- ★ If it does not, adjust the brake light switch [A] up or down. To change the switch position, turn the adjusting nut [B].

**Brake Light Switch Timing**

Standard: ON after 10 mm (0.4 in.) of pedal travel



**CAUTION**

To avoid damaging the electrical connections inside the switch, be sure that the switch body does not turn during adjustment.

**General Lubrication**

*Lubrication*

- Before lubricating each part, clean off any rusty spots with rust remover and wipe off any grease, oil, dirt, or grime.
- Lubricate the points listed below with indicated lubricant.

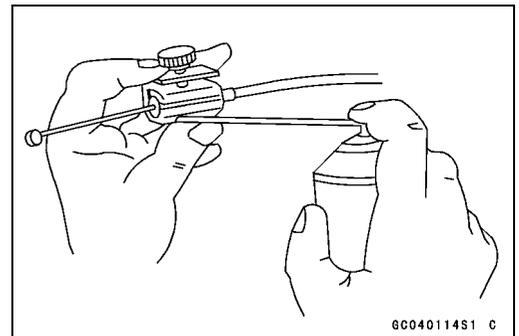
**NOTE**

○Whenever the vehicle has been operated under wet or rainy conditions, or especially after using a high-pressure spray water, perform the general lubrication.

**Cables: Lubricate with Cable Lubricant**

- Brake Cables
- Throttle Cable
- Choke Cable

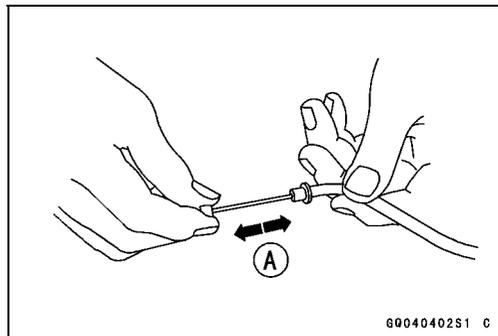
- Lubricate the cables by seeping the oil between the cable and housing.
- The cable may be lubricated by using a pressure cable luber with an aerosol cable lubricant.



## 2-20 PERIODIC MAINTENANCE

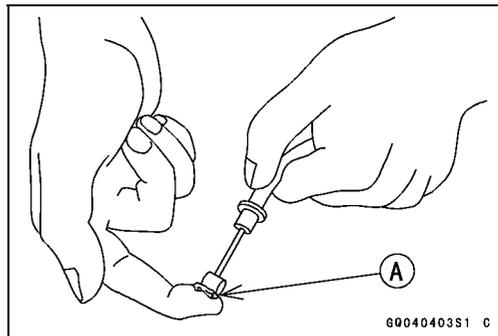
### Periodic Maintenance Procedures

- With the cable disconnected at the both ends, the cable should move freely [A] within the cable housing.
- ★ If cable movement is not free after lubricating, if the cable is frayed, or if the cable housing is kinked, replace the cable.



**Points: Lubricate with Grease.**

Throttle Inner Cable ENds [A]  
Choke Cable Lower End  
Brake Cable Ends



**Slide Points: Lubricate with Grease.**

Brake Lever  
Brake Pedal Pivot Shaft  
Throttle Lever Shaft

---

## Periodic Maintenance Procedures

---

### Bolts and Nuts Tightening

#### *Tightness Inspection*

- Check the tightness of the bolts and nuts listed here in accordance with the Periodic Maintenance Chart. Also, check to see that each cotter pin is in place and in good condition.
- ★ If there are loose fasteners, retorque them to the specified torque following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not listed in the appropriate chapter, see the Basic Torque Table (see Torque and Locking Agent). For each fastener, first loosen it by 1/2 turn, then tighten it.
- ★ If cotter pins are damaged, replace them with new ones.

#### **Bolts, Nuts, and Fasteners to be checked**

##### **Wheels:**

Front Axle Nuts and Cotter Pins  
Rear Axle Nuts and Cotter Pins  
Wheel Nuts

##### **Brakes:**

Brake Lever Pivot Bolt  
Brake Lever Pivot Nut  
Brake Pedal Cotter Pin

##### **Steering/Suspension:**

Handlebar Clamp Bolts  
Stem Clamp Allen Bolts  
Stem Bearing Housing Bolts  
Tie-Rod End Nuts and Cotter Pins  
Tie-Rod Adjusting Sleeve Locknuts  
Shock Absorber Mounting Bolts and Nuts  
Suspension Arm Pivot Bolts  
Steering Knuckle Pivots Nuts and Cotter Pins

##### **Engine:**

Engine Mounting Bolts  
Engine Mounting Bracket Bolts  
Exhaust Pipe Holder Nuts  
Muffler Mounting Bolts  
Muffler Clamp Bolt

##### **Others:**

Footrest Mounting Bolts  
Throttle Mounting Bolts  
Carrier Mounting Bolts



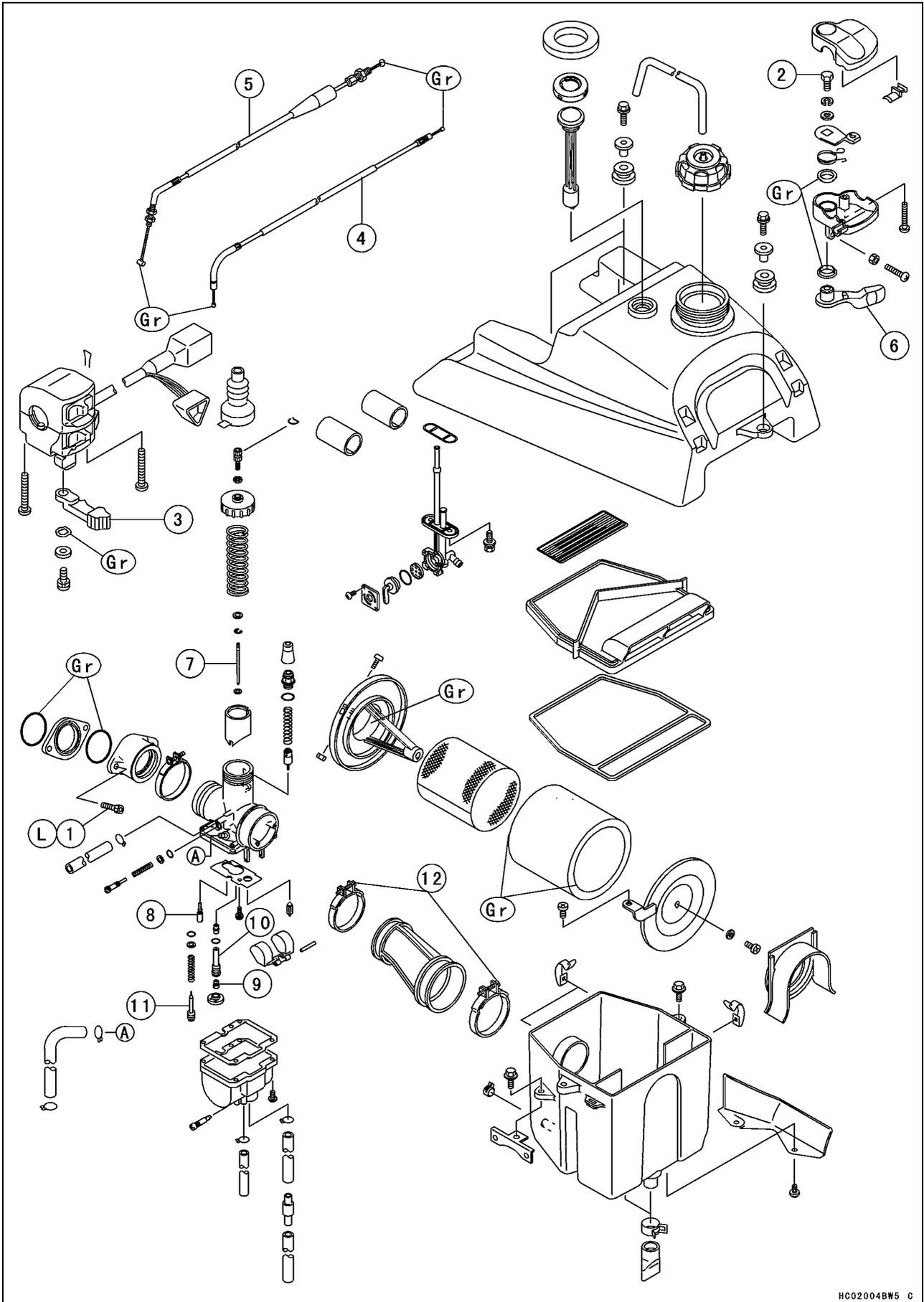
# Fuel System

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# 3-2 FUEL SYSTEM

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Carburetor Holder Bolts	11	1.1	95 in·lb	L
2	Throttle Lever Bolt	5.9	0.6	52 in·lb	

3: Choke Lever

4: Choke Cable

5: Throttle Cable

6: Throttle Lever

7: Jet Needle

8: Pilot Jet

9: Main Jet

10: Needle Jet

11: Pilot Screw

12: Tighten the clamp screws from rear, then front.

Gr: Apply grease.

L: Apply a non-permanent locking agent.

### 3-4 FUEL SYSTEM

#### Specifications

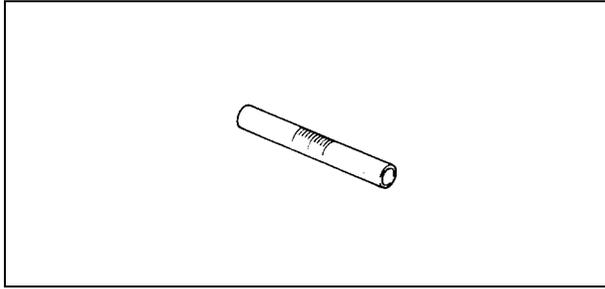
Item	Standard		Service Limit
	KLF250-A1	KLF250-A2 ~	
<b>Throttle Case and Cable</b>			
Throttle Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)		---
<b>Carburetor</b>			
Make/Type	MIKUNI VM24SS		---
Main Jet	#115	#120	---
Main Air Jet	φ1.0	φ1.8	---
Needle Jet	O-6M	O-2M	---
Jet Needle	5GN64-1	5GN74-1	---
Pilot Jet	#30	#22.5	---
Pilot Air Jet	φ1.3	φ1.0	---
Pilot Screw	1 1/2 turns out	2 1/2 turns out	---
Starter Jet	#45		---
Idle Speed	1 300 ~ 1 400 r/min (rpm)		---
Service Fuel Level	5 ± 1 mm (0.20 ± 0.04 in.) below bottom edge of carburetor body		---
Float Height	22.6 ± 2 mm (0.89 ± 0.04 in.)		---
Optional Parts:			
Main Jet:			
Altitude:			
0 ~ 500 m (0 ~ 1 600 ft)	#115 (92063-1109)	#120 (92063-1106)	---
500 ~ 1 500 m (1 600 ~ 4 900 ft)	#112.5 (92063-1110)	#117.5 (92063-1107)	---
1 500 ~ 2 500 m (4 900 ~ 8 200 ft)	#110 (92063-1038)	#115 (92063-1109)	---
2 500 ~ 3 500 m (8 200 ~ 11 500 ft)	#107.5 (92063-073)	#112.5 (92063-1110)	---
3 500 ~ 4 500 m (11 500 ~ 14 800 ft)	#102.5 (92063-1028)	#110 (92063-1038)	---
<b>Air Cleaner</b>			
Air cleaner element oil	High-quality foam air filter oil		---

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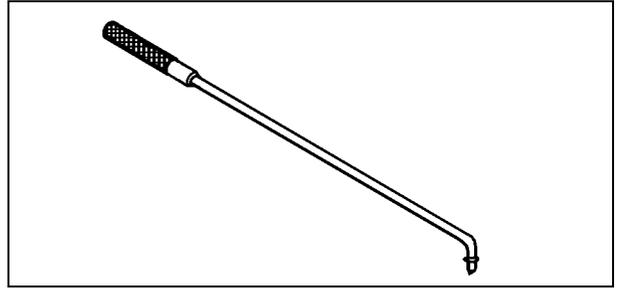
**Special Tools and Sealant**

---

**Fuel Level Gauge:  
57001-1017**



**Pilot Screw Adjuster, A:  
57001-1239**



## 3-6 FUEL SYSTEM

### Throttle Lever and Cable

#### Throttle Lever Free Play Inspection

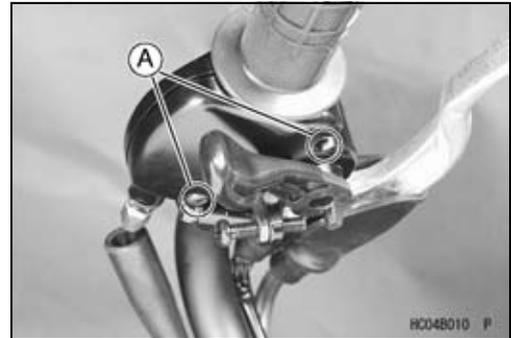
- Refer to the Throttle Lever Free Play Inspection in the Periodic Maintenance chapter.

#### Throttle Lever Free Play Adjustment

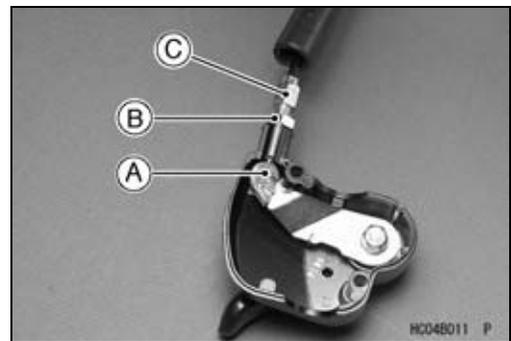
- Refer to the Throttle Lever Free Play Adjustment in the Periodic Maintenance chapter.

#### Throttle Case Removal/Disassembly

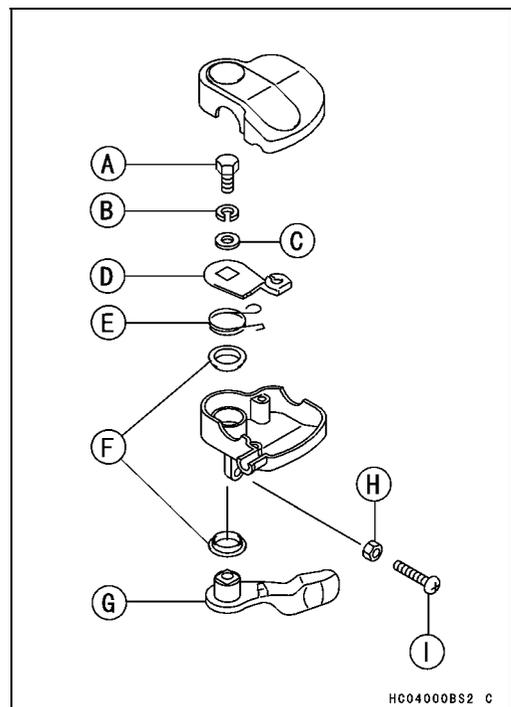
- Remove the throttle case screws [A] and separate the case halves.



- Pull the cable tip [A] out of the throttle lever catch with the throttle lever opened.
- Loosen the locknut [B] and unscrew the adjuster [C].



- Remove:
  - Throttle Lever Bolt [A], Spring Washer [B], and Washer [C]
  - Arm [D] and Spring [E]
  - Collars [F]
  - Throttle Lever [G]
- Loosen the locknut [H] and unscrew the throttle limiter screw [I].



## Throttle Lever and Cable

### Throttle Case Assembly/Installation

- Lubricate the throttle case and cable before assembly/installation.
- Be certain that the return spring [A] is correctly installed on the throttle lever.
- Tighten:

**Torque - Throttle Lever Bolt : 5.9 N·m (0.6 kgf·m, 52 in·lb)**

- Swing the throttle lever so that the carburetor throttle valve is fully open. Turn the throttle limiter screw [A] until it is spaced about 1 mm (0.04 in.) [B] away from the throttle lever stop [C]. Tighten the locknut [D].

### NOTE

○Refer to the Owner's Manual for the function of the throttle limiter and adjustment procedure of it.

### WARNING

**Operation with an improperly assembled throttle case could result in an unsafe riding condition.**

- Check the throttle lever free play (see Throttle Lever Free Play Inspection).

### Throttle Cable Installation

- Lubricate the throttle cable before installation.
- Route the cable correctly according to Appendix chapter.

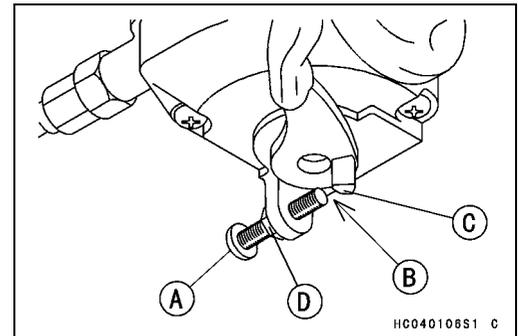
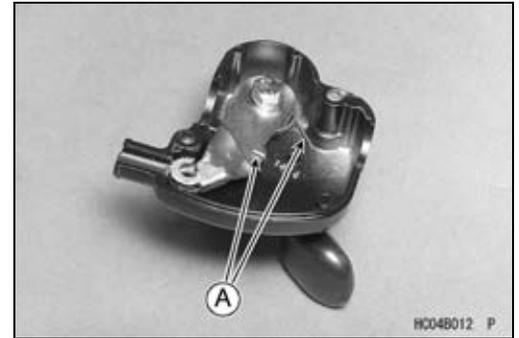
### WARNING

**Operation with an improperly adjusted, incorrectly routed, or damaged cable could result in an unsafe riding condition.**

- Check the throttle cable (see Throttle Lever Free Play Inspection).

### Throttle Case Inspection and Lubrication

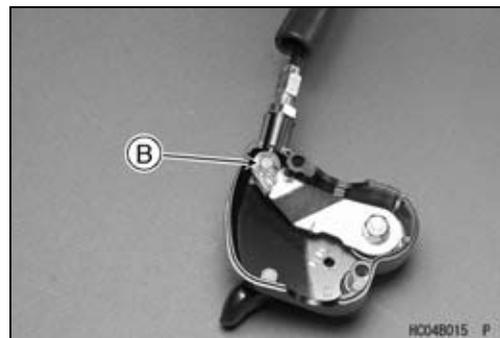
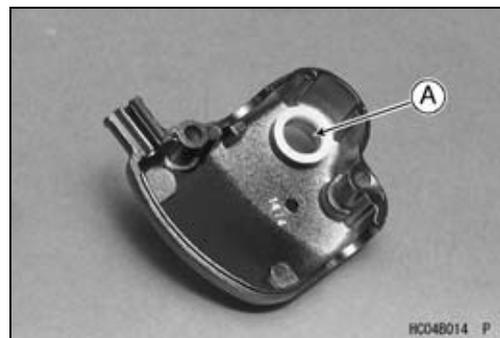
- With the throttle cable disconnected from the throttle lever, the lever should move freely and return smoothly by spring.
- ★ If the lever is heavy, disassemble the throttle case, clean and lubricate the throttle case.
- Examine the lever and case for cracks. Replace the case assembly if it is cracked.



## 3-8 FUEL SYSTEM

### Throttle Lever and Cable

- Apply a thin coating of multi-purpose grease to the throttle lever pivot area [A] and throttle cable end [B].



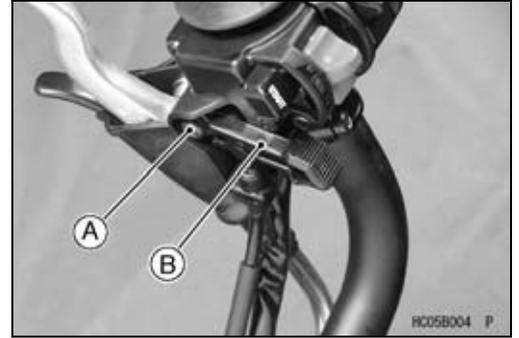
#### *Throttle Cable Lubrication and Inspection*

- Whenever the throttle cable is removed or in accordance with the Periodic Maintenance Chart in the Periodic Maintenance chapter, lubricate the cable.
- Refer to the General Lubrication in the Periodic Maintenance chapter for the cable lubrication and inspection.

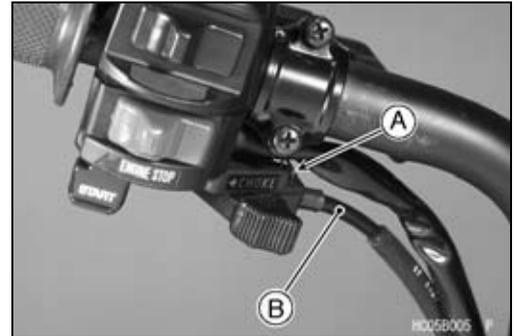
## Choke Lever and Cable

### Choke Lever Removal

- Unscrew the choke lever mounting screw [A] and take off the plane washer and the wave washer.
- Remove the choke lever [B] and free the choke cable upper end from the lever.



- Pull off the retaining ring [A] and free the choke cable [B] from the switch case.
- Pull the cable out of the vehicle.



### Choke Lever and Cable Installation

- Lubricate the choke cable before installation.
- Install the wave washer, plane washer and screw in that order.
- Route the choke cable according to the General Information chapter.

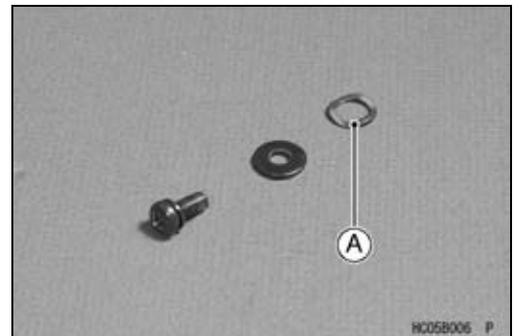
### WARNING

Operation with an incorrectly routed, or damaged cable could result in an unsafe riding condition.

### Choke Lever Lubrication

Whenever the choke cable is removed, lubricate the choke lever as follows:

- Apply a thin coating of multi-purpose grease to the wave washer [A].



### Choke Cable Lubrication and Inspection

- Whenever the choke cable is removed or in accordance with the Periodic Maintenance Chart in the Periodic Maintenance chapter, lubricate the cable.
- Refer to the General Lubrication in the Periodic Maintenance chapter for the cable lubrication and inspection.

## 3-10 FUEL SYSTEM

### Carburetor

#### Idle Speed Adjustment

- Start the engine and warm it up thoroughly.
- With the engine idling, turn the handlebar to both sides to check for any changes in the idle speed.
- ★ If handlebar movement changes the idle speed, the throttle cable may be improperly adjusted, incorrectly routed, or damaged. Be sure to correct any of these conditions before riding.

#### WARNING

Operation with an improperly adjusted, incorrectly routed, or damaged cable could result in an unsafe riding condition.

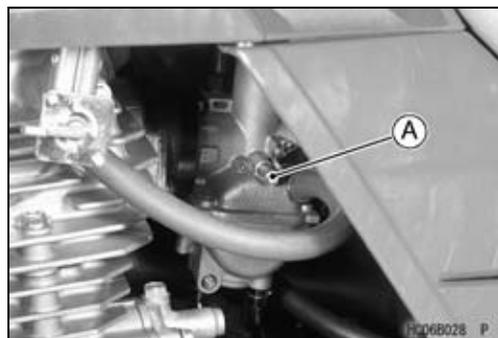
- Check idle speed with a suitable tachometer.
- ★ If the idle speed is out of the specified range, adjust it.

#### Idle Speed

Standard: 1 300 ~ 1 400 r/min (rpm)

#### Idle Speed Adjustment

- Start the engine and warm it up thoroughly.
- Turn the idle adjusting screw [A] until the idle speed is correct.
- Open and close the throttle a few times to make sure that the idle speed is within the specified range.



#### Carburetor Pilot Screw Adjustment

- Adjust the pilot screw if necessary.
- Turn the carburetor pilot screw [A] all the way in until it seats lightly.

Special Tool - Pilot Screw Adjuster, A: 57001-1239 [B]

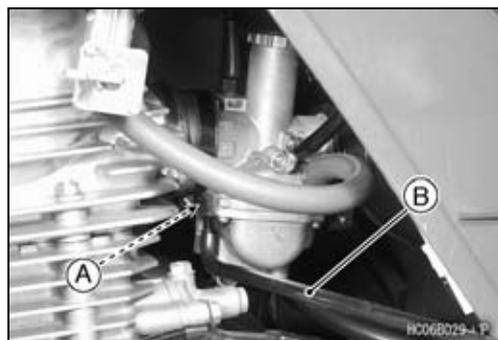
#### CAUTION

Do not overtighten the pilot screw or the carburetor body will be damaged and require replacement.

- Back the pilot screw out the specified number of turns.

#### Carburetor Pilot Screw Setting

Standard: 1 1/2 turns out



#### Fuel Level Inspection

#### WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. 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.

- Park the vehicle on a level surface.

**Carburetor**

- Connect the fuel level gauge to the open end of the carburetor drain hose.

**Special Tool - Fuel Level Gauge: 57001-1017**

- Fuel Level Gauge [A]
- Zero Line [B]
- Drain Plug [C]
- Carburetor Body Bottom Edge [D]
- Fuel Level [E]

- Hold the gauge vertically against the side of the carburetor body so that the "zero" line is several millimeters higher than the bottom edge of the carburetor body.
- Turn the fuel tap to the ON position to feed fuel to the carburetor and gauge, then turn out the carburetor drain plug a few turns.
- Wait until the fuel level in the gauge settles.
- Keeping the gauge vertical, slowly lower the gauge until the "zero" line is even with the bottom edge of the carburetor body.

**NOTE**

○Do not lower the "zero" line below the bottom edge of the carburetor body. If the gauge is lowered and then raised it again, the fuel level measured shows somewhat higher than the actual fuel level. If the gauge is lowered too far, dump the fuel out of it into a suitable container and start the procedure over again.

- Read the fuel level in the gauge and compare it to the specification.
- Tighten the drain plug and remove the fuel level gauge.
- ★ If the fuel level is incorrect, adjust it (see Fuel Level Adjustment).

**Fuel Level**

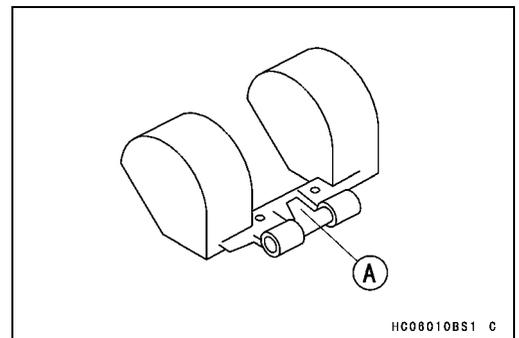
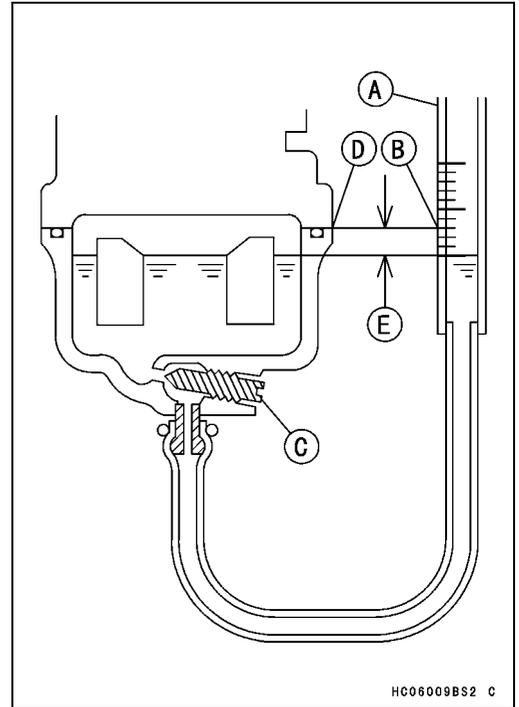
**Standard:**  $5 \pm 1 \text{ mm (} 0.20 \pm 0.04 \text{ in.)}$  below the bottom edge of the carburetor body

*Fuel Level Adjustment*

- Remove the carburetor.
- Drain the carburetor.
- Remove the float bowl by taking out the screws.
- Bend the tang [A] on the float arm very slightly to change the float height. Increasing the float height lowers the fuel level and decreasing the float height raises the fuel level.

**Float Height**

**Standard:**  $22.6 \pm 2 \text{ mm (} 0.89 \pm 0.04 \text{ in.)}$



## 3-12 FUEL SYSTEM

### Carburetor

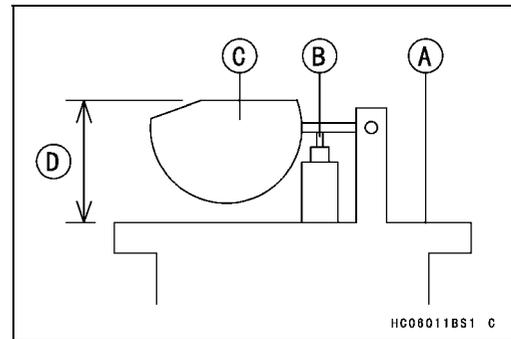
Float Bowl Mating Surface [A]

Float Valve Needle Rod (contacted but unloaded) [B]

Float [C]

Float Height [D]

- ★ If the fuel level cannot be adjusted by this method, the float or the float valve is damaged.
- Assemble the carburetor, install it on the vehicle, and recheck the fuel level.



#### Fuel System Cleanliness Inspection

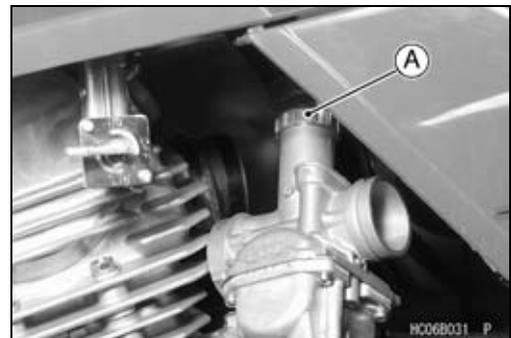
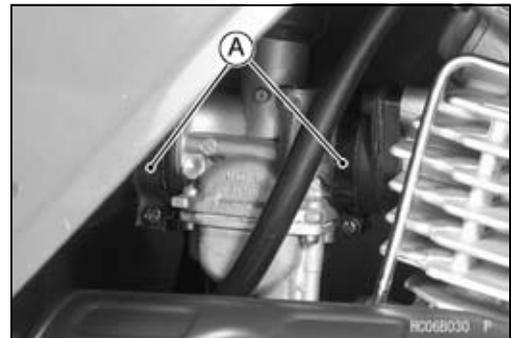
- Refer to the Fuel System Cleanliness Inspection in the Periodic Maintenance chapter.

#### Carburetor Removal

##### WARNING

**Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. 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.**

- Turn the fuel tap to the OFF position.
- Remove:
  - Fuel Hose
  - Starter Plunger
  - Clamps [A]
- Pull out the carburetor.
- Remove the carburetor cap [A].



## Carburetor

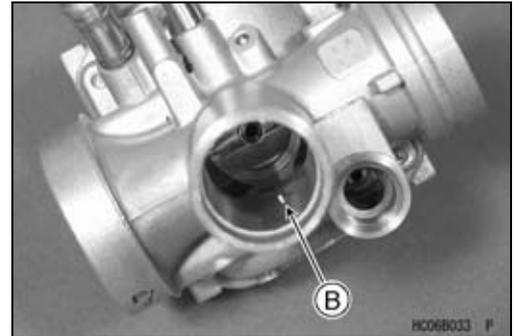
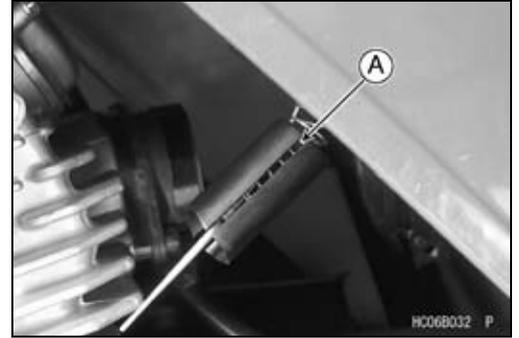
### Carburetor Installation

- Align the slit [A] on the side of the throttle valve with the guide pin [B] in the carburetor body.
- Route the carburetor hoses according to Appendix chapter.
- Check fuel leakage from the carburetor.

### WARNING

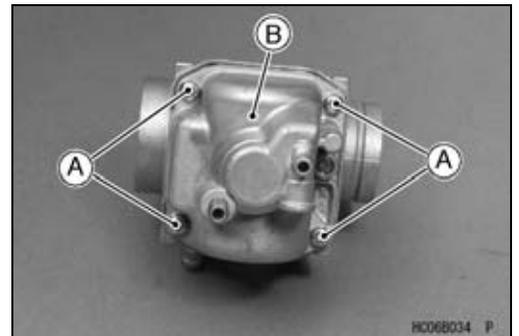
**Fuel spilled from the carburetor is hazardous.**

- ★ If the carburetor has been disassembled, or if there is some other reason that the fuel level may be incorrect, inspect the fuel level (see Carburetor Fuel Level Inspection).
- Adjust the idle speed (see Idle Speed Adjustment).
- Check the throttle cable (see Throttle Lever Free Play Inspection in Periodic Maintenance chapter).

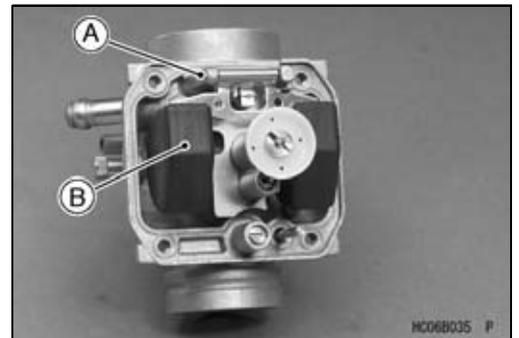


### Carburetor Disassembly

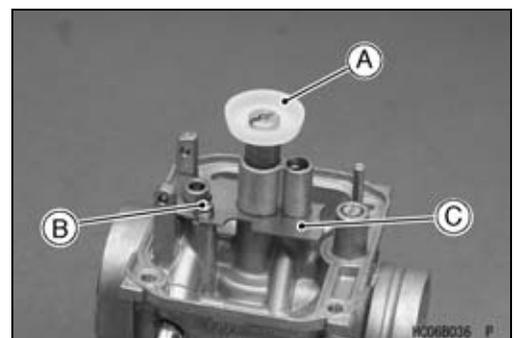
- Remove:
  - Carburetor (see Carburetor Removal)
  - Float Bowl Screws [A]
  - Float Bowl [B]



- Slide out the float pivot pin [A], remove the float [B], and drop out the float valve needle with its hanger.



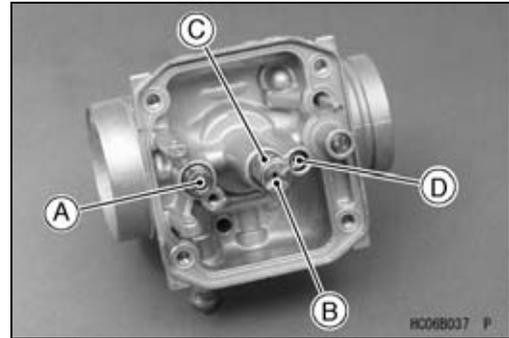
- Remove:
  - Main Jet Fence [A]
  - Plate Screw [B]
  - Plate [C]



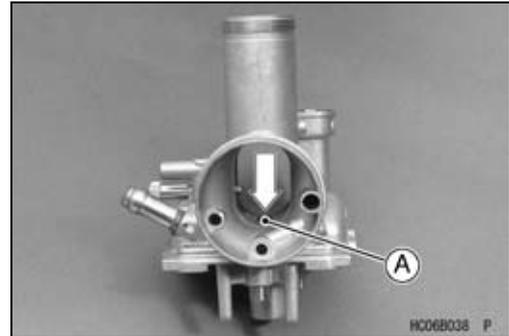
## 3-14 FUEL SYSTEM

### Carburetor

- Remove:
  - Float Valve Seat [A]
  - Main Jet [B]
  - Needle Jet Holder [C]
  - Pilot Jet [D]



- Remove:
  - Needle Jet [A]



### Carburetor Assembly

- Turn the carburetor body upside down, and drop the needle jet into place so that the long end [A] of the jet goes in first.

#### CAUTION

**Do not force the needle jet holder and main jet or overtighten them. The needle jet or the carburetor body could be damaged requiring replacement.**

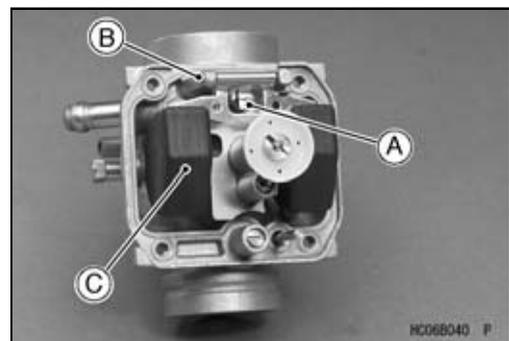


- Drop the float valve needle into the valve seat and hold the float in place with the tang [A] hooked into the needle hanger.
- Slip the float pivot pin [B] through the pivot posts and the float [C] as shown.

#### WARNING

**If the float is improperly installed, the specified fuel level cannot be maintained. Fuel spilled from the carburetor is hazardous.**

- Set the float height as specified.



## Carburetor

### *Carburetor Cleaning*

#### **WARNING**

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

#### **CAUTION**

Do not use compressed air on an assembled carburetor, the float may be crushed by the pressure, and the vacuum piston diaphragm may be damaged. Remove as many rubber or plastic parts from the carburetor as possible before cleaning the carburetor with a cleaning solution. This will prevent damage or deterioration of the parts. The carburetor body has plastic parts that cannot be removed. **DO NOT** use a strong carburetor cleaning solution which could attack these parts, instead, use a mild high-flash point cleaning solution safe for plastic parts.

- Disassemble the carburetor (see Carburetor Disassembly).
- Immerse all the metal parts in a carburetor cleaning solution.
- Rinse the parts in water.
- When the parts are clean, dry them with compressed air.
- Blow the air and fuel passages with compressed air.
- Assemble the carburetor (see Carburetor Assembly).

### *Carburetor Inspection*

#### **WARNING**

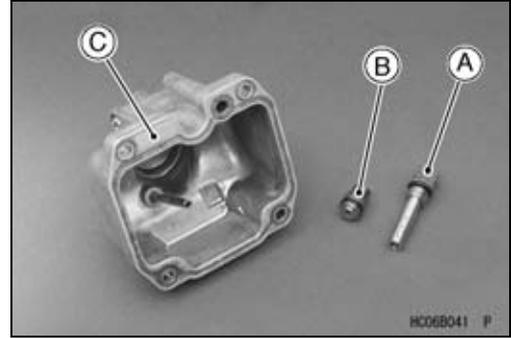
Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

- Before removing the carburetor, check the fuel level (see Fuel Level Inspection).
- ★ If the fuel level is incorrect, inspect the rest of the carburetor before correcting it.

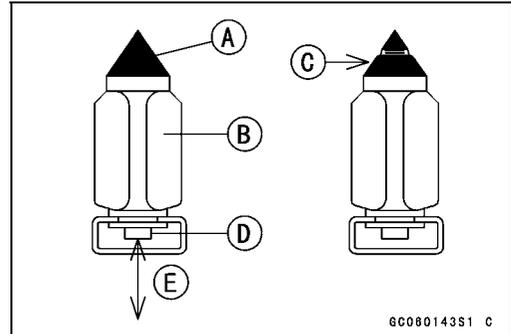
## 3-16 FUEL SYSTEM

### Carburetor

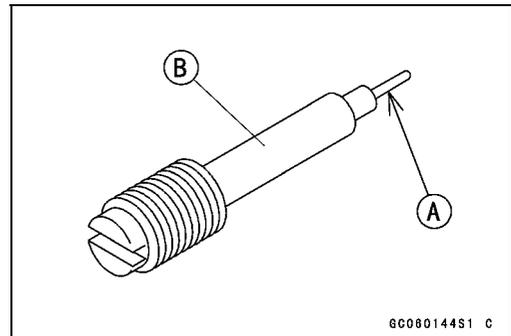
- Disassemble the carburetor (see Carburetor Disassembly).
- Clean the carburetor (see Carburetor Cleaning).
- Check the carburetor holder, starter plunger, plunger cap, idle adjusting screw, pilot screw, needle jet holder [A], and float valve seat [B] and the gaskets on the carburetor cap and float bowl [C] are in good condition.
- ★ If any of the O-rings or gaskets are not in good condition, replace them.



- Check the plastic tip [A] of the float valve needle [B]. It should be smooth, without any grooves, scratches, or tears.
- ★ If the plastic tip is damaged [C], replace the needle.
- Push the rod [D] in the other end of the float valve needle and then release it [E].
- ★ If it does not spring out, replace the float valve needle.



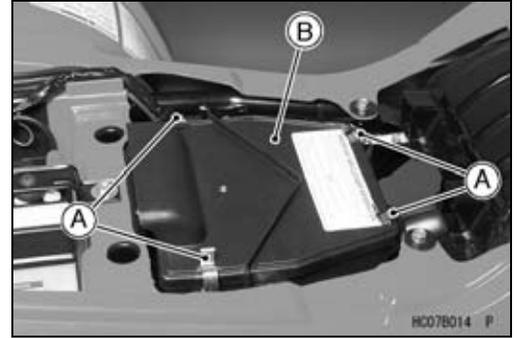
- Check the tapered portion [A] of the pilot screw [B] for wear or damage.
- ★ If the pilot screw is worn or damaged on the tapered portion, it will prevent the engine from idling smoothly. Replace it.



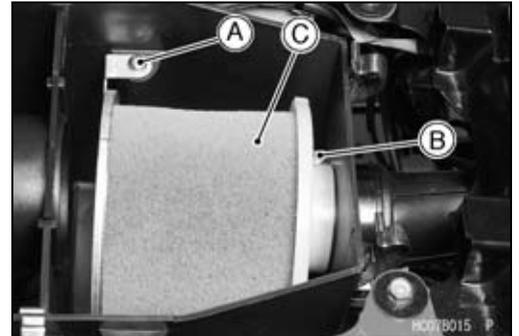
## Air Cleaner

### Air Cleaner Element Removal

- Remove:
  - Seat (see Frame chapter)
  - Clips [A]
  - Air Cleaner Housing Cap [B]



- Remove:
  - Element Mounting Screw [A]
  - Element Clamp Screw [B]
  - Element [C]
- After removing the element, stuff pieces of lint-free, clean cloth into the air cleaner duct to keep dirt out of the carburetor and engine.



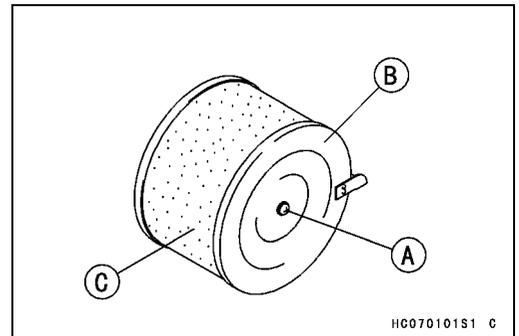
### WARNING

If dirt or dust is allowed to pass through into the carburetor, the throttle may become stuck, possibly causing an accident.

### CAUTION

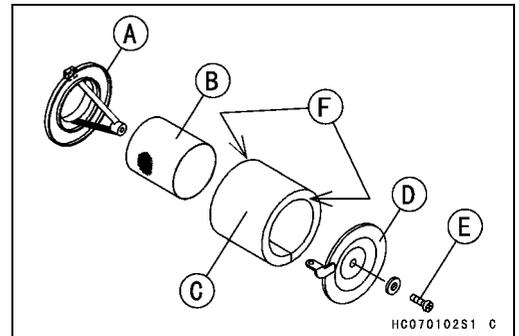
If dirt gets through into the engine, excessive engine wear and possibly engine damage will occur.

- Remove:
  - Screw [A] and Washer
  - Stopper [B]
  - Element [C]



### Air Cleaner Element Installation

- Install the following parts on the holder [A].
  - Metal Net [B]
  - Element [C]
  - Stopper [D]
  - Screw [E] and Washer
- After cleaning the element, grease to the both sides [F] on the element  $2.8 \pm 0.4$  g ( $0.01 \pm 0.014$  oz) on one side.



- Grease the element inlet [A] as shown.



## 3-18 FUEL SYSTEM

### Air Cleaner

#### *Air Cleaner Element Cleaning and Inspection*

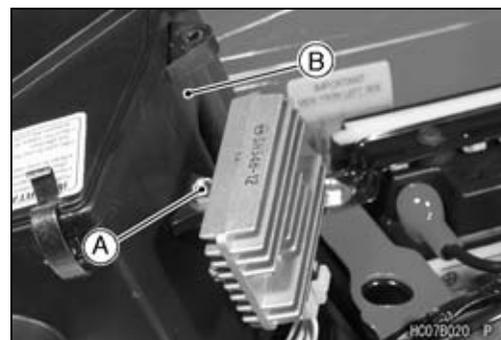
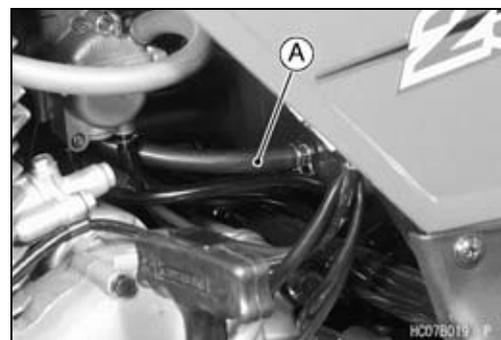
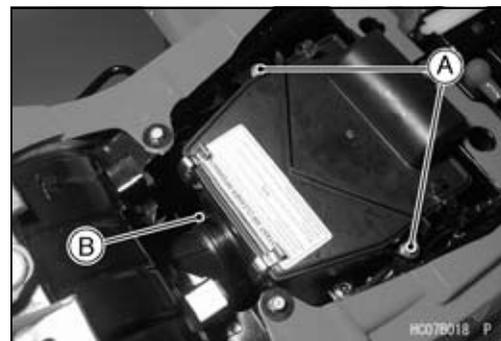
- Refer to the Air Cleaner Element Cleaning and Inspection in the Periodic Maintenance chapter.

#### *Air Cleaner Draining*

- Refer to the Air Cleaner Draining in the Periodic Maintenance chapter.

#### *Air Cleaner Housing Removal*

- Remove:
    - Seat (see Frame chapter)
    - Housing Mounting Bolts [A]
  - Loosen the clamp screw [B].
- 
- Remove:
    - Engine Breather Hose [A]
- 
- Remove:
    - Regulator Mounting Bracket Bolt [A]
    - Air Cleaner Housing [B]



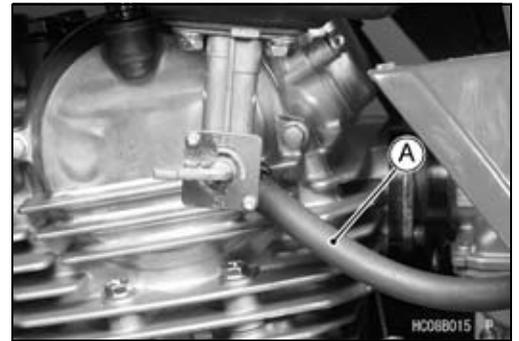
## Fuel Tank

### Fuel Tank Removal

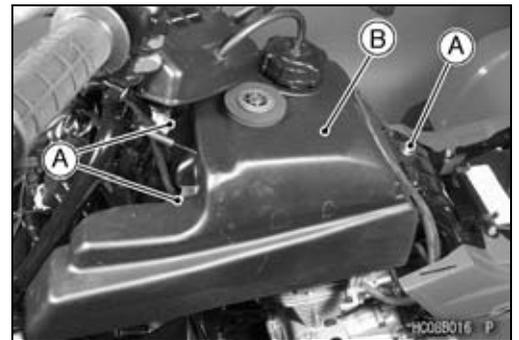
#### WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. 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:
  - Front Fender (see Frame chapter)
- Turn the fuel tap to the OFF position.
- Remove:
  - Fuel Hose [A]



- Remove:
  - Bolts [A]
  - Fuel Tank [B]

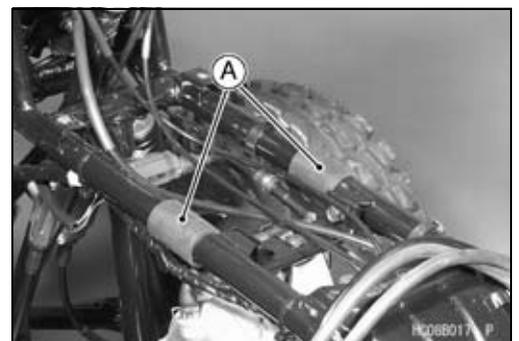


### Fuel Tank Installation

#### WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. 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.

- Check the rubber dampers [A] on the frame top-tubes as shown.
- ★ If the dampers are damaged or deteriorated, replace them.
- Be sure the fuel hose is clamped to the fuel tap to prevent leakage.



#### WARNING

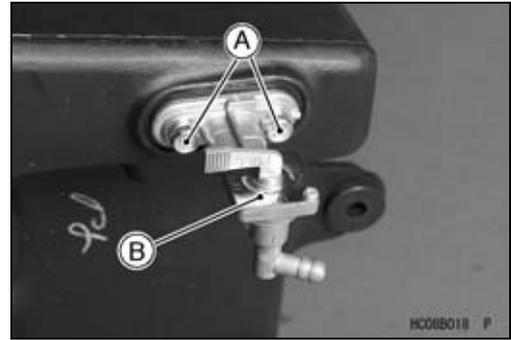
Fuel spilled from the fuel tap is hazardous.

## 3-20 FUEL SYSTEM

### Fuel Tank

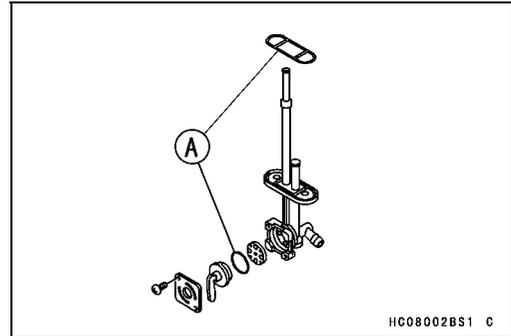
#### *Fuel Tap Removal*

- Remove the fuel tank and drain it (see Fuel Tank Removal).
- Remove:
  - Bolts [A]
  - Fuel Tap [B]



#### *Fuel Tap Installation*

- Be sure the O-rings [A] are in good condition to prevent leakage.



#### *Fuel Tank and Fuel Tap Cleaning*

- Remove the fuel tank and drain it (see Fuel Tank Removal).
- Pour some high-flash point solvent into the fuel tank and shake the tank to remove dirt and fuel deposits.

### **WARNING**

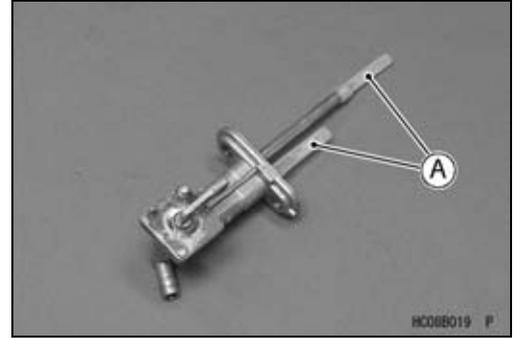
**Clean the tank in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area; this includes any appliance with a pilot light. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents to clean the tank. A fire or explosion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

- Pour the solvent out the tank.
- Remove the fuel filter from the tank by taking out the bolts.
- Clean the fuel filter screens in a high-flash point solvent.
- Pour high-flash point solvent through the tap in both ON and RES positions.
- Dry the tank fuel filter with compressed air.
- Install the fuel filter in the tank (see Fuel Tap, Fuel Filter Installation).
- Install the fuel tank (see Fuel Tank Installation).

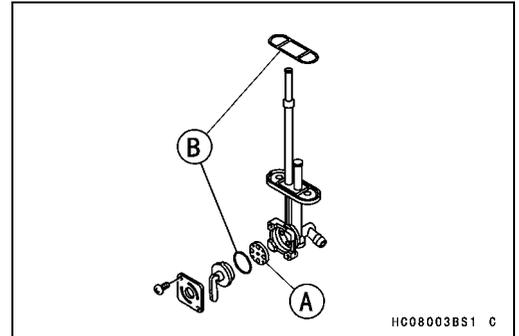
**Fuel Tank**

*Fuel Tap Inspection*

- Check the fuel filter screens [A] for any breaks or deterioration.
- ★ If the fuel filter screens have any breaks or are deteriorated, it may allow dirt to reach the carburetor, causing poor running. Replace the fuel tap.



- ★ If the fuel tap leaks, or allows fuel to flow when it is OFF, replace the damaged gasket [A] or O-rings [B].



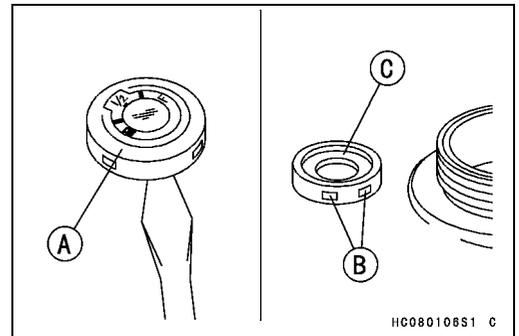
*Fuel Level Gauge Removal*

- Remove the fuel tank cap.

**WARNING**

**Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. 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 the fuel tank cover (see Fuel Tank Removal).
- Install the fuel tank cap immediately.
- Pry off the gauge cap [A] and discard the cap.
- Check the grooves [B] in the fuel tank boss. If the grooves are damaged by removing the cap or can not hold the cap nails, the fuel tank must be replaced.
- Pull out the fuel level gauge [C].



## 3-22 FUEL SYSTEM

### Fuel Tank

#### Fuel Level Gauge Installation

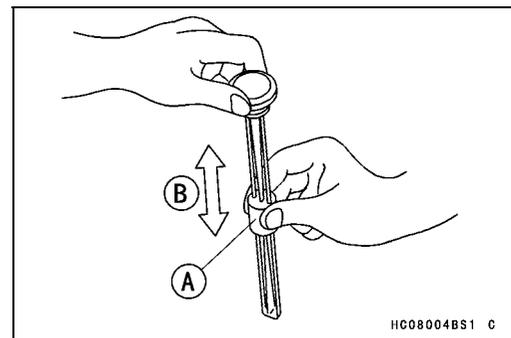
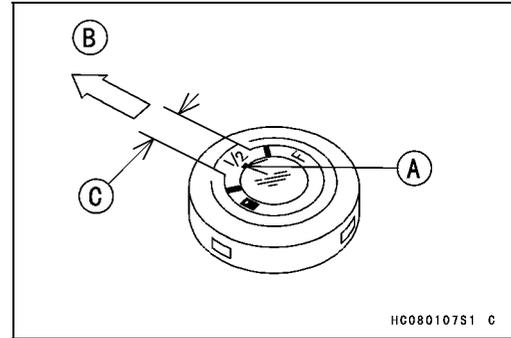
#### WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. 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.

- Install the fuel level gauge so that the 1/2 scale [A] faces the front [B].
- Push the new gauge cap over the gauge so that the notch [C] aligns with the 1/2 scale.
- Check that the gauge cap nails fit securely in the grooves in the fuel tank boss.

#### Fuel Level Gauge Check

- Remove the fuel level gauge from the fuel tank (see Fuel Level Gauge Removal).
- Check that the float [A] moves up and down [B] smoothly without binding. It should go down under its own weight.
- ★ If the float does not move smoothly or has visual damage, replace the gauge.



# Engine Top End

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**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Cylinder Head Bolts (M10), first torque	13	1.3	113 in·lb	L(1), MO, S
1	Cylinder Head Bolts (M10), final torque	34	3.5	25	S
2	Cylinder Head Bolts (M6), first torque	5.9	0.6	52 in·lb	MO, S
2	Cylinder Head Bolts (M6), final torque	9.8	1.0	87 in·lb	S
3	Valve Adjusting Cap Bolts	8.8	0.9	78 in·lb	
4	Retaining Bolt	4.4	0.45	39 in·lb	
5	Compression Releasing Lever Bolt	8.8	0.9	78 in·lb	

G: Apply grease for oil seal and O-ring.

L: Apply a non-permanent locking agent.

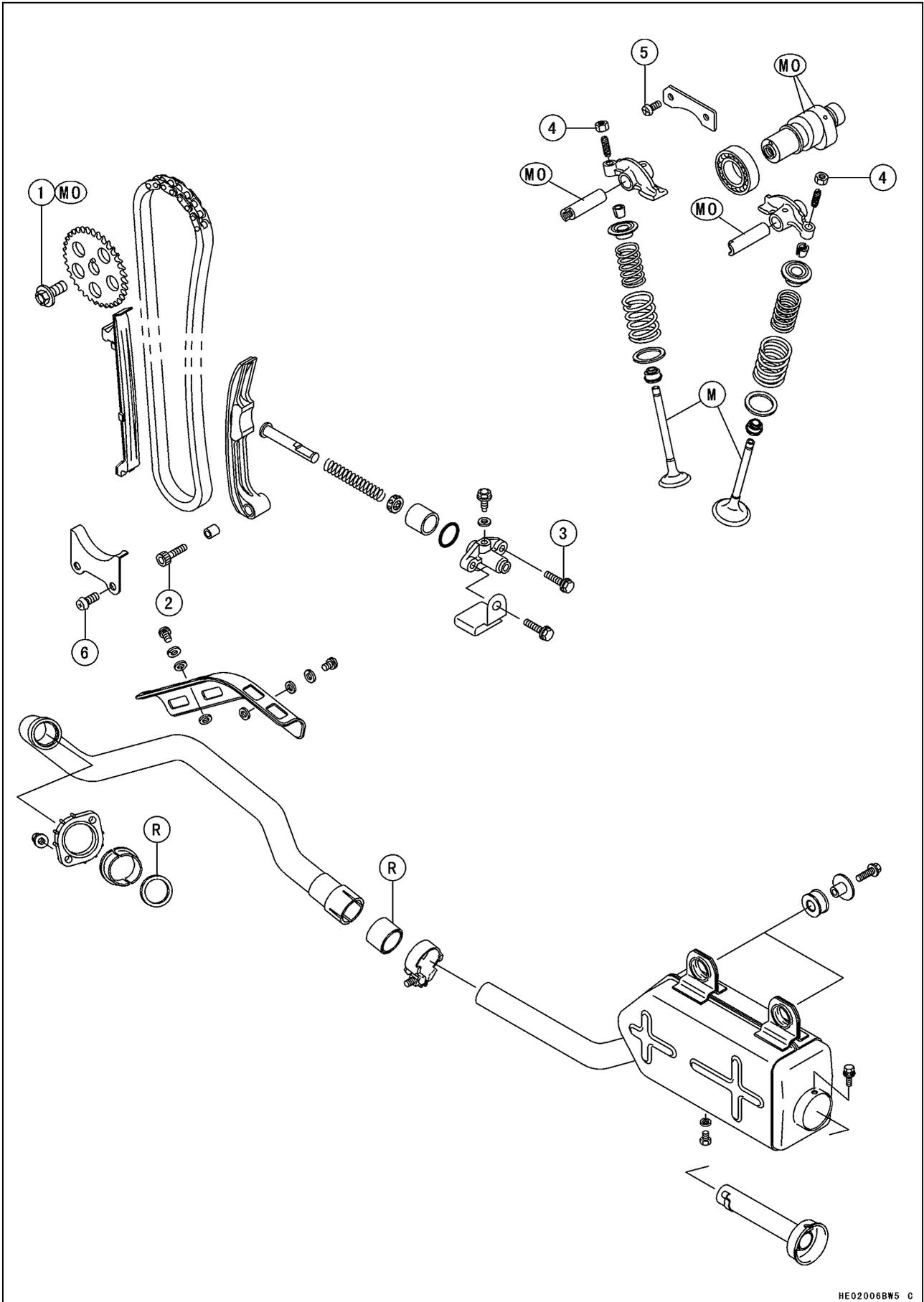
MO: Apply molybdenum disulfide oil.

R: Replacement Parts

S: Follow the specific tightening sequence.

# 4-4 ENGINE TOP END

## Exploded View



**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Camshaft Sprocket Bolt	34	3.5	25	MO
2	Rear Camshaft Chain Guide Bolt	9.8	1.0	87 in·lb	
3	Camshaft Chain Tensioner Mounting Bolts	8.8	0.9	78 in·lb	
4	Valve Adjusting Screw Locknuts	12	1.2	104 in·lb	
5	Rocker Shaft Retainer Screws	4.4	0.45	39 in·lb	
6	Camshaft Chain Guard Screws	4.4	0.45	39 in·lb	

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil.

R: Replacement Parts

## 4-6 ENGINE TOP END

### Specifications

Item	Standard	Service Limit
<b>Rocker Case</b>		
Rocker Arm Inside Diameter	13.000 ~ 13.018 mm (0.5118 ~ 0.5125 in.)	13.05 mm (0.514 in.)
Rocker Shaft Diameter	12.976 ~ 12.994 mm (0.5109 ~ 0.5116 in.)	12.95 mm (0.510 in.)
<b>Camshafts</b>		
Cam Height:		
Exhaust	39.720 ~ 39.828 mm (1.5638 ~ 1.5680 in.)	39.62 mm (1.560 in.)
Inlet	40.395 ~ 40.503 mm (1.5904 ~ 1.5946 in.)	40.30 mm (1.587 in.)
<b>Cylinder Head</b>		
Cylinder Compression:	(usable range)	
with Recoil Starter (5 times)	750 ~ 1 180 kPa (7.7 ~ 12 kgf/cm <sup>2</sup> , 110 ~ 171 psi) @450 r/min (rpm)	---
with Electric Starter	930 ~ 1 435 kPa (9.5 ~ 14.6 kgf/cm <sup>2</sup> , 135 ~ 208 psi) @600 r/min (rpm)	---
Cylinder Head Warp	---	0.05 mm (0.002 in.)
<b>Valve</b>		
Valve Clearance:		
Exhaust	0.18 ~ 0.23 mm (0.0071 ~ 0.0091 in.)	---
Inlet	0.15 ~ 0.20 mm (0.0059 ~ 0.0079 in.)	---
Valve Head Thickness:		
Exhaust	1.0 mm (0.039 in.)	0.5 mm (0.020 in.)
Inlet	0.8 mm (0.031 in.)	0.4 mm (0.016 in.)
Valve Stem Bend	---	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:		
Exhaust	5.480 ~ 5.495 mm (0.2157 ~ 0.2163 in.)	5.47 mm (0.2154 in.)
Inlet	5.495 ~ 5.510 mm (0.2163 ~ 0.2169 in.)	5.48 mm (0.2157 in.)
Valve Guide Inside Diameter:		
Exhaust	5.520 ~ 5.532 mm (0.2173 ~ 0.2178 in.)	5.60 mm (0.220 in.)
Inlet	5.520 ~ 5.532 mm (0.2173 ~ 0.2178 in.)	5.60 mm (0.220 in.)

**Specifications**

Item	Standard	Service Limit
Valve Guide Clearance <small>(wobble method):</small>		
Exhaust	0.05 ~ 0.11 mm (0.0020 ~ 0.0043 in.)	0.27 mm (0.0106 in.)
Inlet	0.02 ~ 0.08 mm (0.0008 ~ 0.0032 in.)	0.23 mm (0.0091 in.)
Valve Seat Cutting Angle	45°, 32°, 60°	---
Valve Stem Bend	---	TIR 0.05 mm
Valve Seat Surface:		
Width:		
Exhaust	0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)	---
Inlet	0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)	---
Outside Diameter:		
Exhaust	26.9 ~ 27.1 mm (1.059 ~ 1.067 in.)	---
Inlet	30.9 ~ 31.1 mm (1.217 ~ 1.224 in.)	---
Valve spring free length:		
Inner	37.8 mm (1.488 in.)	36.2 mm (1.425 in.)
Outer	40.4 mm (1.591 in.)	38.7 mm (1.524 in.)
<b>Cylinder, Piston</b>		
Cylinder Inside Diameter	68.995 ~ 69.007 mm (2.7163 ~ 2.7168 in.)	69.10 mm (2.720 in.)
Piston Diameter	68.960 ~ 68.975 mm (2.7150 ~ 2.7155 in.)	68.81 mm (2.709 in.)
Piston/Cylinder Clearance	0.020 ~ 0.047 mm (0.0008 ~ 0.0019 in.)	---
Piston Ring/Groove Clearance:		
Top	0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)	0.16 mm (0.0063 in.)
Second	0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)	0.16 mm (0.0063 in.)
Piston Ring Groove Width:		
Top	0.81 ~ 0.83 mm (0.0319 ~ 0.0327 in.)	0.91 mm (0.0358 in.)
Second	1.21 ~ 1.23 mm (0.0476 ~ 0.0484 in.)	1.31 mm (0.0516 in.)
Oil	2.51 ~ 2.53 mm (0.0988 ~ 0.0996 in.)	2.61 mm (0.1028 in.)
Piston Ring Thickness:		
Top	0.77 ~ 0.79 mm (0.0303 ~ 0.0311 in.)	0.70 mm (0.028 in.)
Second	1.17 ~ 1.19 mm (0.0461 ~ 0.0469 in.)	1.10 mm (0.043 in.)

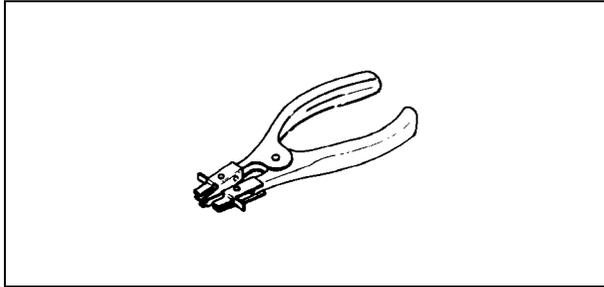
## 4-8 ENGINE TOP END

### Specifications

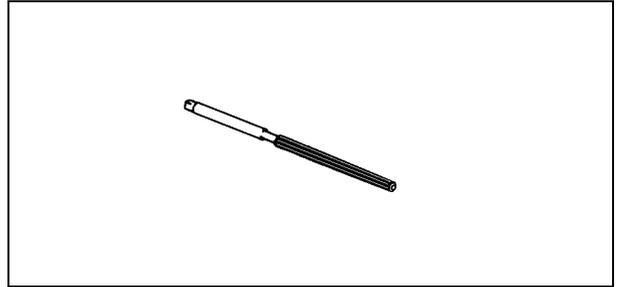
Item	Standard	Service Limit
Piston Ring End Gap:		
Top	0.15 ~ 0.30 mm (0.0059 ~ 0.0118 in.)	0.6 mm (0.0236 in.)
Second	0.30 ~ 0.45 mm (0.0118 ~ 0.0177 in.)	0.8 mm (0.0315 in.)
Oil	0.20 ~ 0.70 mm (0.0079 ~ 0.0276 in.)	1.0 mm (0.0394 in.)

Special Tools and Sealant

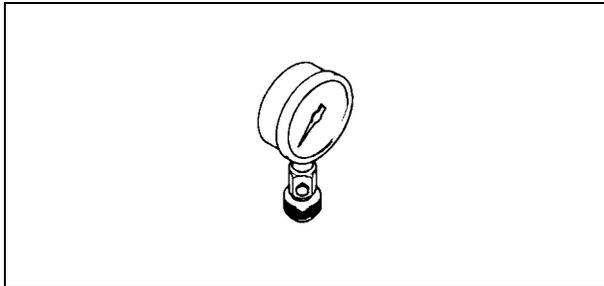
Piston Ring Pliers:  
57001-115



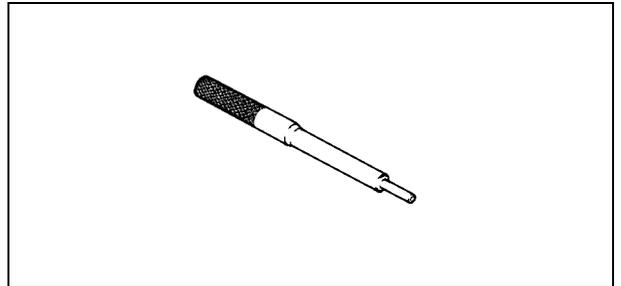
Valve Guide Reamer,  $\phi 5.5$ :  
57001-1020



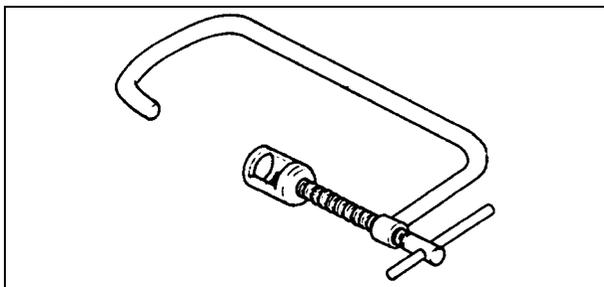
Compression Gauge, 20 kgf/cm<sup>2</sup>:  
57001-221



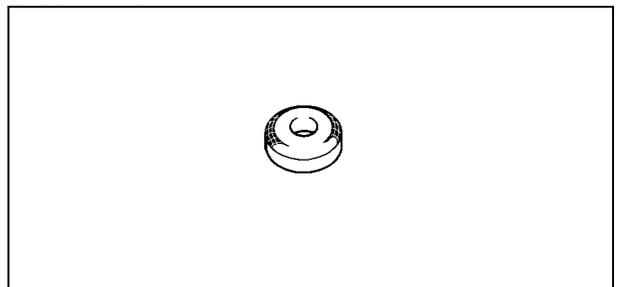
Valve Guide Arbor,  $\phi 5.5$ :  
57001-1021



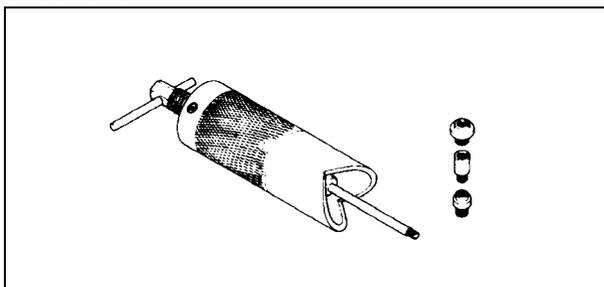
Valve Spring Compressor Assembly:  
57001-241



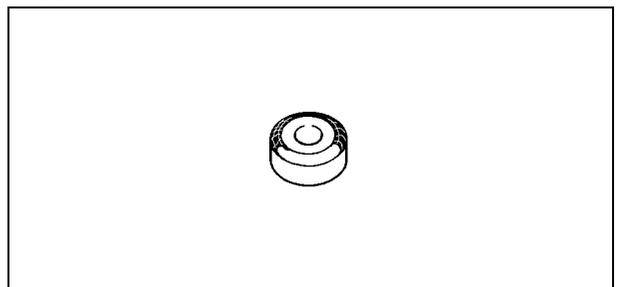
Valve Seat Cutter, 45° -  $\phi 35$ :  
57001-1116



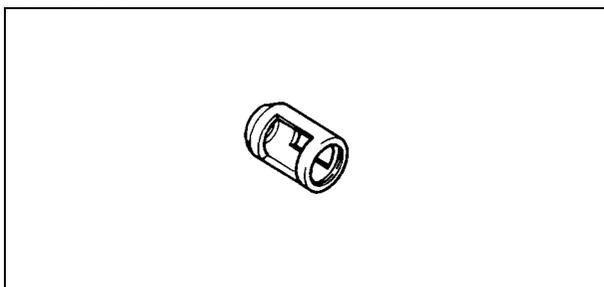
Piston Pin Puller Assembly:  
57001-910



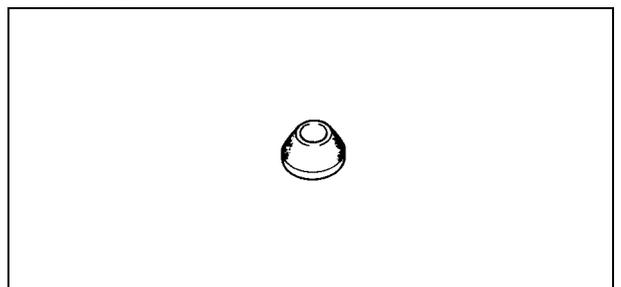
Valve Seat Cutter, 32° -  $\phi 35$ :  
57001-1121



Valve Spring Compressor Adapter,  $\phi 25$ :  
57001-1019



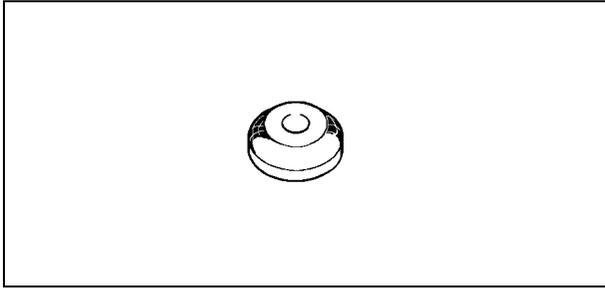
Valve Seat Cutter, 60° -  $\phi 30$ :  
57001-1123



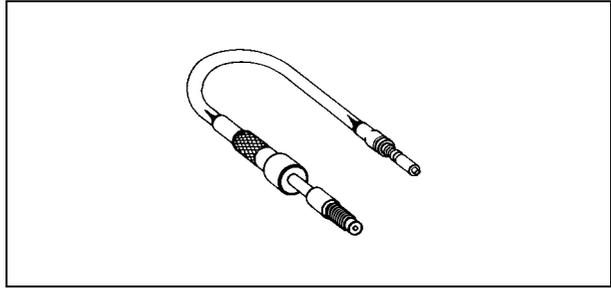
# 4-10 ENGINE TOP END

## Special Tools and Sealant

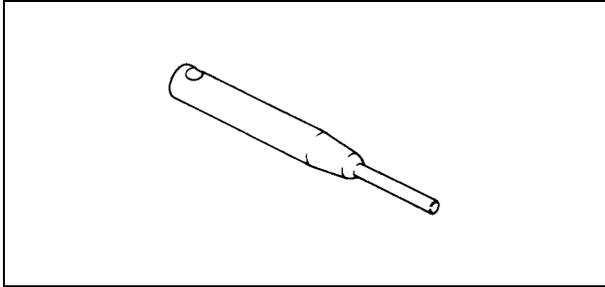
**Valve Seat Cutter, 60° -  $\phi$ 41:**  
**57001-1124**



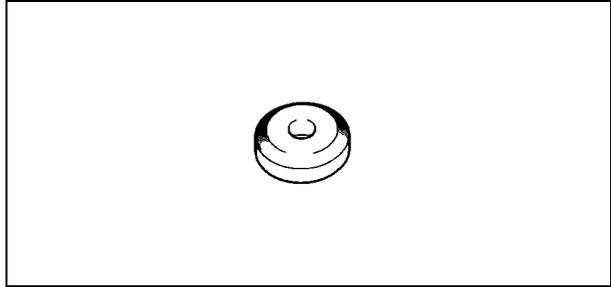
**Compression Gauge Adapter, M12 x 1.25:**  
**57001-1183**



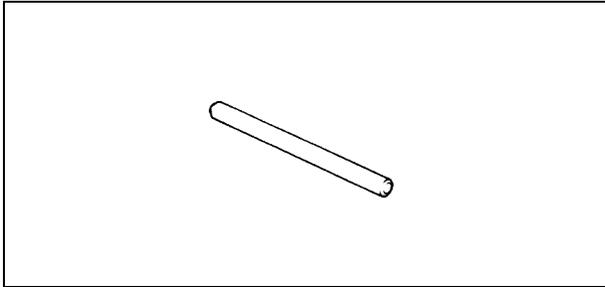
**Valve Seat Cutter Holder,  $\phi$ 5.5:**  
**57001-1125**



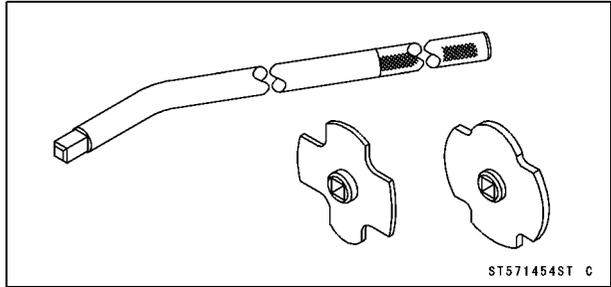
**Valve Seat Cutter, 45° -  $\phi$ 30:**  
**57001-1187**



**Valve Seat Cutter Holder Bar:**  
**57001-1128**



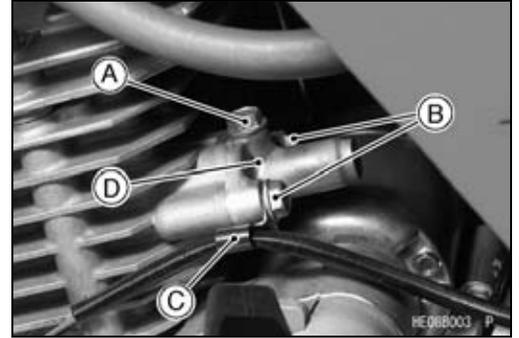
**Filler Cap Driver:**  
**57001-1454**



## Camshaft Chain Tensioner

### Camshaft Chain Tensioner Removal

- Loosen the lock bolt [A] in the top of the camshaft chain tensioner. Do not remove it yet.
- Remove:
  - Tensioner Mounting Bolts [B] and Clamp [C]
  - Camshaft Chain Tensioner [D]



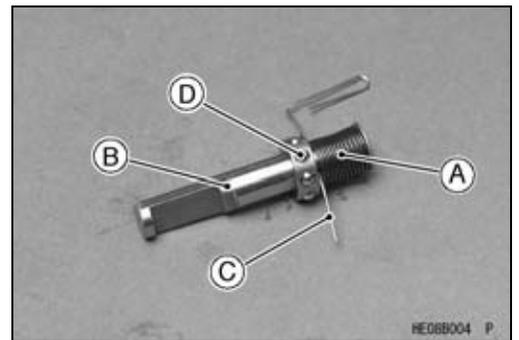
### CAUTION

**Do not turn the engine while the camshaft chain tensioner is removed. Engine damage could result.**

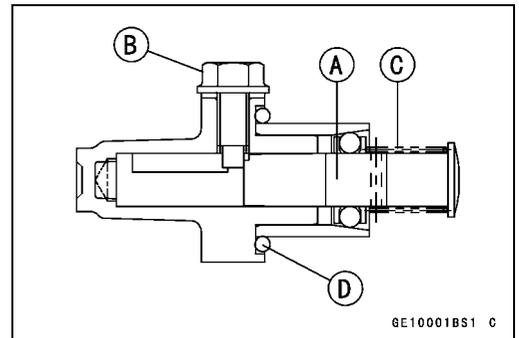
- Remove the lock bolt.
- Carefully pull the push rod out of the tensioner body. Do not drop the ball and retainer assembly or the spring.
- Slide the retainer and the spring off the push rod.

### Camshaft Chain Tensioner Installation

- Slip the spring [A] over the push rod [B] and compress it down past the hole.
- Insert a piece of wire [C] in the hole to hold the spring in place.
- Drop the retainer [D] onto the push rod.



- Insert the push rod [A] into the tensioner body.
  - The flat side of the push rod must face up as shown.
- When the push rod is in as far as it will go, screw in the lock bolt [B] with its washer to lock the push rod.
- Pull out the wire to release the spring [C].
- Be sure the O-ring [D] is in place in the tensioner body.
- Install:
  - Tensioner Body and Clamp
- Tighten:



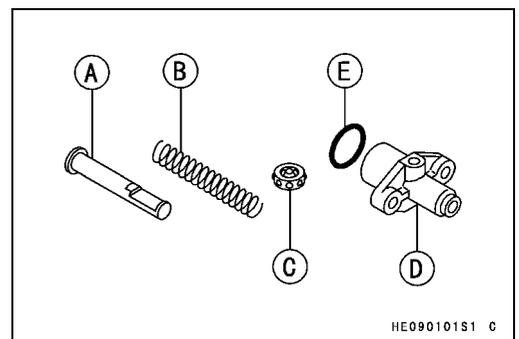
### Torque - Camshaft Chain Tensioner Mounting Bolts:

**8.8 N·m (0.9 kgf·m, 78 in·lb)**

- Loosen the lock bolt and then tighten it. With the bolt loosened, the spring inside takes up any slack automatically.

### Camshaft Chain Tensioner Wear

- Visually inspect the push rod [A], spring [B], ball and retainer assembly [C], tensioner body [D], and O-ring [E].
- Slide the push rod in and out of the tensioner body without the spring or ball and retainer assembly.
- ★ If the parts show any damage, or if the push rod does not slide smoothly in the tensioner body, replace the camshaft chain tensioner.

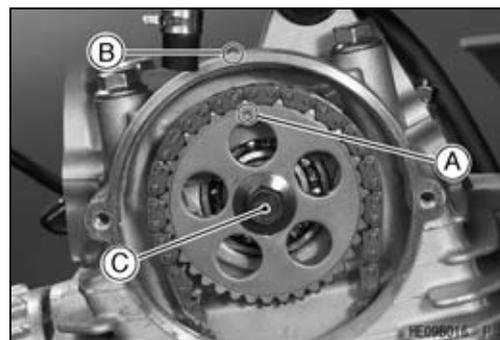
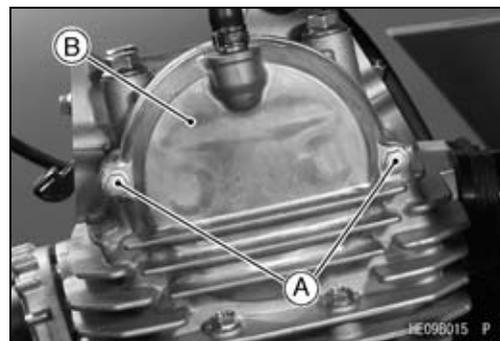


## 4-12 ENGINE TOP END

### Camshaft Sprocket

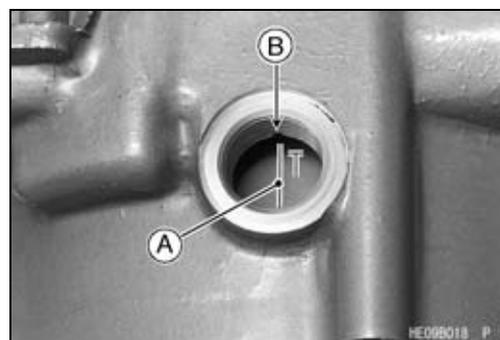
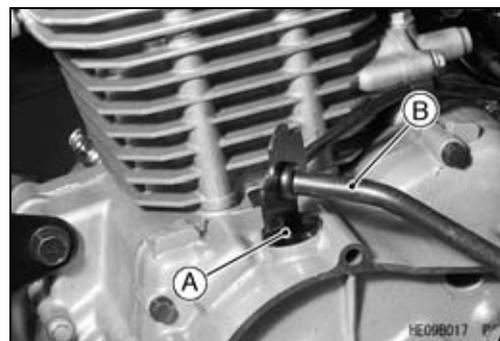
#### Camshaft Sprocket Removal

- Remove:
  - Fuel Tank (see Fuel System chapter)
  - Front Fender (see Frame chapter)
  - Recoil Starter (see Recoil Starter chapter)
  - Bolts [A] and Camshaft Cover [B]
- Turn the crankshaft with a wrench on the alternator rotor bolt until the punch mark [A] on the camshaft sprocket aligns with the pointer [B] on the cylinder head.
- Remove the camshaft chain tensioner (see Camshaft Chain Tensioner Removal).
- Remove the camshaft sprocket bolt [C].
- Hold the crankshaft from turning with a wrench on the alternator rotor bolt.
- Slide the sprocket off the shoulder on the camshaft and out from under the chain.



#### Camshaft Sprocket Installation

- Remove:
  - Timing Inspection Plug [A]
- Special Tool - Filler Cap Driver [B]: 57001-1454**
- Check to see that the "T" mark [A] on the alternator rotor aligns with the slot [B].
- ★ If the "T" mark is not aligned, hold the camshaft chain taut and turn the crankshaft with a wrench on the alternator rotor bolt.



## Camshaft Sprocket

- Fit the sprocket under the chain and slip it over the shoulder on the camshaft so that the tab on the sprocket fits the hole in the end of the camshaft and the punch mark [A] on the sprocket aligns with the pointer [B] on the cylinder head.
- Apply molybdenum disulfide oil to the threads of the camshaft sprocket bolt.
- Tighten the camshaft sprocket bolt, while holding the crankshaft from turning with a wrench on the alternator rotor bolt.

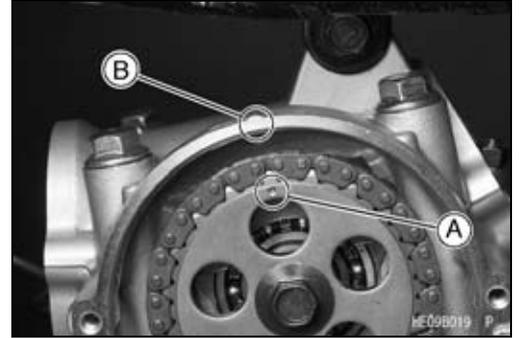
**Torque - Camshaft Sprocket Bolt: 34 N·m (3.5 kgf·m, 25 ft·lb)**

- Install the camshaft chain tensioner (see Camshaft Chain Tensioner Installation).
- Before going any further, check the cam timing.
- Turn the crankshaft counterclockwise with a wrench on the alternator rotor bolt, until the punch mark on the sprocket realigns with the pointer on the head.

### CAUTION

**If any resistance is felt when turning the crankshaft, stop immediately, or you may bend the valves.**

- The "T" mark on the alternator rotor should align with the slot.
- ★ If the camshaft timing is not correct, remove the sprocket from the camshaft, and install it again as detailed above.
- Smear a little engine oil on the camshaft cover O-ring [A], and push the cover into place.
- Put in the camshaft cover bolts and tighten them securely.
- Install the timing inspection plug.

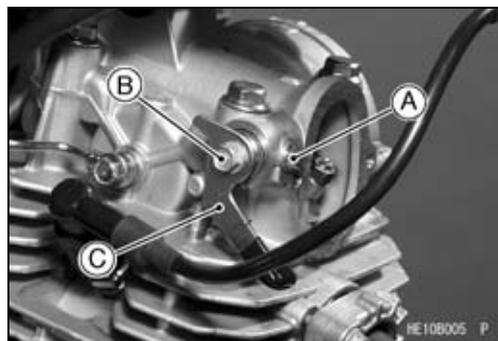


## 4-14 ENGINE TOP END

### Rocker Arms and Shafts

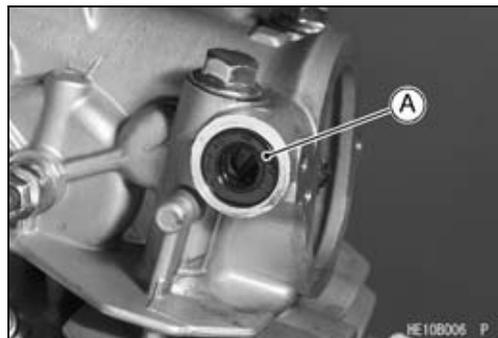
#### Compression Releasing Lever Removal

- Remove:
  - Retaining Bolt [A] and Washer
  - Compression Releasing Lever Bolt [B]
  - Compression Releasing Lever [C], Return Spring, and Washer
  - Compression Releasing Shaft

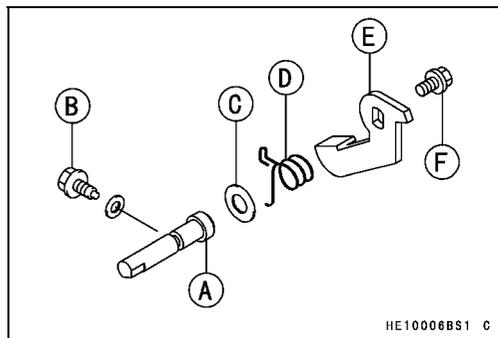


#### Compression Releasing Lever Installation

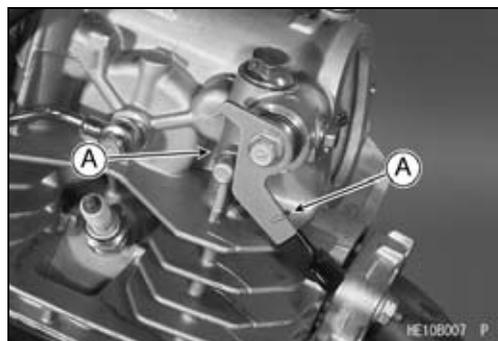
- Replace the oil seal [A], if it is damaged.
- Apply grease to the oil seal lip.



- Install:
  - Compression Releasing Shaft [A]
  - Retaining Bolt [B] and Washer
- Tighten:
  - Torque - Retaining Bolt: 4.4 N·m (0.45 kgf·m, 39 in·lb)**
- Install:
  - Washer [C]
  - Return Spring [D]
  - Compression Releasing Lever [E]
  - Compression Releasing Lever Bolt [F]
- Tighten:
  - Torque - Compression Releasing Lever Bolt: 8.8 N·m (0.9 kgf·m, 78 in·lb)**



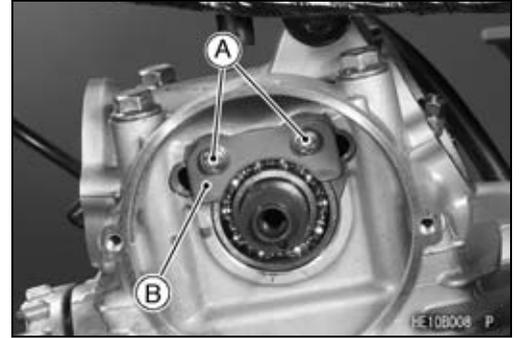
○ Hook the return spring ends [A] as shown.



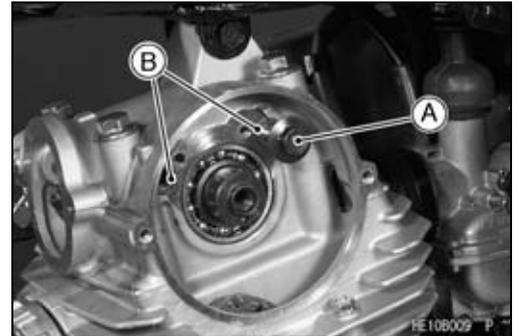
## Rocker Arms and Shafts

### Rocker Arm and Shaft Removal

- Remove:
  - Camshaft Sprocket (see Camshaft Sprocket Removal)
  - Screws [A] and Rocker Shaft Retainer [B]

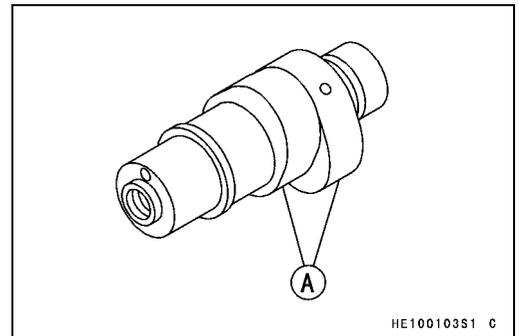


- Remove:
  - Compression Releasing Lever (see Compression Releasing Lever Removal)
  - Valve Adjusting Caps
- Screw the camshaft sprocket bolt [A] into the rocker shaft and pull out the shaft with it.
- Pull out the rocker shafts [B] and remove the rocker arms.

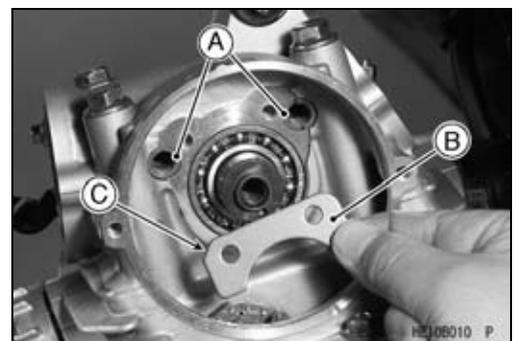


### Rocker Arm and Shaft Installation

- Before installation of the rocker arms and shafts, turn the camshaft so that the cam lobes [A] point to the “down”.



- Apply molybdenum disulfide oil to the rocker shaft.
- Install each rocker shaft with the shaft notch [A] to the inside.
- Install the rocker shaft retainer [B] with the chamfered side [C] to the front side.
- Tighten:
  - Torque - Rocker Shaft Retainer Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)**
- After installation, be sure to check and adjust the valve clearance.



## 4-16 ENGINE TOP END

### Rocker Arms and Shafts

#### *Rocker Arm and Shaft Inspection*

- Inspect the area [A] on the rocker arm where the cam rubs.
- ★ If the rocker arm is scored, discolored or otherwise damaged, replace it. Also inspect the camshaft lobes.
- Inspect the end of the valve clearance adjusting screw [B] where it contacts the valve stem.
- ★ If the end of the adjusting screw is mushroomed or damaged in any way, or if the screw will not turn smoothly, replace it. Also inspect the end of the valve stem.
- Measure the inside diameter [C] of the rocker arm with a dial bore gauge.
- ★ If the rocker arm inside diameter is larger than the service limit, replace it. Also check the rocker shaft diameter [D].

#### **Rocker Arm Inside Diameter**

**Standard:**                **13.000 ~ 13.018 mm**  
                                      **(0.5118 ~ 0.5125 in.)**

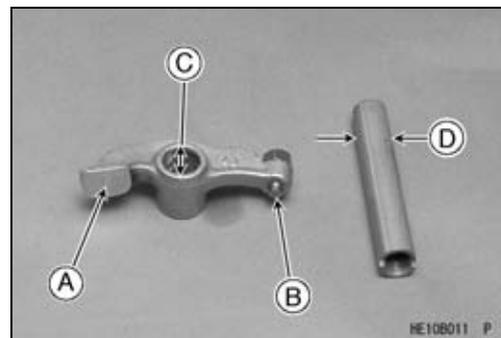
**Service Limit:**        **13.05 mm (0.514 in.)**

- Measure the diameter of the rocker shaft where the rocker arm pivots on it with a micrometer.
- ★ If the rocker shaft diameter is smaller than the service limit, replace it.

#### **Rocker Shaft Diameter**

**Standard:**                **12.976 ~ 12.994 mm**  
                                      **(0.5109 ~ 0.5116 in.)**

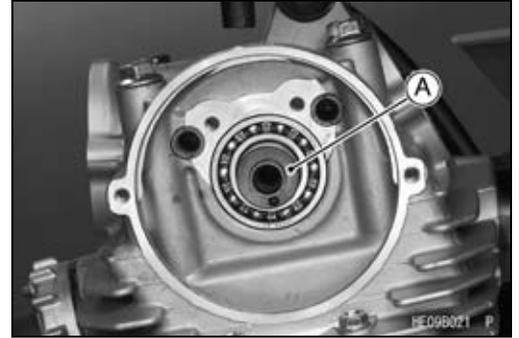
**Service Limit:**        **12.95 mm (0.510 in.)**



## Camshaft

### Camshaft Removal

- Remove:
  - Camshaft Sprocket (see Camshaft Sprocket Removal)
  - Rocker Shaft Retainer (see Rocker Arm and Shaft Removal)
- Pull the camshaft [A] straight out of the head.

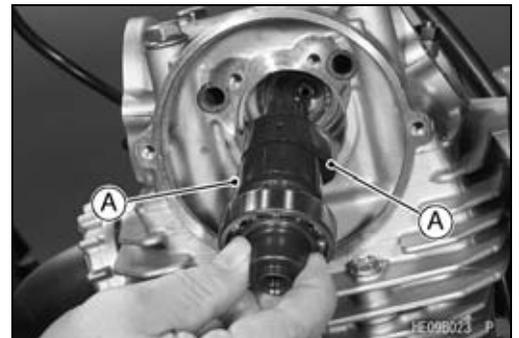


### Camshaft Installation

- Blow the oil passage with compressed air [A].



- Apply molybdenum disulfide oil to the cam lobes [A].
- Carefully push the camshaft into the cylinder head with the cam lobes “down”.

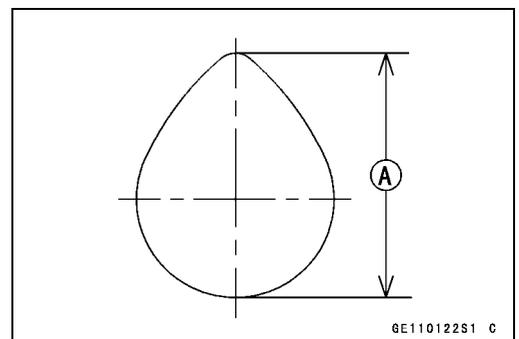


### Cam Wear Inspection

- Measure the height [A] of each cam lobe with a micrometer.
- ★ If the cam height is less than the service limit for either lobe, replace the camshaft.

#### Cam Height

	Standard	Service Limit
Exhaust	39.720 ~ 39.828 mm (1.5638 ~ 1.5680 in.)	39.62 mm (1.560 in.)
Inlet	40.395 ~ 40.503 mm (1.5904 ~ 1.5946 in.)	40.30 mm (1.587 in.)



### Camshaft Bearing Inspection

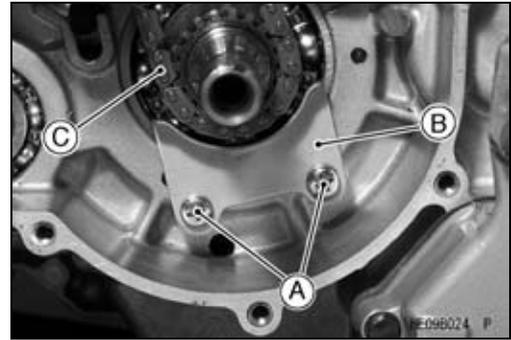
- Check the ball bearing which is press-fitted on the camshaft.
- Since the ball bearing is made to extremely close tolerances, the wear must be judged by feel rather than measurement. Clean the bearing in a high flash-point solvent, dry it (do not spin the bearing while it is dry), and oil it with engine oil.
- Spin the bearing by hand to check its condition.
- ★ If the bearing is noisy, does not spin smoothly, or has any rough stops, replace it.

## 4-18 ENGINE TOP END

### Camshaft Chain and Guides

#### Camshaft Chain Removal

- Remove:
  - Camshaft Sprocket (see Camshaft Sprocket Removal)
  - Alternator Rotor (see Electrical System chapter)
  - Screws [A] and Camshaft Chain Guard [B]
  - Camshaft Chain [C]



#### Camshaft Chain Installation

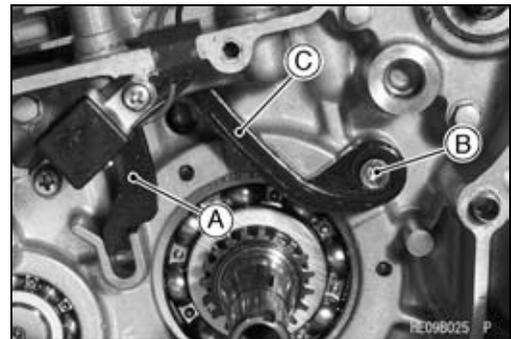
##### CAUTION

**Always pull the camshaft chain taut while turning the crankshaft when the camshaft chain is loose. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.**

- Tighten:
  - Torque - Camshaft Chain Guard Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)
- Install the camshaft sprocket (see Camshaft Sprocket Installation).

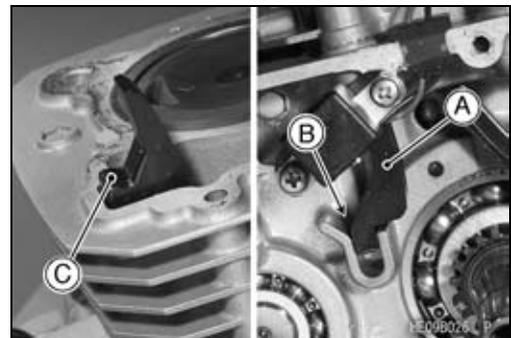
#### Camshaft Chain Guide Removal

- Remove:
  - Cylinder Head (see Cylinder Head Removal)
  - Camshaft Chain (see Camshaft Chain Removal)
  - Front Camshaft Chain Guide [A]
  - Bolt [B], Rear Camshaft Chain Guide [C], and Collar



#### Camshaft Chain Guide Installation

- Slip the front camshaft chain guide [A] into position [B]. Be sure the hook [C] of the chain guide hangs on the cylinder catch.
- Tighten:
  - Torque - Rear Camshaft Chain Guide Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)



#### Camshaft Chain Guide Wear

- Visually inspect the rubber on the guides.
- ★ If the rubber is damaged, cut, or is missing pieces, replace the guide.

## Cylinder Head

### Cylinder Compression Measurement

- Before measuring compression, do the following:
  - Be sure the battery is fully charged.
  - Warm up the engine (if the engine will run).
  - During warm-up, check for leaks around the cylinder head gasket.
- Remove the spark plug.
- Set the compression gauge [A] and adapter [B] into the spark plug hole.

**Special Tools - Compression Gauge: 57001-221**

**Compression Gauge Adapter, M12 × 1.25:  
57001-1183**

- Hold the throttle wide open and crank the engine with the recoil starter or the electric starter.
- When the gauge stops rising, stop cranking and read the gauge.

### Cylinder Compression (Usable Range)

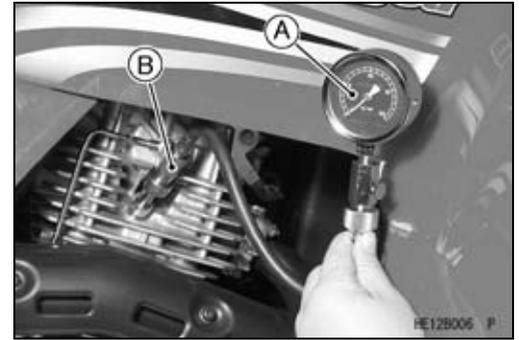
**Recoil Starter**     750 ~ 1 180 kPa (7.7 ~ 12 kgf/cm<sup>2</sup>,

**(5 times):**            110 ~ 171 psi) @450 r/min (rpm)

**Electric Starter:**   930 ~ 1 435 kPa (9.5 ~ 14.6 kgf/cm<sup>2</sup>,

135 ~ 208 psi) @600 r/min (rpm)

- ★ If the compression is within the specified range, the piston rings, cylinder and valves are probably in good condition.
- ★ If the compression is higher than the specified range, see the **Compression Too High** table.
- ★ If the compression is below the specified range, squirt a little oil into the spark plug hole and repeat the compression measurement.
- ★ If the compression does not change very much, the piston rings are probably OK. See the **Wet Compression - No Change** table.
- ★ If the compression increases, the piston rings are not sealing properly. See the **Wet Compression - Increase** table.



## 4-20 ENGINE TOP END

### Cylinder Head

#### Compression Too High

Possible Problems	Solutions	References
Carbon build up on piston head and cylinder head	Remove carbon	Piston Cleaning and Cylinder Head Cleaning
	Check possible oil leaks to combustion chamber	Valve Stem Oil Seal Inspection, Valve Stem Diameter, Valve Guide Inside Diameter, and check piston oil ring for visible damage.
Cylinder head or base gasket too thin	Replace gaskets	Cylinder Head Removal, Cylinder Head Installation, Cylinder Removal, and Cylinder Installation

#### Wet Compression - No Change

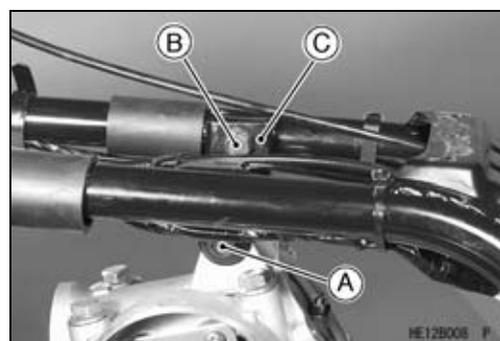
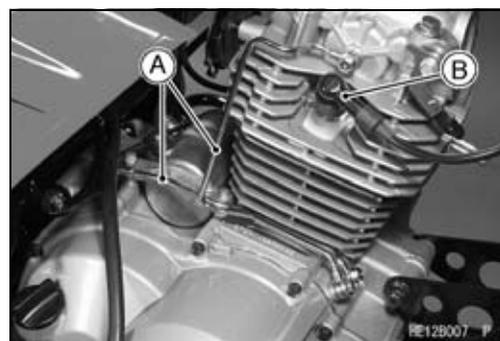
Possible Problems	Solutions	References
Improper valve clearance	Check clearance	Valve Clearance Check, and Valve Clearance Adjustment
Worn valve seats	Check seats	Valve Seat Inspection, and Valve Seat Repair
Burned valve	Check valves	Valve Visual Inspection, and Valve Head Thickness
Cylinder head leak	Check head gasket	Cylinder Head Removal, and Cylinder Head Installation
	Check head flatness	Cylinder Head Warp

#### Wet Compression - Increase

Possible Problems	Solutions	References
Too much piston-to-cylinder clearance	Check clearance	Cylinder/Piston Wear, Piston/Cylinder Clearance
Worn piston rings, and ring grooves	Check piston and rings	Piston Ring and Ring Groove Wear, and Piston Ring End Gap (top and second only).

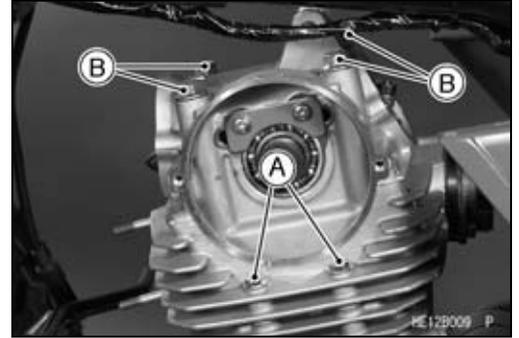
#### Cylinder Head Removal

- Remove:
  - Front Fender (see Frame chapter)
  - Fuel Tank, Carburetor (see Fuel System chapter)
  - Exhaust Pipe and Muffler (see Exhaust Pipe and Muffler Removal)
  - Camshaft Sprocket (see Camshaft Sprocket Removal)
  - Oil Pipes [A]
- Pull the spark plug cap [B] off the spark plug.
  
- Remove:
  - Engine Mounting Bolt [A]
  - Bolts [B] and Engine Bracket [C]



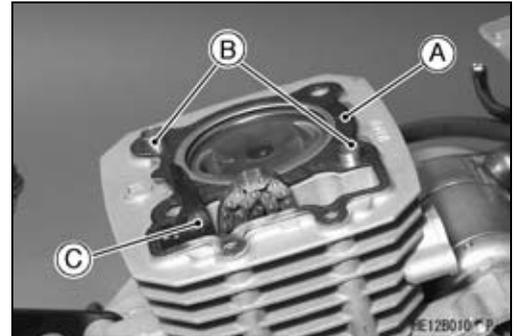
## Cylinder Head

- Loosen the cylinder head M6 bolts [A] and M10 bolts [B] completely and remove all the bolts.
- Remove the cylinder head.



### Cylinder Head Installation

- Blow out the oil passage with compressed air.
- Install a new cylinder head gasket [A].
- Be sure the dowel pins [B] are in place.
- Be sure the front camshaft chain guide [C] is in place (see Camshaft Chain Guide Installation).



- Apply molybdenum disulfide oil [M] to the flange and threads of all cylinder head bolts.
- Apply a non-permanent locking agent [L] to the right front cylinder head bolt [4].
- Tighten the cylinder head bolts in a criss-cross pattern as shown, in two steps.

### Cylinder Head Bolt Torque

#### First Torquing

**M10 Bolts [1 ~ 4] : 13 N·m (1.3 kgf·m, 113 in·lb)**

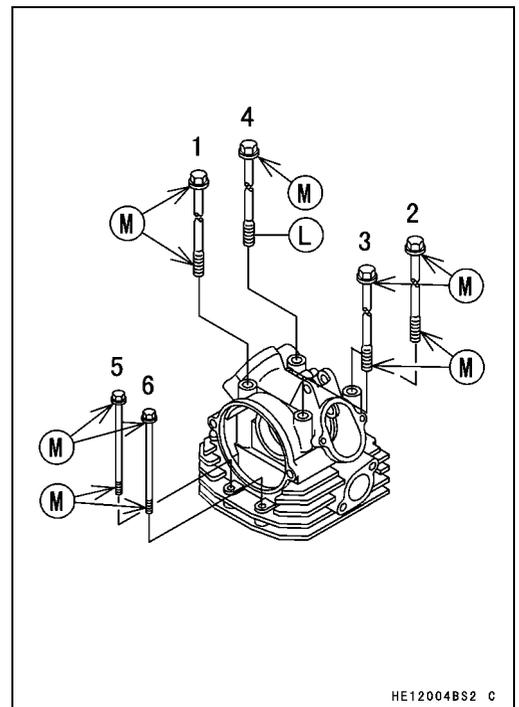
**M6 Bolts [5 ~ 6] : 5.9 N·m (0.6 kgf·m, 52 in·lb)**

#### Final Torquing

**M10 Bolts [1 ~ 4]: 34 N·m (3.5 kgf·m, 25 ft·lb)**

**M6 Bolts [5 ~ 6]: 9.8 N·m (1.0 kgf·m, 87 in·lb)**

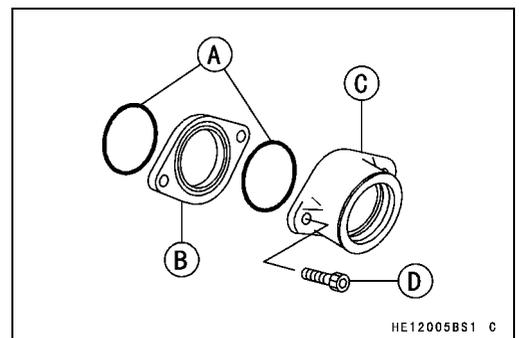
- Tighten:
  - Torque - Engine Bracket Bolts : 26 N·m (2.7 kgf·m, 20 ft·lb)
  - Engine Mounting Nut (M8) : 29 N·m (3.0 kgf·m, 22 ft·lb)



### Cylinder Head Assembly

- Apply grease to the O-rings [A].
- Install:
  - Insulator [B]
  - Carburetor Holder [C]
- Be careful not to pinch the O-rings when installing the insulator.
- Apply a non-permanent locking agent to the carburetor holder bolts [D] and tighten them.

**Torque - Carburetor Holder Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**



## 4-22 ENGINE TOP END

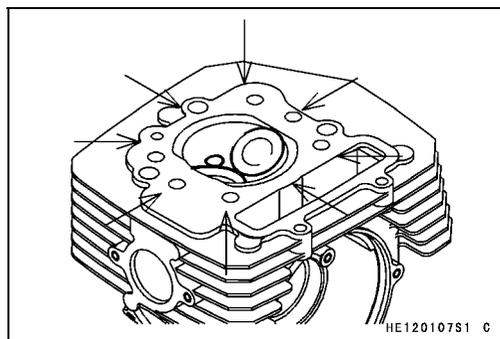
### Cylinder Head

#### Cylinder Head Cleaning

- Remove the cylinder head (see Cylinder Head Removal).
- Remove the valves (see Valve Removal).
- Wash the head with a high-flash point solvent.
- Scrape the carbon out of the combustion chamber and exhaust port with a suitable tool.
- Install the valves (see Valve Installation).

#### Cylinder Head Warp

- Clean the cylinder head (see Cylinder Head Cleaning).
- Lay a straightedge across the lower surface of the cylinder head at the positions shown.

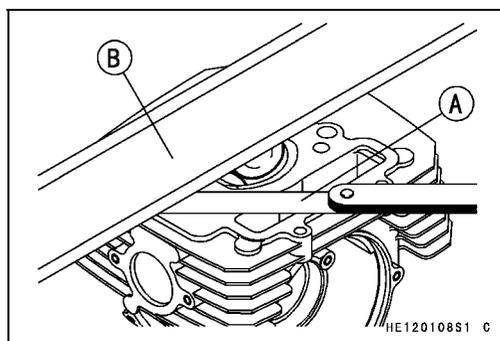


- Use a thickness gauge [A] to measure the space between the straightedge [B] and the head.

#### Cylinder Head Warp

**Service Limit: 0.05 mm (0.002 in.)**

- ★ If the cylinder head is warped more than the service limit, replace it.
- ★ If the cylinder head is warped less than the service limit, repair the head by rubbing the lower surface on emery paper secured to a surface plate (first No. 200, then No. 400).



## Valves, Guides, Seats, Springs, Oil Seals

### Valve Clearance Inspection

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

### Valve Clearance Adjustment

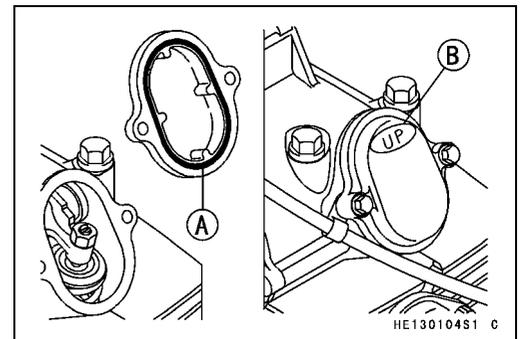
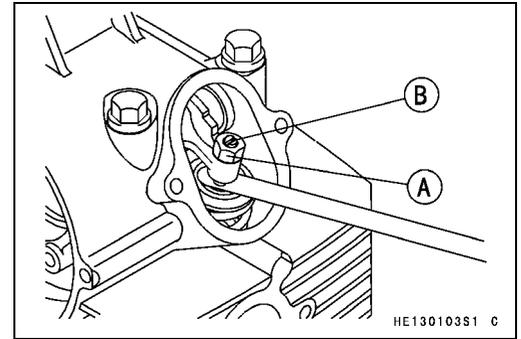
- Loosen the locknut [A] and turn the adjusting screw [B] until the clearance is correct.
- Hold the adjusting screw from turning and tighten the locknut to the specified torque.

**Torque - Valve Adjusting Screw Locknuts: 12 N·m (1.2 kgf·m, 104 in·lb)**

- Recheck the clearance.
- ★ If the clearance is incorrect, repeat the adjustment procedure.
- ★ If the clearance is correct, perform the adjustment procedure on the other valve.

- Be sure that the valve adjusting cap O-ring [A] are in place.
- The valve adjusting caps are marked "UP" [B] on the top end.
- Tighten:

**Torque - Valve Adjusting Cap Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**



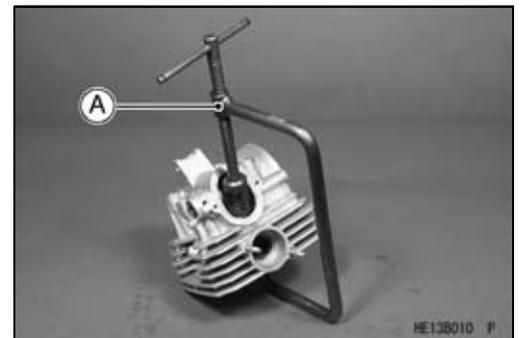
### Valve Removal

- Remove:
  - Cylinder Head (see Cylinder Head Removal)
  - Camshaft (see Camshaft Removal)
  - Rocker Arms and Shafts (see Rocker Arm and Shaft Removal)
- Use the valve spring compressor assembly [A] and adapter to press down the valve spring retainer.

**Special Tools - Valve Spring Compressor Assembly: 57001-241**

**Valve Spring Compressor Adapter,  $\phi 25$ : 57001-1019**

- Remove the split keepers.
- Loosen the valve spring compressor and take out the following parts:
  - Valve Spring Retainer
  - Outer Spring
  - Inner Spring
  - Outer Spring Seat
- Push out the valve.
- Repeat the procedure for the other valve.

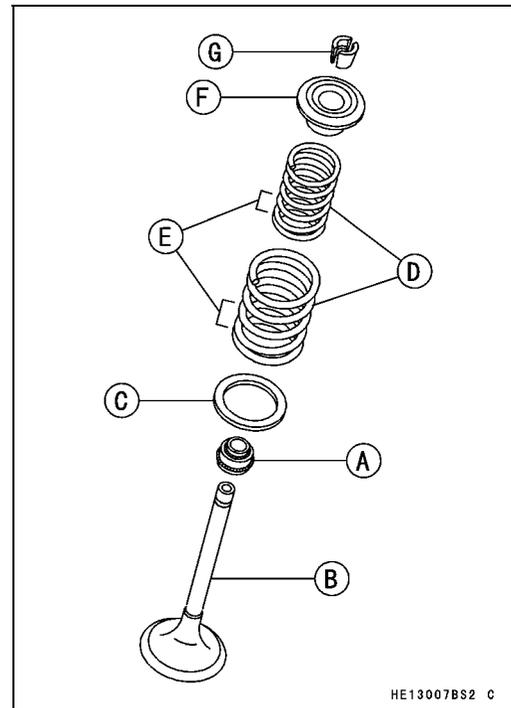


## 4-24 ENGINE TOP END

### Valves, Guides, Seats, Springs, Oil Seals

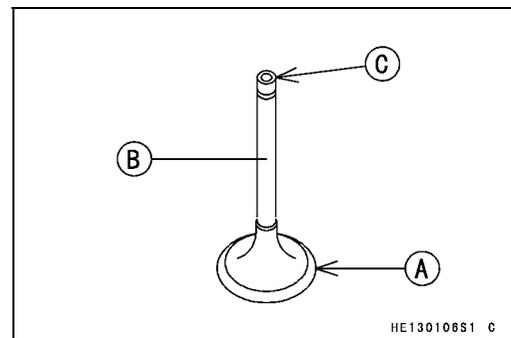
#### Valve Installation

- If a new valve is to be used, check the valve-to-guide clearance.
- ★ If there is too little clearance, ream the valve guide.
- ★ If there is too much clearance, install a new valve guide.
- Check the valve seating.
- After proper valve seating has been confirmed, replace the valve stem oil seal [A].
- Smear the valve stem end with a thin coat of molybdenum disulfide engine assembly grease, and push the valve [B] into the guide.
- Put the spring seat [C] and the inner and outer springs [D] in place.
- Place the springs so that the closed coil end [E] of each spring faces down.
- Set the spring retainer [F] on the springs.
- Use the valve spring compressor to press down the valve spring retainer.
- Install the split keepers [G], and slowly remove the spring compressor. Be sure the keepers stay in place, holding the retainer down.
- Repeat the procedure for the other valve.
- Install the removed parts to the cylinder head.
- Install the cylinder head (see Cylinder Head Installation).
- Adjust the valve clearance (see Valve Clearance Inspection).



#### Valve Visual Inspection

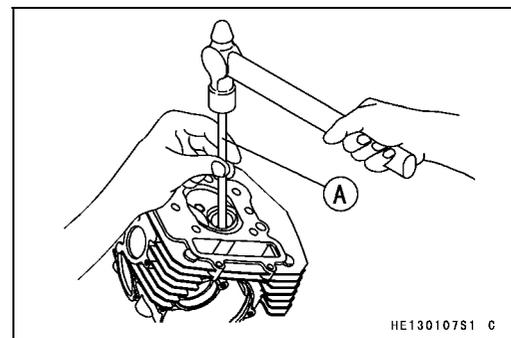
- Inspect the valve head seating area [A] for erosion, nicks, and warpage.
- ★ If the valve head seating area is warped, replace the valve.
- ★ If the valve head seating area is eroded or nicked, it may be possible to repair the valve on a valve refacing machine.
- Inspect the stem [B] for obvious wear, discoloration, and stem end [C] damage.
- ★ If the stem is obviously worn or discolored, replace the valve.
- ★ If the stem end is damaged, it may be possible to repair it on a valve refacing machine.



#### Valve Guide Removal

- Remove:
  - Valve (see Valve Removal)
  - Valve Stem Oil Seal
- Hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.

**Special Tool - Valve Guide Arbor,  $\phi 5.5$  : 57001-1021**

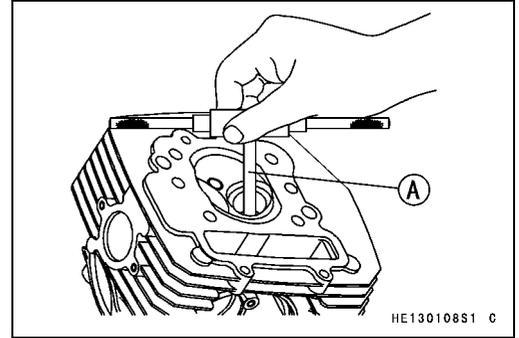


## Valves, Guides, Seats, Springs, Oil Seals

### Valve Guide Installation

- Clean the valve guide hole in the cylinder head.
- Lightly oil the valve guide.
- Set the O-ring under the valve guide flange.
- Use the valve guide arbor and a hammer to drive the guide into the head from the outside until the flange on the guide seats against the head.
- Ream the valve guide with the valve guide reamer [A] even if the old guide is reused.

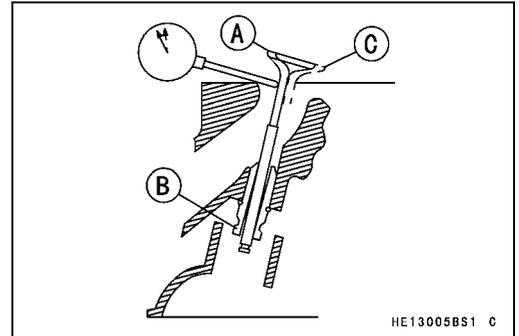
**Special Tool - Valve Guide Reamer,  $\phi 5.5$  : 57001-1020**



### Valve-to-Guide Clearance Measurement

If a small bore gauge is not available, inspect the valve guide wear by measuring the valve to valve guide clearance with the wobble method as indicated below.

- Insert a new valve [A] into the guide [B] and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface.
  - Move [C] the stem back and forth to measure valve/valve guide clearance.
  - Repeat the measurement in a direction at a right angle to the first.
- ★ If the reading exceeds the service limit, replace the guide.



### NOTE

○ The reading is not actual valve/valve guide clearance because the measuring point is above the guide.

### Valve/Valve Guide Clearance (Wobble Method)

	Standard	Service Limit
Exhaust	0.05 ~ 0.11 mm (0.0020 ~ 0.0043 in.)	0.27 mm (0.0106 in.)
Inlet	0.02 ~ 0.08 mm (0.0008 ~ 0.0032 in.)	0.23 mm (0.0091 in.)

## 4-26 ENGINE TOP END

### Valves, Guides, Seats, Springs, Oil Seals

#### Valve Seat Inspection

- Remove the valve (see Valve Removal).
- Check the valve seat width [A].
- Measure the seat width of the portion where there is no build-up carbon (white portion) of the valve seat with vernier calipers.

#### Valve Seat Surface Width

Exhaust: 0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)

Inlet: 0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)

- ★ If the valve seat width is not within the specified range, repair the valve seat.
- Measure the outside diameter [B] of the seating pattern on the valve seat.
  - Good [C]
  - Too Wide [D]
  - Too Narrow [E]
  - Uneven [F]
- ★ If the outside diameter of the valve seating pattern is too large or too small, repair the valve seat.

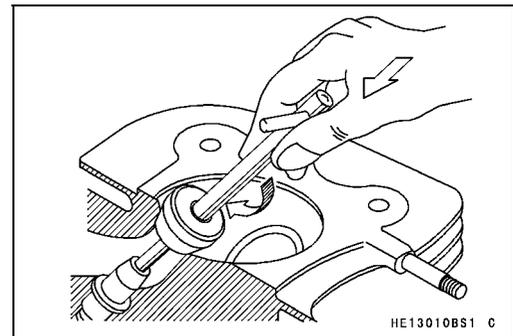
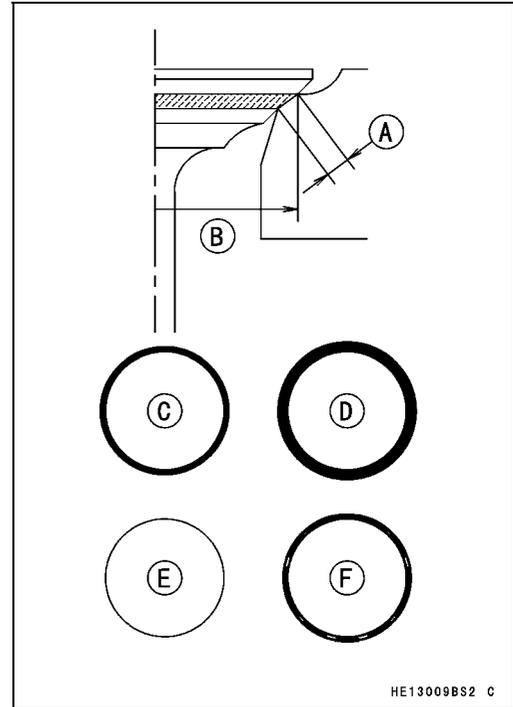
#### Valve Seat Surface Outside Diameter

Exhaust: 26.9 ~ 27.1 mm (1.059 ~ 1.067 in.)

Inlet: 30.9 ~ 31.1 mm (1.217 ~ 1.224 in.)

#### Valve Seat Repair (Valve Lapping)

- Using the valve seat cutters, repair the valve seat.
  - Special Tools - Valve Seat Cutter, 45° -  $\phi$ 30: 57001-1187
  - Valve Seat Cutter, 45° -  $\phi$ 35: 57001-1116
  - Valve Seat Cutter, 32° -  $\phi$ 35: 57001-1121
  - Valve Seat Cutter, 60° -  $\phi$ 30: 57001-1123
  - Valve Seat Cutter, 60° -  $\phi$ 41: 57001-1124
  - Valve Seat Cutter Holder,  $\phi$ 5.5: 57001-1125
  - Valve Seat Cutter Holder Bar: 57001-1128
- ★ If the manufacturer's instructions are not available, use the following procedure.



**Valves, Guides, Seats, Springs, Oil Seals**

**Seat Cutter Operating Care:**

1. This valve seat cutter is developed to grind the valve for repair. Therefore the cutter must not be used for other purposes than seat repair.
2. Do not drop or shock 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.

**CAUTION**

**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 in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

**NOTE**

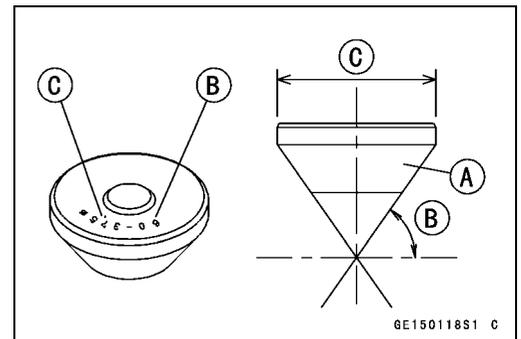
○Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.

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

**Marks Stamped on the Cutter:**

The marks stamped on the back of the cutter [A] represent the following.

- 60° ..... Cutter angle [B]
- 37.5φ ..... Outer diameter of cutter [C]



**Operating Procedures:**

- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

**CAUTION**

**Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced.**

## 4-28 ENGINE TOP END

### Valves, Guides, Seats, Springs, Oil Seals

Widened Width [A] of engagement by machining with 45° cutter

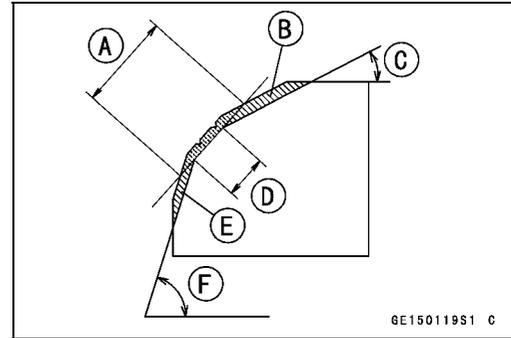
Ground Volume [B] by 32° cutter

32° [C]

Correct Width [D]

Ground Volume [E] by 60° cutter

60° [F]



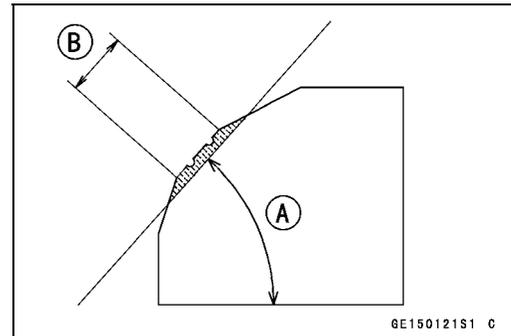
- Measure the outside diameter of the seating surface with a vernier caliper.

- ★ If the outside diameter of the seating surface is too small, repeat the 45° grind [A] until the diameter is within the specified range.

Original Seating Surface [B]

#### NOTE

- Remove all pittings of flaws from 45° ground surface.
- After grinding with 45° cutter, apply thin coat of machinist's dye to seating surface. This makes seating surface distinct and 32° and 60° grinding operation easier.
- When the valve guide is replaced, be sure to grind with 45° cutter for centering and good contact.



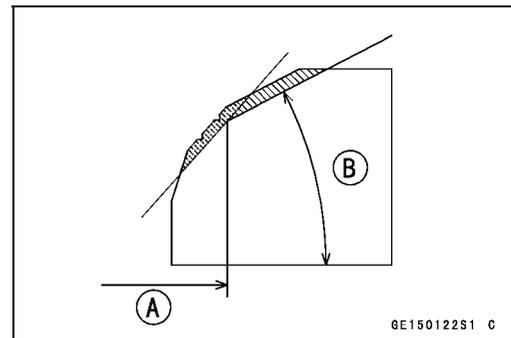
- ★ If the outside diameter [A] of the seating surface is too large, make the 32° grind described below.

- ★ If the outside diameter of the seating surface is within the specified range, measure the seat width as described below.

- Grind the seat at a 32° angle [B] until the seat outside diameter is within the specified range.

- To make the 32° grind, fit a 32° cutter into the holder, and slide it into the valve guide.

- Turn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.



#### CAUTION

**The 32° cutter removes material very quickly. Check the seat outside diameter frequently to prevent overgrinding.**

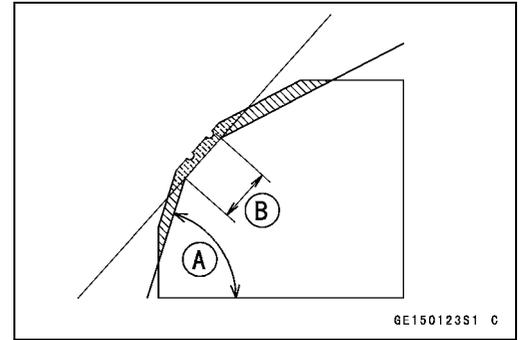
- After making the 32° grind, return to the seat outside diameter measurement step above.

- To measure the seat width, use a vernier caliper to measure the width of the 45° angle portion of the seat at several places around the seat.

- ★ If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat outside diameter measurement step above.

## Valves, Guides, Seats, Springs, Oil Seals

- ★ If the seat width is too wide, make the 60° [A] grind described below.
  - ★ If the seat width is within the specified range, lap the valve to the seat as described below.
  - Grind the seat at a 60° angle until the seat width is within the specified range.
  - To make the 60° grind, fit 60° cutter into the holder, and slide it into the valve guide.
  - Turn the holder, while pressing down lightly.
  - After making the 60° grind, return to the seat width measurement step above.
- Correct Width [B]



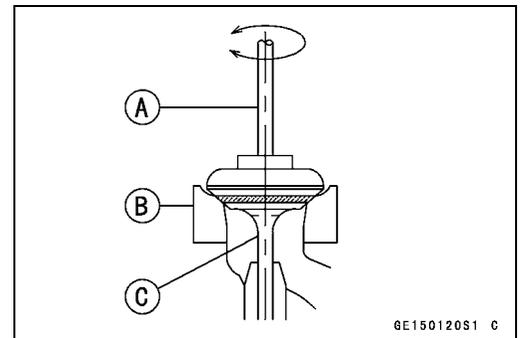
- Lap the valve to the seat, once the seat width and outside diameter are within the ranges specified above.
- Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
- Spin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
- Repeat the process with a fine grinding compound.

[A] Lapper

[B] Valve Seat

[C] Valve

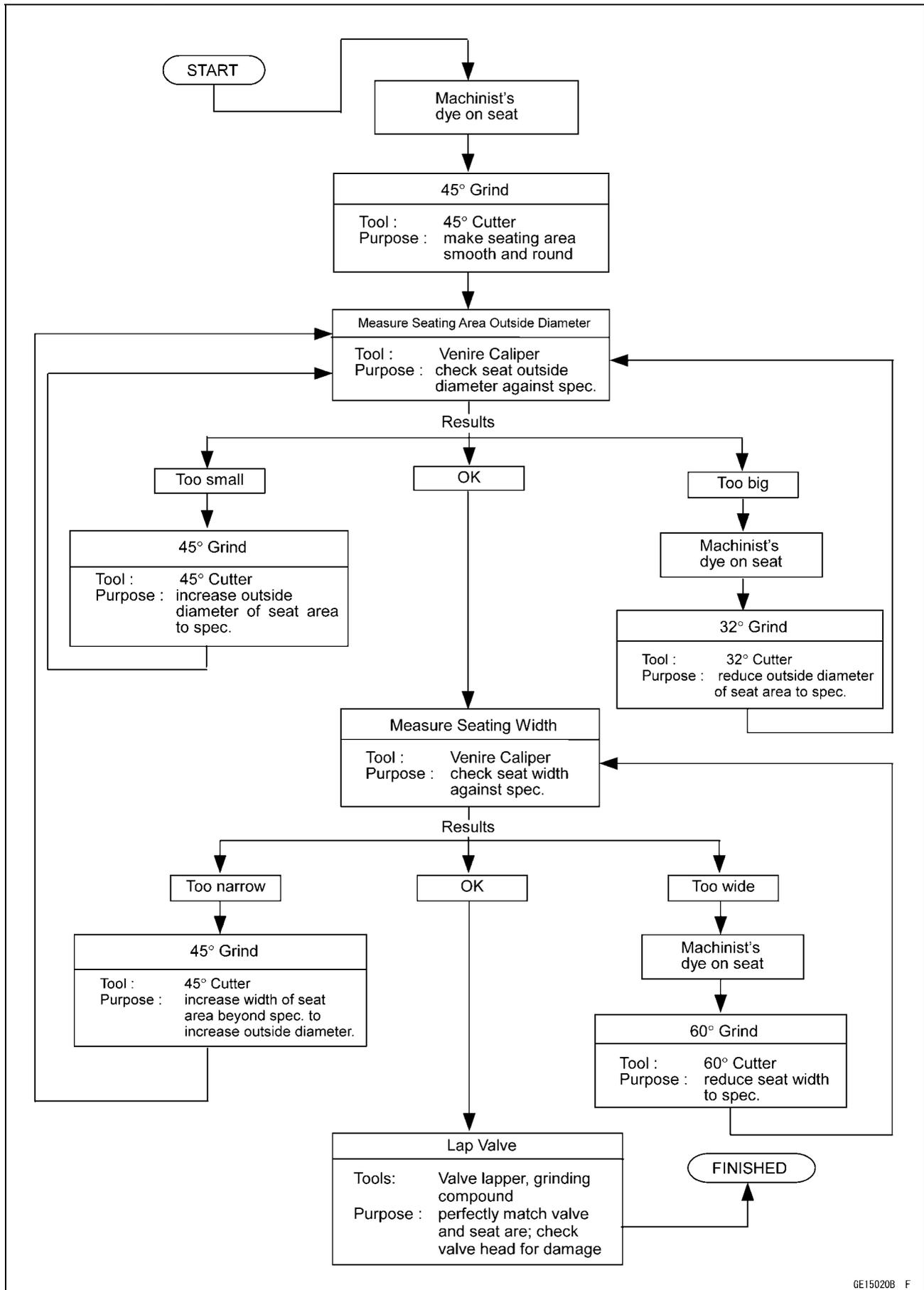
- The seating area should be marked about in the middle of the valve face.
- ★ If the seat area is not in the right place on the valve, check to be sure the valve is the correct part. If it is, it may have been refaced too much; replace it.
- Be sure to remove all grinding compound before assembly.
- When the engine is assembled, be sure to adjust the valve clearance (see Valve Clearance Adjustment).



# 4-30 ENGINE TOP END

## Valves, Guides, Seats, Springs, Oil Seals

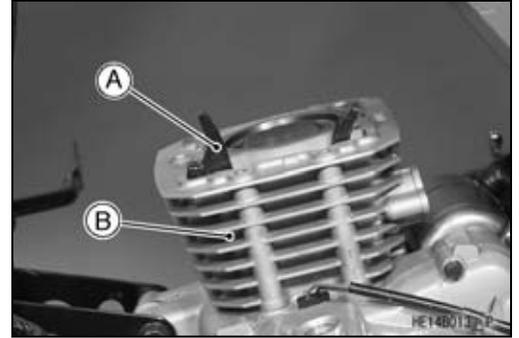
### Valve Seat Repair



## Cylinder and Piston

### Cylinder Removal

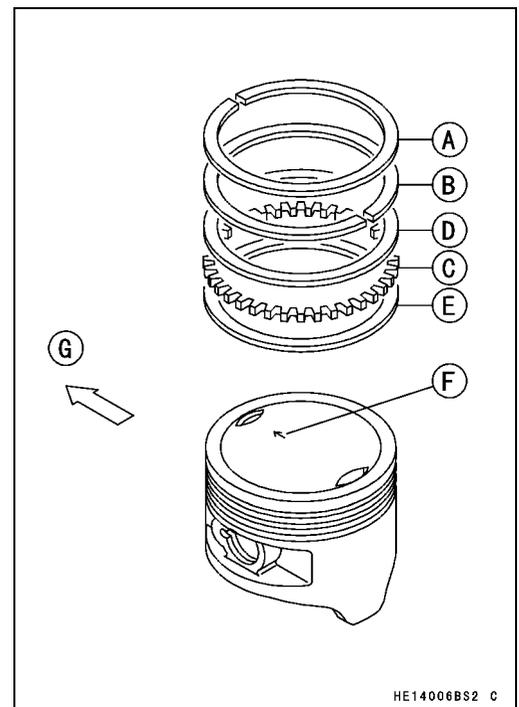
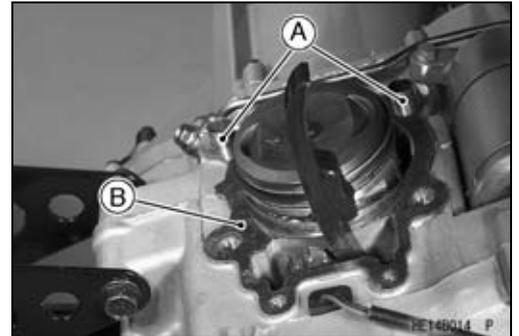
- Remove:
  - Cylinder Head (see Cylinder Head Removal)
  - Front Chain Guide [A]
- Lift off the cylinder [B], and remove the cylinder base gasket. If necessary, tap lightly around the base of the cylinder with a plastic mallet, taking care not to damage the cylinder.
- Immediately stuff a clean cloth around the piston to prevent parts or dirt from falling into the crankcase.



### Cylinder Installation

#### NOTE

- If a new cylinder is installed, be sure to check piston/cylinder clearance (see Piston/Cylinder Clearance).
- Clean any remains of the old cylinder base gasket from the bottom of the cylinder and the top of the crankcase.
- Install:
  - Dowel Pins [A]
  - New Cylinder Base Gasket [B]
- The arrow on the piston head must point toward the front of the engine.
- The piston ring openings must be positioned as shown. The openings of the oil ring steel rails must be about 30° ~ 150° of angle from the opening of the top ring.
  - Top Ring [A]
  - Second Ring [B]
  - Oil Ring Expander [C]
  - Top Oil Ring Steel Rail [D]
  - Bottom Oil Ring Steel Rail [E]
  - Arrow Mark [F]
  - Front [G]
- Apply molybdenum disulfide oil to the piston rings and smear some oil inside the cylinder bore.
- The rear camshaft chain guide also fit inside the tunnel.
- Fit the cylinder down over the piston and rings.
- Hold the rings into their groove with your fingers so that the cylinder does not catch on them.



- Be sure the O-ring [A] is in place at the bottom of the cylinder.
- Push the cylinder down solidly against the crankcase.



## 4-32 ENGINE TOP END

### Cylinder and Piston

#### Piston Removal

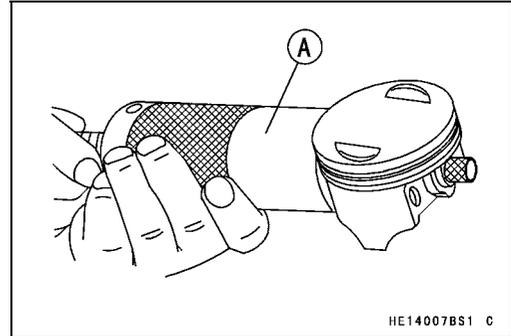
- Remove the cylinder (see Cylinder Removal).
- Place a clean cloth under the piston, remove the one of the piston pin snap rings.

#### CAUTION

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

- Push out the piston pin, and remove the piston.
- If necessary, use the piston pin puller assembly [A].

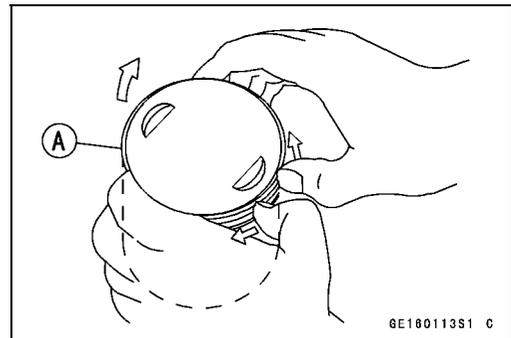
**Special Tool - Piston Pin Puller Assembly: 57001-910**



- Remove the top and second piston rings [A].
- Spread the ring open with your thumbs.
- Push up on the opposite side with your fingers.
- If necessary, use the piston ring pliers.

**Special Tool - Piston Ring Pliers: 57001-115**

- Remove the oil ring upper and lower steel rails.
- Spread the rail open with your thumbs.
- Push up on the opposite side with your fingers.
- Remove the oil ring expander.



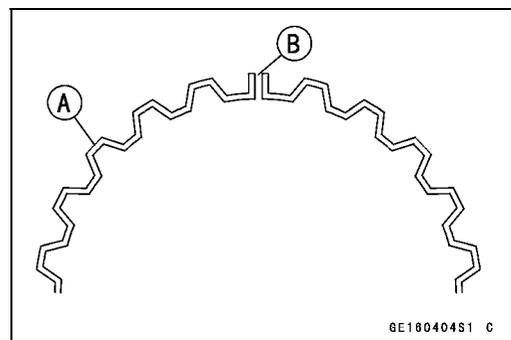
#### Piston Installation

#### NOTE

○ If a new piston is used, check piston to cylinder clearance (see Piston/Cylinder Clearance), and use new piston rings.

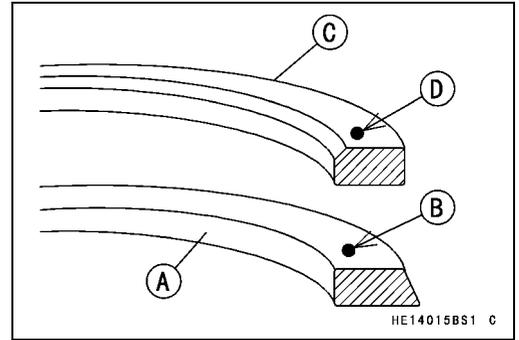
○ The oil ring rails have no "top" or "bottom".

- Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
- Install the oil ring steel rails, one above the expander and one below it.
- Spread the rail with your thumbs, but only enough to fit the rail over the piston.
- Release the rail into the bottom piston ring groove.

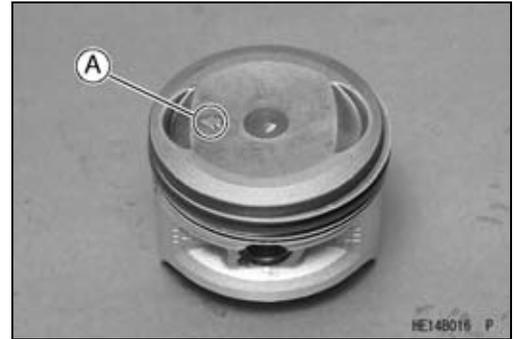


**Cylinder and Piston**

- Install the second ring [A] so that the “RN” mark [B] faces up.
- Install the top ring [C] so that the “R” mark [D] faces up.

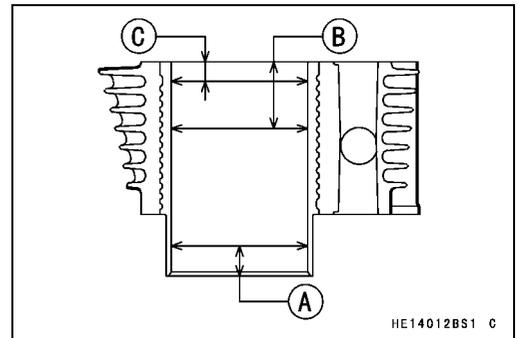


- Install the piston pin.
- Oil the piston pin lightly and slide it through the side of the piston without a snap ring.
- Hold the piston in position over the connecting rod, with the arrow [A] pointing forward, and slide the piston pin the rest of the way through the connecting rod and piston.
- Fit a new piston pin snap ring into the side of the piston so that the ring opening does not coincide with the slit of the piston pin hole.



**Cylinder/Piston Wear**

- Since there is a difference in cylinder wear in different direction, take a side-to-side and a front-to-back measurement at each of the 3 locations (total of 6 measurements) shown in the figure.
- ★ If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.
  - 20 mm (0.79 in.) [A]
  - 40 mm (1.57 in.) [B]
  - 10 mm (0.39 in.) [C]



**Cylinder Inside Diameter**

**Standard:** 68.995 ~ 69.007 mm (2.7163 ~ 2.7168 in.), and less than 0.01 mm (0.0004 in.) difference between any two measurements

**Service Limit:** 69.10 mm (2.720 in.), or more than 0.05 mm (0.0020 in.) difference between any two measurements

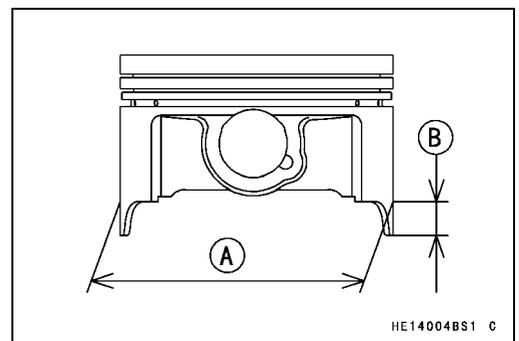
- Measure the piston diameter [A] of each piston 5 mm (0.20 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

**Piston Diameter**

**Standard:** 68.960 ~ 68.975 mm (2.7150 ~ 2.7155 in.)

**Service Limit:** 68.81 mm (2.709 in.)

- ★ If the piston diameter is less than the service limit, replace it.



## 4-34 ENGINE TOP END

### Cylinder and Piston

#### *Piston/Cylinder Clearance*

- Subtract the piston diameter from the cylinder inside diameter to get the piston/cylinder clearance.

#### **Piston/Cylinder Clearance**

**Standard: 0.020 ~ 0.047 mm (0.0008 ~ 0.0019 in.)**

#### *Piston Ring and Ring Groove Wear*

- Check for uneven groove wear by inspecting the ring seating.
- ★ The rings should fit perfectly parallel to groove surfaces. If not, replace the piston and all the piston rings.
- With the piston rings in their grooves, make several measurements with a thickness gauge [A] to determine piston ring/groove clearance.

#### **Piston Ring/Groove Clearance**

	<b>Standard</b>	<b>Service Limit</b>
<b>Top:</b>	<b>0.02 ~ 0.06 mm</b> <b>(0.0008 ~ 0.0024 in.)</b>	<b>0.16 mm</b> <b>(0.0063 in.)</b>
<b>Second:</b>	<b>0.02 ~ 0.06 mm</b> <b>(0.0008 ~ 0.0024 in.)</b>	<b>0.16 mm</b> <b>(0.0063 in.)</b>

- ★ If the piston ring groove clearance is greater than the service limit, measure the ring thickness and groove width as follows to decide whether to replace the rings, the piston or both.

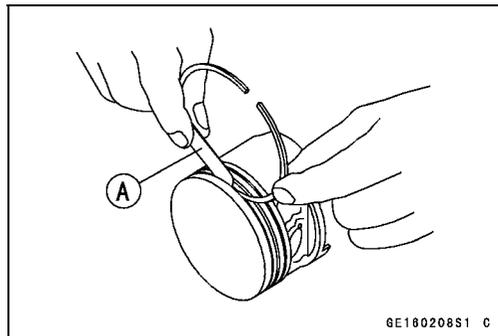
#### *Piston Ring Groove Width*

- Measure the piston ring groove width.
- Use a vernier caliper at several points around the piston.

#### **Piston Ring Groove Width**

	<b>Standard</b>	<b>Service Limit</b>
<b>Top:</b>	<b>0.81 ~ 0.83 mm</b> <b>(0.0319 ~ 0.0327 in.)</b>	<b>0.91 mm</b> <b>(0.0358 in.)</b>
<b>Second:</b>	<b>1.21 ~ 1.23 mm</b> <b>(0.0476 ~ 0.0484 in.)</b>	<b>1.31 mm</b> <b>(0.0516 in.)</b>
<b>Oil:</b>	<b>2.51 ~ 2.53 mm</b> <b>(0.0988 ~ 0.0996 in.)</b>	<b>2.61 mm</b> <b>(0.1028 in.)</b>

- ★ If the width of any of the two grooves is wider than the service limit at any point, replace the piston.



## Cylinder and Piston

### Piston Ring Thickness

- Measure the piston ring thickness.
- Use a micrometer to measure at several points around the ring.

#### Piston Ring Thickness

	Standard	Service Limit
<b>Top:</b>	<b>0.77 ~ 0.79 mm</b> <b>(0.0303 ~ 0.0311 in.)</b>	<b>0.70 mm</b> <b>(0.028 in.)</b>
<b>Second:</b>	<b>1.17 ~ 1.19 mm</b> <b>(0.0461 ~ 0.0469 in.)</b>	<b>1.10 mm</b> <b>(0.043 in.)</b>

- ★ If any of the measurements is less than the service limit on either of the rings, replace all the rings.

#### NOTE

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

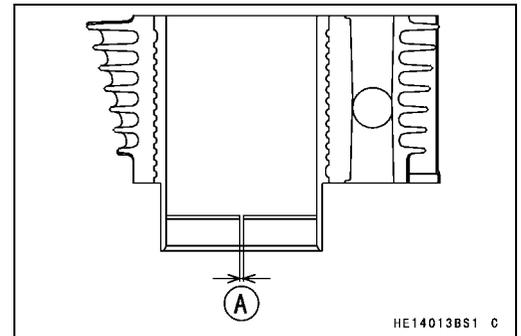
### Piston Ring End Gap Measurement

- Place the piston ring inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low.
- Measure the gap [A] between the ends of the ring with a thickness gauge, where cylinder wear is low.

#### Piston Ring End Gap

	Standard	Service Limit
<b>Top:</b>	<b>0.15 ~ 0.30 mm</b> <b>(0.0059 ~ 0.0118 in.)</b>	<b>0.6 mm</b> <b>(0.0236 in.)</b>
<b>Second:</b>	<b>0.30 ~ 0.45 mm</b> <b>(0.0118 ~ 0.0177 in.)</b>	<b>0.8 mm</b> <b>(0.0315 in.)</b>
<b>Oil:</b>	<b>0.20 ~ 0.70 mm</b> <b>(0.0079 ~ 0.0276 in.)</b>	<b>1.0 mm</b> <b>(0.0394 in.)</b>

- ★ If the end gap of either ring is greater than the service limit, replace all the rings.



## 4-36 ENGINE TOP END

### Exhaust System

This vehicle is equipped with a spark arrester approved for off-road use by the U.S. Forest Service. It must be properly maintained to ensure its efficiency. In accordance with the Periodic Maintenance Chart, clean the spark arrester.

#### CAUTION

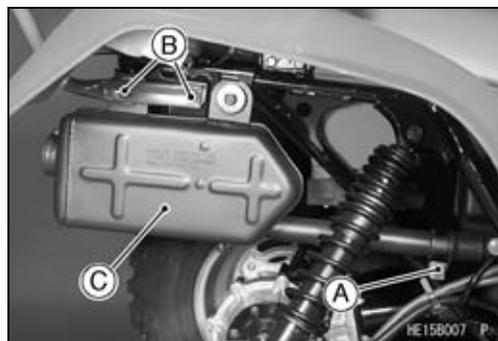
**The spark arrester must be installed correctly and functioning properly to provide adequate fire protection.**

#### *Spark Arrester Cleaning*

- Refer to the Spark Arrester Cleaning in the Periodic Maintenance chapter.

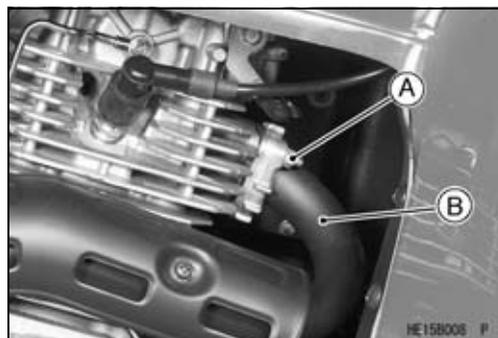
#### *Muffler Removal*

- Loosen the muffler clamp bolt [A] until the clamp turns freely on the muffler.
- Take out the muffler mounting bolts [B].
- Remove the muffler [C] from the rear of the frame.



#### *Exhaust Pipe Removal*

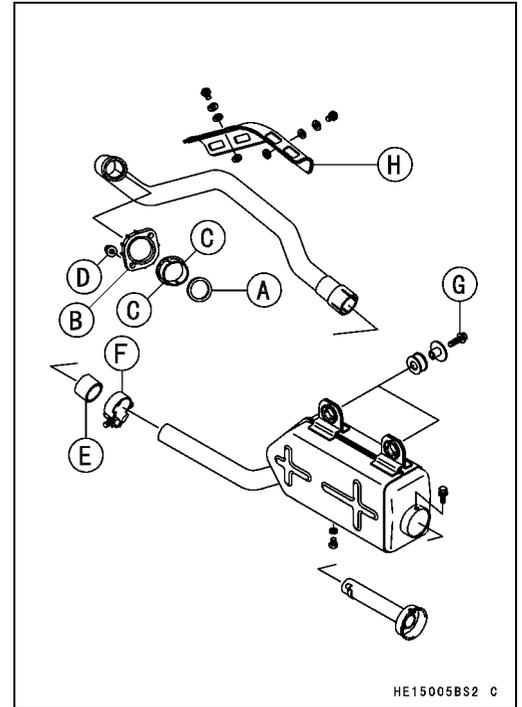
- Remove:
  - Muffler (see Muffler Removal)
  - Exhaust Pipe Holder Nuts [A] (both sides)
- Take off the exhaust pipe [B], work them out of the frame, and remove the exhaust pipe assembly.
- Remove the exhaust pipe gaskets from the cylinder head.



## Exhaust System

### Exhaust Pipe Installation

- Replace the new exhaust pipe gasket [A] and stick it into the exhaust port in the cylinder head.
- Slip the exhaust pipe holder [B] over the exhaust pipe.
- Attach the exhaust pipe loosely to the cylinder head.
- Tape the split collars [C] in place.
- Position the exhaust pipe in the exhaust port.
- Slide the holder into place on the studs.
- Thread on the nuts [D], but do not tighten them yet.
- Fit the gasket [E] into the muffler so that the chamfered side of the gasket faces to the front.
- Put the muffler clamp [F] over the muffler.
- Face the head of the clamp bolt downward and outward.
- Slip the muffler into place from the rear of the frame, so that it fits over the exhaust pipe.
- Hold the muffler and install the mounting bolts [G], but do not tighten them yet.
- Tighten the exhaust pipe holder nuts evenly and securely.
- Tighten the muffler mounting bolts securely.
- Tighten the muffler clamp bolt securely.
- If the exhaust pipe covers [H] were removed, install them.



### Exhaust System Inspection

- Before removing the exhaust system, check for signs of leakage at the exhaust pipe gasket in the cylinder head and at the muffler clamp.
- ★ If there are signs of leakage around the exhaust pipe gasket, it should be replaced. If the muffler-to-exhaust pipe joint leaks, tighten the clamp.
- Remove the exhaust pipe and muffler (see Exhaust Pipe and Muffler Removal).
- Inspect the gasket for damage and signs of leakage.
- ★ If the gasket is damaged or has been leaking, replace it.
- Check the exhaust pipe and muffler for dents, cracks, rust and holes.
- ★ If the exhaust pipe or muffler is damaged or has holes, it should be replaced for best performance and least noise.



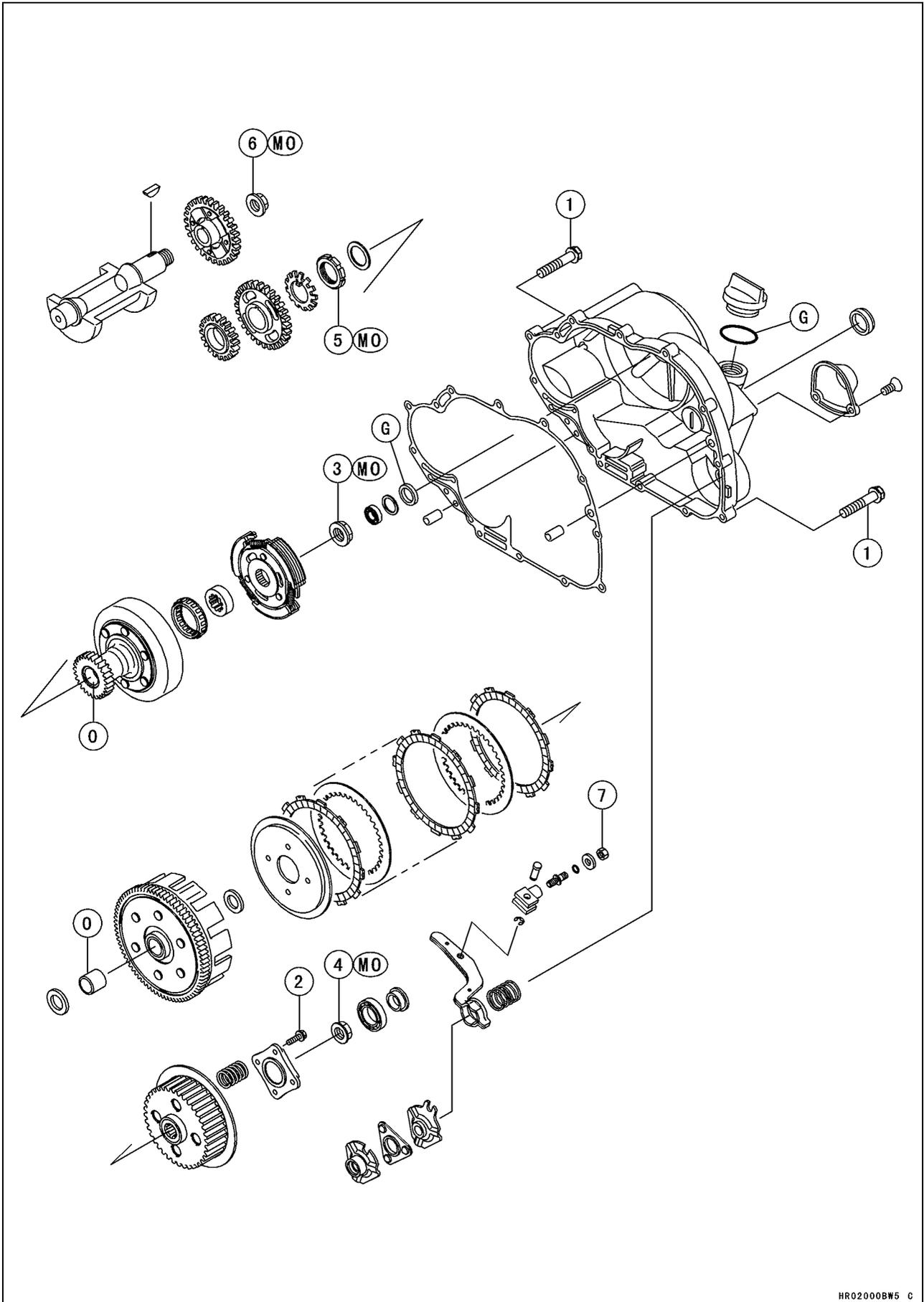
# Engine Right Side

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# 5-2 ENGINE RIGHT SIDE

## Exploded View



**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Right Engine Cover Bolts	8.8	0.9	78 in·lb	
2	Clutch Spring Bolts	12	1.2	104 in·lb	
3	Primary Clutch Hub Nut	127	13	94	MO
4	Secondary Clutch Hub Nut	78	8.0	58	MO
5	Balancer Drive Gear Nut	83	8.5	61	MO
6	Balancer Gear Nut	118	12	87	MO
7	Clutch Adjusting Screw Locknut	11	1.1	95 in·lb	

G: Apply grease for oil seal and O-ring.

MO: Apply molybdenum disulfide oil.

O: Apply engine oil.

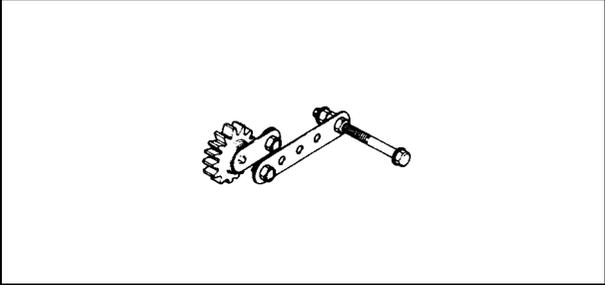
## 5-4 ENGINE RIGHT SIDE

### Specifications

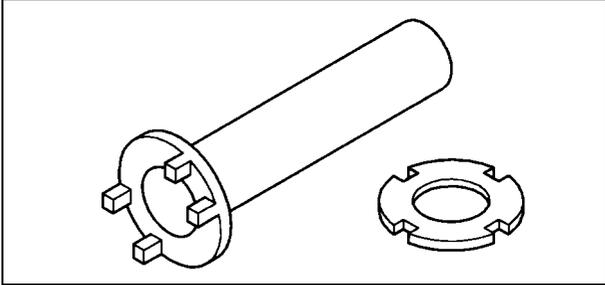
Item	Standard	Service Limit
<b>Primary Clutch</b>		
Primary Clutch Housing Inside Diameter	116.0 ~ 116.2 mm (4.567 ~ 4.575 in.)	116.5 mm (4.587 in.)
Primary Clutch Shoe Groove Depth	1.0 ~ 1.3 mm (0.04 ~ 0.05 in.)	0.5 mm (0.02 in.)
<b>Secondary Clutch</b>		
Friction Plate Thickness	2.9 ~ 3.1 mm (0.11 ~ 0.12 in.)	2.6 mm (0.10 in.)
Friction Plate Warp	less than 0.2 mm (0.008 in.)	0.3 mm (0.012 in.)
Steel Plate Warp	less than 0.1 mm (0.004 in.)	0.3 mm (0.012 in.)
Clutch Spring Free Length	37.2 mm (1.46 in.)	35.7 mm (1.41 in.)
<b>Primary Reduction</b>		
Gear Backlash	0.02 ~ 0.11 mm (0.0008 ~ 0.0043 in.)	0.14 mm (0.0055 in.)
Primary Gear Inside Diameter	27.000 ~ 27.021 mm (1.0630 ~ 1.0638 in.)	27.03 mm (1.0642 in.)
Crankshaft Diameter	26.959 ~ 26.980 mm (1.0614 ~ 1.0622 in.)	26.94 mm (1.0606 in.)
Secondary Gear Inside Diameter	25.000 ~ 25.021 mm (0.9842 ~ 0.9851 in.)	25.03 mm (0.9854 in.)
Secondary Gear Collar Diameter	24.970 ~ 24.985 mm (0.9831 ~ 0.9837 in.)	24.95 mm (0.9823 in.)

**Special Tools and Sealant**

**Gear Holder, m1.75:  
57001-1015**



**Socket Wrench:  
57001-1354**



## 5-6 ENGINE RIGHT SIDE

### Engine Right Side

#### Engine Right Side Disassembly

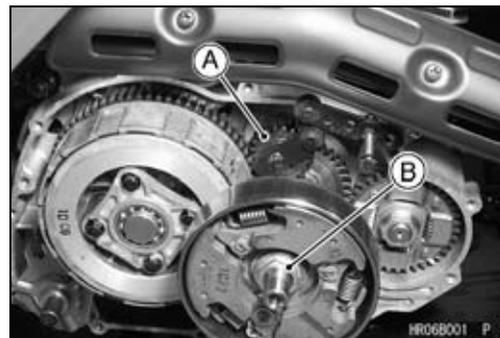
- Drain the engine oil (see Engine Lubrication System chapter).
- Remove:
  - Footpeg
  - Brake Pedal
  - Oil Filter (see Engine Lubrication System chapter)
  - Right Engine Cover Bolts [A]
  - Right Engine Cover [B]



- Using the gear holder [A], hold the primary gear and secondary gear.

**Special Tool - Gear Holder: 57001-1015**

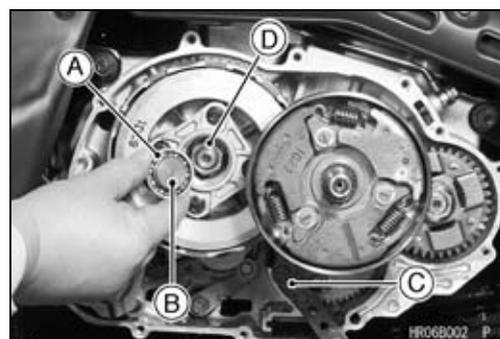
- Remove:
  - Primary Clutch Hub Nut [B]



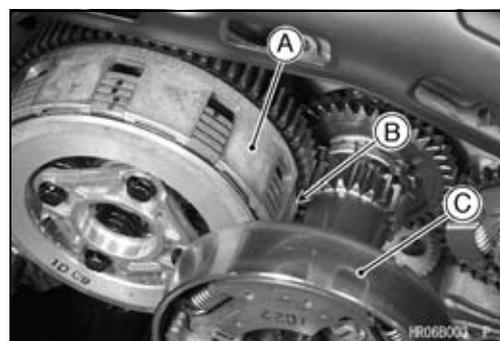
- Remove:
  - Ball Bearing [A] and Pusher [B]
- Using the gear holder [C], hold the primary gear and secondary gear.

**Special Tool - Gear Holder: 57001-1015**

- Remove:
  - Secondary Clutch Hub Nut [D]



- Turn the secondary clutch [A] until the dent [B] on the secondary clutch housing comes against the primary gear, and pull out the primary clutch housing [C] with the hub.
- Remove:
  - Secondary Clutch



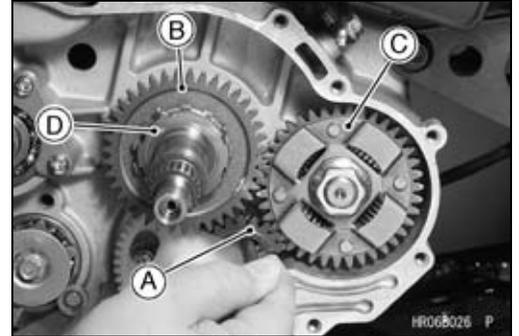
- Flatten out the bent tab [A] of the toothed washer.



## Engine Right Side

- Using a suitable gear [A], hold the balancer drive gear [B] and balancer gear [C].
- Loosen the balancer drive gear nut [D] with socket wrench.

**Special Tool - Socket Wrench: 57001-1354**



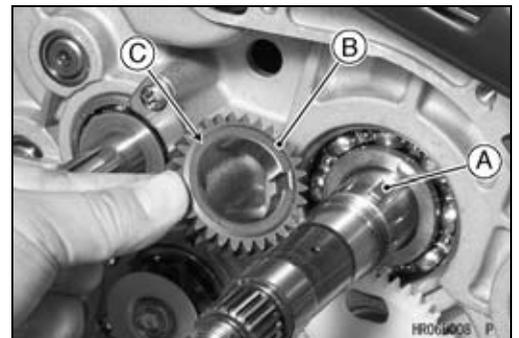
- Using a suitable gear [A], hold the balancer drive gear and balancer gear.
- Remove:
  - Balancer Gear Nut [B]
  - Balancer Gear [C]
  - Balancer Drive Gear Nut [D]
  - Toothed Washer
  - Balancer Drive Gear [E]



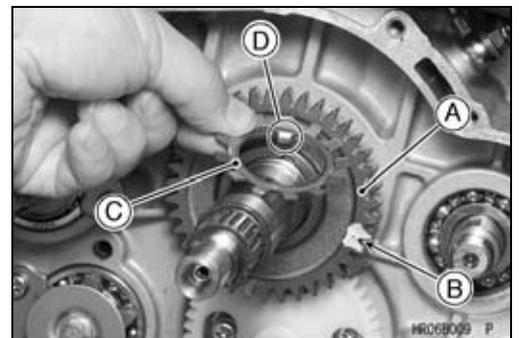
- Remove:
  - Oil Pump (see Engine Lubrication System chapter)
  - External Shift Mechanism (see Crankshaft/Transmission chapter)

### Engine Right Side Assembly

- Install:
  - Oil Pump (see Engine Lubrication system chapter)
  - Woodruff Key [A]
  - Oil Pump Gear [B]
- Face the stepped side [C] of oil pump drive gear inward.



- Install:
  - Balancer Drive Gear [A]
- Face the punch mark side [B] of balancer drive gear outward.
- Install:
  - Toothed Washer [C]
- Fit the tab [D] of the toothed washer into the slot in the balancer drive gear.
- Apply molybdenum disulfide oil to the threads of the balancer drive gear nut.
- Face the chamfered side of the nut inward.



## 5-8 ENGINE RIGHT SIDE

### Engine Right Side

- Apply molybdenum disulfide oil to the threads of the balancer gear nut and balancer drive gear nut.
- Align the punch marks [A] on the balancer drive gear and the balancer gear [B].

- Tighten:

**Torque - Balancer Gear Nut: 118 N·m (12 kgf·m, 87 ft·lb)**

- Tighten:

**Special Tool - Socket Wrench: 57001-1354**

**Torque - Balancer Drive Gear Nut: 83 N·m (8.5 kgf·m, 61 ft·lb)**

- Bend a tab [C] of the toothed washer into the slot in the nut.

- Apply molybdenum disulfide oil to the drive shaft and crankshaft.

- Install:

Thinner Spacer [A] (20.2 x 36 x 2)

Collar [B] and Clutch Housing [C]

- Apply engine oil to the outer surface of collar.

- Install:

Thicker Spacer [D] (20.2 x 35 x 4)

- Install:

Clutch Operating Plate [A]

Friction Plate [B]

Steel Plate [C]

Clutch Hub [D]

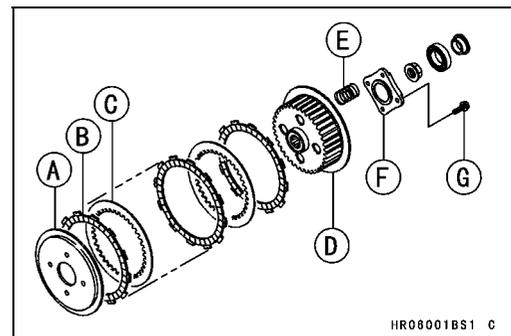
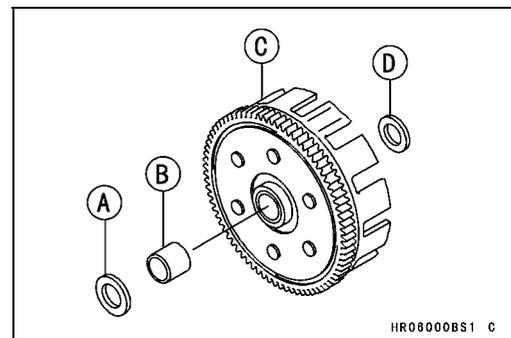
Spring [E]

Spring Holder [F]

Clutch Spring Bolts [G]

- Tighten:

**Torque - Clutch Spring Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)**



#### CAUTION

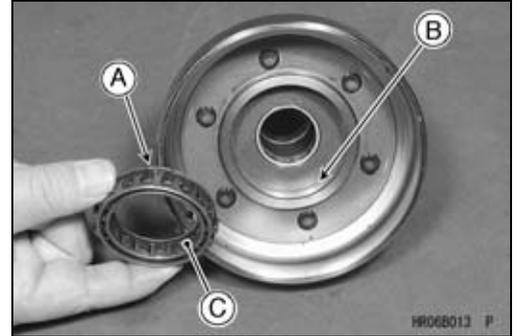
**If new dry steel plates and friction plates are installed, apply engine oil to the surfaces of the each plate to avoid clutch plate seizure.**

- There should be a gap [A] between the clutch wheel and housing.
- Apply molybdenum disulfide oil to the secondary clutch hub nut and tighten it lightly.

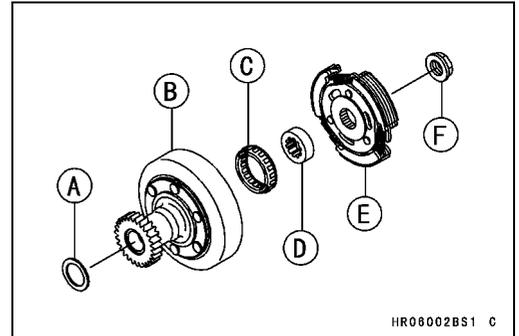


**Engine Right Side**

- Fit the projection [A] on the cage into the groove [B] on the housing first, and then install the one-way clutch [C] completely.



- Install:
  - Spacer [A] (28.1 x 34 x 1.0)
  - Primary Clutch Housing [B]
- Turn the secondary clutch until the dent on the secondary clutch housing comes against the crankshaft, and install the primary clutch housing.
- Install:
  - One-Way Clutch [C]
  - Inner Race [D]
  - Clutch Hub Assembly [E]
  - Primary Clutch Hub Nut [F]
- Apply molybdenum disulfide oil to the primary and secondary clutch hub nuts and tighten them.



**Special Tool - Gear Holder: 57001-1015**

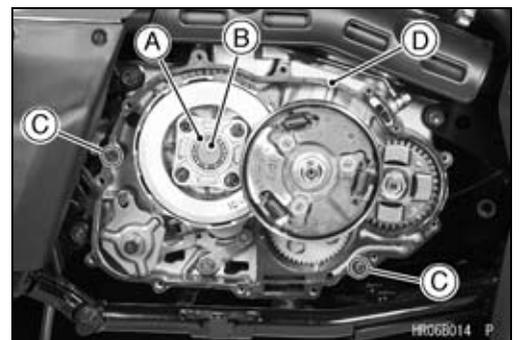
**Torque - Primary Clutch Hub Nut: 127 N·m (13 kgf·m, 94 ft·lb)**

- Tighten:
  - Torque - Secondary Clutch Hub Nut: 78 N·m (8.0 kgf·m, 58 ft·lb)**
- Install:
  - Ball Bearing
  - Pusher

- Install:
  - External Shift Mechanism (see Crankshaft/Transmission chapter)
  - Ball Bearing [A]
  - Pusher [B]
  - Dowel Pins [C]
  - New Gasket [D]
  - Right Engine Cover

- Tighten:
  - Torque - Right Engine Cover Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**

- After assembling the engine right side, adjust the clutch (see Clutch Adjustment).



## 5-10 ENGINE RIGHT SIDE

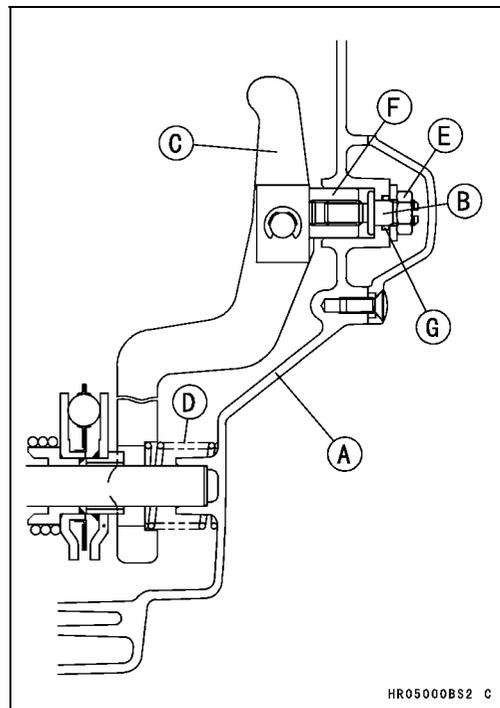
### Clutches

#### Clutch Adjustment

- Refer to the Clutch Adjustment in the Periodic Maintenance chapter.

#### Clutch Release Removal

- Remove:
  - Right Engine Cover [A]
  - Adjusting Screw [B]
- Pull the clutch release lever [C], and spring [D] out of right engine cover.
  - Locknut [E]
  - Holder [F]
  - O-ring [G]



#### Clutch Release Wear

- Visually inspect the O-ring at the clutch adjusting screw.
- ★ If O-ring is damaged, deteriorated, compressed, or hardened, replace it.

#### Primary Clutch Housing Wear

- Measure the inside diameter [A] of the clutch housing where the shoes wear against it.
- Use calipers and measure at several points as shown.
- ★ If any measurement is greater than the service limit, replace the clutch housing.

##### Primary Clutch Housing Inside Diameter

Standard: 116.0 ~ 116.2 mm (4.567 ~ 4.575 in.)

Service Limit: 116.5 mm (4.587 in.)



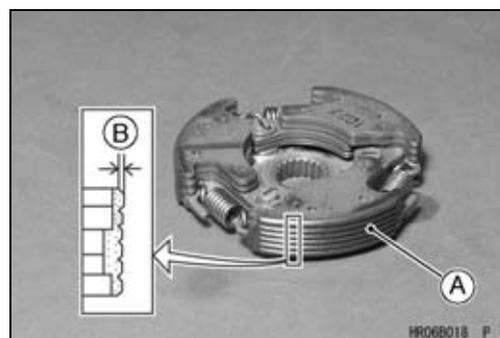
#### Primary Clutch Shoe Lining Wear

- Visually inspect the primary clutch shoe lining [A].
- ★ If any of the linings are damaged, replace the shoes.
- Measure the shoe groove depth [B].
- Use a depth gauge, and measure at several points as shown.
- ★ If any measurement is less than the service limit, replace all shoes as a set.

##### Primary Clutch Shoe Groove Depth

Standard: 1.0 ~ 1.3 mm (0.04 ~ 0.05 in.)

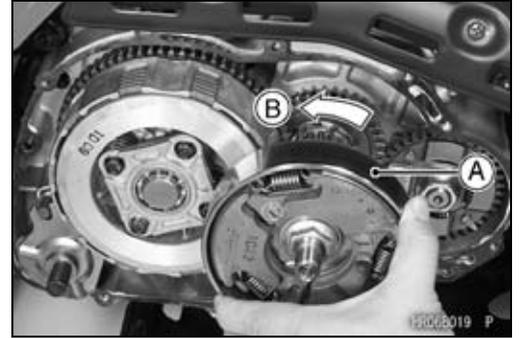
Service Limit: 0.5 mm (0.02 in.)



**Clutches**

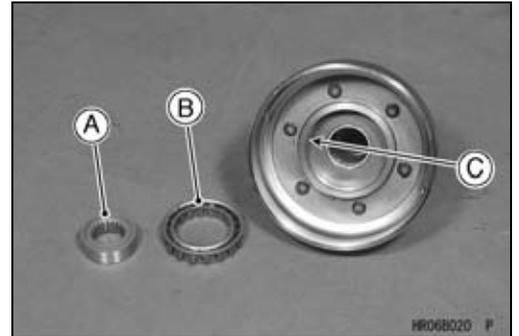
*One-way Clutch Inspection*

- Turn the primary clutch housing [A] by hand. The primary clutch housing should turn counterclockwise [B] freely, but should not turn clockwise.



- Visually inspect the clutch parts; inner race [A], one-way clutch [B], and outer race [C] at the primary clutch housing.

★ If there is any worn or damaged part, replace it.



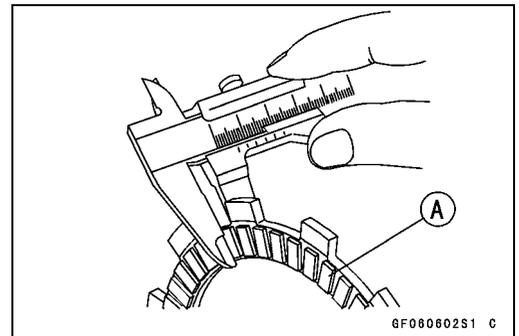
*Friction Plate Wear*

- ★ If any friction plate thickness is less than the service limit, replace the friction plates as a set.

[A] Friction Plate

**Friction Plate Thickness**

- Standard:** 2.9 ~ 3.1 mm (0.11 ~ 0.12 in.)
- Service Limit:** 2.6 mm (0.10 in.)



*Friction and Steel Plate Warp*

- ★ If any plate is warped over the service limit, replace the plates as a set.

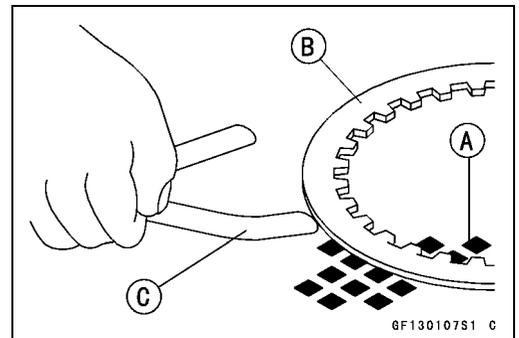
Surface Plate [A]

Friction or Steel Plate [B]

Thickness Gauge [C]

**Friction Plate Warp**

- Standard:** less than 0.2 mm (0.008 in.)
- Service Limit:** 0.3 mm (0.012 in.)



**Steel Plate Warp**

- Standard:** less than 0.1 mm (0.004 in.)
- Service Limit:** 0.3 mm (0.012 in.)

## 5-12 ENGINE RIGHT SIDE

### Clutches

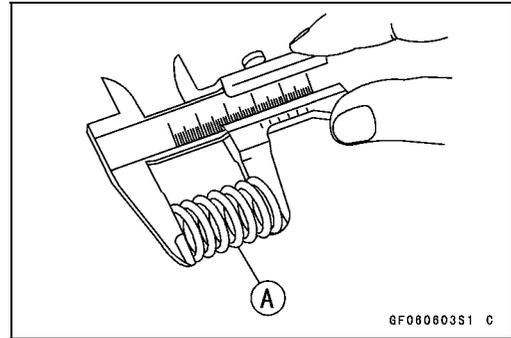
#### *Clutch Spring Free Length Measurement*

★If any of the springs [A] is shorter than the service limit, it must be replaced.

#### **Clutch Spring Free length**

**Standard:** 37.2 mm (1.46 in.)

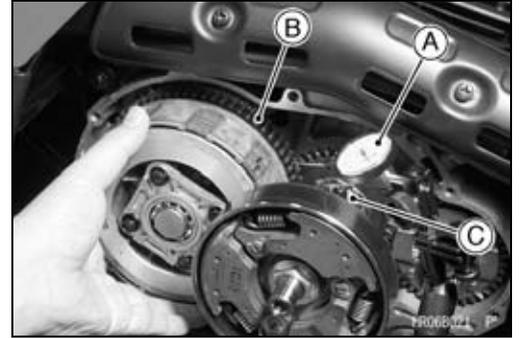
**Service Limit:** 35.7 mm (1.41 in.)



**Primary Reduction**

*Gear Backlash*

- Remove the right engine cover (see Right Engine Cover Removal).
- Set a dial gauge [A] against the teeth on one gear, and move the gear [B] back and forth while holding the other gear [C] steady. The difference between the highest and the lowest gauge readings is the amount of backlash.



**Gear Backlash**

**Standard:** 0.02 ~ 0.11 mm  
(0.0008 ~ 0.0043 in.)

**Service Limit:** 0.14 mm (0.0055 in.)

- ★ If the amount of backlash exceeds the service limit, replace both gears.

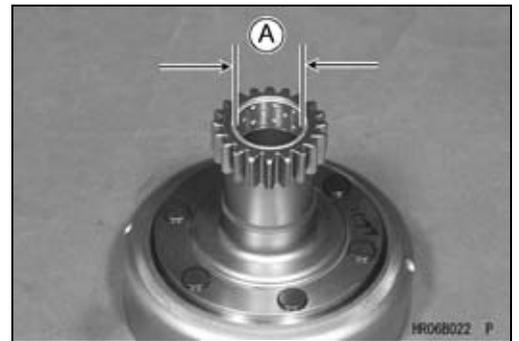
*Primary Gear/Crankshaft Wear*

- ★ If the inside diameter of the primary gear is greater than the service limit, replace it.
- ★ If the outside diameter of the crankshaft is less than the service limit, replace it (see Crankshaft/Transmission chapter).

**Primary Gear Inside Diameter [A]**

**Standard:** 27.000 ~ 27.021 mm  
(1.0630 ~ 1.0638 in.)

**Service Limit:** 27.03 mm (1.0642 in.)



**Crankshaft Diameter [A]**

**Standard:** 26.959 ~ 26.980 mm  
(1.0614 ~ 1.0622 in.)

**Service Limit:** 26.94 mm (1.0606 in.)



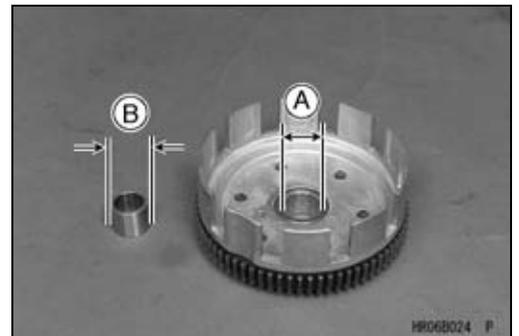
*Secondary Gear/Collar Wear*

- ★ If the inside diameter of the secondary gear is greater than the service limit, replace it.
- ★ If the outside diameter of the collar is less than the service limit, replace it.

**Secondary Gear Inside Diameter [A]**

**Standard:** 25.000 ~ 25.021 mm  
(0.9842 ~ 0.9851 in.)

**Service Limit:** 25.03 mm (0.9854 in.)



**Secondary Gear Collar Diameter [B]**

**Standard:** 24.970 ~ 24.985 mm  
(0.9831 ~ 0.9837 in.)

**Service Limit:** 24.95 mm (0.9823 in.)



# Recoil Starter

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## RECOIL STARTER 6-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Recoil Starter Mounting Bolts	8.8	0.9	78 in·lb	
2	Recoil Starter Flange Nut	12	1.2	104 in·lb	

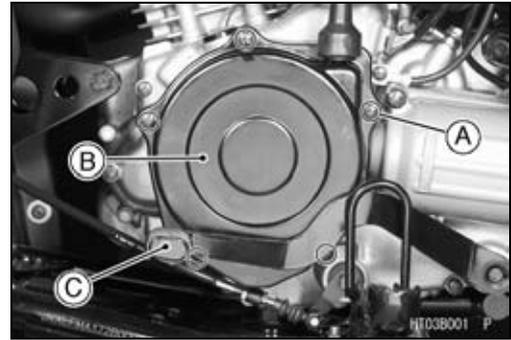
Gr: Apply grease.

## 6-4 RECOIL STARTER

### Recoil Starter

#### Recoil Starter Removal

- Remove:
  - Recoil Starter Mounting Bolts [A]
  - Recoil Starter [B]
- Push down the shift pedal [C], when removing the recoil starter.

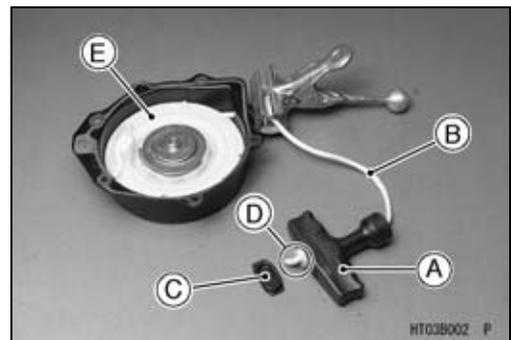


#### Recoil Starter Installation

- Tighten:
  - Torque - Recoil Starter Mounting Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**

#### Recoil Starter Disassembly

- Remove the recoil starter.
- Pull the handle [A] out 100 ~ 200 mm (4.0 ~ 8.0 in.). Clamp the rope [B] in place with locking pliers.
- Remove the handle cap [C].
- Pry the knot [D] out of the handle and untie it. Pull the handle off the rope.
- Hold the reel [E] in one hand while removing the locking pliers with the other.

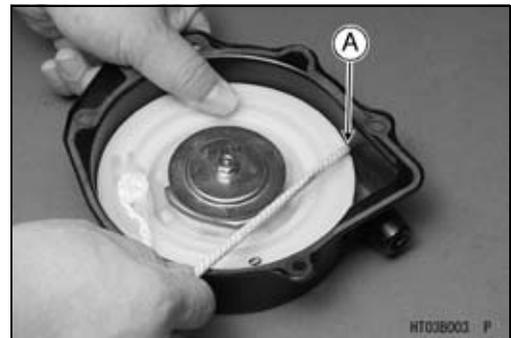


- Pull the rope in through the rope hole in the housing and hold it in the notch [A] in the reel.

#### NOTE

○ Do not let the rope wedge between the reel and the housing.

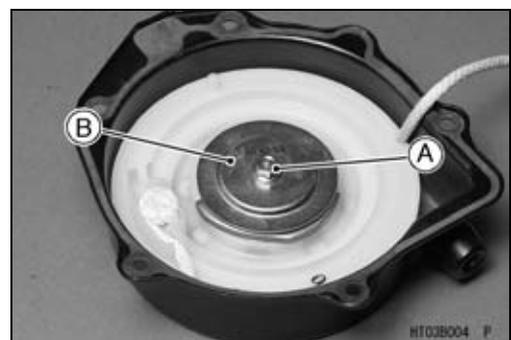
- Slowly allow recoil spring tension to unwind the reel.



- Remove:
  - Flange Nut [A]
  - Friction Plate [B]

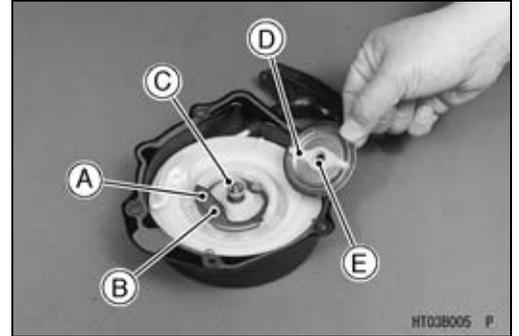
#### WARNING

Be careful that the recoil spring does not fly loose and does not injure you. It is under great pressure. Turn the reel one-quarter turn counterclockwise past the rest position where no tension can be felt. Now, slowly lift the friction plate straight up out of the housing.



**Recoil Starter**

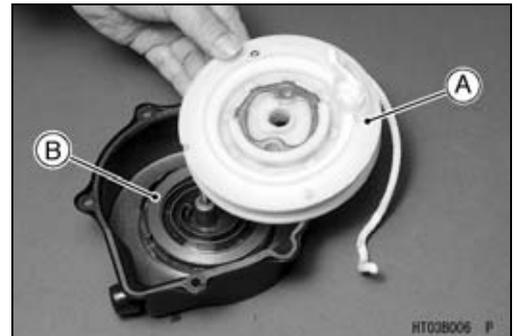
- Remove:
  - Pawl [A]
  - Pin [B]
  - Friction Plate Spring [C]
  - Recoil Guide [D]
  - Collar [E]



- Remove the reel [A] noting the following.

**WARNING**

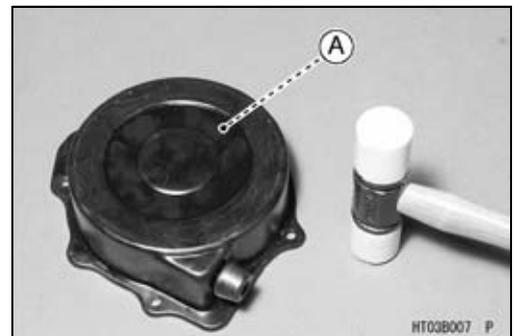
**Be careful that the recoil spring [B] does not fly loose and does not injure you. It is still under great pressure. Turn the reel one-quarter turn counterclockwise past the rest position where no tension can be felt. Now, slowly lift the reel straight up out of the housing.**



**NOTE**

○There should be no spring tension on the reel when removing the reel. Lift the reel slightly. If tension is felt, push the reel back into place and gently “wiggle” it until the reel may be easily removed.

- If necessary, remove the recoil spring [A] as follows:
  - Place the starter housing facing down on a bench.
  - Strike the bench sharply so safely remove the spring.



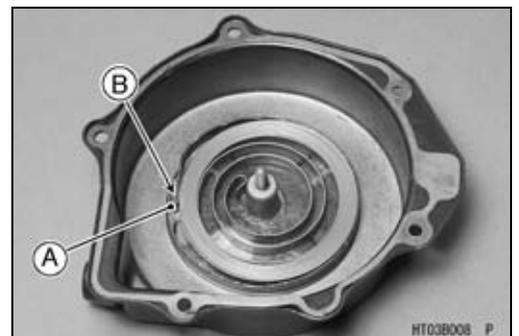
*Recoil Starter Assembly*

- If the recoil spring was removed, install it as shown. If it is not installed correctly, the starter will not operate properly.

**WARNING**

**The recoil spring must be put under great pressure during installation. Wear gloves to avoid injury.**

- Hook the outer end [A] of the recoil spring onto the housing tab [B].
- Reel the recoil spring clockwise into the housing from outside to inside.



**NOTE**

○Push the recoil spring against the housing securely to prevent the spring from slipping off during installation.

- Lightly grease the spring.

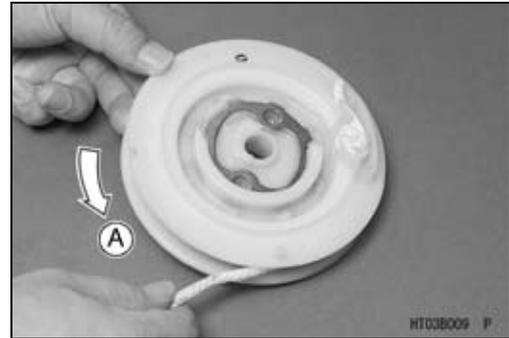
## 6-6 RECOIL STARTER

### Recoil Starter

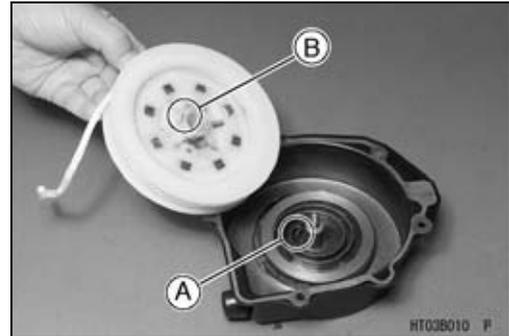
- If the rope was unwound from the reel, it must be wound clockwise for correct starter operation.
- Wind the rope around the smaller diameter of the reel.

#### NOTE

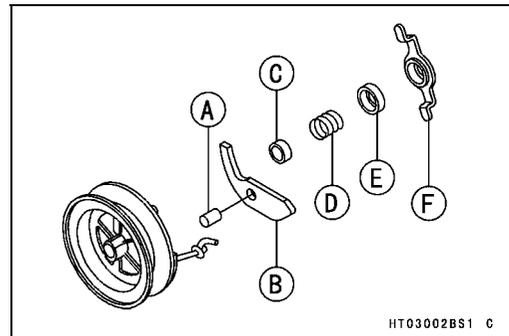
○ Turn the reel counterclockwise [A] to wind the rope clockwise. This prevents the rope from twisting.



- Set the reel into the place so that the hook [A] on the spring catches on the tab [B] in the reel.

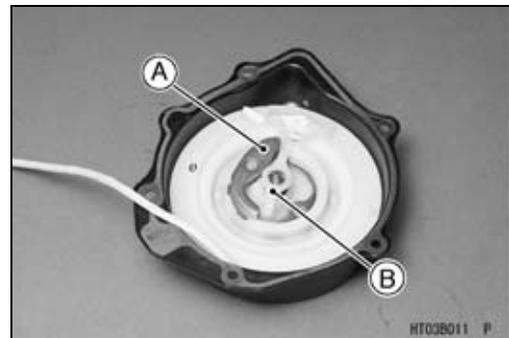


- Install:
  - Pin [A]
  - Pawl [B]
  - Recoil Shaft [C]
  - Friction Plate Spring [D]
  - Collar [E]
  - Recoil Guide [F]
- Apply grease to the pin and collar.

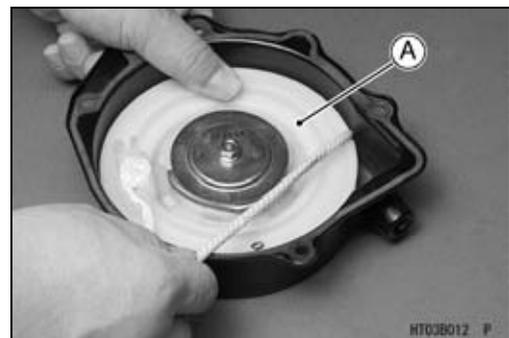


○ Install the pawl [A] and recoil guide [B] as shown for proper starter operation.

- Install:
  - Friction Plate
- Tighten:
  - Torque - Recoil Starter Flange Nut: 12 N·m (1.2 kgf·m, 104 in·lb)**

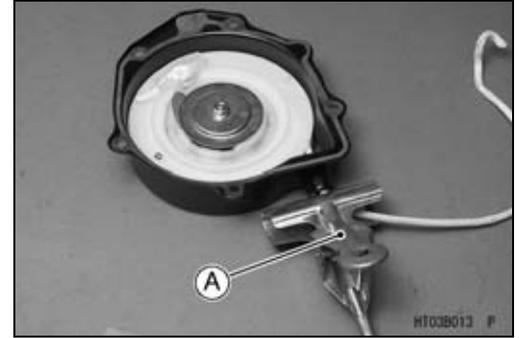


- Turn the reel [A] **two turns clockwise** to preload the spring.



## Recoil Starter

- Clamp the rope with a locking pliers [A].
- Install:
  - Handle
- Knot the end of the rope tightly.
- Install:
  - Handle Cap



### *Recoil Starter Cleaning*

- Disassemble the recoil starter.
- Immerse only the metal parts in a bath of high-flash point solvent.

### **WARNING**

**Clean the starter 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 starter. A fire or explosion could result.**

### **CAUTION**

**Do not clean any non-metallic parts in the solvent as they may be damaged.**

- Use compressed air to dry the cleaned components.

### *Recoil Starter Inspection*

- Clean the recoil starter.
- Examine the starter pawl for chips or excessive wear.
- Check the starter rope for excessive wear or fraying.
- Check the condition of the recoil spring, and friction plate spring.
- Inspect the springs for breaks, rust, distortion, or weakened condition.



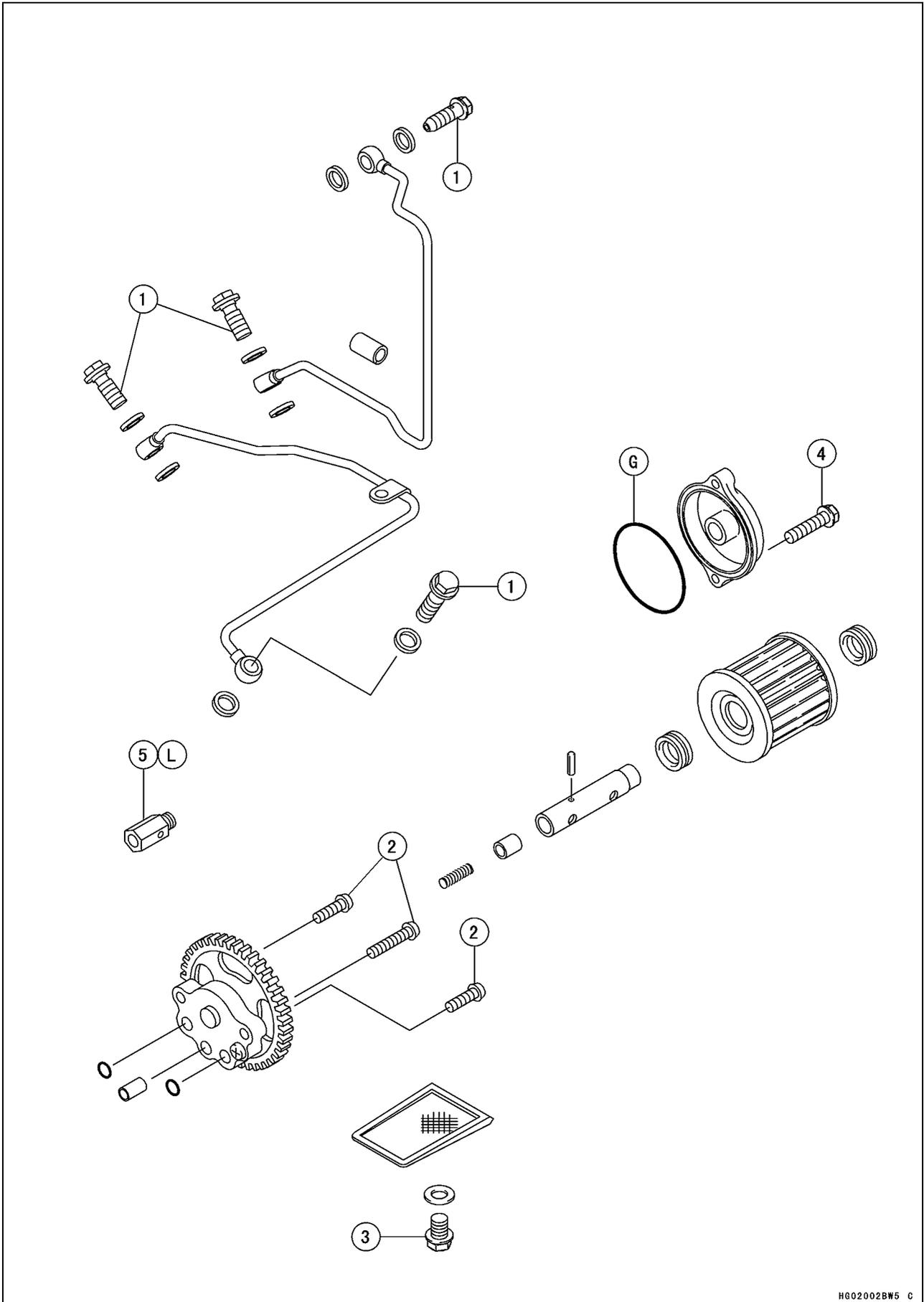
# Engine Lubrication System

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# 7-2 ENGINE LUBRICATION SYSTEM

## Exploded View



## ENGINE LUBRICATION SYSTEM 7-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Pipe Banjo Bolts	15	1.5	11	
2	Oil Pump Screws	4.4	0.45	39 in·lb	
3	Engine Drain Plug	29	3.0	22	
4	Oil Filter Cover Bolts	8.8	0.9	78 in·lb	
5	Oil Pressure Relief Valve	15	1.5	11	L

G: Apply grease for oil seal and O-ring.

L: Apply a non-permanent locking agent.

## 7-4 ENGINE LUBRICATION SYSTEM

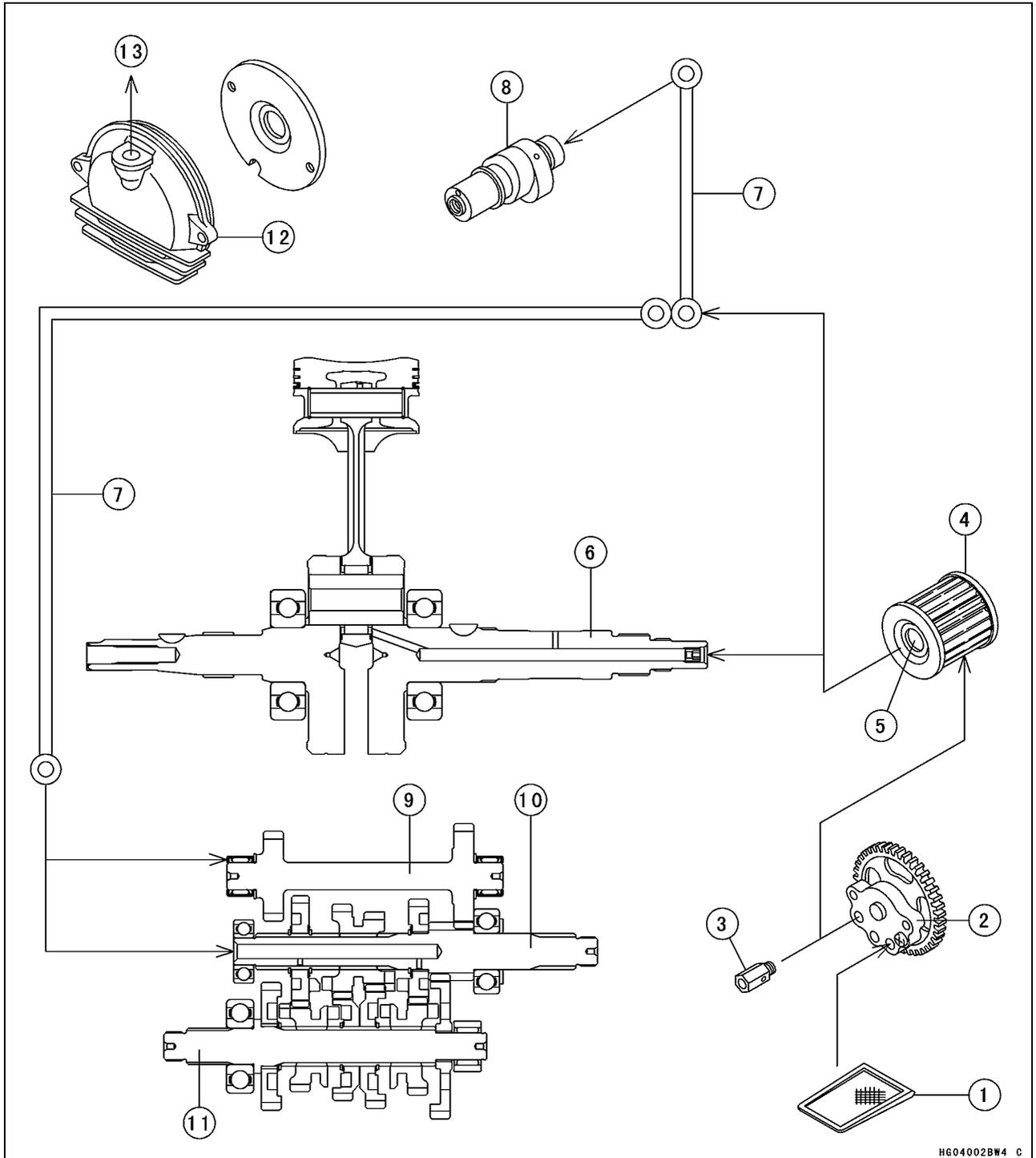
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### Specifications

---

Item	Standard
<b>Engine Oil</b>	
Type	API SF or SG
	API SH or SJ with JASO MA
Viscosity	SAE 10W-40
Capacity	2.0 L (2.11 US qt) (when filter is not removed)
	2.1 L (2.22 US qt) (when filter is removed)
	2.75 L (2.91 US qt) (when engine is completely dry)

Engine Oil Flow Chart



H604002BW4 C

- 1. Oil Screen
- 2. Oil Pump
- 3. Relief Valve
- 4. Oil Filter
- 5. Crankshaft

- 6. Oil Pipe
- 7. Camshaft
- 8. Reverse Shaft
- 9. Input Shaft
- 10. Drive Shaft

- 11. Engine Breather
- 12. Blow-by Gas  
(to Air Cleaner)

## 7-6 ENGINE LUBRICATION SYSTEM

### Engine Oil and Oil Filter

#### WARNING

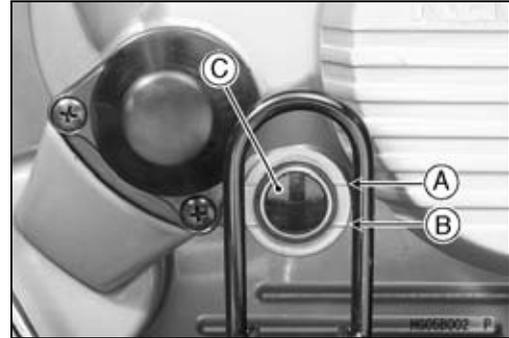
Vehicle operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine or transmission seizure, accident, and injury.

#### Oil Level Inspection

- Park the vehicle so that it is level, both side-to-side and front-to-rear.
- Check that the engine oil level is between the upper [A] and lower [B] lines in the gauge [C].

#### NOTE

○If the oil has just been changed, start the engine and run it for several minutes at idle speed. This fills the oil filter with oil. Stop the engine, then wait several minutes until the oil settles.



#### CAUTION

Racing the engine before the oil reaches every part can cause engine seizure.

- ★ If the level is too high, suck the excess oil out the filler hole with a syringe or other suitable device.
- ★ If the level is too low, add oil through the filler hole. 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 off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.

#### Engine Oil Change

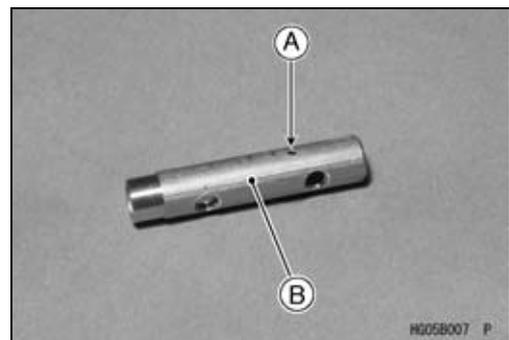
- Refer to the Engine Oil Change in the Periodic Maintenance chapter.

#### Oil Filter Change

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

#### Bypass Valve Removal

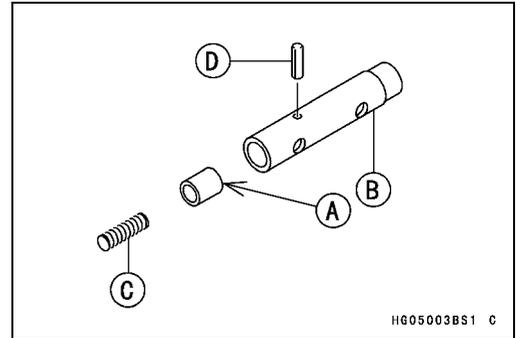
- Remove:
  - Oil Filter (see Oil Filter Removal)
- Drive the retaining pin [A] out of the filter mounting pin [B].
- Remove:
  - Spring
  - Bypass Valve Piston



## Engine Oil and Oil Filter

### Bypass Valve Installation

- Drop the bypass valve piston closed end [A] first into the filter mounting pin [B].
- Put the spring [C] into the mounting pin and compress it beyond the small hole.
- Drive the retaining pin [D] into the small hole to hold the spring.
- Install the oil filter (see Oil Filter Installation).



### Bypass Valve Cleaning and Inspection

- Clean the bypass valve parts in a high-flash point solvent.

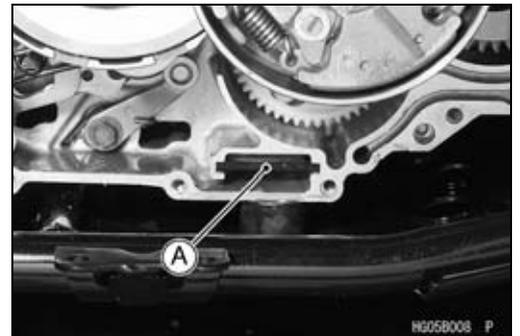
#### WARNING

**Clean the parts 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 solvents.**

- Visually inspect the bypass valve parts.
- ★ If the spring is bent or distorted, replace it. If the piston is worn, replace all of the bypass valve parts.

### Oil Screen Removal

- Remove the right engine cover (see Engine Right Side Disassembly section in Engine Right Side chapter).
- Pull the oil screen [A] out of the crankcase.

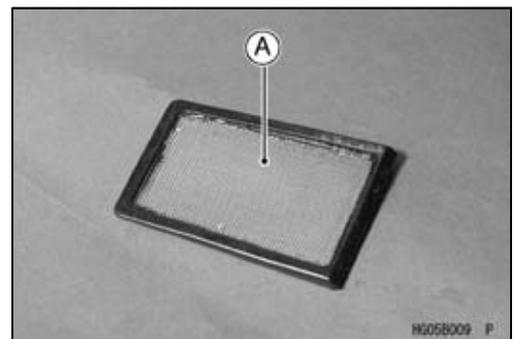


### Oil Screen Installation

- Clean the oil screen [A] thoroughly whenever it is removed for any reason.
- Clean the oil screen with a high-flash point solvent and remove any particles stuck to it.

#### WARNING

**Clean the screen 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 solvents.**



#### NOTE

○ While cleaning the screen, check for any metal particles that might indicate internal engine damage.

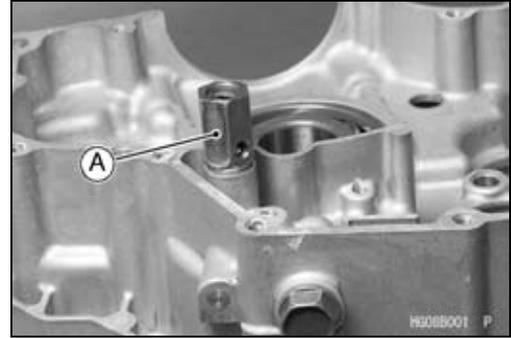
- Check the screen carefully for any damage, holes, broken wires, gasket pulling off.
- ★ If the screen is damaged, replace it.

## 7-8 ENGINE LUBRICATION SYSTEM

### Oil Pressure Relief Valve

#### Oil Pressure Relief Valve Removal

- See Crankcase Disassembly (see Crankshaft / Transmission Chapter).
- Remove the oil pressure relief valve [A].



#### Oil Pressure Relief Valve Installation

- See Crankcase Assembly (See Crankshaft / Transmission Chapter).
- Apply a non-permanent locking agent to the threads of oil pressure relief valve, and tighten it.

**Torque - Oil Pressure Relief Valve: 15 N·m (1.5 kgf·m, 11 ft·lb)**

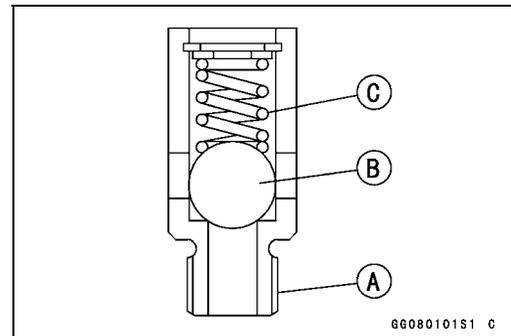
#### Oil Pressure Relief Valve Inspection

- Check to see if the steel ball [B] inside the valve [A] slides smoothly when pushing it in with a wooden or other soft rod, and see if it comes back to its seat by spring [C] pressure.

#### NOTE

○ Inspect the valve in its assembled state. Disassembly and assembly may change the valve performance.

- ★ If any rough spot is found during above inspection, wash the valve clean with a high-flash point solvent and blow out any foreign particles that may be in the valve with compressed air.



#### WARNING

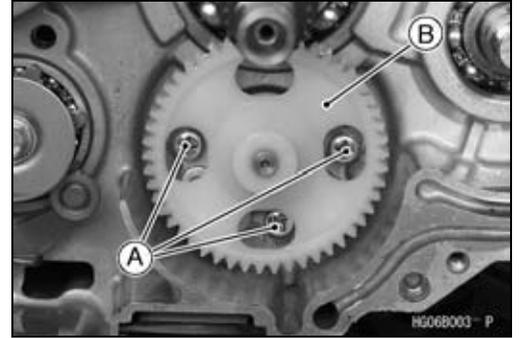
**Clean the oil pressure relief valve in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline to low-flash point solvent.**

- ★ If cleaning does not solve the problem, replace the oil pressure relief valve as an assembly. The oil pressure relief valve is precision made with no allowance for replacement of individual parts.

## Oil Pump

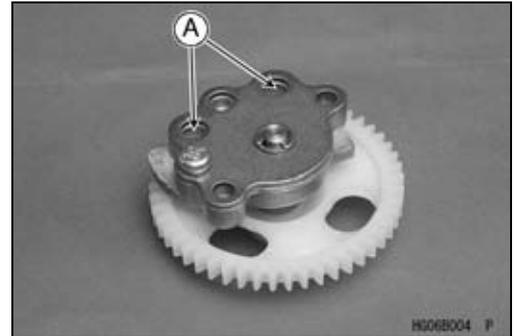
### Oil Pump Removal

- Remove:
  - Oil Pump/Balancer Drive Gear (see Engine Right Side Disassembly section in Engine Right Side chapter)
  - Oil Pump Screws [A]
  - Oil Pump Assembly [B]

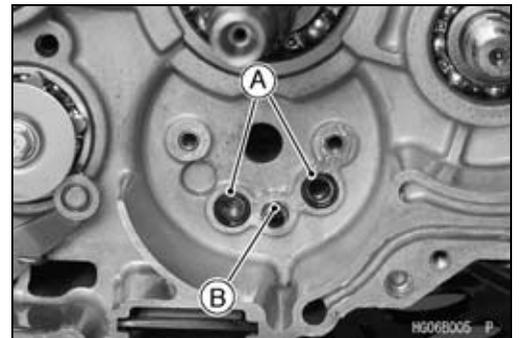


### Oil Pump Installation

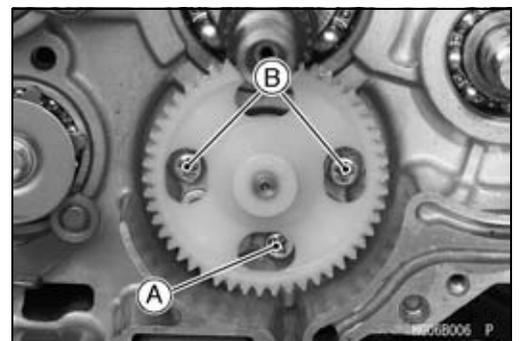
- Fill the pump with engine oil [A].



- Be sure to install the O-rings [A] and dowel pin [B] on the crankcase.



- Tighten:
  - Torque - Oil Pump Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)**
  - [A] L = 30 mm (1.18 in)
  - [B] L = 20 mm (0.79 in)

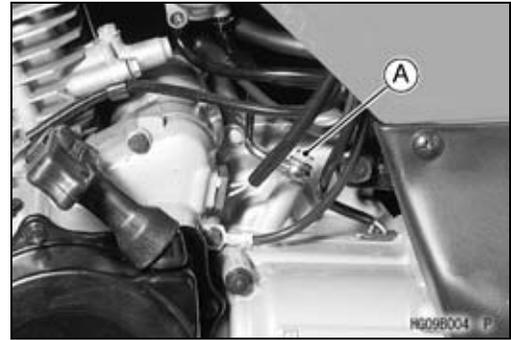


## 7-10 ENGINE LUBRICATION SYSTEM

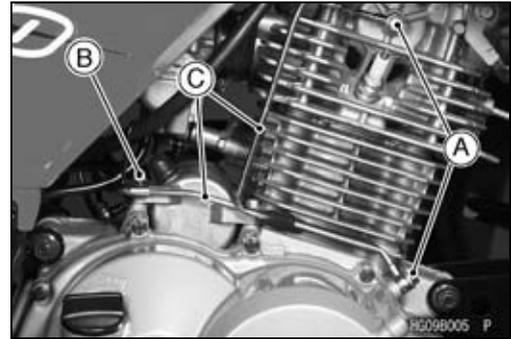
### Oil Pipe

#### *Oil Pipe Removal*

- Remove:
  - Oil Pipe Banjo Bolt [A] and Washers



- Remove:
  - Oil Pipe Banjo Bolts [A] and Washers
  - Starter Motor Mounting Bolt [B]
  - Oil Pipes [C]



#### *Oil Pipe Installation*

- Tighten:
  - Torque - Oil Pipe Banjo Bolts: 15 N·m (1.5 kgf·m, 11 ft·lb)**
  - Starter Motor Mounting Bolt: 8.8 N·m (0.9 kgf·m, 78 in·lb)**

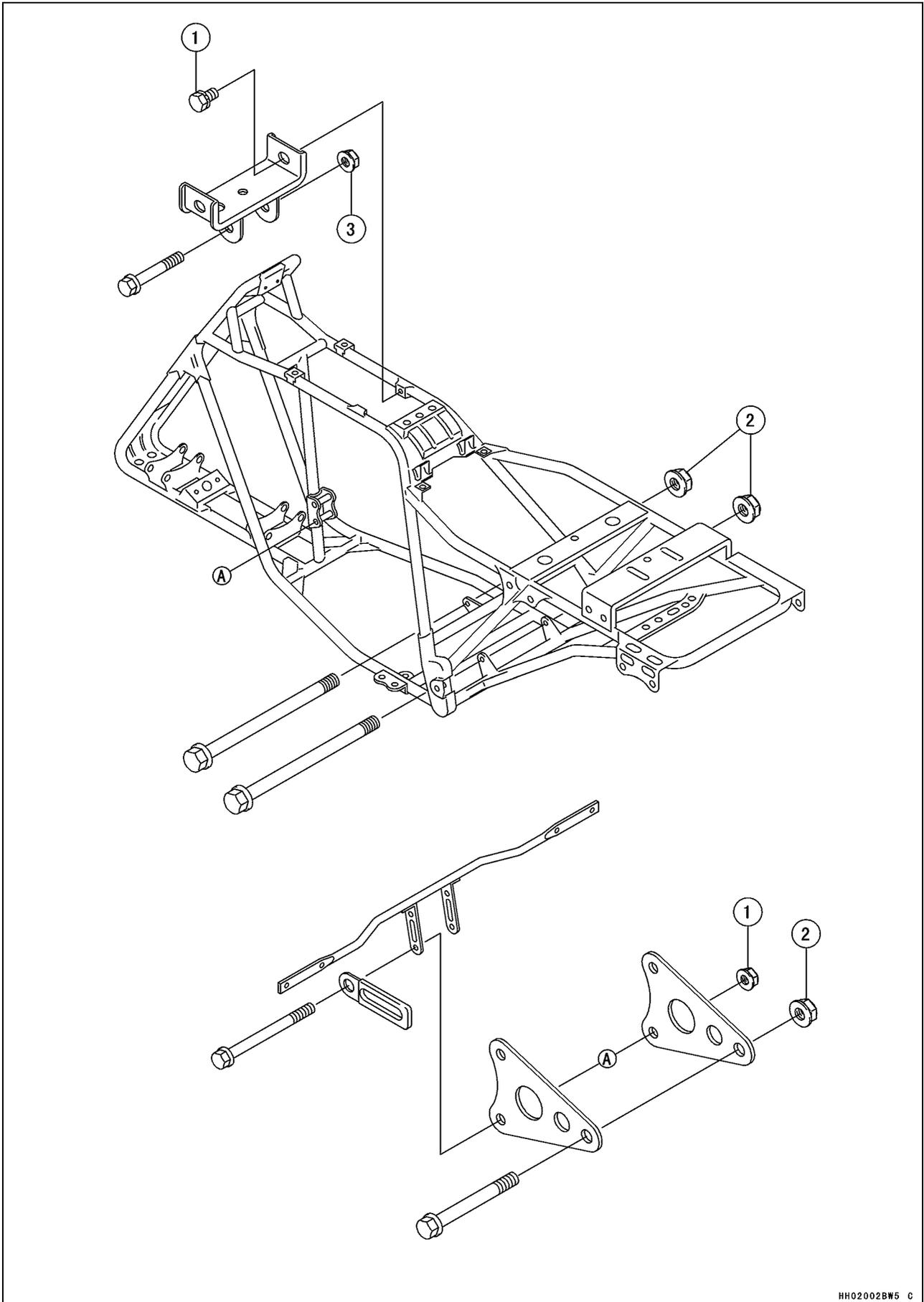
# Engine Removal/Installation

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# 8-2 ENGINE REMOVAL/INSTALLATION

## Exploded View



## ENGINE REMOVAL/INSTALLATION 8-3

### Exploded View

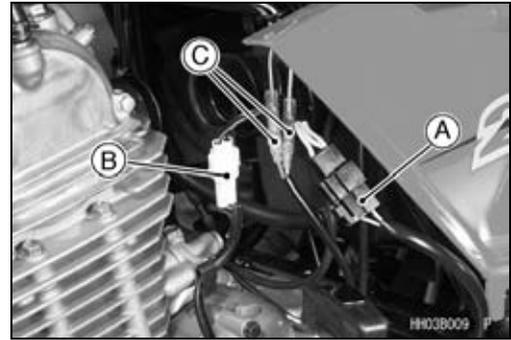
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Bracket Bolts and Nuts	26	2.7	20	
2	Engine Mounting Nuts (M10)	39	4.0	29	
3	Engine Mounting Nut (M8)	29	3.0	22	

## 8-4 ENGINE REMOVAL/INSTALLATION

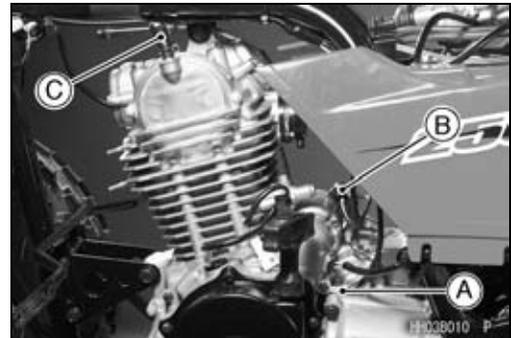
### Engine Removal/Installation

#### Engine Removal

- Remove:
  - Engine Oil (drain)
  - Fuel Tank (see Fuel System chapter)
  - Rear Fender and Front Fender (see Frame chapter)
  - Muffler and Exhaust Pipe (see Engine Top End chapter)
  - Carburetor (see Fuel System chapter)
  - Reverse Lever and Cable (see Crankshaft/Transmission chapter)
  - Spark Plug Cap
  - Alternator Lead Connector [A]
  - Crankshaft Sensor Lead Connector [B]
  - Neutral/Reverse Switch Lead Connectors [C]



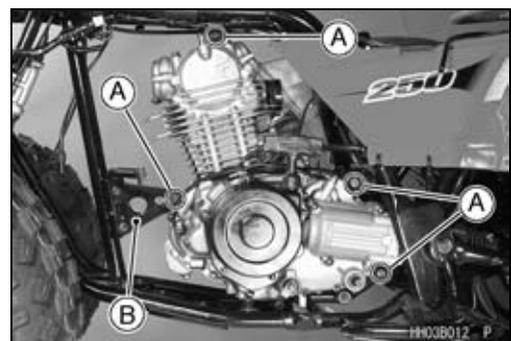
- Remove:
  - Ground Lead (Engine) [A]
  - Starter Motor Lead [B]
  - Engine Breather Hose [C]



- Loosen the propeller shaft dust cover clamp [A].



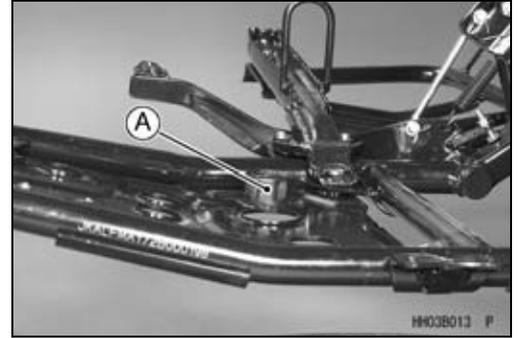
- Remove:
  - Engine Mounting Bolts and Nuts [A]
  - Engine Mounting Brackets [B]
- Free the engine from the propeller shaft and remove the engine.



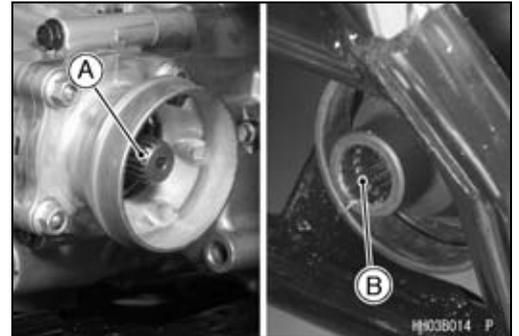
### Engine Removal/Installation

#### Engine Installation

- Be sure the damper [A] is in place.



- Apply grease the splines at the driven gear shaft [A] and front end of the propeller shaft [B].



- Support the vehicle so that the rear wheels are off the ground.
- Fit the driven gear shaft to the propeller shaft while rotating one rear wheel slowly.
- Tighten:
  - Torque - Engine Bracket Bolts and Nuts: 26 N·m (2.7 kgf·m, 20 ft·lb)**
  - Engine Mounting Nut (M8): 29 N·m (3.0 kgf·m, 22 ft·lb)**
  - Engine Mounting Nuts (M10): 39 N·m (4.0 kgf·m, 29 ft·lb)**
- Route the hoses, cables, and leads properly (see Appendix chapter).
- Adjust:
  - Reverse Cable (see Crankshaft/Transmission chapter)
  - Throttle Lever Free Play (see Periodic Maintenance chapter)
  - Engine Oil (see Engine Lubrication System chapter)
  - Idle Speed (see Fuel System chapter)



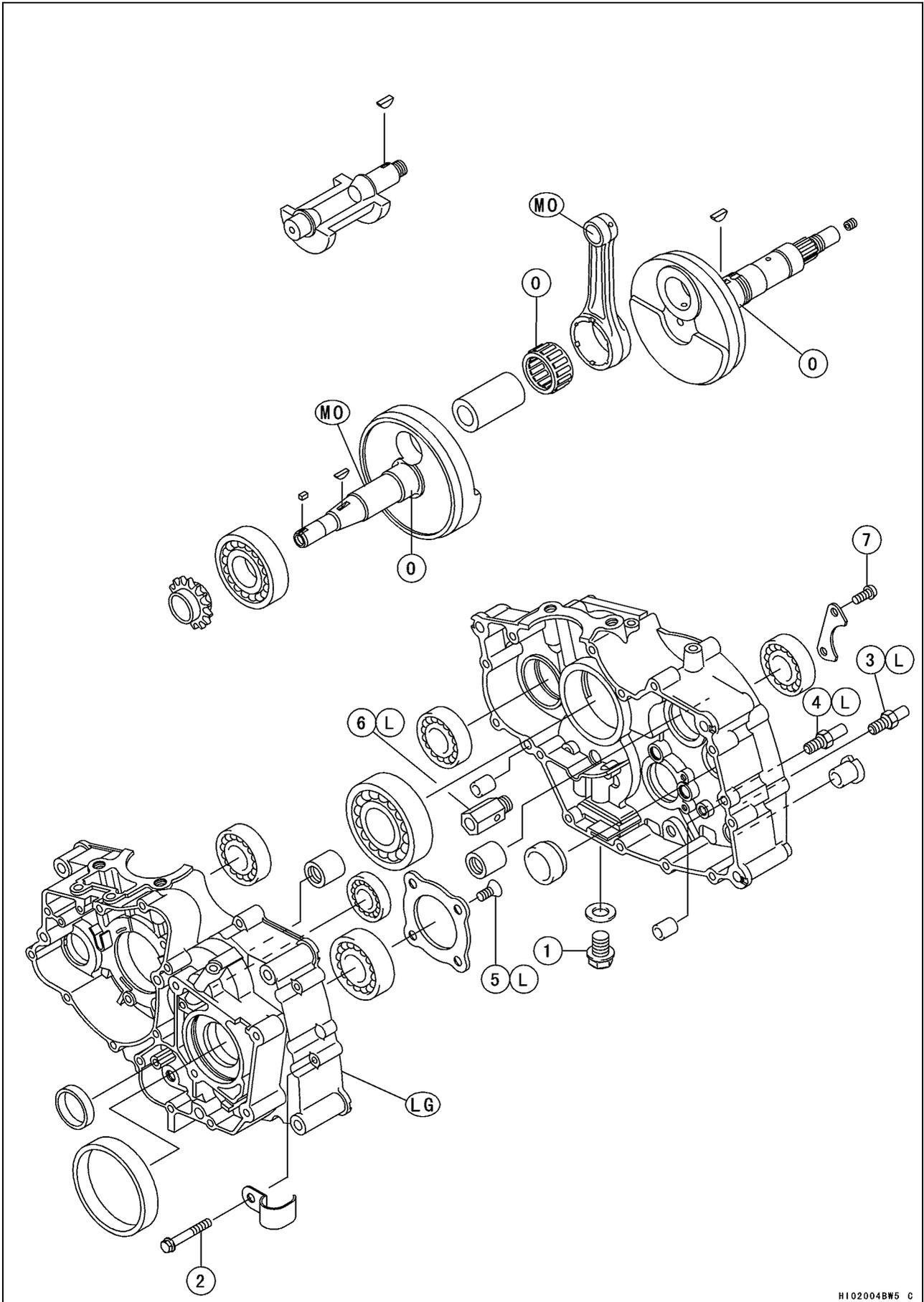
# Crankshaft/Transmission

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# 9-2 CRANKSHAFT/TRANSMISSION

## Exploded View



## CRANKSHAFT/TRANSMISSION 9-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Drain Plug	29	3.0	22	
2	Crankcase Bolts	8.8	0.9	78 in·lb	
3	Clutch Release Cam Pin	25	2.5	18	L
4	Return Spring Pin	25	2.5	18	L
5	Output Shaft Bearing Position Plate Screws	8.8	0.9	78 in·lb	L
6	Relief Valve	15	1.5	11	L
7	Bearing Stopper Screws	9.8	1.0	87 in·lb	

L: Apply a non-permanent locking agent.

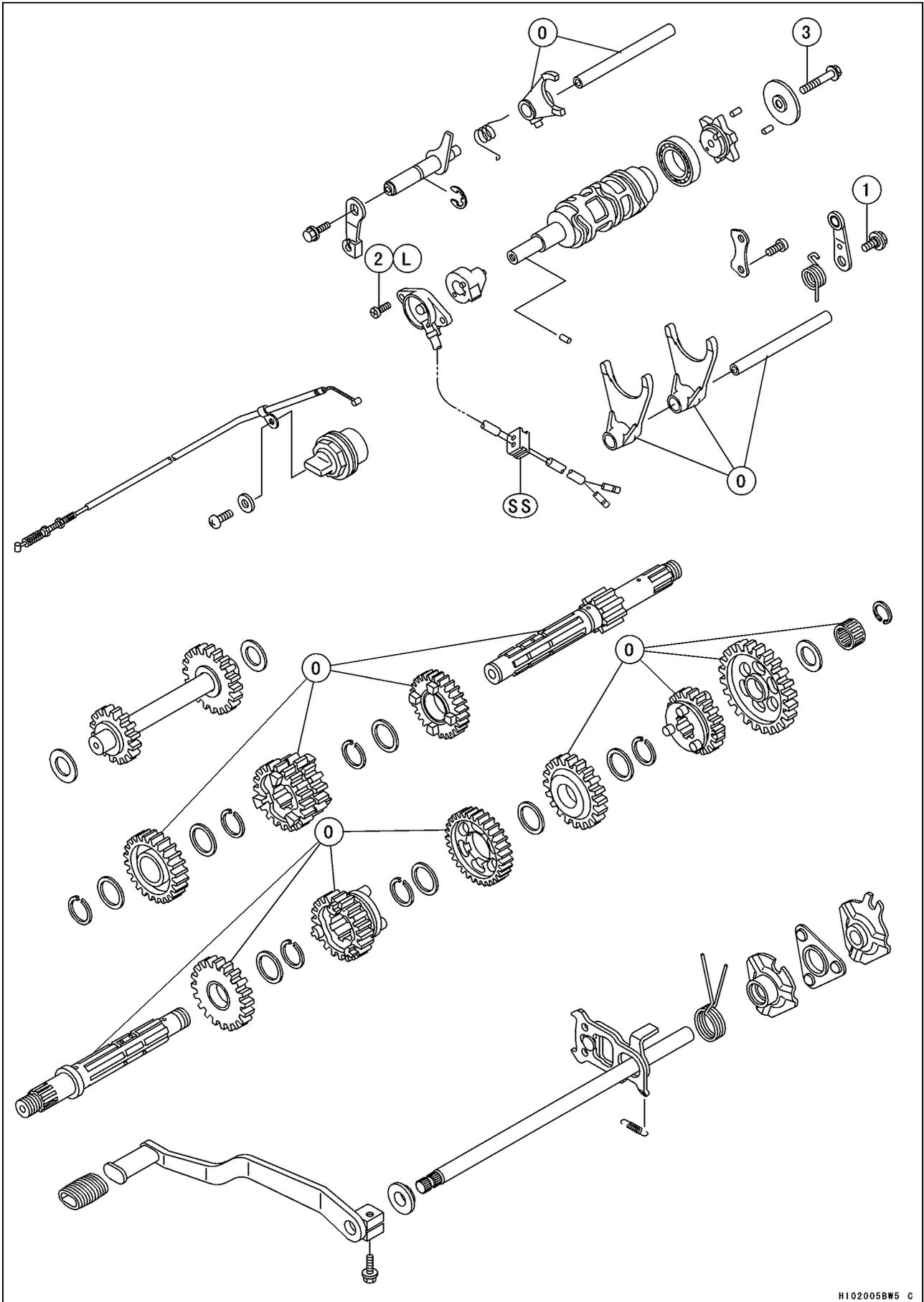
LG: Apply liquid gasket (Kawasaki Bond: 92104-002).

MO: Apply molybdenum disulfide oil.

O: Apply engine oil.

# 9-4 CRANKSHAFT/TRANSMISSION

## Exploded View



## CRANKSHAFT/TRANSMISSION 9-5

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Positioning Lever Bolt	8.8	0.9	78 in·lb	
2	Neutral/Reverse Switch Screws	–	–	–	L
3	Shift Drum Pin Plate Bolt	12	1.2	104 in·lb	

L: Apply a non-permanent locking agent.

O: Apply engine oil.

SS: Apply silicone sealant (Kawasaki Bond: 56019–120).

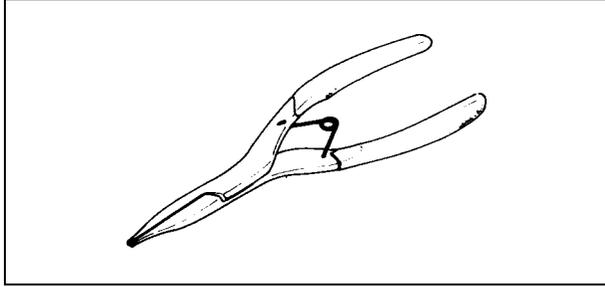
## 9-6 CRANKSHAFT/TRANSMISSION

### Specifications

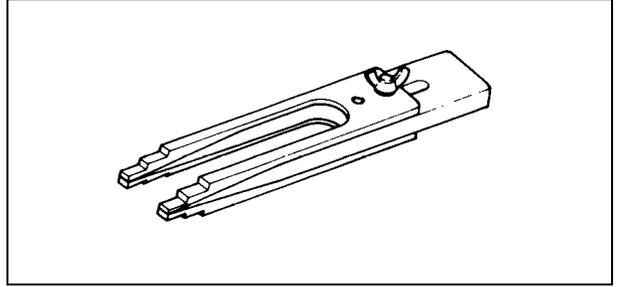
Item	Standard	Service Limit
<b>Crankshaft, Connecting Rod</b>		
Connecting Rod Big End Radial Clearance	0.008 ~ 0.020 mm (0.0003 ~ 0.0008 in.)	0.07 mm (0.003 in.)
Connecting Rod Big End Side Clearance	0.4 ~ 0.5 mm (0.016 ~ 0.020 in.)	0.7 mm (0.028 in.)
Crankshaft Runout	TIR 0.04 mm (0.0016 in.) or less	TIR 0.1 mm (0.0039 in.)
Connecting Rod Bend	under 0.05/100 mm (0.002/3.94 in.)	0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	under 0.15/100 mm (0.006/3.94 in.)	0.2/100 mm (0.008/3.94 in.)
<b>Transmission</b>		
Reverse Knob Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	— — —
Shift Fork Ear Thickness	4.9 ~ 5.0 mm (0.193 ~ 0.197 in.)	4.8 mm (0.189 in.)
Shift Fork Guide Pin Diameter	5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)	5.8 mm (0.228 in.)
Shift Drum Groove Width	6.05 ~ 6.20 mm (0.238 ~ 0.244 in.)	6.3 mm (0.248 in.)
Gear Shift Fork Groove Width	5.05 ~ 5.15 mm (0.199 ~ 0.203 in.)	5.3 mm (0.209 in.)

**Special Tools and Sealant**

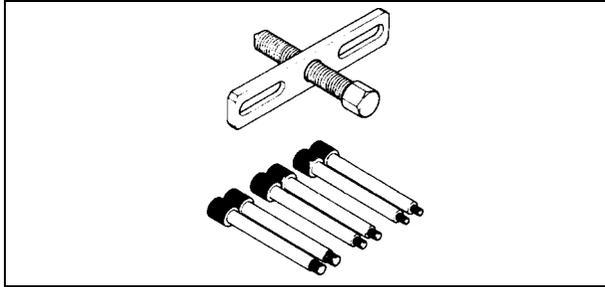
**Outside Circlip Pliers:**  
57001-144



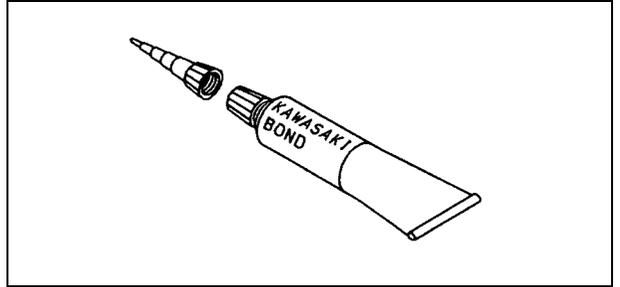
**Crankshaft Jig:**  
57001-1174



**Crankcase Splitting Tool Assembly:**  
57001-1098



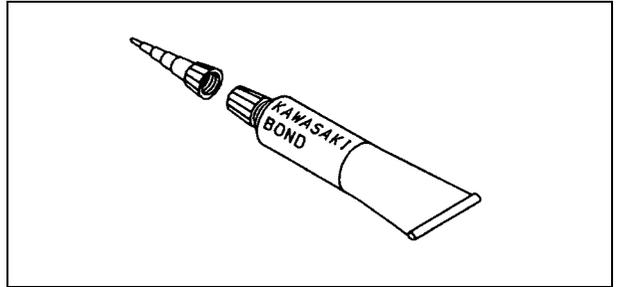
**Kawasaki Bond (Silicone Sealant):**  
56019-120



**Bearing Driver Set:**  
57001-1129



**Kawasaki Bond (Liquid Gasket - Silver):**  
92104-002



## 9-8 CRANKSHAFT/TRANSMISSION

### Crankcase

#### Crankcase Disassembly

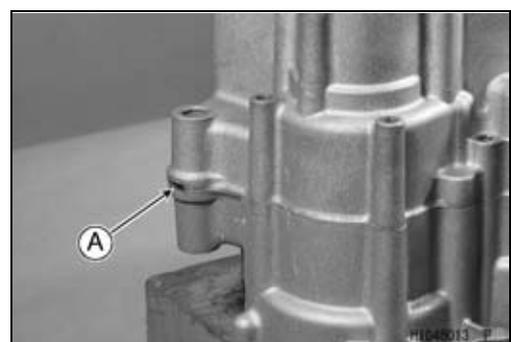
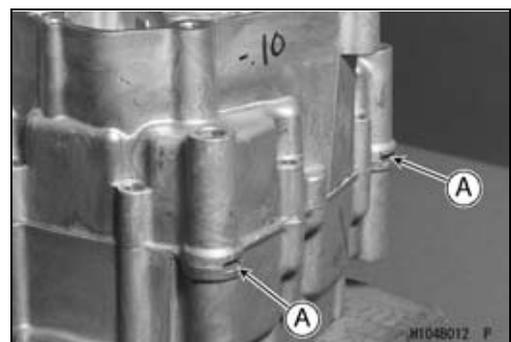
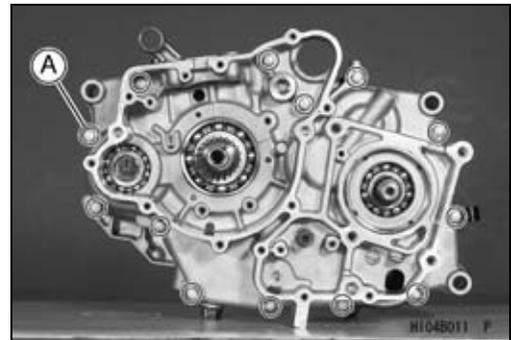
- Remove:
  - Engine (see Engine Removal/Installation chapter)
- Set the engine on a clean surface and hold the engine steady while parts are being removed.
- Remove:
  - Starter Motor (see Electrical System chapter)
  - Output Bevel Gear Case and Output Drive Bevel Gear (see Final Drive chapter)
  - Clutches and Balancer Gear (see Engine Right Side chapter)
  - Oil Pump (see Engine Lubrication System chapter)
  - External Shift Mechanism (see External Shift Mechanism Removal)
  - Cylinder Head, Cylinder, and Piston (see Engine Top End chapter)
  - Alternator and Starter Clutch Gear (see Electrical System chapter)
  - Camshaft Chain and Guide (see Engine Top End chapter)
  - Reverse Shift Mechanism (see Reverse Shift Mechanism Removal)
- Remove:
  - Crankcase Bolts [A]

- Using the pry points [A] split the crankcase halves.
- Lift off the left crankcase half.

#### NOTE

*○If the crankcase is very tight, use the crankcase splitting tool.*

**Special Tool - Crankcase Splitting Tool: 57001-1098**



## Crankcase

### Crankcase Assembly

#### CAUTION

Right and left crankcase halves are machined at the factory in the assembled state, so the crankcase halves must be replaced as a set.

#### NOTE

- Be certain that all parts are cleaned thoroughly before assembly.
- Blow through all oil passages with compressed air [A] to clear any blockage in the crankcase halves and crankshaft.

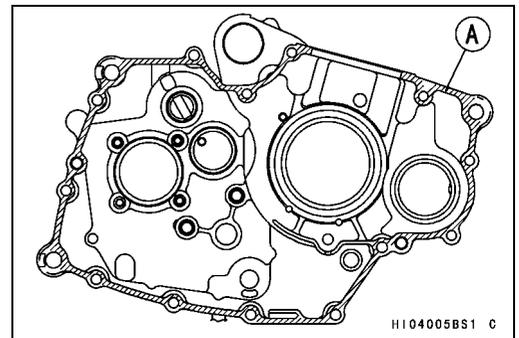
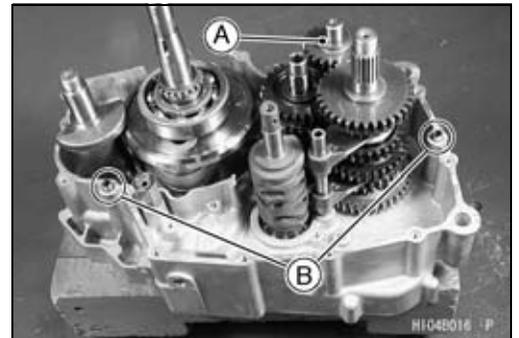
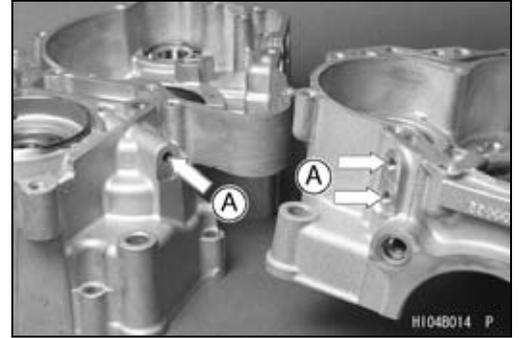
#### WARNING

Clean the engine parts 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.

- Apply a small amount of engine oil to the transmission gears, bearings, and shift forks.
- Be sure the mating surfaces of the crankcase halves are clean and dry.
- Be sure the following parts are in place in the right crankcase half.
  - Crankshaft and Balancer Shaft
  - Transmission Shafts, Shift Forks and Shift Drum (see Transmission Installation)
  - Washer [A]
  - Oil Pressure Relief Valve
  - Dowel Pins [B]

- Apply liquid gasket [A] to the mating surface of the left crankcase half.

Sealant - Kawasaki Bond (Liquid Gasket - Silver): 92104-002

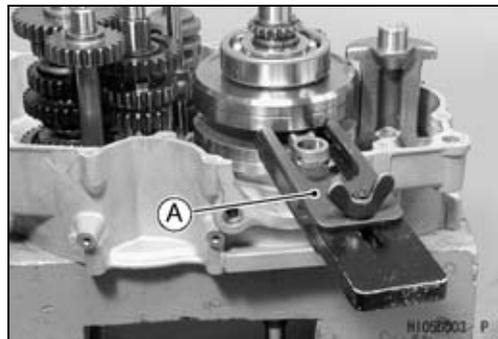


## 9-10 CRANKSHAFT/TRANSMISSION

### Crankcase

- Insert crankshaft jig [A] between the crankshaft halves, opposite the crankpin, to prevent crankshaft distortion during installation.

**Special Tool - Crankshaft Jig: 57001-1174**



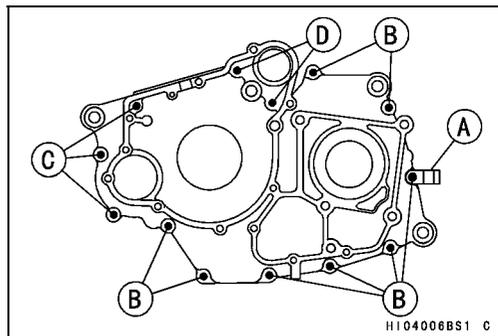
- Install:  
Clamp [A]
- Tighten:

**Torque - Crankcase Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**

**[B] L= 40 mm (1.57 in.) Bolts**

**[C] L= 60 mm (2.36 in.) Bolts**

**[D] L= 75 mm (2.95 in.) Bolts**



- Check:  
Shift of transmission is neutral position.  
Crankshaft, drive shaft and output shaft turn freely.
- ★ If any of the shaft do not turn freely, split the crankcase to locate the problem.

## Crankshaft/Balancer Shaft and Connection Rod

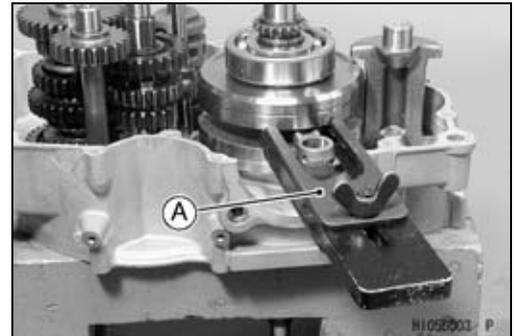
### *Crankshaft Removal*

- Split the crankcase (see Crankcase Disassembly).
- Remove:
  - Transmission
- Push the crankshaft out of the left crankcase half with a press.

### *Crankshaft/Balancer Shaft Installation*

- Position the right crankcase half so that the right-hand main bearing housing is seated on a suitable press fixture.
- Press the crankshaft into the right-hand main bearing housing.
- Insert crankshaft jig [A] between the crankshaft halves, opposite the crankpin, to prevent crankshaft distortion during installation.

**Special Tool - Crankshaft Jig: 57001-1174**



### *Crankshaft Disassembly*

#### **CAUTION**

**Since assembly of the crankshaft demands exacting tolerances, the disassembly and reassembly of the crankshaft should only be performed by experienced mechanics with the necessary tools and equipment.**

**The crankshaft left main bearing, chain sprocket, and left crankshaft are available separately as spare parts, however, it is recommended that the crankshaft assembly be replaced rather than attempting to replace the components.**

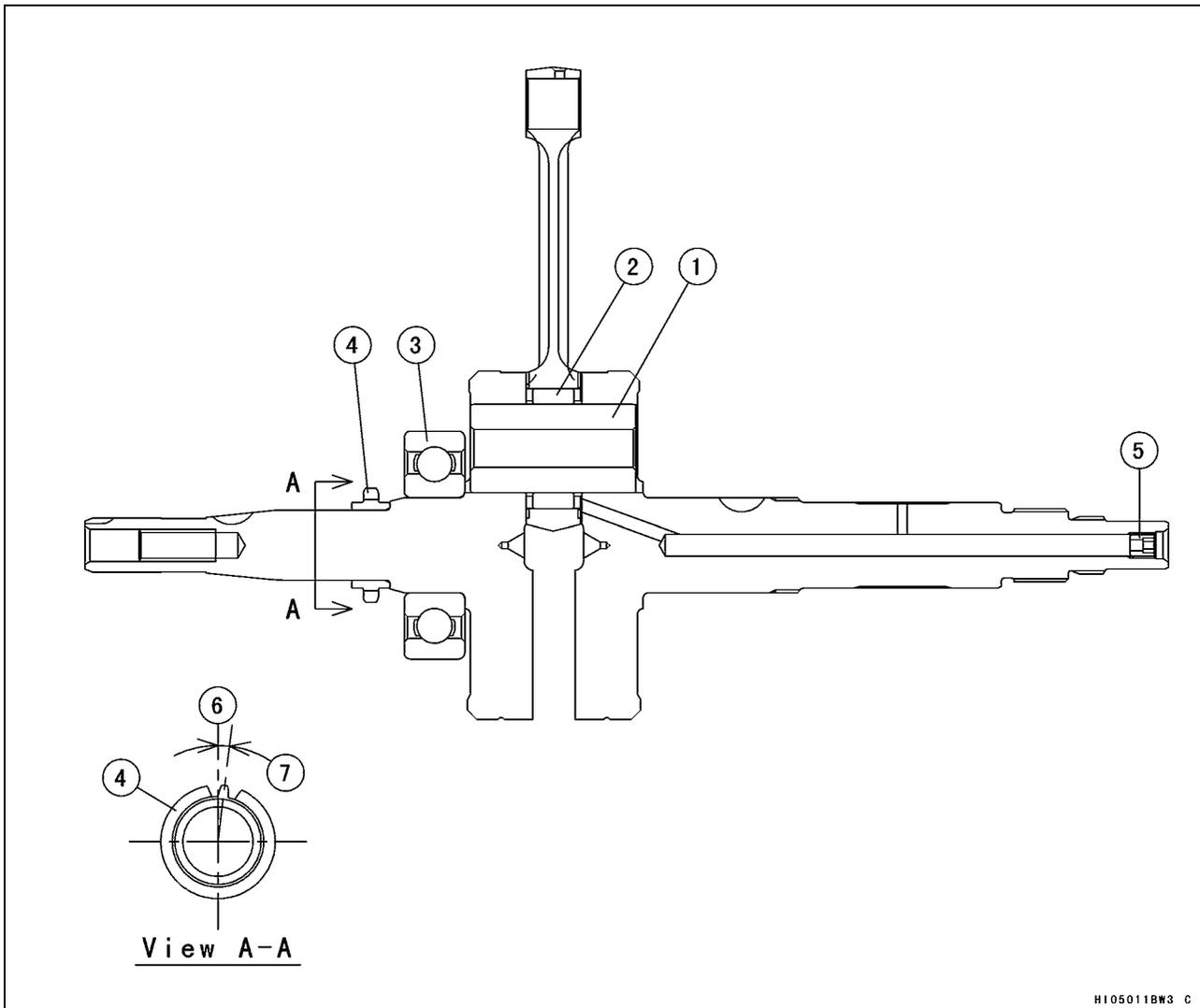
- Press the crankpin out of the crank halves to separate the crank halves, connecting rod, spacers, crankpin needle bearing, and crankpin.

### *Crankshaft Assembly*

- Apply engine oil to the needle bearing.
- Press the crank halves onto the crankpin, noting the crankpin direction until connecting rod side clearance is within specification (see Connecting Rod Big End Side Clearance).
- Make sure oil passages of the crank and crankpin are lined up during assembly.
- Check that the connecting rod radial clearance is within specification (see Connecting Rod Big End Radial Clearance).
- Adjust crankshaft runout until runout is within specification (see Crankshaft Runout).

## 9-12 CRANKSHAFT/TRANSMISSION

### Crankshaft/Balancer Shaft and Connection Rod



1. Crankpin
2. Needle Bearing
3. Ball Bearing
4. Camshaft Chain Sprocket
5. Nozzle
6. Center of Crankpin
7.  $6^{\circ} 47' \pm 30'$

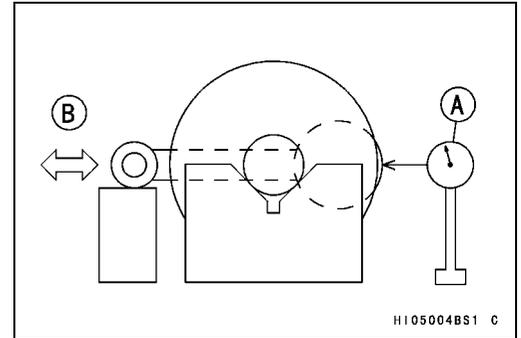
#### *Connecting Rod Big End Seizure*

- In the case of serious seizure with damage to the crank halves, the crankshaft must be replaced.
- ★ If the seizure was less severe, disassemble the crankshaft and replace the crankpin, needle bearing, and connecting rod (see Crankshaft Disassembly).

**Crankshaft/Balancer Shaft and Connection Rod**

**Connecting Rod Big End Radial Clearance**

- Set the crankshaft on V blocks, and place a dial gauge [A] against the connecting rod big end.
- Push [B] the connecting rod first towards the gauge and then in the opposite direction. The difference between the two gauge readings is the radial clearance.
- ★ If the radial clearance exceeds the service limit, the crankshaft assembly must be replaced or disassembled and the crankpin, needle bearing, and connecting rod big end examined or wear.



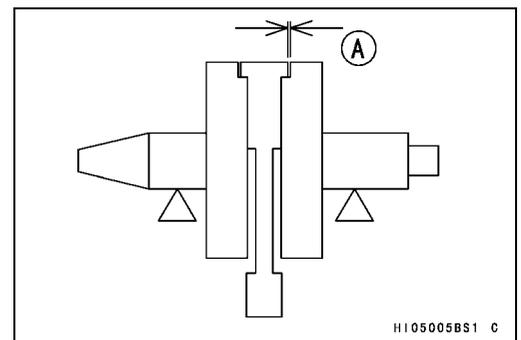
**Connecting Rod Big End Radial Clearance**

**Standard:** 0.008 ~ 0.020 mm (0.0003 ~ 0.0008 in.)

**Service Limit:** 0.07 mm (0.003 in.)

**Connecting Rod Big End Side Clearance**

- Set the crankshaft on V blocks.
- Measure the side clearance [A] of the connecting rod with a thickness gauge.
- ★ If the big end side clearance exceeds the service limit, the crankshaft assembly must be replaced or disassembled and the connecting rod visually inspected for wear.



**Connecting Rod Big End Side Clearance**

**Standard:** 0.4 ~ 0.5 mm (0.016 ~ 0.020 in.)

**Service Limit:** 0.7 mm (0.028 in.)

## 9-14 CRANKSHAFT/TRANSMISSION

### Crankshaft/Balancer Shaft and Connection Rod

#### Crankshaft Alignment

- Check crankshaft alignment by measuring runout.
- With the crankshaft in an alignment jig, turn the crankshaft slowly and measure runout at each of the locations shown.

[A] 10.5 mm (0.413 in.)

#### Crankshaft Runout

**Standard:** TIR 0.04 mm (0.0016 in.) or less

**Service Limit:** TIR 0.1 mm (0.0039 in.)

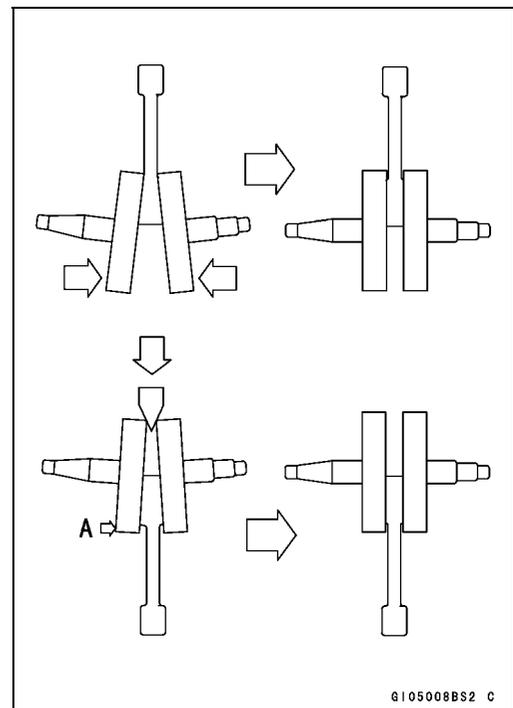
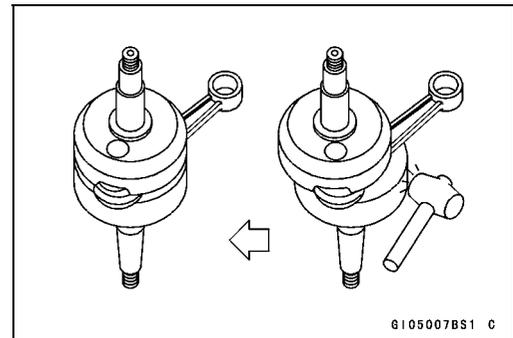
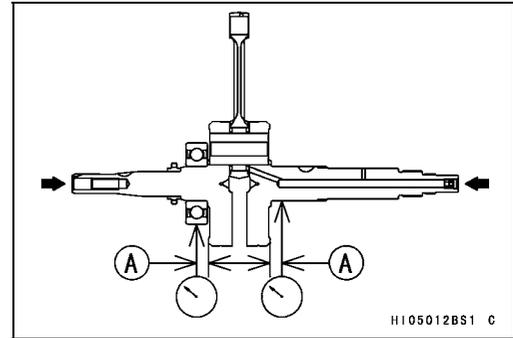
- ★ If runout at either location exceeds the service limit, align the crankshaft so that runout is within the service limits.
- In the case of horizontal misalignment, strike the projecting crankshaft half with a plastic, soft lead, or brass hammer as shown.
- Recheck the runout and repeat the process until the runout is within service limits.
- Vertical misalignment is corrected either by driving a wedge in between the crank halves, or by squeezing the crank halves in a vise, depending on the nature of the misalignment.
- In the case of both horizontal and vertical misalignment, correct the horizontal misalignment first.
- Recheck big end side clearance after aligning crankshaft (see Connecting Rod Big End Side Clearance).

#### NOTE

○ If crankshaft alignment cannot be corrected by the above method, replace the crankpin or crank halves as required.

#### CAUTION

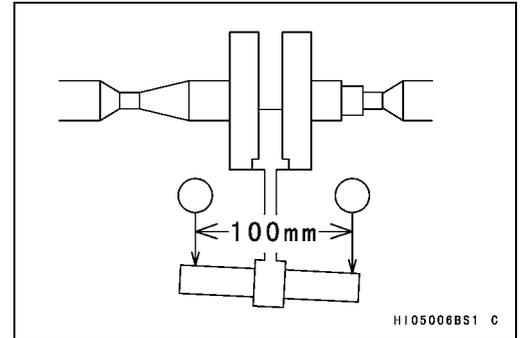
Don't hammer the flywheel at the point [A].



**Crankshaft/Balancer Shaft and Connection Rod**

**Connecting Rod Bend/Twist**

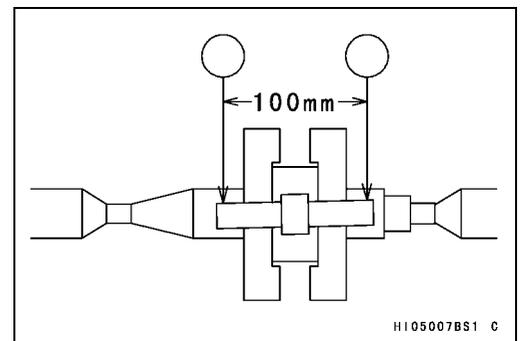
- Measure the connecting rod bend.
- Set the crankshaft in an alignment jig or in V blocks on a surface plate.
- Select an arbor of the same diameter as the piston pin and at least 100 mm (3.94 in.) long, and insert the arbor through the connecting rod small end.
- With the connecting rod held vertically, use a height gauge to measure the difference in the height of the 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**

- Standard:** Under 0.05/100 mm (0.002/3.94 in.)
- Service Limit:** 0.2/100 mm (0.008/3.94 in.)

- Measure the connecting rod twist.
- With the crankshaft still in the alignment jig, hold the connecting rod horizontally and measure the amount that the arbor varies from being parallel with the crankshaft over a 100 mm (3.94 in.) length of the arbor to determine the amount of connecting rod twist.
- ★ If connecting rod twist exceeds the service limit, the connecting rod must be replaced.



**Connecting Rod Twist**

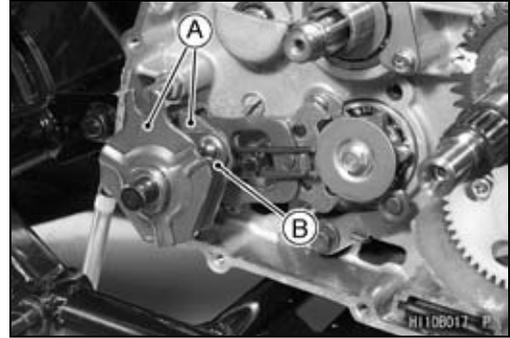
- Standard:** Under 0.15/100 mm (0.006/3.94 in.)
- Service Limit:** 0.2/100 mm (0.008/3.94 in.)

## 9-16 CRANKSHAFT/TRANSMISSION

### Transmission

#### External Shift Mechanism Removal

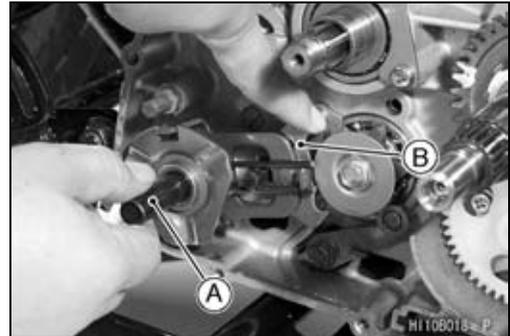
- Remove:
  - Shift Pedal
  - Clutches (see Engine Right Side chapter)
  - Clutch Release Cams [A]
  - Ball Assembly [B]



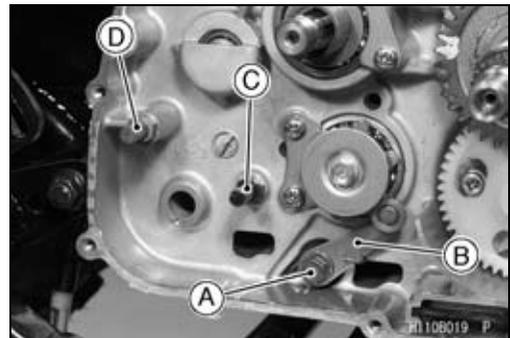
- Remove:
  - Shift Mechanism Shaft [A]

#### NOTE

○ Move the shift mechanism arm [B] out of its position on the end of the shift drum, and pull out the shift mechanism shaft.

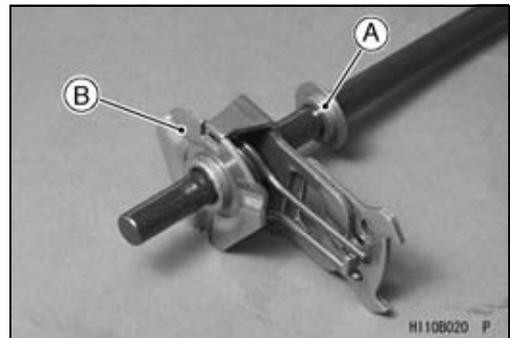


- Remove:
  - Positioning Lever Bolt [A]
  - Positioning Lever [B] and Spring
  - Return Spring Pin [C]
  - Clutch Release Cam Pin [D]



#### External Shift Mechanism Installation

- Apply a non-permanent locking agent to the threads of the return spring pin and cam pin, and tighten them.
  - Torque - Return Spring Pin: 25 N·m (2.5 kgf·m, 18 ft·lb)**
  - Clutch Release Cam Pin: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- Be sure the shift mechanism arm collar [A] and clutch release inner cam [B] are in place.



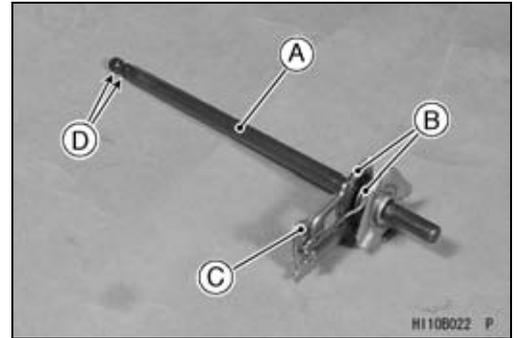
- Install:
  - Ball Assembly [A]
  - Clutch Release Outer Cam [B]



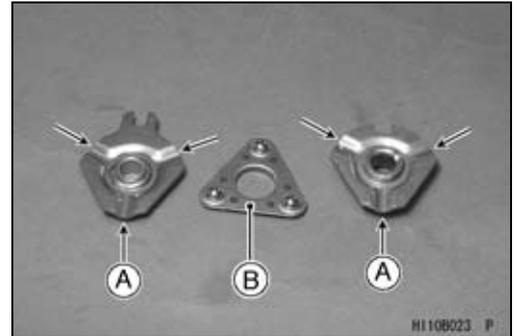
**Transmission**

*External Shift Mechanism Inspection*

- Examine the shift mechanism for any damage.
- Check the shift mechanism shaft [A], springs [B], and shift mechanism arm [C].
- ★ If the shaft is bent, straighten or replace it. If the spline [D] is damaged, replace the shaft.
- ★ If the springs are damaged in any way, replace them.
- ★ If the shift mechanism arm is damaged in any way, replace the lever.



- Check the cam area [A] and ball assembly [B].
- ★ If the cam area is damaged, or if the ball assembly is worn visibly, replace the damaged part.



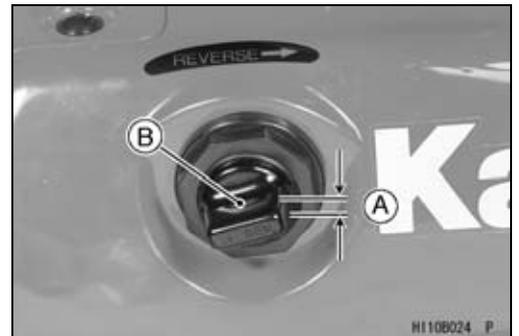
*Reverse Knob Free Play Adjustment*

- Check the reverse knob free play [A] when the transmission is in neutral.

**Reverse Knob Free Play**

**Standard: 2 ~ 3 mm (0.08 ~ 0.12 in.)**

[B] Reverse Knob



- ★ If the free play is incorrect, loosen the locknuts [A] and turn them until the reverse knob has the proper amount of play.



*Reverse Shift Mechanism Removal*

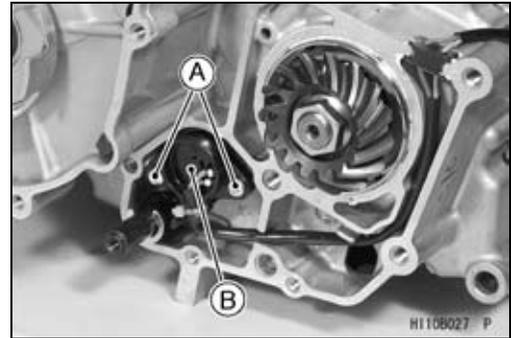
- Drain the engine oil (see Engine Lubrication System chapter).
- Remove:
  - Reverse Lever Bolt [A]
  - Reverse Lever [B]
- Remove the engine (see Engine Removal/Installation chapter).



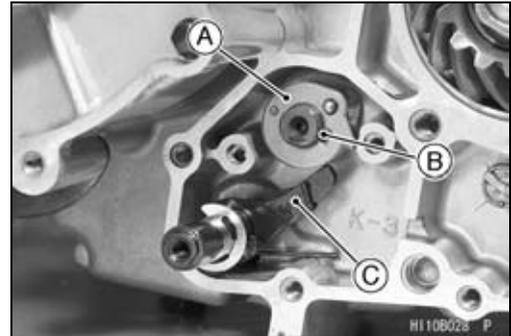
## 9-18 CRANKSHAFT/TRANSMISSION

### Transmission

- Remove:
  - Front Bevel Gear Case (see Final Drive chapter)
  - Screws [A]
  - Neutral/Reverse Switch [B]

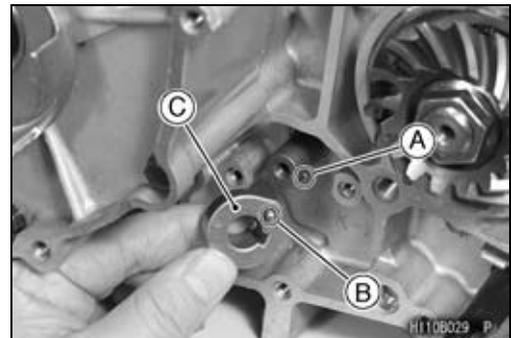


- Remove:
  - Shift Drum Stopper [A]
  - Dowel Pin [B]
  - Shift Drum Stop Lever [C]

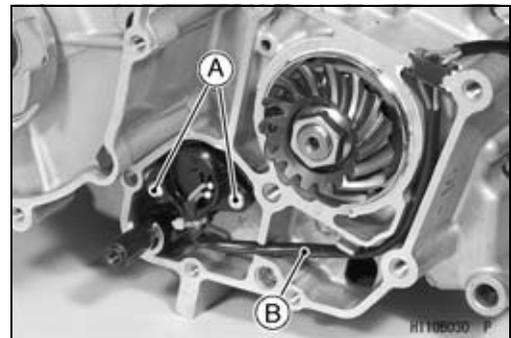


#### Reverse Shift Mechanism Installation

- Be sure the dowel pin [A] and contact pin [B] are in place.
- Push the contact pin in the shift drum stopper [C] and then release it.
- ★ If it does not spring out, replace it the stopper.

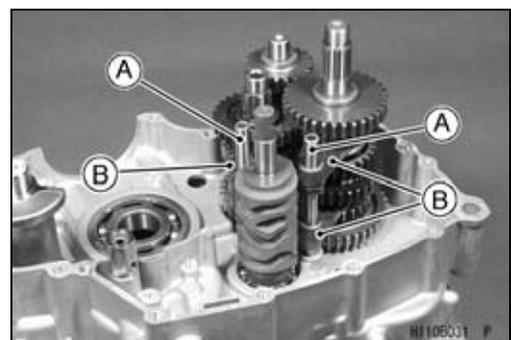


- Apply a non-permanent locking agent to the neutral/reverse switch screws [A].
- Apply silicone sealant to the circumference of the switch lead grommet, and fit the grommet into the notch.
- Sealant - **Kawasaki Bond (Silicone Sealant): 56019-120**
- Route the neutral/reverse switch leads [B] as shown.



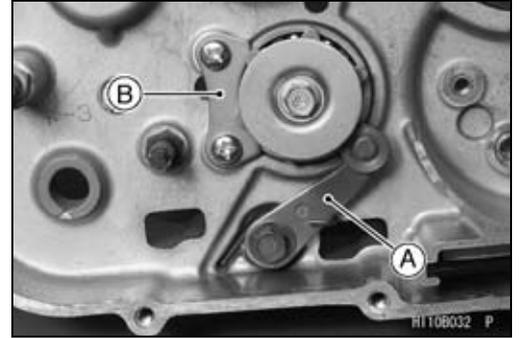
#### Transmission Removal

- Split the crankcase (see Crankcase Disassembly).
- Remove:
  - Shift Rods [A]
  - Shift Forks [B]
- Pull all the transmission shafts out together.



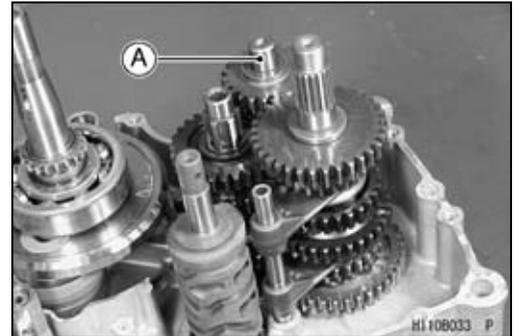
**Transmission**

- Remove:
  - Shift Drum Positioning Lever [A]
  - Shift Drum Bearing Stopper [B]



**Transmission Installation**

- Apply a small amount of engine oil to the transmission gears, bearings, and shaft journals.
- Set the transmission shafts together, and fit them into the left crankcase half at the same time.
- Install the washers on the both ends of the reverse shaft [A].
- Apply a small amount of engine oil to the shift fork fingers.
- Fit each shift fork into the groove of the proper gear so that the shift fork guide pin is in the proper groove on the shift drum.
- Install the shift rods through the shift forks.
- The shift forks are identical.



**Transmission Shaft Disassembly**

- Remove the transmission shafts (see Transmission Removal).
- Using the outside circlip pliers [A], remove the circlip and disassemble the transmission shafts completely.

**Special Tool - Outside Circlip Pliers: 57001-144**



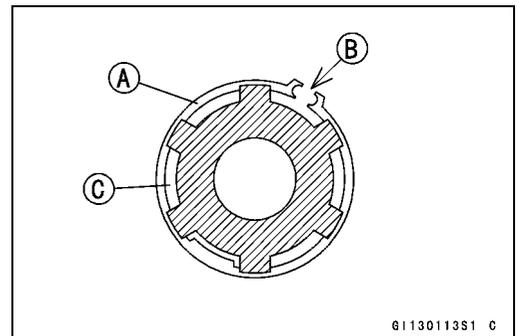
**Transmission Shaft Assembly**

- Replace any circlips that were removed with new ones.

**NOTE**

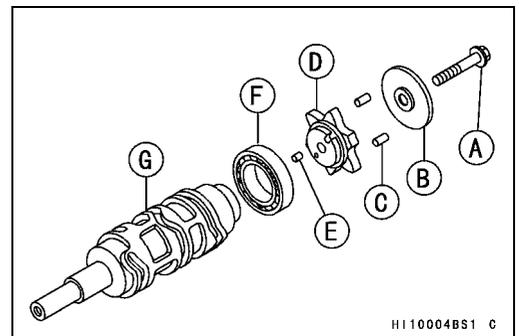
○ To install a circlip without damage, first fit the circlip onto the shaft and then expand it just enough to install. Hence, use a suitable gear to push the circlip into place.

- Install the circlips [A] so that the opening [B] is aligned with a spline groove [C].



**Shift Drum Disassembly**

- Remove:
  - Shift Drum (see Transmission Removal)
  - Pin Plate Bolt [A]
  - Pin Plate [B]
  - Pins [C]
  - Operating Plate [D]
  - Pin [E]
  - Ball Bearing [F]
  - Shift Drum [G]



## 9-20 CRANKSHAFT/TRANSMISSION

### Transmission

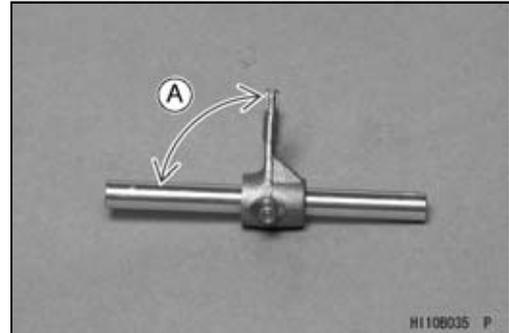
#### Shift Drum Assembly

- Tighten:

**Torque - Shift Drum Pin Plate Bolt: 12 N·m (1.2 kgf·m, 104 in·lb)**

#### Shift Fork Bending

- Visually inspect the shift forks, and replace any fork that is bent. A bent fork could cause difficulty in shifting, or allow the transmission to jump out of gear when under power.  
[A] 90°



#### Shift Fork Wear

- Measure the thickness [A] of the shift fork ears, and diameter [B] of the shift fork guide pin.
- ★ If the thickness and/or diameter of a shift fork is less than the service limit, replace the shift fork.

##### Shift Fork Ear Thickness

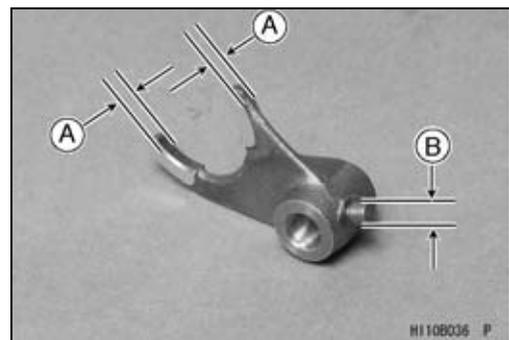
**Standard: 4.9 ~ 5.0 mm (0.193 ~ 0.197 in.)**

**Service Limit: 4.8 mm (0.189 in.)**

##### Shift Fork Guide Pin Diameter

**Standard: 5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)**

**Service Limit: 5.8 mm (0.228 in.)**



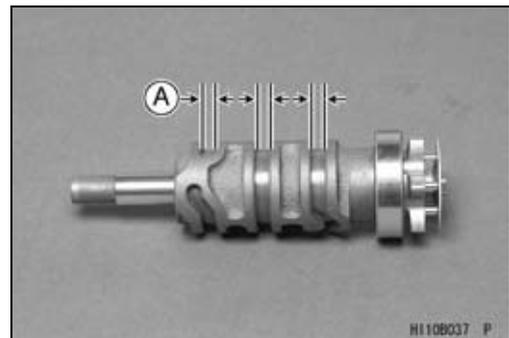
#### Shift Drum Inspection

- Measure the shift drum grooves [A].
- ★ If any shift drum groove is worn over the service limit, replace the drum.

##### Shift Drum Groove Width

**Standard: 6.05 ~ 6.20 mm (0.238 ~ 0.244 in.)**

**Service Limit: 6.3 mm (0.248 in.)**



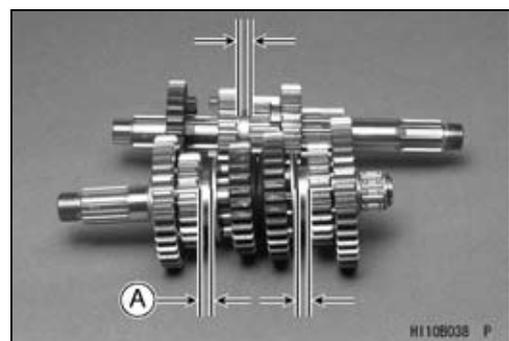
#### Transmission Gear Inspection

- Measure the shift drum grooves [A] in the transmission gear.
- ★ If a shift fork groove in the gear is worn over the service limit, replace the gear.

##### Gear Shift Fork Groove Width

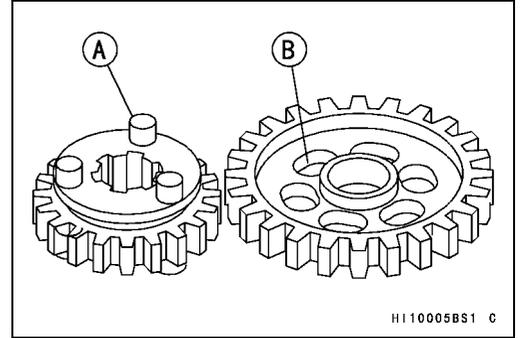
**Standard: 5.05 ~ 5.15 mm (0.199 ~ 0.203 in.)**

**Service Limit: 5.3 mm (0.209 in.)**



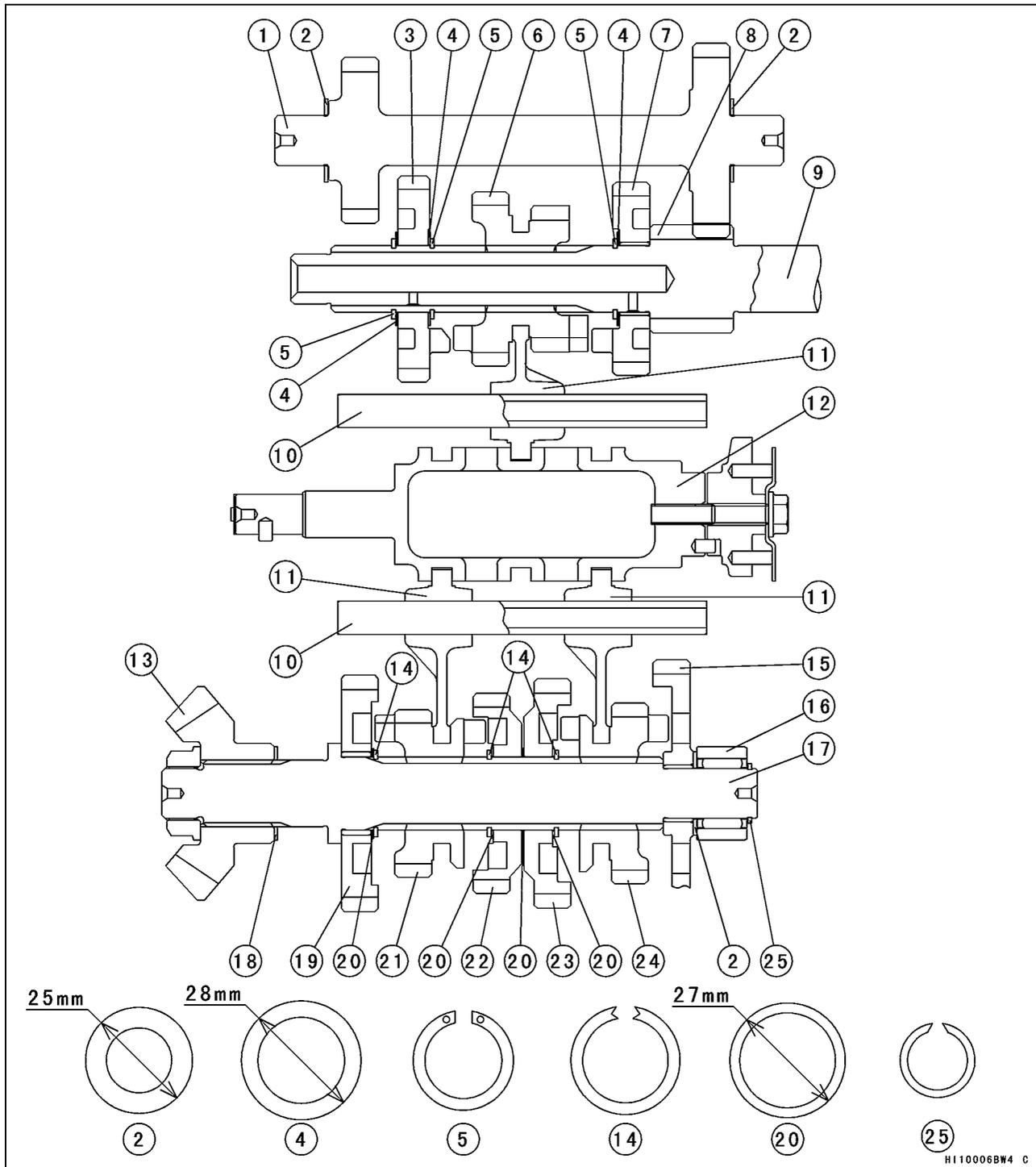
## Transmission

- Visually inspect:
  - Gear Dogs [A]
  - Gear Dog Holes [B]
- ★ Replace any gears that have damaged or excessively worn dogs or dog holes.



# 9-22 CRANKSHAFT/TRANSMISSION

## Transmission



H110006BW4 C

- |                           |                    |                        |
|---------------------------|--------------------|------------------------|
| 1. Reverse Shaft          | 10. Shift Rod      | 19. Reverse Gear (33T) |
| 2. Washer                 | 11. Shift Fork     | 20. Washer             |
| 3. Top Gear (28T)         | 12. Shift Drum     | 21. Top Gear (22T)     |
| 4. Washer                 | 13. Bevel Gear     | 22. 3rd Gear (27T)     |
| 5. Circlip                | 14. Circlip        | 23. 2nd Gear (33T)     |
| 6. 3rd/2nd Gear (23T/19T) | 15. Low Gear (38T) | 24. 4th Gear (24T)     |
| 7. 4th Gear (26T)         | 16. Needle Bearing | 25. Circlip            |
| 8. Low Gear (13T)         | 17. Output Shaft   |                        |
| 9. Input Shaft            | 18. Shim           |                        |

**Ball Bearing, Needle Bearing, and Oil Seal**

*Ball and Needle Bearing Replacement*

<b>CAUTION</b>
<b>Do not remove the ball or needle bearings unless it is necessary. Removal may damage them.</b>

- Using a press or puller, remove the ball bearing and/or needle bearing.

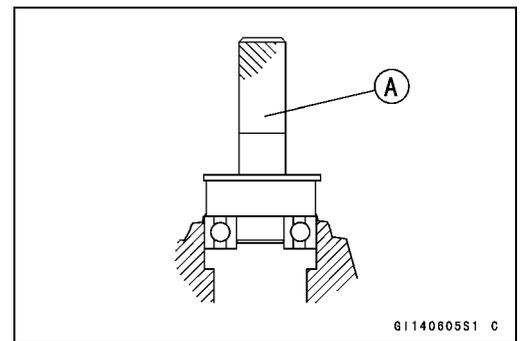
**NOTE**

○ *In the absence of the above mentioned tools, satisfactory results may be obtained by heating the case to approximately 93°C (200°F) max., and tapping the bearing in or out.*

<b>CAUTION</b>
<b>Do not heat the case with a torch. This will warp the case. Soak the case in oil and heat the oil.</b>

- Using a press and the bearing driver set [A], install the new bearing or outer race until it stops at the bottom of its housing.

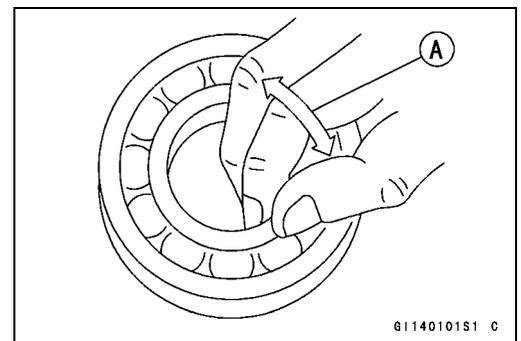
**Special Tool - Bearing Driver Set: 57001-1129**



*Ball and Needle Bearing Wear*

<b>CAUTION</b>
<b>Do not remove the bearings for inspection. Removal may damage them.</b>

- Check the ball bearings.
- Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than measurement. Clean each bearing in a high flash-point solvent, dry it (do not spin the bearing while it is dry), and oil it with engine oil.
- Spin [A] the bearing by hand to check its condition.
- ★ If the bearing is noisy, does not spin smoothly, or has any rough spots, replace it.
- Check the needle bearings.
- The rollers in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.
- ★ If there is any doubt as to the condition of a needle bearing, replace it.



*Oil Seal Inspection*

- Inspect the oil seals.
- ★ Replace it if the lips are misshapen, discolored (indicating that the rubber has deteriorated), hardened or otherwise damaged.



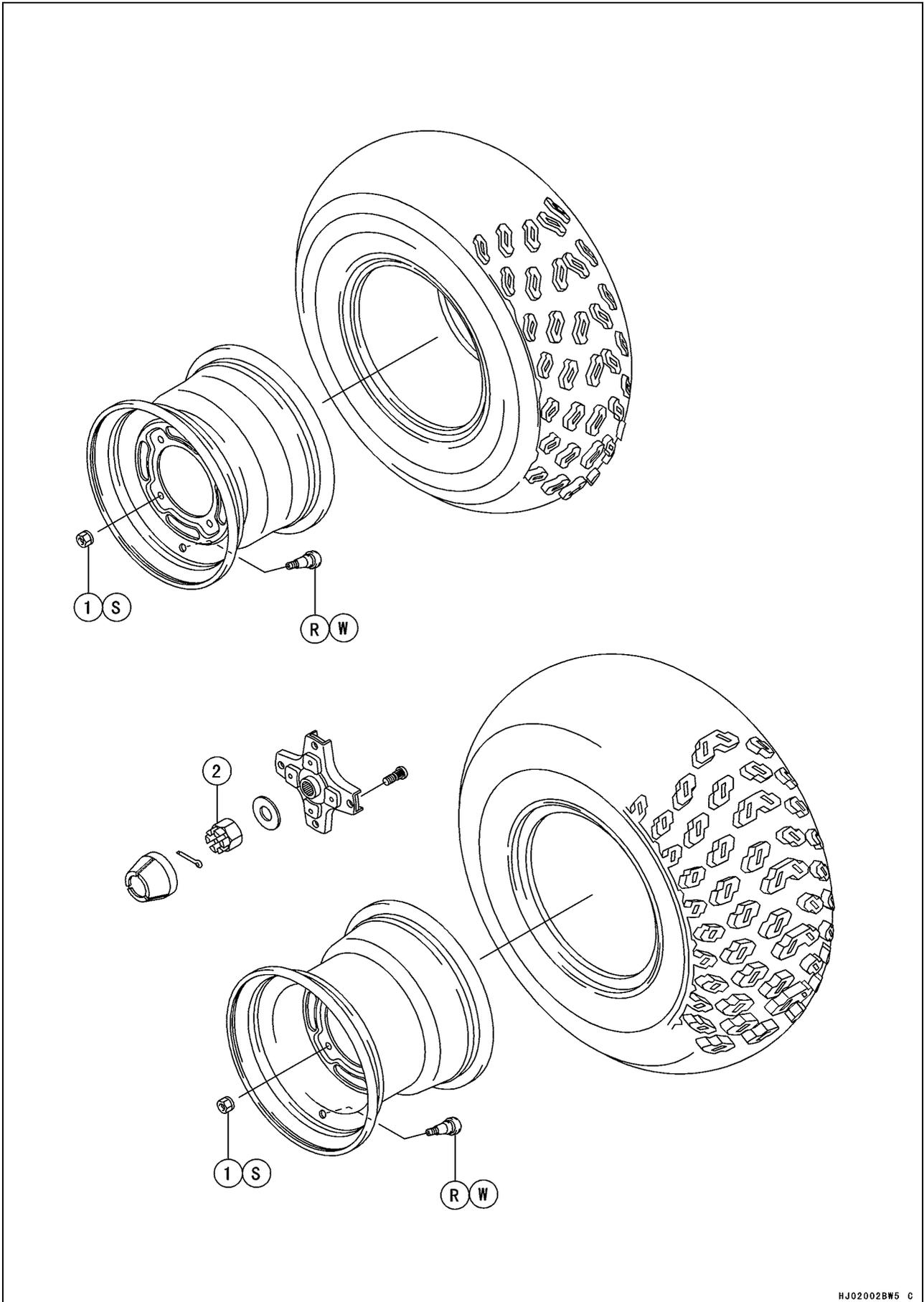
# Wheels/Tires

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# 10-2 WHEELS/TIRES

## Exploded View



**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Wheel Nuts	34	3.5	25	S
2	Rear Axle Nut	147	15	108	

R: Replacement Parts

S: Follow the specific tightening sequence.

W: Apply water or soap and water solution.

## 10-4 WHEELS/TIRES

### Specifications

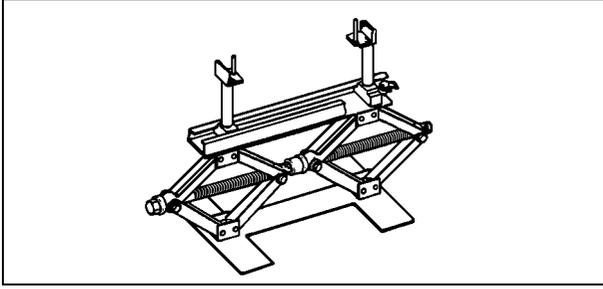
Item	Standard	Service Limit
<b>Wheel Alignment</b>		
Toe-in of Front Wheels	15 ~ 35 mm (0.59 ~ 1.38 in.) at 1G	— — —
<b>Tires</b>		
Standard Tire:		
Front	AT21x8-9 DUNLOP KT856 Tubeless	— — —
Rear	AT22x10-10 DUNLOP KT857 Tubeless	— — —
Tire Air Pressure (when cold):		
Front	21 kPa (0.21 kgf/cm <sup>2</sup> , 3.0 psi)	— — —
Rear	21 kPa (0.21 kgf/cm <sup>2</sup> , 3.0 psi)	— — —
Maximum Tire Air Pressure (to seat beads when cold)	250 kPa (2.5 kgf/cm <sup>2</sup> , 36 psi)	— — —
Tire Tread Depth:		
Front	— — —	4 mm (0.16 in.)
Rear	— — —	4 mm (0.16 in.)

---

**Special Tool and Sealant**

---

**Jack:**  
**57001-1238**



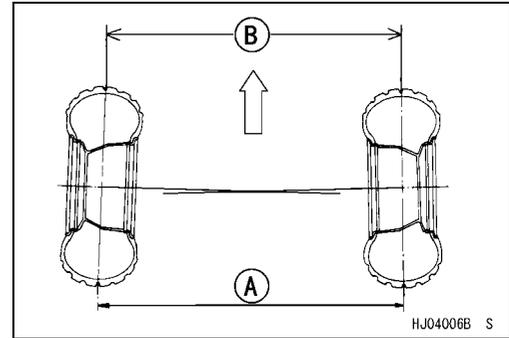
## 10-6 WHEELS/TIRES

### Wheel Alignment

Toe-in is the amount that the front wheels are closer together in front than at the rear at the axle height. When there is toe-in, the distance A (Rear) is the greater than B (Front) as shown.

The purpose of toe-in is to prevent the front wheels from getting out of parallel at any time, and to prevent any slipping or scuffing action between the tires and the ground. If toe-in is incorrect, the front wheels will be dragged along the ground, scuffing and wearing the tread knobs.

Caster and camber are build-in and require no adjustment.



$A \text{ (Rear) } - B \text{ (Front) } = \text{Amount of Toe-in}$   
(Distance A and B are measured at axle height with the vehicle sitting on the ground, or at 1G.)

#### Steering Centering Inspection

- Test ride the vehicle.
- ★ If the handlebar is straight when the vehicle is traveling in a straight line, go on to the Toe-in Inspection procedure.
- ★ Otherwise, go on to the Steering Centering Adjustment procedure.

#### Steering Centering Adjustment

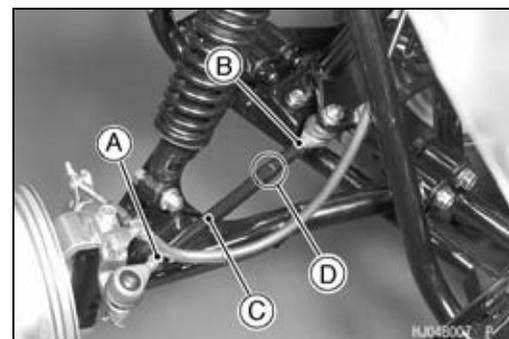
- Hold a straightedge [A] against the rear wheel rim on one side at axle height.



- With the handlebar straight ahead, loosen the locknuts [A] [B] and turn the tie-rod adjusting sleeve [C] until the front wheel on that side is parallel to the straightedge.

#### NOTE

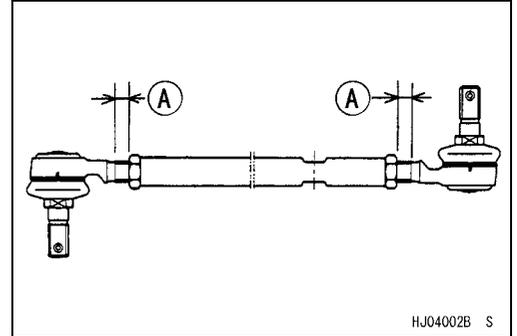
- The locknut [A] on the opposite side of the flattened area [D] on the tie-rod has left-hand threads. Turn the wrench clockwise for loosening.



Wheel Alignment

**CAUTION**

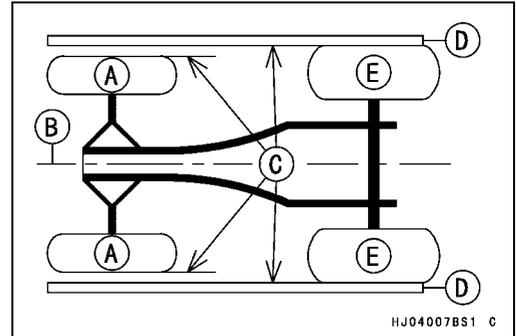
Adjust the tie-rod so that the visible thread length [A] is even on both ends of the tie-rod, or the threads could be damaged.



- Repeat the straightedge procedure on the other side of the vehicle. Now the front wheels are parallel to each other and to the center line of the vehicle.

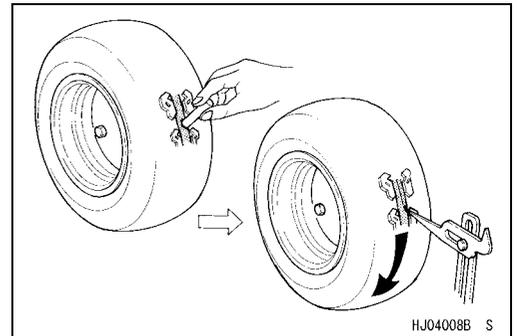
Front Wheel [A]  
 Vehicle Center Line [B]  
 Parallel each other [C]  
 Straightedges [D]  
 Rear Wheels [E]

- Go on to the Toe-in Inspection procedure.



*Toe-in Inspection*

- Apply a heavy coat of chalk or a paint line near the center of the front tires.
- Using a needle nose scribe, make a thin mark near the center of the chalk coating while turning the wheel.



- With the front wheels on the ground, set the handlebar straight ahead.
- At the level of the axle height, measure the distance between the scribed or painted lines for both front and rear of the front tires.
- Subtract the measurement of the front from the measurement of the rear to get the toe-in.
- ★ If the toe-in is not in the specified range, go on to the Toe-in Adjustment procedure.

**Toe-in of Front Wheels**

Standard: 15 ~ 35 mm (0.59 ~ 1.38 in.) at 1 G



## 10-8 WHEELS/TIRES

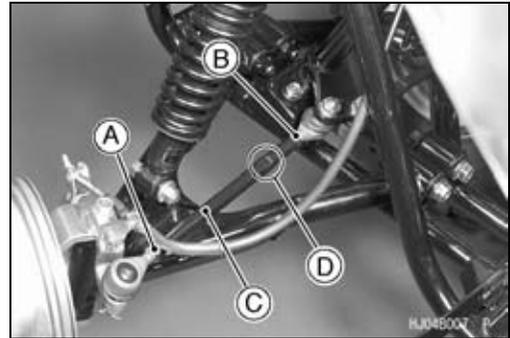
### Wheel Alignment

#### Toe-in Adjustment

- Loosen the locknuts [A] [B] and turn the adjusting sleeves [C] the same number of turns on both sides to achieve the specified toe-in.

#### NOTE

- The locknut [A] on the opposite side of the flattened area [D] on the tie-rod has left-hand threads. Turn the locknut clockwise for loosening.



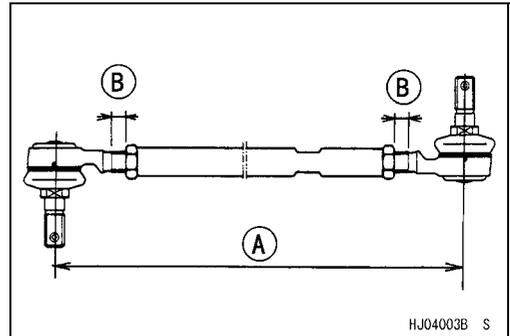
#### NOTE

- The toe-in will be near the specified value, if the tie-rod length [A] is 288 mm (11.3 in.) on each tie-rod.

#### CAUTION

Adjust the tie-rod length so that the visible thread length [B] is even on both ends of the tie-rod. Uneven thread length could cause tie-rod damage.

- Check the toe-in (see Toe-in Inspection).
- Tighten:  
Torque - Tie-rod Adjusting Sleeve Locknuts: 26 N·m (2.7 kgf·m, 20 ft·lb)
- Test ride the vehicle.



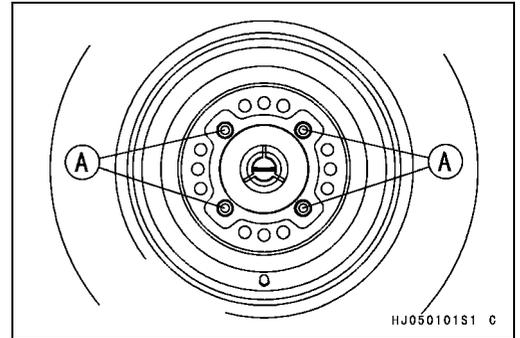
**Wheels (Rims)**

*Wheel Removal*

- Loosen the wheel nuts [A].
- Support the vehicle on a stand or the jack so that the wheels are off the ground.

**Special Tool - Jack: 57001-1238**

- Remove:  
Wheel Nuts  
Wheel

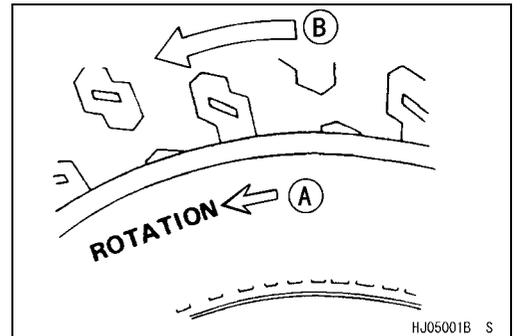


*Wheel Installation*

- Check the tire rotation mark [A] on the tire, and install the wheel accordingly.

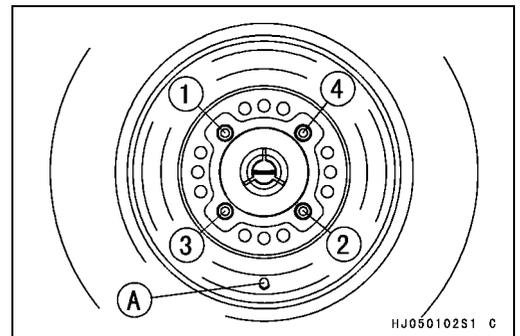
**NOTE**

○ The direction of the tire rotation [B] is shown by an arrow on the tire sidewall.



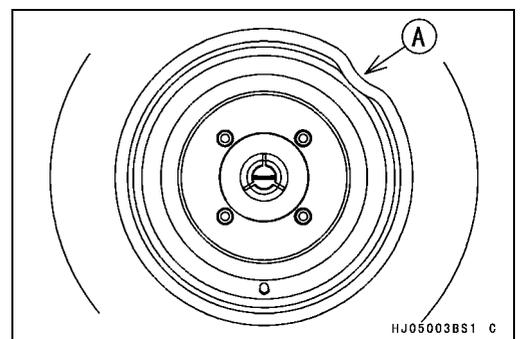
- Position the wheel so that the air valve [A] is toward the outside of the vehicle.
- Tighten the wheel nuts in a criss-cross pattern.

**Torque - Wheel Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

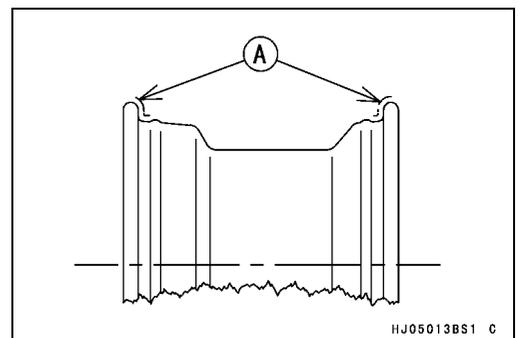


*Wheel (Rim) Inspection*

- Examine both sides of the rim for dents [A]. If the rim is dented, replace it.



- ★ If the tire is removed, inspect the air sealing surfaces [A] of the rim for scratches or nicks. Smooth the sealing surfaces with fine emery cloth if necessary.



## 10-10 WHEELS/TIRES

### Wheels (Rims)

#### Wheel (Rim) Replacement

- Remove the wheel (see Wheel Removal).
- Disassemble the tire from the rim (see Tire Removal).
- Remove the air valve and discard it.

#### CAUTION

**Replace the air valve whenever the tire is replaced.  
Do not reuse the air valve.**

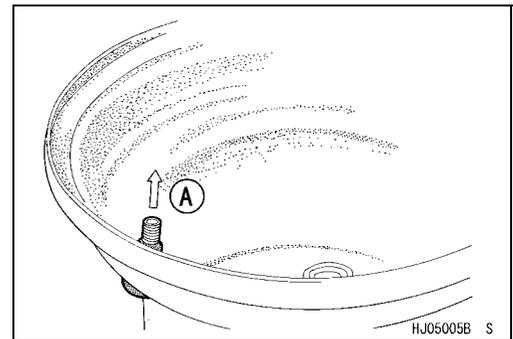
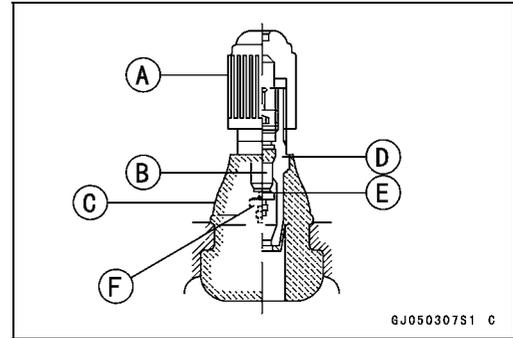
- Air Valve Cap [A]
- Valve Core [B]
- Stem Seal [C]
- Valve Stem [D]
- Valve Seat [E]
- Valve Opened [F]

- Install a new air valve in the new rim.
- Remove the valve cap, lubricate the stem with a soap and water solution, and pull the stem [A] through the rim from the inside out until it snaps into place.

#### CAUTION

**Do not use engine oil or petroleum distillates to lubricate the stem because they will deteriorate the rubber.**

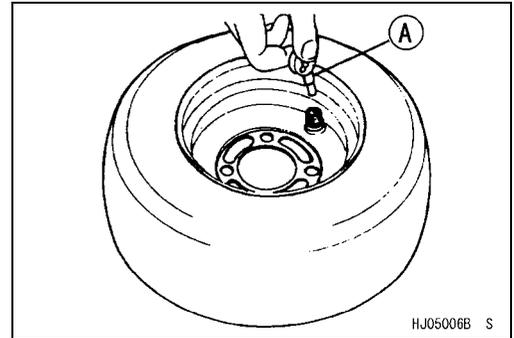
- Mount the tire on the new rim (see Tire Installation).
- Install the wheel (see Wheel Installation).
- Install the air valve cap.



**Tires**

*Tire Removal*

- Remove the wheel.
- Unscrew the valve core to deflate the tire.
- Use a proper valve core tool [A].

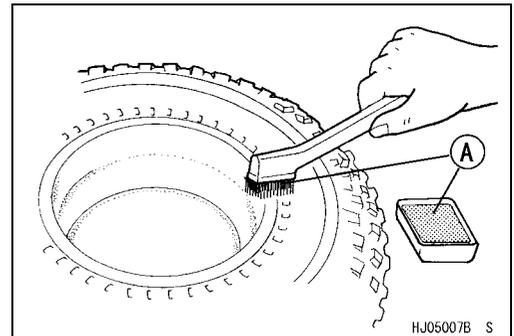


- Lubricate the tire beads and rim flanges on both sides of the wheel with a soap and water solution, or water [A]. This helps the tire beads slip off the rim flanges.

**CAUTION**

**Do not lubricate the tire beads and rim flanges with engine oil or petroleum distillates because they will deteriorate the tire.**

- Remove the tire from the rim using a suitable commercially available tire changer.



**NOTE**

- The tires cannot be removed with hand tools because they fit the rims tightly.

*Tire Installation*

- Inspect the rim (see Wheel (Rim) Inspection).
- Replace the air valve with a new one.

**CAUTION**

**Replace the air valve with whenever the tire is replaced. Do not reuse the air valve.**

- Check the tire for wear and damage (see Tire Inspection).
- Lubricate the tire beads and rim flanges with a soap and water solution, or water.

**WARNING**

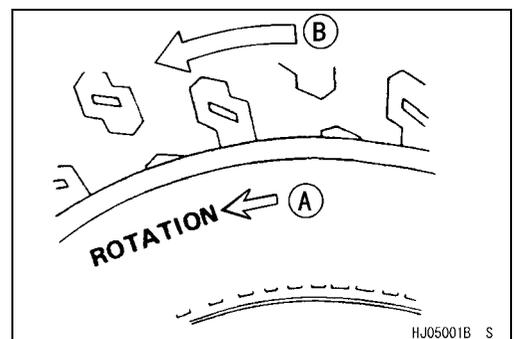
**Do not use the lubricant other than a water and soap solution, or water to lubricate the tire beads and rim because it may cause tire separation.**

- Check the tire rotation mark [A] on the tire, and install the tire on the rim accordingly.
- The tires should be installed on the rims so that each air valve is toward the outside of the vehicle.

**NOTE**

- The direction of the tire rotation [B] is shown by an arrow on the tire sidewall.

- Install the tire on the rim using a suitable commercially available tire changer.
- Lubricate the tire beads again and center the tire on the rim.



## 10-12 WHEELS/TIRES

### Tires

- Support the wheel rim [A] on a suitable stand [B] to prevent the tire from slipping off.
- Inflate the tire until the tire beads seat on the rim.

#### Maximum Tire Air Pressure (to seat beads when cold)

Front and Rear: 250 kPa (2.5 kg/cm<sup>2</sup>, 36 psi)

#### WARNING

Do not inflate the tire to more than the maximum tire air pressure. Overinflation can explode the tire with possibility of injury and loss of line.

- Check to see that rim lines [A] on both sides of the tire are parallel with the rim flanges [B].
- ★ If the rim lines and the rim flanges are not parallel, deflate the tire, lubricate the sealing surfaces again, and reinflate the tire.
- After the beads are properly seated, check for air leaks.
- Apply a soap and water solution around the tire bead and check for bubbles.
- Deflate the tire to the specified pressure.
- Check the tire pressure using an air pressure gauge.

#### NOTE

○Kawasaki provides the air pressure gauge (P/N 52005-1082) as the owner's tool.

#### Tire Air Pressure (when cold)

Front: 21 kPa (0.21 kgf/cm<sup>2</sup>, 3.0 psi)  
Rear: 21 kPa (0.21 kgf/cm<sup>2</sup>, 3.0 psi)

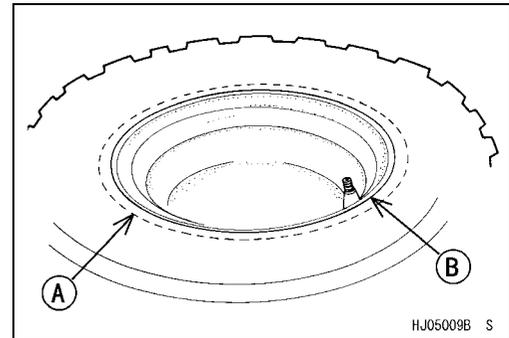
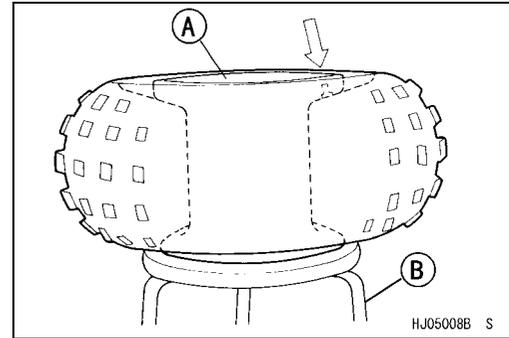
- Install the wheel (see Wheel Installation).
- Wipe off the soap and water solution on the tire and dry the tire before operation.

#### WARNING

Do not operate the vehicle with the water and soap still around the tire beads. They will cause tire separation, and a hazardous condition may result.

#### Tire Inspection

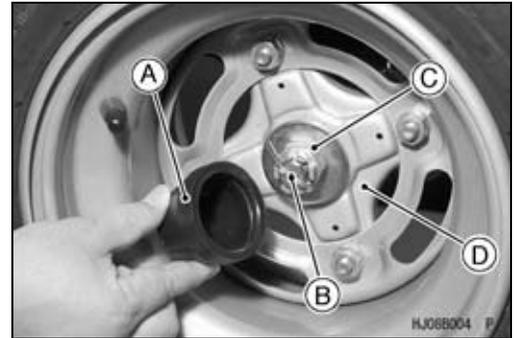
- Refer to the Tire Inspection in the Periodic Maintenance chapter.



## Rear Hub

### Rear Left Hub Removal

- Remove:
  - Cap [A]
  - Cotter Pin [B]
- Loosen the axle nut [C].
- Remove:
  - Wheel (see Wheel Removal)
  - Axle Nut
  - Washer
  - Rear Left Hub [D]

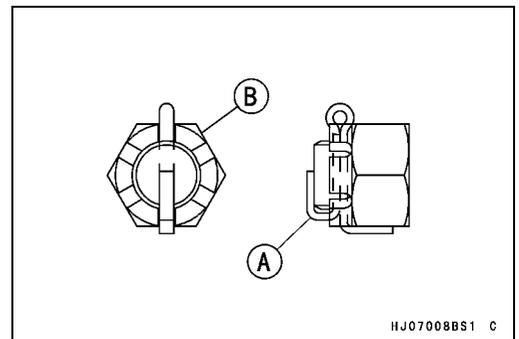
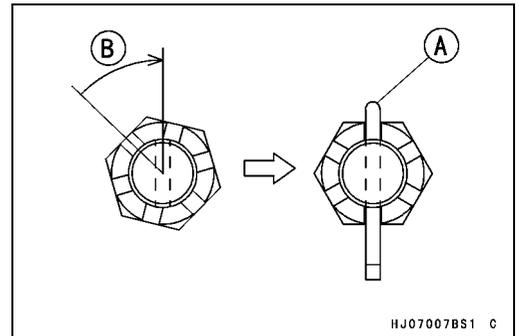


### Rear Left Hub Installation

- Tighten:
  - Torque - Rear Axle Nuts: 147 N·m (15 kgf·m, 108 ft·lb)**
- Insert a new cotter pin [A].

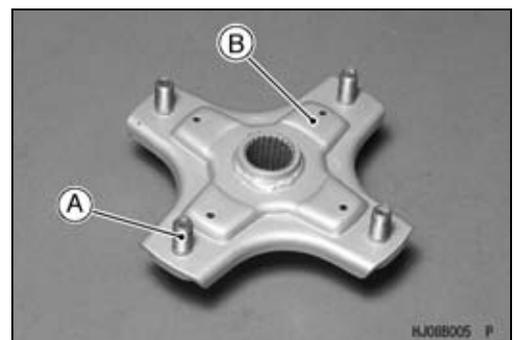
#### NOTE

- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle shaft, tighten the nut clockwise [B] up to next alignment.
  - It should be within 30 degree.
  - Loosen once and tighten again when the slot goes past the nearest hole.
- Bend the cotter pin [A] over the nut [B].



### Rear Left Hub Disassembly/Assembly

- Do not press the hub bolts [A] out.
- ★ If any hub bolt is damaged, replace the hub [B] and bolts as a unit.





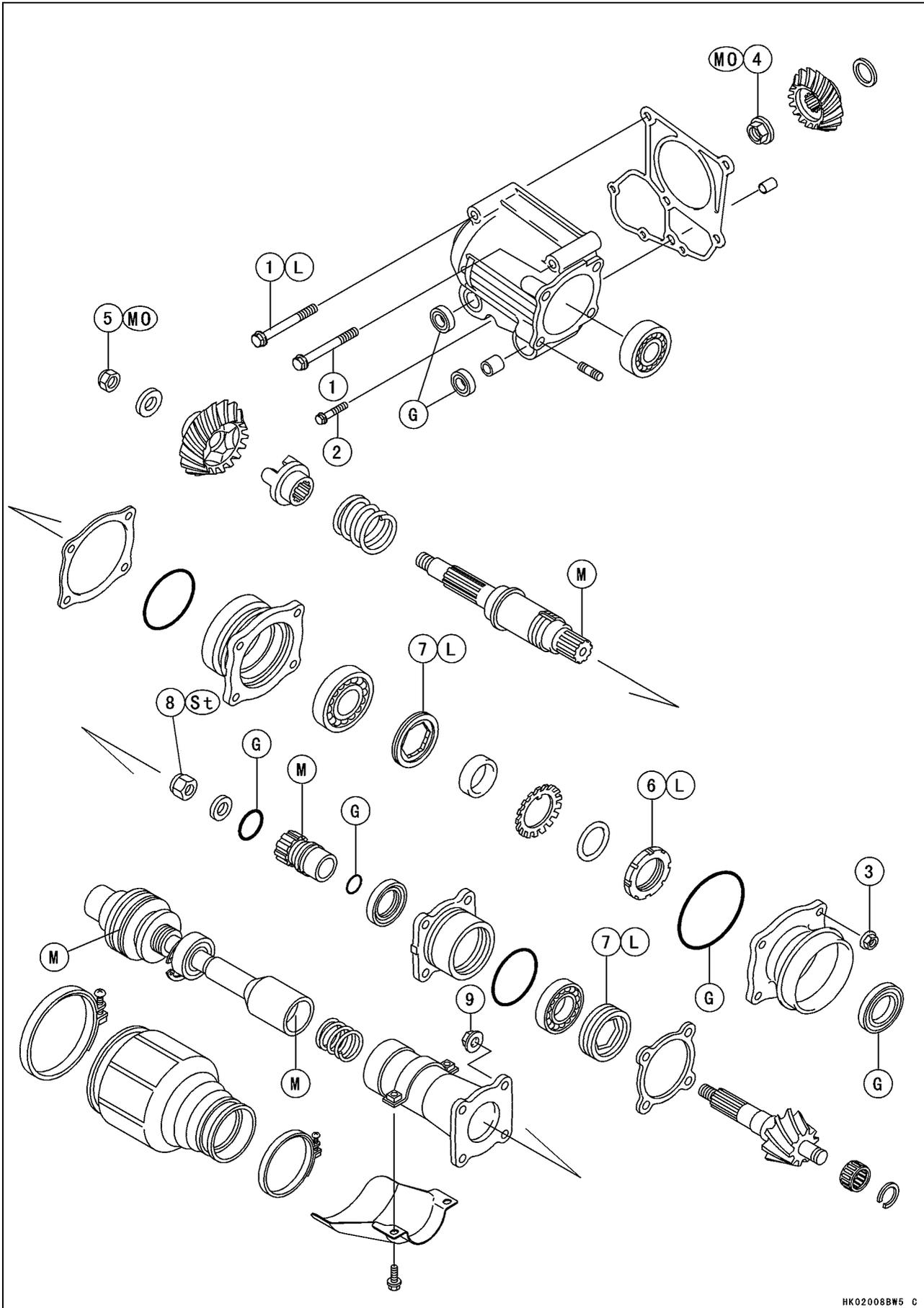
# Final Drive

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# 11-2 FINAL DRIVE

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Output Bevel Gear Case Bolts (M8)	25	2.5	18	L (1)
2	Output Bevel Gear Case Bolts (M6)	8.8	0.9	78 in·lb	
3	Oil Seal Housing Nuts	25	2.5	18	
4	Output Drive Gear Nut	118	12	87	MO
5	Cam Damper Mounting Nut	78	8.0	58	MO
6	Driven Gear Shaft Nut	147	15	108	L
7	Bearing Retainers	108	11	80	L
8	Pinion Gear Nut	69	7.0	51	St
9	Propeller Shaft Housing Nuts	25	2.5	18	

G: Apply grease for oil seal and O-ring.

L: Apply a non-permanent locking agent.

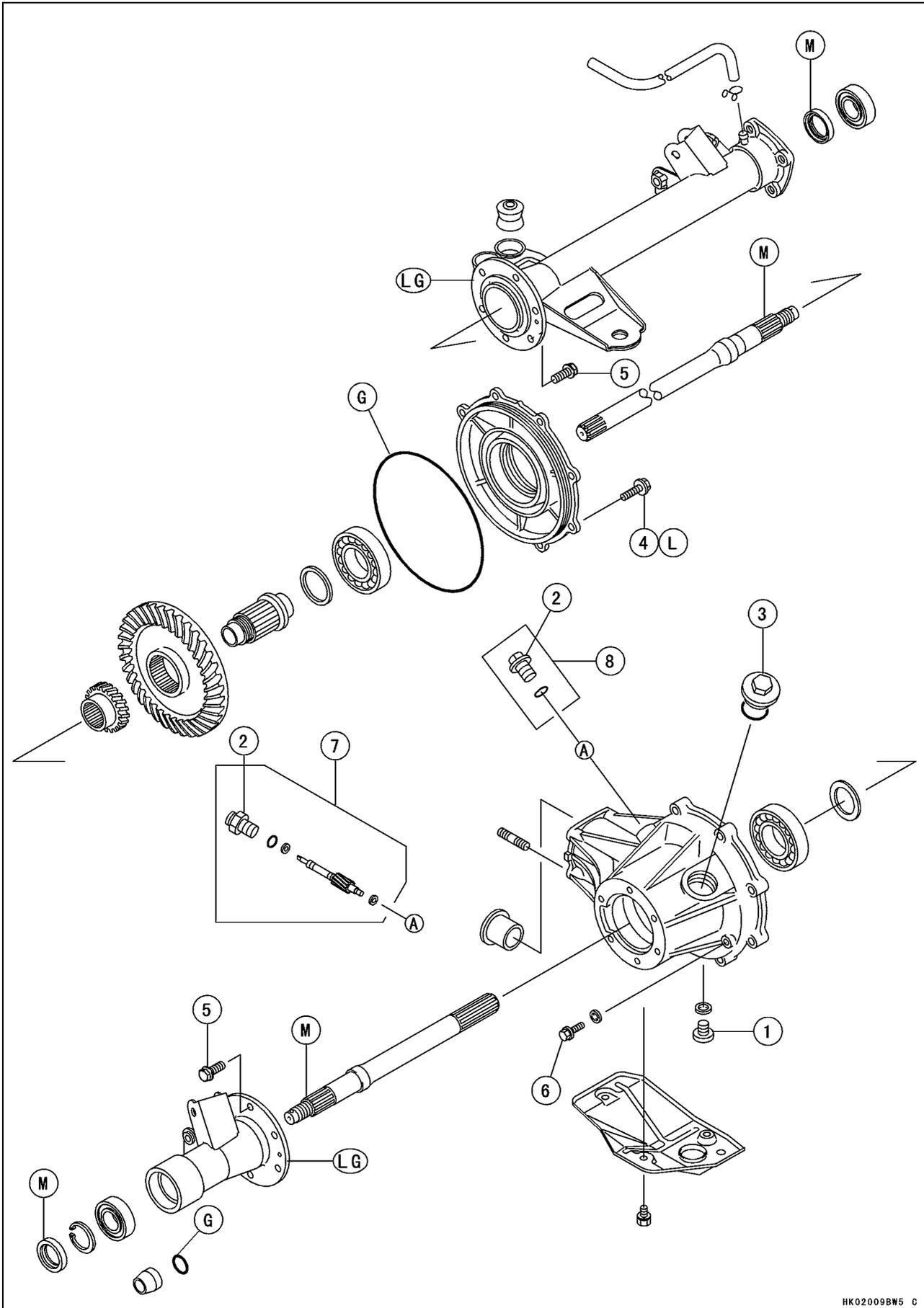
M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil.

St: Stake the fasteners to prevent loosening.

# 11-4 FINAL DRIVE

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Final Gear Case Drain Bolt	20	2.0	14	
2	Speedometer Plug	20	2.0	14	
3	Final Gear Case Filler Cap	15	1.5	11	
4	Ring Gear Cover Bolts	25	2.5	18	L
5	Axle Shaft Pipe Bolts	20	2.0	14	
6	Oil Level Inspection Bolt	7.8	0.8	69 in·lb	

7: Australia and Europe Models

8: U.S.A., Canada and United Kingdom Models

LG: Apply liquid gasket (Three Bond 1215, Gray)

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

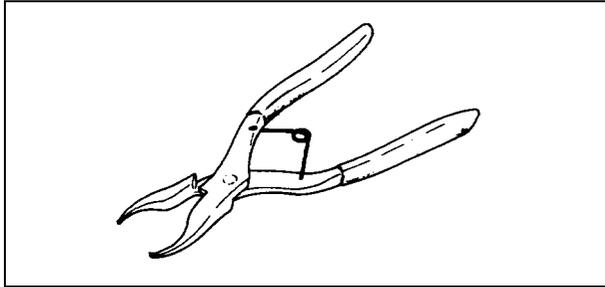
## 11-6 FINAL DRIVE

### Specifications

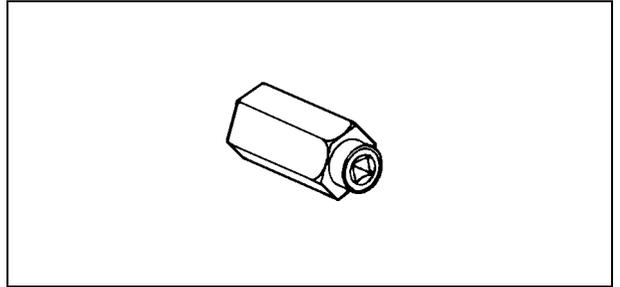
Item	Standard
<b>Bevel Gear Backlash</b>	
Front	0.06 ~ 0.13 mm (0.024 ~ 0.0051 in.) (at driven gear shaft nut)
Final	0.13 ~ 0.25 mm (0.0051 ~ 0.0098 in.) (at ring gear tooth)
<b>Final Gear Case Oil</b>	
Type	API GL-5 Hypoid gear oil
Viscosity	SAE90 (above 5°C, 41°F)
	SAE80 (below 5°C, 41°F)
Capacity	0.2 L (0.21 US qt)

**Special Tools and Sealant**

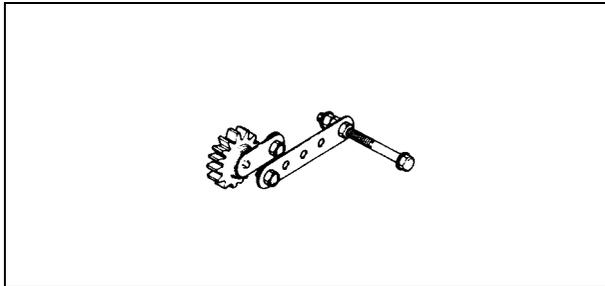
**Inside Circlip Pliers:**  
57001-143



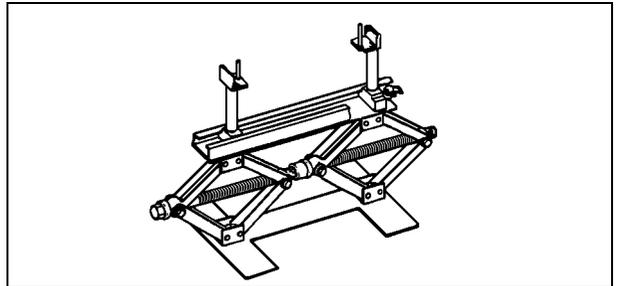
**Hexagon Wrench, Hex 32:**  
57001-1194



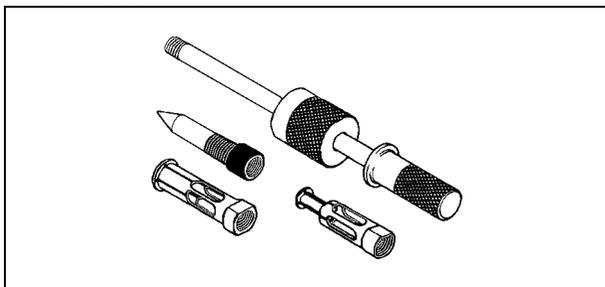
**Gear Holder, m1.75:**  
57001-1015



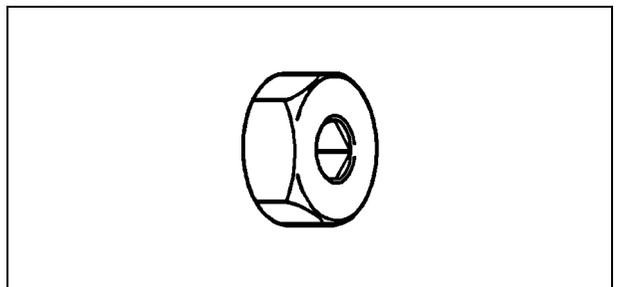
**Jack:**  
57001-1238



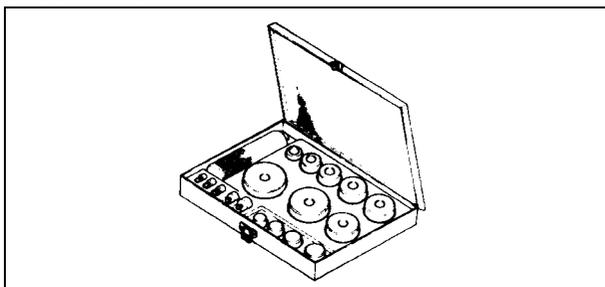
**Oil Seal & Bearing Remover:**  
57001-1058



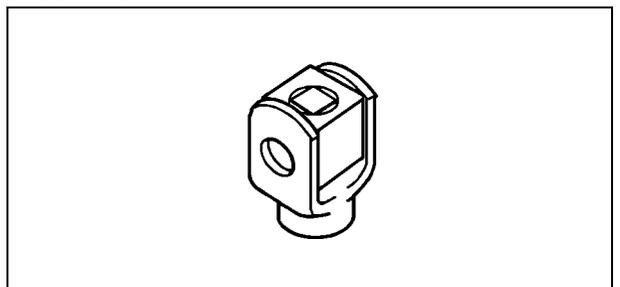
**Bearing Retainer Wrench, Hex 40:**  
57001-1256



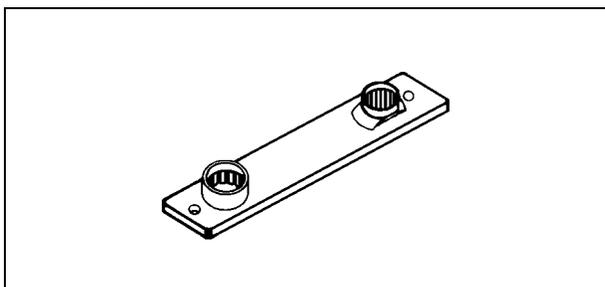
**Bearing Driver Set:**  
57001-1129



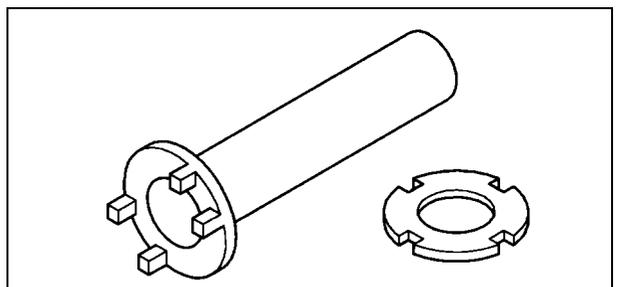
**Pinion Gear Holder:**  
57001-1281



**Bevel Gear Holder m 1.667:**  
57001-1193



**Socket Wrench:**  
57001-1354

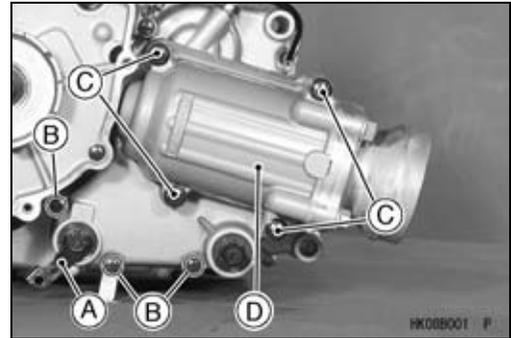


## 11-8 FINAL DRIVE

### Output Bevel Gear Case

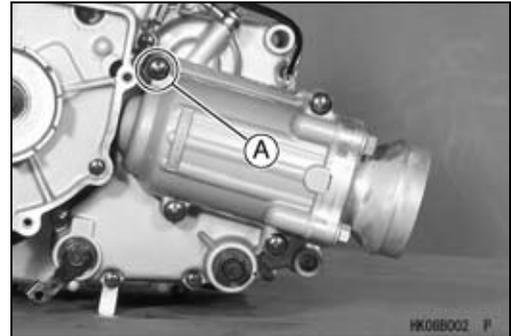
#### Output Bevel Gear Case Removal

- Drain the engine oil (see Engine Lubrication System chapter).
- Remove:
  - Engine (see Engine Removal/Installation chapter)
  - Reverse Lever [A]
  - Output Bevel Gear Case Bolts (M6) [B]
  - Output Bevel Gear Case Bolts (M8) [C]
  - Output Bevel Gear Case [D]



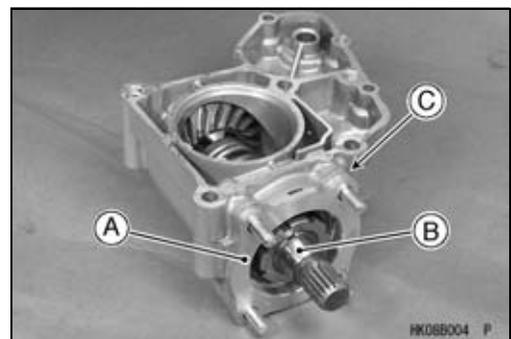
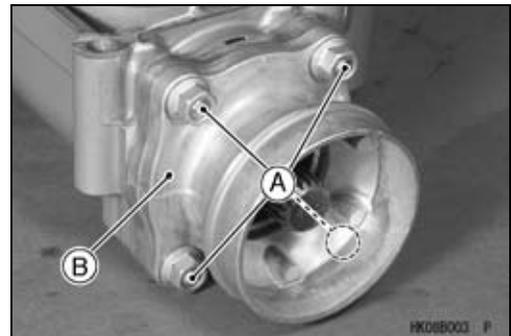
#### Output Bevel Gear Case Installation

- Replace the gasket with a new one.
- Apply a non-permanent locking agent to the output bevel gear case bolt [A].
- Tighten:
  - Torque - Output Bevel Gear Case Bolts (M8): 25 N·m (2.5 kgf·m, 18 ft·lb)**
  - Output Bevel Gear Case Bolts (M6): 8.8 N·m (0.9 kgf·m, 78 in·lb)**



#### Output Bevel Gear Case Disassembly

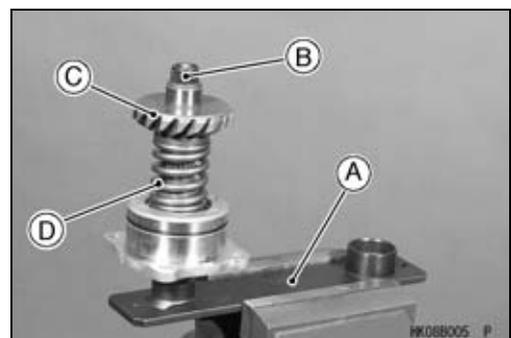
- Remove:
  - Output Bevel Gear Case (see Output Bevel Gear Case Removal)
  - Oil Seal Holder Nuts [A]
  - Oil Seal Holder [B]
- Remove:
  - Bearing Housing [A] and Cam Damper Assembly [B]
  - Shim(s) [C]



- Using the bevel gear holder [A], remove the cam damper mounting nut [B] slowly while holding the driven gear by a person.
- Carefully unscrew the nut to prevent the nut from shooting out as the spring pressure is released.

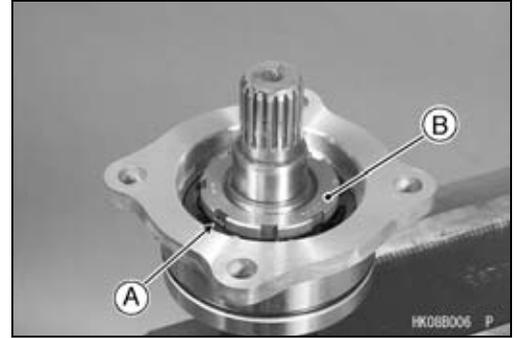
**Special Tool - Bevel Gear Holder: 57001-1193**

- Remove:
  - Washer
  - Driven Gear [C]
  - Spring [D]



**Output Bevel Gear Case**

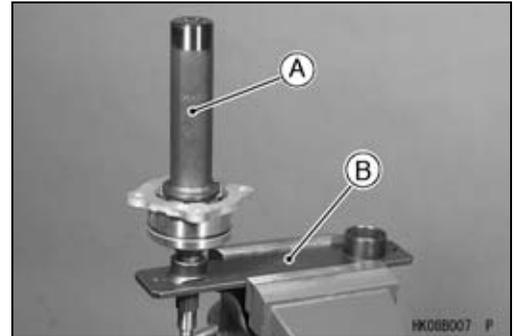
- Turn the driven gear shaft upside down.
- Bend back the toothed washer tab [A].  
[B] Driven Gear Shaft Nut



- Loosen the driven gear shaft nut with the socket wrench [A].

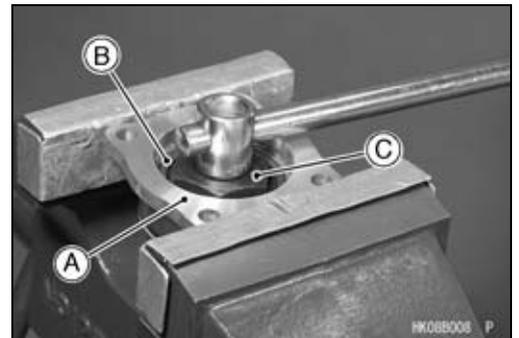
**Special Tools - Socket Wrench: 57001-1354**  
**Bevel Gear Holder [B]: 57001-1193**

- Remove:  
Driven Gear Shaft Nut  
Washer  
Toothed Washer  
Collar



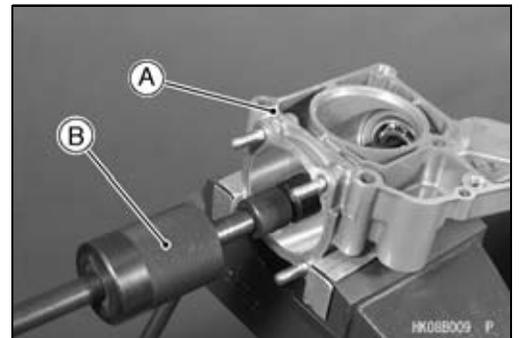
- Hold the bearing housing [A] with a vise and unscrew the bearing retainer [B] using the bearing retainer wrench [C].
- Use aluminum vise jaw plate to prevent damage to the housing.

**Special Tool - Bearing Retainer Wrench, Hex 40: 57001-1256**



- To remove the ball bearing press-fitted into the output bevel gear case [A], use the oil seal & bearing remover [B].

**Special Tool - Oil Seal & Bearing Remover: 57001-1058**



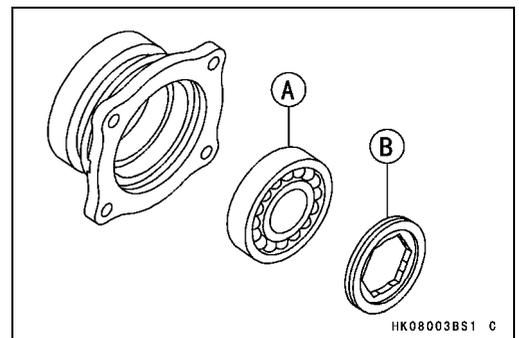
*Output Bevel Gear Case Assembly*

- Press and insert the new ball bearing [A] until it is bottomed.

**Special Tool - Bearing Driver Set: 57001-1129**

- Apply a non-permanent locking agent:  
Bearing Retainer [B]
- Tighten:

**Torque - Bearing Retainer: 108 N·m (11 kgf·m, 80 ft·lb)**

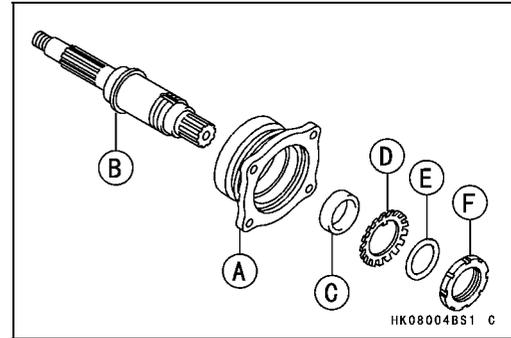


## 11-10 FINAL DRIVE

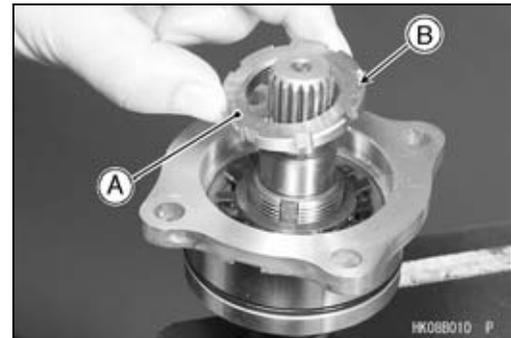
### Output Bevel Gear Case

- Install:

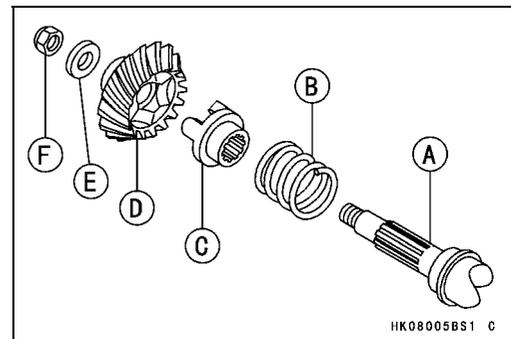
- Bearing Housing [A]
- Driven Gear Shaft [B]
- Collar [C]
- Toothed Washer [D]
- Washer [E]
- Driven Gear Shaft Nut [F]



- Apply a non-permanent locking agent:  
Driven Gear Shaft Nut [A]
- Install the driven gear shaft nut so that the flat side [B] faces upward.
- Tighten:  
**Torque - Driven Gear Shaft Nut: 147 N·m (15 kgf·m, 108 ft·lb)**  
**Special Tools - Bevel Gear Holder: 57001-1193**  
**Socket Wrench: 57001-1354**
- Bend a toothed washer tab into the groove of the driven gear shaft nut.



- Apply molybdenum disulfide oil to the spline cam damper and driven gear shaft [A].
- Install:  
Spring [B]  
Cam Damper [C]  
Driven Gear [D]  
Washer [E]  
Cam Damper Mounting Nut [F]



- Apply molybdenum disulfide oil to the threads of cam damper mounting nut.
- Tighten:  
**Torque - Cam Damper Mounting Nut: 78 N·m (8.0 kgf·m, 58 ft·lb)**  
**Special Tool - Bevel Gear Holder: 57001-1193**
- Be sure to check and adjust the bevel gear backlash and tooth contact, when any of the parts that influence these items are replaced (see Output Bevel Gear Adjustment).

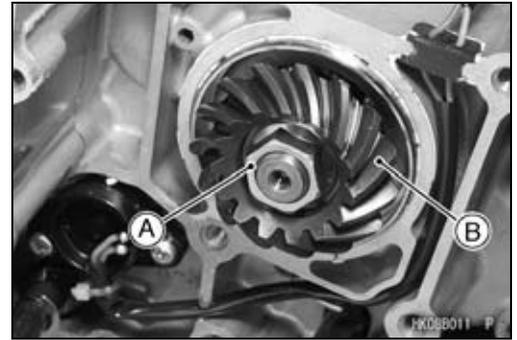
## Output Bevel Gear Case

### Output Drive Gear Removal

- Remove:
  - Engine (Engine Removal/Installation chapter)
  - Output Bevel Gear Case (see Output Bevel Gear Case Removal)
  - Right Engine Cover (see Engine Right Side chapter)
- Shift the transmission into any gear position.
- Using the gear holder, hold the primary and secondary clutch gears to keep them from turning (see Engine Right Side chapter).

**Special Tool - Gear Holder: 57001-1015**

- Remove:
  - Output Drive Gear Nut [A]
  - Output Drive Gear [B]
  - Shim(s)



### Output Drive Gear Installation

- Install:
  - Shim (see Output Bevel Gear Adjustment)
  - Output Drive Gear
- Apply molybdenum disulfide oil to the threads and seating surface of the output drive gear.
- Tighten:

**Torque - Output Drive Gear Nut: 118 N·m (12 kgf·m, 87 ft·lb)**

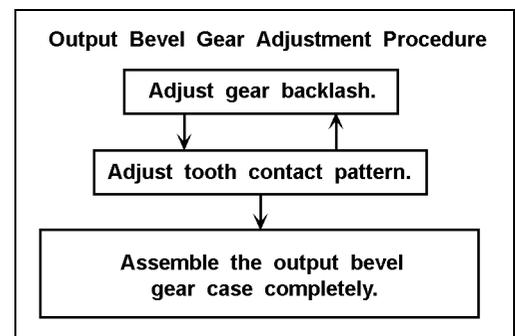
**Special Tool - Gear Holder: 57001-1015**

### Output Bevel Gear Adjustment

In order to prevent one gear from moving away from the other gear under load, the **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.

When replacing any one of the backlash-related parts, be sure to check and adjust the backlash and tooth contact. First adjust the backlash, and then tooth contact by replacing shims.

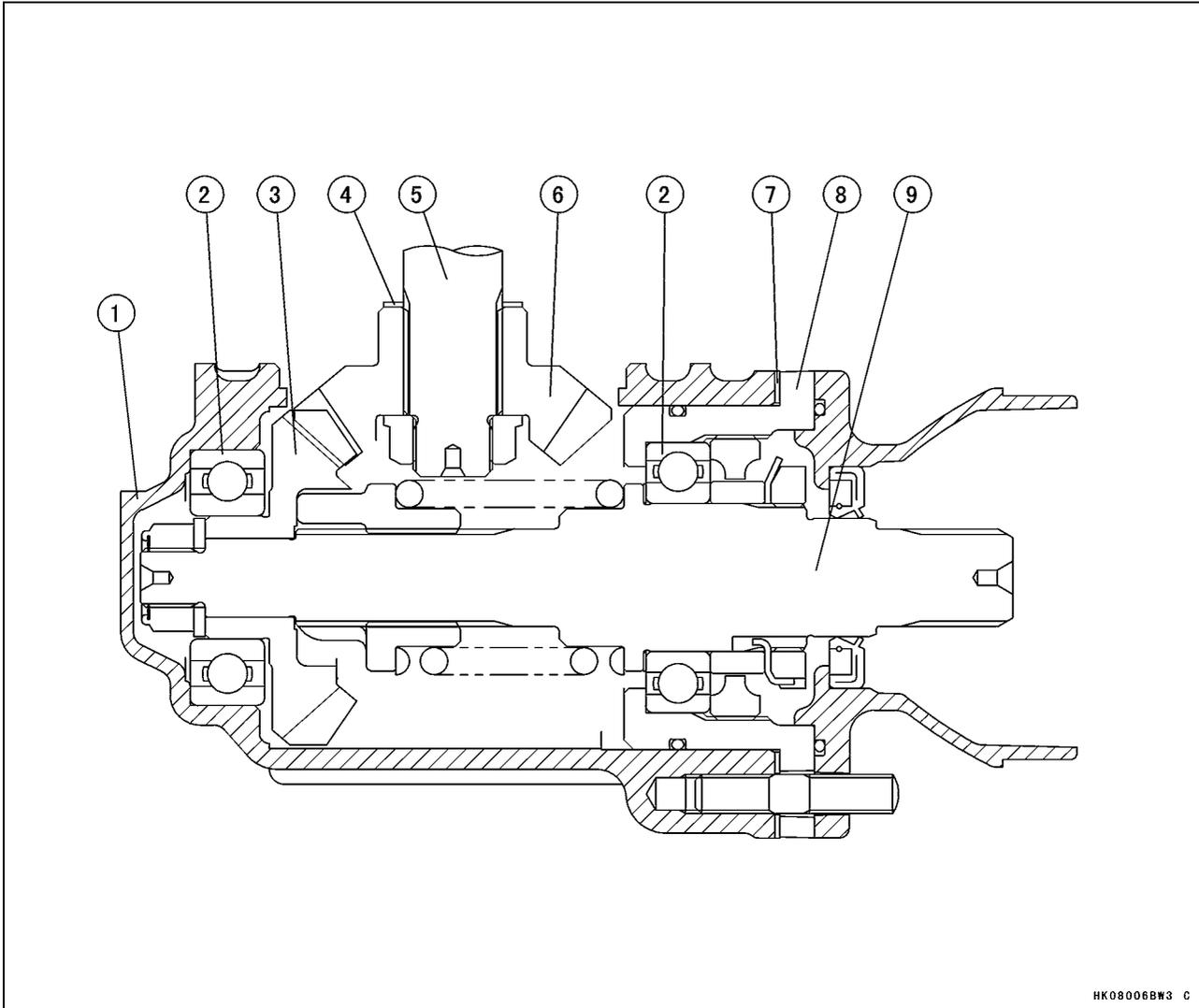
These two adjustments are of critical importance and must be carried out in the correct sequence, using the procedures shown.



# 11-12 FINAL DRIVE

## Output Bevel Gear Case

### Backlash-Related Parts



HK08006BW3 C

- 1. Output Bevel Gear Case
- 2. Ball Bearing
- 3. Output Driven Gear
- 4. Drive Gear Shims

- 5. Transmission Output Shaft
- 6. Output Drive Gear
- 7. Driven Gear Shims

- 8. Bearing Housing
- 9. Driven Gear Shaft

## Output Bevel Gear Case

### Drive Gear Shims

Thickness	Part Number
0.15 mm (0.006 in.)	92025-1573
0.20 mm (0.008 in.)	92025-1574
0.7 mm (0.028 in.)	92025-1534
0.8 mm (0.031 in.)	92025-1535
0.9 mm (0.035 in.)	92025-1536
1.0 mm (0.039 in.) (primary)	92025-1537
1.1 mm (0.043 in.)	92025-1575
1.2 mm (0.047 in.)	92025-1538
1.3 mm (0.051 in.)	92025-1533

### Driven Bevel Gear Shims

Thickness (mm)	Part Number
0.10 mm (0.004 in.)	92025-1859
0.15 mm (0.006 in.)	92025-1860
0.50 mm (0.020 in.)	92025-1861
0.80 mm (0.031 in.)	92025-1862
1.00 mm (0.039 in.) (primary)	92025-1858
1.20 mm (0.047 in.)	92025-1863

### Bevel Gear Backlash Adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Install the output drive gear with the primary shim (see the shim tables).
- Apply molybdenum disulfide oil to the seating surface and threads of the output drive gear nut and tighten it.

**Torque - Output Drive Gear Nut: 118 N·m (12 kgf·m, 87 ft·lb)**

- Install the driven gear with the primary shim (see the shim tables).
- Temporarily install the output bevel gear case on the crankcase, and tighten the case bolts.
- Be sure to install the case gasket.
- Do not install the following part.

Oil Seal Holder

**Torque - Output Bevel Gear Case Bolts (M8): 25 N·m (2.5 kgf·m, 18 ft·lb)**

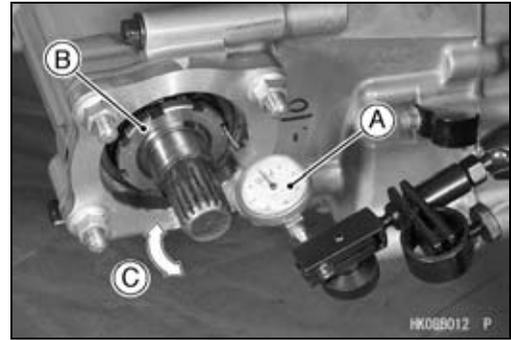
**Output Bevel Gear Case Bolts (M6): 8.8 N·m (0.9 kgf·m, 78 in·lb)**

- Check the backlash during the tightening of the case bolts and stop tightening them immediately if the backlash disappears. Then, change the shim to a thinner one.

## 11-14 FINAL DRIVE

### Output Bevel Gear Case

- Set up a dial gauge [A] against the driven gear shaft nut [B] to check gear backlash.
- To measure the backlash, turn the shaft clockwise and counterclockwise [C] slightly while holding the output drive gear steady. The difference between the highest and lowest gauge reading is the amount of backlash.
- To hold the output drive gear steady, hold the shift drum at the full-turned position.
- ★ If the backlash is not within the limit, replace the shim(s) at the drive and/or driven gear.
- ★ Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.



#### Bevel Gear Backlash (Front)

**Standard:** 0.06 ~ 0.13 mm  
(0.0024 ~ 0.0051 in.) (at driven gear shaft nut)

#### Tooth contact adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Apply checking compound to 4 or 5 teeth on the output driven bevel gear.

#### NOTE

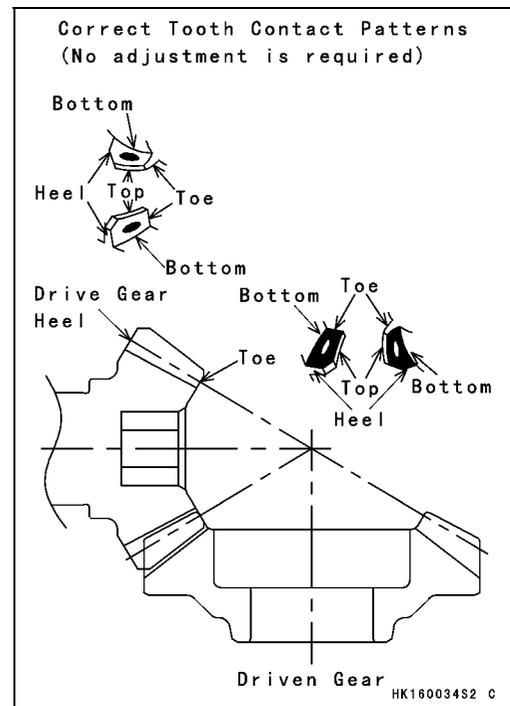
- Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.
- The checking compound must be smooth and firm with the consistency of tooth paste.
- Special compounds are available from automotive supply stores for the purpose of checking differential gear tooth patterns and contact. Use this for checking the bevel gears.
- Turn the front end of the output driven shaft for 3 or 4 turns in the drive and reverse (coast) directions, while creating a drag on the drive bevel gear.

#### Special Tool - Pinion Gear Holder: 57001-1281

- Check the drive pattern and coast pattern of the bevel gear teeth. The tooth contact patterns of both drive and coast sides should be centrally located between the top and bottom of the tooth, and a little closer to the toe of the tooth.
- ★ If the tooth contact pattern is incorrect, replace the shim(s) at the drive bevel gear and shim(s) at the driven bevel gear, following the examples shown. Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shims are replaced. Repeat the shim change procedure as necessary.

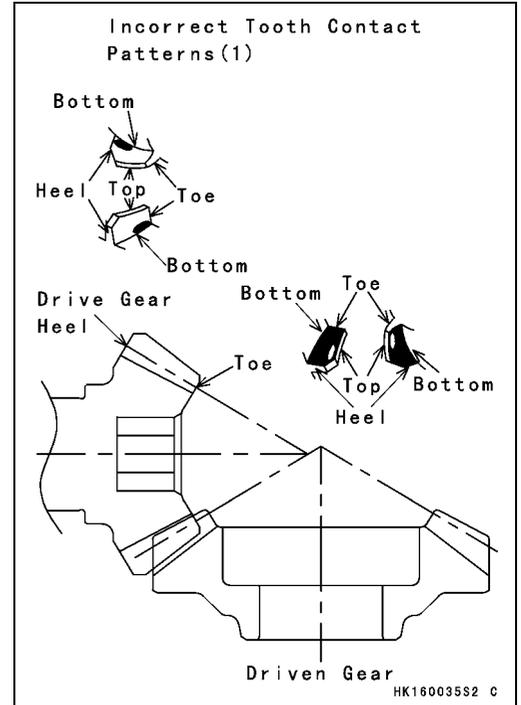
#### NOTE

- If the backlash is out of the standard range after changing shims, correct the backlash before checking the tooth contact pattern.

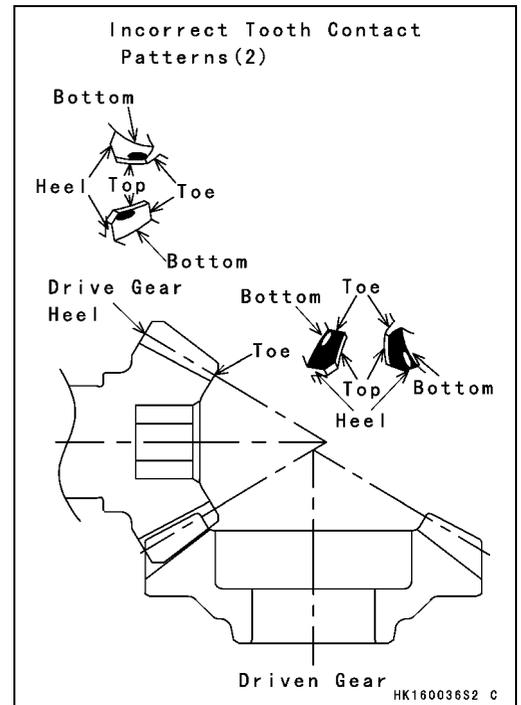


**Output Bevel Gear Case**

Example 1: Decrease the thickness of the drive gear shim(s) by 0.05 mm (0.002 in.), and/or increase the thickness of the driven bevel gear shim(s) by 0.05 mm (0.002 in.) to correct the pattern shown. Repeat in 0.05 mm (0.002 in.) steps if necessary.

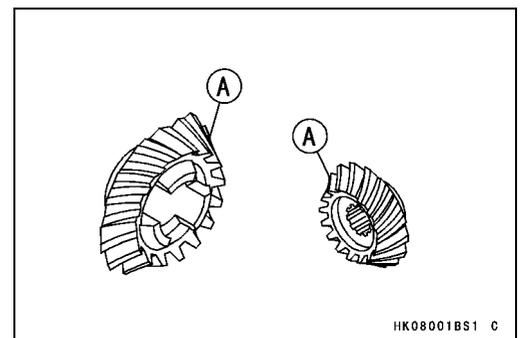


Example 2: Increase the thickness of the drive bevel gear shim(s) by 0.05 mm (0.002 in.), and/or decrease the thickness of the driven bevel gear shim(s) by 0.05 mm (0.002 in.) to correct the pattern shown. Repeat in 0.05 mm (0.002 in.) steps if necessary.



**Bevel Gear Inspection**

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.

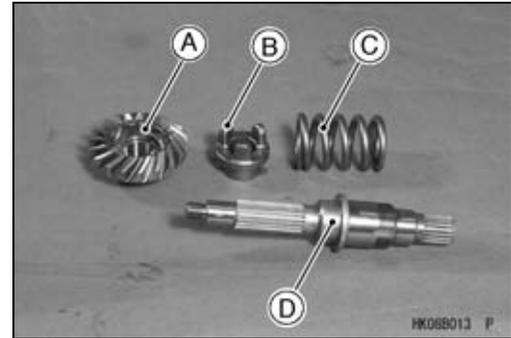


## 11-16 FINAL DRIVE

### Output Bevel Gear Case

#### *Cam Damper Inspection*

- Visually inspect:
  - Bevel Gear Cam [A]
  - Cam Follower [B]
  - Spring [C]
  - Shaft [D]
- ★ Replace any part if it appears damaged.



#### *Ball Bearing Inspection*

- Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than measurement. Clean each bearing in a high-flash point solvent, dry it (do not spin the bearing while it is dry), and oil it with engine oil.
- Spin the bearing by hand to check its condition.
- ★ If the bearing is noisy, does not spin smoothly, or has any rough spots, replace it.

#### *Oil Seal Inspection*

- Inspect the oil seals.
- ★ Replace it if the lips are misshapen, discolored (indicating that the rubber has deteriorated), hardened, or been otherwise damaged.

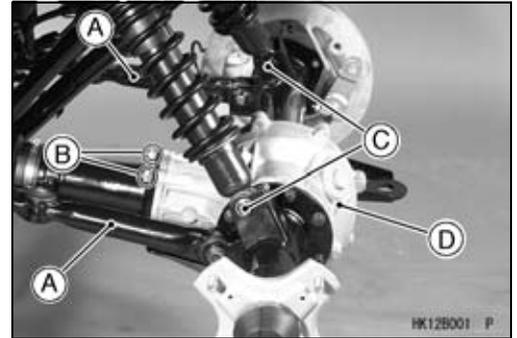
## Propeller Shaft

### Propeller Shaft Removal

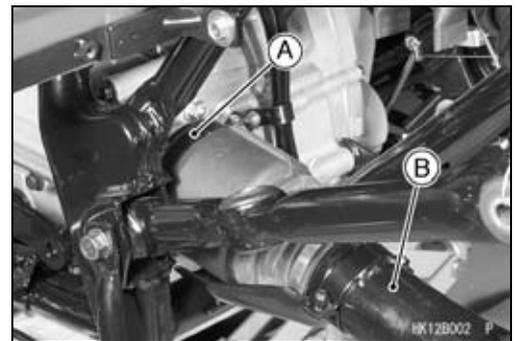
- Support the vehicle on a stand or the jack so that the rear wheels are off the ground.

**Special Tool - Jack: 57001-1238**

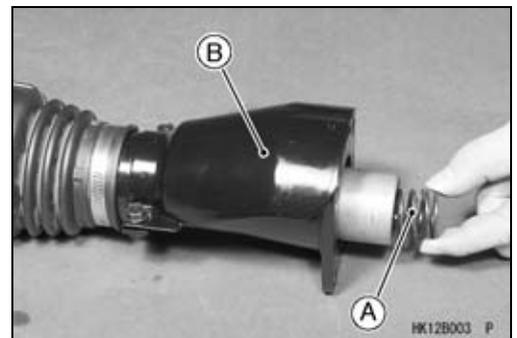
- Loosen the propeller shaft housing mounting nuts.
- Remove:
  - Rear Wheels (see Wheels/Tires chapter)
  - Center Arm (see Suspension chapter)
- Support the final gear case on a stand or jack.
- Remove:
  - Rear Suspension Arms [A]
  - Propeller Shaft Housing Mounting Nuts [B]
  - Rear Shock Absorber Lower Bolts [C]
- Move back the final gear case [D] and rear axle assembly.



- Loosen the clamp [A] and remove the propeller shaft housing [B].



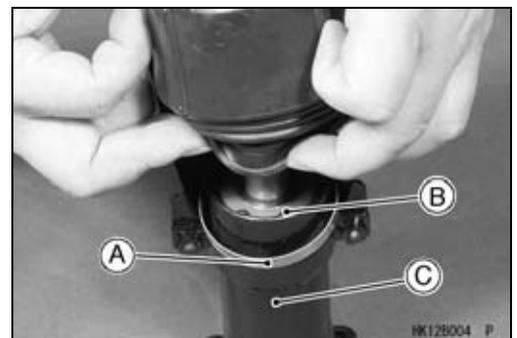
- Remove:
  - Spring [A]
  - Cover [B]



- Remove:
  - Clamp [A]
  - Circlip [B]

**Special Tool - Inside Circlip Pliers: 57001-143**

- Remove the propeller shaft from the propeller shaft housing [C].

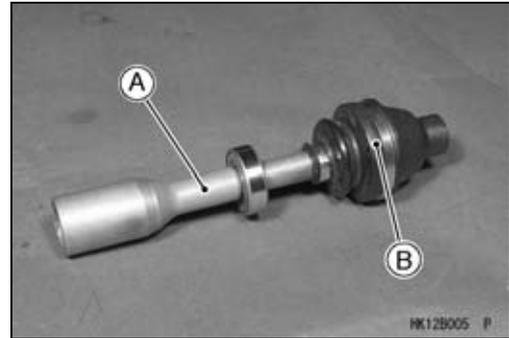


## 11-18 FINAL DRIVE

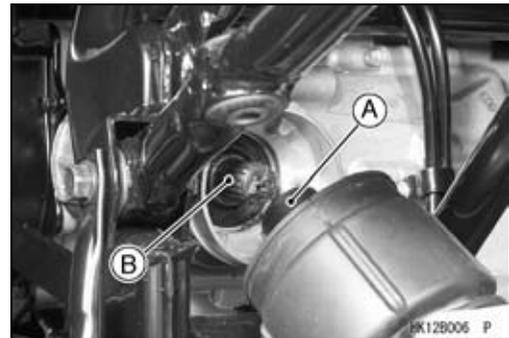
### Propeller Shaft

#### *Propeller Shaft Installation*

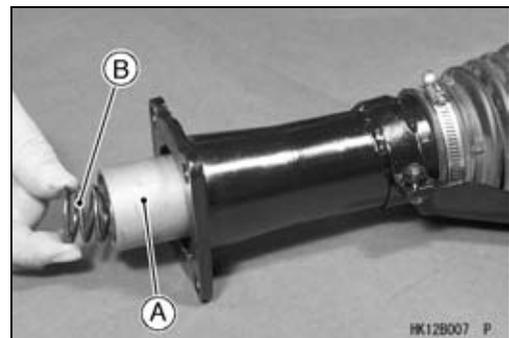
- Wipe off old grease in the ends of propeller shaft [A].
- Apply grease to the universal joint outer surface [B].



- Apply molybdenum disulfide grease:
  - Splines at Front End [A] of Propeller Shaft
  - Splines at Rear End [B] of Driven Gear Shaft
- Fit the propeller shaft to the driven gear shaft.

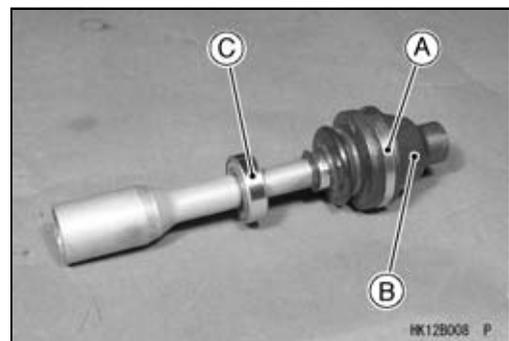


- Apply molybdenum disulfide grease:
  - Splines at Rear End [A] of Propeller Shaft
  - Splines at Front End of Pinion Gear Joint
- Install:
  - Spring [B]
  - Rear Final Gear Case and Rear Axle Assembly
- Tighten:
  - Torque - Propeller Shaft Housing Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)



#### *Propeller Shaft Inspection*

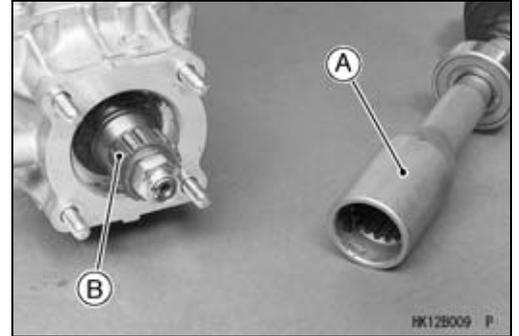
- Remove the propeller shaft (see Propeller Shaft Removal).
- Check that the universal joint [A] works smoothly without rattling or sticking.
  - ★ If it does not, the universal joint is damaged. Replace the propeller shaft with a new one.
- Visually inspect the universal joint grease cap [B].
  - ★ If there are any signs of deterioration, damage, or looseness, replace the propeller shaft.
- ★ If grease leakage is noted, replace the propeller shaft.
- Inspect the center bearing [C].
  - Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than measurement.
  - Spin the bearing by hand to check its condition.
  - ★ If the bearing is noisy, does not spin smoothly, or has any rough spots, replace the propeller shaft.



## Propeller Shaft

### *Propeller Shaft Joint and Pinion Gear Joint Inspection*

- Visually inspect the splines of both the propeller shaft sliding joint [A] and the pinion gear joint [B].
- ★ If they are badly worn or chipped, replace the part with a new one.



### *Propeller Shaft Joint Boot Inspection*

- Refer to the Propeller Shaft Joint Boot Inspection in the Periodic Maintenance chapter.

# 11-20 FINAL DRIVE

## Rear Axle

### Rear Axle Removal

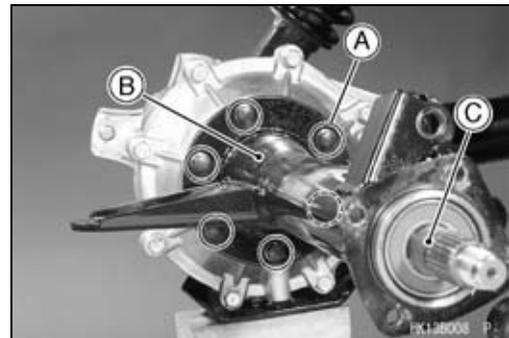
- Drain the rear final gear case oil (see Final Gear Case Oil Change).
- Remove:
  - Rear Wheels (see Wheels/Tires chapter)
  - Rear Hub
  - Brake Drum and Brake Panel (see Brakes chapter)
  - Center Arm (see Suspension chapter)
- Support the final gear case on a stand or jack.
- Remove:
  - Rear Suspension Arms (see Suspension chapter)
  - Rear Shock Absorber Lower Bolts
  - Collar [A]
  - O-ring [B]



- Remove:
  - Left Axle Shaft Pipe Bolts [A]
  - Left Axle Shaft Pipe [B] and Left Rear Axle [C]
- Cut away the sealant between the axle shaft pipe and final gear case.

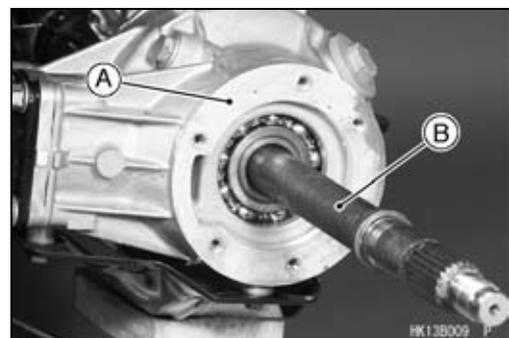


- Remove:
  - Right Axle Shaft Pipe Bolts [A]
  - Right Axle Shaft Pipe [B] and Right Rear Axle [C]
- Cut away the sealant between the axle shaft pipe and final gear case.



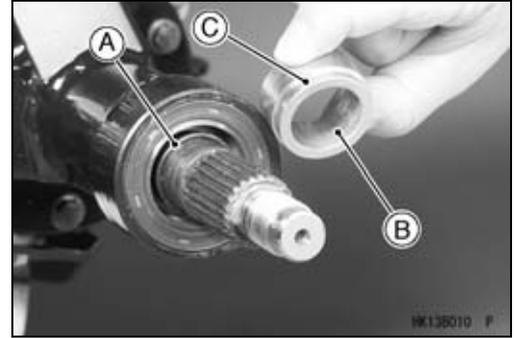
### Rear Axle Installation

- Apply molybdenum disulfide grease to the oil seal lips in the axle shaft pipes.
- Apply liquid gasket to the mating surface [A] of the final gear case.
- Sealant - Three Bond: 1215 (Gray)**
- Insert:
  - Axles [B]
  - Axle Shaft Pipes
- Tighten:
  - Torque - Axle Shaft Pipe Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)**



**Rear Axle**

- Install:
  - O-ring [A]
  - Collar [B]
- Install the collar so that the stepped side [C] face outward.

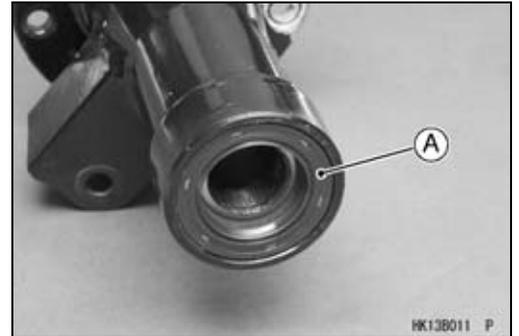


*Axle Shaft Pipe Disassembly*

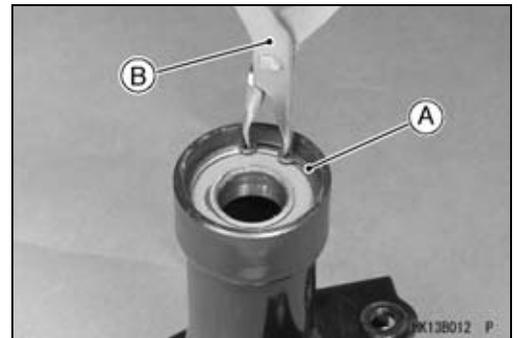
- Remove:
  - Axle Shaft Pipes (see Rear Axle Removal)

**Left Side**

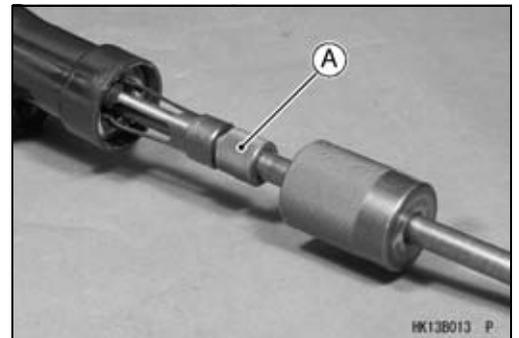
- Remove:
  - Oil Seal [A]



- Remove:
  - Circlip [A]
- Special Tool - Inside Circlip Pliers [B]: 57001-143**

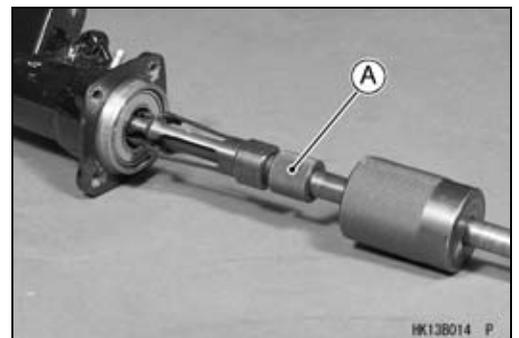


- Remove:
  - Ball Bearing
- Special Tool - Oil Seal & Bearing Remover [A]: 57001-1058**



**Right Side**

- Remove:
  - Ball Bearing
- Special Tool - Oil Seal & Bearing Remover [A]: 57001-1058**
- Remove:
  - Oil Seal



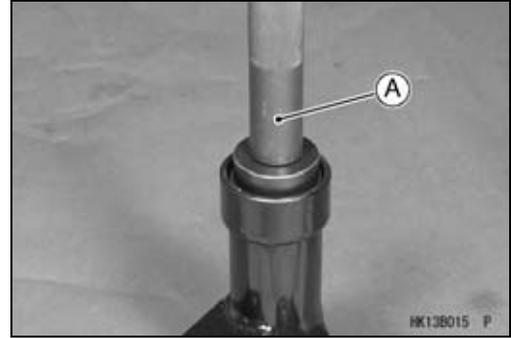
# 11-22 FINAL DRIVE

## Rear Axle

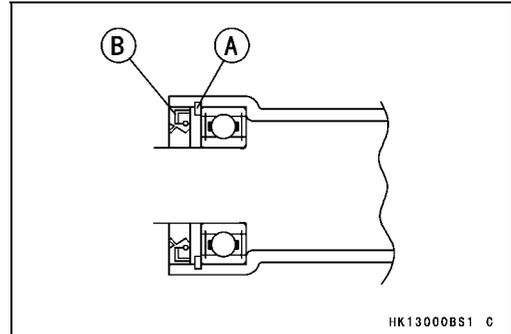
### Axle Shaft Pipe Assembly

#### Left Side

- Press and insert the ball bearing until it is bottomed.  
**Special Tool - Bearing Driver Set [A]: 57001-1129**

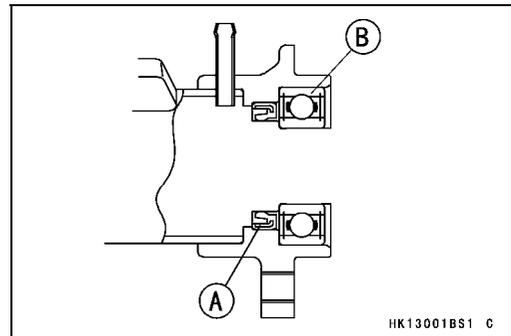


- Install:  
Circlip [A]
- Special Tool - Inside Circlip Pliers: 57001-143**
- Apply molybdenum disulfide grease to the oil seal lips.
- Install the oil seal [B] so that the seal surface is flush with the end of the pipe housing.
- Special Tool - Bearing Driver Set: 57001-1129**



#### Right Side

- Apply molybdenum disulfide grease to the oil seal lips.
- Press and insert the oil seal [A] and ball bearing [B] until they are bottomed.
- Special Tool - Bearing Driver Set: 57001-1129**



## Final Gear Case

### *Final Gear Case Oil Level Inspection*

- Park the vehicle so that it is level, both side-to-side and front-to-rear.
- Unscrew the oil level inspection bolt [A].
- The oil level is correct if a small amount of oil comes out of the bolt hole.
- ★ If no oil comes out, first check the final gear case for oil leakage, remedy it if necessary, and add oil through the filler opening. Use the same type and brand of oil that is already in the final gear case (see Final Gear Case Oil Change).
- Install the oil level inspection bolt
- Tighten:
  - Torque - Oil Level Inspection Bolt: 7.8 N·m (0.8 kgf·m, 69 in·lb)**

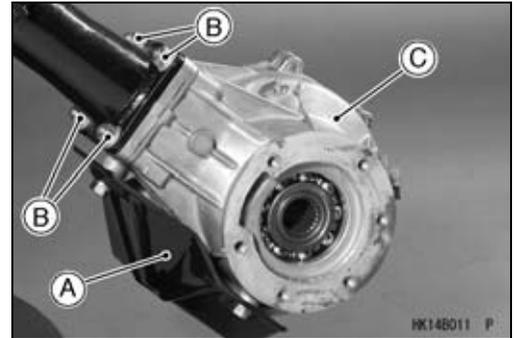


### *Final Gear Case Oil Change*

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

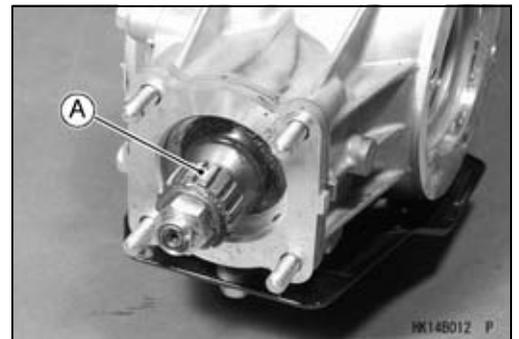
### *Final Gear Case Removal*

- Remove:
  - Rear Axles (see Rear Axle Removal)
  - Skid Plate [A]
  - Speedometer Cable Lower End (if installed)
  - Propeller Shaft Housing Mounting Nuts [B]
- Remove the final gear case [C].



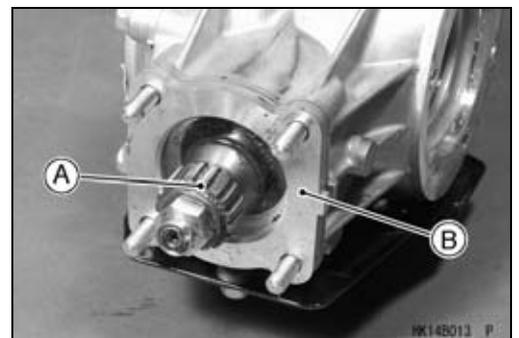
### *Final Gear Case Installation*

- Apply molybdenum disulfide grease to the spline [A] of the pinion gear.
- Tighten:
  - Torque - Propeller Shaft Housing Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- Install:
  - Rear Axles (see Rear Axle Installation)
- Fill the final gear case with the specified oil (see Final Gear Case Oil Change).



### *Final Gear Case Disassembly*

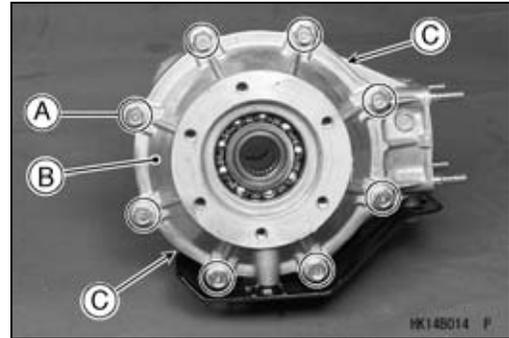
- Remove the final gear case (see Final Gear Case Removal).
- Remove:
  - Pinion Gear Assembly [A] and Pinion Gear Housing [B] Shim(s)



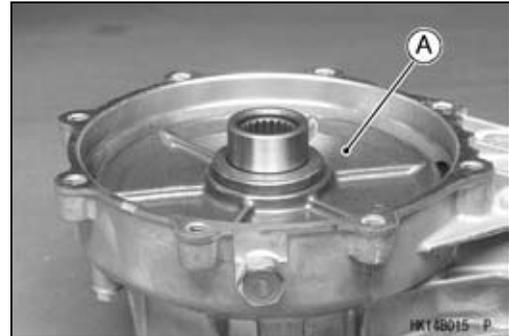
## 11-24 FINAL DRIVE

### Final Gear Case

- Unscrew the ring gear cover bolts [A] and pull off the cover [B]. The shim(s) comes off with the cover.  
Pry Points [C]



- Take the ring gear assembly [A] out of the case.



### Final Gear Case Assembly

#### CAUTION

**Be careful not to scratch the sealing surfaces [A] of the final gear case and case cover during the bearing removal and installation. A scratched sealing surface may allow oil to leak.**

- Check:
  - Oil Seal (see Oil Seal Inspection)
  - Ball Bearings (see Bearing Inspection)
- Visually check the bevel gears for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged since they are lapped as a set in the factory to get the best tooth contact.

○ Be sure to check and adjust the bevel gear backlash and tooth contact when any of the backlash-related parts are replaced (see Final Bevel Gear Adjustment).

- Install:
  - Ring Gear Assembly
- Apply a non-permanent locking agent to the ring gear cover bolts, and tighten them.  
**Torque - Ring Gear Cover Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- Install:
  - Shim(s) (see Final Bevel Gear Adjustment)
  - Pinion Gear Assembly

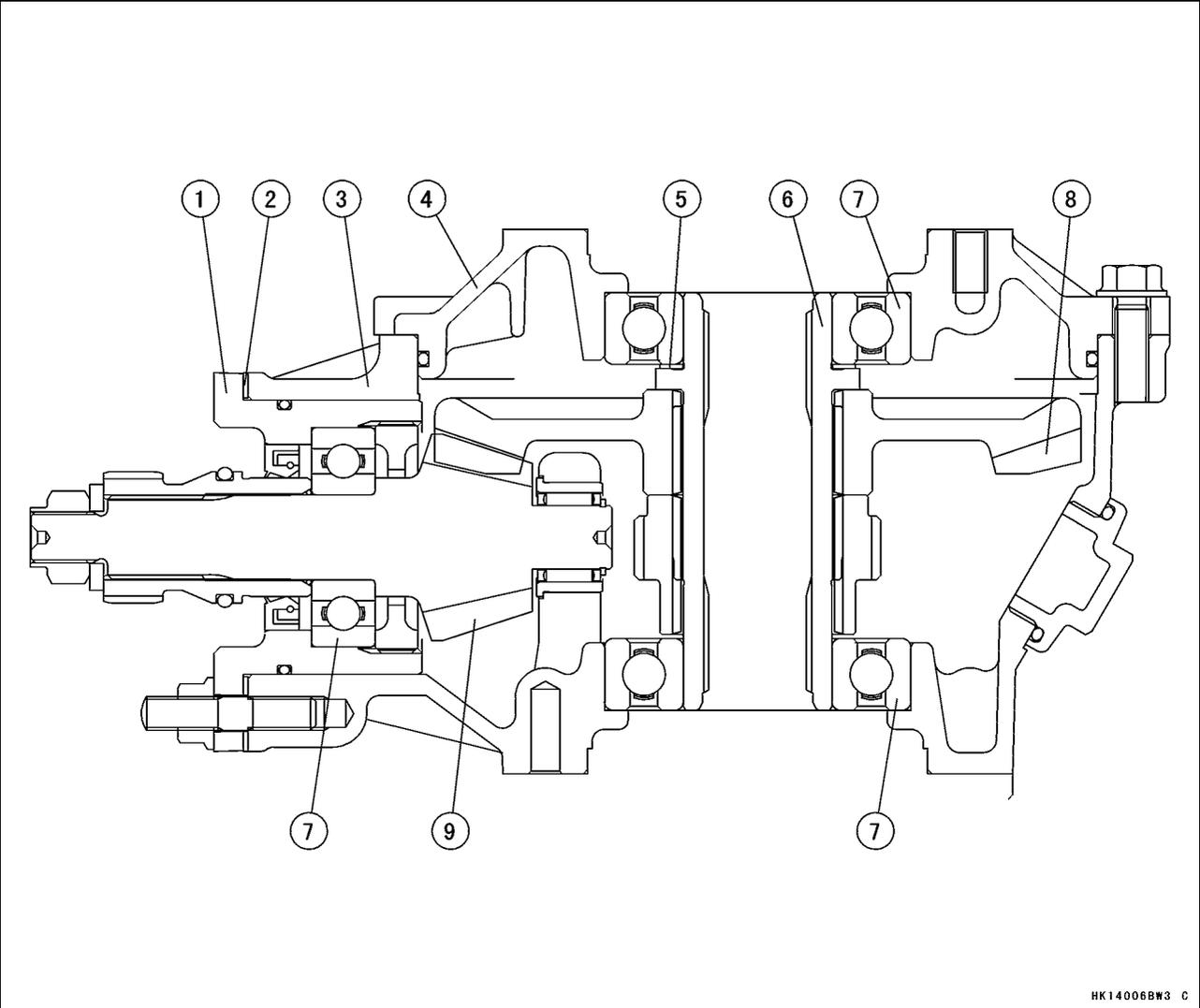


**Final Gear Case**

*Final Bevel Gear Adjustment*

- The **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.
- After replacing any of the backlash-related parts, be sure to check and adjust the backlash and tooth contact of the bevel gears. First, adjust backlash, and then tooth contact by replacing shims.
- The amount of backlash is influenced by the ring gear position more than by the pinion gear position.
- Tooth contact location is influenced by pinion gear position more than by ring gear position.

**Final Gear Case (Backlash-related Parts)**



HK14006BW3 C

- |                        |                      |                  |
|------------------------|----------------------|------------------|
| 1. Pinion Gear Housing | 4. Ring Gear Cover   | 7. Ball Bearings |
| 2. Pinion Gear Shim(s) | 5. Ring Gear Shim(s) | 8. Ring Gear     |
| 3. Final Gear Case     | 6. Final Gear Shaft  | 9. Pinion Gear   |

# 11-26 FINAL DRIVE

## Final Gear Case

### 7. Pinion Gear Shims

Thickness	Part Number
0.10 mm (0.004 in.)	92025-1865
0.15 mm (0.006 in.)	92025-1866
0.50 mm (0.020 in.)	92025-1867
0.80 mm (0.031 in.)	92025-1868
1.0 mm (0.039 in.) (primary)	92025-1864

### 8. Ring Gear Shims

Thickness	Part Number
0.10 mm (0.004 in.)	92025-1850
0.15 mm (0.006 in.)	92025-1851
0.50 mm (0.020 in.)	92025-1856
0.80 mm (0.031 in.)	92025-1857
1.0 mm (0.039 in.) (primary)	92025-1849

### Backlash Adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Install the pinion gear assembly with the primary shim (**1.0 mm thickness**).
- Tighten the propeller shaft housing mounting nuts without the propeller shaft housing.

**Torque - Propeller Shaft Housing Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Install the ring gear in the final gear case with the primary shim (**1.0 mm thickness**) onto the ring gear.

- Install:  
Ring Gear Case Cover

- Tighten:  
**Torque - Ring Gear Cover Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- Check the backlash during tightening the cover bolts, and stop tightening them immediately if the backlash disappears. Then, change the ring gear shim to a thinner one.

- Set up a dial gauge [A] against a ring gear tooth to check gear backlash.
- To measure the backlash, move the ring gear back and forth [B] while holding the pinion gear steady with the bevel gear holder [C].

**Special Tool - Bevel Gear Holder: 57001-1193**

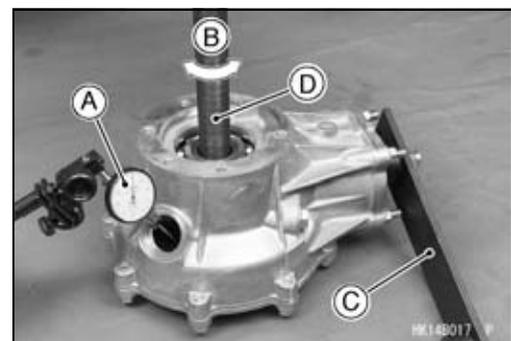
[D] Rear Axle

- The difference between the highest and the lowest gauge reading is the amount of backlash.

### Bevel Gear Backlash (Rear)

**Standard: 0.13 ~ 0.25 mm  
(0.0051 ~ 0.0098 in.) (at ring gear tooth)**

- ★ If the backlash is not within the limit, replace the ring gear shim(s). To increase backlash, decrease the thickness of the shim(s). To decrease backlash, increase the thickness of the shim(s).
- ★ Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.



---

## Final Gear Case

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### Tooth contact adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Apply checking compound to 4 or 5 teeth of the pinion gear.

#### NOTE

- *Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.*
  - *The checking compound must be smooth and firm, with the consistency of tooth paste.*
  - *Special compounds are available at automotive supply stores for the purpose of checking differential gear tooth patterns and contact. Use one of these for checking the bevel gears.*
- Install:
    - Pinion Gear Assembly and Shim(s)
  - Tighten:
    - Torque - Propeller Shaft Housing Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
  - Install:
    - Ring Gear Assembly and Shim(s)
    - Ring Gear Cover
  - Tighten:
    - Torque - Ring Gear Cover Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
  - Turn the pinion gear for one revolution in the drive and reverse (coast) direction, while creating drag on the ring gear.
  - Remove the ring gear and pinion gear assembly to check the drive pattern and coast pattern of the bevel gear teeth.
  - The tooth contact patterns of both (drive and coast) sides should be centrally located between the top and bottom of the tooth. The drive pattern can be a little closer to the toe and the coast pattern can be a somewhat longer and closer to the toe.
  - ★ If the tooth contact pattern is incorrect, replace the pinion gear shim(s), following the examples shown.
  - Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shim(s) are replaced. Repeat the shim change procedure as necessary.

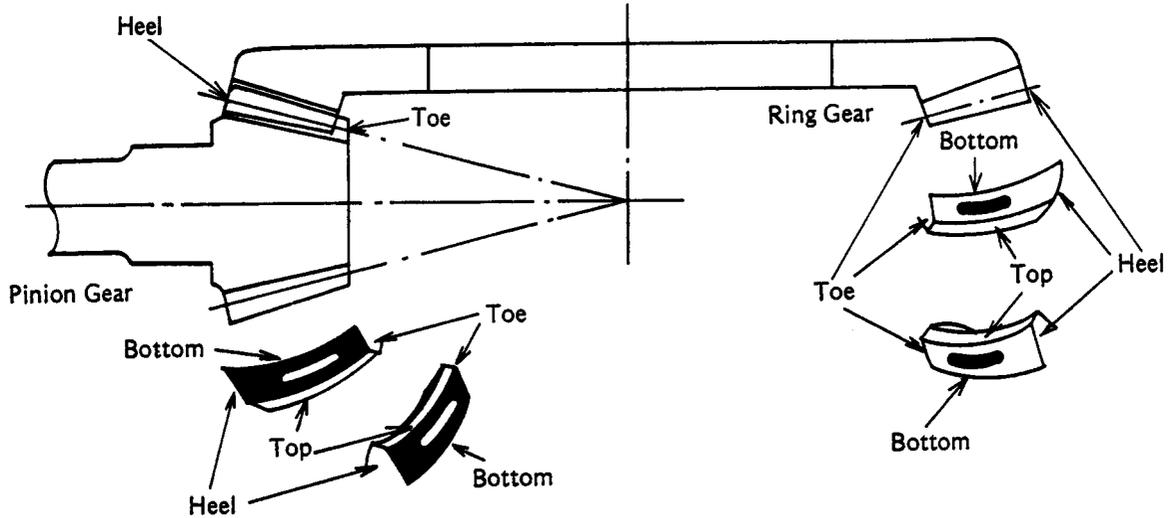
#### NOTE

- *If the backlash is out of the standard range after changing the pinion gear shim(s), change the ring gear shim(s) to correct the backlash before checking the tooth contact pattern.*

# 11-28 FINAL DRIVE

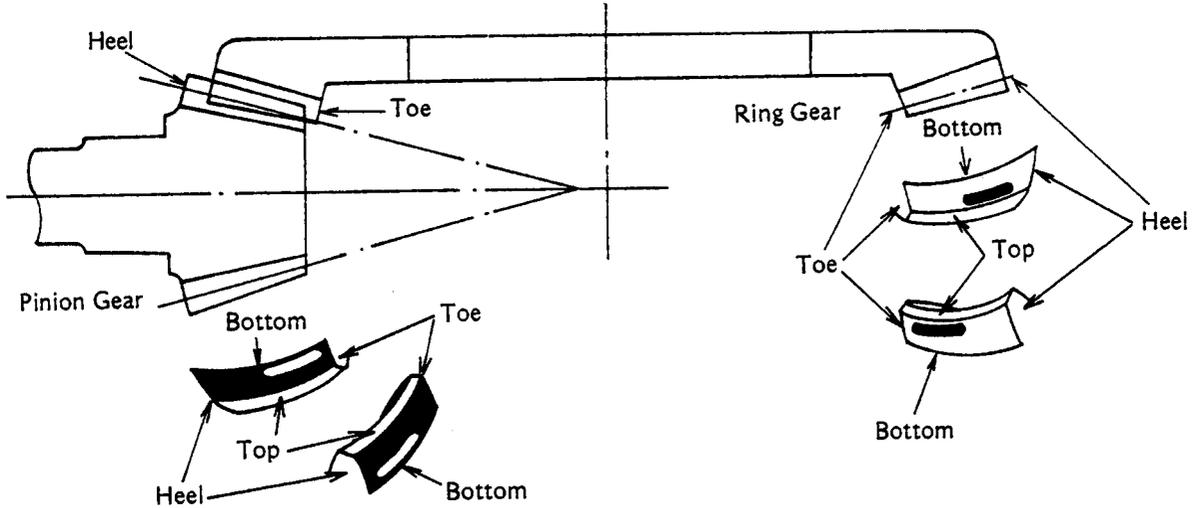
## Final Gear Case

### Correct Tooth Contact Pattern

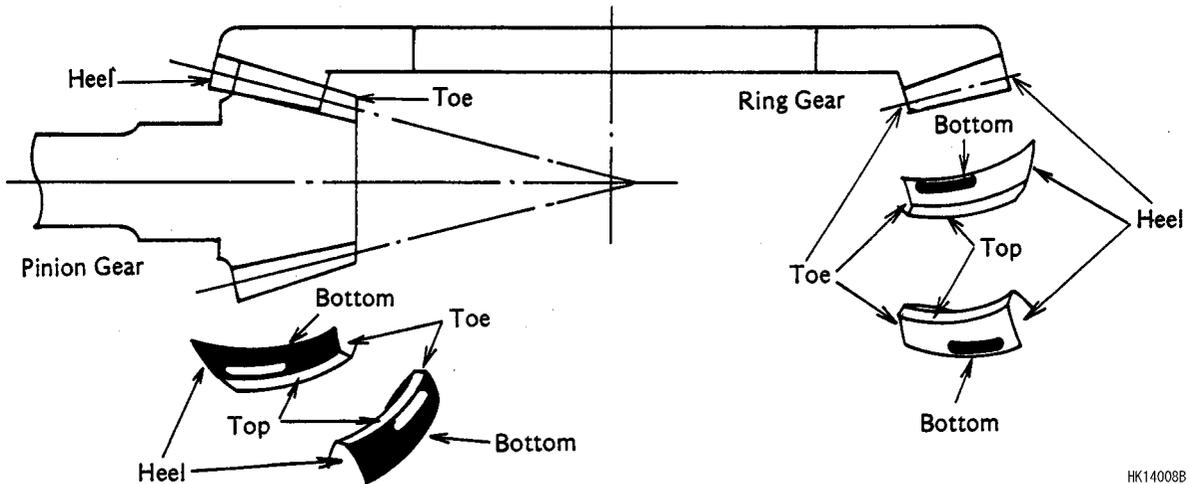


### Incorrect Tooth Contact Patterns

Example 1: Decrease the thickness of the pinion gear shim(s) by 0.05 mm (0.002 in) to correct the pattern shown below. Repeat in 0.05 mm (0.002 in) steps if necessary.



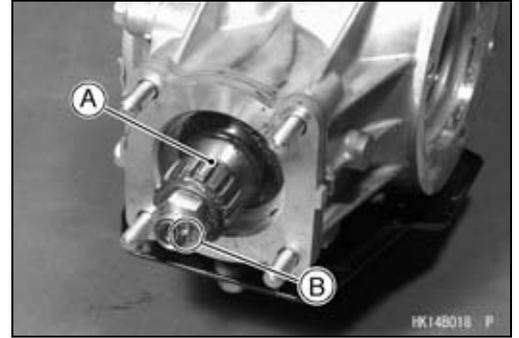
Example 2: Increase the thickness of the pinion gear shim(s) by 0.05 mm (0.002 in) to correct the pattern shown below. Repeat in 0.05 mm (0.002 in) steps if necessary.



## Final Gear Case

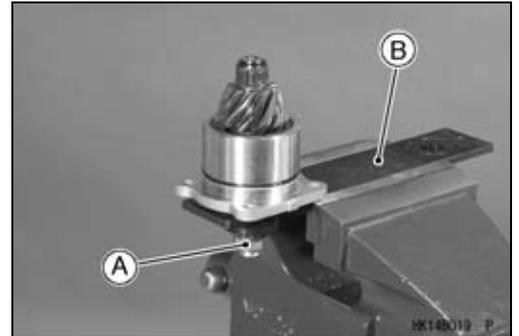
### Pinion Gear Disassembly

- Remove the final gear case (see Final Gear Case Removal).
- Pull the pinion gear assembly [A] off the final gear case. The shim(s) comes off with the assembly.
- Pry open the staking [B] of the pinion gear nut with a small chisel.



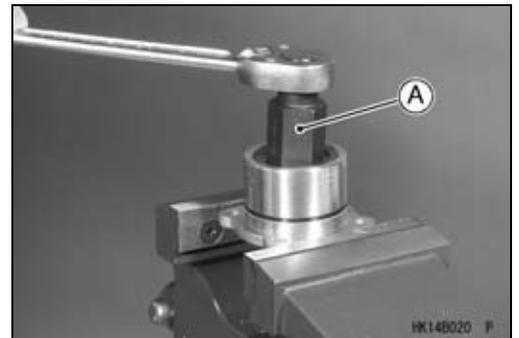
- Unscrew the pinion gear nut [A] using the bevel gear holder [B] to keep the pinion gear assembly as shown, and remove the pinion gear nut, flat washer, and pinion gear joint.

**Special Tool - Bevel Gear Holder: 57001-1193**



- Pull out the pinion gear.
- Pry the oil seal off the housing.
- To remove the bearing, unscrew the bearing retainer using the hexagon wrench [A].

**Special Tool - Hexagon Wrench, Hex 32: 57001-1194**



### Pinion Gear Assembly

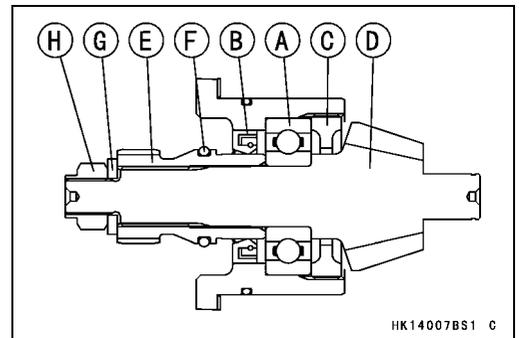
- The pinion gear and ring gear are lapped as a set by the factory to get the best tooth contact. They must be replaced as a set.
- Apply grease to the oil seal lips.
- Install the bearing [A] and oil seal [B] using the bearing driver set.

**Special Tool - Bearing Driver: 57001-1129**

- Apply a non-permanent locking agent to the bearing retainer [C] and tighten it.

**Torque - Bearing Retainer: 108 N·m (11 kgf·m, 80 ft·lb)**

- Install:
  - Pinion Gear [D]
  - Pinion Gear Joint [E]
- Apply grease to the O-ring [F].
- Install:
  - O-ring
  - Washer [G]
- Replace the pinion gear nut [H] with a new one.



## 11-30 FINAL DRIVE

### Final Gear Case

- Apply molybdenum disulfide oil the threads and seated surface of the pinion gear nut, and tighten it.

**Torque - Pinion Gear Nut: 69 N·m (7.0 kgf·m, 51 ft·lb)**

- Stake the head of the pinion gear nut with a punch, to secure the pinion gear nut in place.

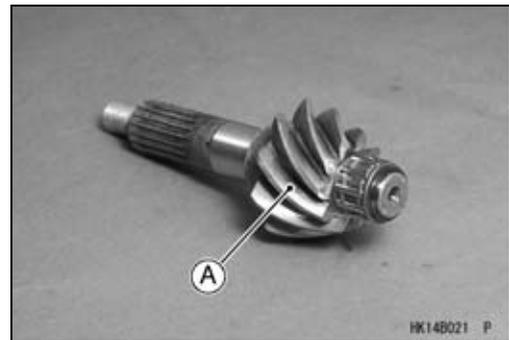
#### CAUTION

**When staking the nut, be careful not to apply shock to the pinion and bearing. Such a shock could damage the pinion and/or bearing.**

- Be sure to check and adjust the bevel gear backlash and tooth contact, when any of the parts which influence these items are replaced (see Final Bevel Gear Adjustment).

#### Bevel Gear Inspection

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.

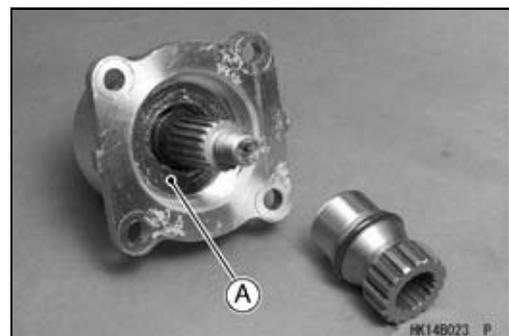


#### Ball Bearing Inspection

- Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than measurement. Clean each bearing in a high-flash point solvent, dry it (do not spin the bearing while it is dry), and oil it with engine oil.
- Spin the bearing by hand to check its condition.
- ★ If the bearing is noisy, does not spin smoothly, or has any rough spots, replace it.

#### Oil Seal Inspection

- Inspect the oil seal [A].
- ★ Replace it if the lips are misshapen, discolored (indicating that the rubber had deteriorated), hardened, or been otherwise damaged.



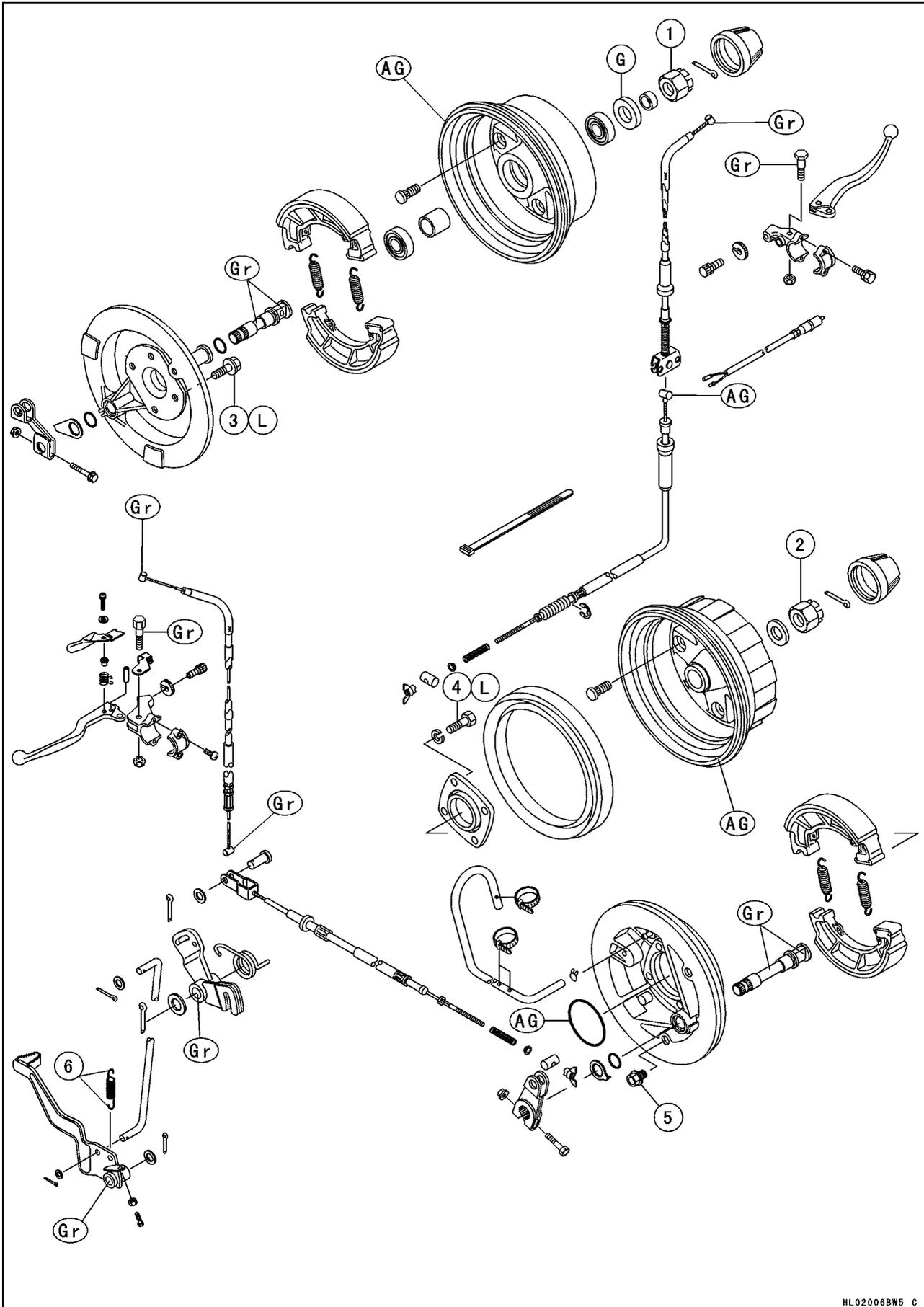
# Brakes

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# 12-2 BRAKES

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Front Axle Nuts	34	3.5	25	
2	Rear Axle Nuts	147	15	108	
3	Front Brake Panel Bolts	25	2.5	18	L
4	Rear Brake Panel Bolts	29	3.0	22	L
5	Rear Brake Drum Drain Bolt	29	3.0	22	

6: Bend both hooks after installing the spring.

AG: Apply grease (Amoco rykon premium grease No. 2 EP Green).

G: Apply grease for oil seal and O-ring.

Gr: Apply grease.

L: Apply a non-permanent locking agent.

## 12-4 BRAKES

### Specifications

Item	Standard	Service Limit
<b>Brake Adjustment</b>		
Front Brake Lever Free play	1 ~ 2 mm (0.04 ~ 0.08 in.)	— — —
Rear (Parking) Brake Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	— — —
Brake Pedal Free Play	25 ~ 35 mm (1.0 ~ 1.4 in.)	— — —
<b>Brake Drum and Panel</b>		
Brake Drum Inside Diameter:		
Front	140.000 ~ 140.160 mm (5.512 ~ 5.518 in.)	140.75 mm (5.541 in.)
Rear	160.000 ~ 160.160 mm (6.299 ~ 6.305 in.)	160.65 mm (6.325 in.)
Brake Shoe Lining Thickness	4.0 mm (0.16 in.)	2.0 mm (0.08 in.)
Brake Cam Diameter:		
Front	14.957 ~ 14.984 mm (0.589 ~ 0.590 in.)	14.88 mm (0.586 in.)
Rear	16.957 ~ 16.984 mm (0.668 ~ 0.669 in.)	16.88 mm (0.665 in.)
Brake Cam Hole Diameter:		
Front	15.00 ~ 15.06 mm (0.591 ~ 0.593 in.)	15.15 mm (0.596 in.)
Rear	17.00 ~ 17.07 mm (0.669 ~ 0.672 in.)	17.15 mm (0.675 in.)
Brake Cam Lever Angle	80 ~ 90°	— — —

## Brake Adjustment

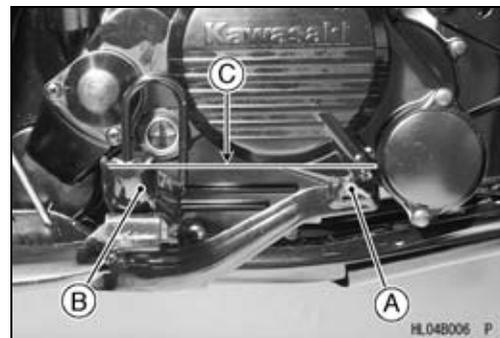
### Front Brake Adjustment

- Refer to the Front Brake Adjustment in the Periodic Maintenance chapter.

### Brake Pedal Position Inspection

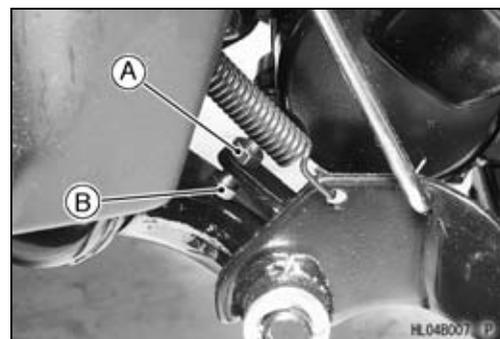
- Measure from the top center of the brake pedal [A] in its rest position to the upper surface of the right footpeg [B]. The brake pedal should be level [C] with the upper surface of the right footpeg.

**Brake Pedal Position: 0 mm (0 in.)**



### Brake Pedal Position Adjustment

- To adjust the pedal position, loosen the locknut [A], turn the adjusting bolt [B], and then tighten the locknut. Now adjust the brake pedal free play.
- After adjusting the pedal position, check the operation of the rear brake light switch (see Electrical System chapter). Then adjust the brake pedal free play.



### Rear (Parking) Brake Lever Free Play Inspection

- Refer to the Rear (Parking) Brake Lever Free Play Inspection in the Periodic Maintenance chapter.

### Brake Pedal Free Play Inspection

- Refer to the Brake Pedal Free Play Inspection in the Periodic Maintenance chapter.

### Rear (Parking) Brake Lever and Brake Pedal Free Play Adjustment

- Refer to the Rear (Parking) Brake Lever and Brake Pedal Free Play Adjustment in the Periodic Maintenance chapter.

### Cam Lever Angle Adjustment (Front and Rear)

- Remove:
  - Cam Lever Bolt [A]
  - Cam Lever [B]



## 12-6 BRAKES

---

### Brake Adjustment

---

- Mount the cam lever at a new position so that the cam lever has the proper angle when the brake is fully applied.

**Cam Lever Angle (front and rear)**

Standard:            80 ~ 90°

#### **WARNING**

**When remounting the cam, be sure that the position of the indicator on the serrated shaft is not altered. A change in cam lever angle is caused by wear of internal brake parts. Whenever the cam lever angle is adjusted, also check for drag and proper operation, taking particular note of the brake lining wear indicator position.**

**In case of doubt as to braking effectiveness, disassemble and inspect all internal brake parts. Worn parts could cause the brake to lock or fail.**

## Brake Drum and Panel

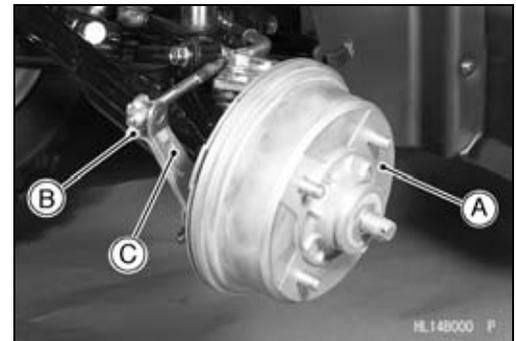
### Front Brake Panel Removal/Disassembly

#### WARNING

Brake linings contain asbestos fiber. Inhalation of asbestos may cause serious scarring of the lungs and may promote other internal injury and illness, including cancer. Observe the following precautions when handling brake linings:

1. Never blow brake lining dust with compressed air.
2. If any component are to be cleaned, wash them with detergent, then immediately discard the cleaning solution and wash your hands.
3. Do not grind any brake lining material unless a ventilation hood is available and properly used.

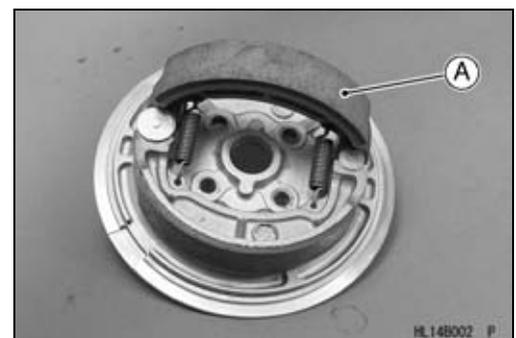
- Loosen the axle nut.
- Remove:
  - Wheel (see Wheels/Tires chapter)
  - Axle Nut
  - Brake Drum [A]
  - Brake Adjuster [B] (at the brake cam lever [C])



- Remove:
  - Brake Panel Bolts [A]
  - Brake Panel [B]



- Remove:
  - Brake Shoes [A]



## 12-8 BRAKES

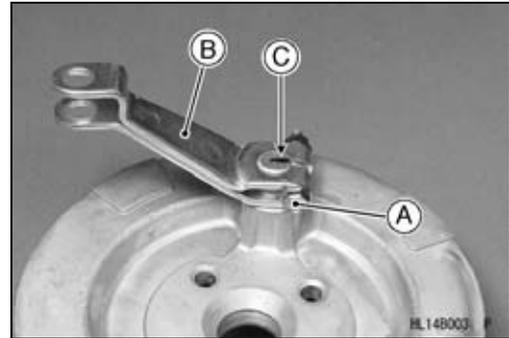
### Brake Drum and Panel

- Remove:
  - Cam Lever Bolt [A]
  - Cam Lever [B]

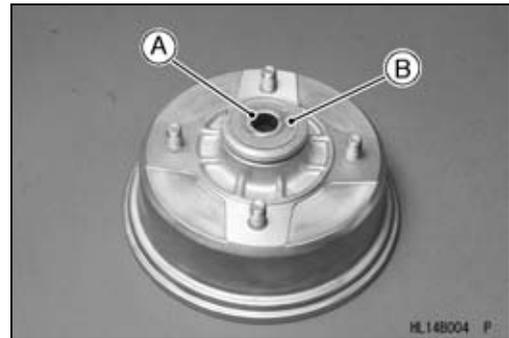
#### NOTE

○ Before removing the brake cam lever, mark [C] the position of the cam lever so that it can be installed later in the same position.

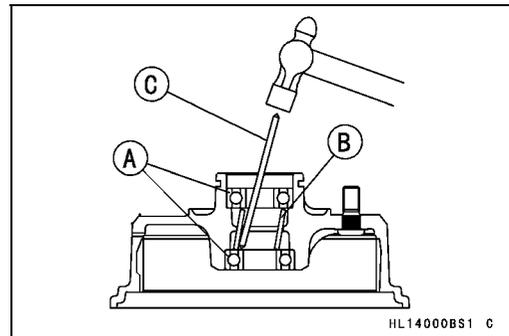
- Pull the brake cam out from the inside.



- Remove:
  - Collar [A]
  - Grease Seal [B]



- Drive out the bearings.
  - Bearings [A]
  - Collar [B]
  - Metal Rod [C]

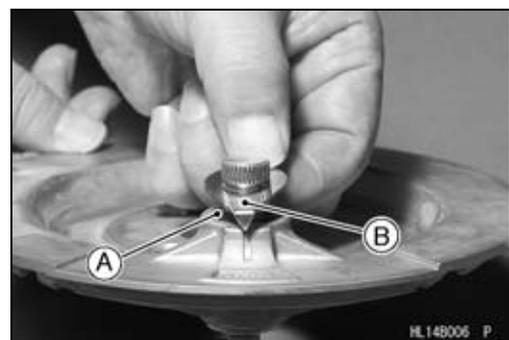
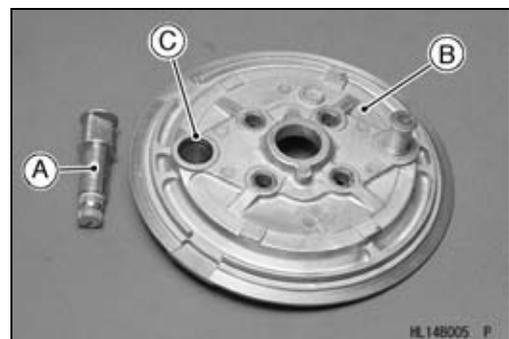


#### Front Brake Panel Assembly/Installation

#### WARNING

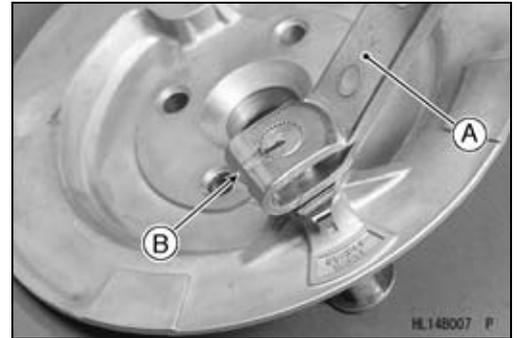
**Improper installation will cause ineffective braking, which could lead to a crash.**

- Apply grease to the brake cam [A].
- Install the following parts to the brake panel [B].
  - O-ring [C]
  - Brake Cam
- Install:
  - O-ring [A]
  - Indicator [B]



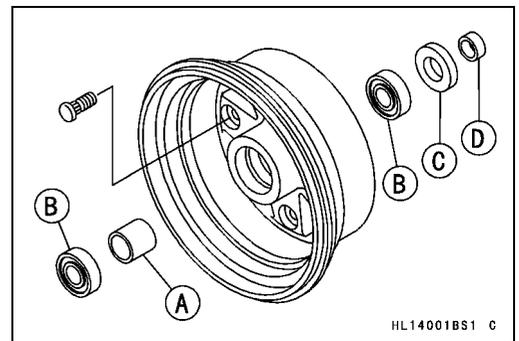
**Brake Drum and Panel**

- Fit the brake cam lever [A] so that the marks align [B].
- Install:
  - Cam Lever Bolt and Nut
  - Brake Shoes



- Install:
  - Brake Panel Assembly
- Apply a non-permanent locking agent to the brake panel bolts, and tighten them.
  - Torque - Front Brake Panel Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

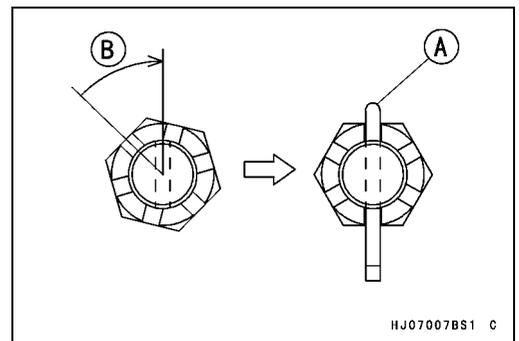
- Install:
  - Collar [A]
  - Ball Bearings [B]
  - Oil Seal [C]
  - Collar [D]
- Apply grease (Amoco rykon premium grease No.2 EP Green) to the seal lips in the drum and install the brake drum.
- Tighten:
  - Torque - Front Axle Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**



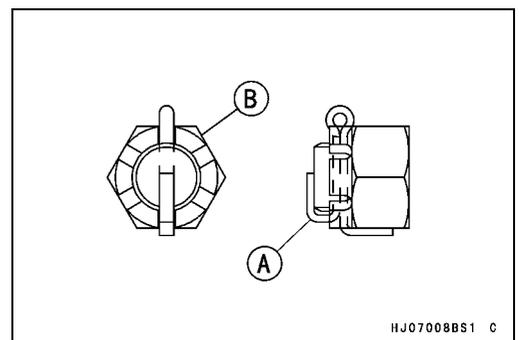
- Insert a new cotter pin [A].

**NOTE**

- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle shaft, tighten the nut clockwise [B] up to next alignment.
- It should be within 30 degree.
- Loosen once and tighten again when the slot goes past the nearest hole.



- Bend the cotter pin [A] over the nut [B].



## 12-10 BRAKES

### Brake Drum and Panel

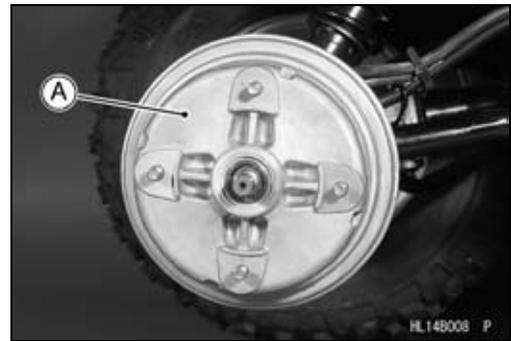
#### Rear Brake Panel Removal/Disassembly

#### WARNING

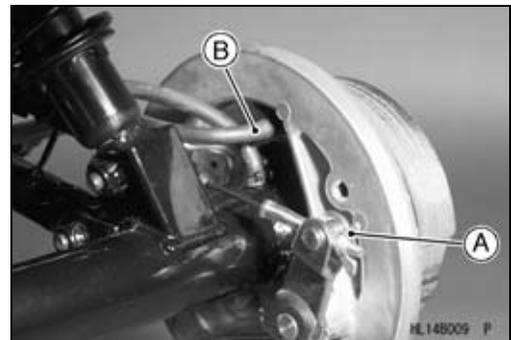
Brake linings contain asbestos fiber. Inhalation of asbestos may cause serious scarring of the lungs and may promote other internal injury and illness, including cancer. Observe the following precautions when handling brake linings:

1. Never blow brake lining dust with compressed air.
2. If any components are to be cleaned, wash them with detergent, then immediately discard the cleaning solution and wash your hands.
3. Do not grind any brake lining material unless a ventilation hood is available and properly used.

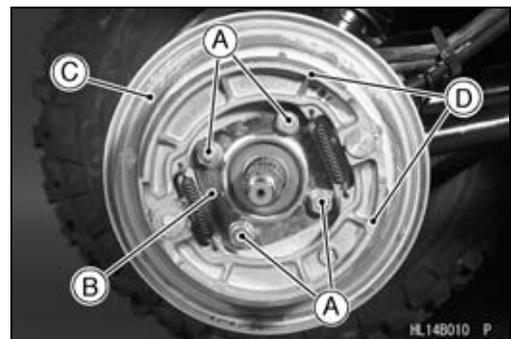
- Loosen the right rear axle nut.
- Remove:
  - Right Rear Wheel (see Wheels/Tires chapter)
  - Axle Nut
  - Brake Drum [A]



- Remove:
  - Brake Adjuster [A]
  - Breather Hose [B]



- Remove:
  - Brake Panel Bolts [A] and Washers
  - Position Plate [B]
  - Brake Panel [C]
  - Brake Shoes [D]



## Brake Drum and Panel

- Remove:
  - Cam Lever Bolt [A]
  - Cam Lever [B]

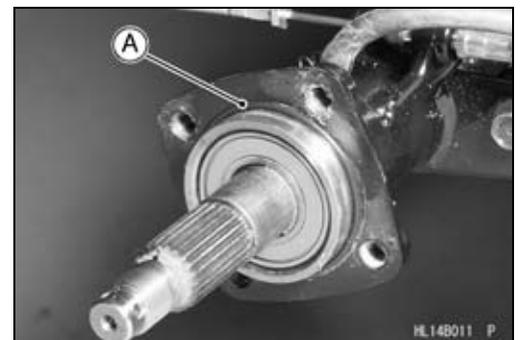
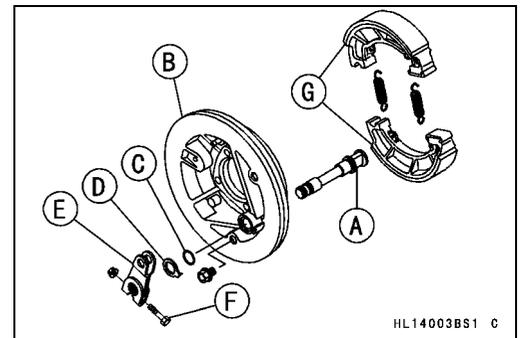
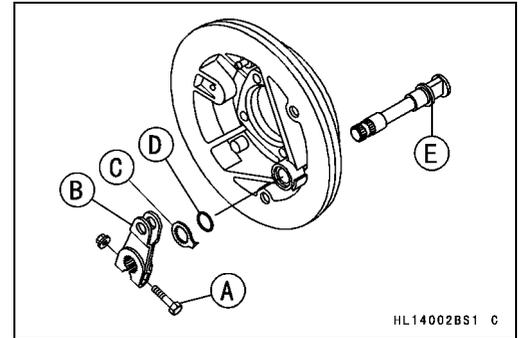
### NOTE

○ Before removing the brake cam lever, mark the position of the cam lever so that it can be installed later in the same position.

- Remove:
  - Indicator [C]
  - O-ring [D]
  - Brake Cam [E]

### Rear Brake Panel Assembly/Installation

- Apply grease to the brake cam [A].
- Install the following parts to the brake panel [B].
  - Brake Cam
  - O-ring [C]
  - Indicator [D]
- Fit the brake cam lever [E] so that the marks align.
- Install:
  - Cam Lever Bolt [F] and Nut
  - Brake Shoes [G]
- Apply grease (Amoco rykon premium grease No.2 EP Green) to the O-ring [A] and install it.



- Install:
  - Brake Panel Assembly
- Apply a non-permanent locking agent to the brake panel bolts, and tighten them.

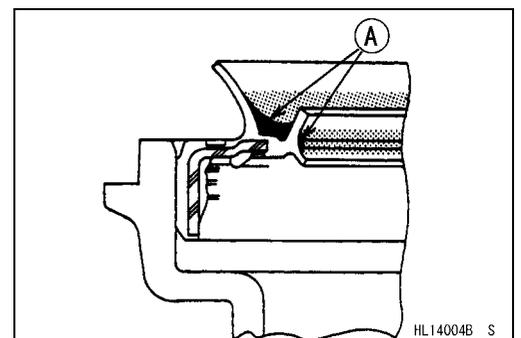
**Torque - Rear Brake Panel Bolts: 29 N·m (3.0 kgf·m, 22 ft·lb)**

- Apply grease (Amoco rykon premium grease No.2 EP Green) to the seal lips [A] in the drum seal.

- Install:
  - Brake Drum
  - Washer

- Tighten:

**Torque - Rear Axle Nut: 147 N·m (15 kgf·m, 108 ft·lb)**



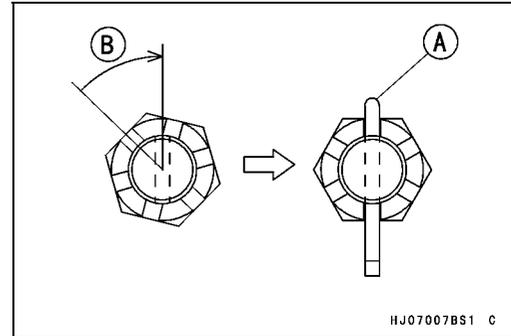
## 12-12 BRAKES

### Brake Drum and Panel

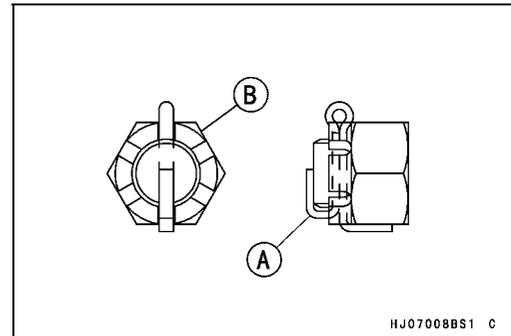
- Insert a new cotter pin [A].

#### NOTE

- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle shaft, tighten the nut clockwise [B] up to next alignment.
- It should be within 30 degree.
- Loosen once and tighten again when the slot goes past the nearest hole.



- Bend the cotter pin [A] over the nut [B].

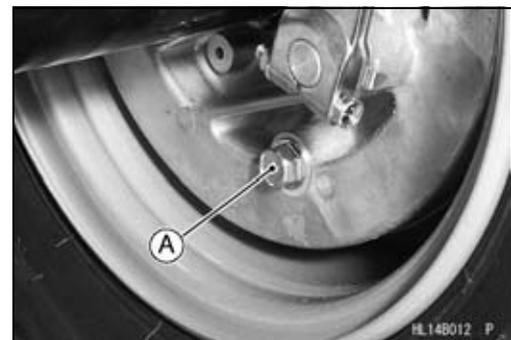


#### Brake Drum Seal Wear

Whenever the braking efficiency of the rear brake panel has decreased perform the following.

- ★ Remove the drain bolt [A] at the bottom of the rear brake panel and check to see if any water comes out.
  - ★ If any water drains, the rear brake drum seal is damaged and must be immediately replaced. Also, inspect the other brake parts.
- Tighten:

**Torque - Rear Brake Drum Drain Bolt: 29 N·m (3.0 kgf·m, 22 ft·lb)**



## Brake Maintenance

### Brake Drum Wear

- Measure the inside diameter [A] of the drum at several points.

#### Front Brake Drum Inside Diameter

**Standard:** 140.000 ~ 140.160 mm (5.512 ~ 5.518 in.)

**Service Limit:** 140.75 mm (5.541 in.)

#### Rear Brake Drum Inside Diameter

**Standard:** 160.000 ~ 160.160 mm (6.299 ~ 6.305 in.)

**Service Limit:** 160.65 mm (6.325 in.)

- ★ If any measurement is greater than the service limit, replace the drum.
- ★ If the drum is worn unevenly or scored, lightly turn the drum on a brake drum lather or replace it. Do not turn the drum beyond the service limit.

### Brake Shoe Lining Wear

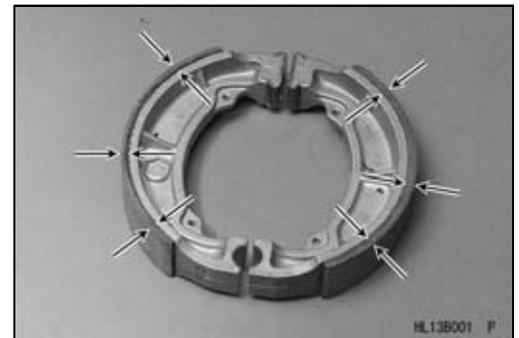
- Measure the lining thickness at several points; as shown.

#### Brake Shoe Lining Thickness (Front and Rear)

**Standard:** 4.0 mm (0.16 in.)

**Service Limit:** 2.0 mm (0.08 in.)

- ★ If any measurement is less than the service limit, replace both shoes as a set.
- ★ If the lining thickness is greater than the service limit, do the following before installing the shoes.
  - File or sand down any high spots on the surface of the lining.
  - Use a wire brush to remove any foreign particles from the lining.
  - Wash off any oil or grease with an oilless solvent.



### CAUTION

**Do not use a solvent which will leave an oily residue or the shoes will have to be replaced.**

## 12-14 BRAKES

### Brake Maintenance

#### *Brake Cam and Cam Hole Wear*

- Measure the brake cam diameter [A].

#### **Brake Cam Diameter**

##### **Front:**

**Standard:** 14.957 ~ 14.984 mm  
(0.589 ~ 0.590 in.)

**Service Limit:** 14.88 mm (0.586 in.)

##### **Rear:**

**Standard:** 16.957 ~ 16.984 mm  
(0.668 ~ 0.669 in.)

**Service Limit:** 16.88 mm (0.665 in.)

- ★ If the brake cam wear is less than the service limit, replace the brake cam.

- Measure the inside diameter [B] of the cam hole.

#### **Cam Hole Inside Diameter**

##### **Front:**

**Standard:** 15.00 ~ 15.06 mm  
(0.591 ~ 0.593 in.)

**Service Limit:** 15.15 mm (0.596 in.)

##### **Rear:**

**Standard:** (0.669 ~ 0.672 in.)  
17.00 ~ 17.07 mm

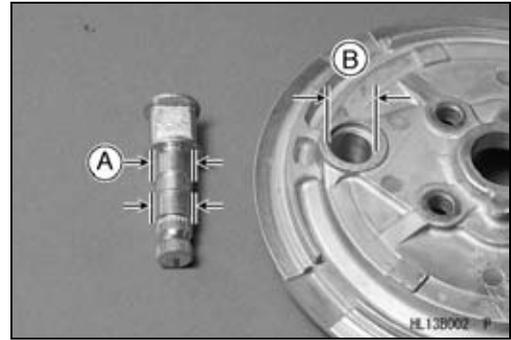
**Service Limit:** 17.15 mm (0.675 in.)

- ★ If the cam hole wear is more than the service limit, replace the brake panel.

#### *Brake Shoe Spring Inspection*

- Visually inspect the brake shoe springs for breaks or distortion.

- ★ If the springs are damaged in any way, replace them.



## Brake Maintenance

### Brake Lubrication

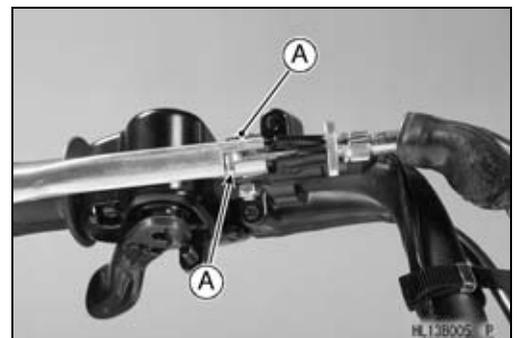
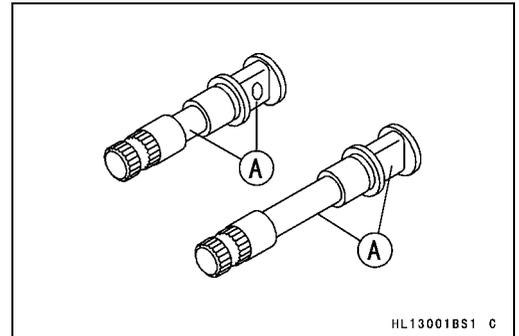
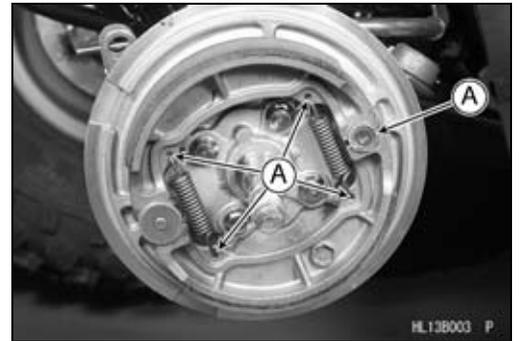
Whenever the brake is disassembled, and in accordance with the Periodic Maintenance Chart, perform the following.

- Clean all old grease out of the brake parts with a cloth.

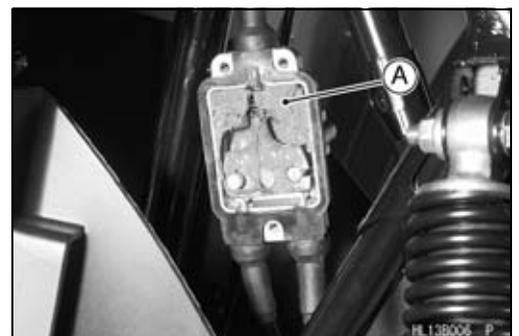
### NOTE

○Do not get any grease on the brake shoe linings, and wipe off any excess grease so that it does not get on the linings or drum after brake assembly.

- Apply high-temperature grease [A] to the following:
  - Brake Shoe Anchor Pin
  - Spring Ends
  - Cam Surfaces
  - Brake Cam Groove
  - Brake Pedal Pivot
  - Front and Parking Brake Lever Pivot



- Fill box with grease (Amoco rykon premium grease No. 2 EP Green) [A] after cables are installed.

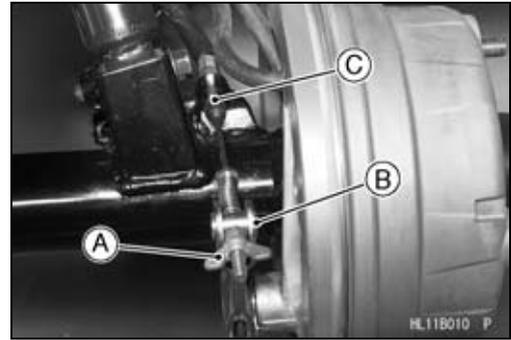


## 12-16 BRAKES

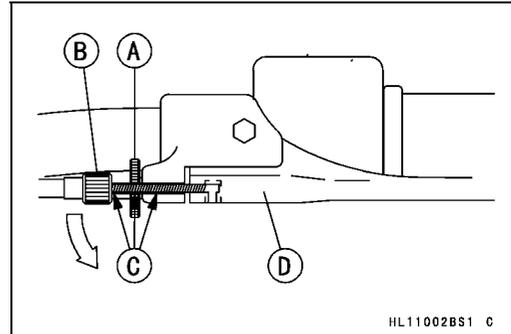
### Brake Pedal and Cables

#### Brake Cable Removal

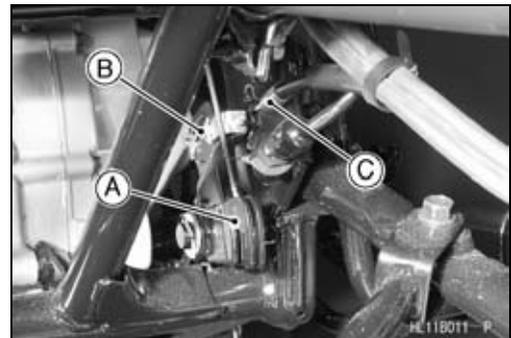
- Unscrew the adjusters [A] at the rear ends of the cables, and pull the cables out of the joints [B] and cable mounts [C].



- Loosen the knurled locknut [A] at the rear brake lever and screw in the adjuster [B].
- Line up the slots [C] in the brake lever, knurled locknut, and adjuster, and then free the cable from the lever [D].
- Remove the brake lever cable from the frame.



- Remove:
  - Rear Brake Lever Cable Rear End [A]
  - Cotter Pin, Washer and Pin [B]
  - Brake Pedal Cable Mount [C]



#### Brake Cable Installation

- Grease the brake cable.
- Replace the cotter pin with a new one.
- Run the brake cables according to the Cable, Wire, and Hose Routing section in Appendix chapter.
- Adjust the brake pedal and rear brake lever.

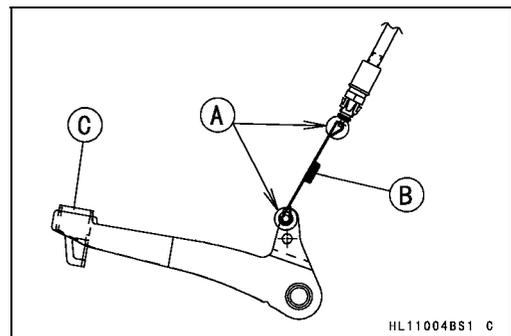
#### Brake Cable Lubrication

Whenever the brake cable is removed, lubricate the cable as follows:

- Lubricate the cable with a penetrating rust inhibitor.

#### Brake Pedal Installation

- Bend both side hooks [A] of switch spring [B] after installing the spring.  
[C] Brake Pedal



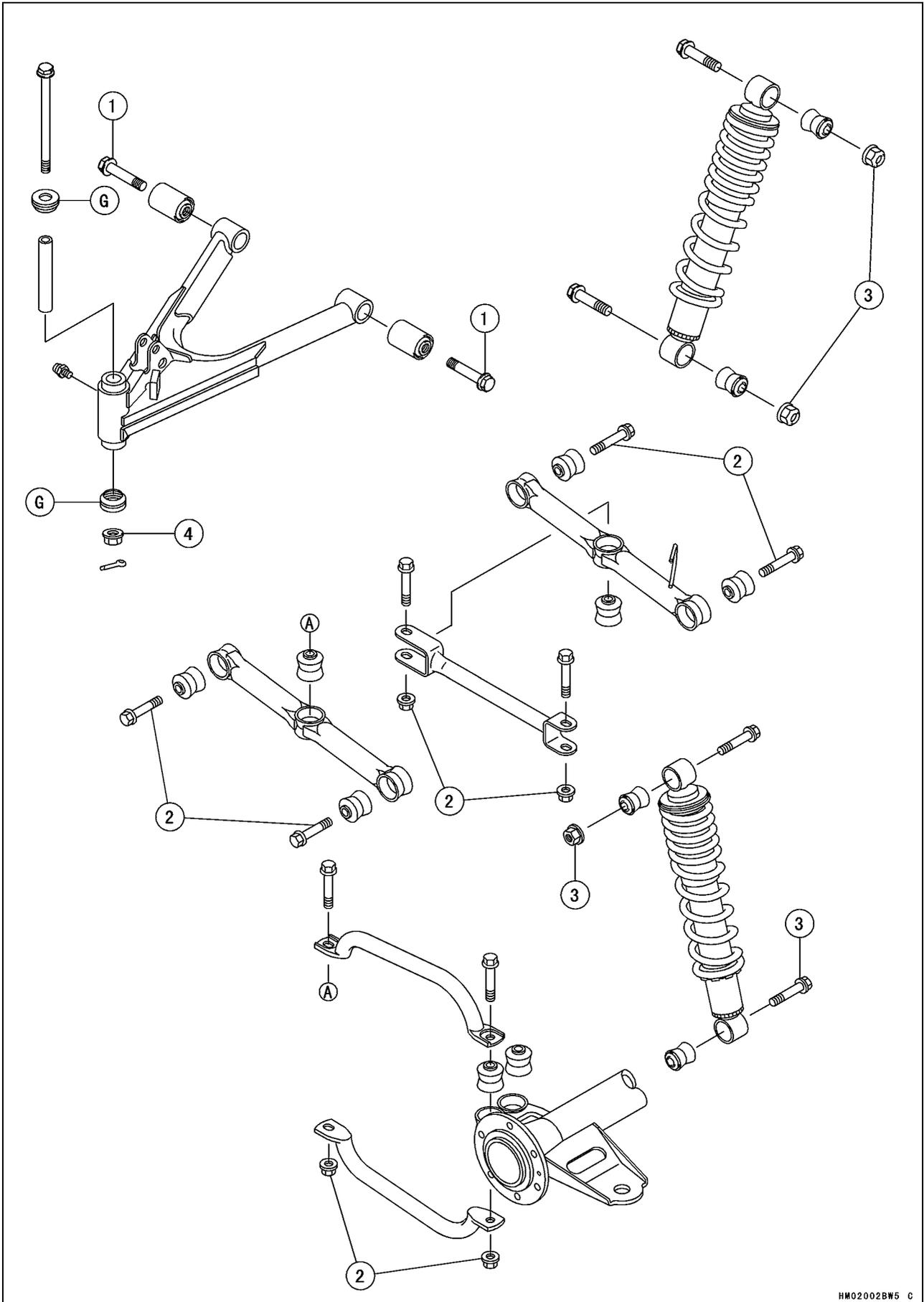
# Suspension

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# 13-2 SUSPENSION

## Exploded View



**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Front Suspension Arm Pivot Bolts	88	9.0	65	
2	Rear Suspension Arm Pivot Bolts and Nuts	34	3.5	25	
3	Shock Absorber Mounting Bolts and Nuts	34	3.5	25	
4	Steering Knuckle Pivot Nuts	39	4.0	29	

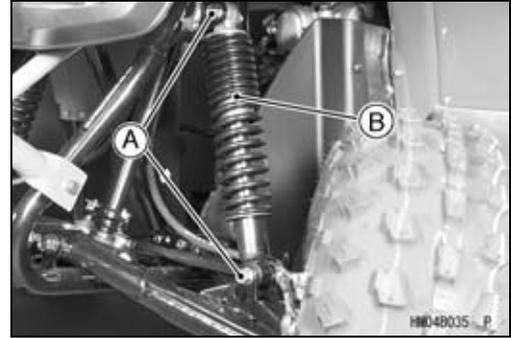
G: Apply grease for oil seal and O-ring.

## 13-4 SUSPENSION

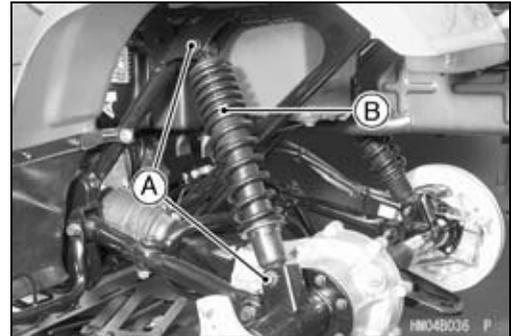
### Shock Absorbers

#### Shock Absorber Removal

- Remove:
  - Front Wheels (see Wheels/Tires chapter)
  - Shock Absorber Mounting Bolts [A] and Nuts
  - Front Shock Absorber [B]



- Remove:
  - Rear Wheels (see Wheels/Tires chapter)
  - Shock Absorber Mounting Bolts [A] and Nuts
  - Rear Shock Absorber [B]



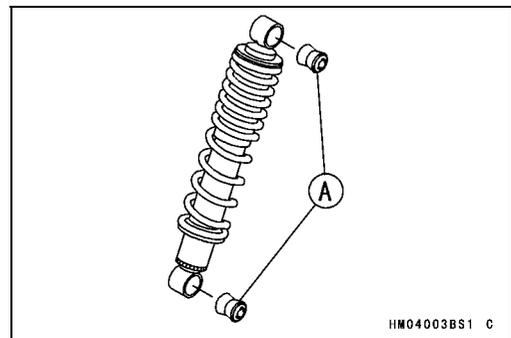
#### Rear Shock Absorber Installation

- Install:
  - Front Shock Absorber
  - Rear Shock Absorber
  - Shock Absorber Mounting Bolts and Nuts
- Install the shock absorber so that the closed coil end of the spring faces upward.
- Tighten:
  - Torque - Shock Absorber Mounting Bolts and Nuts:**  
**34 N·m (3.5 kgf·m, 25 ft·lb)**

#### Rear Shock Absorber Inspection

Since the shock absorbers are sealed units which cannot be disassembled, only external checks are necessary.

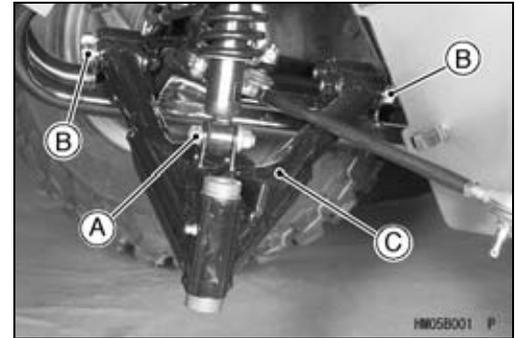
- ★ If one unit is damaged, replace both shock absorbers as a set. If only one unit is replaced and the two are not balanced, vehicle instability at high speed may result.
- Check the rubber bushings [A] in the upper and lower pivots.
- ★ If bushings are worn, cracked, hardened, or otherwise damaged, replace them.



## Suspension Arms

### Front Suspension Arm Removal

- Remove:
  - Front Wheel (see Wheels/Tires chapter)
  - Front Brake Panel Assembly (see Brakes chapter)
  - Steering Knuckle Joint (see Steering chapter)
  - Lower Front Shock Absorber mounting Bolt [A]
  - Suspension Arm Pivot Bolts [B]
  - Front Suspension Arm [C]

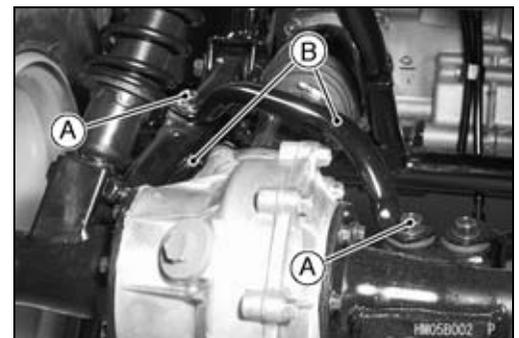


### Front Suspension Arm Installation

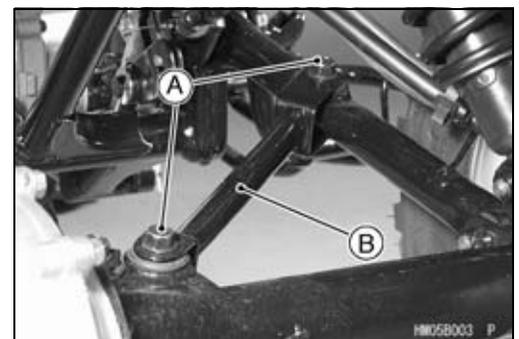
- Tighten:
  - Torque - Front Suspension Arm Pivot Bolts: 88 N·m (9.0 kgf·m, 65 ft·lb)**

### Rear Suspension Arm Removal

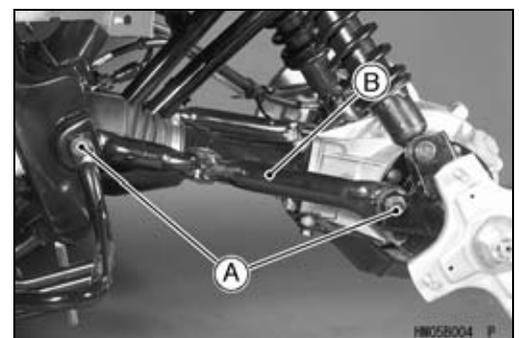
- Remove:
  - Suspension Arm Pivot Bolts [A]
  - Center Arms [B] (Left Side)



- Remove:
  - Suspension Arm Pivot Bolts [A]
  - Center Arm [B] (Right Side)



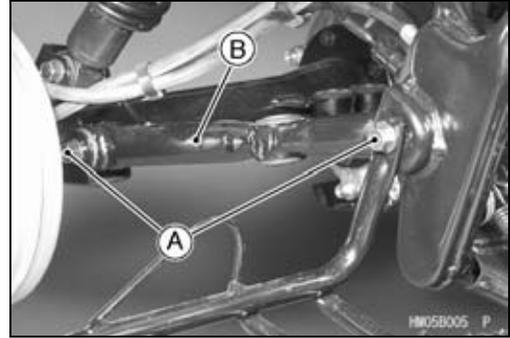
- Remove:
  - Rear Wheels (see Wheels/Tires chapter)
  - Rear Flaps (see Frame chapter)
  - Suspension Arm Pivot Bolts [A]
  - Left Arm [B]



## 13-6 SUSPENSION

### Suspension Arms

- Remove:
  - Suspension Arm Pivot Bolts [A]
  - Right Arm [B]

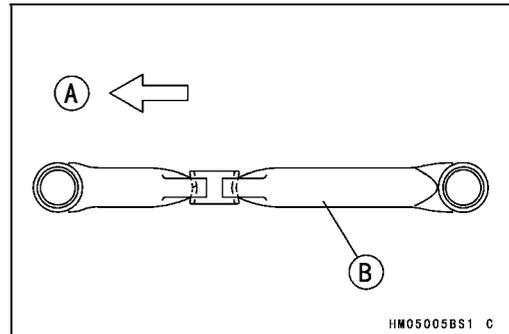


#### Rear Suspension Arm Installation

- Install the left and right arms as shown.
  - [A] Front Side
  - [B] Left Arm

○The right arm has a clamp.

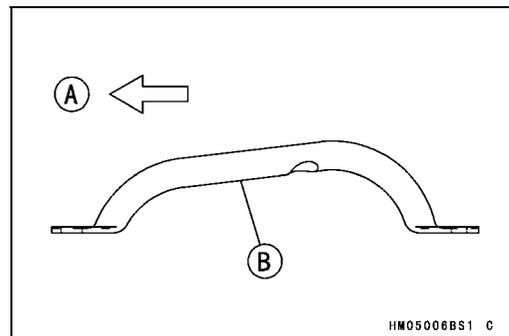
- Tighten:
  - Torque - Rear Suspension Arm Pivot Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**



- Install the center arm as shown.

[A] Front Side  
[B] Center Arm (Left Side)

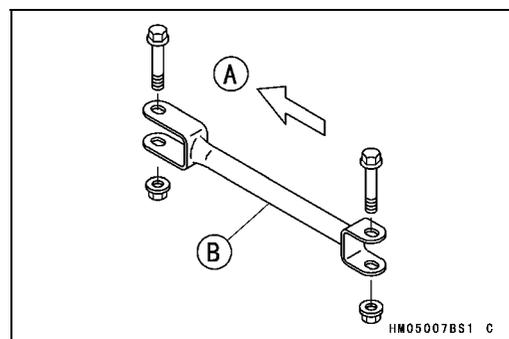
- Tighten:
  - Torque - Rear Suspension Arm Pivot Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**



- Install the center arm as shown.

[A] Front Side  
[B] Center Arm (Right Side)

- Tighten:
  - Torque - Rear Suspension Arm Pivot Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**



#### Suspension Arm Assembly

- When installing the rubber bushings into the arm, lubricate the outer surface of the bushings with a soap and water solution.

#### CAUTION

**Do not lubricate the rubber bushings with engine oil or petroleum distillates because they will deteriorate the rubbers.**

## Suspension Arms

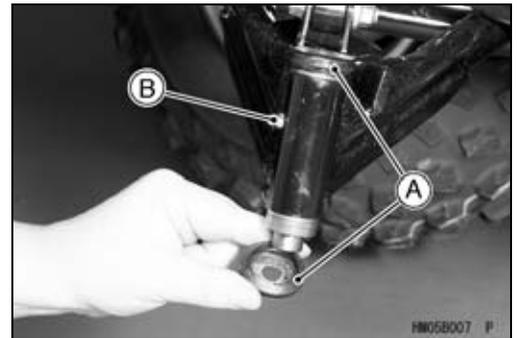
### *Suspension Arm Inspection*

- Move the suspension arm [A] up and down [B] to check for abnormal friction.
- ★ If abnormal is felt, the rubber bushings may be damaged. Remove the suspension arm to check for rubber bushing damage.
- Check the rubber bushings in the pivots.
- ★ Replace any bushings that are worn, cracked, hardened, or otherwise damaged.



### *Front Suspension Arm Lubrication*

- Fill inside of oil seals [A] with grease.
- Force molybdenum disulfide grease into the nipple [B], and wipe off any excess grease (see Steering Knuckle Pivot Lubrication section in Steering chapter).





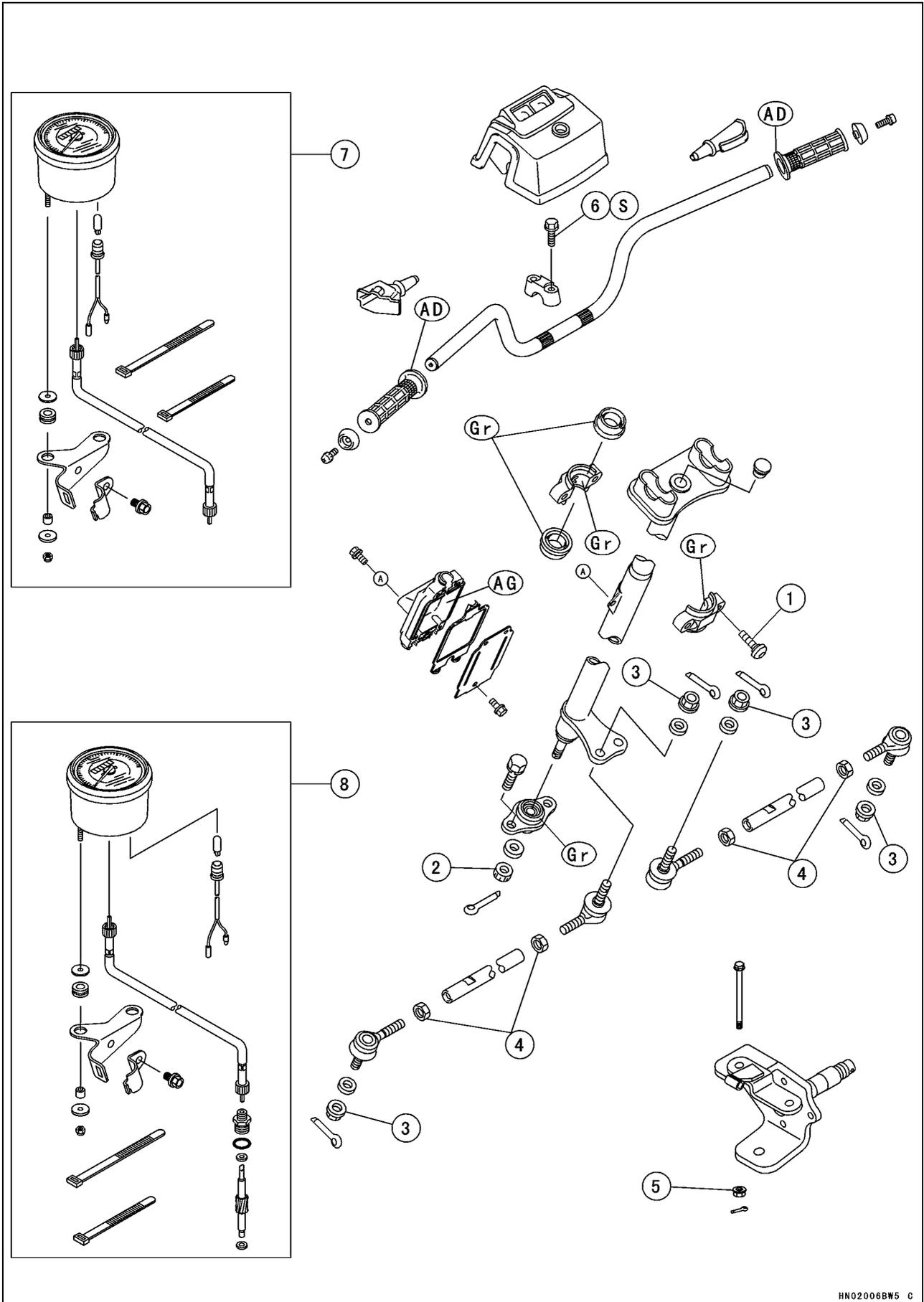
# Steering

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# 14-2 STEERING

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Steering Stem Clamp Allen Bolts	26	2.7	20	
2	Stem Bottom End Nut	29	3.0	22	
3	Tie-rod End Nuts	41	4.2	30	
4	Tie-rod Adjusting Sleeve Locknuts	26	2.7	20	
5	Steering Knuckle Arm Pivot Nuts	39	4.0	29	
6	Handlebar Holder Bolts	20	2.0	14	S

7: Europe and Australia Models

8: Optional Parts for U.S.A., Canada and United Kingdom Models

AD: Apply adhesive agent.

AG: Apply grease (Amoco rykon premium grease No. 2 EP Green).

Gr: Apply grease.

S: Follow the specific tightening sequence.

# 14-4 STEERING

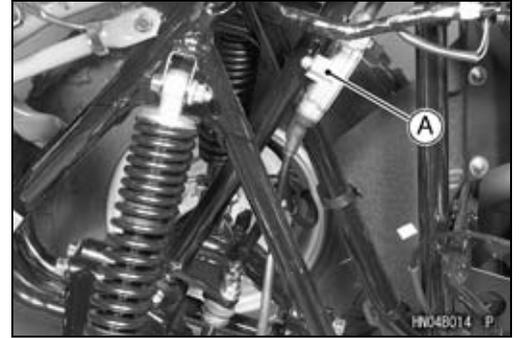
## Specifications

Item	Standard	Service Limit
Tie-rods: Tie-rod Lengths	288 mm (11.3 in.)	- - -

## Steering

### Steering Stem Removal

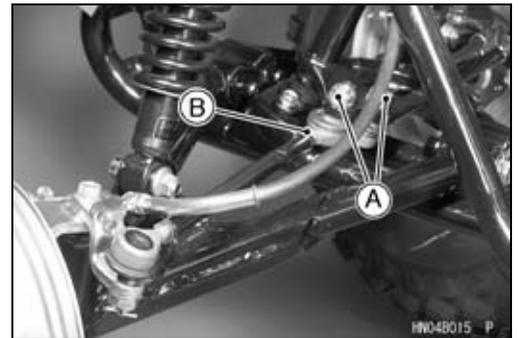
- Remove:
  - Front Fender (see Frame chapter)
  - Fuel Tank (see Fuel System chapter)
  - Front Brake Cable Equalizer [A]
  - Handlebar (see Handlebar Removal)



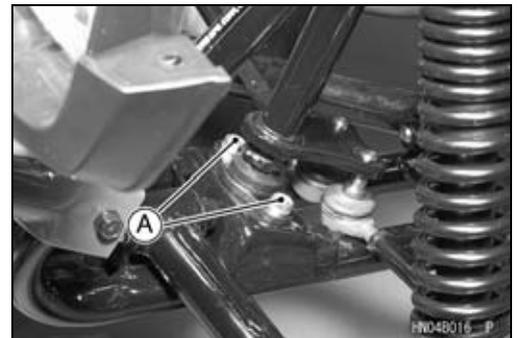
- Remove:
  - Tie-rod End Nuts [A]

**CAUTION**

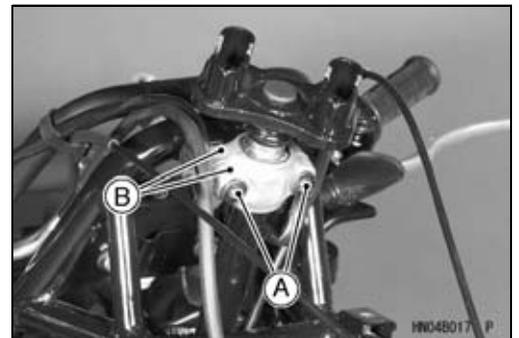
**Do not loosen the locknuts [B] at the ends of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.**



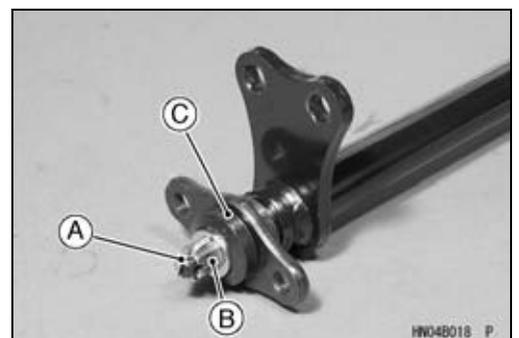
- Remove:
  - Bearing Housing Mounting Bolts [A]



- Remove:
  - Steering Clamp Bolts [A]
  - Steering Clamps [B]



- Pull the steering stem out of the frame.
- Remove:
  - Cotter Pin [A]
  - Stem Bottom End Nut [B]
  - Collar
  - Steering Stem Bearing [C]



## 14-6 STEERING

### Steering

#### Steering Stem Installation

- Lubricate the stem bearing [A] (see Steering Lubrication).
  - Install:
    - Steering Stem Bearing
    - Collar [B]
    - Stem Bottom End Nut [C]
  - Tighten:
    - Torque - Stem Bottom End Nut: 29 N·m (3.0 kgf·m, 22 ft·lb)**
  - Install:
    - Cotter Pin [D]
- 
- Lubricate the steering stem clamps [A] and grease seal [B] (see Steering Lubrication).
  - Install the grease seals.
  - Install the steering stem clamps so that the ribs on both grease seals fit into the grooves [C] on the steering stem clamps.
- 
- Align the marks [A] on the steering stem clamps at right side.
  - Tighten:
    - Torque - Steering Stem Clamp Allen Bolts: 26 N·m (2.7 kgf·m, 20 ft·lb)**
    - Tie-rod End Nuts: 41 N·m (4.2 kgf·m, 30 ft·lb)**
  - Inspect the following and adjust them, if necessary.
    - Toe-in (see Wheels/Tires chapter)
    - Front Brake Cable (see Brakes chapter)

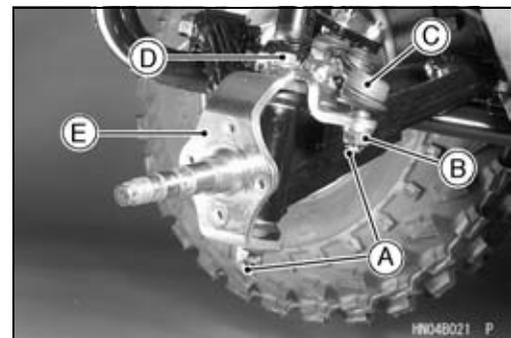
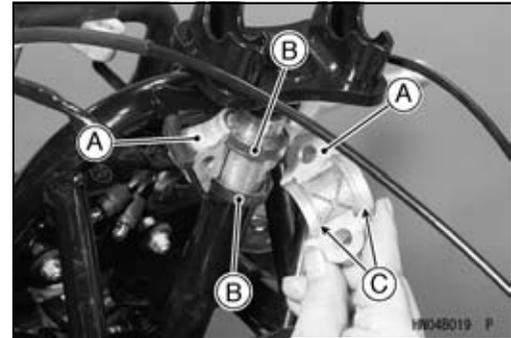
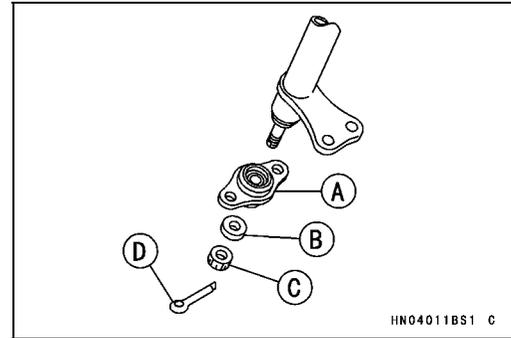
#### Steering Knuckle Removal

- Remove:
  - Front Brake Panel (see Brakes chapter)
  - Brake Cable
  - Cotter Pin [A]
  - Tie-rod End Nut [B] and Tie-rod End [C]

#### CAUTION

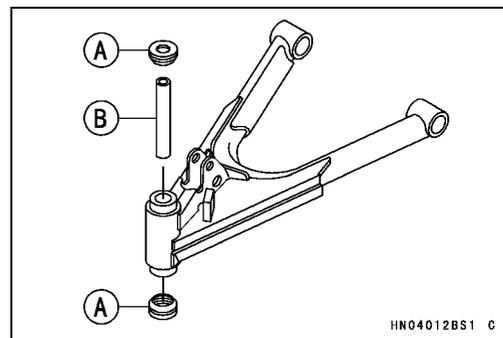
**Do not loosen the locknuts at the ends of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.**

- Remove:
  - Steering Knuckle Pivot Bolt [D] and Nut
  - Steering Knuckle [E]



**Steering**

- Remove:
  - Grease Seals [A]
  - Sleeve [B]

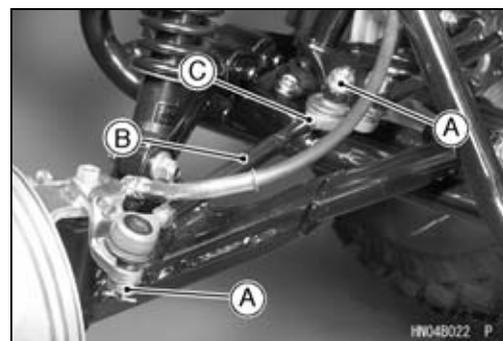


*Steering Knuckle Installation*

- Tighten:
  - Torque - Steering Knuckle Pivot Nut: 39 N·m (4.0 kgf·m, 29 ft·lb)
  - Tie-rod End Nut: 41 N·m (4.2 kgf·m, 30 ft·lb)

*Tie-rod Removal*

- Remove:
  - Cotter Pin and Tie-rod End Nuts [A]
  - Tie-rod [B]

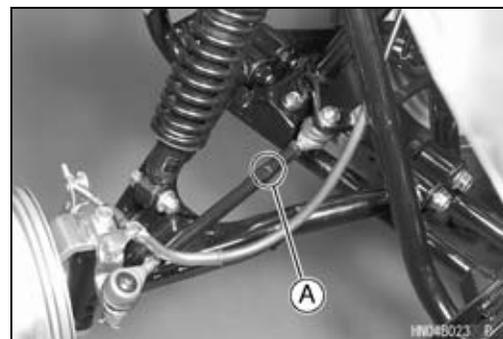


**CAUTION**

**When removing the tie-rod, be careful not to bend it. Do not loosen the locknuts [C] at the end of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.**

*Tie-rod Installation*

- The right and left tie-rods are identical.
- Install the tie-rod with the flattened area [A] located in-board.
- Tighten:
  - Torque - Tie-rod End Nuts: 41 N·m (4.2 kgf·m, 30 ft·lb)
- Inspect the toe-in if necessary (see Wheels/Tires chapter).

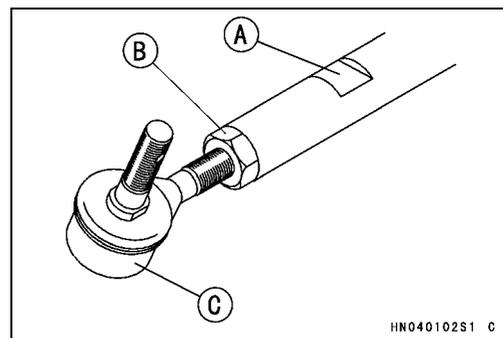


*Tie-rod End Removal*

- Remove the tie-rod (see Tie-rod Removal).
- Holding the tie-rod flattened area [A], loosen the locknut [B] and unscrews the tie-rod end [C].

**NOTE**

○The locknut on the opposite end of the tie-rod from the flattened area has left-hand threads. Turn the wrench clockwise for loosening.



**CAUTION**

**Do not remove the grease seal. It is packed with grease.**

## 14-8 STEERING

### Steering

#### *Tie-rod End Installation*

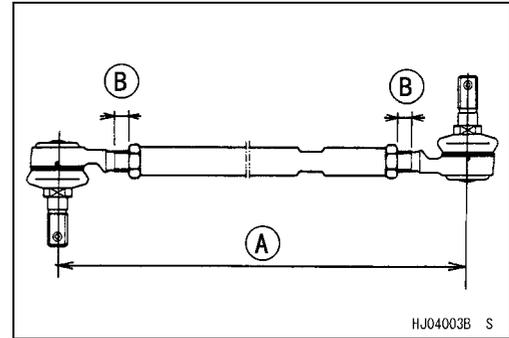
- Inspect the tie-rod end (see Tie-rod End Inspection).
- Install the tie-rod ends so that the tie-rod has the correct length [A], and the both visible thread length [B] make equal.

#### **Tie-rod Length**

**Standard: 288 mm (11.3 in)**

- Tighten:

**Torque - Tie-rod Adjusting Sleeve Locknuts: 26 N·m (2.7 kgf·m, 20 ft·lb)**



## Steering Maintenance

### Steering Inspection

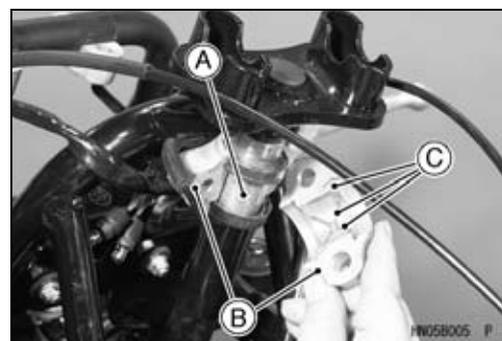
- Refer to the Steering Inspection in the Periodic Maintenance chapter.

### Steering Stem Warp

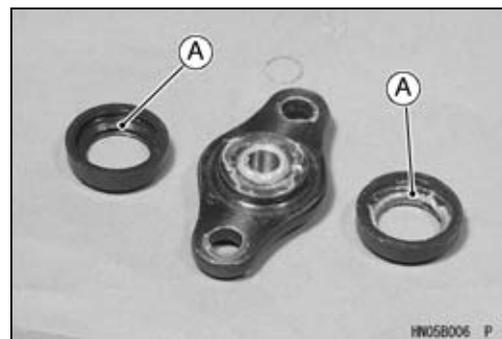
- Remove the steering stem (see Steering Stem Removal).
- Check the steering stem for straightness.
  - Use a straightedge along the stem.
- ★ If the steering stem is bent, replace the steering stem.

### Steering Lubrication

- Lubricate the steering stem clamps.
  - Remove the steering stem (see Steering Stem Removal).
  - Wipe all the old grease off the steering stem and clamps, and out of the grease seals.
  - Apply Amoco Rykon Premium Grease No. 2 EP (Green) to the steering stem [A], grease seal lips and mating surface [B] of the clamp, and pack the grooves [C] in the clamp with grease.

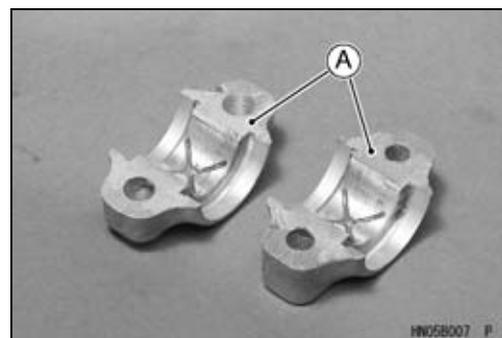


- Lubricate the steering stem bearing.
  - Disassemble the steering stem bearing.
  - Wipe all the old grease off the steering stem and out of bearing grease seal.
  - Pack the grease seal grooves [A] between the lips with grease.



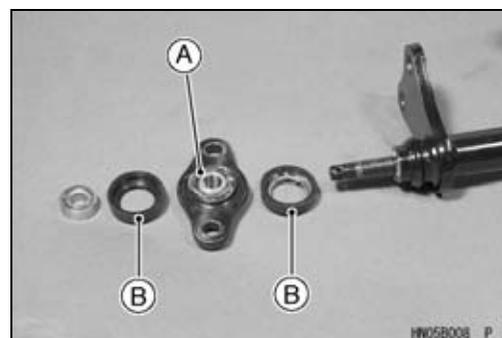
### Steering Stem Clamp Inspection

- Inspect the steering stem clamps [A].
- ★ If roughness, excessive play, or seizure is found, replace both clamps.



### Steering Stem Bearing Inspection

- Inspect the spherical bearing [A].
- ★ If roughness, excessive play, or seizure is found, replace the steering stem bearing assembly.
- Inspect the upper and lower grease seals [B].
- ★ If damage, wear or deterioration is found, replace the steering stem bearing assembly.

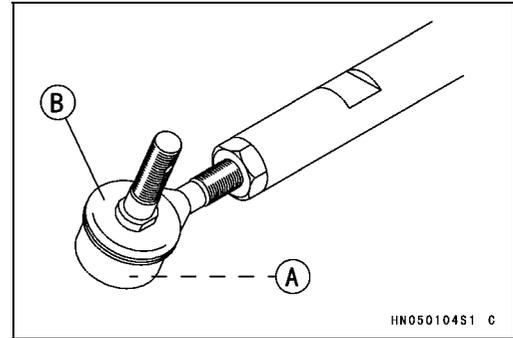


## 14-10 STEERING

### Steering Maintenance

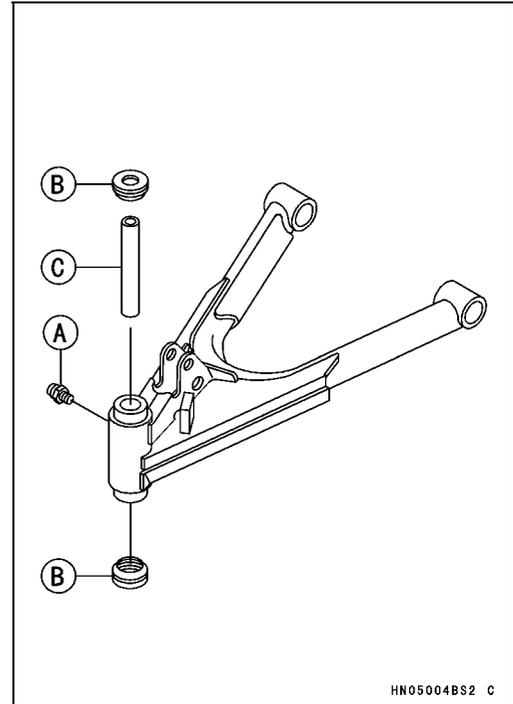
#### *Tie-rod End Inspection*

- Inspect each spherical bearing [A].
- ★ If roughness, excessive play, or seizure is found, replace the tie-rod end.
- Inspect each grease seal [B].
- ★ If damage, wear or deterioration is found, replace the tie-rod end.



#### *Steering Knuckle Pivot Lubrication*

- Lubricate the knuckle pivot in the suspension arm through the grease nipple [A] with a grease gun according to Periodic Maintenance Chart in Appendix chapter.
- It is normal for a small amount of grease to seep out around the grease seals [B].
- ★ If the knuckle pivot is disassembled, lubricate the pivot as follows.
- Wipe all the old grease off the knuckle bushing sleeve [C], and grease seals.
- Grease the knuckle bushing sleeve, and grease seal lips.



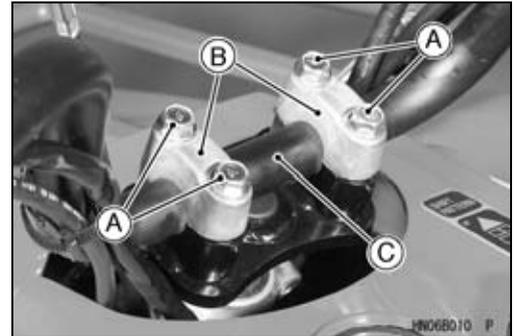
## Handlebar

### Handlebar Removal

- Remove:
  - Handlebar Cover [A]
  - Throttle Case
  - Front Brake Lever
  - Left-hand Switch Housing
  - Rear Brake Lever



- Remove:
  - Handlebar Holder Bolts [A]
  - Handlebar Holders [B]
  - Handlebar [C]

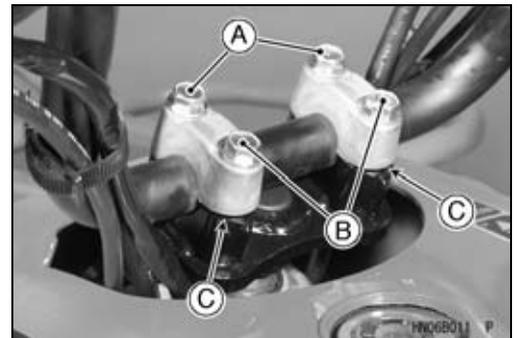


### Handlebar Installation

- Tighten the holder front bolts [A] first and then the rear bolts [B].

**Torque - Handlebar Holder Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)**

- If the holder is correctly installed, there will be even gaps [C] at the rear part of the holder after tightening.





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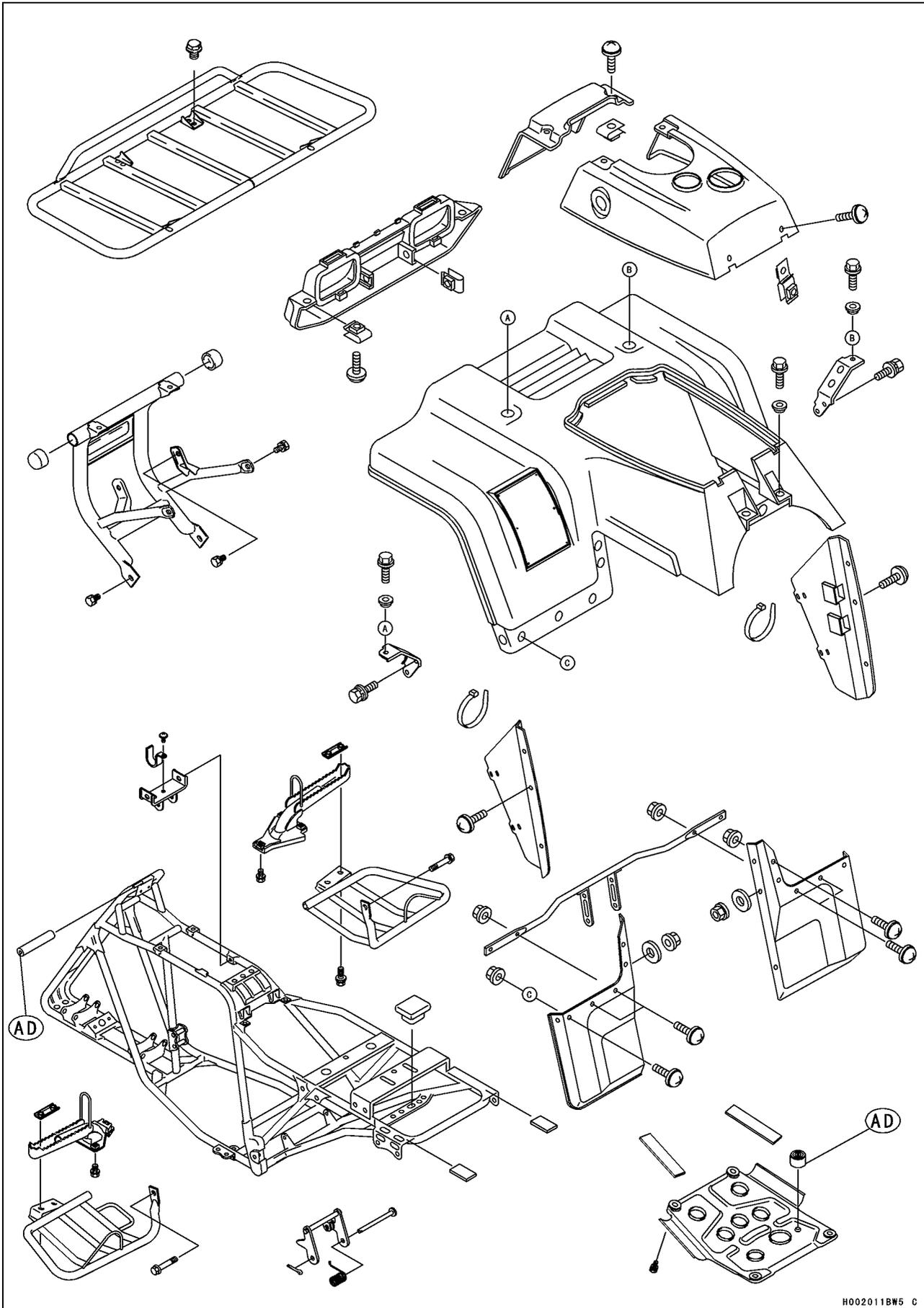
# Frame

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# 15-2 FRAME

## Exploded View



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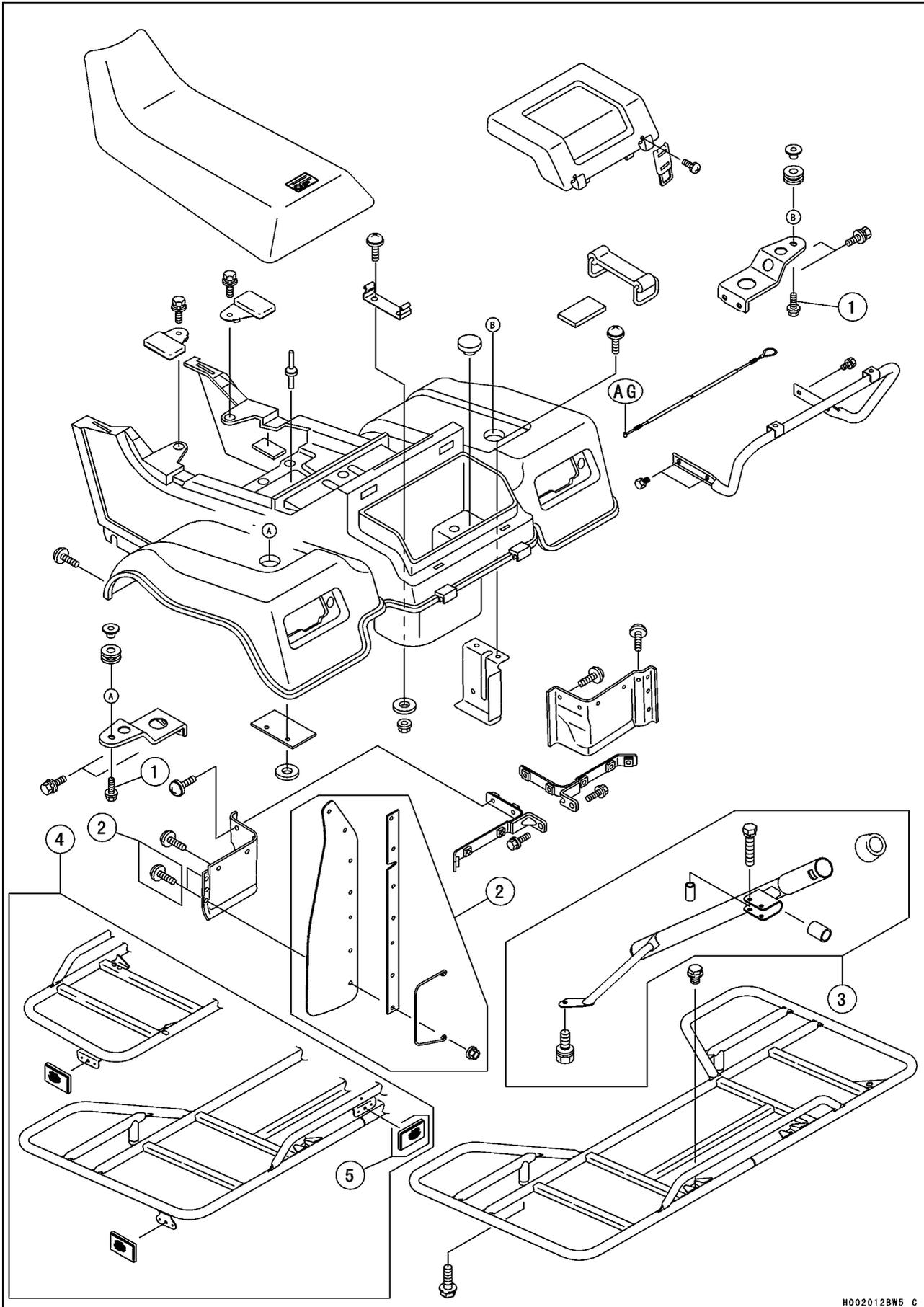
**Exploded View**

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AD: Apply adhesive agent.

# 15-4 FRAME

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear Carrier Bolts	20	2.0	14	

2: Other than U.S.A. and Canada Models

3: United Kingdom and Australia Models

4. Canada Model

5. Europe and United Kingdom Models

AG: Apply grease (Amoco rykon premium grease No. 2 EP Green).

## 15-6 FRAME

### Seat

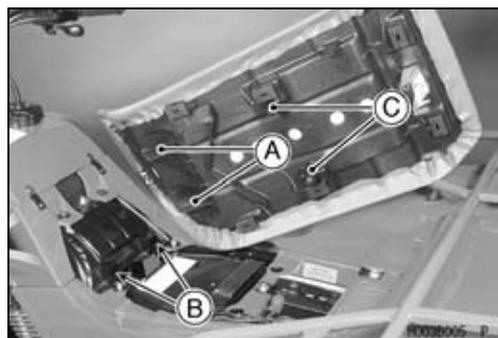
#### *Seat Removal*

- Remove the seat by pulling the seat latch [A] and then pulling the seat up to the rear.



#### *Seat Installation*

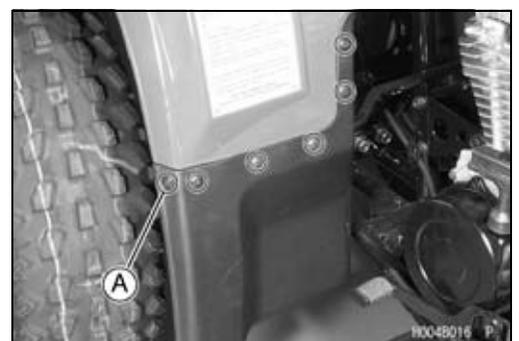
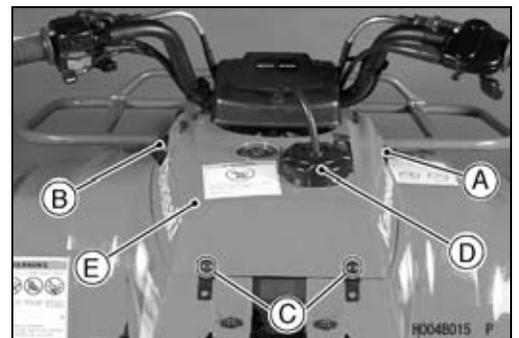
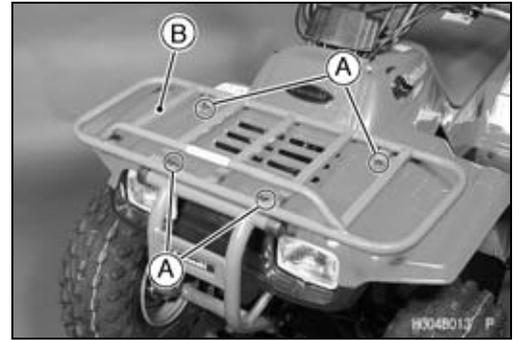
- Slip the seat hooks [A] under the brace [B] on the frame, and put the stoppers [C] into the holes in the frame.
- Push down the rear part of the seat until the lock clicks.



## Front and Rear Fenders

### Front Fender Removal

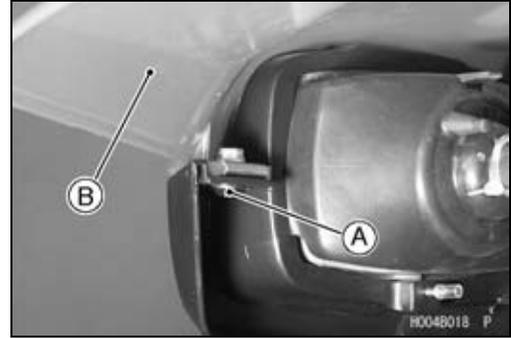
- Remove:
  - Front Carrier Bolts [A]
  - Front Carrier [B]
  
- Remove:
  - Front Cover Screws [A]
  - Front Cover [B]
  
- Remove:
  - Ignition Switch [A]
  - Reverse Knob [B]
  - Fuel Tank Cover Screws [C]
  - Fuel Tank Cap [D]
  - Fuel Tank Cover [E]
- Install the fuel tank cap at once.
  
- Remove:
  - Front Flap Screws [A] (Left and Right Sides)
  
- Remove:
  - Front Fender Bolts [A] and Collars



## 15-8 FRAME

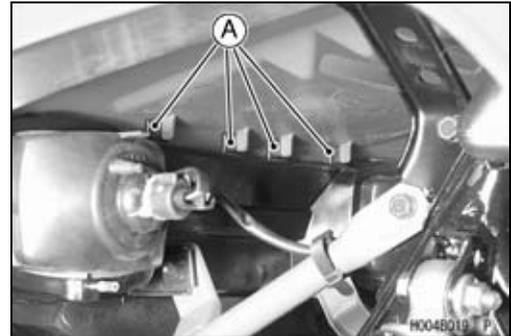
### Front and Rear Fenders

- Remove:  
Front Fender Screws [A] (Left and Right Sides)  
Front Fender [B]



#### *Front Fender Installation*

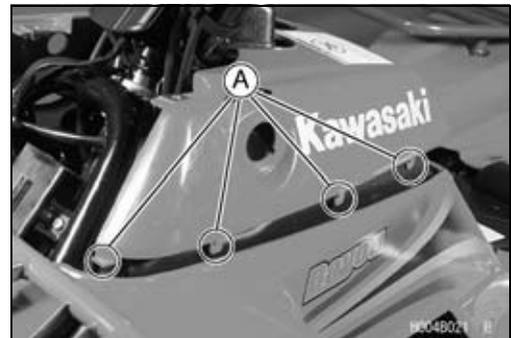
- Fit the tabs [A] on the headlight cover in the slots of the rear fender.



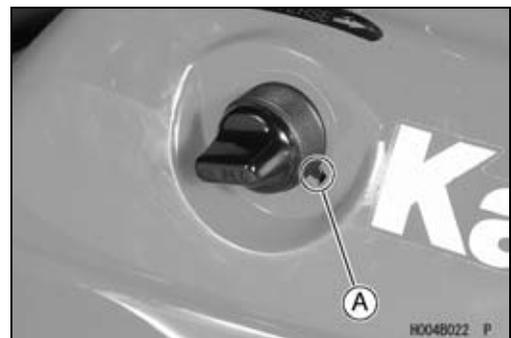
- Fit the tabs [A] on the front fender in the slots of the rear fender.



- Fit the tabs [A] on the fuel tank cover in the slots of the front fender from rear to front.



- Fit the projection [A] on the reverse knob into the recess in the front fender.
- Tighten the nut securely.



## Front and Rear Fenders

- Fit the projection [A] on the ignition switch into the recess in the front fender.
- Tighten:  
**Torque - Ignition Switch Nut: 2.9 N·m (0.3 kgf·m, 26 in·lb)**



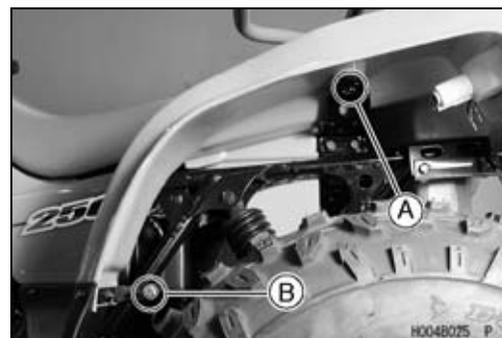
- Install:  
 Front Cover  
 Front Carrier

### Rear Fender Removal

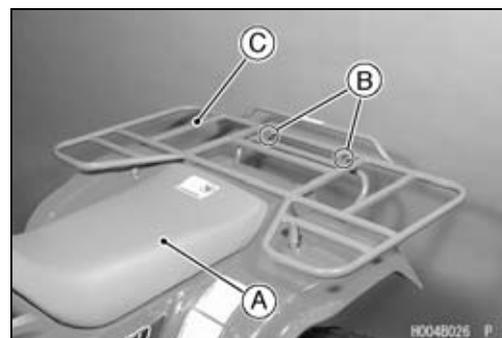
- Remove:  
 Taillight Lead Connectors [A]



- Remove:  
 Rear Carrier Bolts [A]  
 Rear Flap Bracket Bolts [B]



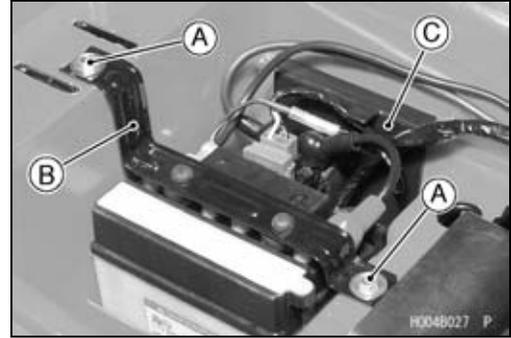
- Remove:  
 Seat [A] (see Seat Removal)  
 Rear Carrier Bolts [B]  
 Rear Carrier [C]



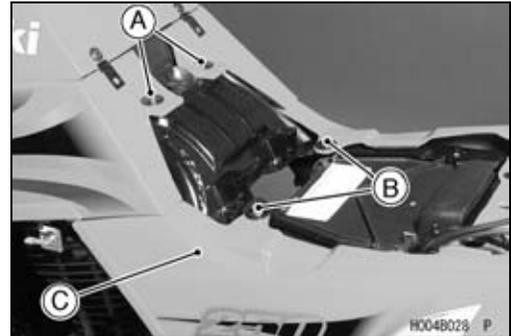
## 15-10 FRAME

### Front and Rear Fenders

- Remove:
  - Bolts [A] and Battery Holder [B]
  - Battery (see Electrical System chapter)
  - Electrical Equipment Plate [C]



- Remove:
  - Front Fender Bolts [A]
  - Rear Fender Bolts [B]
  - Dampers
  - Rear Fender [C]

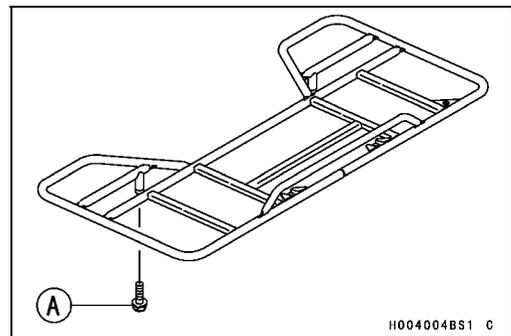


#### Rear Fender Installation

- Fit the tabs [A] of the front fender in the slot.



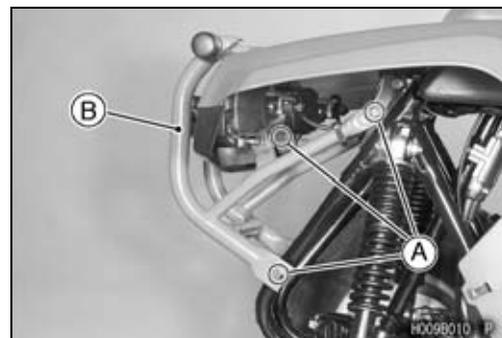
- Install:
  - Battery
  - Electrical Equipment Plate
- Connect:
  - Taillight Lead Connectors
- Tighten:
  - Torque - Rear Carrier Bolts [A]: 20 N·m (2.0 kgf·m, 14 ft·lb)



## Guard

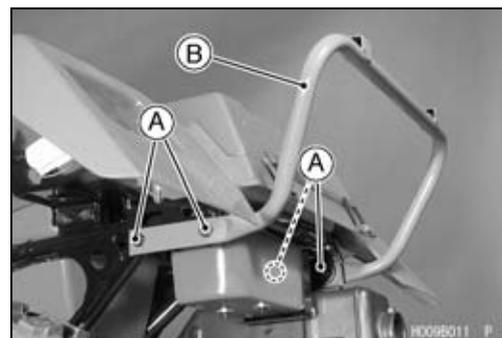
### *Front Guard Removal*

- Remove:
  - Front Carrier (see Front Fender Removal)
  - Front Guard Bolts [A]
  - Front Guard [B]



### *Rear Guard Removal*

- Remove:
  - Rear Carrier (see Rear Fender Removal)
  - Bolts [A]
  - Rear Guard [B]





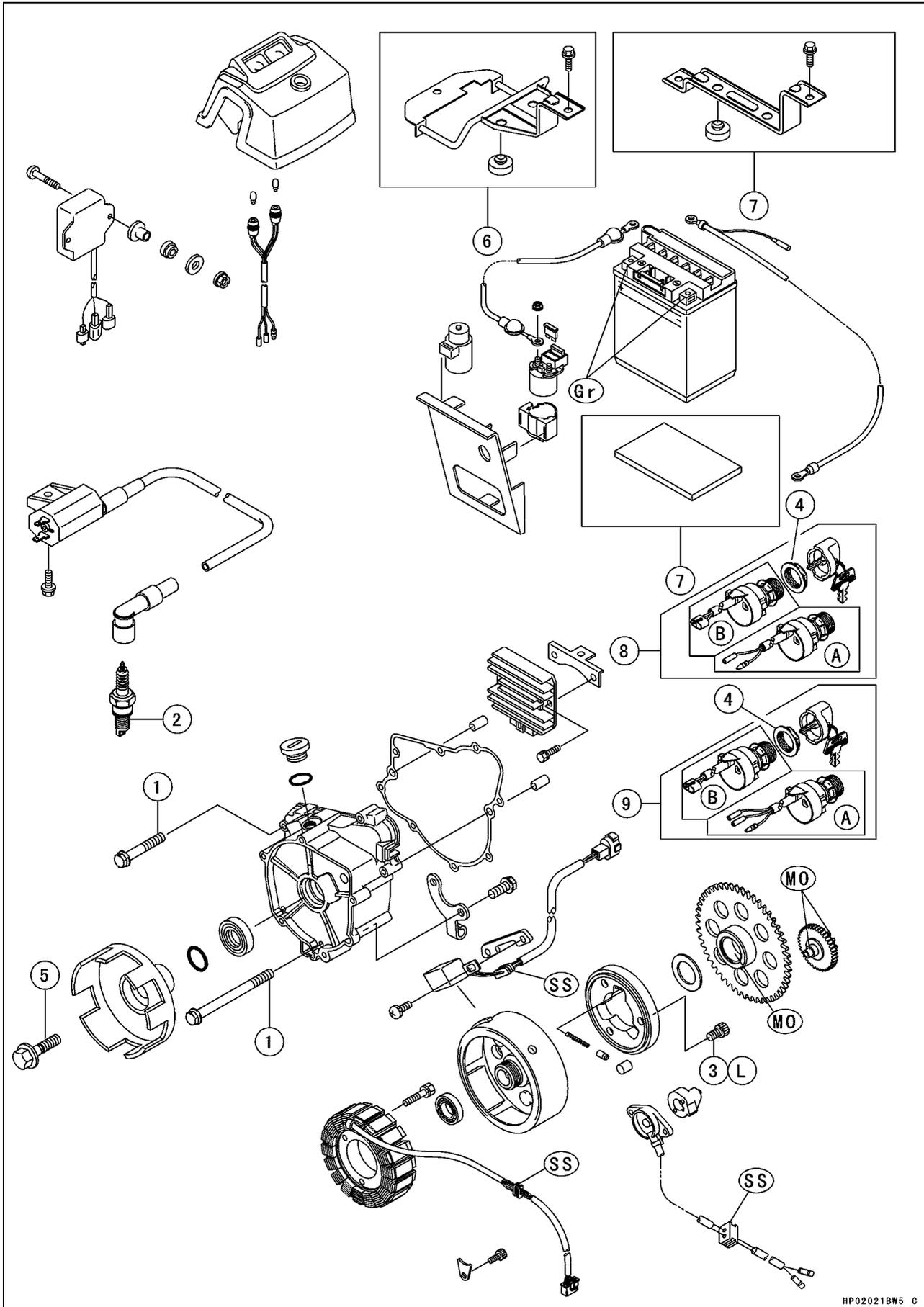
# Electrical System

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# 16-2 ELECTRICAL SYSTEM

## Exploded View



**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Alternator Cover Bolts	8.8	0.9	78 in·lb	
2	Spark Plug	14	1.4	10	
3	Starter Motor Clutch Bolts	34	3.5	25	L
4	Ignition Switch Nut	2.9	0.3	26 in·lb	
5	Alternator Rotor Bolt	59	6.0	43	

6: Other than U.S.A. Model

7: U.S.A. Model

8: U.S.A., Canada and Australia Models

9: Europe and United Kingdom Models

A: KLF250-A1

B: KLF250-A2 ~

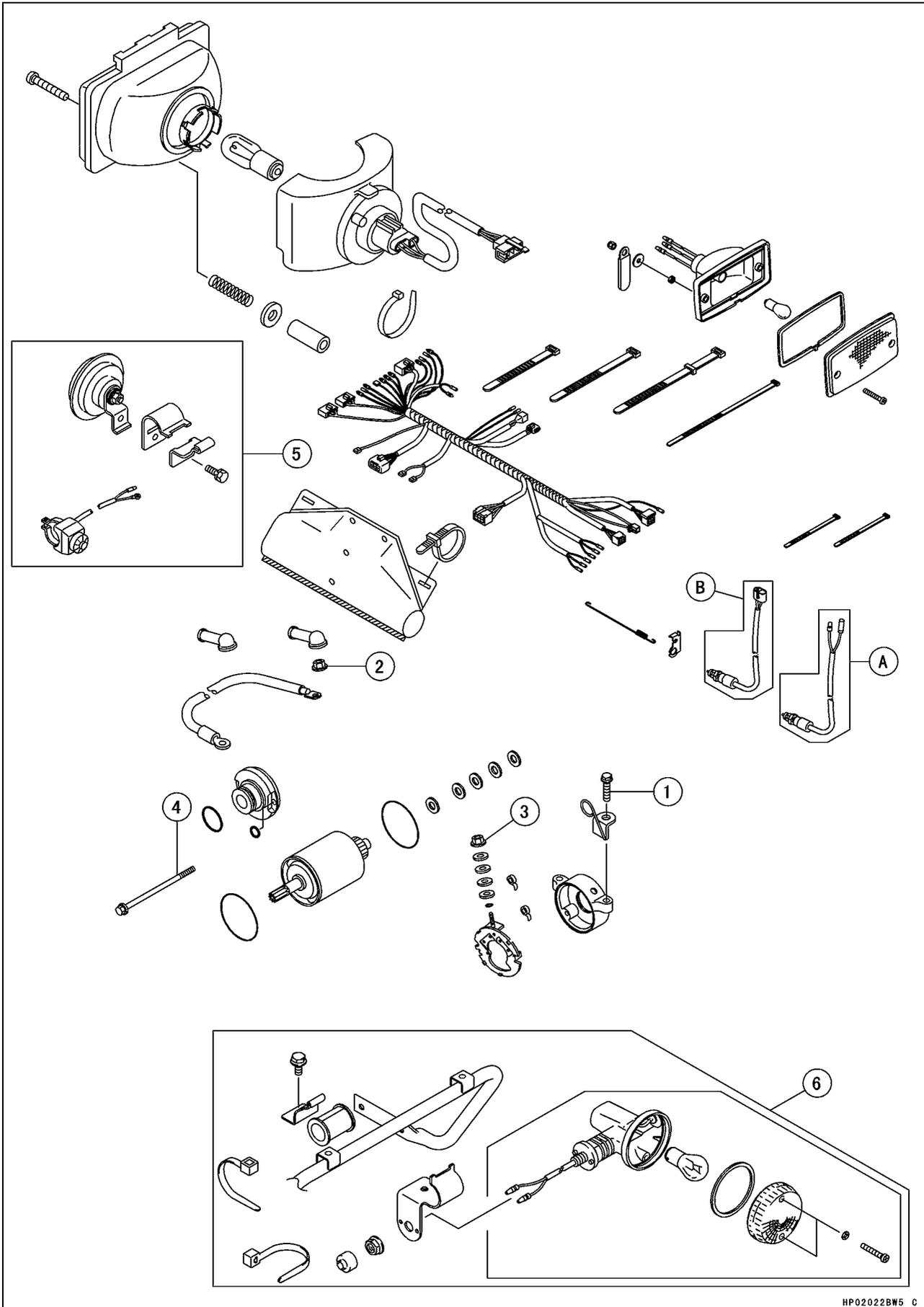
Gr: Apply grease.

MO: Apply molybdenum disulfide oil.

SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

# 16-4 ELECTRICAL SYSTEM

## Exploded View



**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Starter Motor Mounting Bolts	8.8	0.9	78 in·lb	
2	Starter Motor Terminal Nut	4.9	0.5	43 in·lb	
3	Starter Motor Terminal Locknut	6.9	0.7	61 in·lb	
4	Starter Motor Bolts	3.4	0.3	30 in·lb	

5: Other than U.S.A. and Canada Models

6: Europe and United Kingdom Models

A: KLF250-A1

B: KLF250-A2 ~

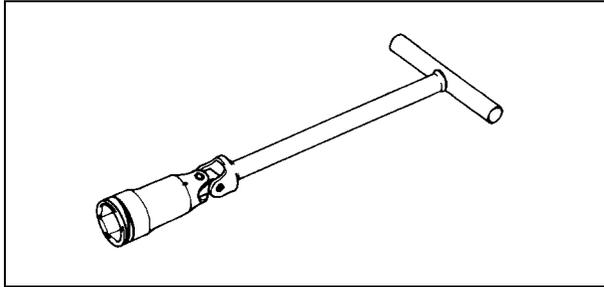
## 16-6 ELECTRICAL SYSTEM

### Specifications

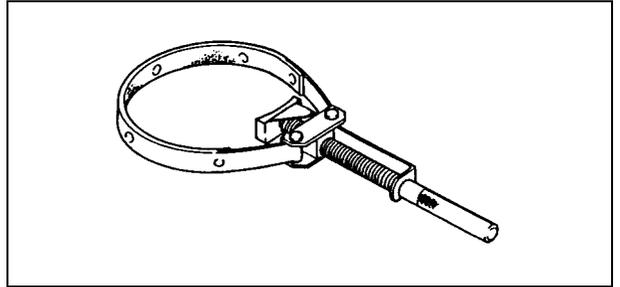
Item	Standard	Service Limit
<b>Battery</b>		
Capacity	12 V 14 Ah, (US) 12 V 11 Ah	---
Electrolyte Level	Between upper and lower levels	---
Specific Gravity of Electrolyte	1.270 @20°C (68°F)	---
<b>Charging System</b>		
Alternator Type	Three-phase AC	---
Charging Voltage (Regulator/Rectifier Output Voltage)	14 ~ 15 V	---
Alternator Output Voltage	38 V or more @4 000 r/min (rpm)	---
Stator Coil Resistance	0.4 ~ 1.1 Ω	---
<b>Ignition System</b>		
Spark Plug:		
Spark Plug Gap	0.6 ~ 0.7 mm (0.024 ~ 0.028 in.)	---
Spark Plug Cap Resistance	3.75 ~ 6.25 kΩ	---
Ignition Coil:		
3 needle Arcing Distance	7 mm (0.28 in.) or more	---
Primary Winding Resistance	0.09 ~ 0.13 Ω	---
Secondary Winding Resistance	3.8 ~ 5.8 kΩ	---
Primary Peak Voltage	100 V or more	---
Crankshaft Sensor:		
Crankshaft Sensor Resistance	100 ~ 150 Ω	---
Crankshaft Sensor Peak Voltage	3.6 V or more	---
<b>Electric Starter System</b>		
Starter Motor:		
Commutator Diameter	28 mm (1.10 in.)	27 mm (1.06 in.)
Brush Length	10 mm (0.39 in.)	6.5 mm (0.26 in.)
<b>Switches</b>		
Brake Light Switch Timing	ON after 10 mm (0.4 in.) of pedal travel	---

**Special Tools and Sealant**

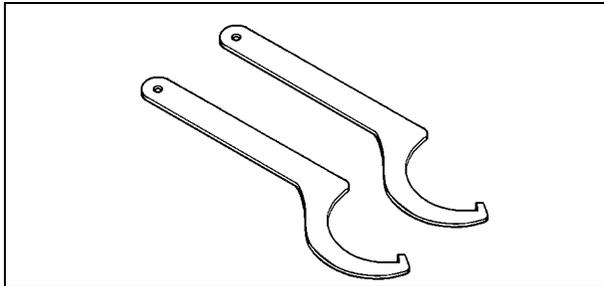
**Spark Plug Wrench, Hex 18:  
57001-1024**



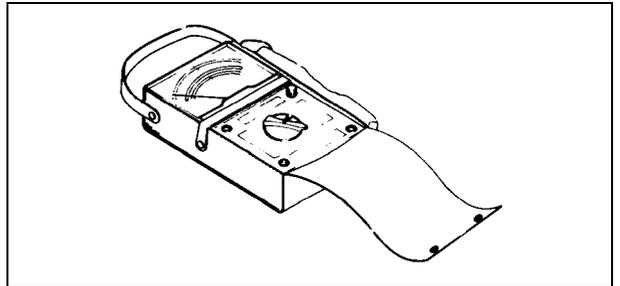
**Flywheel Holder:  
57001-1313**



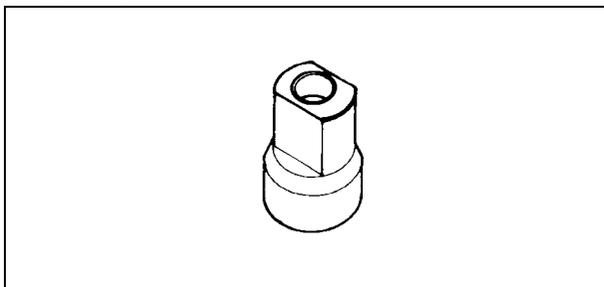
**Hook Wrench R37.5, R42:  
57001-1101**



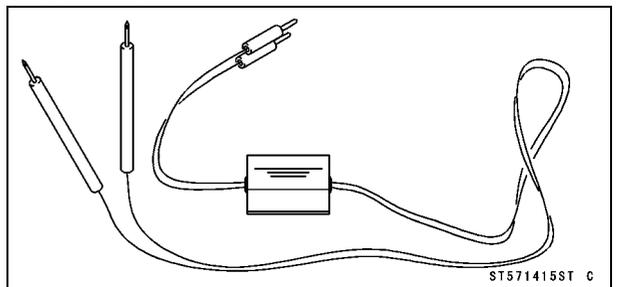
**Hand Tester:  
57001-1394**



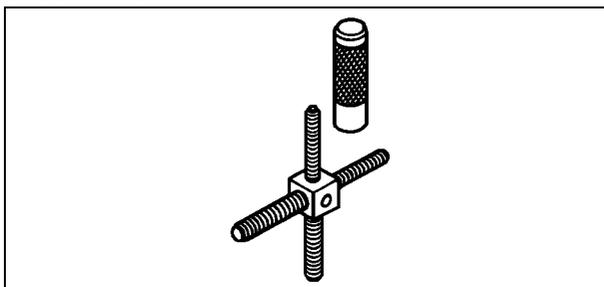
**Flywheel Puller, M30 x 1.5:  
57001-1191**



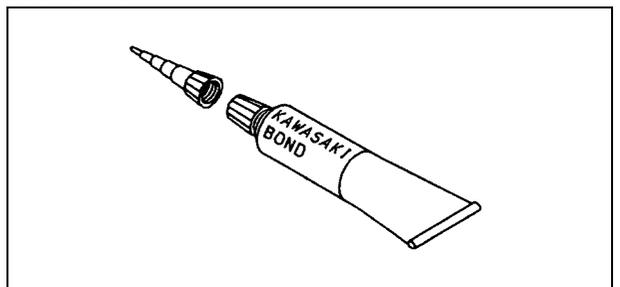
**Peak Volt Adapter:  
57001-1415**



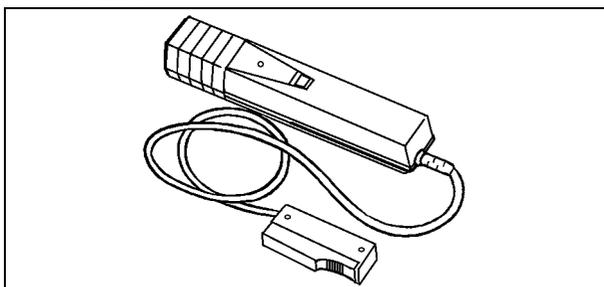
**Rotor Puller, M16/M18/M20/M22 x 1.5:  
57001-1216**



**Kawasaki Bond (Silicone Sealant):  
56019-120**



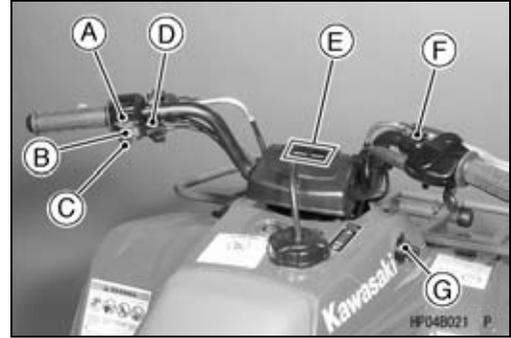
**Timing Light:  
57001-1241**



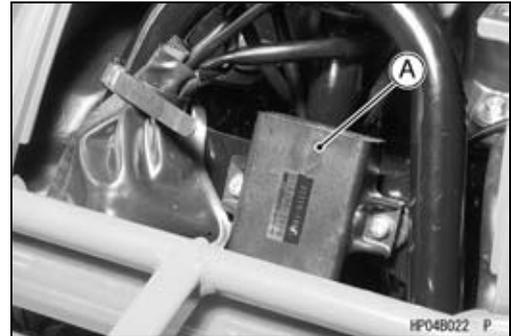
## 16-8 ELECTRICAL SYSTEM

### Parts Location

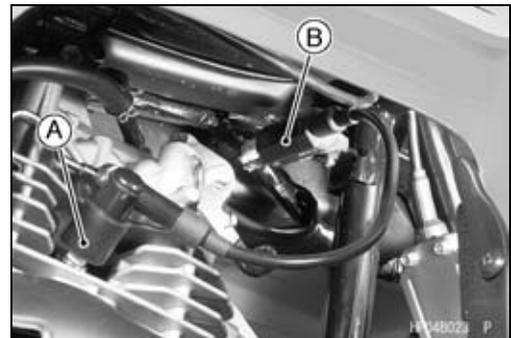
Light/Dimmer Switch [A]  
Engine Stop Switch [B]  
Starter Button [C]  
Front Brake Light Switch [D]  
Neutral/Reverse Indicator Lights [E]  
Rear Brake Light Switch [F]  
Ignition Switch [G]



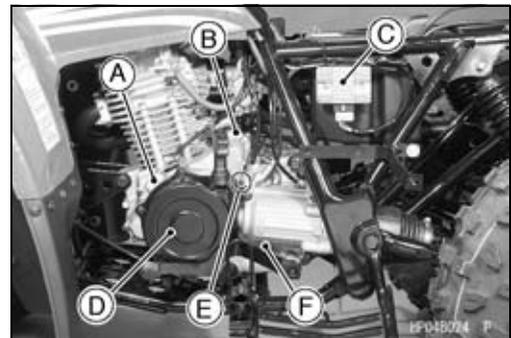
Igniter [A]



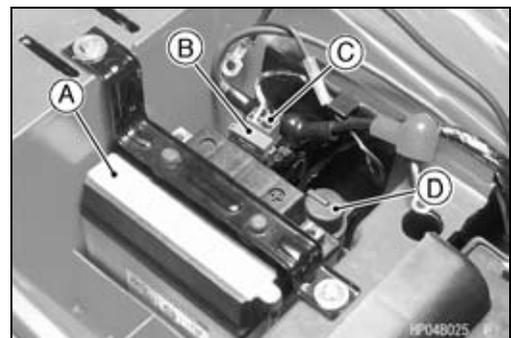
Spark Plug [A]  
Ignition Coil [B]



Crankshaft Sensor [A]  
Starter Motor [B]  
Regulator/Rectifier [C]  
Alternator [D]  
Engine Ground Terminal [E]  
Neutral/Reverse Switch [F]



Battery [A]  
Main Fuse 20 A [B]  
Starter Relay [C]  
Starter Circuit Relay [D]



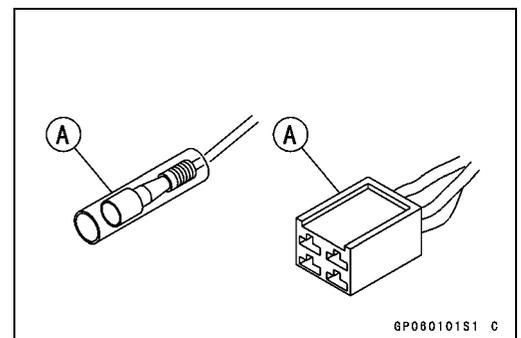
## Precautions

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

- Do not reverse the battery lead connections. This will burn out the diodes in the electrical parts.
- Always check battery condition before condemning other parts of an electrical system. A fully charged battery is required for conducting accurate electrical system tests.
- 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.
- To prevent damaging electrical parts, do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running.
- Because of the high current, never keep the starter button depressed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- Only use an illumination bulb rated for the voltage or wattage specified in the wiring diagram, or the handle cover could be warped by excessive heat radiated from the bulb.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to chassis ground.
- 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 caused by some other item or items, they too must be repaired or replaced, or the new replacement will soon fail again.
- Make sure all connectors in the circuit are clean and tight, and examine wires for signs of burning, fraying, etc. Defective wires and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).
- Color Codes:

BK	Black	G	Green	P	Pink
BL	Blue	GY	Gray	PU	Purple
BR	Brown	LB	Light blue	R	Red
CH	Chocolate	LG	Light green	W	White
DG	Dark green	O	Orange	Y	Yellow

- Electrical Connectors:  
Female Connectors [A]

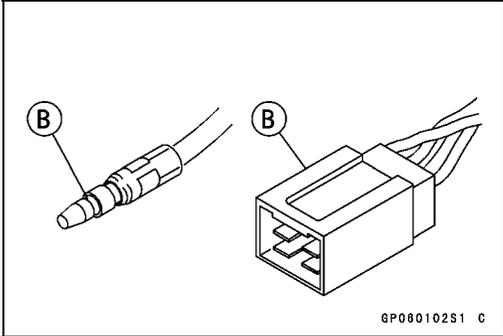


GP080101S1 C

# 16-10 ELECTRICAL SYSTEM

## Precautions

Male Connectors [B]



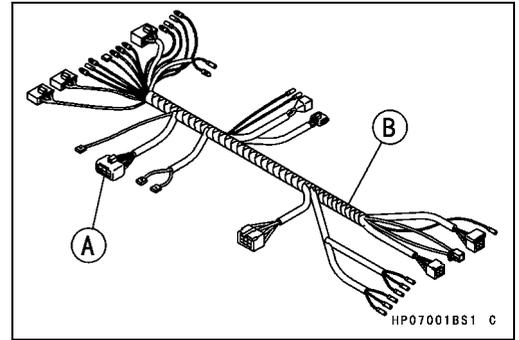
## Electrical Wiring

### Wiring Inspection

- Visually inspect the wiring for signs of burning, fraying, etc.
- ★ If any wiring is defective, replace the damaged wiring.
- Pull each connector [A] apart and inspect for corrosion, dirt, and damage.
- ★ If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it.
- Check the wiring for continuity.
- Use the wiring diagram to find the ends of the lead which is suspected of being a problem.
- Connect the hand tester between the ends of the leads.

#### Special Tool - Hand Tester: 57001-1394

- Set the tester to the x 1  $\Omega$  range.
- ★ If the tester does not read 0  $\Omega$ , the lead is defective. Replace the lead or the wiring harness [B] if necessary.

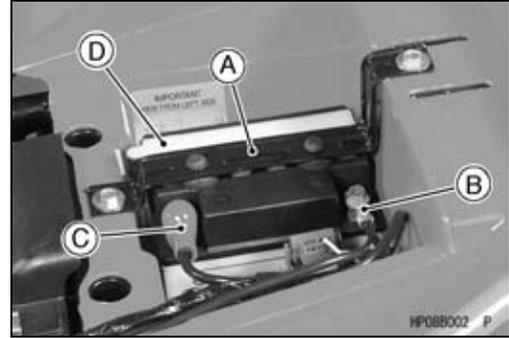


# 16-12 ELECTRICAL SYSTEM

## Battery

### Battery Removal

- Remove:
  - Seat (see Frame chapter)
  - Battery Holder [A]
- Disconnect the battery negative (-) cable [B] first, and then the positive (+) cable [C].
- Take out the battery [D].

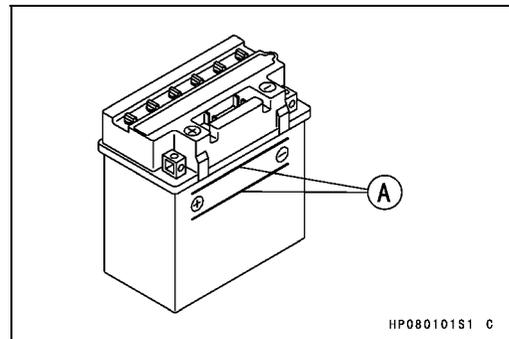


### Battery Installation

- Connect the positive cable first and then the negative cable.
- Put a light coat of grease on the terminals to prevent corrosion.
- Route the battery vent hose according to the Cable, Wire, and Hose Routing section in Appendix chapter.

### Electrolyte Level Inspection

- The electrolyte level should be between the upper and lower level lines [A].
- ★ If the level of electrolyte in any cell is below the lower level line, add only distilled water to the cell, until the level is at the upper level line.

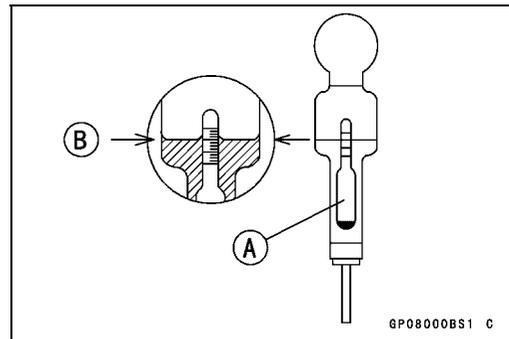


### CAUTION

**Ordinary tap water is not a substitute for distilled water and will shorten the life of the battery.**

### Electrolyte Specific Gravity Inspection

- Check battery condition by testing the specific gravity of the electrolyte in each cell with a hydrometer.
- Read the level of the electrolyte [B] on the floating scale [A].
- ★ If the specific gravity is below 1.200 the battery needs to be charged.



### NOTE

- *The specific gravity of the electrolyte varies with changes in temperature, so the specific gravity reading must be corrected for the temperature of the electrolyte.*
- *Celsius: Add 0.007 points to reading for each 10°C above 20°C or subtract 0.007 points for each 10°C below 20°C.*
- *Fahrenheit: Add 0.004 points to reading for each 10°F above 68°F or subtract 0.004 points for each 10°F below 68°F.*
- ★ If the specific gravity of any of the cells is more than 0.050 away from any other reading, the battery will probably not accept a charge. It is generally best to replace a battery in this condition.
- ★ If the specific gravity of all the cells is 1.270 or more, the battery is fully charged.

## Battery

### Initial Charging

#### WARNING

Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger. This procedure prevents sparks at the battery terminals which could ignite any battery gases.

- Fill each cell to the upper level line on the battery case with fresh electrolyte (specific gravity: 1.270) at a temperature of 30°C (86°F) or less. Let the battery stand for about 30 minutes before charging.

#### NOTE

○ If the electrolyte level drops, add electrolyte to the upper level line before charging.

- Set the charging rate at 1/10 the battery capacity, and **charge it for 10 hours**. For example, if the battery is rated at 14 Ah, 11 Ah (U.S. model), the charging rate would be 1.4 Ah, 1.1 Ah (U.S. model).

#### CAUTION

If the battery is not given a full initial charging, it will discharge in a few weeks. After that it can not be charged by supplemental charging.

Always remove the battery from the vehicle for charging. If the battery is charged while still installed, battery electrolyte may spill and corrode the frame or other parts of the vehicle.

Do not use a high rate battery charger, as is typically employed at automotive service stations, unless the charger rate can be reduced to the level required. Charging the battery at a rate higher than specified may ruin the battery. Charging at a high rate causes excess heat which can warp the plates and cause internal shorting. Higher-than-normal charging rates also cause the plates to shed active material. Deposits will accumulate, and can cause internal shorting.

If the temperature of the electrolyte rises above 45°C (113°F) during charging, reduce the charging rate to lower the temperature, and increase charging time proportionately.

- Turn the charger off, then disconnect it from the battery.
  - Check:
    - Electrolyte Level (see Electrolyte Level Inspection)
    - Battery Voltage
- Battery voltage should be 12.6 V or more.

## 16-14 ELECTRICAL SYSTEM

---

### Battery

---

#### *Ordinary Charging*

- Remove the battery (see Battery Removal).

#### **WARNING**

**Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger. This procedure prevents sparks at the battery terminals which could ignite any battery gases.**

- Connect a charger to the battery BEFORE plugging it in or turning it on.
- Set the charging rate and time according to the battery condition previously determined, using the Battery Charging Rate/Time Table.
- Check the electrolyte level after charging.

#### **CAUTION**

**Always remove the battery from the vehicle for charging. If the battery is charged while still installed, battery electrolyte may spill and corrode the frame or other parts of the vehicle.**

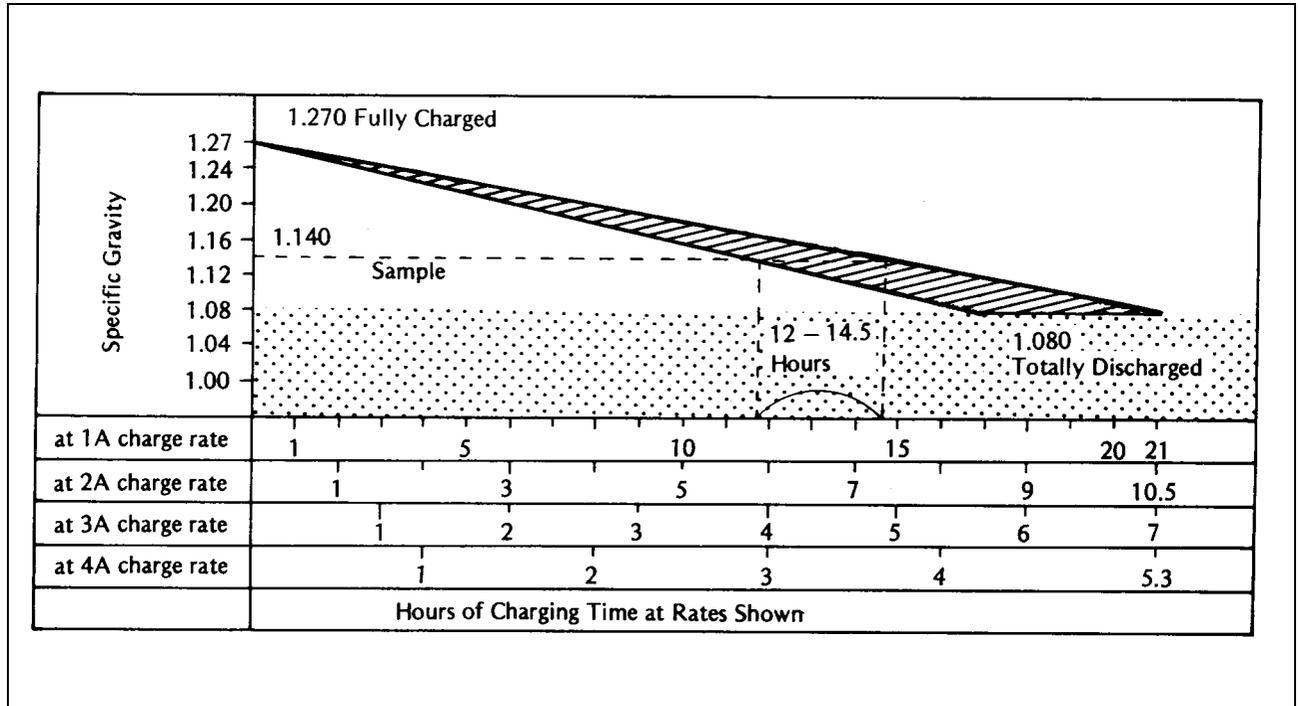
**Do not use a high rate battery charger, as is typically employed at automotive service stations, unless the charger rate can be reduced to the level required. Charging the battery at a rate higher than specified may ruin the battery. Charging at a high rate causes excess heat which can warp the plates and cause internal shorting. Higher-than-normal charging rates also cause the plates to shed active material. Deposits will accumulate, and can cause internal shorting.**

**If the temperature of the electrolyte rises above 45°C (113°F) during charging, reduce the charging rate to lower the temperature, and increase charging time proportionately.**

- Turn the charger off or unplug it, then disconnect it from the battery.
- Check battery condition.
- ★ If the battery condition indicates that it is not fully charged, additional charging time is necessary.

**Battery**

**Battery Charging Rate/Time Table**



**Battery Troubleshooting Guide**

	Good Battery	Suspect Battery	Action
Plates	(+) Chocolate color (-) gray	white (sulphated); + plates broken or corroded	Replace
Sediment	none, or small amount	sediment up to plates, causing short	Replace
Voltage	above 12.6 V	below 12.6 V	Test charge
Electrolyte Level	between upper and lower level lines	below lower level line	Fill and test charge
Specific Gravity	above 1.240 in all cells; no two cells more than 0.020 different	below 1.100, or difference of more than 0.020 between two cells	Test charge

**Battery Test Charging**

- ★ If the battery is suspected of being defective, sulfated, or unable to take a charge, consult the table.
- To test charge a battery, perform the ordinary charging procedure and monitor the battery voltage and other signs as mentioned below.

**Special Tool - Hand Tester : 57001-1394**

- ★ If the battery voltage suddenly jumps to over 13 V just after the start of charging, the plates are probably sulfated. A good battery will rise to 12 V immediately and then gradually go up to 12.5 or 13 V in about 30 min. to an hour after the start of charging.

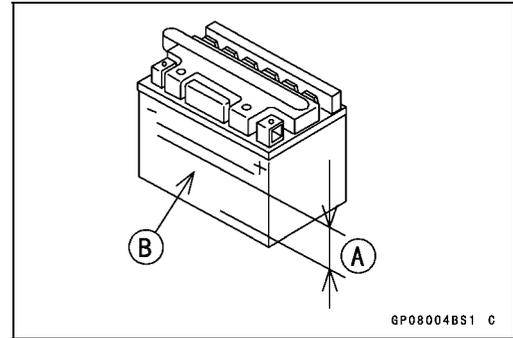
## 16-16 ELECTRICAL SYSTEM

### Battery

- ★ If one cell produces no gas bubbles or has a very low specific gravity, it is probably shorted.
- ★ If there does not appear to be enough sediment in a cell to short the plates, but that cell has a very low specific gravity after the battery is fully charged, the trouble may be that there is not enough acid in that one cell. In this case only, sulfuric acid solution may be added to correct the specific gravity.
- ★ If a fully charged battery not in loses its charge after 2 to 7 days; or if the specific gravity drops markedly, the battery is defective. The self-discharge rate of a good battery is only about 1% per day.

Sulfation here [A]

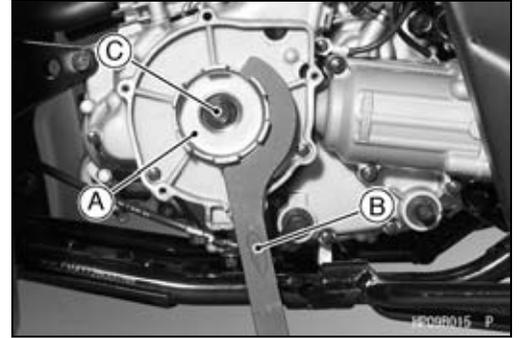
Sediment here [B]



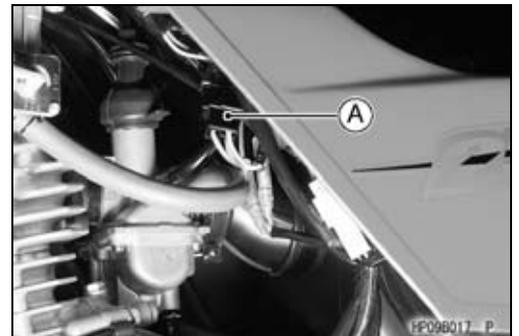
## Charging System

### Alternator Cover Removal

- Remove:
  - Recoil Starter (see Recoil Starter chapter)
  - Footpeg
  - Shift Pedal
- Holding the recoil starter pulley [A] steady with the hook wrench [B], loosen the alternator rotor bolt [C].
- **Special Tool - Hook Wrench: 57001-1101**
- Remove the alternator rotor bolt, pulley, and key. The pulley may be pulled out easily.
- Remove:
  - Reverse Cable Rear End [A]



- Disconnect:
  - Alternator Lead Connector [A]



- Place an oil pan beneath the engine left side.
- Remove:
  - Alternator Cover Bolts [A]
  - Alternator Cover [B]



### Alternator Cover Installation

- Apply silicone sealant to the circumference of the Crankshaft Sensor lead grommet [A], and fit the grommet into the notch of the crankcase.
- Check the dowel pins [B] are in place, and fit a new gasket on the crankcase.
- Check the ball bearing [C] is in place.



## 16-18 ELECTRICAL SYSTEM

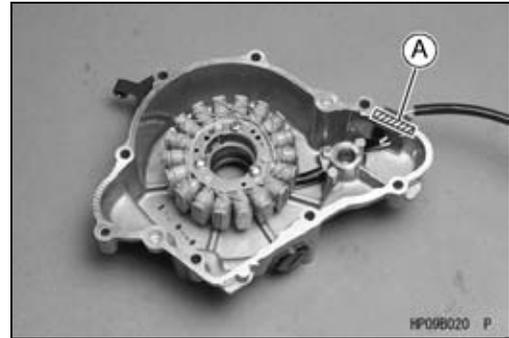
### Charging System

- Apply silicone sealant [A] to the circumference of the stator coil lead grommet, and fit the grommet into the notch of the cover securely.

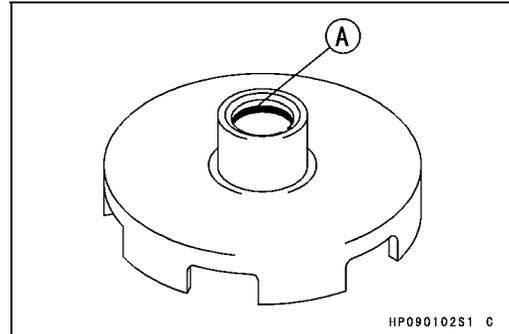
**Sealant - Kawasaki Bond (Silicone Sealant): 56019-120**

- Tighten:

**Torque - Alternator Cover Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**



- Grease the alternator cover oil seal.
- Check that the pulley O-ring [A] is in good condition.
- Clean the pulley boss and apply oil to the O-ring and the boss.

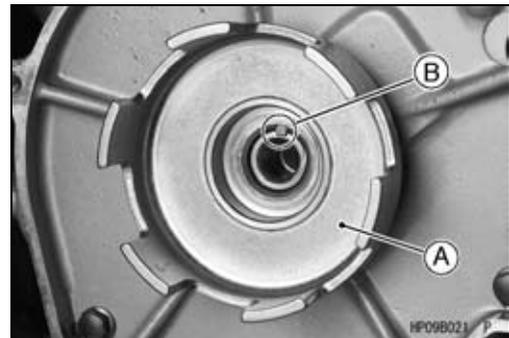


- Push the pulley [A] into the left engine cover oil seal.
- Fit the key [B] in the groove between the pulley and the crankshaft.

- Tighten:

**Torque - Alternator Rotor Bolt: 59 N·m (6.0 kgf·m, 43 ft·lb)**

- Add engine oil.



### Alternator Rotor Removal

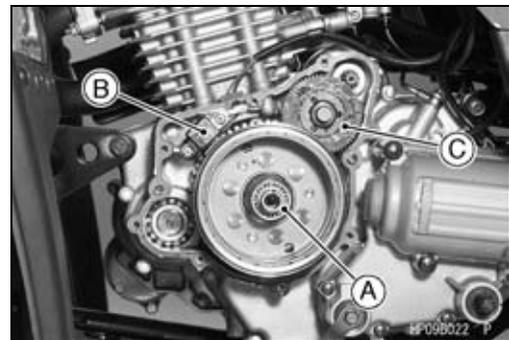
- Remove:

Alternator Cover (see Alternator Cover Removal)

Ball Bearing [A]

Crankshaft Sensor [B]

Torque Limiter [C]

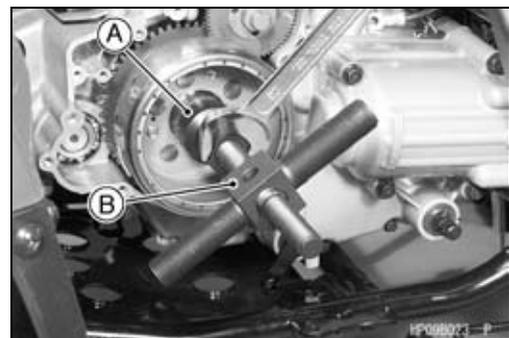


- Thread the flywheel puller [A] and rotor puller [B] onto the alternator rotor.

**Special Tools - Flywheel Puller, M30 x 1.5: 57001-1191**

**Rotor Puller, M16/M18/M20/M22 x 1.5: 57001-1216**

- Holding the flywheel puller, turn the rotor puller until the alternator rotor is forced off the end of the crankshaft.

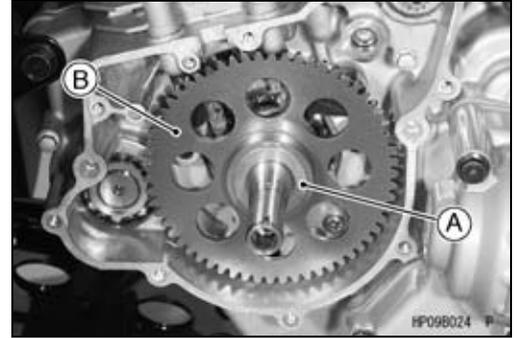


### CAUTION

**If the rotor is difficult to remove, turn the puller while tapping the end of the puller. Do not attempt to strike the alternator rotor itself. Striking the rotor can cause the magnets to lose their magnetism.**

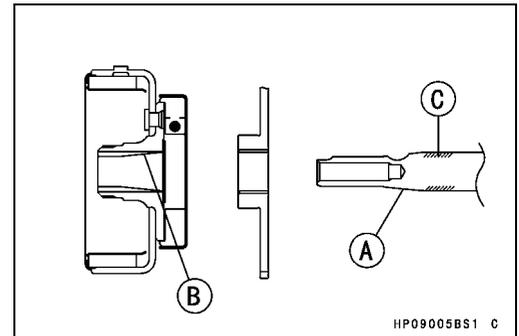
## Charging System

- Remove:
  - Woodruff Key
  - Spacer [A]
  - Starter Clutch Gear [B]

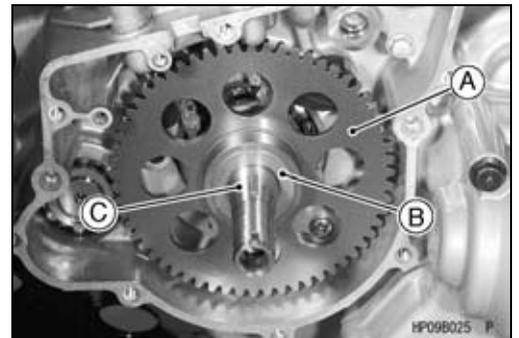


### Alternator Rotor Installation

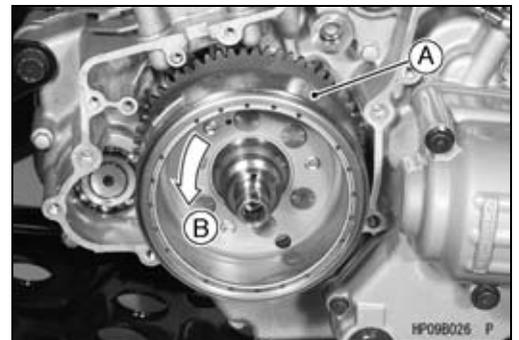
- Using a cleaning fluid, clean off any oil or dirt on the following portions and dry them with a clean cloth.
  - [A] Crankshaft Tapered Portion
  - [B] Alternator Rotor Tapered Portion
- Apply a thin coat of molybdenum disulfide oil to the crankshaft [C].



- Install the starter clutch gear [A] and spacer [B].
- Again, clean the crankshaft tapered portion [C] and dry there.
- Install the woodruff key.



- Install the alternator rotor [A] while turning [B] it counter-clockwise.



- Apply molybdenum disulfide oil to the both ends of the torque limiter [A].
- Apply molybdenum disulfide grease to the gear of the torque limiter and install it.
- Install:
  - Ball Bearing
  - Alternator Cover (see Alternator Cover Installation)

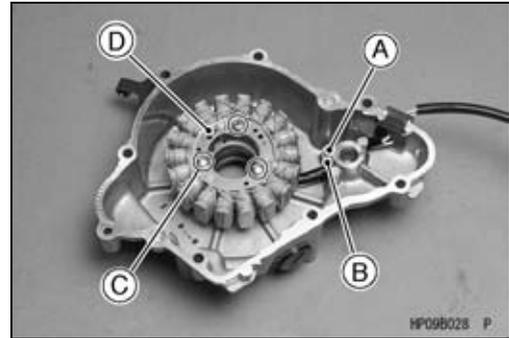


## 16-20 ELECTRICAL SYSTEM

### Charging System

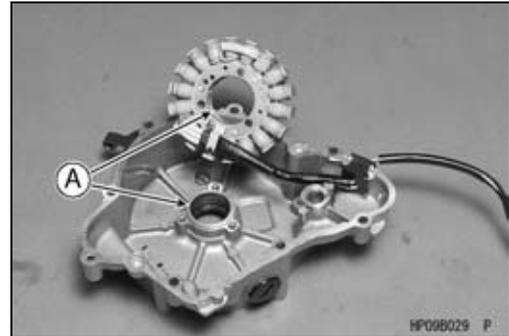
#### *Alternator Stator Removal*

- Remove:
  - Alternator Cover (see Alternator Cover Removal)
  - Alternator Stator Lead Clamp Screw [A] and Plate [B]
  - Alternator Stator Screws [C] and Alternator Stator [D]



#### *Alternator Stator Installation*

- Clean the contact surfaces [A] on the alternator stator core and the left engine cover.



- Apply silicone sealant to the circumference of the stator coil lead grommet, and fit the grommet into the notch of the cover securely.

**Sealant - Kawasaki Bond (Silicone Sealant): 56019-120**

## Charging System

### Regulator / Rectifier Output Voltage Inspection

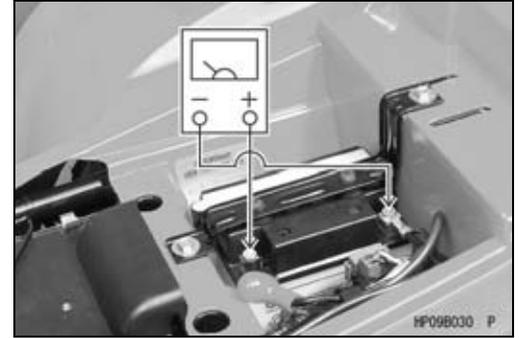
- Remove the seat (see Frame chapter).
- Check the battery condition (see Battery section).
- Warm up the engine to obtain actual alternator operating conditions.
- Check that the ignition switch is turned off, and connect a hand tester to the battery terminals.

**Special Tool - Hand Tester : 57001-1394**

### Regulator/Rectifier Output Voltage

Tester Range	Connections		Reading @4 000 r/min (rpm)
	Tester (+) to	Tester (-) to	
25 V DC	Battery (+)	Battery (-)	14 ~ 15 V

- Start the engine and note the voltage readings at various engine speeds with the headlight turned on and then off.
- The readings should show nearly battery voltage when the engine speed is low, and as the engine speed increases, the readings should also increase.
- Turn off the ignition switch, and disconnect the hand tester.
- ★ If the regulator/rectifier output voltage is between the values given in the table, the charging system is working normally.
- ★ If the output voltage is much higher than the values specified in the table, the regulator/rectifier is defective or the regulator/rectifier leads are loose or open.
- ★ If the battery voltage does not increase as the engine speed increases, then the regulator/rectifier is defective or the alternator output is insufficient for the loads. Check the alternator and regulator/rectifier to determine which part is defective.



# 16-22 ELECTRICAL SYSTEM

## Charging System

### Alternator Inspection

- There are three types of alternator failures: short, open, or loss in rotor magnetism. A short or open in one of the coil wires will result in either a low output, or no output at all. A loss in rotor magnetism, which may be caused by dropping or hitting the alternator, by leaving it near an electromagnetic field, or just by aging, will result in low output.
- To check the alternator output voltage, perform the following procedures.
  - Disconnect the alternator connector [A].
  - Connect a hand tester as shown in the table.
  - Start the engine.
  - Run it at the rpm given in the table.
  - Note the voltage readings (total 3 measurements).



### Alternator Output Voltage

Tester Range	Connections		Reading @4 000 r/min (rpm)
	Tester (+) to	Tester (-) to	
250 V AC	One yellow lead	Another yellow lead	38 V or more

★ If the output voltage is within the values in the table, the alternator is operating correctly, and the regulator/rectifier is damaged. A much lower reading indicates that the alternator is defective.

- Check the stator coil resistance as follows:
  - Stop the engine.
  - Disconnect the alternator connector.
  - Connect a hand tester as shown in the table.
  - Note the readings (total 3 measurement).

### Stator Coil Resistance

Tester Range	Connections		Reading @4 000 r/min (rpm)
	Tester (+) to	Tester (-) to	
x 1 Ω	One yellow lead	Another yellow lead	0.4 ~ 1.1 Ω

★ If there is more resistance than shown in the table, or no reading (infinity) for any two leads, the stator has an open and must be replaced. Much less resistance means the stator is shorted and must be replaced.

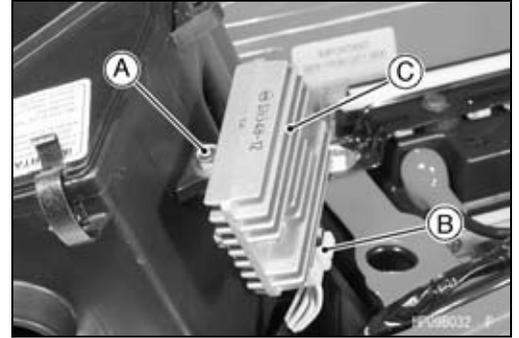
- Using the highest resistance range of the hand tester, measure the resistance between each of the yellow leads and chassis ground.
- ★ Any reading less than infinity ( $\infty$ ) indicates a short, necessitating stator replacement.
- ★ If the stator coils have normal resistance, but the voltage check shows the alternator to be defective; then the rotor magnetism has probably weakened, and the rotor must be replaced.

**Special Tool - Hand Tester : 57001-1394**

## Charging System

### Regulator/Rectifier Inspection

- Remove:
  - Regulator Bracket Bolts [A]
  - Connector [B] (disconnect)
  - Regulator/Rectifier [C]



### Rectifier Circuit Check:

- Check conductivity of the following pair of terminals.

#### Rectifier Circuit Inspection

Tester connection	W-Y1,	W-Y2,	W-Y3
	BK/Y-Y1,	BK/Y-Y2,	BK/Y-Y3

- ★ The resistance should be low in one direction and more than ten times as much in the other direction. If any two leads are low or high in both directions, the rectifier is defective and must be replaced.

#### NOTE

- The actual meter reading varies with the meter and the individual rectifier. Generally speaking the lower reading should be from zero to one half of the scale.

### Regulator Circuit Check:

To test the regulator out of circuit, use three 12 V batteries and a test light (12 V 3 ~ 6 W bulb in a socket with leads).

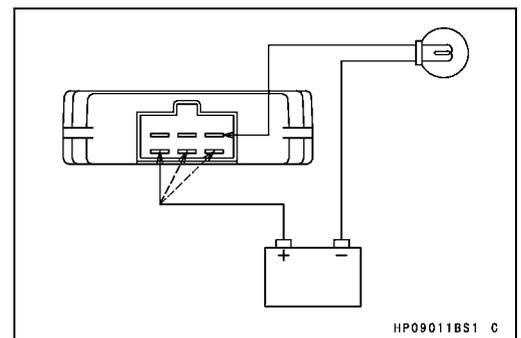
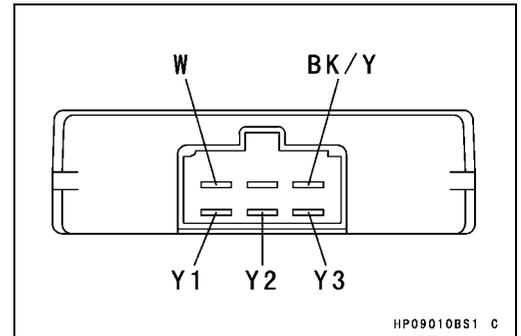
#### CAUTION

The test light works as an indicator and also a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.

- Check to be sure the rectifier circuit is correct before continuing.

### Regulator Circuit Test-1st Step:

- Connect the test light and a 12 V battery to the regulator/rectifier as shown.
- Check Y1, Y2, and Y3 terminal respectively.
- ★ If the test light turns on, the regulator/rectifier is defective.
- ★ If the test light does not turn on, continue the test.

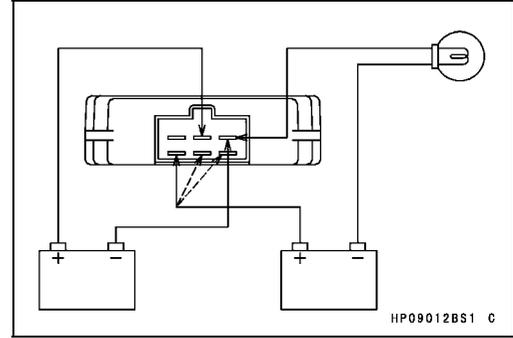


## 16-24 ELECTRICAL SYSTEM

### Charging System

#### Regulator Circuit Test-2nd Step:

- Connect the test light and a 12 V battery in the same manner as specified in the "Regulator Circuit Test-1st Step".
- Apply 12 V to the BR (voltage monitoring) terminal.
- Check Y1, Y2, and Y3 terminals.
- ★ If the test light turns on, the regulator/rectifier is defective.
- ★ If the test light does not turn on, continue the test.



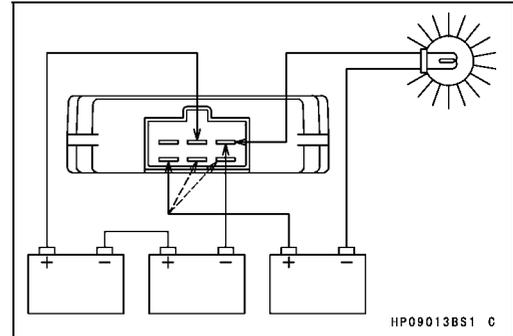
#### Regulator Circuit Test-3rd Step:

- Connect the test light and a 12 V battery in the same manner as specified in the "Regulator Circuit Test-1st Step".
- Momentarily apply 24 V to the BR (voltage monitoring) terminal by adding a 12 V battery.
- Check Y1, Y2, and Y3 terminals.

#### CAUTION

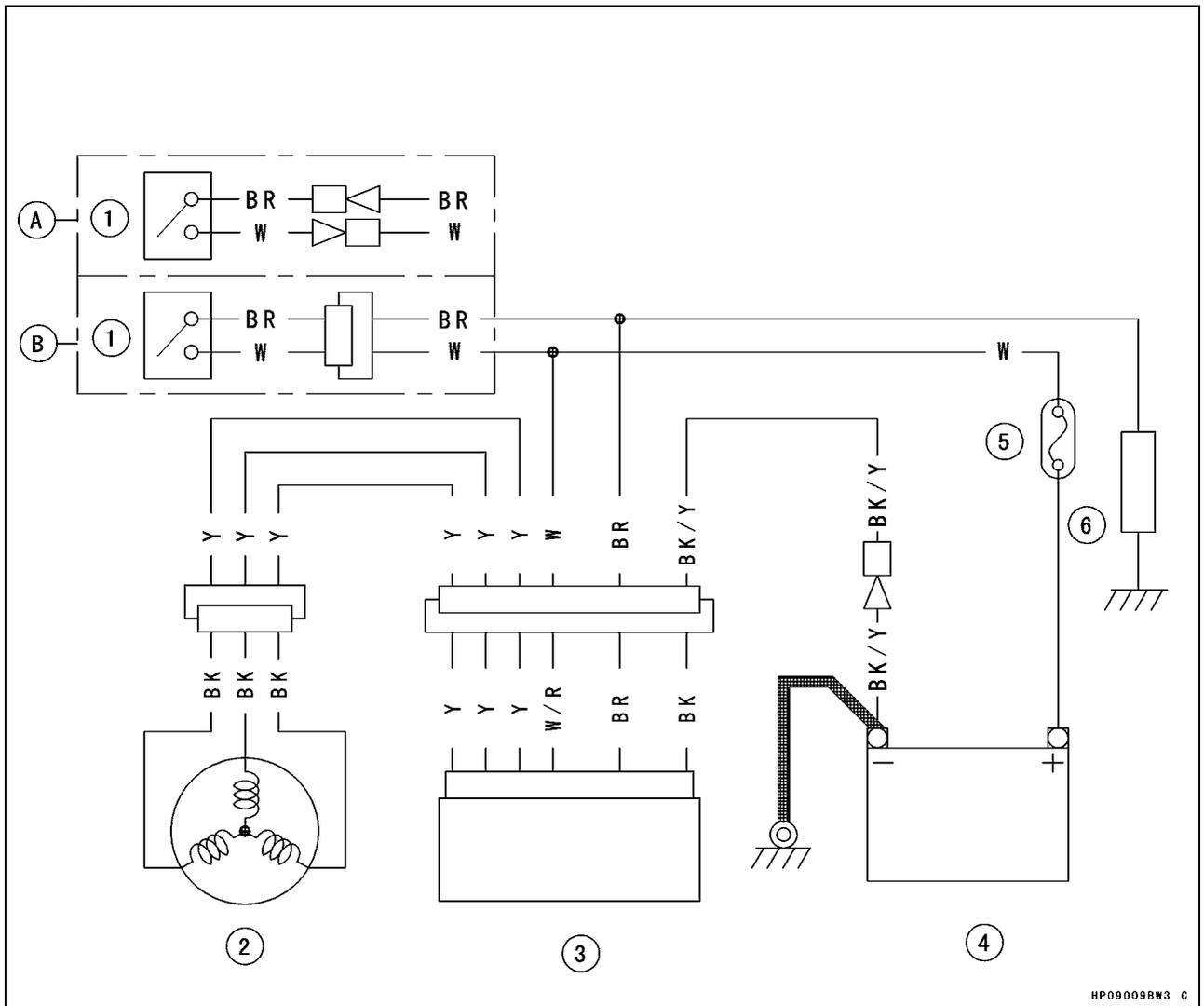
**Do not apply more than 24 V to the regulator/rectifier and do not leave the 24 V applied for more than a few seconds, or the unit will be damaged.**

- ★ If the test light did not light when the 24 V was applied momentarily to the BR (voltage monitoring) terminal, the regulator/rectifier is defective.
- ★ If the regulator/rectifier passes all of the tests described, it may still be defective. If the charging system still does not work properly after checking all of the components and the battery, test the regulator/rectifier by replacing it with a known good unit.



Charging System

Charging System Circuit



HP09009BW3 C

A: KLF250-A1  
B: KLF250-A2 ~

1. Ignition Switch  
2. Alternator  
3. Regulator/Rectifier

4. Battery  
5. Main Fuse 20 A  
6. Load

## 16-26 ELECTRICAL SYSTEM

### Ignition System

#### WARNING

The ignition system produces extremely high voltage.

Do not touch the spark plug, ignition coil, or spark plug lead while the engine is running, or you could receive a severe electrical shock.

#### CAUTION

Do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent igniter damage.

Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the diodes and igniter. Use the standard regulator/rectifier, or the igniter will be damaged.

#### *Spark Plug Removal/Installation*

- Remove the spark plug cap [A].
- Remove or install the spark plug using the spark plug wrench from the vehicle right side.

**Special Tool - Spark Plug Wrench, Hex 18 : 57001-1024**

**Torque - Spark Plug: 14 N·m (1.4 kgf·m, 10 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/Inspection*

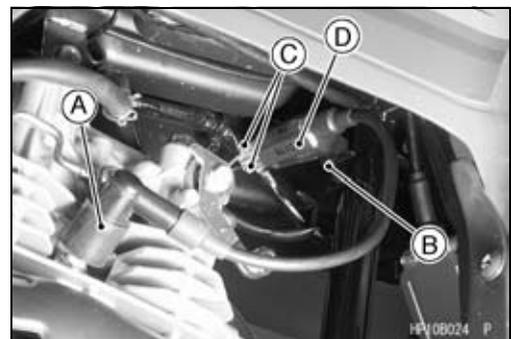
- Refer to the Spark Plug Cleaning/Inspection in the Periodic maintenance chapter.

#### *Spark Plug Gap Inspection*

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

#### *Ignition Coil Removal*

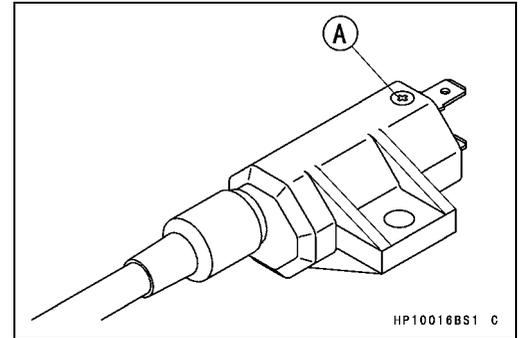
- Remove:
  - Spark Plug Cap [A]
  - Bolt [B]
  - Primary Lead Connectors [C]
  - Ignition Coil [D]



## Ignition System

### Ignition Coil Installation

- Connect the primary winding leads to the ignition coil terminals as shown.
  - G/W Lead ⇒ (+) Mark [A]
  - BK/Y Lead ⇒ (-) Mark



### Ignition Coil Inspection

- Remove the ignition coil.
- Measure the arcing distance with a coil tester [A] to check the condition of the ignition coil [B].
- Connect the ignition coil (with the spark plug cap left attached at the end of the spark plug lead) to the tester in the manner prescribed by the manufacturer and measure the arcing distance.

**Ignition Coil Arcing Distance**  
7 mm (0.28 in.) or more

### WARNING

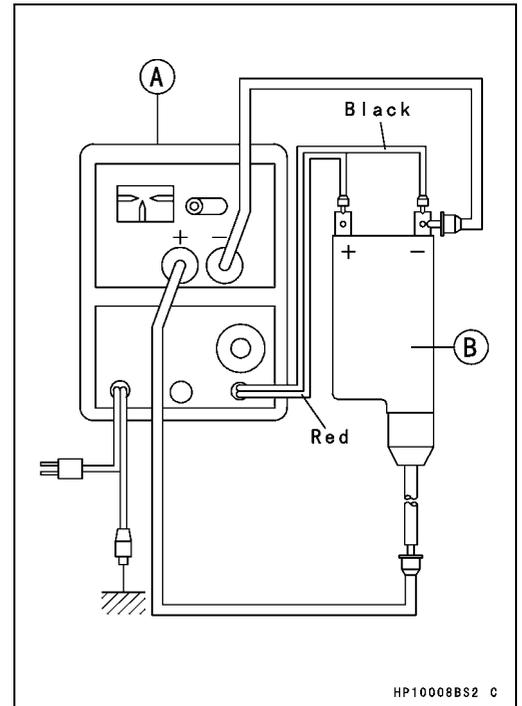
**To avoid extremely high voltage shocks, do not touch the ignition coil body or leads.**

- ★ If the distance reading is less than the specified value, the ignition coil or spark plug cap is defective.
- To determine which part is defective, measure the arcing distance again with the spark plug cap removed from the ignition coil lead.
- Remove the cap by turning it counterclockwise.
- ★ If the arcing distance is subnormal as before, the trouble is with the ignition coil itself. If the arcing distance is now normal, the trouble is with the spark plug cap.
- ★ If the coil tester is not available, the coil can be checked for a broken or badly shorted winding with the hand tester.

**Special Tool - Hand Tester : 57001-1394**

### NOTE

- *The hand tester cannot detect layer shorts and shorts resulting from insulation breakdown under high voltage.*



# 16-28 ELECTRICAL SYSTEM

## Ignition System

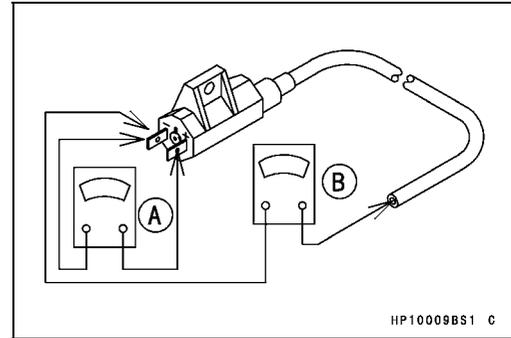
- Measure the primary winding resistance [A] as follows:
  - Connect the tester between the coil terminals.
  - Set the tester to the x 1 Ω range, and read the tester.
- Measure the secondary winding resistance [B] as follows:
  - Remove the plug cap by turning it counterclockwise.
  - Connect the tester between the spark plug lead and (-) terminal.
  - Set the tester to the x 1 kΩ range, and read the tester.

### Ignition Coil Winding Resistance

Primary windings : 0.09 ~ 0.13 Ω

Secondary windings : 3.8 ~ 5.8 kΩ

- ★ If the hand tester does not read as specified, replace the coil.
- To install the plug cap, turn it clockwise.



### Ignition Coil Primary Peak Voltage Inspection

#### NOTE

○ Be sure the battery is fully charged.

- Remove the spark plug cap (see Spark Plug Removal), but do not remove the spark plug.
- Measure the primary peak voltage as follows.
  - Connect a commercial peak voltage adapter [A] to the hand tester [B] (250 V DC range).

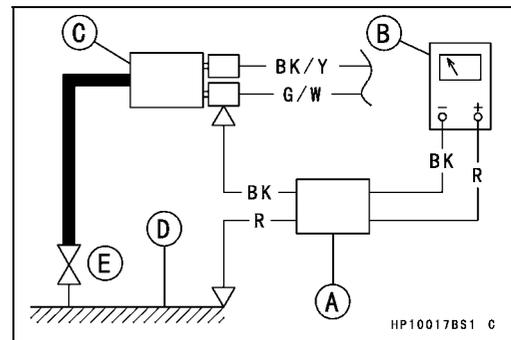
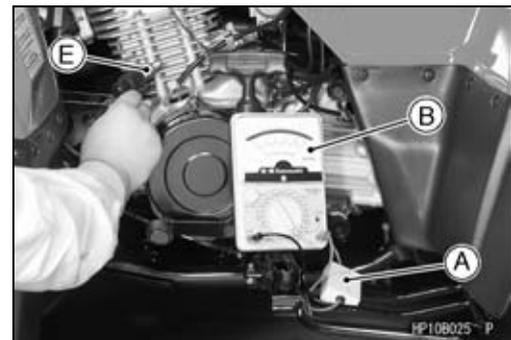
Special Tool - Hand Tester: 57001-1394

Special Tool - Peak Voltage Adapter: 57001-1415

Type: KEK-54-9-B

Brand: KOWA SEIKI

- Connect the adapter between the G/W lead terminal of the ignition coil [C] and the engine ground [D].
- Install a new spark plug [E] into the spark plug cap, and ground it to the engine.



#### WARNING

To avoid extremely high voltage shocks, do not touch the spark plugs or tester connections.

- Turn the ignition switch ON, rotate the engine for 4 ~ 5 seconds with the transmission in neutral to measure the primary peak voltage.
- Repeat the measurements 5 times for one ignition coil.

### Ignition Coil Primary Peak Voltage

Standard: 100 V or more

- ★ If the reading is less than the specified value, check the following.

Ignition Coil (see Ignition Coil Inspection)

Crankshaft Sensor (see Crankshaft Sensor Inspection)

- ★ If the ignition coil and crankshaft sensor are normal, see the Ignition System Troubleshooting chart on page 16-34.

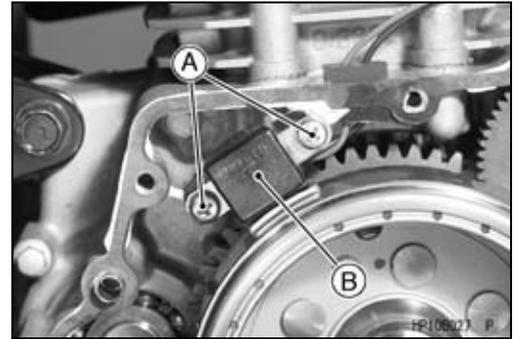
## Ignition System

### Crankshaft Sensor Removal

- Remove:
  - Alternator Cover (see Alternator Cover Removal)
  - Lead Connector [A]



- Remove:
  - Crankshaft Sensor Screws [A]
  - Crankshaft Sensor [B] and Spacer



### Crankshaft Sensor Inspection

- Disconnect the Crankshaft Sensor lead connector [A].
- Measure the Crankshaft Sensor resistance.
- Connect the hand tester between the BK lead and the BL lead.

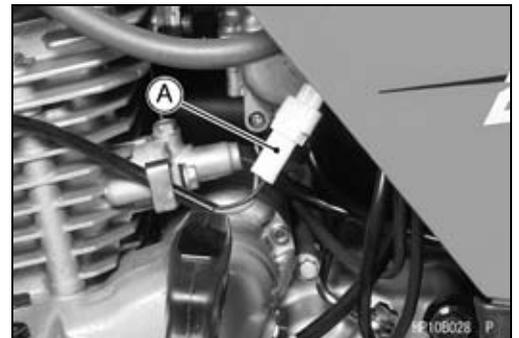
**Special Tool - Hand Tester: 57001-1394**

- Set the tester to the x 10  $\Omega$  range, and read the tester.

**Crankshaft Sensor Resistance**

**100 ~ 150  $\Omega$**

- ★ If the tester does not read as specified, replace the Crankshaft Sensor.



## 16-30 ELECTRICAL SYSTEM

### Ignition System

#### Crankshaft Sensor Peak Voltage Inspection

##### NOTE

○Be sure the battery is fully charged.

- Remove the spark plug cap, but do not remove the spark plug.
- Disconnect:  
Crankshaft Sensor Wire Connector [A]
- Set the hand tester [B] to the 10 V DC range.
- Connect the peak voltage adapter [C] to the hand tester and crankshaft sensor leads in the connector.

**Special Tool - Hand Tester: 57001-1394**

**Recommended Tool - Peak Voltage Adapter**  
**Type: KEK-54-9-B**  
**Brand: KOWA SEIKI**

##### Connections:

Crankshaft Sensor Connector	Adapter	Hand Tester
<b>Bule</b>	← <b>Red</b> →	<b>(+)</b>
<b>Black</b>	← <b>Black</b> →	<b>(-)</b>

- Turn the ignition switch on, and rotate the engine for 4 ~ 5 seconds with the transmission gear in neutral to measure the crankshaft sensor peak voltage.
- Repeat the measurement 5 or more times.

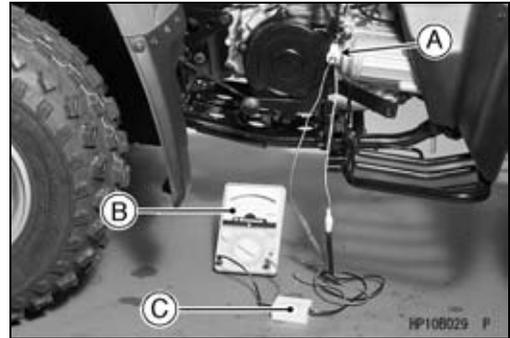
##### Crankshaft Sensor Peak Voltage

**Standard: 3.6 V or more**

- ★ If the peak voltage is lower than the standard, inspect the crankshaft sensor.

#### Alternator Rotor Inspection

- Check the timing projection [A] for damage such as chipping or grooving.
- ★ If the timing projection on the rotor is visibly damaged, replace the alternator rotor.



## Ignition System

### Ignition Timing Test

- Remove the ignition timing inspection plug.
- Attach the timing light [A] and a tachometer in the manner prescribed by the manufacturer.

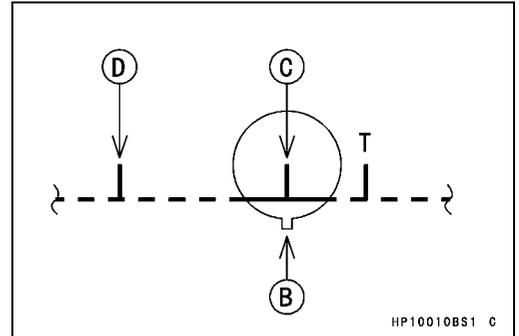
#### Special Tool - Timing Light : 57001-1241

- Start the engine and aim the timing light at the timing mark on the alternator rotor.
- Run the engine at the speeds specified and note the alignment of the timing marks.



### Ignition Timing

Engine speed r/min (rpm)	Slot [B] aligned with:
1 800 and below	Advanced mark [C] on alternator rotor
4 600 and above	Advanced mark [D] on alternator rotor

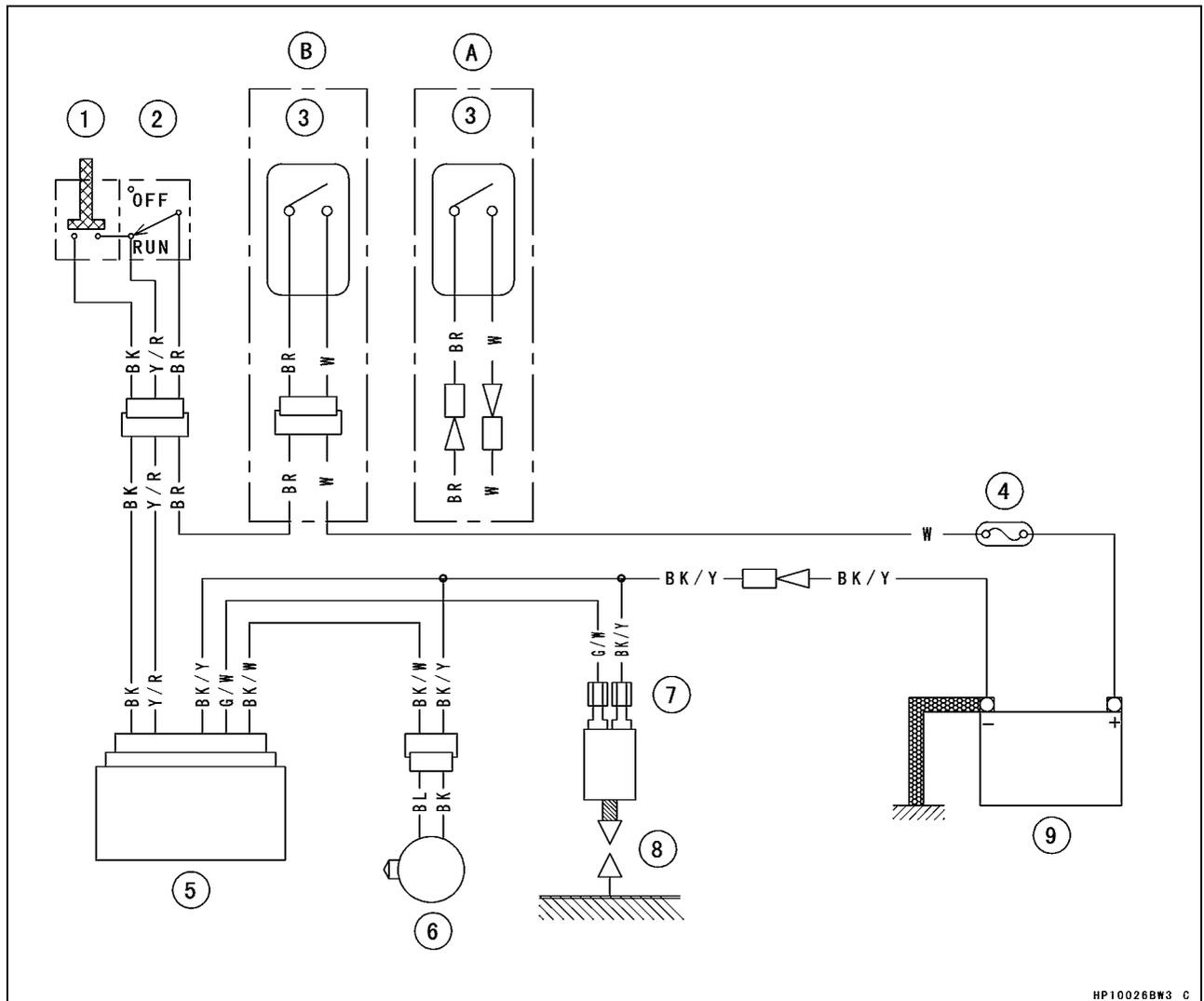


### NOTE

○ Do not mix up the timing marks with the top mark "T".

- ★ If the ignition timing is incorrect, replace the igniter and the Crankshaft Sensor.

## Ignition System Circuit



A: KLF250-A1

## 16-32 ELECTRICAL SYSTEM

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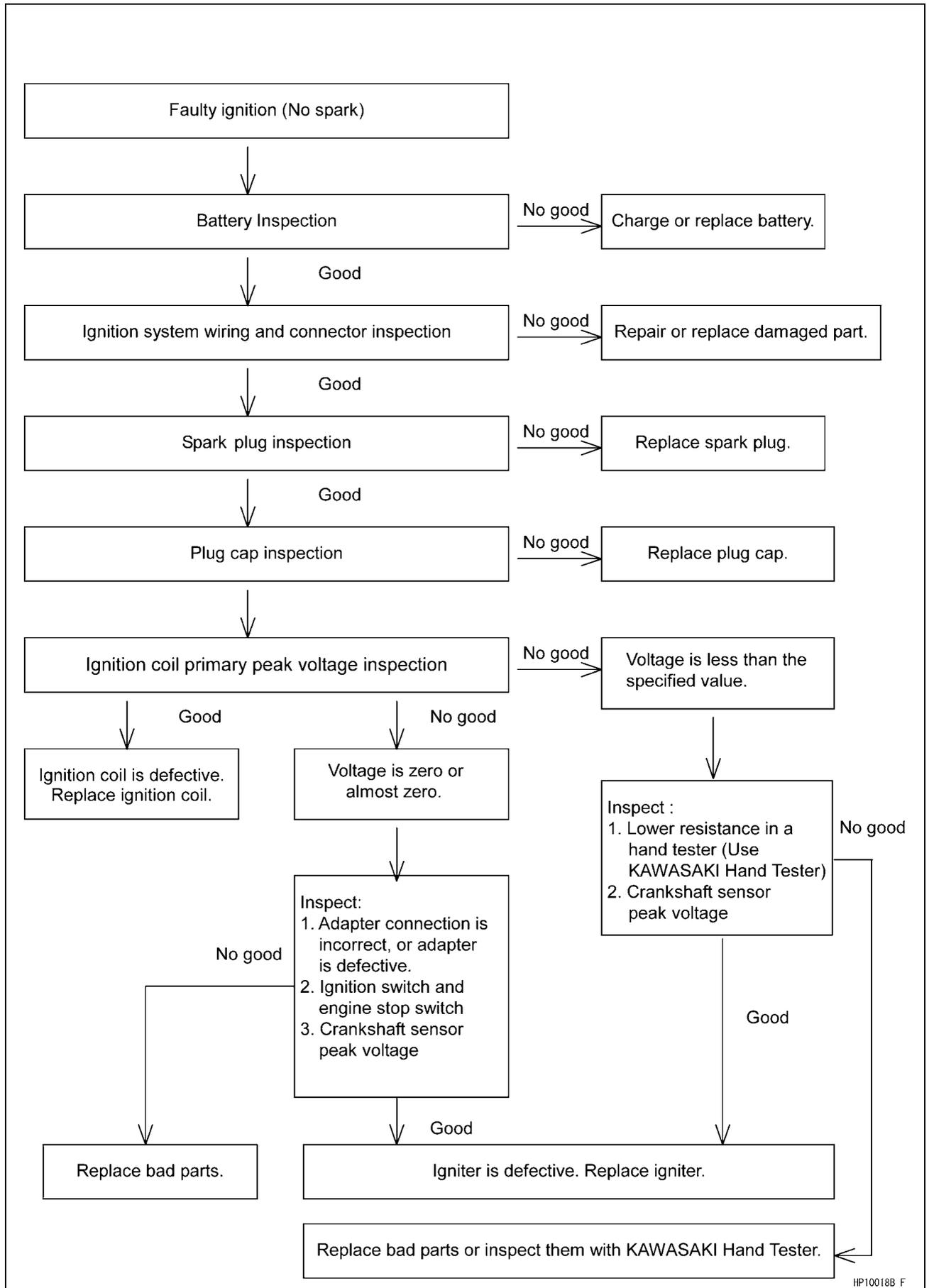
### Ignition System

---

B: KLF250-A2 ~

- |                       |                      |                  |
|-----------------------|----------------------|------------------|
| 1. Starter Button     | 4. Main Fuse 20 A    | 7. Ignition Coil |
| 2. Engine Stop Switch | 5. Igniter           | 8. Spark Plug    |
| 3. Ignition Switch    | 6. Crankshaft Sensor | 9. Battery       |

Ignition System

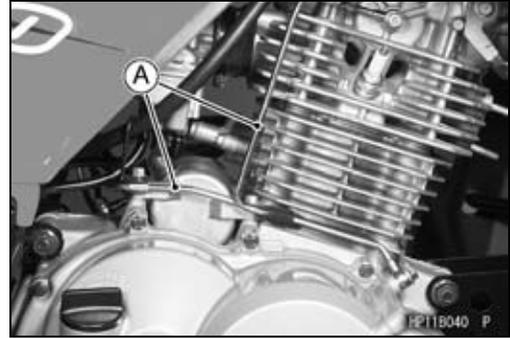


# 16-34 ELECTRICAL SYSTEM

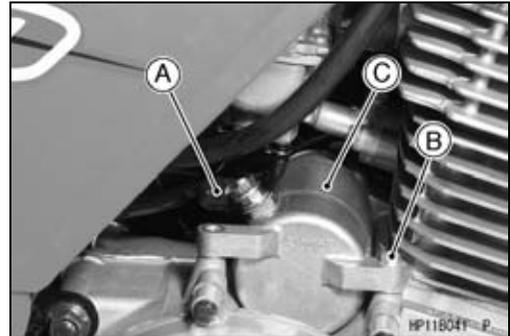
## Electric Starter System

### Starter Motor Removal

- Remove:
  - Exhaust Pipe (see Engine Top End chapter)
  - Oil Pipes [A]



- Remove:
  - Starter Motor Lead [A]
  - Starter Motor Mounting Bolt [B]
  - Starter Motor [C]

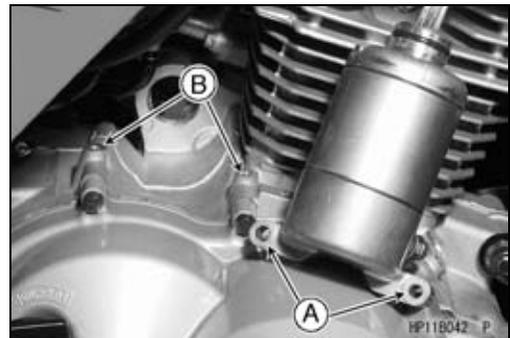


### CAUTION

**Do not tap the end of the starter motor shaft or the motor may be damaged.**

### Starter Motor Installation

- When installing the starter motor, clean the starter motor lugs [A] and crankcase [B] where the starter motor is grounded.



- If the O-ring [A] shows any damage or if it is hardened, replace it with a new one.
- Apply a small amount of engine oil to the O-ring.

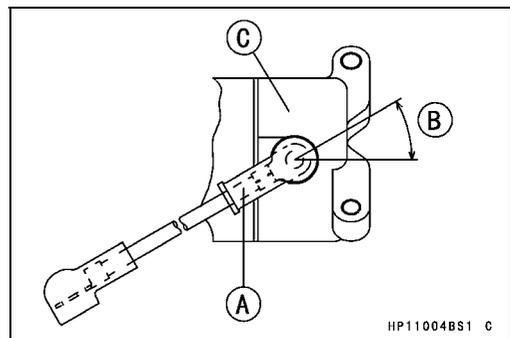


- Attach the stater motor lead [A] at the angle as shown.
  - [B] 30°
  - [C] Starter Motor

- Tighten:

**Torque - Starter Motor Mounting Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**

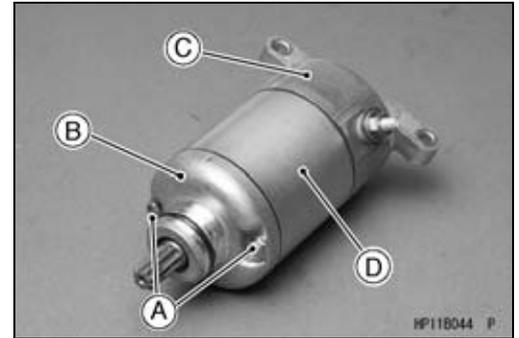
**Starter Motor Terminal Nut : 4.9 N·m (0.5 kgf·m, 43 in·lb)**



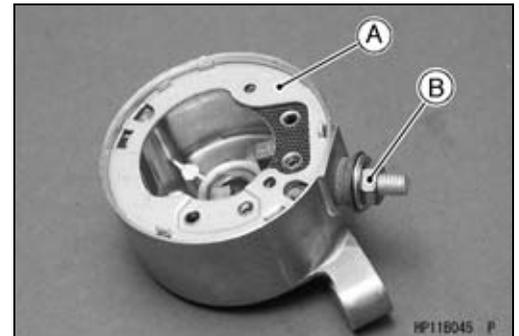
## Electric Starter System

### Starter Motor Disassembly

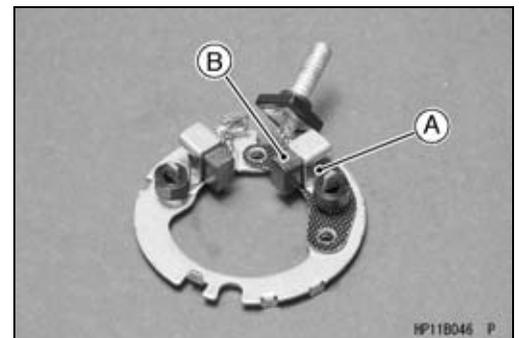
- Remove:
  - Starter Motor Through Bolts [A]
  - Left End Cover [B]
  - Right End Cover [C]
  - Yoke [D]



- To remove the brush plate assembly [A], remove the terminal locknut [B].

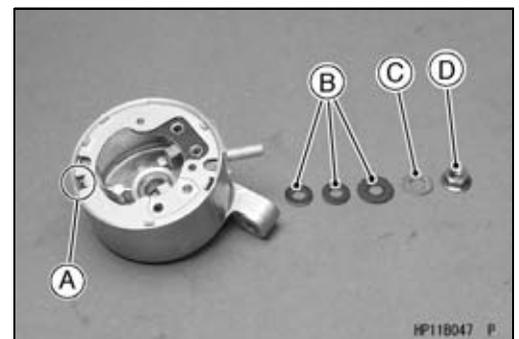


- Hold the brush spring [A] with needle nose pliers, and pull the brush [B] off the holder.

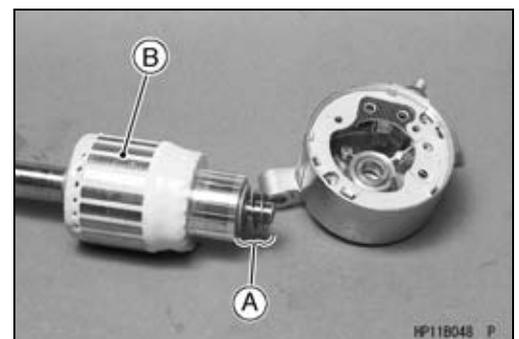


### Starter Motor Assembly

- Replace the O-rings with new ones.
- Install the brush plate assembly to the right end cover so that the projection [A] on the brush plate fits into the groove on the right end cover.
- Install the O-ring, insulators [B], and washer [C] in that order to the terminal bolt.
- Tighten:
  - Torque - Starter Motor Terminal Locknut [D]: 6.9 N·m (0.7 kgf·m, 61 in·lb)**



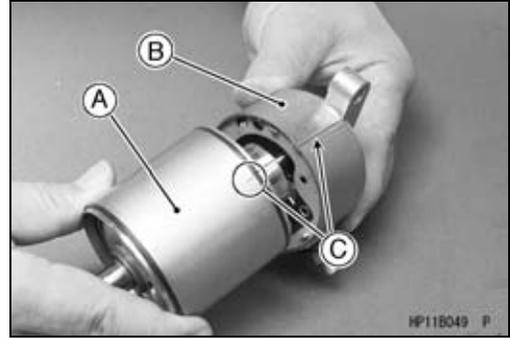
- Install the washers [A].
- Install the armature [B] between the brushes.



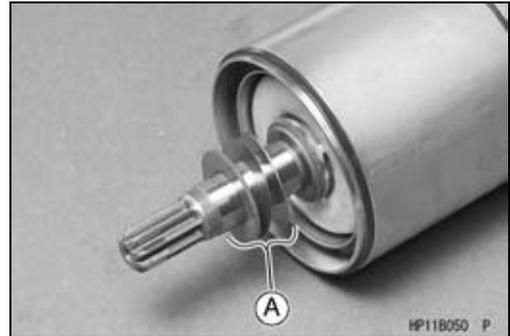
## 16-36 ELECTRICAL SYSTEM

### Electric Starter System

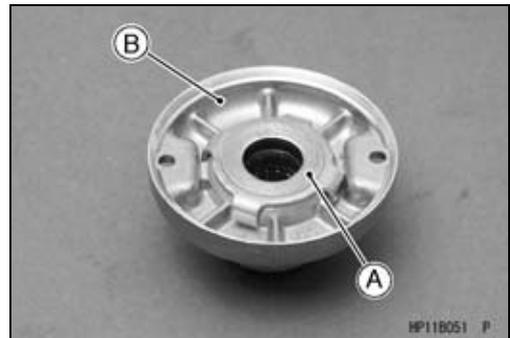
- Install the yoke [A] onto the right end cover [B] aligning the marks [C] on the yoke and right end cover.



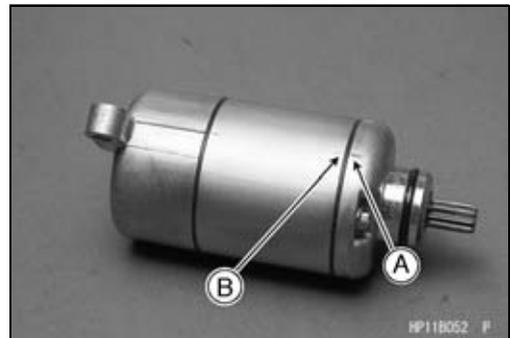
- Install the washers [A].



- Install the plate [A] on the left end cover [B].

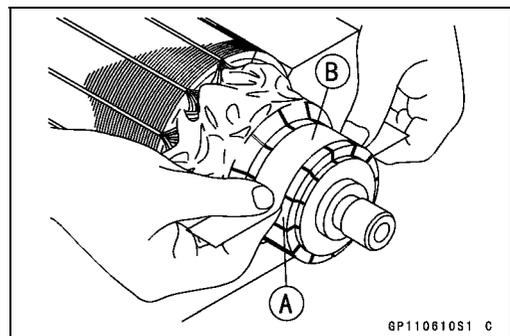


- Align the mark [A] on the left end cover with the mark [B] on the yoke.
- Tighten:  
**Torque - Starter Motor Bolts: 3.4 N·m (0.3 kgf·m, 30 in·lb)**



#### *Commutator Cleaning/Inspection*

- Smooth the commutator surface [A] if necessary with fine emery cloth [B], and clean out the grooves.



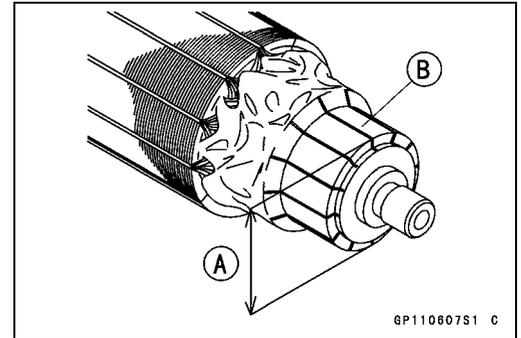
## Electric Starter System

- Measure the diameter [A] of the commutator [B].
- ★ Replace the starter motor with a new one if the commutator diameter is less than the service limit.

### Commutator Diameter

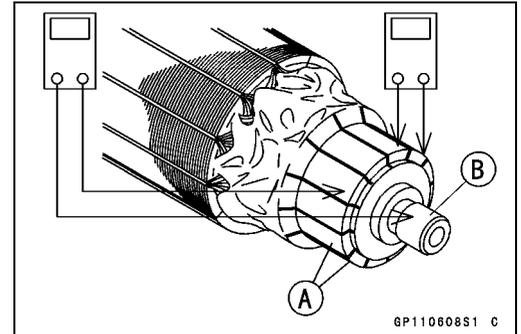
**Standard:** 28 mm (1.10 in.)

**Service Limit:** 27 mm (1.06 in.)



### Armature Inspection

- Using the x 1  $\Omega$  range of the hand tester, measure the resistance between any two commutator segments [A].
- ★ If there is a high resistance or no reading ( $\infty$ ) between any two segments, a winding is open. Replace the starter motor.
- Using the highest range of the hand tester, measure the resistance between the segments and the shaft [B].
- ★ If there is any reading at all, the armature has a short. Replace the starter motor.



### NOTE

○ Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with the hand tester. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.

### Starter Motor Brush Length

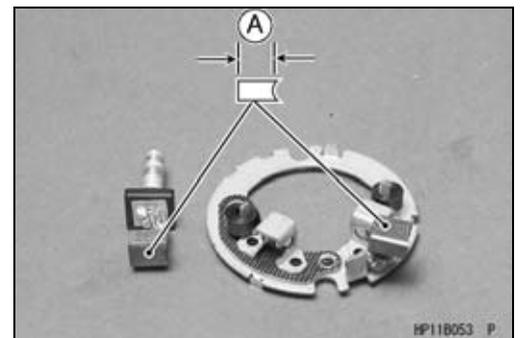
- Measure the overall length [A] of each brush.

### Starter Motor Brush Length

**Standard:** 10 mm (0.39 in.)

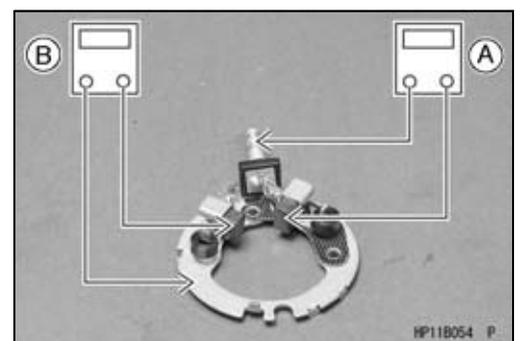
**Service Limit:** 6.5 mm (0.26 in.)

- ★ If any is worn down to the service limit, replace the brush plate assembly.



### Brush Assembly Inspection

- Using the x 1  $\Omega$  range of the hand tester, measure the resistance as shown.
  - [A] Terminal Bolt and Positive Brush
  - [B] Brush Plate and Negative Brush
- ★ If there is not close to 0  $\Omega$ , the brush lead has an open. Replace the brush plate assembly.

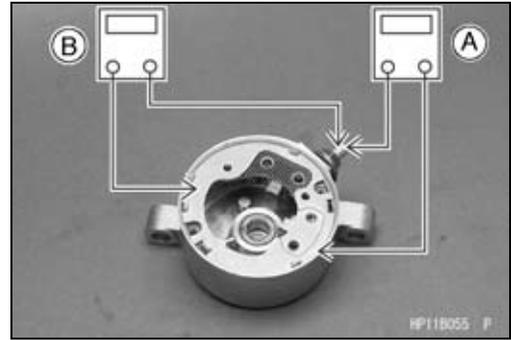


## 16-38 ELECTRICAL SYSTEM

### Electric Starter System

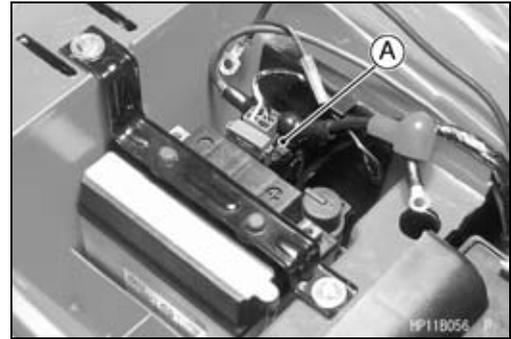
#### Brush Plate and Terminal Bolt Inspection

- Using the highest range of the hand tester, measure the resistance as follows:
  - [A] Terminal Bolt and Right - Hand End Cover
  - [B] Terminal Bolt and Brush Plate
- ★ If there is any reading, the insulator may be failed. Replace the washer (insulator) of the end cover.



#### Starter Relay Inspection

- Remove:
  - Seat (see Frame chapter)
  - Starter Relay [A]
- Connect the hand tester [A] and 12 V battery [B] to the starter relay as shown.
- ★ If the relay does not work as specified, the relay is defective. Replace the relay.

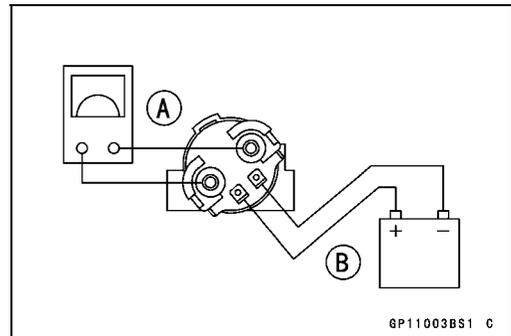


#### Testing Relay

Hand Tester Range: x 1Ω range

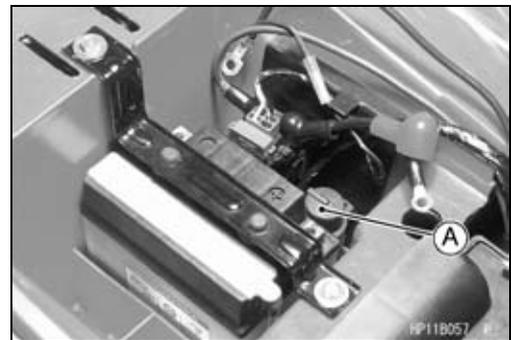
Criteria: When battery is connected ⇒ 0 Ω

When battery is disconnected ⇒ ∞ Ω



#### Starter Circuit Relay Inspection

- Remove:
  - Seat (see Frame chapter).
  - Starter Circuit Relay [A]



**Electric Starter System**

- Connect the hand tester [A] and 12 V battery [B] to the starter circuit relay [C] as shown.
- ★ If the relay does not work as specified, the relay is defective. Replace the relay.

**Testing Relay**

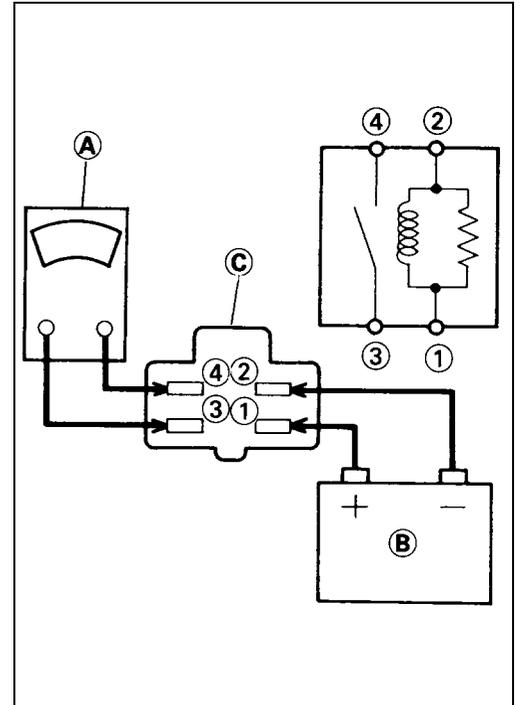
Hand Tester Range: x 1 Ω

Criteria: When battery is connected ⇒ 0 Ω

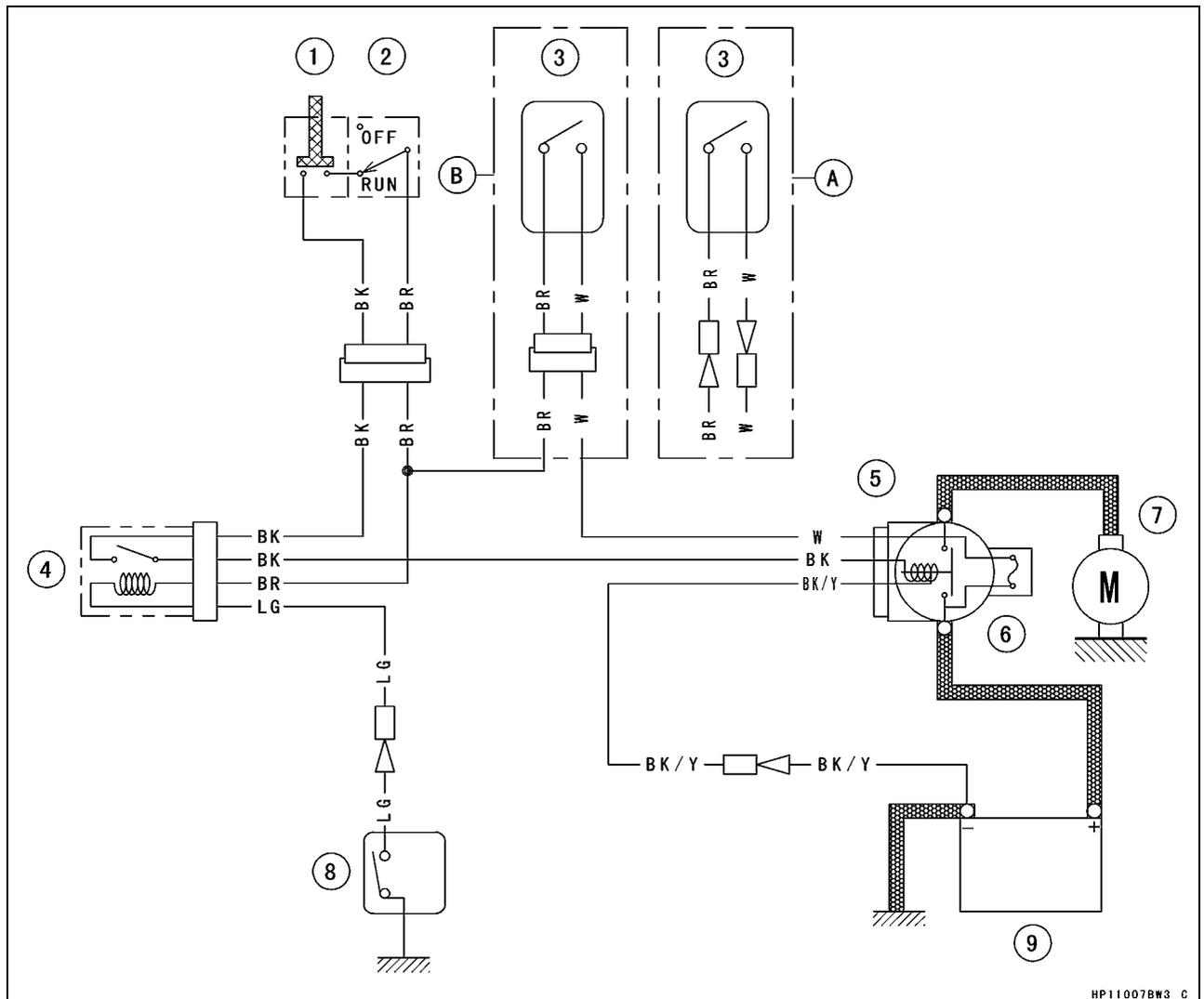
When battery is disconnected ⇒ ∞ Ω

Relay Coil Terminals [1] and [2]

Relay Switch Terminals [3] and [4]



**Electric Starter Circuit**



HP11007BW3 C

- A: KLF250-A1
- B: KLF250-A2 ~

## **16-40 ELECTRICAL SYSTEM**

---

### **Electric Starter System**

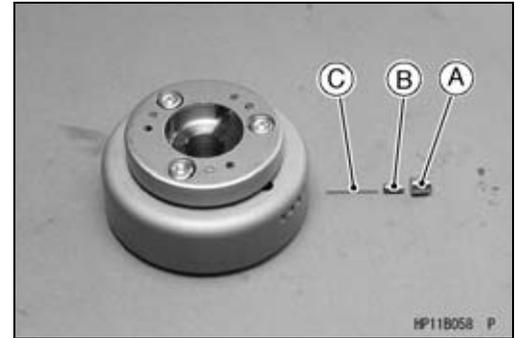
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- |                       |                          |                           |
|-----------------------|--------------------------|---------------------------|
| 1. Starter Button     | 4. Starter Circuit Relay | 7. Starter Motor          |
| 2. Engine Stop Switch | 5. Starter Relay         | 8. Neutral/Reverse Switch |
| 3. Ignition Switch    | 6. Main Fuse 20 A        | 9. Battery                |

## Starter Motor Clutch

### Starter Motor Clutch Removal

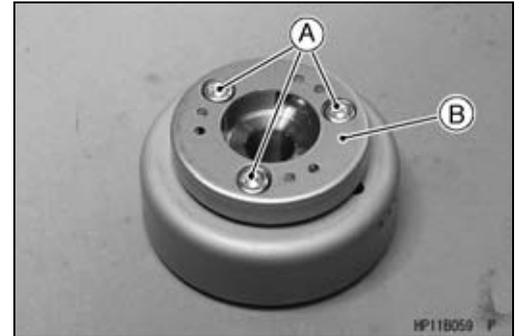
- Remove the alternator rotor (see Alternator Rotor Removal).
- Gently pry the clutch rollers [A] out. They will be followed by the spring caps [B] and springs [C].



- Hold the rotor with the flywheel holder and remove the starter motor clutch bolts [A].

**Special Tool - Flywheel Holder: 57001-1313**

- Take out the starter motor clutch [B].



### Starter Motor Clutch Installation

- Apply a non-permanent locking agent:  
Starter Motor Clutch Bolts
- Tighten:

**Torque - Starter Motor Clutch Bolts : 34 N·m (3.5 kgf·m, 25 ft·lb)**

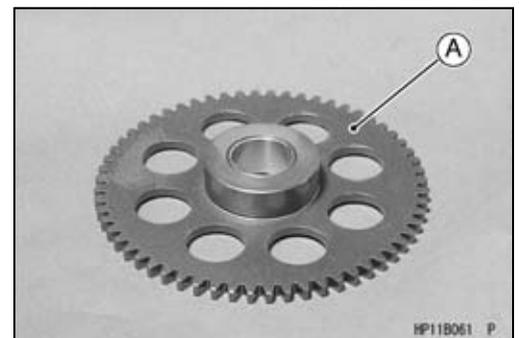
### Starter Motor Clutch Inspection

- Remove the starter motor (see Starter Motor Removal).
- Turn the starter idle gear with your finger.
- ★ If the idle gear turns clockwise [A] freely, but not counter-clockwise, the clutch is operating as it should.
- ★ If the clutch does not operate as it should, or if it makes noise, disassemble it, examine each part visually, and replace any worn or damaged parts.



### NOTE

○ Examine the starter clutch gear [A] as well. Replace it if it is worn or damaged.

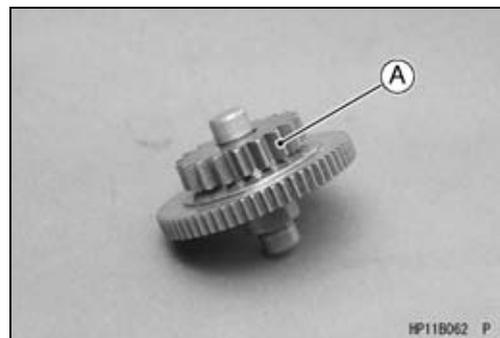


## 16-42 ELECTRICAL SYSTEM

### Starter Chain and Sprockets

#### *Torque Limiter Inspection*

- Remove the torque limiter [A] and visually inspect it.
- ★ If the limiter has wear, discoloration, or other damage, replace it as a unit.



## Lighting System

### Headlight Beam Vertical Adjustment

- Turn the adjusting screws [A] on each headlight rim in or out to adjust the headlight vertically.

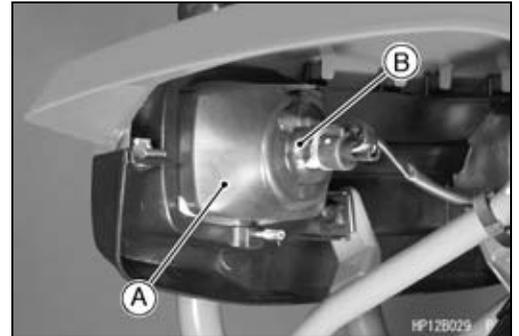
#### NOTE

○ On high beam, the brightest point should be slightly below horizontal with the vehicle on its wheels and the rider seated. Adjust both headlights to the same angle.

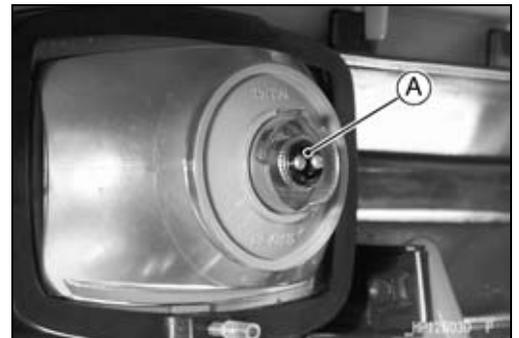


### Headlight Bulb Replacement

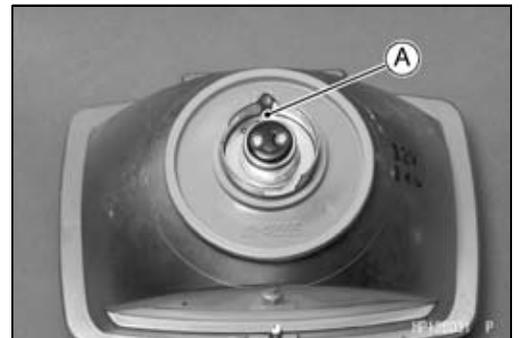
- Slide back the dust cover [A].
- Push and turn the bulb holder [B] counterclockwise and remove the bulb holder from the headlight unit.



- Remove:  
Bulb [A]



- Install the new bulb by aligning the tang [A] with the notch in the headlight unit.



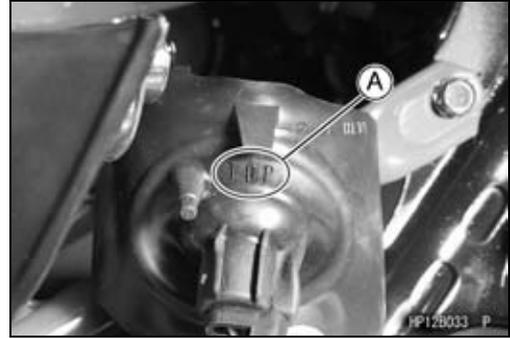
- Fit the tangs [A] to the notches in the headlight unit, and then push and turn the bulb holder clockwise.



## 16-44 ELECTRICAL SYSTEM

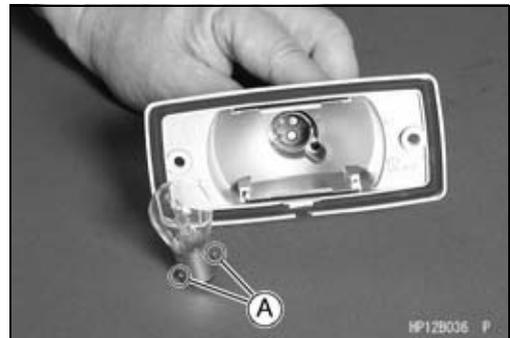
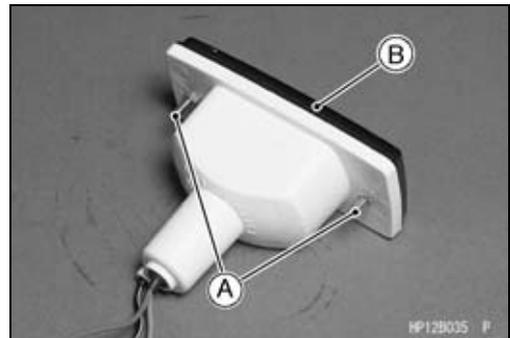
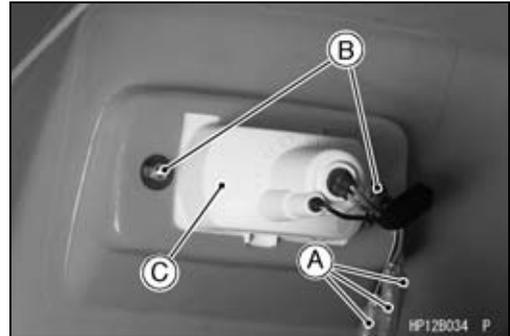
### Lighting System

- Face the TOP mark [A] on the dust cover upward and fit it completely.



#### Taillight Bulb Replacement

- Remove:
  - Taillight Lead Connectors [A]
  - Taillight Housing Holder Nuts [B] and Washers
  - Taillight Assembly [C]
- Remove:
  - Taillight Lens Mounting Screws [A] and Nuts
  - Taillight Lens [B]
- Push the bulb in, turn it counterclockwise, and pull it out.
- Be sure the socket is clean.
- Insert the new bulb by aligning the pins [A] with the grooves in the walls of the sprocket.
- Push the bulb in, turn it clockwise, and release it. It should lock in position.

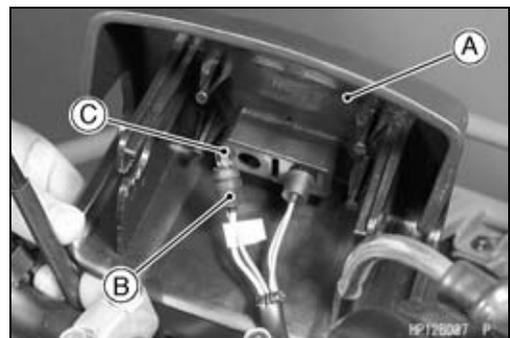


#### Neutral and Reverse Indicator Light Bulb Replacement

- Remove:
  - Handlebar Cover [A]
- Remove the socket [B] with the bulb attached.
- Pull the bulb [C] out of the socket.

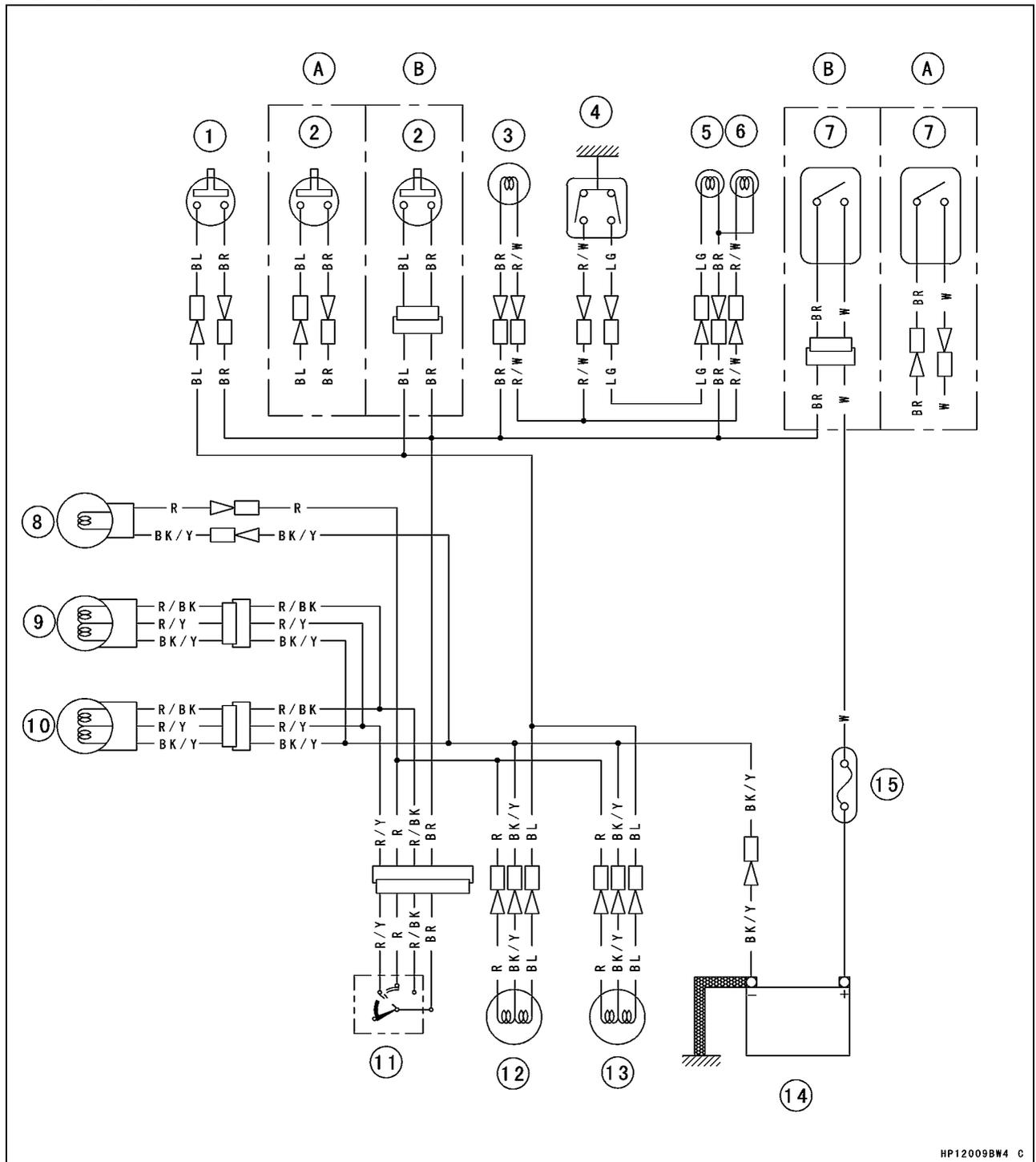
#### CAUTION

**Do not turn the bulb to prevent damage to the bulb. The indicator bulbs are of a wedge-base type. Do not use the bulb rated for greater wattage than the specified value.**



Lighting System

Lighting System Circuit



HP12009BW4 C

A: KLF250-A1

B: KLF250-A2 ~

- |   |  |                              |
|---|--|------------------------------|
| 1. Front Brake Light Switch               | 6. Reverse Indicator Light                         | 10. Headlight (Left)         |
| 2. Rear Brake Light Switch                | 7. Ignition Switch                                 | 11. Light/Dimmer Switch      |
| 3. Reverse Light (Europe and U.K. models) | 8. Speedometer Light (Australia and Europe models) | 12. Tail/Brake Light (Right) |
| 4. Neutral/Reverse Switch                 | 9. Headlight (Right)                               | 13. Tail/Brake Light (Left)  |
| 5. Neutral Indicator Light                |  | 14. Battery                  |
|   |  | 15. Main Fuse 20 A           |

# 16-46 ELECTRICAL SYSTEM

## Switches

### *Brake Light Switch Adjustment*

- Refer to the Brake Light Switch Adjustment in the Periodic Maintenance chapter.

### *Switch Inspection*

- Using the hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).
- For the handlebar switches, and ignition switch refer to tables in the Wiring Diagram.
- ★ If the switch has an open or short, repair or replace it with a new one.

### Front Brake Light Switch Connections

	B L	B R
Brake lever pulled in		
Brake lever released		

HP14006B3 C

### Rear Brake Light Switch Connections

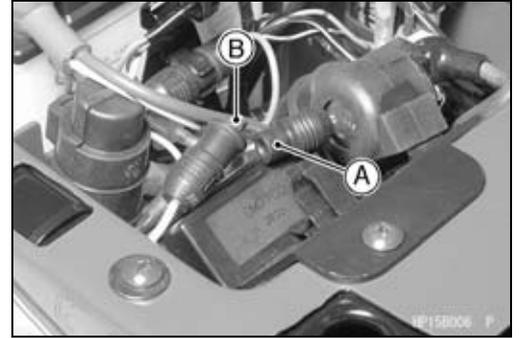
	B L	B R
Brake pedal pushed down		
Brake pedal released		

HP14006B3 C

## Fuses

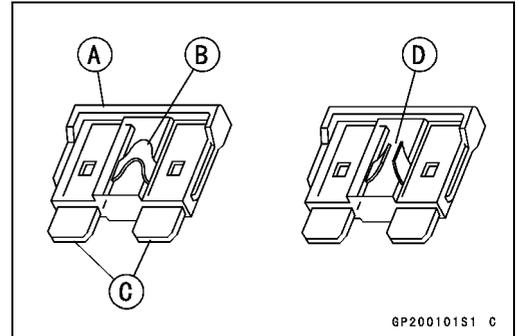
### 20 A Main Fuse Removal

- Remove:
  - Seat (see Frame chapter)
  - Fuse Connector [A]
- Pull out the main fuse [B] from the starter relay.



### Fuse Inspection

- Inspect the fuse element.
- ★ If it is blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.
  - Housing [A]
  - Fuse Element [B]
  - Terminals [C]
  - Blown Element [D]

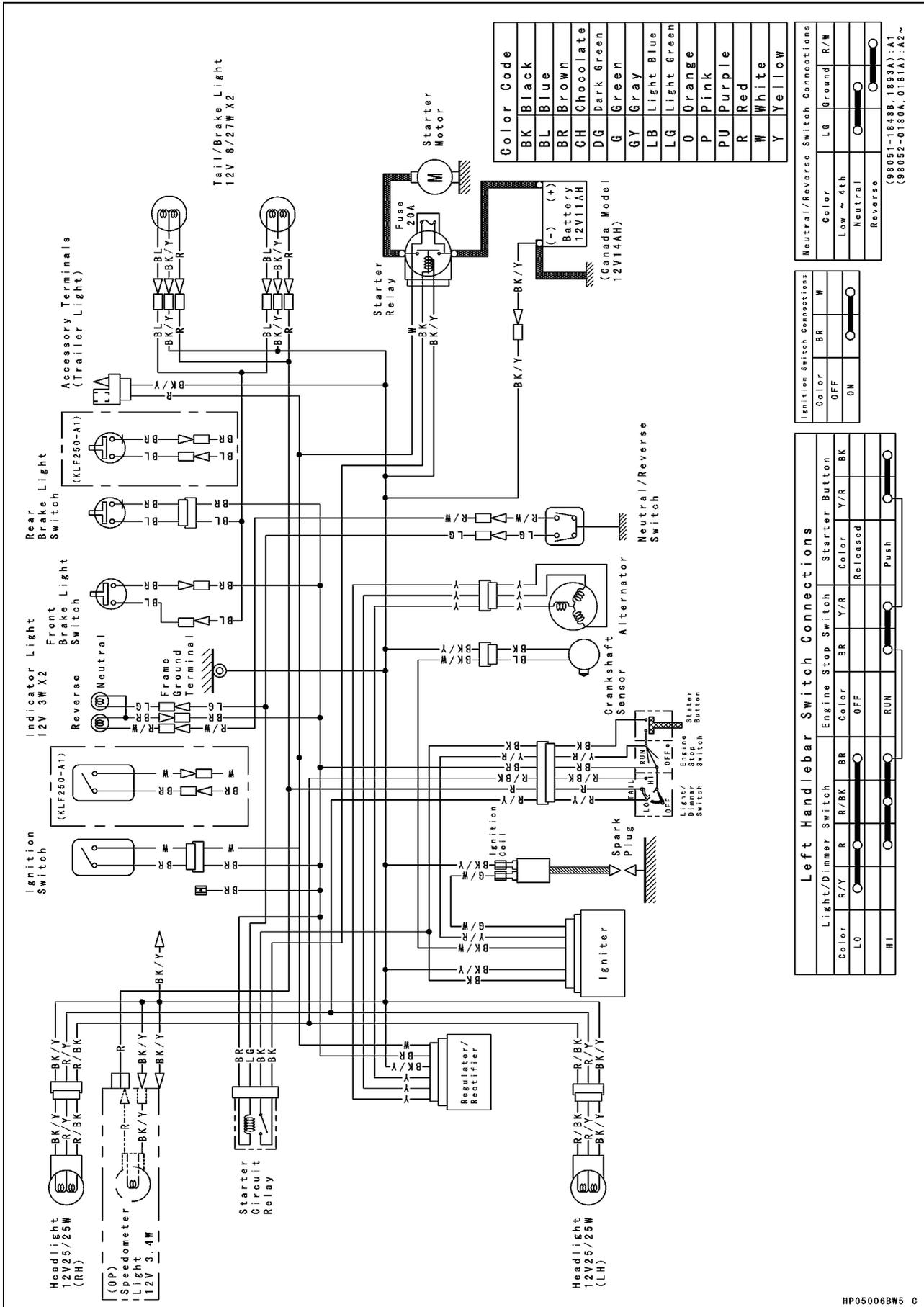


### CAUTION

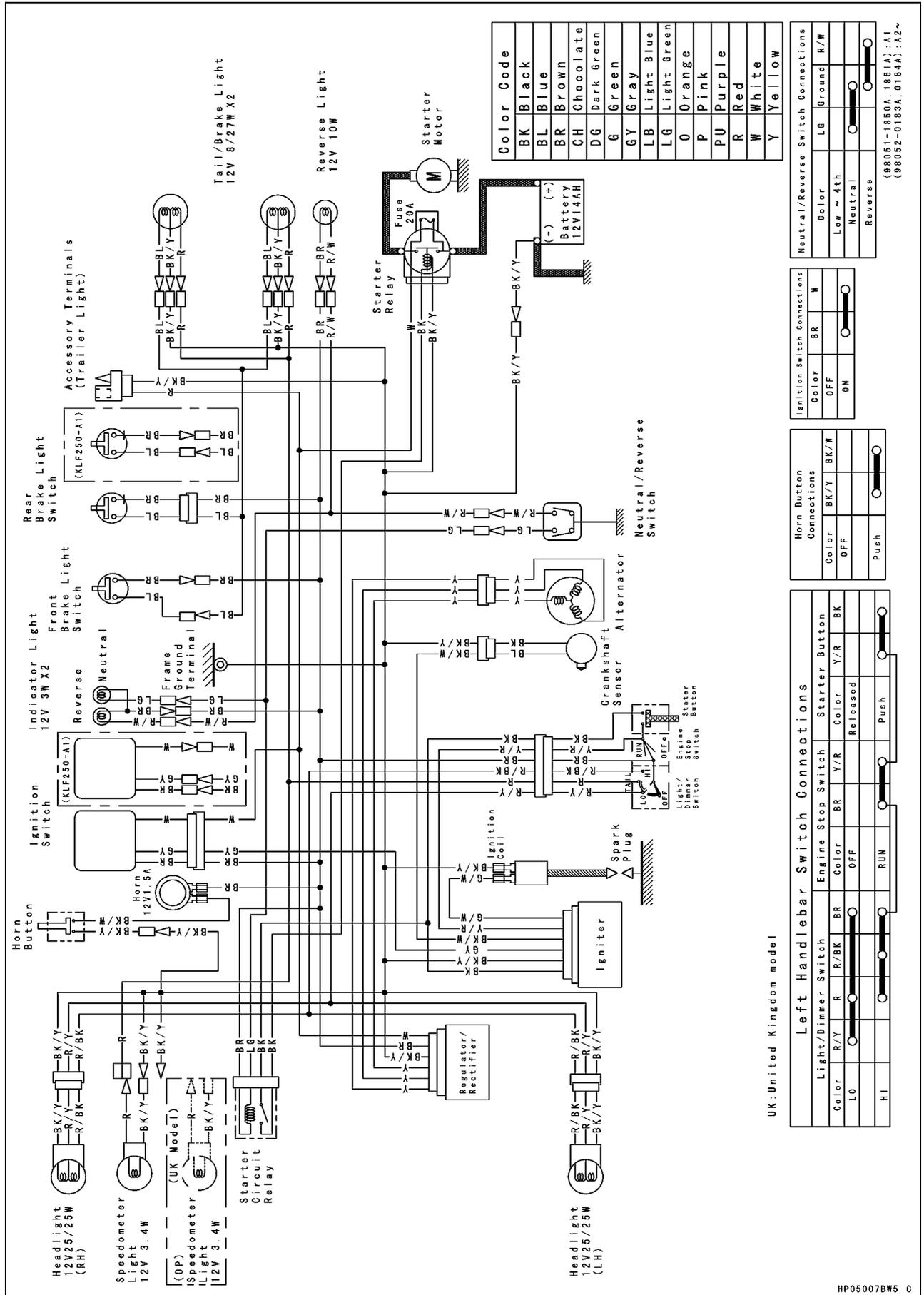
**When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Installation of a fuse with a higher rating may cause damage to wiring and components.**

# 16-48 ELECTRICAL SYSTEM

## Wiring Diagram (U.S.A. and Canada Models)

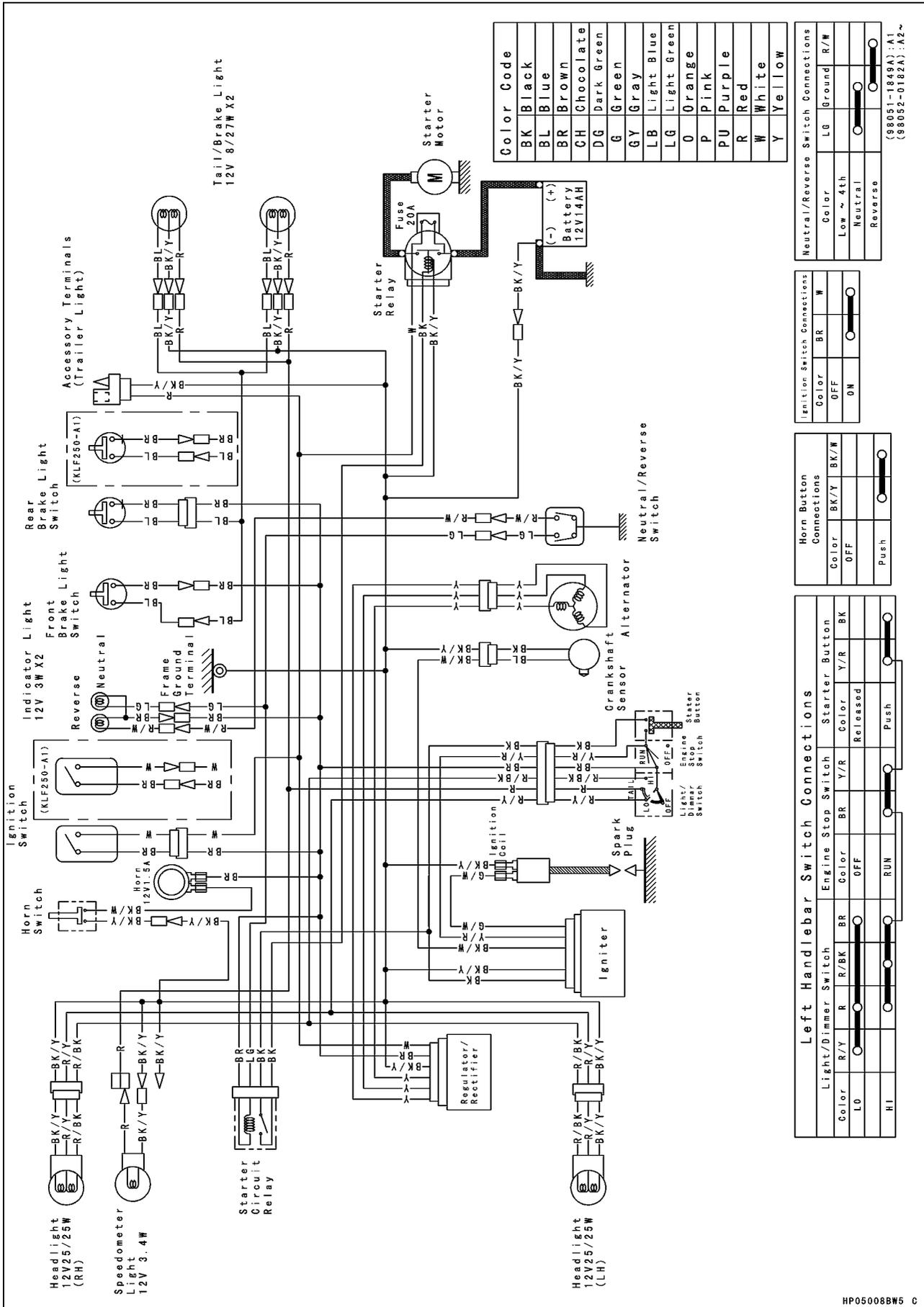


Wiring Diagram (Europe Model)



# 16-50 ELECTRICAL SYSTEM

## Wiring Diagram (Australia Model)



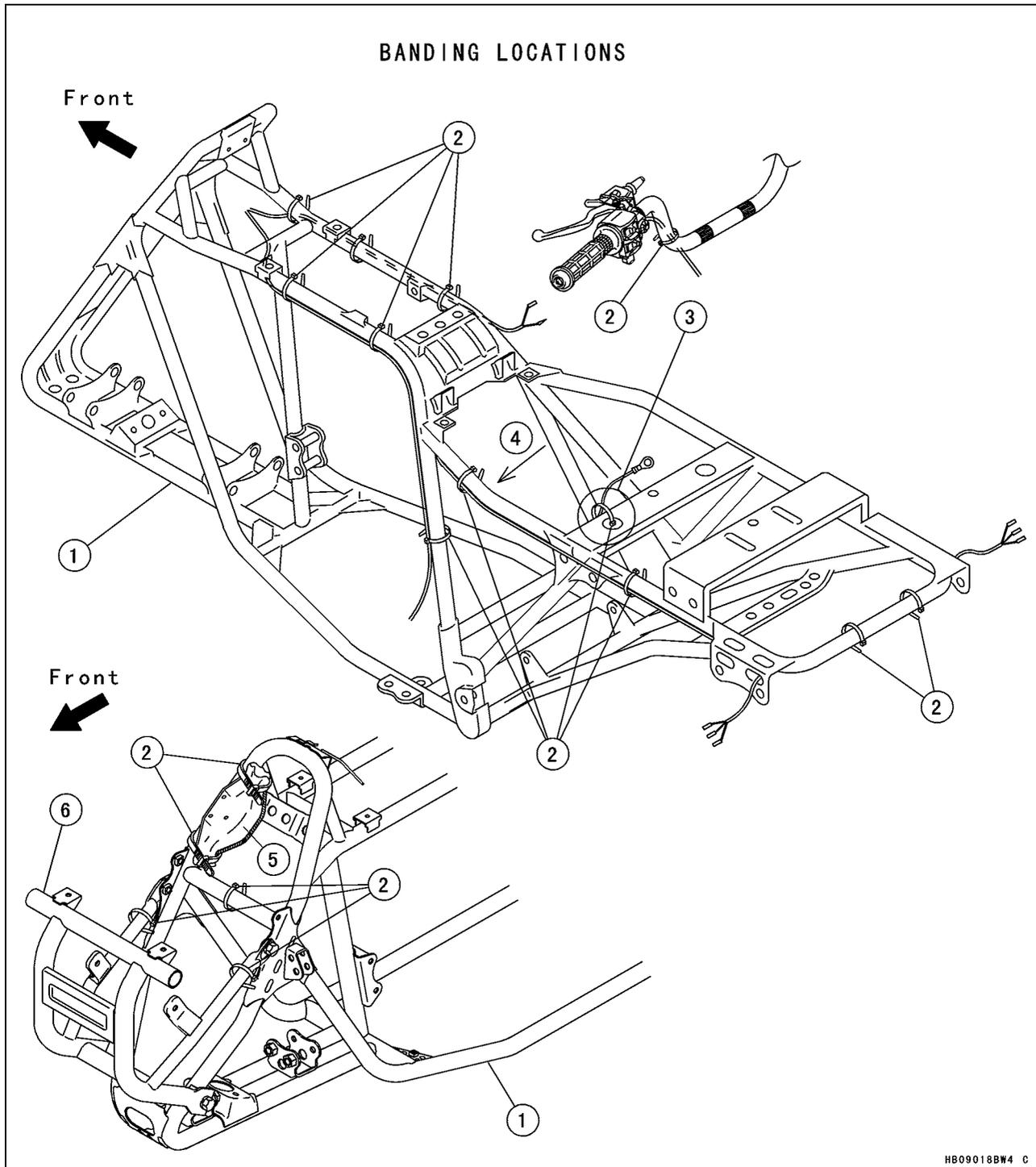
# Appendix

## Table of Contents

Cable, Wire, and Hose Routing ..... 17-2  
Troubleshooting Guide ..... 17-12

## 17-2 APPENDIX

### Cable, Wire, and Hose Routing



1. Frame

2. Bands

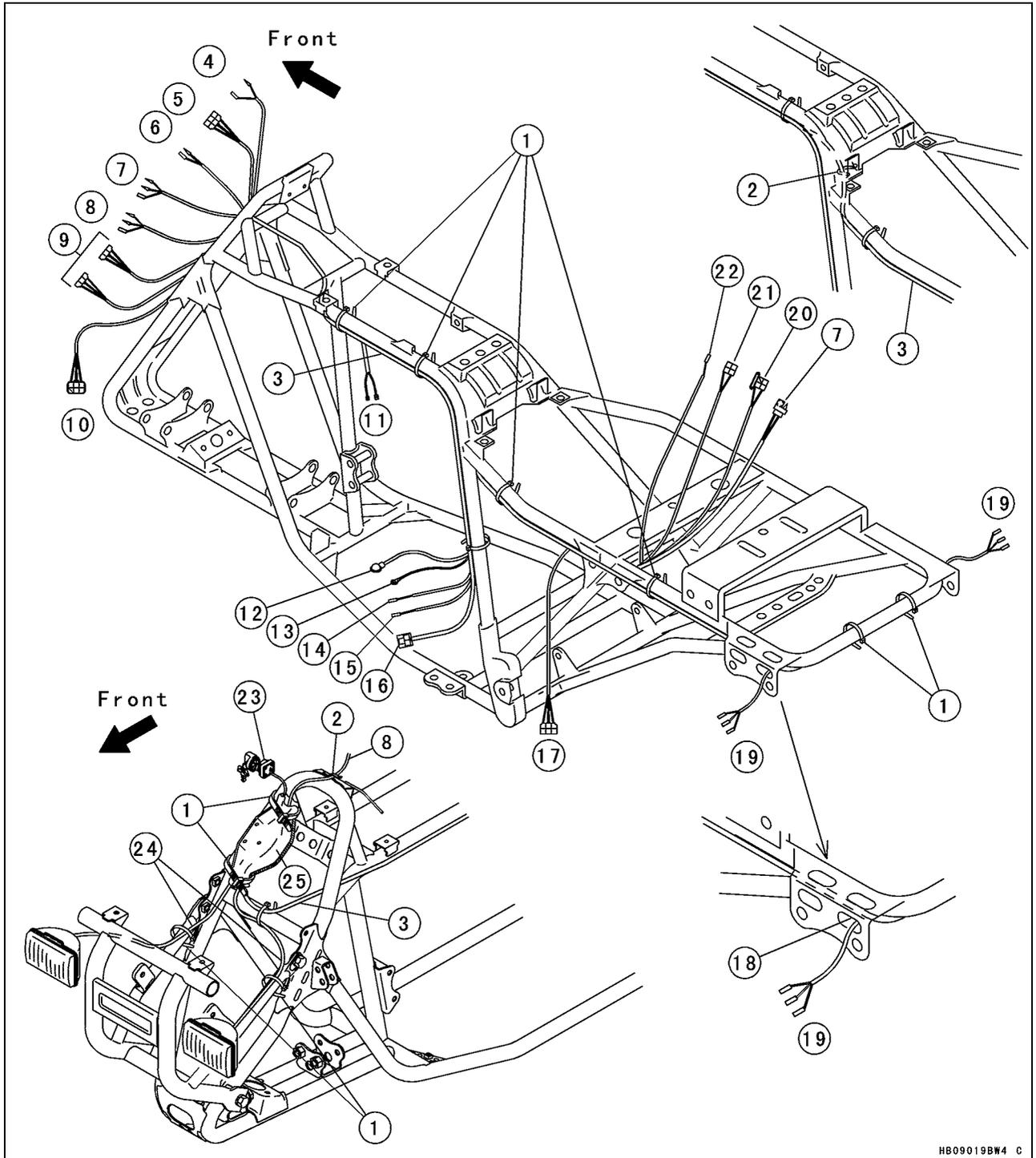
3. Turn outward the cutting portion of the band away from the frame center.

4. Outward

5. Coupler Cover

6. Front Guard

Cable, Wire, and Hose Routing

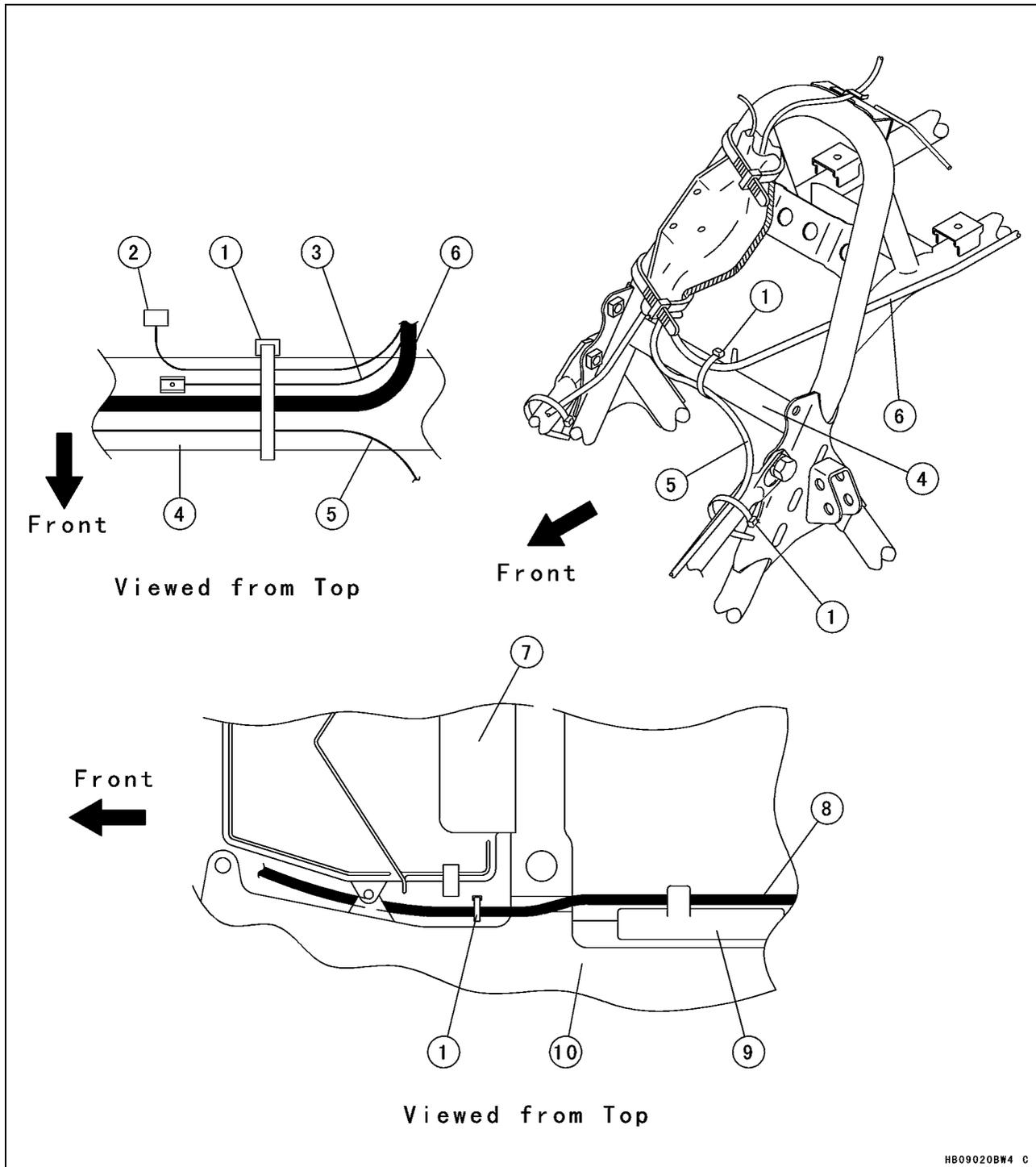


HB09019BW4 C

- |                                   |  |                                 |
|-----------------------------------|--|---------------------------------|
| 1. Bands                          | 11. To Ignition Coil                             | 20. Starter Circuit Relay Leads |
| 2. Clamps                         | 12. To Starter Motor                             | 21. Starter Relay Leads         |
| 3. Main Harness                   | 13. To Engine Ground Terminal                    | 22. To Battery Ground Terminal  |
| 4. Ignition Switch Leads          | 14. Reverse Switch lead                          | 23. Ignition Switch             |
| 5. Handlebar Switch Leads         | 15. Neutral Switch Lead                          | 24. Headlight Lead              |
| 6. Front Brake Light Switch Leads | 16. Charging Coil Leads                          | 25. Coupler Cover               |
| 7. Accessory Leads                | 17. To Regulator/Rectifier                       |                                 |
| 8. Indicator Light Leads          | 18. Route the taillight leads through this hole. |                                 |
| 9. Headlight Leads                | 19. Tail/Brake Light Leads                       |                                 |
| 10. To Igniter                    |  |                                 |

## 17-4 APPENDIX

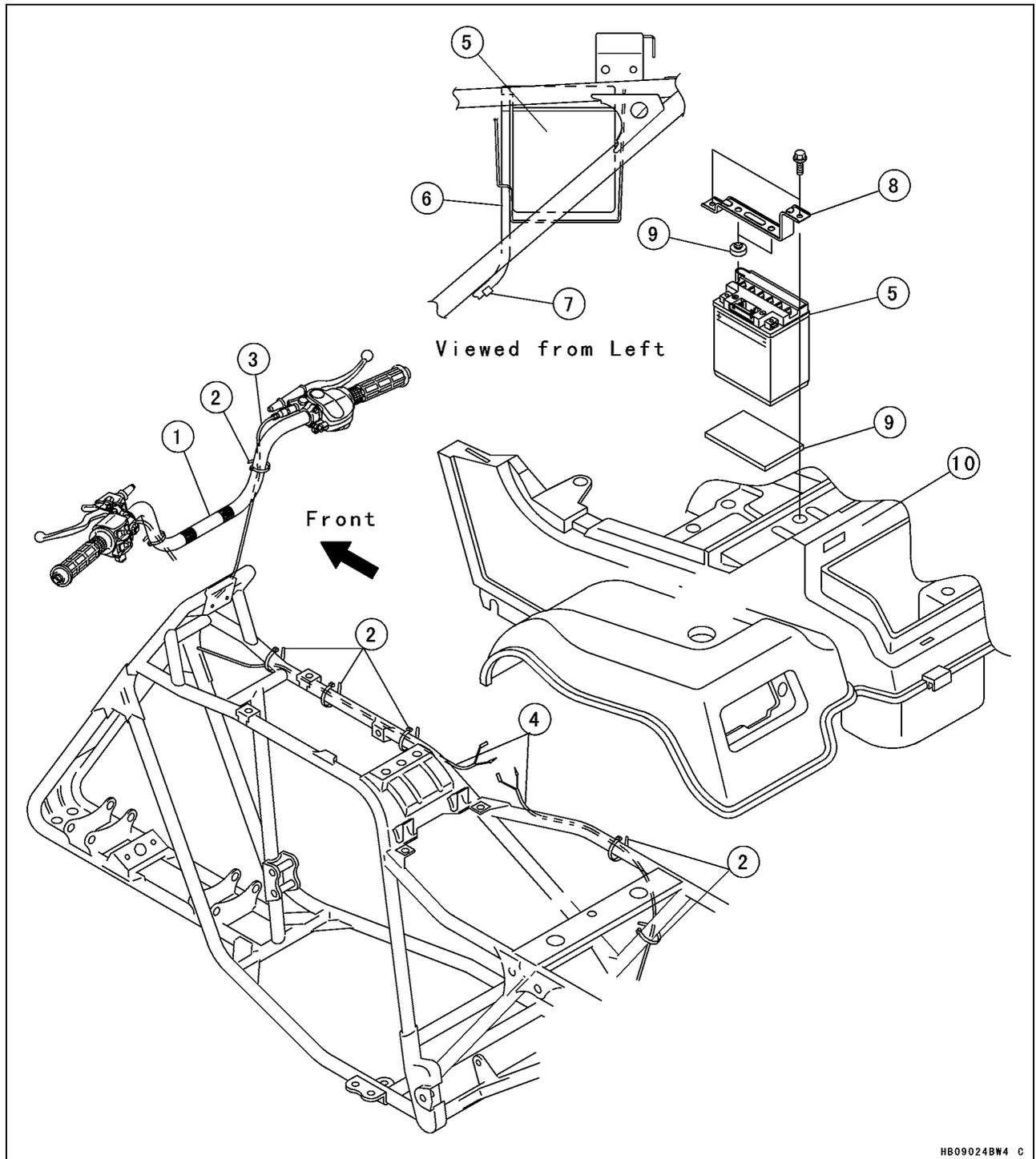
### Cable, Wire, and Hose Routing



1. Bands
2. To Igniter
3. Horn Lead
4. Cross Pipe
5. To Left Headlight
6. Main Harness

7. Air Cleaner
8. Main Harness, Battery Ground Cable and Starter Motor Cable
9. Route the harness under the plate shown.
10. Rear Fender

Cable, Wire, and Hose Routing



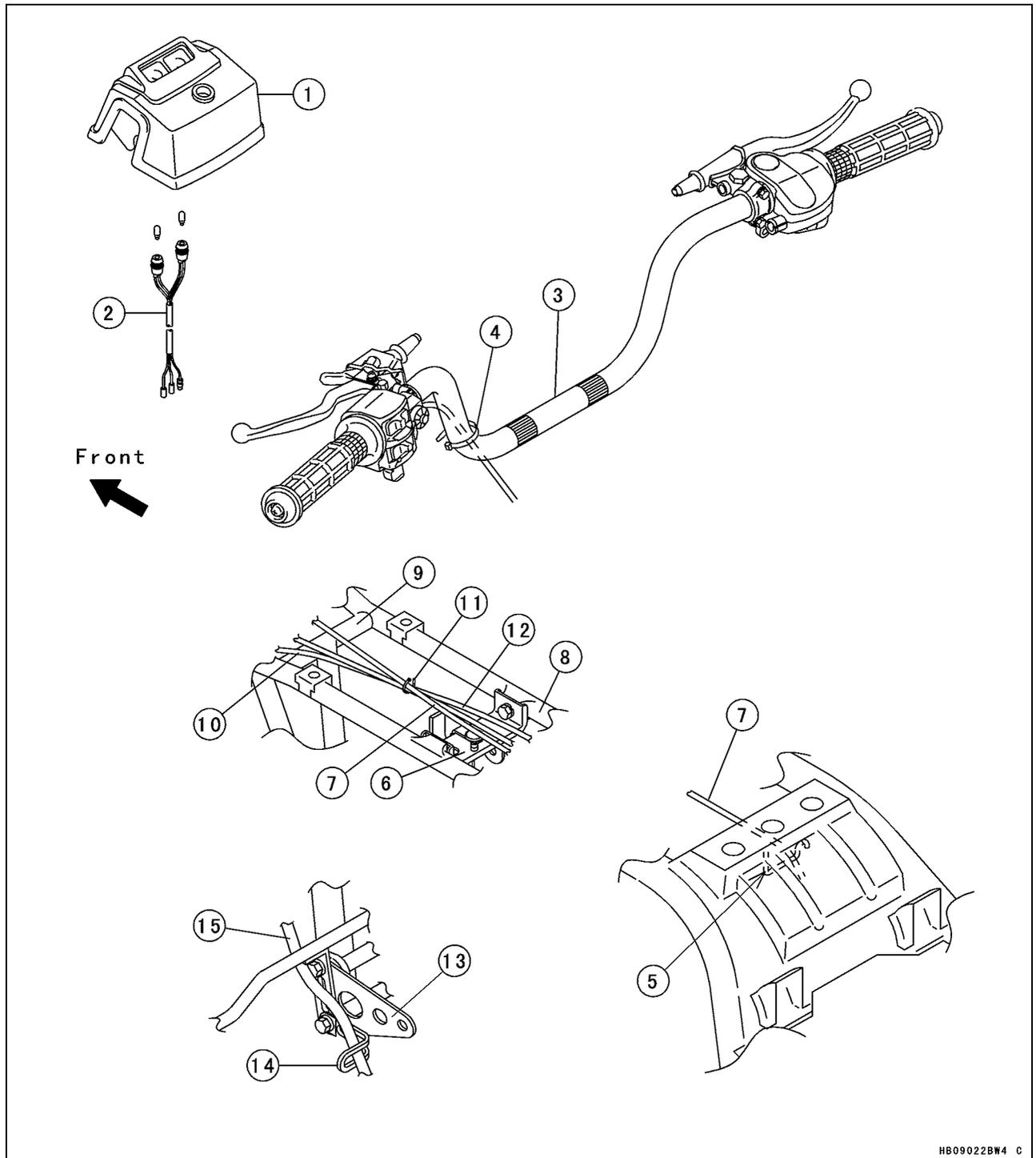
HB09024BW4 C

- 1. Handlebar
- 2. Bands
- 3. Front Brake Light Switch Leads
- 4. Rear Brake Light Switch Leads
- 5. Battery

- 6. Battery Breather Hose
- 7. Clamp
- 8. Battery Band
- 9. Damper
- 10. Rear Fender



Cable, Wire, and Hose Routing

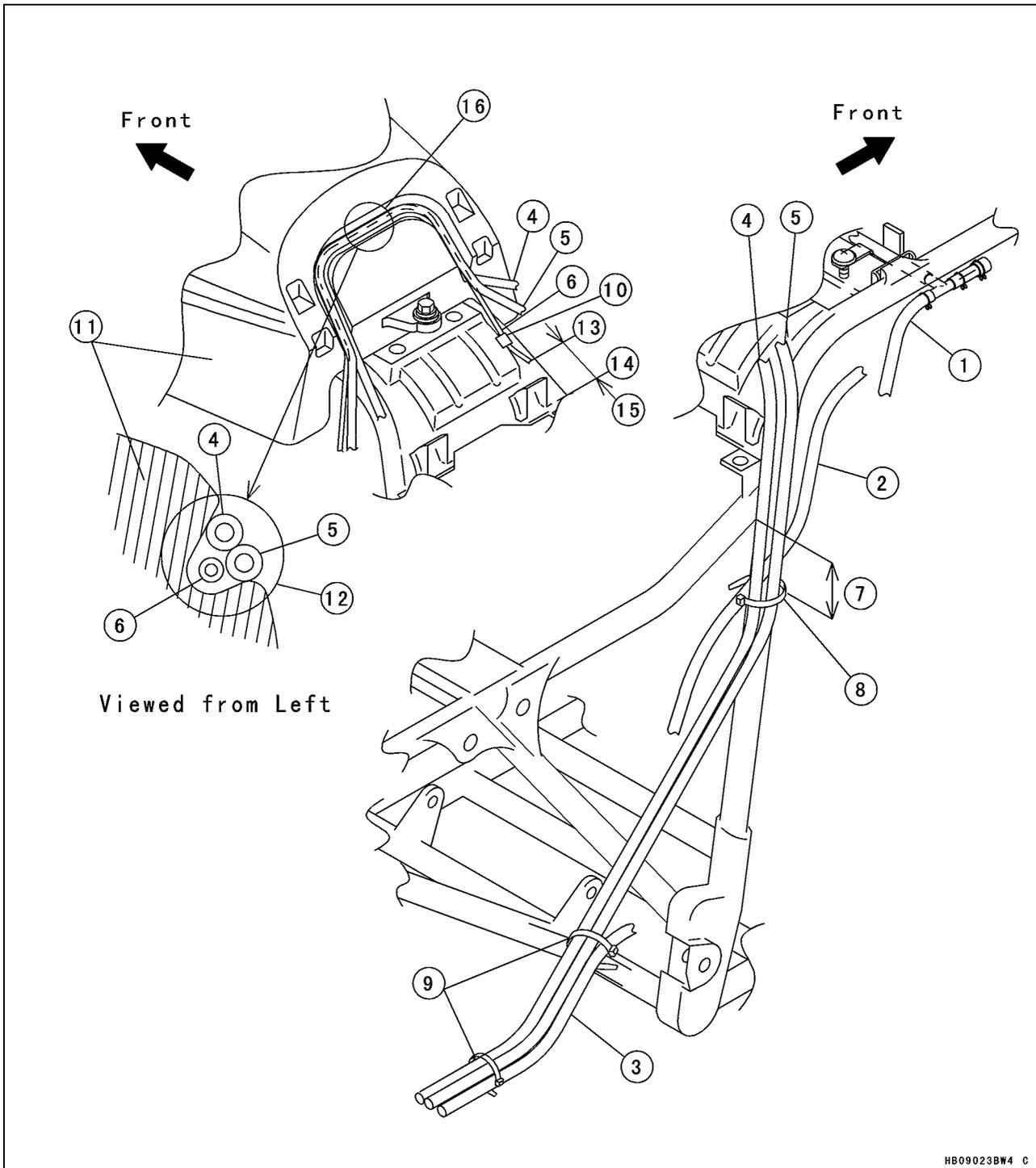


HB09022BW4 C

- |  |                                |
|--|--------------------------------|
| 1. Handlebar Cover                                   | 8. Frame                       |
| 2. Indicator Light Leads                             | 9. Cross Pipe                  |
| 3. Handlebar   | 10. Choke Cable                |
| 4. Clamp the choke cable and handlebar switch leads. | 11. Band                       |
| 5. Install the throttle cable only in the clamp.     | 12. Rear (Parking) Brake Cable |
| 6. Bracket   | 13. Engine Bracket             |
| 7. Throttle Cable                                    | 14. Clamp                      |
|  | 15. Reverse Cable              |

## 17-8 APPENDIX

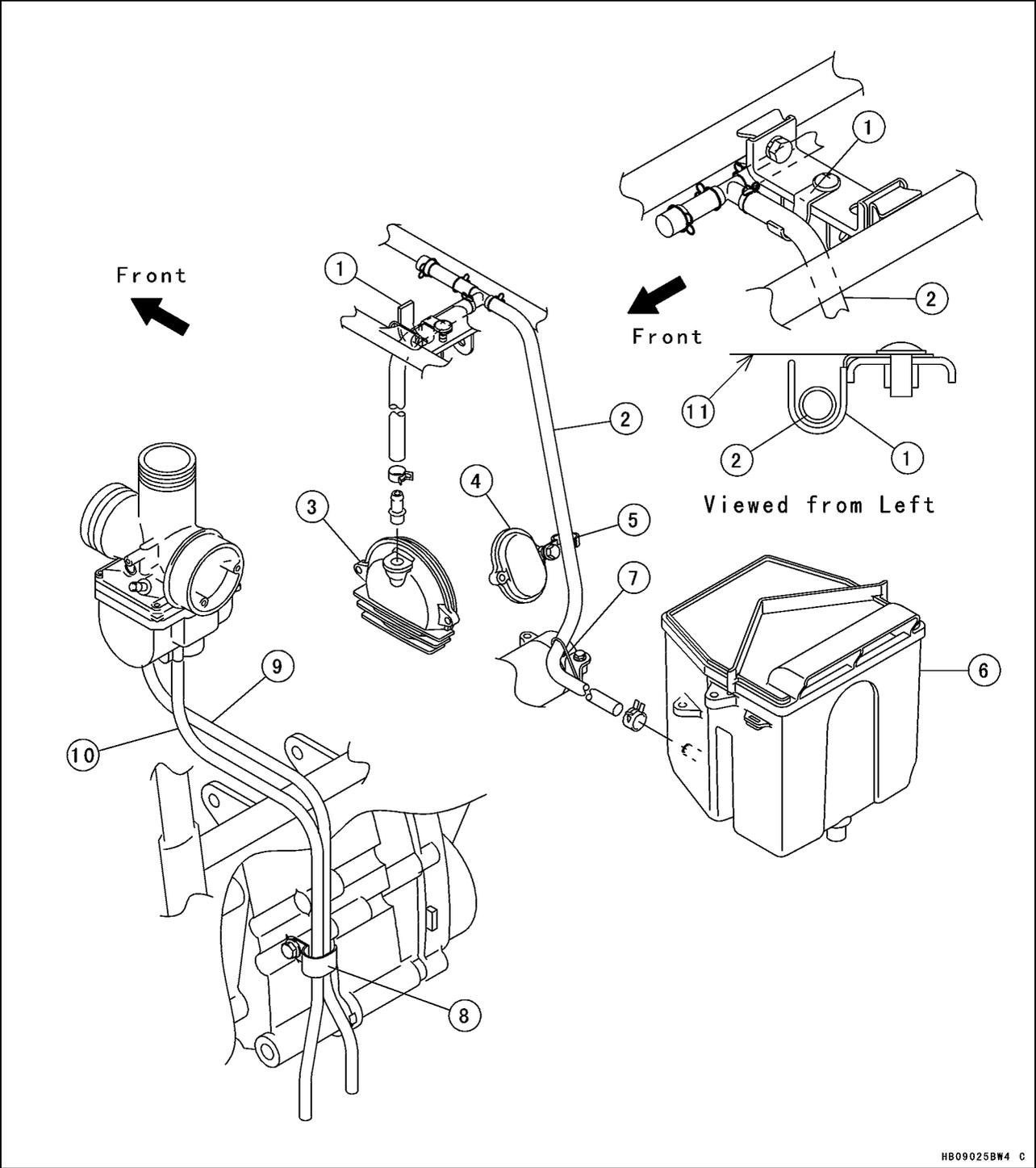
### Cable, Wire, and Hose Routing



HB09023BW4 C

1. Breather Hose for Engine
2. Parking Cable
3. Rear Brake Cable
4. Breather Hose for Final Gear Case
5. Breather Hose for Rear Brake
6. Carburetor Vent Hose: Make sure the carburetor vent hose is not kinked.
7. 70 mm (2.7559 in)
8. Clamp the breather hoses and parking cable with the band.
9. Clamp the breather hoses and rear brake cable with the bands.
10. Clamp
11. Fuel Tank
12. It is important to position three hoses as shown.
13. Carburetor Vent Hose End
14. Frame Gusset Upper Surface
15. 3 ~ 9 mm (0.1181 ~ 0.3543 in)
16. Install the vent hoses in the slots at the back of the fuel tank.

Cable, Wire, and Hose Routing

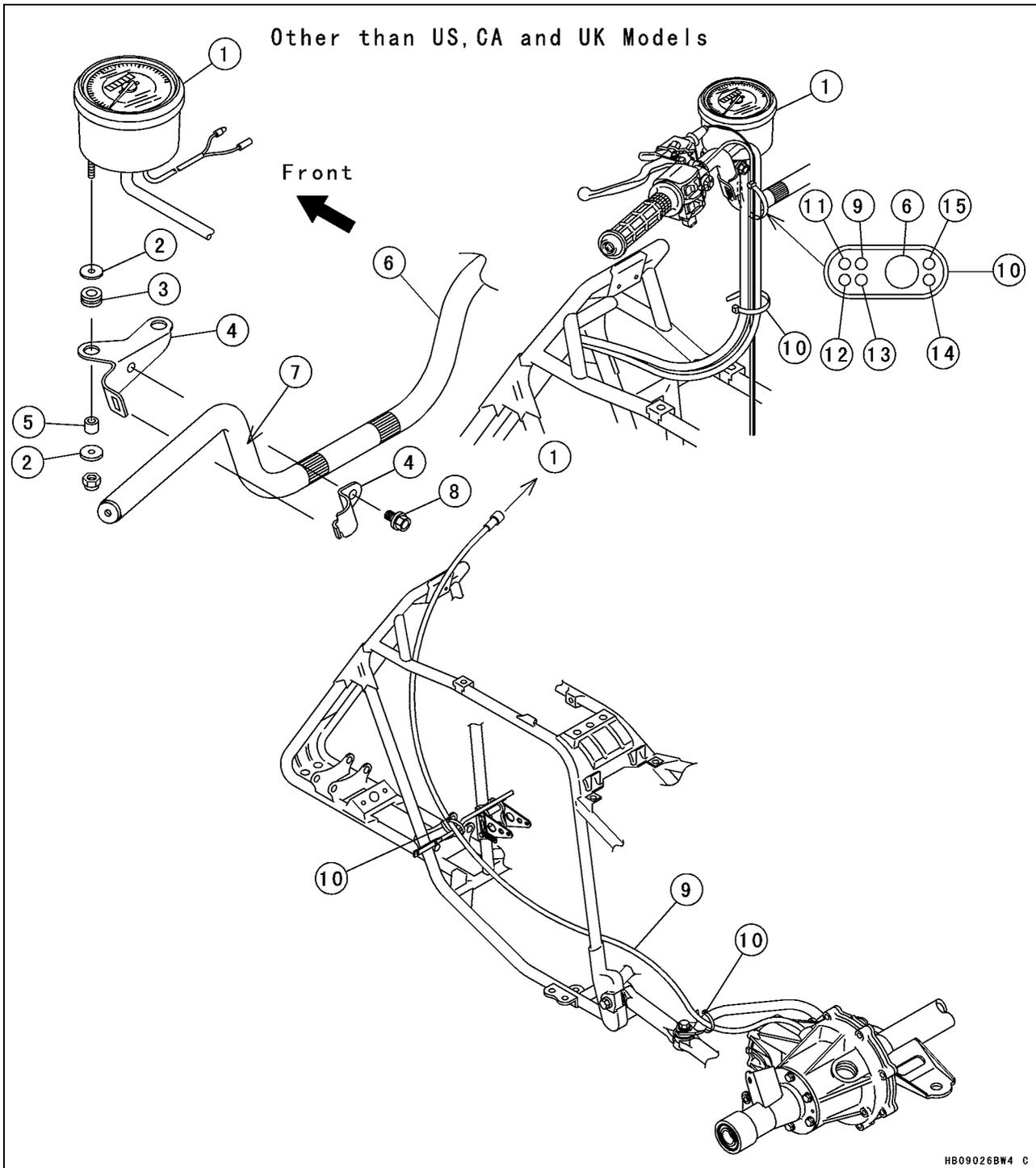


HB09025BW4 C

- 1. Clamp
- 2. Engine Breather Hose
- 3. Camshaft Cover
- 4. Valve Adjusting Cap
- 5. Clamp on Valve Adjusting Cap Bolt
- 6. Air Cleaner
- 7. Clamp on Starter Motor Mounting Bolt
- 8. Clamp on Crankcase Bolt
- 9. Carburetor Drain Hose
- 10. Carburetor Overflow Hose
- 11. Assemble the clamp in this line.

# 17-10 APPENDIX

## Cable, Wire, and Hose Routing

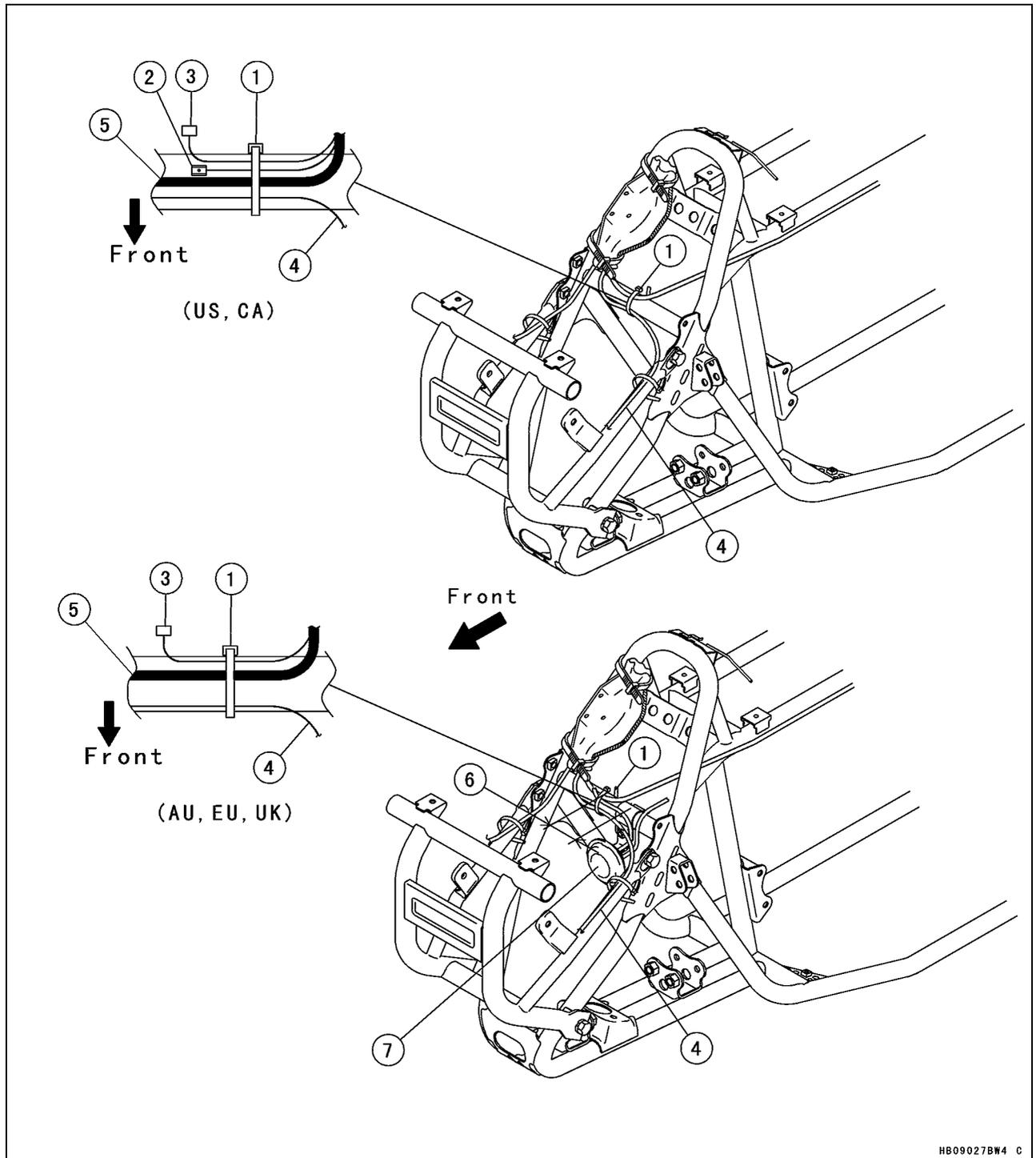


HB09026BW4 C

- 1. Speedometer
- 2. Washers
- 3. Damper
- 4. Meter Brackets
- 5. Collar
- 6. Handlebar
- 7. Clamp the meter bracket at the portion indicated in the figure.
- 8. Bracket Mounting Bolt
- 9. Speedometer Cable

- 10. Bands
- 11. Meter Harness
- 12. Rear (Parking) Brake Cable
- 13. Choke Cable
- 14. Horn Harness
- 15. Handlebar Switch Leads
- US: U.S.A. Model
- CA: Canada Model
- UK: United Kingdom Model

Cable, Wire, and Hose Routing



HB09027BW4 C

- 1. Bands
- 2. Horn Leads
- 3. To Igniter
- 4. To Left Headlight
- 5. Main Harness
- 6. 35 mm (1.378 in)
- 7. Horn

- US: U.S.A. Model
- CA: Canada Model
- AU: Australia Model
- EU: Europe Model
- UK: United Kingdom Model

## 17-12 APPENDIX

### Troubleshooting Guide

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#### NOTE

○ *This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*

#### Engine Doesn't Start, Starting Difficulty:

##### Starter motor not rotating:

- Neutral switch trouble
- Starter motor trouble
- Battery voltage low
- Relays not contacting or operating
- Starter button not contacting
- Wiring open or shorted
- Ignition switch trouble
- Engine stop switch trouble
- Fuse blown

##### Starter motor rotating but engine doesn't turn over:

- Starter motor clutch trouble

##### Recoil starter not operating

- Recoil starter spring broken
- Recoil starter pawl not engaging

##### Engine won't turn over:

- Valve seizure
- Rocker arm seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Transmission gear or bearing seizure
- Camshaft seizure
- Balancer bearing seizure

##### No fuel flow:

- Fuel tank air vent obstructed
- Fuel tap clogged
- Fuel line clogged
- Float valve clogged

##### Engine flooded:

- Fuel level too high
- Float valve worn or stuck open
- Starting technique faulty  
(When flooded, crank the engine with the throttle fully opened to allow more air to reach the engine.)

#### Fuel/air mixture incorrect:

- Pilot screw and/or idle adjusting screw maladjusted
- Pilot jet, or air passage clogged
- Air cleaner clogged, poorly sealed, or missing
- Starter jet clogged

#### No spark; spark weak:

- Spark plug dirty, broken, or maladjusted
- Spark plug cap or spark plug lead trouble
- Spark plug cap not in good contact
- Spark plug incorrect
- Crankshaft Sensor trouble
- Igniter trouble
- Ignition coil trouble
- Battery voltage low
- Ignition or engine stop switch shorted
- Wiring shorted or open
- Fuse blown

#### Compression Low:

- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)
- Compression release mechanism trouble

#### Poor Running at Low Speed:

##### Spark weak:

- Spark plug dirty, broken, or maladjusted
- Spark plug cap or spark plug lead trouble
- Spark plug cap shorted or not in good contact
- Spark plug incorrect
- Igniter trouble
- Crankshaft Sensor trouble
- Ignition coil trouble
- Battery voltage low

## Troubleshooting Guide

### Fuel/air mixture incorrect:

- Pilot screw and/or idle adjusting screw mal-adjusted
- Pilot jet, or air passage clogged
- Starter plunger stuck open
- Air cleaner clogged, poorly sealed, or missing
- Fuel level too high or too low
- Fuel tank air vent obstructed
- Carburetor holder loose
- Air cleaner duct loose

### Compression low:

- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)
- Compression release mechanism trouble

### Other:

- Carburetor throttle valve doesn't slide smoothly
- Engine oil viscosity too high
- Brake dragging
- Igniter trouble
- Final gear case oil level too high
- Final gear case oil viscosity too high

### Poor Running or No Power at High Speed:

#### Firing incorrect:

- Spark plug dirty, broken, or maladjusted
- Spark plug cap or spark plug lead trouble
- Spark plug cap shorted or not in good contact
- Spark plug incorrect
- Crankshaft Sensor trouble
- Igniter trouble
- Ignition coil trouble

#### Fuel/air mixture incorrect:

- Main jet clogged or wrong size
- Jet needle or needle jet worn
- Main air jet clogged
- Needle jet clogged
- Fuel level too high or too low
- Air cleaner clogged, poorly sealed, or missing
- Starter plunger stuck open
- Water or foreign matter in fuel
- Carburetor holder loose
- Air cleaner duct loose

- Fuel tank air vent obstructed

- Fuel tap clogged

- Fuel line clogged

### Compression low:

- Spark plug loose

- Cylinder head not sufficiently tightened down

- No valve clearance

- Cylinder, piston worn

- Piston rings bad (worn, weak, broken, or sticking)

- Piston ring/groove clearance excessive

- Cylinder head gasket damaged

- Cylinder head warped

- Valve spring broken or weak

- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface.)

- Compression release mechanism trouble

### Knocking:

- Carbon built up in combustion chamber

- Fuel poor quality or incorrect

- Spark plug incorrect

- Igniter trouble

### Miscellaneous:

- Throttle valve won't fully open

- Carburetor throttle valve doesn't slide smoothly

- Brake dragging

- Clutch slipping

- Overheating

- Engine oil level too high

- Engine oil viscosity too high

- Balancer mechanism malfunctioning

- Final gear case oil level too high

- Final gear case oil viscosity too high

### Overheating:

#### Firing incorrect:

- Spark plug dirty, broken, or maladjusted

- Spark plug incorrect

- Igniter trouble

#### Fuel/air mixture incorrect:

- Main jet clogged

- Fuel level too low

- Carburetor holder loose

- Air cleaner poorly sealed, or missing

- Air cleaner duct loose

- Air cleaner clogged

### Compression high:

- Carbon built up in combustion chamber

### Engine load faulty:

- Clutch slipping

- Engine oil level too high

- Engine oil viscosity too high

- Brake dragging

### Lubrication inadequate:

- Engine oil level too low

## 17-14 APPENDIX

### Troubleshooting Guide

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Engine oil poor quality or incorrect

#### **Rear final gear case overheating:**

Insufficient oil

Bevel gears maladjusted

#### **Clutch Operation Faulty:**

##### **Clutch slipping:**

Friction and/or steel plates worn or warped

Clutch housing or shoe linings overworn or worn unevenly

Clutch spring broken or weak

Clutch release maladjusted

Clutch release mechanism trouble

Clutch hub or housing unevenly worn

##### **Clutch not disengaging properly**

Friction and/or steel plates warped or too rough

Clutch spring tension uneven

Clutch shoe spring broken or weak

Engine oil deteriorated

Engine oil viscosity too high

Engine oil level too high

Clutch housing frozen on crankshaft or drive shaft

Clutch release mechanism trouble

#### **Gear Shifting Faulty:**

##### **Doesn't go into gear; shift pedal doesn't return:**

Clutch not disengaging

Shift fork(s) bent or seized

Gear(s) stuck on the shaft

Shift return spring weak or broken

Shift mechanism arm spring broken

Shift return spring pin loose

Shift drum positioning lever binding on pivot bolt

Shift mechanism arm broken

Shift drum damaged

##### **Jumps out of gear:**

Shift fork(s) worn

Gear groove(s) worn

Gear dogs, dog recesses, and/or dog holes worn

Shift drum groove(s) worn

Shift drum positioning lever spring weak or broken

Shift fork guide pin(s) worn

Shift mechanism arm spring weak or broken

Drive shaft, output shaft, and/or gear splines worn

##### **Overshifts:**

Shift drum positioning lever spring weak or broken

Shift mechanism arm spring weak or broken

#### **Abnormal Engine Noise:**

##### **Knocking:**

Igniter trouble

Carbon built up in combustion chamber

Fuel poor quality or incorrect

Spark plug incorrect

Overheating

##### **Piston Slap:**

Cylinder/piston clearance excessive

Cylinder, piston worn

Connecting rod bent

Piston pin, piston holes worn

##### **Valve noise:**

Valve clearance incorrect

Valve spring broken or weak

Camshaft bearing worn

Rocker arm worn

##### **Other noise:**

Connecting rod small end clearance excessive

Connecting rod big end clearance excessive

Piston ring worn, broken, or stuck

Piston seizure, damage

Cylinder head gasket leaking

Exhaust pipe leaking at cylinder head connection

Crankshaft runout excessive

Engine mounts loose

Crankshaft bearing worn

Camshaft chain tensioner trouble

Camshaft chain, sprocket, guides worn

Balancer bearing worn

Balancer gear worn or shipped

Loose alternator rotor

#### **Abnormal Drive Train Noise:**

##### **Clutch noise:**

Clutch housing and/or hub damaged

##### **Transmission noise:**

Bearing worn

Transmission gears worn or chipped

## Troubleshooting Guide

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Metal chips jammed in gear teeth  
 Engine oil insufficient or too thin

### **Drive train noise:**

Insufficient lubricant  
 Bevel gear bearings worn  
 Bevel gears worn or chipped  
 Bevel gears maladjusted  
 Propeller shaft bearing worn  
 Front bevel gear cam damper damage

### **Abnormal Frame Noise:**

#### **Shock absorber noise:**

Shock absorber damaged

#### **Brake noise:**

Brake linings overworn or worn unevenly  
 Drum worn unevenly or scored  
 Brake spring weak or broken  
 Foreign matter in hub  
 Brake not properly adjusted

#### **Other noise:**

Bracket, nut, bolt, etc. not properly  
 mounted or tightened

### **Exhaust Smokes Excessively:**

#### **White smoke:**

Piston oil ring worn  
 Cylinder worn  
 Valve oil seal damaged  
 Valve guide worn  
 Cylinder head gasket damaged  
 Engine oil level to high

#### **Black Smoke:**

Air cleaner clogged  
 Main jet too large or fallen off  
 Starter plunger stuck open  
 Fuel level too high

#### **Brown smoke:**

Main jet too small  
 Fuel level too low  
 Air cleaner duct loose  
 Air cleaner poorly sealed or missing

### **Handling and/or Stability Unsatisfactory**

#### **Handlebar hard to turn:**

Tire air pressure too low  
 Steering stem bearing damaged  
 Steering stem bearing lubrication inadequate  
 Steering stem bent

Damage tie-rod end

#### **Handlebar shakes or excessively vibrates:**

Tire worn  
 Wheel rim warped  
 Rear axle runout excessive  
 Wheel bearing worn  
 Handlebar clamp loose  
 Steering stem clamp bolt loose

#### **Handlebar pulls to one side:**

Frame bent  
 Wheel maladjustment  
 Suspension arm bent or twisted  
 Steering stem bent  
 Front or rear tire air pressure unbalanced  
 Front shock absorber unbalanced

#### **Shock absorption unsatisfactory:**

(Too hard)  
 Tire air pressure too high  
 Shock absorber maladjusted  
 (Too soft)  
 Shock absorber oil leaking  
 Shock absorber spring weak  
 Tire air pressure too low  
 Shock absorber maladjusted

#### **Brake Doesn't Hold**

Brake not properly adjusted  
 Linings overworn or worn unevenly  
 Drum worn unevenly or scored  
 Cam, camshaft, shaft hole worn  
 Oil, grease on lining and drum  
 Dirt, water between lining and drum  
 Overheated

#### **Battery Discharged:**

Battery faulty (e.g., plates sulphated,  
 shorted through sedimentation, elec-  
 trolyte level too low)  
 Battery leads making poor contact  
 Load excessive (e.g., bulb of excessive  
 wattage)  
 Ignition switch trouble  
 Regulator/rectifier trouble  
 Alternator trouble  
 Wiring faulty

#### **Battery Overcharged:**

Regulator/rectifier trouble  
 Battery trouble

### MODEL APPLICATION

Year	Model	Beginning Frame No.
2003	KLF250-A1	JKALFMA1□3B500001,or JKALF250AAB600001
2004	KLF250-A2	JKALFMA1□4B523201,or JKALF250AAB601301
2005	KLF250-A3	JKALFMA1□5B534201,or JKALF250AAB602001

□:This digit in the frame number changes from one machine to another.



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