



**VULCAN 1600 CLASSIC**

**VN1600 CLASSIC**



# **Motorcycle 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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# Motorcycle Service Manual

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No liability can be accepted for any inaccuracies or omissions in this publication, although every possible care has been taken to make it as complete and accurate as possible.

The right is reserved to make changes at any time without prior notice and without incurring an obligation to make such changes to products manufactured previously. See your Motorcycle dealer for the latest information on product improvements incorporated after this publication.

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	pound(s)
ABDC	after bottom dead center	m	meter(s)
AC	alternating current	min	minute(s)
ATDC	after top dead center	N	newton(s)
BBDC	before bottom dead center	Pa	pascal(s)
BDC	bottom dead center	PS	horsepower
BTDC	before top dead center	psi	pound(s) per square inch
°C	degree(s) Celsius	r	revolution
DC	direct current	r/min, 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) (mass)	W	watt(s)
h	hour(s)	Ω	ohm(s)
kg	(mass)		
kgf	(force)		
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 United States Environmental Protection Agency and California Air Resources Board. Additionally, Kawasaki has incorporated an evaporative emission control system (3) in compliance with applicable regulations of the California Air Resources Board on vehicles sold in California only.

### 1. Crankcase Emission Control System

This system eliminates the release of crankcase vapors into the atmosphere. Instead, the vapors are routed through an oil separator to the inlet side of the engine. While the engine is operating, the vapors are drawn into combustion chamber, where they are burned along with the fuel and air supplied by the fuel injection system.

### 2. Exhaust Emission Control System

This system reduces the amount of pollutants discharged into the atmosphere by the exhaust of this motorcycle. The fuel, ignition, and exhaust systems of this motorcycle have been carefully designed and constructed to ensure an efficient engine with low exhaust pollutant levels.

The exhaust system of this model motorcycle manufactured primarily for sale in California includes a catalytic converter system.

### 3. Evaporative Emission Control System

Vapors caused by fuel evaporation in the fuel system are not vented into the atmosphere. Instead, fuel vapors are routed into the running engine to be burned, or stored in a canister when the engine is stopped. Liquid fuel is caught by a vapor separator and returned to the fuel tank.

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.**

## **TAMPERING WITH NOISE CONTROL SYSTEM PROHIBITED**

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

Among those acts presumed to constitute tampering are the acts listed below:

- Replacement of the original exhaust system or muffler with a component not in compliance with Federal regulations.
- Removal of the muffler(s) or any internal portion of the muffler(s).
- Removal of the air box or air box cover.
- Modifications to the muffler(s) or air inlet system by cutting, drilling, or other means if such modifications result in increased noise levels.

# 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 Motorcycle parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki motorcycles 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 preparing this manual, we divided the product into its major systems. These systems became the manual's chapters. All information for a particular system from adjustment through disassembly and inspection is located in a single chapter.

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.

The Periodic Maintenance Chart is located in the Periodic Maintenance chapter. The chart gives a time schedule for required maintenance operations.

If you want spark plug information, for example, go to the Periodic Maintenance Chart first. The chart tells you how frequently to clean and gap the plug. Next, use the Quick Reference Guide to locate the Periodic Maintenance chapter. Then, use the Table of Contents on the first page of the chapter to find the Spark Plug 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

1

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## 1-2 GENERAL INFORMATION

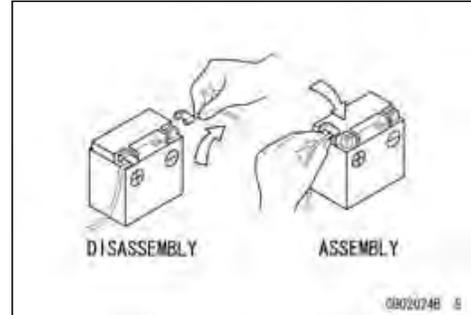
### Before Servicing

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:

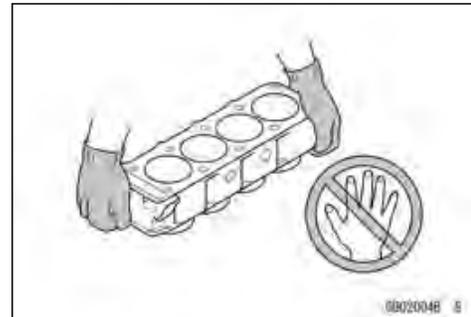
#### *Battery Ground*

Before completing any service on the motorcycle, disconnect the battery wires from the battery to prevent the engine from accidentally turning over. Disconnect the ground wire (-) first and then the positive (+). When completed with the service, first connect the positive (+) wire to the positive (+) terminal of the battery then the negative (-) wire to the negative terminal.



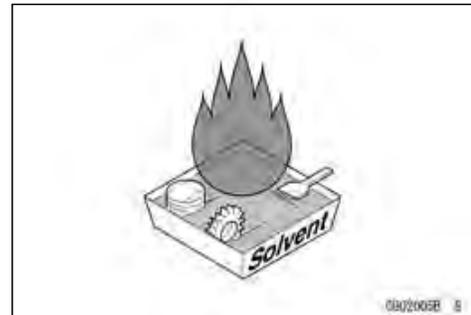
#### *Edges of Parts*

Lift large or heavy parts wearing gloves to prevent injury from possible sharp edges on the parts.



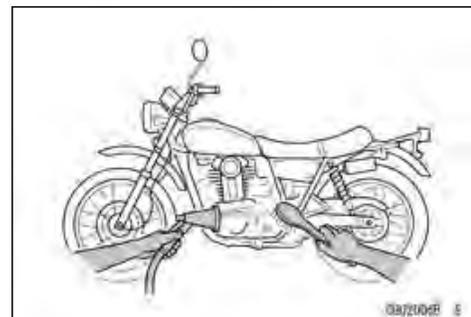
#### *Solvent*

Use a high flash point solvent when cleaning parts. High flash point solvent should be used according to directions of the solvent manufacturer.



#### *Cleaning vehicle before disassembly*

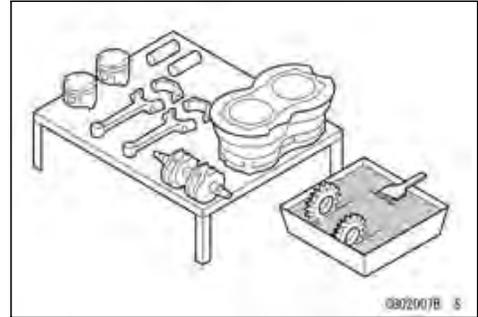
Clean the vehicle thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during vehicle disassembly can cause excessive wear and decrease performance of the vehicle.



**Before Servicing**

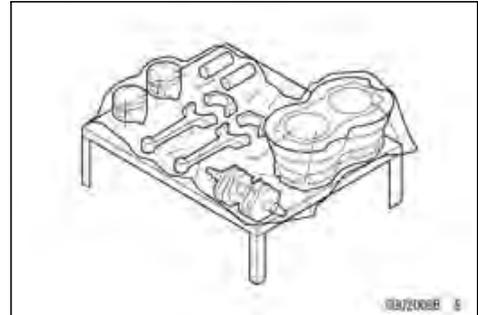
*Arrangement and Cleaning of Removed Parts*

Disassembled parts are easy to confuse. Arrange the parts according to the order the parts were disassembled and clean the parts in order prior to assembly.



*Storage of Removed Parts*

After all the parts including subassembly parts have been cleaned, store the parts in a clean area. Put a clean cloth or plastic sheet over the parts to protect from any foreign materials that may collect before re-assembly.



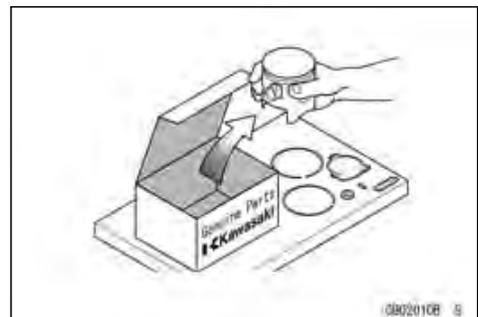
*Inspection*

Reuse of worn or damaged parts may lead to serious accident. Visually inspect removed parts for corrosion, discoloration, or other damage. Refer to the appropriate sections of this manual for service limits on individual parts. Replace the parts if any damage has been found or if the part is beyond its service limit.



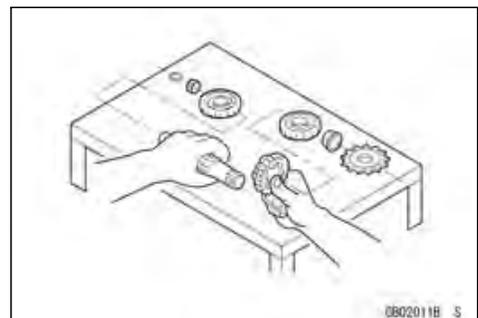
*Replacement Parts*

Replacement Parts must be KAWASAKI genuine or recommended by KAWASAKI. Gaskets, O-rings, Oil seals, Grease seals, circlips or cotter pins must be replaced with new ones whenever disassembled.



*Assembly Order*

In most cases assembly order is the reverse of disassembly, however, if assembly order is provided in this Service Manual, follow the procedures given.

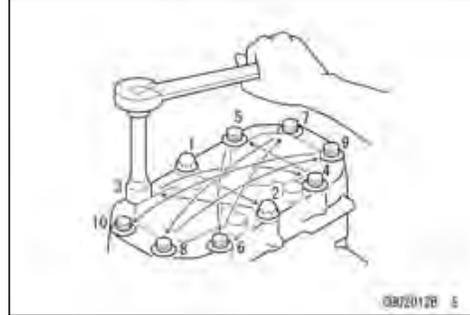


## 1-4 GENERAL INFORMATION

### Before Servicing

#### *Tightening Sequence*

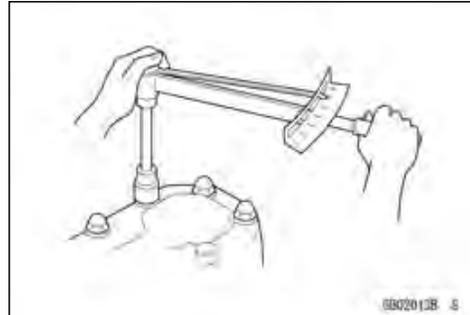
Bolts, nuts, or screws must be tightened according to the specified sequence to prevent case warpage or deformation which can lead to malfunction. If the specified tightening sequence is not indicated, tighten the fasteners alternating diagonally.



#### *Tightening Torque*

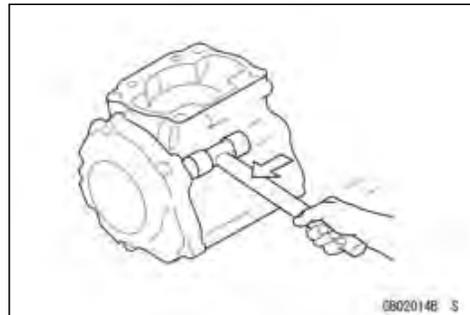
Incorrect torque applied to a bolt, nut, or screw may lead to serious damage. Tighten fasteners to the specified torque using a good quality torque wrench.

Often, the tightening sequence is followed twice-initial tightening and final tightening with torque wrench.



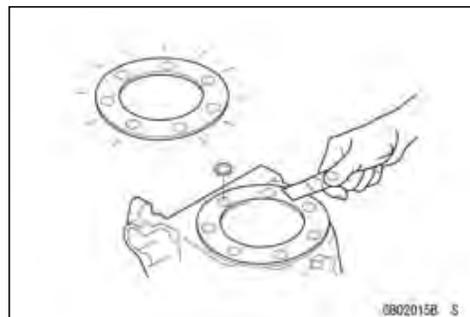
#### *Force*

Use common sense during disassembly and assembly, excessive force can cause expensive or hard to repair damage. When necessary, remove screws that have a non-permanent locking agent applied using an impact driver. Use a plastic-faced mallet whenever tapping is necessary.



#### *Gasket, O-ring*

Hardening, shrinkage, or damage of both gaskets and O-rings after disassembly can reduce sealing performance. Remove old gaskets and clean the sealing surfaces thoroughly so that no gasket material or other material remains. Install new gaskets and replace used O-rings when re-assembling.



#### *Liquid Gasket, Locking Agent*

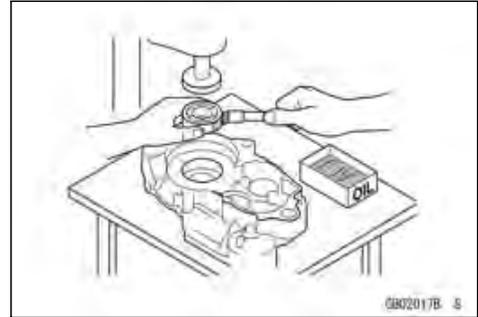
For applications that require Liquid Gasket or a Locking agent, clean the surfaces so that no oil residue remains before applying liquid gasket or locking agent. Do not apply them excessively. Excessive application can clog oil passages and cause serious damage.



**Before Servicing**

*Press*

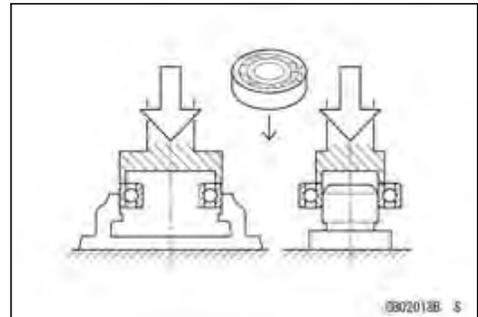
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



*Ball Bearing and Needle Bearing*

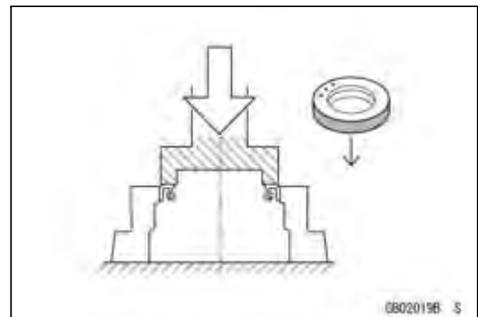
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

Pressing the incorrect race can cause pressure between the inner and outer race and result in bearing damage.



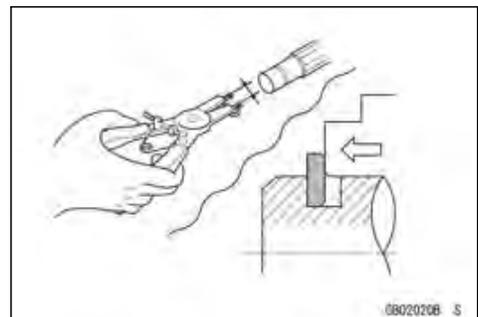
*Oil Seal, Grease Seal*

Do not remove pressed oil or grease seals unless removal is necessary. Replace with new ones whenever removed. Press new oil seals with manufacture and size marks facing out. Make sure the seal is aligned properly when installing.



*Circlips, Cotter Pins*

Replace circlips or cotter pins that were removed with new ones. Install the circlip with its sharp edge facing outward and its chamfered side facing inward to prevent the clip from being pushed out of its groove when loaded. Take care not to open the clip excessively when installing to prevent deformation.



*Lubrication*

It is important to lubricate rotating or sliding parts during assembly to minimize wear during initial operation. Lubrication points are called out throughout this manual, apply the specific oil or grease as specified.

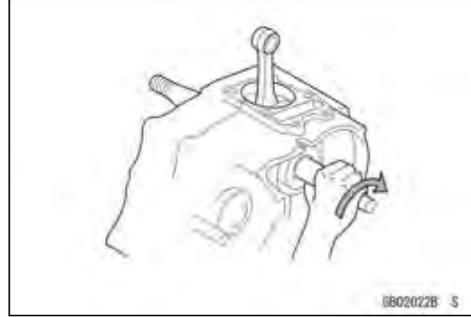


## 1-6 GENERAL INFORMATION

### Before Servicing

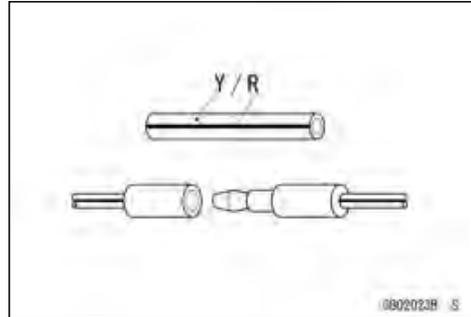
#### *Direction of Engine Rotation*

When rotating the crankshaft by hand, the free play amount of rotating direction will affect the adjustment. Rotate the crankshaft to positive direction (clockwise viewed from output side).



#### *Electrical Wires*

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



**Model Identification**

**VN1600-A1 (US, and Canada) Left Side View:**



**VN1600-A1 (US, and Canada) Right Side View:**



## 1-8 GENERAL INFORMATION

### Model Identification

#### VN1600-A1 (Europe) Left Side View:



#### VN1600-A1 (Europe) Right Side View:



General Specifications

Items	VN1600-A1 ~
<b>Dimensions:</b>	
Overall length	2 505 mm (98.62 in.)
Overall width	1 040 mm (40.9 in.), (AU) 990 mm (39 in.)
Overall height	1 130 mm (44.5 in.)
Wheelbase	1 680 mm (66.1 in.)
Road clearance	130 mm (5.12 in.)
Seat height	680 mm (26.8 in.)
Dry mass	306 kg (675 lb), (AU) 307 kg (677 lb)
Curb mass:	
Front	156 kg (345 lb)
Rear	181 kg (399 lb), (AU) 182 kg (401 lb)
Fuel tank capacity	20 L (5.3 US gal)
Fuel	Unleaded and high-octane gasoline (see VN1600-A1 ~ Owner's Manual)
<b>Performance:</b>	
Minimum turning radius	3.5 m (11.5 ft)
<b>Engine:</b>	
Type	4-stroke, SOHC, V2-cylinder
Cooling system	Liquid-cooled
Bore and stroke	102 × 95 mm (4.02 × 3.74 in.)
Displacement	1 552 mL (94.70 cu in.)
Compression ratio	9.0 : 1
Maximum horsepower	49 kW (67 PS) @ 4 700 r/min (rpm), (CA) (CAL) (US) –
Maximum torque	127 N·m (12.95 kgf·m, 93.7 ft·lb) @ 2 700 r/min (rpm), (CA) (CAL) (US) –
Carburetion system	DFI (Digital Fuel Injection) System
Starting system	Electric starter
Ignition system	Battery and coil (transistorized)
Timing advance	Electronically advanced (digital)
Ignition timing	From 0° BTDC @ 950 r/min (rpm) ~ 25° BTDC @ 4 500 r/min (rpm)
Spark plugs	NGK DPR6EA-9 or ND X20EPR-U9
Cylinder numbering method	Front to Rear, 1-2
Firing order	1-2
Valve timing:	
Inlet	Open 22° BTDC
	Close 66° ABDC
	Duration 268°
Exhaust	Open 66° BBDC
	Close 26° ATDC
	Duration 272°
Lubrication system	Forced lubrication (wet sump)
Engine oil:	
Type	API SE, SF or SG class API SH or SJ class with JASO MA
Viscosity	SAE10W-40
Capacity	3.5 L (3.7US qt, when engine is completely disassembled and dry)

# 1-10 GENERAL INFORMATION

## General Specifications

Items	VN1600-A1 ~
<b>Drive Train:</b>	
Primary reduction system:	
Type	Gear
Reduction ratio	1.517 (85/56)
Clutch type	Wet multi disc
Transmission:	
Type	5-speed, constant mesh, return shift
Gear ratios:	
1st	2.500 (40/16)
2nd	1.590 (35/22)
3rd	1.192 (31/26)
4th	0.965 (28/29)
5th	0.781 (25/32)
Final drive system:	
Type	Shaft
Reduction ratio	2.619 (15/21 × 33/9)
Overall drive ratio	3.105 @ Top gear
Final gear case oil:	
Grade	API Service Classification: GL-5 Hypoid gear oil
Viscosity	SAE90 (above 5°C), SAE80 (below 5°C)
Capacity	200 mL (6.76 US oz)
<b>Frame:</b>	
Type	Tubular, double cradle
Caster (rake angel)	32°
Trail	168 mm (6.61 in.)
Front tire:	
Type	Tubeless
Size	130/90 - 16 M/C 67H
Rear tire:	
Type	Tubeless
Size	170/70B16 M/C 75H
Front suspension:	
Type	Telescopic fork
Wheel travel	150 mm (5.91 in.)
Rear suspension:	
Type	Swingarm
Wheel travel	95 mm (3.74 in.)
Brake Type:	
Front	Dual disc
Rear	Single disc
<b>Electrical Equipment:</b>	
Battery	
Capacity	12 V 18 Ah
Headlight:	
Type	Semi-sealed beam
Bulb	12 V 60/55 W (quartz-halogen)
Tail/brake light	12 V 5/21 W
Alternator:	
Type	Three-phase AC, twin rotor
Rated output	42A × 14 V @ 6 000 r/min (rpm)

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

AU: Australia

CAL: California

CA: Canada

US: United States of America

**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	=	kgf
N	×	0.2248	=	lb
kg	×	9.807	=	N
kg	×	2.205	=	lb

**Units of Length:**

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

**Units of Torque:**

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

**Units of Pressure:**

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

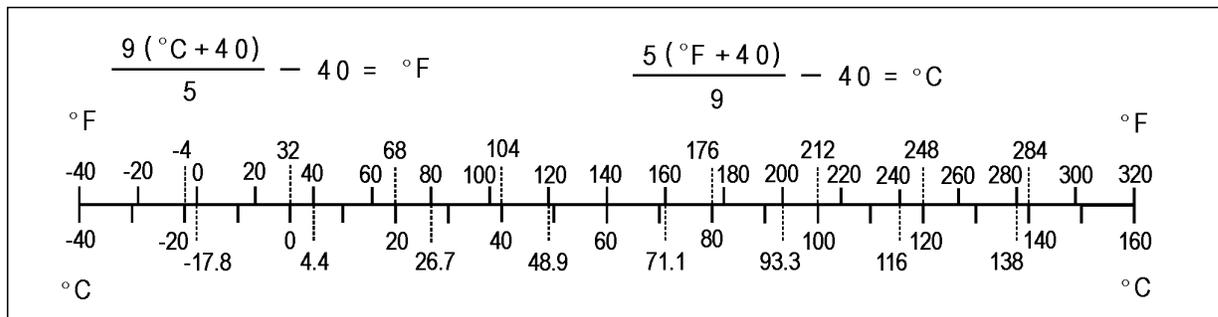
**Units of Speed:**

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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Throttle Control System		Brake Fluid Level Inspection.....	2-27
Inspection.....	2-13	Brake Fluid Change .....	2-28
Idle Speed Inspection .....	2-14	Brake Master Cylinder Cup and	
Air Cleaner Element Cleaning.....	2-15	Dust Seal Replacement .....	2-29
Evaporative Emission Control		Caliper Piston/Dust Seals	
System Inspection (CAL) .....	2-15	Replacement.....	2-29
Cooling System.....	2-16	Front Brake Light Switch	
Radiator Hose and Connection		Inspection.....	2-29
Inspection.....	2-16	Rear Brake Light Switch	
Coolant Change .....	2-17	Check/Adjustment.....	2-30
Engine Top End .....	2-19	Suspension .....	2-30
Air Suction Valve Inspection .....	2-19	Front Fork Oil Leak Inspection.....	2-30
Clutch.....	2-19	Rear Shock Absorber Oil Leak	
Clutch Hose and Connection		Inspection .....	2-31
Inspection.....	2-19	Swingarm Pivot Lubrication .....	2-31
Clutch Fluid Level Inspection.....	2-20	Steering .....	2-31
Clutch Fluid Change .....	2-20	Stem Bearing Lubrication.....	2-31
Clutch Master Cylinder Cup and		Steering Check .....	2-31
Dust Seal Replacement .....	2-21	Steering Adjustment.....	2-32
Clutch Slave Cylinder Piston Seal		Electrical System .....	2-33
Replacement .....	2-22	Spark Plug Cleaning/Inspection...	2-33
Engine Lubrication System .....	2-23	General Lubrication .....	2-33
Engine Oil Change.....	2-23	Lubrication .....	2-33
Oil Filter Replacement .....	2-24	Nut, Bolt, and Fastener Tightness ..	2-34
Wheel/Tires.....	2-24	Tightness Inspection .....	2-34
Tire Inspection .....	2-24		

## 2-2 PERIODIC MAINTENANCE

### Periodic Maintenance Chart

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

OPERATION	FREQUENCY	Whichever comes first → ↓	* ODOMETER READING							
			1 000 km (600 mile)	6 000 km (4 000 mile)	12 000 km (7 500 mile)	18 000 km (12 000 mile)	24 000 km (15 000 mile)	30 000 km (20 000 mile)	36 000 km (24 000 mile)	
		Every								See Page
Spark plug (e) - clean and gap †			●	●	●	●	●	●	●	2-35
Air suction valve (e) - inspect †			●	●	●	●	●	●	●	2-20
Air cleaner element (e) - clean † #				●		●		●		2-16
Throttle control system (e) - inspect †			●	●	●	●	●	●	●	2-14
Idle speed (e) - inspect †			●		●		●		●	2-15
Fuel hoses, connections - inspect †				●	●	●	●	●	●	2-14
Engine oil - change #		year	●		●		●		●	2-24
Oil filter - replace			●		●		●		●	2-26
Evaporative emission control system (e) (CAL) - inspect †			●	●	●	●	●	●	●	2-17
Final gear case oil level - inspect †				●		●		●		2-28
Final gear case oil - change			●						●	2-28
Propeller shaft joint - lubricate				●					●	2-29
Brake pad wear - inspect † #				●	●	●	●	●	●	2-29
Brake light switch - inspect †			●	●	●	●	●	●	●	2-32
Steering - inspect †			●	●	●	●	●	●	●	2-34
Rear shock absorber oil leak - inspect †					●		●		●	2-33
Front fork oil leak - inspect †					●		●		●	2-33
Tire wear - inspect †			●	●	●	●	●	●	●	2-27
Swingarm pivot - lubricate				●					●	2-33
General lubrication - perform				●		●		●		2-36
Nut, bolt, and fastener tightness - inspect †			●		●		●		●	2-37
Brake/clutch hoses, connections - inspect †				●	●	●	●	●	●	2-21, 2-29
Brake/clutch fluid level - inspect †		month	●	●	●	●	●	●	●	2-21, 2-29
Coolant hoses, connections - inspect †			●							2-18
Brake/clutch fluid - change		2 years					●			2-22, 2-30

## PERIODIC MAINTENANCE 2-3

### Periodic Maintenance Chart

FREQUENCY	Whichever comes first → ↓	* ODOMETER READING						
		1 000 km (600 mile)	6 000 km (4 000 mile)	12 000 km (7 500 mile)	18 000 km (12 000 mile)	24 000 km (15 000 mile)	30 000 km (20 000 mile)	36 000 km (24 000 mile)
OPERATION	Every							See Page
Brake/clutch master cylinder cup and dust seal - replace	4 years							2-23, 2-32
Coolant - change	2 years					●		2-28
Caliper piston seal and dust seal - replace	4 years							2-32
Steering stem bearing - lubricate	2 years					●		2-34
Clutch slave cylinder piston seal - replace	4 years							2-24

# : Service more frequently when operating in severe conditions; dusty, wet, muddy, high speed or frequent starting/stopping.

\* : For higher odometer readings, repeat at the frequency interval established here.

† : Replace, add, adjust, clean, or torque if necessary.

Throttle control system inspection: Inspection of throttle grip play and throttle bore cleanliness.

(CAL): California

(e): Emission Related Items

## 2-4 PERIODIC MAINTENANCE

### Torque and Locking Agent

The following tables list the tightening torque for the major fasteners 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.

**G:** Apply grease to the threads.

**MO:** Apply molybdenum disulfide grease oil solution.

**O:** Apply oil to the threads and seating surface.

**S:** Tighten the fasteners following the specified sequence.

**SS:** Apply silicone sealant.

**Si:** Apply silicone grease (ex. PBC grease).

**R:** Replacement parts

**Lh:** Left-hand-threads

**St:** Stake the fasteners to prevent loosening.

**AL:** Tighten the two clamp bolts alternately two times to ensure even tightening torque.

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 System:</b>				
Throttle body assy holder bolts	11	1.1	95 in·lb	Right Side
Inlet manifold bolts	12	1.2	104 in·lb	on Cyl. Head
Spark plug lead holder bolts	11	1.1	95 in·lb	Right Side
ISC pipe holder bolts	11	1.1	95 in·lb	
Air cleaner duct holder bolts	9.8	1.0	69 in·lb	Left Side
Right and left air cleaner base bolts	11	1.1	95 in·lb	
Right and left air cleaner base screws	2.2	0.22	19 in·lb	L, Lower Duct
Left air cleaner cover Allen bolt $\phi 8$	16	1.6	12	
Right air cleaner cover Allen bolt $\phi 8$	16	1.6	12	
Right air cleaner Allen bolts	11	1.1	95 in·lb	Throttle Body
Choke cable plate screw	2.9	0.30	26 in·lb	L, Throttle Body
Inlet air temperature sensor nut (DFI)	7.8	0.80	69 in·lb	
Water temperature sensor (DFI)	18	1.8	13	SS
Fuel pump bolts	9.8	1.0	87 in·lb	S, L
<b>Cooling System:</b>				
Radiator hose clamp screws	2.5	0.25	22 in·lb	
Radiator fan switch	18	1.8	13	
Radiator fan bolts	8.3	0.85	74 in·lb	
Water temperature switch	7.8	0.80	69 in·lb	SS
Water pump impeller bolt	8.8	0.90	78 in·lb	Lh
Water pump cover bolts	11	1.1	97 in·lb	
Water pump air bleeder bolt	11	1.1	97 in·lb	
Water pump drain bolt	11	1.1	97 in·lb	
Water pipe bolts	11	1.1	97 in·lb	

**Torque and Locking Agent**

Fastener	Torque			Remarks
	N-m	kgf-m	ft-lb	
Radiator drain bolt	7.4	0.75	65 in-lb	
Water temperature sensor (DFI)	18	1.8	13	SS
<b>Engine Top End:</b>				
Spark plugs	18	1.8	13	
Spark plug retainer	12	1.2	104 in-lb	
Air suction valve cover bolts	7.4	0.75	65 in-lb	
Chain tensioner mounting bolts	11	1.1	95 in-lb	S
Chain tensioner cap	20	2.0	14	S
Chain tensioner lockbolt	4.9	0.50	43 in-lb	S
Timing inspection cap	1.5	0.15	13 in-lb	
Rotor bolt cap	1.5	0.15	13 in-lb	
Camshaft sprocket bolts	15	1.5	11	L
Oil hose flange bolts	9.8	1.0	87 in-lb	
Rocker shafts	25	2.5	18	
Rocker case nuts: 12 mm	78	8.0	58	MO, S
8 mm	25	2.5	18	S
Rocker case bolts 6 mm	8.8	0.90	78 in-lb	S
Cylinder head nuts	25	2.5	18	S
Cylinder head jacket plugs	20	2.0	14	L
Rocker case cover bolts	8.8	0.90	78 in-lb	S
Camshaft chain guide bolts	11	1.1	95 in-lb	L
Cylinder nuts	25	2.5	18	S
Inlet manifold bolts	12	1.2	104 in-lb	on Cyl. Head
Exhaust pipe cover clamp bolts	6.9	0.70	61 in-lb	
Chamber bolts	29	3.0	22	except US, CA
Muffler stay mounting bolts and nuts, $\phi 8$	25	2.5	18	
Muffler bracket bolt and nut	29	3.0	22	
<b>Clutch:</b>				
Clutch lever pivot bolt	1.0	0.10	8.7 in-lb	Si
Clutch lever pivot bolt locknut	5.9	0.60	52 in-lb	
Clutch reservoir cap crews	1.5	0.15	13 in-lb	
Clutch slave cylinder bleed valve	7.8	0.80	69 in-lb	
Clutch slave cylinder bolts	6.9	0.70	61 in-lb	L
Clutch hose banjo bolts	25	2.5	18	
Clutch master cylinder clamp bolts	11	1.1	95 in-lb	S
Starter lockout switch screws	1.2	0.12	10 in-lb	
Push rod guide bolts	11	1.1	95 in-lb	L
Clutch cover bolts	11	1.1	95 in-lb	
Clutch damper cover bolts (outside)	9.8	1.0	87 in-lb	L
Clutch cover damper plate bolts	9.8	1.0	87 in-lb	EO (tip)
Clutch cover damper screws	4.9	0.50	43 in-lb	L
Clutch hub nut	147	15.0	108	MO

## 2-6 PERIODIC MAINTENANCE

### Torque and Locking Agent

Fastener	Torque			Remarks	
	N-m	kgf-m	ft-lb		
<b>Engine Lubrication System:</b>					
Oil filler cap	1.5	0.15	13 in-lb		
Oil screen plug	20	2.0	14		
Engine oil drain plug	20	2.0	14		
Oil filter (cartridge type)	18	1.8	13	R, EO	
Oil filter Pipe	25	2.5	18	SS	
Oil pressure relief valve	15	1.5	11	L	
Oil pressure switch terminal screw	1.5	0.15	13 in-lb		
Oil pressure switch	15	1.5	11	SS	
Oil pump mounting bolts	11	1.1	95 in-lb		
Oil hose banjo bolts	9.8	1.0	87 in-lb		
Oil hose flange bolt (outside)	9.8	1.0	87 in-lb		
Oil pipe holder bolts (inside)	11	1.1	95 in-lb	L	
Oil pipe clamp bolts (inside)	11	1.1	95 in-lb	L	
Right & left crankcase oil nozzles	2.9	0.30	26 in-lb	× 3	
Right crankcase oil nozzle	2.9	0.30	26 in-lb	× 1, Lh	
Oil baffle bolt	11	1.1	95 in-lb	L	
<b>Engine Removal/Installation:</b>					
Downtube bolts and nuts	44	4.5	33		
Engine mounting bolts and nuts	44	4.5	33		
Engine mounting bracket bolts	25	2.5	18		
Engine ground terminal bolt	7.8	0.80	69 in-lb		
<b>Crankshaft/Transmission:</b>					
Crankcase bolts:	10 mm	39	4.0	29	S
	8 mm	21	2.1	15	S
	6 mm	11	1.1	95 in-lb	S
Frame ground bracket bolt		1.1	1.1	95 in-lb	Left Crankcase
Crankcase bearing retainer bolts		11	1.1	95 in-lb	L
Camshaft chain guide bolts		11	1.1	95 in-lb	L
Right, left crankcase oil nozzles		2.9	0.30	26 in-lb	× 3
Right crankcase oil nozzles		2.9	0.30	26 in-lb	× 1, Lh
Oil baffle bolt		11	1.1	95 in-lb	L
Connecting rod big end nuts		59	6.0	43	MO
Oil pressure relief valve		15	1.5	11	L
Oil filter Pipe		25	2.5	18	SS
Oil hose banjo bolts		9.8	1.0	87 in-lb	
Primary gear bolt		147	15.0	108	MO
Water pump chain guide spring hook bolt		2.9	0.30	26 in-lb	
Water pump chain guide bolt		8.3	0.85	73 in-lb	
Idle shaft holder bolts		8.3	0.85	73 in-lb	
Oil pressure switch terminal screw		1.5	0.15	13 in-lb	
Oil pressure switch		15	1.5	11	SS
Oil pipe clamp bolts (inside)		11	1.1	95 in-lb	L

**Torque and Locking Agent**

Fastener	Torque			Remarks
	N-m	kgf-m	ft-lb	
Left balancer gear bolt	85	8.7	63	MO
Starter clutch bolt	85	8.7	63	MO
Starter clutch coupling bolts	15	1.5	11	L
Gear set lever bolt	11	1.1	95 in-lb	
Shift shaft return spring pin (bolt)	39	4.0	29	L
Shift pedal clamp bolt	25	2.5	18	
Shift pedal clamp bolts (VN1600-A2 ~)	30	3.1	22	
Rear shift lever clamp bolt	12	1.2	104 in-lb	
Shift rod locknuts	11	1.1	95 in-lb	(Rear: Lh)
Shift drum bearing holder bolts	11	1.1	95 in-lb	L
Shift drum cam screw	15	1.5	11	L
Damper cam nut (front gear)	195	20	144	MO (threads)
Push rod guide bolts	9.8	1.0	87 in-lb	L
<b>Wheels/Tires:</b>				
Front axle clamp bolts	20	2.0	14	AL
Front axle	108	11.0	79.6	S
Rear axle nut	108	11.0	79.6	
Tire air valve stem nuts	1.5	0.15	13 in-lb	
Tire air valve caps	0.15	0.015	1.3 in-lb	
Air valve cores	0.3	0.03	2.6 in-lb	
<b>Final Drive:</b>				
Oil pipe banjo bolts (front gear)	12	1.2	104 in-lb	
Oil nozzle (front gear)	2.9	0.30	26 in-lb	
Oil nozzle (front gear)	18	1.8	13	
Neutral switch	15	1.5	11	
Front gear case bolts:	6 mm	12	1.2	104 in-lb
	8 mm	29	3.0	22
Speed sensor bolt	9.8	1.0	87 in-lb	L
Damper cam nut (front gear)	195	20	144	MO (threads)
Drive gear nut (front gear)	265	27	195	MO, St
Driven gear assy mounting bolts	25	2.5	18	
Driven gear bolt (front gear)	137	14	101	MO, St
Bearing retainer bolts (front gear)	8.8	0.9	78 in-lb	L
Final gear case drain plug	8.8	0.9	78 in-lb	
Final gear case mounting nuts	34	3.5	25	
Final gear case studs	-	-	-	L
Final gear case cover bolts:	8 mm	23	2.3	L
	10 mm	34	3.5	L
Pinion gear nut (final gear)	130	13	94	St, MO
Bearing retainer bolt	6.9	0.7	61 in-lb	L
<b>Brakes:</b>				
Caliper bleed valves	7.8	0.8	69 in-lb	
Brake hose banjo bolts	25	2.5	18	

## 2-8 PERIODIC MAINTENANCE

### Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Brake lever pivot bolt	1.0	0.10	8.7 in·lb	
Brake lever pivot bolt locknut	5.9	0.60	52 in·lb	
Front brake reservoir cap screws	1.5	0.15	13 in·lb	
Front brake light switch screw	1.2	0.12	10 in·lb	
Front master cylinder clamp bolts	8.8	0.9	78 in·lb	G, S
Front caliper mounting bolts	34	3.5	25	
Rear caliper mounting bolts	34	3.5	25	
Rear caliper holder bolt	64	6.5	47	
Brake disc bolts	27	2.8	20	L
Rear master cylinder mounting bolts	25	2.5	18	
Rear master cylinder push rod locknut	18	1.8	13	
Brake pedal clamp bolt	25	2.5	18	
<b>Suspension:</b>				
Upper front fork clamp bolts	20	2.0	14	
Lower front fork clamp bolts	29	3.0	21	AL
Front fork top plugs	22	2.2	16	
Piston rod nuts or joint rod nut	20	2.0	14	
Front fork bottom allen bolt	30	3.1	22	L
Front axle clamp bolts	20	2.0	14	AL
Rear shock absorber nuts	34	3.5	25	
Swingarm pivot shaft	108	11.0	79.6	G
<b>Steering:</b>				
Steering stem head nut	88	9.0	65	
Steering stem nut	5	0.5	43 in·lb	
Handlebar clamp bolts	34	3.5	25	
Handlebar holder nuts	34	3.5	25	
Upper front fork clamp bolts	20	2.0	14	
Lower front fork clamp bolts	29	3.0	21	AL
Turn signal light mounting nuts	5.9	0.6	52 in·lb	
<b>Frame:</b>				
Downtube bolts and nuts	44	4.5	33	
Footboard bracket bolts	34	3.5	25	front
Footpeg bracket bolts	25	2.5	18	rear, L
Sidestand nut	44	4.5	33	
<b>Electrical System:</b>				
Spark plugs	18	1.8	13	
Crankshaft sensor screws	2.9	0.30	26 in·lb	
Stator lead holder screw	9.8	1.0	87 in·lb	L
Inside stator holder bolts	11	1.1	95 in·lb	L
Crankshaft sensor lead holder bolt	2.9	0.30	26 in·lb	L
Alternator outer cover bolts	6.9	0.70	61 in·lb	
Alternator outer cover joint bolts	6.9	0.70	61 in·lb	L
Alternator outer cover damper bolts	6.9	0.70	61 in·lb	L

**Torque and Locking Agent**

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Alternator outer cover assembly bolts	6.9	0.70	61 in·lb	
Alternator cover bolts	11	1.1	95 in·lb	
Alternator inner cover bolts	11	1.1	95 in·lb	
Alternator rotor bolt	78	8.0	58	MO
Alternator stator bolts	13	1.3	113 in·lb	L
Regulator/rectifier bolts	6.5	0.66	57 in·lb	
Timing inspection cap	1.5	0.15	13 in·lb	
Rotor bolt cap	1.5	0.15	13 in·lb	
Starter motor terminal locknut	11	1.1	95 in·lb	
Starter motor terminal nut	4.9	0.50	43 in·lb	
Starter motor assembly bolts	4.9	0.50	43 in·lb	
Starter motor mounting bolts	11	1.1	95 in·lb	
Headlight rim screws	2.9	0.30	26 in·lb	
Headlight unit bracket screws	1.0	0.10	8.7 in·lb	L
Starter lockout switch screw	1.2	0.12	10 in·lb	
Front brake light switch screw	1.2	0.12	10 in·lb	
Sidestand switch bolt	8.8	0.90	78 in·lb	L
Radiator fan switch	18	1.8	13	
Radiator fan bolts	8.3	0.85	7.4 in·lb	
Fuel level sensor mounting bolts	6.9	0.70	61 in·lb	L
Fuel pump mounting bolts	9.8	1.0	87 in·lb	S
Water temperature switch	7.8	0.80	69 in·lb	SS
Water temperature sensor	18	1.8	13	SS
Oil pressure switch terminal screw	1.5	0.15	13 in·lb	G
Oil pressure switch	15	1.5	11	SS
Neutral switch	15	1.5	11	
Speed sensor mounting bolt	9.8	1.0	8.7 in·lb	L
Turn signal light mounting screws	6.9	0.70	61 in·lb	
Turn signal light lens screws	1.0	0.10	8.7 in·lb	
Tail/brake light mounting nuts	5.9	0.60	52 in·lb	
Tail/brake light lens screws	1.2	0.12	10 in·lb	
Tail/brake light assembly screws	1.2	0.12	10 in·lb	

## 2-10 PERIODIC MAINTENANCE

### Specifications

Item	Standard	Service Limit
<b>Fuel System (DFI):</b>		
Throttle grip free play	2 ~ 3 mm (0.08 ~ 0.12 in.)	— — —
Idle speed	950 ± 50 r/min (rpm)	— — —
Air cleaner element	Paper filter	— — —
<b>Cooling System:</b>		
Coolant:		
Type (recommended)	Permanent type antifreeze	— — —
Color	Green	— — —
Mixed ratio	Soft water 50%, Coolant 50%	— — —
Freezing point	– 35°C (– 31°F)	— — —
Total amount	2.3 L (2.4 US qt)	— — —
<b>Engine Top End:</b>		
Valve clearance	Non-adjustable (hydraulic lash adjusters)	— — —
<b>Clutch:</b>		
Clutch fluid:		
Grade	DOT4	— — —
Clutch lever free play	Non-adjustable	— — —
<b>Engine Lubrication System:</b>		
Engine oil:		
Type	API SE, SF or SG API SH or SJ with JASO MA	— — —
Viscosity	SAE 10W-40	— — —
Capacity	2.9 L (3.1 US qt, when filter is not removed) 3.1 L (3.3 US qt, when filter is removed) 3.5 L (3.7 US qt, when engine is completely disassembled and dry)	— — — — — — — — —
Level	Between upper and lower level lines (Wait 2 ~ 3 minutes after idling or running)	— — —
<b>Tires:</b>		
Tread depth:		
Front	BRIDGESTONE EXEDRA G721: 4.3 mm (0.17 in.)	1 mm (0.04 in.), (DE, AT, CH): 1.6 mm (0.063 in.)
Rear	BRIDGESTONE EXEDRA G722: 7.2 mm (0.28 in.)	Up to 130 km/h (80 mph): 2 mm (0.08 in.) Over 130km/h (80mph): 3 mm (0.1 in.)
Air pressure: (when cold)		
Front	Up to 186 kg (410 lb) load: 200 kPa (2.0 kgf/cm <sup>2</sup> , 28 psi)	— — —
Rear	Up to 186 kg (410 lb) load: 250 kPa (2.5 kgf/cm <sup>2</sup> , 36 psi)	— — —

**Specifications**

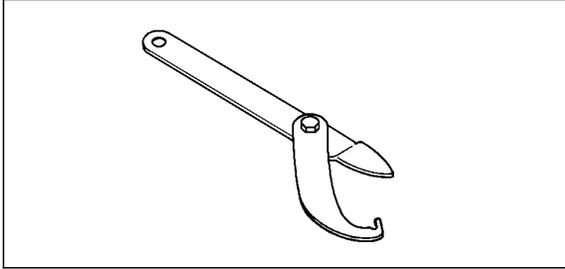
Item	Standard	Service Limit
<b>Final Drive:</b>		
Final gear case oil:		
Grade	API Service Classification: GL-5 hypoid gear oil	---
Viscosity	when above 5°C (41°F) SAE90 when below 5°C (41°F) SAE80	---
Oil level	Filler opening bottom	---
Amount	200 mL (6.76 US oz)	---
Propeller shaft joint grease	20 mL (0.68 US oz), high-temperature grease	---
<b>Brakes:</b>		
Brake fluid		
Grade	DOT4	---
Brake pad lining thickness:		
Front	4.5 mm (0.18 in.)	1 mm (0.04 in.)
Rear	7.5 mm (0.295 in.)	1 mm (0.04 in.)
Brake light timing:		
Front	Pulled ON	---
Rear	ON after about 10 mm (0.39 in.) of pedal travel	---
<b>Electrical System:</b>		
Spark plug gap	0.8 ~ 0.9 mm (0.031 ~ 0.035 in.)	---

AT: Republic of Austria  
 CH: Swiss Confederation  
 DE: Federal Republic of Germany

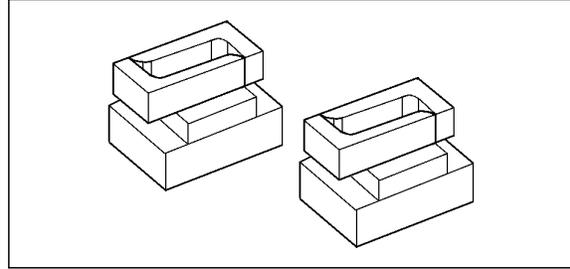
## 2-12 PERIODIC MAINTENANCE

### Special Tools

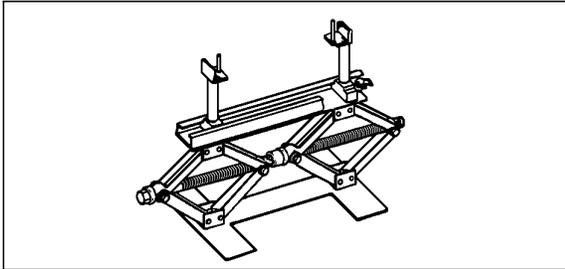
**Steering Stem Nut Wrench :**  
57001-1100



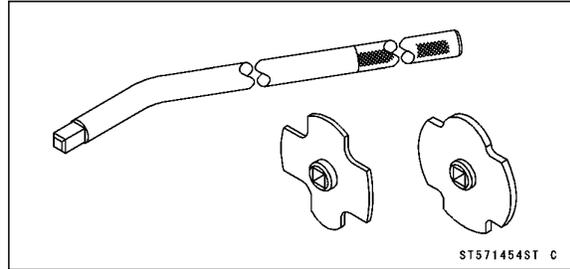
**Attachment Jack :**  
57001-1398



**Jack :**  
57001-1238



**Filler Cap Driver :**  
57001-1454



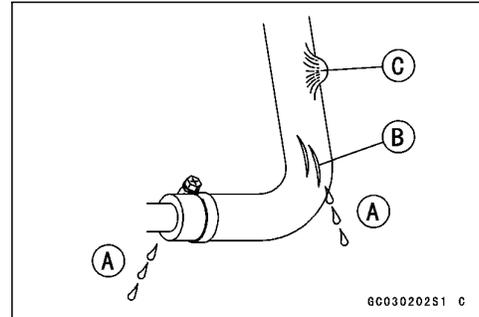
**Periodic Maintenance Procedures**

**Fuel System (DFI)**

*Fuel Hose and Connection Inspection*

○The fuel hoses are designed to be used throughout the motorcycle's life without any maintenance, however, if the motorcycle is not properly handled, the high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Remove the fuel tank (see Fuel System chapter) and check the fuel hose.

- ★Replace the fuel hose if any fraying, cracks [B] or bulges [C] are noticed.
- Check that the hoses are securely connected and clamps are tightened correctly.
- When installing, route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- When installing the fuel hoses, avoid sharp bending, kinking, flattening or twisting, and route the fuel hoses with a minimum of bending so that the fuel flow will not be obstructed.
- ★Replace the hose if it has been sharply bent or kinked.



*Throttle Control System Inspection*

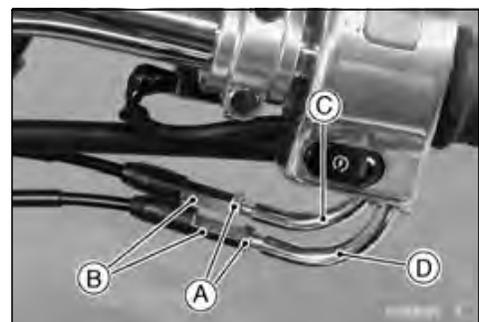
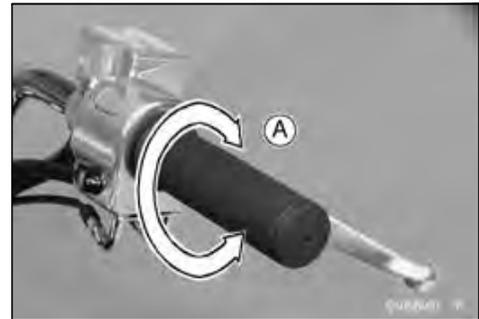
**Throttle Grip Play Inspection**

- Check the throttle grip free play [A].
- ★If the free play is incorrect, adjust the throttle cable (see below).

**Throttle Grip Free Play**

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

- Check that the throttle grip moves smoothly from close to full open, and the throttle closes quickly and completely in all steering positions by the return spring.
- ★If the throttle grip doesn't return properly, check the throttle cable routing, grip 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 doesn't change.
- ★If the idle speed increases, check the throttle grip free play and the cable routing.
- If necessary, adjust the throttle cable as follows:
  - Loosen the locknuts [A] and screw the adjusters [B] all the way in so as to give the throttle grip plenty of play (rear view).
  - Turn out the adjuster of the decelerator cable [C] until there is no play.
  - Tighten the locknut against the adjuster.
  - Turn the adjuster of the accelerator cable [D] until the proper amount of throttle grip free play is obtained and tighten the locknut against the adjuster.

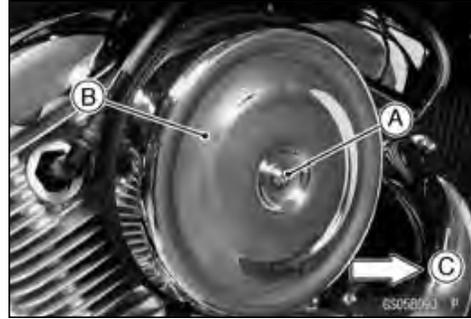


## 2-14 PERIODIC MAINTENANCE

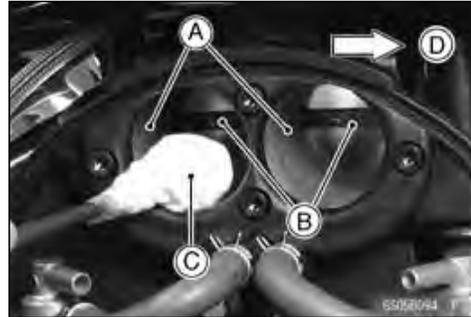
### Periodic Maintenance Procedures

#### Throttle Bore Cleaning

- Check the throttle bore for cleanliness as follows:
  - Remove the air cleaner cover Allen bolt [A] and take off the right air cleaner cover [B].
  - Front [C]



- Check the throttle bores [A] at the throttle valves [B] and around them for carbon deposits by opening the valves.
- ★ If any carbon accumulates, wipe the carbon off the throttle bores around the throttle valves, using a lint-free cloth [C] penetrated with a high-flash point solvent.
- Front [D]



#### Idle Speed Inspection

- Start the engine and warm it up thoroughly.
- At first the engine will run fast to decrease warm up time (fast idle).
- Gradually the fast idle will lower to a certain RPM automatically. This is the idle speed.
- Check the idle speed.

#### Idle Speed

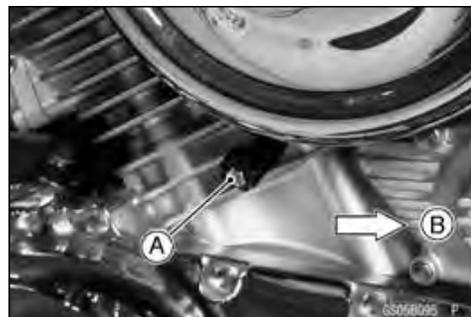
**Standard: 950 ± 50 r/min (rpm)**

- With the engine idling, turn the handlebar to both sides.
- ★ If handlebar movement changes the idle speed, the throttle cables may be improperly adjusted or incorrectly routed or damaged. Be sure to correct any of these conditions before riding (see Cable, Wire, and Hose Routing section in the Appendix chapter).

#### **⚠ WARNING**

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

- ★ If the idle speed is out of the specified range, adjust it.
  - Start the engine and warm it up thoroughly.
  - Wait until fast idle speed lowers to a certain value.
  - Turn the 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. Readjust if necessary.
  - Front [B]



**Periodic Maintenance Procedures**

*Air Cleaner Element Cleaning*

**NOTE**

- In dusty areas, the element should be cleaned more frequently than the recommended interval.
- After riding through rain or on muddy roads, the element should be cleaned immediately.

- Remove:
  - Allen Bolt and Washer [A] and Left Air Cleaner Cover [B]
  - Front [C]
- Remove the element [A].
- Push a clean, lint-free towel into the lower air cleaner duct to keep dirt or other foreign material from entering.



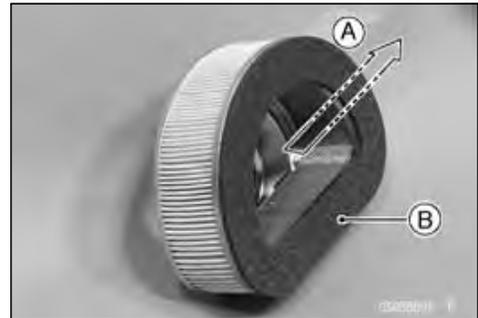
**⚠ WARNING**

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

**CAUTION**

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

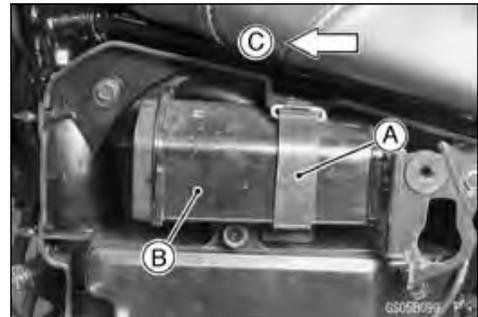
- Clean the element by tapping it lightly to loosen dust.
- Blow away the remaining dust by applying compressed air [A] from the inside to the outside (from the clean side to the dirty side).
- Visually check the element for no tears or no breaks and check the sponge gasket [B] also.
- ★ If the element or gasket has any tears or breaks, replace the element.
- Install the left air cleaner cover.



**Torque - Left Air Cleaner Cover Allen Bolt: 16 N·m (1.6 kgf·m, 12 ft·lb)**

*Evaporative Emission Control System Inspection (CAL)*

- Inspect the canister as follows:
  - Remove the left side cover (see Frame chapter).
  - Remove the band [A] and take out the canister [B].
  - Visually inspect the canister for cracks and other damage.
- ★ If the canister has any cracks or bad damage, replace it with a new one.



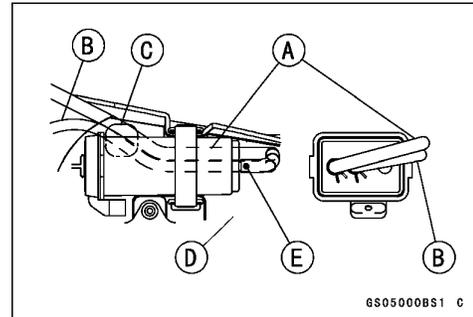
**NOTE**

- The canister is designed to work well through the motor-cycle's life without any maintenance if it is used under normal conditions.

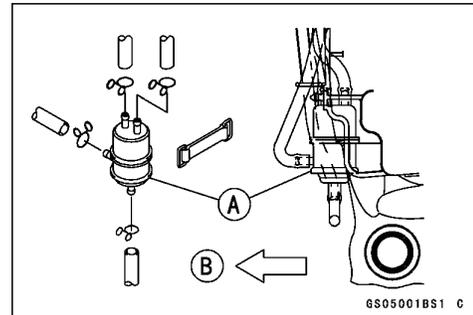
## 2-16 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Run the purge hose (green) [A] above the canister breather hose (blue) [B] through the hole [C] into the tool case [D].
- Do not run these hoses side by side on the battery side of the canister. This prevents hoses from being flattened when installing the left side cover.
- Install the canister and the left side cover (see Frame chapter).
- Face the white mark [E] left as shown.



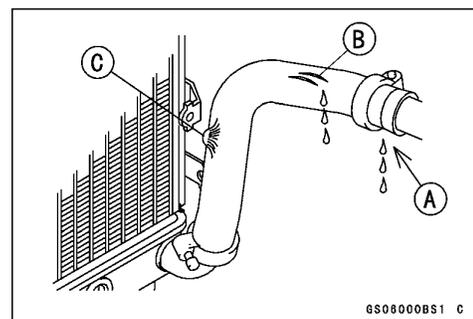
- Check the liquid/vapor separator as follows:
  - Disconnect the hoses from the separator, and remove the separator [A] from the motorcycle right side. Front [B]
  - Visually inspect the separator for cracks and other damage.
  - ★ If the separator has any cracks or damage, replace it with a new one.
  - To prevent the gasoline from flowing into or out of the canister, hold the separator perpendicular to the ground.
- Check the hoses of the evaporative emission control system as follows:
  - Check that the hoses are securely connected and clips are in position.
  - Replace any kinked, deteriorated or damaged hoses.
  - Route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter. Refer to the diagram of the evaporative emission control system in the Fuel System chapter too.
  - When installing the hoses, avoid sharp bending, kinking, flattening or twisting, and route the hoses with a minimum of bending so that the emission flow will not be obstructed.



### Cooling System

#### Radiator Hose and Connection Inspection

- The high pressure inside the radiator hose can cause coolant to leak [A] or the hose to burst if the line is not properly maintained. Visually inspect the hoses for signs of deterioration. Squeeze the hoses. A hose should not be hard and brittle, nor should it be soft or swollen.
- ★ Replace the hose if any fraying, cracks [B] or bulges [C] are noticed.
- Check that the hoses are securely connected and clamps are tightened correctly.



**Torque - Radiator Hose Clamp Screws: 2.5 N·m (0.25 kgf·m, 22 in·lb)**

**Periodic Maintenance Procedures**

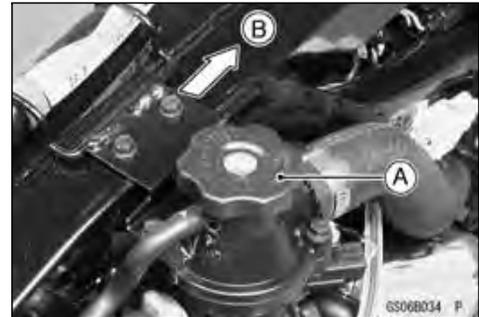
*Coolant Change*

**⚠ WARNING**

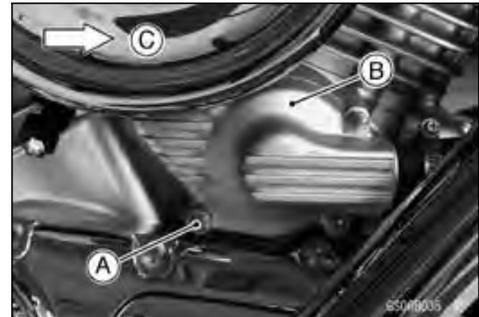
**To avoid burns, do not remove the radiator cap or try to change the coolant when the engine is still hot. Wait until it cools down. Coolant on tires will make them slippery, and can cause an accident and injury. Since coolant is harmful to the human body, do not use for drinking.**



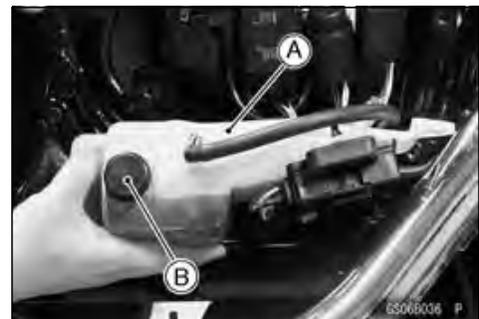
- Place a container under the radiator drain bolt [A], then remove the drain bolt (front view).
- Remove the fuel tank (see Fuel System (DFI) chapter).
- Remove the radiator cap [A] in two steps. First turn the cap counterclockwise to the first stop. Then push and turn it further in the same direction and remove the cap.
- The coolant will drain from the radiator and engine.  
Front [B]



- Remove the water pump drain bolt [A]. The remaining coolant will drain from the water pump [B].
- Place a conduit under the drain hole of the pump cover. The conduit leads to a container.  
Front [C]



- Remove :
  - Right Side Cover (see Frame chapter)
  - Reserve Tank Bolts
- Turn over the reserve tank [A], remove the cap [B], and pour the coolant into a suitable container.
- Install the reserve tank.
- When filling the coolant, choose a suitable mixture ratio by referring to the coolant manufacturer's directions.



**CAUTION**

**Soft or distilled water must be used with the antifreeze (see Specifications in this chapter) in the cooling system. If hard water is used in the system, it causes scale accumulation in the water passages, and considerably reduces the efficiency of the cooling system.**

## 2-18 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Water and Coolant Mixture Ratio (when shipping)

Soft Water	:	50 %
Coolant	:	50 %
Freezing Point	:	- 35°C (- 31°F)
Total Amount	:	2.3 L (2.4 US qt)

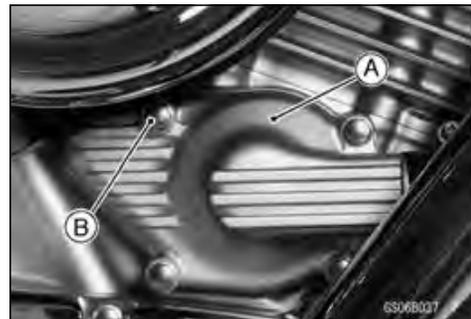
- Tighten the drain bolts.  
Torque - Radiator Drain Bolt: 7.4 N·m (0.75 kgf·m, 65 in·lb)  
Water Pump Drain Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)

- Fill the coolant into the radiator.

#### NOTE

○ Fill in the coolant slowly so that it can expel the air from the engine and radiator.

- Check the cooling system for leaks.
- Bleed the air from the water pump [A].  
○ Loosen the air bleeder bolt [B] until the coolant seeps out around the bolt, then tighten it.  
Torque - Water Pump Air Bleeder Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)



- Tap the radiator hoses to force any air bubbles caught inside.
- Fill the radiator up to the filler neck [A] with coolant.
- Install the radiator cap.



- Fill the reserve tank up to the "F" (full) level line [A] with coolant and install the cap.
- Install the fuel tank (see Fuel System (DFI) chapter).
- Start the engine and warm it up thoroughly until the radiator fan turns on and then stop the engine.
- Check the coolant level in the reserve tank several times while the engine is cooling down, and replenish as necessary.
- ★ If the coolant level is lower than the "L" level line, add coolant to the "F" level line.



#### CAUTION

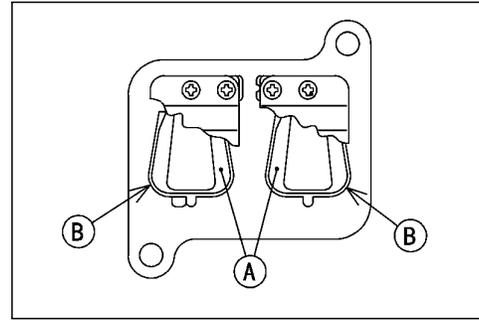
Do not add more coolant above the "F" level line.

**Periodic Maintenance Procedures**

**Engine Top End**

*Air Suction Valve Inspection*

- Remove the air suction valve (see Engine Top End chapter).
- Visually inspect the reeds for cracks, folds, warps, heat damage or other damage.
- ★ If there is any doubt as to the condition of the reeds [A], replace the air suction valve as an assembly.
- Check the reed contact areas [B] of the valve holder for grooves, scratches, any signs of separation from the holder or heat damage.
- If there is any doubt as to the condition of the reed contact areas, replace the air suction valve as an assembly.
- If any carbon or other foreign particles have accumulated between the reed and the reed contact area, wash the valve assembly clean with a high-flash point solvent.



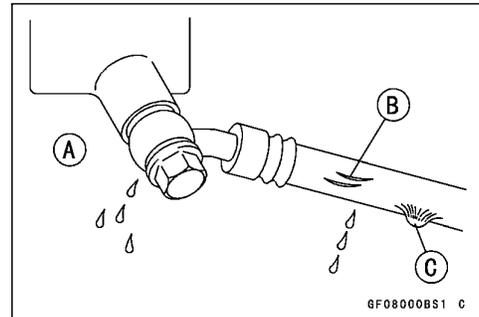
**CAUTION**

**Do not scrape off the deposits with a scraper as this could damage the rubber, requiring replacement of the suction valve assembly.**

**Clutch**

*Clutch Hose and Connection Inspection*

- The high pressure inside the clutch line can cause fluid to leak [A] or the hose to burst if the line is not properly maintained. Bend and twist the rubber hose while examining it.
  - ★ Replace it if any fraying, cracks [B] or bulges [C] are noticed.
  - Check that the hoses are securely connected and banjo bolts are tightened correctly.
- Torque - Clutch Hose Banjo Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- When installing the clutch hose, route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.
  - ★ Replace the hose if it has been sharply bent or kinked.



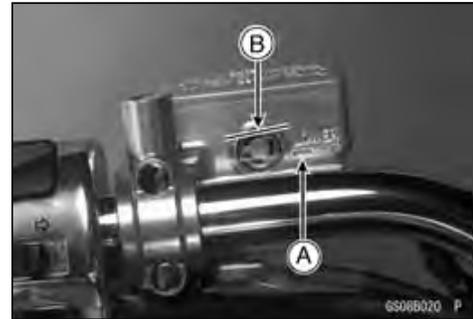
## 2-20 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Clutch Fluid Level Inspection

- Hold the clutch fluid reservoir horizontal.
- Check that the clutch fluid level of the clutch reservoir is between the lower [A] and the upper [B] level lines.
- ★ If the fluid level is lower than the lower level line, fill the reservoir to the upper level line in the reservoir.
- Since the clutch fluid is the same as the brake fluid, refer to Brake Fluid Section in the Brakes chapter for further details.

**Torque - Clutch Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

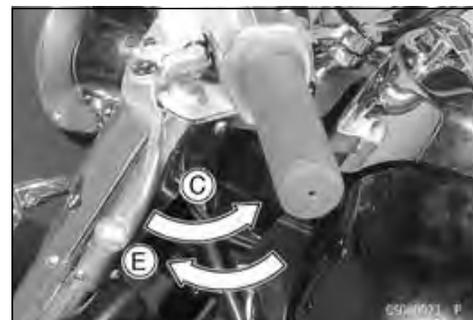
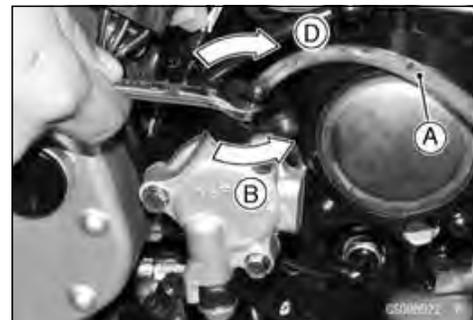


#### **⚠ WARNING**

**Change the fluid in the clutch line completely if the fluid must be refilled but the type and brand of the fluid that already is in the reservoir are unidentified. After changing the fluid, use only the same type and brand of fluid thereafter. Mixing different types and brands of fluid lowers the fluid boiling point and could cause the clutch to be ineffective. It may also cause the rubber clutch parts to deteriorate.**

#### Clutch Fluid Change

- Level the clutch fluid reservoir and remove the reservoir cap.
- Remove the alternator outer cover (see Electrical System chapter.) and the rubber cap from the bleed valve on the clutch slave cylinder.
- Attach a clear plastic hose [A] to the bleed valve and run the other end of the hose into a container.
- Fill the reservoir with fresh fluid.
- Change the clutch fluid as follows.
  - Open [B] the bleed valve, using a wrench.
  - Pump the clutch lever and hold [C] it.
  - Close [D] the bleed valve.
  - Release [E] the clutch lever.
- Repeat this operation until fresh fluid comes out from the plastic hose or the color of the fluid changes.
- Check the fluid level in the reservoir often, replenishing it as necessary.



#### **NOTE**

*○ If the fluid in the reservoir runs completely out any time during fluid changing, the bleeding operation must be done over again from the beginning since air will have entered the line.*

#### **⚠ WARNING**

**Do not mix two brands of fluid.**

**Periodic Maintenance Procedures**

- After changing the fluid, check the clutch for good clutch power and no fluid leakage.
- ★ If necessary, bleed the air from the lines (see Clutch Line Bleeding in the Clutch chapter).
- Remove the clear plastic hose.
- Install the reservoir cap.
- Tighten the bleed valve, and install the rubber cap.

**Torque - Clutch Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

**Clutch Slave Cylinder Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

*Clutch Master Cylinder Cup and Dust Seal Replacement*

- Remove the clutch master cylinder (see Clutch chapter).
- Remove the reservoir cap [A] and diaphragm [B], and pour the clutch fluid into a container.
- Unscrew the locknut [C] and pivot bolt [D], and remove the clutch lever [E].
- Pull the dust cover [F] out of place, and remove the circlip [G].

**Special Tool - Inside Circlip Pliers: 57001-143**

- Pull out the primary cup [H], piston assembly [I], and return spring [J].

**CAUTION**

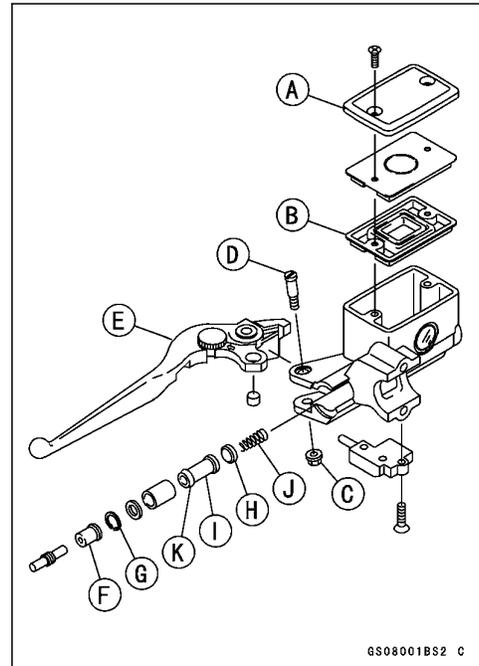
**Do not remove the secondary cup [K] from the piston since removal will damage it.**

- Check the parts of the clutch master cylinder (see Clutch chapter).
- ★ If any part shows signs of damage, replace it.

- Before assembly, clean all parts including the master cylinder with clutch fluid or alcohol.

**CAUTION**

**Use only disc brake fluid, isopropyl alcohol or ethyl alcohol, for cleaning parts. Do not use any other fluid for cleaning these parts. Gasoline, motor oil or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely, and will eventually deteriorate the rubber used in the cylinder.**



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## 2-22 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Apply clutch fluid to the parts removed and to the inner wall of the cylinder.
- Take care not to scratch the piston or the inner wall of the cylinder.
- Install the push rod with the dust seal fitted into the groove.

○ The push rod round end must be faced inwards.

**Torque - Clutch Lever Pivot Bolt: 1.0 N·m (0.10 kgf·m, 8.7 in·lb)**

**Clutch Lever Pivot Bolt Locknut: 5.9 N·m (0.60 kgf·m, 52 in·lb)**

- Install the clutch master cylinder (see Clutch chapter).

#### *Clutch Slave Cylinder Piston Seal Replacement*

- Remove the clutch slave cylinder (see Clutch chapter).
- Loosen the banjo bolt [A] at the clutch pipe lower end, and tighten it loosely.
- Unscrew the slave cylinder bolts [B] and detach the slave cylinder with the pipe installed from the engine.
- Pump the clutch lever until the piston comes out of the cylinder.
- Unscrew the banjo bolt and remove the slave cylinder [C].

#### CAUTION

**Immediately wash away any clutch fluid that spills. It may damage painted surfaces.**

#### NOTE

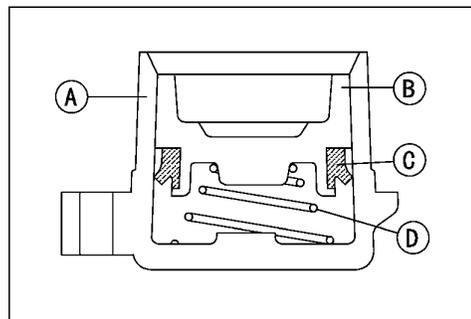
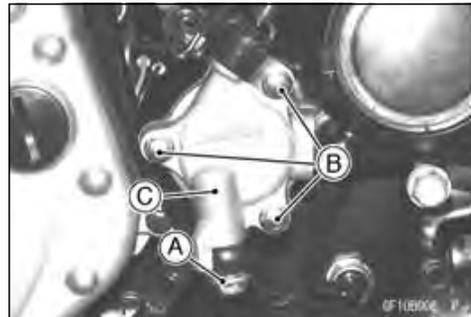
○ If the clutch slave cylinder is removed and left alone, the piston will be pushed out by spring force.

- Remove the spring and piston seal.

#### CAUTION

**Replace the piston seal with a new one if it was removed from the piston.**

- Before assembly, apply clutch fluid to the outside of the piston and the piston seal.
- Install the piston seal as shown.
  - Cylinder [A]
  - Piston [B]
  - Piston Seal [C]
  - Spring [D]



**Periodic Maintenance Procedures**

**Engine Lubrication System**

*Engine Oil Change*

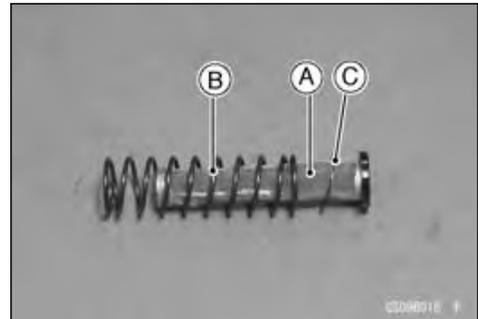
- Situate the motorcycle so that it is vertical after warming up the engine.
- Remove the engine oil drain plug [A] and drain the oil.



- Remove:  
Oil Screen Plug [A] (Engine right side)



- Remove the oil screen [A], the spring [B], and the washer [C].
- Clean the oil screen with a high-flash point solvent and remove any particles stuck to it.
- Clean the screen thoroughly whenever the engine oil is changed.



**⚠ 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 and broken wires.
- ★ If the screen is damaged, replace it.
- Be sure to put in the oil screen with the rubber gasket end inside.
- ★ Replace the screen plug O-ring with new one if it is damaged.

**Torque - Oil Screen Plug: 20 N·m (2.0 kgf·m, 14 ft·lb)**

- The oil in the filter can be drained by removing the filter (see Oil Filter Change in this section).

- ★ Replace the drain plug gasket with a new one if it is damaged.

**Torque - Engine Oil Drain Plug , Oil Screen Plug: 20 N·m (2.0 kgf·m, 14 ft·lb)**

**Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)**

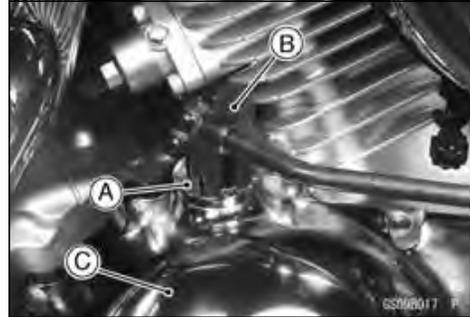
## 2-24 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Remove the oil filler cap [A] with the driver-filler cap [B] and pour in the specified type and amount of oil.  
Clutch Cover [C]

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

**Torque - Oil Filler Cap: 1.5 N·m (0.15 kgf·m, 13 in·lb)**



#### Engine Oil

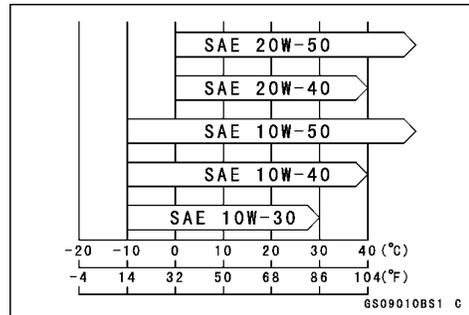
**Type:** API SE, SF or SG class  
API SH or SJ class with JASO MA

**Viscosity:** SAE 10W-40

**Amount:** 2.9 L (3.1 US qt, when filter is not removed)  
3.1 L (3.3 US qt, when filter is removed)  
3.5 L (3.7 US qt, when engine is completely disassembled and dry)

#### NOTE

○ Although 10W-40 engine oil is the recommended oil for most conditions, the oil viscosity may need to be changed to accommodate atmospheric conditions in your riding area.



#### Oil Filter Replacement

- Drain the engine oil (see Engine Oil Change in this section).
- Remove the oil filter [A] with the oil filter wrench [B] and discard the oil filter.

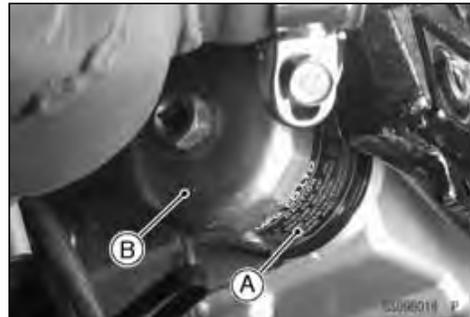
**Special Tool - Oil Filter Wrench: 57001-1249**

#### NOTE

○ The filter has an oil filter bypass valve which can not be removed.

- Replace the oil filter with the new one.
- Apply oil to the gasket of the new filter before installation.
- Tighten the filter with the oil filter wrench.
- Pour in the specified type and amount of oil.

**Torque - Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)**



## Wheel/Tires

### Tire Inspection

As the tire tread wears down, the tire becomes more susceptible to puncture and failure. An accepted estimate is that 90% of all tire failures occur during the last 10% of tread life (90% worn). So it is false economy and unsafe to use the tires until they are bald.

- Remove any imbedded stones or other foreign particles from the tread.
- Visually inspect the tire for cracks and cuts, replacing the tire in case of damage. Swelling or high spots indicate internal damage, requiring tire replacement.

**Periodic Maintenance Procedures**

- Measure the tread depth at the center of the tread with a depth gauge [A]. Since the tire may wear unevenly, take measurement at several places.

★ If any measurement is less than the service limit, replace the tire (see Wheels/Tires chapter).

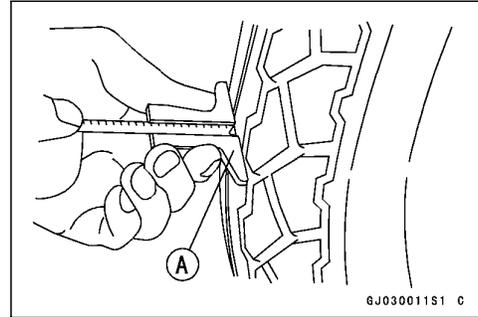
**Tread Depth**

**Front:**

- Standard: 4.3 mm (0.17 in.)
- Service Limit: 1 mm (0.04 in.)  
(DE, AT, CH) 1.6 mm (0.063 in.)

**Rear:**

- Standard: 7.2 mm (0.28 in.)
- Service Limit: 2 mm (0.08 in.):  
Up to 130 km/h (80 mph)  
3 mm (0.1 in.):  
Over to 130 km/h (80 mph)

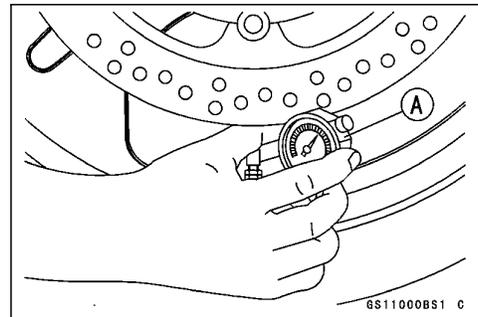


- Measure the tire air pressure with an air pressure gauge [A] when the tires are cold (that is, when the motorcycle has not been ridden more than a mile during the past 3 hours.)

★ Adjust the tire air pressure according to the specifications if necessary.

**Air Pressure (when cold)**

Front	Up to 186 kg (410 lb)	200 kPa (2.0 kgf/cm <sup>2</sup> , 28 psi)
Rear	Up to 186 kg (410 lb)	250 kPa (2.5 kgf/cm <sup>2</sup> , 36 psi)



**⚠ WARNING**

To ensure safe handling and stability, use only the recommended standard tires for replacement, inflated to the standard pressure. Use the same manufacturer's tires on both front and rear wheels.

**NOTE**

- Most countries may have their own regulations requiring a minimum tire tread depth; be sure to follow them.
- Check and balance the wheel when a tire is replaced with a new one (see Wheels/Tires chapter).

**Final Drive**

*Oil Level Inspection*

**⚠ WARNING**

Motorcycle operation with insufficient, deteriorated, or contaminated oil causes accelerated wear and may result in seizure of the pinion and ring gears. Seizure can lock the rear wheel and skid the rear tire, with consequent loss of control.

- Support the motorcycle perpendicular to the ground.
- Unscrew the filler plug [A], using the driver-filler cap [B].

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



## 2-26 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- The oil level [A] should come to the bottom of the filler opening.
- ★ If it is low, 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.
- Install the filler plug.



#### Oil Change

- Warm up the oil by running the motorcycle so that the oil will pick up any sediment and drain easily. Stop the motorcycle and turn the ignition switch OFF.
- Place an oil pan beneath the final gear case, and remove the filler cap and drain plug [A].



#### **⚠ WARNING**

**When draining or filling the final gear case, be careful that no oil gets on the tire, spoke, or rim. 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 gasket.  
**Torque - Final Gear Case Drain Plug: 8.8 N·m (0.90 kgf·m, 78 in·lb)**
- Fill the final gear case with the specified oil and quantity.

#### Final Gear Case Oil:

**Amount:** 200 mL (6.76 US oz)  
**Grade:** API GL-5 hypoid gear oil  
**Viscosity:** When above 5°C (41°F) SAE 90  
When below 5°C (41°F) SAE 80

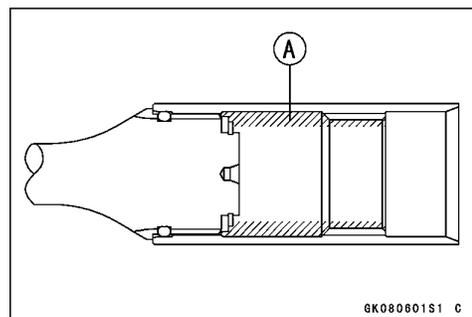
#### NOTE

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

- Be sure the O-ring is in place, and install the filler plug.

#### Propeller Shaft Joint Lubrication

- Remove the final gear case and propeller shaft joint (see Final Drive chapter).
- Wipe the old grease off the propeller shaft sliding joint and pinion joint.
- Pack the propeller shaft sliding joint with 20 mL (16 grams) of high temperature grease [A].



**Periodic Maintenance Procedures**

**Brakes**

*Brake Pad Wear Inspection*

- Check the lining thickness [A] of the pads in each caliper.
- ★ If the lining thickness of either pad is less than the service limit [B], replace both pads in the caliper as a set (see Brakes chapter).

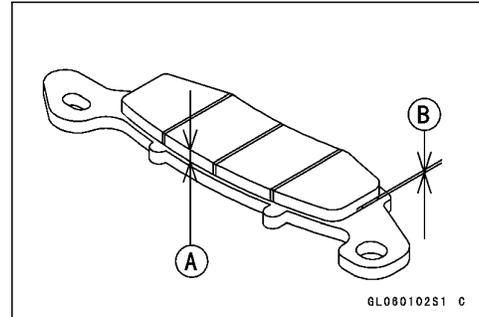
**Pad Lining Thickness**

**Standard:**

**Front: 4.5 mm (0.18 in.)**

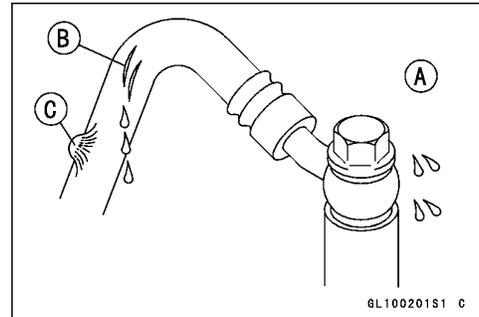
**Rear: 7.5 mm (0.295 in.)**

**Service Limit: 1 mm (0.04 in.)**



*Brake Hose and Connection Inspection*

- Inspect the brake hose and fittings for deterioration, cracks and signs of leakage.
- The high pressure inside the brake line can cause fluid to leak [A] or the hose to burst if the line is not properly maintained. Bend and twist the rubber hose while examining it.
- ★ Replace the hose if any cracks [B] or bulges [C] are noticed.
- ★ Tighten any loose fittings.

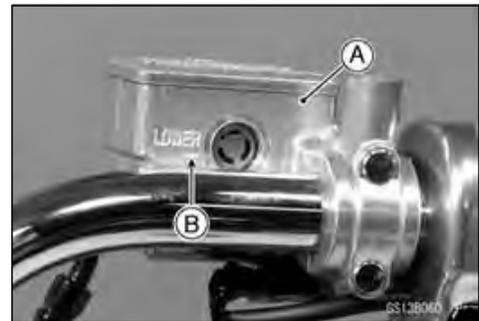


*Brake Fluid Level Inspection*

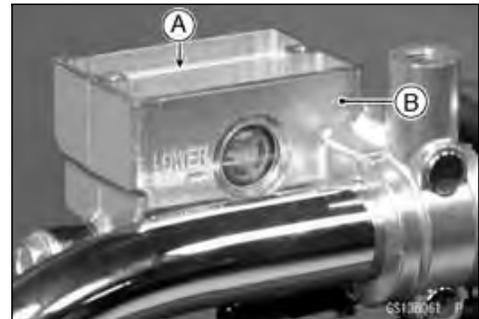
- Check that the brake fluid level in the front brake reservoir [A] is above the lower [B] level line.

**NOTE**

○ Hold the reservoir horizontal by turning the handlebar when checking brake fluid level.



- ★ If the fluid level is lower than the lower level line, fill the reservoir to the upper level line [A] in the reservoir [B].

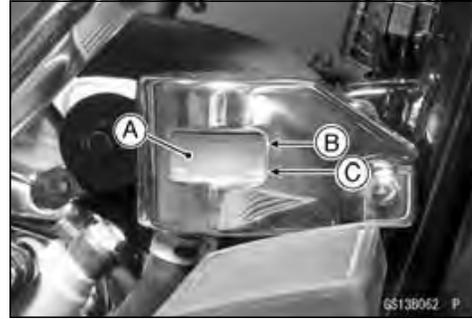


## 2-28 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Check that the brake fluid level in the rear brake reservoir [A] is between the upper [B] and the lower [C] level lines.
- ★ If the fluid level is lower than the lower level line, fill the reservoir to the upper level line.
- Use extra heavy-duty brake fluid only from a container marked DOT4.
- Brake fluid of DOT4 is installed in the brake system when shipped.

**Torque - Front Brake Reservoir Cap Screws: 1.5 N-m (0.15 kgf-m, 13 in-lb)**



#### **⚠ WARNING**

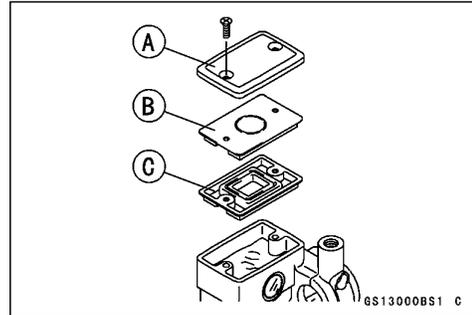
**Do not mix two brands of fluid. Change the brake fluid in the brake line completely if the brake fluid must be refilled but the type and brand of the brake fluid that is already in the reservoir are unidentified. After changing the fluid, use only the same type and brand of fluid thereafter.**

#### *Brake Fluid Change*

##### **NOTE**

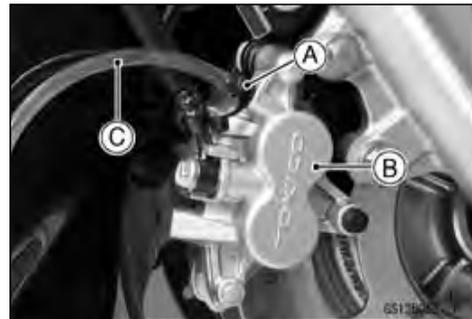
○ *The procedure to change the front brake fluid is as follows. Changing the rear brake fluid is almost the same as for the front brake.*

- Level the brake fluid reservoir.
  - Remove the reservoir cap [A], plate [B] and diaphragm [C]
- 
- Remove the rubber cap from the bleed valve [A] on the front caliper [B].
  - Attach a clear plastic hose [C] to the bleed valve, and run the other end of the hose into a container.
  - Fill the reservoir with new brake fluid.
  - Temporarily install the reservoir cap.
  - Change the brake fluid as follows:



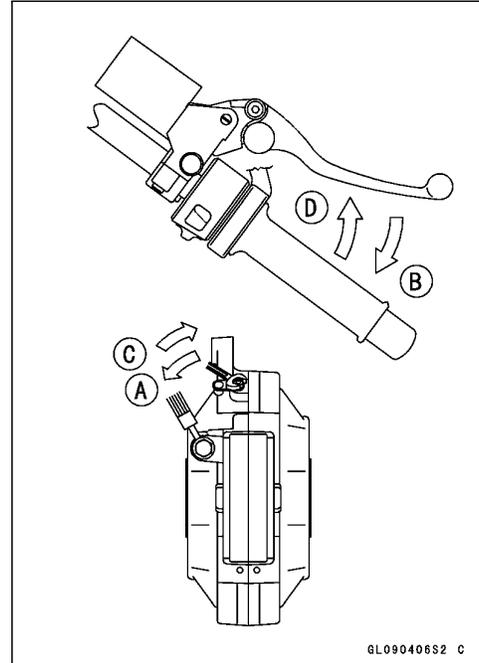
##### **NOTE**

○ *The fluid level must be checked often during the changing operation and replenished with fresh brake fluid. If the fluid in the reservoir runs out any time during the changing operation, the brakes will need to be bled since air will have entered the brake line.*



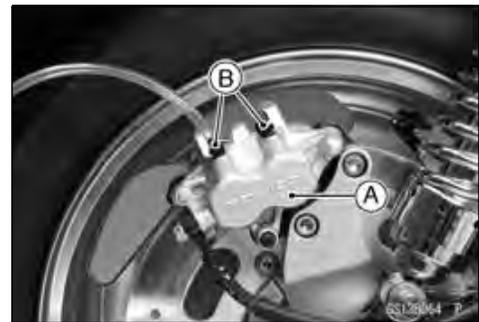
**Periodic Maintenance Procedures**

- Repeat this operation until fresh brake fluid comes out from the plastic hose or the color of the fluid changes.
  - Open the bleed valve [A].
  - Pump the brake lever and hold it [B].
  - Close the bleed valve [C].
  - Release the brake lever [D].
- Front Brake : Repeat the above steps for other caliper.



- Remove the clear plastic hose.
- Install the reservoir cap.
- Tighten the bleed valves, and install the rubber caps.
  - Torque - Caliper Bleed Valves: 7.8 N·m (0.8 kgf·m, 69 in·lb)
  - Front Brake Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

- For the rear brake caliper [A], change the brake fluid for two bleed valves [B].
- After changing the fluid, check the brake for good braking power, no brake drag, and no fluid leakage.
- ★ If necessary, bleed the air from the lines (see Brakes chapter).



*Brake Master Cylinder Cup and Dust Seal Replacement*

- Refer to the Master Cylinder section in the Brakes chapter for Brake/Master Cylinder Cup and Dust Seal Replacement.

*Caliper Piston/Dust Seals Replacement*

- Refer to the Calipers section in the Brakes chapter for Caliper Piston/Dust Seals Replacement.

*Front Brake Light Switch Inspection*

- Turn on the ignition switch.
- The brake light should go on when the front brake lever is applied.
- ★ If it does not, replace the switch.

## 2-30 PERIODIC MAINTENANCE

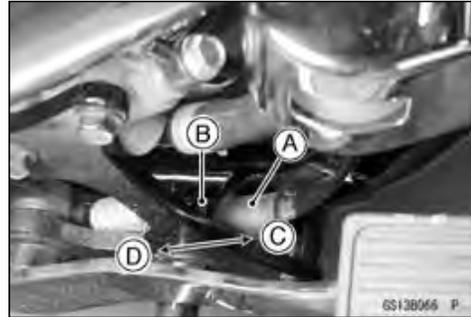
### Periodic Maintenance Procedures

#### Rear Brake Light Switch Check/Adjustment

- Turn on the ignition switch.
- Check the operation of the rear brake light switch by depressing the brake pedal [A]. The brake light should go on after about **10 mm (0.39 in.)** of the pedal travel [B].



- ★ If it does not, adjust the brake light switch.
- While holding the switch body, turn the adjusting nut to adjust the switch.
  - Switch Body [A]
  - Adjusting Nut [B]
  - Light sooner as the body rises [C]
  - Light later as the body lowers [D]



#### CAUTION

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

### Suspension

#### Front Fork Oil Leak Inspection

- Remove the bolts [A] and then slide the cover downward.



- Visually inspect the front forks [A] for oil leakage, scoring or scratches on the outer surface of the inner tubes.
- ★ Replace or repair any defective parts, if necessary.



**Periodic Maintenance Procedures**

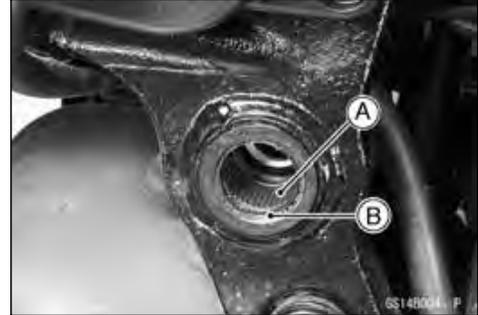
*Rear Shock Absorber Oil Leak Inspection*

- Visually inspect the shock absorbers [A] for oil leakage.
- ★ If they are oil leaked, one unit feels weaker than the other, replace both shock absorber as a set.



*Swingarm Pivot Lubrication*

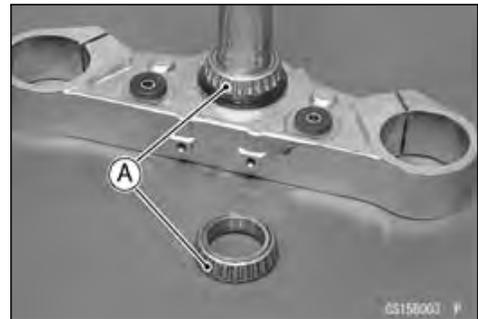
- Remove the swingarm (see Suspension chapter).
- Clean the old grease out of the bearings.
- Apply grease to the inner surface of the needle bearings [A].
- Apply a thin coat of grease to the lips [B] of the grease seals.
- Install the swingarm (see Suspension chapter).



**Steering**

*Stem Bearing Lubrication*

- Remove the steering stem. (see Steering chapter).
- Using a high-flash point solvent, wash the upper and lower tapered roller bearings [A] in the cages, and wipe the upper and lower outer races, which are press-fitted into the frame head pipe, clean of grease and dirt.
- Visually check the outer races and the rollers.
- ★ If the rollers or races are worn, or if either race is dented, replace both races and all the roller bearings as a set (see Steering chapter).
- Pack the upper and lower tapered roller bearings in the cages with grease, and apply a light coat of grease to the upper and lower outer races.
- Install the steering stem, and adjust the steering (see Steering chapter).



*Steering Check*

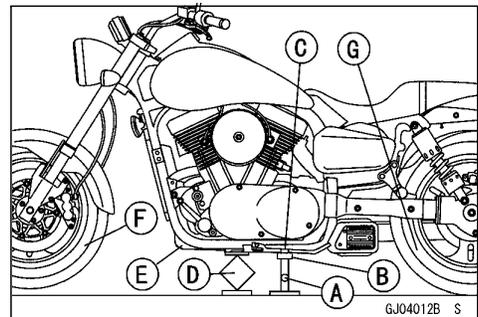
- Check steering as follows.
- Use the jack [A], the attachment jack [B] under the frame pipe ribs [C], and a commercially available jack [D] under the engine [E] to lift the front wheel [F] off the ground.

**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**

- With the front wheel pointing straight ahead, alternately tap each end of the handlebar. The front wheel should swing fully right and left from the force of gravity until the fork hits the stop.

- ★ If the wheel binds or catches before the stop, the steering is too tight.



## 2-32 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

○ Feel for steering looseness by pushing and pulling [A] the fork.

★ If you feel looseness, the steering is too loose.

#### NOTE

- The cables and wiring will have some effect on the motion of the fork which must be taken into account. Be sure the wires and cables are properly routed.
- The bearings must be in good condition and properly lubricated in order for any test to be valid.

#### Steering Adjustment

- ★ Adjust the steering, if necessary.
- Loosen the upper fork clamp bolt [A] on both side and unscrew the stem head nut [B].
- Remove the O-ring (see Steering chapter).
- Remove the steering stem head [C] together with the handlebar installed.

- Remove the claw washer.
- Adjust the stem nut [A] with the stem nut wrench [B] by tightening to the specified torque.

**Special Tool - Steering Stem Nut Wrench: 57001-1100**

**Torque - Steering Stem Nut: 49 N·m (0.5 kgf·m, 43 ft·lb)**

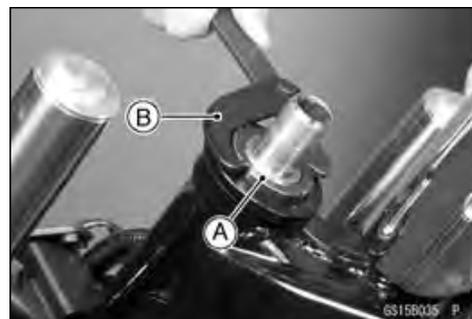
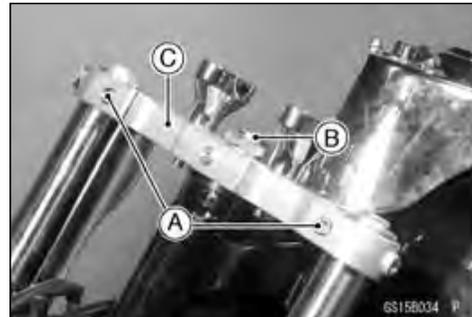
- Install the stem head.
- Tighten the following in the order listed.

**Torque - Stem Head Nut: 88 N·m (9.0 kgf·m, 65 ft·lb)**

**Upper Fork Clamp Bolts: 20 N·m (2.0 kgf·m, 14 in·lb)**

○ Run the throttle cables, brake hose, and clutch hose in accordance with the Cable, Wire, and Hose Routing section in the General Information chapter.

- Check and adjust the steering and throttle cables after installation.



#### **⚠ WARNING**

**Do not attempt to ride the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brakes will not function on the first application of the lever if this is not done.**

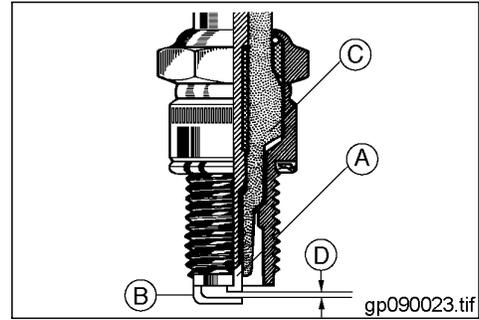
**Periodic Maintenance Procedures**

**Electrical System**

*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 high-flash point solvent and a wire brush or other tool.
- ★ If the spark plug center electrode [A] and/or side electrode [B] are corroded or damaged, or if the insulator [C] is cracked, replace the plug.
- Use the standard spark plug or its equivalent.
- Measure the gap [D] with a wire-type thickness gauge.
- ★ If the gap is incorrect, carefully bend the side electrode with a tool to obtain the correct gap.

**Spark Plug Gap: 0.8 ~ 0.9 mm (0.031 ~ 0.035 in.)**



**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**

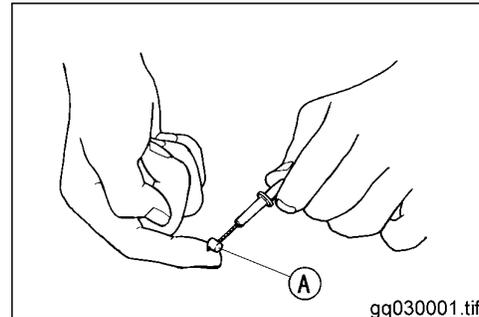
○ *Whenever the vehicle has been operated under wet or rainy conditions, or especially after using a high-pressure water spray, perform the general lubrication.*

**Pivots: Lubricate with Motor Oil.**

Rear Brake Rod Joint

**Points: Lubricate with Grease.**

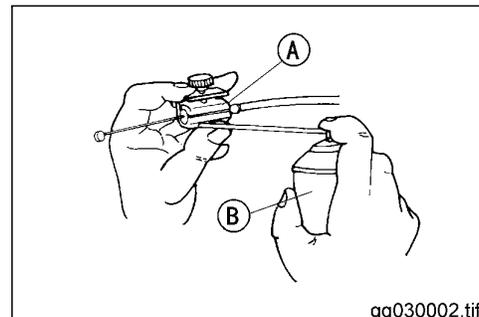
- Throttle Inner Cable Upper Ends [A]
- Clutch Lever Pivot (Apply silicone grease)
- Brake Lever Pivot (Apply silicone grease)
- Brake Pedal Pivot
- Sidestand



**Cable: Lubricate with Cable Lubricant.**

- Choke Cable
- Throttle Cables

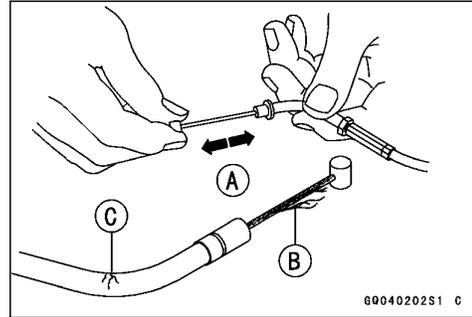
- Lubricate the cables by seeping the oil between the cable and housing.
- The cable may be lubricated by using a commercially available pressure cable lubricator [A] with an aerosol cable lubricant [B].



## 2-34 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- With the cable disconnected at 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 [B], or if the cable housing is kinked [C], replace the cable.



### Nut, Bolt, and Fastener Tightness

#### *Tightness Inspection*

- Check the tightness of the bolts and nuts listed here. Also, check to see that each cotter pin is in place and in good condition.

#### **NOTE**

○ For the engine fasteners, check the tightness of them when the engine is cold (at room temperature).

- ★ If there are loose fasteners, retighten them to the specified torque, following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not in the appropriate chapter, see the Standard Torque Table in this chapter. For each fastener, first loosen it by 1/2 turn, then tighten it.
- ★ If cotter pins are damaged, replace them with new ones.

#### **Nut, Bolt and Fastener to be checked**

##### Wheels:

- Front Axle
- Front Axle Clamp Bolts
- Rear Axle Nut
- Rear Axle Nut Cotter Pin

##### Final Drive:

- Final Gear Case Mounting Nuts

##### Brakes:

- Front Master Cylinder Clamp Bolts
- Caliper Mounting Bolts
- Rear Master Cylinder Mounting Bolts
- Rear Caliper Holder Bolt
- Brake Lever Pivot Nut
- Brake Pedal Bolt
- Brake Rod Joint Cotter Pin

##### Suspension:

- Front Fork Clamp Bolts
- Front Fender Mounting Bolts
- Rear Shock Absorber Mounting Nuts
- Swingarm Pivot Shaft

##### Steering:

- Stem Head Nut
- Handlebar Clamp Bolts

---

**Periodic Maintenance Procedures**

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Engine:

- Throttle Cable Adjuster Locknuts
- Engine Mounting Bolts and Nuts
- Shift Pedal Bolts
- Muffler Mounting Bolt and Nut
- Exhaust Pipe Holder Nuts
- Clutch Master Cylinder Clamp Bolts
- Clutch Lever Pivot Nut
- Radiator Mounting Bolt
- Radiator Bracket Bolts

Others:

- Sidestand Bolt and Nut
- Footboard Bracket Bolts
- Footpeg Bracket Mounting Bolts
- Downtube Bolts (Right)



# Fuel System (DFI)

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## 3-2 FUEL SYSTEM (DFI)

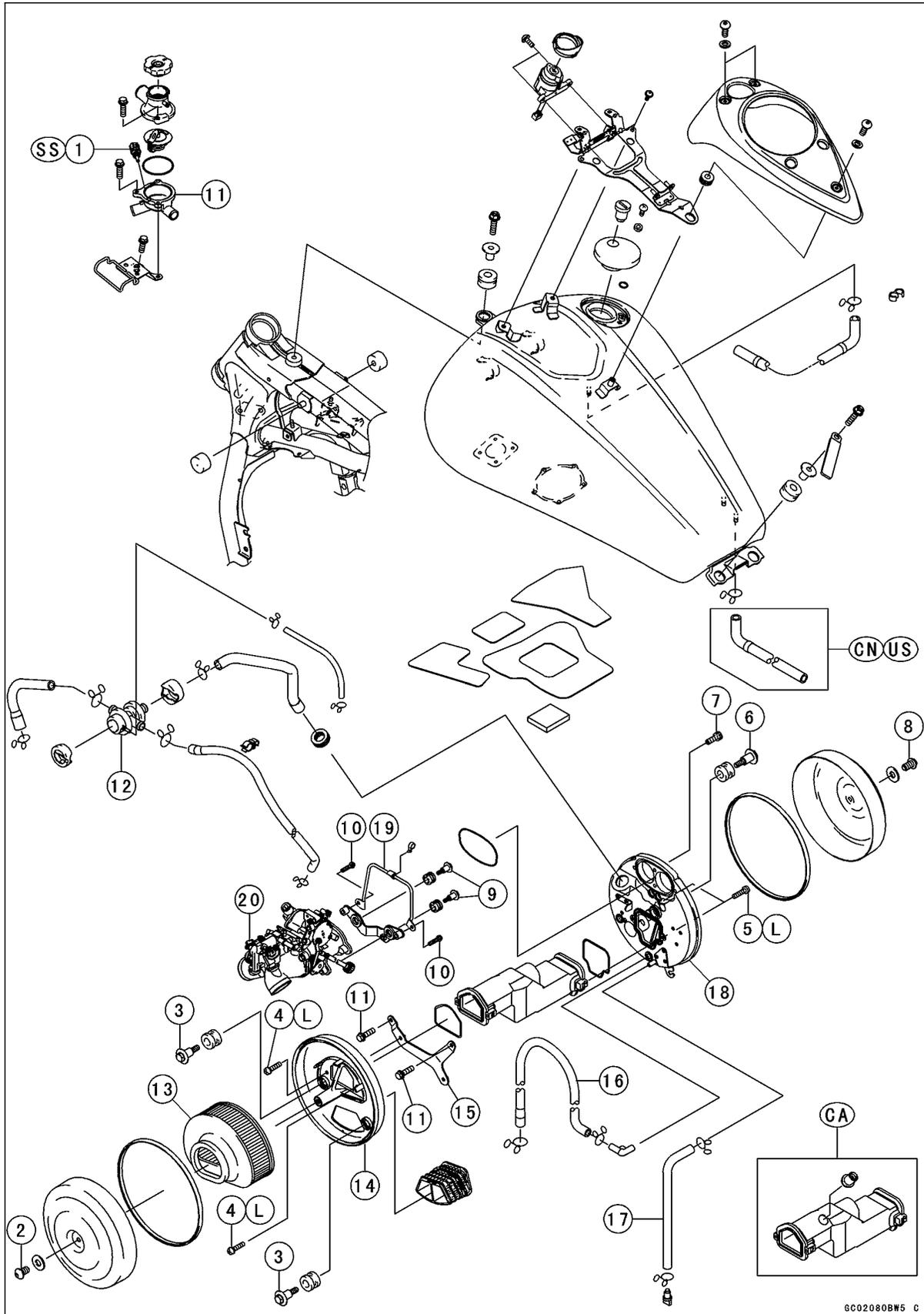
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# 3-4 FUEL SYSTEM (DFI)

## Exploded View



GC02080BW5 C

**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Water temperature sensor	18	1.8	13	SS
2	Left air cleaner cover Allen bolt $\phi 8$	16	1.6	12	
3	Left air cleaner base bolts	11	1.1	95 in·lb	
4	Left air cleaner base screws	2.2	0.22	19 in·lb	L
5	Right air cleaner base screws	2.2	0.22	19 in·lb	L
6	Right air cleaner base bolt	11	1.1	95 in·lb	
7	Right air cleaner Allen bolts	11	1.1	95 in·lb	
8	Right air cleaner cover Allen bolt $\phi 8$	16	1.6	12	
9	Throttle body assy holder bolts	11	1.1	95 in·lb	
10	Spark plug lead holder bolts	11	1.1	95 in·lb	
11	Air cleaner duct holder bolts	9.8	1.0	69 in·lb	

- 12. Vacuum switch valve
- 13. Air cleaner element
- 14. Left air cleaner base
- 15. Air cleaner duct holder
- 16. Crankcase breather hose
- 17. Air cleaner drain hose
- 18. Right air cleaner base
- 19. Right spark plug lead holder
- 20. Throttle body assy

CA: California Model

CN: Canadian Model

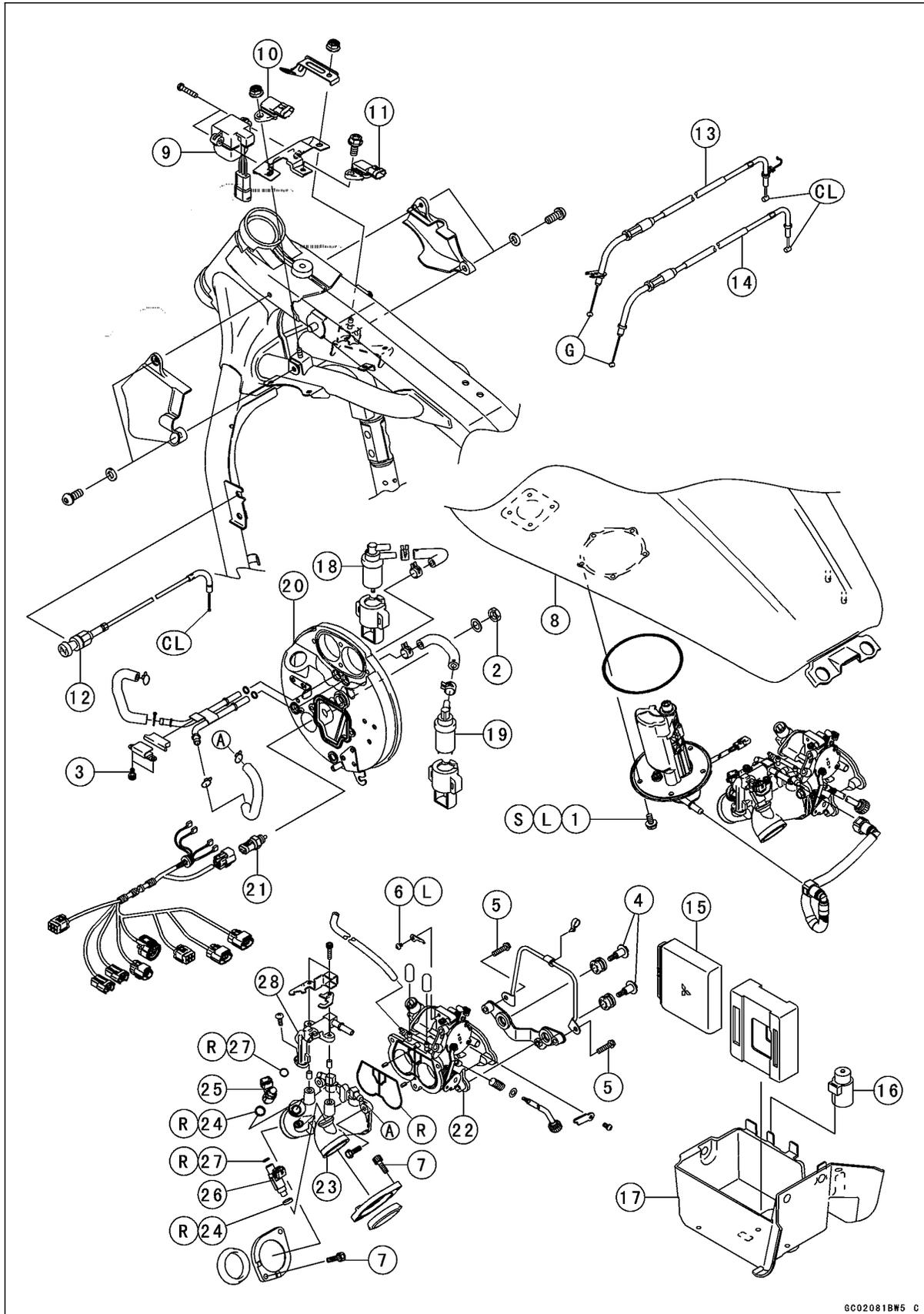
U.S.: United States Model

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

L: Apply a non-permanent locking agent.

# 3-6 FUEL SYSTEM (DFI)

## Exploded View



GC02081BW5 C

**Exploded View**

No.	Fastener	Torque			Remarks
		N-m	kgf-m	ft-lb	
1	Fuel pump bolts	9.8	1.0	87 in-lb	S, L
2	Inlet air temperature sensor nut	7.8	0.80	69 in-lb	
3	ISC pipe bolts	11	1.1	95 in-lb	
4	Throttle body assy holder bolts	11	1.1	95 in-lb	
5	Spark plug lead holder bolts	11	1.1	95 in-lb	
6	Choke cable plate screw	2.9	0.30	26 in-lb	L
7	Inlet manifold bolt	12	1.2	104 in-lb	

- 8. Fuel tank
- 9. Vehicle-down sensor
- 10. Atmospheric pressure sensor
- 11. Inlet air pressure sensor
- 12. Choke cable
- 13. Throttle cable (accelerator)
- 14. Throttle cable (decelerator)
- 15. ECU (Electronic control unit)
- 16. DFI main relay
- 17. Battery case
- 18. ISC valve #1 (for Front cylinder)
- 19. ISC valve #2 (for Rear cylinder)
- 20. Right air cleaner base
- 21. Inlet air temperature sensor
- 22. Throttle body
- 23. Inlet manifold
- 24. Seal
- 25. Injector #1 for front cylinder
- 26. Injector #2 for rear cylinder
- 27. O-ring
- 28. Delivery joint
- R: Replacement Parts
- L: Apply a non-permanent locking agent.
- G: Apply grease.
- CL: Apply cable lubricant.
- S: Follow the specified tightening sequence.



### DFI Parts Location

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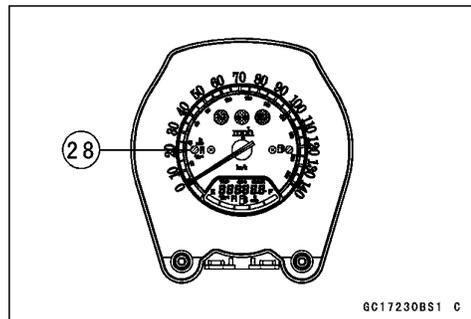
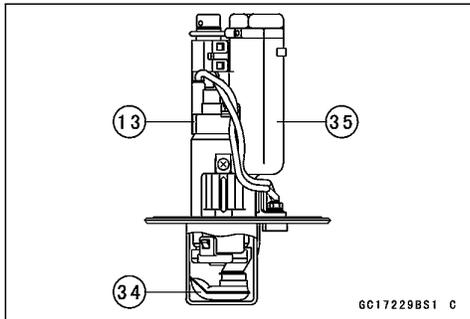
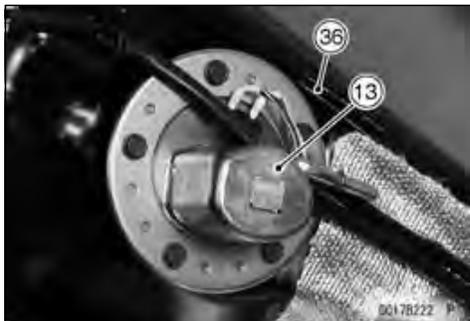
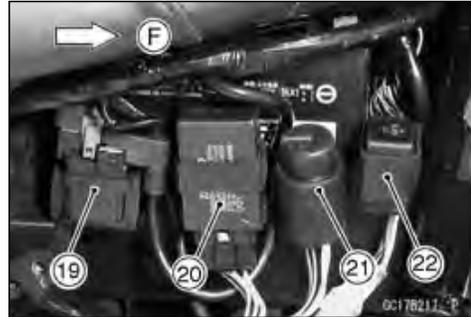
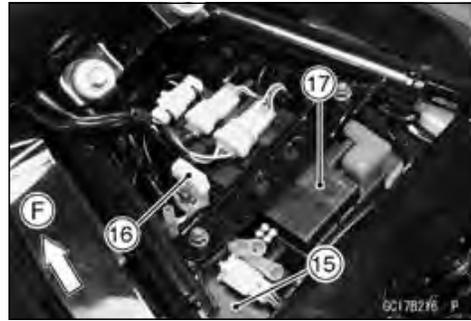
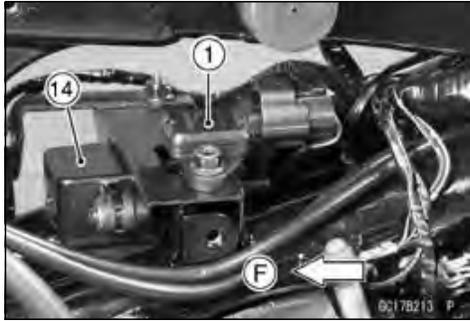
DFI: DFI Parts (this chapter)

F: Front

1. Atmospheric Pressure Sensor (DFI)
2. Water Temperature Sensor (DFI)
3. Ignition Coils
4. Ignition Switch (see next page)
5. Starter Motor
6. Water Temperature Switch
7. Regulator/Rectifier
8. Crankshaft Sensors
9. Alternator
10. Sidestand Switch
11. Neutral Switch
12. Oil Pressure Switch
13. Fuel Pump (DFI) (see next page)
14. Vehicle-down Sensor (DFI)
15. ECU (DFI)
16. DFI Fuse 15 A x 32 V
17. Sealed Battery
18. Junction Box
19. Starter Relay
20. Turn Signal Control Unit
21. DFI Main Relay
22. Oil Pressure Light Delay Unit
23. ISC Valve #1 (DFI, for Front Cylinder)
24. ISC Valve #2 (DFI, for Rear Cylinder)
25. Inlet Air Temperature Sensor (DFI)
26. Injectors (DFI)
27. Inlet Air Pressure Sensor (DFI)
28. FI Indicator LED Light (DFI) (see next page)
29. Throttle Sensor (DFI)
30. Rear Brake Light Switch
31. Radiator Fan
32. Radiator Fan Switch
33. Delivery Joint (DFI)
34. Pump Screen (see next page)
35. Fuel Filter (see next page)
36. Fuel Tank (reverse side)

# 3-10 FUEL SYSTEM (DFI)

## DFI Parts Location

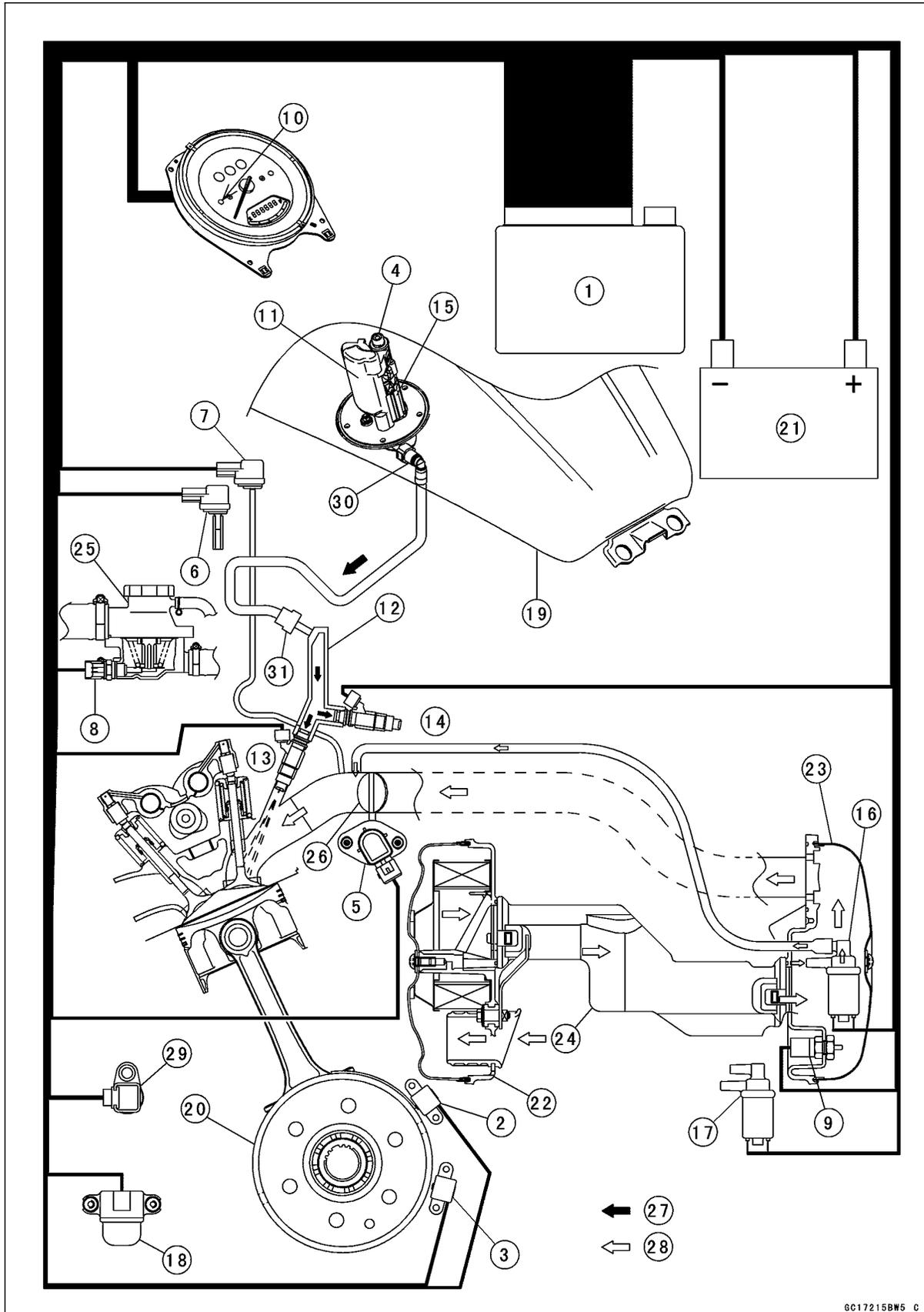


DFI Parts Location



# 3-12 FUEL SYSTEM (DFI)

## DFI System



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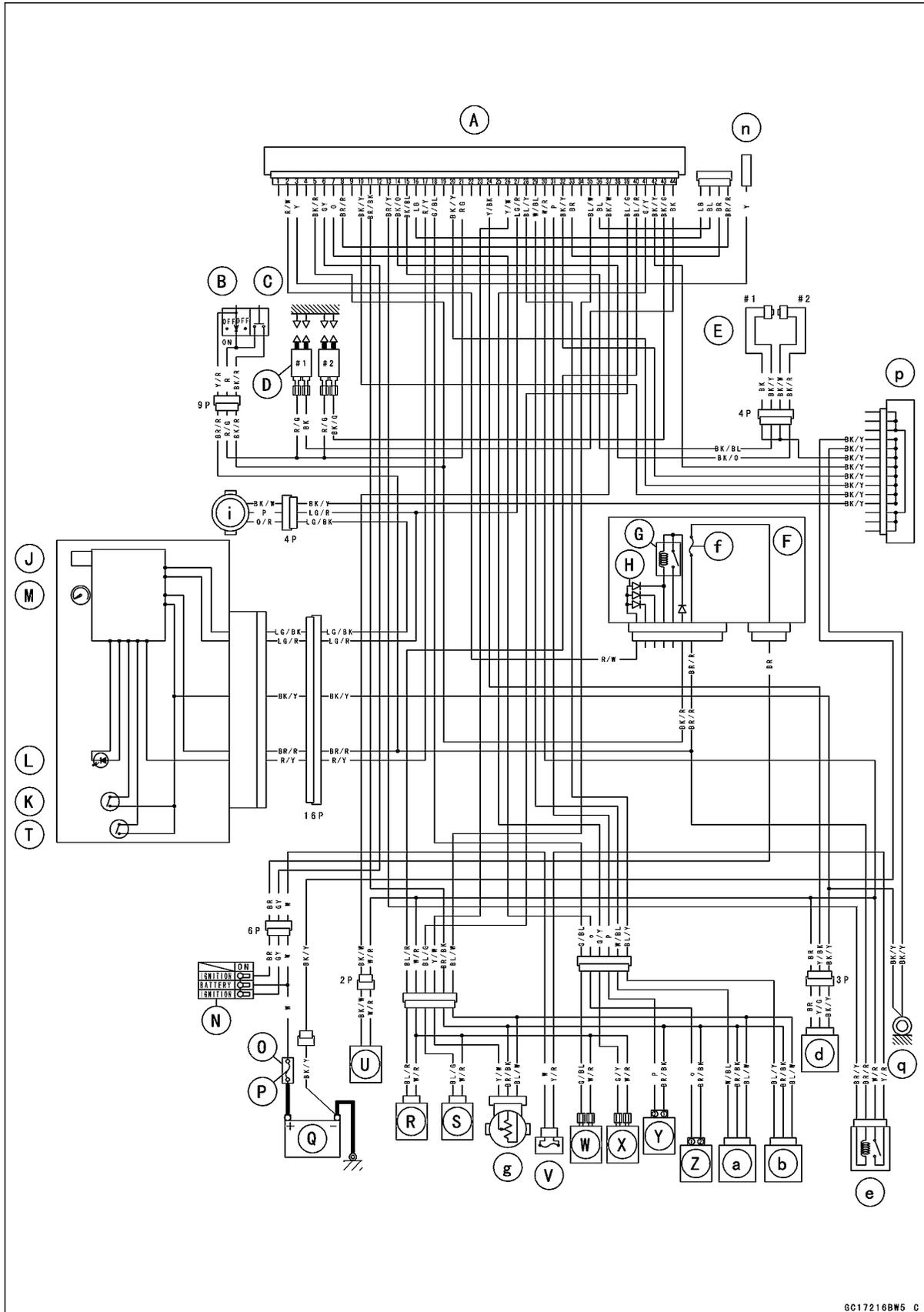
**DFI System**

---

- #1: For Front Cylinder
- #2: For Rear Cylinder
  - 1. ECU (Electronic Control Unit)
  - 2. Crankshaft Sensor #1
  - 3. Crankshaft Sensor #2
  - 4. Pressure Regulator
  - 5. Throttle Sensor (front view)
  - 6. Atmospheric Pressure Sensor
  - 7. Inlet Air Pressure Sensor
  - 8. Water Temperature Sensor
  - 9. Inlet Air Temperature Sensor
- 10. FI Indicator LED Light
- 11. Fuel Filter
- 12. Delivery Joint
- 13. Injector #1
- 14. Injector #2
- 15. Fuel Pump
- 16. ISC Valve #1 (Idle Speed Control Valve #1, rear side)
- 17. ISC Valve #2 (Idle Speed Control Valve #2, front side)
- 18. Vehicle-down Sensor (rear view)
- 19. Fuel Tank (left view)
- 20. Alternator Rotor (left view)
- 21. Sealed Battery (left view)
- 22. Left Air Cleaner Housing (rear view)
- 23. Right Air Cleaner Housing (rear view)
- 24. Lower Air Cleaner Duct (rear view)
- 25. Thermostat Housing (left view)
- 26. Throttle Valves
- 27. Fuel Flow
- 28. Air Flow
- 29. Speed Sensor (upper view)
- 30. Fuel Hose Joint #1
- 31. Fuel Hose Joint #2

# 3-14 FUEL SYSTEM (DFI)

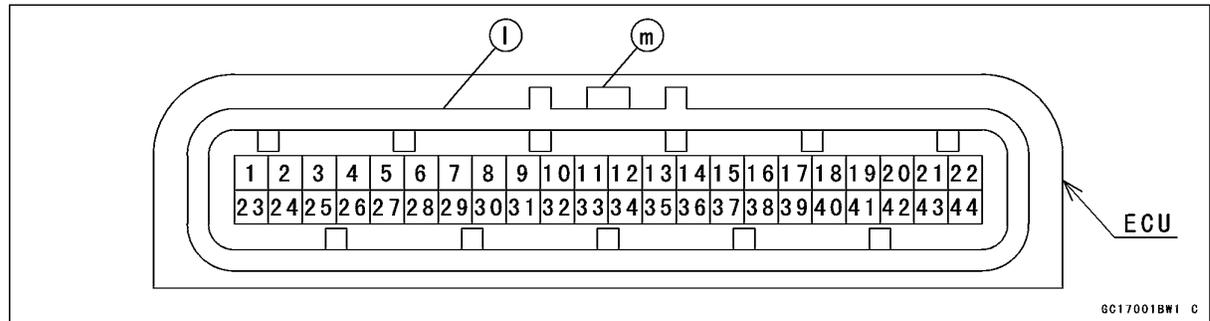
## DFI Wiring Diagram



6C17216BW 5 C

**DFI Wiring Diagram**

**Terminal Numbers of ECU Connectors**



**Terminal Names**

#1: Front Cylinder, #2: Rear Cylinder

1. Starter Lockout Switch Signal
2. Interlock Circuit Signal
3. Self-diagnosis Signal (generated by grounding this terminal and shown by FI indicator LED light)
4. Tachometer Signal
5. Electric Starter Button Signal
6. —
7. Water Temperature Sensor (+)
8. Power Source for Diagnosis Tool
9. —
10. ECU Power Source Circuit Ground to Battery (-) Terminal
11. Ground of Inlet Air Temperature, Water Temperature, Inlet Air Pressure, Atmospheric Pressure, and Throttle Sensors
12. Neutral Switch
13. DFI Main Relay Solenoid Ground in ECU
14. Crankshaft Sensor #2 Signal
15. Crankshaft Sensor #1 Signal
16. Com. Line A
17. FI Indicator LED Light Signal
18. ISC Valve #1 Signal
19. —
20. Ignition Control Circuit Ground to Battery (-) Terminal
21. Engine Stop Signal
22. 23. —
24. Vehicle-down Sensor Signal
25. —
26. Throttle Sensor Signal
27. Speed Sensor Signal
28. Atmospheric Pressure Sensor Signal
29. Inlet Air Pressure Sensor Signal
30. Power Supply to ECU, ISC Valves, Injectors, and Fuel Pump, Vehicle-down Sensor
31. Inlet Air Temperature Sensor (+)
32. ECU Power Source Circuit Ground to Battery (-) Terminal (the same as #10)
33. Power Source Ground for Diagnosis Tool
34. —
35. Power Supply to Sensors (Inlet air pressure, atmospheric pressure, and throttle sensors) from ECU
36. Com. Line B
37. Fuel Pump Signal
38. —
39. Injector #2 Signal
40. Injector #1 Signal
41. ISC Valve #2 Signal
42. Ignition Control Circuit Ground to Battery (-) Terminal
43. Ignition Coil #2 Signal

## 3-16 FUEL SYSTEM (DFI)

### DFI Wiring Diagram

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#### 44. Ignition Coil #1 Signal

#### DFI and Electrical Parts

DFI: DFI Parts  
ECU [A]: Electronic Control Unit (DFI)  
Engine Stop Switch [B]  
Starter Button [C]  
Ignition Coils [D]  
Crankshaft Sensors (Crankshaft Sensors) [E]  
Junction Box [F]  
Starter Circuit Relay [G]  
Interlock Diodes [H]  
LCD (Liquid Crystal Display) [J]  
MODE Button [K]  
FI Indicator LED Light [L]: (DFI)  
Speedometer [M]  
Ignition Switch [N]  
Starter Relay [O]  
Main Fuse 30 A × 32 V [P]  
Sealed Battery [Q]  
Fuel Injector #1 [R]: (DFI)  
Fuel Injector #2 [S]: (DFI)  
RESET Button [T]  
Fuel Pump [U]: (DFI)  
DFI Fuse 15 A × 32 V [V]: (for ECU, Injectors, Fuel Pump, DFI Main Relay, and ISC Valves)  
ISC Valve #1 [W]: (DFI)  
ISC Valve #2 [X]: (DFI)  
Inlet Air Temperature Sensor [Y]: (DFI)  
Water Temperature Sensor [Z]: (DFI)  
Inlet Air Pressure Sensor [a]: (DFI)  
Atmospheric Pressure Sensor [b]: (DFI)  
Throttle Sensor [g]: (DFI)  
Vehicle-down Sensor [d]: (DFI)  
DFI Main Relay [e]: (for ECU, Injectors, Fuel Pump, and ISC Valves)  
Ignition Fuse 10 A × 32 V [f]  
Speed Sensor [i]  
ECU Connector [l]  
Connector Lock [m]  
Self-diagnosis Check Female Connector [n]  
Joint Connector 1 [p]  
Frame Earth [q]

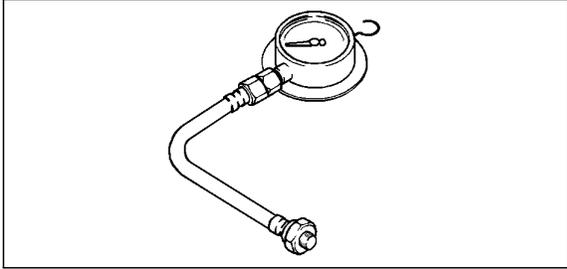
**Specifications**

Item	Standard
<b>Throttle Grip Free Play:</b>	2 ~ 3 mm (0.08 ~ 0.12 in.)
<b>Air Cleaner Element:</b>	Paper filter
<b>DFI System:</b>	
Make:	Mitsubishi Electric
Idle Speed:	950 ± 50 r/min (rpm)
Throttle Body Assy:	
Type × Bore	Two barrel type × $\phi$ 36 mm (1.42 in.)
ECU (Electronic Control Unit):	
Type	Digital memory type, with built in IC igniter, sealed with resin
Usable engine speed	100 ~ 6 200 r/min (rpm)
ISC Valves:	(Idle Speed Control Valve, or Fast Idle Solenoid Valve)
Maximum air flow rate	75 ± 7 L (19.8 ± 1.8 US gal)/min
Solenoid resistance	13.6 ~ 20.4 $\Omega$
Fuel Pressure (high pressure line):	
Right after Ignition SW ON	304 kPa (3.1 kgf/cm <sup>2</sup> , 44 psi) with fuel pump running
After pump runs 3 sec. and stops.	280 kPa (2.9 kgf/cm <sup>2</sup> , 41 psi) with fuel pump stopped
With engine idling	304 kPa (3.1 kgf/cm <sup>2</sup> , 44 psi) with fuel pump running
Throttle Sensor:	
Input voltage	4.75 ~ 5.25 V DC between BL/W and BR/BK leads
Output voltage at idle throttle opening	0.584 ~ 0.604 V DC between Y/W and BR/BK leads
Output voltage at full throttle opening	4.29 ~ 4.59 V DC between Y/W and BR/BK leads
Resistance	4 ~ 6 k $\Omega$ between BL/W and BR/BK leads
Atmospheric Pressure Sensor	
or Inlet Air Pressure Sensor:	
Input voltage	4.75 ~ 5.25 V DC
Output voltage	3.74 ~ 4.26 V DC at standard atmospheric pressure
Inlet Air Temperature Sensor:	
Resistance	5.4 ~ 6.6 k $\Omega$ at 0° C (32° F)
Resistance	2.26 ~ 2.86 k $\Omega$ at 20° C (68° F)
Resistance	0.29 ~ 0.39 k $\Omega$ at 80° C (176° F)
Water Temperature Sensor:	
Resistance	2.162 ~ 3.112 k $\Omega$ at 20° C (68° F)
Resistance	0.785 ~ 1.049 k $\Omega$ at 50° C (122° F)
Resistance	0.207 ~ 0.253 k $\Omega$ at 100° C (212° F)
Vehicle-down Sensor:	
Detection angle	More than 45° ± 5° for each bank
Detection time	Within 0.5 ~ 1.0 sec.
Fuel Injectors:	
Type	INP- 281
Static injection quantity	273.0 ~ 289.8 mL (9.23 ~ 9.80 US oz)/min
Nozzle type × diameter	One spray type with 4 holes
Resistance	11.7 ~ 12.3 $\Omega$ at 20° C (68° F)
Fuel Pump:	
Type	Friction pump
Discharge	67 mL (2.27 US oz) or more for 3 seconds

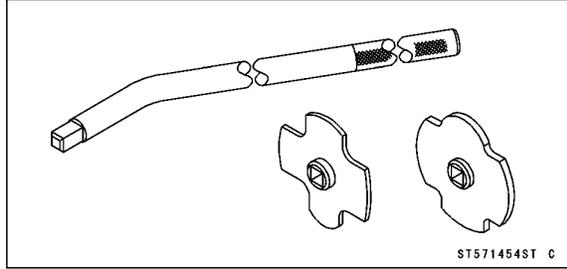
# 3-18 FUEL SYSTEM (DFI)

## Special Tools and Sealant

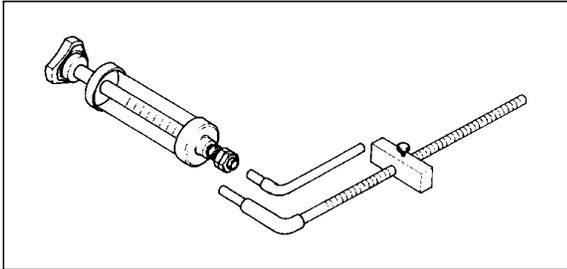
**Oil Pressure Gauge, 5 kgf/cm<sup>2</sup> :**  
57001-125



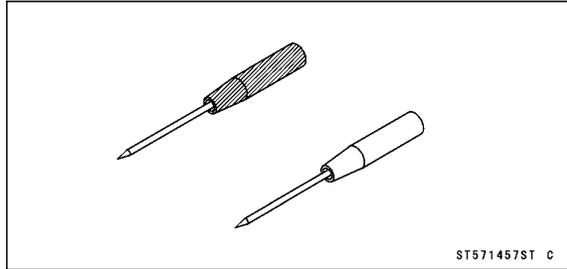
**Filler Cap Driver :**  
57001-1454



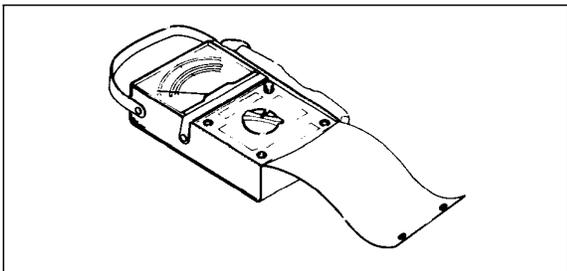
**Fork Oil Level Gauge :**  
57001-1290



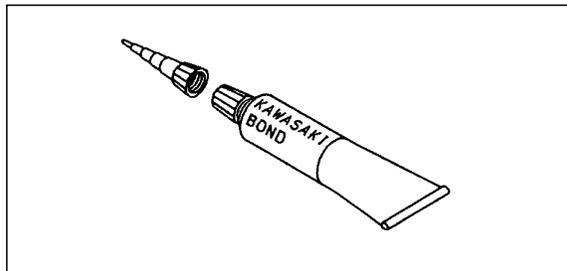
**Needle Adapter Set :**  
57001-1457



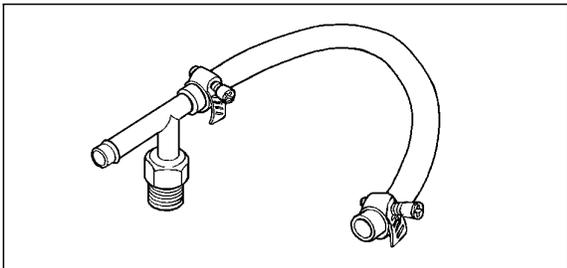
**Hand Tester :**  
57001-1394



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



**Fuel Pressure Gauge Adapter :**  
57001-1417



## DFI Servicing Precautions

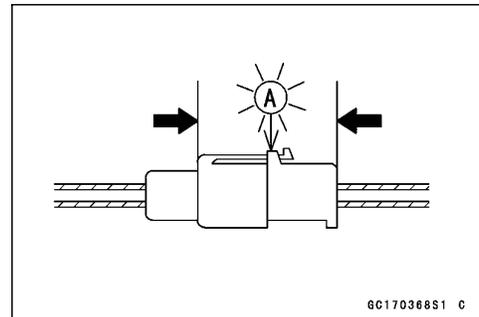
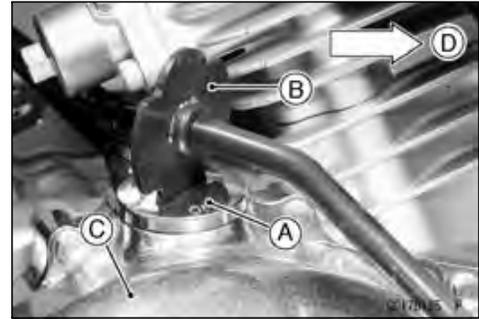
There are a number of important precautions that should be followed servicing the DFI system.

- To maintain the correct fuel-air mixture (F/A), there must be no inlet air leaks in the DFI system. Be sure to install the oil filler cap [A] after filling the engine oil, using the driver-filler cap [B].  
Clutch Cover [C]  
Front [D]

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

**Torque - Oil Filler Cap: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

- This DFI system is designed to be used with a 12 V sealed battery as its power source. Do not use any other battery except for a 12 V sealed battery as a power source.
- Do not reverse the battery lead connections. This will damage the ECU.
- Do not disconnect the battery leads or any other electrical connections when the ignition SW (switch) is on, or while the engine is running. Otherwise, surge damages the connector terminals or the DFI parts.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to the chassis ground.
- When charging, remove the battery from the motorcycle. This is to prevent ECU damage by excessive voltage.
- Whenever the DFI electrical connections are to be disconnected, first turn off the ignition SW (switch), and disconnect the battery (-) terminal. Do not pull the lead, only the connector. Conversely, make sure that all the DFI electrical connections are firmly reconnected before starting the engine.
- Connect these connectors until they click [A].
- Do not turn the ignition SW ON while any of the DFI electrical connectors are disconnected. The ECU memorizes fault codes.
- Do not spray water on the electrical parts, DFI parts, connectors, leads, and wiring. Never water a vehicle with connectors unplugged because seals don't work and terminals could corrode.
- To prevent corrosion and deposits in the fuel system, do not add any fuel antifreeze chemicals to fuel.
- When any fuel hose is disconnected, do not turn on the ignition SW. Otherwise, the fuel pump will operate and fuel will spout from the fuel hose.
- Do not operate the fuel pump if the pump is completely dry. This is to prevent pump seizure.
- Before removing the fuel system parts, blow the outer surfaces of these parts clean with compressed air.
- When any fuel hose is disconnected, fuel may spout out by residual pressure in the fuel line. Cover the hose joint with a piece of clean cloth to prevent fuel spillage.



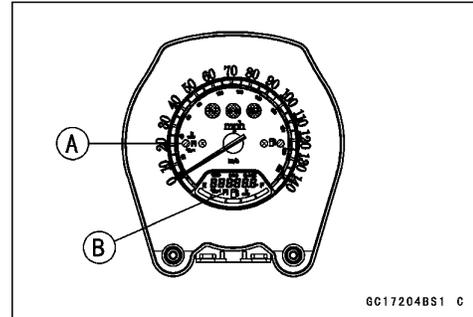
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## 3-20 FUEL SYSTEM (DFI)

### Troubleshooting the DFI System

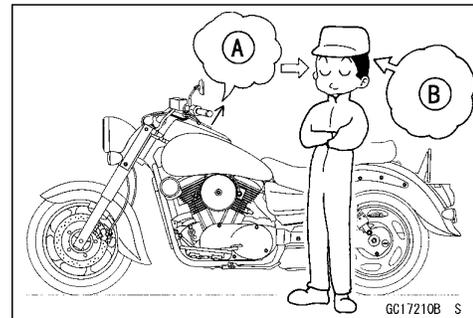
#### Outline

When an abnormality in the system occurs, the FI indicator LED light [A] and FI symbol [B] go on to alert the rider on the meter panel. In addition, the condition of the problem is stored in the memory of the ECU (electronic control unit).



With the engine stopped and turned in the self-diagnosis mode, the service code [A] is indicated by the number of times the FI indicator LED light blinks.

When due to a malfunction, the FI indicator LED light and FI symbol remains lit, ask the rider about the conditions [B] under which the problem occurred and try to determine the cause. Don't rely solely on the DFI self-diagnosis function, use common sense.



First conduct a self-diagnosis inspection, and then a non-self-diagnosis. The non-self-diagnosis items are not indicated by the FI indicator LED light.

Even when the DFI system is operating normally, the FI indicator LED light and FI symbol may light up under strong electrical interference. No repair needed. Turn the ignition SW (switch) OFF to stop the indicator light and FI symbol.

When the FI indicator LED light and FI symbol go on and the motorcycle is brought in for repair, check the service codes.

When the repair has been done, the LED light and FI symbol do not go on.

○ There are two ways to inspect the DFI system. One is Voltage Check Method and the other is Resistance Check Method.

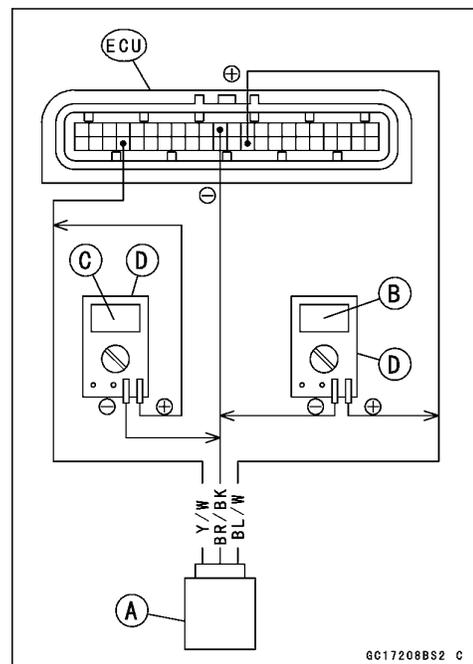
#### Voltage Check Method

○ This method is conducted by measuring the input voltage [B] to a sensor [A] first, and then the output voltage [C] from the sensor.

○ Sometime this method can detect a fault of the ECU.

○ Refer to each Sensor Inspection section for detail in this chapter.

● Use a fully charged battery, and a digital meter [D] which can be read two decimal places voltage or resistance.



## Troubleshooting the DFI System

- The DFI part connectors [A] have seals [B], including the ECU (except for ISC valves).
- Join the connector [A] and insert the needle adapter (special tool) [C] inside the seal [B] from behind the connector until the adapter reaches the terminal.

**Special Tool - Needle Adapter Set: 57001-1457**

### CAUTION

**Insert the needle adapter straight along the terminal in the connector to prevent short-circuit between terminals.**

- Make sure that measuring points are correct in the connector, noting the position of the lock [D] and the lead color before measurement. Do not reverse connections of the hand tester or a digital meter.
- Be careful not to short-circuit the leads of the DFI or electrical system parts by contact between adapters.
- Turn the ignition SW ON and measure the voltage with the connector joined.

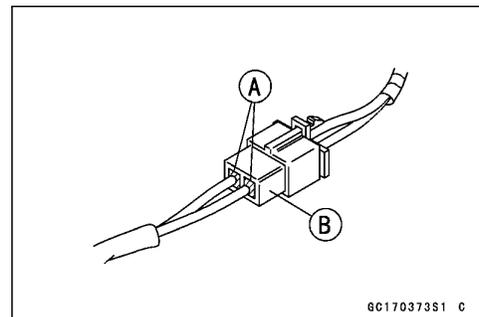
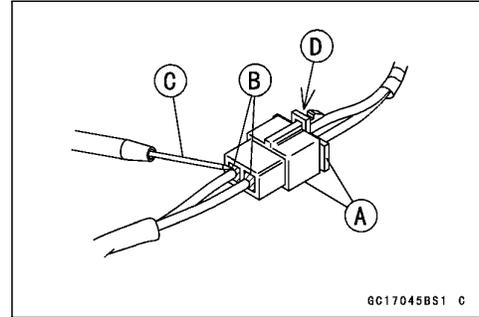
### CAUTION

**Incorrect, reverse connection or short circuit by needle adapters could damage the DFI or electrical system parts.**

- After measurement, remove the needle adapters and apply silicone sealant to the seals [A] of the connector [B] for waterproofing.

**Silicone Sealant- (Kawasaki Bond: 56019-120)-Seals of Connector**

- Always check battery condition before replacing the DFI parts. A fully charged battery is a must for conducting accurate tests of the DFI system.



## 3-22 FUEL SYSTEM (DFI)

### Troubleshooting the DFI System

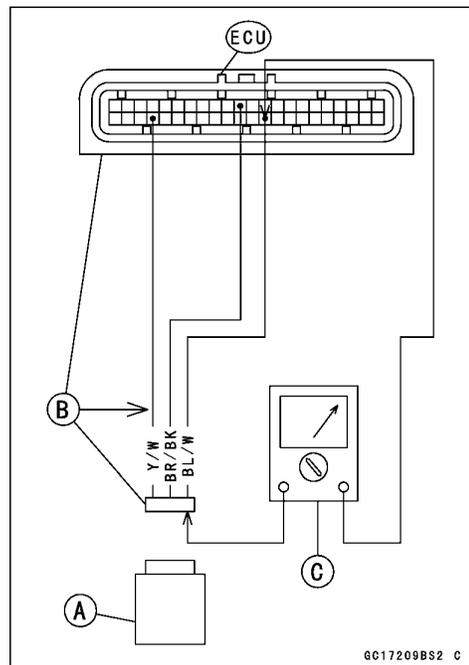
#### Resistance Check Method

○ This method is simple. No need for a fully charged battery and the needle adapter. Just do the following especially when a sensor [A] is suspect.

- Turn the ignition SW OFF and disconnect the connectors.
- Inspect the sensor resistance, using a digital meter (see each Sensor Inspection in this chapter).
- Inspect the wiring and connections [B] for continuity, using the hand tester [C] (special tool, analog tester) rather than a digital meter.

#### Special Tool - Hand Tester: 57001-1394

★ If the sensor, the wiring and connections are good, inspect the ECU for its ground and power supply (see this chapter). If the ground and power supply are good, the ECU is suspect. Replace the ECU.



- Trouble may involve one or in some cases all items. Never replace a defective part without determining what CAUSED the problem. If the problem was caused by some other item or items, they too must be repaired or replaced, or the new replacement part will soon fail again.
- Measure coil winding resistance when the DFI part is cold (at room temperature)
- Make sure all connectors in the circuit are clean and tight, and examine wires for signs of burning, fraying, short, etc. Deteriorated wires and bad connections can cause reappearance of problems and unstable operation of the DFI system.

★ If any wiring is deteriorated, replace the wiring.

- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.

★ If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it. Connect the connectors securely.

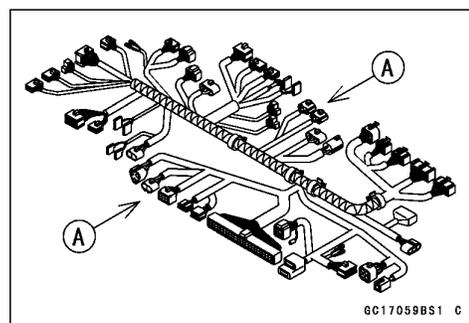
- Check the wiring for continuity.

○ 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.

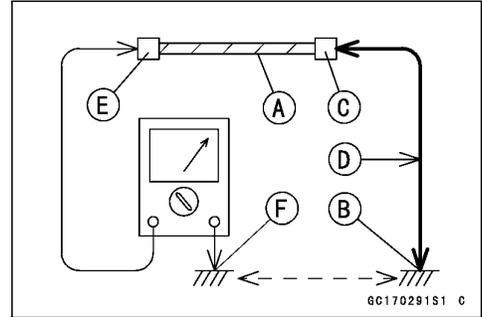
○ Set the tester to the  $\times 1 \Omega$  range, and read the tester.

★ If the tester does not read  $0 \Omega$ , the lead is defective. Replace the lead.

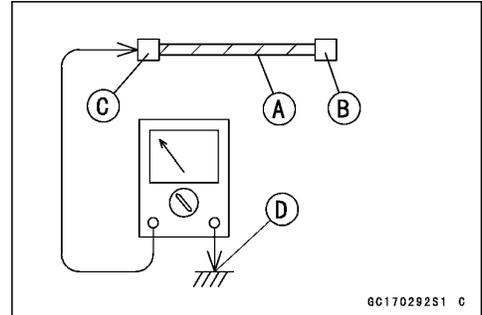


## Troubleshooting the DFI System

○ If both ends of a harness [A] are far apart, ground [B] the one end [C], using an auxiliary wire [D] and check the continuity between the end [E] and the ground [F]. This enables to check a long harness for continuity. If the harness is open, repair or replace the harness.



○ When checking a harness [A] for short circuit, open one end [B] and check the continuity between the other end [C] and ground [D]. If there is continuity, the harness has a short circuit to ground, and it must be repaired or replaced.



- Narrow down suspicious locations by repeating the continuity tests from the ECU connectors.
  - ★ If no abnormality is found in the wiring or connectors, the DFI parts are the next likely suspects. Check the part, starting with input and output voltages. However, there is no way to check the ECU itself.
  - ★ If an abnormality is found, replace the affected DFI part.
  - ★ If no abnormality is found in the wiring, connectors, and DFI parts, replace the ECU.
- The following diagnosis flow chart illustrates the above procedures.

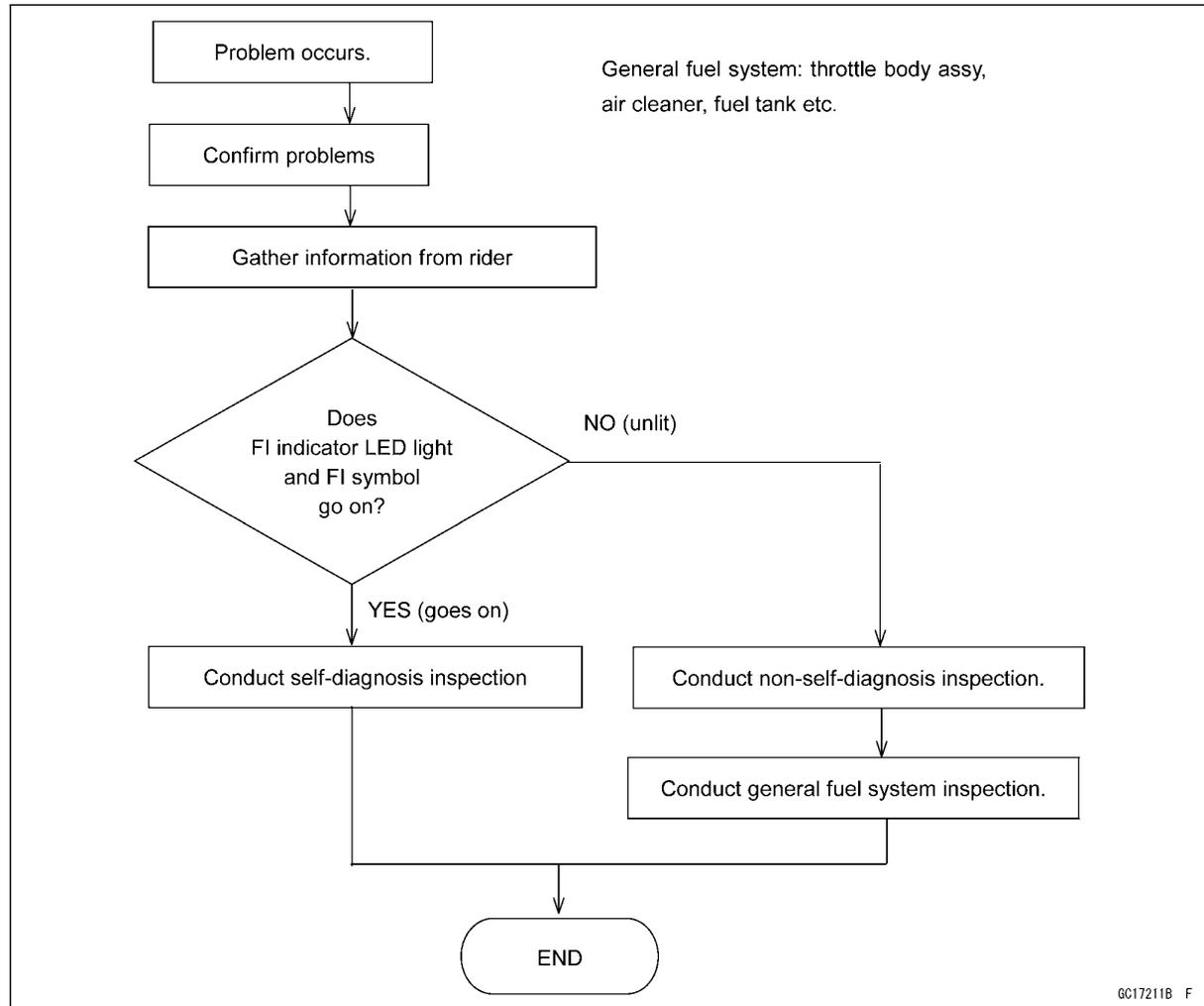
○ Wire Color Codes:

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

## 3-24 FUEL SYSTEM (DFI)

### Troubleshooting the DFI System

#### DFI Diagnosis Flow Chart



#### Inquiries to Rider

- Refer to the next sample diagnosis chart.
- Each rider reacts to problems in different ways, so it is important to confirm what kind of symptoms the rider has encountered.
- Try to find out exactly what problem occurred under exactly what conditions by asking the rider; knowing this information may help you reproduce the problem.
- The diagnosis sheet will help prevent you from overlooking any areas, and will help you decide if it is a DFI system problem, or a general engine problem.

**Troubleshooting the DFI System**

**Sample Diagnosis Sheet**

<b>Rider name:</b>	<b>Registration No. (license plate No.):</b>	<b>Year of initial registration:</b>
<b>Model:</b>	<b>Engine No.:</b>	<b>Frame No.:</b>
<b>Date problem occurred:</b>		<b>Mileage:</b>
<b>Environment when problem occurred.</b>		
Weather	<input type="checkbox"/> fine, <input type="checkbox"/> cloudy, <input type="checkbox"/> rain, <input type="checkbox"/> snow, <input type="checkbox"/> always, <input type="checkbox"/> other:	
Temperature	<input type="checkbox"/> hot, <input type="checkbox"/> warm, <input type="checkbox"/> cold, <input type="checkbox"/> very cold, <input type="checkbox"/> always	
Problem frequency	<input type="checkbox"/> chronic, <input type="checkbox"/> often, <input type="checkbox"/> once	
Road	<input type="checkbox"/> street, <input type="checkbox"/> highway, <input type="checkbox"/> mountain road ( <input type="checkbox"/> uphill, <input type="checkbox"/> downhill), <input type="checkbox"/> bumpy, <input type="checkbox"/> pebble	
Altitude	<input type="checkbox"/> normal, <input type="checkbox"/> high (about 1 000 m (3 281 ft) or more)	
<b>Motorcycle conditions when problem occurred.</b>		
FI indicator LED light	<input type="checkbox"/> light up immediately after ignition SW ON, and goes off after engine oil pressure is high enough (with engine running) (normal).	
	<input type="checkbox"/> lights up immediately after ignition SW ON, and stays on after engine oil pressure is high enough (with engine running) (DFI problem)	
	<input type="checkbox"/> lights up immediately after ignition SW ON, but goes off after about 10 seconds though engine oil pressure is high enough (with engine running) (DFI problem).	
	<input type="checkbox"/> unlights (LED light, ECU or its wiring fault).	
	<input type="checkbox"/> sometimes lights up (probably wiring fault).	
Starting difficulty	<input type="checkbox"/> starter motor not rotating.	
	<input type="checkbox"/> starter motor rotating but engine doesn't turn over.	
	<input type="checkbox"/> starter motor and engine don't turn over.	
	<input type="checkbox"/> no fuel flow ( <input type="checkbox"/> no fuel in tank, <input type="checkbox"/> no fuel pump sound).	
	<input type="checkbox"/> engine flooded (do not crank engine with throttle opened, which promotes engine flooding).	
	<input type="checkbox"/> no spark.	
	<input type="checkbox"/> choke knob is not pulled fully when using the knob (pull it fully when using).	
<input type="checkbox"/> other:		
Engine stops	<input type="checkbox"/> right after starting.	
	<input type="checkbox"/> when opening throttle grip.	
	<input type="checkbox"/> when closing throttle grip.	
	<input type="checkbox"/> when moving off.	
	<input type="checkbox"/> when stopping the motorcycle.	
	<input type="checkbox"/> when cruising.	
<input type="checkbox"/> other:		
Poor running at low speed	<input type="checkbox"/> choke knob left pulled out fully (push it in fully).	
	<input type="checkbox"/> very low fast idle speed.	
	<input type="checkbox"/> very low idle speed, <input type="checkbox"/> very high idle speed, <input type="checkbox"/> rough idle speed.	
	<input type="checkbox"/> battery voltage is low (charge the battery).	
	<input type="checkbox"/> spark plug loose (tighten it).	
	<input type="checkbox"/> spark plug dirty, broken, or gap maladjusted (adjust it).	
	<input type="checkbox"/> backfiring.	
	<input type="checkbox"/> afterfiring.	
	<input type="checkbox"/> hesitation when acceleration.	
<input type="checkbox"/> engine oil viscosity too high.		

### 3-26 FUEL SYSTEM (DFI)

#### Troubleshooting the DFI System

	<input type="checkbox"/> brake dragging.
	<input type="checkbox"/> engine overheating.
	<input type="checkbox"/> clutch slipping.
	<input type="checkbox"/> other:
Poor running or no power at high speed	<input type="checkbox"/> choke knob left pulled out fully (push it in fully).
	<input type="checkbox"/> spark plug loose (tighten it).
	<input type="checkbox"/> spark plug dirty, broken, or gap maladjusted (remedy it).
	<input type="checkbox"/> spark plug incorrect (replace it).
	<input type="checkbox"/> knocking (fuel poor quality or incorrect, → use high-octane gasoline).
	<input type="checkbox"/> brake dragging.
	<input type="checkbox"/> clutch slipping.
	<input type="checkbox"/> engine overheating.
	<input type="checkbox"/> engine oil level too high.
	<input type="checkbox"/> engine oil viscosity too high.
	<input type="checkbox"/> other:

**DFI System Troubleshooting Guide**

**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.*
- *The ECU may be involved in the DFI electrical and ignition system troubles. If these parts and circuits checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked good, replace the ECU.*

**Engine Doesn't Start, Starting Difficulty**

Symptoms or Possible Causes	Actions (chapter)
<b>Starter motor not rotating:</b>	
Ignition and engine stop switches not ON	Turn both switches ON.
Starter lockout switch or neutral switch trouble	Inspect (see chapter 16).
Starter motor trouble	Inspect (see chapter 16).
Battery voltage low	Inspect and charge (see chapter 16).
Starter relays not contacting or operating	Inspect the starter relay (see chapter 16).
Starter button not contacting	Inspect and replace (see chapter 16).
Starter system wiring open or shorted	Inspect the wiring (see chapter 16).
Ignition switch trouble	Inspect and replace (see chapter 16).
Engine stop switch trouble	Inspect and repair or replace (see chapter 16).
Main 30A or ignition fuse blown	Inspect and replace (see chapter 16).
<b>Starter motor rotating but engine doesn't turn over:</b>	
Starter clutch trouble	Inspect (see chapter 9).
Starter idle gear trouble	Inspect (see chapter 9).
<b>Engine won't turn over:</b>	
Valve seizure	Inspect and replace (see chapter 5).
Rocker arm seizure	Inspect and replace (see chapter 5).
Cylinder, piston seizure	Inspect and replace (see chapter 5).
Camshaft seizure	Inspect and replace (see chapter 5).
Connecting rod small end seizure	Inspect and replace (see chapter 9).
Connecting rod big end seizure	Inspect and replace (see chapter 9).
Crankshaft seizure	Inspect and replace (see chapter 9).
Transmission gear or bearing seizure	Inspect and replace (see chapter 9).
Balancer bearing seizure	Inspect and replace (see chapter 9).
<b>No fuel flow:</b>	
No or little fuel in tank	Supply fuel (see Owner's Manual).
Fuel pump not rotating	Inspect (see chapter 3).
Fuel injector trouble	Inspect and replace (see chapter 3).
Fuel tank air vent obstructed	Inspect and repair (see chapter 3).
Fuel filter or pump screen clogged	Inspect and replace fuel pump (see chapter 3)
Fuel pressure regulator clogged	Inspect and replace fuel pump (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
<b>Engine flooded:</b>	
Spark plug dirty, broken or gap maladjusted	Clean spark plugs and adjust plug gap (see chapter 2).
Starting technique faulty	When flooded, don't crank engine with throttle fully opened.

### 3-28 FUEL SYSTEM (DFI)

#### DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
<b>No spark or spark weak:</b>	
Ignition and engine stop switches not ON	Turn both switches ON.
Clutch lever not pulled in and gear not in neutral whether sidestand up or not	Pull the lever in and shift the gear in neutral.
Though clutch lever pulled in but sidestand up and gear not in neutral	Sidestand down and clutch lever pulled in whether gear in neutral, or not.
Vehicle-down sensor coming off	Reinstall (see chapter 3).
Vehicle-down sensor trouble	Inspect (see chapter 3).
ECU ground or power supply trouble	Inspect (see chapter 3).
Battery voltage low	Inspect and charge (see chapter 16).
Spark plug dirty, broken or gap maladjusted	Clean spark plug and adjust plug gap (see chapter 2).
Spark plug cap or high tension wiring trouble	Inspect the ignition coil (see chapter 16).
Spark plug cap shorted or not in good contact	Reinstall or inspect the cap (see chapter 16).
Spark plug incorrect	Replace it with the correct plug (see chapter 16).
IC igniter in ECU trouble	Inspect (see chapter 16).
Neutral, starter lockout or sidestand switch trouble	Inspect each switch (see chapter 16).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
Ignition switch shorted	Inspect and replace (see chapter 16).
Engine stop switch shorted	Inspect and repair or replace (see chapter 16).
Starter system wiring shorted or open	Inspect and repair or replace (see chapter 16).
Main 30A or ignition fuse blown	Inspect and replace (see chapter 16).
<b>Fuel/air mixture incorrect:</b>	
Air cleaner clogged, poorly sealed or missing	Clean or reinstall (see chapter 3).
Leak from oil filler cap, crankcase breather hose or air cleaner drain hose	Inspect and repair or replace (see chapter 3).
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Fuel pressure regulator trouble	Inspect fuel pressure and replace fuel pump (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
Fuel pressure may be low	Inspect (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
ISC valve trouble	Inspect (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 3).
<b>Compression low:</b>	
Spark plug loose	Reinstall (see chapter 16).
Cylinder head not sufficiently tightened down	Tighten (see chapter 5).

**DFI System Troubleshooting Guide**

Symptoms or Possible Causes	Actions (chapter)
Cylinder, piston worn	Inspect and replace (see chapter 5).
Piston ring bad (worn, weak, broken or sticking)	Inspect and replace (see chapter 5).
Piston ring/groove clearance excessive	Inspect and replace (see chapter 5).
Cylinder head gasket damaged	Replace (see chapter 5).
Cylinder head warped	Inspect and replace (see chapter 5).
Valve guide worn	Inspect and replace (see chapter 5).
Valve spring broken or weak	Inspect and replace (see chapter 5).
Valve not seating properly (valve bent, worn or carbon accumulating on seating surface)	Inspect and repair or replace (see chapter 5).
KACR (compression release cam) sticks open (Engine stalls when moving off)	Inspect and repair or replace (see chapter 5).
HLA (hydraulic lash adjuster) damaged (worn, seizure or spring broken)	Inspect and replace (see chapter 5).
HLA oil passage clogged	Inspect and repair or replace (see chapter 5).

**Poor Running at Low Speed**

Symptoms or Possible Causes	Actions (chapter)
<b>Spark weak:</b>	
Battery voltage low	Inspect and charge (see chapter 16).
Spark plug dirty, broken, or gap maladjusted	Clean spark plugs and adjust plug gap (see chapter 2).
Spark plug cap or high tension wiring trouble	Inspect the ignition coil (see chapter 16).
Spark plug cap shorted or not in good contact	Reinstall or inspect the cap (see chapter 16).
Spark plug incorrect	Replace it with the correct plug (see chapter 16).
IC igniter in ECU trouble	Inspect (see chapter 16).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
<b>Fuel/air mixture incorrect :</b>	
Little fuel in tank	Supply fuel (see Owner's Manual).
Air cleaner clogged, poorly sealed, or missing	Clean element or inspect sealing (see chapter 3).
Air cleaner duct loose	Reinstall (see chapter 3).
Air cleaner O-ring damaged	Replace (see chapter 3).
Fuel tank air vent obstructed	Inspect and repair (see chapter 3).
Throttle body assy loose	Reinstall (see chapter 3).
Throttle body assy O-ring damage	Replace (see chapter 3).
Choke knob left pulled out	Push in (see chapter 3).
Fuel filter or pump screen clogged	Inspect and replace fuel pump (see chapter 3).
Fuel pressure regulator clogged	Inspect fuel pressure and replace fuel pump (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
Thermostat trouble	Inspect and replace (see chapter 4).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
<b>Unstable (rough) idling:</b>	
ISC valve trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).

### 3-30 FUEL SYSTEM (DFI)

#### DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Throttle sensor trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Battery voltage low	Inspect and charge (see chapter 16).
<b>Incorrect idle speed:</b>	
Water temperature sensor trouble	Inspect (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
ISC valve trouble	Inspect (see chapter 3).
<b>Engine stalls easily:</b>	
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Throttle sensor trouble (engine stops when opening the throttle)	Inspect (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Fuel pressure regulator trouble	Inspect and replace (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
<b>Compression Low :</b>	
Spark plug loose	Reinstall (see chapter 16).
Cylinder head not sufficiently tightened down	Tighten (see chapter 5).
Cylinder, piston worn	Inspect and replace (see chapter 5).
Piston ring bad (worn, weak, broken or sticking)	Inspect and replace (see chapter 5).
Piston ring/groove clearance excessive	Inspect and replace (see chapter 5).
Cylinder head gasket damaged	Replace (see chapter 5).
Cylinder head warped	Inspect and replace (see chapter 5).
Valve guide worn or stem seal damaged	Inspect and replace (see chapter 5).
Valve spring broken or weak	Inspect and replace (see chapter 5).
Valve not seating properly (valve bent, worn or carbon accumulating on seating surface)	Inspect and repair or replace (see chapter 5).
Camshaft cam worn	Inspect and replace (see chapter 5).
KACR (compression release cam) sticks open	Inspect and repair or replace (see chapter 5).
HLA (hydraulic lash adjuster) damaged	Inspect and replace (see chapter 5).
HLA oil passage clogged	Inspect and repair or replace (see chapter 5).
<b>Hesitation:</b>	
Too low fuel pressure	Inspect (see chapter 3).
Clogged fuel line	Inspect and repair (see chapter 3).
Cracked or obstructed inlet air pressure sensor hose	Inspect and repair or replace (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).

**DFI System Troubleshooting Guide**

<b>Symptoms or Possible Causes</b>	<b>Actions (chapter)</b>
Throttle sensor malfunction	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Loose injector connectors	Remedy (see chapter 3).
Crankshaft sensor trouble	Inspect and repair or replace (see chapter 16).
Ignition coil trouble	Inspect and repair or replace (see chapter 16).
Loose terminal of battery (-) lead or engine ground lead	Inspect and repair (see chapter 16).
Delay of ignition timing	Inspect pickup coil and IC igniter in ECU (see chapter 16).
<b>Poor acceleration:</b>	
Choke knob left pulled out	Push in (see chapter 3).
Too low fuel pressure	Inspect (see chapter 3).
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Clogged fuel filter	Inspect (see chapter 3) and replace fuel pump.
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3)
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
Ignition coil trouble	Inspect and replace (see chapter 16).
Engine oil level too high	Repair (see chapter 7)
Spark plug dirty, broken or gap maladjusted	Clean spark plugs and adjust plug gap (see chapter 2)
<b>Stumble:</b>	
Too low fuel pressure	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Throttle sensor malfunction	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
<b>Surge:</b>	
Unstable fuel pressure	Fuel pressure regulator trouble (Inspect and replace fuel pump) or kinked fuel line (Inspect and repair fuel line) (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
<b>Backfiring when deceleration:</b>	
Spark plug dirty, broken or gap maladjusted	Clean spark plugs and adjust plug gap (see chapter 2)
Too low fuel pressure	Inspect (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Throttle sensor malfunction	Inspect (see chapter 3).

### 3-32 FUEL SYSTEM (DFI)

#### DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Vacuum switch valve broken	Inspect and replace (see chapter 5).
Air suction valve trouble	Inspect and replace (see chapter 5).
<b>After fire:</b>	
Spark plug burned or gap maladjusted	Adjust plug gap or replace plug (see chapter 16).
Crankshaft sensor trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
<b>Run-on (dieseling):</b>	
Ignition switch trouble	Inspect and replace (see chapter 16).
Engine switch trouble	Inspect and repair or replace (see chapter 16).
Fuel injector trouble	Inspect (see chapter 3).
Engine overheating	(see Overheating of Troubleshooting Guide, see chapter 17)
<b>Other:</b>	
Engine oil viscosity too high	Change (see chapter 2).
Drive train trouble	Inspect tightness of bolts and nuts (see chapter 2) or bearing wear (see chapter 11).
Final gear case oil viscosity too high	Change (see chapter 2).
Brake dragging	Inspect caliper fluid seal damage or clogging of master cylinder relief and supply ports (see chapter 12).
Clutch slipping	Inspect friction plates for wear (see chapter 6).
Engine overheating	(see Overheating of Troubleshooting Guide in chapter 17)
Vacuum switch valve trouble	Inspect and replace (see chapter 5).
Air suction valve trouble	Inspect and replace (see chapter 5).
Intermittent any DFI fault and its recovery	Check that DFI connectors are clean and tight, and examine wires for signs of burning or fraying (see chapter 3).

**DFI System Troubleshooting Guide**

**Poor Running or No Power at High Speed:**

Symptoms or Possible Causes	Actions (detailed reference)
<b>Firing incorrect:</b>	
Spark plug dirty, broken or maladjusted	Clean spark plug and adjust plug gap (see chapter 2).
Spark plug cap or high tension wiring trouble	Inspect plug cap and ignition coil (see chapter 16).
Spark plug cap shorted or not in good contact	Reinstall or inspect the cap (see chapter 16).
Spark plug incorrect	Replace it with the correct plug (see chapter 16)
IC igniter in ECU trouble	Inspect (see chapter 16).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
<b>Fuel/mixture incorrect:</b>	
Choke knob left pulled out	Push in (see chapter 3).
Air cleaner clogged, poorly sealed, or missing	Clean element or inspect sealing (see chapter 3).
Air cleaner duct loose	Reinstall (see chapter 3).
Air cleaner O-ring damaged	Replace (see chapter 3).
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Throttle body assy loose	Reinstall (see chapter 3).
Throttle body assy O-ring damaged	Replace (see chapter 3).
Fuel tank air vent obstructed	Inspect and repair (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
Fuel pump operates intermittently and often DFI fuse blows.	Pump bearings may wear. Replace the pump (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Throttle sensor malfunction	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Cracked or obstructed inlet air pressure sensor hose	Inspect and repair or replace (see chapter 3)
Injector clogged	Visually inspect and replace (see chapter 3)
<b>Compression low:</b>	
Spark plug loose	Reinstall (see chapter 16).
Cylinder head not sufficiently tightened down	Tighten (see chapter 5).
Cylinder, piston worn	Inspect and replace (see chapter 5).
Piston ring bad (worn, weak, broken or sticking)	Inspect and replace (see chapter 5).
Piston ring/groove clearance excessive	Inspect and replace (see chapter 5).
Cylinder head gasket damaged	Replace (see chapter 5).
Cylinder head warped	Inspect and replace (see chapter 5).
Valve spring broken or weak	Inspect and replace (see chapter 5).
Valve not seating properly (valve bent , worn or carbon accumulating on the seating surface)	Inspect and repair or replace (see chapter 5).
KACR (compression release cam) sticks open (engine stalls when moving off)	Inspect and repair or replace (see chapter 5).

### 3-34 FUEL SYSTEM (DFI)

#### DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (detailed reference)
HLA ( hydraulic lash adjuster) damaged (worn, seizure or spring broken)	Inspect and replace (see chapter 5).
<b>Knocking:</b>	
Carbon built up in combustion chamber	Repair (see chapter 5).
Fuel poor quality or incorrect (Use high-octane gasoline recommended in the Owner's Manual)	Change fuel (see chapter 3).
Spark plug incorrect	Replace it with the correct plug (see chapter 16)
Ignition coil trouble	Inspect (see chapter 16).
IC igniter in ECU trouble	Inspect (see chapter 16).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Atmospheric pressure sensor trouble	Inspect (see chapter 3).
<b>Miscellaneous:</b>	
Throttle valves won't fully open	Inspect throttle cable and lever linkage (see chapter 3).
Brake dragging	Inspect caliper fluid seal damage or clogging of master cylinder relief and supply ports (see chapter 12).
Clutch slipping	Inspect friction plates for wear (see chapter 6).
Engine overheating	(see Overheating of Troubleshooting Guide in chapter 17)
Engine oil level too high	Repair (see chapter 7).
Engine oil viscosity too high	Change (see chapter 3).
Drive train trouble	Inspect tightness of bolts and nuts (see chapter 2) or bearing wear (see chapter 11).
Final gear case oil viscosity too high	Change (see chapter 2).
Camshaft cam worn	Inspect and replace (see chapter 5).
Vacuum switch valve trouble	Inspect and replace (see chapter 5).
Air suction valve trouble	Inspect and replace (see chapter 5).
Catalytic converters melt down due to muffler overheating (KLEEN)	Replace muffler (see chapter 5).
<b>Exhaust Smokes Excessively:</b>	
<b>White smokes:</b>	
Piston oil ring worn	Inspect and replace (see chapter 5).
Cylinder worn	Inspect and replace (see chapter 5).
Valve oil seal damaged	Replace (see chapter 5).
Valve guide worn	Replace the guide (see chapter 5).
Engine oil level too high	Repair (see chapter 7).
<b>Black smoke:</b>	
Air cleaner clogged	Clean (see chapter 3).
Choke knob left pulled out	Push in (see chapter 3).
Too high fuel pressure	Inspect (see chapter 3).
Injection stuck open	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect and replace (see chapter 3).
Inlet air temperature sensor trouble	Inspect and replace (see chapter 3).
<b>Brown smoke :</b>	
Air cleaner duct loose	Reinstall (see chapter 3).

**DFI System Troubleshooting Guide**

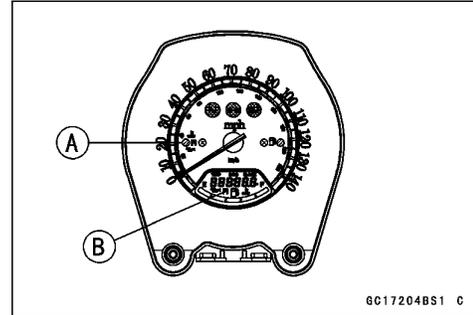
<b>Symptoms or Possible Causes</b>	<b>Actions (detailed reference)</b>
Air cleaner O-ring damaged	Replace (see chapter 3).
Too low fuel pressure	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect and replace (see chapter 3).
Inlet air temperature sensor trouble	Inspect and replace (see chapter 3).

## 3-36 FUEL SYSTEM (DFI)

### Self-Diagnosis

#### Self-diagnosis Procedures

○When a problem occurs with the DFI system, the FI indicator LED light [A] and FI symbol [B] go on.



- Remove the rear and front seats (see Frame chapter).
- Ground [A] the self-diagnosis terminal [B] (yellow lead) to the battery (-) terminal [C], using a wire [D].



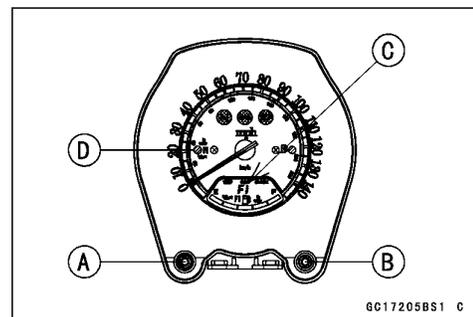
- Turn the ignition SW ON.
- Push the MODE button [A] and display the odo meter.
- Push the RESET button [B] for more than two seconds. The LCD FI characters [C] are displayed.
- Count the blinks of the LED light [D] to read the service code.

#### NOTE

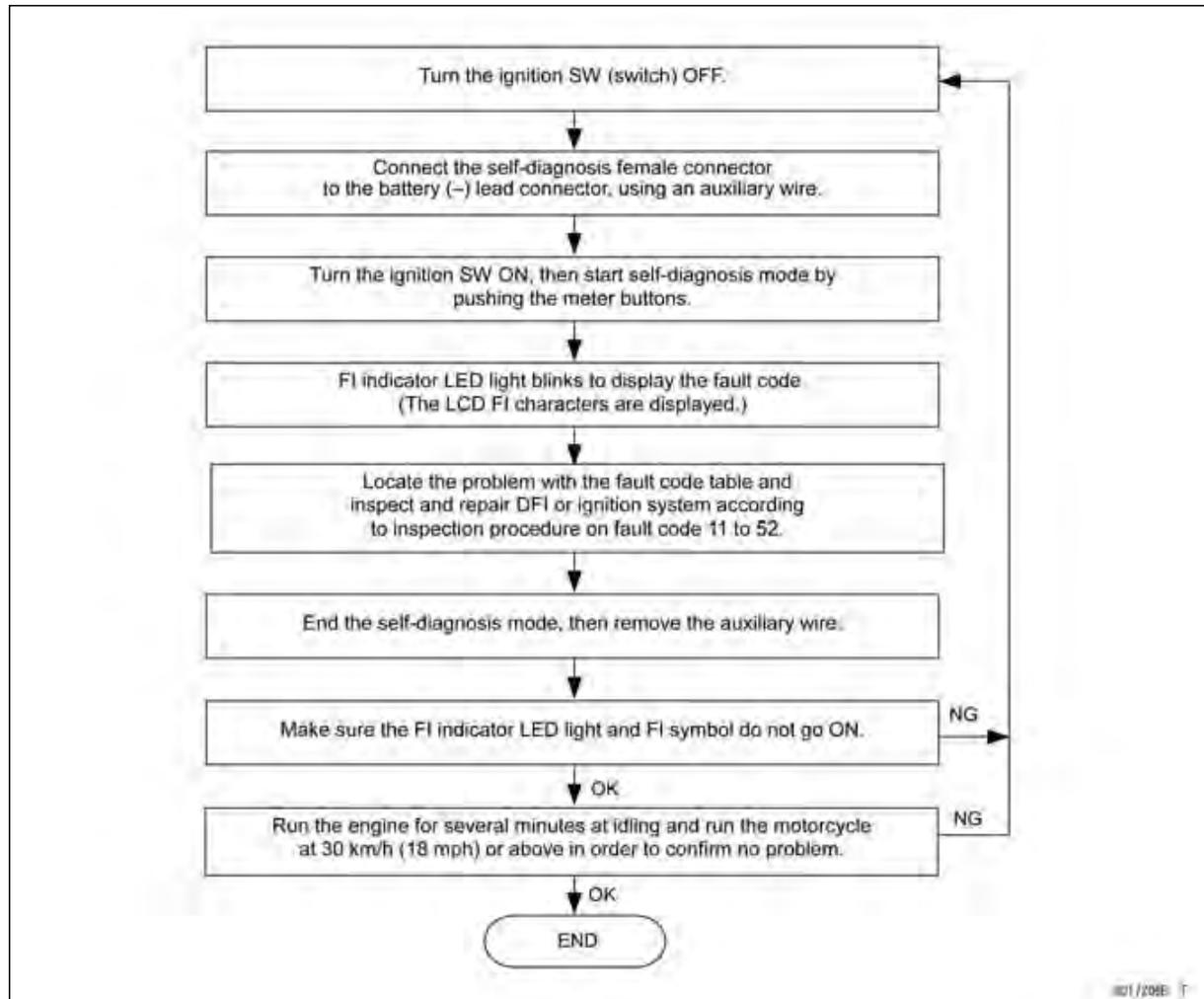
○Use a fully charged battery when conducting self-diagnosis. Otherwise, the LED light blinks very slowly or doesn't blink.

○Keep the self-diagnosis female connector grounded during self-diagnosis, using a wire.

- Any of the following procedures (conditions) ends self-diagnosis.
  - When pushing the RESET button more than 2 seconds and 2 seconds passed.
  - When the ignition SW is turned to OFF.
  - Pushing the MODE button and the trip meter is displayed.
  - When the ECU receives the speed sensor signal.



Self-Diagnosis



Service Code Reading

○Service codes are shown by a series of long and short blinks of the FI indicator LED light as shown below.

○Read 10th digit and unit digit as the FI indicator LED light blinks.

○When there are a number of problems, all the fault codes can be stored and the display will begin starting from the lowest number service code in the numerical order. Then after completing all codes, the display is repeated until the ignition SW is turned OFF.

○For example, if four problems occurred in the order of 31, 15, 41, 12, the fault codes are displayed from the lowest number in the order listed.

(12 → 15 → 31 → 41) → (12 → 15 → 31 → 41) → . . . (repeated)

○If there is no problem or when the repair has been done, no service code is shown.

If the problem is with the following parts, the ECU cannot memorize these problems, the FI indicator LED light doesn't go on, and no fault codes can be displayed.

FI Indicator LED Light

ISC Valves

DFI Main Relay

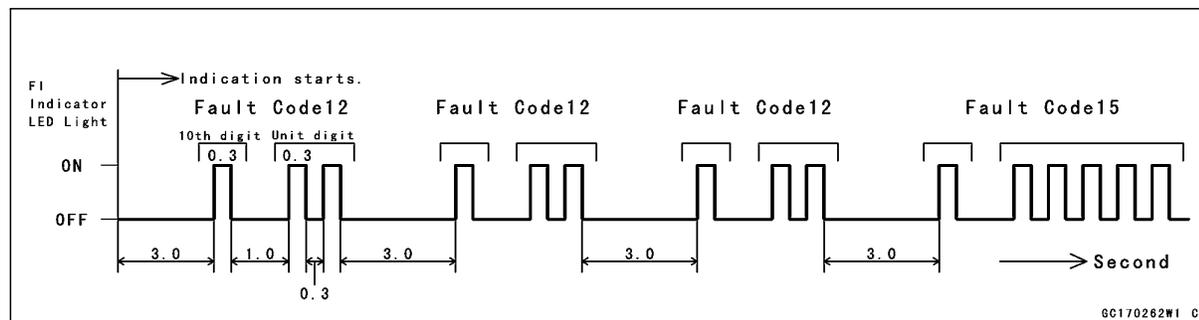
Ignition Coil Secondary Wiring (check the internal resistance, see Electrical System chapter)

ECU Power Source Wiring and Ground Wiring (see ECU Inspection in this chapter)

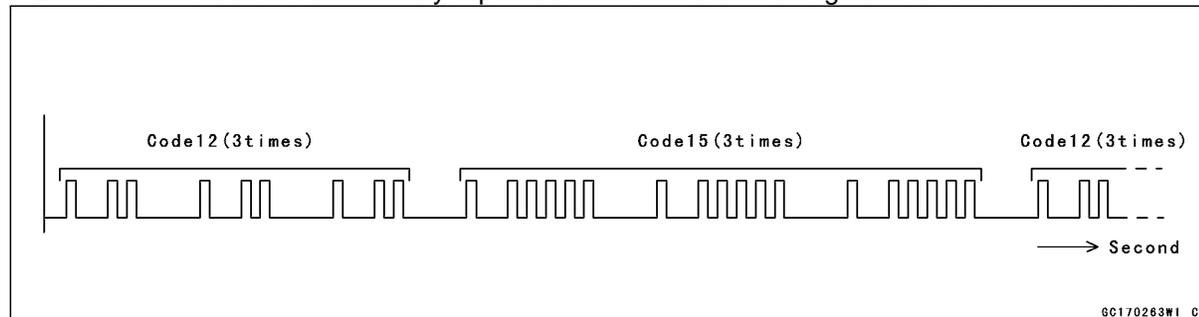
○For example, if two problems of 12 and 15 occur, the service code 12 and 15 are shown as follows.

## 3-38 FUEL SYSTEM (DFI)

### Self-Diagnosis



○ Each service code is continuously repeated three times until the ignition SW is turned OFF.

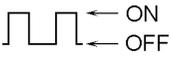
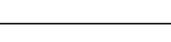


#### Service Code Erasing

○ When the repair has been done, the LED light will not show fault codes any more.

★ But even if the repair has been done, the ignition SW is turned OFF, or the battery is disconnected, all the fault codes remain in the ECU, which need not be absolutely erased.

#### Service Code Table

Service Code	FI Indicator LED Light	Problems (1)
11	 gc170322.tif	Throttle sensor malfunction, wiring open or short
12	 gc170323.tif	Vacuum sensor malfunction, wiring open or short
13	 gc170324.tif	Inlet air temperature sensor malfunction, wiring open or short
14	 gc170325.tif	Water temperature sensor malfunction, wiring open or short
15	 gc170326.tif	Atmospheric pressure sensor malfunction, wiring open or short
21	 gc170327.tif	Pickup coil #1 malfunction, wiring open or short
22	 gc170328.tif	Pickup coil #2 malfunction, wiring open or short
31	 gc170329.tif	Vehicle-down sensor malfunction wiring open or short
41	 gc170330.tif	Injector #1 malfunction, wiring open or short

Self-Diagnosis

Service Code	FI Indicator LED Light	Problems (1)
42	 <small>gc170331.tif</small>	Injector #2 malfunction, wiring open or short
45	 <small>gc170332.tif</small>	Fuel pump malfunction, wiring open or short
51	 <small>gc170333.tif</small>	Ignition coil primary winding #1 malfunction, wiring open or short
52	 <small>gc170334.tif</small>	Ignition coil primary winding #2 malfunction, wiring open or short

Footnotes:

- (1) The ECU may be involved in these problems. If all the parts and circuits checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked good, replace the ECU.
- (2) When no service code is displayed, the electrical parts of the DFI system has no fault, and the mechanical parts of the DFI system and the engine are suspect.
  - #1: For Front Cylinder
  - #2: For Rear Cylinder

Backups

○The ECU takes the following measures to prevent engine damage when the DFI electrical or the ignition system parts have troubles.

Service Codes	Parts	Output Signal Usable Range or Criteria	Backups by ECU
11	Throttle Sensor	Throttle Valve Opening Angle $\alpha = -4^\circ \sim +85^\circ$	★If the throttle sensor system fails (the signal is out of the usable range, wiring short or open), the ECU locks ignition timing into the ignition timing at full throttle open position and sets the DFI in the D-J method (1).
12	Vacuum Sensor	Absolute Vacuum $P_v = 63 \text{ mmHg} \sim 860 \text{ mmHg}$	★If the inlet air pressure sensor system fails (the signal $P_v$ is out of the usable range, wiring short or open), the ECU sets the DFI in the $\alpha - N$ method (1).
13	Inlet Air Temperature Sensor	Inlet Air Temperature $T_a = -47^\circ\text{C} \sim +178^\circ\text{C}$	★If the inlet air temperature sensor fails (the signal is out of the usable range, wiring short or open), the ECU sets $T_a$ at $45^\circ\text{C}$ .
14	Water Temperature Sensor	Water Temperature $T_w = -28^\circ\text{C} \sim +161^\circ\text{C}$	★If the water temperature sensor system fails (the signal is out of the usable range, wiring short or open), the ECU sets $T_w$ at $86^\circ\text{C}$ .
15	Atmospheric Pressure Sensor	Absolute Atmospheric Pressure $P_a = 63 \text{ mmHg} \sim 860 \text{ mmHg}$	★If the atmospheric pressure sensor system fails (the signal is out of the usable range, wiring short or open), the ECU sets $P_a$ at $760 \text{ mmHg}$ (the standard atmospheric pressure).

### 3-40 FUEL SYSTEM (DFI)

#### Self-Diagnosis

Service Codes	Parts	Output Signal Usable Range or Criteria	Backups by ECU
21	Crankshaft Sensor #1	Either crankshaft sensor must send signals (output voltage)	★If either crankshaft sensor generates 8 or more signals, the ECU runs the engine by the signal of the good crankshaft sensor, but neither crankshaft sensors generate signals, the engine stops by itself.
22	Crankshaft Sensor #2	8 or more times continuously to the ECU.	
31	Vehicle-down Sensor	Vehicle-down Sensor Output Voltage (signal) Vd = 0.2 V ~ 4.6 V	★If the vehicle-down sensor system has failures (the output voltage Vd is out of the usable range, wiring short or open), the ECU shuts off the fuel pump, the fuel injectors and the ignition system.
41	Fuel Injector #1	The injector must send signals (output voltage) 16 or more times continuously to the ECU.	★If the injector #1 fails (signals less than 16 times, wiring short or open), the ECU shuts off the signal to the injector. Fuel is not supplied to the cylinder #1, though the engine keeps running.
42	Fuel Injector #2	The injector must send signals (output voltage) 16 or more times continuously to the ECU.	★If the injector #2 fails (signals less than 16 times, wiring short or open), the ECU shuts off the signal to the injector. Fuel is not supplied to the cylinder #2, though the engine keeps running.
45	Fuel Pump	The pump must send signals (output voltage) continuously to the ECU.	★If the fuel pump fails (no signals to ECU, wiring short or open), the ECU shuts off the pump, and then the engine stops because of fuel pressure drop.
51	Ignition Coil #1	The ignition coil primary winding must send signals (output voltage) continuously to the ECU.	★If the ignition primary winding #1 has failures (no signal, wiring short or open), the ECU shuts off the injector #1 to stop fuel to the cylinder #1, though the engine keeps running.
52	Ignition Coil #2	The ignition coil primary winding must send signals (output voltage) continuously to the ECU.	★If the ignition primary winding #2 has failures (no signal, wiring short or open), the ECU shuts off the injector #2 to stop fuel to the cylinder #2, though the engine keeps running.

**Note:**

(1) When the engine load is light like at idling or low speed, the ECU determines injection quantity by calculating from throttle vacuum (inlet air pressure sensor output voltage) and engine speed (crankshaft sensor output voltage). This method is called D-J method (low-speed mode). As engine speed increases, and the engine load turns middle to heavy, the ECU determines injection quantity by calculating from throttle opening (throttle sensor output voltage) and engine speed. This method is called  $\alpha - N$  method (high-speed mode).

## Throttle Sensor (Service Code 11)

### Throttle Sensor Removal/Adjustment

#### CAUTION

**Do not remove or adjust the throttle sensor [A] since it has been adjusted and set with precision at the factory.**  
**Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.**

Front View [B]



### Input Voltage Inspection

#### NOTE

- Be sure the battery is fully charged.
- The inspection is the same as "Input Voltage Inspection" of the inlet air pressure sensor or the atmospheric pressure sensor.

- Turn the ignition SW OFF.
- Remove the ECU (see this chapter). Do not disconnect the ECU connectors.
- Connect a digital voltmeter [A] to the connector [B], using two needle adapters [C].

**Special Tool - Needle Adapter Set: 57001-1457**

- Measure the input voltage to the throttle sensor with the engine stopped, and with the connectors joined.
- Turn the ignition SW ON.

#### Throttle Sensor Input Voltage

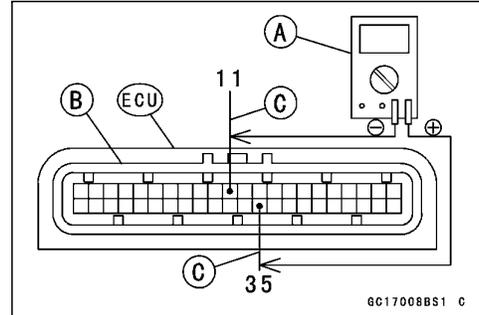
##### Connections to ECU Connector

Meter (+) → BL/W lead (terminal 35)

Meter (-) → BR/BK lead (terminal 11)

**Standard: 4.75 ~ 5.25 V DC**

- Turn the ignition SW OFF.
- ★ If the reading of input voltage is less than the standard, check the ECU for its ground, and power supply (see ECU section).
- ★ If the input voltage is within the standard range, remove the fuel tank, and check the wiring from the ECU to the throttle sensor for continuity.
- ★ If the wiring is good, check the output voltage of the throttle sensor.



## 3-42 FUEL SYSTEM (DFI)

### Throttle Sensor (Service Code 11)

#### Output Voltage Inspection

- Start the engine and warm it up thoroughly.
- Check idle speed to make sure the throttle opening is correct.

#### Idle Speed

**Standard:** 950 ± 50 r/min (rpm)

- ★ If the idle speed is out of the specified range, adjust the idle speed (see this chapter).
- Turn off the ignition switch.
- Remove the ECU (see this chapter). Do not disconnect the ECU connectors.
- Connect a digital meter [A] to the connector [B], using the needle adapters [C].

**Special Tool - Needle Adapter Set: 57001-1457**

#### CAUTION

**Insert the needle adapter straight along the lead in the connector to prevent short circuit between terminals.**

- Measure the output voltage of the sensor with the engine stopped, and with the connector joined.
- Turn the ignition SW ON.

#### Throttle Sensor Output Voltage

##### Connections to Sensor

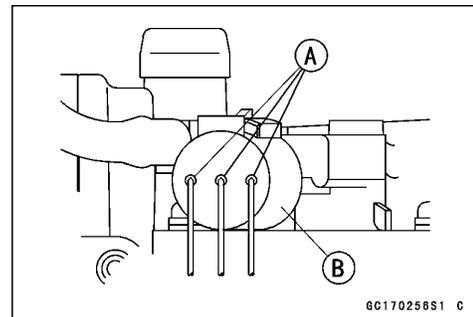
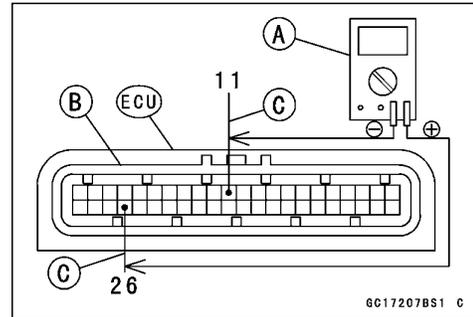
**Meter (+)** → Y/W lead (terminal 26)

**Meter (-)** → BR/BK lead (terminal 11)

**Standard:** 0.584 ~ 0.604 V DC  
(at idle throttle opening)  
4.29 ~ 4.59 V DC  
(at full throttle opening)

- ★ If the output voltage is normal, replace the ECU.
- ★ If the reading is out of the standard range, inspect the throttle sensor resistance.
- After throttle sensor inspection, remove the needle adapters, and apply silicone sealant to the seals [A] of the connector [B] for waterproofing.

**Silicone Sealant (Kawasaki Bond: 56019-120)**  
- Seals of Connectors



**Throttle Sensor (Service Code 11)**

*Resistance Inspection*

- Turn the ignition switch OFF.
- Disconnect the throttle sensor connector.
- Connect a digital meter [A] to the throttle sensor connector [B].
- Measure the throttle sensor resistance.

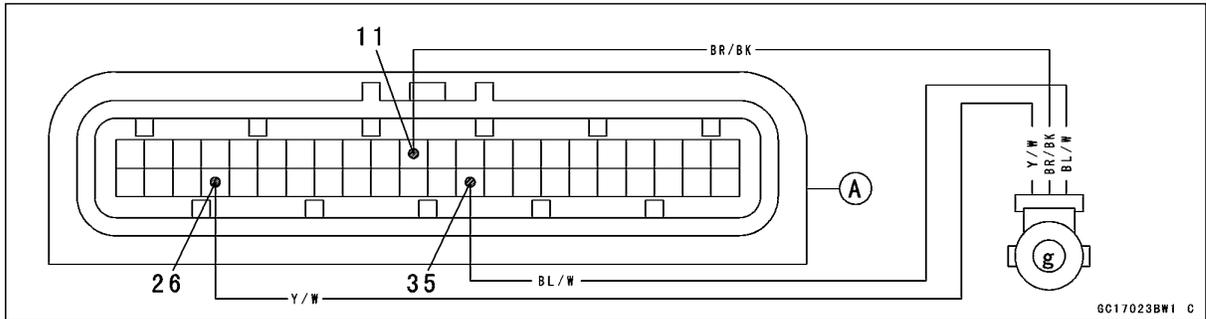
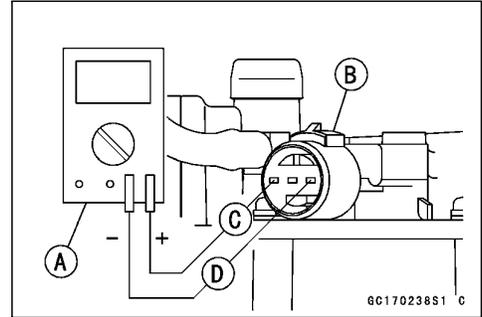
**Throttle Sensor Resistance**

**Connections:** BL/W lead [C] ↔ BR/BK lead [D]

**Standard:** 4 ~ 6 kΩ

★If the reading is out of the range, replace the throttle sensor along with the throttle body.

★If the reading is within the range, but the problem still exists, the ECU is suspect. Replace the ECU.



A. ECU

g. Throttle Sensor

## 3-44 FUEL SYSTEM (DFI)

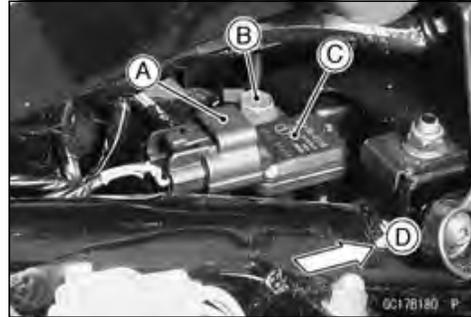
### Inlet Air Pressure Sensor (Service Code 12)

#### Removal

#### CAUTION

**Never drop the sensor, especially on a hard surface. Such a shock to the part can damage it.**

- Remove the fuel tank (see Fuel Tank section in this chapter).
- Disconnect the inlet air pressure sensor connector [A].
- Unscrew the inlet air pressure sensor bolt [B] and remove the sensor [C].
- Disconnect the vacuum hose from the sensor. Front [D]

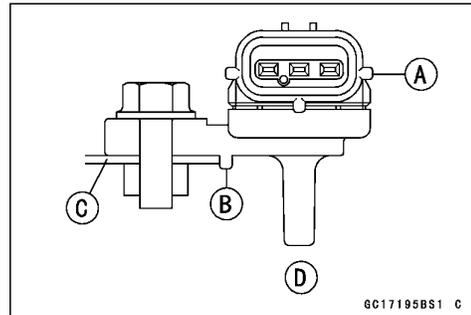


#### Installation

#### NOTE

○ The inlet air pressure sensor is the same part as the atmospheric pressure sensor except for a vacuum hose and different wiring.

- Route the vacuum hose correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter). Make sure it doesn't get pinched or kinked.
- Install the inlet air pressure sensor [A].
- The stopper [B] must not be on the sensor holder [C]. Rear View [D]
- Tighten the inlet air pressure sensor nut securely.
- Install the fuel tank (see this chapter).



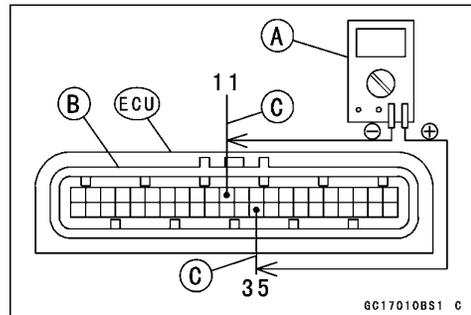
#### Input Voltage Inspection

#### NOTE

○ Be sure the battery is fully charged.  
○ The inspection is the same as "Input Voltage Inspection" of the throttle sensor or the atmospheric pressure sensor.

- Turn the ignition SW OFF.
- Remove the ECU (see this chapter). Do not disconnect the ECU connector.
- Connect a digital voltmeter [A] to the connector [B], using two needle adapters [C].

**Special Tool - Needle Adapter Set: 57001-1457**



## Inlet Air Pressure Sensor (Service Code 12)

- Measure the input voltage to the inlet air pressure sensor with the engine stopped, and with the connectors joined.
- Turn the ignition SW ON.

### Inlet Air Pressure Sensor Input Voltage

#### Connections to ECU

- Meter (+) → BL/W lead (terminal 35)
- Meter (-) → BR/BK lead (terminal 11)

**Standard:** 4.75 ~ 5.25 V DC

- Turn the ignition SW OFF.
- ★ If the reading is less than the standard range, check the ECU for its ground, and power supply (see this chapter). If the ground and power supply are good, the ECU is suspect. Replace the ECU.
- ★ If the reading is within the standard range, check the sensor output voltage.

### Output Voltage Inspection

#### NOTE

- The output voltage changes according to the local atmospheric pressure.

- ★ Check the output voltage of the sensor at the ECU connector [A].
- Measure the output voltage with the engine stopped and with the connector joined.
- Turn the ignition SW ON.  
Needle Adapters [B]

### Inlet Air Pressure Sensor Output Voltage

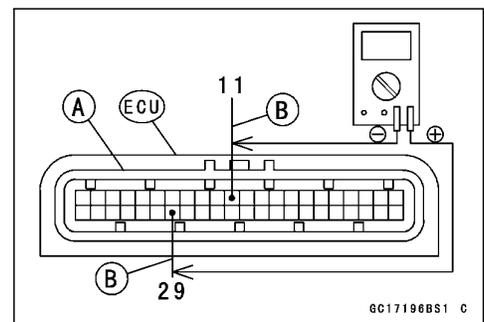
#### Connections to ECU

- Meter (+) → W/BL lead (terminal 29)
- Meter (-) → BR/BK lead (terminal 11)

**Usable Range:** 3.74 ~ 4.26 V DC at the standard atmospheric pressure (101.32 kPa, or 76 cmHg absolute)

- ★ If the output voltage is at about 4.8 V, the ECU is normal. Remove the fuel tank and check the wiring between the ECU and the sensor.
- ★ If the output voltage is at about 4.8 V and out of the usable range, remove the fuel tank and check the wiring. If the wiring is good, check the sensor itself as follows.
- Turn the ignition SW OFF and remove the needle adapters.
- Apply silicone sealant to the seals of the connector for waterproofing.

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



## 3-46 FUEL SYSTEM (DFI)

### Inlet Air Pressure Sensor (Service Code 12)

- ★ If the output voltage is normal, check the inlet air pressure sensor itself.
- Check the output voltage for vacuum as follows. If the output voltage changes within the usable range as vacuum changes, the sensor is normal and the ECU is suspect. Check the ECU for its ground and power supply (see ECU section).
- Remove the inlet air pressure sensor [D] and disconnect the vacuum hose from the sensor.
- Connect an auxiliary hose [E] to the inlet air pressure sensor.
- Temporarily install the inlet air pressure sensor.
- Connect a commercially available digital meter [A], the needle adapters [F], vacuum gauge [B], and the fork oil level gauge [C] to the inlet air pressure sensor.

Front [G]

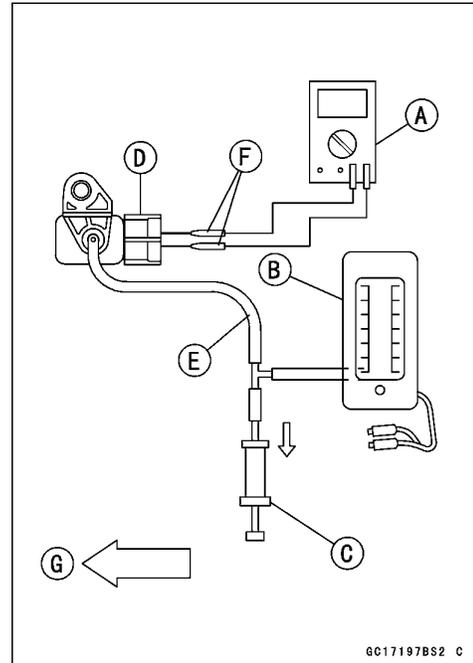
**Special Tools - Fork Oil Level Gauge: 57001-1290**  
**Needle Adapter Set: 57001-1457**

#### Digital Volt Meter Connections

**Meter (+) → W/BL lead of Inlet Air Pressure Sensor**

**Meter (-) → BR/BK lead of Inlet Air Pressure Sensor**

- Turn the ignition SW ON.
- Measure the inlet air pressure sensor output voltage from various vacuum readings, while pulling the handle of the fork oil level gauge.
- Inspect the inlet air pressure sensor output voltage, using the following formula and charts for  $P_v = 24 \sim 55$  cm Hg and  $55 \sim 86$  cm Hg.



**Inlet Air Pressure Sensor (Service Code 12)**

Suppose:

- Pg : Vacuum (gauge) of Throttle Assy
- PI : Local Atmospheric Pressure (absolute) measured by a barometer
- Pv : Vacuum (absolute) of Throttle Assy
- Vv : Sensor Output Voltage (v)

then

$$Pv = PI - Pg$$

For example, suppose the following data is obtained in the chart of the next page.

- Pg = 8 cmHg (vacuum gauge reading)
- PI = 70 cmHg (barometer reading)
- Vv = 3.2 V (digital volt meter reading)

then

$$Pv = 70 - 8 = 62 \text{ cmHg (abs)}$$

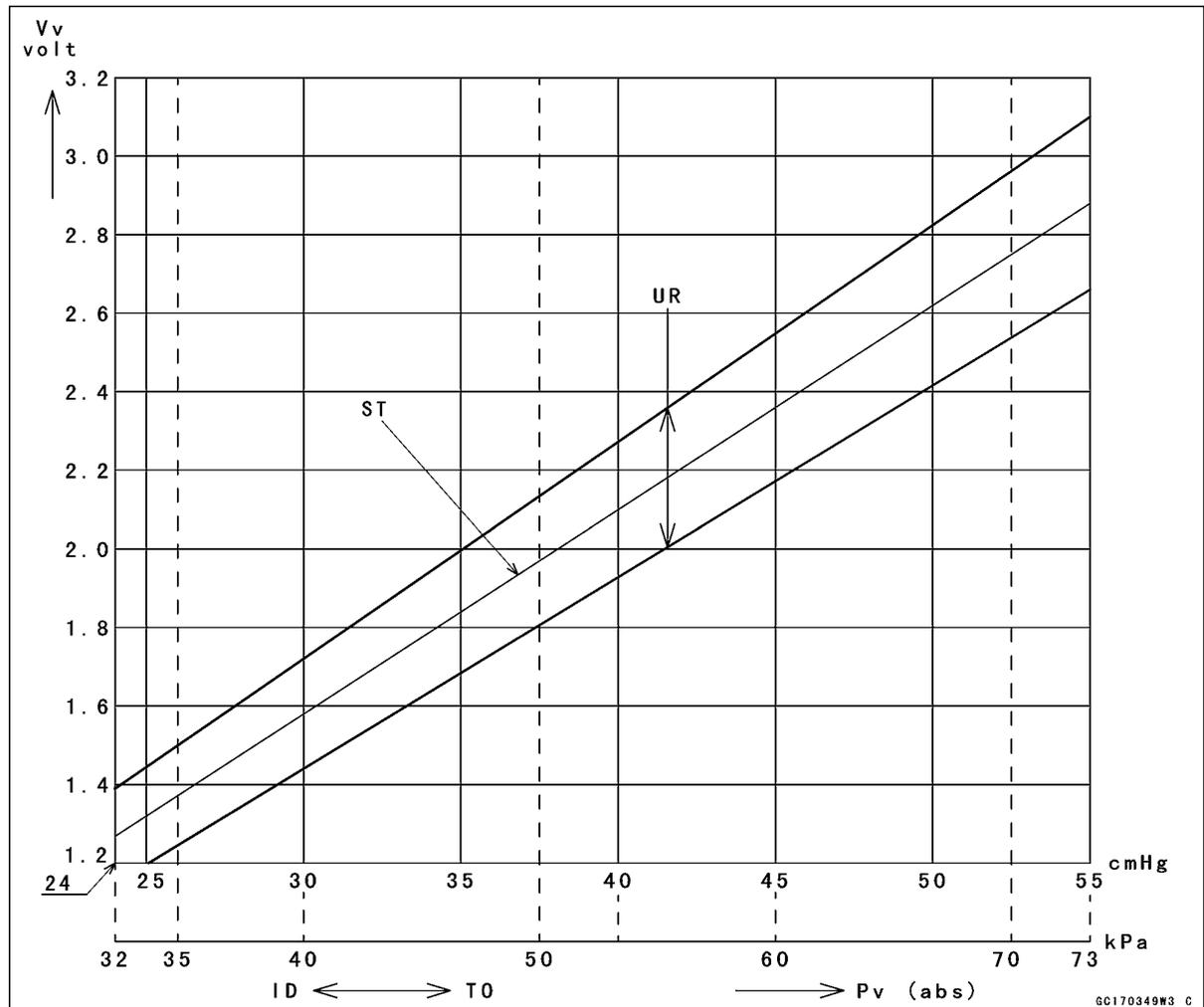
Plot this Pv (62 cmHg) at a point [1] on the chart and draw a vertical line through the point. Then, you can get the usable range [2] of the sensor output voltage.

$$\text{Usable range} = 3.04 \sim 3.49 \text{ V}$$

Plot Vv (3.2 V) on the vertical line. → Point [3].

**Results: In the chart, Vv is within the usable range and the sensor is normal.**

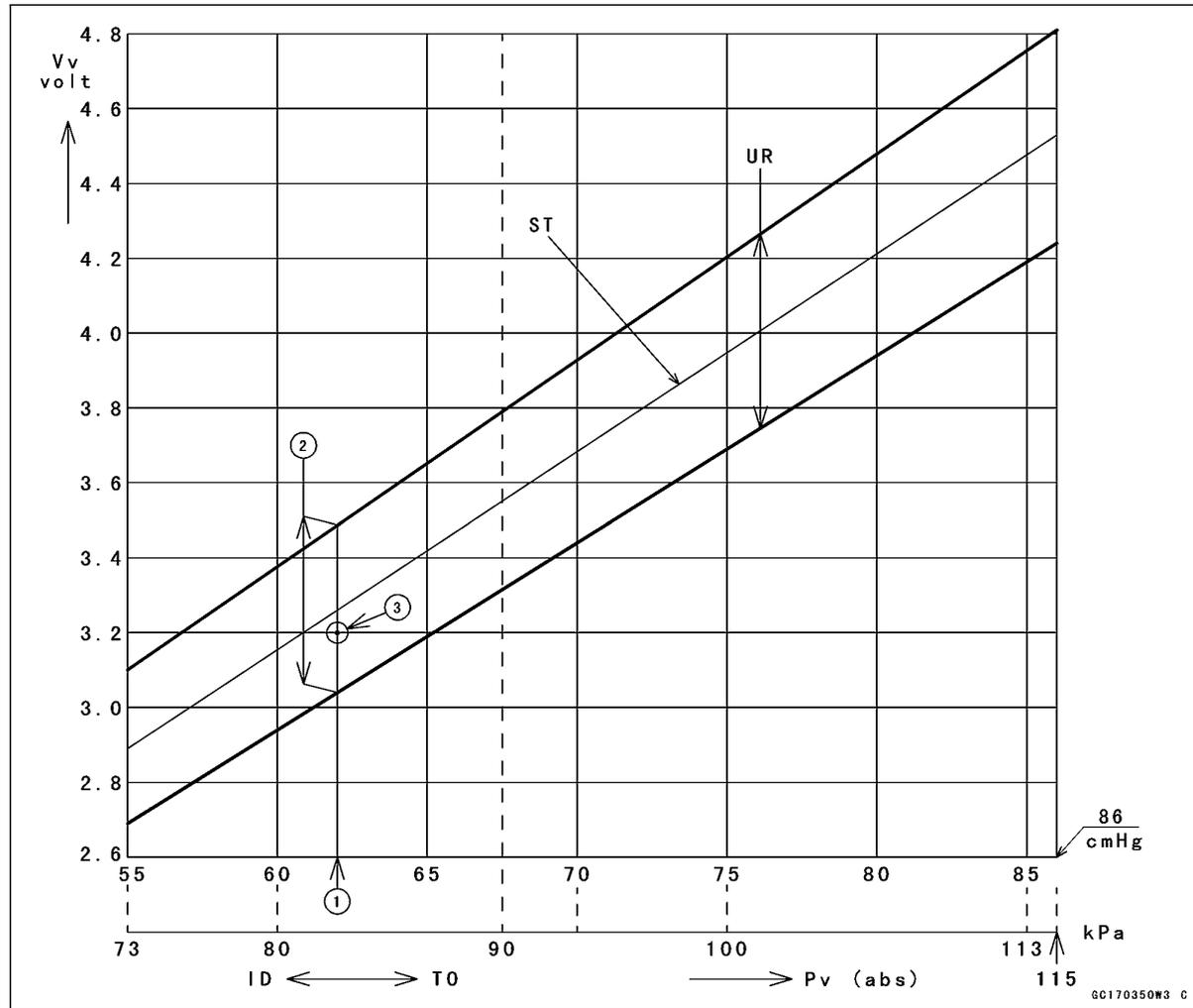
**Pv = 24 ~ 55 cm Hg**



### 3-48 FUEL SYSTEM (DFI)

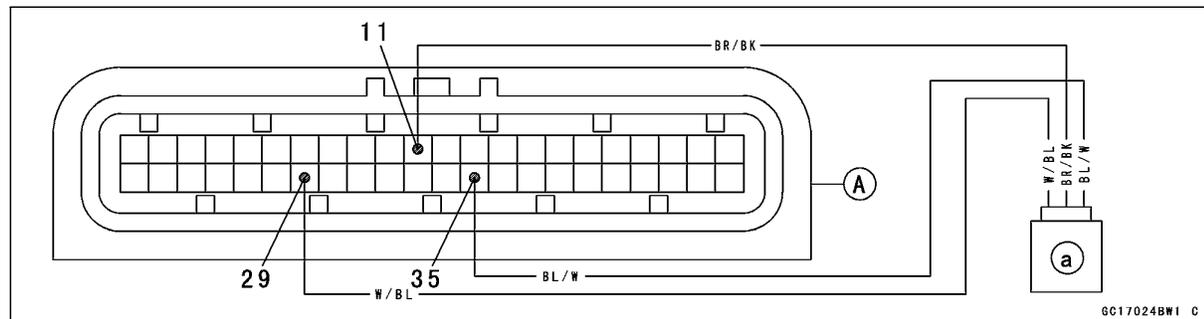
#### Inlet Air Pressure Sensor (Service Code 12)

Pv = 55 ~ 86 cm Hg



Vv: Inlet Air Pressure Sensor Output Voltage (V)  
(Digital Meter Reading)  
Pv: Throttle Vacuum (absolute)  
Ps: Standard Atmospheric Pressure (absolute)  
ID: Idling

TO: Throttle Full Open  
ST: Standard of Sensor Output  
Voltage (v)  
UR: Usable Range of Sensor Output  
Voltage (v)



ECU [A]

Inlet Air Pressure Sensor [a]

## Inlet Air Temperature Sensor (Service Code 13)

### Removal/Installation

#### CAUTION

**Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.**

- Remove the right air cleaner base (see Right Air Cleaner Housing Removal in this chapter).
- Disconnect the connector [A] from the inlet air temperature sensor, and unscrew the nut [B].
- Remove the inlet air temperature sensor.

**Torque - Inlet Air Temperature Sensor Nut: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

### Output Voltage Inspection

#### NOTE

- Be sure the battery is fully charged.
- The output voltage changes according to the inlet air temperature.

- Remove the ECU (see this chapter). Do not disconnect the ECU connectors.
- Connect a digital voltmeter [A] to the ECU connector [B], using two needle adapters [C].

**Special Tool - Needle Adapter Set: 57001-1457**

- Measure the output voltage of the sensor with the engine stopped and the connector joined.
- Turn the ignition SW ON.

#### Inlet Air Temperature Sensor Output Voltage

##### Connections to ECU Connector

**Meter (+) → P lead (terminal 31)**

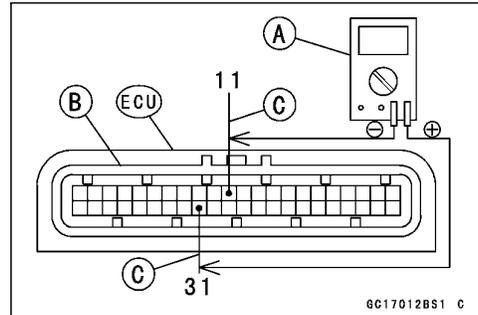
**Meter (-) → BR/BK lead (terminal 11)**

**Standard: 2.4 V at inlet air temperature 25°C (77°F)**

- Turn the ignition SW OFF.
- ★ If the output voltage is normal but there is still trouble, check the sensor resistance.
- ★ If the output voltage is about 4.8 V, the ECU is normal. Remove the right air cleaner base and check the wiring between the ECU and the sensor.
- ★ If the output voltage is not about 4.8 V and out of the specified, remove the right air cleaner base, check the wiring between the ECU and the inlet air temperature sensor.
- ★ If the wiring is good, check the sensor resistance.
- Remove the needle adapters, and apply silicone sealant to the seals of the connector for waterproofing.

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

**- Seals of Connector**



## 3-50 FUEL SYSTEM (DFI)

### Inlet Air Temperature Sensor (Service Code 13)

#### Sensor Resistance Inspection

- Remove the inlet air temperature sensor (see this section).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend a thermometer [B] with the heat-sensitive portion [C] located in almost the same depth with the sensor.

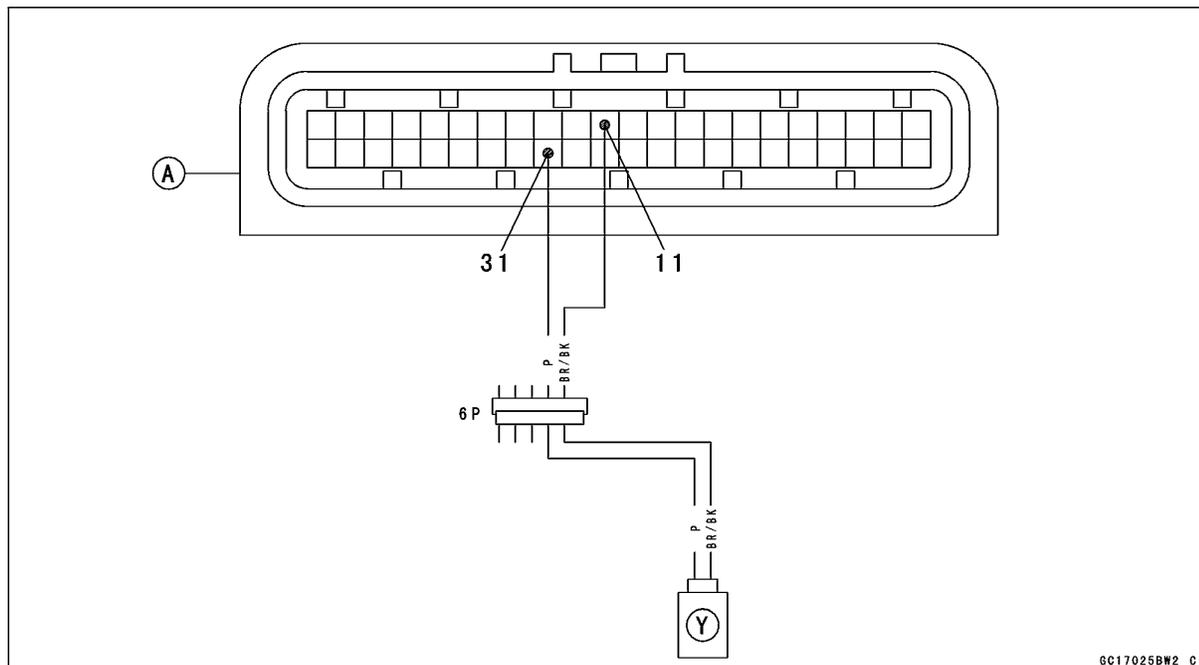
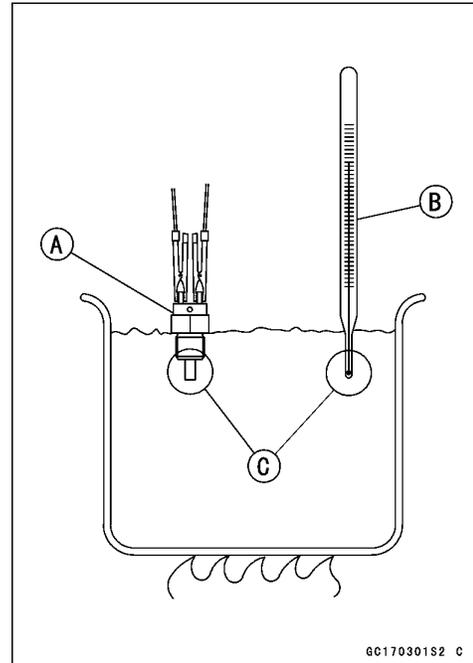
#### NOTE

- The sensor and thermometer must not touch the container side or bottom.
- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using a digital meter, measure the internal resistance of the sensor across the terminals at the temperatures shown in the table.

#### Inlet Air Temperature Sensor Resistance

Standard:	5.4 ~ 6.6 k $\Omega$ at 0°C (32°F)
	2.26 ~ 2.86 k $\Omega$ at 20°C (68°F)
	0.29 ~ 0.39 k $\Omega$ at 80°C (176°F)

- ★ If the measurement is out of the range, replace the sensor.
- ★ If the measurement is within the specified, check the ECU for its ground and power supply (see ECU section in this chapter).
- Clean off machine oil that inadvertently gets on the sensor, especially on the terminals with a high-flush point solvent.



ECU [A]

Inlet Air Temperature Sensor [Y]

## Water Temperature Sensor (Service Code 14)

### Removal/Installation

#### CAUTION

**Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.**

- Remove the thermostat housing [A] (see Thermostat Removal in the Cooling System chapter).
- Disconnect the sensor connector [B], and unscrew the water temperature sensor [C].

**Silicone Sealant (Kawasaki Bond: 56019-120)**  
- Threads of Water Temperature Sensor

**Torque - Water Temperature Sensor: 18 N·m (1.8 kgf·m, 13 ft·lb)**

- Fill the engine with coolant and bleed the air from the cooling system (see Coolant Filling in the Cooling System chapter).

### Output Voltage Inspection

#### NOTE

- Be sure the battery is fully charged.
- The output voltage changes according to the coolant temperature in the engine.

- Remove the ECU (see this chapter). Do not disconnect the connectors.
- Connect a digital voltmeter [A] to the ECU connector [B], using two needle adapters [C].

**Special Tool - Needle Adapter Set: 57001-1457**

- Measure the output voltage of the sensor with the engine stopped and the connector joined.
- Turn the ignition SW ON.

### Water Temperature Sensor Output Voltage

#### Connections to ECU

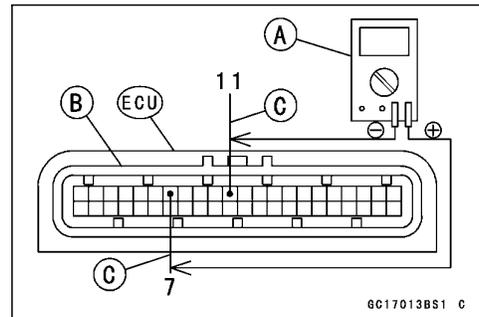
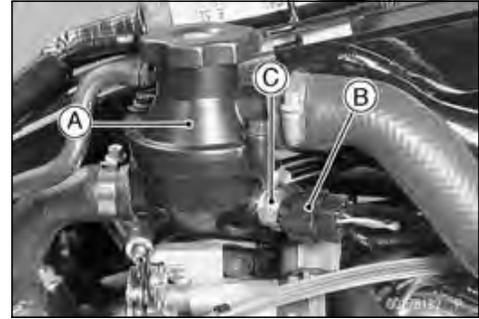
**Meter (+) → O lead (terminal 7)**

**Meter (-) → BR/BK lead (terminal 11)**

**Standard: 3.38 V at coolant temperature 25°C (77°F)**

- ★ If the output voltage is normal but there is still trouble, check the sensor resistance.
- ★ If the output voltage is about 4.8 V, the ECU is normal. Remove the fuel tank and check the wiring between the ECU and the sensor.
- Turn the ignition SW OFF.
- ★ If the output voltage is not about 4.8 V and out of the specified, remove the fuel tank and check the wiring between the ECU and the water temperature sensor for continuity.
- ★ If the wiring is good, check the water temperature sensor resistance.
- Remove the needle adapters, and apply silicone sealant to the seals of the connector for waterproofing.

**Silicone Sealant (Kawasaki Bond: 56019-120)**  
- Seals of ECU Connector



## 3-52 FUEL SYSTEM (DFI)

### Water Temperature Sensor (Service Code 14)

#### Water Temperature Sensor Resistance Inspection

- Remove the water temperature sensor (see this section).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend a thermometer [B] with the heat-sensitive portion [C] located in almost the same depth with the sensor.

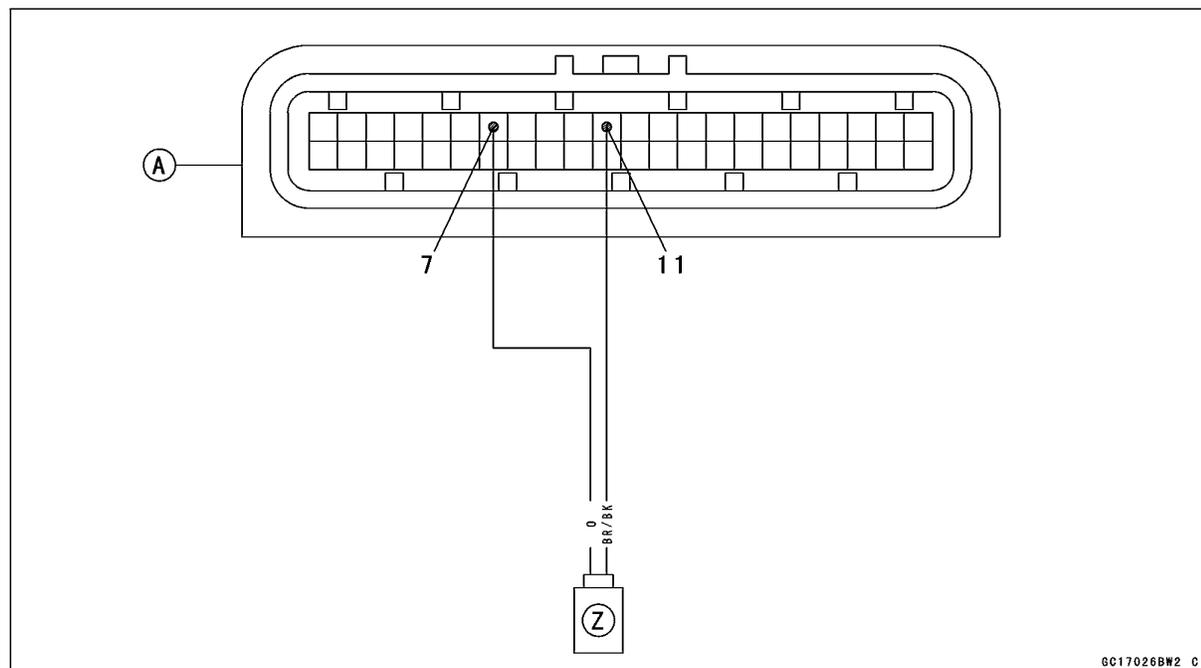
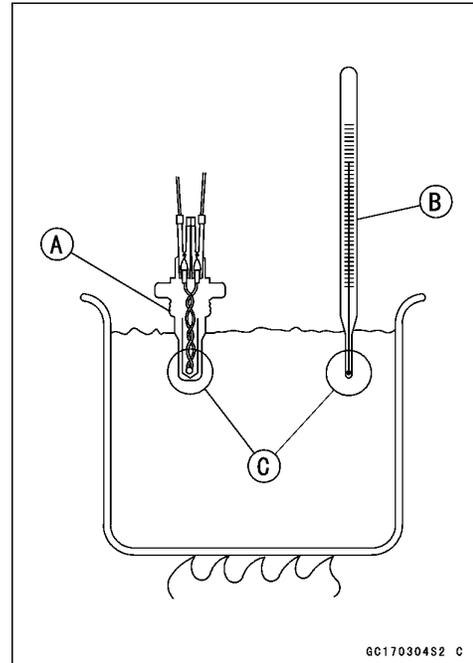
#### NOTE

- The sensor and thermometer must not touch the container side or bottom.
- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using a digital meter, measure the internal resistance of the sensor across the terminals at the temperatures shown in the table.

#### Water Temperature Sensor Resistance

Standard:	2.162 ~ 3.112 k $\Omega$ at 20°C (68°F)
	0.785 ~ 1.049 k $\Omega$ at 50°C (122°F)
	0.207 ~ 0.253 k $\Omega$ at 100°C (212°F)

- ★ If the measurement is out of the range, replace the sensor.
- ★ If the measurement is within the specified, check the ECU for its ground and power supply (see ECU section in this chapter).
- Clean off machine oil that inadvertently gets on the sensor, especially on the terminals with a high-flush point solvent.



A. ECU

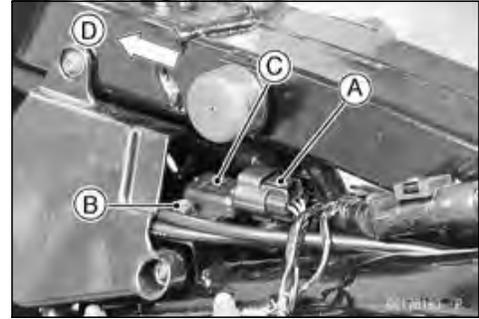
Z. Water Temperature Sensor

**Atmospheric Pressure Sensor (Service Code 15)**

*Removal*

<b>CAUTION</b>
<b>Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.</b>

- Remove the fuel tank (see Fuel Tank section in this chapter).
- Disconnect the atmospheric pressure sensor connector [A].
- Remove the sensor nut [B].
- Remove the atmospheric pressure sensor [C].
- Front [D]

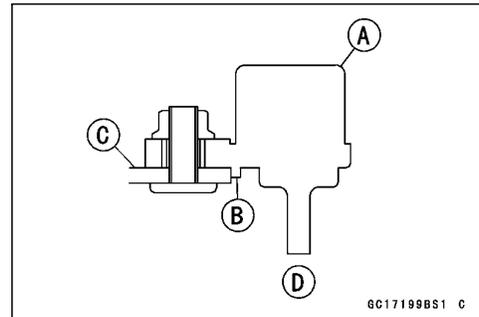


*Installation*

**NOTE**

○ The atmospheric pressure sensor is the same part as the inlet air pressure sensor except for different wiring and no hose.

- Install the atmospheric pressure sensor [A].
- The stopper [B] must not be on the sensor holder [C].
- Rear View [D]
- Tighten the atmospheric pressure sensor nut securely.
- Install the fuel tank (see this chapter).



*Input Voltage Inspection*

**NOTE**

○ Be sure the battery is fully charged.  
 ○ The inspection is the same as "Input Voltage Inspection" of the throttle sensor or the inlet air pressure sensor.

- Turn the ignition SW OFF.
- Remove the ECU (see this chapter). Do not disconnect the ECU connectors.
- Connect a digital voltmeter [A] to the connector [B], using two needle adapters [C].

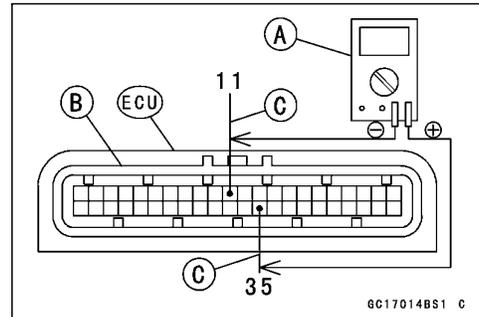
**Special Tool - Needle Adapter Set: 57001-1457**

- Measure the input voltage to the sensor with the engine stopped, and with the connectors joined.
- Turn the ignition SW ON.

**Atmospheric Pressure Sensor Input Voltage Connections to ECU**

**Meter (+) → BL/W lead (terminal 35)**  
**Meter (-) → BR/BK lead (terminal 11)**  
**Standard: 4.75 ~ 5.25 V DC**

- Turn the ignition SW OFF.
- ★ If the reading is less than the standard range, check the ECU for its ground, and power supply (see ECU section in this chapter).
- ★ If the reading is within the standard range, check the sensor output voltage.



## 3-54 FUEL SYSTEM (DFI)

### Atmospheric Pressure Sensor (Service Code 15)

- Remove the needle adapters.
- Apply silicone sealant to the seals of the connector for waterproofing.

**Silicone Sealant (Kawasaki Bond: 56019-120)**  
- ECU Connector Seals

#### Output Voltage Inspection

##### NOTE

○ The output voltage changes according to the local atmospheric pressure.

- ★ Check the output voltage of the sensor at the ECU connector [A].  
Needle Adapters [B]
- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition SW ON.

#### Atmospheric Pressure Sensor Output Voltage

##### Connections to ECU

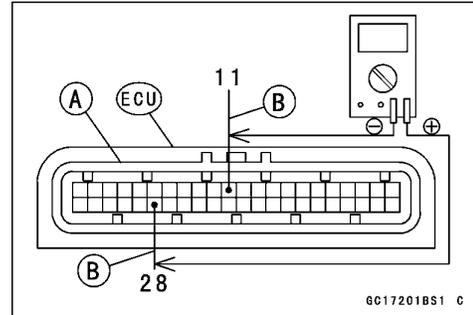
**Meter (+)** → BL/Y lead (terminal 28)

**Meter (-)** → BR/BK lead (terminal 11)

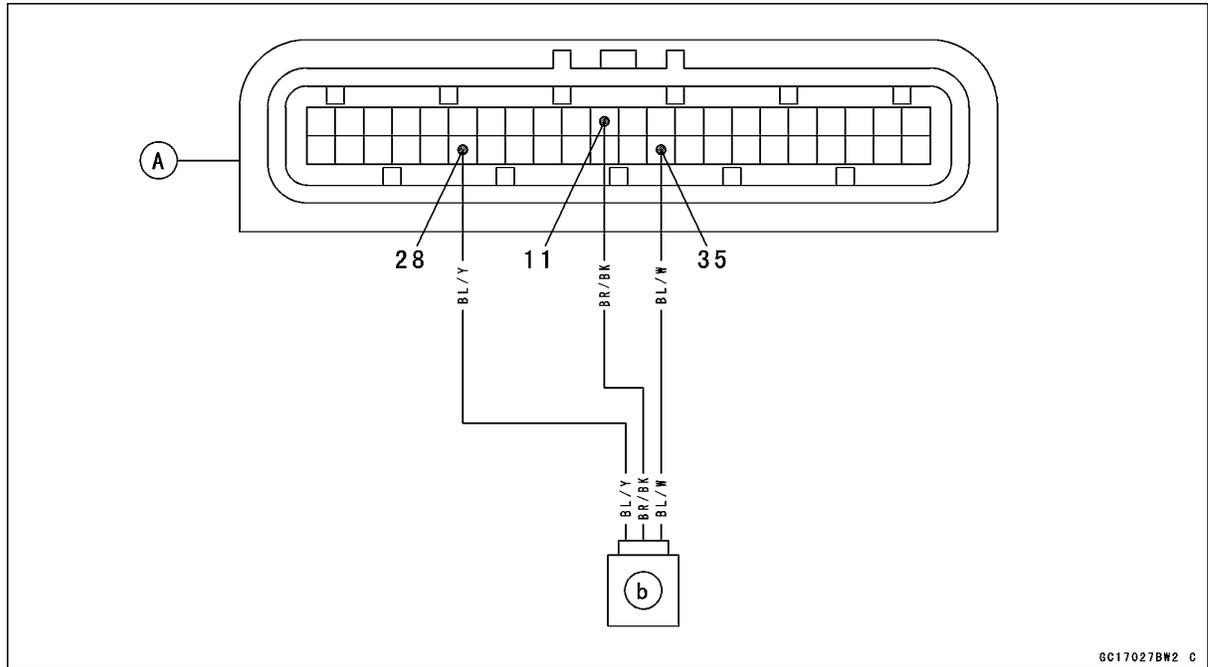
**Usable Range: 3.74 ~ 4.26 V DC at the standard atmospheric pressure (101.32 kPa, or 76 cmHg abs)**

- ★ If the output voltage is about 4.8 V, the ECU is normal. Remove the fuel tank and check the wiring between the ECU and the sensor.
- ★ If the output voltage is not about 4.8 V and out of the usable range, remove the fuel tank and check the wiring. If the wiring is good, check the sensor itself as follows.
- ★ If the output voltage is normal, check the output voltage for vacuum (see Inlet Air Pressure Sensor section in this chapter). If the output voltage changes within the usable range as vacuum changes, the sensor is normal and the ECU is suspect. Check the ECU for its ground and power supply.
- Turn the ignition SW OFF and remove the needle adapters.
- Apply silicone sealant the seals of the connector for waterproofing.

**Silicone Sealant (Kawasaki Bond: 56019-120)**  
- Seals of Sensor Connector



Atmospheric Pressure Sensor (Service Code 15)



A. ECU

b. Atmospheric Pressure Sensor

★If you need to check the atmospheric pressure sensor for various altitudes other than sea level, check the output voltage as follows:

○Determine the local altitude (elevation).

★If you know the local atmospheric pressure using a barometer, substitute the atmospheric pressure for Pv (Throttle Vacuum) in the inlet air pressure sensor chart (see Inlet Air Pressure Sensor section in this chapter).

○Get the usable range of the atmospheric pressure sensor output voltage in the same way as Output Voltage Inspection of the inlet air pressure sensor and check if Va (output voltage) is within the usable range or not.

★If you know the local altitude, use the following chart.

For example:

Suppose the local altitude is 1 300 m (4 200 ft) and the sensor output voltage Va is 3.3 V.

Plot this H (1 300 m) at a point [1] on the following chart and draw a vertical line through the point. Then, you can get the usable range [2] of the sensor output voltage.

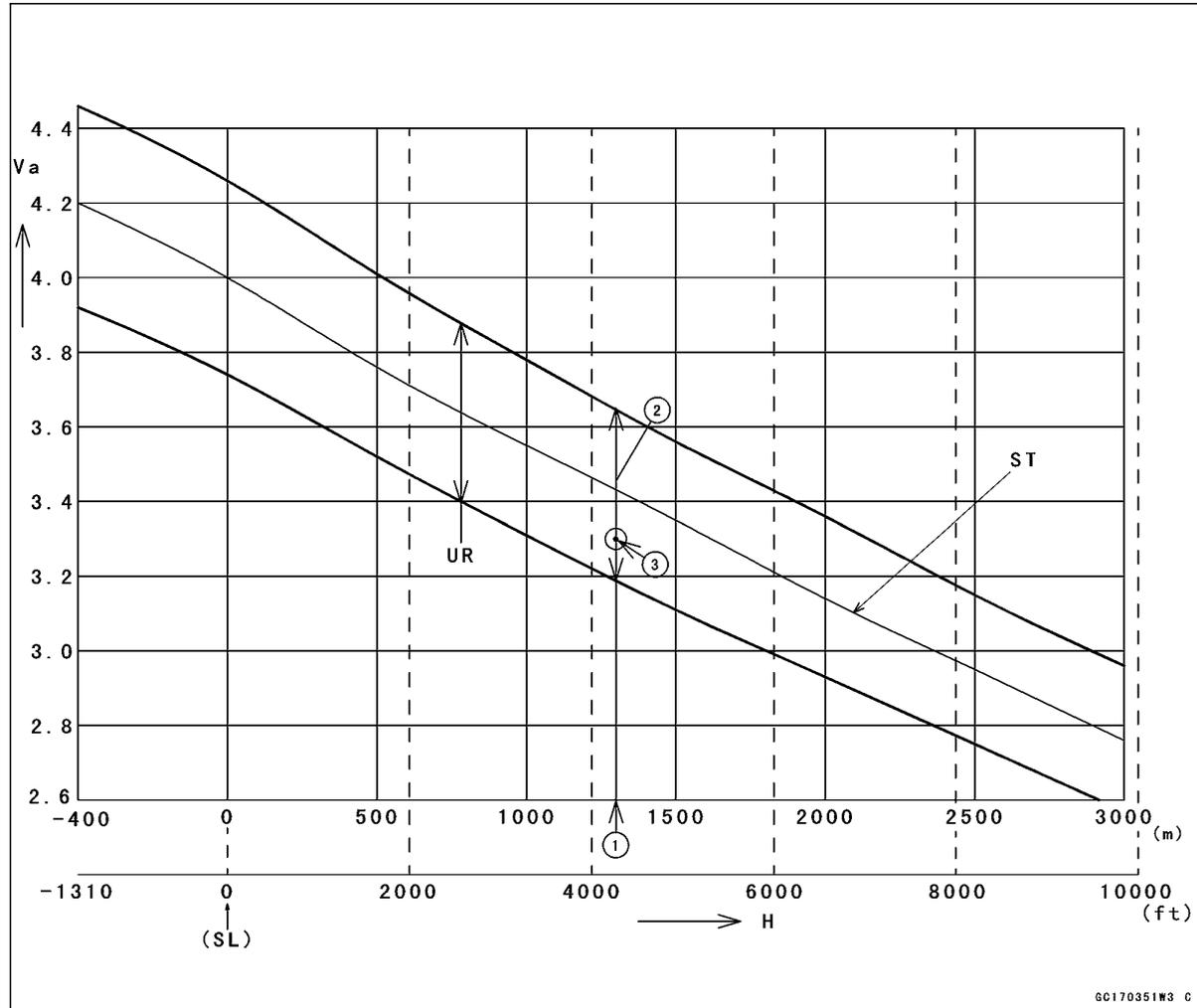
Usable Range = 3.2 ~ 3.64 V

Plot Va (3.3 V) on the vertical line → Point [3]

**Results: In the chart, Va is within the usable range and the sensor is normal.**

### 3-56 FUEL SYSTEM (DFI)

#### Atmospheric Pressure Sensor (Service Code 15)



- $V_a$ : Atmospheric Pressure Sensor Output Voltage (v)
- $H$ : Altitude (m or feet)
- SL: Sea Level (0 m)
- ST: Standard of Sensor Output Voltage (v)
- UR: Usable Range of Sensor Output Voltage (v)

## Crankshaft Sensors (#1, #2: Service Code 21, 22)

Crankshaft Sensor #1: for Front Cylinder (Service Code 21)

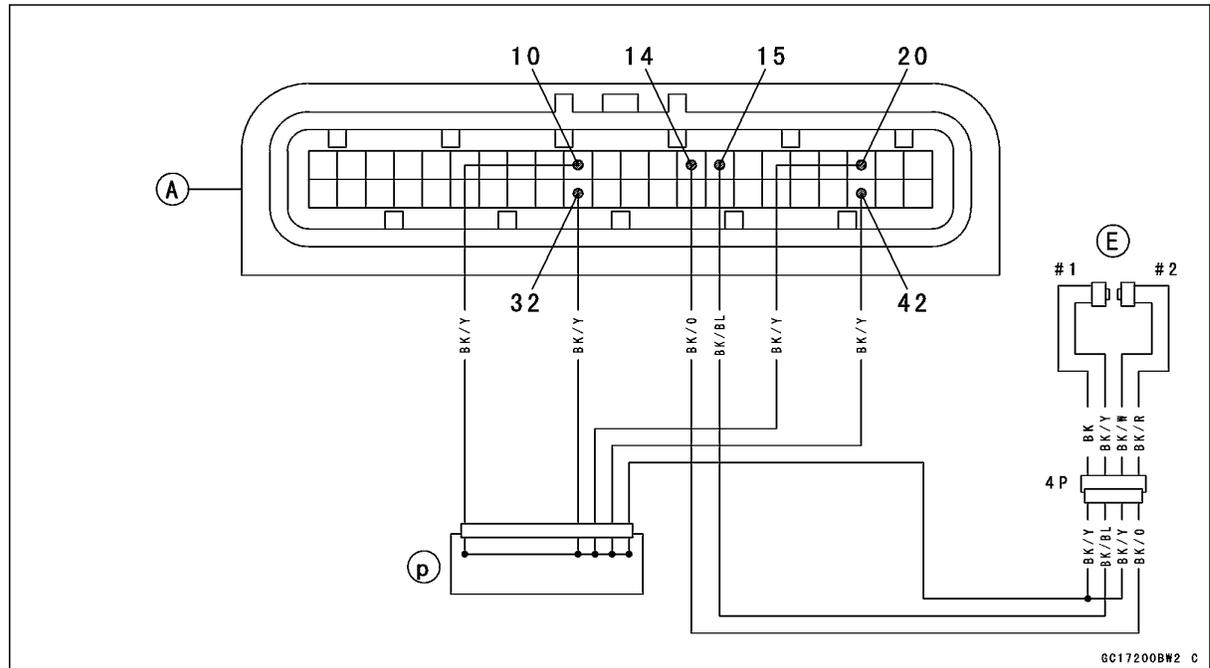
Crankshaft Sensor #2: for Rear Cylinder (Service Code 22)

### Crankshaft Sensor Removal/Installation

- See Ignition System section in the Electrical System chapter.

### Crankshaft Sensor Inspection

- The crankshaft sensors have no power source, and when the engine stops, the crankshaft sensors generates no signals.
- Remove the alternator outer cover and check the wiring for continuity, using the following diagram.
- Crank the engine and measure the peak voltage of the crankshaft sensors (see Electrical System chapter) in order to check the coils.



A. ECU

E. Crankshaft Sensors

p. Joint Connector 1

## 3-58 FUEL SYSTEM (DFI)

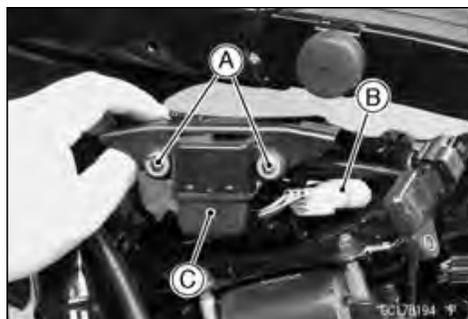
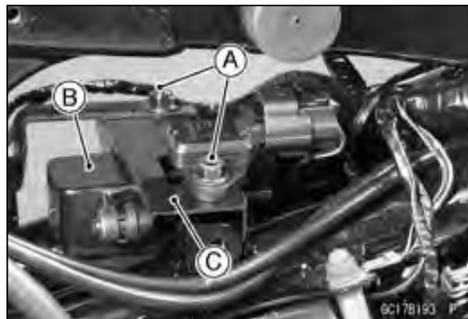
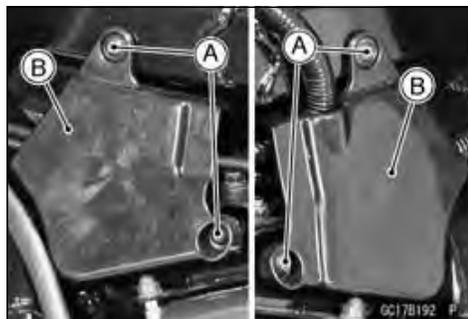
### Vehicle-down Sensor (Service Code 31)

#### Vehicle-down Sensor Removal

#### CAUTION

Never drop the down-sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Remove the fuel tank (see this chapter).
- Remove the bolts [A] and take out the covers [B].
- Remove the bracket nuts [A] and pull the vehicle down sensor [B] with the bracket [C] out of the frame.
- Unscrew the screws [A] and disconnect the connector [B].
- Remove the vehicle down sensor [C].

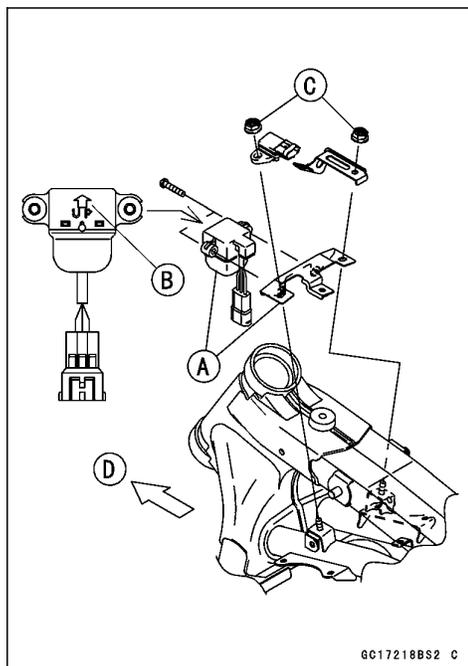


#### Installation

- Install the vehicle-down sensor assy [A] in the original position. The arrow mark [B] on the sensor must be on the front and point upward.
- Do not install the sensor upside down.
- Tighten the sensor bracket nuts [C] securely.
- Front [D]
- Install the seat (see Frame chapter).

#### ⚠ WARNING

Incorrect installation of the vehicle-down sensor could cause sudden loss of engine power. The rider could lose balance during certain riding situations, like leaning over in a turn, with the potential for an accident resulting in injury or death. Ensure that the down sensor is held in place by the bracket and its bolt as shown.



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**Vehicle-down Sensor (Service Code 31)**

*Vehicle-down Sensor Inspection*

**NOTE**

○ Be sure the battery is fully charged.

- Take out the vehicle-down sensor [A] (see this section). Do not disconnect the connector [B].
- Connect a digital volt meter [C] to the connector (natural, 3P), using two needle adapters [D].

**Special Tool - Needle Adapter Set: 57001-1457**

- Turn the ignition SW ON, and measure the power source voltage with the connector joined.

**Vehicle-down Sensor Power Source Voltage**

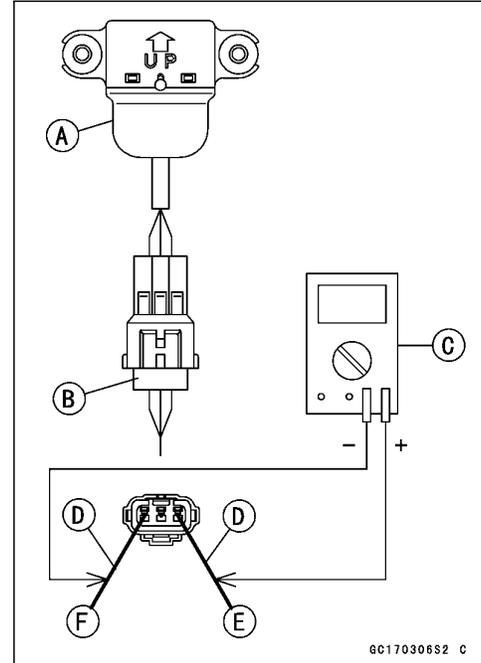
**Connections to Sensor**

**Meter (+)** → BR lead [E]

**Meter (-)** → BK/Y lead [F]

**Standard: Battery Voltage (12.5 V or more)**

- Turn the ignition SW OFF.
- ★ If there is no battery voltage, check the DFI power source circuit (see DFI Power Source Section in this chapter).



6C170306S2 C

- ★ If the power source is normal, check the output voltage of the sensor.
- Connect a digital volt meter [A] to the connector (natural, 3P), using two needle adapters [B].
- Turn the ignition SW ON, and measure the output voltage with the connector joined.
- Tilt the sensor (40 ~ 50°) or more [C] right or left, then hold the sensor almost vertical [D] with the arrow mark pointed up, and measure the output voltage.

**Vehicle-down Sensor Output Voltage**

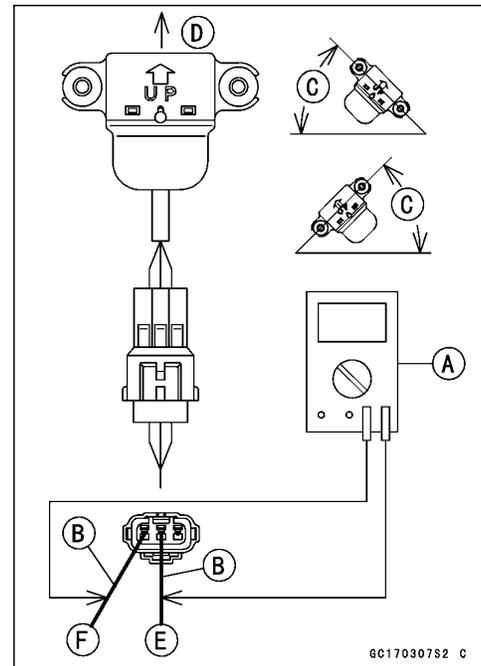
**Connections to Sensor**

**Meter (+)** → Y/G lead [E]

**Meter (-)** → BK/Y lead [F]

**Standard: with sensor tilted 40 ~ 50° or more right or left: 3.7 ~ 4.4 V**

**with sensor arrow mark pointed up: 0.4 ~ 1.4 V**



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**NOTE**

○ If you need to test again, turn the ignition SW OFF, and then ON.

- Turn the ignition SW OFF.
- Remove the needle adapters, and apply silicone sealant to the seals of the connector for waterproofing.

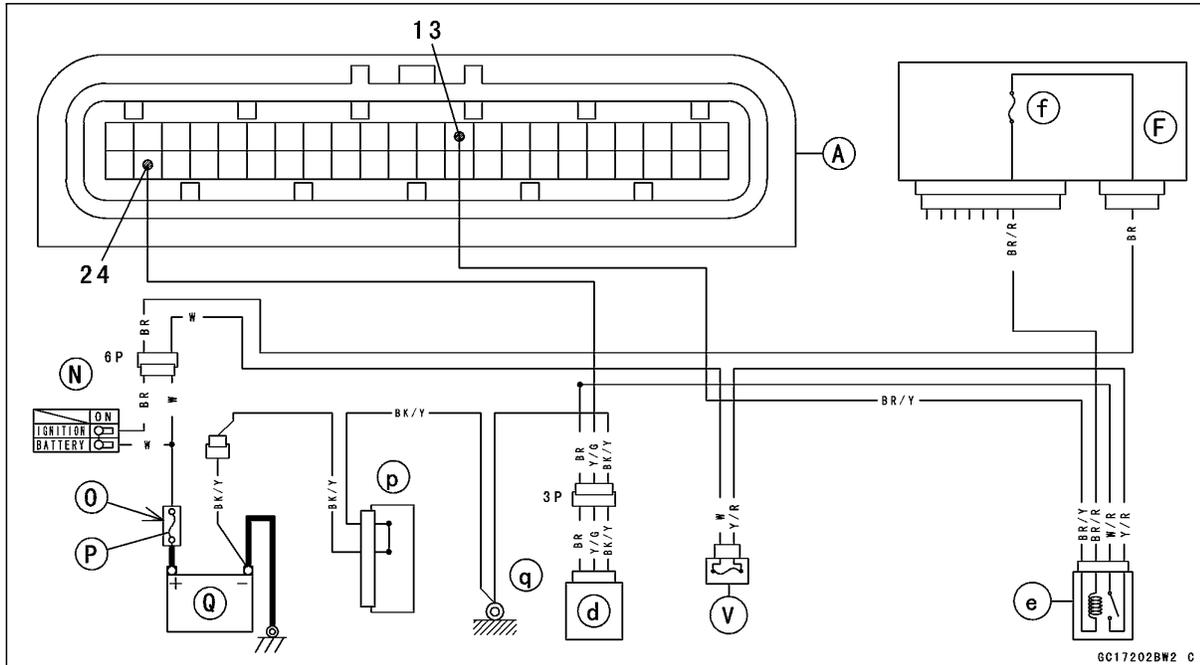
**Silicone Sealant (Kawasaki Bond: 56019-120)**

**- Seals of Vehicle-down Sensor Connector**

- ★ If the output voltage is out of the specified, replace the vehicle-down sensor.
- ★ If the output voltage is normal, the wiring is suspect. Check the wiring. If the wiring is good, check the ECU for its ground and power supply (see ECU section in this chapter).

### 3-60 FUEL SYSTEM (DFI)

#### Vehicle-down Sensor (Service Code 31)



A. ECU  
 d. Vehicle-down Sensor  
 F. Junction Box  
 e. DFI Main Relay

N. Ignition Switch  
 O. Starter Relay  
 P. Main Fuse 30 A x 32 V  
 p. Joint Connector 1

Q. Sealed Battery  
 q. Frame Earth  
 f. Ignition Fuse 10 A x 32 V  
 V. DFI Fuse 15A

**Fuel Injectors (#1, #2: Service Code 41, 42)**

Fuel Injector #1: Front Fuel Injector for Front Cylinder (Service Code 41)  
 Fuel Injector #2: Rear Fuel Injector for Rear Cylinder (Service Code 42)

**CAUTION**

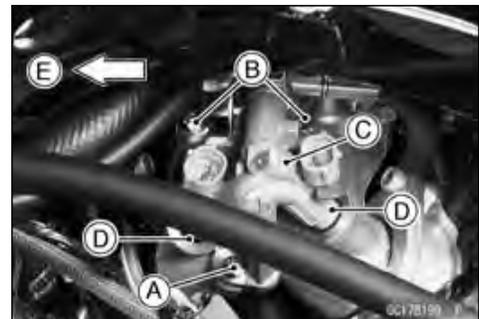
**Never drop the injector, especially on a hard surface. Such a shock to the injector can damage it.**

*Injector Removal*

**⚠ WARNING**

**Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. Disconnect the battery (-) lead terminal. 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. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.**

- Check to see that the battery (-) lead terminal is disconnected.
- Remove:
  - Fuel Tank (see this chapter)
  - Front and Rear Injector Connectors
- Remove the fuel hose joint #2 [A] from the pipe for the delivery joint and take out the fuel hose assy (outlet hose) [B].
  
- Unscrew the delivery joint screw [A] and bolts [B], and lift up the delivery joint [C] with the injectors [D]. Front [E]
- Remove the injectors from the delivery joint.

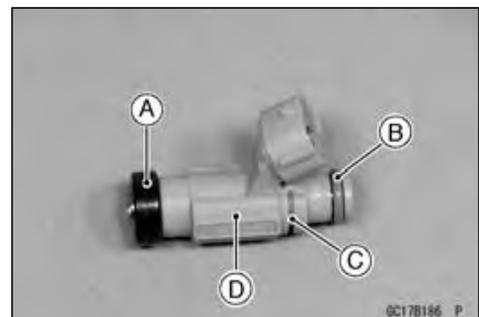


*Injector Installation*

- The front and rear injectors are the same.
- Replace the seal [A], O-ring [B], and seal ring [C] with new ones, and install them onto the injector [D].
- Apply engine oil to the O-ring, and install them onto the injector.

**CAUTION**

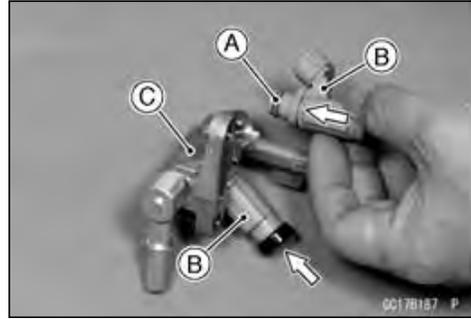
**To avoid air and fuel leak, be careful not to get dirt or dust on the O-ring. Be careful not to damage the O-ring.**



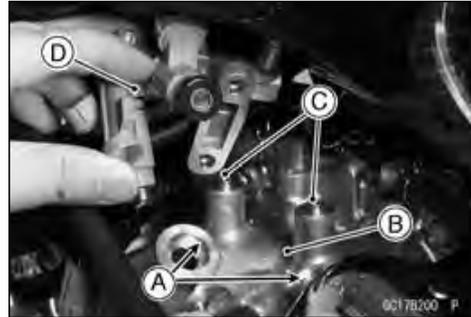
## 3-62 FUEL SYSTEM (DFI)

### Fuel Injectors (#1, #2: Service Code 41, 42)

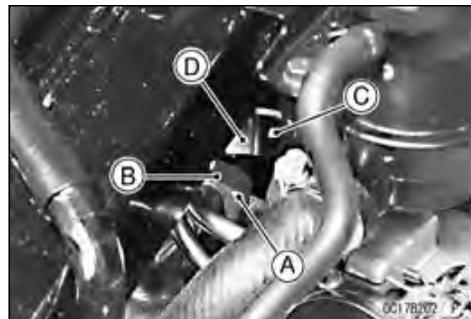
- Apply engine oil to the O-ring [A], and install each injector [B] into the delivery joint [C].



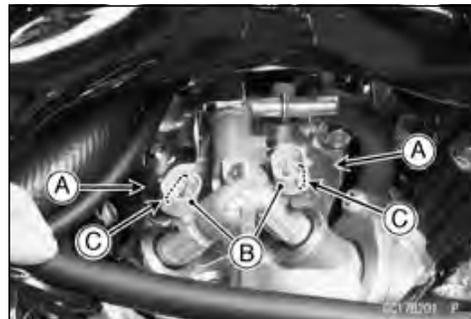
- Check that there is no dirt or dust on the injector seating surface [A] of the inlet manifold [B].
- Check that the two dowel pins [C] are in place in the inlet manifold.
- Fit the end of the injector into the delivery joint [D], and install them into the inlet manifold [B].



- Align the projection [A] on the delivery joint [B] with the hole [C] of the left side bracket [D].



- Fit [A] the connectors [B] of the injector into the bracket recesses [C].
- Tighten the delivery joint screw and bolts securely.



**Fuel Injectors (#1, #2: Service Code 41, 42)**

- Check the injector fuel line for leakage as follows:
  - Connect a commercially available vacuum/pressure pump [A] to the nipple of the delivery pipe [B] with a high-pressure fuel hose [C] (both ends connected with clamps [D]) as shown.

**Torque - Fuel Hose Clamp Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

- Apply a soap and water solution to the areas [E] shown.
- Watching the pressure gauge, squeeze the pump lever [F], and build up the pressure until the pressure reaches the maximum pressure.

**Injector Fuel Line Maximum Pressure**  
**Standard: 300 kPa (3.06 kgf/cm<sup>2</sup>, 43 psi)**

**CAUTION**

**During pressure testing, do not exceed the maximum pressure for which the system is designed.**

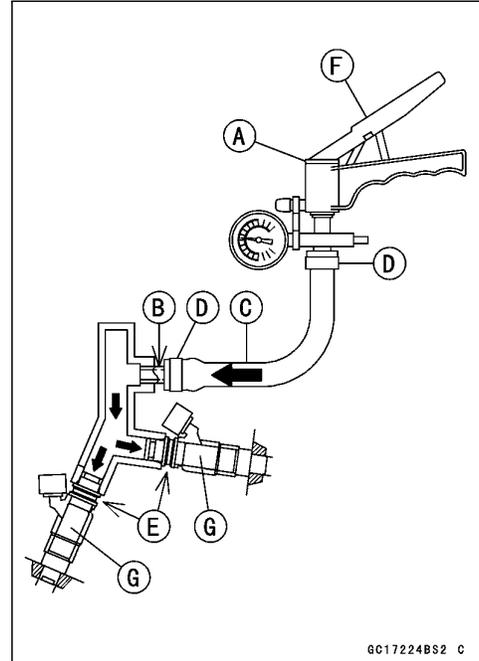
- Watch the gauge for at least 6 seconds.
- ★ If the pressure holds steady, the system is good.
- ★ If the pressure drops at once, or if bubbles are found in the area, the line is leaking. Perform the following as necessary.
- Retighten the fuel hose clamps [D].

**Torque - Fuel Hose Clamp Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

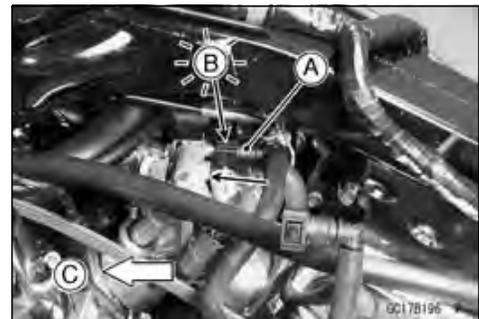
- Replace:
  - O-ring, and Seal Ring of Injectors [G]
- Repeat the leak test, and check the fuel line for no leakage.

- Install the fuel outlet hose (see Fuel Tank Installation).
- Run the hoses correctly (see Cable, Wire, and Hose Routing section in the General Information chapter).

- Fit the fuel hose joint #2 [A] onto the pipe (for delivery joint) until the joint clicks [B].
- Insert the hose joint #2 straight along the pipe. Front [C]



GC17224BS2 C



GC178196

## 3-64 FUEL SYSTEM (DFI)

### Fuel Injectors (#1, #2: Service Code 41, 42)

- Push and pull [A] the fuel hose joint #2 [B] back and forth more than two times and make sure it is locked and doesn't come off. When the fuel hose joint #2 is correctly installed, it should slide on the delivery pipe about 5 mm (0.2 in.).

#### **⚠ WARNING**

**Make sure the fuel hose joint is installed correctly on the delivery pipe by sliding the joint, or the fuel could leak.**

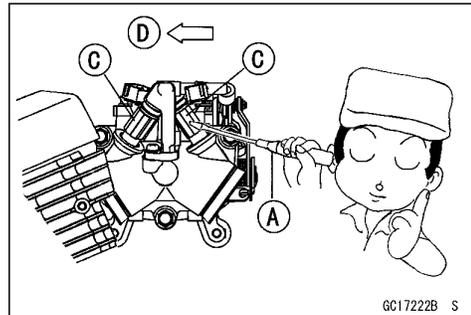
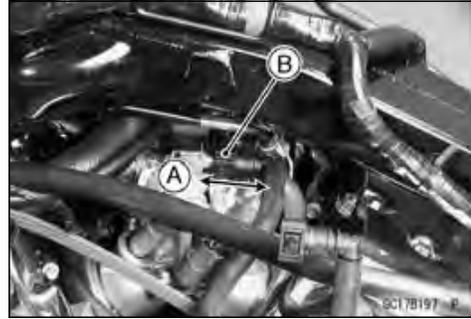
- Install the fuel tank (see this chapter) and connect the battery (-) terminal.

#### *Audible Inspection*

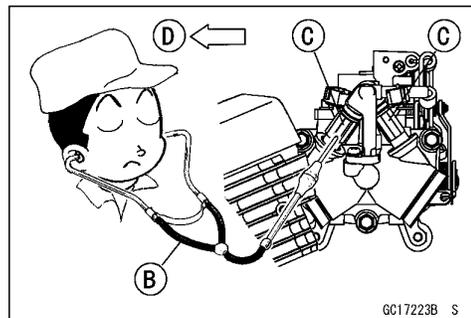
- Remove the left air cleaner housing (see this chapter).
- Start the engine.
- Apply the tip of a screwdriver [A] to the injector [C]. Put the grip end onto your ear, and listen whether the injector is clicking or not.
- A sound scope [B] can also be used.
- Do the same for the other injector.

#### Front [D]

- ★ If all the injectors click at a regular intervals, the injectors are good. The trouble may be related to the fuel line, requiring fuel pressure inspection (see Fuel Line section in this chapter).
- The click interval becomes shorter as the engine speed rises.
- ★ If either injector doesn't click, the DFI circuit or the injector is suspect. Perform "Power Source Voltage Inspection", first.



GC17222B S



GC17223B S

#### *Power Source Voltage Inspection*

#### **NOTE**

○ Be sure the battery is fully charged.

- Turn the ignition SW OFF.
- Remove the coolant reserve tank (see Cooling System chapter).
- Connect a digital voltmeter [B] to the DFI main relay connector [A], using the needle adapter.

Battery [C] in the frame

**Special Tool - Needle Adapter Set: 57001-1457**

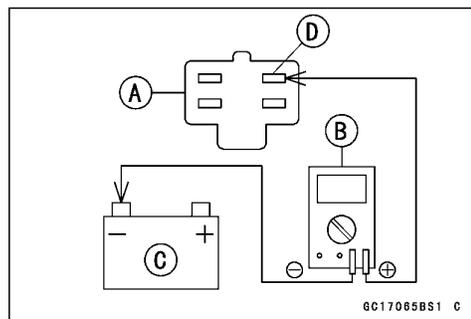
- Measure the power source voltage of the injector with the engine stopped, and with the connectors joined.
- Turn the ignition SW ON.

#### **Injector Power Source Voltage at DFI Main Relay Connections**

**Meter (+) → W/R Lead Terminal [D]**

**Meter (-) → Battery (-) Terminal**

**Standard: Battery Voltage (12.5 V or more)**



GC17065BS1 C

**Fuel Injectors (#1, #2: Service Code 41, 42)**

- ★If the power source voltage is incorrect, check the DFI power source (see DFI Power Source in this chapter). If the DFI power source is good, check the ECU for its ground and power supply. If the ground and power supply of the ECU are good, the ECU is suspect. Replace the ECU.
- ★If the power source voltage is normal, check the output voltage of the injector.

*Output Voltage Inspection*

- Remove the ECU (see ECU section in this chapter). Do not disconnect the ECU connector.
- Measure the output voltage of the injector at the ECU connector in the same way as power source voltage inspection. Note the following.

**Injector Output Voltage at ECU**

**Connections for Injector #1**

- Meter (+)** → BL/R lead (terminal 40)
- Meter (-)** → Battery (-) Terminal

**Connections for Injector #2**

- Meter (+)** → BL/G lead (terminal 39)
- Meter (-)** → Battery (-) Terminal

**Standard: Battery Voltage (12.5 V or more)**

- ★If the output voltage is normal, perform “Injector Signal Test”.
- ★If the output voltage is out of the standard, turn the ignition SW OFF, remove the fuel tank, and check the injector wiring for continuity.

**Injector Wiring Inspection**

ECU Connector	Injector Connectors
Terminal 30 →	Injector #1 Terminal (W/R)
Terminal 30 →	Injector #2 Terminal (W/R)
Terminal 40 →	Injector #1 Terminal (BL/R)
Terminal 39 →	Injector #2 Terminal (BL/G)

- ★If the wiring is good, inspect the resistance of the injectors (see Injector Resistance Inspection in chapter).
- Remove the needle adapter.
- Apply silicone sealant to the seals of the ECU connector for waterproofing.

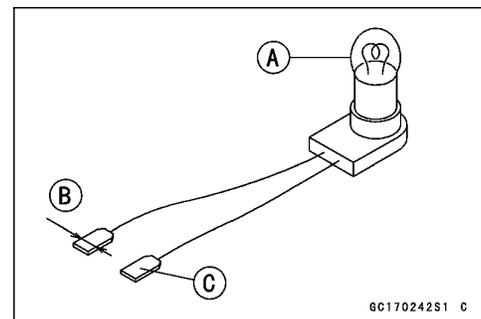
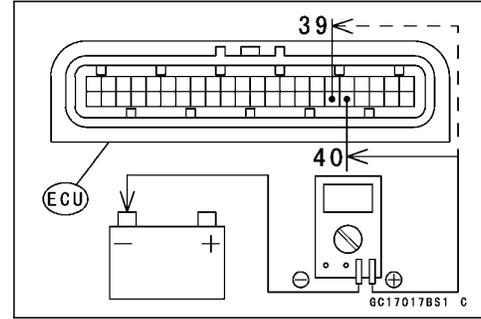
*Injector Signal Test*

- Prepare two test light sets with male terminals as shown.  
 Rating of Bulb [A]: 12 V × 3 ~ 3.4 W  
 Terminal Width [B]: 1.8 mm (0.07 in.)  
 Terminal Thickness [C]: 0.8 mm (0.03 in.)

**CAUTION**

**Do not use larger terminals than specified above. A larger terminal could damage the injector main harness connector (female), leading to harness repair or replacement.**

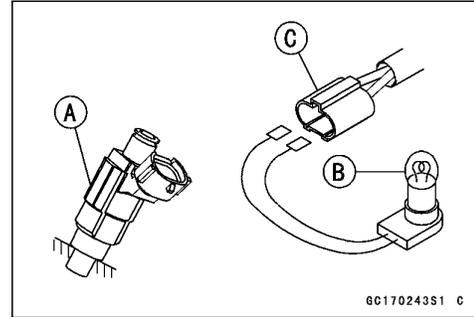
**Be sure to connect bulbs in series. The bulb works as a current limiter to protect the solenoid in the injector from excessive current.**



## 3-66 FUEL SYSTEM (DFI)

### Fuel Injectors (#1, #2: Service Code 41, 42)

- Remove the fuel tank (see this chapter).
- Plug the fuel hose ends.
- Remove connectors for injector [A].
- Connect each test light set [B] to the injector main harness connector [C].
- Connect the battery (-) lead terminal.
- While cranking the engine with the starter motor, watch the test lights.
- ★ If the test lights flicker at regular intervals, the injector circuit in the ECU, and the wiring are good. Perform the "Injector Resistance Inspection".



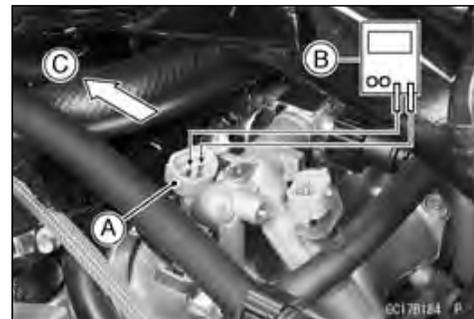
- Injector signals can be also confirmed by connecting the hand tester ( $\times 10$  V AC) instead of the test light set to the injector main harness (female) connector. Crank the engine with the starter motor, and check to see if the needle oscillates at regular intervals.

#### Special Tool - Hand Tester: 57001-1394

- ★ If the test light doesn't flicker (or the tester needle doesn't oscillates), check the wiring and connectors again. If the wiring is good, the ECU is suspect. Replace the ECU.

#### Injector Resistance Inspection

- Remove the fuel tank (see this chapter).
- Disconnect the connector from the injector [A] (see Injector Removal).
- Measure the injector resistance with a digital voltmeter [B].
- Front [C]



#### Injector Resistance

##### Connections to Injector

Meter (+)		Meter (-)
#1: W/R	↔	BL/R Terminal
#2: W/R	↔	BL/G Terminal

**Standard:** 11.7 ~ 12.3  $\Omega$  at 20 °C (68 °F)

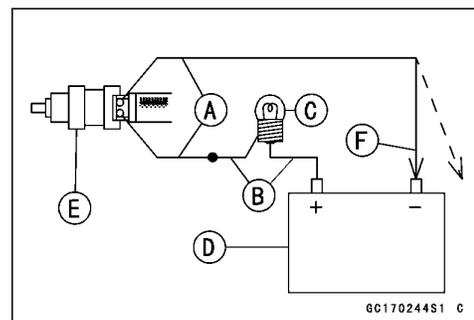
- ★ If the reading is out of the range, perform the "Injector Unit Test".
- ★ If the reading is normal, perform the "Injector Unit Test" for confirmation.

#### Injector Unit Test

- Use two wires [A] and the same test light set [B] as in "Injector Signal Test".
- Rating of Bulb [C]: 12 V  $\times$  (3 ~ 3.4) W
- 12 V Sealed Battery [D]

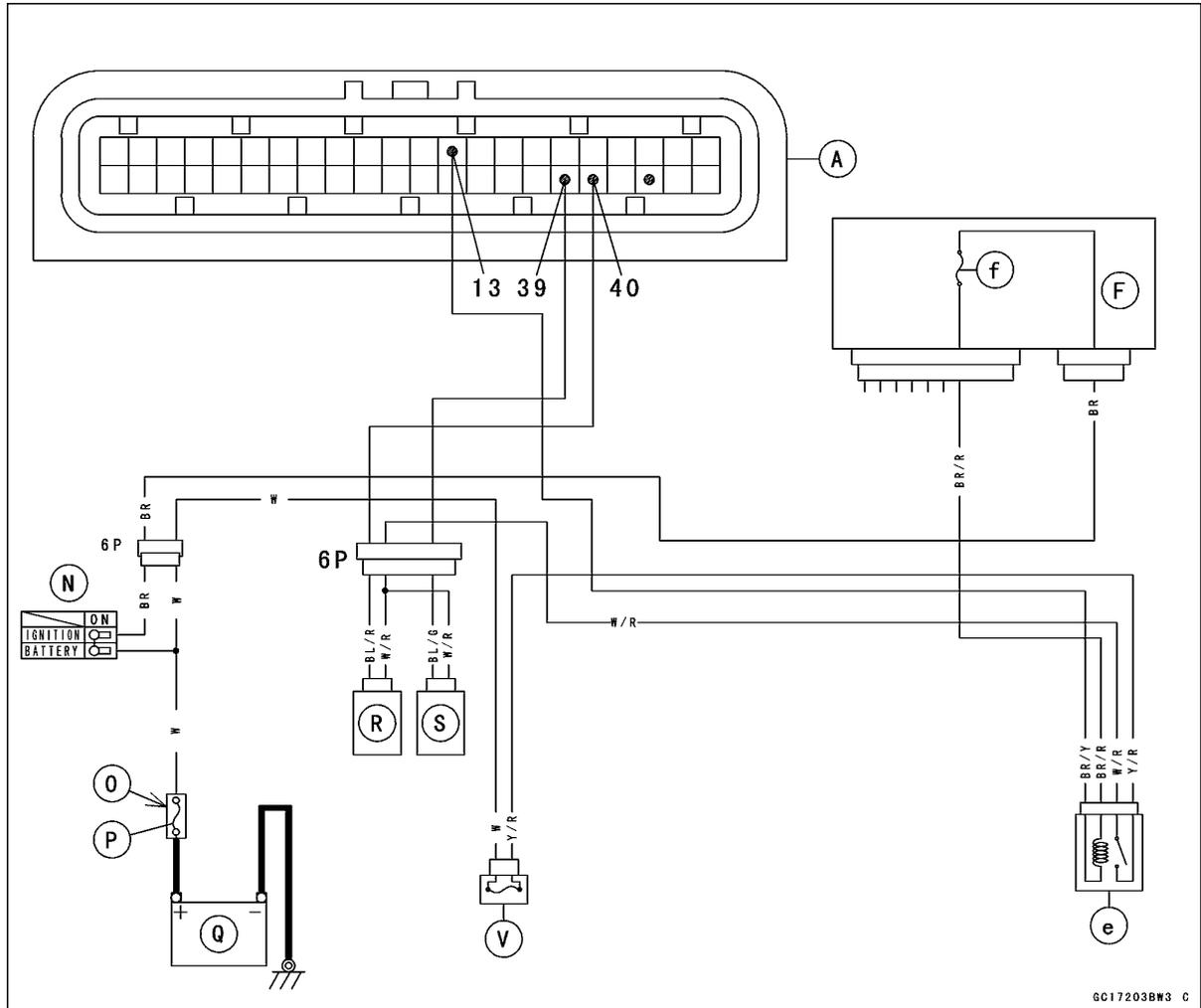
#### CAUTION

**Be sure to connect the bulb in series. The bulb works as a current limiter to protect the solenoid in the injector from excessive current.**



- Connect the test light set to the injector [E] as shown.
- Open and connect [F] the end of the wire to the battery (-) terminal repeatedly. The injector should click.
- ★ If the injector does not click, replace the injector.
- ★ If the injector clicks, check the wiring again. If the wiring is good, replace the injector (may be clogged) or ECU.

Fuel Injectors (#1, #2: Service Code 41, 42)



- A. ECU
- F. Junction Box
- N. Ignition Switch
- O. Starter Relay
- P. Main Fuse 30 A x 32 V
- Q. Sealed Battery

- R. Fuel Injector #1
- S. Fuel Injector #2
- V. DFI Fuse 15 A x 32 V
- e. DFI Main Relay
- f. Ignition Fuse 10 A x 32 V

GC17203BW3 C

## 3-68 FUEL SYSTEM (DFI)

### Fuel Pump (Service Code 45)

#### Fuel Pump Removal

#### CAUTION

Never drop the fuel pump, especially on a hard surface. Such a shock to the pump can damage it.

#### ⚠ WARNING

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

To make fuel spillage minimum, draw the fuel out from the fuel tank when the engine is cold. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

- Remove the fuel tank (see Fuel Tank Removal).
- Be careful of fuel spillage from the fuel tank since fuel still remains in the fuel tank and fuel pump. Plug the fuel pipe of the fuel tank.
- Turn the fuel tank upside down.
- Remove the fuel pump inlet hose.
- Unscrew the fuel pump bolts [A], and take out the fuel pump [B] and gasket.
- Discard the fuel pump gasket.

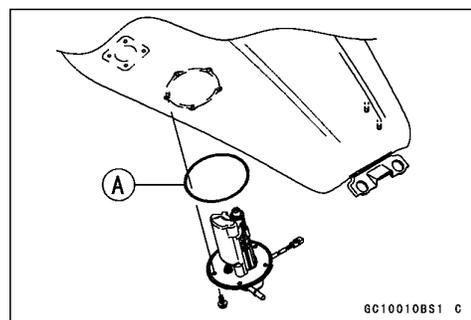
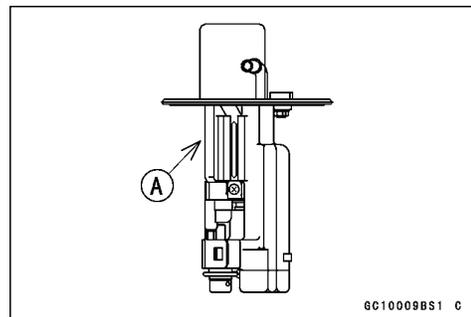
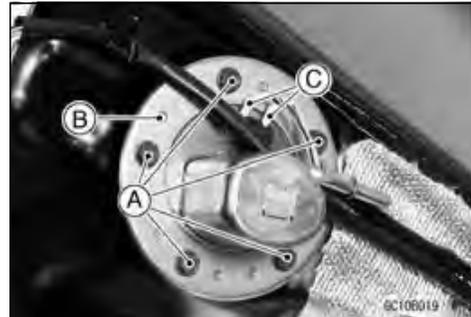
#### CAUTION

Do not pull the leads (C) of the fuel pump. If they are pulled, the lead terminals may be damaged.

#### Fuel Pump Installation

- Remove dirt or dust from the fuel pump [A] by lightly applying compressed air.

- Replace the fuel pump gasket [A] with a new one.



**Fuel Pump (Service Code 45)**

- Check that the fuel pump (-) terminals [A] and band [B] are in place.  
Front [C]
- Apply a non-permanent locking agent to the threads of the fuel pump bolts.
- Tighten the fuel pump bolts to a snug fit, following the tightening sequence shown.
- Following the tightening sequence, tighten the pump bolts to the specified torque.

**Torque - Fuel Pump Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**

- Tighten the pump bolts again to check the tightness in the order shown.

*Pressure Regulator Removal*

- The pressure regulator [A] is built into the fuel pump [B] and cannot be removed.

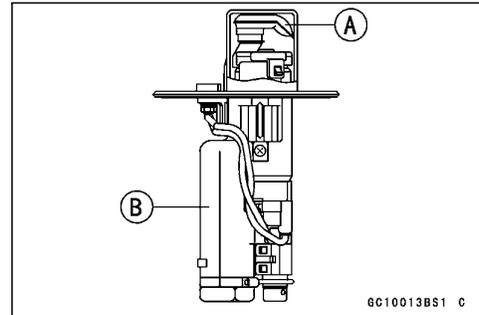
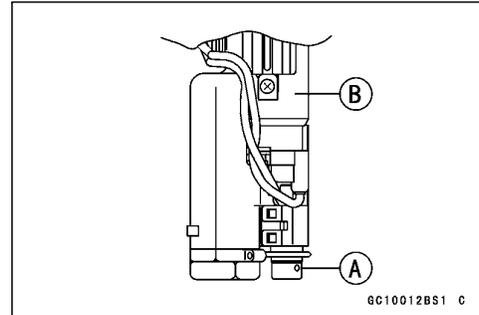
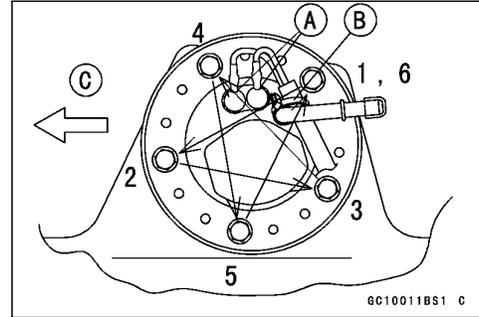
*Pump Screen, Fuel Filter Cleaning*

- The pump screen [A] and fuel filter [B] are built into the pump and cannot be cleaned or checked.
- ★ If the pump screen or fuel filter is suspected of clogging or being damaged, replace it with the fuel pump as a set.

*Operation Inspection*

**NOTE**

- Be sure the battery is fully charged.
- Just listen to the pump sound in the fuel tank to confirm pump operation.
- Turn the ignition SW ON and make sure that the fuel pump operates (make light sounds) for 3 seconds, and then stops.
- Turn the ignition SW OFF.
- ★ If the pump does not work as described above, inspect the power source voltage.



## 3-70 FUEL SYSTEM (DFI)

### Fuel Pump (Service Code 45)

#### Operating Voltage Inspection

##### NOTE

○ Be sure the battery is fully charged.

- Turn the ignition switch OFF.
- Remove the seat (see Frame chapter).
- Connect the hand tester (25 V DC) to the fuel pump connector [A] with needle adapter set.

**Special Tools - Hand Tester: 57001-1394**

**Needle Adapter Set: 57001-1457**

- Measure the operating voltage with the engine stopped, and with the connector joined.
- Turn the ignition switch ON.
- The tester needle should indicate battery voltage for 3 seconds, and then 0 V.

#### Pump Operating Voltage at Pump

##### Connections to Pump Connectors

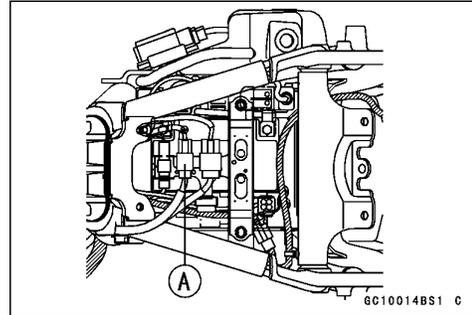
Tester (+) → Y/R Lead

Tester (-) → BK/W Lead

##### Operating Voltage at Pump Connector

**Standard: Battery Voltage (12.6 V or more) for 3 seconds, and then 0 V.**

- ★ If the reading stays on battery voltage, and never shows 0 V. Check the ECU and fuel pump relay.
- ★ If the voltage is in specification, but the pump doesn't work, replace the pump.
- ★ If there is still no battery voltage, check the pump relay (see this chapter).



**Fuel Pump (Service Code 45)**

*Power Source Voltage Inspection*

**NOTE**

○ Be sure the battery is fully charged.

- Remove the seat (see Frame chapter).
- Connect a digital voltmeter [A] to the fuel pump connector [B] (2P), using the needle adapter [C].

**Special Tool - Needle Adapter Set: 57001-1457**

- Measure the power source voltage with the engine stopped, and with the pump connector joined.
- Turn the ignition SW ON.

**Pump Power Source Voltage**

**Connections to Pump Connector**

Tester (+) → Y/R lead [D]

Tester (-) → Battery (-) Terminal [E]

**Standard: Battery Voltage (12.5 V or more)**

Fuel Pump [F]

★ If the reading is good, the power source voltage is normal.  
Inspect operating source voltage (see in this section).

★ If the reading is incorrect, check the following:

Battery

Main Fuse 30 A in Starter Relay (see Electrical System chapter)

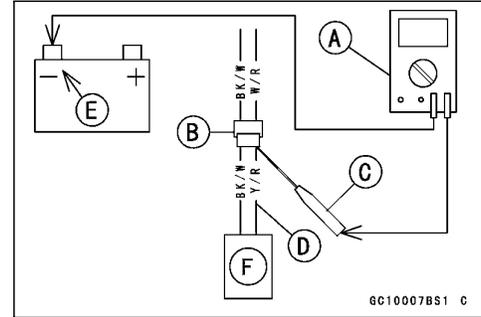
DFI Fuse 15 A (see this chapter)

Ignition Fuse 10 A in Junction Box (see Electrical System chapter)

DFI Main Relay (see this chapter)

Wiring for Fuel Pump Power Source (see next diagram)

Vehicle-down Sensor (see this chapter)



*Operating Voltage Inspection*

**NOTE**

○ Be sure the battery is fully charged.

- Turn the ignition SW OFF.
- Remove the seat (see Frame chapter).
- Measure the operating voltage of the fuel pump at the fuel pump connector [A] with the connector joined.  
Hand Tester [B]  
Needle Adapters [C]

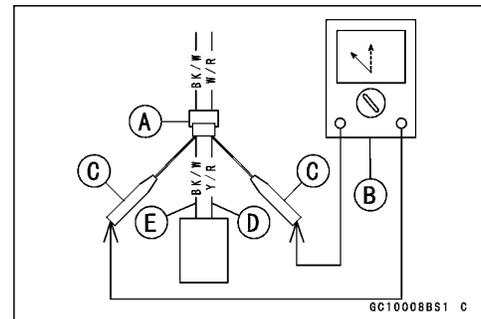
**Pump Operating Voltage at Pump Connector**

**Connections to Pump Connector**

Tester (+) → Y/R lead [D]

Tester (-) → BK/W lead [E]

**Reading: Battery Voltage (12.5 V or more) for 3 seconds, and then 0 V**

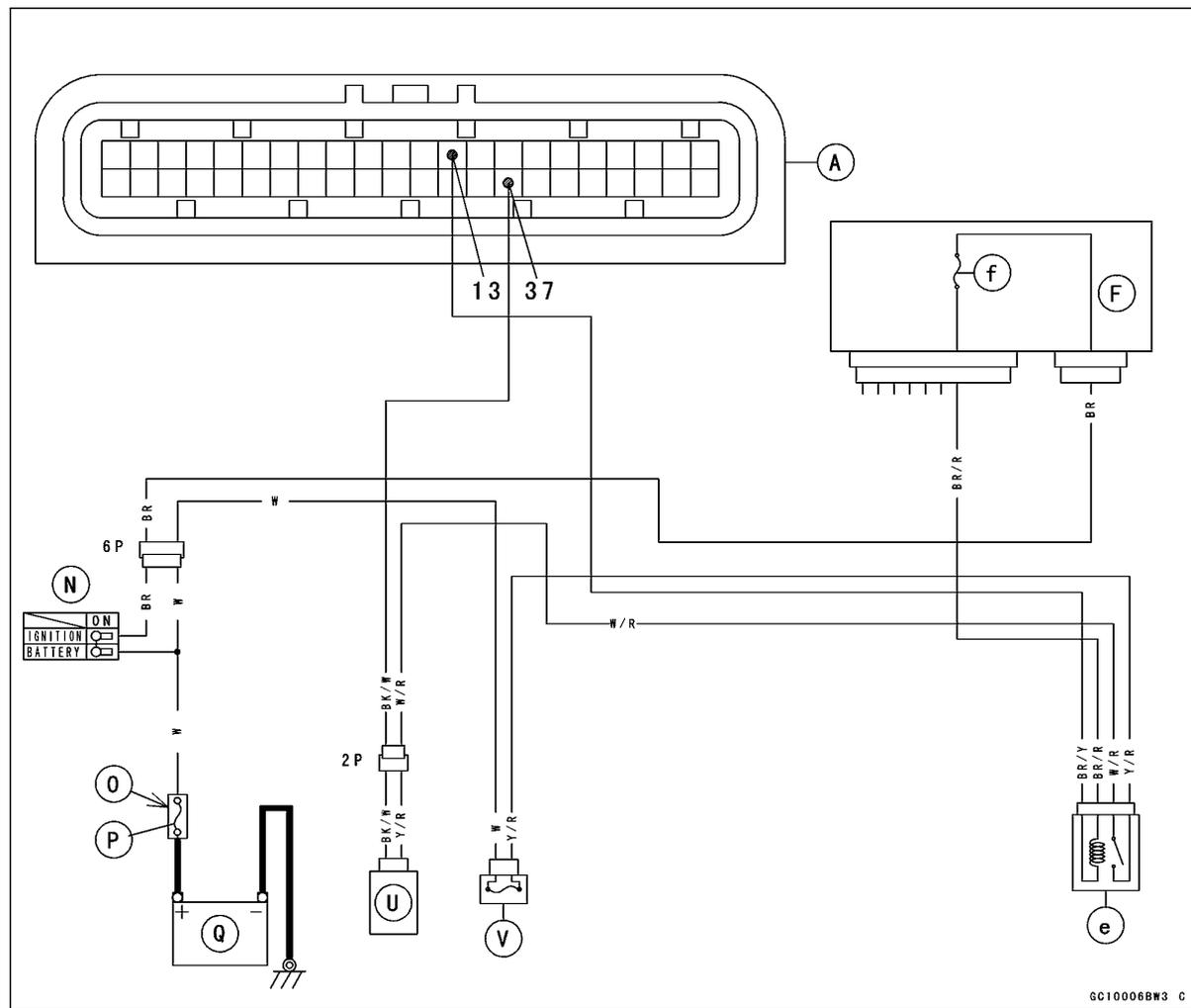


## 3-72 FUEL SYSTEM (DFI)

### Fuel Pump (Service Code 45)

- ★ If the measurement is normal, replace the fuel pump.
- ★ If the measurement stays on the battery voltage or 0 volt, turn the ignition SW OFF, and remove the fuel tank. And inspect the BK/W lead between the ECU connector and the fuel pump for continuity.
- ★ If the wiring is good, inspect the ECU for its ground, and power supply (see ECU section in this chapter). If the ground and power supply are good, the ECU is suspect. Replace the ECU.
- After inspection, remove the needle adapter, and apply silicone sealant to the seal of the connector for water-proofing.

#### Silicone Sealant (Kawasaki Bond: 56019-120) - Sealing of Fuel Pump Connector



A. ECU  
F. Junction Box  
N. Ignition Switch  
O. Starter Relay  
P. Main Fuse 30 A x 32 V

Q. Sealed Battery  
U. Fuel Pump  
V. DFI Fuse 15 A x 32 V  
e. DFI Main Relay  
f. Ignition Fuse 10 A x 32 V

## Ignition Coils (#1, #2: Service Code 51, 52)

Ignition Coil #1: Ignition Coil for Front Cylinder (Service Code 51)

Ignition Coil #2: Ignition Coil for Rear Cylinder (Service Code 52)

### Removal/Installation

#### CAUTION

**Never drop the ignition coils, especially on a hard surface. Such a shock to the ignition coil can damage it.**

- See Ignition Coil Removal/Installation of the Ignition System section in the Electrical System chapter.

### Input Voltage Inspection

#### NOTE

○ Be sure the battery is fully charged.

- Turn the ignition SW OFF.
- Remove the ECU (see this chapter). Do not disconnect the ECU connector.
- Connect a digital voltmeter [A] as shown, using two needle adapters [B].
- Measure the input voltage to each primary winding of the ignition coils with the engine stopped, and with the connectors joined.
- Turn the ignition SW ON.

#### Ignition Coil Input Voltage at ECU

##### Connections for Ignition Coil #1

**Meter (+) → BK lead (terminal 44)**

**Meter (-) → Battery (-) Terminal**

##### Connections for Ignition Coil #2

**Meter (+) → BK/G lead (terminal 43)**

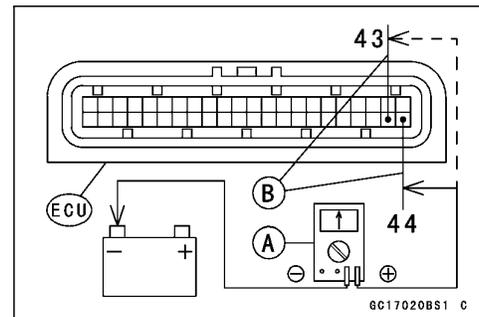
**Meter (-) → Battery (-) Terminal**

#### Standard: Battery Voltage (12.5 V or more)

- ★ If the reading is out of the standard, check the ECU for its ground and power supply (see ECU section).
- ★ If the reading is good remove the fuel tank and check the wiring between the ECU and the primary lead terminals at the ignition coils.
- ★ If the wiring is good, crank the engine, and check the peak voltage of the ignition coils (see Electrical System chapter) in order to check the primary coils.
- Remove the needle adapters.
- Apply silicone sealant to the seals of the connector for waterproofing.

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

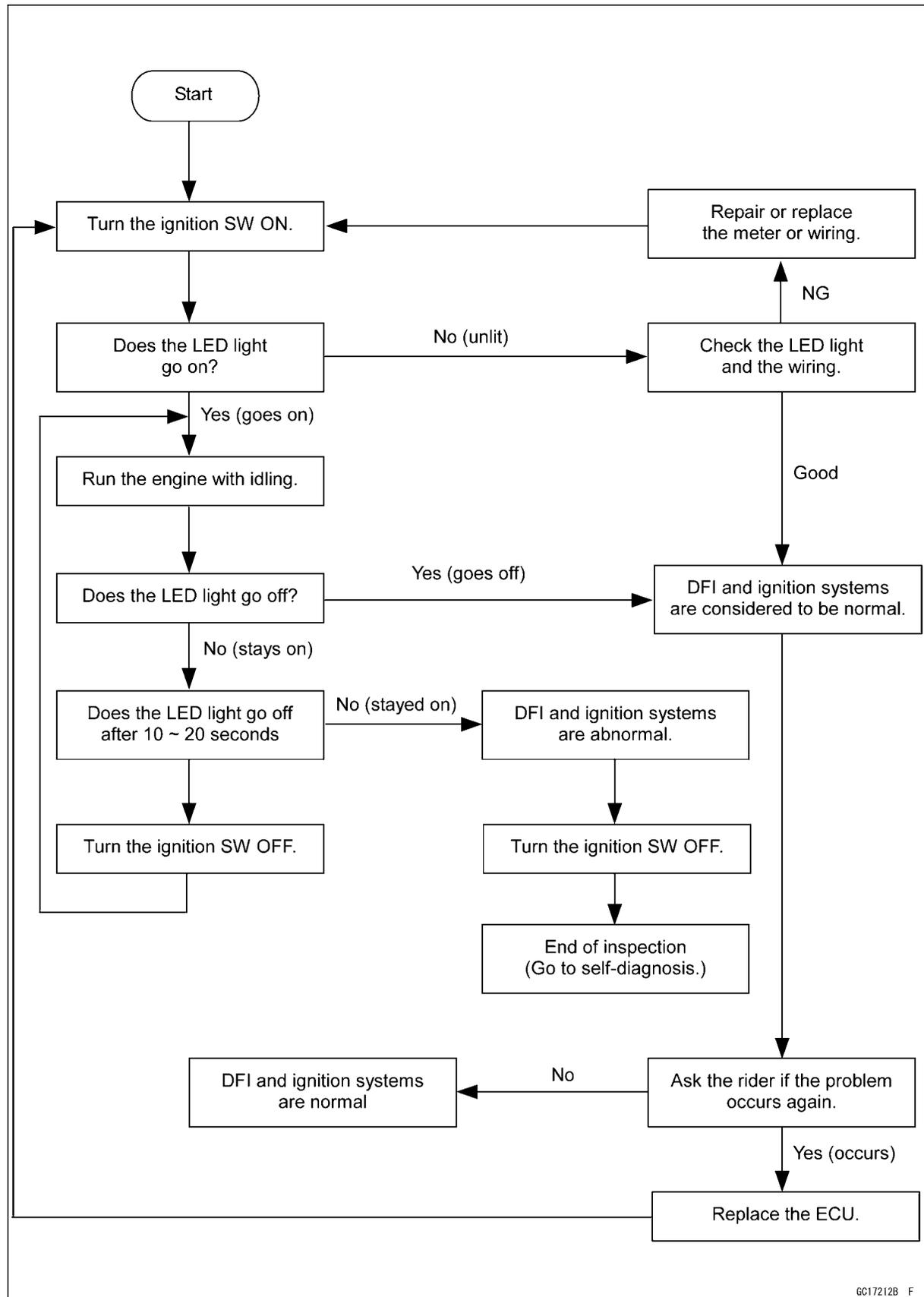
- ECU Connector Seals



# 3-74 FUEL SYSTEM (DFI)

## FI Indicator LED Light

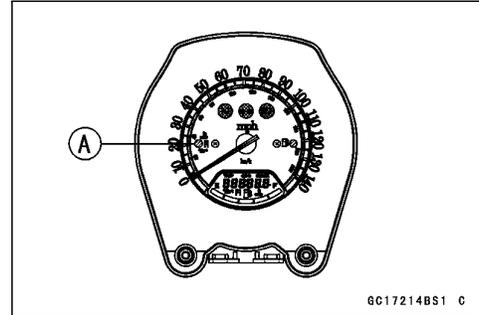
### Inspection Flow Chart



## FI Indicator LED Light

### LED Light Inspection

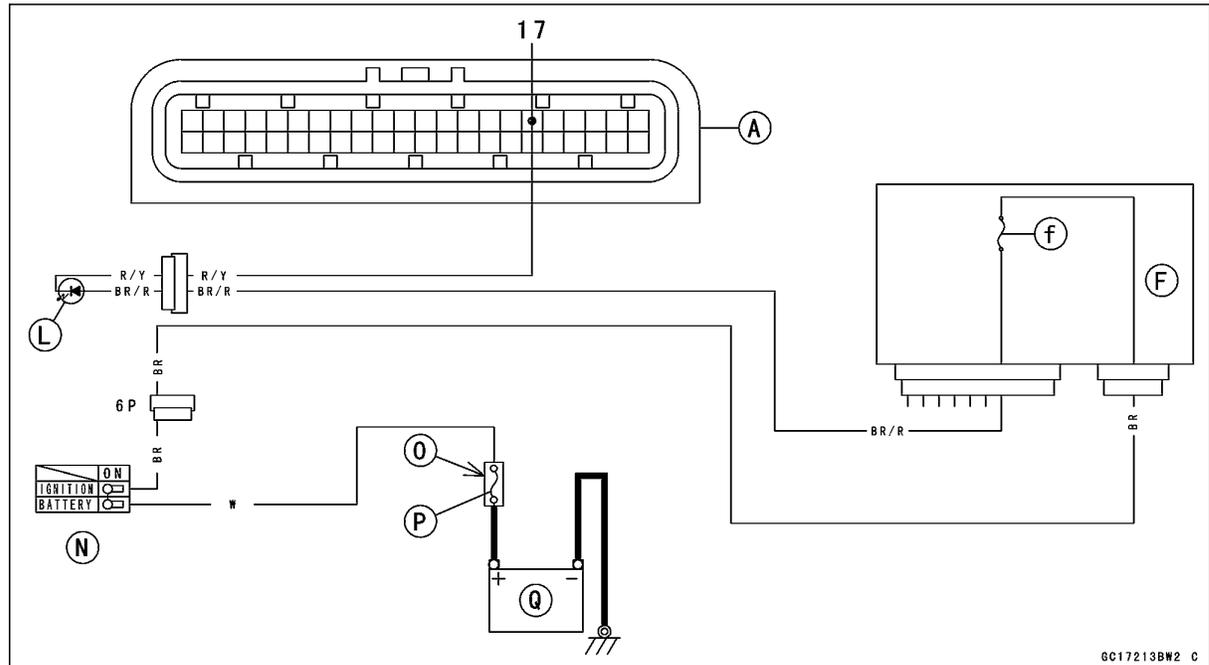
- The FI indicator LED light [A] goes ON when the ignition SW is turned ON and the LED light goes OFF when the engine oil pressure is high enough (the engine is running). This is to ensure that the FI indicator LED light has not burned out and the DFI system and the ignition system function properly.
- Refer to the Meter, Gauge section in the Electrical System chapter for LED Light Inspection.



### ⚠ WARNING

**This inspection may produce sparks. Keep the battery and the meter unit away from the fuel tank.**

- ★If the LED light is subnormal, replace the meter unit.
- ★If the FI indicator LED light is normal, the wiring or ECU has trouble. Check the wiring (see next diagram). If the wiring is good, check the ECU for its ground and power supply (see ECU section).



A. ECU  
 F. Junction Box  
 L. FI Indicator LED Light  
 N. Ignition Switch

O. Starter Relay  
 P. Main Fuse 30 A x 32 V  
 Q. Sealed Battery  
 f. Ignition Fuse 10 A x 32 V

## 3-76 FUEL SYSTEM (DFI)

### ECU

#### ECU Identification

○Most countries have their own regulations, so each ECU has different characteristic of fuel injection according to each country. So, do not confuse ECU's with each other and use only the ECU's for your country. Otherwise, the motorcycle could not clear the emission regulation.

#### ECU Identification

Models	Type [A]	Part No. [B]
CN and US	F8T97371	21175-1099
EU	F8T97372	21175-1100
AU	F8T97372	21175-1100

CN: Canadian Model

US: United States of America Model

EU: European Model

AU: Australian Model

#### ECU Removal

#### CAUTION

**Never drop the ECU, especially on a hard surface. Such a shock to the ECU can damage it.**

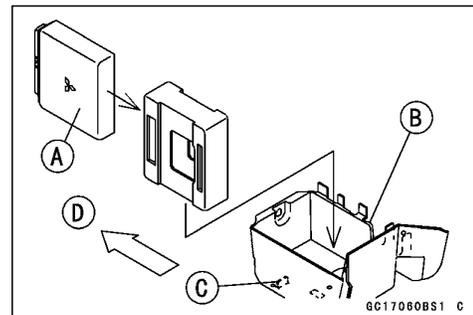
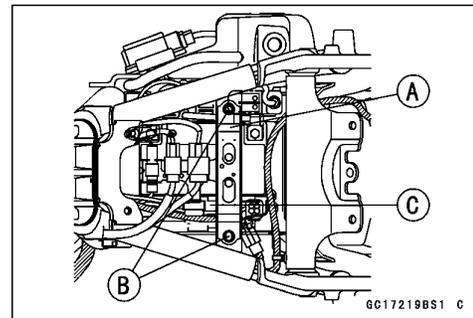
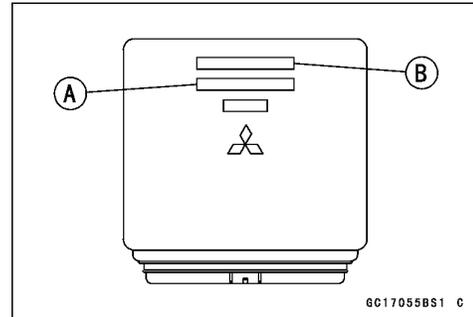
- Remove:
  - Seat (see Frame chapter)
  - Battery Holder [A] and Bolt [B]
- Pull the ECU [C] out along with the harness.
- ★ If necessary, push the lock and disconnect the ECU connectors.

#### ECU Installation

- Connect the ECU connector.
- Fit the ECU [A] in behind the left side rib [C] of the battery case [B] until the ECU bottoms. Front [D]

#### ECU Power Supply Inspection

- Visually inspect the terminals of the ECU connector.
- ★ If the connector is clogged with mud or dust, blow it off with compressed air.
- ★ Replace the main harness if the terminals [A] of the main harness connectors are cracked, bent, or otherwise damaged.
- ★ Replace the ECU if the terminals of the ECU connector are cracked, bent, or otherwise damaged.



**ECU**

- With the ECU connector [A] joined, check the following ground leads for continuity with the ignition SW ON or OFF, using a digital voltmeter [D].

**ECU Grounding Inspection**

**Meter Connections:**

- 10, 20, 32, or 42 (BK/Y) Terminal ↔ Battery (-) Terminal
- 21 (BR/BK) Terminal ↔ Battery (-) Terminal
- Engine Ground Terminal [B] ↔ Battery (-) Terminal

**Readings: 0 Ω (regardless of the ignition SW ON or OFF)**

- ★ If no continuity, check the connector, the engine ground lead, or main harness, and repair or replace them if necessary.

Battery [C] in the Frame

**Special Tool - Needle Adapter Set: 57001-1457**

- Check the power source voltage of the ECU with a digital voltmeter.

**ECU Power Source Inspection**

**Meter Connection: between 30 (W/R) Terminal and Battery (-) Terminal**

**Ignition SW OFF: 0 V**

**Ignition SW ON: Battery Voltage (12.5 V or more)**

- ★ If the voltmeter does not read as specified, check the following:

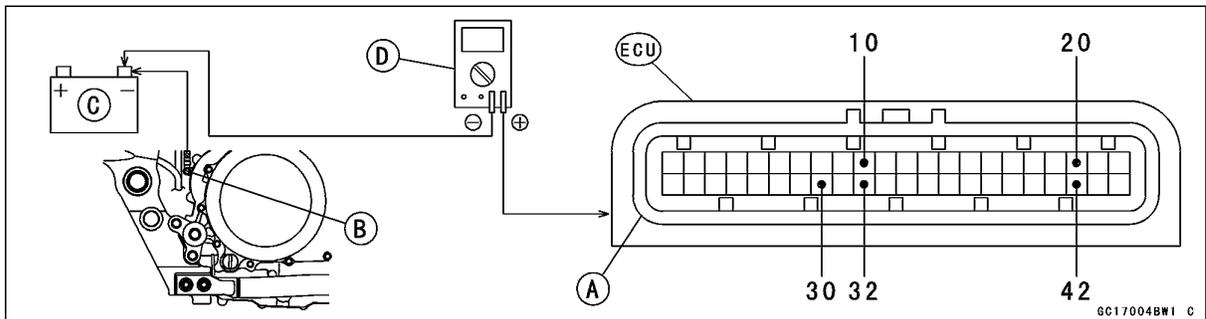
Power Source Wiring (see wiring diagram of DFI Power Source section in this chapter).

DFI Fuse 15 A (see DFI Power Source section)

DFI Main Relay (see DFI Power Source section)

Ignition Fuse 10 A (see Electrical System chapter)

- ★ If the inspection checks good, the ECU is damaged. Replace the ECU. The ECU itself cannot be checked or serviced.



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## 3-78 FUEL SYSTEM (DFI)

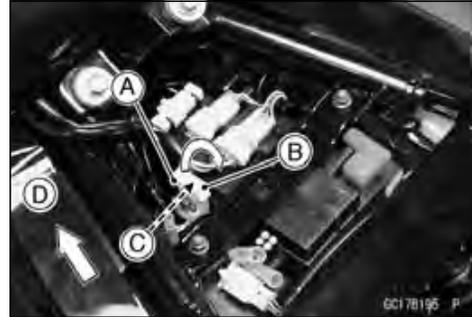
### DFI Power Source

#### DFI Fuse Removal

- Remove the seat (see Frame chapter).
- Pull the lock [A] and open the lid [B].
- Pull out the DFI fuse [C] from the case with needle nose pliers.

Front [D]

- ★ If a fuse fails during operation, inspect the DFI system to determine the cause, and then replace it with a new fuse of proper amperage.



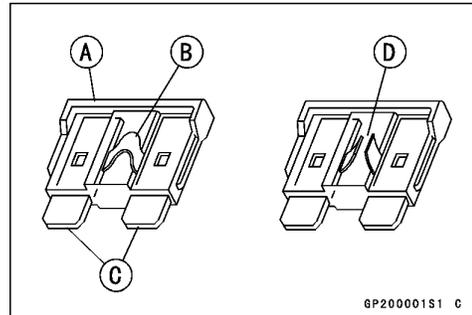
#### DFI Fuse Inspection

- Remove the fuse (see DFI Fuse Removal).
- Inspect the fuse element.
- ★ If it is open, 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] and Blown Element [D]

Terminals [C]



#### CAUTION

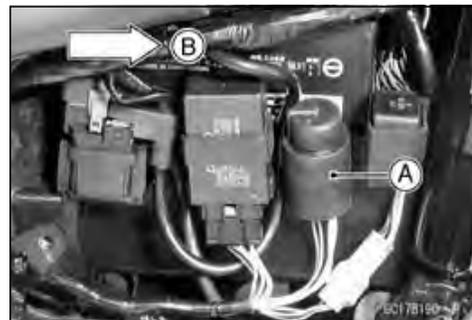
When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Do not use a fuse rated for other than amperage and voltage specified in the Wiring Diagram.

#### DFI Main Relay Removal

#### CAUTION

Never drop the relay, especially on a hard surface. Such a shock to the relay can damage it.

- Remove:
    - Right Side Cover (see Frame chapter)
    - Coolant Reserve Tank (see Coolant System chapter)
  - Remove the DFI main relay [A] and disconnect the connector.
- Front [B]



#### DFI Main Relay Inspection

- Remove the DFI main relay (see above).
- Connect the hand tester [A] and one 12 V battery [B] to the relay connector [C] as shown.

**Special Tool - Hand Tester: 57001-1394**

Relay Coil Terminals [1] and [2]

Relay Switch Terminals [3] and [4]

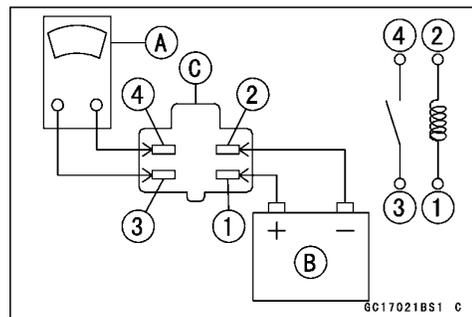
#### Testing Relay

**Tester range: 1  $\Omega$  range**

**Criteria: When battery is connected  $\rightarrow$  0  $\Omega$**

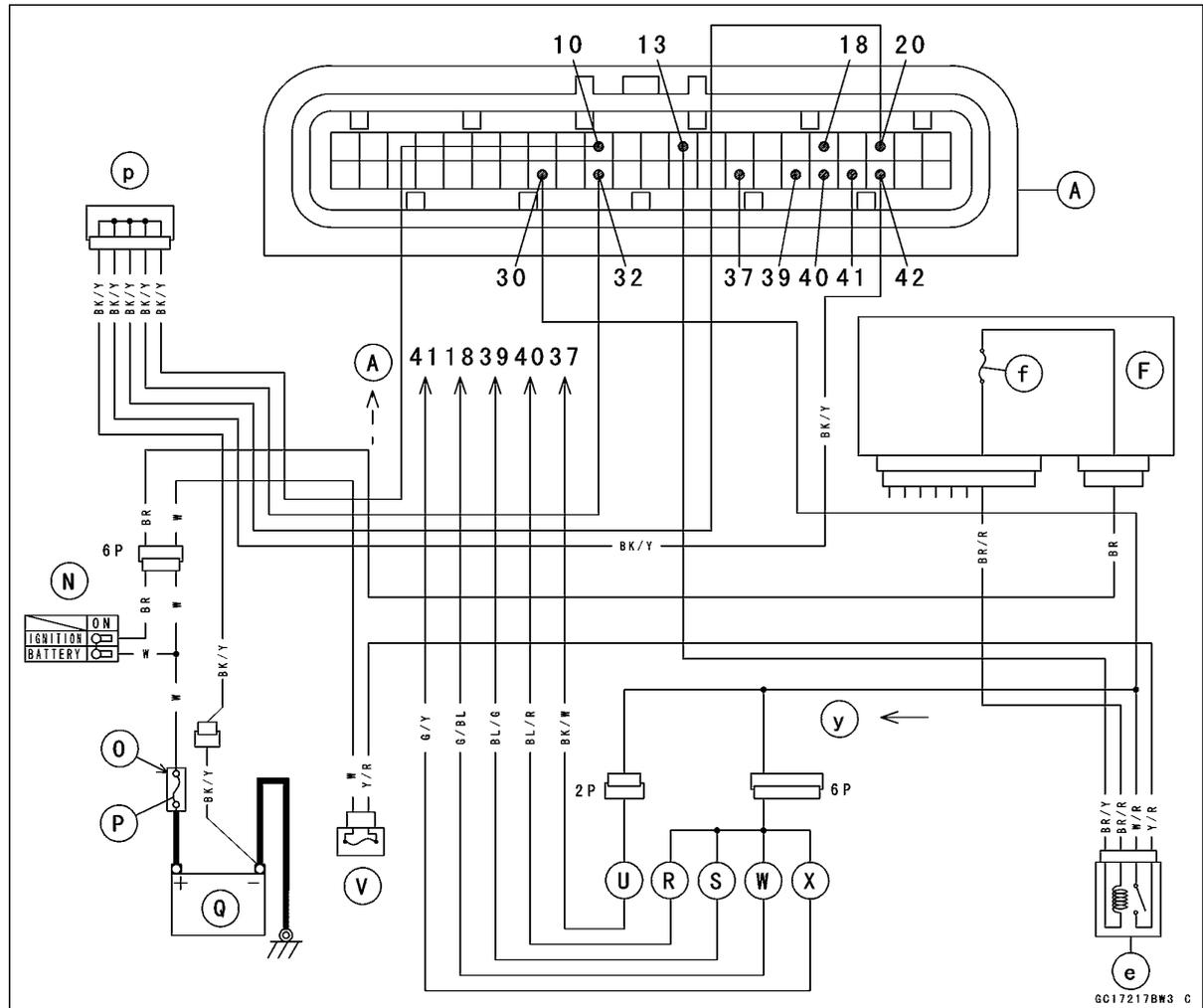
**When battery is disconnected  $\rightarrow$   $\infty$   $\Omega$**

- ★ If the relay does not work as specified, replace the relay.



DFI Power Source

DFI Power Source Circuit



A. ECU  
 F. Junction Box  
 N. Ignition SW  
 O. Starter Relay  
 P. Main Fuse 30 A

Q. Sealed Battery  
 R. Fuel Injector #1  
 S. Fuel Injector #2  
 U. Fuel Pump  
 V. DFI Fuse 15 A

W. ISC Valve #1  
 X. ISC Valve #2  
 e. DFI Main Relay  
 f. Ignition Fuse 10 A  
 y. Actuators : R, S, U, W, X  
 p. Joint Connector 2

GC17217BW3 C

## 3-80 FUEL SYSTEM (DFI)

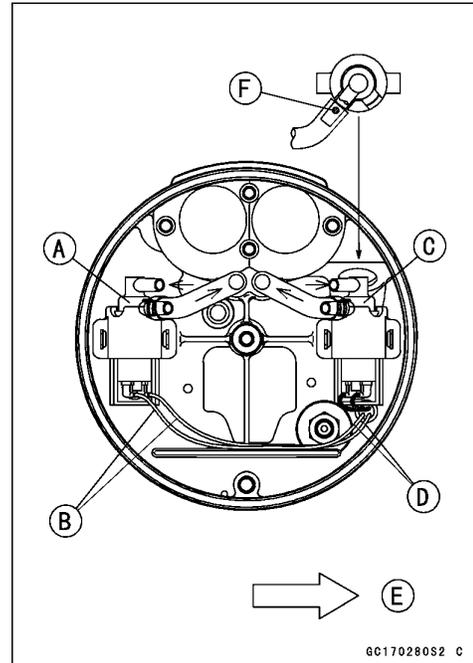
### ISC Valves

#### Removal/Installation

#### CAUTION

**Never drop the ISC valves, especially on a hard surface. Such a shock to the valve can damage it.**

- The ISC valves are removed during right air cleaner housing removal (see this chapter).
- The ISC valve itself is the same for front and rear, but wiring is different. Be careful not to reverse the leads.
  - ISC Valve #2 [A] → G/Y, W/R leads [B]
  - ISC Valve #1 [C] → G/BL, W/R leads [D]
  - Front [E]
- Install the ISC hoses as shown.
  - ISC Hose #2 with the red paint mark on the top
  - ISC Hose #1 with the blue paint mark [F] on the top



#### Power Source Voltage Inspection

#### NOTE

- Be sure the battery is fully charged.
- The inspection is the same as "Power Source Voltage Inspection" of the fuel pump.

- Turn the ignition SW OFF.
- Remove the right air cleaner cover (see this chapter).
- Connect a digital voltmeter [A] to the connectors [B] of each ISC valve.
- Measure the power source voltage with the engine stopped, and with the connectors joined.
- Turn the ignition SW ON.

#### Power Source Voltage at ISC Valve Connector

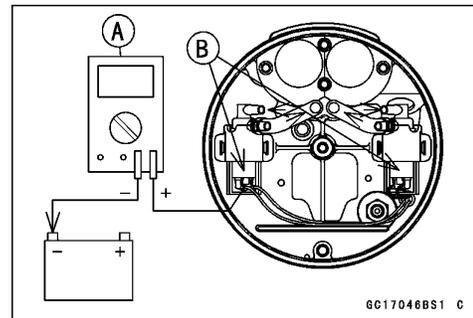
##### Connections to ISC Valve #1, #2

**Meter (+) → W/R Lead Terminal**

**Meter (-) → Battery (-) Terminal**

##### Standard: Battery Voltage (12.5 V or more)

- Turn the ignition SW OFF.
- ★ If there is no battery voltage, check the DFI power source circuit (see DFI Power Source section in this chapter).
- ★ If the reading is normal, the power supply voltage is normal. Check the output voltage.



## ISC Valves

### Output Voltage Inspection

- Check the output voltage at the connectors [A] of the ISC Valves.
- Remove the right air cleaner cover (see this chapter).

**Special Tool - Hand Tester [B] : 57001-1394**

- Measure the output voltage with the engine stopped, and with the connector joined.
- Turn the ignition SW ON.

### Output Voltage of ISC Valves

#### Connections for ISC Valve #2 [C]

Tester (+) → W/R lead

Tester (-) → G/Y lead

#### Connections for ISC Valve #1 [D]

Tester (+) → W/R lead

Tester (-) → G/BL lead

**Reading: The needle points battery voltage (12.5 V or more) and 11 seconds later 0 V.**

- ★ If the reading is incorrect, check the resistance of the ISC valve (see Resistance Inspection in this section).
- ★ If the reading of the resistance is normal, check the wiring for continuity (see next diagram).
- ★ If the wiring is normal, check the ECU for its ground, and power supply (see this chapter).

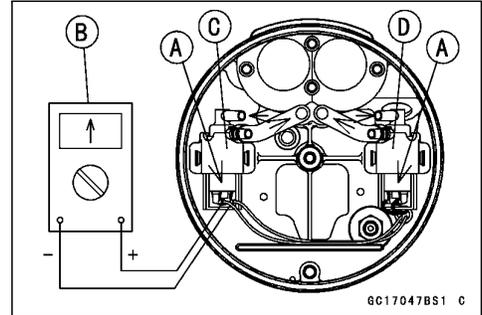
### Resistance Inspection

- Disconnect the connectors from the ISC valve.
- Measure the resistance between the terminals of the ISC valve with a digital volt meter.

#### ISC Valve Solenoid Resistance (#1, #2)

**Standard: 13.6 ~ 20.4 Ω**

- ★ If the reading is out of the standard range, replace the ISC valve.





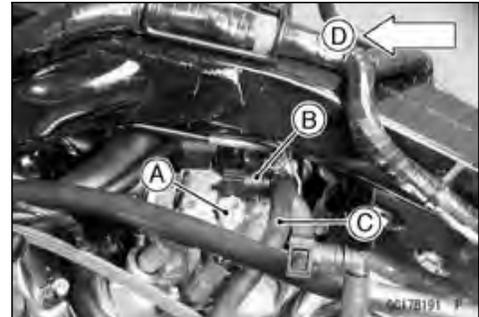
**Fuel Line**

*Fuel Pressure Inspection*

**NOTE**

- This inspection can determine which trouble the DFI system has, mechanical or electrical trouble.
- It is preferable to measure the fuel pressure while running the motorcycle when the trouble has occurred in order to know symptom well.
- Be sure the battery is fully charged.

- Remove the fuel tank (see this chapter).
- Disconnect the #2 fuel injector connector [A].
- Pinch the lock of the fuel hose joint #2 with fingers, disconnect the joint [B] and take out the fuel hose assy [C].  
Front [D]



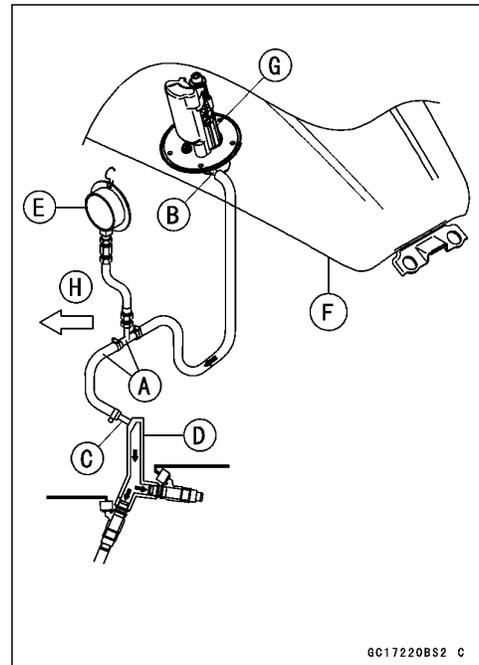
**⚠ WARNING**

**Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe. Cover the hose connection with a clean shop towel to prevent fuel spillage.**

- Install the fuel pressure gauge adapter [A] (special tool) between the fuel tank outlet pipe [B] and the inlet pipe [C] to the delivery joint [D].
- Put the fuel pressure gauge adapter outside the frame.
- Connect the pressure gauge [E] (special tool) to the fuel pressure gauge adapter.  
Fuel Tank [F]  
Fuel Pump [G]  
Front [H]  
→: Fuel Flow

**Special Tools - Fuel Pressure Gauge Adapter: 57001-1417  
Oil Pressure Gauge: 57001-125**

- Temporarily, install the fuel tank.
- Connect:  
Fuel Pump Connector 2P  
Battery Lead (-) Terminal



**⚠ WARNING**

**Do not try to start the engine with the fuel hoses disconnected.**

- Turn the ignition SW ON. The fuel pump will turn for 3 seconds, and then stop.
- Measure the fuel pressure with the engine stopped.

**Fuel Pressure**

**right after Ignition SW ON, with pump running:**

**Standard: 304 kPa (3.1 kgf/cm<sup>2</sup>, 44 psi)**

**after 3 seconds from Ignition SW ON, with pump stopped:**

**Standard: 280 kPa (2.9 kgf/cm<sup>2</sup>, 41 psi, residual fuel pressure)**

**The system should hold the residual pressure about 30 seconds.**

## 3-84 FUEL SYSTEM (DFI)

### Fuel Line

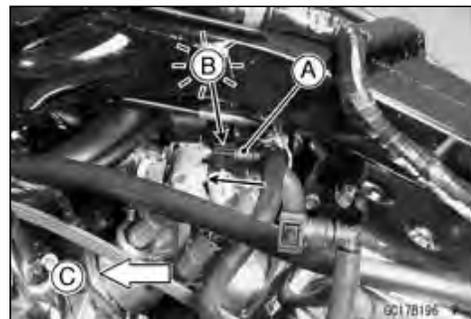
- Start the engine, and let it idle.
- Measure the fuel pressure with the engine idling.

#### Fuel Pressure (idling)

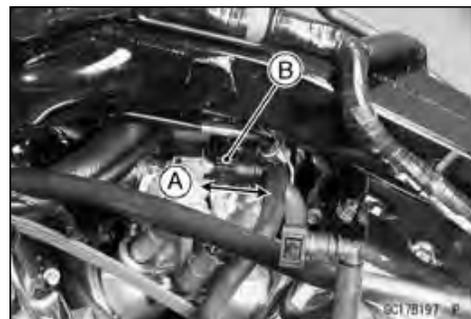
Standard: 304 kPa (3.1 kgf/cm<sup>2</sup>, 44 psi)

#### NOTE

- *The gauge needle will fluctuate. Read the pressure at the average of the maximum and minimum indications.*
- ★ If the fuel pressure is normal, the fuel circulation system (fuel pump, pressure regulator, and oil passage) is no faults. Check the DFI electronic control system (injectors, sensors, crankshaft sensors, and ECU).
- ★ If the fuel pressure is much higher than the specified, check the following:
  - Delivery Pipe Clogging
  - Injector Clogging
- ★ If the fuel pressure is much lower than specified, check the following:
  - Fuel Pump for Operation (check the sound of the pump)
  - Fuel Line Leakage or Clogging
  - Amount of Fuel Flow (see Fuel Flow Rate Inspection)
- ★ If the fuel pressure is much lower than specified, and if inspection above checks out good, replace the fuel pump assy (the fuel filter may be clogged) and measure the fuel pressure again.
- ★ If the residual pressure 260 ~ 280 kPa drops at once, the high pressure fuel line could be leaking.
- Remove the fuel pressure gauge and adapter.
- Run the fuel hoses in accordance with the Cable, Wire, and Hose Routing section in the Appendix chapter
- Fit the fuel hose joint #2 [A] onto the pipe (for delivery joint) until the joint clicks [B].
- Insert the hose joint straight along the pipe.  
Front [C]



- Push and pull [A] the fuel hose joint #2 [B] back and forth more than two times and make sure it is locked and doesn't come off. When the fuel hose joint #2 is correctly installed, it should slide on the delivery pipe about 5 mm (0.2 in.).



#### **⚠ WARNING**

**Make sure the fuel hose joint is installed correctly on the delivery pipe by sliding the joint, or the fuel could leak.**

**Fuel Line**

*Fuel Flow Rate Inspection*

**NOTE**

○ Be sure the battery is fully charged.

**⚠ WARNING**

**Gasoline is extremely flammable and can be explosive under certain conditions. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.**

- Turn both ignition SW, and engine stop SW OFF.
- Wait until the engine cools down.
- Open the fuel tank cap [A] to lower the pressure in the tank.  
Front [B]
- Prepare a plastic hose of the inside diameter 7.5 mm (0.30 in.) × L about 400 mm (15.7 in.) and a measuring cylinder.
- Remove:
  - Seat (see Frame chapter)
  - Meter Cover (see Fuel Tank Removal in this chapter).
  - Fuel Tank Bolts
- Raise the fuel tank.
- Stuff a clean shop towel around the fuel outlet hose joint.
- While pinching the locks of the hose joint #1 with fingers, disconnect the joint (see Fuel Tank Removal) and insert the plastic hose [A] quickly onto the tank outlet pipe.
- Secure the plastic hose with a clamp [B].
- Run the other side of the plastic hose into the measuring cylinder [C].
- Temporarily install the fuel tank and close the fuel tank cap.

**⚠ WARNING**

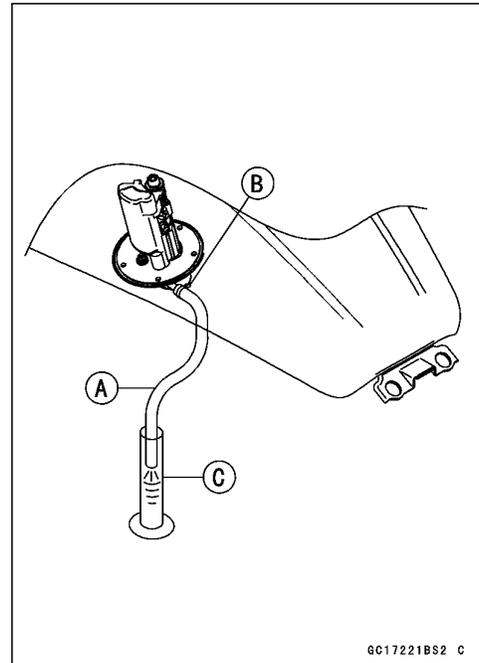
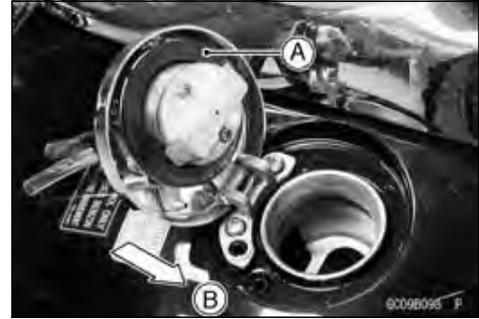
**Wipe off spilled out fuel immediately. Be sure to hold the measuring cylinder vertical.**

- With the engine stopped, turn the ignition SW ON. The fuel pump should operate for 3 seconds, and then should stop. Repeat this several times until the plastic hose is filled with fuel.
- Measure the discharge for 3 seconds with the plastic hose filled with fuel.

**Amount of Fuel Flow**

**Standard: 67 mL (2.27 US oz) or more for 3 seconds**

- ★ If the fuel flow is much less than the specified, check the battery condition (see Electrical System chapter). If the battery is good, replace the fuel pump.
- After inspection, connect the fuel hoses, and install the fuel tank (see Fuel Tank Installation).
- Start the engine and check for no fuel leakage.



## 3-86 FUEL SYSTEM (DFI)

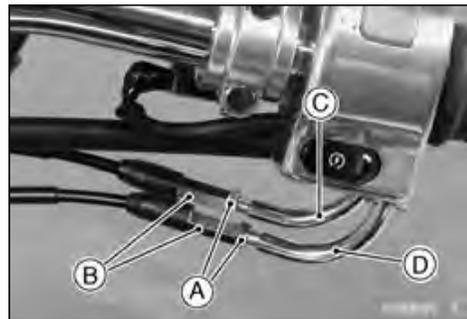
### Throttle Grip and Cables

#### *Throttle Grip Free Play Inspection*

- Refer to Throttle Control System Check in the Periodic Maintenance Chapter.

#### *Throttle Grip Free Play Adjustment*

- Loosen the locknuts [A] and screw the adjusters [B] all the way in so as to give the throttle grip plenty of play.
- Turn out the adjuster of the decelerator cable [C] until there is no play.
- Tighten the locknut against the adjuster.
- Turn the adjuster of the accelerator cable [D] until the proper amount of throttle grip free play is obtained and tighten the locknut against the adjuster.



#### **⚠ WARNING**

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

#### *Choke Knob Operation*

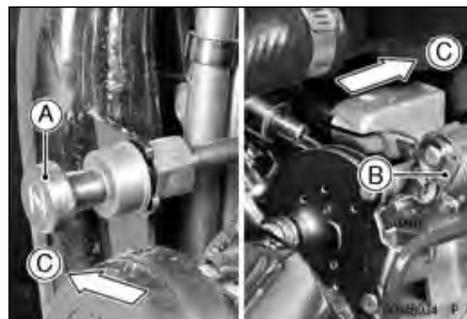
- Do not use the choke knob except when the engine has a starting difficulty, like in cold weather (10°C or below) or at high altitude. The DFI system has an automatic choke system, using ISC valves, a water temperature sensor, and an atmospheric pressure sensor, which provide start ability.

#### **NOTE**

- Pull the choke knob [A] fully when using. The choke lever [B] doesn't work with the choke knob halfway.

Front [C]

- When flooded, do not crank the engine with the throttle fully opened. This promotes engine flooding because more fuel is supplied automatically by the DFI system.



#### *Choke Cable Free Play Inspection*

- Choke cable free play cannot be adjusted.
- Check that the choke inner cable slides smoothly by pulling and pushing the choke knob lightly.
- ★ If there is any irregularity, or the choke lever doesn't work when the choke knob is pulled fully, replace the choke cable.

#### *Cable Removal/Installation*

- See Throttle Assy section in this chapter for removal/installation of the throttle cables and choke cable.

#### *Cable Lubrication and Inspection*

- Whenever the choke cable or the throttle cables are removed or in accordance with the Periodic Maintenance Chart, lubricate these cables. Refer to General Lubrication in the Periodic Maintenance Chapter.
- Use a commercially available pressure cable lubricator to lubricate these cables.
- With the cable disconnected at both ends, the cable should move freely in the cable housing.

## Throttle Body Assy

### Idle Speed Check

- Refer to Idle Speed Check in the Periodic Maintenance Chapter.

### Idle Speed Adjustment

- Refer to Idle Speed Check in the Periodic Maintenance Chapter.

### Throttle Bore Cleaning

- Refer to Throttle Control System Check in the Periodic Maintenance Chapter.

### High Altitude Performance Adjustment

- Any modification is not necessary in this model since the atmospheric pressure sensor senses pressure change due to high altitude and the ECU compensates the change.

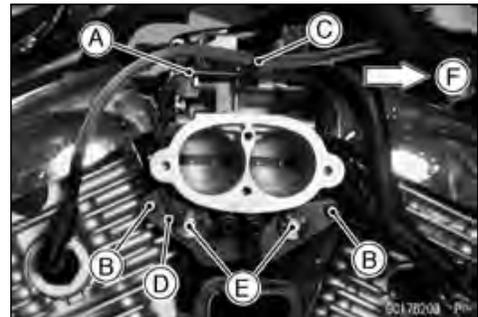
### Throttle Body Assy Removal

- Remove the fuel tank (see this chapter).

#### **⚠ WARNING**

**Gasoline is extremely flammable and can be explosive under certain conditions. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Disconnect the battery (-) terminal. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.**

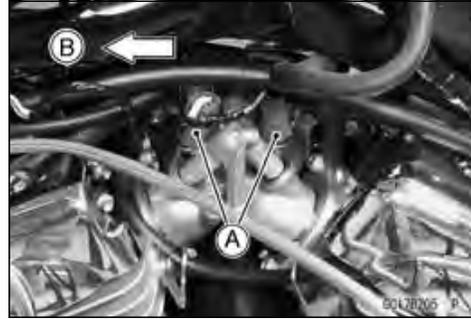
- Remove:
  - Thermostat Housing (see Thermostat Removal in the Cooling System chapter)
  - Right and Left Air Cleaner Base (see this chapter)
  - Right Spark Plug Lead Holder [A] and Bolts [B] and Clamp [C]
  - Throttle Body Assy Holder Bolts [E]
  - Throttle Body Assy Holder [D]
  - Front [F]
- Disconnect:
  - Throttle Sensor Connector [A] (from the throttle sensor)
  - Vacuum Hose [B] from Inlet Air Pressure Sensor
  - Vacuum Hose [C] between Vacuum Switch Valve and Throttle Body Assy



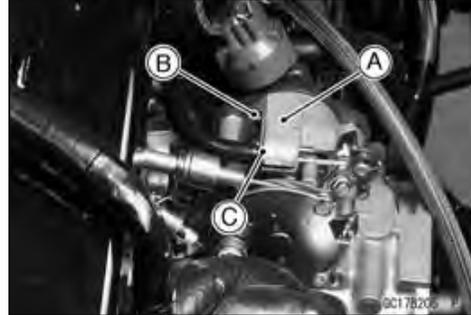
## 3-88 FUEL SYSTEM (DFI)

### Throttle Body Assy

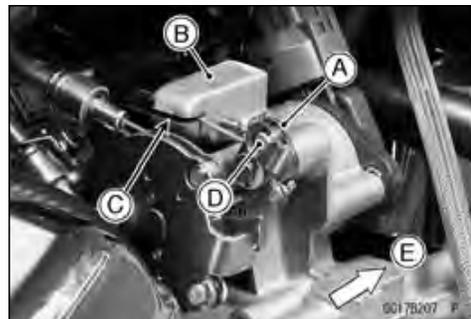
- Disconnect the front and rear injector connectors [A].  
Front [B]



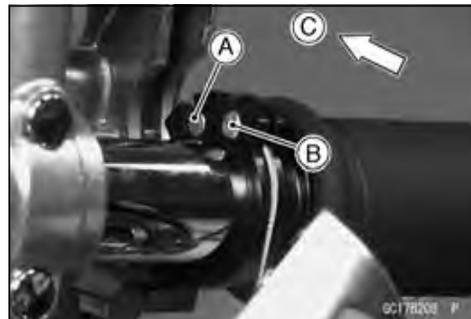
- Remove the following from the choke cable holder [A].  
Screw [B]  
Choke Cable Plate [C]



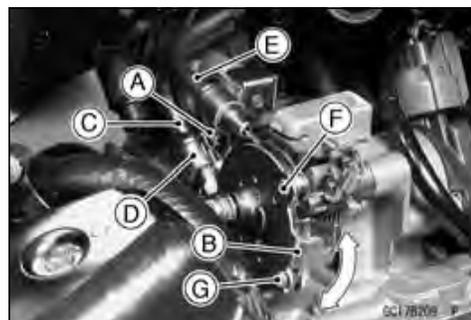
- While pushing the choke lever [A] forward, remove the cable housing from the choke cable holder [B] and the inner cable out of the holder slit [C].
- Take off the lower end [D] from the choke lever.  
Front [E]



- Remove the screws and take off the right switch housing.
- Remove the accelerator cable end [A] and decelerator cable end [B] at the throttle grip.  
Front [C]



- Remove the cable clip [A].
- Turn the throttle pulley [B] as shown, and pull out the accelerator cable housing [C] from the cable holder [D].
- Return the pulley, and pull out the decelerator cable housing [E] from the cable holder.
- Remove the decelerator cable end [F] and the accelerator cable end [G] from the throttle pulley [B].

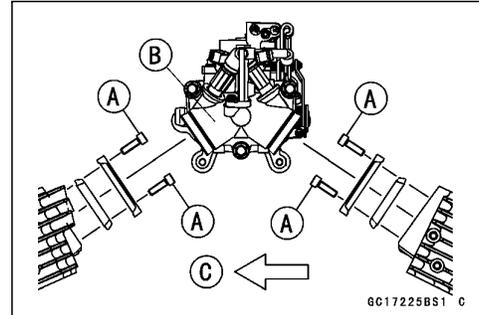


## Throttle Body Assy

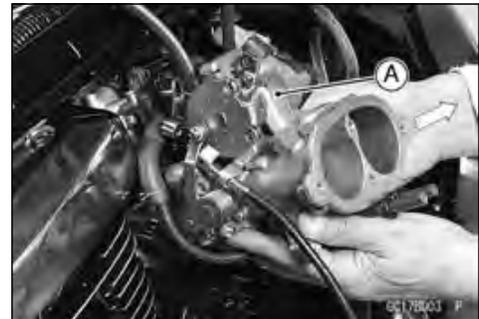
- Pinch the lock of the fuel hose joint #2 [A] with your fingers, pull the joint #2 out along the pipe (for delivery joint), and take out the fuel hose assy [B].  
Front [C]



- Unscrew the inlet manifold bolts [A].  
Inlet Manifold [B]  
Front [C]



- Take out the throttle body assy [A] from the right side, while tilting it up.
- Be careful not to damage (dent, nick, flaw, and crack) the flange mating surface and the plastic parts.
- Do not drop the throttle body assy, especially on a hard surface.



**⚠ WARNING**

The throttle body assy should never be allowed to fall. Throttle may become stuck, possibly causing an accident.

- Stuff a piece of lint-free, clean cloth into the throttle body assy, and the inlet ports of the cylinder heads to keep dirt out of the engine.

**⚠ WARNING**

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

**CAUTION**

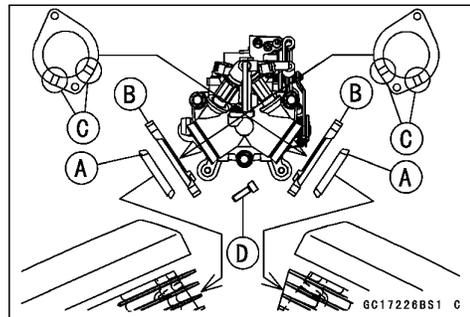
If dirt gets through into the engine, excessive engine wear and possibly engine damage will occur.

## 3-90 FUEL SYSTEM (DFI)

### Throttle Body Assy

#### Throttle Assy Installation

- Install the lower air cleaner duct between cylinders.
- Replace the flange seal [A] with a new one.
- With a high-flash point solvent, clean off the flange surface of the cylinder head and wipe dry.
- Install the flange [B] and the seal in the direction shown. Face the ribs [C] of the flange and the smaller diameter end upwards.
- The seal should be centered on the flange.
- Tighten the inlet manifold bolts [D] to a snug fit.



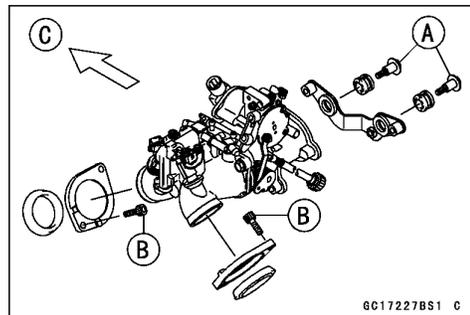
- First, tighten the throttle assy holder bolts [A], secondly the inlet manifold bolts [B] to the specified torque.

Front [C]

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

**Inlet Manifold Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)**

**Right Spark Plug Lead Holder Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**



- Install the lower ends of the throttle cables in the throttle pulley.

Accelerator Cable [A] and Decelerator Cable [B]

- Run the throttle cables correctly (see Cable, Wire, and Hose Routing section in the General Information chapter).
- Stake [C] the cable clip [D] on the throttle cable holder [E].

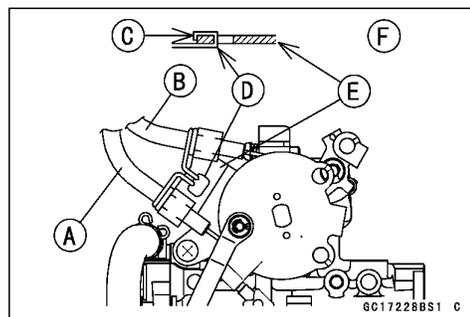
Rear View [F]

- Install the lower end of the choke cable in the choke lever.

**Non-permanent Locking Agent -**

**Choke Cable Plate Screw**

**Torque - Choke Cable Plate Screw: 2.9 N·m (0.30 kgf·m, 26 in·lb)**



- Run the choke cable correctly (see General Information chapter) and check that the choke knob moves smoothly.

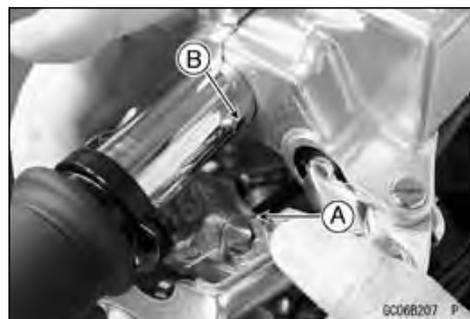
- Apply a thin coating of grease to the throttle cable upper ends.

- Install the upper ends of the throttle cables in the grip.

- Fit the projection [A] of the right switch housing into the hole [B] of the handlebar (front view).

- Turn the throttle grip and make sure that the throttle valves move smoothly and return by spring force.

- Check the throttle grip free play (see Throttle Grip Free Play Inspection).

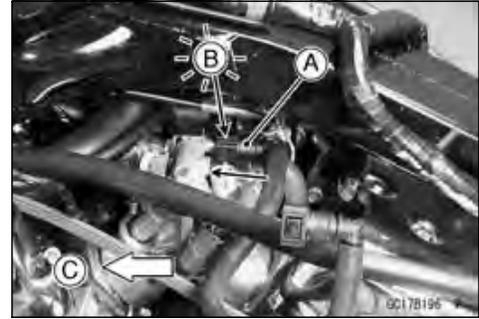


#### **⚠ WARNING**

**Operation with an incorrectly routed cable could result in an unsafe riding condition.**

## Throttle Body Assy

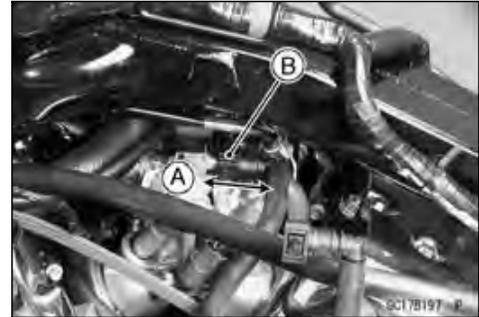
- Fit the fuel hose joint #2 [A] onto the pipe (for delivery joint) until the joint clicks [B].
- Insert the hose joint straight along the pipe.  
Front [C]



- Push and pull [A] the fuel hose joint #2 [B] back and forth more than two times and make sure it is locked and doesn't come off. When the fuel hose joint #2 is correctly installed, it should slide on the delivery pipe about 5 mm (0.2 in.).

**⚠ WARNING**

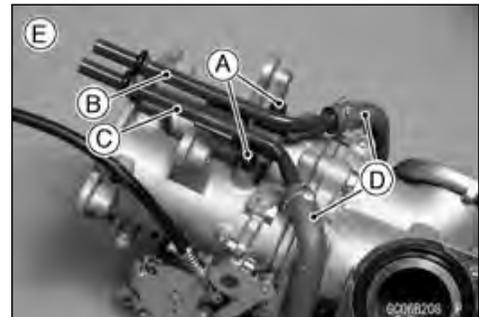
**Make sure the fuel hose joint is installed correctly on the delivery pipe by sliding the joint, or the fuel could leak.**



- Install the fuel tank and the air cleaner housing (see this chapter).

### *Throttle Assy Disassembly/Assembly*

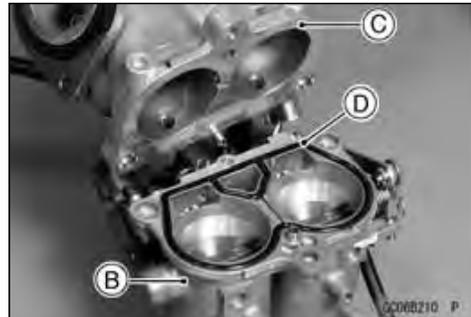
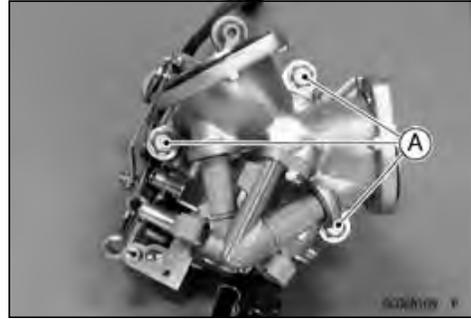
- Remove the throttle assy (see this chapter).
- Unscrew two bolts [A], and pull out the ISC pipe #1 [B], and ISC pipe #2 [C] from the hoses [D].  
Bottom View [E]



## 3-92 FUEL SYSTEM (DFI)

### Throttle Body Assy

- Remove the three throttle body flange bolts [A].
- Split the throttle assy into the throttle body [B] and the inlet manifold [C]. The gasket [D] comes off.
- Discard the gasket.



○ Do not remove or adjust the following parts. These parts are set at the factory and cannot be readjusted.

#### CAUTION

**Adjustment of some of these parts could result in poor performance, requiring replacement of the throttle body.**

Throttle Sensor [A]:

Turning the sensor body could spoil the ignition timing and injection quantity.

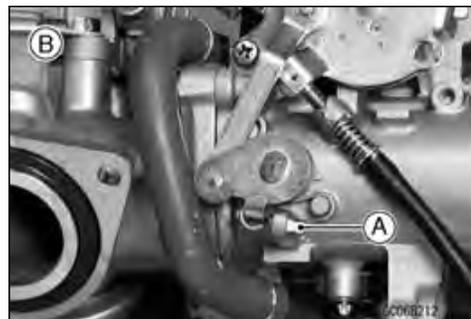
Front View [B]



Throttle Stop Screw [A]:

Tampering with this screw could spoil the idling performance since the screw sets the gap between the throttle valves and the throttle bore with throttle grip closed.

Rear View [B]



Choke Lever Stop Screw [A]:

This screw sets the throttle valve opening when the choke knob is pulled fully. Tampering with the screw could cause malfunction of the choke lever.

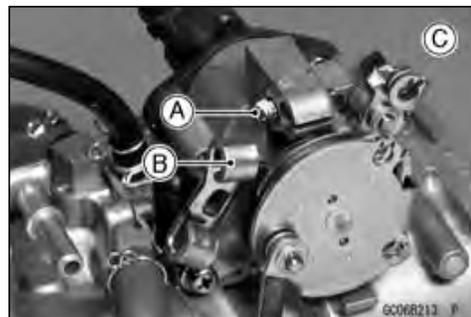
Throttle Cable Holder [B]:

This is sold with a throttle body as a unit.

Rear View [C]

Throttle Valve and Throttle Shaft:

They are not allowed to remove because of difficulty of removal.



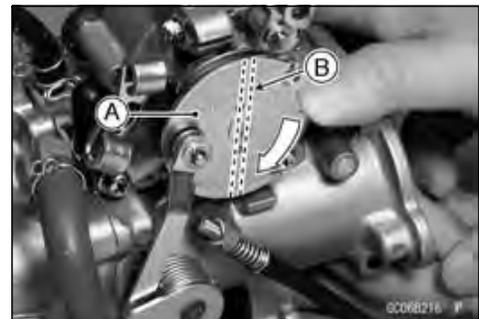
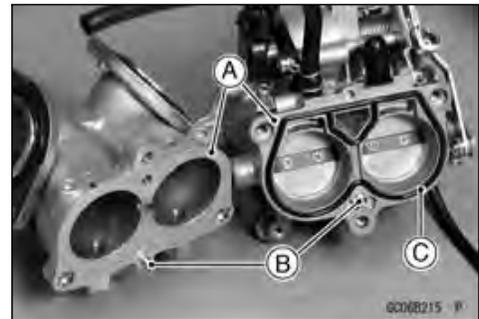
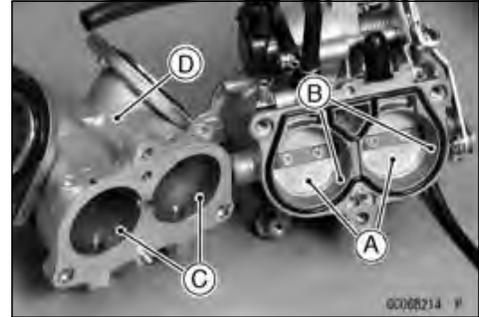
## Throttle Body Assy

- Remove the delivery joint and injectors (see Injector section in this chapter).
- Open the butterfly valves [A], and wipe any carbon off the throttle bores [B] around the valves, using a piece of lint-free cloth penetrated with a high-flash point solvent.
- Clean the bores [C] of the inlet manifold [D] as well.
- Blow away dirt or dust from the throttle body and the inlet manifold by applying compressed air.

### CAUTION

**Do not immerse the throttle body (or throttle assy) in a high-flash point solvent for cleaning. This could damage the throttle sensor on the throttle body.**

- Before assembly, visually inspect the mating surfaces [A] for any damage, like dent, nick, rust, flaw, and crack.
  - Nick or rust damage can sometimes be repaired by using emery paper (first No. 200, then 400) to remove sharp edges or raised areas.
  - ★ If the damage is not repairable, replace the throttle body and/or the inlet manifold to prevent leakage.
  - With a high-flash point solvent, clean off the mating surfaces and wipe dry.
  - Be sure to install the dowel pins [B].
  - Fit the new gasket [C] into the groove. Be careful not to pinch the gasket between the mating surfaces.
  - Tighten the flange bolts evenly.
- Turn the throttle pulley [A] to check that the throttle valves [B] move smoothly and return by spring force.
  - ★ If the throttle valves do not move smoothly, replace the throttle body.

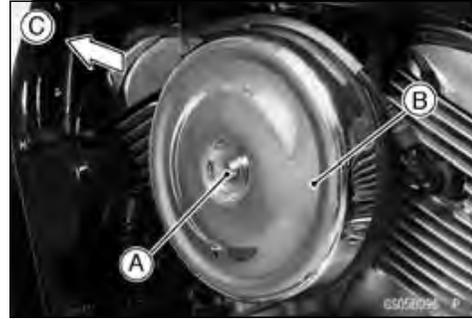


## 3-94 FUEL SYSTEM (DFI)

### Air Cleaner

#### Element Removal

- Remove:
  - Allen Bolt and Washer [A]
  - Left Air Cleaner Cover [B]
  - Front [C]



- Remove the element [A].
- Push a clean, lint-free towel into the lower air cleaner duct to keep dirt or other foreign material from entering.

#### **⚠ WARNING**

If dirt or dust is allowed to pass through into the throttle assy, 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.

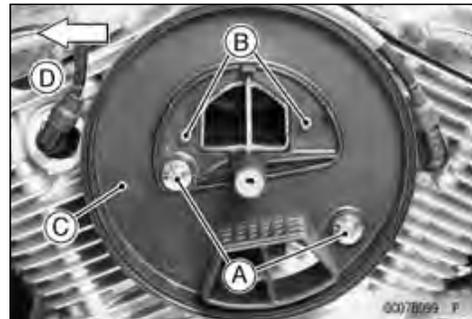


#### Element Cleaning

- Refer to Air Cleaner Element Cleaning in the Periodic Maintenance Chapter.

#### Left Air Cleaner Housing Removal/Installation

- Remove:
  - Air Cleaner Element (see Air Cleaner Element Removal)
  - Air Cleaner Base Bolts [A] and Screws [B]
- Remove the air cleaner base [C].
  - Front [D]



- Be careful not to lose the air cleaner base mounting nuts [A]. These nuts and lower air cleaner duct are sold as a unit.

#### **Non-permanent Locking Agent - Air Cleaner Base Screws**

**Torque - Left Air Cleaner Base Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

**Left Air Cleaner Base Screws: 2.2 N·m (0.22 kgf·m, 19 in·lb)**

**Left Air Cleaner Cover Allen Bolt: 16 N·m (1.6 kgf·m, 12 ft·lb)**

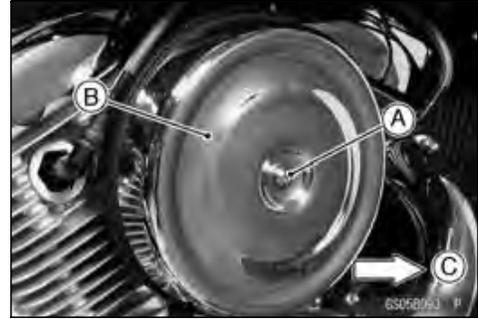


## Air Cleaner

### Right Air Cleaner Housing Removal

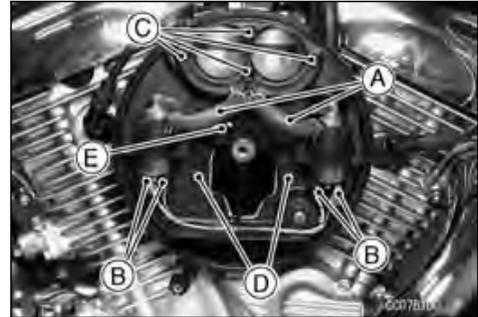
● Remove:

- Allen Bolt and Washer [A]
- Right Air Cleaner Cover [B]
- Front [C]



● Remove:

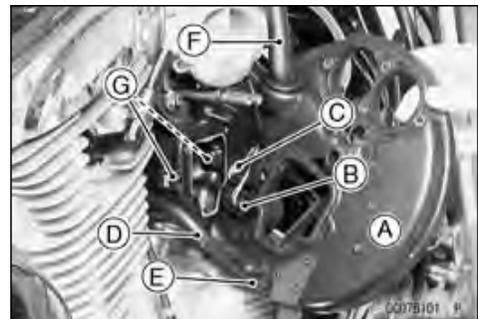
- ISC Valve Hoses [A]
- ISC Valve Lead Connectors [B]
- Air Cleaner Allen Bolts [C] and Screws [D]
- Air Cleaner Base Bolt [E]



● Remove:

- Air Cleaner Base [A]
- Inlet Air Temperature Sensor Connector [B]
- ISC Valve Leads [C]
- Crankcase Breather Hose [D]
- Air Cleaner Drain Hose [E] (separate from the base [A])
- Vacuum Switch Valve Air Hose [F]

- Be careful not to lose the air cleaner base mounting nuts [G]. These nuts and lower air cleaner duct are sold as a unit.



### Right Air Cleaner Housing Installation

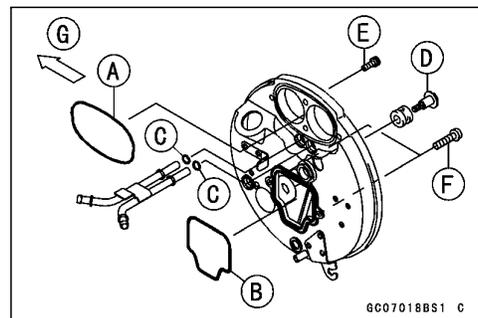
- Check to see that the seals [A], [B] and the ISC pipe O-rings [C] are in place.

**Non-permanent Locking Agent -  
Right Air Cleaner Base Screws**

● Tighten:

- Torque - Right Air Cleaner Base Bolt [D]: 11 N·m (1.1 kgf·m, 95 in·lb),**
- Right Air Cleaner Allen Bolts [E]: 11 N·m (1.1 kgf·m, 95 in·lb),**
- Right Air Cleaner Base Screws [F]: 2.2 N·m (0.22 kgf·m, 19 in·lb)**

Front [G]



## 3-96 FUEL SYSTEM (DFI)

### Air Cleaner

★ If the air cleaner drain hose [A] has been removed with it attached to the right air cleaner base, pull the drain hose off the right air cleaner base. Remove the left air cleaner base and insert the drain hose under the lower air cleaner duct.

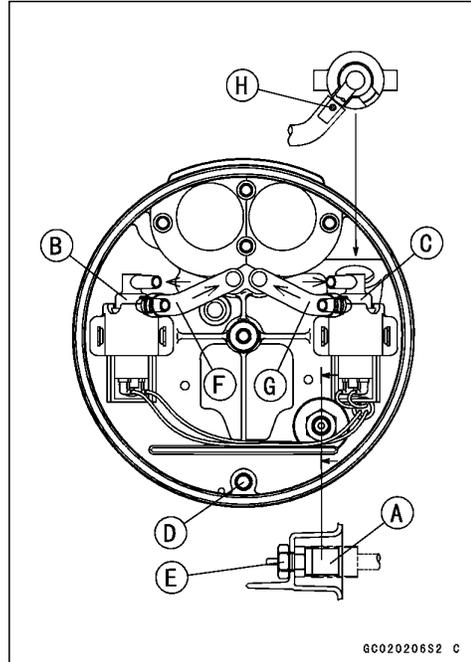


● Install the inlet air temperature sensor [A], the ISC valve #2 [B], ISC valve #1 [C], and the crankcase breather hose [D].

**Torque - Inlet Air Temperature Sensor Nut [E]: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

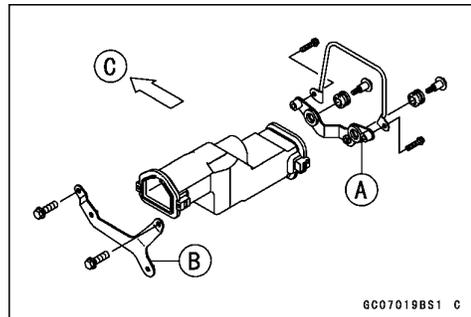
- The ISC valve #2 is connected to W/R and G/Y leads, and the hose [F] marked red.
- The ISC valve #1 is connected to W/R and G/BL leads, and the hose [G] marked blue.
- The ISC valve #1 and #2 are the same parts.  
Top Marks [H]

**Torque - Right Air Cleaner Cover Allen Bolt: 16 N·m (1.6 kgf·m, 12 ft·lb)**



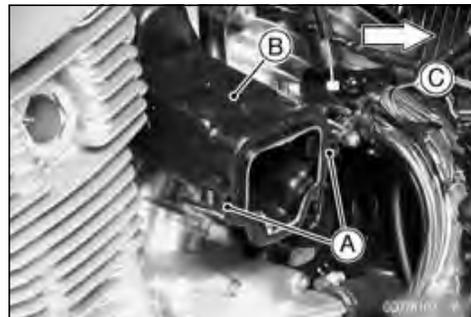
#### Lower Air Cleaner Duct Removal/Installation

- Remove:
  - Right and Left Air Cleaner Housing (see this chapter)
  - Throttle Assy Holder [A]
  - Air Cleaner Duct Holder [B]
  - Throttle Assy (see this chapter)
  - Inlet Manifold (see this chapter)
  - Front [C]



- Remove:
  - Right and Left Air Cleaner Base Mounting Nuts [A]
  - Lower Air Cleaner Duct [B]
  - Front [C]

**Torque - Air Cleaner Duct Holder Bolts: 9.8 N·m (1.0 kgf·m, 69 in·lb)**



## Fuel Tank

### Fuel Tank Removal

#### **⚠ WARNING**

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

To avoid fire, do not remove the fuel tank when the engine is still hot. Wait until it cools down.

To make fuel spillage minimum, draw the fuel out from the fuel tank with a pump as much as possible when the engine is cold.

Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

- Turn both ignition switch, and engine stop switch OFF.
  - Wait until the engine cools down.
  - Open the fuel tank cap [A] to lower the pressure in the tank, and draw the fuel out from the fuel tank with a commercially available pump.
- Front [B]

#### **⚠ WARNING**

The fuel cannot be removed completely from the fuel tank. Be careful for remained fuel spillage.

- Remove the Allen bolt [A], and nut [B], and take out the meter cover [C].
- Disconnect the meter [A] and ignition switch [B] connectors.



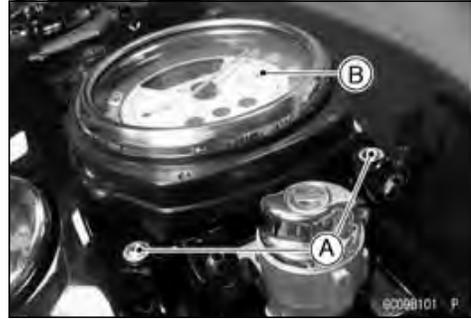
## 3-98 FUEL SYSTEM (DFI)

### Fuel Tank

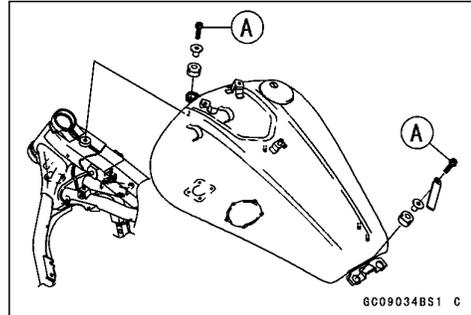
- Remove the Allen bolts [A] and take out the meter unit [B].

#### CAUTION

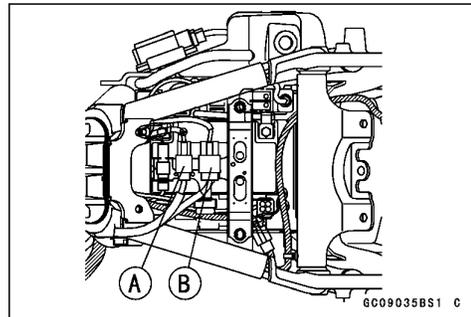
Place the meter so that the face is up. If a meter is left upside down or sideways for any length of time, it will malfunction.



- Remove:
  - Front Seat (see Frame chapter)
  - Fuel Tank Bolts [A]
- Disconnect the battery (-) terminal.



- Disconnect the fuel pump connector [A] (2p).
- Disconnect the fuel level sensor connector (3p) [B].



#### NOTE

○ During tank removal, keep the fuel tank cap [A] open to release pressure in the fuel tank. This makes fuel spillage less.

Front [B]

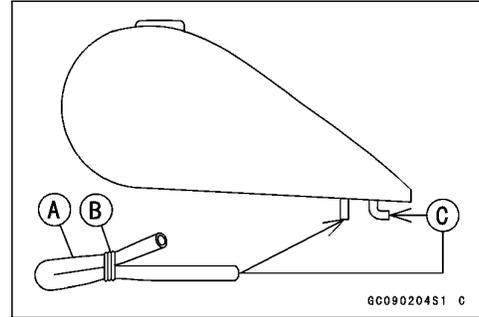


- Draw the fuel out from the fuel tank with a commercially available pump.
- Put the soft plastic hose [A] into the drain pipe [B] and draw the fuel out.

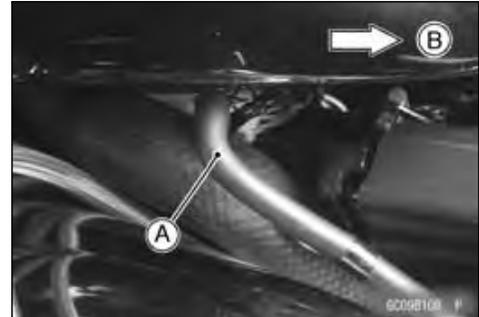


**Fuel Tank**

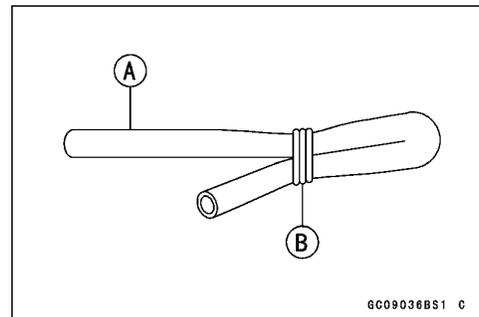
- Prepare rubber hoses of the inside diameter 5 ~ 5.8 mm (0.20 ~ 0.23 in.) [e.g. Rubber Tube: Part No. 92191-1272] × L 80 mm (3.1 in.) and make plug hoses [A] of the rubber hose with one end tied with a wire [B].
- Raise the rear of the tank up, and disconnect the hoses on the bottom.
- Plug these pipes [C] with plug hoses to prevent fuel spillage.



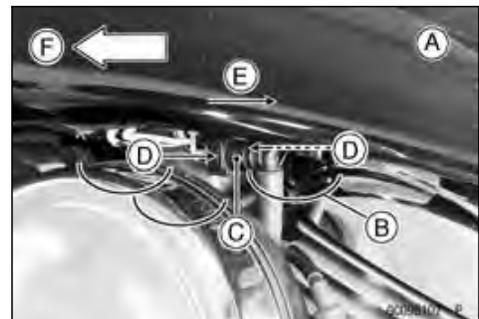
- Disconnect the fuel drain hose [A].  
Front [B]



- Prepare a rubber hose of the inside diameter 7.3 ~ 7.5 mm (0.29 ~ 0.30 in.) [e.g. Part No. 92191-1264] × L 100 mm (3.9 in.) and make a plug hose [A] with one end tied with a wire [B].



- Raise the fuel tank [A] up, and make sure that the shop towel [B] is around the fuel hose joint #1 [C].
- A person should pinch the hose joint locks [D] with fingers, disconnect the joint [E], and plug the tank outlet pipe with the plug hose.
- Front [F]



**⚠ WARNING**  
Immediately wipe up fuel that spills.

## 3-100 FUEL SYSTEM (DFI)

### Fuel Tank

---

- Close the fuel tank cap.
- Remove the fuel tank from the vehicle, and place it on a flat surface.

#### CAUTION

**For California model, if gasoline, solvent, water or any other liquid enters the canister, the canister's vapor absorbing capacity is greatly reduced. If the canister does become contaminated, replace it with a new one.**

- For California Model, note the following:
  - To prevent the gasoline from flowing into or out of the canister, hold the separator perpendicular to the ground.

#### WARNING

**For California model, be careful not to spill the gasoline through the return hose. Spilled fuel is hazardous.**

- ★ If liquid or gasoline flows into the breather hose, remove the hose and blow it clean with compressed air (California model).
- Be careful of fuel spillage from the fuel tank since fuel still remains in the fuel tank and fuel pump.

#### WARNING

**Store the fuel tank in an area which is well-ventilated and free from any source of flame or sparks. Do not smoke in this area. Place the fuel tank on a flat surface and plug the fuel pipes to prevent fuel leakage.**

#### *Fuel Tank Installation*

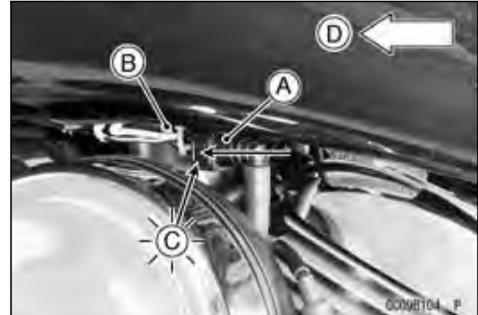
- Read the above WARNING.
- Route the hoses correctly (see Appendix chapter).
- For California Model, note the following:
  - To prevent the gasoline from flowing into or out of the canister, hold the separator perpendicular to the ground.
  - Connect the hoses according to the diagram of the system (see the last page of this chapter or Cable, Wire, and Hose Routing section in the Appendix chapter). Make sure they do not get pinched or kinked.
  - Route hoses with a minimum of bending so that the air or vapor will not be obstructed.

**Fuel Tank**

- Check that the rubber dampers [A] are in place.
- ★ If the dampers are damaged or deteriorated, replace them.
- Remove the plug hoses, and  $\phi 8$  mm plug, then quickly install the fuel hoses one by one.
- Be sure the hoses are clamped securely to prevent leakage.



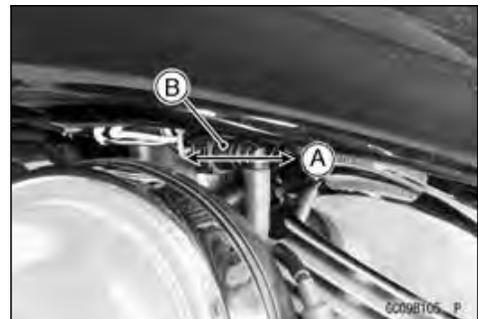
- Insert the fuel hose joint #1 [A] straight onto the tank outlet pipe [B] until the hose joint clicks [C]  
Front [D]



- Push and pull [A] the hose joint [B] back and forth more than two times and make sure it is locked and doesn't come off. When the hose joint is correctly installed, it should slide on the delivery pipe about 5 mm (0.2 in.)

**⚠ WARNING**

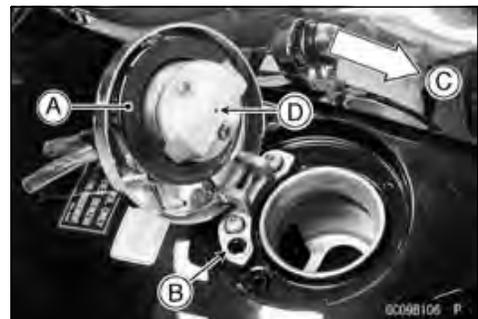
**Make sure the hose joint is installed correctly on the delivery pipe by sliding the joint, or the fuel could leak.**



- ★ If it does not slide, reinstall the hose joint.
- Connect the fuel pump and the fuel level sensor connectors and the battery (-) lead terminal.

*Fuel Tank and Cap Inspection*

- Visually inspect the gasket [A] on the tank cap for any damage.
- ★ Replace the gasket if it is damaged.
- Check to see if the breather pipe [B] in the tank is not clogged.
- ★ If the breather pipe is clogged, blow the breather free with compressed air.
- ★ If the tank cap breather is clogged, replace the tank cap.  
Front [C]



**CAUTION**

**Do not apply compressed air to the air vent holes [D] in the tank cap. This could damage and clog the labyrinth in the cap.**

## 3-102 FUEL SYSTEM (DFI)

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### Fuel Tank

---

#### *Fuel Tank Cleaning*

#### **⚠ WARNING**

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

- Remove the fuel tank (see this chapter).
- Remove the fuel pump from the fuel tank (see Fuel Pump section in this chapter).
- Fill the fuel tank with some high-flash point solvent, and shake the tank to remove dirt and fuel deposits.
- Draw the solvent out of the tank.
- Dry the tank with compressed air.
- Install the fuel pump on the fuel tank (see this chapter).
- Install the fuel tank (see Fuel Tank Installation).

## Evaporative Emission Control System

The Evaporative Emission Control System for California Model routes fuel vapors from the fuel system into the running engine or stores the vapors in a canister when the engine is stopped. Although no adjustments are required, a thorough visual inspection must be made at the intervals specified by the Periodic Maintenance Chart.

### Parts Removal/Installation

#### **⚠ WARNING**

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

#### **CAUTION**

**If gasoline, solvent, water or any other liquid enters the canister, the canister's vapor absorbing capacity is greatly reduced. If the canister does become contaminated, replace it with a new one.**

- To prevent the gasoline from flowing into or out of the canister, hold the separator perpendicular to the ground.
- Be sure to plug the return hose to prevent fuel spilling before fuel tank removal.

#### **⚠ WARNING**

**When removing the fuel tank, be careful not to spill the gasoline through the return hose. Spilled fuel is hazardous.**

- ★ If liquid or gasoline flows into the breather hose, remove the hose and blow it clean with compressed air.
- Connect the hoses according to the diagram of the system (see Cable, Wire, and Hose Routing section in the Appendix chapter). Make sure they do not get pinched or kinked.
- Route hoses with a minimum of bending so that the air or vapor will not be obstructed.

### Canister Installation

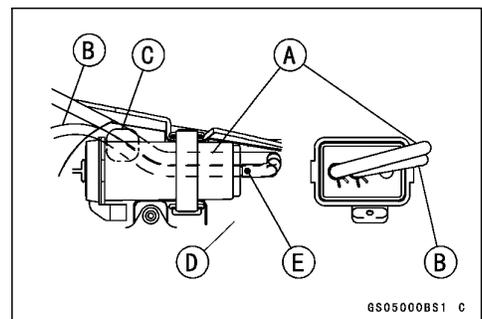
- Run the purge hose (green) [A] above the canister breather hose (blue) [B] through the hole [C] into the tool case [D].
- Do not run these hoses side by side on the battery side of the canister. This prevents hoses from being flattened when installing the left side cover.
- Install the canister and the left side cover (see Frame chapter).
- Face the white mark [E] left as shown.

### Canister Inspection (Periodic Inspection)

- Refer to Evaporative Emission Control System Check in the Periodic Maintenance Chapter (chapter 2).

### Separator Inspection (Periodic Inspection)

- Refer to Evaporative Emission Control System Check in the Periodic Maintenance Chapter (chapter 2).



## 3-104 FUEL SYSTEM (DFI)

### Evaporative Emission Control System

#### Hose Inspection (Periodic Inspection)

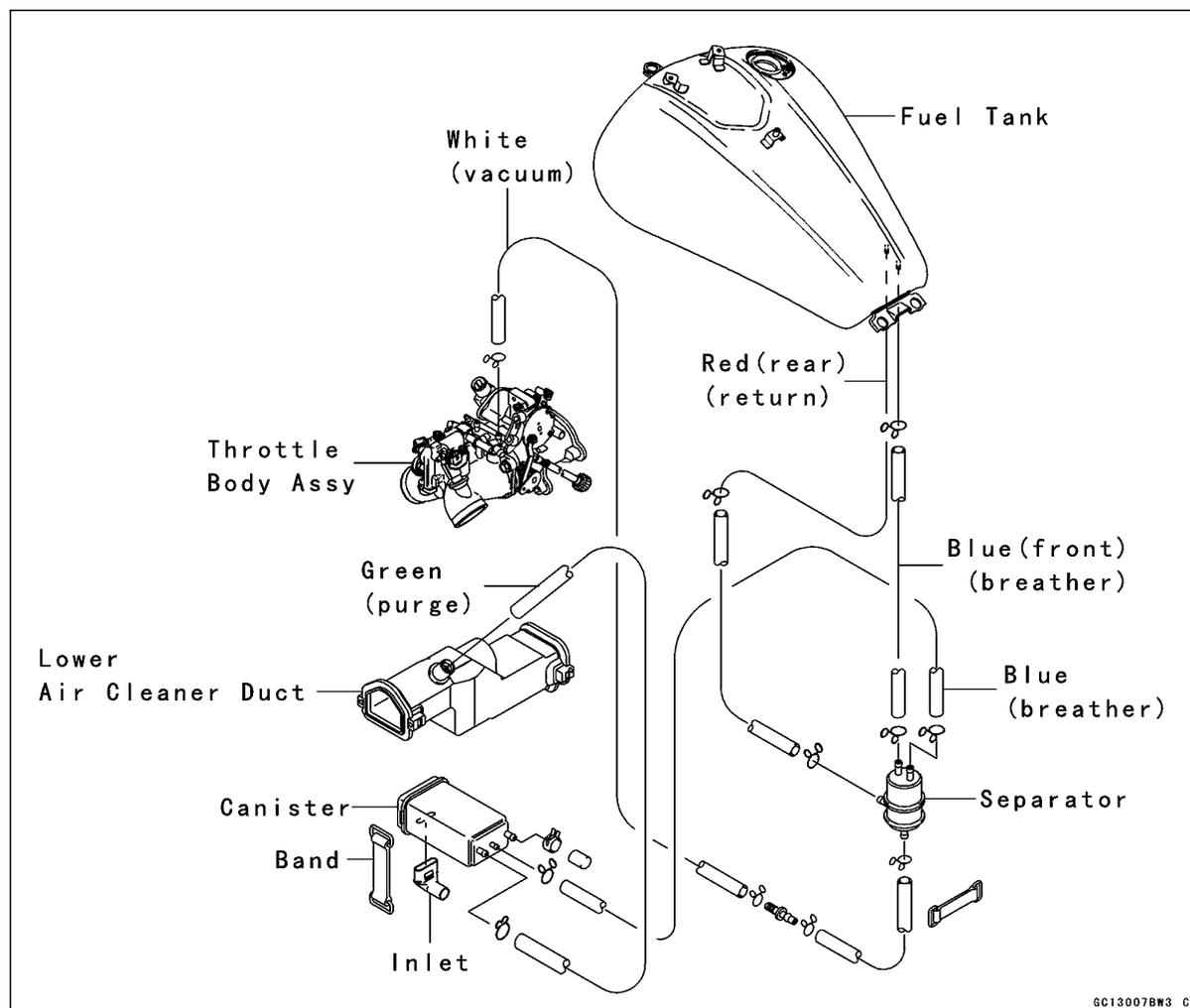
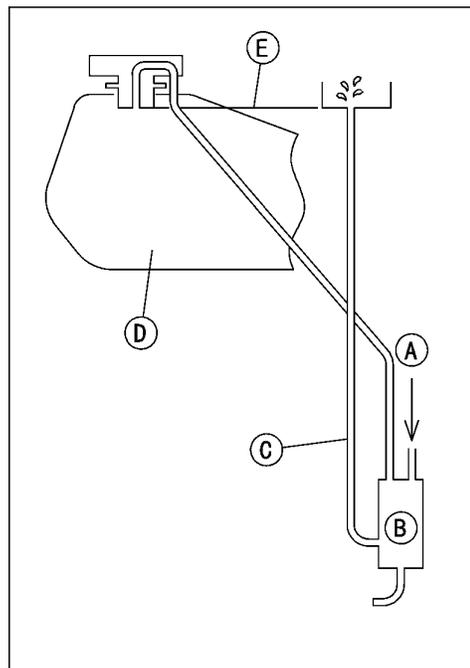
- Refer to Evaporative Emission Control System Check in the Periodic Maintenance Chapter (chapter 2).

#### Separator Operation Test

##### **⚠ WARNING**

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

- Remove the seat and left side cover (see Frame chapter).
- Connect the hoses to the separator.
- Disconnect the breather hose from the separator, and inject about **20 mL (0.68 US oz)** of gasoline [A] into the separator [B] through the hose fitting.
- Disconnect the evaporative fuel return hose [C] from the fuel tank [D]
- Run the open end of the return hose into the container level with the tank top [E].
- Start the engine, and let it idle.
- ★ If the gasoline in the separator comes out of the hose, the separator works well. If it does not, replace the separator with a new one.



GC13007BW3 C

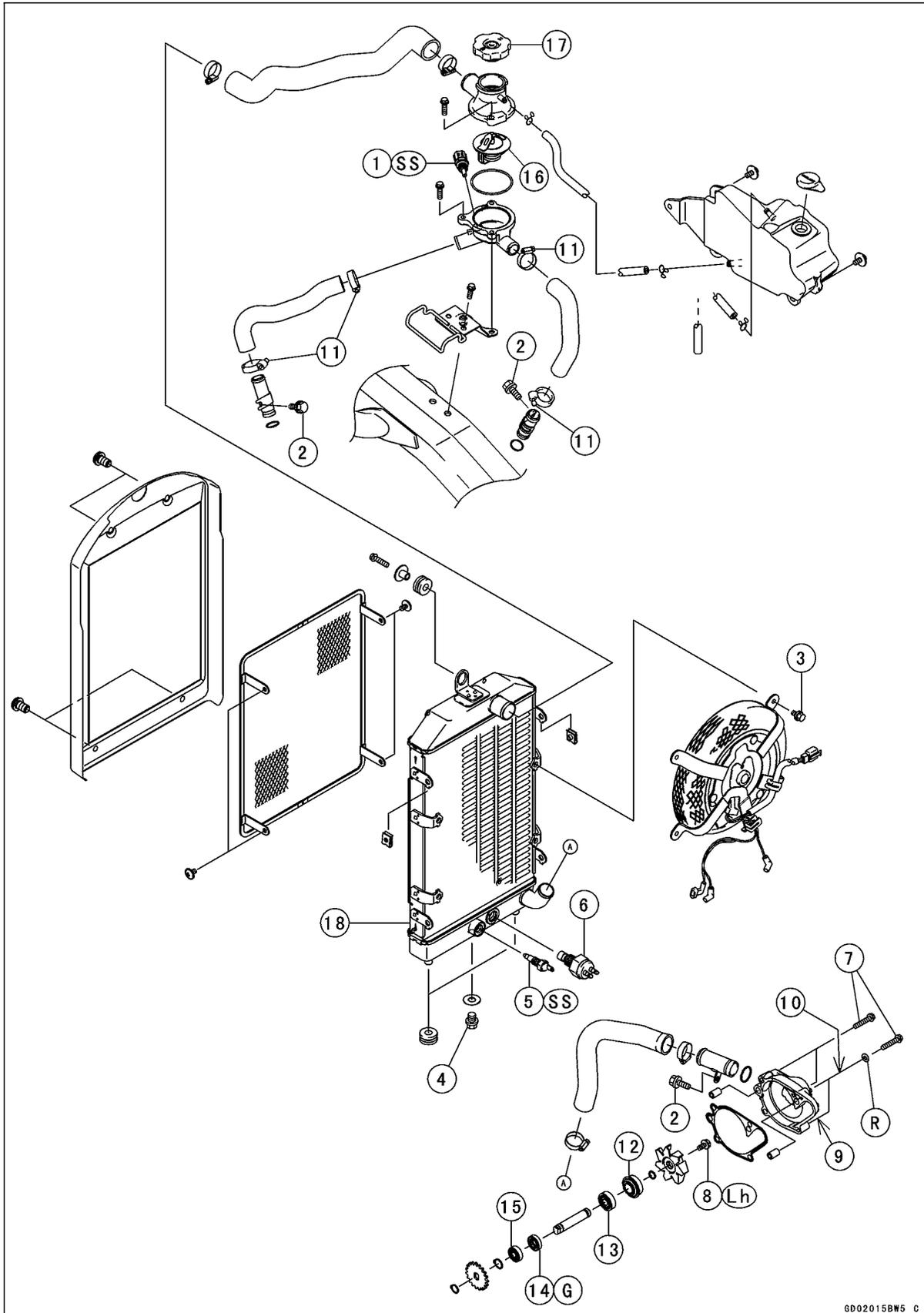
# Cooling System

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# 4-2 COOLING SYSTEM

## Exploded View



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**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Water temperature sensor (DFI)	18	1.8	13	SS
2	Water pipe bolts	11	1.1	97 in·lb	
3	Radiator fan bolts	8.3	0.85	74 in·lb	
4	Radiator drain bolt	7.4	0.75	65 in·lb	
5	Water temperature switch	7.8	0.80	69 in·lb	SS
6	Radiator fan switch	18	1.8	13	
7	Water pump cover bolts	11	1.1	97 in·lb	
8	Water pump impeller bolt	8.8	0.90	78 in·lb	Lh
9	Water pump drain bolt	11	1.1	97 in·lb	
10	Water pump air bleeder bolt	11	1.1	97 in·lb	
11	Radiator hose clamp screws	2.5	0.25	22 in·lb	

12. Mechanical seal

13. Double seal bearing

14. Oil seal

15. Ball bearing

16. Thermostat

17. Radiator cap

18. Radiator

R: Replacement parts

Lh: Left-hand threads

G: Apply grease.

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

## 4-4 COOLING SYSTEM

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### Coolant Flow Chart

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Permanent type antifreeze is used as a coolant to protect the cooling system from rust and corrosion. When the engine starts, the water pump turns and the coolant circulates.

The thermostat is a wax pellet type which opens or closes as coolant temperature changes. The thermostat continuously changes its valve opening to keep the coolant temperature at the proper level. When coolant temperature is below 58 ~ 62°C (136 ~ 144°F), the thermostat closes so that the coolant flow is restricted through the air bleeder hole, causing the engine to warm up more quickly. When coolant temperature is more than 58 ~ 62°C (136 ~ 144°F), the thermostat opens and the coolant flows.

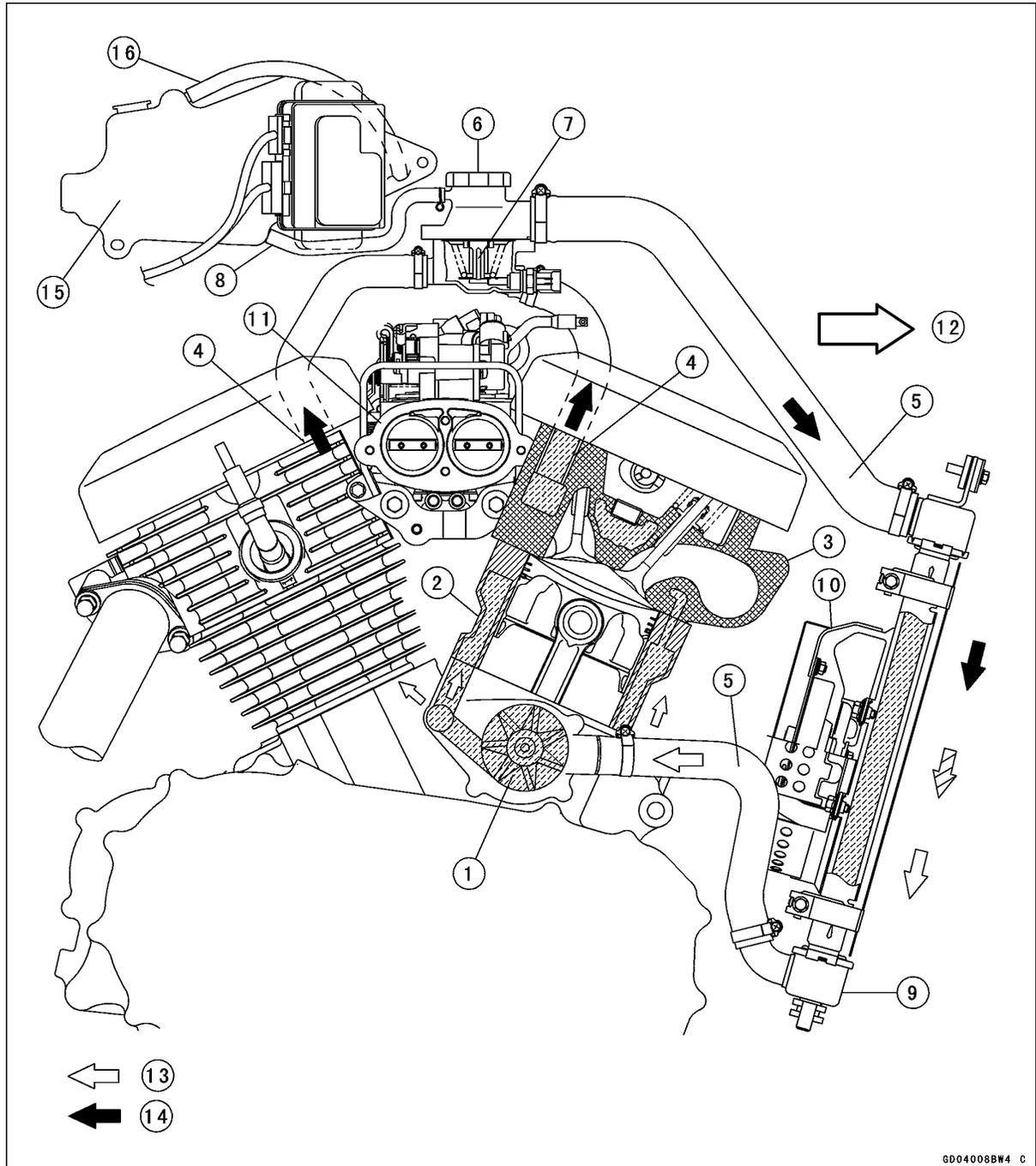
When the coolant temperature goes up beyond 100 ~ 110°C (212 ~ 230°F), the radiator fan switch conducts to operate the radiator fan. The radiator fan draws air through the radiator core when there is not sufficient air flow such as at low speeds. This increases up the cooling action of the radiator. When the temperature is below 97 ~ 103°C (207 ~ 217°F), the fan switch opens and the radiator fan stops.

In this way, this system controls the engine temperature within narrow limits where the engine operates most efficiently even if the engine load varies.

The system is pressurized by the radiator cap to suppress boiling and the resultant air bubbles which can cause engine overheating. As the engine warms up, the coolant in the radiator and the water jacket expands. The excess coolant flows through the radiator cap and hose to the reserve tank to be stored there temporarily. Conversely, as the engine cools down, the coolant in the radiator and the water jacket contracts, and the stored coolant flows back to the radiator from the reserve tank.

The radiator cap has two valves. One is a pressure valve which holds the pressure in the system when the engine is running. When the pressure exceeds 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm<sup>2</sup>, 13.5 ~ 17.8 psi), the pressure valve opens and releases the pressure to the reserve tank. As soon as pressure escapes, the valve closes, and keeps the pressure at 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm<sup>2</sup>, 13.5 ~ 17.8 psi). When the engine cools down, another small valve (vacuum valve) in the cap opens. As the coolant cools, the coolant contracts to form a vacuum in the system. The vacuum valve opens and allows the coolant from the reserve tank to enter the radiator.

Coolant Flow Chart



- 1. Water Pump
- 2. Water Jacket
- 3. Cylinder Head
- 4. Water Pipe
- 5. Water Hose
- 6. Radiator Cap
- 7. Thermostat
- 8. Reserve Tank Hose

- 9. Radiator
- 10. Radiator Fan
- 11. Throttle Body Assy
- 12. Front
- 13. Cold Coolant
- 14. Hot Coolant
- 15. Reserve Tank
- 16. Reserve Tank Overflow Hose

GD04008BW4 C

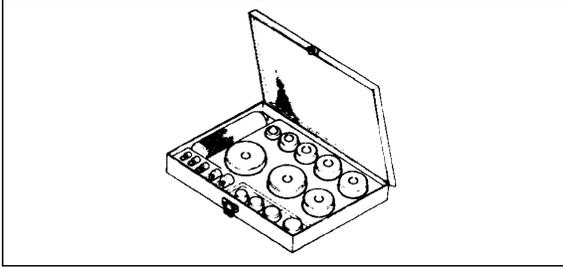
## 4-6 COOLING SYSTEM

### Specifications

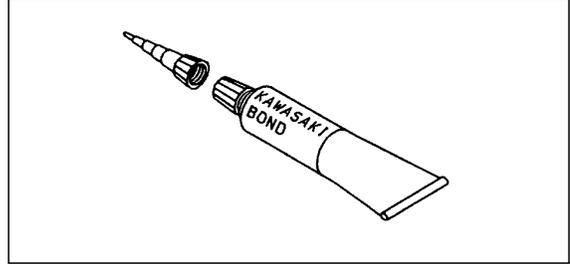
<b>Coolant provided when shipping:</b>	
Type (recommended)	Permanent type antifreeze (soft water and ethylene glycol plus corrosion and rust inhibitor chemicals for aluminum engines and radiators)
Color	Green
Mixed ratio	Soft water 50%, coolant 50%
Freezing point	- 35°C (- 31°F)
Total amount	2.3 L (2.4 US qt., reserve tank full level including radiator and engine)
<b>Radiator Cap:</b>	
Relief pressure	93 ~ 123 kPa (0.95 ~ 1.25 kg/cm <sup>2</sup> , 13.5 ~ 17.8 psi)
<b>Thermostat:</b>	
Valve opening temperature	58 ~ 62°C (136 ~ 144°F)
Valve full opening lift	8 mm (0.3 in) or more @ 75°C (167°F)

**Special Tools and Sealant**

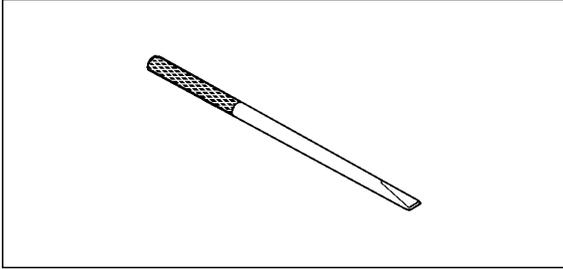
**Bearing Driver Set :**  
57001-1129



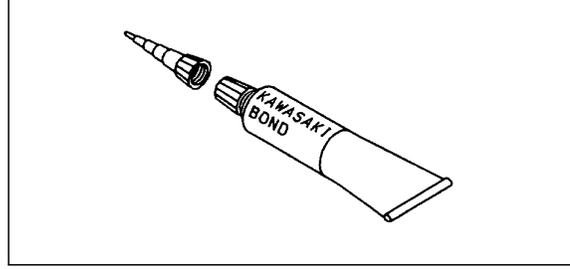
**Kawasaki Bond (Silicone Sealant) :**  
56019-120



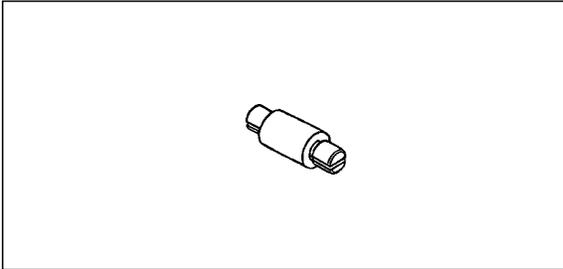
**Bearing Remover Shaft,  $\phi 9$  :**  
57001-1265



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



**Bearing Remover Head,  $\phi 10 \times \phi 12$  :**  
57001-1266



## 4-8 COOLING SYSTEM

### Coolant

#### Coolant Deterioration Inspection

- Remove the right side cover (see Frame chapter).
- Visually inspect the coolant [A] in the reserve tank.
- ★ If whitish cotton-like wafts are observed, aluminum parts in the cooling system are corroded. If the coolant is brown, iron or steel parts are rusting. In either case, flush the cooling system.
- ★ If the coolant gives off an abnormal smell, check for a cooling system leak. It may be caused by exhaust gas leaking into the cooling system.



#### Coolant Level Inspection

##### NOTE

○ Check the level when the engine is cold (room or ambient temperature).

- Check the coolant level in the reserve tank with the motorcycle held upright. The coolant level should be between the “F” (full) level and the “L” (low) level (In the photo, the right side cover has been removed for clarity).

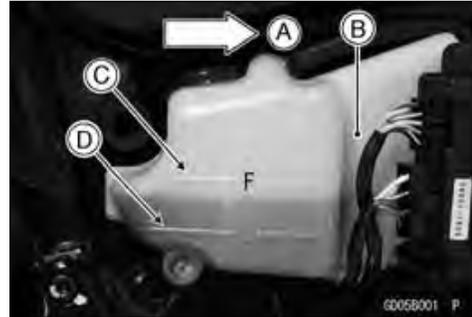
Front [A]

Reserve Tank [B]

“F” Level [C]

“L” Level [D]

- ★ If the coolant level is lower than the “L” level, remove the right side cover and the reserve tank cap, then add coolant to the “F” level.



##### CAUTION

**For refilling, add the specified mixture of coolant and soft water. Adding water alone dilutes the coolant and degrades its anticorrosion properties. The diluted coolant can attack the aluminum engine parts. In an emergency, soft water can be added, but the diluted coolant must be returned to the correct mixture ratio within a few days.**

**If coolant must be added often or the reserve tank has run completely dry, there is probably leakage in the cooling system. Check the system for leaks. Coolant ruins painted surfaces. Immediately wash away any coolant that spills on the frame, engine, wheels, or other painted parts.**

#### Coolant Draining

- Refer to Coolant Change in the Periodic Maintenance Chapter .

#### Coolant Filling

- Refer to Coolant Change in the Periodic Maintenance Chapter.

**Coolant**

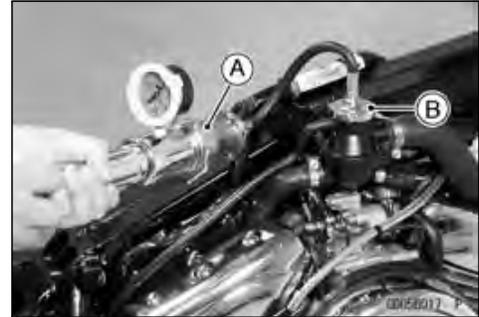
*Pressure Testing*

- Remove the fuel tank (see Fuel System chapter).
- Remove the radiator cap, and install a cooling system pressure tester [A] on the radiator filler neck [B].

**NOTE**

○ *Wet the cap sealing surfaces with water or coolant to prevent pressure leakage.*

- Build up pressure in the system carefully until the pressure reaches 123 kPa (1.25 kg/cm<sup>2</sup>, 17.8 psi).



**CAUTION**

**During pressure testing, do not exceed the pressure for which the system is designed. The maximum pressure is 123 kPa (1.25 kg/cm<sup>2</sup>, 17.8 psi).**

- Watch the gauge for at least 6 seconds.
- ★ If the pressure holds 93 kPa (0.95 kg/cm<sup>2</sup>, 13.5 psi) or more, the system is all right.
- ★ If the pressure drops and no external source is found, check for internal leakage. Droplets in the engine oil indicate internal leakage. Check the cylinder head and cylinder gaskets and the water pump.
- Remove the pressure tester, replenish the coolant, and install the radiator cap.

*Cooling System Flushing*

Over a period of time, the cooling system accumulates rust, scale, and lime in the water jacket and radiator. When this accumulation is suspected or observed, flush the cooling system. If this accumulation is not removed, it will clog up the water passage and considerably reduce the efficiency of the cooling system.

- Drain the cooling system (see Coolant Change in the Periodic Maintenance chapter).
- Fill the cooling system with fresh water mixed with a flushing compound.

**CAUTION**

**Do not use a flushing compound which is harmful to the aluminum engine and radiator. Carefully follow the instructions supplied by the manufacturer of the cleaning product.**

- Warm up the engine, and run it at normal operating temperature for about ten minutes.
- Stop the engine, and drain the cooling system.
- Fill the system with fresh water.
- Warm up the engine and drain the system.
- Repeat the previous two steps once more.
- Fill the system with a permanent type coolant and bleed the air from the system (see Coolant Change in the Periodic Maintenance chapter).

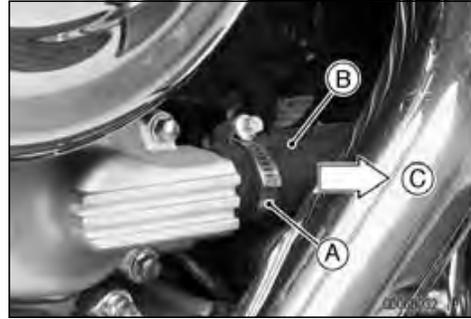
## 4-10 COOLING SYSTEM

### Water Pump

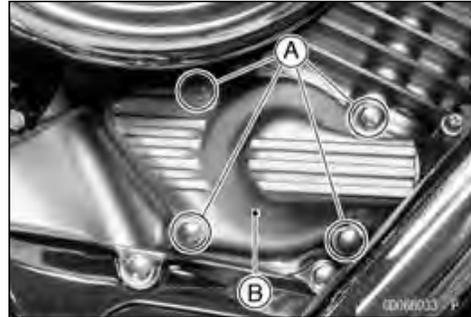
#### Water Pump Removal

- Drain the coolant (see Coolant Change in the Periodic Maintenance chapter).

- Remove:
  - Water Hose Clamp [A]
  - Water Hose [B]
  - Front [C]



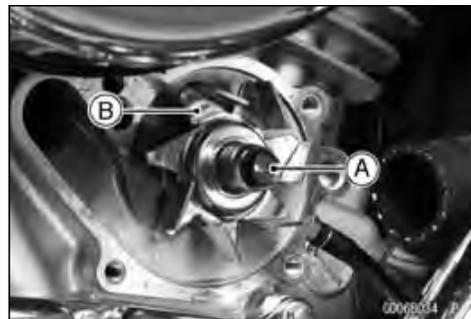
- Remove:
  - Water Pump Cover Bolts [A]
  - Water Pump Cover [B]



- Remove:
  - Impeller Bolt [A]
  - Impeller [B]

#### NOTE

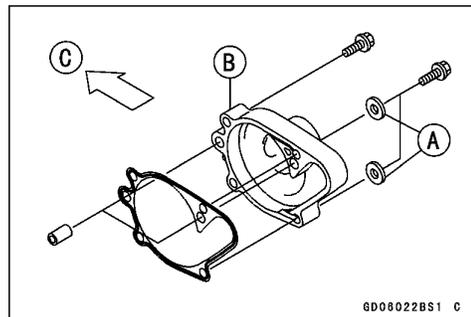
○ The impeller bolt has left-hand threads. Turn the bolt clockwise and remove it.



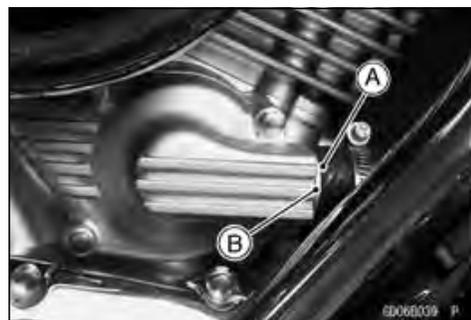
#### Water Pump Installation

- There are aluminum washers [A] on rear side of the water pump cover [B]. Replace them with new ones when installing.
  - Front [C]

**Torque - Water Pump Cover Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**



- Insert the pump inlet hose until the hose end [A] touches the pump inlet step [B].
- Tighten the hose clamp screw securely.



## Water Pump

### Water Pump Inspection

- Check the water pump drainage outlet hose [A] at the bottom of the water pump for coolant leakage.
- ★ If the mechanical seal is damaged, the coolant leaks through the seal and drain through the passage. Replace the mechanical seal.



- Visually inspect the impeller [A].
- ★ If the surface is corroded, or if the blades are damaged, replace the impeller.



### Mechanical Seal Replacement

- Remove the water pump impeller (see Water Pump Removal in this chapter).
- Pry the mechanical seal flange off with a small chisel [A].
- Pull the mechanical seal out of the right crankcase with needle nose pliers. Discard the mechanical seal.



### CAUTION

Be careful not to damage the water pump shaft and the inner sealing surface of the crankcase.

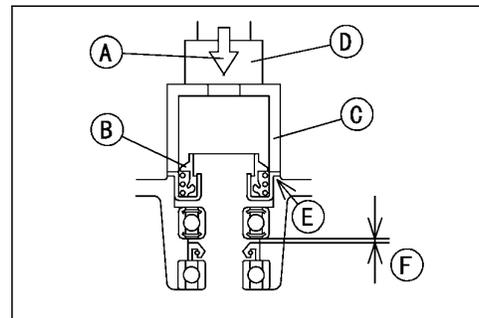
### NOTE

○ Since the replacement mechanical seal has an adhesive coated body, do not apply a liquid gasket to the exterior surface of the body.

- Press [A] the mechanical seal [B] by using a suitable 28 mm socket [C] and a bearing driver [D] until its flange touches the step [E].

Gap [F]

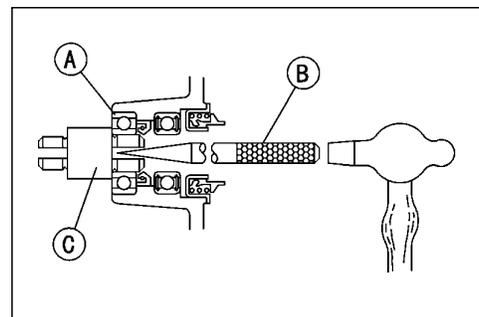
**Special Tool - Bearing Driver Set: 57001-1129**



- ★ If the coolant still leaks through the drainage outlet hose, the seal and ball bearings is probably damaged. Replace the mechanical seal, ball bearings, and oil seal by splitting the crankcase.

- Split the crankcase (see Crankshaft/Transmission chapter).
- Remove the water pump impeller.
- Pull out the water pump shaft from the inside of the right crankcase.
- Take the bearing [A] out of the right crankcase, using the bearing remover.

**Special Tools - Bearing Remover Shaft: 57001-1265 [B]  
Bearing Remover Head:,  $\phi 10 \times \phi 12$ : 57001-1266 [C]**

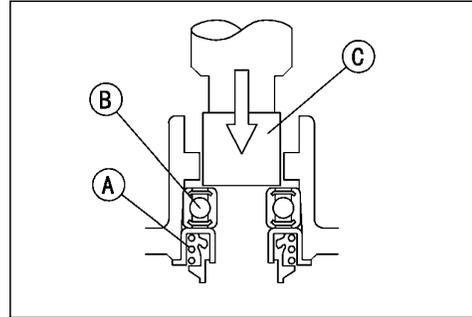


## 4-12 COOLING SYSTEM

### Water Pump

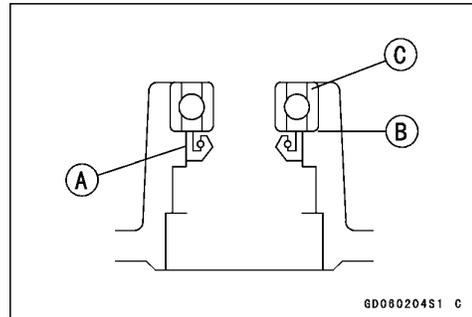
- Using a thin-bladed screwdriver, pry out the oil seal.
- Press out the mechanical seal [A] and ball bearing [B] from the inside of the right crankcase with the bearing driver set [C].

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



- Be sure to replace the mechanical seal, oil seal, O-ring, and ball bearings with new ones because these parts will be damaged by removal.

- Apply plenty of high temperature grease to the oil seal lips.
- Apply oil to the outer circumference of the oil seal.
- Press the oil seal [A] into the hole from the inside of the right crankcase with the bearing driver set so that the spring side of the seal lips is toward the inside of the crankcase.



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

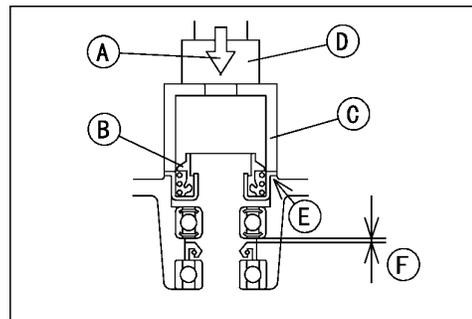
- Press the oil seal in until the seal end is even with step [B] of the hole as shown.
- Use the bearing driver which has a larger diameter than the oil seal.
- Press in each ball bearing [C] with its manufacturer's mark facing out until it bottoms out.

- Press [A] the mechanical seal [B] by using a suitable 28 mm socket [C] and a bearing driver [D] until its flange touches the step [E].

Gap [F]

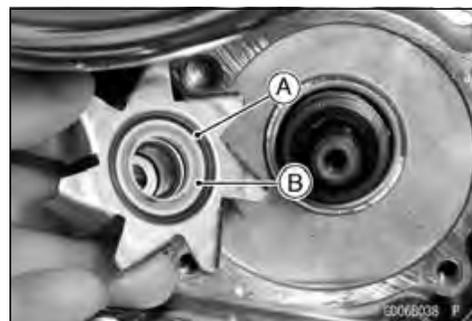
- Install the water pump shaft from the inside of the right crankcase.

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



- Clean both sliding surfaces of a new mechanical seal with a high-flash point solvent (e.g. ethyl alcohol), and apply a little coolant to the sliding surface to give the mechanical seal initial lubrication.
- Apply coolant to the surface of the rubber seal [A] and sealing seat [B], and press the rubber seal and sealing seat into the impeller by hand until the seat bottoms out.
- Tighten the water pump impeller bolt by turning the bolt counterclockwise.

**Torque - Water Pump Impeller Bolt: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



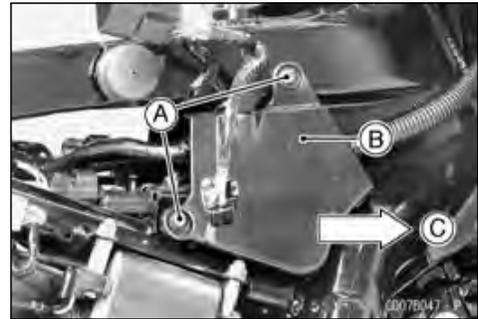
Radiator

**⚠ WARNING**

The radiator fan is connected directly to the battery. The radiator fan may start even if the ignition switch is off. **NEVER TOUCH THE RADIATOR FAN UNTIL THE RADIATOR FAN CONNECTOR IS DISCONNECTED. TOUCHING THE FAN BEFORE THE CONNECTOR IS DISCONNECTED COULD CAUSE INJURY FROM THE FAN BLADES.**

*Radiator Removal*

- Drain the coolant (see this chapter).
- Remove:
  - Fuel Tank (see Fuel System chapter.)
  - Cover Bolt [A]
  - Cover [B]
  - Front [C]



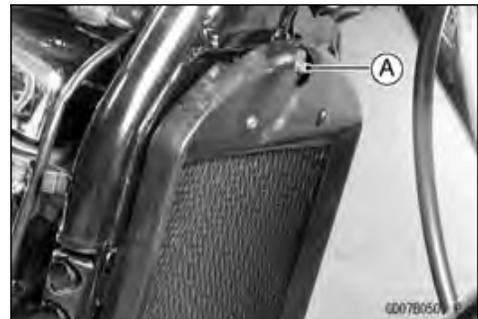
- Pry the plastic clamps [A].



- Remove:
  - Radiator Fan Motor Connector [A]
  - Radiator Hoses



- Remove the mounting bolt [A].
- Lift up the radiator to clear the stoppers.
- Remove the radiator.



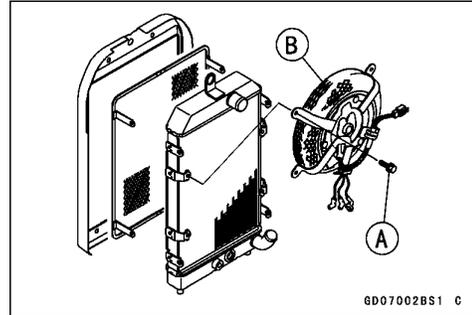
**CAUTION**

**Do not touch the radiator core. This could damage the radiator fins, resulting in loss of cooling efficiency.**

## 4-14 COOLING SYSTEM

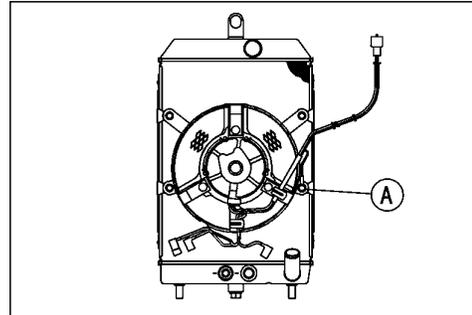
### Radiator

- Remove:
  - Radiator Fan Bolts [A]
  - Radiator Fan [B]



#### Radiator Installation

- Be sure to install the radiator fan ground lead terminal [A].  
**Torque - Radiator Fan Bolts and Fan Ground Lead Terminal Bolt: 8.3 N-m (0.85 kgf-m, 74 in-lb)**

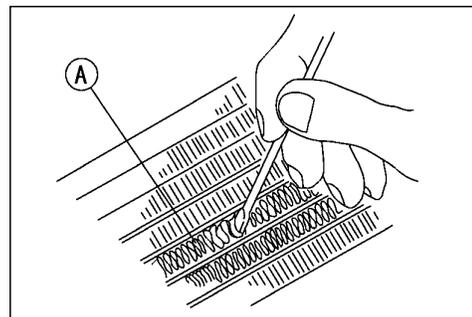


- Fit the radiator stoppers [A] into the right and left grommets.
- Install the pump inlet hose and position the hose clamp (see Water Pump Installation in this chapter).
- Tighten the hose clamp screw securely.



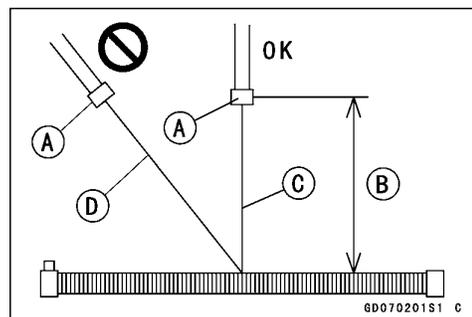
#### Radiator Inspection

- Check the radiator core.
  - ★ If there are obstructions to air flow, remove them.
  - ★ If the corrugated fins [A] are deformed, carefully straighten them.
  - ★ If the air passages of the radiator core are blocked more than **20%** by unremovable obstructions or irreparably deformed fins, replace the radiator with a new one.



#### CAUTION

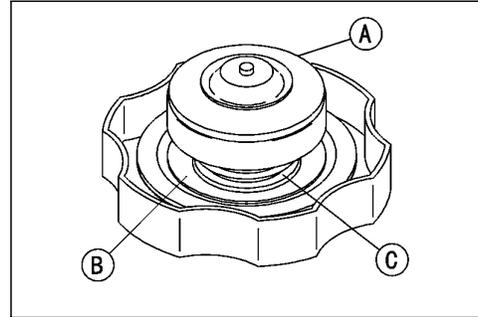
When cleaning the radiator with steam cleaner, be careful of the following to prevent radiator damage. Keep the steam gun [A] away more than 0.5 m (1.6 ft) [B] from the radiator core. Hold the steam gun perpendicular [C] (not oblique [D]) to the core surface and run the steam gun following the core fin direction.



**Radiator**

*Radiator Cap Inspection*

- Check the condition of the top and bottom valve seals of the radiator cap.
- ★ If any one of them shows visible damage, replace the cap.
  - Bottom Valve Seal [A]
  - Top Valve Seal [B]
  - Valve Spring [C]

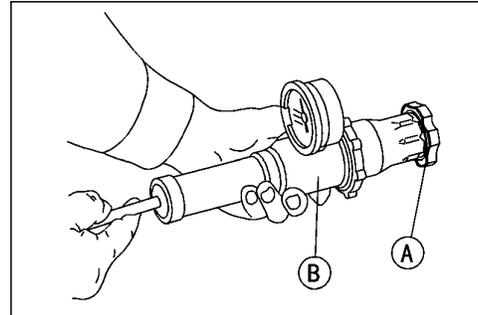


- Install the cap [A] on a cooling system pressure tester [B].

**NOTE**

○ Wet the cap sealing surfaces with water or coolant to prevent pressure leakage.

- Watching the pressure gauge, pump the pressure tester to build up the pressure until the relief valve opens: the gauge needle flicks downward. Stop pumping and measure leak time at once. The relief valve must open within the specified range in the table below and the gauge needle must remain within the same range at least 6 seconds.



**Radiator Cap Relief Pressure**

**Standard: 93 ~ 123 kPa (0.95 ~ 1.25 kg/cm<sup>2</sup>, 13.5 ~ 17.8 psi) for 6 seconds**

- ★ If the cap holds too much pressure or cannot hold the specified pressure, replace it with a new one.

*Radiator Filler Neck Inspection*

- Remove the radiator cap.
- Check the radiator filler neck for signs of damage.
- Check the condition of the top and bottom sealing seats [A] in the filler neck. They must be smooth and clean for the radiator cap to function properly.
  - Front [B]

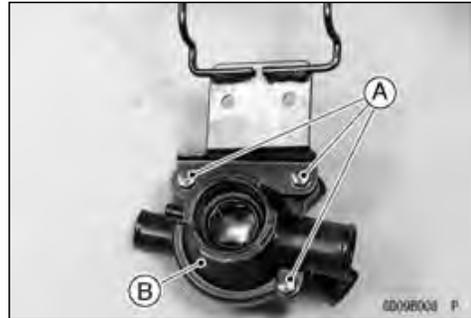
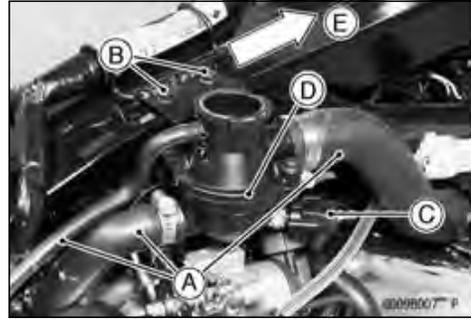


## 4-16 COOLING SYSTEM

### Thermostat

#### Thermostat Removal

- Remove:
  - Coolant : Drain about 200 mL
  - Fuel Tank (see Fuel System chapter)
  - Three Water Hoses [A]
  - Bracket Bolts [B]
  - One Water Hose (from #1 cylinder)
  - Water Temperature Sensor Connector [C]
- Remove the thermostat housing [D] along with the bracket.
  - Front [E]
- Remove the screws [A], take off the cap [B], and take out the thermostat.



#### Thermostat Installation

- Install the thermostat [A] in the housing so that the air bleeder hole [B] is on top.
- Install a new O-ring into the housing.
- Fill the radiator with coolant (see Coolant Change in the Periodic Maintenance chapter).



#### Thermostat Inspection

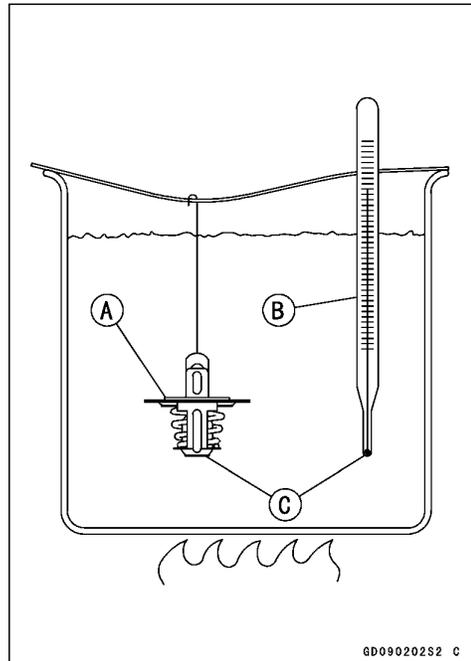
- Remove the thermostat, and inspect the thermostat valve at room temperature.
- ★ If the valve is open, replace the valve with a new one.
- To check valve opening temperature, suspend the thermostat [A] and an accurate thermometer [B] in a container of water with the heat-sensitive portions [C] in almost the same depth.

#### NOTE

- The thermostat must be completely submerged and the thermostat and thermometer must not touch the container sides or bottom.
- Gradually raise the temperature of the water while stirring the water gently for even temperature.
- ★ If the measurement is out of the range, replace the thermostat.

#### Thermostat Valve Opening Temperature

58 ~ 62°C (136 ~ 144°F)



GD090202S2 C

**Hoses and Pipes**

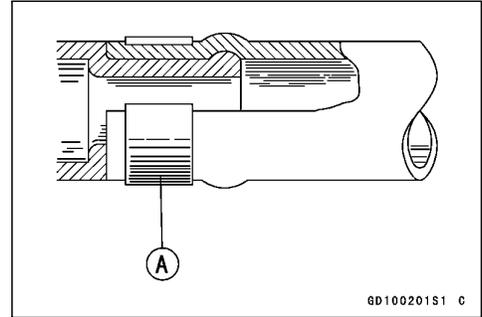
*Hose Installation*

- Install the hoses and pipes being careful to follow bending direction. Avoid sharp bending, kinking, flattening, or twisting.
- Install the clamps [A] as near as possible to the hose end to clear the raised rib on the fitting. This will prevent the hoses from working loose.
- The clamp screws should be positioned correctly to prevent the clamps from contacting the other parts.

**Torque - Water Hose Clamp Screws: 2.5 N·m (0.25 kgf·m, 22 in·lb)**

*Hose Inspection*

- Whenever the radiator or water hoses are removed or in accordance with the Periodic Maintenance Chart, check the radiator or water hoses and their connections. Refer to Radiator Hose and Connection Check in the Periodic Maintenance Chapter.





# Engine Top End

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## 5-2 ENGINE TOP END

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**Specifications**

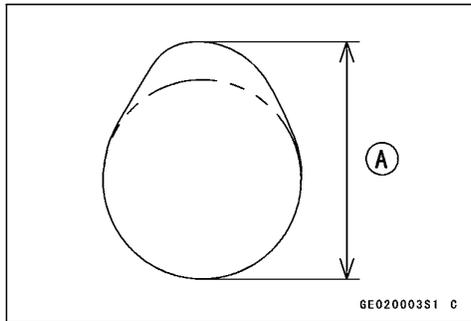
Item	Standard	Service Limit
<b>Clean Air System:</b>		
Vacuum switch valve closing pressure:	Open → Close 49.3 ~ 65.3 kPa (370 ~ 490 mm Hg)	— — —
<b>Camshafts:</b>		
Cam height: Exhaust	33.741 ~ 33.857 mm (1.32839 ~ 1.33295 in.)	33.64 mm (1.3244 in.)
Inlet	33.928 ~ 34.044 mm (1.33575 ~ 1.34031 in.)	33.83 mm (1.3319 in.)
Camshaft/rocker case clearance		
$\phi 25$	0.020 ~ 0.062 mm (0.000787 ~ 0.00244 in.)	0.15 mm (0.00591 in.)
$\phi 17$	0.016 ~ 0.055 mm (0.000630 ~ 0.00217 in.)	0.14 mm (0.00551 in.)
Camshaft journal diameter		
$\phi 25$	24.959 ~ 24.980 mm (0.982638 ~ 0.983465 in.)	24.93 mm (0.98150 in.)
Rocker case bearing inside diameter		
$\phi 25$	25.000 ~ 25.021 mm (0.984252 ~ 0.985079 in.)	25.08 mm (0.98740 in.)
Camshaft journal diameter		
$\phi 17$	16.966 ~ 16.984 mm (0.667953 ~ 0.668661 in.)	16.93 mm (0.66654 in.)
Rocker case bearing inside diameter		
$\phi 17$	17.000 ~ 17.021 mm (0.669291 ~ 0.670118 in.)	17.08 mm (0.67244 in.)
Camshaft runout	TIR 0.02 mm (0.00079 in.) or less	TIR 0.1 mm (0.0039 in.)
Rocker arm inside diameter	16.000 ~ 16.018 mm (0.629921 ~ 0.630630 in.)	16.05 mm (0.63189 in.)
Rocker shaft diameter	15.966 ~ 15.984 mm (0.628583 ~ 0.629291 in.)	15.94 mm (0.62756 in.)
<b>Cylinder Head:</b>		
Cylinder compression usable range	340 ~ 590 kPa (3.5 ~ 6.0 kg/cm <sup>2</sup> , 50 ~ 85 psi) @300 r/min (rpm) with electric starter	— — —
Cylinder head warp	— — —	0.05 mm (0.0020 in.)
<b>Valve:</b>		
Valve clearance	Non-adjustable (Auto adjuster)	— — —
Valve head thickness: Exhaust	0.9 ~ 1.1 mm (0.035 ~ 0.0433 in.)	0.7 mm (0.028 in.)
Inlet	0.9 ~ 1.1 mm (0.035 ~ 0.0433 in.)	0.5 mm (0.020 in.)
Valve stem bend	TIR 0.01 mm (0.00039 in.) or less	TIR 0.05 mm (0.0020 in.)
Valve stem diameter: Exhaust	6.955 ~ 6.970 mm (0.27382 ~ 0.27441 in.)	6.94 mm (0.2732 in.)

# 5-4 ENGINE TOP END

## Specifications

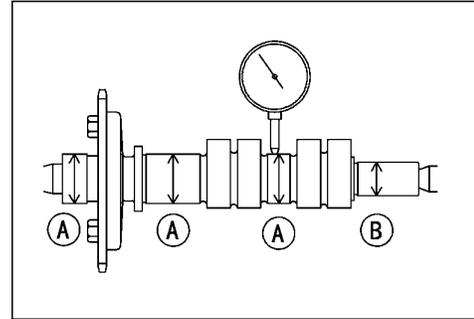
Item		Standard	Service Limit
Valve guide inside diameter:	Inlet	6.965 ~ 6.980 mm (0.27421 ~ 0.27480 in.)	6.95 mm (0.2736 in.)
	Exhaust	7.000 ~ 7.015 mm (0.27559 ~ 0.27618 in.)	7.08 mm (0.2787 in.)
Valve/valve guide clearance (wobble method):	Inlet	7.000 ~ 7.015 mm (0.27559 ~ 0.27618 in.)	7.08 mm (0.2787 in.)
	Exhaust	0.08 ~ 0.16 mm (0.0031 ~ 0.00630 in.)	0.30 mm (0.0118 in.)
	Inlet	0.05 ~ 0.13 mm (0.0020 ~ 0.00512 in.)	0.27 mm (0.0106 in.)

### Cam Height



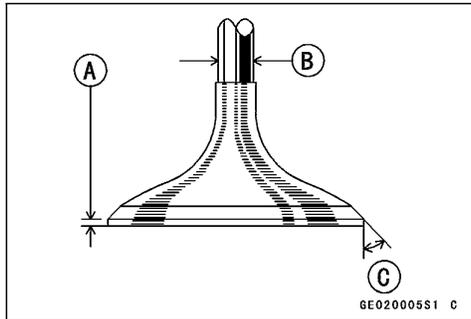
Cam Height (maximum) [A]

### Camshaft Journals and Runout



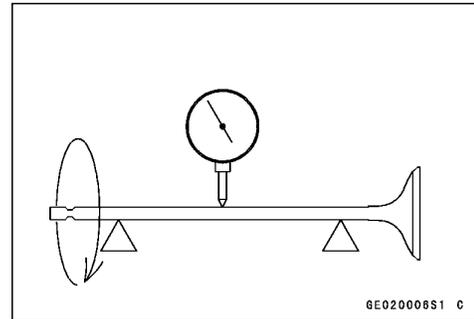
$\phi 25$  mm (0.984 in.) [A]  
 $\phi 17$  mm (0.669 in.) [B]

### Valve Head Thickness



Valve Head Thickness [A]  
 Valve Stem Diameter [B]  
 45° [C]

### Valve Stem Bend

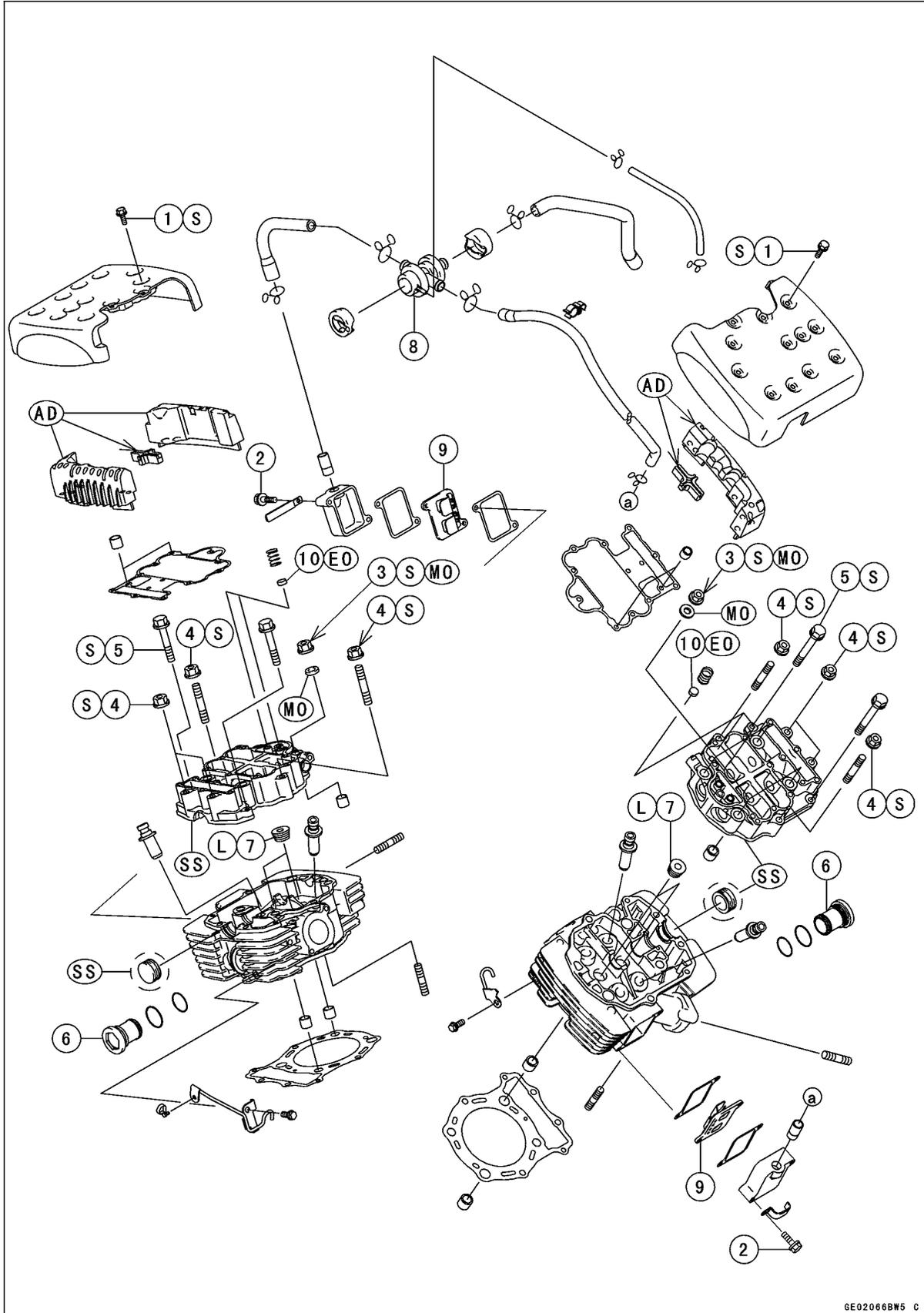


**Specifications**

Item		Standard	Service Limit
Valve seat surface:			
Valve seat cutting angle		45°, 32°, 55°	— — —
Outside diameter:	Exhaust	29.9 ~ 30.1 mm (1.295 ~ 1.303 in.)	— — —
	Inlet	32.9 ~ 33.1 mm (1.177 ~ 1.185 in.)	— — —
Width:	Exhaust	0.5 ~ 1.0 mm (0.020 ~ 0.039 in.)	— — —
	Inlet	0.5 ~ 1.0 mm (0.020 ~ 0.039 in.)	— — —
Valve spring free length:	Outer (EX, IN)	44.76 mm (orange) (1.7622 in.)	43.2 mm (1.700 in.)
	Inner (EX, IN)	39.82 mm (orange) (1.5677 in.)	38.3 mm (1.508 in.)
<b>Cylinder, Piston:</b>			
Cylinder inside diameter		102.000 ~ 102.012 mm (4.015748 ~ 4.016220 in.)	102.10 mm (4.01969 in.)
Piston diameter		101.942 ~ 101.957 mm (4.013457 ~ 4.014047 in.)	101.79 mm (4.00748 in.)
Piston/cylinder clearance		0.043 ~ 0.070 mm (0.00169 ~ 0.00276 in.)	— — —
Oversize piston and rings		+ 0.5 mm (0.020 in.)	— — —
Piston ring/groove clearance:			
	Top	0.05 ~ 0.09 mm (0.00197 ~ 0.00354 in.)	0.19 mm (0.00748 in.)
	Second	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.00669 in.)
Piston ring groove width:	Top	1.24 ~ 1.26 mm (0.048819 ~ 0.049606 in.)	1.34 mm (0.05276 in.)
	Second	1.22 mm ~ 1.24 mm (0.04803 ~ 0.04882 in.)	1.32 mm (0.05197 in.)
Piston ring thickness:	Top	1.17 mm ~ 1.19 mm (0.04606 ~ 0.04685 in.)	1.10 mm (0.0433 in.)
	Second	1.17 mm ~ 1.19 mm (0.04606 ~ 0.04685 in.)	1.10 mm (0.0433 in.)
Piston ring end gap:	Top	0.25 ~ 0.35 mm (0.0098 ~ 0.0138 in.)	0.7 mm (0.028 in.)
	Second	0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)	0.8 mm (0.031 in.)
	Oil	0.3 ~ 0.9 mm (0.012 ~ 0.035 in.)	1.2 mm (0.0472 in.)

# 5-6 ENGINE TOP END

## Exploded View



GE02066BW5 C

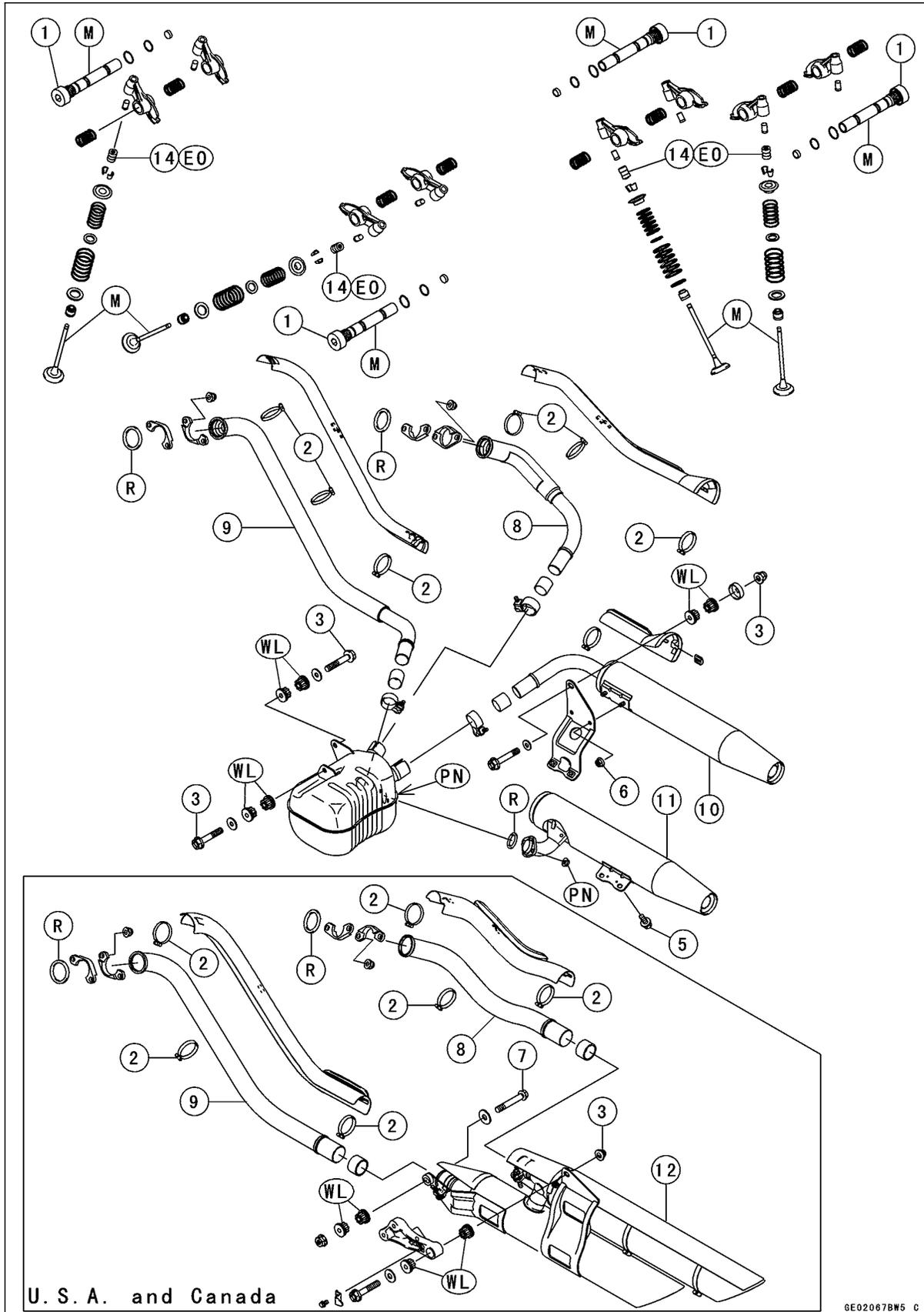
**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rocker case cover bolts	8.8	0.90	78 in·lb	S
2	Air suction valve cover bolts	7.4	0.75	65 in·lb	
3	Rocker case nuts $\phi$ 12 mm	78	8.0	58	S, MO
4	Rocker case nuts $\phi$ 8 mm	25	2.5	18	S
5	Rocker case bolts $\phi$ 6 mm	8.8	0.90	78 in·lb	S
6	Spark plug retainers	12	1.2	104 in·lb	
7	Plugs	20	2.0	14	L

- 8. Vacuum Switch Valve
- 9. Air Suction Valves
- 10. HLA Oil Filters
- AD: Apply adhesive.
- EO: Apply engine oil.
- MO: Apply molybdenum disulfide oil.
- L: Apply a non-permanent locking agent.
- S: Follow the specific tightening sequence.
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

# 5-8 ENGINE TOP END

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rocker shafts	25	2.5	18	
2	Exhaust pipe cover clamp screws	6.9	0.70	61 in·lb	
3	Premuffler chamber bolts	29	3.0	22	
4	Muffler bracket nut	29	3.0	22	
5	Muffler stay mounting bolts, $\phi$ 8	25	2.5	18	
6	Muffler stay mounting nuts, $\phi$ 8	25	2.5	18	
7	Muffler bracket bolt	29	3.0	22	

- 8. Rear Exhaust Pipe
  - 9. Front Exhaust Pipe
  - 10. Upper Muffler
  - 11. Lower Muffler
  - 12. Muffler Assembly
  - 13. Premuffler Chamber
  - 14. Hydraulic Lash Adjusters
- PN: Spray a penetrating oil on the nuts and studs if the nuts are difficult to remove.  
M: Apply molybdenum disulfide grease.  
R: Replacement Parts  
WL: Apply a soap and water solution or rubber lubricant.



**Exploded View**

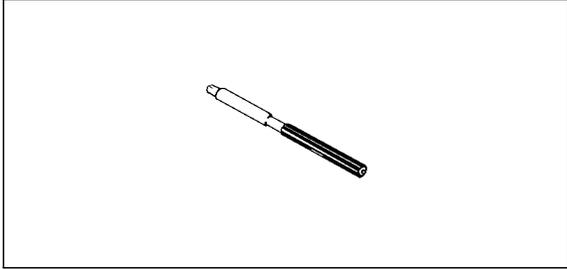
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Cylinder coolant drain plug	11	1.1	95 in·lb	
2	Cylinder head nuts	25	2.5	18	S
3	Cylinder nuts	25	2.5	18	S
4	Chain tensioner cap	20	2.0	14	S
5	Chain tensioner lockbolt	4.9	0.50	43 in·lb	S
6	Chain tensioner mounting bolts	11	1.1	95 in·lb	S
7	Chain guide mounting bolts	11	1.1	95 in·lb	L
8	Camshaft sprocket bolts	15	1.5	11	L

- 9. KACR Unit
- 10. "R" marked side faces up.
- 11. "RN" marked side faces up.
- 12. Each arrow mark points to the front side.
- EO: Apply engine oil.
- L: Apply a non-permanent locking agent.
- MO: Apply molybdenum disulfide oil.
- R: Replacement Parts
- S: Follow the specific tightening sequence.

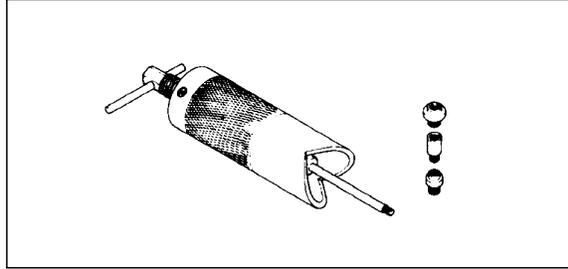
# 5-12 ENGINE TOP END

## Special Tools and Sealant

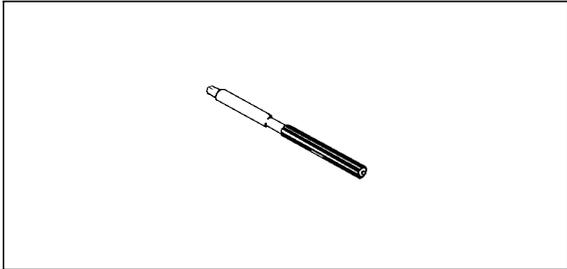
Valve Guide Reamer,  $\phi 7$  :  
57001-162



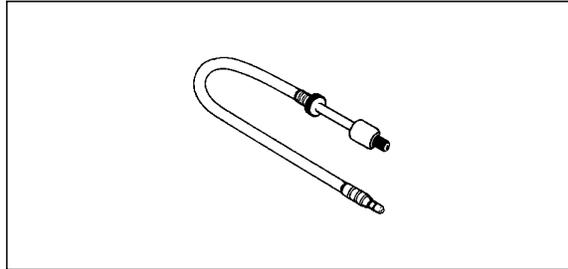
Piston Pin Puller Assembly :  
57001-910



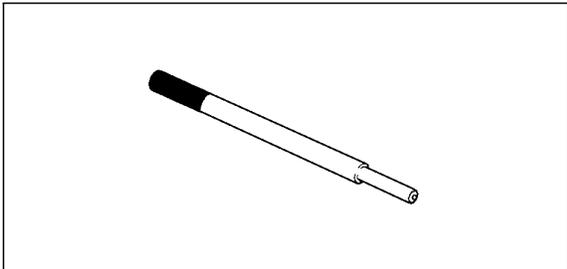
Valve Guide Reamer,  $\phi 7$  :  
57001-162



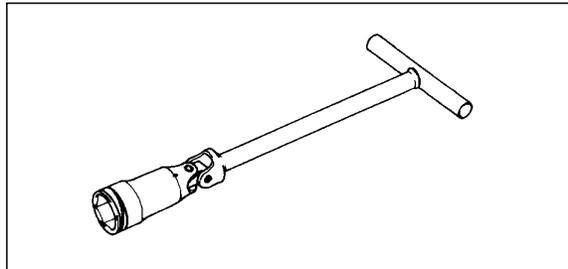
Compression Gauge Adapter, M12 x 1.25 :  
57001-1018



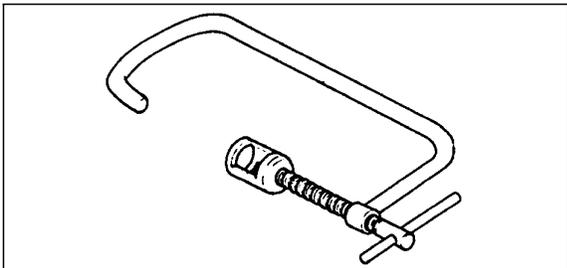
Valve Guide Arbor,  $\phi 7$  :  
57001-163



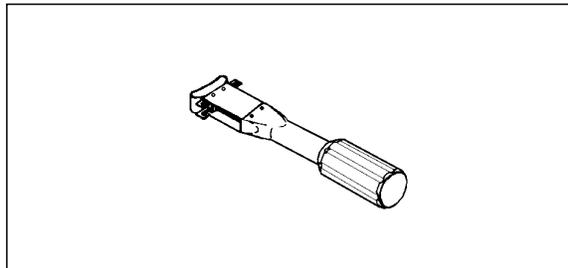
Spark Plug Wrench, Hex 18 :  
57001-1024



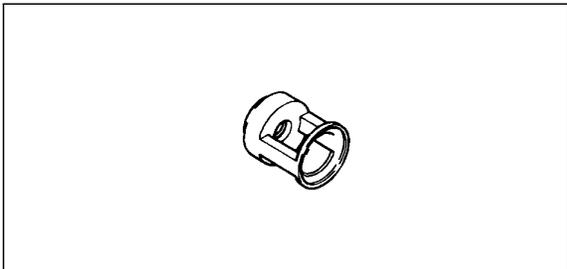
Valve Spring Compressor Assembly :  
57001-241



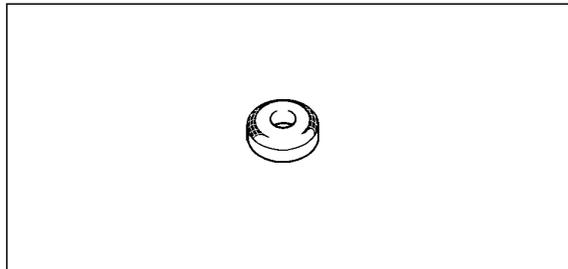
Piston Ring Compressor Grip :  
57001-1095



Valve Spring Compressor Adapter,  $\phi 28.2$  :  
57001-243

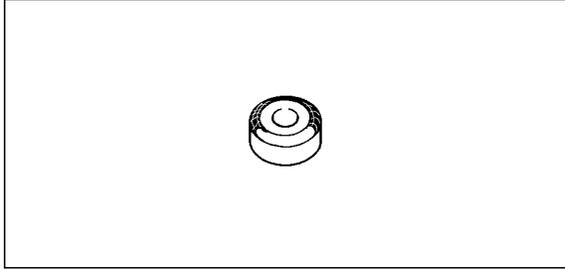


Valve Seat Cutter, 45° -  $\phi 35$  :  
57001-1116

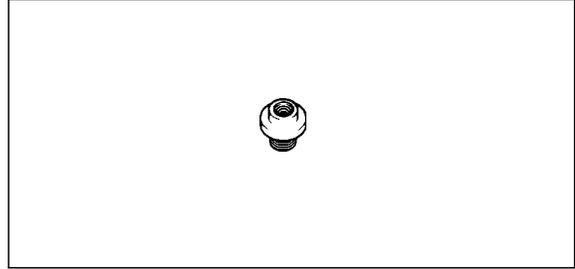


Special Tools and Sealant

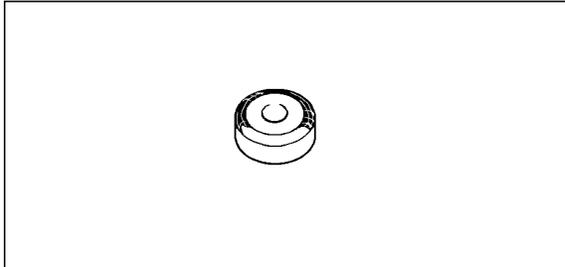
Valve Seat Cutter, 32° -  $\phi 35$  :  
57001-1121



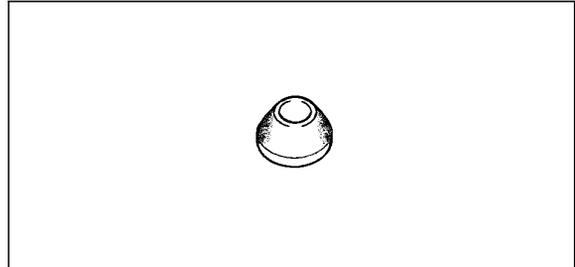
Piston Pin Puller Adapter,  $\phi 14$  :  
57001-1211



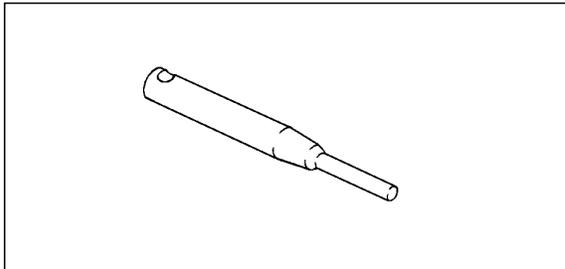
Valve Seat Cutter, 32° -  $\phi 38.5$  :  
57001-1122



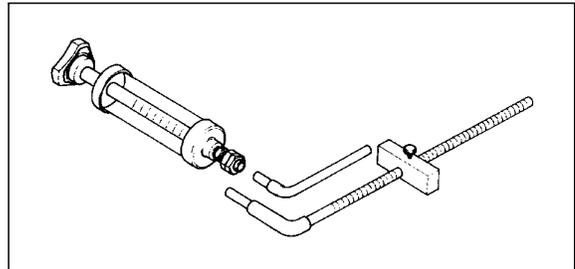
Valve Seat Cutter, 55° -  $\phi 35$  :  
57001-1247



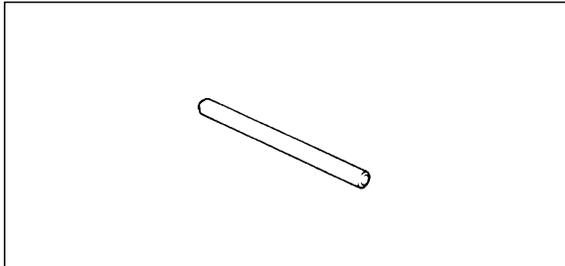
Valve Seat Cutter Holder,  $\phi 7$  :  
57001-1126



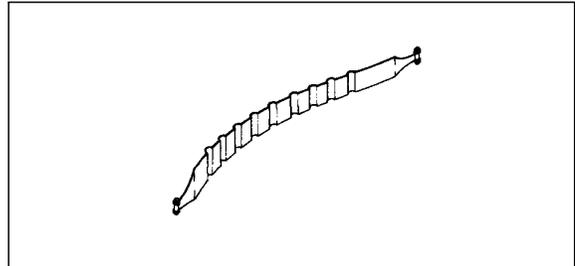
Fork Oil Level Gauge :  
57001-1290



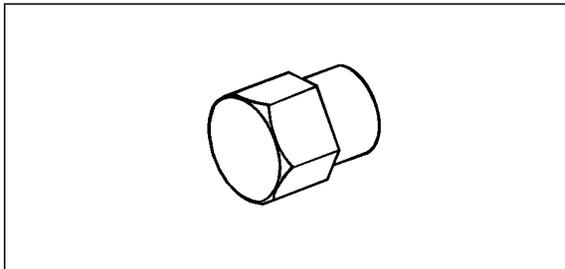
Valve Seat Cutter Holder Bar :  
57001-1128



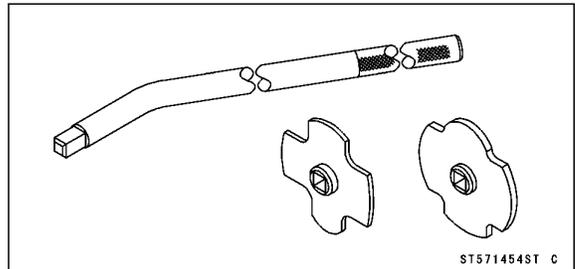
Piston Ring Compressor Belt,  $\phi 95 \sim \phi 108$  :  
57001-1358



Hexagon Wrench, Hex 27 :  
57001-1210



Filler Cap Driver :  
57001-1454



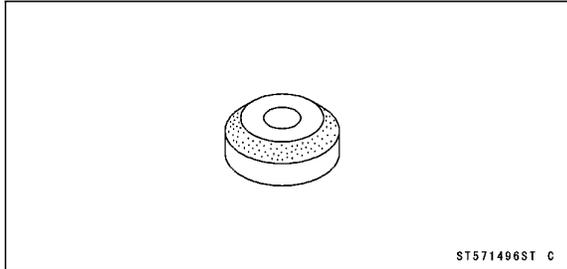
ST571454ST C

## 5-14 ENGINE TOP END

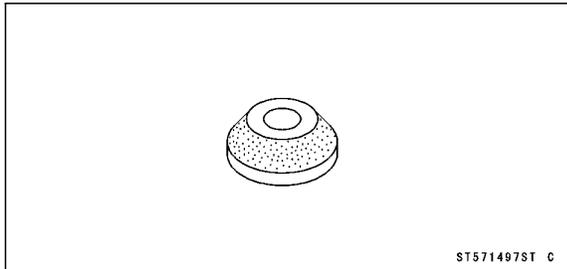
### Special Tools and Sealant

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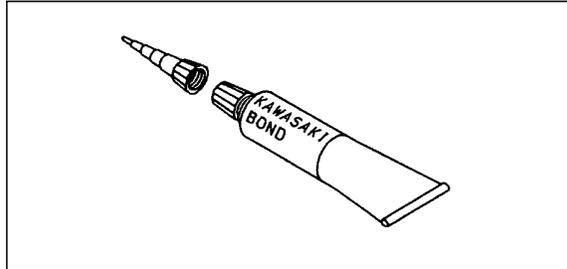
**Valve Seat Cutter 45° –  $\phi$ 40 :**  
57001-1496



**Valve Seat Cutter 55° –  $\phi$ 38.5 :**  
57001-1497



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



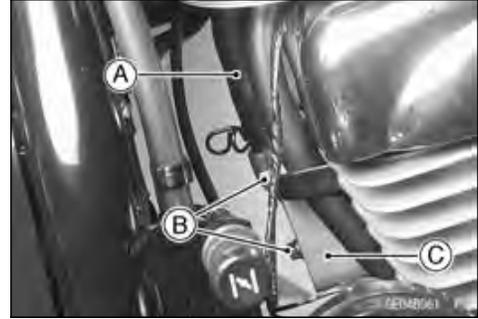
○Compression Gauge Adapter: 57001-1183  
can also be used.

○Valve Seat Cutter, 32° –  $\phi$ 33: 57001-1199  
can also be used instead of Valve Seat Cutter,  
32° –  $\phi$ 35: 57001-1121

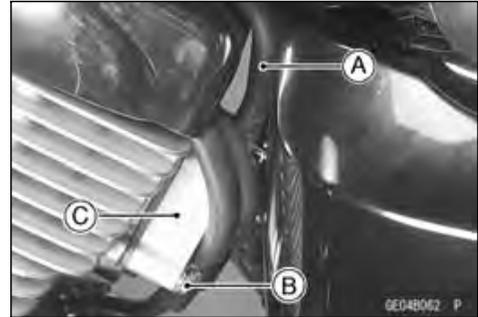
## Clean Air System

### *Air Suction Valve Removal*

- For rear air suction valve removal, remove the hose [A].
- Unscrew the mounting bolts [B] and remove the rear air suction valve cover [C].
- Remove the rear air suction valve.

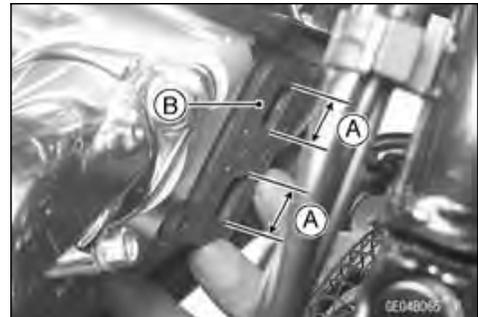


- For front air suction valve removal, remove the horn, the radiator mounting bolt and move the radiator forward.
- Remove the hose [A].
- Unscrew the mounting bolts [B] and remove the front air suction valve cover [C].
- Remove the front air suction valve.



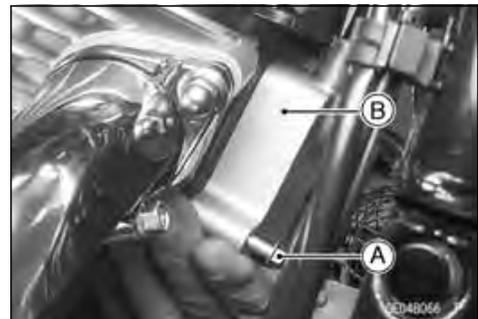
### *Air Suction Valve Installation*

- Replace the gasket with a new one.
  - Install each air suction valve so that its wider side [A] of the reed faces left.
- Front Air Suction Valve [B]



- For the front air suction valve cover installation, set the lower bolt [A] in the cover [B] and install it.

**Torque - Air Suction Valve Cover Bolts: 7.4 N·m (0.75 kgf·m, 65 in·lb)**



### *Air Suction Valve Check*

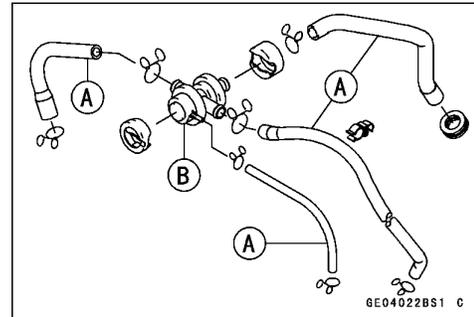
- Refer to Air Suction Valve Check in the Periodic Maintenance Chapter.

## 5-16 ENGINE TOP END

### Clean Air System

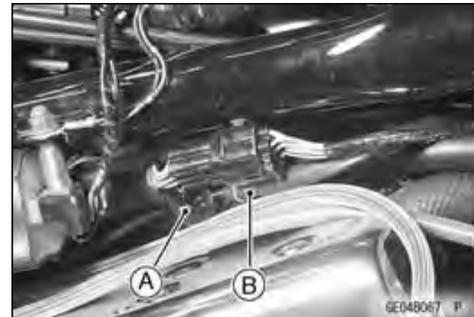
#### Vacuum Switch Valve Removal

- Remove:
  - Fuel Tank (see Fuel System Chapter)
- Pull off the hoses [A] and take out the vacuum switch valve [B].



#### Vacuum Switch Valve Installation

- Install the vacuum switch valve [A] so that the inlet vacuum hose [B] faces rear side.
- Route the hoses correctly (see General Information chapter).

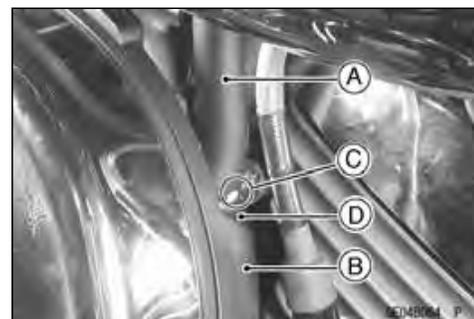


#### Vacuum Switch Valve Operation Test

- Pull the vacuum switch hose [A] out of the right air cleaner base.
- Start the engine and run it at idle speed.
- Plug the vacuum switch hose end with your finger and feel vacuum pulsing in the hose.
- ★ If there is no vacuum pulsation, check the hose line for leak. If there is no leak, check the vacuum switch valve (see Vacuum Switch Valve Unit Test).



- Apply a soap and water solution or rubber lubricant to the end of the vacuum switch hose [A] and put the hose into the right air cleaner base [B] with the white mark [C] faced forward until the white mark aligns with the top of the grommet [D].

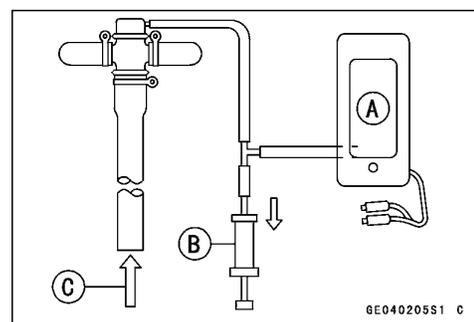


#### Vacuum Switch Valve Unit Test

- Remove the vacuum switch valve (see Vacuum Switch Valve Removal).
- Connect a commercially available vacuum gauge [A] and syringe [B] (or fork oil level gauge) to the vacuum hoses as shown.

**Special Tool - Fork Oil Level Gauge: 57001-1290**

Air Flow [C]



## Clean Air System

- Gradually raise the vacuum (lower the pressure) applied to the vacuum switch valve, and check the valve operation. When the vacuum is low, the vacuum switch valve should permit air to flow. When the vacuum raises to valve closing pressure, it should stop air flow.

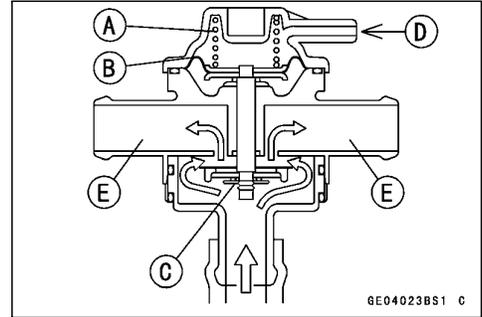
Spring [A]

Diaphragm [B]

Valve [C]

Low Vacuum [D]

Secondary air flows [E].



- ★ If the vacuum switch valve does not operate as described, replace it with a new one.

### NOTE

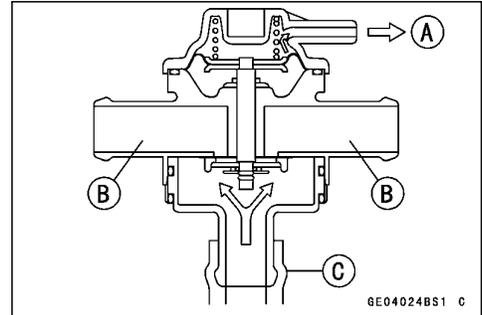
- To check air flow through the vacuum switch valve, just blow through the air cleaner hose [C].

### Vacuum Switch Valve Closing Pressure (Open → Close)

**Standard: 49.3 ~ 65.3 kPa (370 ~ 490 mm Hg)**

High Vacuum [A]

Secondary air cannot flow [B].



### Clean Air System Hose Inspection

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the right air cleaner base, vacuum switch valve, throttle body, and air suction valve covers.
- ★ If they are not, correct them. Replace them if they are damaged.

## 5-18 ENGINE TOP END

### Camshaft Chain Tensioner

#### Camshaft Chain Tensioner Removal

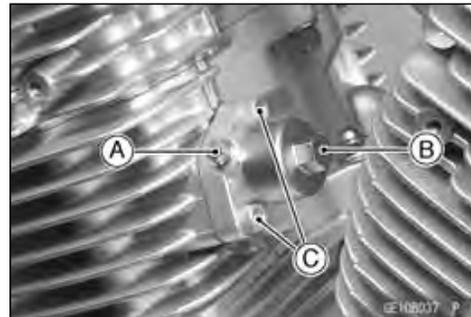
##### CAUTION

This is a non-return type cam chain tensioner. The push rod does not return to its original position once it moves out to take up camshaft chain slack. Observe all the rules listed below:

When removing the tensioner, do not take out the mounting bolts only halfway. Retightening the mounting bolts from this position could damage the tensioner and the camshaft chain. Once the bolts are loosened, the tensioner must be removed and reset as described in "Camshaft Chain Tensioner Installation".

Do not turn over the crankshaft while the tensioner is removed. This could upset the cam chain timing, and damage the valves.

- For the front chain tensioner, remove the lower air cleaner duct and left air cleaner base holder (see Fuel System chapter).
  - The procedure to remove the front chain tensioner is as follows.
  - Loosen the lockbolt [A] and remove the tensioner cap [B].
  - Remove the tensioner mounting bolts [C] and take off the chain tensioner.
- 
- For the rear chain tensioner [A], removal is the same as for the front chain tensioner.

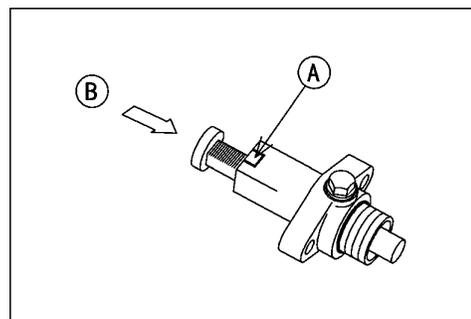


#### Camshaft Chain Tensioner Installation

##### CAUTION

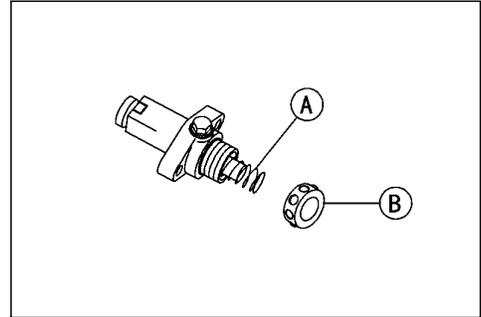
Be sure to install the camshaft chain tensioner after camshaft chain is timed.

- Push the stopper [A] to release the ratchet and push the push rod [B] into the tensioner body.

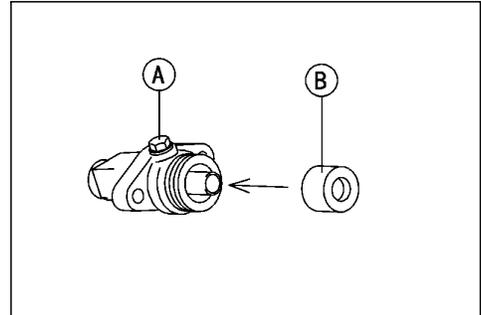


## Camshaft Chain Tensioner

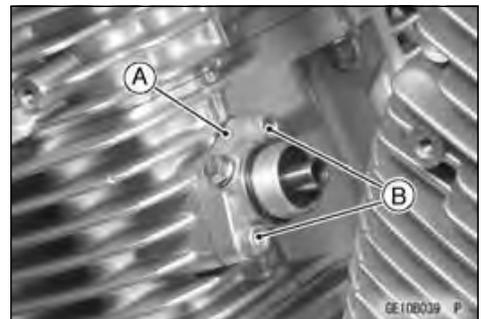
- Install the larger spring [A], and then the ball bearing assy [B].
- Fit the ball bearing assy into the body until it bottoms out, using a thin-bladed screwdriver.



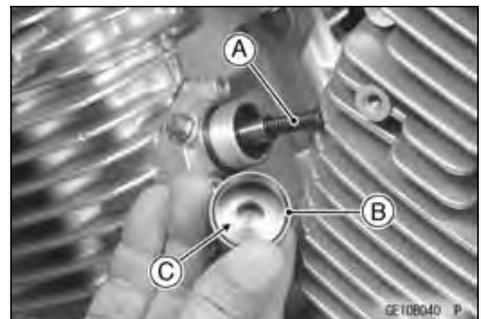
- Screw in the lockbolt [A] finger-tight to hold the ball bearing assy temporarily.
- Install the retainer [B].



- Install the tensioner body [A] and tighten the mounting bolts [B] to the specified torque.
- Torque - Chain Tensioner Mounting Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**



- Install the smaller spring [A] and the tensioner cap [B].
  - Set the spring end into the hollow [C] of the cap.
  - Tighten the tensioner cap to the specified torque.
- Torque - Chain Tensioner Cap: 20 N·m (2.0 kgf·m, 14 ft·lb)**



- Remove the lockbolt [A] and check to be sure that the larger spring clicks, then install the lockbolt.
- Torque - Chain Tensioner Lockbolt: 4.9 N·m (0.50 kgf·m, 43 in·lb)**

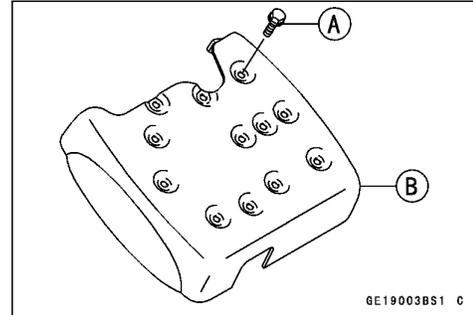


## 5-20 ENGINE TOP END

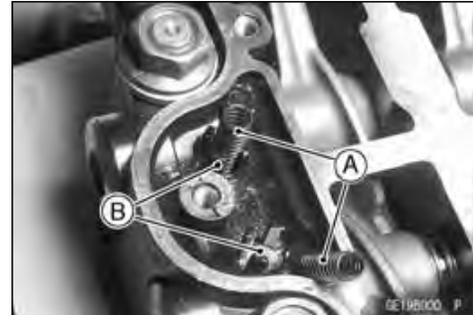
### Rocker Case Cover

#### Rocker Case Cover Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Remove the bolts [A] and take off the cover [B] from the rocker case.



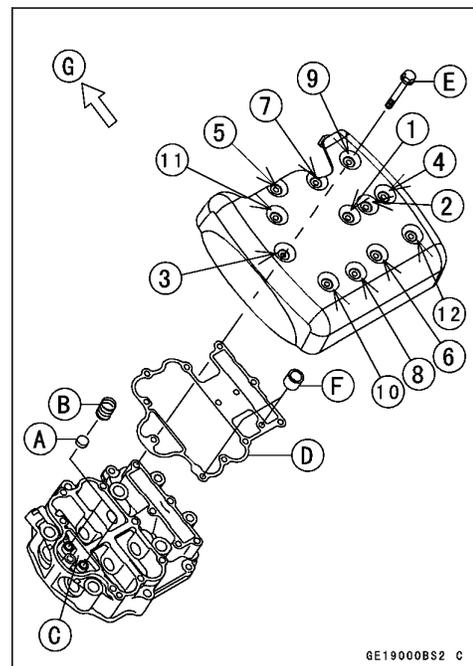
- Take out the oil filter springs [A] and HLA oil filters [B].



#### Rocker Case Cover Installation

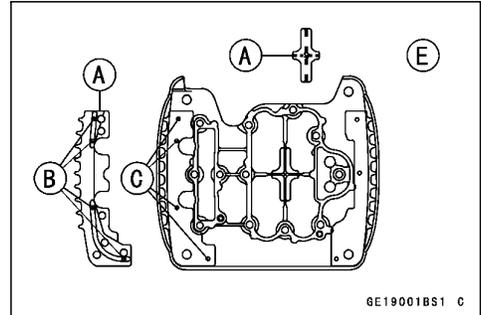
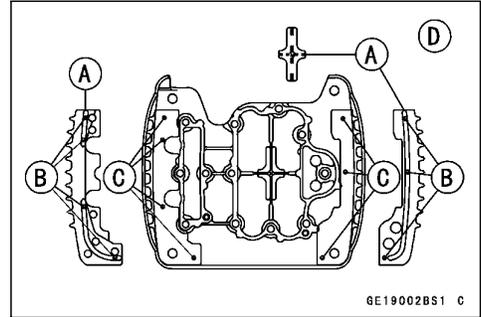
- Replace the HLA oil filters [A] with new ones.
- Install the oil filter springs [B]
- After installing the rocker case, fill the oil reservoir [C] with engine oil.
- Replace the cover gasket [D] with a new one.
- Tighten the cover bolts [E] to the specified torque following the tightening sequence.
  - Dowel Pins [F]
  - Inlet Side [G]

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



**Rocker Case Cover***Rocker Case Cover Assembly*

- Apply adhesive to the rubber dampers [A] and install them on the rocker case cover as shown.
- Insert the projections [B] of the dampers to the holes [C] of the cover.
  - Front Cover [D]
  - Rear Cover [E]



## 5-22 ENGINE TOP END

### Rocker Case

#### Rocker Case Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Remove the throttle body assy (see Fuel System (DFI) chapter).
- Remove the rocker case covers (see this chapter).
- Remove the alternator outer cover (see Electrical System chapter).
- Remove the timing inspection plug [A] and rotor bolt plug [B].

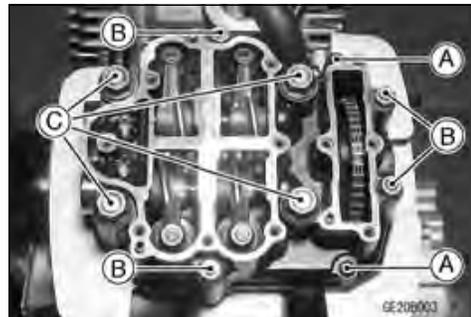
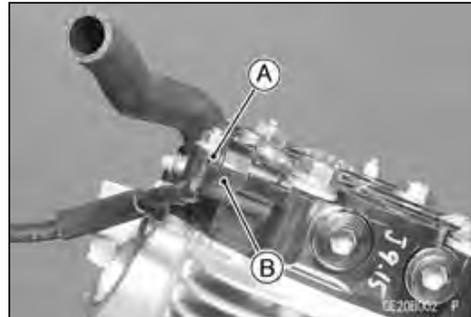
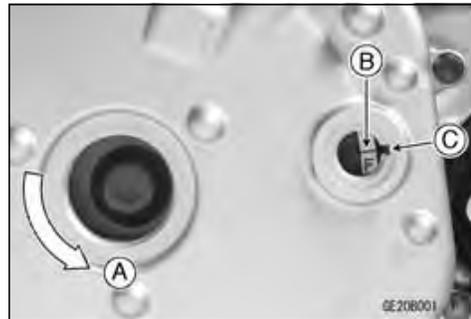
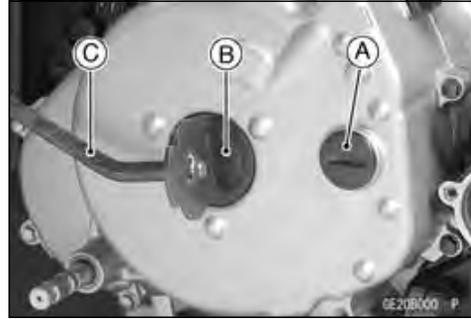
**Special Tool - Driver-Filler Cap: 57001-1454 [C]**

- Turn the crankshaft counterclockwise [A] and align the "F" mark (TDC mark for front piston) [B] with the middle of the notch [C].

- Remove:
  - Oil Hose Banjo Bolt [A]
  - Oil Hose [B]

- Remove the camshaft chain tensioner (see Camshaft Chain Tensioner Removal).
- Remove the rocker case bolts [A], smaller nuts [B], and then larger nuts [C].

- Using the pry points [A], take the rocker case out of the cylinder head.

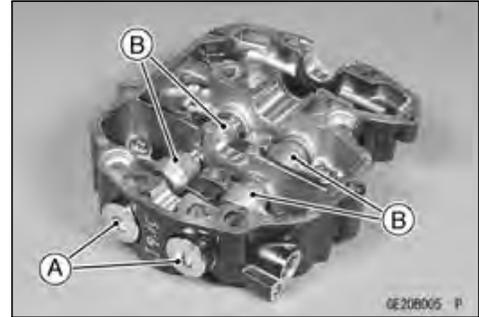


**Rocker Case**

- Unscrew the rocker shafts [A], and take the rocker arms [B] out of the rocker case.
- Take out the oil filters if necessary.
- Remove the lash adjuster if necessary (see HLA Removal).

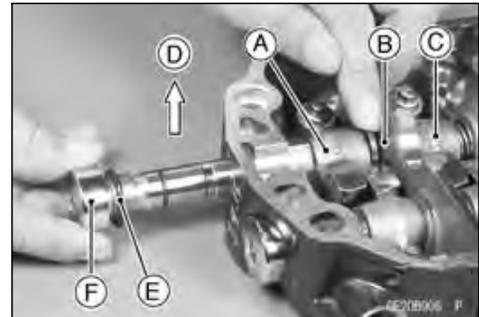
**CAUTION**

The cylinder head and rocker case are machined in the assembled state, so they must be used as a set. Be careful not to mix them up for front and rear cylinders.



*Rocker Case Installation*

- Install the rocker arms [A] and retaining springs [B] on each rocker shaft as shown. These retaining springs are the same.
- The rocker arm [C] of the exhaust side [D] next to the chain tunnel is different from the others.
- Be careful not to tip the rocker arm and not to allow the oil to leak out of HLA.
- Replace the O-rings [E] with new ones and install them on the rocker shaft [F].
- Tighten the rocker shafts to the specified torque.

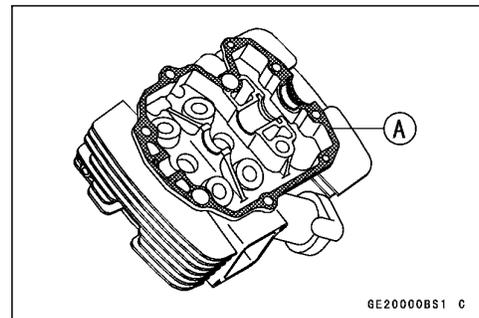


**Torque - Rocker Shafts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Apply silicone sealant [A] to the rocker case mating surface and the outer circumference of the plugs as shown.

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

- Do not apply silicone sealant around the camshaft bearing.

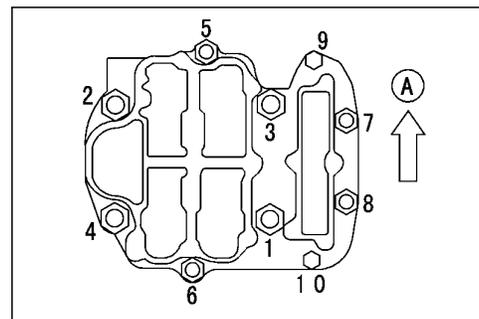


- Apply molybdenum disulfide oil to the threads and seating surface of  $\phi 12$  mm nuts and both sides of washers.
- Tighten the rocker case nuts and bolts temporarily following the tightening sequence shown, and then tighten them to the specified torque.

**Torque - Rocker Case Nuts  $\phi 12$  mm: 78 N·m (8.0 kgf·m, 58 ft·lb)**

**Rocker Case Nuts  $\phi 8$  mm: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**Rocker Case Bolts  $\phi 6$  mm: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



**Inlet Side [A]**

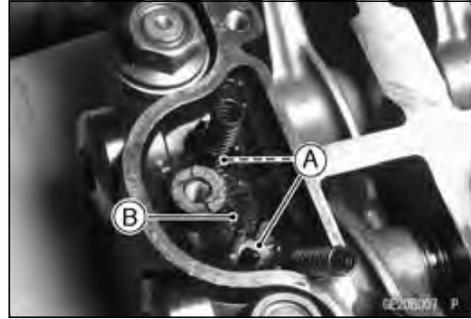
- The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).

## 5-24 ENGINE TOP END

### Rocker Case

- Replace the HLA oil filters [A] with new ones.
- After installing the rocker case, fill the oil reservoir [B] with engine oil.
- Tighten:

**Torque - Oil Hose Flange Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**



- Tighten the cylinder head nuts [A] and cylinder nuts [B] to the specified torque.

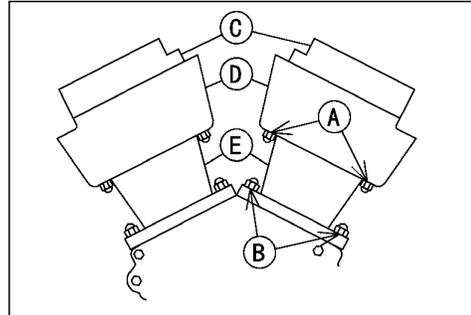
**Torque - Cylinder Head Nuts, Cylinder Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

Rocker Cases [C]  
Cylinder Heads [D]  
Cylinders [E]

- Tighten:

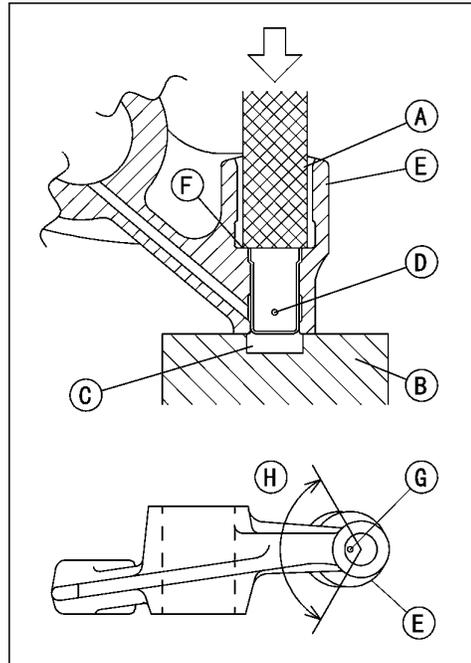
**Torque - Timing Inspection Plug, Rotor Bolt Plug: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

- Install the engine (see Engine Removal/Installation chapter).



### Rocker Arm Assembly

- Prepare a flat-end bar [A] and a block [B] with a recess [C].
- Press the oil chamber [D] for the HLA into the rocker arm end [E] until the chamber end is even with the step [F] of the hole.
- Install the oil chamber as shown so that the air bleed hole [G] is placed within 120 degrees [H]. This makes HLA bleeding easier.



## Rocker Case

### HLA Removal

- Remove the rocker case (see this chapter).
- Remove the rocker arms.
- Pull the HLA (hydraulic lash adjuster) [B] out of the rocker arm [A] with your fingers.

### CAUTION

Be careful not to damage or deform an HLA by tapping it during removal or installation. Do not drop the HLA or hit it sharply. If it is damaged, the plunger will not operate smoothly.

### HLA Air Bleeding

- Fill a container with engine oil.
- Prepare a thumbtack and cut its needle to 2.1 ~ 2.3 mm (0.0827 ~ 0.0906 in.) long [A]. Grind its cutting edge [B] smooth.
- Push in the check valve of the HLA [D] with the needle of the tack [C] and move the plunger up and down in the oil bath.
- ★ If the plunger sinks into the HLA body, repeat the air bleeding procedure and then push the plunger.
- ★ After air bleeding, if the plunger sinks into the HLA body again, replace the HLA.

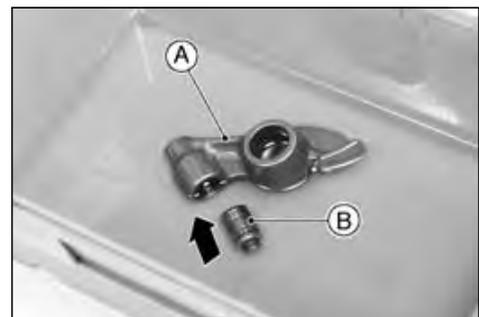
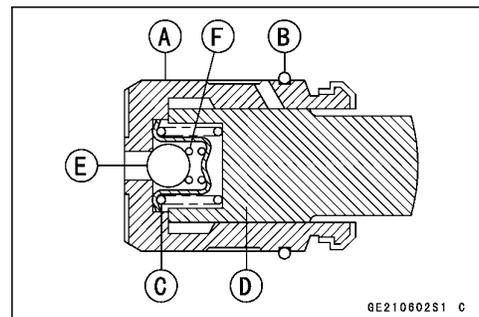
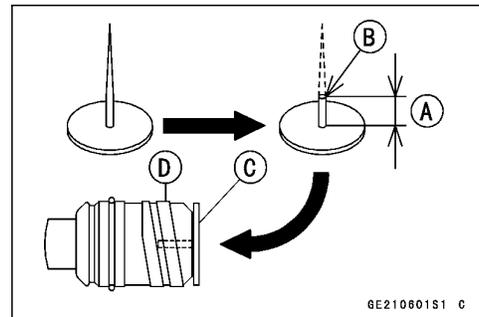
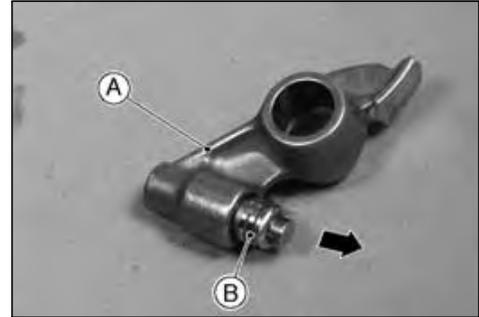
### CAUTION

Do not push the check valve in more than 2.1 ~ 2.3 mm. Pushing too deep may cause the damage of the HLA.

### HLA Installation

- Check that the HLA plunger is not damaged.
- ★ If the plunger does damage, replace the HLA.
  - HLA Body [A]
  - O-ring [B]
  - Plunger Spring [C]
  - Pivot Plunger [D]
  - Check Valve [E]
  - Check Valve Spring [F]

- Air-bleed the HLA (see HLA Air Bleeding).
- Soak a rocker arm [A] in engine oil, and then insert the HLA [B] into the rocker arm.
- Be careful not to tip the rocker arm having the HLA, and not to allow engine oil to leak out of the HLA.



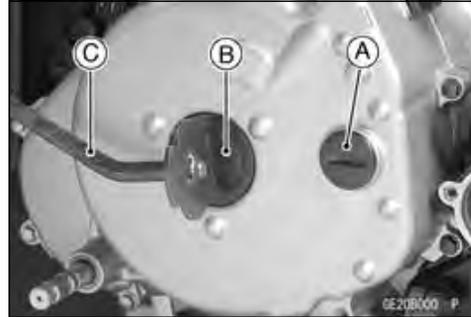
## 5-26 ENGINE TOP END

### Camshafts

#### Camshaft Removal

- Remove the timing inspection cap [A] and rotor bolt cap [B].

Special Tool - Driver-Filler Cap: 57001-1454 [C]



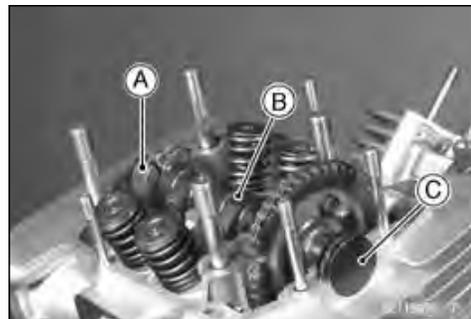
- Turn the crankshaft counterclockwise [A] and align the “F” mark [B] (TDC mark for the front piston) with the middle of the notch [C].
- Remove the front and rear rocker case covers (see this chapter).
- Remove the front and rear rocker cases (see this chapter).



- Remove the camshaft [B] along with the KACR [A].
- Remove the camshaft plug [C].
- Stuff a clean cloth into the chain tunnel to keep any parts from dropping into the crankcase.

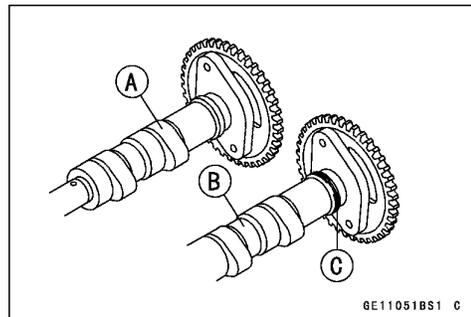
#### CAUTION

The crankshaft may be turned while the camshafts are removed. Always pull the chain taut while turning the crankshaft. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both chain and sprocket.



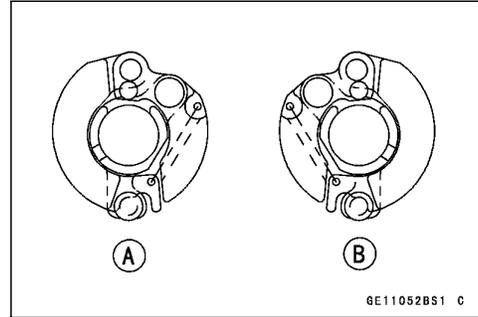
#### Camshaft Installation

- The front camshaft [A] and rear camshaft [B] are different. The rear camshaft has a groove [C].

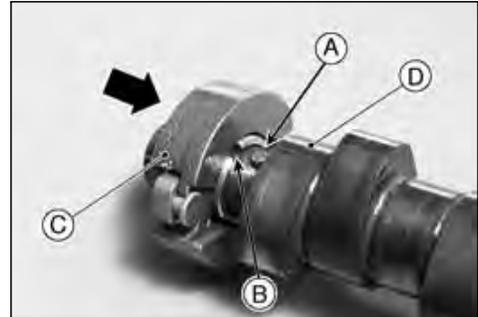


**Camshafts**

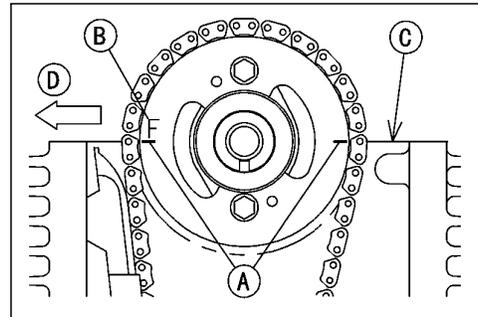
- Install the KACR on each camshaft.
- The front KACR [A] and rear KACR [B] are different (inside view). Do not confuse these KACRs.



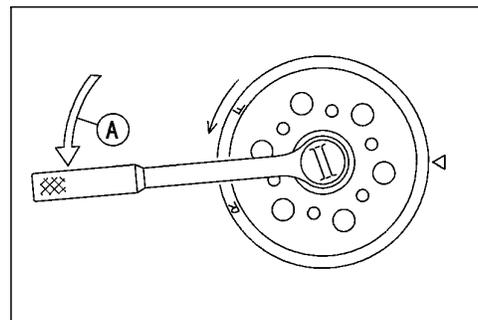
- Fit the pin [A] into the notch [B], and install the KACR [C] onto the camshaft [D].
- Apply molybdenum disulfide oil to all cam parts, including their journals.
- The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).
- Remove the timing inspection cap and check that the “F” mark aligns with the middle of the notch (front piston TDC) (see Camshaft Removal).
- ★ If necessary, align them.



- First, install the front camshaft.
- Engage the front camshaft sprocket with the camshaft chain as shown.
  - Timing Marks [A]
  - F mark [B]
  - Cylinder Head Upper Surface [C]
  - Front [D]
- Pull the front side (exhaust side) of the chain taut to install the camshaft.
- Install the front chain tensioner (see this chapter). The timing marks must be aligned with the cylinder head upper surface.



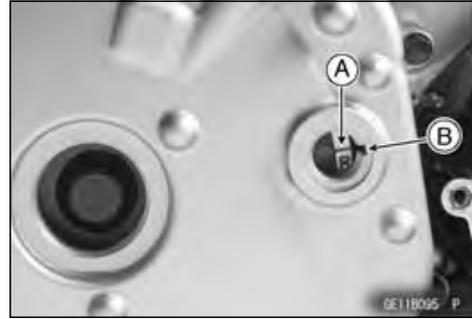
- Next, install the rear camshaft.
- Check to be sure that the front camshaft chain timing is correct.
- Turn the crankshaft counterclockwise [A].



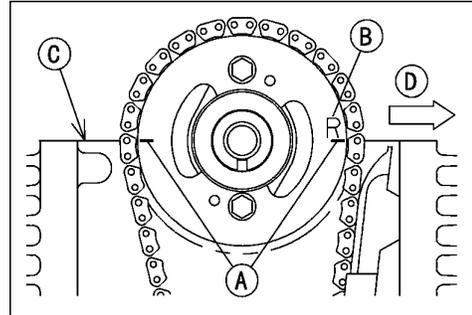
## 5-28 ENGINE TOP END

### Camshafts

- Align the “R” mark [A] (TDC mark for the rear piston) with the middle of the notch [B] (310° turn from the front piston TDC).



- Engage the rear camshaft sprocket with the camshaft chain as shown.
  - Timing Marks [A] and R Mark [B]
  - Cylinder Head Upper Surface [C]
  - Front [D]
- Pull the front side (inlet side) of the chain taut to install the camshaft.
- Install the rear chain tensioner and check the front/rear chain timing again.
- The timing marks must be aligned with the cylinder head upper surface and positioned as shown after chain tensioner installation.
- Install the rocker cases and rocker case covers (see this chapter).

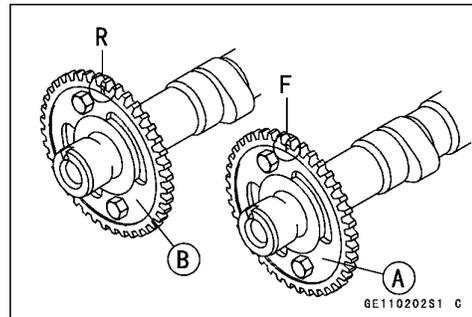


**Torque - Timing Inspection Cap, Rotor Bolt Cap: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

#### Camshaft Sprocket Installation

- Use the sprocket marked F for the front camshaft [A] and the sprocket marked R for the rear camshaft [B].
- Apply a non-permanent locking agent to the camshaft sprocket bolts and tighten them to the specified torque.

**Torque - Camshaft Sprocket Bolts: 15 N·m (1.5 kgf·m, 11 ft·lb)**



#### Camshaft/Rocker Case Wear

- Cut strips of plastigage to journal width. Place a strip on each journal parallel to the camshaft installed in the correct position.
- Measure each clearance between the camshaft and the rocker case using plastigage.

#### NOTE

- Do not turn the camshaft when the plastigage is between the journal and camshaft cap.

## Camshafts

- Apply molybdenum disulfide oil to the threads and seating surface of  $\phi 12$  mm nuts and both sides of washers.
- Tighten the rocker case nuts and bolts temporarily following the tightening sequence shown, and then tighten them to the specified torque.

**Torque - Rocker Case Nuts  $\phi 12$  mm: 78 N·m (8.0 kgf·m, 58 ft·lb)**

**Rocker Case Nuts  $\phi 8$  mm: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**Rocker Case Bolts  $\phi 6$  mm: 8.8 N·m (0.90 kgf·m, 78 in·lb)**

Inlet Side [A]

- Remove the rocker case again, and measure the plastigage width [A] to determine the clearance between each journal and the rocker case. Measure the maximum plastigage width.

### Camshaft/Rocker Case Clearance

**Standard:** ( $\phi 25$ ) 0.020 ~ 0.062 mm  
(0.000787 ~ 0.00244 in.)  
( $\phi 17$ ) 0.016 ~ 0.055 mm  
(0.000630 ~ 0.00217 in.)

**Service Limit:** ( $\phi 25$ ) 0.15 mm (0.00591 in.)  
( $\phi 17$ ) 0.14 mm (0.00551 in.)

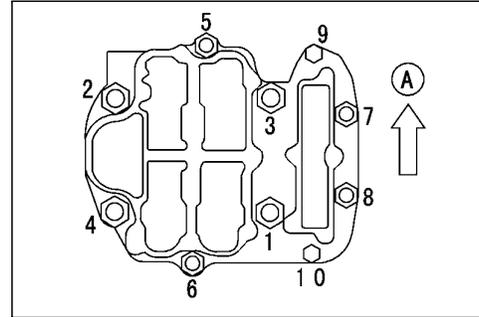
- ★ If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

### Camshaft Journal Diameter

**Standard:** ( $\phi 25$ ) 24.959 ~ 24.980 mm  
(0.982638 ~ 0.983465 in.)  
( $\phi 17$ ) 16.966 ~ 16.984 mm  
(0.667953 ~ 0.668661 in.)

**Service Limit:** ( $\phi 25$ ) 24.93 mm (0.98150 in.)  
( $\phi 17$ ) 16.93 mm (0.66654 in.)

- ★ If the camshaft journal diameter is less than the service limit, replace the camshaft with a new one and measure the clearance again.
- ★ If the clearance still remains out of the limit, replace the cylinder head and rocker case.



### CAUTION

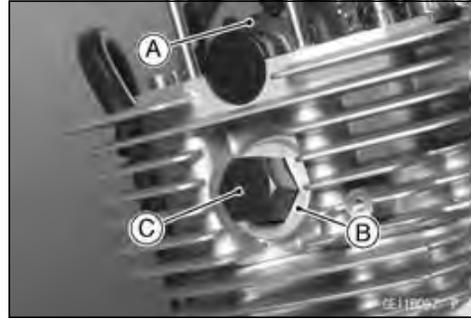
**The rocker case and cylinder head are machined in the assembled state, so they must be replaced as a set.**

## 5-30 ENGINE TOP END

### Camshafts

#### Front Camshaft Chain Removal

- Remove:
  - Front Camshaft [A] (see this chapter)
  - Spark Plug (left side, see Cylinder Compression Measurement)
  - Spark Plug Retainer [B] (left side)
- **Special Tool - Hexagon Wrench, Hex 27 [C]: 57001-1210**

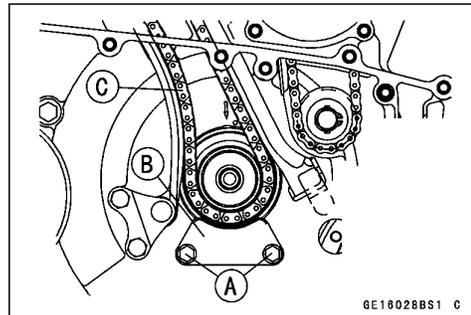


- Remove:
  - Alternator Rotor (see Electrical System chapter)
  - Lower Chain Guide Bolts [A]
  - Lower Chain Guide [B]
- Take out the front camshaft chain [C].



#### Rear Camshaft Chain Removal

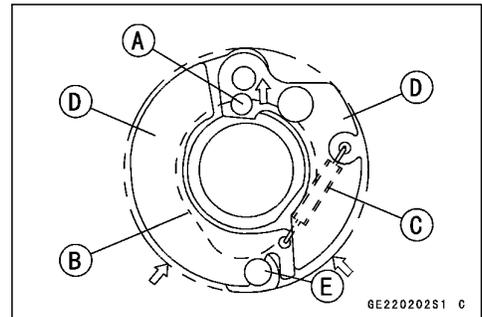
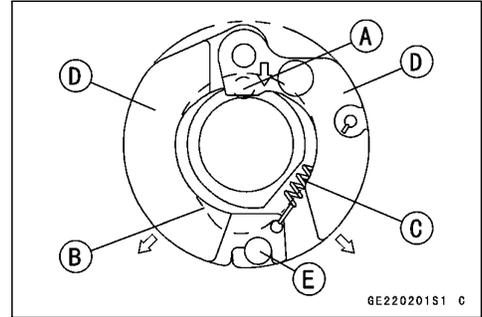
- Remove:
  - Rear Camshaft (see this chapter)
  - Spark Plug (left side, see Cylinder Compression Measurement)
  - Spark Plug Retainer (see Front Chain Removal)
  - Clutch (see Clutch chapter)
  - Starter Clutch Gear (see Crankshaft/Transmission chapter)
  - Primary Gear (see Crankshaft/Transmission chapter)
- Lower Chain Guide Bolts [A]
- Lower Chain Guide [B] (right view)
- Take out the rear camshaft chain [C].



## Camshafts

### KACR Inspection

- Due to the simplicity of the KACR (Kawasaki Automatic Compression Release), no periodic maintenance is needed. There are only two symptoms of problems with the KACR mechanism: compression is not released during starting, and compression is released during running.
- The cylinder compression is not released during starting (abnormal): the pin [A] stays within the cam [B] and will not push up the exhaust rocker arm.
  - Remove the KACR unit and visually inspect the spring [C].
  - ★ If the spring is damaged, deformed, or missing, replace the spring.
  - Remove the spring and move the weights [D] back and forth.
  - ★ If the weights do not move smoothly all the way, replace the KACR unit. Also inspect the exhaust rocker arm for any damage, and replace the rocker arm if necessary.  
Stopper [E]
- The cylinder compression is released while the engine is running (abnormal): the pin [A] stays out the cam [B] and pushes up the exhaust rocker arm.
  - Remove the spring [C] and move the weights [D] back and forth.
  - ★ If the weights do not move easily from the retracted position, replace the KACR unit. Also inspect the exhaust rocker arm for any damage, and replace the rocker arm if necessary.  
Stopper [E]



## 5-32 ENGINE TOP END

### Cylinder Head

#### Cylinder Compression Measurement

##### NOTE

○ Be sure the battery is fully charged.

- Warm up the engine thoroughly.
- Stop the engine.
- Remove one spark plug and attach the compression gauge and adapter firmly into the spark plug hole. Do not remove the other spark plug, only the plug lead.
- For the other cylinder, remove both spark plugs.

**Special Tool - Spark Plug Wrench, Hex 18: 57001-1024 [A]**

- Using the starter motor, turn the engine over with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.

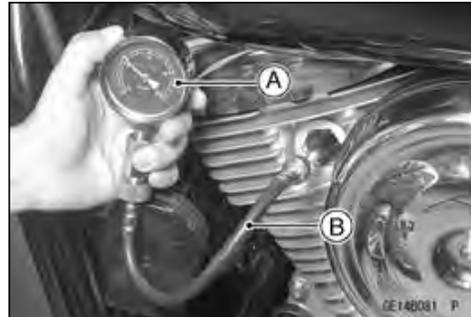
**Special Tools - Compression Gauge: 57001-221 [A]  
Compression Gauge Adapter, M12 x 1.25:  
57001-1018 [B] (or 57001-1183)**

#### Cylinder Compression (Usable Range)

**340 ~ 590 kPa (3.5 ~ 6.0 kg/cm<sup>2</sup>, 50 ~ 85 psi) @ 300 r/min (rpm)**

- The compression gauge adapter: 57001-1183 can also be used.
- Repeat the measurement for the other cylinder.
- Install the spark plugs.

**Torque - Spark Plugs: 18 N·m (1.8 kgf·m, 13 ft·lb)**



**Cylinder Head**

The following table should be consulted if the obtainable compression reading is not within the usable range.

Problem	Diagnosis	Remedy (Action)
Cylinder compression is higher than usable range	Carbon buildup on piston and in combustion chamber possibly due to damaged valve stem, valve guide, stem oil seal and/or damaged piston oil rings (This may be indicated by white exhaust smoke).	Remove the carbon deposits and replace damaged parts if necessary.
	Incorrect cylinder head gasket thickness.	Replace the gasket with a standard part.
	Damaged or missing compression release cam spring.	Replace the spring.
	Compression release weights do not move smoothly.	Replace the compression release unit.
Cylinder compression is lower than usable range	Gas leakage around cylinder head	Replace damaged gasket and check cylinder head warp.
	Bad condition of valve seats, valves, and valve springs.	Repair them if necessary.
	HLA seizure.	Replace the HLA.
	Incorrect piston/cylinder clearance	Replace the piston and/or cylinder.
	Piston seizure.	Inspect the cylinder and liner and replace/repair the cylinder and/or piston as necessary.
	Bad condition of piston ring and/or piston ring grooves.	Replace the piston and/or the piston rings.
	Compression release weights do not move smoothly.	Replace the compression release unit.

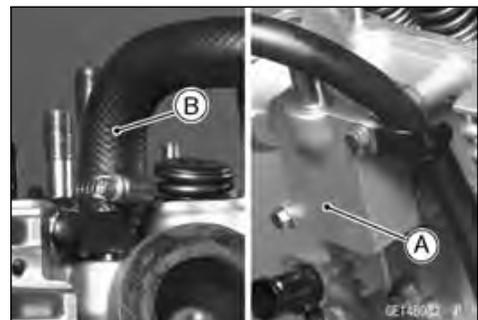
*Cylinder Head Removal*

- Remove:
  - Engine (see Engine Removal/Installation chapter)
  - Rocker Cases (see this chapter)
  - Camshafts (see this chapter)
  - Spark Plug Retainers (see this chapter)

**Special Tool - Hexagon Wrench, Hex 27: 57001-1210**

○The camshaft chain comes off.

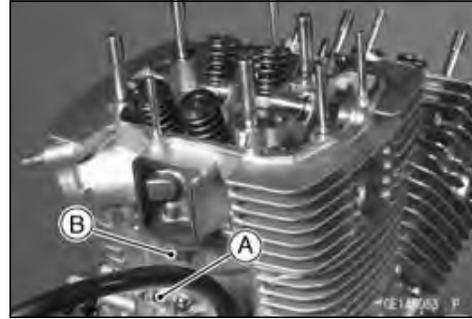
- Remove:
  - Air Suction Valve Cover with Valve [A]
  - Cooling Pipe with Hose [B]



## 5-34 ENGINE TOP END

### Cylinder Head

- Do not remove the coolant drain plug [A] yet.
- Remove the cylinder head nuts [B].
- Take the cylinder head off the cylinder.



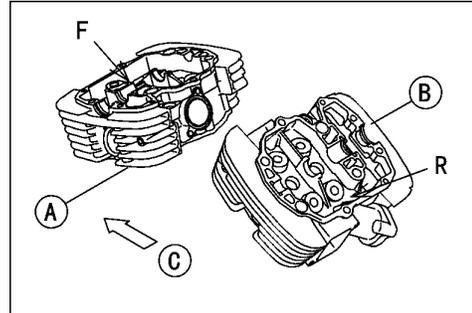
#### Cylinder Head Installation

- The front cylinder head [A] has an **F** mark while the rear cylinder head [B] has an **R** mark. Be careful not to mix them up.

Front [C]

#### CAUTION

The cylinder head and rocker case are machined in the assembled state, so they must be used as a set.



- Replace the cylinder head gasket with a new one.
- Tighten the cylinder head nuts temporarily (These nuts are tightened to the specified torque after installing rocker case installation).
- Apply grease to the O-ring [A].
- Pull the camshaft chain up the chain tunnel, insert the spark plug retainer [B] through the chain loop, and tighten it.

**Special Tool - Hexagon Wrench, Hex 27: 57001-1210**

**Torque - Spark Plug Retainer: 12 N·m (1.2 kgf·m, 104 in·lb)**

**Spark Plugs: 18 N·m (1.8 kgf·m, 13 ft·lb)**

- Install:
  - Camshafts (see this chapter)
  - Rocker Cases (see this chapter)

- Tighten:

**Torque - Cylinder Head Nuts and Cylinder Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

#### Cylinder Head Warp

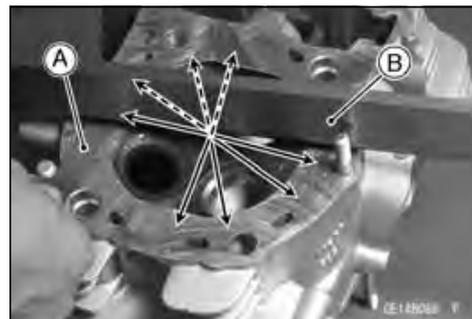
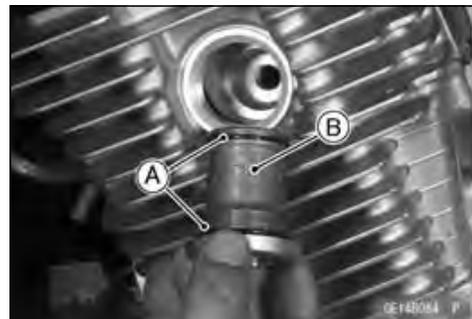
- Remove the cylinder head (see this chapter).
- Lay a straightedge across the lower surface of the cylinder head at several positions.
- Use a thickness gauge [A] to measure the space between the straight edge [B] and the head.

#### Cylinder Head Warp

**Standard: ---**

**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).



## Cylinder Head

### Valve Clearance Adjustment

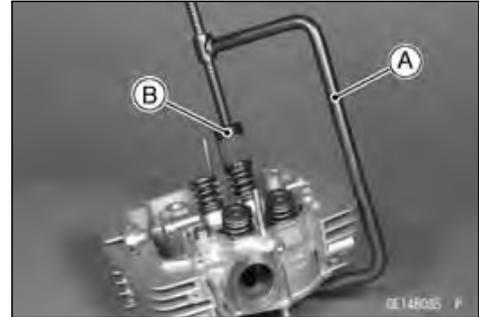
#### NOTE

- Since the hydraulic lash adjusters constantly maintain zero clearance, it is not necessary to inspect or adjust the valve clearance.

### Valve Removal

- Remove the cylinder head (see this chapter).
- Swing open the rocker arm.
- Using the valve spring compressor assembly, remove the valve.

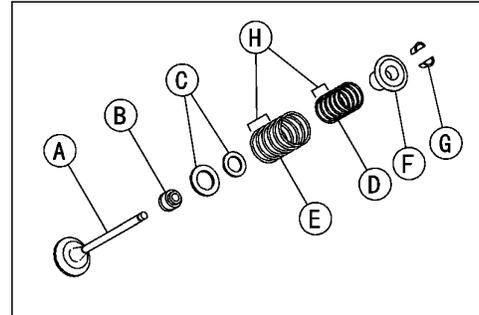
**Special Tools - Valve Spring Compressor Assembly: 57001-241 [A]**  
**Valve Spring Compressor Adapter,  $\phi$ 28.2: 57001-243 [B]**



### Valve Installation

- Replace the stem oil seal with a new one.
- Apply a thin coat of molybdenum disulfide grease to the valve stem before valve installation.
- Install the springs so that the closed coil end faces downwards.

Valve [A] and Stem Oil Seal [B]  
 Spring Seats [C]  
 Inner Spring [D] and Outer Spring [E]  
 Retainer [F] and Split Keepers [G]  
 Closed Coil End [H]



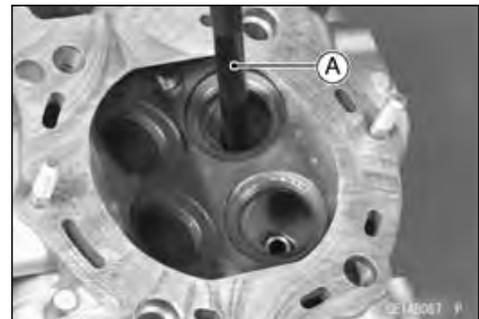
### Valve Guide Removal

- Remove the valve, stem oil seal and spring seats.
- Heat the area around the valve guide to 120 ~ 150°C (248 ~ 302°F), and hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.

**Special Tool - Valve Guide Arbor,  $\phi$ 7: 57001-163**

#### CAUTION

**Do not heat the cylinder head with a blowtorch. This will warp the head. Soak the cylinder head in engine oil and heat the oil.**



## 5-36 ENGINE TOP END

### Cylinder Head

#### Valve Guide Installation

- Apply engine oil to the valve guide outer surface before installation.
- Heat the area around the valve guide hole to about 120 ~ 150°C (248 ~ 302°F) in the engine oil.
- Drive the valve guide in from the top of the head using the valve guide arbor. The flange stops the guide from going in too far.

**Special Tool - Valve Guide Arbor,  $\phi$ 7: 57001-163**

- Wait until the cylinder head cools down and then ream the valve guide with the valve guide reamer [A] even if the old guide is reused.
- Turn the reamer in a clockwise direction until the reamer turns freely in the guide. Never turn the reamer counter-clockwise or it will be dulled.
- Once the guides are reamed, they must be cleaned thoroughly.

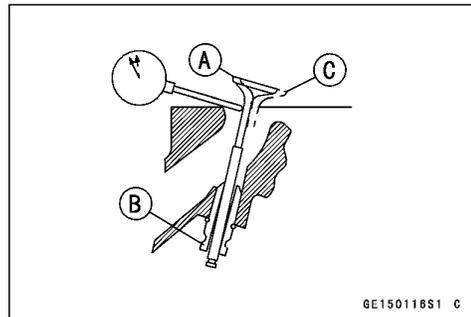
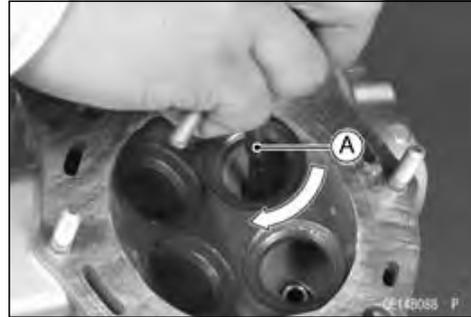
**Special Tool - Valve Guide Reamer,  $\phi$ 7: 57001-162**

#### Valve Guide Wear (Wobble Method)

- If a small bore gauge is not available, inspect the valve guide wear by measuring the valve-to-guide clearance with the wobble method as indicated below. The reading is not actual valve-to-guide clearance because the measuring point is above the guide.
- 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 the stem back and forth [C] to measure valve-to-guide clearance.
- Repeat the measurement in a direction at a right angle (90°) to the first.
- ★ If the reading exceeds the service limit, replace the guide.

#### Valve-to-Guide Clearance (Wobble Method)

	Standard	Service Limit
Exhaust	0.08 ~ 0.16 mm (0.0031 ~ 0.00630 in.)	0.30 mm (0.0118 in.)
Inlet	0.05 ~ 0.13 mm (0.0020 ~ 0.00512 in.)	0.27 mm (0.0106 in.)



**Cylinder Head**

*Valve Seat Inspection*

- Remove the valve (see Valve Removal).
- Check the valve seat surface [A] between the valve [B] and valve seat [C].
- Measure the outside diameter [D] of the seating pattern on the valve seat with vernier calipers.
- ★ If the outside diameter is too large or too small, repair the seat (see Seat Repair).

**Valve Seat Surface Outside Diameter (Seat O.D.)**

**Standard: Exhaust 31.9 ~ 32.1 mm (1.256 ~ 1.264 in.)**  
**Inlet 36.4 ~ 36.6 mm (1.433 ~ 1.441 in.)**

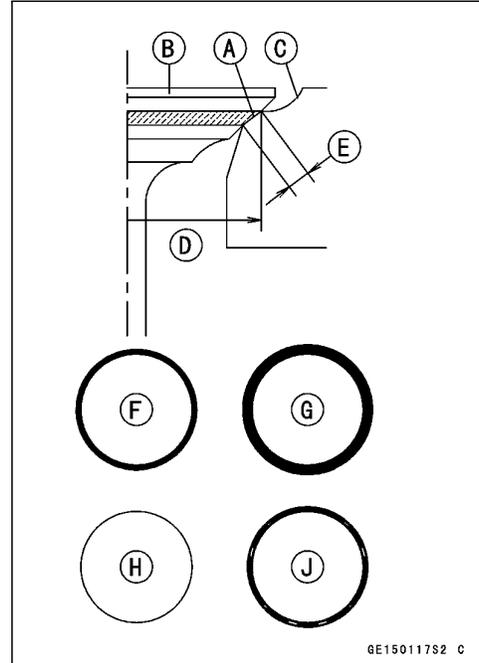
- Measure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with vernier calipers.

Good [F]

- ★ If the width is too wide [G], too narrow [H] or uneven [J], repair the seat (see Valve Seat Repair).

**Valve Seat Surface Width (or Seat Width)**

**Standard: Exhaust: 0.5 ~ 1.0 mm (0.020 ~ 0.039 in.)**  
**Inlet: 0.8 ~ 1.2 mm (0.031 ~ 0.047 in.)**



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*Valve Seat Repair*

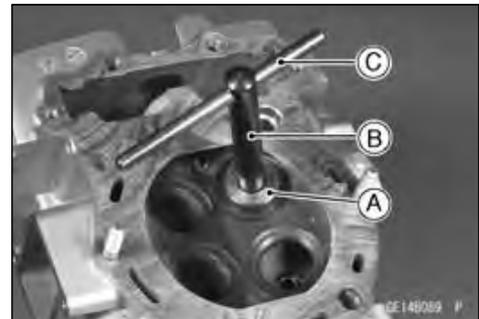
- Repair the valve seat with the valve seat cutters [A].
- Special Tools - Valve Seat Cutter Holder,  $\phi 7$ : 57001-1126 [B]**
- Valve Seat Cutter Holder Bar: 57001-1128 [C]**

**[For Exhaust Valve Seat]**

**Valve Seat Cutter, 45° -  $\phi 35$ : 57001-1116**  
**Valve Seat Cutter, 32° -  $\phi 35$ : 57001-1121**  
**(or 32° -  $\phi 33$ : 57001 - 1199)**  
**Valve Seat Cutter, 55° -  $\phi 35$ : 57001-1247**

**[For Inlet Valve Seat]**

**Valve Seat Cutter, 45° -  $\phi 40$ : 57001-1496**  
**Valve Seat Cutter, 32° -  $\phi 38.5$ : 57001-1122**  
**Valve Seat Cutter, 55° -  $\phi 38.5$ : 57001-1497**

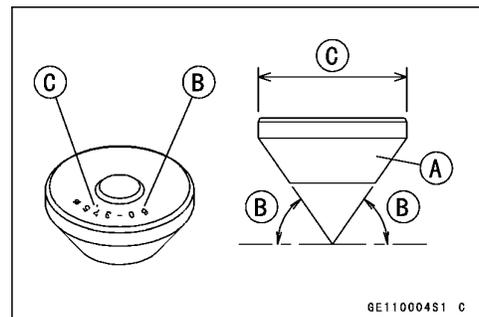


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- The marks stamped on the back of the cutter [A] represent the following.

55° ..... Cutter Angle [B]  
 37.5 $\phi$  ..... Outer Diameter of Cutter [C]

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



GE110004S1 C

## 5-38 ENGINE TOP END

### Cylinder Head

#### Seat Cutter Operation 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.

Do not drop or shock the valve seat cutter, or the diamond particles may fall off.

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.**

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. During operation, wash off any ground particles sticking to the cutter with washing oil

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

#### Operating Procedures:

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

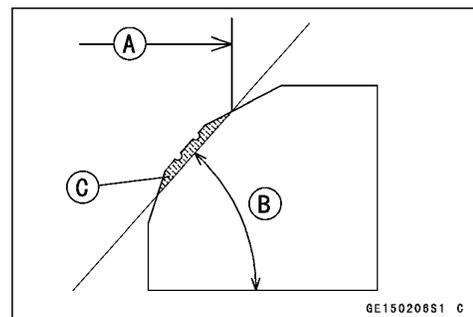
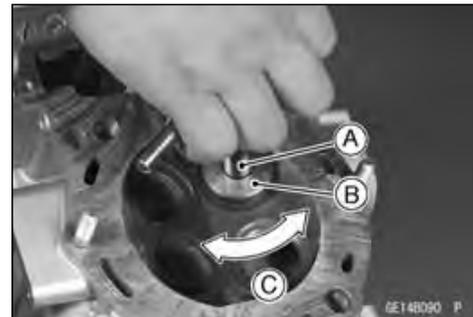
#### CAUTION

**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, HLA could not work and the cylinder head must be replaced.**

- Measure the outside diameter [A] of the seat surface (seat O.D.) with vernier calipers.
- ★ If the seat O.D. is too small, repeat the 45° grind [B] until the diameter is within the specified range.  
Ground Voluum [C]

#### NOTE

- Remove all pittings or flaws from 45° ground surface.
  - After grinding with 45° cutter, apply thin coat of machinist's dye to seat surface. This makes seat surface distinct and 32° and 55° grinding operation easier.
  - When the valve guide is replaced, be sure to grind with 45° cutter for centering and good contact.
- ★ If the seat O.D. is too large, make the 32° grind described below.



## Cylinder Head

- 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.

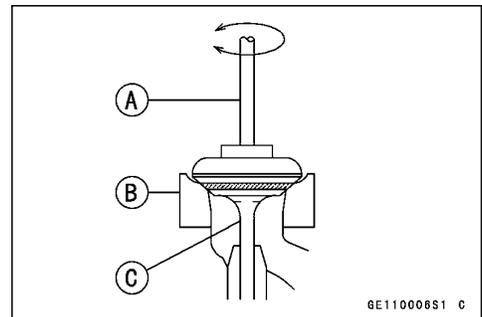
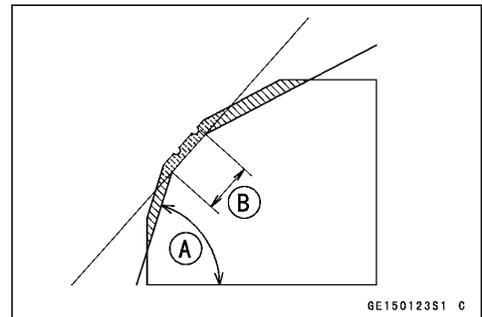
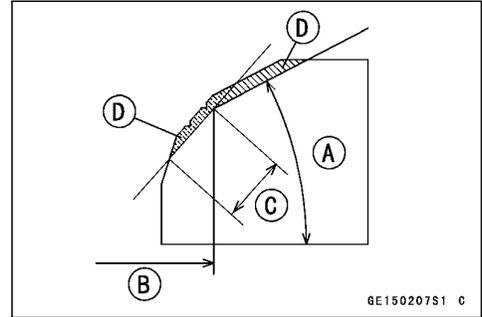
### CAUTION

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

- Grind the seat at a 32° angle [A] until the seat O.D. [B] is within the specified range.
- ★ If the seat O.D. is within the specified range, measure the seat width as described below.
- To measure the seat width, use vernier calipers to measure the width [C] of the 45° angle portion of the seat at several places around the seat.  
Ground Voluum [D]
- ★ If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then measure the seat O.D..
- ★ If the seat width is too wide, make the 55° grind described below.
- To make the 55° grind, fit 55° cutter into the holder, and slide it into the valve guide.
- Turn the holder, while pressing down lightly.
- Grind the seat at a 55° angle [A] until the seat width [B] is within the specified range.
- ★ If the seat width is within the specified range, lap the valve to the seat as described below.

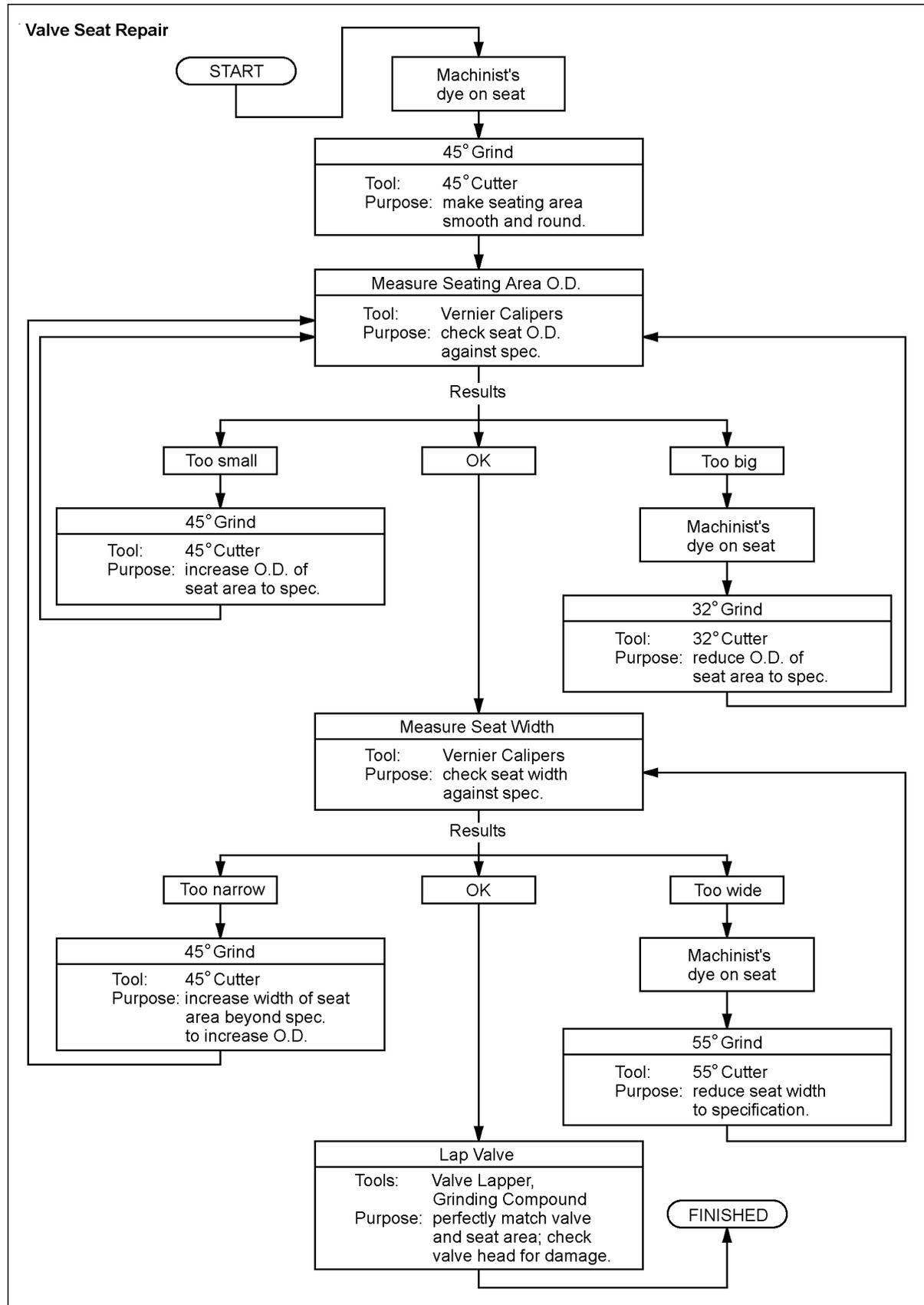
- Lap the valve to the seat, once the seat width and O.D. are within the ranges specified above.
- Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
- Spin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
- Repeat the process with a fine grinding compound.  
Lapper [A]  
Valve Seat [B]  
Valve [C]

- The seat 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.



# 5-40 ENGINE TOP END

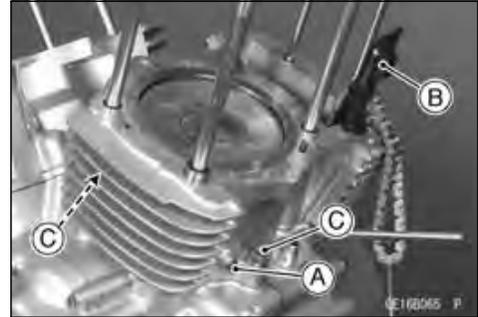
## Cylinder Head



## Cylinders, Piston

### Cylinder Removal

- Remove the cylinder head (see this chapter).
- Remove the coolant drain plug [A] and drain the coolant from the cylinder.
- Pull out the front camshaft chain guide [B].
- Remove the cylinder nuts [C].
- Tap lightly up the cylinder with a plastic mallet to separate from the crankcase.
- Remove the cylinder base gasket.

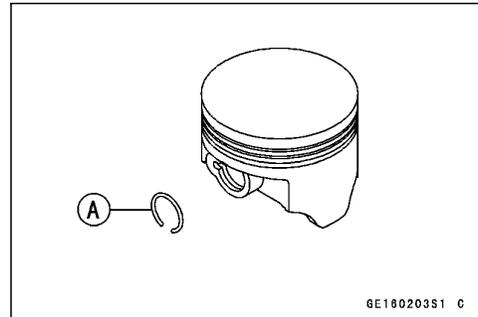


### Piston Removal

- Remove the cylinder block (see this chapter).
- Place a piece of clean cloth under the piston and remove the piston pin snap rings [A] from the outside of each piston.

#### CAUTION

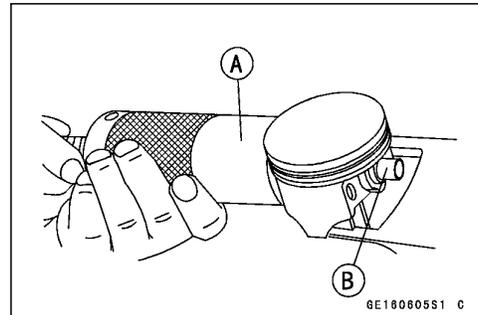
**Do not reuse snap rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.**



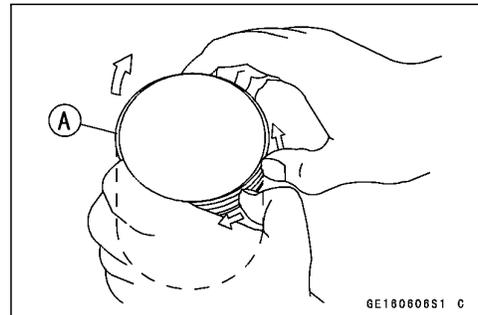
- Using the piston pin puller assembly, remove the piston pins.

**Special Tools - Piston Pin Puller Assembly [A]: 57001-910  
Piston Pin Puller Adapter [B]: 57001-1211**

- Remove the piston.



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

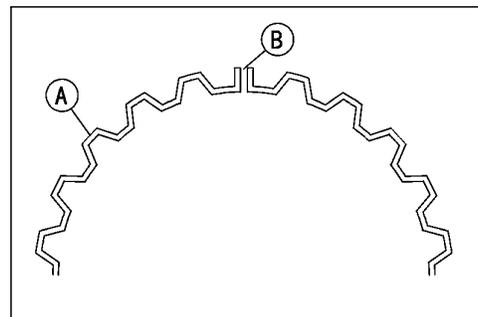


### Cylinder, Piston Installation

#### NOTE

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

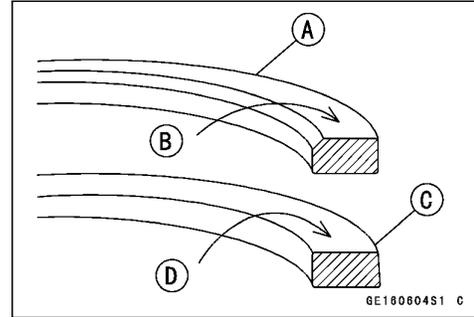
- Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
- Install the oil ring steel rails, one above the expander and one below it.
- Spread the rail with your thumbs, but only enough to fit the rail over the piston.
- Release the rail into the bottom piston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



## 5-42 ENGINE TOP END

### Cylinders, Piston

- Do not mix up the top ring and second ring.
- Install the top ring [A] so that the “R” mark [B] faces up.
- Install the second ring [C] so that the “RN” mark [D] faces up.



- The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails must be about 30 ~ 45° [F] of angle from the opening of the top ring.

Top Ring [A]

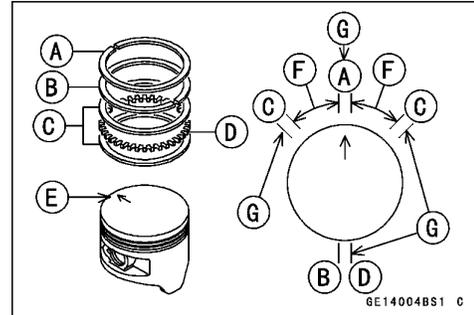
Second Ring [B]

Oil Ring Steel Rails [C]

Oil Ring Expander [D]

Arrow mark [E] must be faced toward the engine front.

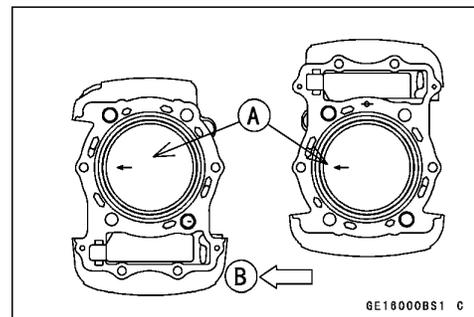
Opening Positions [G]



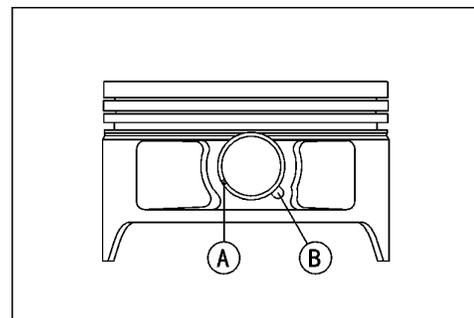
- Face the arrow mark [A] on each piston toward the front side [B].
- The front and rear pistons are the same, but they should be installed in their original positions.

#### CAUTION

**Incorrect installation of the piston could cause piston seizure and result in severe engine damage.**



- Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.
- Apply molybdenum disulfide oil to the outer surface of the piston pin.
- The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).
- When installing the piston pin snap ring, compress it only enough to install it and no more.
- Apply molybdenum disulfide oil to the cylinder bore.
- Apply molybdenum disulfide oil to the front and rear of the piston skirt.
- Install the rear cylinder first, with the rear piston at TDC.

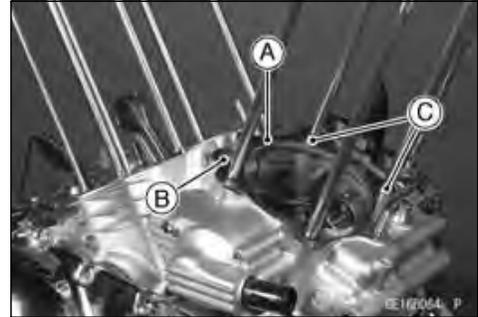


**Cylinders, Piston**

**NOTE**

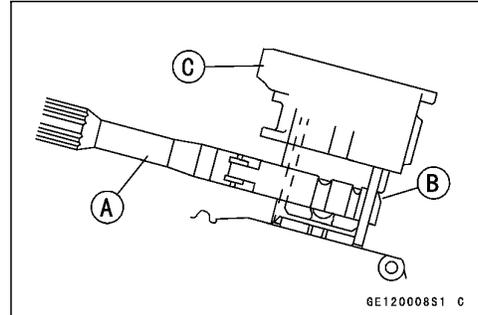
○ If a new piston or cylinder is used, check piston to cylinder clearance (see *Piston/Cylinder Clearance*), and use new piston ring.

- Replace the cylinder base gasket [A] with a new one, and install the gaskets aligning the holes with the crankcase water passages [B].
- Be sure to install the dowel pins [C].

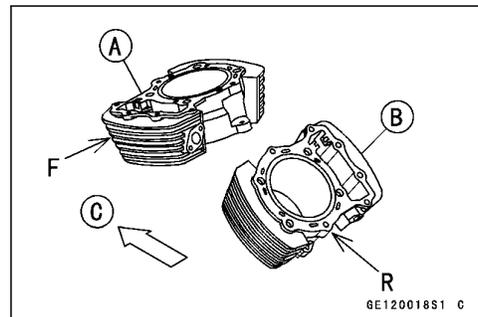


- Using the piston ring compressor assembly [A] with the chamfered side [B] upward, install the cylinder block [C].

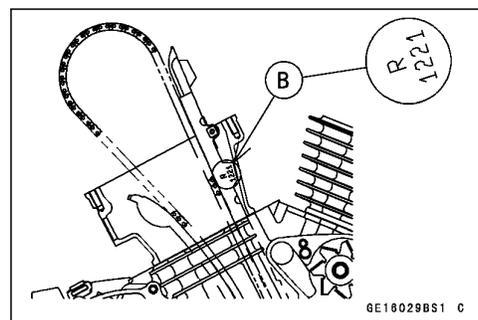
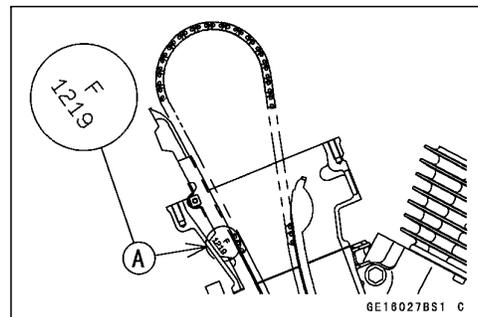
**Special Tools - Piston Ring Compressor Grip: 57001-1095**  
**Piston Ring Compressor Belt,  $\phi 95 \sim \phi 108$ : 57001-1358**



- The front cylinder [A] has an **F** mark and the rear cylinder [B] has an **R** mark. Be careful not to mix them up.  
 Front [C]



- Insert the chain guide into the cylinder.
- The front chain guide for the front cylinder has an **F** mark [A] and the front chain guide for the rear cylinder has an **R** mark [B]. Be careful not to mix up these chain guides since the front chain guide for the rear cylinder is longer.



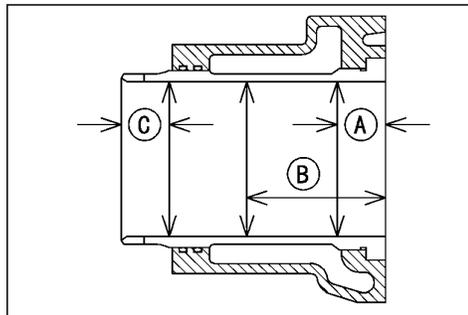
## 5-44 ENGINE TOP END

### Cylinders, Piston

- Install the front cylinder in the same way.
- Position the front piston at TDC.
- Tighten the cylinder nuts temporarily (These nuts are tightened to the specified torque after rocker case installation).

#### Cylinder Wear

- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the three locations (total of six measurements) shown in the figure.
- ★ If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.
  - 10 mm (0.39 in.) [A]
  - 70 mm (2.76 in.) [B]
  - 20 mm (0.79 in.) [C]



#### Cylinder Inside Diameter

**Standard:** 102.000 ~ 102.012 mm (4.015748 ~ 4.01622 in.), and less than 0.01 mm (0.0004 in.) difference between any two measurements.

**Service Limit:** 102.10 mm (4.01969 in.) or 0.05 mm (0.002 in.) difference between any two measurements.

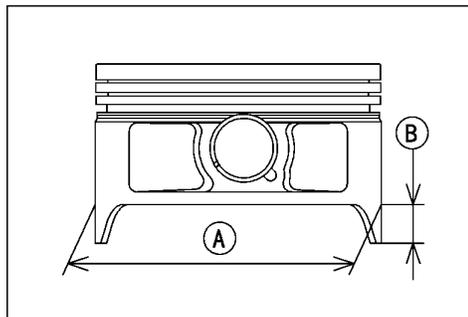
#### Piston Wear

- Measure the outside diameter [A] of each piston 5 mm [B] up from the bottom of the piston at a right angle to the direction of the piston pin.
- ★ If the measurement is under service limit, replace the piston.

#### Piston Diameter

**Standard:** 101.942 ~ 101.957 mm (4.013457 ~ 4.014047 in.)

**Service Limit:** 101.79 mm (4.00748 in.)



#### Piston/Cylinder Clearance

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

#### Piston/Cylinder Clearance

**Standard:** 0.043 ~ 0.070 mm (0.00169 ~ 0.00276 in.)

- ★ If the piston/cylinder clearance is less than the specified range, use a smaller piston made within the standard diameter or increase the cylinder inside diameter within the standard diameter by honing.
- ★ If the piston/cylinder clearance is greater than specified range, use a larger piston made within the standard diameter.
- ★ If only a piston is replaced, the clearance may exceed the standard slightly. But it must not be less than the minimum of the clearance in order to avoid piston seizure.

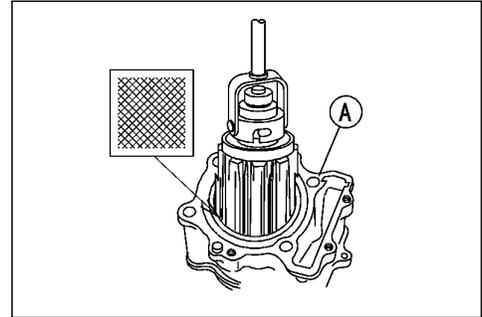
## Cylinders, Piston

### Cylinder Boring and Honing

○ There is an oversize piston available. The oversize piston requires oversize rings.

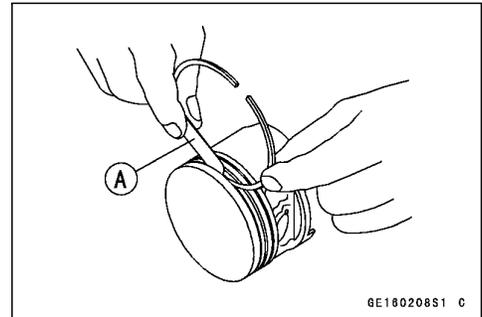
#### Oversize Piston and Rings: 0.5 mm (0.02 in.) oversize

- Before boring a cylinder [A], first measure the exact diameter of the oversize piston, and then, according to the standard clearance in the Specifications, determine the rebore diameter. However, if the amount of boring necessary would make the inside diameter greater than **0.5 mm (0.02 in.)**, the cylinder block must be replaced.
- Cylinder inside diameter must not vary more than **0.01 mm (0.0004 in.)** at any point.
- Be wary of measurements taken immediately after boring since the heat affects cylinder diameter.
- In the case of rebored cylinder and oversize piston, the service limit for the cylinder is the diameter that the cylinder was bored to plus **0.1 mm (0.004 in.)** and the service limit for the piston is the oversize piston original diameter minus **0.15 mm (0.0059 in.)**. If the exact figure for the rebored diameter is unknown, it can be roughly determined by measuring the diameter at the base of the cylinder.



### Piston Ring, Piston 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

	Standard:	Service Limit:
Top	0.05 ~ 0.09 mm (0.00197 ~ 0.00354 in.)	0.19 mm (0.00748 in.)
Second	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.00669 in.)

- ★ 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.

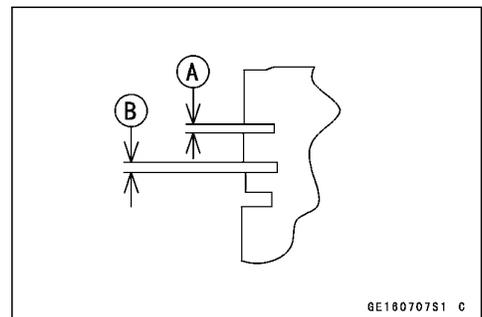
### Piston Ring Groove Width

- Measure the width of the top [A] and second [B] ring grooves.
- Use vernier calipers at several points around the piston.

#### Piston Ring Groove Width

	Standard	Service Limit
Top	1.24 ~ 1.26 mm (0.048819 ~ 0.049606 in.)	1.34 mm (0.05276 in.)
Second	1.22 ~ 1.24 mm (0.04803 ~ 0.04882 in.)	1.32 mm (0.05197 in.)

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



## 5-46 ENGINE TOP END

### Cylinders, Piston

#### Piston Ring Thickness

- Measure the thickness of the top [A] and second [B] rings.
- Use a micrometer to measure at several points around the ring.

#### Piston Ring Thickness

	Standard	Service Limit
Top	1.17 ~ 1.19 mm (0.04606 ~ 0.04685 in.)	1.10 mm (0.0433 in.)
Second	1.17 ~ 1.19 mm (0.04606 ~ 0.04685 in.)	1.10 mm (0.0433 in.)

- ★ 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 perfectly parallel to the groove sides. If not, replace the piston.

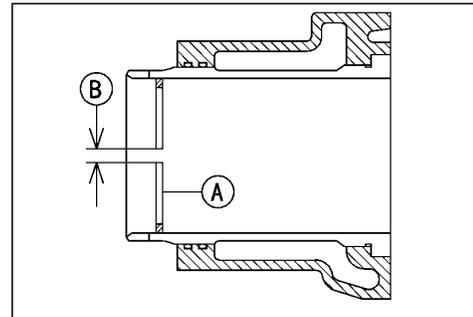
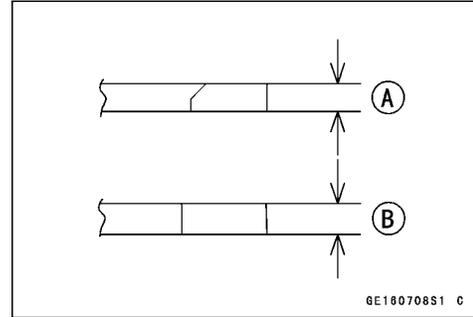
#### Piston Ring End Gap

- Place the piston ring [A] 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 [B] between the ends of the ring with a thickness gauge.

#### Piston Ring End Gap

	Standard	Service Limit
Top	0.25 ~ 0.35 mm (0.0098 ~ 0.0138 in.)	0.7 mm (0.028 in.)
Second	0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)	0.8 mm (0.031 in.)
Oil	0.3 ~ 0.9 mm (0.012 ~ 0.035 in.)	1.2 mm (0.0472 in.)

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



## Mufflers

### Exhaust Pipe Removal (For other than U.S.A. and Canadian Models)

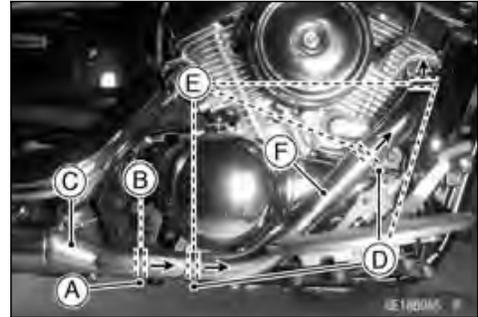
#### **⚠ WARNING**

**To avoid a serious burn, do not remove the exhaust pipe or muffler when the engine is still hot. Wait until the muffler cools down.**

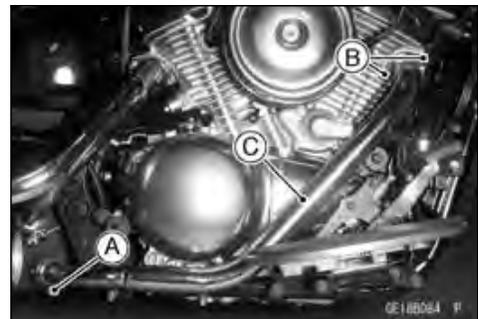
- Loosen the upper muffler bracket nut [A] for easy removal or installation of exhaust pipes.



- Loosen the clamp screw [A].
- Detach the lower clamp [B] by sliding it forward.
- Remove the lower front exhaust pipe cover [C].
- Loosen the clamp screws [D].
- Detach the upper clamps [E] by sliding them up or forward.
- Remove the front exhaust pipe cover [F].

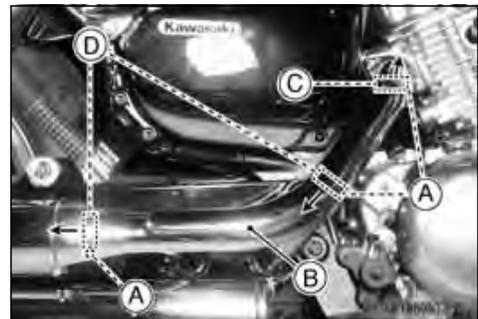


- Loosen the front exhaust pipe clamp bolt [A].
- Remove the front exhaust pipe holder nuts [B].
- Take off the front exhaust pipe [C].

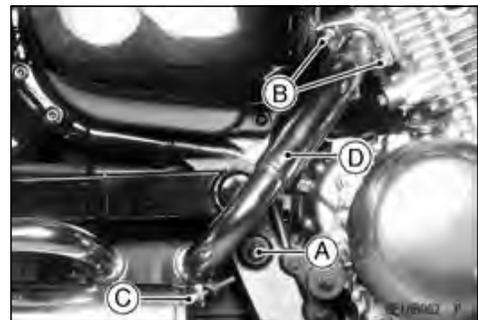


○Next, remove the rear exhaust pipe.

- Loosen the clamp screws [A] on the rear exhaust pipe cover [B].
- Detach the clamp [C] by sliding it up.
- Detach the clamps [D] by sliding them down or backward.
- Remove the rear exhaust pipe cover by sliding it forward.



- Loosen the right and left chamber bolts [A]
- Remove the rear exhaust pipe holder nuts [B].
- Loosen the rear exhaust pipe clamp bolt [C].
- Pull the upper end of the rear exhaust pipe outward and twist clockwise a little, and then take off the rear exhaust pipe [D].



## 5-48 ENGINE TOP END

### Mufflers

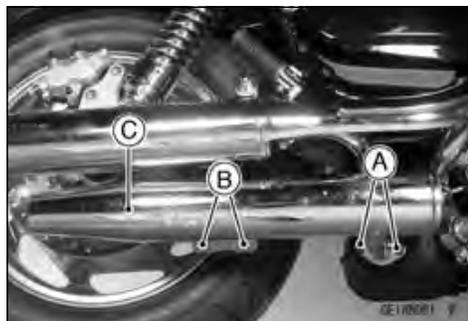
#### Lower Muffler Removal

(For other than U.S.A. and Canadian Models)

- Remove:
  - Lower Front Exhaust Pipe Cover (see above)
  - Chamber Flange Nuts [A]
  - Muffler Bracket Bolts [B]
- Remove the lower muffler [C].

#### NOTE

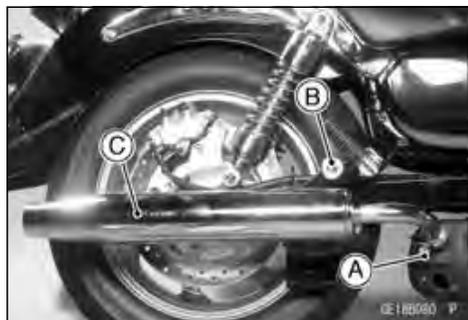
○ If the chamber flange nuts are difficult to remove, spray a penetrating oil on the studs and nuts.



#### Upper Muffler Removal

(For other than U.S.A. and Canadian Models)

- Remove:
  - Rear Exhaust Pipe Cover (see above)
  - Lower Muffler (see above)
  - Muffler Pipe Clamp Bolt [A]
  - Upper Muffler Bracket Nut [B]
- Remove the upper muffler [C].



#### Muffler, Exhaust Pipe Installation

(For other than U.S.A. and Canadian Models)

- Replace the exhaust pipe holder gasket [A] with new ones.

**Torque - Muffler Stay Mounting Bolts,  $\phi 8$  (lower): 25 N·m (2.5 kgf·m, 18 ft·lb)**

**Upper Muffler Bracket Nut: 29 N·m (3.0 kgf·m, 22 ft·lb)**



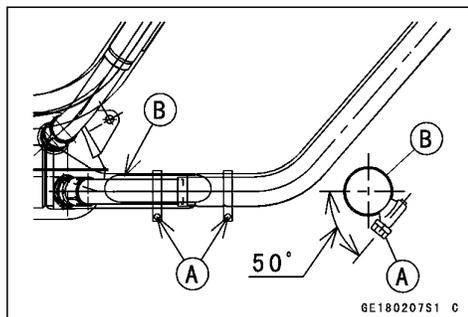
- Install the lower front exhaust pipe cover [A].
- Fit the two plastic tabs [B] of the front lower exhaust cover into the slots [C] in the lower muffler [D].



- Tighten the lower and front exhaust pipe cover clamp lower screws [A] with they are head inclined at 50° [B] or less to horizontal as shown. This prevents the screw from touching ground when banking.

**Torque - Exhaust Pipe Cover Clamp Screws: 6.9 N·m (0.70 kgf·m, 61 in·lb)**

- First, tighten all the bolts and nuts to a snug fit.
- Secondary, tighten the exhaust pipe holder nuts evenly.
- Finally, tighten the rest of the mounting bolts and clamp bolts securely.
- Thoroughly warm up the engine, wait until the engine cools down, and retighten all the clamp bolts.



**Mufflers**

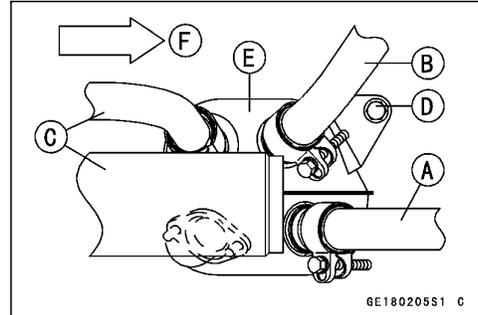
*Chamber Removal*

*(For other than U.S.A. and Canadian Models)*

- Remove:
  - Bolts [A]
  - Rear Regulator/Rectifier Bracket [B]



- Remove:
  - Front Exhaust Pipe [A]
  - Rear Exhaust Pipe [B]
  - Lower and Upper Mufflers [C]
  - Right and Left Chamber Bolts [D]
- Take out the premuffler chamber [E].
  - Front [F]

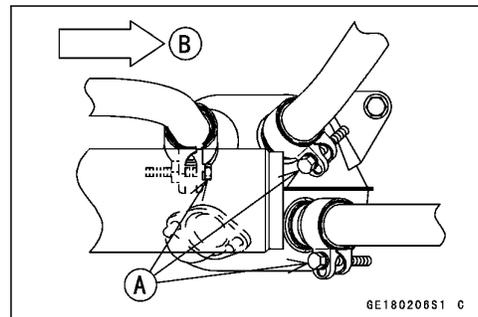


*Chamber Installation*

*(For other than U.S.A. and Canadian Models)*

- Replace the muffler flange gasket with new ones.
- Install the exhaust pipe and muffler pipe clamps [A] with its bolt downward.
  - Front [B]

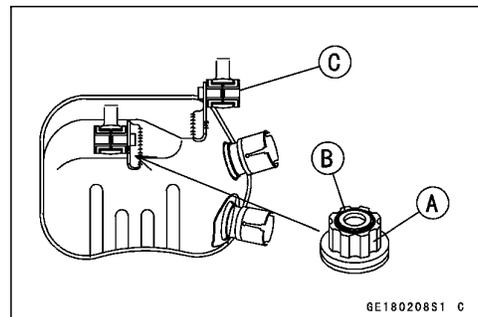
**Torque - Chamber Bolts: 29 N·m (3.0 kgf·m, 22 ft·lb)**



*Chamber Assembly*

*(For other than U.S.A. and Canadian Models)*

- Apply a soap and water solution or rubber lubricant to the surface of the rubber bushings and install them into the brackets of the chamber as shown (Top View).
  - Rubber Bushings [A]  $\phi$ 24.8 mm (0.98 in.) with a raised ring [B]
  - Rubber Bushings [C]  $\phi$ 25.3 mm (1.0 in.) without raised ring



## 5-50 ENGINE TOP END

### Mufflers

#### Chamber Identification

(For other than U.S.A. and Canadian Models)

○The this models have a premuffler chamber (Identification No. KHI M 091) with a honeycomb type catalytic converter and without any catalyst protection system. Do not mix up this chamber with the other type chamber (especially with a non-catalyst chamber). The motorcycle could not clear the emission regulation.

→ : Exhaust Gas Flow

Premuffler Chamber [A]

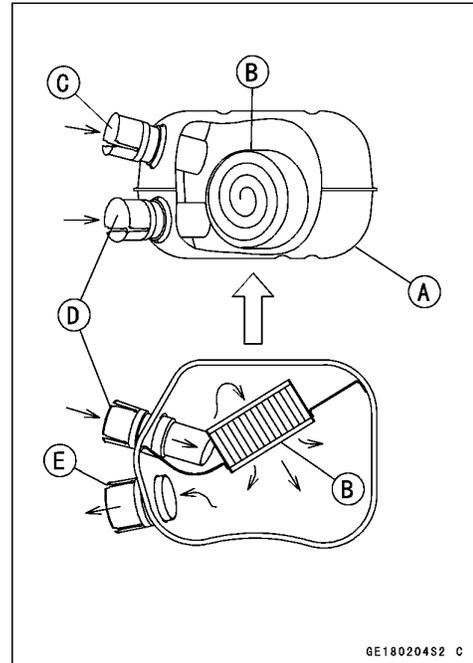
Honeycomb Type Catalytic Converter [B]

Inlet [C] from Rear Exhaust Pipe

Inlet [D] from Front Exhaust Pipe

Premuffler Chamber Outlet [E]

○Refer to the VN1500 G/H Service Manual (Part No. 99924-1241) for more information about the KLEEN (theory, maintenance, and handling precautions), including the secondary air injection system.

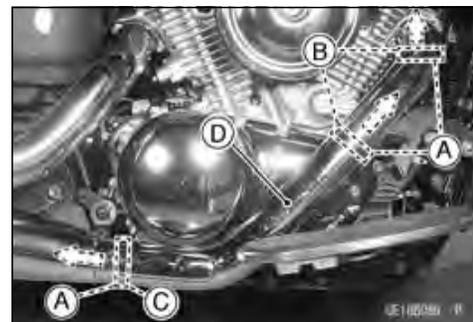


#### Front Exhaust Pipe Removal (U.S.A. and Canadian Models)

#### ⚠ WARNING

To avoid a serious burn, do not remove the muffler when the engine is still hot. Wait until the muffler cools down.

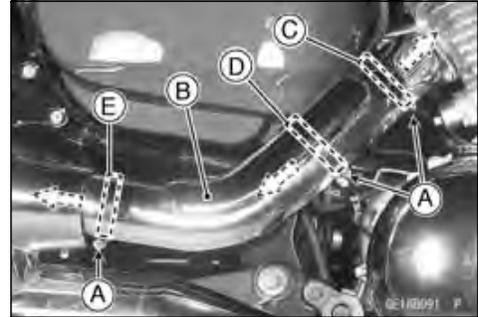
- Loosen the clamp screws [A].
- Detach the upper clamps [B] by sliding them up or forward.
- Detach the lower clamp [C] by sliding it forward.
- Remove the front exhaust pipe cover [D].
  
- Loosen the front exhaust pipe clamp bolt [A].
- Remove the front exhaust pipe holder nuts [B].
- Take off the front exhaust pipe [C].



**Mufflers**

*Rear Exhaust Pipe Removal  
(U.S.A. and Canadian Models)*

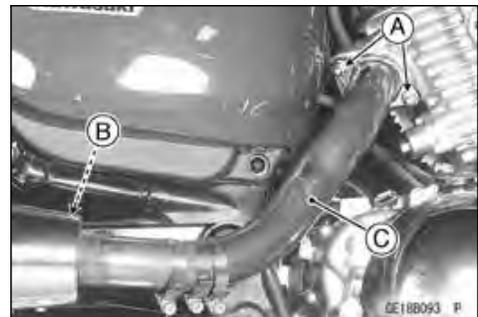
- Loosen the clamp screws [A] on the rear exhaust pipe cover [B].
- Detach the upper clamp [C] by sliding it up.
- Detach the middle [D] and lower clamp [E] by sliding it back.
- Remove the rear exhaust pipe cover.



- Remove the upper muffler bracket nut [A] and lower muffler bracket bolt [B].

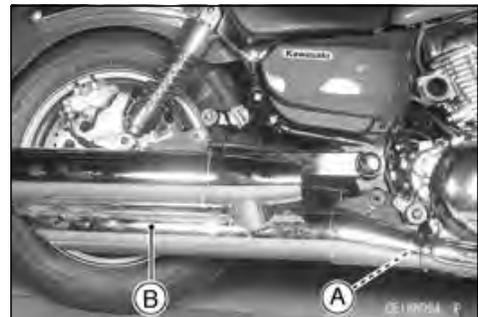


- Remove the rear exhaust pipe holder nuts [A].
- Loosen the rear exhaust pipe clamp bolt [B].
- Pull the upper end of the rear exhaust pipe outward and twist clockwise a little, and then take off the rear exhaust pipe [C].



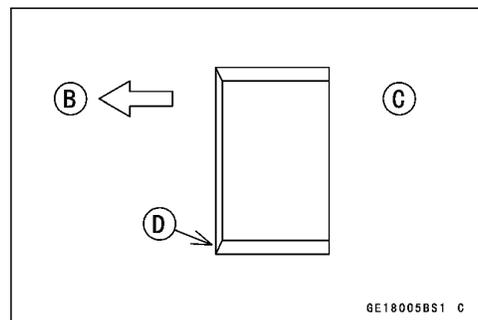
*Muffler Removal (U.S.A. and Canadian Models)*

- Remove:
  - Rear Exhaust Pipe Covers (see This chapter)
  - Rear Exhaust Pipe (see This chapter)
- Loosen the front exhaust pipe clamp bolts [A].
- Remove the muffler Assembly [B].



*Muffler, Exhaust Pipe Installation  
(U.S.A. and Canadian Models)*

- Replace the exhaust pipe holder gasket with new ones.
- Insert the exhaust pipe joint gaskets [A] direction as shown.
  - Front [B]
  - Rear [C]
  - Chamfer Side [D]



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## 5-52 ENGINE TOP END

### Mufflers

- Tighten the front exhaust pipe cover clamp screws [A] with its head inclined at  $50^\circ$  or less to horizontal as shown. This prevents the screw from touching ground when banking.

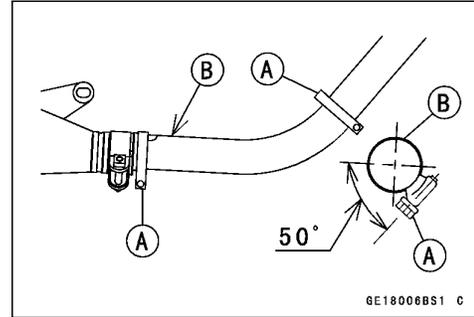
Front Exhaust Pipe [B]

**Torque - Exhaust Pipe Cover Clamp Screws: 6.9 N·m (0.70 kgf·m, 61 in·lb)**

- First, tighten all the bolts and nuts to a snug fit.
- Secondary, tighten the exhaust pipe holder nuts evenly.
- Finally, tighten the rest of the mounting bolts and clamp bolts securely.

**Torque - Muffler Bracket Bolt and Nut: 29 N·m (3.0 kgf·m, 22 ft·lb)**

- Thoroughly warm up the engine, wait until the engine cools down, and retighten all the clamp bolts.



# Clutch

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## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Clutch reservoir cap screws	1.5	0.15	13 in·lb	
2	Clutch slave cylinder bleed valve	7.8	0.80	69 in·lb	
3	Clutch master cylinder clamp bolts	11	1.1	95 in·lb	S
4	Clutch hose banjo bolt	25	2.5	18	
5	Clutch slave cylinder bolts	6.9	0.70	61 in·lb	L
6	Clutch pipe banjo bolt	25	2.5	18	
7	Clutch hub nut	147	15.0	108	
8	Clutch cover bolts	11	1.1	95 in·lb	
9	Clutch damper cover bolts	9.8	1.0	87 in·lb	L
10	Clutch damper screws	4.9	0.50	43 in·lb	L
11	Clutch lever pivot bolt	1.0	0.10	8.7 in·lb	Si
12	Clutch lever pivot bolt locknut	5.9	0.60	52 in·lb	
13	Starter lockout switch screw	1.2	0.12	10 in·lb	
14	Clutch damper plate bolts	9.8	1.0	87 in·lb	EO

15. Starter Lockout Switch

16. Clutch Slave Cylinder

17. Cup point side faces outside.

EO: Apply engine oil.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil.

R: Replacement Parts

S: Follow the specific tightening sequence.

Si: Apply silicone grease or PBC grease.

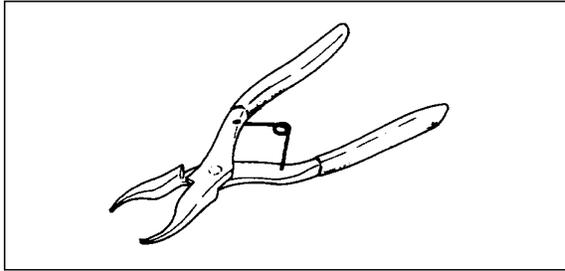
## 6-4 CLUTCH

### Specifications

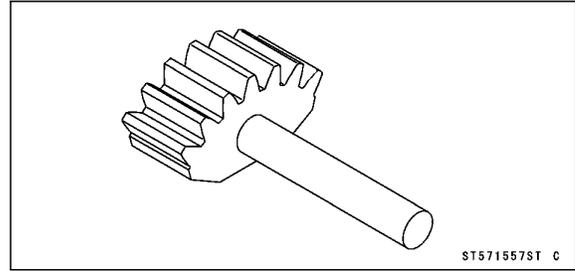
Item	Standard	Service Limit
<b>Clutch Fluid</b>		
Grade	DOT4 (provided when shipping)	— — —
<b>Clutch Lever Position</b>	No. 1 (to suit rider)	5-way adjustable
<b>Clutch Lever Free Play</b>	Non-adjustable	— — —
<b>Clutch</b>		
Clutch spring free height	4.3 mm (0.235 in)	4.0 mm (0.16 in)
Spring plate gap (usable range)	1.95 ~ 2.45 mm (0.0768 ~ 0.0965 in)	— — —
Friction plate thickness	3.3 ~ 3.5 mm (0.130 ~ 0.138 in)	3.1 mm (0.122 in)
Friction or steel plate warp	0.2 mm (0.0079 in) or less	0.3 mm (0.012 in)

**Special Tools and Sealant**

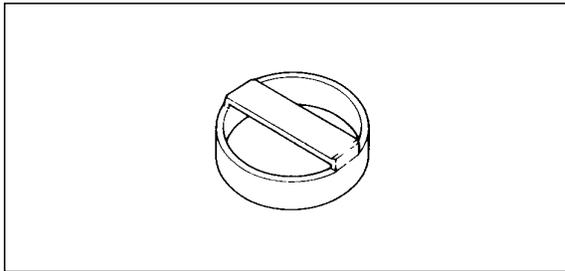
**Inside Circlip Pliers :**  
**57001-143**



**Gear Holder, m2.0 :**  
**57001-1557**



**Clutch Spring Compressor :**  
**57001-1162**



## 6-6 CLUTCH

### Clutch Fluid

#### *Clutch Fluid Level Check*

- Refer to Clutch Fluid Level Check in the Periodic Maintenance Chapter.

#### *Clutch Fluid Change*

- Refer to Clutch Fluid Change in the Periodic Maintenance Chapter.

#### *Clutch Line Bleeding*

- Remove:
  - Alternator Outer Cover (see Electrical System chapter)
- With the reservoir cap off, slowly pump the clutch lever several times until no air bubbles can be seen rising up through the fluid from the holes at the bottom of the reservoir. This bleeds the air from the master cylinder end of the line.

#### **NOTE**

- Tap the clutch hose lightly going from the lower end to the upper end and bleed the air off at the reservoir.

- Attach a clear plastic hose [A] to the bleed valve on the clutch slave cylinder, and run the other end of the hose into a container.
- Bleed the clutch line as follows:
  - Pump the clutch lever a few times until it becomes hard and then hold it applied [B].
  - Quickly open and close [C] the bleed valve.
  - Release [D] the clutch lever.
  - Check the fluid level in the reservoir often, replenishing it as necessary.

#### **NOTE**

- If the fluid in the reservoir runs completely out any time during bleeding, the bleeding operation must be done over again from the beginning since air will have entered the line.

- Repeat this operation until no more air can be seen coming out into the plastic hose.

#### **⚠ WARNING**

**Do not mix different grades and brands of fluid.**

**Torque - Clutch Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**

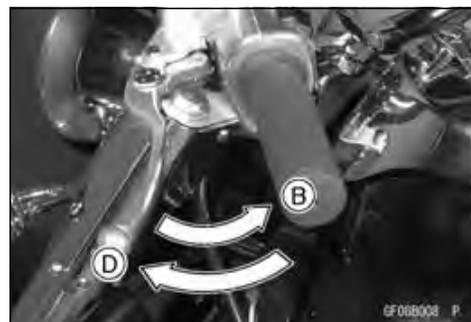
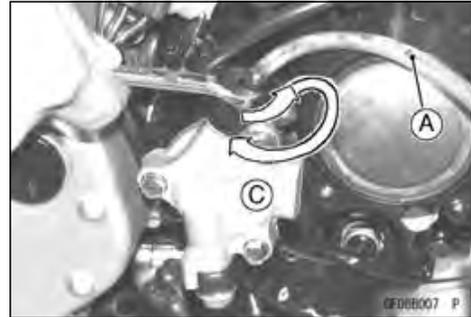
**Clutch Slave Cylinder Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

#### *Clutch Hose Removal/Installation*

- Since the clutch hose is the same as the brake hose, refer to Brake Hoses section in the Brakes chapter for clutch hose removal or installation.

#### *Clutch Hose and Connection Check*

- Refer to Clutch Hose and Connection Check in the Periodic Maintenance Chapter.

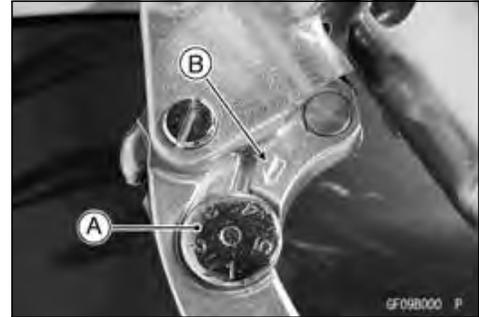


## Clutch Master Cylinder

### Clutch Lever Adjustment

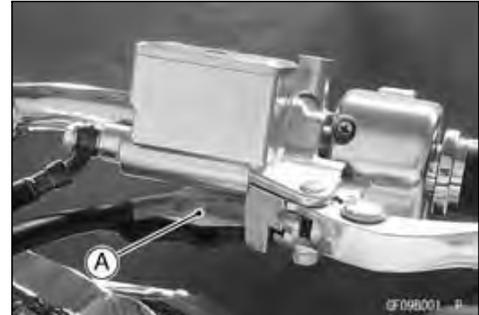
The adjuster has 5 positions so that the clutch lever position can be adjusted to suit the operator's hand.

- Push the lever forward and turn the adjuster [A] to align the number with the arrow mark [B] on the lever holder (front view).
- The distance from the grip to the lever is minimum at number 5 and maximum at number 1.



### Clutch Master Cylinder Removal

- Disconnect the starter lockout switch connector [A].
- Draw out the clutch fluid from the reservoir with a means like the fork oil level gauge.



- Remove the banjo bolt [A] to disconnect the clutch hose from the master cylinder (rear view).
- Unscrew the clamp bolts [B], and take off the master cylinder [C] as an assembly with the clutch reservoir, clutch lever, and starter lockout switch installed.



### CAUTION

**Clutch fluid quickly ruins painted surface; any spilled fluid should be completely washed away immediately.**

### Clutch Master Cylinder Installation

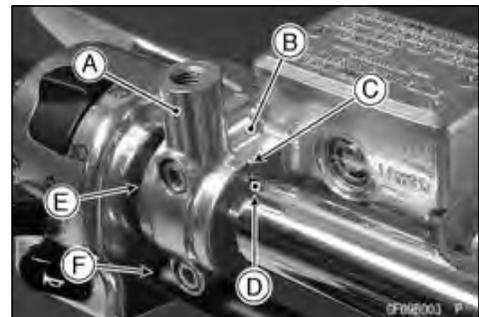
- The master cylinder clamp must be installed with the rear view mirror boss [A] upward.
- Set the clutch master cylinder [B] to match its mating surface [C] to the punch mark [D] of the handlebar (rear view).
- Tighten the upper clamp bolt [E] first, and then the lower clamp bolt [F]. There will be a gap at the lower part of the clamp after tightening.

**Torque - Clutch Master Cylinder Clamp Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

- Use a new flat washer on each side of the clutch hose fitting.
- Tighten the clutch hose banjo bolt.

**Torque - Clutch Hose Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Replenish the clutch fluid into the reservoir and bleed the clutch line (see Clutch Line Bleeding).
- Check that the clutch line has proper fluid pressure and no fluid leakage.



### Clutch Master Cylinder Disassembly/Assembly

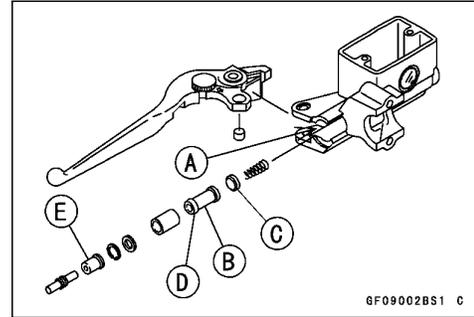
- Refer to Clutch Master Cylinder Cup and Dust Seal Replacement in the Periodic Maintenance Chapter.

## 6-8 CLUTCH

### Clutch Master Cylinder

#### *Clutch Master Cylinder Inspection*

- Disassemble the clutch master cylinder.
- Check that there are no scratches, rust or pitting on the inside of the master cylinder [A] and on the outside of the piston [B].
- ★ If the master cylinder or piston shows any damage, replace them.
- Inspect the primary cup [C] and secondary cup [D].
- ★ If a cup is worn, damaged, softened (rotted), or swollen, the piston assembly should be replaced to renew the cups.
- If fluid leakage is noted at the clutch lever, the piston assembly should be replaced to renew the cups.
- Check the dust cover [E] for damage.
- If it is damaged, replace it.
  
- Check that the relief and supply ports are not plugged.
- ★ If the small relief port becomes plugged, the clutch will drag. Blow the ports clean with compressed air.
- Check the piston return spring for any damage.
- ★ If the spring is damaged, replace it.



## Clutch Slave Cylinder

### Clutch Slave Cylinder Removal

- Remove:
  - Alternator Outer Cover (see Electrical System chapter)
  - Banjo Bolt [A]
  - Clutch Slave Cylinder Bolts [B]
  - Slave Cylinder [C]

**CAUTION**

**Immediately wash away any clutch fluid that spills. It may damage painted surfaces.**

- Perform the following if the clutch slave cylinder is to be removed but not disassembled.

**CAUTION**

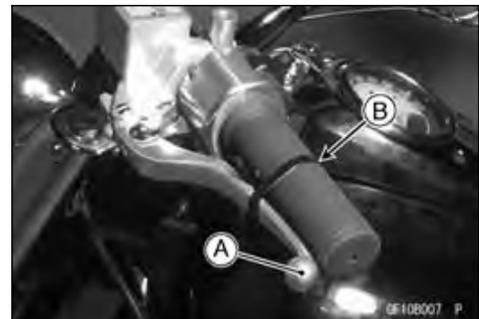
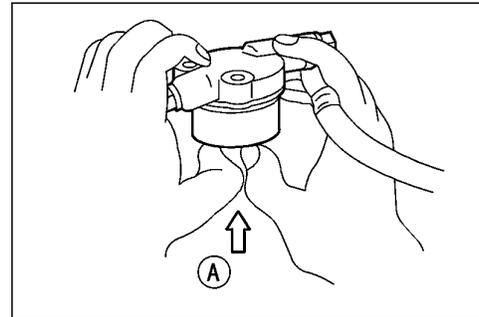
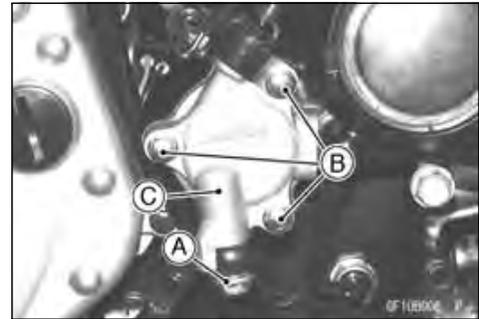
**If the clutch slave cylinder is removed and left alone, the piston will be pushed out by spring force and the clutch fluid will drain out.**

- Remove the clutch slave cylinder with the pipe installed.
- Push [A] the piston into the cylinder as far as it will go.

- Apply the clutch lever [A] slowly and hold it with a band [B].

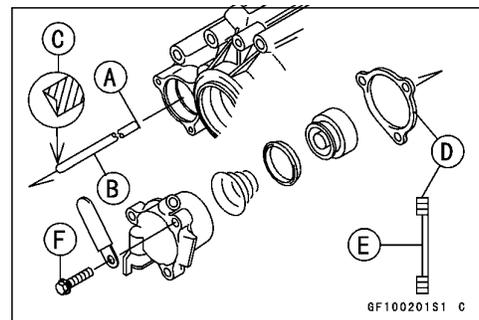
**NOTE**

- Holding the clutch lever keeps the piston from coming out.



### Clutch Slave Cylinder Installation

- Apply molybdenum disulfide grease to the flat end [A] of the push rod [B].
- Install the push rod so that the flat end faces in. Cup Point [C]
- Replace the spacer [D] of the clutch slave cylinder with a new one.
- Install the spacer so that the stepped side [E] faces outward.
- Apply a non-permanent locking agent to the threads of the clutch slave cylinder bolts [F].
- Finger tighten the clutch slave cylinder bolts.
- Remove the band from the clutch lever and release the clutch lever.



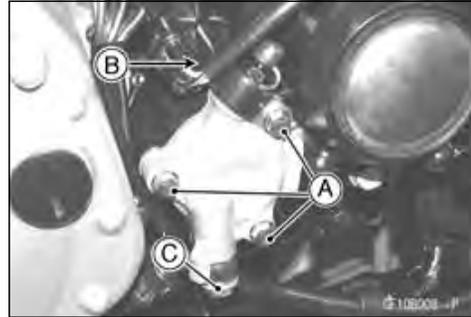
## 6-10 CLUTCH

### Clutch Slave Cylinder

- Tighten the bolts [A].  
**Torque - Clutch Slave Cylinder Bolts: 6.9 N·m (0.70 kgf·m, 61 in·lb)**
- Put the clamp [B] together the clutch slave cylinder bolt and bend along the slave cylinder with the end of the clamp straight to the engine side as shown in the figure. This clamp is to prevent the edge of the slave cylinder from damaging the wire, not to clamp the wire.
- Replace the washers on each side of the clutch hose fitting with new ones.
- Tighten the banjo bolt [C] to the specified torque.  
**Torque - Clutch Pipe Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- Check the fluid level in the master cylinder reservoir, and bleed the air in the clutch line.
- Check the clutch operation.

#### *Clutch Slave Cylinder Disassembly/Assembly*

- Refer to Clutch Slave Cylinder Piston Seal Replacement in the Periodic Maintenance Chapter.



## Clutch

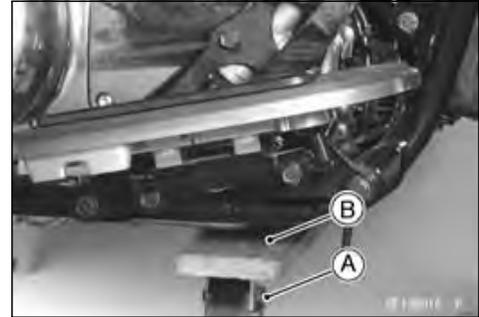
### Clutch Cover Removal

- Raise the rear wheel off the ground.

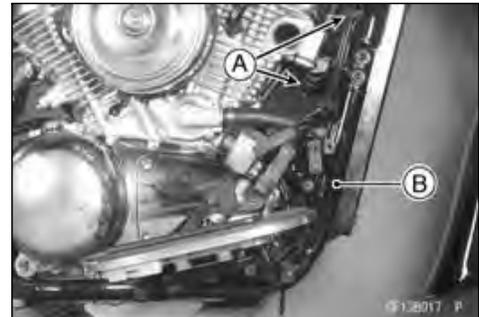
**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**

- Drain the engine oil (see Periodic Maintenance chapter).
- Support the engine with a suitable stand [A].
- Put a plank [B] onto the stand.



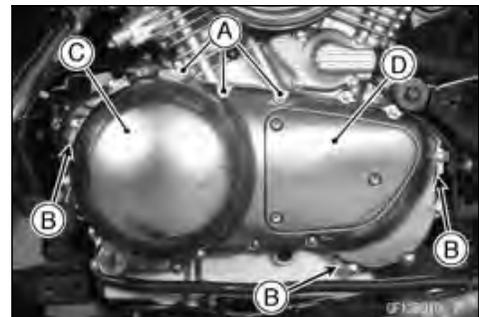
- Remove:
  - Front Exhaust Pipe (see Engine Top End chapter)
  - Clamps (open) [A]
  - Downtube [B] (see Frame chapter, but remove the downtube with the right footpeg and rear master cylinder left installed)



- Unscrew the eighteen cover bolts [A].
- Using the pry points [B], take the cover [C] off the crankcase.

### NOTE

○ Do not remove the damper cover [D].

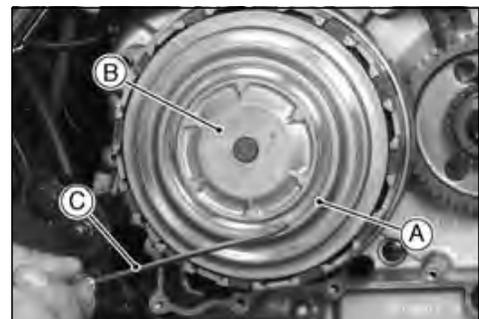


### Clutch Removal

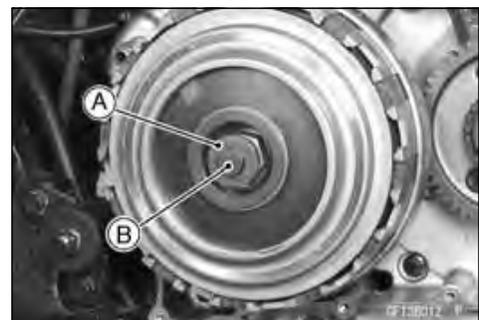
### NOTE

○ Use an air impact wrench for removal of the clutch hub nut.

- Remove the clutch cover (see this chapter).
- Remove the retaining ring [A] and take the operating plate [B] out of the clutch assembly.
  - Screw Driver [C]



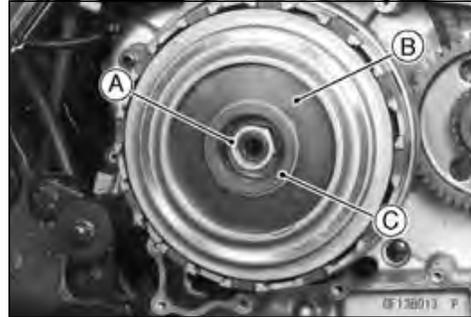
- Remove:
  - Washer [A]
  - Spring Plate Pusher [B]
  - Needle Bearing
  - Washer



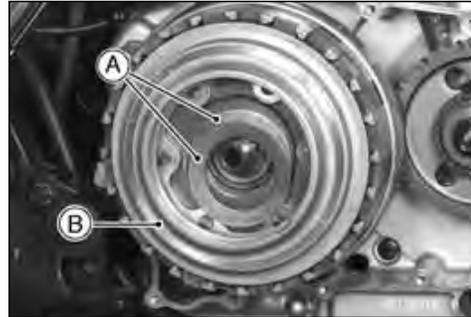
## 6-12 CLUTCH

### Clutch

- Unscrew the clutch hub nut [A] by using an air impact wrench.
- Take the clutch spring [B], and the clutch spring holder [C] out of the clutch hub.



- Take the back torque limiter springs [A], and the clutch spring plate out of the clutch housing.



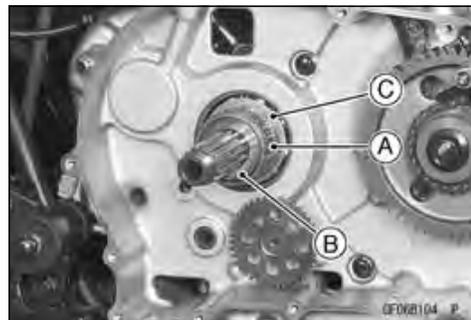
- Take the friction/steel plate [A], and outer clutch hub [B] out of the clutch housing.



- Take the inner clutch hub [A], collar [B], washer [C] and clutch housing [D] out of the crankcase.



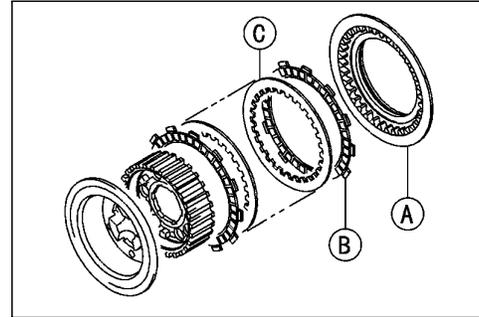
- Pull the needle bearing [A], sleeve [B], and thrust washer [C] off the drive shaft.



**Clutch**

*Clutch Installation*

- ★When replacing any one of the following parts, check the spring plate gap (see Spring Plate Gap Measurement).
  - Spring Plate [A]
  - Friction Plates [B]
  - Steel Plates [C]



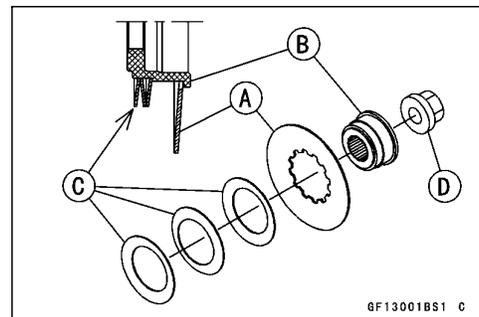
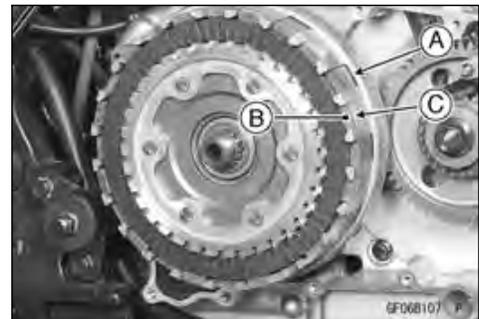
- When installing the clutch housing, mesh the oil pump drive gear [A] with the oil pump gear [B] so that the pump gear turns smoothly.



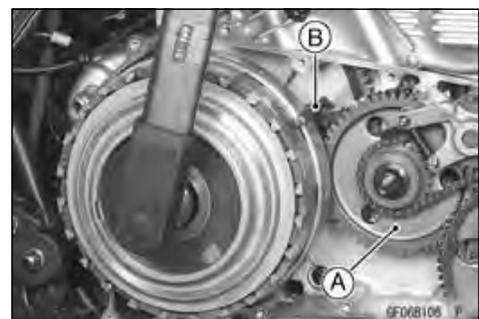
**CAUTION**

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

- Install the friction plates and steel plates, starting with a friction plate and alternating them.
- First, install the friction plates, fitting their tangs in the deeper grooves [A], and finally the outermost friction plate [B] in the shallower grooves [C].
- Install the clutch spring [A] on the spring holder [B], nothing the direction.
- Apply grease to the back torque limiter springs [C] and install them on the spring holder as shown.  
Clutch Hub Nut [D] (for reference)



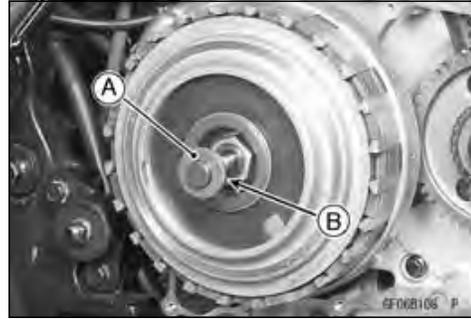
- Apply molybdenum disulfide oil to the clutch hub nut.
  - Molybdenum Disulfide Oil- Threads and Seating Surface of Clutch Hub Nut**
  - The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).
  - Tighten the clutch hub nut to the specified torque while holding the primary gear [A] with the gear holder [B].
  - Torque - Clutch Hub Nut: 147 N·m (15.0 kgf·m, 108 ft·lb)**
  - Special Tool - Gear Holder : 57001-1557**



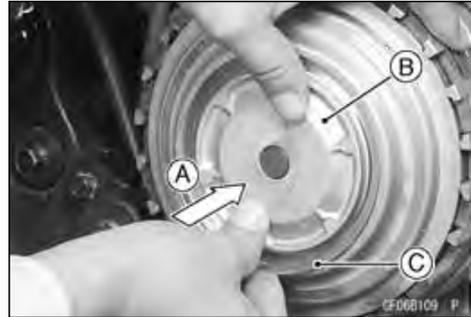
## 6-14 CLUTCH

### Clutch

- The spring plate pusher [A] into the clutch hub. Squeeze the clutch lever slowly and hold it with a band.
- Install the needle bearing [B] and the washer onto the pusher.



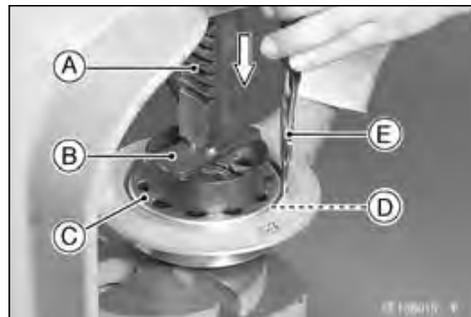
- Pushing [A] the operating plate [B] into the clutch hub, and insert the retaining ring [C] by hand.



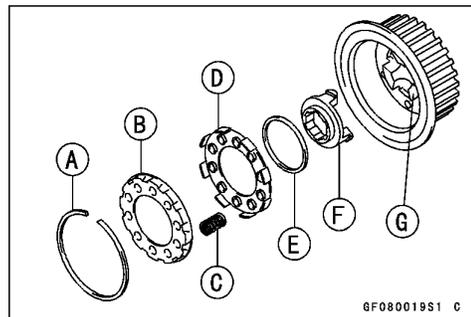
#### *Inner Clutch Hub Disassembly*

- Using a press [A], and the clutch spring compressor [B], push the damper spring holder [C] to remove the retaining ring [D].

**Special Tool - Clutch Spring Compressor : 57001-1162**  
**Inside Circlip Pliers: 57001-143 [E]**



- Remove:
  - Retaining Ring [A]
  - Spring Holder [B]
  - Damper Spring [C]
  - Spring Holder [D]
  - Spacer [E]
  - Damper Cam [F]
  - Inner Clutch Hub [G]

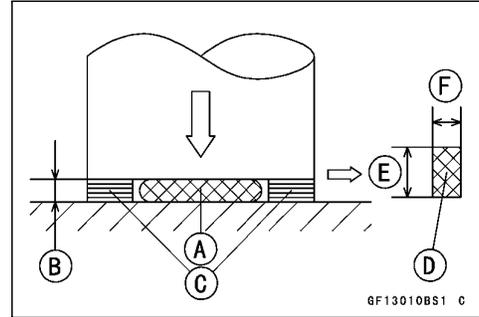


#### *Spring Plate Gap Measurement*

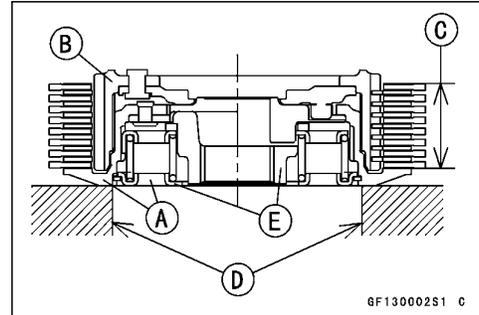
Insufficient spring plate gap will cause the engine braking effect to be more sudden, resulting in rear wheel hop. On the other hand, if the spring plate gap is excessive, the clutch may slip or the clutch lever may feel “spongy” or pulsate when pulled.

**Clutch**

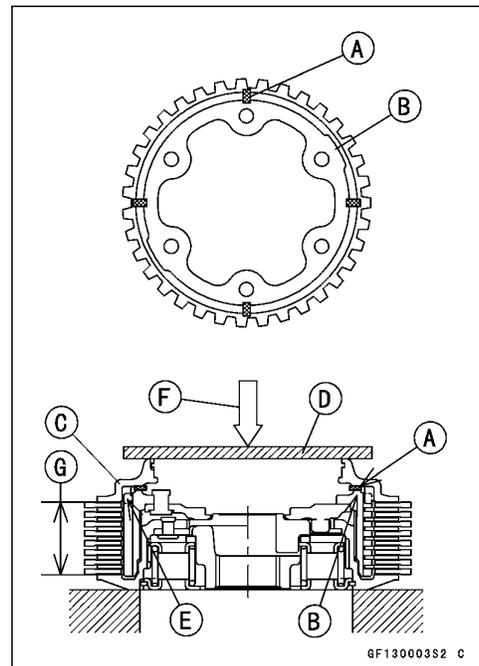
- Prepare sheet gum (chewing gum) or about 5 g (0.176 oz) clay [A].
- Make an about 2.5 mm (0.10 in.) thick sheet [B] of gum or clay, using a press and two thickness gauges [C] which are overlapped to about 2.5 mm (0.10 in.).
- Cut the sheet with scissors into four strips [D] of gum or clay as shown.
  - [E] : 7 mm (0.276 in.)
  - [F] : 4 mm (0.157 in.)



- Remove the clutch (see this chapter).
- Place the inner clutch hub, spring holder assy [A], the outer clutch hub [B], and the clutch plates (friction and steel plates) [C] on blocks [D].
- Do not support the spring holder [E] with the blocks.



- Apply a soap and water solution to the strips. This is to separate the strips easily from the clutch spring plate and clutch hub when removing strips.
- Place these four strips [A] on the raised surface [B] of the outer clutch hub in a criss-cross pattern as shown.
- Install the clutch spring plate [C] and a block [D].
- While noting the positions of the spline teeth [E], fit the clutch spring plate into the outer clutch hub smoothly. Be careful not to move these strips.
- Press [F] the block until the clutch plates [G] seat closely.



**CAUTION**

**Do not press the block too much. This could damage the clutch parts. The maximum press force is 100 kg.**

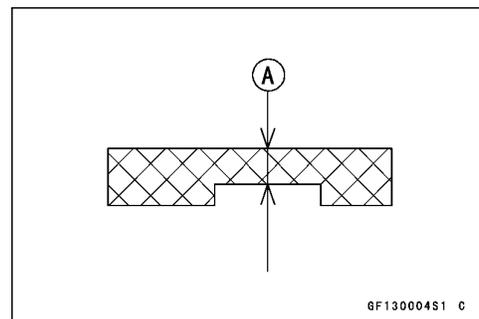
- Remove the clutch spring plate.
- Peel off these strips with a thin-bladed screwdriver.
- Measure the pressed thickness [A] of each strip with vernier calipers.
- The thickness represents the spring plate gap.

**Spring Plate Gap**

**Usable Range: 1.95 ~ 2.45 mm (0.0768 ~ 0.0965 in)**

**NOTE**

○ In case of rear wheel hop, adjust the spring plate gap a bit larger, and in case of clutch slip or "spongy" clutch lever, adjust the gap a bit smaller within the usable range.



## 6-16 CLUTCH

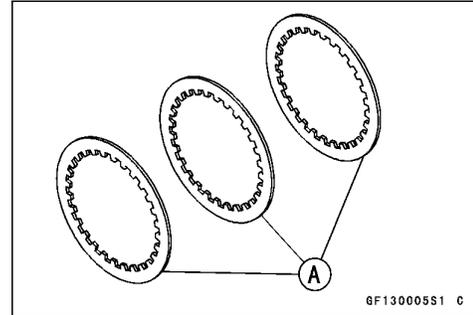
### Clutch

#### Spring Plate Gap Adjustment

- ★ If the plate gap is out of the usable range, change one of the steel plates [A] to a thicker or thinner one to get the correct gap.
- Use the standard steel plates (2.0 mm, 0.079 in. thick) × (6 ~ 7) plates, and the adjustment steel plate (1.6 or 2.3 mm, 0.063 or 0.090 in. thick) × (0 ~ 1) plates: total 7 plates.

#### Steel Plates

Thickness	Part No.
1.6 mm (0.063 in.)	13089-1080
2.0 mm (0.079 in.)	13089-1075 (standard)
2.3 mm (0.090 in.)	13089-1081



### CAUTION

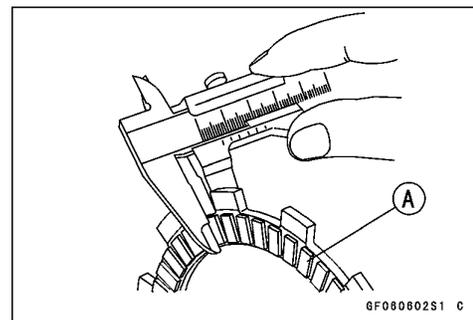
If new friction or steel plates are installed, apply engine oil to the surfaces of each plate to avoid clutch plate seizure.

#### Friction and Steel Plate Wear, and Damage Inspection

- Visually inspect the friction and steel plates for signs of seizure, overheating (discoloration), or uneven wear.
- ★ If any plates show signs of damage, replace the plates.
- Measure the thickness of the friction plates [A] at several points.
- ★ If they have worn past the service limit, replace the friction plate and measure the spring plate gap and adjust it if necessary.

#### Friction Plate Thickness

Standard:	3.3 ~ 3.5 mm (0.130 ~ 0.138 in)
Service Limit:	3.1 mm (0.122 in)

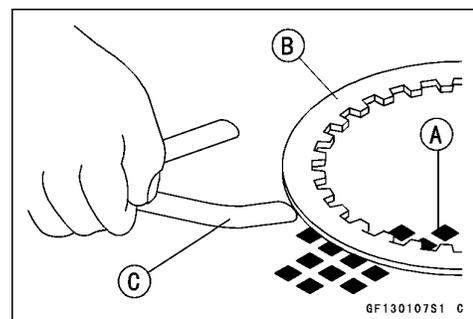


#### Friction or Steel Plate Warp

- Place each friction plate or steel plate on a surface plate, and measure the gap between the surface plate [A] and each friction plate or steel plate [B] with a thickness gauge [C]. The gap is the amount of friction or steel plate warp.
- ★ If any friction plate is warped over the service limit, replace it and measure the spring plate gap, and adjust it if necessary.
- ★ If any steel plate is warped over the service limit, replace it with a new one of the same thickness.

#### Friction or Steel Plate Warp

Standard:	0.2 mm (0.0079 in) or less
Service Limit:	0.3 mm (0.012 in)



**Clutch**

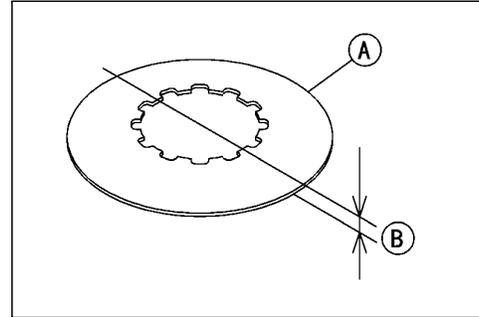
*Clutch Spring Height Measurement*

- Measure the height [B] of the clutch spring [A].
- ★ If the spring height is less than the service limit, it must be replaced.

**Clutch Spring Height**

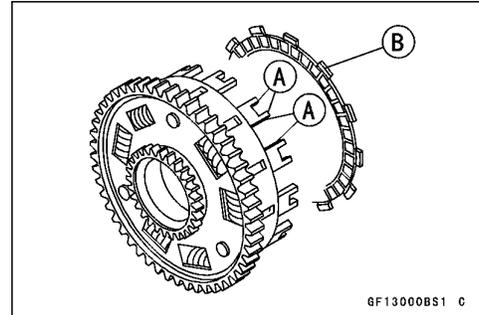
**Standard:** 4.3 mm (0.235 in)

**Service Limit:** 4.0 mm (0.16 in)



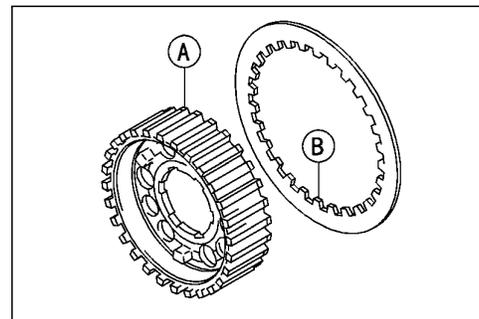
*Clutch Housing Finger Inspection*

- Visually inspect the fingers [A] of the clutch housing where the tangs [B] of the friction plates hit them.
- ★ If they are badly worn or if there are groove cuts where the tangs hit, replace the housing. Also, replace the friction plates if their tangs are damaged and measure the spring plate gap and adjust it if necessary.



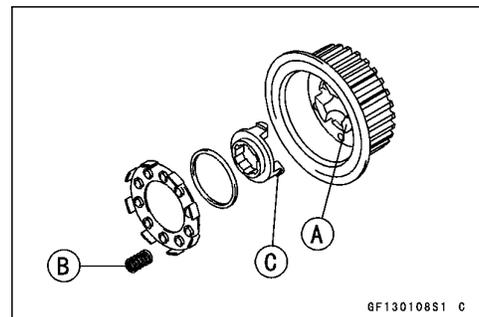
*Outer Clutch Hub Spline Inspection*

- Visually inspect where the teeth [B] on the steel plates wear against the splines [A] of the outer clutch hub.
- ★ If there are notches worn into the splines, replace the outer clutch hub. Also, replace the steel plate with a new one of the same thickness if their teeth are damaged.



*Cam Damper Inspection*

- Disassemble the clutch (see Clutch Inner Hub Disassembly).
- Visually inspect the damper cam [A], damper spring [B], and cam follower [C].
- ★ Replace any damaged parts.





# Engine Lubrication System

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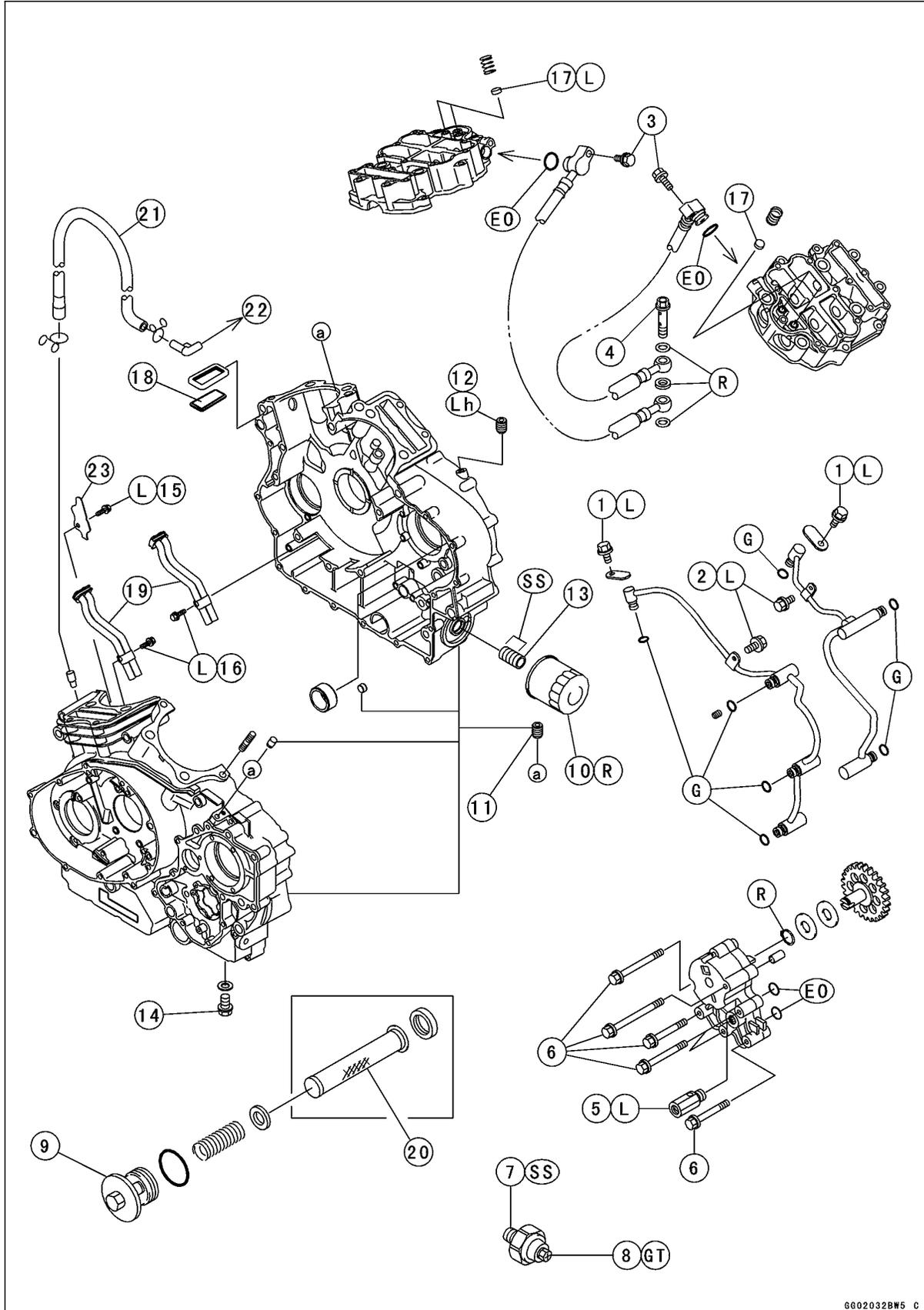
### Engine Oil Flow Chart

---

- : Oil Flow (1 ~ 30)
- : Blowby Gas
- 1. Oil Screen
- 2. Oil Pump
- 3. Relief Valve
- 4. Oil Filter
- 5. Bypass Valve
- 6. Oil Pressure Switch
- 7. Inside Oil Pipe
- 8. Banjo Bolts of Right Crankcase Rear
- 9. Outside Oil Hoses
- 10. HLA Oil Filter
- 11. Rocker Shafts
- 12. Rocker Arms
- 13. HLA (Hydraulic Lash Adjuster)
- 14. Camshafts
- 15. Outside Oil Pipe
- 16. Front Gear Case
- 17. Inside Oil Pipe
- 18. Crankshaft
- 19. Alternator Rotor
- 20. Oil Nozzle
- 21. Front Piston
- 22. Drive Shaft
- 23. Output Shaft
- 24. Rear Piston
- 25. Front Rockercase
- 26. Rear Rockercase
- 27. Inside Oil Pipe Fittings
- 28. Oil Baffle
- 29. Fitting
- 30. Left Crankcase
- 31. Right Air Cleaner Housing (rear view)
- 32. Crankcase Breather Hose
- 33. Oil Separating Chambers
- 34. Right Crankcase
- 35. Oil Return Pipes

# 7-4 ENGINE LUBRICATION SYSTEM

## Exploded View



6602032BW5 C

## ENGINE LUBRICATION SYSTEM 7-5

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil pipe holder bolts	11	1.1	95 in·lb	L
2	Oil pipe clamp bolts	11	1.1	95 in·lb	L
3	Oil hose flange bolts	9.8	1.0	87 in·lb	
4	Oil hose banjo bolt	9.8	1.0	87 in·lb	
5	Relief valve	15	1.5	11	L
6	Oil pump mounting bolts	11	1.1	95 in·lb	
7	Oil pressure switch	15	1.5	11	SS
8	Oil pressure switch terminal screw	1.5	0.15	13 in·lb	
9	Oil screen plug	20	2.0	14	
10	Oil filter	18	1.8	13	R
11	Oil nozzles	2.9	0.30	26 in·lb	
12	Oil nozzle	2.9	0.30	26 in·lb	Lh
13	Oil filter pipe	25	2.5	18	SS
14	Oil drain plug	20	2.0	14	
15	Oil baffle bolt	11	1.1	95 in·lb	L
16	Oil return pipe bolts	11	1.1	95 in·lb	L

17. HLA Oil Filters

18. Oil Separator (smaller side goes first.)

19. Oil Return Pipes

20. Oil Screen

21. Crankcase Breather Hose

22. To right air cleaner base

23. Oil Baffle

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

Lh: Left-hand Threads

R: Replacement Parts

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

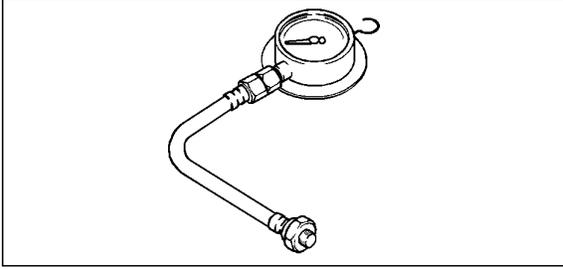
## 7-6 ENGINE LUBRICATION SYSTEM

### Specifications

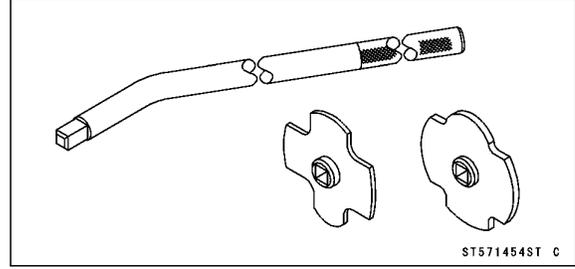
Item	Standard
<b>Engine Oil:</b> Type  Viscosity Capacity  Level (Wait 2 ~ 3 minutes after idling or running)	API Service Classification : SE, SF or SG class API Service Classification : SH or SJ class with JASO MA SAE 10W-40 2.9 L (3.1 US qt, when filter is not removed) 3.1 L (3.3 US qt, when filter is removed) 3.5 L (3.7 US qt, when engine is completely disassembled and dry) Between upper and lower level lines
<b>Oil Pressure Measurement:</b> Oil pressure @2 000 r/min (rpm), Oil temp. 90°C (194°F)	340 ~ 440 kPa (3.5 ~ 4.5 kg/cm <sup>2</sup> , 50 ~ 64 psi)

## Special Tools and Sealant

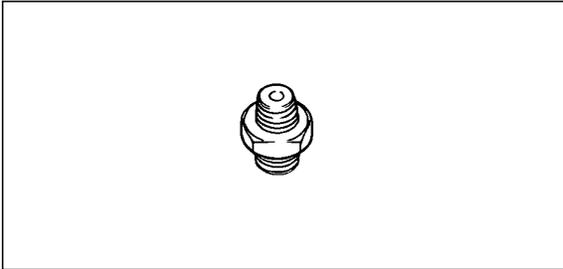
**Oil Pressure Gauge, 5 kgf/cm<sup>2</sup> :**  
57001-125



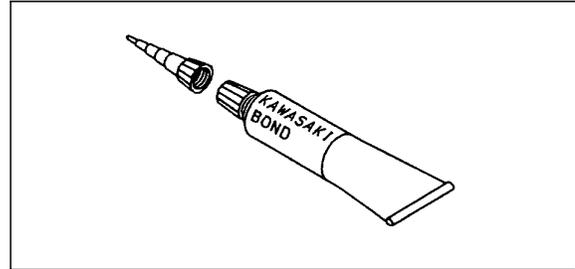
**Filler Cap Driver :**  
57001-1454



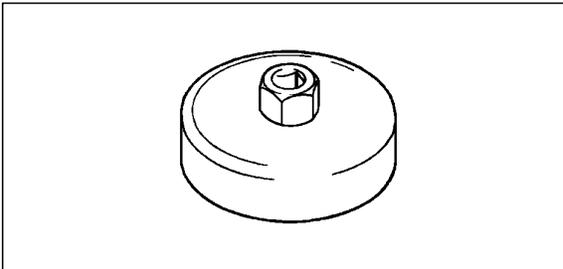
**Oil Pressure Gauge Adapter, PT 1/8 :**  
57001-1033



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



**Oil Filter Wrench :**  
57001-1249



## 7-8 ENGINE LUBRICATION SYSTEM

### Engine Oil and Oil Filter

#### **⚠ WARNING**

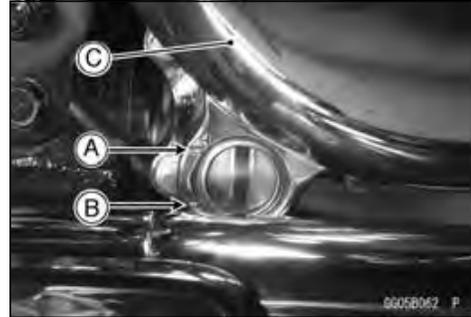
**Motorcycle operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine or transmission seizure, accident, and injury.**

#### *Oil Level Inspection*

- Situate the motorcycle so that it is vertical.
- Check that the engine oil level is between the upper [A] and lower [B] levels in the gauge.  
Clutch Cover [C]

#### **NOTE**

- Situate the motorcycle so that it is perpendicular to the ground.
- If the motorcycle has just been used, wait 2 ~ 3 minutes for all the oil to drain down.
- 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 2 ~ 3 minutes until the oil settles.



#### **CAUTION**

**Racing the engine before the oil reaches every part can cause engine seizure. If the engine oil gets extremely low or if the oil pump or oil passages clog up or otherwise do not function properly, the oil pressure warning light will light. If this light stays on when the engine is running above idle speed, stop the engine immediately and find the cause.**

- ★ If the oil level is too high, remove the excess oil, using a syringe or some other suitable device.
- ★ If the oil level is too low, add the correct amount of oil through the oil filler opening. 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 Engine Oil Change in the Periodic Maintenance Chapter.

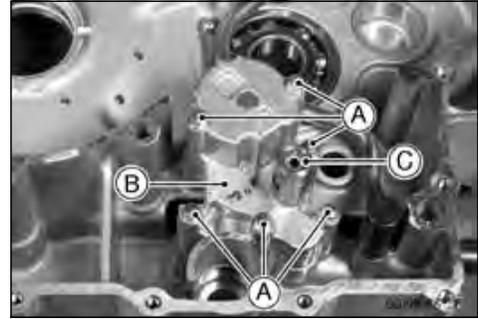
#### *Oil Filter Replacement*

- Refer to Oil Filter Replacement in the Periodic Maintenance Chapter.

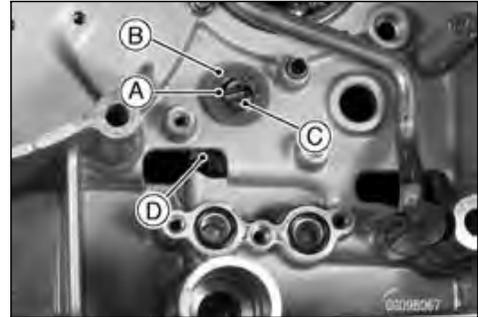
## Oil Pump and Oil Line

### Oil Pump Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Split the crankcase (see Crankshaft/Transmission chapter).
- Remove the oil pump mounting bolts [A], and take off the pump [B] out of the right crankcase.
- Unscrew the relief valve [C] if necessary.

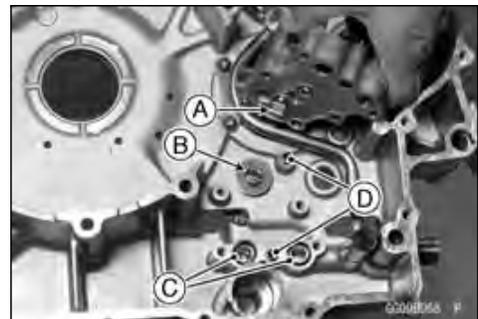


- Remove:
  - Circlip [A]
  - Washer [B]
  - Pump Shaft [C]
  - Pump Gear [D]



### Oil Pump Installation

- Note the position of the oil pump shaft tang [A] and turn the pump gear shaft so that the tang fits into the slot [B] of the oil pump gear.
- Replace the O-rings [C] with new ones if they are damaged.
- Be sure to install the dowel pins [D].
- Tighten:



**Torque - Oil Pump Mounting Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

- Check that the oil pump gear turns smoothly in the left side of the right crankcase.
- Apply a non-permanent locking agent to the threads of the relief valve and install it.

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

### Oil Hose Removal

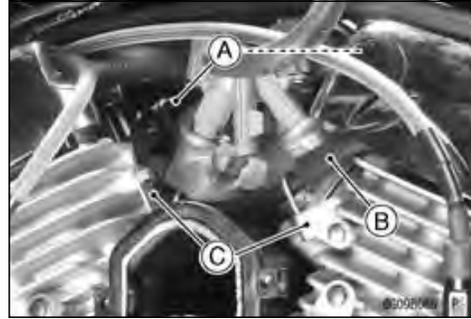
- Remove the fuel tank (see Fuel System (DFI) chapter).
- Disconnect:
  - Water Temperature Sensor Connector [A]
  - Vacuum Switch Valve Hose [B] (air cleaner side)
  - Throttle Sensor Connector [C]



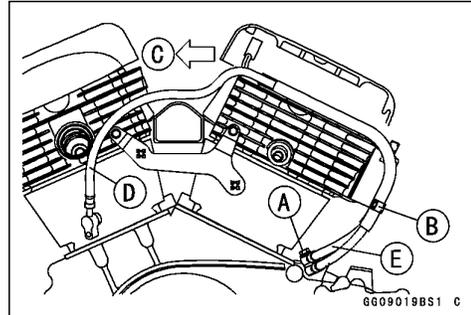
## 7-10 ENGINE LUBRICATION SYSTEM

### Oil Pump and Oil Line

- Remove:
  - Left Air Cleaner Housing (see Fuel System (DFI) chapter)
  - Oil Hose Flange Bolts [A] on Front and Rear Rocker Cases
- For the front oil hose [B], remove the clamps [C].

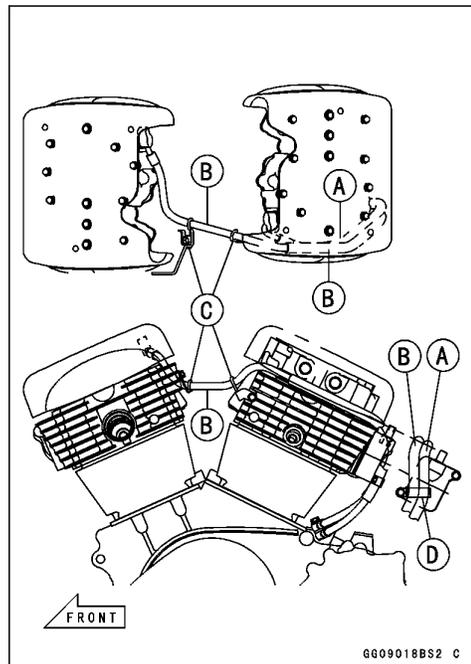


- Remove:
  - Oil Hose Banjo Bolt [A] on Right Crankcase behind Rear Cylinder
  - Clamp (open) [B]
- Pull [C] out the front oil hose [D] forward and the rear oil hose [E].



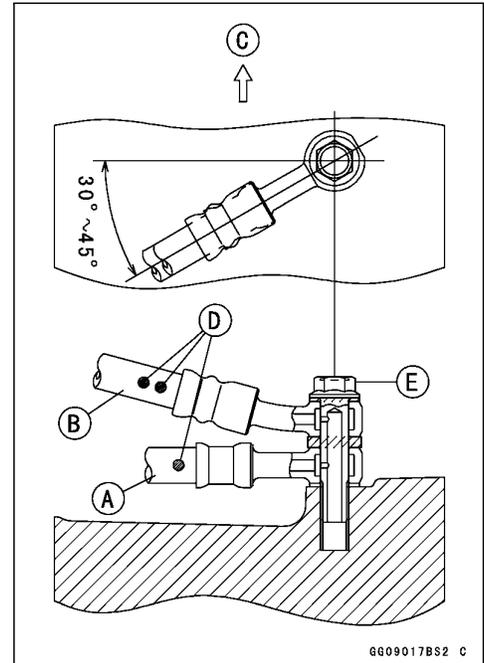
#### *Oil Hose Installation*

- Run the front oil hose over the rear oil hose as shown.
- Insert the rear oil hose [A] first.
- Next insert the front oil hose [B].
- Run both oil hoses between the rocker case and the rocker case cover.
- Torque - Oil Hose Flange Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Install the clamps [C].
- Fit the clamp [D] as shown.



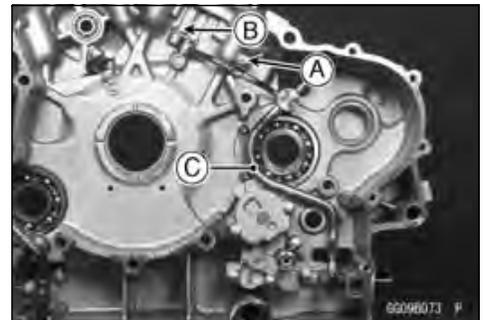
## Oil Pump and Oil Line

- Install each bottom end of the oil hoses on the right crankcase behind the rear cylinder as shown.
  - Front Oil Hose [A]
  - Rear Oil Hose [B]
  - Front [C]
- Face the paint marks [D] rearward.
- Replace the copper washers on each side of the banjo bolt with new ones.
- Torque - Oil Hose Banjo Bolt [E]: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Install the removed parts.



### Inside Oil Pipe Removal

- Split the crankcase (see Crankshaft/Transmission chapter).
- Remove:
  - Oil Pipe Clamp Bolts [A]
  - Oil Pipe Holder Bolt [B]
- Remove the inside oil pipe [C] from the right crankcase.



- Remove the oil pipe clamp bolt [A], and oil return pipe [B].



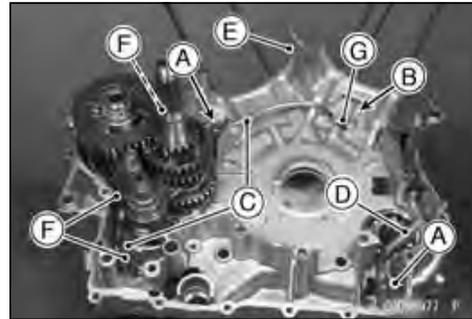
- Remove the separator [A].



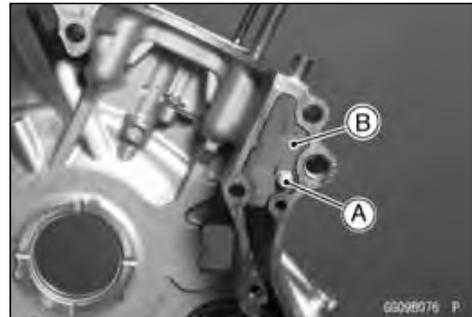
## 7-12 ENGINE LUBRICATION SYSTEM

### Oil Pump and Oil Line

- Remove:
  - Oil Pipe Clamp Bolt [A]
  - Oil Pipe Holder Bolt [B]
- Remove the inside oil pipe [C] and the oil return pipe [D] from the left crankcase [E].
- Pull out the large size fittings [F] first, and remove the small size fitting [G] upward.

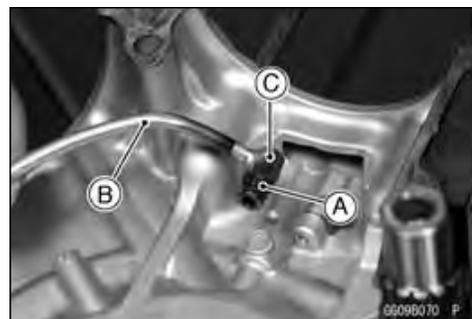


- Remove the bolt [A] and the separator [B].



#### *Inside Oil Pipe Installation*

- Check that the oil pipe fitting O-rings [A] are in good condition.
- Apply grease to the O-rings before installation.
  - Oil Pipe [B]
  - Fitting [C]



## Oil Pump and Oil Line

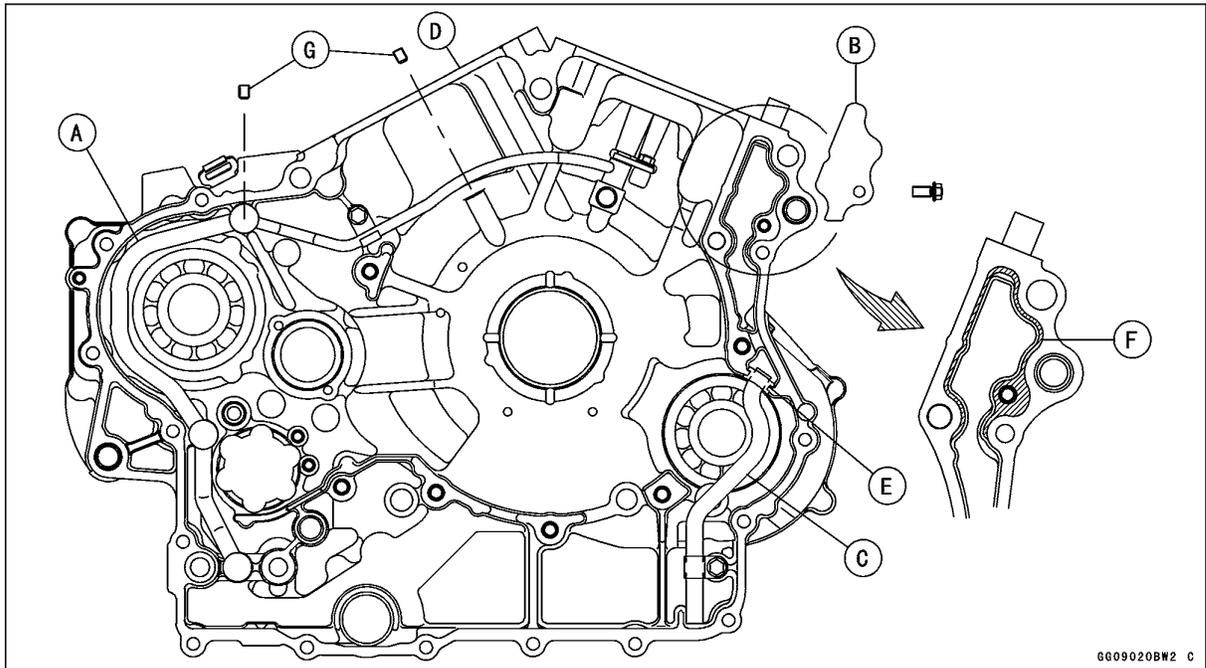
- Install the inside oil pipe [A], separator [B] and the oil return pipe [C] to left crankcase [D] as shown.
- Do not apply silicone sealant to the groove of the grommet and the mating surface of the grommet [E].
- Apply silicone sealant to the crankcase mating surface [F] of the separator.
- Apply a non-permanent locking agent to the oil pipe holder bolt, oil pipe clamp bolts, and oil baffle bolt.
- If the oil nozzles [G] are removed, install them.

**Torque - Oil Pipe Holder Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)**

**Oil Pipe Clamp Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

**Oil Baffle Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)**

**Oil Nozzle: 3.0 N·m (0.30 kgf·m, 26 in·lb)**

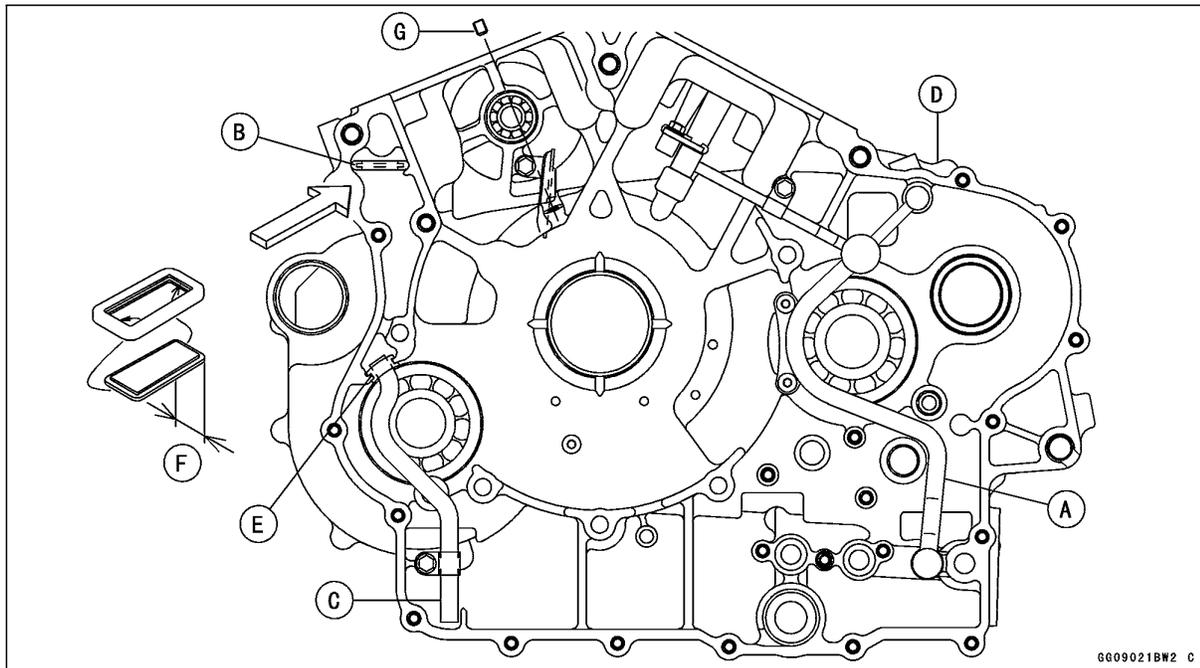


GG09020BW2 C

## 7-14 ENGINE LUBRICATION SYSTEM

### Oil Pump and Oil Line

- Install the inside oil pipe [A], separator [B], and the oil return pipe [C] to the right crankcase [D].
- Do not apply silicone sealant to the groove of the grommet and the mating surface of the grommet [E].
- Install the separator so that its smaller side [F] faces inside.
- Apply a non-permanent locking agent to the oil pipe holder bolt and oil pipe clamp bolts.
- If the oil nozzle [G] is removed, install it.



**Torque - Oil Pipe Holder Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**  
**Oil Pipe Clamp Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**  
**Oil Nozzle: 3.0 N·m (0.30 kgf·m, 26 in·lb)**

- Install the removed parts.

#### *Blowby Gas System Inspection*

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the oil reserve tank and right air cleaner base.
- ★ If they are not, correct them.
- Inspect the breather hoses [A], breather pipe [B], and the air cleaner drain hose for damage or signs of deterioration.
- These hoses should not be hard and brittle, nor should be soft or swollen.
- ★ Replace it if any cracks or swelling are noticed.
- Check that the hoses are securely connected.



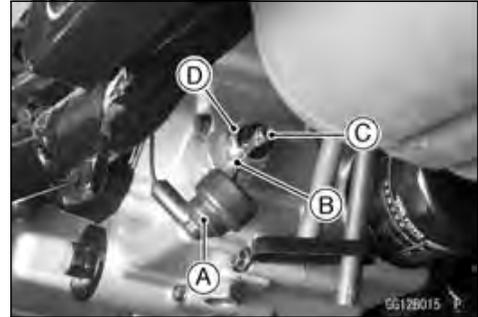
#### *Breather Drain Cleaning*

- Refer to Breather Drain Cleaning in the Periodic Maintenance Chapter.

## Oil Pressure

### Oil Pressure Measurement

- Slide out the rubber boot [A].
- Disconnect the oil pressure switch lead [B] from the terminal screw [C].
- Unscrew the oil pressure switch [D].



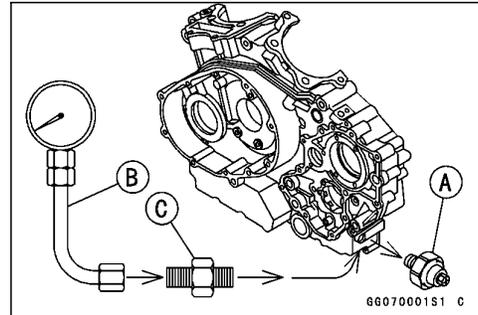
### NOTE

○ Measure the oil pressure after the engine is warmed up.

- Attach the oil pressure gauge [B] and adapter [C] to the switch hole.

Oil Pressure Switch [A]

**Special Tools - Oil Pressure Gauge, 5 kg/cm<sup>2</sup>: 57001-125**  
**Oil Pressure Gauge Adapter, PT 1/8: 57001-1033**



- Start the engine and warm up the engine.
- Run the engine at the specified speed, and read the oil pressure gauge.
- ★ If the oil pressure is much lower than the standard, check the oil pump, oil pressure relief valve, and/or crankshaft bearing wear and con-rod big end bearing insert wear immediately.
- ★ If the reading is much higher than the standard, check the oil screen first, and the oil passages for dirt or clogging. Also, replace the oil filter.

### Oil Pressure

**Standard: 340 ~ 440 kPa (3.5 ~ 4.5 kg/cm<sup>2</sup>, 50 ~ 64 psi)**  
**@ 2 000 r/min (rpm), oil temp. 90°C (194°F)**

- Stop the engine.
- Remove the oil pressure gauge and adapter.

### ⚠ WARNING

**Take care against burns from hot engine oil that will drain through the oil passage when the plug is removed.**

- When installing the oil pressure switch, apply silicone sealant to the threads of the switch, and tighten it to the specified torque.

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

## 7-16 ENGINE LUBRICATION SYSTEM

### Oil Pressure

#### Relief Valve Inspection

- Split the crankcase (see Crankshaft/Transmission chapter).
- Remove the relief valve [A] from the oil pump [B].
- Check to see if the valve slides smoothly when pushing it in with a wooden or other soft rod, and see if it comes back to its seat by spring pressure.

#### NOTE

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

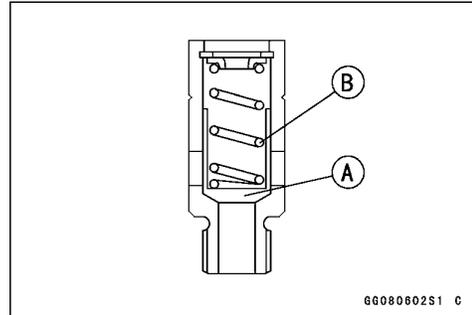
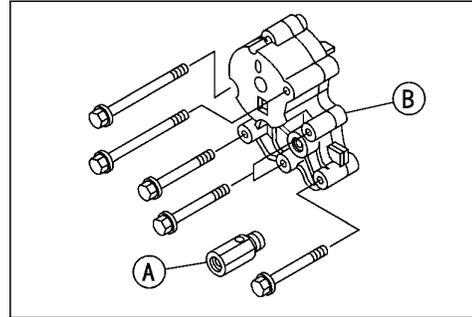
- ★ If any rough spots are found during above inspection, wash the valve clean with a high-flash point solvent and blow out any foreign particles that may be in the valve with compressed air in a well-ventilated area.

○ Take care that there is no spark or flame anywhere near the working area.

Valve [A]

Spring [B]

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



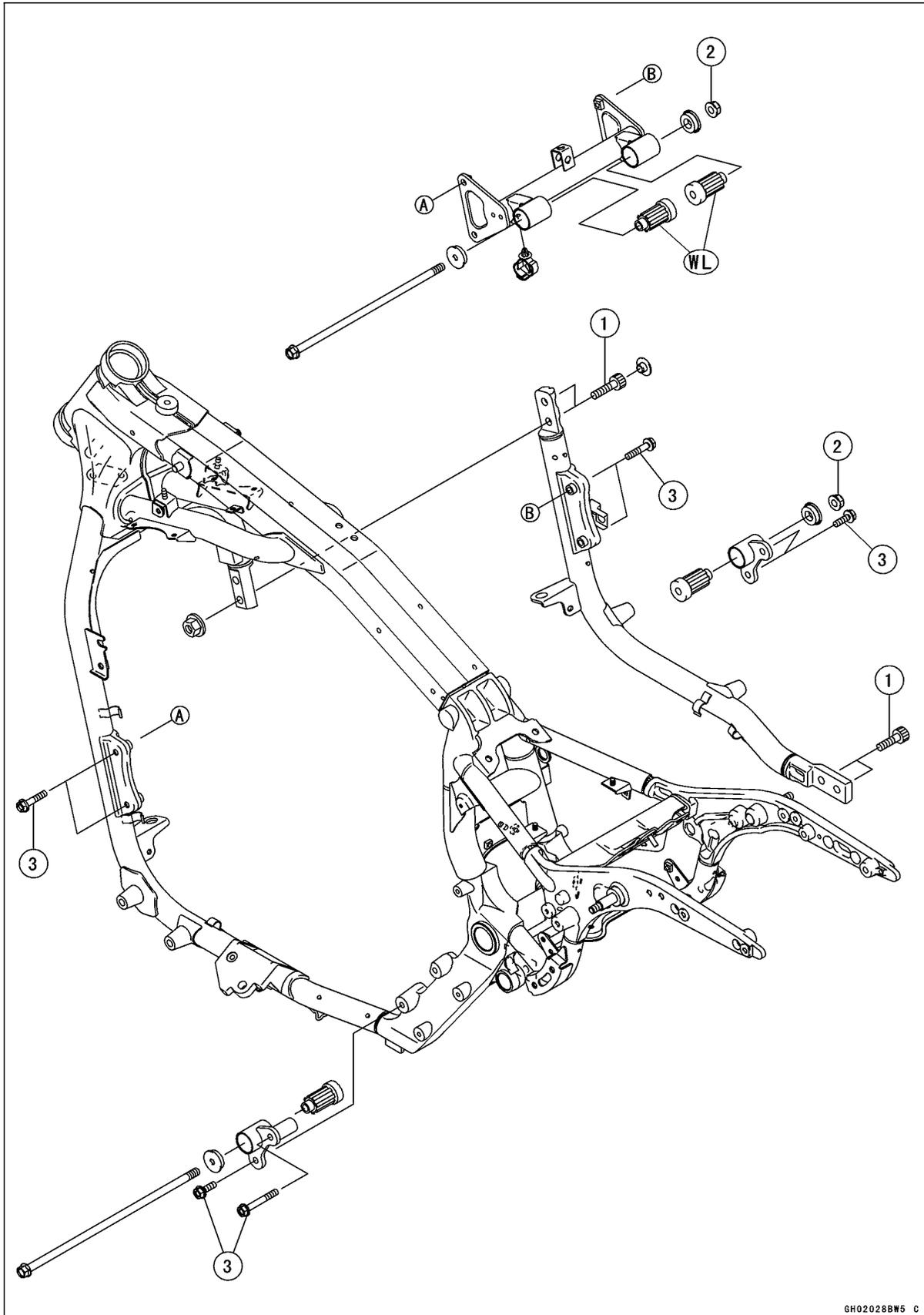
# Engine Removal/Installation

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Engine Removal.....	8-5
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# 8-2 ENGINE REMOVAL/INSTALLATION

## Exploded View



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## ENGINE REMOVAL/INSTALLATION 8-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Downtube bolts and nuts	44	4.5	33	
2	Engine mounting bolts and nuts	44	4.5	33	
3	Engine mounting bracket bolts	25	2.5	18	

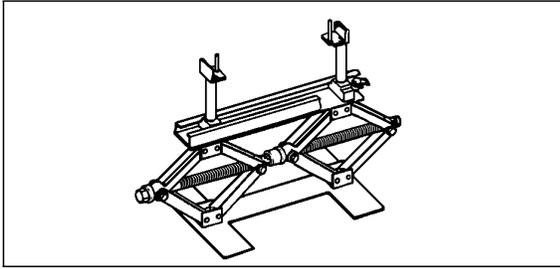
WL: Apply a soap and water solution or rubber lubricant.

## 8-4 ENGINE REMOVAL/INSTALLATION

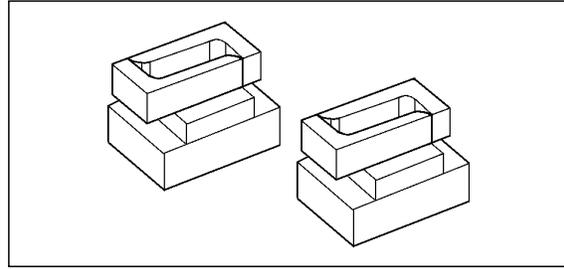
### Specifications

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Jack : 57001-1238



Attachment Jack : 57001-1398



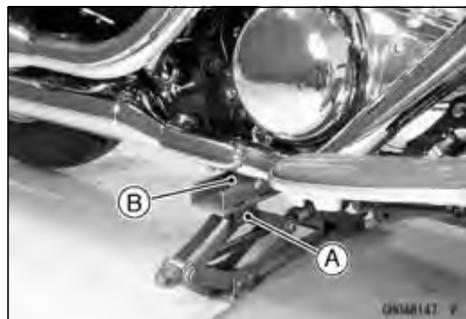
## Engine Removal/Installation

### Engine Removal

- Support the rear part of the frame on the jack [A] and the attachment jack [B].

**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**



- Fit the ribs of the frame into the groove [C] of the attachments.



- Squeeze the brake lever slowly and hold it with a band [A].

### **⚠ WARNING**

**Be sure to hold the front brake when removing the engine, or the motorcycle may fall over. It could cause an accident and injury.**

### **CAUTION**

**Be sure to hold the front brake when removing the engine, or the motorcycle may fall over. The engine or the motorcycle could be damaged.**



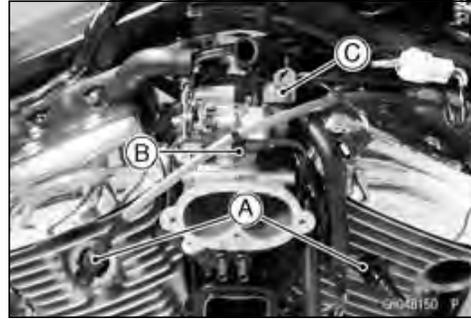
- Drain:
  - Coolant (see Cooling System chapter)
  - Engine Oil (see Engine Lubrication System chapter)
- Remove:
  - Battery Cables
  - Fuel Tank (see Fuel (DFI) System chapter)
  - Left and Right Air Cleaner Housings (see Fuel (DFI) System chapter)
  - Front and Rear Exhaust Pipes (see Engine Top End chapter)
  - Shift Pedals (see Crankshaft/Transmission chapter)
  - Alternator Outer Cover (see Electrical System chapter)
  - Radiator (see Cooling System chapter)
  - Thermostat Removal (see Cooling System chapter)
  - #2 Ignition Coil (right side, see Electrical System chapter)

## 8-6 ENGINE REMOVAL/INSTALLATION

### Engine Removal/Installation

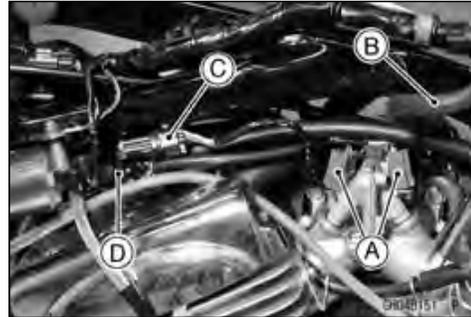
- Remove:

- Spark Plug Caps [A]
- Clamp [B]
- Throttle Sensor Connector [C]



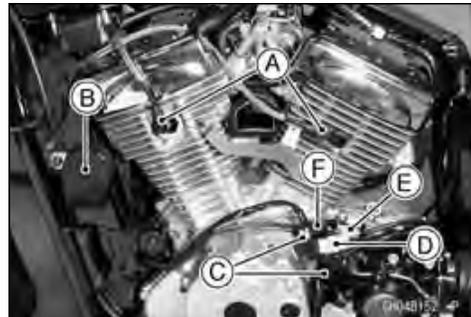
- Remove:

- Injector Connectors [A]
- Fuel Hose [B]
- Connector [C]
- Vacuum Switch Valve [D]
- Inlet Air Pressure Sensor Hose



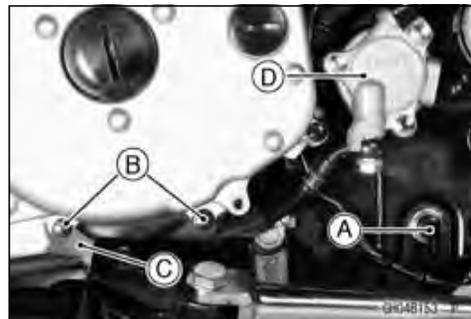
- Remove:

- Spark Plug Caps [A]
- Horn [B]
- Regulator/Rectifier Lead Connectors [C]
- Alternator Lead Connectors [D]
- Crankshaft Sensor Lead Connector [E]
- Side Stand Switch Lead Connector [F]
- Speed Sensor Lead Connector
- Oil Pressure Switch Connector



- Remove:

- Neutral Switch Connector [A]
- Bracket Bolts [B]
- Clutch Hose Bracket [C]
- Clutch Slave Cylinder [D] (see Clutch chapter)



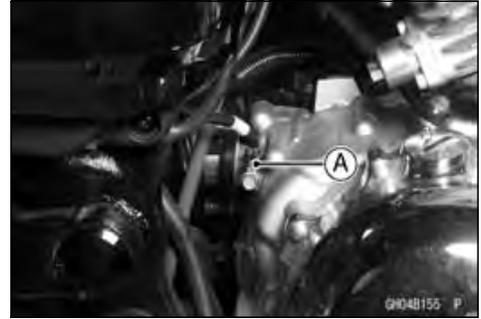
- Remove:

- Bracket Bolts [A]
- Regulator/Rectifier Bracket [B]
- Starter Motor Lead [C]

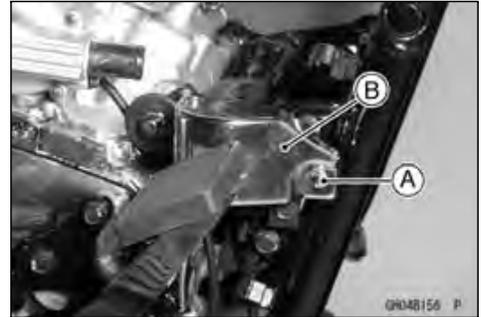


## Engine Removal/Installation

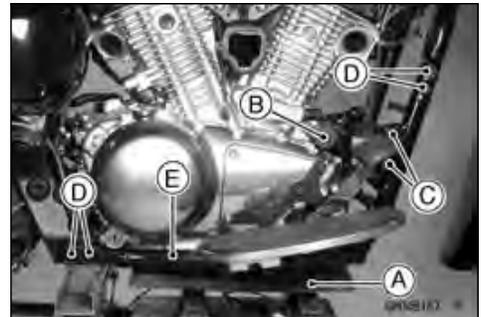
- Remove:  
Engine Ground Terminal [A]



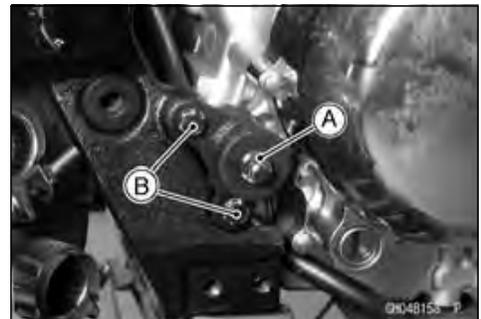
- Remove:  
Brake Reservoir Cover Bolt [A]  
Brake Reservoir Cover [B]



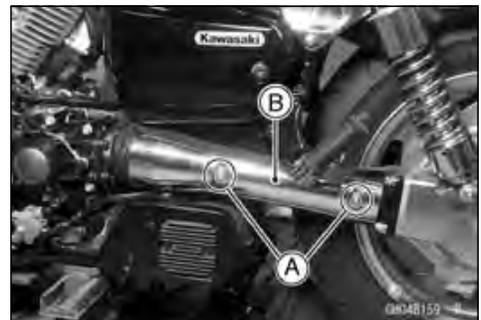
- Support the engine with a commercially available stand [A].
- Loosen the engine mounting nut [B].
- Remove:  
Engine Mounting Bracket Bolts [C]  
Downtube Bolts [D]
- Remove the downtube [E] with the right footpeg and rear master cylinder installed.



- Remove:  
Engine Mounting Bolts and Nuts [A]  
Engine Mounting Bracket Bolts [B]



- Remove:  
Swingarm Cover Bolts [A]  
Swingarm Cover [B]



## 8-8 ENGINE REMOVAL/INSTALLATION

### Engine Removal/Installation

- Disengage the propeller shaft from the engine.
- Pull off the rubber boot [A] and push on the lockpin [B] a little with a pin.
- Move the engine forward [C] to free it from the rear propeller shaft.



- Remove the engine [A] from the motorcycle right side.



### Engine Installation

- Support the engine with a commercially available stand and move them inside the frame in the reverse order of removal.
- Install the rubber boot [A] on the rear end of the front bevel gear case.
- Fit the spring [B] into the front bevel gear joint.
- Put the lockpin [C] into the front bevel gear joint.



- Apply a thin coat of high temperature grease to the driven gear joint and to the propeller shaft joint.
- Push on the lockpin [A] and move back the engine to engage the front bevel gear joint with the propeller shaft joint.



- Insert the rear mounting bolt from the left side of the engine to set the engine into its original position in the frame.
- Tighten:

**Torque - Downtube Bolts and Nuts: 44 N·m (4.5 kgf·m, 33 ft·lb)**

**Engine Mounting Bolts and Nuts: 44 N·m (4.5 kgf·m, 33 ft·lb)**

**Engine Mounting Bracket Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Run the leads, cables and hoses correctly (see Cable, Wire and Hose Routing section in the General Information chapter).

### Engine Removal/Installation

- Connect the engine ground lead [A] down to the engine as shown.

**Torque - Engine Ground Terminal Bolt: 7.8 N·m (0.80 kgf·m, 69 in·lb)**



- Install the removed parts (see appropriate chapters).
- Adjust the throttle cables (see Fuel System chapter).
- Fill the engine with engine oil (see Periodic Maintenance chapter).
- Fill the engine with coolant and bleed the air from the cooling system (see Periodic Maintenance chapter).
- Adjust the idling (see Periodic Maintenance chapter).
- Check the clutch operation.
- Check the brake effectiveness.

#### **⚠ WARNING**

**Do not attempt to ride the motorcycle until a full brake lever or pedal is obtained by pumping the brake lever or pedal until the pads are against the disc. The brake will not function on the first application of the lever or pedal if this is not done.**



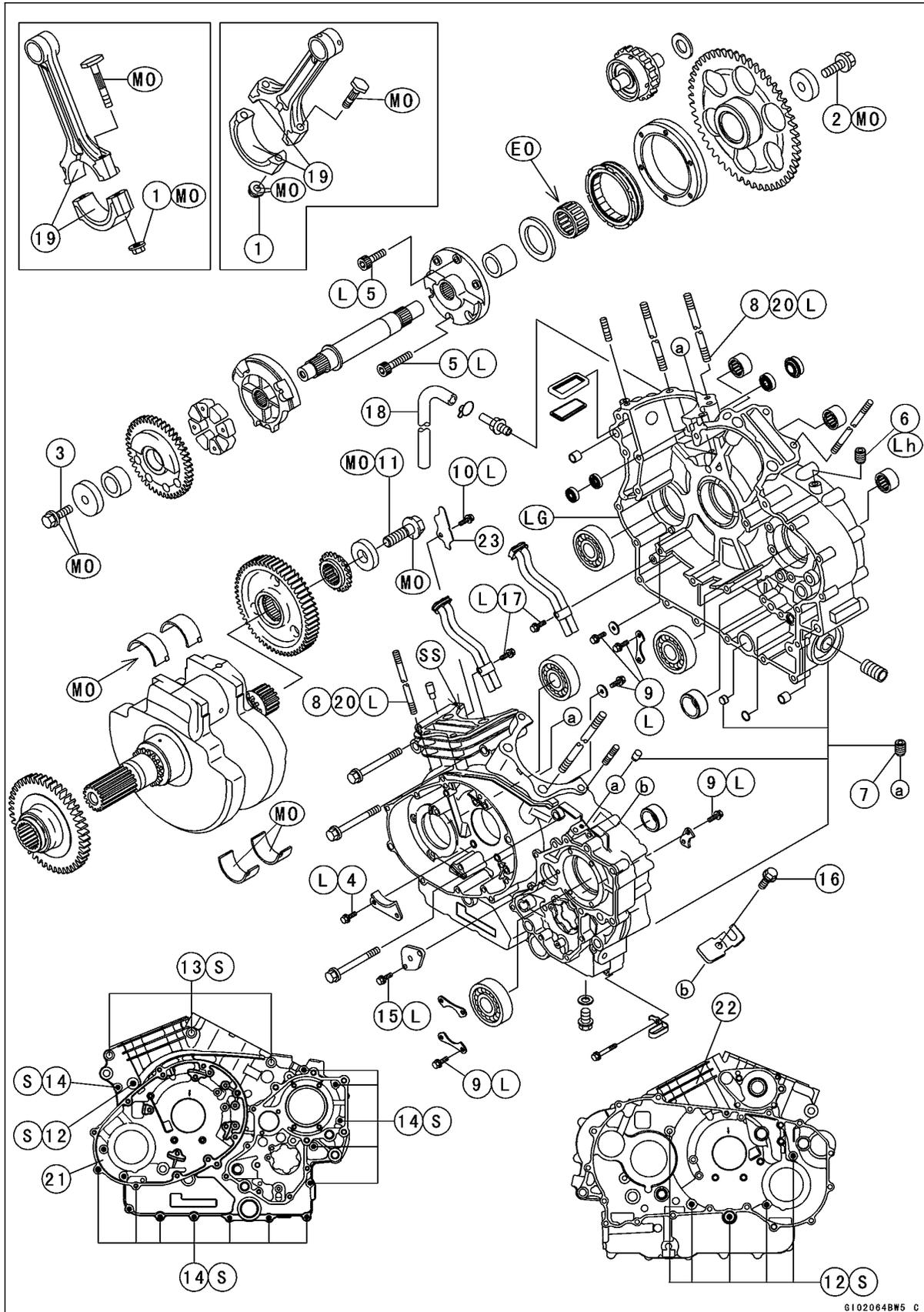
# Crankshaft/Transmission

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# 9-2 CRANKSHAFT/TRANSMISSION

## Exploded View



G102064BW5 C

## CRANKSHAFT/TRANSMISSION 9-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Connecting rod big end nuts	59	6.0	43	MO
2	Starter clutch bolt	85	8.7	63	MO
3	Left balancer gear bolt	85	8.7	63	MO
4	Camshaft chain guide bolts	11	1.1	95 in·lb	L
5	Starter clutch coupling bolts	15	1.5	11	L
6	Oil nozzle	2.9	0.30	26 in·lb	LH
7	Oil nozzles	2.9	0.30	26 in·lb	
8	Cylinder stud	–	–	–	L
9	Bearing retainer bolts	11	1.1	95 in·lb	L
10	Oil baffle bolt	11	1.1	95 in·lb	L
11	Primary gear bolt	147	15.0	108	MO
12	Crankcase bolts, $\phi 8$	21	2.1	15	S
13	Crankcase bolts, $\phi 10$	39	4.0	29	S
14	Crankcase bolts, $\phi 6$	11	1.1	95 in·lb	S
15	Clutch push rod guide bolts	11	1.1	95 in·lb	L
16	Frame ground bracket bolt	11	1.1	95 in·lb	
17	Oil pipe clamp bolts	11	1.1	95 in·lb	L

18. Water Pump Drainage Outlet Hose

19. Do not apply any oil.

20. Apply a non-permanent locking agent to the tap end of this stud only.

21. Left Crankcase

22. Right Crankcase

23. Oil Baffle

EO: Apply engine oil.

L: Apply a non-permanent locking agent.

LG: Apply liquid gasket (Kawasaki Bond: 92104-1064).

Lh: Left-hand Threads

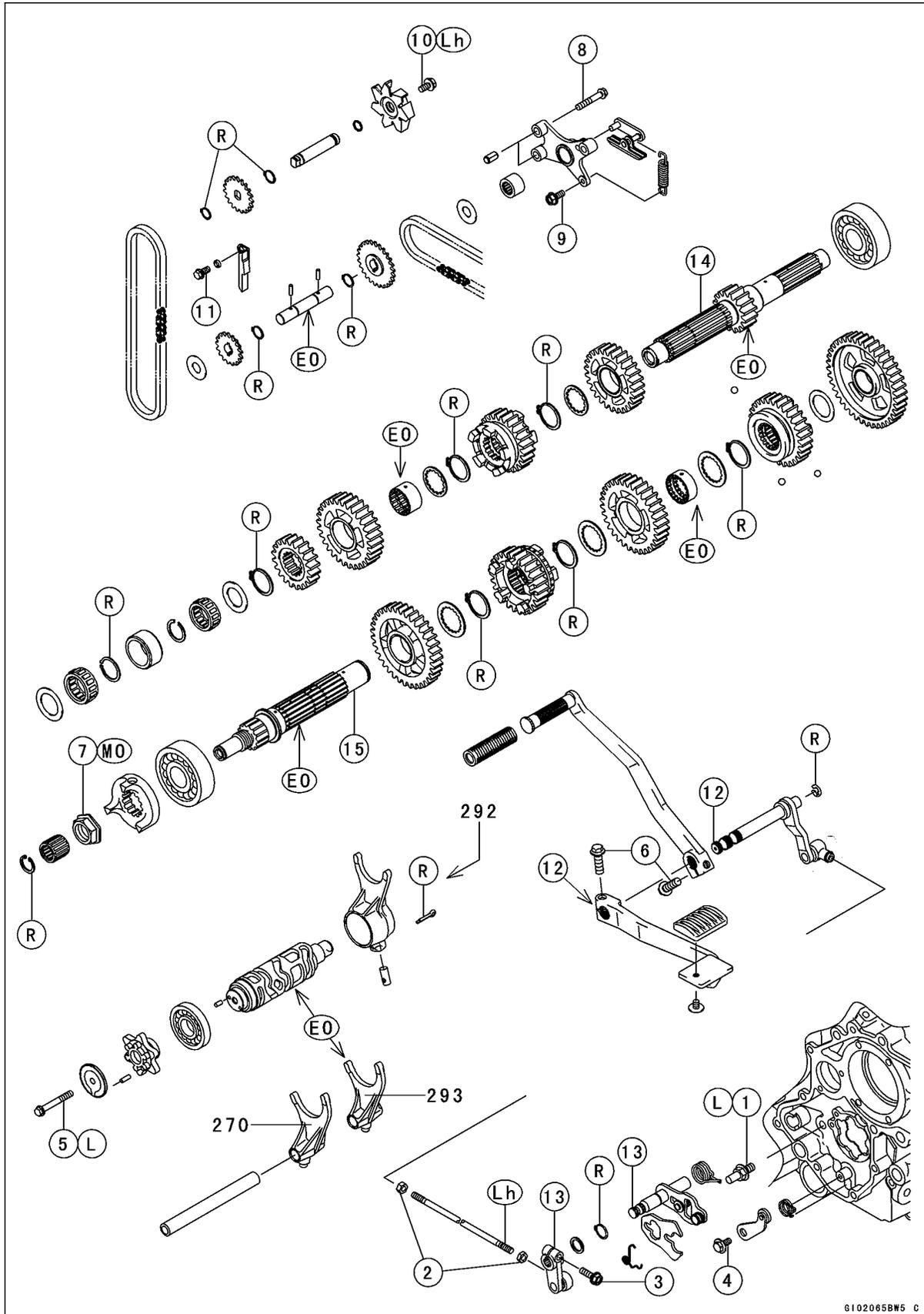
MO: Apply molybdenum disulfide oil to the threads and the seating surface. The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).

S: Follow the specific tightening sequence.

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

# 9-4 CRANKSHAFT/TRANSMISSION

## Exploded View



G102065BW5 C

## CRANKSHAFT/TRANSMISSION 9-5

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Shift shaft return spring pin	39	4.0	29	L
2	Shift rod locknuts	11	1.1	95 in·lb	
3	Rear shift lever clamp bolt	12	1.2	104 in·lb	
4	Gear set lever bolt	11	1.1	95 in·lb	L
5	Shift drum cam bolt	15	1.5	11	L
6	Shift pedal clamp bolts	25	2.5	18	
	Shift pedal clamp bolts (VN1600-A2 ~)	30	3.1	22	
7	Damper cam nut	195	20	144	MO
8	Idle shaft holder bolts	8.3	0.85	73 in·lb	
9	Water pump chain guide spring hook bolt	2.9	0.30	26 in·lb	
10	Water pump impeller bolt	8.8	0.9	78 in·lb	Lh
11	Water pump chain guide bolt	8.3	0.85	73 in·lb	

- 12. Align the punch marks.
- 13. Align the punch mark with the slit.
- 14. Drive Shaft
- 15. Output Shaft
- EO: Apply engine oil.
- L: Apply a non-permanent locking agent.
- Lh: Left-hand Threads
- MO: Apply molybdenum disulfide oil.
- R: Replacement Parts

## 9-6 CRANKSHAFT/TRANSMISSION

### Specifications

Item	Standard	Service Limit																					
<b>Crankshaft, Connecting Rods:</b>																							
Connecting rod bend	-- --	TIR 0.2/100 mm (0.08/3.94 in)																					
Connecting rod twist	-- --	TIR 0.2/100 mm (0.08/3.94 in)																					
Connecting rod big end side clearance	0.16 ~ 0.46 mm (0.0062 ~ 0.0181 in)	0.7 mm (0.028 in)																					
Connecting rod big end bearing insert/crankpin clearance	0.026 ~ 0.057 mm (0.001024 ~ 0.0022 in)	0.10 mm (0.0039 in)																					
Crankpin diameter:	54.981 ~ 55.000 mm (2.1646 ~ 2.1654 in)	54.97 mm (2.1642 in)																					
Marking	None	-- --																					
	○	-- --																					
Connecting rod big end bore diameter:	58.000 ~ 58.020 mm (2.2835 ~ 2.2843 in)	-- --																					
Marking	None	-- --																					
	○	-- --																					
Connecting rod big end bearing insert thickness:																							
	Brown	1.483 ~ 1.487 mm (0.05839 ~ 0.05854 in)																					
	Black	1.487 ~ 1.491 mm (0.05854 ~ 0.05870 in)																					
	Blue	1.491 ~ 1.495 mm (0.05870 ~ 0.05886 in)																					
Connecting rod big end bearing insert selection:																							
<table border="1"> <thead> <tr> <th rowspan="2">Con-rod Big End Bore Diameter Marking</th> <th rowspan="2">Crankpin Diameter Marking</th> <th colspan="2">Bearing Insert</th> </tr> <tr> <th>Size Color</th> <th>Parts Number</th> </tr> </thead> <tbody> <tr> <td>None</td> <td>○</td> <td>Brown</td> <td>92028-1476</td> </tr> <tr> <td>None</td> <td>None</td> <td rowspan="2">Black</td> <td rowspan="2">92028-1475</td> </tr> <tr> <td>○</td> <td>○</td> </tr> <tr> <td>○</td> <td>None</td> <td>Blue</td> <td>92028-1474</td> </tr> </tbody> </table>				Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert		Size Color	Parts Number	None	○	Brown	92028-1476	None	None	Black	92028-1475	○	○	○	None	Blue	92028-1474
Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert																					
		Size Color	Parts Number																				
None	○	Brown	92028-1476																				
None	None	Black	92028-1475																				
○	○																						
○	None	Blue	92028-1474																				
Crankshaft side clearance	0.05 ~ 0.55 mm (0.00197 ~ 0.0217 in)	0.75 mm (0.0295 in)																					
Crankshaft web length	96.85 ~ 96.95 mm (3.8130 ~ 3.8169 in)	96.6 mm (3.803 in)																					

## CRANKSHAFT/TRANSMISSION 9-7

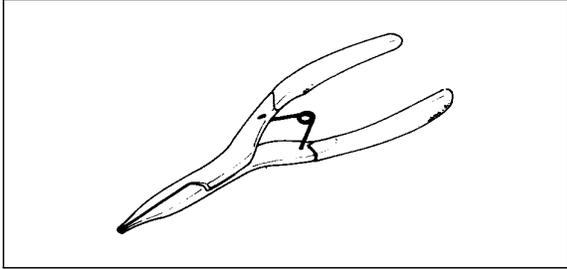
### Specifications

Item	Standard	Service Limit
Crankshaft runout	TIR 0.02 mm (0.0008 in) or less	TIR 0.05 mm (0.0020 in)
Crankshaft main bearing/journal clearance	0.025 ~ 0.052 mm (0.00098 ~ 0.00205 in)	0.10 mm (0.00394 in)
Crankshaft main journal diameter	54.986 ~ 55.000 mm (2.1648 ~ 2.1654 in)	54.96 mm (2.1638 in)
Crankcase main bearing bore diameter	55.025 ~ 55.038 mm (2.1663 ~ 2.1669 in)	55.07 mm (2.1681 in)
<b>Transmission</b>		
Shift fork ear thickness	5.9 ~ 6.0 mm (0.232 ~ 0.236 in)	5.8 mm (0.228 in)
Gear shift fork groove width	6.05 ~ 6.15 mm (0.238 ~ 0.242 in)	6.3 mm (0.248 in)
Shift fork guide pin diameter	7.9 ~ 8.0 mm (0.311 ~ 0.315 in)	7.8 mm (0.307 in)
Shift drum groove width	8.05 ~ 8.20 mm (0.317 ~ 0.323 in)	8.3 mm (0.327 in)

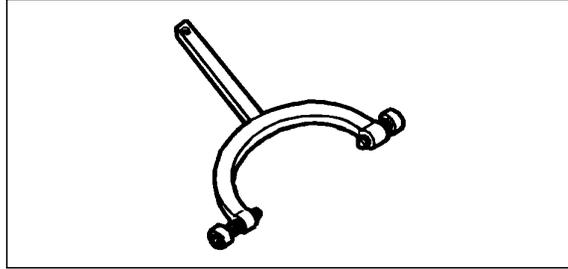
# 9-8 CRANKSHAFT/TRANSMISSION

## Special Tools and Sealants

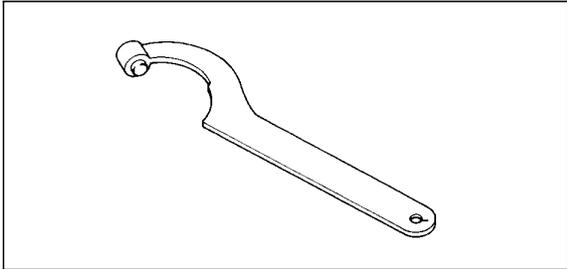
Outside Circlip Pliers :  
57001-144



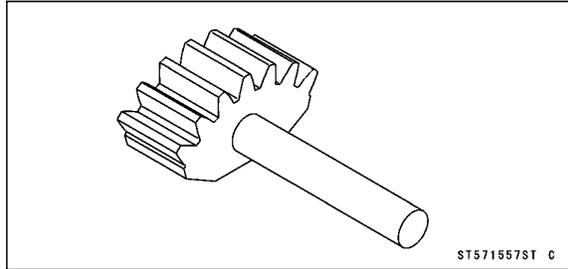
Flywheel Holder :  
57001-1410



Damper Cam Holder :  
57001-1025



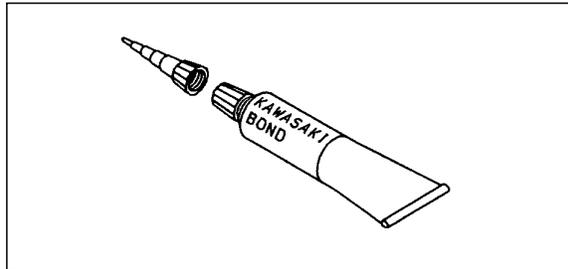
Gear Holder, m2.0 :  
57001-1557



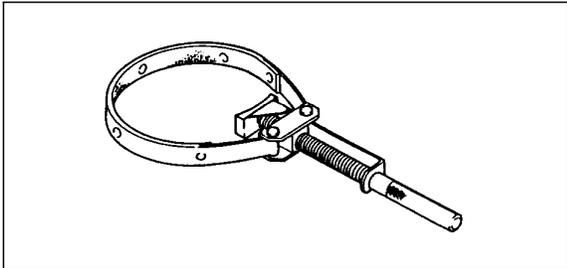
Bearing Driver Set :  
57001-1129



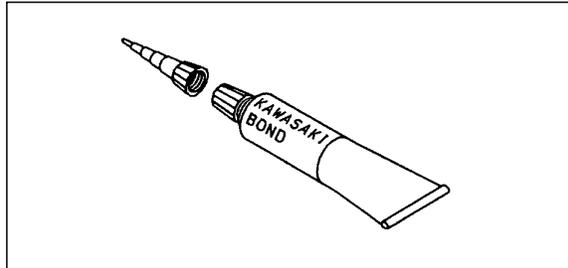
Kawasaki Bond (Silicone Sealant) :  
56019-120



Flywheel Holder :  
57001-1313



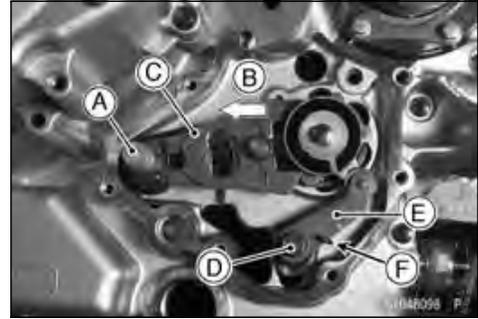
Kawasaki Bond (Liquid Gasket - Black) :  
92104-1064



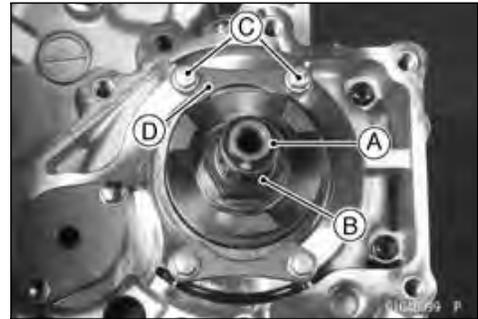
**Crankcase**

*Crankcase Disassembly*

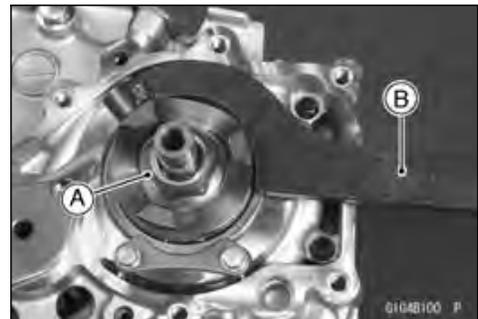
- Drain the engine oil (see Periodic Maintenance chapter).
- Remove:
  - Engine (see Engine Removal/Installation chapter)
  - Cylinder Blocks (see Engine Top End chapter)
  - Pistons (see Engine Top End chapter)
  - Clutch (see Clutch chapter)
  - Front Gear Case (see Final Drive chapter)
- Remove the shift shaft [A] while pushing [B] the shift mechanism arm [C] towards the shift shaft.
- Unscrew the bolt [D] and remove the gear set lever [E] and its spring [F].
- Remove the retainer [A] and needle bearing [B] from the output shaft.
- Remove crankcase bearing upper retainer bolts [C] and retainer [D].



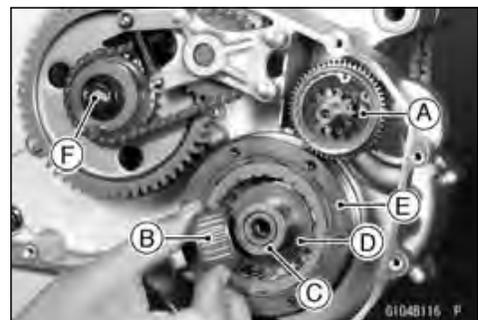
- Unscrew the damper cam nut [A] using the damper cam holder [B] and deep socket wrench.
- Special Tool - Damper Cam Holder: 57001-1025**



- Pull the starter clutch gear [A] out of the starter clutch (The starter clutch gear can be removed with the engine in the frame).
- Unscrew the starter clutch bolt [B] while holding the primary gear bolt [C]. Washer [D]



- Remove the following from the right end of the balancer shaft.
    - Torque Limit [A]
    - Needle Bearing [B]
    - Collar [C]
    - Copper Washer [D]
    - Starter Clutch [E]
  - Unscrew the primary gear bolt [F] while holding the alternator rotor steady with the flywheel holder (The primary gear can be removed with the engine in the frame).
- Special Tool - Flywheel Holder: 57001-1410**



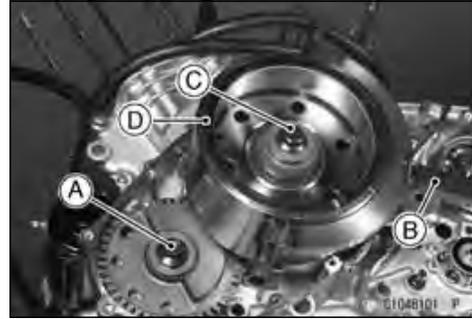
## 9-10 CRANKSHAFT/TRANSMISSION

### Crankcase

- Remove
  - Alternator Cover (see Electrical System chapter)
  - Alternator Inner Cover (see Electrical System chapter)
- Loosen the left balancer gear bolt [A], using the flywheel holder [B]. The left balancer gear bolt has right-hand threads.

**Special Tool - Flywheel Holder: 57001-1410**

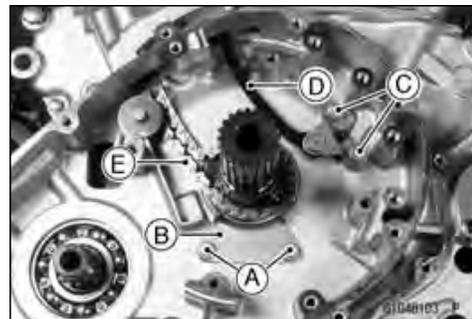
Remove the alternator rotor bolt [C] and the alternator rotor [D].



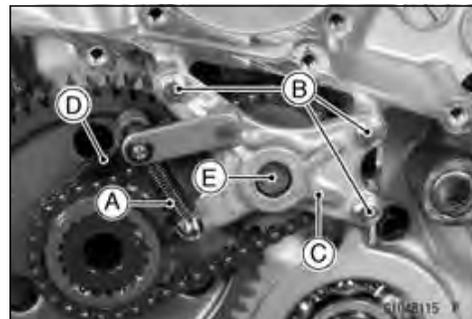
- Take the balancer drive gear [A].
- Take the balancer gear [B], washer, and left balancer off the balancer shaft as a set.



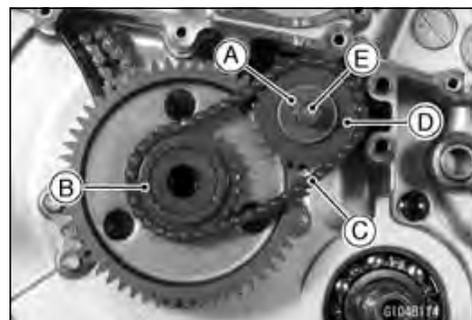
- Remove:
  - Lower Chain Guide Bolts [A]
  - Lower Chain Guide [B]
  - Rear Chain Guide Bolts [C]
  - Rear Chain Guide [D]
  - Front Camshaft Chain [E]



- Take the end of the spring [A] off the hook and unscrew the bolts [B].
- Remove the idle shaft holder [C] and chain guide [D] from the right crankcase (The idle shaft holder can be removed with the engine in the frame).
- Pushing the idle shaft [E], remove the holder.

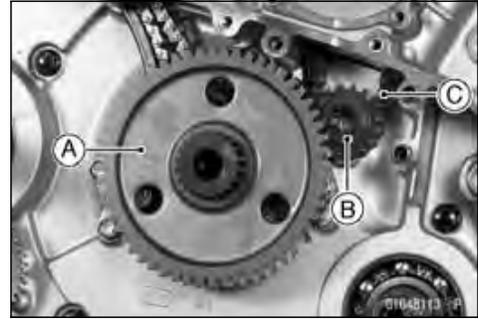


- Remove the washer [A].
- Take out the water pump drive sprocket [B], chain [C] and idle shaft sprocket [D] as a set.
- Take the idle shaft [E] out of the crankcase.
- The idle shaft has two pins.

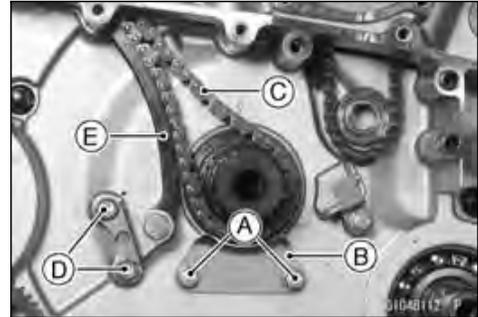


## Crankcase

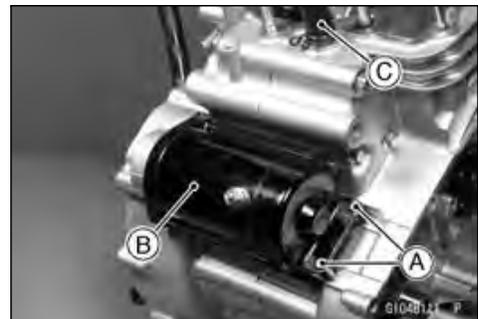
- Pull the primary gear [A] out of the crankshaft.
- Remove the idle shaft sprocket [B] with the flat washer from the water pump chain [C].



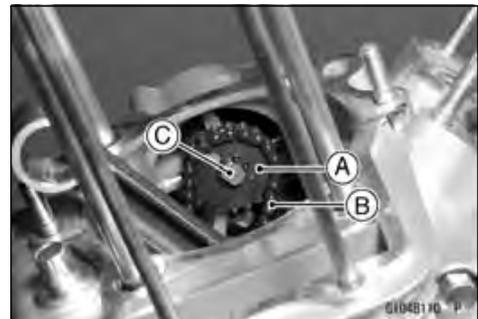
- Remove the following with the cylinder head removed.
  - Lower Chain Guide Bolts [A]
  - Lower Chain Guide [B]
  - Rear Camshaft Chain [C]
  - Rear Chain Guide Bolts [D]
  - Rear Chain Guide [E]



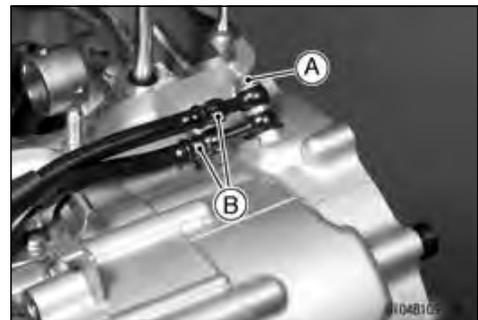
- Remove the starter motor bolts [A] and the motor [B] from the crankcase.
- Pull the breather tube [C] out of the crankcase.



- Pull the water pump sprocket [A] with its chain [B] and shaft [C].



- Remove the oil banjo bolt [A] with the hoses [B].



## 9-12 CRANKSHAFT/TRANSMISSION

### Crankcase

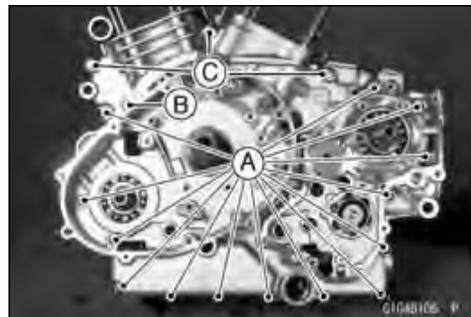
- Remove the oil filter [A] with the oil filter wrench [B].  
Special Tool - Oil Filter Wrench: 57001-1249
- Remove the oil pressure switch [C].



- Remove the right crankcase bolts.  
φ8 mm Bolts (5) [A]  
○Be sure to remove this bolt [B]



- Remove all the left crankcase bolts in the order listed.  
φ6 mm Bolts (14) [A]  
φ8 mm Bolt (1) [B]  
φ10 mm Bolts (3) [C]

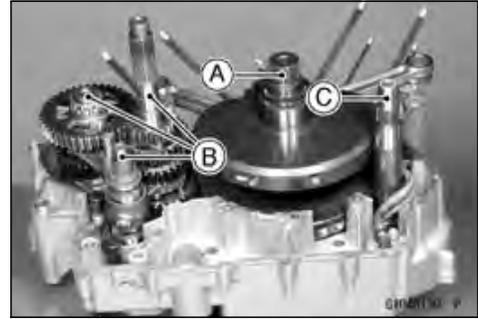


- Turn the left crankcase down.
- Lift up the right crankcase.
- Using the pry points, split the crankcase halves.  
Pry Point (Front) [A]  
Pry Point (Rear) [B]



**Crankcase**

- Remove the following from the left crankcase.
  - Crankshaft [A]
  - Transmission Gear Assy [B] (see Transmission Removal)
  - Balancer Shaft [C]

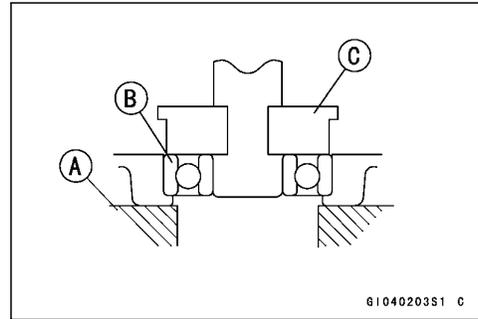


**CAUTION**

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

*Crankcase Assembly*

- With a high-flash point solvent, clean off the mating surfaces of the crankcase halves and wipe dry.
- Using compressed air, blow out the oil passages in the crankcase halves.
- Support the crankcase bearing boss with a suitable retainer [A].
- Using a press and the bearing driver set [C], install a new bearing [B] or/and race by pushing the bearing outer race until it bottoms out.



**CAUTION**

**Support the crankcase bearing boss when pushing the bearing, otherwise the crankcase could be damaged.**

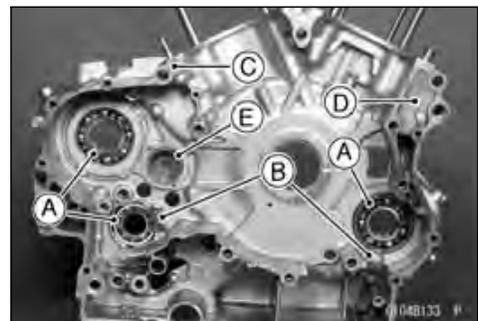
- Press the three needle bearings with manufacturer's marks facing out into holes on the right side of the right crankcase. Push the needle bearing outer race until the face of the bearing is even with the end of the hole, using a driver.

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

- Apply a non-permanent locking agent to the retainer bolts and the oil baffle bolts.
- Install the bearing retainers.

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

- Bearings [A]
- Bearing Retainers [B]
- Left Crankcase [C]
- Oil Baffle [D]
- Race [E]



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

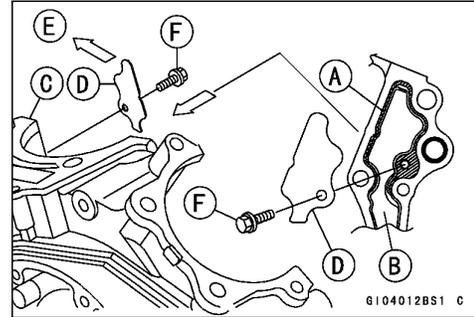
## 9-14 CRANKSHAFT/TRANSMISSION

### Crankcase

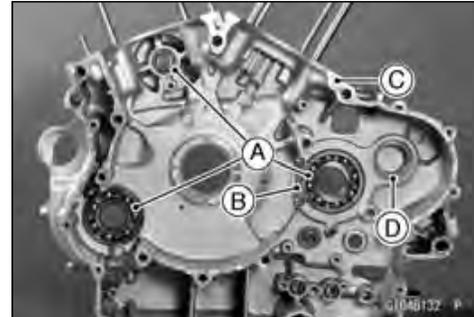
- Apply silicone sealant [A] to the step of the oil separating chamber [B] in the left crankcase [C].
- Install the oil baffle [D] on the chamber.  
Front [E]

**Torque - Oil Baffle Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)**

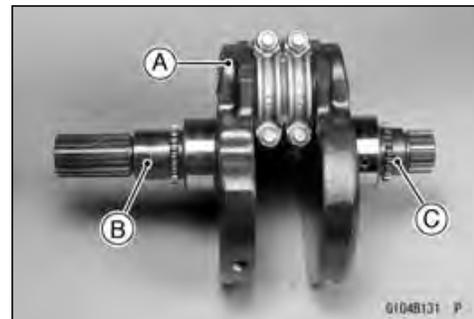
**Sealant - Silicone Sealant: 56019-120**



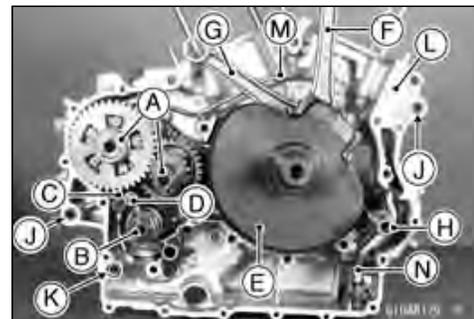
- Install:
    - Bearings [A]
    - Bearing Retainer [B]
    - Right Crankcase [C]
    - Race [D]
- Torque - Bearing Retainer Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**



- Apply engine oil to the transmission gears, ball bearings, shift drum, and crankshaft main bearing.
- Install:
  - Oil Pipe and Oil Return Pipes (see Engine Lubrication System chapter)
- The left shaft [B] of the crankshaft [A] is longer than the right shaft [C].

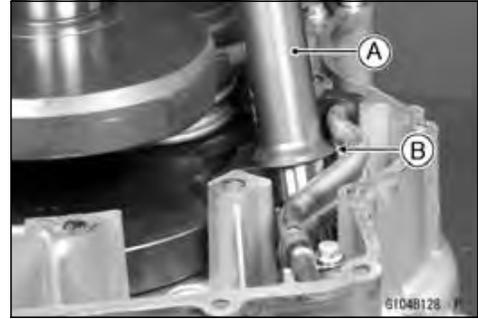


- Check to see that the following parts are in place in the left crankcase.
  - Transmission Assy [A] and Shift Drum [B]
  - Shift Fork [C] and Shift Rod [D]
  - Crankshaft [E]
  - Front Connecting Rod [F] (right)
  - Rear Connecting Rod [G] (left)
  - Balancer Shaft [H]
  - Dowel Pins [J]
  - O-ring [K]
  - Oil Baffle [L]
  - Oil Pipe [M]
  - Oil Return Pipe [N]



**Crankcase**

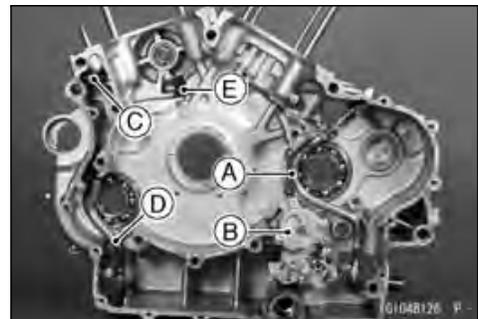
- Install the balancer shaft [A] so that the flanged side [B] faces downward (toward the left crankcase).



- Install the water pump chain guide [A].
  - Be sure to install the collar [B] in the bolt hole.
- Torque - Water Pump Chain Guide Bolt: 8.3 N·m (0.85 kgf·m, 73 in·lb)**

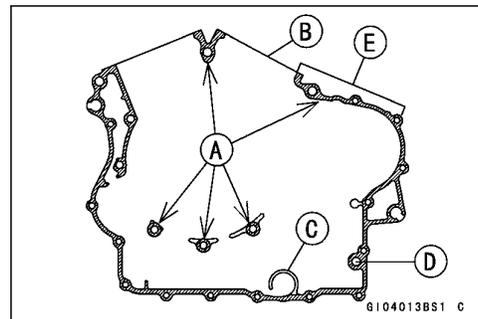


- Check to see that the following parts are in place in the right crankcase.
  - Oil Pipe [A]
  - Oil Pump [B]
  - Oil Separator [C]
  - Oil Return Pipe [D]
  - Water Pump Chain Guide [E]



- Apply liquid gasket [A] to the mating surface of the right crankcase [B].
- Sealant - Kawasaki Bond (Liquid Gasket-Black): 92104-1064**

- Do not apply liquid gasket to the area [C] around the hole of the oil screen.
- Do not drop liquid gasket into the oil passage [D].
- After tightening the crankcase bolts, wipe up the liquid gasket seeping out around the mating surface, especially around the area [E].



**NOTE**

- Make the application finish within 30 minutes when the liquid gasket to the mating surface of the right crankcase half is applied.
- Moreover fit the case and tighten the case bolts just after finishing the application of the liquid gasket.

## 9-16 CRANKSHAFT/TRANSMISSION

### Crankcase

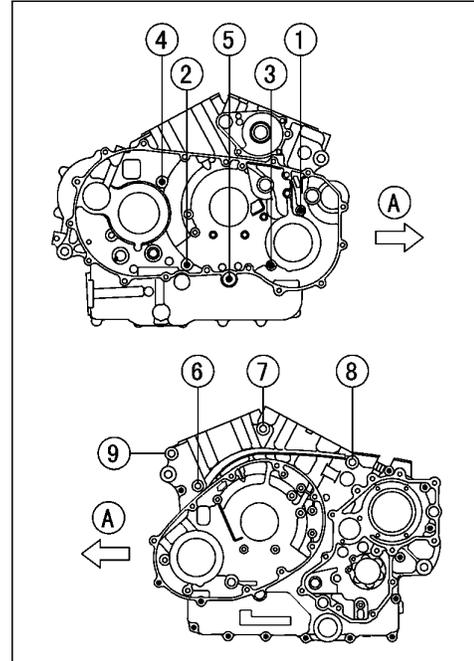
- Tighten the crankcase bolts as follows.
- Lightly tighten all the bolts to a snug fit.
- Tighten the **8 mm** and **10 mm** bolts in the order shown, and then tighten the **6 mm** bolts to the specified torque.

**Torque - 8 mm Crankcase Bolts (1 ~ 6): 21 N·m (2.1 kgf·m, 15 ft·lb)**

**10 mm Crankcase Bolts (7 ~ 9): 39 N·m (4.0 kgf·m, 29 ft·lb)**

**6 mm Crankcase Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

Front [A]



- After tightening all the crankcase bolts, check the following items.
- Wipe up the liquid gasket that seeps out around the crankcase mating surface.
- Turn the right crankcase down, and check that the drive shaft and output shaft turn freely.

- Check that the positive neutral finder operates properly: While spinning [C] the output shaft [A] using an air impact wrench, gears shift smoothly from the 1st, 2nd . . . 5th gear, and 5th, 4th . . . 1st. When the output shaft stays still, the gear can be shifted to only the 1st gear or neutral. It should not be shifted to the 2nd gear or other higher gear positions.

Shift Drum [B]

- Apply a non-permanent locking agent to the shift shaft return spring pin [D], and tighten it.

**Torque - Shift Shaft Return Spring Pin: 39 N·m (4.0 kgf·m, 29 ft·lb)**

- Set the gear set lever to the neutral position.

Shift Drum Cam [A]

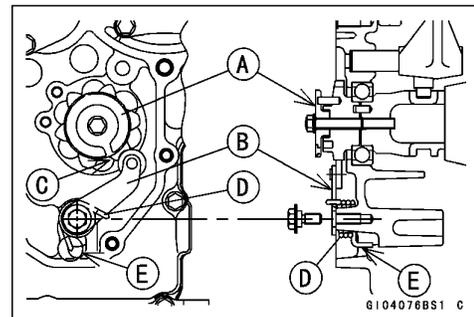
Gear Set Lever [B]

Neutral Position [C]

Spring [D]

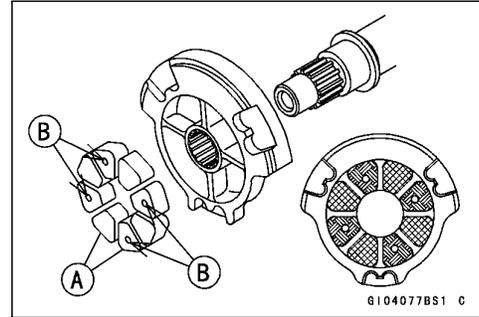
- Set the spring end to the crankcase as shown [E].

**Torque - Gear Set Lever Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)**

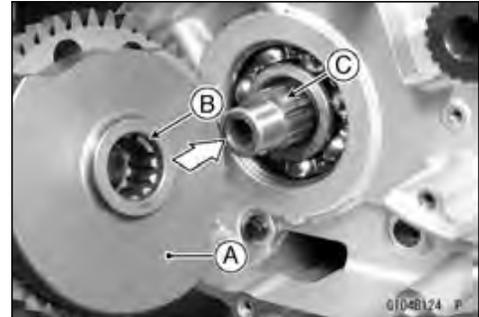


## Crankcase

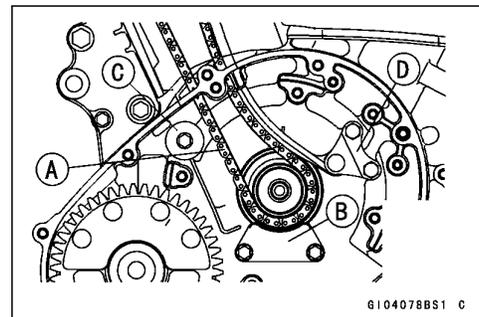
- Install the balancer dampers [A] so that each damper hole [B] is positioned alternately.



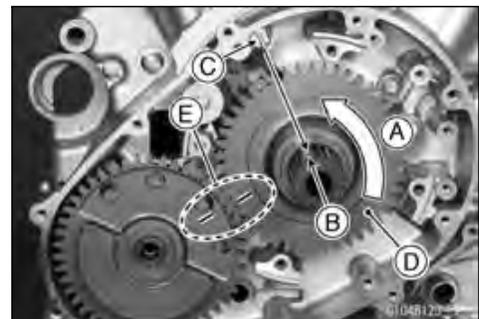
- Install the left balancer [A] on the balancer shaft in the engine left side while fitting the alignment tooth [B] onto the alignment notch [C] of the splines.



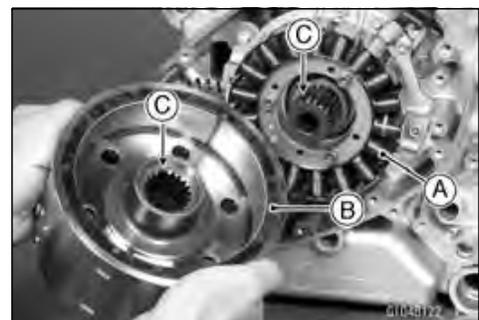
- Install the camshaft chain [A], lower chain guide [B], retainer [C] and rear chain guide [D] in the engine left side.



- Turn the crankshaft counterclockwise [A] and align the alignment tooth [B] with the middle of the crankcase rib [C]. This makes the front piston set to its top dead center.
- Install the crankshaft balancer gear [D] while fitting the alignment notch of the splines onto the alignment tooth.
- Aligning the balancer gear marks (line mark) [E] with the front piston on its top dead center.



- Install:
  - Inside Stator Coil [A] (see Electrical System chapter)
  - Alternator Rotor [B]
- Install the alternator rotor while fitting the alignment notch [C] of the splines onto the alignment tooth [D].



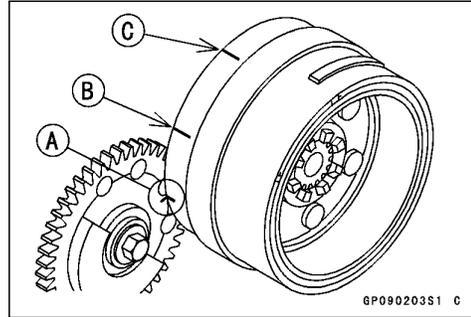
## 9-18 CRANKSHAFT/TRANSMISSION

### Crankcase

- Be sure to align the balancer gear mark with the alternator mark (shorter line mark) [A] while keeping the front piston on its top dead center.

Top Mark for Rear Piston [B] (longer mark)

Top Mark for Front Piston [C] (longer mark)



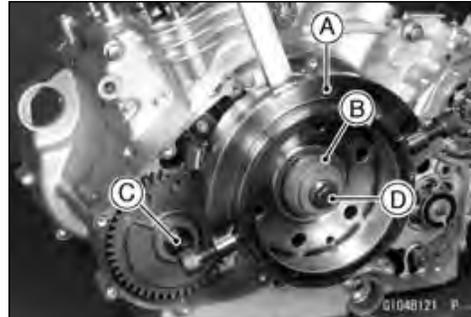
- Apply molybdenum disulfide oil to the threads and the seating surface of the left balancer gear bolt, and alternator rotor bolt.
- Holding the alternator rotor steady with the flywheel holder [A].

**Special Tool - Flywheel Holder: 57001-1410**

- Install the ratchet [B].
- Tighten:

**Torque - Left Balancer Gear Bolt [C]: 85 N·m (8.7 kgf·m, 63 ft·lb)**

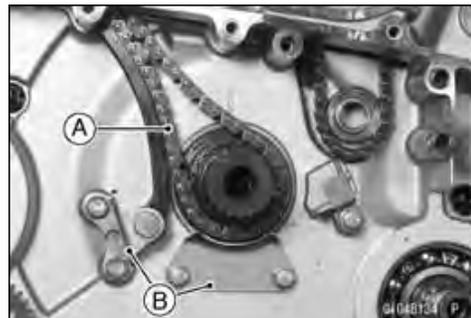
**Alternator Rotor Bolt [D]: 78 N·m (8.0 kgf·m, 58 ft·lb)**



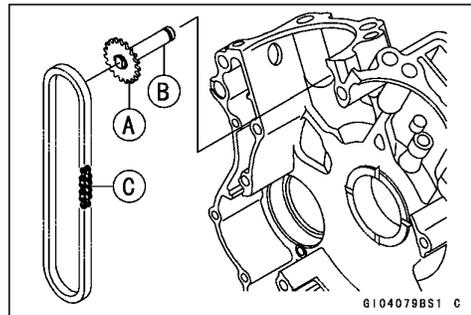
- Install:
  - Camshaft Chain [A]
  - Chain Guide [B]

**Torque - Camshaft Chain Guide Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

**Camshaft Chain Guide Retainer Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)**

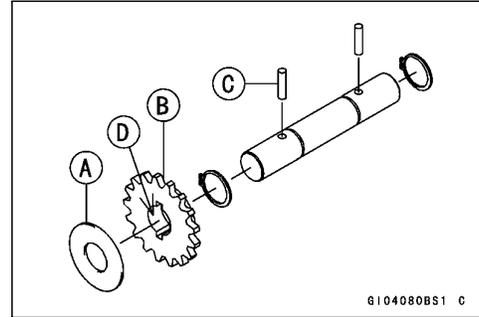


- Install:
  - Water Pump Sprocket [A] with Shaft [B]
  - Chain [C]

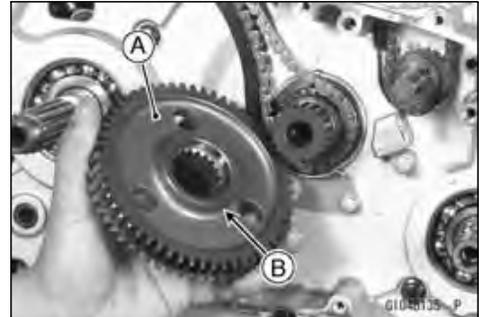


## Crankcase

- Install:
  - Washer [A]
  - Idle Shaft Sprocket [B]
- Fit the pin [C] into the slots [D] of the idle shaft sprocket.



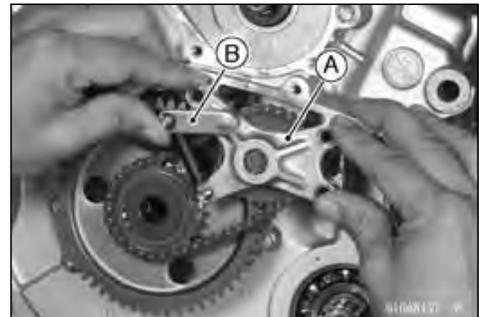
- Install the primary gear [A] with the boss [B] facing toward the engine inside.



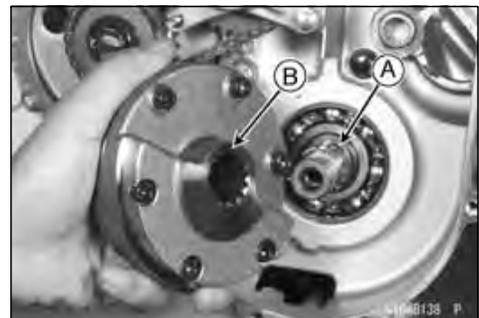
- Install:
  - Pin [A]
  - Idle Shaft Sprocket [B]
  - Water Pump Drive Sprocket [C] and Chain [D]
  - Dowel Pins [E]
- Stuff the cloth on the holes of the crankcase so that the pin does not drop into the crankcase bottom.



- Install:
  - Idle Shaft Holder [A] and Water Pump Chain Guide [B] as shown.
- Torque - Idle Shaft Holder Bolts: 8.3 N·m (0.85 kgf·m, 73 in·lb)**



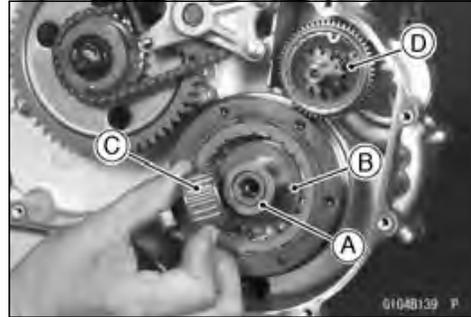
- Fit the alignment tooth [A] of the splines of the right balancer [B] onto the alignment notch of the balancer shaft.



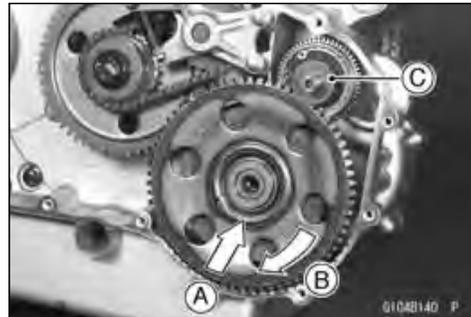
## 9-20 CRANKSHAFT/TRANSMISSION

### Crankcase

- Install the collar [A], copper washer [B], and needle bearing [C] in the order listed.
- The copper washer must be on the collar.
- Install the starter torque limiter [D].



- Push the starter clutch gear [A] in and turn it clockwise [B] and install it.
- Apply molybdenum disulfide oil to the threads and seating surface of the starter clutch bolt and tighten it to the specified torque while holding the primary gear bolt.
- The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).



**Torque - Starter Clutch Bolt: 85 N·m (8.7 kgf·m, 63 ft·lb)**

- Be sure to install the washer [C] onto the torque limiter.

- Install:
  - Clutch (see Clutch chapter)
  - Clutch Cover
  - Shift Mechanism (see this chapter)
  - Damper Cam and Front Gear Case (see Final Drive chapter)
  - Water Pump (see Cooling System chapter)
  - Engine Top End (see Engine Top End chapter)
  - Alternator Inner Cover, Alternator Cover, Alternator Outer Cover (see Electrical System chapter)
  - Engine (see Engine Removal/Installation chapter)

#### Starter Clutch Disassembly

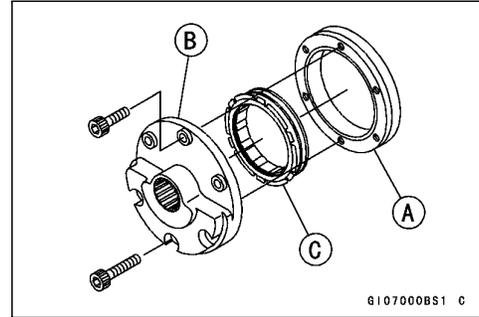
- Remove the starter clutch assy (see Crankcase Disassembly).
- Remove the Allen bolts [A] with the balancer mass [B] held with the flywheel holder [C].

**Special Tool - Flywheel Holder: 57001-1313**



**Crankcase**

- Pull the coupling [A] out of the right balancer [B].
- Take the one-way clutch [C] out of the coupling.

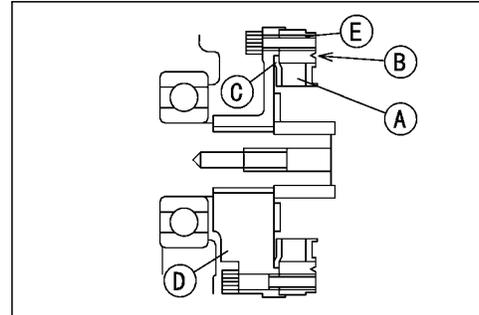


**Starter Clutch Assembly**

- Install the one way clutch [A] so that its groove [B] faces outward and its flange [C] fits between the right balancer [D] and the coupling [E].
- Apply a non-permanent locking agent to the threads of the coupling bolts, and tighten them to the specified torque.

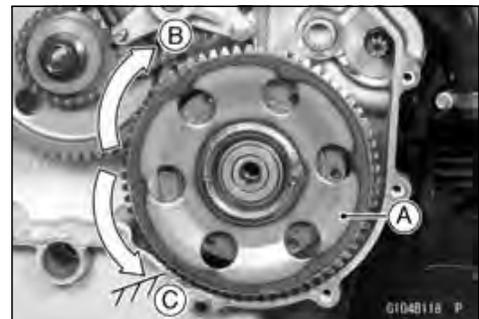
**Torque - Starter Clutch Coupling Bolts: 15 N·m (1.5 kgf·m, 11 ft·lb)**

**Special Tool - Flywheel Holder: 57001-1313**

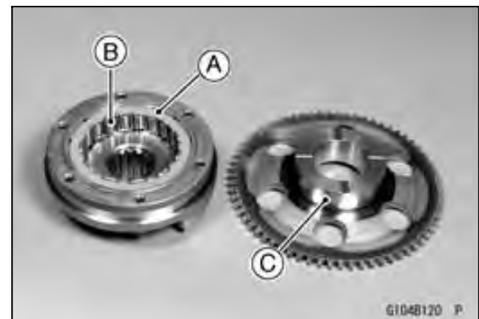


**Starter Clutch Inspection**

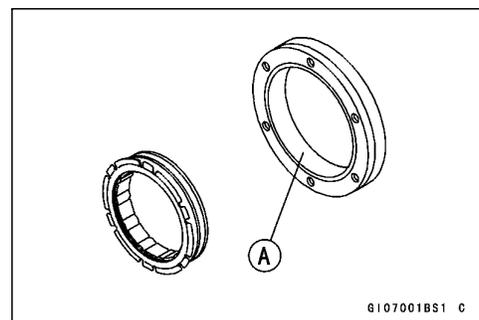
- Remove the starter clutch gear [A] and torque limiter, then reinstall the starter clutch gear into the starter clutch.
- Turn the starter clutch to both side.
- When viewed from the right side of the engine, the clutch should turn clockwise [B] freely, but should not turn counterclockwise [C].



- ★ If the starter clutch does not operate as it should or if it makes noise, disassemble the starter clutch.
- ★ If one-way clutch [A] installation is wrong, reinstall it.
- ★ Visually inspect the one-way clutch, coupling and starter clutch gear for damage.
- ★ If there is any worn or damaged surface in the following parts, replace it.
  - Sliding Surface [B] and Cage of One-way Clutch
  - Sliding Surface [C] of Starter Clutch Gear



Sliding Surface [A] of Coupling



## 9-22 CRANKSHAFT/TRANSMISSION

### Crankcase

#### *Starter Torque Limiter Check*

● Remove the torque limiter (see Crankcase Disassembly) and visually inspect it.

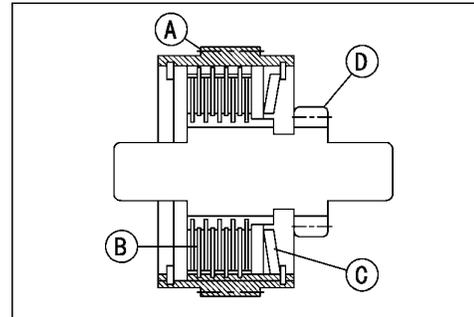
★ If the limiter has wear, discoloration, or other damage, replace it as a set.

Gear [A]

Friction Plates [B]

Spring [C]

Pinion [D]



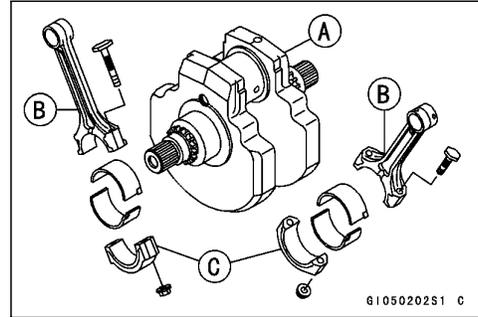
**Crankshaft/Connecting Rods**

*Connecting Rod Removal*

- Remove the crankshaft.
- Remove the connecting rod big end nuts, and take off the rod and cap along with the bearing inserts from the crankshaft [A].

**NOTE**

- Mark and record the locations of the connecting rods [B] and their big end caps [C] with the bearing inserts left attached so that they can be installed in their original positions.



**CAUTION**

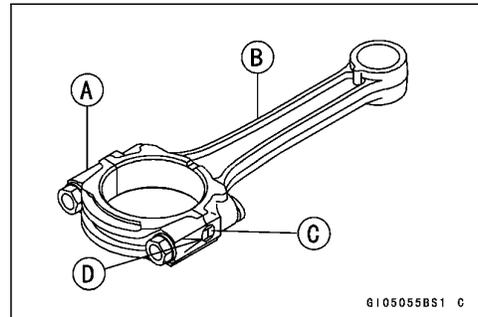
To prevent damage to the crankpin surfaces, do not allow the connecting rod bolts to bump against the crankpins.

*Connecting Rod Installation*

**CAUTION**

To minimize vibration, the connecting rods should have the same weight mark.

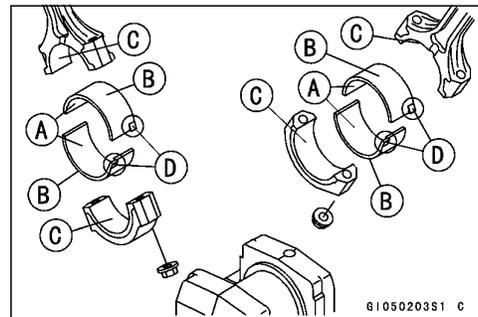
- Big End Cap [A]
- Connecting Rod [B]
- Weight Mark, Alphabet [C]
- Diameter Mark (Around Weight Mark) [D]: "○" or no mark



**CAUTION**

If the connecting rods, bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

- Apply molybdenum disulfide oil to the inside [A] of the big end bearing inserts.
- The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).
- ★ If bearing inserts are replaced, install them as follows.
  - Do not apply molybdenum disulfide oil to the outside [B] of the inserts or the inside [C] of the connecting rod and cap.
  - Install the inserts so that their nails [D] are on the same side and fit into the recess of the connecting rod and cap.



## 9-24 CRANKSHAFT/TRANSMISSION

### Crankshaft/Connecting Rods

○When installing the inserts [A], be careful not to damage the insert surface with the edge of the connecting rod [B] or the cap [C]. One way to install inserts is as follows:

- Installation [D] to Cap
- Installation [E] to Connecting Rod
- Push [F]
- Dowel Pin [G]
- Connecting Rod Bolts [H]

- Install the cap on the connecting rod, aligning the weight and diameter marks.
- Remove debris and clean the surface of inserts.
- Apply molybdenum disulfide oil [MO] to the threads, seating surfaces of the big end nuts and threads of con-rod bolts.
- Tighten the big end nuts to the specified torque.

**Torque - Connecting Rod Big End Nuts: 59 N·m (6.0 kgf·m, 43 ft·lb)**

#### Crankshaft/Connecting Rod Cleaning

- After removing the connecting rods from the crankshaft, clean them with a high-flash point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

#### Connecting Rod Bend

- Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end cap.
  - Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
  - Select an arbor of the same diameter as the piston pin and more than 105 mm long, and insert the arbor [B] through the connecting rod small end.
  - On a surface plate, set the big-end arbor on a V block [C].
  - 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 length to determine the amount of connecting rod bend.
- ★ If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

#### Connecting Rod Bend

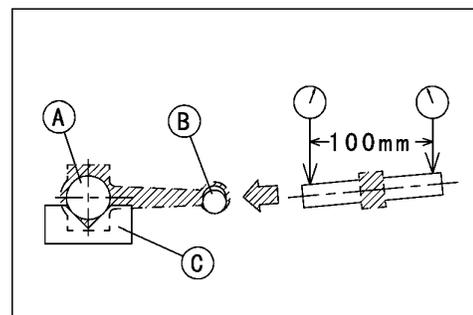
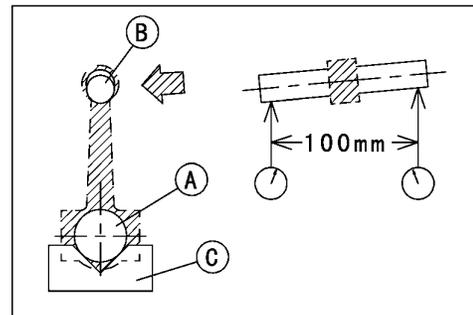
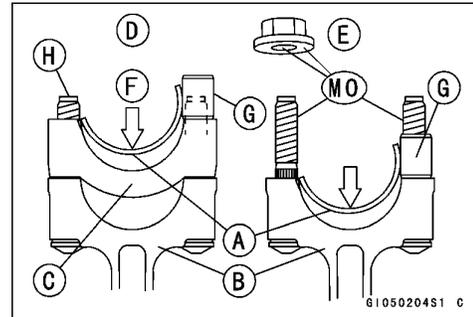
**Service Limit: TIR 0.2/100 mm (0.08/3.94 in)**

#### Connecting Rod Twist

- With the big-end arbor [A] still on the V block [C], hold the connecting rod horizontally and measure the amount that the arbor [B] varies from being parallel with the surface plate over a 100 mm 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

**Service Limit: TIR 0.2/100 mm (0.08/3.94 in)**



**Crankshaft/Connecting Rods**

*Connecting Rod Big End Side Clearance*

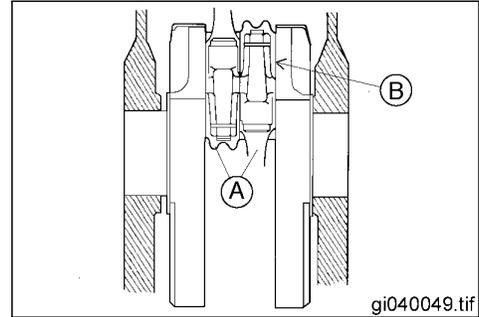
- Measure the side clearance [B] of the connecting rod big end [A].
- Insert a thickness gauge between the big end and either crank web to determine clearance.

**Connecting Rod Big End Side Clearance**

**Standard: 0.16 ~ 0.46 mm (0.0062 ~ 0.0181 in)**

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

- ★ If the clearance exceeds the service limit, replace the connecting rod with new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.



*Connecting Rod Big End Bearing Wear*

- Remove the big end cap and place a strip of plastigage on the crankpin [A].
- Tighten the big end nuts to the specified torque to compress the plastigage and measure the plastigage width [B] to determine the bearing insert/crankpin clearance (see Camshaft/Rocker Case Wear in the Engine Top End chapter).

**Molybdenum Disulfide Oil- Threads and Seating Surface of Big End Nuts**

**Torque - Connecting Rod Big End Nuts: 59 N·m (6.0 kgf·m, 43 ft·lb)**

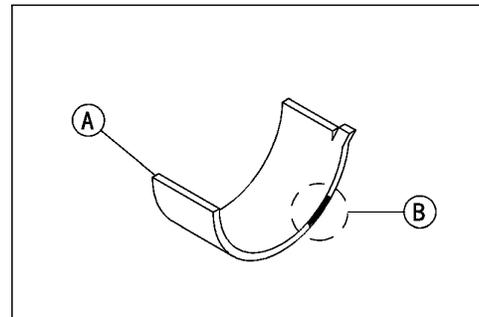
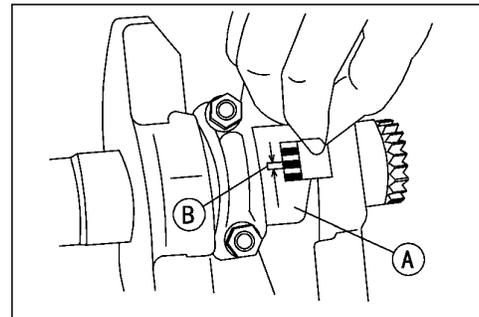
- Do not move the connecting rod and crankshaft during clearance measurement.

**Connecting Rod Big End Bearing/Crankpin Clearance**

**Standard: 0.026 ~ 0.057 mm (0.001024 ~ 0.0022 in)**

**Service Limit: 0.10 mm (0.0039 in)**

- ★ If the clearance is within the standard, no bearing insert replacement is required.
- ★ If the clearance is between 0.057 mm (0.0022 in) and the service limit (0.10 mm, or 0.0039 in), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/crankpin clearance with plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.



## 9-26 CRANKSHAFT/TRANSMISSION

### Crankshaft/Connecting Rods

- ★ If the clearance exceeds the service limit, measure the diameter of the crankpin [A].

#### Crankpin Diameter

**Standard:** 54.981 ~ 55.000 mm (2.1646 ~ 2.1654 in)

**Service Limit:** 54.97 mm (2.1642 in)

- ★ If the crankpin has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured crankpin diameter is not less than the service limit, but does not coincide with the original diameter marking on the crankshaft, make a new mark on it.

#### Crankpin Diameter Marks

**None:** 54.981 ~ 54.991 mm (2.1646 ~ 2.16500 in)

○: 54.992 ~ 55.000 mm (2.16504 ~ 2.1654 in)

Crankpin Diameter Mark: “○” mark or no mark [B]

- Temporarily, install the big end cap and tighten the big end nuts to the specified torque.

#### Molybdenum Disulfide Oil -

##### Threads and Seating Surface of Big End Nuts

**Torque - Connecting Rod Big End Nuts:** 59 N·m (6.0 kgf·m, 43 ft·lb)

- Measure the connecting rod big end inside diameter, and mark each connecting rod big end in accordance with the inside diameter.
- The mark already on the big end should almost coincide with the measurement because of little wear.

#### Connecting Rod Big End Inside Diameter Marks

**None:** 58.000 ~ 58.010 mm (2.2835 ~ 2.28386 in)

○: 58.011 ~ 58.020 mm (2.28390 ~ 2.2843 in)

Big End Cap [A]

Connecting Rod [B]

Weight Mark, Alphabet [C]

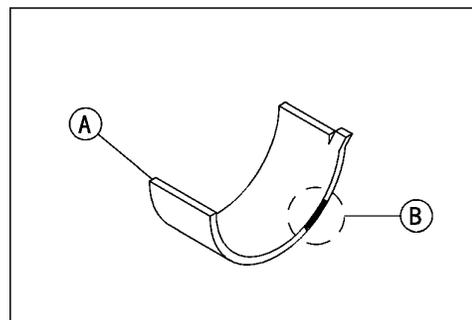
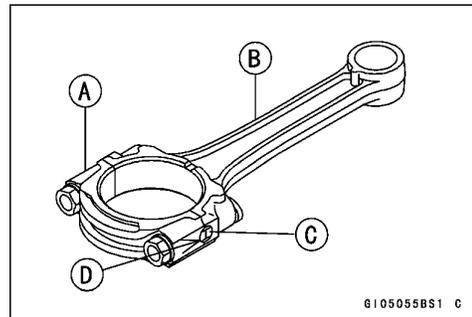
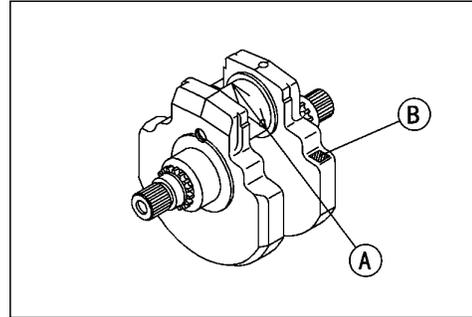
Diameter Mark (around weight mark) [D]: “○” or no mark

- Select the proper bearing insert [A] identified by the size color [B] in accordance with the combination of the connecting rod and crankshaft coding.

#### Big End Bearing Insert Selection

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Mark	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92028-1476
None	None	Black	92028-1475
○	○		
○	None	Blue	92028-1474

- Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.



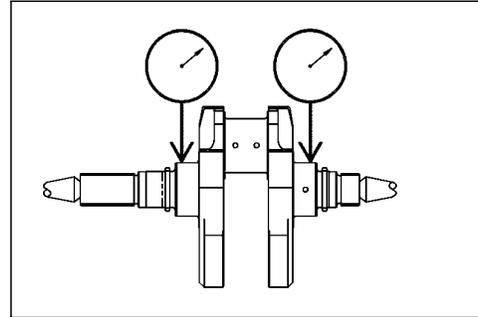
**Crankshaft/Connecting Rods**

*Crankshaft Runout*

- Measure the crankshaft runout.
- ★ If the measurement exceeds the service limit, replace the crankshaft.

**Crankshaft Runout**

**Standard:** TIR 0.02 mm (0.0008 in) or less  
**Service Limit:** TIR 0.05 mm (0.0020 in)



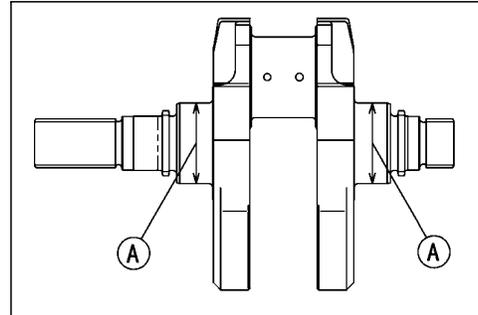
*Crankshaft Main Bearing/Journal Wear*

- Measure the diameter [A] of the crankshaft main journal.

**Crankshaft Main Journal Diameter**

**Standard:** 54.986 ~ 55.000 mm (2.1648 ~ 2.1654 in)  
**Service Limit:** 54.96 mm (2.1638 in)

- ★ If any journal has worn past the service limit, replace the crankshaft with a new one.

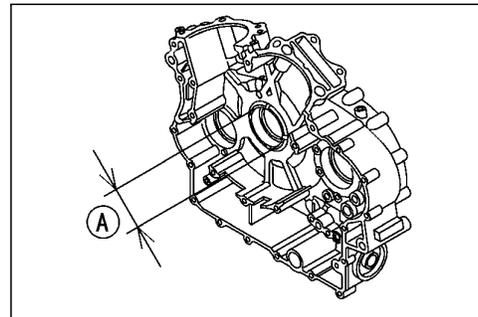


- Measure the main bearing bore diameter [A] in the crankcase halves.

**Crankcase Main Bearing Bore Diameter**

**Standard:** 55.025 ~ 55.038 mm (2.1663 ~ 2.1669 in)  
**Service Limit:** 55.07 mm (2.1681 in)

- ★ If there are any signs of seizure, damage, or excessive wear, replace the crankcase halves as a set.



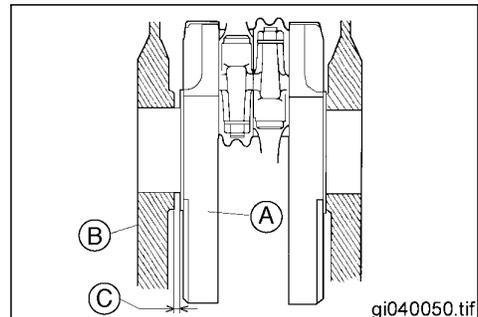
*Crankshaft Side Clearance*

- Measure the crankshaft side clearance.

**Crankshaft Side Clearance**

**Standard:** 0.05 ~ 0.55 mm (0.00197 ~ 0.0217 in)  
**Service Limit:** 0.75 mm (0.0295 in)

Crankshaft [A]  
 Crankcase [B]  
 Clearance [C]

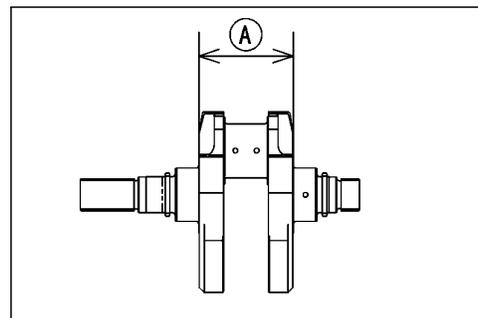


- ★ If the clearance is greater than the service limit, measure the crankshaft web length [A] to see whether the crankshaft or the crankcase is faulty.

**Crankshaft Web Length**

**Standard:** 96.85 ~ 96.95 mm (3.8130 ~ 3.8169 in)  
**Service Limit:** 96.6 mm (3.803 in)

- ★ If the length measurement is smaller than the service limit, replace the crankshaft. Otherwise, replace the crankcase halves as a set.



**CAUTION**

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

## 9-28 CRANKSHAFT/TRANSMISSION

### Primary Gear

#### Primary Gear Removal

- Remove:
  - Clutch Cover (see Clutch chapter)
  - Starter Clutch Gear (see this chapter)
- Using the gear holder [A] to loosen the primary gear bolt [B].

**Special Tool - Gear Holder: 57001-1557**

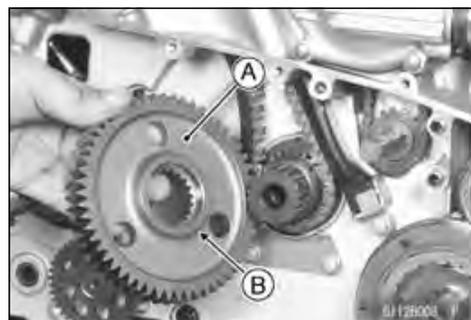
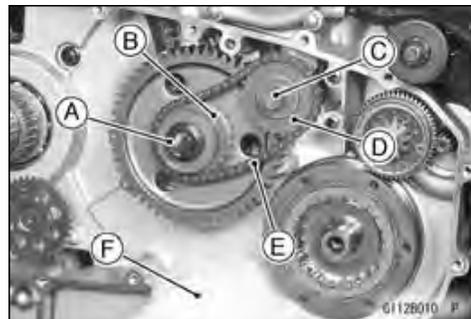
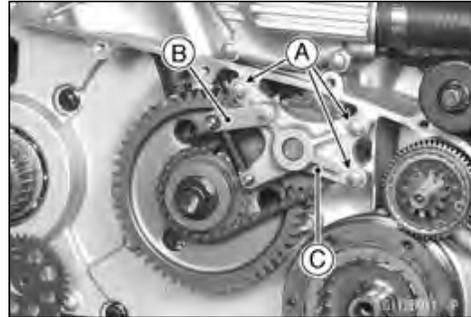
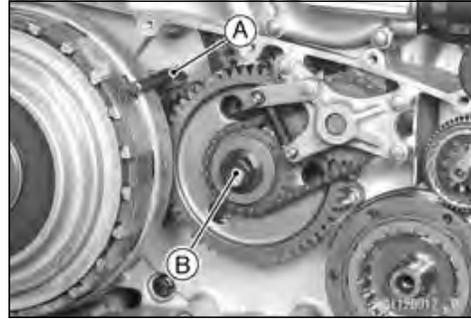
- Install:
  - Clutch (see Clutch chapter)
  - Bolts [A]
- Remove the water pump chain guide [B] and water pump idle shaft holder [C] from the right crankcase.

- Remove the primary gear bolt [A], water pump drive sprocket [B], idle shaft [C], and idle shaft sprocket [D].
  - Water Pump Chain [E]
- Stuff the cloth [F] on the holes of the crankcase so that the pin close not drop into the crankcase bottom.

- Pull the primary gear [A] out of the crankshaft, and take the pin [B] out of the idle shaft.

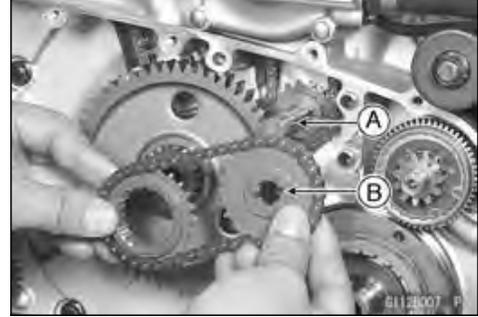
#### Primary Gear Installation

- Fit the primary gear [A] with the boss [B] facing toward the engine inside.

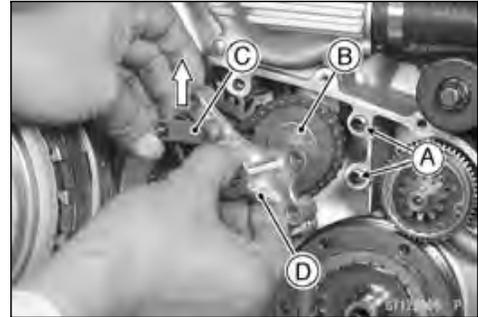


**Primary Gear**

- Fit the pin [A] into the slot [B] of the water pump drive sprocket boss and install the sprockets.



- Install:  
 Dowel Pins [A]  
 Washer [B]
- Pulling the chain guide [C] and install the idle shaft holder [D].
- Install the clutch (see Clutch chapter).

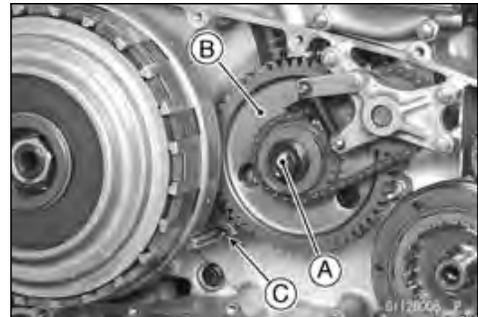


**Torque - Idle Shaft Holder Bolts: 8.3 N·m (0.85 kgf·m, 73 in·lb)**

- Apply molybdenum disulfide oil to the threads and seating surface, and tighten the primary gear bolt [A], while holding the primary gear [B] with the gear holder [C].

**Special Tool - Gear Holder: 57001-1557**

**Torque - Primary Gear Bolt: 147 N·m (15.0 kgf·m, 108 ft·lb)**

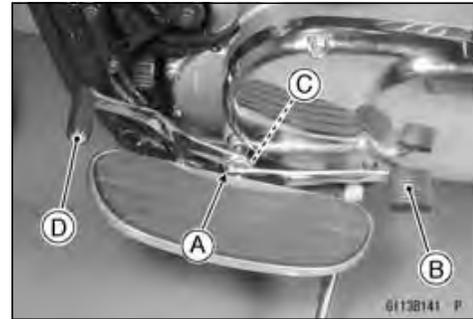


## 9-30 CRANKSHAFT/TRANSMISSION

### Transmission

#### Shift Pedal Removal

- Unscrew the rear shift pedal clamp bolt [A] and take off the rear shift pedal [B].
- Unscrew the front shift pedal clamp bolt [C] and pull out the front shift pedal [D].



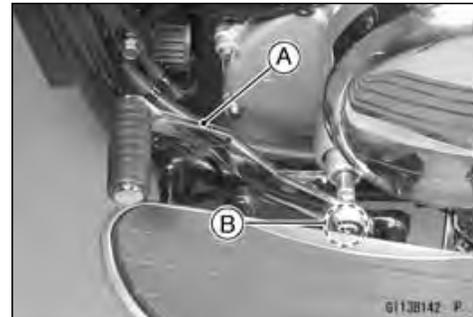
#### Shift Pedal Installation

- For the front shift pedal, install the shift pedal [A] so that the punched mark on the pedal is up the 1 serration [B] from the punched mark on the shaft.
- Tighten the clamp bolt.

##### Torque - Shift Pedal Clamp Bolt:

25 N·m (2.5 kgf·m, 18 ft·lb)

30 N·m (3.1 kgf·m, 22 ft·lb) VN1600-A2 ~

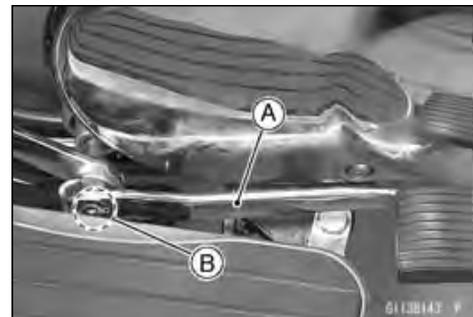


- For the rear shift pedal, install the shift pedal [A] so that the punched mark on the shaft is aligned [B] with the punched mark on the pedal.
- Tighten the clamp bolt.

##### Torque - Shift Pedal Clamp Bolt:

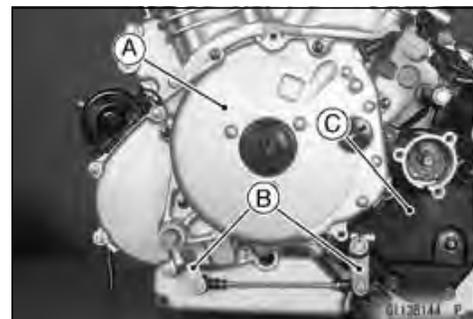
25 N·m (2.5 kgf·m, 18 ft·lb)

30 N·m (3.1 kgf·m, 22 ft·lb) VN1600-A2 ~

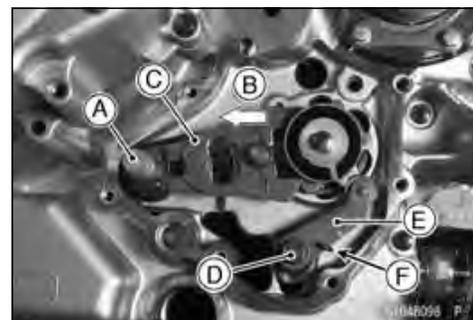


#### External Shift Mechanism Removal

- Remove:
  - Shift Pedals (see this chapter)
  - Alternator Outer Cover [A] (see Electrical System chapter)
  - Engine (see Engine Removal/Installation chapter)
  - Front and Rear Shift Levers [B]
  - Front Gear Case [C] (see Final Drive chapter)



- Remove the shift shaft [A] while pushing [B] the shift mechanism arm [C] towards the shift shaft.
- Unscrew the bolt [D] and remove the gear set lever [E] and its spring [F].



**Transmission**

*External Shift Mechanism Installation*

- Install the gear set lever [A] and the spring [B] in the crankcase and tighten the bolt [C].

**Torque - Gear Set Lever Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)**

- Install the shift mechanism arm assy. Be sure to install the washer [D] onto the shift shaft.
- Install the front gear case (see Final Drive chapter).
- Install the front shift lever and the rear shift lever.

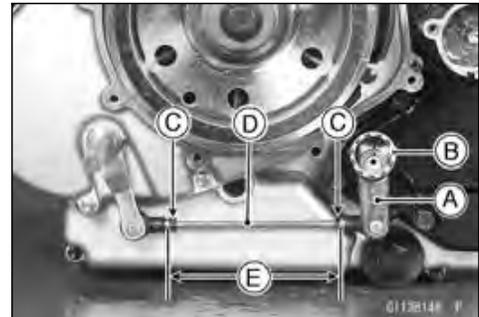


- Install the rear shift lever [A] on the shift shaft so that the punched mark on the shaft is aligned [B] with the slot of the rear shift lever.

- Loosen the locknuts [C] and turn the shift rod [D] so that the outside length [E] of the locknuts is **112 ± 1 mm (4.4 ± 0.04 in.)**.

- The rear locknut has left-hand threads.

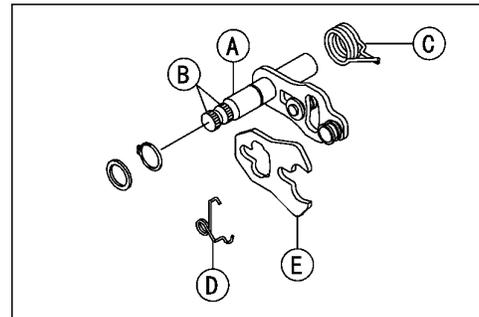
**Torque - Shift Rod Locknuts: 11 N·m (1.1 kgf·m, 95 in·lb)**  
**Rear Shift Lever Clamp Bolt: 12 N·m (1.2 kgf·m, 104 in·lb)**



- Install:  
 Engine (see Engine Removal/Installation)  
 Shift Pedal (see this chapter)

*External Shift Mechanism Inspection*

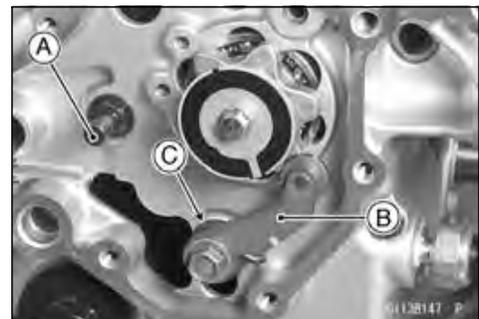
- Examine the shift shaft [A] for any damage.
- ★ If the shaft is bent, straighten or replace it.
- ★ If the serrations [B] are damaged, replace the shaft.
- ★ If the springs [C] [D] are damaged in any way, replace them.
- ★ If the shift mechanism arm [E] is damaged in any way, replace the arm.



- Check the return spring pin [A] is not loose.
- ★ If it is loose, unscrew it, apply a non-permanent locking agent to the threads, and tighten it.

**Torque - Shift Shaft Return Spring Pin: 39 N·m (4.0 kgf·m, 29 ft·lb)**

- Check the gear set lever [B], and its spring [C] for breaks or distortion.
- ★ If the lever or spring is damaged in any way, replace it.
- Visually inspect the shift drum pins, pin holder, and pin plate.
- ★ If they are badly worn or if they show any damage, replace them.

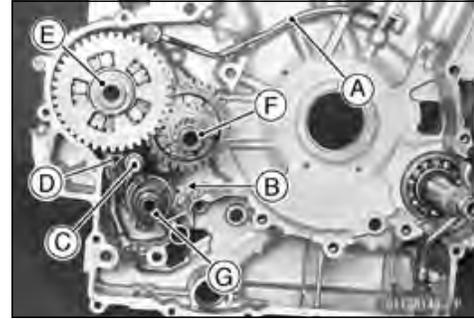


## 9-32 CRANKSHAFT/TRANSMISSION

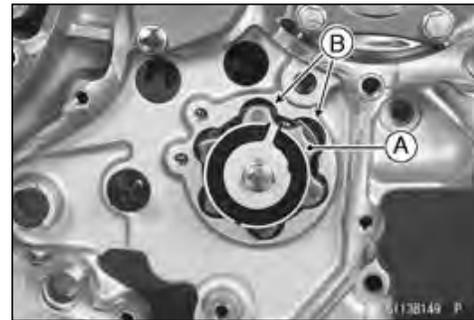
### Transmission

#### Transmission Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Split the crankcase (see this chapter).
- Remove the crankshaft.
- First, remove the oil pipe [A] (see Engine Lubrication System chapter), and then remove the shift drum bearing holder bolts and holder [B].
- Pull out the shift rod [C] and take the shift fork [D] out of the output shaft 4th gear.  
Output Shaft [E]  
Drive Shaft [F]  
Shift Drum [G]
- Align the shift drum cam [A] with the cutoff [B] of the left crankcase by turning the shift drum.

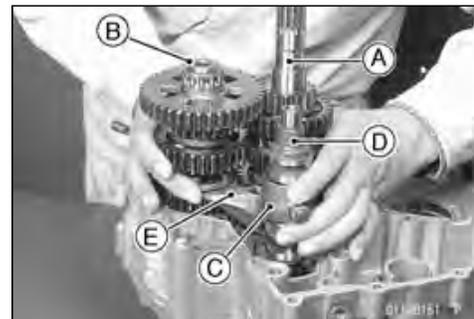
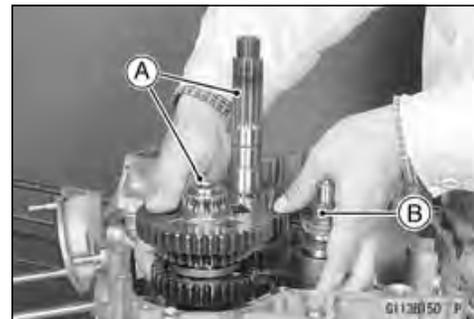


- Take out the transmission shafts [A] and shift drum [B] as a set.
- Separate the drive and output shafts, shift drum, and shift forks.



#### Transmission Installation

- Install the drive and output shaft assy, shift drum, and output shaft 5th gear shift fork as a set.  
Drive Shaft Assy [A]  
Output Shaft Assy [B]  
Shift Fork (drive shaft, 3rd gear) [C] and Shift Drum Assy [D]  
Shift Fork (No. 270, output shaft, 5th gear) [E]



**Transmission**

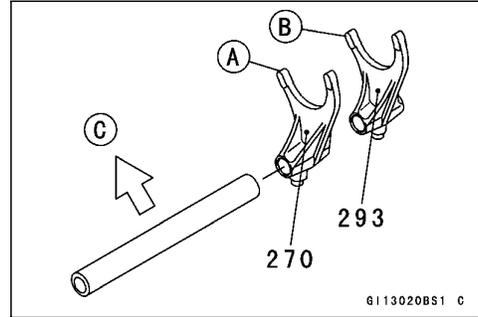
○ Each output shaft shift fork has an identification number. Do not confuse them.

● Install the shift forks with each number faced left as shown.

Shift Fork (No. 270, 5th gear) [A]

Shift Fork (No. 293, 4th gear) [B]

Front [C].



● Apply a non-permanent locking agent to the shift drum bearing holder bolts.

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

Install:

Shift Drum Bearing Holder [A]

Bolts [B]

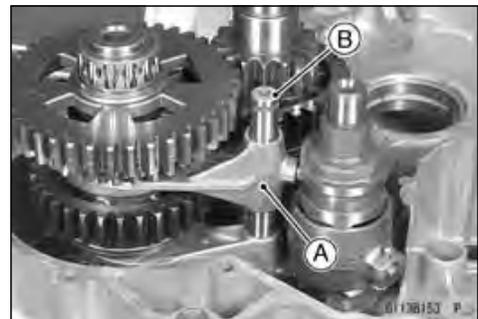
● Apply engine oil to the shift rod, the shift forks, and gears.



● Install:

Shift Fork (No. 293 output shaft, 4th gear) [A]

Shift Rod [B]



*Shift Drum Disassembly/Assembly*

● Remove the shift drum assy [A] (see this chapter).

● Remove:

Drive Shaft Shift Fork (No. 292, drive shaft) [B]

Cotter Pin [C]



● Disassemble the shift drum assy as shown.

Pin Plate [A]

Pin [B]

Cam [C]

Bearing [D]

Shift Drum [E]

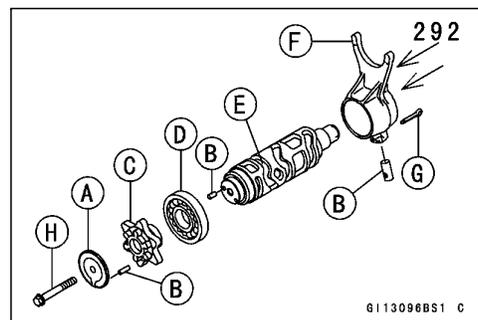
Drive Shaft Shift Fork (No. 292) [F]

Cotter Pin [G]

● Be sure to face the number to the right and insert the cotter pin of the drive shaft shift fork from the right as shown.

● Apply a non-permanent locking agent to the threads of the shift drum cam bolt [H].

**Torque - Shift Drum Cam Bolt: 15 N·m (1.5 kgf·m, 11 in·lb)**



## 9-34 CRANKSHAFT/TRANSMISSION

### Transmission

#### Transmission Disassembly

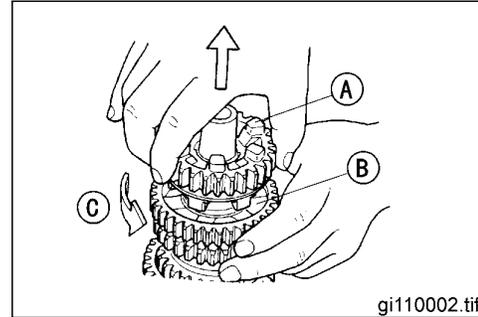
● Remove the transmission shafts (see this chapter).  
Using the circlip pliers (special tool), remove the circlips, and disassemble the transmission shaft.

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

The 4th gear [A] on the output shaft has three steel balls for the positive neutral finder mechanism.

Remove the 4th gear as follows.

- Set the output shaft in a vertical position holding the 3rd gear [B].
- Spin the 4th gear quickly [C] and pull it off upward.



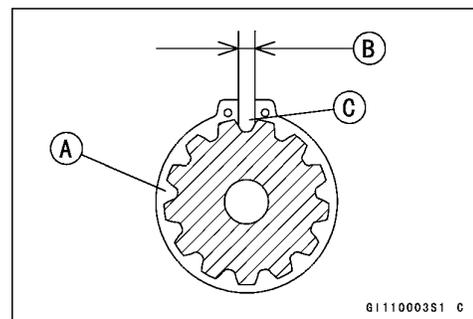
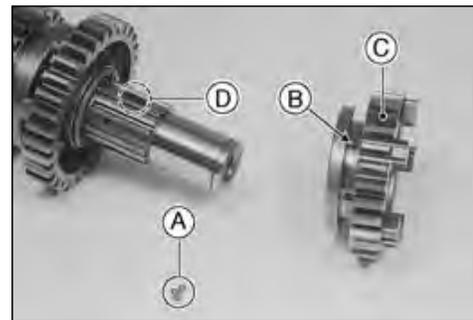
#### Transmission Assembly

- Refer to the illustration on P.29.
- Align each gear oil hole with the drive shaft oil hole when installing the 3rd gear [9] and the 5th gear [6].
- Align each oil hole with the output shaft oil hole, when installing the 3rd gear [17], bushing [18], and the 5th gear [16].

#### CAUTION

**Do not apply grease to the steel balls to hold them in place. This will cause the positive neutral finder mechanism to malfunction.**

- Fit the three steel balls [A] into the holes [B] of the output 4th gear [C], and then install the gear on the output shaft so that the steel balls align with the recesses [D] in the shaft.
- After assembling the 4th gear with steel balls in place on the output shaft, check the ball-locking effect that the 4th gear does not come out of the output shaft when moving it up and down by hand.
- Replace any circlip [A] that were removed with new ones.
- Install the circlips so that the opening [B] is aligned with a spline groove [C].

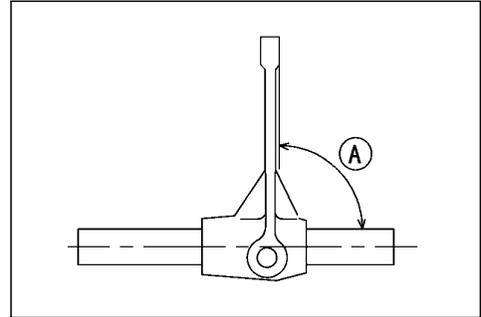


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**Transmission**

*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 under load.  
90° [A]



*Shift Fork/Gear Groove Wear*

- Measure the thickness of the shift fork ears [A], and measure the width [B] of the gear grooves.
- ★ If the thickness of a shift fork ear is less than the service limit, the shift fork must be replaced.

**Shift Fork Ear Thickness**

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

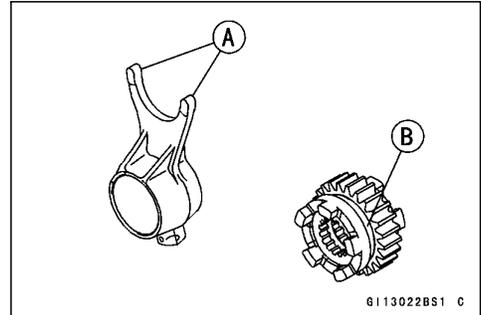
**Service Limit:** 5.8 mm (0.228 in)

- ★ If the gear groove is worn over the service limit, the gear must be replaced.

**Gear Groove Width**

**Standard:** 6.05 ~ 6.15 mm (0.238 ~ 0.242 in)

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



*Shift Fork Guide Pin/Drum Groove Wear*

- Measure the diameter of each shift fork guide pin [B], and measure the width [A] of each shift drum groove.
- ★ If the guide pin on any shift fork is less than the service limit, the fork must be replaced.

**Shift Fork Guide Pin Diameter**

**Standard:** 7.9 ~ 8.0 mm (0.311 ~ 0.315 in)

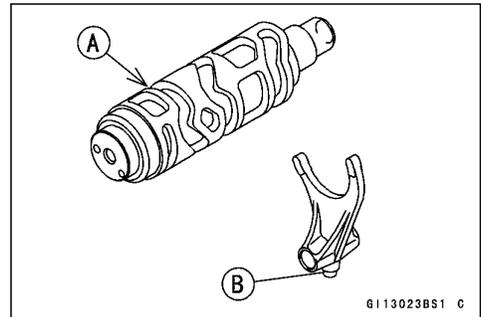
**Service Limit:** 7.8 mm (0.307 in)

- ★ If any shift drum groove is worn over the service limit, the drum must be replaced.

**Shift Drum Groove Width**

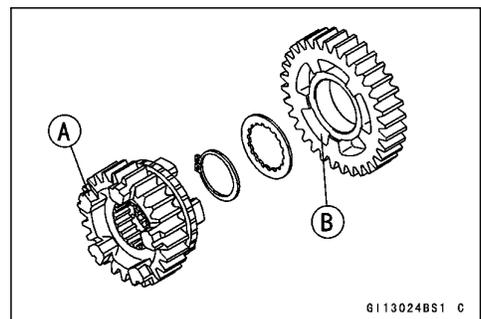
**Standard:** 8.05 ~ 8.20 mm (0.317 ~ 0.323 in)

**Service Limit:** 8.3 mm (0.327 in)



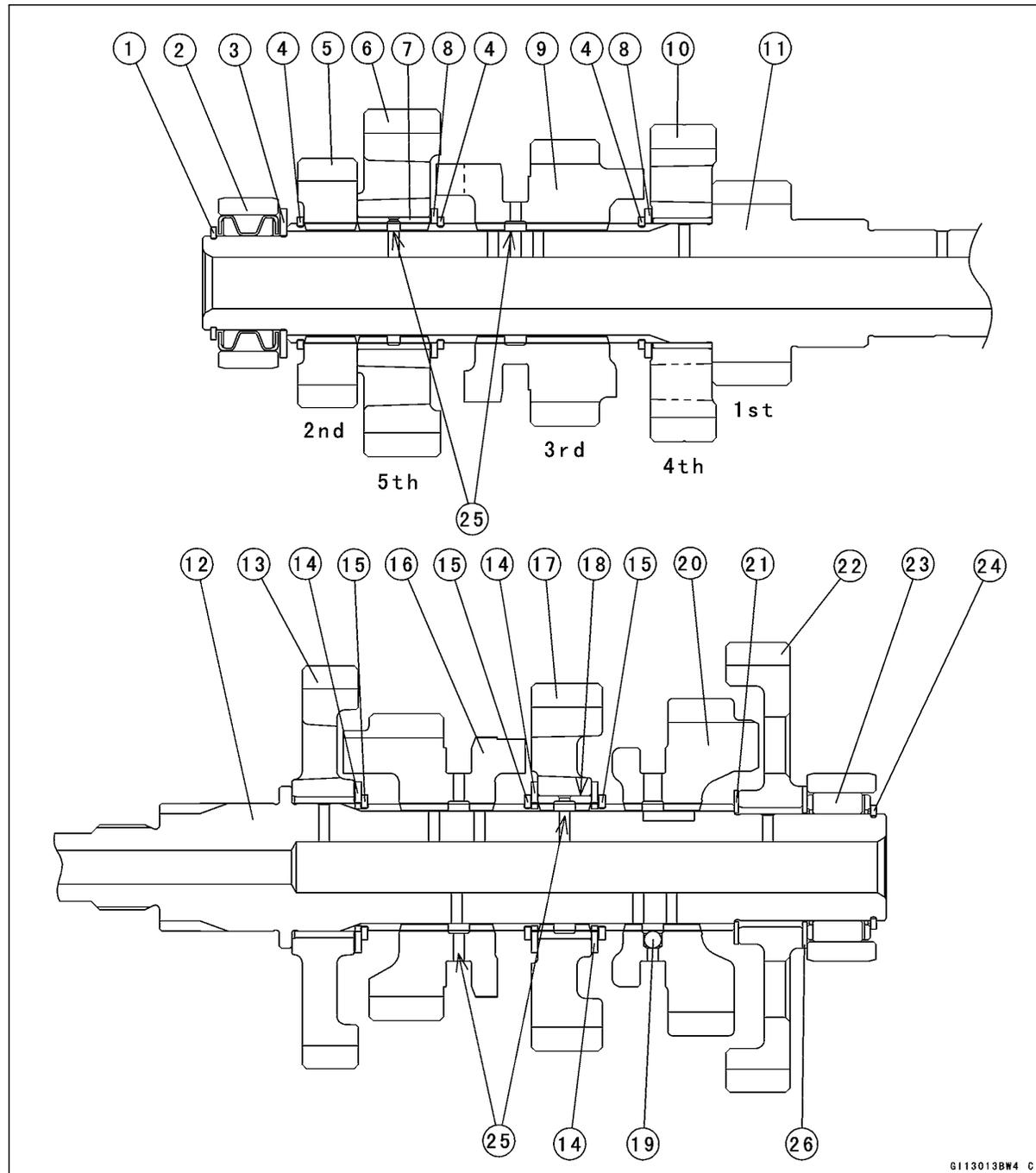
*Gear Dog and Gear Dog Hole Damage*

- Visually inspect the gear dogs [A] and gear dog holes [B].
- ★ Replace any damaged gears or gears with excessively worn dogs or dog holes.



# 9-36 CRANKSHAFT/TRANSMISSION

## Transmission



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- |   |  |   |
|---|--|---|
| 1. Circlip<br>( $\phi$ 20 x 25.5 x t 1.2)             | 10. 4th Gear   | 21. Washer<br>( $\phi$ 25.5 x 36 x t 1.0)                       |
| 2. Needle Bearing                                     | 11. 1st Gear (drive shaft)                               | 22. 1st Gear  |
| 3. Thrust Washer<br>( $\phi$ 22.3 x 35 x t 1.6)       | 12. Output Shaft   | 23. Needle Bearing  |
| 4. Three Circlips ( $\phi$ 28)                        | 13. 2nd Gear   | 24. Circlip ( $\phi$ 25)  |
| 5. 2nd Gear   | 14. Three Splined Washers<br>( $\phi$ 30.3 x 40 x t 1.5) | 25. Align gear or bushing<br>oil holes with the shaft<br>holes. |
| 6. 5th (top) Gear                                     | 15. Three Circlips ( $\phi$ 29)                          | 26. Washer<br>( $\phi$ 25.5 x 38 x t 1.0)                       |
| 7. Bushing (5th gear)                                 | 16. 5th (top) Gear                                       |   |
| 8. Two Splined Washers<br>( $\phi$ 28.5 x 34 x t 1.5) | 17. 3rd Gear   |   |
| 9. 3rd Gear   | 18. Bushing (3rd gear)                                   |   |
|   | 19. Steel Balls  |   |
|   | 20. 4th Gear   |   |

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

*Ball Bearing and Outer Race Replacement*

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

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

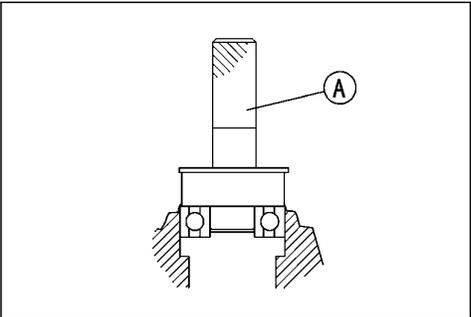
**NOTE**

○ *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 blowtorch. 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.

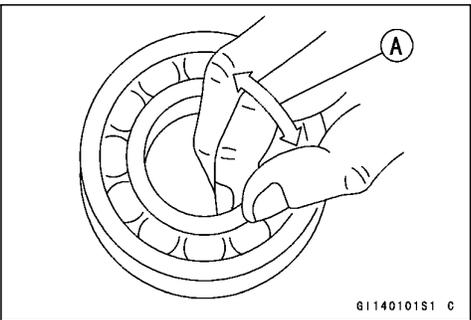
**Special Tool - Bearing Driver Set: 57001-1129**



*Ball and Needle Bearing Wear*

<b>CAUTION</b>
<b>Do not remove the ball 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.



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## 9-38 CRANKSHAFT/TRANSMISSION

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### Ball Bearing, Needle Bearing, and Oil Seal

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#### *Oil Seal Inspection*

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

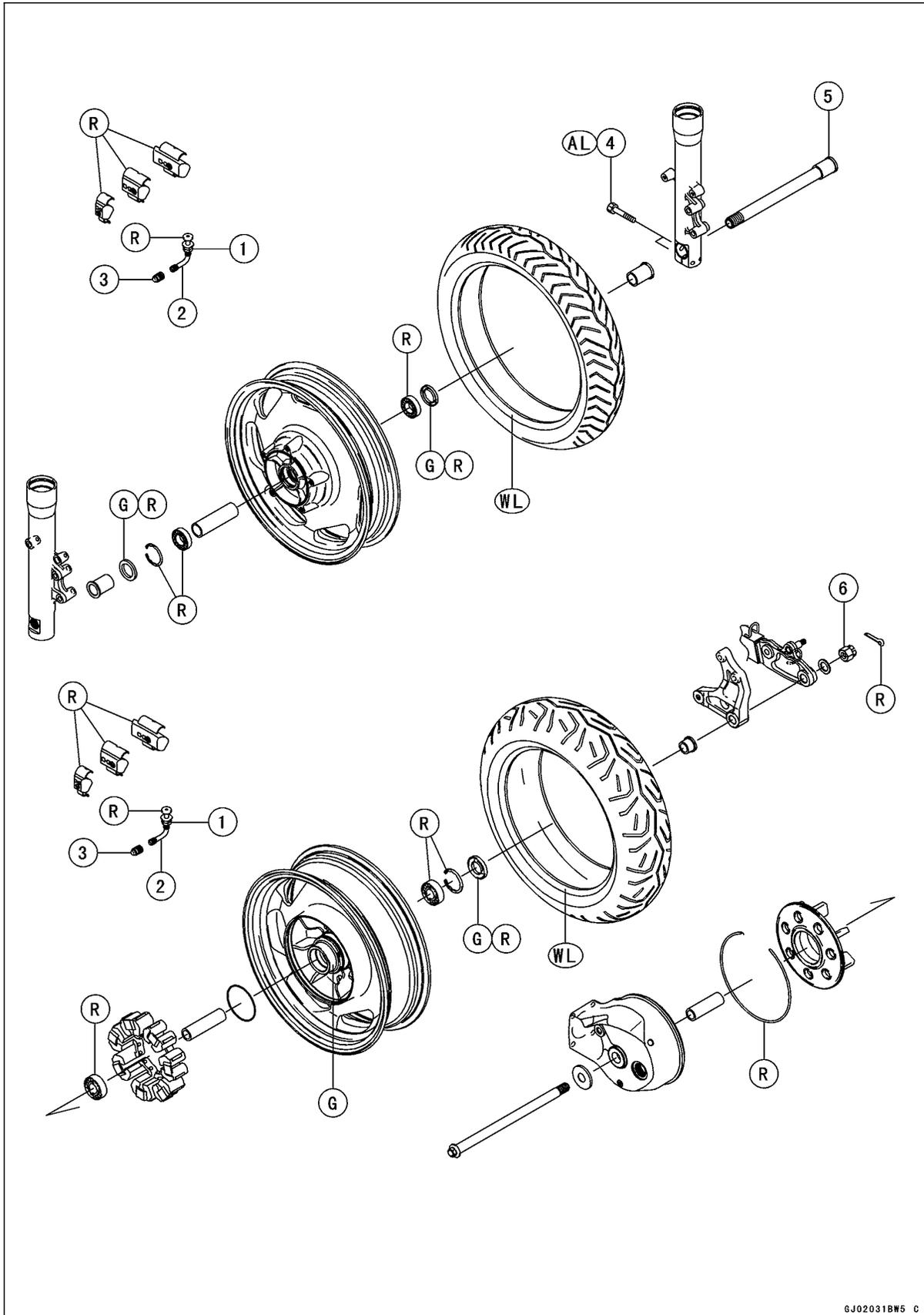
# Wheels/Tires

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# 10-2 WHEELS/TIRES

## Exploded View



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**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Tire air valve stem nuts	1.5	0.15	13 in·lb	
2	Air valve cores	0.3	0.03	2.6 in·lb	
3	Tire air valve caps	0.15	0.015	1.3 in·lb	
4	Front axle clamp bolts	20	2.0	15	AL
5	Front axle	108	11.0	79.6	
6	Rear axle nut	108	11.0	79.6	

G: Apply grease.

R: Replacement Parts

AL: Tighten the two clamp bolts alternately two times to ensure even tightening torque.

WL: Apply soap and water solution or rubber lubricant.

## 10-4 WHEELS/TIRES

### Specifications

Item	Standard	Service Limit
<b>Wheels (Rims):</b>		
Rim runout: Axial		TIR 0.5 mm (0.02 in.)
Radial		TIR 0.8 mm (0.03 in.)
Axle runout/100 mm	TIR 0.05 mm (0.002 in.) or less	TIR 0.2 mm (0.008 in.)
Wheel balance	10 g (0.35 oz.) or less	— — —
Balance weights	10 g (0.35 oz.), 20 g (0.71 oz.), 30 g (1.1 oz.)	
<b>Tires:</b>		
Air pressure (when cold):		
Front	Up to 186 kg (410 lb) load: 200 kPa (2.0 kg/cm <sup>2</sup> , 28 psi)	— — —
Rear	Up to 186 kg (410 lb) load: 250 kPa (2.5 kg/cm <sup>2</sup> , 36 psi)	— — —
Tread depth:		
Front	BRIDGESTONE: 4.3 mm (0.17 in.)	1 mm (0.04 in.) (DE, AT, CH) 1.6 mm (0.063 in.)
Rear	BRIDGESTONE: 7.2 mm (0.28 in.)	Up to 130 km/h (80 mph): 2 mm (0.08 in.) Over 130 km/h (80 mph): 3 mm (0.1 in.)
Standard tires:	Make, Type	Size
Front	BRIDGESTONE EXEDRA G721	130/90-16 M/C 67H
Rear	BRIDGESTONE EXEDRA G722	170/70B 16 M/C 75H

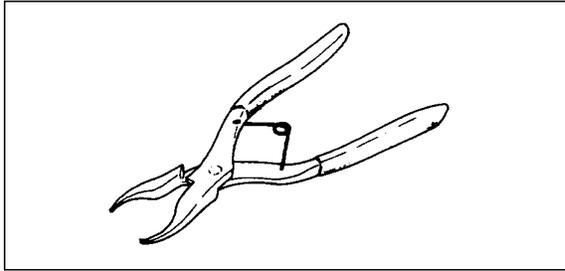
### WARNING

**Use the same manufacturer's tires on both front and rear wheels.**

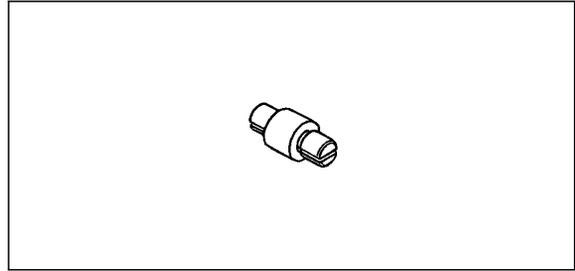
AT: Republic of Austria  
 CH: Swiss Confederation  
 DE: Federal Republic of Germany

**Special Tools**

**Inside Circlip Pliers :**  
57001-143



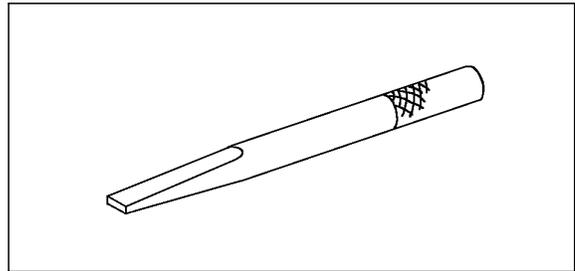
**Bearing Remover Head,  $\phi 20 \times \phi 22$  :**  
57001-1293



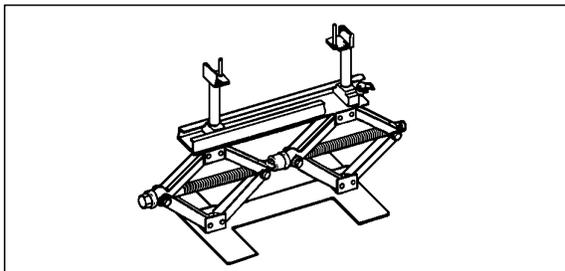
**Bearing Driver Set :**  
57001-1129



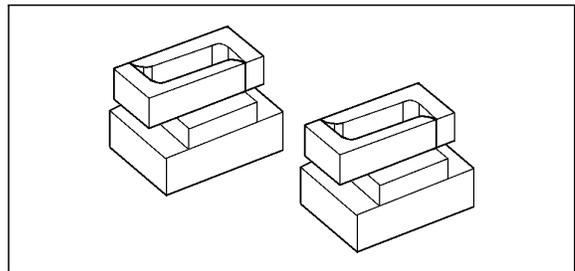
**Bearing Remover Shaft,  $\phi 13$  :**  
57001-1377



**Jack :**  
57001-1238



**Attachment Jack :**  
57001-1398

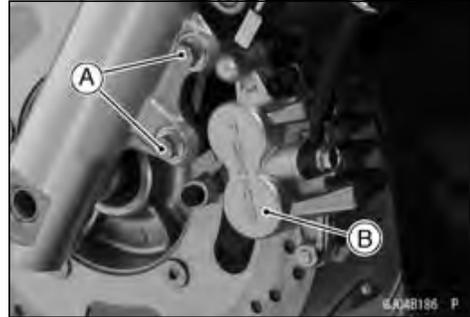


## 10-6 WHEELS/TIRES

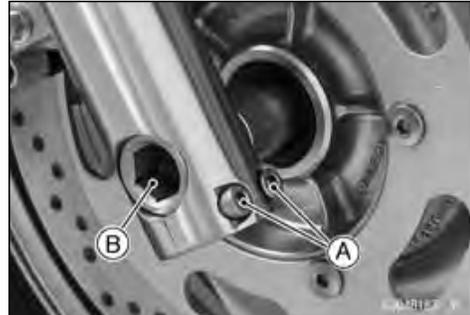
### Wheels (Rims)

#### Front Wheel Removal

- Unscrew the front brake caliper mounting bolts [A] and remove the brake calipers [B] with the hose installed.



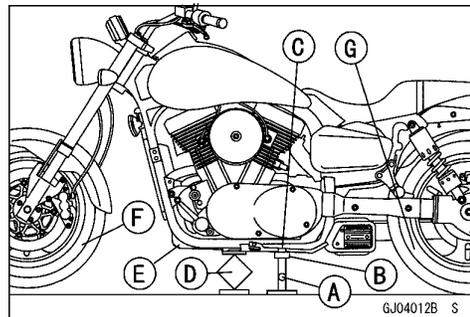
- For the European Model, remove the cap.
- Loosen:
  - Front Axle Clamp Bolts [A]
  - Front Axle [B]



- Using the jack [A] and the attachment jack [B] under the frame pipe ribs [C], and a commercially available jack [D] under the engine [E], lift the front wheel [F] OFF the ground until the rear wheel [G] touches the ground.

**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**



#### CAUTION

**Be sure to put the rear wheel ON the ground when removing the front wheel, or the motorcycle may fall over. The motorcycle could be damaged.**

#### ⚠ WARNING

**Be sure to put the rear wheel ON the ground when removing the front wheel, or the motorcycle may fall over. It could cause an accident and injury.**

- Unscrew the axle to the right and drop the front wheel [A] out of the fork.

#### CAUTION

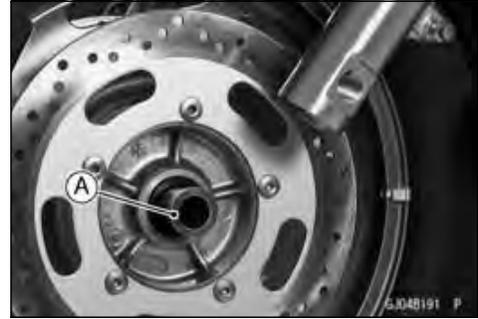
**Do not lay the wheel directly on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so that the disc does not touch the ground.**



## Wheels (Rims)

### Front Wheel Installation

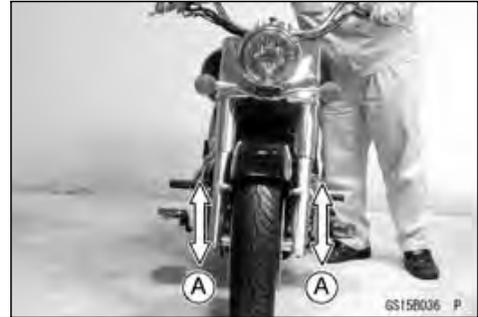
- Apply grease to the seal lips.
- Fit the collars [A] on the both side of the hub.
- The collars are identical.



- Insert the axle from the right side of the wheel.
- Tighten the axle.

**Torque - Front Axle: 110 N·m (11 kgf·m, 79.6 ft·lb)**

- Before tightening the clamp bolts on the right fork leg, pump the forks up and down [A] 4 or 5 times to allow the right fork leg to find a neutral position on the front axle.



#### NOTE

- Do not apply the front brake during this process to stop the motorcycle from rolling forward. Put a block in front of the wheel to stop it from moving.

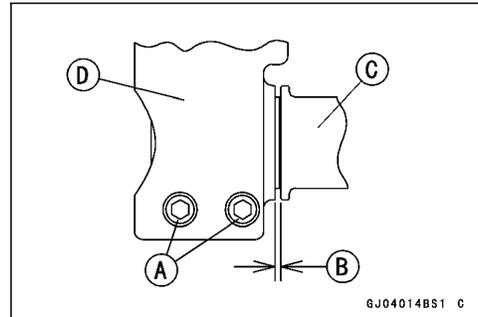
- Tighten the axle clamp bolts [A] to the specified torque.

**Torque - Front Axle Clamp Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)**

#### NOTE

- Tighten the two clamp bolts alternately two times to ensure even tightening torque.

- Check the clearance [B] between the front axle collar [C] and the right fork leg [D]. The clearance between the front axle collar and the right fork leg should be between 1.05 ~ 3.19 mm (0.041 ~ 0.124 in.).



- ★ If the clearance is out of this range, remove the front wheel again and check the axle, wheel hub and other related parts for damage.

- Tighten the caliper mounting bolts.

**Torque - Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

- Check the front brake effectiveness.

### ⚠ WARNING

Do not attempt to ride the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brakes will not function on the first application of the lever if this is not done.

## 10-8 WHEELS/TIRES

### Wheels (Rims)

#### Rear Wheel Removal

- Using the jack [A] and attachment jack [B] under the frame pipe ribs [C], lift the rear wheel [D] off the ground until the front wheel [E] touches the ground.

#### CAUTION

Be sure to put the front wheel ON the ground when removing the rear wheel, or the motorcycle may fall over. The motorcycle could be damaged.

#### ⚠ WARNING

Be sure to put the front wheel ON the ground when removing the rear wheel, or the motorcycle may fall over. It could cause an accident and injury.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

- Squeeze the brake lever slowly and hold it with a band [A]

#### CAUTION

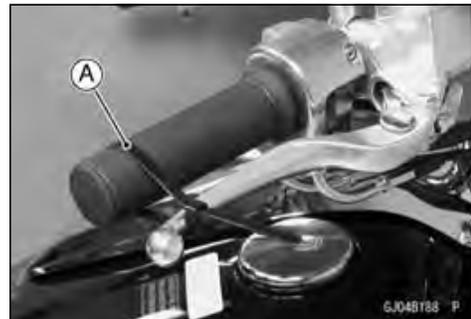
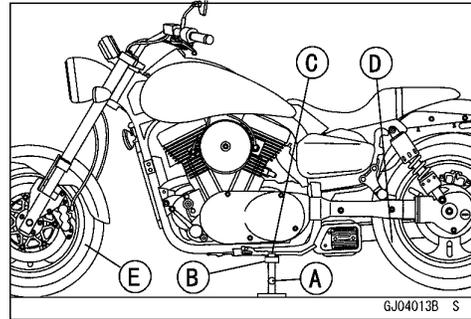
Be sure to hold the front brake when removing the rear wheel, or the motorcycle may fall over. The motorcycle could be damaged.

#### ⚠ WARNING

Be sure to hold the front brake when removing the rear wheel, or the motorcycle may fall over. It could cause an accident and injury.

- Remove:  
Caliper Mounting Bolts [A]  
Caliper [B]

- Remove:  
Rear Shock Absorbers [A]

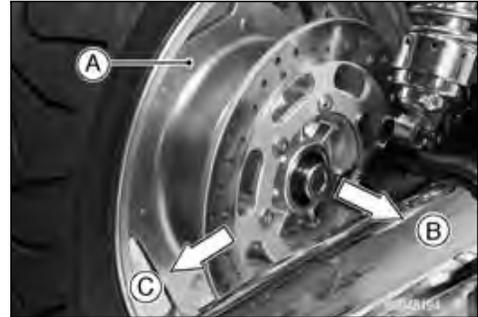


## Wheels (Rims)

- Remove:
  - Caliper Holder Bolt [A]
  - Axle Nut Cotter Pin [B]
  - Axle Nut [C]
- Pull the silencer out side and straighten the cotter pin.



- Temporarily install the rear shock absorber.
- Pull out the axle, and slide the rear wheel [A] toward the right [B] to disengage the wheel from the final gear case.
- Move the rear wheel back [C] and remove it.

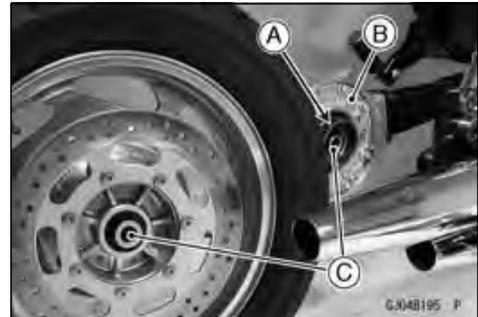


### CAUTION

**Do not lay the wheel directly on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so that the disc does not touch the ground.**

### Rear Wheel Installation

- Apply grease to the grease seal of the wheel.
- Apply grease to the ring gear hub splines [A] of the final gear case [B].
- Insert the collars [C] on both sides of the hub.



- Insert the axle [A] from the left side of the rear wheel.
- Slide the rear wheel to the left side, and engage the ring gear hub splines with the wheel coupling hub splines.
- Pull the axle little and install the caliper holder.
- Tighten:

**Torque - Rear Axle Nut: 110 N·m (11 kgf·m, 79.6 ft·lb)**  
**Rear Caliper Holder Bolt: 64 N·m (6.5 kgf·m, 47 ft·lb)**  
**Rear Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**



### ⚠ WARNING

**If the axle nut is not securely tightened, an unsafe riding condition may result.**

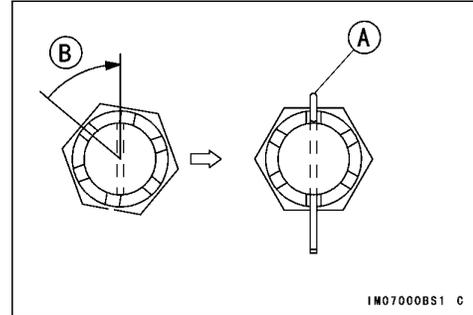
## 10-10 WHEELS/TIRES

### Wheels (Rims)

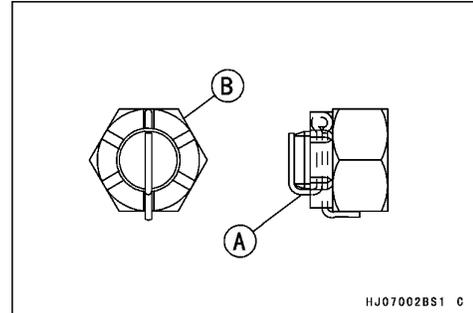
- Insert a new cotter pin [A].

#### NOTE

- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle, 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 as shown [B].



- Visually inspect the tire for stuck any grease [A].
- ★ If any grease have stuck to the surface of the tire, wash the tire clean with soap and water solution.



- Check the rear brake effectiveness.

#### ⚠ WARNING

**Do not attempt to ride the motorcycle until a full brake pedal is obtained by pumping the brake pedal until the pads are against the disc. The brake will not function on the first application of the pedal if this is not done.**

#### Wheel Coupling Removal

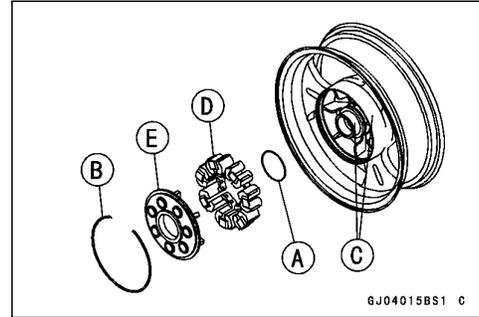
- Remove the rear wheel (see Rear Wheel Removal).
- Remove the coupling retaining ring [A].
- Remove the wheel coupling [B] with a bearing puller if necessary.



## Wheels (Rims)

### Wheel Coupling Installation

- Replace the O-ring [A] and the retaining ring [B].
- Grease the following:
  - O-ring
  - Bosses [C] of Rear Drum Hub
- Install:
  - Rubber Damper [D]
  - Coupling [E]
  - Retaining Ring



### Wheel Inspection

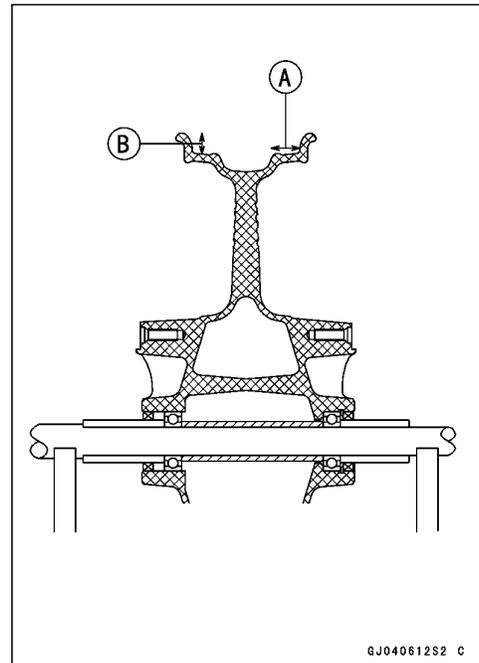
- Raise the front or rear wheel off the ground.
  - Special Tools - Jack: 57001-1238**
  - Attachment Jack: 57001-1398**
- Spin [A] the wheel lightly, and check for roughness or binding.
- ★ If roughness or binding is found, replace the hub bearings.
- Inspect the front and rear axles for damage (see this chapter).
- ★ If the axle is damaged or bent, replace it.
- Inspect the wheel for small cracks, dents, bending, or warp.
- ★ If there is any damage to the wheel, replace the wheel.
- Remove the wheel, and support it without the tire by the axle.
- Measure the rim runout, radial [A] and axial [B], with a dial gauge.
- ★ If the rim runout exceeds the service limit, check the hub bearings. Replace them if they are damaged.
- ★ If the problem is not due to the bearings, replace the wheel.



#### Rim Runout

##### Service Limit:

Axial	0.5 mm (0.02 in.)
Radial	0.8 mm (0.03 in.)



### ⚠ WARNING

Never attempt to repair a damaged wheel. If there is any damage besides wheel bearings, the wheel must be replaced to insure safe operational condition.

## 10-12 WHEELS/TIRES

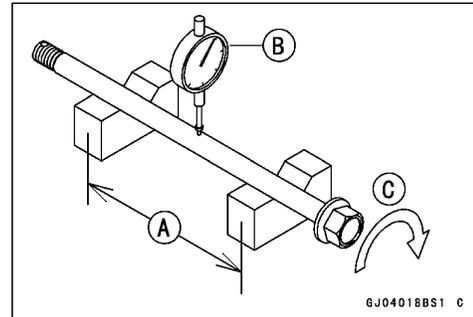
### Wheels (Rims)

#### Axle Inspection

- Visually inspect the front and rear axles for damage.
- ★ If the axle is damaged or bent, replace it.
- Place the axle in V blocks that are 100 mm [A] apart, and set a dial gauge [B] on the axle at a point halfway between the blocks. Turn [C] the axle to measure the runout. The difference between the highest and lowest dial readings is the amount of runout.
- ★ If axle runout exceeds the service limit, replace the axle.

#### Axle Runout/100 mm

- Standard:** TIR 0.05 mm (0.002 in.) or less
- Service Limit:** TIR 0.2 mm (0.008 in.)

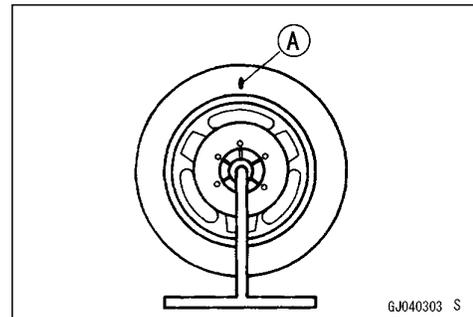


#### Wheel Balance

- To improve stability and decrease vibration at high speed, the front and rear wheels must be kept balanced.
- Check and balance the wheels when required, or when a tire is replaced with a new one.

#### Balance Inspection

- Remove the wheel.
- Support the wheel so that it can be spun freely.
- Spin the wheel lightly, and mark [A] the wheel at the top when the wheel stops.
- Repeat this procedure several times. If the wheel stops of its own accord in various positions, it is well balanced.
- ★ If the wheel always stops in one position, adjust the wheel balance.



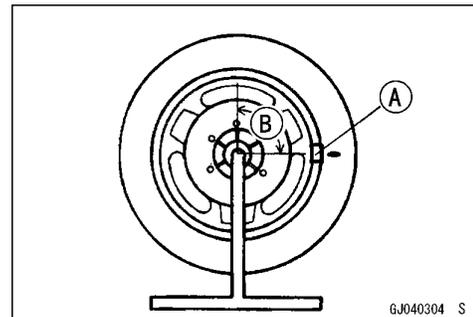
#### Balance Adjustment

- If the wheel always stops in one position, provisionally attach a balance weight [A] to the rim flange at the marking, using adhesive tape.

#### **⚠ WARNING**

**Use only the genuine balance weights.**

- Rotate the wheel 1/4 turn [B], and see whether or not the wheel stops in this position. If it does, the correct balance weight is being used.
- ★ If the wheel rotates and the weight goes up, replace the weight with the next heavier size. If the wheel rotates and the weight goes down, replace the weight with the next lighter size. Repeat these steps until the wheel remains at rest after being rotated 1/4 turn.
- Rotate the wheel another 1/4 turn and then another 1/4 turn to see if the wheel is correctly balanced.
- Repeat the entire procedure as many times as necessary to achieve correct wheel balance.



**Wheels (Rims)**

★If proper balance has been achieved, permanently install the balance weight.

**Balance Weight**

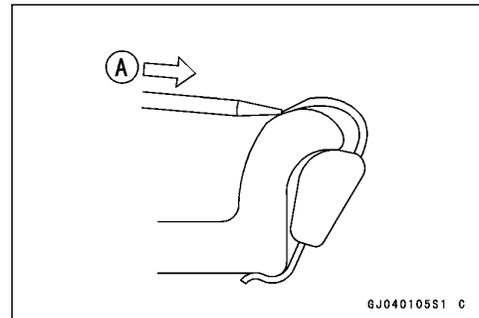
Part Number	Weight (grams)
41075-1014	10 (0.35 oz.)
41075-1015	20 (0.71 oz.)
41075-1016	30 (1.1 oz.)

**NOTE**

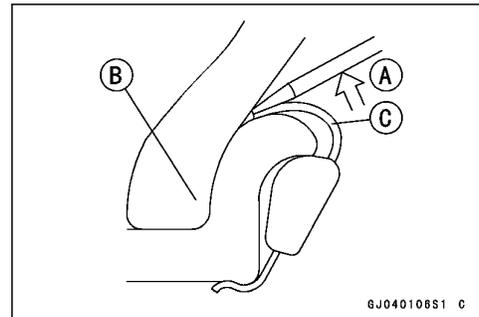
- Balance weights are available from Kawasaki Dealers in 10, 20, and 30 gram (0.35, 0.71 and 1.1 ounce) sizes. An imbalance of less than 10 grams (0.35 ounce) will not usually affect running stability.
- Do not use four or more balance weights (more than 90 gram, 3.2 ounce). If the wheel requires an excess balance weight, remove and disassemble the wheel to find the cause.

**Balance Weight Removal**

- (a) When the tire is not on the rim.
  - Push [A] the blade portion toward the outside with a regular tip screw driver, and slip the weight off the rim flange.
  - Discard the used balance weight.



- (b) When the tire is on the rim.
  - Pry [A] the balance weight off the rim flange using a regular tip screw driver as shown in the figure.
  - Insert a tip of the screw driver between the tire bead [B] and weight blade [C] until the end of the tip reaches the end of the weight blade.
  - Push the driver grip toward the tire so that the balance weight slips off the rim flange.
  - Discard the used balance weight.



**Balance Weight Installation**

- Check if the weight portion has any play on the blade-and-clip plate.
- ★ If it does, discard it.

**⚠ WARNING**

**If the balance weight has any play on the rim flange, the blade and/or clip have been stretched. Replace the loose balance weight. Do not reuse used balance weight. Unbalanced wheels can create an unsafe riding condition.**

# 10-14 WHEELS/TIRES

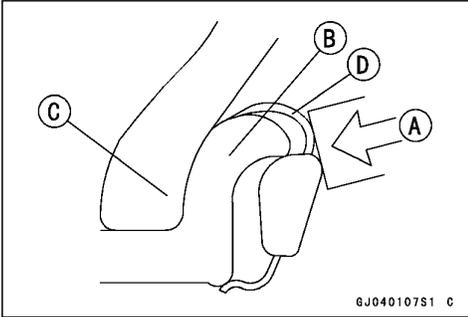
## Wheels (Rims)

- Lubricate the balance weight blade, tire bead, and rim flange with a soap and water solution or rubber lubricant. This helps the balance weight slip onto the rim flange.

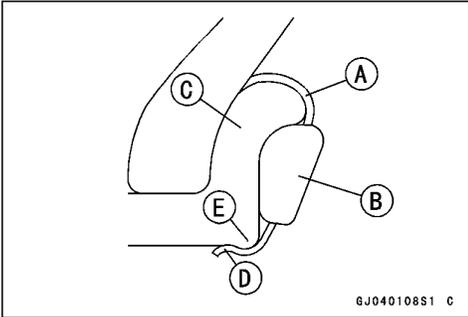
**CAUTION**

**Do not lubricate the tire bead with engine oil or petroleum distillates because they will deteriorate the tire.**

- Install the balance weight on the rim.
  - Slip the weight on the rim flange [B] by pushing or lightly hammering [A] the weight in the direction shown in the figure.
    - Tire Bead [C]
    - Blade [D]

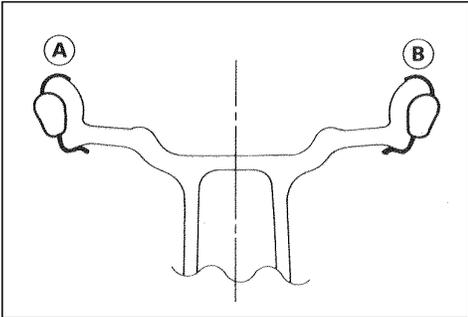


- Check that the blade [A] and weight [B] seat fully on the rim flange [C], and that the clip [D] is hooked over the rim ridge [E] and reaches rim flat portion.



- When required total weight exceeds 20 g, install balance weight at both sides of rim flange as shown.

Required Total Weight	Weight Selection	
	One Side [A]	Other Side [B]
10 g (0.35 oz.)	10 g (0.35 oz.)	–
20 g (0.71 oz.)	10 g (0.35 oz.)	10 g (0.35 oz.)
30 g (1.1 oz.)	20 g (0.71 oz.)	10 g (0.35 oz.)
40 g (1.4 oz.)	20 g (0.71 oz.)	20 g (0.71 oz.)
50 g (1.8 oz.)	30 g (1.1 oz.)	20 g (0.71 oz.)
60 g (2.1 oz.)	30 g (1.1 oz.)	30 g (1.1 oz.)
70 g (2.5 oz.)	20 g (0.71 oz.) + 20 g (0.71 oz.)	30 g (1.1 oz.)
80 g (2.8 oz.)	20 g (0.71 oz.) + 20 g (0.71 oz.)	20 g (0.71 oz.) + 20 g (0.71 oz.)
90 g (3.2 oz.)	20 g (0.71 oz.) + 30 g (1.1 oz.)	20 g (0.71 oz.) + 20 g (0.71 oz.)



**Tires**

*Air Pressure Inspection/Adjustment*

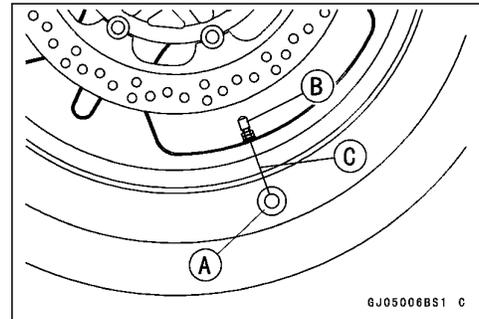
- Refer to Tire Inspection in the Periodic Maintenance chapter.

*Tire Inspection*

- Refer to Tire Inspection in the Periodic Maintenance chapter.

*Tire Removal*

- Remove the following.
  - Wheel (see this chapter)
  - Brake Disc (see Brakes chapter)
  - Valve Core (let out the air)
- To maintain wheel balance, mark the valve stem position on the tire with chalk so that the tire can be reinstalled in the same position.
  - Chalk Mark or Yellow Mark [A]
  - Valve Stem [B]
  - Align [C]
- Lubricate the tire beads and rim flanges on both sides with a soap and water solution or rubber lubricant. This helps the tire beads slip off the rim flanges.



<b>CAUTION</b>
<b>Never lubricate with engine oil or petroleum distillates because they will deteriorate the tire.</b>

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

**NOTE**

○ *The tires cannot be removed with hand tools because they fit the rims too tightly.*

*Tire Installation*

<b>⚠ WARNING</b>
<b>To ensure safe handling and stability, use only the standard tires for replacement, inflated to the standard pressure. Use the same manufacturer's tires on both front and rear wheels.</b>

- Inspect the rim and tire, and replace them if necessary.
- Clean the sealing surfaces of the rim and tire, and smooth the sealing surfaces of the rim with a fine emery cloth if necessary.
- Remove the air valve and discard it.

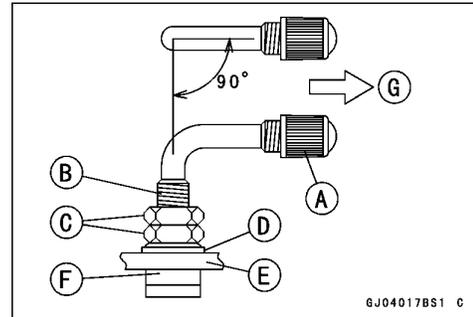
<b>CAUTION</b>
<b>Replace the air valve whenever the tire is replaced. Do not reuse the air valve.</b>

## 10-16 WHEELS/TIRES

### Tires

- Insert the new air valve in the rear wheel rim.

Valve Cap [A]  
Valve Body [B]  
Valve Nuts [C]  
Valve Washer [D]  
Rim [E]  
Valve Grommet [F]  
Coupling Damper Side [G]



- Remove the valve cap, valve nuts, valve washer and insert the valve stem through the rim from the inside out.

**Torque - Tire Air Valve Nuts: 1.5 N·m (0.15 kgf·m, 13 in·lb)**  
**Tire Air Valve Cap: 0.15 N·m (0.015 kgf·m, 1.3 in·lb)**  
**Tire Air Valve Core: 0.3 N·m (0.03 kgf·m, 2.6 in·lb)**

- Apply a soap and water solution, or rubber lubricant to the rim flange and tire beads.

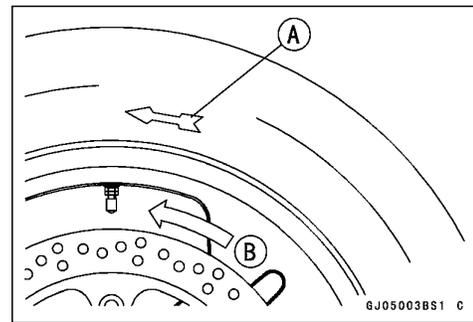
#### CAUTION

**Never lubricate with mineral oil (engine oil) or gasoline because they will cause deterioration of the tire.**

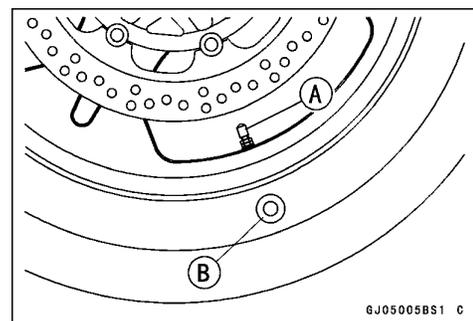
- Check the tire rotation mark on the front and rear tires and install them on the rim accordingly.

Tire Rotation Mark [A]  
Rotation Direction [B]

- The front rim is no right and left distinction.
- Install the rear tire on the rim so that the damper faces left.



- Position the tire on the rim so that the valve [A] is at the tire balance mark [B] (the chalk mark made during removal, or the yellow paint mark on a new tire).
- Install the tire bead over the rim flange using a commercially available tire changer.
- Lubricate the tire beads and rim flanges with a soap and water solution or rubber lubricant to help seat the tire beads in the sealing surfaces of the rim while inflating the tire.
- Center the rim in the tire beads, and inflate the tire with compressed air until the tire beads seat in the sealing surfaces.



#### ⚠ WARNING

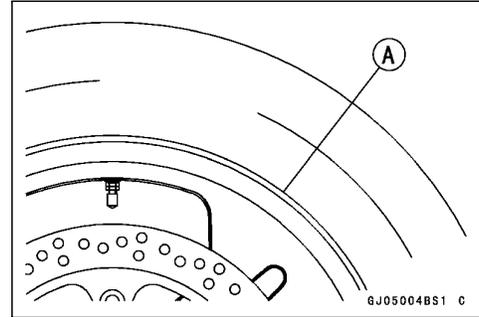
**Be sure to install the valve core whenever inflating the tire, and do not inflate the tire to more than 400 kPa (4.0 kg/cm<sup>2</sup>, 57 psi). Overinflation can explode the tire with possibility of injury and loss of life.**

**Tires**

- Check to see that the bead lines [A] on both sides of the tire sidewalls are parallel with the rim flanges.
- ★ If the rim flanges and tire sidewall bead lines are not parallel, remove the valve core.
- Lubricate the rim flanges and tire beads.
- Install the valve core and inflate the tire again.
- After the tire beads seat in the rim flanges, check for air leakage.
- Inflate the tire slightly above standard inflation.
- Use a soap and water solution or submerge the tire, and check for bubbles that would indicate leakage.
- Adjust the air pressure to the specified pressure (see Tire Inspection).
- Install the air valve cap.
  
- Install the brake disc [A] so that the marked side [B] faces out.
- Apply a non-permanent locking agent, and tighten the brake disc bolts [C].

**Torque - Brake Disc Bolts: 27 N·m (2.8 kgf·m, 20 ft·lb)**

- Adjust the wheel balance.



**⚠ WARNING**

**Check and balance the wheel when a tire is replaced with a new one. New tires are slippery and may cause loss of control and injury. A break-in period of 160 km (100 mi) is necessary to establish normal tire traction. During break-in, avoid sudden and maximum braking and acceleration, and hard cornering.**

*Tire Repair*

Currently two types of repair for tubeless tires have come into wide use. One type is called a temporary (external) repair which can be carried out without removing the tire from the rim, and the other type is called permanent (internal) repair which requires tire removal. It is generally understood that higher running durability is obtained by permanent (internal) repairs than by temporary (external) ones. Also, permanent (internal) repairs have the advantage of permitting a thorough examination for secondary damage not visible from external inspection of the tire. For these reasons, Kawasaki does not recommend temporary (external) repair. Only appropriate permanent (internal) repairs are recommended. Repair methods may vary slightly from make to make. Follow the repair methods indicated by the manufacturer of the repair tools and materials so that safe results can be obtained.

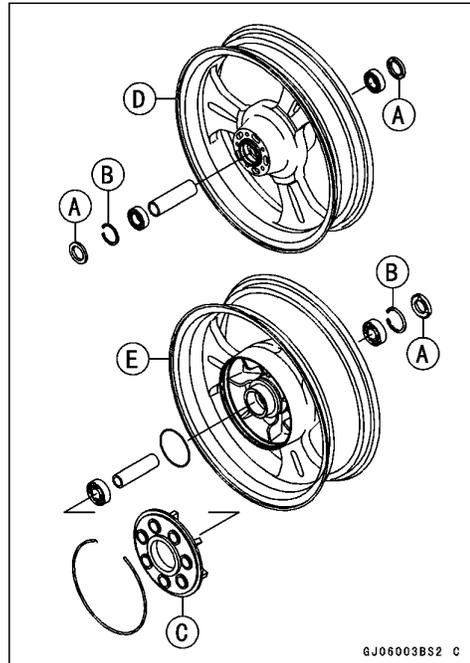
## 10-18 WHEELS/TIRES

### Hub Bearings (Wheel Bearings)

#### Hub Bearings Removal

- Remove the wheel, and take out the following.
  - Collars
  - Grease Seals [A]
  - Circlips [B]
  - Coupling [C] (Out of Rear Hub)
  - Front Hub [D]
  - Rear Hub [E]

**Special Tool - Inside Circlip Pliers: 57001-143**



- Use the bearing remover to remove the hub bearings [A].

#### CAUTION

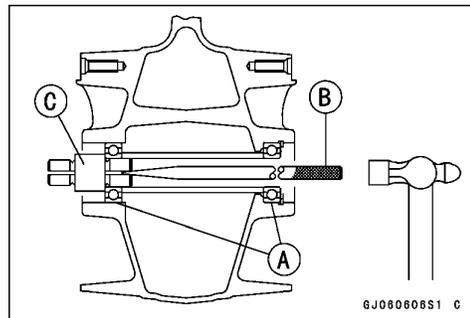
Do not lay the wheel directly on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so that the disc does not touch the ground.

**Special Tools - Bearing Remover Shaft,  $\phi 13$ :**

**57001-1377 [B]**

**Bearing Remover Head,  $\phi 20 \times \phi 22$ :**

**57001-1293 [C]**



#### Hub Bearings Installation

- Before installing the wheel bearings, blow any dirt or foreign particles out of the hub with compressed air to prevent contamination of the bearings.
- Replace the bearings with new ones.

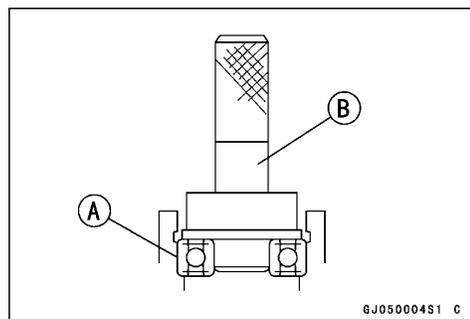
#### NOTE

○ Install the bearings so that the marked side faces out.

- Install the bearings by using a bearing driver.
- First, press each right bearing [A] in until it bottoms out.

**Special Tool - Bearing Driver Set: 57001-1129 [B]**

- Next, install the following:
  - New Circlip
  - Distance Collar
  - Left Bearing



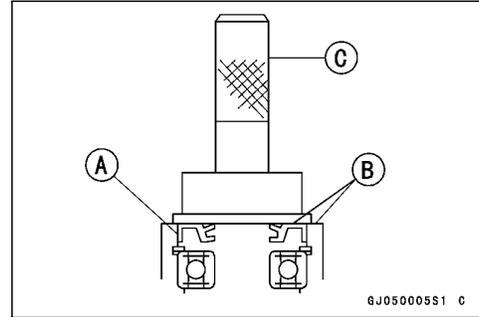
## Hub Bearings (Wheel Bearings)

○ Replace the circlips with new ones.

**Special Tool - Inside Circlip Pliers: 57001-143**

- Replace the grease seals with new ones.
- Press in the grease seals [A] so that the seal surface is flush [B] with the end of the hole.
- Apply high temperature grease to the grease seal lips.

**Special Tool - Bearing Driver Set: 57001-1129 [C]**



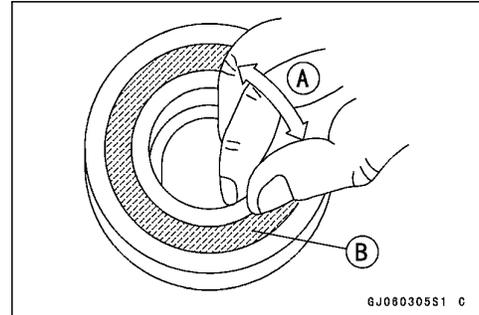
### Hub Bearings Inspection

○ Since the hub bearings are made to extremely close tolerance, the clearance cannot normally be measured.

#### NOTE

○ Do not remove any bearings for inspection. If any bearings are removed, they will need to be replaced with new ones.

- Turn each bearing in the hub back and forth [A] while checking for plays, roughness, or binding.
- ★ If bearing play, roughness, or binding is found, replace the bearing.
- Examine the bearing seal [B] for tears or leakage.
- ★ If the seal is torn or is leaking, replace the bearing.



### Hub Bearings Lubrication

#### NOTE

○ Since the hub bearings are packed with grease and sealed, lubrication is not required.



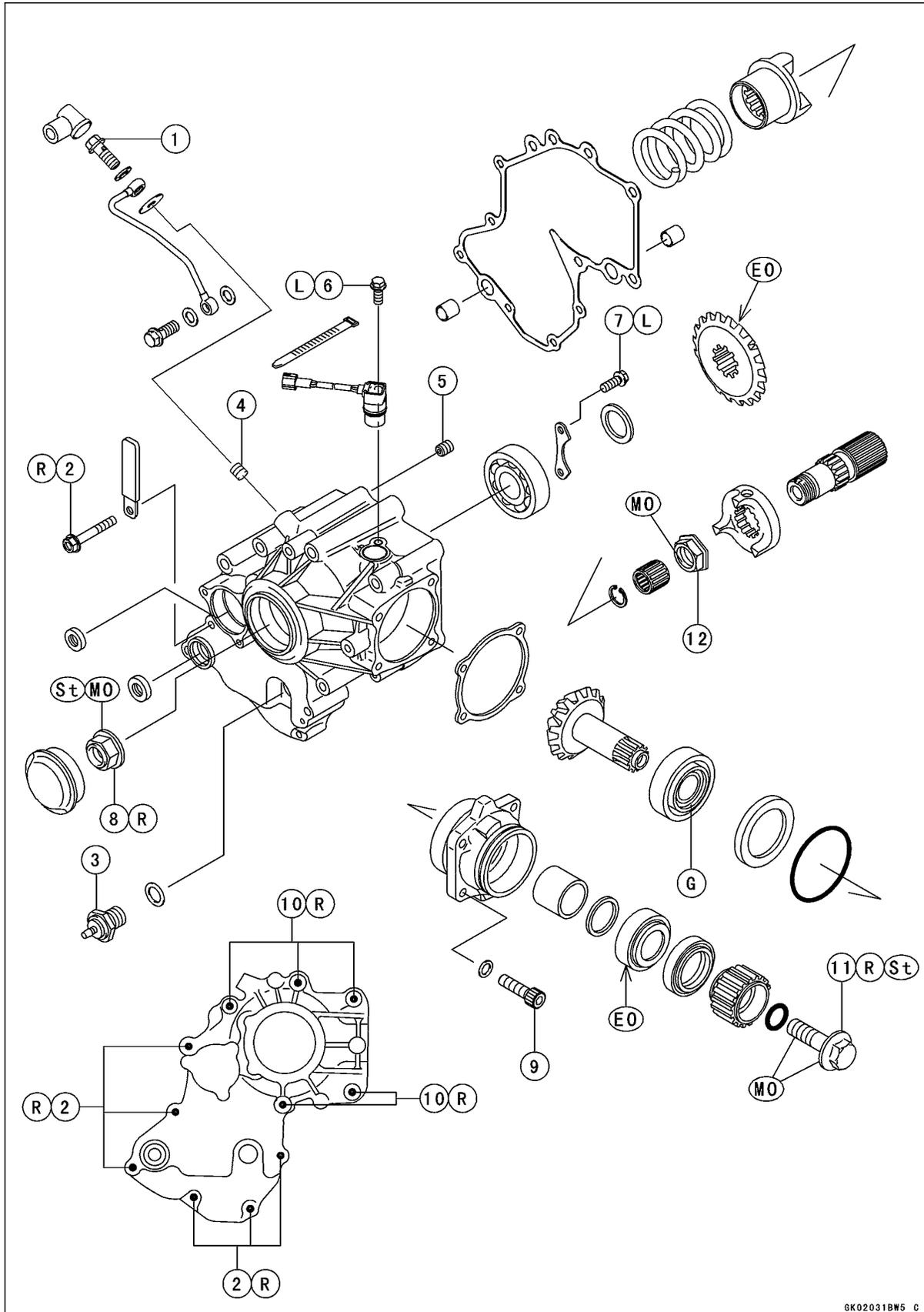
# Final Drive

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# 11-2 FINAL DRIVE

## Exploded View



GK02031BW5 C

**Exploded View**

**Front Gear Case**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil pipe banjo bolts (front gear)	12	1.2	104 in·lb	
2	Front gear case bolts 6 mm	12	1.2	104 in·lb	R
3	Neutral switch	15	1.5	11	
4	Oil nozzle (front gear)	2.9	0.30	26 in·lb	
5	Oil nozzle (front gear)	18	1.8	13	
6	Speed sensor bolt	9.8	1.0	87 in·lb	L
7	Bearing retainer bolts (front gear)	8.8	0.9	78 in·lb	L
8	Drive gear nut (front gear)	265	27	195	MO, St
9	Driven gear assy mounting bolts	25	2.5	18	
10	Front gear case bolts 8 mm	29	3.0	22	R
11	Driven gear bolt (front gear)	137	14	101	MO, St
12	Damper cam nut (front gear)	195	20	144	MO (threads)

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

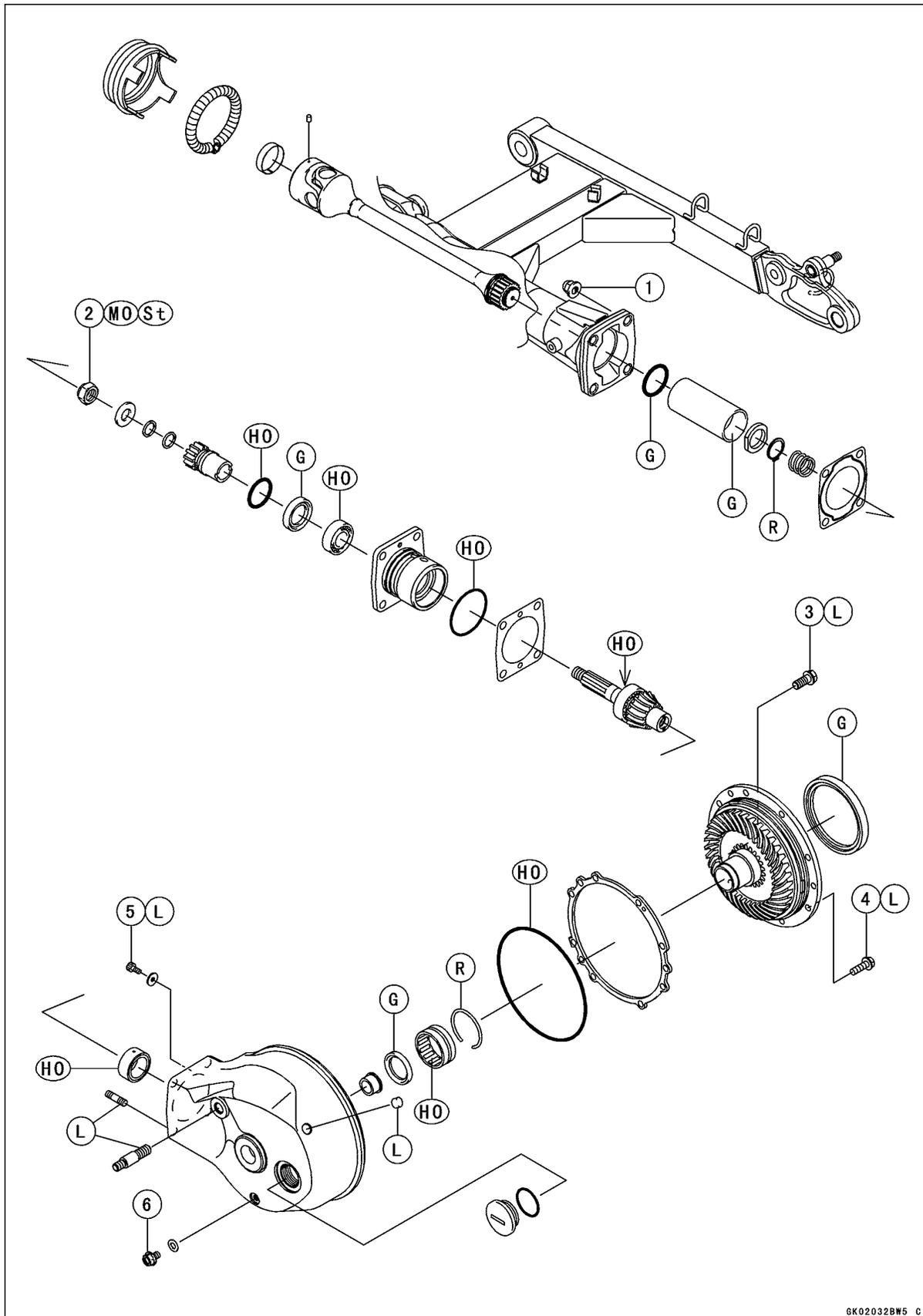
MO: Apply molybdenum disulfide oil.

R: Replacement Parts

St: Stake the fasteners.

# 11-4 FINAL DRIVE

## Exploded View



GK02032BW5 C

**Exploded View**

**Final Gear Case**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Final gear case mounting nuts	34	3.5	25	
2	Pinion gear nut (final gear)	130	13	94	MO, St
3	Final gear case cover bolts 10 mm	34	3.5	25	L
4	Final gear case cover bolts 8 mm	23	2.3	17	L
5	Bearing retainer bolt	6.9	0.7	61 in·lb	L
6	Final gear case drain plug	8.8	0.9	78 in·lb	
7	Final gear case studs	–	–	–	L

G: Apply grease.

L: Apply a non-permanent locking agent.

MO: Apply molybdeum disulfide oil.

HO: Apply hypoid gear oil.

R: Replacement Parts

St: Stake the fasteners.

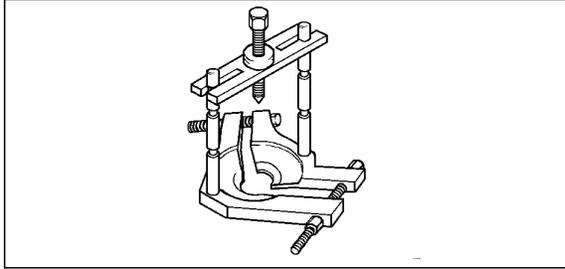
## 11-6 FINAL DRIVE

### Specifications

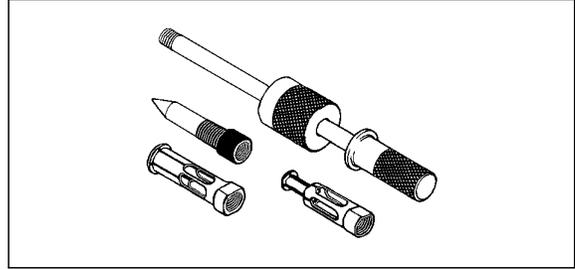
Item	Standard
<b>Final Gear Case Oil:</b>	
Grade	API Service Classification: GL-5 hypoid gear oil
Viscosity	When above 5°C (41°F) SAE90 When below 5°C (41°F) SAE80
Oil level	Filler opening bottom
Amount	200 mL (6.76 US oz.)
<b>Final Bevel Gear Backlash</b>	0.06 ~ 0.09 mm (0.0024 ~ 0.0035 in.) (at gear hub splines)
<b>Preload for Pinion Gear Bearing:</b>	
Torque wrench	0.6 ~ 1.0 N·m (0.06 ~ 0.10 kgf·m, 5.2 ~ 8.7 in·lb)
Spring seal	3.0 ~ 5.0 N (0.3 ~ 0.5 kg, 0.7 ~ 1.1 lb)
<b>Propeller Shaft Joint Grease</b>	20 mL (0.68 US oz.), high-temperature grease
<b>Front Bevel Gear Backlash</b>	0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.) (at gear teeth)
<b>Preload for Front Bevel Gear Bearing:</b>	
Torque wrench	0.5 ~ 0.9 N·m (0.05 ~ 0.09 kgf·m, 4.3 ~ 7.8 in·lb)
Spring scale	3 ~ 4 N (0.3 ~ 0.5 kg, 0.6 ~ 1.0 lb)

Special Tools

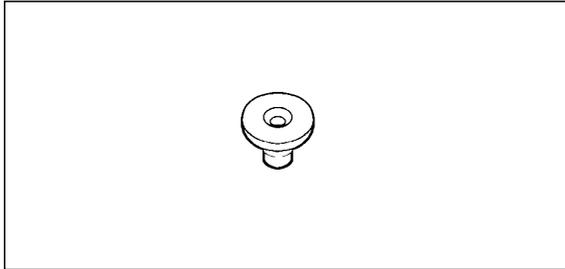
**Bearing Puller :**  
57001-158



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



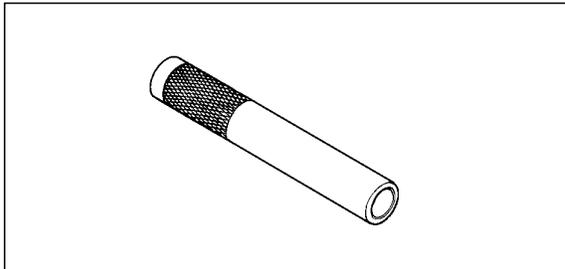
**Bearing Puller Adapter :**  
57001-317



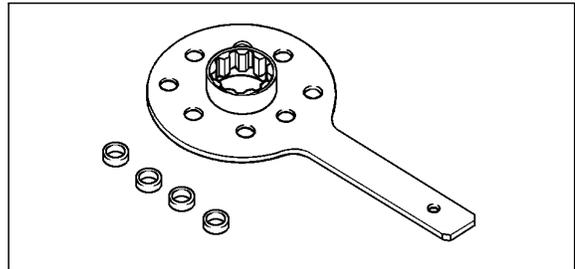
**Bearing Driver Set :**  
57001-1129



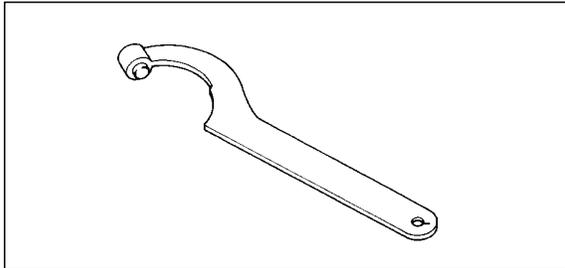
**Bearing Driver,  $\phi 32$  :**  
57001-382



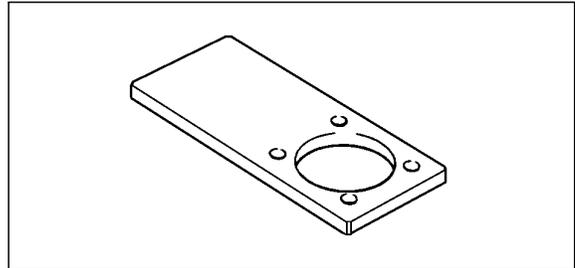
**Pinion Gear Holder, m1.9 :**  
57001-1165



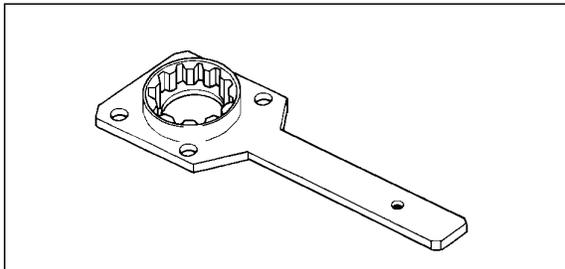
**Damper Cam Holder :**  
57001-1025



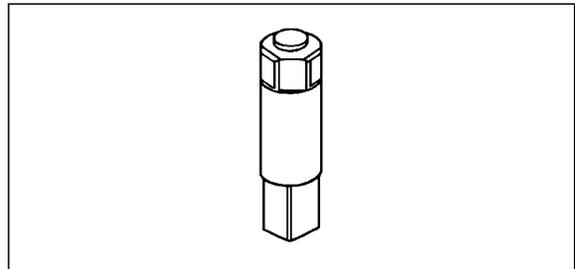
**Final Gear Case Holder :**  
57001-1250



**Driven Gear Holder, m2 :**  
57001-1027



**Drive Shaft Holder :**  
57001-1407



## 11-8 FINAL DRIVE

### Final Gear Case and Oil

#### Oil Level Inspection

- Refer to Oil Level Inspection in Periodic Maintenance chapter.

#### Oil Change

- Refer to Oil Change in Periodic Maintenance chapter.

#### Final Gear Case Removal

- ★ If the final gear case is to be disassembled, drain the final gear case oil.
- Remove the rear wheel (see Wheels/Tires chapter).
- Remove the left shock absorber [A] from its studs by taking off the nuts.
- Remove the swingarm cover (see Suspension chapter).
- Remove the final gear case by taking off the nuts [B]. The spring comes off with the case.

#### NOTE

○ If the final gear case is full of oil, place the case so that the breather hole [C] is on top.

#### Final Gear Case Installation

- Lubricate the propeller shaft joint (see Periodic Maintenance chapter).
- Install the spring so that the smaller diameter end [A] faces toward the final gear case.

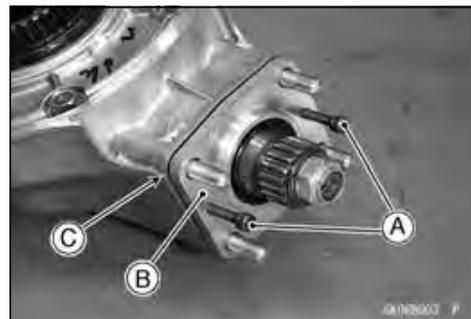
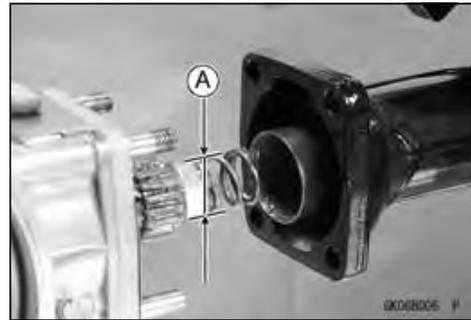
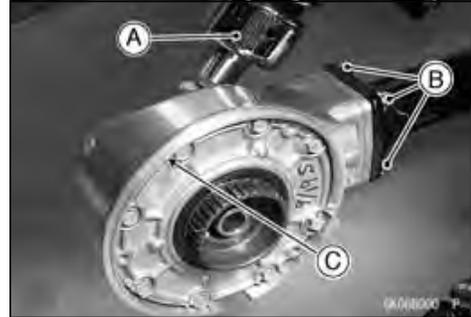
- Fit the pinion gear splines into the propeller shaft joint while turning the ring gear hub [A].
- Tighten the final gear case mounting nuts to the specified torque.

**Torque - Final Gear Case Mounting Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

- ★ If the final gear case oil was drained, fill the case with oil.

#### Final Gear Case Disassembly

- Remove the final gear case.
- Using 6 mm bolts [A] with 10 mm pitch threads, jack up the pinion gear assembly [B].
- Remove the pinion gear assembly and shim(s) [C] from the final gear case.

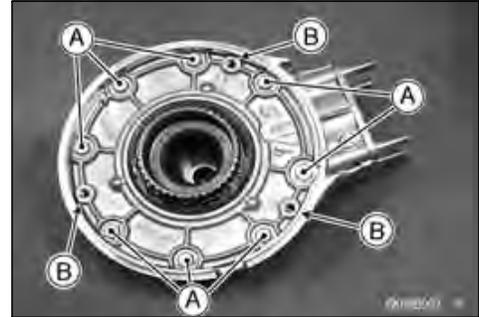


**Final Gear Case and Oil**

- Remove the final gear case cover bolts [A].
- Use three tapped holes [B] to lift the ring gear assy from the gear case. The shim(s) comes off with the assy.

**NOTE**

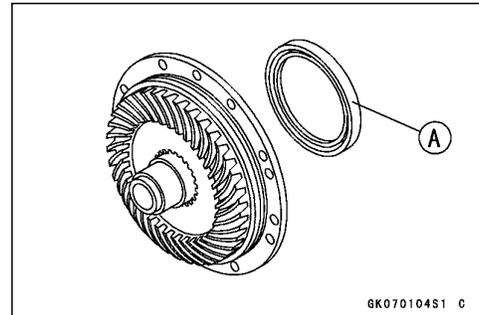
○ Do not disassemble the ring gear assy (ring gear, ring gear hub, and final gear case cover), but the oil seal can be removed.



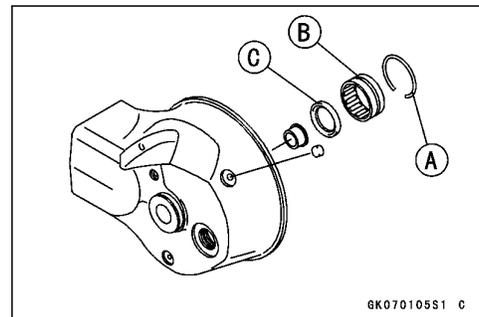
- To remove the ring gear oil seal [A], heat the ring gear assy in an oil bath to 120 ~ 150°C (248 ~ 302°F), then pry out the oil seal with an awl or other tool. Be careful not to scratch the sealing surface on the ring gear hub.

**CAUTION**

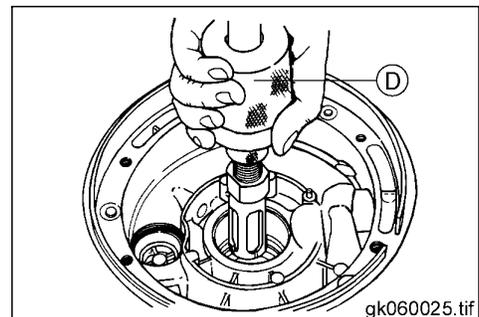
**Do not heat the case with a blowtorch. This will warp the case.**



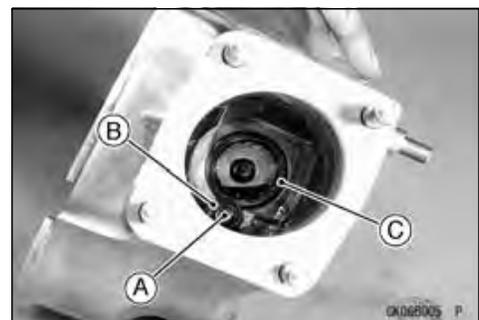
- Remove the snap ring [A] and pull out the needle bearing [B].
- ★ If the small ring gear oil seal [C] is damaged, remove it using the oil seal and bearing remover.



- Remove the small ring gear oil seal if damaged.
- Special Tool - Oil Seal & Bearing Remover [D]: 57001-1058**



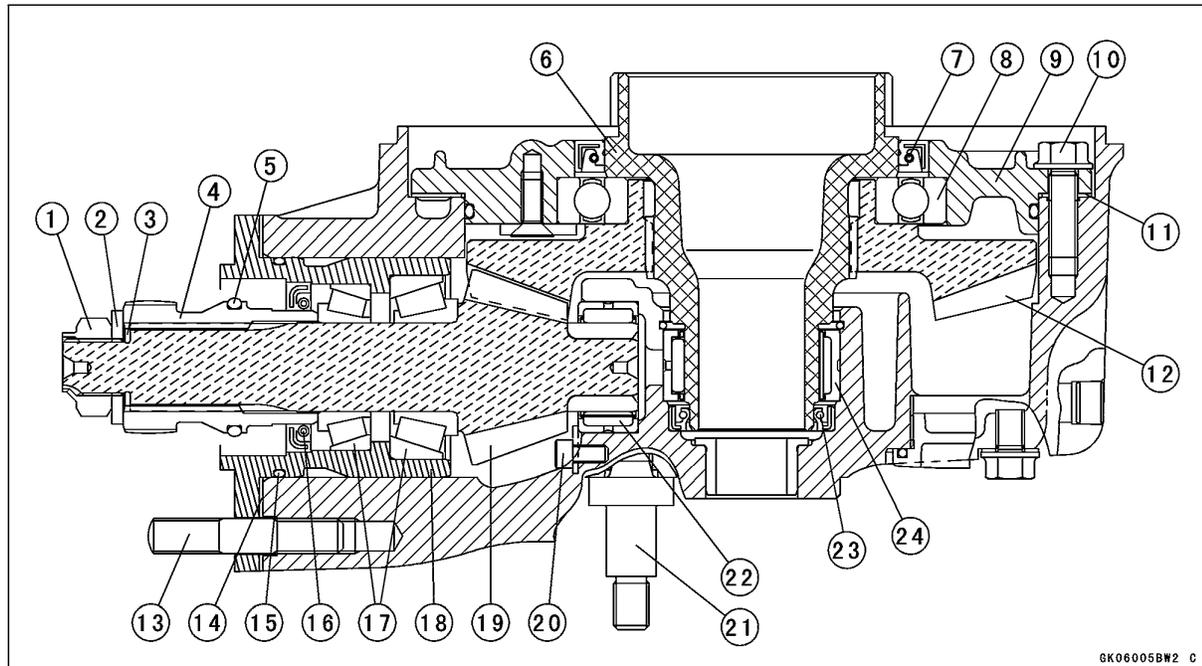
- Unscrew the bearing retainer bolt [A] and washer [B].
- Pull out the needle bearing [C].
- Special Tool - Oil Seal & Bearing Remover: 57001-1058**



# 11-10 FINAL DRIVE

## Final Gear Case and Oil

### Final Gear Case



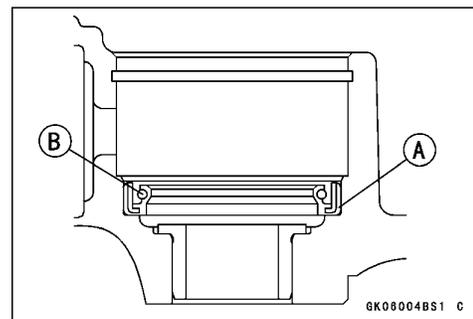
- |                          |                                 |
|--------------------------|---------------------------------|
| 1. Pinion Gear Nut       | 13. Studs                       |
| 2. Washer                | 14. Pinion Gear Shim(s)         |
| 3. Shim(s) for Preload   | 15. O-ring                      |
| 4. Pinion Gear Joint     | 16. Oil Seal                    |
| 5. O-ring                | 17. Tapered Roller Bearings     |
| 6. Ring Gear Hub         | 18. Pinion Gear Bearing Housing |
| 7. Ring Gear Oil Seal    | 19. Pinion Gear                 |
| 8. Ball Bearing          | 20. Retainer Bolt               |
| 9. Final Gear Case Cover | 21. Stud                        |
| 10. Cover Mounting Bolts | 22. Needle Bearing              |
| 11. Ring Gear Shim(s)    | 23. Small Ring Gear Oil Seal    |
| 12. Ring Gear            | 24. Needle Bearing              |

### Final Gear Case Assembly

- The ring gear and pinion gear are lapped as a set in the factory to get the best tooth contact. They must be installed as a pair, and never replace one without the other.
- Press the small ring gear oil seal [A] until it bottoms out with its spring [B] facing inward.
- Apply a thin coat of high temperature grease to the oil seal lip.

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

- Apply a thin coat of high temperature grease to the oil seal lip.



**Final Gear Case and Oil**

- Replace the needle bearings [A] with new ones.
- Apply a hypoid gear oil to the roller parts of the needle bearings.

**NOTE**

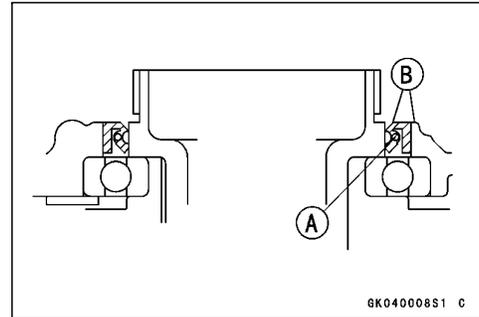
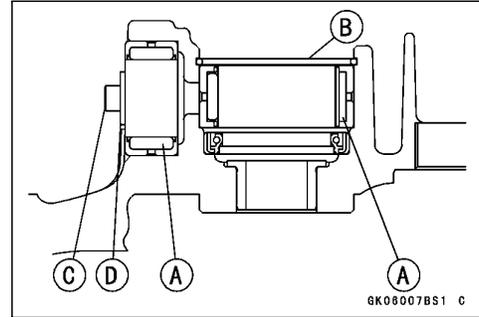
- Install the bearing so that the marked side faces out.
- Press in the bearings until they are bottomed.

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

- Install the snapping [B] secure.
- Apply a non-permanent locking agent to the bearing retainer bolt [C].
- Install the washer [D] and the bearing retainer bolt.

**Torque - Bearing Retainer Bolt: 7 N·m (0.7 kgf·m, 61 in·lb)**

- Apply a thin coat of high temperature grease to the oil seal lip of the ring gear oil seal.
- Install the ring gear oil seal with its spring [A] facing inward using a suitable driver until the face of the seal is even [B] with the end of the hole.



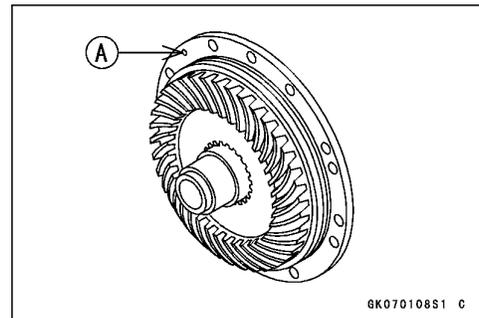
- Blow the breather hole [A] in the final gear case cover clean with compressed air.
- Apply a non-permanent locking agent to the threads of each stud and install them to the case if they were removed.
- Reinstall the original ring gear shim(s) to keep the gear backlash and the tooth contact unchanged.
- When final gear case parts are replaced, the final bevel gear must be adjusted (see Final Gear Backlash and Tooth Contact Adjustment).
- Apply a non-permanent locking agent to the threads of the final gear case cover bolts.
- Tighten:

**Torque - Final Gear Case Cover Bolts:**

$\phi 10$ : 34 N·m (3.5 kgf·m, 25 ft·lb)

$\phi 8$ : 23 N·m (2.3 kgf·m, 17 ft·lb)

- Insert the pinion gear assembly into the final gear housing.
- Reinstall the pinion gear assembly shim(s) to keep the gear backlash and the tooth contact unchanged.

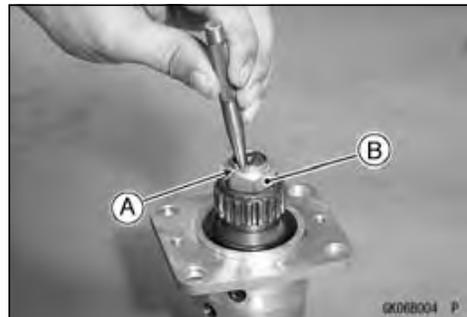


## 11-12 FINAL DRIVE

### Final Gear Case and Oil

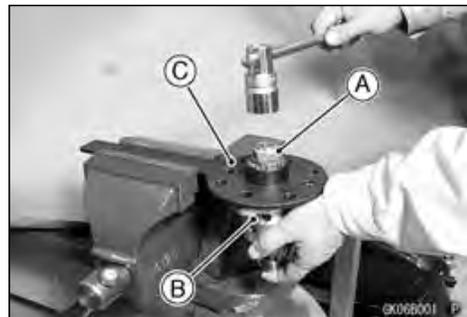
#### Pinion Gear Removal

- Pry open the staking [A] on the pinion gear nut [B].

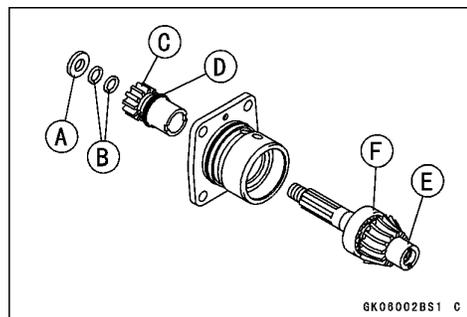


- Unscrew the nut [A] while holding the pinion gear assembly [B] with the pinion gear holder [C].

**Special Tool - Pinion Gear Holder: 57001-1165**

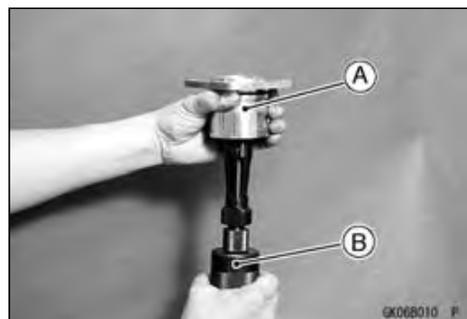


- Remove:  
Washer [A]  
Shim(s) [B]  
Pinion gear joint [C] with the O-ring [D].  
Pinion gear [E] with the Tapered Roller Bearing [F]



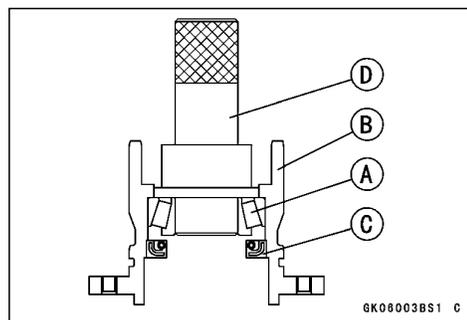
- Drive out the bearing outer race from the bearing housing [A].

**Special Tool - Oil Seal & Bearing: 57001-1058 [B]**



- Drive out the tapered roller bearing [A] in the bearing housing [B] and the oil seal [C] using the bearing driver set [D].

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

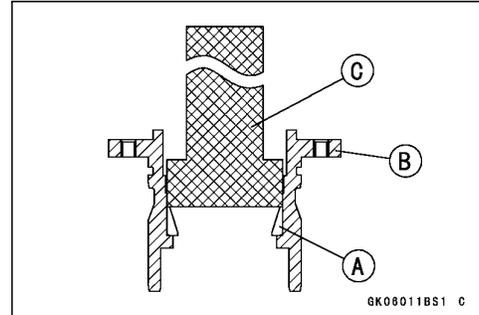


**Final Gear Case and Oil**

*Pinion Gear Installation*

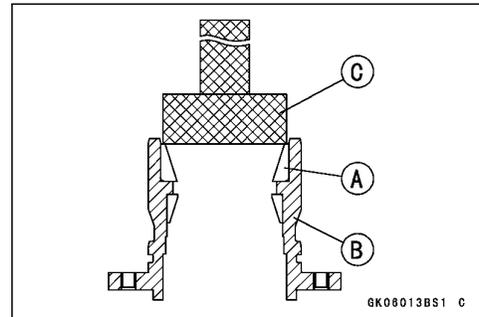
- The pinion gear and ring gear are lapped as a set in the factory to get the best tooth contact. They must be replaced as a set.
- Check the tapered roller bearing (see this chapter).
- Apply a hypoid gear oil to the roller bearings.
- Drive the tapered roller bearing [A] into the pinion gear housing [B] using the bearing driver set [C].

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

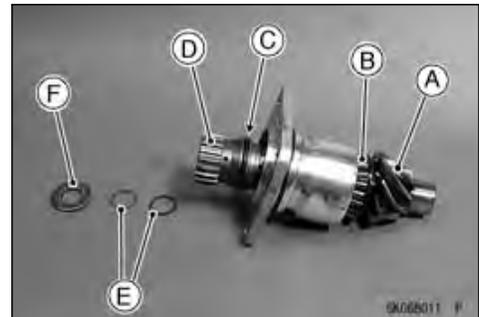


- Drive the tapered roller bearing outer race [A] into the pinion gear housing [B] using the bearing driver set [C].

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



- Insert the pinion gear [A].
- Install the pinion gear with the tapered roller bearing as [B] one unit.
- Check the O-ring [C] on the pinion gear joint [D] for any kind of damage.
- ★ Replace it if necessary.
- Apply a hypoid gear oil to the O-ring.
- Install the pinion gear joint, shim(s) [E] and washer [F].



- Replace the pinion gear nut with a new one.

**Molybdeum Disulfide Oil -**

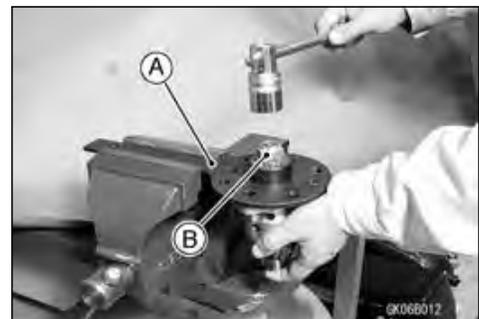
**Threads and Seating Surface of Pinion Gear Nut**

- The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).
- Using the pinion gear holder [A], tighten the pinion gear nut [B].

**Special Tool - Pinion Gear Holder: 57001-1165**

**Torque - Pinion Gear Nut: 127 N·m (13 kgf·m, 93 ft·lb)**

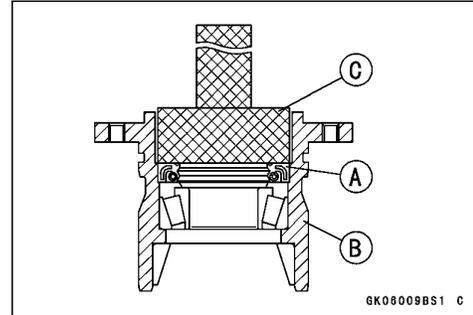
- Check the pinion gear bearing preload (see this chapter).
- Remove:
  - Pinion Gear Nut
  - Washer Shim(s)
  - Pinion Gear Joint
  - Pinion Gear Assy



## 11-14 FINAL DRIVE

### Final Gear Case and Oil

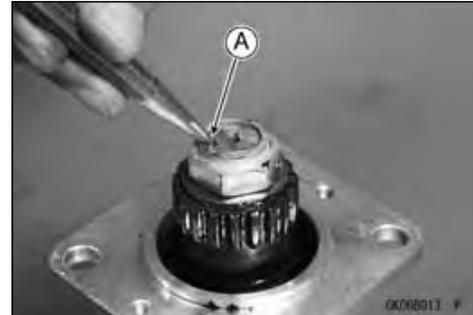
- Replace the oil seal with a new one.
- Drive the oil seal [A] using the bearing driver set [B].  
Special Tool - Bearing Driver Set: 57001-1129 [C]



- Reinstall the above removed parts.
- Stake [A] the pinion gear nut with a punch.

#### CAUTION

**When staking the nut, be careful not to apply shock to the pinion gear and its bearing. Such a shock could damage the pinion gear and/or bearing.**



#### *Pinion Gear Bearing Preload Adjustment*

##### **Preload Measurement:**

- Check and adjust the bearing preload in the following case.
  - When any of the parts listed below are replaced with new ones.
    - Tapered roller bearings
    - Bevel gears
    - Bearing housing
    - Pinion gear joint
  - When the pinion gear nut is loosened, even if the purpose is not to replace the parts.
- Assemble the pinion gear bearing housing, and tighten the pinion gear nut to the specified torque. Oil seal installation is not required until the correct bearing preload is obtained.

#### CAUTION

**To start with, choose a shim or shims so that the bearings are just SNUG with NO play but also with NO preload. Any over-preload on the bearings could damage the bearings.**

**Final Gear Case and Oil**

- Apply a little hypoid gear oil to the bearings, and turn the gear shaft more than 5 turns to allow the bearings to seat.
- Measure the bearing preload. Bearing preload is defined as the force or torque which is needed to start the gear shaft turning.

**Preload for Pinion Gear Bearing**

**Using Spring Scale:**

3.0 ~ 5.0 N (0.30 ~ 0.50 kg, 0.7 ~ 1.1 lb)

**Using Torque Wrench:**

0.6 ~ 1.0 N·m (0.06 ~ 0.10 kgf·m, 5.2 ~ 8.7 in·lb)

**NOTE**

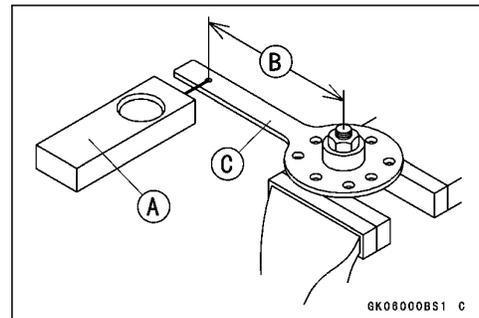
○ Preload can be measured either with a spring scale or a beam-type torque wrench. When measured with a spring scale, the preload is designated by force (N, kg, lb), and when measured with a torque wrench, it is designated by torque N·m, (kgf·m, in·lb).

**Using Spring Scale:**

- Hook the spring scale [A] on the handle at the point 200 mm (7.87 in.) [B] from the center of the gear shaft.
- Hold the bearing housing in a vise so that the gear shaft axis is vertical.
- Apply force to the handle horizontally and at a right angle to it.

**Special Tool - Pinion Gear Holder: 57001-1165 [C]**

- ★ If the preload is out of the specified range, replace the shims under the flat washer, and re-check the preload. Refer to the next paragraph to select suitable shims.



**Preload Adjustment:**

- To increase preload, decrease the thickness of the size of the shim(s). To decrease preload increase the thickness of the shim(s).
- Change the thickness a little at a time.
- Re-adjust the bearing preload, and re-adjust if necessary.

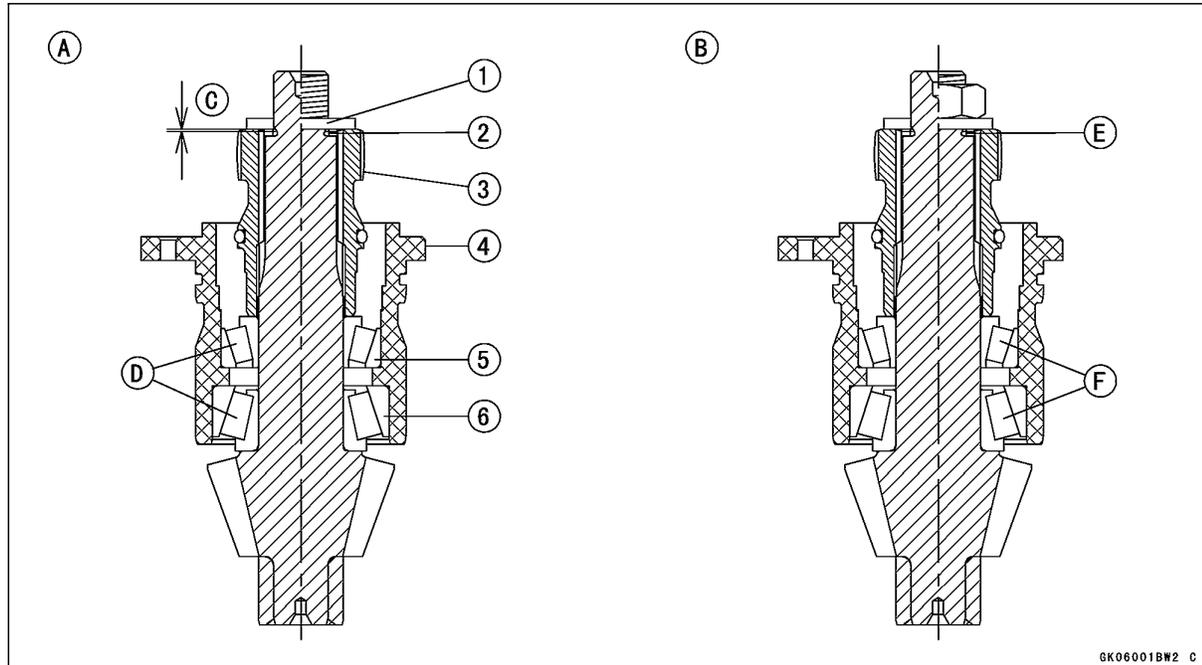
**Shims for Preload Adjustment**

Thickness	Part Number
0.1 (0.004 in.)	92025-1219
0.2 (0.008 in.)	92025-1220
0.3 (0.012 in.)	92025-1221
0.5 (0.020 in.)	92025-1222
0.6 (0.024 in.)	92025-1223
0.7 (0.028 in.)	92025-1224
0.8 (0.031 in.)	92025-1225
* 0.9 (0.035 in.)	92025-1226
1.0 (0.040 in.)	92025-1227
1.30 (0.051 in.)	92025-1214
1.32 (0.052 in.)	92025-1215
1.34 (0.053 in.)	92025-1216
1.36 (0.054 in.)	92025-1217
1.38 (0.0543 in.)	92025-1218

\*: Standard

# 11-16 FINAL DRIVE

## Final Gear Case and Oil



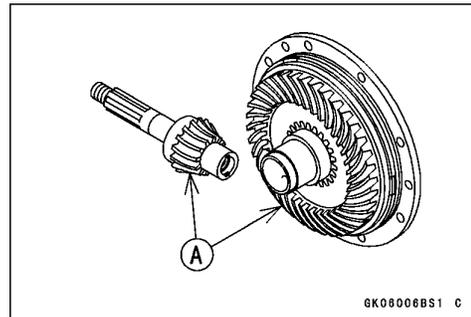
- 1. Washer
- 2. Shim(s)
- 3. Pinion Gear Joint
- 4. Bearing Housing

- 5. Tapered Roller Bearing
  - 6. Tapered Roller Bearing
- Before Tightening [A]  
After Tightening [B]

- Initial Clearance [C]  
Under No Preload [D]  
No Clearance [E]  
Under Preload [F]

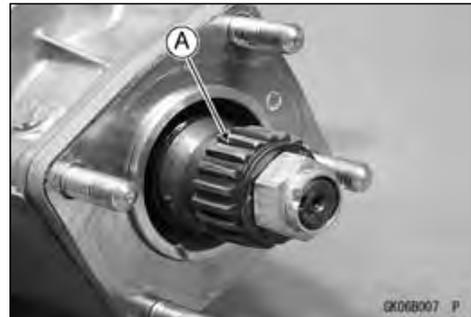
### Bevel Gear Inspection

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.



### Pinion Gear Joint Inspection

- Visually inspect the splines [A] of the pinion gear joint.
- ★ If they are badly worn or chipped, replace the joint with a new one. Also, inspect the propeller shaft sliding joint.

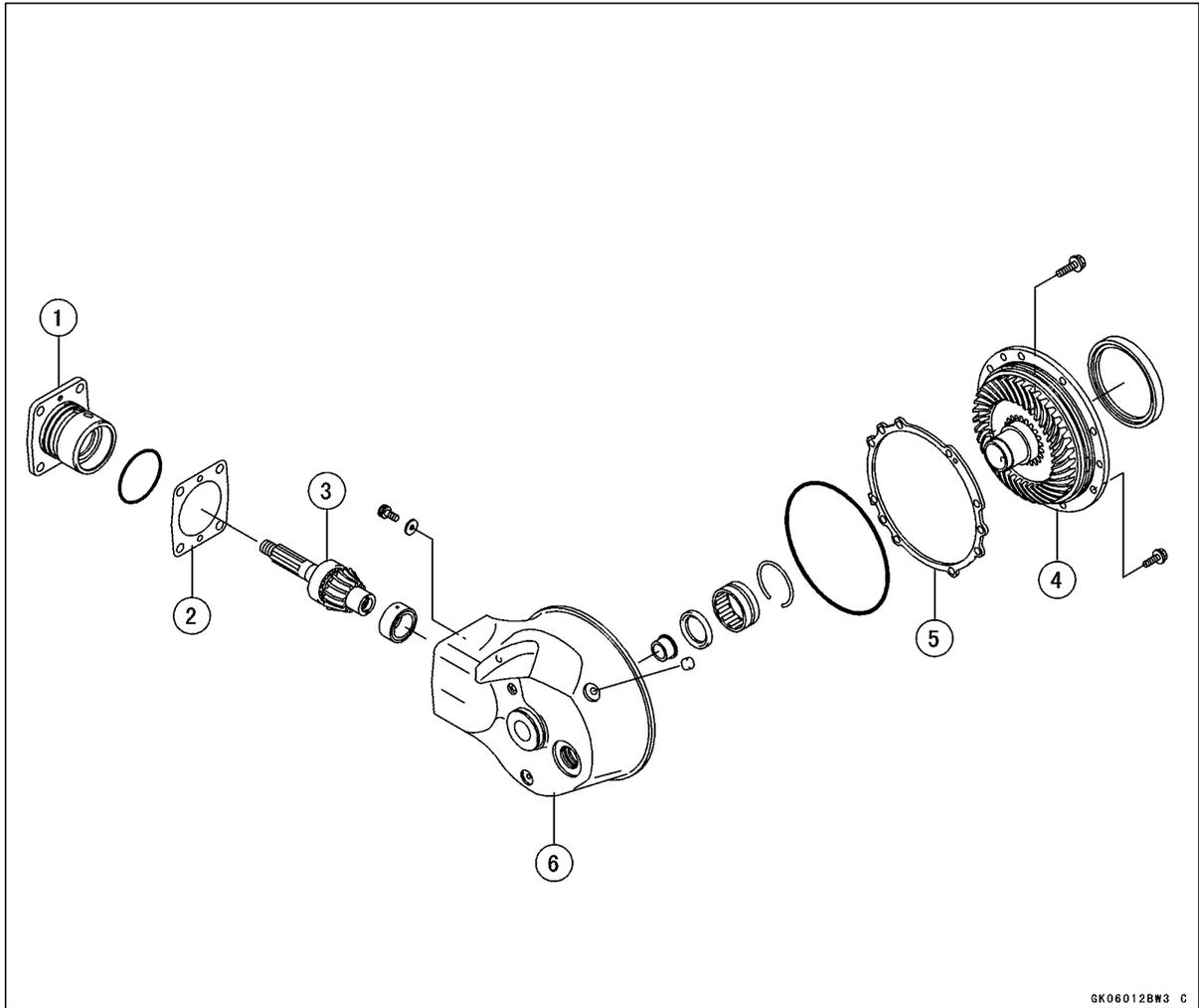


**Final Gear Case and Oil**

*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 locations is influenced by pinion gear position more than by ring gear position.

**Backlash-Related Parts**



- 1. Pinion Gear Bearing Housing
- 2. Pinion Gear Shim(s)

- 3. Pinion Gear Assy
- 4. Ring Gear Assy

- 5. Ring Gear Shim(s)
- 6. Final Gear Case

GK06012BW3 C

# 11-18 FINAL DRIVE

## Final Gear Case and Oil

### Ring Gear Shims for Backlash Adjustment

Thickness (mm)	Parts Number
0.15 (0.0059 in.)	92025-1783
0.5 (0.02 in.)	92025-1784
0.6 (0.023 in.)	92025-1785
0.7 (0.028 in.)	92025-1786
0.8 (0.031 in.)	92025-1787
0.9 (0.035 in.)	92025-1788
1.0 (0.039 in.)	92025-1789
1.2 (0.047 in.)	92025-1790

### Pinion Gear Shims for Tooth Contact Adjustment

Thickness (mm)	Parts Number
0.15 (0.0059 in.)	92180-0009
0.5 (0.02 in.)	92180-0010
0.6 (0.023 in.)	92180-0011
0.7 (0.028 in.)	92180-0012
0.8 (0.031 in.)	92180-0013
0.9 (0.035 in.)	92180-0014
1.0 (0.039 in.)	92180-0015
1.2 (0.047 in.)	92180-0016

### Backlash Adjustment

- Clean any dirt and oil off the bevel gear teeth with a high-flash point solvent.

#### CAUTION

**Do not install the O-ring or oil seals during adjustment.**

- Install the pinion gear bearing housing with the primary shim (**1.0 mm, 0.04 in. thickness**).
- Hold the pinion gear steady with the pinion gear holder [A] and tighten the final gear case mounting nuts to the specified torque.

**Special Tool - Pinion Gear Holder: 57001-1165**

**Torque - Final Gear Case Mounting Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

- Install the ring gear assy with the primary shim (**1.0 mm, 0.04 in. thickness**), and tighten the cover bolts to the specified torque.

**Torque - Final Gear Case Cover Bolts:**

**M10: 34 N·m (3.5 kgf·m, 25 ft·lb)**

**M8: 23 N·m (2.3 kgf·m, 17 ft·lb)**

- Check the backlash during tightening of the cover bolts, and stop tightening them immediately if the backlash disappears. Then, change the ring gear shim to a thicker one.

- Mount a dial gage [D] on a vise so that the tip of the gage is against the splines of the ring gear hub.
- To measure the backlash, turn the ring gear hub [B] back and forth [C]. The difference between the highest and the lowest gage reading is the amount of backlash.
- Measure backlash at three locations equally spaced on the splines.

**Final Bevel Gear Backlash: 0.06 ~ 0.09 mm (0.0024 ~ 0.0035 in.) (at ring gear hub splines)**

- ★ If the backlash is out of the limit, replace the ring gear shims. To increase backlash, increase the thickness of the shim(s). To decrease backlash, decrease the thickness of the shim(s).
- ★ Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.



## Final Gear Case and Oil

### *Tooth Contact Adjustment*

- Clean any dirt and oil off the bevel gear teeth with a high-flash point solvent.
- 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.*

- Hold the pinion gear assembly with the final gear case holder [A].

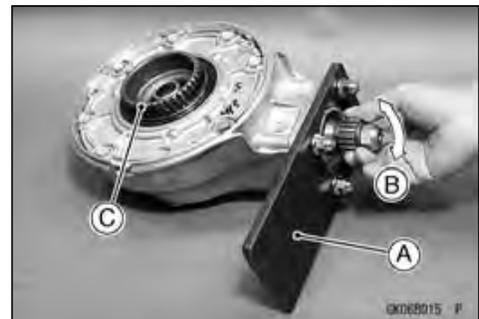
**Special Tool - Final Gear Case Holder: 57001-1250**

**Torque - Final Gear Case Mounting Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

- Turn the pinion gear for one revolution [B] back and forth, while creating a drag on the ring gear hub [C].
- Remove the ring gear assy and pinion gear assy 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), replace the ring gear shim(s) to correct the backlash before checking the tooth contact pattern.*





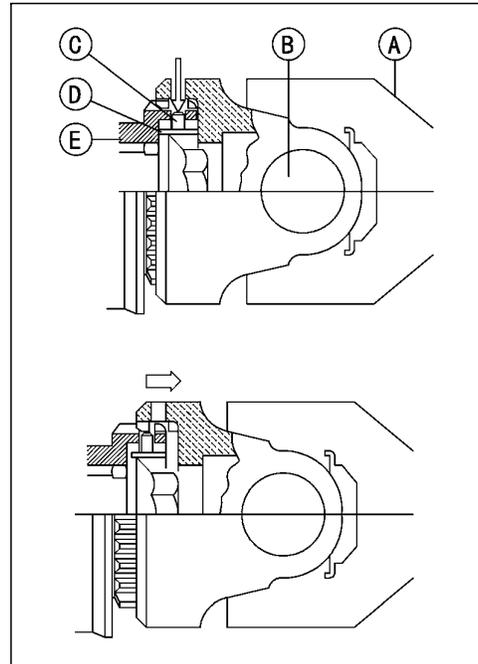
## Propeller Shaft

### Propeller Shaft Removal

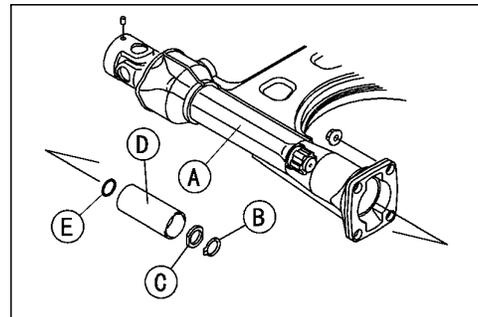
- Remove:
  - Final Gear Case (see this chapter)
  - Swingarm (see Suspension chapter)
- Remove the propeller shaft from the front driven gear joint.
- Turn the propeller shaft so that the lockpin access hole [A] in the propeller shaft comes outside.



- Move back the propeller shaft and slip the propeller shaft off the driven gear joint while pushing on the lockpin.
  - Propeller Shaft [A]
  - Universal Joint [B]
  - Lockpin [C]
  - Spring [D]
  - Driven Gear Joint [E]



- Remove the circlip [B] from the rear end of the propeller shaft [A] using a circlip pliers.
- Remove the washer [C] and pull out the propeller shaft sliding joint [D].



### Propeller Shaft Installation

- Check the O-ring [E] on the rear end of the propeller shaft for any kind of damage, and replace it if necessary.
- Lubricate the propeller shaft joint (see Periodic Maintenance chapter).
- After connecting the propeller shaft to the driven gear joint, pull the propeller shaft rearward to check that the shaft is secured in place by the lockpin.



### Propeller Shaft Joint Lubrication

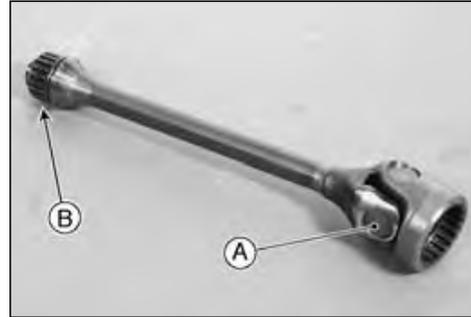
- Refer to Propeller Shaft Joint Lubrication in the Periodic Maintenance chapter.

## 11-22 FINAL DRIVE

### Propeller Shaft

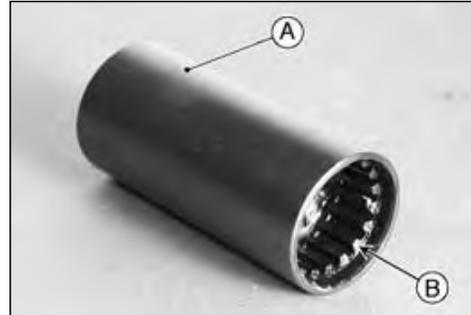
#### *Propeller Shaft Inspection*

- Check that the universal joint [A] works smoothly without rattling or sticking.
- ★ If it does not work smoothly, the needle bearings of the universal joint are damaged. Replace the propeller shaft assy with a new one.
- Visually inspect the bearing of the shaft and the wear of the splines [B] at the rear end of the shaft.
- ★ If it is bent at all, replace the propeller shaft assy. Do not attempt to straighten a bent shaft.



#### *Sliding Joint Inspection*

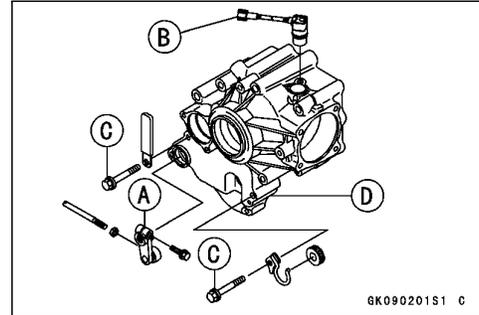
- Visually inspect the internal splines [B] of the propeller shaft sliding joint [A].
- ★ If they are badly worn or chipped, replace the joint with a new one.



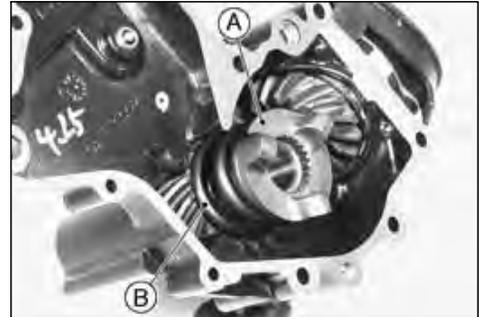
## Front Bevel Gears

### Front Gear Case Removal

- Remove:
  - Engine (see Engine Removal/Installation chapter)
  - Rear Shift Lever [A]
- The speed sensor connector [B] is disconnected during engine removal.
- Unscrew the front gear case bolts [C] and remove the front gear case [D].



- The cam follower [A] and the damper spring [B] come off with the gear case.
- Check that the shift shaft oil seal and replace it if damaged.



### Front Gear Case Installation

- Tighten the front gear case bolts to the specified torque.

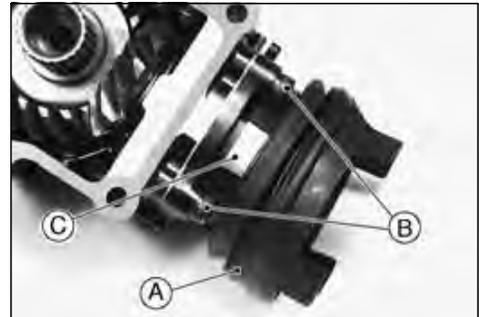
#### Torque - Front Gear Case Bolts:

**M8: 29 N·m (3.0 kgf·m, 22 ft·lb)**

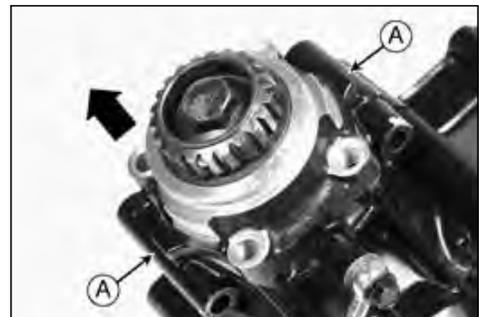
**M6: 12 N·m (1.2 kgf·m, 104 in·lb)**

### Front Gear Case Disassembly

- Remove:
  - Front Gear Case (see this chapter)
  - Cam Follower
  - Damper Spring
  - Rubber Boot [A]
- Remove the driven gear assy mounting bolts [B] and pry the assy [C] off the case.



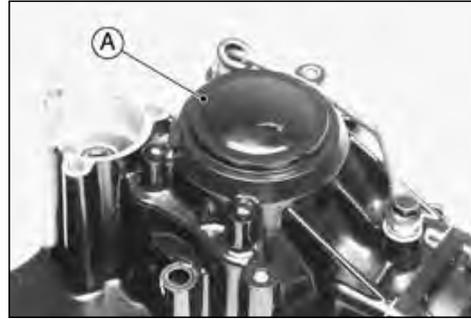
- Raise the driven gear, using the following pry points [A].



## 11-24 FINAL DRIVE

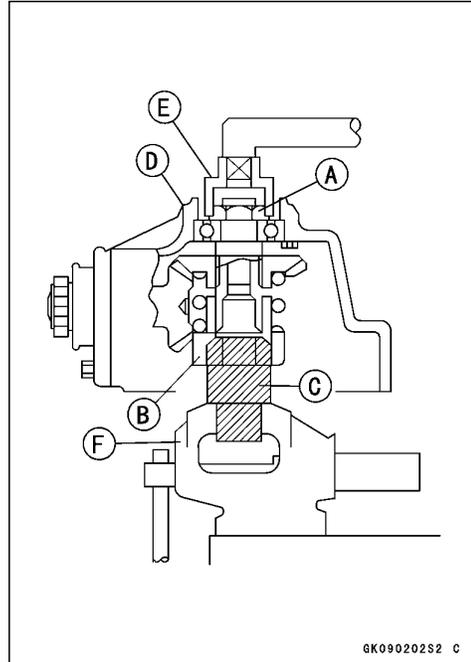
### Front Bevel Gears

- Remove the drive gear assy as follows.
- Pry off the gear case cap [A] with a tool.



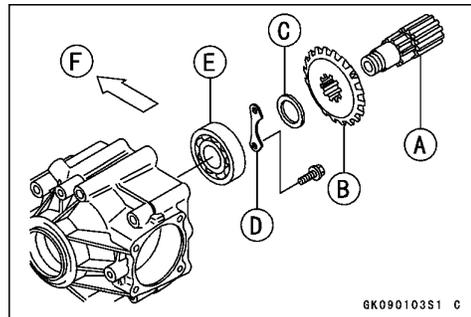
- Pry open the drive gear nut [A] with a small chisel.
- Install:
  - Damper Spring
  - Cam Follower [B]
- Unscrew the drive gear nut while holding the drive gear shaft with the drive shaft holder [C] (special tool).
  - Front Gear Case [D]
  - Socket Wrench [E]
  - Vise [F]

**Special Tool - Drive Shaft Holder: 57001-1407**



- Pull off the drive gear shaft [A], the drive gear [B], and shim(s) [C].
- Remove the bearing holder [D] from the gear case.
- Remove the drive gear shaft ball bearing [E] using the bearing driver set.
  - Front [F]

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



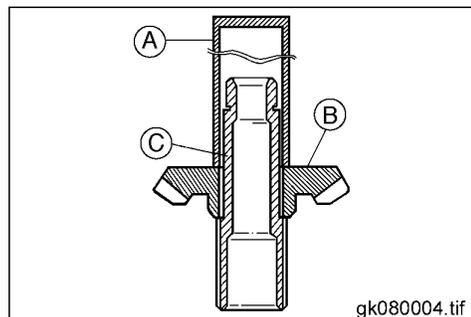
#### *Front Gear Case Assembly*

- The drive and driven gear are lapped as a set in the factory to get the best tooth contact. They must be replaced as a set.
- Press the drive gear [B] slowly with the driver [A] onto the shaft [C].

**Special Tool - Bearing Driver: 57001-382**

**Non-permanent Locking Agent -  
Bearing Retainer Bolts**

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



## Front Bevel Gears

- Be sure to check and adjust the bearing preload, the bevel gear backlash, and tooth contact, when any of the backlash-related parts are replaced (see Front Bevel Gear Adjustment).
- After completing all adjustment, reassemble the front gear case.
- Replace the drive gear nut with a new one.
- Apply molybdenum disulfide oil to the threads and seating surface of the nut, and tighten it to the specified torque to settle the bearings in place.
- Loosen the nut completely and retighten it to the specified torque.

**Torque - Drive Gear Nut: 265 N·m (27 kgf·m, 195 ft·lb)**

- Stake the nut to secure it in place.

### CAUTION

**When staking the nut, be careful not to apply shock to the shaft and its bearing. Such a shock could damage the shaft and/or bearing.**

- Install the shim [A].
- Install the driven gear assy so that the pry ribs [B] and machined surfaces [C] align.
- Tighten the driven gear assy mounting bolts to the specified torque.

**Torque - Driven Gear Assy Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- ★ If the oil pipe [A] was removed, use a new flat washer on each side of the fittings, and tighten the banjo bolts to the specified torque.
- Tighten the front banjo bolt [B] first, then the rear banjo bolt [C].
- Install the rear shift lever [D], aligning the lever slit [E] with the punch mark of the shaft.

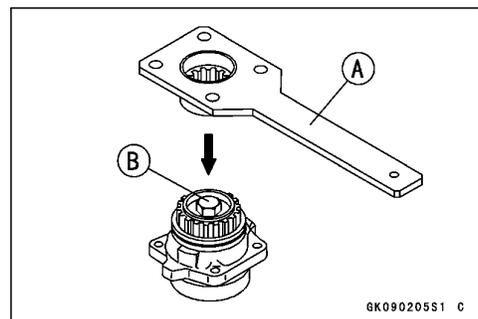
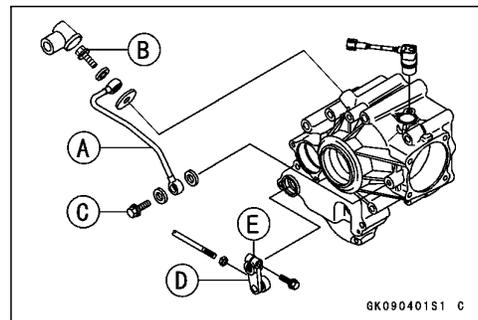
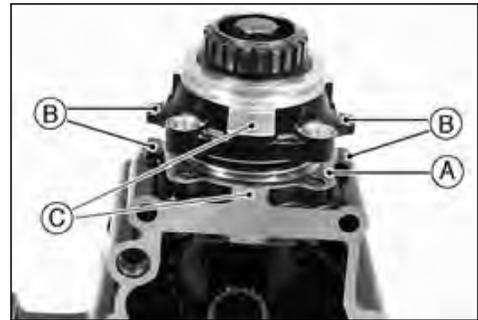
**Torque - Oil Pipe Banjo Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)**

**Rear Shift Lever Clamp Bolt: 12 N·m (1.2 kgf·m, 104 in·lb)**

### Driven Gear Disassembly

- Holding the driven gear joint with the driven gear holder [A] in a vise, unscrew the driven gear bolt [B].

**Special Tool - Driven Gear Holder: 57001-1027**



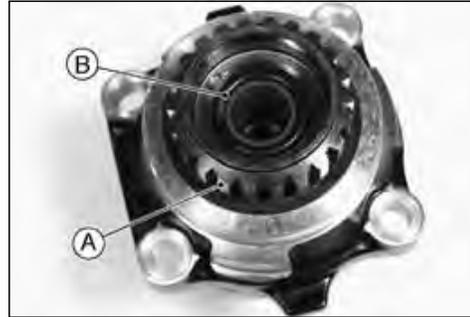
## 11-26 FINAL DRIVE

### Front Bevel Gears

- Remove the driven gear joint [A] with the O-ring [B].
- Remove the driven gear from the bearing housing.
- Remove the oil seal from the housing with a hook, and pull the tapered roller bearing out of the housing.
- Remove the tapered roller bearing which is pressed onto the driven gear shaft with the bearing puller and adapter.

**Special Tools - Bearing Puller: 57001-158**

**Adapter: 57001-317**



#### *Driven Gear Assembly*

- Replace the driven gear bolt with a new one.
- The drive and driven gears are lapped as a set at the factory to get the best tooth contact. They must be replaced as a set.
- Be sure to check and adjust the bearing preload, the bevel gear backlash, and tooth contact (see Front Bevel Gear Adjustment).
- Drive the tapered roller bearing inner race [B] onto the driven gear shaft [C] using the bearing driver [A].

**Special Tool - Bearing Driver: 57001-382**

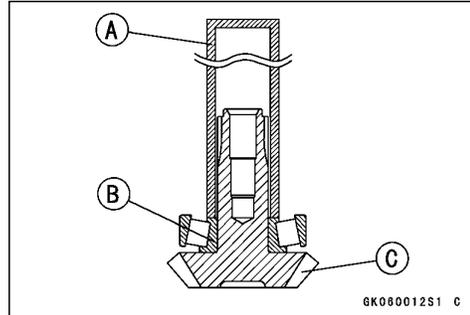
- After completing the bearing preload adjustment, reassemble the driven gear assy.
- Using the bearing driver set, press the oil seal in until the face of the seal is level with the end of the bearing housing hole.

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

- Apply molybdenum disulfide oil to the threads and the seating surface of the driven gear bolt.
- Tighten the driven gear bolt to the specified torque.

**Torque - Driven Gear Bolt: 137 N·m (14 kgf·m, 101 ft·lb)**

- Stake [A] the driven gear bolt to prevent it from loosening.



#### **CAUTION**

**When staking the bolt, be careful not to apply shock to the driven gear and their bearings. Such a shock could damage the driven gear and/or bearings.**



#### *Damper Cam Removal*

- Remove the front gear case (see this chapter).
- Remove the retainer and needle bearing of the output shaft.
- Remove the clutch push rod guide [A] and bolts, and crankcase bearing upper retainer and bolts.
- Insert a bolt ( $\phi 12$  mm, L100 mm,  $\phi 0.47$  in., L3.94 in.) [B] into the engine mounting bolt hole.
- Unscrew the damper cam nut [C] using a damper cam holder [D] (special tool) and deep socket wrench.

**Special Tool - Damper Cam Holder: 57001-1025**



**Front Bevel Gears**

*Damper Cam Installation*

- Replace the damper cam nut with a new one.
- Remove the clutch push rod guide [A] and bolts, and crankcase bearing lower retainer and bolts.
- Insert the bolt ( $\phi 12$  mm, L100 mm  $\phi 0.47$  in., L3.94 in.) [B] into the engine mounting bolt hole.
- Tighten the damper cam nut [C] to the specified torque.
- Apply oil to the threads and the seating surface of the nut.

**Torque - Damper Cam Nut: 226 N-m (23 kgf-m, 166 ft-lb)**

**Special Tool - Damper Cam Holder: 57001-1025**

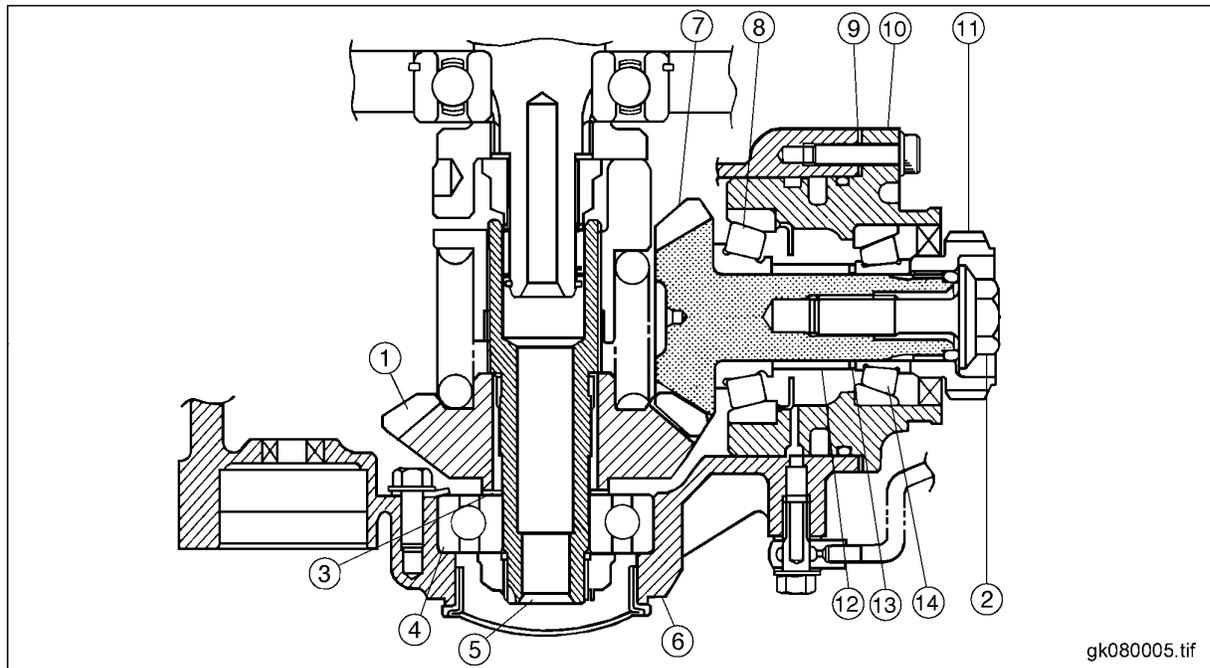


*Front Bevel Gear Adjustment*

In order to prevent one gear from moving away from the other gear under load, the tapered roller bearings must be properly **preloaded**. Also the **backlash** (the distance one gear will move back and forth without moving the other gear) and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.

Above three adjustments are of critical importance and must be carried out in the correct sequence and method.

- Preload adjustment is necessary whenever the driven gear bolt [2] loosened, even if the purpose is not to replace the parts.



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**Backlash-related Parts**

- 1. Drive Gear
- 2. Driven Gear Bolt
- 3. Drive Gear Shim(s)
- 4. Ball Bearing
- 5. Drive Gear Shaft
- 6. Front Gear Case

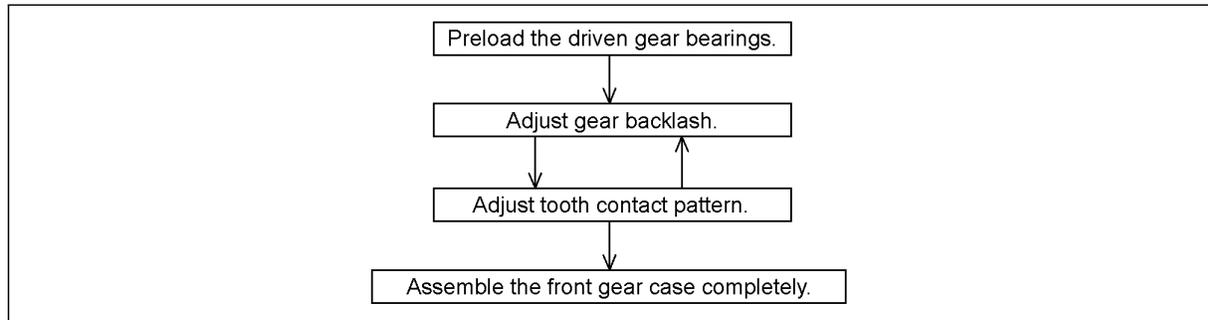
**Preload-related Parts**

- 7. Driven Gear
- 8. Tapered Roller Bearing
- 9. Driven Gear Shim(s)
- 10. Driven Gear Bearing Housing
- 11. Driven Gear Joint
- 12. Collar (Preload Adjustment)
- 13. Spacer (Preload Adjustment)
- 14. Tapered Roller Bearing

# 11-28 FINAL DRIVE

## Front Bevel Gears

### Front Bevel Gear Adjustment



○When any of the backlash-related parts are replaced, or the driven gear bolt is loosened; even if the purpose is not to replace the parts, be sure to check and adjust the bearing preload, the bevel gear backlash, and tooth contact by replacing shims.

#### *Preload Adjustment*

● Install the driven gear assy, and tighten the driven gear nut to the specified torque.

**Torque - Driven Gear Bolt: 137 N·m (14 kgf·m, 101 ft·lb)**

○Do not install the oil seal, and O-ring, and do not stake the bolt until the correct bearing preload is obtained.

#### **CAUTION**

**To start with, choose a shim or collar so that the bearings are just SNUG with NO play and also with NO preload.**

**Any overpreload on the bearings could damage the bearings.**

- Apply a little engine oil to the bearings, and turn the gear shaft more than 5 turns to allow the bearings to seat.
- Measure the bearing preload. Bearing preload is defined as a force or torque which is needed to start the gear shaft turning.

#### **Preload for Driven Gear Bearing**

**Using Spring Scale:**

**3 ~ 4 N (0.3 ~ 0.5 kg, 0.6 ~ 1.0 lb)**

**Using Torque Wrench:**

**0.5 ~ 0.9 N·m (0.05 ~ 0.09 kgf·m, 4.3 ~ 7.8 in·lb)**

#### **NOTE**

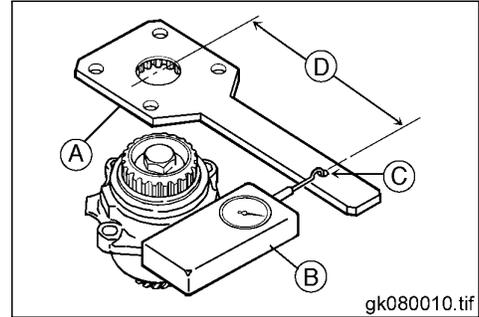
○Preload can be measured either with a spring scale or a beam-type torque wrench. When measured with a spring scale, the preload is designated by force (N, kg, lb), and when measured with a torque wrench, it is designated by torque (N·m, kgf·m, in·lb).

**Front Bevel Gears**

*Preload Measurement with Spring Scale*

- Hold the bearing housing in a vise so that the gear shaft axis is vertical.
- Hook [C] the spring scale [B] on the driven gear holder [A] at a point 200 mm (7.9 in.) [D] apart from the center of the gear shaft.
- Apply force to the handle horizontally and at a right angle to it.

**Special Tool - Driven Gear Holder: 57001-1027**



- ★ If the preload is out of specified range, replace the bearing collar and/or spacer. To increase preload, decrease the stack length of the collar and spacer. To decrease preload, increase the stack length of the collar and spacer.
- ★ Change the stack length a little at a time.
- Recheck the bearing preload, and readjust if necessary.

**Collars for Preload Adjustment**

Length (mm)	Part Number
22.8 (0.898 in.)	92027-1152
22.9 (0.902 in.)	92027-1153
23.0 (0.906 in.)	92027-1154
23.1 (0.909 in.)	92027-1155
23.2 (0.913 in.)	92027-1156
23.3 (0.917 in.)	92027-1157
23.4 (0.921 in.)	92027-1158
23.5 (0.925 in.)	92027-1159
23.6 (0.929 in.)	92027-1160
23.7 (0.933 in.)	92027-1161
23.8 (0.937 in.)	92027-1162
23.9 (0.941 in.)	92027-1163
24.0 (0.945 in.)	92027-1164
24.1 (0.949 in.)	92027-1165

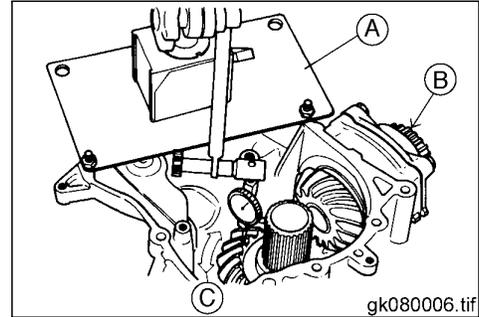
**Spacers for Preload Adjustment**

Thickness (mm)	Part Number
1.70 (0.0669 in.)	92025-1072
1.72 (0.0677 in.)	92025-1073
1.74 (0.0685 in.)	92025-1074
1.76 (0.0693 in.)	92025-1075
1.78 (0.0701 in.)	92025-1076
1.80 (0.0709 in.)	92025-1077



**Front Bevel Gears**

- Install a holder [A] with 6 mm bolts and nuts on the front gear case to mount a dial gage.
- Set up a dial gage against a drive gear tooth to check gear backlash. The gage stem must be in line with the direction of tooth travel.
- To measure the backlash, move the drive gear back and forth [C] while holding [B] the driven gear steady with a tool. The difference between the highest and lowest gage readings is the amount of backlash.
- ★ If the backlash is not within the limit, replace the gear shim(s) at the drive and/or driven gear. To increase backlash, increase the thickness of the shim(s). To decrease backlash, decrease the thickness of the shim(s).
- ★ Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.



**NOTE**

○ It is OK to pack two shims. Do not pack three or more shims.

**Front Bevel Gear Backlash (at the gear tooth)**  
**0.10 ~ 0.15 mm (0.039 ~ 0.0059 in.)**

**Shims for Drive Gear**

Thickness (mm)	Parts Number
0.15 (0.0059 in.)	92025-1688
0.5 (0.02 in.)	92025-1689
0.6 (0.023 in.)	92025-1690
0.7 (0.028 in.)	92025-1691
0.8 (0.031 in.)	92025-1692
0.9 (0.035 in.)	92025-1693
1.0 (0.039 in.)	92025-1694
1.1 (0.043 in.)	92025-1695
1.2 (0.047 in.)	92025-1696

**Shims for Driven Gear**

Thickness (mm)	Parts Number
0.1 (0.039 in.)	92025-1826
0.15 (0.0059 in.)	92025-1818
0.5 (0.02 in.)	92025-1819
0.6 (0.023 in.)	92025-1820
0.7 (0.028 in.)	92025-1821
0.8 (0.031 in.)	92025-1822
0.9 (0.035 in.)	92025-1823
1.0 (0.039 in.)	92025-1824
1.2 (0.047 in.)	92025-1825

**Tooth Contact Adjustment**

- Clean any dirt and oil off the bevel gear teeth with a high-flash point solvent.
- Apply checking compound to 4 or 5 teeth on the driven 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.

## 11-32 FINAL DRIVE

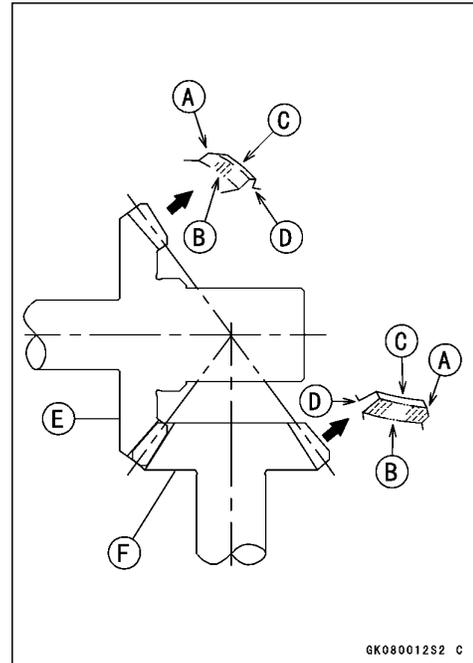
### Front Bevel Gears

- Turn the driven gear for 3 or 4 revolutions in the drive and reverse (coast) directions, while creating a drag on the drive gear.
- 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 little closer to the toe of the tooth.
- ★ If the tooth contact pattern is incorrect, replace the shim(s) at the driven gear and shim(s) at the driven 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 goes out of standard range after changing shims, correct the backlash before checking the tooth contact pattern.
- It is OK to pack two shims. Do not pack three or more shims.

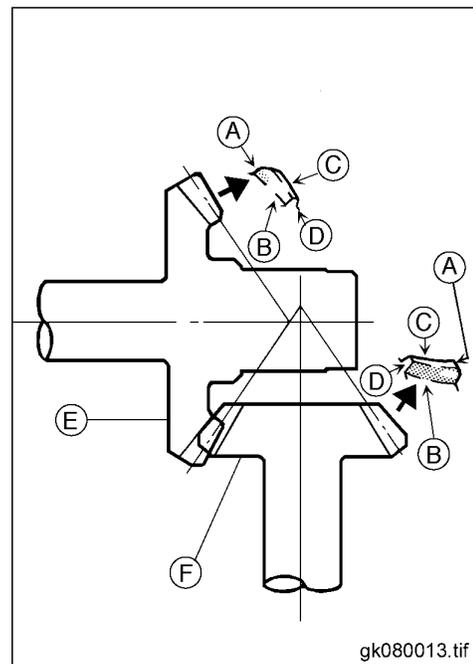
Heel [A]  
Bottom [B]  
Top [C]  
Toe [D]  
Drive Gear [E]  
Driven Gear [F]



#### Incorrect Tooth Contact Patterns (Example 1):

- Increase the thickness of the drive gear shim(s) by 0.05 mm (0.002 in.), and/or increase the thickness of the driven 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.

Heel [A]  
Bottom [B]  
Top [C]  
Toe [D]  
Drive Gear [E]  
Driven Gear [F]

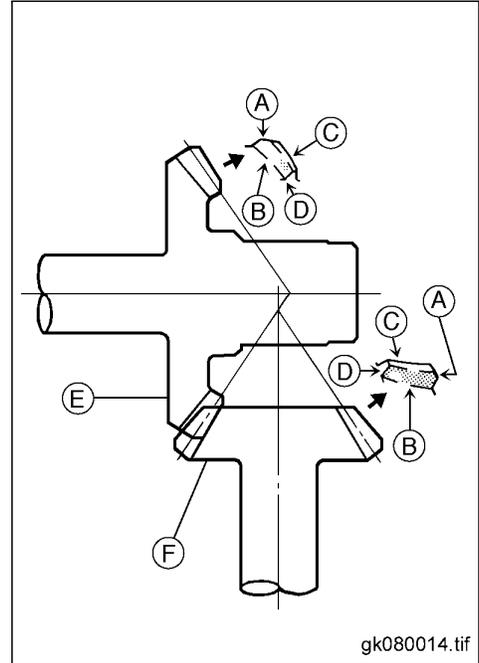


**Front Bevel Gears**

**Incorrect Tooth Contact Patterns (Example 2):**

- Decrease the thickness of the drive gear shim(s) by 0.05 mm (0.002 in.), and/or decrease the thickness of the driven 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.

- Heel [A]
- Bottom [B]
- Top [C]
- Toe [D]
- Drive Gear [E]
- Driven Gear [F]

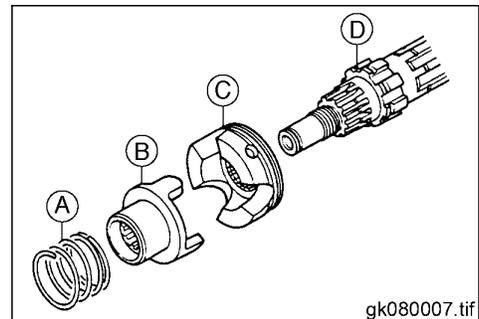


*Bevel Gear Inspection*

- Visually check the bevel gears for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.

*Cam Damper Inspection*

- Visually inspect the spring [A], cam follower [B], damper cam [C], and output shaft [D].
- ★ Replace the damaged parts.



## 11-34 FINAL DRIVE

### Bearing and Oil Seal

#### Ball or Needle Bearing Replacement

- Using the bearing driver set or the oil seal & bearing remover, remove the bearings.

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

**Bearing Driver Set: 57001-1129**

#### NOTE

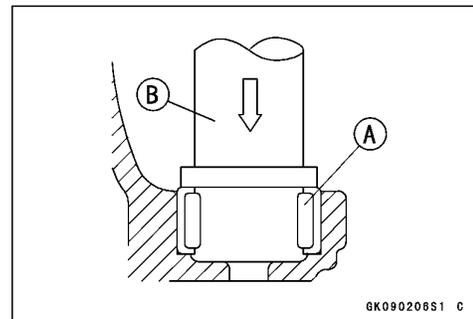
- In the absence of the above mentioned tools, satisfactory results may be obtained by heating the case to approximately 93°C (200°F) max., and tapping the bearing in or out.

#### CAUTION

**Do not heat the case with a blowtorch. This will warp the case. Soak the case in oil and heat the oil.**

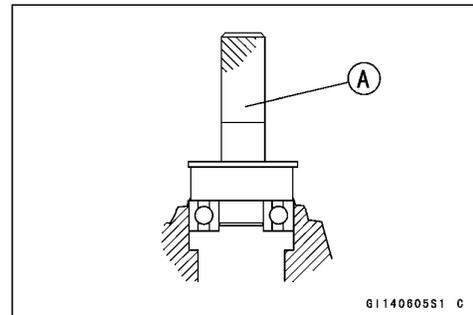
- Install a new needle bearing [A] with the marked side facing out until it bottoms out, using the bearing driver set [B]. This prevents bearing damage.

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



- Using a press and the bearing driver set [A], install a new ball bearing until it stops at the bottom of the case.

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

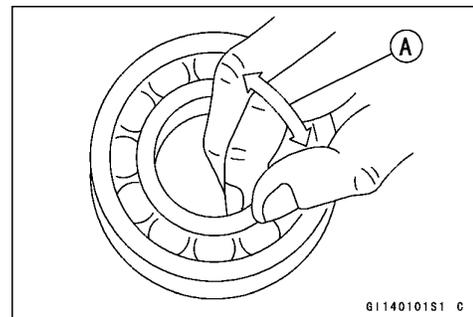


#### Ball Bearing Wear

#### CAUTION

**Do not remove the bearings for inspection. Removal may damage them.**

- 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.



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## Bearing and Oil Seal

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### *Tapered Roller Bearing Inspection*

<b>CAUTION</b>
----------------

<b>Do not remove the tapered roller bearing for inspection. Removal may damage them.</b>
--

- Visually inspect the bearing in the front and final gear cases for abrasion, color change, or other damage.
- ★ If there is any doubt as to the condition of the bearing, replace it.

### *Needle Bearing Inspection*

<b>CAUTION</b>
----------------

<b>Do not remove the needle bearing in the final gear case for inspection. Removal may damage them.</b>
---

- Check the needle bearings in the front and final gear cases.
- The rollers in the 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.



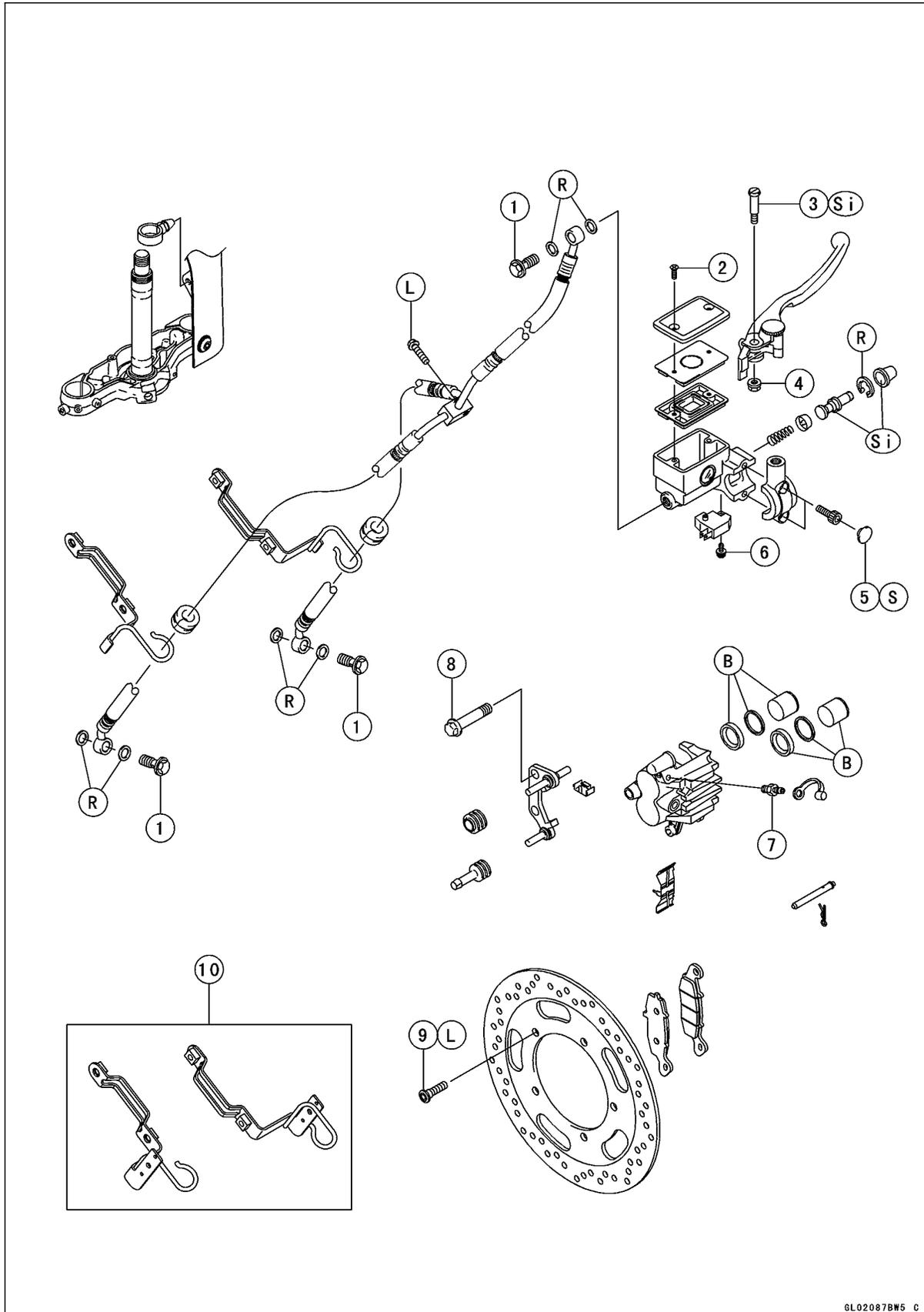
# Brakes

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# 12-2 BRAKES

## Exploded View



GL02087BW5 C

## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Brake hose banjo bolts	25	2.5	18	
2	Front brake reservoir cap screws	1.5	0.15	13 in·lb	
3	Brake lever pivot bolt	1.0	0.10	87 in·lb	Si
4	Brake lever pivot bolt locknut	5.9	0.60	52 in·lb	
5	Front master cylinder clamp bolts	8.8	0.9	78 in·lb	S
6	Front brake light switch screw	1.2	0.12	10 in·lb	
7	Caliper bleed valves	7.8	0.8	69 in·lb	
8	Front caliper mounting bolts	34	3.5	25	
9	Brake disc bolts	27	2.8	20	L

10. Hose Holders (U.S.A. and Canada Models)

B: Apply brake fluid.

L: Apply a non-permanent locking agent.

R: Replacement Parts

S: Follow the specific tightening sequence.

Si: Apply silicone grease or PBC grease.



## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear master cylinder mounting bolts	25	2.5	18	
2	Brake hose banjo bolts	25	2.5	18	
3	Rear master cylinder push rod locknut	18	1.8	13	
4	Brake pedal clamp bolt	25	2.5	18	
5	Caliper bleed valves	7.8	0.8	69 in·lb	
6	Rear caliper mounting bolts	34	3.5	25	
7	Rear caliper holder bolt	64	6.5	47	
8	Brake disc bolts	27	2.8	20	L

B: Apply brake fluid.

G: Apply grease.

L: Apply a non-permanent locking agent.

R: Replacement Parts

Si: Apply silicone grease or PBC grease.

## 12-6 BRAKES

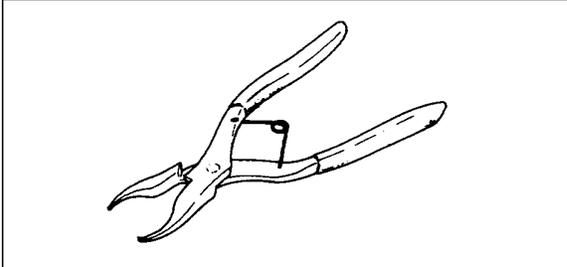
### Specifications

Item	Standard	Service Limit
<b>Brake Lever, Brake Pedal:</b> Brake lever position Brake lever free play Pedal free play Pedal position	No.1 Non-adjustable Non-adjustable About 110 mm (4.33 in.) (height from pedal top to footpeg top)	5-way adjustable - - - - - - - - -
<b>Brake Fluid:</b> Grade	DOT4	- - -
<b>Brake Pads:</b> Pad lining thickness:	Front 4.5 mm (0.2 in.) Rear 7.5 mm (0.295 in.)	1 mm (0.04 in.) 1 mm (0.04 in.)
<b>Brake Discs:</b> Thickness: Runout	Front 4.8 ~ 5.2 mm (0.19 ~ 0.20 in.) Rear 6.8 ~ 7.2 mm (0.268 ~ 0.283 in.) TIR 0.15 mm (0.0059 in.) or less	4.5 mm (0.18 in.) 6.0 mm (0.24 in.) TIR 0.3 mm (0.01 in.)

**Special Tool**

---

**Inside Circlip Pliers :**  
**57001-143**



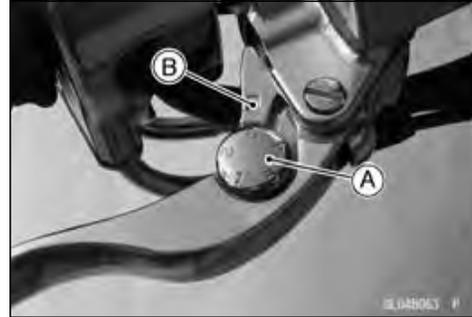
## 12-8 BRAKES

### Brake Lever, Brake Pedal

#### Brake Lever Position Adjustment

The brake lever adjuster has 5 positions so that the brake lever position can be adjusted to suit the operator's hand.

- Push the lever forward and turn the adjuster [A] to align the number with the arrow mark [B] on the lever holder.
- The distance from the grip to the lever is minimum at number 5 and maximum at number 1.



#### Brake Pedal Position Adjustment

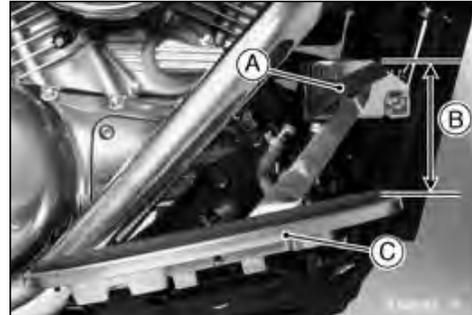
- Check that the brake pedal [A] is in the correct position.

##### Pedal Position

**Standard:** About 110 mm (4.33 in.) [B]  
(height from pedal top to footboard top [C])

##### NOTE

- Usually it's not necessary to adjust the pedal position, but always adjust it when push rod locknut has been loosened.
  - If the push rod length cannot be adjusted by turning the clevis, the brake pedal may be deformed or incorrectly installed.
- Unscrew the brake fluid reservoir cover bolt [A] and remove the brake fluid reservoir cover [B].

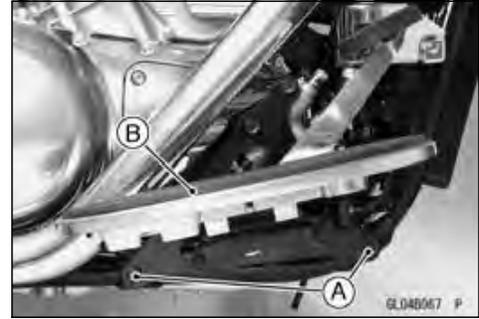


- Unscrew the reservoir bolt [A] and take off the brake fluid reservoir [B].

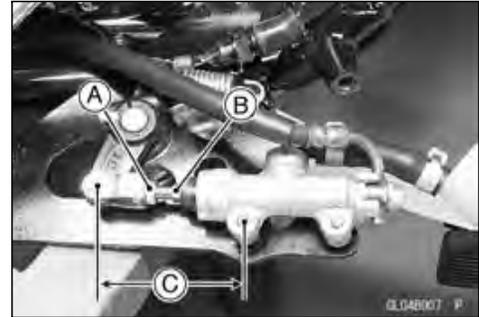


## Brake Lever, Brake Pedal

- Remove the right front footboard bracket bolts [A] and turn over the footpeg [B].

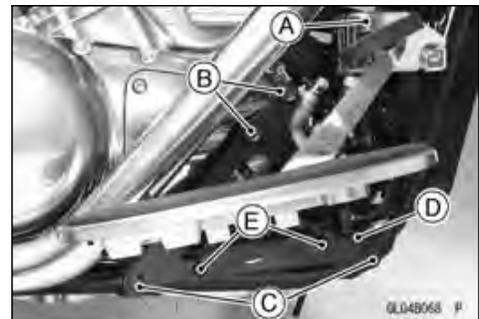


- Loosen the locknut [A] and turn the push rod with the hex head [B] to achieve the correct pedal position.
- ★ If the length [C] is  $80 \pm 1 \text{ mm}$  ( $3.1 \pm 0.04 \text{ in.}$ ), the pedal position will be within the standard range.
- Tighten:
  - Torque - Push Rod Locknut: 18 N·m (1.8 kgf·m, 13 ft·lb)**

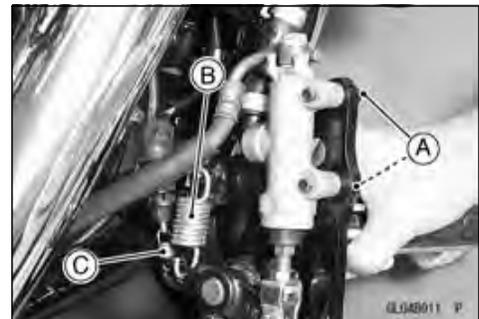


### Brake Pedal Removal

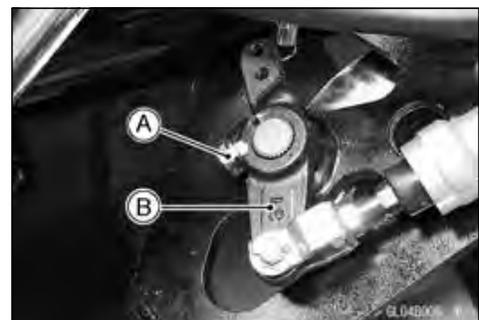
- Remove the brake fluid reservoir [A] (see Brake Pedal Position Adjustment).
- Loosen the rear master cylinder mounting bolts [B].
- Remove the right front footboard bracket bolts [C] and footboard bolts [E], and turn over the footboard bracket [D].



- Remove:
  - Rear Master Cylinder Mounting Bolts [A]
  - Brake Pedal Return Spring [B]
  - Brake Switch Return Spring [C]



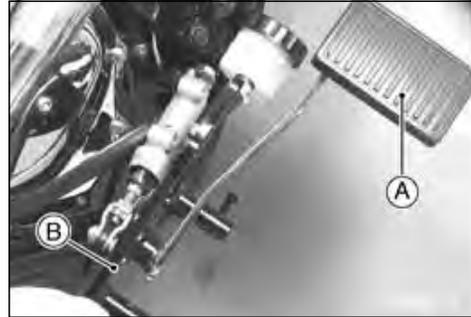
- Unscrew the brake pedal clamp bolt [A].
- Pull out the brake lever [B] with the master cylinder installed.



## 12-10 BRAKES

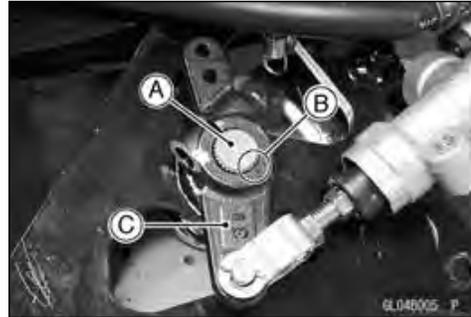
### Brake Lever, Brake Pedal

- Pull out the brake pedal [A] from the right footboard bracket [B].



#### *Brake Pedal Installation*

- Apply grease to the brake pedal shaft.
- Install the pedal shaft [A] so that the punched mark on the shaft is aligned [B] with the punched mark on the brake lever [C].
- Install:
  - Brake Pedal Return Spring
  - Brake Switch Return Spring
- Tighten:
  - Torque - Brake Pedal Clamp Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**
  - Front Footboard Bracket Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
  - Rear Master Cylinder Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**
- Replenish the fluid in the reservoir, and bleed the brake line (see Brake Line Bleeding).
- Check the brake for proper braking power, no brake drag, and no fluid leakage.



#### **⚠ WARNING**

**Do not attempt to ride the motorcycle until a full brake pedal is obtained by pumping the brake pedal until the pads are against the disc. The brake will not function on the first application of the pedal if this is not done.**

- Check the brake pedal position and adjust it if necessary.
- Check the rear brake light switch operation and adjust the switch if necessary (see Periodic Maintenance chapter).

## Calipers

### Front Caliper Removal

- Loosen the banjo bolt [A] at the brake hose lower end, and tighten it loosely.
- Unscrew the caliper mounting bolts [B].

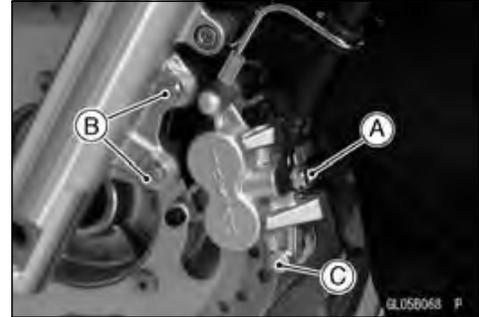
#### CAUTION

**Do not loosen the caliper assembly bolt [C]. Take out only the caliper mounting bolts for caliper removal. Loosening the caliper assembly bolts will cause brake fluid leakage. Immediately wash away any brake fluid that spills.**

- Take off the caliper.
- Unscrew the banjo bolt and remove the brake hose from the caliper.

### Rear Caliper Removal

- Remove:
  - Caliper Mounting Bolts [A]
  - Brake Hose [B]
  - Rear Caliper [C]



### Caliper Installation

- Install the caliper and brake hose lower end.
- Replace the washer on each side of hose fitting with new ones.
- Tighten the caliper mounting bolts and banjo bolt.

**Torque - Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

**Rear Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

**Brake Hose Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Check the fluid level in the brake reservoirs.
- Bleed the brake line (see Brake Line Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.

#### ⚠ WARNING

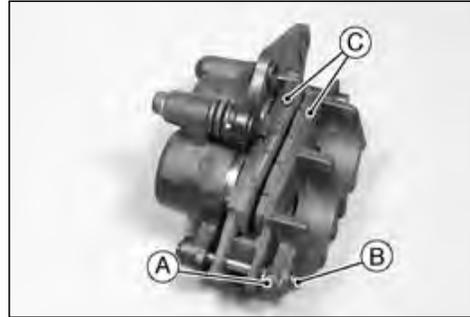
**Do not attempt to ride the motorcycle until a full brake lever or pedal is obtained by pumping the brake lever or pedal until the pads are against the disc. The brakes will not function on the first application of the lever or pedal if this is not done.**

## 12-12 BRAKES

### Calipers

#### Front Caliper Disassembly

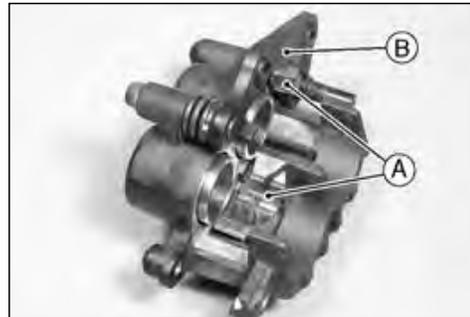
- Remove:
  - Caliper (see Front Caliper Removal)
  - Cotter Pin [A]
  - Pin [B]
  - Pads [C]
- Push the piston in.



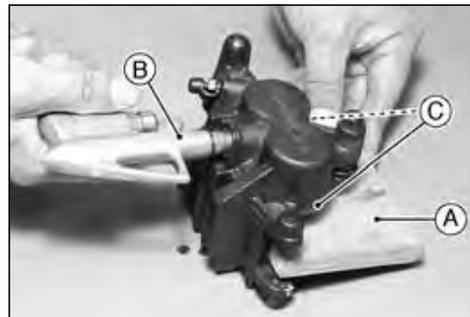
- Remove:
  - Pad Springs [A]
  - Caliper Holder [B]
- Using compressed air, remove the piston.

#### **⚠ WARNING**

**To avoid serious injury, never place your fingers or palm inside the caliper opening. If you apply compressed air into the caliper, the piston may crush your hand or fingers.**



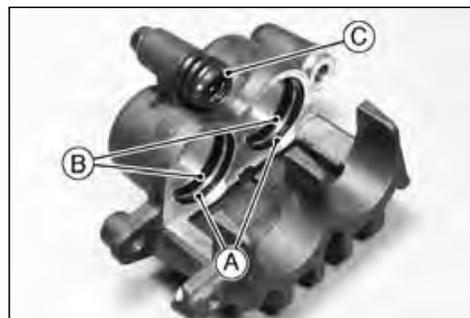
- Insert a wooden board [A] 5 mm (0.2 in.) thick inside the caliper opening.
- Apply compressed air [B] to the banjo bolt hole to allow the pistons [C] to protrude and stop at the wooden board.
- Remove the wooden board and pull out the piston by hand.
- ★ If compressed air is not available, with the brake hose still attached, apply the brake lever to remove the pistons. The remaining process is as described above.



- Remove:
  - Dust Seals [A]
  - Fluid Seals (piston seals) [B]
  - Friction Boot [C]
  - Bleed Valve

#### **CAUTION**

**Immediately wash away any brake fluid that spills.**



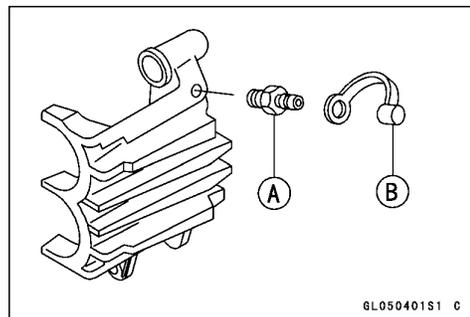
#### Front Caliper Assembly

- Clean all parts other than the outer and inner pads.

#### **CAUTION**

**For cleaning the parts, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol.**

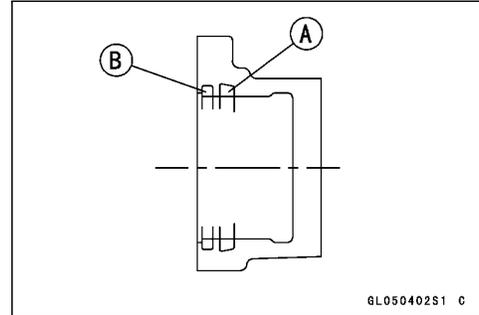
- Install the bleed valve [A] and the rubber cap [B].  
**Torque - Caliper Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)**



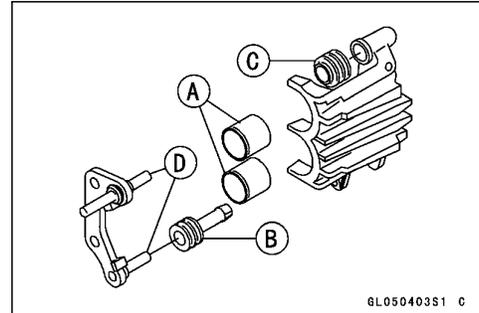
GL050401S1 C

**Calipers**

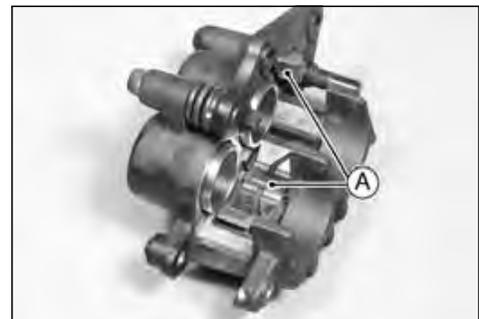
- Replace the fluid seals [A] with new ones, apply brake fluid to them, and install them in the caliper body. Either side of the fluid seal may face outboard.
- Check the dust seals [B] and replace them with new ones if they are damaged.



- Apply brake fluid to the inside of the cylinders and to the outside of the pistons and push the pistons [A] into the cylinders.
- Check the friction boot [B] and dust boot [C] and replace them with new ones if they are damaged.
- Apply a thin coat of silicon grease to the holder shafts [D] and the holder holes.



- Install the pad springs [A].
- Install the pads.
- Wash the caliper with water to remove brake fluid and wipe it off.



*Rear Caliper Disassembly*

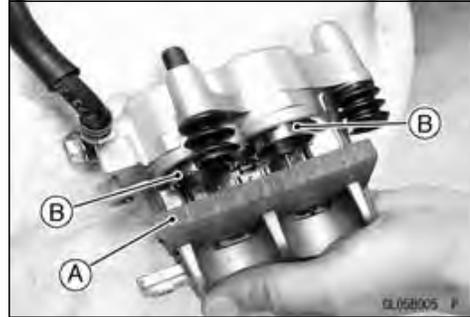
- Remove the caliper with the hose installed (see Caliper Removal).
- Remove the pads (see Pad Removal).
- Pull out the caliper holder [A].



## 12-14 BRAKES

### Calipers

- Insert a wooden board [A] 5 mm (0.2 in.) thick inside the caliper opening.
- Pump the brake pedal until the pistons [B] push the wooden board.



- Remove the board and pull out the pistons [A] by hand.
- These pistons can also be removed by disconnecting the hose and applying compressed air to the hose joint opening using the same wooden board. But be careful not to put your fingers or palm inside the caliper opening during work.



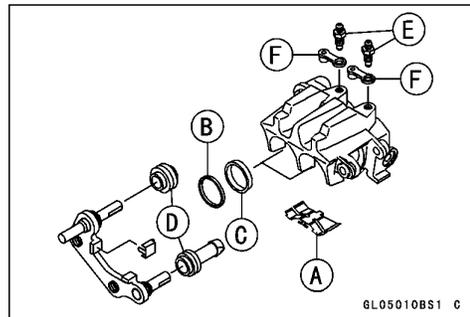
#### **⚠ WARNING**

**To avoid serious injury, never place your fingers or palm inside the caliper opening. If you apply compressed air into the caliper, the pistons may crush your hand or fingers.**

#### **CAUTION**

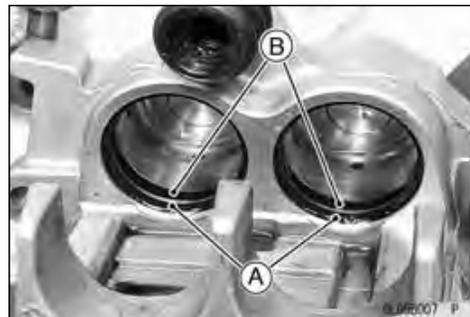
**Immediately wash away any brake fluid that spills.**

- Remove the anti rattle spring [A].
- Remove the dust seals [B] and fluid seals [C].
- Remove the rubber friction boots [D].
- Remove the bleed valve [E] and rubber cap [F].



#### *Rear Caliper Assembly*

- Tighten the bleed valve.  
**Torque - Caliper Bleed Valve: 7.8 N·m (0.8 kgf·m, 69 in·lb)**
- It is recommended that the fluid seal (piston seal) which is removed, be replaced with a new one.
- Replace the dust seals [A] if they are damaged.
- Install the fluid seal [B]. Either side of the seal may face outboard.



## Calipers

- Install the anti-rattle spring [A] in the caliper as shown.
- Apply brake fluid to the cylinders, pistons, and fluid seals (piston seals), and push the pistons into the cylinders by hand. Take care that neither the cylinder nor the piston skirt gets scratched.



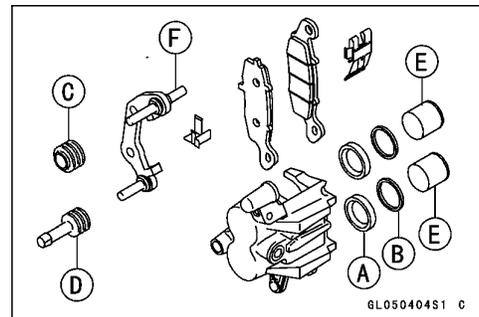
- Replace the caliper holder shaft rubber friction boot [A] and dust boot [B] if they are damaged.
- Apply a thin coat of silicone or PBC grease to the caliper holder shafts [C] and holder holes (Silicone or PBC grease is a special high temperature, water-resistance grease).
- Install the pads (see Brake Pad Installation).



### Caliper Fluid Seal Damage

The fluid seal (piston seal) [A] is placed around the piston to maintain clearance between the pad and the disc. If the seal is in a poor condition, it could lead the pad to wear excessively or the brake to drag, which may cause the temperature of the discs or the brake fluid to increase.

- Replace the fluid seal if it exhibits any of the conditions listed below.
  - Brake fluid leakage around the pad.
  - Brakes overheat.
  - Considerable difference in inner and outer pad wear.
  - Seal and piston are stuck together.
- ★ If the fluid seal is replaced, replace the dust seal [B] as well. Also, replace all seals every other time the pads are changed.



### Caliper Dust Boot and Friction Boot Damage

- Check that the dust boot [C] and friction boot [D] are not cracked, worn, swollen, or otherwise damaged.
- If they show any damage, replace it.

### Caliper Piston and Cylinder Damage

- Visually inspect the piston [E] and cylinder surfaces.
- ★ Replace the caliper if the cylinder and piston are badly scored or rusty.

### Caliper Holder Shaft Wear

The caliper body must slide smoothly on the caliper holder shafts. If the body does not slide smoothly, one pad will wear more than the other, and constant drag on the disc may cause the temperature of the discs or the brake fluid to increase.

- Visually inspect that the caliper holder shafts [F] are not badly worn or bent.
- ★ If the caliper holder shafts are damaged, replace the entire caliper assembly.

## 12-16 BRAKES

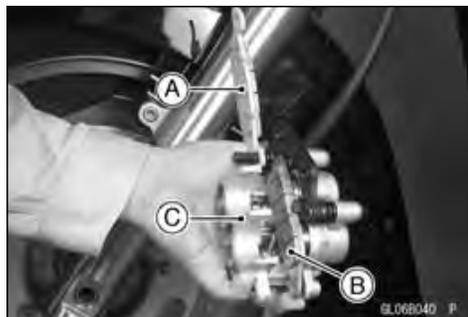
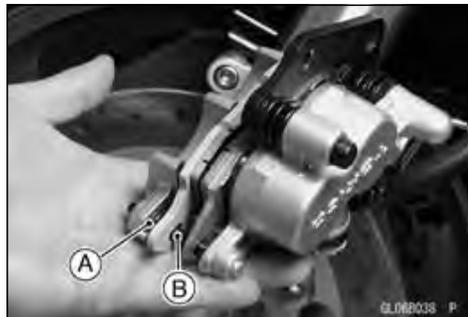
### Brake Pads

#### Front Brake Pad Removal

##### NOTE

○ The procedure to remove the front caliper is as follows.  
The rear caliper pad removal is the same as for the front caliper.

- Remove the caliper with the hose installed (see Caliper Removal).
- Remove:
  - Snap Pin [A]
  - Pad Pin [B]
- Remove the jaw side pad [A], and then remove the piston side pad [B].
  - Jaw [C]



#### Front Brake Pad Installation

- Push the caliper pistons in by hand as far as they will go.
- Install the brake pads.
- Install the pad pin and snap pin [A]. The snap pin must be “outside” of the pads.

##### **⚠ WARNING**

**Do not attempt to drive the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brake will not function on the first application of the lever if this is not done.**



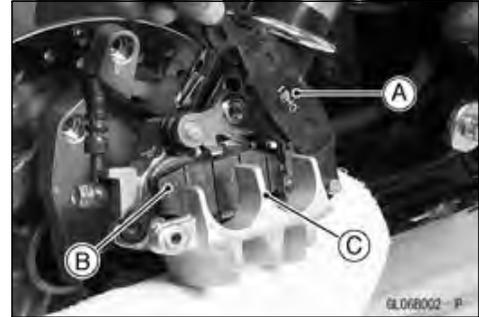
#### Rear Brake Pad Removal

- Remove the caliper with the hose installed (see Caliper Removal).
- Remove:
  - Snap Pin [A]
  - Pad Pin [B]



## Brake Pads

- Remove the jaw side pad [A], and then remove the piston side pad [B].  
Jaw [C]



### Rear Brake Pad Installation

- Before installation, clean the pads with a high-flash point solvent.
- Push [A] the caliper pistons in by hand as far as they will go.
- Be sure to install the snap pin for the caliper.

### **⚠ WARNING**

**Do not attempt to ride the motorcycle until a full pedal is obtained by pumping the brake lever or pedal until the pads are against the disc. The brakes will not function on the first application of the lever or pedal if this is not done.**



### Brake Pad Wear Inspection

- Refer to Brake Pad Wear Inspection in the Periodic Maintenance chapter.

## 12-18 BRAKES

### Master Cylinder

#### Front Master Cylinder Removal

- Disconnect the front brake light switch connectors [A].
- Draw out the brake fluid from the reservoir with a means like the fork oil level gage.
- Pull the bolt caps out.
- Remove the banjo bolt [C] to disconnect the brake hose from the master cylinder (see Brake Hose Removal/Installation).
- Unscrew the clamp bolts [B], and take off the master cylinder as an assembly with the reservoir, brake lever, and brake switch installed.



#### CAUTION

**Immediately wash away any brake fluid that spills.**

#### Front Master Cylinder Installation

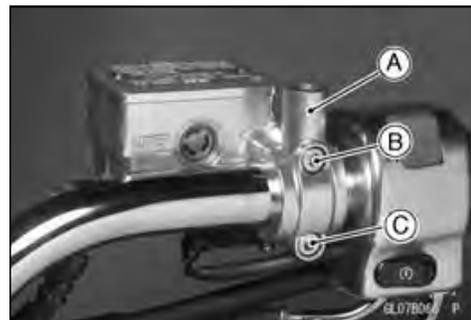
- Set the front master cylinder [A] to match its mating surface [B] to the punched mark [C] of the handlebar.



○The master cylinder clamp must be installed with the rear view mirror boss [A] faced upward.

- Tighten the upper clamp bolt [B] first, and then the lower clamp bolt [C]. There will be a gap at the lower part of the clamp after tightening.

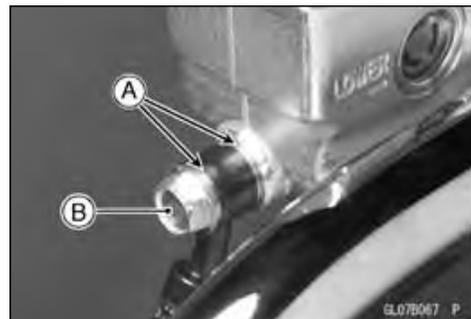
**Torque - Front Master Cylinder Clamp Bolts: 8.8 N-m (0.9 kgf-m, 78 in-lb)**



- Install the bolt caps.
- Use a new flat washers [A] on each side of the brake hose fitting.
- Tighten the brake hose banjo bolt [B].

**Torque - Brake Hose Banjo Bolt: 25 N-m (2.5 kgf-m, 18 ft-lb)**

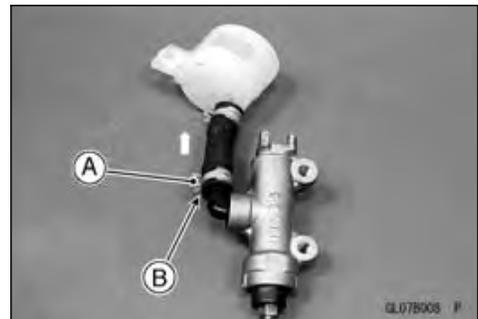
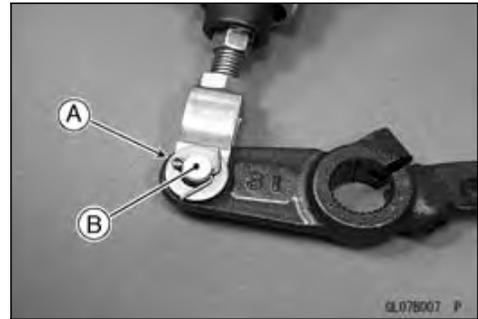
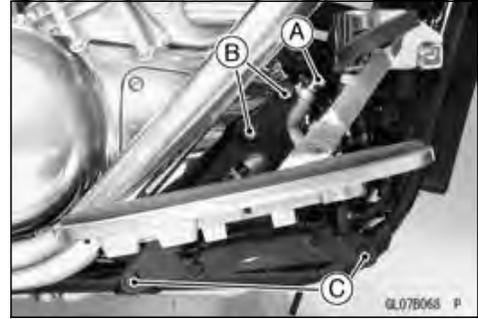
- Replenish the fluid in the reservoir, and bleed the brake line (see Bleeding the Brake Line).
- Check the brake for good braking power, no brake drag, and no fluid leakage.



## Master Cylinder

### Rear Master Cylinder Removal

- Remove the brake fluid reservoir cover (see Brake Pedal Position Adjustment).
  - Draw out the brake fluid from the reservoir with a means like the fork oil level gage.
  - Remove the brake fluid reservoir (see Brake Pedal Position Adjustment).
  - Unscrew the brake hose banjo bolt [A] on the master cylinder.
  - Loosen the master cylinder mounting bolts [B].
  - Unscrew the footpeg bracket bolts [C].
  - Remove:
    - Rear Master Cylinder Mounting Bolts
    - Brake Pedal Return Spring (see Brake Pedal Removal)
    - Brake Switch Return Spring [B] (see Brake Pedal Removal)
    - Brake Lever (see Brake Pedal Removal)
  - Remove the cotter pin [A] and joint pin [B].
- 
- Slide the reservoir hose lower end clamp [A].
  - Pull out the reservoir hose lower end [B], and drain the brake fluid into a container.



## 12-20 BRAKES

### Master Cylinder

#### Rear Master Cylinder Installation

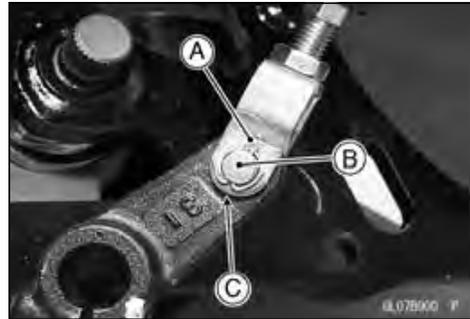
- Replace the cotter pin with a new one.
- Insert the cotter pin [A] to the hole of the joint pin [B] and separate [C] the cotter pin ends.
- Use a new flat washer on each side of the brake hose fitting.
- Tighten:

**Torque - Front Footboard Bracket Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**Rear Master Cylinder Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**Brake Hose Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Bleed the brake line (see Brake Line Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.



#### **⚠ WARNING**

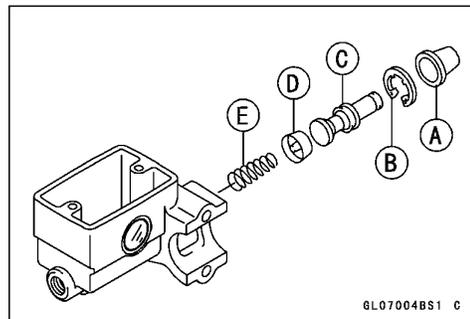
**Do not attempt to ride the motorcycle until a full brake pedal is obtained by pumping the brake pedal until the pads are against the disc. The brake will not function on the first application of the pedal if this is not done.**

#### Front Master Cylinder Disassembly

- Remove the front master cylinder.
- Remove the reservoir cap, plate and diaphragm.
- Unscrew the locknut and pivot bolt, and remove the brake lever.
- Pull the dust cover [A] out of place, and remove the circlip [B].

**Special Tool - Inside Circlip Pliers: 57001-143**

- Pull out the piston assy [C], primary cup [D], and return spring [E].



#### **CAUTION**

**Do not remove the secondary cup from the piston since removal will damage it.**

## Master Cylinder

### Rear Master Cylinder Disassembly

#### NOTE

○ Do not remove the push rod clevis [A] for master cylinder disassembly since removal requires brake pedal position adjustment.

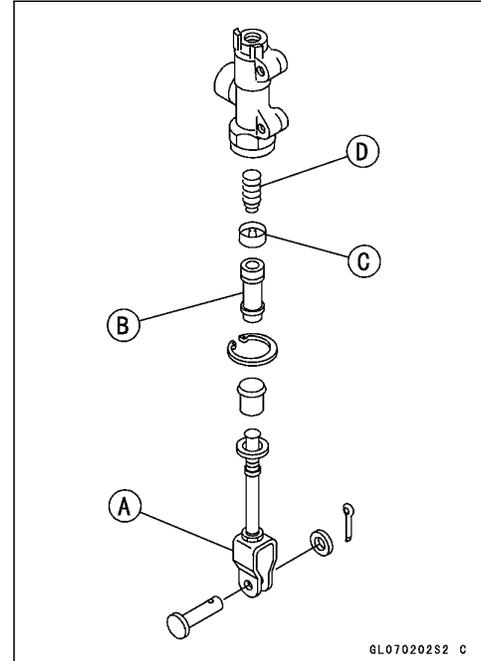
- Remove the rear master cylinder (see Rear Master Cylinder Removal).
- Slide the dust cover on the push rod out of place, and remove the circlip.

**Special Tool - Inside Circlip Pliers: 57001-143**

- Pull out the push rod with the piston stop.
- Take off the piston assy [B], primary cup [C], and return spring [D].

#### CAUTION

**Do not remove the secondary cup from the piston since removal will damage it.**



GL070202S2 C

### Master Cylinder Assembly

- Before assembly, clean all parts including the master cylinder with brake fluid or alcohol.

#### CAUTION

**Except for the disc pads and disc, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, engine oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely, and will eventually deteriorate the rubber used in the disc brake.**

- Apply brake fluid to the removed parts and to the inner wall of the cylinder.
- Take care not to scratch the piston or the inner wall of the cylinder.
- Tighten the brake lever pivot bolt and the locknut.

**Silicone Grease - Brake Lever Pivot Bolt, Brake Lever Pivot Contact, Push Rod Contact, Dust Cover**

**Torque - Brake Lever Pivot Bolt: 1.0 N·m (0.10 kgf·m, 8.7 in·lb)**

**Brake Lever Pivot Bolt Locknut: 5.9 N·m (0.60 kgf·m, 52 in·lb)**

## 12-22 BRAKES

### Master Cylinder

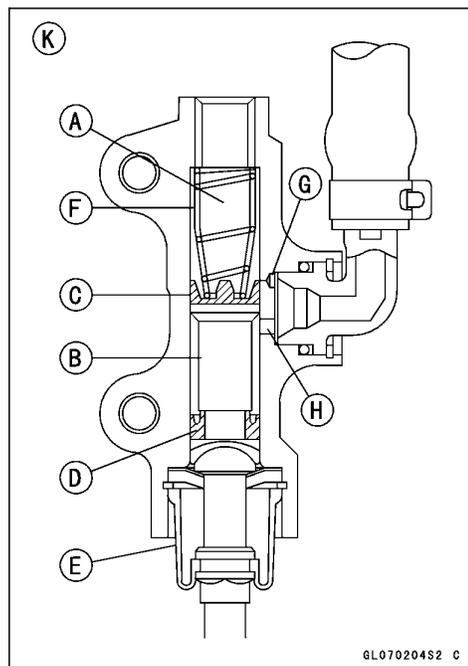
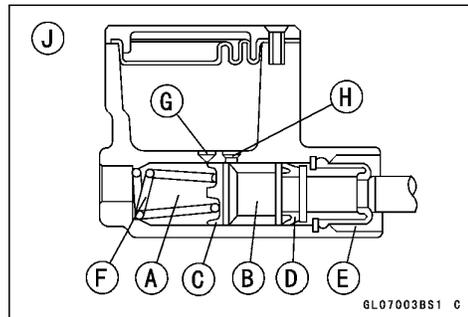
#### Master Cylinder Inspection

- Disassemble the front and rear master cylinders.
- Check that there are no scratches, rust or pitting on the inner wall [A] of each master cylinder and on the outside of each piston [B].
- ★ If a master cylinder or piston shows any damage, replace them.
- Inspect the primary cup [C] and secondary cup [D].
- ★ If a cup is worn, damaged softened (rotted), or swollen, the piston assy should be replaced to renew the cups.
- ★ If fluid leakage is noted at the brake lever, the piston assy should be replaced to renew the cups.

#### Front Master Cylinder [J]

- Check the dust covers [E] for damage.
- ★ If they are damaged, replace them.
- Check the piston return spring [F] for any damage.
- ★ If the springs are damaged, replace them.
- Check that relief port [G] and supply port [H] are not plugged.
- ★ If the relief port becomes plugged, the brake pads will drag on the disc. Blow the ports clean with compressed air.

#### Rear Master Cylinder [K]



## Brake Discs

### Brake Disc Removal

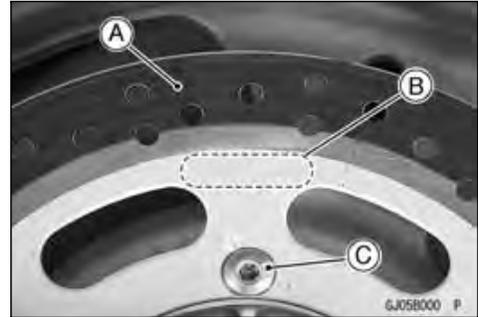
- Remove the wheel (see Wheels/Tires chapter).
- Unscrew the mounting bolts [A], and take off the disc.



### Brake Disc Installation

- Install the brake disc [A] on the wheel so that the marked side [B] faces out.
- Apply a non-permanent locking agent to the threads of the brake disc bolts [C].
- Tighten:

**Torque - Brake Disc Bolts: 27 N·m (2.8 kgf·m, 20 ft·lb)**



### Brake Disc Wear

- Measure the thickness of each disc [A] at the point where it has worn the most.
- Measuring Area [B]
- ★ Replace the disc if the sliding surface has worn past the service limit.

#### Front Disc Thickness

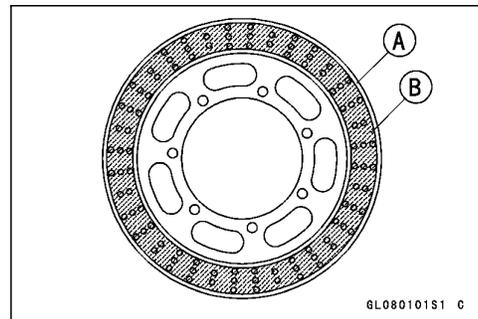
**Standard: 4.8 ~ 5.2 mm (0.19 ~ 0.20 in.)**

**Service Limit: 4.5 mm (0.18 in.)**

#### Rear Disk Thickness

**Standard: 6.8 ~ 7.2 mm (0.268 ~ 0.283 in.)**

**Service Limit: 6.0 mm (0.24 in.)**



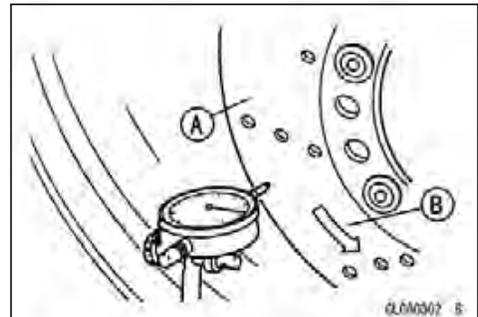
### Brake Disc Warp

- Jack up the motorcycle so that the wheel is off the ground (see Wheels/Tires chapter).
- For front disc inspection, turn the handlebar fully to one side.
- Set up a dial gage against the disc [A] as shown and measure disc runout, while turning [B] the wheel by hand.
- ★ If the runout exceeds the service limit, replace the disc.

#### Disc Runout

**Standard: TIR 0.15 mm (0.0059 in.) or less**

**Service Limit: TIR 0.3 mm (0.01 in.)**



## 12-24 BRAKES

### Brake Fluid

#### *Brake Fluid Level Inspection*

- Refer to Brake Fluid Level Inspection in Periodic Maintenance chapter.

#### *Brake Fluid Change*

- Refer to Brake Fluid Change in Periodic Maintenance chapter.

#### *Brake Line Bleeding*

The brake fluid has a very low compression coefficient so that almost all the movement of the brake lever or pedal is transmitted directly to the caliper for braking action. Air, however, is easily compressed. When air enters the brake lines, brake lever or pedal movement will be partially used in compressing the air. This will make the lever or pedal feel spongy, and there will be a loss in braking power.

#### **⚠ WARNING**

**Be sure to bleed the air from the brake line whenever brake lever or pedal action feels soft or spongy after the brake fluid is changed, or whenever a brake line fitting has been loosened for any reason.**

#### **NOTE**

- *The procedure to bleed the front brake line is as follows. Bleeding the rear brake line is almost the same as for the front brake.*
- Remove the reservoir cap, and fill the reservoir with fresh brake fluid to the upper level line in the reservoir.
- With the reservoir cap off, slowly pump the brake lever several times until no air bubbles can be seen rising up through the fluid from the holes [A] at the bottom of the reservoir.
- Install the reservoir cap.



## Brake Fluid

- Remove the rubber cap from the bleed valve on the caliper.
- Attach a clear plastic hose to the bleed valve, and run the other end of the hose into a container.
- Bleed the brake line and the caliper as follows:
  - Repeat this operation until no more air can be seen coming out into the plastic hose.
    - Pump the brake lever until it becomes hard, and apply the brake lever and hold it [A].
    - Quickly open and close [B] the bleed valve while holding the brake lever applied.
    - Release the brake lever [C].

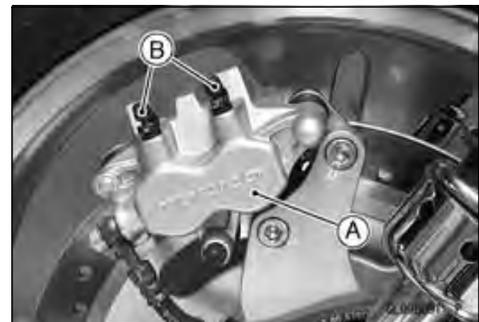
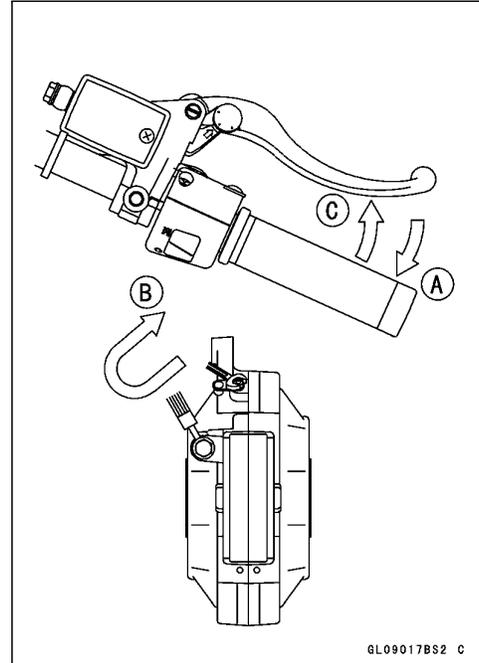
### NOTE

- The fluid level must be checked often during the bleeding operation and replenished with fresh brake fluid as necessary. If the fluid in the reservoir runs completely out any time during bleeding, the bleeding operation must be done over again from the beginning since air will have entered the line.
- Tap the brake hose lightly from the caliper to the reservoir for more complete bleeding.

- Remove the clear plastic hose.
- Tighten:
  - Torque - Caliper Bleed Valve: 7.8 N·m (0.8 kgf·m, 69 in·lb)**
  - Front Brake Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**
- Repeat the above steps for other caliper.

### NOTE

- For the rear brake caliper [A], bleed the brake line for two bleed valves [B].
- Check the fluid level.
- After bleeding is done, check the brake for good braking power, no brake drag, and no fluid leakage.



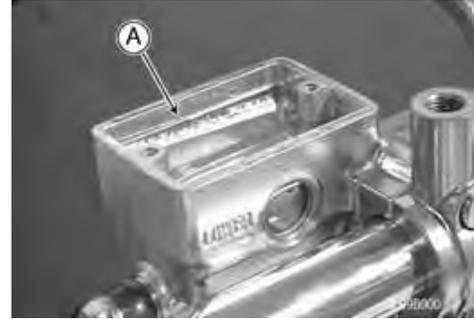
## 12-26 BRAKES

### Brake Fluid

#### **⚠ WARNING**

**When working with the disc brake, observe the precautions listed below.**

1. Never reuse old brake fluid.
2. Do not use fluid from a container that has been left unsealed or that has been open for a long time.
3. Do not mix two types and brands of fluid for use in the brake. This lowers the brake fluid boiling point and could cause the brake to be ineffective. It may also cause the rubber brake parts to deteriorate.
4. Don't leave the reservoir cap off [A] for any length of time to avoid moisture contamination of the fluid.
5. Don't change the fluid in the rain or when a strong wind is blowing.
6. Except for the disc pads and disc, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, engine oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely and will eventually deteriorate the rubber used in the disc brake.
7. When handling the disc pads or disc, be careful that no disc brake fluid or any oil gets on them. Clean off any fluid or oil that inadvertently gets on the pads or disc with a high-flash point solvent. Do not use one which will leave an oily residue. Replace the pads with new ones if they cannot be cleaned satisfactorily.
8. Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely washed away immediately.
9. If any of the brake line fittings or the bleed valve is opened at any time, the **AIR MUST BE BLED FROM THE BRAKE LINE.**



## Brake Hoses

### Brake Hose Removal/Installation

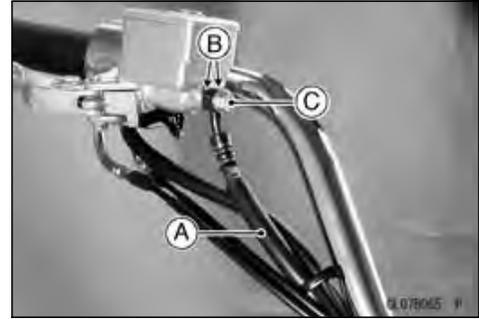
#### CAUTION

**Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely washed away immediately.**

- When removing the brake hose, take care not to spill the brake fluid on the painted or plastic parts.
- When removing the brake hose [A], temporarily secure the end of the brake hose to some high place to keep fluid loss to a minimum.
- Immediately wash away any brake fluid that spills.
- There are washers [B] on each side of the brake hose fitting. Replace them with new ones when installing.
- Tighten the banjo bolts [C] on the hose fittings.

**Torque - Brake Hose Banjo Bolts: 25 N·m (2.5 kgf·m, 18.0 ft·lb)**

- When installing the hoses [A], avoid sharp bending, kinking, flattening or twisting, and route the hoses according to Cable, Wire, and Hose Routing section in the General Information chapter.
- Fill the brake line after installing the brake hose (see Brake Fluid Changing).





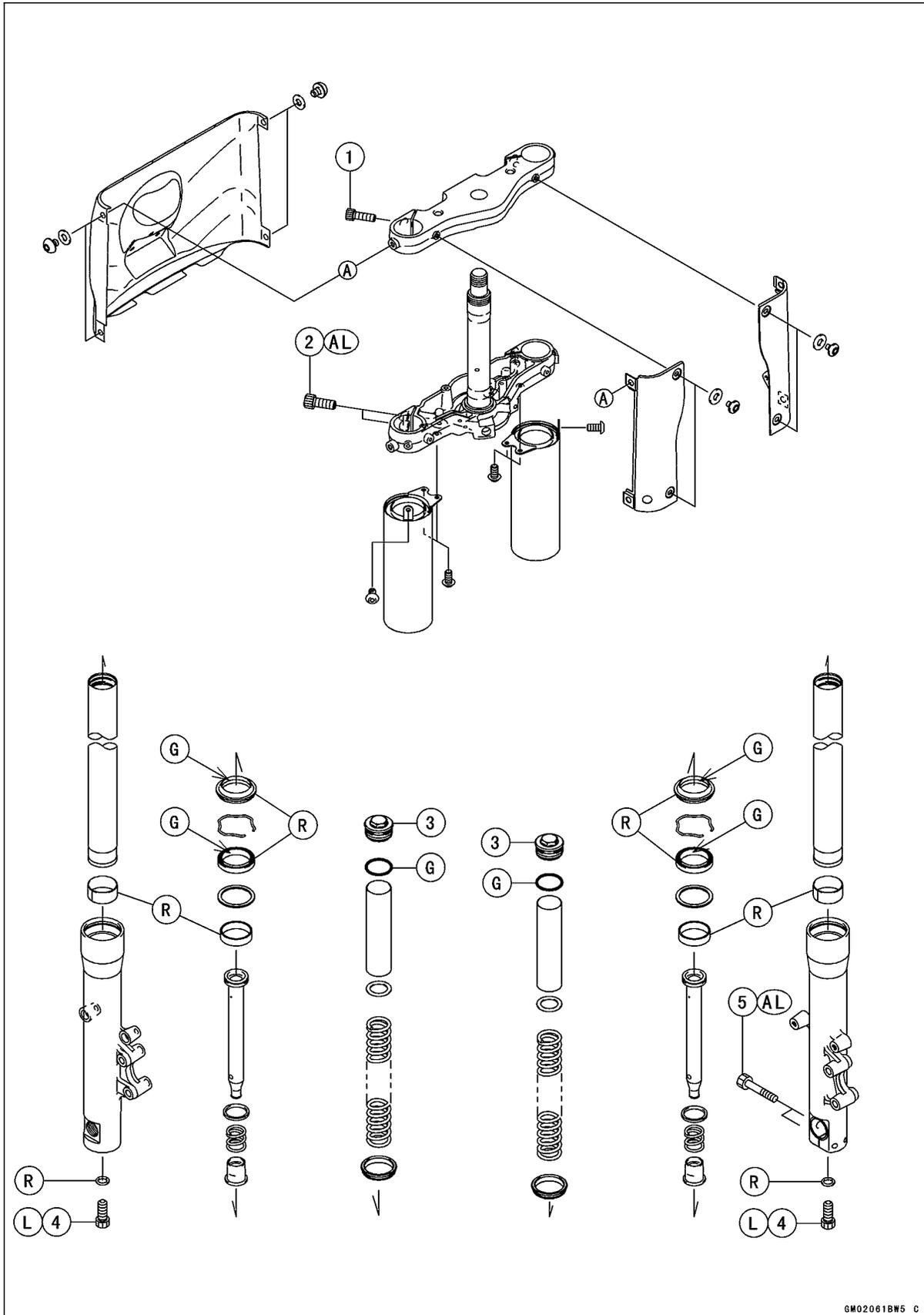
# Suspension

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# 13-2 SUSPENSION

## Exploded View



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**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Upper front fork clamp bolts	20	2.0	15	
2	Lower front fork clamp bolts	29	3.0	21	
3	Front fork top plugs	22	2.2	16	
4	Front fork bottom allen bolt	30	3.1	22	L
5	Front axle clamp bolts	20	2.0	15	AL

L: Apply a non-permanent locking agent.

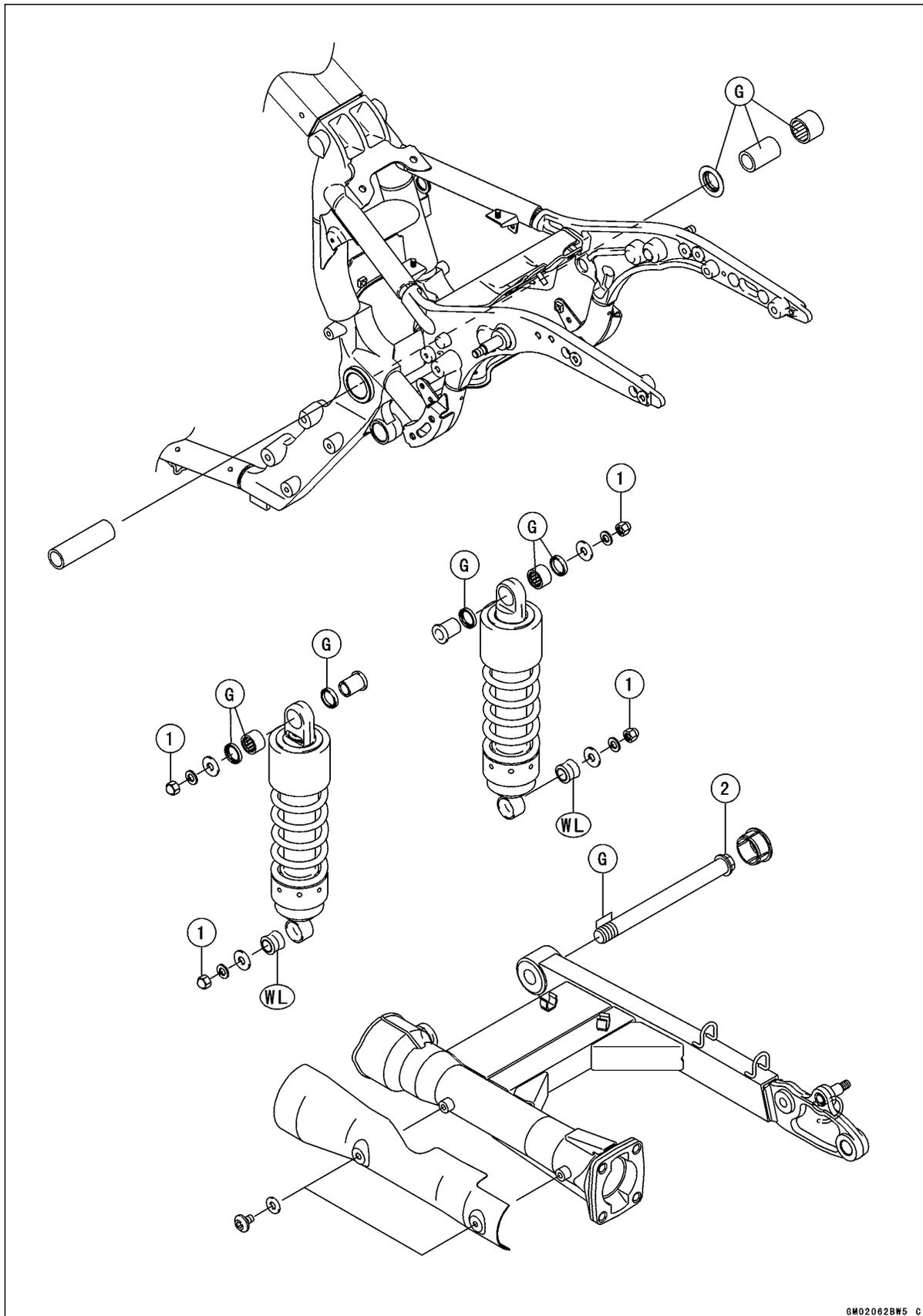
R: Replacement Parts

G: Apply grease.

AL: Tighten the two clamp bolts alternately two times to ensure even tightening torque.

# 13-4 SUSPENSION

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear shock absorber nuts	34	3.5	25	
2	Swingarm pivot shaft	108	11.0	79.6	G

G: Apply grease.

WL: Apply a soap and water solution or rubber lubricant.

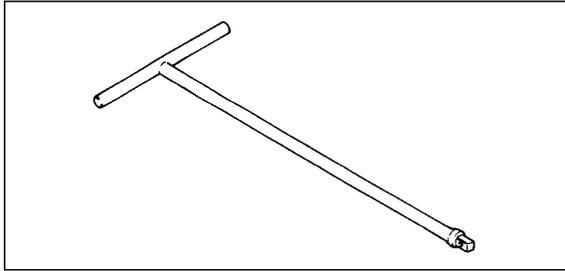
## 13-6 SUSPENSION

### Specifications

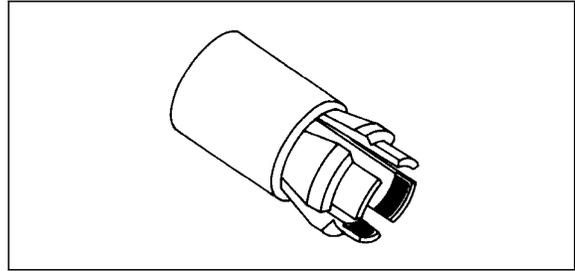
Item	Standard
<b>Front Fork (per one unit):</b>	
Fork inner tube diameter	$\phi 43$ mm ( $\phi$ 1.7 in.)
Fork spring setting	Non-adjustable
Air pressure	Atmospheric pressure (Non-adjustable)
Rebound damper setting	Non-adjustable
Fork oil viscosity	SAE 10W-20
Fork oil capacity:	521 $\pm$ 2 mL (17.6 $\pm$ 0.068 US oz.) (completely disassembled and dry)
	approx. 445 mL (15.0 US oz.) (when changing oil)
Fork oil level:	Fully compressed, without fork spring, below from inner tube top 120 mm (4.72 in.)
Fork spring free length	382.4 mm (15.06 in.) (Service limit: 375 mm (14.8 in.))
<b>Rear Shock Absorber:</b>	
Rebound damper set	No.2 of 4 positions
Spring setting position	No.2 of 5 positions

**Special Tools**

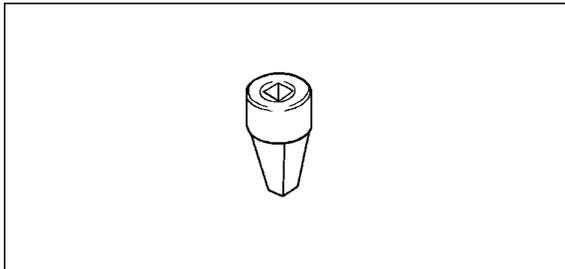
**Fork Cylinder Holder Handle :**  
57001-183



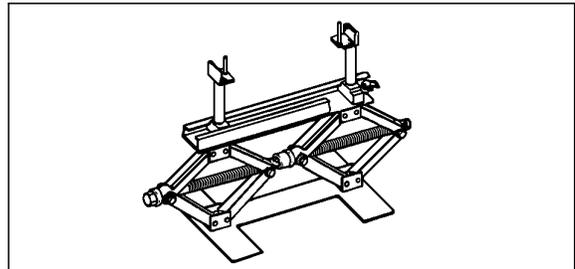
**Front Fork Oil Seal Driver :**  
57001-1219



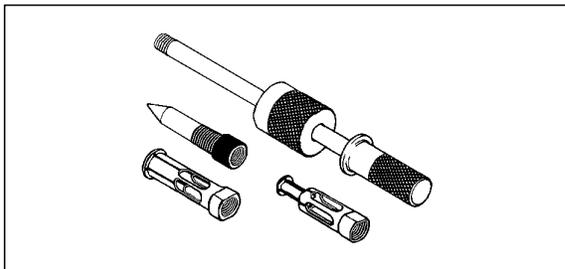
**Fork Cylinder Holder Adapter :**  
57001-1057



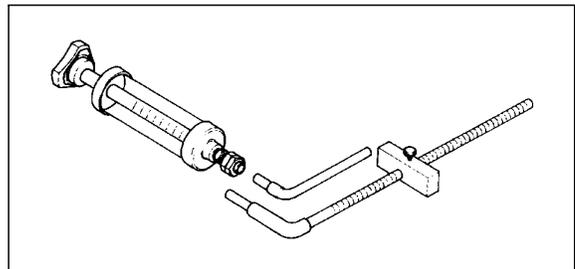
**Jack :**  
57001-1238



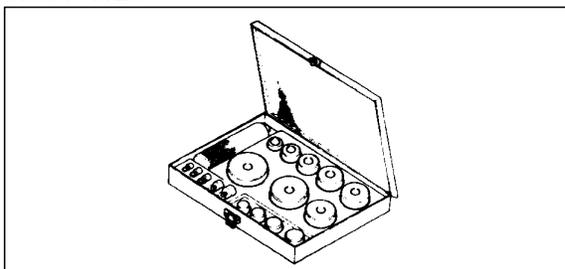
**Oil Seal & Bearing Remover :**  
57001-1058



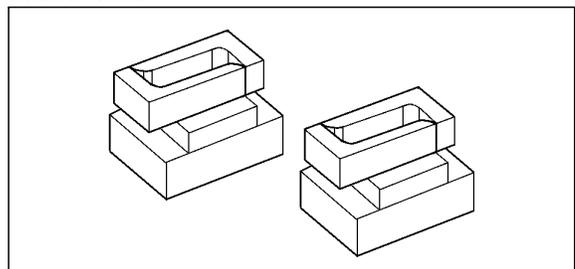
**Fork Oil Level Gauge :**  
57001-1290



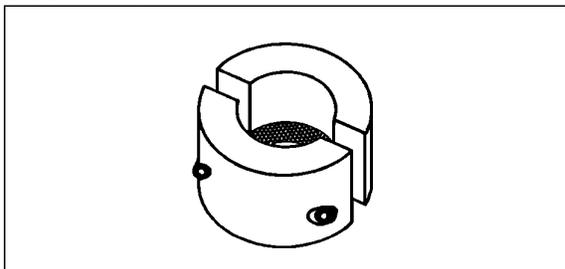
**Bearing Driver Set :**  
57001-1129



**Attachment Jack :**  
57001-1398



**Fork Outer Tube Weight :**  
57001-1218

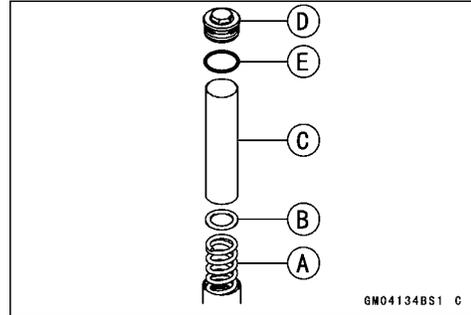


## 13-8 SUSPENSION

### Front Fork

#### Fork Oil Change

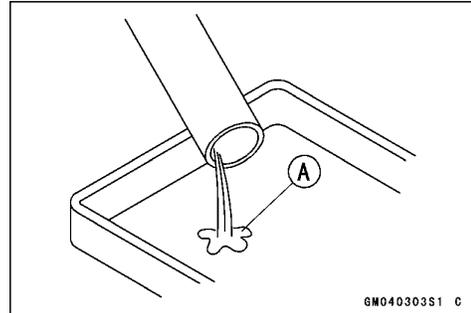
- Remove the front fork (see Front Fork Removal).
- Hold the outer tube vertically in a vise.
- Remove:
  - Top Plug [D] (with O-ring [E])
  - Collar [C]
  - Washer [B]
  - Spring [A]



- Pour out the fork oil [A] with the fork upside down.
- Hold the outer tube vertically in a vise.
- Fill the front fork with the specified oil.

**Fork Oil Viscosity: SAE10W-20**

**Fork Oil Capacity (when changing oil): Approx. 445 mL (15.0 US oz.)**

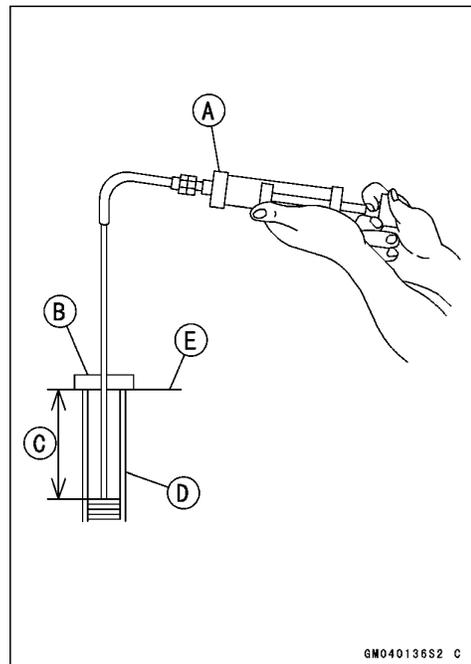


- Wait for about five minutes so that any suspended air bubbles can surface.
- Measure the oil level, using the fork oil level gauge [A].

**Special Tool - Fork Oil Level Gauge: 57001-1290**

- Set the gauge stopper [B] so that its lower side shows the oil level distance specified [C].
- Insert the gauge tube into the inner tube [D] and position the stopper across the top of the inner tube [E].
- Pull the handle slowly to draw out the excess oil until no more oil comes up the tube.
- ★ If no oil is drawn out from the beginning, there is not enough oil in the fork. Pour in some more oil, then draw out the excess.

**Front Fork Oil Level (Fully compressed without fork spring)**  
**Standard: 120 ± 2 mm (4.72 ± 0.08 in.)**



- Install the fork spring with the smaller diameter end [A] facing down [B].
- Tighten:

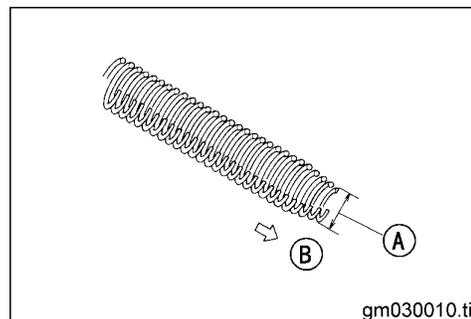
**Torque - Lower Fork Clamp Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb)**

**Upper Fork Clamp Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)**

**Front Axle Clamp Bolt: 20 N·m (2.0 kgf·m, 22 ft·lb)**

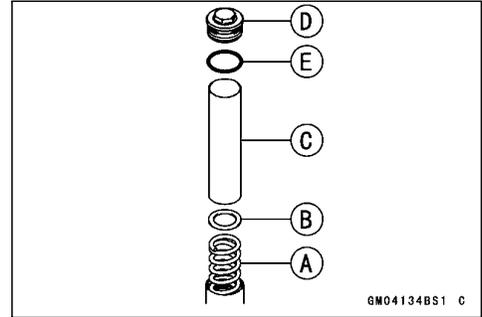
**Front Axle Nut: 110 N·m (11.0 kgf·m, 79.6 ft·lb)**

**Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**



## Front Fork

- Install:
  - Fork Spring [A]
  - Washer [B]
  - Spacer [C]
  - Top Plug [D] with O-ring [E]

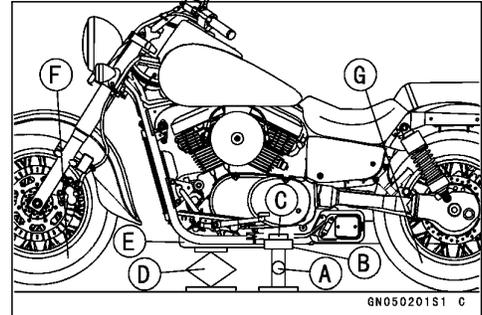


### Front Fork Removal

- Using the jack [A] and attachment jack [B] under the frame pipe ribs [C], and a commercially available jack [D] under the engine [E], lift the front wheel [F] **OFF** the ground until the rear wheel [G] touches the ground.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398



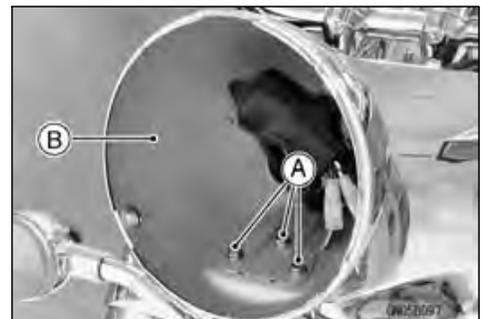
### CAUTION

Be sure to put the rear wheel on the ground when removing the front fork, or the motorcycle may fall over. The motorcycle could be damaged.

### ⚠ WARNING

Be sure to put the rear wheel on the ground when removing the front fork, or the motorcycle may fall over. It could cause an accident and injury.

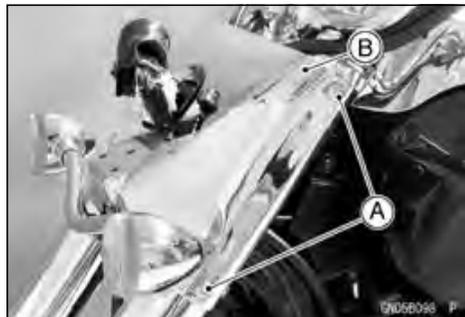
- Remove:
  - Caliper (see Brakes chapter)
  - Front tire (see Wheels/Tires chapter)
  - Front fender (see Frame chapter)
  - Headlight (see Electrical System chapter)
- Remove:
  - Bolts [A]
  - Headlight body [B]



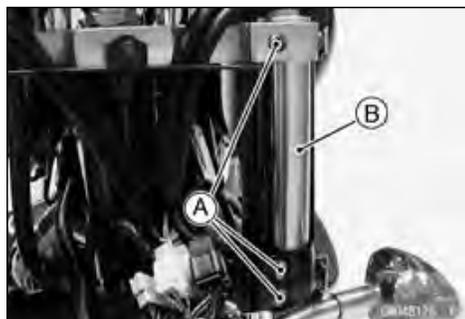
## 13-10 SUSPENSION

### Front Fork

- Remove:
  - Bolts [A] (both side)
  - Front fork center cover [B]

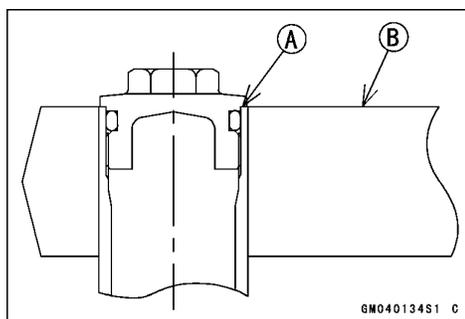


- Remove:
  - Front fork clamp bolts [A]
  - Front fork inner cover
  - Front fork [B]



#### Front Fork Installation

- Install the fork so that the top end [A] of the inner tube is flush with the upper surface [B] of the steering stem head bracket.
- Tighten:
  - Torque - Front Fork Clamp Bolts (Lower):**  
20 N·m (2.0 kgf·m, 15 ft·lb)
  - Front Fork Top Plug: 22 N·m (2.2 kgf·m, 16 ft·lb)**



#### NOTE

- Tighten the top plug before tightening the upper fork clamp bolts.
- Tighten the two clamp bolts alternately two times to ensure even tightening torque.

- Tighten:
  - Torque - Front Fork Clamp Bolt (Upper):**  
20 N·m (2.0 kgf·m, 15 ft·lb)
- Install the removed parts and tighten:
  - Torque - Front Axle Clamp Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)**
  - Front Axle Bolt: 110 N·m (11.0 kgf·m, 79.6 ft·lb)**
  - Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

#### NOTE

- Tighten the two clamp bolts alternately two times to ensure even tightening torque.
- Check the front brake effectiveness after installation.

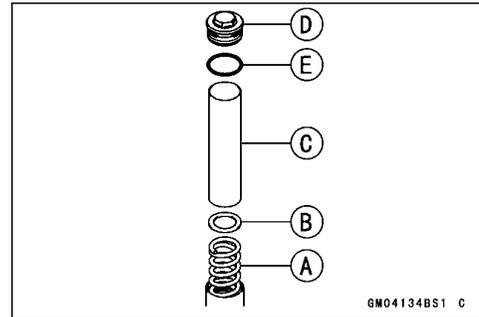
#### **⚠ WARNING**

**Do not attempt to ride the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brake will not function on the first application of the lever if this is not done.**

**Front Fork**

*Disassembly*

- Remove the front fork (see Front Fork Removal in this chapter).
- Drain the fork oil (see Fork Oil Change in this chapter).
- The following parts are removed during draining the fork oil.
  - Top Plug [D] with O-ring [E]
  - Spacer [C]
  - Washer [B]
  - Fork Spring [A]



- Hold the front fork horizontally in a vise [A].
- Stop the cylinder unit [B] from turning by using the special tools.
- Unscrew the Allen bolt [C], and take the gasket out of the bottom of the outer tube.

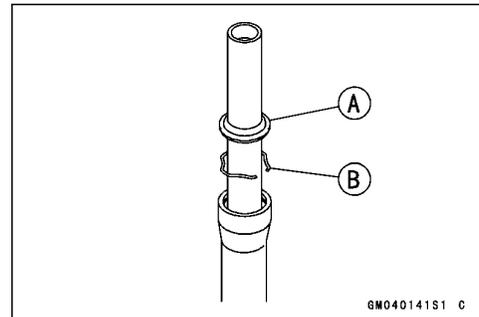
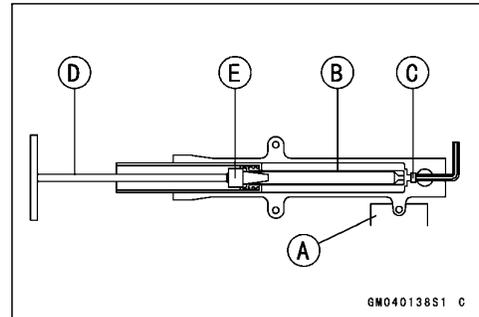
**Special Tools - Fork Cylinder Holder Handle:**

**57001-183 [D]**

**Fork Cylinder Holder Adapter:**

**57001-1057 [E]**

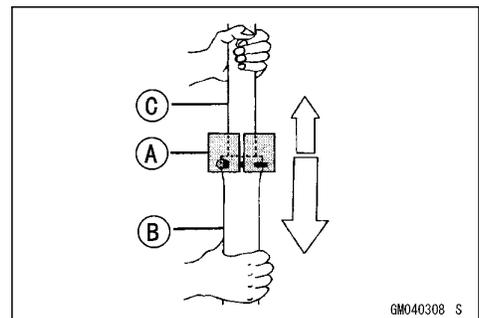
- Take the cylinder unit out of the inner tube.
- Separate the inner tube from the outer tube as follows:
  - Remove the dust seal [A] from the outer tube.
  - Remove the retaining ring [B] from the outer tube.



- Use the fork outer tube weight [A] to separate the outer tube [B] from the inner tube [C].
- Holding the inner tube by hand, pull the outer tube several times to pull out the inner tube.

**Special Tool - Fork Outer Tube Weight: 57001-1218**

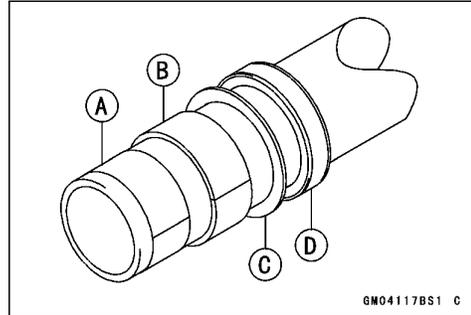
- Take out the cylinder base out of the outer tube.



## 13-12 SUSPENSION

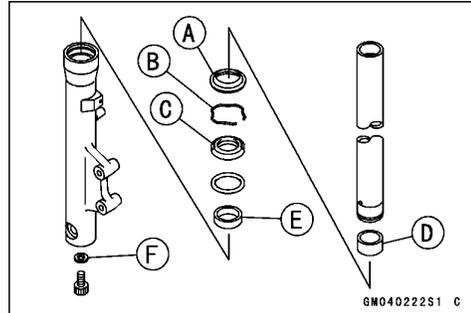
### Front Fork

- Remove the inner tube guide bushing [A], outer tube guide bushing [B], washer [C], and oil seal [D] from the inner tube.

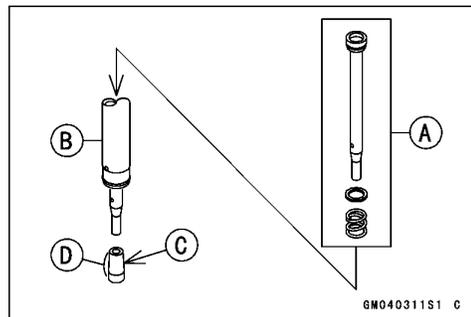


#### Assembly

- Replace the following parts with new ones after removal.
  - Dust Seal [A]
  - Retaining Ring [B]
  - Oil Seal [C]
  - Inner Guide Bushing [D]
  - Outer Guide Bushing [E]
  - Bottom Allen Bolt Gasket [F]

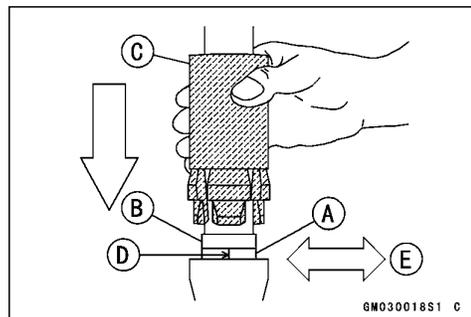


- Put the cylinder unit [A] with the spring into the inner tube [B], protruding from the inner tube, and install the cylinder base [C] onto the bottom end of the cylinder unit.
- Install the cylinder base with the tapered end [D] up.
- Install the inner tube, cylinder unit, and cylinder base as a set into the outer tube.



- Install the new guide bushing [A] with a used guide bushing [B] on it by tapping the used guide bushing with fork oil seal driver [C] until it stops.
- The split [D] of the bushing should face toward the side [E] of the vehicle.

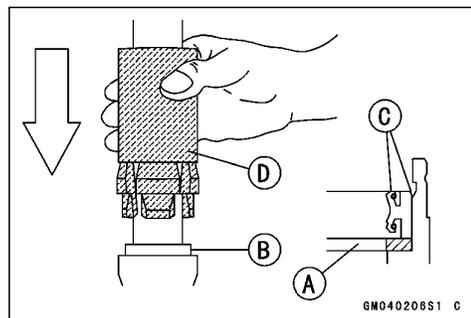
**Special Tool - Front Fork Oil Seal Driver: 57001-1219**



- Apply molybdenum disulfide grease to the oil seal lips and install the washer [A] and the oil seal [B] into the outer tube.
- Face the flat side [C] of the seal upward.

**Special Tool - Front Fork Oil Seal Driver [D]: 57001-1219**

- Install:
  - Retaining Ring
  - Dust Seal



**Front Fork**

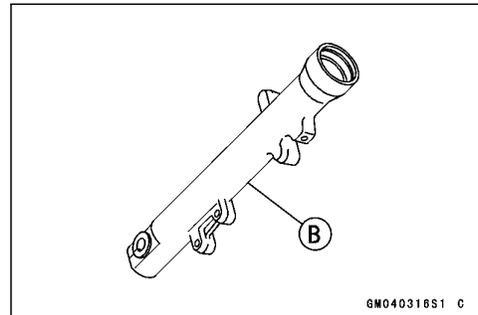
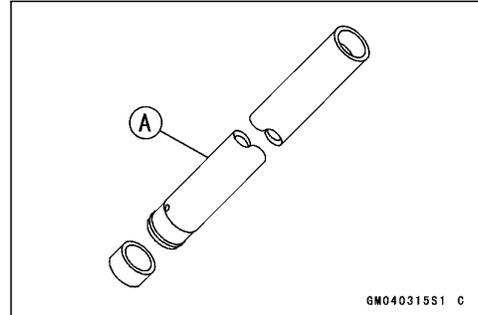
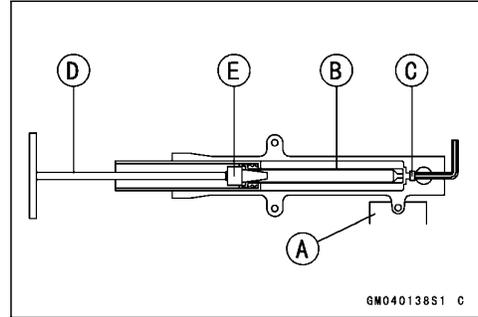
- Apply a non-permanent locking agent to the threads of the Allen bolt and screw the Allen bolt into the bottom of the outer tube.
- Hold the front fork horizontally in a vise [A].
- Hold the cylinder unit [B] with the special tools and tighten the Allen bolt [C].

**Special Tools - Fork Cylinder Holder Handle: 57001-183 [D]  
Fork Cylinder Holder Adapter: 57001-1057 [E]**

**Torque - Bottom Allen Bolt: 30 N-m (3.1 kgf-m, 22 ft-lb)**

*Inner Tube, Outer Tube Inspection*

- Visually inspect the inner tube [A] and repair any damage.
- Nick or rust damage can sometimes be repaired by using a wet- stone to remove sharp edges or raised areas which cause seal damage.
- ★ If the damage is not repairable, replace the inner tube. Since damage to the inner tube damages the oil seal, replace the oil seal whenever the inner tube is repaired or replaced.



**CAUTION**

**If the inner tube is badly bent or creased, replace it. Excessive bending, followed by subsequent straightening, can weaken the inner tube.**

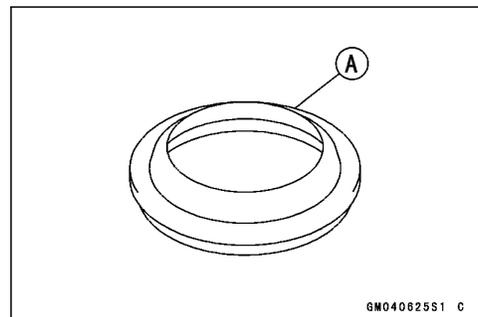
- Temporarily assemble the inner and outer tubes, and pump them back and forth manually to check for smooth operation.
- ★ If you feel binding or catching, the inner and outer tubes must be replaced.

**⚠ WARNING**

**A straightened inner or outer fork tube [B] may fail in use, possibly, causing an accident. Replace a badly bent or damaged inner or outer tube, and inspect the other tube carefully before reusing it.**

*Dust Seal Inspection*

- ★ Inspect the dust seal [A] for any signs of deterioration or damage.
- ★ Replace them if necessary.



## 13-14 SUSPENSION

### Front Fork

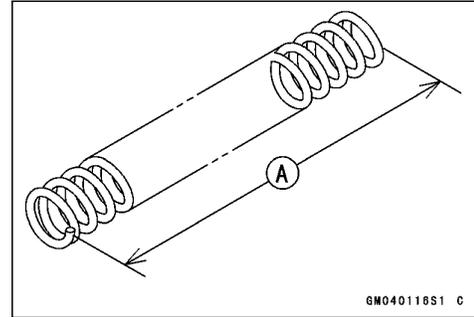
#### *Spring Tension*

- Since the spring becomes shorter as it weakens, check its free length [A] to determine its condition.
- ★ If the spring of either fork leg is shorter than the service limit, it must be replaced.
- ★ If the length of a replacement spring and that of the remaining spring vary greatly, the remaining spring should also be replaced in order to keep the fork legs balanced for motorcycle stability.

#### **Spring Free Length**

**Standard:** 382.4 mm (15.06 in.)

**Service Limit:** 375 mm (14.8 in.)

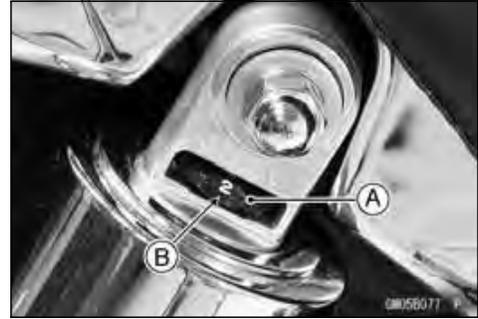


## Rear Shock Absorber

### Rebound Damping Adjustment

The rebound damping force adjuster on each rear shock absorber has 4 positions so that the rebound damping force can be adjusted for different road and loading conditions. The numbers on the adjuster show the setting position.

- Turn the adjuster [A] until the desired number [B].
- The standard adjuster setting is **No.2** for an average-build rider of 68 kg (150 lb) with no passenger and no accessories.
- ★ If the damper setting feels too soft or too stiff, adjust it in accordance with the following table.



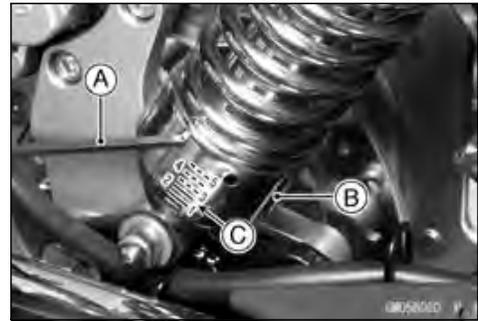
### Rebound Damping Adjustment

Adjuster Position	Damping Force	Setting	Load	Road	Speed
1	Weak ↑	Soft	Light	Good	Low
2		↑	↑	↑	↑
3	Strong ↓	↓	↓	↓	↓
4		Hard	Heavy	Bad	High

### Spring Preload Adjustment

The spring preload adjuster on each rear shock absorber has 5 positions so that the spring tension can be adjusted for different road and loading conditions.

- Using the wrench [A], turn the adjuster [B] to adjust the spring tension.
- The standard adjuster position for an average-build rider of 68 kg (150 lb) with no passenger and no accessories is 2nd step [C] from the weakest position.
- ★ If the spring action feels too soft or too stiff, adjust it in accordance with the following table.



### Spring Preload Adjustment

Position	Spring Force	Setting	Load	Road	Speed
1	Stronger ↓	Soft	Light	Good	Low
2		↑	↑	↑	↑
3		↓	↓	↓	↓
4		↓	↓	↓	↓
5		Hard	Heavy	Bad	High

- Check to see that both adjusting sleeves are turned to the same relative position.

### ⚠ WARNING

If both adjusters are not adjusted equally, handling may be impaired and a hazardous condition may result.

## 13-16 SUSPENSION

### Rear Shock Absorber

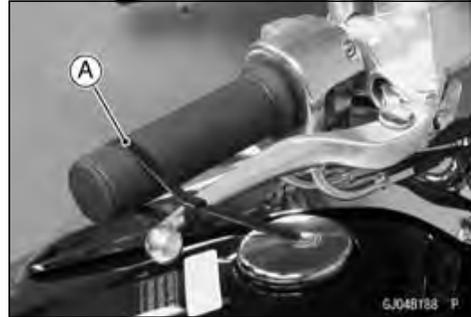
#### Rear Shock Absorber Removal

- Lift the rear wheel off the ground, using the jack and the attachment jack.

**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**

- Squeeze the brake lever slowly and hold it with a band [A].



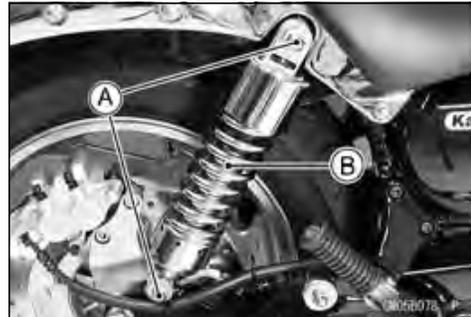
#### CAUTION

**Be sure to hold the front brake when removing the shock absorber, or the motorcycle may fall over. The motorcycle could be damaged.**

#### ⚠ WARNING

**Be sure to hold the front brake when removing the shock absorber, or the motorcycle may fall over. It could cause an accident and injury.**

- Remove the cap nuts [A], lock washers, and flat washers from both ends of the rear shock absorber [B].
- Pull the rear shock absorber off the frame.



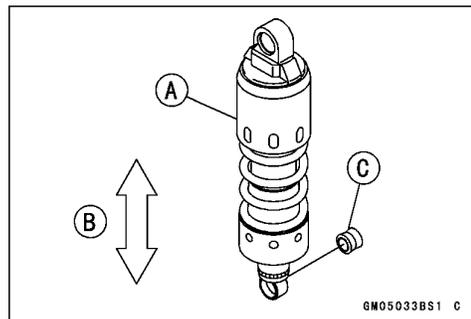
#### Rear Shock Absorber Installation

- Install the sleeve so the flange side faces inside.
- Tighten the rear shock absorber nuts to the specified torque.

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

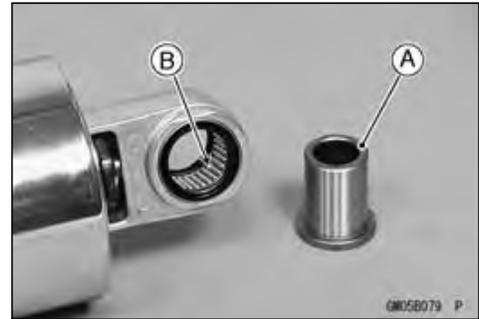
#### Rear Shock Absorber Inspection

- Remove the rear shock absorbers [A].
- Visually inspect the following items.
  - Smooth Stroke [B]
  - Oil Leakage (see Periodic Maintenance chapter)
  - Crack or Dent
- ★ If there is any damage to the rear shock absorber, one unit feels weaker than the other, replace both shock absorbers as a set.
- Visually inspect the rubber bushings [C].
- ★ If they show any signs of damage, replace them.



### Rear Shock Absorber

- Visually inspect the shock absorber sleeves [A] and needle bearings [B].
- The roller in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing in the shock absorber for abrasion, color change, or other damage.
- ★ If there is any doubt as to the condition of any of the needle bearings or sleeves, replace the sleeves, and needle bearings as a set.



## 13-18 SUSPENSION

### Swingarm

#### Swingarm Removal

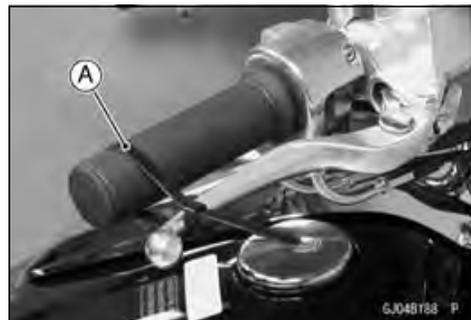
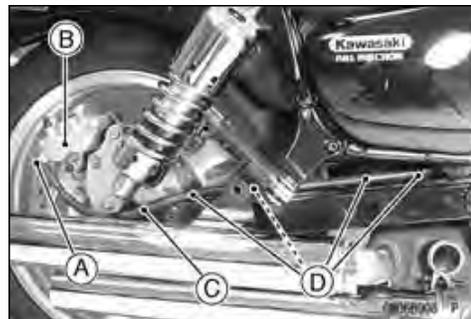
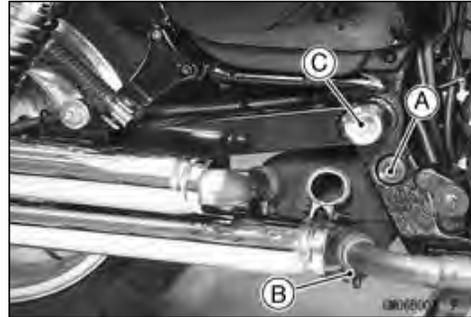
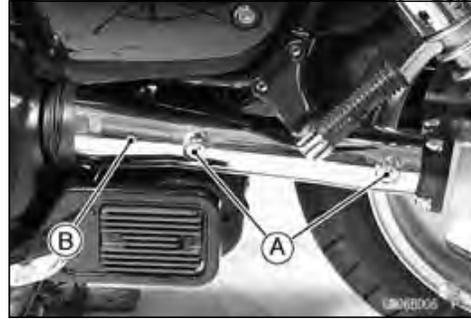
- Remove:
    - Bolts [A]
    - Swingarm Cover [B]
  
  - Remove the rear exhaust pipe (see Engine Top End chapter).
  - Loosen:
    - Right Muffler Chamber Bolt [A]
    - Front Exhaust Pipe Clamp Bolt [B]
  - Remove:
    - Swingarm Pivot Cap [C]
  
  - Before removing the swingarm, unscrew the banjo bolt [A] on the rear caliper [B].
  - Temporarily secure the end of the brake hose to some high place to keep fluid loss to a minimum.
  - Immediately wash away any brake fluid that spills.
  - Detach the rear brake hose [C] from the holders [D] on the swingarm.
  - Using the jack and attachment jack under the frame pipe ribs, lift the rear wheel OFF the ground until the front wheel touches the ground (see Rear Shock Absorber Removal).
- Special Tools - Jack: 57001-1238**  
**Attachment Jack: 57001-1398**
- Squeeze the brake lever slowly and hold it with a band [A].

#### CAUTION

Be sure to hold the front brake when removing the swingarm, or the motorcycle may fall over. The motorcycle could be damaged.

#### ⚠ WARNING

Be sure to hold the front brake when removing the swingarm, or the motorcycle may fall over. It could cause an accident and injury.



## Swingarm

- Remove:
  - Rear Wheel (see Wheels/Tires chapter)
  - Final Gear Case (see Final Drive chapter)
- Remove the right rear shock absorber.
- Unscrew the pivot shaft [A], and pull it out while turning.
- Pull the swingarm [B] rearward, and take it off.

### CAUTION

**Do not tap the swingarm pivot shaft when removing or installing. Push or pull the pivot shaft while turning the shaft. Tapping on the shaft could damage the needle bearings in the swingarm.**

### Swingarm Installation

- Apply grease to the needle bearings and grease seals.
- Apply grease to the threads [A] of the swingarm pivot shaft.

**Torque - Swingarm Pivot Shaft: 110 N·m (11 kgf·m, 79.6 ft·lb)**

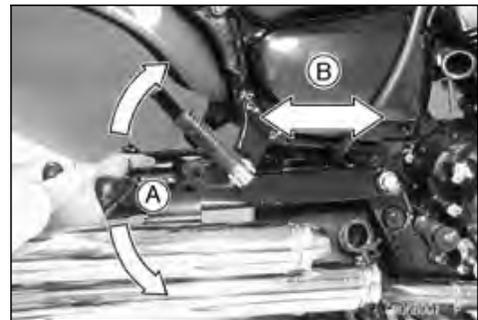
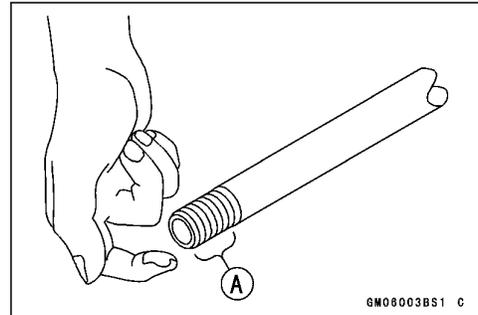
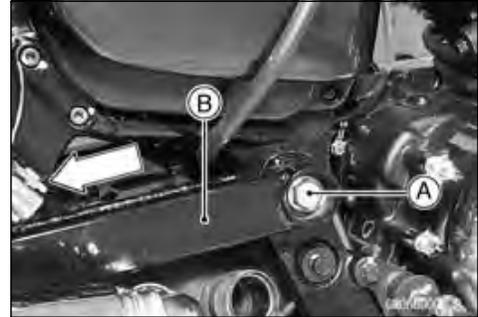
- Move the swingarm up and down [A] to check for abnormal friction, and push and pull [B] it to check for bearing play.
- Tighten:

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

**Rear Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

**Rear Caliper Holder Bolt: 64 N·m (6.5 kgf·m, 47 ft·lb)**

- Install:
  - Final Gear Case (see Final Drive chapter)
  - Rear Wheel (see Wheels/Tires chapter)
- Tighten:
  - Silencer Stay Bolt (see Engine Top End chapter)
  - Right Muffler Chamber Bolt (see Engine Top End chapter)
- After installing the swingarm, replenish the brake fluid into the reservoir and bleed the brake line (see Brake Line Bleeding in Brakes chapter).



## 13-20 SUSPENSION

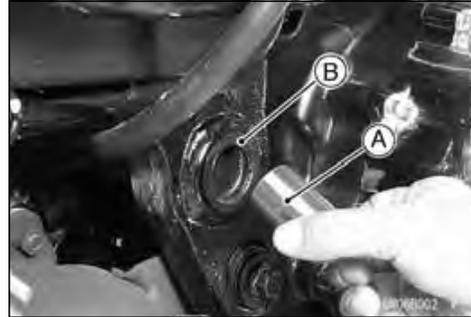
### Swingarm

#### Swingarm Bearing Removal

- Remove:
  - Swingarm (see this chapter)
  - Propeller Shaft (see Final Drive chapter)
  - Right and Left Sleeves [A]
  - Right and Left Grease Seals [B]
- Remove the needle bearings, using the oil seal & bearing remover [A].

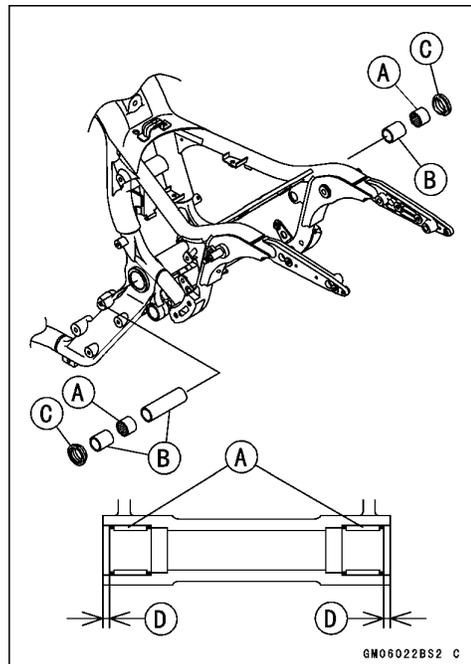
**Special Tool - Oil Seal & Bearing Remover: 57001-1058**

- Replace the bearings and sleeves with new ones.
- Remove the other side bearing in the same manner.



#### Swingarm Bearing Installation

- Apply plenty of grease to the needle bearings, and sleeve.
  - Be sure to install the needle bearings so that the manufacturer's marks are faced out. This prevents bearing damage.
  - Position the bearings [A] as shown, using a suitable bearing driver in the bearing driver set.
    - Sleeves [B]
    - Grease Seals [C]
    - 5 mm [D]
- Special Tool - Bearing Driver Set: 57001-1129**

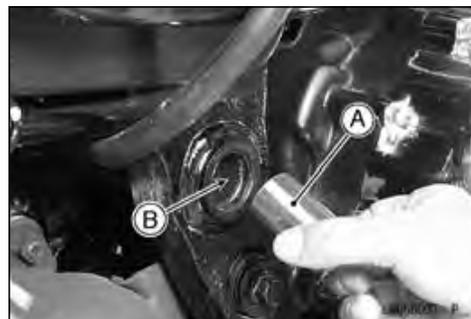


#### Swingarm Bearing, Sleeve Inspection

##### CAUTION

**Do not remove the needle bearings for inspection. Remove may damage them.**

- Visually inspect the swingarm sleeves [A] and needle bearings [B].
- The rollers in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing in the swingarm for abrasion, color change, or other damage.
- ★ If there is any doubt as to the condition of any of the needle bearings or sleeve, replace the sleeve, and needle bearings as a set.



## Swingarm

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### *Grease Seal and Needle Bearing Lubrication*

- Refer to the Swingarm Pivot Lubrication in the Periodic Maintenance chapter.



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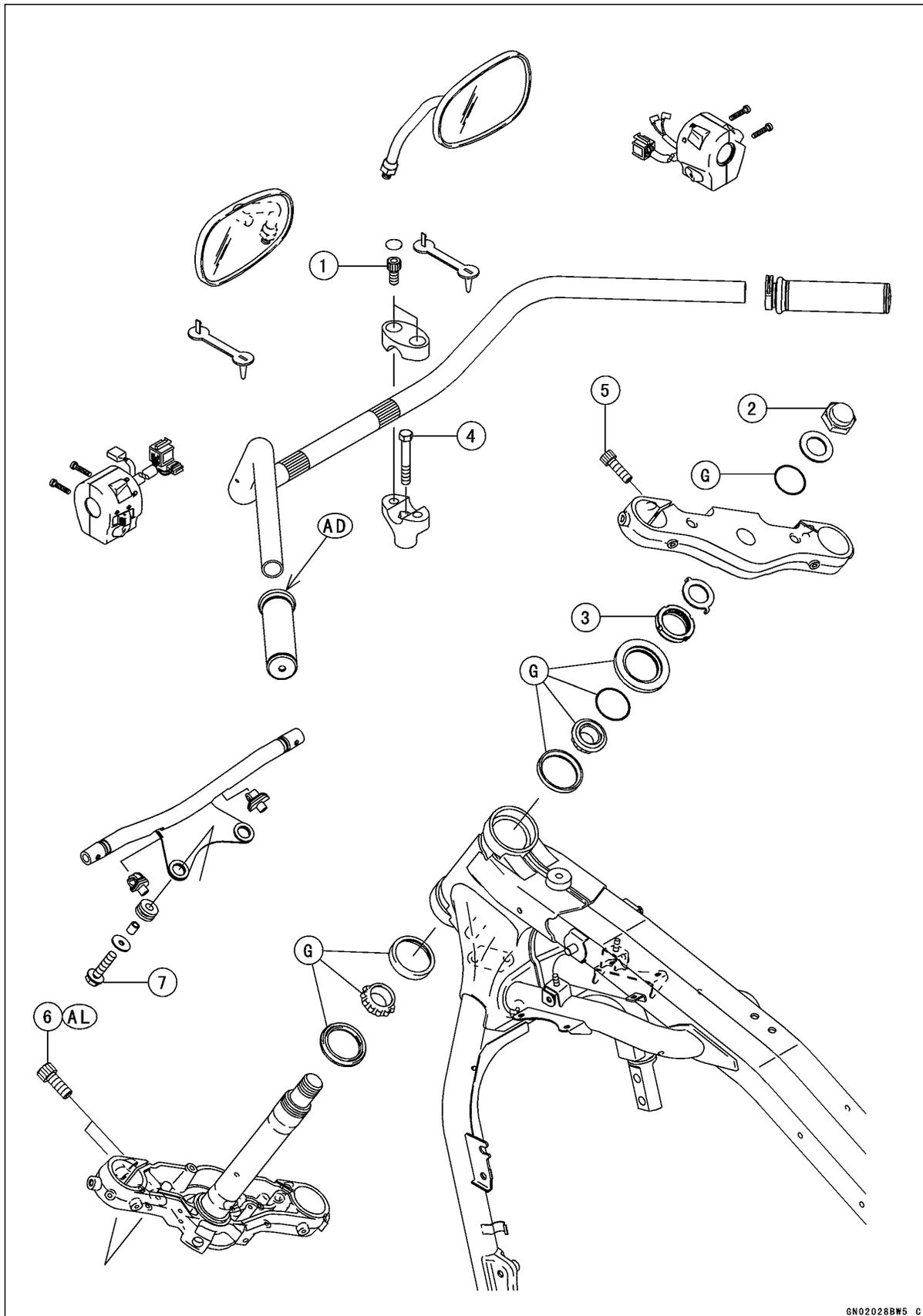
# Steering

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# 14-2 STEERING

## Exploded View



## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handlebar clamp bolts	34	3.5	25	
2	Steering stem head nut	88	9.0	65	
3	Steering stem nut	5	0.5	43 in·lb	
4	Handlebar holder nuts	34	3.5	25	
5	Upper front fork clamp bolts	20	2.0	14	
6	Lower front fork clamp bolts	2.9	3.0	21	AL
7	Turn signal light mounting nuts	5.9	0.6	52 in·lb	

AD: Apply adhesive.

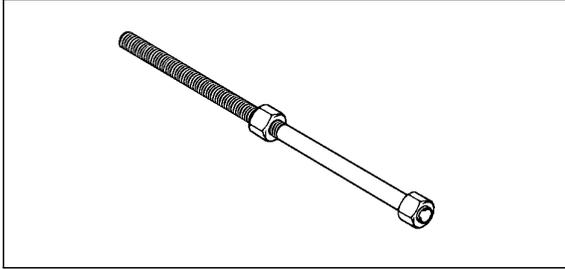
G: Apply grease.

AL: Tighten the two clamp bolts alternately two times to ensure even tightening torque.

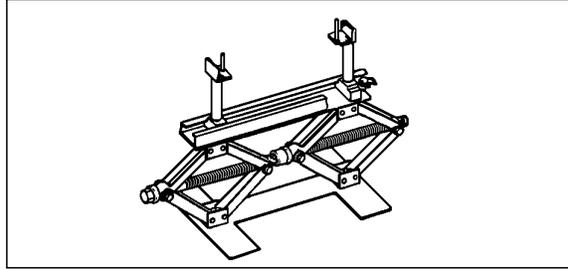
## 14-4 STEERING

### Special tools

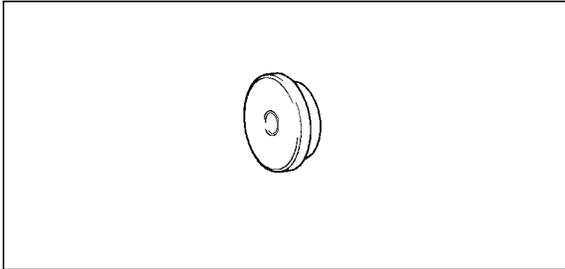
**Head Pipe Outer Race Press Shaft :**  
57001-1075



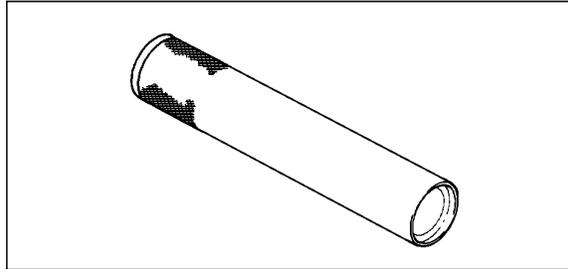
**Jack :**  
57001-1238



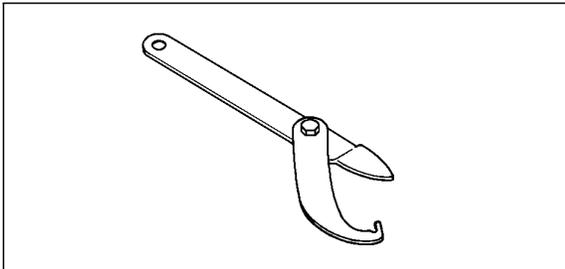
**Head Pipe Outer Race Driver,  $\phi 54.5$  :**  
57001-1077



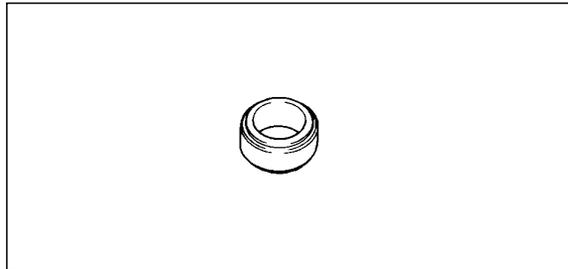
**Steering Stem Bearing Driver,  $\phi 42.5$  :**  
57001-1344



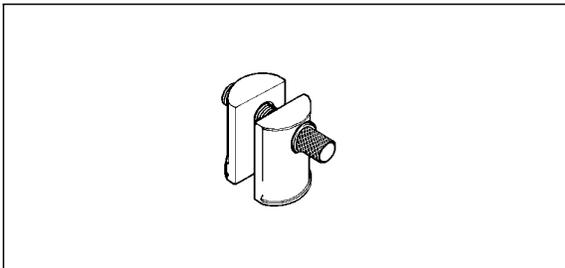
**Steering Stem Nut Wrench :**  
57001-1100



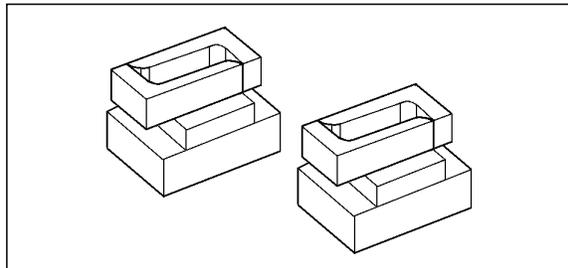
**Steering Stem Bearing Driver Adapter,  $\phi 41.5$  :**  
57001-1345



**Head Pipe Outer Race Remover ID > 37 mm :**  
57001-1107



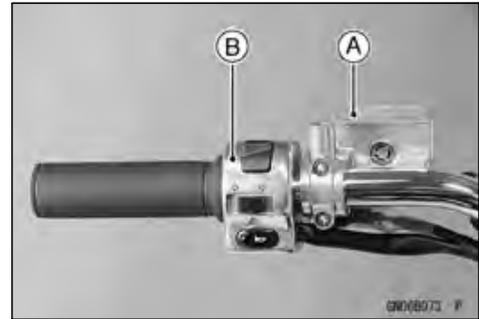
**Attachment Jack :**  
57001-1398



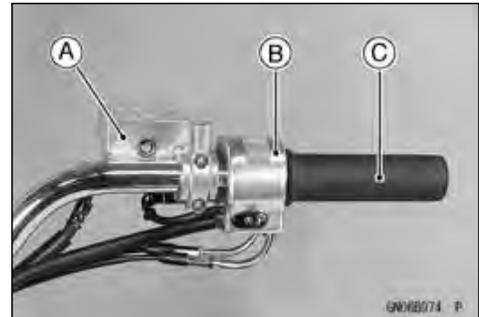
## Handlebar

### Handlebar Removal

- Cut the straps.
- Remove:
  - Clutch Master Cylinder [A]
  - Left Handlebar Switch Housing [B]



- Front Brake Master Cylinder [A]
- Right Handlebar Switch Housing [B]
- Throttle Grip [C]

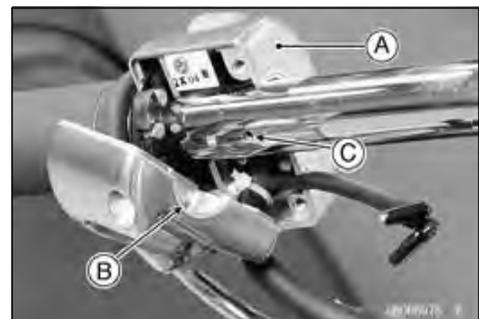


- Unscrew the bolts [A] and remove the handlebar [B] from the stem head.

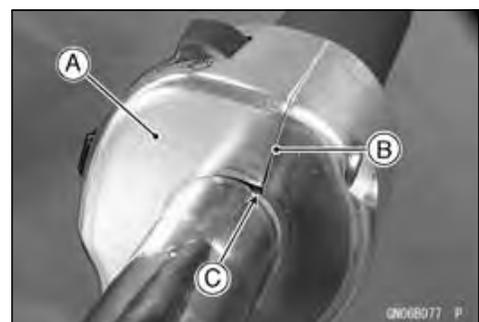


### Handlebar Installation

- Tighten the handlebar bolts.
- Torque - Handlebar Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**
- The front half of the right handlebar switch housing [A] has a small projection [B]. Fit the projection into the small hole [C] in the handlebar.



- Set the left handlebar switch housing [A] to match its mating surface [B] to the punched mark [C] of the handlebar.
- Install the handlebar switch housings.
- Install:
  - Clutch Master Cylinder (see Clutch chapter)
  - Front Brake Master Cylinder (see Brakes chapter)



## 14-6 STEERING

---

### Steering

---

#### *Steering Check*

- Refer to Steering Check in the Periodic Maintenance chapter.

#### *Steering Adjustment*

- Refer to Steering Adjustment in the Periodic Maintenance chapter.

## Steering Stem

### Steering Stem Removal

- Using the jack [A] and attachment jack [B] under the frame pipe ribs [C], and a commercially available jack [D] under the engine [E], lift the front wheel [F] **OFF** the ground until the rear wheel [G] touches the ground.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

- Remove the front wheel (see Tires/Wheels chapter).

### CAUTION

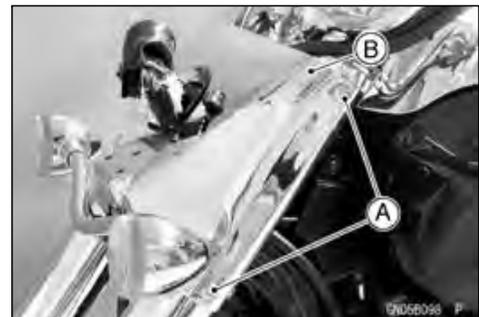
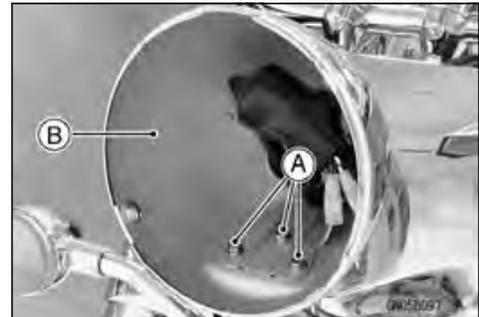
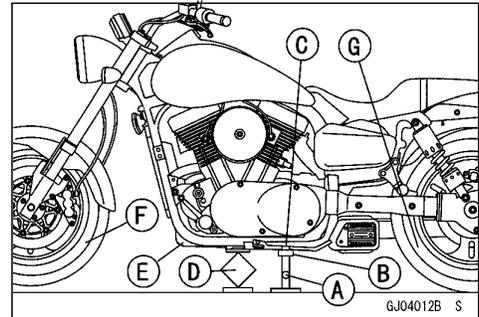
Be sure to put the rear wheel on the ground when removing the steering, or the motorcycle may fall over. The motorcycle could be damaged.

### ⚠ WARNING

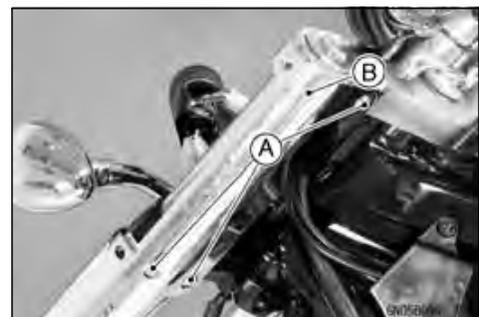
Be sure to put the rear wheel on the ground when removing the steering, or the motorcycle may fall over. It could cause an accident and injury.

- Unscrew the headlight rim screws and open the headlight unit (see Electrical System chapter).

- Remove:
  - Bolts [A]
  - Headlight body [B]



- Remove:
  - Bolts [A] (both side)
  - Front fork center cover [B]

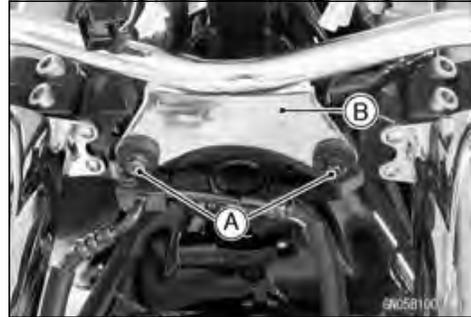


- Remove:
  - Bolts [A] (both side)
  - Front fork rear covers [B]

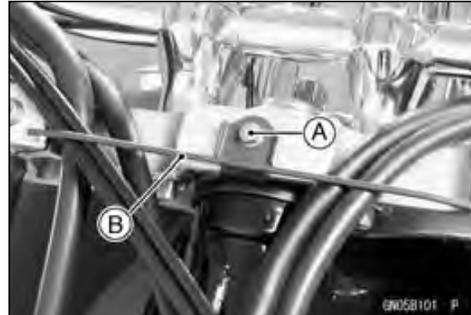
## 14-8 STEERING

### Steering Stem

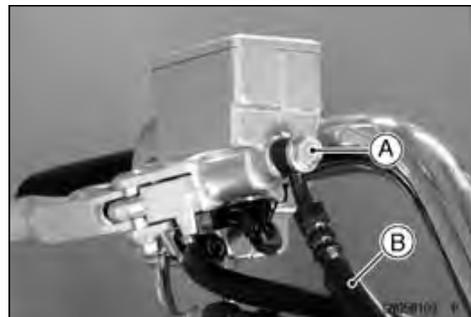
- Remove:  
Bolts [A]  
Turn signal rights bracket [B]



- Remove:  
Bolt [A]  
Cable bracket [B]



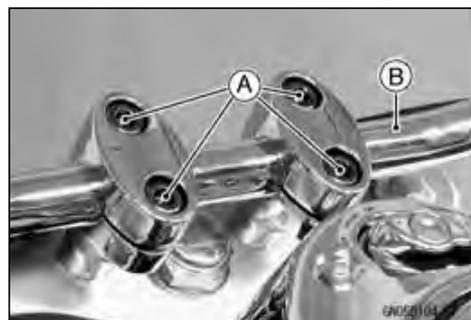
- Remove:  
Brake hose banjo bolt [A]  
Brake hose [B]



- Remove:  
Brake hose joint bolt [A]

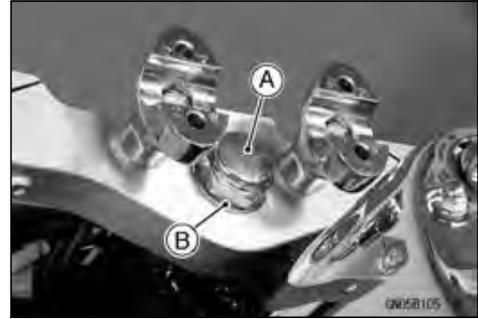


- Remove:  
Handlebar holder bolts [A]  
Handlebar [B]

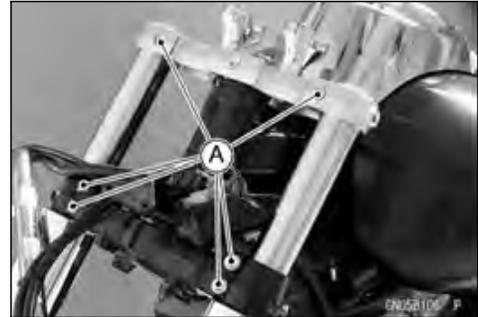


## Steering Stem

- Remove:  
Steering stem head nut [A]  
Washer [B]



- Remove:  
Front fork clamp bolts [A]



- Remove:  
Bolts [A]  
Front fork inner cover [B]

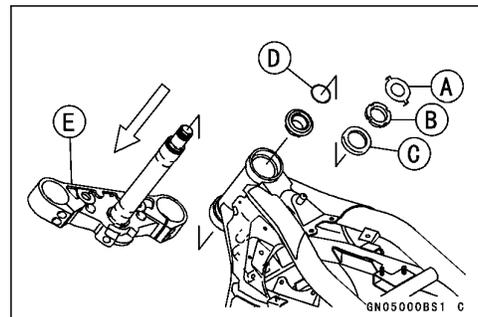


- Remove:  
Claw Washer [A]  
Steering Stem Nut [B]  
Stem Cap [C]  
O-ring [D]

### NOTE

○ Be sure to remove the O-ring for removal of the steering stem.

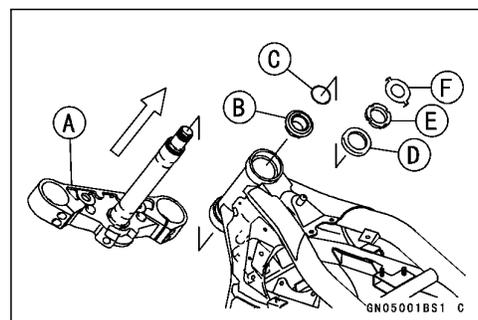
- Pull out the steering stem [E] from the bottom.



### Steering Stem Installation

- Install:  
Steering Stem [A]  
Bearing [B]  
New O-ring [C] (I.D. 34.5 x  $\phi$ 2 mm)  
Stem Cap [D]  
Stem Nut [E]  
Claw Washer [F]

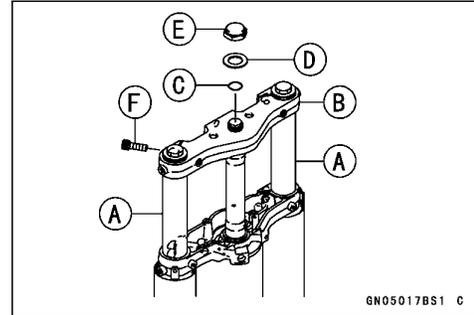
**Torque - Steering Stem Nut: 4.9 N·m (0.5 kgf·m, 43 in·lb)**



## 14-10 STEERING

### Steering Stem

- Install the fork leg [A] and push it up tightly against the stem bottom.
- Temporarily tighten the lower fork clamp bolts.
- Install:
  - Steering Stem Head [B] with Handlebar
  - O-ring [C]
  - Washer [D]
  - Stem Head Nut [E]
- Temporarily tighten the upper fork clamp bolts [F].

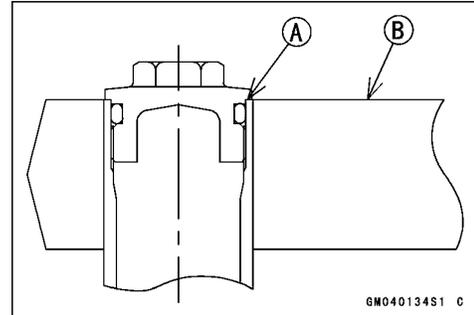


- Check that the top end [A] of the inner tube is flush with the upper surface [B] of the steering stem head. Otherwise reinstall the fork leg.
- Tighten the fork upper clamp bolts and then the stem head nut, and finally the fork lower clamp bolts.

**Torque - Fork Upper Clamp Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)**

**Steering Stem Head Nut: 88 N·m (9.0 kgf·m, 65 ft·lb)**

**Fork Lower Clamp Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb)**



#### NOTE

- Tighten the two clamp bolts alternately two times to ensure even tightening torque.

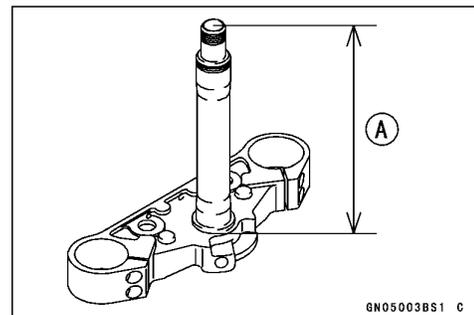
- Install the removed parts.
- Check and adjust the following items after installation.
  - Steering (see Steering Check)
  - Throttle Cables (see Fuel System chapter)
  - Headlight Aim
- Check the front brake effectiveness.

#### **⚠ WARNING**

**Do not attempt to ride the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brakes will not function on the first application of the lever if this is not done.**

#### Steering Stem Warp

- Whenever the steering stem is removed, or if the steering cannot be adjusted for smooth action, check the steering stem for straightness.
- ★ If the steering stem [A] is bent, replace the steering stem.



## Steering Stem Bearing

### Stem Bearing Removal

- Remove the steering stem (see this chapter).
- Drive out the bearing outer races from the head pipe.

**Special Tool - Head Pipe Outer Race Remover:**  
57001-1107 [A]

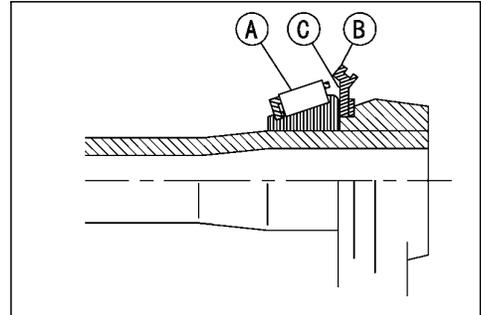
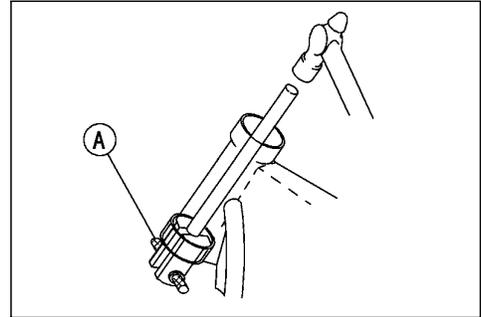
### NOTE

○If either steering stem bearing is damaged, it is recommended that both the upper and lower bearings (including outer races) be replaced with new ones.

- Remove the lower inner race [A] which is pressed onto the steering stem, using a chisel.

Grease Seal [B]

Tap here [C]

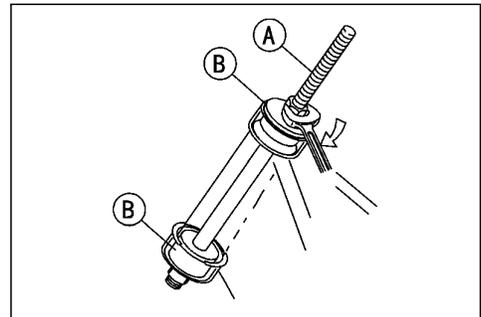


### Stem Bearing Installation

- Replace the bearing outer races with new ones.
- Apply grease to the outer races, and drive them into the head pipe at the same time.

**Special Tools - Head Pipe Outer Race Press Shaft:**  
57001-1075 [A]

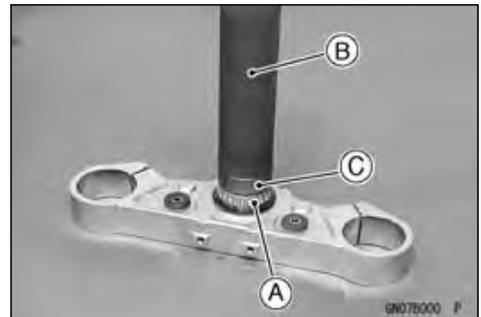
**Head Pipe Outer Race Drivers:**  
57001-1077 [B]



- Replace the stem bearing inner races with new ones.
- Apply grease to the lower inner race [A], and drive it onto the stem base.

**Special Tools - Steering Stem Bearing Driver:**  
57001-1344 [B]

**Steering Stem Bearing Driver Adapter:**  
57001-1345 [C]



- Install the steering stem.

### NOTE

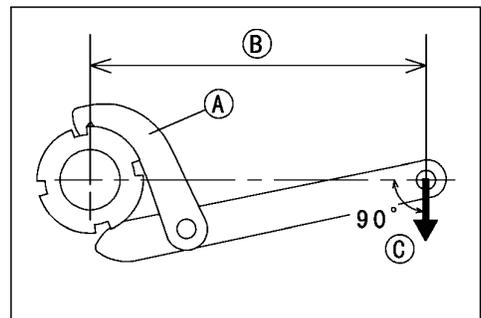
○Do not install the O-rings yet.

- Settle the bearings in place as follows:
  - Tighten the stem nut to **49 N·m (0.5 kgf·m, 43 in·lb)** of torque. (To tighten the steering stem nut to the specified torque, hook the wrench on the stem nut, and pull the wrench at the hole by **440 N (45 kg, 99 lb)** force in the direction shown.)

**Special Tool - Steering Stem Nut Wrench:** 57001-1100 [A]

180 mm [B]

Force [C]



## 14-12 STEERING

### Steering Stem Bearing

---

○ Check that there is no play and the steering stem turns smoothly without rattles. If not, the steering stem bearings may be damaged.

- Remove the stem nut.
- Install the O-rings and adjust the steering (see Periodic Maintenance chapter).

**Torque - Steering Stem Nut: 49 N·m (0.5 kgf·m, 43 in·lb)**

#### *Stem Bearing Lubrication*

In accordance with the Periodic Maintenance Chart, lubricate the steering stem bearings. Refer to the Stem Bearing Lubrication in Periodic Maintenance chapter.

#### *Stem Cap Deterioration, Damage*

- ★ Replace the stem cap if its grease seal [A] shows damage.



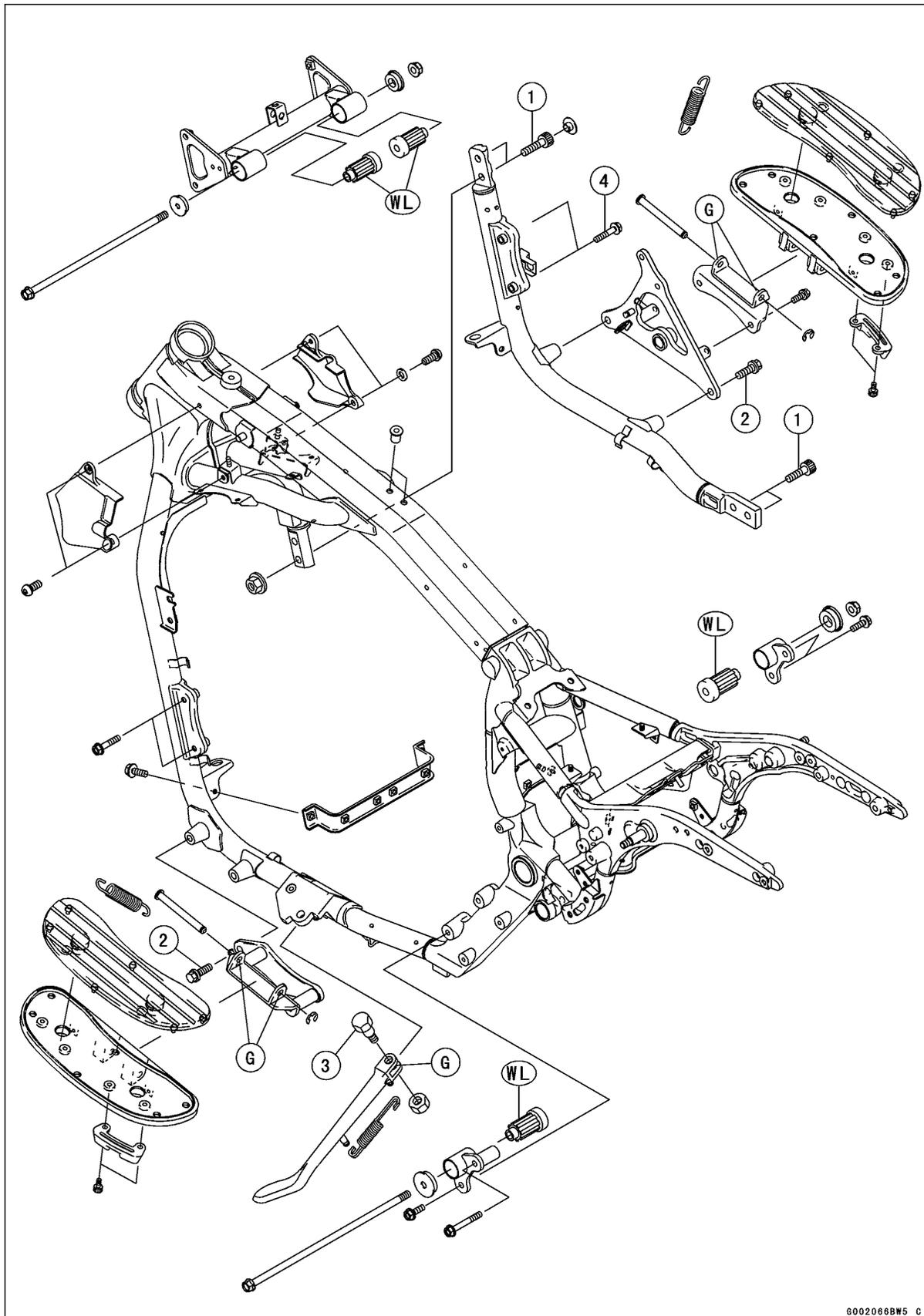
# Frame

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# 15-2 FRAME

## Exploded View



6002066BW5 C

**Exploded View**

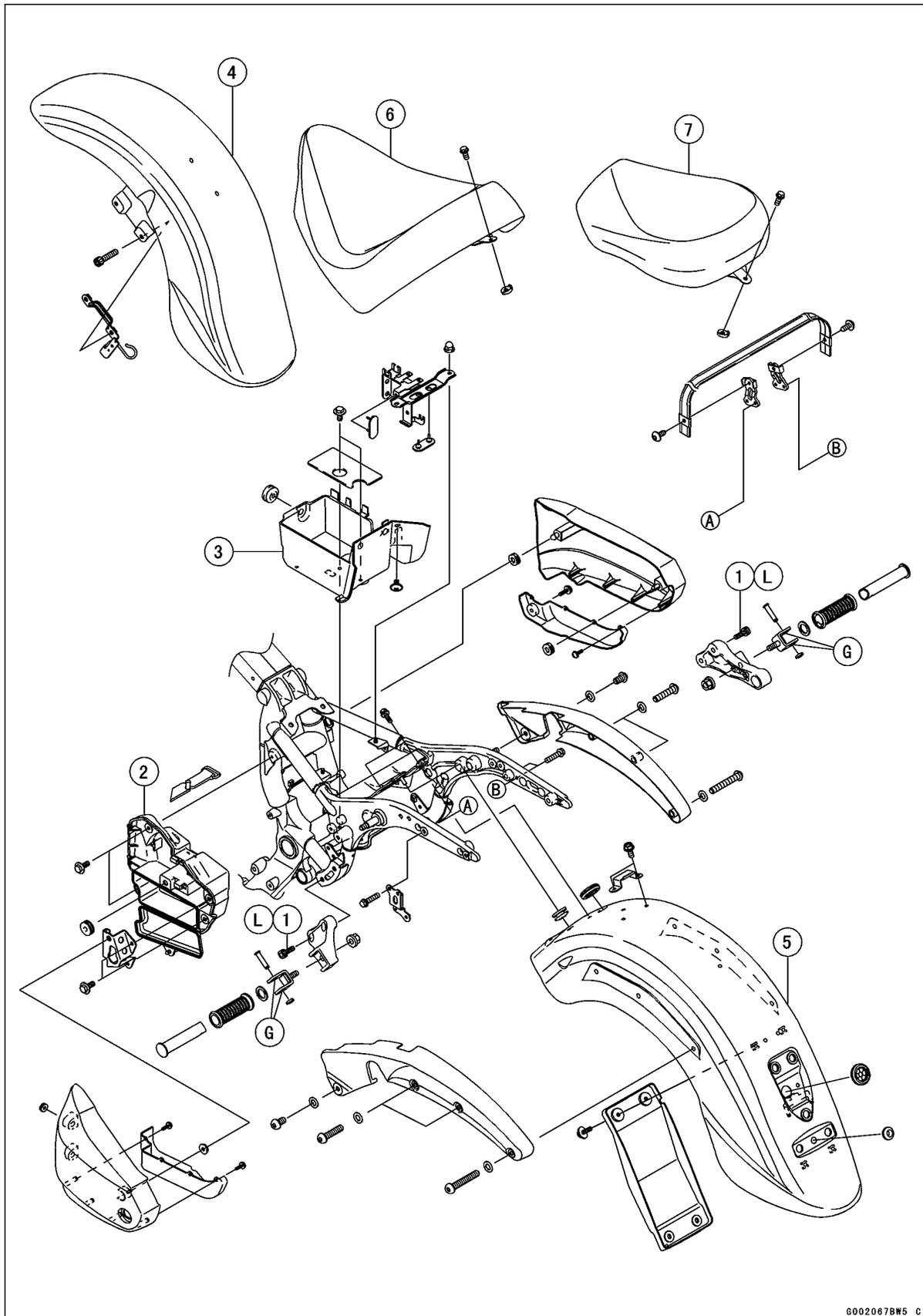
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Downtube bolts	44	4.5	33	
2	Footboard bracket bolts	34	3.5	25	
3	Sidestand bolt	44	4.5	33	
4	Engine mounting bracket bolts	25	2.5	18	

G: Apply grease.

WL: Apply a soap and water solution or rubber lubricant.

# 15-4 FRAME

## Exploded View



6002067BW5 C

**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Footpeg bracket bolts	25	2.5	18	L

2. Tool box

3. Battery case

4. Front fender

5. Rear fender

6. Front seat

7. Rear seat

G: Apply grease.

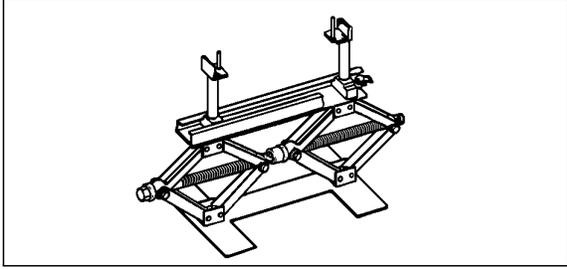
L: Apply a non-permanent locking agent.

## 15-6 FRAME

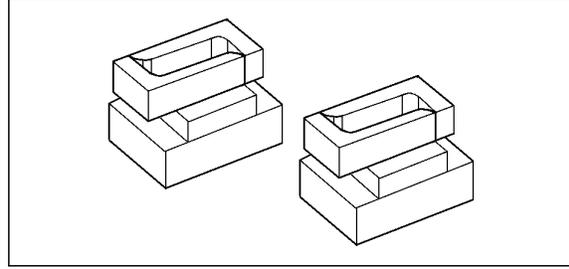
### Special Tools

---

Jack :  
57001-1238



Attachment Jack :  
57001-1398



## Seats

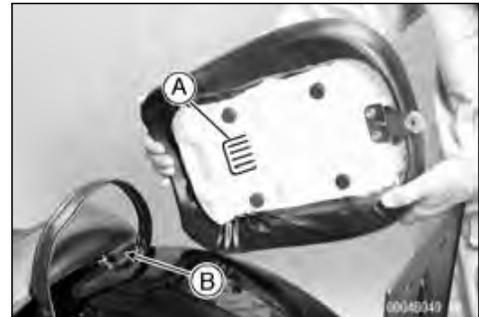
### Rear Seat Removal

- Remove the rear seat bolt [A] and move the rear seat backwards [B] and remove it (left view).



### Rear Seat Installation

- Slip the hook [A] of the rear seat into the bracket [B] on the rear fender.
- Tighten the rear seat bolt.



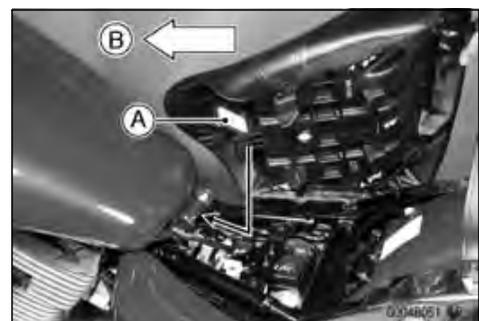
### Front Seat Removal

- Remove the rear seat (see this section).
- Remove the front seat bolt [A].
- Pull the front seat [B] backwards and up, then remove it.



### Front Seat Installation

- Insert the hook [A] of the seat under the fuel tank bracket.
- Tighten the front seat bolt.
- Install the rear seat (see this section).



## 15-8 FRAME

### Side Covers

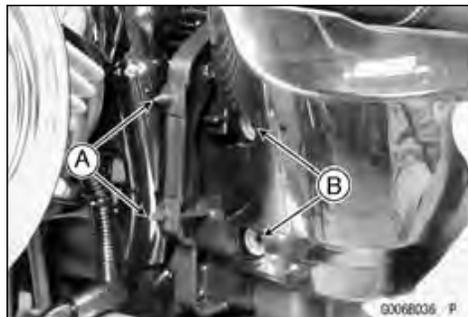
#### Left Side Cover Removal

- Insert the ignition switch key [A] into the left side cover, and turn the key clockwise until the key slot is vertical.
- Pull [B] the rear part of the left side cover, push [C] the left side cover slightly forward, and remove it.

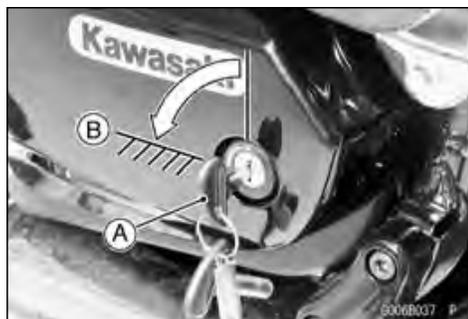


#### Left Side Cover Installation

- Put the front stoppers [A] into the grommets [B] first, then put the rear stopper into the grommet.



- Turn the ignition switch key [A] counterclockwise until the key slot is horizontal [B] to secure the left side cover.



#### Right Side Cover Removal/Installation

- Remove the screw [A].

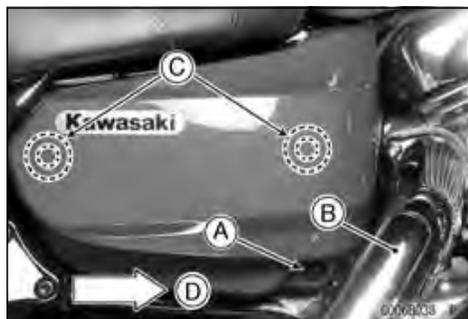
#### CAUTION

**Be careful not to scratch the right side cover surface with the rear exhaust pipe [B] during removal or installation.**

- Cover the rear exhaust pipe with a shop towel and pull the right side cover evenly outward to clear the stoppers.
- Pull the right side cover off the grommets [C] and remove the cover.

Front [D]

- Put the stoppers into the grommets.
- Tighten the screw.



## Fenders

### Front Fender Removal

#### CAUTION

**Be careful not to scratch the painted surface during removal or installation.**

- Remove the mounting bolts [A] on both sides to separate the fender from the front fork (right side view).
- Move the fender forwards with the wheel installed and remove it.

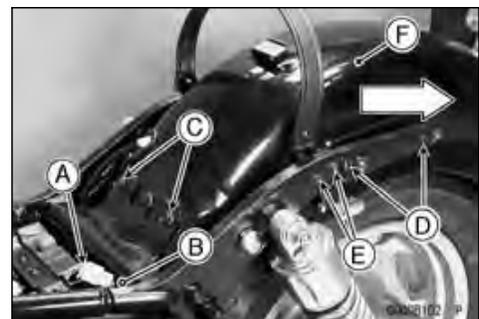
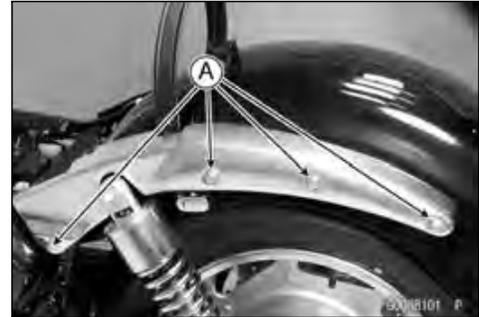


### Rear Fender Removal

#### CAUTION

**Be careful not to scratch the painted surface during removal or installation.**

- Remove the front and rear seats (see this chapter).
- Remove the rear fender cover bolts [A] on both sides.
- Disconnect the rear turn signal and taillight lead connector [A] and pull off the female connector along with the strap [B].
- Remove:
  - Rear Fender Front Bolts [C]
  - Rear Fender Allen Bolts [D]
  - Seat Band Stay Bolts [E]
- Remove the rear fender [F] rearwards.

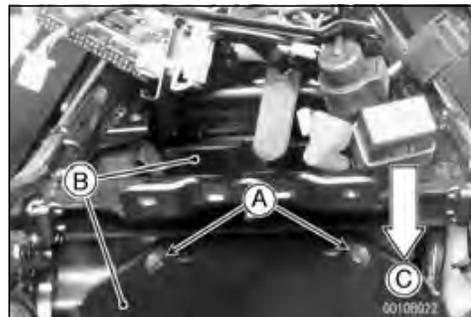
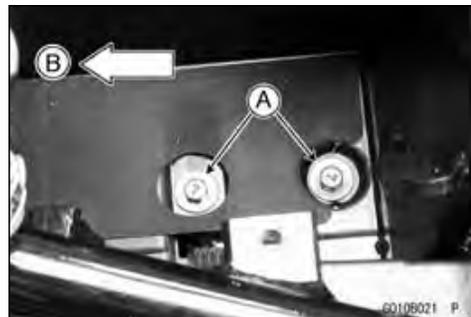
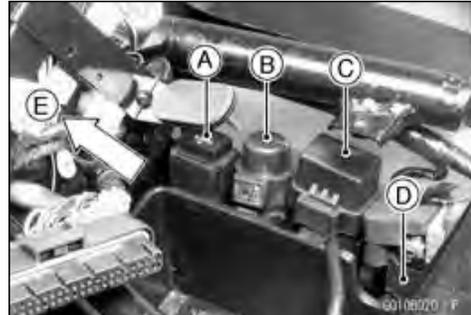
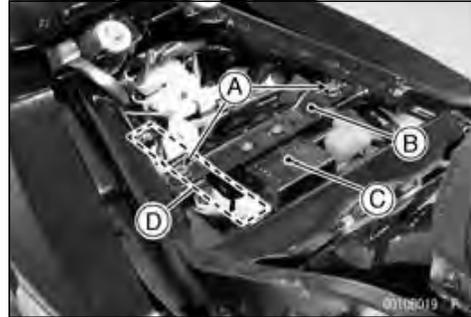


## 15-10 FRAME

### Battery Case/Tool Box

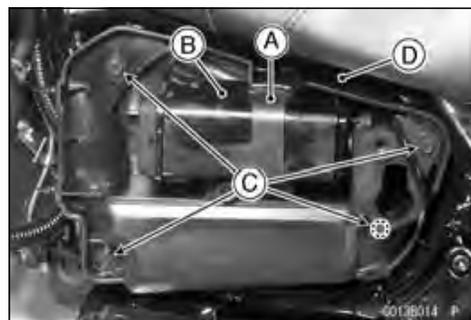
#### Battery Case Removal

- Remove (left view):
  - Front and Rear Seats (see this chapter)
  - Bolts [A] and Battery Holder [B]
  - Battery [C] (see Electrical System chapter)
  - ECU [D] (see Fuel System (DFI) chapter)
  
- Pull the following upwards:
  - Oil Pressure Light Delay Unit [A]
  - DFI Main Relay [B]
  - Turn Signal Control Unit [C]
  - Starter Relay [D]
  - Front [E]
  
- Remove two bottom bolts [A].
  - Front [B]
  
- Remove the rear wheel (see Wheels/Tires chapter).
- Remove two rear screws [A] (rear view).
- Remove the battery case [B] towards the rear [C].



#### Tool Box Removal

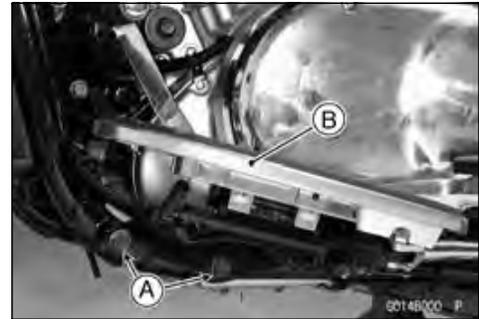
- Remove the left side cover (see this chapter).
- For California, remove the band [A] and canister [B].
- Unscrew the bolts [C].
- Pull the tool case [D] out.



## Front Footboard, Sidestand

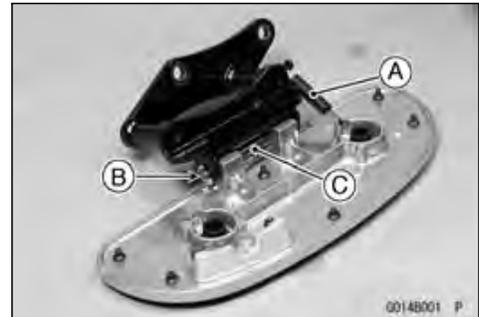
### Footboard Removal

- Unscrew the bolts [A] and remove the left front footboard [B].
- The right front footboard is removed during brake pedal removal (see Brakes chapter).



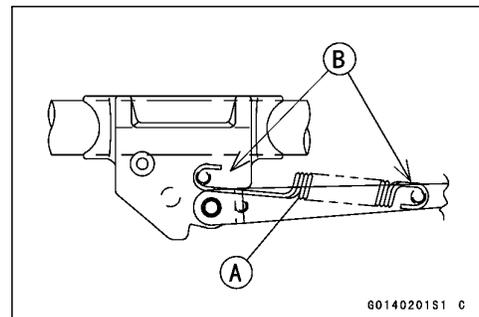
### Footboard Disassembly

- Remove the front footboard.
- Remove:
  - Footboard Spring [A]
  - Circlip [B]
  - Pin [C]



### Sidestand Installation

- Tighten:
  - Torque - Sidestand Bolt: 44 N·m (4.5 kgf·m, 33 ft·lb)**
- Install the sidestand spring [A], noting the direction of the hooks [B].



## 15-12 FRAME

### Frame

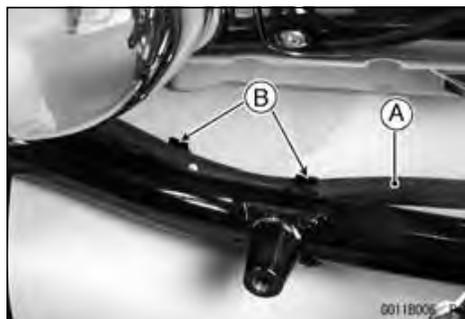
#### *Downtube Removal*

- Using the jack and the attachment jack, raise the rear wheel off the ground (see *Wheels/Tires* chapter).

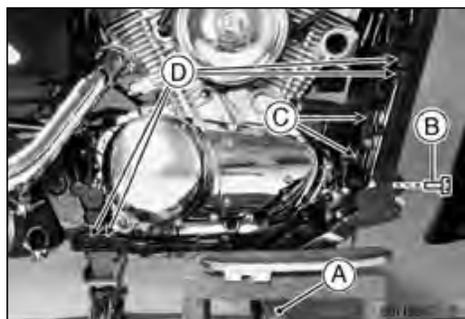
**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**

- Remove the brake reservoir cover [A] and reservoir (see *Brakes* chapter).
- Open the lead clamps [B]
- Remove the right footboard assembly [C] by taking off the bolts [D] with the brake pedal and rear master cylinder installed. Place the assembly on a block.
- Remove the front exhaust pipe [E] (see *Engine Top End* chapter).
- Take off the brake hose [A] from the clamps [B].



- Support the engine with a commercially available stand [A].
- Remove:
  - Right Radiator Cover Bolt [B]
  - Engine Mounting Bracket Bolts [C]
  - Downtube Bolts [D]



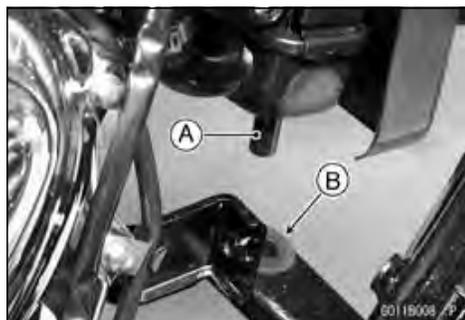
#### *Downtube Installation*

- Run the brake hose inside the downtube and clamp it.
- Put right and left stoppers [A] of the radiator into the grommets [B] of the downtube.
- Tighten:

**Torque - Downtube Bolts: 44 N·m (4.5 kgf·m, 33 ft·lb)**

**Engine Mounting Bracket Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**Footboard Bracket Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)**



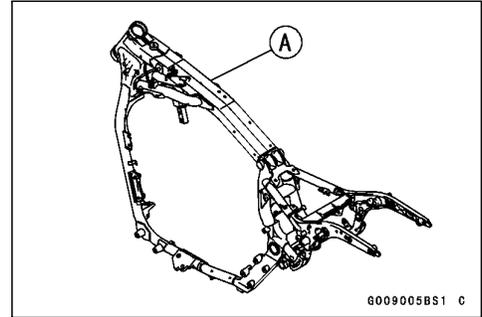
## Frame

### *Frame Inspection*

- Visually inspect the frame [A] for cracks, dents, bending, or warp.
- ★ If there is any damage to the frame, replace it.

### **⚠ WARNING**

**A repaired frame may fail in use, possibly causing an accident. If the frame is bent, dented, cracked, or warped, replace it.**





# Electrical System

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## 16-2 ELECTRICAL SYSTEM

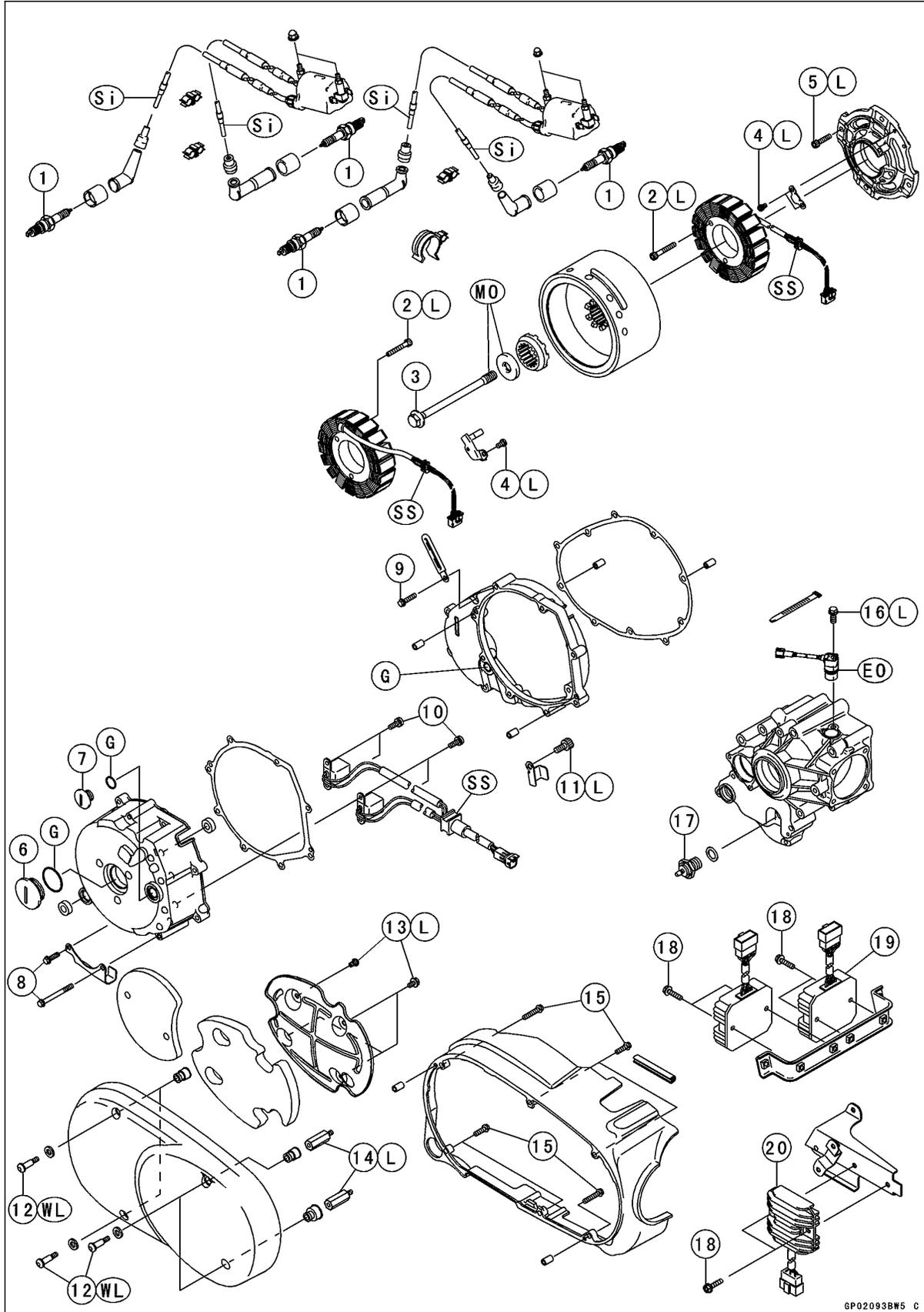
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# 16-4 ELECTRICAL SYSTEM

## Exploded View



GP02093BW5 C

## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Spark plugs	18	1.8	13	
2	Alternator stator bolts	13	1.3	113 in·lb	L
3	Alternator rotor bolt	78	8.0	58	MO
4	Stator lead holder screw	9.8	1.0	87 in·lb	L
5	Inside stator holder bolts	11	1.1	95 in·lb	L
6	Rotor bolt cap	1.5	0.15	13 in·lb	
7	Timing inspection cap	1.5	0.15	13 in·lb	
8	Alternator cover bolts	11	1.1	95 in·lb	
9	Alternator inner cover bolts	11	1.1	95 in·lb	
10	Crankshaft sensor screws	2.9	0.30	26 in·lb	
11	Crankshaft sensor lead holder bolt	2.9	0.30	26 in·lb	L
12	Alternator outer cover bolts	6.9	0.70	61 in·lb	
13	Alternator outer cover damper bolts	6.9	0.70	61 in·lb	L
14	Alternator outer cover joint bolts	6.9	0.70	61 in·lb	L
15	Alternator outer cover assembly bolts	6.9	0.70	61 in·lb	
16	Speed sensor mounting bolt	9.8	1.0	87 in·lb	L
17	Neutral switch	15	1.5	11	
18	Regulator/Rectifier bolts	6.5	0.66	57 in·lb	

19. Regulator/Rectifier (United State and Canada models)

20. Regulator/Rectifier (other than United State and Canada models)

L: Apply a non-permanent locking agent.

G: Apply grease.

EO: Apply engine oil.

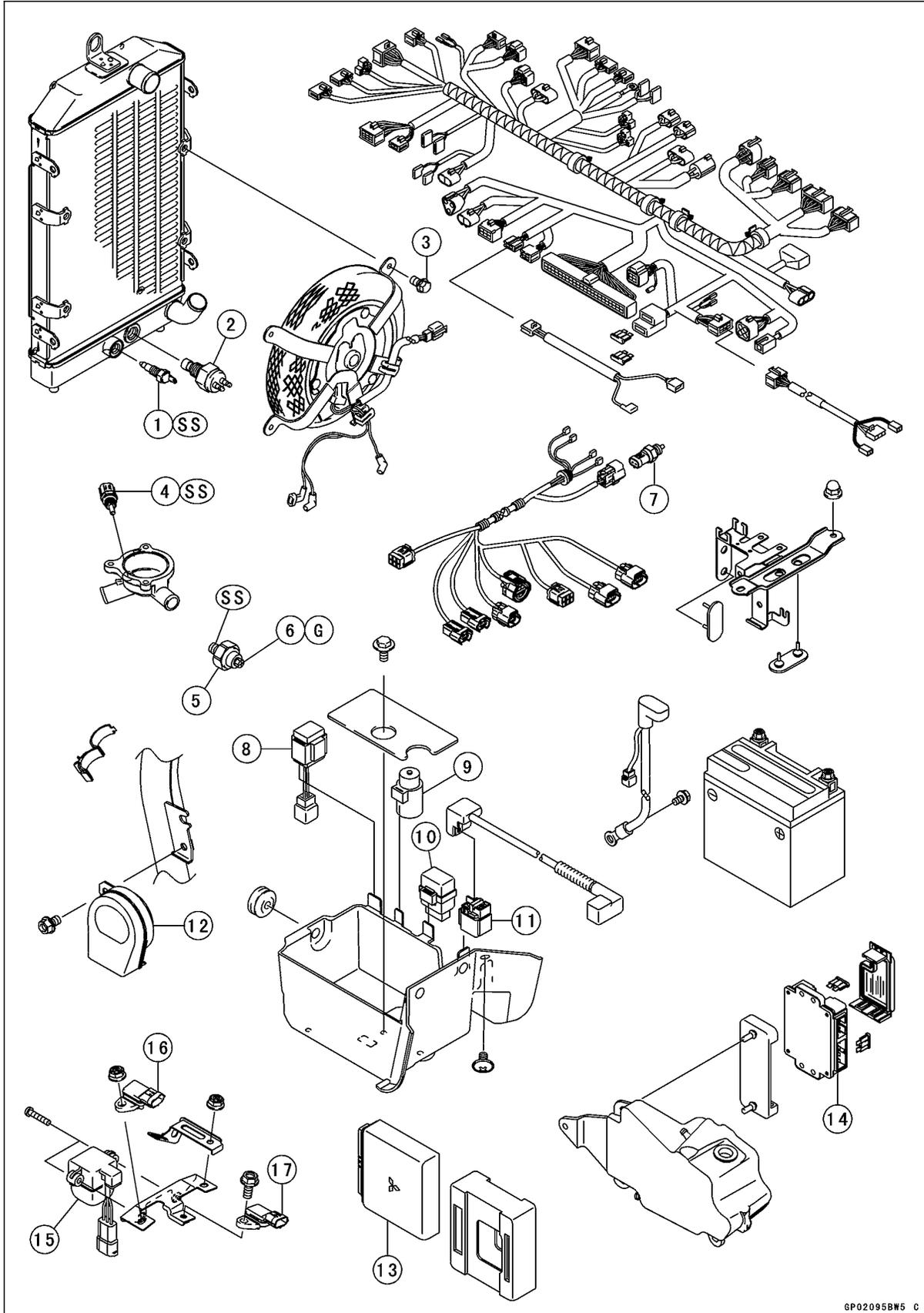
SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

Si: Apply silicone grease.

WL: Apply a soap and water solution or rubber lubricant.

# 16-6 ELECTRICAL SYSTEM

## Exploded View



GP02095BW5 C

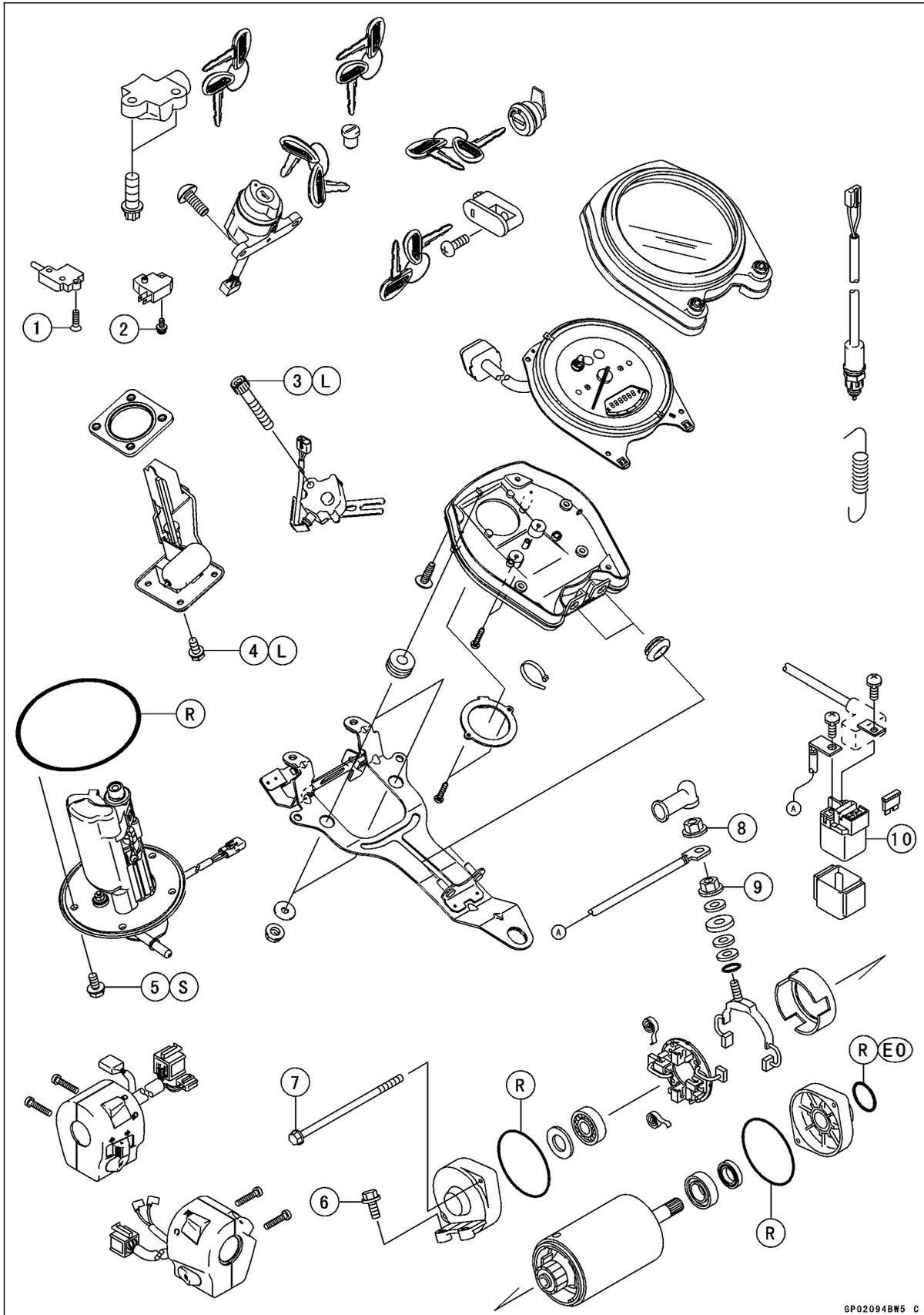
## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Water temperature switch	7.8	0.80	69 in·lb	SS
2	Radiator fan switch	18	1.8	13	
3	Radiator fan bolts	8.3	0.85	74 in·lb	
4	Water temperature sensor	18	1.8	13	SS
5	Oil pressure switch	15	1.5	11	SS
6	Oil pressure switch terminal screw	1.5	0.15	13 in·lb	G

- 7. Inlet air temperature sensor
  - 8. Oil pressure light delay unit
  - 9. DFI main relay
  - 10. Turn signal control relay
  - 11. Starter Relay
  - 12. Horn
  - 13. Electronic control unit
  - 14. Junction Box
  - 15. Vehicle-down sensor
  - 16. Atmospheric pressure sensor
  - 17. Inlet air pressure sensor
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

# 16-8 ELECTRICAL SYSTEM

## Exploded View



GP02094BW5 C

## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Starter lockout switch screw	1.2	0.12	10 in·lb	
2	Front brake light switch screw	1.2	0.12	10 in·lb	
3	Side stand switch mounting bolt	8.8	0.90	78 in·lb	L
4	Fuel level sensor mounting bolts	6.9	0.70	61 in·lb	L
5	Fuel pump mounting bolts	9.8	1.0	87 in·lb	S
6	Starter motor mounting bolts	11	1.1	95 in·lb	
7	Starter motor assembly bolts	4.9	0.50	43 in·lb	
8	Starter motor terminal nut	4.9	0.50	43 in·lb	
9	Starter motor terminal locknut	11	1.1	95 in·lb	

10. Starter relay

L: Apply a non-permanent locking agent.

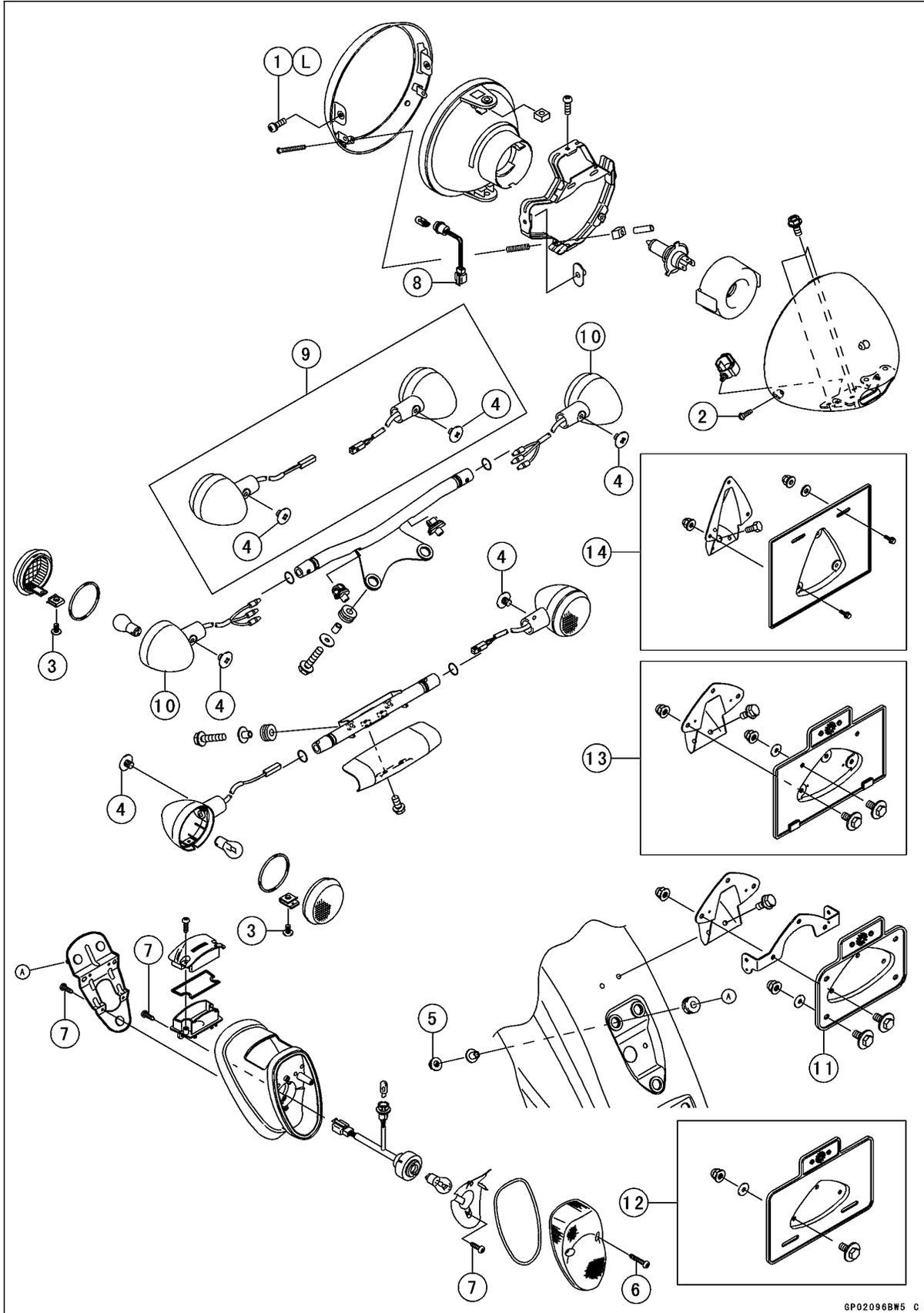
S: Follow the specific tightening sequence.

R: Replacement Parts

EO: Apply engine oil.

# 16-10 ELECTRICAL SYSTEM

## Exploded View



GP02096BW5 C

## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Headlight unit bracket screws	1.0	0.10	8.7 in·lb	L
2	Headlight rim screws	2.9	0.30	26 in·lb	
3	Turn signal light lens screws	1.0	0.10	8.7 in·lb	
4	Turn signal light mounting screws	6.9	0.70	61 in·lb	
5	Tail/brake light mounting nuts	5.9	0.60	52 in·lb	
6	Tail/brake light lens screws	1.2	0.12	10 in·lb	
7	Tail/brake light assembly screws	1.2	0.12	10 in·lb	

8. City Light (other than US, Canada and Australia models)

9. Other than US and Canada models

10. US and Canada models

11. US model

12. Canada model

13. Australia model

14. Other than US, Canada and Australia models

L: Apply a non-permanent locking agent.

## 16-12 ELECTRICAL SYSTEM

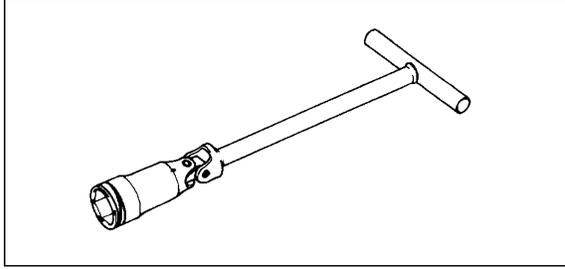
### Specifications

Item	Standard
<b>Battery:</b> Type Model name Capacity Voltage	Sealed Battery FTZ16-BS 12 V 18 Ah 12.6 V or more
<b>Charging System:</b> Alternator type  Battery charging voltage Alternator output voltage (no load) Stator coil (battery charging coil) resistance Regulator/rectifier Type Resistance	Three-phase AC with delta connection, and rare-earth single magnet rotor  14.2 ~ 15.2 V @3 000 r/min (rpm) 60 ~ 90 V @3 000 r/min (rpm) 0.33 ~ 0.49 $\Omega$ Load dumping regulator with full-wave rectifier in the text
<b>Ignition System:</b> Ignition coil: 3 needle arcing distance Primary winding resistance Secondary winding resistance Primary peak voltage      Front Rear  Spark plug: Spark plug gap Spark plug cap resistance Crankshaft sensor: Crankshaft sensor peak voltage                              Front Rear  Crankshaft sensor resistance Crankshaft sensor air gap	6 mm (0.24 in.) or more 1.9 ~ 2.9 $\Omega$ 18 ~ 28 k $\Omega$ 208 V or more 192 V or more  0.8 ~ 0.9 mm (0.031 ~ 0.035 in.) 3.75 ~ 6.25 k $\Omega$   2.2 V or more 2.0 V or more 380 ~ 560 $\Omega$ 1.0 mm (0.04 in.) (Non-measurable and non-adjustable)
<b>Electric Starter System:</b> Starter motor: Brush length Commutator diameter	12 mm (0.47 in.) (Service limit 8.5 mm, 0.33 in.) 28 mm (1.10 in.) (Service limit 27 mm, 1.06 in.)
<b>Switch and Sensor:</b> Fuel level sensor resistance  Rear brake light switch timing Engine oil pressure switch resistance  Radiator fan switch resistance Rising temperature Falling temperature  Water temperature switch resistance Rising temperature Falling temperature	FULL position: 3 ~ 5 $\Omega$ EMPTY position: 213 ~ 219 $\Omega$ ON after about 10 mm (0.39 in.) pedal travel When engine is stopped: ON When engine is running: OFF  From OFF to ON @102 ~ 108°C (212 ~ 226°F) From ON to OFF @97 ~ 103°C (207 ~ 217°F) ON: Less than 0.5 $\Omega$ OFF: More than 1 M $\Omega$  From OFF to ON: 113 ~ 117°C (235 ~ 243°F) From ON to OFF: 108°C (226°F) ~ temperature less than ON temperature

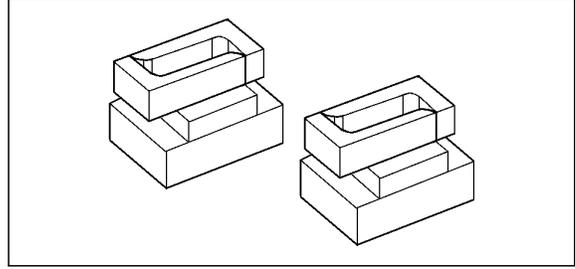
○Refer to Fuel System chapter for specifications of DFI parts.

**Special Tools**

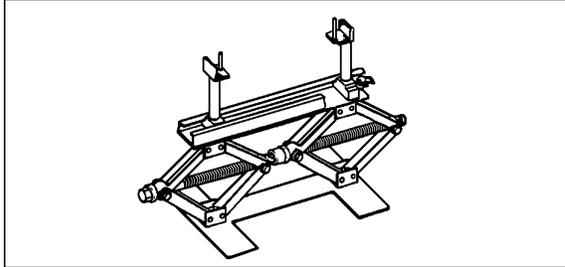
**Spark Plug Wrench, Hex 18 :**  
57001-1024



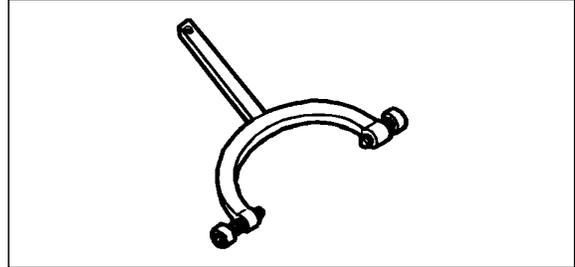
**Attachment Jack :**  
57001-1398



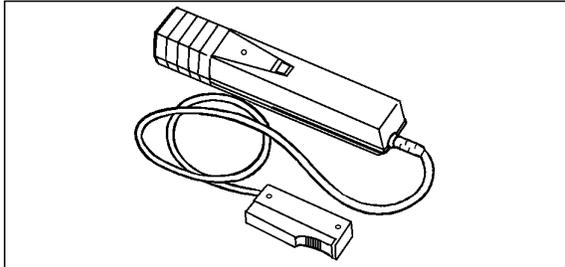
**Jack :**  
57001-1238



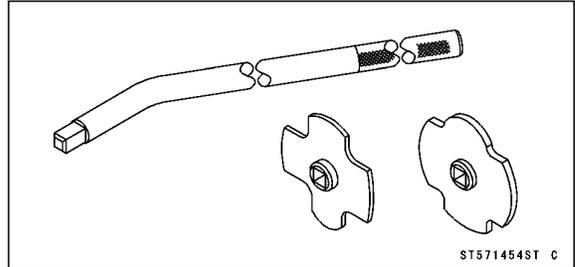
**Flywheel Holder :**  
57001-1410



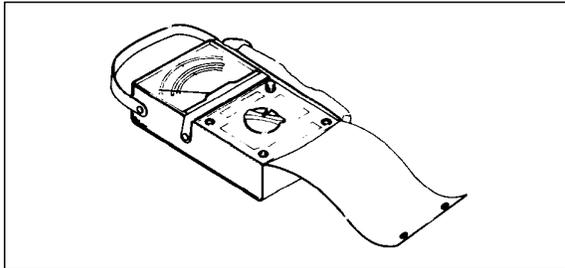
**Timing Light :**  
57001-1241



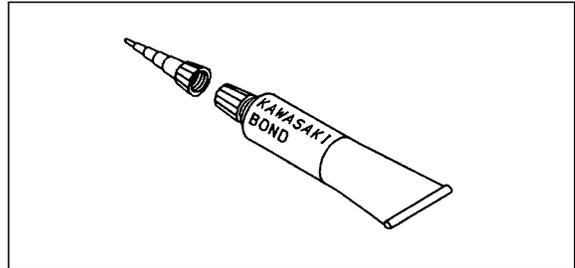
**Filler Cap Driver :**  
57001-1454



**Hand Tester :**  
57001-1394

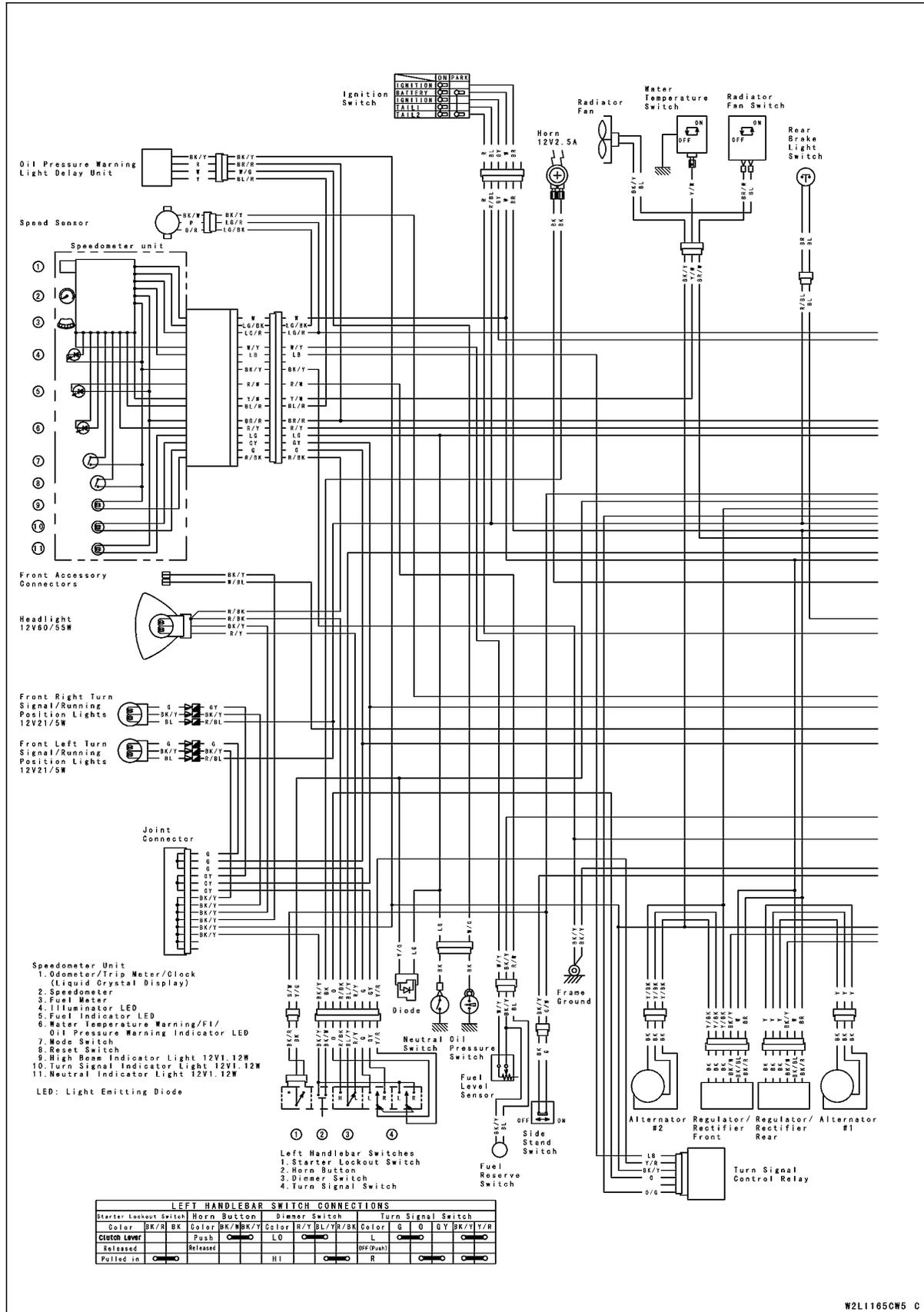


**Kawasaki Bond (Silicone Sealant) :**  
56019-120

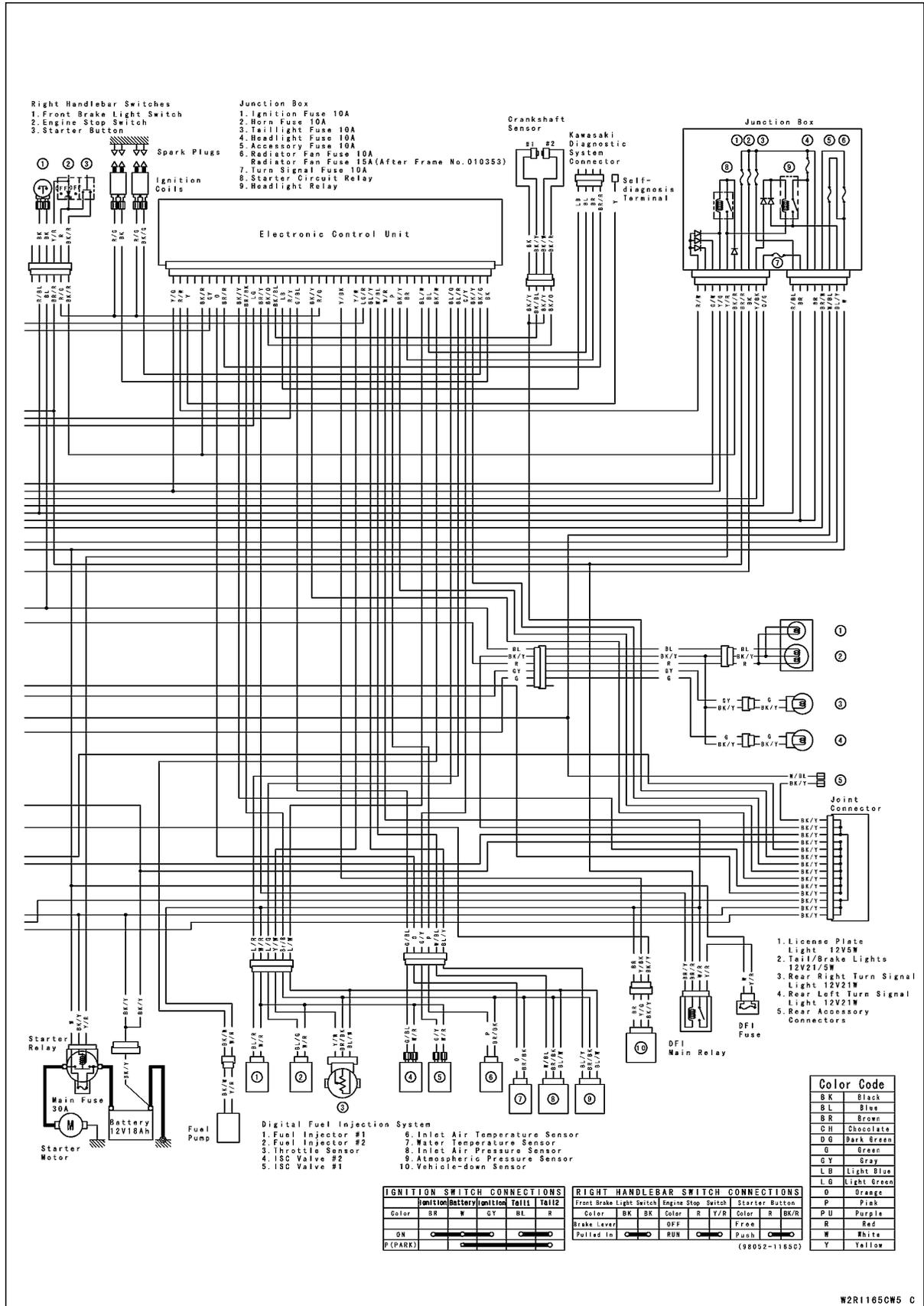


# 16-14 ELECTRICAL SYSTEM

## Wiring Diagram (United States and Canada)

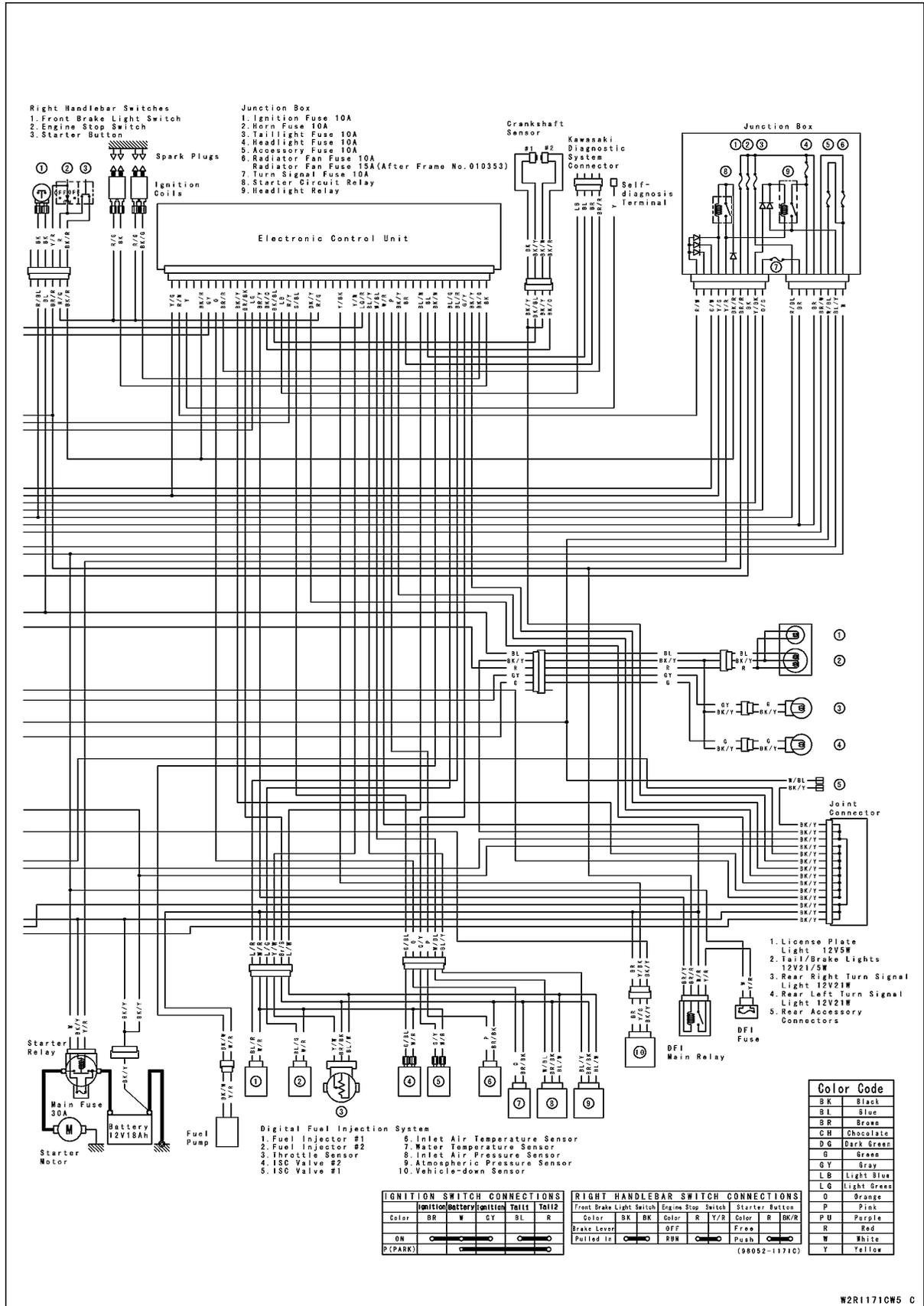


Wiring Diagram (United States and Canada)



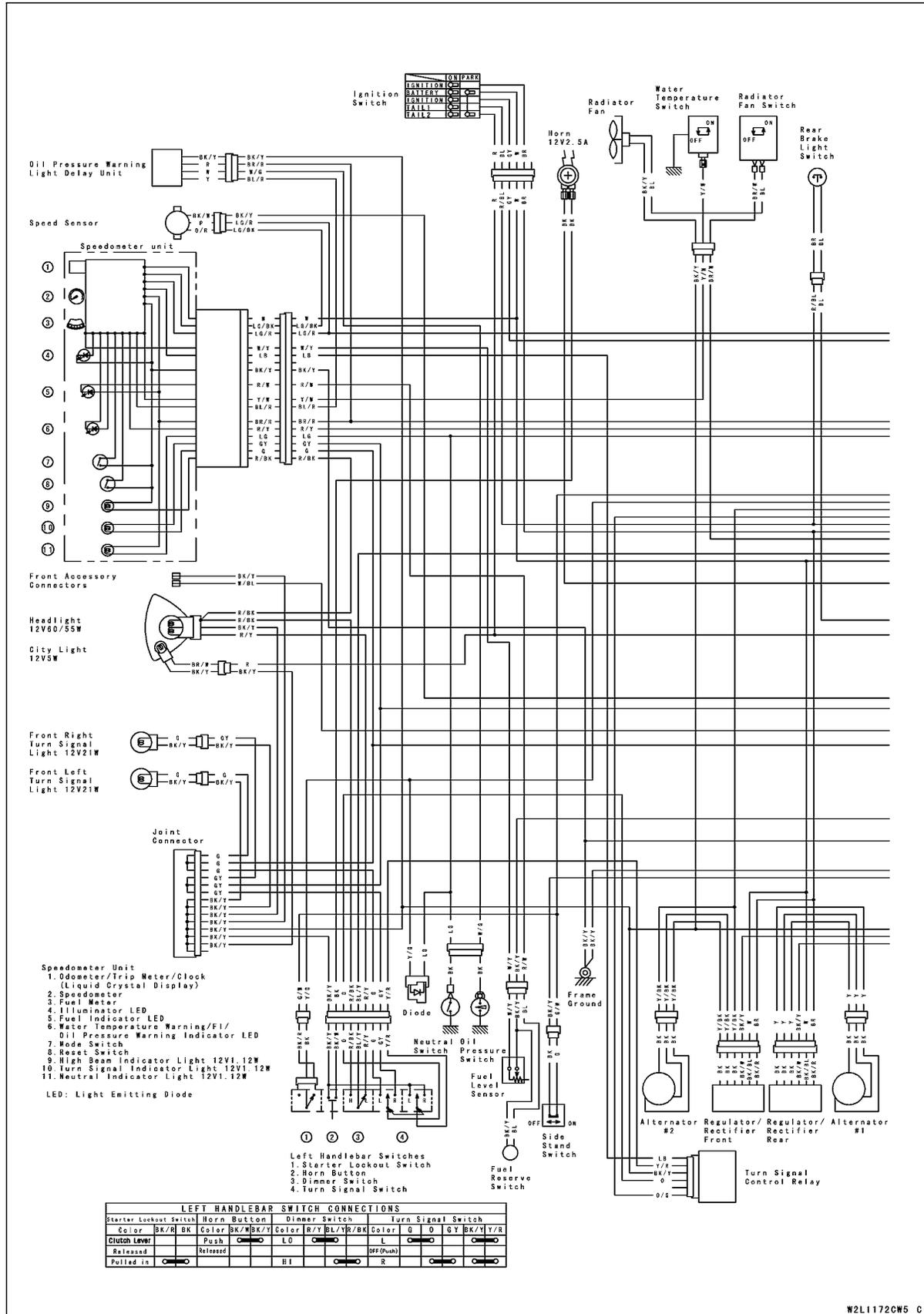


Wiring Diagram (Australia)



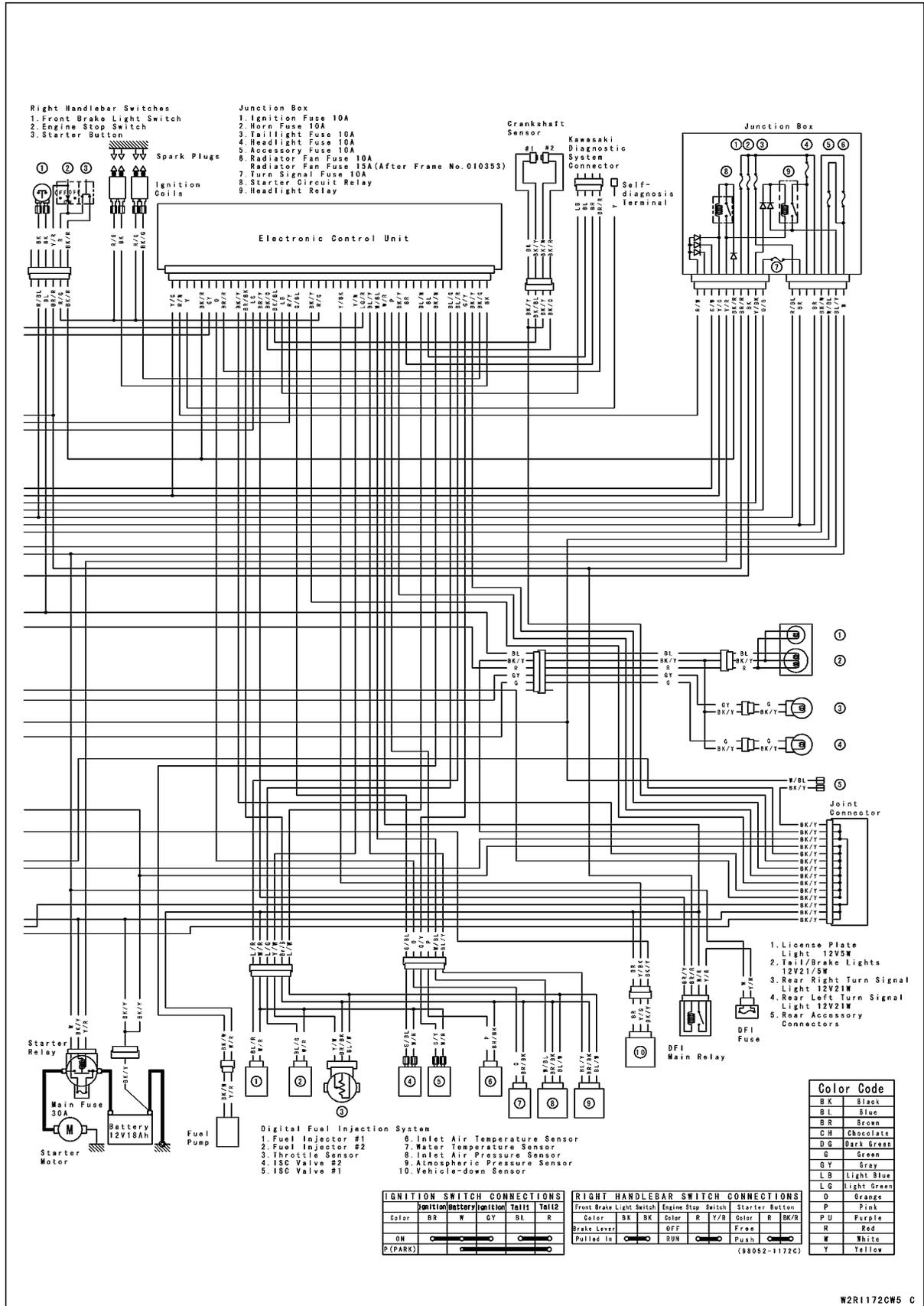
# 16-18 ELECTRICAL SYSTEM

## Wiring Diagram (Other than United States, Canada and Australia)



# ELECTRICAL SYSTEM 16-19

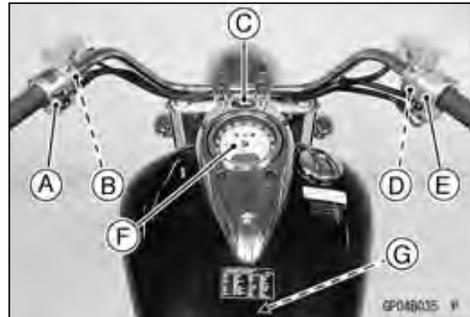
## Wiring Diagram (Other than United States, Canada and Australia)



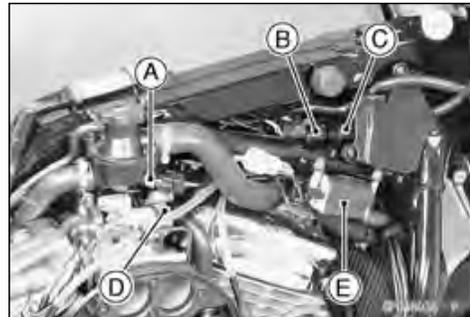
# 16-20 ELECTRICAL SYSTEM

## Electrical Parts Location

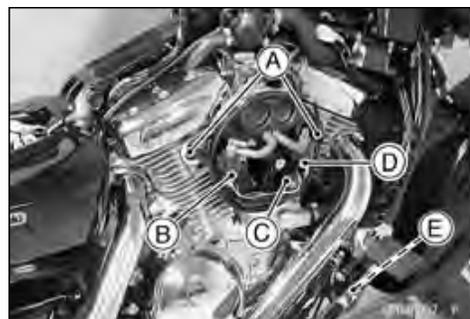
Left Handlebar Switches [A]  
Starter Lockout Switch [B]  
Ignition Switch [C]  
Front Brake Light Switch [D]  
Right Handlebar Switches [E]  
Meter Unit [F]  
Fuel Pump with Fuel Reserve Switch [G]



Water Temperature Sensor [A]  
Inlet Air Pressure Sensor [B]  
Vehicle-down Sensor [C]  
Throttle Sensor [D]  
Ignition Coil [E]



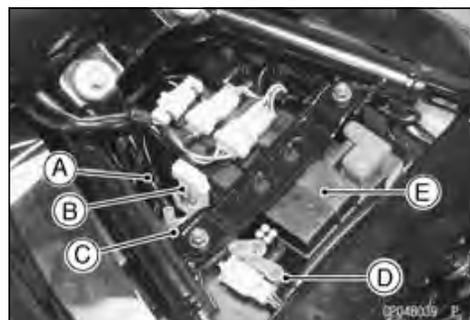
Spark Plugs [A]  
ISC Valve #2 (Rear Cylinder) [B]  
Inlet Air Temperature Sensor [C]  
ISC Valve #1 (Front Cylinder) [D]  
Rear Brake Light Switch [E]



Starter Relay and Main Fuse 30 A [A]  
Turn Signal Control Relay [B]  
DFI Main Relay [C]  
Oil Pressure Light Delay Unit [D]  
Junction Box [E]

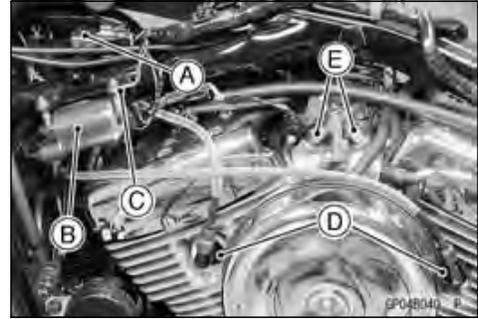


Diode [A] (in main harness)  
DFI Fuse 15 A [B]  
Self-diagnosis Terminal [C]  
ECU (Electronic Control Unit) [D]  
Battery [E]

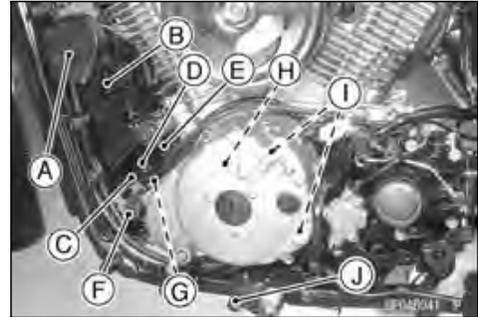


**Electrical Parts Location**

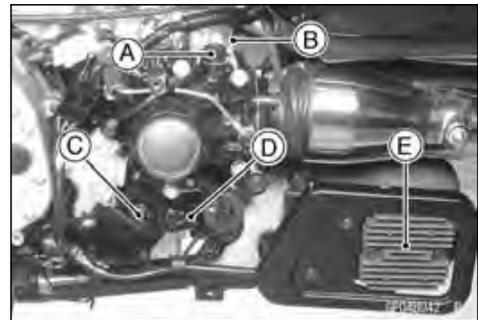
- Atmospheric Pressure Sensor [A]
- Ignition Coil [B]
- Frame Ground Terminal [C]
- Spark Plugs [D]
- Injectors [E]



- Horn [A]
- Radiator Fan [B]
- Water Temperature Switch [C]
- Radiator Fan Switch [D]
- Starter Motor [E]
- Regulator/Rectifier [F]
- Regulator/Rectifier [G] (US and Canada Models)
- Alternator [H]
- Crankshaft Sensors [I]
- Sidestand Switch [J]



- Speed Sensor [A]
- Engine Ground Terminal [B]
- Neutral Switch [C]
- Oil Pressure Switch [D]
- Regulator/Rectifier [E] (except US and Canada Models)



## 16-22 ELECTRICAL SYSTEM

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### Servicing Precautions

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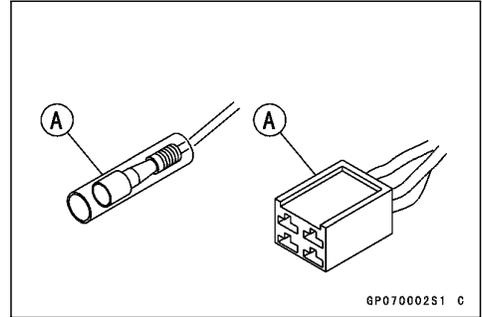
There are a number of important precautions that should be followed servicing electrical systems.

- Do not reverse the battery cable connections. This will burn out the diodes on the electrical parts.
- Always check battery condition before condemning other parts of an electrical system. A fully charged battery is a must 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 damage to 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 large amount of current, never keep the starter button pushed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to the 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. Poor wires and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).
- Wire Color Codes:

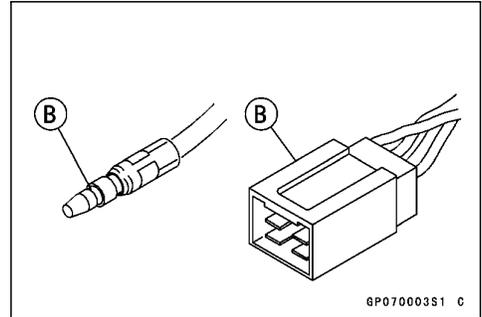
BK: Black	G: Green	P: Pink
BL: Blue	GY: Gray	PU: Purple
BR: Brown	LB: Light blue	R: Red
CH: Chocolate	LG: Light green	W: White
DG: Dark green	O: Orange	Y: Yellow

**Servicing Precautions**

- Electrical Connectors
  - Female Connectors [A]



- Male Connectors [B]



## 16-24 ELECTRICAL SYSTEM

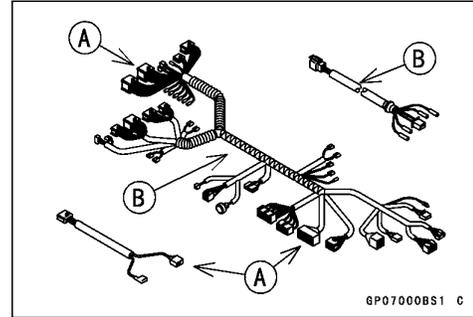
### Electrical Wiring

#### Wiring Inspection

- Visually inspect the wiring for signs of burning, fraying, etc.
- ★ If any wiring is poor, replace the damaged wiring.
- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
- ★ If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it.
- Check that the connectors are not loose.
- Check the wiring for continuity.
- Use the wiring diagram to find the ends of the wire which is suspected of being a problem.
- Connect the hand tester between the ends of the wires.

#### Special Tool - Hand Tester: 57001-1394

- Set the tester to the  $\times 1 \Omega$  range, and read the tester.
- ★ If the tester does not read  $0 \Omega$ , the lead is defective. Replace the wire or the wiring harness [B] if necessary.



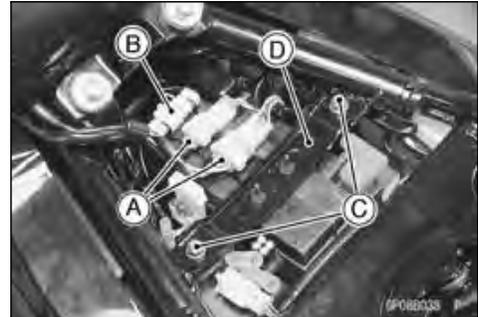
## Battery

### Battery Removal

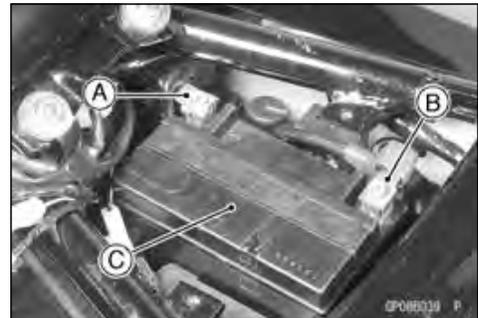
#### CAUTION

**Do not disconnect the battery cables or any other electrical connections when the ignition switch in ON, as this could damage the ECU (Electronic Control Unit).**  
**Never reverse the connections of the battery, this could damage the ECU.**

- Turn off the ignition switch.
- Remove the seats (see Frame chapter).
- Disconnect:
  - Connectors [A]
  - Battery (-) Lead Connector [B]
- Remove:
  - Bolts [C]
  - Battery Holder [D]



- Slide the black and red caps out.
- Disconnect the negative (-) cable [A] from the battery first and then the positive (+) cable [B] from the battery.
- Pull the battery [C] out of the case.
- Clean the battery using a solution of baking soda and water. Be sure that the wire connections are clean.



### Battery Installation

- Visually inspect the surface of the battery container.
- ★ If any signs of cracking or electrolyte leakage from the sides of the battery.
- Face the (-) terminal forward [A] and put the battery into the battery case.



#### CAUTION

**Do not install the battery backwards.**

- Connect the positive cable [B] (red cap) to the (+) terminal first, and then the negative cable [C] (black cap) to the (-) terminal.
- Apply a light coat of grease on the terminals to prevent corrosion.
- Cover the terminals with the black and red caps.

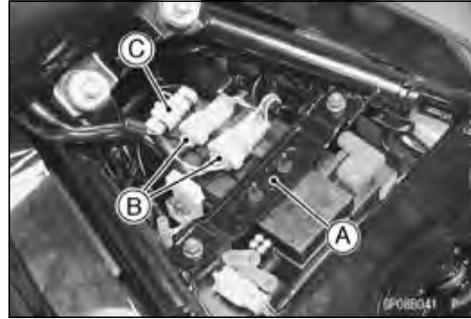
#### CAUTION

**If each battery cable is not correctly disconnected or connected, sparks can arise at electrical connections, causing damage to electrical and DFI parts.**

## 16-26 ELECTRICAL SYSTEM

### Battery

- Put the battery holder [A] on the battery.
- Tighten the bolts securely.
- Connect:
  - Connectors [B]
  - Battery (-) Lead Connector [C]
- Install the seats (see Frame chapter).



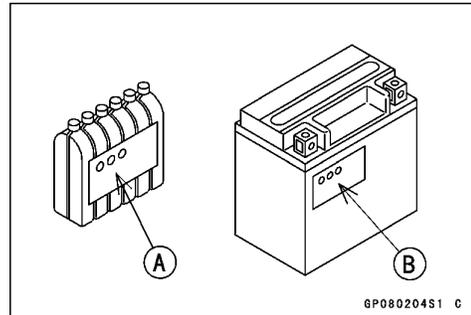
#### Electrolyte Filling

- Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

Battery Model Name for VN1600-A1 ~ : FTZ16-BS

#### CAUTION

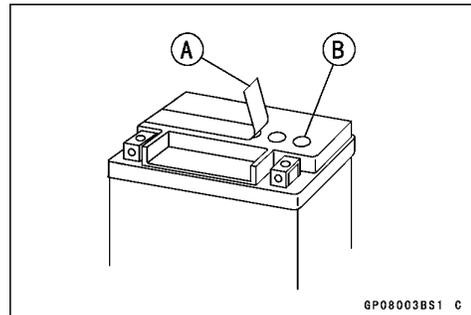
Be sure to use the electrolyte container with the same model name as the battery since the electrolyte volume and specific gravity vary with the battery type. This is to prevent overfilling of the electrolyte, shorting the battery life, and deterioration of the battery performance.



- Check to see that there is no peeling, tears or holes in the seal sheet on the top of the battery.
- Place the battery on a level surface.
- Remove the seal sheet [A].

#### CAUTION

Do not remove the seal sheet sealing the filler ports [B] until just before use.



#### NOTE

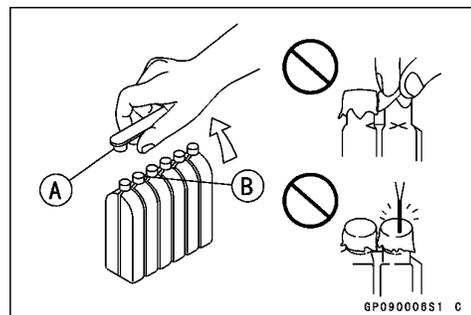
○A battery whose seal sheet has any peeling, tears, or holes, requires a refreshing charge (initial charge).

- Take the electrolyte container out of the plastic bag.
- Detach the seal cap [A] from the container.

#### NOTE

○Do not discard the seal cap because it is used as the battery plugs later.

○Do not peel back or pierce the seals [B] on the container.

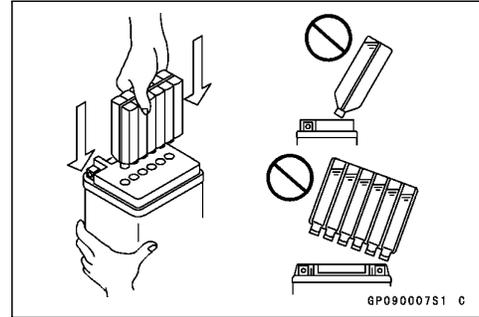


## Battery

- Place the electrolyte container upside down aligning the six seals with the six battery filler ports.
- Push the container down strongly enough to break the seals. Now the electrolyte should start to flow into the battery.

### NOTE

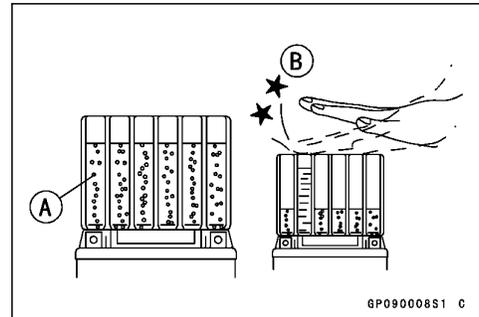
- Do not tilt the container as the electrolyte flow may be interrupted.



- Make sure air bubbles [A] are coming up from all six filler ports.
- Leave the container this way for 5 minutes or longer.

### NOTE

- If no air bubbles are coming up from a filler port, tap [B] the bottom of the container two or three times. Never remove the container from the battery.



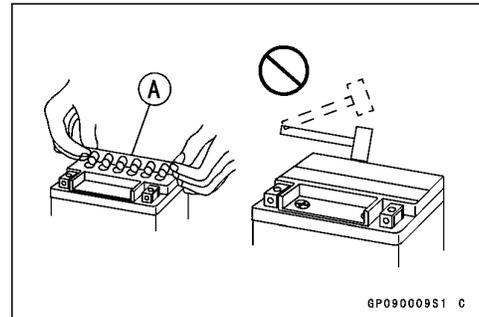
### CAUTION

**Fill the electrolyte into the battery until the container is completely emptied.**

- Be certain that all the electrolyte has flowed out.
- Tap the bottom the same way as above if there is any electrolyte left in the container.
- Now pull the container gently out of the battery.
- Let the battery sit for **20** minutes. During this time, the electrolyte permeates the special separators and the gas generated by chemical reaction is released.
- Fit the seal cap [A] tightly into the filler ports until the seal cap is at the same level as the top of the battery.

### NOTE

- Do not hammer. Press down evenly with both hands.



### **⚠ WARNING**

**Once you installed the seal cap after filling the battery, never remove it, nor add any water or electrolyte.**

## 16-28 ELECTRICAL SYSTEM

### Battery

#### Initial Charge

While a sealed battery can be used after only filling with electrolyte, a battery may not be able to sufficiently move a starter motor to start an engine in the cases shown in the table below, where an initial charge is required before use. However, if a battery shows a terminal voltage of 12.6 V or more, using a digital volt meter, after 10 minutes of filling, no initial charge is necessary.

#### NOTE

- To measure battery terminal voltage, use a digital voltmeter which can be read one decimal place voltage.

Condition requiring initial charge	Charging method
At low temperature (lower than 0°C)	1.8 A × 2 ~ 3 hours
Battery has been stored under high temperature and humidity.	1.8 A × 15 ~ 20 hours
Seal sheet has been removed, or broken – peeling, tear or hole.	
Battery two or more years old from date of manufacture. Battery manufacturing date is printed on battery top. Example) <u>12</u> <u>10</u> <u>99</u> <u>T1</u> Day    Month    Year    Mfg. location	

#### Precautions

- 1) No need of topping-up

No topping-up is necessary in this battery until it ends its life under normal use. Forcibly prying off the seal cap to add water is very dangerous. Never do that.

- 2) Refreshing charge

If an engine will not start, a horn sounds weak, or lamps are dim, it indicates the battery has been discharged. Give refresh charge for 5 to 10 hours with charge current shown in the specification (see this chapter).

When a fast charge is inevitably required, do it following precisely the maximum charge current and time conditions indicated on the battery.

#### CAUTION

**This battery is designed to sustain no unusual deterioration if refresh-charged according to the method specified above. However, the battery's performance may be reduced noticeably if charged under conditions other than given above. Never remove the seal cap during refresh charge.**

**If by chance an excessive amount of gas is generated due to overcharging, the relief valve releases the gas to keep the battery normal.**

- 3) When you do not use the motorcycle for months:

Give a refresh charge before you store the motorcycle and store it with the negative cable removed. Give a refresh charge **once a month** during storage.

- 4) Battery life:

If the battery will not start the engine even after several refresh charges, the battery has exceeded its useful life. Replace it (Provided, however, the vehicle's starting system has no problem).

#### ⚠ 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.**

**No fire should be drawn near the battery, or no terminals should have the tightening loosened.**

**The electrolyte contains sulfuric acid. Be careful not to have it touch your skin or eyes. If touched, wash it off with liberal amount of water. Get medical attention if severe.**

## Battery

### Interchange

The sealed battery can fully display its performance only when combined with a proper vehicle electric system. Therefore, replace the sealed battery only on a motorcycle which was originally equipped with the sealed battery.

Be careful, if the sealed battery is installed on a motorcycle which had an ordinary battery as original equipment, the sealed battery's life will be shortened.

### Charging Condition Inspection

- Battery charging condition can be checked by measuring battery terminal voltage with a digital voltmeter [A].
- Remove the seats (see Frame chapter).
- Disconnect the battery terminals.

### CAUTION

**Be sure to disconnect the negative (-) cable first.**

- Measure the battery terminal voltage.

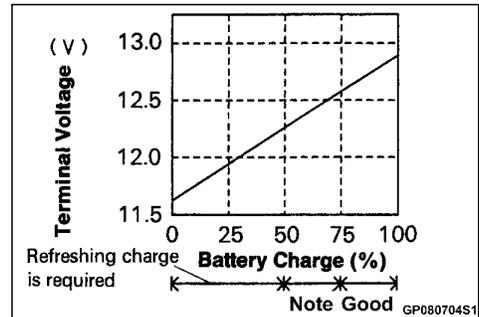
### NOTE

○ Measure with a digital voltmeter which can be read one decimal place voltage.

- ★ If the reading is 12.6 V or more, no refresh charge is required, however, if the read is below the specified, refresh charge is required.

### Battery Terminal Voltage

Standard: 12.6 V or more

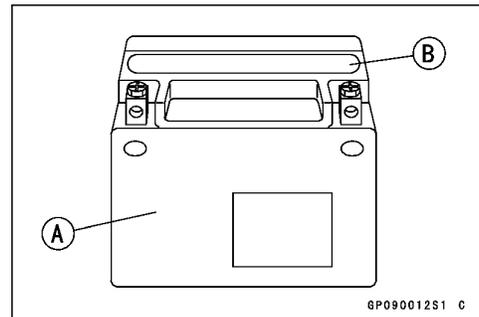


### Refreshing Charge

- Remove the battery [A] (see this chapter).
- Do refresh charge by following method according to the battery terminal voltage.

### ⚠ WARNING

**This battery is sealed type. Never remove seal cap [B] even at charging. Never add water. Charge with current and time as stated below.**



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# 16-30 ELECTRICAL SYSTEM

## Battery

Terminal Voltage: 11.5 ~ less than 12.6 V  
 Standard Charge 1.8 A × 5 ~ 10 h (see following chart)  
 Quick Charge 9 A × 1 h

**CAUTION**

**If possible, do not quick charge. If quick charge is done unavoidably, do standard charge later on.**

Terminal Voltage: less than 11.5 V  
 Charging Method: 1.8 A × 20 h

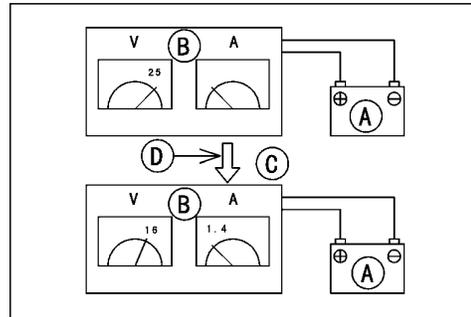
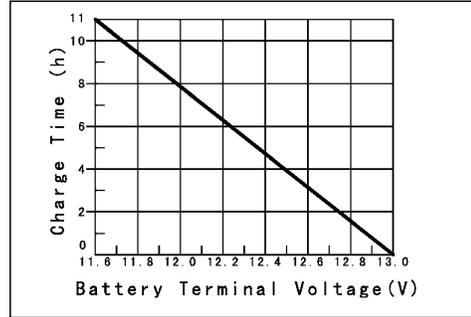
**NOTE**

○ Increase the charging voltage to a maximum voltage of 25 V if the battery will not accept current initially. Charge for no more than 5 minutes at the increased voltage then check if the battery is drawing current. If the battery will accept current decrease the voltage and charge by the standard charging method described on the battery case. If the battery will not accept current after 5 minutes, replace the battery.

Battery [A]  
 Battery Charger [B]  
 Standard Value [C]  
 Current starts to flow [D]

- Determine the battery condition after refresh charge.
- Determine the condition of the battery left for 30 minutes after completion of the charge by measuring the terminal voltage according to the table below.

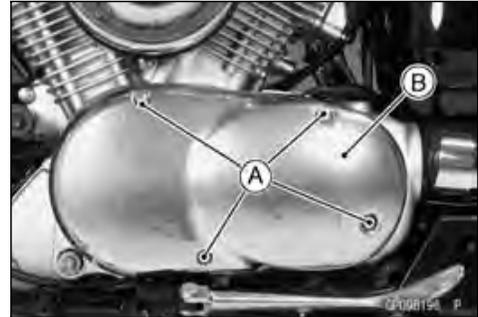
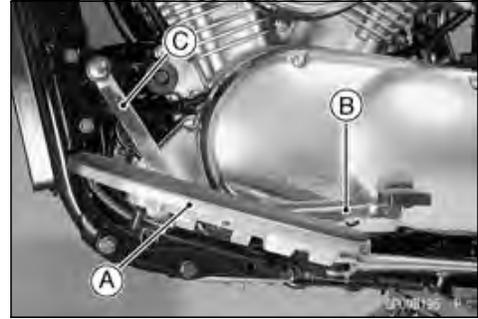
Criteria	Judgement
12.6 V or higher	Good
12.0 ~ lower than 12.6 V	Charge insufficient → Recharge
lower than 12.0 V	Unserviceable → Replace



## Charging System

### Alternator Outer Cover Removal

- Remove:
  - Left Front Footboard [A] (see Crankshaft/Transmission chapter)
  - Rear Shift Pedal [B] (see Crankshaft/Transmission chapter)
  - Front Shift Pedal [C] (see Crankshaft/Transmission chapter)
  
- Unscrew the bolts [A] and take off the alternator outer cover [B].



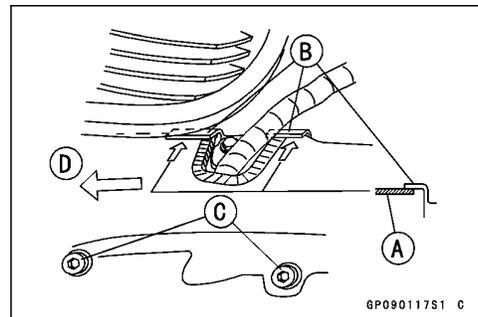
### Alternator Outer Cover Installation

- First, insert the upper edge [A] of the alternator outer cover under the left crankcase ribs [B]. This prevents the rib failure.
- Apply a soap and water solution or rubber lubricant to the body of the alternator outer cover bolts [C] for easy installation and tighten them.

**Torque - Alternator Outer Cover Bolts: 6.9 N·m (0.70 kgf·m, 61 in·lb)**

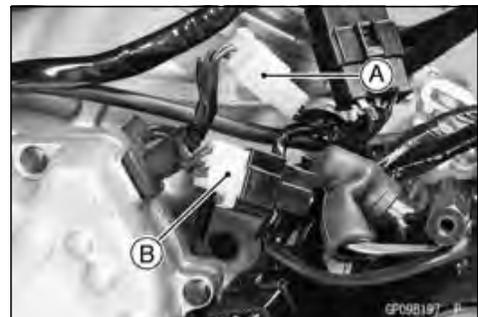
Front [D]

- Install:
  - Front and Rear Shift Pedals (see Crankshaft/Transmission chapter)
  - Left Front Footboard (see Crankshaft/Transmission chapter)



### Alternator Cover Removal/Installation

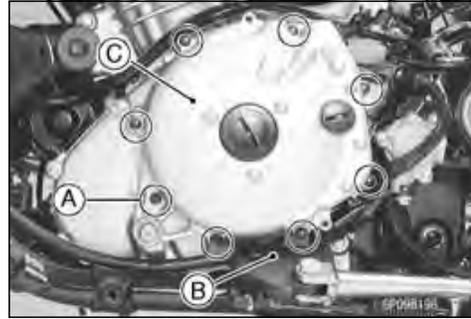
- Remove:
  - Left Front Footboard (see Crankshaft/Transmission chapter)
  - Rear Shift Pedal (see Crankshaft/Transmission chapter)
  - Front Shift Pedal (see Crankshaft/Transmission chapter)
- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Disconnect the crankshaft sensor lead connector [A] and alternator lead connector [B].



## 16-32 ELECTRICAL SYSTEM

### Charging System

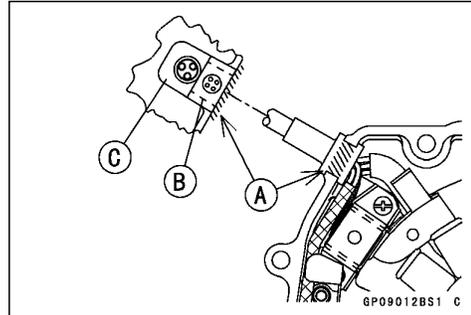
- Remove:
  - Alternator Cover Bolts [A]
  - Bracket [B]
  - Alternator Cover [C]



- Discard and replace the gasket with a new one.
- Apply silicone sealant to the area [A] to the crankshaft sensor wire grommet [B].
  - Stator Lead Grommet [C]

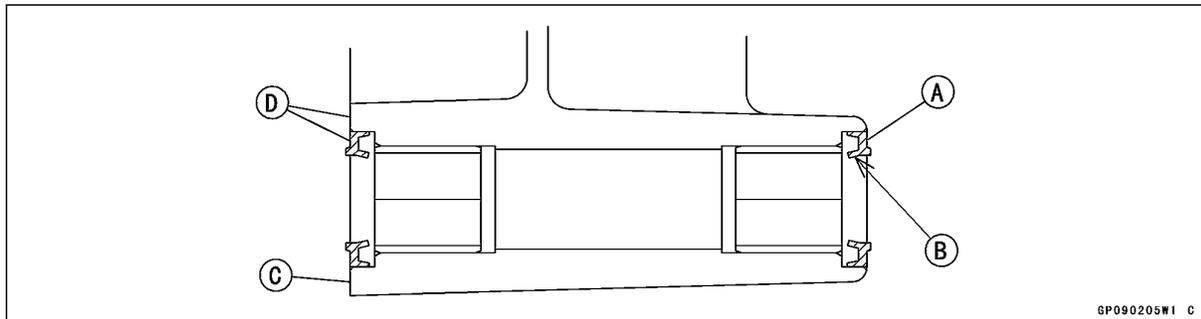
**Sealant - Kawasaki Bond (Silicone Sealant): 56019-120**

- Tighten the cover bolts.
  - Torque - Alternator Cover Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**



#### *Alternator Cover Assembly*

- Install each shift shaft grease seal [A] with the lip [B] facing inside the alternator cover [C] until the seal side is even [D] with the end of the hole.
- Apply a little high temperature grease on the lips.



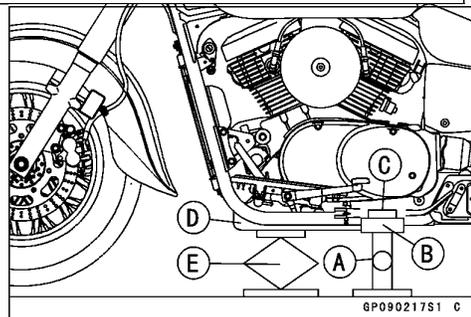
#### *Alternator Inner Cover Removal*

- Drain the engine oil (see Engine Lubrication System chapter).
- Using the jack [A] and the attachment jack [B], raise the front and rear wheels just off the ground.
  - Frame Pipe Rib [C]

**Special Tools - Jack: 57001-1238**

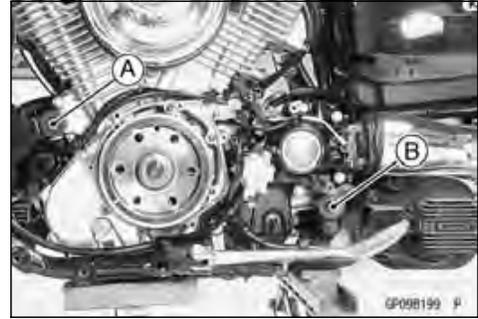
**Attachment Jack: 57001-1398**

- Remove:
  - Fuel Tank (see Fuel System chapter)
  - Alternator Outer Cover and Alternator Cover (see this chapter)
  - Alternator Lead Connectors
- Loosen the front and rear exhaust pipe holder nuts, and both chamber bolts.
- Support the front part of the engine bottom [D], using a commercially available jack [E].



## Charging System

- Remove the front engine mounting bolt [A].
- Loosen the rear engine mounting bolt [B].

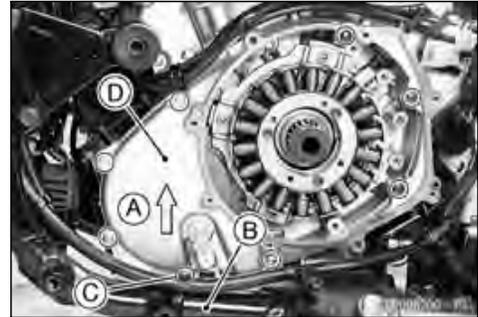


- Lift up [A] the front part of the engine, using the jack until the lower part of the alternator inner cover clears the lower frame [B].

### NOTE

○ Turn the propeller shaft so that the engine can be raised as high as possible.

- Unscrew the bolts [C] and take off the alternator inner cover [D].



### Alternator Inner Cover Installation

- Replace the gasket with a new one.
- Install the alternator inner cover.

**Torque - Alternator Inner Cover Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

- Move the engine into its original position and tighten the engine mounting bolts.

**Torque - Engine Mounting Bolts and Nuts: 44 N·m (4.5 kgf·m, 32 ft·lb)**

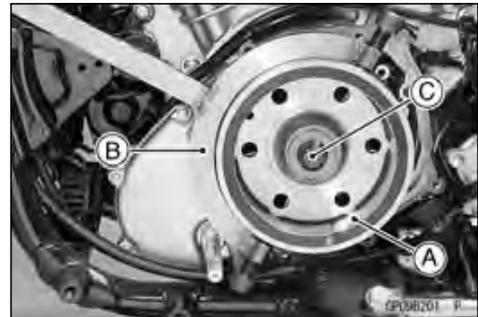
- Install the removed parts.

### Alternator Rotor Removal

- Remove the alternator cover (see Alternator Cover Removal/Installation).
- Hold the alternator rotor [A] steady with the flywheel holder [B], and remove the rotor bolt [C].

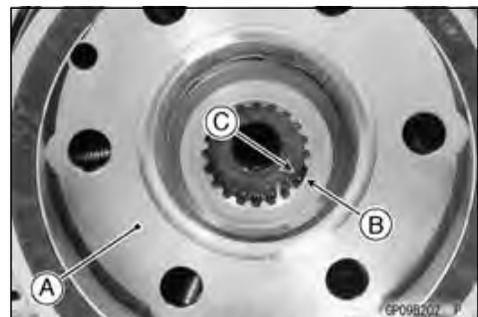
**Special Tool - Flywheel Holder: 57001-1410**

- Take the alternator rotor, washer, and ratchet off the crankshaft.



### Alternator Rotor Installation

- Install the alternator rotor [A] while fitting the alignment notch [B] of the splines onto the alignment tooth [C].



## 16-34 ELECTRICAL SYSTEM

### Charging System

- Apply molybdenum disulfide oil to the threads of the alternator rotor bolt.
- The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).
- Tighten:
  - Torque - Alternator Rotor Bolt: 78 N·m (8.0 kgf·m, 58 ft·lb)**
- Install:
  - Alternator Cover (see Alternator Cover Removal/Installation)

#### *Alternator Outside Stator Removal*

- Remove the alternator cover [A] (see Alternator Cover Removal/Installation).
- Remove the crankshaft sensors [B] (see Crankshaft Sensor Removal).
- Unscrew the Allen bolts [C] and take the stator [D] off the alternator cover.



## Charging System

### Alternator Outside Stator Installation

- Install the stator with the BK leads on the alternator cover [A].

#### Non-permanent Locking Agent - Alternator Stator Bolts

**Torque - Alternator Stator Bolts: 13 N·m (1.3 kgf·m, 113 in·lb)**

- Install the crankshaft sensors as shown.  
Crankshaft Sensor [B] with shorter leads (BK and BK/Y) for #1 (front)  
Crankshaft Sensor [C] with longer leads (BK/W and BK/R) for #2 (rear)

**Torque - Crankshaft Sensor Screws: 2.9 N·m (0.30 N·m, 26 in·lb)**

- Run the shorter crankshaft sensor leads over the alternator leads, and the longer crankshaft sensor leads over the shorter crankshaft sensor leads.

#### Non-permanent Locking Agent - Stator Lead Holder Screw Crankshaft Sensor Lead Holder Bolt

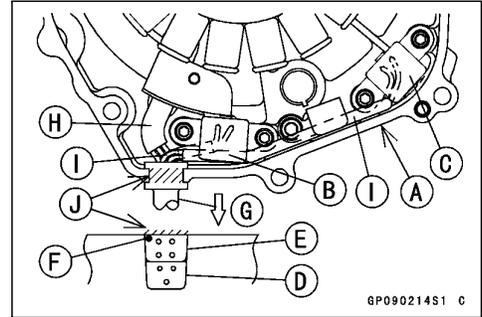
**Torque - Stator Lead Holder Screw: 9.8 N·m (1.0 kgf·m, 87 in·lb)**

**Crankshaft Sensor Lead Holder Bolt: 2.9 N·m (0.30 kgf·m, 26 in·lb)**

- Apply silicone sealant to all the sides of the grommets as shown, and fit the grommets into the notch of the alternator cover.
- First, install the grommet [D] of the alternator leads, and then the grommet [E] of the crankshaft sensor leads with the round mark [F] up.
- Pull [G] the alternator leads [H] and crankshaft sensor leads [I] outside the alternator cover, and **reduce the slack of leads as possible in the cover** in order to prevent contact with the rotor.
- Apply silicone sealant to the mating surface [J] of the grommet.
- Connect the outside alternator connector (BK leads) to the connector (Y leads) of the regulator/rectifier.

### Alternator Inside Stator Removal

- Remove:  
Alternator Rotor (see Alternator Rotor Removal)  
Alternator Inner Cover (see Alternator Inner Cover Removal)
- Unscrew the inside stator holder bolts [A] and take the inside stator [B] and holder [C] off the left crankcase.



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## 16-36 ELECTRICAL SYSTEM

### Charging System

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#### *Alternator Inside Stator Installation*

- Install the inside stator with the BK leads on the left crankcase.

#### **Non-permanent Locking Agent - Inside Stator Holder Bolts**

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

- Apply silicone sealant to the grommet and fit it into the notch of the alternator inner cover.
- Connect the inside alternator connector (BK leads) to the connector (Y/BK leads) of the regulator/rectifier.

#### *Charging Voltage Inspection*

- Check the battery condition.
- Warm up the engine to obtain actual alternator operating conditions.
- Remove the seats (see Frame chapter).
- Check that the ignition switch is turned off, and connect the hand tester to the battery as shown in the table.

**Special Tool - Hand Tester: 57001–1394**

#### **Battery Charging Voltage**

Tester Range	Connections		Reading @3 000 rpm
	Tester (+) to	Tester (-) to	
25 V DC	Battery (+)	Battery (-)	14.2 ~ 15.2 V

- Turn on the ignition switch and start the engine, and note the voltage readings at various engine speeds with the headlight turned on and then turned off (To turn off the headlight, disconnect the headlight connector in the headlight unit). The readings should show nearly battery voltage when the engine speed is low, and as the engine speed rises, the readings should also rise. But they must be kept under the specified voltage.
- Turn off the ignition switch to stop the engine, and disconnect the hand tester.
- ★ If the charging voltage is kept between the values given in the table, the charging system is considered to be 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 rise 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.

#### *Alternator Inspection*

There are three types of alternator failures: short, open (lead burned out), or loss in rotor magnetism. A short or open in one of the stator coil lead 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.

## Charging System

- To check the alternator output voltage, do the following procedures.
- Remove the alternator outer cover and disconnect the outside alternator connector [A].
- Connect the hand tester to the outer as shown.

**Special Tool - Hand Tester: 57001-1394**

- Start the engine.
- Run it at 3 000 rpm of the engine speed.
- Note the voltage readings.

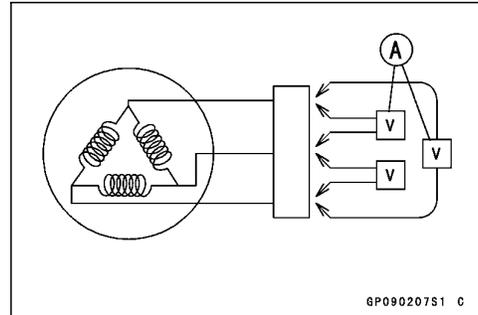


### Alternator Output Voltage

Tester Range	Connections		Reading @3 000 rpm
	Tester (+) to	Tester (-) to	
250 V AC	One black lead	Another black lead	60 ~ 90 V

- ★ If the output voltage shows the value in the table, the alternator operates properly and the regulator/rectifier is damaged. A much lower reading than the value in the table indicates that the alternator is defective.

- Repeat the test for the other black leads.  
Hand Tester [A]



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- Check the stator coil resistance as follows:

- Stop the engine.
- Connect the hand tester [A] to the connector as shown in the table.
- Note the resistance readings.

### Stator Coil Resistance

Tester Range	Connections		Reading
	Tester (+) to	Tester (-) to	
×1 Ω	One black lead	Another black lead	0.33 ~ 0.49 Ω

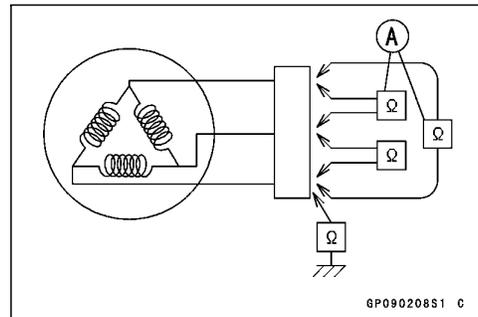
- ★ If there is more resistance than shown in the table, or no hand tester reading (infinity), the stator has an open wire and must be replaced. Much less than this resistance means the stator is shorted, and must be replaced.

- Using the highest resistance range of the hand tester, measure the resistance between each of the black leads and chassis ground.

- ★ Any hand tester reading less than infinity (∞) indicates a short, necessitating stator replacement.

- ★ If the stator coil has normal resistance, but the voltage check showed the alternator to be defective, then the rotor magnets have probably weakened, and the rotor must be replaced.

- Repeat the test for the other black leads.
- Repeat the test for the inside alternator connector.



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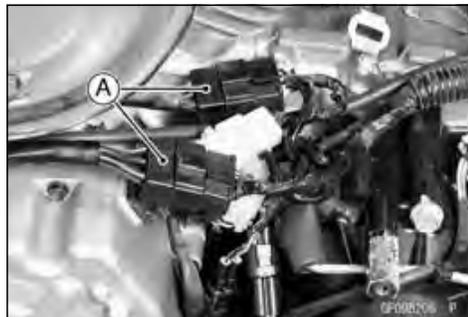
## 16-38 ELECTRICAL SYSTEM

### Charging System

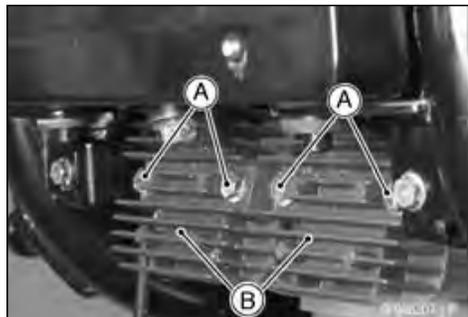
#### *Regulator/Rectifier Removal*

##### **US and Canada Models:**

- Remove:
  - Alternator Cover (see Alternator Cover Removal)
  - Regulator/Rectifier Lead Connectors [A]



- Remove:
  - Regulator/Rectifier Bolts [A]
  - Regulator/Rectifiers [B]



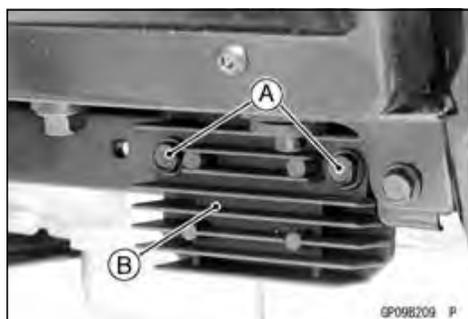
##### **Except US and Canada Models:**

- Remove:
  - Alternator Cover (see Alternator Cover Removal)
  - Regulator/Rectifier Lead Connectors [A]



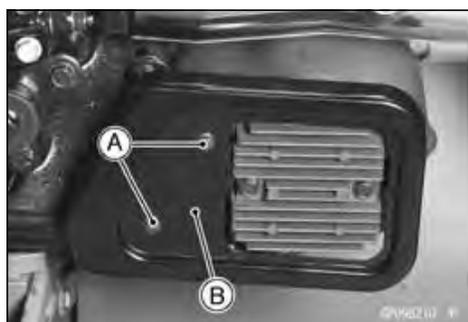
##### **Front Side:**

- Remove:
  - Regulator/Rectifier Bolts [A]
  - Regulator/Rectifier [B]



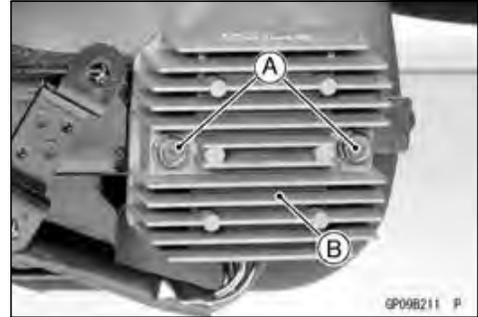
##### **Rear Side:**

- Remove:
  - Regulator/Rectifier Cover Bolts [A]
  - Regulator/Rectifier Cover [B]



**Charging System**

- Remove:
  - Regulator/Rectifier Bolts [A]
  - Regulator/Rectifier [B]

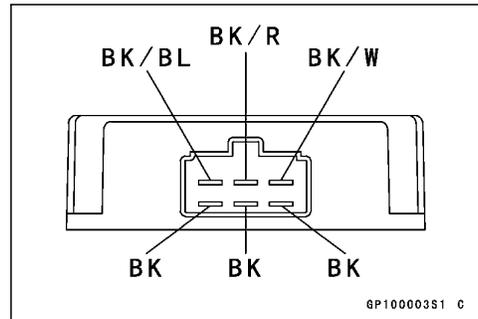


*Regulator/Rectifier Installation*

- Run the regulator/rectifier leads according to the Cable, Wire, and Hose Routing section in the Appendix chapter.
- Tighten:
  - Torque - Regulator/Rectifier Bolts: 6.5 N·m (0.66 kgf·m, 57 in·lb)**

*Rectifier Inspection*

- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Check the rectifier resistance as follows.
- Disconnect the regulator/rectifier connector.
- Connect the hand tester (special tool) to the regulator/rectifier as shown in the table, and check the resistance in both directions of each diode in the rectifier following the table.
- ★ The resistance should be low in one direction and more than ten times as much in the other direction. If any two wires are low or high in both directions, the rectifier is defective and the regulator/rectifier must be replaced.



**NOTE**

○ The actual tester reading varies with the hand tester used and the individual rectifier, but, generally speaking, the lower reading should be from zero to one half the scale.

**Rectifier Circuit Inspection**

No.	Connections		Reading	Tester Range
	Tester (+) to	Tester (-) to		
1	BK1	BK/BL	∞	× 10 Ω or × 100 Ω
2	BK2			
3	BK3			
4	BK1	BK/W	1/2 scale	
5	BK2			
6	BK3			
7	BK/BL	BK1	∞	
8		BK2		
9		BK3		
10	BK/W	BK1	∞	
11		BK2		
12		BK3		

- Repeat the test for another regulator/rectifier.

# 16-40 ELECTRICAL SYSTEM

## Charging System

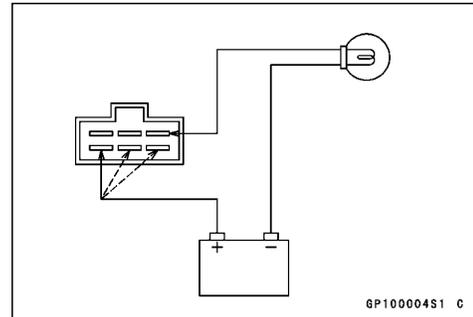
### Regulator Inspection

○ 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).

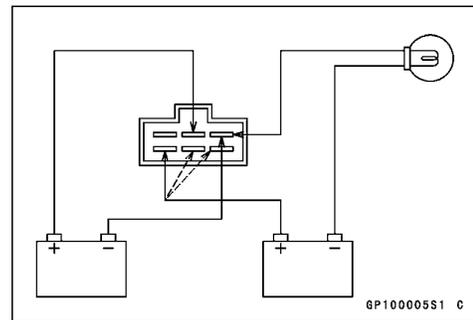
#### CAUTION

**The test light works as an indicator and also as a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.**

- Do the 1st step regulator circuit test.
- Connect the test light and the 12 V battery to the regulator/rectifier as shown.
- Check BK1, BK2, BK3 terminals respectively.
- ★ If the test light turns on, the regulator/rectifier is defective. Replace it.
- ★ If the test light does not turn on, continue the test.



- Do the 2nd step regulator circuit test.
- Connect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- Apply 12 V to the BK/R terminal.
- Check BK1, BK2, and BK3 terminals respectively.
- ★ If the test light turns on, the regulator/rectifier is defective. Replace it.
- If the test light does not turn on, continue the test.

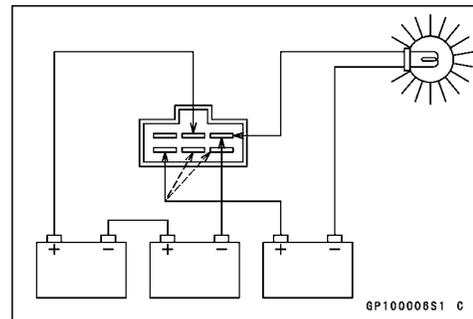


- Do the 3rd step regulator circuit test.
- Connect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- Momentarily apply 24 V to the BK/R terminal by adding a 12 V battery.
- Check BK1, BK2, and BK3 terminals respectively.

#### CAUTION

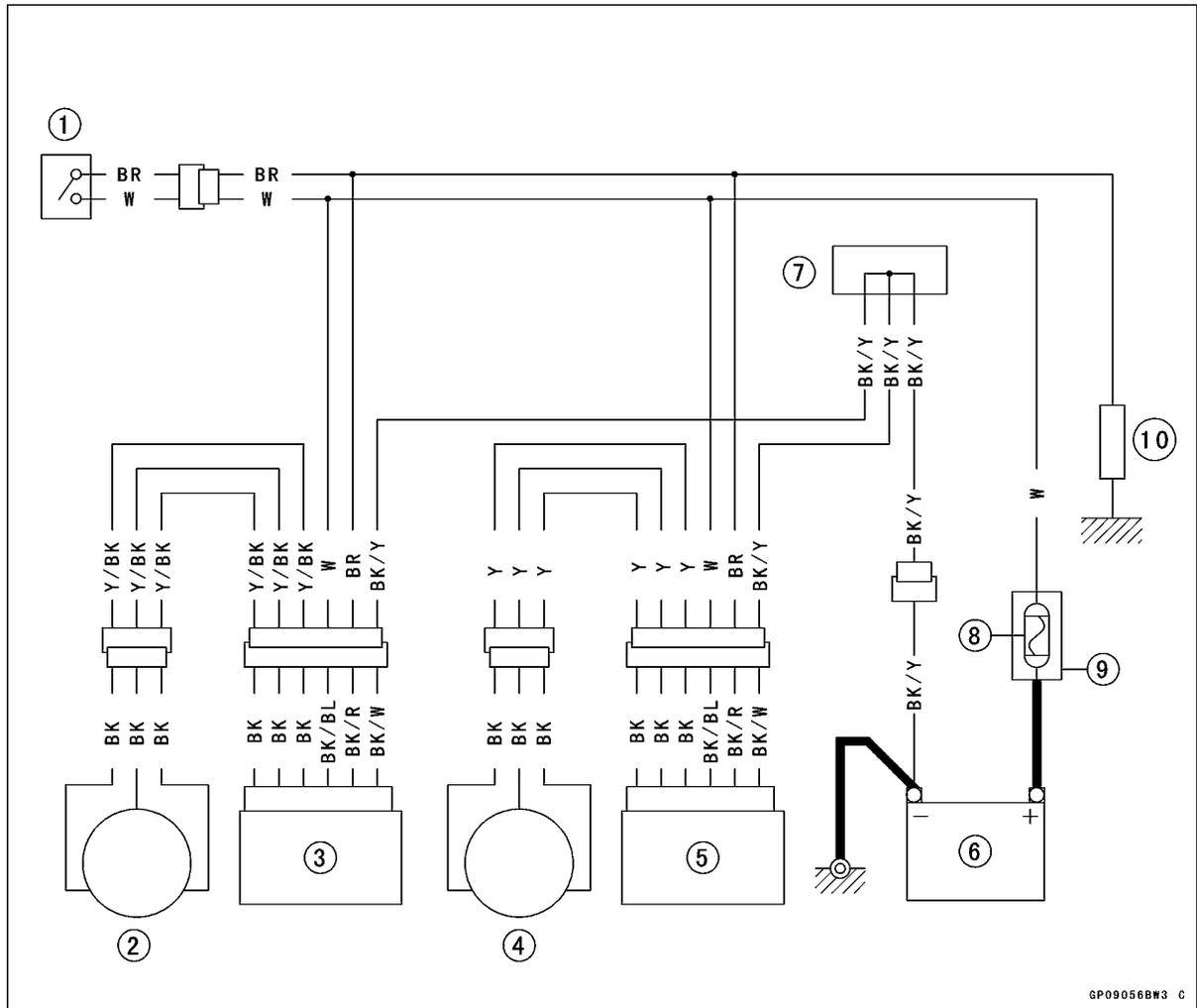
**Do not apply more than 24 volts. If more than 24 volts is applied, the regulator/rectifier may be damaged. Do not apply 24 V more than a few seconds. If 24 volts is applied for more than a few seconds, the regulator/rectifier may be damaged.**

- ★ If the test light does not light when 24 V is applied momentarily to the BK/R terminal, the regulator/rectifier is defective. Replace it.
- ★ If the regulator/rectifier passes all the tests described, it may still be defective. If the charging system still does not work properly after checking all the components and the battery, test the regulator/rectifier by replacing it with a known good unit.
- Repeat the test for another regulator/rectifier.



Charging System

Charging System Circuit



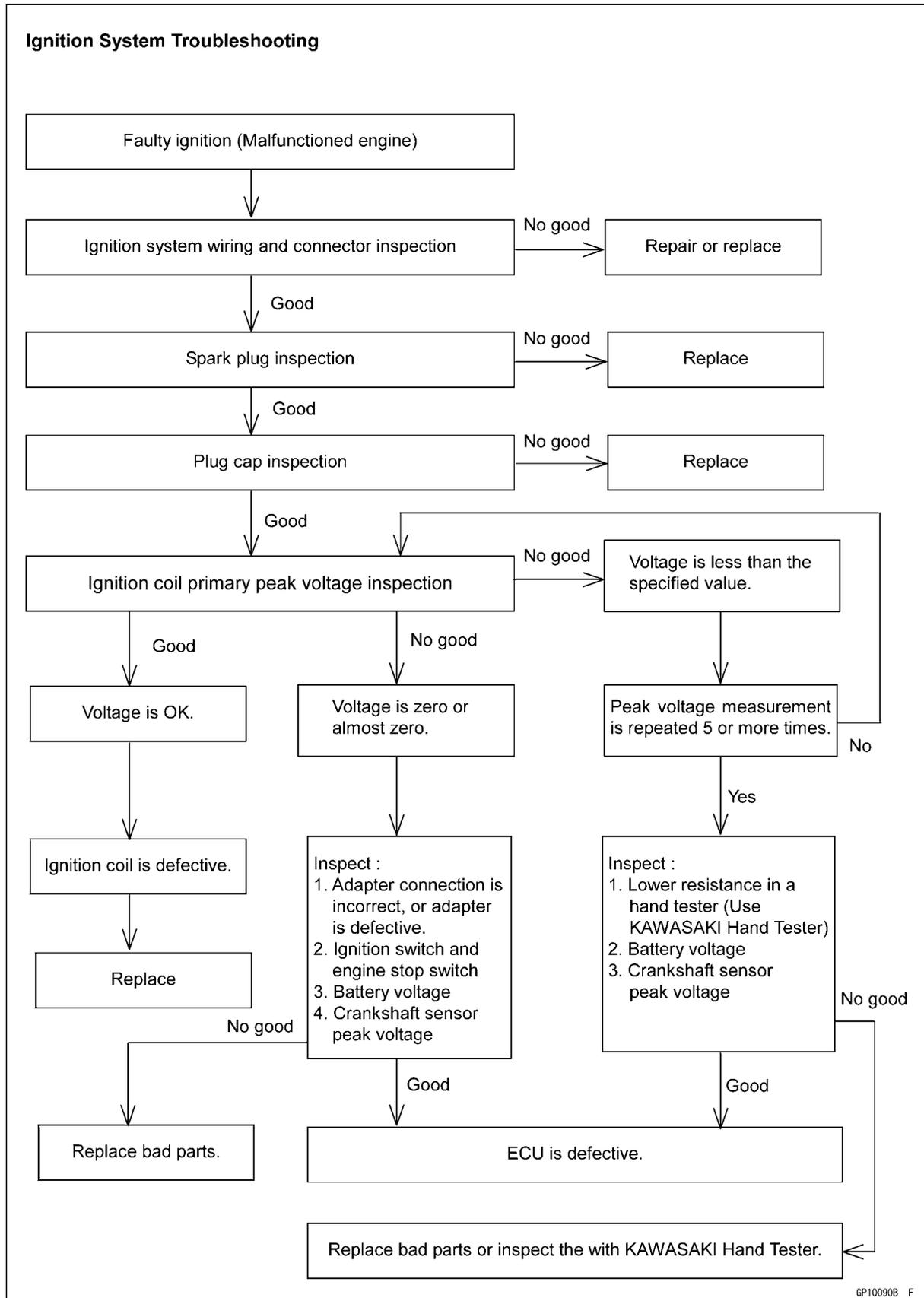
- 1. Ignition Switch
- 2. Alternator #2 (inside stator)
- 3. Regulator/Rectifier #2
- 4. Alternator #1 (outside stator)
- 5. Regulator/Rectifier #1

- 6. Battery
- 7. Joint Connector
- 8. Main Fuse 30 A
- 9. Starter Relay
- 10. Load

GP09056BW3 C

# 16-42 ELECTRICAL SYSTEM

## Ignition System



## Ignition System

### ⚠ WARNING

The ignition system produces extremely high voltage. Do not touch the spark plugs, ignition coils, or spark plug high-tension cables while the engine is running, or you could receive a severe electrical shock.

### CAUTION

Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent IC igniter damage in the ECU.

Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the IC igniter in the ECU and the diodes.

### Ignition Coil Removal

- Remove:
  - Fuel Tank (see Fuel System (DFI) chapter)
  - Clamps [A]
  - Primary Leads
  - Ignition Coil Mounting Nuts [B]
  - Frame Ground Lead [C] (Left Side)
  - Ignition Coil [D] (Left Side)



- Remove:
  - Clamps [A]
  - Primary Leads
  - Ignition Coil Mounting Nuts [B]
  - Ignition Coil [C] (Right Side)



### Ignition Coil Installation

- Connect the primary leads to the ignition coil terminals and run the high-tension cables according to the Cable, Wire, and Hose Routing section in the Appendix chapter.
- Install the frame ground lead [A] to the rear mounting bolt of the left ignition coil.



## 16-44 ELECTRICAL SYSTEM

### Ignition System

#### Ignition Coil Inspection

- Remove the ignition coils (see this chapter).
- Measure the arcing distance with a commercially available 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 terminal) to the tester in the manner prescribed by the manufacturer and measure the arcing distance.

#### 3 Needle Arcing Distance

**Standard:** 6 mm (0.24 in.) or more

#### **⚠ WARNING**

**To avoid extremely high voltage shocks, do not touch the coil body or leads.**

- ★ If the distance reading is less than the specified value, the ignition coil or spark plug caps are defective.
- To determine which part is defective, measure the arcing distance again with the spark plug caps removed from the ignition coil. Remove the caps by turning them 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.*

- Measure the primary winding resistance as follows.
  - Connect the hand tester between the coil terminals.
  - Set the tester to the  $\times 1 \Omega$  range, and read the tester.
- Measure the secondary winding resistance as follows.
  - Remove the plug caps by turning them counterclockwise.
  - Connect the tester between the spark plug High-Tension cables.
  - Set the tester to the  $\times 1 \text{ k}\Omega$  range and read the tester.
    - Measure primary winding resistance [A].
    - Measure secondary winding resistance [B].

#### **Ignition Coil Winding Resistance**

**Primary Windings:** 1.9 ~ 2.9  $\Omega$

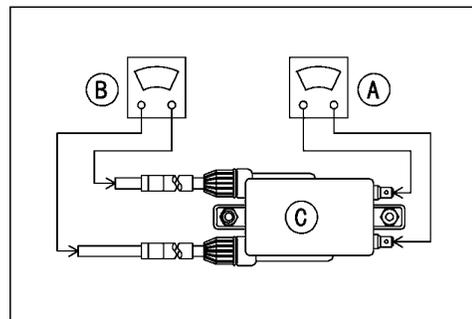
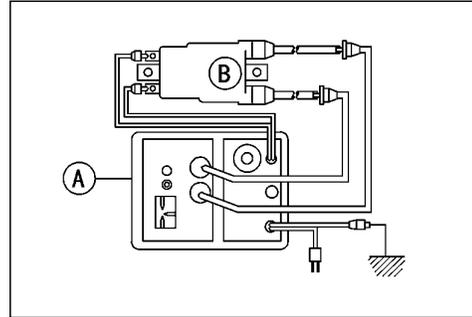
**Secondary Windings:** 18 ~ 28  $\text{k}\Omega$

- ★ If the tester does not read as specified, replace the coil.
- To install the plug cap, turn it clockwise.

#### Spark Plug Removal

- Remove the spark plug caps.
- Remove the spark plugs using the 18 mm (0.71 in.) plug wrench.

**Special Tool - Spark Plug Wrench, Hex 18: 57001-1024**



## Ignition System

### Spark Plug Installation

- Insert the spark plug vertically into the plug hole with the plug installed in the plug wrench [A].
- Tighten the plugs.

**Special Tool - Spark Plug Wrench, Hex 18: 57001-1024**

**Torque - Spark Plugs: 18 N·m (1.8 kgf·m, 13 ft·lb)**

- Fit the plug caps securely.



### Spark Plug Cleaning/Inspection

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

### Ignition Coil Primary Peak Voltage

#### NOTE

○ Be sure the battery is fully charged.

- Remove the fuel tank (see Fuel System chapter).
- Remove all the spark plug caps but do not remove the spark plugs.
- Install new spark plugs into all the spark plug caps, and ground them onto the engine.
- Install a commercially available peak voltage adapter [A] into the hand tester [B].
- Connect the adapter between the ignition coil primary wire terminal and the engine ground with the primary lead left connected.

**Recommended Tool: Peak Voltage Adapter**

**Type: KEK-54-9-B**

**Brand: KOWA SEIKI**

- Insert the adapter probe into the terminal of the primary lead [C].

ECU [D]

Battery [E]

Ignition Coil [F]

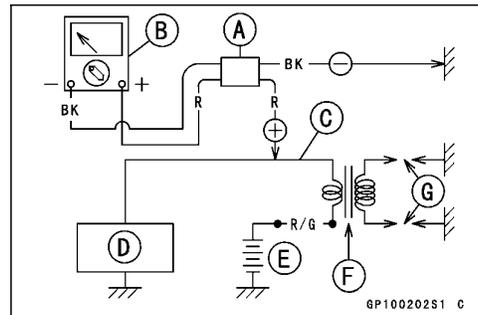
New Spark Plug [G]

**Special Tool - Hand Tester: 57001-1394**

**Hand Tester Range: DC 1 000 V**

**Primary Lead Connections:**

	Adapter (R, +)	Adapter (BK, -)
Front Ignition Coil:	BK	↔ Ground
Rear Ignition Coil:	BK/G	↔ Ground



## 16-46 ELECTRICAL SYSTEM

### Ignition System

#### **⚠ WARNING**

**To avoid extremely high voltage shocks, do not touch the spark plugs or tester connections.**

- Turn the ignition switch and the engine stop switch ON.
- Pushing the starter button, turn the engine 4 ~ 5 seconds with the transmission in neutral to measure the primary peak voltage.
- Repeat the measurements 5 or more times for one ignition coil.

#### **Ignition Coil Primary Peak Voltage**

##### **Standard:**

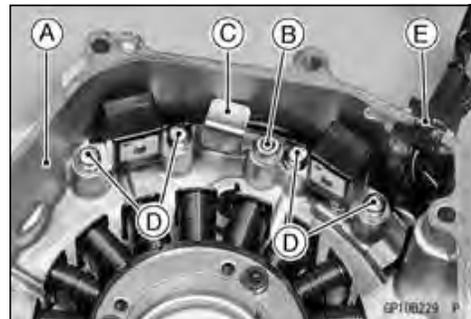
**Front: 208 V or more**

**Rear: 192 V or more**

- Repeat the test for the other ignition coil.
- ★ If the reading is less than the specified value, check the following:
  - Ignition Coils (see Ignition Coil Inspection)
  - Crankshaft Sensors (see Crankshaft Sensor Inspection)
- ★ If the ignition coils and crankshaft sensors are normal, check the ECU (see Fuel System chapter).

#### *Crankshaft Sensor Removal*

- Remove the alternator cover [A] (see Alternator Cover Removal).
- Unscrew the holder bolt [B] and take off the crankshaft sensor lead holder [C].
- Unscrew the screws [D] and take off the crankshaft sensors with the grommet [E].

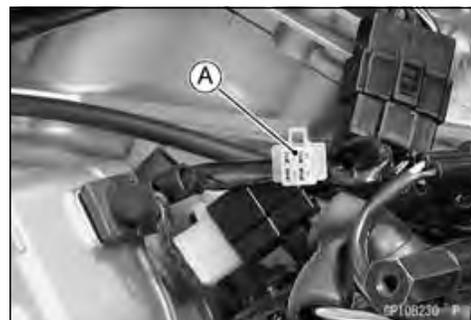


#### *Crankshaft Sensor Installation*

○ Refer to Alternator Stator Installation in this chapter.

#### *Crankshaft Sensor Inspection*

- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Remove all the spark plug caps but do not remove the spark plugs.
- Disconnect the crankshaft sensor lead connector [A].



## Ignition System

- Connect a commercially available peak voltage adapter [A] to the hand tester [B].

### Recommended Tool: Peak Voltage Adapter

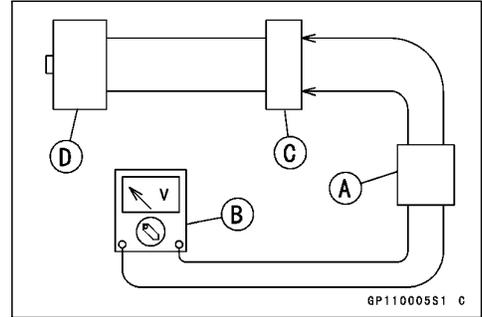
Type: KEK-54-9-B  
Brand: KOWA SEIKI

### Special Tool - Hand Tester: 57001-1394

- Insert the adapter probes into the connector [C] of the crankshaft sensor [D] as shown.

### Connections:

	Adapter (R, +)		Adapter (BK, -)
Front Crankshaft Sensor:	BK/Y	↔	BK
Rear Crankshaft Sensor:	BK/R	↔	BK/W



### NOTE

○ Be sure the battery is fully charged.

### Hand Tester Range: DC 10 V

- Turn the ignition switch and the engine stop switch ON.
- Pushing the starter button, turn the engine 4 ~ 5 seconds with the transmission in neutral to measure the crankshaft sensor peak voltage.
- Repeat the measurements 5 or more times for one crankshaft sensor.
- Repeat the test for the other crankshaft sensor.

### Crankshaft Sensor Peak Voltage

#### Standard:

Front	2.2 V or more
Rear	2.0 V or more

- ★ If the reading is less than the specified value, replace the crankshaft sensor.
- ★ If the reading is normal, check the ECU (see Fuel System chapter).
- ★ If the peak voltage adapter is not available, the coil can be checked for a broken or badly shorted winding with the hand tester (special tool).

### NOTE

○ Using the peak voltage adapter is a more reliable way to determine the condition of the crankshaft sensor than crankshaft sensor internal resistance measurements.

- Disconnect the crankshaft sensor lead connector.

# 16-48 ELECTRICAL SYSTEM

## Ignition System

- Set the hand tester [A] to the  $\times 100 \Omega$  range and wire it to the crankshaft sensor lead connector [B].

**Connections:**

	<b>Tester Connections</b>
<b>Front Crankshaft Sensor:</b>	<b>BK/Y</b> $\longleftrightarrow$ <b>BK</b>
<b>Rear Crankshaft Sensor:</b>	<b>BK/R</b> $\longleftrightarrow$ <b>BK/W</b>

- ★ If there is more resistance than the specified value, the coil has an open wire and must be replaced. Much less than this resistance means the coil is shorted, and must be replaced.

**Crankshaft Sensor Resistance: Standard: 380 ~ 560  $\Omega$**

- Using the highest resistance range of the tester, measure the resistance between the crankshaft sensor leads and chassis ground.
- ★ Any tester reading less than infinity ( $\infty$ ) indicates a short, necessitating replacement of the crankshaft sensor assy.

### Ignition Timing Inspection

- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Remove the timing inspection plug.

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

- Attach the timing light [A] to the front ignition coil lead in the manner prescribed by the manufacturer.

**Special Tool - Timing Light: 57001-1241**

- Start the engine and aim the timing light at the ignition timing mark on the alternator rotor.
- Run the engine at the speeds specified and note the alignment of the ignition timing marks.

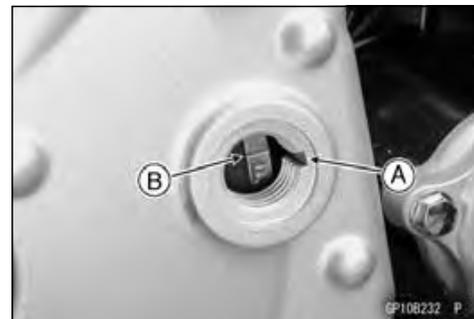
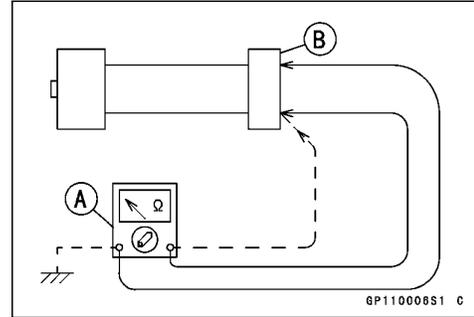
### Ignition Timing

Engine speed r/min (rpm)	Hole notch [A] aligns with:
950	F or R mark [B] on alternator rotor

F Mark: For front cylinder

R Mark: For rear cylinder

- Repeat the test for the rear cylinder, using the rear ignition coil lead.
- ★ If the ignition timing is incorrect, check the crankshaft sensor (see Crankshaft Sensor Inspection).
- ★ If the crankshaft sensor are normal, check the ECU (see Fuel System chapter).



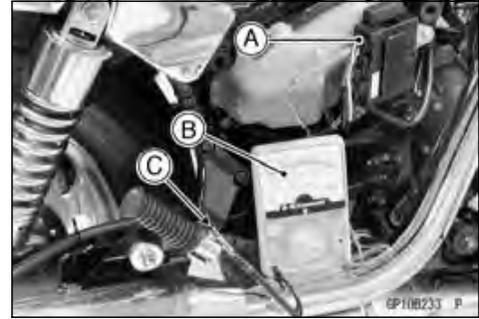
## Ignition System

### *Interlock Operation Inspection*

- Remove:
  - Right Side Cover (see Frame chapter)
- Do not disconnect the connectors.

#### 1st Check

- Measure the terminal voltage of the R/W lead in the junction box connector [A] in accordance with the following procedure.
- Set the tester [B] to the 10 V DC range, connect it to the R/W lead and frame ground [C].



#### Connection:

**Tester (+) Terminal → R/W Lead Terminal**

**Tester (-) Terminal → Frame Ground**

#### Condition:

**Transmission Gear → 1st Position**

**Clutch Lever → Release**

**Side Stand → Down**

- Turn the ignition switch on.
- Read the voltage.

#### Interlock Operation Voltage

**Standard: 4 V or more**

- ★ If the voltage is lower than the standard, inspect the side stand switch, starter lockout switch, gear position switch and junction box.
- ★ If their parts are normality, replace the ECU.
- ★ If the voltage is standard, push the starter button.
- Then the starter motor should not turn when the starter system circuit is normality.
- ★ If the starter motor turned, ECU is defective. Replace the ECU.

#### 2nd Check

Using a stand, raise the rear wheel off the ground.

- Inspect the engine for its secure stop after the following operations are completed.
- Run the engine to the following conditions.

#### Condition:

**Transmission Gear → 1st Position**

**Clutch Lever → Release**

**Side Stand → Up**

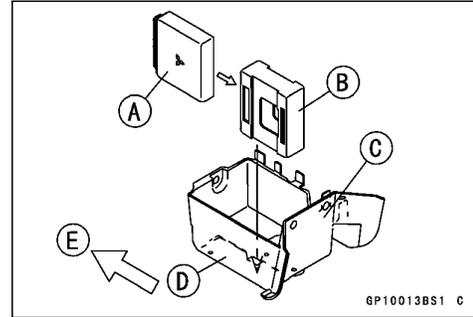
- Set the side stand on the ground, then the engine will stop.
- ★ If whichever may not be stopped, inspect the gear position switch, starter lockout switch, side stand switch and junction box.
- ★ If their parts are normality, replace the ECU.

## 16-50 ELECTRICAL SYSTEM

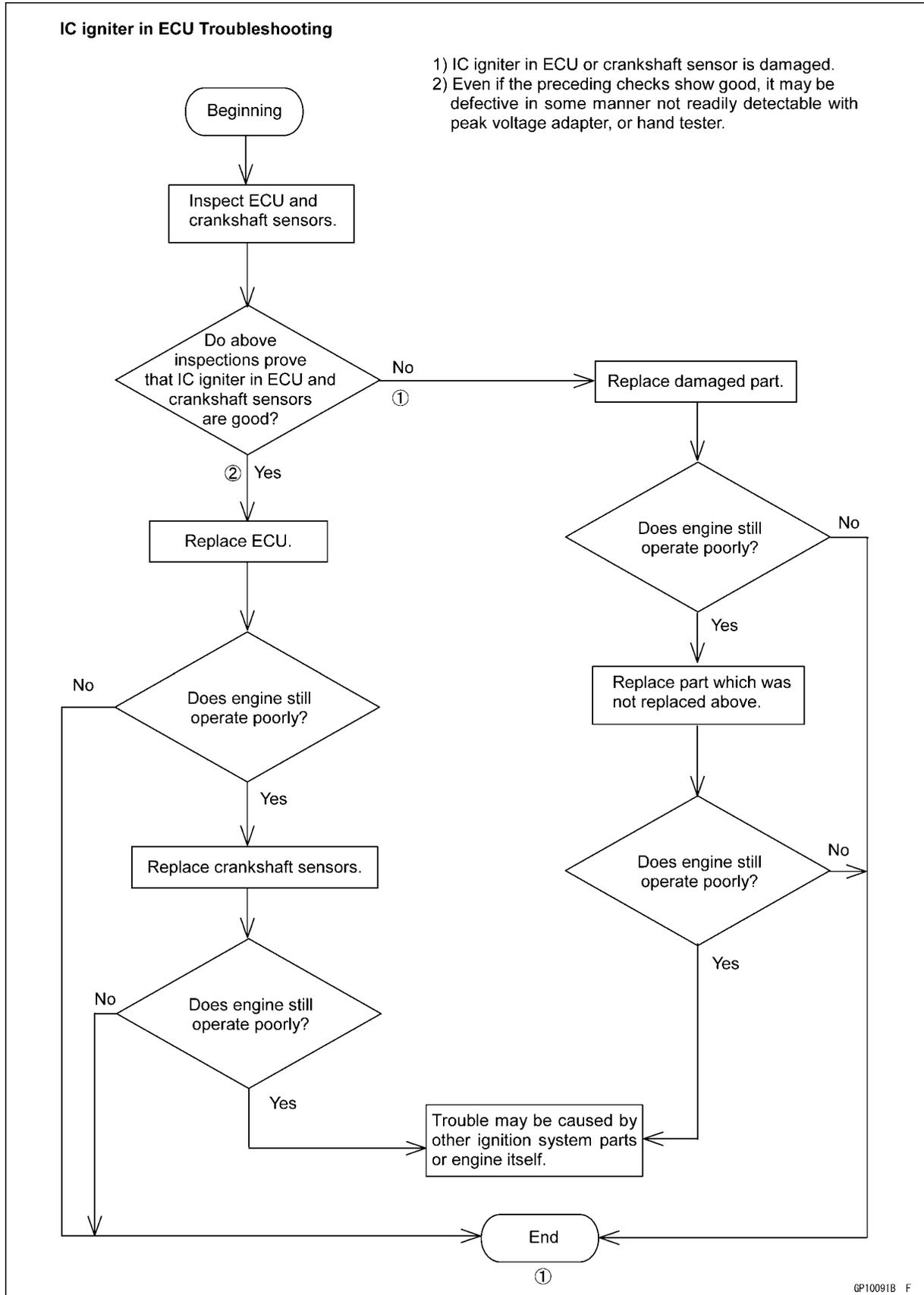
### Ignition System

#### *IC Igniter Inspection*

- The IC igniter is built in the ECU [A].
  - Damper [B]
  - Battery Case [C]
  - Groove [D]
  - Front [E]
- Refer to Fuel System chapter for ECU Inspection.



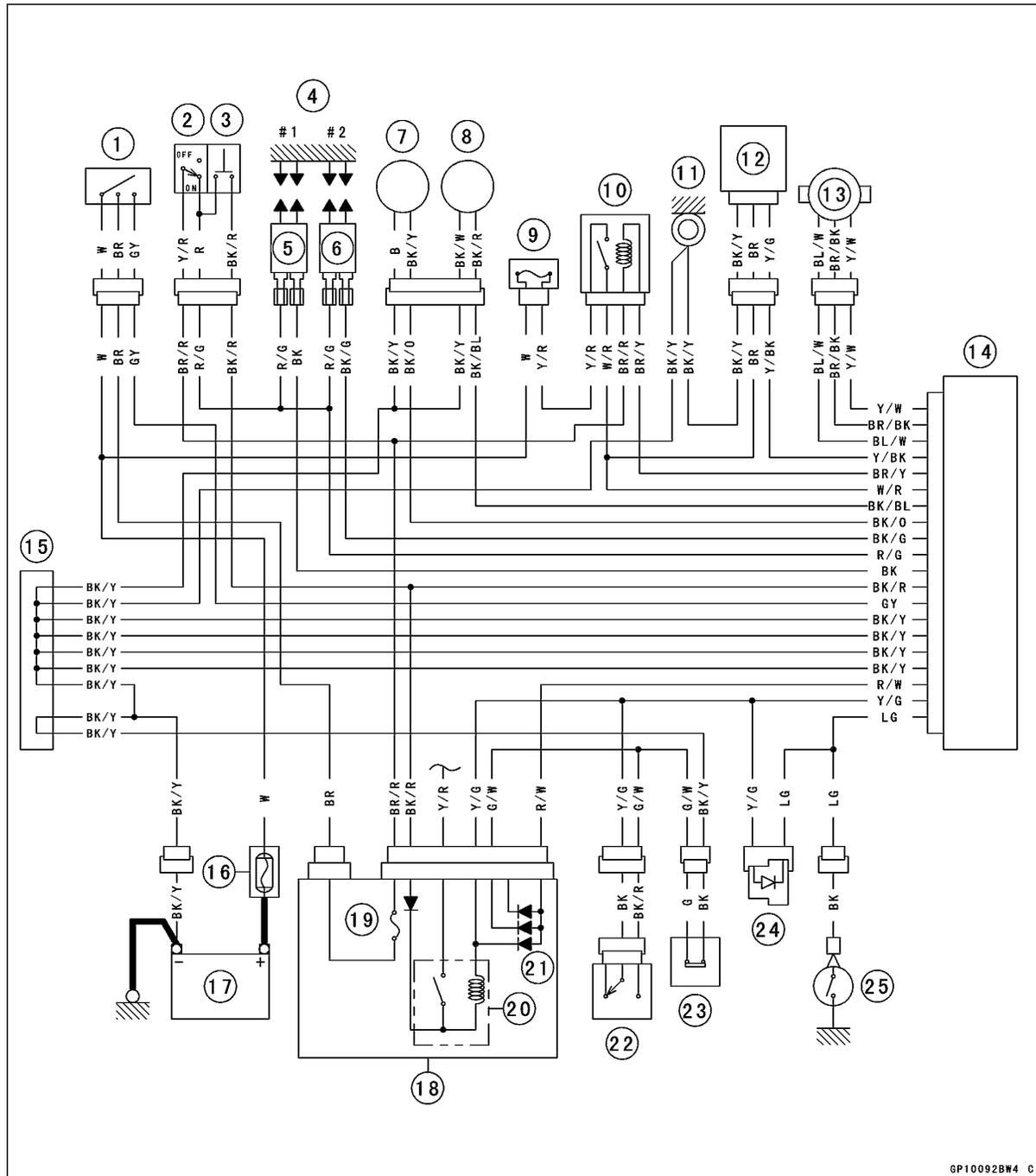
Ignition System



# 16-52 ELECTRICAL SYSTEM

## Ignition System

### Ignition System Circuit

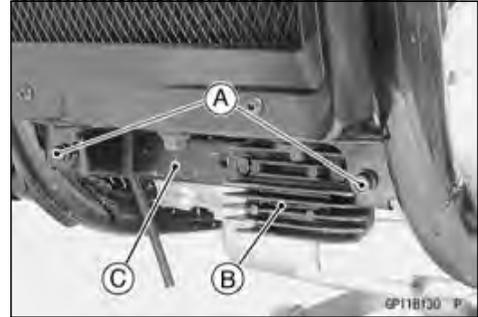


- |   |  |                            |
|---|--|----------------------------|
| 1. Ignition Switch                          | 8. Crankshaft Sensor #2<br>(rear cylinder) | 17. Battery                |
| 2. Engine Stop Switch                       | 9. DFI Fuse 15 A                           | 18. Junction Box           |
| 3. Starter Button                           | 10. DFI Main Relay                         | 19. Ignition Fuse 10 A     |
| 4. Spark Plugs                              | 11. Frame Ground                           | 20. Starter Circuit Relay  |
| 5. Ignition Coil #1<br>(front cylinder)     | 12. Vehicle-down Sensor                    | 21. Interlock Diodes       |
| 6. Ignition Coil #2<br>(rear cylinder)      | 13. Throttle Sensor                        | 22. Starter Lockout Switch |
| 7. Crankshaft Sensor #1<br>(front cylinder) | 14. Electronic Control Unit                | 23. Side Stand Switch      |
|   | 15. Joint Connector                        | 24. Diode                  |
|   | 16. Main Fuse 30 A                         | 25. Neutral Switch         |

## Starter Motor

### Starter Motor Removal

- Unscrew the bracket bolts [A] and take off the regulator/rectifier [B] with its bracket [C].



- Remove:  
Starter Motor Bolts [A]



- Pull the starter motor [A] toward the left.
- Remove:  
Starter Motor Terminal Nut [B] and Cable



### CAUTION

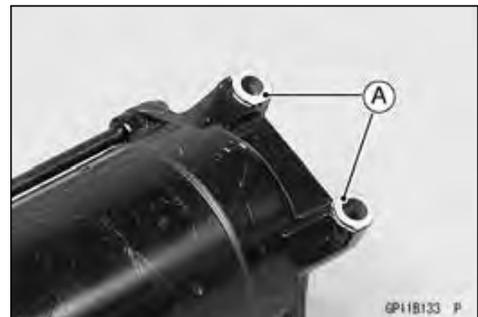
**Never drop the starter motor, especially on a hard surface.  
Such a shock to the motor can damage it.**

### Starter Motor Installation

### CAUTION

**Do not tap the starter motor shaft or body. Tapping the shaft or body could damage the motor.**

- When installing the starter motor, clean the starter motor legs [A] and crankcase [B] where the starter motor is grounded.



## 16-54 ELECTRICAL SYSTEM

### Starter Motor

- Replace the O-ring [A] with a new one.
- Apply a small amount of engine oil to the O-ring.

**Torque - Starter Motor Mounting Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)**

**Starter Motor Terminal Nut: 4.9 N·m (0.50 kgf·m, 43 in·lb)**

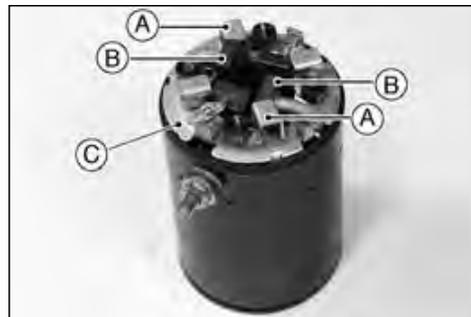


#### Starter Motor Disassembly

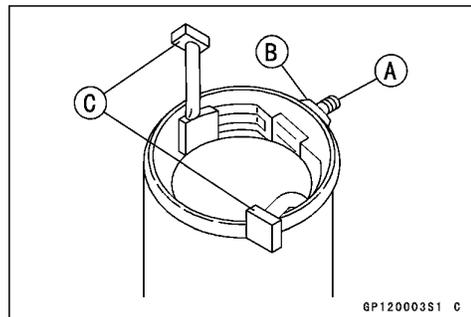
- Remove the starter motor (see Starter Motor Removal).
- Take off the starter motor assembly bolts [A] and remove both end covers [B] and pull the armature out of the yoke.



- Take the positive carbon brushes [B] out of the brush holders [A].
- Take off the brush plate [C] with brush wire from the yoke.

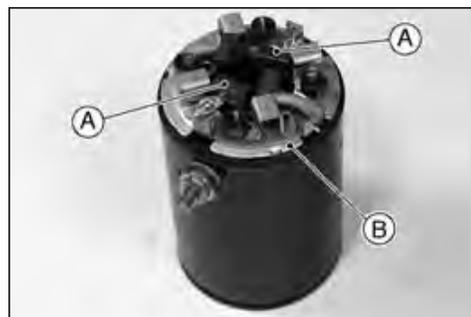


- Unscrew the terminal locknut [B] and remove the terminal bolt [A].
- Take the positive carbon brushes and wire assy [C] out of the yoke.



#### NOTE

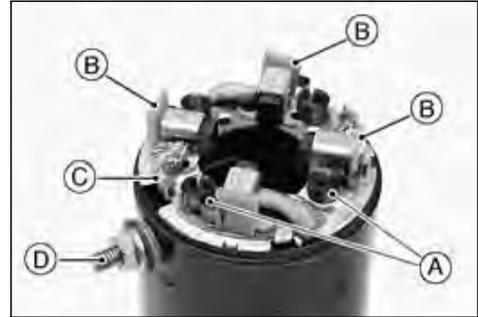
○ Do not remove the negative carbon brushes [A] from the brush plate [B].



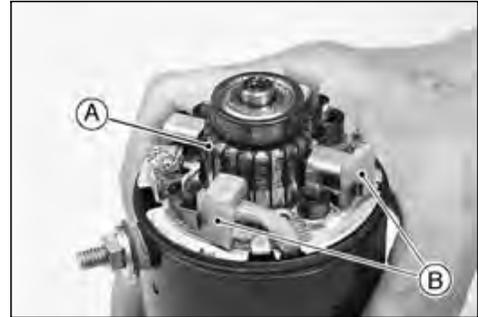
## Starter Motor

### Starter Motor Assembly

- Holding the springs [A] with plastic washers [B], insert the brushes.
- Fit the brush wire into the holder groove.
- Align the tang [C] with the terminal bolt [D].



- Put the armature [A] among the brushes, and remove the plastic washers [B].



- Fit the tang [A] of the brush plate into the left end cover groove [B].



- Apply a thin coat of grease to the oil seal [B] in the right end cover [A].



- Apply a thin coat of grease to the left bearing [A].
- Fit shims onto the right end cover.

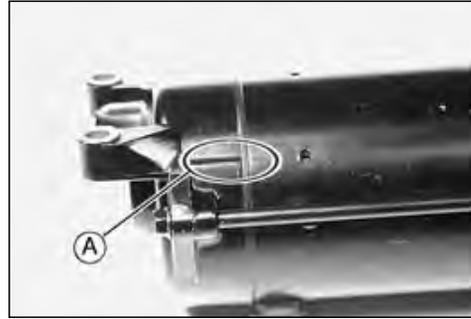


## 16-56 ELECTRICAL SYSTEM

### Starter Motor

○The line on the yoke should align [A] with the line on the left cover.

**Torque - Starter Motor Assembly Bolts: 4.9 N-m (0.50 kgf-m, 43 in-lb)**



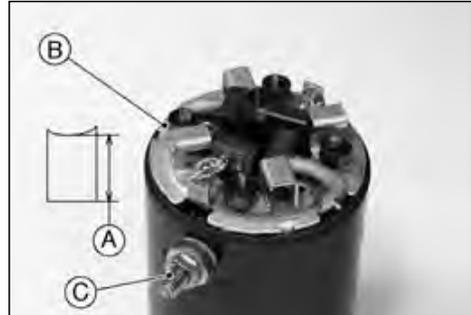
#### Brush Inspection

- Measure the length [A] of each brush.
- ★ If any is worn down to the service limit, replace the carbon brush holder assy [B] and the terminal bolt assy [C].

#### Starter Motor Brush Length

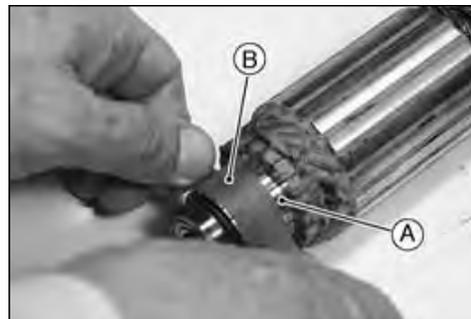
**Standard: 12 mm (0.47 in.)**

**Service Limit: 8.5 mm (0.33 in.)**



#### Commutator Cleaning and Inspection

- Smooth the commutator surface [A] if necessary with fine emery cloth [B], and clean out the grooves.

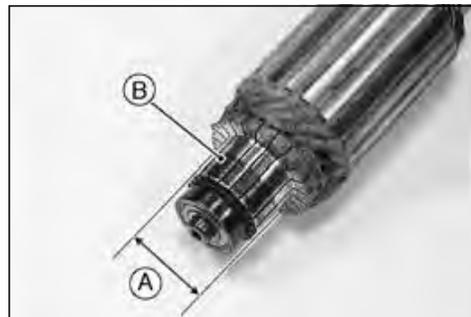


- Measure the diameter [A] of the commutator [B].
- ★ Replace the starter motor with a new one if the commutator diameter is less than the service limit.

#### Commutator Diameter

**Standard: 28 mm (1.10 in.)**

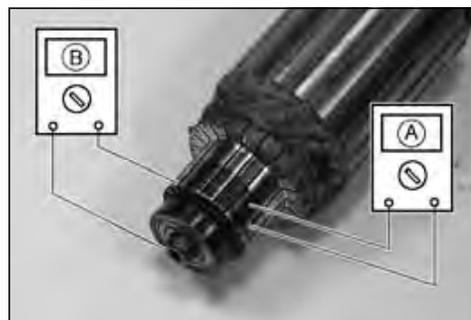
**Service Limit: 27 mm (1.06 in.)**



#### Armature Inspection

- Using the  $\times 1 \Omega$  hand tester range, 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 and the starter motor must be replaced.
- Using the highest hand tester range, measure the resistance between the segments and the shaft [B].
- ★ If there is any reading at all, the armature has a short and the starter motor must be replaced.

**Special Tool - Hand Tester: 57001-1394**



## 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 components 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.

### Brush Assy Inspection

● Using the  $\times 1 \Omega$  hand tester range, measure the resistance as follows.

Terminal Bolt and Positive Brushes [A]

Brush Plate and Negative Brushes [B]

Plastic [C]

○ The reading should be zero.

★ If there is not close to zero ohms, the brush lead has an open. Replace the terminal bolt assembly and the brush holder assembly.

### Brush Plate and Terminal Bolt Inspection

● Using the highest hand tester range, measure the resistance as shown.

Terminal Bolt and Brush Plate [A]

Terminal Bolt and Negative Brush Holders [B]

Terminal Bolt and Yoke [C]

○ The reading should be infinite ( $\infty \Omega$ ).

★ If there is any reading, the brush holder assembly and/or terminal bolt assembly have a short. Replace the brush holder assembly and the terminal bolt assembly.

### Starter Relay Inspection

● Remove the right side covers (see Frame chapter).

● Remove the coolant reserve tank, then the starter relay.

● Connect the hand tester [A] and 12 V battery [B] to the starter relay [C] as shown.

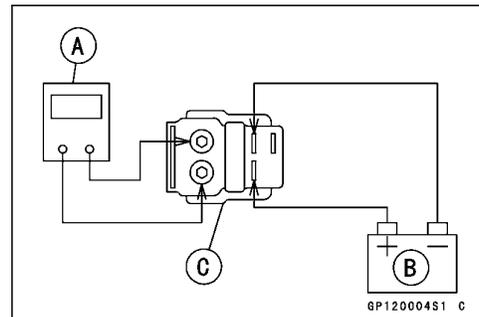
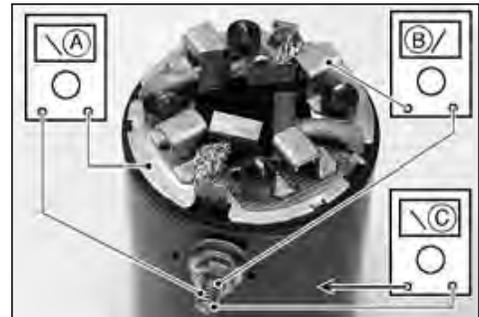
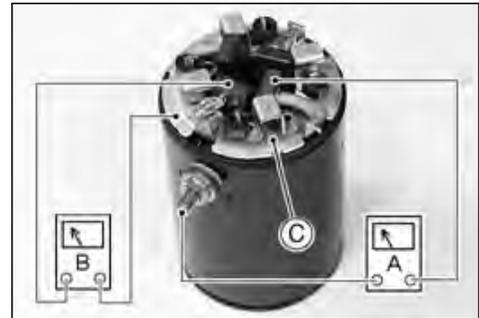
★ If the relay does not work as specified, the relay is defective. Replace the relay.

### Testing Relay

Tester Range:  $\times 1 \Omega$  range

Criteria: When battery is connected  $\rightarrow 0 \Omega$

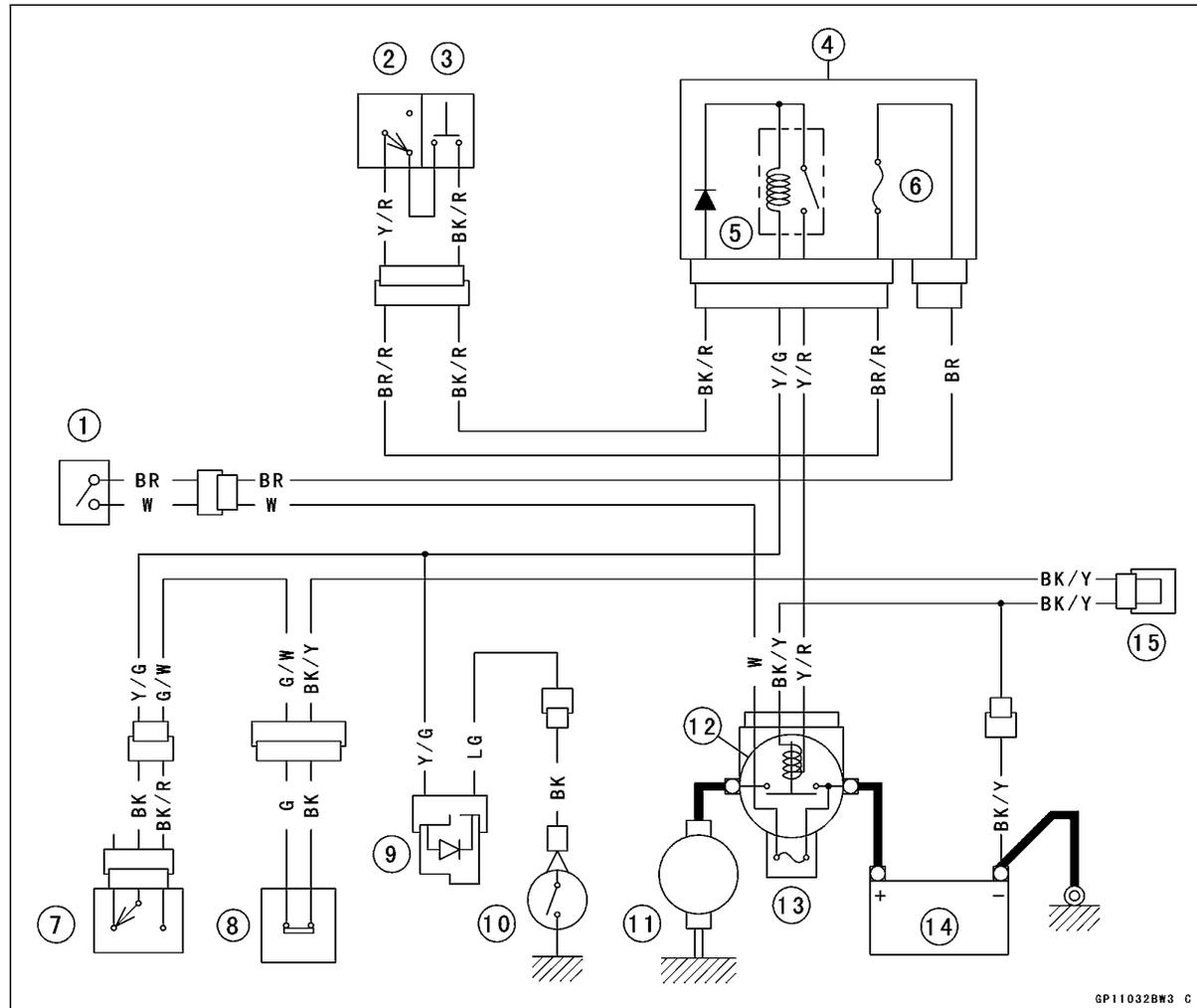
When battery is disconnected  $\rightarrow \infty \Omega$



# 16-58 ELECTRICAL SYSTEM

## Starter Motor

### Electric Starter Circuit



- 1. Ignition Switch
- 2. Engine Stop Switch
- 3. Starter Button
- 4. Junction Box
- 5. Starter Circuit Relay

- 6. Ignition Fuse 10 A
- 7. Starter Lockout Switch
- 8. Side Stand Switch
- 9. Diode
- 10. Neutral Switch

- 11. Starter Motor
- 12. Starter Relay
- 13. Main Fuse 30 A
- 14. Battery
- 15. Joint Connector

GP11032BW3 C

## Lighting System

This model adopts the daylight system and has a headlight relay in the junction box. The headlight does not go on when the ignition switch and the engine stop switch are first turned on. The headlight comes on when the engine starts running and stays on even if the engine stalls. The headlight goes out when the ignition switch is turned off. It also goes out while the starter button is depressed.

### Headlight Beam Horizontal Adjustment

- Turn the horizontal adjuster [A] on the headlight with a screwdriver in or out until the beam points straight ahead.
- Turn the adjuster clockwise to face the headlight to the left.



### Headlight Beam Vertical Adjustment

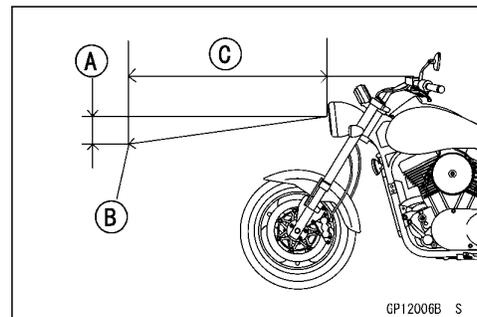
- Turn the vertical adjuster [A] in the headlight in or out with a screwdriver to adjust the headlight vertically.
- Turn the adjuster clockwise to face the headlight up.



### NOTE

- ON high beam, the brightest points should be slightly below horizontal with the motorcycle on its wheels and the rider seated. Adjust the headlight to the proper angle according to local regulations.
- For US model, the proper angle is 0.4 degrees below horizontal. This is 50 mm (2 in.) drop at 7.6 m (25 ft.) measured from the center of the headlight with the motorcycle on its wheels and the rider seated.

50 mm (2 in.) [A]  
Center of Brightest Spot [B]  
7.6 m (25 ft.) [C]



### Headlight Bulb Replacement

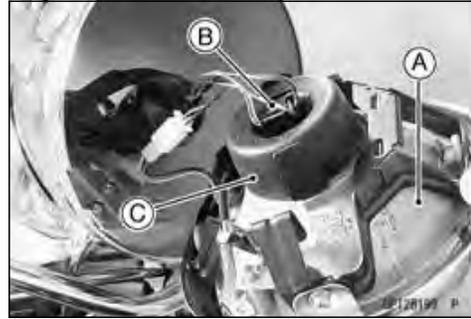
- Remove the headlight rim screws [A] on both sides.



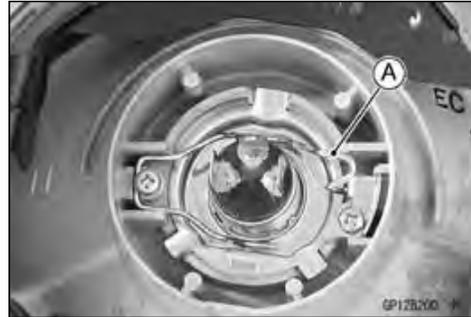
## 16-60 ELECTRICAL SYSTEM

### Lighting System

- Pull the headlight unit [A] and drop it out.
- Pull the headlight connector [B].
- Remove the headlight dust cover [C].



- Push the hook [A] to unlock.



- Take out the bulb [A].

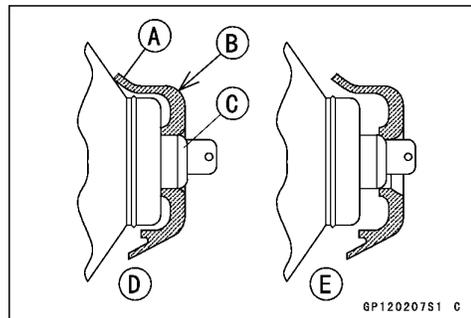
#### CAUTION

When handling the quartz-halogen bulb, never touch the glass portion with bare hands. Always use a clean cloth. Oil contamination from hands or dirty rags can reduce bulb life or cause the bulb to explode.

- Clean off any contamination that inadvertently gets on the bulb with alcohol or a soap and water solution.



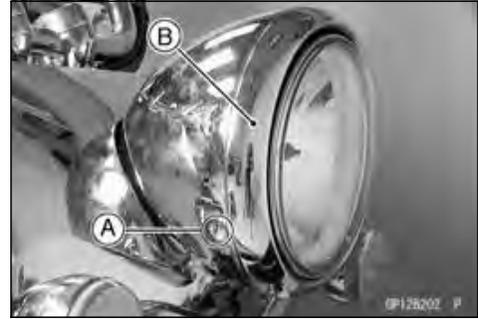
- Replace the headlight bulb.
- Fit the dust cover [A] with the TOP mark [B] upward onto the bulb [C] firmly as shown.
  - Good [D]
  - Bad [E]
- Tighten:
  - Torque - Headlight Rim Screws: 2.9 N·m (0.30 kgf·m, 26 in·lb)**
- After installation, adjust the headlight aim (see this chapter).



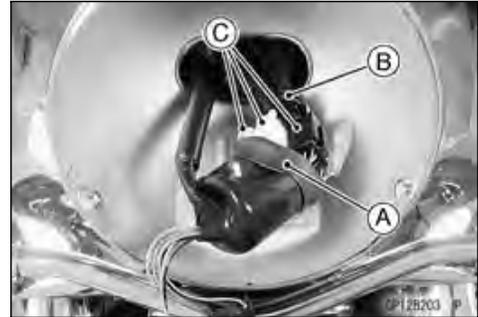
## Lighting System

### Headlight Body Removal

- Remove the headlight rim screws [A].
- Pull the headlight unit [B] and drop it out.



- Remove:
  - Rubber Cover [A]
  - Clamp [B]
  - Connectors [C]



- Remove the headlight body bolts [A], then take off the body [B].



### City Light Bulb Replacement (other than US, CA and AU)

US: United States model  
 CA: Canada model  
 AU: Australia model

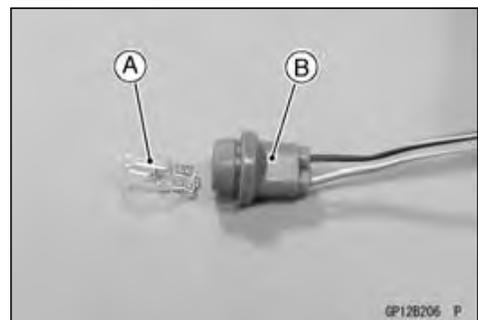
- Remove the headlight unit (see this chapter).
- Pull out the socket [A] together with the bulb.



- Remove the wedge-base type bulb [A], pull the bulb straight out of the socket [B].

### CAUTION

**Do not turn the bulb. Pull the bulb out to prevent damage to the bulb. Do not use bulb rated for greater wattage than the specified value.**

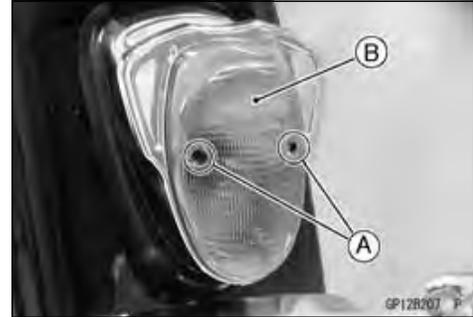


## 16-62 ELECTRICAL SYSTEM

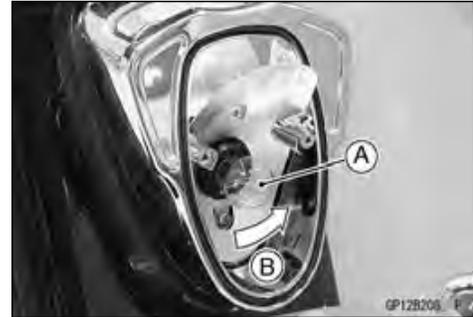
### Lighting System

#### *Tail/Brake Light Bulb Replacement*

- Unscrew the screws [A] in the taillight lens.
- Pull the lens [B] off.

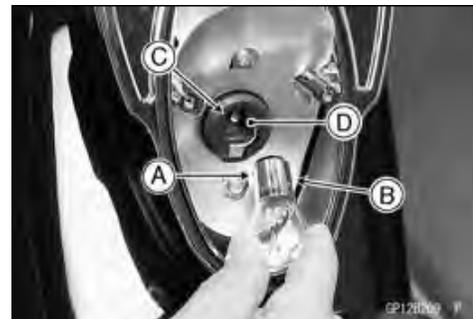


- Push the bulb [A] in, turn it counterclockwise [B], and pull it out.
- Replace the bulb with a new one.



- With the front pin [A] up and the rear pin [B] down, insert the new bulb by aligning the front pin with the left groove [C] in the walls of the socket [D].
- Push the bulb in, turn it clockwise, and release it. It should lock in position.
- Tighten:

**Torque - Tail/Brake Light Lense Screws: 1.2 N·m (0.12 kgf·m, 10 in·lb)**





## 16-64 ELECTRICAL SYSTEM

### Automatic Turn Signal Canceling System

Automobiles use a turn signal canceling system actuated by steering wheel turn. But, motorcycles turn with a bank additionally, and so have a smaller steer angle. This makes difficult to adopt an automobile type turn signal canceling system because of inaccurate operation in motorcycles. So, motorcycles adopt time & distance counting system.

The canceling system consists of a battery, turn signal control relay, distance sensor, and turn signal switch. When the turn signal switch is pushed onto the right or left, the turn signals start flashing and the control relay starts counting off **8 seconds**. At the end of this time, the control relay starts calculating distance traveled using pulses from the distance sensor in the speedometer. The control relay keeps working even after the turn signal switch was released and returned to the neutral position by spring force. When the motorcycle has traveled an additional **65 meters (213 feet)**, the control relay shuts off the current, turns off the turn signal lights, and resets itself.

★ If the turn signal canceling system does not function properly, first check all the wiring connections carefully.

- Secondly, inspect the distance sensor.
- Thirdly, inspect the turn signal switch in the left handlebar switch.
- Lastly, check the turn signal control relay.

#### Wiring Inspection

- Connect all the connectors.
- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.
- Remove the turn signal control relay [A].
- Pull off the 6-pin connector of the relay, the 9-pin and 4-pin meter connectors in the headlight housing, and the 9-pin left handlebar switch connector under the fuel tank.
- Make sure all connector terminals are clean and tight, and none of them have been bent.
- Clean the dirty terminals, and straighten slightly-bent terminals.
- Check conductivity or voltage of the numbered terminals with the hand tester.
- The terminal numbers are shown in the wiring diagram of Turn Signal Canceling System.



**Special Tool - Hand Tester: 57001-1394**

#### Wiring Inspection

Connectors	Tester Connection	Tester Reading
Turn Signal Control Relay ↔ Distance Sensor	1 – 8 3 – 7	0 Ω
Turn Signal Control Relay ↔ Left Handlebar Switch	2 – 11 3 – 9 4 – 10	
Turn Signal Control Relay ↔ Battery	6 – Battery (+)	

IG. SW.: Ignition Switch

★ If any one of the hand tester readings shows an improper values, check the wiring and connections of the turn signal switch, distance sensor, and turn signal control relay. Check the turn signal control relay (see Turn Signal Control Relay Inspection) if all of them turn out good.

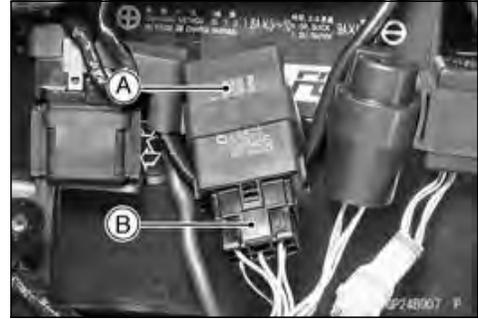
## Automatic Turn Signal Canceling System

### Distance Sensor Inspection

- Remove the right side cover (see this chapter).
- Remove the turn signal control relay [A].
- Do not disconnect the connector [B].
- Use the jack and the attachment jack to lift the rear wheel.

**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**



- Set the hand tester to the DC25 V range and connect it to the LB lead terminal [A] and battery (-) terminal [B] as shown.

#### Connections

**Hand Tester (+) → LB Lead Terminal**

**Hand Tester (-) → Battery (-) Terminal**

- Remove all the spark plugs and shift the gear into 1st.
- Turn the rear wheel slowly to see that the tester's pointer fluctuates repeated by reading 0.5 V and 12 V.
- ★ If the tester's pointer fluctuates, distance sensor is normal.
- ★ If the tester's pointer does not fluctuate, inspect the speed sensor and turn signal control relay. If the speed sensor and control relay are good, replace the digital meter assembly.



### Turn Signal Switch Inspection

- Open the headlight housing.
- Unplug the 9-pin connectors that leads to the left handlebar switch.
- Check the turn signal switch connections according to the table.
- ★ If the switch has an open circuit or a short, it can be disassembled for repair. The contact surfaces may be cleaned, but no internal parts are available for replacement.
- ★ If any parts are not repairable, the left handlebar switch must be replaced as a unit.

#### Turn Signal Switch Connections

Color	G	O	GY	BK/Y	Y/R
L (left)	● — ●			● — ●	
OFF (push)					
R (right)		● — ●		● — ●	

### Turn Signal Control Relay Inspection

#### CAUTION

**Never drop the turn signal control relay, especially on a hard surface. Such a shock to the unit can damage it.**

- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.

## 16-66 ELECTRICAL SYSTEM

### Automatic Turn Signal Canceling System

- Connect one 12 V battery and turn signal lights as indicated in the figure, and count how many times the lights flash for one minute.

Turn Signal Control Relay Connector [A]

Turn Signal Lights [B]

12 V Battery [C]

- ★ If the lights do not flash as specified, replace the turn signal control relay.

#### Testing Turn Signal Control Relay Inspection

Load		Flashing Times (c/m*)
The Number of Turn Signal Lights	Wattage (W)	
1**	21 ~ 23	140 ~ 250
2	42 ~ 46	75 ~ 95

(\*): Cycle(s) per minute

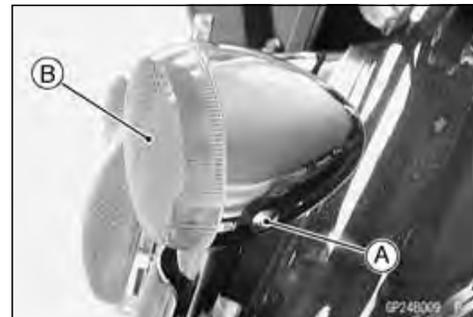
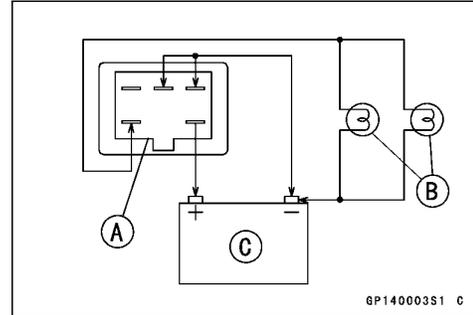
(\*\*): corresponds to "one light burned out, and the other lights stay ON".

#### NOTE

○ Even if the foregoing checks show the turn signal control relay to be good, it may be defective in some manner especially for automatic turn signal canceling operation not readily detectable with above checks. If all other checks are good, replace the turn signal control relay.

#### Turn Signal Light Bulb Replacement

- Remove the turn signal light lens screw [A] and take off the lens [B].

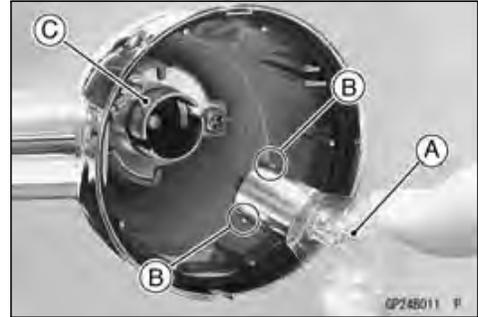


- Push the bulb [A] in the socket and turn the bulb counter-clockwise [B].
- Replace the bulb.



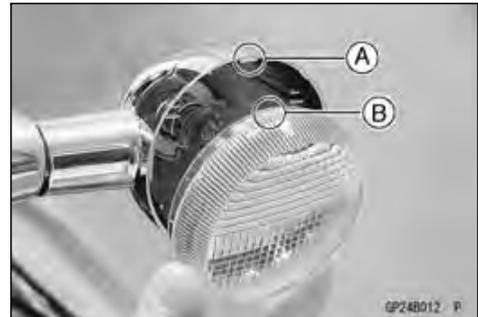
### Automatic Turn Signal Canceling System

- Insert the new bulb [A] by aligning the pins [B] with the groove in the walls of the socket [C].



- Fit the projection [A] in the recess [B] of the lens.
- Tighten:

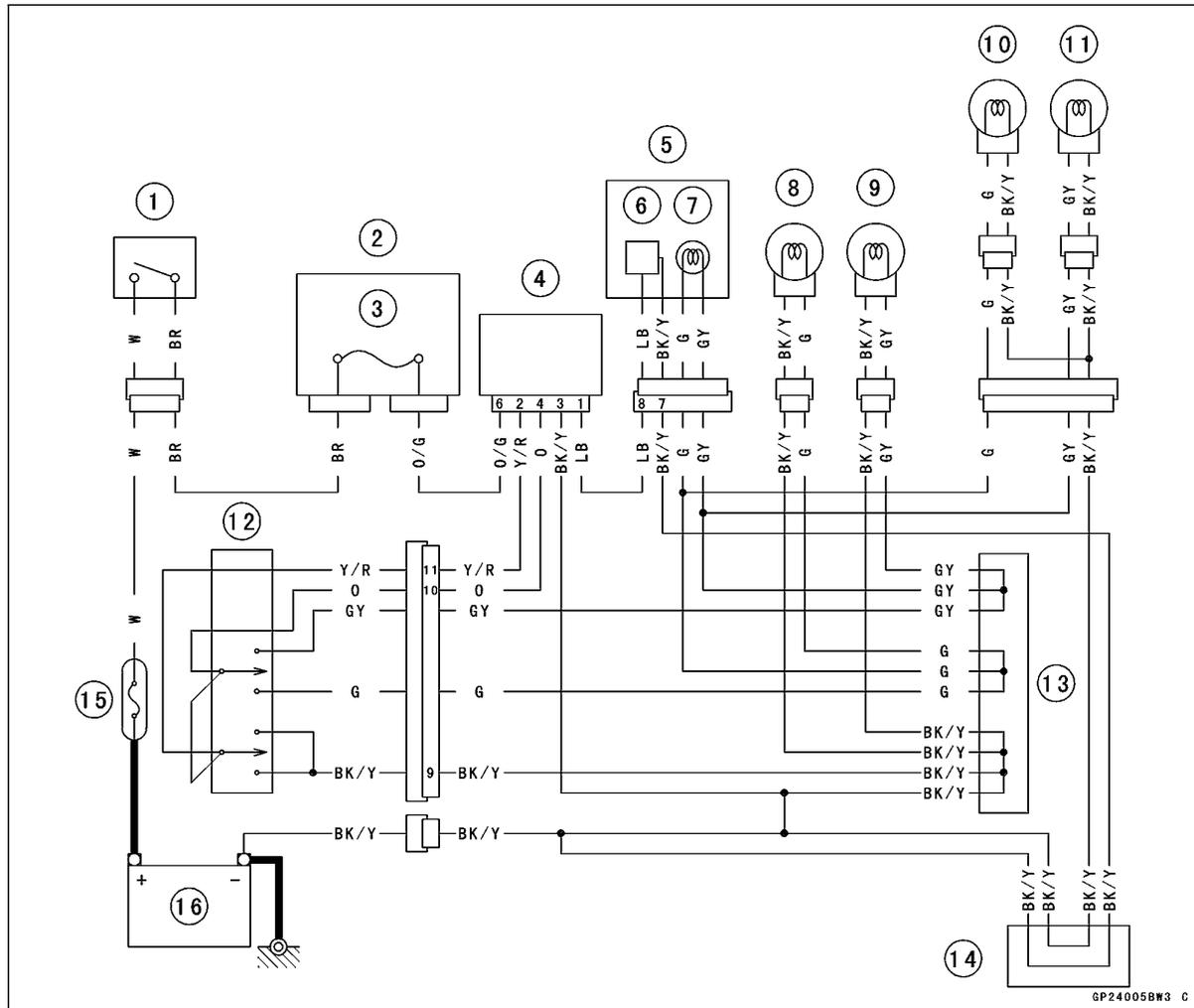
**Torque - Turn Signal Light Lens Screws: 1.0 N·m (0.10 kgf·m, 8.7 in·lb)**



# 16-68 ELECTRICAL SYSTEM

## Automatic Turn Signal Canceling System

### Turn Signal Cancelling System Circuit



1. Ignition Switch
2. Junction Box
3. Turn Signal Control Relay Fuse 10 A
4. Turn Signal Control Relay
5. Meter Unit
6. Distance Sensor
7. Turn Signal Indicator Light
8. Front Left Turn Signal Light

9. Front Right Turn Signal Light
10. Rear Left Turn Signal Light
11. Rear Right Turn Signal Light
12. Turn Signal Switch
13. Joint Connector
14. Joint Connector
15. Main Fuse 30 A
16. Battery

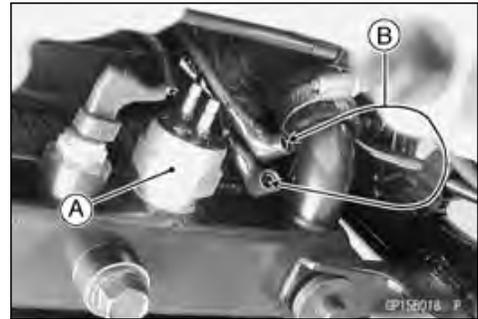
GP24005BM3 C

Radiator Fan System

**⚠ WARNING**  
 The radiator fan is connected directly to the battery. The fan may start even if the ignition switch is off. NEVER TOUCH THE RADIATOR FAN UNTIL THE RADIATOR FAN CONNECTOR IS DISCONNECTED. TOUCHING THE FAN BEFORE THE CONNECTOR IS DISCONNECTED COULD CAUSE INJURY FROM THE FAN BLADES.

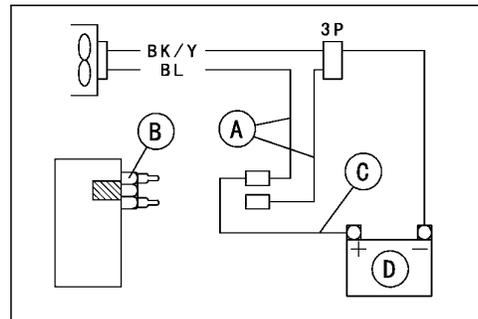
*Fan System Circuit Inspection*

- Disconnect the leads from the radiator fan switch [A].
- Using an auxiliary lead [B], connect the radiator fan switch leads.
- ★ If the fan rotates, inspect the fan switch.
- ★ If the fan does not rotate, inspect the following.
  - Leads and Connectors
  - Main Fuse 30 A and Fan Fuse 10 A
  - Fan Motor

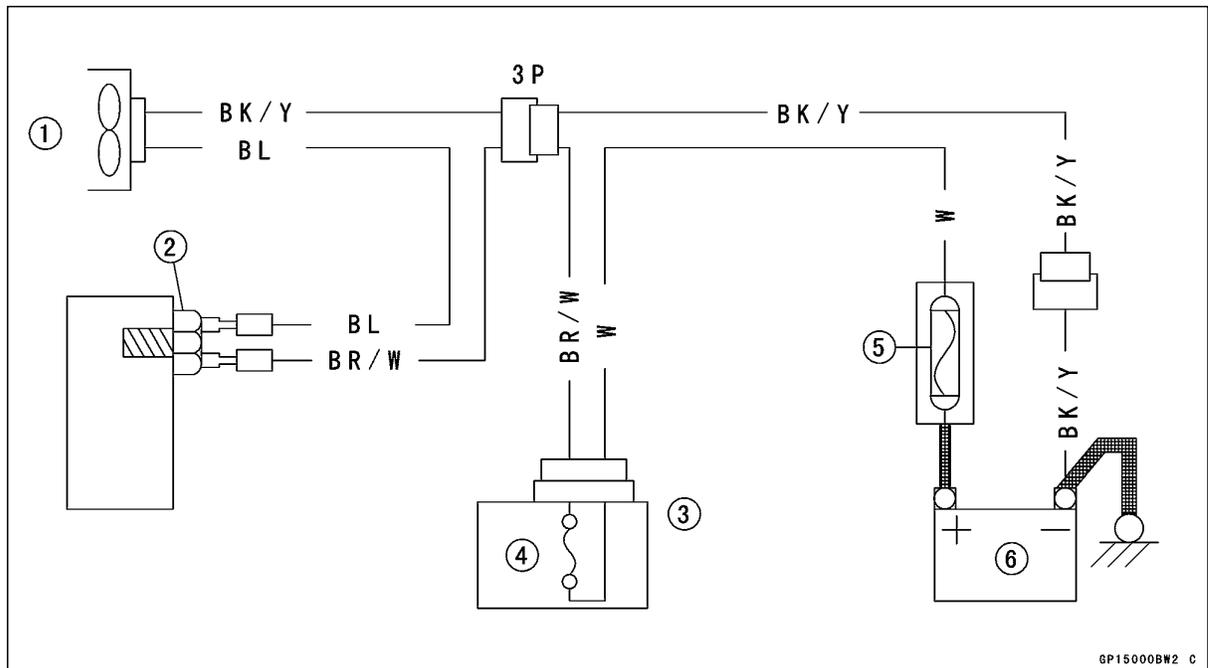


*Fan Motor Inspection*

- Disconnect the leads [A] from the radiator fan switch [B].
- Using an auxiliary lead [C], supply battery power to the fan motor.
- ★ If the fan does not rotate, the fan motor is defective and must be replaced.
  - Battery [D]



Radiator Fan Circuit



- 1. Radiator Fan
- 2. Radiator Fan Switch
- 3. Junction Box
- 4. Fan Fuse 10 A
- 5. Main Fuse 30 A
- 6. Battery

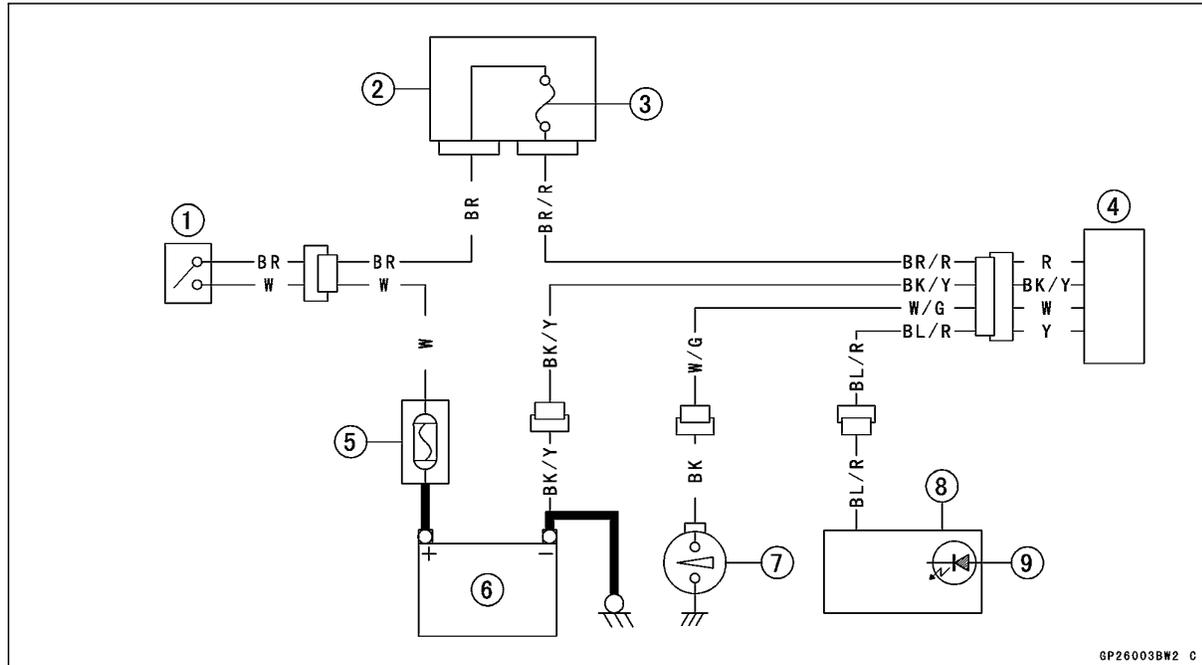
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## 16-70 ELECTRICAL SYSTEM

### Oil Pressure Warning System

Motorcycle operation with low engine oil level, even if it is higher than the lower level line, will cause oil level change when sudden acceleration, or deceleration, and may lead flicker of the oil pressure warning light because of too rapid response of the oil pressure switch. To improve this operation, the oil pressure light delay unit is adopted, which prevents flicker of the oil pressure warning light by delaying its lighting.

#### Oil Pressure Warning System Circuit



1. Ignition Switch
2. Junction Box
3. Ignition Fuse 10 A
4. Oil Pressure Light Delay Unit
5. Main Fuse 30 A

6. Battery
7. Oil Pressure Switch
8. Meter Unit
9. Oil Pressure Warning LED Light

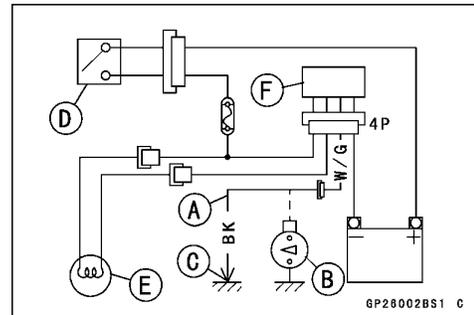
#### Oil Pressure Light Delay Unit Removal

- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.
- Pull the connectors out of the oil pressure light delay unit [A].



#### Oil Pressure Light Delay Unit Inspection

- Disconnect the lead [A] of the oil pressure switch [B], and ground [C] it to the engine, using an auxiliary wire.
- Turn the ignition switch [D] ON.
- ★ If the oil pressure warning LED light [E] in the meter unit is lit, check the oil pressure switch connections (see Switch Inspection).
- ★ If the warning LED light is not lit, check the warning LED light and wiring (see Meter Unit Inspection).
- ★ If the LED light and wiring are good, replace the oil pressure light delay unit [F].



### Oil Pressure Warning System

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- Turn the ignition switch ON.
- Ground the oil pressure switch lead to the engine, then the oil pressure warning LED light should be lit with a delay.
- Measure this delay time from grounding of the switch lead to lighting of the warning LED light.

#### Lighting Delay Time

**Standard: about 3 seconds**

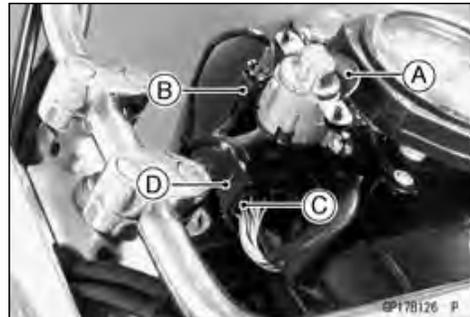
- ★ If the lighting delay time is out of the standard too far, replace the oil pressure light delay unit.

## 16-72 ELECTRICAL SYSTEM

### Meter, Gauge

#### Meter Unit Removal

- Remove:
  - Bolts [A] and Washers
  - Nuts [B]
  - Meter Cover [C]
  
- Remove:
  - Cover [A]
  - Ignition Switch Lead Connector [B]
  - Meter Unit Lead Connector [C]
- Remove the connector [D] from the bracket.
  
- Remove:
  - Bolts [A]
  - Meter Unit [B] with Bracket
  
- Remove:
  - Nuts [A]
  
- Pull out the meter unit [A] from the pins [B] on the bracket.



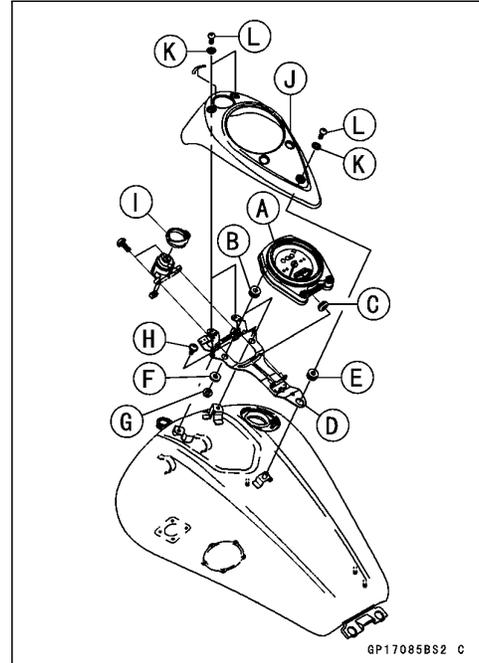
#### CAUTION

Never drop the meter unit, especially on a hard surface. Such a shock to the unit can damage it. Place the speedometer so that the face is up. If the meter is left upside down or sideways for any length of time, it will malfunction.

## Meter, Gauge

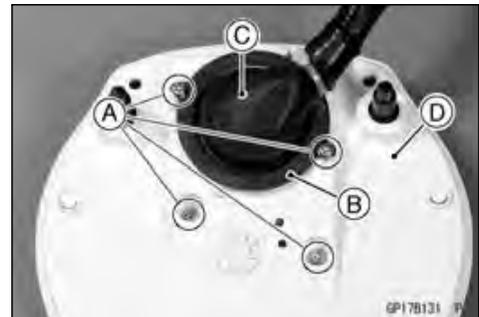
### Meter Unit Installation

- Install:
  - Meter Unit [A]
  - Damper [B] (Outside Diameter: 22 mm (0.87 in.))
  - Damper [C] (Outside Diameter: 16 mm (0.63 in.))
  - Bracket [D]
  - Damper [E] (Outside Diameter: 24 mm (0.94 in.))
  - Washers [F] (steel)
  - Nuts [G]
  - Bolts [H] (L: 12 mm (0.47 in.))
  - Cover [I]
  - Meter Cover [J]
  - Washers [K] (nylon)
  - Bolts [L] (L: 10 mm (0.39 in.))



### Meter Unit Disassembly

- Remove the meter unit (see Meter Unit Removal).
- Remove:
  - Screws [A]
  - Upper Meter Cover [B]
- Remove:
  - Screws [A]
  - Holder [B]
- Remove the grommet [C] from the lower meter cover [D].



### NOTE

- The water temperature warning LED light, oil pressure warning LED light and FI indicator LED light can not be exchanged.

## 16-74 ELECTRICAL SYSTEM

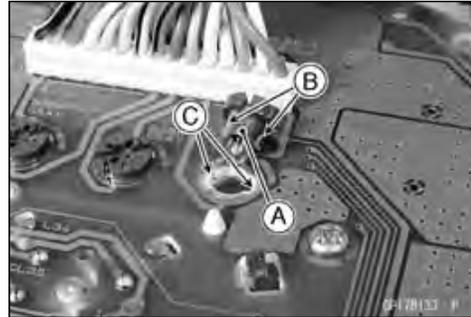
### Meter, Gauge

- Turn out the socket [A] counterclockwise.
- These sockets are for the high beam indicator light, turn signal indicator light and neutral indicator light.

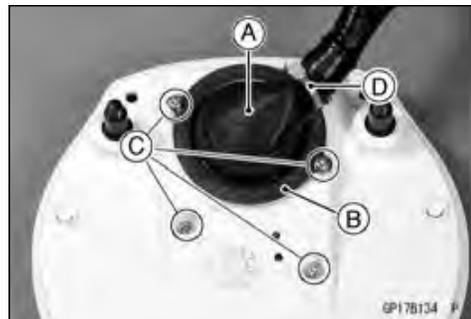


#### *Meter Unit Assembly*

- Insert the bulb [A] so that the projections [B] align with the grooves [C] in the panel, and turn in the socket clockwise.



- Fit the grommet [A] in the lower meter cover.
- Install:
  - Holder [B]
  - Screws [C]
- Tighten the band [D] as shown.



## Meter, Gauge

### Meter Unit Inspection

#### LCD Segment Inspection:

- Remove the meter unit (see Meter Unit Removal).  
[A] Meter Unit Lead Connector

#### CAUTION

**Do not drop the meter unit. Such a shock to the meter unit can damage it. Place the meter facing up. If a meter is left upside down or sideways for any length of time, it will malfunction.**

- [1] Neutral Indicator Light (–)
- [2] FI Indicator LED Light (–)
- [3] Oil Pressure Warning LED Light (–)
- [4] Water Temperature Warning LED Light (–)
- [5] Speed Signal for Turn Signal Control Relay
- [6] Unused
- [7] Battery (+)
- [8] Ignition, Neutral Indicator Light (+) and Illumination (+)
- [9] Battery (–), High Beam Indicator Light (–) and Illumination (–)
- [10] Speed Sensor Supply Voltage
- [11] Speed Sensor Signal
- [12] Fuel Level Sensor Signal
- [13] Right Turn Signal Indicator Light (±)
- [14] Left Turn Signal Indicator Light (±)
- [15] Fuel Level Warning Indicator LED Light (–)
- [16] High Beam Indicator Light (+)

#### CAUTION

**Do not short each terminals. When inspecting the meter unit be sure to connect each connections.**

#### Check 1 :

- Using the auxiliary leads, connect a 12 V battery [A] to the meter unit lead connector terminals.

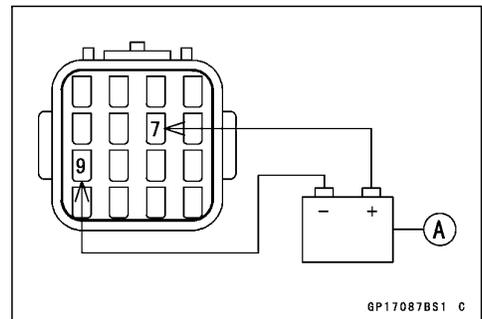
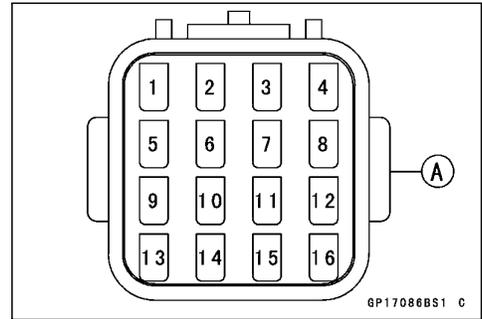
#### Connections

**Battery Positive Terminal (+) → Terminal [7]**

**Battery Negative Terminal (–) → Terminal [9]**

○When the terminals are connected, the speedometer needle momentarily points to the last reading, and then return to the 0 position.

- ★If the needle function does not work, replace the meter unit.



## 16-76 ELECTRICAL SYSTEM

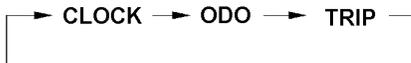
### Meter, Gauge

#### Check 2 :

- Using the auxiliary lead, connect the battery positive terminal to terminal [8].
- Verify that all the LCD segments (the letters and numbers of the liquid crystal display) to appear for 3 seconds, and the speedometer needle momentary points to the last reading and then return to the 0 position. Then the clock or meters operates normally depending on the mode selected.
- Disconnect the terminal [8].
- Verify that all the LCD segments and symbols disappear.
- ★ If the display function does not work, replace the meter unit.

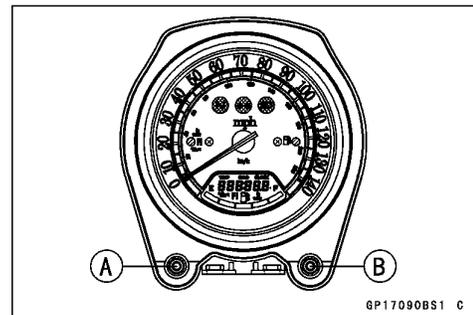
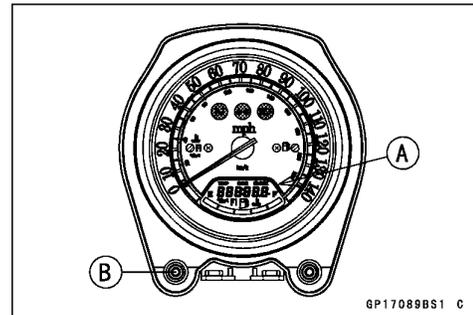
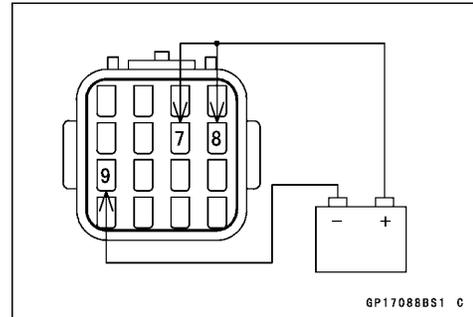
#### Mode Button Operation Checks:

- Connect the lead in the same circuit as for the LCD Segment Inspection, Check 2.
- Check that the display [A] changes to the CLOCK, ODO, and TRIP display each time the mode button [B] is pushed.



- ★ If the display does not work, replace the meter unit.

- Push the mode button [A] to TRIP and push the reset button [B] more than 2 seconds. The display shows "0.0".
- ★ If the display does not show "0.0", replace the meter unit.

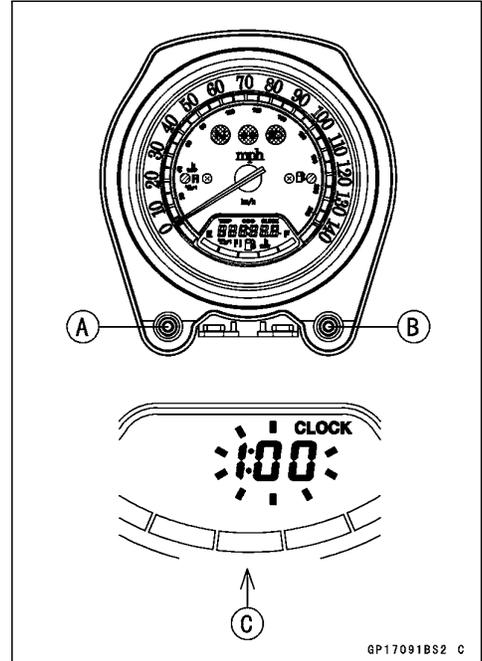


## Meter, Gauge

- Push the mode button [A] to CLOCK.
- Push the reset button [B] more than 2 seconds, then the display turns to the HOUR/MINUTE mode [C].
- In the HOUR/MINUTE mode, the numbers flash on the display.
- Check that the flashing number changes to the HOUR or MINUTE display each time the reset button is pushed.



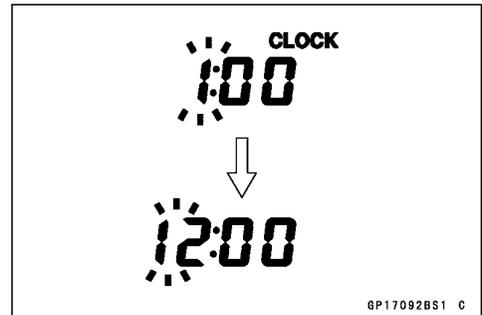
- ★ If the display does not work, replace the meter unit.



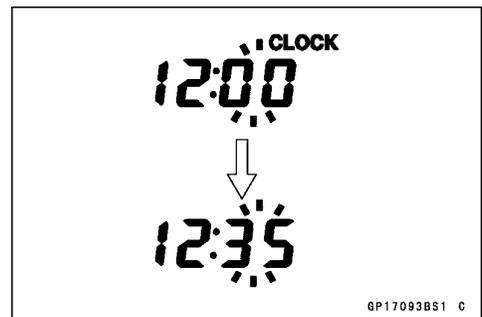
- Check that the time can be set.
- ★ If the time cannot be set, replace the meter unit.

### Clock Setting:

- In the HOUR/MINUTE mode, push the reset button again to effect the HOUR setting mode.
- The hour display flashes on the display.
- Push the mode button to set the hour.



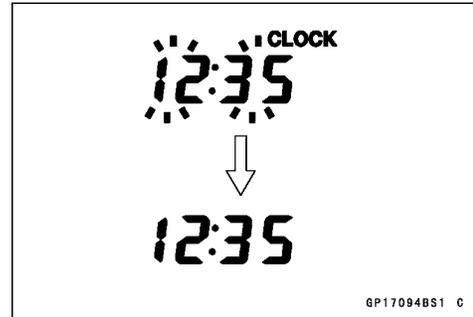
- In the HOUR mode, push the reset button once to effect the MINUTE setting mode.
- The minute display flashes on the display.
- Push the mode button to set the minute.



## 16-78 ELECTRICAL SYSTEM

### Meter, Gauge

- Set the minute, push the reset button to return to the HOUR/MINUTE mode.
- Push the mode button to complete the time setting process.
- The clock starts counting the seconds as soon as the mode button is pushed.



#### Speedometer Inspection:

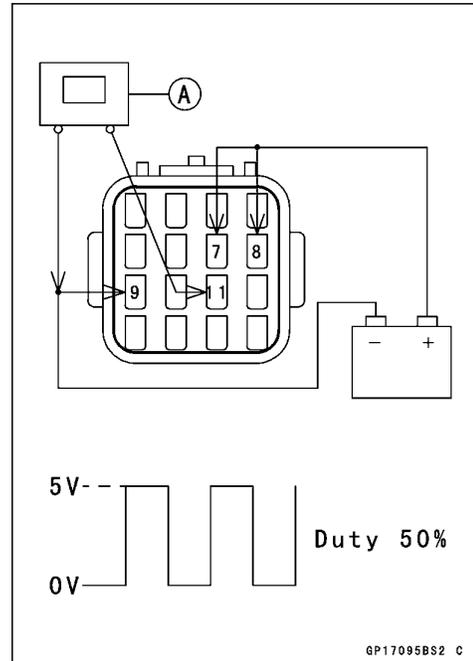
- Connect the leads in the same circuit as for the LCD Segment Inspection, check 2.
- Connect the oscillator [A] to the terminal [11]. The vehicle speed that corresponds to the input frequency will be displayed when a short wave form such as the one show in the diagram is input.

#### Example:

An input frequency of 720 Hz will display about 60 mph.

An input frequency of 450 Hz will display about 60 km/h.

- ★ If the meter does not function correctly, replace the meter unit.



- ★ If an oscillator is unavailable, check the speedometer as follows.

- Install the meter unit.
- Use the jack and the attachment jack to lift the rear wheel.

**Special Tools - Jack: 57001-1238**

**Attachment Jack: 57001-1398**

- Turn the ignition switch ON.
- Turn the rear wheel by hand to see if the speedometer shows the vehicle speed that corresponds to the wheel rotation.
- ★ If it does not show properly, inspect the speed sensor and speed sensor power supply voltage.
- ★ If the speed sensor and speed sensor power supply voltage are normal, replace the meter unit.

**Meter, Gauge**

**Speed Sensor Power Supply Voltage Inspection:**

- Connect the leads in the same circuit as for the LCD Segment Inspection, Check 2.
- Set the hand tester [A] to DC25 V, check the voltage between terminal [10] and battery negative lead.

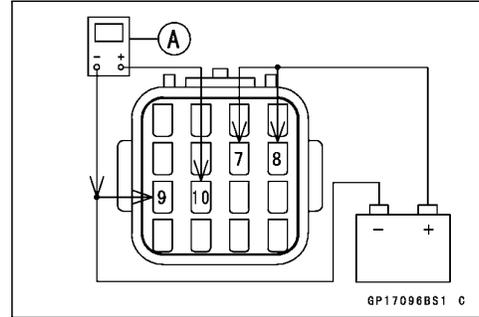
**Connections**

Hand Tester (+) → Terminal [10]

Hand Tester (-) → Battery Negative (-) Terminal

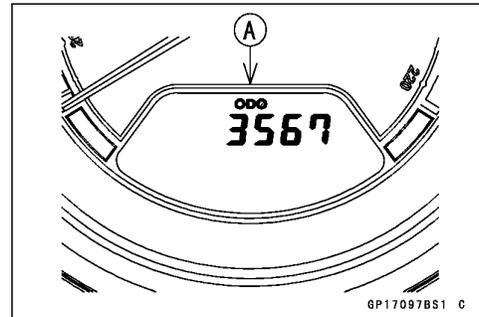
Special Tool - Hand Tester: 57001-1394

★If the voltage is less than 6 V, replace the meter unit.



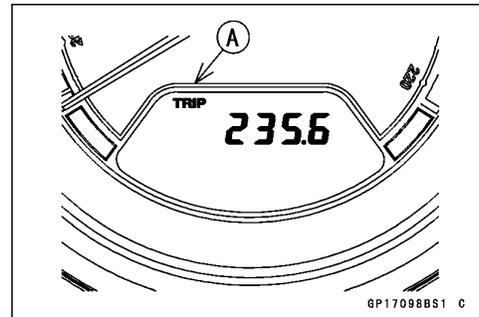
**ODO Meter Inspection:**

- Connect the leads in the same circuit as for the Speedometer Inspection.
- Push the mode button to ODO [A].
- Raise the input frequency of the oscillator to quickly see the result of this inspection.
- ★If the value indicated by the odo meter does not increase, replace the meter unit.



**TRIP Meter Inspection:**

- Connect the leads in the same circuit as for the Speedometer Inspection.
- Push the mode button to TRIP [A].
- Rise the input frequency of the oscillator to quickly see the result of this inspection.
- ★If the value indicated by the trip meter does not increase, replace the meter unit.



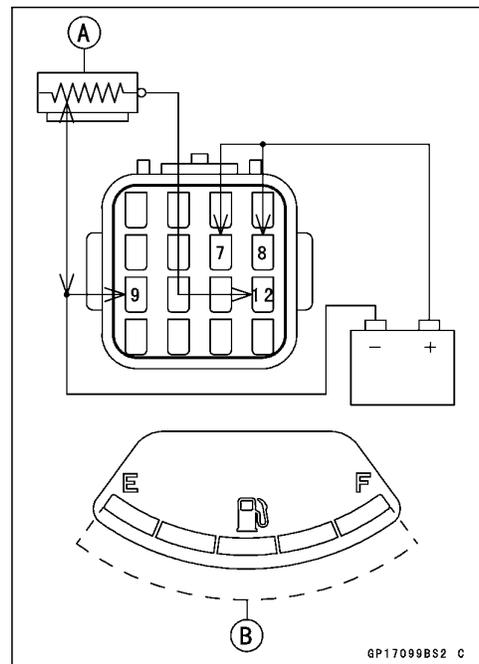
**Fuel Level Gauge Inspection:**

- Connect the leads in the same circuit as for the LCD segment inspection, Check 2.
- Connect a variable rheostat [A] to the terminal [12] and battery negative lead as shown.
- Check that the number of segments [B] matches the resistance value of the variable rheostat.
- When terminal [12] is connected, one segment should appear about 10 ~ 15 seconds.

Resistance (Ω)	Number of Segments
50	5
100	3
210	1

Resistance values are standard and they have tolerance.

★If this indicator function does not work, replace the meter unit.



## 16-80 ELECTRICAL SYSTEM

### Meter, Gauge

#### LED Light Inspection

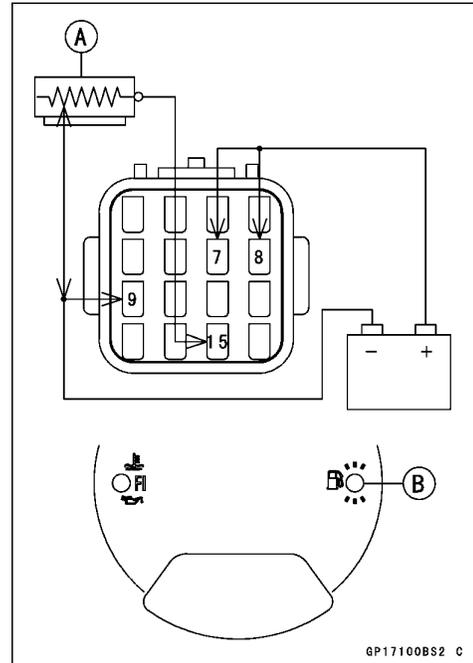
- Connect the leads in the same circuit as for the LCD Segments Inspection, Check 2.

#### Fuel Level Warning Indicator LED Light:

- Connect an about 30  $\Omega$  resistor [A] to the terminal [15] and battery negative lead.

#### Fuel Level Warning Indicator LED Light Connections: Battery Negative Lead (-) to Terminal [15]

- The fuel level warning indicator LED light [B] should go on.
- ★ If the fuel level warning indicator LED light does not go on, replace the meter unit.

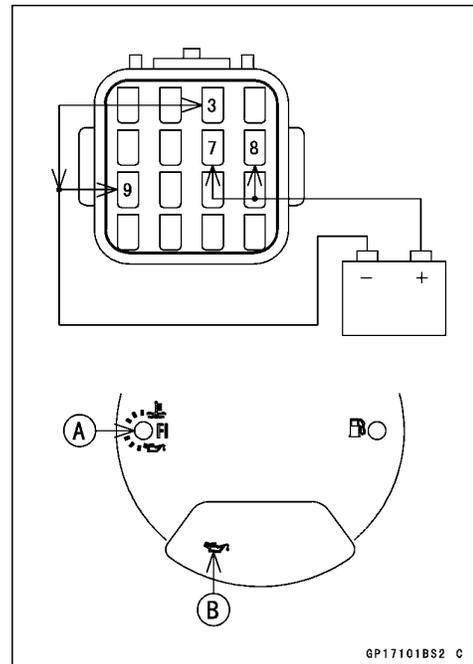


#### Oil Pressure Warning Indicator LED Light and LCD Symbol:

- Connect the lead to the terminal [3] and battery negative lead.

#### Oil Pressure Warning Indicator LED Light Connections: Battery Negative Lead (-) to Terminal [3]

- The oil pressure warning indicator LED light [A] and symbol [B] in the LCD should go on.
- ★ If the LED light and/or symbol do not go on, replace the meter unit.



## Meter, Gauge

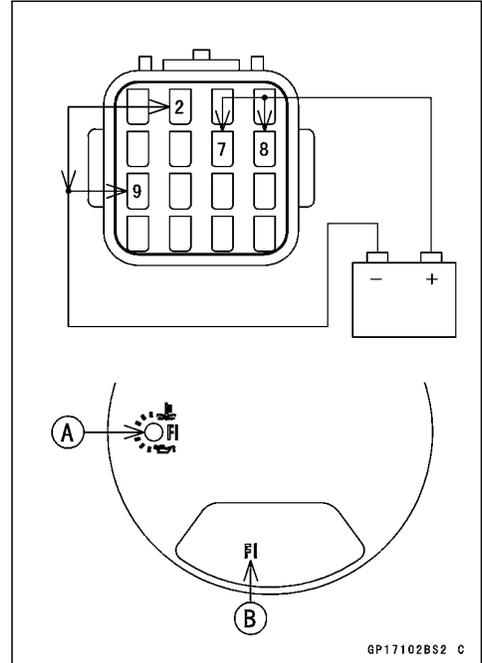
### FI Indicator LED Light and LCD Symbol:

- Connect the lead to the terminal [2] and battery negative lead.

#### FI Indicator LED Light Connections:

##### Battery Negative Lead (-) to Terminal [2]

- The FI indicator LED light [A] and symbol [B] in the LCD should go on.
- ★ If the LED light and/or symbol do not go on, replace the meter unit.



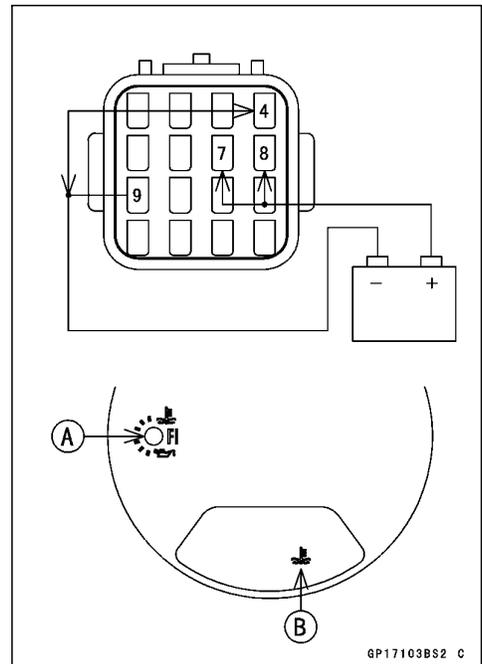
### Water Temperature Warning Indicator LED Light and LCD Symbol:

- Connect the lead to the terminal [4] and battery negative lead.

#### Water Temperature Warning Indicator LED Light Connections:

##### Battery Negative Lead (-) to Terminal [4]

- The water temperature warning indicator LED light [A] and symbol [B] in the LCD should go on.
- ★ If the LED light and/or symbol do not go on, replace the meter unit.



### Indicator Light Inspection

- Connect the leads in the same circuit as for the LCD Segments Inspection, Check 2.

## 16-82 ELECTRICAL SYSTEM

### Meter, Gauge

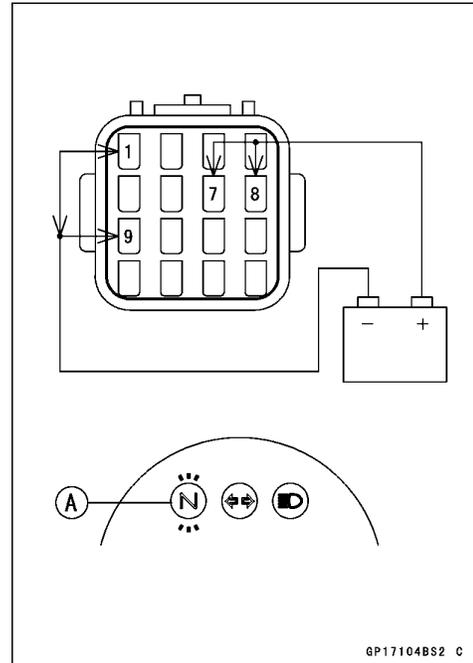
#### Neutral Indicator Light:

- Connect the lead to the terminal [1] and battery negative lead.

#### Neutral Indicator Light Connections:

##### Battery Negative Lead (-) to Terminal [1]

- The neutral indicator light [A] should go on.
- ★ If the indicator light does not go on, inspect the bulb.
- Check conductivity of the bulb with the hand tester.
- ★ If the bulb is open, replace the bulb.
- ★ Even if the bulb is replacement but the indicator light does not go on, replace the meter unit.



#### Turn Signal Indicator Light:

- Connect the lead to the terminal [13] and [14] as follows.

#### Neutral Indicator Light Connections:

##### Battery Positive Lead (+) to Terminal [13]

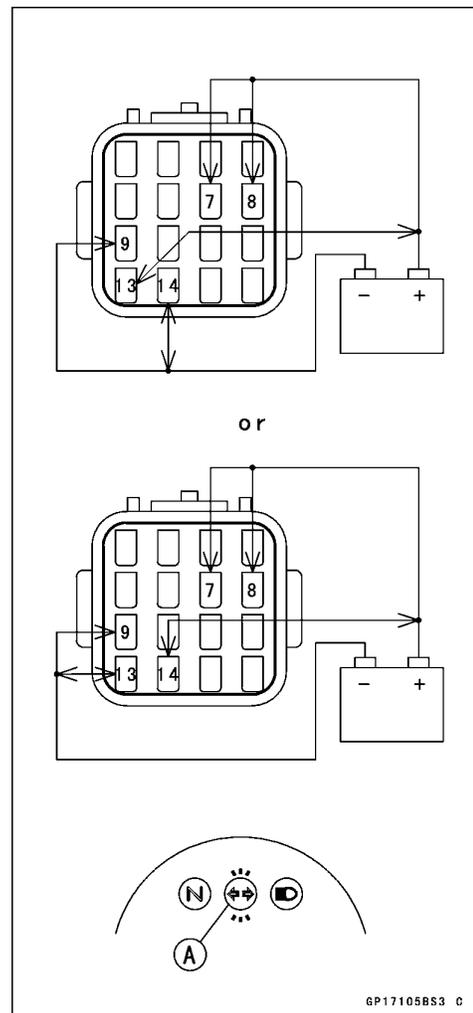
##### Battery Negative Lead (-) to Terminal [14]

or

##### Battery Positive Lead (+) to Terminal [14]

##### Battery Negative Lead (-) to Terminal [13]

- The turn signal indicator light [A] should go on.
- ★ If the indicator light does not go on, inspect the bulb.
- Check conductivity of the bulb with the hand tester.
- ★ If the bulb is open, replace the bulb.
- ★ Even if the bulb is replacement but the indicator light does not go on, replace the meter unit.



## Meter, Gauge

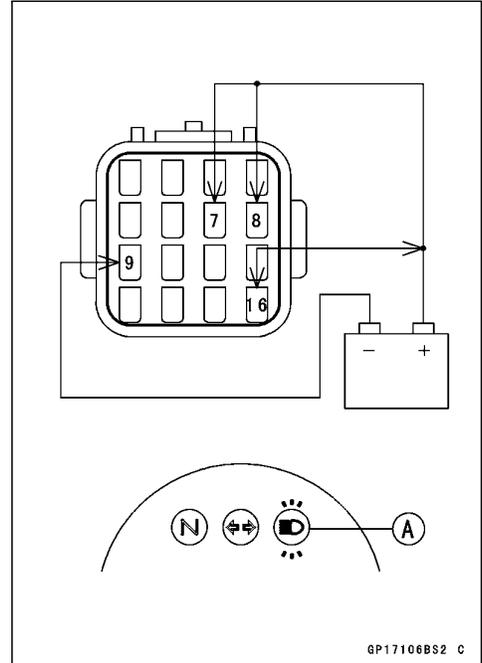
### High Beam Indicator Light:

- Connect the lead to the terminal [16] and battery positive lead.

#### High Beam Indicator Light Connections:

##### Battery Positive Lead (+) to Terminal [16]

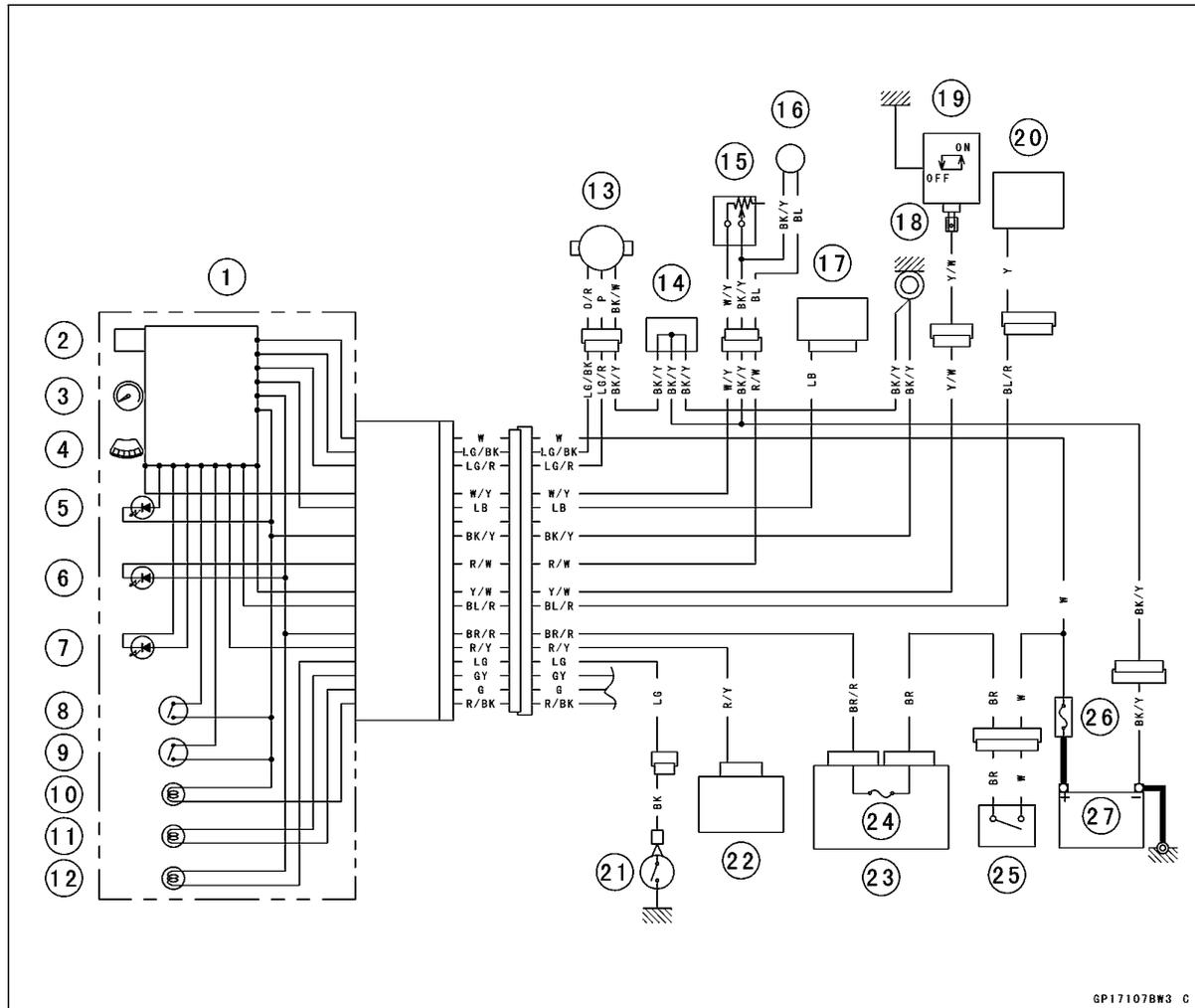
- The high beam indicator light [A] should go on.
- ★ If the indicator light does not go on, inspect the bulb.
- Check conductivity of the bulb with the hand tester.
- ★ If the bulb is open, replace the bulb.
- ★ Even if the bulb is replacement but the indicator light does not go on, replace the meter unit.



# 16-84 ELECTRICAL SYSTEM

## Meter, Gauge

### Meter Unit Circuit



- |   |  |
|---|--|
| 1. Meter Unit   | 15. Fuel Level Sensor                        |
| 2. Odometer/Trip Meter/Clock LCD                                      | 16. Fuel Reserve Switch                      |
| 3. Speedometer  | 17. Turn Signal Control Relay                |
| 4. Fuel Meter   | 18. Frame Ground                             |
| 5. Illuminator LED  | 19. Water Temperature Switch                 |
| 6. Fuel Indicator LED   | 20. Oil Pressure Warning Light<br>Delay Unit |
| 7. Water Temperature Warning/FI/Oil Pressure Warning<br>Indicator LED | 21. Neutral Switch                           |
| 8. Mode Button  | 22. Electronic Control Unit                  |
| 9. Reset Button   | 23. Junction Box                             |
| 10. High Beam Indicator Light   | 24. Ignition Fuse 10 A                       |
| 11. Turn Signal Indicator Light                                       | 25. Ignition Switch                          |
| 12. Neutral Indicator Light   | 26. Main Fuse 30 A                           |
| 13. Speed Sensor  | 27. Battery                                  |
| 14. Joint Connector   |  |

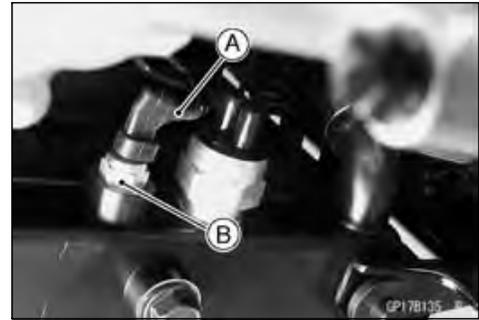
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## Water Temperature Warning System

### *Water Temperature Warning System Check*

The water temperature warning LED light goes on when the ignition switch is turned on and goes off soon to ensure that its circuit functions properly and the warning LED light has not burned out. The warning LED light also goes on whenever the coolant temperature rises to **113 ~ 117° (235 ~ 243°F)** when the motorcycle is in operation. If it stays on, stop the engine and check the coolant level in the reserve tank after the engine cools down.

- Inspect the water temperature warning LED light and the system wiring.
- Turn on the ignition switch.
- Disconnect the water temperature switch lead [A] then ground it to the frame or engine using an auxiliary lead.
- ★ If the water temperature warning LED light is lit, inspect the water temperature switch [B] (see Switches and Sensors section). Replace the switch if damaged.
- ★ If the warning LED light is not lit, check the warning LED light and wiring.

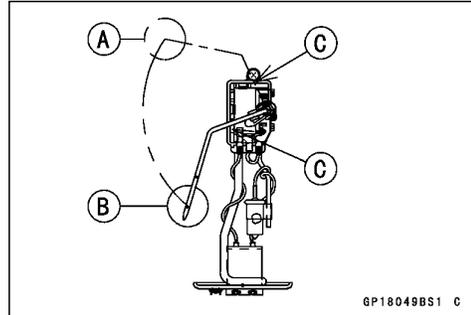
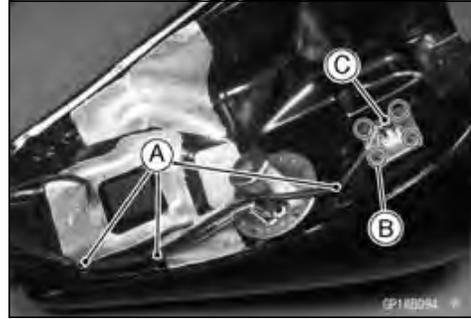


## 16-86 ELECTRICAL SYSTEM

### Switch and Sensors

#### Fuel Level Sensor Inspection

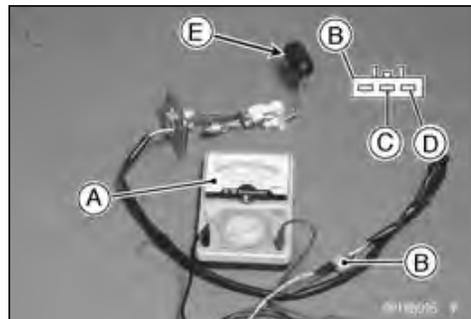
- Remove:
    - Fuel Tank (see Fuel System (DFI) chapter)
  - Open the clamps [A].
  - Remove:
    - Bolts [B]
    - Fuel Level Sensor [C]
- 
- Check that the float moves up and down smoothly without binding. It should go down under its own weight.
  - ★ If the float does not move smoothly, replace the sensor.
    - Float in Full Position [A]
    - Float in Empty Position [B]
    - Float Arm Stoppers [C]



- Using the hand tester [A], measure the resistance across the terminals in the fuel level sensor lead connector [B].
  - Black/Yellow [C]
  - White/Yellow [D]

**Special Tool - Hand Tester: 57001-1394**

- ★ If the tester readings are not as specified, or do not change smoothly according as the float moves up and down, replace the sensor.



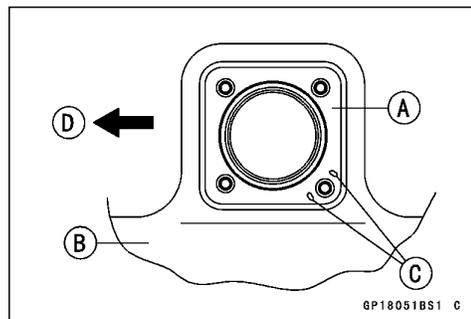
#### Fuel Level Sensor Resistance

**Standard: Full position [E]: 3 ~ 5  $\Omega$**

**Empty position: 213 ~ 219  $\Omega$**

- Install a new gasket [A] on the fuel tank [B] as shown.
  - [C] Hollows
  - [D] Front Side
- Apply a non-permanent locking agent to the threads of the level sensor mounting bolts and tighten it.

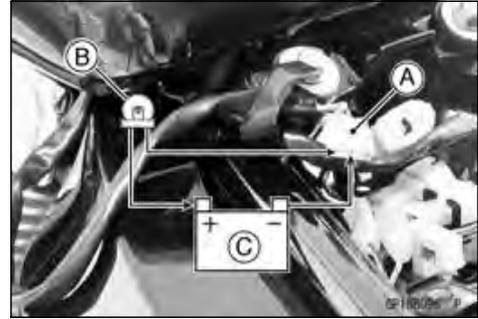
**Torque - Fuel Level Sensor Mounting Bolts: 6.9 N·m (0.7 kgf·m, 61 in·lb)**



## Switch and Sensors

### Fuel Reserve Switch Inspection

- Fill the fuel tank with fuel.
- Close the fuel tank cap surely.
- Remove:
  - Seats (see Frame chapter)
  - Fuel Level Sensor Lead Connector [A]
- Connect the test light [B] (12 V 3.4 W bulb in a socket with leads) and the 12 V battery [C] to the fuel level sensor lead connector.



### Connections:

- Battery (+) → 12 V 3.4 W Bulb (one side)
- 12 V 3.4 W Bulb (other side) → LB Lead Terminal
- Battery (-) → BK/Y Lead Terminal

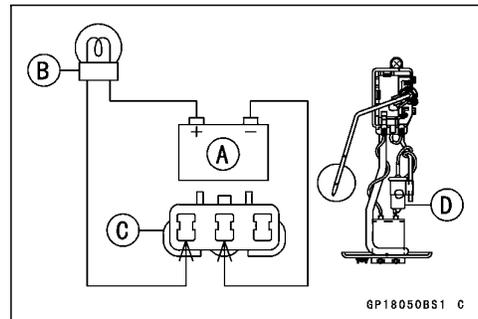
- ★ If the test light turn on, the reserve switch is defective. Replace the fuel level sensor.

- Remove:
  - Fuel Level Sensor (see Fuel Level Sensor Inspection)
- Connect the test light (12 V 3.4 W bulb in a socket with leads) and the 12 V battery to the fuel level sensor lead connector as shown.
  - 12 V Battery [A]
  - Test Light [B]
  - Fuel Level Sensor Connector [C]
  - Fuel Reserve Switch [D]

- ★ If the test light doesn't light, replace the fuel level sensor.

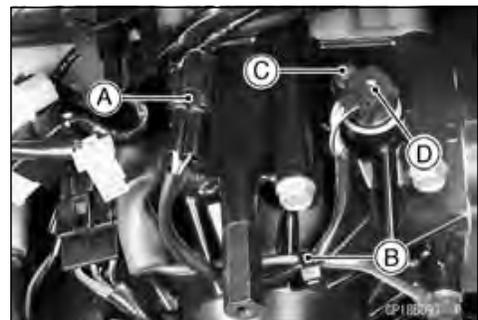
### NOTE

- It may take a long time to turn on the test light in case that the fuel reserve switch is inspected just after the fuel level sensor is removed. Leave the fuel reserve switch with leads for inspection connected for few minutes.



### Speed Sensor Removal

- Remove:
  - Alternator Outer Cover (see Alternator Outer Cover Removal)
  - Speed Sensor Lead Connector [A]
  - Band [B]
  - Bolt [C]
  - Speed Sensor [D]



## 16-88 ELECTRICAL SYSTEM

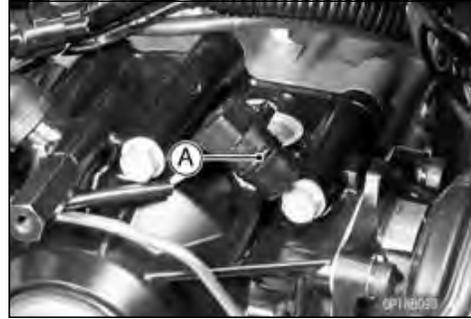
### Switch and Sensors

#### Speed Sensor Installation

- Apply grease to the O-ring [A] on the speed sensor.
- Tighten:

**Non-permanent Locking Agent -  
Speed Sensor Mounting Bolt**

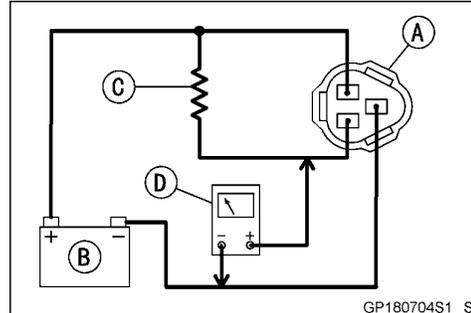
**Torque - Speed Sensor Mounting Bolt: 9.8 N·m (1.0 kgf·m,  
87 in·lb)**



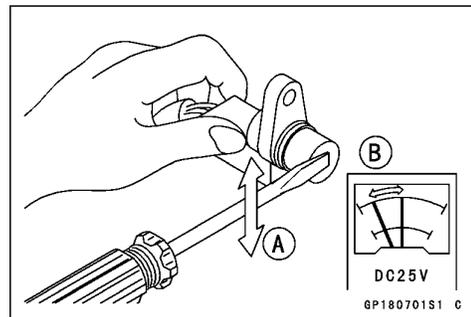
#### Speed Sensor Inspection

- Remove:  
Speed Sensor (see Speed Sensor Removal)
- Connect the speed sensor connector [A] with a battery [B], 10 kΩ resistor [C] and hand tester [D] as shown.
- Set the tester to the DC 25 V range.

**Special Tool - Hand Tester : 57001-1394**



- Trace [A] the speed sensor surface with the screw driver.
- Then the tester indicator should flick [B].
- ★ If the tester indicator does not flick, replace the speed sensor.



#### Front Brake Light Switch Inspection

- Refer to the Front Brake Light Switch Inspection in the Periodic Maintenance chapter.

#### Rear Brake Light Switch Check/Adjustment

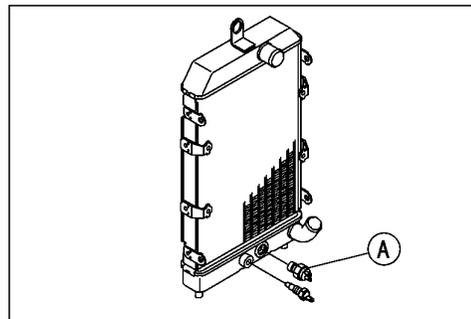
- Refer to the Rear Brake Light Switch Check/Adjustment in the Periodic Maintenance chapter.

#### Radiator Fan Switch Removal

##### CAUTION

**Never drop the fan switch, especially on a hard surface. Such a shock to the part can damage it.**

- Drain the coolant (see Cooling System chapter).
- Disconnect the fan switch leads.
- Unscrew the radiator fan switch [A] from the radiator.



#### Radiator Fan Switch Installation

- Tighten:  
**Torque - Radiator Fan Switch: 18 N·m (1.8 kgf·m, 13 ft·lb)**
- Fill the coolant and bleed the air from the cooling system (see Coolant Filling in the Cooling System chapter).

## Switch and Sensors

### Radiator Fan Switch Inspection

- Remove the fan switch from the radiator (see Radiator Fan Switch Removal).
- Suspend the switch [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend an accurate thermometer [B] with heat-sensitive portions [C] located in almost the same depth.

#### NOTE

- *The switch and thermometer must not touch the container sides or bottom.*
- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using the hand tester (special tool), measure the internal resistance of the switch across the terminals at the temperatures shown in the table.
- ★ If the measurement is out of the range, replace the switch.

#### Fan Switch Resistance

- **Rising temperature:**

From OFF to ON at 102 ~ 108°C (212 ~ 226°F)

- **Falling temperature:**

From ON to OFF at 97 ~ 103°C (203 ~ 217°F)

**ON:** Less than 0.5 Ω

**OFF:** More than 1 MΩ

### Water Temperature Switch Removal

#### CAUTION

The water temperature switch should never be allowed to fall on a hard surface. Such a shock to the part can damage it.

- Drain the coolant (see Cooling System chapter).
- Disconnect the switch connector.
- Remove the water temperature switch [A] from the radiator.

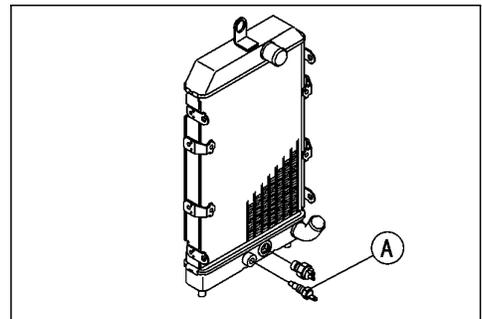
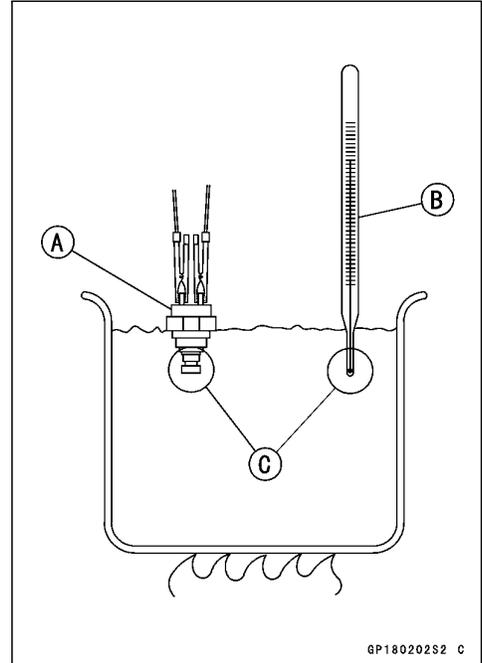
### Water Temperature Switch Installation

- Apply silicone sealant to the threads of the water temperature switch.

**Sealant - Kawasaki Bond: 59019-120**

**Torque - Water Temperature Switch: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

- Fill the engine with coolant and bleed the air from the cooling system (see Coolant Filling in the Cooling System chapter).



# 16-90 ELECTRICAL SYSTEM

## Switch and Sensors

### Water Temperature Switch Inspection

- Remove the water temperature switch.
- Suspend the switch [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend an accurate thermometer [B] with heat-sensitive portions [C] located in almost the same depth.

#### NOTE

- The switch and thermometer must not touch the container side or bottom.
- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using the hand tester, measure the internal resistance of the switch across the terminal and the body at the temperatures shown in the table.
- ★ If the measurement is out of the range, replace the switch.

#### Water Temperature Switch Resistance

##### ○ Rising temperature:

From OFF to ON at 113 ~ 117°C (235 ~ 243°F)

##### ○ Falling temperature:

From ON to OFF at 108°C (226°F) ~ temperature less than ON temperature

**ON: Less than 0.5 Ω**

**OFF: More than 1 MΩ**

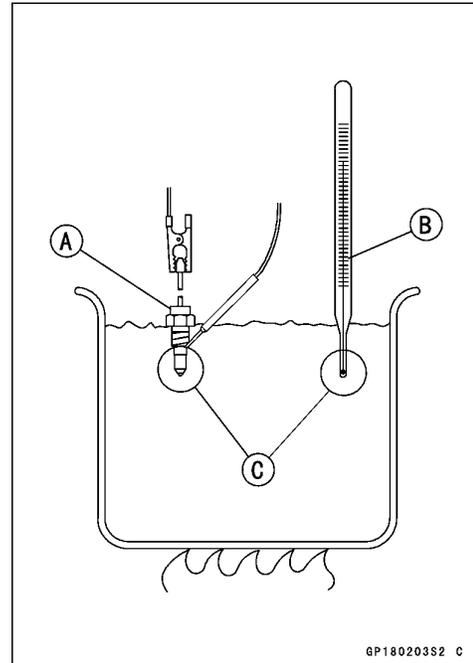
### Switch Inspection

- Using a hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).
- For the handlebar switches and the ignition switch, refer to the tables in the Wiring Diagram.
- ★ If the switch has an open or short, repair it or replace it with a new one.

**Special Tool - Hand Tester: 57001-1394**

#### Rear Brake Light Switch Connections

	BR	BL
When brake pedal is pushed down	○	○
When brake pedal is released		



**Switch and Sensors**

**Side Stand Switch Connections**

	G	BK
When side stand is up	○ ————— ○	
When side stand is down		

**Neutral Switch Connections**

	SW. Terminal	$\overline{\text{TTT}}$
When transmission is in neutral	○ ————— ○	
When transmission is not in neutral		

**Oil Pressure Switch Connections\***

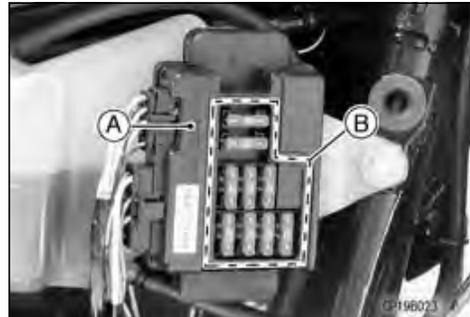
	SW. Terminal	$\overline{\text{TTT}}$
When engine is stopped	○ ————— ○	
When engine is running		

\*: Engine lubrication system is in good condition

## 16-92 ELECTRICAL SYSTEM

### Junction Box

The junction box [A] has fuses [B], relays, and diodes. The relays and diodes can not be removed.



#### *Junction Box Fuse Circuit Inspection*

- Remove the right side cover (see Frame chapter).
- Remove the junction box.
- Pull off the connectors from the junction box.
- Make sure all connector terminals are clean and tight, and none of them have been bent.
- ★ Clean the dirty terminals, and straighten slightly-bent terminals.
- Check conductivity of the numbered terminals with the hand tester (see Junction Box Internal Circuit).
- ★ If the tester does not read as specified, replace the junction box.

#### **Fuse Circuit Inspection**

Tester Connection	Tester Reading ( $\Omega$ )
1 – 1A	0
1 – 2	0
3A – 4	0
6 – 5	0
6 – 10	0
6 – 7	0
6 – 17	0

Tester Connection	Tester Reading ( $\Omega$ )
1A – 8	$\infty$
2 – 8	$\infty$
3A – 8	$\infty$
6 – 2	$\infty$
6 – 3A	$\infty$
17 – 3A	$\infty$

#### *Starter Circuit/Headlight Relay Inspection*

- Remove the junction box.
- Check conductivity of the following numbered terminals by connecting the hand tester and one 12 V battery to the junction box as shown (see Junction Box Internal Circuit).
- ★ If the tester does not read as specified, replace the junction box.

**Junction Box**

**Relay Circuit Inspection (with the battery disconnected)**

	Tester Connection	Tester Reading ( $\Omega$ )		Tester Connection	Tester Reading ( $\Omega$ )
Headlight Relay	7 - 8	$\infty$	Starter Circuit Relay	9 - 11	$\infty$
	7 - 13	$\infty$		12 - 13	$\infty$
	(+) (-) 13 - 9	Not $\infty^*$		(+) (-) 13 - 11	$\infty$
		(+) (-) 12 - 11		Not $\infty^*$	

(\*): The actual reading varies with the hand tester used.  
 (+): Apply tester positive lead.  
 (-): Apply tester negative lead.

**Relay Circuit Inspection (with the battery connected)**

Reading	Battery Connection		Tester Connection	Tester Reading ( $\Omega$ )
	(+)	(-)		
Headlight Relay	9	13	7 - 8	0
Starter Circuit Relay	11	12	(+) (-) 13 - 11	Not $\infty^*$

(\*): The actual reading varies with the hand tester used.  
 (+): Apply tester positive lead.  
 (-): Apply tester negative lead.

*Diode Circuit Inspection*

- Remove the junction box.
- Check conductivity of the following pairs of terminals (see Junction Box Internal Circuit).

**Diode Circuit Inspection**

Tester Connection	13 - 8, 13 - 9, 12 - 11, 12 - 14, 15 - 14, 16 - 14
-------------------	---

★ The resistance should be low in one direction and more than ten times as much in the other direction. If any diode shows low or high in both directions, the diode is defective and the junction box must be replaced.

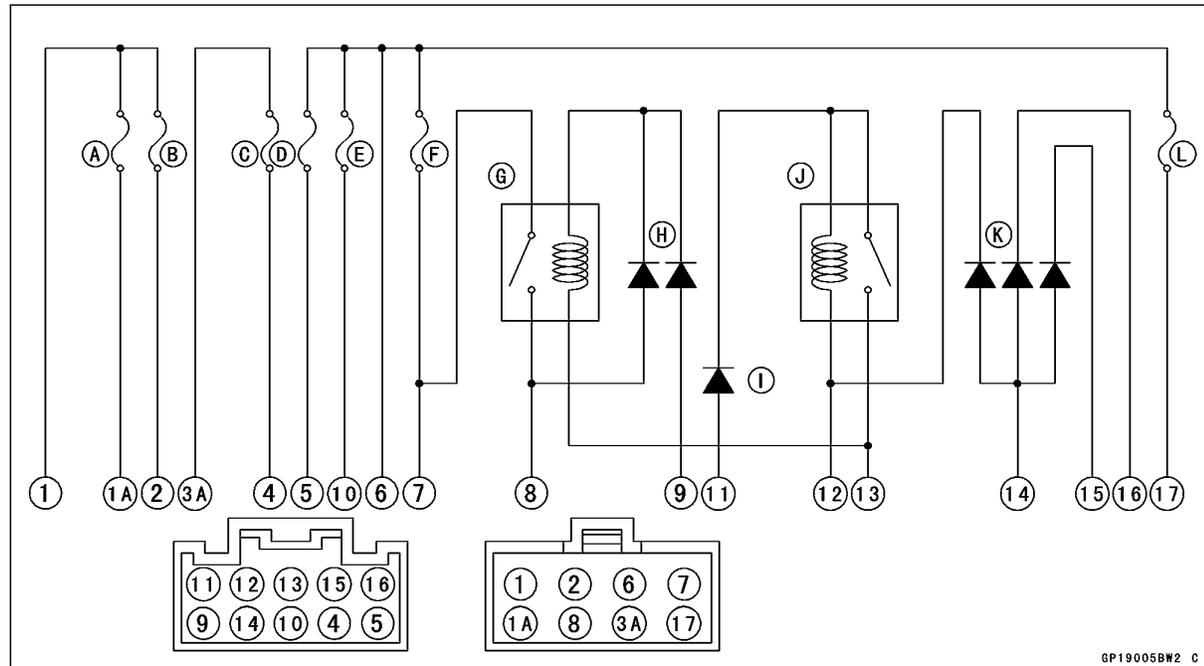
**NOTE**

○ The actual meter reading varies with the meter or tester used and the individual diodes, but generally speaking, the lower reading should be from zero to one half the scale.

# 16-94 ELECTRICAL SYSTEM

## Junction Box

### Junction Box Internal Circuit



- A. Accessory Fuse 10 A
- B. Fan Fuse 10 A  
Fan Fuse 15 A (After  
Frame No. 010353)
- C. Turn Signal Fuse 10 A

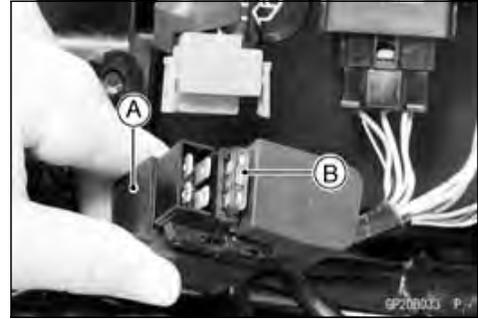
- D. Horn Fuse 10 A
- E. Ignition Fuse 10 A
- F. Headlight Fuse 10 A
- G. Headlight Relay
- H. Headlight Diodes

- I. Starter Diode
- J. Starter Circuit Relay
- K. Interlock Diodes
- L. Taillight Fuse 10 A

## Fuse

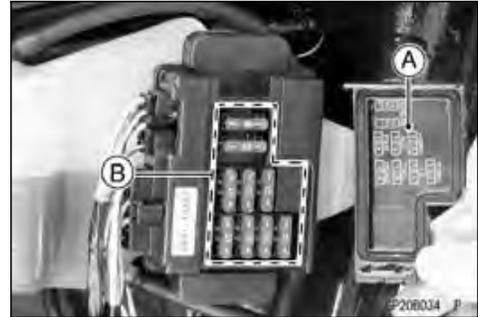
### Main Fuse Removal

- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.
- Remove the starter relay [A].
- Pull out the main fuse [B] from the starter relay with needle nose pliers.



### Junction Box Fuse Removal

- Remove the right side cover (see Frame chapter).
- Unlock the hook to lift up the lid [A].
- Pull the fuses [B] straight out of the junction box with needle nose pliers.



### Fuse Installation

- ★ If a fuse fails during operation, inspect the electrical system to determine the cause, and then replace it with a new fuse of proper amperage.
- Install the junction box fuses on the original position as specified on the lid.

### Fuse Inspection

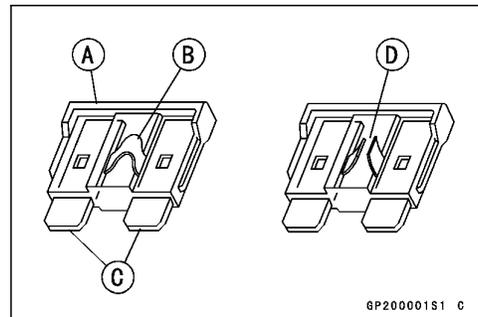
- Remove the fuse (see Fuse Removal).
- Inspect the fuse element.
- ★ If it is down out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.

Housing [A]

Fuse Element [B]

Terminals [C]

Blown Element [D]



### NOTE

- A mass current flows to the battery according to the state of the battery which needs refreshing charge when the engine is turned causing main fuse blown out.

### CAUTION

**Do not use a fuse rated for other amperage and voltage specified in the wiring diagram. Installation of a fuse with a higher rating may cause damage to wiring and components, and a fuse of a lower rating will soon blow again.**



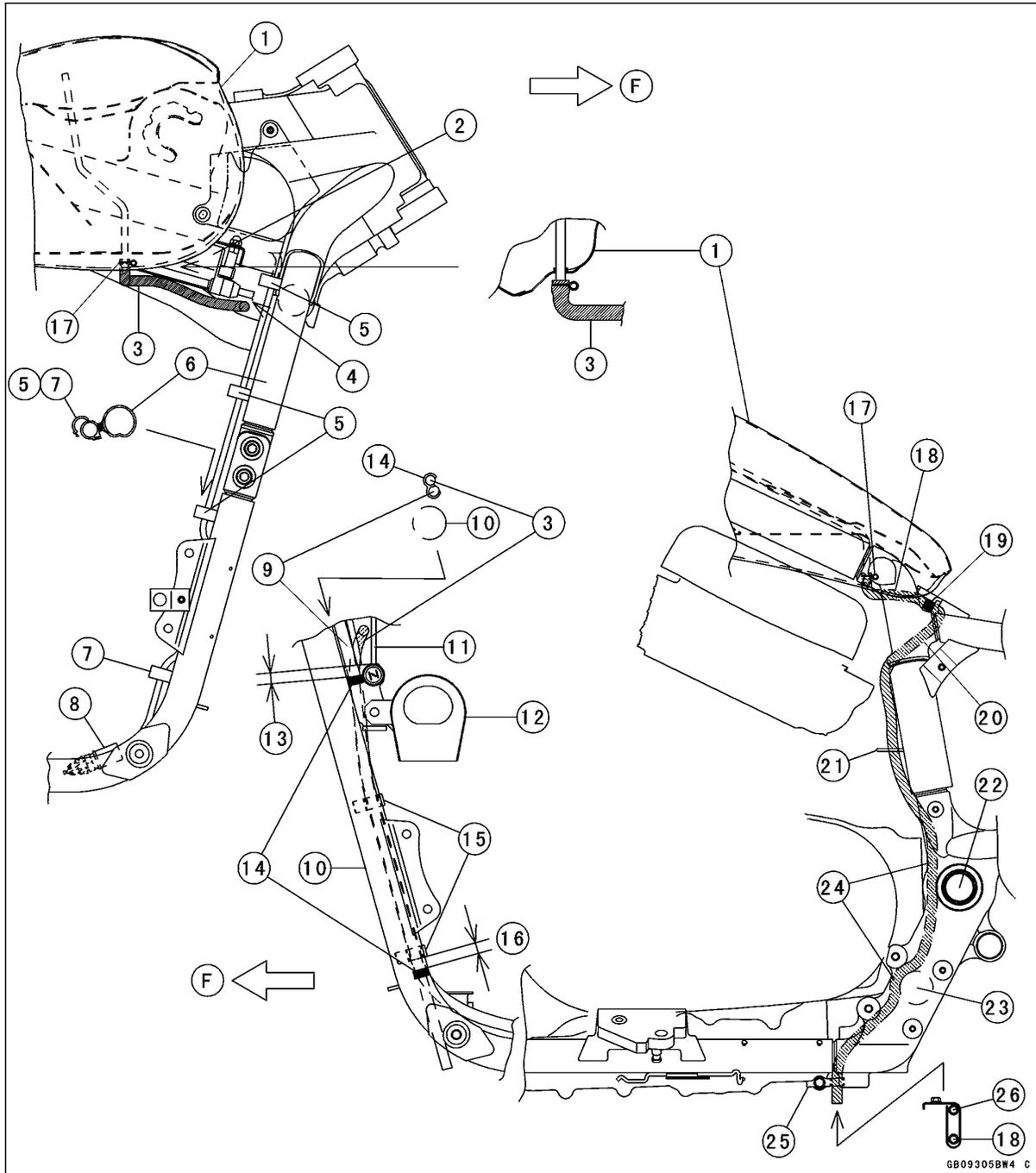
# Appendix

## Table of Contents

Cable, Wire, and Hose Routing .....	17-2
Troubleshooting Guide (except DFI) .....	17-28

# 17-2 APPENDIX

## Cable, Wire, and Hose Routing



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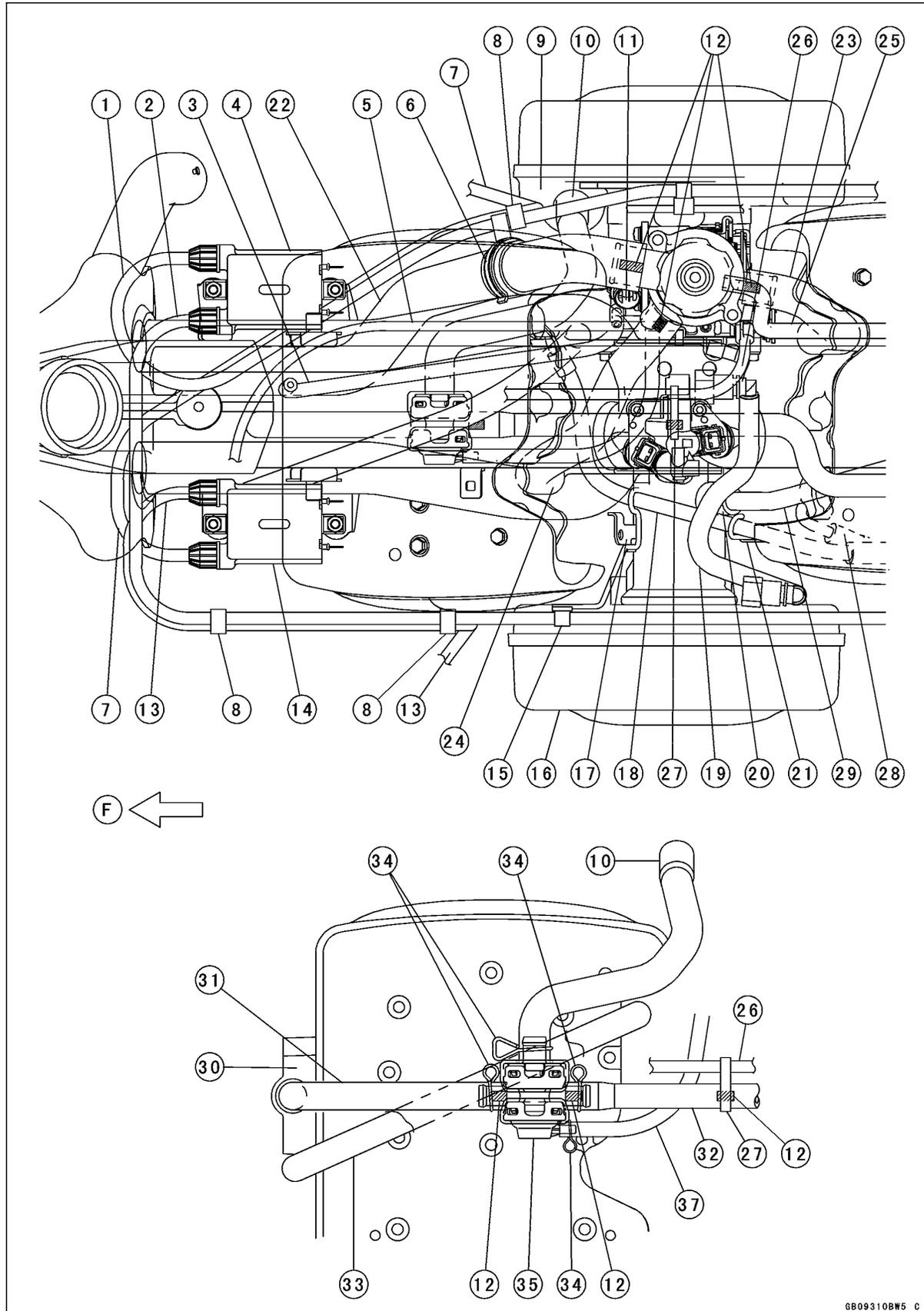
**Cable, Wire, and Hose Routing**

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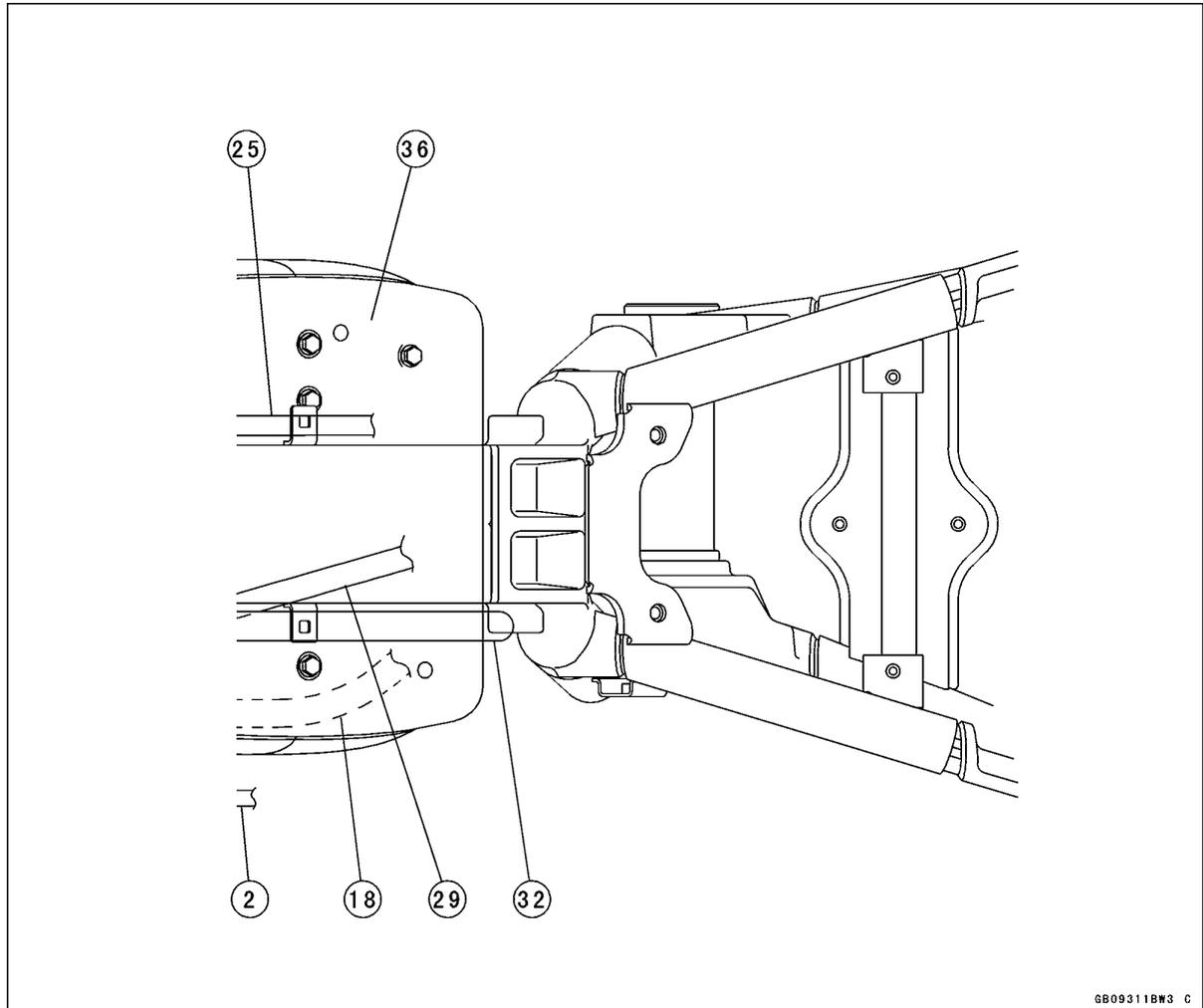
- F: Front
- 1. Fuel Tank
- 2. Ignition Coil for Rear Spark Plugs
- 3. Fuel Tank Water Drain Hose
- 4. Run the hose over the cooling hose.
- 5. Plastic Snap-on Clamps (rear brake light switch and radiator fan leads)
- 6. Right Frame Pipe
- 7. Plastic Snap-on Clamp (rear brake light switch lead)
- 8. Rear Brake Light Switch
- 9. Clutch Hose
- 10. Left Frame Pipe
- 11. Choke Knob and Cable
- 12. Horn
- 13. -10 ~ +10 mm (-0.4 ~ +0.4 in.)
- 14. Two Way Holders on the black type of hoses [3]
- 15. Welded Clamps
- 16. 10 ~ 30 mm (0.4 ~ 1.2 in.)
- 17. Clips
- 18. Fuel Tank Breather Hose (except California)
- 19. Marking (Position here.)
- 20. Run the hose [18] between the bracket and the right frame pipe.
- 21. Holder
- 22. Swingarm Pivot
- 23. Cross Pipe
- 24. Run the hose in front of [22] and [23].
- 25. Clamp
- 26. Coolant Reserve Tank Overflow Hose

# 17-4 APPENDIX

## Cable, Wire, and Hose Routing



## Cable, Wire, and Hose Routing

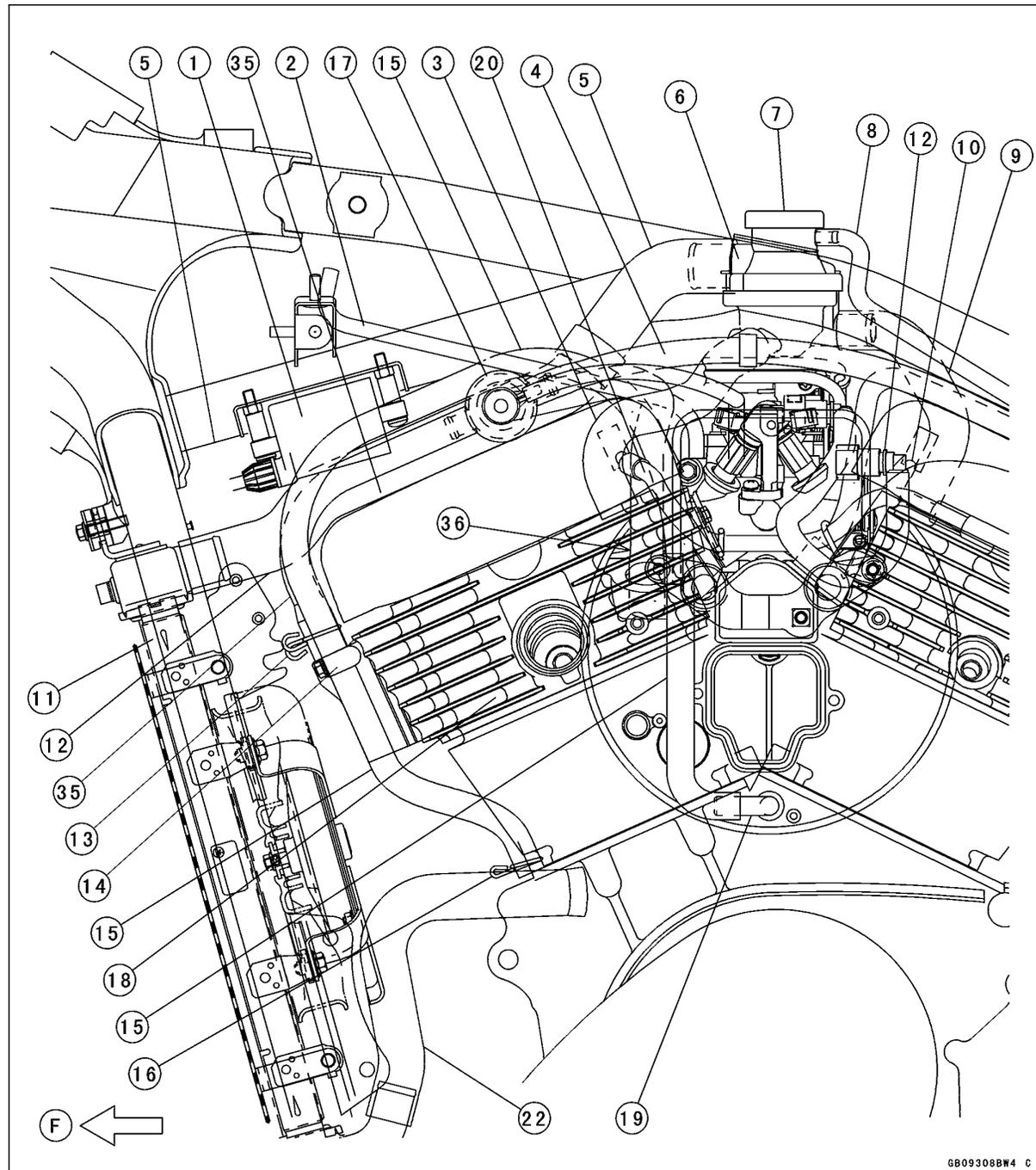


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- F: Front
- |  |  |  |
|--|--|--|
| 1. Right Rear Spark Plug Lead                | 14. Ignition Coil for Front Spark Plugs                      | 27. Plastic Clamp: Align the clamp with the mark [12]. |
| 2. Left Rear Spark Plug Lead                 | 15. Plastic Clamp  | 28. Rear Oil Hose into the cover [36]                  |
| 3. Inlet Air Pressure Hose                   | 16. Left Air Cleaner Housing                                 | 29. Canister Purge Hose (green) for California         |
| 4. Ignition Coil for Rear Spark Plugs        | 17. Clamp  | 30. Air Suction Valve                                  |
| 5. Choke Cable                               | 18. Front Oil Hose   | 31. Front Vacuum Switch Valve Hose                     |
| 6. Clamp                                     | 19. Fuel Pump Outlet Hose                                    | 32. Rear Vacuum Switch Valve Hose                      |
| 7. To Right Front Spark Plug                 | 20. Grommet  | 33. Crankcase Breather Hose over the valve [35]        |
| 8. Plastic Clamps                            | 21. Clamp  | 34. Wire Clamps: Face the tab as shown.                |
| 9. Right Air Cleaner Base                    | 22. Radiator Inlet Hose                                      | 35. Vacuum Switch Valve                                |
| 10. Vacuum Switch Valve Hose to the base [9] | 23. Rear Coolant Hose (mark [12])                            | 36. Rear Rocker Case Cover                             |
| 11. Throttle Sensor                          | 24. Front Coolant Hose (mark [12])                           | 37. Vacuum Hose to throttle body                       |
| 12. White Marks faced upwards                | 25. Reserve Tank Hose (without mark)                         |  |
| 13. Left Front Spark Plug Lead               | 26. Throttle Cables (upper: decelerator, lower: accelerator) |  |

## 17-6 APPENDIX

### Cable, Wire, and Hose Routing



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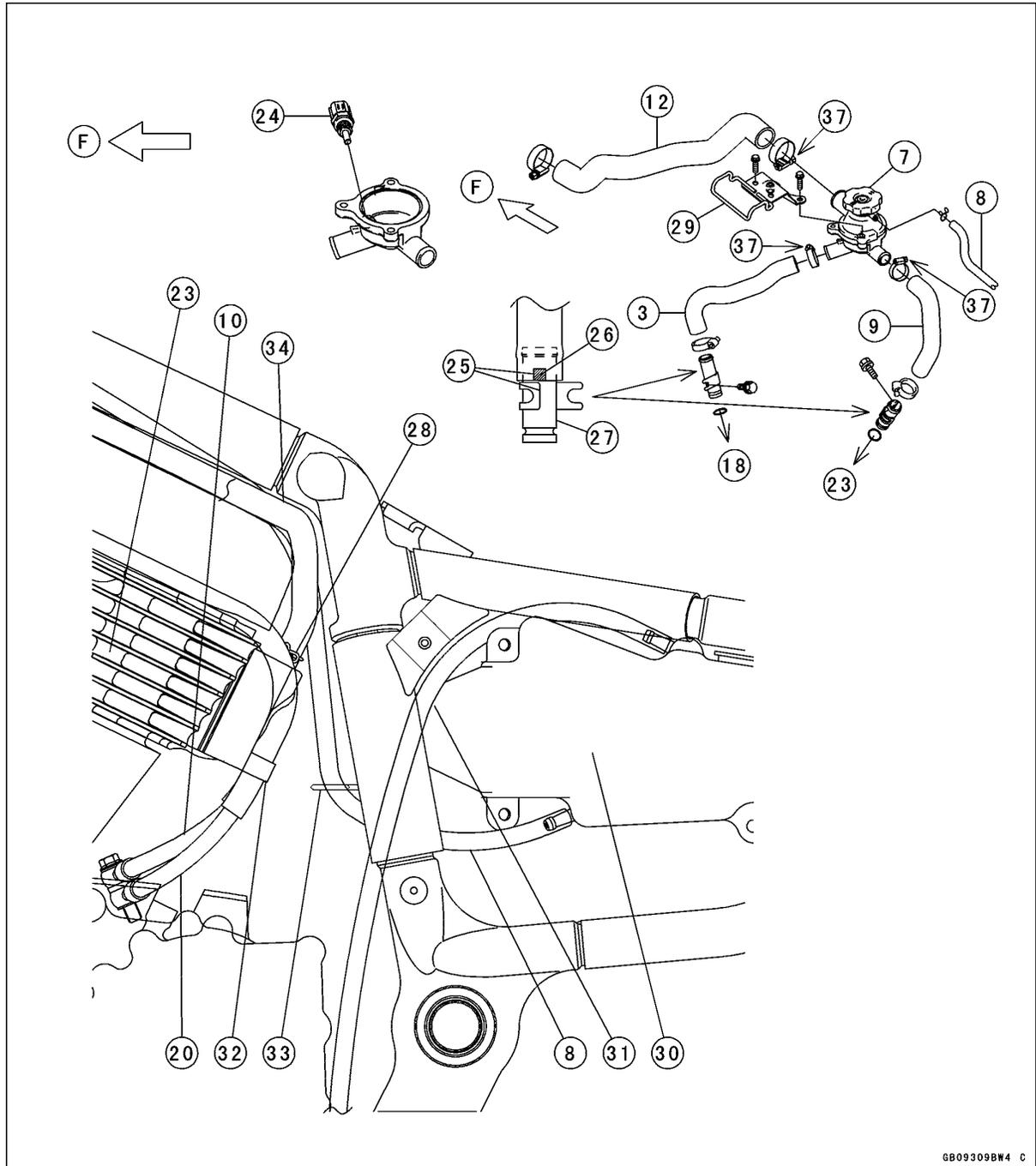
F: Front

1. Ignition Coil for Front Spark Plugs
2. Inlet Air Pressure Sensor Hose
3. Front Coolant Hose
4. Vacuum Switch Valve Hose (vacuum)
5. Radiator Inlet Hose (middle)
6. Thermostat Housing
7. Radiator Cap
8. Coolant Reserve Tank Hose
9. Rear Coolant Hose

10. Rear Oil Hose

11. Radiator
12. Fuel Pump Outlet Hose
13. Wire Clamp
14. Clamp
15. Crankcase Breather Hose
16. Wire Clamp
17. Vacuum Switch Valve
18. Front Cylinder Head
19. Elbow Joint

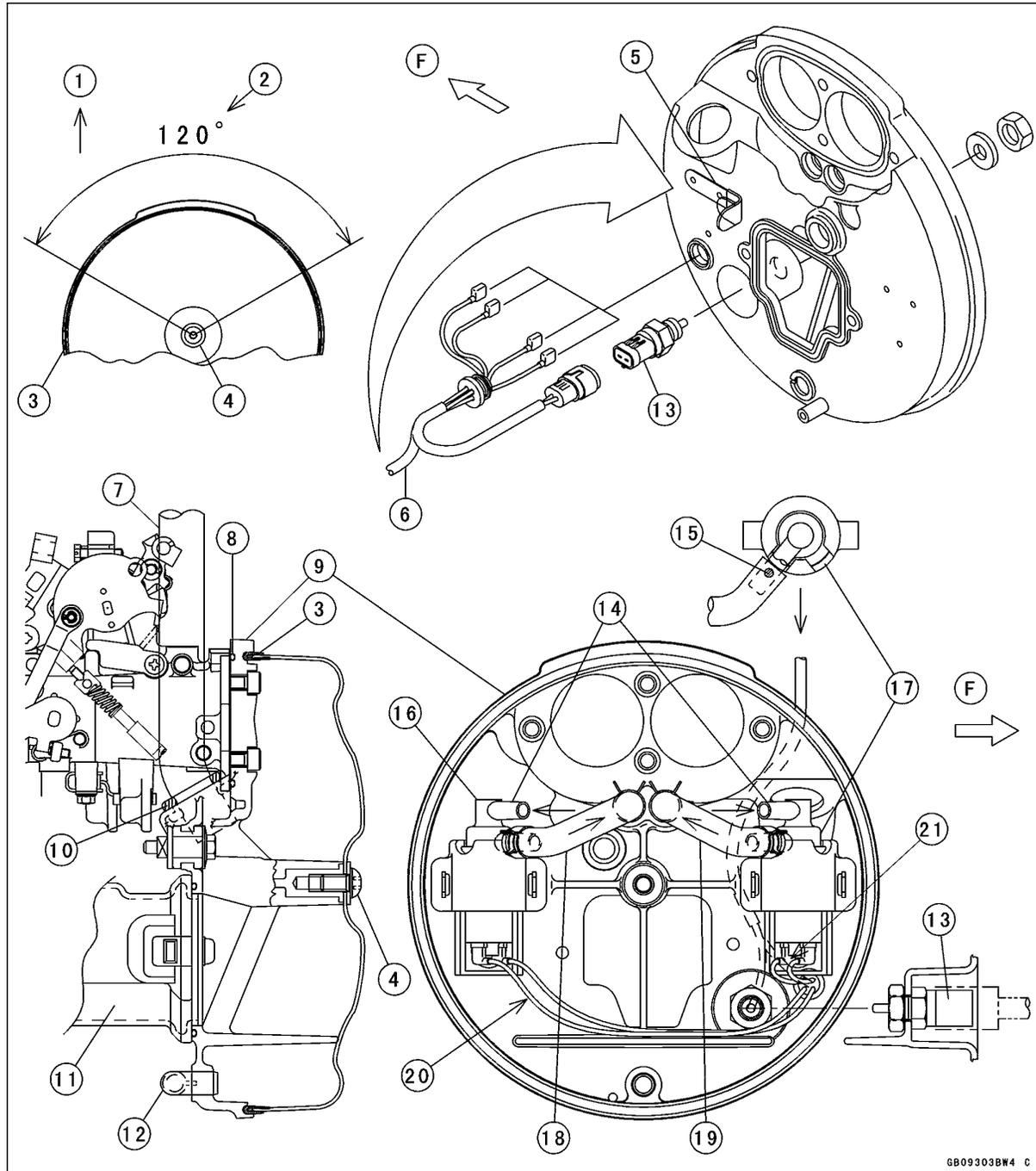
Cable, Wire, and Hose Routing



- |   |  |
|---|--|
| F: Front                                    | 30. Coolant Reserve Tank                                 |
| 20. Front Oil Hose                          | 31. Coolant Reserve Tank Overflow Hose                   |
| 21. Right Air Cleaner Base                  | 32. Clamp  |
| 22. Radiator Outlet Hose (right)            | 33. Holder   |
| 23. Rear Cylinder Head                      | 34. Rear Vacuum Switch Valve Hose                        |
| 24. Water Temperature Sensor (DFI)          | 35. Front Vacuum Switch Valve Hose                       |
| 25. Align the mark [26] with the clamp end. | 36. Vacuum Switch Valve Hose to the base [21]            |
| 26. White Marks on the hoses [3] and [9]    | 37. Note each position and direction of the clamp bolts. |
| 27. Water Pipes                             |  |
| 28. Wire Clamp with the tab on the left     |  |
| 29. Main Harness Bracket                    |  |

# 17-8 APPENDIX

## Cable, Wire, and Hose Routing



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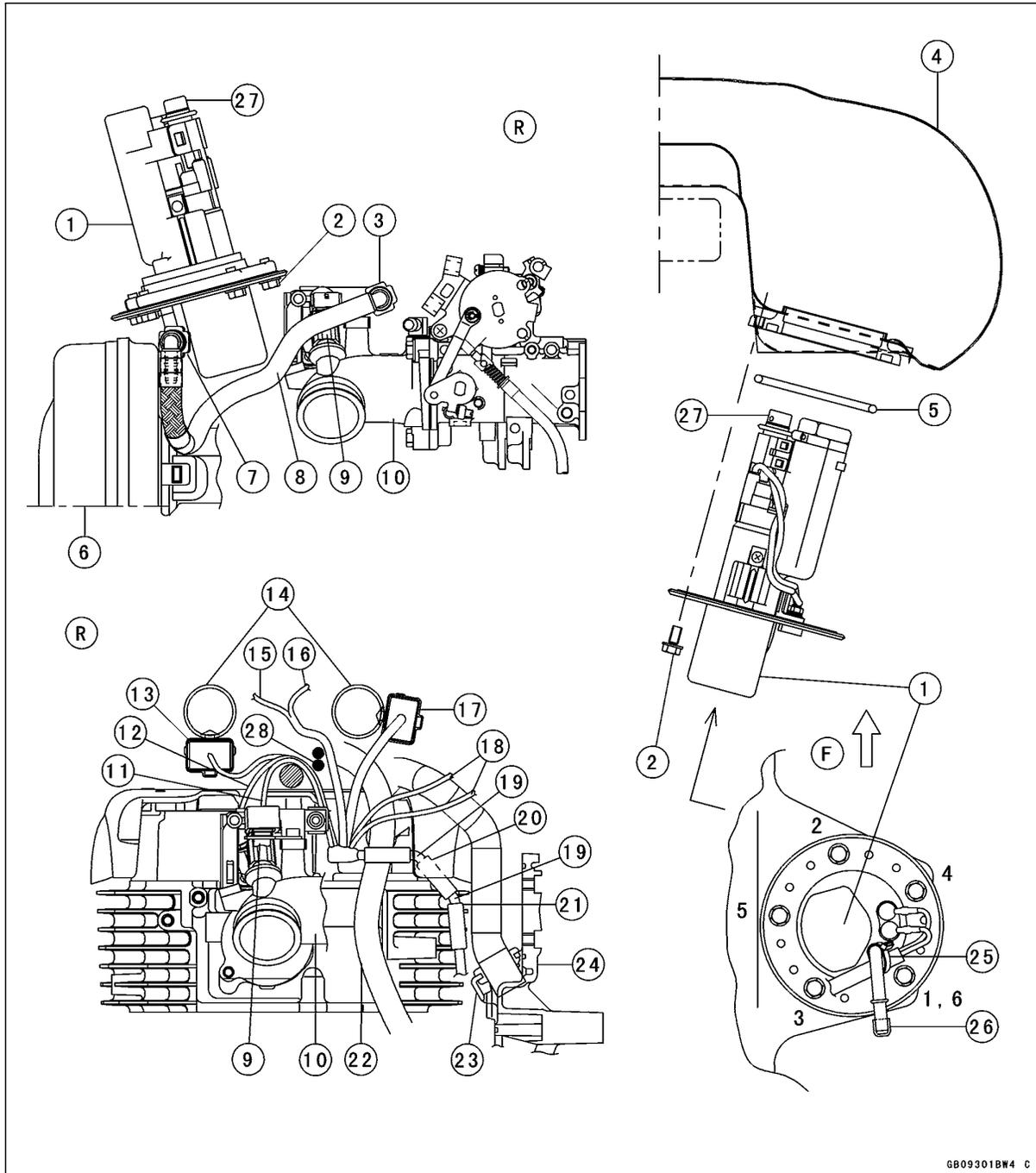
**Cable, Wire, and Hose Routing**

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- F: Front
- ←: Air Flow
- 1. Top
- 2. Locate the glued joint of the gasket [3] within the angle.
- 3. Gasket
- 4. Right Air Cleaner Cover Allen Bolt
- 5. Clamp (lead [6])
- 6. Inlet Air Temperature Sensor and ISC Valve Leads
- 7. Vacuum Switch Valve Hose
- 8. O-Ring
- 9. Right Air Cleaner Base
- 10. Grommet
- 11. Lower Air Cleaner Duct between #1 and #2 Cylinders
- 12. Elbow Joint connected to crankcase breather hose
- 13. Inlet Air Temperature Sensor
- 14. ISC Valve Inlets
- 15. Blue Mark on Top
- 16. ISC Valve #2 (rear cylinder)
- 17. ISC Valve #1 (front cylinder)
- 18. ISC Valve Hose #2 (red mark)
- 19. ISC Valve Hose #1 (blue mark)
- 20. ISC Valve #2 G/Y, W/R Leads
- 21. ISC Valve #1 G/BL, W/R Leads

# 17-10 APPENDIX

## Cable, Wire, and Hose Routing



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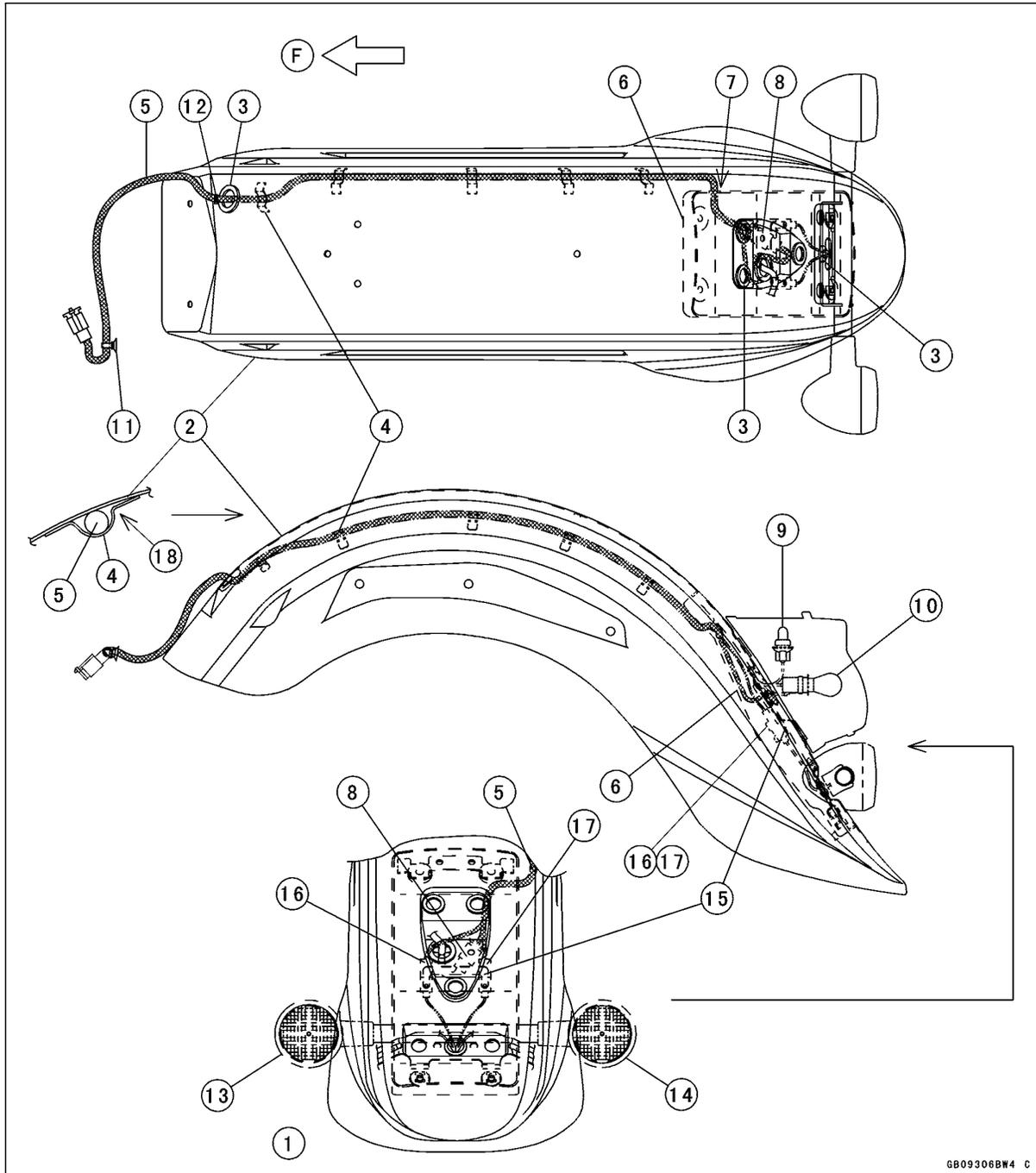
**Cable, Wire, and Hose Routing**

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- F: Front R: Rear View
1. Fuel Pump with the fuel filter and screen belt in
  2. Fuel Pump Bolts
  3. Fuel Hose Joint (delivery joint)
  4. Fuel Tank
  5. O-ring
  6. Left Air Cleaner Cover
  7. Fuel Hose Joint (fuel pump)
  8. Fuel Pump Outlet Hose
  9. Fuel Injector #2
  10. Inlet Manifold
  11. Injector Lead #2
  12. Injector Lead #1 (white tape)
  13. Connector (black)
  14. Frame Pipes
  15. Atmospheric Pressure Sensor Lead
  16. Inlet Air Pressure Sensor Lead (white tape)
  17. Connector (natural)
  18. Water Temperature Sensor Lead
  19. Bend before install.
  20. Run the lead [21] inside the rocker case cover.
  21. ISC Valve Lead, Inlet Air Temperature Sensor Leads
  22. Vacuum Switch Valve Hoes
  23. Grommet
  24. Right Air Cleaner Base
  25. Strap
  26. Fuel Pump Outlet Pipe
  27. Pressure Regulator
  28. Throttle Cables

# 17-12 APPENDIX

## Cable, Wire, and Hose Routing



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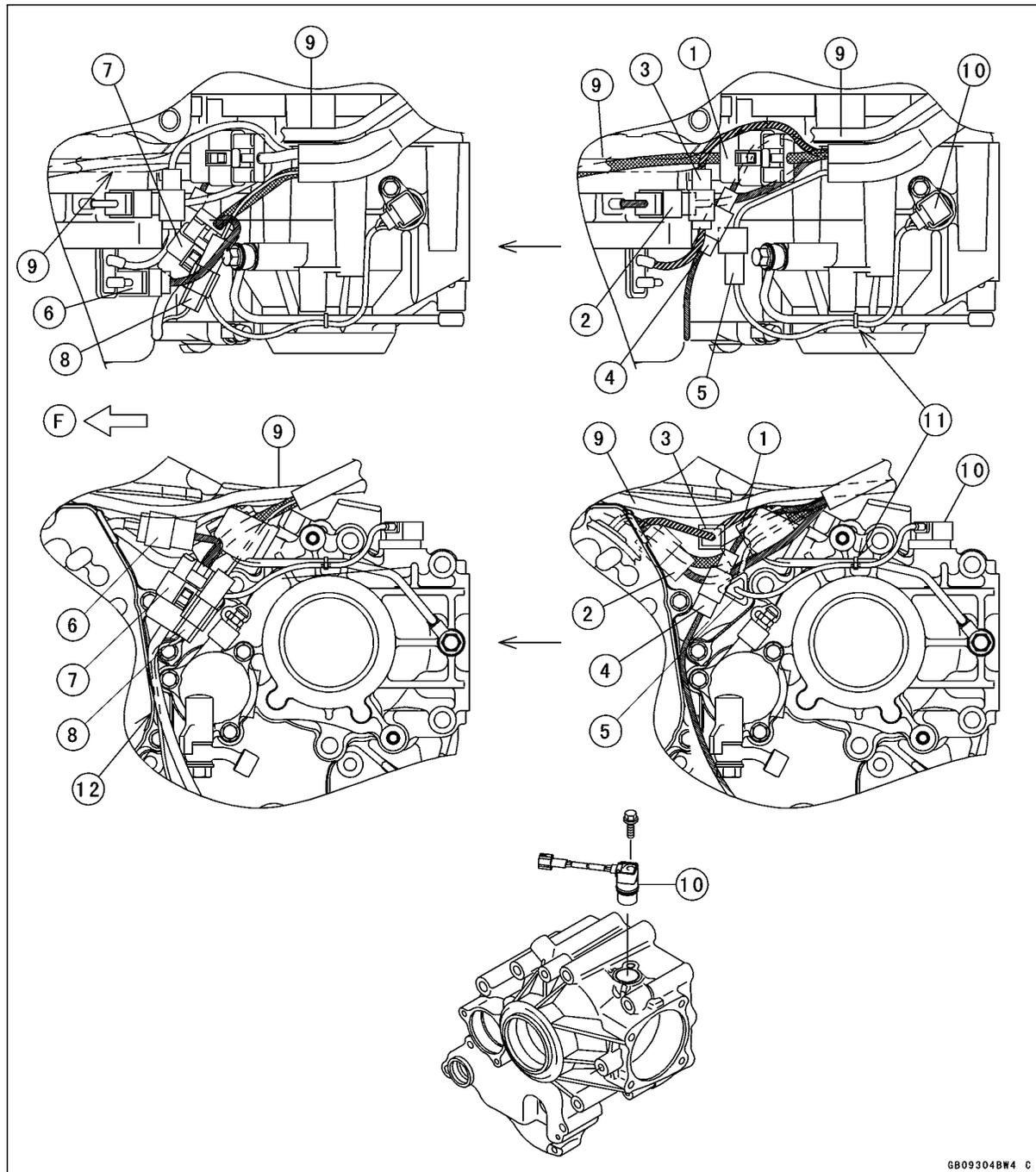
**Cable, Wire, and Hose Routing**

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- F: Front
- 1. Rear View
- 2. Rear Fender
- 3. Grommets
- 4. Five Clamps
- 5. Rear Fender Harness
- 6. Plastic Cover
- 7. Run the harness [5] into the cut of plastic cover [6]
- 8. Connector for [9] and [10]
- 9. License Plate Light
- 10. Tail/Brake Light
- 11. Snap-on Strap
- 12. White Mark of [5] (position here.)
- 13. Rear Left Turn Signal Light
- 14. Rear Right Turn Signal Light
- 15. Bracket
- 16. Connector of [13] (the female plug is fitted into [15].)
- 17. Connector of [14] (the female plug is fitted into [15].)
- 18. Press by hands: Clamp the harness [5] with these clamps [4] and press each end of clamps by hands against the rear fender.

## 17-14 APPENDIX

### Cable, Wire, and Hose Routing



F: Front

○ Connect the following connectors in the order numbered and locate them as shown.

1. Front Regulator/Rectifier Connector
2. Inside Alternator Connector
3. Crankshaft Sensor Connector
4. Oil Pressure Switch/Neutral Switch Connector
5. Speed Sensor Connector
6. 10. Outside Alternator Connector

7. 1. Rear Regulator/Rectifier Connector

8. Sidestand Switch Connector

9. Starter Motor Lead

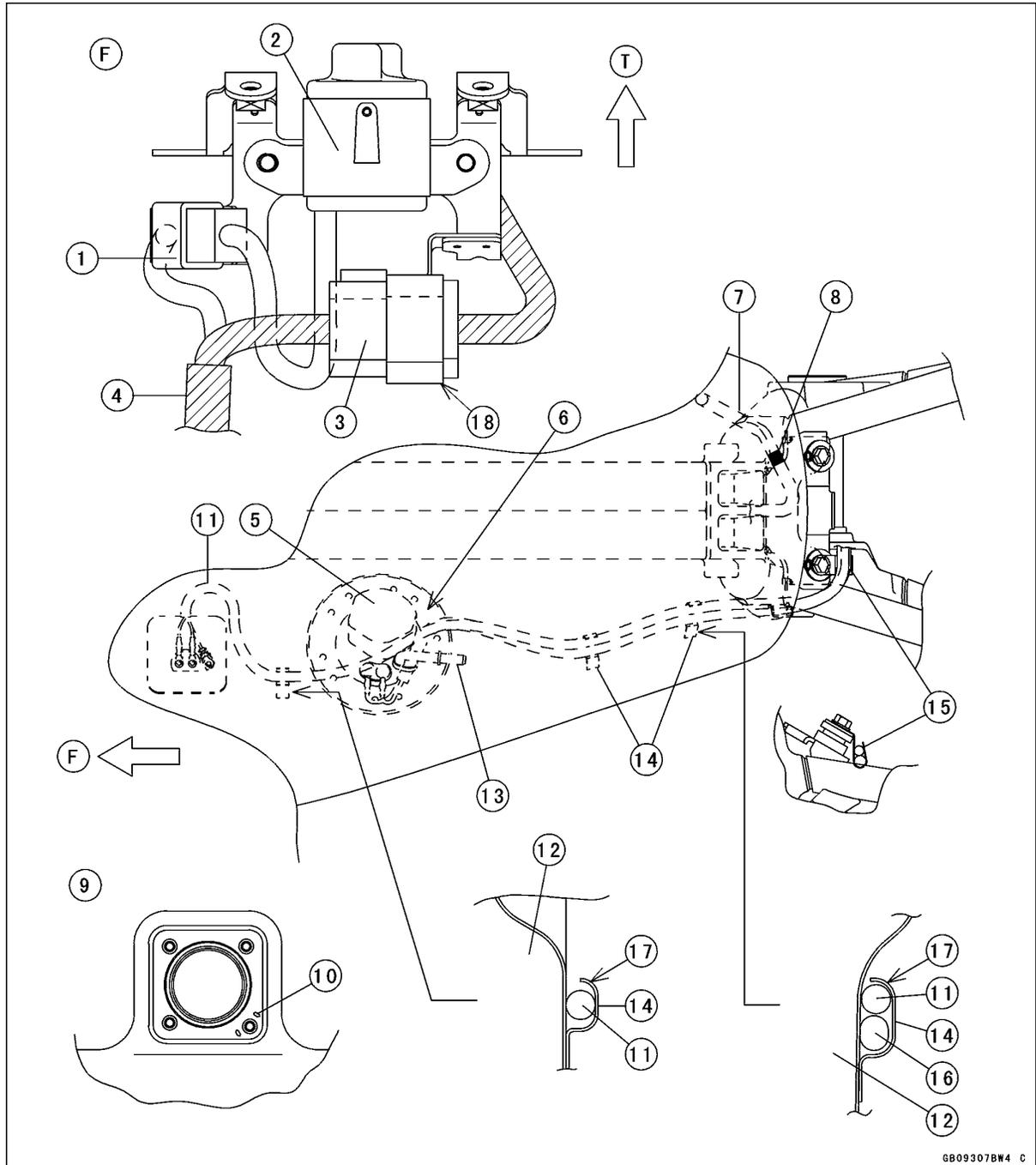
10. Speed Sensor

11. Strap (speed sensor lead)

12. Insert the oil pressure/neutral switch leads, sidestand switch leads, and regulator/rectifier leads in this order between the alternator cover and the clutch slave cylinder.

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Cable, Wire, and Hose Routing



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F: Front T: Top

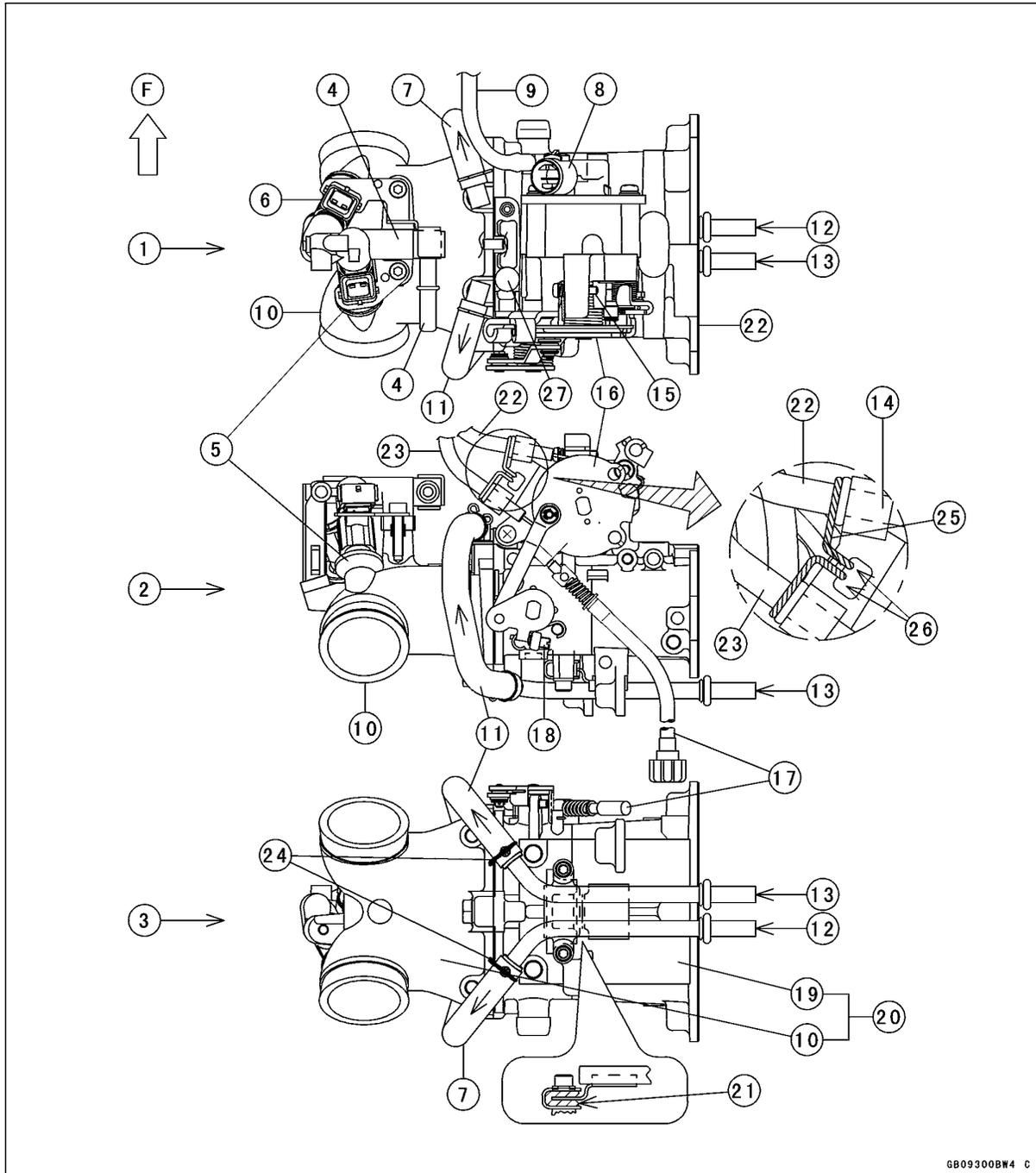
- 1. Ignition Switch Connector: Push the lock to disconnect. Join the connector and fit it into the slit of the bracket.
- 2. Ignition Switch
- 3. Speedometer/Fuel Level Sensor Connector
- 4. Main Harness

- 5. Fuel Pump
- 6. Run the hose [16] between the pump [5] and the pipe [3].
- 7. Fuel Tank Breather Hose (except California)
- 8. Mark (Position here.)
- 9. Fuel Tank Bottom View
- 10. Two Recesses (Position here.)

- 11. Fuel Level Sensor Lead
- 12. Inside of Fuel Tank
- 13. Fuel Pump Outlet Pipe
- 14. Clamps
- 15. Clamp
- 16. Fuel Pump Lead
- 17. Press the clamps
- 18. Raise the lock to disconnect.

# 17-16 APPENDIX

## Cable, Wire, and Hose Routing



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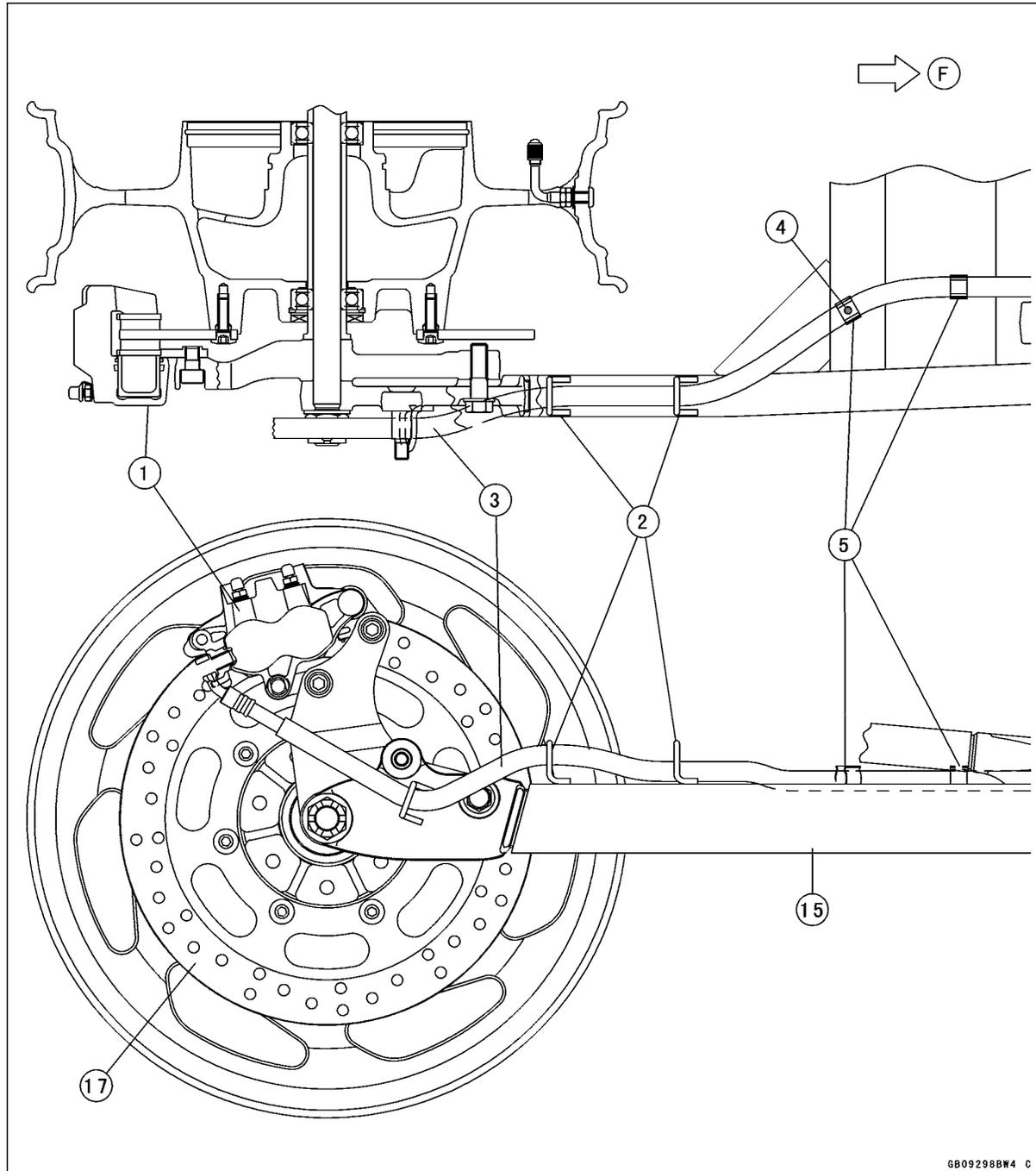
**Cable, Wire, and Hose Routing**

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- F: Front
- ←→: Vacuum Pulsation
- : Bypass Air Flow
- #1: For Front Cylinder
- #2: For Rear Cylinder
- 1. Top View
- 2. Rear View
- 3. Bottom View
- 4. Delivery Joint
- 5. Fuel Injector #2
- 6. Fuel Injector #1
- 7. ISC Hose #1 (blue mark)
- 8. Throttle Sensor
- 9. Vacuum Hose to Inlet Air Pressure Sensor
- 10. Inlet Manifold
- 11. ISC Hose #2 (red mark)
- 12. ISC Pipe #1
- 13. ISC Pipe #2
- 14. Throttle Cable Holder
- 15. Choke Lever Stop Screw
- 16. Throttle Pulley
- 17. Idle Adjusting Screw
- 18. Throttle Stop Screw
- 19. Throttle Body
- 20. Throttle Body Assy
- 21. ISC Pipe Damper
- 22. Decelerator Cable
- 23. Accelerator Cable
- 24. Position the white marks here.
- 25. Cable Clip
- 26. Stake the cable clip [25] on the holder [14].
- 27. Rubble Plug (except California)

## 17-18 APPENDIX

### Cable, Wire, and Hose Routing



F: Front

1. Rear Brake Caliper

2. Hose Holders

3. Rear Brake Hose

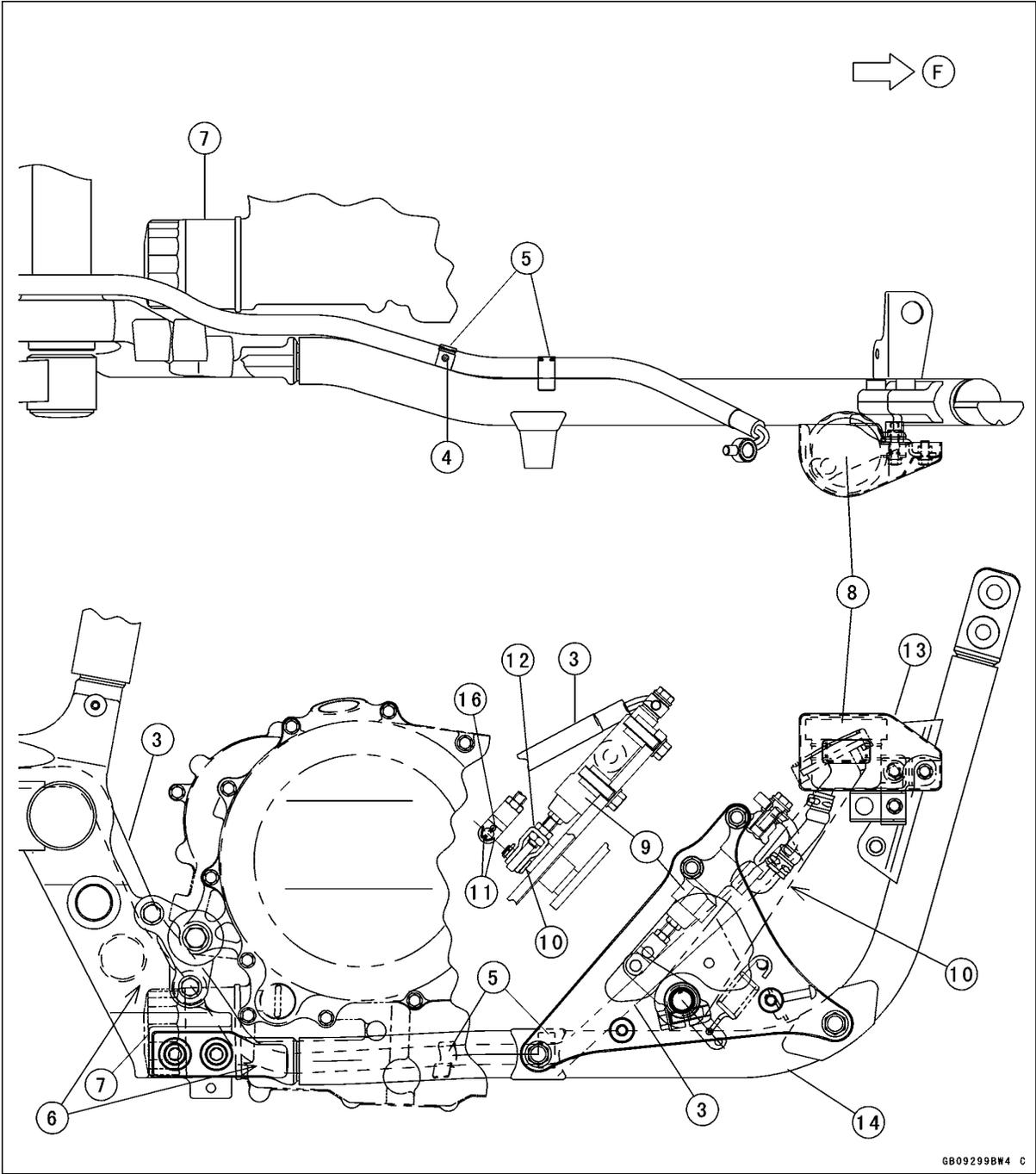
4. Hose White Marks (Position here.)

5. Hose Clamps

6. Run the brake hose between the engine mounting bracket bosses and the oil filter, and then along the downtube towards the front.

7. Oil Filter

Cable, Wire, and Hose Routing

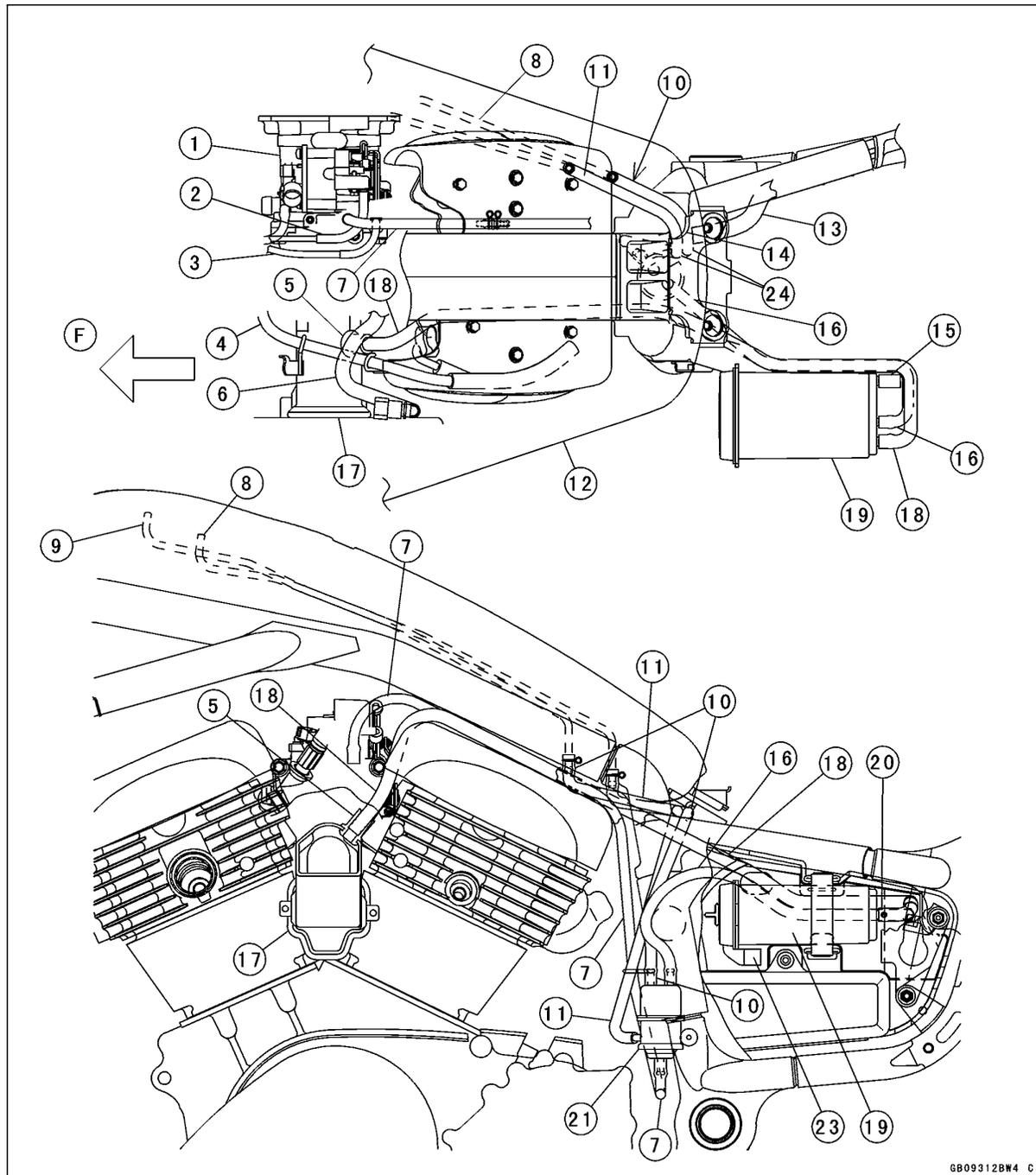


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- 8. Rear Brake Reservoir
- 9. Rear Master Cylinder
- 10. Brake Pedal
- 11. Bend both ends of the cotter pin [16] as shown.
- 12. Clevis
- 13. Rear Brake Reservoir Cover
- 14. Downtube
- 15. Swingarm
- 16. Cotter Pin
- 17. Rear Brake Disc

# 17-20 APPENDIX

## Cable, Wire, and Hose Routing



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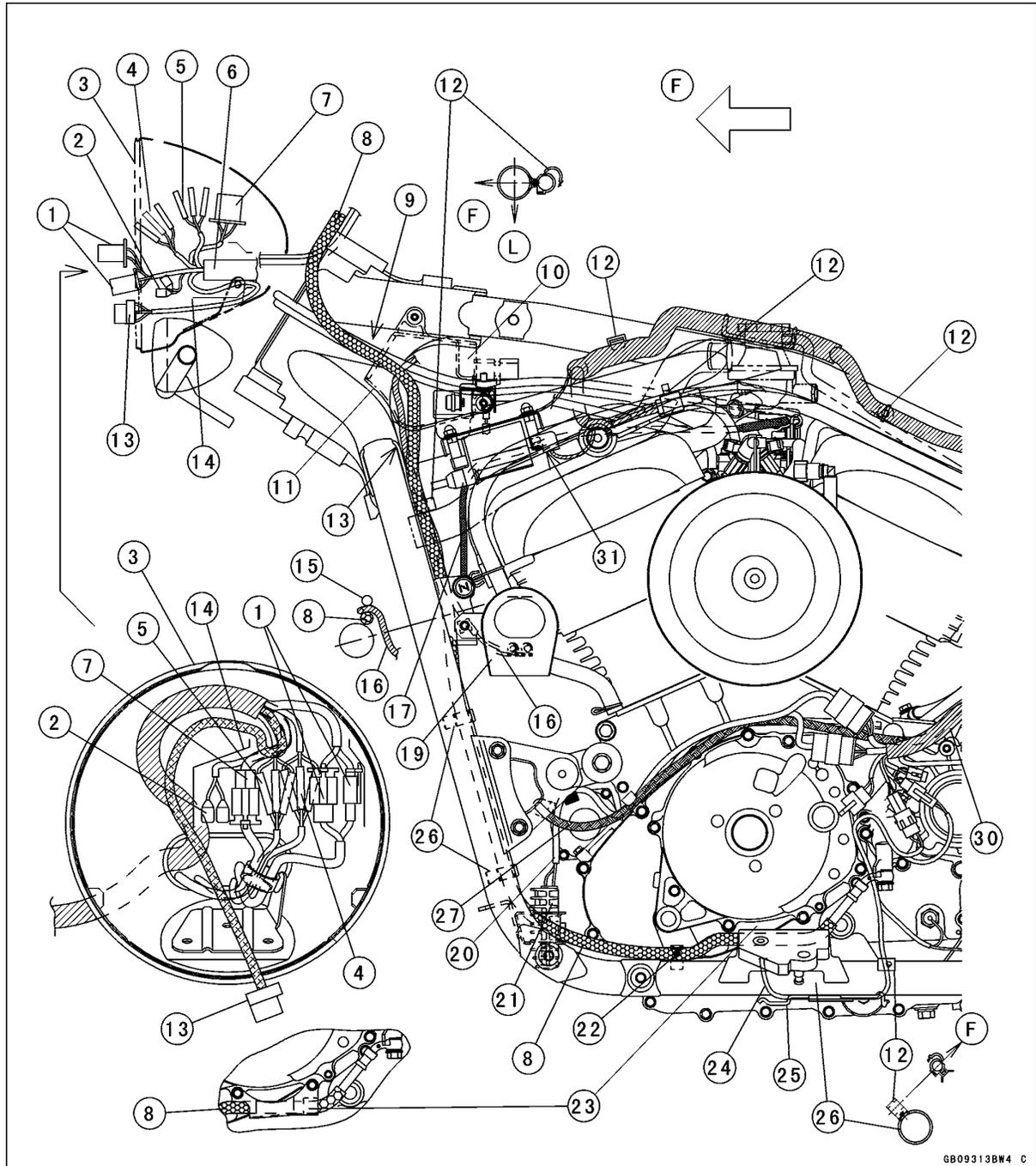
F: Front

- 1. Throttle Body Assy
- 2. Decelerator Cable
- 3. Accelerator Cable
- 4. Front Oil Hose
- 5. Grommet
- 6. Fuel Pump Outlet Hose
- 7. Separator Vacuum Hose (white)
- 8. Fuel Tank Breather Pipe
- 9. Filler Drainpipe

- 10. Fuel Tank Breather Hose (blue, rear)
- 11. Fuel Tank Return Hose (red, front)
- 12. Fuel Tank
- 13. Main Harness
- 14. Run the hoses through the hole.
- 15. Plug
- 16. Separator Breather Hose (blue)

- 17. Lower Air Cleaner Duct
- 18. Canister Purge Hose (green)
- 19. Canister
- 20. Face the white mark left.
- 21. Separator
- 22. Rear Oil Hose
- 23. Separator Inlet
- 24. Run these hoses on the left of the harness [13].

## Cable, Wire, and Hose Routing



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F: Front L: Left

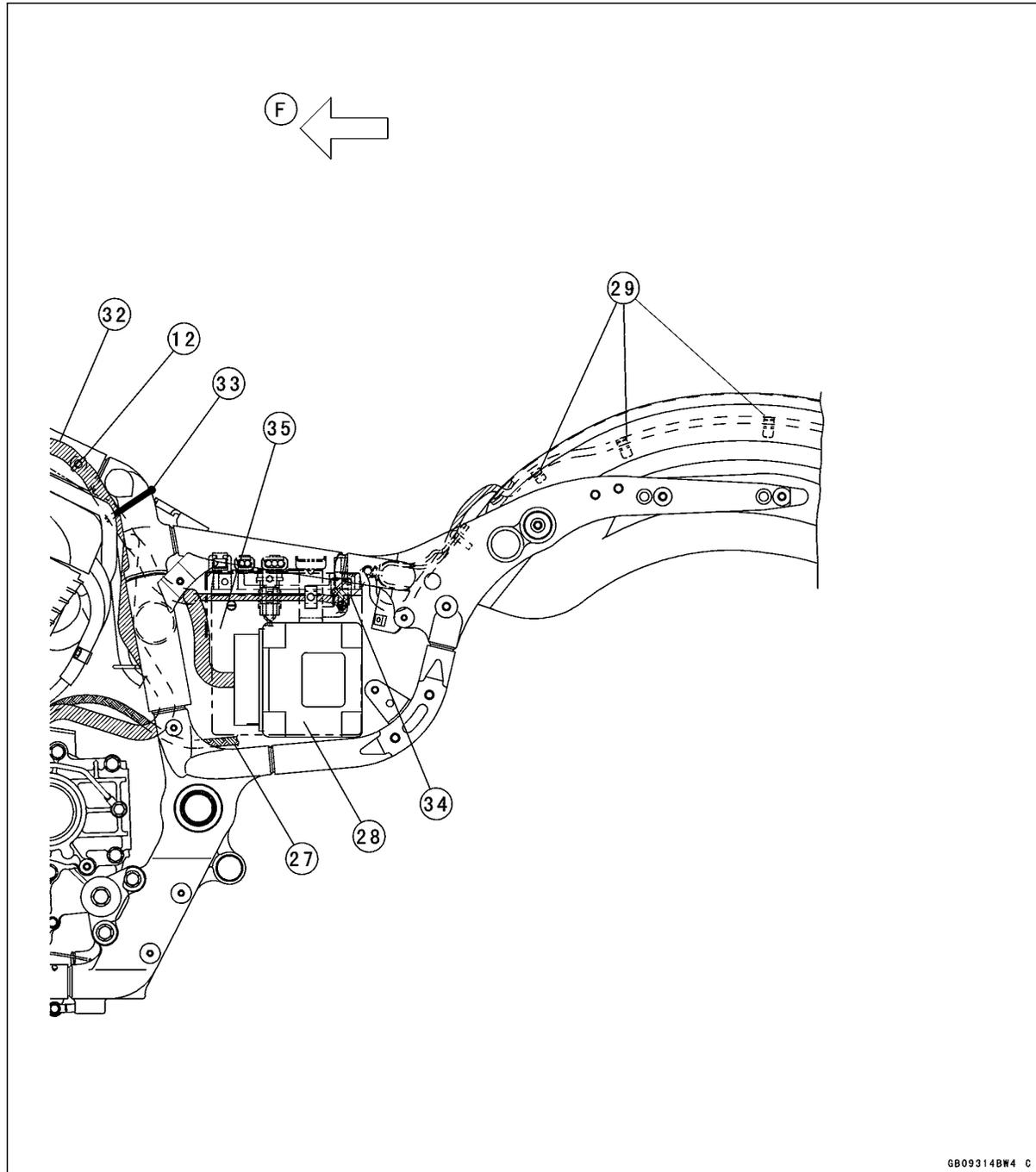
1. Left Handlebar Switch Connectors
2. Accessory Lead Connectors
3. Headlight Body
4. Front Turn Signal Light Lead Connectors (left)
5. Front Turn Signal Light Lead Connectors (right)
6. Main Harness
7. Right Handlebar Switch Connectors

8. Clutch Hose
9. Run the throttle cables inside the clutch hose [8].
10. Run the throttle cables inside the cover [11].
11. Head Pipe Cover
12. Plastic Snap-on Clamps: Fit them into the frame pipe.
13. Put the clutch hose [8] into the hole of the cover [1].
14. Water Baffle Plats

15. Fuel Tank Water Drain Hose
16. Horn Leads
17. Choke Cable
19. Horn
20. Starter Motor
21. Front Regulator/Rectifier
22. White Mark (Position it here.)
23. Clutch Hose Clamp on alternator cover (with white mark [22] outside)

## 17-22 APPENDIX

### Cable, Wire, and Hose Routing



F: Front

24. Sidestand Switch Leads:  
Run the leads through the front and rear hooks and hold them with the clamp [11] a bit tight behind the sidestand bracket.

25. Welded Clamp

26. Left Frame Pipe

27. Electric Starter Lead

28. ECU: Fit it into the battery case behind the case rib on the bottom.

29. Five Clamps

30. Install the alternator outer cover and make sure the sheath of the harness is inside the cover.

31. Connect the ignition primary lead connector as shown.

32. Main Harness

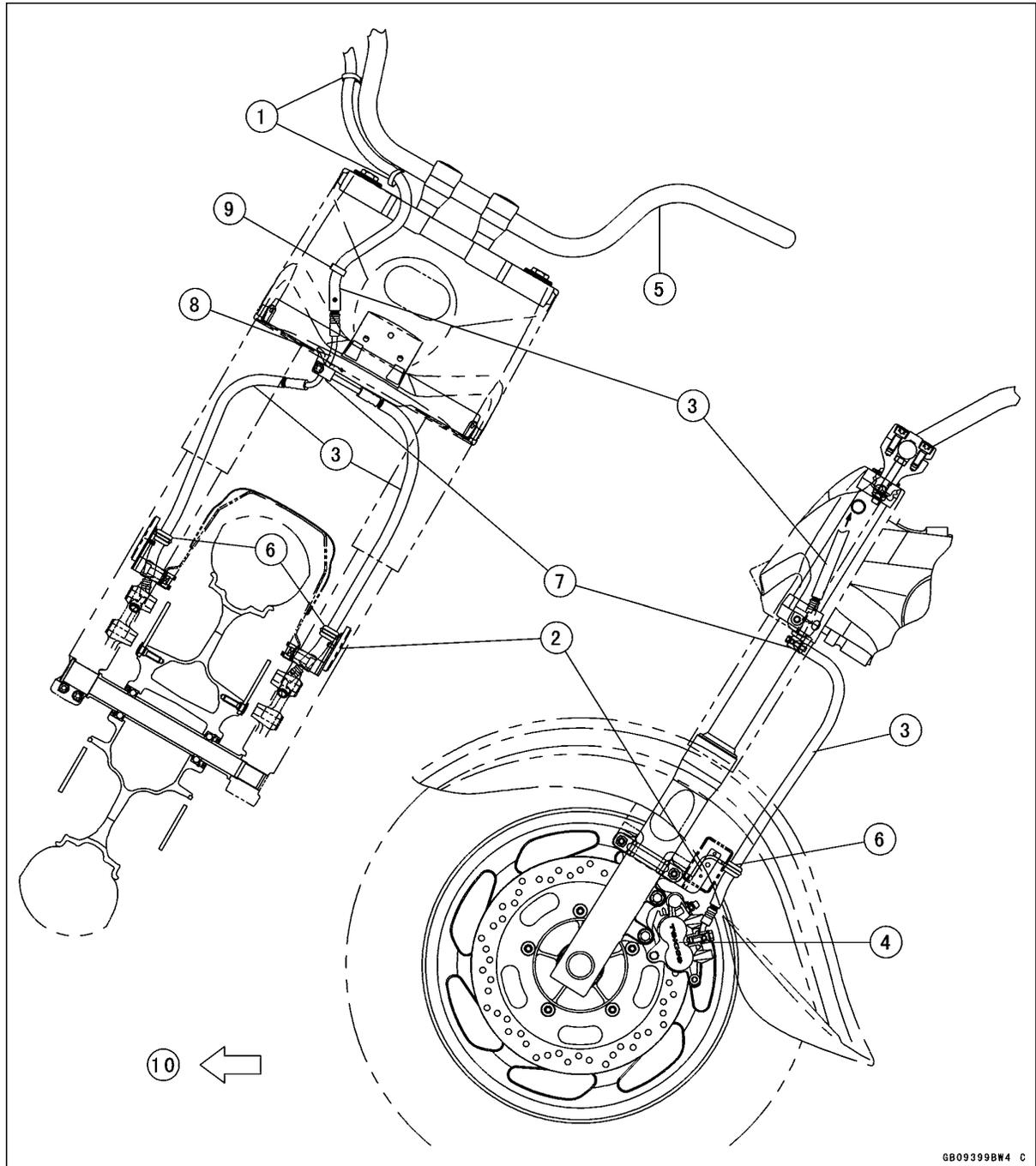
33. Strap (main harness [32] and California purge hose-green)

34. Rear Turn Signal/Taillight Lead Connector

35. Sealed Battery

GB09314BW4 C

Cable, Wire, and Hose Routing



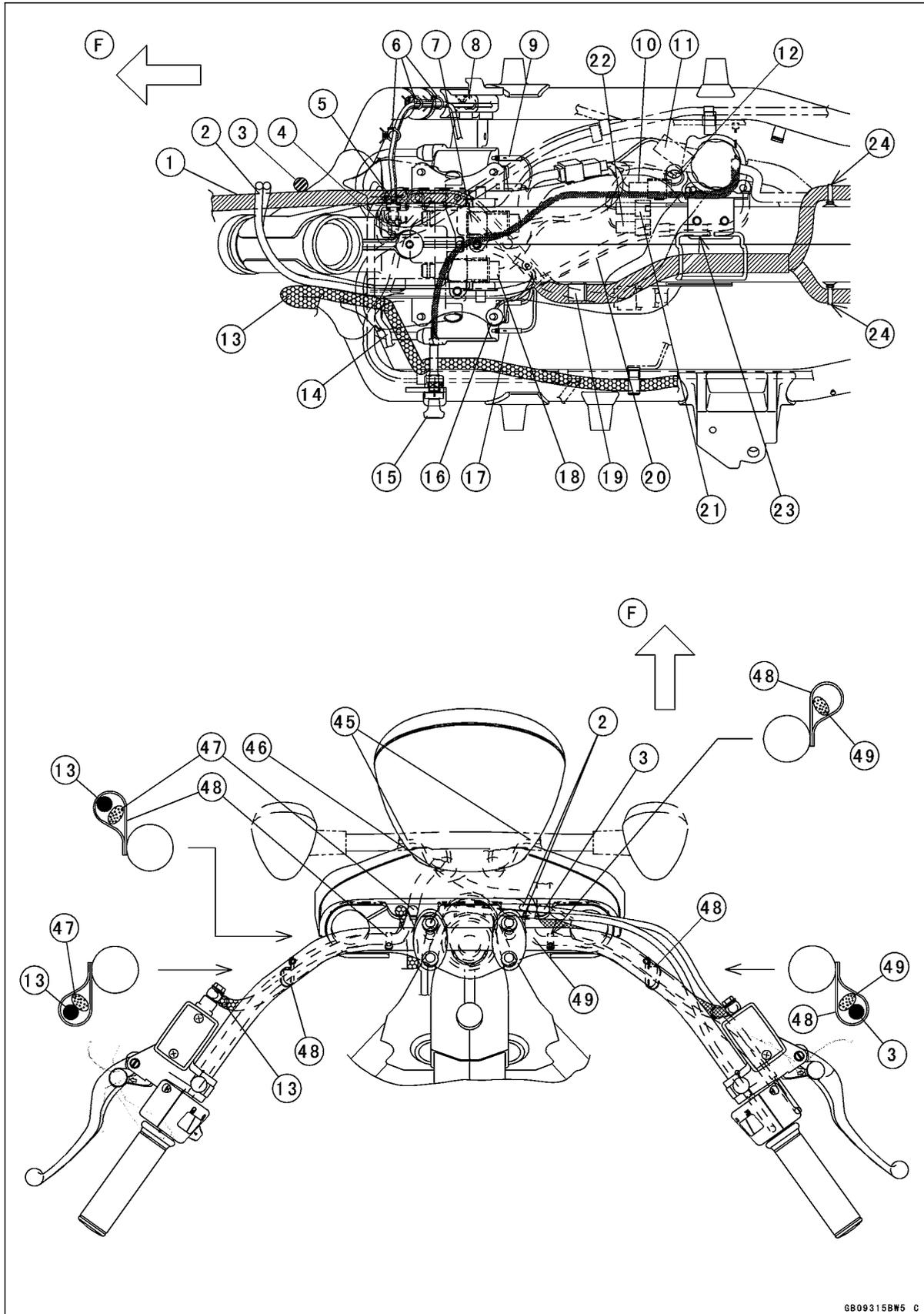
GB09399BW4 C

- 1. Snap-on Straps
- 2. Front Brake Hose Holders
- 3. Front Brake Hose Assembly
- 4. Front Brake Calipers
- 5. Handlebar
- 6. Grommets

- 7. Brake Hoes Joint
- 8. Run the hose [3] through the steering stem bracket.
- 9. Clamp
- 10. Front

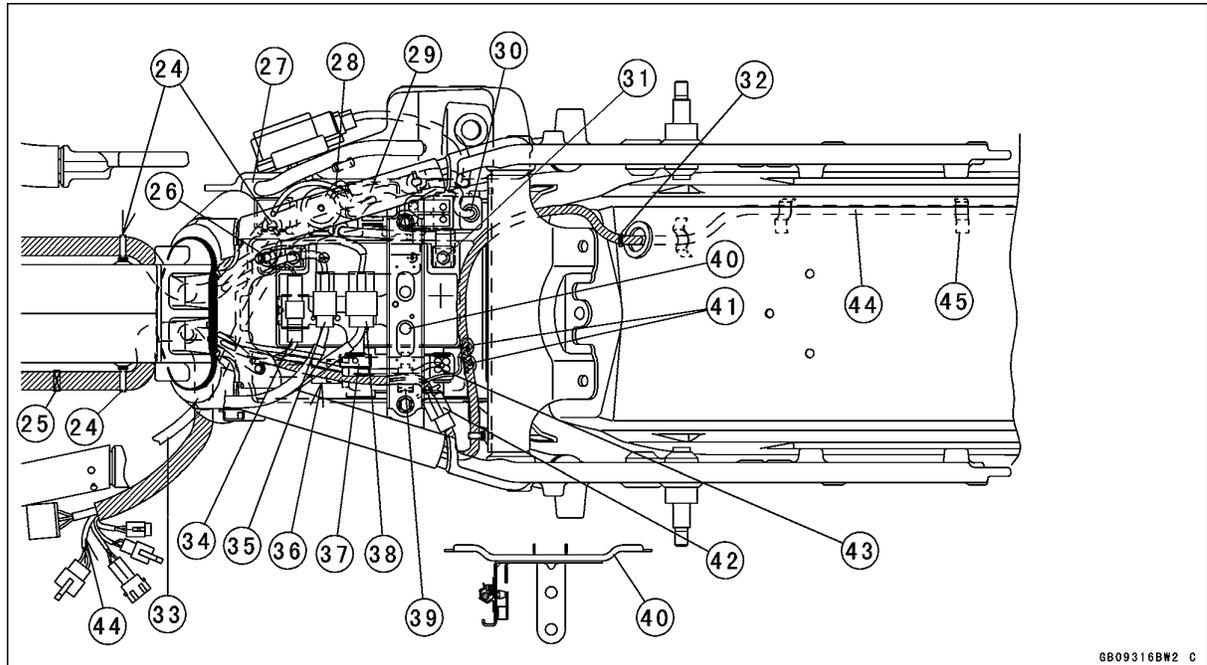
# 17-24 APPENDIX

## Cable, Wire, and Hose Routing



6B09315BW5 C

## Cable, Wire, and Hose Routing



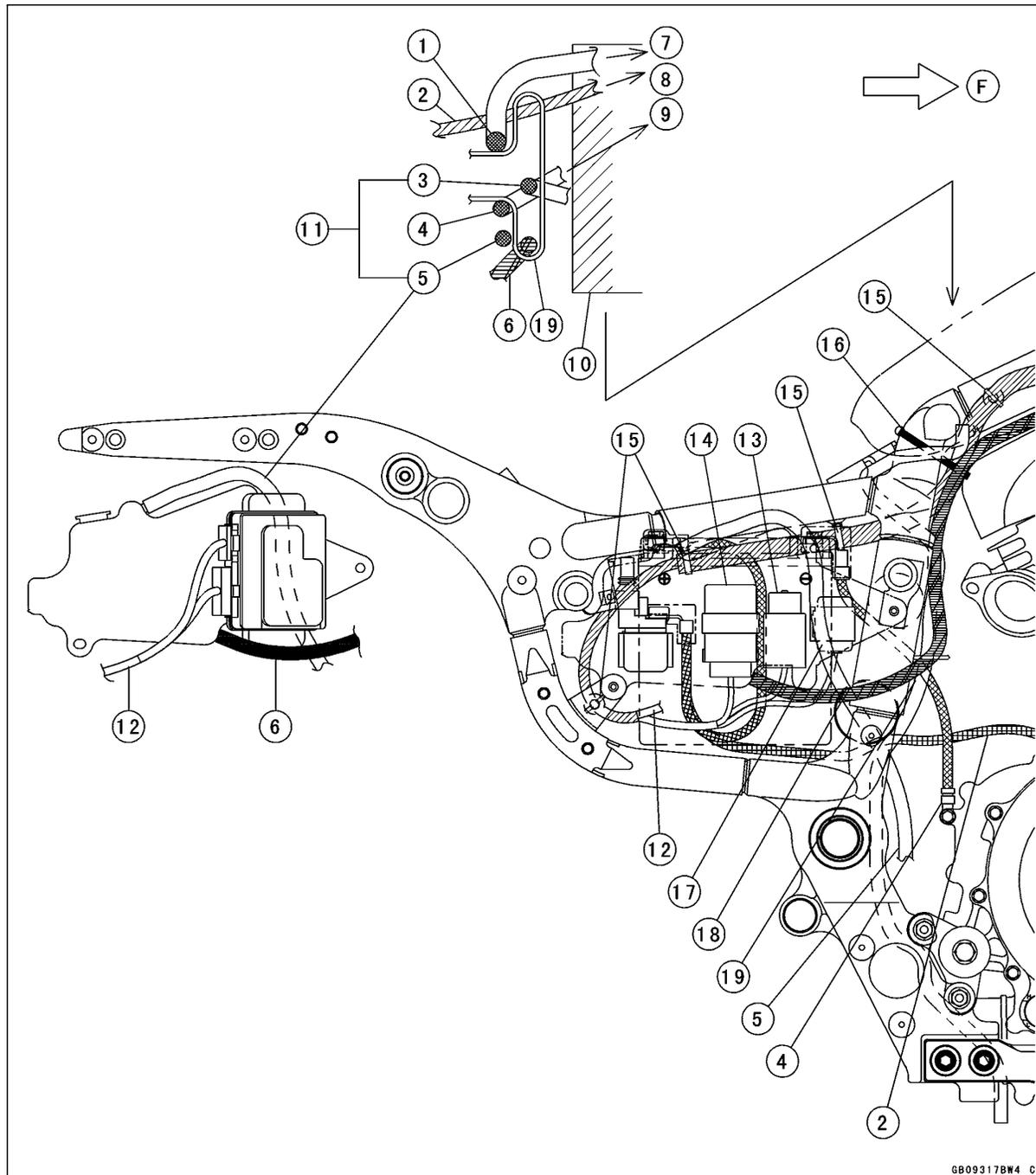
F: Front

1. Main Harness: Run it into the headlight body and inside the brake hose [3].
2. Throttle Cables
3. Front Brake Hose
4. Rear Brake Light Switch Connector (BR, BL leads, under the connector [5])
5. Radiator Fan Connector (BK/Y, Y/W, BR/W lead, over the connector [4])
6. Plastic Snap-on Clamp (radiator fan and rear brake light switch leads)
7. Inlet Air Pressure Sensor Connector
8. Plastic Snap-on Clamp (rear brake light switch lead)
9. Ignition Coil Primary Lead Connectors (for rear cylinder)
10. Injector #2 Connector (rear)
11. Water Temperature Sensor Connector (thermostat housing)
12. Throttle Sensor Connector
13. Clutch Hose
14. Horn Lead
15. Choke Knob
16. Frame Ground Terminal
17. Ignition Coil Primary Lead Connectors (for front cylinders)
18. Atmospheric Pressure Sensor Connector
19. Harness Clamp: Fit it into the frame pipe.
20. Throttle Cables
21. Injector #2 Connector (rear)
22. Injector #1 Connector (front)
23. Main Harness Bracket
24. Fit the straps into the frame pipe
25. White Tape for Identification
26. Battery (-) Lead from engine ground lead
27. Oil Pressure Light Delay Unit
28. ECU Main Relay
29. Turn Signal Control Unit
30. Starter Relay
31. Batter (+) Terminal
32. White Tape: Align it with the grommet
33. Starter Motor Lead
34. Battery (-) Lead Connector
35. Fuel Pump Connector
36. ECU Connector
37. ECU Main Fuse
38. Fuel Level Sensor Connector
39. Plastic Snap-on Clamp
40. Battery Holder: Fit [35], [37], [38] and [39] into the holder.
41. Accessory Lead Connectors (female)
42. Rear Turn Signal/Taillight Lead Connector
43. Self-Diagnosis Terminal
44. Put these connectors into the alternator outer cover.
45. Front Turn Signal Light Leads: Connect them in the headlight body.
46. Run the leads [45] into the holes of the bracket.
47. Left Handlebar Switch Leads: Connect them in the headlight body.
48. Straps
49. Right Handlebar Switch Leads

GB09316BW2 C

## 17-26 APPENDIX

### Cable, Wire, and Hose Routing



GB09317BW4 C

F: Front

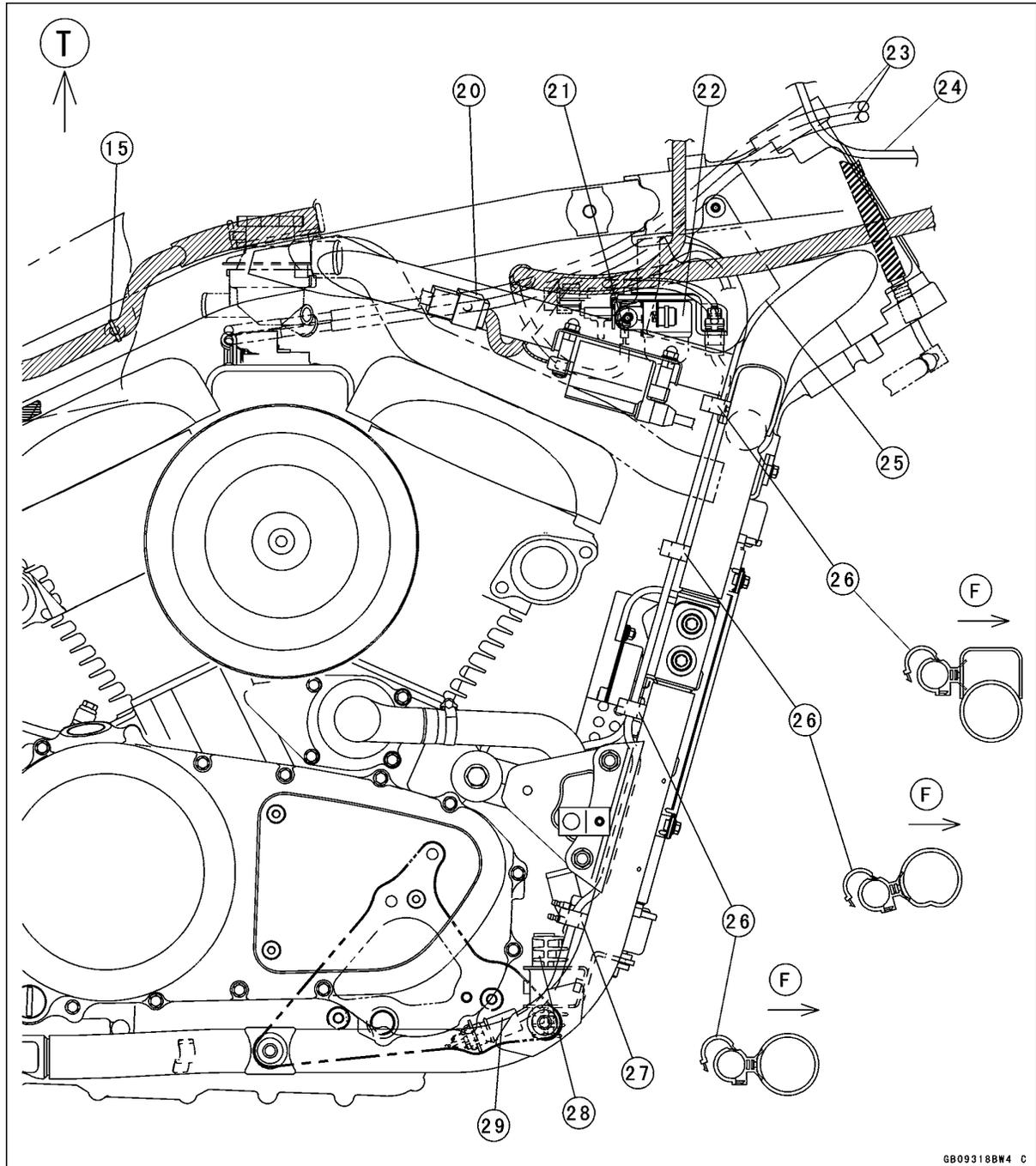
T: Top

1. Main Harness
2. Electric Starter Lead
3. Fuel Tank Filler Drain Hose (Except CA.)
4. Engine Ground Lead (Run it downward)
5. Coolant Reserve Tank Overflow Hose
6. Coolant Reserve Tank Hose (from the radiator cap to the Coolant reserve tank)

7. To the inside of the alternator outer cover
8. Through the alternator outer cover to the starter motor
9. To the engine ground
10. Crank Case
11. To the crankcase backward lower clamp
12. Junction Box Leads
13. DFI Main Relay
14. Turn Signal Control Unit
15. Insert the band attached main harness

16. Band (Fix the main harness and frame joint part only. CA run the green hose inside the band.)
17. Oil Pressure Light Delay Unit
18. Coolant Reserve Tank Hose (Run the upper side of the frame bracket).
19. Holder

## Cable, Wire, and Hose Routing



GB09318BW4 C

20. Insert the sub harness connector to the frame.

21. Vehicle-down Sensor Connector

22. Vehicle-down Sensor

23. Throttle Cables

24. Right Handlebar Switch Lead

25. Head Pipe Cover

26. Plastic Snap-on Clamps ( $\phi$  15 mm, rear brake light switch and radiator fan leads)

27. Plastic Snap-on Clamps ( $\phi$  15 mm, rear brake light switch)

28. Regulator/Rectifier

29. Rear Brake Light Switch

## 17-28 APPENDIX

### Troubleshooting Guide (except DFI)

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#### NOTE

- Refer to Fuel System chapter for most of DFI troubleshooting guide.
- 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:

- Starter lockout switch or neutral switch trouble
- Starter motor trouble
- Battery voltage low
- Starter 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 clutch trouble
- Vehicle-down sensor (DFI) coming off

##### 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:

- No fuel in tank
- Fuel pump trouble
- Fuel tank air vent obstructed
- Fuel filter clogged
- Fuel line clogged

##### Engine flooded:

- Clean spark plugs and adjust plug gaps
- Starting technique faulty (When flooded, do not crank the engine with the throttle fully opened. This promotes engine flood because more fuel is supplied automatically by DFI.)

##### No spark; spark weak:

- Vehicle-down sensor (DFI) coming off
- Ignition switch not ON
- Engine stop switch turned off
- Clutch lever not pulled in and gear not in neutral whether sidestand up or down
- Though clutch lever pulled in, sidestand up and gear not in neutral

- Battery voltage low
- Spark plug dirty, broken, or gap maladjusted
- Spark plug cap or high tension wiring trouble
- Spark plug cap shorted or not in good contact
- Spark plug incorrect
- IC igniter in ECU trouble
- Neutral, starter lockout, or sidestand switch trouble
- Crankshaft sensor trouble
- Ignition coil trouble
- Ignition switch or engine stop switch shorted
- Wiring shorted or open
- Fuse blown

##### Fuel/air mixture incorrect:

- Air cleaner clogged, poorly sealed, or missing

##### Compression Low:

- Spark plug loose
- Cylinder head not sufficiently tightened down
- 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)
- KACR (compression release cam) sticks open (engine stalls when moving off)
- HLA (hydraulic lash adjuster) damaged (worn, seizure, or spring broken)
- HLA oil passage clogged

#### Poor Running at Low Speed:

##### Spark weak:

- Battery voltage low
- Spark plug dirty, broken, or maladjusted
- Spark plug cap or high tension wiring trouble
- Spark plug cap shorted or not in good contact
- Spark plug incorrect
- IC igniter in ECU trouble
- Crankshaft sensor trouble
- Ignition coil trouble

##### Fuel/air mixture incorrect:

- Air cleaner clogged, poorly sealed, or missing
- Fuel tank air vent obstructed
- Throttle body assy loose

## Troubleshooting Guide (except DFI)

Choke knob left pulled out (DFI)  
 Throttle body assy O-ring damage  
 Air cleaner duct loose  
 Air cleaner O-ring damaged  
 Fuel pump (DFI) trouble

### Compression low:

Spark plug loose  
 Cylinder head not sufficiently tightened down  
 Cylinder, piston worn  
 Piston ring bad (worn, weak, broken, or sticking)  
 Piston ring/groove clearance excessive  
 Cylinder head warped  
 Cylinder head gasket damaged  
 Valve spring broken or weak  
 Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)  
 KACR sticks open (engine stalls when moving off)  
 HLA seizure

### Backfiring when deceleration:

Vacuum switch valve broken  
 Air suction valve trouble

### Other:

IC igniter in ECU trouble  
 Engine oil viscosity too high  
 Drive train trouble  
 Final gear case oil viscosity too high  
 Brake dragging  
 Engine overheating  
 Clutch slipping  
 Air suction valve trouble  
 Vacuum switch valve trouble

## Poor Running or No Power at High Speed:

### Firing incorrect:

Spark plug dirty, broken, or maladjusted  
 Spark plug cap or high tension wiring trouble  
 Spark plug cap shorted or not in good contact  
 Spark plug incorrect  
 IC igniter in ECU trouble  
 Crankshaft sensor trouble  
 Ignition coil trouble

### Fuel/air mixture incorrect:

Choke knob left pulled out (DFI)  
 Air cleaner clogged, poorly sealed, or missing  
 Air cleaner duct loose  
 Air cleaner O-ring damaged  
 Water or foreign matter in fuel  
 Throttle body assy loose  
 Throttle body assy O-ring damage

Fuel to injector insufficient (DFI)  
 Fuel tank air vent obstructed  
 Fuel line clogged  
 Fuel pump trouble (DFI)

### Compression low:

Spark plug loose  
 Cylinder head not sufficiently tightened down  
 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.)  
 KACR sticks open (engine stalls when moving off)  
 HLA seizure

### Knocking:

Carbon built up in combustion chamber  
 Fuel poor quality or incorrect (Be sure to use high-octane gasoline recommended by Owner's Manual)  
 Spark plug incorrect  
 IC igniter in ECU trouble

### Miscellaneous:

Throttle valves won't fully open  
 Brake dragging  
 Clutch slipping  
 Engine overheating  
 Engine oil level too high  
 Engine oil viscosity too high  
 Drive train trouble  
 Final gear case oil viscosity too high  
 Air suction valve trouble  
 Vacuum switch valve trouble  
 Catalytic converters melt down due to muffler overheating (KLEEN)

## Overheating:

### Firing incorrect:

Spark plug dirty, broken, or maladjusted  
 Spark plug incorrect  
 IC igniter in ECU trouble

### Muffler overheating:

For KLEEN, do not run the engine even if with only one cylinder misfiring or poor running (Request the nearest service facility to correct it)  
 For KLEEN, do not push-start with a dead battery (Connect another full-charged battery with jumper cables, and start the engine, using the electric starter)

## 17-30 APPENDIX

### Troubleshooting Guide (except DFI)

---

For KLEEN, do not start the engine under misfire due to spark plug fouling or poor connection of the spark plug

For KLEEN, do not coast the motorcycle with the ignition switch off (Turn the ignition switch ON and run the engine)

IC igniter in ECU trouble

#### **Fuel/air mixture incorrect:**

Throttle body assy loose

Throttle body assy O-ring damage

Air cleaner duct loose

Air cleaner poorly sealed, or missing

Air cleaner O-ring damaged

Air cleaner clogged

#### **Compression high:**

Carbon built up in combustion chamber

KACR sticks close

#### **Engine load faulty:**

Clutch slipping

Engine oil level too high

Engine oil viscosity too high

Drive train trouble

Final gear case oil viscosity too high

Brake dragging

#### **Lubrication inadequate:**

Engine oil level too low

Engine oil poor quality or incorrect

#### **Water temperature warning system incorrect:**

Water temperature warning light broken

Water temperature switch broken

#### **Coolant incorrect:**

Coolant level too low

Coolant deteriorated

Wrong coolant mixed ratio

#### **Cooling system component incorrect:**

Radiator fin damaged

Radiator clogged

Thermostat trouble

Radiator cap trouble

Radiator fan switch trouble

Fan motor broken

Fan blade damaged

Water pump not turning

Water pump impeller damaged

#### **Over Cooling:**

##### **Cooling system component incorrect:**

Radiator fan switch trouble

Thermostat trouble

#### **Clutch Operation Faulty:**

##### **Clutch slipping:**

Friction plate worn or warped

Steel plate worn or warped

Spring plate free play maladjustment

Clutch spring broken or weak

Clutch slave cylinder trouble

Clutch hub or housing unevenly worn

Clutch master cylinder trouble

##### **Clutch not disengaging properly:**

Clutch plate warped or too rough

Spring plate free play maladjustment

Engine oil deteriorated

Engine oil viscosity too high

Engine oil level too high

Clutch housing frozen on drive shaft

Clutch slave cylinder trouble

Clutch hub nut loose

Clutch hub spline damaged

Clutch friction plate installed wrong

Clutch fluid leakage

Clutch fluid deteriorated

Clutch master cylinder primary or secondary cup damaged

Clutch master cylinder scratched inside

Air in the clutch fluid line

#### **Gear Shifting Faulty:**

##### **Doesn't go into gear; shift pedal doesn't return:**

Clutch not disengaging

Shift fork bent or seized

Gear stuck on the shaft

Gear set lever binding

Shift return spring weak or broken

Shift return spring pin loose

Shift mechanism arm spring broken

Shift mechanism arm broken

##### **Jumps out of gear:**

Shift fork ear worn, bent

Gear groove worn

Gear dogs and/or dog holes worn

Shift drum groove worn

Gear set lever spring weak or broken

Shift fork guide pin worn

Drive shaft, output shaft, and/or gear splines worn

##### **Overshifts:**

Gear set lever spring weak or broken

Shift mechanism arm spring broken

#### **Abnormal Engine Noise:**

##### **Knocking:**

IC igniter in ECU trouble

Carbon built up in combustion chamber

Fuel poor quality or incorrect (Be sure to use high-octane gasoline recommended in Owner's Manual)

Spark plug incorrect

Overheating

##### **Piston slap:**

Cylinder/piston clearance excessive

Cylinder, piston worn

## Troubleshooting Guide (except DFI)

Connecting rod bent  
Piston pin, piston pin hole worn

### Valve noise:

Engine not sufficiently warmed up after HLA installation  
HLA damaged (worn, seizure, or spring broken)  
HLA aeration due to low oil level  
Air in HLA  
Metal chips or dust jammed in HLA  
Engine operated in red zone  
Valve spring broken or weak  
Camshaft bearing portion 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  
Primary gear worn or chipped  
Camshaft chain tensioner trouble  
Camshaft chain, sprocket, guide worn  
Air suction valve damaged  
Vacuum switch valve damaged  
Alternator rotor loose  
Catalytic converters melt down due to muffler overheating (KLEEN)  
Balancer gear worn or chipped  
Balancer shaft position maladjusted  
Balancer bearing worn  
Balancer shaft coupling rubber damper damaged  
Water pump chain, sprocket worn

### Abnormal Drive Train Noise:

#### Clutch noise:

Clutch rubber damper weak or damaged  
Clutch housing/friction plate clearance excessive  
Clutch housing gear worn  
Wrong installation of outside friction plate

#### Transmission noise:

Bearings worn  
Transmission gears worn or chipped  
Metal chips jammed in gear teeth  
Engine oil insufficient

#### Drive line noise:

Bevel gear bearings worn  
Bevel gears worn or chipped  
Bevel gears maladjusted

Rear wheel coupling damaged  
Final gear case oil level too low or oil too thin  
Insufficient grease in propeller shaft joint

### Abnormal Frame Noise:

#### Front fork noise:

Oil insufficient or too thin  
Spring weak or broken

#### Rear shock absorber noise:

Shock absorber damaged

#### Disc brake noise:

Pad installed incorrectly  
Pad surface glazed  
Disc warped  
Caliper trouble  
Master cylinder damaged

#### Other noise:

Bracket, nut, bolt, etc. not properly mounted or tightened

### Oil Pressure Warning Light Goes On:

Engine oil pump damaged  
Engine oil screen clogged  
Engine oil filter clogged  
Engine oil level too low  
Engine oil viscosity too low  
Camshaft bearing portion worn  
Crankshaft bearings worn  
Oil pressure switch damaged  
Oil pressure switch lead damaged  
Relief valve stuck open  
O-ring at the oil pipe in the crankcase damaged

### Exhaust Smokes Excessively:

#### White smoke:

Piston oil ring worn  
Cylinder worn  
Valve oil seal damaged  
Valve guide worn  
Engine oil level too high

#### Black smoke:

Air cleaner clogged  
Choke knob left pulled out (DFI)

#### Brown smoke:

Air cleaner duct loose  
Air cleaner O-ring damaged  
Air cleaner poorly sealed or missing

### Handling and/or Stability

#### Unsatisfactory:

##### Handlebar hard to turn:

Cable routing incorrect  
Hose routing incorrect  
Wiring routing incorrect

## 17-32 APPENDIX

### Troubleshooting Guide (except DFI)

---

Steering stem nut too tight  
Steering stem bearing damaged  
Steering stem bearing lubrication inadequate  
Steering stem bent  
Tire air pressure too low

**Handlebar shakes or excessively vibrates:**

Tire worn  
Swingarm sleeve or pivot bearings worn  
Wheel rim warped, or not balanced  
Wheel bearing worn  
Handlebar nuts loose  
Steering stem head nut loose  
Front, rear axle runout excessive

**Handlebar pulls to one side:**

Frame bent  
Swingarm bent or twisted  
Swingarm pivot shaft runout excessive  
Steering maladjusted  
Front fork bent  
Right and/or left front fork oil level incorrect

**Shock absorption unsatisfactory:**

(Too hard)  
Front fork oil excessive  
Front fork oil viscosity too high  
Rear shock absorber adjustment too hard  
Tire air pressure too high  
Front fork bent  
(Too soft)  
Tire air pressure too low  
Front fork oil insufficient and/or leaking  
Front fork oil viscosity too low

Rear shock adjustment too soft  
Front fork, rear shock absorber spring weak  
Rear shock absorber oil leaking

**Brake Doesn't Hold:**

Air in the brake line  
Pad or disc worn  
Brake fluid leakage  
Disc warped  
Contaminated pad  
Brake fluid deteriorated  
Primary or secondary cup damaged in master cylinder  
Master cylinder scratched inside

**Battery Trouble:**

**Battery discharged:**

Charge insufficient  
Battery faulty (too low terminal voltage)  
Battery leads making poor contact  
Load excessive (e.g., bulb of excessive wattage)  
Ignition switch trouble  
Alternator trouble  
Wiring faulty  
Regulator/rectifier trouble

**Battery overcharged:**

Alternator trouble  
Regulator/rectifier trouble  
Battery faulty

### MODEL APPLICATION

Year	Model	Beginning Frame No.
2003	VN1600-A1	JKBVNKA1□3A000001 or JKBVNT60AAA000001
2004	VN1600-A2	JKBVNKA1□4A009001 or JKBVNT60AAA009001

□: This digit in the frame number changes from one machine to another.



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