

**Kawasaki**

**W800**



# **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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**W800**

# **Motorcycle Service Manual**

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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	rpm	revolution(s) per minute
F	farad(s)	TDC	top dead center
°F	degree(s) Fahrenheit	TIR	total indicator reading
ft	foot, feet	V	volt(s)
g	gram(s)	W	watt(s)
h	hour(s)	Ω	ohm(s)
L	liter(s)		

## COUNTRY AND AREA CODES

AU	Austria	MY	Malaysia
BR	Brazil	SEA	Southeast Asia
CA	Canada	US	United States
CAL	California	WVTA (FULL H)	WVTA Model with Honeycomb Catalytic Converter (Full Power)
CH	Switzerland	GB WVTA (FULL H)	WVTA Model with Honeycomb Catalytic Converter (Left Side Traffic, Full Power)
DE	Germany	WVTA (78.2 H)	WVTA Model with Honeycomb Catalytic Converter (78.2 Kw Power)
GB	United Kingdom		

# 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 Service Manual. Genuine parts provided as spare parts are listed in the Parts Catalog.
- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

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## How to Use This Manual

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In this manual, the product is divided into its major systems and these systems make up the manual's chapters. The Quick Reference

Guide shows you all of the product's system and assists in locating their chapters. Each chapter in turn has its own comprehensive Table of Contents.

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

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

### **DANGER**

**DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.

### **WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### **NOTICE**

**NOTICE** is used to address practices not related to personal injury.

This manual contains four more symbols which will help you distinguish different types of information.

### **NOTE**

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

- Indicates a procedural step or work to be done.
- Indicates a procedural sub-step or how to do the work of the procedural step it follows. It also precedes the text of a NOTE.
- ★ Indicates a conditional step or what action to take based on the results of the test or inspection in the procedural step or sub-step it follows.

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



# General Information

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## 1-2 GENERAL INFORMATION

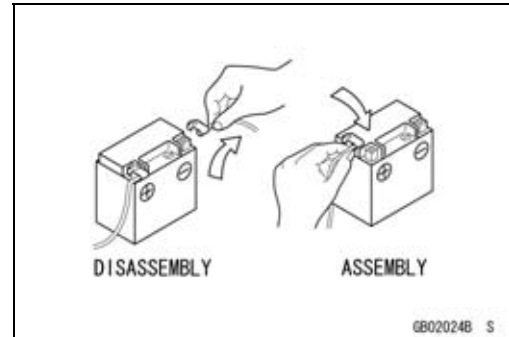
### Before Servicing

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.

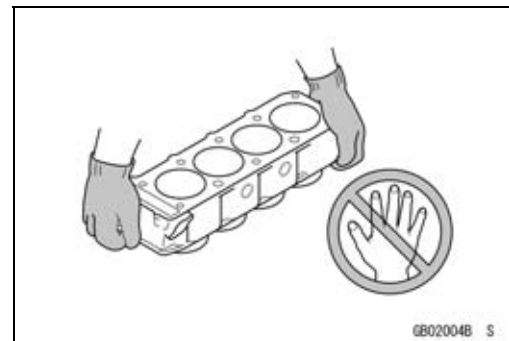
#### **Battery Ground**

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



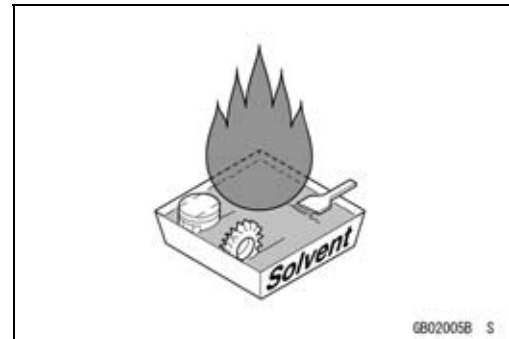
#### **Edges of Parts**

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



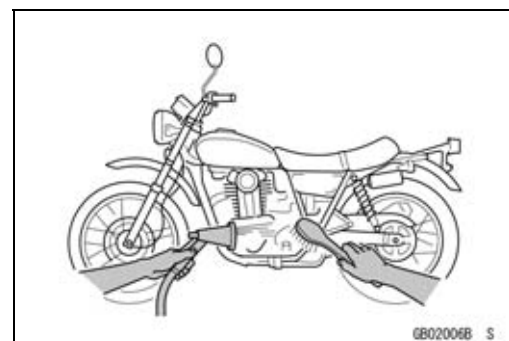
#### **Solvent**

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



#### **Cleaning Vehicle before Disassembly**

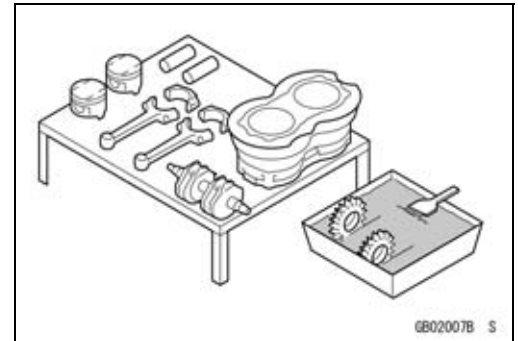
Clean the vehicle thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during vehicle disassembly can cause excessive wear and decrease performance of the vehicle.



## Before Servicing

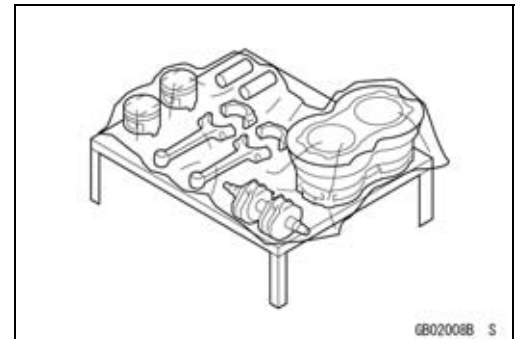
### **Arrangement and Cleaning of Removed Parts**

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.



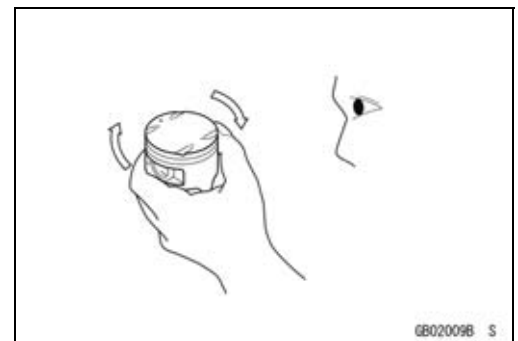
### **Storage of Removed Parts**

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.



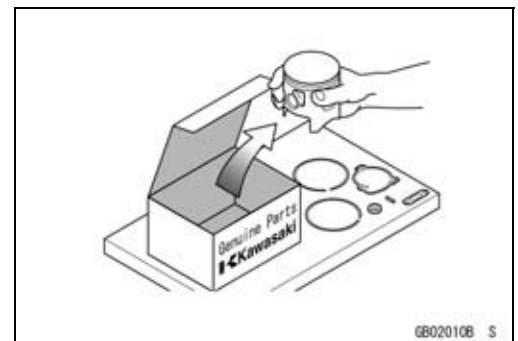
### **Inspection**

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.



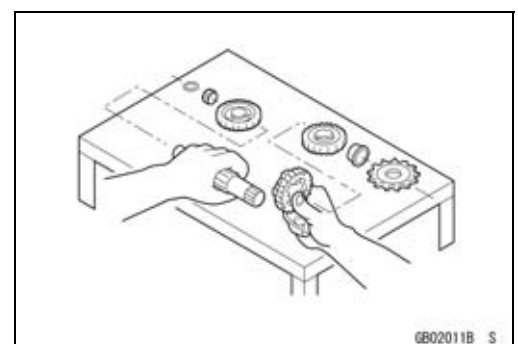
### **Replacement Parts**

Replacement parts must be KAWASAKI genuine or recommended by KAWASAKI. Gaskets, O-rings, oil seals, grease seals, circlips, cotter pins or self-locking nuts 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.

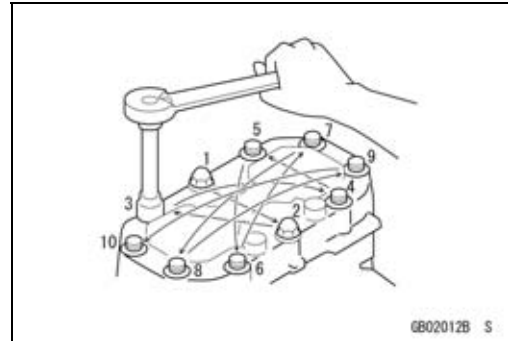


## 1-4 GENERAL INFORMATION

### Before Servicing

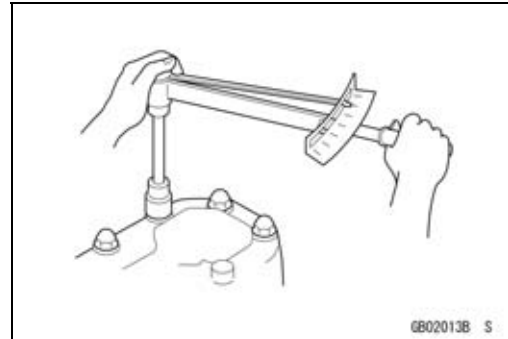
#### **Tightening Sequence**

Generally, when installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit. Then tighten them according to the specified sequence to prevent case warpage or deformation which can lead to malfunction. Conversely when loosening the bolts, nuts, or screws, first loosen all of them by about a quarter turn and then remove them. If the specified tightening sequence is not indicated, tighten the fasteners alternating diagonally.



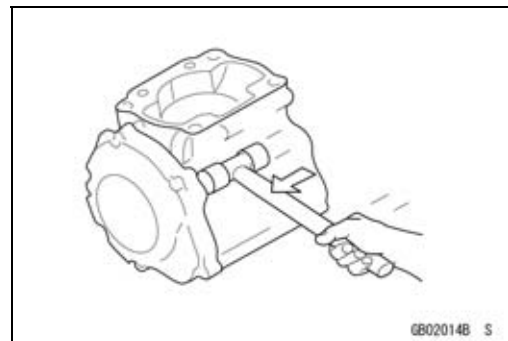
#### **Tightening Torque**

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.



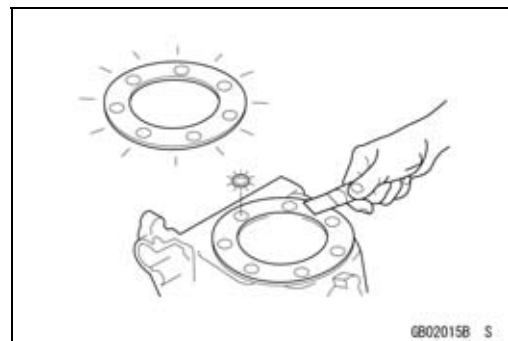
#### **Force**

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 the new gaskets and replace the used O-rings when re-assembling.



#### **Liquid Gasket, Non-permanent Locking Agent**

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

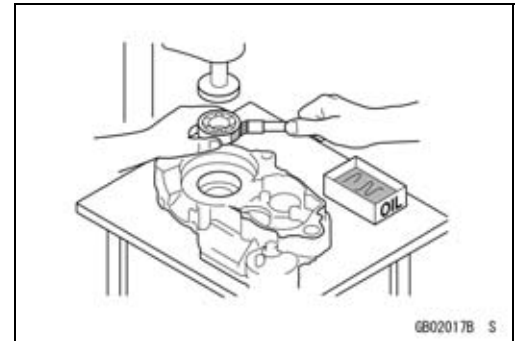




**Before Servicing**

**Press**

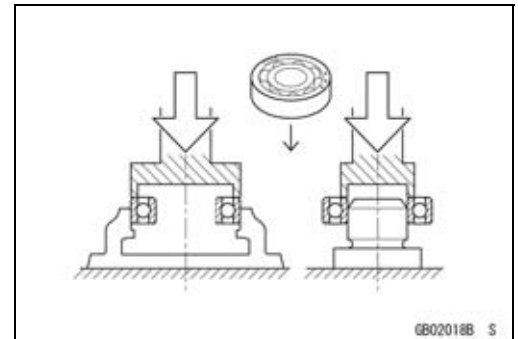
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



**Ball Bearing and Needle Bearing**

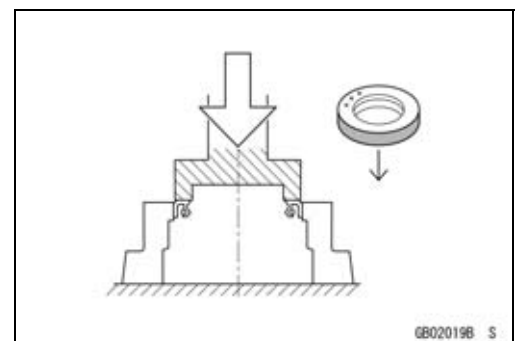
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

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

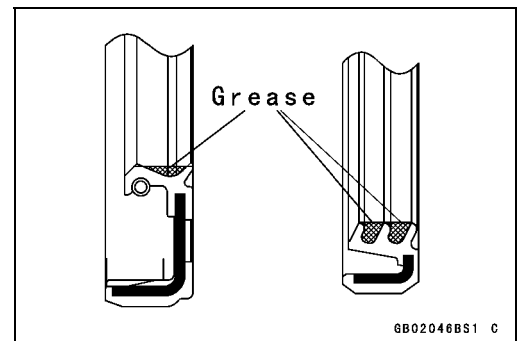


**Oil Seal, Grease Seal**

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.

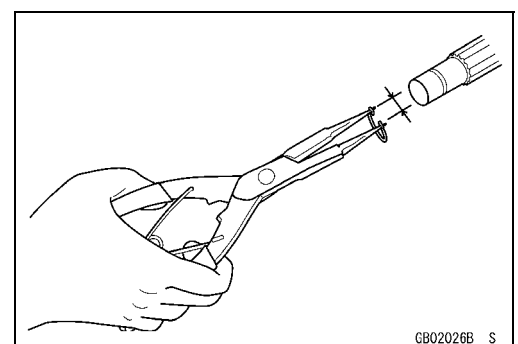


Apply specified grease to the lip of seal before installing the seal.



**Circlips, Cotter Pins**

Replace the circlips or cotter pins that were removed with new ones. Take care not to open the clip excessively when installing to prevent deformation.

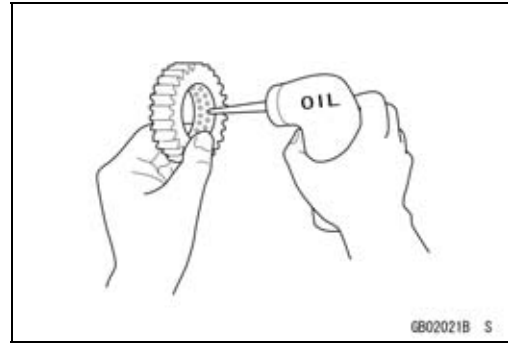


## 1-6 GENERAL INFORMATION

### Before Servicing

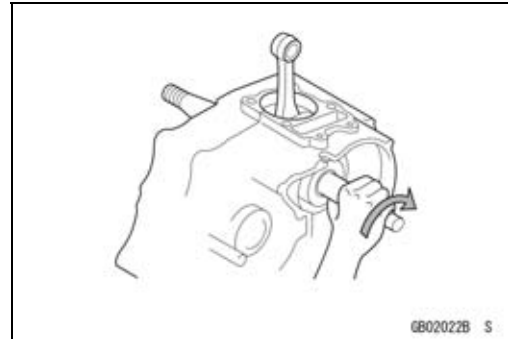
#### **Lubrication**

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.



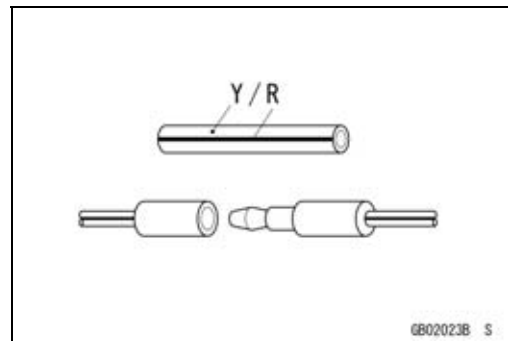
#### **Direction of Engine Rotation**

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).



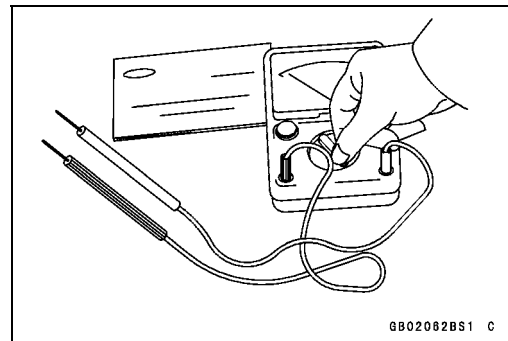
#### **Electrical Wires**

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.



#### **Instrument**

Use a meter that has enough accuracy for an accurate measurement. Read the manufacture's instructions thoroughly before using the meter. Incorrect values may lead to improper adjustments.



Model Identification

EJ800AB Left Side View



EJ800AB Right Side View



Frame Number



Engine Number



# 1-8 GENERAL INFORMATION

## General Specifications

Items	EJ800AB ~
<b>Dimensions</b> Overall Length Overall Width Overall Height Wheelbase Road Clearance Seat Height Curb Mass Front Rear Fuel Tank Capacity	2 190 mm (86.22 in.) 790 mm (31.1 in.) 1 075 mm (42.32 in.) 1 465 mm (57.68 in.) 125 mm (4.92 in.) 790 mm (31.1 in.) 217 kg (478 lb) 100 kg (220 lb) 117 kg (258 lb) 14 L (3.7 US gal.)
<b>Performance</b> Minimum Turning Radius	2.7 m (8.9 ft)
<b>Engine</b> Type Cooling System Bore and Stroke Displacement Compression Ratio Maximum Horsepower Maximum Torque Fuel System Starting System Ignition System Timing Advance Ignition Timing Spark Plug Cylinder Numbering Method Firing Order Valve Timing: Intake: Open Close Duration Exhaust: Open Close Duration Lubrication System Engine Oil: Type Viscosity Capacity	4-stroke, SOHC, 2-cylinder Air-cooled 77.0 × 83.0 mm (3.03 × 3.27 in.) 773 cm <sup>3</sup> (47.2 cu in.) 8.4 : 1 35 kW (48 PS) @6 500 r/min (rpm) 60 N·m (6.1 kgf·m, 44 ft·lb) @2 500 r/min (rpm) FI (Fuel Injection) KEIHIN TTK34 × 2 Electric starter Battery and coil (transistorized) Electronically advanced (digital igniter) 0° BTDC @1 200 r/min (rpm) NGK CR8E Left to right, 1-2 1-2  25° BTDC 55° ABDC 260°  55° BBDC 25° ATDC 260° Forced lubrication (wet sump)  API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2 SAE 10W-40 3.2 L (3.4 US qt)

## General Specifications

Items	EJ800AB ~
<b>Drive Train</b> Primary Reduction System: Type Reduction Ratio Clutch Type Transmission: Type Gear Ratios: 1st 2nd 3rd 4th 5th Final Drive System: Type Reduction Ratio Overall Drive Ratio	Gear 2.095 (88/42) Wet multi disc 5-speed, constant mesh, return shift 2.353 (40/17) 1.591 (35/22) 1.240 (31/25) 1.000 (28/28) 0.852 (23/27) Chain drive 2.467 (37/15) 4.403 @Top gear
<b>Frame</b> Type Caster (Rake Angle) Trail Front Tire: Type Size Rim Size Rear Tire: Type Size Rim Size Front Suspension: Type Wheel Travel Rear Suspension: Type Wheel Travel Brake Type: Front Rear	Tubular, Double cradle 27° 108 mm (4.06 in.) TT100GP G 100/90 19 M/C (57H) J19 × 2.15 TT100GP 130/80 18 M/C (66H) J18M/C × MT2.75 Telescopic fork 130 mm (5.12 in.) Swingarm, shock absorber 106 mm (4.17 in.) Single disc Drum
<b>Electrical Equipment</b> Battery Headlight: Type Bulb Tail/Brake Light	12 V 10 Ah Semi-sealed beam 12 V 60/55 W (quartz-halogen) 12 V 5/21 W

## 1-10 GENERAL INFORMATION

### General Specifications

Items	EJ800AB ~
Alternator: Type Rated Output	Three-phase AC 18 A/14 V @7 000 r/min (rpm)

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

**Unit Conversion Table**

**Prefixes for Units:**

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

**Units of Mass:**

kg	×	2.205	=	lb
g	×	0.03527	=	oz

**Units of Volume:**

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

**Units of Force:**

N	×	0.1020	=	kg
N	×	0.2248	=	lb

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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

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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	=	cmHg

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kgf/cm <sup>2</sup>	×	98.07	=	kPa
kgf/cm <sup>2</sup>	×	14.22	=	psi
cmHg	×	1.333	=	kPa

**Units of Speed:**

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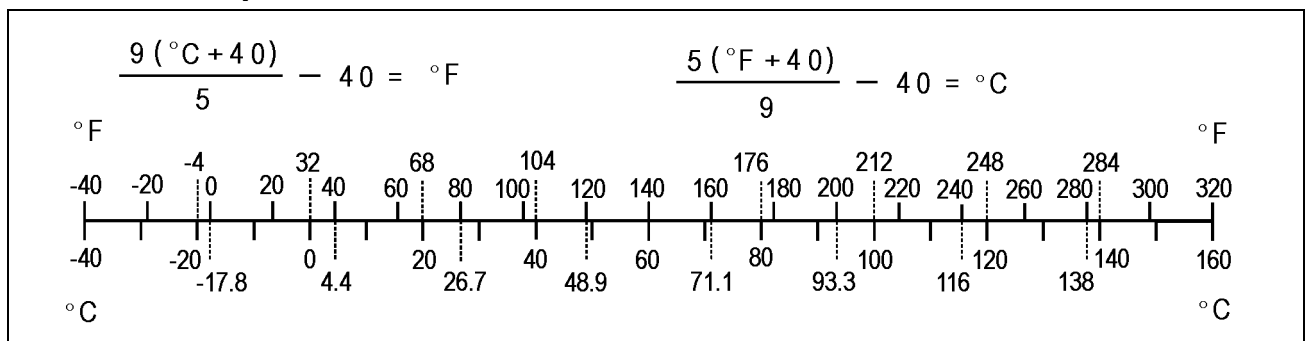
**Units of Power:**

kW	×	1.360	=	PS
kW	×	1.341	=	HP

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PS	×	0.7355	=	kW
PS	×	0.9863	=	HP

**Units of Temperature:**







# Periodic Maintenance

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Periodic Maintenance Chart

ITEM	FREQUENCY	* ODOMETER READING							See Page
		Whichever comes first ↓	1 (0.6)	6 (3.75)	12 (7.5)	18 (11.25)	24 (15)	30 (18.75)	
Brake hose installation condition - inspect	year	•	•	•	•	•	•	•	2-32
Brake fluid level - inspect	6 months	•	•	•	•	•	•	•	2-32
Brake pad wear - inspect #			•	•	•	•	•	•	2-33
Brake operation (effectiveness, play, no drag) - inspect	year	•	•	•	•	•	•	•	2-33
Brake lining wear - inspect			•	•	•	•	•	•	2-34
Brake light switch operation - inspect		•	•	•	•	•	•	•	2-34
<b>Suspension</b>									
Front forks/rear shock absorbers operation (damping and smooth stroke) - inspect				•		•		•	2-35
Front forks/rear shock absorbers oil leak - inspect	year			•		•		•	2-36
Swingarm pivot - lubricate						•			2-36
<b>Steering</b>									
Steering play - inspect	year	•		•		•		•	2-36
Steering stem bearings - lubricate	2 years					•			2-37
<b>Electrical System</b>									
Lights and switches operation - inspect	year			•		•		•	2-38
Headlight aiming - inspect	year			•		•		•	2-40
Sidestand switch operation - inspect	year			•		•		•	2-41
Engine stop switch operation - inspect	year			•		•		•	2-42
<b>Others</b>									
Chassis parts - lubricate	year			•		•		•	2-42
Bolts and nuts tightness - inspect		•		•		•		•	2-44

#: 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.

## 2-4 PERIODIC MAINTENANCE

### Periodic Maintenance Chart

#### Periodic Replacement Parts

ITEM	FREQUENCY	Whichever comes first ↓ Every	* ODOMETER READING × 1 000 km (× 1 000 mile)					See Page
			1 (0.6)	12 (7.5)	24 (15)	36 (22.5)	48 (30)	
Air cleaner element # - replace	2 years							2-45
Fuel hose - replace	5 years							2-45
Engine oil # - change	year	•	•	•	•	•		2-47
Oil filter - replace	year	•	•	•	•	•		2-48
Brake hose - replace	4 years					•		2-48
Brake fluid - change	2 years			•		•		2-49
Rubber parts of master cylinder and caliper - replace	4 years					•		2-50, 2-51
Spark plug - replace			•	•	•	•		2-52

#: 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.

**Torque and Locking Agent**

The following tables list the tightening torque for the major fasteners requiring use of a non-permanent locking agent or silicone sealant etc.

Letters used in the “Remarks” column mean:

CP: Bolt with copper-plated washer.

G: Apply grease.

HL: Apply high-lock agent to the threads.

L: Apply a non-permanent locking agent.

Lh: Left-hand Threads

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil solution.

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

R: Replacement parts

S: Follow the specified tightening sequence.

Si: Apply silicone grease.

SS: Apply silicone sealant.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
<b>Fuel System</b>				
Fuel Reserve Switch Screws	2.1	0.21	19 in·lb	
Fuel Pump Bolts	9.8	1.0	87 in·lb	L
Throttle Cable Plate Bolt	5.9	0.60	52 in·lb	
Delivery Pipe Mounting Screws	3.43	0.35	30 in·lb	
Engine Temperature Sensor	9.8	1.0	87 in·lb	
Oxygen Sensor	25	2.5	18	
Crankshaft Sensor Bolts	7.8	0.80	69 in·lb	L
Speed Sensor Mounting Bolt	4.5	0.46	40 in·lb	
<b>Engine Top End</b>				
Spark Plug Hole Holder Cover Bolts	7.8	0.8	69 in·lb	
Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
Bevel Gear Cover Bolts	3.9	0.4	35 in·lb	L
Air Suction Valve Cover Bolts	12	1.2	106 in·lb	L
Cylinder Head Bolts (New Bolts)	49	5.0	36	MO, S
Cylinder Head Bolts (Used Bolts)	47	4.8	35	MO, S
Spark Plugs	13	1.3	115 in·lb	
Spark Plug Hole Pipes	120	12.2	89	L
Camshaft Cap Bolts (8 mm)	25	2.5	18	S
Camshaft Cap Bolts (6 mm)	12	1.2	106 in·lb	S
Oil Fitting Bracket Bolts	12	1.2	106 in·lb	L
Oxygen Sensor	25	2.5	18	
Muffler Bracket Bolts	21	2.1	15	
Rocker Shaft Bolts	12	1.2	106 in·lb	L
Camshaft Locating Plate Bolts	12	1.2	106 in·lb	
Driven Bevel Gear Bolts	20	2.0	15	L
Bevel Gear Mounting Nuts	59	6.0	44	R
Gear Case	98	10	72	L
Bevel Gear Case Locknuts	20	2.0	15	
Bevel Gear Case Bolts	12	1.2	106 in·lb	

## 2-6 PERIODIC MAINTENANCE

### Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Bevel Gear Oil Passage Nozzle	3.5	0.36	31 in·lb	
Bevel Gear Holder Screws	4.9	0.5	43 in·lb	L
Bearing Holder Allen Bolts	7.8	0.8	69 in·lb	L
Locknut Stop Screw	2.1	0.2	1.5	L
<b>Clutch</b>				
Clutch Lever Clamp Bolts	7.8	0.80	69 in·lb	S
Clutch Hub Nut	145	14.8	107	R
Clutch Spring Bolts	9.8	1.0	87 in·lb	
Clutch Cover Damper Plate Bolts	12	1.2	106 in·lb	L
Clutch Cable Lower Holder Bolts	12	1.2	106 in·lb	L
Clutch Release Case Mounting Bolt (L = 80 mm)	12	1.2	106 in·lb	
Clutch Release Case Mounting Bolt (L = 70 mm)	12	1.2	106 in·lb	
Release Shaft Locating Bolt	9.8	1.0	87 in·lb	
Release Lever Clamp Bolt	12	1.2	106 in·lb	
Clutch Cover Bolts (M6, L = 25)	12	1.2	106 in·lb	
Clutch Cover Bolts (M6, L = 50)	12	1.2	106 in·lb	
Clutch Cover Bolt (M6, L = 70)	12	1.2	106 in·lb	L
<b>Engine Lubrication System</b>				
Oil Fitting Bracket Bolts (L = 20 mm)	12	1.2	106 in·lb	L
Oil Fitting Bracket Bolt (L = 25 mm)	12	1.2	106 in·lb	L
Oil Filler Cap	1.5	0.15	13 in·lb	(Hand tighten)
Oil Filter Cap Bolts	12	1.2	106 in·lb	L
Oil Filter	17	1.7	13	
Oil Filter Passage Pipe	25	2.5	18	SS
Oil Pressure Relief Nozzle	3.4	0.35	30 in·lb	
Oil Passage Nozzle	3.4	0.35	30 in·lb	
Oil Pressure Switch Plug	20	2.0	15	L
Oil Pressure Switch	15	1.5	11	SS
Oil Pump Cover Bolts	9.8	1.0	87 in·lb	L
Oil Pump Gear Bolt	12	1.2	106 in·lb	L
Oil Pipe Plate Bolt	9.8	1.0	87 in·lb	L
Oil Pressure Relief Valve	15	1.5	11	HL
Oil Drain Plug	29	3.0	21	
Oil Pan Bolts	12	1.2	106 in·lb	L (2)
<b>Engine Removal/Installation</b>				
Engine Bracket Bolts (L = 60 mm)	25	2.5	18	
Engine Bracket Bolts (L = 16 mm)	25	2.5	18	
Engine Mounting Nuts	44	4.5	32	R
Lower Engine Mounting Nut	59	6.0	44	R
<b>Crankshaft/Transmission</b>				
Connecting Rod Big End Cap Nuts	see the text	←	←	MO
Breather Cap Bolts	12	1.2	106 in·lb	

**Torque and Locking Agent**

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Starter Motor Clutch Bolts	34	3.5	25	L
Breather Plate Screws	4.9	0.50	43 in·lb	L
External Shift Mechanism Cover Bolts (M6, L = 35 mm)	12	1.2	106 in·lb	
Neutral Switch Screws	3.9	0.40	35 in·lb	L
External Shift Mechanism Cover Bolts (M6, L = 25 mm)	12	1.2	106 in·lb	L
Return Spring Pin	42	4.3	31	L
Rear Engine Cover Bolts (M6, L = 30 mm)	12	1.2	106 in·lb	
Rear Engine Cover Bolts (M6, L = 22 mm)	12	1.2	106 in·lb	
Upper Crankcase Bolts (M8, L = 73 mm)	29	3.0	21	CP (1)
Upper Crankcase Bolt (M6, L = 45 mm)	20	2.0	15	
Upper Crankcase Bolt (M6, L = 70 mm)	20	2.0	15	
Upper Crankcase Bolts (M6, L = 117 mm)	20	2.0	15	
Upper Crankcase Bolts (M8, L = 50 mm)	29	3.0	21	
Lower Crankcase Bolts (M9, L = 130 mm)	41	4.2	30	S, MO
Lower Crankcase Bolts (M9, L = 110 mm)	41	4.2	30	S, MO
Lower Crankcase Bolt (M9, L = 90 mm)	41	4.2	30	S, MO
Lower Crankcase Bolts (M6, L = 45 mm)	20	2.0	15	S
Lower Crankcase Bolts (M8, L = 73 mm)	29	3.0	21	S, MO, CP (1)
Lower Crankcase Bolt (M6, L = 32 mm)	20	2.0	15	S
Lower Crankcase Bolt (M8, L = 60 mm)	29	3.0	21	S, MO
Shift Drum Cam Bolt	12	1.2	106 in·lb	L
Shift Drum Bearing Holder Screw	4.9	0.50	43 in·lb	S, L
Shift Drum Bearing Holder Bolt	12	1.2	106 in·lb	S, L
Gear Positioning Lever Bolt	12	1.2	106 in·lb	L
<b>Wheels/Tires</b>				
Spoke Nipples	5.2	0.53	46 in·lb	
Front Axle Clamp Bolt	20	2.0	15	
Front Axle Nut	98	10	72	
Rear Axle Nut	98	10	72	
<b>Final Drive</b>				
Engine Sprocket Cover Bolts	12	1.2	106 in·lb	L
Engine Sprocket Nut	127	13	94	MO
Rear Sprocket Nuts	59	6.0	44	R
<b>Brakes</b>				
Brake Reservoir Cap Screws	1.5	0.15	13 in·lb	
Brake Lever Pivot Bolt	1.0	0.10	9 in·lb	Si
Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
Master Cylinder Clamp Bolts	11	1.1	97 in·lb	S
Front Brake Light Switch Screw	1.2	0.12	11 in·lb	
Brake Hose Banjo Bolts	25	2.5	18	
Brake Disc Mounting Bolts	23	2.3	17	

## 2-8 PERIODIC MAINTENANCE

### Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Caliper Mounting Bolts	34	3.5	25	
Bleed Valve	7.8	0.80	69 in·lb	
Brake Pedal Bolt (EJ800AB)	25	2.5	18	
Brake Pedal Bolt (EJ800AC)	34	3.5	25	
Torque Link Bolt	32	3.3	24	
Torque Link Nut	32	3.3	24	
Cam Lever Bolt	19	1.9	14	
<b>Suspension</b>				
Front Fork Top Plugs	23	2.3	17	
Front Fork Clamp Bolts (Upper)	20	2.0	15	
Front Axle Clamp Bolt	20	2.0	15	
Front Fork Bottom Allen Bolts	30	3.1	22	L
Front Fork Clamp Bolts (Lower)	29	3.0	21	
Rear Shock Absorber Nuts	59	6.0	44	
Rear Shock Absorber Bolts	44	4.5	32	
Swingarm Pivot Shaft Nut	98	10	72	
Torque Link Bolt	32	3.3	24	
Torque Link Nut	32	3.3	24	
<b>Steering</b>				
Handlebar Clamp Bolts	25	2.5	18	S
Steering Stem Head Nut	49	5.0	36	
Front Fork Clamp Bolts (Upper)	20	2.0	15	
Steering Stem Nut	4.9	0.50	43 in·lb	
Front Fork Clamp Bolts (Lower)	29	3.0	21	
<b>Frame</b>				
Rear View Mirror Locknut (Upper)	30	3.1	22	G, Lh
Rear View Mirror Nut (Lower)	30	3.1	22	
Sidestand Switch Bolt	8.8	0.9	78 in·lb	L
Sidestand Bolt	44	4.5	32	
Sidestand Nut	44	4.5	32	R
Front Step Mounting Bolts	59	6.0	44	
Center Stand Bolt	44	4.5	32	
Grab Rail Bolts	25	2.5	18	
<b>Electrical System</b>				
Tail/Brake Light Mounting Nuts	5.9	0.60	52 in·lb	
Starter Motor Terminal Locknut	11	1.1	97 in·lb	
Starter Motor Mounting Bolts	9.8	1.0	87 in·lb	L
Starter Motor Through Bolts	4.9	0.50	43 in·lb	
Starter Motor Cable Terminal Nut	4.9	0.50	43 in·lb	
One-Way Clutch Mounting Allen Bolts	34	3.5	25	L
Stator Coil Bolts	12	1.2	106 in·lb	L
Alternator Rotor Bolt	155	15.8	114	MO
Alternator Lead Holding Plate Bolts	7.8	0.80	69 in·lb	L



**Torque and Locking Agent**

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Crankshaft Sensor Bracket Bolt (L = 45 mm)	12	1.2	106 in·lb	L
Crankshaft Sensor Bracket Bolts (L = 40 mm)	12	1.2	106 in·lb	L
Crankshaft Sensor Bolts	7.8	0.80	69 in·lb	L
Crankshaft Sensor Lead Guard Plate Bolts	10	1.0	89 in·lb	L
Oil Pressure Switch	15	1.5	11	SS
Speed Sensor Mounting Bolt	4.5	0.46	40 in·lb	L
Neutral Switch Screws	3.9	0.40	35 in·lb	L
Alternator Cover Bolts (M6, L = 35 mm)	12	1.2	106 in·lb	(L, 2)
Alternator Cover Bolts (M6, L = 40 mm)	12	1.2	106 in·lb	
Alternator Cover Bolts (M6, L = 45 mm)	12	1.2	106 in·lb	
Front Brake Light Switch Screw	1.2	0.12	11 in·lb	
Spark Plugs	13	1.3	115 in·lb	
Sidestand Switch Bolt	8.8	0.9	78 in·lb	L
Fuel Reserve Switch Screws	2.1	0.21	19 in·lb	
Oxygen Sensor	25	2.5	18	

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

**Basic Torque for General Fasteners**

Threads Diameter (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	23.0 ~ 33.0	165 ~ 240

## 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	1 200 ±50 r/min (rpm)	---
Throttle Body Vacuum	21.3 ~ 26.7 kPa (160 ~ 200 mmHg) at idle speed (for reference)	---
Engine Synchronization Vacuum	Less than 2.4 kPa (18 mmHg) difference between both cylinders	---
Air Cleaner Element	Polyurethane Foam	---
<b>Engine Top End</b>		
Valve Clearance:		
Exhaust	0.14 ~ 0.19 mm (0.0055 ~ 0.0075 in.)	---
Intake	0.08 ~ 0.13 mm (0.0031 ~ 0.0051 in.)	---
<b>Clutch</b>		
Clutch Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	---
<b>Engine Lubrication System</b>		
Engine Oil:		
Type	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2	---
Viscosity	SAE 10W-40	---
Capacity	2.7 L (2.9 US qt) (when filter is not removed)	---
	2.9 L (3.1 US qt) (when filter is removed)	---
	3.2 L (3.4 US qt) (when engine is completely dry)	---
Level	Between upper and lower level lines (Wait 2 ~ 3 minutes after idling or running)	---
<b>Wheels/Tires</b>		
Tread Depth:		
Front	4.4 mm (0.17 in.)	1 mm (0.04 in.)
Rear	7.4 mm (0.29 in.)	2 mm (0.08 in.) up to 130km/h (80 mph) 3 mm (0.12 in.) over 130km/h (80 mph)
Air Pressure (When Cold):		
Front	200 kPa (2.0 kgf/cm <sup>2</sup> , 28 psi)	---
Rear	Up to 97.5 kg (215 lb) load: 225 kPa (2.25 kgf/cm <sup>2</sup> , 32 psi)	---
	Over 97.5 kg (215 lb) load: 250 kPa (2.50 kgf/cm <sup>2</sup> , 36 psi)	---
Rim Runout:		
Front:		
Axial	TIR 0.7 mm (0.03 in.) or less	TIR 2.0 mm (0.08 in.)
Radial	TIR 1 mm (0.04 in.) or less	TIR 2.0 mm (0.08 in.)
Rear:		
Axial	TIR 0.8 mm (0.03 in.) or less	TIR 2.0 mm (0.08 in.)
Radial	TIR 1.2 mm (0.05 in.) or less	TIR 2.0 mm (0.08 in.)

**Specifications**

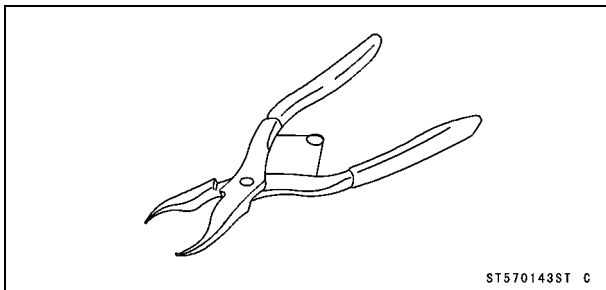
Item	Standard	Service Limit
<b>Final Drive</b>		
Drive Chain Slack	25 ~ 35 mm (1.0 ~ 1.4 in.)	---
20-link Length	317.5 ~ 318.2 mm (12.50 ~ 12.53 in.)	319 mm (12.6 in.)
Standard Chain:		
Make	ENUMA	---
Type	EK520MVXL	---
Link	104 links	---
<b>Brakes</b>		
Brake Fluid:		
Grade	DOT4	---
Brake Pedal Free Play	20 ~ 30 mm (0.8 ~ 1.2 in.)	---
Brake Pad Lining Thickness	4.5 mm (0.18 in.)	1 mm (0.04 in.)
Brake Shoe Lining Thickness	3.55 ~ 3.85 mm (0.140 ~ 0.152 in.)	1.85 mm (0.073 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:		
Type	NGK CR8E	---

## 2-12 PERIODIC MAINTENANCE

### Special Tools

**Inside Circlip Pliers:**

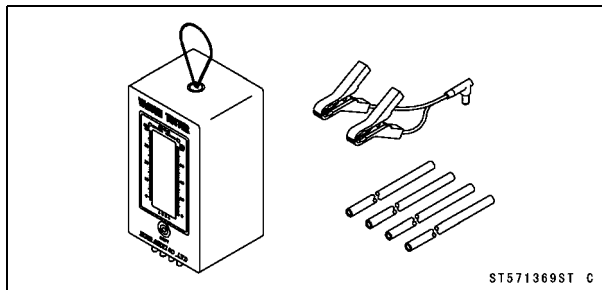
**57001-143**



ST570143ST C

**Vacuum Gauge:**

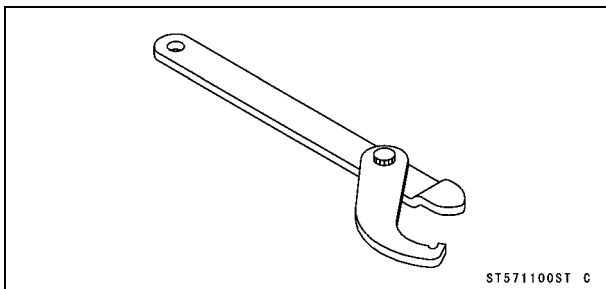
**57001-1369**



ST571369ST C

**Steering Stem Nut Wrench:**

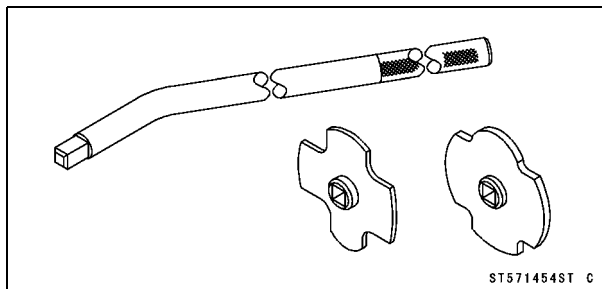
**57001-1100**



ST571100ST C

**Filler Cap Driver:**

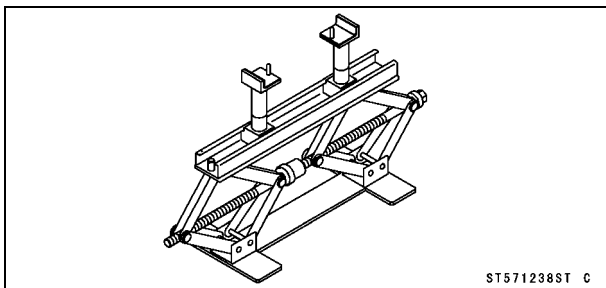
**57001-1454**



ST571454ST C

**Jack:**

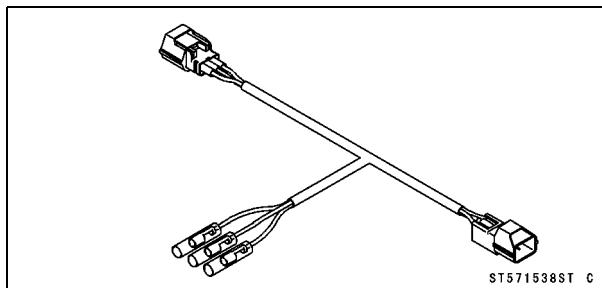
**57001-1238**



ST571238ST C

**Throttle Sensor Setting Adapter:**

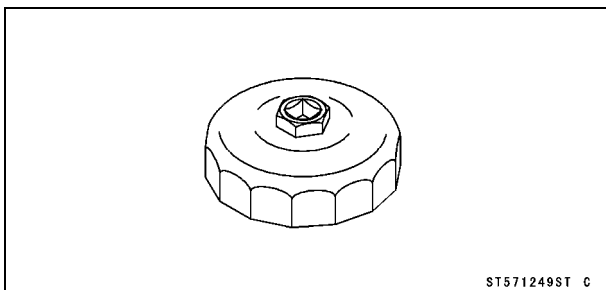
**57001-1538**



ST571538ST C

**Oil Filter Wrench:**

**57001-1249**



ST571249ST C

**Periodic Maintenance Procedures**

**Fuel System**

**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.

**⚠ WARNING**

If dirt or dust is allowed to pass through into the throttle body assy, the throttle may become stuck, possibly causing accident. Replace the air cleaner element according to the maintenance chart.

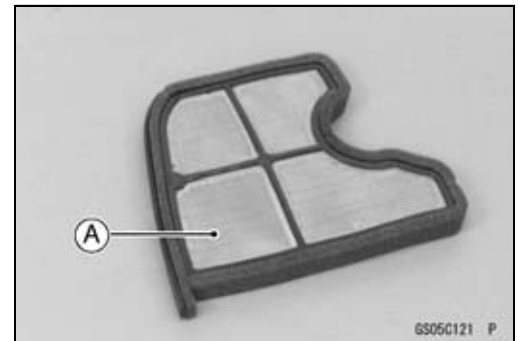
**NOTICE**

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

**⚠ WARNING**

Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the element in a well-ventilated area, and take care that there is no spark or flame anywhere near the working areas. Do not use gasoline or low-flash point solvents to clean the element.

- Remove the air cleaner element (see Air Cleaner Element Replacement).
- Clean the element [A] in a bath of high-flash point solvent, and then dry it with compressed air or by squeezing it.
- After cleaning, saturate the element with SG, SH, SJ, SL or SM class engine oil, squeeze out the excess oil, then wrap it in a clean rag and squeeze it as dry as possible.
- Visually inspect the element for tears or breaks.
- ★ If the element has any tears or breaks, replace the element with a new one.
- Install the element (see Air Cleaner Element Replacement).

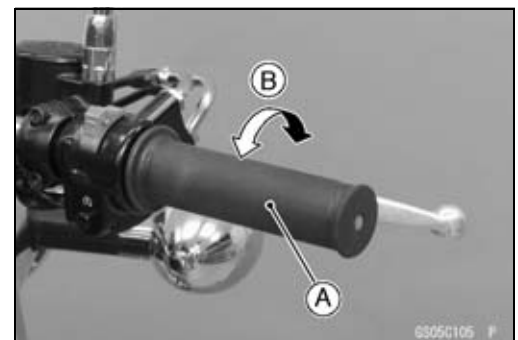


**Throttle Control System Inspection**

- Check that the throttle grip [A] moves smoothly from full open to close, and the throttle closes quickly and completely by the return spring in all steering positions.
- ★ If the throttle grip does not return properly, check the throttle cable routing, grip free play, and cable damage. Then lubricate the throttle cable.
- Check the throttle grip free play [B].

**Throttle Grip Free Play**

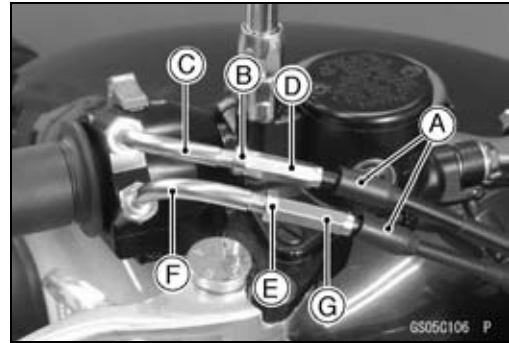
Standard: 2 ~ 3 mm (0.08 ~ 0.12 in.)



## 2-14 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- ★ If the free play is incorrect, adjust the throttle cable as follows.
- Slide the rubber boots [A].
- Loosen the locknut [B] at the accelerator cable [C], screw in the adjuster [D].
- Loosen the locknut [E] at the decelerator cable [F].
- When the throttle grip full close, turn the adjuster [G] does not free play.
- Tighten the locknut.
- Turn the accelerator cable adjuster of the throttle grip free play is obtained.
- Tighten the locknut.



#### **⚠ WARNING**

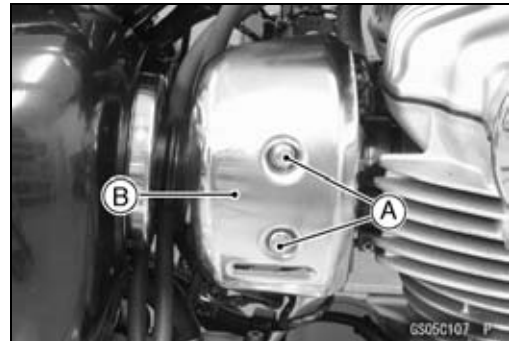
Operation with improperly adjusted, incorrectly routed or damaged cables could result in an unsafe riding condition. Follow the service manual to be make sure to correct any of these conditions.

### **Engine Vacuum Synchronization Inspection**

#### **NOTE**

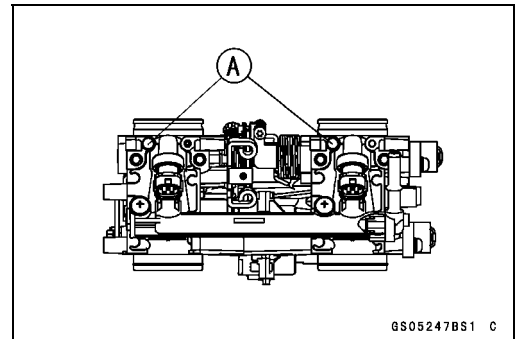
○ These procedures are explained on the assumption that the intake and exhaust systems of the engine are in good condition.

- Remove:
  - Bolts [A]
  - Cover [B]

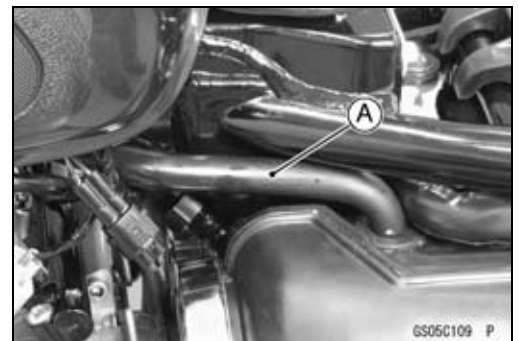


**Periodic Maintenance Procedures**

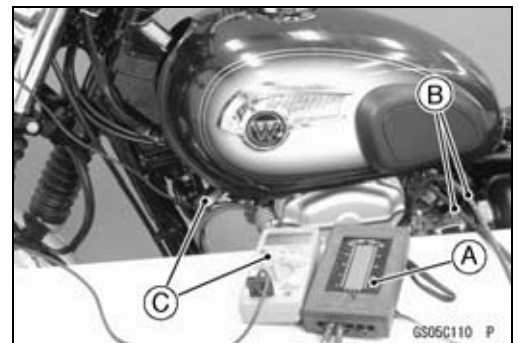
- Situate the motorcycle so that it is vertical.
- Pull off the rubber caps [A] from the fittings of each throttle body.



- Remove the left side cover (see Left Side Cover Removal in the Frame chapter).
- Pull off the air switching valve hose [A] from the air cleaner housing.
- Plug the air switching valve hose end and air cleaner housing fitting.



- Connect a vacuum gauge [A] (special tool) and hoses [B] to the fittings on the throttle body.
- **Special Tool - Vacuum Gauge: 57001-1369**
- Connect a highly accurate tachometer [C] to one of the spark plug cable.



## 2-16 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

---

- Start the engine and warm it up thoroughly.
- Check the idle speed, using a highly accurate tachometer.

#### Idle Speed

**Standard:** 1 200 ±50 r/min (rpm)

- ★ If the idle speed is out of the specified range, adjust it with the adjusting screw (see Idle Speed Adjustment).

#### NOTICE

**Do not measure the idle speed by the tachometer of the meter unit.**

- While idling the engine, inspect the throttle body vacuum, using the vacuum gauge.
- If the throttle vacuum difference between the two cylinders exceeds the limit, adjust the synchronization.

#### Engine Vacuum Synchronization

**Less than 2.4 kPa (18 mmHg) difference between both cylinders**

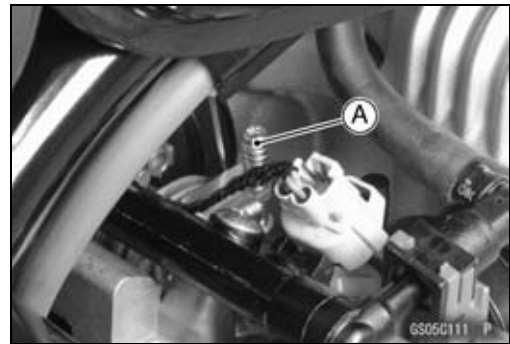
#### Throttle Body Vacuum

**Standard:** 21.3 ~ 26.7 kPa (160 ~ 200 mmHg) at idle speed (for reference)

#### NOTE

○ This model is not equipped with bypass screw.

- Turn the adjusting screw [A] synchronize the throttle body.
- Open and close the throttle valves after each measurement and adjust the idle speed as necessary.
- Inspect the vacuums as before.



- ★ If the vacuums are correct, check the output voltage of the main throttle sensor (see Main Throttle Sensor Output Voltage Inspection in the Fuel System (DFI) chapter).

**Special Tool - Throttle Sensor Setting Adapter: 57001-1538**

#### Main Throttle Sensor Output Voltage

**Connections to Adapter:**

**Digital Meter (+)** → R (sensor Y/W) lead

**Digital Meter (-)** → W (sensor BR/BK) lead

**Standard:** DC 1.06 ~ 1.10 V at idle throttle opening

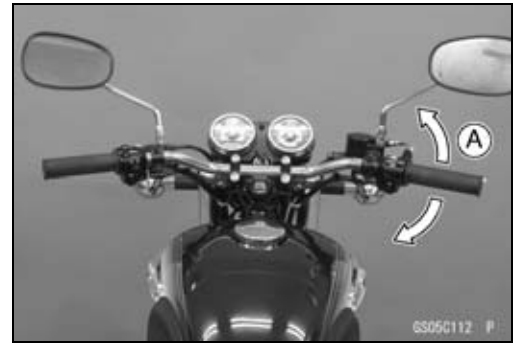
- ★ If the output voltage is out of the standard, check the input voltage of the main throttle sensor (see Main Throttle Sensor Input Voltage Inspection in the Fuel System (DFI) chapter).
- Remove the vacuum gauge hoses and install the rubber caps on the original position.



**Periodic Maintenance Procedures**

**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.
- With the engine idling, turn the handlebar to both sides [A].
- ★ 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 Throttle Control System Inspection and 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. Follow the service manual to be make sure to correct any of these conditions.**

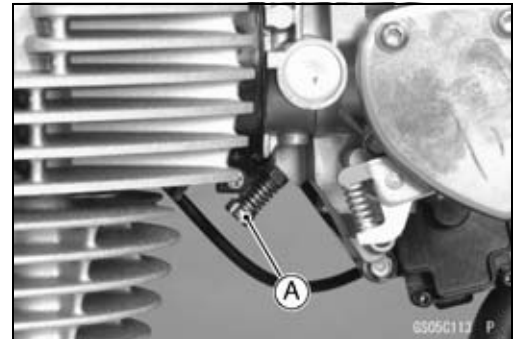
- Check the idle speed.

**Idle Speed**

**Standard: 1 200 ±50 r/min (rpm)**

**Idle Speed Adjustment**

- Start the engine and warm it up thoroughly.
- 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.

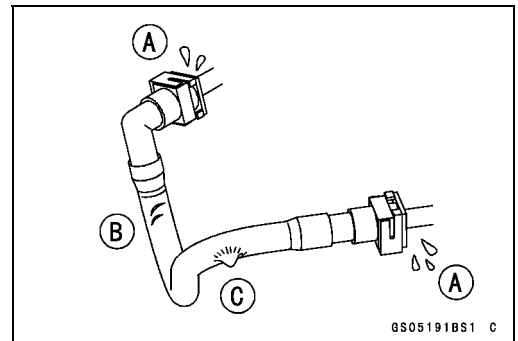


**⚠ WARNING**

**The engine gets extremely hot during normal operation and can cause serious burns. Never touch a hot engine.**

**Fuel Hose and Pipe Inspection (fuel leak, damage, installation condition)**

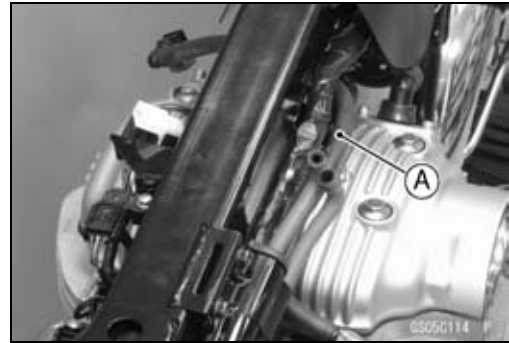
- If the motorcycle is not properly handled, the high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter) and check the fuel hoses.
- ★ Replace the fuel hose if any fraying, cracks [B] or bulges [C] are noticed.



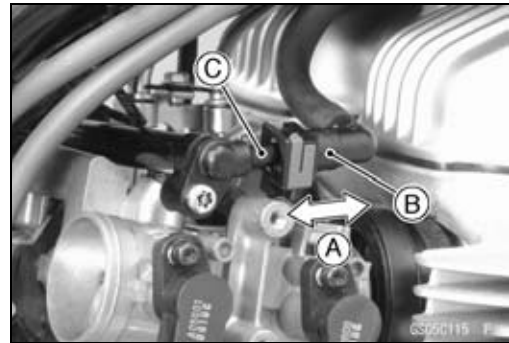
## 2-18 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Check that the fuel hose [A] are routed according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- ★ Replace the hose if it has been sharply bent or kinked.



- Check that the fuel hose joints are securely connected.
- Push and pull [A] the fuel hose joint [B] back and forth more than two times, and make sure it is locked.
- Check the other hose joint in the same way.



#### NOTICE

When pushing and pulling the fuel hose joint, do not apply strong force to the delivery pipe [C] on the nozzle assy and the pipe on the fuel pump. The pipe made from resin could be damaged.

#### ⚠ WARNING

Operation with improperly adjusted, incorrectly routed or damaged cables could result in an unsafe riding condition. Follow the service manual to be make sure to correct any of these conditions.

- ★ If it does not locked, reinstall the hose joint.

### Engine Top End

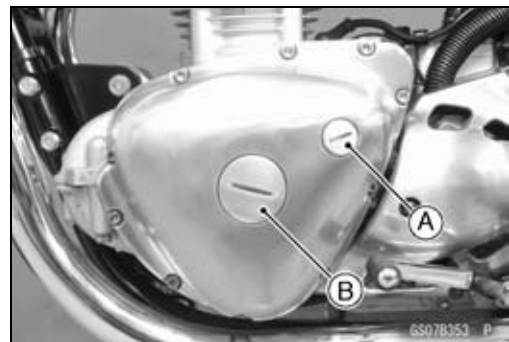
#### Valve Clearance Inspection

##### NOTE

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

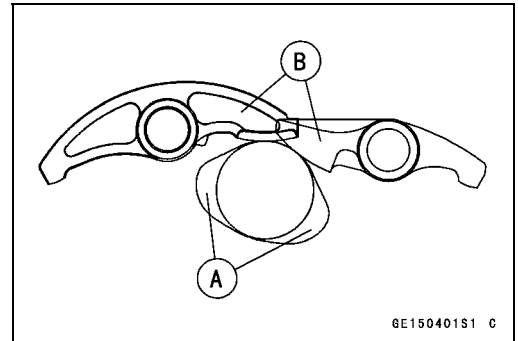
- Remove:
  - Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  - Cylinder Head Cover (see Cylinder Head Cover Removal in the Engine Top End chapter)
  - Timing Inspection Cap [A]
  - Timing Rotor Bolt Cap [B]

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

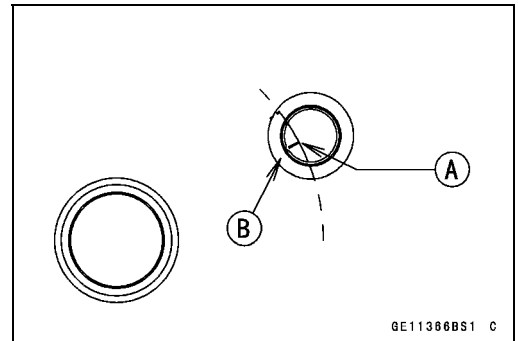


**Periodic Maintenance Procedures**

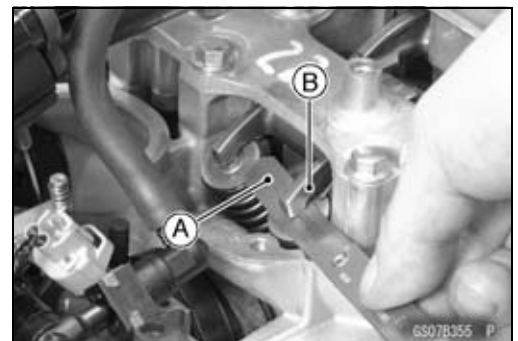
- Bring the piston to the TDC of its compression stroke to inspect the valve clearance (the position at the end of the compression stroke, with the cam lobes [A] facing in the direction opposite the rocker arm [B]).



- Place a wrench over the rotor bolt and turn it counterclockwise to align the TDC mark [A] with the timing notch [B].



- Using a thickness gauge [A], measure the clearance between each rocker arm [B] and shim.
- For the purpose of adjusting the valve clearances, record the measured values.



**Valve Clearance Standard:**

<b>Exhaust</b>	<b>0.14 ~ 0.19 mm (0.0055 ~ 0.0075 in.)</b>
<b>Intake</b>	<b>0.08 ~ 0.13 mm (0.0031 ~ 0.0051 in.)</b>

**NOTE**

- Check the valve clearance using this method only. Checking the clearance at any other cam position may result in improper valve clearance.

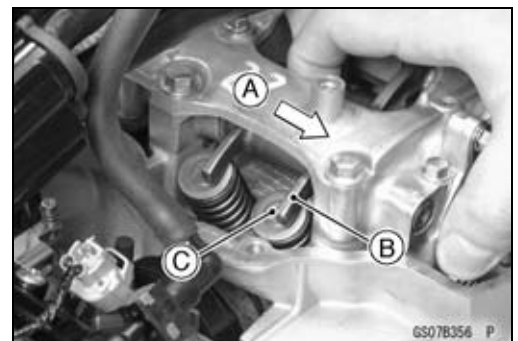
- ★ If the valve clearance is not within the specified range, adjust it.

**Valve Clearance Adjustment**

- To change the valve clearance, slide [A] the rocker arm [B] to the spring side and change the shim [C]. Replace the shim with one of a different thickness.
- To slide the rocker arm on the intake side, first move the rocker arm on the exhaust side.

**NOTE**

- Mark and record the shim locations so that the shims can be reinstalled in their original positions.
- If there is no clearance, select a shim which is several sizes smaller and then measure the clearance.



## 2-20 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

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- To select a new shim which brings the valve clearance within the specified range, refer to the Valve Clearance Adjustment Charts.
- Remeasure any valve clearance that was adjusted. Readjust if necessary.

#### ***NOTICE***

**Do not put shim stock under the shim. This may cause the shim to pop out at high rpm, causing extensive engine damage.**

**Do not grind the shim. This may cause it to fracture, causing extensive engine damage.**

#### ***NOTICE***

**When returning the rocker arm to its original position after adjusting the valve clearance on the intake side, make sure to also return the rocker arm on the exhaust side to its original position.**

Periodic Maintenance Procedures

VALVE CLEARANCE ADJUSTMENT CHART INTAKE VALVE

	Present shim															Example					
Part No. (92180-)	1014	1016	1018	1020	1022	1024	1026	1028	1030	1032	1034	1036	1038	1040	1042	1044	1046	1048	1050	1052	1054
Mark	50	55	60	65	70	75	80	85	90	95	00	5	10	15	20	25	30	35	40	45	50
Thickness (mm)	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50

Valve clearance measurement (mm)	0.00~0.03	-	-	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	
	0.04~0.07	-	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	
	0.08~0.13	Specified Valve Clearance/No change required																					
	0.14~0.18	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50		
	0.19~0.23	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50			
	0.24~0.28	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50				
	0.29~0.33	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50					
	0.34~0.38	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50						
	0.39~0.43	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50							
	0.44~0.48	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50								
	0.49~0.53	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50									
	0.54~0.58	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50										
	0.59~0.63	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50											
	0.64~0.68	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50												
	0.69~0.73	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50													
	0.74~0.78	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50														
	0.79~0.83	3.20	3.25	3.30	3.35	3.40	3.45	3.50															
	0.84~0.88	3.25	3.30	3.35	3.40	3.45	3.50																
	0.89~0.93	3.30	3.35	3.40	3.45	3.50																	
	0.94~0.98	3.35	3.40	3.45	3.50																		
0.99~1.03	3.40	3.45	3.50																				
1.04~1.08	3.45	3.50																					
1.09~1.13	3.50																						

Example: An arrow points from the word "Example" to the 0.34~0.38 row and the 2.95 column. Another arrow points from the word "Example" to the 0.35 column and the 0.34~0.38 row. A third arrow points from the text "Install the shim of this thickness (mm)." to the 3.20 column.

GE15025BW3 C

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect. This shim will give the proper clearance.

**Example:** Present shim is **2.95 mm** (0.116 in.)  
 Measured clearance is **0.35 mm** (0.014 in.)  
 Replace **2.95 mm** (0.116 in.) shim with **3.20 mm** (0.126 in.) shim.

5. Remeasure the valve clearance and readjust if necessary.

# 2-22 PERIODIC MAINTENANCE

## Periodic Maintenance Procedures

### VALVE CLEARANCE ADJUSTMENT CHART EXHAUST VALVE

	Present shim														Example									
Part No. (92180-)	1014	1016	1018	1020	1022	1024	1026	1028	1030	1032	1034	1036	1038	1040	1042	1044	1046	1048	1050	1052	1054			
Mark	50	55	60	65	70	75	80	85	90	95	00	5	10	15	20	25	30	35	40	45	50			
Thickness (mm)	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50			

0.00~0.04	-	-	-	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35
0.05~0.08	-	-	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40
0.10~0.13	-	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45
0.14~0.19	Specified Valve Clearance/No change required																				
0.20~0.24	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50	
0.25~0.29	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50		
0.30~0.34	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50			
0.35~0.39	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50				
0.40~0.44	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50					
0.45~0.49	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50						
0.50~0.54	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50							
0.55~0.59	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50								
0.60~0.64	2.95	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50									
0.65~0.69	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50										
0.70~0.74	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50											
0.75~0.79	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50												
0.80~0.84	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50													
0.85~0.89	3.20	3.25	3.30	3.35	3.40	3.45	3.50														
0.90~0.94	3.25	3.30	3.35	3.40	3.45	3.50															
0.95~0.99	3.30	3.35	3.40	3.45	3.50																
1.00~1.04	3.35	3.40	3.45	3.50																	
1.05~1.09	3.40	3.45	3.50																		
2.00~2.04	3.45	3.50																			
2.05~2.09	3.50																				

Example →

←

Install the shim of this thickness (mm).

GE150248W3 C

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect. This shim will give the proper clearance.

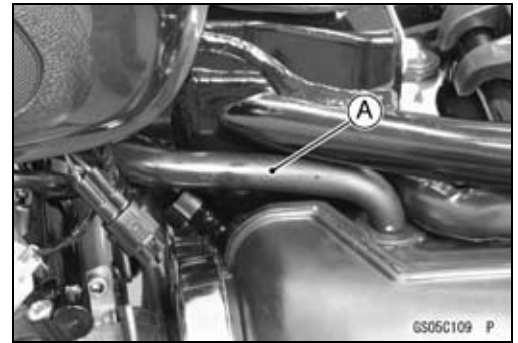
**Example:** Present shim is **2.95 mm** (0.116 in.)  
 Measured clearance is **0.38 mm** (0.015 in.)  
 Replace **2.95 mm** (0.116 in.) shim with **3.15 mm** (0.124 in.) shim.

5. Remeasure the valve clearance and readjust if necessary.

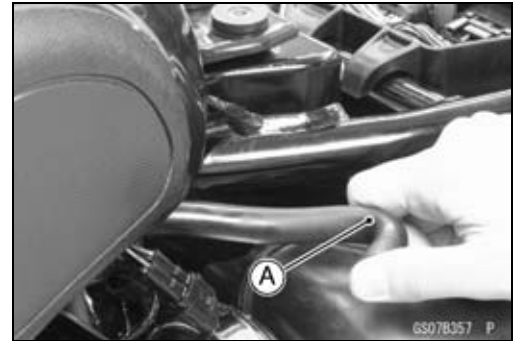
## Periodic Maintenance Procedures

### **Air Suction System Damage Inspection**

- Remove the left side cover (see Left Side Cover Removal in the Frame chapter).
- Separate the air switching valve hose [A] from the air cleaner housing.



- Start the engine and run it at idle speed.
- Plug the air switching valve hose end [A] 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 air switching valve (see Air Switching Valve Unit Test in the Electrical System chapter) or air suction valve (see Air Suction Valve Inspection in the Engine Top End chapter).



## Clutch

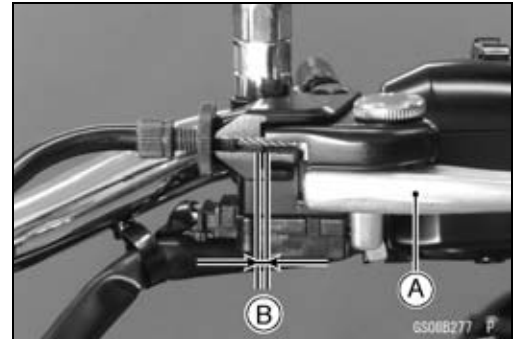
### **Clutch Operation Inspection**

- Pull the clutch lever [A] lightly, and check the clutch lever free play [B].

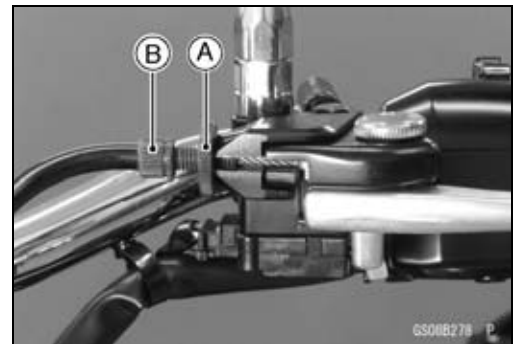
#### **Clutch Lever Free Play**

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

- ★ If the free play is incorrect, adjust it.



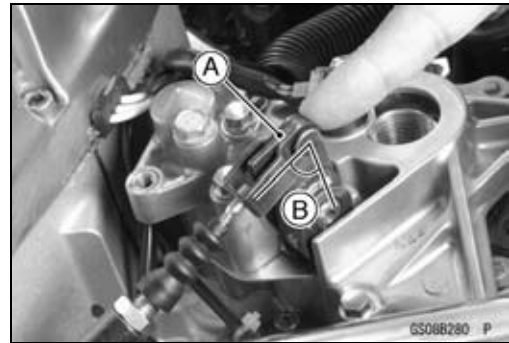
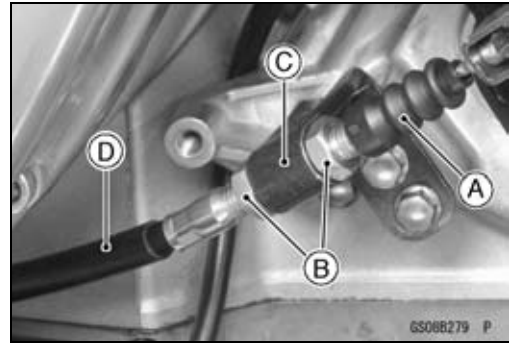
- Loosen the locknut [A].
- Turn the adjuster [B] to adjust the free play.
- Tighten the locknut.
- ★ If the free play can not be adjusted with the adjuster at the clutch lever, use the adjuster at the lower end of the clutch cable.



## 2-24 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Remove the engine sprocket cover (see Engine Sprocket Cover Removal in the Final Drive chapter).
  - Slide the dust cover [A].
  - Loosen both adjusting nuts [B] at the bracket [C] on the clutch cover as far as they will go.
  - Pull the clutch outer cable [D] tight and tighten the adjusting nuts against the bracket.
  - Turn the adjuster at the clutch lever until the free play is correct.
- 
- Push the release lever [A] toward the front of the motorcycle until it becomes hard to turn.
  - At this time, the release lever should have the proper angle shown.  
83° [B]
  - ★ If the angle is wrong, check the clutch and release parts for wear.



#### **⚠ WARNING**

**Too much cable play can prevent clutch disengagement and cause an accident resulting in serious injury or death. When adjusting the clutch or replacing the cable, be sure the upper end of the clutch outer cable is fully seated in its fitting, or it could slip into place later, creating enough cable play to prevent clutch disengagement.**

- After the adjustment, start the engine and check that the clutch does not slip and that it releases properly.

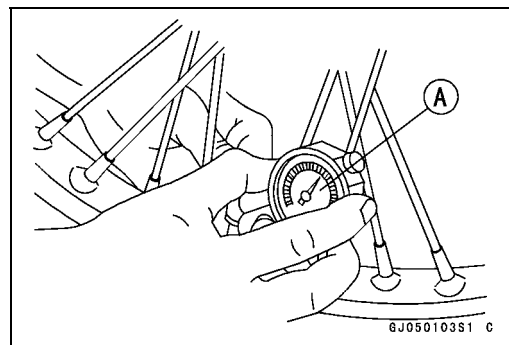
### Wheels/Tires

#### ***Tire Air Pressure Inspection***

- Remove the air valve cap.
- 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).
- Install the air valve cap.
- ★ Adjust the tire air pressure according to the specifications if necessary.

#### **Air Pressure (when Cold)**

<b>Front:</b>	<b>200 kPa (2.00 kgf/cm<sup>2</sup>, 28 psi)</b>
<b>Rear:</b>	<b>Up to 97.5 kg (215 lb) load:</b>
	<b>225 kPa (2.25 kgf/cm<sup>2</sup>, 32 psi)</b>
	<b>Over 97.5 kg (215 lb) load:</b>
	<b>250 kPa (2.50 kgf/cm<sup>2</sup>, 36 psi)</b>

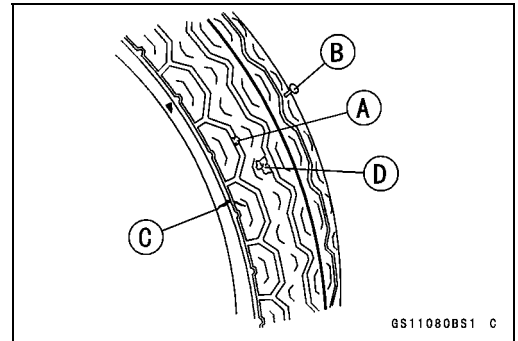




**Periodic Maintenance Procedures**

**Wheel/Tire Damage Inspection**

- Remove any imbedded stones [A] or other foreign particles [B] from tread.
  - Visually inspect the tire for cracks [C] and cuts [D], and replace the tire if necessary. Swelling or high spots indicate internal damage, requiring tire replacement.
  - Visually inspect the wheel for cracks, cuts and dents damage.
- ★ If any damage is found, replace the wheel if necessary.



**Tire Tread Wear 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.

- 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 Tire Removal/Installation in the Wheels/Tires chapter).



**Tread Depth**

**Standard:**

- Front            4.4 mm (0.17 in.)
- Rear             7.4 mm (0.29 in.)

**Service Limit:**

- Front            1 mm (0.04 in.)
- Rear             Up to 130 km/h (80 mph): 2 mm (0.08 in.)
- Over 130 km/h (80 mph): 3mm (0.12 in.)

**⚠ WARNING**

Some replacement tires may adversely affect handling and cause an accident resulting in serious injury or death. To ensure proper handling and stability, use only the recommended standard tires for replacement, inflated to the standard pressure.

**NOTE**

- Most countries may have their own regulations requiring a minimum tire tread depth; be sure to follow them.
- Have the wheel balance inspected whenever a new tire is installed.

## 2-26 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### **Wheel Bearing Damage Inspection**

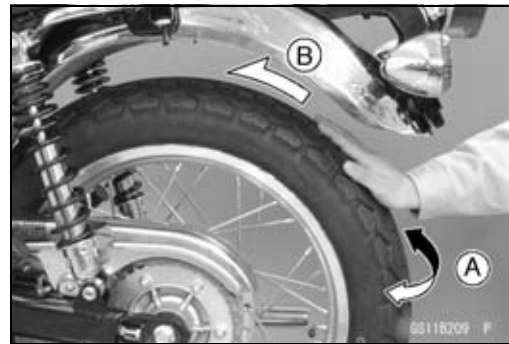
- Raise the front wheel off the ground with jack.

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

- Turn the handlebar all the way to the right or left.
- Inspect the roughness of the front wheel bearing by pushing and pulling [A] the wheel.
- Spin [B] the front wheel lightly, and check for smoothly turn, roughness, binding or noise.
- ★ If roughness, binding or noise is found, remove the front wheel and inspect the wheel bearing (see Front Wheel Removal, Hub Bearing Inspection in the Wheels/Tires chapter).



- Raise the rear wheel off the ground with the center stand.
- Inspect the roughness of the rear wheel bearing by pushing and pulling [A] the wheel.
- Spin [B] the rear wheel lightly, and check for smoothly turn, roughness, binding or noise.
- ★ If roughness, binding or noise is found, remove the rear wheel and inspect the wheel bearing (see Rear Wheel Removal, Hub Bearing Inspection in the Wheels/Tires chapter).



#### **Spoke Tightness and Rim Runout Inspection**

- Check that all the spokes are tightened evenly.
- ★ If spoke tightness is uneven or loose, tighten the spoke nipples evenly.

**Torque - Spoke Nipples: 5.2 N·m (0.53 kgf·m, 46 in·lb)**

- Check the rim runout.

#### **⚠ WARNING**

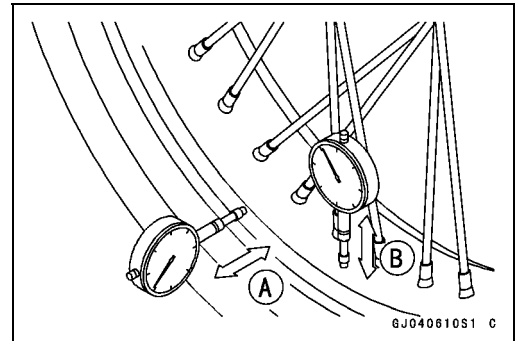
**A missing spoke places an additional load on the other spokes, which will eventually cause other spokes to break, creating the potential for an accident resulting in serious injury or death. Immediately replace any broken spoke(s).**

**Periodic Maintenance Procedures**

- Raise the front/rear wheel off the ground with jack/center stand.

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

- Inspect the rim for small cracks, dents, bending, or warping.
- ★ If there is any damage to the rim, it must be replaced.
- Set a dial gauge against the side of the rim, and rotate the rim to measure the axial runout [A]. The difference between the highest and lowest dial readings is the amount of runout.
- Set a dial gauge against the outer circumference of the rim, and rotate the rim to measure radial runout [B]. The difference between the highest and lowest dial readings is the amount of runout.
- ★ If rim runout exceeds the service limit, check the wheel bearings first. Replace them if they are damaged. If the problem is not due to the bearings, correct the rim warp (runout). A certain amount of rim warp can be corrected by recentering the rim. Loosen some spokes and tighten others within the standard torque to change the position of different parts of the rim. If the rim is badly bent, however, it must be replaced.



**Rim Runout (with tire installed)**

**Standard:**

**Front:**

- Axial** TIR 0.7 mm (0.03 in.) or less
- Radial** TIR 1 mm (0.04 in.) or less

**Rear:**

- Axial** TIR 0.8 mm (0.03 in.) or less
- Radial** TIR 1.2 mm (0.05 in.) or less

**Service Limit:**

- Axial** TIR 2.0 mm (0.08 in.)
- Radial** TIR 2.0 mm (0.08 in.)

## 2-28 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Final Drive

##### **Drive Chain Lubrication Condition Inspection**

- If a special lubricant is not available, a heavy oil such as SAE 90 is preferred to a lighter oil because it will stay on the chain longer and provide better lubrication.
- If the chain appears especially dirty, clean it before lubrication.

#### **NOTICE**

The O-rings between the side plates seal in the lubricant between the pin and the bushing. To avoid damaging the O-rings and resultant loss of lubricant, observe the following rules.

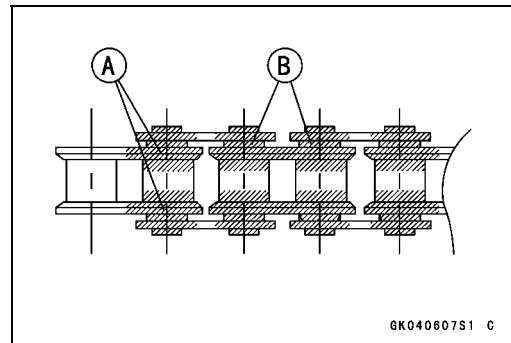
Use only kerosene or diesel oil for cleaning of the O-ring of the drive chain.

Any other cleaning solution such as gasoline or trichloroethylene will cause deterioration and swelling of the O-ring.

Immediately blow the chain dry with compressed air after cleaning.

Complete cleaning and drying the chain within 10 minutes.

- Apply oil to the sides of the rollers so that oil will penetrate to the rollers and bushings. Apply the oil to the O-rings so that the O-rings will be coated with oil.
- Wipe off any excess oil.
  - Oil Applied Areas [A]
  - O-rings [B]



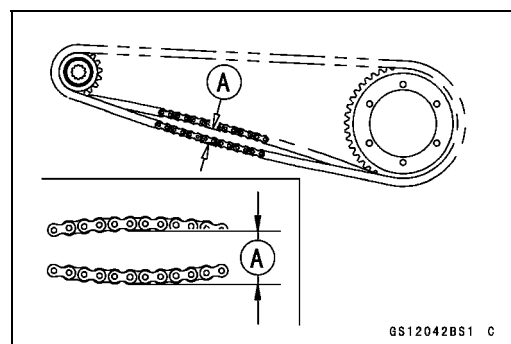
##### **Drive Chain Slack Inspection**

#### **NOTE**

- Check the slack with the motorcycle setting on its side stand.
- Clean the chain if it is dirty, and lubricate it if it appears dry.
- Check the wheel alignment (see Wheel Alignment Inspection).
- Rotate the rear wheel to find the position where the chain is tightest.
- Measure the vertical movement (chain slack) [A] midway between the sprockets.
- ★ If the chain slack exceeds the standard, adjust it.

#### **Chain Slack**

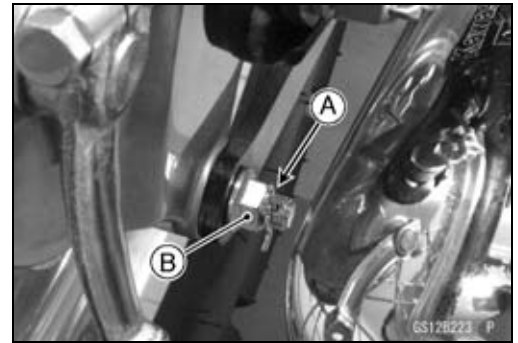
Standard: 25 ~ 35 mm (1.0 ~ 1.4 in.)



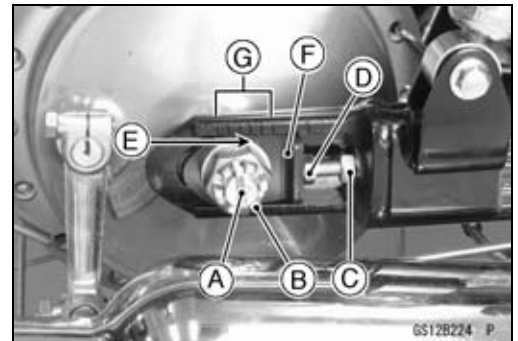
Periodic Maintenance Procedures

**Drive Chain Slack Adjustment**

- Remove the snap pin [A] and torque link nut [B].



- Remove the cotter pin [A], and loosen the rear axle nut [B].
- Loosen the both chain adjuster locknuts [C].
- ★ If the chain is too loose, turn out the left and right chain adjusters [D] evenly.
- ★ If the chain is too tight, turn in the left and right chain adjusters evenly, and kick the wheel forward.
- Turn the left and right chain adjusters evenly until the drive chain has the correct amount of slack. To keep the chain and wheel properly aligned, the notch [E] on the left wheel alignment indicator [F] should align with the same swingarm mark or position [G] that the right indicator notch aligns with.



**⚠ WARNING**

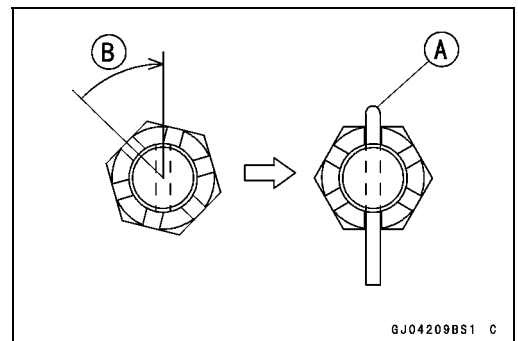
**Misalignment of the wheel will result in abnormal wear and may result in an unsafe riding condition. Be sure the wheel is properly aligned.**

- Tighten the both chain adjuster locknuts securely.
- Tighten the rear axle nut.  
**Torque - Rear Axle Nut: 98 N·m (10 kgf·m, 72 ft·lb)**
- Turn the wheel, measure the chain slack again at the tightest position, and readjust if necessary.
- Tighten the torque link nut and install the snap pin.  
**Torque - Torque Link Nut: 32 N·m (33 kgf·m, 24 ft·lb)**

- Insert a new cotter pin [A].

**NOTE**

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



GJ04209BS1 C

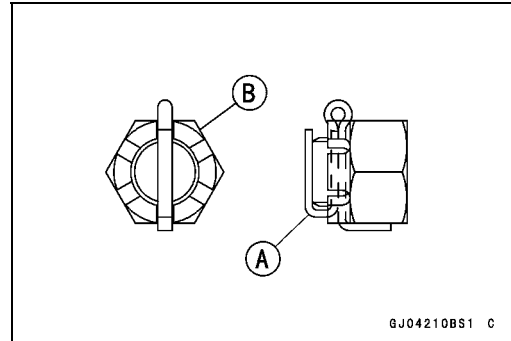
## 2-30 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Bend the cotter pin [A] over the nut [B].

#### **⚠ WARNING**

**A loose axle nut can lead to an accident resulting in serious injury or death. Tighten the axle nut to the proper torque and install a new cotter pin.**

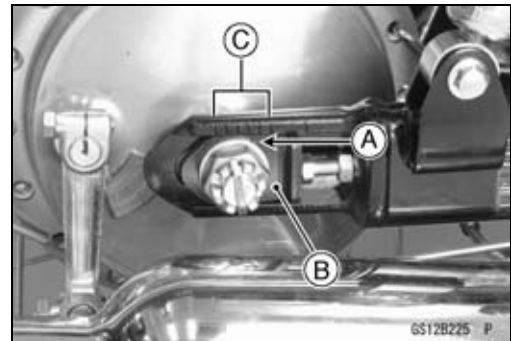


#### **Wheel Alignment Inspection/Adjustment**

- Check that the notch [A] on the right alignment indicator [B] aligns with the same swingarm mark or position [C] that the left alignment indicator notch aligns with.
- ★ If they do not, adjust the chain slack and align the wheel alignment (see Drive Chain Slack Adjustment).

#### **NOTE**

○ *Wheel alignment can be also checked using the straightedge or string method.*



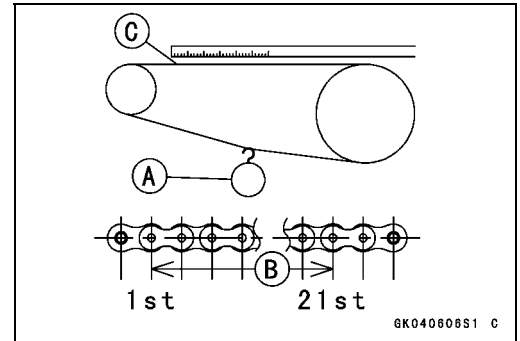
#### **⚠ WARNING**

**Misalignment of the wheel will result in abnormal wear and may result in an unsafe riding condition. Be sure the wheel is properly aligned.**

**Periodic Maintenance Procedures**

**Drive Chain Wear Inspection**

- Remove the chain cover (see Drive Chain Removal in the Final Drive chapter).
- Rotate the rear wheel to inspect the drive chain for damaged rollers, and loose pins and links.
- ★ If there is any irregularity, replace the drive chain.
- ★ Lubricate the drive chain if it appears dry.
- Stretch the chain taut by hanging a 98 N (10 kg, 20 lb) weight [A] on the chain.
- Measure the length of 20 links [B] on the straight part [C] of the chain from the pin center of the 1st pin to the pin center of the 21st pin. Since the chain may wear unevenly, take measurements at several places.
- ★ If any measurements exceed the service limit, replace the chain. Also, replace the front and rear sprockets when the drive chain is replaced.



**Drive Chain 20-link Length**

**Standard:** 317.5 ~ 318.2 mm (12.50 ~ 12.53 in.)

**Service Limit:** 319 mm (12.6 in.)

**⚠ WARNING**

A chain that breaks or jumps off the sprockets could snag on the engine sprocket or lock the rear wheel, severely damaging the motorcycle and causing it to go out of control. Inspect the chain for damage and proper adjustment before each ride. If chain wear exceeds the service limit, replace it with the standard chain. It is an endless type and should not be cut for installation.

**Standard Chain**

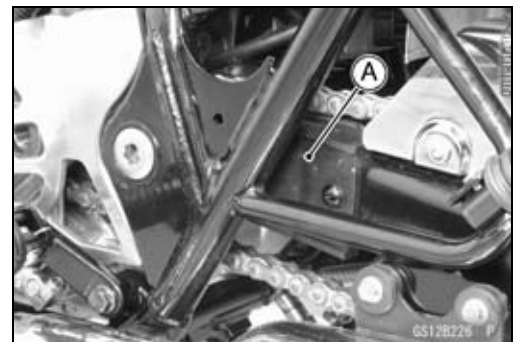
**Make:** ENUMA

**Type:** EX520MVXL

**Link:** 104 Links

**Chain Guide Wear Inspection**

- Visually inspect the chain guide [A].
- ★ Replace the chain guide if it shows any signs of abnormal wear or damage.



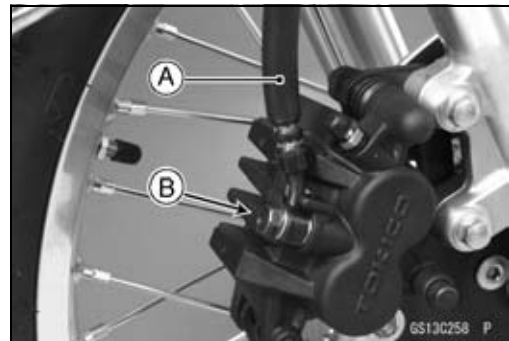
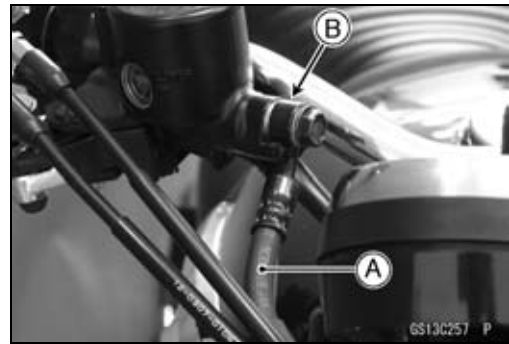
## 2-32 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Brake System

##### **Brake Fluid Leak Inspection**

- Apply the brake lever or pedal and inspect the brake fluid leak from the brake hoses [A] and fittings [B].
- ★ If the brake fluid leaked from any position, inspect or replace the problem part.



##### **Brake Hose Damage and Installation Condition Inspection**

- Inspect the brake hoses 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 crack [B], bulge [C] or leakage is noticed.
- ★ Tighten any brake hose banjo bolts and brake pipe joint nuts.

**Torque - Brake Hose Banjo Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

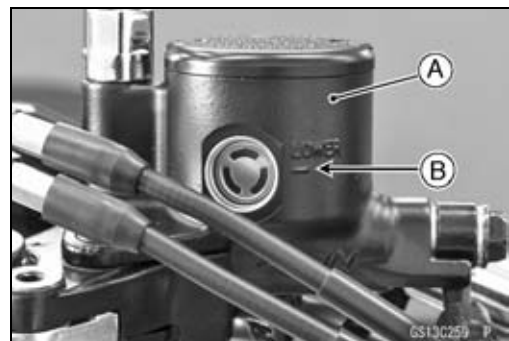
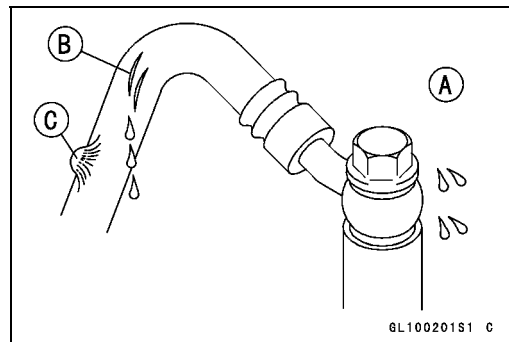
- Inspect the brake hose routing.
- ★ If any brake hose routing is incorrect, route the brake hose according to Cable, Wire, and Hose Routing section in the Appendix chapter.

##### **Brake Fluid Level Inspection**

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

##### **NOTE**

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

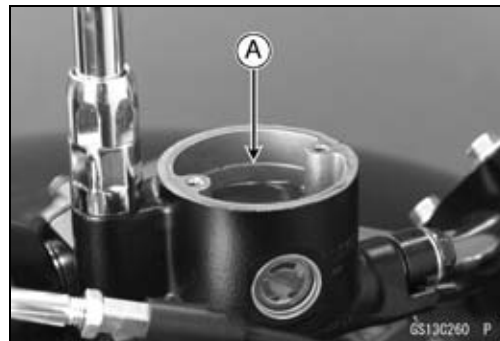




## Periodic Maintenance Procedures

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

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



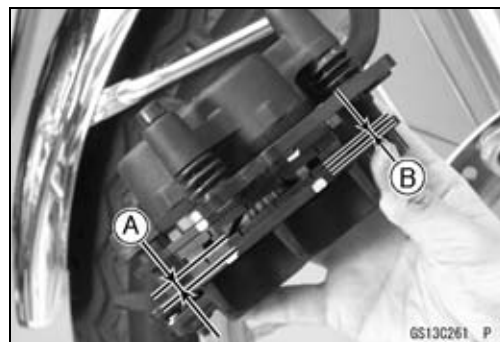
### **Brake Pad Wear Inspection**

- Remove the caliper (see Caliper Removal in the Brakes chapter).
- 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.

#### **Pad Lining Thickness**

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

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



### **Brake Operation Inspection**

- Inspect the operation of the front and rear brake by running the vehicle on the dry road.
- ★ If the brake operation is insufficiency, inspect the brake system.

### **⚠ WARNING**

**When test riding the motorcycle, be aware of surrounding traffic for your safety.**

### **Brake Pedal Free Play Inspection**

- Check the brake pedal free play [A] when the pedal is pushed down lightly by hand.

#### **Brake Pedal Free Play**

**Standard: 20 ~ 30 mm (0.8 ~ 1.2 in.)**

- ★ If the pedal has improper play, adjust it.
- Operate the pedal a few times to see that it returns to its rest position immediately upon release.
- Rotate the rear wheel to check for brake drag.
- Check braking effectiveness.
- ★ If there is any doubt as to the conditions of the brake, check the brake parts for wear or damage.



## 2-34 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

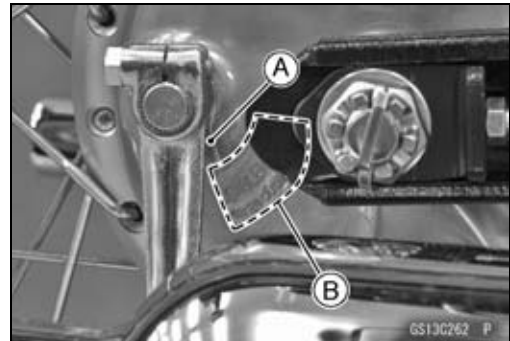
#### Brake Pedal Free Play Adjustment

- Turn the adjusting nut [A] at the brake cam lever so that the pedal has proper play.
- Operate the pedal a few times to see that it returns to its rest position immediately upon release.
- Rotate the rear wheel to check for brake drag.
- Check braking effectiveness.
- ★ If there is any doubt as to the conditions of the brake, check the brake parts for wear or damage.



#### Brake Lining Wear Inspection

- Check whether the brake lining wear indicator [A] points within the USABLE RANGE [B] when the brakes are firmly applied, or remove the brake shoes and inspect the lining thickness at few locations.
- ★ If the lining thickness is out of the range, or beyond the service limit, replace the brake shoes as a set and inspect other brake parts.
- ★ If the lining thickness is greater than the service limit, do the following before installing the shoes.
  - File or sand down any high spots on the surface of the lining.
  - Use a wire brush to remove any foreign particles from the lining.

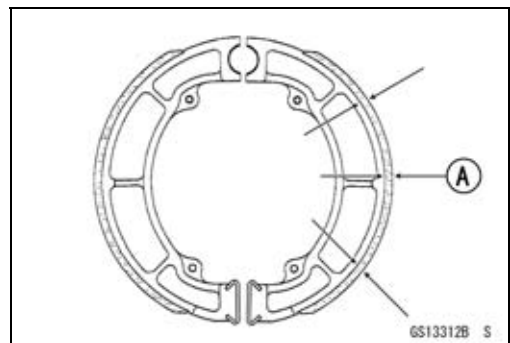


#### Brake Shoe Lining Thickness [A]

**Standard:** 3.55 ~ 3.85 mm (0.140 ~ 0.152 in.)  
(When the wear indicator is within the USABLE RANGE.)

**Service limit:** 1.85 mm (0.073 in.)  
(When the wear indicator is out of the USABLE RANGE.)

- Wash off any oil or grease with oilless cleaning fluid such as trichloroethylene or acetone.



#### **⚠ WARNING**

**These cleaning fluids are usually highly flammable and harmful if breathed for prolonged periods. Be sure to heed the fluid manufacturer's warnings.**

- Install the brake panel (see Brake Panel Installation in the Brakes chapter).

#### Brake Light Switch Operation Inspection

- Turn the ignition switch to ON.
- The brake light [A] should go on when the brake lever is applied or after the brake pedal is depressed about 10 mm (0.39 in.).

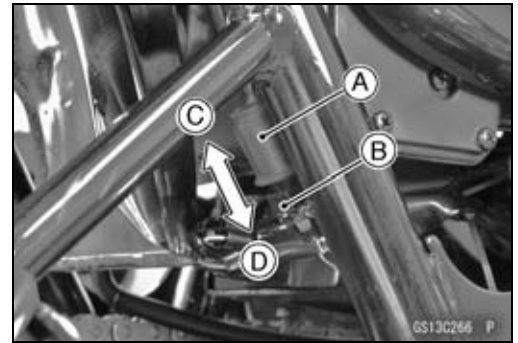


## Periodic Maintenance Procedures

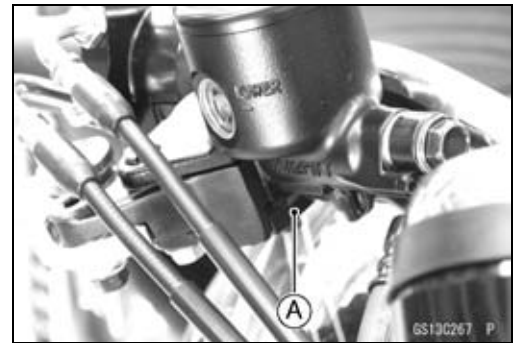
- ★ If it does not, adjust the brake light switch.
- While holding the switch body, turn the adjusting nut to adjust the switch.
  - Switch Body [A]
  - Adjusting Nut [B]
  - Light sooner as the body rises [C]
  - Light later as the body lowers [D]

### NOTICE

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



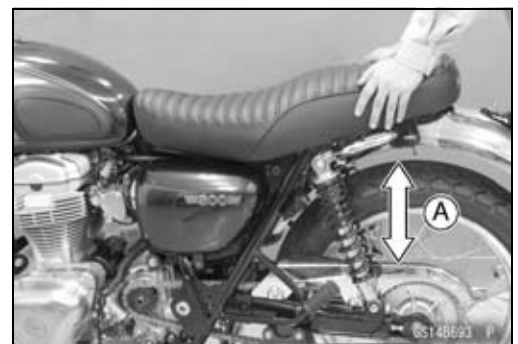
- ★ If it does not go on, inspect or replace the following items.
  - Battery (see Battery Condition in the Electrical System chapter)
  - Brake Light (see Tail/Brake Light Bulb Replacement in the Electrical System chapter)
  - Main Fuse 30 A (see Fuse Inspection in the Electrical System chapter)
  - Front Brake Light Switch [A] (see Switch Inspection in the Electrical System chapter)
  - Rear Brake Light Switch (see Switch Inspection in the Electrical System chapter)
  - Harness (see Wiring Inspection in the Electrical System chapter)



## Suspensions

### Front Forks/Rear Shock Absorber Operation Inspection

- Pump the forks down and up [A] 4 or 5 times, and inspect the smooth stroke.
  - ★ If the forks do not smoothly or noise is found, inspect the fork oil level or fork clamps (see Front Fork Oil Change in the Suspension chapter).
- 
- Pump the tail portion down and up [A] 4 or 5 times, and inspect the smooth stroke.
  - ★ If the shock absorber does not smoothly stroke or noise is found, inspect the oil leak (see Rear Shock Absorber Oil Leak Inspection).



## 2-36 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Front Forks Oil Leak Inspection

- Tuck up the fork boots.
- Visually inspect the front forks [A] for oil leakage.
- ★ Replace or repair any defective parts, if necessary.



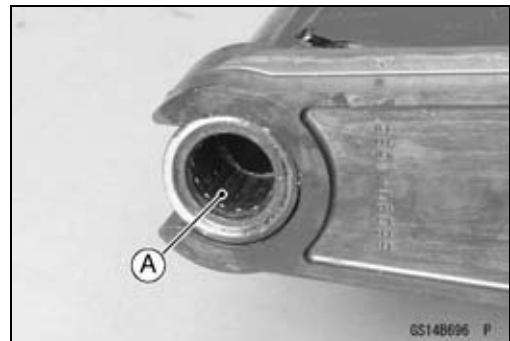
#### Rear Shock Absorbers Oil Leak Inspection

- Visually inspect the rear shock absorbers [A] for oil leakage.
- ★ If they are oil leaked, replace shock absorber.



#### Swingarm Pivot Lubrication

- Remove the swingarm (see Swingarm Removal in the Suspension chapter).
- Remove the sleeve.
- Using a high-flash point solvent, clean the old grease out of the needle bearings [A].
- Apply plenty of grease to the inner surface of the needle bearings.
- Apply thin coat of grease to the lips of the grease seals [B].
- Install the swingarm (see Swingarm Installation in the Suspension chapter).



### Steering System

#### Steering Play Inspection

- Raise the front wheel off the ground with jack.  
**Special Tools - Jack: 57001-1238**
- With the front wheel pointing straight ahead, alternately tap each end of the handlebar. The front wheel should swing fully left and right 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.
- Feel for steering looseness by pushing and pulling [A] the forks.
- ★ If you feel looseness, the steering is too loose.



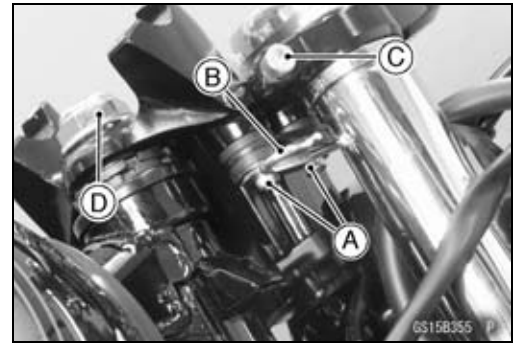
#### NOTE

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

**Periodic Maintenance Procedures**

**Steering Play Adjustment**

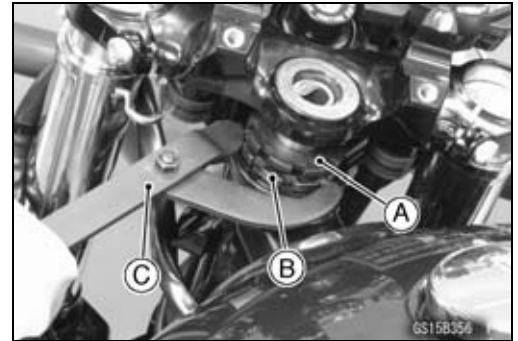
- Remove:
  - Handlebar (see Handlebar Removal in the Steering chapter)
  - Bolts [A]
  - Clamp [B]
- Loosen the front fork clamp bolts (upper) [C]
- Remove the steering stem head nut [D].



- Loosen the lock nut [A] and adjust the steering stem nut [B], using the steering stem nut wrench [C].

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

- ★ If the steering is too tight, loosen the stem nut a fraction of a turn.
- ★ If the steering is too loose, tighten the stem nut a fraction of a turn.



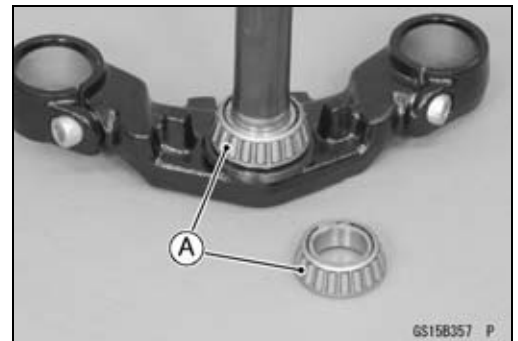
**NOTE**

○ Turn the stem nut 1/8 turn at time maximum.

- Tighten:
  - Torque - Steering Stem Head Nut: 49 N·m (5.0 kgf·m, 36 ft·lb)**
  - Front Fork Clamp Bolts (Upper): 20 N·m (2.0 kgf·m, 15 ft·lb)**
- Check the steering again.
- ★ If the steering is still too tight or too loose, repeat the adjustment.

**Steering Stem Bearing Lubrication**

- Remove the steering stem (see Stem, Stem Bearing Removal in the 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 off grease and dirt.
- Visually check the outer races and rollers.
- ★ If the rollers or races are worn, or if either race is dented, replace both races and all the bearings as a set.
- 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 (see Stem, Stem Bearing Installation in the Steering chapter).
- Adjust the steering (see Steering Play Adjustment).



## 2-38 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Electrical System

##### Lights and Switches Operation Inspection

###### First Step

- Set the gear position in the neutral position.
- Turn the ignition switch to ON.
- The following lights should go on according to below table.

City Light [A] (EUR Models)	goes on
Taillight [B]	goes on
Meter Panel LCD [C]	goes on
Meter Panel Illumination Lights [D]	go on
Fuel Level Warning Indicator Light (LED) [E]	goes on about 3 seconds
FI Indicator Light (LED) [F]	goes on about 3 seconds
Neutral Indicator Light (LED) [G]	goes on

★ If the light does not go on, inspect or replace the following item.

Battery (see Charging Condition Inspection in the Electrical System chapter)

Taillight Bulb (Tail/Brake Light Bulb Replacement in the Electrical System chapter)

City Light Bulb (see City Light Bulb Replacement (EUR Models) in the Electrical System chapter)

Meter Unit for Illumination Light (see Meter Unit Disassembly in the Electrical System chapter)

Meter Unit for Indicator Lights (LED) (see Meter Unit Disassembly in the Electrical System chapter)

Neutral Switch (see Switch Inspection in the Electrical System chapter)

ECU (see ECU Power Supply Inspection in the Fuel System (DFI) chapter)

Main Fuse 30 A and Lighting Fuse 10 A (see Fuse Inspection in the Electrical System chapter)

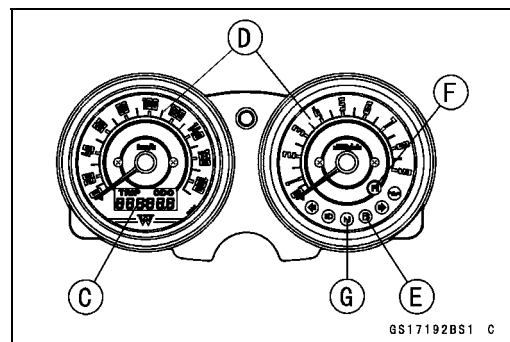
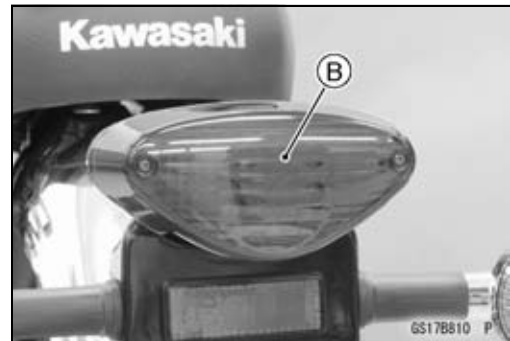
Ignition Switch (see Switch Inspection in the Electrical System chapter)

Harness (see Wiring Inspection in the Electrical System chapter)

- Turn the ignition switch to OFF.
- The all lights should go off.
- ★ If the light does not go off, replace the ignition switch.

###### Second Step

- Turn the ignition switch to P (Park) position.
- The city light and taillight should go on.
- ★ If the light does not go on, inspect or replace the ignition switch (see Switch Inspection in the Electrical System chapter).



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Periodic Maintenance Procedures

**Third Step**

- Turn the ignition switch to ON.
- Turn on the turn signal switch [A] (left or right position).
- The left or right turn signal lights [B] (front and rear) according to the switch position should flash.
- The turn signal indicator light [C] in the meter unit should flash.

★ If the each light does not flash, inspect or replace the following item.

Turn Signal Light Bulb (see Turn Signal Light Bulb Replacement in the Electrical System chapter)

Meter Unit for Turn Signal Light Indicator Light (LED) (see Meter Unit Disassembly in the Electrical System chapter)

Turn Signal Switch (see Switch Inspection in the Electrical System chapter)

Turn Signal Relay (see Turn Signal Relay Inspection in the Electrical System chapter)

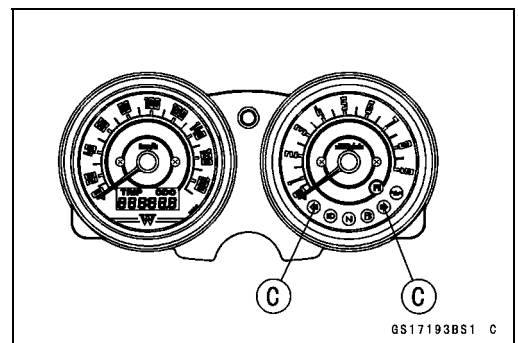
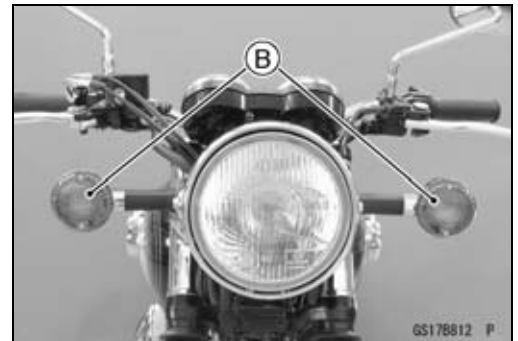
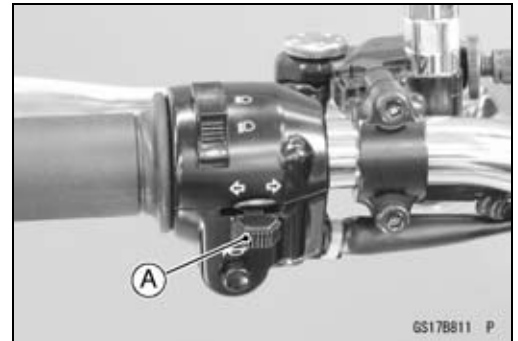
Harness (see Wiring Inspection in the Electrical System chapter)

- Push the turn signal switch.
- The turn signal light and indicator light (LED) should go off.

★ If the light does not go off, inspect or replace the following item.

Turn Signal Switch (see Switch Inspection in the Electrical System chapter)

Turn Signal Relay (see Turn Signal Relay Inspection in the Electrical System chapter)

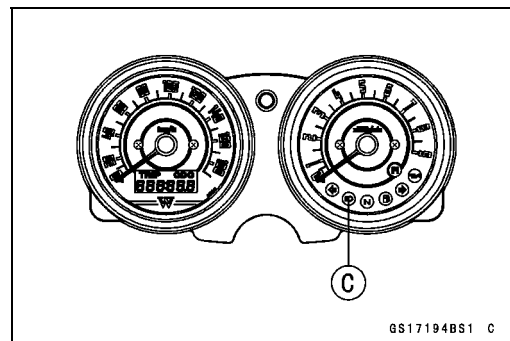
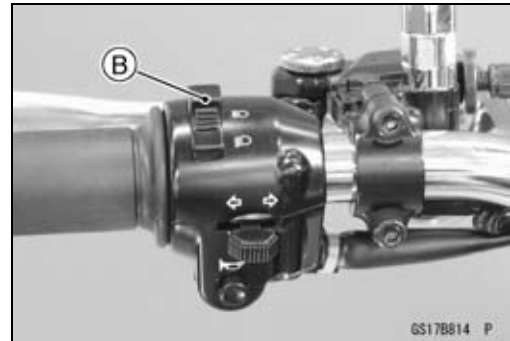
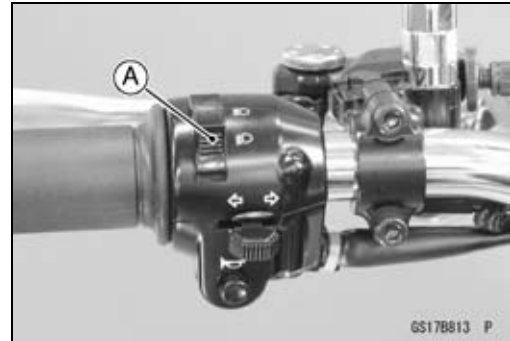


## 2-40 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Fourth Step

- Set the dimmer switch [A] to low beam position.
- Start the engine.
- The low beam headlight should go on.
- ★ If the low beam headlight does not go on, inspect or replace the following item.
  - Headlight Bulb (see Headlight Bulb Replacement in the Electrical System chapter)
  - Headlight Fuse 10 A (see Fuse Inspection in the Electrical System chapter)
  - Dimmer Switch (see Switch Inspection in the Electrical System chapter)
  - Harness (see Wiring Inspection in the Electrical System chapter)
- Set the dimmer switch to high beam position [B].
- The high beam headlight should go on.
- The high beam indicator light (LED) [C] should go on.
- ★ If the high beam headlight and/or high beam indicator light (LED) does not go on, inspect or replace the following item.
  - Headlight Bulb (see Headlight Bulb Replacement in the Electrical System chapter)
  - Meter Unit for High Beam Indicator Light (LED) (see Meter Unit Disassembly in the Electrical System chapter)
  - Dimmer Switch (see Switch Inspection in the Electrical System chapter)
- Turn the ignition switch to OFF.
- The headlight and high beam indicator light (LED) should go off.



#### Headlight Aiming Inspection

- Inspect the headlight beam for aiming.
- ★ If the headlight beam points to one side rather than straight ahead, adjust the horizontal beam.

#### Headlight Beam Horizontal Adjustment

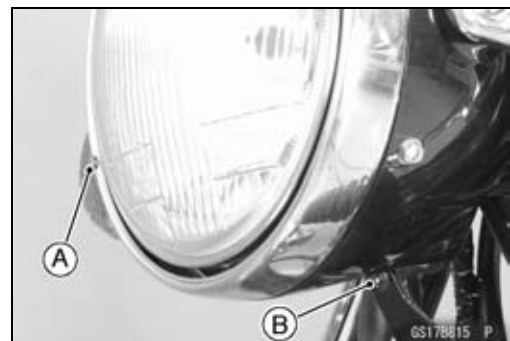
- Turn the horizontal adjuster [A] in the headlight with the screwdriver in or out until the beam points straight ahead.
- ★ If the headlight beam points too low or high, adjust the vertical beam.

#### Headlight Beam Vertical Adjustment

- Turn the vertical adjuster [B] in the headlight in or out to adjust the headlight vertically.

#### 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.





**Periodic Maintenance Procedures**

**Sidestand Switch Operation Inspection**

- Raise the rear wheel off the ground with center stand.
- Inspect the sidestand switch [A] operation accordance to the following table.

**Sidestand Switch Operation**

Sidestand	Gear Position	Clutch Lever	Engine Start	Engine Run
Up	Neutral	Released	Starts	Continue running
Up	Neutral	Pulled in	Starts	Continue running
Up	In Gear	Released	Doesn't start	Continue running
Up	In Gear	Pulled in	Starts	Continue running
Down	Neutral	Released	Starts	Continue running
Down	Neutral	Pulled in	Starts	Continue running
Down	In Gear	Released	Doesn't start	Stops
Down	In Gear	Pulled in	Doesn't start	Stops



★ If the sidestand switch operation does not work, inspect or replace the following item.

Battery (see Charging Condition Inspection in the Electrical System chapter)

Main Fuse 30 A (see Fuse Inspection in the Electrical System chapter)

Ignition Fuse 10 A (see Fuse Inspection in the Electrical System chapter)

Ignition Switch (see Switch Inspection in the Electrical System chapter)

Sidestand Switch (see Switch Inspection in the Electrical System chapter)

Engine Stop Switch (see Switch Inspection in the Electrical System chapter)

Starter Button (see Switch Inspection in the Electrical System chapter)

Neutral Switch (see Switch Inspection in the Electrical System chapter)

Starter Relay (see Starter Relay Inspection in the Electrical System chapter)

Junction Box (see Relay Circuit Inspection in the Electrical System chapter)

Starter Circuit Relay (see Starter Circuit Relay Inspection in the Electrical System chapter)

Harness (see Wiring Inspection in the Electrical System chapter)

★ If the all parts are good condition, replace the ECU (see ECU Removal/Installation in the Fuel System (DFI) chapter).

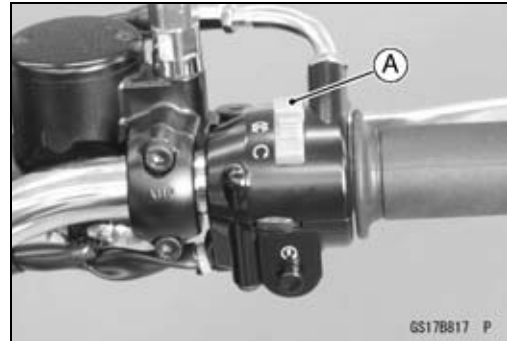
## 2-42 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### **Engine Stop Switch Operation Inspection**

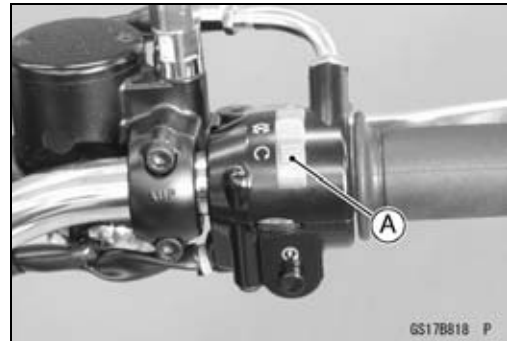
##### **First Step**

- Set the gear position in the neutral position.
- Turn the ignition switch to ON.
- Push the engine stop switch to stop position [A].
- Push the starter button.
- The engine does not start.
- ★ If the engine starts, inspect or replace the engine stop switch (see Switch Inspection in the Electrical System chapter).



##### **Second Step**

- Push the engine stop switch to run position [A].
- Turn the ignition switch to ON.
- Push the starter button and start the engine.
- Push the engine stop switch to stop position.
- Immediately the engine should be stop.
- ★ If the engine does not stop, inspect or replace the engine stop switch (see Switch Inspection in the Electrical System chapter).



#### **Others**

##### **Chassis Parts 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**

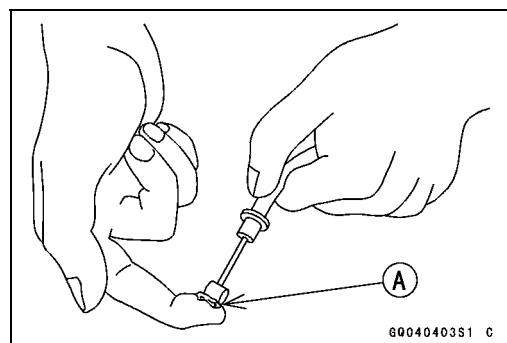
○Whenever the vehicle has been operated under wet or rainy conditions, or especially after using a high-pressure water spray, perform the general lubrication.

##### **Pivots: Lubricate with Grease.**

Brake Lever Pivot (Apply silicone grease.)  
Brake Pedal  
Center Stand  
Clutch Lever  
Sidestand

##### **Points: Lubricate with Grease.**

Clutch Inner Cable Upper and Lower Ends [A]  
Throttle Inner Cable Upper and Lower Ends

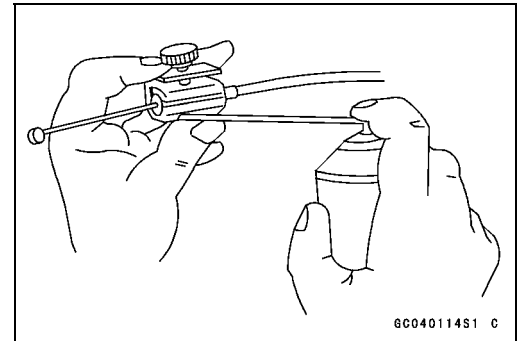


Periodic Maintenance Procedures

**Cables: Lubricate with Rust Inhibitor.**

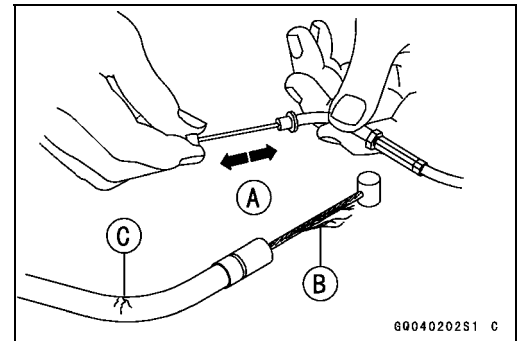
- Clutch Cable
- Throttle Cables

- 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 with an aerosol cable lubricant.



6G040114S1 C

- 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.



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## 2-44 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

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#### ***Bolts, Nuts and Fasteners 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. For each fastener, first loosen it by 1/2 turn, then tighten it.
- ★ If cotter pins are damaged, replace them with new ones.

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

##### Engine:

Clutch Lever Pivot Bolt Locknut  
Engine Mounting Bolts and Nuts  
Exhaust Pipe Holder Nuts  
Muffler Connecting Pipe Clamp Bolt  
Muffler Bracket Bolts

##### Wheels:

Front Axle Clamp Bolt  
Front Axle Nut  
Rear Axle Nut  
Rear Axle Nut Cotter Pin

##### Brakes:

Brake Lever Pivot Bolt and Locknut  
Brake Pedal Bolt  
Caliper Mounting Bolts  
Master Cylinder Clamp Bolts  
Torque Link Nuts

##### Suspension:

Front Fork Clamp Bolts  
Rear Shock Absorber Nuts  
Swingarm Pivot Shaft Nut

##### Steering:

Handlebar Clamp Bolts  
Steering Stem Head Nut

##### Others:

Center Stand Bolts and Nuts  
Footpeg Bracket Bolts  
Front Fender Mounting Bolts  
Sidestand Bolt and Nut

## Periodic Maintenance Procedures

### Replacement Parts

#### *Air Cleaner Element Replacement*

##### NOTE

○ In dusty areas, the element should be replaced more frequently than the recommended interval.

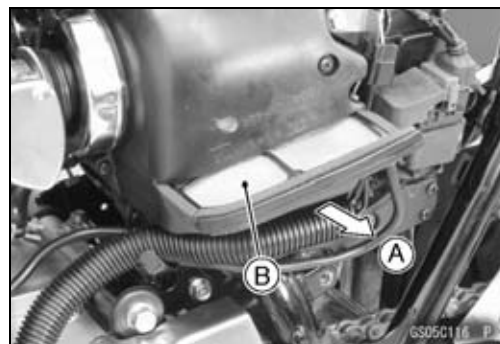
##### **⚠ WARNING**

If dirt or dust is allowed to pass through into the throttle body assy, the throttle may become stuck, possibly causing accident. Replace the air cleaner element according to the maintenance chart.

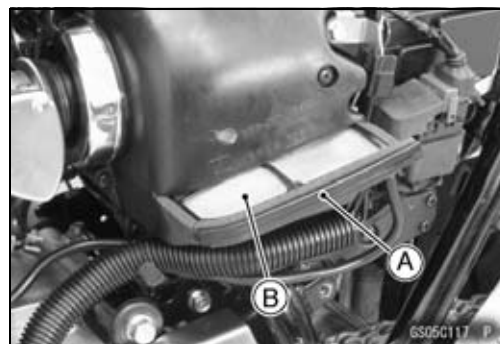
##### **NOTICE**

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

- Remove the left and right side cover (see Left/Right Side Cover Removal in the Frame chapter).
- Pull out [A] the air cleaner elements [B] from both side of the air cleaner housing.



- Install the new air cleaner elements [A] so that the wire net side [B] faces upward.
- Install the left and right side cover (see Left/Right Side Cover Installation).



#### *Fuel Hose Replacement*

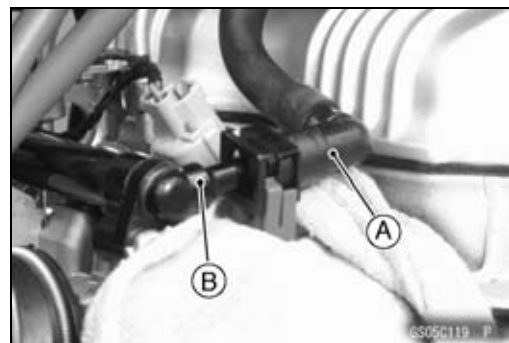
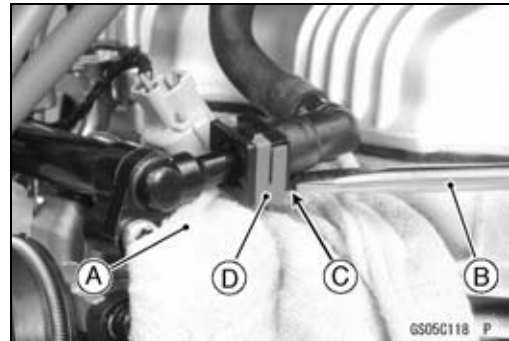
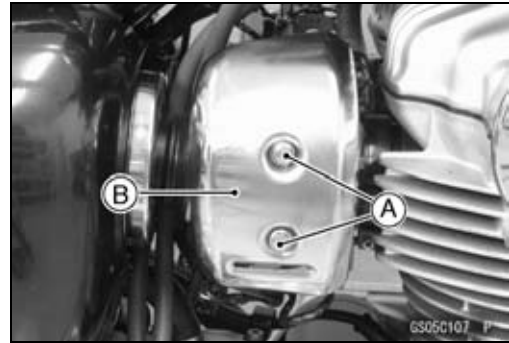
##### **⚠ WARNING**

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

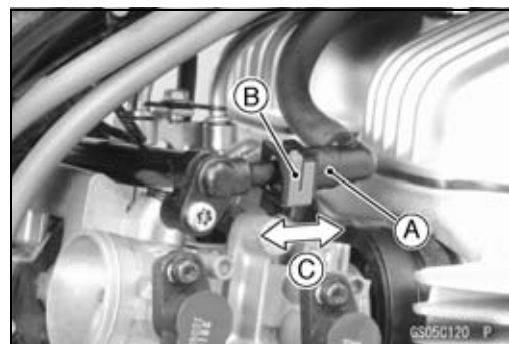
## 2-46 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

- Remove:
  - Bolts [A]
  - Cover [B]
- Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter).
- Be sure to place a piece of cloth [A] around the fuel hose joint.
- Insert a thin blade screw driver [B] into the slit [C] on the joint lock.
- Turn the driver to disconnect the joint lock [D].
- Pull the fuel hose joint [A] out of the delivery pipe [B].
- Replace the fuel hose with a new one.



- Insert the fuel hose joint [A] straight onto the delivery pipe until the hose joint clicks.
- Push the joint lock [B] until the hose joint clicks.
- Push and pull [C] the fuel hose joint back and forth more than two times, and make sure it is locked and does not come off.



#### NOTICE

**When pushing and pulling the fuel hose joint, do not apply strong force to the delivery pipe on the nozzle assy. The pipe made from resin could be damaged.**

#### ⚠ WARNING

**Leaking fuel can cause a fire or explosion resulting in severe burns. Make sure the fuel hose joint is installed correctly on the delivery pipe and that it doesn't leak.**

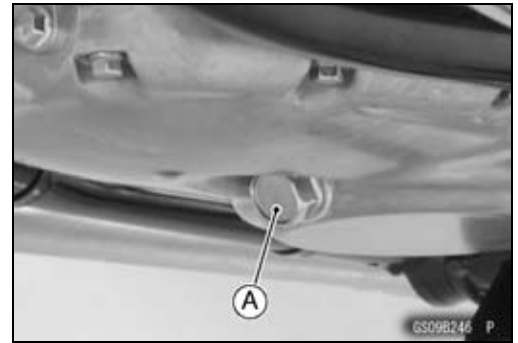
- ★ If it comes off, reinstall the hose joint.
- Run the fuel hose correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Install the fuel tank (see Fuel Tank Installation in the Fuel System (DFI) chapter).
- Start the engine and check the fuel hose for leaks.

**Periodic Maintenance Procedures**

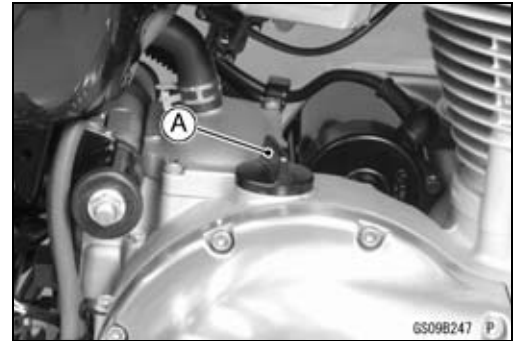
**Engine Oil Change**

- Situate the motorcycle so that it is vertical after warming up the engine.
- Remove the engine oil drain plug [A], to drain the oil.
- Replace the oil drain gasket with a new one.
- Tighten the drain plug.

**Torque - Engine Oil Drain Plug: 29 N·m (3.0 kgf·m, 21 ft·lb)**



- Remove the oil filler cap [A].



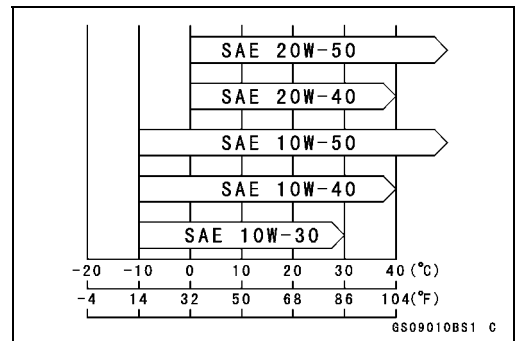
- Pour in the specified type and amount of oil.

**Recommended Engine**

**Type:** API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2

**Viscosity:** SAE 10W-40

**Capacity:** 2.7 L (2.9 US qt) (when filter is not removed)  
 2.9 L (3.1 US qt) (when filter is removed)  
 3.2 L (3.4 US qt) (when engine is completely dry)



**NOTE**

- Do not add any chemical additive to the oil. Oils fulfilling the above requirements are fully formulated and provide adequate lubrication for both the engine and the clutch.
- 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.

- Replace the O-ring of the oil filler cap with a new one.
- Apply the grease to the new O-ring.
- Install the oil filler cap.

**Torque - Hand-tighten**

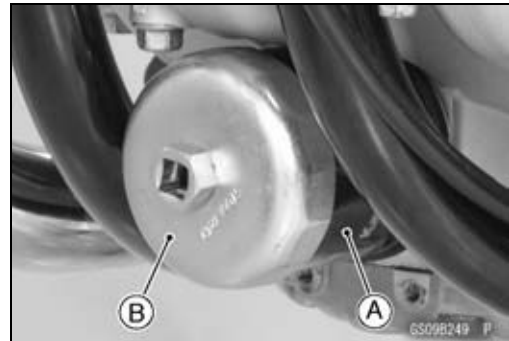
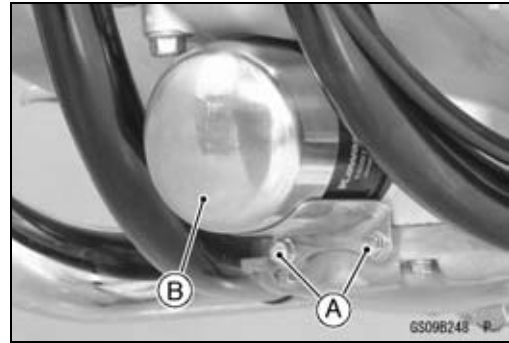
- Check the oil level (see Oil Level Inspection in the Engine Lubrication System chapter).

## 2-48 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

#### Oil Filter Replacement

- Drain the engine oil (see Engine Oil Change).
- Remove:
  - Oil Filter Cap Bolts [A]
  - Oil Filter Cap [B]
  - Oil Filter Damper
  
- Remove the oil filter [A] with the oil filter wrench [B].  
**Special Tool - Oil Filter Wrench: 57001-1249**



- Replace the filter with a new one.
- Apply grease to the gasket [A] before installation.
- Tighten the filter with the oil filter wrench.

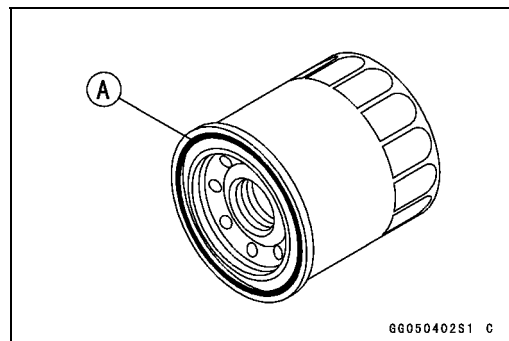
**Special Tool - Oil Filter Wrench: 57001-1249**

**Torque - Oil Filter: 17 N·m (1.7 kgf·m, 13 ft·lb)**

#### NOTE

○ *Hand tightening of the oil filter can not be allowed since it does not reach to this tightening torque.*

- Apply a non-permanent locking agent to the threads of the oil filter cap bolts.
- Install the oil filter cap and tighten the bolts.  
**Torque - Oil Filter Cap Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**
- Pour in the specified grade and amount of oil (see Engine Oil Change).



#### Brake Hose Replacement

#### NOTICE

**Brake fluid quickly ruins painted plastic surfaces; any spilled fluid should be completely washed away immediately.**

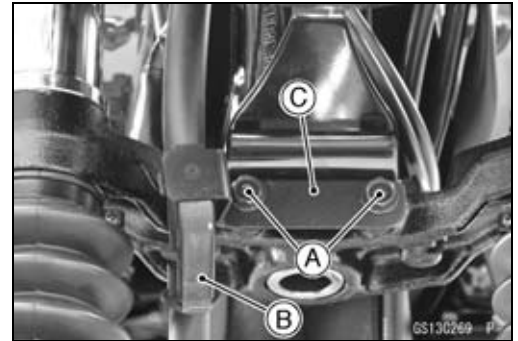


**Periodic Maintenance Procedures**

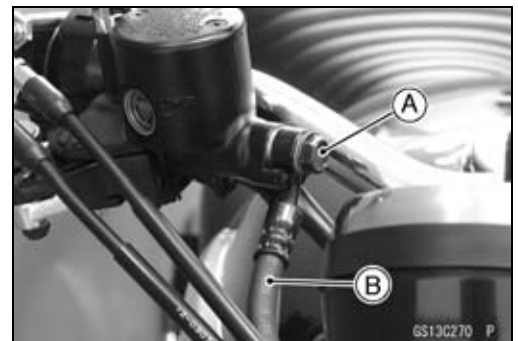
- Remove:
  - Brake Hose Clamp Bolt [A]
  - Brake Hose Clamp [B]



- Remove:
  - Bolts [A]
  - Clamp [B] with the Bracket [C]



- Remove the brake hose banjo bolts [A].
- When removing the brake hose, take care not to spill the brake fluid on the painted or plastic parts.
- When removing the brake hose [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.
- There are washers on each side of the brake hose fitting. Replace them with new ones when installing.
- Tighten:



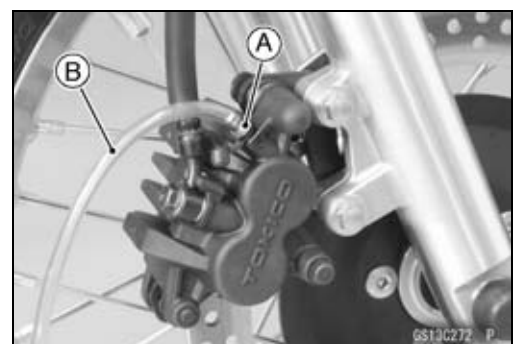
**Torque - Brake Hose Banjo Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- When installing the hose, avoid sharp bending, kinking, flattening or twisting, and route the hose according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- Fill the brake line after installing the brake hose (see Brake Fluid Change).



**Brake Fluid Change**

- Level the brake fluid reservoir.
- Remove the reservoir cap and diaphragm.
- Remove the rubber cap from the bleed valve [A] on the caliper.
- Attach a clear plastic hose [B] to the bleed valve, and run the other end of the hose into a container.
- Fill the reservoir with fresh specified brake fluid.



## 2-50 PERIODIC MAINTENANCE

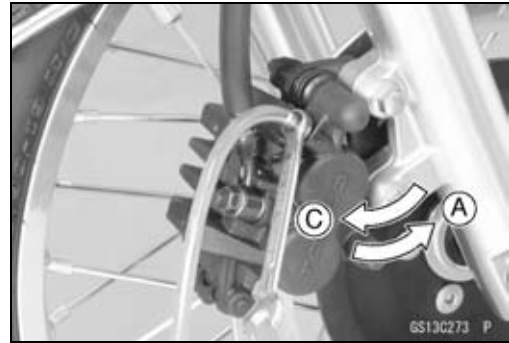
### Periodic Maintenance Procedures

- Change the brake fluid.
  - Repeat this operation until fresh brake fluid comes out from the plastic hose or the color of the fluid changes.
1. Open the bleed valve [A].
  2. Apply the brake and hold it [B].
  3. Close the bleed valve [C].
  4. Release the brake [D].

#### 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.*

- Remove the clear plastic hose.
- Install the diaphragm and reservoir cap.
- Tighten:
  - Torque - Brake Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**
  - Caliper Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)**
- Install the rubber cap on the bleed valve.
- 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.



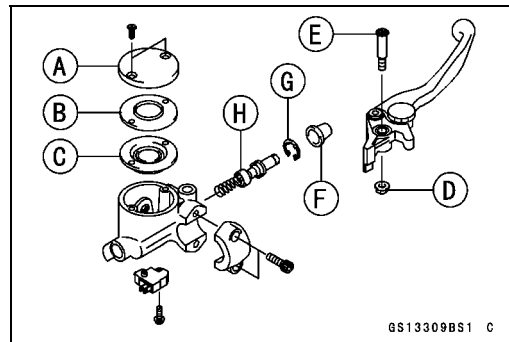
### Master Cylinder Rubber Parts Replacement

#### Master Cylinder Disassembly

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

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

- Pull out the piston assy [H].



#### NOTICE

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

- Replace:
  - Diaphragm [C]
  - Dust Cover [F]
  - Circlip [G]
  - Piston Assy [H]

Periodic Maintenance Procedures

Master Cylinder Assembly

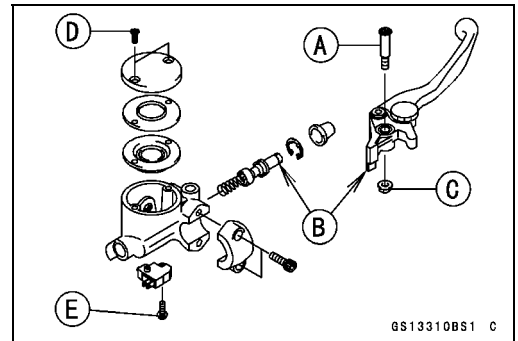
- Before assembly, clean all parts including the master cylinder with brake fluid or alcohol.

**NOTICE**

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 new parts and to the inner wall of the cylinder.
- Take care not to scratch the piston or the inner wall of the cylinder.
- Apply silicone grease to the brake lever pivot bolt [A].
- Apply silicone grease to the contact surface [B] of the brake lever and piston.
- Tighten:

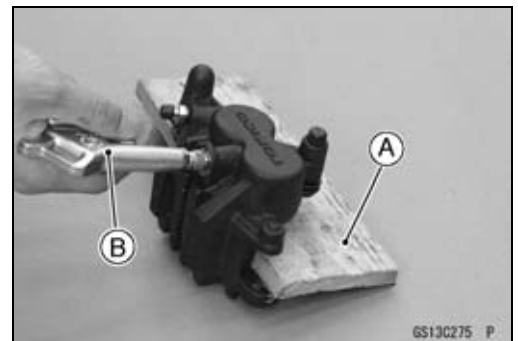
- Torque - Brake Lever Pivot Bolt: 1.0 N·m (0.10 kgf·m, 9 in·lb)
- Brake Lever Pivot Bolt Locknut [C]: 5.9 N·m (0.60 kgf·m, 52 in·lb)
- Brake Reservoir Cap Screws [D]: 1.5 N·m (0.15 kgf·m, 13 in·lb)
- Front Brake Light Switch Screw [E]: 1.2 N·m (0.12 kgf·m, 11 in·lb)



Caliper Rubber Parts Replacement

Caliper Disassembly

- Remove:
  - Caliper (see Caliper Removal in the Brakes chapter)
  - Brake Pads (see Brake Pad Removal in the Brakes chapter)
- Using compressed air, remove the pistons.
  - Cover the piston area with wooden board [A].
  - Blow compressed air [B] into the hole for the banjo bolt to remove the piston.



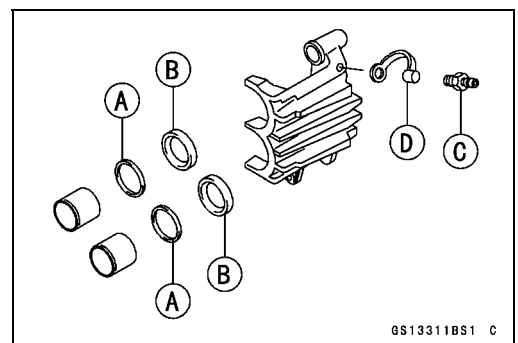
**⚠ WARNING**

The piston in the brake caliper can crush hands and fingers. Never place your hand or fingers in front of the piston.

- Pull out the pistons by hand.
- Remove the dust seals [A] and fluid seals [B].
- Remove the bleed valve [C] and rubber cap [D].

**NOTE**

○ If compressed air is not available, with the brake hose still attached, apply the brake lever to remove the piston. The remaining process is as described above.



## 2-52 PERIODIC MAINTENANCE

### Periodic Maintenance Procedures

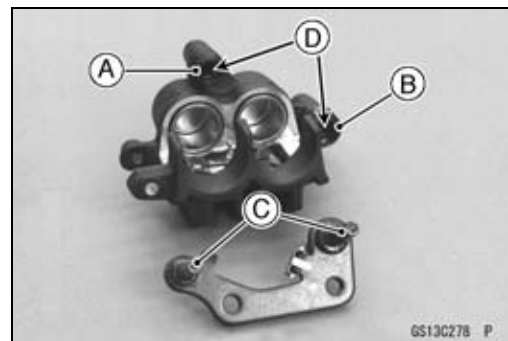
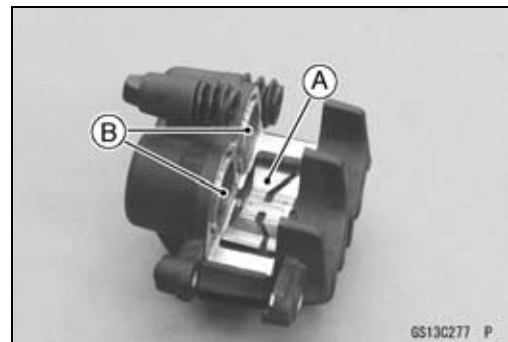
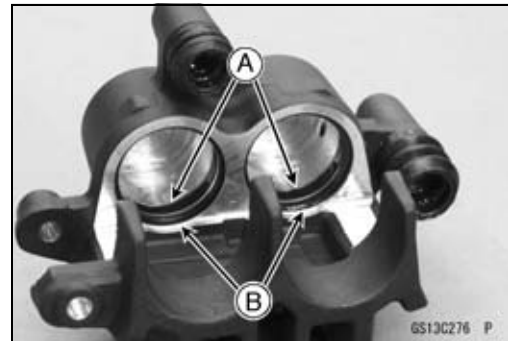
#### Caliper Assembly

- Clean the caliper parts except for the pads.

#### NOTICE

**For cleaning the parts, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol.**

- Install the bleed valve and rubber cap.  
**Torque - Caliper Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)**
- Replace the fluid seals [A] with new ones.
  - Apply silicone grease to the fluid seals, and install them into the cylinders by hand.
- Replace the dust seals [B] with new ones.
  - Apply silicone grease to the dust seals, and install them into the cylinders by hand.
- Install the anti-rattle spring [A] as shown.
- Apply brake fluid to the outside of the pistons [B], and push them into each cylinder by hand.
- Check the shaft rubber friction boot [A] and the dust boot [B] replace them with new ones if they are damaged.
- Apply silicone grease to the caliper holder shafts [C] and holder holes [D].
- Install the pads (see Brake Pad Installation in the Brakes chapter).
- Wipe up any spilled brake fluid on the caliper with wet cloth.



#### Spark Plug Replacement

- Remove:
  - Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  - Spark Plug Cap
- Remove the spark plugs using the 16 mm plug wrench [A] vertically.
- Replace the spark plug with new ones.

#### Standard Spark Plug

Type: NGK CR8E



---

**Periodic Maintenance Procedures**

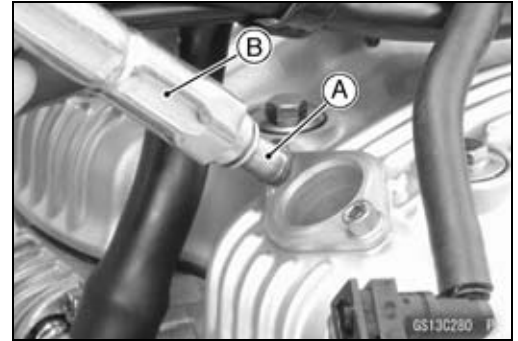
---

- Insert the spark plug [A] vertically into the spark plug hole with the spark plug installed in the plug wrench [B] , and finger-tighten it first.

**NOTICE**

**If tightening the spark plug with the wrench inclined, the insulator of the spark plug may break.**

- Tighten:  
**Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 115 in·lb)**
- Install the spark plug cap.
- After installation, be sure the spark plug cap are installed securely by pulling up them lightly.





# Fuel System (DFI)

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## 3-2 FUEL SYSTEM (DFI)

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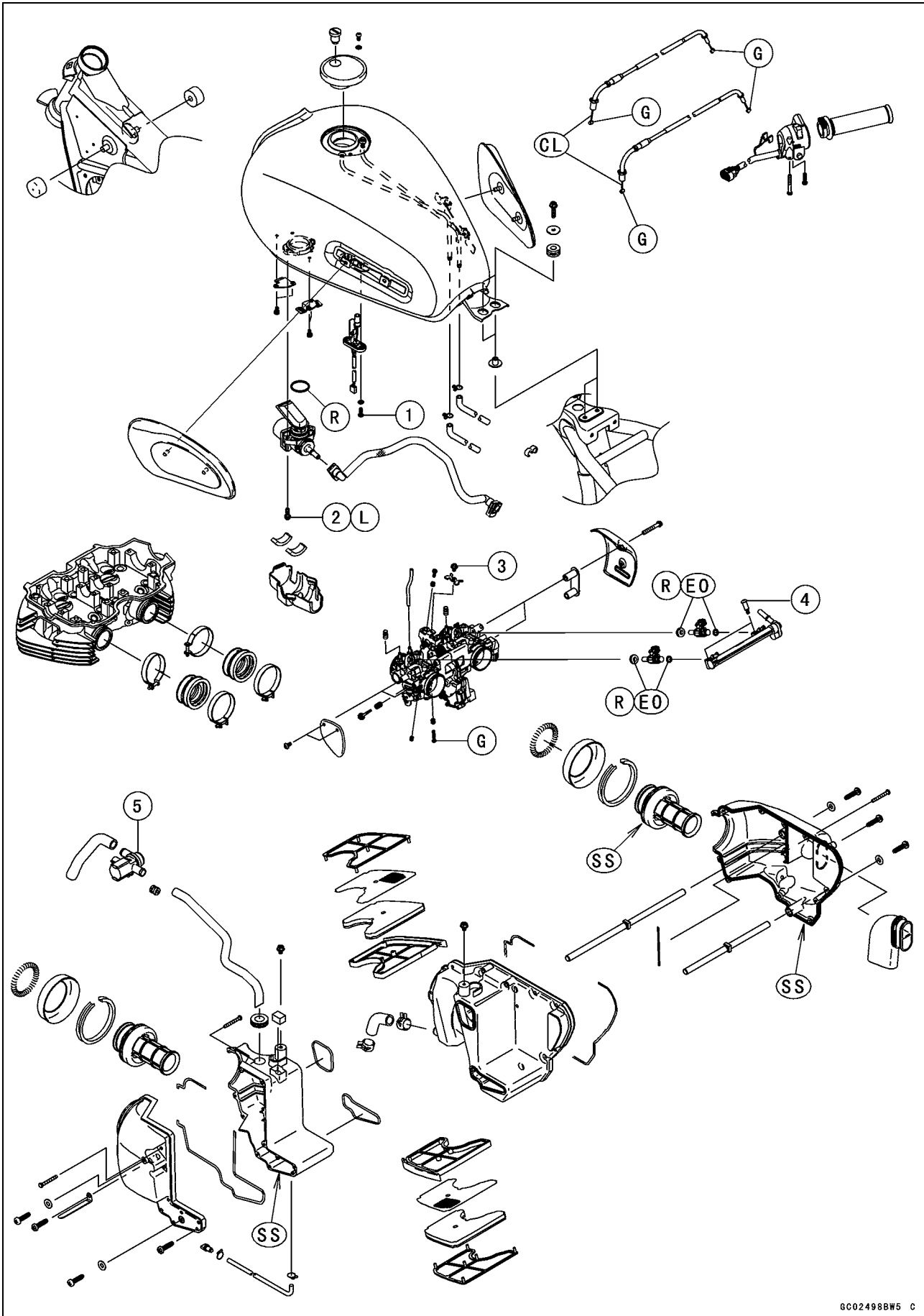
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# 3-4 FUEL SYSTEM (DFI)

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Fuel Reserve Switch Screws	2.1	0.21	19 in·lb	
2	Fuel Pump Bolts	9.8	1.0	87 in·lb	L
3	Throttle Cable Plate Bolt	5.9	0.60	52 in·lb	
4	Delivery Pipe Mounting Screws	3.43	0.35	30 in·lb	

5. Air Switching Valve

CL: Apply cable lubricant.

EO: Apply engine oil.

G: Apply grease.

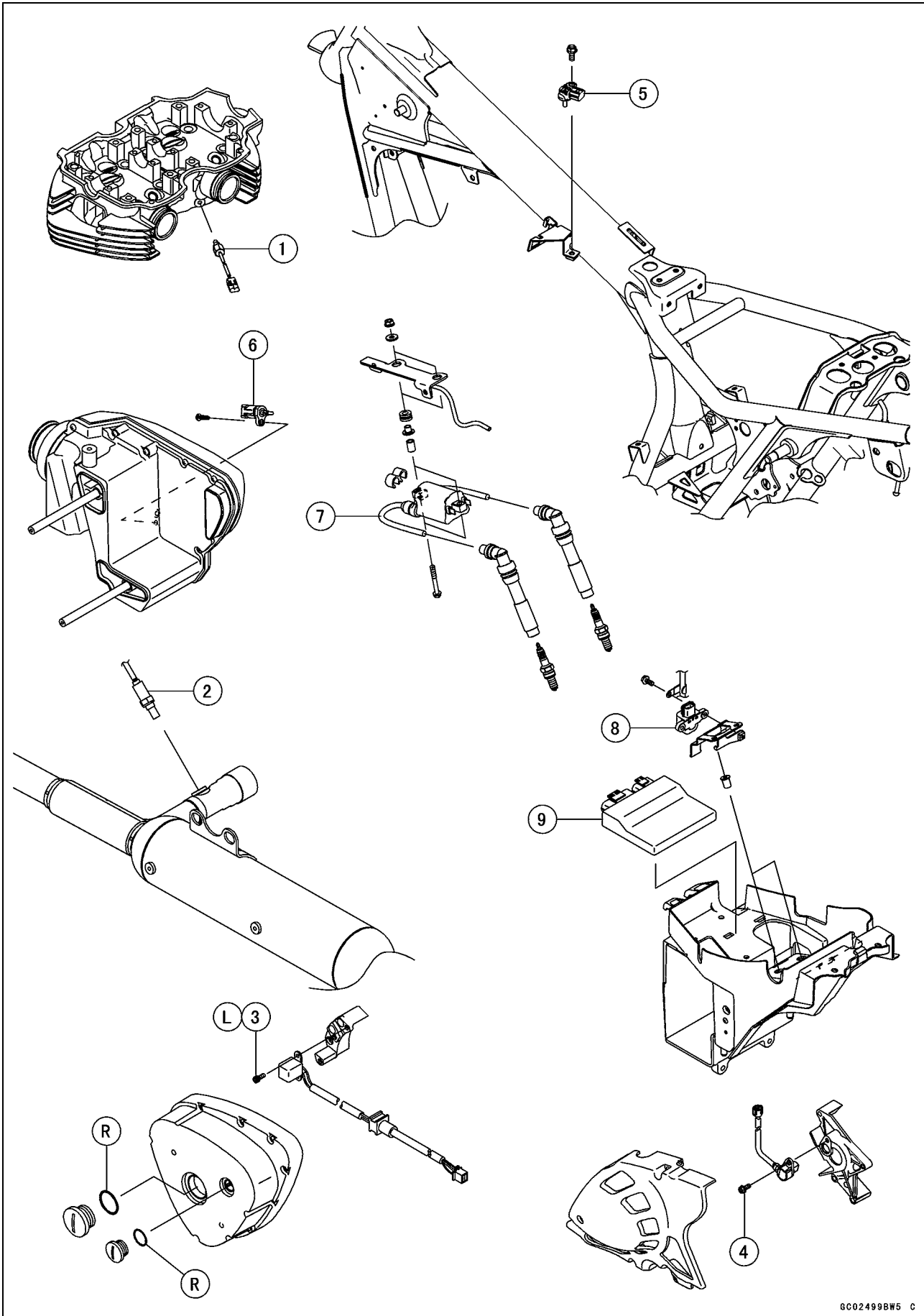
L: Apply a non-permanent locking agent.

R: Replacement Parts

SS: Apply silicone sealant.

# 3-6 FUEL SYSTEM (DFI)

## Exploded View



**Exploded View**

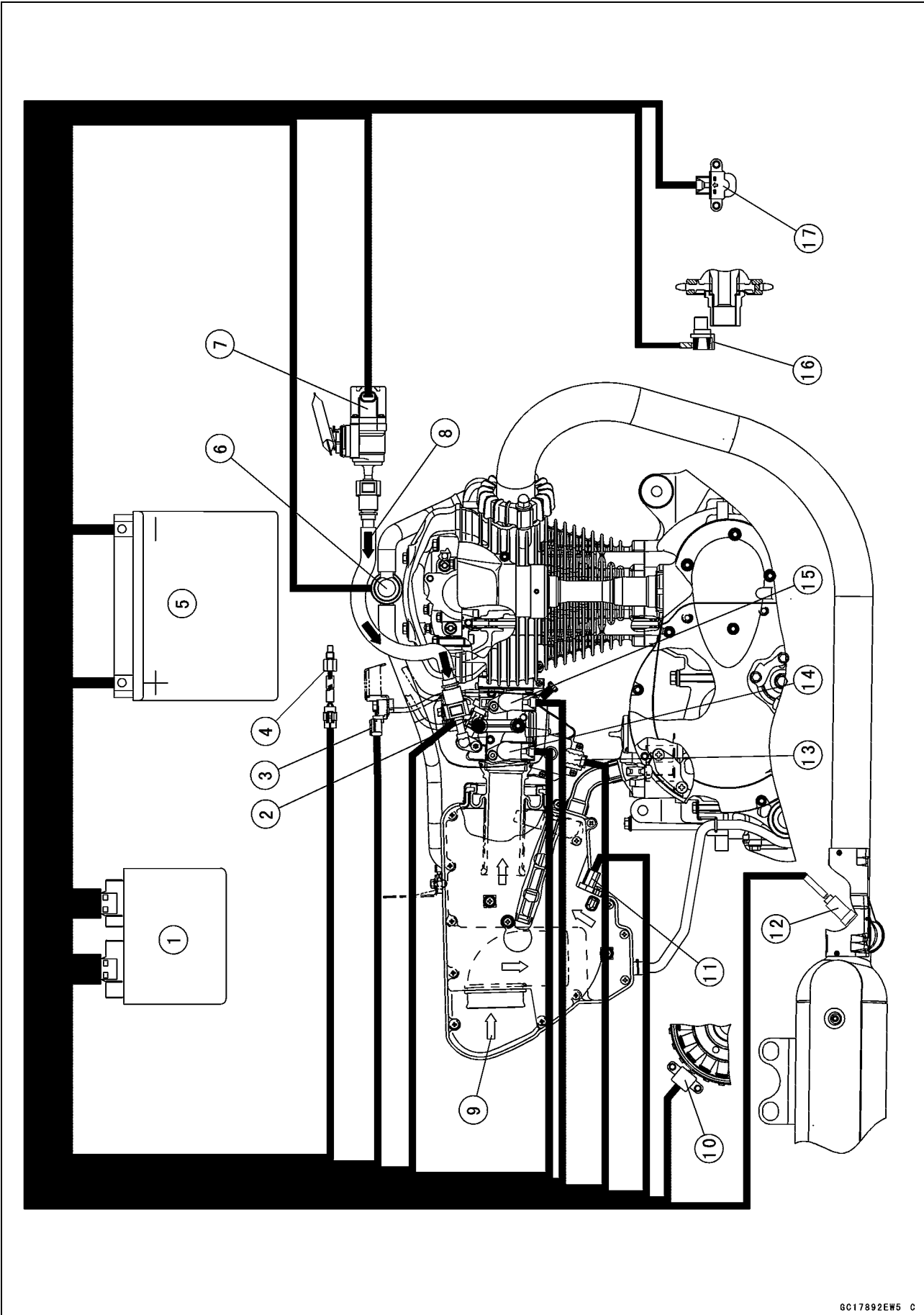
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Temperature Sensor	9.8	1.0	87 in·lb	
2	Oxygen Sensor	25	2.5	18	
3	Crankshaft Sensor Bolts	7.8	0.80	69 in·lb	L
4	Speed Sensor Mounting Bolt	4.5	0.46	40 in·lb	

- 5. Intake Air Pressure Sensor
  - 6. Intake Air Temperature Sensor
  - 7. Ignition Coil
  - 8. Vehicle-down Sensor
  - 9. ECU
- L: Apply a non-permanent locking agent.

# 3-8 FUEL SYSTEM (DFI)

## DFI System

## DFI System



### DFI System

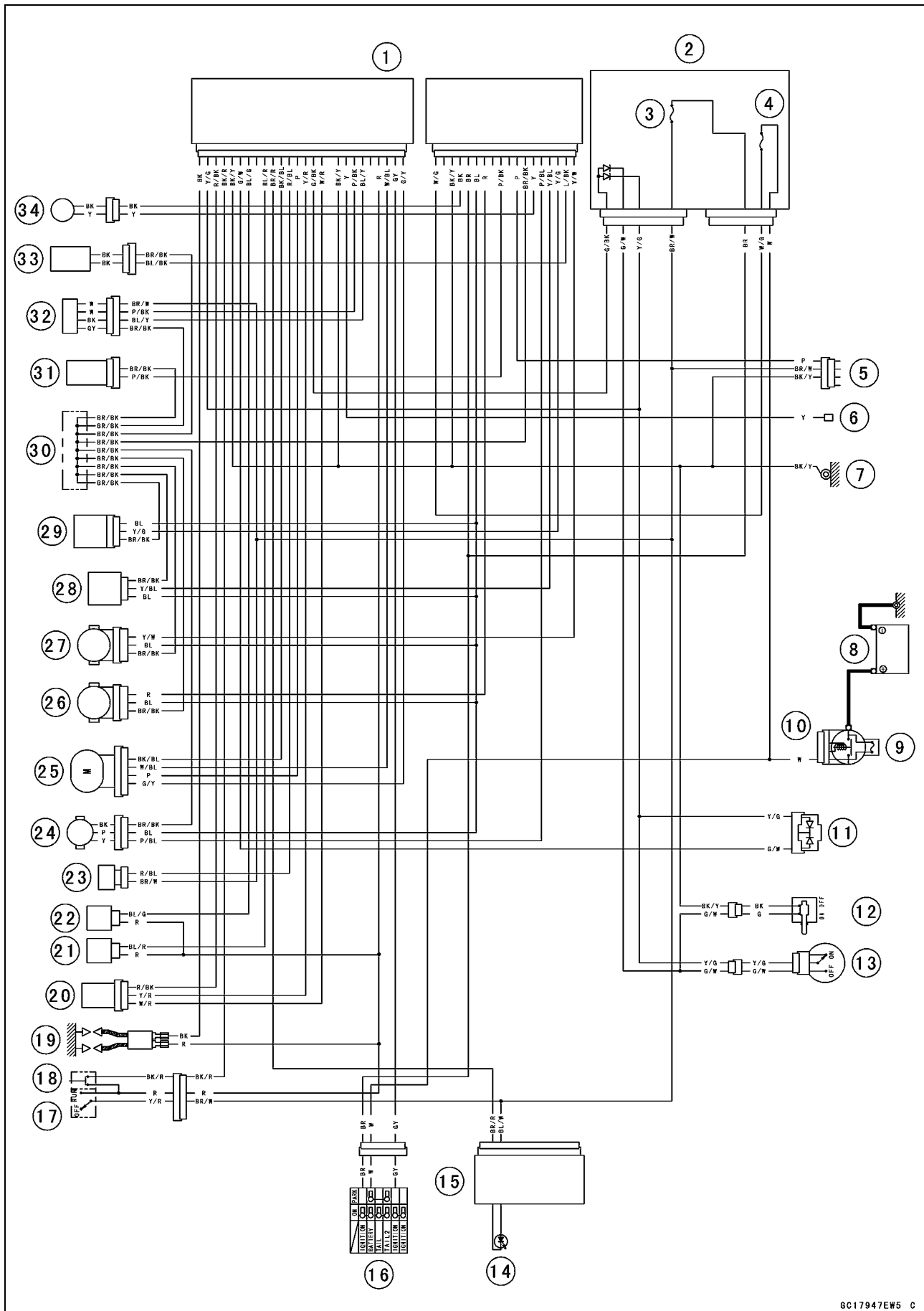
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1. ECU
2. Fuel Injectors
3. Intake Air Pressure Sensor
4. Engine Temperature Sensor
5. Battery
6. Air Switching Valve
7. Fuel Pump
8. Fuel Flow
9. Air Flow
10. Crankshaft Sensor
11. Intake Air Temperature Sensor
12. Oxygen Sensor
13. Subthrottle Valve Actuator
14. Subthrottle Sensor
15. Main Throttle Sensor
16. Speed Sensor
17. Vehicle-down Sensor

# 3-10 FUEL SYSTEM (DFI)

## DFI System

### DFI System Wiring Diagram





---

**DFI System**

---

**Part Names**

1. ECU
2. Junction Box
3. Ignition Fuse 10 A
4. ECU Fuse 10 A
5. Kawasaki Diagnostic System Connector
6. Self-diagnosis Terminal
7. Frame Ground
8. Battery 12 V 10 Ah
9. Main Fuse 30 A
10. Starter Relay
11. Diode
12. Sidestand Switch
13. Stater Lockout Switch
14. FI Warning Indicator Light (LED)
15. Meter Unit
16. Ignition Switch
17. Engine Stop Switch
18. Starter Button
19. Ignition Coils
20. Fuel Pump
21. Injector #1
22. Injector #2
23. Air Switching Valve
24. Speed Sensor
25. Subthrottle Valve Actuator
26. Subthrottle Sensor
27. Main Throttle Sensor
28. Intake Air Pressure Sensor
29. Vehicle-down Sensor
30. Water-proof Joint
31. Intake Air Temperature Sensor
32. Oxygen Sensor
33. Engine Temperature Sensor
34. Crankshaft Sensor

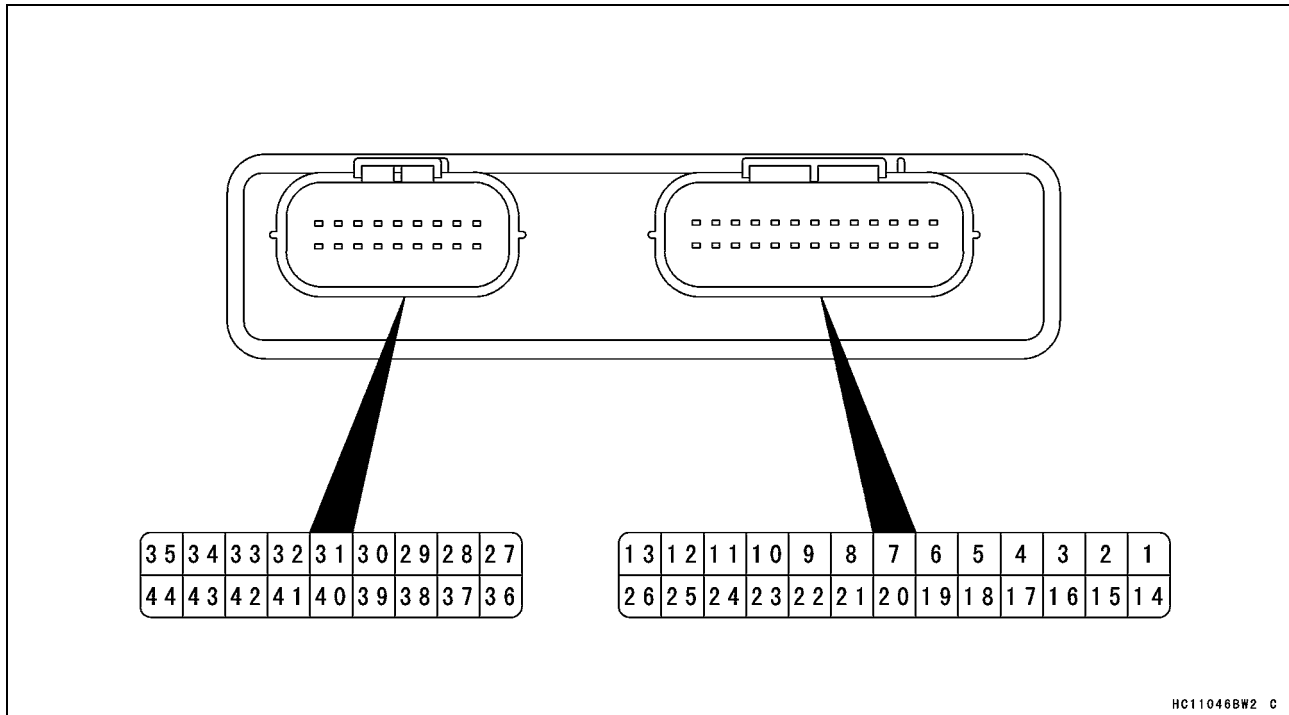
## ○Color Codes:

BK: Black	GY: Gray	PU: Purple
BL: Blue	LB: Light Blue	R: Red
BR: Brown	LG: Light Green	V: Violet
CH: Chocolate	O: Orange	W: White
DG: Dark Green	P: Pink	Y: Yellow
G: Green		

# 3-12 FUEL SYSTEM (DFI)

## DFI System

### Terminal Numbers of ECU Connectors



HC11046BW2 C

### Terminal Names

1. Ignition Coil Signal
2. Starter Lockout Switch Signal
3. Fuel Pump Signal
4. Starter Button Signal
5. Ground #1 for Engine
6. Neutral Switch Signal
7. Injector #2 Signal
8. Unused
9. Injector #1 Signal
10. FI Indicator (LCD) Signal
11. Subthrottle Valve Actuator 1(A+)
12. Air Switching Valve
13. Subthrottle Valve Actuator 2(A-)
14. Fuel Pump Signal
15. Sidestand Switch Signal
16. Fuel Pump Signal
17. Tacho Meter Output Signal
18. Ground #2 for Engine
19. Diagnosis Mode Switch Signal
20. Oxygen Sensor Heater Signal
21. Oxygen Sensor #1 Signal
22. Oxygen Sensor #2 Signal
23. Engine Stop Switch
24. Subthrottle Valve Actuator 3(B+)
25. Unused
26. Subthrottle Valve Actuator 4(B-)
27. Power Supply to ECU (from Battery)
28. Unused
29. Ground for Sensors
30. Crankshaft Sensor (+) Signal
31. Ignition Switch Signal
32. Power Supply to Sensors
33. Subthrottle Sensor Signal
34. Unused

---

**DFI System**

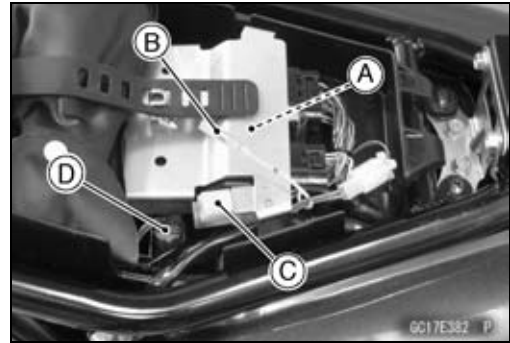
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- 35. Intake Air Temperature Sensor Signal
  - 36. Unused
  - 37. External Communication Line (KDS)
  - 38. Ground for Sensors
  - 39. Crankshaft Sensor (-) Signal
  - 40. Speed Sensor Signal
  - 41. Intake Air Pressure Sensor Signal
  - 42. Vehicle-down Sensor Signal
  - 43. Engine Temperature Sensor Signal
  - 44. Main Throttle Sensor Signal
- \*: KDS (Kawasaki Diagnostic System)

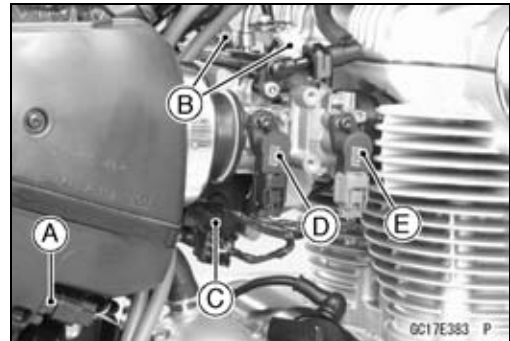
## 3-14 FUEL SYSTEM (DFI)

### DFI Parts Location

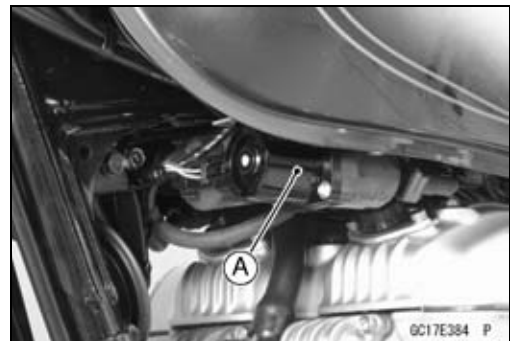
ECU [A]  
Self-diagnosis Terminal [B]  
Kawasaki Diagnostic System Connector [C]  
Vehicle-down Sensor [D]



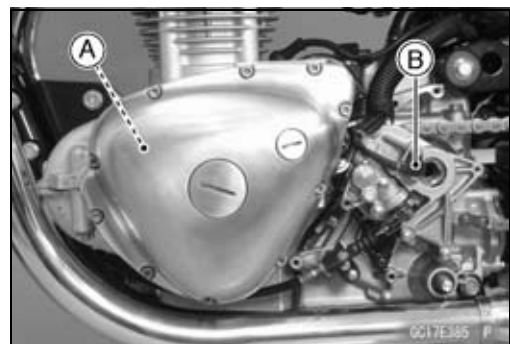
Intake Air Temperature Sensor [A]  
Fuel Injectors [B]  
Subthrottle Valve Actuator [C]  
Subthrottle Valve Sensor [D]  
Main Throttle Valve Sensor [E]



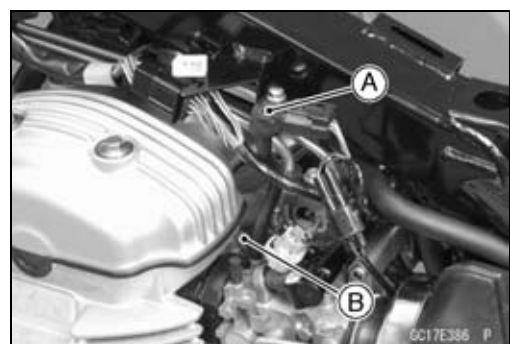
Fuel Pump [A]



Crankshaft Sensor [A]  
Speed Sensor [B]

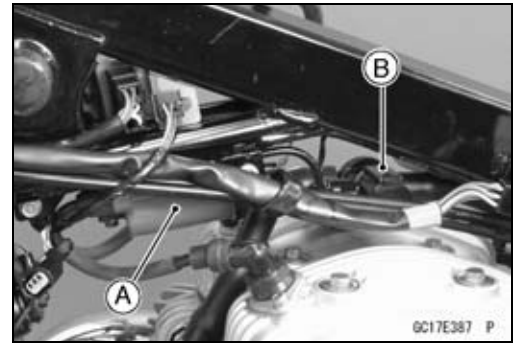


Intake Air Pressure Sensor [A]  
Engine Temperature Sensor [B]



## DFI Parts Location

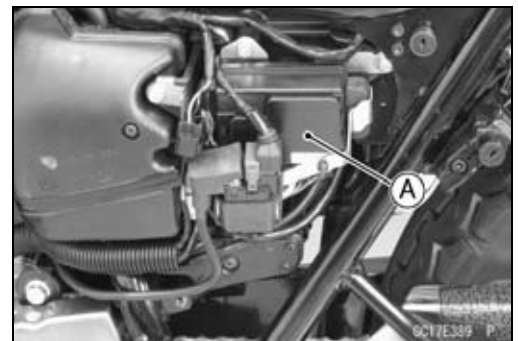
Ignition Coil [A]  
Air Switching Valve [B]



Oxygen Sensor [A]



Junction Box [A] (Ignition Fuse 10 A, ECU Fuse 10 A)



## 3-16 FUEL SYSTEM (DFI)

### Specifications

Item	Standard
<b>Digital Fuel Injection System</b>	
Idle Speed	1 200 ±50 r/min (rpm)
Throttle Body Assy:	
Throttle Valve	Dual throttle valve
Bore	φ34 mm (1.34 in.)
Throttle Body Vacuum	21.3 ~ 26.7 kPa (160 ~ 200 mmHg) at idle speed (for reference)
ECU:	
Make	MITSUBISHI ELECTRIC
Type	Digital memory type, with built in IC igniter, sealed with resin
Fuel Pressure (High Pressure Line)	300 kPa (3.06 kgf/cm <sup>2</sup> , 43.5 psi) with engine idling
Fuel Pump:	
Type	Piston pump
Discharge	20 mL (0.68 US oz.) or more for 3 seconds
Resistance	1.4 ~ 2.0 Ω at 23°C (73°F)
Fuel Injectors:	
Type	EAT804
Nozzle Type	Fine atomizing type with 12 holes
Resistance	About 11.7 ~ 12.3 Ω at 20°C (68°F)
Main Throttle Sensor:	
Input Voltage	DC 4.75 ~ 5.25 V
Output Voltage	DC 1.06 ~ 1.10 V at idle throttle opening DC 4.14 ~ 4.34 V at full throttle opening (for reference)
Resistance	4 ~ 6 kΩ
Intake Air Pressure Sensor:	
Input Voltage	DC 4.75 ~ 5.25 V
Output Voltage	DC 3.80 ~ 4.20 V at standard atmospheric pressure (see this text for details)
Intake Air Temperature Sensor:	
Output Voltage	About DC 2.25 ~ 2.50 V at intake air temperature 20°C (68°F)
Resistance	5.4 ~ 6.6 kΩ at 0°C (32°F) About 0.29 ~ 0.39 kΩ at 80°C (176°F)
Engine Temperature Sensor:	
Output Voltage	About DC 3.68 ~ 3.79 V at 20°C (68°F)
Resistance	see Electrical System chapter
Speed Sensor:	
Input Voltage	DC 4.75 ~ 5.25 V
Output Voltage	About DC 0.6V or less, or 4.8V or more
Vehicle-down Sensor:	
Detection Angle	60 ~ 70° or more for each bank
Input Voltage	DC 4.75 ~ 5.25 V
Output Voltage	With sensor tilted 60 ~ 70° or more right or left: DC 0.65 ~ 1.35 V With sensor arrow mark pointed up: DC 3.55 ~ 4.45 V

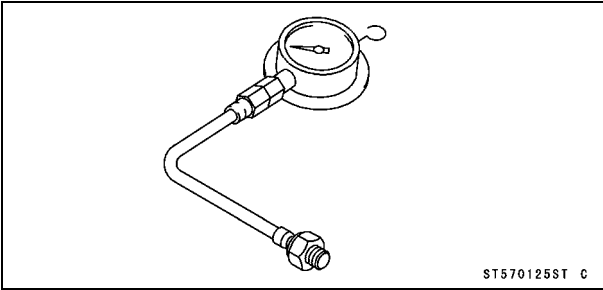
**Specifications**

<b>Item</b>	<b>Standard</b>
Subthrottle Sensor: Input Voltage Output Voltage  Resistance Subthrottle Valve Actuator: Input Voltage Resistance Oxygen Sensor: Output Voltage (Rich) Output Voltage (Lean) Heater Resistance	DC 4.75 ~ 5.25 V DC 0.6 ~ 0.8 V at subthrottle valve full close position DC 4.08 ~ 4.12 V at subthrottle valve full open position (for reference) 4 ~ 6 kΩ  About DC 10.3 ~ 12.3 V About 5.2 ~ 7.8 Ω  DC 0.8 V or more DC 0.24 V or less 6.7 ~ 10.5 Ω at 20°C (68°F)
<b>Throttle Grip and Cables</b> Throttle Grip Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)
<b>Air Cleaner</b> Element	Polyurethane Foam

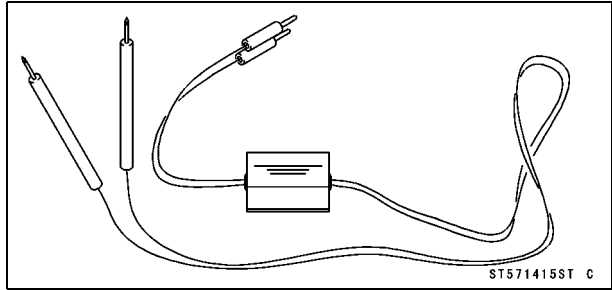
# 3-18 FUEL SYSTEM (DFI)

## Special Tools and Sealant

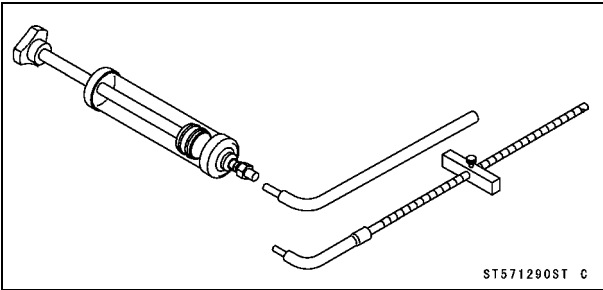
**Oil Pressure Gauge, 5 kgf/cm<sup>2</sup>:**  
57001-125



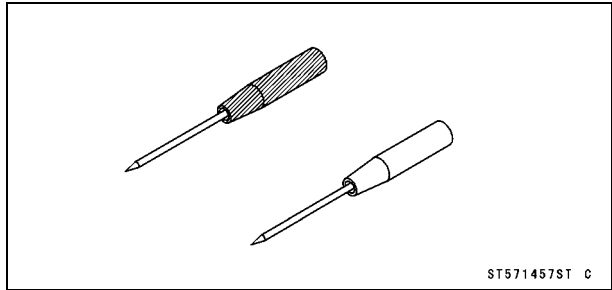
**Peak Voltage Adapter:**  
57001-1415



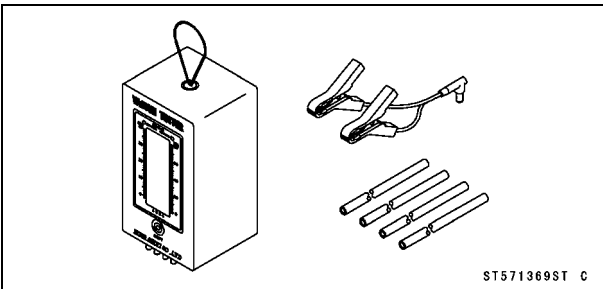
**Fork Oil Level Gauge:**  
57001-1290



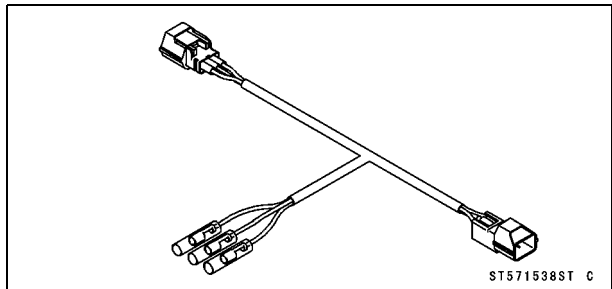
**Needle Adapter Set:**  
57001-1457



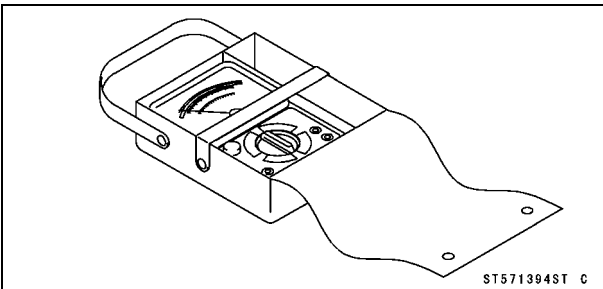
**Vacuum Gauge:**  
57001-1369



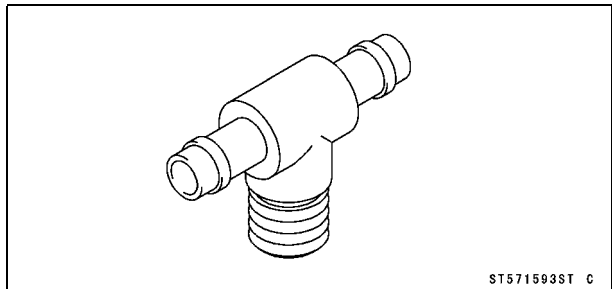
**Throttle Sensor Setting Adapter:**  
57001-1538



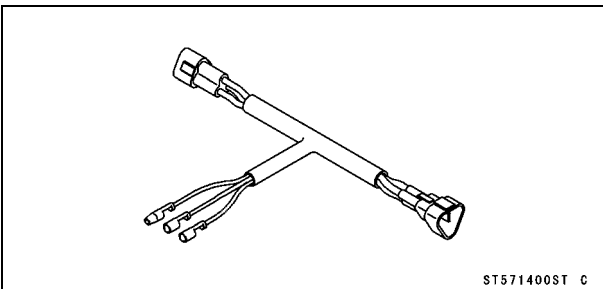
**Hand Tester:**  
57001-1394



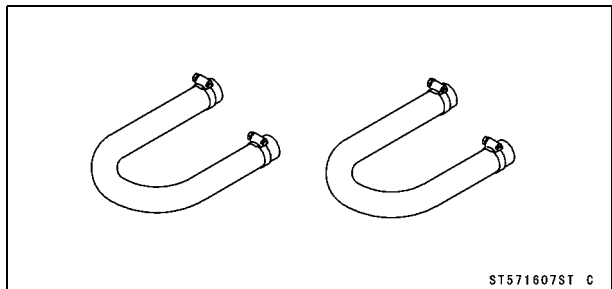
**Fuel Pressure Gauge Adapter:**  
57001-1593



**Throttle Sensor Setting Adapter #1:**  
57001-1400



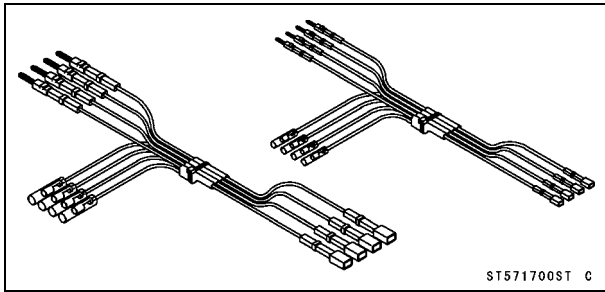
**Fuel Hose:**  
57001-1607



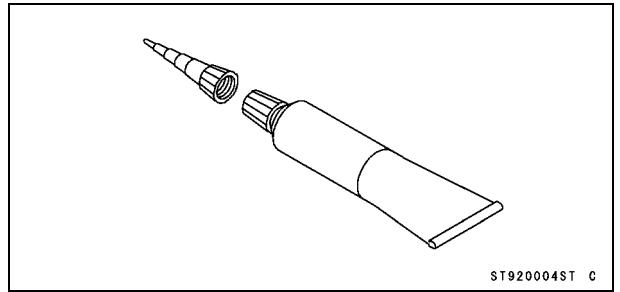


Special Tools and Sealant

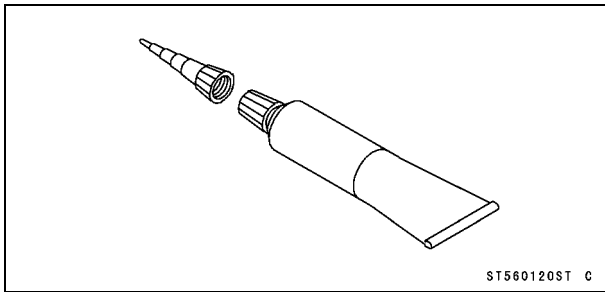
Measuring Adapter:  
57001-1700



Liquid Gasket, TB1211F:  
92104-0004



Liquid Gasket, TB1211:  
56019-120



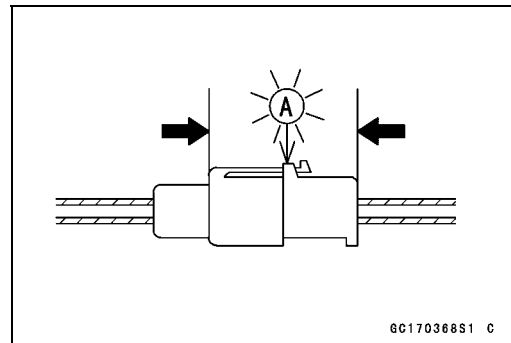
## 3-20 FUEL SYSTEM (DFI)

### DFI Servicing Precautions

#### DFI Servicing Precautions

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

- 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 cable connections. This will damage the ECU.
- To prevent damage to the DFI parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is ON, or while the engine is running.
- 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 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 switch to ON while any of the DFI electrical connectors are disconnected. The ECU memorizes service codes.
- Do not spray water on the electrical parts, DFI parts, connectors, leads and wiring.
- If a transceiver is installed on the motorcycle, make sure that the operation of the DFI system is not influenced by electric wave radiated from the antenna. Check operation of the system with the engine at idle. Locate the antenna as far as possible away from the ECU.
- When the fuel hose is disconnected, do not turn on the ignition switch. 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.
- When installing the fuel hoses, avoid sharp bending, kinking, flattening or twisting, and run the fuel hoses with a minimum of bending so that the fuel flow will not be obstructed.
- Route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- To prevent corrosion and deposits in the fuel system, do not add to fuel any fuel antifreeze chemicals.

### DFI Servicing Precautions

○If the motorcycle is not properly handled, the high pressure inside the fuel line can cause fuel to leak or the hose to burst. Remove the fuel tank (see Fuel Tank Removal) and check the fuel hose.

Fuel Hose [A]

★Replace the fuel hose if any fraying, cracks or bulges are noticed.



○To maintain the correct fuel/air mixture (F/A), there must be no intake air leaks in the DFI system. Be sure to install the oil filler plug [A] after filling the engine oil.

**Torque - Oil Filler Plug: Hand-tighten**



## 3-22 FUEL SYSTEM (DFI)

### Troubleshooting the DFI System

#### Outline

When an abnormality in the system occurs, the FI warning indicator light (LED) goes 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 warning indicator light (LED) blinks.

When due to a malfunction, the FI warning indicator light (LED) remains lit, ask the rider about the conditions [B] under which the problem occurred and try to determine the cause [C].

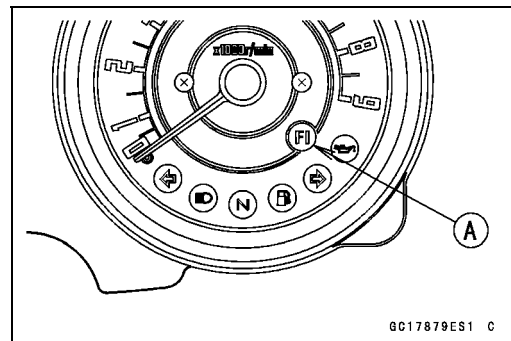
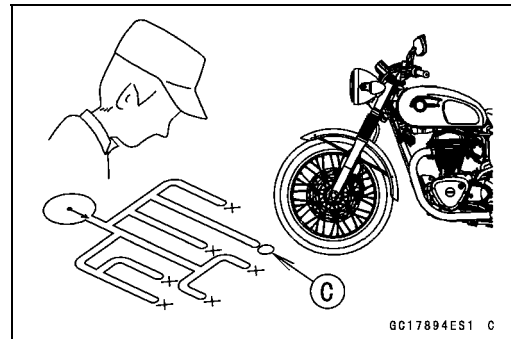
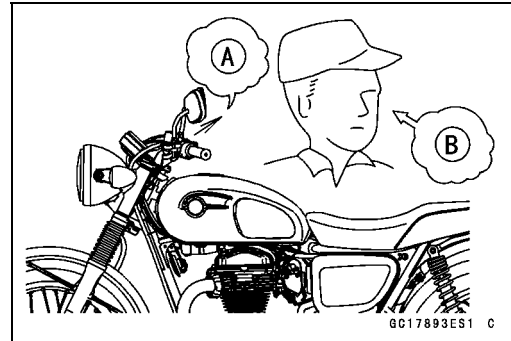
- First, conduct a self-diagnosis inspection and then a non-self-diagnosis inspection. The non-self-diagnosis items are not indicated by the FI warning indicator light (LED). Don't rely solely on the DFI self-diagnosis function, use common sense.

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

When the FI warning indicator light (LED) goes on and the motorcycle is brought in for repair, check the service codes.

When the repair has been done, the light doesn't go on. But the service codes stored in memory are not erased to preserve the problem history, and the light can display the codes in the self-diagnosis mode. The problem history is referred when solving unstable problems.

When the motorcycle is down, the vehicle-down sensor is turned off and the ECU shuts off the fuel injectors and ignition system. The FI warning indicator light (LED) goes on. The ignition switch is left to ON. If the starter button is pushed, the electric starter turns but the engine doesn't start. To start the engine again, raise the motorcycle, turn the ignition switch to OFF, and then ON. The vehicle-down sensor is turned on and the light goes off.



## Troubleshooting the DFI System

- When checking the DFI parts, use a digital meter which can be read two decimal place voltage or resistance.
- The DFI part connectors [A] have seals [B], including the ECU. When measuring the input or output voltage with the connector joined, use the needle adapter set [C]. Insert the needle adapter inside the seal until the needle adapter reaches the terminal.

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

### NOTICE

**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 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 switch to ON and measure the voltage with the connector joined.

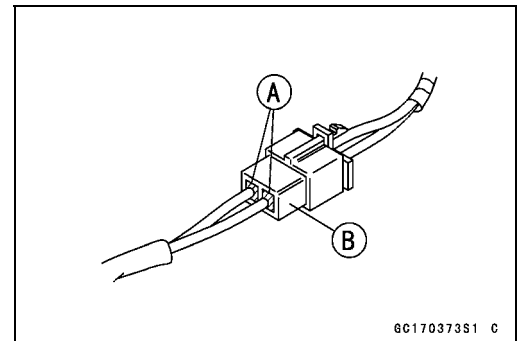
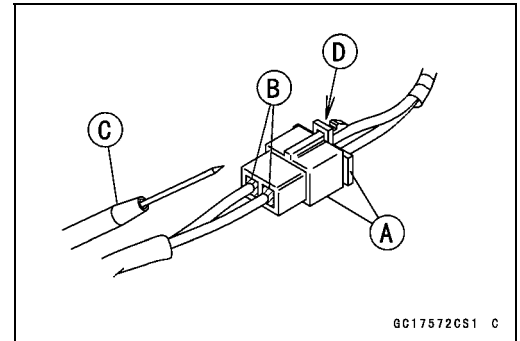
### NOTICE

**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.

**Sealant - Liquid Gasket, TB1211: 56019-120**

- Always check battery condition before replacing the DFI parts. A fully charged battery is a must for conducting accurate tests of the DFI system.
- 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 leads for signs of burning, fraying, short, etc. Deteriorated leads and bad connections can cause reappearance of problems and unstable operation of the DFI system.
- ★ If any wiring is deteriorated, replace the wiring.



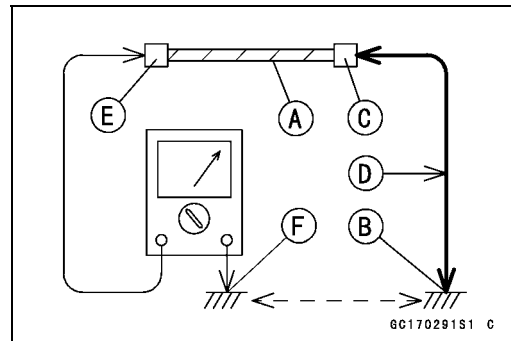
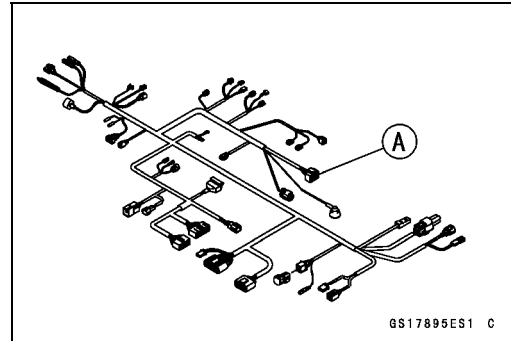
## 3-24 FUEL SYSTEM (DFI)

### Troubleshooting the DFI System

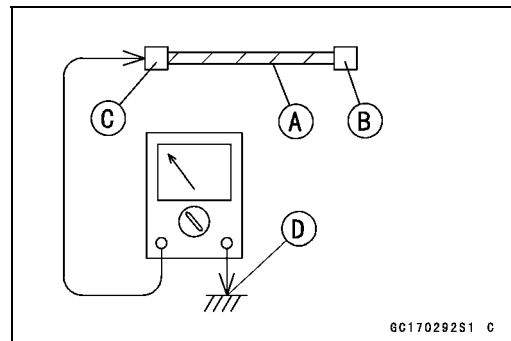
- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
- ★ If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it. Connect the connectors securely.
- Check the wiring for continuity.
- Use the wiring diagram to find the ends of the lead which is suspected of being a problem.
- Connect the hand tester between the ends of the leads.

**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 lead or the main harness or the subharness.
- If both ends of a harness [A] are far apart, ground [B] the one end [C], using a jumper lead [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.



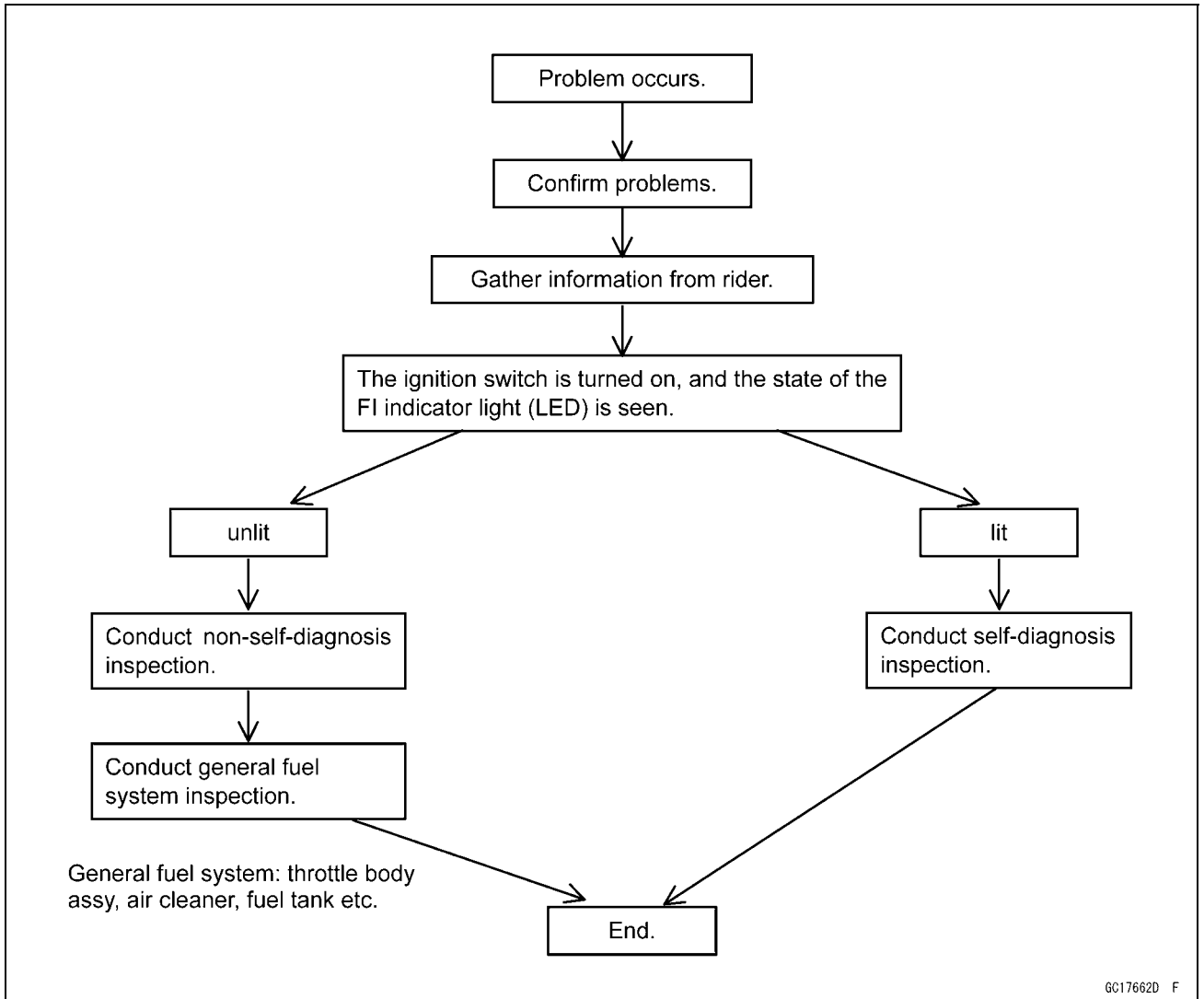
- When checking a harness [A] for short circuit, open one end [B] and check the continuity between the other end [C] and ground [D]. If there is continuity, the harness has a short circuit to ground, and it must be repaired or replaced.



- 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.

Troubleshooting the DFI System

DFI Diagnosis Flow Chart



## 3-26 FUEL SYSTEM (DFI)

### Troubleshooting the DFI System

#### Inquiries to Rider

- 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 following sample 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.

#### 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 1000 m or more)
<b>Motorcycle conditions when problem occurred.</b>	
FI warning indicator light (LED)	<input type="checkbox"/> goes on immediately after ignition switch ON, and goes off after 3 seconds (normal).
	<input type="checkbox"/> goes on immediately after ignition switch ON, and stays on (DFI problem).
	<input type="checkbox"/> does not go on 3 seconds after ignition switch ON.
	<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"/> 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:



**Troubleshooting the DFI System**

Poor running at low 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.
	<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"/> 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).
	<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:	

## 3-28 FUEL SYSTEM (DFI)

### 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 in DFI system.*
- *The ECU may be involved in the DFI electrical and ignition system troubles. If these parts and circuits are 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 Won't Turn Over

Symptoms or Possible Causes	Actions (chapter)
Neutral, starter lockout or sidestand switch trouble	Inspect each switch (see chapter 15).
Vehicle-down sensor operated	Turn ignition switch OFF (see chapter 3).
Vehicle-down sensor trouble	Inspect (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 15).
Ignition coil shorted or not in good contact	Inspect or Reinstall (see chapter 15).
Ignition coil trouble	Inspect (see chapter 15).
Spark plug dirty, broken or gap maladjusted	Inspect and replace (see chapter 15).
Spark plug incorrect	Replace it with correct plug (see chapter 2).
ECU ground and power supply trouble	Inspect (see chapter 3).
ECU trouble	Inspect (see chapter 3).
No or little fuel in tank	Supply fuel (see Owner's Manual).
Fuel injector trouble	Inspect and replace (see chapter 3).
Fuel pump not operating	Inspect (see chapter 3).
Fuel filter or pump screen clogged	Inspect and replace fuel pump (see chapter 3).
Fuel pressure regulator trouble	Inspect fuel pressure and replace fuel pump (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).

#### Poor Running at Low Speed

Symptoms or Possible Causes	Actions (chapter)
<b>Spark weak:</b>	
Ignition coil shorted or not in good contact	Inspect or reinstall (see chapter 15).
Ignition coil trouble	Inspect (see chapter 15).
Spark plug dirty, broken or gap maladjusted	Inspect and replace (see chapter 15).
Spark plug incorrect	Replace it with the correct plug (see chapter 2).
ECU trouble	Inspect (see chapter 3).
<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).
Throttle body assy holder loose	Reinstall (see chapter 3).
Fuel injector dust seal damage	Replace (see chapter 3).
Fuel injector O-ring damage	Replace (see chapter 3).
Fuel filter or pump screen clogged	Inspect and replace fuel pump (see chapter 3).
Fuel pressure regulator trouble	Inspect fuel pressure and replace fuel pump (see chapter 3).

**DFI System Troubleshooting Guide**

Symptoms or Possible Causes	Actions (chapter)
Fuel line clogged	Inspect and repair (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
<b>Unstable (rough) idling:</b>	
Fuel pressure too low or too high	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
Engine vacuum not synchronizing	Inspect and adjust (see chapter 2).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
<b>Engine stalls easily:</b>	
Spark plug dirty, broken or gap maladjusted	Inspect and replace (see chapter 15).
Ignition coil trouble	Inspect (see chapter 15).
Main throttle sensor trouble	Inspect (see chapter 3).
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Fuel pressure regulator trouble	Inspect fuel pressure and replace fuel pump (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
<b>Poor acceleration:</b>	
Fuel pressure too low	Inspect (see chapter 3).
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Fuel filter or pump screen clogged	Inspect and replace fuel pump (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).

### 3-30 FUEL SYSTEM (DFI)

#### DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Spark plug dirty, broken or gap maladjusted	Inspect and replace (see chapter 15).
Ignition coil trouble	Inspect (see chapter 15).
<b>Stumble:</b>	
Fuel pressure too low	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature 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 replace fuel pump) (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
<b>Backfiring when deceleration:</b>	
Spark plug dirty, broken or gap maladjusted	Inspect and replace (see chapter 15).
Fuel pressure too low	Inspect (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Air switching valve trouble	Inspect and replace (see chapter 15).
Air suction valve trouble	Inspect and replace (see chapter 4).
<b>After fire:</b>	
Spark plug burned or gap maladjusted	Replace (see chapter 15).
Fuel injector trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
<b>Other:</b>	
Intermittent any DFI fault and its recovery	Check that DFI connectors are clean and tight, and examine leads 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 (chapter)
<b>Firing incorrect:</b>	
Ignition coil shorted or not in good contact	Inspect or Reinstall (see chapter 15).
Ignition coil trouble	Inspect (see chapter 15).
Spark plug dirty, broken or gap maladjusted	Inspect and replace (see chapter 15).
Spark plug incorrect	Replace it with the correct plug (see chapter 2).
ECU trouble	Inspect (see chapter 3).
<b>Fuel/air mixture incorrect:</b>	
Air cleaner clogged, poorly sealed, or missing	Clean element or inspect sealing (see chapter 3).
Air cleaner housing loose	Reinstall (see chapter 3).
Throttle body assy holder loose	Reinstall (see chapter 3).
Fuel injector dust seal damage	Replace (see chapter 3).
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Fuel injector O-ring damage	Replace (see chapter 3).
Fuel injector clogged	Inspect and repair (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
Fuel pump operates intermittently.	Fuel pump bearings may wear. Replace the fuel pump (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Cracked or obstructed intake air pressure sensor vacuum hose	Inspect and repair or replace (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
<b>Knocking:</b>	
Fuel poor quality or incorrect	Fuel change (Use the gasoline recommended in the Owner's Manual).
Spark plug incorrect	Replace it with the correct plug (see chapter 2).
Ignition coil trouble	Inspect (see chapter 15).
ECU trouble	Inspect (see chapter 3).
Engine vacuum not synchronizing	Inspect and adjust (see chapter 2).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
<b>Miscellaneous:</b>	
Subthrottle sensor trouble	Inspect (see chapter 3).
Subthrottle valve actuator trouble	Inspect (see chapter 3).
Throttle valve will not fully open	Inspect throttle cables and lever linkage (see chapter 3).
Engine overheating - Engine temperature sensor, crankshaft sensor or speed sensor trouble	(see Overheating of Troubleshooting Guide in chapter 16)

## 3-32 FUEL SYSTEM (DFI)

### DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Air switching valve trouble	Inspect and replace (see chapter 15).
Air suction valve trouble	Inspect and replace (see chapter 4).
<b>Exhaust Smokes Excessively:</b>	
<b>(Black smoke)</b>	
Air cleaner element clogged	Clean element (see chapter 3).
Fuel pressure too high	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
<b>(Brown smoke)</b>	
Air cleaner housing loose	Reinstall (see chapter 3).
Fuel pressure too low	Inspect (see chapter 3).
Engine temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).

## Self-Diagnosis

### Self-diagnosis Outline

The self-diagnosis system has two modes and can be switched to another mode by grounding the self-diagnosis terminal.

### User Mode

The ECU notifies the rider of troubles in DFI system and ignition system by lighting the FI indicator when DFI system and ignition system parts are faulty, and initiates fail-safe function. In case of serious troubles, the ECU stops the injection/ignition operation.

### Dealer Mode

The FI warning indicator light (LED) emits service code(s) to show the problem(s) which the DFI system and ignition system have at the moment of diagnosis.

### Self-diagnosis Procedures

○When a problem occurs with the DFI system and ignition system, the FI warning indicator light (LED) [A] goes on.

#### NOTE

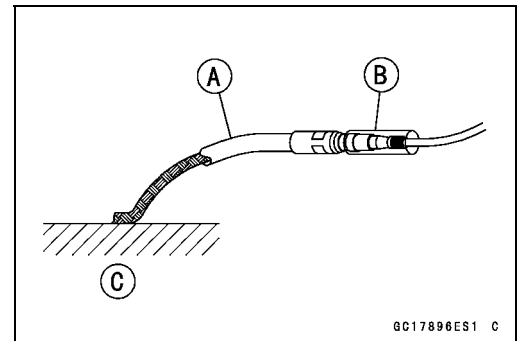
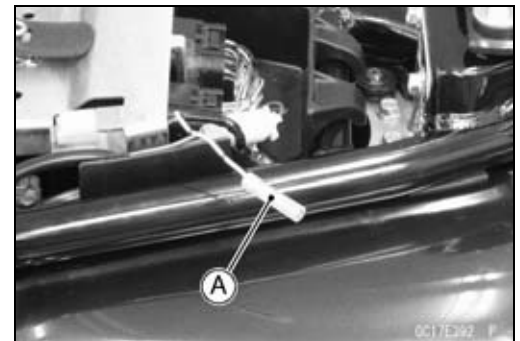
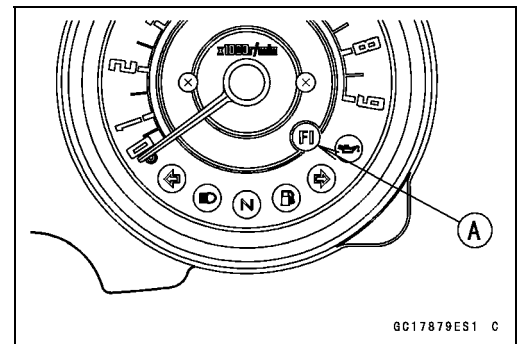
○Use a fully charged battery when conducting self-diagnosis. Otherwise, the light (LED) blinks very slowly or does not blink.

- Remove the seat (see Seat Removal in the Frame chapter).
- Pull out the self-diagnosis terminal [A] (Y lead).

- Turn on the ignition switch.
- Connect an auxiliary lead [A] to the self-diagnosis terminal [B] for grounding.
- To enter the self-diagnosis dealer mode, ground [C] the self-diagnosis indicator terminal to the battery (–) terminal, and then keep it grounded continuously.
- Count the blinks of the light (LED) to read the service code. Keep the auxiliary lead ground until you finish reading the service code.

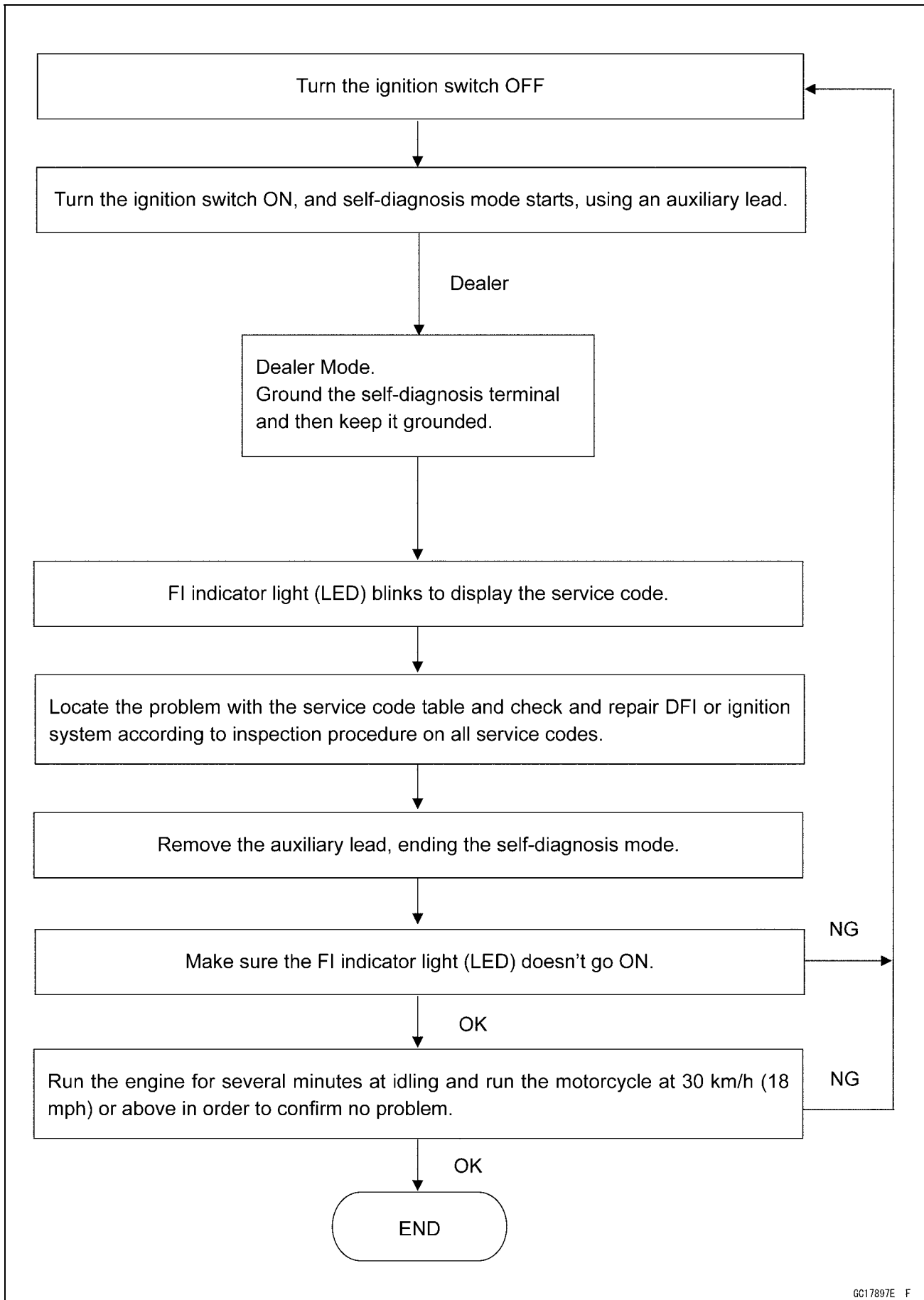
#### NOTE

○Keep the self-diagnosis terminal grounded during self-diagnosis, with an auxiliary lead.



### 3-34 FUEL SYSTEM (DFI)

#### Self-Diagnosis

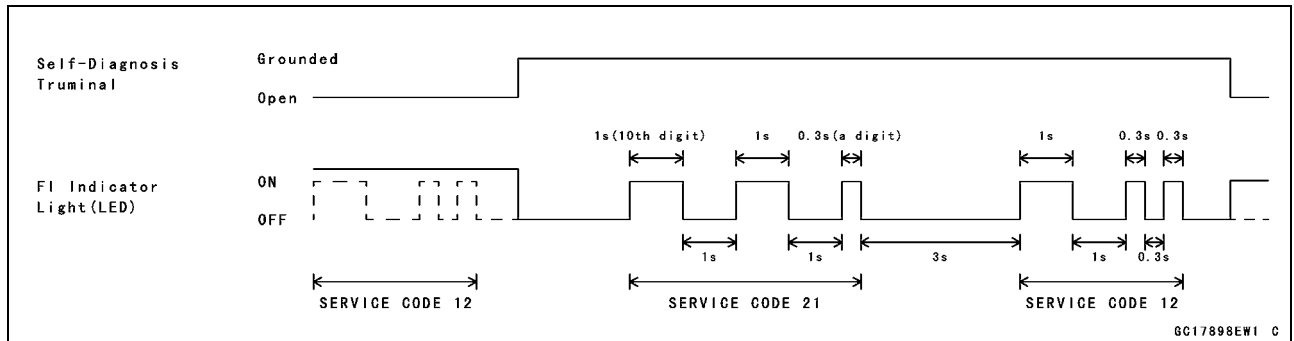




## Self-Diagnosis

### How to Read Service Codes

- Service codes are shown by a series of long and short blinks of the FI warning indicator light (LED) as shown below.
- Read 10th digit and unit digit as the FI warning indicator light (LED) blinks.
- Once problem(s) occurs, the service code(s) continues to be sent in the ECU.
- When there are a number of problems, all the service 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 self-diagnosis indicator terminal is open.
- For example, if two problems occurred in the order of 21, 12, the service codes are displayed from the lowest number in the order listed.  
(12 → 21) → (12 → 21) → ... (repeated)



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

- FI Warning Indicator Light (LED)
- ECU Power Source Wiring and Ground Wiring (see ECU Power Supply Inspection)
- ECU Main Relay
- Fuel Injectors

### How to Erase Service Codes

- When repair has been done, the service code disappears.
- But the service codes stored in memory of the ECU are not erased to preserve the problem history.
- Even if the ignition switch is turned to OFF, the battery or the ECU are disconnected or the problem is solved, all service codes remain in the ECU.
- The past service code(s) cannot be erased.



**Self-Diagnosis**

**Backups**

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

<b>Service Codes</b>	<b>Parts</b>	<b>Output Signal Usable Range or Criteria</b>	<b>Backups by ECU</b>
<b>11</b>	Main Throttle Sensor	Output Voltage 0.2 ~ 4.8 V	If the main 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 closed throttle position and sets the DFI in the D-J method (1).
<b>12</b>	Inlet Air Pressure Sensor	Inlet Air Pressure (absolute) $P_v = 150 \sim 800$ 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 (2).
<b>13</b>	Inlet Air Temperature Sensor	Inlet Air Temperature $T_a = -30 \sim +120^\circ\text{C}$	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 $30^\circ\text{C}$ .
<b>17</b>	Engine Temperature Sensor	Engine Temperature $T_o = -30^\circ\text{C} \sim +200^\circ\text{C}$	If the Engine temperature sensor system fails (the signal is out of the usable range, wiring short or open), the ECU sets $T_o$ at $160^\circ\text{C}$ .
<b>21</b>	Crankshaft Sensor	Crankshaft sensor must send 22 signals to the ECU at the 1 cranking.	If the crankshaft sensor fails, the engine stops by itself.
<b>24</b>	Speed Sensor	Speed sensor must send 4 signals to the ECU at the one rotation of the engine sprocket. The gear position is decided by the signal of the speed sensor.	If the speed sensor system fails (no signal, wiring short or open), the speedometer shows 0.
<b>31</b>	Vehicle-down Sensor	Output Voltage 0.2 ~ 4.8 V	If the vehicle-down sensor fails, the ECU shuts off the fuel system and the ignition system.
<b>32</b>	Subthrottle Sensor	Output Voltage 0.2 ~ 4.8 V	If the subthrottle sensor system fails (the output voltage is out of the usable range, wiring short or open), the ECU drive the subthrottle valve to the full closed position, and it stops the current to the subthrottle valve actuator.
<b>33</b>	Oxygen Sensor	The oxygen sensor is active and sensor must send signals (output voltage) continuously to the ECU.	If the oxygen sensor is not activated, the ECU stops oxygen sensor feedback mode. If the fuel pump fails, the fuel pump stops by itself.
<b>46</b>	Fuel Pump	Output Voltage 1.6 ~ 6.0 V	If the fuel pump fails, the fuel pump stops by itself.
<b>51</b>	Ignition Coil	The ignition coil primary winding must send signals (output voltage) continuously to the ECU.	If the ignition coil primary winding has failures (wiring short or open), the ECU shuts off the injector #1 to stop fuel to the cylinder, though the engine keeps running.

### 3-38 FUEL SYSTEM (DFI)

#### Self-Diagnosis

Service Codes	Parts	Output Signal Usable Range or Criteria	Backups by ECU
62	Subthrottle Valve Actuator	The actuator operates open and close of the subthrottle valve by the pulse signal from the ECU.	If the subthrottle valve actuator fails (the signal is out to the usable range, wiring short or open), the ECU stops the current to the actuator.
64	Air Switching Valve	The air switching valve controls the flow of the secondary air by opening and shutting the solenoid valve.	—
67	Oxygen Sensor Heater	The oxygen sensor heater raise temperature of the sensor for its earlier activation.	If the oxygen sensor heater fails (wiring short or open), the ECU stops the current to the heater.

**Note:**

(1) D-J Method: the DFI control method from medium to heavy engine load. When the engine load is light like at idling or low speed, the ECU determines the injection quantity by calculating from the throttle vacuum (intake air pressure sensor output voltage) and engine speed (crankshaft sensor output voltage). This method is called D-J method.

(2)  $\alpha$ -N Method: As the engine speed increases, and the engine load turns middle to heavy, the ECU determines the injection quantity by calculating from the throttle opening (main throttle sensor output voltage) and the engine speed. This method is called  $\alpha$ -N method.

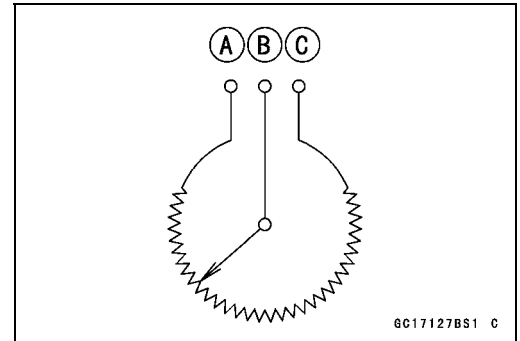
## Main Throttle Sensor (Service Code 11)

The main throttle sensor is a rotating variable resistor that change output voltage according to throttle operating. The ECU senses this voltage change and determines fuel injection quantity, and ignition timing according to engine rpm, and throttle opening.

Input Terminal [A]

Output Terminal [B]

Ground Terminal [C]

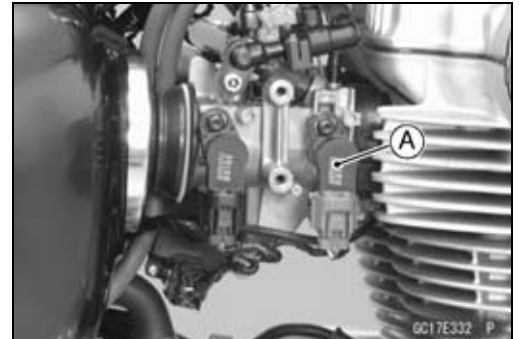


### Main Throttle Sensor Removal/Adjustment

#### NOTICE

Do not remove or adjust the main throttle sensor [A] since it has been adjusted and set with precision at the factory.

Never drop the throttle body assy especially on a hard surface. Such a shock to the main throttle sensor can damage it.



### Main Throttle Sensor Input Voltage Inspection

#### NOTE

○Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
  - Remove:
    - Bolts [A]
    - Cover [B]
  - Disconnect the main throttle sensor connector and connect the adapter [A] between these connectors.
- Special Tool - Throttle Sensor Setting Adapter: 57001-1538**
- Connect a digital meter to the harness adapter leads.

#### Main Throttle Sensor Input Voltage

##### Connections to Adapter:

Digital Meter (+) → BK (main harness BL) lead

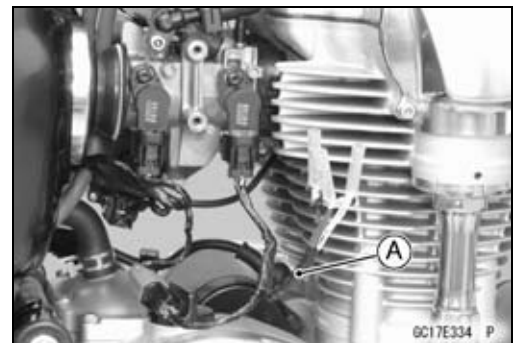
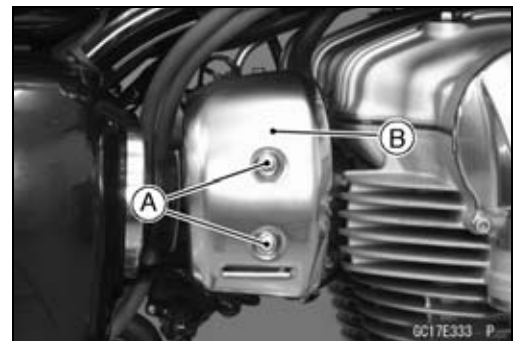
Digital Meter (-) → W (main harness BR/BK) lead

- Measure the input voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

#### Input Voltage

Standard: DC 4.75 ~ 5.25 V

- Turn the ignition switch to OFF.
- ★ If the reading is within the standard, check the output voltage (see Main Throttle Sensor Output Voltage Inspection).



## 3-40 FUEL SYSTEM (DFI)

### Main Throttle Sensor (Service Code 11)

★ If the reading is out of the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

○ Disconnect the ECU and sensor connectors.

#### Wiring Continuity Inspection

**ECU Connector [A]** ↔

**Main Throttle Sensor Connector [B]**

**BL lead (ECU terminal 32) [C]**

**BR/BK lead (ECU terminal 38) [D]**

★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).

★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).

#### Main Throttle Sensor Output Voltage Inspection

● Measure the output voltage at the main throttle sensor in the same way as input voltage inspection. Note the following.

○ Disconnect the main throttle sensor connector and connect the adapter [A] between these connectors.

**Special Tool - Throttle Sensor Setting Adapter: 57001-1538**

#### Main Throttle Sensor Output Voltage

**Connections to Adapter:**

**Digital Meter (+)** → R (main harness Y/W) lead

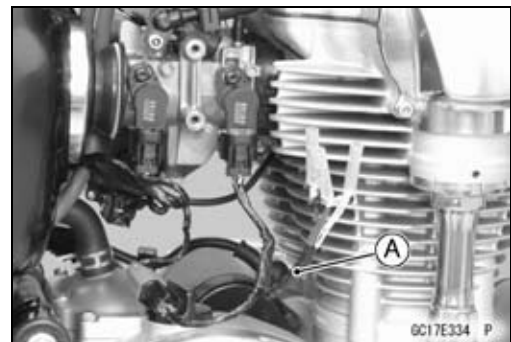
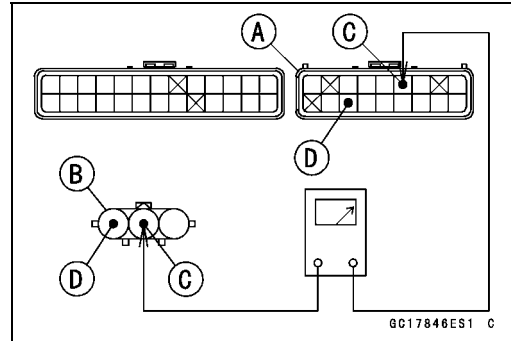
**Digital Meter (-)** → W (main harness BR/BK) lead

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

#### Idle Speed

**Standard: 1 200 ±50 r/min (rpm)**

★ If the idle speed is out of the specified range, adjust it (see Idle Speed Inspection in the Periodic Maintenance chapter).



**Main Throttle Sensor (Service Code 11)**

- Turn the ignition switch to OFF.
- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

**Output Voltage**

**Standard:** DC 1.06 ~ 1.10 V at idle throttle opening  
 DC 4.14 ~ 4.34 V at full throttle opening (for reference)

**NOTE**

- Open the throttle, confirm the output voltage will be rise.
- The standard voltage refers to the value when the voltage reading at the Input Voltage Inspection shows 5 V exactly.
- When the input voltage reading shows other than 5 V, derive a voltage range as follows.  
*Example:*  
 In the case of a input voltage of 4.75 V.  
 $1.06 \times 4.75 \div 5.00 = 1.007 \text{ V}$   
 $1.10 \times 4.75 \div 5.00 = 1.045 \text{ V}$   
 Thus, the valid range is 1.007 ~ 1.045 V

- Turn the ignition switch to OFF.
- ★ If the reading is out of the standard, check the main throttle sensor resistance (see Main Throttle Sensor Resistance Inspection).
- ★ If the reading is within the standard, remove the ECU and check the wiring for continuity between the main harness connectors.

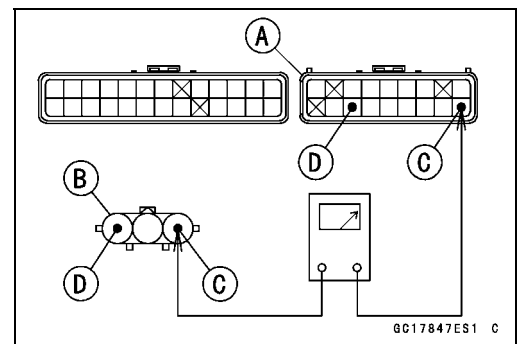
**Special Tool - Hand Tester: 57001-1394**

- Disconnect the ECU and sensor connectors.

**Wiring Continuity Inspection**

**ECU Connector [A]** ↔  
**Main Throttle Sensor Connector [B]**  
**Y/W lead (ECU terminal 44) [C]**  
**BR/BK lead (ECU terminal 38) [D]**

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



## 3-42 FUEL SYSTEM (DFI)

### Main Throttle Sensor (Service Code 11)

#### Main Throttle Sensor Resistance Inspection

- Turn the ignition switch to OFF.
- Disconnect the main throttle sensor connector.
- Connect the adapter [A] to the main throttle sensor.
- Do not connect the adapter to the main harness [B].

**Special Tool - Throttle Sensor Setting Adapter: 57001-1538**

#### Main Throttle Sensor Resistance

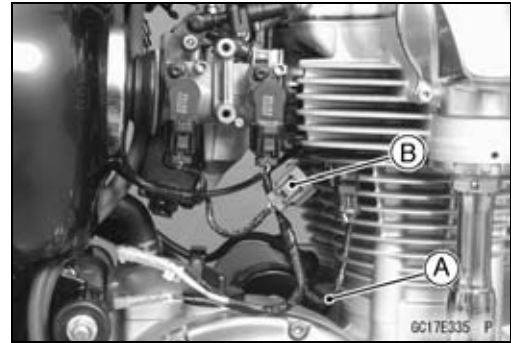
##### Connections to Adapter:

**Digital Meter (+)** → BK (main harness BL) lead

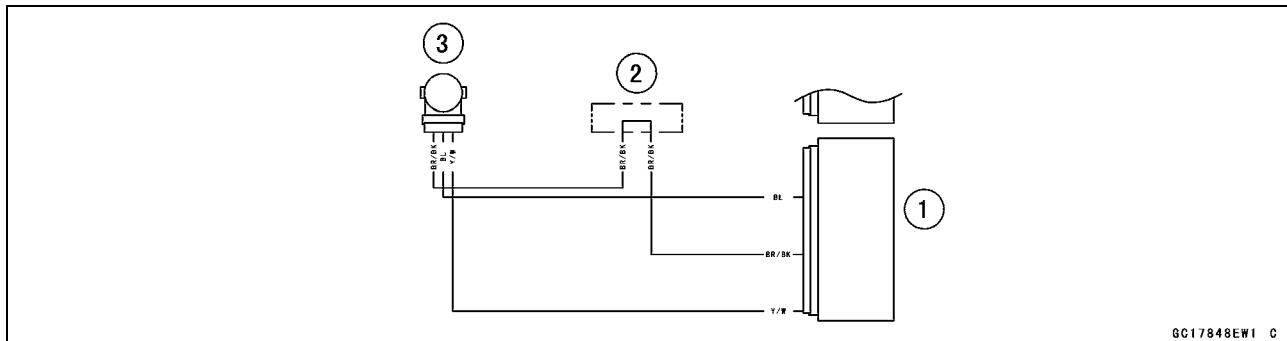
**Digital Meter (-)** → W (main harness BR/BK) lead

**Standard:** 4 ~ 6 kΩ

- ★ If the reading is out of the standard, replace the throttle body assy (see Throttle Body Assy Removal/Installation).
- ★ If the reading is within the standard, but the problem still exists, replace the ECU (see ECU Removal/Installation).



#### Main Throttle Sensor Circuit



1. ECU
2. Water-proof Joint
3. Main Throttle Sensor



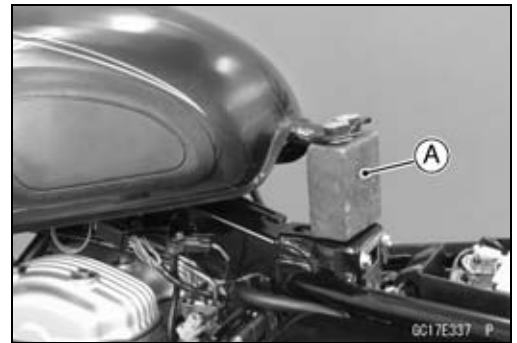
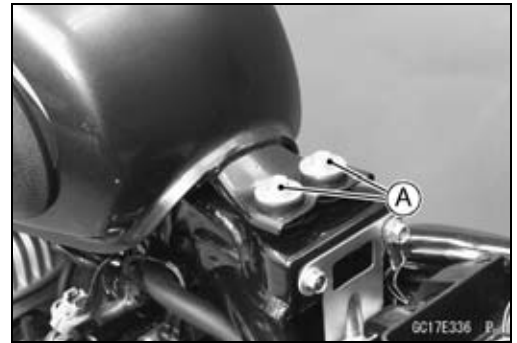
**Intake Air Pressure Sensor (Service Code 12)**

**Intake Air Pressure Sensor Removal/Installation**

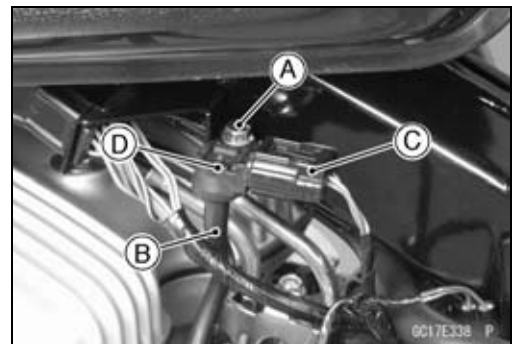
**NOTICE**

Never drop the intake air pressure sensor especially on a hard surface. Such a shock to the sensor can damage it.

- Remove:
  - Seat (see Seat Removal in the Frame chapter)
  - Bolts [A]
- Put a block [A] under the fuel tank as shown in the figure.



- Remove:
  - Bolt [A]
  - Hose [B]
  - Connector [C]
  - Intake Air Pressure Sensor [D]
- Installation is the reverse of removal.



**Intake Air Pressure Sensor Input Voltage Inspection**

**NOTE**

○Be sure the battery is fully charged.

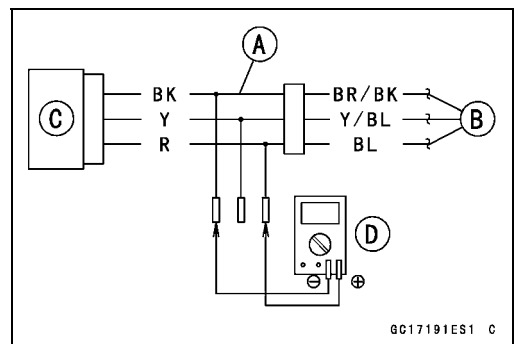
- Turn the ignition switch to OFF.
- Disconnect the intake air pressure sensor connector and connect the adapter [A] between these connectors.
  - Main Harness [B]
  - Intake Air Pressure Sensor [C]

**Special Tool - Measuring Adapter: 57001-1700**

- Connect a digital meter [D] to the adapter leads.

**Intake Air Pressure Sensor Input Voltage Connections to Adapter:**

- Digital Meter (+) → R (main harness BL) lead
- Digital Meter (-) → BK (main harness BR/BK) lead



## 3-44 FUEL SYSTEM (DFI)

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

- Measure the input voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

#### Input Voltage

**Standard: DC 4.75 ~ 5.25 V**

- Turn the ignition switch to OFF.
- ★ If the reading is within the standard, check the output voltage (see Intake Air Pressure Sensor Output Voltage Inspection).
- ★ If the reading is out of the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

- Disconnect the ECU and sensor connectors.

#### Wiring Continuity Inspection

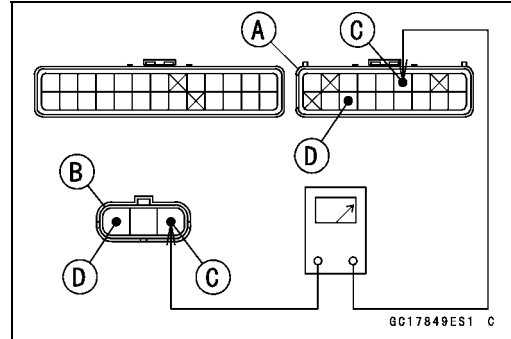
**ECU Connector [A] ↔**

**Intake Air Pressure Sensor Connector [B]**

**BL lead (ECU terminal 32) [C]**

**BR/BK lead (ECU terminal 38) [D]**

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



#### Intake Air Pressure Sensor Output Voltage Inspection

- Measure the output voltage at the intake air pressure sensor in the same way as input voltage inspection. Note the following.
- Disconnect the intake air pressure sensor connector and connect the adapter [A] between these connectors.
  - Main Harness [B]
  - Intake Air Pressure Sensor [C]
  - Digital Meter [D]

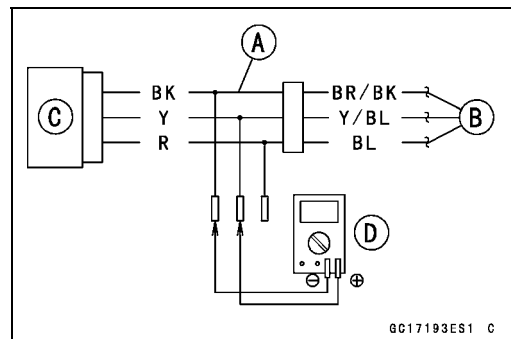
**Special Tool - Measuring Adapter: 57001-1700**

#### Intake Air Pressure Sensor Output Voltage Connections to Adapter:

**Connections to Adapter:**

**Digital Meter (+) → Y (main harness Y/BL) lead**

**Digital Meter (-) → BK (main harness BR/BK) lead**



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

- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

**Output Voltage**

**Usable Range:** DC 3.80 ~ 4.20 V at standard atmospheric pressure (101.32 kPa, 76 cmHg)

**NOTE**

○ The output voltage changes according to local atmospheric pressure.

- Turn the ignition switch to OFF.
- ★ If the reading is out of the usable range, replace the sensor.
- ★ If the reading is within the usable range, remove the ECU and check the wiring for continuity between main harness connector.

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

○ Disconnect the ECU and sensor connectors.

**Wiring Continuity Inspection**

**ECU Connector [A]** ↔  
**Intake Air Pressure Sensor Connector [B]**  
**Y/BL lead (ECU terminal 41) [C]**  
**BR/BK lead (ECU terminal 38) [D]**

- ★ If the wiring is good, check the sensor for various vacuum.
- Remove the intake air pressure sensor [A] and disconnect the vacuum hose from the sensor.
- Connect an auxiliary hose [B] to the intake air pressure sensor.
- Temporarily install the intake air pressure sensor.
- Connect a digital meter [C], vacuum gauge [D], the fork oil level gauge [E] and the measuring adapter to the intake air pressure sensor.

**Special Tools - Fork Oil Level Gauge: 57001-1290**  
**Vacuum Gauge: 57001-1369**  
**Measuring Adapter: 57001-1700**

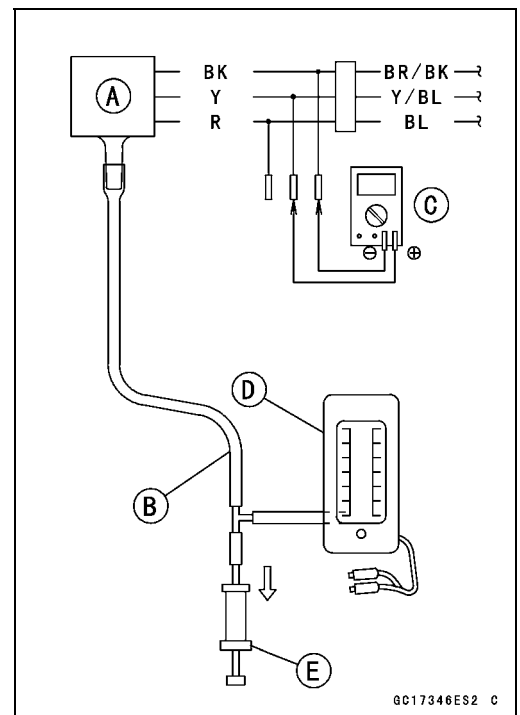
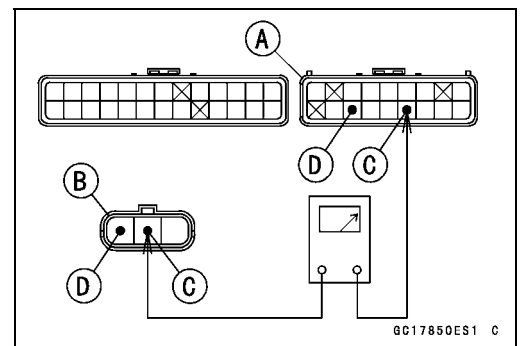
**Intake Air Pressure Sensor Output Voltage**

**Connections to Adapter:**  
**Digital Meter (+) → Y (main harness Y/BL) lead**  
**Digital Meter (-) → BK (main harness BR/BK) lead**

- Turn the ignition switch to ON.
- Measure the intake air pressure sensor output voltage from various vacuum readings, while pulling the handle of the fork oil level gauge.
- Check the intake air pressure sensor output voltage, using the following formula and chart.

Suppose:

Pg: Vacuum Pressure (Gauge) of Throttle Body  
 Pl: Local Atmospheric Pressure (Absolute) measured by a barometer  
 Pv: Vacuum Pressure (Absolute) of Throttle Body  
 Vv: Sensor Output Voltage (V)



## 3-46 FUEL SYSTEM (DFI)

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

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then

$$P_v = P_i - P_g$$

For example, suppose the following data is obtained:

$P_g = 8$  cmHg (Vacuum Gauge Reading)

$P_i = 70$  cmHg (Barometer Reading)

$V_v = 3.2$  V (Digital Meter Reading)

then

$$P_v = 70 - 8 = 62 \text{ cmHg (Absolute)}$$

Plot this  $P_v$  (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.

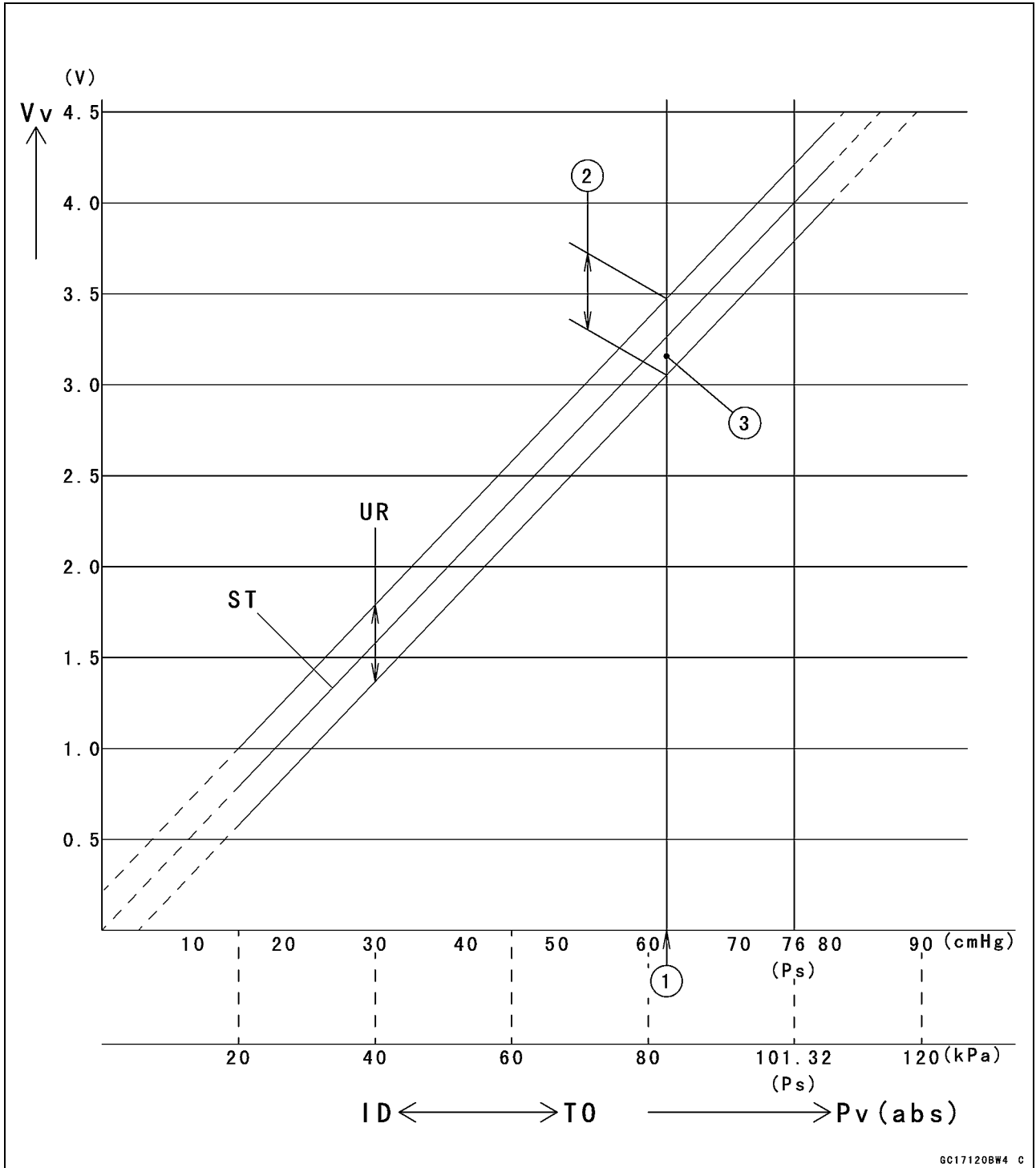
Usable range = 3.08 ~ 3.48 V

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

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

- ★ If the reading is out of the usable range, replace the sensor.
- ★ If the reading is within the usable range, check the ECU for its ground and power supply (see ECU Power Supply Inspection in the Fuel System (DFI) chapter).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation in the Fuel System (DFI) chapter).

Intake Air Pressure Sensor (Service Code 12)



ID: Idling

Ps: Standard Atmospheric Pressure (Absolute)

Pv: Throttle Vacuum Pressure (Absolute)

ST: Standard of Sensor Output Voltage (V)

TO: Throttle Full Open

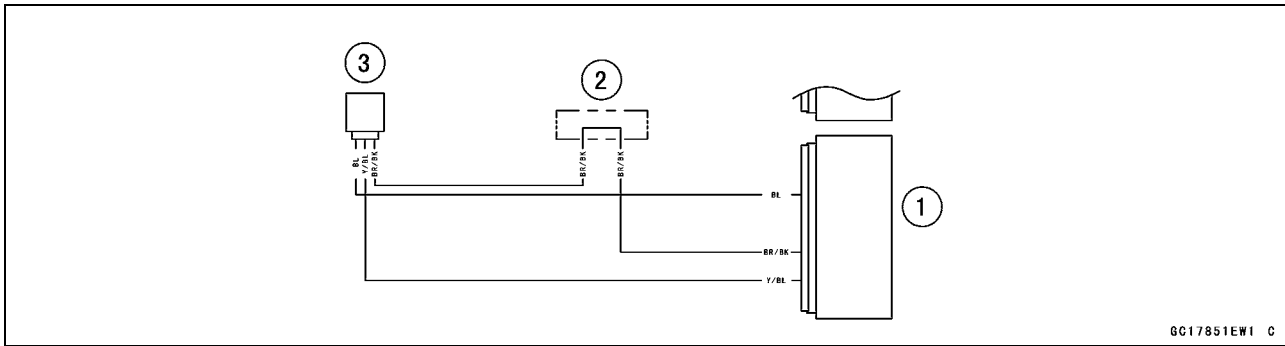
UR: Usable Range of Sensor Output Voltage (V)

Vv: Intake Air Pressure Sensor Output Voltage (V) (Digital Meter Reading)

## 3-48 FUEL SYSTEM (DFI)

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

#### Intake Air Pressure Sensor Circuit



1. ECU
2. Water-proof Joint
3. Intake Air Pressure Sensor

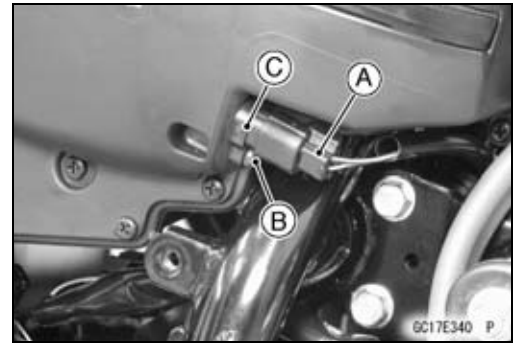
**Intake Air Temperature Sensor (Service Code 13)**

**Intake Air Temperature Sensor Removal/Installation**

**NOTICE**

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

- Remove:
  - Right Side Cover (see Right Side Cover Removal in the Frame chapter)
  - Connector [A]
  - Screw [B]
  - Intake Air Temperature Sensor [C]
- Installation is the reverse of removal.



**Intake Air Temperature Sensor Output Voltage Inspection**

**NOTE**

○ Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Disconnect the intake air temperature sensor connector and connect the adapter [A] between these connectors.
  - Main Harness [B]
  - Intake Air Temperature Sensor [C]

**Special Tool - Measuring Adapter: 57001-1700**

- Connect a digital meter [D] to the adapter leads.

**Intake Air Temperature Sensor Output Voltage Connections to Adapter:**

**Digital Meter (+) → R (main harness P/BK) lead**

**Digital Meter (-) → BK (main harness BR/BK) lead**

- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

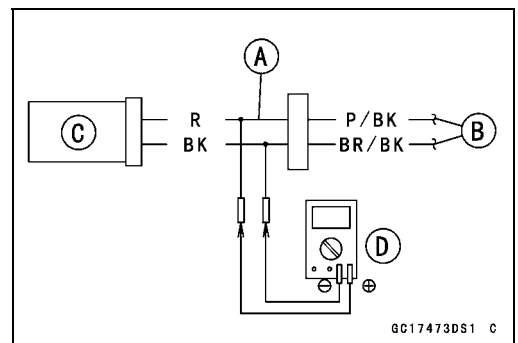
**Output Voltage**

**Standard: About DC 2.25 ~ 2.50 V at intake air temperature 20°C (68°F)**

**NOTE**

○ The output voltage changes according to the intake air temperature.

- Turn the ignition switch to OFF.
- ★ If the reading is within the standard, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



## 3-50 FUEL SYSTEM (DFI)

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

★ If the reading is out of the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

○ Disconnect the ECU and sensor connectors.

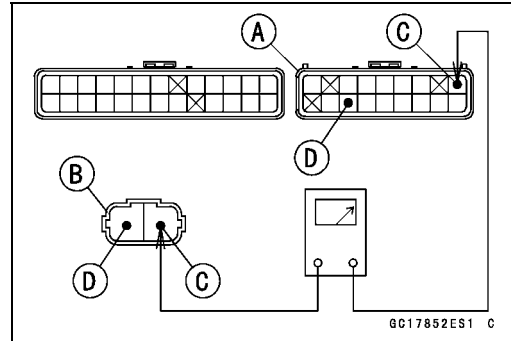
#### Wiring Continuity Inspection

**ECU Connector [A]** ↔

**Intake Air Temperature Sensor Connector [B]**

**P/BK lead (ECU terminal 35) [C]**

**BR/BK lead (ECU terminal 38) [D]**



★ If the wiring is good, check the intake air temperature sensor resistance (see Intake Air Temperature Sensor Resistance Inspection).

#### Intake Air Temperature Sensor Resistance Inspection

- Remove the intake air temperature sensor (see Intake Air Temperature Sensor Removal/Installation).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion is 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.

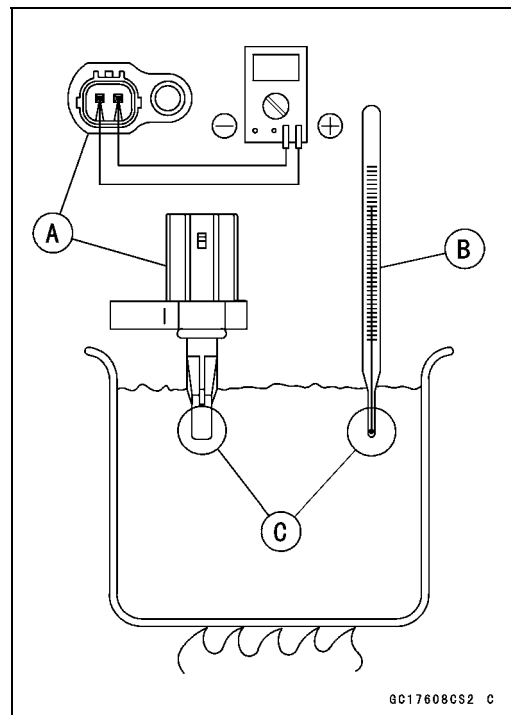
- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using a digital meter, measure the internal resistance of the sensor across the terminals at the temperatures shown in the following.

#### Intake Air Temperature Sensor Resistance

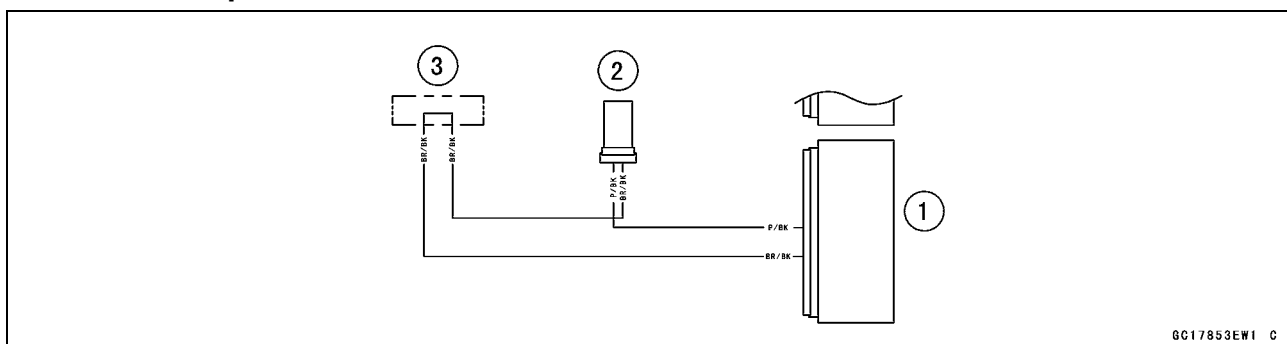
**Standard: 5.4 ~ 6.6 kΩ at 0°C (32°F)**

**About 0.29 ~ 0.39 kΩ at 80°C (176°F)**

- ★ If the reading is out of the standard, replace the sensor.
- ★ If the reading is within the standard, but the problem still exists, replace the ECU (see ECU Removal/Installation).



#### Intake Air Temperature Sensor Circuit



1. ECU
2. Intake Air Temperature Sensor
3. Water-proof Joint



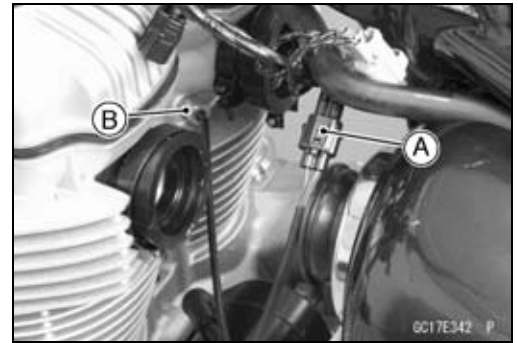
**Engine Temperature Sensor (Service Code 17)**

**Engine Temperature Sensor Removal/Installation**

**NOTICE**

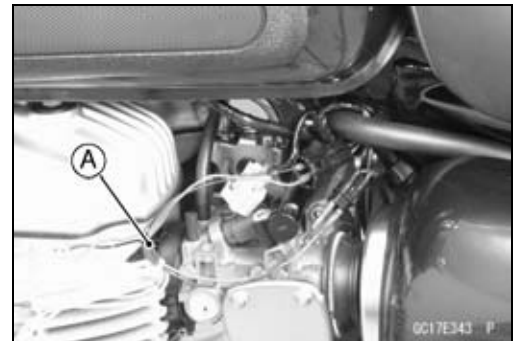
**Never drop the engine temperature sensor especially on a hard surface. Such a shock to the sensor can damage it.**

- Remove the throttle body assy (see Throttle Body Assy Removal).
- Remove:
  - Engine Temperature Sensor Lead Connector [A]
  - Engine Temperature Sensor [B]
- Tighten:
  - Torque - Engine Temperature Sensor: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Install the removed parts (see appropriate chapters).



**Engine Temperature Sensor Output Voltage Inspection**

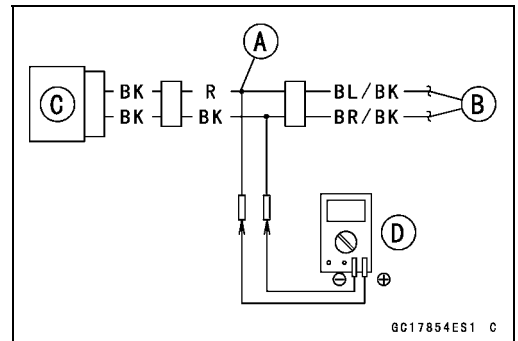
- NOTE**
- Be sure the battery is fully charged.
- Turn the ignition switch to OFF.
  - Disconnect the engine temperature sensor lead connector and connect the adapter [A] between these connectors.
    - Main Harness [B]
    - Engine Temperature Sensor [C]



- Special Tool - Measuring Adapter: 57001-1700**
- Connect a digital meter [D] to the adapter leads.

**Engine Temperature Sensor Output Voltage Connections to Adapter:**

- Digital Meter (+) → R (main harness BL/BK) lead**
- Digital Meter (-) → BK (main harness BK/BR) lead**
- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.



**Output Voltage**  
**Standard: About DC 3.68 ~ 3.79 V at 20°C (68°F)**

- NOTE**
- The output voltage changes according to the engine temperature.
- Turn the ignition switch to OFF.
  - ★ If the reading is within the standard, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
  - ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).

## 3-52 FUEL SYSTEM (DFI)

### Engine Temperature Sensor (Service Code 17)

★ If the reading is out of the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

○ Disconnect the ECU and sensor connectors.

#### Wiring Continuity Inspection

**ECU Connector [A]** ←→

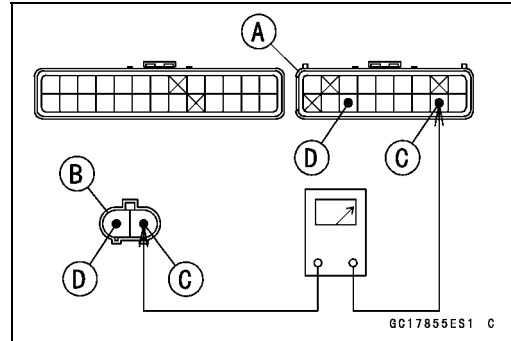
**Engine Temperature Sensor Connector [B]**

**BL/BK lead (ECU terminal 43) [C]**

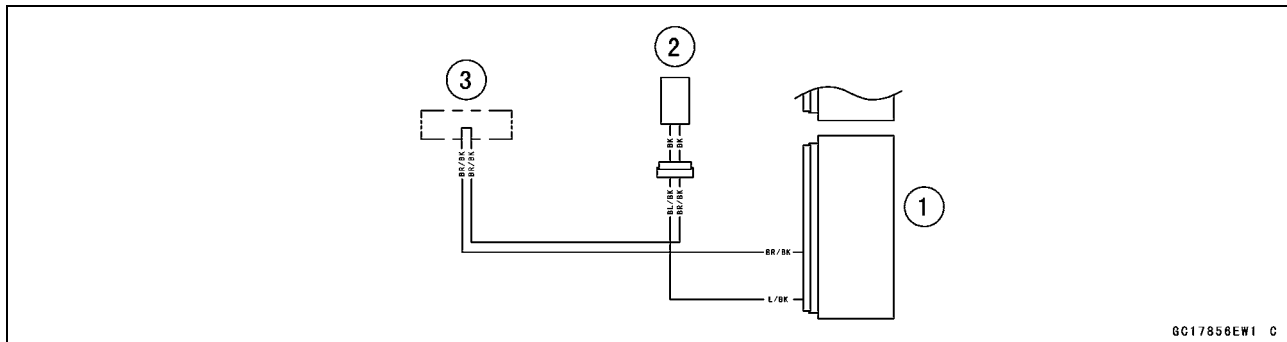
**BR/BK lead (ECU terminal 38) [D]**

★ If the wiring is good, check the engine temperature sensor resistance (see Engine Temperature Sensor Inspection in the Electrical System chapter).

★ If the reading is within the standard, but the problem still exists, replace the ECU (see ECU Removal/Installation).



### Engine Temperature Sensor Circuit



1. ECU
2. Engine Temperature Sensor
3. Water-proof Joint

**Crankshaft Sensor (Service Code 21)**

The crankshaft sensor has no power source, and when the engine stops, the crankshaft sensor generates no signals.

**Crankshaft Sensor Removal/Installation**

- Refer to the Stator Coil Removal/Installation in the Electrical System chapter.

**Crankshaft Sensor Resistance Inspection**

- Refer to the Crankshaft Sensor Inspection in the Electrical System chapter.
- ★ If the reading is within the standard, check the peak voltage (see Crankshaft Sensor Peak Voltage Inspection).

**Crankshaft Sensor Peak Voltage Inspection**

- Refer to the Crankshaft Sensor Peak Voltage Inspection in the Electrical System chapter.
- ★ If the reading is within the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

- Disconnect the ECU and sensor connectors.

**Wiring Continuity Inspection**

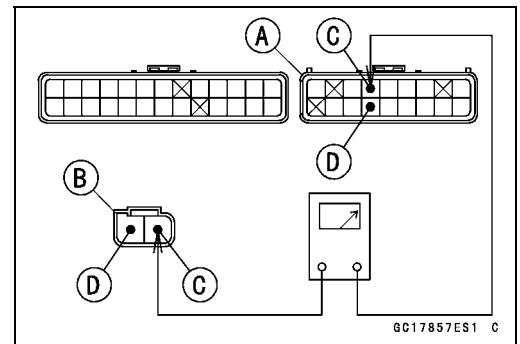
**ECU Connector [A] ←→**

**Crankshaft Sensor Connector [B]**

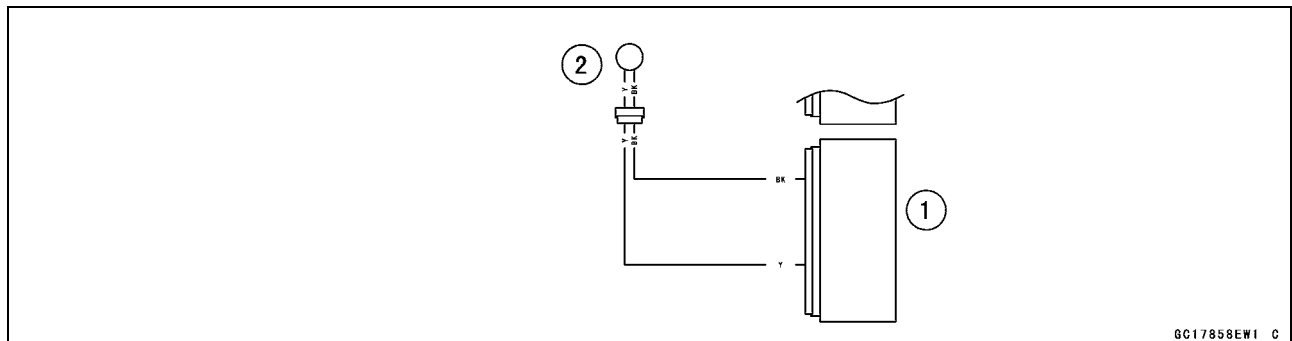
**BK lead (ECU terminal 30) [C]**

**Y lead (ECU terminal 39) [D]**

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



**Crankshaft Sensor Circuit**



- 1. ECU
- 2. Crankshaft Sensor

## 3-54 FUEL SYSTEM (DFI)

### Speed Sensor (Service Code 24)

#### Speed Sensor Removal/Installation

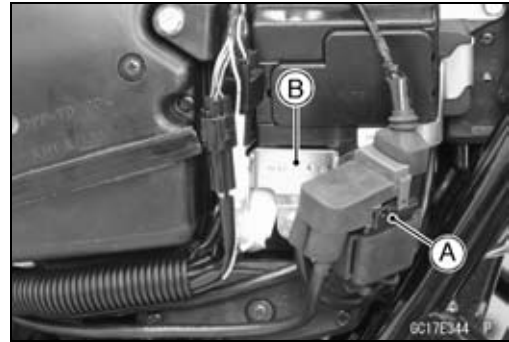
- Refer to the Speed Sensor Removal/Installation in the Electrical System chapter.

#### Speed Sensor Input Voltage Inspection

##### NOTE

○ Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Remove the left side cover (see Left Side Cover Removal in the Frame chapter).
- Take the starter relay [A] off the bracket [B].



- Disconnect the speed sensor connector and connect the harness adapter [A] between these connectors.

**Special Tool - Throttle Sensor Setting Adapter #1: 57001-1400**

- Connect a digital meter to the harness adapter leads.

##### Speed Sensor Input Voltage

###### Connections to Adapter:

**Digital Meter (+)** → BL (main harness BL) lead

**Digital Meter (-)** → BK/Y (main harness BR/BK) lead

- Measure the input voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

##### Input Voltage

**Standard: DC 4.75 ~ 5.25 V**

- Turn the ignition switch to OFF.
- ★ If the reading is within the standard, check the output voltage (see Speed Sensor Output Voltage Inspection).
- ★ If the reading is out of the standard, remove the ECU and check the wiring for continuity between the main harness connectors.

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

- Disconnect the ECU and sensor connectors.

##### Wiring Continuity Inspection

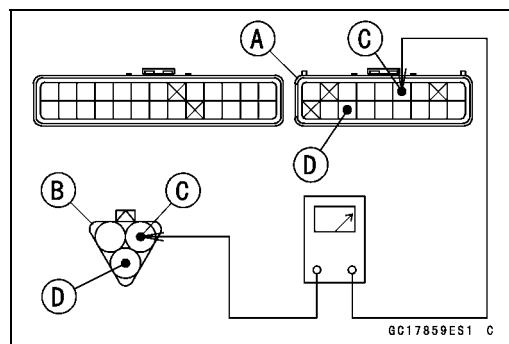
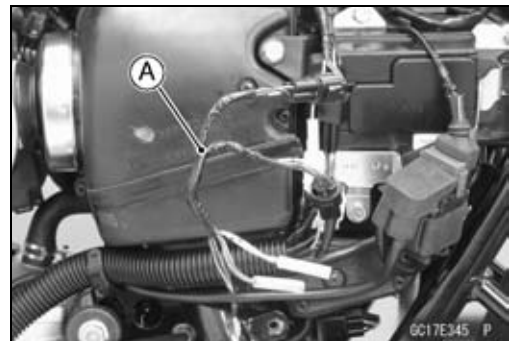
**ECU Connector [A]** ↔

**Speed Sensor Connector [B]**

**BL lead (ECU terminal 32) [C]**

**BR/BK lead (ECU terminal 38) [D]**

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



**Speed Sensor (Service Code 24)**

**Speed Sensor Output Voltage Inspection**

- Using the stand, raise the rear wheel off the ground.
- Measure the output voltage at the speed sensor in the same way as input voltage inspection. Note the following.
- Disconnect the speed sensor connector and connect the harness adapter [A] between these connectors.

**Special Tool - Throttle Sensor Setting Adapter #1: 57001-1400**

**Speed Sensor Output Voltage Connections to Adapter:**

**Digital Meter (+) → Y/W (main harness P/BL) lead**

**Digital Meter (-) → BK/BL (main harness BR/BK) lead**

- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

**Output Voltage**

**Standard: About DC 0.6 V or less, or 4.8 V or more**

**NOTE**

○ Rotate the rear wheel by hand, confirm the output voltage will be raise or lower.

- Turn the ignition switch to OFF.
- ★ If the reading is out of the standard, replace the sensor.
- ★ If the reading is within the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

○ Disconnect the ECU and sensor connectors.

**Wiring Continuity Inspection**

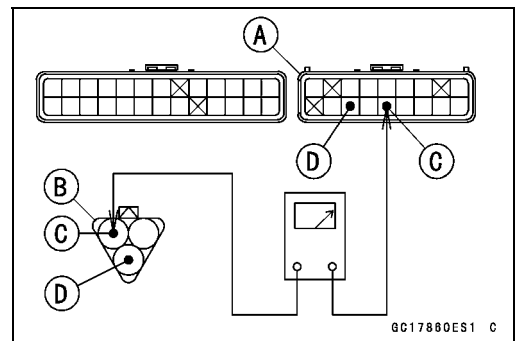
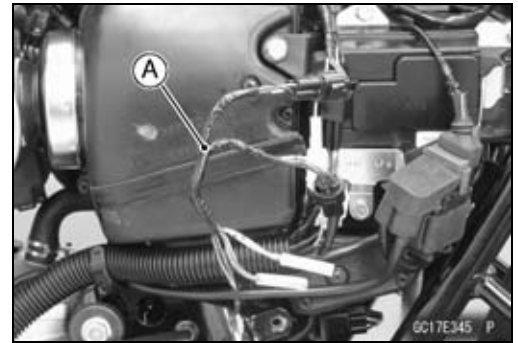
**ECU Connector [A] ↔**

**Speed Sensor Connector [B]**

**P/BL lead (ECU terminal 40) [C]**

**BR/BK lead (ECU terminal 38) [D]**

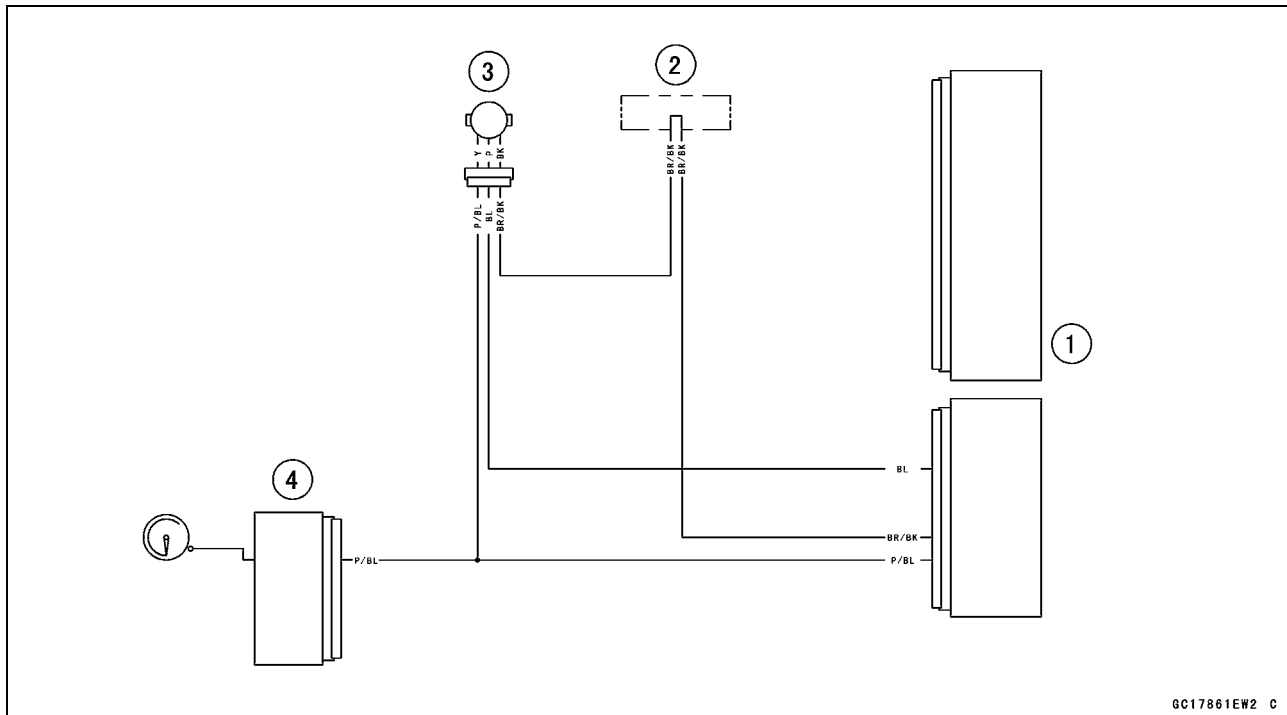
- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



## 3-56 FUEL SYSTEM (DFI)

### Speed Sensor (Service Code 24)

#### Speed Sensor Circuit



1. ECU
2. Water-proof Joint
3. Speed Sensor
4. Meter Unit

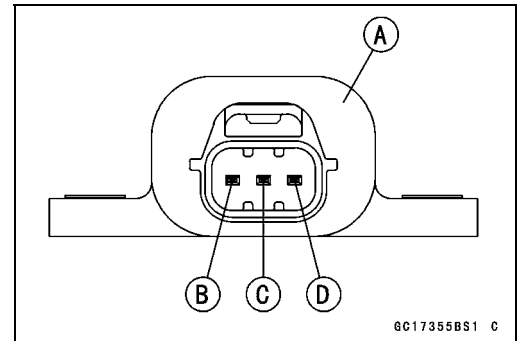
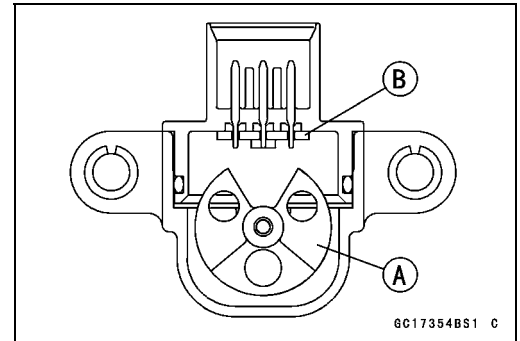
**Vehicle-down Sensor (Service Code 31)**

This sensor has a weight [A] with two magnets inside, and sends a signal to the ECU. But when the motorcycle banks 60 ~ 70° or more to either side (in fact falls down), the weight turns and the signal changes. The ECU senses this change, and stops the fuel pump relay, the fuel injectors and the ignition system.

Hall IC [B]

When the motorcycle is down, the ignition switch is left to ON. If the starter button is pushed, the electric starter turns but the engine does not start. To start the engine again, raise the motorcycle, turn the ignition switch to OFF, and then to ON.

- Vehicle-down Sensor [A]
- Ground Terminal: BR/BK [B]
- Output Terminal: Y/G [C]
- Power Source Terminal: BL [D]

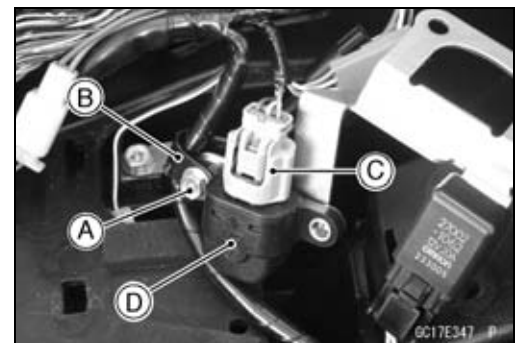
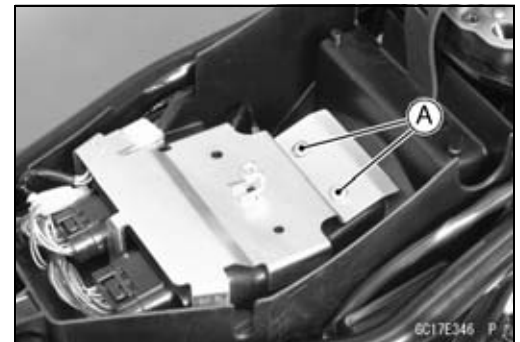


**Vehicle-down Sensor Removal**

**NOTICE**

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

- Remove:
  - Seat (see Seat Removal in the Frame chapter)
  - Screws [A]
- Remove:
  - Bolt [A]
  - Clamp [B]
  - Connector [C]
  - Vehicle-down Sensor [D]

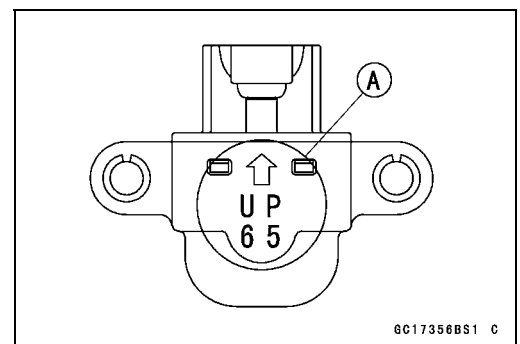


**Vehicle-down Sensor Installation**

- The UP mark [A] of the sensor should face upward.

**⚠ WARNING**

**Incorrect installation of the vehicle-down sensor could cause sudden loss of engine power. The rider could lose balance during certain riding situations for an accident resulting in injury or death. Ensure that the vehicle-down sensor is held in place by the sensor brackets.**



# 3-58 FUEL SYSTEM (DFI)

## Vehicle-down Sensor (Service Code 31)

### Vehicle-down Sensor Input Voltage Inspection

#### NOTE

○Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Remove the vehicle-down sensor (see Vehicle-Down Sensor Removal).
- Disconnect the vehicle-down sensor connector and connect the adapter [A] between these connectors.  
Main Harness [B]  
Vehicle-down Sensor [C]

#### Special Tool - Measuring Adapter: 57001-1700

- Connect a digital meter [D] to the adapter leads.

#### Vehicle-down Sensor Input Voltage

##### Connections to Adapter:

Digital Meter (+) → R (main harness BL) lead

Digital Meter (-) → BK (main harness BR/BK) lead

- Measure the input voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

#### Input Voltage

Standard: DC 4.75 ~ 5.25 V

- Turn the ignition switch to OFF.
- ★ If the reading is within the standard, check the output voltage (see Vehicle-down Sensor Output Voltage Inspection).
- ★ If the reading is out of the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

- Disconnect the ECU and sensor connectors.

#### Wiring Continuity Inspection

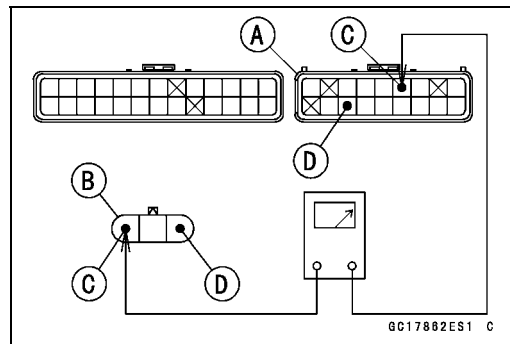
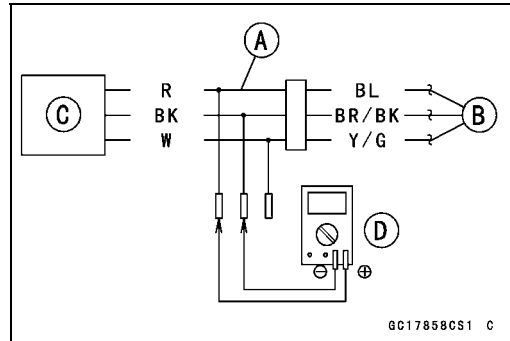
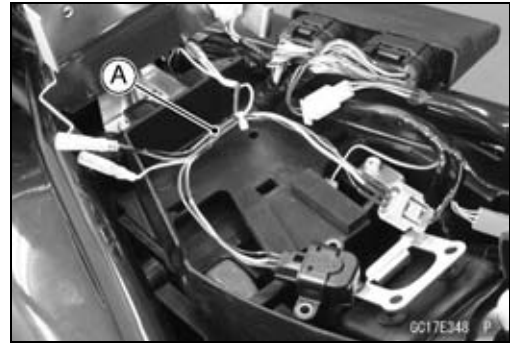
ECU Connector [A] ↔

Vehicle-down Sensor Connector [B]

BL lead (ECU terminal 32) [C]

BR/BK lead (ECU terminal 38) [D]

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).





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

**Vehicle-down Sensor Output Voltage Inspection**

- Remove the vehicle-down sensor (see Vehicle-down Sensor Removal).
- Connect the adapter [A] to the vehicle-down sensor connectors.

**Special Tool - Measuring Adapter: 57001-1700**

Main Harness [B]

Vehicle-down Sensor [C]

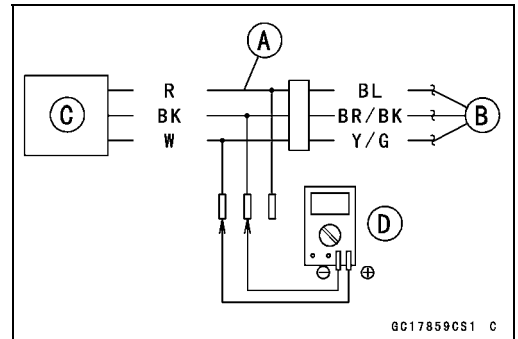
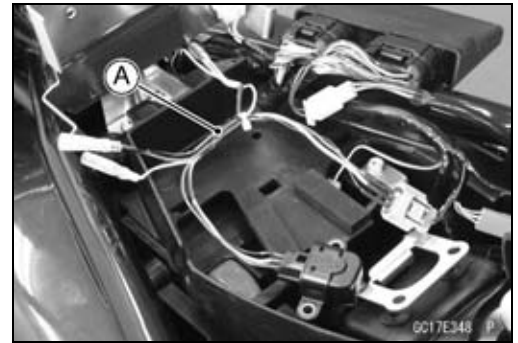
- Connect a digital meter [D] to the adapter leads.

**Vehicle-down Sensor Output Voltage**

**Connections to Adapter:**

**Digital Meter (+) → W (main harness Y/G) lead**

**Digital Meter (-) → BK (main harness BR/BK) lead**



- Hold the sensor vertically.
- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.
- Tilt the sensor 60 ~ 70° or more [A] right or left, then hold the sensor almost vertical with the arrow mark pointed up [B], and measure the output voltage.

**Output Voltage**

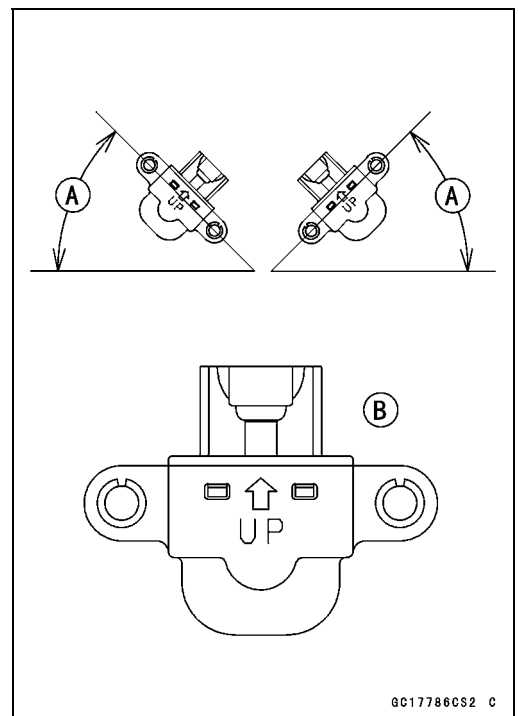
**Standard: With sensor tilted 60~ 70° or more right or left: DC 0.65 ~ 1.35V**

**With sensor arrow mark pointed up: DC 3.55~ 4.45 V**

**NOTE**

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

- Turn the ignition switch to OFF.
- ★If the reading is out of the standard, replace the sensor.



# 3-60 FUEL SYSTEM (DFI)

## Vehicle-down Sensor (Service Code 31)

★ If the reading is within the standard, remove the ECU and check the wiring for continuity between main harness connectors.

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

○ Disconnect the ECU and sensor connectors.

### Wiring Continuity Inspection

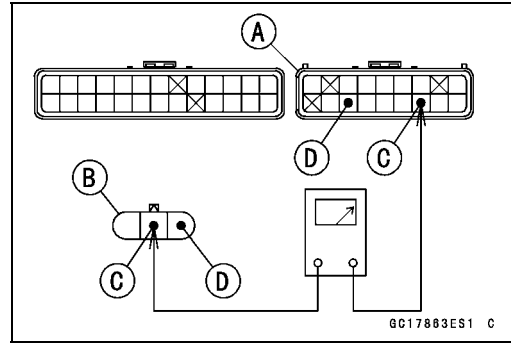
**ECU Connector [A]** ↔

**Vehicle-down Sensor Connector [B]**

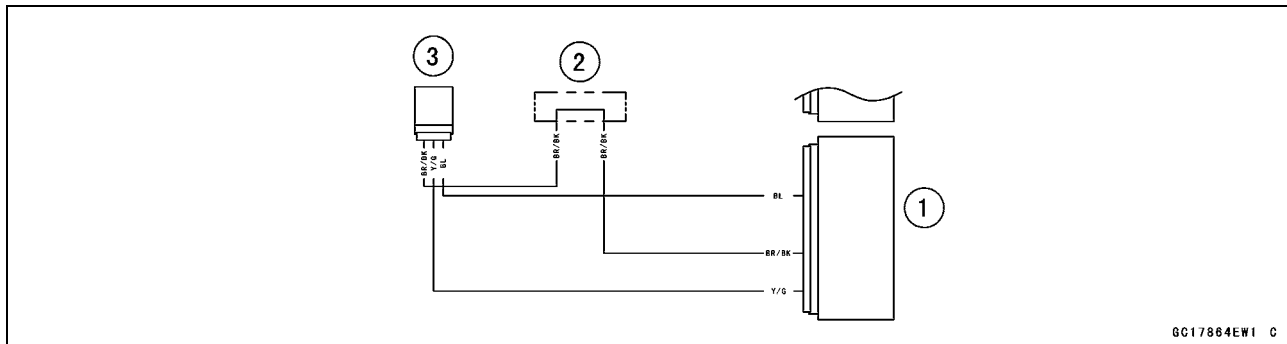
**Y/G lead (ECU terminal 42) [C]**

**BR/BK lead (ECU terminal 38) [D]**

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



### Vehicle-down Sensor Circuit

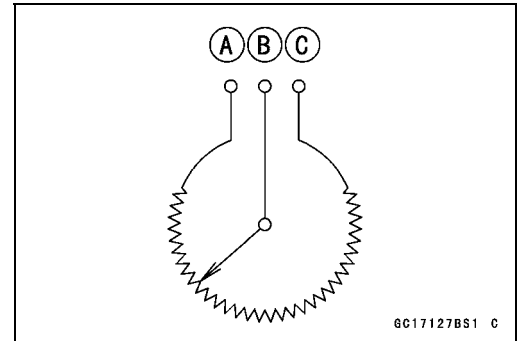


1. ECU
2. Water-proof Joint
3. Vehicle-down Sensor

**Subthrottle Sensor (Service Code 32)**

The subthrottle sensor is a rotating variable resistor that change output voltage according to throttle operating. The ECU senses this voltage change and determines fuel injection quantity, and ignition timing according to engine rpm, and throttle opening.

- Input Terminal [A]
- Output Terminal [B]
- Ground Terminal [C]

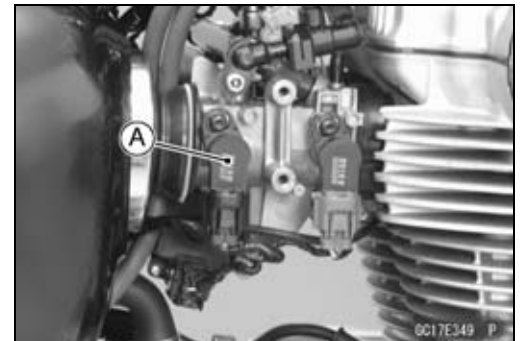


**Subthrottle Sensor Removal/Adjustment**

**NOTICE**

**Do not remove or adjust the subthrottle sensor [A] since it has been adjusted and set with precision at the factory.**

**Never drop the throttle body assy especially on a hard surface. Such a shock to the subthrottle sensor can damage it.**



**Subthrottle Sensor Input Voltage Inspection**

**NOTE**

○Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Disconnect the subthrottle sensor and connect the harness adapter [A] between these connectors.

**Special Tool - Throttle Sensor Setting Adapter: 57001-1538**

- Connect a digital meter to the harness adapter leads.

**Subthrottle Sensor Input Voltage**

**Connections to Adapter:**

**Digital Meter (+) → BK (main harness BL) lead**

**Digital Meter (-) → W (main harness BR/BK) lead**

- Measure the input voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

**Input Voltage**

**Standard: DC 4.75 ~ 5.25 V**

- Turn the ignition switch to OFF.
- ★ If the reading is within the standard, check the output voltage (see Subthrottle Sensor Output Voltage Inspection).



## 3-62 FUEL SYSTEM (DFI)

### Subthrottle Sensor (Service Code 32)

★ If the reading is out of the standard, remove the ECU and check the wiring for continuity between main harness connectors.

○ Disconnect the ECU and sensor connectors.

#### Wiring Inspection

ECU Connector [A] ←→

Subthrottle Sensor Connector [B]

BL lead (ECU terminal 32) [C]

BR/BK lead (ECU terminal 38) [D]

★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).

★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).

#### Subthrottle Sensor Output Voltage Inspection

● Measure the output voltage at the subthrottle sensor in the same way as input voltage inspection. Note the following.

○ Disconnect the subthrottle sensor connector and connect the harness adapter [A] between these connectors.

**Special Tool - Throttle Sensor Setting Adapter: 57001-1538**

#### Subthrottle Sensor Output Voltage

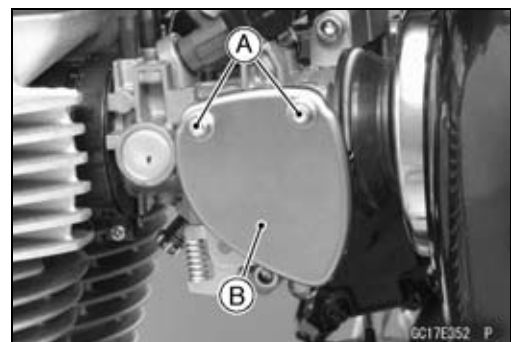
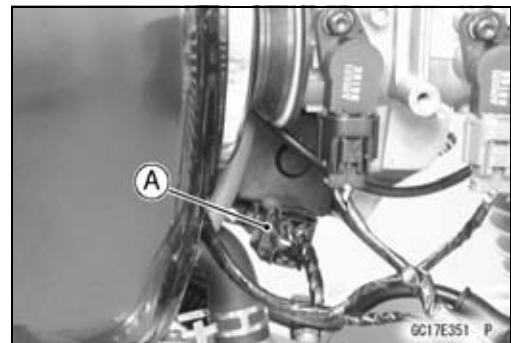
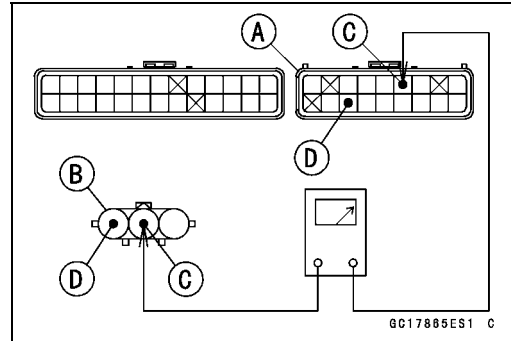
Connections to Adapter:

Digital Meter (+) → R (main harness R) lead

Digital Meter (-) → W (main harness BR/BK) lead

● Disconnect the subthrottle valve actuator connector [A].

● Remove:  
Bolts [A]  
Cover [B]

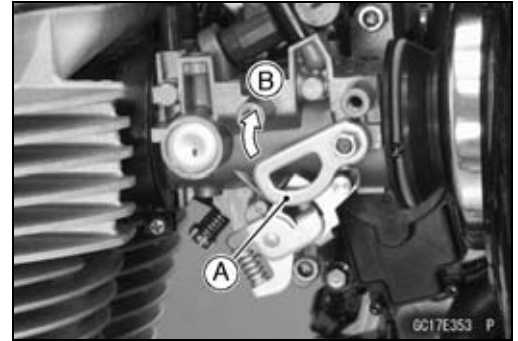


## Subthrottle Sensor (Service Code 32)

- Measure the output voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.
- Measure the output voltage when the subthrottle valve is completely closed by turning the lever [A] fully clockwise [B].

### Output Voltage

- Standard: DC 0.6 ~ 0.8 V at subthrottle valve full close position
- DC 4.08 ~ 4.12 V at subthrottle valve full open position (for reference)



### NOTE

- Turn the lever counterclockwise, confirm the output voltage will be raise.
- The standard voltage refers to the value when the voltage reading at the Input Voltage Inspection shows 5 V exactly.
- When the input voltage reading shows other than 5 V, derive a voltage range as follows.  
Example:  
In the case of a input voltage of 4.75 V.  
 $4.08 \times 4.75 \div 5.00 = 3.88 \text{ V}$   
 $4.12 \times 4.75 \div 5.00 = 3.91 \text{ V}$   
Thus, the valid range is 3.88 ~ 3.91 V
- Turn the ignition switch to OFF.
- ★ If the reading is out of the standard, check the subthrottle sensor resistance (see Subthrottle Sensor Resistance Inspection).
- ★ If the reading is within the standard, remove the ECU and check the wiring for continuity between main harness side connectors.
- Disconnect the ECU and sensor connectors.

### Wiring Continuity Inspection

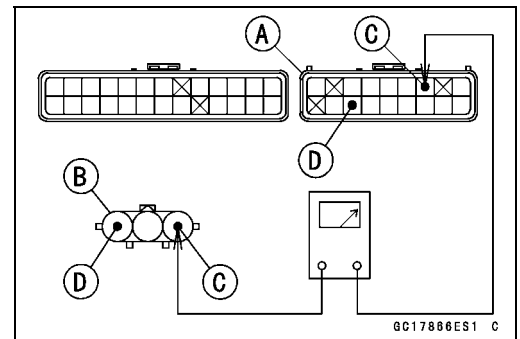
ECU Connector [A] ↔

Subthrottle Sensor Connector [B]

R lead (ECU terminal 33) [C]

BR/BK lead (ECU terminal 38) [D]

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



## 3-64 FUEL SYSTEM (DFI)

### Subthrottle Sensor (Service Code 32)

#### Subthrottle Sensor Resistance Inspection

- Turn the ignition switch to OFF.
- Disconnect the subthrottle sensor connector.
- Connect the harness adapter [A] to the subthrottle sensor.
- Do not connect the adapter to the main harness [B].

**Special Tool - Throttle Sensor Setting Adapter: 57001-1538**

#### Subthrottle Sensor Resistance

##### Connections to Adapter:

Digital Meter (+) → BK (main harness BL) lead

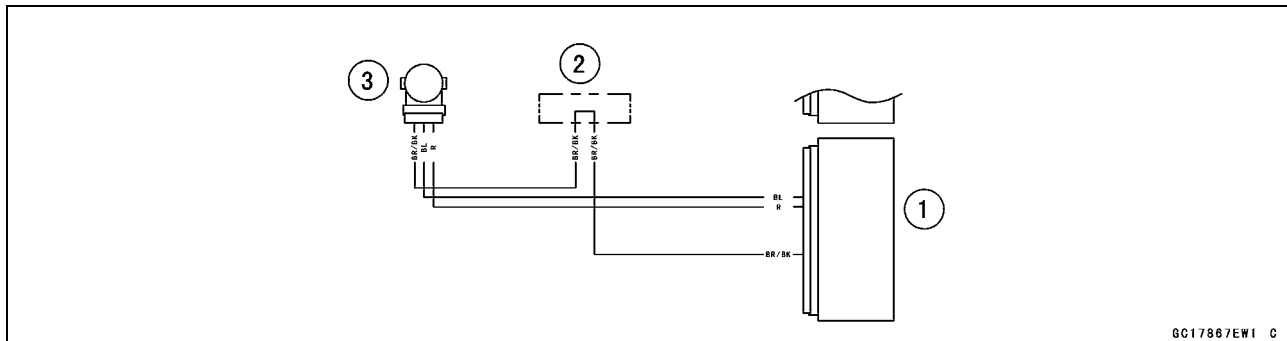
Digital Meter (-) → W (main harness BR/BK) lead

Standard: 4 ~ 6 kΩ

- ★ If the reading is out of the standard, replace the throttle body assy.
- ★ If the reading is within the standard, but the problem still exists, replace the ECU (see ECU Removal/Installation).



#### Subthrottle Sensor Circuit



1. ECU
2. Water-proof Joint
3. Subthrottle Sensor

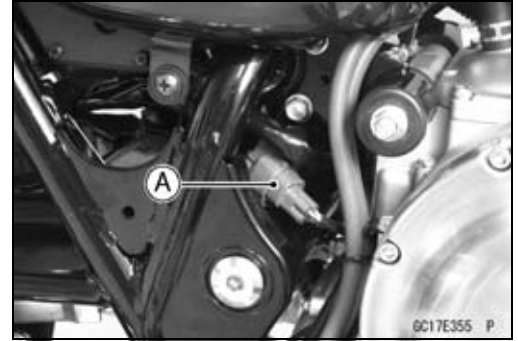
Oxygen Sensor - not activated (Service Code 33)

**Oxygen Sensor Removal/Installation**

- Refer to the Oxygen Sensor Removal/Installation in the Electrical System chapter.

**Oxygen Sensor Inspection**

- Turn the ignition switch to OFF.
- Disconnect the oxygen sensor lead connector [A].



- Connect the adapter [A] between these connectors.  
Main Harness [B]  
Oxygen Sensor [C]

**Special Tool - Measuring Adapter: 57001-1700**

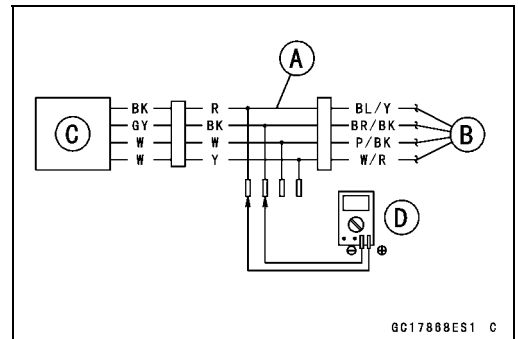
- Connect a digital meter [D] to the adapter leads.

**Oxygen Sensor Output Voltage**

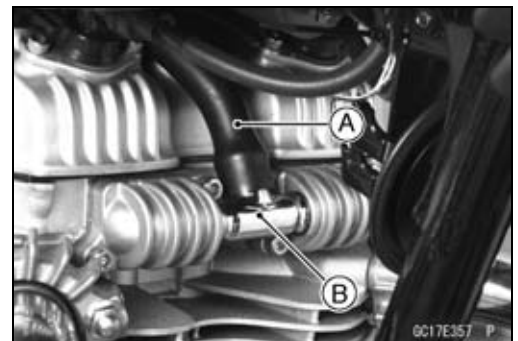
**Connections to Adapter:**

**Digital Meter (+) → R (sensor BK) lead**

**Digital Meter (-) → BK (sensor GY) lead**



- Separate the air switching valve hose [A] from the air suction valve fitting [B].
- Do not disconnect the air switching valve connector.



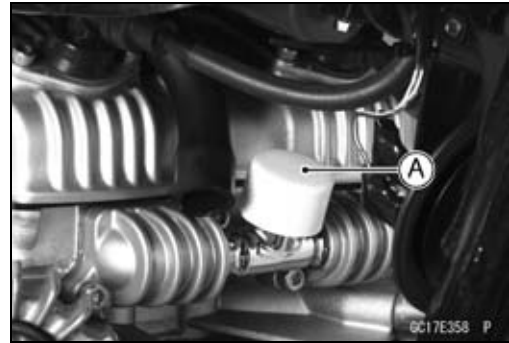
## 3-66 FUEL SYSTEM (DFI)

### Oxygen Sensor - not activated (Service Code 33)

- Install the suitable plug [A] on the air suction valve fitting and shut off the secondary air.
- Warm up the engine thoroughly.
- Measure the output voltage with the connector joined.

#### Output Voltage (with Plug, Rich)

Standard: DC 0.8 V or more



- Turn the ignition switch to OFF.
- Remove the plug from the air suction valve fitting [A].

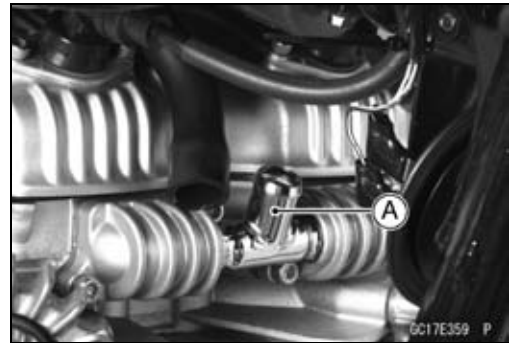
#### **⚠ WARNING**

The engine gets extremely hot during normal operation and can cause serious burns. Never touch a hot engine.

- Start the engine, and let it idle.
- Measure the output voltage with the connector joined.

#### Output Voltage (without Plug, Lean)

Standard: DC 0.24 V or less



- Turn the ignition switch to OFF.

- ★ If the reading is out of the standard (with plug: 0.8 V or more, without plug: 0.24 V or less), remove the ECU and check the wiring for continuity between harness connectors.

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

- Disconnect the ECU and sensor connectors.

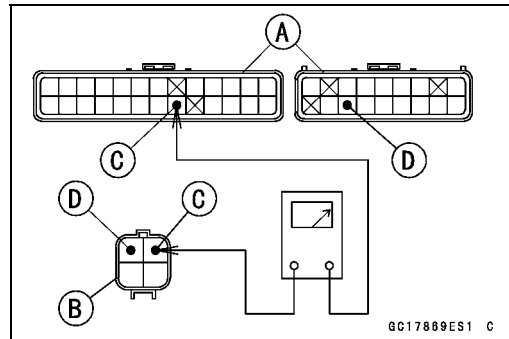
#### Wiring Continuity Inspection

ECU Connectors [A] ↔

Oxygen Sensor Connector [B]

BL/Y lead (ECU terminal 21) [C]

BR/BK lead (ECU terminal 38) [D]

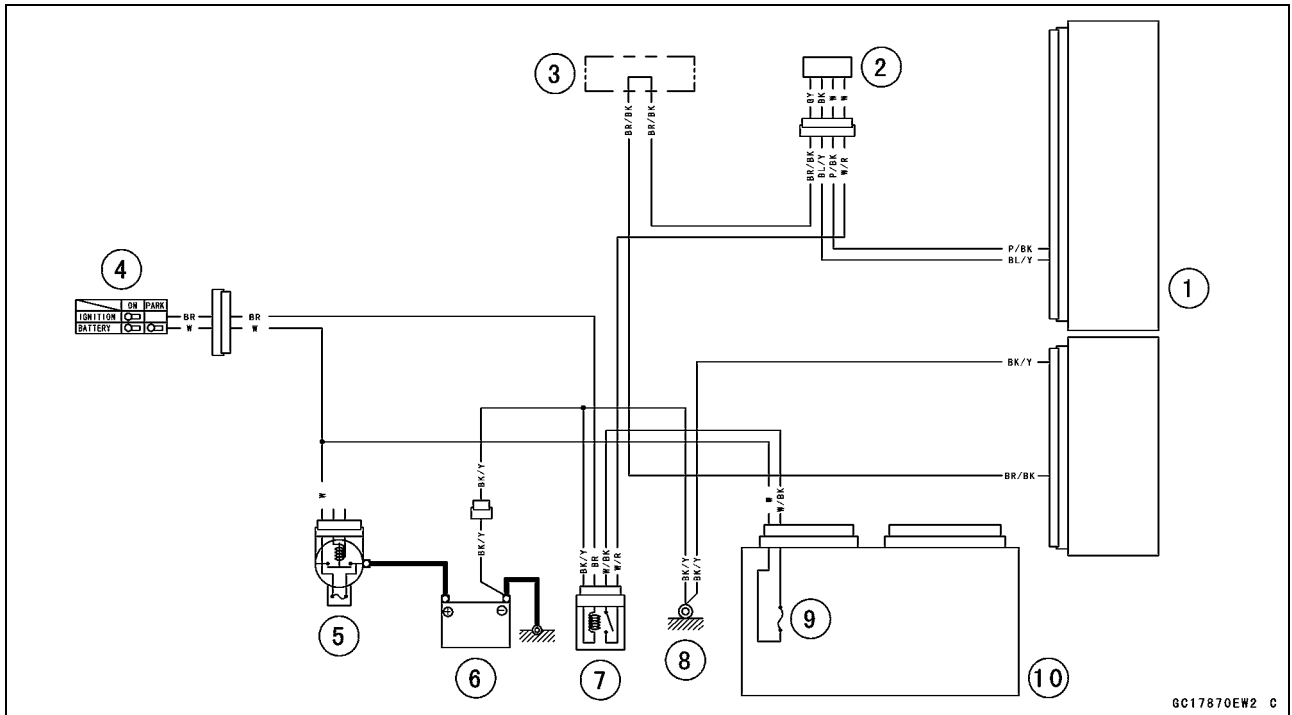


- ★ If the wiring is good, replace the sensor.
- ★ If the reading is within the standard (with plug: 0.8 V or more, without plug: 0.24 V or less), check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



Oxygen Sensor - not activated (Service Code 33)

Oxygen Sensor Circuit



GC17870EW2 C

1. ECU
2. Oxygen Sensor
3. Water-proof Joint
4. Ignition Switch
5. Main Fuse 30 A
6. Battery 12 V 10 Ah
7. ECU Main Relay
8. Frame Ground
9. Headlight Fuse 10 A
10. Junction Box

## 3-68 FUEL SYSTEM (DFI)

### Fuel Pump (Service Code 46)

#### Fuel Pump Removal

#### **⚠ WARNING**

Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. 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 fuel spills, draw it from the tank when the engine is cold. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

#### **NOTICE**

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

- Draw the fuel out from the fuel tank with a commercially available pump.
- 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 outlet pipe of the fuel pump.
- Turn the fuel tank upside down.
- Unscrew the fuel pump bolts [A], and take out the fuel pump [B].

#### **NOTE**

○ The fuel outlet pipe is resin. Take care not to damage it.

#### Fuel Pump Installation

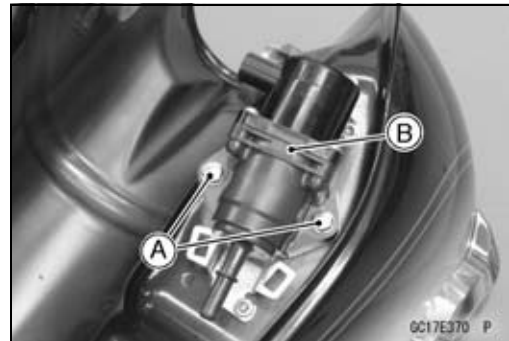
- Remove the dirt or dust from the fuel pump by lightly applying compressed air.
- Replace the O-ring [A] with a new one and apply engine oil to it.
- Apply a non-permanent locking agent to the threads of the fuel pump bolts.
- Tighten:
  - Torque - Fuel Pump Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)
- Tighten the pump bolts again to check the tightness.

#### Fuel Pump Operation Inspection

#### **NOTE**

○ Be sure the battery is fully charged.

- Turn the engine stop switch to run position.
- Turn the ignition switch to ON and make sure that the fuel pump operates (make light sounds) for 3 seconds, and then stops.
- Turn the ignition switch to OFF.
- ★ If the pump does not operate as described above, check the fuel pump resistance (see Fuel Pump Resistance Inspection).



**Fuel Pump (Service Code 46)**

**Fuel Pump Resistance Inspection**

**NOTE**

○Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Disconnect the fuel pump connector [A].



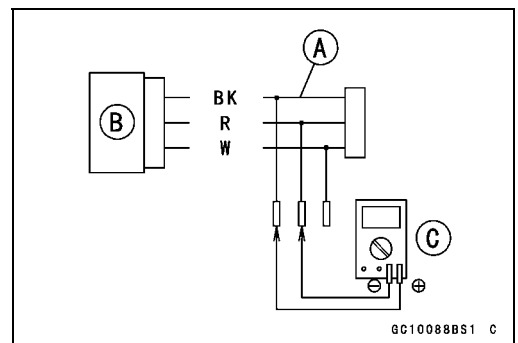
- Connect the adapter [A] to the fuel pump [B].
  - Do not connect to the main harness.
- Special Tool - Measuring Adapter: 57001-1700**
- Connect a digital meter [C] to the adapter leads.
  - Measure the fuel pump resistance.



**Fuel Pump Resistance Connections:**

- Adapter BK lead ↔ Adapter R lead
  - Adapter BK lead ↔ Adapter W lead
  - Adapter R lead ↔ Adapter W lead
- Standard: 1.4 ~ 2.0 Ω at 23°C (73°F)**

★ If the reading is out of the standard, replace the fuel pump.



★ If the reading is within the standard, remove the ECU and check the wiring for continuity between main harness connectors.

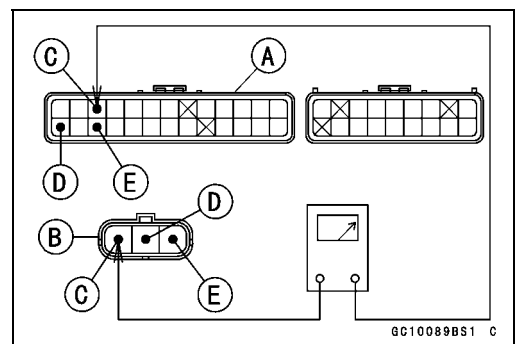
**Special Tool - Hand Tester: 57001-1394**

○ Disconnect the ECU connectors.

**Wiring Continuity Inspection**

- ECU Connector [A] ↔ Fuel Pump Connector [B]
- R/BK lead (ECU Terminal 3) [C]
- Y/R lead (ECU Terminal 14) [D]
- W/R lead (ECU Terminal 16) [E]

- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



### 3-70 FUEL SYSTEM (DFI)

#### Fuel Pump (Service Code 46)

##### Pump Screen, Fuel Filter Cleaning

###### NOTICE

Do not remove the pump screen and the fuel filter, because they are set surely at the manufacture. Removal of these parts could result in poor performance, requiring replacement of the fuel pump.

- The pump screen [A] is built into the pump and can not be cleaned or checked.
- Wash the fuel filter [B] in non-flammable or high-flash point solvent. Use a soft brush to remove any contaminants trapped in the fuel filter.

###### ⚠ WARNING

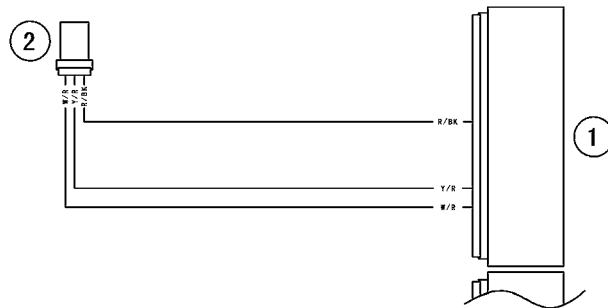
Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the fuel filter in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area. Do not use gasoline or low-flash point solvents to clean the fuel filter.

- ★If the pump screen or fuel filter is suspected of clogging or being damaged, replace it with the fuel pump as a set.

##### Pressure Regulator Removal

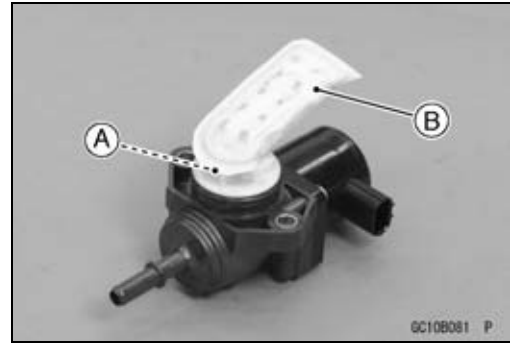
- The pressure regulator is built into the fuel pump and can not be removed.

##### Fuel Pump Circuit



GC10087BW1 C

- 1. ECU
- 2. Fuel Pump



## Ignition Coil (Service Code 51)

### Ignition Coil Removal/Installation

- Refer to the Ignition Coil Removal/Installation in the Electrical System chapter.

### Ignition Coil Primary Winding Resistance Inspection

- Refer to the Ignition Coil Inspection in the Electrical System chapter.
- ★ If the reading is within the standard, check the input voltage (see Ignition Coil Input Voltage Inspection).

### Ignition Coil Input Voltage Inspection

#### NOTE

○ Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Remove the ECU (see ECU Removal).
- Do not disconnect the ECU connector.
- Connect a digital meter [A] to the connector [B] with the needle adapter set.

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

#### Ignition Coil Input Voltage

**Connections to ECU Connector:**

**Digital Meter (+) → BK lead (terminal 1)**

**Digital Meter (-) → Battery (-) Terminal**

- Measure the input voltage to the primary winding of the ignition coil with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

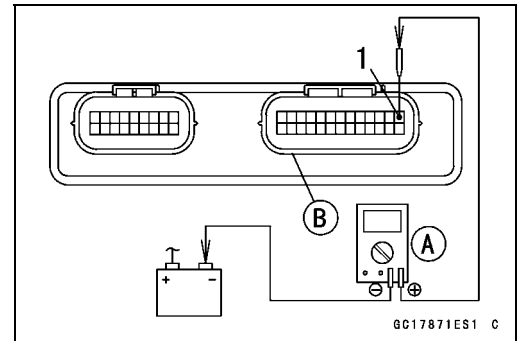
#### Input Voltage

**Standard: Battery Voltage**

- Turn the ignition switch to OFF.
- ★ If the input voltage is out of the standard, check the wiring for continuity (see Ignition Coil Circuit).

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

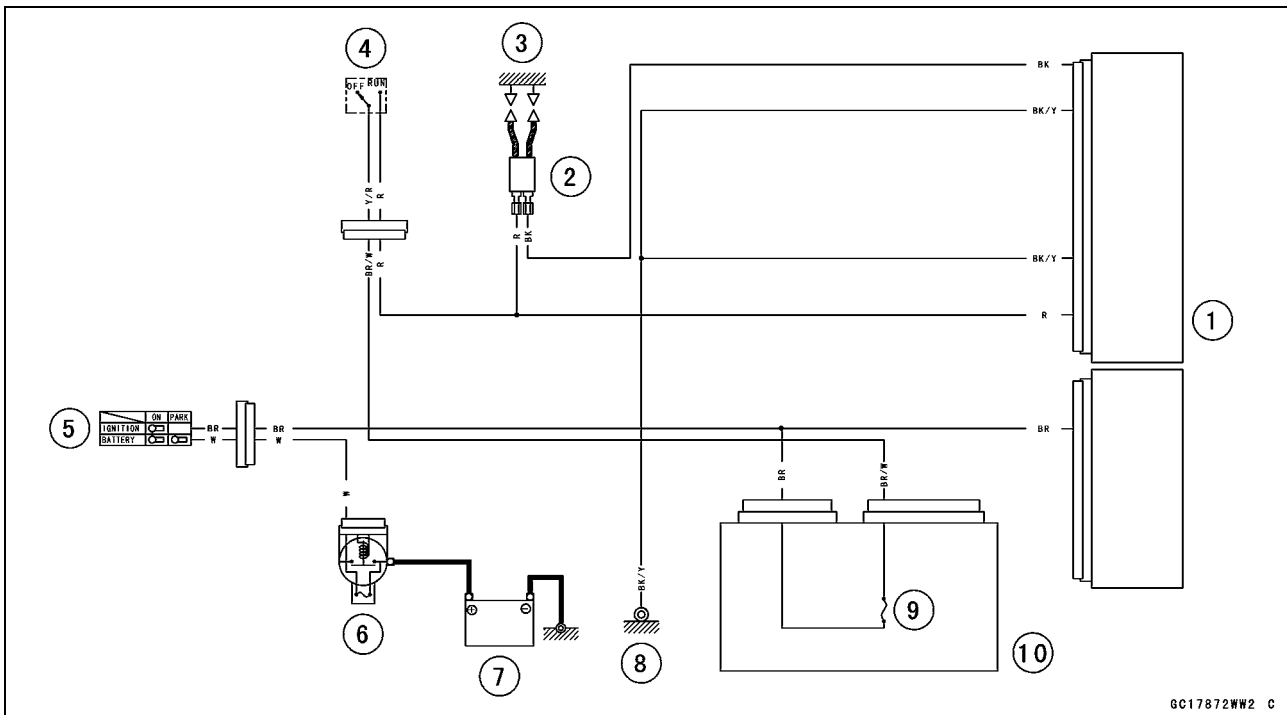
- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).
- ★ If the input voltage is within the standard, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



# 3-72 FUEL SYSTEM (DFI)

## Ignition Coil (Service Code 51)

### Ignition Coil Circuit



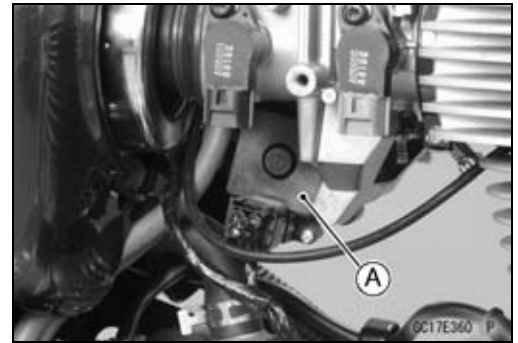
1. ECU
2. Ignition Coil
3. Spark Plugs
4. Engine Stop Switch
5. Ignition Switch
6. Main Fuse 30 A
7. Battery 12 V 10 Ah
8. Frame Ground
9. Ignition Fuse 10 A
10. Junction Box

**Subthrottle Valve Actuator (Service Code 62)**

**Subthrottle Valve Actuator Removal**

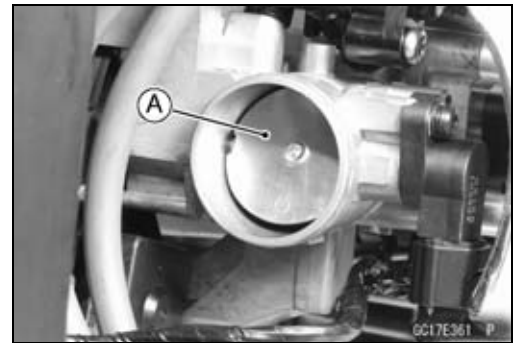
**NOTICE**

Do not remove the subthrottle valve actuator [A] since it has been adjusted and set with precision at the factory.  
 Never drop the throttle body assy especially on a hard surface. Such a shock to the subthrottle valve actuator can damage it.



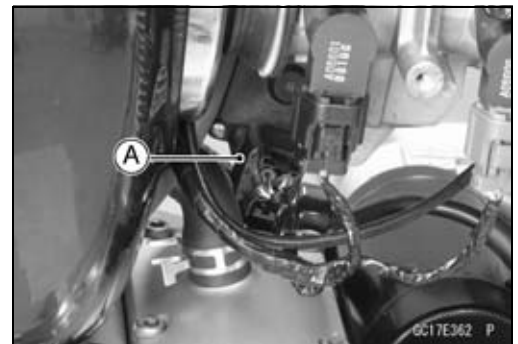
**Subthrottle Valve Actuator Inspection**

- NOTE**
- Be sure the battery is fully charged.
  - Remove the air cleaner housing (see Air Cleaner Housing Removal).
  - Install the battery temporary.
  - Turn the ignition switch to ON.
  - Check to see that all the subthrottle valves (right [A] and left) open and close smoothly.
  - Turn the ignition switch to OFF.
  - ★ If the subthrottle valves do not operate, check the subthrottle valve actuator resistance (see Subthrottle Valve Actuator Resistance Inspection).



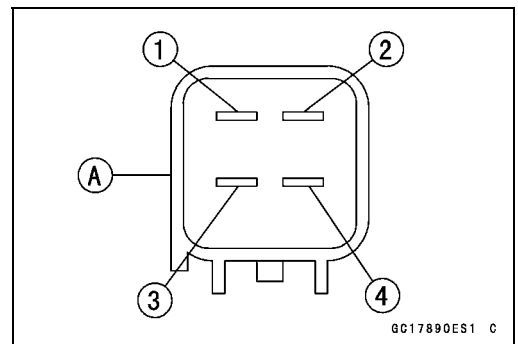
**Subthrottle Valve Actuator Resistance Inspection**

- Turn the ignition switch to OFF.
  - Disconnect the subthrottle valve actuator connector [A].
- Connect a digital meter to the subthrottle valve actuator connector [A].
  - Measure the subthrottle valve actuator resistance.



**Subthrottle Valve Actuator Resistance**  
**Connections:** BK/BL lead [1] ↔ P lead [2]  
 W/BL lead [3] ↔ G/Y lead [4]  
**Standard:** About 5.2 ~ 7.8 Ω

- ★ If the reading is out of the standard, replace the throttle body assy.
- ★ If the reading is within the standard, check the input voltage (see Subthrottle Valve Actuator Input Voltage Inspection).



## 3-74 FUEL SYSTEM (DFI)

### Subthrottle Valve Actuator (Service Code 62)

#### Subthrottle Valve Actuator Input Voltage Inspection

##### NOTE

○Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Disconnect the subthrottle valve actuator connector and connect the adapter [A] between these connectors.  
Main Harness [B]  
Subthrottle Valve Actuator [C]

**Special Tool - Measuring Adapter: 57001-1700**

- Connect the peak voltage adapter [D] and a digital meter [E] to the harness adapter leads.

**Special Tool - Peak Voltage Adapter: 57001-1415**  
**Type: KEK-54-9-B**

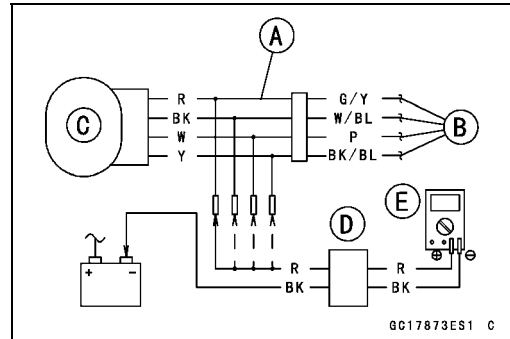
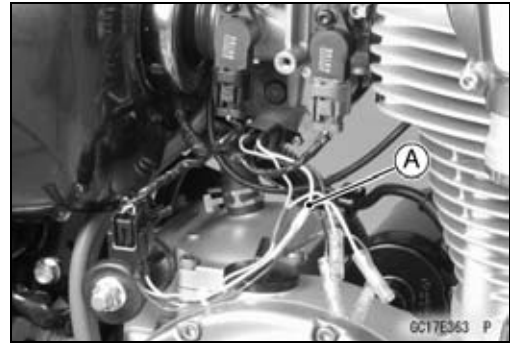
#### Subthrottle Valve Actuator Input Voltage Connections to Adapter:

- (I) Digital Meter (+) → R (actuator G/Y) lead  
Digital Meter (-) → Battery (-) terminal
  - (II) Digital Meter (+) → BK (actuator W/BL) lead  
Digital Meter (-) → Battery (-) terminal
  - (III) Digital Meter (+) → W (actuator P) lead  
Digital Meter (-) → Battery (-) terminal
  - (IV) Digital Meter (+) → Y (actuator BK/BL) lead  
Digital Meter (-) → Battery (-) terminal
- Measure the actuator input voltage with the engine stopped and the connector joined.
  - Turn the ignition switch to ON.

#### Input Voltage

**Standard: About DC 10.3 ~ 12.3 V**

- Turn the ignition switch to OFF.
- ★ If the reading is in specification, but the actuator does not operate, replace the throttle body assy.





**Subthrottle Valve Actuator (Service Code 62)**

★ If the reading is out of the specification, remove the ECU and check the wiring for continuity between main harness connector.

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

○ Disconnect the ECU and actuator connectors.

**Wiring Continuity Inspection**

**ECU Connector [A]** ←→

**Subthrottle Valve Actuator Connector [B]**

**BK/BL lead (ECU terminal 11) [C]**

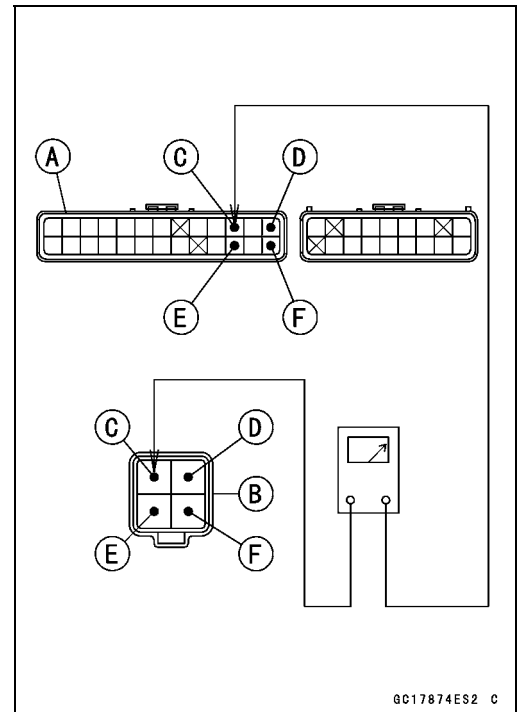
**P lead (ECU terminal 13) [D]**

**W/BL lead (ECU terminal 24) [E]**

**G/Y lead (ECU terminal 26) [F]**

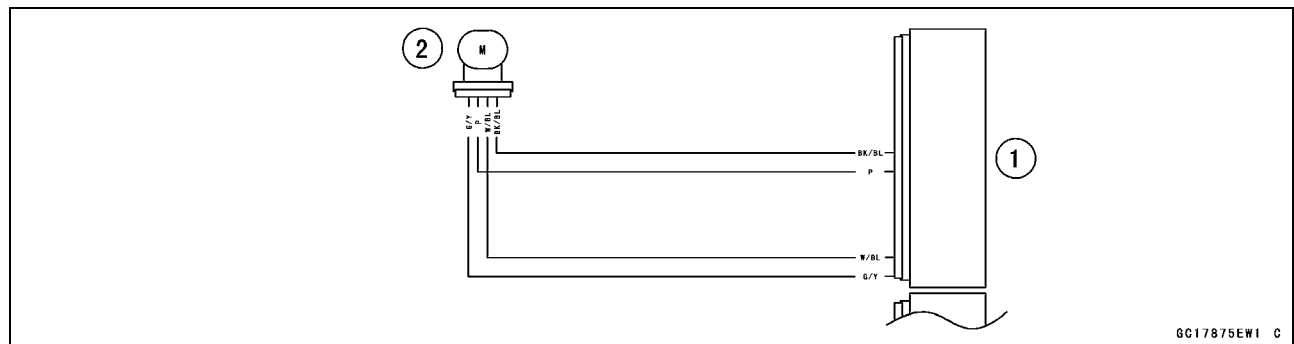
★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).

★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



GC17874ES2 C

**Subthrottle Valve Actuator Circuit**



GC17875EW1 C

- 1. ECU
- 2. Subthrottle Valve Actuator

## 3-76 FUEL SYSTEM (DFI)

### Air Switching Valve (Service Code 64)

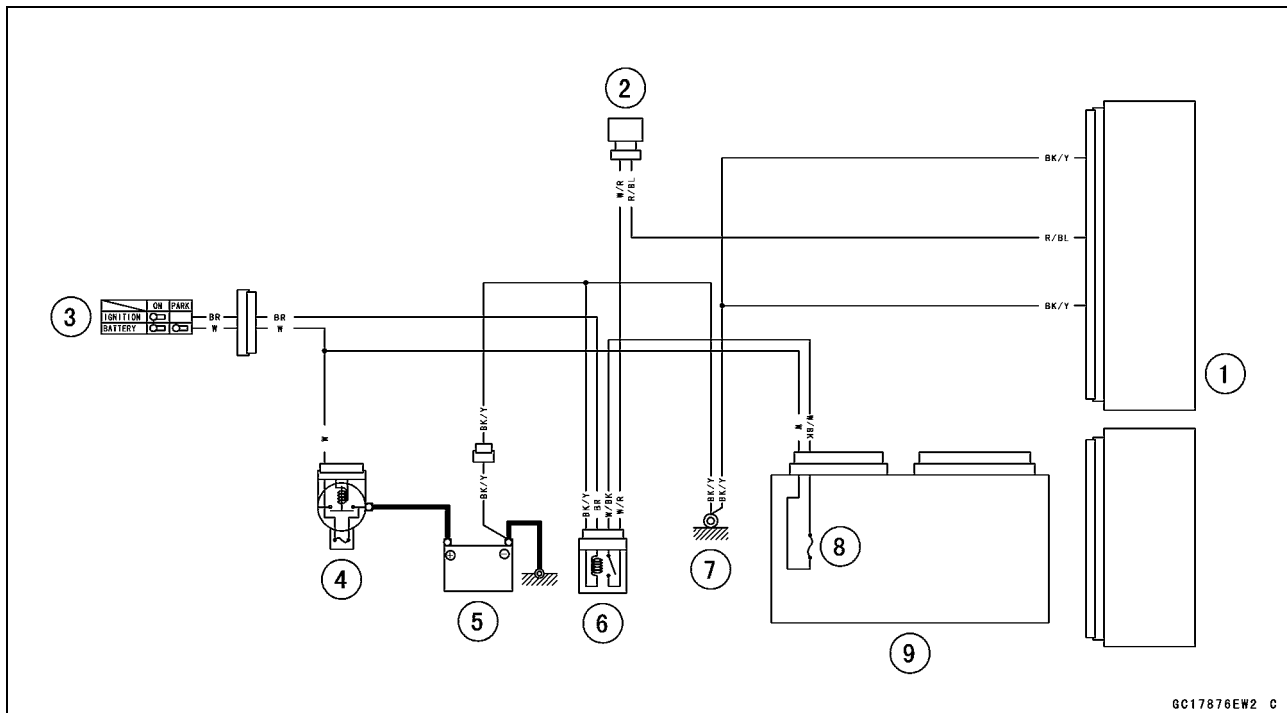
#### Air Switching Valve Removal/Installation

- Refer to the Air Switching Valve Removal/Installation in the Engine Top End chapter.

#### Air Switching Valve Inspection

- Refer to the Air Switching Valve Unit Test in the Electrical System chapter.
- ★ If the air switching valve is normal, check the wiring for continuity (see wiring diagram in this section).
- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).

#### Air Switching Valve Circuit



1. ECU
2. Air Switching Valve
3. Ignition Switch
4. Main Fuse 30 A
5. Battery 12 V 10 Ah
6. ECU Main Relay
7. Frame Ground
8. Headlight Fuse 10 A
9. Junction Box

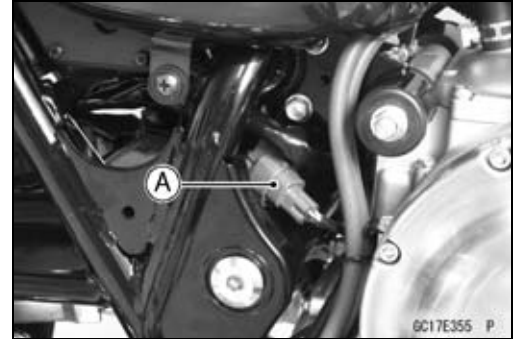
**Oxygen Sensor Heater (Service Code 67)**

**Oxygen Sensor Heater Removal/Installation**

The oxygen sensor heater is built in the oxygen sensor. So, the heater itself can not be removed. Remove the oxygen sensor (see Oxygen Sensor Removal in the Electrical System chapter).

**Oxygen Sensor Heater Resistance Inspection**

- Turn the ignition switch to OFF.
- Disconnect the oxygen sensor lead connector [A].



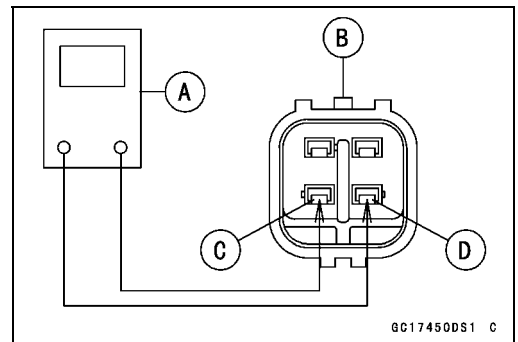
- Connect a digital meter [A] to the oxygen sensor lead connector [B].
- Measure the oxygen sensor heater resistance.

**Oxygen Sensor Heaters Resistance**

Connections: W lead [C] ↔ W lead [D]

Standard: 6.7 ~ 10.5 Ω at 20° C (68°F)

- ★ If the reading is out of the standard, replace the sensor.
- ★ If the reading is within the standard, check the power supply voltage (see Oxygen Sensor Heater Power Supply Voltage Inspection).



**Oxygen Sensor Heater Power Source Voltage Inspection**

**NOTE**

○ Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Disconnect the oxygen sensor lead connector and connect the adapter [A] between these connectors. Oxygen Sensor [B]

**Special Tool - Measuring Adapter: 57001-1700**

- Connect a digital meter [C] to the adapter lead.

**Oxygen Sensor Heater Power Source Voltage**

Connections to Adapter:

Digital Meter (+) → R (main harness W/R) lead

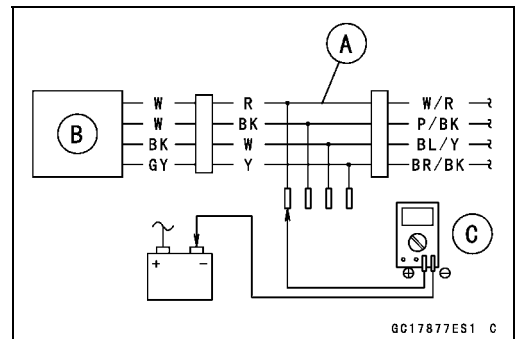
Digital Meter (-) → Battery (-) terminal

- Measure the power source voltage with the engine stopped and the connector joined.
- Turn the ignition switch to ON.

**Power Source Voltage**

Standard: Battery Voltage

- Turn the ignition switch to OFF.
- ★ If the reading is in specification, but the problem still exists, replace the ECU (see ECU Removal/Installation).
- ★ If the reading is out of the standard, check the following.
  - ECU Fuse 10 A (see Fuse Inspection in the Electrical System chapter)
  - Power Source Wiring (see Oxygen Sensor Circuit)



## 3-78 FUEL SYSTEM (DFI)

### Oxygen Sensor Heater (Service Code 67)

★ If the fuse and wiring are good, remove the ECU and check the wiring for continuity between main harness connectors.

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

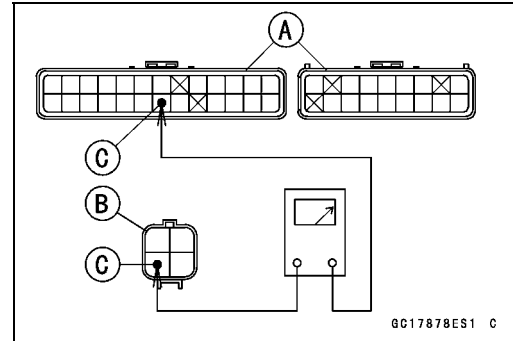
○ Disconnect the ECU and sensor connectors.

#### Wiring Continuity Inspection

ECU Connector [A] ↔

Oxygen Sensor Connector [B]

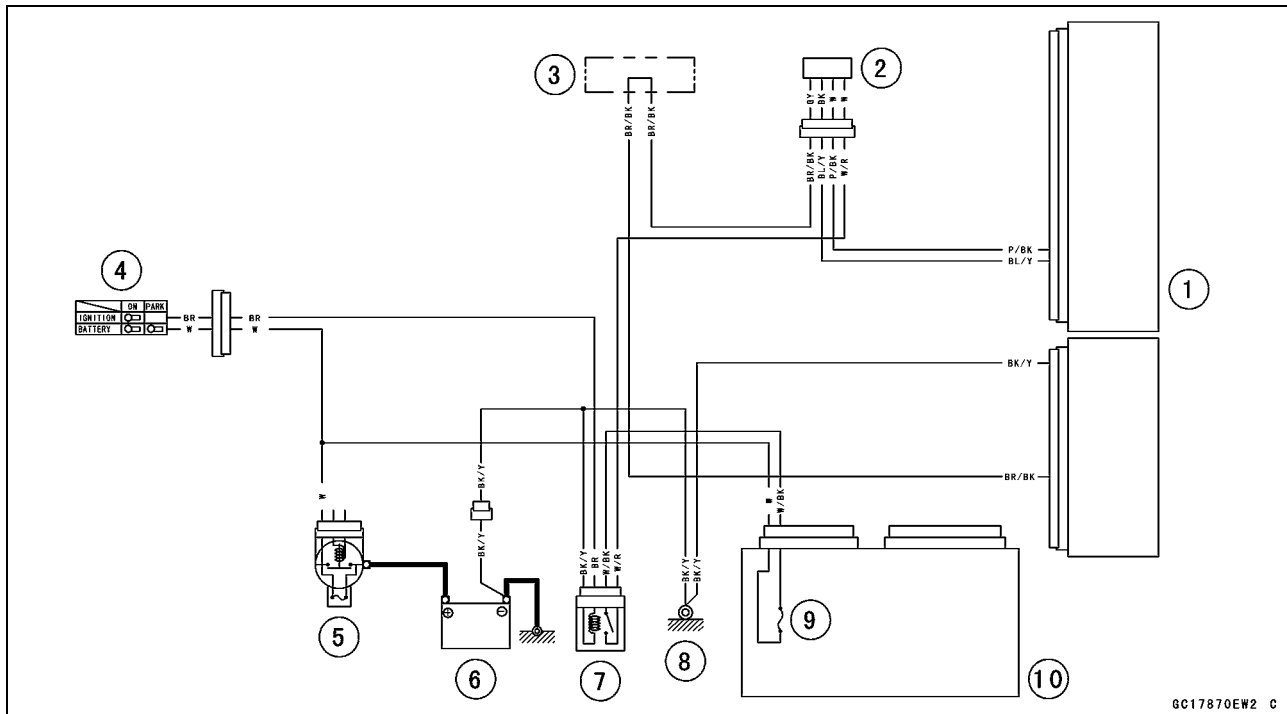
P/BK lead (ECU terminal 20) [C]



★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).

★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).

### Oxygen Sensor Circuit

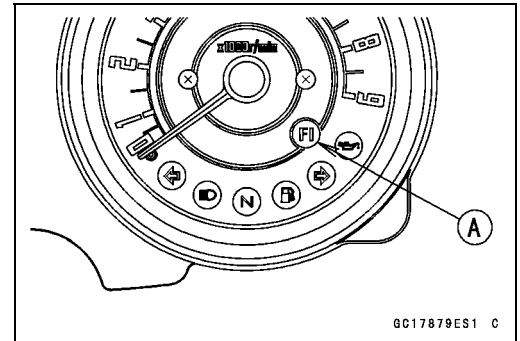


1. ECU
2. Oxygen Sensor
3. Water-proof Joint
4. Ignition Switch
5. Main Fuse 30 A
6. Battery 12 V 10 Ah
7. ECU Main Relay
8. Frame Ground
9. Headlight Fuse 10 A
10. Junction Box

**FI Warning Indicator Light (LED)**

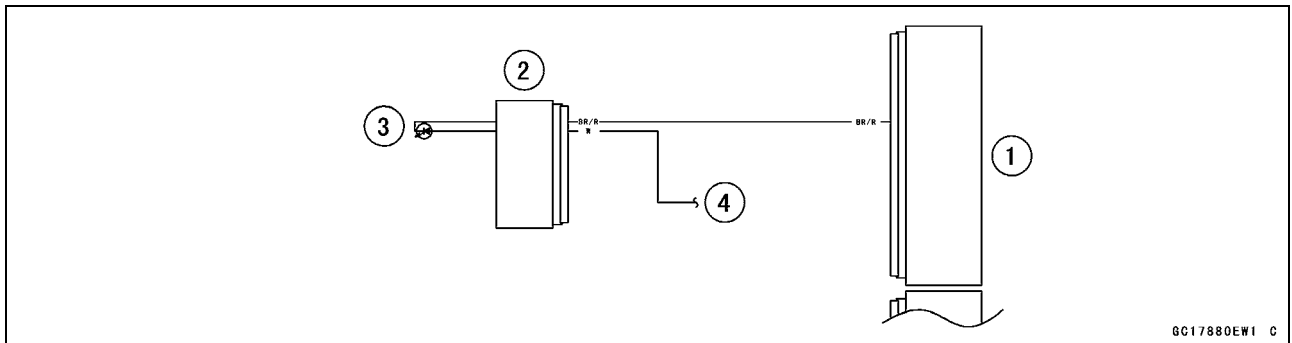
**FI Warning Indicator Light (LED) Inspection**

- In this model, the FI warning indicator light (LED) [A] goes on or blinks by the data sent from the ECU.
- Refer to the Meter Unit Inspection in the Electrical System chapter for the FI warning indicator light (LED) inspection.



GC17879ES1 C

**FI Warning Indicator Light Circuit**



GC17880EW1 C

1. ECU
2. Meter Unit
3. FI Warning Indicator Light (LED)
4. Ignition Switch

# 3-80 FUEL SYSTEM (DFI)

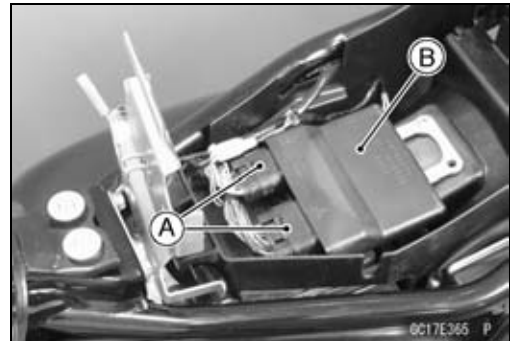
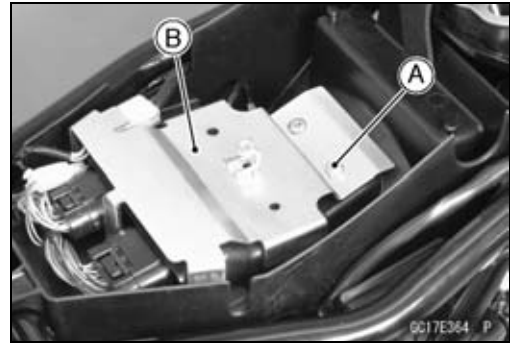
## ECU

### ECU Removal/Installation

#### NOTICE

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

- Remove:
  - Seat (see Seat Removal in the Frame chapter)
  - Screw [A]
- Take the bracket [B] off the ECU.
  
- Remove:
  - ECU Connectors [A]
  - ECU [B]
- Installation is the reverse of removal.



### ECU Power Supply Inspection

- Visually inspect the ECU connectors.
- ★ If the connector is clogged with mud or dust, blow it off with compressed air.
- Remove the ECU connectors.
- Visually inspect the terminals [A] of the ECU connectors.
- ★ If the terminals of the main harness connector are damaged, replace the main harness.
- ★ If the terminals of the ECU connector are damaged, replace the ECU.
  
- Disconnect the ECU connectors [A].
- Set the hand tester [B] to the  $\times 1 \Omega$  range and check the following wiring for continuity.



Special Tool - Hand Tester: 57001-1394

### ECU Grounding Continuity Inspection

Connections:

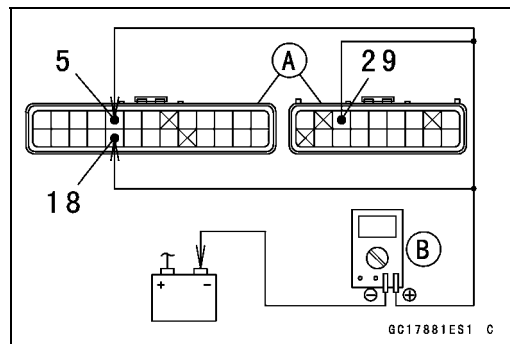
(I) BK/Y leads (ECU terminal 5, 18 or 29)  $\longleftrightarrow$  Battery (-) Terminal

(II) Engine Ground  $\longleftrightarrow$  Battery (-) Terminal

Criteria:

Both:  $0 \Omega$

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



## ECU

★ If the wiring is good, check the power supply voltage of the ECU.

### NOTE

○ Be sure the battery is fully charged.

- Connect the ECU connector.
- Connect a digital meter [A] to the connector [B] with the needle adapter set.

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

### ECU Power Supply Inspection

#### Connections:

- (I) Digital Meter (+) → Terminal 27 (W/G lead)  
Digital Meter (-) → Battery (-) terminal
- (II) Digital Meter (+) → Terminal 31 (BR lead)  
Digital Meter (-) → Battery (-) terminal

#### Ignition Switch OFF:

Terminal 27 (W/G lead): Battery Voltage

Terminal 31 (BR lead): DC 0 V

#### Ignition Switch ON:

Both: Battery Voltage

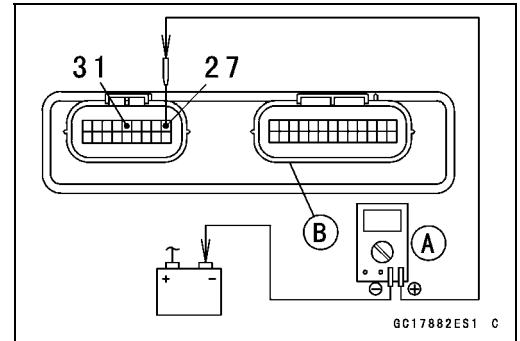
★ If the reading is out of the specification, check the following.

Main Fuse 30 A (see Fuse Inspection in the Electrical System chapter)

ECU Fuse 10 A (see Fuse Inspection in the Electrical System chapter)

Power Supply Wiring (see ECU Power Supply Circuit )

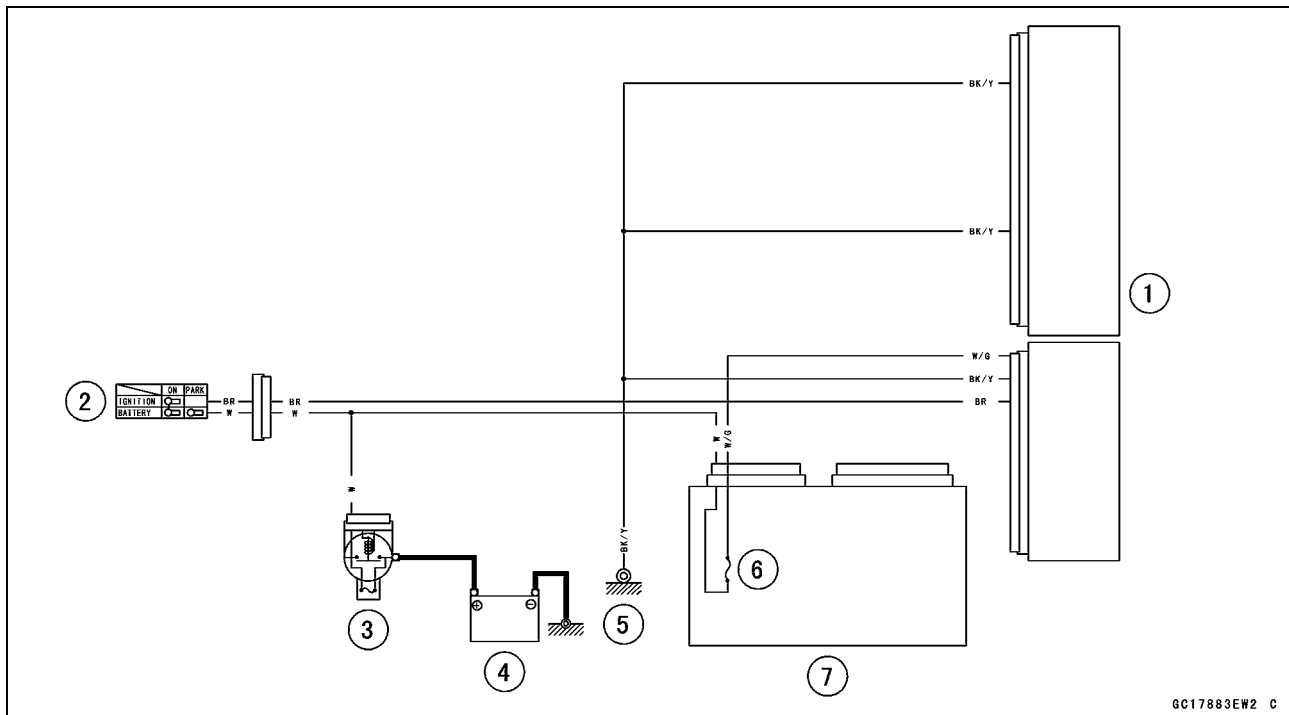
★ If the fuse and wiring are good, replace the ECU (see ECU Removal/Installation).



# 3-82 FUEL SYSTEM (DFI)

## ECU

### ECU Power Supply Circuit



1. ECU
2. Ignition Switch
3. Main Fuse 30 A
4. Battery 12 V 10 Ah
5. Frame Ground
6. ECU Fuse 10 A
7. Junction Box



### DFI Power Source

---

#### ***ECU Fuse Removal***

- Refer to the Fuse Box Fuse Removal in the Electrical System chapter.

#### ***ECU Fuse Installation***

- ★ If a fuse fails during operation, inspect the DFI system to determine the cause, and then replace the fuse with a new one of proper amperage.
- Refer to the Fuse Installation in the Electrical System chapter.

#### ***ECU Fuse Inspection***

- Refer to the Fuse Inspection in the Electrical System chapter.

## 3-84 FUEL SYSTEM (DFI)

### Fuel Line

#### Fuel Pressure Inspection

##### NOTE

○Be sure the battery is fully charged.

- Remove:
  - Fuel Hose (see Fuel Hose Replacement in the Periodic Maintenance chapter)
- Be sure to place a clean cloth around the following parts.
  - Fuel Outlet Pipe (Fuel Pump)
  - Delivery Pipe (Throttle Body Assy)

##### **⚠ WARNING**

**Fuel is flammable and explosive under certain conditions and can cause severe burns. 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 because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.**

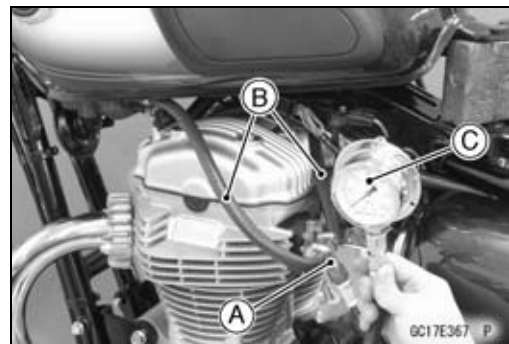
- Install the fuel pressure gauge adapter [A] and fuel hoses (special tool) [B] between the fuel outlet pipe and delivery pipe.

##### NOTE

○The fuel outlet pipe is resin. Do not tighten the clamp screw of the hose excessively.

- Secure the fuel hoses with the clamps.
- Connect the pressure gauge [C] to the fuel pressure gauge adapter.

**Special Tools - Oil Pressure Gauge, 5 kgf/cm<sup>2</sup>: 57001-125**  
**Fuel Pressure Gauge Adapter: 57001-1593**  
**Fuel Hose: 57001-1607**



##### **⚠ WARNING**

**Fuel is extremely flammable and can be explosive under certain conditions resulting in serious injury or death.**  
**Do not try to start the engine with the fuel hoses disconnected.**

- Turn the engine stop switch to run position.
- Turn the ignition switch to ON.
- The fuel pump should operate for 3 seconds, and then should stop.

##### NOTE

○After turning on the engine stop switch and ignition switch, inspect the fuel leakage from the connected portion of the special tools.

##### **NOTICE**

**Do not drive the fuel pump 3 seconds or more without the fuel in the fuel tank. If the fuel pump is driven without the fuel, it may be damaged.**

## Fuel Line

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

### Fuel Pressure (with Engine Idling)

Standard: 300 kPa (3.06 kgf/cm<sup>2</sup>, 43.5 psi)

### NOTE

○ *The gauge needle will fluctuate. Read the pressure at the average of the maximum and minimum indications.*

- Turn the ignition switch to OFF.
- ★ If the fuel pressure is much higher than specified, replace the fuel pump because the fuel pressure regulator in the fuel pump have been clogged or stuck.
- ★ If the fuel pressure is much lower than specified, check the following.
  - Fuel Line Leakage (see Injector Fuel Line Inspection)
  - Amount of Fuel Flow (see Fuel Flow Rate Inspection)
- After above checks, measure the fuel pressure again.
- Remove the fuel pressure gauge, hoses and adapter.

### NOTE

○ *The fuel outlet pipe is resin. Take care not damage it.*

### WARNING

**The engine gets extremely hot during normal operation and can cause serious burns. Never touch a hot engine.**

- Install:
  - Fuel Hose (see Fuel Injector Installation)
- Start the engine and check for fuel leakage.

## Fuel Flow Rate Inspection

### WARNING

**Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. 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.**

### NOTE

○ *Be sure the battery is fully charged.*

- Turn the ignition switch to OFF.
- Wait until the engine cools down.
- Prepare a fuel hose (special tool) and a measuring cylinder.

**Special Tool - Fuel Hose: 57001-1607**

## 3-86 FUEL SYSTEM (DFI)

### Fuel Line

- Open the fuel tank cap [A] to lower the pressure in the tank.
- Remove the fuel hose from the fuel pump (see Fuel Tank Removal).
- Be sure to place a clean cloth around the following part.  
Fuel Outlet Pipe (Fuel Pump)

#### **⚠ WARNING**

**Fuel is flammable and explosive under certain conditions and can cause severe burns. 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 because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.**

- Connect the prepared fuel hose [A] to the fuel outlet pipe.

#### **NOTE**

○ *The fuel outlet pipe is resin. Do not tighten the clamp screw of the hose excessively.*

- Secure the fuel hose with a clamp.
- Insert the fuel hose into the measuring cylinder [B].

#### **⚠ WARNING**

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

- Close the fuel tank cap.
- Turn the engine stop switch to run position.
- Turn the ignition switch to ON.
- The fuel pump should operate for 3 seconds, and then should stop.

#### **NOTICE**

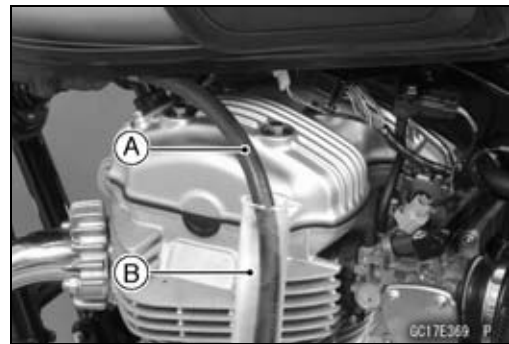
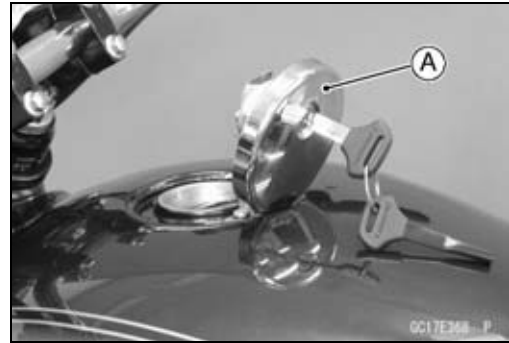
**Do not drive the fuel pump 3 seconds or more without the fuel in the fuel tank. If the fuel pump is driven without the fuel, it may be damaged.**

- Turn the ignition switch to OFF.
- Measure the discharge for 3 seconds.
- Repeat this operation several times.

#### **Amount of Fuel Flow**

**Standard: 20 mL (0.68 US oz.) or more for 3 seconds**

- ★ If the fuel flow is much less than the specified, replace the fuel pump (see Fuel Pump Removal/Installation).
- Install the fuel tank (see Fuel Tank Installation).
- Start the engine and check for fuel leakage.



## Fuel Injectors

### Fuel Injector Removal/Installation

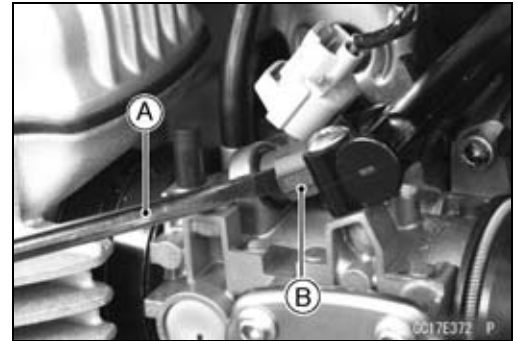
- Refer to the Throttle Body Assy Disassembly/Assembly.

### Fuel Injector Audible Inspection

#### NOTE

○ Be sure the battery is fully charged.

- Start the engine, and let it idle.
- Apply the tip of a screwdriver [A] to the fuel injector [B]. Put the grip end onto your ear, and listen whether the fuel injector is clicking or not.
- A sound scope can also be used.
- The click interval becomes shorter as the engine speed rises.
- Do the same for the other fuel injector.
- ★ If all the fuel injectors click at a regular intervals, the fuel injectors are normal.
- Turn the ignition switch to OFF.
- ★ If any fuel injector does not click, check the fuel injector resistance (see Fuel Injector Resistance Inspection).



### Fuel Injector Resistance Inspection

- Disconnect the fuel injector connector.
- Connect a digital meter to the terminals [A].
- Measure the fuel injector resistance.

#### Fuel Injector Resistance

##### Connections:

For Fuel Injector #1

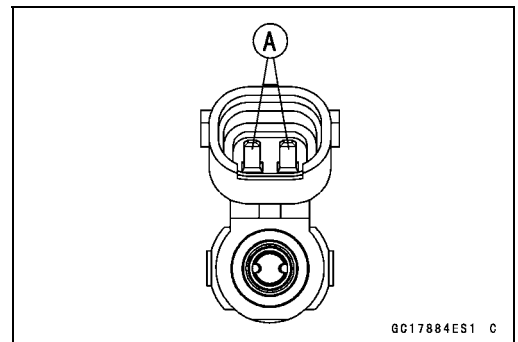
R ↔ BL/R terminal

For Fuel Injector #2

R ↔ BL/G terminal

**Standard: About 11.7 ~ 12.3 Ω at 20°C (68°F)**

- ★ If the reading is out of the standard, replace the injector.



# 3-88 FUEL SYSTEM (DFI)

## Fuel Injectors

### Fuel Injector Power Source Voltage Inspection

#### NOTE

○Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Disconnect the injector connector and connect the adapter [A] between these connectors.  
Main Harness [B]  
Fuel Injector #1 [C]  
Fuel Injector #2 [D]

**Special Tool - Measuring Adapter: 57001-1700**

- Connect a digital meter [E] to the adapter lead.

#### Fuel Injector Power Source Voltage Connections to Adapter:

**For Fuel Injector #1, #2**

**Digital Meter (+) → R (injector R) lead**

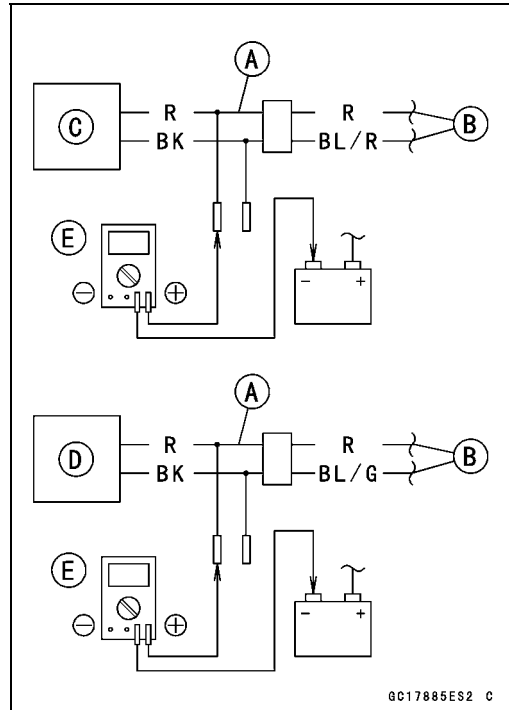
**Digital Meter (-) → Battery (-) terminal**

- Measure the power source voltage with the engine stopped.
- Turn the engine stop switch to run position.
- Turn the ignition switch to ON.

#### Power Source Voltage

**Standard: Battery Voltage for 3 seconds, and then 0 V**

- Turn the ignition switch to OFF.
- ★ If the reading is not the standard, check the wiring (see Fuel Injector Circuit).
- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



### Fuel Injector Output Voltage Inspection

#### NOTE

○Be sure the battery is fully charged.

- Turn the ignition switch to OFF.
- Remove the ECU (see ECU Removal).
- Do not disconnect the ECU connector.
- Connect a digital meter [A] to the connectors [B] with the needle adapter set.

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

#### Fuel Injector Output Voltage

**Connections to ECU Connector:**

**For Fuel Injector #1**

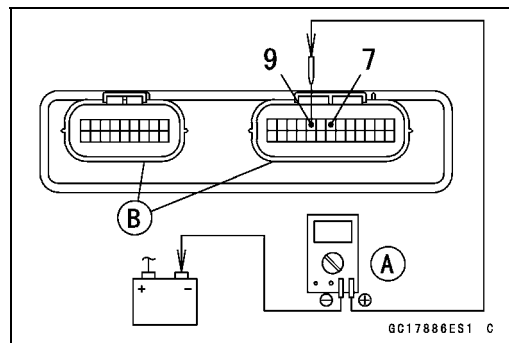
**Digital Meter (+) → BL/R lead (ECU terminal 9)**

**Digital Meter (-) → Battery (-) terminal**

**For Fuel Injector #2**

**Digital Meter (+) → BL/G lead (ECU terminal 7)**

**Digital Meter (-) → Battery (-) terminal**



## Fuel Injectors

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- Measure the output voltage with the engine stopped and the connector joined.
- Turn the engine stop switch to run position.
- Turn the ignition switch to ON.

### Output Voltage

**Standard: Battery Voltage for 3 seconds, and then 0 V**

- Turn the ignition switch to OFF.
- ★ If the reading is not the standard, check the wiring (see Fuel Injector Circuit).
- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).
- ★ If there is still no battery voltage, check the fuel injector resistance (see Fuel Injector Resistance Inspection) and wiring (see Fuel Injector Circuit).

### ***Fuel Injector Fuel Line Inspection***

- Remove:
  - Fuel Hose (see Fuel Hose Replacement in the Periodic Maintenance chapter)
- Be sure to place a clean cloth around the following parts.
  - Fuel Outlet Pipe (Fuel Pump)
  - Delivery Pipe (Throttle Body Assy)

 <b>WARNING</b>
<p><b>Fuel is flammable and explosive under certain conditions and can cause severe burns. 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 because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.</b></p>

## 3-90 FUEL SYSTEM (DFI)

### Fuel Injectors

- 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 the fuel hose [C] (both ends with the clamps [D]) as shown in the figure.
    - View from Top [E]
  - Apply soap and water solution to the areas [F] as shown in the figure.
  - Watching the pressure gauge, squeeze the pump lever [G], and build up the pressure until the pressure reaches the maximum pressure.

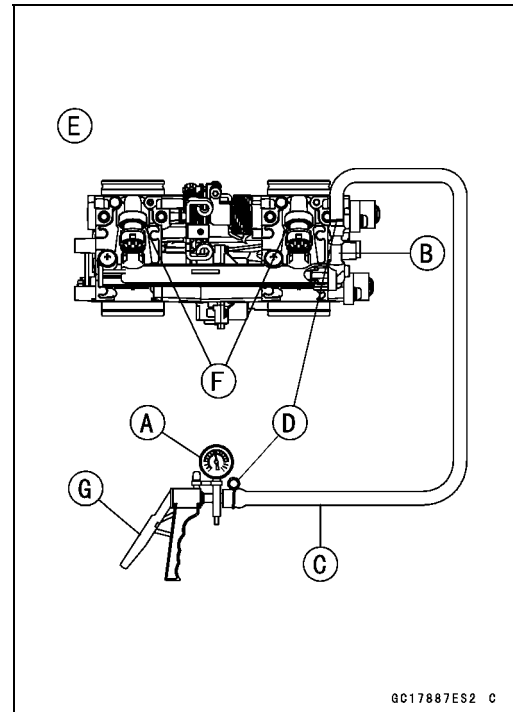
#### Injector Fuel Line Maximum Pressure

Standard: 300 kPa (3.06 kgf/cm<sup>2</sup>, 43.5 psi)

#### NOTICE

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

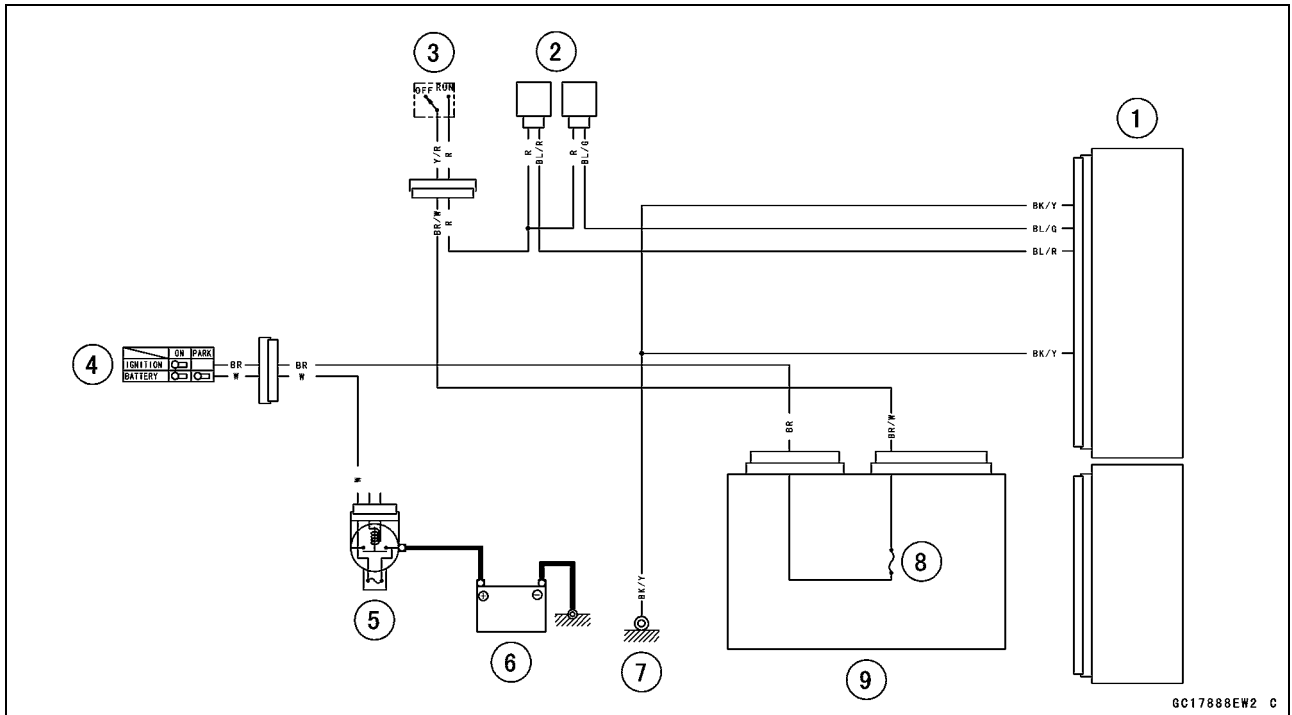
- Watch the gauge for at least 6 seconds.
- ★ If the pressure holds steady, the fuel line is good.
- ★ If the pressure drops at once or if bubbles are found in the area, the fuel line is leaking. Replace the delivery pipe assy, injectors and related parts.
- Repeat the leak test, and check the fuel line for no leakage.
- Install:
  - Fuel Hose (see Fuel Hose Replacement in the Periodic Maintenance chapter)
- Start the engine and check for fuel leakage.





Fuel Injectors

Fuel Injector Circuit



GC17888EW2 C

1. ECU
2. Fuel Injectors
3. Engine Stop Switch
4. Ignition Switch
5. Main Fuse 30 A

6. Battery 12 V 10 Ah
7. Frame Ground
8. Ignition Fuse 10 A
9. Junction Box

## 3-92 FUEL SYSTEM (DFI)

### Throttle Grip and Cables

#### **Throttle Grip Free Play Inspection**

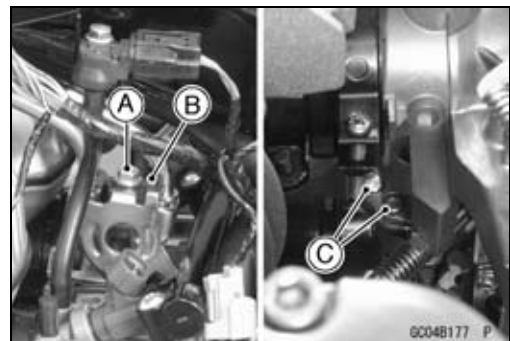
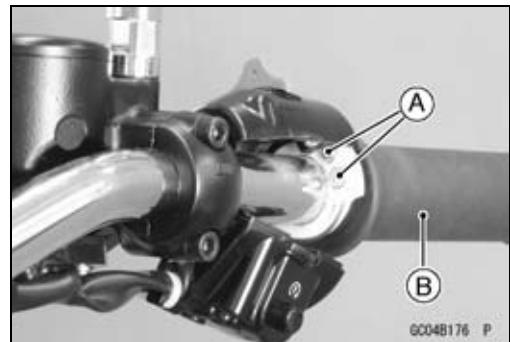
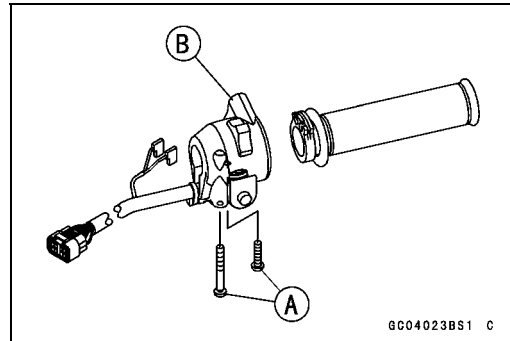
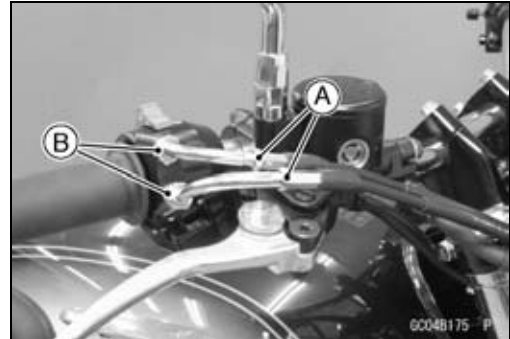
- Refer to the Throttle Control System Inspection in the Periodic Maintenance chapter.

#### **Throttle Grip Free Play Adjustment**

- Refer to the Throttle Control System Inspection in the Periodic Maintenance chapter.

#### **Throttle Cable Removal**

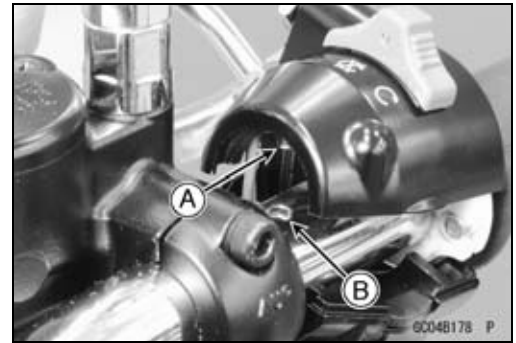
- Remove the fuel tank (see Fuel Tank Removal).
- Loosen:
  - Throttle Cable Adjuster Locknuts [A]
  - Nuts [B]
- Remove the screws [A].
- Separate the right handlebar switch housing [B].
- Take the throttle cable upper ends [A] off throttle grip [B].
- Remove:
  - Throttle Cable Plate Bolt [A]
  - Throttle Cable Plate [B]
- Remove the throttle cable from holder and remove the cable lower ends [C] from the throttle pulley.
- Pull out the throttle cables from the frame.



## Throttle Grip and Cables

### **Throttle Cable Installation**

- Lubricate the cable.
- Apply grease to the upper and lower ends of the cable.
- Install the cables to the right handlebar switch housing.
- Install the cable in accordance with the Cable, Wire, and Hose Routing section in the Appendix chapter.
- Install the lower ends of the cable to the throttle pulley.
- Install the right handlebar switch housing after installing the upper ends of the cable in the throttle grip.
- When installing the right handlebar switch housing, fit the projection [A] to the hole [B].
- Install the throttle cable plate.
- Tighten:
  - Torque - Throttle Cable Plate Bolt: 5.9 N·m (0.60 kgf·m, 52 in·lb)**
- After installation, adjust each cable properly (see Throttle Control System Inspection in the Periodic Maintenance chapter).



### **⚠ WARNING**

**Operation with incorrectly routed or improperly adjusted cables could result in an unsafe riding condition. Be sure the cables are routed correctly and properly adjusted.**

### **Cable Lubrication**

- Refer to the Chassis Parts Lubrication in the Periodic Maintenance chapter.

## 3-94 FUEL SYSTEM (DFI)

### Throttle Body Assy

#### Idle Speed Inspection/Adjustment

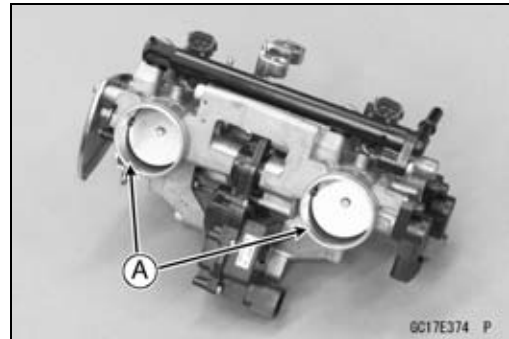
- Refer to the Idle Speed Inspection in the Periodic Maintenance chapter.

#### Synchronization Inspection/Adjustment

- Refer to the Engine Vacuum Synchronization Inspection in the Periodic Maintenance chapter.

#### Throttle Bore Cleaning

- Check the throttle bore for cleanliness as follows.
  - Remove the throttle body assy (see Throttle Body Assy Removal).
  - Check the throttle bore [A] at the throttle valve for carbon deposits by opening the throttle valve.
  - ★ If any carbon accumulates, wipe the carbon off the throttle bore and the throttle valve, using a lint-free cloth penetrated with a high-flash point solvent.



#### Throttle Body Assy Removal

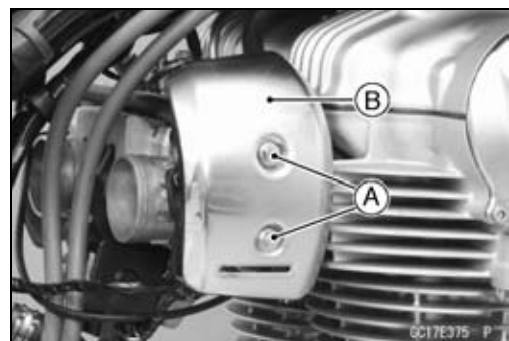
##### **⚠ WARNING**

Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. 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.

##### **NOTICE**

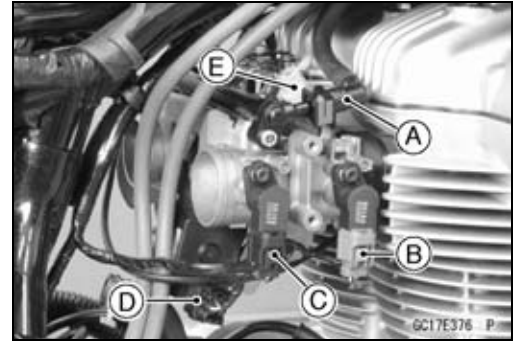
Never drop the throttle body assy especially on a hard surface. Such a shock to the body assy can damage it.

- Remove:
  - Air Cleaner Housing (see Air Cleaner Housing Removal)
  - Bolts [A]
  - Cover [B]

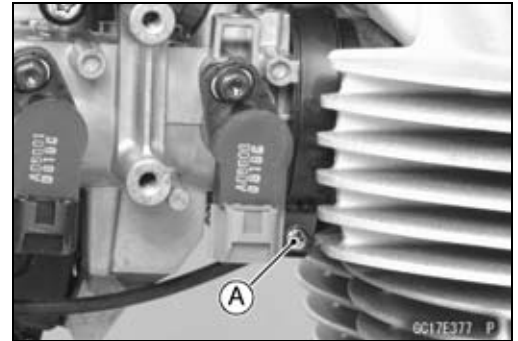


## Throttle Body Assy

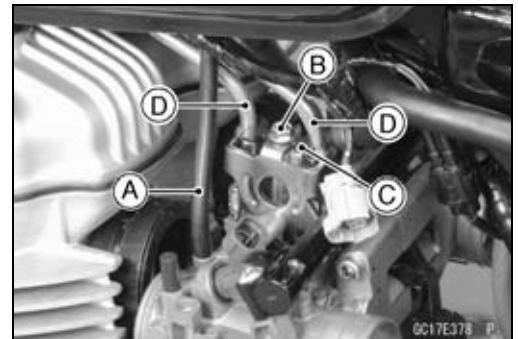
- Disconnect:
  - Fuel Hose [A] (see Fuel Hose Replacement in the Periodic Maintenance chapter)
  - Main Throttle Sensor Connector [B]
  - Subthrottle Sensor Connector [C]
  - Subthrottle Valve Actuator Connector [D]
  - Fuel Injector Connector [E] (Both Sides)



- Loosen the throttle body assy clamp screw [A] (both sides).
- Take the throttle body assy off the engine.

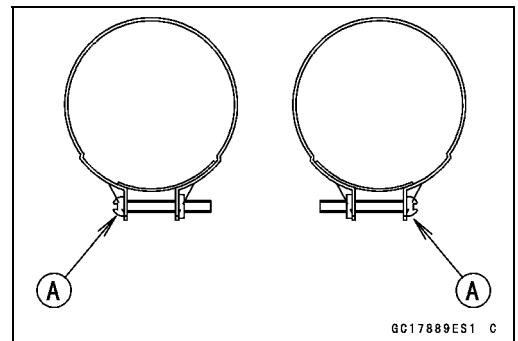


- Remove:
  - Hose [A]
  - Throttle Cable Plate Bolt [B]
  - Throttle Cable Plate [C]
  - Throttle Cable Lower Ends [D]



### Throttle Body Assy Installation

- Installation is the reverse of removal. Note the following.
  - Turn the screw head [A] of the throttle body assy clamps to outside.
- Tighten:
  - Torque - Throttle Cable Plate Bolt: 5.9 Nm (0.60 kgf·m, 52 in·lb)



### Throttle Body Assy Disassembly

#### NOTICE

Do not remove, disassemble or adjust the throttle sensor, throttle link mechanism, because they are adjust or set surely at the manufacturer. Adjustment of these parts could result in poor performance, requiring replacement of the throttle body assy.

## 3-96 FUEL SYSTEM (DFI)

### Throttle Body Assy

- Remove the throttle body assy (see Throttle Body Assy Removal).
- Remove:
  - Delivery Pipe Mounting Screws [A]
  - Delivery Pipe [B] with Fuel Injectors [C]

#### NOTE

○ Do not damage the insertion portions of the injector when they are removed from the throttle body.

#### NOTICE

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

- Take the injectors [A] off the delivery pipe [B].

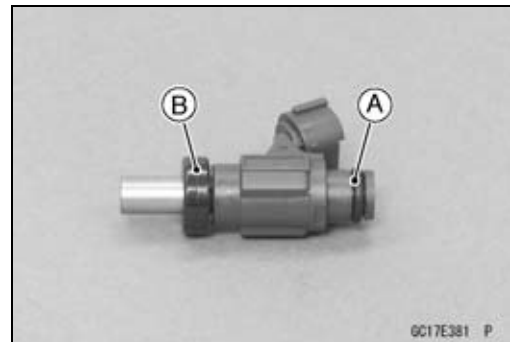
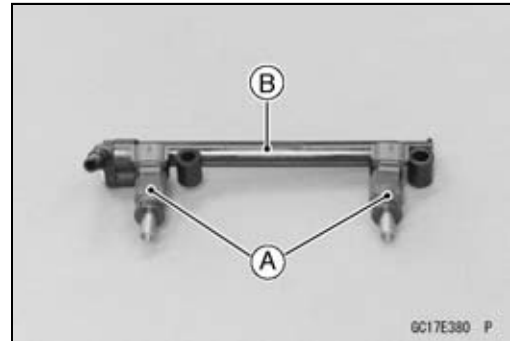
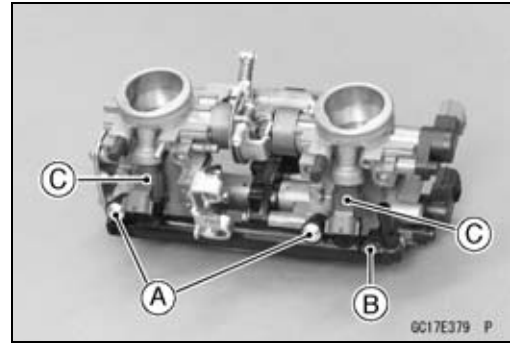
#### NOTE

○ Do not damage the insertion portions of the injector when they are removed from the delivery pipe.

### Throttle Body Assy Assembly

- Replace the O-ring [A] and dust seal [B] with new ones.
- Apply engine oil to the new O-ring and dust seal.
- Install the fuel injector to the delivery pipe.
- Install the delivery pipe assembly to the throttle body.
- Tighten:

**Torque - Delivery Pipe Mounting Screws: 3.43 N·m (0.35 kgf·m, 30 in·lb)**



## Air Cleaner

### **Air Cleaner Element Removal/Installation**

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

### **Air Cleaner Element Inspection**

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

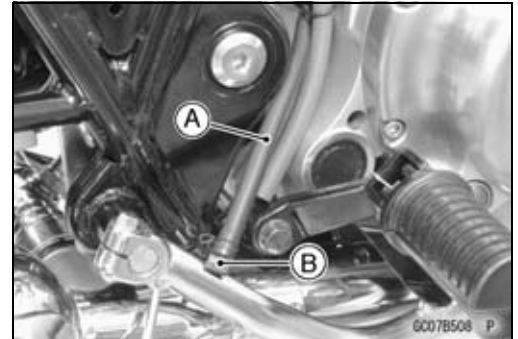
### **Air Cleaner Oil Draining**

A drain hose is connected to the bottom of the air cleaner to drain water or oil accumulated in the cleaner part.

- Visually check the drain hose [A] of the drain hose, if the water or oil accumulates in the tank.
- ★ If any water or oil accumulates in the hose, remove the plug [B] from the drain hose and drain it.

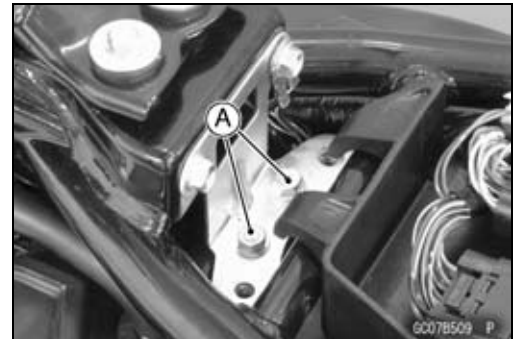
**⚠ WARNING**

**Oil on tires will make them slippery and can cause an accident and injury. Be sure to reinstall the catch tank after draining.**

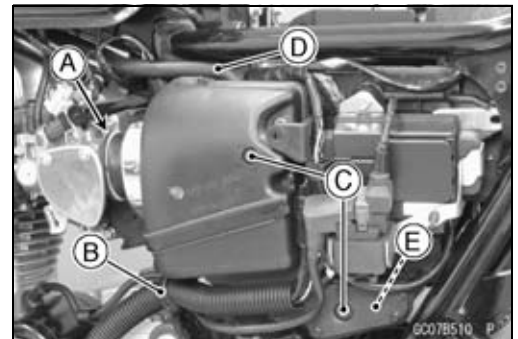


### **Air Cleaner Housing Removal**

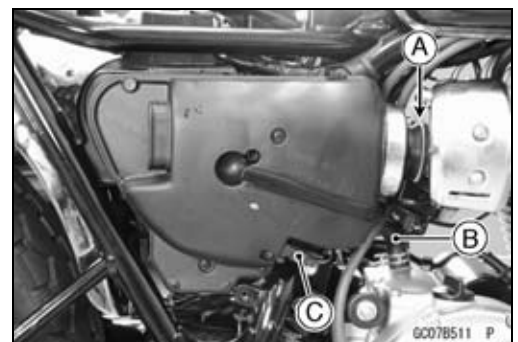
- Remove:
  - Seat (see Seat Removal in the Frame chapter)
  - Side Covers (see Left/Right Side Cover Removal in the Frame chapter)
  - Battery (see Battery Removal in the Electrical System chapter)
  - Bolts [A]



- Remove:
  - Throttle Body Assy Holder Spring [A]
  - Clamp [B] (Open)
  - Connecting Pipe Screws [C] and Washers
  - Secondary Air Hose [D]
  - Air Cleaner Drain Hose [E]
  - Left Air Cleaner Housing



- Remove:
  - Throttle Body Assy Holder Spring [A]
  - Engine Breather Hose [B]
  - Intake Air Temperature Sensor Connector [C]
  - Right Air Cleaner Housing

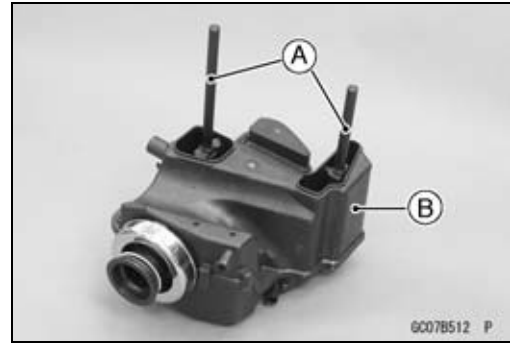


## 3-98 FUEL SYSTEM (DFI)

### Air Cleaner

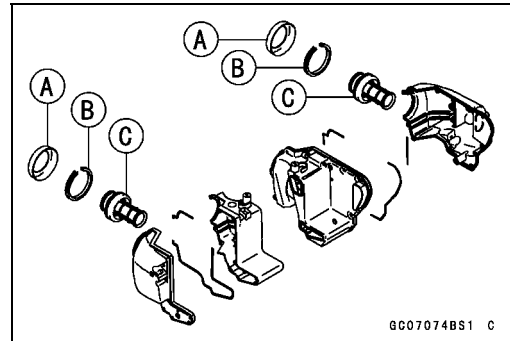
#### Air Cleaner Housing Installation

- Installation is the reverse of removal. Note the following.
- Make sure that the connecting pipes [A] is secured to the right air cleaner housing [B].



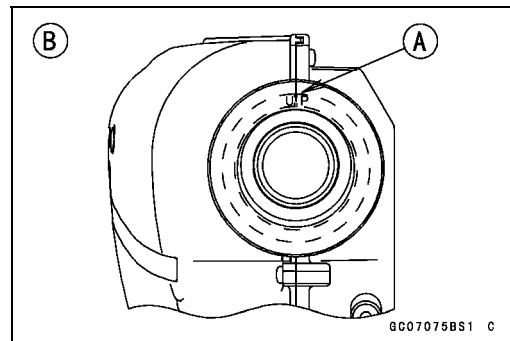
#### Intake Duct Removal

- Remove:
  - Air Cleaner Housing (see Air Cleaner Housing Removal)
  - Intake Duct Cover [A]
  - Clamp [B]
  - Intake Duct [C]



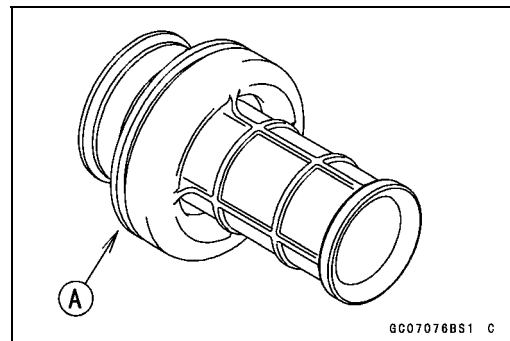
#### Intake Duct Installation

- Install the intake duct as shown in the figure.
- Align the line [A] of the intake duct and the air cleaner housing mating surface.
- Right Air Cleaner Housing [B]

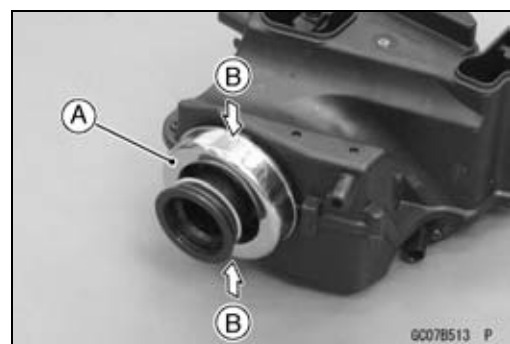


- For the right intake duct, apply sealant to the groove [A] of the duct.

Sealant - Liquid Gasket, TB1211F: 92104-0004



- Install the clamps.
- Install the intake duct cover [A].
- Punch the both sides of the intake duct cover [B] to fix it.





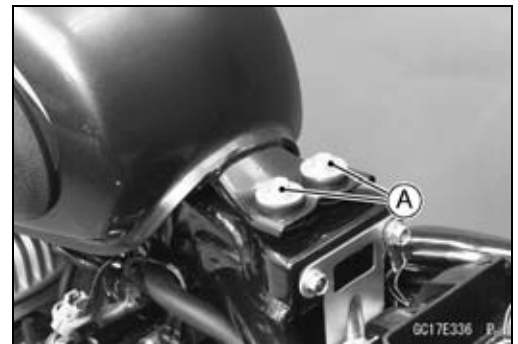
Fuel Tank

Fuel Tank Removal

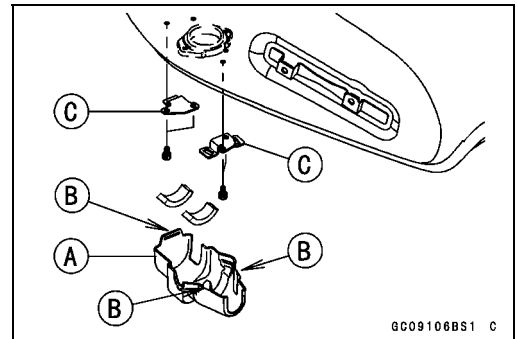
**⚠ WARNING**

Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. 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 fuel spills, draw it from the tank when the engine is cold. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

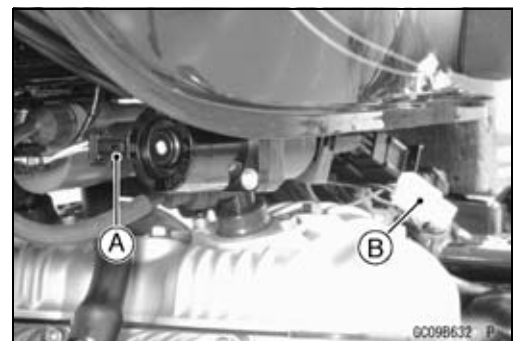
- Turn the ignition switch to OFF.
- Wait until the engine cools down.
- Disconnect the battery (-) terminal (see Battery Removal in the Electrical System chapter).
- Remove:
  - Seat (see Seat Removal in the Frame chapter)
  - Fuel Tank Bolts [A]



- Remove the fuel pump cover [A].
- Take the claws [B] off the brackets [C].



- Disconnect:
  - Fuel Pump Connector [A]
  - Fuel Reserve Switch Lead Connector [B]



# 3-100 FUEL SYSTEM (DFI)

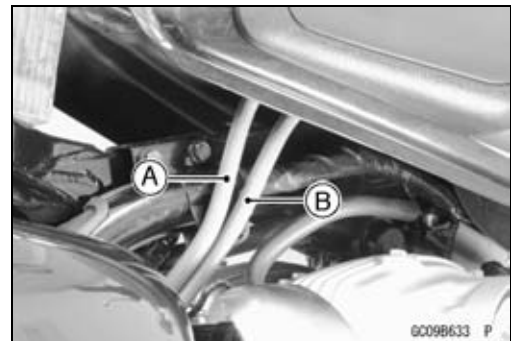
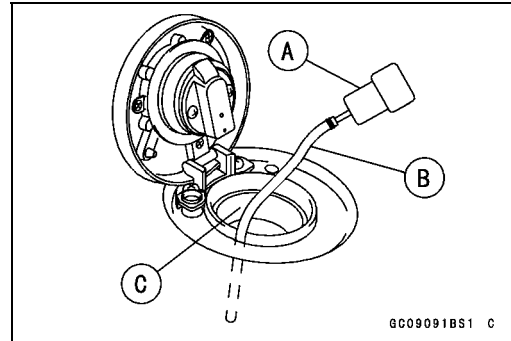
## Fuel Tank

- Draw the fuel out from the fuel tank with a commercially available pump [A].
- Use a soft plastic hose [B] as a pump intake hose in order to insert the hose smoothly.
- Put the hose through the filler opening [C] into the tank and draw the fuel out.

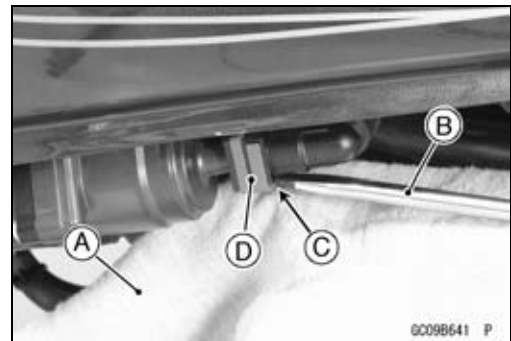
### **⚠ WARNING**

**Spilled fuel is flammable and can be explosive under certain conditions. The fuel can not be removed completely from the fuel tank. Be careful for remained fuel spillage.**

- Remove:
  - Breather Hose [A]
  - Drain Hose [B]



- Be sure to place a piece of cloth [A] around the fuel hose joint.
- Insert a thin blade screw driver [B] into the slit [C] on the joint lock [D].
- Turn the driver to open the joint lock.



- Take the fuel hose joint [A] off the fuel outlet pipe.

### **NOTE**

○ The fuel outlet pipe is resin. Take care not to damage it.

### **⚠ WARNING**

**Fuel is flammable and explosive under certain conditions and can cause severe burns. 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 because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.**



- Close the fuel tank cap.
- Remove the fuel tank, and place it on a flat surface.
- Do not apply the load to the fuel pump.

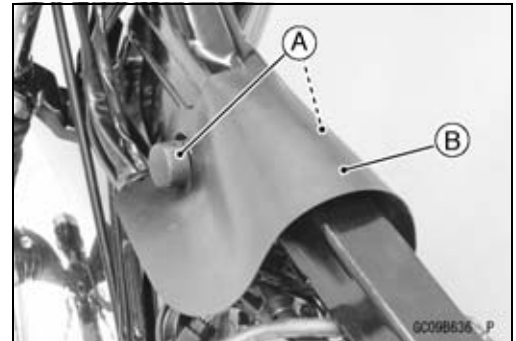
Fuel Tank

**⚠ WARNING**

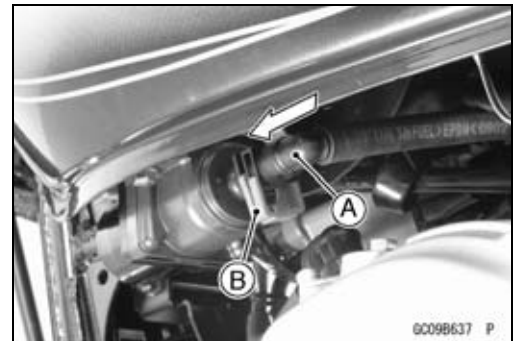
Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. Store the fuel tank in an area which is well-ventilated and free from any source of flame or sparks. Do not smoke in this area. Place the fuel tank on a flat surface and plug the fuel pipes to prevent fuel leakage.

**Fuel Tank Installation**

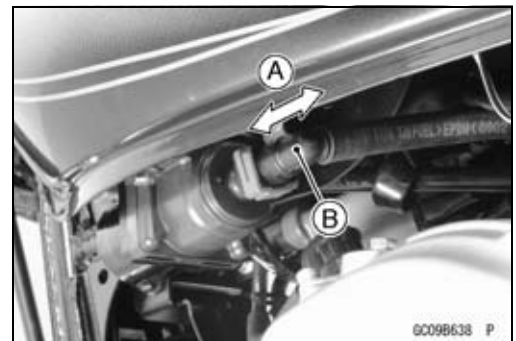
- Note the above WARNING (see Fuel Tank Removal).
- Route the hoses correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Check that the dampers [A] and the heat insulation rubber plate [B] are in place on the frame.
- ★ If the dampers are damaged or deteriorated, replace it.



- Insert the fuel hose joint [A] straight onto the fuel outlet pipe until the hose joint clicks.
- Push the joint lock [B] until the hose joint clicks.



- Push and pull [A] the hose joint [B] back and forth more than two times, and make sure it is locked and does not come off.



**NOTE**

○ The fuel outlet pipe is resin. Take care not to damage it.

**⚠ WARNING**

Leaking fuel can cause a fire or explosion resulting in serious burns. Make sure the hose joint is installed correctly on the delivery pipe.

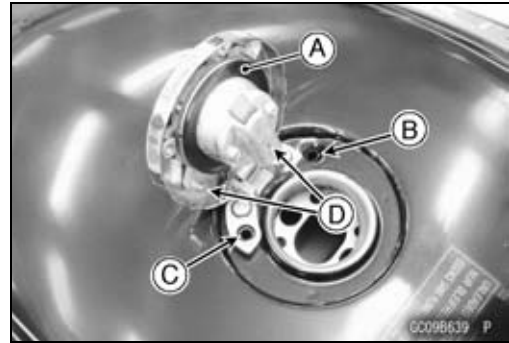
- ★ If it comes off, reinstall the hose joint.
- Install the breather hose and the drain hose.
- Install the fuel tank.
- Tighten the fuel tank bolt.
- Connect the fuel pump lead connector and the fuel reserve switch lead connector.
- Install the removed parts (see appropriate chapters).

## 3-102 FUEL SYSTEM (DFI)

### Fuel Tank

#### **Fuel Tank Inspection**

- Open the tank cap.
- Visually inspect the gasket [A] on the tank cap for any damage.
- ★ If the gasket is damaged, replace the tank cap with a new one.
- Check to see if the water drain pipe [B] and fuel breather pipe [C] in the tank are not clogged. Check the tank cap breather also.
- ★ If they are clogged, remove the tank and drain it, and then blow the breather free with compressed air.



#### **NOTICE**

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

#### **Fuel Tank Cleaning**

#### **⚠ WARNING**

**Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the tank in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area. Do not use gasoline or low-flash point solvents to clean the tank.**

- Remove:
  - Fuel Tank (see Fuel Tank Removal)
  - Fuel Pump (see Fuel Pump Removal)
  - Fuel Reserve Switch
- Pour some high-flash point solvent into the fuel tank and shake the tank to remove dirt and fuel deposits.
- Draw the solvent out of the fuel tank.
- Dry the tank with compressed air.
- Install the removed parts (see appropriate chapters).

# Engine Top End

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## 4-2 ENGINE TOP END

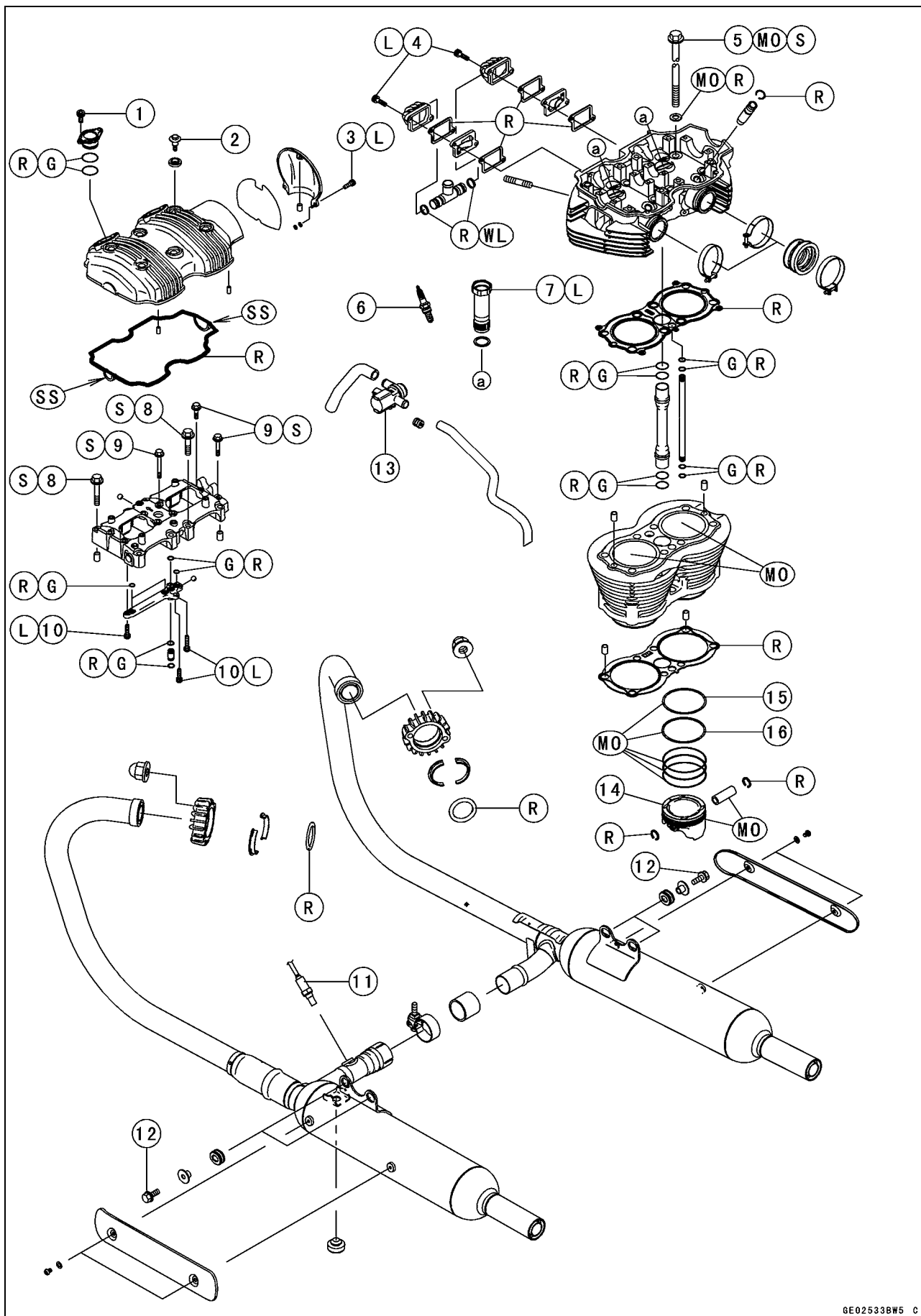
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# 4-4 ENGINE TOP END

## Exploded View





**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Spark Plug Hole Holder Cover Bolts	7.8	0.8	69 in·lb	
2	Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
3	Bevel Gear Cover Bolts	3.9	0.4	35 in·lb	L
4	Air Suction Valve Cover Bolts	12	1.2	106 in·lb	L
5	Cylinder Head Bolts (New Bolts)	49	5.0	36	MO, S
	Cylinder Head Bolts (Used Bolts)	47	4.8	35	MO, S
6	Spark Plugs	13	1.3	115 in·lb	
7	Spark Plug Hole Pipes	120	12.2	89	L
8	Camshaft Cap Bolts (8 mm)	25	2.5	18	S
9	Camshaft Cap Bolts (6 mm)	12	1.2	106 in·lb	S
10	Oil Fitting Bracket Bolts	12	1.2	106 in·lb	L
11	Oxygen Sensor	25	2.5	18	
12	Muffler Bracket Bolts	21	2.1	15	

13. Air Switching Valve

14. Dent mark faces front

15. "1R" mark faces up

16. "RH" mark faces up

G: Apply grease.

L: Apply a non-permanent locking agent.

MO: Apply molybdenum disulfide oil.

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

R: Replacement Parts

S: Follow the specified tightening sequence.

SS: Apply silicone sealant.

WL: Apply soap and water solution or rubber lubricant.



## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rocker Shaft Bolts	12	1.2	106 in·lb	L
2	Camshaft Locating Plate Bolts	12	1.2	106 in·lb	
3	Driven Bevel Gear Bolts	20	2.0	15	L
4	Bevel Gear Mounting Nuts	59	6.0	44	R
5	Gear Case	98	10	72	L
6	Bevel Gear Case Locknuts	20	2.0	15	
7	Bevel Gear Case Bolts	12	1.2	106 in·lb	
8	Bevel Gear Oil Passage Nozzle	3.5	0.36	31 in·lb	
9	Bevel Gear Holder Screws	4.9	0.5	43 in·lb	L
10	Bearing Holder Allen Bolts	7.8	0.8	69 in·lb	L
11	Locknut Stop Screw	2.1	0.2	1.5	L

12. Camshaft side shim

13. Crankshaft side primary shim

14. Crankshaft side secondary shim

G: Apply grease.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil.

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

R: Replacement Parts

# 4-8 ENGINE TOP END

## Exhaust System Identification

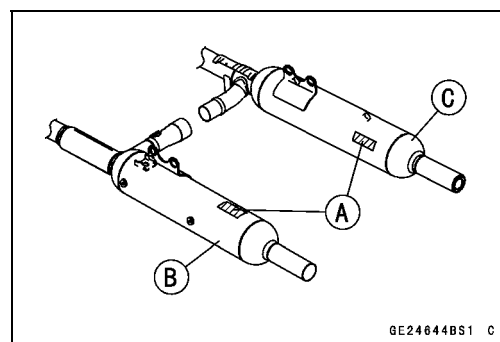
MUFFLER	SPECIFICATION	MODEL
<div style="border: 1px solid black; padding: 5px;"> <p align="center"><b>Honeycomb Type Catalyst with Oxygen Sensor</b></p> <hr style="border-top: 1px dashed black;"/> <p>P/No. 18087-0274 P/No. 18087-0275 Mark: KHI K 615</p> </div>	<p>WVTA(FULL H) GB WVTA(FULL H) AU</p>	<p>EJ800AB/AC Early Model EJ800AB/AC Early Model EJ800AB/AC</p>
<div style="border: 1px solid black; padding: 5px;"> <p align="center"><b>Honeycomb Type Catalyst with Oxygen Sensor</b></p> <hr style="border-top: 1px dashed black;"/> <p>P/No. 18087-0298 P/No. 18087-0299 Mark: KHI K 615</p> </div>	<p>WVTA(FULL H) GB WVTA(FULL H)</p>	<p>EJ800AC Late Model EJ800AC Late Model</p>

GE24761B F

Muffler Mark Position [A]

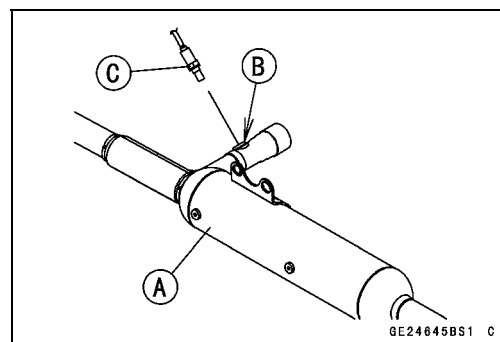
Left Muffler [B]

Right Muffler [C]



GE24644BS1 C

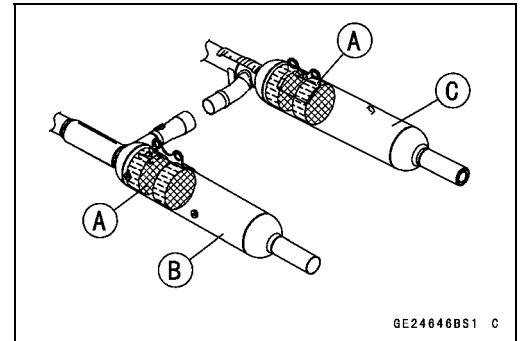
Left Muffler [A] with Hole [B] for Oxygen Sensor [C]



GE24645BS1 C

**Exhaust System Identification**

Honey Comb Type Catalyst Positions [A]  
Left Muffler [B]  
Right Muffler [C]



## 4-10 ENGINE TOP END

### Specifications

Item	Standard	Service Limit
<b>Rocker Shafts, Rocker Arms</b>		
Rocker Shaft Diameter	12.976 ~ 12.994 mm (0.5109 ~ 0.5116 in.)	12.95 mm (0.5098 in.)
Rocker Arm Inside Diameter	13.000 ~ 13.018 mm (0.5118 ~ 0.5125 in.)	13.05 mm (0.5138 in.)
<b>Camshaft</b>		
Cam Height:		
Exhaust	36.393 ~ 36.507 mm (1.4328 ~ 1.4373 in.)	36.29 mm (1.429 in.)
Intake	36.239 ~ 36.353 mm (1.4267 ~ 1.4312 in.)	36.14 mm (1.423 in.)
Camshaft Journal/Camshaft Cap Clearance	0.048 ~ 0.091 mm (0.0019 ~ 0.0036 in.)	0.18 mm (0.0071 in.)
Camshaft Journal Diameter	24.930 ~ 24.952 mm (0.9815 ~ 0.9824 in.)	24.90 mm (0.980 in.)
Camshaft Bearing Inside Diameter	25.000 ~ 25.021 mm (0.9843 ~ 0.9851 in.)	25.08 mm (0.987 in.)
Camshaft Runout	TIR 0.02 mm (0.0008 in.) or less	TIR 0.1 mm (0.004 in.)
<b>Cylinder Head</b>		
Cylinder Compression	(Usable range) 749 ~ 1 168 kPa (7.6 ~ 11.9 kgf/cm <sup>2</sup> , 109 ~ 169 psi) @500 rpm	–
Cylinder Head Warp	–	0.05 mm (0.002 in.)
<b>Valves</b>		
Valve Clearance:		
Exhaust	0.14 ~ 0.19 mm (0.0055 ~ 0.0075 in.)	–
Intake	0.08 ~ 0.13 mm (0.0031 ~ 0.0051 in.)	–
Valve Head Thickness:		
Exhaust	0.8 mm (0.031 in.)	0.4 mm (0.016 in.)
Intake	0.5 mm (0.020 in.)	0.3 mm (0.012 in.)
Valve Stem Bend	TIR 0.01 mm (0.0004 in.) or less	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:		
Exhaust	4.460 ~ 4.470 mm (0.1756 ~ 0.1760 in.)	4.44 mm (0.175 in.)
Intake	4.475 ~ 4.490 mm (0.1762 ~ 0.1768 in.)	4.46 mm (0.176 in.)
Valve Guide Inside Diameter:		
Exhaust	4.500 ~ 4.512 mm (0.1772 ~ 0.1776 in.)	4.58 mm (0.180 in.)
Intake	4.500 ~ 4.512 mm (0.1772 ~ 0.1776 in.)	4.58 mm (0.180 in.)

**Specifications**

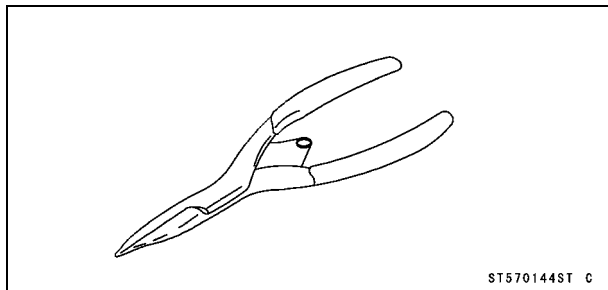
Item	Standard	Service Limit
Valve/Valve Guide Clearance (Wobble method): Exhaust Intake Valve Seat Cutting Angle Valve Seating Surface: Width Outside Diameter: Exhaust Intake Valve Spring Free Length	0.08 ~ 0.13 mm (0.0031 ~ 0.0051 in.) 0.02 ~ 0.09 mm (0.0008 ~ 0.0035 in.) 32°, 45°, 60° 0.8 ~ 1.2 mm (0.031 ~ 0.047 in.) 24.4 ~ 24.6 mm (0.961 ~ 0.969 in.) 28.4 ~ 28.6 mm (1.118 ~ 1.126 in.) 47.3 mm (1.862 in.)	0.30 mm (0.0118 in.) 0.26 mm (0.0102 in.) – – – – 45.1 mm (1.776 in.)
<b>Cylinders and Pistons</b> Cylinder Inside Diameter Piston Diameter Piston/Cylinder Clearance Piston Ring/Ring Groove Clearance: Top Second Piston Ring Groove Width: Top Second Piston Ring Thickness: Top Second Piston Ring End Gap: Top Second	77.000 ~ 77.012 mm (3.0315 ~ 3.0320 in.) 76.950 ~ 76.960 mm (3.0295 ~ 3.0299 in.) 0.040 ~ 0.062 mm (0.0016 ~ 0.0024 in.) 0.05 ~ 0.09 mm (0.0020 ~ 0.0035 in.) 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.) 1.04 ~ 1.06 mm (0.0409 ~ 0.0417 in.) 1.02 ~ 1.04 mm (0.0402 ~ 0.0409 in.) 0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.) 0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.) 0.17 ~ 0.32 mm (0.0067 ~ 0.0126 in.) 0.35 ~ 0.50 mm (0.0138 ~ 0.0197 in.)	77.10 mm (3.035 in.) 76.80 mm (3.024 in.) – 0.19 mm (0.0075 in.) 0.17 mm (0.0067 in.) 1.14 mm (0.0449 in.) 1.12 mm (0.0441 in.) 0.90 mm (0.0354 in.) 0.90 mm (0.0354 in.) 0.6 mm (0.024 in.) 0.8 mm (0.031 in.)

# 4-12 ENGINE TOP END

## Special Tools and Sealant

Outside Circlip Pliers:

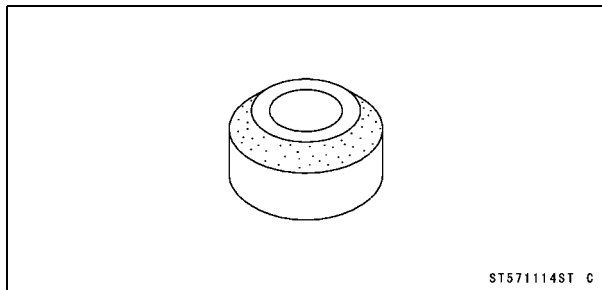
57001-144



ST570144ST C

Valve Seat Cutter, 45° -  $\phi$ 27.5:

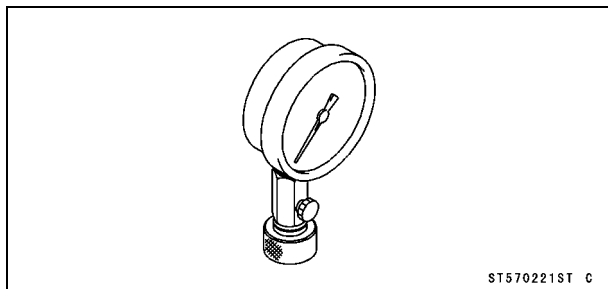
57001-1114



ST571114ST C

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

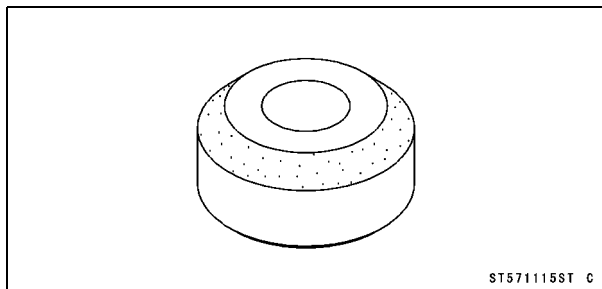
57001-221



ST570221ST C

Valve Seat Cutter, 45° -  $\phi$ 32:

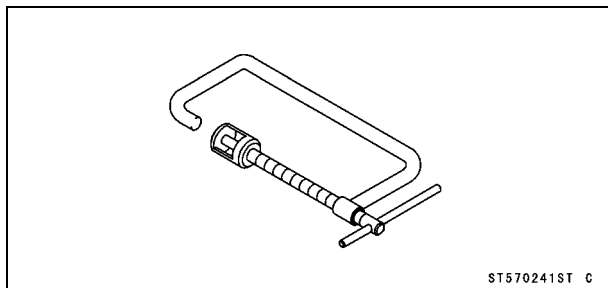
57001-1115



ST571115ST C

Valve Spring Compressor Assembly:

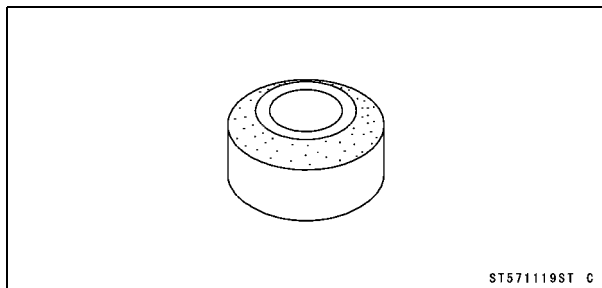
57001-241



ST570241ST C

Valve Seat Cutter, 32° -  $\phi$ 28:

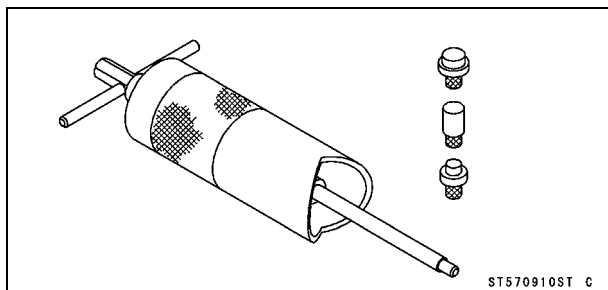
57001-1119



ST571119ST C

Piston Pin Puller Assembly:

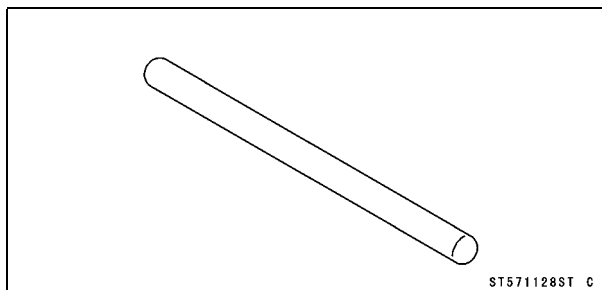
57001-910



ST570910ST C

Valve Seat Cutter Holder Bar:

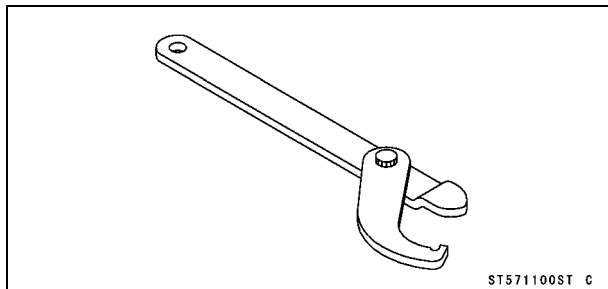
57001-1128



ST571128ST C

Steering Stem Nut Wrench:

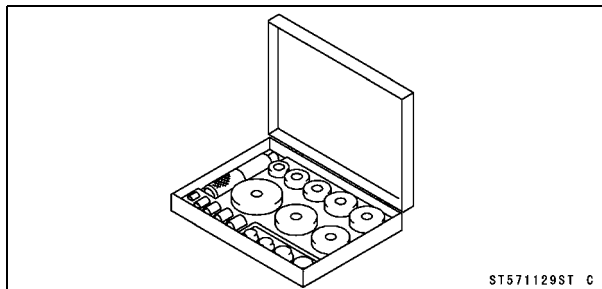
57001-1100



ST571100ST C

Bearing Driver Set:

57001-1129

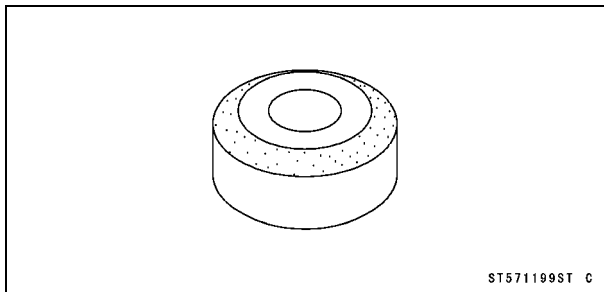


ST571129ST C



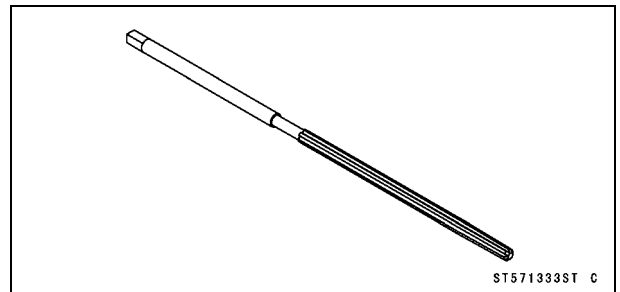
Special Tools and Sealant

Valve Seat Cutter, 32° -  $\phi$ 33:  
57001-1199



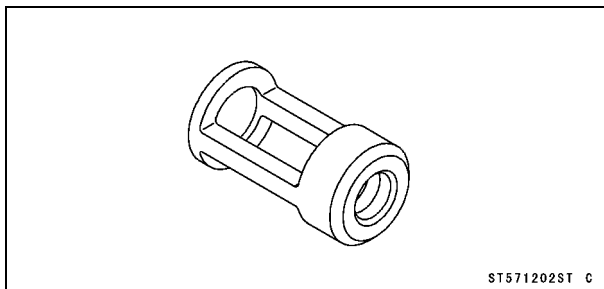
ST571199ST C

Valve Guide Reamer,  $\phi$ 4.5:  
57001-1333



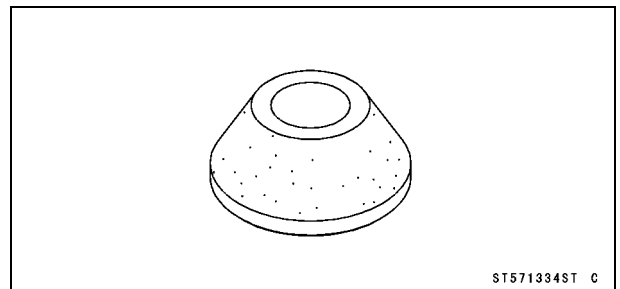
ST571333ST C

Valve Spring Compressor Adapter,  $\phi$ 22:  
57001-1202



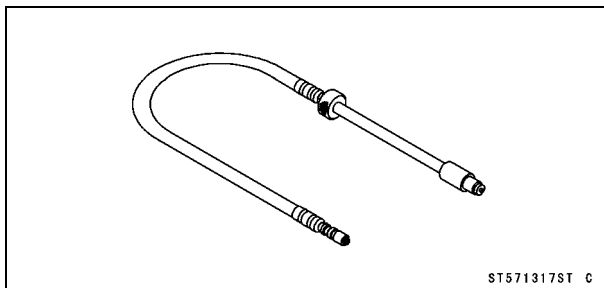
ST571202ST C

Valve Seat Cutter, 60° -  $\phi$ 33:  
57001-1334



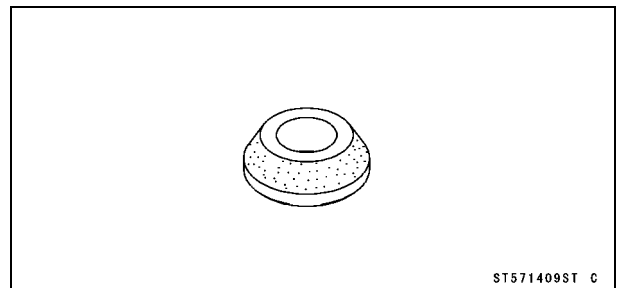
ST571334ST C

Compression Gauge Adapter, M10 × 1.0:  
57001-1317



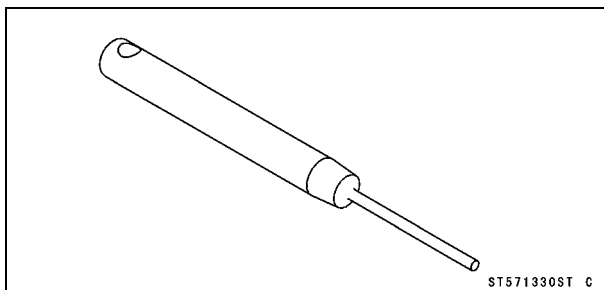
ST571317ST C

Valve Seat Cutter, 60° -  $\phi$ 27:  
57001-1409



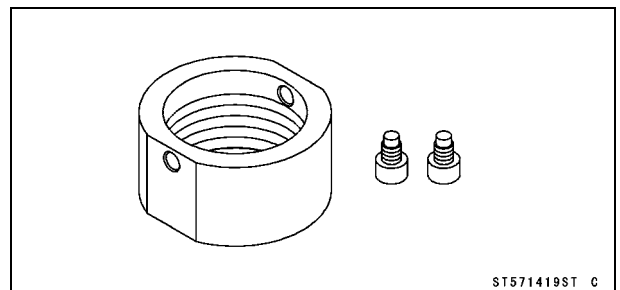
ST571409ST C

Valve Seat Cutter Holder,  $\phi$ 4.5:  
57001-1330



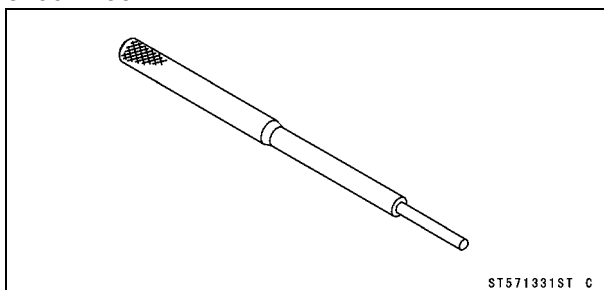
ST571330ST C

Bearing Housing Jig, M45 × 1.0:  
57001-1419



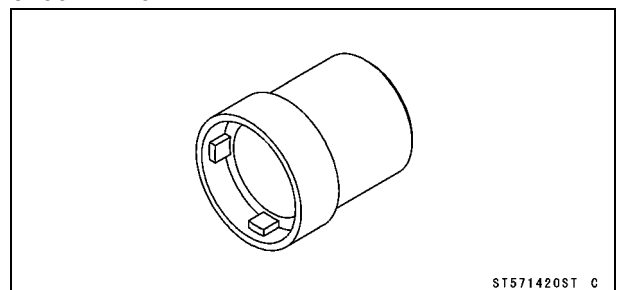
ST571419ST C

Valve Guide Arbor,  $\phi$ 4.5:  
57001-1331



ST571331ST C

Socket Wrench:  
57001-1420



ST571420ST C

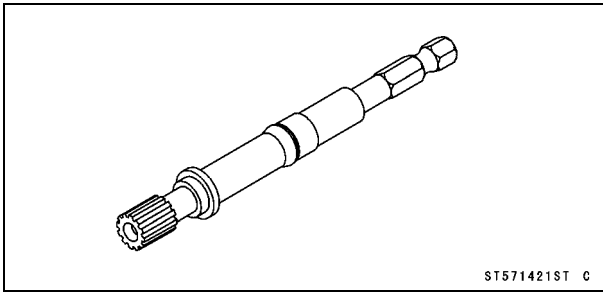
## 4-14 ENGINE TOP END

### Special Tools and Sealant

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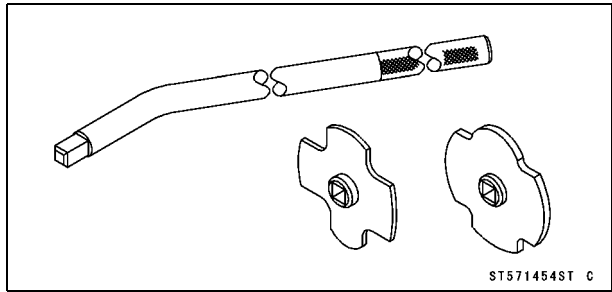
**Bevel Gear Drive Bit m0.75:**

**57001-1421**



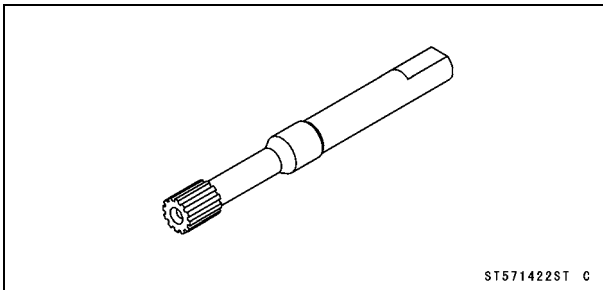
**Filler Cap Driver:**

**57001-1454**



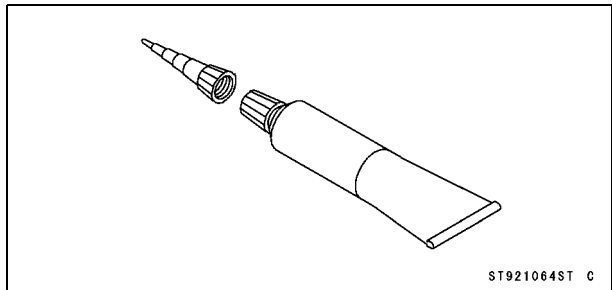
**Bevel Gear Holder m0.75:**

**57001-1422**



**Liquid Gasket, TB1216B:**

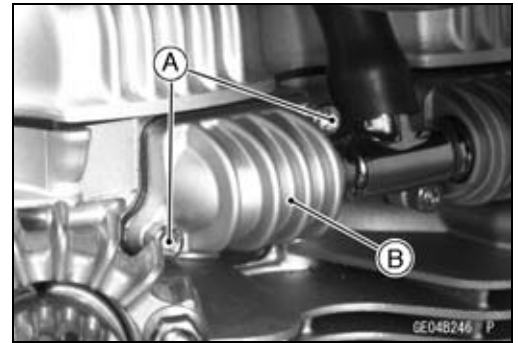
**92104-1064**



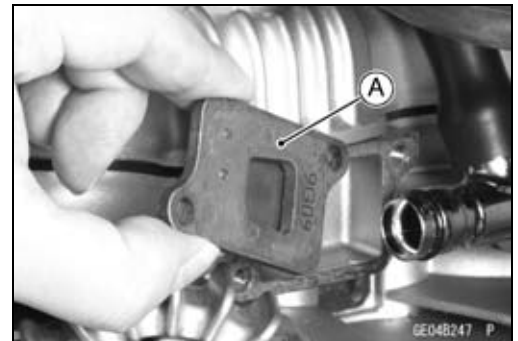
**Clean Air System**

**Air Suction Valve Removal**

- Remove:
  - Air Suction Valve Cover Bolts [A]
  - Air Suction Valve Cover [B]

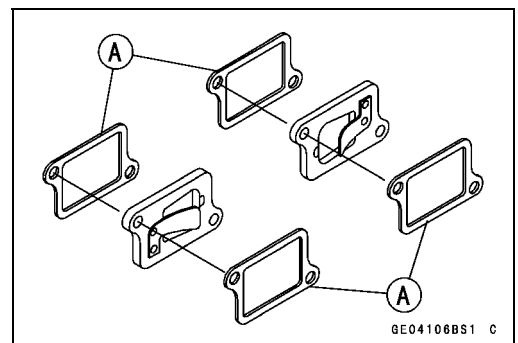


- Remove the air suction valve [A].



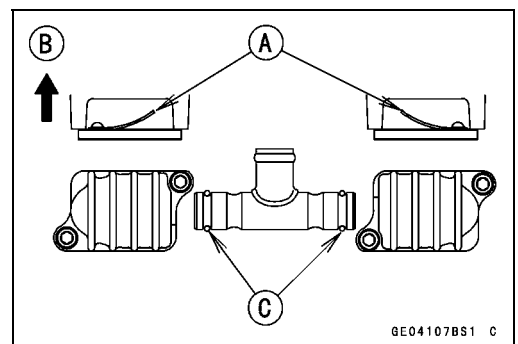
**Air Suction Valve Installation**

- Replace the gaskets [A] with new ones.



- Install the air suction valve so that opening [A] of the reed faces the inside.  
Cylinder Head Side [B]
- Replace the O-rings [C] with new ones.
- Apply soap and water solution to the new O-rings.
- Apply a non-permanent locking agent to the threads of the air suction valve cover bolts, and tighten them.

**Torque - Air Suction Valve Cover Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**



## 4-16 ENGINE TOP END

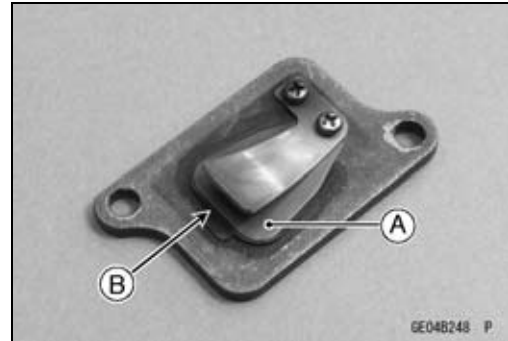
### Clean Air System

#### **Air Suction Valve Inspection**

- Remove the air suction valve (see Air Suction Valve Removal).
- Visually inspect the reeds [A] for cracks, folds, warps, heat damage or other damage.
- ★ If there is any doubt as to the condition of the reeds, 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.

#### **NOTICE**

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

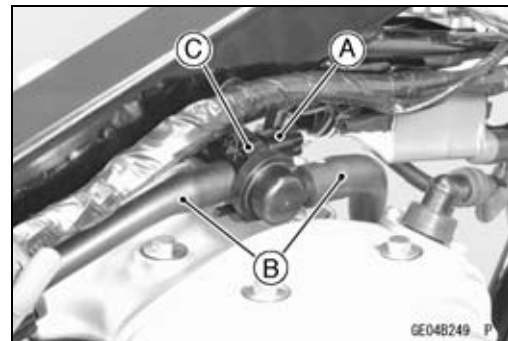


#### **Air Switching Valve Removal**

#### **NOTICE**

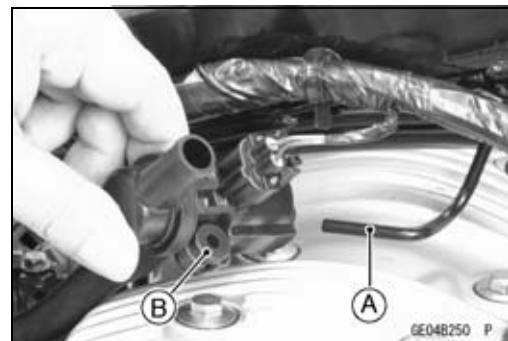
**Never drop the air switching valve especially on a hard surface. Such a shock to the air switching valve can damage it.**

- Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter).
- Disconnect the connector [A].
- Separate the hoses [B] from the air switching valve [C] to remove the air switching valve.

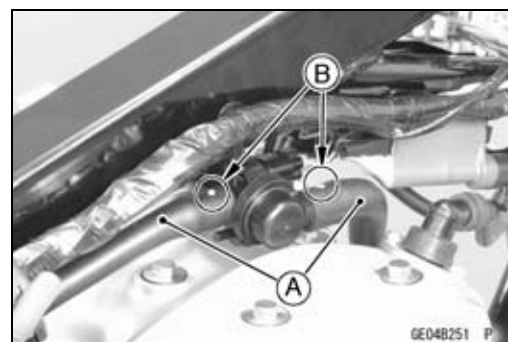


#### **Air Switching Valve Installation**

- Insert the stick [A] of the ignition coil bracket into the grommet [B] on the air switching valve.



- Install the hoses [A] so that the white marks [B] are upside.



#### **Air Switching Valve Operation Test**

- Refer to the Air Suction System Damage Inspection in the Periodic Maintenance chapter.

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## Clean Air System

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### ***Air Switching Valve Unit Test***

- Refer to the Air Switching Valve Unit Test in the Electrical System chapter.

### ***Clean Air System Hose Inspection***

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the air cleaner housing, air switching valve and air suction valve covers.
- ★ If they are not, correct them. Replace them if they are damaged.

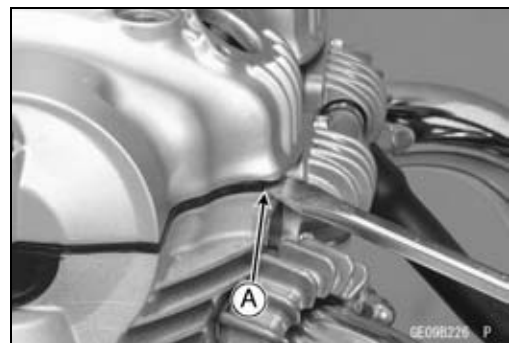
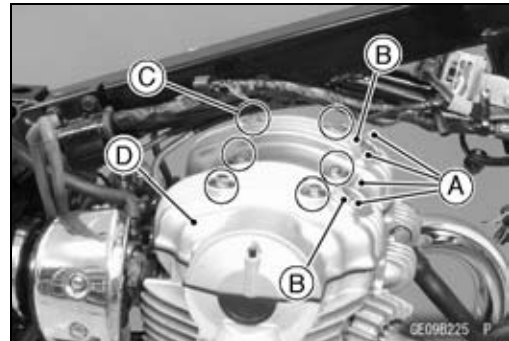
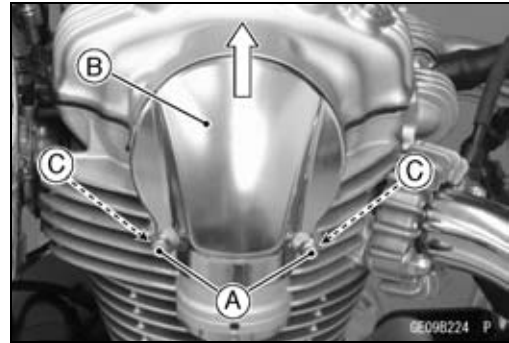
## 4-18 ENGINE TOP END

### Cylinder Head Cover

#### **Cylinder Head Cover Removal**

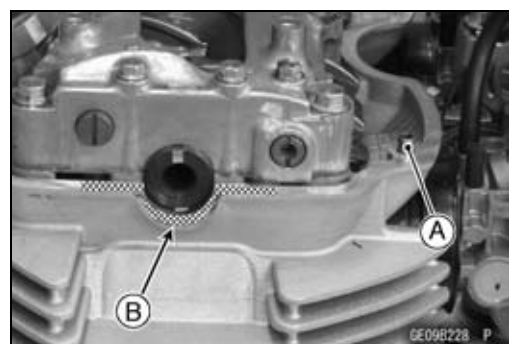
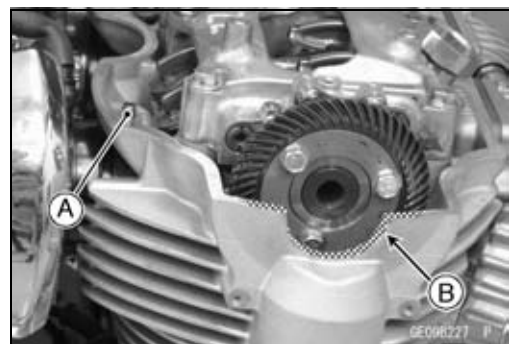
- Remove:
  - Fuel Tank (see Fuel Tank Removal Fuel System (DFI) chapter)
  - Ignition Coil (see Ignition Coil Removal in the Electrical System chapter)
  - Air Switching Valve (see Air Switching Valve Removal)
- Remove the bolts [A] and pull the bevel gear cover [B] upward.
- Make sure not to lose the washers [C].
- Remove the bolts [A] and remove the spark plug hole holder covers [B].
- Remove the bolts [C] and remove the cylinder head cover [D].

○ If the cylinder head cover does not come out easily, pry the points [A] (both ends).



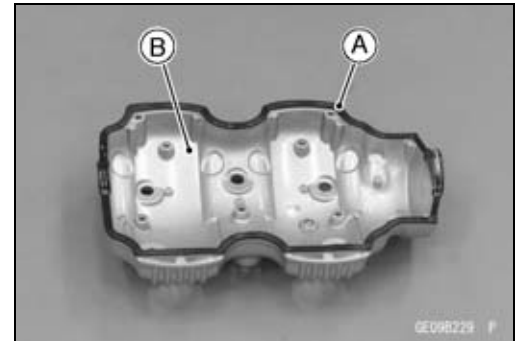
#### **Cylinder Head Cover Installation**

- Install the knock pins [A] on the cylinder head.
- Using a high-flash point solvent, clean off any oil or dirt that may be on the liquid gasket coating area. Dry them with a clean cloth.
- Apply liquid gasket [B] to the cylinder head as shown.  
**Sealant - Liquid Gasket, TB1216B: 92104-1064**



## Cylinder Head Cover

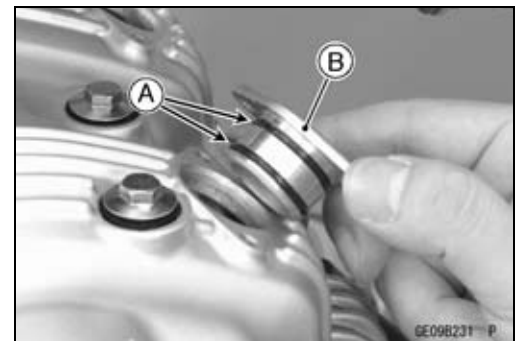
- Replace the head cover gasket [A] with a new one.
- Install the gasket to the cylinder head cover [B].



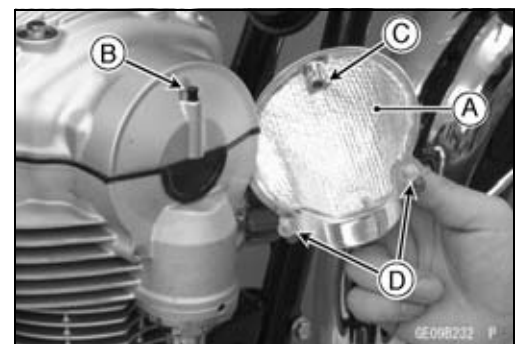
- Install the cylinder head cover.
- Install the cylinder head cover bolt washers [A] with their metal portion [B] facing up.
- Tighten:
  - Torque - Cylinder Head Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**



- Replace the O-rings [A] with new ones.
- Apply grease to the O-rings.
- Insert the spark plug hole cover [B] into the plug hole.
- Apply non-permanent locking agent to the threads of the spark plug hole holder cover bolts, and tighten them.
- Torque - Spark Plug Hole Holder Cover Bolts: 7.8 N·m (0.8 kgf·m, 69 in·lb)**



- Be sure that the insulator [A] is in place.
- Align and insert the cylinder head cover pin [B] into the hole [C] of the bevel gear cover.
- Apply non-permanent locking agent to the threads of the bevel gear cover bolt.
- Place the washers [D] in the bolt holes between the cylinder head and the bevel gear cover, and tighten the bolts.
- Torque - Bevel Gear Cover Bolts: 3.9 N·m (0.4 kgf·m, 35 in·lb)**
- Install the removed parts.



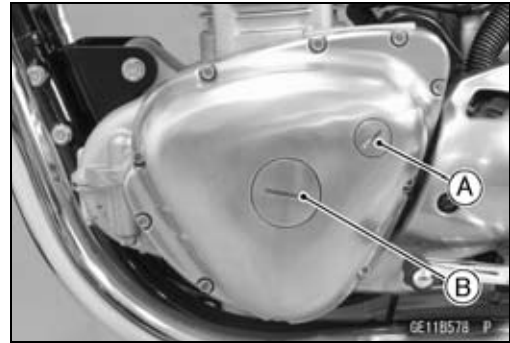
## 4-20 ENGINE TOP END

### Camshaft

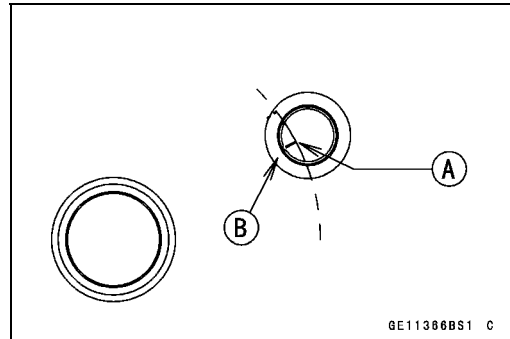
#### Camshaft Removal

- Remove:
  - Cylinder Head Cover (see Cylinder Head Cover Removal)
  - Timing Inspection Cap [A]
  - Rotor Bolt Cap [B]

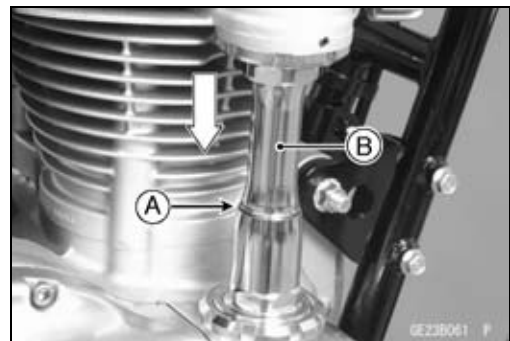
**Special Tool - Filler Cap Driver: 57001-1454**



- Bring the piston to the TDC.
- Place a wrench over the rotor bolt and turn it counterclockwise to align the TDC mark [A] with the timing notch [B].



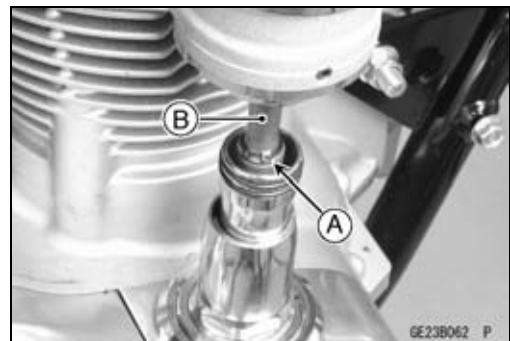
- Remove the snap ring [A].
- Pull the outer pipe [B] down.



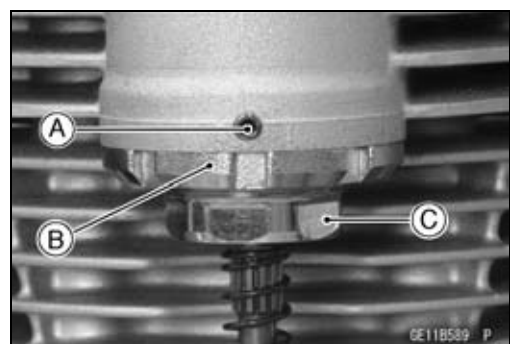
- Remove the circlip [A]
- Pull the driveshaft [B] down until the tip of the shaft is visible.

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

- Remove the bevel gear case (see Bevel Gear Case Removal).



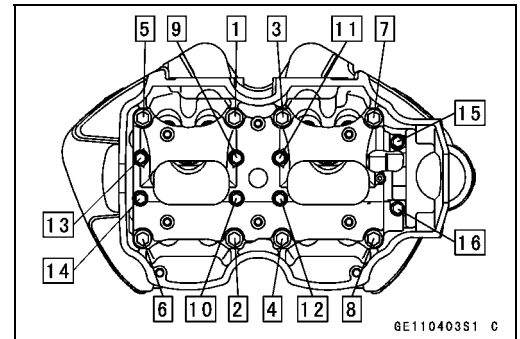
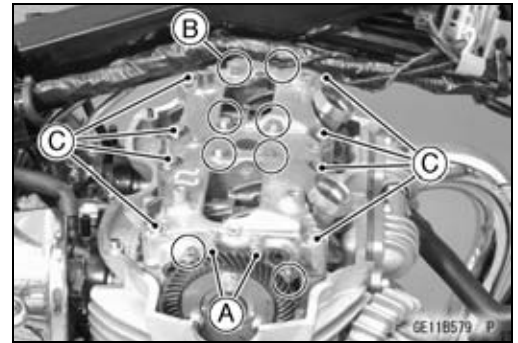
- Loosen the locknut stop screw [A].
- Loosen the bevel gear case locknut [B].
- **Special Tool - Steering Stem Nut Wrench: 57001-1100**
- Loosen the gear case unit [C] approximately one turn.





## Camshaft

- Loosen the camshaft locating plate bolts [A].
- First remove the 6 mm camshaft cap bolts [B] (16 → 9); then, remove the 8 mm camshaft cap bolts [C] (8 → 1).
- Remove:  
Camshaft Cap  
Camshaft

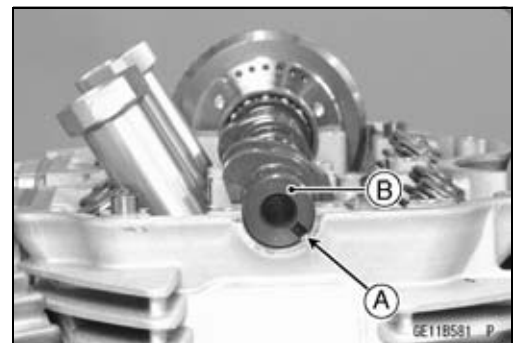
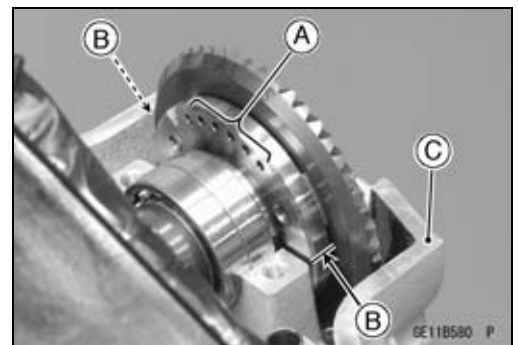


### Camshaft Installation

#### NOTICE

If the camshaft is replaced with a new part, make sure to adjust the bevel gear tooth contact.

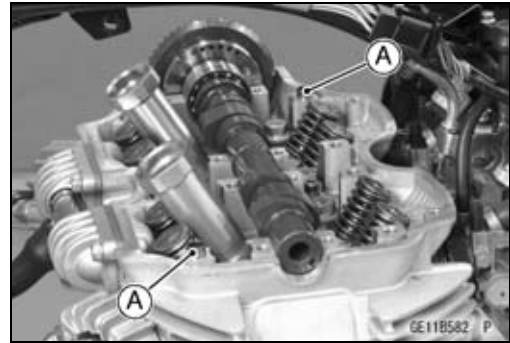
- Adjust the camshaft side bevel gear (see Bevel Gear Adjustment).
- Apply molybdenum disulfide oil solution to all cam parts and journals.
- Face the six holes [A] in the bevel gear holder of the camshaft upward. Then, mesh the drive bevel gear and the driven bevel gear together so that the right and left timing marks [B] on the side of the bevel gear holder parallel the cylinder head top surface [C].
- Be sure that the groove [A] of the camshaft end [B] is as shown.



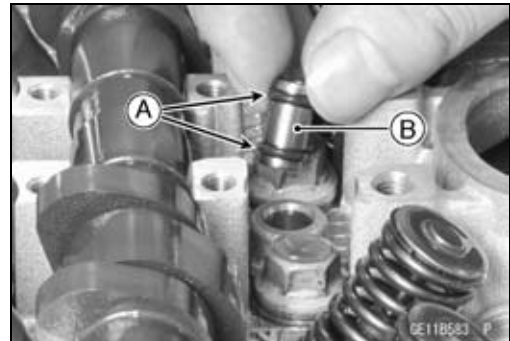
## 4-22 ENGINE TOP END

### Camshaft

- Install the dowel pins [A].



- Replace the O-rings [A] of the oil pipe [B] with new ones.
- Apply grease to the O-rings.
- Install the oil pipe.

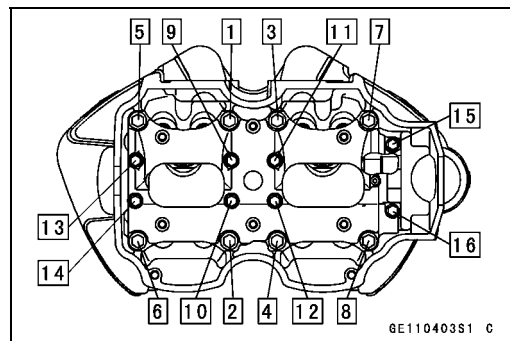


- Install the camshaft cap and tighten the bolts following the specified sequence.

#### Torque - Camshaft Cap Bolts

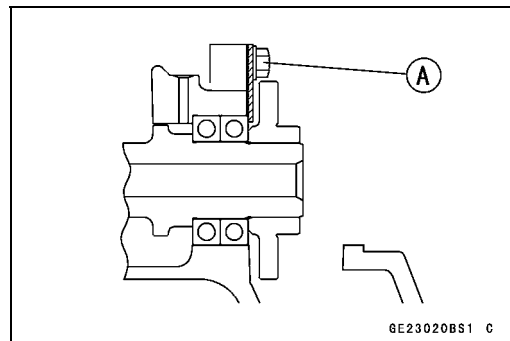
**M8 mm: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**M6 mm: 12 N·m (1.2 kgf·m, 106 in·lb)**

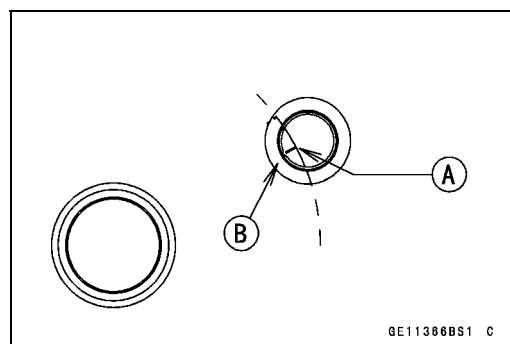


- Tighten the locating plate bolts [A] at the camshaft position.

**Torque - Camshaft Locating Plate Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**



- Bring the piston to the TDC.
- Place a wrench over the rotor bolt and turn it counterclockwise to align the TDC mark [A] with the timing notch [B].

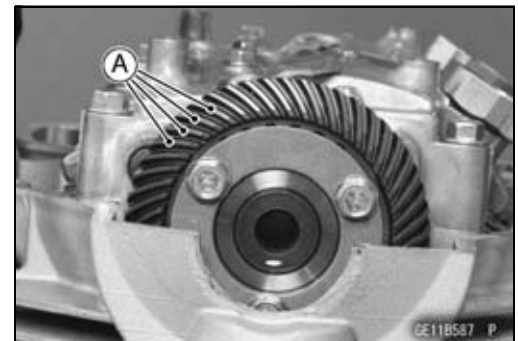
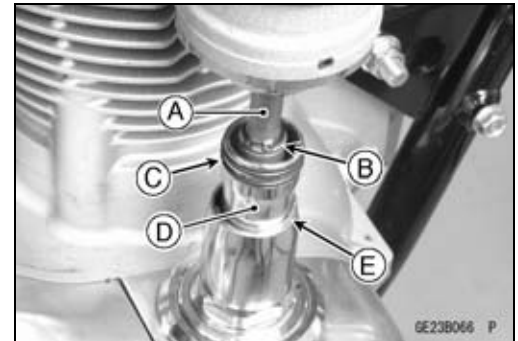


## Camshaft

- Replace the circlip with a new one (see Bevel Gear Case Assembly).
- Install the bevel gear case (see Bevel Gear Case Installation).
- Insert the driveshaft [A] into the camshaft side drive bevel gear splines, and fit the circlip [B] in the groove of the driveshaft.

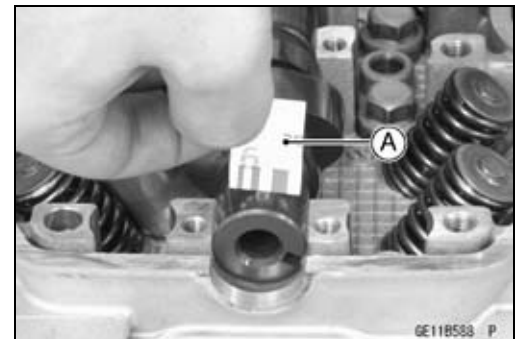
### Special Tool - Outside Circlip Pliers: 57001-144

- If the driveshaft cannot be inserted, move the driveshaft down for the time being. Then, slightly rotate the crankshaft clockwise or counterclockwise and attempt to insert the driveshaft again.
- Apply grease to the O-rings [C], and insert the outer pipe [D] into the bevel gear case.
- Fit the snap ring [E] in the groove of the outer pipe, with the gap of the snap ring facing the cylinder.
- Turn the rotor bolt counterclockwise and make sure that the cam is timed correctly.
- Apply molybdenum disulfide grease to all the tooth flanks [A] of the driven bevel gear.
- Install the removed parts.



### Camshaft, Camshaft Cap Wear Inspection

- Remove:
  - Cylinder Head Cover (see Cylinder Head Cover Removal)
  - Camshaft Cap (see Camshaft Removal)
- 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 journal and the camshaft cap using plastigage [A].
- Tighten the camshaft cap bolts (see Camshaft Installation).



### NOTE

- Do not turn the camshaft when the plastigage is between the journal and camshaft cap.

### Camshaft Journal/Camshaft Cap Clearance

**Standard:** 0.048 ~ 0.091 mm (0.0019 ~ 0.0036 in.)

**Service Limit:** 0.18 mm (0.0071 in.)

## 4-24 ENGINE TOP END

### Camshaft

- ★ If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

#### Camshaft Journal Diameter

**Standard:** 24.930 ~ 24.952 mm (0.9815 ~ 0.9824 in.)

**Service Limit:** 24.90 mm (0.980 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 unit.

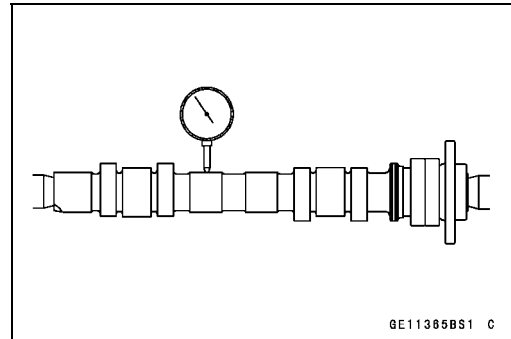
#### Camshaft Runout Inspection

- Remove the camshafts (see Camshaft Removal).
- Set the camshaft in a camshaft alignment jig or on V blocks.
- Measure runout with a dial gauge at the specified place as shown in the figure.
- ★ If the runout exceeds the service limit, replace the shaft.

#### Camshaft Runout

**Standard:** TIR 0.02 mm (0.0008 in.) or less

**Service Limit:** TIR 0.1 mm (0.004 in.)



#### Cam Wear Inspection

- Remove the camshafts (see Camshaft Removal).
- Measure the height [A] of each cam with a micrometer.
- ★ If the cams are worn down past the service limit, replace the camshaft.

#### Cam Height

**Standard:**

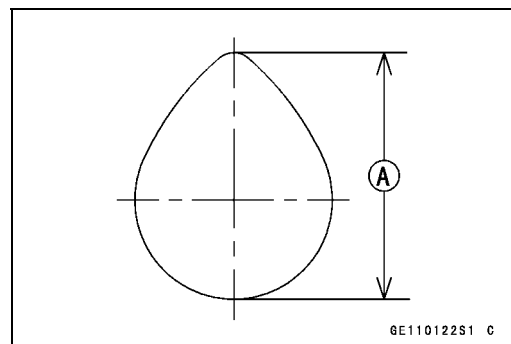
**Exhaust** 36.393 ~ 36.507 mm (1.4328 ~ 1.4373 in.)

**Intake** 36.239 ~ 36.353 mm (1.4267 ~ 1.4312 in.)

**Service Limit:**

**Exhaust** 36.29 mm (1.429 in.)

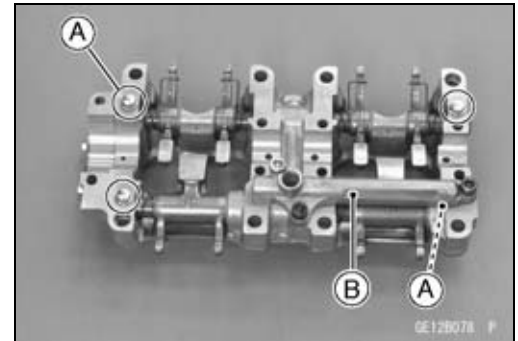
**Intake** 36.14 mm (1.423 in.)



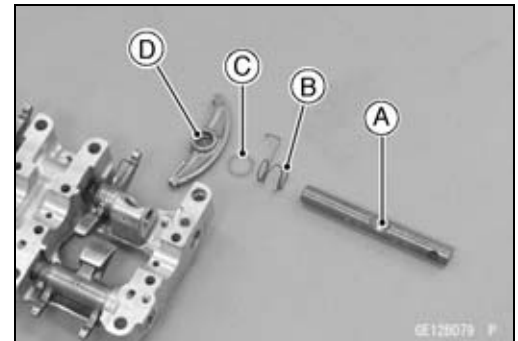
## Rocker Arm, Rocker Shaft

### Rocker Arm and Rocker Shaft Removal

- Remove:
  - Cylinder Head Cover (see Cylinder Head Cover Removal)
  - Camshaft Cap (see Camshaft Removal)
- Remove the Rocker shaft bolts [A].
- For the intake side of the #1 cylinder, remove the oil fitting bracket [B].

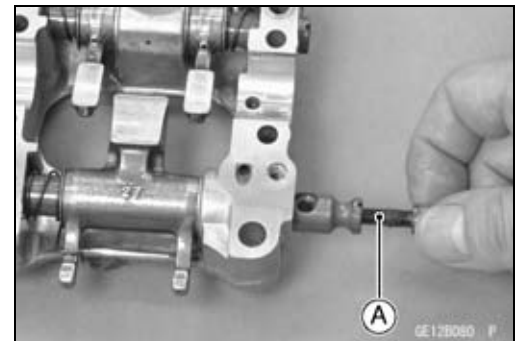


- Remove:
  - Rocker Shaft [A]
  - Spring [B]
  - Washer [C]
  - Rocker Arm [D]



### NOTE

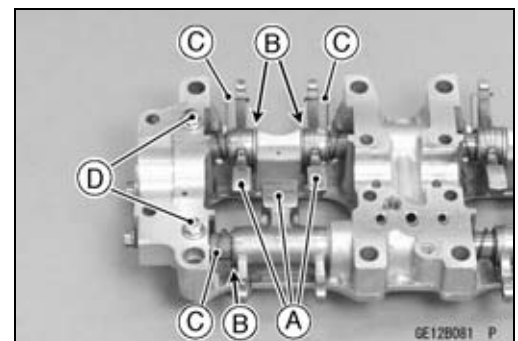
- Mark and record the rocker shafts and the rocker arms so that they can be reinstalled in their original positions. If the rocker shaft does not pull out easily, pull it out by tightening the removed rocker shaft bolt [A] into the shaft.



### Rocker Arm and Rocker Shaft Installation

- Blow through the oil passages of the rocker arm, rocker shaft, camshaft cap, and the oil fitting bracket with compressed air.
- Apply molybdenum disulfide oil solution to the sliding surfaces of the rocker arm and the rocker shaft.
- Install the rocker arms [A], washers [B], and springs [C], and insert the rocker shafts.
- Apply a non-permanent locking agent to the thread of the rocker shaft bolts [D], and tighten them.

**Torque - Rocker Shaft Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**



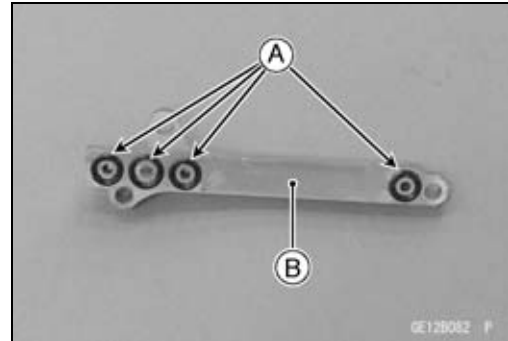
## 4-26 ENGINE TOP END

### Rocker Arm, Rocker Shaft

- Replace the O-rings [A] with new ones.
- Apply grease to the O-rings.
- Install the oil fitting bracket [B].
- Apply a non-permanent locking agent to the thread of the oil fitting bracket bolts, and tighten the bolts.

**Torque - Oil Fitting Bracket Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**

- Install the removed parts.



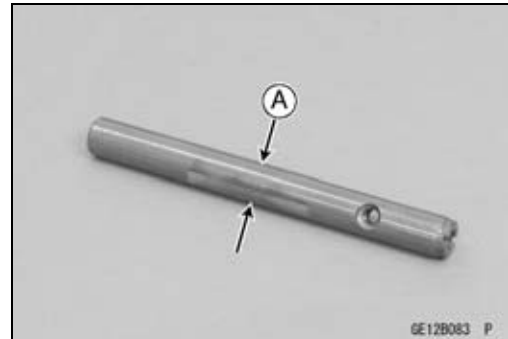
#### ***Rocker Shaft Diameter Measurement***

- Remove the rocker shaft (see Rocker Shaft and Rocker Arm Removal).
- Measure the diameter [A] of the rocker shaft where the rocker arm pivots on it with a micrometer.
- ★ If the rocker shaft diameter is smaller than the service limit, replace it. Also check the rocker arm inside diameter (see Rocker Arm Inspection).

#### **Rocker Shaft Diameter**

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

**Service Limit: 12.95 mm (0.5098 in.)**



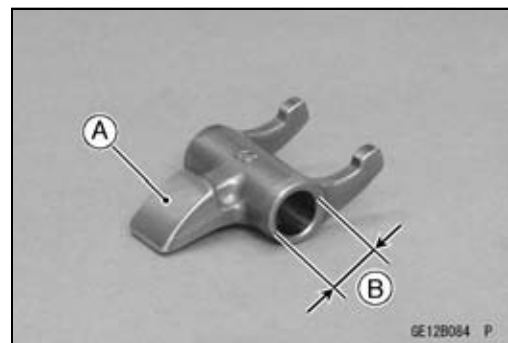
#### ***Rocker Arm Inspection***

- Remove the rocker arm (see Rocker Shaft and Rocker Arm Removal).
- Inspect the area [A] on the rocker arm where the cam rubs.
- ★ If the rocker arm is scored, discolored or otherwise damaged, replace it. Also inspect the camshaft lobes.
- Measure the inside diameter [B] of the rocker arm with a dial bore gauge.
- ★ If the rocker arm inside diameter is larger than the service limit, replace it. Also check the rocker shaft diameter (see Rocker Shaft Diameter Measurement).

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

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

**Service Limit: 13.05 mm (0.5138 in.)**



**Cylinder Head**

**Cylinder Compression Measurement**

**NOTE**

○Use the battery which is fully charged.

- Warm up the engine thoroughly.
- Stop the engine.
- Remove:
  - Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  - Spark Plugs (see Spark Plug Replacement in the Periodic Maintenance chapter)
- Attach the compression gauge [A] and adapter [B] firmly into the spark plug hole.
- 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, 20 kgf/cm<sup>2</sup>: 57001-221**  
**Compression Gauge Adapter, M10 × 1.0: 57001-1317**



**Cylinder Compression**

**Usable Range: 749 ~ 1 168 kPa (7.6 ~ 11.9 kgf/cm<sup>2</sup>, 109 ~ 169 psi) at 500 r/min (rpm)**

- Repeat the measurement for the other cylinders.
- Install the spark plugs.

**Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 115 in·lb)**

○The following table should be consulted if the obtainable compression reading is not within the usable range.

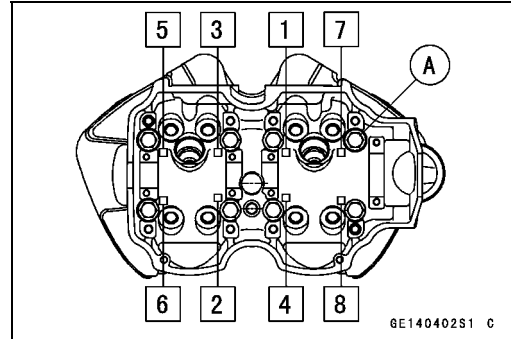
<b>Problem</b>	<b>Diagnosis</b>	<b>Remedy (Action)</b>
Cylinder compression is higher than usable range.	Carbon accumulation on piston and in combustion chamber possibly due to damaged valve stem oil seal and/or damaged piston oil rings (This may be indicated by white exhaust smoke).	Remove the carbon deposits and replace damaged parts if necessary.
	Incorrect cylinder head gasket thickness	Replace the gasket with a standard part.
Cylinder compression is lower than usable range.	Gas leakage around cylinder head	Replace damaged check gasket and cylinder head warp.
	Bad condition of valve seating	Repair if necessary.
	Incorrect valve clearance	Adjust the valve clearance.
	Incorrect piston/cylinder clearance	Replace the piston and/or cylinder.
	Piston seizure	Inspect the cylinder 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.

# 4-28 ENGINE TOP END

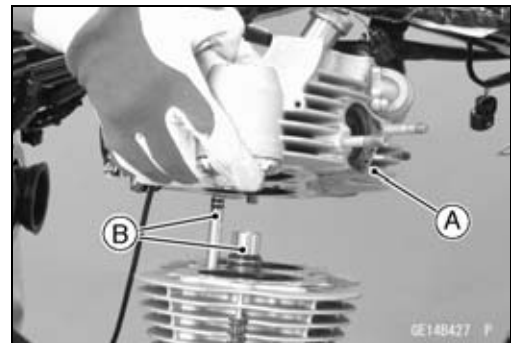
## Cylinder Head

### Cylinder Head Removal

- Remove:
  - Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  - Throttle Body Assy (see Throttle Body Assy Removal in the Fuel System (DFI) chapter)
  - Mufflers (see Muffler Removal)
  - Cylinder Head Cover (see Cylinder Head Cover Removal)
  - Camshaft (see Camshaft Removal)
- Remove the cylinder head bolts [A] in the sequence (8 → 1) indicated by the raised lettering.
- To remove the inner four cylinder head bolts, alternately tilt the cylinder head sideways, removing two bolts at a time.

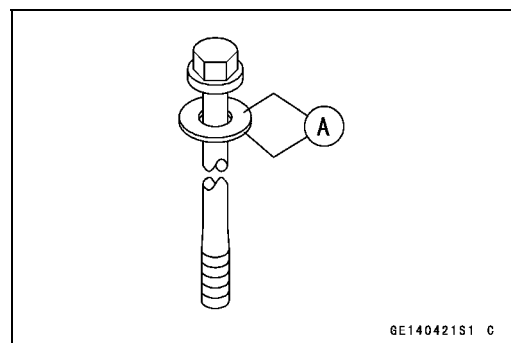
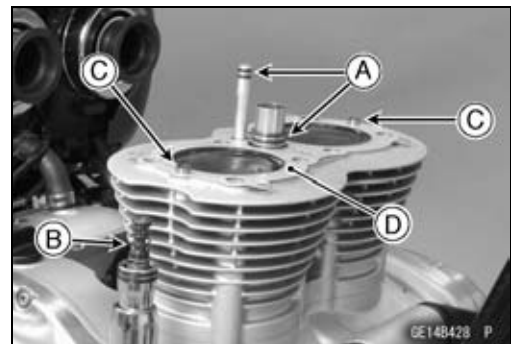


- Slightly raise the cylinder head [A] to remove it.
- Clear the tips of the two oil pipes [B].



### Cylinder Head Installation

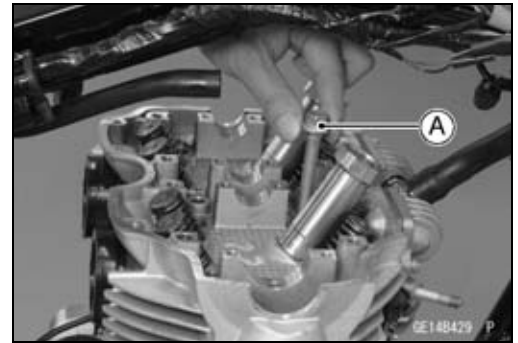
- Replace the O-rings [A] with new ones.
  - Apply grease to the O-rings.
  - Be sure that the oil pipes are installed properly.
  - Be sure that the spring [B] is installed to the bevel gear drive shaft.
  - Install the dowel pins [C] and a new gasket [D].
- Replace the cylinder head bolt washers with new ones.
  - Apply molybdenum disulfide oil solution to both surfaces [A] of the washers for the cylinder head bolts.





## Cylinder Head

- Insert the four inner cylinder head bolts [A] before fitting the cylinder head to the oil pipes.



- Tighten the cylinder head bolts [A] to their temporary torque value in the sequence (1 → 8) indicated by the raised lettering.

**Temporary Torque- Cylinder Head Bolts:**

**24.5 N·m (2.5 kgf·m, 18 ft·lb)**

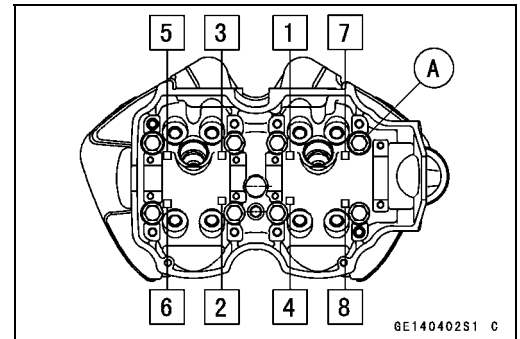
- Tighten the cylinder head bolts to their final torque value in the sequence (1 → 8) indicated by the raised lettering.

**Final Torque - Cylinder Head Bolts (New Bolts):**

**49.0 N·m (5.0 kgf·m, 36 ft·lb)**

**Cylinder Head Bolts (Used Bolts):**

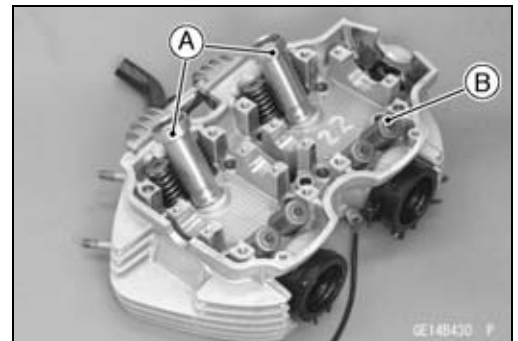
**47.0 N·m (4.8 kgf·m, 35 ft·lb)**



- Install the removed parts.
- Start the engine and adjust the bevel gear sound as necessary.

### Cylinder Head Disassembly

- Remove:
  - Spark Plug Hole Pipes [A]
  - Camshaft Valves [B] (see Valve Removal)
  - Drive Bevel Gear Case Unit (see Drive Bevel Gear Case Unit Removal)
  - Throttle Body Assy Holder (Throttle Body Assy Holder Removal)
  - Air Suction Valves (see Air Suction Valve Removal)
  - Engine Temperature Sensor (see Engine Temperature Sensor Removal in the Fuel System (DFI) chapter)



### Cylinder Head Assembly

- Apply a non-permanent locking agent to the thread of the spark plug hole pipes, and tighten them.

**Torque - Spark Plug Hole Pipes: 120 N·m (12.2 kgf·m, 89 ft·lb)**

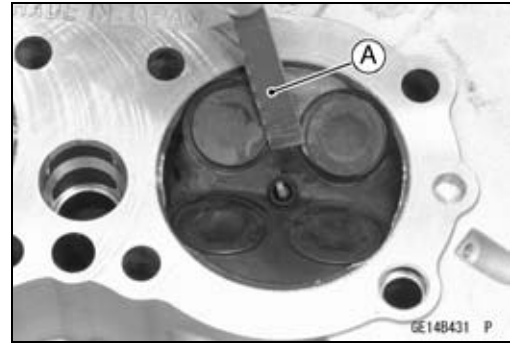
- Install the removed parts (see appropriate sections).

## 4-30 ENGINE TOP END

### Cylinder Head

#### **Cylinder Head Cleaning**

- Remove the cylinder head (see Cylinder Head Removal).
- Disassemble the cylinder head (see Cylinder Head Disassembly).
- Scrape the carbon out of the combustion chamber and exhaust port with a scraper [A] or a suitable tool.
- Using high-flash point solvent, clean the cylinder head.
- Assemble the cylinder head (see Cylinder Head Assembly).



#### **Cylinder Head Warp Inspection**

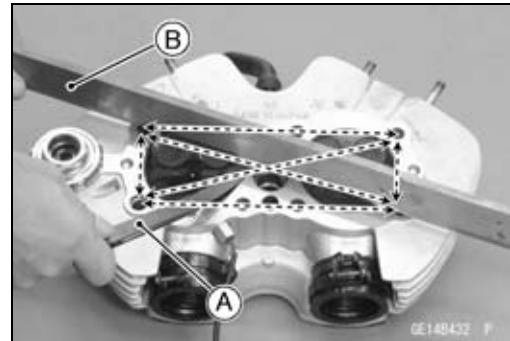
- Clean the cylinder head.
- Lay a straightedge across the lower surface of the cylinder head at several positions.
- Use a thickness gauge [A] to measure the space between the straightedge [B] and the head.

#### **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).



## Valve

### Valve Clearance Inspection

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

### Valve Clearance Adjustment

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

### Valve Removal

- Remove:
  - Camshaft (see Camshaft Removal)
  - Cylinder Head (see Cylinder Head Removal)
- Remove the shims from the valves.

#### NOTE

○ Mark and record the locations of the shims so that they can be installed in their original positions.

- Using the special tool, remove the valves.

**Special Tools - Valve Spring Compressor Assembly: 57001-241 [A]**

**Valve Spring Compressor Adapter,  $\phi 22$ : 57001-1202 [B]**

### Valve Installation

- Replace the 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 Stem [A]  
 Spring Seat [B]  
 Oil Seal [C]  
 Closed Coil End [D]  
 Valve Spring [E]  
 Retainer [F]  
 Split Keepers [G]  
 Shim [H]

### Valve Guide Removal

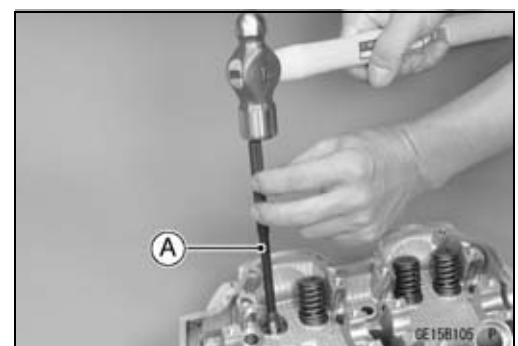
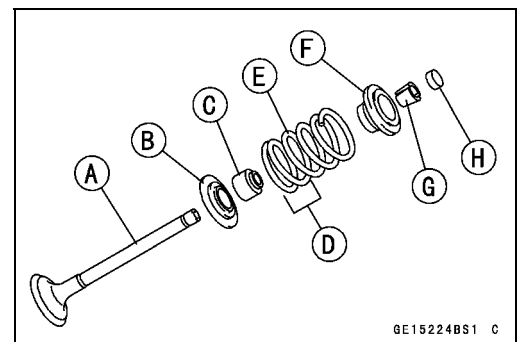
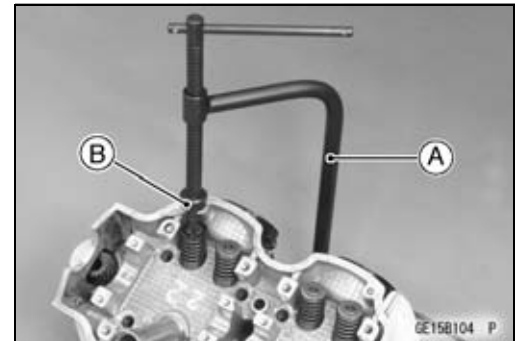
- Remove:
  - Valve (see Valve Removal)
  - Oil Seal
  - Spring Seat
- Heat the area around the valve guide to 120 ~ 150°C (248 ~ 302°F).

#### NOTICE

**Do not heat the cylinder head with a torch, as this will warp the head. Instead, soak the head in oil, and heat the oil.**

- Use the valve guide arbor [A] to hammer out the guide.

**Special Tool - Valve Guide Arbor,  $\phi 4.5$ : 57001-1331**



## 4-32 ENGINE TOP END

### Valve

#### Valve Guide Installation

- Apply a thin coat of oil to the outer surface of the valve guide.
- Heat the area around the valve guide hole to 120 ~ 150° C (248 ~ 302 °F).

#### NOTICE

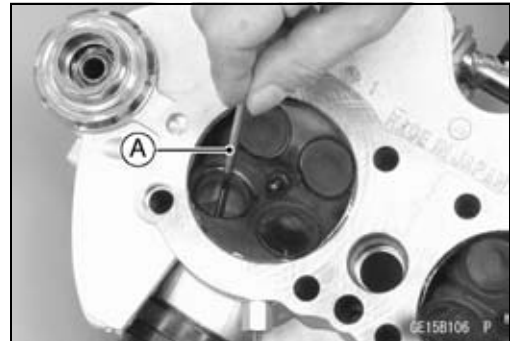
**Do not heat the cylinder head with a torch, as this will warp the head. Instead, soak the head in oil, and heat the oil.**

- Using the valve guide arbor, drive the valve guide in until its snap ring comes in contact with the head surface.

**Special Tool - Valve Guide Arbor,  $\phi$ 4.5: 57001-1331**

- Ream the valve guide bore with the valve guide reamer [A], even if the old guide is being reused.

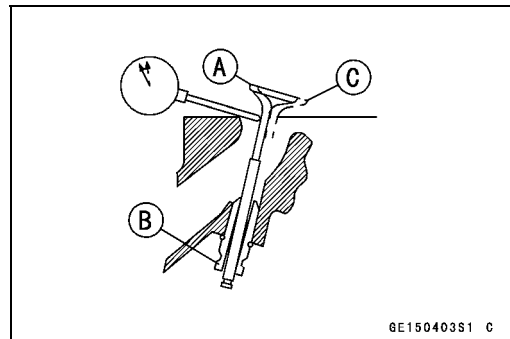
**Special Tool - Valve Guide Reamer,  $\phi$ 4.5: 57001-1333**



#### Valve-to-Guide Clearance Measurement (Wobble Method)

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

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



#### NOTE

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

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

##### Standard:

Exhaust	0.08 ~ 0.13 mm (0.0031 ~ 0.0051 in.)
Intake	0.02 ~ 0.09 mm (0.0008 ~ 0.0035 in.)

##### Service Limit:

Exhaust	0.30 mm (0.0118 in.)
Intake	0.26 mm (0.0102 in.)

## Valve

### Valve Seat Inspection

- Remove the valve (see Valve Removal).
- Check the valve seating surface [A] between the valve [B] and valve seat [C].
- Measure the outside diameter [D] of the seating pattern on the valve seat.
- ★ If the outside diameter is too large or too small, repair the seat (see Seat Repair).

#### Valve Seating Surface Outside Diameter

##### Standard:

Exhaust 24.4 ~ 24.6 mm (0.961 ~ 0.969 in.)

Intake 28.4 ~ 28.6 mm (1.118 ~ 1.126 in.)

- Measure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with a vernier caliper.

Good [F]

- ★ If the width is too wide [G], too narrow [H] or uneven [J], repair the seat (see Valve Seat Repair).

#### Valve Seating Surface Width

##### Standard:

Exhaust 0.8 ~ 1.2 mm (0.031 ~ 0.047 in.)

Intake 0.8 ~ 1.2 mm (0.031 ~ 0.047 in.)

### Valve Seat Repair

- Repair the valve seat with the valve seat cutters [A].

Special Tools - Valve Seat Cutter Holder Bar [B]: 57001-1128

Valve Seat Cutter Holder,  $\phi$ 4.5 [C]: 57001-1330

#### [For Exhaust Valve Seat]

Valve Seat Cutter, 45° -  $\phi$ 27.5: 57001-1114

Valve Seat Cutter, 32° -  $\phi$ 28: 57001-1119

Valve Seat Cutter, 60° -  $\phi$ 27: 57001-1409

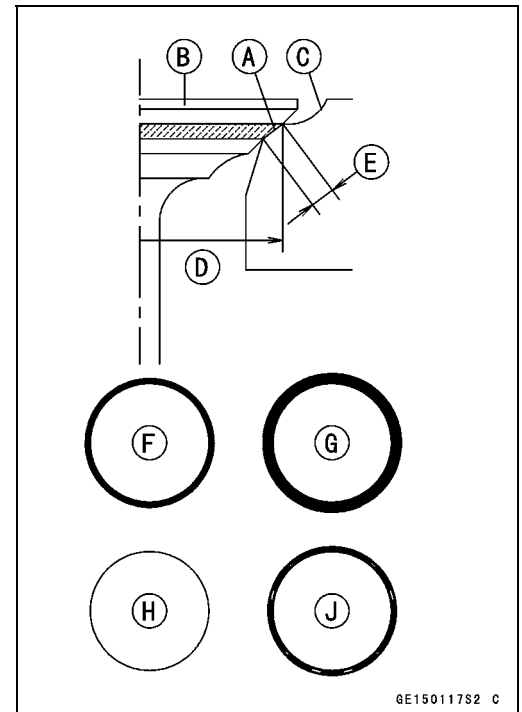
#### [For Intake Valve Seat]

Valve Seat Cutter, 45° -  $\phi$ 32: 57001-1115

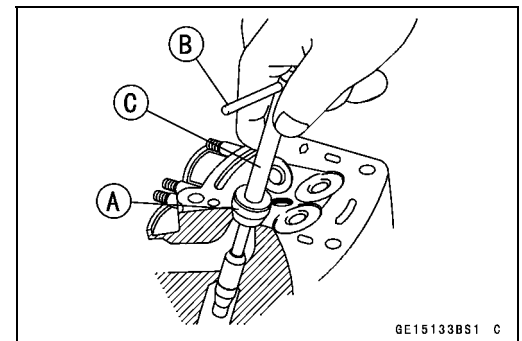
Valve Seat Cutter, 32° -  $\phi$ 33: 57001-1199

Valve Seat Cutter, 60° -  $\phi$ 33: 57001-1334

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



GE150117S2 C



GE15133BS1 C

## 4-34 ENGINE TOP END

### Valve

#### 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.
2. Do not drop or shock the valve seat cutter, or the diamond particles may fall off.
3. Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

#### NOTE

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

4. Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

#### NOTE

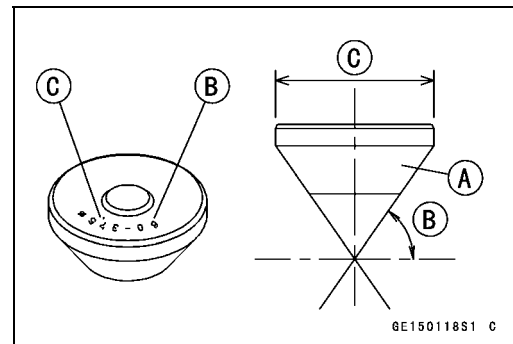
○Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.

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

#### Marks Stamped on the Cutter

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

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



#### Operating Procedures

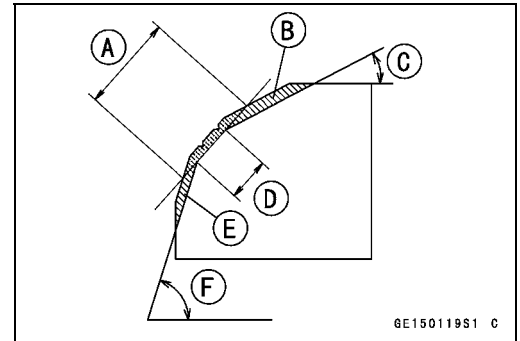
- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

#### NOTICE

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

## Valve

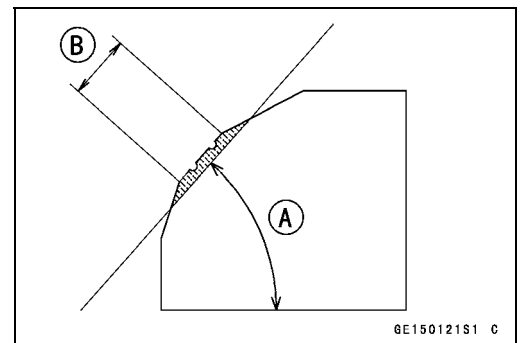
- Measure the outside diameter of the seating surface with a vernier caliper.
- ★ If the outside diameter of the seating surface is too small, repeat the 45° grind until the diameter is within the specified range.
  - Widened Width [A] of engagement by machining with 45° cutter
  - Ground Volume [B] by 32° cutter
  - 32° [C]
  - Correct Width [D]
  - Ground Volume [E] by 60° cutter
  - 60° [F]



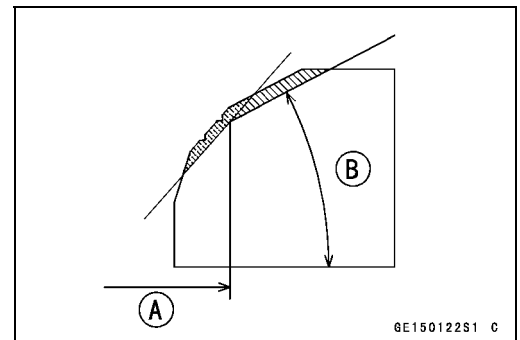
- Measure the outside diameter of the seating surface with a vernier caliper.
- ★ If the outside diameter of the seating surface is too small, repeat the 45° grind [A] until the diameter is within the specified range.
  - Original Seating Surface [B]

### NOTE

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



- ★ If the outside diameter [A] of the seating surface is too large, make the 32° grind described below.
- ★ If the outside diameter of the seating surface is within the specified range, measure the seat width as described below.
- Grind the seat at a 32° angle [B] until the seat outside diameter is within the specified range.
  - To make the 32° grind, fit a 32° cutter into the holder, and slide it into the valve guide.
  - Turn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.



### NOTICE

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

- After making the 32° grind, return to the seat outside diameter measurement step above.
- To measure the seat width, use a vernier caliper to measure the width of the 45° angle portion of the seat at several places around the seat.
- ★ If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat outside diameter measurement step above.

## 4-36 ENGINE TOP END

### Valve

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

Correct Width [B]

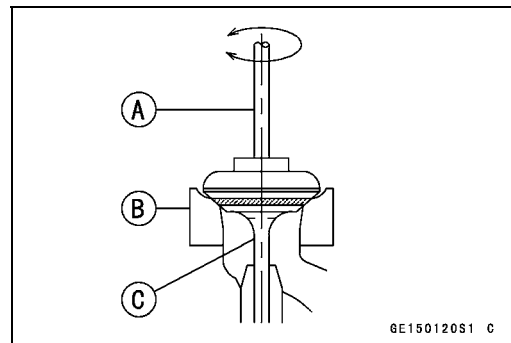
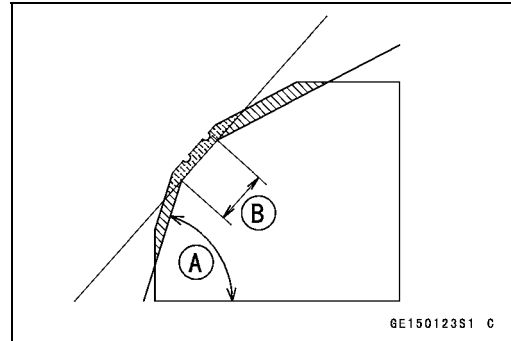
- Lap the valve to the seat, once the seat width and outside diameter are within the ranges specified above.
- Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
- Spin the valve against the seat until the grinding compound produces a smooth, matched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

Lapper [A]

Valve Seat [B]

Valve [C]

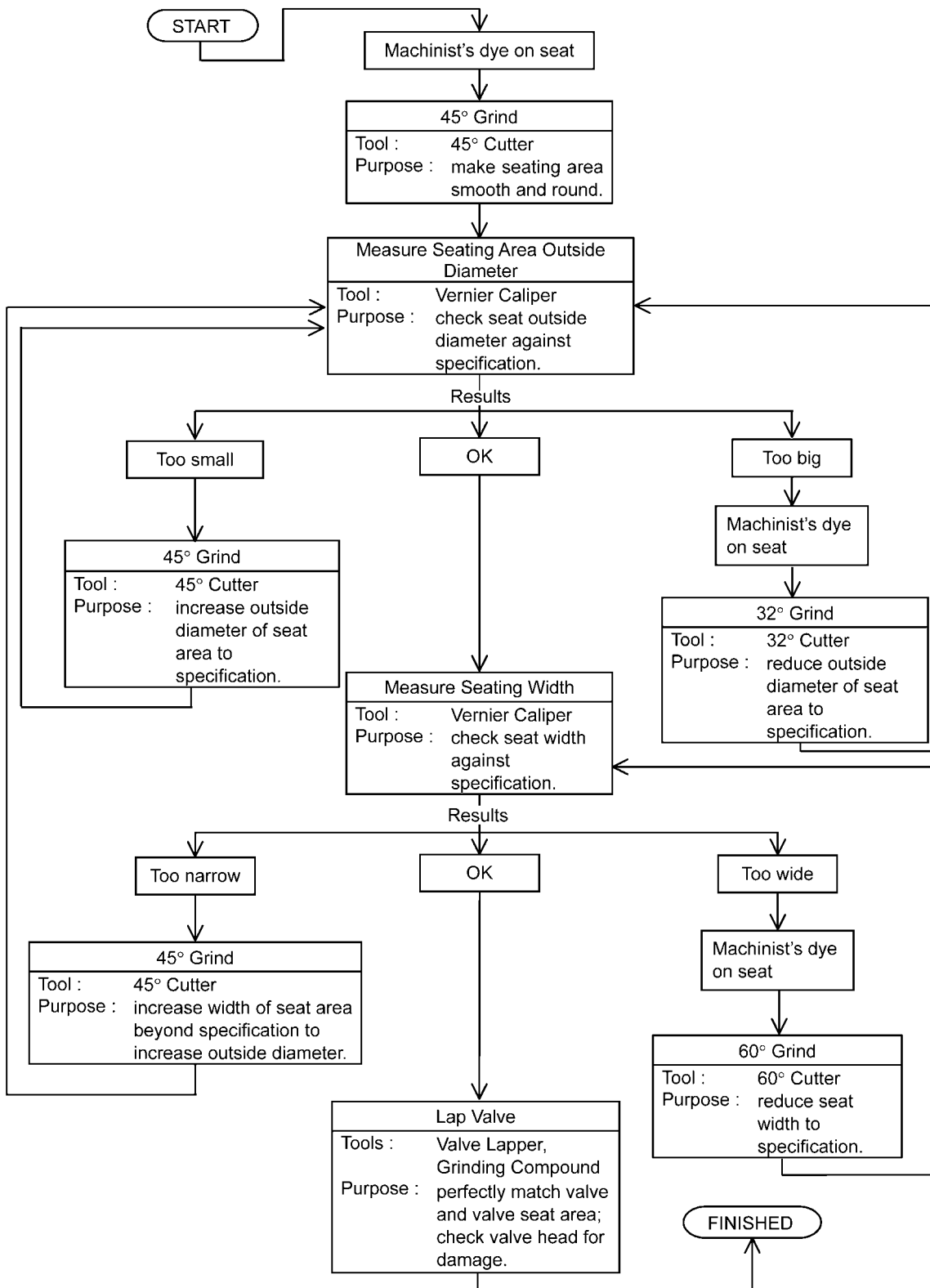
- The seating area should be marked about in the middle of the valve face.
- ★ If the seat area is not in the right place on the valve, check to be sure the valve is the correct part. If it is, it may have been refaced too much; replace it.
- Be sure to remove all grinding compound before assembly.
-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





Valve

Valve Seat Repair

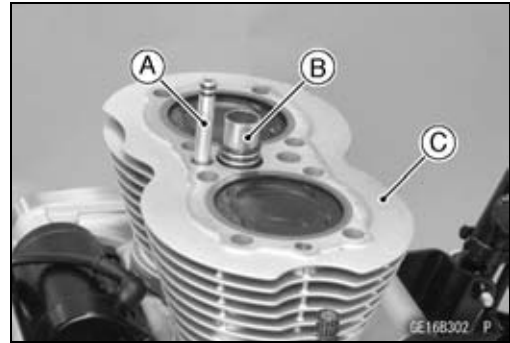


# 4-38 ENGINE TOP END

## Cylinder, Pistons

### Cylinder Removal

- Remove:
  - Cylinder Head (see Cylinder Head Removal)
  - Pressure Oil Pipe [A]
  - Return Oil Pipe [B]
- Tap lightly with a plastic mallet to separate the cylinder [C].
- Remove the cylinder base gasket.

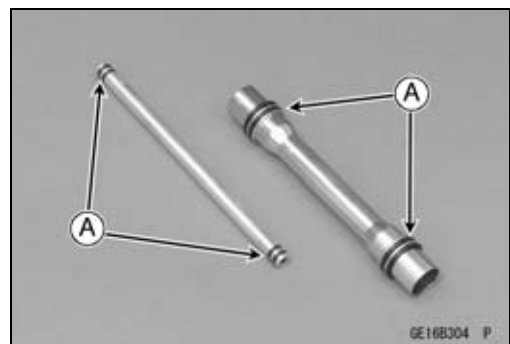
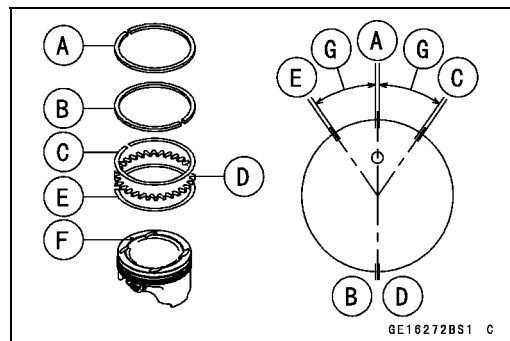
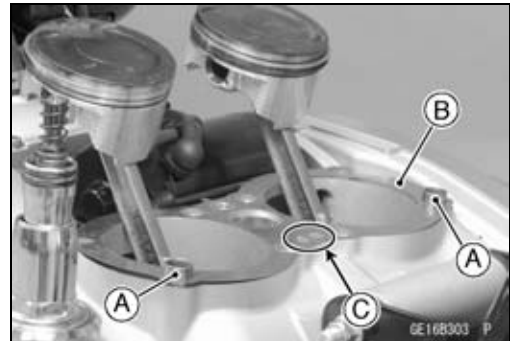


### Cylinder Installation

#### NOTE

○ If a new cylinder is used, use new piston ring.

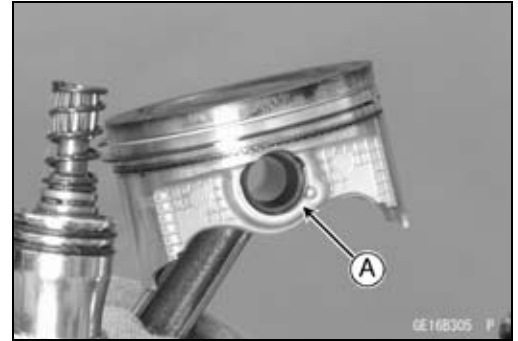
- Install the dowel pins [A].
- Replace the cylinder base gasket [B] with a new one.
- Install the new cylinder base gasket with its “UP” mark [C] facing up.
- Apply molybdenum disulfide oil solution to the cylinder bore.
- The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails must be about 30 ~ 40° of angle from the opening of the top ring.
  - Top Ring [A]
  - Second Ring [B]
  - Upper Oil Ring Steel Rail [C]
  - Oil Ring Expander [D]
  - Lower Oil Ring Steel Rail [E]
  - Dent [F]
  - 30 ~ 40° [G]
- Determine the position of the piston ring end.
- Insert the cylinder while compressing the piston rings with your fingers.
- Replace the O-rings [A] of the pressure oil pipe and return oil pipe with new ones.
- Apply grease to the O-rings.
- Install:
  - Pressure Oil Pipe
  - Return Oil Pipe
  - Cylinder
- Install the removed parts.



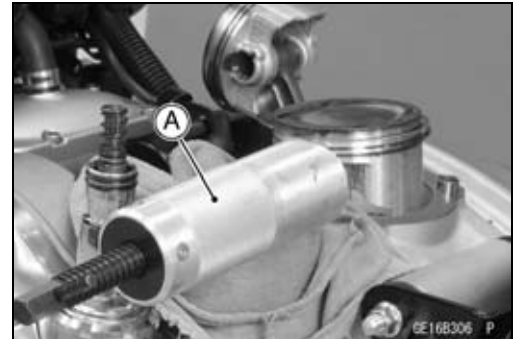
## Cylinder, Pistons

### Piston Removal

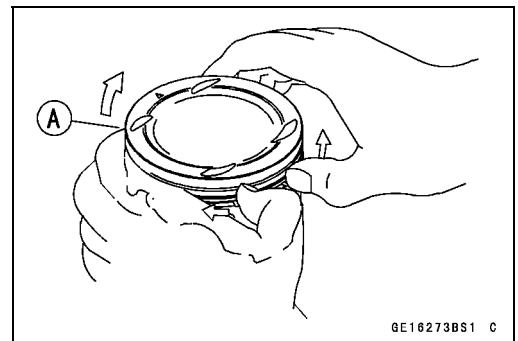
- Remove the cylinder (see Cylinder Removal).
- Place a clean cloth under the pistons and remove the piston pin snap ring [A] from the outside of each piston.



- Remove the piston pins.
  - Special Tool - Piston Pin Puller Assembly [A]: 57001-910
- Remove the pistons.

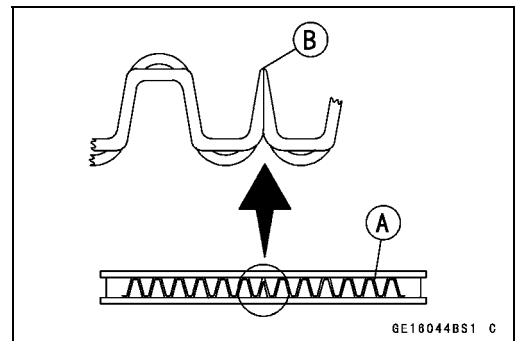


- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.



### Piston Installation

- Apply molybdenum disulfide oil solution to the oil ring expander, and install the oil ring expander [A] in the bottom piston ring groove so the ends [B] not butt together.
- Apply molybdenum disulfide oil solution to the oil ring steel rails, and 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.



### NOTE

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

# 4-40 ENGINE TOP END

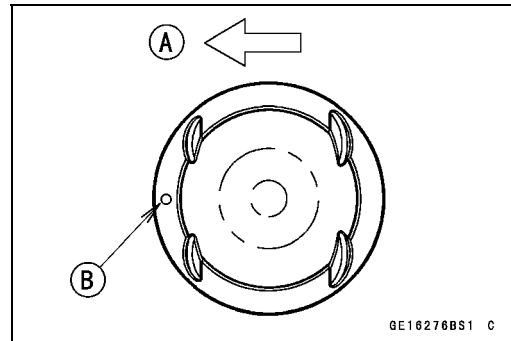
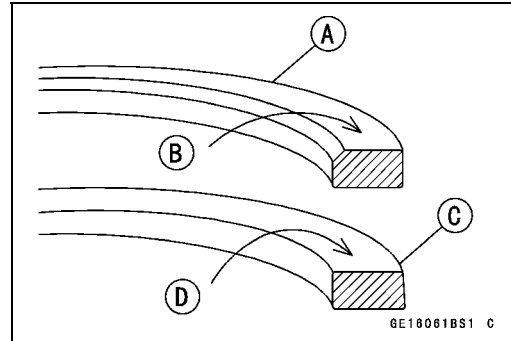
## Cylinder, Pistons

- Do not mix up the top and second ring.
- Install the top ring [A] so that the "1R" mark [B] faces up.
- Install the second ring [C] so that the "RH" mark [D] faces up.
- Apply molybdenum disulfide oil solution to the piston rings.

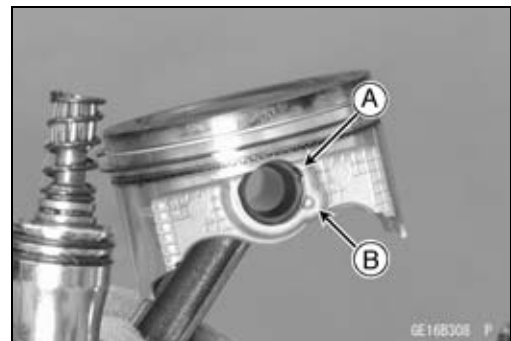
**NOTE**

○ If a new piston is used, use new piston ring.

- Install the piston with its marking dent [A] facing forward [B].



- 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 solution to the piston pins and piston journals.
- When installing the piston pin snap ring, compress it only enough to install it and no more.



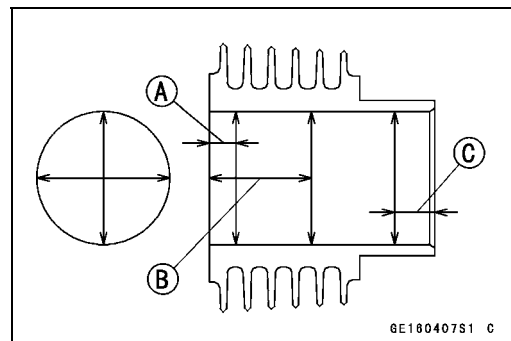
**NOTICE**

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

- Install the cylinder (see Cylinder Installation).

**Cylinder Wear Inspection**

- 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) as 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]
  - 40 mm (1.57 in.) [B]
  - 25 mm (0.98 in.) [C]



**Cylinder Inside Diameter**

**Standard:** 77.000 ~ 77.012 mm (3.0315 ~ 3.0320 in.)  
**Service Limit:** 77.10 mm (3.035 in.)

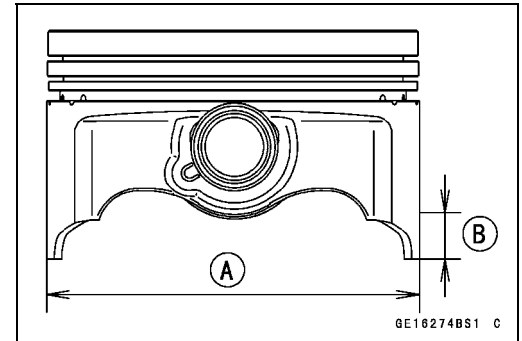
**Cylinder, Pistons**

**Piston Wear Inspection**

- Measure the outside diameter [A] of each piston 9.5 mm (0.37 in.) [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:** 76.950 ~ 76.960 mm (3.0295 ~ 3.0299 in.)
- Service Limit:** 76.80 mm (3.024 in.)



**Piston Ring, Piston Ring Groove Wear Inspection**

- 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.

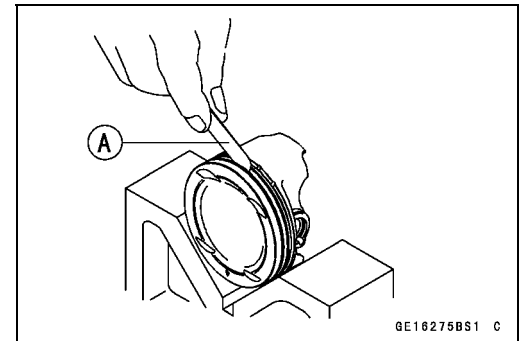
**Piston Ring/Groove Clearance**

**Standard:**

- Top** 0.05 ~ 0.09 mm (0.0020 ~ 0.0035 in.)
- Second** 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)

**Service Limit:**

- Top** 0.19 mm (0.0075 in.)
- Second** 0.17 mm (0.0067 in.)



**Piston Ring Groove Width Inspection**

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

**Piston Ring Groove Width**

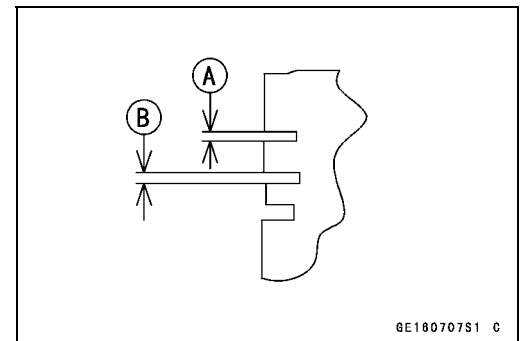
**Standard:**

- Top [A]** 1.04 ~ 1.06 mm (0.0409 ~ 0.0417 in.)
- Second [B]** 1.02 ~ 1.04 mm (0.0402 ~ 0.0409 in.)

**Service Limit:**

- Top [A]** 1.14 mm (0.0449 in.)
- Second [B]** 1.12 mm (0.0441 in.)

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



## 4-42 ENGINE TOP END

### Cylinder, Pistons

#### **Piston Ring Thickness Inspection**

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

#### **Piston Ring Thickness**

##### **Standard:**

Top [A]            0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)

Second [B]        0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)

##### **Service Limit:**

Top [A]            0.90 mm (0.035 in.)

Second [B]        0.90 mm (0.035 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 Inspection**

- 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:**

Top                0.17 ~ 0.32 mm (0.067 ~ 0.0126 in.)

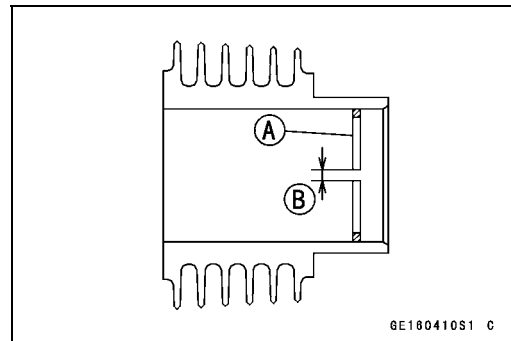
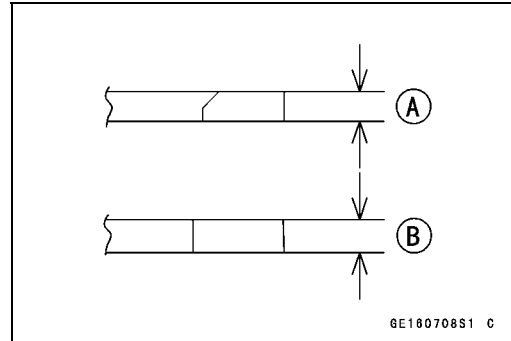
Second           0.35 ~ 0.50 mm (0.0138 ~ 0.0197 in.)

##### **Service Limit:**

Top                0.6 mm (0.024 in.)

Second           0.8 mm (0.031 in.)

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



## Bevel Gears (Hypoid Gears)

### Crankshaft Side Bevel Gear Sound Adjustment

A bevel gear sound adjustment must be performed only by a competent mechanic. The standard factory setting for adjusting the bevel gears is described on page 4-61. Ordinarily, the bevel gears do not require adjustments. However, in case the customer strongly requests a reduction in the whining sound when the engine is cold, it is possible to do so to a certain extent. When this is done, the gear lash sound increases after the engine has warmed up. This section explains how to change the factory setting upon the request of the customer.

#### NOTE

- A bevel gear sound adjustment can be done only on the crankshaft side bevel gear. Refer to the bevel gear adjustment on page 4-61 for the camshaft side bevel gear.

#### NOTICE

**Do not adjust the camshaft side bevel gear without the check of the rotating torque of the camshaft. If adjusting it by other methods, the gears may be damaged.**

### Crankshaft Side Bevel Gear

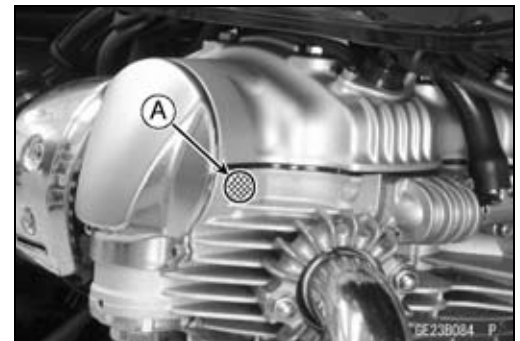
- Start the engine and warm it up thoroughly.

#### NOTE

- Perform the bevel gear adjustment when the cylinder head outside surface temperature measuring point [A] is 90 ~ 100°C (194 ~ 212°F).

#### ⚠ WARNING

**The engine and exhaust system get extremely hot during normal operation and can cause serious burns. Never touch the engine or exhaust pipe during adjustment.**



## 4-44 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

- Mark [A] the hexagonal portion [B] of the bevel gear case unit to align with the locknut stop screw hole [C].
- Loosen the locknut stop screw.
- Loosen the bevel gear case locknut [D].

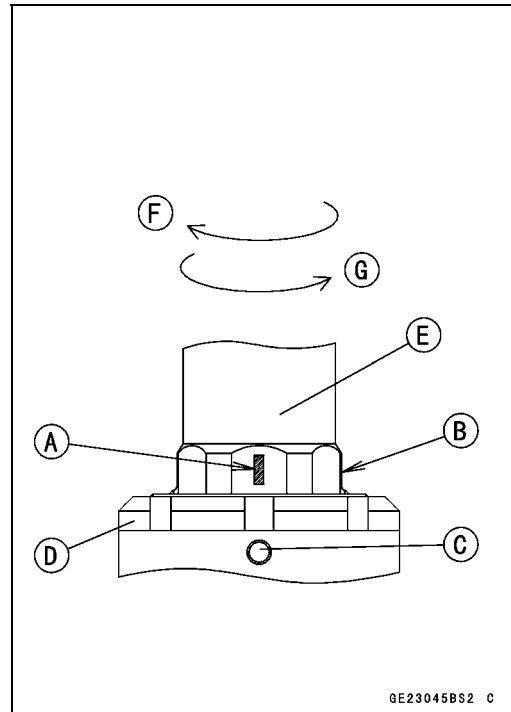
**Special Tool - Steering Stem Nut Wrench: 57001-1100**

- To eliminate the gear lash sound, rotate the gear case unit [E] slowly in direction [F].
- ★ This increases the gear whining sound when the engine is cold.

#### NOTICE

**When turning the gear case unit in direction [F], it must not be turned more than 20° from the locknut stop screw hole (factory standard setting), as doing so could damage the bevel gears.**

- To eliminate the gear whining sound, rotate the gear case unit slowly in direction [G].
- ★ This decreases the gear whining sound when the engine is cold.



#### After the adjustment

- Hold the bevel gear case unit with a wrench, and tighten the bevel gear case locknut to the specified torque.

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

**Torque - Bevel Gear Case Locknut: 20 N·m (2.0 kgf·m, 15 ft·lb)**

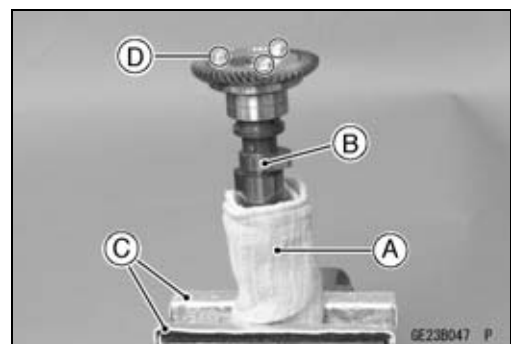
- Remove the locknut stop screw, and apply a non-permanent locking agent to the threads of the locknut stop screw, and then tighten the stop screw.

**Torque - Locknut Stop Screw: 2.1 N·m (0.2 kgf·m, 1.5 ft·lb)**

- Stop the engine, and after the engine has cooled sufficiently, check the gear sound.

#### Camshaft Side Driven Bevel Gear Removal

- Remove:  
Camshaft (see Camshaft Removal)
- Wrap a cloth [A] around the cam portion of the camshaft [B]. Then, holding it on a vise with aluminum plates [C] placed in between, remove the bevel gear holder bolts [D].
- Remove:  
Bevel Gear Holder





## Bevel Gears (Hypoid Gears)

- Remove:  
Pin [A]

### NOTE

○Make sure to mark [B] the hole into which the pin is inserted to ensure the proper cam timing when reusing the removed driven bevel gear.

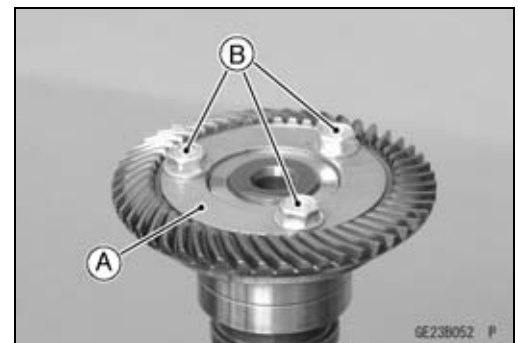
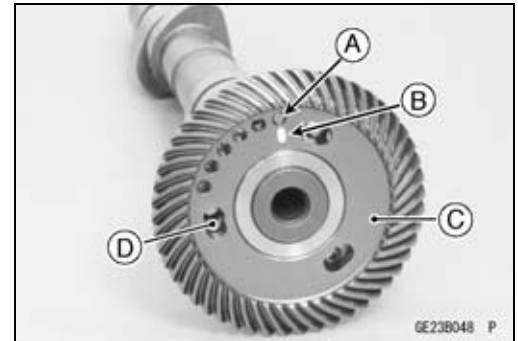
- Remove:  
Camshaft Side Driven Bevel Gear [C]  
Shim(s) [D]

### NOTE

○After removing the shim(s), measure their thicknesses with a micrometer and record the results.

### Camshaft Side Driven Bevel Gear Installation

- Wrap a cloth around the cam portion of the camshaft. Then, hold it on a vise with aluminum plates placed in between.
  - Install:  
Removed Shim(s)  
Driven Bevel Gear
  - Insert the pin into the hole that was marked during removal.
  - Install the bevel gear holder [A].
  - Apply a non-permanent locking agent to the thread of the driven bevel gear bolt [B] and tighten them.
- Torque - Driven Bevel Gear Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)**
- Install the camshaft on the cylinder head (see Camshaft Installation).

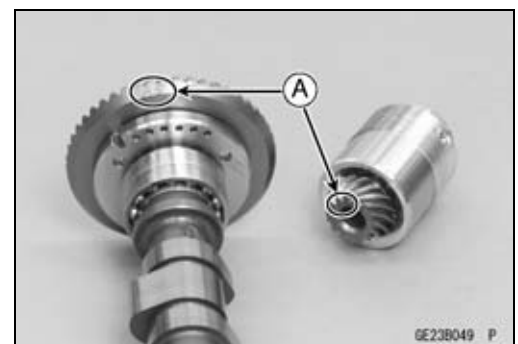


### Camshaft Side Driven Bevel Gear Replacement

#### NOTICE

To ensure optimal tooth contact, the camshaft side drive and driven bevel gears are machine-lapped together. To replace the gears, they must be replaced as a set. The two gears are marked [A] with matching numbers.

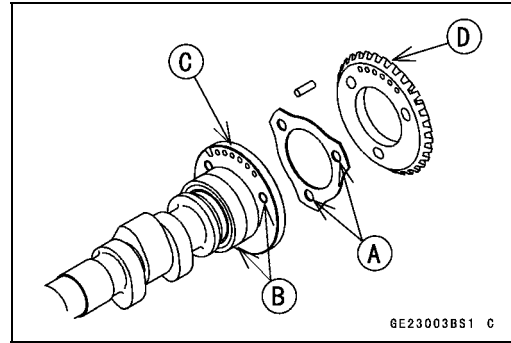
- Remove:  
Camshaft (see Camshaft Removal)
- Replace the drive bevel gear (see Drive/Driven Bevel Gear Case Unit Disassembly).
- Remove the driven bevel gear from the camshaft (see Camshaft Side Driven Bevel Gear Removal).



## 4-46 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

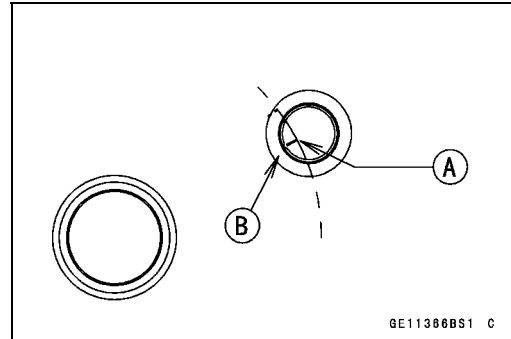
- Install a shim(s) that is 0.20 mm (0.0079 in.) thinner than the old shim(s) on the camshaft.
- Align the shim holes [A] with the bevel gear holder bolt holes [B].
- Approximately align the six holes [C] of the bevel gear holder with the six holes [D] of the driven bevel gear, and install the driven bevel gear.



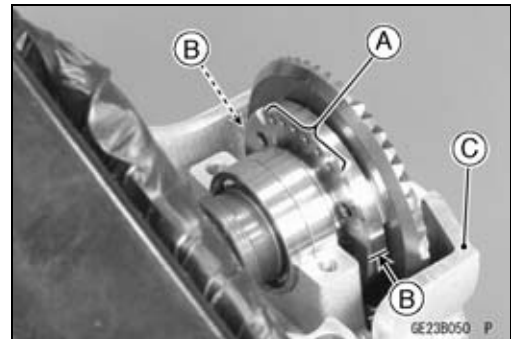
- Bring the piston to the TDC.  
TDC Mark [A]  
Timing Notch [B]

#### NOTE

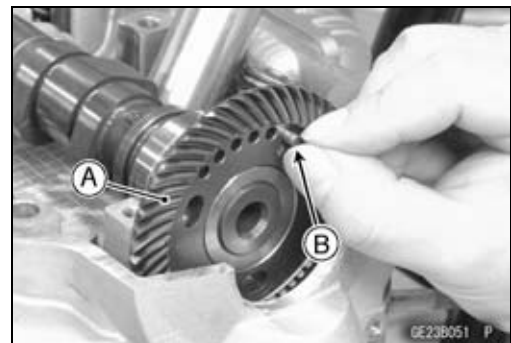
○ Install the removed parts so that the camshaft side drive bevel gear rotates in unison with the crankshaft.



- With the six holes [A] facing up, mesh the driven gear and the drive gear (so that the right and left timing marks [B] on the side of the bevel gear holder is parallel with the outer surface [C] of the cylinder head) and install the camshaft on the cylinder head.



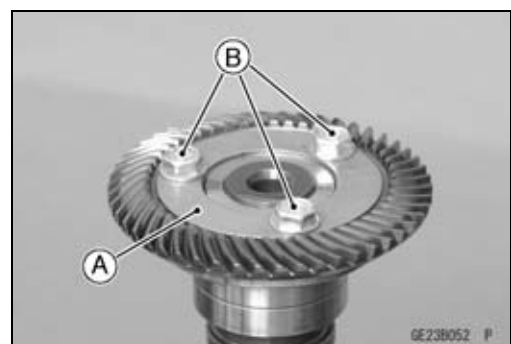
- At this time, one of the six holes of the bevel gear holder [A] and one of the six holes of the driven bevel gear should align perfectly. Insert the pin [B] into the perfectly aligned holes.
- Remove the camshaft from the cylinder head without removing the pin or the driven bevel gear.



- Install the bevel gear holder [A], and tighten the bevel gear bolts [B].

**Torque - Drive Bevel Gear Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)**

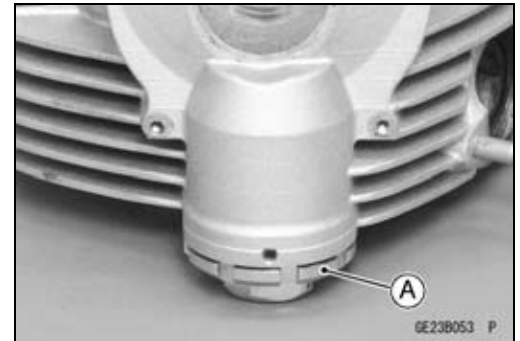
- Adjust the tooth contact of the camshaft side bevel gear (see Bevel Gear Tooth Contact Adjustment).



## Bevel Gears (Hypoid Gears)

### Camshaft Side Drive Bevel Gear Case Unit Removal

- Remove:
  - Cylinder Head Assembly (see Cylinder Head Removal)
  - Bevel Gear Case Locknut [A]

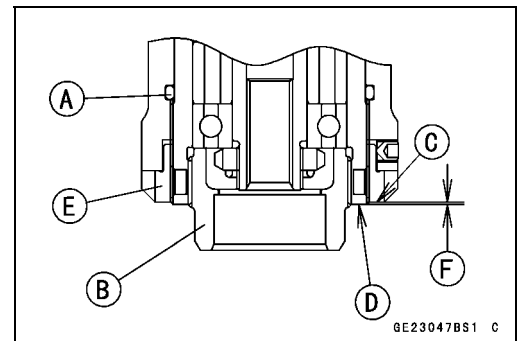


- Using the wrench [A], remove the camshaft side drive bevel gear case unit [B].



### Camshaft Side Drive Bevel Gear Case Unit Installation

- Replace the O-ring [A] with a new one.
- Apply grease to the O-ring.
- Tighten the drive bevel gear case unit [B] onto the cylinder head so that the bottom surface [C] of the lock nut is higher than the outer surface [D] of the bearing housing.
  - Bevel Gear Case Locknut [E]
  - Approximately 1.5 mm (0.06 in.) [F]
- Install:
  - Cylinder Head (see Cylinder Head Installation)
- Adjust the camshaft side bevel gear (see Bevel Gear Adjustment).



### Drive/Driven Bevel Gear Case Unit Disassembly

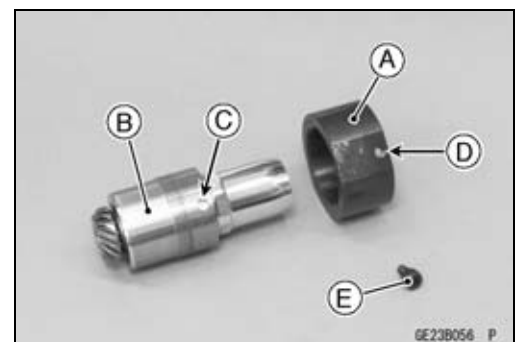
- Remove the drive/driven bevel gear case units.

#### NOTE

○ The construction of the camshaft side drive bevel gear case unit is the same as that of the crankshaft side driven bevel gear case unit.

- Install the bearing housing jig [A] on the case unit [B].
- Align the hole [C] of the case unit with the hole [D] of the bearing housing.
- Tighten the stop screw [E].

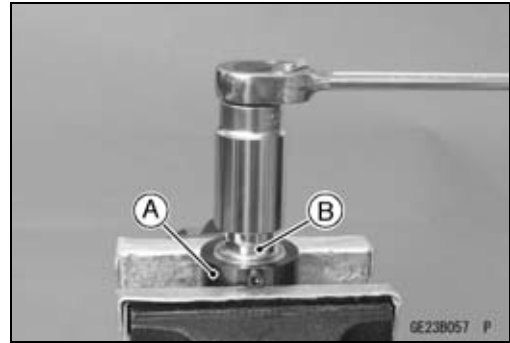
**Special Tool - Bearing Housing Jig, M45 × 1.0: 57001-1419**



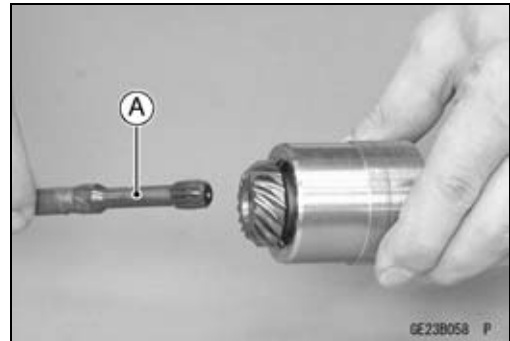
## 4-48 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

- Place the bearing housing jig [A] on a vise with the gear case vertical.
- Remove the gear case [B].

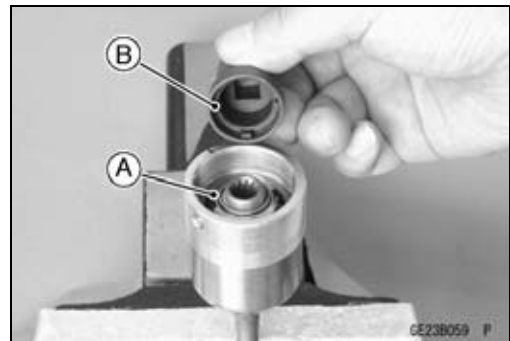


- Insert the bevel gear holder [A] into the bevel gear splines.  
**Special Tool - Bevel Gear Holder m0.75: 57001-1422**



- Place the bevel gear holder on a vise.
- Using the socket wrench [B], loosen the bevel gear nut [A].

**Special Tool - Socket Wrench: 57001-1420**

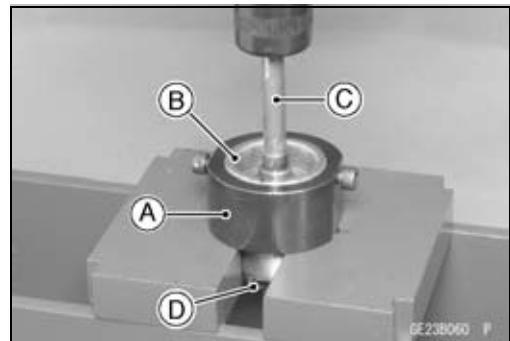


- Install the bearing housing jig [A] on the bearing housing [B].
- Insert the bevel gear drive bit [C] into the bevel gear splines.

**Special Tool - Bevel Gear Drive Bit m0.75: 57001-1421**

- Using a press, remove the bevel gear [D] from the bearing housing.
- Using a press, remove the bearing and the outer collar from the bearing housing.

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



## Bevel Gears (Hypoid Gears)

### Drive/Driven Bevel Gear Case Unit Assembly

#### NOTICE

To ensure optimal tooth contact, the drive and driven bevel gears are machined together. To replace the gears, they must be replaced as a set. The two gears are marked with matching numbers.

- Replace the bearings with new ones.
- Using a press, drive the bearing and the collar on the bevel gear shaft until they bottom.
  - Bearings [A]
  - Outer Collar [B]
  - Inner Collar [C]
  - Bearing Housing [D]
  - Bevel Gear [E]
- Replace the bevel gear mounting nut [F] with a new one.
- Tighten the bevel gear mounting nut.

**Torque - Bevel Gear Mounting Nut: 59 N·m (6.0 kgf·m, 44 ft·lb)**

- Apply a non-permanent locking agent to the thread of the gear case [G], and tighten it onto the bearing housing.

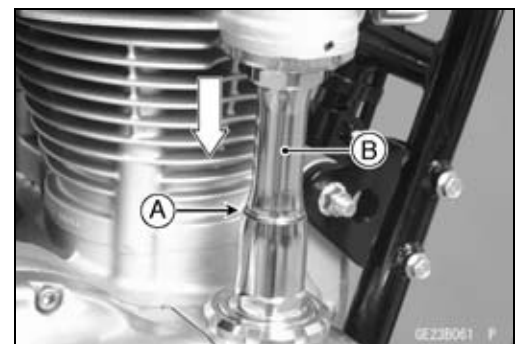
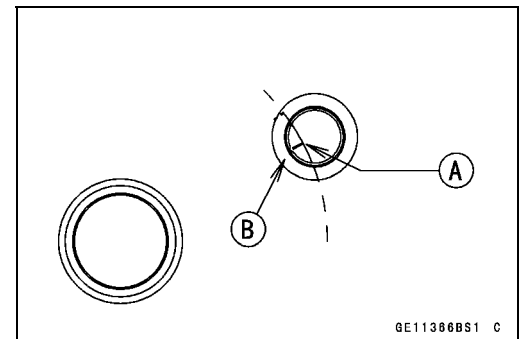
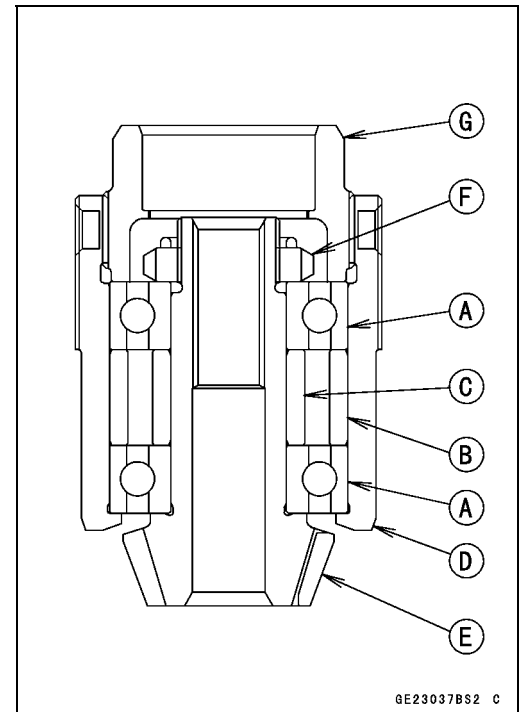
**Torque - Gear Case: 98 N·m (10.0 kgf·m, 72 ft·lb)**

- Make sure that the bevel gear turns freely.

### Bevel Gear Case Removal

- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Remove:
  - Rotor Plug (see Camshaft Removal)
  - Timing Inspection Plug (see Camshaft Removal)
- Bring the piston to the TDC.
  - TDC Mark [A]
  - Timing Notch [B]

- Remove the snap ring [A].
- Pull the outer pipe [B] down.

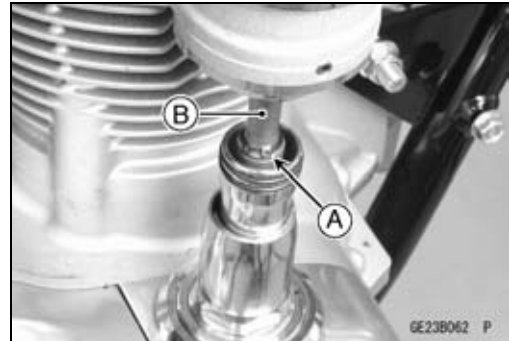


## 4-50 ENGINE TOP END

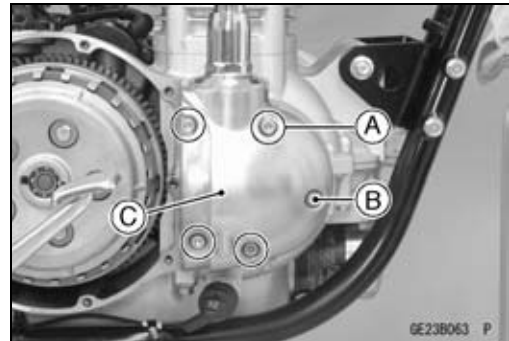
### Bevel Gears (Hypoid Gears)

- Remove the circlip [A]
- Pull the driveshaft [B] down until the tip of the shaft is visible.

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

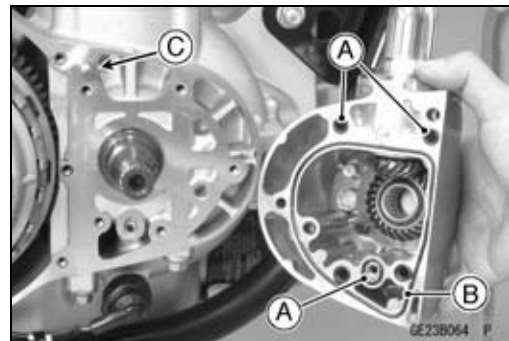


- Remove the clutch cover (see Clutch Cover Removal in the Clutch chapter).
- Remove:
  - Bevel Gear Case Bolts [A] and Washers
  - Bevel Gear Case Bolt [B]
  - Bevel Gear Case [C]



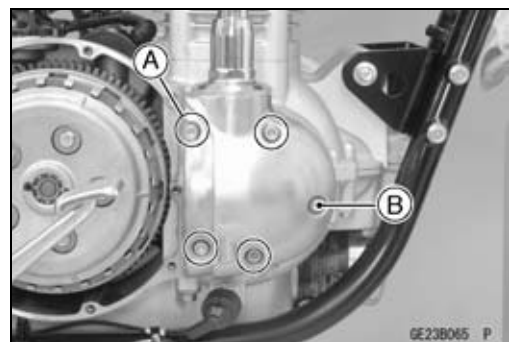
#### **Bevel Gear Case Installation**

- Replace the circlip and the snap ring with new ones, and fit them in place.
  - Make sure that a spring is installed on the tip of the driveshaft.
  - Replace the O-rings [A] and the rubber gasket [B] with new ones.
  - Apply grease to the O-rings and the rubber gasket, and install them on the bevel gear case.
  - Install the knock pin [C] on the crankcase.
  - Install the bevel gear case.
- If the bevel gear case cannot be installed easily, turn the driveshaft while installing the bevel gear case.



- Replace the bevel gear case bolt washers with new ones.
- Tighten:
  - Bevel Gear Case Bolts [A] and Washers
  - Bevel Gear Case Bolt [B]

**Torque - Bevel Gear Case Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**

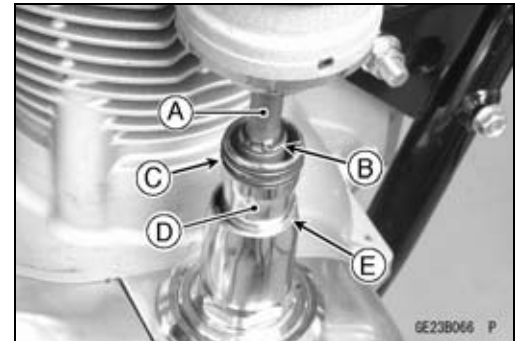


## Bevel Gears (Hypoid Gears)

- Replace the circlip with a new one (see Bevel Gear Case Assembly).
- Bring the piston to the TDC.
- Insert the driveshaft [A] into the camshaft side drive bevel gear splines, and fit the circlip [B] in the groove of the driveshaft.

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

- If the driveshaft cannot be inserted, move the driveshaft down for the time being. Then, slightly rotate the crankshaft clockwise or counterclockwise and attempt to insert the driveshaft again.
- Apply grease to the O-rings [C], and insert the outer pipe [D] into the bevel gear case.
- Fit the snap ring [E] in the groove of the outer pipe, with the gap of the snap ring facing the cylinder.



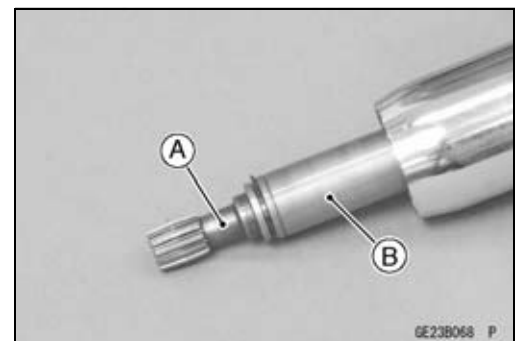
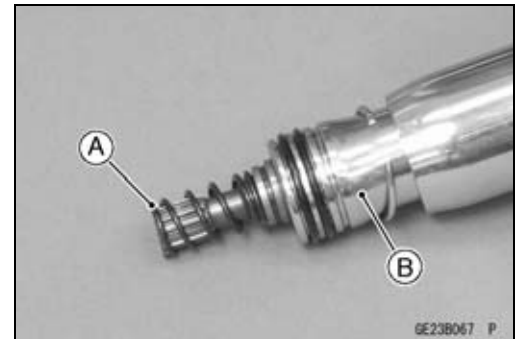
### NOTICE

**Do not rotate the camshaft side bevel gear after the bevel gear case has been removed. Make sure to check the camshaft timing if the camshaft side bevel gear has been rotated.**

- Adjust the crankshaft side bevel gear (see Bevel Gear Adjustment).

### Bevel Gear Case Disassembly

- Remove:
  - Bevel Gear Case (see Bevel Gear Case Removal)
  - Spring [A]
  - Outer Pipe [B]
- Remove:
  - Driveshaft [A]
  - Inner Pipe [B]

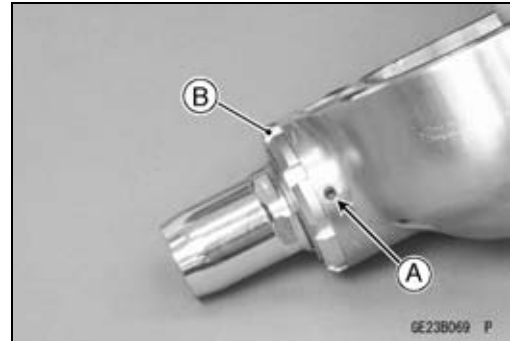


## 4-52 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

- Loosen the locknut stop screw [A].
- Using the steering stem nut wrench, remove the bevel gear case locknut [B].

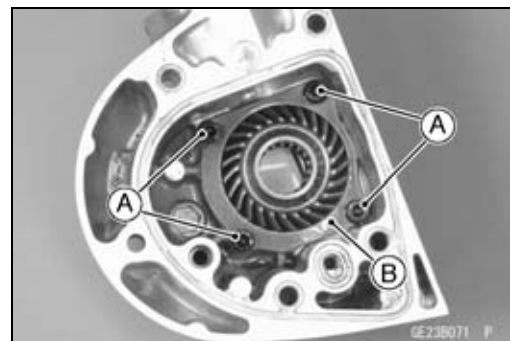
**Special Tool - Steering Stem Nut Wrench: 57001-1100**



- Remove the driven gear case unit [A].
- Disassemble the driven gear case unit (see Drive/Driven Bevel Gear Case Unit Disassembly).



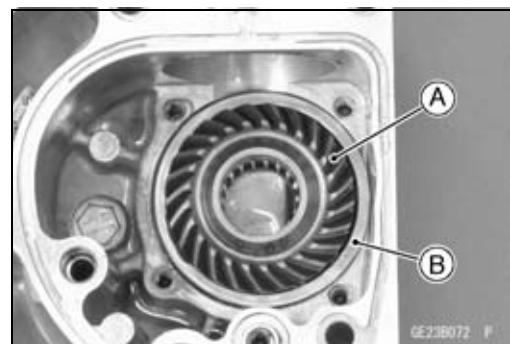
- Remove the bearing holder allen bolts [A].
- Remove the bearing holder [B].



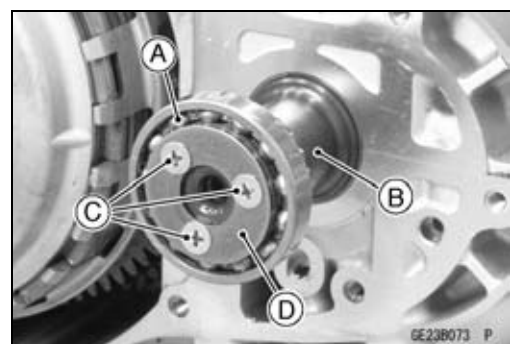
- Pull out the drive gear assembly [A] together with the secondary shim(s) [B].
- Remove the primary shim(s).

#### NOTE

○ Mark the shims or record their thicknesses so that the primary and secondary shims can be reinstalled in their original positions.



- Fit the drive gear assembly [A] on the crankshaft [B].
- Remove the mounting screws [C] to remove the bearing support plate [D].
- Using a press, remove the bevel gear from the bearing.



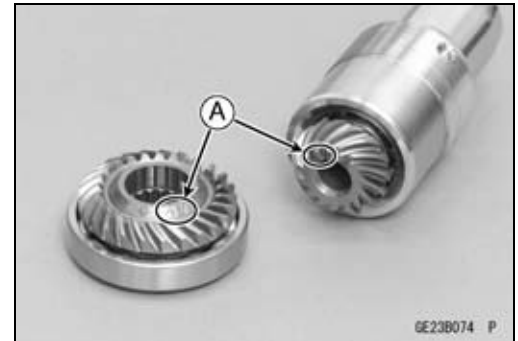


## Bevel Gears (Hypoid Gears)

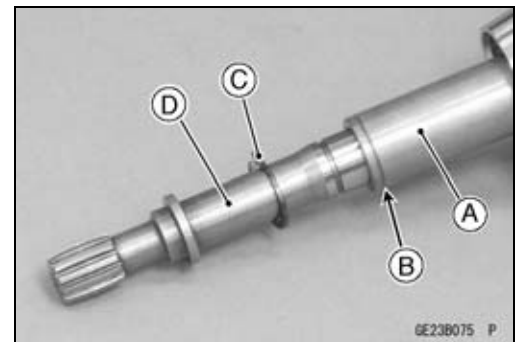
### Bevel Gear Case Assembly

#### NOTICE

To ensure optimal tooth contact, the crankshaft side drive and driven bevel gears are machined together. To replace the gears, they must be replaced as a set. The two gears are marked [A] with matching numbers.



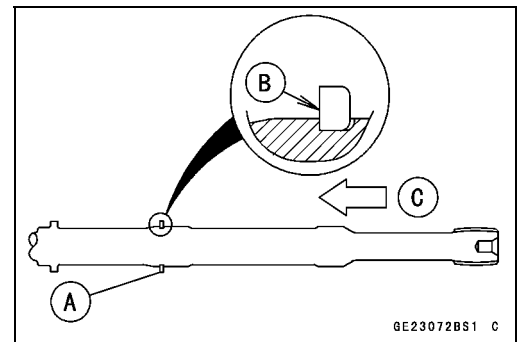
- Inspect the bevel gear for damage.
- Replace the ball bearing with a new one.
- To assemble the driven and drive bevel gears, refer to the instructions for adjusting the crankshaft bevel gear tooth contact in the Bevel Gear Tooth Contact Adjustment section.
- Install the inner pipe [A] so that the end with the groove [B] faces up.
- Install a new circlip [C] on the driveshaft [D].



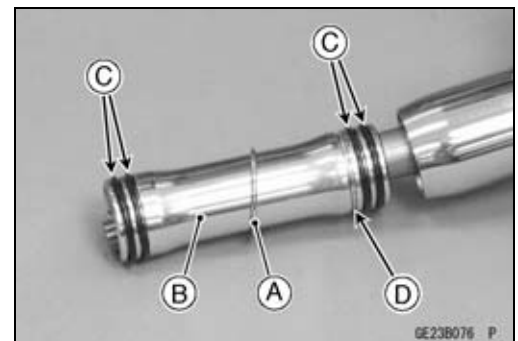
#### NOTE

○ Install the circlip [A] with the flat side facing [B] upward on the driveshaft direction [C] as shown in the figure.

- Insert the driveshaft via the inner pipe into the driven bevel gear.



- Install a new snap ring [A] on the outer pipe [B].
- Replace the O-ring [C] with new ones.
- Apply grease to the O-rings and install them in the outer pipe.
- Insert the outer pipe into the gear case so that the snap ring groove [D] faces down.
- Install the bevel gear case (see Bevel Gear Case Installation).

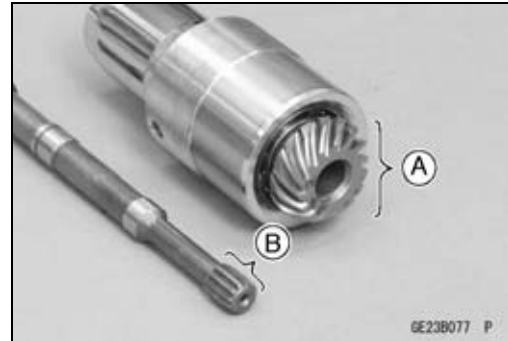


## 4-54 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

#### **Bevel Gear/Driveshaft Inspection**

- Visually inspect the gears for cuts, peeling, or other damage on the tooth flank [A].
- ★ If a gear is damaged, the drive and driven bevel gears must be replaced as a set.
- Visually inspect the driveshaft splines [B] for cuts, peeling, or other damage.
- ★ If the driveshaft splines are damaged, replace the drive-shaft, and visually inspect the bevel gear splines.
- ★ If the bevel gear splines are damaged, replace the bevel gears as a set.



#### **Bevel Gear Bearing Inspection**

##### **NOTICE**

**Do not remove the bearings for inspection. Removal may damage them.**

- Remove:
  - Bevel Gear Case (see Bevel Gear Case Removal)
  - Drive/Driven Bevel Gear Case Unit
- Inspect the ball bearings [A].
- Visually inspect the bearings for discoloration.
- Because the ball bearings are produced with extreme precision, they must be inspected for wear by spinning them by hand, instead of measuring them.
- Turn the bevel gear by hand to inspect its condition.
- ★ Replace a bearing that is noisy, does not spin smoothly, or catches.



#### **Bevel Gear Tooth Contact Adjustment**

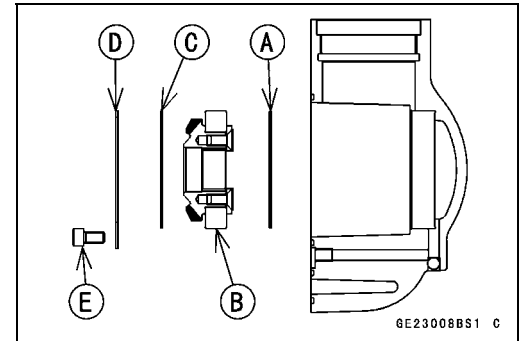
An improperly adjusted bevel gear tooth contact could lead to gear noise and damage. Therefore, when replacing a part that could affect the tooth contact, make sure to adjust the bevel gear tooth contact. Listed below are parts that could alter the tooth contact.

- Bevel Gear Case
- Drive/Driven Bevel Gear
- Bearing Housing
- Camshaft
- Cylinder Head

## Bevel Gears (Hypoid Gears)

### Crankshaft Side Bevel Gear Tooth Contact Check

- Remove:
  - Bevel Gear Case (see Bevel Gear Case Removal)
  - Driven Bevel Gear Case (see Bevel Gear Case Disassembly)
  - Drive Bevel Gear Assembly (see Bevel Gear Case Disassembly)
- Install:
  - Primary Shim (s) [A] to install = (old primary shim thickness - 0.15 mm (0.006 in.))
  - Drive Bevel Gear Assembly [B]
  - Old Secondary Shim(s) [C]
  - Bearing Holder Plate [D]



### NOTE

○ Install a primary shim(s) with a thickness that is 0.15 mm (0.006 in.) less than the old primary shim(s).

- Tighten:
  - Torque - Bearing Holder Allen Bolts [E]: 7.8 N·m (0.8 kgf·m, 69 in·lb)

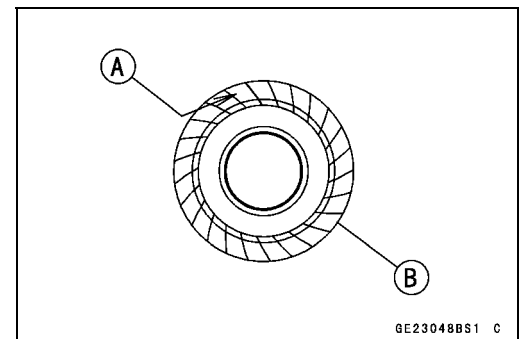
### Crankshaft Side Bevel Gear Adjustment Shims

Thickness (mm) (in.)	Part Number
0.08 (0.003)	92180-1306
0.1 (0.004)	92180-1285
0.15 (0.006)	92180-1286
0.2 (0.008)	92180-1287
0.3 (0.012)	92180-1288
0.4 (0.016)	92180-1289
0.5 (0.020)	92180-1290
0.6 (0.024)	92180-1291
0.7 (0.028)	92180-1292
0.8 (0.031)	92180-1293
0.9 (0.035)	92180-1294
1.0 (0.039)	92180-1284
1.2 (0.047)	92180-1296
0.13 (0.005)	92180-1324

- Clean the bevel gears to remove any dust or oil.
- Apply checking compound to the contact surface (concave area) [A] of approximately five tooth flanks of the drive bevel gear [B].

### NOTE

○ Using a brush with firm bristles, apply a thin and uniform coat of checking compound to the tooth flank (so that the tooth flank is faintly colored with the checking compound). The extent of the tooth contact cannot be properly discerned if you apply a thick coat. The checking compound must have the smooth and firm consistency of ordinary toothpaste.



## 4-56 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

- Tighten the driven bevel gear case unit [A] until the bevel gear backlash is 0 mm (0 in.).
- Tighten the locknut [B] to the specified torque to adjust the backlash.

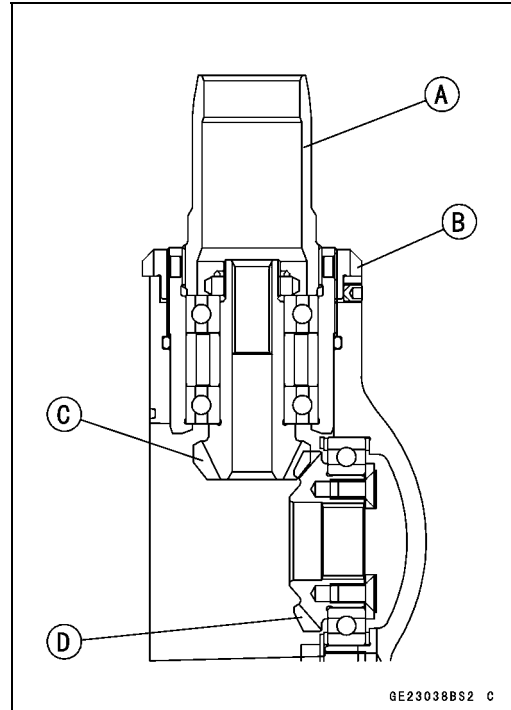
**Special Tool - Steering Stem Nut Wrench: 57001-1100**

- Push one of the gears with your fingers. A backlash of 0 mm (0 in.) is reached when there is no play.

#### NOTE

○ A backlash or a gear lash is the amount of relative movement [C] of a given gear, with the other gear remaining stationary [D].

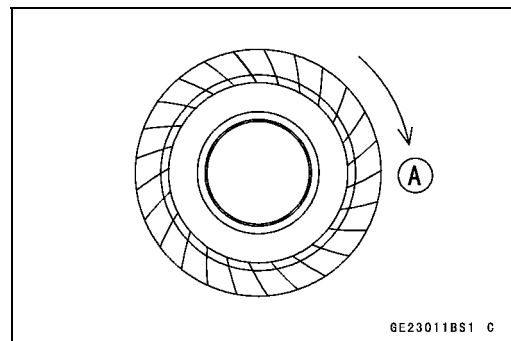
**Torque - Bevel Gear Case Locknut: 20 N·m (2.0 kgf·m, 15 ft·lb)**



- Attach the bevel gear drive bit to the driven bevel gear, and use an air or electric drill to rotate it clockwise with a light pressure for 20 seconds.

Drive Bevel Gear Rotation Direction [A]

**Special Tool - Bevel Gear Drive Bit m0.75: 57001-1421**



- Inspect the tooth contact on the concave portion of the drive gear. Good contact is achieved when the pattern of tooth contact is visible in the center of the tooth flank.

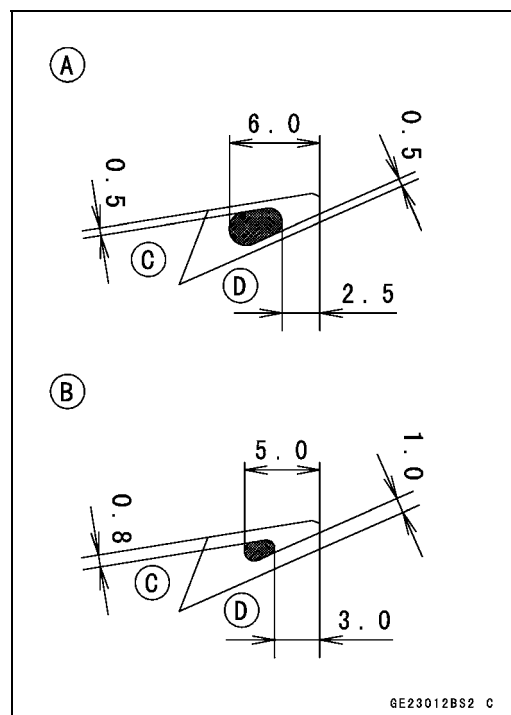
Good tooth contact pattern, upper limit [A]

Good tooth contact pattern, lower limit [B]

Diameter side [C]

Tooth bottom side [D]

- ★ Proceed to the operation that follows the tooth contact pattern adjustment if a good tooth contact pattern has been achieved.



- ★ If the tooth contact pattern is improper, adjust the shim(s) following the procedure given below.

## Bevel Gears (Hypoid Gears)

### Example 1

- Decrease the thickness of the primary shim and increase the thickness of the secondary shim.

#### NOTE

- The thickness of the secondary shim is determined by the thickness of the primary shim. However, if the figure of the second digit below the decimal point is 2 or 7, apply a correction value to determine the ultimate thickness of the secondary shim.

#### Secondary Shim Thickness Calculation

2.0 mm - (primary shim thickness)

= (secondary shim thickness)

Second digit below decimal point → Correction value

2 → 3

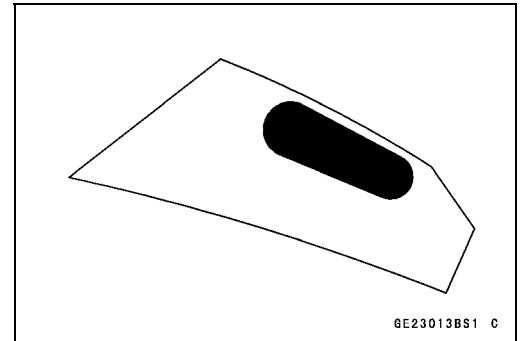
7 → 8

Calculation example:

$$2 - 1.08 = 0.92 \rightarrow 0.93$$

$$2 - 1.03 = 0.97 \rightarrow 0.98$$

- Recheck the tooth contact of the crankshaft side bevel gear.



## 4-58 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

#### Example 2

- Increase the thickness of the primary shim and decrease the thickness of the secondary shim.

#### NOTE

- The thickness of the secondary shim is determined by the thickness of the primary shim. However, if the figure of the second digit below the decimal point is 2 or 7, apply a correction value to determine the ultimate thickness of the secondary shim.

#### Secondary Shim Thickness Calculation

2.0 mm - (primary shim thickness)

= (secondary shim thickness)

Second digit below decimal point → Correction value

2 → 3

7 → 8

Calculation example:

$$2 - 1.08 = 0.92 \rightarrow 0.93$$

$$2 - 1.03 = 0.97 \rightarrow 0.98$$

- Recheck the tooth contact of the crankshaft side bevel gear.

#### After adjusting the tooth contact pattern

- Remove the drive bevel gear assembly.
- Increase the primary shim thickness by 0.15 mm (0.006 in.).

○ Do not increase the thickness of the secondary shim.

- Install:

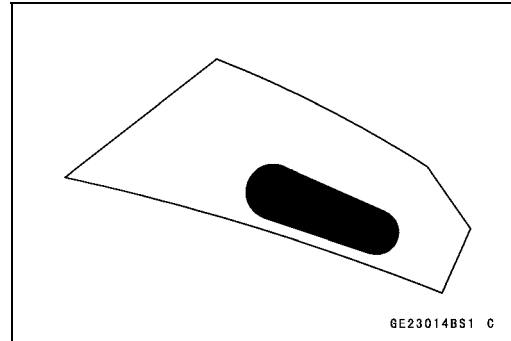
Drive Bevel Gear Assembly

Secondary Shim(s)

Bearing Holder Plate

- Apply a non-permanent locking agent to the bearing holder allen bolts and tighten them.

**Torque - Bearing Holder Allen Bolt: 7.8 N·m (0.8 kgf·m, 69 in·lb)**



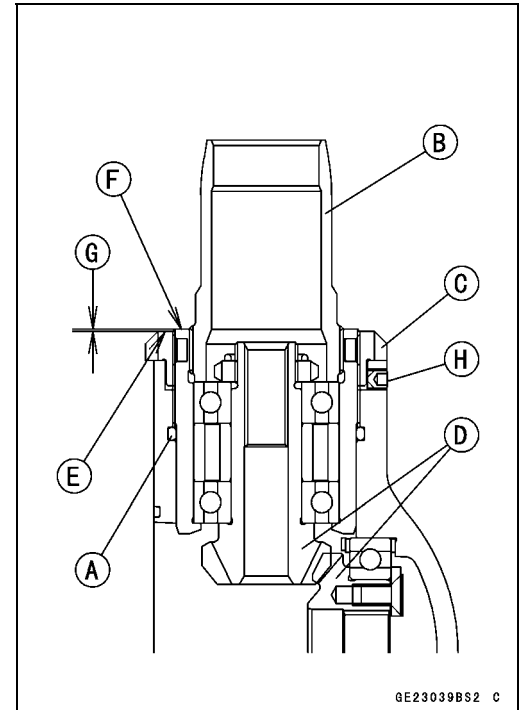
## Bevel Gears (Hypoid Gears)

- Replace the O-ring [A] with a new one.
- Apply grease to the O-ring.
- Tighten the drive side bevel gear case unit [B] until the gear backlash is 0 mm (0 in.), and tighten the locknut [C] to the specified torque to adjust the backlash.

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

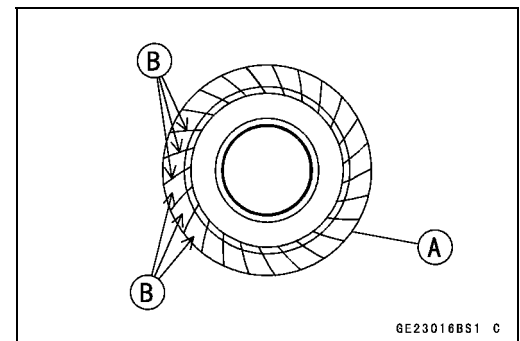
**Torque - Bevel Gear Case Locknut: 20 N·m (2.0 kgf·m, 15 ft·lb)**

- Make sure that the bevel gear [D] turns freely.
- Make sure that the top surface [E] of the lock nut is lower than the top surface [F] of the bearing housing. Approximately 0.5 mm (0.02 in.) [G]
- ★ If it is not as illustrated, the gear backlash could be improperly adjusted or the tooth contact could be improper.
- Tighten the locknut stop screw [H] temporarily.



GE23039BS2 C

- Apply a thin coat of molybdenum disulfide grease to all the tooth flanks [B] of the crankshaft side drive bevel gear [A].
- Install the bevel gear case (see Bevel Gear Case Installation).
- Adjust the crankshaft side bevel gear (see Bevel Gear Adjustment).



GE23016BS1 C

### Camshaft Side Bevel Gear Tooth Contact Check

- Remove:
  - Cylinder Head Cover (see Cylinder Head Cover Removal)
  - Camshaft (see Camshaft Removal)
  - Driven Bevel Gear (see Camshaft Side Driven Bevel Gear Removal)
  - Bevel Gear Case (see Bevel Gear Case Removal)

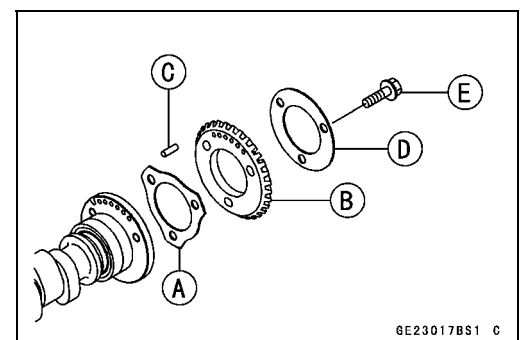
- Assemble:
  - See Camshaft Side Driven Bevel Gear Installation.
  - Shim [A] to install = (old shim thickness - 0.20 mm (0.0079 in.))
  - Driven Bevel Gear [B]
  - Pin [C]
  - Bevel Gear Holder [D]

#### NOTE

○ Install a shim(s) with a thickness that is 0.20 mm (0.0079 in.) less than the old shim(s).

- Tighten the bevel gear bolts [E].

**Torque - Driven Bevel Gear Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)**



GE23017BS1 C

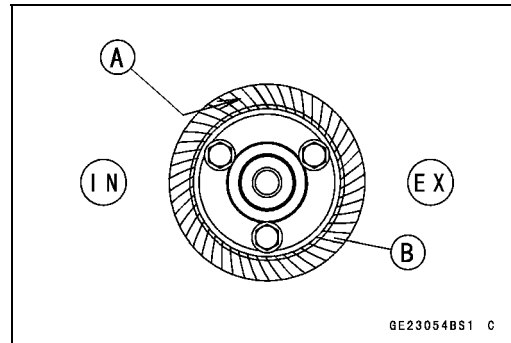
## 4-60 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

- Clean the bevel gears to remove any dust or oil.
- Apply checking compound to the contact surface (concave area) [A] of approximately ten tooth flanks of the driven bevel gear [B].

#### NOTE

○ Using a brush with firm bristles, apply a thin and uniform coat of checking compound to the tooth flank (so that the tooth flank is faintly colored with the checking compound). The extent of the tooth contact cannot be properly discerned if you apply a thick coat. The checking compound must have the smooth and moist consistency of ordinary toothpaste.



### Crankshaft Side Bevel Gear Adjustment Shims

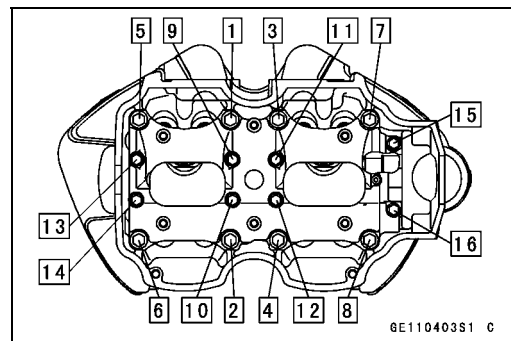
Thickness (mm) (in.)	Part Number
0.08 (0.003)	92180-1305
0.1 (0.004)	92180-1280
0.15 (0.006)	92180-1281
0.2 (0.008)	92180-1282
0.3 (0.012)	92180-1283
0.4 (0.016)	92180-1299
0.5 (0.020)	92180-1300
0.6 (0.024)	92180-1301
0.7 (0.028)	92180-1279
0.8 (0.031)	92180-1302
0.9 (0.035)	92180-1303
1.0 (0.039)	92180-1304
0.13 (0.005)	92180-1323

- Remove the rocker arm shafts, rocker arms, washers, and springs from the camshaft cap (see Rocker Arm and Rocker Shaft Removal).
- Install the rocker arm shafts to the camshaft cap.
- Apply molybdenum disulfide oil solution to all camshaft journals and install the camshaft on the cylinder head.
- Install the camshaft cap and tighten the bolts following the specified sequence.

#### Torque - Camshaft Cap Bolts

**M8 mm: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**M6 mm: 12 N·m (1.2 kgf·m, 106 in·lb)**

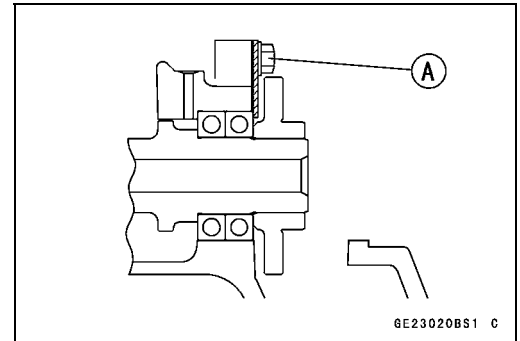




## Bevel Gears (Hypoid Gears)

- Tighten the locating plate bolts [A] at the camshaft position.

**Torque - Camshaft Locating Plate Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**



- Tighten the drive bevel gear case unit [A] until the bevel gear backlash is 0 mm (0 in.).
- Tighten the locknut [B] to the specified torque to adjust the backlash.

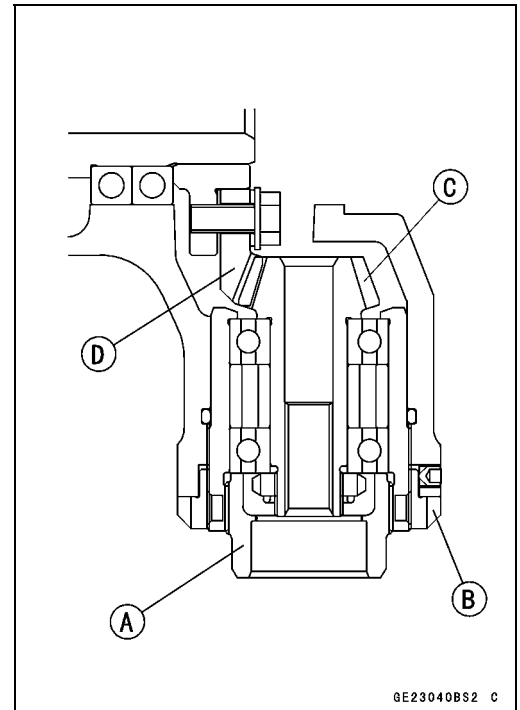
**Special Tool - Steering Stem Nut Wrench: 57001-1100**

- Push one of the gears with your fingers. A backlash of 0 mm (0 in.) is reached when there is no play.

**Torque - Bevel Gear Case Locknut: 20 N·m (2.0 kgf·m, 15 ft·lb)**

### NOTE

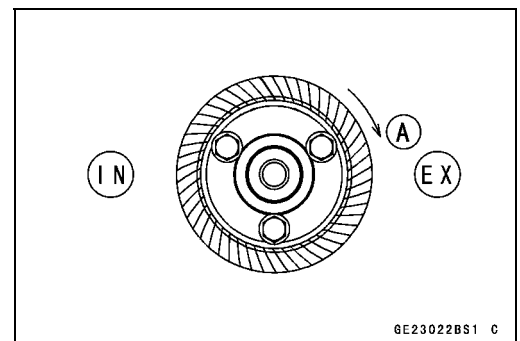
- A backlash or a gear lash is the amount of relative movement [C] of a given gear, with the other gear remaining stationary [D].



- Attach the bevel gear drive bit to the drive bevel gear, and use an air or electric drill to rotate it clockwise with a light pressure for 20 seconds.

Driven Bevel Gear Rotation Direction [A]

**Special Tool - Bevel Gear Drive Bit m0.75: 57001-1421**



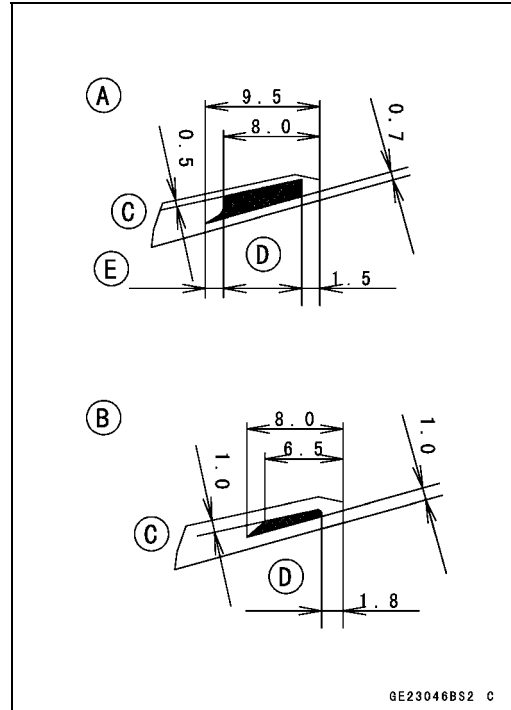
## 4-62 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

- Inspect the tooth contact on the concave portion of the driven gear. Good contact is achieved when the pattern of tooth contact is visible in the center of the tooth flank.
  - Good tooth contact pattern, upper limit [A]
  - Good tooth contact pattern, lower limit [B]
  - Diameter side [C]
  - Tooth bottom side [D]
  - None also OK [E]
- ★ Proceed to the operation that follows the tooth contact pattern adjustment if a good tooth contact pattern has been achieved.

#### NOTE

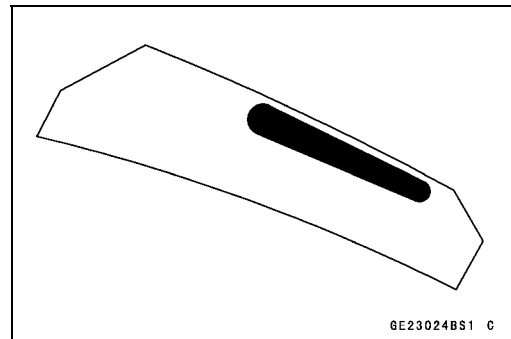
○ An optimal tooth contact pattern is similar to [A]. Thus, to adjust the tooth contact, aim for pattern [A].



- ★ If the tooth contact pattern is improper, replace the shim(s) following the procedure given below.

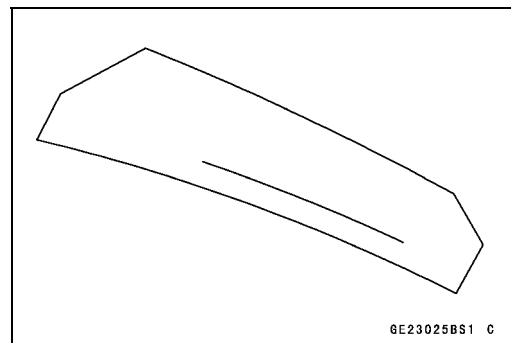
#### Example 1

- Decrease the thickness of the shim(s).
- Recheck the tooth contact of the camshaft side bevel gear.



#### Example 2

- Increase the thickness of the shim(s).
- Recheck the tooth contact of the camshaft side bevel gear.

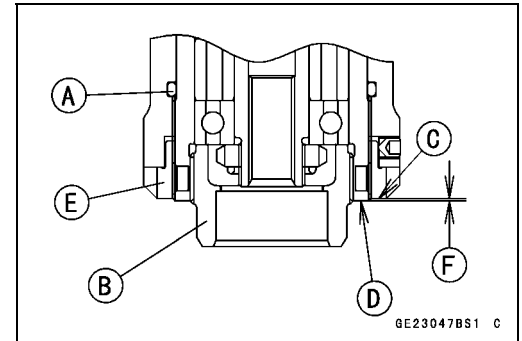


#### After adjusting the tooth contact pattern

- Remove:
  - Camshaft
  - Driven Bevel Gear
- Reinstall the driven bevel gear (see Camshaft Side Driven Bevel Gear Installation).
- Increase the shim thickness by 0.20 mm (0.0079 in.).

## Bevel Gears (Hypoid Gears)

- Replace the O-ring [A] with a new one.
- Apply grease to the O-ring.
- Tighten the drive bevel gear case unit [B] onto the cylinder head so that the bottom surface [C] of the lock nut is higher than the outer surface [D] of the bearing housing.  
Bevel Gear Case Locknut [E]  
Approximately 1.5 mm (0.06 in.) [F]



- Install the bevel gear case (see Bevel Gear Case Installation).
- Adjust the camshaft side bevel gear (see Bevel Gear Adjustment).

### Bevel Gear Adjustment

An improperly adjusted bevel gear could lead to gear noise and damage. Therefore, when replacing a part that could affect the bevel gear backlash, make sure to perform an inspection and adjustment.

#### NOTE

○A bevel gear adjustment must be performed only by a competent mechanic.

### Camshaft Side Bevel Gear

#### NOTICE

**Do not adjust the camshaft side bevel gear without the check of the rotating torque of the camshaft. If adjusting it by other methods, the gears may be damaged.**

#### NOTE

○Adjust the camshaft side bevel gear when the engine is cold.

- Remove:
  - Cylinder Head Cover (see Cylinder Head Cover Removal)
  - Camshaft (see Camshaft Removal)
- Remove the rocker arm shafts, rocker arms, washers and springs from the camshaft cap (see Rocker Arm and Rocker Shaft Removal).
- Install the rocker arm shafts to the camshaft cap.
- Apply molybdenum disulfide oil solution to all camshaft journals.

## 4-64 ENGINE TOP END

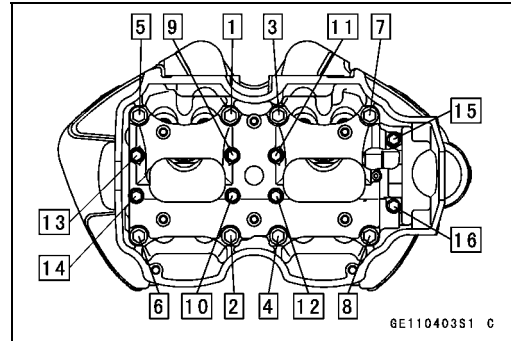
### Bevel Gears (Hypoid Gears)

- Install the camshaft cap and tighten the bolts following the specified sequence.

#### Torque - Camshaft Cap Bolts

M8 mm: 25 N·m (2.5 kgf·m, 18 ft·lb)

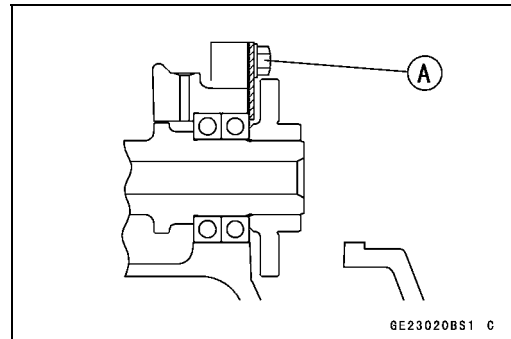
M6 mm: 12 N·m (1.2 kgf·m, 106 in·lb)



- Tighten the locating plate bolts [A] at the camshaft position.

**Torque - Camshaft Locating Plate Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**

- Loosen the bevel gear case unit, and be sure that the camshaft is turned lightly.

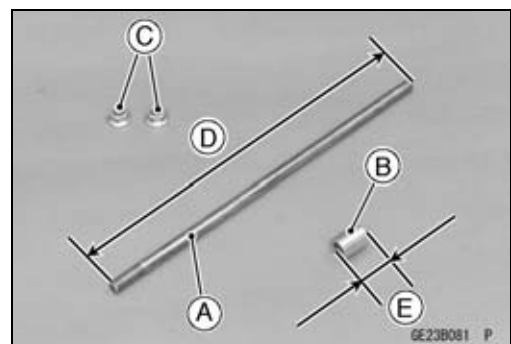
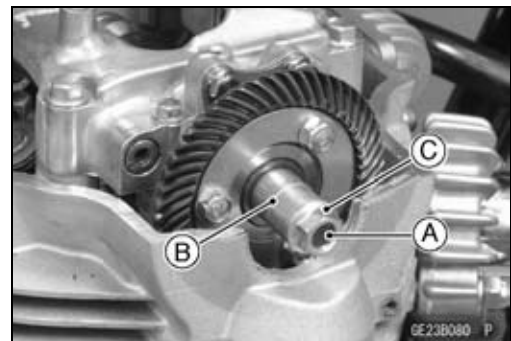


- Install the suitable shaft [A] (or bolt), collar [B] and nuts [C] for measuring the rotating torque of the camshaft.

Shaft (or Bolt), Nuts: M10 mm

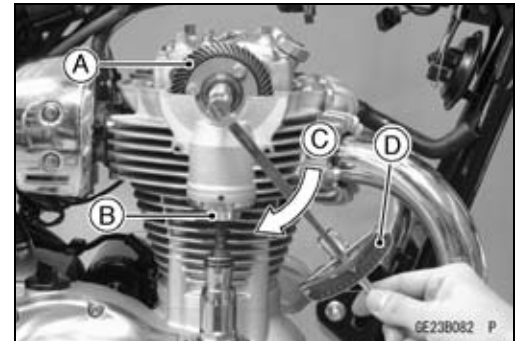
Approximately 300 mm (11.8 in.) [D]

Approximately 22 mm (0.87 in.) [E]



## Bevel Gears (Hypoid Gears)

- Apply molybdenum disulfide oil solution to driven bevel gear [A], and rotate the camshaft one revolution.
- Adjust the rotating torque of the camshaft as follows.
  1. First, tighten the bevel gear case unit [B] until you feel the rotating torque of the camshaft.
  2. Rotate the camshaft clockwise three turns.
  3. Find the largest rotating torque position, while rotating the camshaft clockwise [C] by torque wrench [D].
  4. Make sure that the torque reading at the position is between 2.5 and 3.0 N·m (0.25 ~ 0.31 kgf·m, 22 ~ 27 in·lb).
  5. If the torque does not reach the range above, tighten the bevel gear case unit a bit.
  6. If the torque exceeds the above torque, loosen the bevel gear case unit a bit.
  7. Repeat procedures from No.3 to No.6 until the torque reading specified above is obtained.

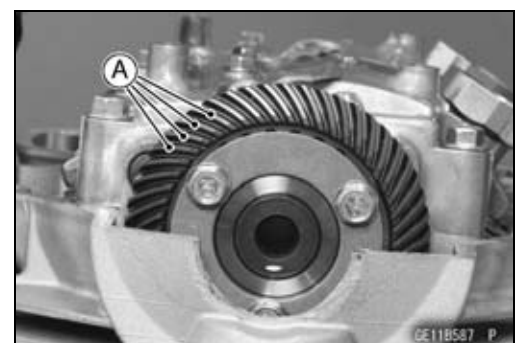
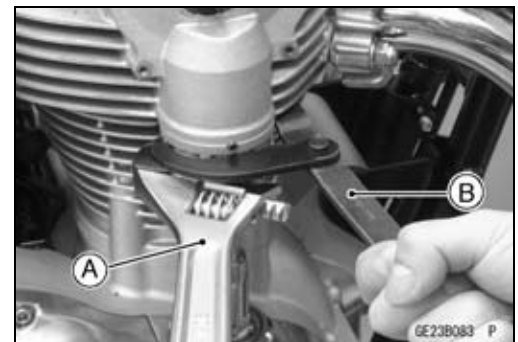


- While holding the bevel gear case unit with the wrench [A], tighten the bevel gear case locknut with steering stem nut wrench [B].

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

**Torque - Bevel Gear Case Locknut: 20 N·m (2.0 kgf·m, 15 ft·lb)**

- Measure the rotating torque of the camshaft again, and be sure that the rotating torque is same as the previous one.
  - Remove the locknut stop screw, and apply a non-permanent locking agent to the threads of the locknut stop screw, and then tighten the stop screw.
- Torque - Locknut Stop Screw: 2.1 N·m (0.2 kgf·m, 1.5 ft·lb)**
- Remove the shaft (or bolt), collar and nuts after measuring the rotating torque of the camshaft.
  - Apply a thin coat of molybdenum disulfide grease to all the tooth flanks [A] of the camshaft side driven bevel gear.



- Remove the camshaft, and reinstall the rocker arms, washers and springs to the camshaft cap (see Rocker Arm and Rocker Shaft Installation).
- Install the removed parts.

## 4-66 ENGINE TOP END

### Bevel Gears (Hypoid Gears)

#### Crankshaft Side Bevel Gear

- Start the engine and warm it up thoroughly.

#### NOTE

- Perform the crankshaft side bevel gear adjustment when the cylinder head outside surface temperature measuring point [A] is 90 ~ 100°C (194 ~ 212°F).
- The standard factory setting for the bevel gear adjustment is designed to eliminate the gear lash sound and to practically eliminate any whining during the operating temperature indicated above. However, this setting has a tendency to generate a whining sound when the engine is cold.
- Refer to page 4-42 if the factory setting of the crankshaft side bevel gear must be changed upon the customer's request.

#### ⚠ WARNING

The engine and exhaust system get extremely hot during normal operation and can cause serious burns. Never touch the engine or exhaust pipe during adjustment.

- Mark [A] the hexagonal portion [B] of the bevel gear case unit to align with the locknut stop screw hole [C].
- Loosen the locknut stop screw.
- Loosen the bevel gear case locknut [D]

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

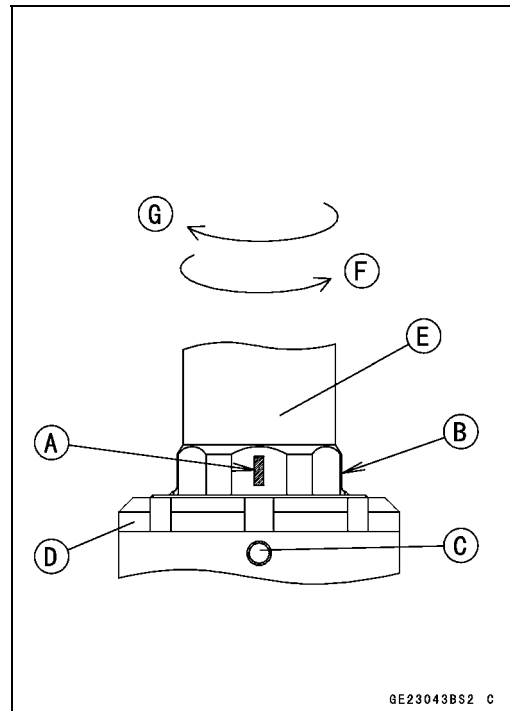
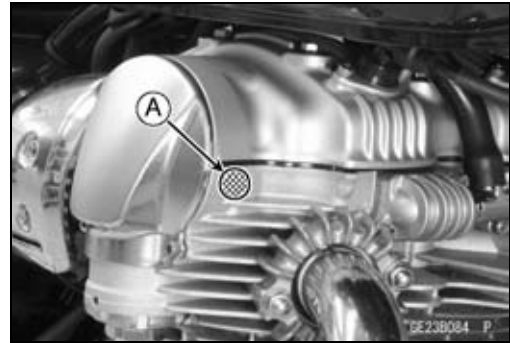
- Rotate the bevel gear case unit [E] approximately 45° counterclockwise [F]. Verify that the gear lash sound can be heard.
- Rotate the bevel gear case unit clockwise [G]. Stop the rotation when the gear lash disappears and the whining sound appears.
- Slowly rotate the bevel gear case unit counterclockwise again. Stop the rotation when the whining sound disappears and the gear lash sound can no longer be heard and tighten the locknut.
- Hold the bevel gear case unit with a wrench to tighten the locknut.

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

**Torque - Bevel Gear Case Locknut: 20 N·m (2.0 kgf·m, 15 ft·lb)**

- Remove the locknut stop screw, and apply a non-permanent locking agent to the threads of the locknut stop screw, and then tighten the stop screw.

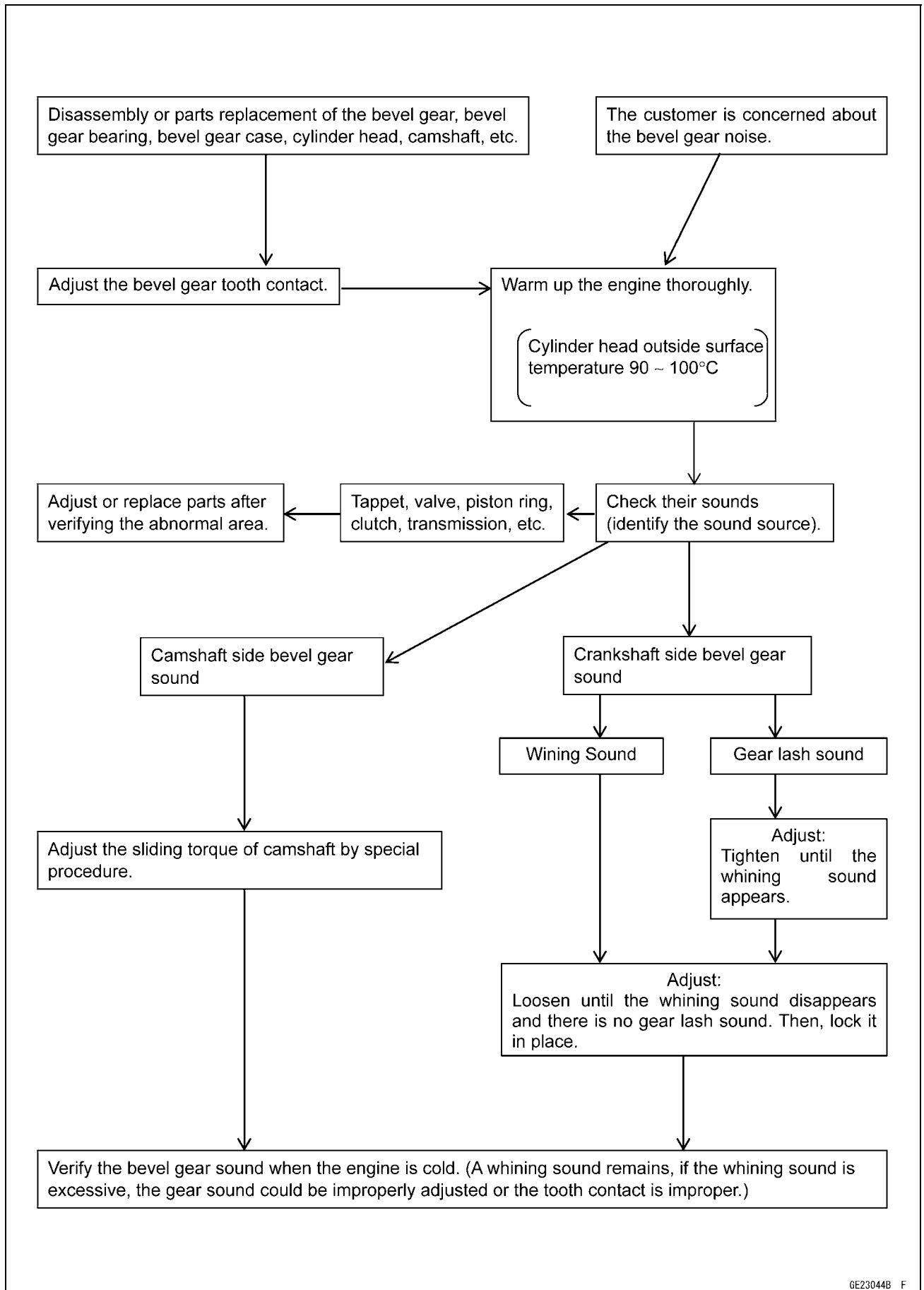
**Torque - Locknut Stop Screw: 2.1 N·m (0.2 kgf·m, 1.5 ft·lb)**



GE23043BS2 C

Bevel Gears (Hypoid Gears)

Bevel Gear Adjustment Flowchart

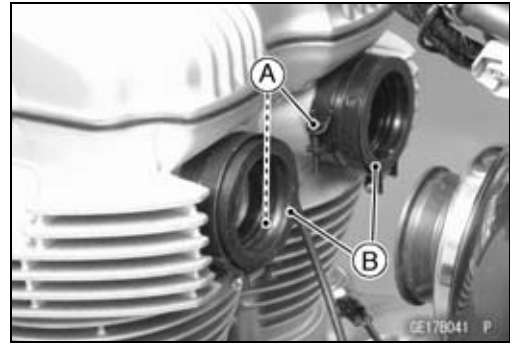


## 4-68 ENGINE TOP END

### Throttle Body Assy Holder

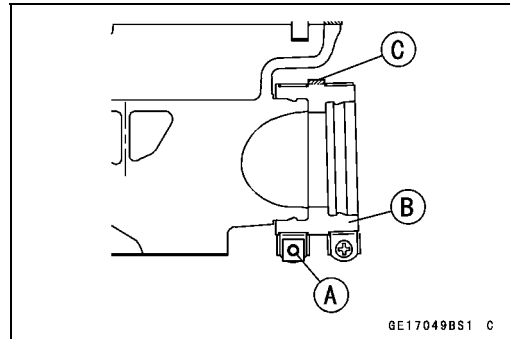
#### **Throttle Body Assy Holder Removal**

- Remove the throttle body assy (see Throttle Body Assy Removal in the Fuel System (DFI) chapter).
- Loosen the screws [A].
- Remove the throttle body assy holders [B].

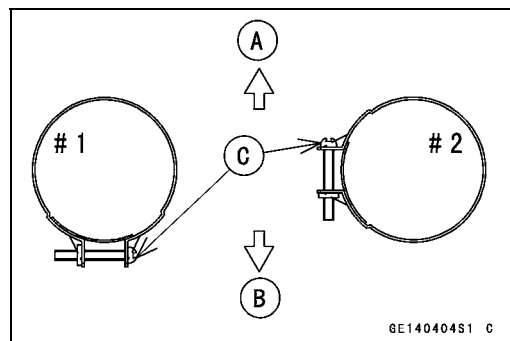


#### **Throttle Body Assy Holder Installation**

- Install the clamps [A], and install the throttle body assy holder [B] on the cylinder head, with the protrusion [C] facing upward.



- The clamp tightening positions are as shown.  
Cylinder Head Cover Side [A]  
Cylinder Side [B]  
Clamp Bolt Heads [C]





## Muffler

### **⚠ WARNING**

The muffler can become extremely hot during normal operation and cause severe burns. Do not remove the muffler while it is hot.

### **Muffler Removal**

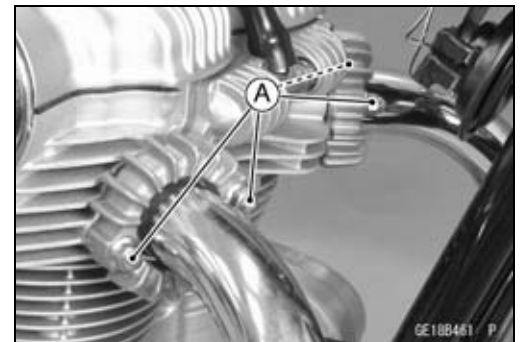
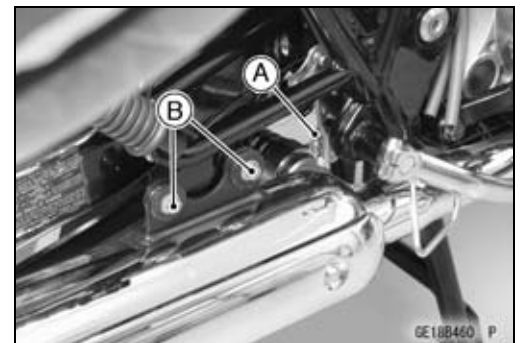
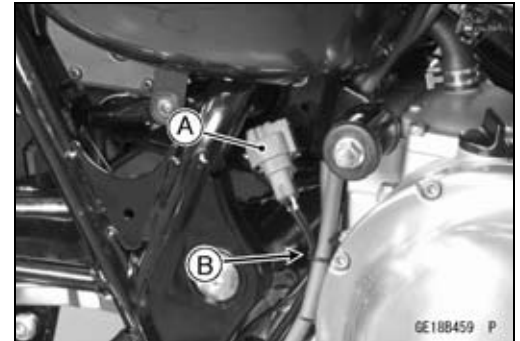
- Pull out the oxygen sensor lead connector from the bracket.
- Disconnect the oxygen sensor lead connector [A], and free the lead from the clamp [B].

### **NOTICE**

Do not pull strongly, twist, or bend the oxygen sensor lead. This may cause the wiring open.

- Loosen the connecting pipe clamp bolt [A]
- Remove the right and left muffler bracket bolts [B].

- Remove the right and left exhaust pipe holder nuts [A].
- Remove the right and left mufflers.



### **Muffler Installation**

- Replace the exhaust pipe gaskets and connecting pipe gasket with new ones.
- Install the connecting pipe gasket to the left muffler until it is bottomed.
- Installing the right and left exhaust pipes on the cylinder head and install the exhaust pipe holders, connect the right and left mufflers.
- Temporarily tighten the exhaust pipe holder nuts.
- Temporarily tighten the right and left muffler bracket bolts.
- Tighten the exhaust pipe holder nuts, muffler bracket bolts, and the connecting pipe clamp bolt, in that order.

**Torque - Muffler Bracket Bolts: 21 N·m (2.1 kgf·m, 15 ft·lb)**



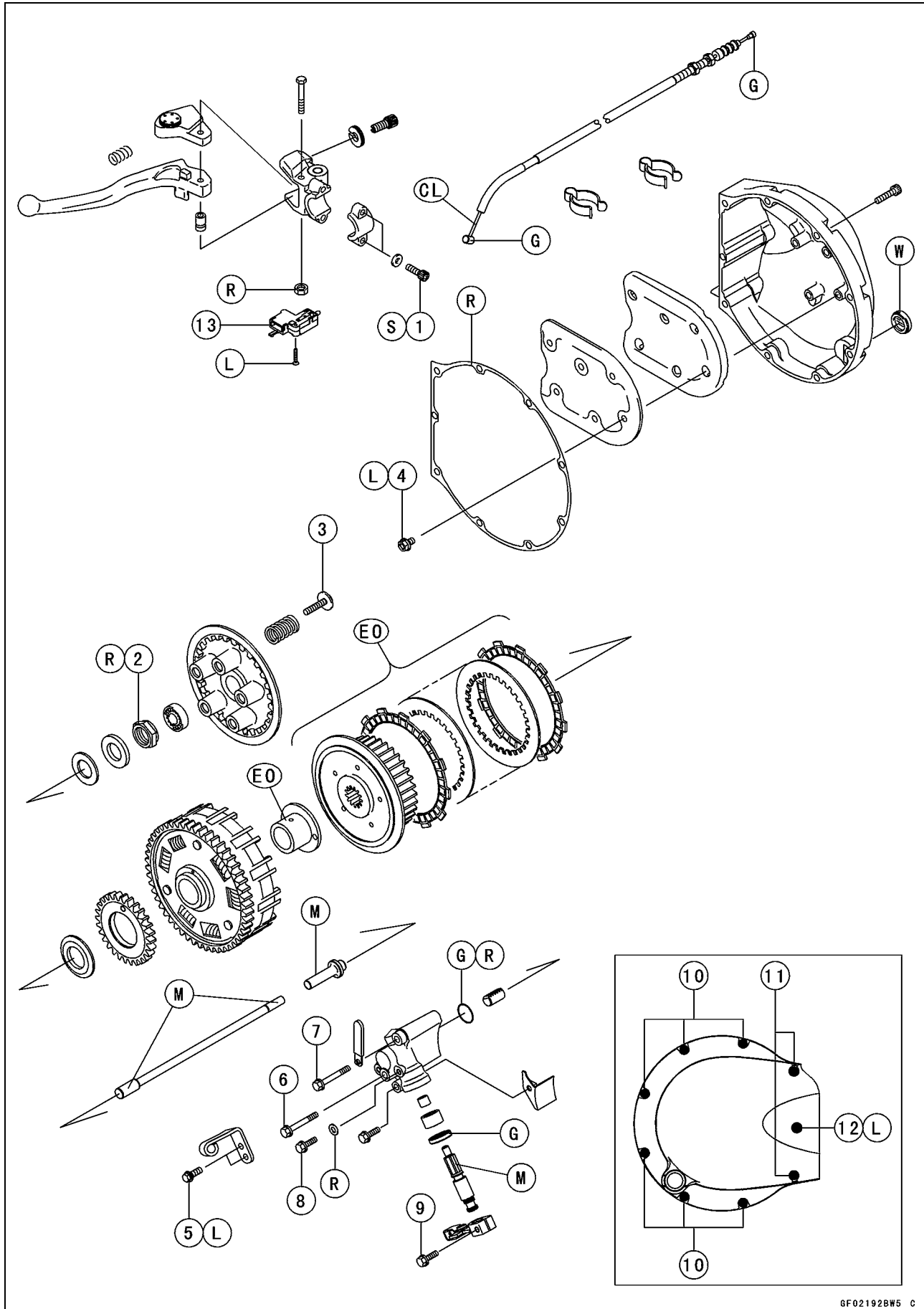
# Clutch

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# 5-2 CLUTCH

## Exploded View



## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Clutch Lever Clamp Bolts	7.8	0.80	69 in·lb	S
2	Clutch Hub Nut	145	14.8	107	R
3	Clutch Spring Bolts	9.8	1.0	87 in·lb	
4	Clutch Cover Damper Plate Bolts	12	1.2	106 in·lb	L
5	Clutch Cable Lower Holder Bolts	12	1.2	106 in·lb	L
6	Clutch Release Case Mounting Bolt (L = 80 mm)	12	1.2	106 in·lb	
7	Clutch Release Case Mounting Bolt (L = 70 mm)	12	1.2	106 in·lb	
8	Release Shaft Locating Bolt	9.8	1.0	87 in·lb	
9	Release Lever Clamp Bolt	12	1.2	106 in·lb	
10	Clutch Cover Bolts (M6, L = 25)	12	1.2	106 in·lb	
11	Clutch Cover Bolts (M6, L = 50)	12	1.2	106 in·lb	
12	Clutch Cover Bolt (M6, L = 70)	12	1.2	106 in·lb	L

13. Starter Lockout Switch

CL: Apply cable lubricant.

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

R: Replacement Parts

W: Apply water.

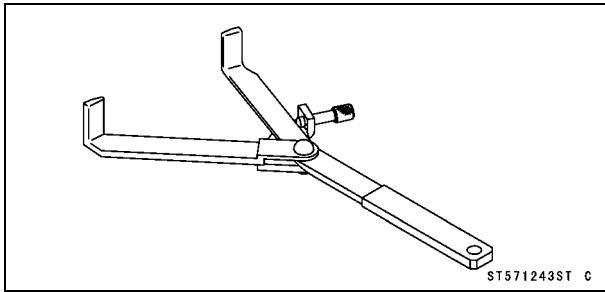
## 5-4 CLUTCH

### Specifications

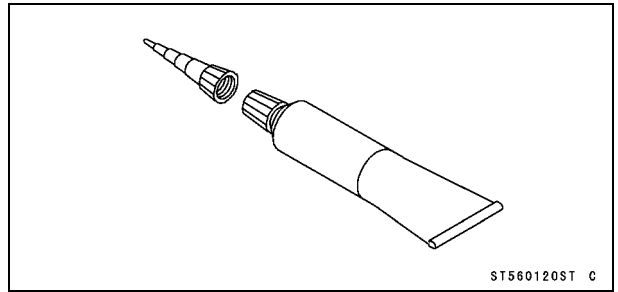
Item	Standard	Service Limit
<b>Clutch Lever</b>		
Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	— — —
<b>Clutch</b>		
Friction Plate Thickness	2.92 ~ 3.08 mm (0.115 ~ 0.121 in.)	2.7 mm (0.11 in.)
Steel Plate Thickness	1.46 ~ 1.74 mm (0.057 ~ 0.069 in.)	1.36 mm (0.054 in.)
Friction Plate Warp	0.15 mm (0.0059 in.) or less	0.3 mm (0.01 in.)
Steel Plate Warp	0.2 mm (0.008 in.) or less	0.3 mm (0.01 in.)
Clutch Spring Free Length	45.76 mm (1.802 in.)	43.5 mm (1.71 in.)

**Special Tool**

**Clutch Holder:  
57001-1243**



**Liquid Gasket, TB1211:  
56019-120**



## 5-6 CLUTCH

### Clutch Lever and Cable

Due to friction plate wear and clutch cable stretch over a long period of use, the clutch must be adjusted in accordance with the Periodic Maintenance Chart.

#### **⚠ WARNING**

**The engine and exhaust system get extremely hot during normal operation and can cause serious burns. Never touch the engine or exhaust pipe during clutch adjustment.**

#### **Clutch Lever Free Play Inspection**

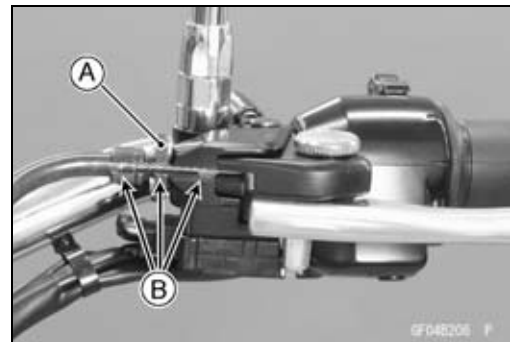
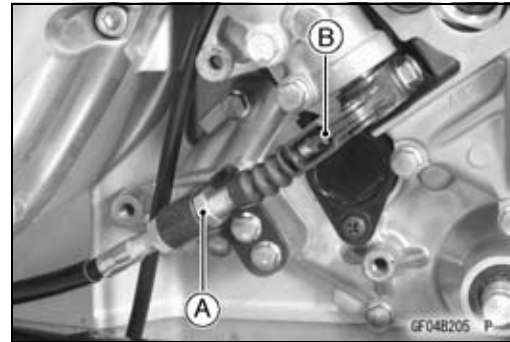
- Refer to the Clutch Operation Inspection in the Periodic Maintenance chapter.

#### **Clutch Lever Free Play Adjustment**

- Refer to the Clutch Operation Inspection in the Periodic Maintenance chapter.

#### **Clutch Cable Removal**

- Remove:
  - Left Front Step
  - Shift Pedal (see Shift Pedal Removal in the Crankshaft/Transmission chapter)
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal in the Final Drive chapter)
- Screw in the adjuster on the clutch lever entirely to increase the free play.
- Loosen the rear locknut [A] at the lower end of the clutch cable, and remove the clutch cable from the clutch release lever [B].
- Loosen the locknut [A].
- Align the slots [B] in the clutch lever, locknut, and adjuster and then free the cable from the lever.
- Pull the clutch cable out of the frame.



#### **Clutch Cable Installation**

- Installation is the reverse of removal.
- Run the clutch cable correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Adjust the clutch cable (see Clutch Operation Inspection in the Periodic Maintenance chapter).

#### **Clutch Cable Lubrication**

- Refer to the Chassis Parts Lubrication in the Periodic Maintenance chapter.

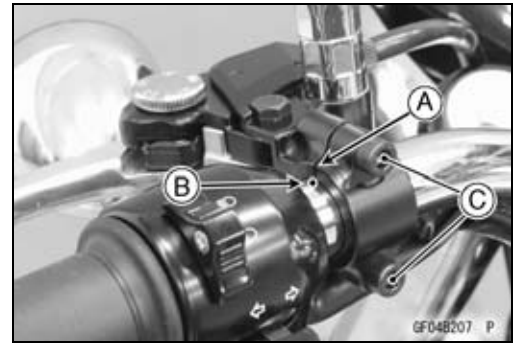


## Clutch Lever and Cable

### Clutch Lever Installation

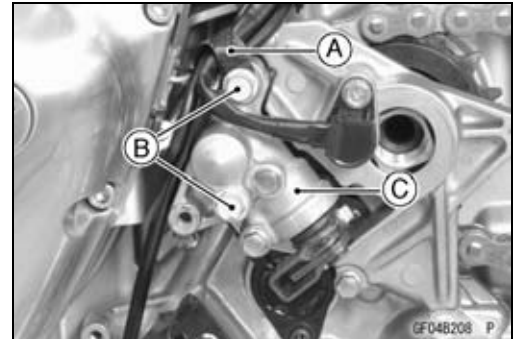
- Install the clutch lever so that the slit [A] of the clutch lever clamp is aligned with the punch mark [B].
- Tighten the upper clamp bolt first, and then the lower clamp bolt.

**Torque - Clutch Lever Clamp Bolts [C]: 7.8 N·m (0.80 kgf·m, 69 in·lb)**



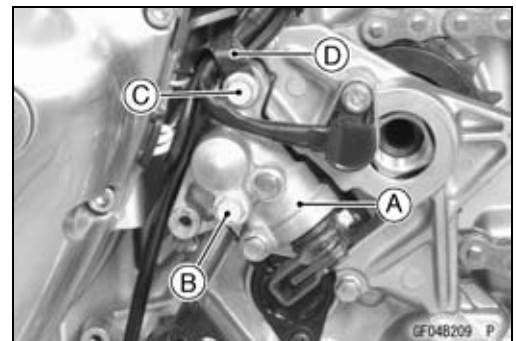
### Clutch Release Case Removal

- Remove the clutch cable (see Clutch Cable Removal).
- Open the clamp [A].
- Remove:
  - Clutch Release Case Mounting Bolts [B]
  - Clutch Release Case [C]



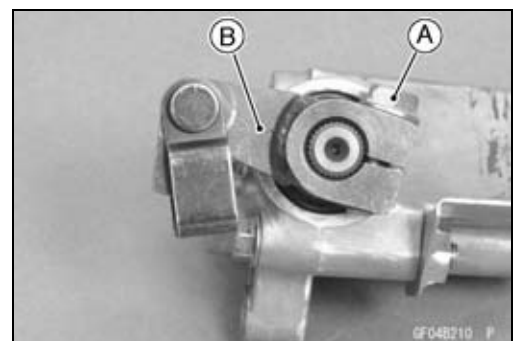
### Clutch Release Case Installation

- Install the clutch release case [A].
- Tighten:
  - Torque - Clutch Release Case Mounting Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**
  - L = 70 mm (2.76 in.) [B]
  - L = 80 mm (3.15 in.) [C]
- Tighten the clamp [D] together with the clutch release case mounting bolt.
- Install the clutch cable on the clutch release lever.
- Adjust the clutch free play (see Clutch Operation Inspection in the Periodic Maintenance chapter).



### Clutch Release Case Disassembly

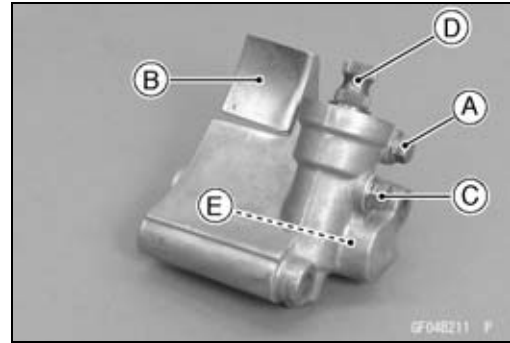
- Remove the clutch release case (see Clutch Release Case Removal).
- Remove the release lever clamp bolt [A] and pull out the release lever [B].



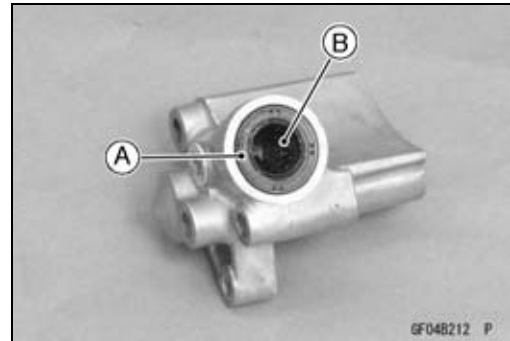
## 5-8 CLUTCH

### Clutch Lever and Cable

- Remove the chain guide plate bolt [A] and remove the chain guide plate [B].
- Remove the release shaft locating bolt [C] and pull out the release shaft [D].
- Remove the rod [E].

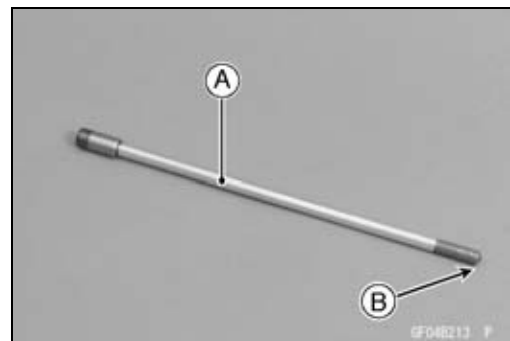


- Remove the oil seal [A] and remove the needle bearing [B].
- Replace the removed oil seal and needle bearing with new parts.

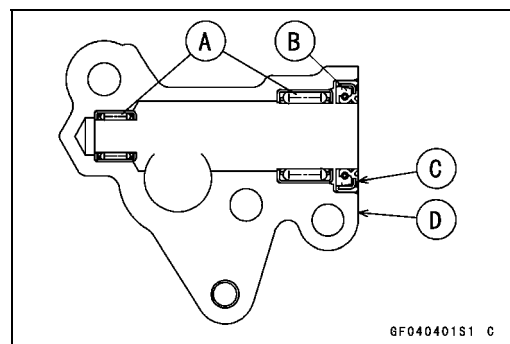


### Clutch Release Case Assembly

- Apply molybdenum disulfide grease to both ends of the pushrod.
- When inserting the pushrod [A], make sure to insert the tapered side [B] facing the clutch housing.



- Drive the new needle bearings [A] into the case until it bottoms out.
- Drive the oil seal [B] into the case so that the oil seal outer surface [C] is flush with the release case outer surface [D].
- Apply grease to the oil seal lip.



## Clutch Lever and Cable

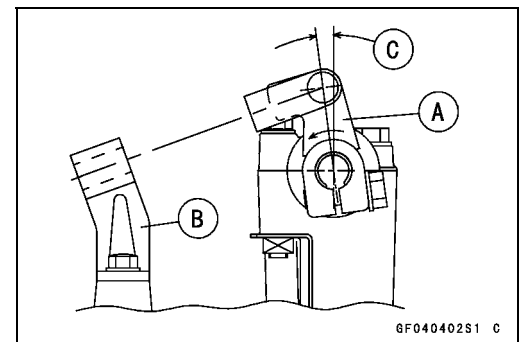
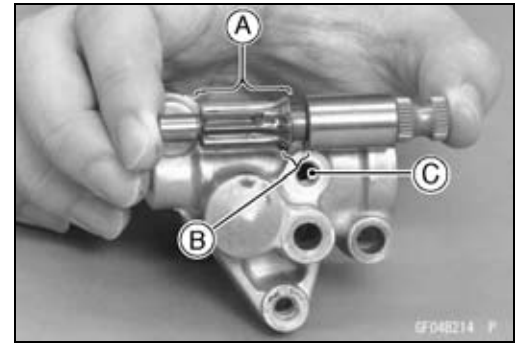
- Apply molybdenum disulfide grease to the pinion [A], and insert the release shaft into the case.
- Align the locating groove [B] with the bolt hole [C], and tighten the bolt.

**Torque - Release Shaft Locating Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)**

- Insert the rod into the case until it stops moving.
- Rotate the shaft to check whether the rack portion of the rod is meshed with the pinion portion of the shaft.
- Install the chain guide plate.
- Install the release lever on the release shaft.

**Torque - Release Lever Clamp Bolt: 12 N·m (1.2 kgf·m, 106 in·lb)**

- Push the release lever [A] towards the clutch cable holder [B] so that when it stops moving, the angle of the release lever is as shown (viewed from the bottom).  
Approximately 7° [C]

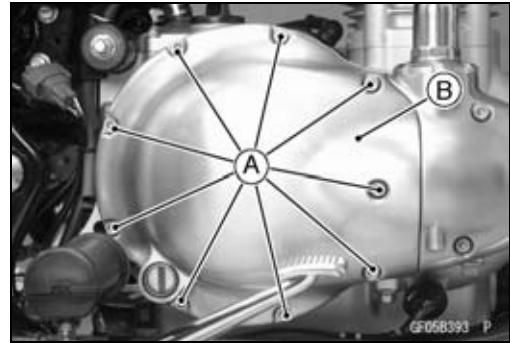


## 5-10 CLUTCH

### Clutch Cover

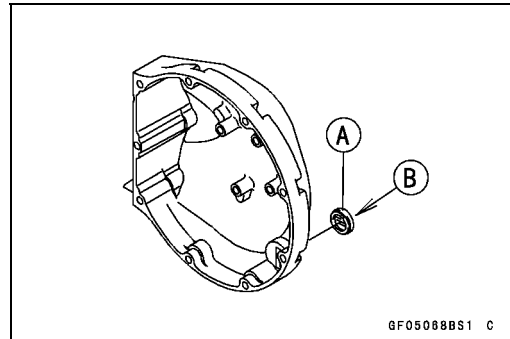
#### Clutch Cover Removal

- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Remove:
  - Clutch Cover Bolts [A]
  - Clutch Cover [B]



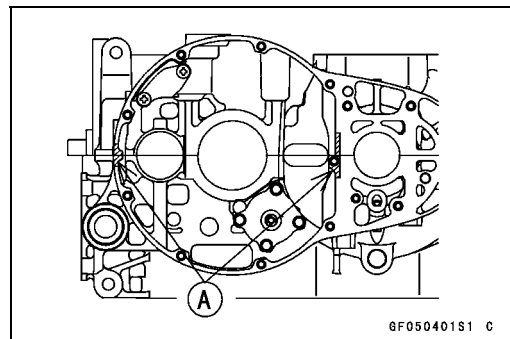
#### Clutch Cover Installation

- When the oil level gauge installing, apply water to the gauge [A] and press it until it is bottomed so that the glass side [B] faces outward.
- Blow out off the protruded water by compressed air.



- Using a high-flash point solvent, clean off any oil or dirt that may be on the liquid gasket coating area [A]. Dry them with a clean cloth.
- Apply liquid gasket to the area where the mating surface of the crankcase touches the clutch cover gasket.

**Sealant - Liquid Gasket, TB1211: 56019-120**



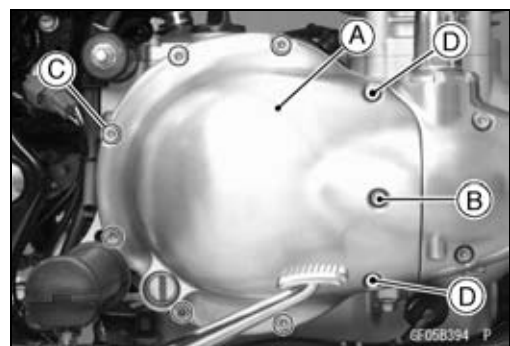
- Replace the gasket with a new one.
- Install:
  - Gasket
  - Clutch Cover [A]
- Apply a non-permanent locking agent to the clutch cover bolt (L = 70 mm) [B].
- Tighten:

**Torque - Clutch Cover Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**

L = 25 mm (0.98 in.) [C]

L = 50 mm (1.96 in.) [D]

- Pour in the specified engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Inspect and adjust the clutch lever free play.



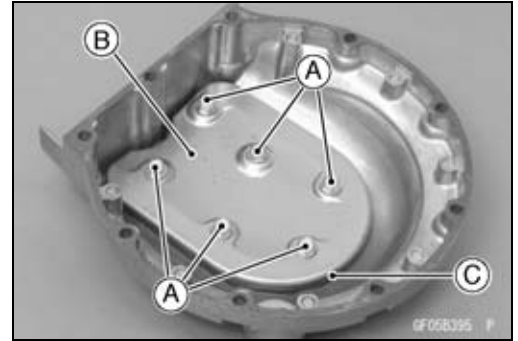
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## Clutch Cover

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### ***Clutch Cover Damper Removal***

- Remove:
  - Clutch Cover (see Clutch Cover Removal)
  - Clutch Cover Damper Plate Bolts [A]
  - Clutch Cover Damper Plate [B]
  - Clutch Cover Damper [C]



### ***Clutch Cover Damper Installation***

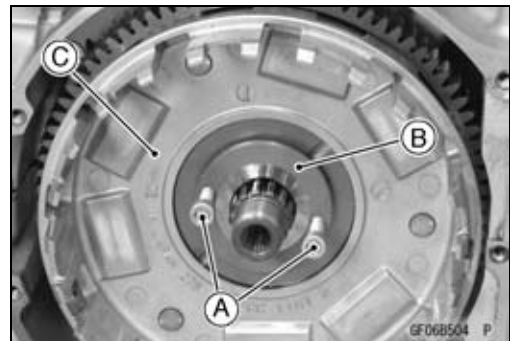
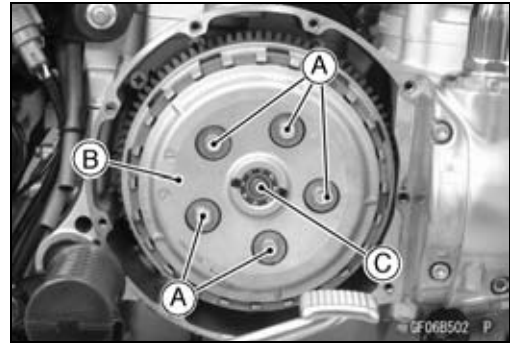
- Apply non-permanent locking agent to the clutch cover damper plate bolts and tighten it.
  - Torque - Clutch Cover Damper Plate Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**

## 5-12 CLUTCH

### Clutch

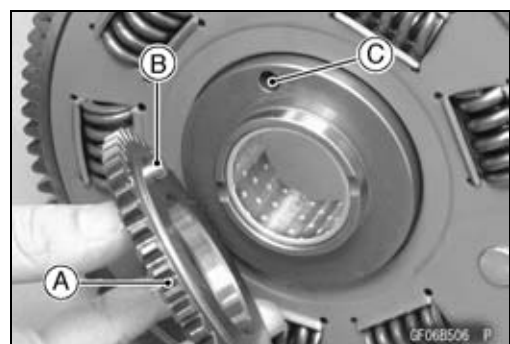
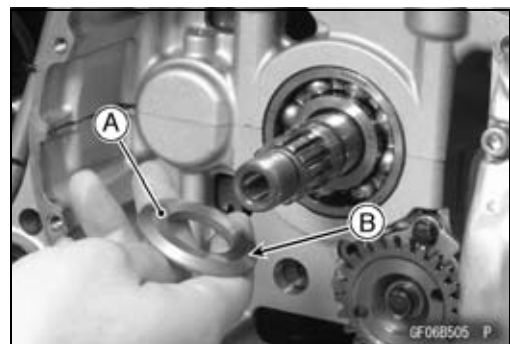
#### Clutch Removal

- Remove:
  - Clutch Cover (see Clutch Cover Removal)
  - Clutch Spring Bolts [A]
  - Clutch Springs
  - Clutch Spring Plate [B]
  - Pusher and Bearing [C]
- Remove:
  - Friction Plates and Steel Plates
- Hold the clutch hub [A] steady with the clutch holder [C], and remove the nut [B] and washers.
  - Special Tool - Clutch Holder: 57001-1243**
- Remove the clutch hub.
- Using the two M6 bolts or screws [A], pull out the collar [B], and then remove the clutch housing [C].
- Remove the spacer.



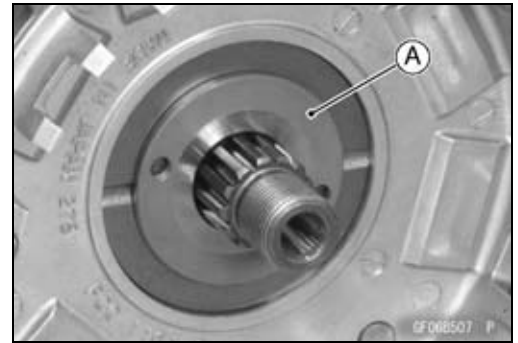
#### Clutch Installation

- Install the spacer [A] so that the chamfered side [B] faces inward.
- Install the oil pump drive gear [A] in the clutch housing.
  - Insert the pin [B] of the drive gear into the hole [C] of the clutch housing.
- Apply engine oil to the sliding surface of the clutch housing.

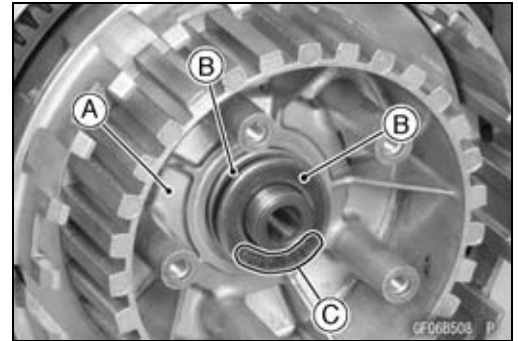


## Clutch

- Install the clutch housing and collar [A].



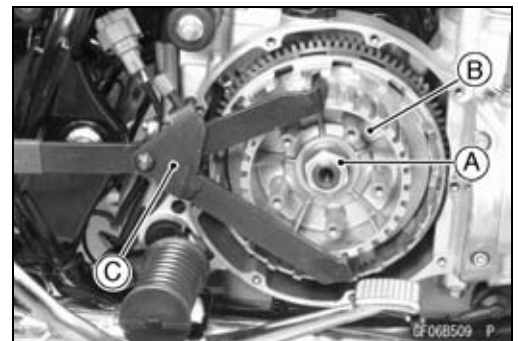
- Install the clutch hub [A].
- Install the washers [B] so that the "OUTSIDE" mark [C] faces outward.



- Replace the clutch hub nut [A] with a new one.
- Hold the clutch hub [B] steady with the clutch holder [C], and tighten the clutch hub nut.

**Special Tool - Clutch Holder: 57001-1243**

**Torque - Clutch Hub Nut: 145 N·m (14.8 kgf·m, 107 ft·lb)**

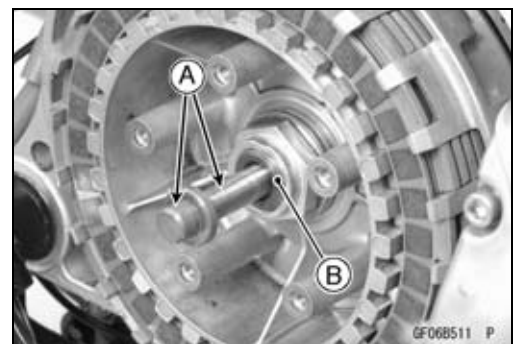
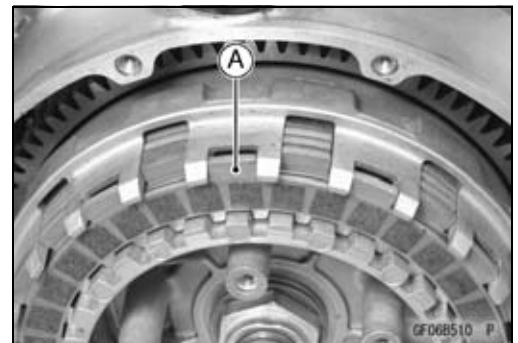


- Install the friction plates and steel plates, starting with a friction plate and alternating them.

### NOTICE

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

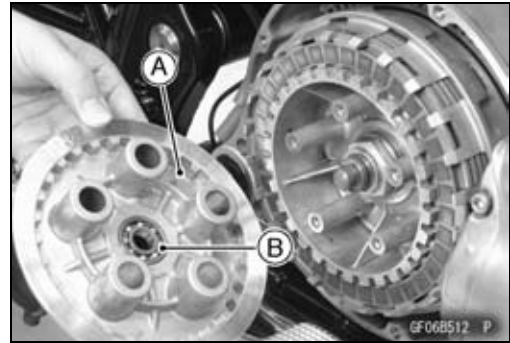
- Install the last friction plate [A] fitting the tangs in the grooves in the housing as shown in the figure.
- Apply molybdenum disulfide grease to the pusher shaft [A], and insert the pusher shaft into the output shaft [B].



## 5-14 CLUTCH

### Clutch

- Install the clutch spring plate [A] after making sure that the bearing [B] is attached to the clutch spring plate.
- Install:
  - Clutch Springs
  - Clutch Spring Bolts
- Tighten:
  - Torque - Clutch Spring Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Install the clutch cover (see Clutch Cover Installation).

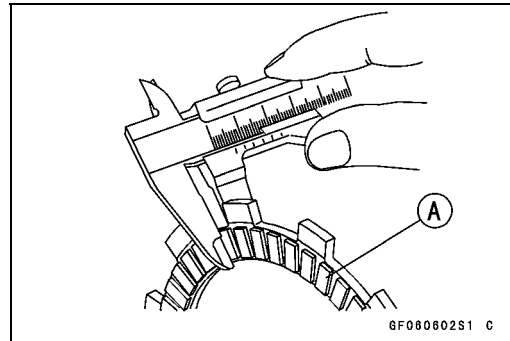


### **Friction and Steel Plate Damage, Wear Inspection**

- Visually inspect the friction and steel plates for signs of seizure, overheating (discoloration), or uneven wear.
- Measure the thickness of the friction plates [A] and steel plate [B] at several points.
- ★ If any plates show signs of damage, or if they have worn past the service limit, replace them with new ones.

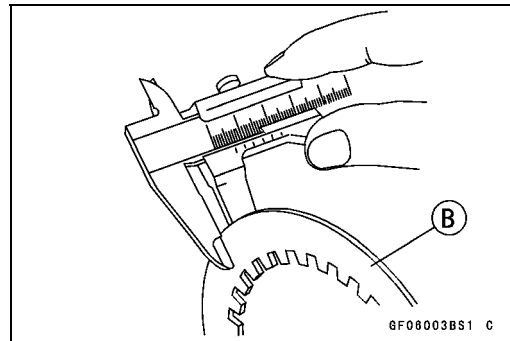
#### **Friction Plate Thickness**

- Standard:** 2.92 ~ 3.08 mm (0.115 ~ 0.121 in.)
- Service Limit:** 2.7 mm (0.11 in.)



#### **Steel Plate Thickness**

- Standard:** 1.46 ~ 1.74 mm (0.057 ~ 0.069 in.)
- Service Limit:** 1.36 mm (0.054 in.)



### **Friction and Steel Plate Warp Inspection**

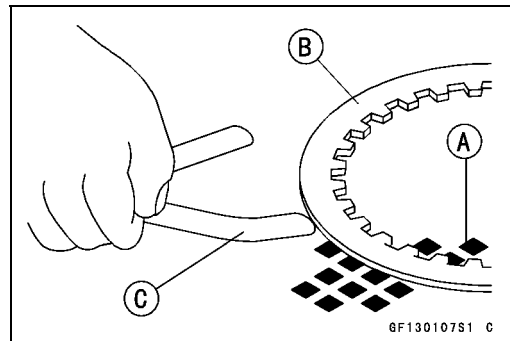
- Place friction plate or steel plate [B] on a surface plate [A], and measure the gap between the surface plate [A] with a thickness gauge [C]. The gap is the amount of friction or steel plate warp.
- ★ If any plate is warped over the service limit, replace it with a new one.

#### **Friction Plate Warp**

- Standard:** 0.15 mm (0.0059 in.) or less
- Service Limit:** 0.3 mm (0.01 in.)

#### **Steel Plate Warp**

- Standard:** 0.2 mm (0.008 in.) or less
- Service Limit:** 0.3 mm (0.01 in.)





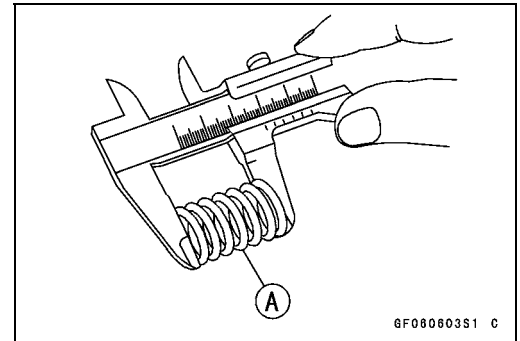
## Clutch

### Clutch Spring Free Length Measurement

- Measure the free length of the clutch springs [A].
- ★ If any spring is shorter than the service limit, it must be replaced.

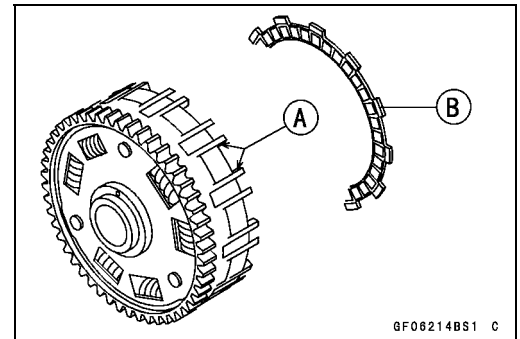
#### Clutch Spring Free Length

Standard:	45.76 mm (1.802 in.)
Service Limit:	43.5 mm (1.71 in.)



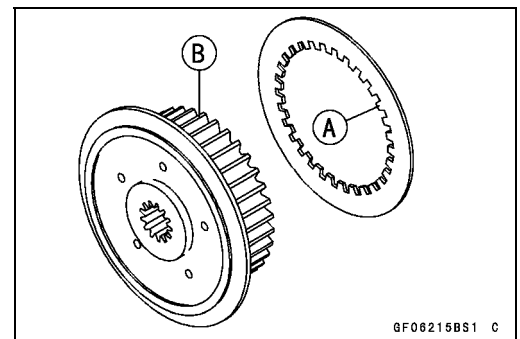
### Clutch Housing Finger Damage Inspection

- Visually inspect the clutch housing fingers [A] where the friction plate tangs [B] 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.



### Clutch Hub Spline Damage Inspection

- Visually inspect where the teeth [A] on the steel plates wear against the clutch hub splines [B].
- ★ If there are notches worn into the clutch hub splines [B], replace the clutch hub. Also, replace the steel plates if their teeth are damaged.





# Engine Lubrication System

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## ENGINE LUBRICATION SYSTEM 6-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Fitting Bracket Bolts (L = 20 mm)	12	1.2	106 in·lb	L
2	Oil Fitting Bracket Bolt (L = 25 mm)	12	1.2	106 in·lb	L
3	Oil Filler Cap	1.5	0.15	13 in·lb	(Hand tighten)
4	Oil Filter Cap Bolts	12	1.2	106 in·lb	L
5	Oil Filter	17	1.7	13	
6	Oil Filter Passage Pipe	25	2.5	18	SS
7	Oil Pressure Relief Nozzle	3.4	0.35	30 in·lb	
8	Oil Passage Nozzle	3.4	0.35	30 in·lb	
9	Oil Pressure Switch Plug	20	2.0	15	L
10	Oil Pressure Switch	15	1.5	11	SS
11	Oil Pump Cover Bolts	9.8	1.0	87 in·lb	L
12	Oil Pump Gear Bolt	12	1.2	106 in·lb	L
13	Oil Pipe Plate Bolt	9.8	1.0	87 in·lb	L
14	Oil Pressure Relief Valve	15	1.5	11	HL
15	Oil Drain Plug	29	3.0	21	
16	Oil Pan Bolts	12	1.2	106 in·lb	L (2)

EO: Apply engine oil.

G: Apply grease.

HL: Apply high-lock agent to the threads.

L: Apply a non-permanent locking agent.

MO: Apply molybdenum disulfide oil solution.

(mixture of engine oil and molybdenum disulfide grease in a weight ratio is 10:1)

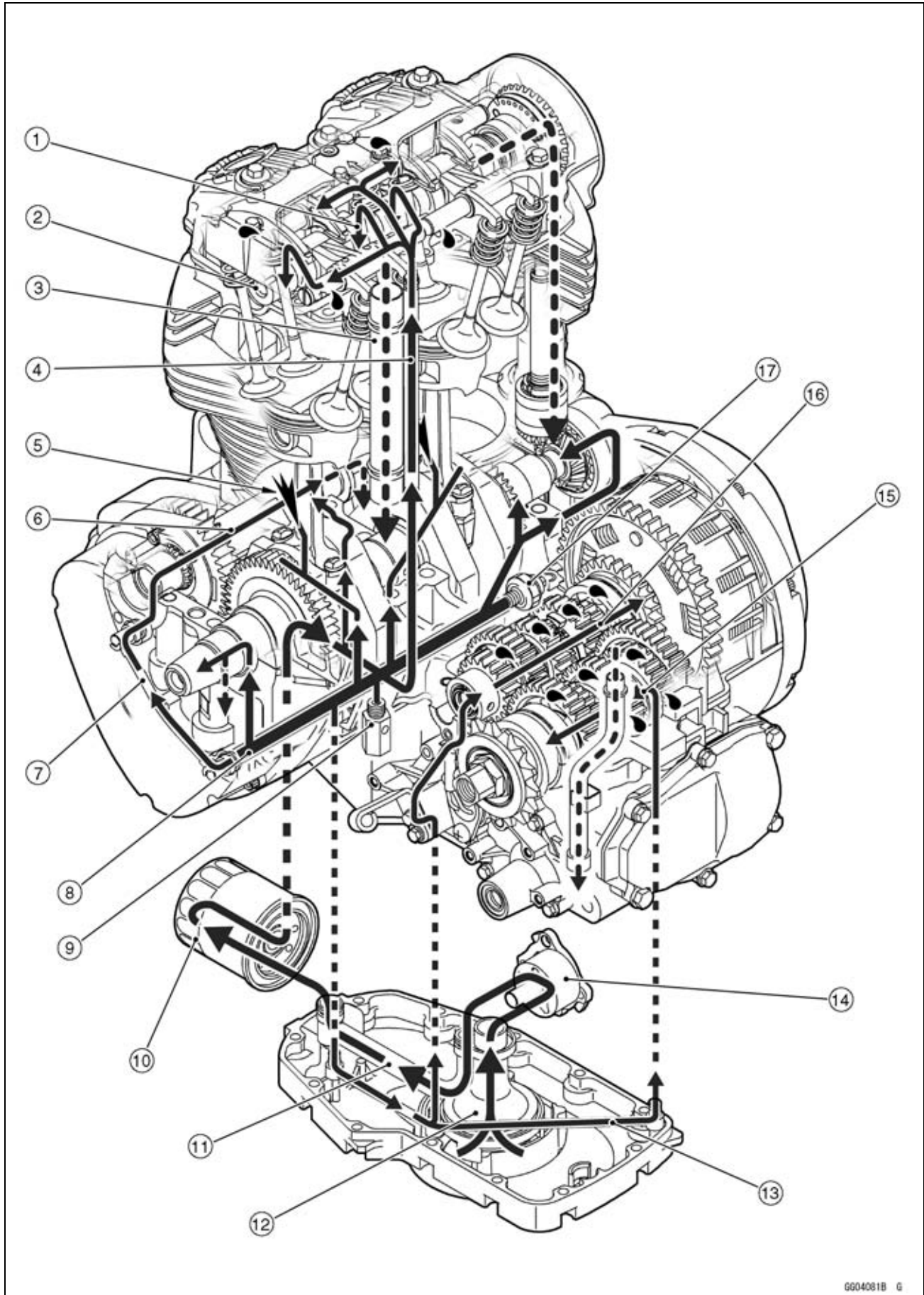
R: Replacement Parts

SS: Apply silicone sealant.

W: Apply water

# 6-4 ENGINE LUBRICATION SYSTEM

## Engine Oil Flow Chart



### Engine Oil Flow Chart

---

1. Oil Fitting Bracket
2. Camshaft
3. Return Side Oil Pipe
4. Pressure Side Oil Pipe
5. Oil Jet
6. Balancer Shaft Oil Passage
7. Oil Pipe
8. Main Oil Passage
9. Oil Pressure Relief Valve
10. Oil Filter
11. Oil Pipe
12. Oil Screen
13. Oil Pipe
14. Oil Pump
15. Output Shaft Oil Passage
16. Drive Shaft Oil Passage
17. Oil Pressure Switch

## 6-6 ENGINE LUBRICATION SYSTEM

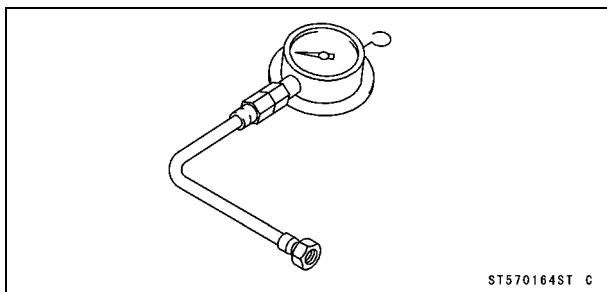
### Specifications

Item	Standard
<b>Engine Oil</b> Type Viscosity Capacity:  Level	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2 SAE 10W-40 2.7 L (2.9 US qt) (when filter is not removed) 2.9 L (3.1 US qt) (when filter is removed) 3.2 L (3.4 US qt) (when engine is completely dry) Between upper and lower level lines (Wait 2 ~ 3 minutes after idling or running)
<b>Oil Pressure Measurement</b> Oil Pressure	310 ~ 410 kPa (3.16 ~ 4.18 kgf/cm <sup>2</sup> , 45 ~ 59 psi) at 3 000 r/min (rpm), Oil Temperature 70 ~ 80°C (158 ~ 176°F)

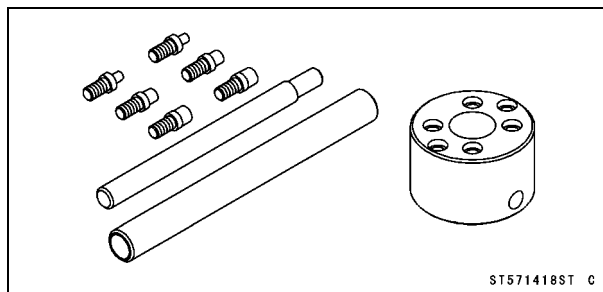


**Special Tools and Sealants**

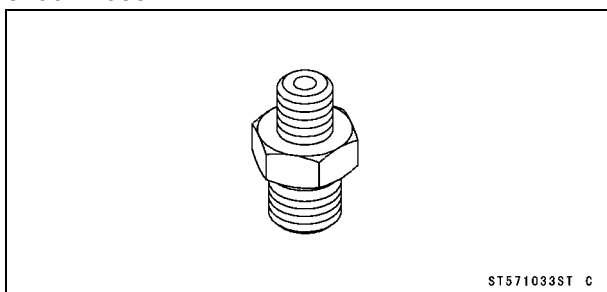
**Oil Pressure Gauge, 10 kgf/cm<sup>2</sup>:  
57001-164**



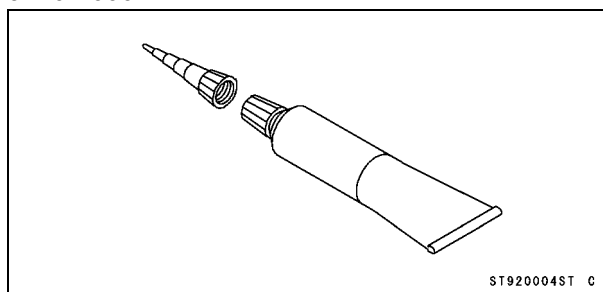
**Holder:  
57001-1418**



**Oil Pressure Gauge Adapter, PT 1/8:  
57001-1033**



**Liquid Gasket, TB1211F:  
92104-0004**



## 6-8 ENGINE LUBRICATION SYSTEM

### Engine Oil and Oil Filter

#### **⚠ WARNING**

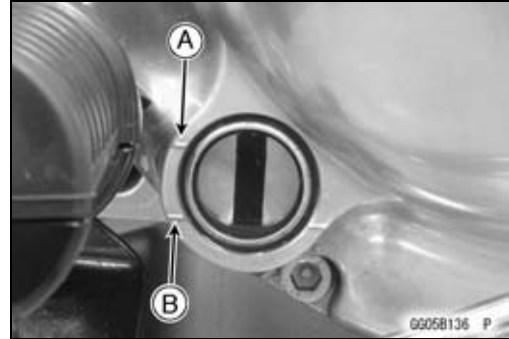
Vehicle operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine seizure, accident, and injury. Check the oil level before each use and change the oil and filter according to the periodic maintenance chart.

#### **Oil Level Inspection**

- Check that the engine oil level is between the upper [A] and lower [B] levels in the gauge.

#### **NOTE**

- Situate the motorcycle so that it is perpendicular to the ground.
- If the motorcycle has just been used, wait several 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.



#### **NOTICE**

Warm up the engine idle. Increasing the engine speed 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 warning indicator light (LED) 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 the Engine Oil Change in the Periodic Maintenance chapter.

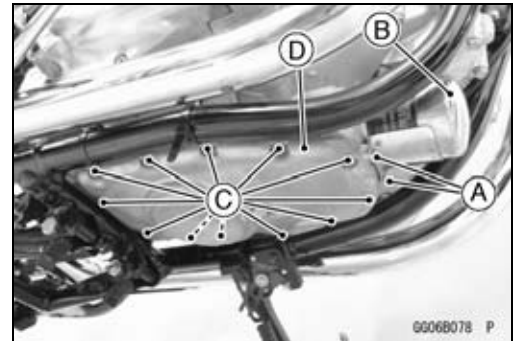
#### **Oil Filter Replacement**

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

## Oil Pan

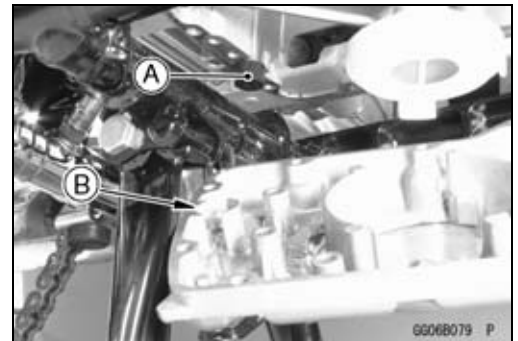
### Oil Pan Removal

- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Remove:
  - Oil Filter Cap Bolts [A]
  - Oil Filter Cap [B]
  - Oil Pan Bolts [C]
  - Oil Pan [D]

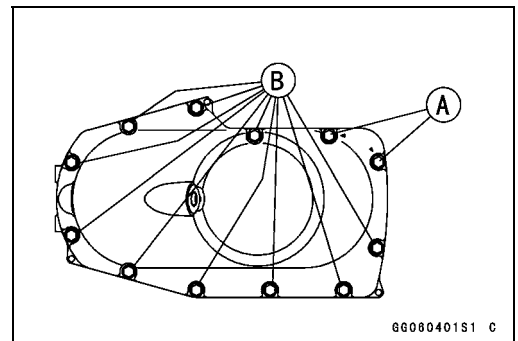


### Oil Pan Installation

- Replace the oil pan gasket with a new one.
- Install the breather pipe damper [A].
- Fit the breather pipe damper on the hole [B] and install the oil pan.



- Apply a non-permanent locking agent to the two oil pan bolts [A].
- Tighten the oil pan bolts [A] [B].
  - Torque - Oil Pan Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**
- Install the oil filter cap.
- Apply a non-permanent locking agent to the threads of the oil filter cap bolt.
- Tighten the oil filter cap bolts.
  - Torque - Oil Filter Cap Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**

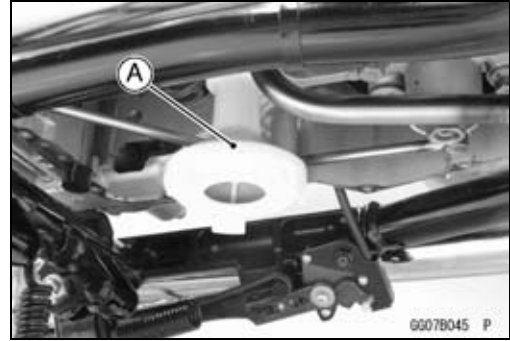


## 6-10 ENGINE LUBRICATION SYSTEM

### Oil Screen

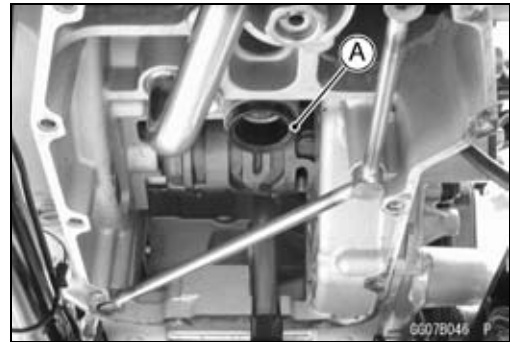
#### Oil Screen Removal

- Remove:
  - Oil Pan (see Oil Pan Removal)
  - Oil Screen [A]



#### Oil Screen Installation

- Clean the oil screen (see Oil Screen Cleaning).
- Install the O-ring [A].
- Install the oil screen.



#### Oil Screen Cleaning

- Remove the oil screen (see Oil Screen Removal).
- Clean the oil screen with a high-flash point solvent and remove the particles stuck.
- Blow away the particles by applying compressed air [A] from the inside to the outside (from the clean side to the dirty side).



#### **⚠ WARNING**

**Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the screen in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the screen.**

#### **NOTE**

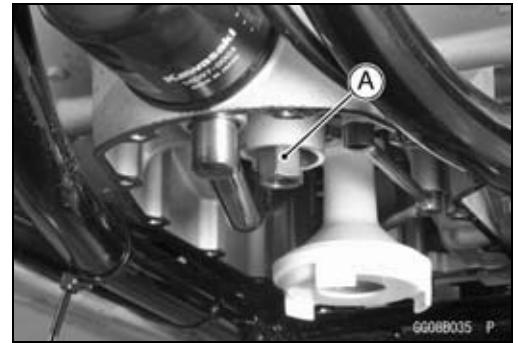
○ While cleaning the screen, check for any metal particles that might indicate internal engine damage.

- Check the screens carefully for any damage.
- ★ If the screen is damaged, replace the oil screen.

## Oil Pressure Relief Valve

### Oil Pressure Relief Valve Removal

- Remove:
  - Oil Pan (see Oil Pan Removal)
  - Oil Pressure Relief Valve [A]



### Oil Pressure Relief Valve Installation

- Apply a high-lock agent to the threads of the oil pressure relief valve, and tighten it.
  - Torque - Oil Pressure Relief Valve: 15 N·m (1.5 kgf·m, 11 ft·lb)

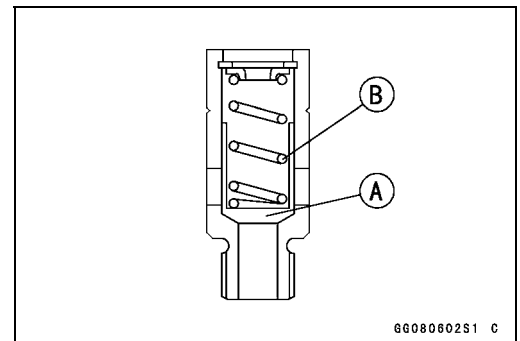
### Oil Pressure Relief Valve Inspection

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



#### **⚠ WARNING**

**Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the oil pressure relief valve in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the oil pressure relief valve.**

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

# 6-12 ENGINE LUBRICATION SYSTEM

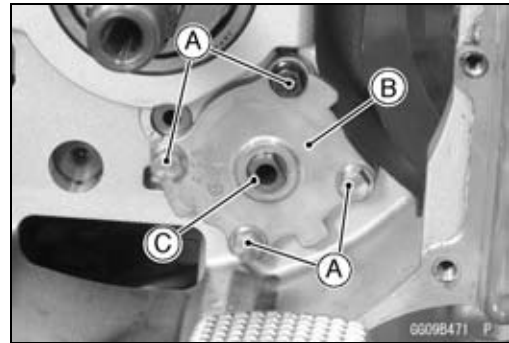
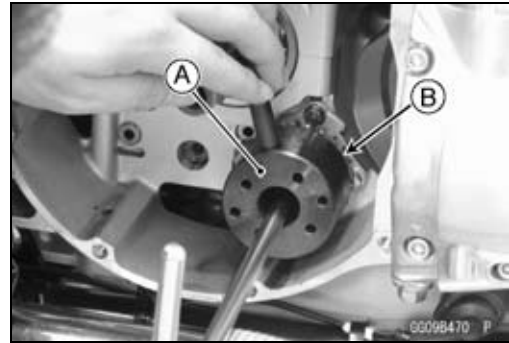
## Oil Pump

### Oil Pump Removal

- Remove:
  - Clutch Cover (see Clutch Cover Removal in the Clutch chapter)
  - Clutch Housing (see Clutch Removal in the Clutch chapter)
- Using the holder [A] to hold the oil pump gear [B], remove the oil pump gear bolt.

**Special Tool - Holder: 57001-1418**

- Remove the oil pump cover bolts [A] and oil pump cover [B].
- Remove:
  - Oil Pump Shaft [C]
  - Oil Pump Body
  - Rotor



### Oil Pump Installation

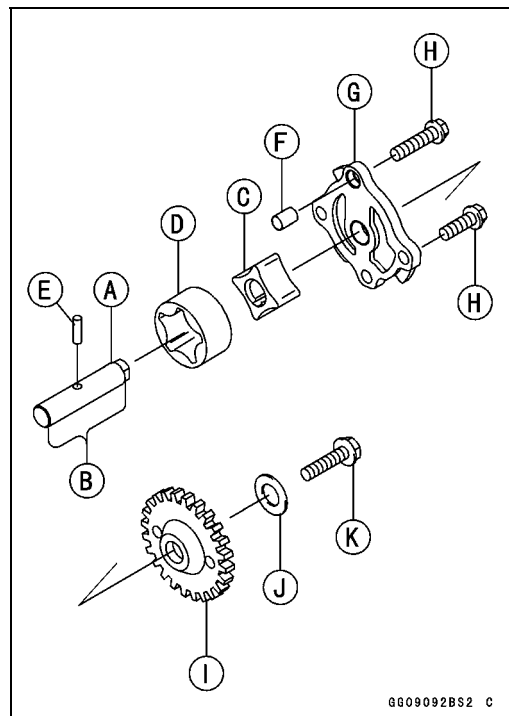
- Apply molybdenum disulfide oil solution [B] to the oil pump shaft [A].
- Install the rotor [C] and pump body [D] on the pump shaft.
- Install the pin [E] in the pin hole of the pump shaft, and fit it into the rotor groove.
- Install the pump assembly.
- Install the dowel pin [F].
- Install the pump cover [G].
- Apply a non-permanent locking agent to the pump cover bolts [H] and tighten them.

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

- Install the oil pump gear [I].
- Place a washer [J] on the oil pump gear bolt [K] and apply a non-permanent locking agent to the bolt.
- Using the holder to hold the oil pump gear, tighten the gear bolt.

**Special Tool - Holder: 57001-1418**

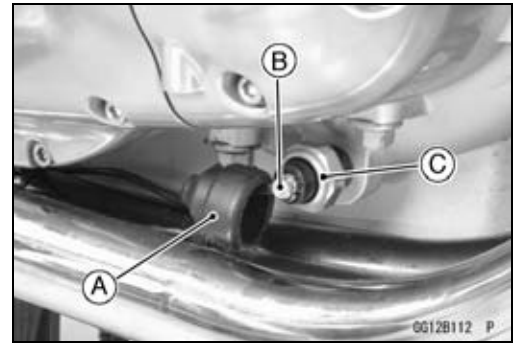
**Torque - Oil Pump Gear Bolt: 12 N·m (1.2 kgf·m, 106 in·lb)**



## Oil Pressure Measurement

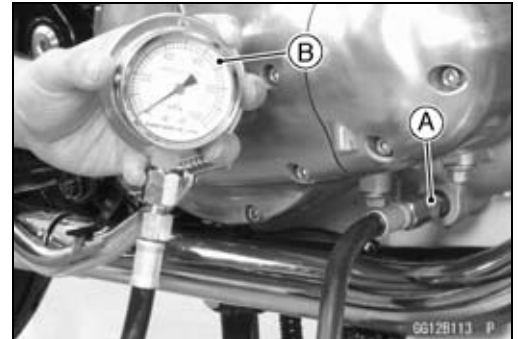
### Oil Pressure Measurement

- Slide out the rubber boot [A].
- Remove:
  - Oil Pressure Switch Terminal Bolt [B]
  - Oil Pressure Switch [C]



- Attach the adapter [A] and gauge [B] to the oil pressure switch fitting hole.

**Special Tools - Oil Pressure Gauge, 10 kgf/cm<sup>2</sup>: 57001-164**  
**Oil Pressure Gauge Adapter, PT1/8: 57001-1033**



- Start the engine and warm up the engine.

### NOTE

○ Start the engine and wait until the engine completes the fast-idle operation (Do not snap the throttle while the fast-idle operation.). Then warm up the engine while snapping the throttle so that the engine speed is not exceeding 3 000 r/min (rpm).

- Run the engine at the specified speed, and read the oil pressure gauge.
- ★ If the measured oil pressure is considerably lower than the standard, inspect the oil pump and the relief valve. If the oil pump and the relief valve do not exhibit any abnormal conditions, inspect the remaining areas of the lubrication system.
- ★ If the measured oil pressure is considerably higher than the standard, inspect the oil filter and other areas of the lubrication system for contamination or clogging.

### Oil Pressure

**Standard: 310 ~ 410 kPa (3.16 ~ 4.18 kgf/cm<sup>2</sup>, 45 ~ 59 psi) at 3 000 r/min (rpm), oil temperature 70 ~ 80°C (158 ~ 176°F)**

- Stop the engine.
- Remove the oil pressure gauge and adapter.

### **⚠ WARNING**

**Hot oil can cause severe burns. Beware of hot engine oil that will drain through the oil passage when the gauge adapter is removed.**

- Apply a liquid gasket to the threads of the oil pressure switch, and tighten it.

**Sealant - Liquid Gasket, TB1211F: 92104-0004**

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

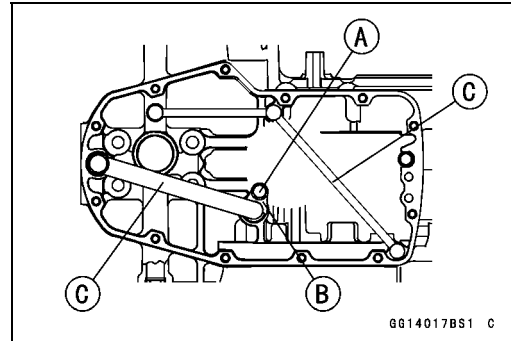
## 6-14 ENGINE LUBRICATION SYSTEM

### Oil Pipes and Oil Fittings

#### Oil Pipe and Fitting Removal

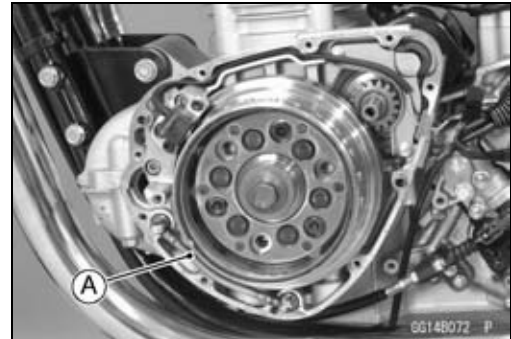
##### Oil Pipe at Engine Bottom

- Remove:
  - Oil Pan (see Oil Pan Removal)
  - Oil Screen (see Oil Screen Removal)
  - Oil Pipe Plate Bolt [A]
  - Oil Pipe Plate [B]
  - Oil Pipes [C]



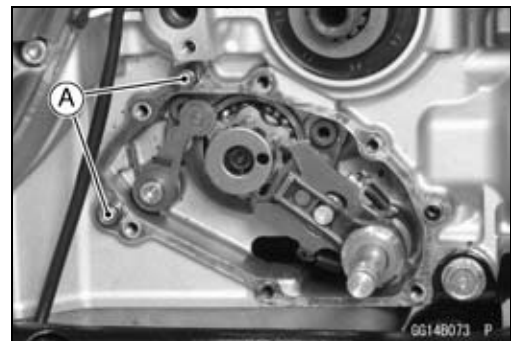
##### Oil Pipe at Alternator

- Remove:
  - Alternator Cover (see Alternator Cover Removal in the Electrical System chapter)
  - Oil Pipe [A]



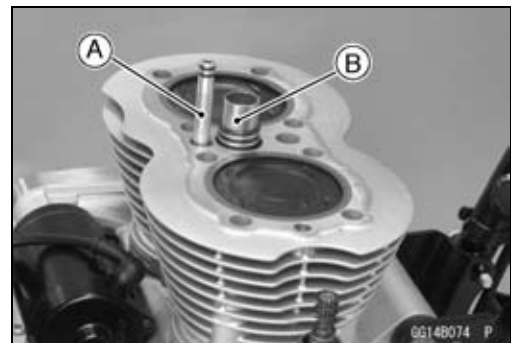
##### Oil Fitting Pin at Outer Shift Mechanism

- Remove:
  - External Shift Mechanism Cover (see External Shift Mechanism Cover Removal in the Crankshaft/Transmission chapter)
  - Oil Fitting Pins [A]



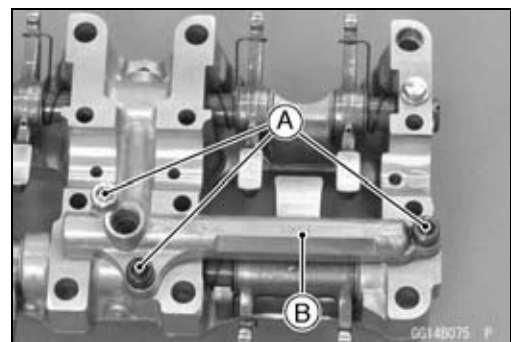
##### Oil Pump at Cylinder

- Remove:
  - Cylinder Head (see Cylinder Head Removal in the Engine Top End chapter)
  - Pressure Side Oil Pipe [A]
  - Return Side Oil Pipe [B]



##### Oil Fitting Bracket at Camshaft Cap

- Remove:
  - Camshaft Cap (see Camshaft Removal in the Engine Top End chapter)
  - Bolts [A]
  - Oil Fitting Bracket [B]





---

## Oil Pipes and Oil Fittings

---

### Oil Fitting Pin at Cylinder Head

- Remove:
  - Camshaft Cap (see Camshaft Removal in the Engine Top End chapter)
  - Oil Fitting Pin [A]



### ***Oil Pipe and Fitting Installation***

- Replace the O-rings with new ones.
- Apply grease to the O-rings and install the O-rings.
- Clean the oil screen in solvent (see Oil Screen Cleaning).
- Check the oil screen for any damage, holes, or torn mesh.
- Apply a non-permanent locking agent to the oil pipe plate bolt and oil fitting bracket bolts, and tighten them.

**Torque - Oil Pipe Plate Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)**

**Oil Fitting Bracket Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**



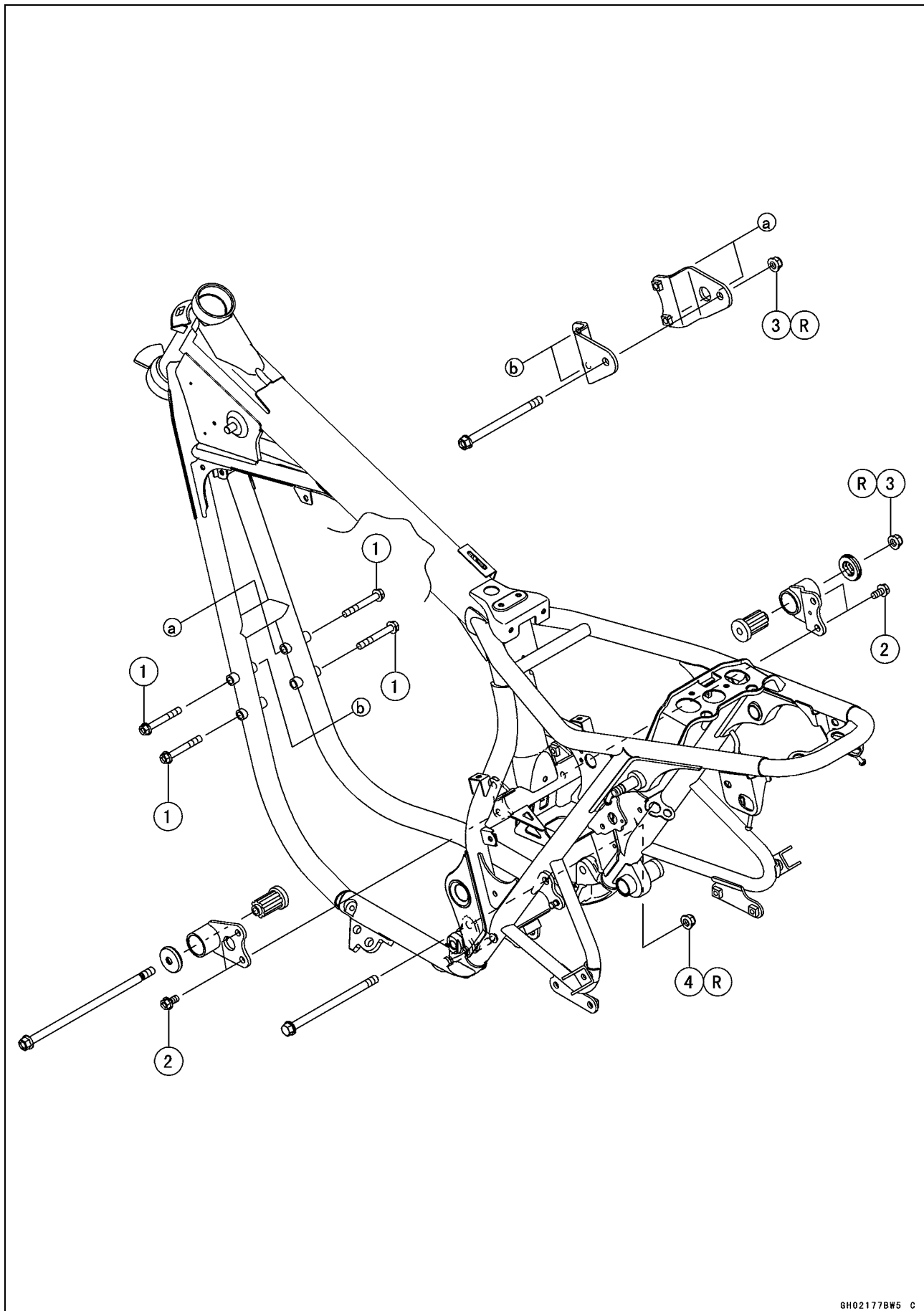
# Engine Removal/Installation

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# 7-2 ENGINE REMOVAL/INSTALLATION

## Exploded View



## ENGINE REMOVAL/INSTALLATION 7-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Bracket Bolts (L = 60 mm)	25	2.5	18	
2	Engine Bracket Bolts (L = 16 mm)	25	2.5	18	
3	Engine Mounting Nuts	44	4.5	32	R
4	Lower Engine Mounting Nut	59	6.0	44	R

R: Replacement Parts

## 7-4 ENGINE REMOVAL/INSTALLATION

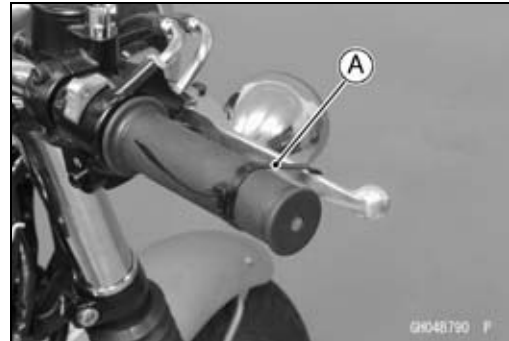
### Engine Removal/Installation

#### Engine Removal

- Set the motorcycle on its center stand.
- Squeeze the brake lever slowly and hold it with a band [A].

#### **⚠ WARNING**

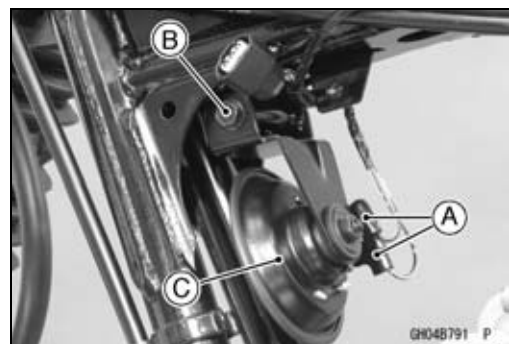
**Motorcycle may fall over unexpectedly resulting in an accident or injury. Be sure to hold the front brake when removing the engine.**



#### **NOTICE**

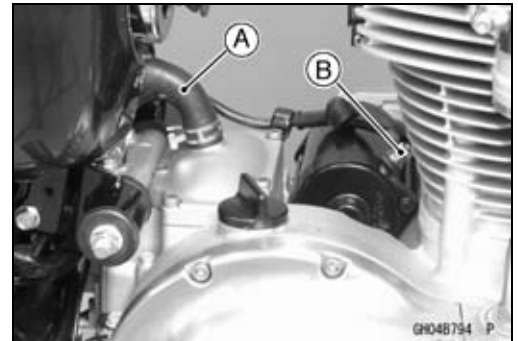
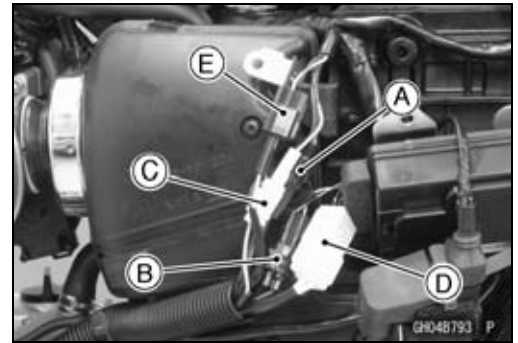
**Be sure to hold the front brake when removing the engine, or the motorcycle may fall over. The engine or the motorcycle could be damaged.**

- Drain:  
Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)
- Remove:  
Seat (see Seat Removal in the Frame chapter)  
Fuel Tank (see Fuel Tank Removal in the Fuel System chapter)  
Muffler (see Muffler Removal in the Engine Top End chapter)  
Throttle Body Assy (see Throttle Body Assy Removal in the Fuel System chapter)  
Ignition Coil (see Ignition Coil Removal in the Electrical System chapter)  
Brake Pedal (see Brake Pedal Removal in the Brake chapter)  
Right Front Step  
Shift Pedal (see Shift Pedal Removal in the Crankshaft/Transmission chapter)  
Engine Sprocket (see Engine Sprocket Removal in the Final Drive chapter)  
Clutch Cable Lower End (see Clutch Cable Removal in the Clutch chapter)
- Disconnect the horn lead terminals [A].
- Remove the bolt [B].
- Take off the horn [C].

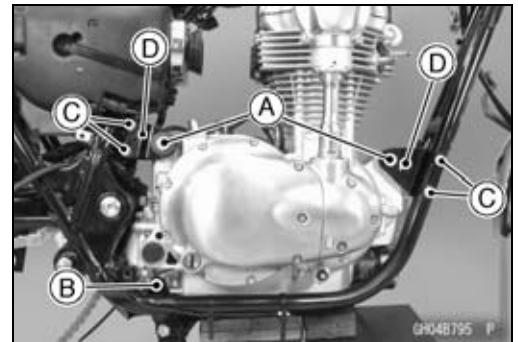


## Engine Removal/Installation

- Remove the junction box (see Alternator Cover Removal in the Electrical System chapter).
- Disconnect:
  - Speed Sensor Lead Connector [A]
  - Side Stand Switch Lead Connector [B]
  - Neutral Switch Lead connector [C]
  - Alternator Lead Connector [D]
  - Crankshaft Sensor Lead Connector [E]
  - Oil Pressure Switch Lead (see Oil Pressure Measurement in the Engine Lubrication System)
  - Battery Ground Lead (at battery)
- Remove:
  - Breather Hose [A]
  - Starter Motor Cable [B]



- Remove:
  - Engine Mounting Nuts [A]
  - Lower Engine Mounting Nut [B]
  - Engine Bracket Bolts [C] (Both Sides)
  - Engine Brackets [D] (Both Sides)
- While raising the engine, pull out the engine mounting bolts.
- Raise the engine so that the rear bottom area of the engine is higher than the frame bracket (bracket for engine bolt), turn it to the right, and pull out the engine.



### Engine Installation

- Replace the engine mounting nuts and lower engine mounting nut with new ones.
- Install the engine from the right side of the frame.
- Hang the drive chain over the output shaft.
- Insert the lower engine mounting bolt [A] from the left.
- Install the engine brackets [B] temporarily.
- Temporarily tighten the engine mounting bolts and nuts.
- Tighten :

**Torque - Engine Mounting Nuts [C]: 44 N·m (4.5 kgf·m, 32 ft·lb)**

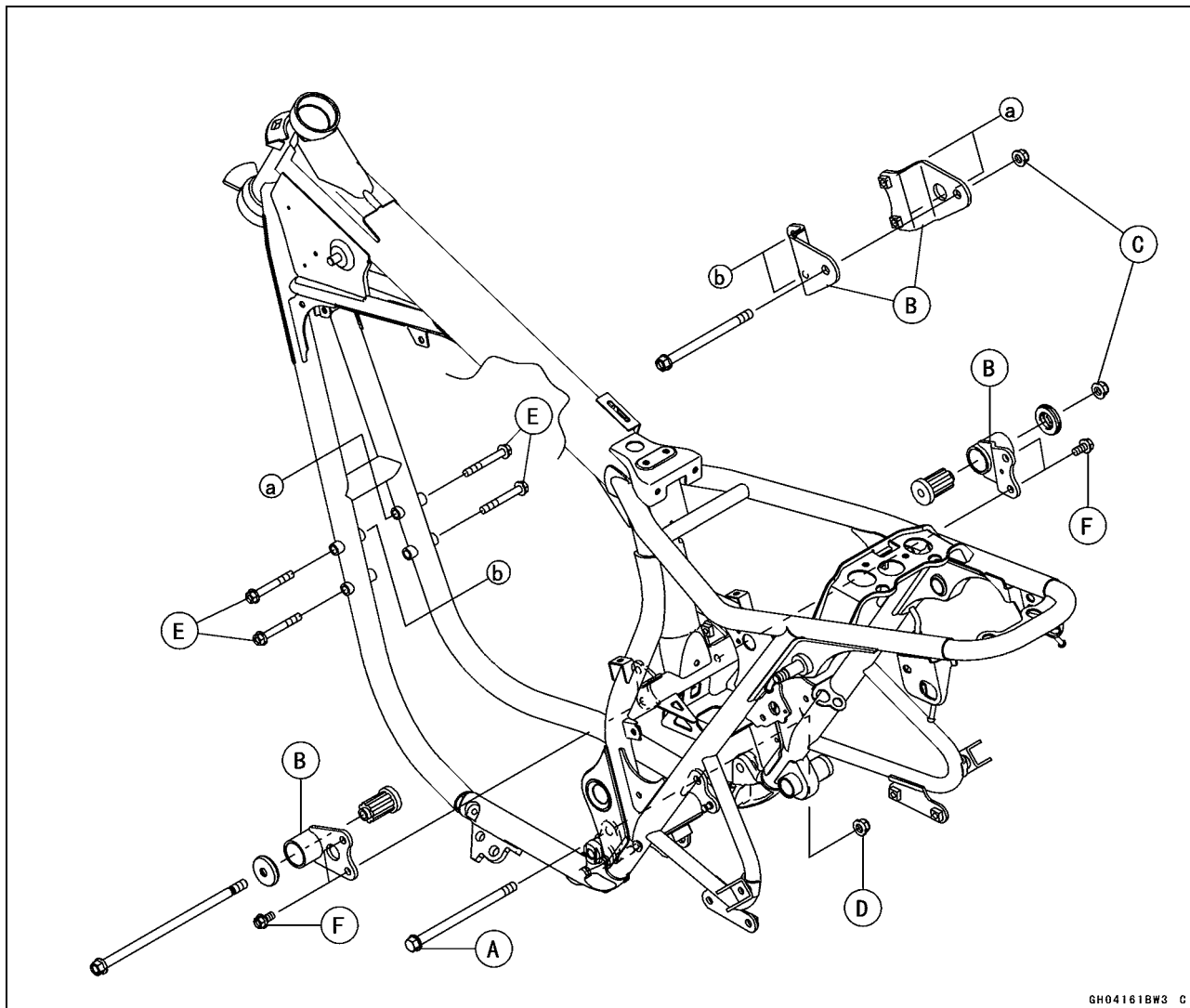
**Lower Engine Mounting Nut [D]: 59 N·m (6.0 kgf·m, 44 ft·lb)**

**Engine Bracket Bolts (L = 60 mm) [E]: 25 N·m (2.5 kgf·m, 18 ft·lb)**

**Engine Bracket Bolts (L = 16 mm) [F]: 25 N·m (2.5 kgf·m, 18 ft·lb)**

## 7-6 ENGINE REMOVAL/INSTALLATION

### Engine Removal/Installation



GH04161BW3 C

- Refer to the Cable, Wire, and Hose Routing in the Appendix chapter.
- Install the removed parts (see the respective chapters).
- Adjust:
  - Throttle Cables (see Throttle Control System Inspection in the Periodic Maintenance chapter)
  - Clutch Cable (see Clutch Operation Inspection in the Periodic Maintenance chapter)
  - Drive Chain (see Drive Chain Slack Inspection in the Periodic Maintenance chapter)
- Fill the engine with engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Adjust the idling (see Idle Speed Adjustment in the Periodic Maintenance chapter).



# Crankshaft/Transmission

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**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Connecting Rod Big End Cap Nuts	see the text	←	←	MO
2	Breather Cap Bolts	12	1.2	106 in·lb	
3	Starter Motor Clutch Bolts	34	3.5	25	L
4	Breather Plate Screws	4.9	0.50	43 in·lb	L
5	External Shift Mechanism Cover Bolts (M6, L = 35 mm)	12	1.2	106 in·lb	
6	Neutral Switch Screws	3.9	0.40	35 in·lb	L
7	External Shift Mechanism Cover Bolts (M6, L = 25 mm)	12	1.2	106 in·lb	L
8	Return Spring Pin	42	4.3	31	L
9	Rear Engine Cover Bolts (M6, L = 30 mm)	12	1.2	106 in·lb	
10	Rear Engine Cover Bolts (M6, L = 22 mm)	12	1.2	106 in·lb	
11	Upper Crankcase Bolts (M8, L = 73 mm)	29	3.0	21	CP (1)
12	Upper Crankcase Bolt (M6, L = 45 mm)	20	2.0	15	
13	Upper Crankcase Bolt (M6, L = 70 mm)	20	2.0	15	
14	Upper Crankcase Bolts (M6, L = 117 mm)	20	2.0	15	
15	Upper Crankcase Bolts (M8, L = 50 mm)	29	3.0	21	
16	Lower Crankcase Bolts (M9, L = 130 mm)	41	4.2	30	S, MO
17	Lower Crankcase Bolts (M9, L = 110 mm)	41	4.2	30	S, MO
18	Lower Crankcase Bolt (M9, L = 90 mm)	41	4.2	30	S, MO
19	Lower Crankcase Bolts (M6, L = 45 mm)	20	2.0	15	S
20	Lower Crankcase Bolts (M8, L = 73 mm)	29	3.0	21	S, MO, CP (1)
21	Lower Crankcase Bolt (M6, L = 32 mm)	20	2.0	15	S
22	Lower Crankcase Bolt (M8, L = 60 mm)	29	3.0	21	S, MO

CP: Bolt with copper-plated washer.

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

LG: Apply liquid gasket.

MO: Apply molybdenum disulfide oil solution.

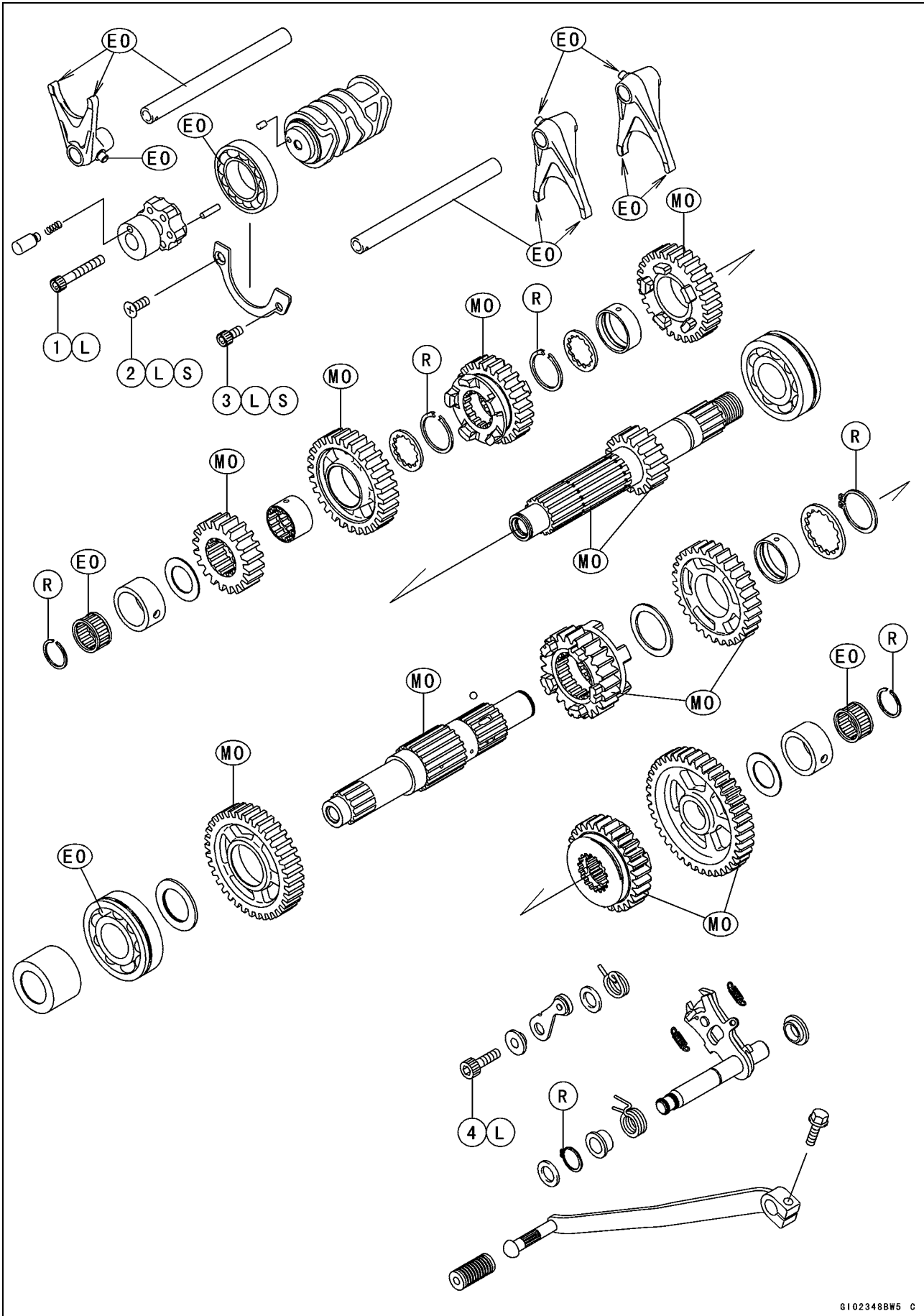
(mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10:1)

R: Replacement Parts

S: Follow the specified tightening sequence.

# 8-4 CRANKSHAFT/TRANSMISSION

## Exploded View



## CRANKSHAFT/TRANSMISSION 8-5

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Shift Drum Cam Bolt	12	1.2	106 in·lb	L
2	Shift Drum Bearing Holder Screw	4.9	0.50	43 in·lb	S, L
3	Shift Drum Bearing Holder Bolt	12	1.2	106 in·lb	S, L
4	Gear Positioning Lever Bolt	12	1.2	106 in·lb	L

EO: Apply engine oil.

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

MO: Apply molybdenum disulfide oil solution.

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

R: Replacement part

S: Tighten the fasteners following the specified sequence.

## 8-6 CRANKSHAFT/TRANSMISSION

### Specifications

Item	Standard	Service Limit
<b>Crankshaft, Connecting Rods</b>		
Connecting Rod Bend	—	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	—	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Big End Side Clearance	0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)	0.58 mm (0.023 in.)
Connecting Rod Big End Bearing Insert/Crankpin Clearance	0.017 ~ 0.041 mm (0.0007 ~ 0.0016 in.)	0.08 mm (0.003 in.)
Crankpin Diameter:	37.984 ~ 38.000 mm (1.4954 ~ 1.4961 in.)	37.97 mm (1.495 in.)
Marking	None	—
	○	—
Connecting Rod Big End Inside Diameter:	41.000 ~ 41.016 mm (1.6142 ~ 1.6148 in.)	—
Marking	None	—
	○	—
Connecting Rod Big End Bearing Insert Thickness:		
	Brown	1.475 ~ 1.480 mm (0.0581 ~ 0.0583 in.)
	Black	1.480 ~ 1.485 mm (0.0583 ~ 0.0585 in.)
	Blue	1.485 ~ 1.490 mm (0.0585 ~ 0.0587 in.)
Connecting Rod Bolt Stretch	see text.	—
Crankshaft Side Clearance	0.05 ~ 0.20 mm (0.002 ~ 0.0079 in.)	0.40 mm (0.016 in.)
Crankshaft Runout	TIR 0.02 mm (0.0008 in.) or less	TIR 0.05 mm (0.002 in.)
Crankshaft Main Bearing Insert/Journal Clearance	0.016 ~ 0.040 mm (0.0006 ~ 0.0016 in.)	0.07 mm (0.003 in.)
Crankshaft Main Journal Diameter:	37.984 ~ 38.000 mm (1.4954 ~ 1.4961 in.)	37.96 mm (1.494 in.)
Marking	None	—
	1	—
Crankcase Main Bearing Inside Diameter:	41.000 ~ 41.016 mm (1.6142 ~ 1.6148 in.)	—
Marking	○	—
	None	—
	41.009 ~ 41.016 mm (1.6145 ~ 1.6148 in.)	—

## CRANKSHAFT/TRANSMISSION 8-7

### Specifications

Item	Standard	Service Limit
Crankshaft Main Bearing Insert Thickness:		
Brown	1.490 ~ 1.494 mm (0.0587 ~ 0.0588 in.)	-
Black	1.494 ~ 1.498 mm (0.0588 ~ 0.0590 in.)	-
Blue	1.498 ~ 1.502 mm (0.0590 ~ 0.0591 in.)	-
<b>Balancer shaft</b>		
Balancer Shaft Bearing Insert/Journal Clearance	0.016 ~ 0.038 mm (0.0006 ~ 0.0015 in.)	0.07 mm (0.003 in.)
Balancer Shaft Journal Diameter:	27.987 ~ 28.000 mm (1.1018 ~ 1.1024 in.)	27.97 mm (1.101 in.)
Marking	None	-
○	27.987 ~ 27.993 mm (1.1018 ~ 1.1021 in.)	-
○	27.994 ~ 28.000 mm (1.1021 ~ 1.1024 in.)	-
Crankcase Bearing Inside Diameter:	31.000 ~ 31.016 mm (1.2205 ~ 1.2211 in.)	-
Marking	None	-
○	31.000 ~ 31.008 mm (1.2205 ~ 1.2208 in.)	-
○	31.009 ~ 31.016 mm (1.2208 ~ 1.2211 in.)	-
Balancer Shaft Bearing Insert Thickness:		
Brown	1.490 ~ 1.494 mm (0.0587 ~ 0.0588 in.)	-
Black	1.494 ~ 1.498 mm (0.0588 ~ 0.0590 in.)	-
Blue	1.498 ~ 1.502 mm (0.0590 ~ 0.0591 in.)	-
<b>Transmission</b>		
Shift Fork Ear Thickness	5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)	5.8 mm (0.23 in.)
Gear Groove Width	6.05 ~ 6.15 mm (0.238 ~ 0.242 in.)	6.3 mm (0.25 in.)
Shift Fork Guide Pin Diameter	5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)	5.8 mm (0.23 in.)
Shift Drum Groove Width	6.05 ~ 6.20 mm (0.238 ~ 0.244 in.)	6.3 mm (0.25 in.)

## 8-8 CRANKSHAFT/TRANSMISSION

### Specifications

#### Connecting Rod Big End Bearing Insert Selection

Connecting Rod Big End Inside Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
○	○	Black	92028-1907
None	None		
○	None	Blue	92028-1906
None	○	Brown	92028-1908

#### Crankshaft Main Bearing Insert Selection

Crankcase Main Bearing Inside Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert	
		Size Color	Part Number
○	1	Brown	92028-1905
None	None	Blue	92028-1903
None	1	Black	92028-1904
○	None		

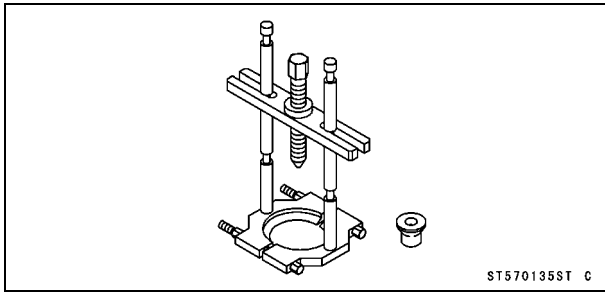
#### Balancer Shaft Bearing Insert Selection

Crankcase Bearing Inside Diameter Marking	Balancer Shaft Journal Diameter Marking	Bearing Insert	
		Size Color	Part Number
○	○	Brown	92028-1911
None	None	Blue	92028-1909
None	○	Black	92028-1910
○	None		

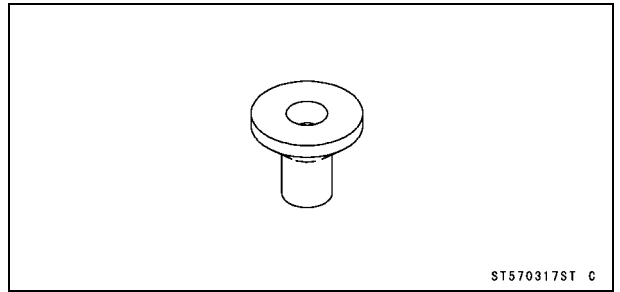


**Special Tools and Sealants**

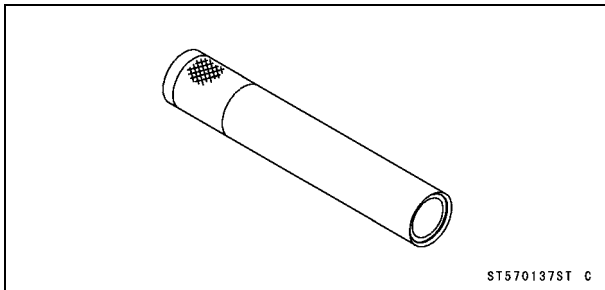
**Bearing Puller:  
57001-135**



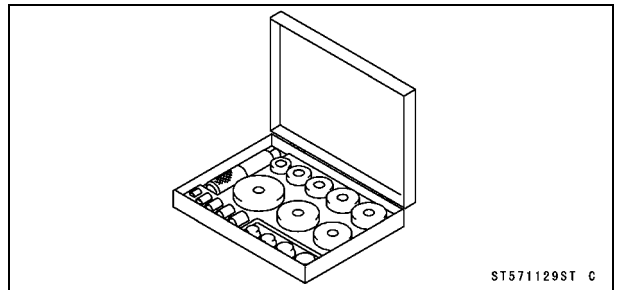
**Bearing Puller Adapter:  
57001-317**



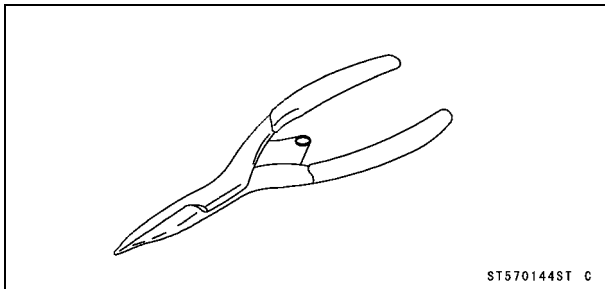
**Steering Stem Bearing Driver:  
57001-137**



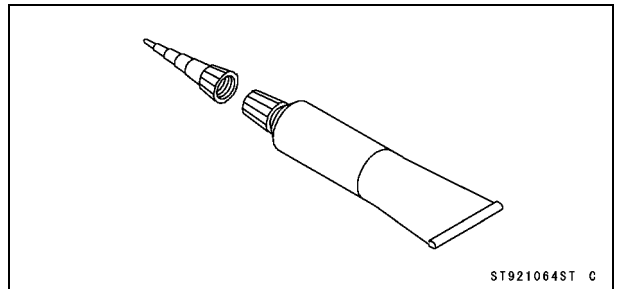
**Bearing Driver Set:  
57001-1129**



**Outside Circlip Pliers:  
57001-144**



**Liquid Gasket, TB1216B:  
92104-1064**

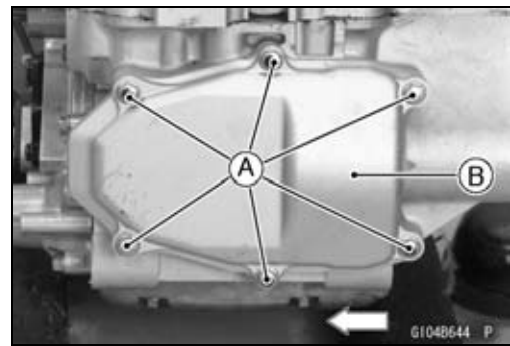


## 8-10 CRANKSHAFT/TRANSMISSION

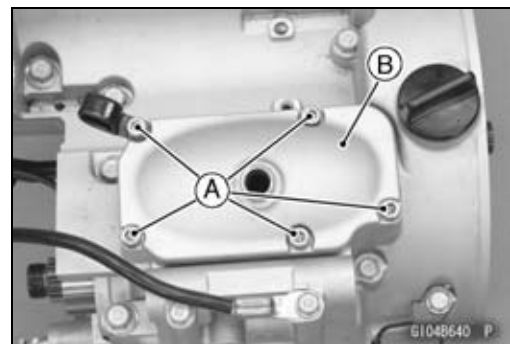
### Crankcase

#### **Crankcase Splitting**

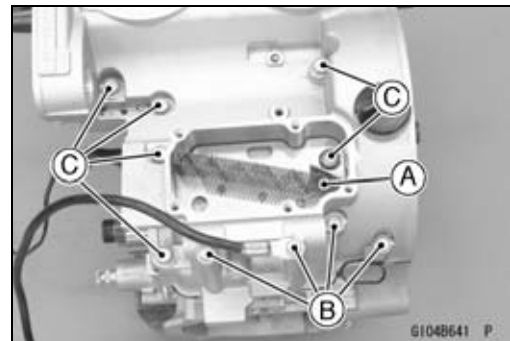
- Remove the engine (see Engine Removal in the Engine Removal/Installation chapter).
- Set the engine on a clean surface and hold the engine steady while parts are being removed.
- Remove:
  - Starter Motor (see Starter Motor Removal in the Electrical System chapter)
  - Alternator (see Alternator Removal in the Electrical System chapter)
  - Crankshaft Sensor (see Crankshaft Sensor Removal in the Electrical System chapter)
  - Clutch Cover (see Clutch Cover Removal in the Clutch chapter)
  - Bevel Gear Case (see Bevel Gear Case Removal in the Engine Top End chapter)
- ★ If the crankshaft is to be removed, remove the pistons (see Piston Removal in the Engine Top End chapter).
- ★ If the driveshaft is to be removed, remove the clutch (see Clutch Removal in the Clutch chapter).
- Remove the rear engine cover bolts [A] and the rear engine cover [B] by sliding it towards the left side.



- Remove:
  - Breather Cap Bolts [A]
  - Breather Cap [B]

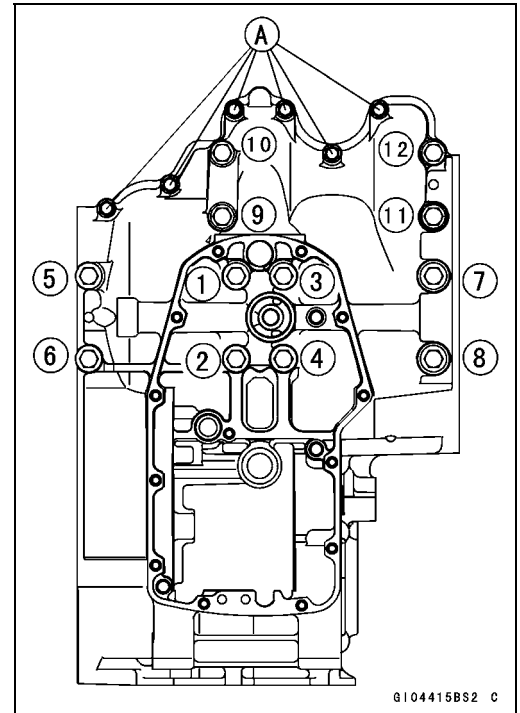


- Pull out the breather separator [A].
- Remove the upper crankcase bolts following the specified sequence.
  - M6 Bolts [B]
  - M8 Bolts [C]
- Turn the engine upside down, and remove the following parts.
  - Oil Pan (see Oil Pan Removal in the Engine Lubrication System chapter)
  - Oil Pipes (see Oil Pipe Removal in the Engine Lubrication System chapter)
  - Oil Screen (see Oil Screen Removal in the Engine Lubrication System chapter)



## Crankcase

- Remove the lower crankcase bolts following the specified sequence.
  - First, loosen the M6 bolts [A].
  - Second, loosen the M8 bolts as shown sequence [12 ~ 9] in the figure.
  - Lastly, loosen the M9 bolts as shown sequence [8 ~ 1] in the figure.
- Tap lightly around the crankcase mating surface with a plastic mallet, and split the crankcase.
  - Take care not to damage the crankcase.

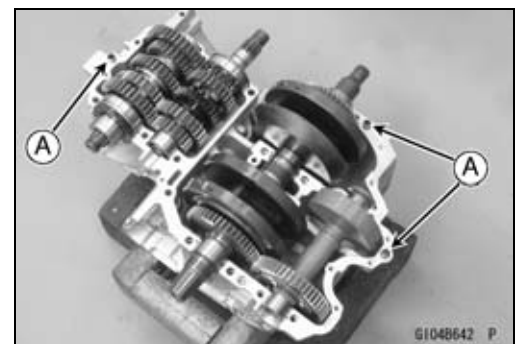


## Crankcase Assembly

### NOTICE

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

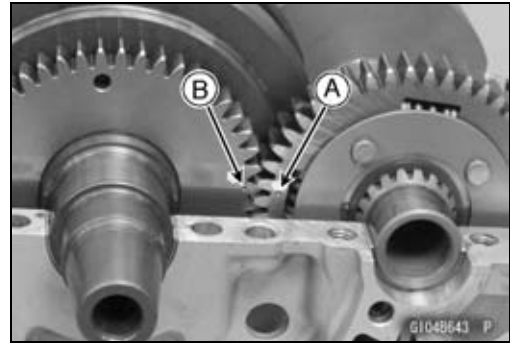
- With a high-flash point solvent, clean off the mating surfaces of the crankcase halves and wipe dry.
- Using compressed air, blow out the oil passages in the crankcase halves.
- Install:
  - Crankshaft (see Crankshaft Installation)
  - Connecting Rods (see Connecting Rod Installation)
  - Transmission Shafts and Gears (see Transmission Shaft Installation)
  - Dowel Pins [A]
  - Shift Drum (see Shift Drum and Fork Installation)
  - Shift Forks and Shift Rods (see Shift Drum and Fork Installation)
- Before fitting the lower case on the upper case, check the following.
  - Check to see that the shift drum and transmission gears are in the neutral position.



## 8-12 CRANKSHAFT/TRANSMISSION

### Crankcase

- Align the punch mark [A] on the balancer gear with the punch mark [B] on the balancer drive gear of crankshaft.

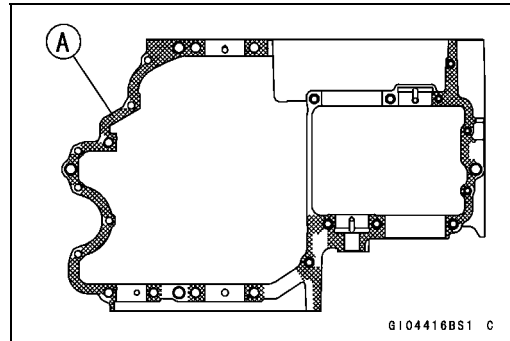


- Apply liquid gasket [A] to the mating surface of the lower crankcase half.

#### NOTE

- Make the application finish within 20 minutes when the liquid gasket to the mating surface of the crankcase half is applied.
- Moreover fit the case and tighten the bolts just after application of the liquid gasket.

Sealant - Liquid Gasket, TB1216B: 92104-1064



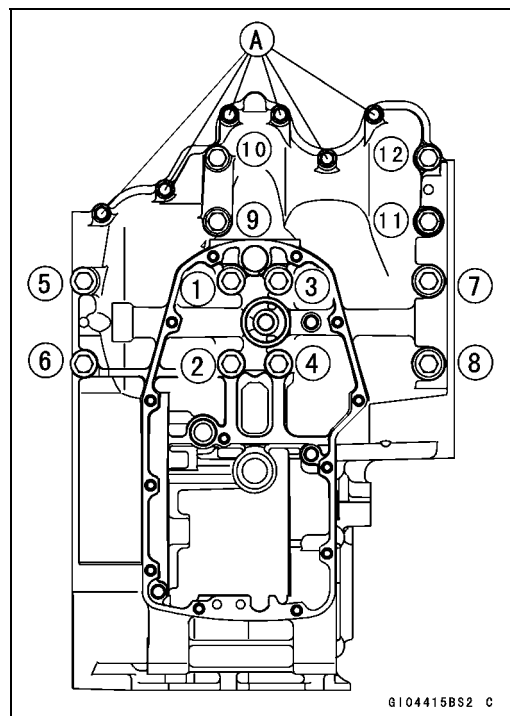
#### NOTICE

**Do not apply liquid gasket around the crankshaft main bearing and balancer shaft bearing.**

- Apply molybdenum disulfide grease to the crankshaft thrust surface (see Crankshaft Installation).
- Fit the lower crankcase to the upper crankcase.
- Fit the shift fork ears into the grooves of the respective gears.
- Tighten the lower crankcase bolts in the following sequence:
  - Clean the seating surface for the 6 mm bolts.
  - Temporarily tighten all bolts. Place copper-plated washer on the [9] bolt shown.

#### NOTE

- Insert the bolts into the holes with appropriate lengths.
- Apply molybdenum disulfide oil solution to the threads and seating surface of the crankcase bolts [1 ~ 12].
- Tighten the M9 bolts to the specified torque in sequence [1 ~ 8].
  - Torque - M9 Bolts: 41 N·m (4.2 kgf·m, 30 ft·lb)**
- Tighten the M8 bolts to the specified torque in sequence [9 ~ 12].
  - Torque - M8 Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb)**
- Tighten the M6 bolts [A] to the specified torque.
  - Torque - M6 Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)**



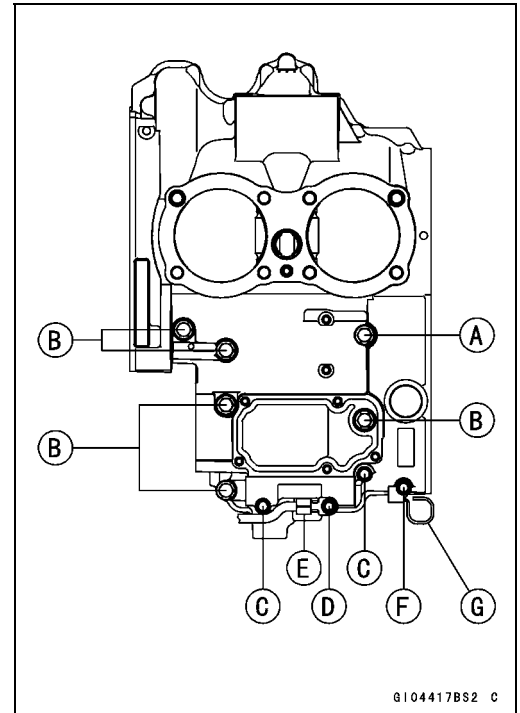
## Crankcase

- Tighten the upper crankcase bolts in the following sequence:
  - M8 Bolts [A, B]
  - M6 Bolts [C]
- The M8 bolt [A] has copper-plated washer.
- Clean the bolt seating surfaces.
- Tighten the M6 bolt [D] together with the engine ground cable so that the crimp side [E] of the terminal faces upward.
- Tighten the M6 bolt [F] together with the clamp [G] as shown in the figure.

**Torque - M8 Bolts: 29 N·m (3.0 kgf·m, 22 ft·lb)**

**M6 Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)**

- After tightening all the crankcase bolts, check the following:
  - The shift drum is in neutral.
  - The drive shaft and the output shaft rotate smoothly.
  - The gears shift smoothly from 1st to 5th, and from 5th to 1st, while the output shaft is being rotated. When the output shaft is stationary, the gears can be shifted to 1st and neutral, but not to 2nd and higher gears.
  - The crankshaft and the balancer shaft rotate smoothly.
- Install the breather separator and install the breather cap.
  - Torque - Breather Cap Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**
- Install the removed parts.

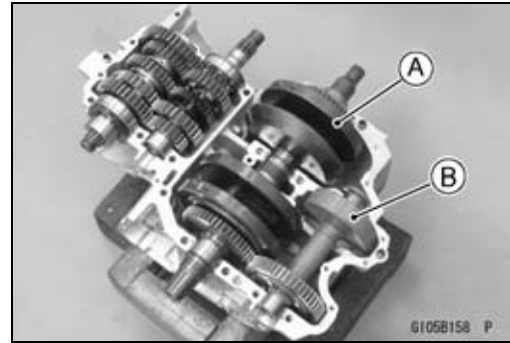


## 8-14 CRANKSHAFT/TRANSMISSION

### Crankshaft and Connecting Rods

#### **Crankshaft Removal**

- Split the crankcase (see Crankcase Splitting).
- Remove:
  - Crankshaft [A]
  - Balancer Shaft [B]

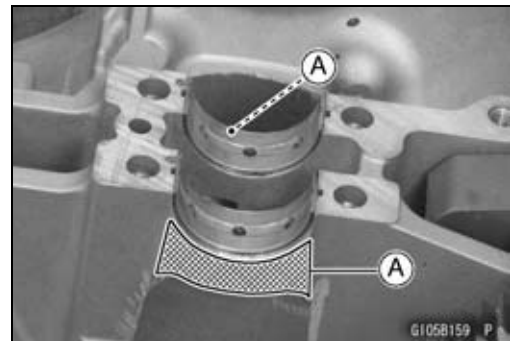


#### **Crankshaft Installation**

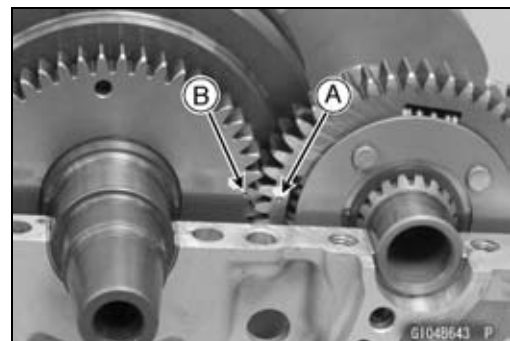
##### **NOTICE**

If the crankshaft, bearing inserts, or crankcase halves are replaced with new ones, select the bearing inserts and check clearance with a plastigage (press gauge) before assembling engine to be sure the correct bearing inserts are installed.

- Apply molybdenum disulfide oil solution to the inside of the bearing insert of the crankshaft.
- Apply molybdenum disulfide grease to the crankshaft thrust surfaces [A] of the crankcase.



- Install the crankshaft and balancer shaft.
- Align the punch mark [A] on the balancer gear with the punch mark [B] on the balancer drive gear of crankshaft.
- Assemble the crankcase (see Crankcase Assembly).



**Crankshaft and Connecting Rods**

**Connecting Rod Removal**

- Split the crankcase (see Crankcase Splitting).
- Remove the connecting rod big end nuts [A].
- Remove the crankshaft [B].

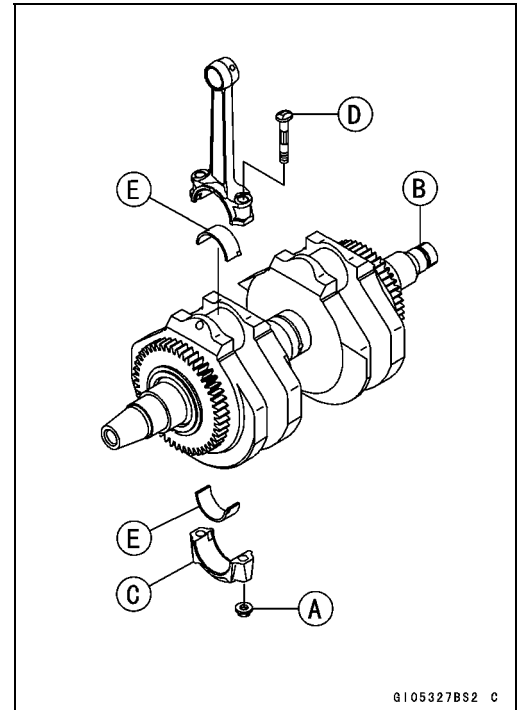
**NOTE**

○Mark and record the locations of the connecting rods and their big end caps so that they can be reassembled in their original positions.

- Remove:
  - Big End Cap [C]
  - Connecting Rod
  - Connecting Rod Bolts [D]
  - Big End Bearing Inserts [E]

**NOTICE**

Discard the connecting rod bolts. To prevent damage to the crankpin surfaces, do not allow the connecting rod bolts to bump against the crankpins.



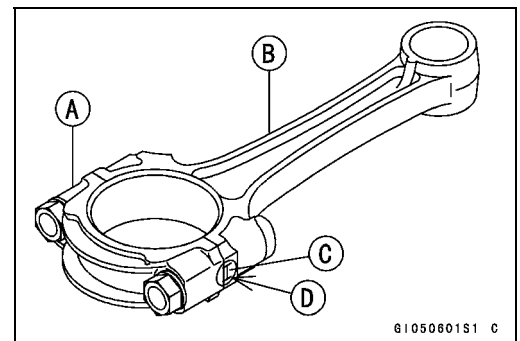
G105327BS2 C

**Connecting Rod Installation**

**NOTICE**

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 [D]: "O" or no mark



G1050601S1 C

**NOTICE**

If the connecting rods, big end bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plasti-gage (press gauge) before assembling engine to be sure the correct bearing inserts are installed.

**WARNING**

Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the bolts, nuts, and connecting rods in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean them.

- Thoroughly wash the new connecting rods, bolts, and nuts to remove the rust-preventive oil from them.
- Immediately dry the bolts and nuts with compressed air after cleaning.

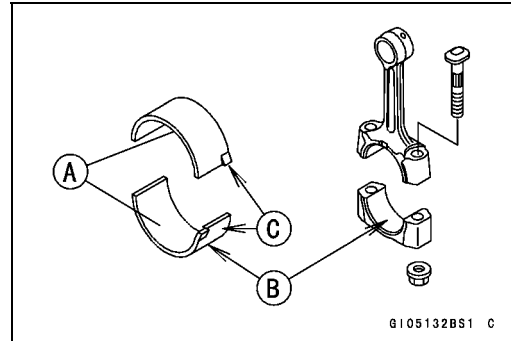
## 8-16 CRANKSHAFT/TRANSMISSION

### Crankshaft and Connecting Rods

- Apply molybdenum disulfide oil solution [A] to the inner surfaces of upper and lower bearing inserts.
- Do not apply any grease or oil to the cap inside and cap insert outside [B].
- Install the inserts so that their nails [C] are on the same side and fit them into the recess of the connecting rod and cap.

#### NOTICE

**Wrong application of oil and grease could cause bearing damage.**



- 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

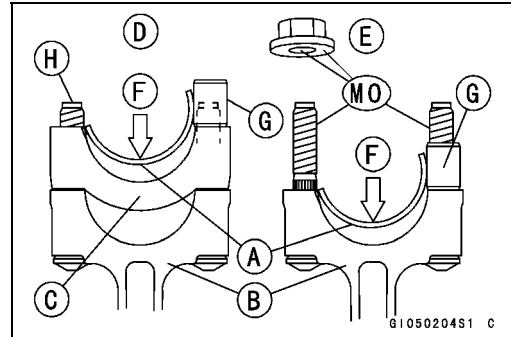
Installation [E] to Connecting Rod

Push [F]

Spare Dowel Pin [G]

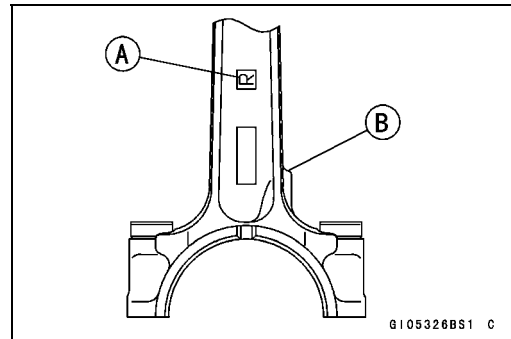
Connecting Rod Bolts [H]

- 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 solution [MO] to the threads and seating surface of the big end nuts.



- Install each connecting rod on its original crankpin.
- Install the crankshaft (see Crankshaft Installation).

- Install the connecting rod so that its "R" [A] side faces engine right side.
- The oil injection hole [B] faces the exhaust.
- The connecting rod big end is bolted using the "plastic region fastening method".
- This method precisely achieves the needed clamping force without exceeding it unnecessarily, allowing the use of thinner, lighter bolts further decreasing connecting rod weight.
- There are two types of the plastic region fastening. One is a bolt length measurement method and other is a rotation angle method. Observe one of the following two, but the bolt length measurement method is preferable because this is a more reliable way to tighten the big end nuts.



#### NOTICE

**The connecting rod bolts are designed to stretch when tightened. Never reuse the connecting rod bolts. See the table below for correct bolt and nut usage.**

#### NOTICE

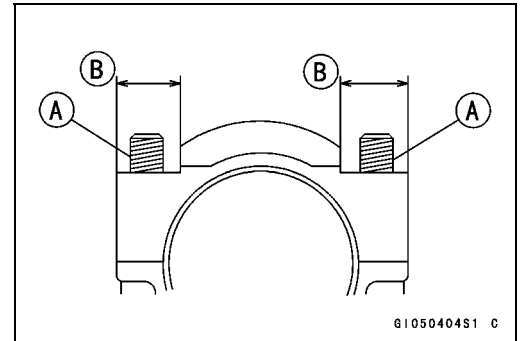
**Be careful not to overtighten the nuts. The bolts must be positioned on the seating surface correctly to prevent the bolt heads from hitting the crankcase.**



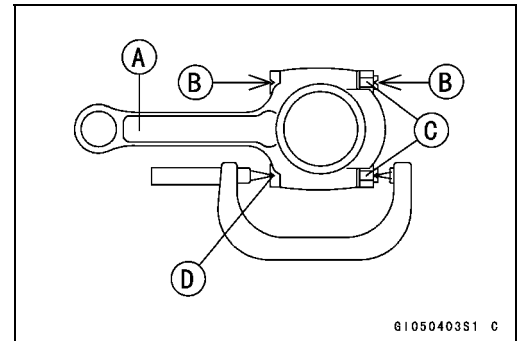
**Crankshaft and Connecting Rods**

(1) Bolt Length Measurement Method

- Dent both ends of the connecting bolt with a punch.
- Install new bolts and nuts in reused connecting rod.
- ★ If the connecting rod assy was replaced, use the bolts and nuts attached to the new connecting rod assy.
- Apply molybdenum disulfide oil solution to the following portions.
  - Threads [A] of Bolts
  - Seating Surfaces [B] of Nuts



- Before tightening, use a point micrometer to measure the length of new connecting rod bolts and record the values to find the bolt stretch.
  - Connecting Rod [A]
  - Dented Portion [B]
  - Nuts [C]
  - Fit micrometer pins into dents [D].
- Tighten the big end nuts so that the bolts stretch will be within the service limit shown in the table.



$$\text{Bolt Length after tightening} - \text{Bolt Length before tightening} = \text{Bolt Stretch}$$

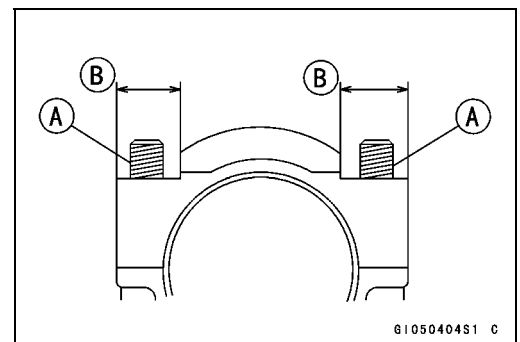
- ★ Replace the bolts that have stretched over the service limit.

**Connecting Rod Bolt Stretch**

Connecting Rod Assembly	Bolt	Nut	Bolt Stretch (service limit)
New Part	Bolts provided with new connecting rod assembly	Nuts provided with new connecting rod assembly	0.20 ~ 0.32 mm (0.008 ~ 0.013 in.)
		New Part (unused part)	
Reused Part	New Part (unused part)	Reused Part	0.24 ~ 0.36 mm (0.009 ~ 0.014 in.)
		New Part (unused part)	

(2) Rotation Angle Method

- ★ If you do not have a point micrometer, you may tighten the nuts using the "Rotation Angle Method".
- Install new bolts and nuts in reused connecting rods.
- ★ If the connecting rod assy was replaced, use the bolts and nuts attached to the new connecting rod assy.
- Apply a small amount of molybdenum disulfide oil solution to the following portions.
  - Threads [A] of Bolts
  - Seating Surfaces [B] of Nuts



## 8-18 CRANKSHAFT/TRANSMISSION

### Crankshaft and Connecting Rods

- First, tighten the nuts to the specified torque. See the table below.
- Next, tighten the nuts  $120^\circ \pm 5^\circ$ .
- Mark [A] the connecting rod big end caps and nuts so that nuts can be turned  $120^\circ$  [B] properly.
- Tighten the hexagon nut by 2 corners.

#### Connecting Rod Big End Nut Tightening Torque and Angle

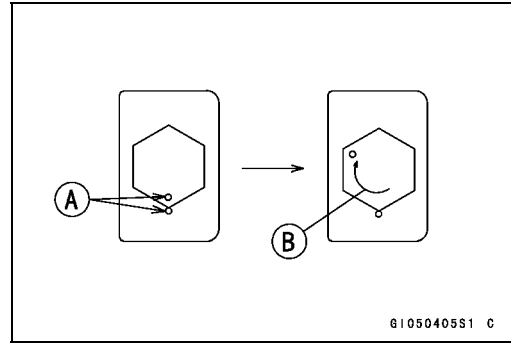
Connecting Rod Assembly	Bolt	Nut	Tightening Torque + Tightening Angle
New Part	Bolts provided with new connecting rod assembly	Nuts provided with new connecting rod assembly	18 N·m (1.8 kgf·m, 13 ft·lb) + $120^\circ$
		New Part (unused part)	20 N·m (2.0 kgf·m, 15 ft·lb) + $120^\circ$
Reused Part	New Part (unused part)	Reused Part	24 N·m (2.4 kgf·m, 17.7 ft·lb) + $120^\circ$
		New Part (unused part)	25 N·m (2.6 kgf·m, 18.4 ft·lb) + $120^\circ$

#### NOTICE

Since the friction force of the seating surface and thread portion of new nuts is different from that of used ones, the nut tightening torque should be changed as specified in the above table. Be careful not to overtighten the nuts.

#### Crankshaft/Connecting Rod Cleaning

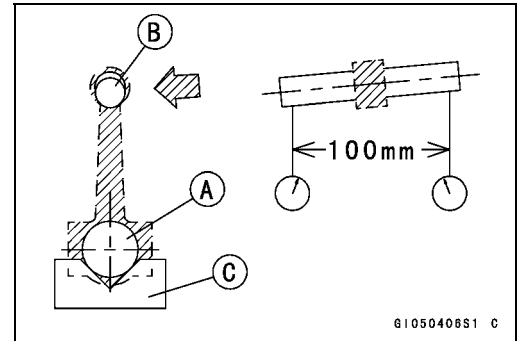
- After removing the connecting rods from the crankshaft, clean them with a high-flash point solvent.
- Blow the crankshaft and connecting rod oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.



**Crankshaft and Connecting Rods**

**Connecting Rod Bend Inspection**

- 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 at least 100 mm (3.94 in.) long, and insert the arbor [B] through the connecting rod small end.
  - On a surface plate, set the big-end arbor on V blocks [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 (3.94 in.) length to determine the amount of connecting rod bend.
- ★ If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

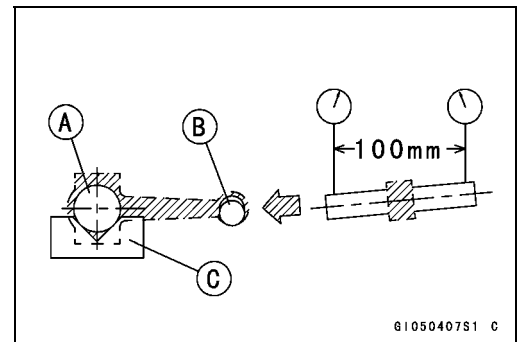


**Connecting Rod Bend**

**Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)**

**Connecting Rod Twist Inspection**

- With the big-end arbor [A] still on 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 (3.94 in.) length of the arbor to determine the amount of connecting rod twist.
- ★ If connecting rod twist exceeds the service limit, the connecting rod must be replaced.



**Connecting Rod Twist**

**Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)**

**Connecting Rod Big End Side Clearance Inspection**

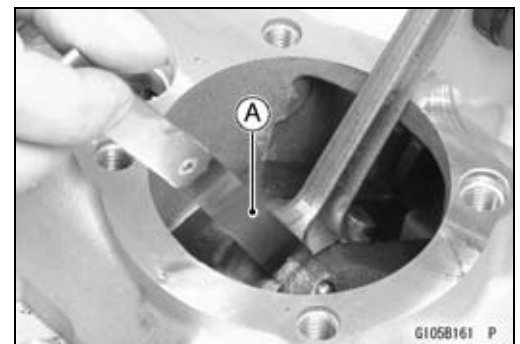
- Measure connecting rod big end side clearance.
- Insert a thickness gauge [A] between the big end and either crank web to determine clearance.

**Connecting Rod Big End Side Clearance**

**Standard: 0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)**

**Service Limit: 0.6 mm (0.024 in.)**

- ★ If the clearance exceeds the service limit, replace the connecting rod with a new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.



## 8-20 CRANKSHAFT/TRANSMISSION

### Crankshaft and Connecting Rods

#### Connecting Rod Big End Bearing Insert/Crankpin Wear Inspection

- Using a plastigage (press gauge) [A], measure the bearing insert/crankpin [B] clearance.
- Tighten the big end nuts to the specified torque (see Connecting Rod Installation).

#### NOTE

○ Do not move the connecting rod and crankshaft during clearance measurement.

#### NOTICE

After measurement, replace the connecting rod bolts.

#### Connecting Rod Big End Bearing Insert/Crankpin Clearance

Standard: 0.017 ~ 0.041 mm (0.0007 ~ 0.0016 in.)

Service Limit: 0.08 mm (0.003 in.)

- ★ If the clearance is within the standard, no bearing replacement is required.
- ★ If the clearance is between 0.042 mm (0.0017 in.) and the service limit 0.08 mm (0.0031 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/crankpin clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If the clearance exceeds the service limit, measure the diameter of the crankpins.

#### Crankpin Diameter

Standard: 37.984 ~ 38.000 mm (1.4954 ~ 1.4961 in.)

Service Limit: 37.97 mm (1.495 in.)

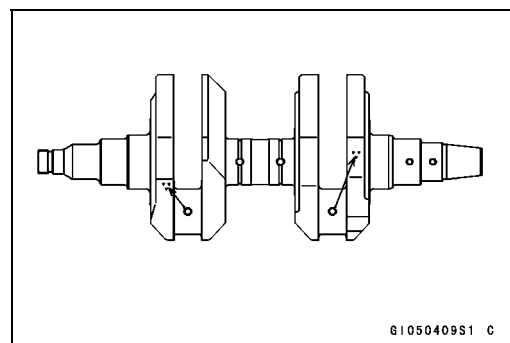
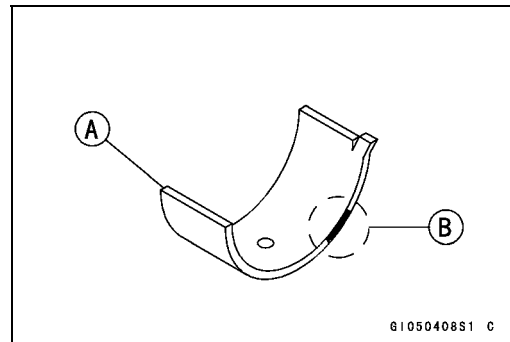
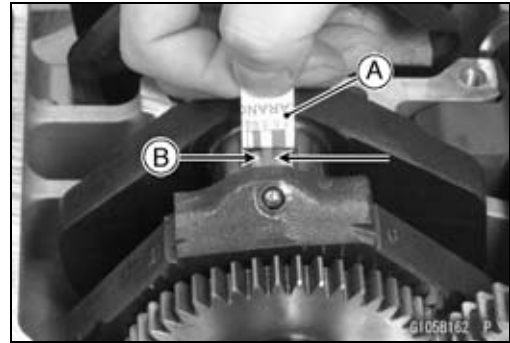
- ★ If any crankpin has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured crankpin diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.

#### Crankpin Diameter Marks

None 37.984 ~ 37.992 mm (1.4954 ~ 1.4957 in.)

○ 37.993 ~ 38.000 mm (1.4958 ~ 1.4961 in.)

△: Crankpin Diameter Marks, "○" or no mark.



**Crankshaft and Connecting Rods**

- Measure the connecting rod big end inside diameter, and mark each connecting rod big end in accordance with the inside diameter.
- Tighten the connecting rod big end nuts to the specified torque (see Connecting Rod Installation).

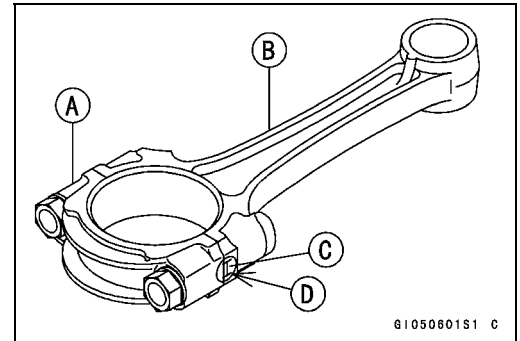
**NOTE**

○ *The mark already on the big end should almost coincide with the measurement.*

**Connecting Rod Big End Inside Diameter Marks**

- None     41.000 ~ 41.008 mm (1.6142 ~ 1.6145 in.)
- 41.009 ~ 41.016 mm (1.6145 ~ 1.6148 in.)

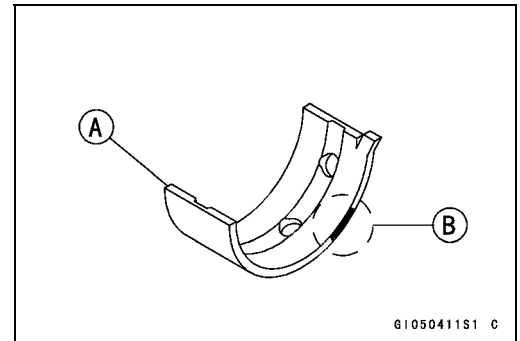
Big End Cap [A]  
 Connecting Rod [B]  
 Weight Mark, Alphabet [C]  
 Diameter Mark (Around Weight Mark) [D]: “○” or no mark



- Select the proper bearing insert [A] in accordance with the combination of the connecting rod and crankshaft marking.  
 Size Color [B]

**Connecting Rod Big End Bearing Insert Selection**

Connecting Rod Big End Inside Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
○	○	Black	92028-1907
None	None		
○	None	Blue	92028-1906
None	○	Brown	92028-1908



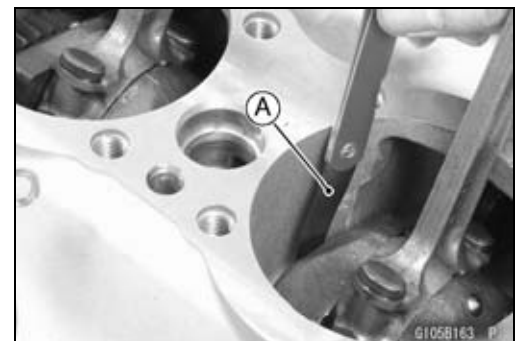
- Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.

**Crankshaft Side Clearance Inspection**

- Insert a thickness gauge [A] between the crankcase end at the center journal and the crank web to measure the clearance.
- ★ If the clearance exceeds the service limit, replace the crankcase halves as a set.

**NOTE**

○ *The upper and lower crankcase halves are machined at the factory in the assembled state, so the crankcase halves must be replaced as a set.*



**Crankshaft Side Clearance**

- Standard:     0.05 ~ 0.20 mm (0.0020 ~ 0.0079 in.)
- Service Limit: 0.40 mm (0.016 in.)

## 8-22 CRANKSHAFT/TRANSMISSION

### Crankshaft and Connecting Rods

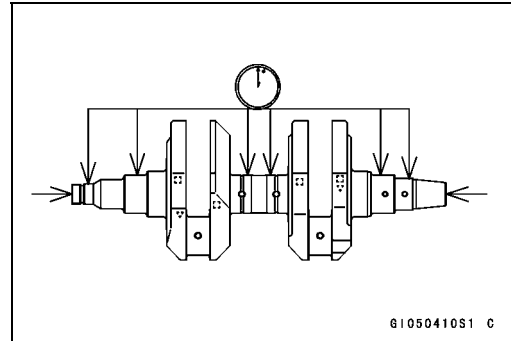
#### Crankshaft Runout Inspection

- 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.)

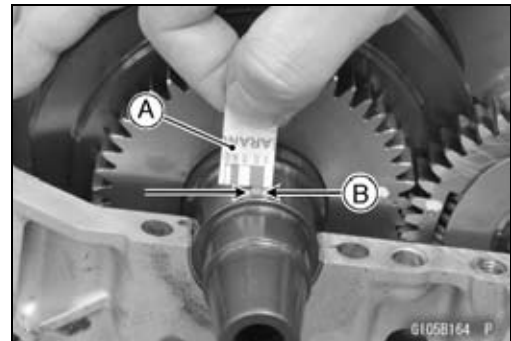


#### Crankshaft Main Bearing Insert/Journal Wear Inspection

- Using a plastigage (press gauge) [A], measure the bearing insert/journal [B] clearance.

#### NOTE

- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).
- Do not turn the crankshaft during clearance measurement.
- Journal clearance less than 0.025 mm (0.00098 in.) can not be measured by plastigage, however, using genuine parts maintains the minimum standard clearance.

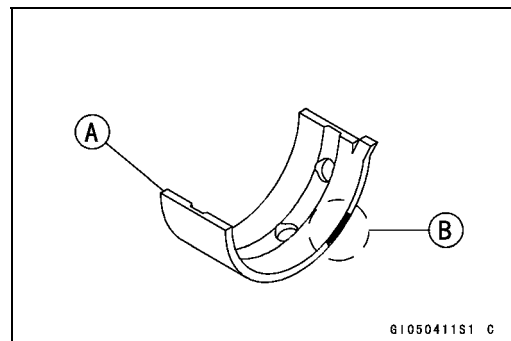


#### Crankshaft Main Bearing Insert/Journal Clearance

**Standard:** 0.016 ~ 0.040 mm (0.0006 ~ 0.0016 in.)

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

- ★ If the clearance is within the standard, no bearing insert replacement is required.
- ★ If the clearance is between 0.041 mm (0.0016 in.) and the service limit 0.07 mm (0.0028 in.), replace the bearing inserts [A] with bearing inserts painted blue [B]. Check insert/journal clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If the clearance exceeds the service limit, measure the diameter of the crankshaft main journal.

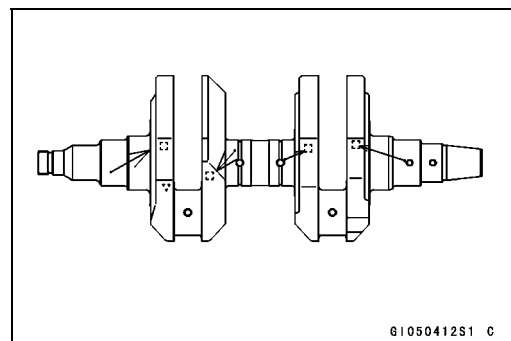


#### Crankshaft Main Journal Diameter

**Standard:** 37.984 ~ 38.000 mm (1.4954 ~ 1.4961 in.)

**Service Limit:** 37.96 mm (1.494 in.)

- ★ If any main journal has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured main journal diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.



#### Crankshaft Main Journal Diameter Marks

**None** 37.984 ~ 37.992 mm (1.4954 ~ 1.4957 in.)

**1** 37.993 ~ 38.000 mm (1.4958 ~ 1.4961 in.)

□: Crankshaft Main Journal Diameter Marks, "1" or no mark.

**Crankshaft and Connecting Rods**

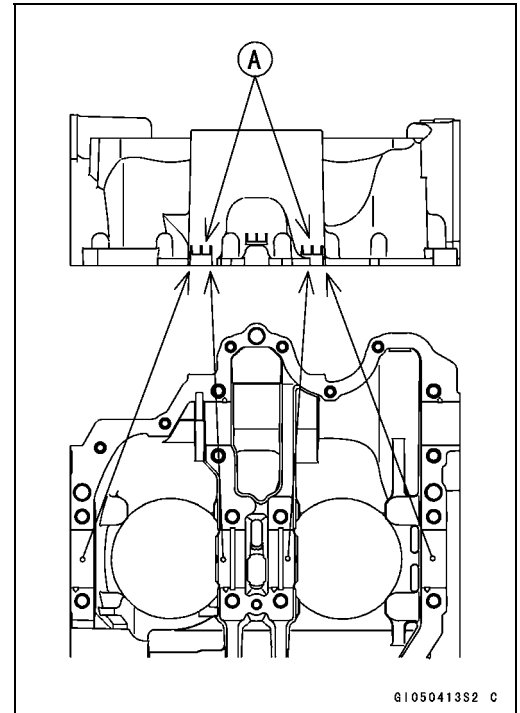
- Measure the main bearing inside diameter, and mark [A] the upper crankcase half in accordance with the inside diameter.  
Crankcase Main Bearing Inside Diameter Marks: “○” or no mark.
- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).

**NOTE**

○ The mark already on the upper crankcase half should almost coincide with the measurement.

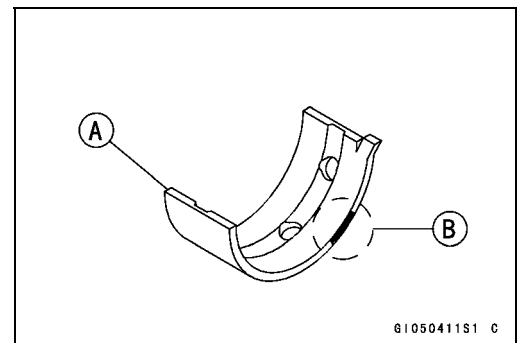
**Crankcase Main Bearing Inside Diameter Marks**

- 41.000 ~ 41.008 mm (1.6142 ~ 1.6145 in.)
- None 41.009 ~ 41.016 mm (1.6145 ~ 1.6148 in.)



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- Select the proper bearing insert [A] in accordance with the combination of the crankcase and crankshaft markings.  
Size Color [B]



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**Crankshaft Main Bearing Insert Selection**

Crankcase Main Bearing Inside Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert	
		Size Color	Part Number
○	1	Brown	92028-1905
None	None	Blue	92028-1903
None	1	Black	92028-1904
○	None		

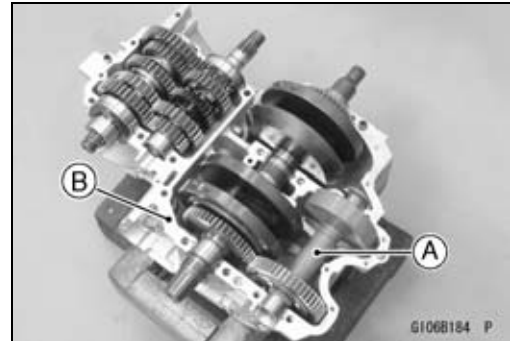
- Install the new bearing inserts in the crankcase halves and check insert/journal clearance with the plastigage.
- When installing the bearing inserts, make sure not to scrape the back of the insert with the edge of the crankcase bearing.

## 8-24 CRANKSHAFT/TRANSMISSION

### Balancer

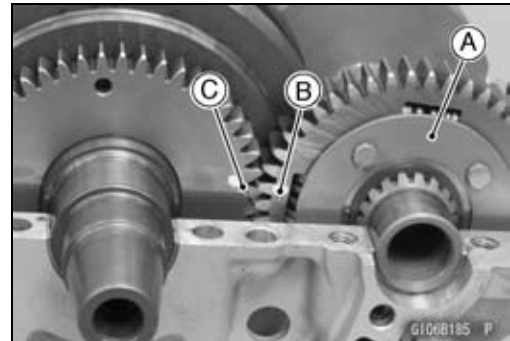
#### Balancer Removal

- Split the crankcase (see Crankcase Splitting).
- Remove the balancer [A] from the upper crankcase half [B].



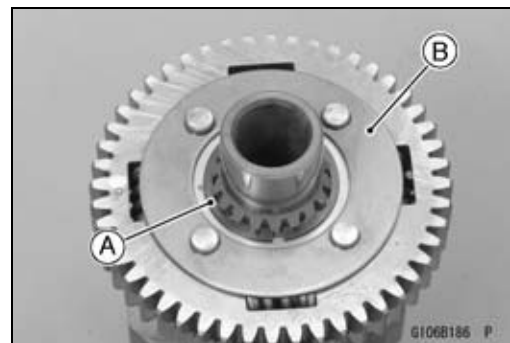
#### Balancer Installation

- Apply molybdenum disulfide oil solution to the inside of the bearing insert of the balancer shaft.
- Set the balancer [A] on the upper crankcase half.
- Align the punch mark [B] on the balancer gear with the punch mark [C] on the balancer drive gear of crankshaft.
- Assemble the crankcase (see Crankcase Assembly).



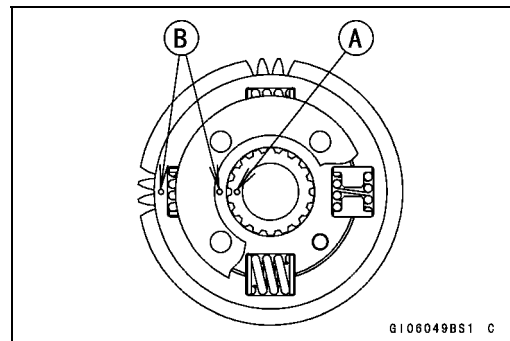
#### Balancer Gear Removal

- Remove the balancer shaft (see Balancer Removal).
- Remove the circlip [A].
- Remove the balancer gear [B].



#### Balancer Gear Installation

- Align the punch mark [A] of the balancer shaft with the punch marks [B] of the balancer gear and assemble them.

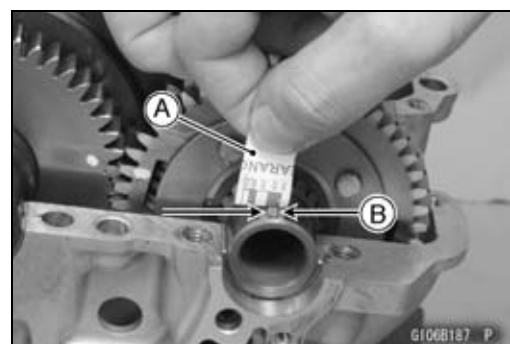


#### Balancer Shaft Bearing Insert/Journal Wear Inspection

- Using a plastigage (press gauge) [A], measure the bearing insert/journal [B] clearance.

#### NOTE

- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).
- Do not turn the crankshaft during clearance measurement.



#### Balancer Shaft Bearing Insert/Journal Clearance

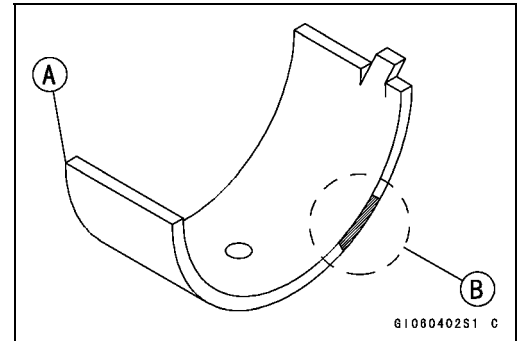
Standard: 0.016 ~ 0.038 mm (0.0006 ~ 0.0015 in.)

Service Limit: 0.07 mm (0.003 in.)



**Balancer**

- ★ If the clearance is within the standard, no bearing insert replacement is required.
- ★ If the clearance is between 0.039 mm (0.0015 in.) and the service limit 0.07 mm (0.0028 in.), replace the bearing inserts [A] with the bearing inserts painted blue [B]. Check insert/journal clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If the clearance exceeds the service limit, measure the diameter of the balancer shaft journal.



**Balancer Shaft Journal Diameter**

**Standard:** 27.987 ~ 28.000 mm (1.1018 ~ 1.1024 in.)

**Service Limit:** 27.96 mm (1.101 in.)

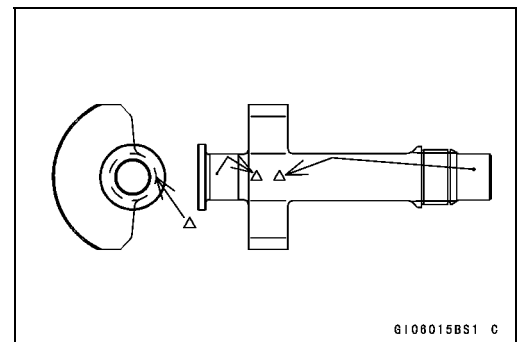
- ★ If the journal has worn past the service limit, replace the balancer shaft with a new one.
- ★ If the measured journal diameters are not less than the service limit, but has do not coincide with the original diameter markings on the balancer shaft, make new marks on it.

**Balancer Shaft Journal Diameter Marks**

**None:** 27.987 ~ 27.993 mm (1.1018 ~ 1.1021 in.)

○: 27.994 ~ 28.000 mm (1.1021 ~ 1.1024 in.)

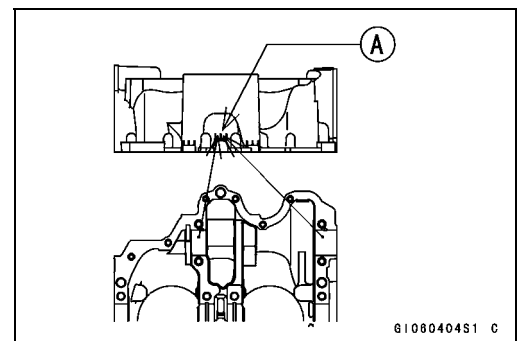
△: **Balancer Shaft Journal Diameter Mark: no mark or "○"**



- Measure the bearing inside diameter of the crankcase, and mark [A] the upper crankcase half in accordance with the inside diameter.  
Crankcase Main Bearing Inside Diameter Marks: "○" or no mark
- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).

**NOTE**

○ The mark already on the upper crankcase half should almost coincide with the measurement.



**Crankcase Bearing Inside Diameter Marks**

○: 31.000 ~ 31.008 mm (1.2205 ~ 1.2208 in.)

**None:** 31.009 ~ 31.016 mm (1.2208 ~ 1.2211 in.)

- Select the proper bearing insert in accordance with the combination of the crankcase and balancer shaft markings.

## 8-26 CRANKSHAFT/TRANSMISSION

### Balancer

#### Balancer Shaft Bearing Insert Selection

Crankcase Bearing Inside Diameter Marking	Balancer Shaft Journal Diameter Marking	Bearing Insert	
		Size Color	Part Number
○	○	Brown	92028-1911
None	None	Blue	92028-1909
None	○	Black	92028-1910
○	None		

- Install the new bearing inserts in the crankcase halves and check insert/journal clearance with the plastigage.
- When installing the bearing inserts, make sure not to scrape the back of the insert with the edge of the crankcase bearing.

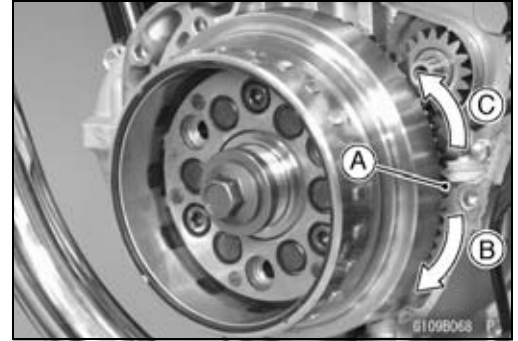
## Starter Motor Clutch

### Starter Motor Clutch Removal/Installation

- Refer to the Alternator Rotor Removal/Installation in the Electrical System chapter.

### Starter Motor Clutch Inspection

- Remove:
  - Alternator Cover (see Alternator Cover Removal in the Electrical System chapter)
  - Starter Motor
- Turn the starter motor clutch gear [A] by hand. The starter motor clutch gear should turn clockwise [B] freely, but should not turn counterclockwise [C].
- ★ If the starter motor clutch does not operate as it should or if it makes noise, go to the next step.
- Disassemble the starter motor clutch, and visually inspect the clutch parts.
- ★ If there is any worn or damaged part, replace it.

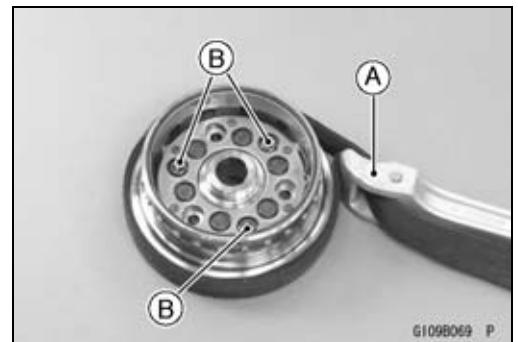


### NOTE

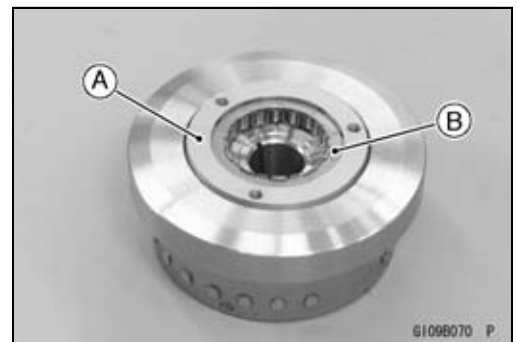
○ Examine the starter motor clutch gear as well. Replace it if it worn or damaged.

### Starter Motor Clutch Disassembly

- Remove:
  - Alternator Rotor (see Alternator Rotor Removal in the Electrical System chapter)
- Hold the alternator rotor with the suitable holder [A].
- Remove the starter motor clutch bolts [B].



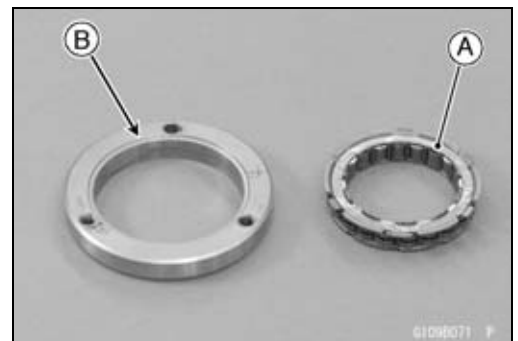
- Remove:
  - Starter Motor Clutch Housing [A]
  - Starter Motor Clutch [B]



### Starter Motor Clutch Assembly

- Install the starter motor clutch to the housing so that the flange [A] fit to the housing groove [B].
- Apply a non-permanent locking agent to the threads of the starter motor clutch bolts and tighten them.

**Torque - Starter Motor Clutch Bolts: 34.3 N·m (3.5 kgf·m, 25 ft·lb)**

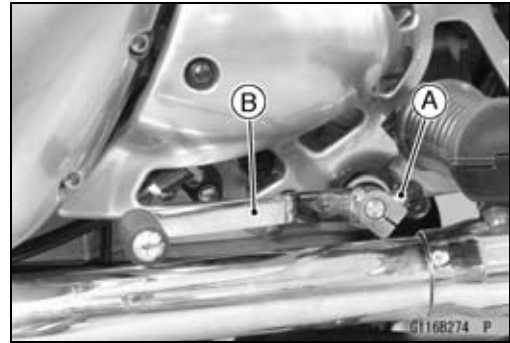


## 8-28 CRANKSHAFT/TRANSMISSION

### External Shift Mechanism

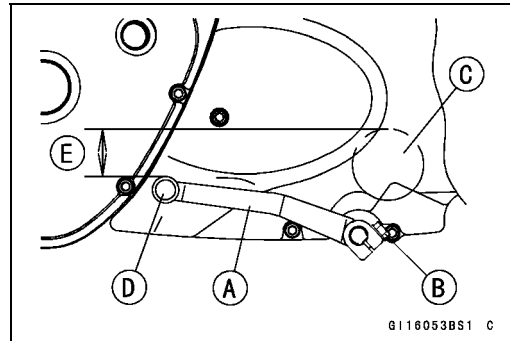
#### Shift Pedal Removal

- Remove:
  - Shift Pedal Bolt [A]
  - Shift Pedal [B]



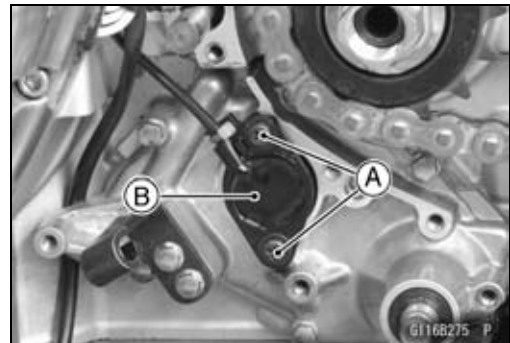
#### Shift Pedal Installation

- Install the shift pedal [A] as shown in the figure.
  - Shift Pedal Bolt [B]
  - Left, Front Step [C]
  - Shift Pedal Front Step [D]
  - 31 mm (1.22 in.) [E]

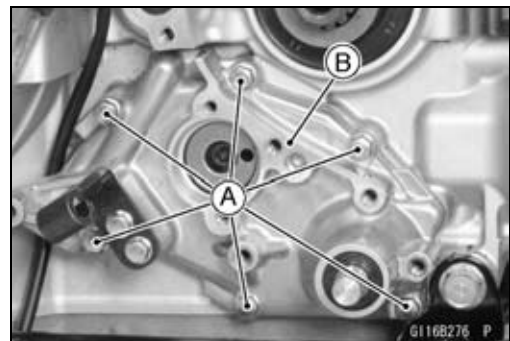


#### External Shift Mechanism Removal

- Remove:
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal in the Final Drive chapter)
  - Speed Sensor Bracket (see Speed Sensor Removal in the Electrical System chapter)
  - Clutch Release Case (see Clutch Release Case Removal in the Clutch chapter)
  - Engine Sprocket (see Engine Sprocket Removal in the Final Drive chapter)
- Remove the neutral switch screws [A] and remove the neutral switch [B].

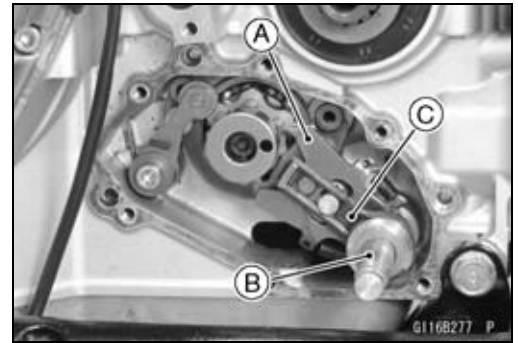


- Remove the external shift mechanism cover bolts [A] and remove the external shift mechanism cover [B].

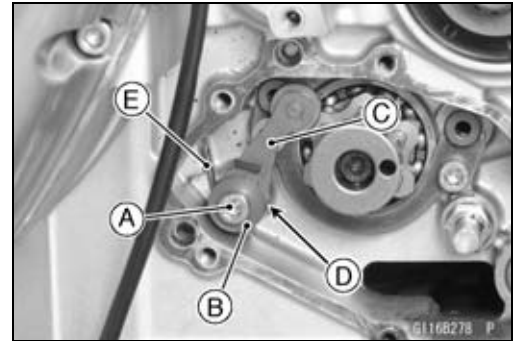


**External Shift Mechanism**

- Push the shift arm [A] to the direction of the shift shaft [B], and remove the shift shaft assembly [C].



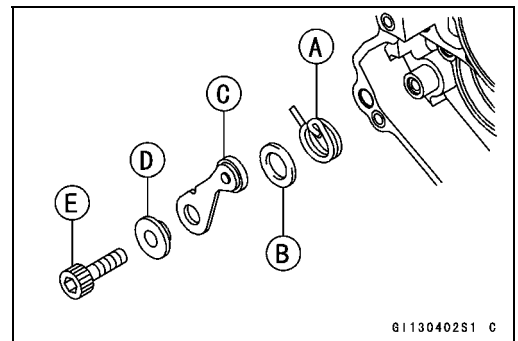
- Remove:
  - Gear Positioning Lever Bolt [A]
  - Spacer [B]
  - Gear Positioning Lever [C]
  - Flat Washer [D]
  - Positioning Lever Spring [E]



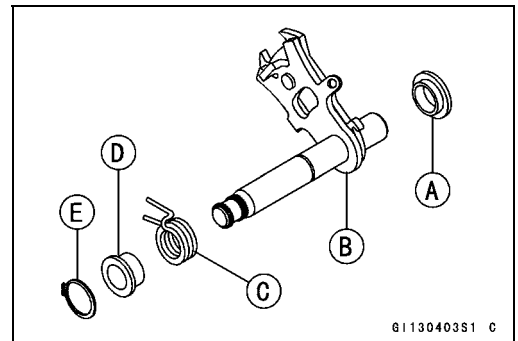
**External Shift Mechanism Installation**

- Apply non-permanent locking agent to the gear positioning lever bolt [E].
- Install:
  - Positioning Lever Spring [A]
  - Flat Washer [B]
  - Gear Positioning Lever [C]
  - Spacer [D]
  - Gear Positioning Lever Bolt

**Torque - Gear Positioning Lever Bolt: 12 N·m (1.2 kgf·m, 106 in·lb)**



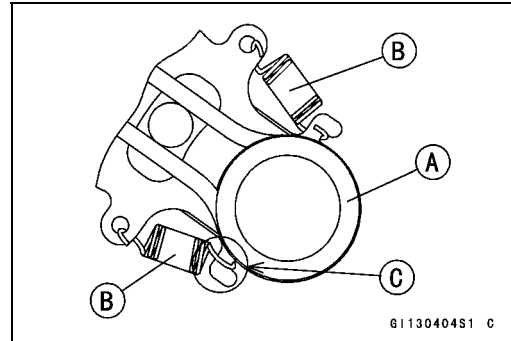
- If the shift shaft assembly has been disassembled, re-assemble as follows:
  - Collar [A]
  - Shift Shaft [B]
  - Return Spring [C]
  - Return Spring Collar [D]
  - Circlip [E]



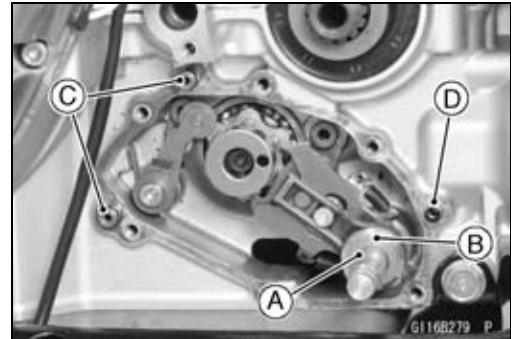
## 8-30 CRANKSHAFT/TRANSMISSION

### External Shift Mechanism

- Install the lever position spring as shown in the figure.  
Return Spring [A]  
Lever Position Springs [B]  
Reverse Installation [C]



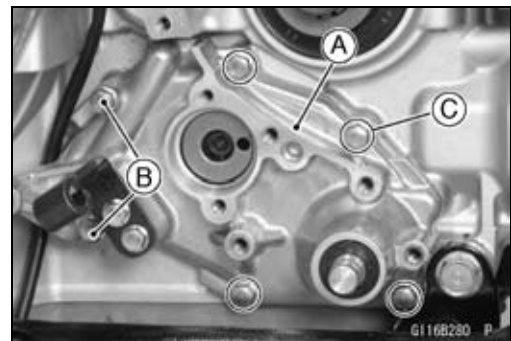
- Install the shift shaft assembly [A].
- Make sure that the washer [B] is in place.
- Install the oil fitting pins [C] and the dowel pin [D].



- Replace the gasket with a new one.
- Apply grease to the oil seal lip.
- Apply non-permanent locking agent to the external shift mechanism cover bolt (L = 25 mm).
- Install the external shift mechanism cover [A].
- Tighten the external shift mechanism cover bolts.

**Torque - External Shift Mechanism Cover Bolts: 12 N·m  
(1.2 kgf·m, 106 in·lb)**

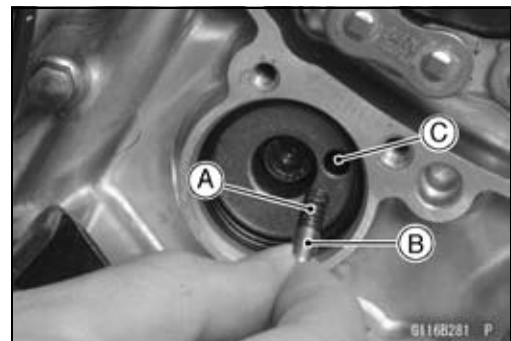
L = 35 mm (1.38 in.) [B]  
L = 25 mm (0.98 in.) [C]



- Securely place the spring [A] and pin [B] into the hole [C] of the drum holder.
- Replace the O-ring at the neutral switch with a new one.
- Apply soap and water solution to the new O-ring and install the neutral switch.
- Apply non-permanent locking agent to the neutral switch screws and tighten them.

**Torque - Neutral Switch Screws: 3.9 N·m (0.4 kgf·m, 35 in·lb)**

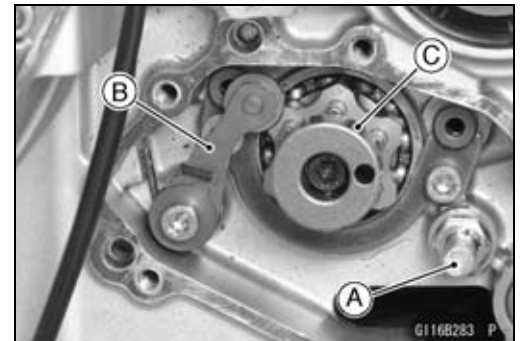
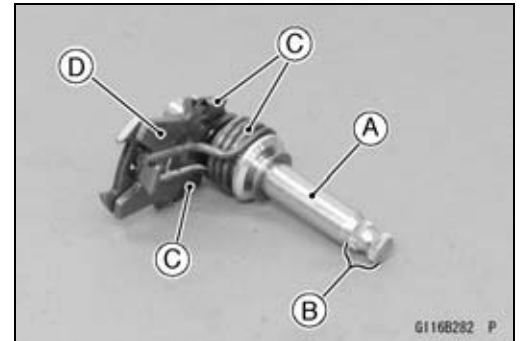
- Install the removed parts (see appropriate chapters).
- Check the engine oil level (see Oil Level Inspection in the Engine Lubrication System chapter).



## External Shift Mechanism

### External Shift Mechanism Inspection

- Remove the shift shaft assembly (see External Shift Mechanism Removal).
  - Examine the shift shaft [A] for any damage.
  - ★ If the shaft is bent, straighten or replace it.
  - ★ If the serration [B] are damaged, replace the shaft.
  - ★ If the springs [C] are damaged in any way, replace them.
  - ★ If the shift mechanism arm [D] is damaged in any way, replace the shift shaft.
- 
- 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 - Return Spring Pin: 42 N·m (4.3 kgf·m, 31 ft·lb)**
- Check the gear positioning lever [B] and its spring for breaks or distortion.
  - ★ If the lever and/or spring are damaged in any way, replace them.
  - Inspect the shift drum pin and drum holder.
  - ★ Replace them if they are significantly worn or damaged.

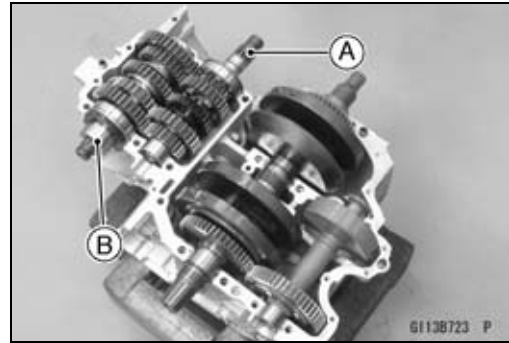


## 8-32 CRANKSHAFT/TRANSMISSION

### Transmission

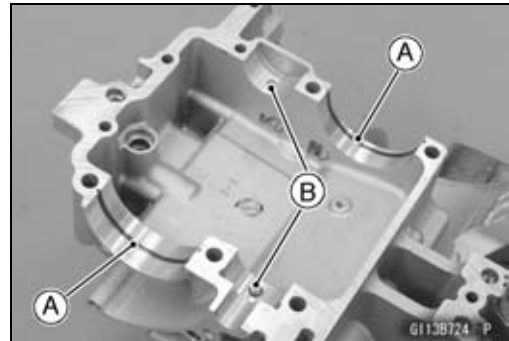
#### **Transmission Shaft Removal**

- Split the crankcase (see Crankcase Splitting).
- Remove the drive shaft [A] and output shaft [B].

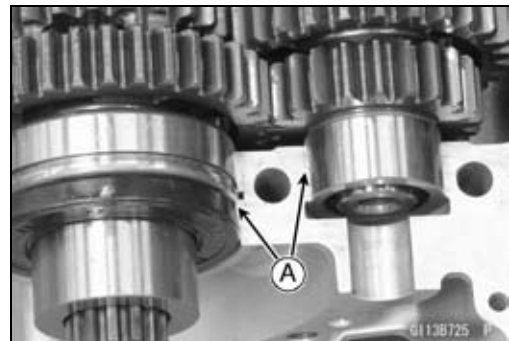


#### **Transmission Shaft Installation**

- Blow and clean the oil passage of the lower crankcase half with compressed air.
- Check to see that the set rings [A] and set pins [B] are in place of the upper crankcase half.



- Install the drive shaft and output shaft into the upper crankcase half.
- Apply engine oil to the transmission gears and bearings.
- The bearing set pins and rings must match properly with the holes or grooves in the bearing outer races. When they are properly matched, there is no clearance [A] between the crankcase and the bearing outer races.
- Assemble the crankcase (see Crankcase Assembly).

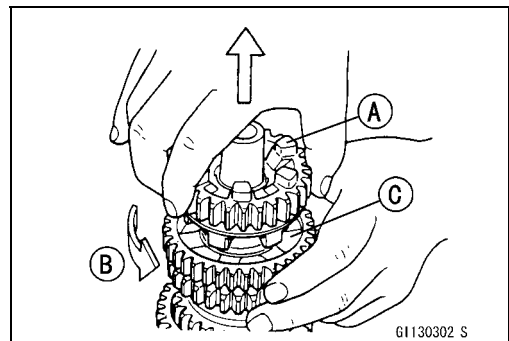


#### **Transmission Shaft Disassembly**

- Remove the transmission shafts (see Transmission Shaft Removal).
- Remove the circlips, and disassemble the transmission shafts.

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

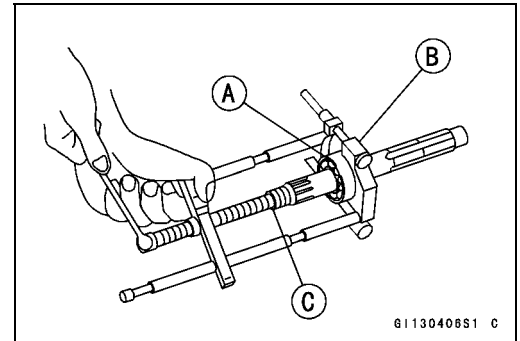
- The 4th gear [A] on the output shaft has three steel balls assembled into it for the positive neutral finder mechanism. Remove the 4th gear.
- Set the output shaft in a vertical position holding the 3rd gear [C].
- Spin the 4th gear quickly [B] and pull it off upward.





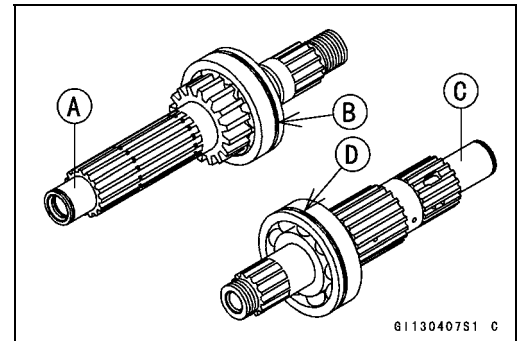
**Transmission**

- Remove the ball bearing [A] from each shafts.  
**Special Tools - Bearing Puller [B]: 57001-135**  
**Bearing Puller Adapter [C]: 57001-317**
- Discard the removed bearing.

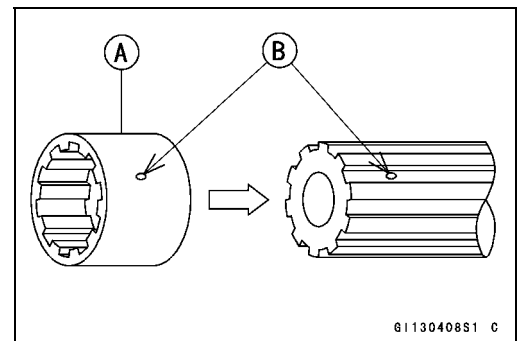


**Transmission Shaft Assembly**

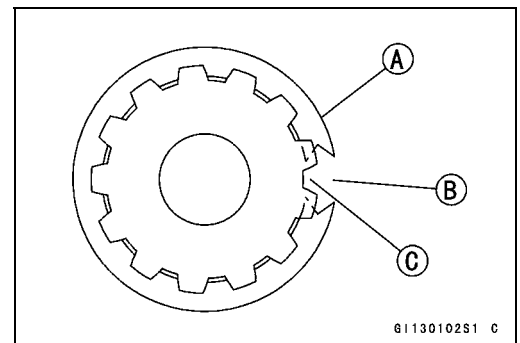
- Apply engine oil to the ball bearings and the shafts.
- Install the ball bearing onto the driveshaft [A], with the groove [B] facing clutch side.
- Install the ball bearing onto the output shaft [C], with the groove [D] facing engine sprocket side.
- **Spacial Tool - Steering Stem Bearing Driver: 57001-137**



- Install the 5th gear bushing [A] on the drive shaft with their holes [B] aligned.



- Replace any circlips removed with new ones.
- Install the circlips [A] so that the opening [B] is aligned with a spline groove [C].



- The drive shaft gears can be recognized by size: the gear with the smallest diameter is 1st gear, and the largest one is 5th gear. Be sure that all parts are put back in the correct sequence and all circlips and washers are properly in place.
- Install the 3th gear onto the drive shaft with their oil holes aligned.
- The output shaft gears can be recognized by size: the gear with the largest diameter is 1st gear, and the smallest one is 5th gear. Be sure that all parts are put back in the correct sequence and all circlips and washers are properly in place.
- Install the 5th gear onto the output shaft with their oil holes aligned.

## 8-34 CRANKSHAFT/TRANSMISSION

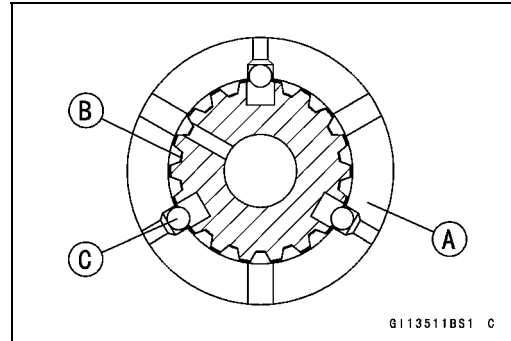
### Transmission

- Fit the steel balls in the 4th gear holes into the groove of the output shaft.  
4th Gear [A]  
Output Shaft [B]  
Steel Balls [C]

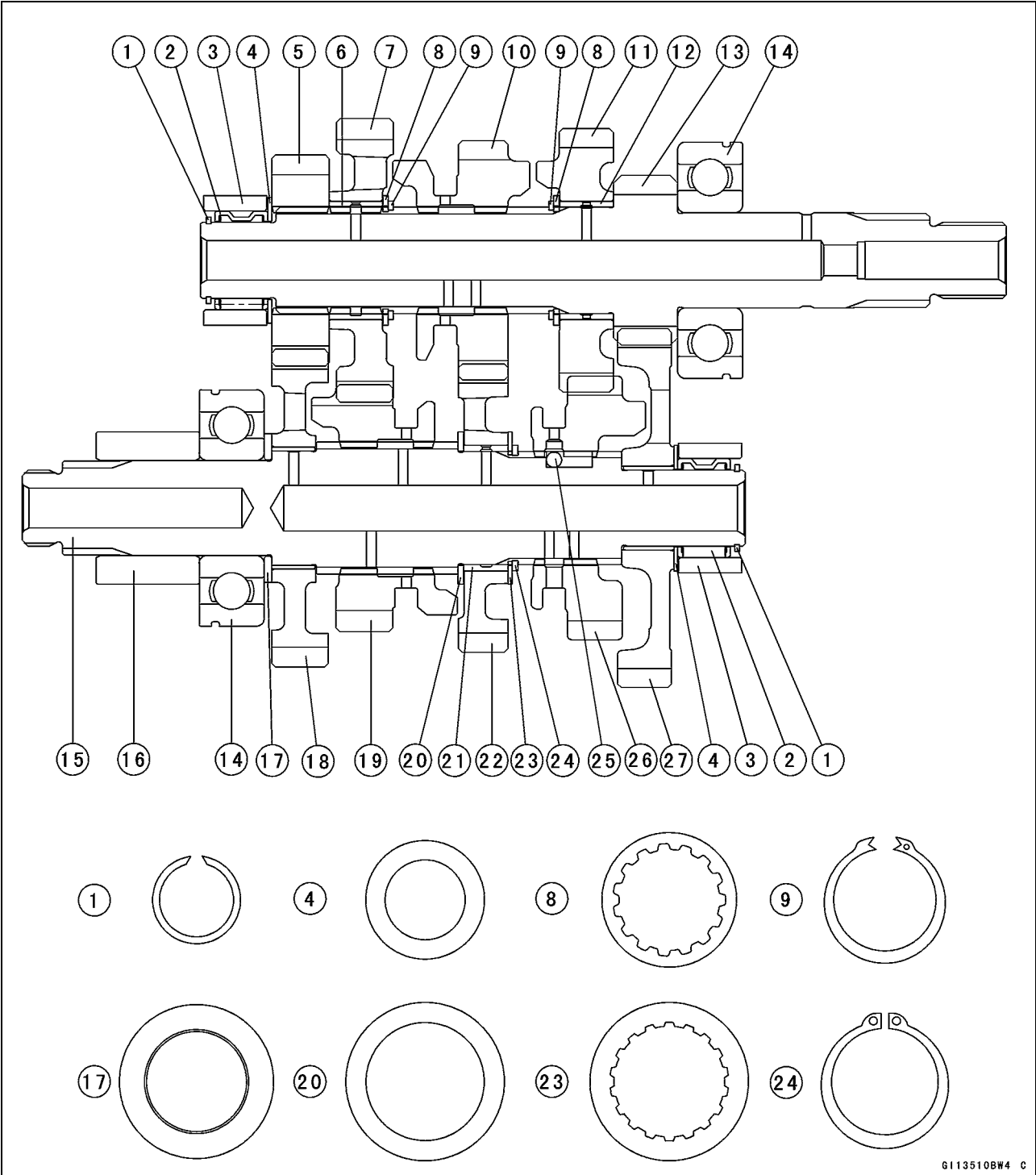
#### **NOTICE**

**Do not apply grease to the balls to hold them in place. This will cause the positive neutral finder mechanism to malfunction.**

- After assembling the 4th gear with steel balls in place on the output shaft, check the ball-locking effect that the 4th gear doesn't come out of the output shaft when moving it up and down by hand.
- Check that each gear spins or slides freely on the transmission shafts without binding after assembly.



Transmission



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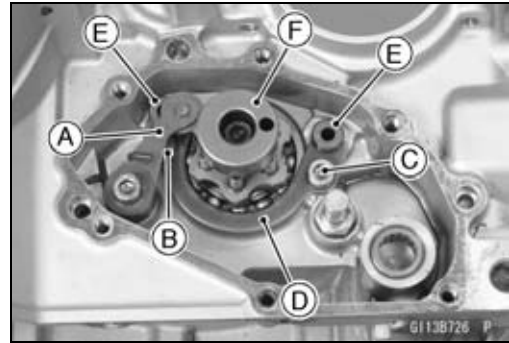
- |                                 |                    |
|---------------------------------|--------------------|
| 1. Circlip                      | 15. Output Shaft   |
| 2. Needle Bearing               | 16. Collar         |
| 3. Bushing                      | 17. Spacer         |
| 4. Spacer                       | 18. 2nd Gear (35T) |
| 5. 2nd Gear (22T)               | 19. Top Gear (23T) |
| 6. Bushing                      | 20. Washer         |
| 7. Top Gear (27T)               | 21. Bushing        |
| 8. Toothed Washer               | 22. 3rd Gear (31T) |
| 9. Circlips                     | 23. Toothed Spacer |
| 10. 3rd Gear (25T)              | 24. Circlip        |
| 11. 4th Gear (28T)              | 25. Steel Ball     |
| 12. Bushing                     | 26. 4th Gear (28T) |
| 13. Drive Shaft, Low Gear (17T) | 27. Low Gear (40T) |
| 14. Ball Bearing                |                    |

## 8-36 CRANKSHAFT/TRANSMISSION

### Transmission

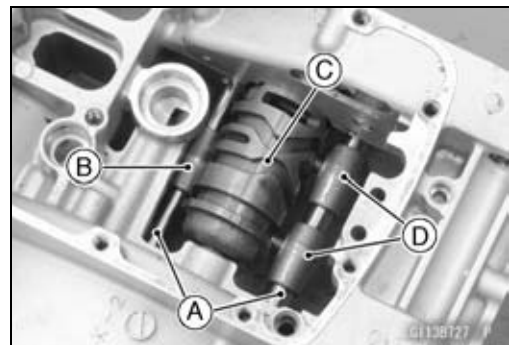
#### Shift Drum and Fork Removal

- Remove:
  - Lower Crankcase Half (see Crankcase Splitting)
  - Shift Shaft Assembly (see External Shift Mechanism Removal)
  - Gear Positioning Lever [A] (see External Shift Mechanism Removal)
  - Screw [B]
  - Bolt [C]
  - Shift Drum Bearing Holder [D]
- Pull out the shift rods [E], and take off the shift forks.
- Pull out the shift drum [F].



#### Shift Drum and Fork Installation

- Apply engine oil to the shift drum, forks and rods.
- Insert the shift drum into the lower crankcase half.
- Install the shift rods [A], noting the groove position.
- The rods are identical.
- Position the one with shortest ears [B] on the drive shaft and place the pin in the center groove in the shift drum [C].
- The two forks [D] on the output shaft are identical.
- Install the forks so that its "282" and "283" side faces engine left side.
- Apply a non-permanent locking agent to the threads of the shift drum bearing holder bolt and screw.
- Tighten the screw first, and then the shift drum bearing holder bolt.

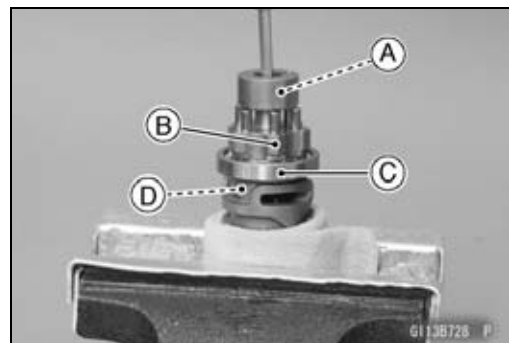


**Torque - Shift Drum Bearing Holder Screw: 4.9 N·m (0.50 kgf·m, 43 in·lb)**

**Shift Drum Bearing Holder Bolt: 12 N·m (1.2 kgf·m, 106 in·lb)**

#### Shift Drum Disassembly

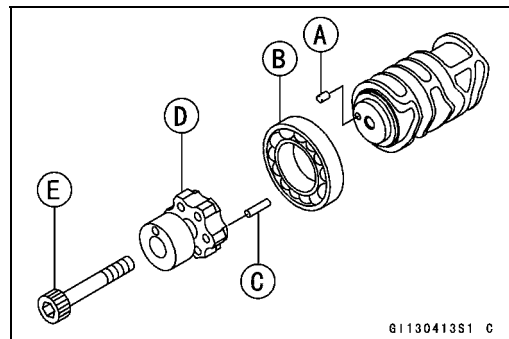
- Remove the shift drum (see Shift Drum and Fork Removal).
- While holding the shift drum with a vise, remove the shift drum cam bolt [A].
- Remove:
  - Shift Drum Cam [B]
  - Ball Bearing [C]
  - Dowel Pin [D]



#### Shift Drum Assembly

- Install:
  - Dowel Pin [A]
  - Ball Bearing [B]
- Be sure to install the dowel pin [C] on the shift drum cam [D] and install the cam.
- Apply a non-permanent locking agent to the threads of the shift drum cam bolt [E], and tighten it.

**Torque - Shift Drum Cam Bolt: 12 N·m (1.2 kgf·m, 106 in·lb)**

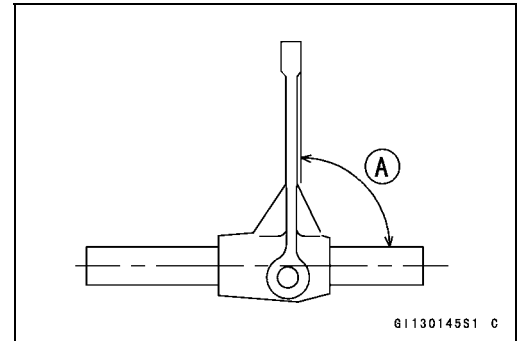


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**Transmission**

**Shift Fork Bending Inspection**

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



**Shift Fork/Gear Groove Wear Inspection**

- Measure the thickness of the shift fork ears [A], and measure the width of the gear grooves [B].
- ★ 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.)

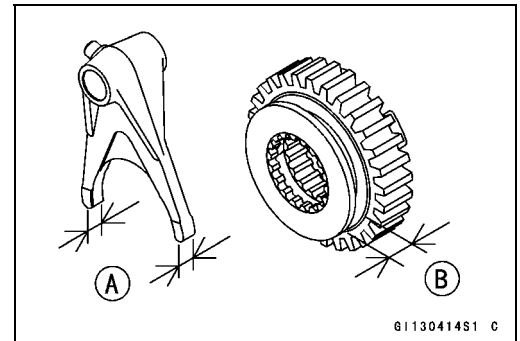
Service Limit: 5.8 mm (0.23 in.)

- ★ 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 (0.25 in.)



**Shift Fork Guide Pin/Drum Groove Wear Inspection**

- Measure the diameter of each shift fork guide pin [A], and measure the width of each shift drum groove [B].
- ★ 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: 5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)

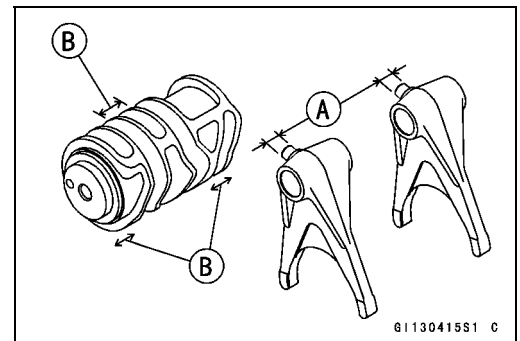
Service Limit: 5.8 mm (0.23 in.)

- ★ If any shift drum groove is worn over the service limit, the drum must be replaced.

**Shift Drum Groove Width**

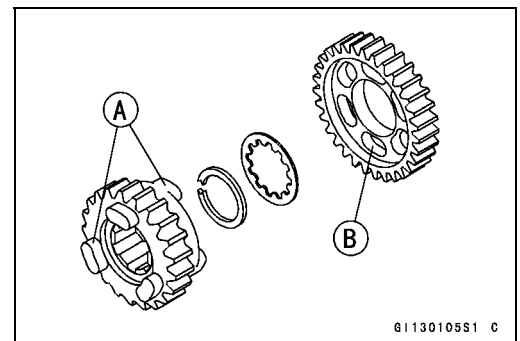
Standard: 6.05 ~ 6.20 mm (0.238 ~ 0.244 in.)

Service Limit: 6.3 mm (0.25 in.)



**Gear Dog and Gear Dog Hole Damage Inspection**

- Visually inspect the gear dogs [A] and gear dog holes [B].
- ★ Replace any damaged gears or gears with excessively worn dogs or dog holes.



## 8-38 CRANKSHAFT/TRANSMISSION

### Ball Bearing, Needle Bearing, and Oil Seal

#### Ball and Needle Bearing Replacement

##### NOTICE

**Do not remove the ball or needle bearings unless it is necessary. Removal may damage them.**

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

##### 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.*

##### NOTICE

**Do not heat the case with a torch. This will warp the case. Soak the case in oil and heat the oil.**

- Using a press and the bearing driver set [A], install the new ball bearing until it stops at the bottom of its housing.
- The new needle bearings must be pressed into the crankcase so that the end is flush with the end of the hole.

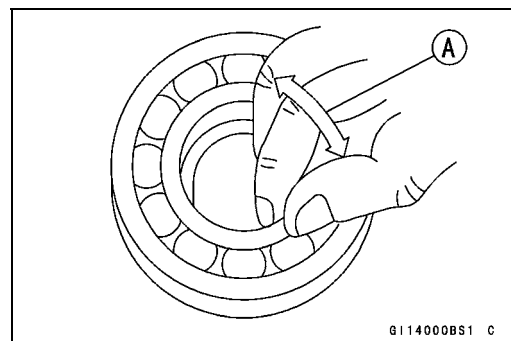
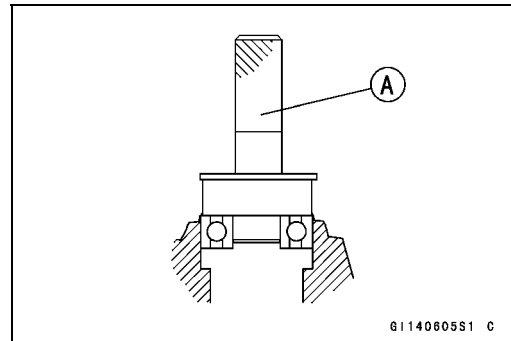
**Special Tool - Bearing Driver Set: 57001-1129**

#### Ball and Needle Bearing Wear Inspection

##### NOTICE

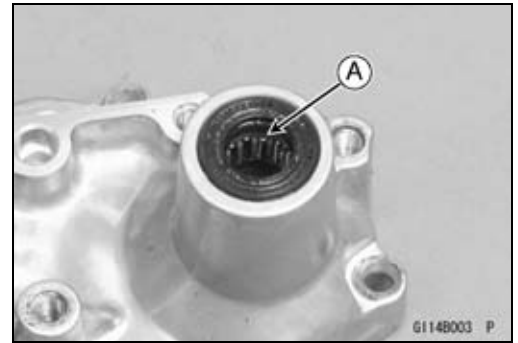
**Do not remove the bearings for inspection. Removal may damage them.**

- 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.



### Ball Bearing, Needle Bearing, and Oil Seal

- Check the needle bearing [A].
- The rollers in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.
- ★ If there is any doubt as to the condition of a needle bearing, replace it.



#### ***Oil Seal Inspection***

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





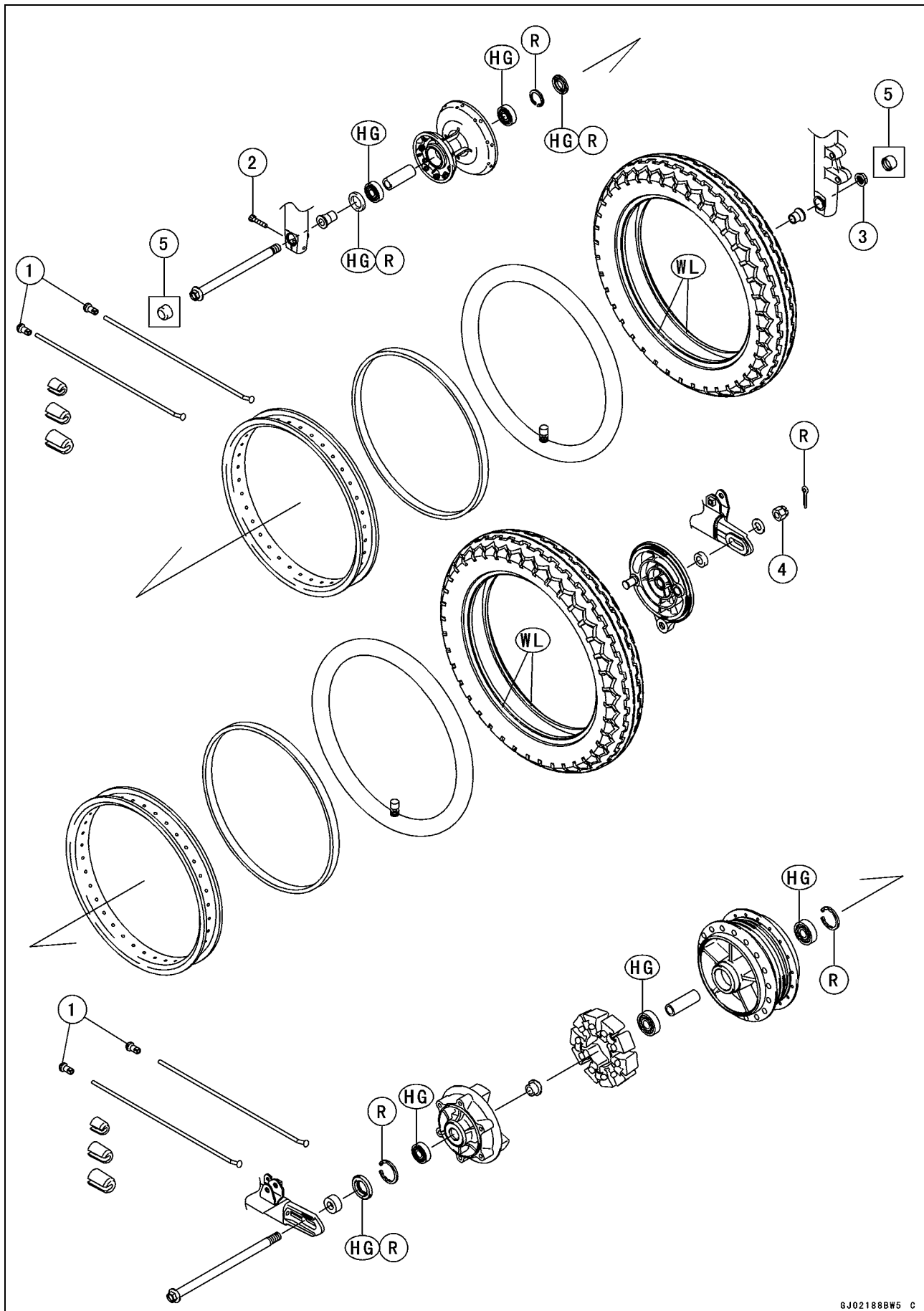
# Wheels/Tires

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# 9-2 WHEELS/TIRES

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Spoke Nipples	5.2	0.53	46 in·lb	
2	Front Axle Clamp Bolt	20	2.0	15	
3	Front Axle Nut	98	10	72	
4	Rear Axle Nut	98	10	72	

5. EUR Model

HG: Apply high-temperature grease.

R: Replacement Parts

WL: Apply soap and water solution or rubber lubricant.

## 9-4 WHEELS/TIRES

### Specifications

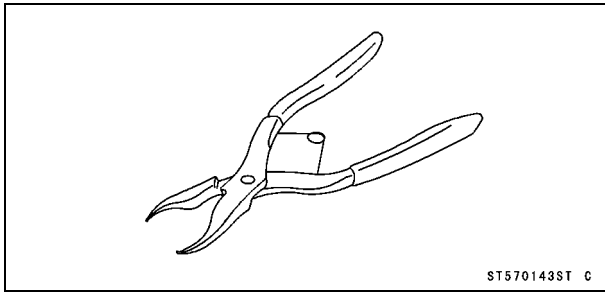
Item	Standard	Service Limit
<b>Wheels (Rims)</b>		
Rim Runout:		
Axial:		
Front	TIR 0.7 mm (0.03 in.) or less	TIR 2.0 mm (0.08 in.)
Rear	TIR 0.8 mm (0.03 in.) or less	TIR 2.0 mm (0.08 in.)
Radial:		
Front	TIR 1.0 mm (0.04 in.) or less	TIR 2.0 mm (0.08 in.)
Rear	TIR 1.2 mm (0.05 in.) or less	TIR 2.0 mm (0.08 in.)
Axle Runout/100 mm (3.94 in.)	TIR 0.03 mm (0.0012 in.) or less	TIR 0.2 mm (0.008 in.)
Balance Weights	10 g (0.35 oz.), 20 g (0.71 oz.), 30 g (1.06 oz.)	— — —
Rim Size:		
Front	J19 × 2.15	— — —
Rear	J18M/C × MT2.75	— — —
<b>Tires</b>		
Air Pressure (When Cold):		
Front	200 kPa (2.0 kgf/cm <sup>2</sup> , 28 psi)	— — —
Rear	Up to 97.5 kg (215 lb) load: 225 kPa (2.25 kgf/cm <sup>2</sup> , 32 psi) Over 97.5 kg (215 lb) load: 250 kPa (2.50 kgf/cm <sup>2</sup> , 36 psi)	— — —
Tread Depth:		
Front:		
DUNLOP	4.4 mm (0.17 in.)	1 mm (0.04 in.)
Rear:		
DUNLOP	7.4 mm (0.29 in.)	Up to 130 km/h (80 mph): 2 mm (0.08 in.)
Standard Tires:	Make, Type	Size
Front	DUNLOP TT100GP G	100/90-19M/C 57H
Rear	DUNLOP TT100GP GP	130/80/18M/C 66H

### **WARNING**

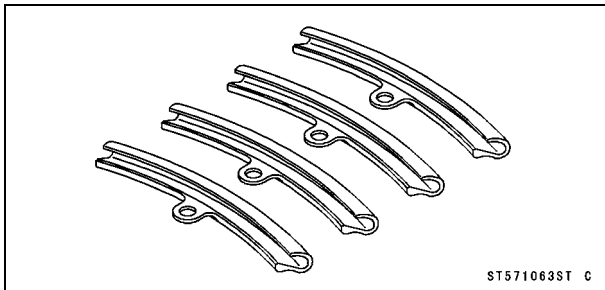
**Some replacement tires may adversely affect handling and cause an accident resulting in serious injury or death. To ensure proper handling and stability, use only the recommended standard tires for replacement, inflated to the standard pressure.**

Special Tools

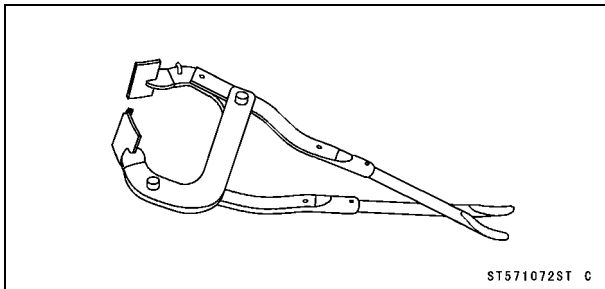
Inside Circlip Pliers:  
57001-143



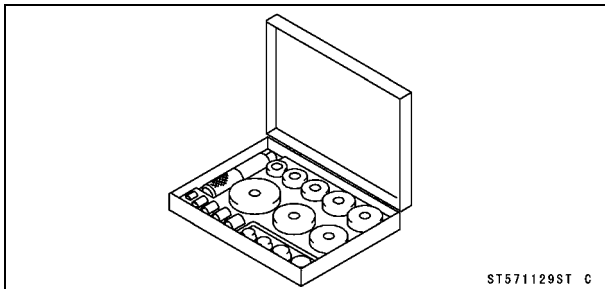
Rim Protector:  
57001-1063



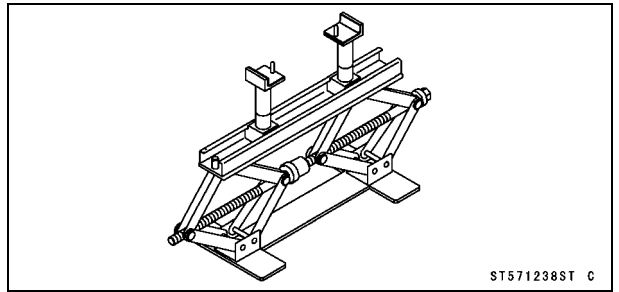
Bead Breaker Assembly:  
57001-1072



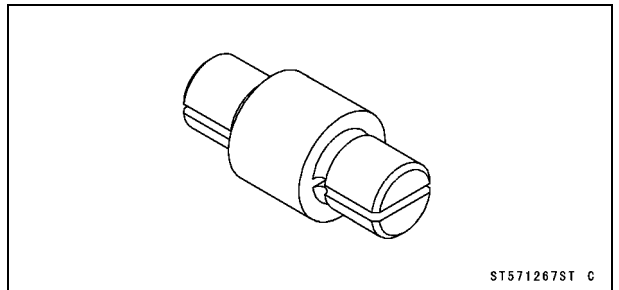
Bearing Driver Set:  
57001-1129



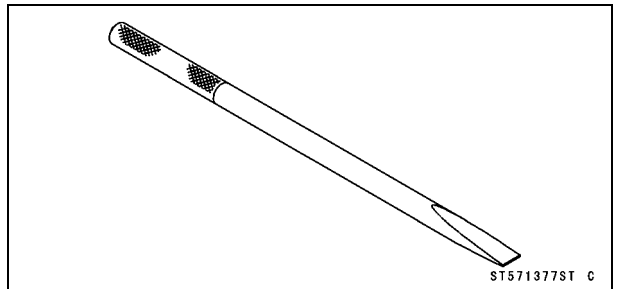
Jack:  
57001-1238



Bearing Remover Head,  $\phi 15 \times \phi 17$ :  
57001-1267



Bearing Remover Shaft,  $\phi 13$ :  
57001-1377



## 9-6 WHEELS/TIRES

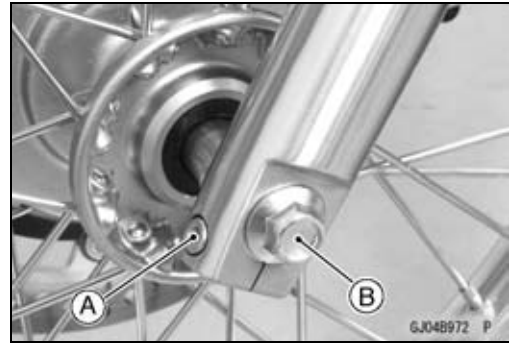
### Wheels (Rims)

#### Front Wheel Removal

- Remove the both front axle caps (EUR model).
- Remove the front axle nut.
- Loosen the front axle clamp bolt [A].
- Raise the front wheel off the ground with jack.

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

- Pull out the axle [B] to the left and drop the front wheel out of the forks.



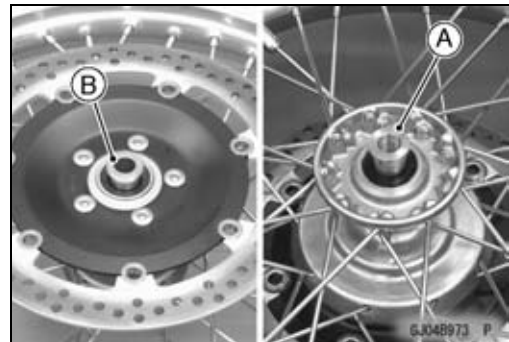
#### NOTICE

**Do not lay the front wheel 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.**

#### Front Wheel Installation

- Apply high-temperature grease to the grease seal lips.
- Fit the collars on the both sides of the hub.
  - Left Side Collar [A] (L = 31.5)
  - Right Side Collar [B] (L = 25.5)
- Insert the front axle.
- Tighten:

**Torque - Front Axle Nut: 98 N·m (10 kgf·m, 72 ft·lb)**



- Before tightening the axle clamp bolt [A] on the left front fork leg, pump the front fork up and down 4 or 5 times to allow the right front fork leg to seat on the front axle.

#### NOTE

○Put a block in front of the front wheel to stop moving.

- Tighten:
  - Torque - Front Axle Clamp Bolt: 20 N·m (2.0 kgf·m, 15 ft·lb)**
- Install the both front axle caps (EUR model).
- Check the front brake effectiveness (see Brake Operation Inspection in the Periodic Maintenance chapter).



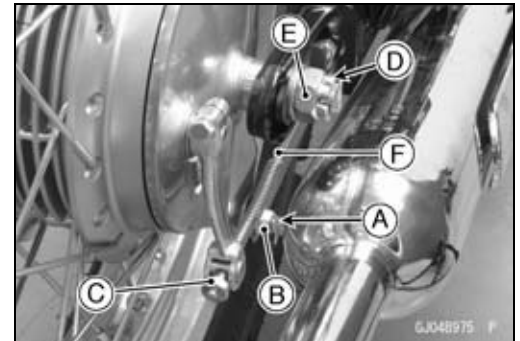
#### ⚠ WARNING

**After servicing, it takes several applications of the brake lever before the brake pads contact the disc, which could result in increased stopping distance and cause an accident resulting in injury or death. Do not attempt to ride the motorcycle until a firm brake lever is obtained by pumping the lever until the pads are against the disc.**

## Wheels (Rims)

### Rear Wheel Removal

- Remove:
  - Snap Pin [A]
  - Torque Link Nut [B] and Bolt
  - Brake Adjusting Nut [C]
  - Cotter Pin [D]
  - Axle Nut [E]
- Depress the brake pedal and remove the brake rod [F].



#### NOTICE

Do not depress the brake pedal deeply in order to separate the brake rod from the brake cam lever joint, this may extend the brake spring beyond its allowable spring extension.

Rotate the rear brake panel clockwise as far as it will go with the brake rod inserted into the brake cam lever joint, then depress the brake pedal lightly, the brake rod will be separated from the brake cam lever joint.

- Use the center stand to support the motorcycle upright.
- Squeeze the front brake lever, and hold it with a band [A] to prevent the motorcycle from running forward.



#### ⚠ WARNING

Motorcycle may fall over unexpectedly resulting in an accident or injury. Be sure to hold the front brake when removing the rear wheel.

#### NOTICE

Be sure to hold the front brake when removing the rear wheel, or the motorcycle may fall over. The rear wheel or the motorcycle could be damaged.

- Pull out the rear axle from the left side.
- Remove the drive chain [A] from the rear sprocket toward the left.
- Move the rear wheel back and remove it.

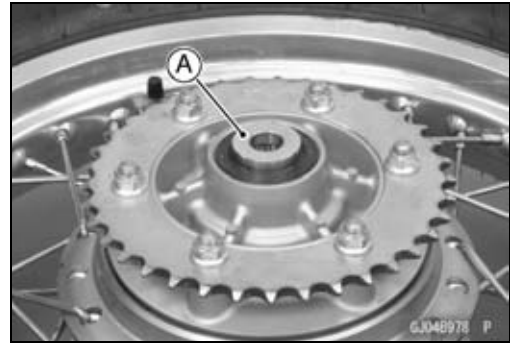


## 9-8 WHEELS/TIRES

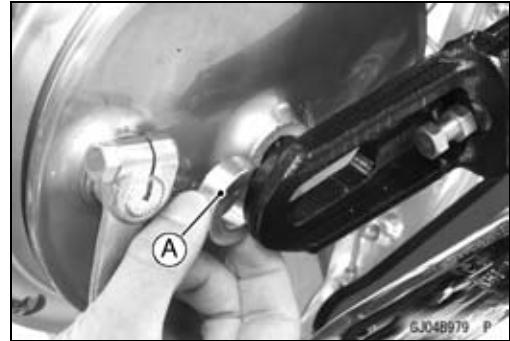
### Wheels (Rims)

#### Rear Wheel Installation

- Apply high-temperature grease to the grease seal lip.
- Fit the collar [A] on the hub.



- Engage the drive chain with the rear sprocket.
- Insert the rear axle from the left side of the wheel.
- Insert the right collar [A] between the brake panel and the swing arm.
- Install the following parts temporarily.
  - Brake Rod
  - Torque Link Nut and Bolt
- Adjust the drive chain slack before tightening the axle nut (see Drive Chain Slack Inspection in the Periodic Maintenance chapter).
- Tighten:

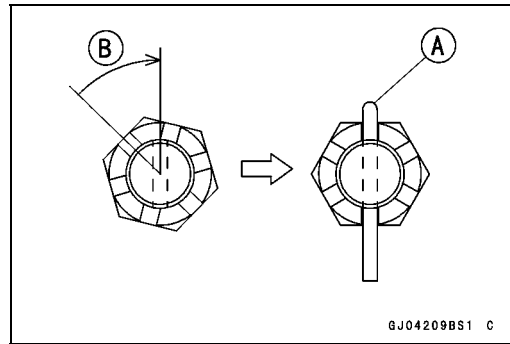


**Torque - Rear Axle Nut: 98 N·m (10 kgf·m, 72 ft·lb)**

- Insert a new cotter pin [A].

#### NOTE

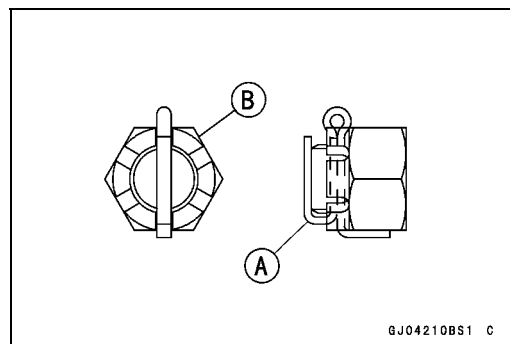
- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle, tighten the nut clockwise [B] up to next alignment.
- It should be within 30°.
- Loosen once and tighten again when the slot goes past the nearest hole.



- Bend the cotter pin [A] over the nut [B].

#### **⚠ WARNING**

**A loose axle nut can lead to an accident resulting in serious injury or death. Tighten the axle nut to the proper torque and install a new cotter pin.**



- Tighten
  - Torque - Torque Link Nut: 32 N·m (3.3 kgf·m, 24 ft·lb)**
- Insert a snap pin.
- Check the rear brake effectiveness (see Brake Operation Inspection in the Periodic Maintenance chapter).

#### Wheel Inspection

- Refer to the Wheel Bearing Damage Inspection in the Periodic Maintenance chapter.



## Wheels (Rims)

### Spoke Inspection

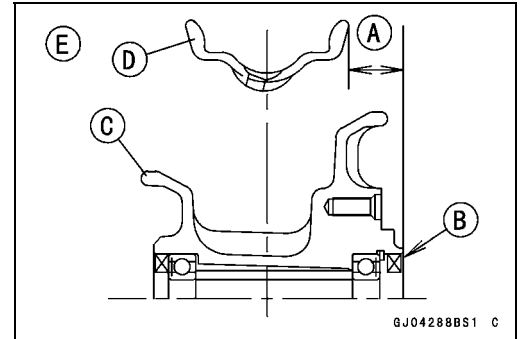
- Refer to the Spoke Tightness and Rim Runout Inspection in the Periodic Maintenance chapter.

### Rim Inspection

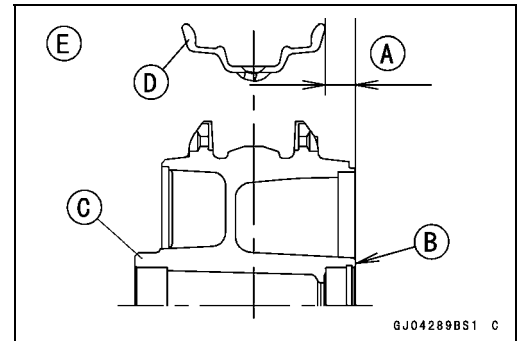
- Refer to the Spoke Tightness and Rim Runout Inspection in the Periodic Maintenance chapter.

### Rim Installation Position

- When installing the rim, set the rim following position.
- The distance [A] from the brake disc seating surface [B] of the front hub [C] to left end of the front rim [D] should be as follows.  
View from Front [E]  
Distance: 25.5 ±0.5 mm (1.00 ±0.020 in.)



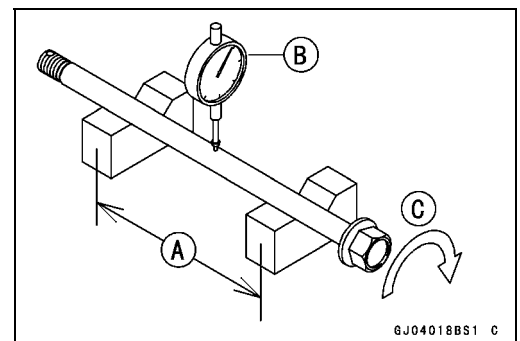
- The distance [A] from the brake disc seating surface [B] of the rear hub [C] to right end of the rear rim [D] should be as follows.  
View from Rear [E]  
Distance: 19.0 ±0.5 mm (0.75 ±0.020 in.)



- Check the rim runout (see Rim Runout Inspection in the Periodic Maintenance chapter).

### Axle Inspection

- Remove the axles (see Front/Rear Wheel Removal).
- Visually inspect the front and rear axle for damages.
- ★ If the axle is damaged or bent, replace it.
- Place the axle on the V blocks that are 100 mm (3.94 in.) [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 gauge reading is the amount of runout.
- ★ If the axle runout exceeds the service limit, replace the axle.



#### Axle Runout/100 mm (3.94 in.)

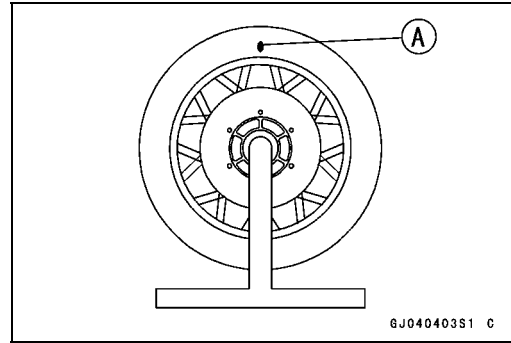
- Standard: TIR 0.03 mm (0.0012 in.) or less
- Service Limit: TIR 0.2 mm (0.008 in.)

# 9-10 WHEELS/TIRES

## Wheels (Rims)

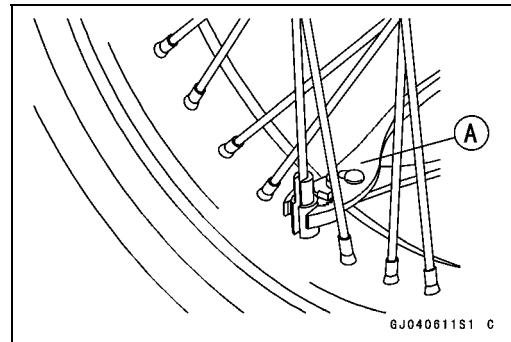
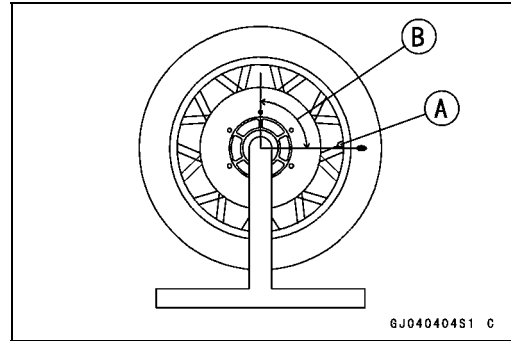
### Balance Inspection

- Remove the front and rear wheels (see Front/Rear Wheel Removal).
- 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 (see Balance Adjustment).



### Balance Adjustment

- If the wheel always stops in one position, provisionally attach a balance weight [A] on the rim at the marking using adhesive tape.
- 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.
- Permanently install the balance weight, using a pliers [A].



### Balance Weight

Part Number	Weight
41075-0011	10 g (0.35 oz.)
41075-0012	20 g (0.71 oz.)
41075-0013	30 g (1.06 oz.)

### NOTE

- Balance weights are available from Kawasaki dealers in 10, 20 and 30 grams (0.35, 0.71 and 1.06 oz.) sizes. An imbalance of less than 10 grams (0.35 oz.) will not usually affect running stability.
- Do not use three or more balance weight (more than 90 gram, 3.2 oz.). If the wheel requires an excess balance weight, disassemble the wheel to find the cause.

**Tires**

**Air Pressure Inspection/Adjustment**

- Refer to the Air Pressure Inspection in the Periodic Maintenance chapter.

**Tire Inspection**

- Refer to the Wheel/Tire Damage Inspection in the Periodic Maintenance chapter.

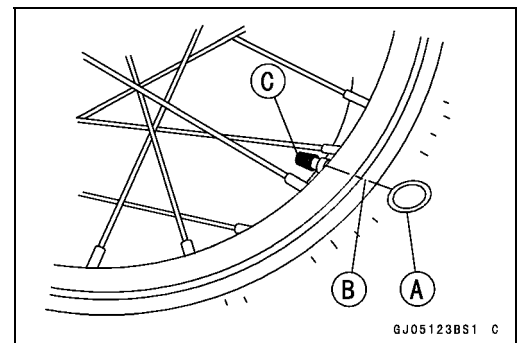
**Tire Removal**

- Remove the wheel (see Front/Rear Wheel Removal).

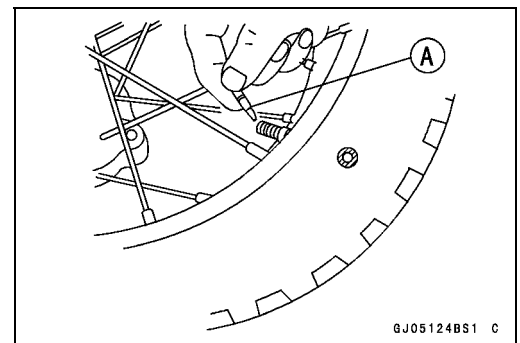
**NOTICE**

**Do not lay the front wheel 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.**

- To maintain wheel balance, mark the air valve position on the tire with chalk so that the tire can be reinstalled in the same position.  
Chalk Mark or Yellow Mark [A]  
Align [B]
- Remove the air valve cap [C].



- Take out the valve core [A] to let out the air.



- Remove the air valve nut.
- 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.

**NOTICE**

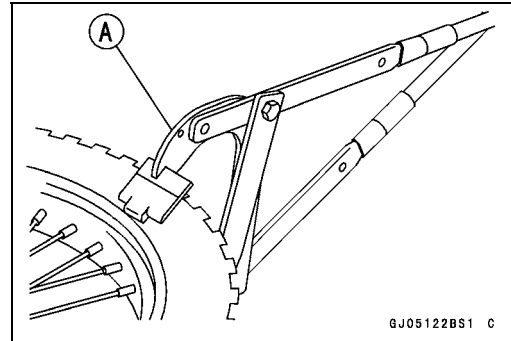
**Never lubricate with engine oil or petroleum distillates because they will deteriorate the tire.**

## 9-12 WHEELS/TIRES

### Tires

- Break the beads away from both sides of the rim with the bead breaker [A].

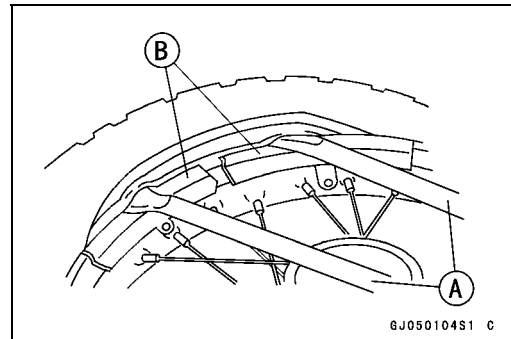
**Special Tool - Bead Breaker Assembly: 57001-1072**



- Lubricate the tire irons [A] (included in Bead Breaker Assembly: 57001-1072) and rim protectors [B] with soap and water solution or rubber lubricant.
- Step on the side of the tire opposite air valve, and pry the tire off the rim with the tire irons of the bead breaker protecting the rim with rim protectors.

#### NOTICE

**Take care not to insert the tire irons so deeply that the tube gets damaged.**



- Remove the tube when one side of the tire is pried off.
- Pry the other side of the tire off the rim.

### Tire Installation

#### ⚠ WARNING

**Some replacement tires may adversely affect handling and cause an accident resulting in serious injury or death. To ensure proper 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

○ *Replace the rim band with a new one whenever the tire is replaced.*

- Inspect the rim and the tire before installing the tire, and replace them if necessary.
- Apply a soap and water solution or rubber lubricant to both the tire bead and the rim flange.
- Check the tire rotation mark [A] on the front and rear tires and install them on the rim accordingly.



**Tires**

- Position the tire on the rim so that the air valve [A] is at the tire balance mark [B] (the chalk mark made during removal, or the paint mark on a new tire).
- Insert the valve stem into the rim, and screw the nut on loosely.
- Fit the rim protectors and use tire irons to install the tire bead.

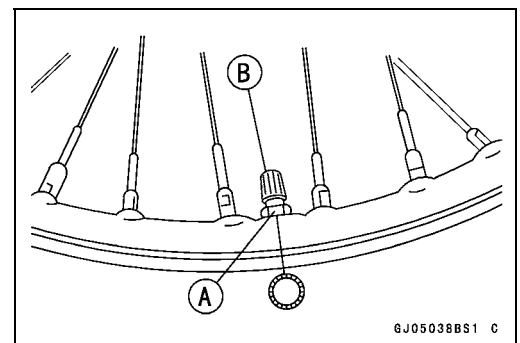
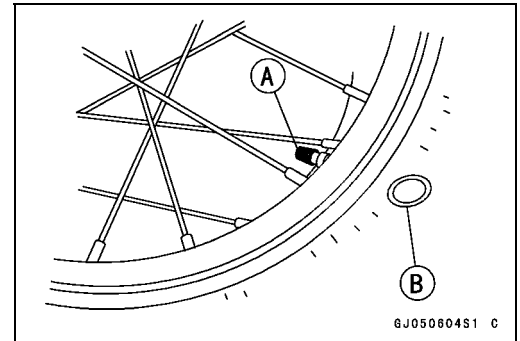
**Special Tools - Rim Protector: 57001-1063**

**Bead Breaker Assembly: 57001-1072**

**NOTICE**

**To prevent rim damage, be sure to place the rim protectors at any place the tire irons are applied.**

- Install the tire on the rim from the air valve side.
- Fit the rim protectors and insert the tire irons so deeply that the tube is not damaged.
- Similarly, slip the tire bead over the rim on the other side.
- Check that the tube is not pinched between the tire and rim.
- Tighten the air valve nut [A] and air valve cap [B].
- Adjust the tire air pressure to the specified pressure (see Air Pressure Inspection in the Periodic Maintenance chapter).



## 9-14 WHEELS/TIRES

### Hub Bearing

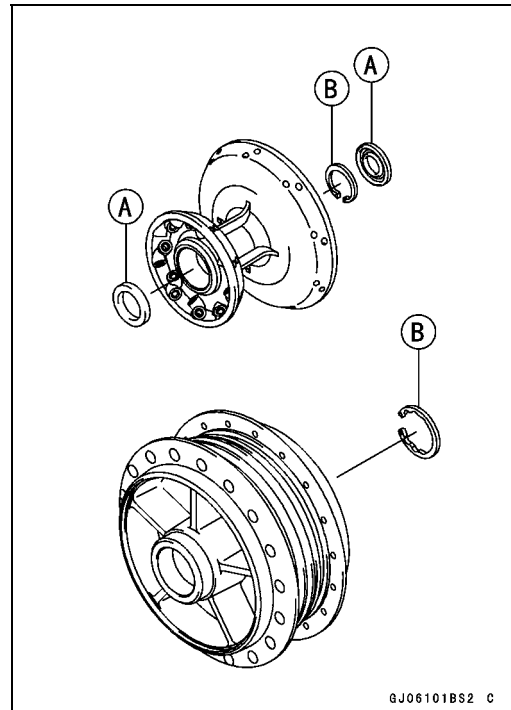
#### Hub Bearing Removal

- Remove the wheel (see Front/Rear Wheel Removal), and take out the following.

Grease Seals [A]

Circlips [B]

Special Tool - Inside Circlip Pliers: 57001-143



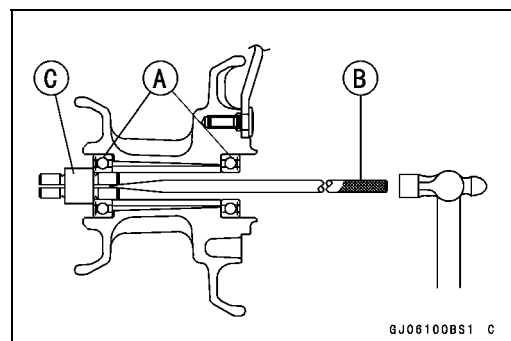
- Use the bearing remover to remove the hub bearings [A].

#### NOTICE

Do not lay the wheel on the ground with the disc facing down. This can damage or warp the disc. Place wooden 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,  $\phi 15 \times \phi 17$ : 57001-1267 [C]



## Hub Bearing

### Hub Bearing Installation

- Before installing the hub 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 or sealed side faces out.

- Install the hub front bearings in the following sequence.
- Press in the right side bearing [A] until it is bottomed.

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

- Insert the collar [B] in the hub [C].
- Press in the left side bearing [D] until it is bottomed.

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

- Install the rear hub bearings in the following sequence.
- Press in the right side bearing until it is bottomed.

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

- Insert the collar in the hub.
- Press in the left side bearing until it is bottomed.

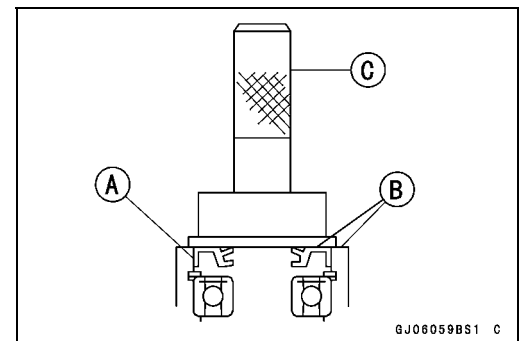
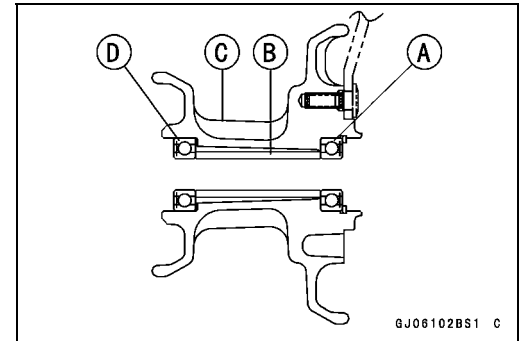
**Special Tool - Bearing Driver Set: 57001-1129**

- Replace the circlips with a new one.

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

- Replace the grease seals with new ones.
- Press in the grease seal [A] so that the seal surface is flush [B] with the end of the hole.
- Apply high-temperature grease to the grease seal lip.

**Special Tool - Bearing Driver Set: 57001-1129 [C]**



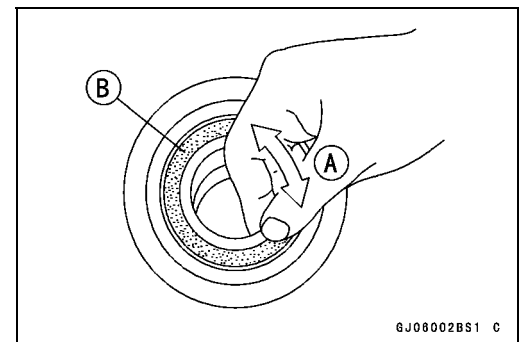
### Hub Bearing Inspection

Since the hub bearings are made to extremely close tolerances, the clearance can not 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 Bearing Lubrication

#### NOTE

○ Since the hub bearings are packed with grease and sealed, lubrication is not required.





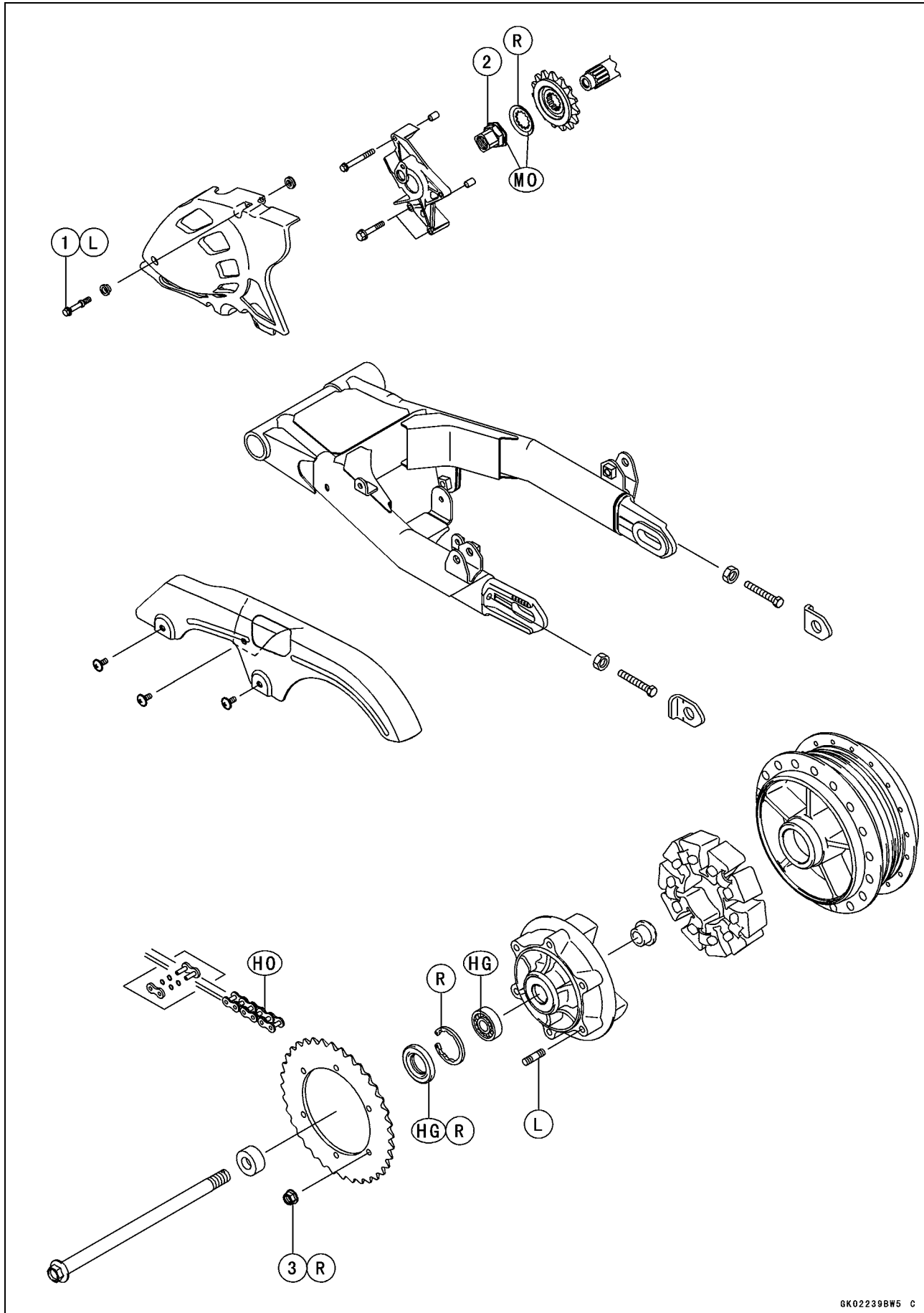
# Final Drive

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# 10-2 FINAL DRIVE

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Sprocket Cover Bolts	12	1.2	106 in·lb	L
2	Engine Sprocket Nut	127	13	94	MO
3	Rear Sprocket Nuts	59	6.0	44	R

HG: Apply high-temperature grease.

HO: Apply heavy oil.

L: Apply a non-permanent locking agent.

MO: Apply molybdenum disulfide oil solution.

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

R: Replacement Parts

## 10-4 FINAL DRIVE

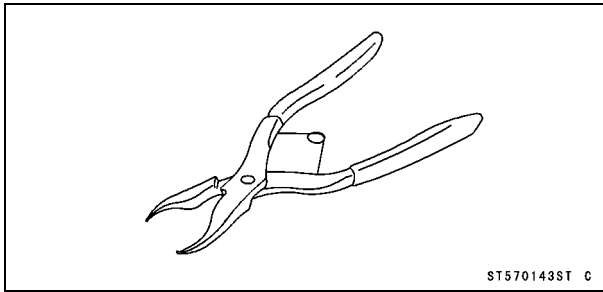
### Specifications

Item	Standard	Service Limit
<b>Drive Chain</b>		
Drive Chain Slack	25 ~ 35 mm (1.0 ~ 1.4 in.)	---
Drive Chain Wear (20-link Length)	317.5 ~ 318.2 mm (12.50 ~ 12.53 in.)	319 mm (12.6 in.)
Standard Chain:		
Make	ENUMA	---
Type	EK520MVXL	---
Link	104 links	---
Link Pin Outside Diameter (When drive chain replacing)	5.7 ~ 6.0 mm (0.22 ~ 0.24 in.)	---
Link Plates Outside width (When drive chain replacing)	17.25 ~ 17.45 mm (0.6791 ~ 0.6870 in.)	---
<b>Sprockets</b>		
Rear Sprocket Warp	0.4 mm (0.016 in.) or less	0.5 mm (0.020 in.)

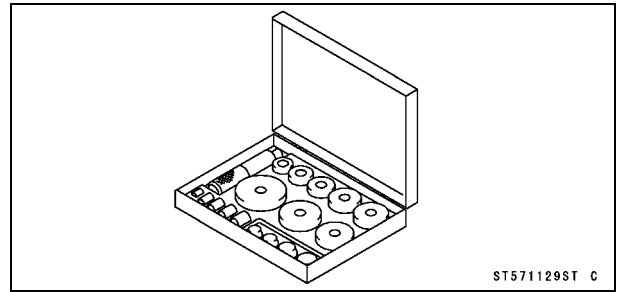
**Special Tools**

---

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



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



## 10-6 FINAL DRIVE

### Drive Chain

#### **Drive Chain Slack Inspection**

- Refer to the Drive Chain Slack Inspection in the Periodic Maintenance chapter.

#### **Drive Chain Slack Adjustment**

- Refer to the Drive Chain Slack Adjustment in the Periodic Maintenance chapter.

#### **Wheel Alignment Inspection/Adjustment**

- Refer to the Wheel Alignment Inspection/Adjustment in the Periodic Maintenance chapter.

#### **Drive Chain Wear Inspection**

- Refer to the Drive Chain Wear Inspection in the Periodic Maintenance chapter.

#### **Drive Chain Lubrication**

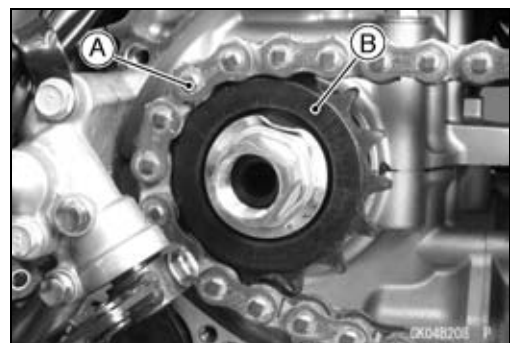
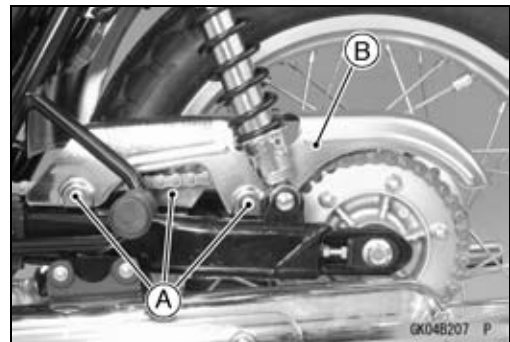
- Refer to the Drive Chain Lubrication in the Periodic Maintenance chapter.

#### **Chain Guide Wear Inspection**

- Refer to the Chain Guide Inspection in the Periodic Maintenance chapter.

#### **Drive Chain Removal**

- Remove:
  - Bolts [A] and Washers
  - Chain Cover [B]
  - Rear Wheel (see Rear Wheel Removal in the Wheels/Tires chapter)
  - Swingarm (see Swingarm Removal in the Suspension chapter)
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal)
  - Speed Sensor Bracket (see Engine Sprocket Removal)
- Remove the drive chain [A] from the engine sprocket [B], and take off the chassis.



#### **Drive Chain Installation**

- Installation is the reverse of removal, note the following.
- Adjust the drive chain slack after installing the chain (see Drive Chain Slack Adjustment in the Periodic Maintenance chapter).

#### **Drive Chain Replacement**

- Remove:
  - Chain Cover (see Drive Chain Removal)
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal)
  - Speed Sensor Bracket (see Engine Sprocket Removal)

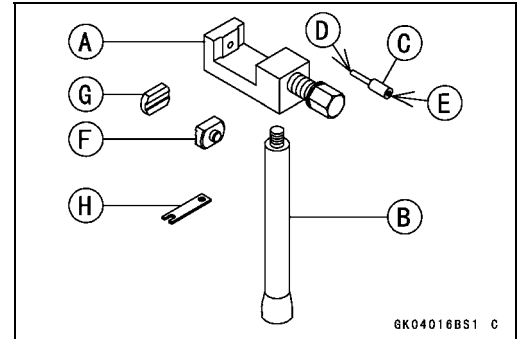
Drive Chain

**NOTICE**

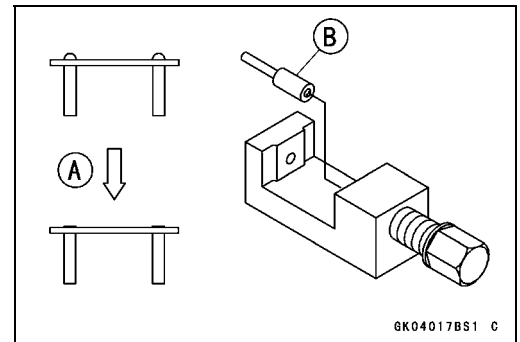
For safety, if the drive chain shall be replaced, replace it using a recommended tool.

Recommended Tool - Type: EK Joint Tool #50  
Brand: ENUMA

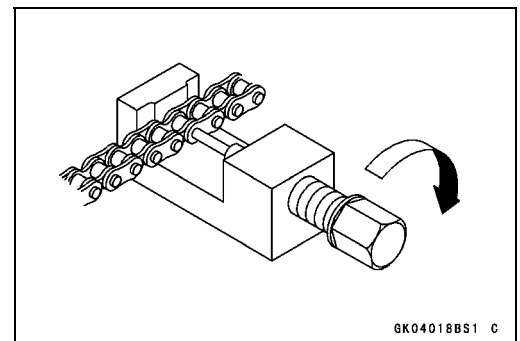
- Body [A]
- Handlebar [B]
- Cutting and Riveting Pin [C]
- For Cutting [D]
- For Riveting [E]
- Plate Holder (A) [F]
- Plate Holder (B) [G]
- Gauge [H]



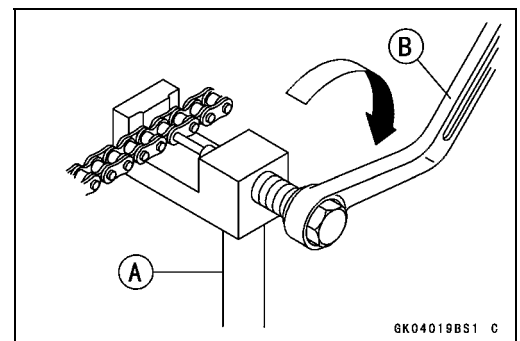
- Grind [A] the pin head to make it flat.
- Set the cutting and riveting pin [B] as shown in the figure.



- Screw the pin holder until it touches chain pin.
- Be sure that the cutting pin hits center of chain pin.



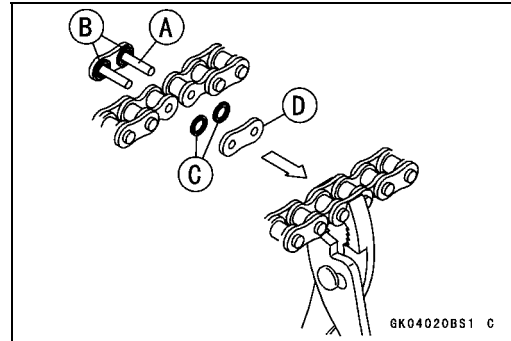
- Screw the handlebar [A] into body.
- Turn the pin holder with wrench [B] clockwise to extract chain pin.



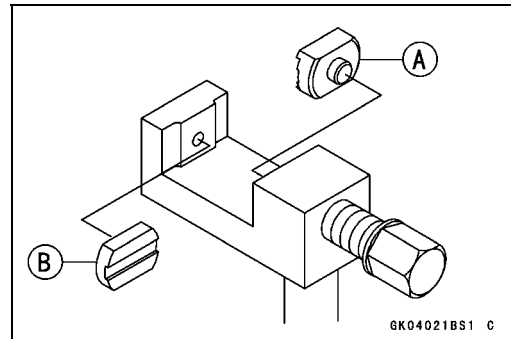
## 10-8 FINAL DRIVE

### Drive Chain

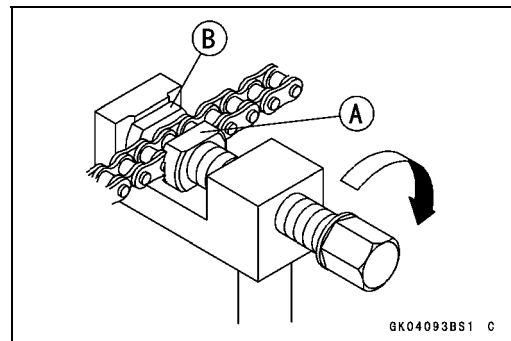
- Replace the link pin, link plate and grease seals.
- Apply grease to the link pins [A] and grease seals [B] [C].
- Engage the drive chain on the engine and rear sprockets.
- Insert the link pins in the drive chain ends.
- Install the grease seals.
- Install the link plate [D] so that the mark faces out.
- Push the link plate by hand or plier to fix it.
- In case of grease seals chain, be sure to set the grease seals correctly.



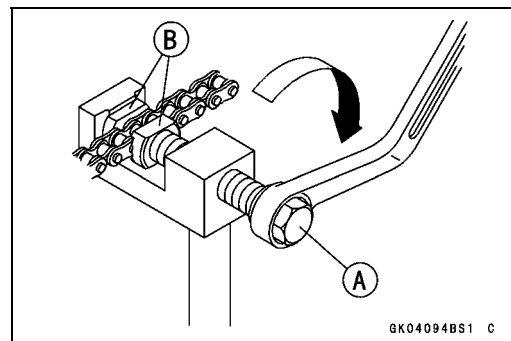
- Set the plate holder (A) [A] and plate holder (B) [B] on the body.



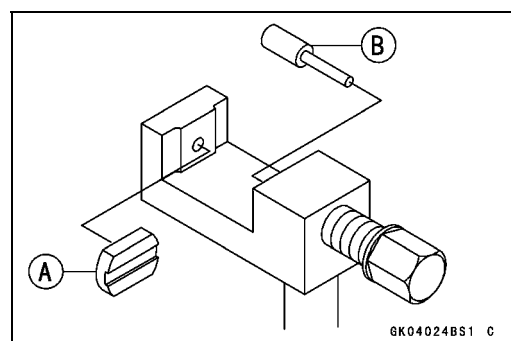
- Fit the plate holder (A) [A] to link plate.
- Turn the pin holder by hand until plate holder (B) [B] touches the other link plate.



- Turn the pin holder [A] by wrench clockwise until two pins of link come into groove of plate holders [B].
- Take off the plate holder.



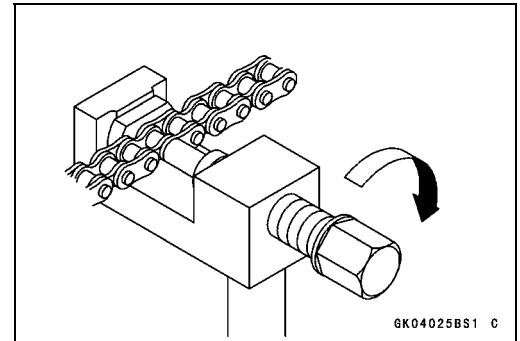
- Set the plate holder (B) [A] and cutting and riveting pin [B] as shown in the figure.



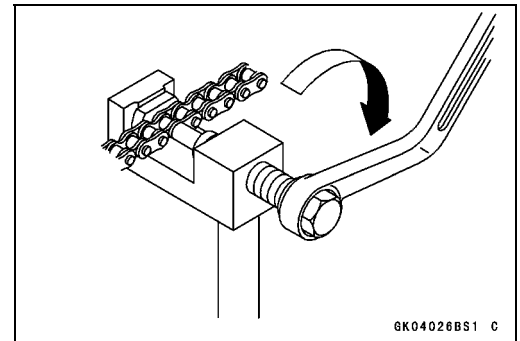


**Drive Chain**

- Turn the pin holder until riveting pin touches link pin.



- Turn the wrench clockwise until tip of riveting pin hits to the link pin.
- Rivet it.
- Same work for the other link pin.



- After staking, check the staked area of the link pin for cracks.
- Measure the outside diameter [A] of the link pin and link plates width [B].

**Link Pin Outside Diameter**

**Standard:** 5.7 ~ 6.0 mm (0.22 ~ 0.24 in.)

**Link Plates Outside Width**

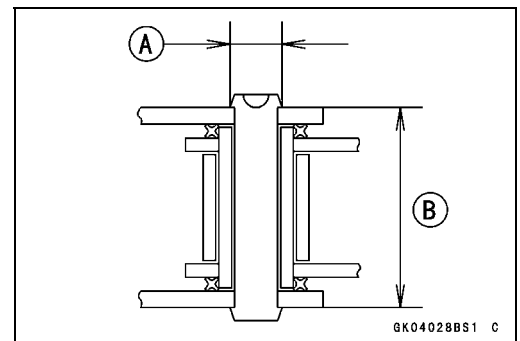
**Standard:** 17.25 ~ 17.45 mm (0.6791 ~ 0.6870 in.)

- ★ If the reading exceeds the specified length, cut and rejoin the chain again.

- Check:

Movement of the Rollers

- Adjust the drive chain slack after installing the chain (see Drive Chain Slack Adjustment in the Periodic Maintenance chapter).

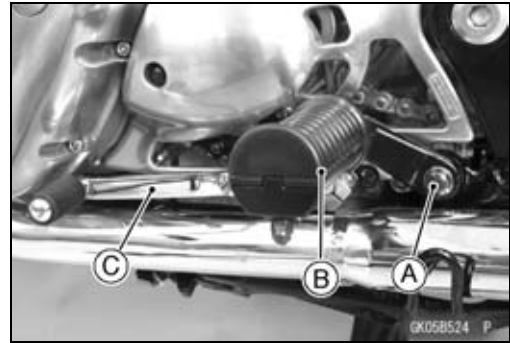


## 10-10 FINAL DRIVE

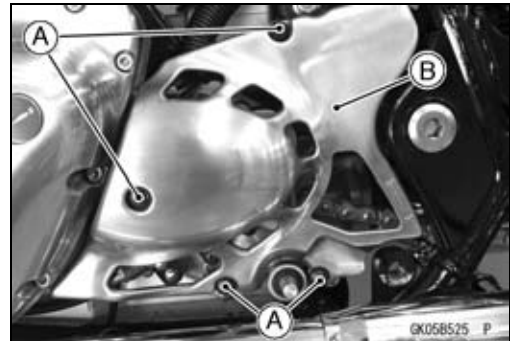
### Sprocket, Sprocket Coupling

#### Engine Sprocket Cover Removal

- Remove:
  - Bolt [A]
  - Left Front Step [B]
  - Shift Pedal [C] (see Shift Pedal Removal in the Crankshaft/Transmission chapter)



- Engine Sprocket Cover Bolts with Dampers [A]
- Engine Sprocket Cover [B]
- Dampers

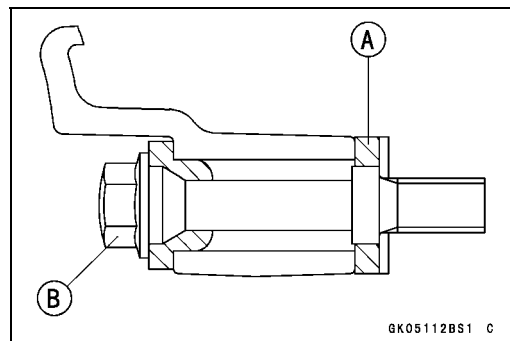


#### Engine Sprocket Cover Installation

- Installation is the reverse of removal.
- Apply a non-permanent locking agent to the threads of the engine sprocket cover bolts.
- Install the dampers [A] and engine sprocket cover bolts [B] as shown in the figure.
- Tighten:

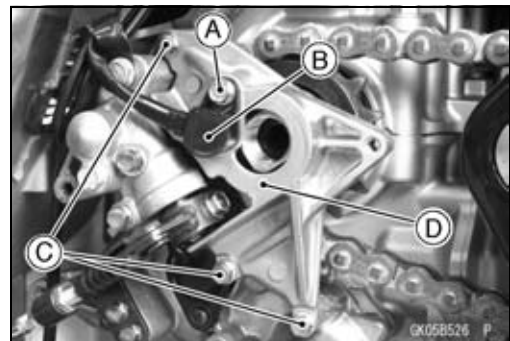
**Torque - Engine Sprocket Cover Bolts: 12 N·m (1.2 kgf·m, 106 ft·lb)**

**Front Step Mounting Bolt: 59 N·m (6.0 kgf·m, 44 ft·lb)**



#### Engine Sprocket Removal

- Remove:
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal)
  - Speed Sensor Mounting Bolt [A]
  - Speed Sensor [B]
  - Speed Sensor Bracket Bolts [C]
  - Speed Sensor Bracket [D]



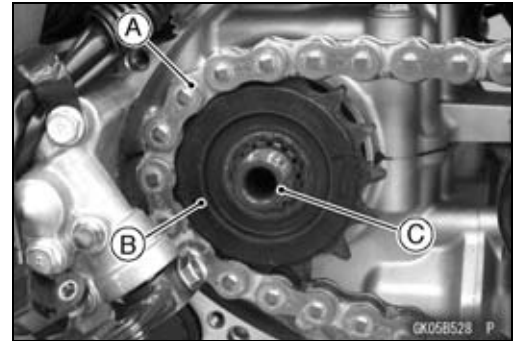
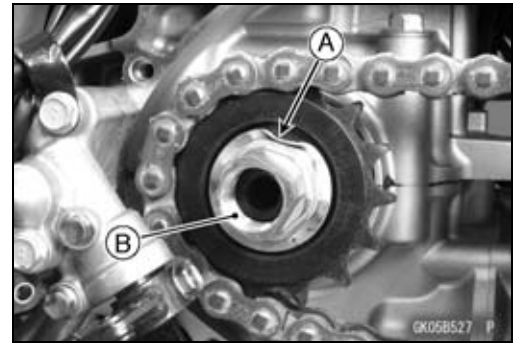
## Sprocket, Sprocket Coupling

- Flatten out the bended sprocket washer [A].
- Remove the engine sprocket nut [B] and washer.

### NOTE

○When loosening the engine sprocket nut, hold the rear brake on.

- Raise the rear wheel off the ground with the stand.
- Loosen the drive chain (see Drive Chain Slack Adjustment in the Periodic Maintenance chapter).
- Remove the drive chain from the rear sprocket toward the right.
- Disengage the drive chain [A] from the engine sprocket [B].
- Pull the engine sprocket off the output shaft [C].



### Engine Sprocket Installation

- Replace the sprocket washer.
- Apply molybdenum disulfide oil solution to the threads and the seating surface of the engine sprocket nut.
- Tighten:

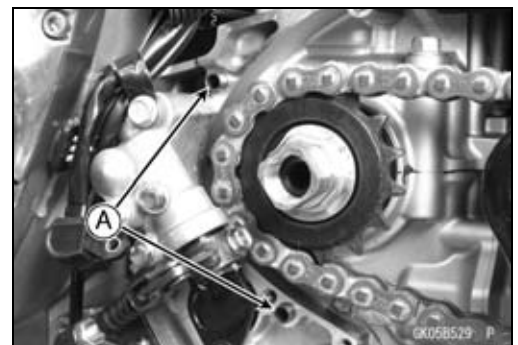
**Torque - Engine Sprocket Nut: 127 N·m (13 kgf·m, 94 ft·lb)**

### NOTE

○Tighten the nut while applying the rear brake.

- After torquing the engine sprocket nut, bend the one side of the washer over the nut.
- Adjust the drive chain slack after installing the engine sprocket (see Drive Chain Slack Adjustment in the Periodic Maintenance chapter).
- Be sure to install the dowel pins [A].
- Install the speed sensor bracket.
- Apply a non-permanent locking agent to the thread of the speed sensor mounting bolt.
- Tighten:

**Torque - Speed Sensor Mounting Bolt: 4.5 N·m (0.46 kgf·m, 40 in·lb)**



## 10-12 FINAL DRIVE

### Sprocket, Sprocket Coupling

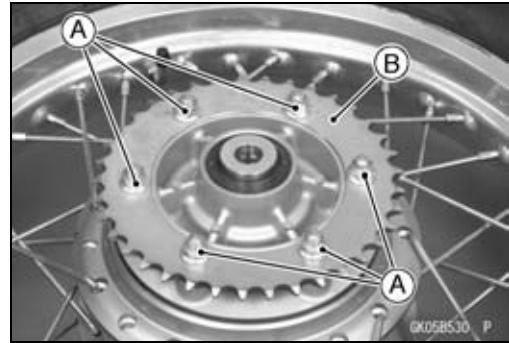
#### Rear Sprocket Removal

- Remove the rear wheel (see Rear Wheel Removal in the Wheels/Tires chapter).

#### NOTICE

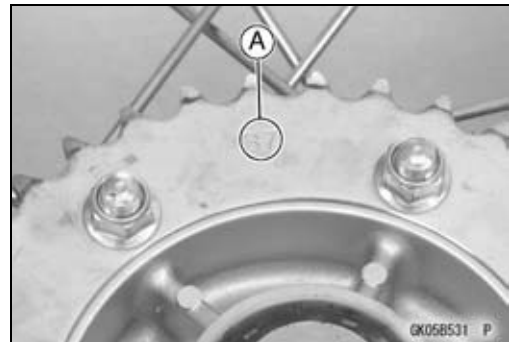
**Do not lay the wheel on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so that the disc does not touch the ground.**

- Remove the rear sprocket nuts [A].
- Remove the rear sprocket [B].



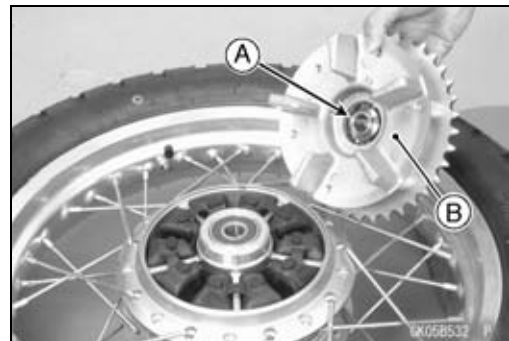
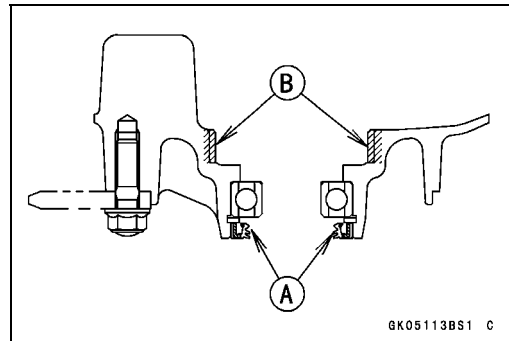
#### Rear Sprocket Installation

- Install the sprocket facing the tooth number marking [A] outward.
- Replace the rear sprocket nuts with new ones.
- Tighten:  
**Torque - Rear Sprocket Nuts: 59 N·m (6.0 kgf·m, 44 ft·lb)**
- Install the rear wheel (see Rear Wheel Installation in the Wheels/Tires chapter).



#### Coupling Installation

- Apply high-temperature grease to the following parts:
  - Coupling Grease Seal Lip [A]
  - Coupling Internal Surface [B]
  
- Install:
  - Collar [A]
  - Coupling [B]

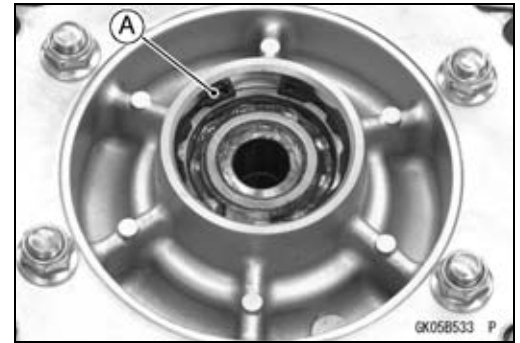


## Sprocket, Sprocket Coupling

### Coupling Bearing Removal

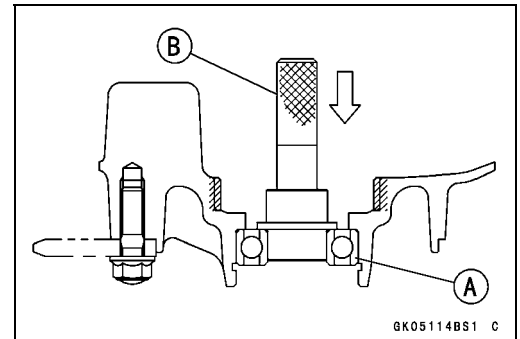
- Remove:
  - Coupling
  - Grease Seal
  - Circlip [A]

Special Tool - Inside Circlip Pliers: 57001-143



- Remove the bearing [A] by tapping from the wheel side.

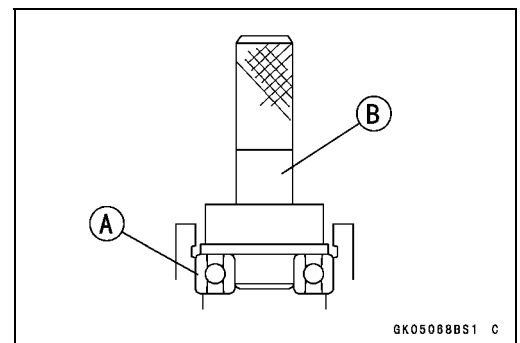
Special Tool - Bearing Driver Set [B]: 57001-1129



### Coupling Bearing Installation

- Replace the bearing with a new one.
- Press in the bearing [A] until it is bottomed.
- Special Tool - Bearing Driver Set [B]: 57001-1129
- Pack the bearing with high-temperature grease.
- Replace the circlip with a new one.

Special Tool - Inside Circlip Pliers: 57001-143



- Replace the grease seal with a new one.
- Press in the grease seal so that the seal surface is flush with the end of the hole.
- Apply high-temperature grease to the grease seal lip.

Special Tool - Bearing Driver Set: 57001-1129

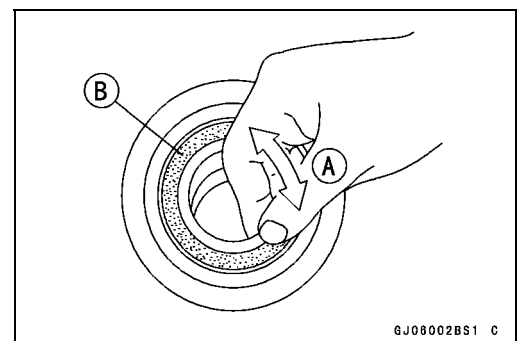
### Coupling Bearing Inspection

Since the coupling bearing is made to extremely close tolerances, the clearance can not normally be measured.

#### NOTE

○ It is not necessary to remove the coupling bearing for inspection. If the bearing is removed, it will need to be replaced with a new one.

- Turn the bearing in the coupling back and forth [A] while checking for plays, roughness or binding.
- ★ If the 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.



### Coupling Bearing Lubrication

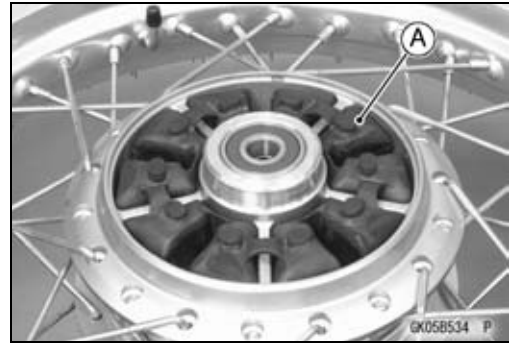
- Pack the bearing with good quality bearing grease. Turn the bearing around by hand a few times to make sure the grease is distributed uniformly inside the bearing.

## 10-14 FINAL DRIVE

### Sprocket, Sprocket Coupling

#### **Coupling Damper Inspection**

- Remove the rear wheel coupling, and inspect the rubber dampers [A].
- Replace the damper if it appears damaged or deteriorated.



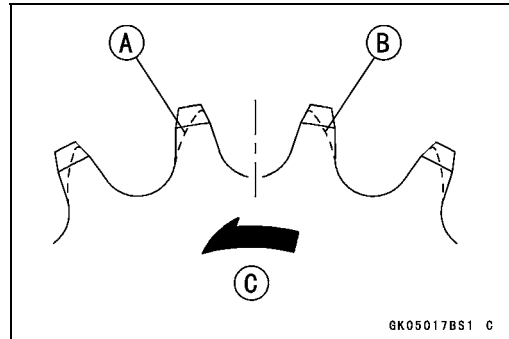
#### **Sprocket Wear Inspection**

- Visually inspect the engine and rear sprocket teeth for wear and damage.
- ★ If the teeth are worn as illustrated, replace the sprocket, and inspect the drive chain wear (see Drive Chain Wear Inspection in the Periodic Maintenance chapter).

Worn Tooth (Engine Sprocket) [A]

Worn Tooth (Rear Sprocket) [B]

Direction of Rotation [C]

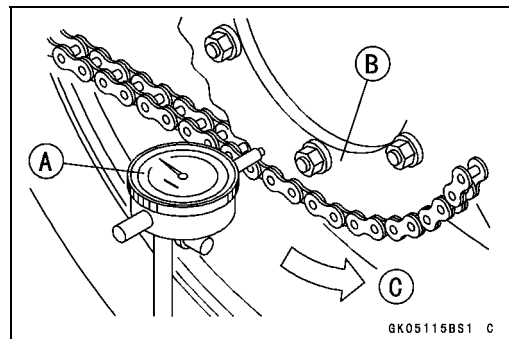


#### **NOTE**

- If a sprocket requires replacement, the chain is probably worn also. When replacing a sprocket, inspect the chain.

#### **Rear Sprocket Warp Inspection**

- Raise the rear wheel off the ground with the stand so that it will turn freely.
- Set a dial gauge [A] against the rear sprocket [B] near the teeth as shown in the figure, and rotate [C] the rear wheel to measure the sprocket runout (warp). The difference between the highest and lowest dial gauge readings is the amount of runout (warp).
- ★ If the runout exceeds the service limit, replace the rear sprocket.



#### **Rear Sprocket Warp**

**Standard:** 0.4 mm (0.016 in.) or less

**Service Limit:** 0.5 mm (0.020 in.)

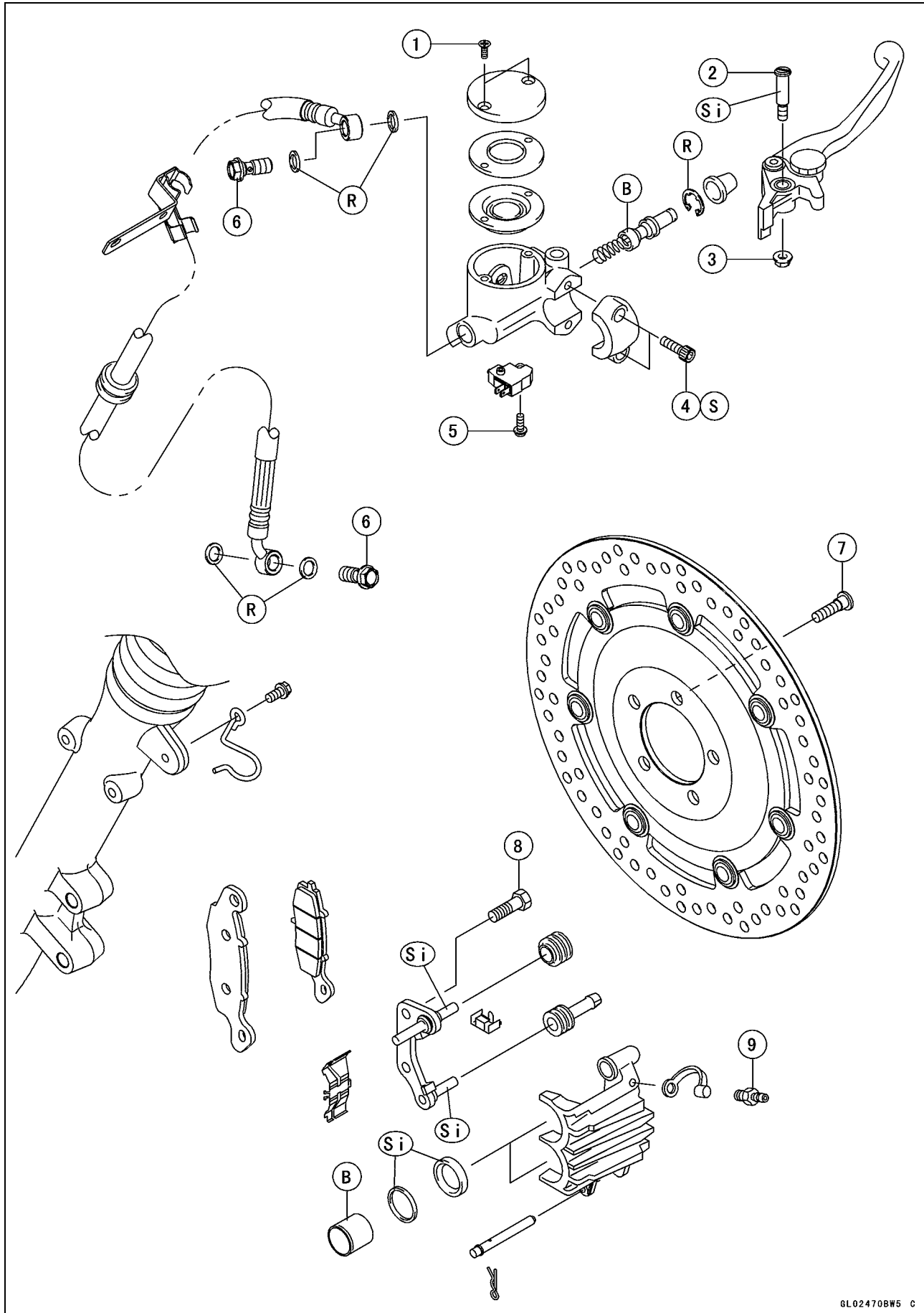
# Brakes

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# 11-2 BRAKES

## Exploded View





## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Brake Reservoir Cap Screws	1.5	0.15	13 in·lb	
2	Brake Lever Pivot Bolt	1.0	0.10	9 in·lb	Si
3	Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
4	Master Cylinder Clamp Bolts	11	1.1	97 in·lb	S
5	Front Brake Light Switch Screw	1.2	0.12	11 in·lb	
6	Brake Hose Banjo Bolts	25	2.5	18	
7	Brake Disc Mounting Bolts	23	2.3	17	
8	Caliper Mounting Bolts	34	3.5	25	
9	Bleed Valve	7.8	0.80	69 in·lb	

B: Apply brake fluid.

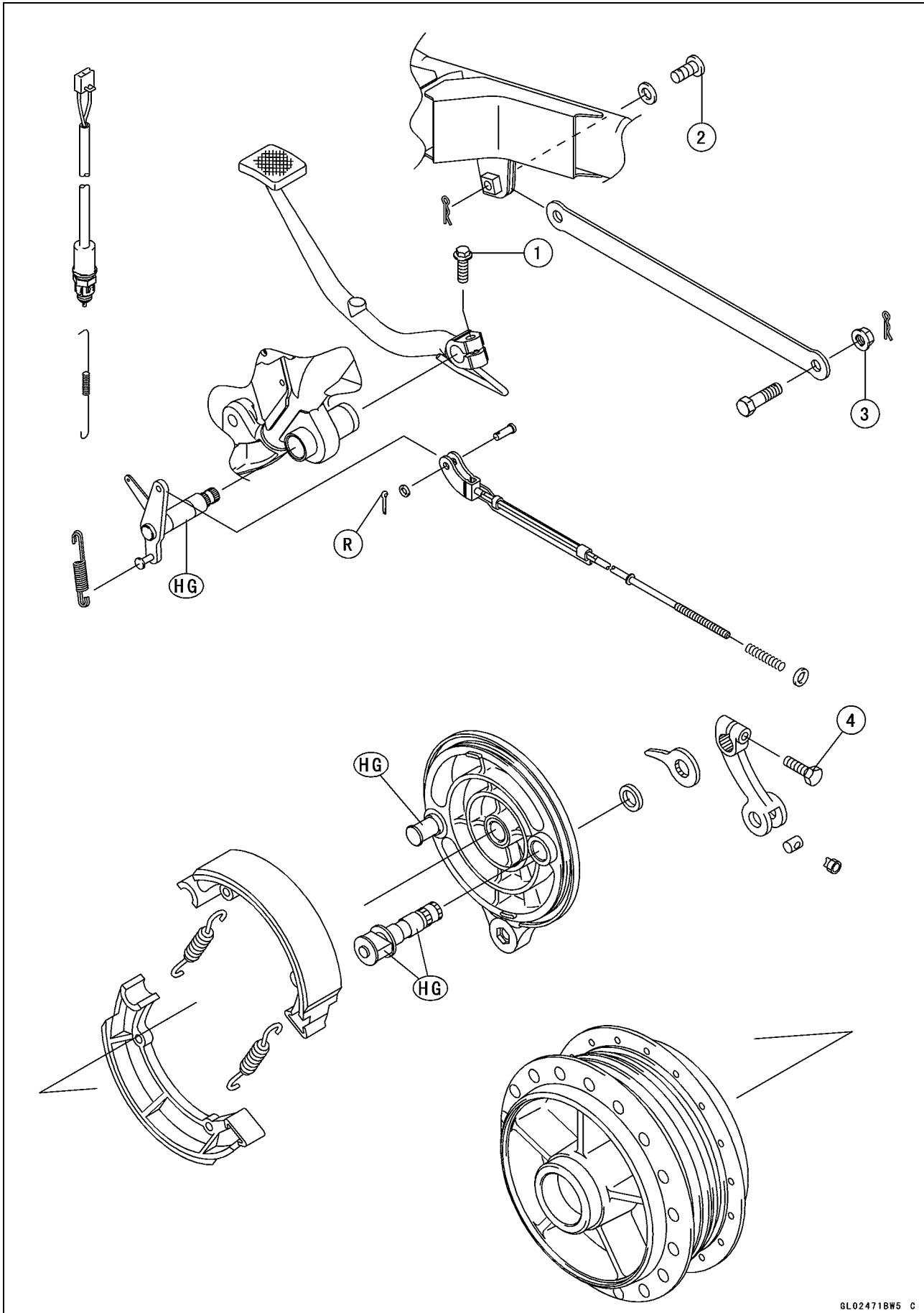
R: Replacement Parts

S: Follow the specified tightening sequence.

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

# 11-4 BRAKES

## Exploded View



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**Exploded View**


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No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Brake Pedal Bolt (EJ800AB)	25	2.5	18	
	Brake Pedal Bolt (EJ800AC)	34	3.5	25	
2	Torque Link Bolt	32	3.3	24	
3	Torque Link Nut	32	3.3	24	
4	Cam Lever Bolt	19	1.9	14	

HG: Apply high-temperature grease.

R: Replacement Parts

## 11-6 BRAKES

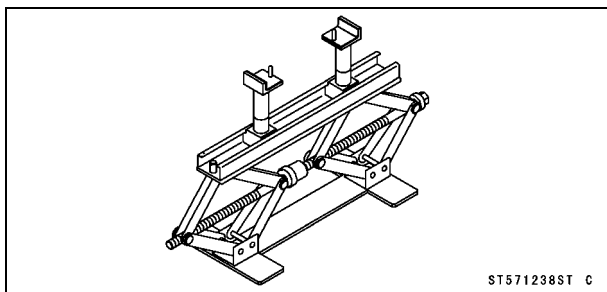
### Specifications

Fastener	Standard	Service Limit
<b>Brake Lever</b>		
Brake Lever Position	4-way adjustable (to suit rider)	— — —
Brake Lever Free Play	Non-adjustable	— — —
<b>Brake fluid</b>		
Grade	DOT4	
<b>Brake Pads</b>		
Pad Lining Thickness	4.5 mm (0.18 in.)	1 mm (0.04 in.)
<b>Brake Disc</b>		
Thickness	4.8 ~ 5.1 mm (0.19 ~ 0.20 in.)	4.5 mm (0.18 in.)
Runout	TIR 0.15 mm (0.0059 in.) or less	TIR 0.3 mm (0.01 in.)
<b>Brake Pedal</b>		
Pedal Free Play	20 ~ 30 mm (0.8 ~ 1.2 in.)	— — —
Pedal Position	Non-adjustable	— — —
<b>Brake Drum, Brake Shoes</b>		
Shoe Lining Thickness	3.55 ~ 3.85 mm (0.140 ~ 0.152 in.)	1.85 mm (0.073 in.)
Shoe Spring Free Length	47.5 ~ 48.5 mm (1.87 ~ 1.91 in.)	50.4 mm (1.98 in.)
Drum Inside Diameter	160.00 ~ 160.16 mm (6.299 ~ 6.305 in.)	160.75 mm (6.329 in.)
Camshaft Diameter	16.957 ~ 16.984 mm (0.6676 ~ 0.6687 in.)	16.88 mm (0.665 in.)
Camshaft Hole Inside Diameter	17.000 ~ 17.027 mm (0.6693 ~ 0.6704 in.)	17.15 mm (0.675 in.)
Cam Lever Angle	80 ~ 90°	— — —

**Special Tool**

---

**Jack:  
57001-1238**



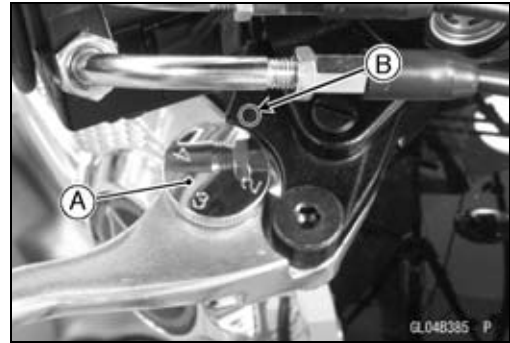
## 11-8 BRAKES

### Brake Lever

#### ***Brake Lever Position Adjustment***

The brake lever adjuster has 4 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 4 and maximum at number 1.



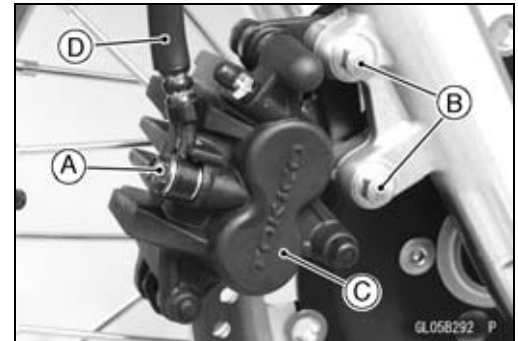
## Caliper

### Caliper Removal

- Loosen the banjo bolt [A] at the brake hose lower end, and tighten it loosely.
- Unscrew the caliper mounting bolts [B], and detach the caliper [C] from the disc.
- Unscrew the banjo bolt and remove the brake hose [D] from the caliper (see Brake Hose Replacement in the Periodic Maintenance chapter).

#### NOTICE

**Immediately wash away any brake fluid that spills.**



#### NOTE

*○ If the caliper is to be disassembled after removal and if compressed air is not available, disassemble the caliper before the brake hose is removed (see Caliper Rubber Parts Replacement in the Periodic Maintenance chapter).*

### Caliper Installation

- Install the caliper and brake hose lower end.
- Replace the washers on each side of hose fitting with new ones.
- Tighten:
  - Torque - 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)**
- Bleed the brake line (see Brake Line Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.

#### **⚠ WARNING**

**After servicing, it takes several applications of the brake lever or pedal before the brake pads contact the disc, which could result in increased stopping distance and cause an accident resulting in injury or death. Do not attempt to ride the motorcycle until a firm brake lever or pedal is obtained by pumping the lever until the pads are against the disc.**

### Caliper Disassembly

- Refer to the Caliper Rubber Parts Replacement in the Periodic Maintenance chapter.

### Caliper Assembly

- Refer to the Caliper Rubber Parts Replacement in the Periodic Maintenance chapter.

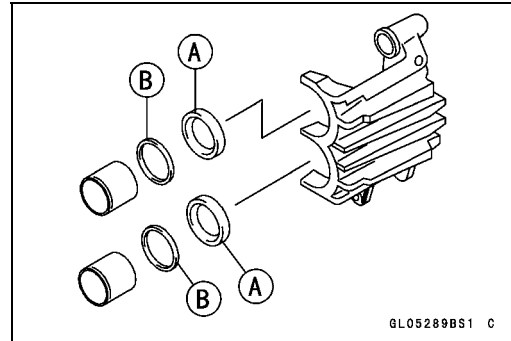
## 11-10 BRAKES

### Caliper

#### **Caliper Fluid Seal Damage Inspection**

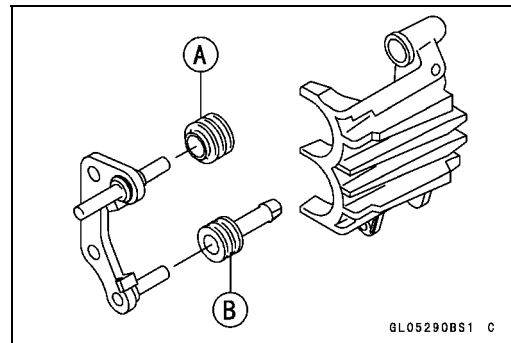
The fluid seal (piston seal) [A] is placed around the piston to maintain clearance between the pad and the disc. If the seal is in a poor condition, it could lead the pad to wear excessively or the brake to drag, which may cause the temperature of the discs or the brake fluid to increase.

- 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.



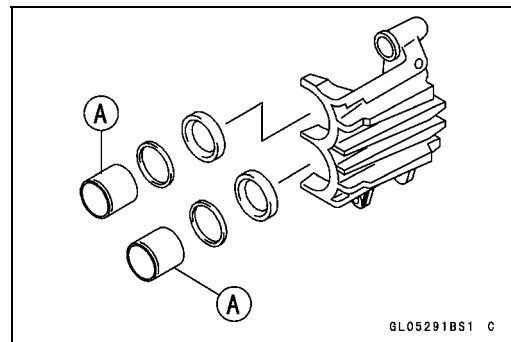
#### **Caliper Dust Boot and Friction Boot Damage Inspection**

- Check that the dust boot [A] and friction boot [B] are not cracked, worn, swollen, or otherwise damaged.
- ★ If they show any damage, replace it.



#### **Caliper Piston and Cylinder Damage Inspection**

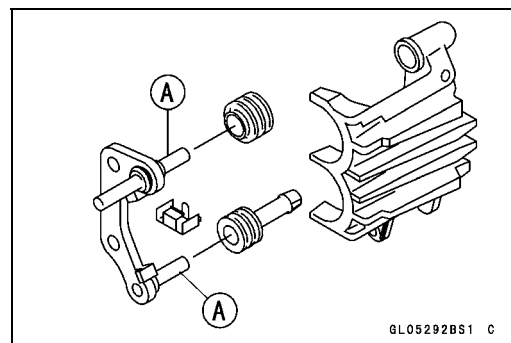
- Visually inspect the pistons [A] and cylinder surfaces.
- ★ Replace the caliper if the cylinder and piston are badly scored or rusty.



#### **Caliper Holder Shaft Wear Inspection**

The caliper body must slide smoothly on the caliper holder shafts [A]. If the body does not slide smoothly, one pad will wear more than the other pad wear will increase, and constant drag on the disc will raise brake and brake fluid temperature.

- Check to see that the caliper holder shafts are not badly worn or stepped, and that the rubber friction boots are not damaged.
- ★ If the rubber friction boot is damaged, replace the rubber friction boot. To replace the friction boot, remove the pads and the caliper bracket.
- ★ If the caliper holder shaft is damaged, replace the caliper bracket.

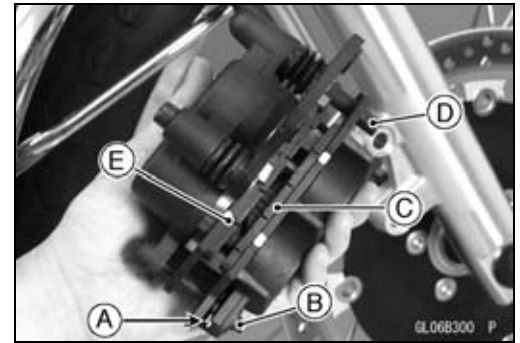




## Brake Pads

### **Brake Pad Removal**

- Remove the caliper with the hose installed (see Caliper Removal).
- Draw out the holder shaft pin [A], and take off the holder shaft [B].
- Remove the pad [C] from the holder shaft [D].
- Remove the other side pad [E].



### **Brake Pad Installation**

- Push the caliper pistons in by hand as far as they will go.
- Install the pad spring in its correct position.
- Install the pad on the piston side first, then install the other pad on the holder.
- Install the caliper (see Caliper Installation).

### **⚠ WARNING**

**After servicing, it takes several applications of the brake lever before the brake pads contact the disc, which could result in increased stopping distance and cause an accident resulting in injury or death. Do not attempt to ride the motorcycle until a firm brake lever is obtained by pumping the lever until the pads are against the disc.**

### **Brake Pad Wear Inspection**

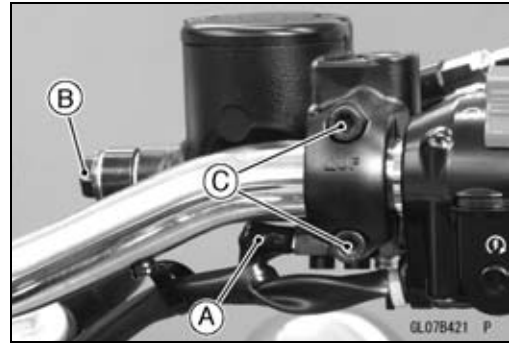
- Refer to the Brake Pad Wear Inspection in the Periodic Maintenance chapter.

## 11-12 BRAKES

### Master Cylinder

#### **Master Cylinder Removal**

- Remove the rear view mirror (see Rear View Mirror Removal in the Frame chapter).
- Disconnect the front brake light switch connectors [A].
- Remove the banjo bolt [B] to disconnect the brake hose from the master cylinder (see Brake Hose Removal/Installation).
- Unscrew the clamp bolts [C], and take off the master cylinder as an assembly with the reservoir, brake lever, and brake switch installed.



#### **NOTICE**

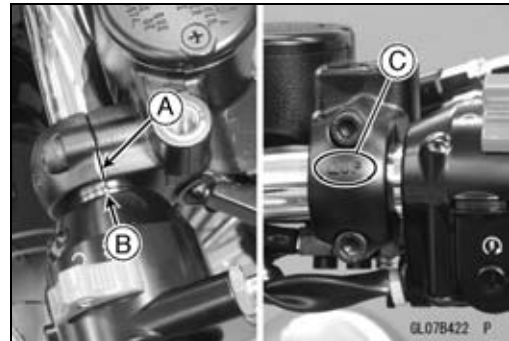
**Immediately wash away any brake fluid that spills.**

#### **Master Cylinder Installation**

- Set the master cylinder to match its mating surface [A] to the punch mark [B] of the handlebar.
- The master cylinder clamp must be installed with the arrow mark [C] upward.
- Tighten the upper clamp bolt first, and then the lower clamp bolt.

**Torque - Master Cylinder Clamp Bolts: 11 N·m (1.1 kgf·m, 97 in·lb)**

- Replace the washers that are on each side of the hose fitting with new ones.
- Tighten:
  - Torque - 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.



#### **Master Cylinder Disassembly**

- Refer to the Master Cylinder Rubber Parts Replacement in the Periodic Maintenance chapter.

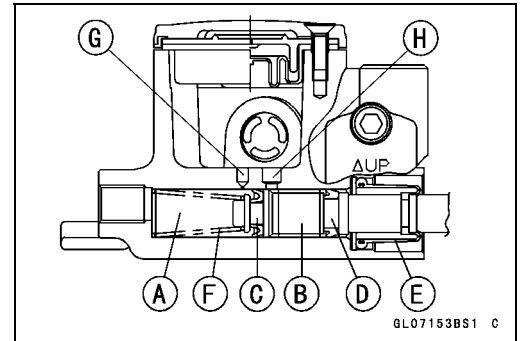
#### **Master Cylinder Assembly**

- Refer to the Master Cylinder Rubber Parts Replacement in the Periodic Maintenance chapter.

## Master Cylinder

### Master Cylinder Inspection

- Remove the master cylinder (see Master Cylinder Removal).
- Disassemble the master cylinder.
- 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 assembly should be replaced to renew the cups.
- ★ If fluid leakage is noted at the brake 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 the piston return spring [F] for any damage.
- ★ If the spring is damaged, replace it.
- 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.

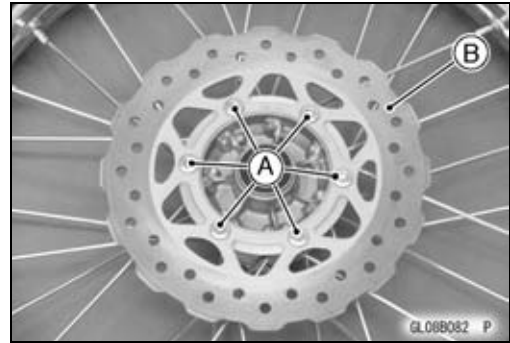


# 11-14 BRAKES

## Brake Disc

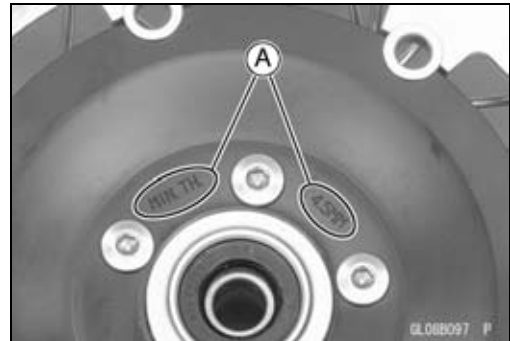
### Brake Disc Removal

- Remove the front wheel (see Front Wheel Removal in the Wheels/Tires chapter).
- Unscrew the mounting bolts [A], and take off the brake disc [B].



### Brake Disc Installation

- Install the brake disc on the wheel so that the marked side [A] faces out.
- Tighten:  
Torque - Brake Disc Mounting Bolts: 23 N·m (2.3 kgf·m, 17 ft·lb)



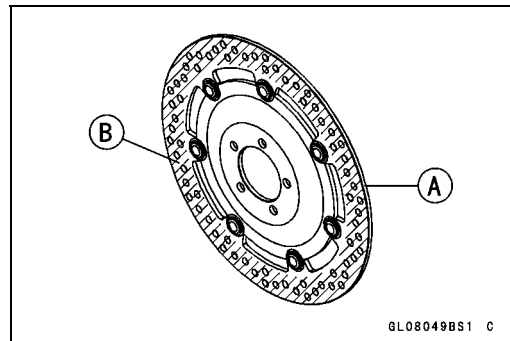
### Brake Disc Wear Inspection

- Measure the thickness of the disc [A] at the point where it has worn the most.
- ★ If the disc has worn past the service limit, replace it.  
Measuring Area [B]

#### Brake Discs Thickness

Standard: 4.8 ~ 5.1 mm (0.19 ~ 0.20 in.)

Service Limit: 4.5 mm (0.18 in.)



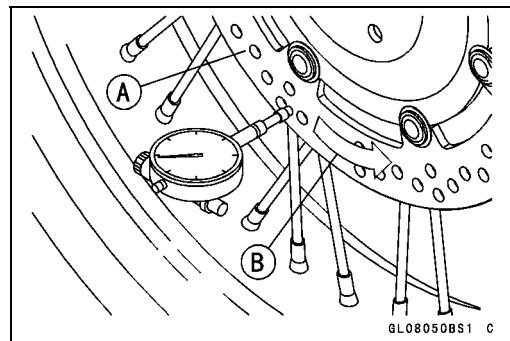
### Brake Disc Warp Inspection

- Raise the wheel off the ground with jack (see Front/Rear Wheel Removal in the Wheels/Tires chapter).
- Special Tool - Jack: 57001-1238
- Turn the handlebar fully to one side.
- Set up a dial gauge against the disc [A] as shown and measure disc runout, while turning [B] the wheel by hand.
- ★ If 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.)



## Brake Fluid

### **Brake Fluid Level Inspection**

- Refer to the Brake Fluid Level Inspection in the Periodic Maintenance chapter.

### **Brake Fluid Change**

- Refer to the Brake Fluid Change in the 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 is transmitted directly to the caliper for braking action. Air, however, is easily compressed. When air enters the brake lines, brake lever movement will be partially used in compressing the air. This will make the lever feel spongy, and there will be a loss in braking power.

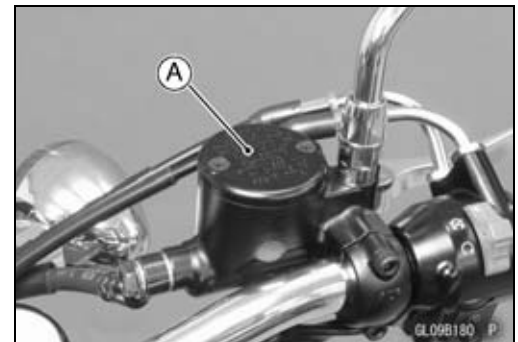
#### **⚠ WARNING**

**Air in the brake lines diminish braking performance and can cause an accident resulting in injury or death. If the brake lever has a soft or "spongy" feeling mushy when it is applied, there might be air in the brake lines or the brake may be defective. Do not operate the vehicle and service the brake system immediately.**

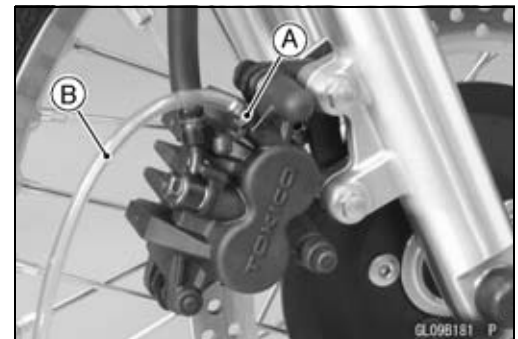
#### **NOTE**

○ *The procedure to bleed the front brake line is as follows.*

- Remove the reservoir cap [A] and diaphragm.
  - Fill the reservoir with fresh brake fluid to the upper level line in the reservoir.
  - Slowly pump the brake lever several times until no air bubbles can be seen rising up through the fluid from the holes at the bottom of the reservoir.
- Bleed the air completely from the master cylinder by this operation.



- Remove the rubber cap from the bleed valve [A] on the caliper.
- Attach a clear plastic hose [B] to the bleed valve, and run the other end of the hose into a container.



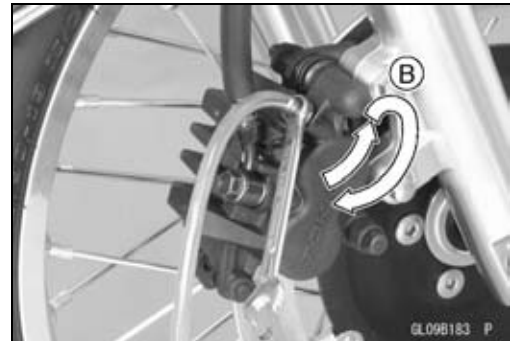
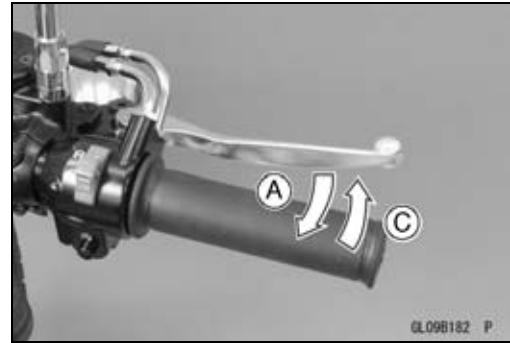
## 11-16 BRAKES

### Brake Fluid

- Bleed the brake line and the caliper.
- Repeat this operation until no more air can be seen coming out into the plastic hose.
  1. Pump the brake lever until it becomes hard, and apply the brake and hold it [A].
  2. Quickly open and close [B] the bleed valve while holding the brake applied.
  3. Release the brake [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.
- Check the fluid level (see Brake Fluid Level Inspection in the Periodic Maintenance chapter).
- Install the diaphragm and reservoir cap.
- Tighten:
  - Torque - Brake Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)**
- Tighten the bleed valve, and install the rubber cap.
  - Torque - Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)**
- After bleeding is done, check the brake for good braking power, no brake drag, and no fluid leakage.



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**Brake Fluid**

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** 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 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 of the 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 wiped up 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.**

## 11-18 BRAKES

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### Brake Hose

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#### ***Brake Hose Removal/Installation***

- Refer to the Brake Hose Replacement in the Periodic Maintenance chapter.

#### ***Brake Hose Inspection***

- Refer to the Brake Hose Damage and Installation Condition Inspection in the Periodic Maintenance chapter.



## Brake Pedal and Brake Rod

### **Brake Pedal Free Play Inspection**

- Refer to the Brake Pedal Free Play Inspection in the Periodic Maintenance chapter.

### **Brake Pedal Free Play Adjustment**

- Refer to the Brake Pedal Free Play Adjustment in the Periodic Maintenance chapter.

### **Brake Pedal and Brake Rod Removal**

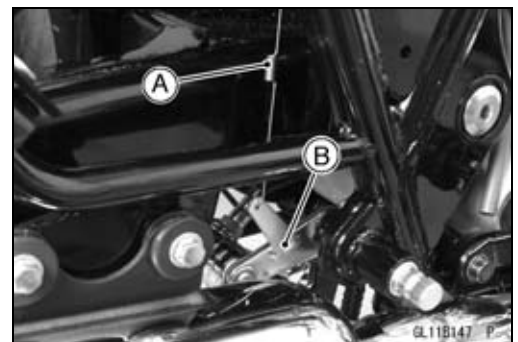
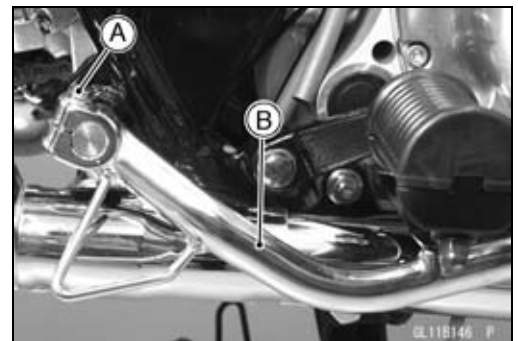
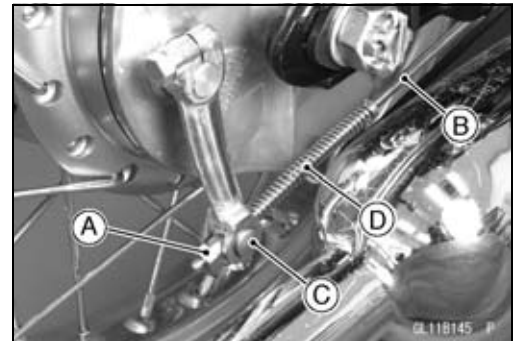
- Remove the rear brake adjusting nut [A].
- Depress the brake pedal and remove the brake rod [B].

#### **NOTICE**

Do not depress the brake pedal deeply in order to separate the brake rod from the brake cam lever joint, this may extend the brake spring beyond its allowable spring extension.

Rotate the rear brake panel clockwise as far as it will go with the brake rod inserted into the brake cam lever joint, then depress the brake pedal lightly, the brake rod will be separated from the brake cam lever joint.

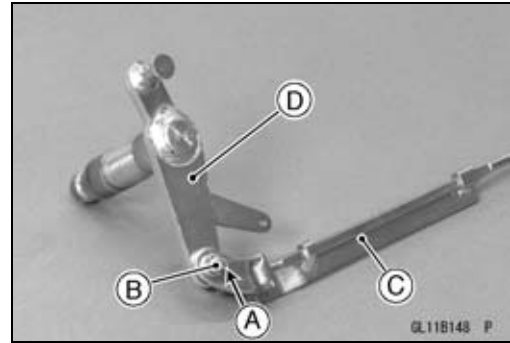
- Remove:
  - Brake Cam Lever Joint [C]
  - Spring [D] and Washer
- Remove:
  - Brake Pedal Bolt [A]
  - Brake Pedal [B]
- Remove:
  - Return Spring
  - Rear Brake Light Switch Spring [A]
  - Brake Pedal Lever [B] with Brake Rod



## 11-20 BRAKES

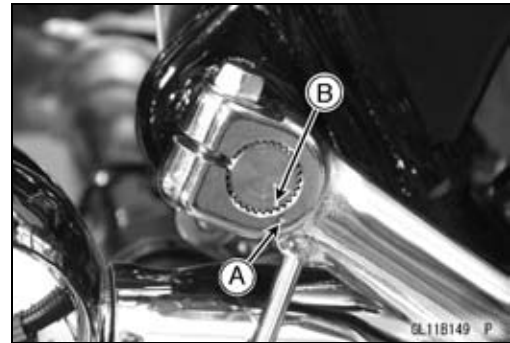
### Brake Pedal and Brake Rod

- Remove:
  - Cotter Pin [A] and Washer
  - Joint Pin [B]
  - Brake Rod [C]
  - Brake Pedal Lever [D]



#### ***Brake Pedal and Brake Rod Installation***

- Installation is the reverse of removal.
- Replace the cotter pin with a new one.
- Bend the cotter pin securely on both sides.
- Apply high-temperature grease to the sliding portion of the brake pedal lever shaft.
- Align the punch mark [A] on the brake pedal with the punch mark [B] on the brake pedal lever shaft.
- Tighten:
  - Torque - Brake Pedal Bolt (EJ800AB): 25 N·m (2.5 kgf·m, 18 ft·lb)**
  - Brake Pedal Bolt (EJ800AC): 34 N·m (3.5 kgf·m, 25 ft·lb)**
- Adjust:
  - Brake Pedal Free Play (see Brake Pedal Free Play Inspection in the Periodic Maintenance chapter)
  - Brake Light Switch Operation (see Brake Light Switch Operation Inspection in the Periodic Maintenance chapter)



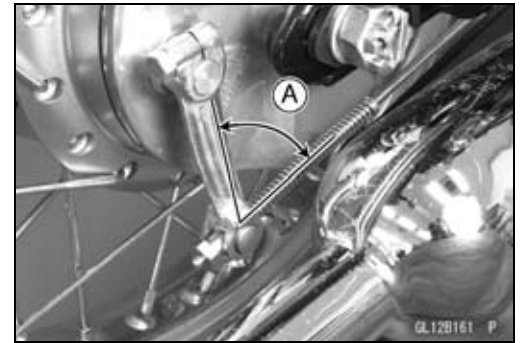
## Brake Panel and Drum

### Cam Lever Angle Inspection

- Make sure that the brake cam lever comes to an 80° ~ 90° angle [A] with the brake rod when the brake is fully applied.
- ★ If it does not, adjust the brake cam lever angle (see Cam Lever Angle Adjustment).

### **⚠ WARNING**

Since a cam lever angle greater than 90° reduces braking effectiveness, periodically check and adjust the cam lever angle.



### Cam Lever Angle Adjustment

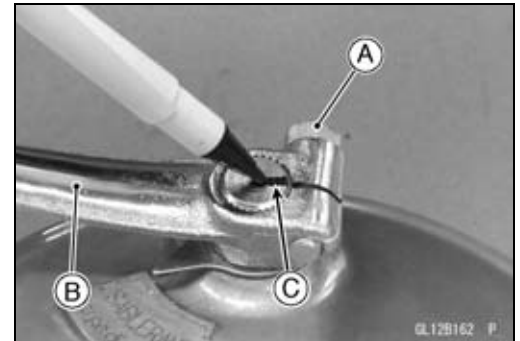
- Remove:
  - Rear Wheel (see Rear Wheel Removal in the Wheels/Tires chapter)
  - Brake Panel (see Brake Panel Removal)
  - Cam Lever Bolt [A]
- Before removing the cam lever [B], mark [C] the position of the cam lever on the camshaft.
- Remove the cam lever, and move it by one crest of the threads to reinstall.
- Tighten:
  - Torque - Cam Lever Bolt: 19 N·m (1.9 kgf·m, 14 ft·lb)

### **⚠ WARNING**

When remounting the cam lever, be sure that the position of the wear indicator on the serrated shaft is not altered.

A change in cam lever angle is caused by wear of internal brake parts. Whenever the cam lever angle is adjusted, also check for drag and proper operation, taking particular note of the brake lining wear indicator position.

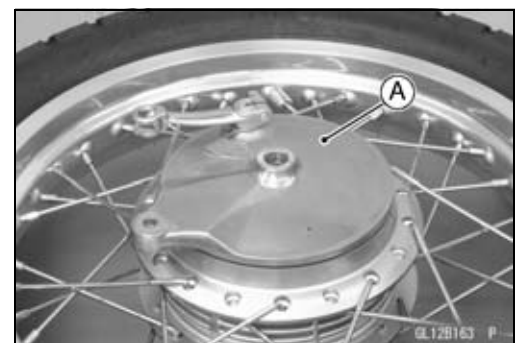
In case of doubt as to braking effectiveness, disassemble and inspect all internal brake parts. Worn parts can result in the brake locking or failing.



- Adjust the brake pedal free play (see Brake Pedal Free Play Adjustment in the Periodic Maintenance chapter).

### Brake Panel Removal

- Remove:
  - Rear Wheel (see Rear Wheel Removal in the Wheels/Tires chapter)
  - Brake Panel [A]



### Brake Panel Installation

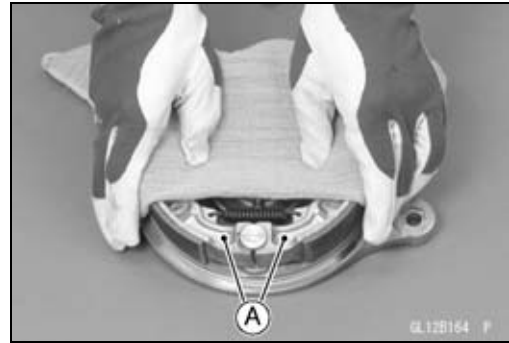
- Installation is the reverse of removal.

# 11-22 BRAKES

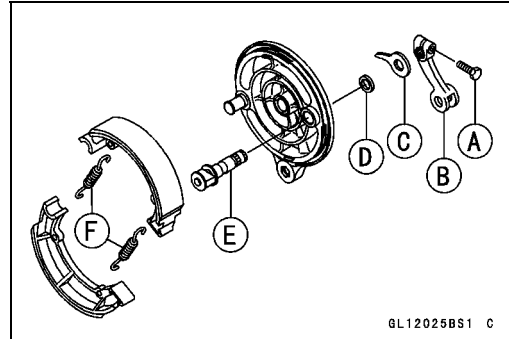
## Brake Panel and Drum

### Brake Panel Disassembly

- Remove the brake panel (see Brake Panel Removal).
- Wrap the brake shoes [A] with a clean cloth to prevent the lining from coming into contact with grease or oil, and remove the brake shoes.

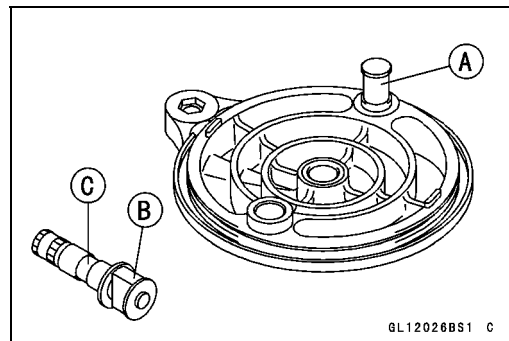


- To enable the cam lever to be placed back in its original position, mark to the camshaft (see Cam Lever Angle Adjustment).
- Remove:
  - Cam Lever Bolt [A]
  - Cam Lever [B]
  - Wear Indicator [C]
  - Dust Seal [D]
  - Camshaft [E]
  - Brake Shoe Springs [F]

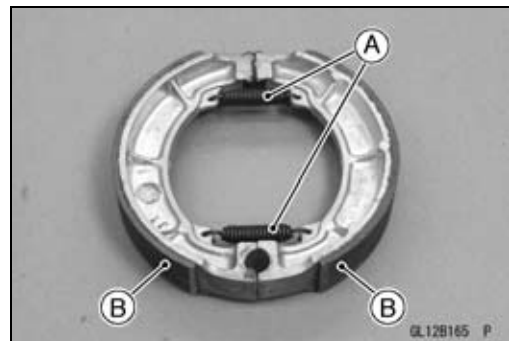


### Brake Panel Assembly

- Wipe off any old grease from the various areas of the brake panel.
- Apply a thin coat of high-temperature grease:
  - Anchor Pin [A]
  - Camshaft cam face [B]
  - Camshaft shaft portion [C]
- Do not allow grease to come in contact with the lining of the brake shoes.
- Wipe off any excess grease.

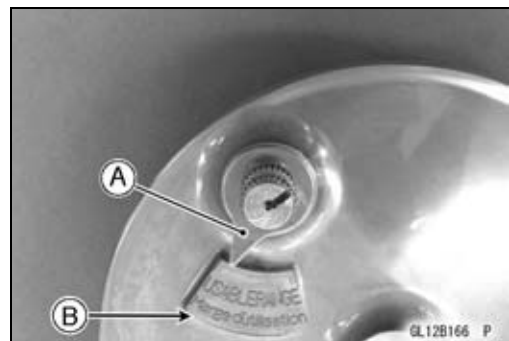


- Install the shoe springs [A] as shown in the figure.
- Install the brake shoes, making sure that grease does not come in contact with the lining [B].



- Install the dust seal.
- Install the wear indicator [A] to point the left side of the USABLE RANGE [B].
- Install the cam lever in its original position by aligning it with the mark and tighten the cam lever bolt.

**Torque - Cam Lever Bolt: 19 N·m (1.9 kgf·m, 14 ft·lb)**



## Brake Panel and Drum

### Brake Drum Wear Inspection

- ★ If the drum is worn unevenly or if it is scored, turn the drum down on a brake drum lathe or replace the hub with a new one (Do not turn it down to the service limit, and do not turn it down if any diameter measurement exceeds the service limit).
- Measure the inside diameter [A] of the brake drum. Since uneven drum wear will decrease braking effectiveness, take measurement at a minimum of two places.
- ★ If any diameter measurement exceeds the service limit, replace the hub with a new one.



#### Brake Drum Inside Diameter

**Standard:** 160.00 ~ 160.16 mm (6.299 ~ 6.305 in.)

**Service Limit:** 160.75 mm (6.329 in.)

### Brake Shoe Lining Wear Inspection

- Refer to the Brake Shoe Lining Wear Inspection in the Periodic Maintenance chapter.

### Camshaft Wear Inspection

- Measure the shaft diameter [A].
- ★ If it is worn down to less than the service limit, replace the shaft.
- Measure the inside diameter [B] of the camshaft hole.
- ★ If it is worn past the service limit, replace the brake panel.

#### Brake Camshaft, Hole Diameter

**Standard:**

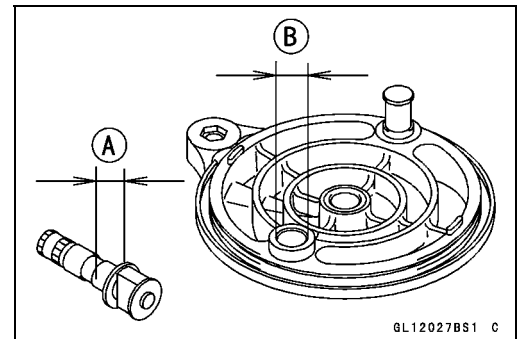
**Camshaft** 16.957 ~ 16.984 mm (0.6676 ~ 0.6687 in.)

**Hole** 17.000 ~ 17.027 mm (0.6693 ~ 0.6704 in.)

**Service Limit:**

**Camshaft** 16.88 mm (0.665 in.)

**Hole** 17.15 mm (0.675 in.)



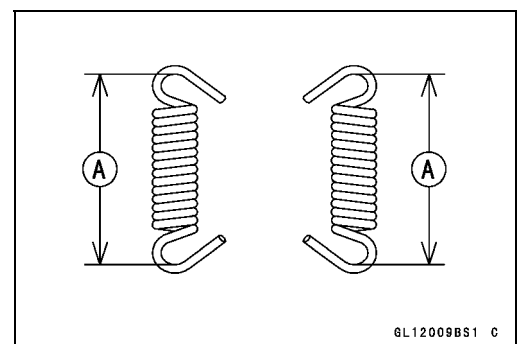
### Brake Shoe Springs Inspection

- Visually inspect the brake shoe springs for breaks or distortion.
- ★ If the springs are damaged in any way, replace them.
- Measure the free length [A] of the brake shoe springs.
- ★ If either is stretched beyond the service limit, replace both springs.

#### Brake Shoe Spring Free Length

**Standard:** 47.5 ~ 48.5 mm (1.87 ~ 1.91 in.)

**Service Limit:** 50.4 mm (1.98 in.)





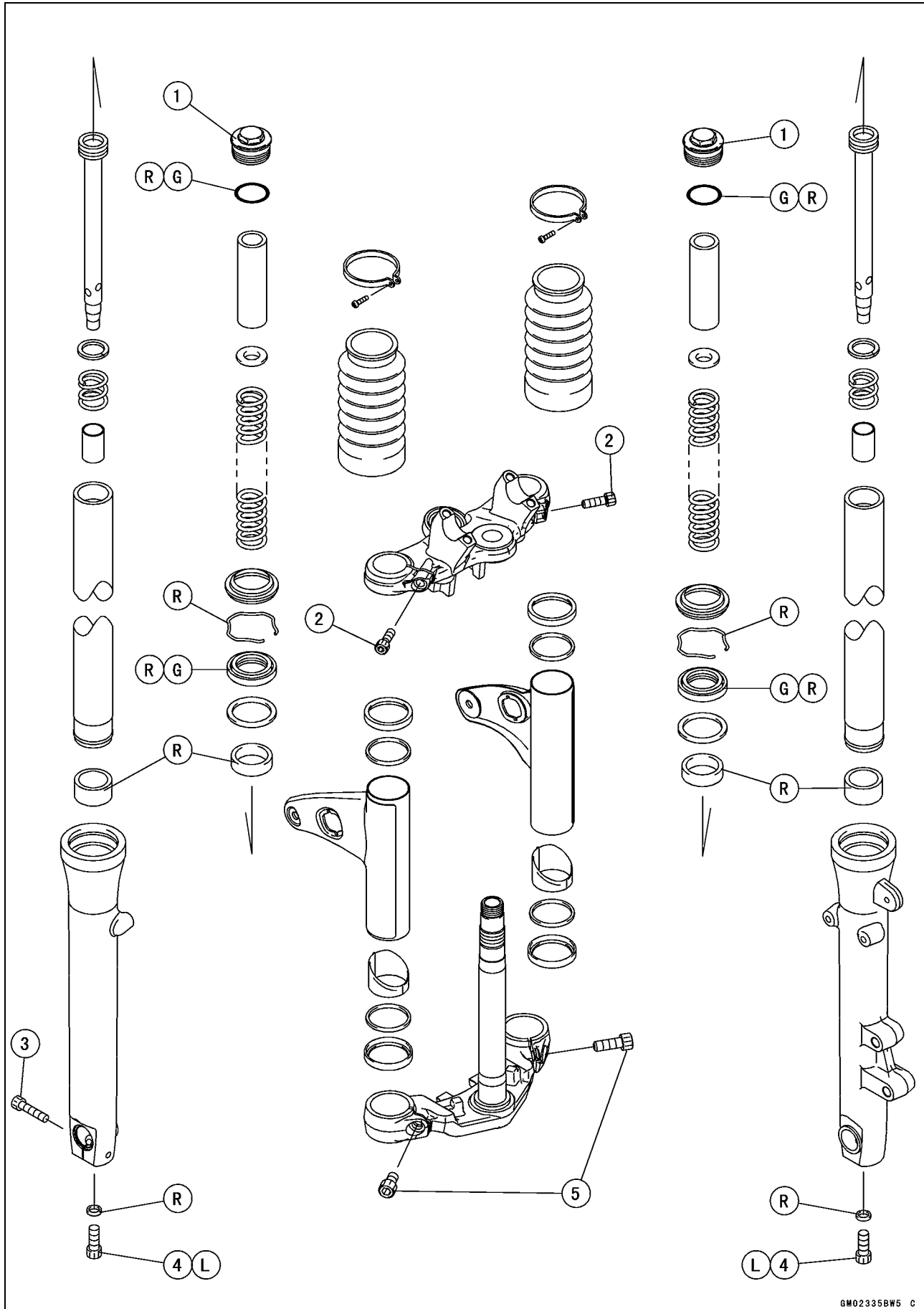
# Suspension

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# 12-2 SUSPENSION

## Exploded View





**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Front Fork Top Plugs	23	2.3	17	
2	Front Fork Clamp Bolts (Upper)	20	2.0	15	
3	Front Axle Clamp Bolt	20	2.0	15	
4	Front Fork Bottom Allen Bolts	30	3.1	22	L
5	Front Fork Clamp Bolts (Lower)	29	3.0	21	

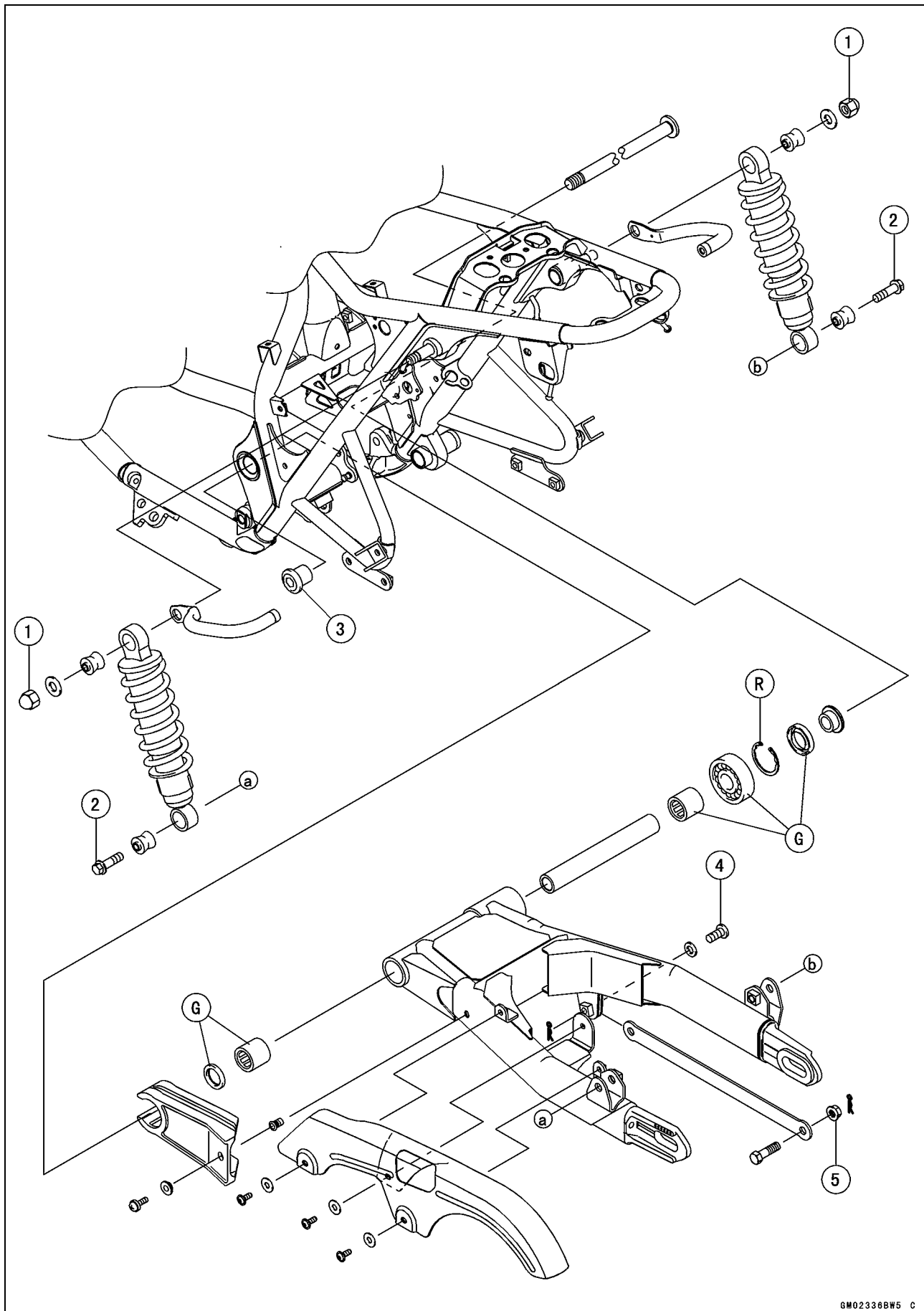
G: Apply grease.

L: Apply a non-permanent locking agent.

R: Replacement Parts

# 12-4 SUSPENSION

## Exploded View



**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Rear Shock Absorber Nuts	59	6.0	44	
2	Rear Shock Absorber Bolts	44	4.5	32	
3	Swingarm Pivot Shaft Nut	98	10	72	
4	Torque Link Bolt	32	3.3	24	
5	Torque Link Nut	32	3.3	24	

G: Apply grease.

R: Replacement Parts

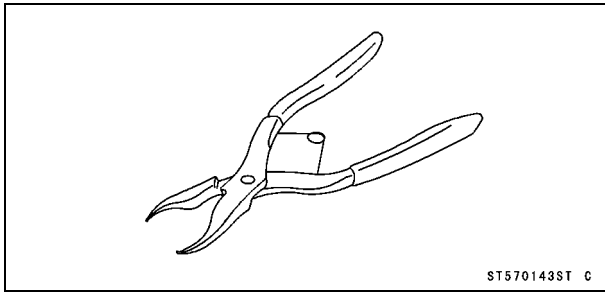
## 12-6 SUSPENSION

### Specifications

Item	Standard	Service Limit
<b>Front Fork</b>		
Fork Inner Tube Diameter	$\phi 39$ mm (1.5 in.)	- - -
Air Pressure	Atmospheric pressure (Non-adjustable)	- - -
Fork Spring Setting	Non-adjustable	- - -
Damper Setting	Non-adjustable	- - -
Fork Oil:		
Recommended Oil	KAYABA KHL34-G10 or equivalent	- - -
Amount	Approx. 343 mL (11.6 US oz) (When changing oil)	- - -
Oil Level	400 $\pm$ 4 mL (16.5 $\pm$ 0.14 US oz) (after disassembly and completely dry)	- - -
Oil Level	112 $\pm$ 2 mm (4.41 $\pm$ 0.08 in.) (fully compressed, without fork spring, below from the top of the inner tube)	- - -
Fork Spring Free Length	409.4 mm (16.12 in.)	402 mm (15.8 in.)
<b>Rear Shock Absorber</b>		
Spring Preload Adjustment	2nd position (from the weakest position)	(Adjustable Range) 1 ~ 5th position

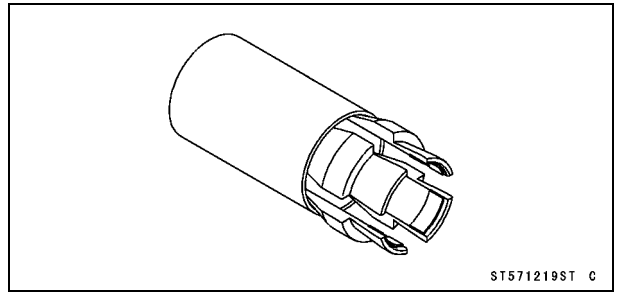
**Special Tools**

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



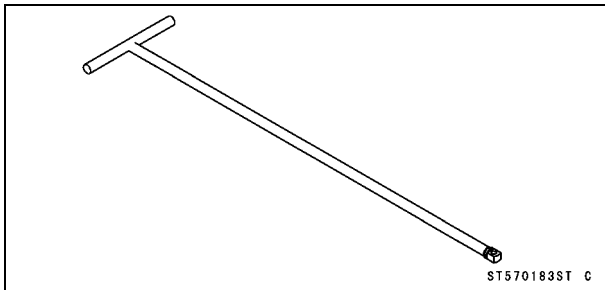
ST570143ST C

**Front Fork Oil Seal Driver:**  
**57001-1219**



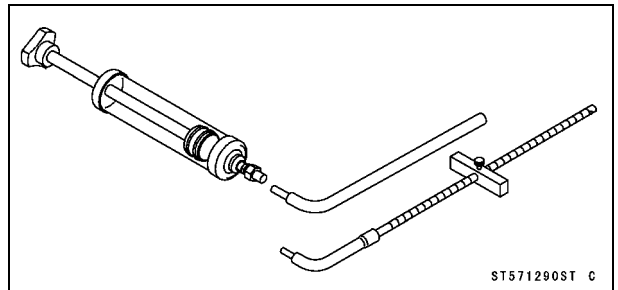
ST571219ST C

**Fork Cylinder Holder Handle:**  
**57001-183**



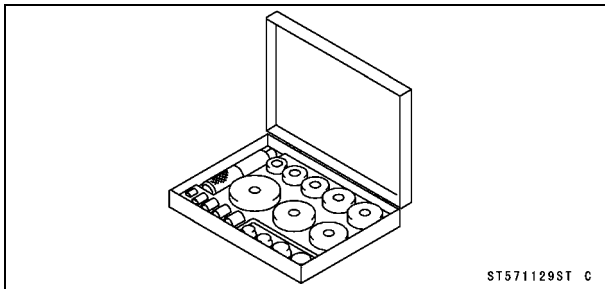
ST570183ST C

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



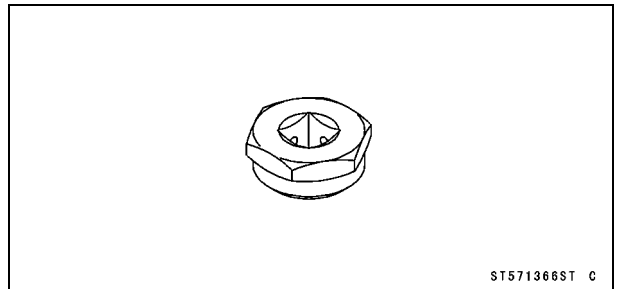
ST571290ST C

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



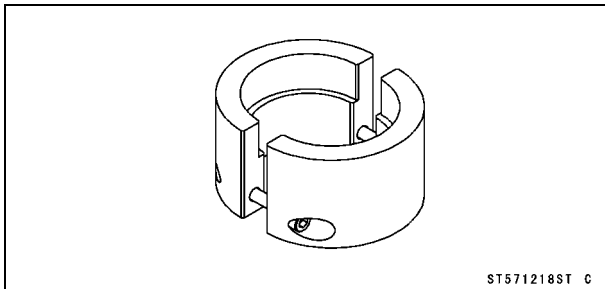
ST571129ST C

**Hexagon Wrench, Hex 24:**  
**57001-1366**



ST571366ST C

**Fork Outer Tube Weight:**  
**57001-1218**



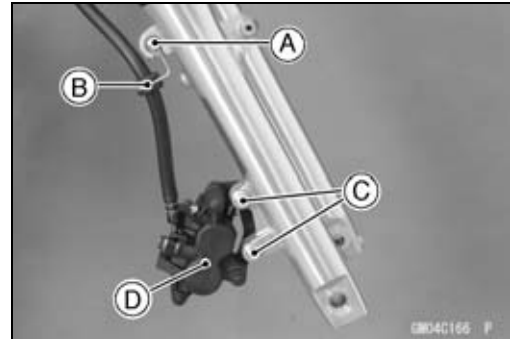
ST571218ST C

## 12-8 SUSPENSION

### Front Fork

#### Front Fork Removal (Each Fork Leg)

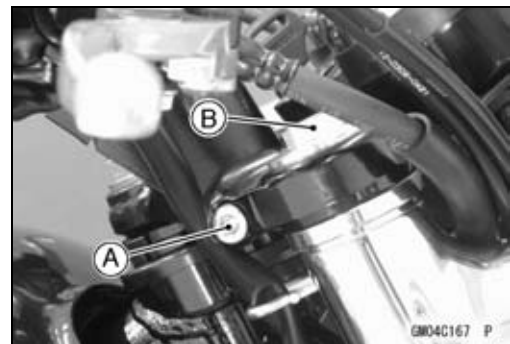
- Remove:
  - Front Fender (see Front Fender Removal in the Frame chapter)
  - Front Wheel (see Front Wheel Removal in the Wheel/Tire chapter)
- For the right fork leg, remove the following parts.
  - Bolt [A]
  - Clamp [B]
  - Caliper Mounting Bolts [C]
- Put the front caliper [D] on a suitable stand.



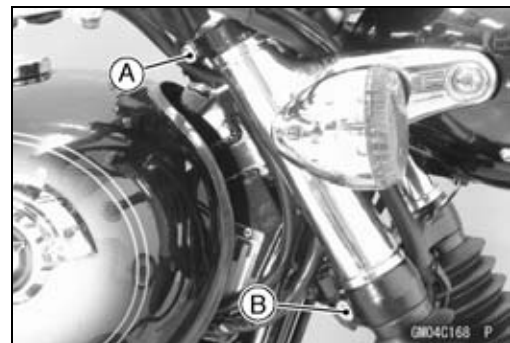
- ★ Loosen the front fork clamp bolt (upper) [A] and top plug [B] beforehand if the fork leg is to be disassembled.

#### NOTE

○ Loosen the front fork clamp bolt (upper) first.



- Loosen the front fork clamp bolt (upper) [A] and front fork clamp bolt (lower) [B].
- With a twisting motion, work the fork leg down and out.



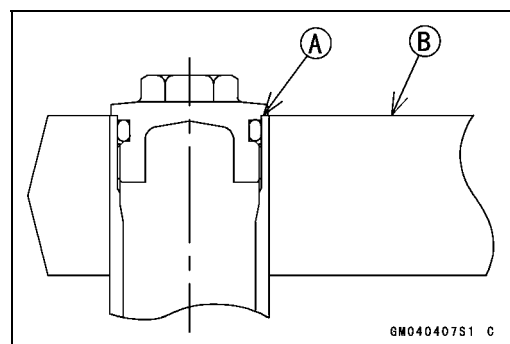
#### Front Fork Installation

- Install the fork with the upper end of inner tube flush [A] against the top surface of the stem head [B].
- Tighten the front fork clamp bolt (lower) and fork top plug.
  - Torque - Front Fork Clamp Bolt (Lower): 29 N·m (3.0 kgf·m, 21 ft·lb)
  - Front Fork Top Plug: 23 N·m (2.3 kgf·m, 17 ft·lb)

#### NOTE

○ Tighten the top plug before tightening the front fork clamp bolt (upper).

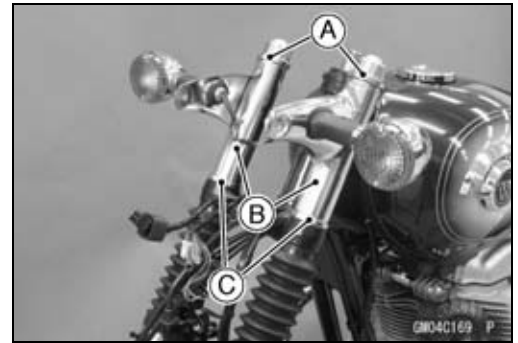
- Tighten:
  - Torque - Front Fork Clamp Bolt (Upper): 20 N·m (2.0 kgf·m, 15 ft·lb)
- Install the removed parts (see appropriate chapters).



## Front Fork

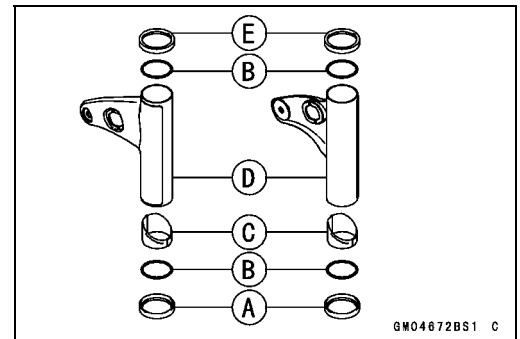
### Front Fork Cover Removal

- Remove:
  - Headlight Unit (see Headlight Unit Removal in the Electrical System chapter)
  - Handlebar (see Handlebar Removal in the Steering chapter)
  - Steering Stem Head (see Stem, Stem Bearing Removal in the Steering chapter)
  - Front Fork Cover Caps (Upper) [A]
  - Rubber Dumpers [B]
  - Front Fork Covers [B]
  - Front Fork Cover Spacers
  - Front Fork Cover Caps (Lower) [C]



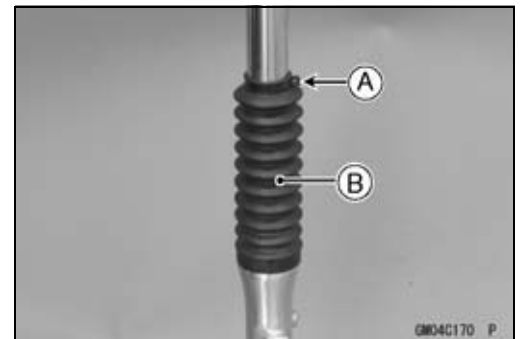
### Front Fork Cover Installation

- Install:
  - Front Fork Cover Caps (Lower) [A]
  - Rubber Dumpers [B]
  - Front Fork Cover Spacers [C]
  - Front Fork Covers [D]
  - Front Fork Cover Caps (Upper) [E]
- Install the removed parts (see appropriate chapters).

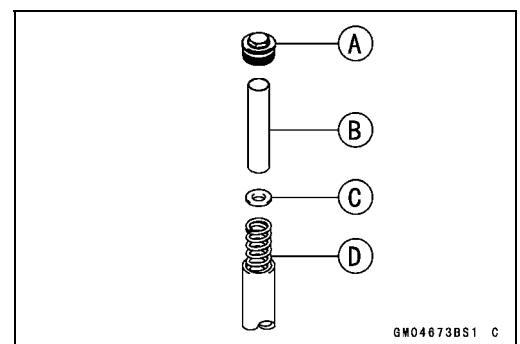


### Front Fork Oil Change

- Remove the front fork (see Front Fork Removal (Each Fork Leg)).
- Loosen the clamp screw [A], and remove the fork boot [B].



- Remove:
  - Top Plug [A] with O-ring
  - Collar [B]
  - Fork Spring Seat [C]
  - Fork Spring [D]



## 12-10 SUSPENSION

### Front Fork

- Compress [A] the fork [B] upside down to draw out the oil into the suitable container [C].
- Pour in the type and amount of fork oil specified.

#### Fork Oil

##### Recommended Oil:

**KAYABA KHL34-G10 or equivalent**

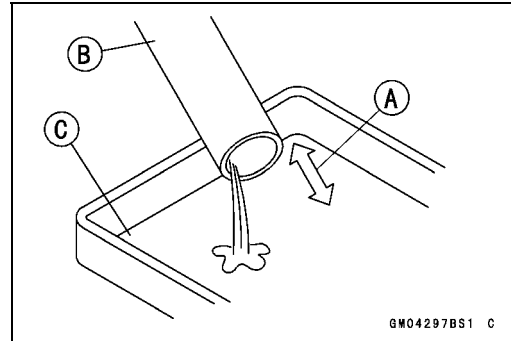
##### Amount (Per Side):

###### When changing oil:

**Approx. 343 mL (11.6 US oz.)**

###### After disassembly and completely dry:

**400 ±4 mL (16.5 ±0.14 US oz.)**



### NOTE

○ Move the outer tube up and down a few times to remove the air that is trapped in the fork oil in order to stabilize the oil level.

- Hold the outer tube vertically in a vise and compress the fork completely.
- Wait until the oil level stabilizes.
- Use the fork oil level gauge [A] to measure the distance between the top of the inner tube to the oil level.

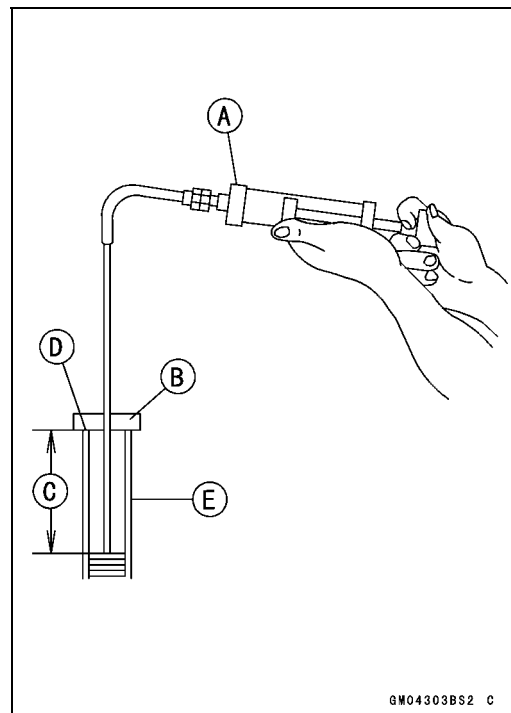
#### Special Tool - Fork Oil Level Gauge: 57001-1290

- Set the oil level gauge stopper [B] so that the distance [C] from the bottom of the stopper to the lower end of the pipe is the standard oil level distance.
- A correct measurement can not be obtained unless the level gauge pipe is placed in the center of the inner tube.

#### Oil Level (fully compressed, without spring)

**Standard: 112 ±2 mm (4.41 ±0.08 in.)**

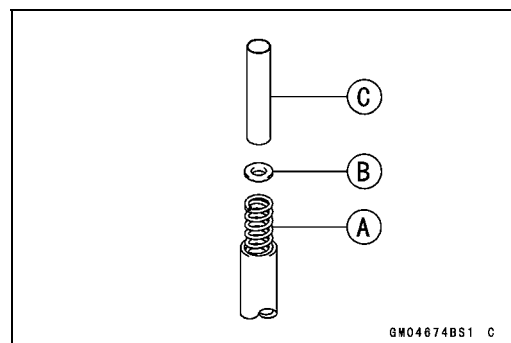
- Place the stopper of the level gauge at the top [D] of the inner tube [E] and pull the handle slowly to draw out the excess oil from fork into the gauge, thus attaining the standard level.
- If not oil is drawn out, there is not enough oil in the fork. Pour in some more oil and measure again.
- Repeat the same procedure for adjusting the other fork.



- Install the front fork spring [A], front fork spring seat [B] and collar [C].
- Replace the O-ring on the top plug with a new one.
- Apply grease to the new O-ring.
- Lift up the inner tube and install the top plug.
- Tighten:

#### Torque - Front Fork Top Plug: 23 N·m (2.3 kgf·m, 17 ft·lb)

- Install the fork boot and front fork (see Front Fork Installation).
- Tighten the fork boot clamp screw from front and inside.



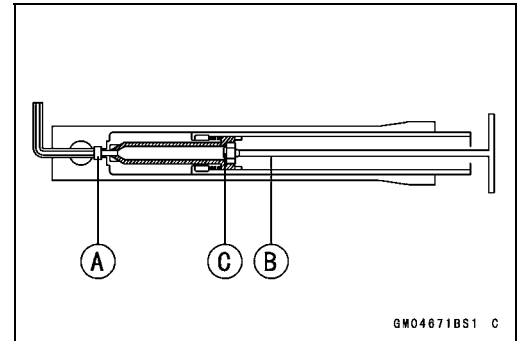


**Front Fork**

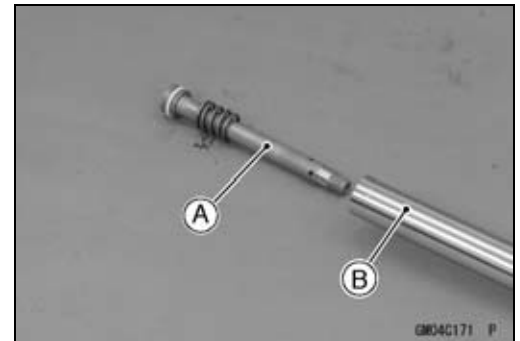
**Front Fork Disassembly**

- Remove the front fork (see Front Fork Removal).
- Drain the fork oil (see Front Fork Oil Change).
- Hold the outer tube in a vice, stop the cylinder unit from turning by using the special tools, and unscrew the Allen bolt [A].

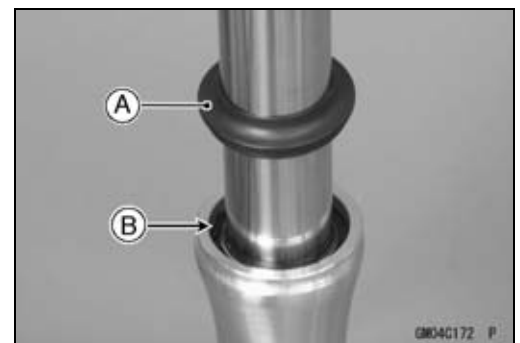
**Special Tools - Fork Cylinder Holder Handle [B]: 57001-183**  
**Hexagon Wrench, Hex 24 [C]: 57001-1366**



- Remove the cylinder unit [A] from the inner tube [B].

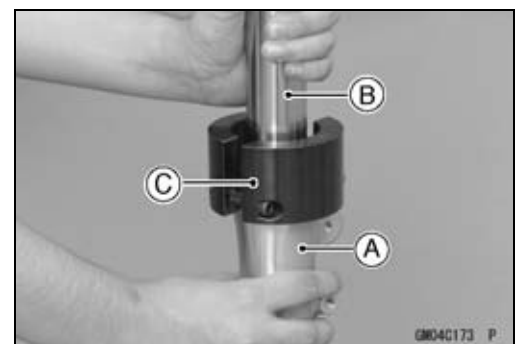


- Separate the inner tube from the outer tube as follows.
  - Slide up the dust seal [A].
  - Remove the retaining ring [B] from the outer tube.

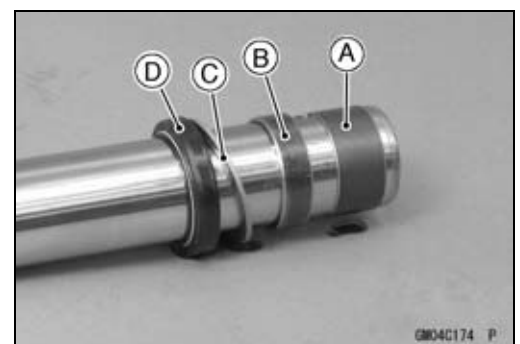


- Holding the outer tube [A] by hand, pull the inner tube [B] several times to pull out the outer tube.
- ★ If the tubes are tight, use a fork outer tube weight [C].

**Special Tool - Fork Outer Tube Weight: 57001-1218**



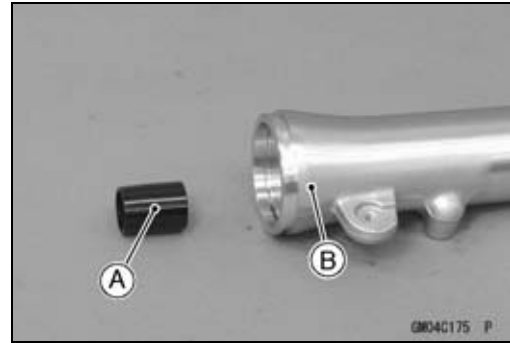
- Remove the inner tube guide bushing [A], outer tube guide bushing [B], washer [C], oil seal [D] from the inner tube.



## 12-12 SUSPENSION

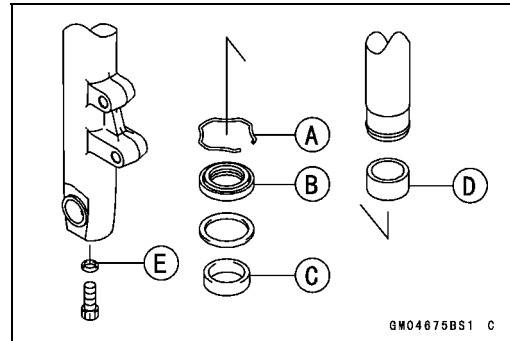
### Front Fork

- Remove the cylinder base [A] from the bottom of the outer tube [B].

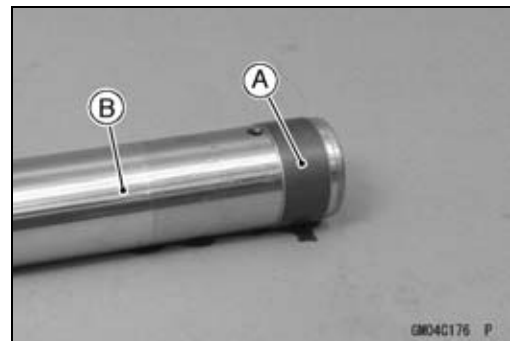


### Front Fork Assembly

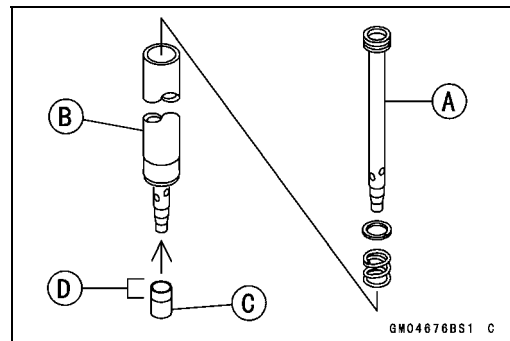
- Replace the following parts with new ones.
  - Retaining Ring [A]
  - Oil Seal [B]
  - Inner Guide Bushing [C]
  - Outer Guide Bushing [D]
  - Fork Bottom Allen Bolt Gasket [E]



- Install the inner guide bushing [A] on the end of the inner tube [B].



- 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] facing upward.
- Install the inner tube, cylinder unit, and cylinder base as a set into the outer tube.

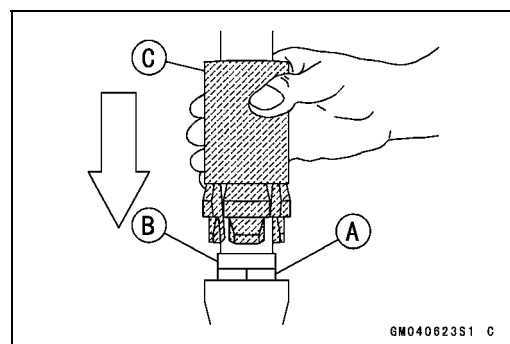


- Fit the new outer guide bushing [A] into the outer tube.

#### NOTE

○ When assembling the new outer guide bushing, hold the used guide bushing [B] against the new bushing and tap the used guide bushing with the fork oil seal driver [C] until it stops.

**Special Tool - Front Fork Oil Seal Driver: 57001-1219**

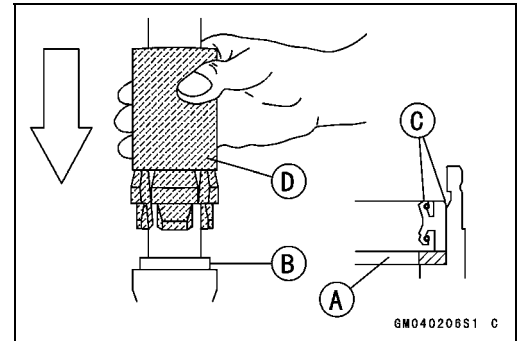


## Front Fork

- Apply 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

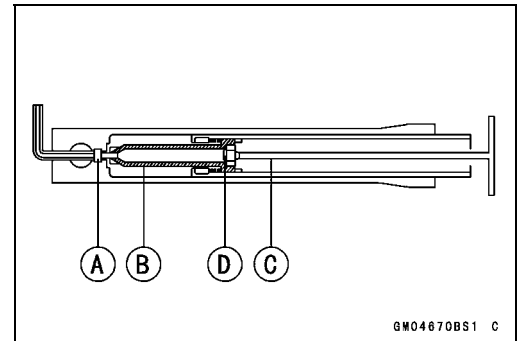


- Apply non-permanent locking agent to the threads of the bottom Allen bolt [A].
- Hold the outer tube in a vice.
- Hold the cylinder unit [B] with the special tools and tighten the bottom Allen bolt to secure the cylinder in place.

**Torque - Front Fork Bottom Allen Bolt: 30 N·m (3.1 kgf·m, 22 ft·lb)**

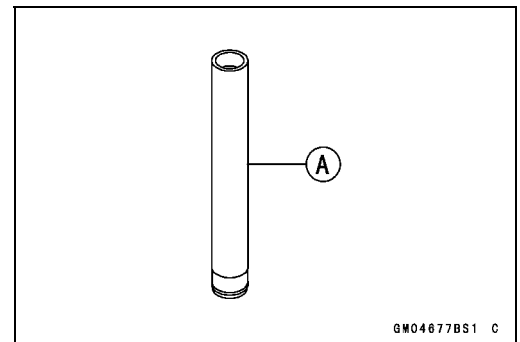
**Special Tools - Fork Cylinder Holder Handle [C]: 57001-183  
Hexagon Wrench, Hex 24 [D]: 57001-1366**

- Install the removed parts (see Front Fork Installation).



### 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.



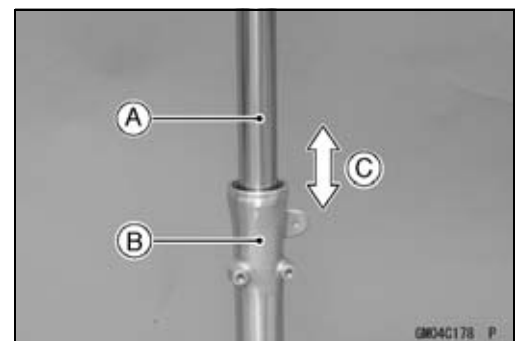
### NOTICE

**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 tube [A] and outer tube [B], and pump [C] 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 may fall in use, possibly causing an accident resulting in serious injury or death. Replace a badly bent or damaged inner or outer tube and inspect the other tube carefully before reusing it.**

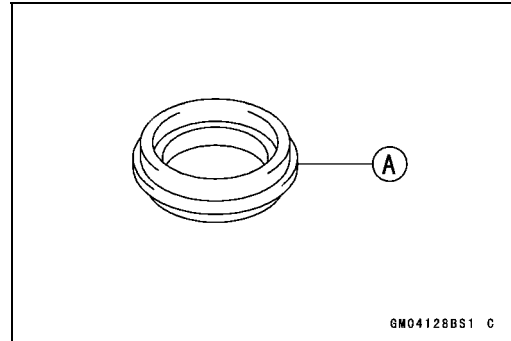


## 12-14 SUSPENSION

### Front Fork

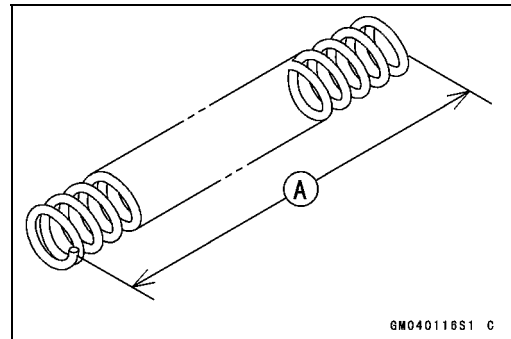
#### **Dust Seal Inspection**

- Inspect the dust seals [A] for any signs of deterioration or damage.
- ★ Replace it if necessary.



#### **Spring Tension Inspection**

- Since a 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:** 409.4 mm (16.12 in.)

**Service Limit:** 402 mm (15.8 in.)

## Rear Suspension

### Spring Preload Adjustment

- Using the suitable bar [A], turn the adjusting sleeve [B] to adjust the spring preload.
- The standard adjusting sleeve is 2nd step from the weakest position.

#### Spring Preload Setting

**Standard Position:** 2nd position  
**Adjustable Range:** 1st ~ 5th position

- If the compression of the spring is not suited to the operating conditions, adjust it to an appropriate position by referring to the table below.

#### Spring Preload Adjustment

Adjuster Position	Spring Force	Shock Absorber Hardness	Load	Road Conditions	Driving Speed
1st	Weak	Soft	Light	Good	Low
↑	↑	↑	↑	↑	↑
↓	↓	↓	↓	↓	↓
5th	Strong	Hard	Heavy	Bad	Highway

#### **⚠ WARNING**

**If both adjusters are not adjusted equally, handling may be impaired and a hazardous condition may result. Be sure the adjusters are set equally.**

### Rear Shock Absorber Removal

- Use the center stand to support the motorcycle upright.
- Squeeze the brake lever slowly and hold it with a band [A].

#### **⚠ 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.**

#### **NOTICE**

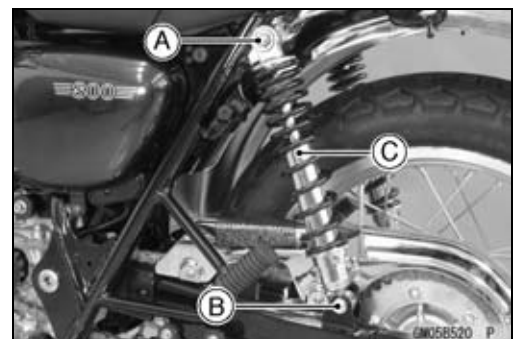
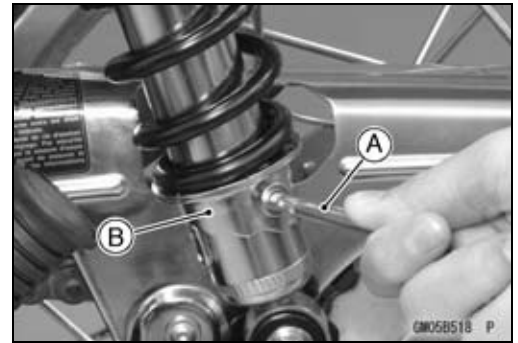
**Be sure to hold the front brake when removing the shock absorber, or the motorcycle may fall over. The motorcycle could be damaged.**

- Remove the nut [A], bolt [B], and washer from the rear shock absorber [C].

#### **NOTE**

○ Pull out the bolt by lifting the swingarm to lighten the load on the bolt.

- Pull the rear shock absorber off the frame.

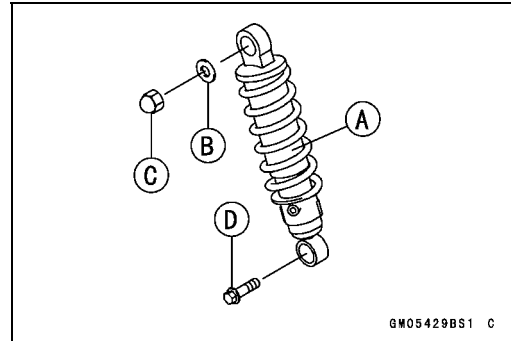


## 12-16 SUSPENSION

### Rear Suspension

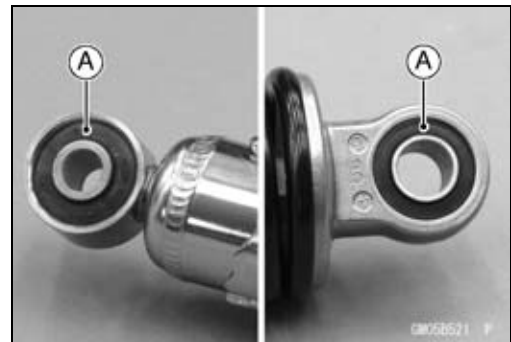
#### Rear Shock Absorber Installation

- Install the rear shock absorber [A] and washer [B].
- Tighten:
  - Torque - Rear Shock Absorber Nut [C]: 59 N·m (6.0 kgf·m, 44 ft·lb)
  - Rear Shock Absorber Bolt [D]: 44 N·m (4.5 kgf·m, 32 ft·lb)



#### Rear Shock Absorber Inspection

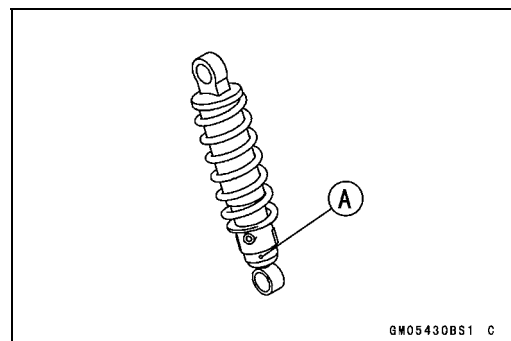
- Remove the rear shock absorbers (see Rear Shock Absorber Removal).
- Visually inspect the following items.
  - Smooth Stroke
  - Oil Leakage (see Rear Shock Absorber Oil Leak Inspection in the Periodic Maintenance chapter)
  - Crack or Dent
- ★ If there is any damage to the rear shock absorber, one unit feels weaker than the other, replace both shock absorbers as a set.
- Visually inspect the rubber bushings [A].
- ★ If they show any signs of damage, replace them.



#### Rear Shock Absorber Scrapping

##### **⚠ WARNING**

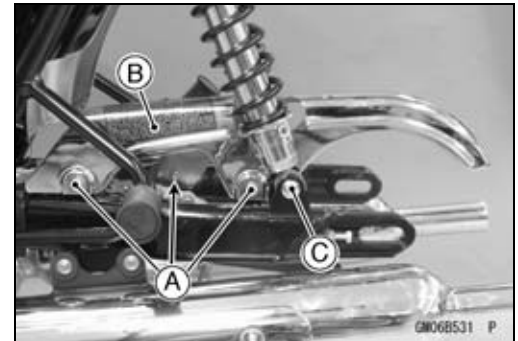
Since the rear shock absorber contains nitrogen gas, do not incinerate the rear shock absorber without first releasing the gas or it may explode. Before a rear shock absorber is scrapped, drill a hole at the point [A] shown to release the nitrogen gas completely. Wear safety glasses when drilling the hole, as the gas may blow out bits of drilled metal when the hole opens.



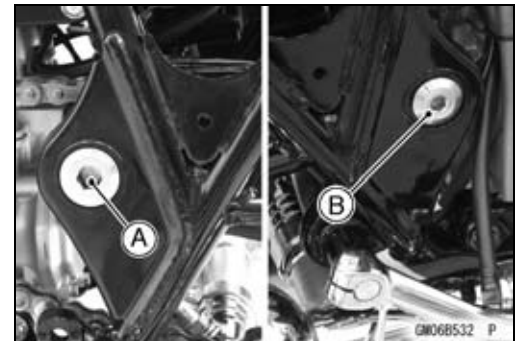
## Swingarm

### Swingarm Removal

- Remove:
  - Rear Wheel (see Rear Wheel Removal in the Wheels/Tires chapter)
  - Bolts [A]
  - Chain Cover [B]
  - Rear Shock Absorber Bolts [C] (Both Sides)

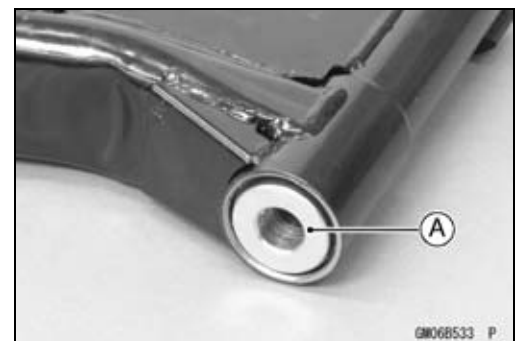


- Remove the swingarm pivot shaft nut [A].
- Pull out the pivot shaft [B] to the right, and remove the swingarm.



### Swingarm Installation

- Apply plenty of grease to the needle bearings and grease seals.
- Install the collar [A].
- Install the swingarm and insert the swingarm pivot shaft from the right side.
- Tighten:
  - Torque - Swingarm Pivot Shaft Nut: 98 N·m (10 kgf·m, 72 ft·lb)
  - Rear Shock Absorber Bolts: 44 N·m (4.5 kgf·m, 32 ft·lb)



- Install the removed parts (see appropriate chapter).

### Swingarm Bearing Removal

- Remove the swingarm (see Swingarm Removal).

#### Right Side

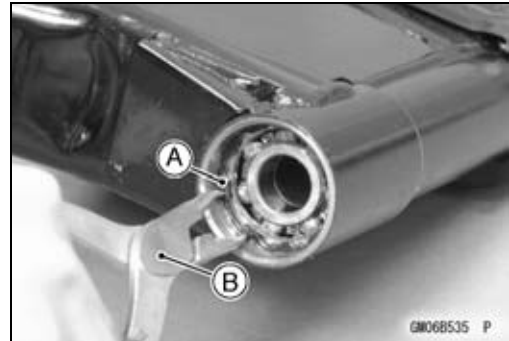
- Remove:
  - Collar
  - Grease Seal [A]



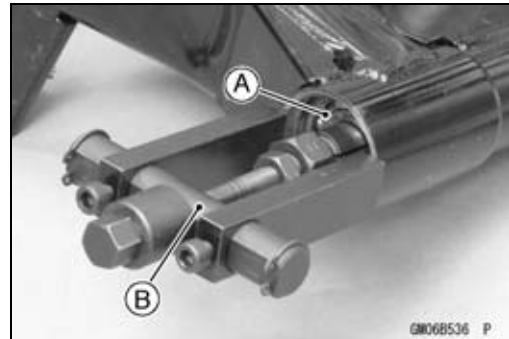
## 12-18 SUSPENSION

### Swingarm

- Remove the circlip [A].  
**Special Tool - Inside Circlip Pliers [B]: 57001-143**

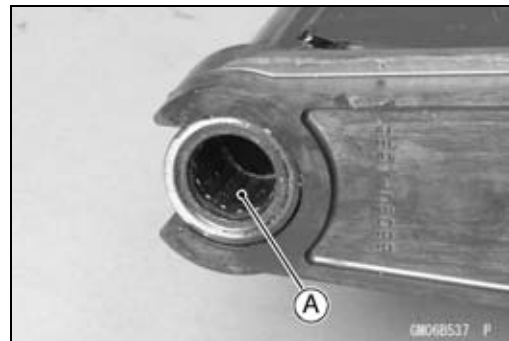


- Remove the sleeve to the left side.
- Remove the ball bearing [A] and needle bearing with the available bearing remover [B].



#### Left Side

- Remove the grease seal.
- Remove the needle bearing [A] with the available bearing remover.



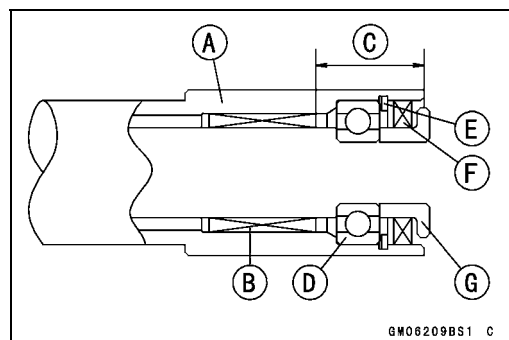
#### Swingarm Bearing Installation

- 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 following bearings as shown, using a suitable bearing driver in the bearing driver set.

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

#### Right Side

- Swingarm [A]
- Needle Bearing [B]
- 28 ±2 mm (1.1 ±0.08 in.) [C]
- Ball Bearing (until bottom end) [D]
- Circlip [E]
- Grease Seal [F]
- Collar [G]

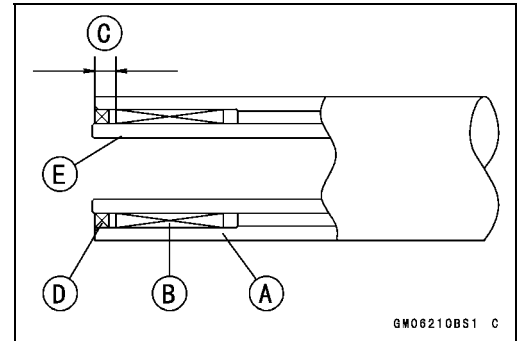




## Swingarm

### Left Side

- Swingarm [A]
- Needle Bearing [B]
- 5.5 ±0.4 mm (0.22 ±0.02 in.) [C]
- Grease Seal [D]
- Sleeve [E]



### Swingarm Bearing, Sleeve Inspection

#### NOTICE

**Do not remove the bearings for inspection. Removal may damage them.**

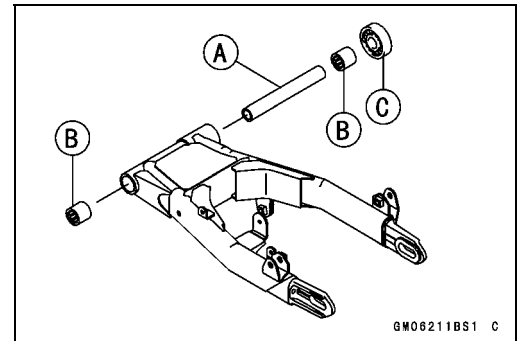
- Inspect the swingarm sleeve [A], needle bearings [B] and ball bearing [C] installed in the swingarm.
- The rollers and balls in the bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearings in the swingarm for abrasion, discoloration, or other damage.
- ★ If the sleeve, needle bearings and ball bearing show any signs of abnormal wear, discoloration, or damage, replace them as a set.

### Swingarm Bearing Lubrication

- Refer to the Swingarm Pivot Lubrication in the Periodic Maintenance chapter.

### Chain Guide Inspection

- Refer to the Chain Guide Wear Inspection in the Periodic Maintenance chapter.





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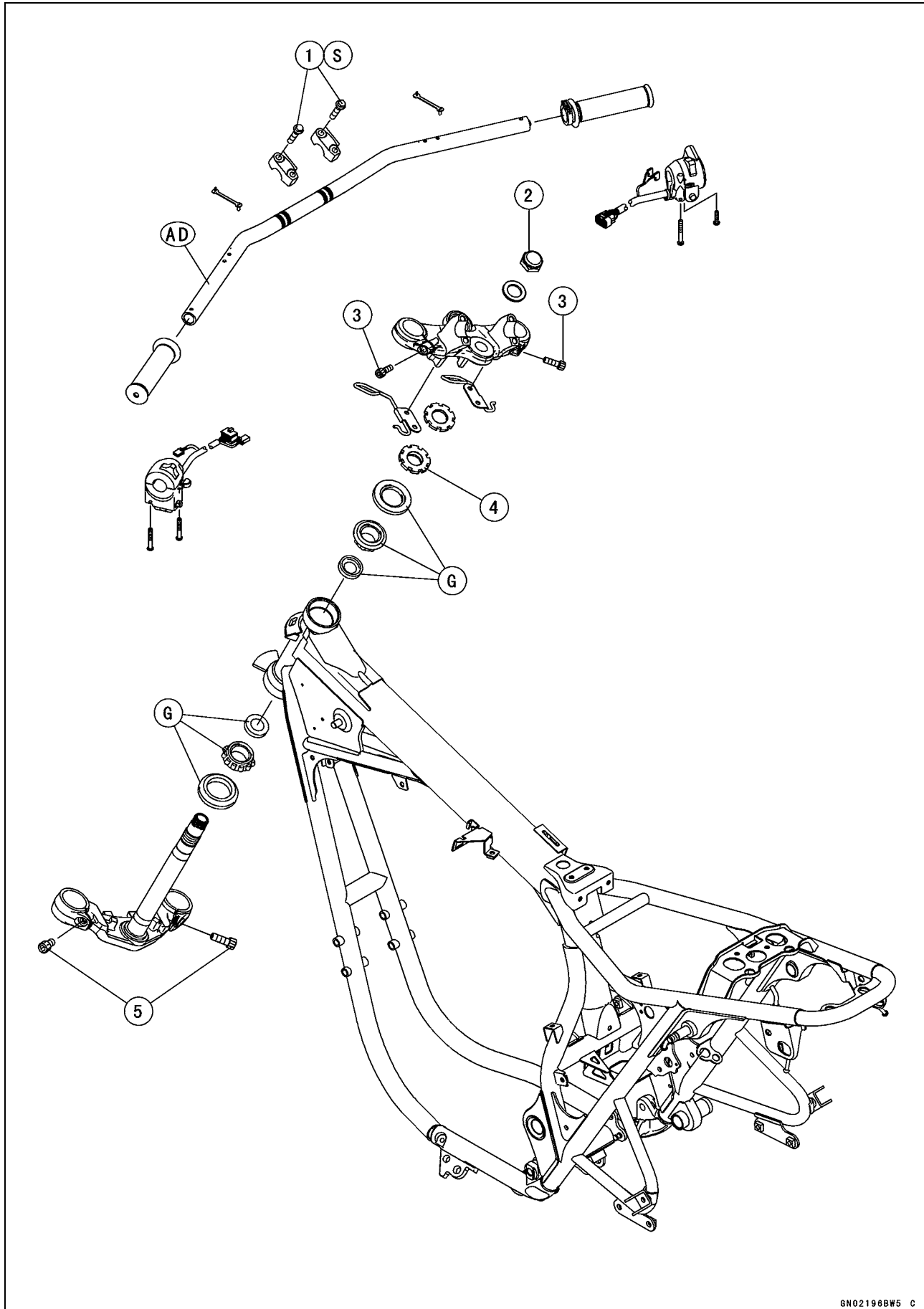
# Steering

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# 13-2 STEERING

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handlebar Clamp Bolts	25	2.5	18	S
2	Steering Stem Head Nut	49	5.0	36	
3	Front Fork Clamp Bolts (Upper)	20	2.0	15	
4	Steering Stem Nut	4.9	0.50	43 in·lb	
5	Front Fork Clamp Bolts (Lower)	29	3.0	21	

AD: Apply adhesive.

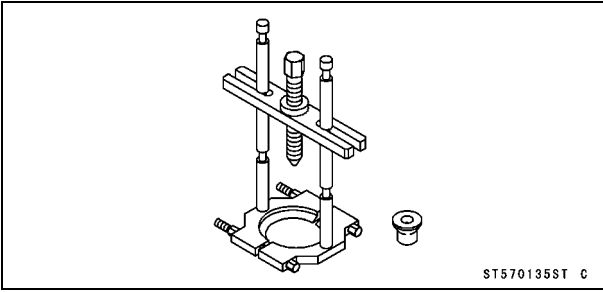
G: Apply grease.

S: Follow the specified tightening sequence.

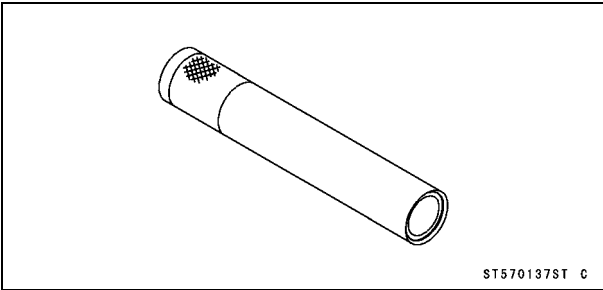
# 13-4 STEERING

## Special Tools

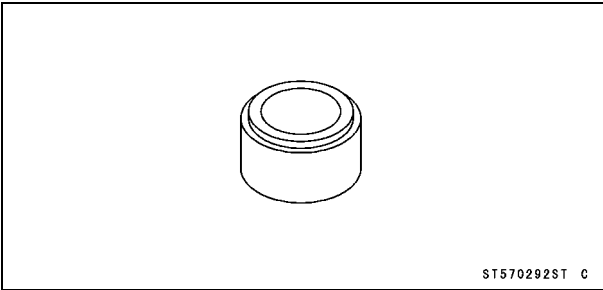
**Bearing Puller:**  
57001-135



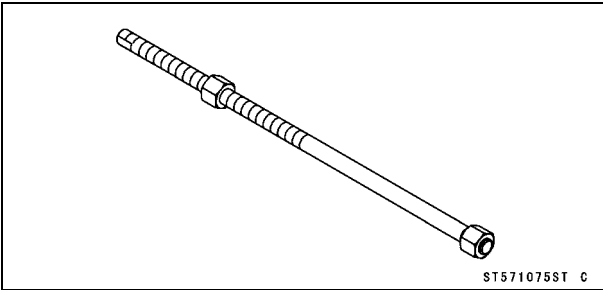
**Steering Stem Bearing Driver:**  
57001-137



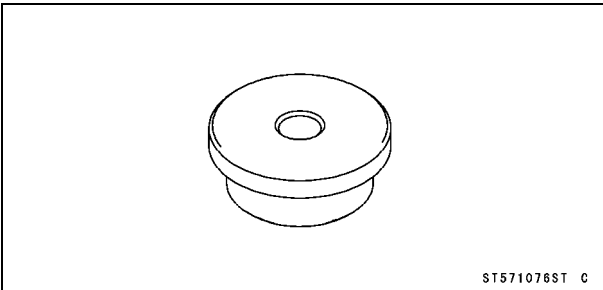
**Steering Stem Bearing Driver Adapter,  $\phi 32$ :**  
57001-292



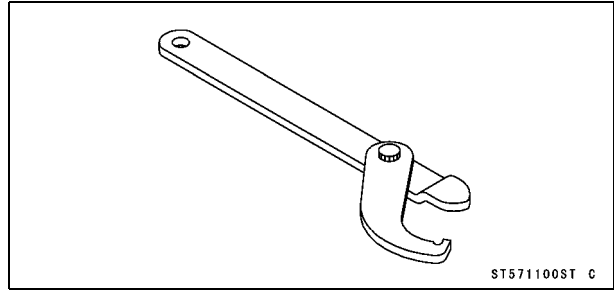
**Head Pipe Outer Race Press Shaft:**  
57001-1075



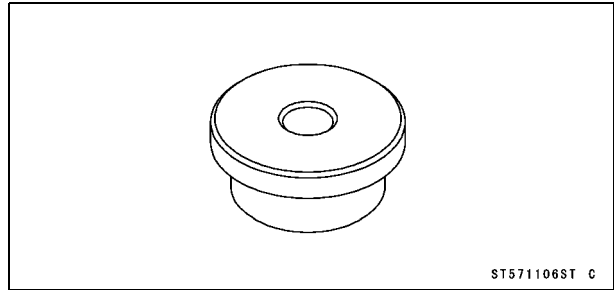
**Head Pipe Outer Race Driver,  $\phi 51.5$ :**  
57001-1076



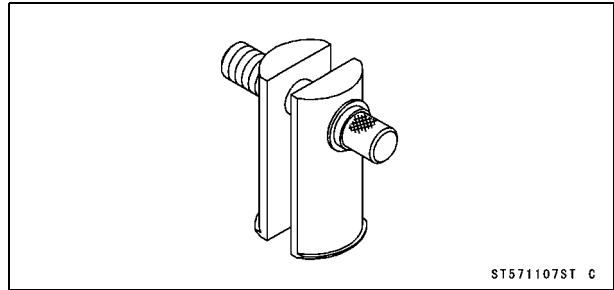
**Steering Stem Nut Wrench:**  
57001-1100



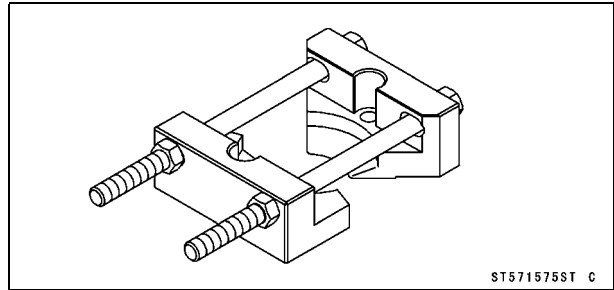
**Head Pipe Outer Race Driver,  $\phi 46.5$ :**  
57001-1106



**Head Pipe Outer Race Remover ID > 37 mm:**  
57001-1107



**Bearing Puller:**  
57001-1575



**Steering**

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***Steering Inspection***

- Refer to the Steering Play Inspection in the Periodic Maintenance chapter.

***Steering Adjustment***

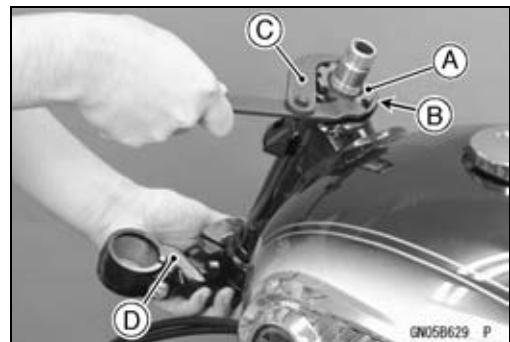
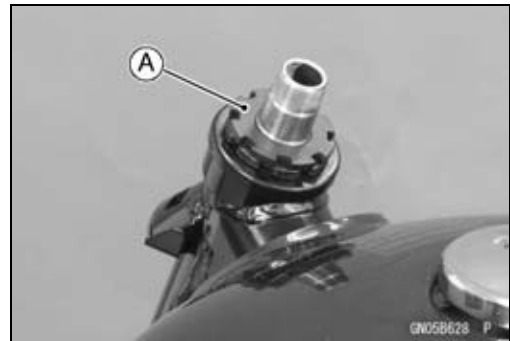
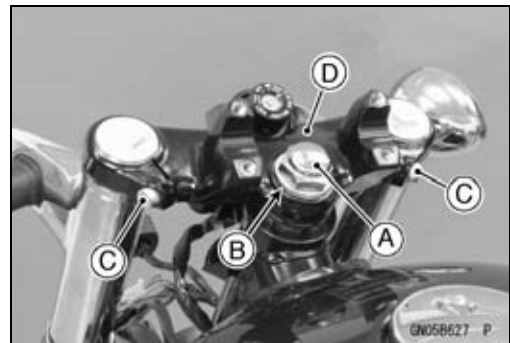
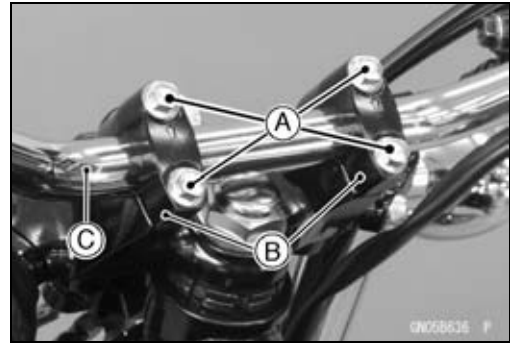
- Refer to the Steering Play Adjustment in the Periodic Maintenance chapter.

## 13-6 STEERING

### Steering Stem

#### Stem, Stem Bearing Removal

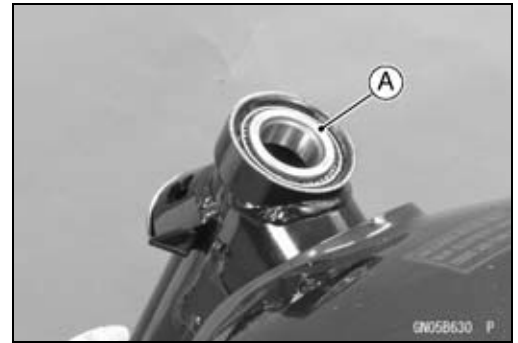
- Remove:
  - Headlight Unit (with the headlight cover installed, see Headlight Unit Removal in the Electrical System chapter)
  - Meter Unit (see Meter Unit Removal in the Electrical System chapter)
  - Front Fender (see Front Fender Removal in the Frame chapter)
  - Front Wheel (see Front Wheel Removal in the Wheels/Tires chapter)
- Remove:
  - Handlebar Clamp Bolts [A]
  - Handlebar Clamps [B]
  - Handlebar Assy [C]
- Remove the steering stem head nut [A] and washer [B].
- Loosen the front fork clamp bolts (upper) [C].
- Pull out the steering stem head [D].
- Remove:
  - Front Fork Covers (see Front Fork Cover Removal in the Suspension chapter)
  - Front Fork (see Front Fork Removal in the Suspension chapter)
- Remove the steering stem locknut [A].  
**Special Tool - Steering Stem Nut Wrench: 57001-1100**
- Pushing up the stem base, and remove the steering stem nut [A] and stem cap [B].  
**Special Tool - Steering Stem Nut Wrench [C]: 57001-1100**
- Remove the steering stem [D].





**Steering Stem**

- Remove the upper bearing inner race (with tapered roller bearing) [A].

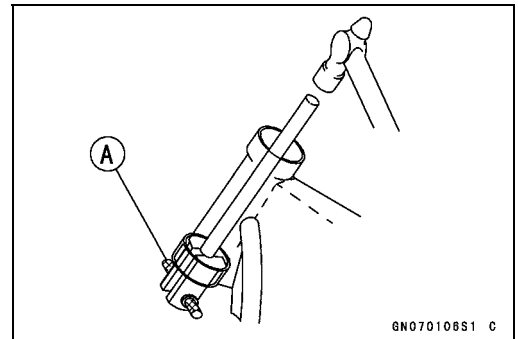


- Drive out the bearing outer races from the head pipe.
- Remove the outer races pressed into the head pipe, using the head pipe outer race remover [A], and hammer the head pipe outer race remover to drive it out.

**Special Tool - Head Pipe Outer Race Remover ID > 37 mm: 57001-1107**

**NOTE**

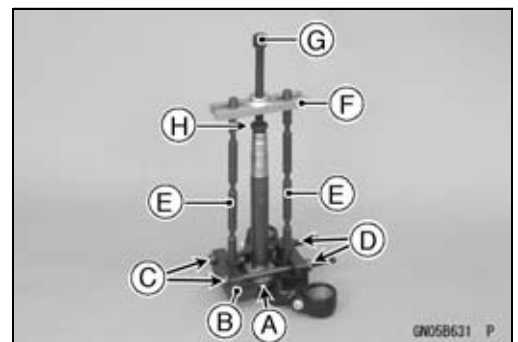
○ If either steering stem bearing is damaged, it is recommended that both the upper and lower bearing (including outer races) should be replaced with new ones.



- Remove the lower bearing inner race (with tapered roller bearing) [A] with its grease seal from the stem using bearing pullers.

**Special Tools - Bearing Puller: 57001-135**  
**Bearing Puller: 57001-1575**

- Assemble the bearing puller (Special Tool: 57001-1575).
- Insert the each half-split base [B] under the bottom of bearing inner race and connect the both bases by tightening the bolts [C] and nuts [D].
- Assemble the parts of the bearing puller (Special Tool: 57001-135) as shown.
  - Stud Bolts [E]
  - Arm [F]
  - Center Bolt [G]
  - Adapter [H]
- Turn the center bolt by a wrench and pull the bearing inner race.



**NOTE**

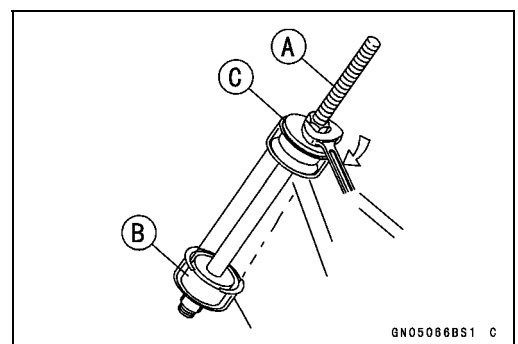
○ Tighten evenly two bases by the two bolts.

**Steering Stem, Stem Bearing Installation**

- Replace the bearing outer races with new ones.
- Drive the outer races into the head pipe at the same time.

**Special Tools - Head Pipe Outer Race Press Shaft: 57001-1075 [A]**  
**Head Pipe Outer Race Driver,  $\phi 51.5$ : 57001-1076 [B]**  
**Head Pipe Outer Race Driver,  $\phi 46.5$ : 57001-1106 [C]**

- Apply grease to the outer races.



## 13-8 STEERING

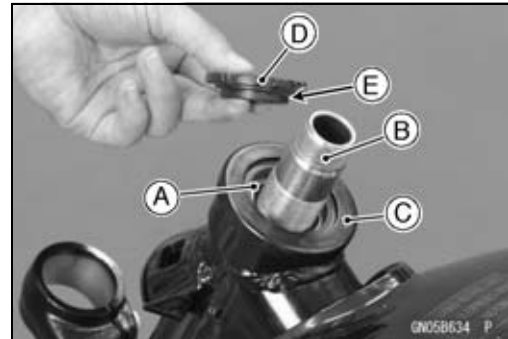
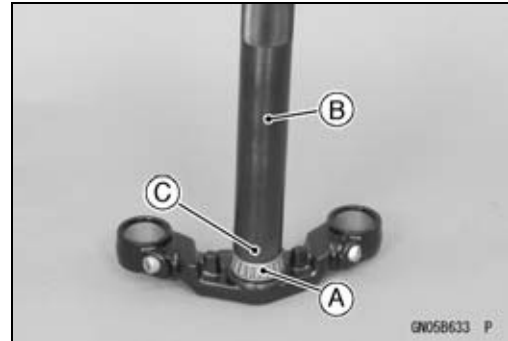
### Steering Stem

- Replace the lower bearing inner race (with tapered roller bearing) with a new one.
- Drive the lower bearing inner race (with tapered roller bearing) [A] applied grease onto the stem.
- The upper and lower bearing inner races are identical.

**Special Tools - Steering Stem Bearing Driver: 57001-137 [B]**

**Steering Stem Bearing Driver Adapter,  $\phi$ 32: 57001-292 [C]**

- Apply grease to the lower tapered roller bearing.
- Apply grease to the upper tapered roller bearing, and install the upper bearing inner race [A] onto the head pipe.
- Install the steering stem [B] through the head pipe and upper bearing inner race.
- Install the stem cap [C] and the steering stem nut [D] so that the stepped side [E] faces downward.

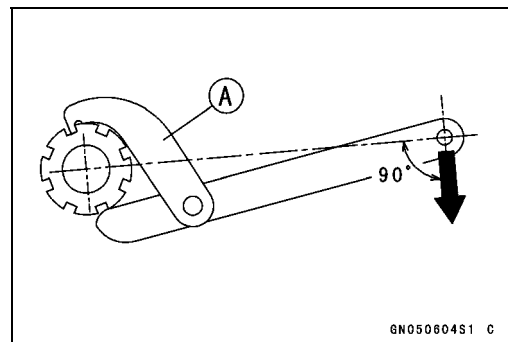


- Settle the inner races in place as follows.
- Tighten the steering stem nut with **39 N·m (4.0 kgf·m, 29 ft·lb)** of torque first, and loosen it a fraction of a turn until it turns lightly. Afterward tighten it again with specified torque using a stem nut wrench [A] in the direction shown.
- Check that there is no play and the steering stem turns smoothly without rattles. If not, the steering stem bearings may be damaged.

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

**Torque - Steering Stem Nut: 4.9 N·m (0.50 kgf·m, 43 in·lb)**

- Tighten the steering stem locknut securely.



## Steering Stem

- Install the front forks and tighten the lower front fork clamp bolts temporarily.
- Install:
  - Front Fork Cover (see Front Fork Cover Installation in the Suspension chapter)
  - Steering Stem Head
  - Washer
- Tighten the steering stem head nut temporarily.
- Hold the fork leg and loosen the lower front fork clamp bolt.
- Align the mounting position of the fork and tighten the fork upper clamp bolt.
- Repeat the same procedure for other fork leg.
- Tighten the steering stem head nut and the lower front fork clamp bolts.

### NOTE

- *Tighten the upper front fork clamp bolts first, next the steering stem head nut, last the lower front fork clamp bolts.*

**Torque - Front Fork Clamp Bolts (Upper): 20 N·m (2.0 kgf·m, 15 ft·lb)**

**Steering Stem Head Nut: 49 N·m (5.0 kgf·m, 36 ft·lb)**

**Front Fork Clamp Bolts (Lower): 29 N·m (3.0 kgf·m, 21 ft·lb)**

### **⚠ WARNING**

**If the handlebar does not turn to the steering stop it may cause an accident resulting in injury or death. Be sure the cables, harnesses and hoses are routed properly and do not interfere with handlebar movement (see Cable, Wire, and Hose Routing section in the Appendix chapter).**

- Install the removed parts (see appropriate chapters).
- Run the cables, leads and hose correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).

### **Stem Bearing Lubrication**

- Refer to the Steering Stem Bearing Lubrication in the Periodic Maintenance chapter.

### **Steering Stem Warp Inspection**

- 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.



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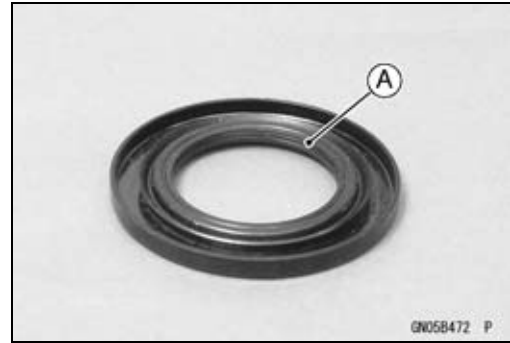
## 13-10 STEERING

### Steering Stem

---

#### ***Stem Cap Deterioration, Damage Inspection***

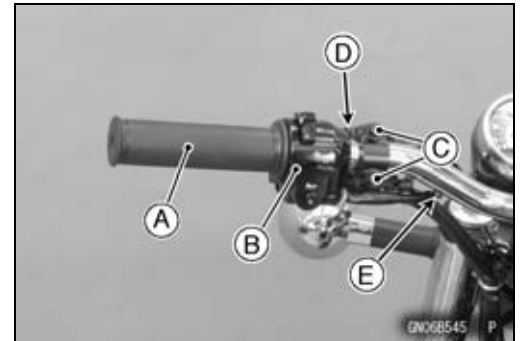
★ Replace the stem cap if its oil seal [A] shows damage.



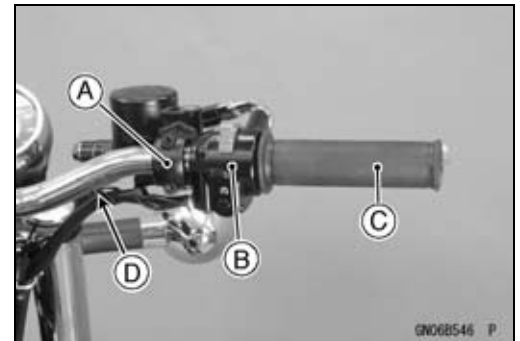
## Handlebar

### Handlebar Removal

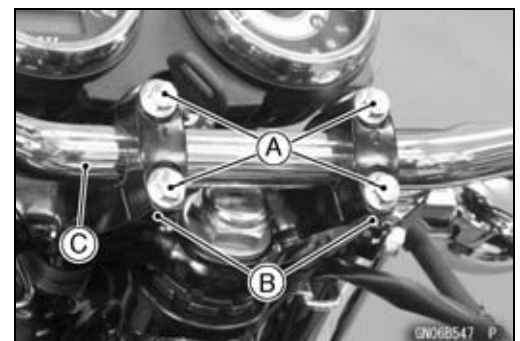
- Remove:
  - Rear View Mirrors (see Rear View Mirrors Removal in the Frame chapter)
  - Left Handlebar Grip [A]
  - Left Handlebar Switch Housing [B]
  - Clutch Lever Clamp Bolts [C]
  - Clutch Lever Assembly [D]
  - Clamp [E]



- Remove:
  - Master Cylinder [A] (see Master Cylinder Removal in the Brakes chapter)
  - Right Handlebar Switch Housing [B]
  - Throttle Grip [C]
  - Clamp [D]

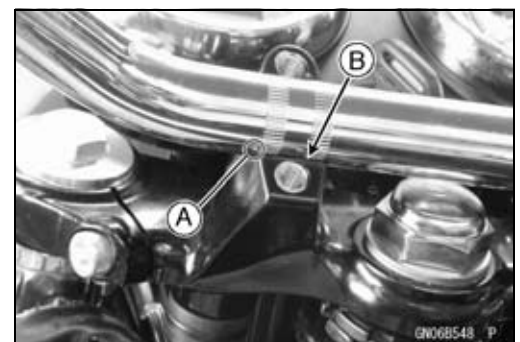


- Remove:
  - Handlebar Clamp Bolts [A]
  - Handlebar Clamps [B]
  - Handlebar [C]



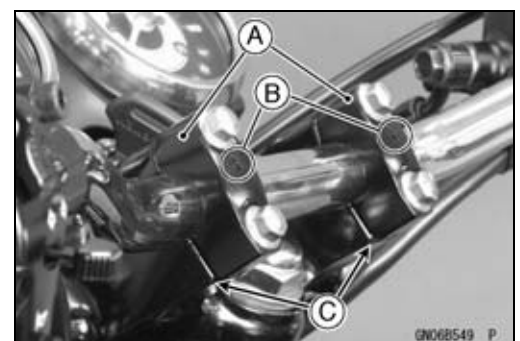
### Handlebar Installation

- Align the punch mark [A] of the handlebar with the upper surface [B] of the left handlebar holder.



- Set the handlebar clamp [A] so that the arrow marks [B] point at the front.
- Tighten the front clamp bolts first, and then the rear clamp bolts. There will be a gap [C] at the rear part of the clamp after tightening.

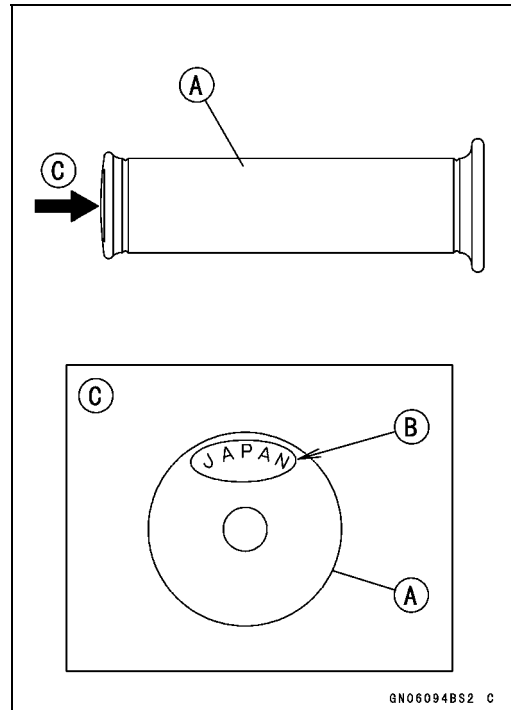
**Torque - Handlebar Clamp Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)**



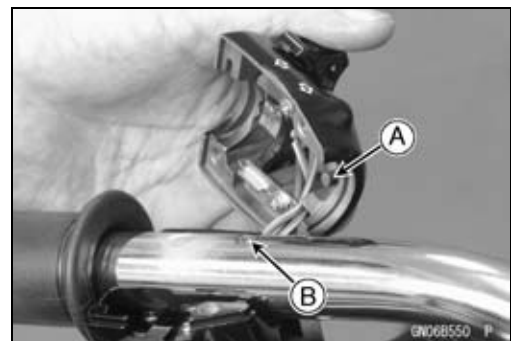
## 13-12 STEERING

### Handlebar

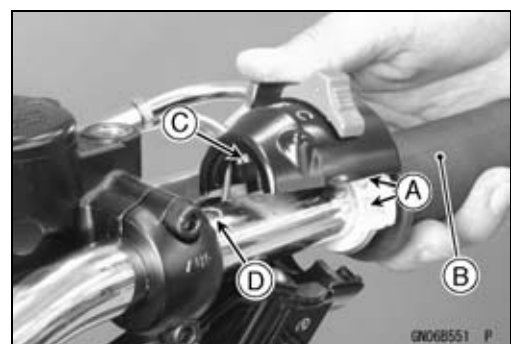
- Install the clutch lever (see Clutch Lever Installation in the Clutch chapter).
- Apply adhesive to the inside of the left handlebar grip [A].
- Install the left handlebar grip so that the mark [B] faces upward.  
Left Side View [C]



- Install the left switch housing.
  - Fit the projection [A] into a hole [B] in the handlebar.
  - Tighten:  
**Torque - Switch Housing Screws: 3.5 N·m (0.36 kgf·m, 31 in·lb)**
- Install the clutch lever (see Clutch Lever Installation in the Clutch chapter).



- Install the front master cylinder (see Front Master Cylinder Installation in the Brakes chapter).
- Install the right handlebar switch housing.
  - Run the cables and lead correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
  - Apply a thin coat of grease to the throttle cable upper ends.
  - Install the throttle cable upper ends [A] in the throttle grip [B].
  - Fit the projection [C] into the a small hole [D] in the handlebar.



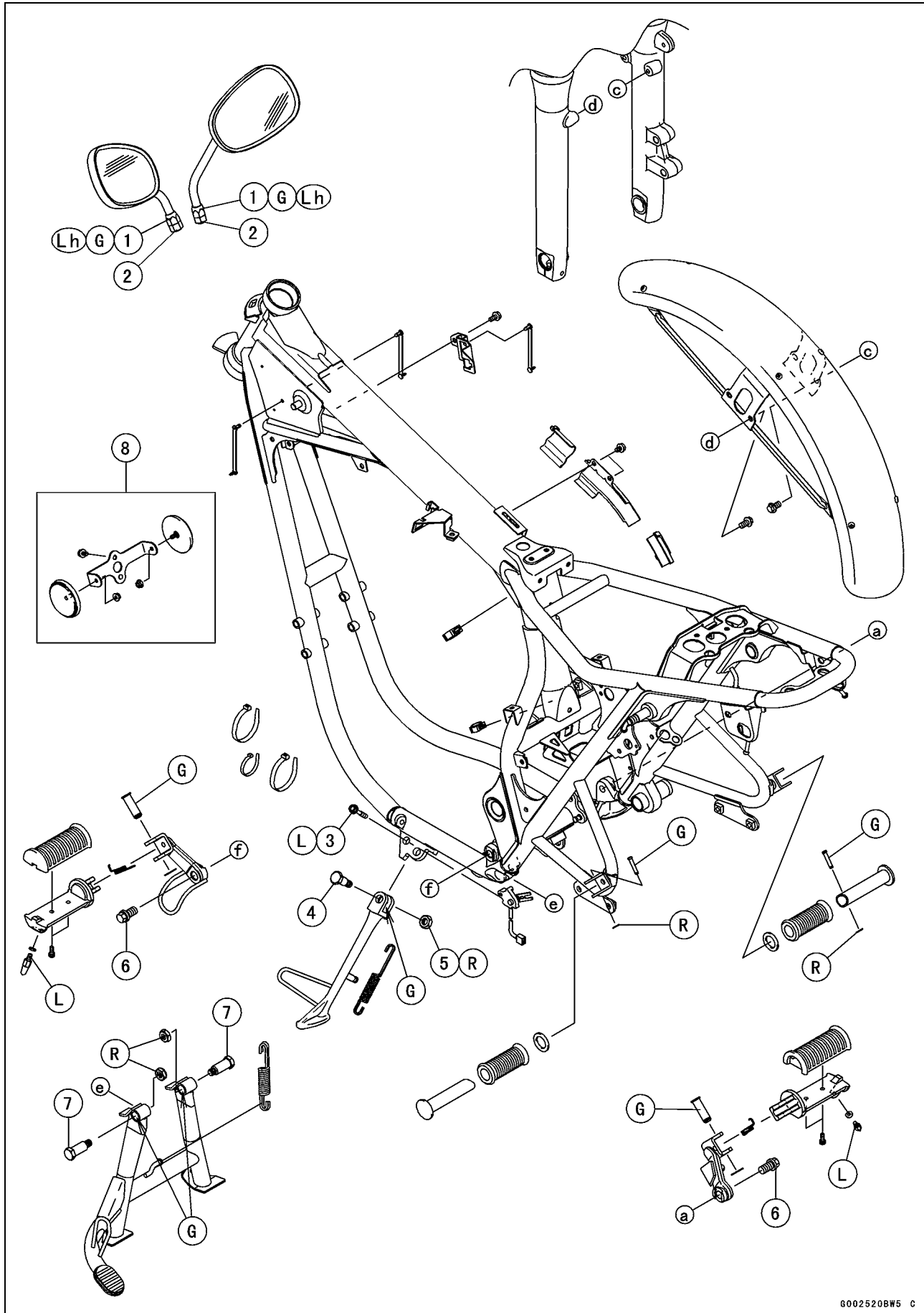
# Frame

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# 14-2 FRAME

## Exploded View





**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear View Mirror Locknut (Upper)	30	3.1	22	G, Lh
2	Rear View Mirror Nut (Lower)	30	3.1	22	
3	Sidestand Switch Bolt	8.8	0.9	78 in·lb	L
4	Sidestand Bolt	44	4.5	32	
5	Sidestand Nut	44	4.5	32	R
6	Front Step Mounting Bolts	59	6.0	44	
7	Center Stand Bolt	44	4.5	32	

8. AU Model

G: Apply grease.

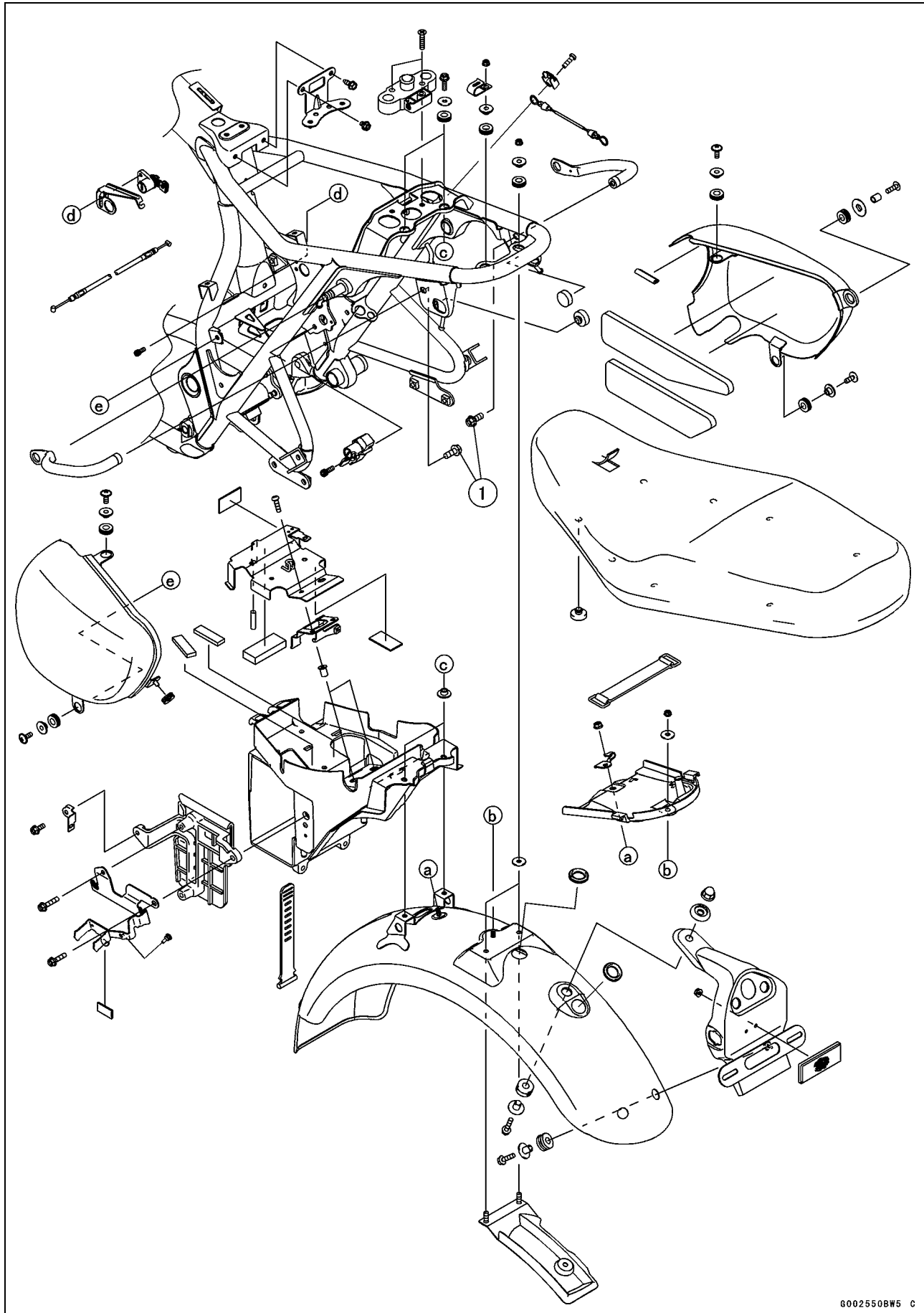
L: Apply a non-permanent locking agent.

Lh: Left-hand Threads

R: Replacement Parts

# 14-4 FRAME

## Exploded View



**Exploded View**

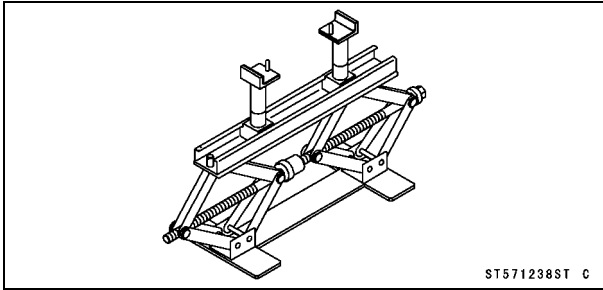
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Grab Rail Bolts	25	2.5	18	

# 14-6 FRAME

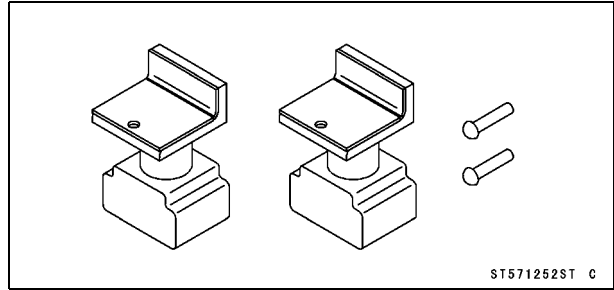
## Special Tools

---

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



**Attachment Jack:**  
**57001-1252**



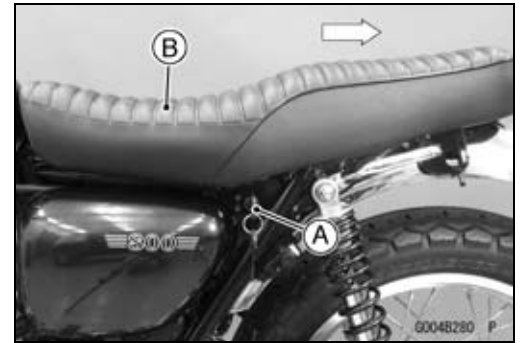
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**Seat**

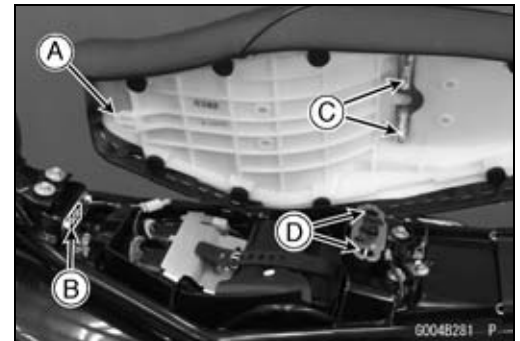
---

**Seat Removal**

- Insert the ignition switch key [A] into the seat lock.
- Turn the key clockwise, and pull up on the rear of the seat [B].
- Remove the seat backward.

**Seat Installation**

- Insert the seat hook [A] into the hole [B] on the frame.
- Insert the seat latches [C] into the latch holes [D].
- Push down the rear part of the seat until the lock clicks.



## 14-8 FRAME

### Side Covers

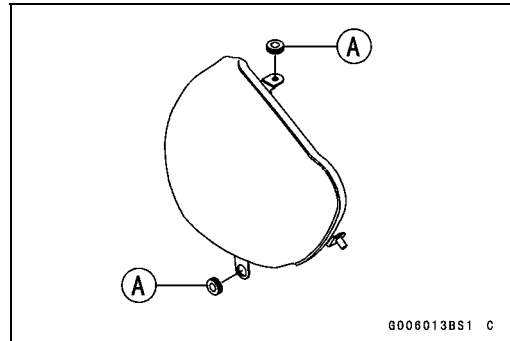
#### Left Side Cover Removal

- Remove:
  - Seat (see Seat Removal)
  - Screws [A]
- Pull the left side cover [B] forward to clear the stopper [C], and then take it off.

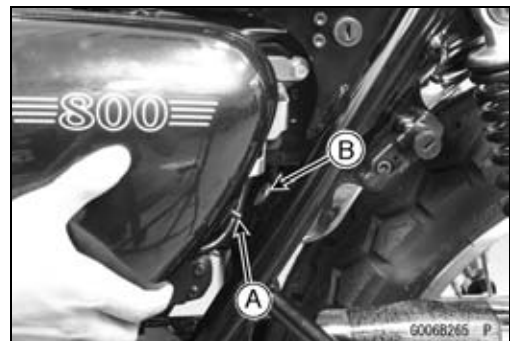


#### Left Side Cover Installation

- Be sure that the dampers [A] are in position on the left side cover.

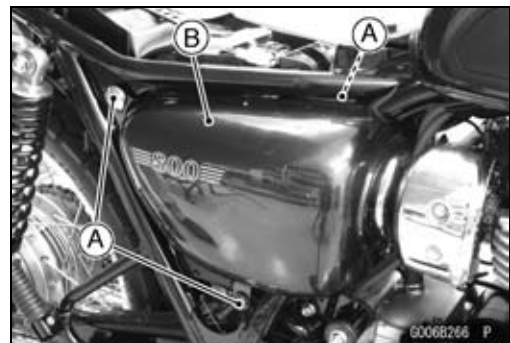


- Insert the projection [A] into the grommet [B].
- Install the screws and collars.



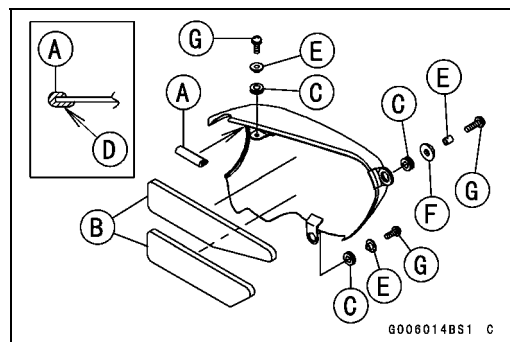
#### Right Side Cover Removal

- Remove:
  - Seat (see Seat Removal)
  - Screws [A]
  - Right Side Cover [B]



#### Right Side Cover Installation

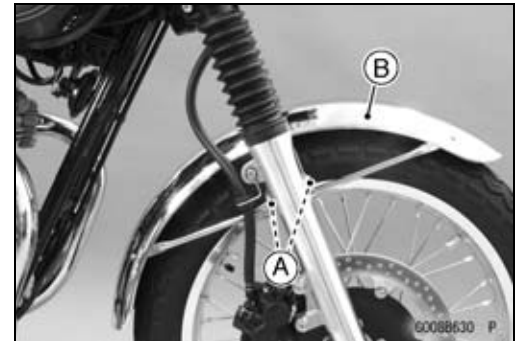
- Be sure that the rubber trim [A], pads [B] and dampers [C] are in position on the right side cover.
- Install the rubber trim so that the long side [D] faces inside.
- Install:
  - Collars [E]
  - Washer [F]
  - Screws [G]



## Fenders

### Front Fender Removal

- Remove:
  - Bolts [A] (Both Sides)
  - Front Fender [B]

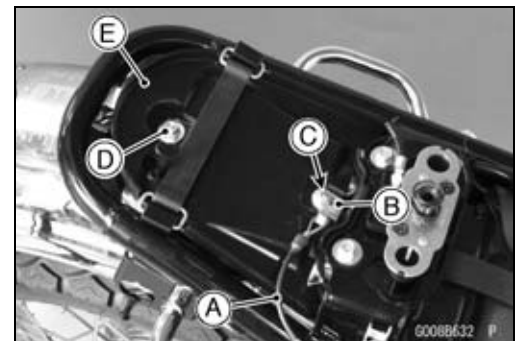


### Front Fender Installation

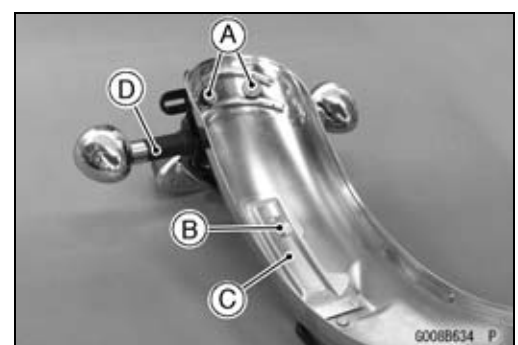
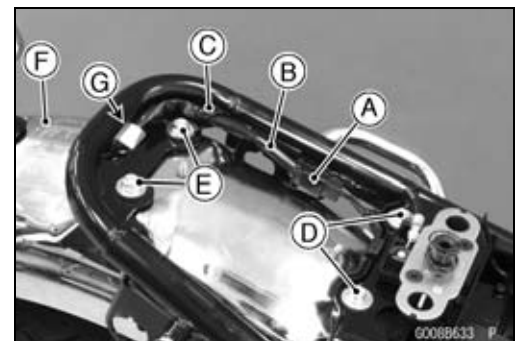
- Installation is the reverse of removal.

### Flap and Rear Fender Removal

- Remove the seat (see Seat Removal).
- Clear the helmet cable [A] from the bracket [B].
- Remove:
  - Nut [C] and Bracket
  - Nut [D] and Washer
  - Document Compartment [E]



- Disconnect the tail/brake light lead connector [A].
- Clear the tail/brake light lead [B] from the clamp [C].
- Remove:
  - Bolts [D]
  - Nuts [E]
  - Clamp
- Remove the rear fender [F] together with the tail/brake light lead.
- Remove the tail/brake light lead through the hole [G] of the frame.
- Remove:
  - Bolts [A] and Washers
  - Bolt [B] and Nut
  - Bracket [C]
- Remove the flap assembly [D] together with the tail/brake light lead.

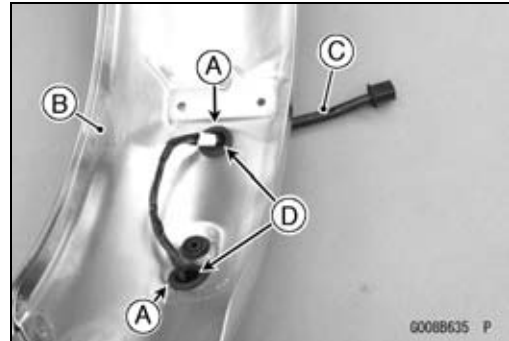


# 14-10 FRAME

## Fenders

### Flap and Rear Fender Installation

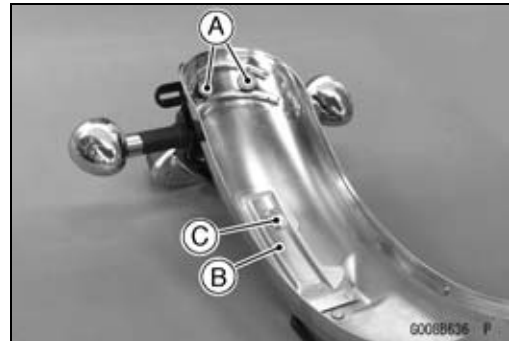
- Be sure that the dampers [A] are in position on the rear fender [B].
- Install the flap assembly together with the tail/brake light lead.
- Install the tail/brake light lead [C] through the holes [D] of the rear fender as shown in the figure.



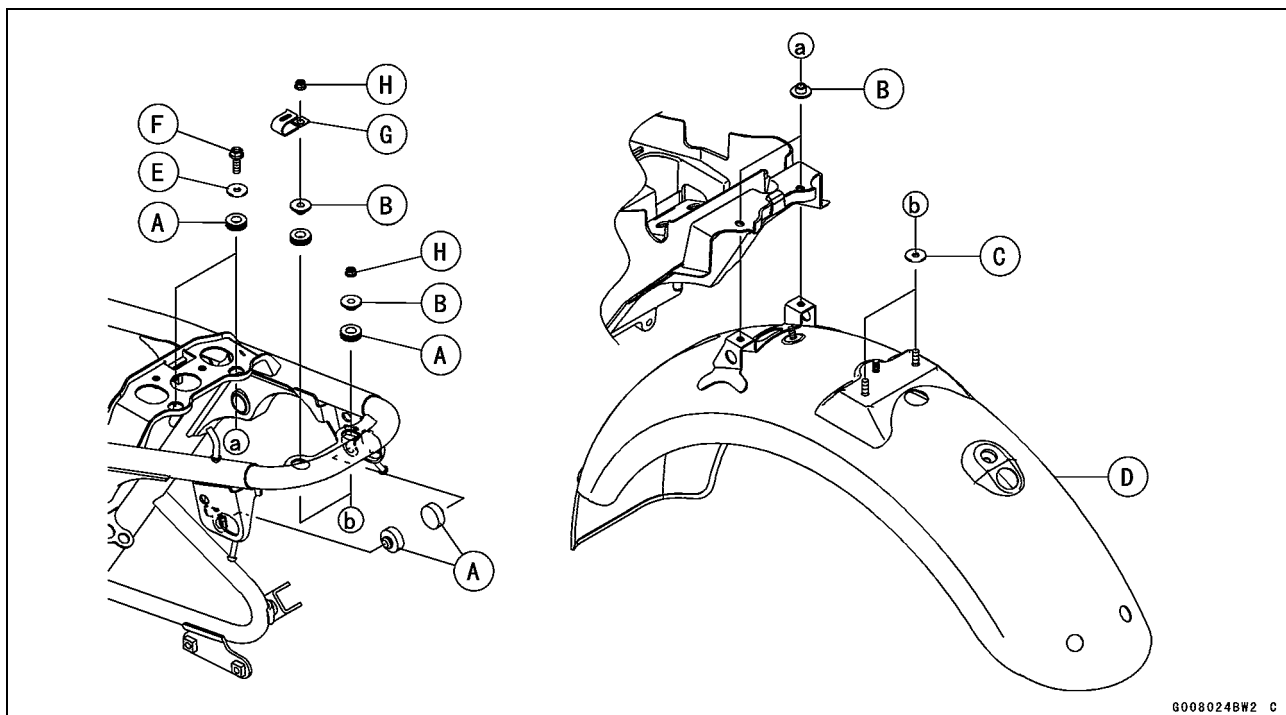
- Install:
  - Bolts [A] and Washers
  - Bracket [B]
  - Bolt [C] and Nut

### NOTICE

**Do not pinch the tail/brake light lead.**



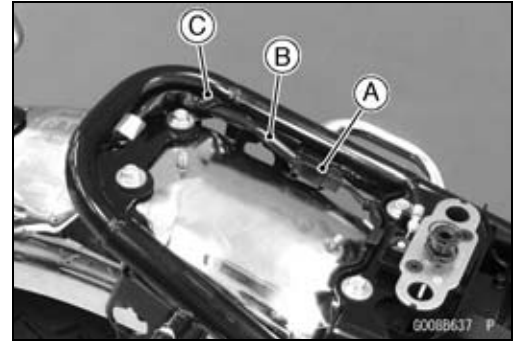
- Be sure that the dampers [A] and collars [B] are in position on the frame.
- Install the washers [C] on the rear fender [D].
- Install the rear fender together with the tail/brake light lead (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Install:
  - Washers [E]
  - Bolts [F]
  - Clamp [G]
  - Nuts [H]



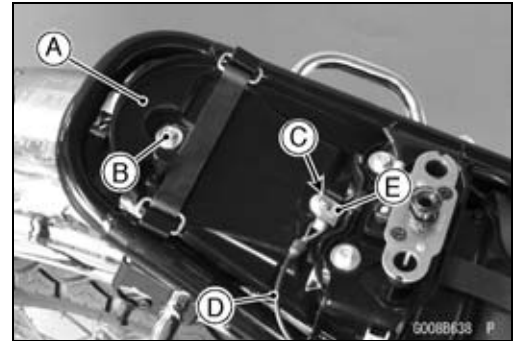


## Fenders

- Connect the tail/brake light lead connector [A].
- Hold the tail/brake light lead [B] at the clamp [C].



- Install:
  - Document Compartment [A]
  - Nut [B] and Washer
  - Nut [C] and Bracket
- Hook the helmet cable [D] to the bracket [E].
- Install the seat (see Seat Installation).

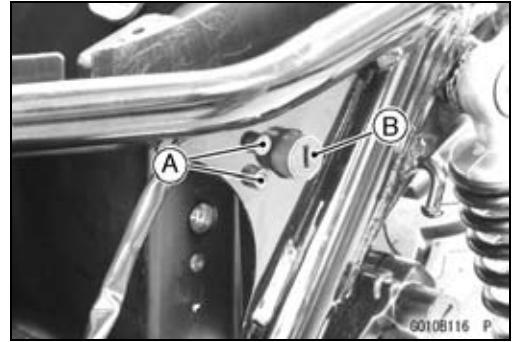
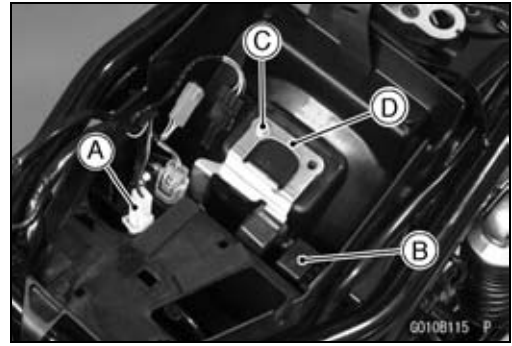


## 14-12 FRAME

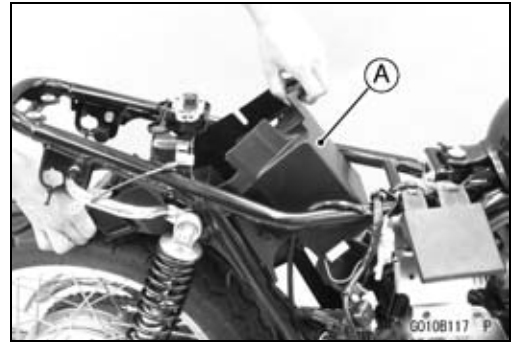
### Battery Case

#### **Battery Case Removal**

- Remove:
  - Air Cleaner Housing (see Air Cleaner Housing Removal in the Fuel System chapter)
  - Battery (see Battery Removal in the Electrical System chapter)
  - Rear Fender (see Rear Fender Removal)
  - Negative Lead Connector [A] (Disconnect)
  - Turn Signal Relay [B]
  - Screw [C]
  - Bracket [D]
- Remove:
  - Bolts [A]
  - Seat Lock [B]

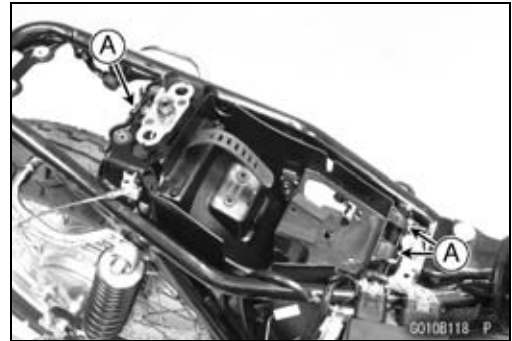


- Raise the front of the battery case [A] to take off the battery case.



#### **Battery Case Installation**

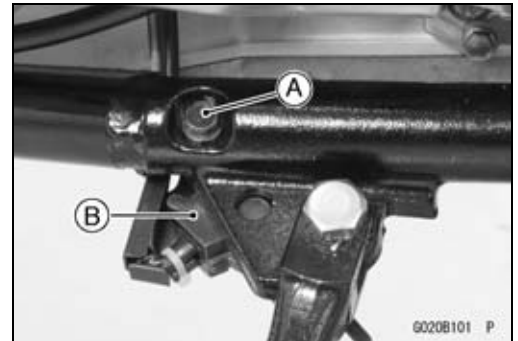
- Installation is the reverse of removal.
- Attach the front and rear hooks [A] to the frame.
- Install the removed parts (see appropriate chapters).
- Run the cables, leads harness and hose correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).



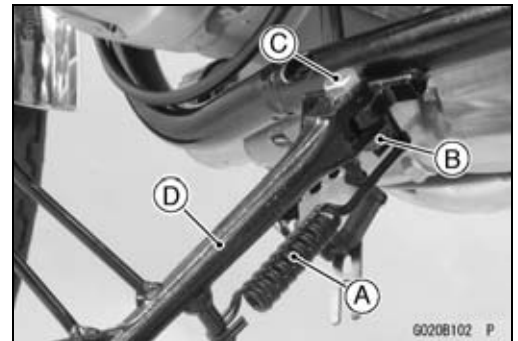
**Side Stand, Center Stand, Frame**

**Sidestand Removal**

- Remove the left muffler body (see Muffler Body Removal in the Engine Top End chapter).
- Use the center stand to support the motorcycle upright.
- Remove:
  - Sidestand Switch Bolt [A]
  - Sidestand Switch [B]



- Remove:
  - Spring [A]
  - Sidestand Nut [B]
  - Sidestand Bolt [C]
  - Sidestand [D]

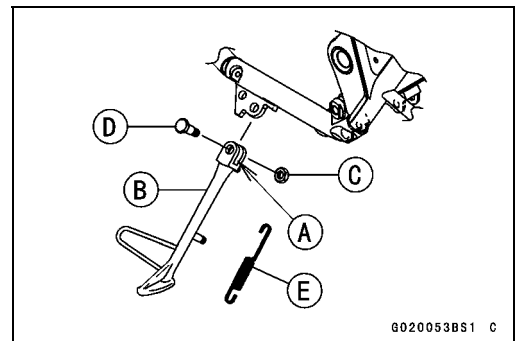


**Sidestand Installation**

- Apply grease to the sliding area [A] of the sidestand [B].
- Replace the sidestand nut [C] with a new one.
- Tighten the sidestand bolt [D] first, and then the sidestand nut.

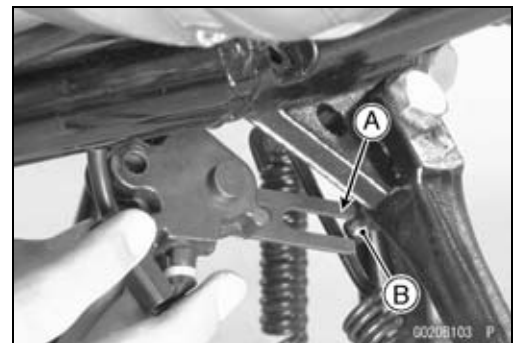
**Torque - Sidestand Bolt: 44 N·m (4.5 kgf·m, 32 ft·lb)**  
**Sidestand Nut: 44 N·m (4.5 kgf·m, 32 ft·lb)**

- Hook the spring [E] so that the long end faces upward.
- Install the spring hook direction as shown in the figure.



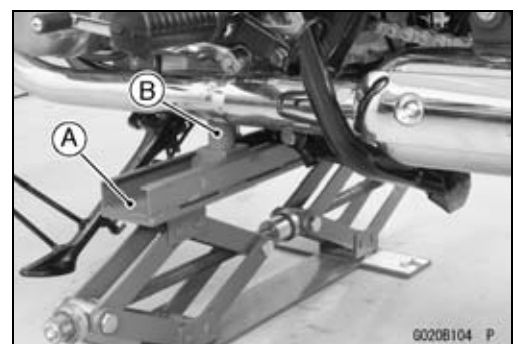
- Install the sidestand switch.
- Fit the slit [A] on the sidestand switch to the pin [B] on the sidestand.
- Apply a non-permanent locking agent to the thread of the switch bolt, and tighten it.

**Torque - Sidestand Switch Bolt: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



**Center Stand Removal**

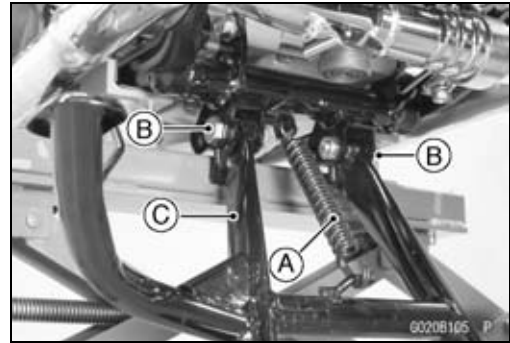
- Using the jack [A] raise the rear wheel off the ground.
  - Special Tools - Jack: 57001-1238**
  - Attachment Jack [B]: 57001-1252**



## 14-14 FRAME

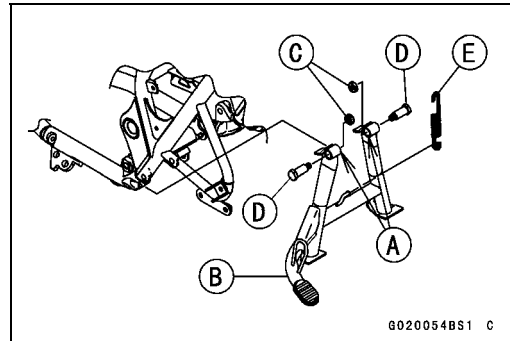
### Side Stand, Center Stand, Frame

- Remove:
  - Spring [A]
  - Center Stand Bolts [B] and Nuts
  - Center Stand [C]



#### **Center Stand Installation**

- Apply grease to the sliding area [A] of the center stand [B].
- Replace the center stand nuts [C] with new ones.
- Tighten the center stand bolts [D] with the nuts.
  - Torque - Center Stand Bolts: 44 N·m (4.5 kgf·m, 32 ft·lb)**
- Hook the spring [E] so that the long end faces upward.
- Install the spring hook direction as shown in the figure.



#### **Frame Inspection**

- Visually inspect the frame for cracks, dents, bending, or warp.
- ★ If there is any damage to the frame, replace it.

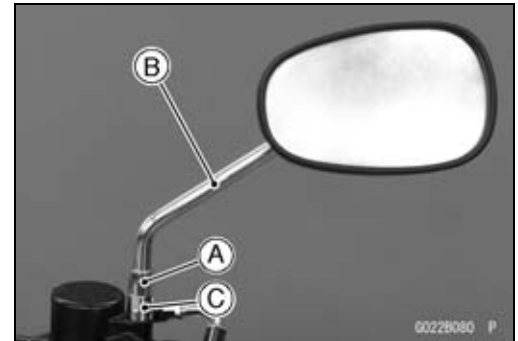
#### **⚠ WARNING**

**A repaired frame may fail in use, possibly causing an accident resulting in injury or death. If the frame is bent, dented, cracked, or warped, replace it.**

## Rear View Mirrors

### Rear View Mirror Removal

- Loosen the rear view mirror locknut (upper) [A], and remove the rear view mirror stay [B] from the rear view mirror nut (lower) [C].
- The rear view mirror locknut (upper) and rear view mirror stay are left-hand thread.
- Loosen the rear view mirror nut (lower), and remove it.



### Rear View Mirror Installation

- Tighten the rear view mirror nut (lower) [A].
- Torque - Rear View Mirror Nut (Lower): 30 N·m (3.1 kgf·m, 22 ft·lb)**
- Apply grease to the threads of the rear view mirror stay [B].

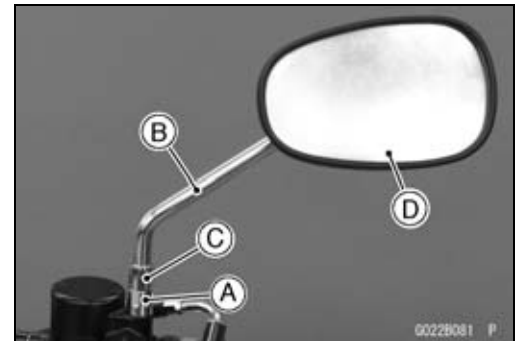
#### NOTE

○ The threads of the new rear view mirror stay applied with a grease.

- Tighten the rear view mirror stay until the fully position.
- Adjust the rear view mirror stay to assure the safe conditions of the rear with the rider sitting on the motorcycle.
- The rear view mirror locknut (upper) and rear view mirror stay are left-hand thread.
- Tighten the rear view mirror locknut (upper) [C].

**Torque - Rear View Mirror Locknut (Upper): 30 N·m (3.1 kgf·m, 22 ft·lb)**

- Adjust the rear view mirror [D] by slightly moving only the mirror portion of the assembly.
- Installation and adjustment of the left side are common with those of the right side. Follow the procedure specified at the right side.





# Electrical System

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## 15-2 ELECTRICAL SYSTEM

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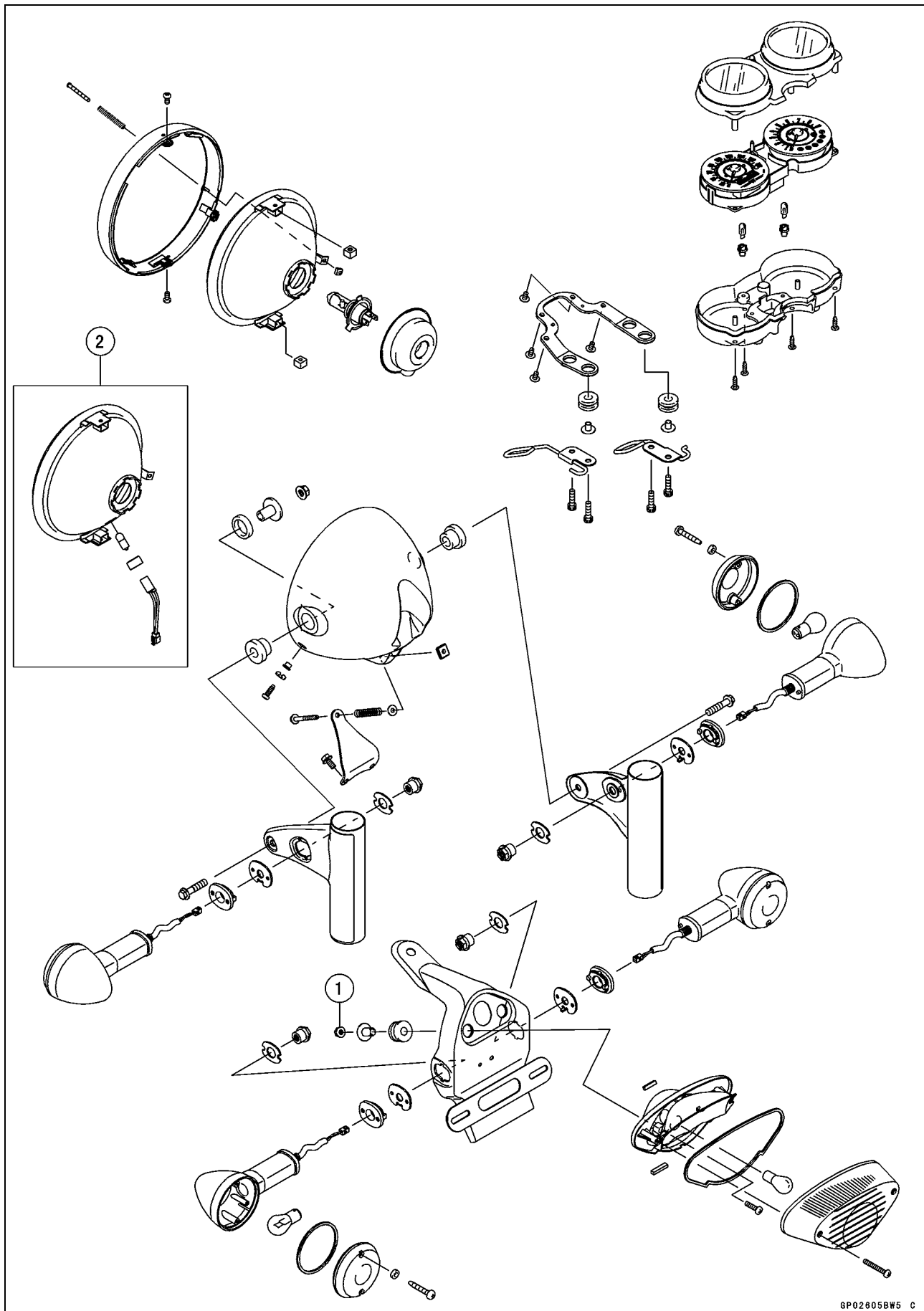
**Exploded View**

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# 15-4 ELECTRICAL SYSTEM

## Exploded View



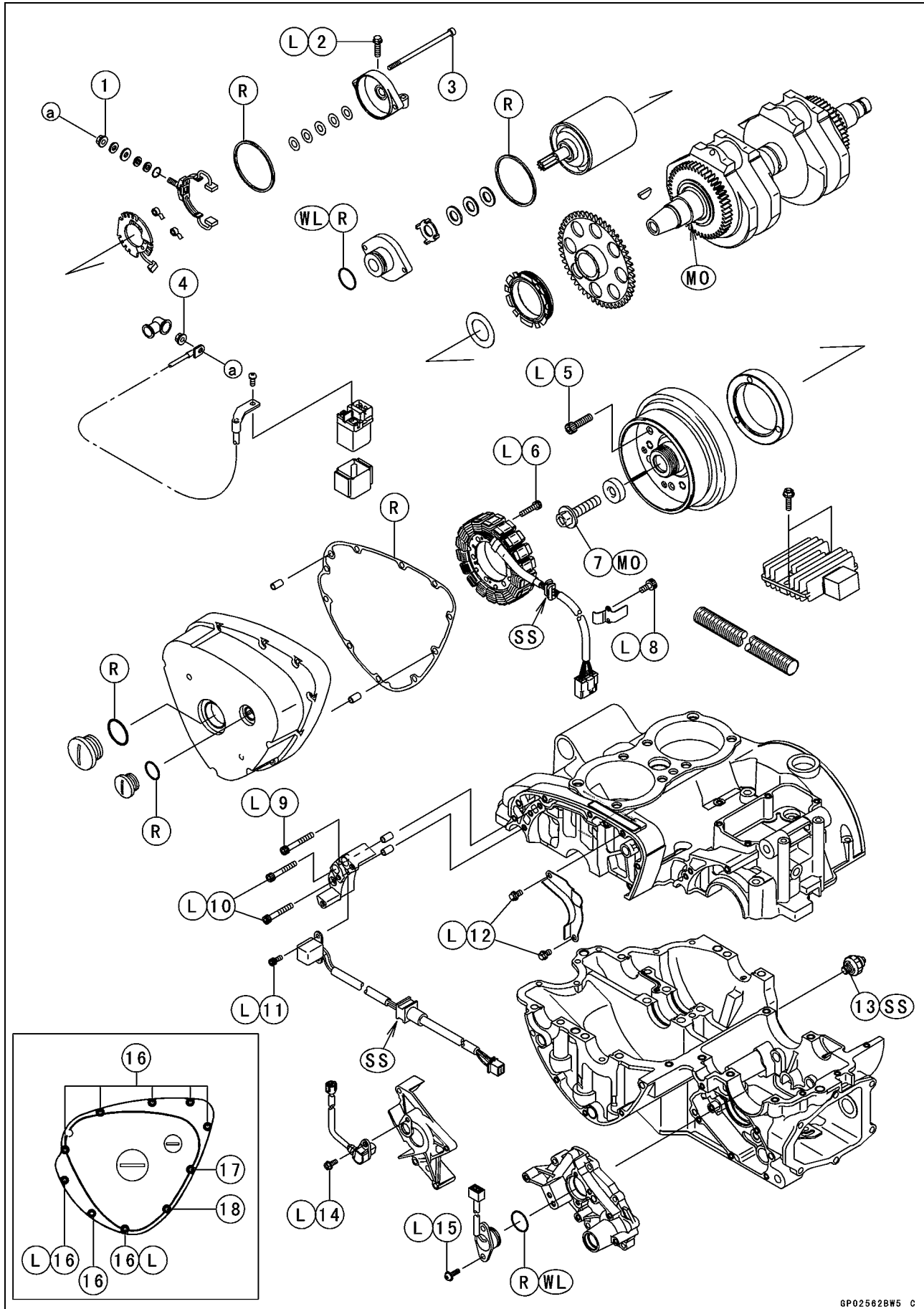
**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Tail/Brake Light Mounting Nuts	5.9	0.60	52 in·lb	

2. EUR Models

# 15-6 ELECTRICAL SYSTEM

## Exploded View



## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Starter Motor Terminal Locknut	11	1.1	97 in·lb	
2	Starter Motor Mounting Bolts	9.8	1.0	87 in·lb	L
3	Starter Motor Through Bolts	4.9	0.50	43 in·lb	
4	Starter Motor Cable Terminal Nut	4.9	0.50	43 in·lb	
5	Starter Motor Clutch Bolts	34	3.5	25	L
6	Stator Coil Bolts	12	1.2	106 in·lb	L
7	Alternator Rotor Bolt	155	15.8	114	MO
8	Alternator Lead Holding Plate Bolts	7.8	0.80	69 in·lb	L
9	Crankshaft Sensor Bracket Bolt (L = 45 mm)	12	1.2	106 in·lb	L
10	Crankshaft Sensor Bracket Bolts (L = 40 mm)	12	1.2	106 in·lb	L
11	Crankshaft Sensor Bolts	7.8	0.80	69 in·lb	L
12	Crankshaft Sensor Lead Guard Plate Bolts	10	1.0	89 in·lb	L
13	Oil Pressure Switch	15	1.5	11	SS
14	Speed Sensor Mounting Bolt	4.5	0.46	40 in·lb	L
15	Neutral Switch Screws	3.9	0.40	35 in·lb	L
16	Alternator Cover Bolts (M6, L = 35 mm)	12	1.2	106 in·lb	(L, 2)
17	Alternator Cover Bolts (M6, L = 40 mm)	12	1.2	106 in·lb	
18	Alternator Cover Bolts (M6, L = 45 mm)	12	1.2	106 in·lb	

L: Apply a non-permanent locking agent.

MO: Apply molybdenum disulfide oil solution

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

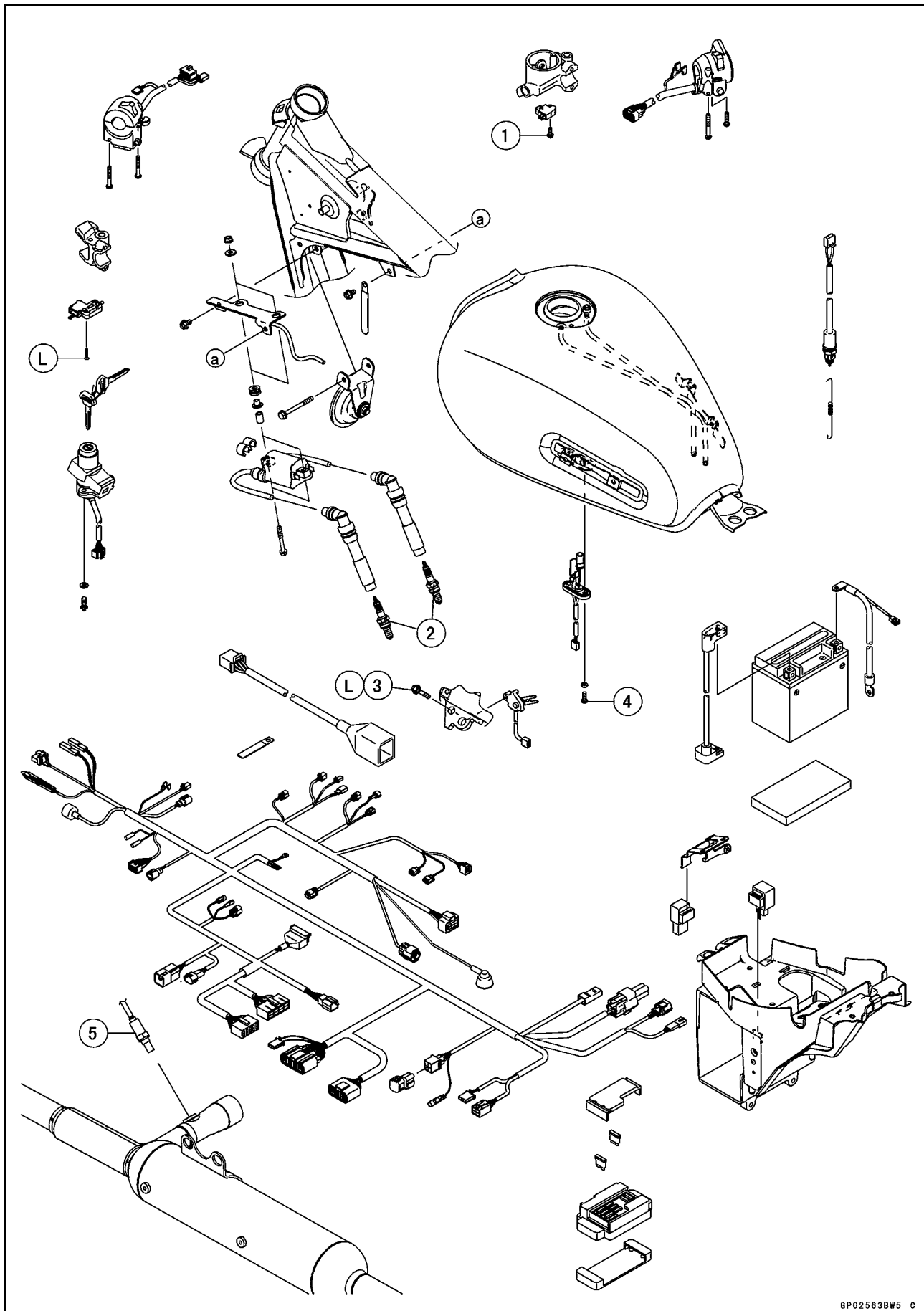
R: Replacement Parts

SS: Apply silicone sealant.

WL: Apply soap and water solution or rubber lubricant.

# 15-8 ELECTRICAL SYSTEM

## Exploded View



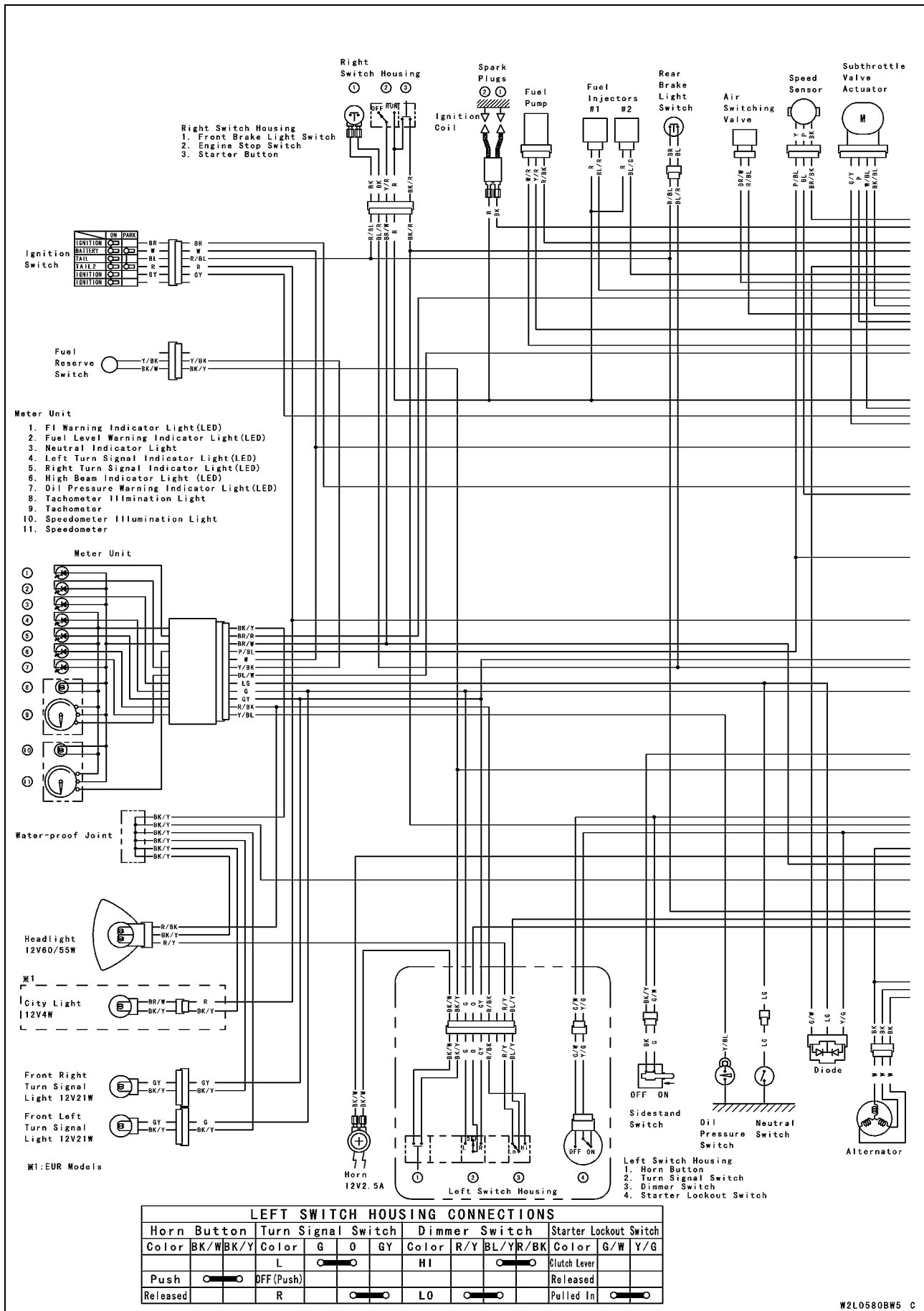
**Exploded View**

<b>No.</b>	<b>Fastener</b>	<b>Torque</b>			<b>Remarks</b>
		<b>N·m</b>	<b>kgf·m</b>	<b>ft·lb</b>	
1	Front Brake Light Switch Screw	1.2	0.12	11 in·lb	
2	Spark Plugs	13	1.3	115 in·lb	
3	Sidestand Switch Bolt	8.8	0.9	78 in·lb	L
4	Fuel Reserve Switch Screws	2.1	0.21	19 in·lb	
5	Oxygen Sensor	25	2.5	18	

L: Apply a non-permanent locking agent.

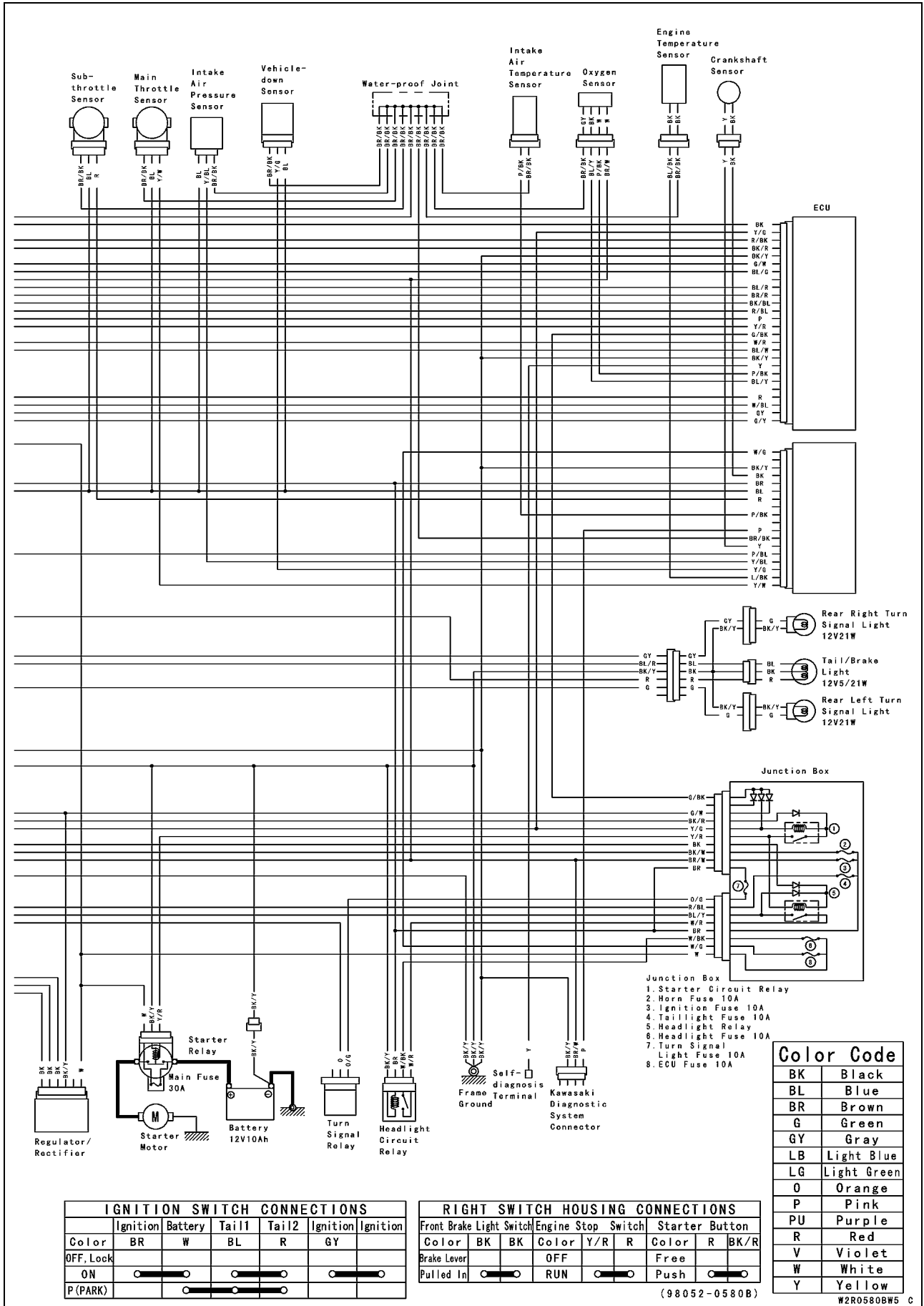
# 15-10 ELECTRICAL SYSTEM

## Wiring Diagram





## Wiring Diagram



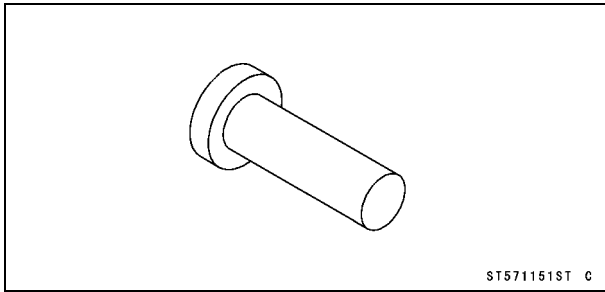
# 15-12 ELECTRICAL SYSTEM

## Specifications

Item	Standard	Service Limit
<b>Battery</b>		
Type	Sealed Battery	---
Model	YTX12-BS	---
Capacity	12 V 10 Ah	---
Voltage	12.8 V or more	---
<b>Charging System</b>		
Alternator Type	Three-phase AC	---
Charging Voltage (Regulator/Rectifier Output Voltage)	14 ~ 15 V	---
Alternator Output Voltage	63.2 ~ 94.8 V @4 000 r/min (rpm)	---
Stator Coil Resistance	0.4 ~ 0.6 Ω	---
Regulator/Rectifier Resistance	in the text	---
<b>Ignition System</b>		
Ignition Coil:		
3 Needle Arcing Distance	6 mm (0.24 in.) or more	---
Primary Winding Resistance	2.61 ~ 3.19 Ω at 20°C (68°F)	---
Secondary Winding Resistance	13.5 ~ 16.5 kΩ at 20°C (68°F)	---
Primary Peak Voltage	100 V or more	---
Spark Plug:		
Type	NGK CR8E	---
Spark Plug Gap	0.7 ~ 0.8 mm (0.027 ~ 0.031 in.)	---
Spark Plug Cap Resistance	3.75 ~ 6.25 kΩ at 20°C (68°F)	---
Crankshaft Sensor:		
Crankshaft Sensor Resistance	376 ~ 564 Ω	---
Crankshaft Sensor Peak Voltage	5 V or more	---
<b>Electric Starter System</b>		
Starter Motor:		
Brush Length	12.0 ~ 12.5 mm (0.47 ~ 0.49 in.)	5.5 mm (0.22 in.)
Commutator Diameter	28 mm (1.1 in.)	27 mm (1.06 in.)
<b>Air Switching Valve</b>		
Resistance	20 ~ 24 Ω at 20°C (68°F)	---
<b>Switch and Sensor</b>		
Rear Brake Light Switch Timing	On after about 10 mm (0.39 in.) of pedal travel	---
Oil Pressure Switch Connections	When engine is stopped: ON  When engine is running: OFF	---
Engine Temperature Sensor Resistance	in the text	---

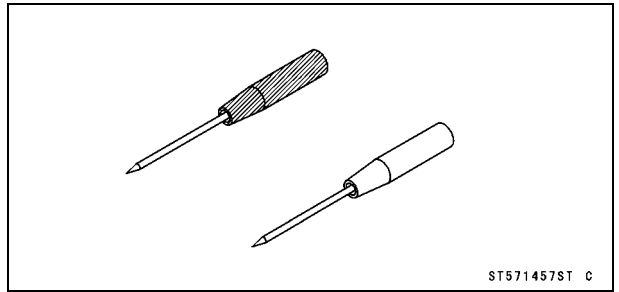
**Special Tools and Sealant**

**Rotor Puller Adapter,  $\phi 9.5$ :**  
**57001-1151**



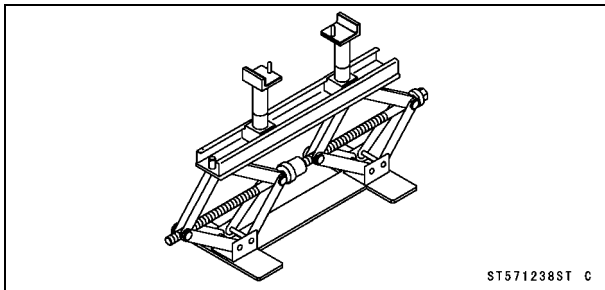
ST571151ST C

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



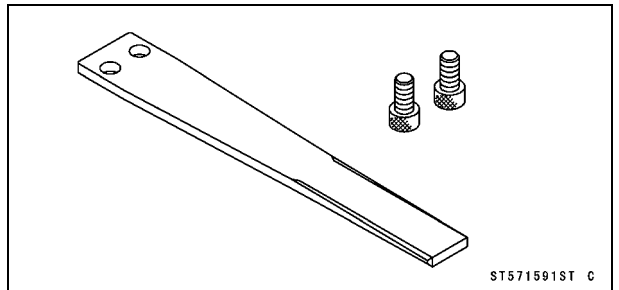
ST571457ST C

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



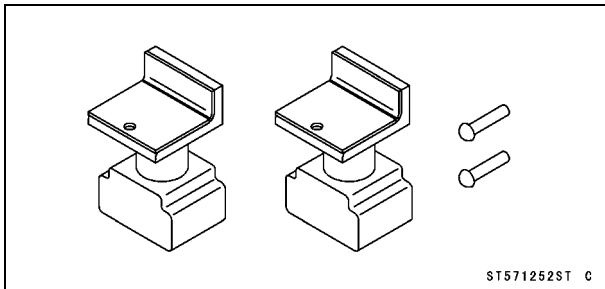
ST571238ST C

**Grip:**  
**57001-1591**



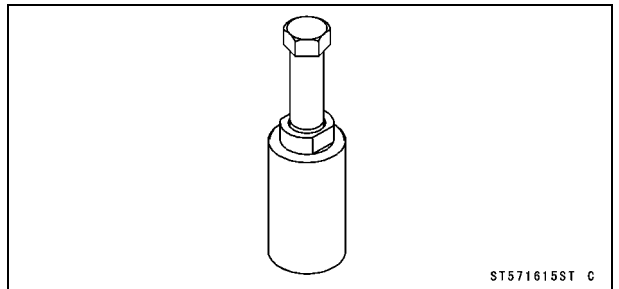
ST571591ST C

**Attachment Jack:**  
**57001-1252**



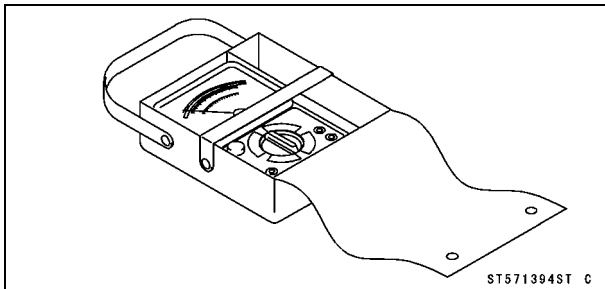
ST571252ST C

**Flywheel Puller Assembly, M38 x 1.5/M35 x 1.5:**  
**57001-1615**



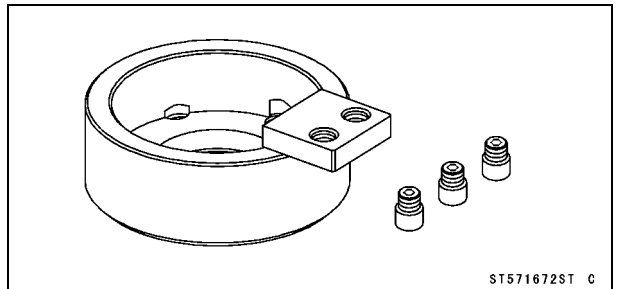
ST571615ST C

**Hand Tester:**  
**57001-1394**



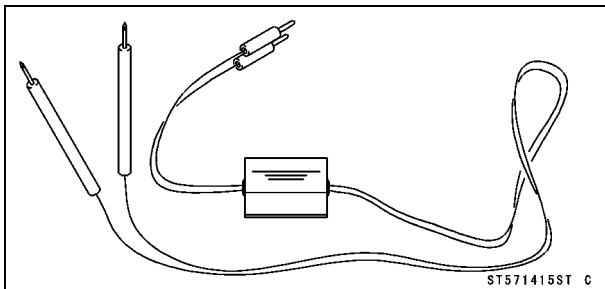
ST571394ST C

**Rotor Holder:**  
**57001-1672**



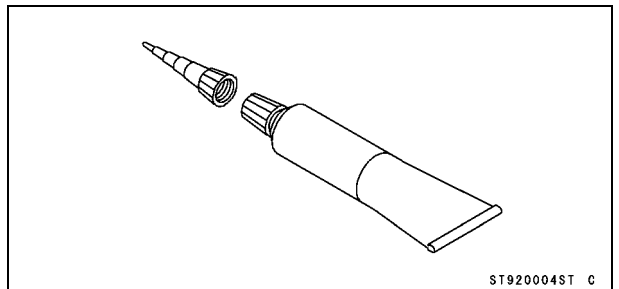
ST571672ST C

**Peak Voltage Adapter:**  
**57001-1415**



ST571415ST C

**Liquid Gasket, TB1211F:**  
**92104-0004**

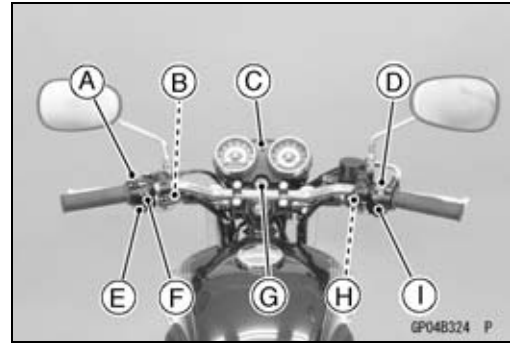


ST920004ST C

# 15-14 ELECTRICAL SYSTEM

## Parts Location

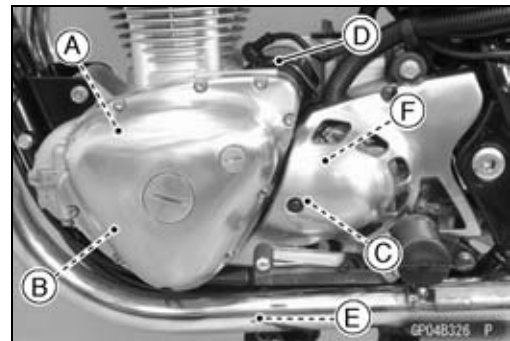
- Dimmer Switch [A]
- Starter Lockout Switch [B]
- Meter Unit [C]
- Engine Stop Switch [D]
- Horn Button [E]
- Turn Signal Switch [F]
- Ignition Switch [G]
- Front Brake Light Switch [H]
- Starter Button [I]



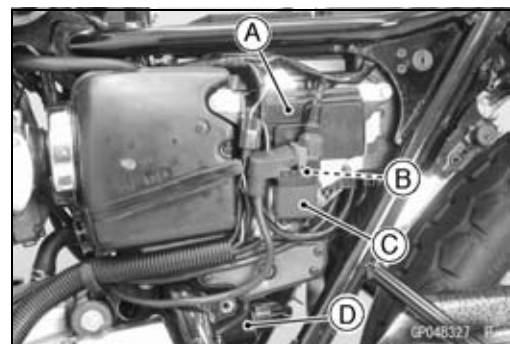
- Fuel Reserve Switch [A]



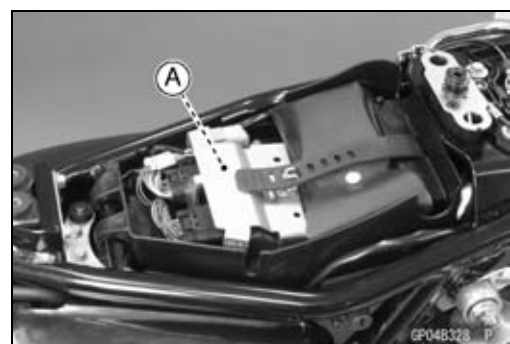
- Crankshaft Sensor [A]
- Alternator [B]
- Neutral Switch [C]
- Starter Motor [D]
- Sidestand Switch [E]
- Speed Sensor [F]



- Junction Box [A]
- Main Fuse 30 A [B]
- Starter Relay [C]
- Regulator/Rectifier [D]

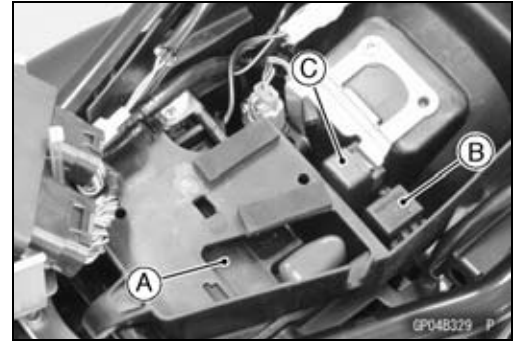


- ECU [A]

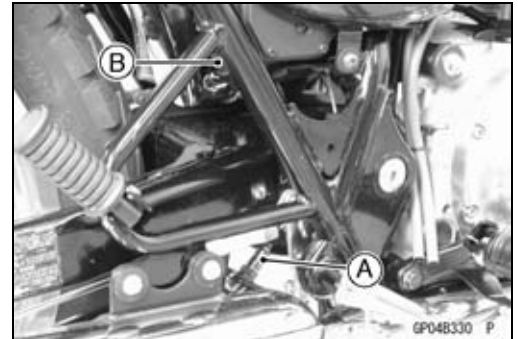


## Parts Location

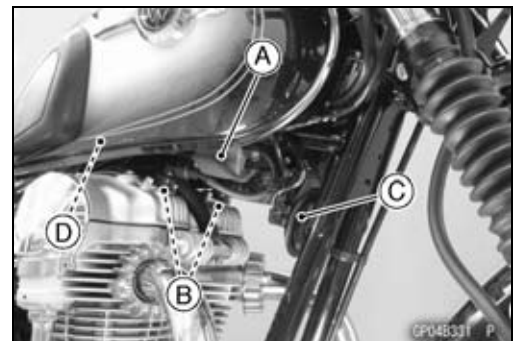
Battery 12 V 10 Ah [A]  
Turn Signal Relay [B]  
ECU Main Relay [C]



Oxygen Sensor [A]  
Rear Brake Light Switch [B]



Ignition Coil [A]  
Spark Plugs [B]  
Horn [C]  
Air Switching Valve [D]



## 15-16 ELECTRICAL SYSTEM

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### Precautions

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

- 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 cables 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 cables 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 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).

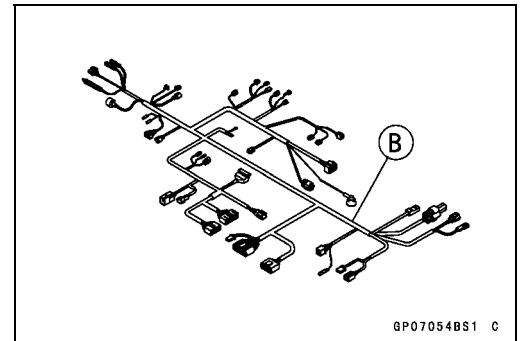
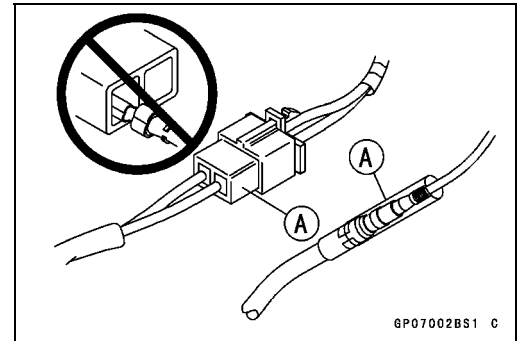
## Electrical Wiring

### 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 the wiring for continuity.
- Use the wiring diagram to find the ends of the lead which is suspected of being a problem.
- Connect the hand tester between the ends of the leads.

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

- Set the tester to the  $\times 1 \Omega$  range, and read the tester.
- ★ If the tester does not read  $0 \Omega$ , the lead is defective. Replace the lead or the wiring harness [B] if necessary.

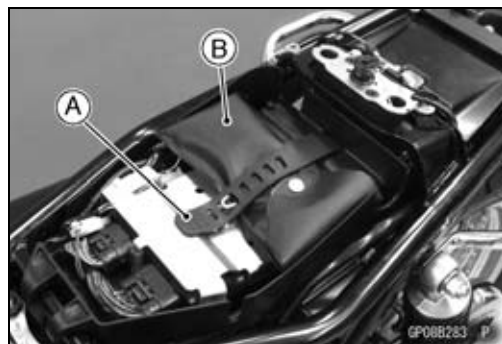


## 15-18 ELECTRICAL SYSTEM

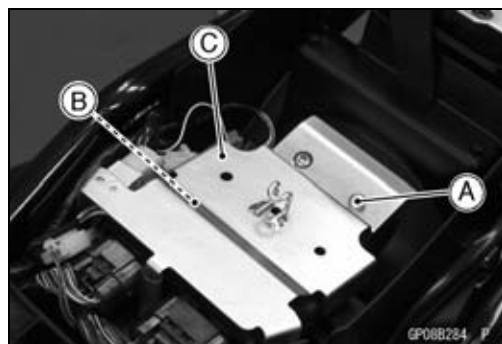
### Battery

#### Battery Removal

- Turn off the ignition switch.
- Remove:
  - Left Side Cover (see Left Side Cover Removal in the Frame chapter)
  - Band [A]
  - Tool Kit [B]



- Remove:
  - Screw [A]
- Remove the ECU [B] together with the bracket [C].
- Disconnect the ECU connector.

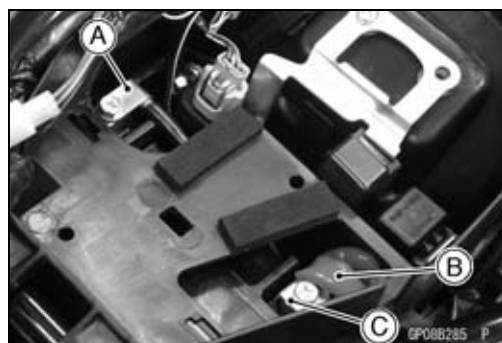


- Disconnect the negative (-) cable [A].

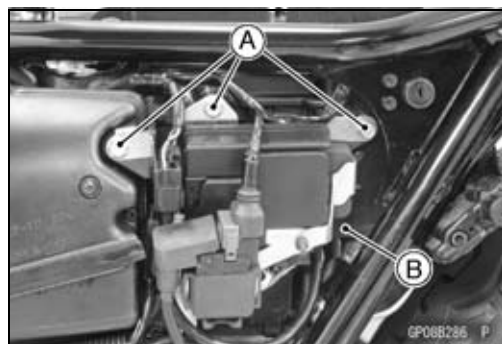
#### NOTICE

**Be sure to disconnect the negative (-) cable first.**

- Slide the red cap [B].
- Disconnect the positive (+) cable [C].

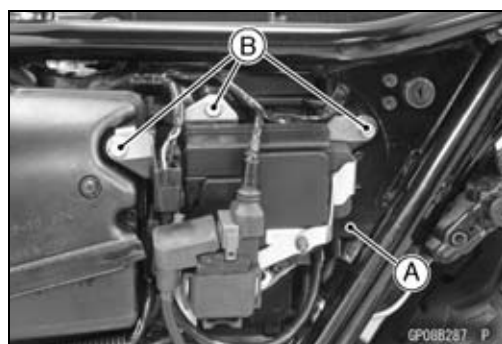


- Remove the bolts [A], and pull out the battery holder [B].
- Remove the battery.



#### Battery Installation

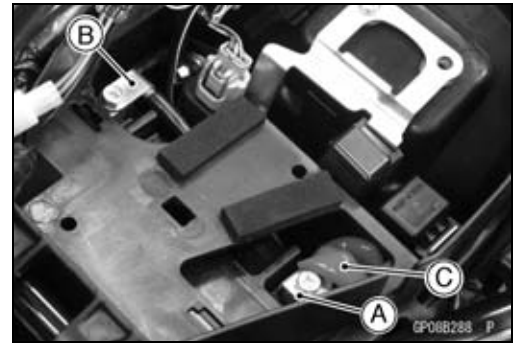
- Install the battery into the battery case.
- Install the battery holder [A], and tighten the bolts [B].



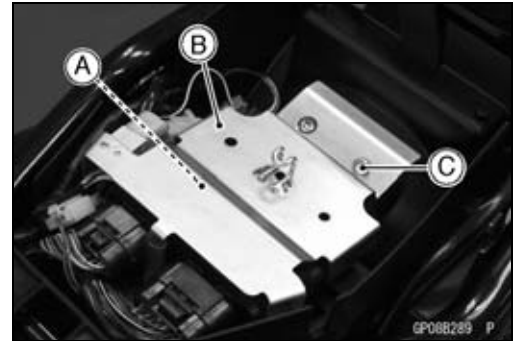


## Battery

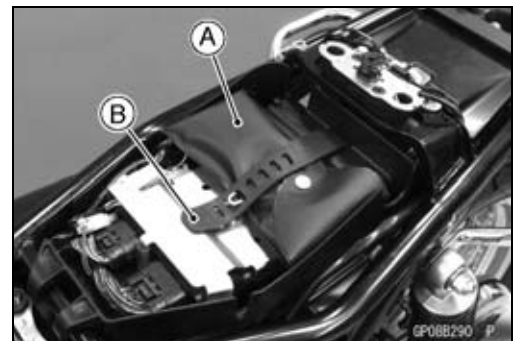
- Connect the positive (+) cable [A] (red cap) to the positive (+) terminal first, and then the negative (-) cable [B] to the negative (-) terminal.
- Apply a light coat of grease on the terminals to prevent corrosion.
- Cover the positive (+) terminal with the red cap [C].



- Install the ECU [A] together with the bracket [B], and tighten the screw [C].



- Put the tool kit [A], and hook the band [B].
- Install the removed parts (see appropriate chapters).



### Battery Activation

#### Electrolyte Filling

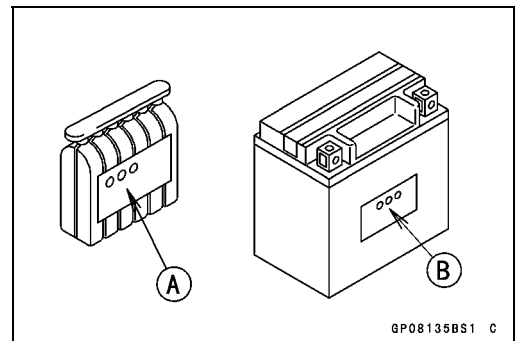
- Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

#### Battery Model Name

EJ800A: YTX12-BS

#### NOTICE

Each battery comes with its own specific electrolyte container; using the wrong container may overfill the battery with incorrect electrolyte, which can shorten battery life and deteriorate battery performance. 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.



# 15-20 ELECTRICAL SYSTEM

## Battery

### NOTICE

Do not remove the aluminum sealing sheet [A] from the filler ports [B] until just prior to use. Be sure to use the dedicated electrolyte container for correct electrolyte volume.

### ⚠ DANGER

Sulfuric acid in battery electrolyte can cause severe burns. To prevent burns, wear protective clothing and safety glasses when handling electrolyte. If the electrolyte comes in contact with your skin or eyes, wash the area with liberal amounts of water and seek medical attention for more severe burns.

- Place the battery on a level surface.
- Check to see that the sealing sheet has no peeling, tears, or holes in it.
- Remove the sealing sheet.

### NOTE

○The battery is vacuum sealed. If the sealing sheet has leaked air into the battery, it may require a longer initial charge.

- Remove the electrolyte container from the vinyl bag.
- Detach the strip of caps [A] from the container and set aside, these will be used later to seal the battery.

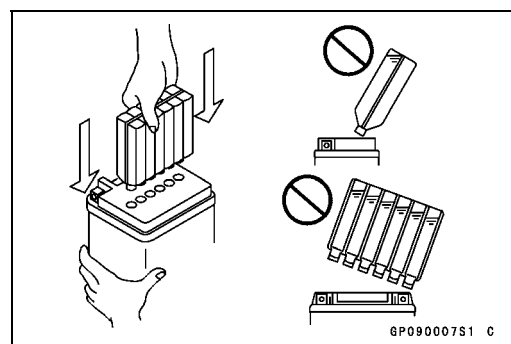
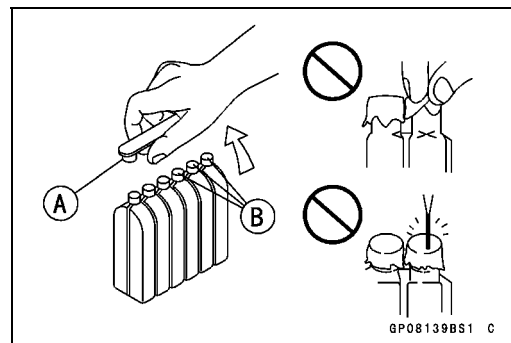
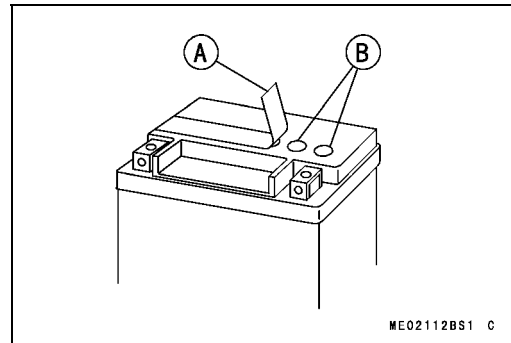
### NOTE

○Do not pierce or otherwise open the sealed cells [B] of the electrolyte container. Do not attempt to separate individual cells.

- Place the electrolyte container upside down with the six sealed cells into the filler ports of the battery. Hold the container level, push down to break the seals of all six cells. You will see air bubbles rising into each cell as the ports fill.

### NOTE

○Do not tilt the electrolyte container.



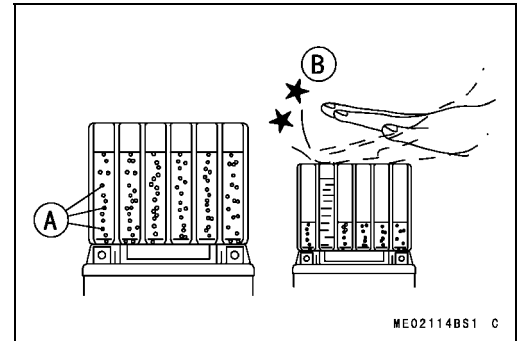
## Battery

- Check the electrolyte flow.
- ★ If no air bubbles [A] are coming up from the filler ports, or if the container cells have not emptied completely, tap the container [B] a few times.

### NOTE

○ Be careful not to have the battery fall down.

- Keep the container in place. Don't remove the container from the battery, the battery requires all the electrolyte from the container for proper operation.



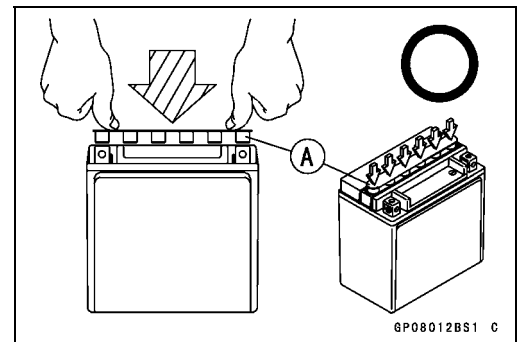
### NOTICE

**Removal of the container before it is completely empty can shorten the service life of the battery. Do not remove the container until it is completely empty.**

- After filling, let the battery sit for 20 ~ 60 minutes with the electrolyte container kept in place, which is required for the electrolyte to fully permeate into the plates.
- Make sure that the container cells have emptied completely, and remove the container from the battery.
- Place the strip of caps [A] loosely over the filler ports, press down firmly with both hands to seat the strip of caps into the battery (don't pound or hammer). When properly installed, the strip of caps will be level with the top of the battery.

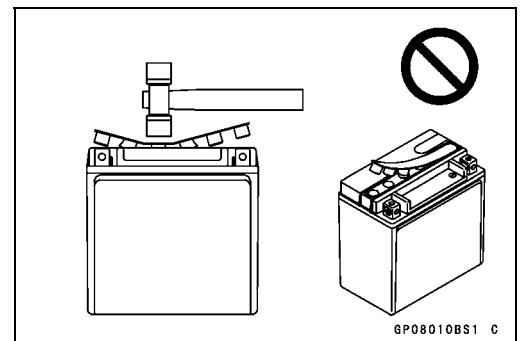
### NOTICE

**Once the strip of caps is installed onto the battery, never remove the caps, nor add water or electrolyte to the battery.**



### NOTE

○ Charging the battery immediately after filling can shorten service life.



## 15-22 ELECTRICAL SYSTEM

### Battery

#### Initial Charge

- Newly activated sealed batteries require an initial charge.

**Standard Charge: 1.2 A × 5 ~ 10 hours**

- ★ If using a recommended battery charger, follow the charger's instructions for newly activated sealed battery.

#### Kawasaki-recommended chargers:

**Battery Mate 150-9**

**OptiMate PRO 4-S/PRO S/PRO2**

**Yuasa MB-2040/2060**

**Christie C10122S**

- ★ If the above chargers are not available, use equivalent one.
- Let battery sit 30 minutes after initial charge, then check voltage using a voltmeter. (Voltage immediately after charging becomes temporarily high. For accurate measuring, let the battery sit for given time.)

#### NOTE

- *Charging rates will vary depending on how long the battery has been stored, temperature, and the type of charger used. If voltage is not at least 12.8 V, repeat charging cycle.*
- *To ensure maximum battery life and customer satisfaction, it is recommended the battery be load tested at three times its amp-hour rating for 15 seconds. Re-check voltage and if less than 12.8 V repeat the charging cycle and load test. If still below 12.8 V the battery is defective.*

#### 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 lights are dim, it indicates the battery has been discharged. Give refresh charge for 5 to 10 hours with charging current shown in the specification (see Refreshing Charge).

When a fast charge is inevitably required, do it following precisely the maximum charge current and time conditions indicated on the battery.

#### NOTICE

**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).

## Battery

### **⚠ DANGER**

Batteries produce an explosive gas mixture of hydrogen and oxygen that can cause serious injury and burns if ignited. Keep the battery away from sparks and open flames during charging. 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. 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 and seek medical attention for more severe burns.

### Interchange

A sealed battery can fully display its performance only when combined with a proper vehicle electric system. Therefore, replace a sealed battery only on a motorcycle which was originally equipped with a sealed battery.

Be careful, if a 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 battery (see Battery Removal).
- Measure the battery terminal voltage.

#### NOTE

- Measure with a digital voltmeter which can be read one decimal place voltage.

- ★ If the reading is 12.8 V or more, no refresh charge is required, however, if the read is below the specified, refresh charge is required.

#### Battery Terminal Voltage

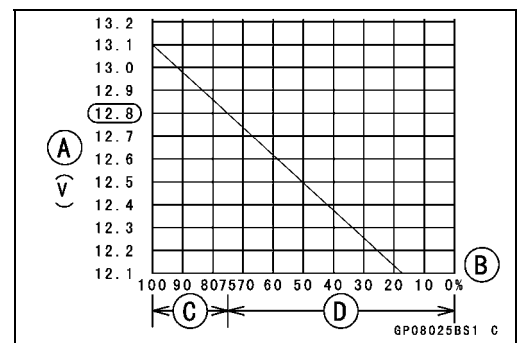
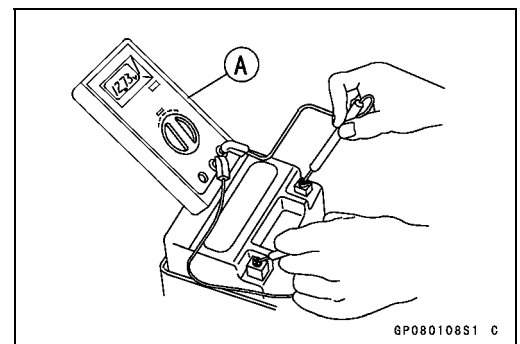
Standard: 12.8 V or more

Terminal Voltage (V) [A]

Battery Charge Rate (%) [B]

Good [C]

Refresh charge is required [D]

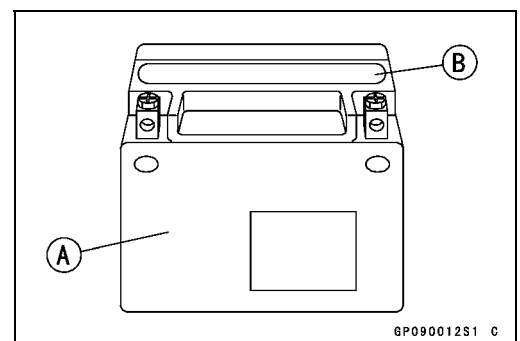


### Refreshing Charge

- Remove the battery [A] (see Battery Removal).
- Do refresh charge by following method according to the battery terminal voltage.

### **⚠ WARNING**

This battery is sealed type. Never remove sealing cap [B] even at charging. Never add water. Charge with current and time as stated below.



# 15-24 ELECTRICAL SYSTEM

## Battery

Terminal Voltage: 11.5 ~ less than 12.8 V  
 Standard Charge 1.2 A × 5 ~ 10 h (see following chart)  
 Quick Charge 5 A × 1 h

### NOTICE

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: 1.2 A × 20 h

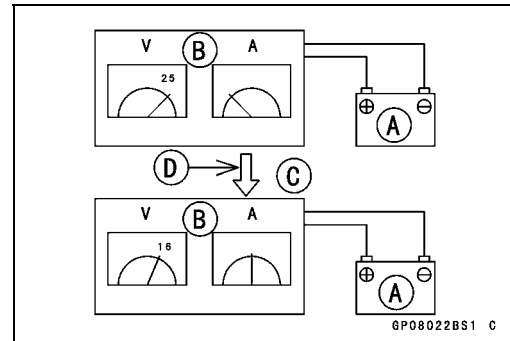
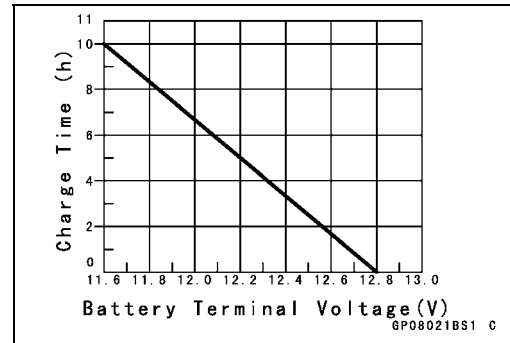
### NOTE

○ 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.

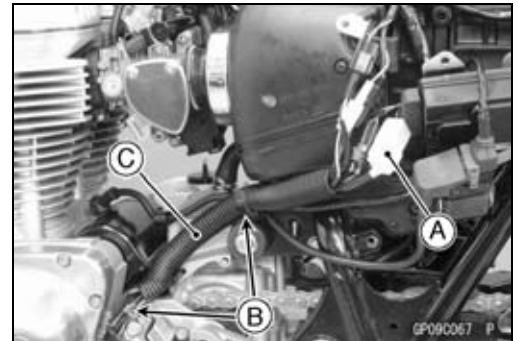
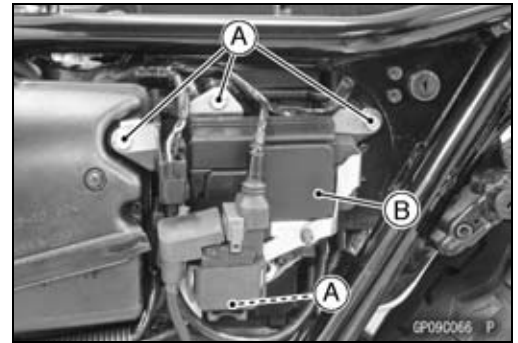
Criteria	Judgement
12.8 V or higher	Good
12.0 ~ lower than 12.8 V	Charge insufficient → Recharge
lower than 12.0 V	Unserviceable → Replace



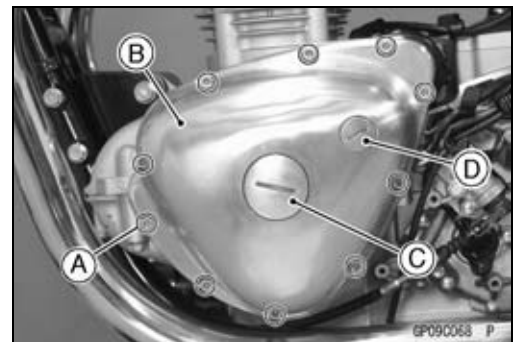
## Charging System

### Alternator Cover Removal

- Remove:
  - Engine Oil (Drain, see Engine Oil Change in the Periodic Maintenance chapter)
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal in the Final Drive chapter)
  - Left Side Cover (see Left Side Cover Removal in the Frame chapter)
- Remove the bolts [A] and pull out the bracket together with the junction box [B].
- Disconnect the junction box connectors.
- Disconnect the alternator lead connector [A].
- Open the clamps [B].
- Clear the alternator lead from the lead protective tube [C].

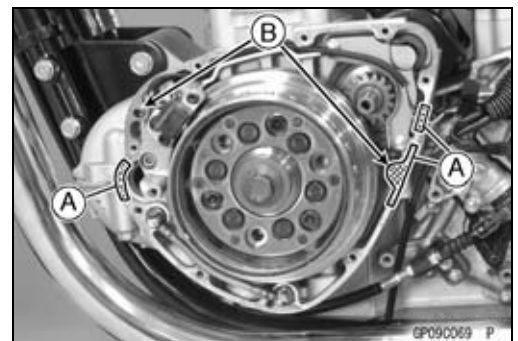


- Remove:
  - Alternator Cover Bolts [A]
  - Alternator Cover [B]
- Remove the rotor plug [C] and timing plug [D], and remove the alternator cover by placing your finger in the plug holes.



### Alternator Cover Installation

- Using a high-flash point solvent, clean off any oil or dirt that may be on the silicone sealant coating area. Dry them with a clean cloth.
- Apply silicone sealant to the alternator lead grommet and crankcase halves mating surface [A].
  - Sealant - Liquid Gasket, TB1211F: 92104-0004**
- Check that dowel pins [B] are in place on the crankcase.



## 15-26 ELECTRICAL SYSTEM

### Charging System

- Replace the alternator cover gasket with a new one.
- When removing the rotor plug and timing plug, replace the their O-rings with new ones.
- Install the alternator cove [A].
- Apply non-permanent locking agent to the threads of alternator cover bolts (L = 35 mm) [B].
- Tighten:

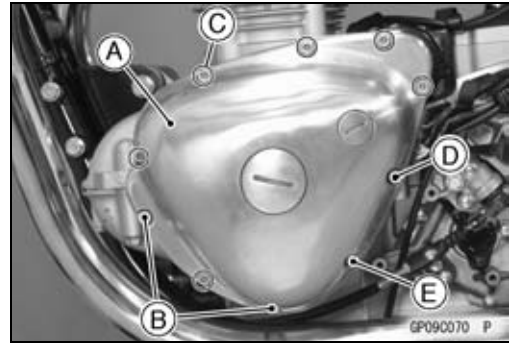
**Torque - Alternator Cover Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**

L = 35 mm (1.38 in.) [C]

L = 40 mm (1.57 in.) [D]

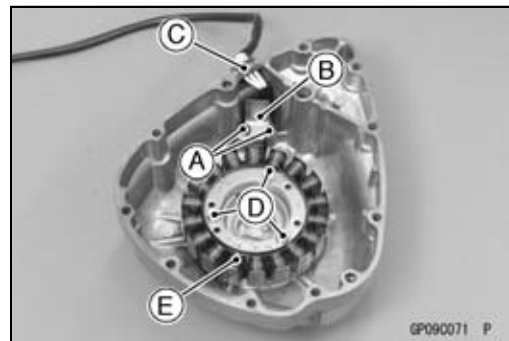
L = 45 mm (1.77 in.) [E]

- Run the alternator lead correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Install the removed parts (see appropriate chapters).



### Stator Coil Removal

- Remove:
  - Alternator Cover (see Alternator Cover Removal)
  - Holding Plate Bolts [A] and Plate [B]
  - Alternator Lead Grommet [C]
  - Stator Coil Bolts [D]
- Remove the stator coil [E] from the alternator cover.



### Stator Coil Installation

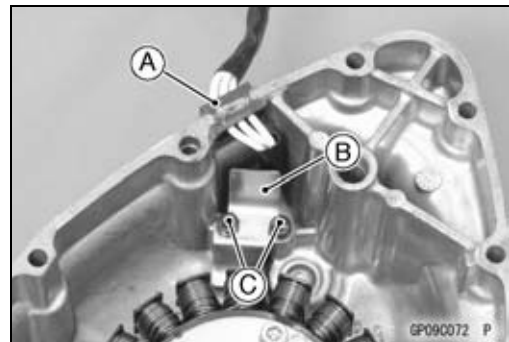
- Apply non-permanent locking agent to the threads of the stator coil bolts and tighten them.
- Torque - Stator Coil Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**
- Using a high-flash point solvent, clean off any oil or dirt that may be on the silicone sealant coating area. Dry them with a clean cloth.
- Apply silicone sealant to the circumference of the alternator lead grommet [A], and fit the grommet into the notch of the cover securely.

**Sealant - Liquid Gasket, TB1211F: 92104-0004**

- Secure the alternator lead with a holding plate [B], and apply a non-permanent locking agent to the threads of the plate bolts [C] and tighten them.

**Torque - Alternator Lead Holding Plate Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

- Install the alternator cover (see Alternator Cover Installation).

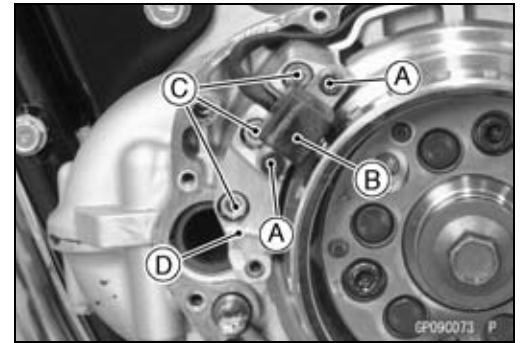




## Charging System

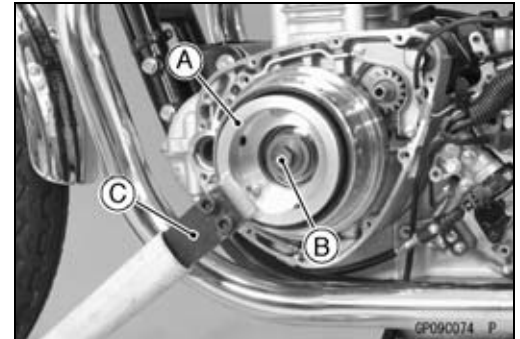
### Alternator Rotor Removal

- Remove:
  - Alternator Cover (see Alternator Cover Removal)
  - Crankshaft Sensor Bolts [A]
  - Crankshaft Sensor [B]
  - Crankshaft Sensor Bracket Bolts [C]
  - Crankshaft Sensor Bracket [D]



- Hold the alternator rotor steady with the rotor holder [A].
- Remove the rotor bolt [B] and washer.

**Special Tools - Grip [C]: 57001-1591**  
**Rotor Holder: 57001-1672**



- Insert the rotor puller adapter [A] into the crankshaft hole.

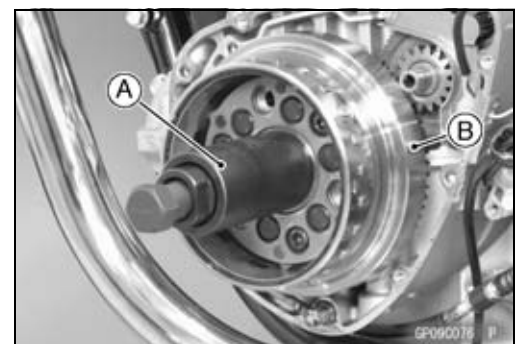
**Special Tool - Rotor Puller Adapter,  $\phi 9.5$ : 57001-1151**



- Using the flywheel puller [A], remove the alternator rotor [B] from the crankshaft.

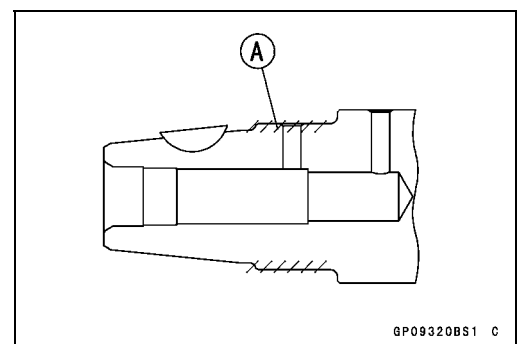
**Special Tool - Flywheel Puller Assembly, M38 x 1.5/M35 x 1.5: 57001-1615**

- Remove:
  - Woodruff Key
  - Spacer
  - Starter Clutch Gear



### Alternator Rotor Installation

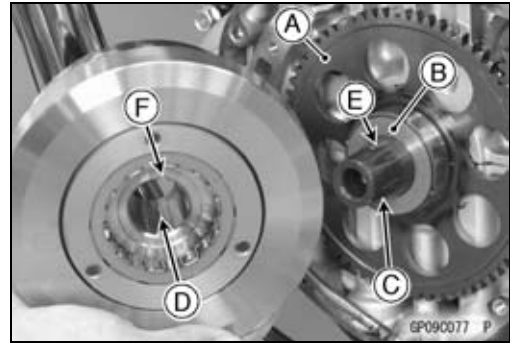
- Apply a thin coat of molybdenum disulfide grease to the crankshaft journal [A] of the starter clutch gear.



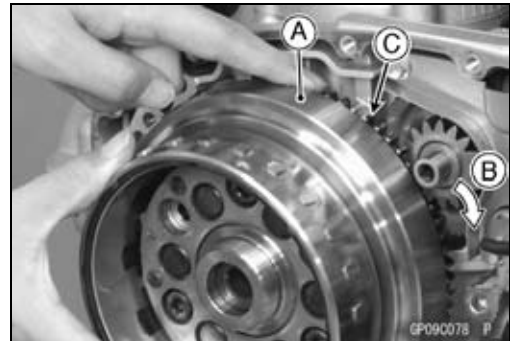
## 15-28 ELECTRICAL SYSTEM

### Charging System

- Install the starter clutch gear [A] and spacer [B].
- Using a cleaning fluid, clean off any oil or dirt on the following portions and dry them with a clean cloth.
  - Crankshaft Tapered Portion [C]
  - Alternator Rotor Tapered Portion [D]
- Fit the woodruff key [E] securely in the slot in the crankshaft.
- Align the groove [F] of the alternator rotor with the woodruff key of the crankshaft.



- Remove the starter motor (see Starter Motor Removal).
- Install the alternator rotor [A] while turning [B] the starter clutch gear [C] clockwise.

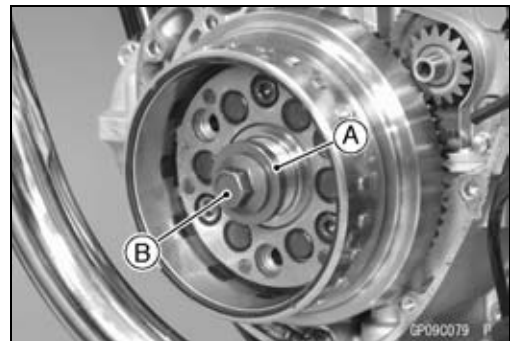


- Using a cleaning fluid, clean off any oil or dirt on the washer [A] and dry it with a clean cloth.
- Install the washer.

#### NOTE

○ Confirm the alternator rotor fit or not to the crankshaft before tightening it with specified torque.

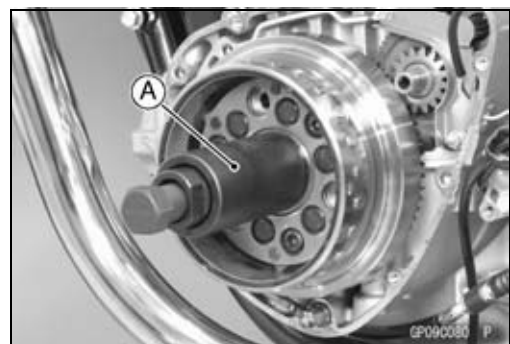
- Install the rotor bolt [B] and tighten it with 70 N·m (7.0 kgf·m, 52 ft·lb) of torque.



- Remove the rotor bolt and washer.
- Check the tightening torque with flywheel puller [A].

**Special Tool - Flywheel Puller Assembly, M38 × 1.5/M35 × 1.5: 57001-1615**

- ★ If the rotor is not pulled out with 20 N·m (2.0 kgf·m, 15 ft·lb) of drawing torque, it is installed correctly.
- ★ If the rotor is pulled out with under 20 N·m (2.0 kgf·m, 15 ft·lb) of drawing torque, clean off any oil dirt or flaw of the crankshaft and rotor tapered portion, and dry them with a clean cloth. Then, confirm that it is not pulled out with above torque.

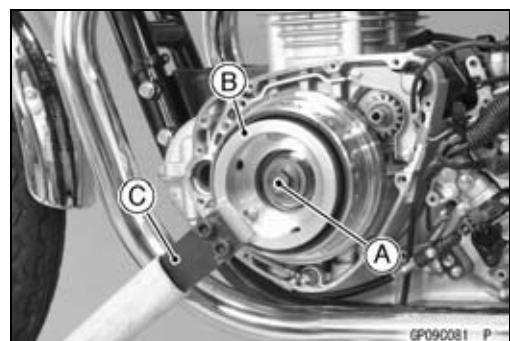


- Apply molybdenum disulfide oil solution to the treads of the alternator rotor bolt and seating surface of the bolt head.
- Install the washer and rotor bolt.
- Tighten the alternator rotor bolt [A] while holding the alternator rotor steadily with the holder [B].

**Special Tools - Grip [C]: 57001-1591**

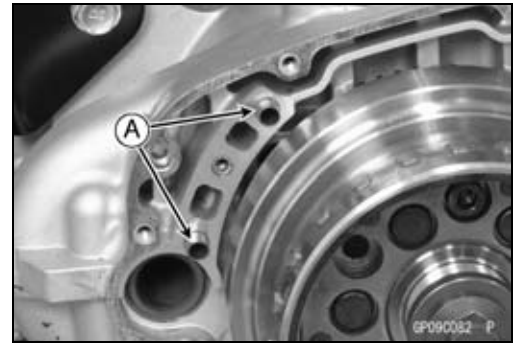
**Rotor Holder: 57001-1672**

**Torque - Alternator Rotor Bolt: 155 N·m (15.8 kgf·m, 114 ft·lb)**



## Charging System

- Install the dowel pins [A].



- Install the crankshaft sensor bracket [A].
- Apply non-permanent locking agent to the threads of the crankshaft sensor bracket bolts and tighten them.

**Torque - Crankshaft Sensor Bracket Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)**

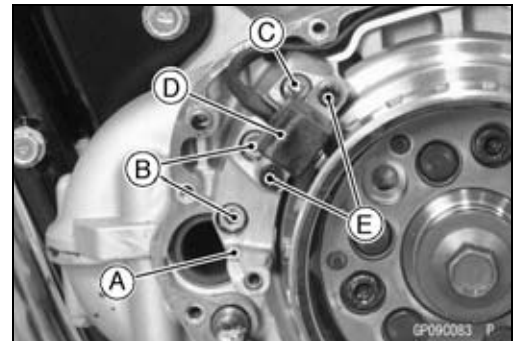
L = 40 mm (1.57 in.) [B]

L = 45 mm (1.77 in.) [C]

- Install the crankshaft sensor [D].
- Apply non-permanent locking agent to the threads of the crankshaft sensor bolts [E] and tighten them.

**Torque - Crankshaft Sensor Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

- Install the removed parts (see appropriate chapters).



### Alternator Inspection

There are three types of alternator failures: short, open (wire burned out), or loss in rotor magnetism. A short or open in one of the coil wires will result in either a low output, or no output at all. A loss in rotor magnetism, which may be caused by dropping or hitting the alternator, by leaving it near an electromagnetic field, or just by aging, will result in low output.

- To check the alternator output voltage, do the following procedures.
  - Turn the ignition switch to OFF.
  - Remove the junction box (see Alternator Cover Removal).
  - Disconnect the alternator lead connector [A].
  - Connect the hand tester as shown in the table 1.

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

- Start the engine.
- Run it at the rpm given in the table 1.
- Note the voltage readings (total 3 measurements).



**Table 1 Alternator Output Voltage**

Tester Range	Connections		Reading at 4 000 rpm
	Tester (+) to	Tester (-) to	
AC 250 V	One W lead	Another W lead	63.2 ~ 94.8 V

## 15-30 ELECTRICAL SYSTEM

### Charging System

- ★ If the output voltage shows the value in the table, the alternator operates properly.
- ★ If the output voltage shows a much higher than the value in the table, the regulator/rectifier is damaged. A much lower reading than that given in the table indicates that the alternator is defective.
- Check the stator coil resistance as follows.
- Stop the engine.
- Connect the hand tester as shown in the table 2.

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

- Note the readings (total 3 measurement).

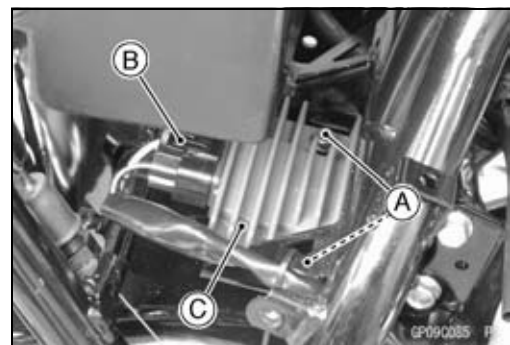
**Table 2 Stator Coil Resistance at 20°C (68°F)**

Tester Range	Connections		Reading
	Tester (+) to	Tester (-) to	
× 1 Ω	One W lead	Another W lead	0.4 ~ 0.6 Ω

- ★ If there is more resistance than shown in the table, or no tester reading (infinity) for any two leads, the stator has an open lead 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 white leads and chassis ground.
- ★ Any hand tester reading less than infinity ( $\infty$ ) 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.

#### Regulator/Rectifier Inspection

- Remove the air cleaner housing (see Air Cleaner Housing Removal in the Fuel System (DFI) chapter).
- Remove:
  - Bolts [A]
  - Regulator/Rectifier Lead Connector [B] (Disconnect)
  - Regulator/Rectifier [C]



## Charging System

### Rectifier Circuit Check

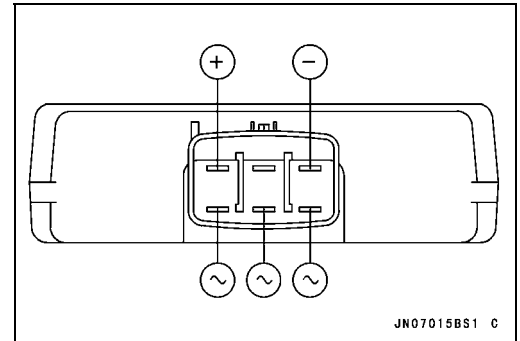
- With the hand tester set to the  $R \times 1 \text{ k}\Omega$  range, test the rectifier according to the following table.

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

- Connect the hand tester to the regulator/rectifier.
- ★ If the tester readings are not as specified, replace the regulator/rectifier.

### NOTICE

**Use only Kawasaki Hand Tester 57001-1394 for this test. A tester other than the Kawasaki Hand Tester may show different readings. If a megger or a meter with a large capacity battery is used, the regulator/rectifier will be damaged.**



### Rectifier Circuit Inspection

(Unit:  $\text{k}\Omega$ )

		Tester (+) Lead Connection				
Terminal		+	~	~	~	-
(-)*	+	-	500 ~ $\infty$	500 ~ $\infty$	500 ~ $\infty$	500 ~ $\infty$
	~	2 ~ 20	-	500 ~ $\infty$	500 ~ $\infty$	500 ~ $\infty$
	~	2 ~ 20	500 ~ $\infty$	-	500 ~ $\infty$	500 ~ $\infty$
	~	2 ~ 20	500 ~ $\infty$	500 ~ $\infty$	-	500 ~ $\infty$
	-	2 ~ 40	2 ~ 20	2 ~ 20	2 ~ 20	-

(-)\*: Tester (-) lead Connection

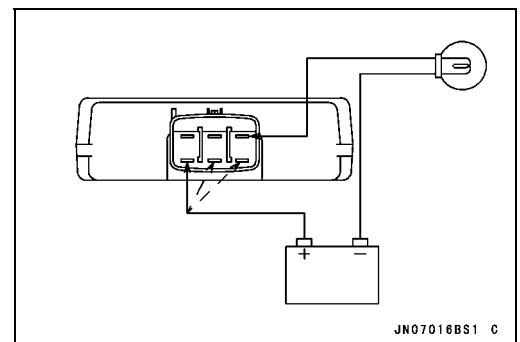
### Regulator Circuit Check

To test the regulator out of circuit, use three 12 V batteries and a test light (12 V 3 ~ 6 W bulb in a socket with leads).

### NOTICE

**The test light works as an indicator and also a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.**

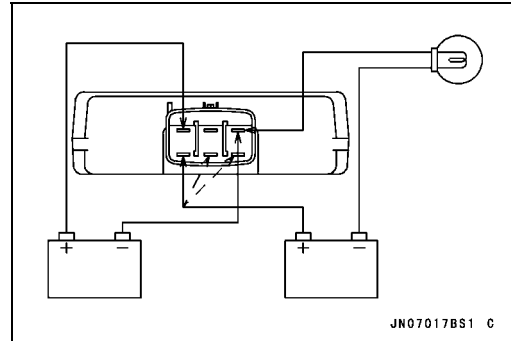
- Check to be sure the rectifier circuit is normal before continuing.
- Do the 1st step regulator circuit test.
  - Connect the test light and the 12 V battery to the regulator/rectifier as shown in the figure.
  - Check infinity (~) terminals respectively.
  - ★ If the test light turns on, the regulator/rectifier is defective. Replace it.
  - ★ If the test light does not turn on, continue the test.



## 15-32 ELECTRICAL SYSTEM

### Charging System

- 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 positive (+) terminal.
- Check infinity (~) 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.

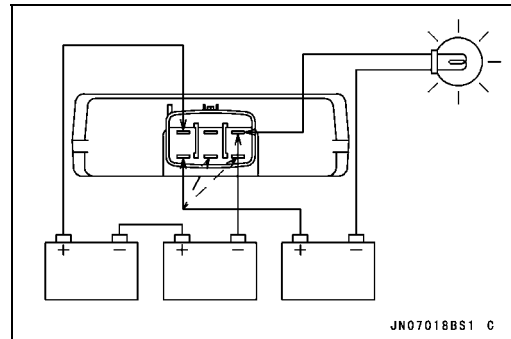


- Do the 3rd step regulator circuit test.
- Connect the test light and the 12 V battery in the same manner as specified in the “1st step regulator circuit test”.
- Momentarily apply 24 V to the positive (+) terminal by adding a 12 V battery.
- Check infinity (~) terminals respectively.

#### NOTICE

**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 the 24 V was applied momentarily to the positive (+) terminal, the regulator/rectifier is defective. Replace it.
- ★ If the regulator/rectifier passes all of the tests described, it may still be defective. If the charging system still does not work properly after checking all the components and the battery, test the regulator/rectifier by replacing it with a known good unit.



## Charging System

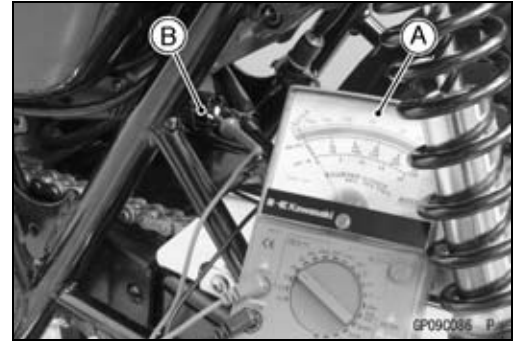
### Charging Voltage Inspection

- Check the battery condition (see Charging Condition Inspection).
- Warm up the engine to obtain actual alternator operating conditions.
- Remove the rear fender (see Flap and Rear Fender Removal in the Frame chapter).
- Check that the ignition switch is turned off, and connect the hand tester [A] to the regulator/rectifier lead connector [B] with the needle adapter set.

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

**Needle Adapter Set: 57001-1457**

- 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.). 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.



### Charging Voltage

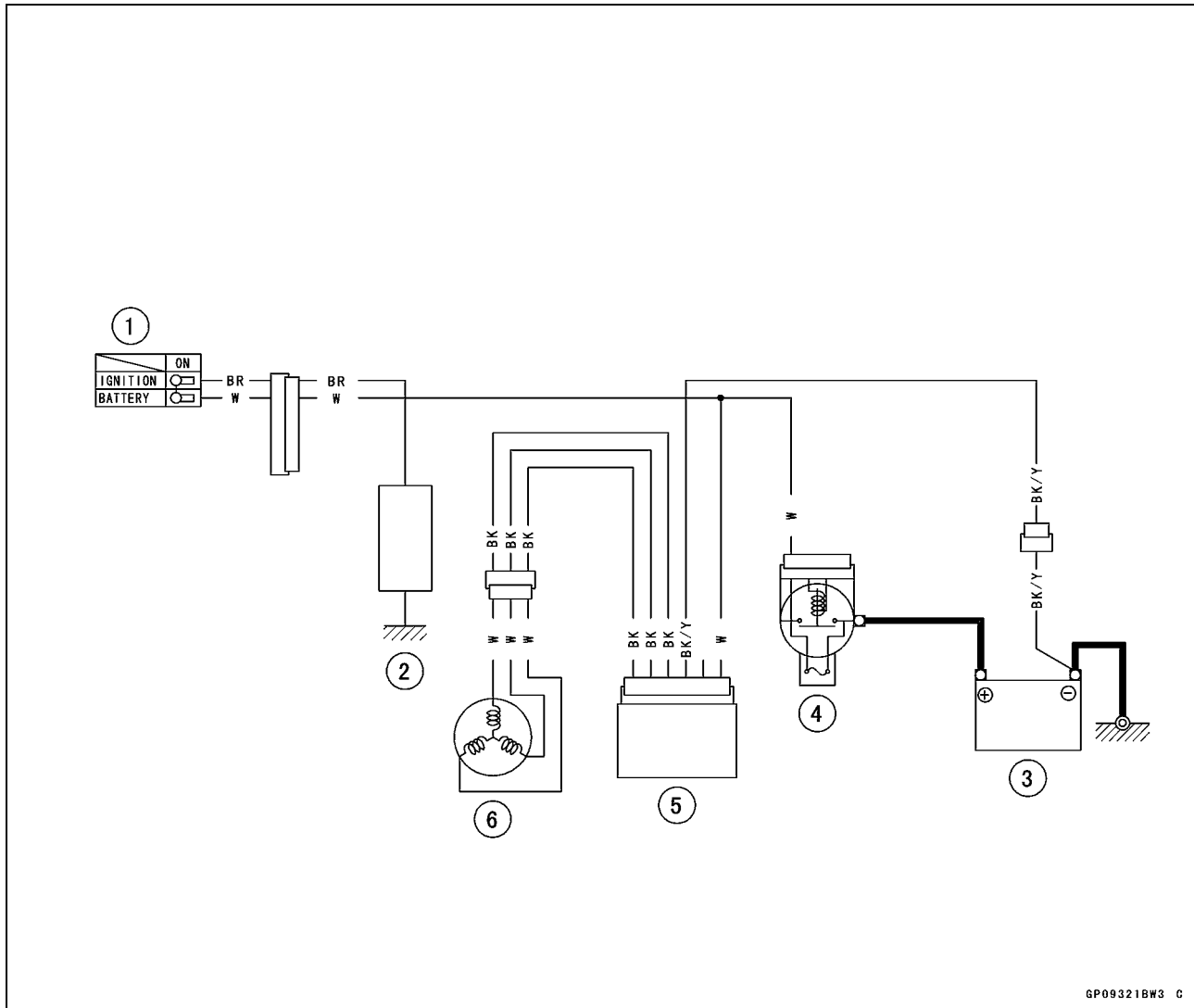
Tester Range	Connections		Reading
	Tester (+) to	Tester (-) to	
DC 25 V	W lead	BK/Y lead	14 ~ 15 V

- Turn off the ignition switch to stop the engine, and disconnect the hand tester with needle adapter set.
- ★ If the charging voltage is kept between the values given in the table, the charging system is considered to be working normally.
- ★ If the charging 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 charging 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.

# 15-34 ELECTRICAL SYSTEM

## Charging System

### Charging System Circuit



GP09321BW3 C

1. Ignition Switch
2. Load
3. Battery 12 V 10 Ah
4. Main Fuse 30 A
5. Regulator/Rectifier
6. Alternator



## Ignition System

### **⚠ WARNING**

The ignition system produces extremely high voltage. Do not touch the spark plug, ignition coil or high tension lead while the engine is running, or you could receive a severe electrical shock.

### **NOTICE**

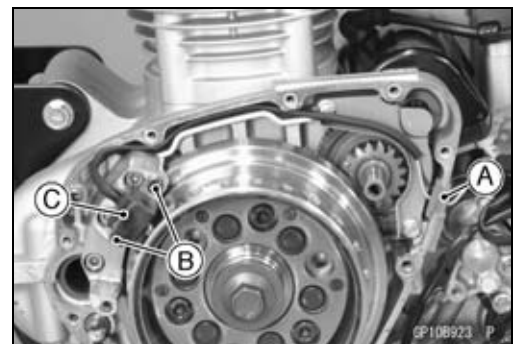
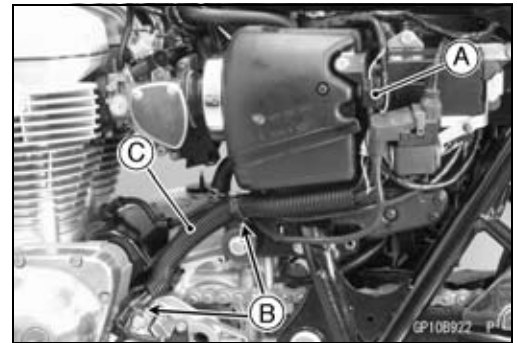
Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent igniter damage.

Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the diodes and igniter.

Use the standard regulator/rectifier, or the igniter will be damaged.

### **Crankshaft Sensor Removal**

- Remove:
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal in the Final Drive chapter)
  - Left Side Cover (see Left Side Cover Removal in the Frame chapter)
- Remove the crankshaft sensor lead connector from the bracket.
- Disconnect the crankshaft sensor lead connector [A].
- Open the clamps [B].
- Clear the crankshaft sensor lead from the lead protective tube [C].
- Remove:
  - Alternator Cover (see Alternator Cover Removal)
  - Crankshaft Sensor Lead Grommet [A]
  - Crankshaft Sensor Bolts [B]
  - Crankshaft Sensor [C]



## 15-36 ELECTRICAL SYSTEM

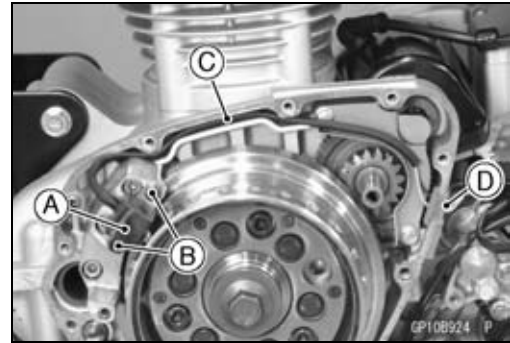
### Ignition System

#### **Crankshaft Sensor Installation**

- Install the crankshaft sensor [A].
- Apply non-permanent locking agent to the threads of the crankshaft sensor bolts [B] and tighten them.

**Torque - Crankshaft Sensor Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

- Install the crankshaft sensor lead [C] along the crankcase groove as shown in the figure.
- Using a high-flash point solvent, clean off any oil or dirt that may be on the silicone sealant coating area. Dry them with a clean cloth.
- Apply silicone sealant to the circumference of the crankshaft sensor lead grommet [D], and fit the grommet into the notch of the crankcase securely.
- Install the alternator cover (see Alternator Cover Installation).
- Run the crankshaft sensor lead correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Install the removed parts (see appropriate chapters).



#### **Crankshaft Sensor Inspection**

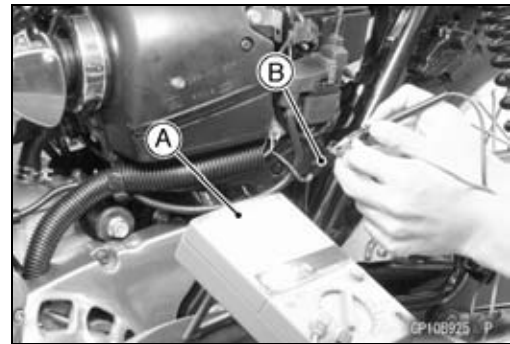
- Disconnect the crankshaft sensor lead connector (see Crankshaft Sensor Removal).
- Set the hand tester [A] to the  $\times 10 \Omega$  range and connect it to the crankshaft sensor lead connector [B].

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

#### **Crankshaft Sensor Resistance**

**Standard: 376 ~ 564  $\Omega$**

- ★ If there is more resistance than the specified value, the coil has an open lead and must be replaced. Much less than this resistance means the coil is shorted, and must be replaced.
- 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.



## Ignition System

### Crankshaft Sensor Peak Voltage Inspection

#### NOTE

- Be sure the battery is fully charged.
- Using the peak voltage adapter [A] is more reliable way to determine the condition of the crankshaft sensor than crankshaft sensor internal resistance measurements.

- Disconnect the crankshaft sensor lead connector (see Crankshaft Sensor Removal).
- Set the hand tester [B] to the DC 10 V range, and connect it peak voltage adapter.

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

**Peak Voltage Adapter: 57001-1415**

**Type: KEK-54-9-B**

- Connect the adapter to the terminals of the crankshaft sensor lead connector [C].

#### Connections:

Crankshaft Sensor Lead Connector		Peak Voltage Adapter		Hand Tester
BK lead	←	R lead	→	(+)
Y lead	←	BK lead	→	(-)

- Push the engine stop switch to run position.
- Turn the ignition switch to ON.
- Pushing the starter button, turn the engine 4 ~ 5 seconds with the transmission in neutral to measure the peak voltage.
- Repeat the measurements 5 times or more times.

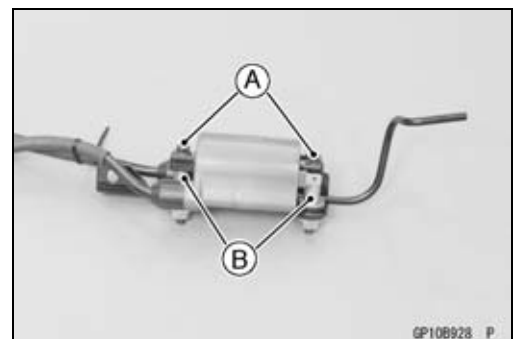
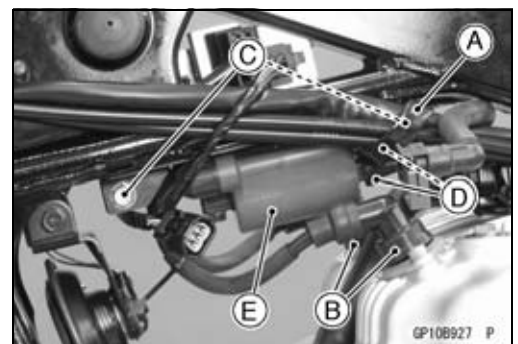
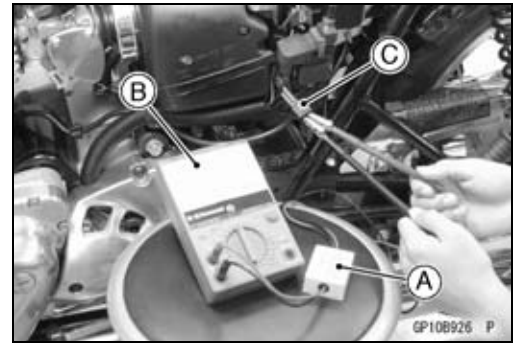
#### Crankshaft Sensor Peak Voltage

**Standard: 5 V or more**

- ★ If the reading is less than the standard, inspect the crankshaft sensor (see Crankshaft Sensor Inspection).

### Ignition Coil Removal

- Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter).
- Open the clamp [A].
- Remove:
  - Spark Plug Caps [B]
  - Bolts [C]
  - Connectors [D]
  - Ignition Coil [E] with Bracket
- Remove:
  - Bolts [A] and Nuts
  - Collars [B]

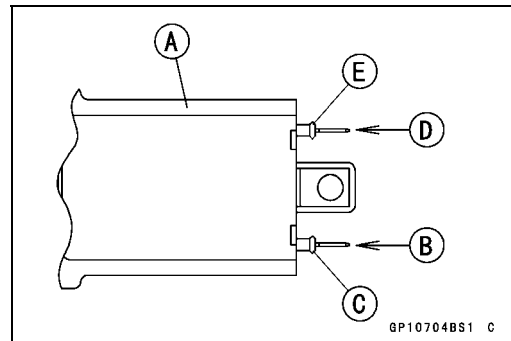


## 15-38 ELECTRICAL SYSTEM

### Ignition System

#### Ignition Coil Installation

- Installation is basically the reverse of removal and refer to the Cable, Wire and Hose Routing in the Appendix chapter.
- Connect the primary leads to the ignition coil [A].
  - BK Lead [B] to Green Terminal Cover [C]
  - R Lead [D] to Black Terminal Cover [E]
- Install the ignition coil together with the bracket, and tighten the bolts.
- Install the spark plug caps securely.
- Be sure the spark plug caps is installed by pulling up it lightly.



#### Ignition Coil Inspection

- Remove the ignition coils (see Ignition Coil Removal).
- 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**

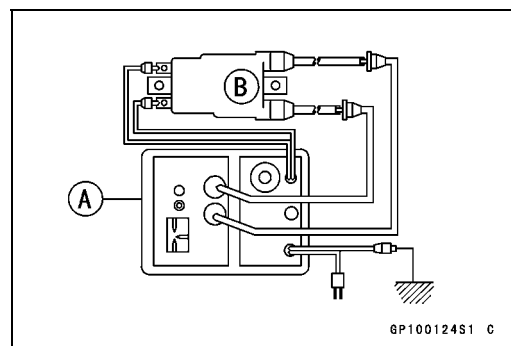
**To avoid extremely high voltage shocks, do not touch the coil body or leads.**

- ★ 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 counter-clockwise.
- ★ 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.



## Ignition System

- Measure the primary winding resistance [A] 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 [B] as follows.
  - Remove the plug caps by turning them counterclockwise.
  - Connect the tester between the high-tension cables.
  - Set the tester to the  $\times 1 \text{ k}\Omega$  range and read the tester.

### Ignition Coil Winding Resistance

<b>Primary Windings:</b>	<b>1.6 ~ 2.4 <math>\Omega</math></b>
<b>Secondary Windings:</b>	<b>12.8 ~ 19.2 <math>\text{k}\Omega</math></b>

- ★ If the tester does not read as specified, replace the coil [C].
- ★ If the meter reads as specified, the ignition coil windings are probably good. However, if the ignition system still does not perform as it should after all other components have been checked, test replace the coil with one known to be good.
- Check the high-tension cables for visible damage.
- ★ If the high-tension cables is damaged, replace the coil.

### Ignition Coil Primary Peak Voltage Inspection

#### NOTE

○ Be sure the battery is fully charged.

- Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter).
- Remove the spark plug caps but do not remove the spark plugs.
- Install a new spark plugs into the spark plug caps.
- Connect the peak voltage adapter [A] to the hand tester [B].

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

**Peak Voltage Adapter: 57001-1415**

**Type: KEK-54-9-B**

**Hand Tester Range: DC 250 V**

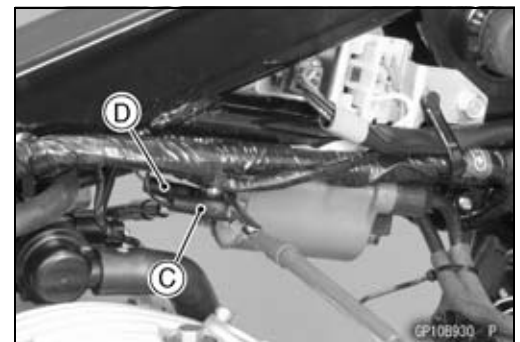
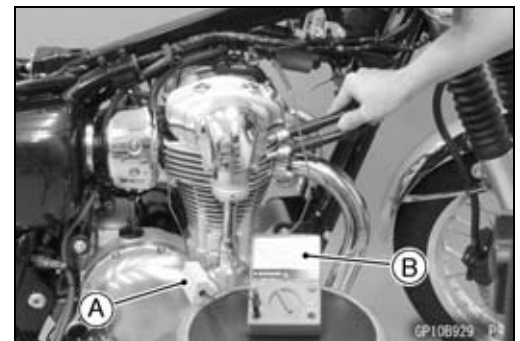
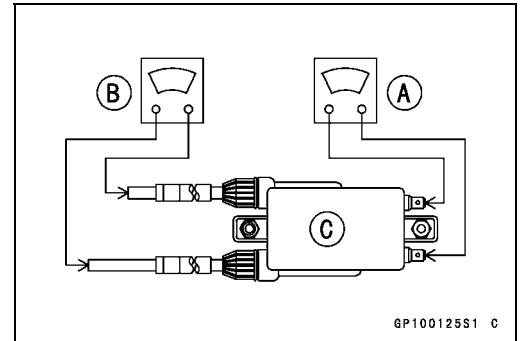
- Connect the peak voltage adapter to the ignition coil terminals.

**Connections:**

	Peak Voltage Adapter	Hand Tester
Terminal (BK Lead) [C]	← R Lead →	(+)
Terminal (R Lead) [D]	← BK Lead →	(-)

#### **⚠ WARNING**

**To avoid extremely high voltage shocks, do not touch the spark plug or tester connections.**



## 15-40 ELECTRICAL SYSTEM

### Ignition System

- Push the engine stop switch to run position.
- Turn the ignition switch to ON.
- Ground the new spark plugs onto the engine.
- 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 times.

#### Ignition Coil Primary Peak Voltage

Standard: 100 V or more

- ★ If the reading is less than the specified value, check the following:
  - Ignition Coil (see Ignition Coil Inspection)
  - Crankshaft Sensor (see Crankshaft Sensor Inspection)
- ★ If the ignition coil and crankshaft sensor are normal, check the ECU (see ECU Power Supply Inspection in the Fuel System (DFI) chapter).

#### Spark Plug Removal

- Refer to the Spark Plug Replacement in the Periodic Maintenance chapter.

#### Spark Plug Installation

- Refer to the Spark Plug Replacement in the Periodic Maintenance chapter.

#### Spark Plug Condition Inspection

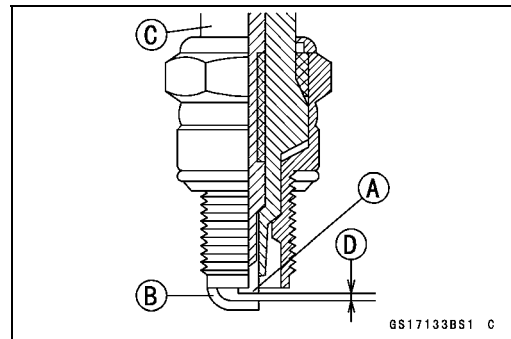
- Remove the spark plugs (see Spark Plug Replacement in the Periodic Maintenance chapter).
- Visually inspect the spark plugs.
- ★ If the spark plug center electrode [A] and/or side electrode [B] are corroded or damaged, or if the insulator [C] is cracked, replace the plug.
- ★ If the spark plug is dirtied or the carbon is accumulated, replace the spark plug.
- Measure the gap [D] with a wire-type thickness gauge.
- ★ If the gap is incorrect, replace the spark plug.

**Spark Plug Gap: 0.7 ~ 0.8 mm (0.027 ~ 0.031 in.)**

- Use the standard spark plug or its equivalent.

#### Standard Spark Plug

Type: NGK CR8E



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## Ignition System

---

### ***Interlock Operation Inspection***

- Raise the rear wheel off the ground with jack.

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

**Attachment Jack: 57001-1252**

#### **1st Check**

- Start the engine to the following conditions.

##### **Condition**

**Transmission Gear → 1st Position**

**Clutch Lever → Release**

**Sidestand → Down or Up**

○ Turn the ignition switch to ON and push the starter button.

○ Then the starter motor should not turn when the starter system circuit is normality.

- ★ If the engine is start, inspect the starter lockout switch, neutral switch, sidestand switch, junction box and starter relay.

#### **2nd Check**

- Start the engine to the following conditions.

##### **Condition**

**Transmission Gear → 1st Position**

**Clutch Lever → Pulled in**

**Sidestand → Up**

○ Turn the ignition switch to ON and push the starter button.

○ Then the starter motor should turn when the starter system circuit is normality.

- ★ If the starter motor is not turn, inspect the starter lockout switch, sidestand switch, junction box and starter relay.

#### **3rd Check**

- 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 → Pulled in**

**Sidestand → Up**

- Set the sidestand on the ground, then the engine will stop.

- ★ If whichever may not be stopped, inspect the neutral switch, sidestand switch and junction box.

- ★ If their parts are normality, replace the ECU.

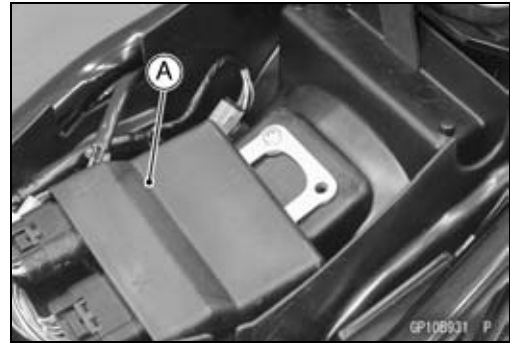
## 15-42 ELECTRICAL SYSTEM

### Ignition System

#### ***IC Igniter Inspection***

○The IC igniter is built in the ECU [A].

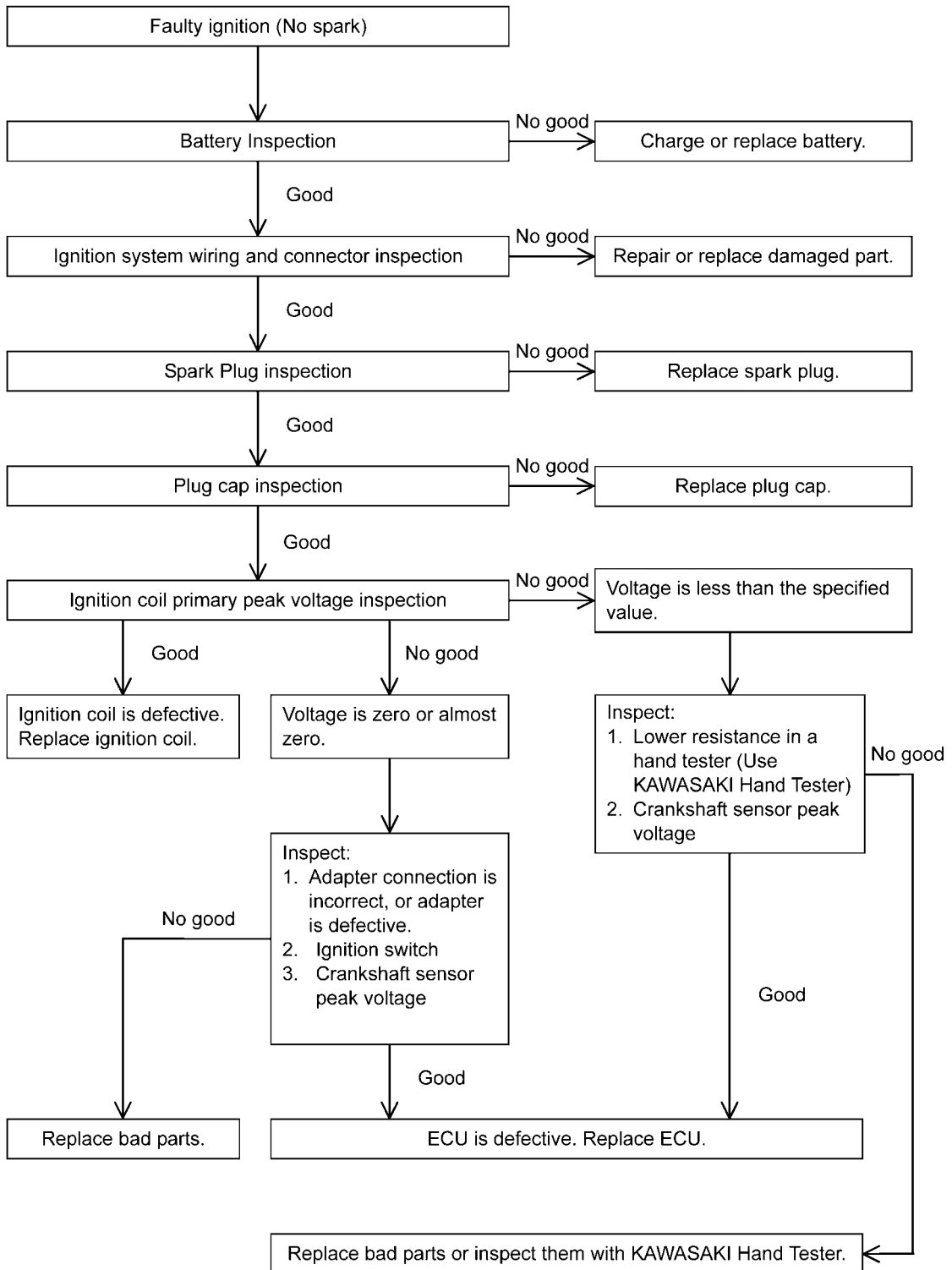
- Refer to the following items.
  - Interlock Operation Inspection (see Interlock Operation Inspection)
  - Ignition System Troubleshooting (see Ignition System section)
  - ECU Power Supply Inspection (see ECU Power Supply Inspection in the Fuel System (DFI) chapter)





Ignition System

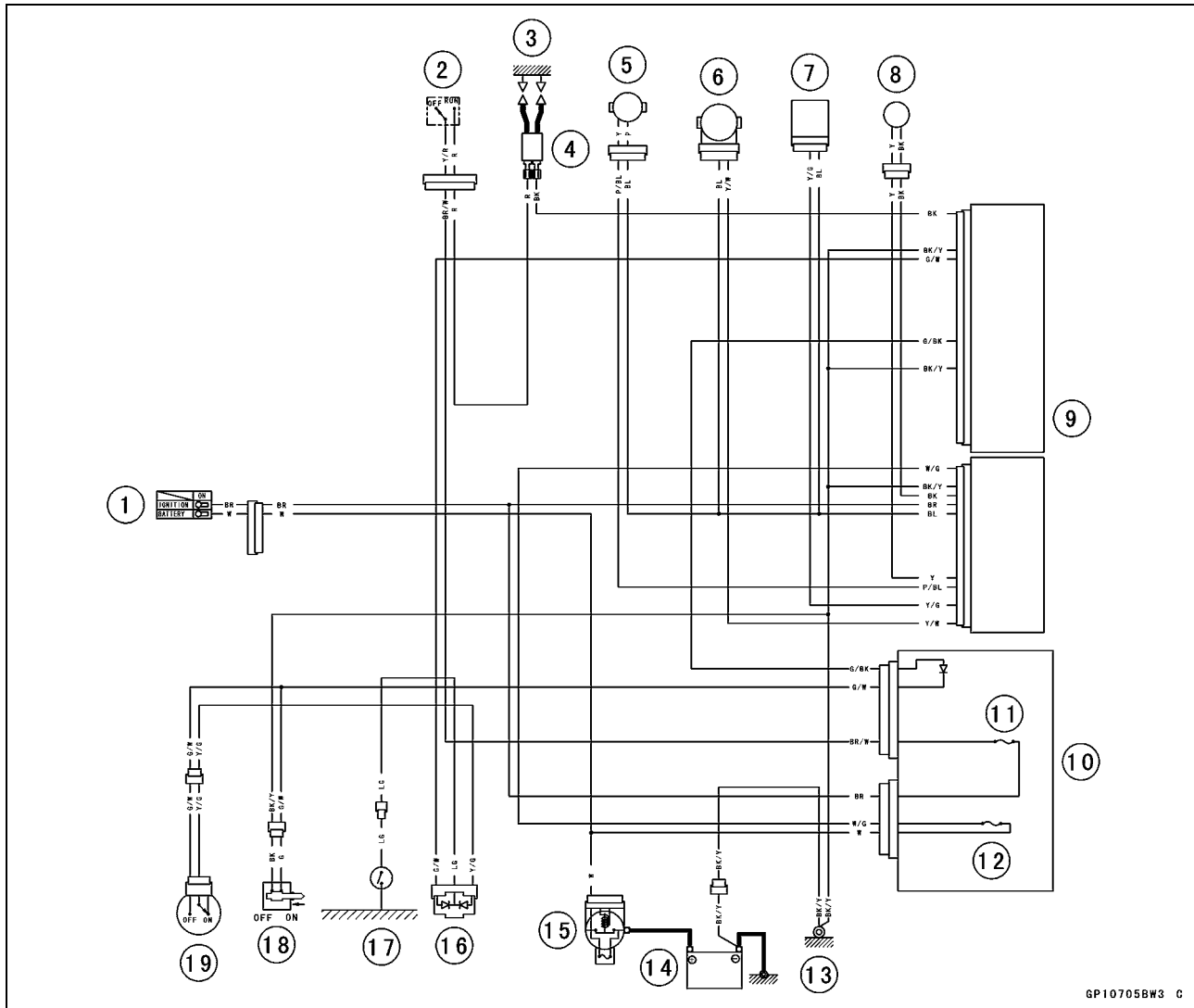
Ignition System Troubleshooting



# 15-44 ELECTRICAL SYSTEM

## Ignition System

### Ignition System Circuit



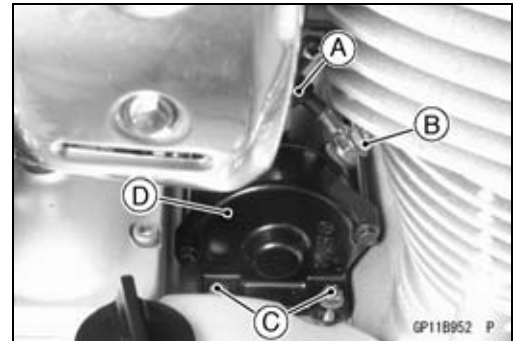
GP10705BW3 C

- |                         |                            |
|-------------------------|----------------------------|
| 1. Ignition Switch      | 11. Ignition Fuse 10 A     |
| 2. Engine Stop Switch   | 12. ECU Fuse 10 A          |
| 3. Spark Plugs          | 13. Frame Ground           |
| 4. Ignition Coil        | 14. Battery 12 V 10 Ah     |
| 5. Speed Sensor         | 15. Main Fuse 30 A         |
| 6. Main Throttle Sensor | 16. Diode                  |
| 7. Vehicle-down Sensor  | 17. Neutral Switch         |
| 8. Crankshaft Sensor    | 18. Sidestand Switch       |
| 9. ECU                  | 19. Starter Lockout Switch |
| 10. Junction Box        |                            |

## Electrical Starter System

### Starter Motor Removal

- Slide out the rubber cap [A].
- Remove:
  - Starter Motor Cable Terminal Nut [B]
  - Starter Motor Mounting Bolts [C]
- Pull out the starter motor [D] to right side.

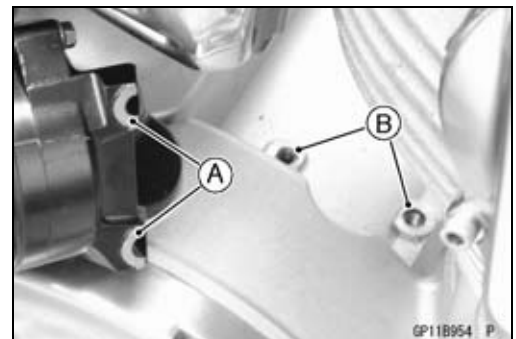
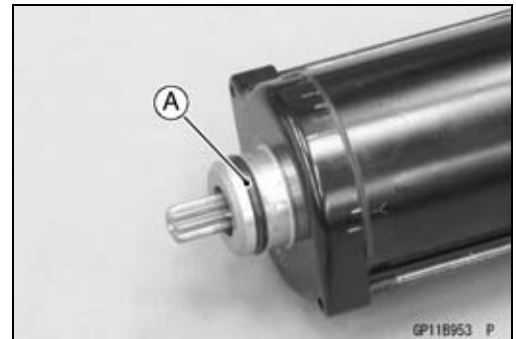


### Starter Motor Installation

#### NOTICE

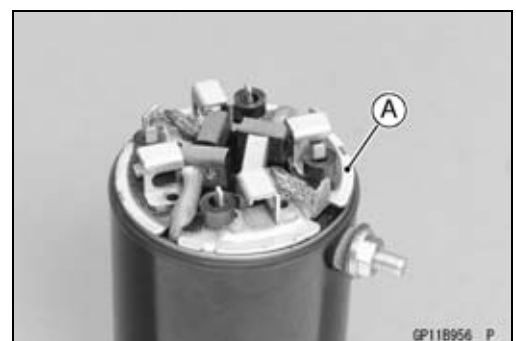
**Do not tap the starter motor shaft or body. Tapping the shaft or body could damage the motor.**

- Replace the O-ring [A] with a new one.
  - Apply soap and water solution to the new O-ring
- 
- Clean the starter motor legs [A] and crankcase [B] where the starter motor is grounded.
  - Apply non-permanent locking agent to the threads of the starter motor mounting bolts and tighten them.
- Torque - Starter Motor Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**  
**Starter Motor Cable Terminal Nut: 4.9 N·m (0.50 kgf·m, 43 in·lb)**



### Starter Motor Disassembly

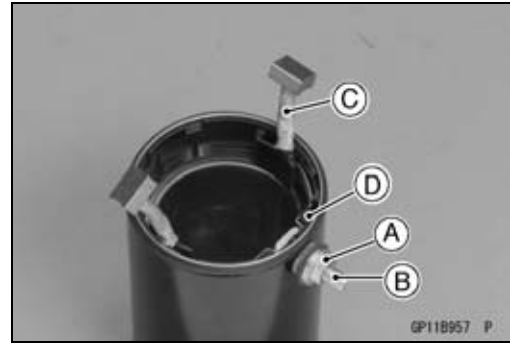
- Remove:
    - Starter Motor (see Starter Motor Removal)
    - Starter Motor Through Bolts [A]
    - Both End Covers [B]
  - Pull the armature out of the yoke [C].
- 
- Remove the negative brush assy bracket [A].



# 15-46 ELECTRICAL SYSTEM

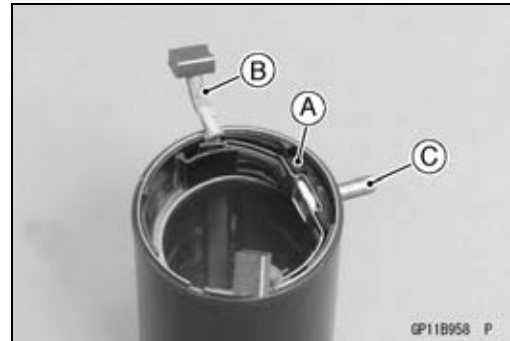
## Electrical Starter System

- Remove:
  - Starter Motor Terminal Locknut [A], Washers and Collars
  - Starter Motor Terminal Bolt [B]
  - Positive Brush Assy [C]
  - Terminal Insulator [D]

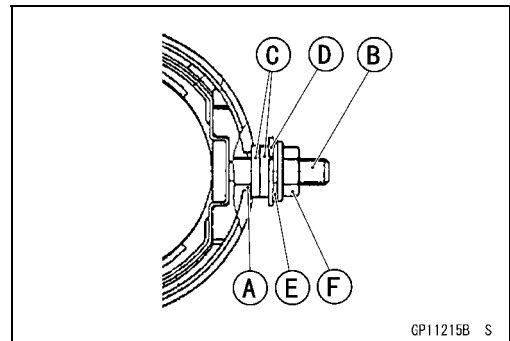


### Starter Motor Assembly

- Install:
  - Terminal Insulator [A]
  - Positive Brush Assy [B]
  - Starter Motor Terminal Bolt [C]

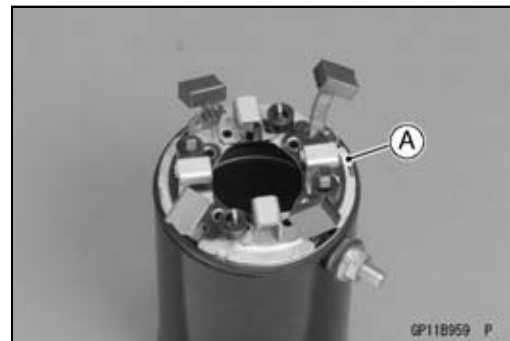


- Replace the O-ring [A] with a new one.
- Install the following parts to the starter motor terminal bolt [B].
  - O-ring
  - Insulator Collars [C]
  - Insulator Washer [D]
  - Washer [E]
  - Starter Motor Terminal Locknut [F]



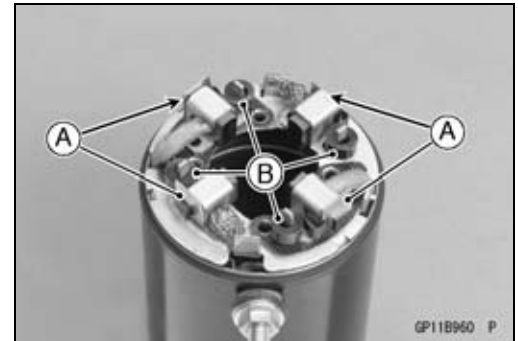
- Tighten:
  - Torque - Starter Motor Terminal Locknut: 11 N·m (1.1 kgf·m, 97 in·lb)**

- Install the negative brush assy bracket [A].



## Electrical Starter System

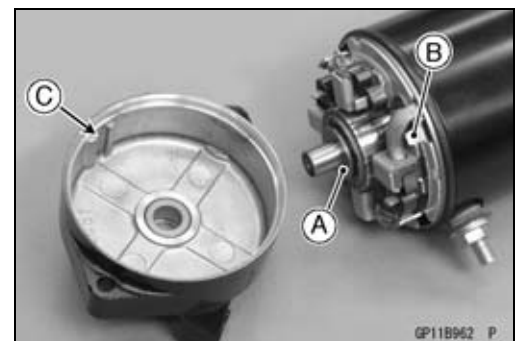
- Insert the suitable plastic sheets [A] between the springs [B] and brush holders to keep the springs in place.
- Insert the brushes into the brush holders.
- Insert the armature and remove the plastic sheets.



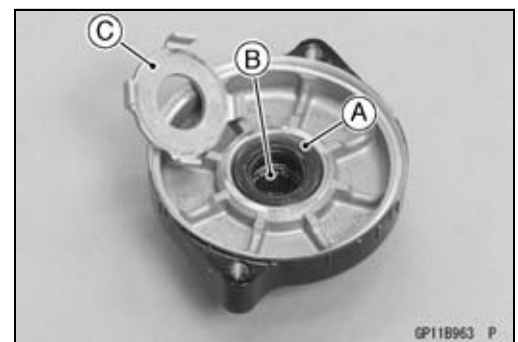
- Replace the O-rings [A] with new ones.



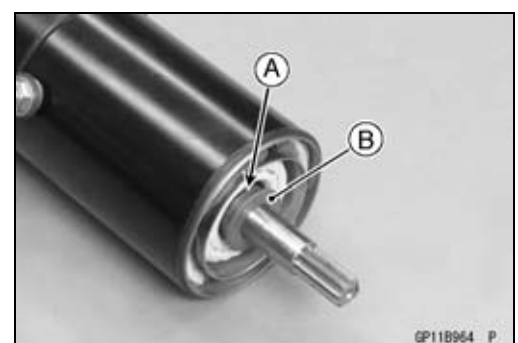
- Install the washers [A].
- Fit the tongue [B] on the negative brush assy bracket into the end cover groove [C].



- Apply a thin coat of grease to the oil seal [A] and needle bearing [B] in the end cover.
- Fit the toothed washer [C] into the end cover.



- Install:  
Thick Washer [A]  
Thin Washer [B]

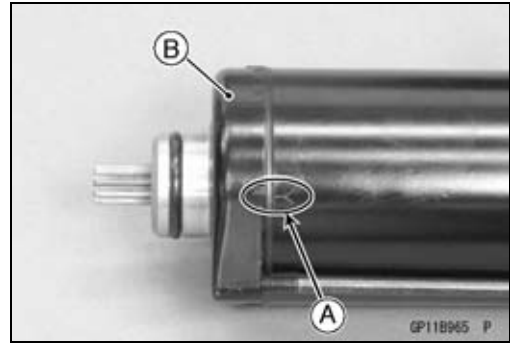


# 15-48 ELECTRICAL SYSTEM

## Electrical Starter System

- Align the marks [A] to assemble the yoke and the end cover [B].
- Tighten:

**Torque - Starter Motor Through Bolts: 4.9 N·m (0.50 kgf·m, 43 in·lb)**



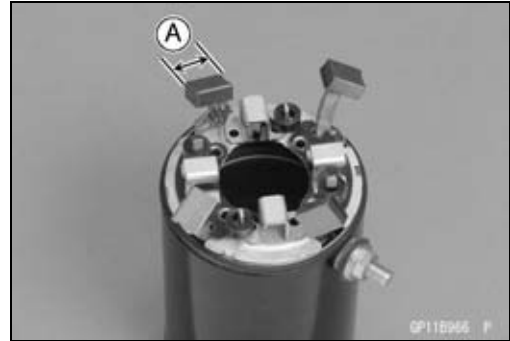
### Brush Inspection

- Measure the length [A] of each brush.
- ★ If any is worn down to the service limit, replace the brush assembly.

#### Starter Motor Brush Length

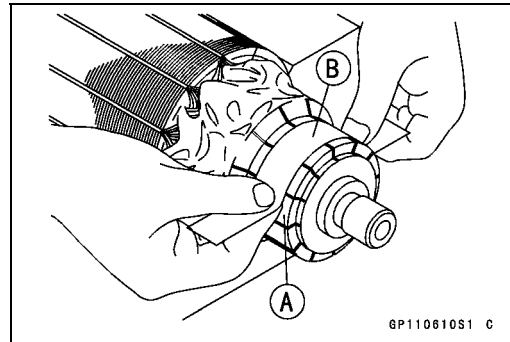
**Standard: 12.0 ~ 12.5 mm (0.47 ~ 0.49 in.)**

**Service Limit: 5.5 mm (0.22 in.)**



### Commutator Cleaning and Inspection

- Smooth the commutator surface [A] if necessary with fine emery cloth [B], and clean out the grooves.

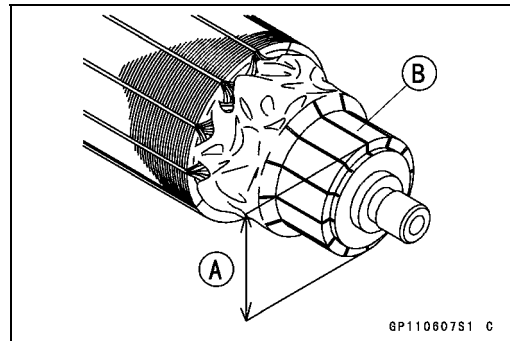


- Measure the diameter [A] of the commutator [B].
- ★ If the commutator diameter is less than the service limit, replace the starter motor with a new one.

#### Commutator Diameter

**Standard: 28 mm (1.1 in.)**

**Service Limit: 27 mm (1.06 in.)**



## Electrical Starter System

### Armature Inspection

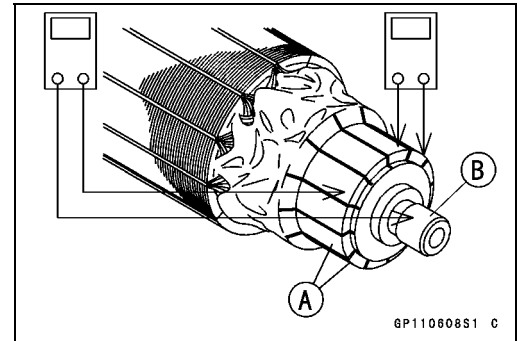
- Using the  $\times 1 \Omega$  hand tester range, measure the resistance between any two commutator segments [A].

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

- ★ 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.

### NOTE

○ Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with the hand tester. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.



### Brush Lead Inspection

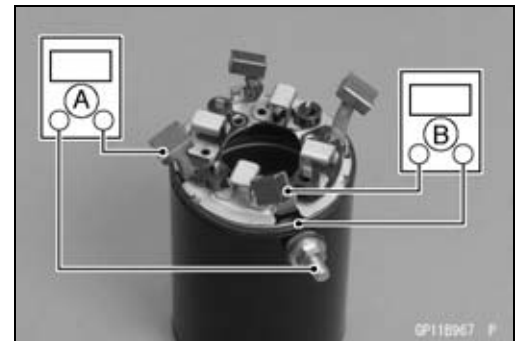
- Using the  $\times 1 \Omega$  hand tester range, measure the resistance as shown in the figure.

Terminal Bolt and Positive (+) Brush [A]

Yoke and Negative (-) Brush [B]

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

- ★ If there is not close to zero ohms, the brush lead has an open. Replace the brush assembly.



### Terminal Bolt Inspection

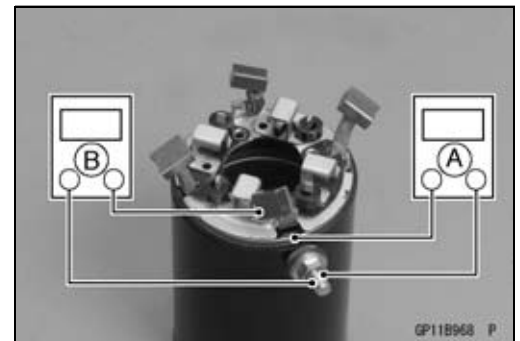
- Using the highest hand tester range, measure the resistance as shown in the figure.

Terminal Bolt and Yoke [A]

Terminal Bolt and Negative (-) Brush [B]

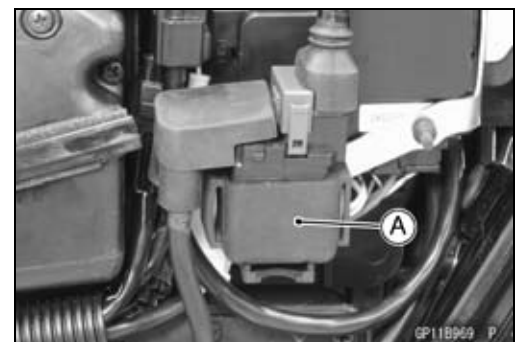
**Special Tool - Hand Tester: 57001-1394**

- ★ If there is any reading, the brush assembly and/or terminal bolt assembly have a short. Replace the brush assembly.



### Starter Relay Inspection

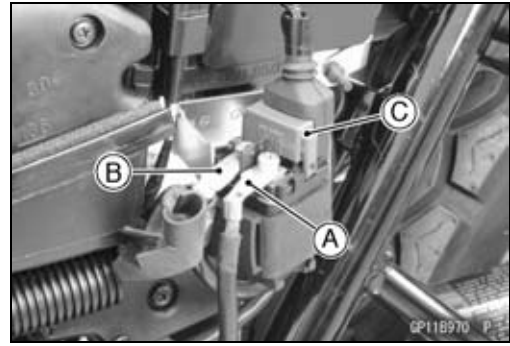
- Remove the left side cover (see Left Side Cover Removal in the Frame chapter).
- Remove the battery negative (-) cable from the battery negative (-) terminal (see Battery Removal).
- Pull out the starter relay [A] from the bracket.



# 15-50 ELECTRICAL SYSTEM

## Electrical Starter System

- Remove the starter motor cable [A] and battery positive (+) cable [B].
- Disconnect the connector [C].



- Connect the hand tester [A] and 12 V battery [B] to the starter relay [C] as shown in the figure.

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

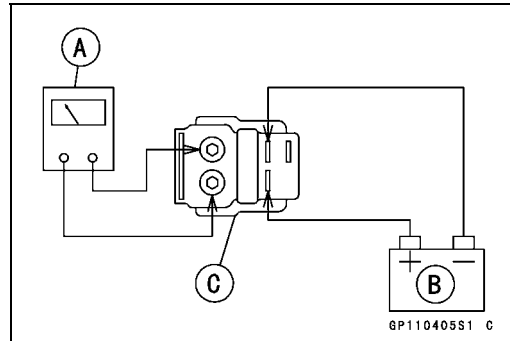
- ★ If the relay does not work as specified, the relay is defective. Replace the relay.

### Testing Relay

**Tester Range: × 1 Ω range**

**Criteria: When battery is connected → 0 Ω**

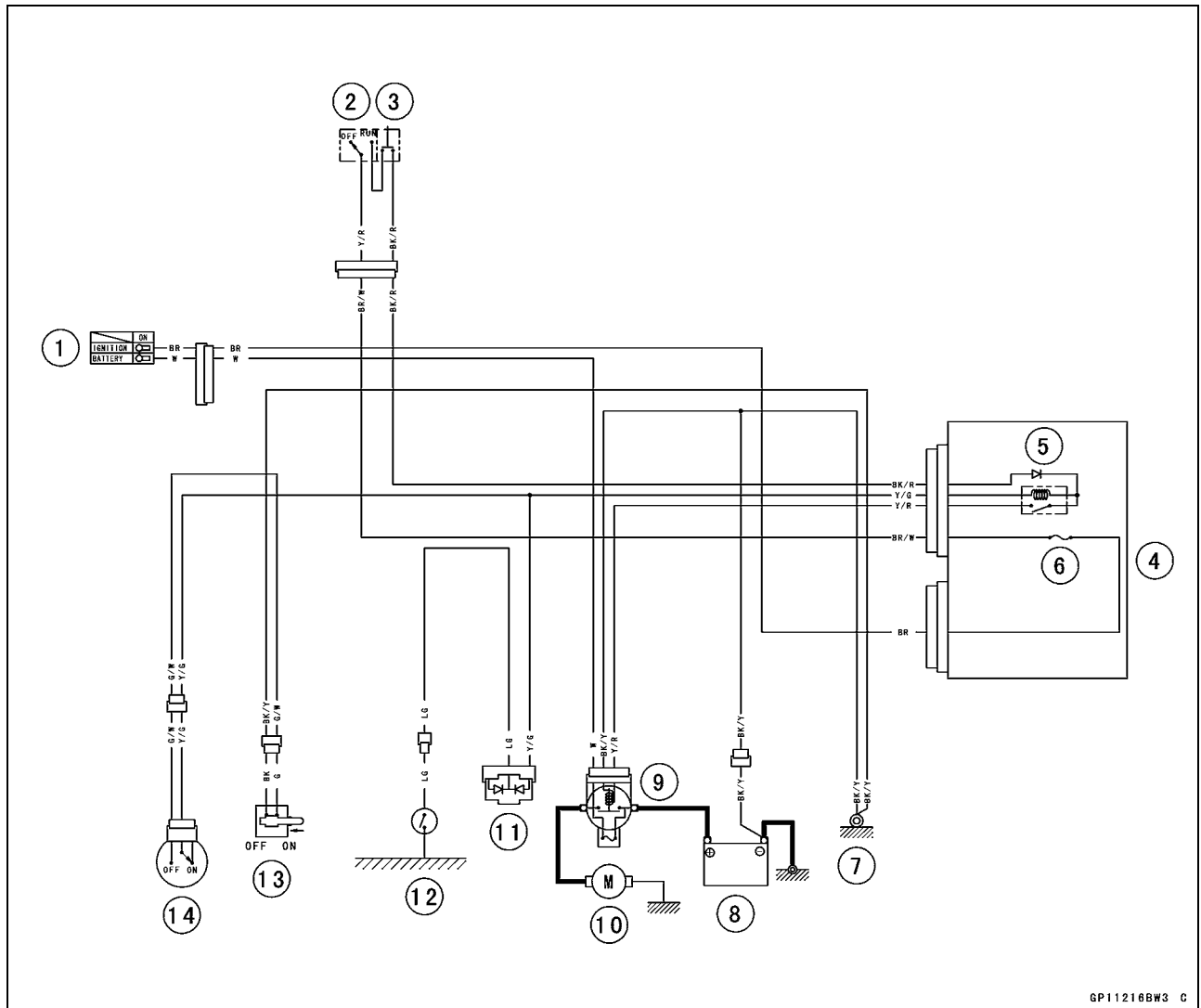
**When battery is disconnected → ∞ Ω**





Electrical Starter System

Electrical Starter Circuit



GP11216BW3 C

- |                          |                            |
|--------------------------|----------------------------|
| 1. Ignition Switch       | 8. Battery 12 V 10 Ah      |
| 2. Engine Stop Switch    | 9. Starter Relay           |
| 3. Starter Button        | 10. Starter Motor          |
| 4. Junction Box          | 11. Diode                  |
| 5. Starter Circuit Relay | 12. Neutral Switch         |
| 6. Ignition Fuse 10 A    | 13. Sidestand Switch       |
| 7. Frame Ground          | 14. Starter Lockout Switch |

## 15-52 ELECTRICAL SYSTEM

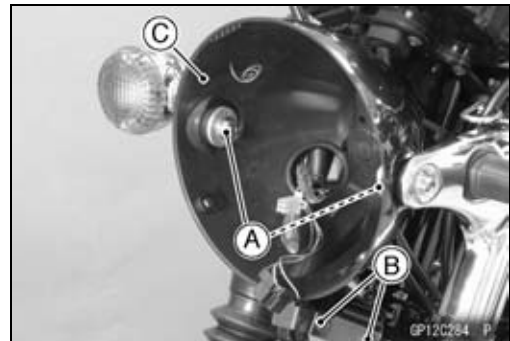
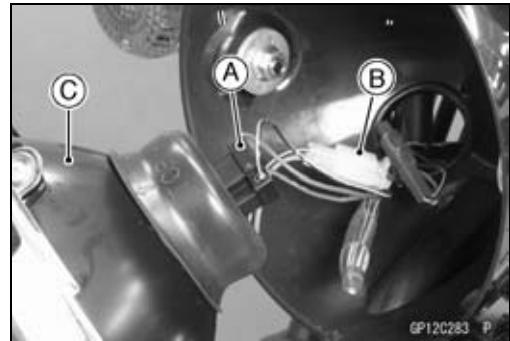
### Lighting System

#### **Headlight Beam Adjustment**

- Refer to the Headlight Aiming Inspection in the Periodic Maintenance chapter.

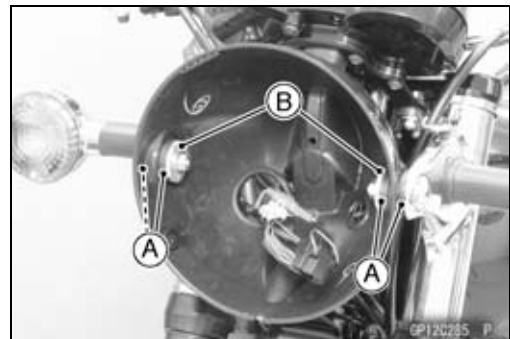
#### **Headlight Unit Removal**

- Remove:
  - Screws [A]
  - Spring Washers
  - Collars
  
- Disconnect:
  - Headlight Lead Connector [A]
  - City Light Lead Connector [B] (EUR Models)
  - Headlight Unit [C]
  
- Remove:
  - Bolts and Nuts [A]
  - Bracket Bolts [B]
  - Headlight Housing [C]



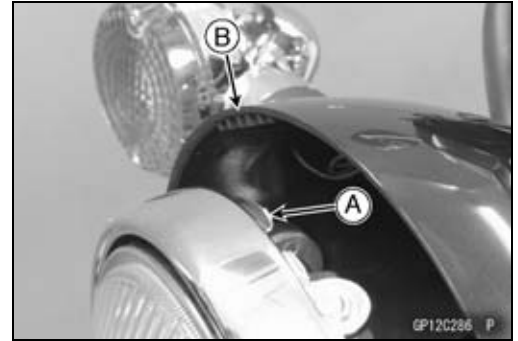
#### **Headlight Unit Installation**

- Installation is the reverse of removal.
- Be sure that the dampers [A] and collars [B] are in position on the headlight housing.



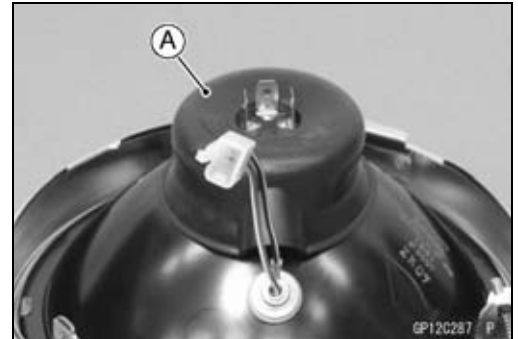
## Lighting System

- Fit the projection [A] on the headlight unit rim into the recess [B] of the headlight housing.

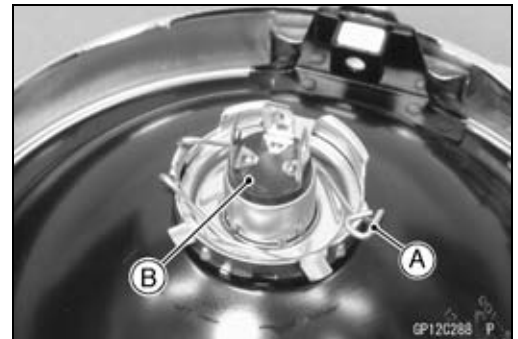


### Headlight Bulb Replacement

- Remove:
  - Headlight Unit (see Headlight Unit Removal)
  - Dust Cover [A]



- Remove:
  - Hook [A]
  - Headlight Bulb [B]



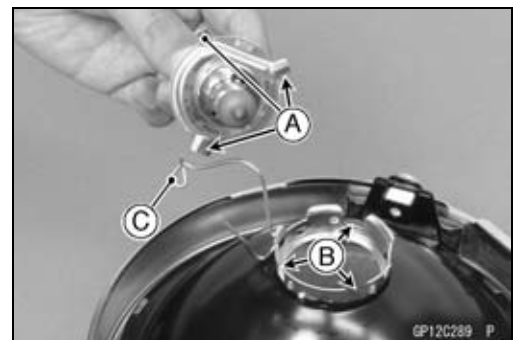
#### NOTICE

**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.**

#### NOTE

○Clean off any contamination that inadvertently gets on the bulb with alcohol or a soap and water solution.

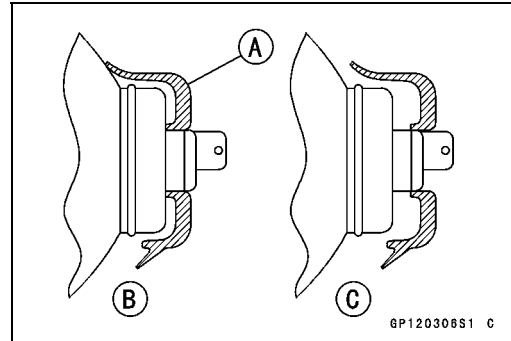
- Replace the headlight bulb with a new one.
- Fit the projections [A] of the bulb in the hollows [B] of the headlight.
- Install the hook [C].



## 15-54 ELECTRICAL SYSTEM

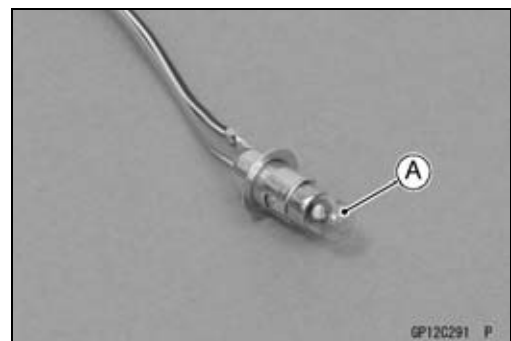
### Lighting System

- Fit the dust cover [A] with the TOP mark upward, onto the bulb firmly as shown in the figure.  
Good [B]  
Bad [C]
- Install the headlight unit (see Headlight Unit Installation).
- After installation, adjust the headlight aim (see Headlight Aiming Inspection in the Periodic Maintenance chapter).



### City Light Bulb Replacement (EUR Models)

- Remove:
  - Headlight Unit (see Headlight Unit Removal)
- Pull out the socket [A] with the bulb.
- Push and turn the city light bulb [A] counterclockwise and remove it.
- Replace the bulb with a new one.

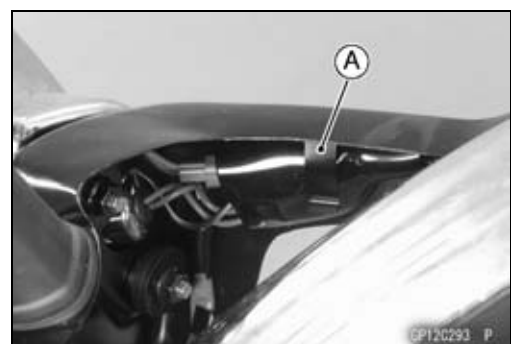


- Insert the new bulb [A] by aligning its left and right pins [B] with the left and right grooves [C] in the socket, and turn the bulb clockwise.
- Install the socket in the headlight firmly.
- Install the headlight unit (see Headlight Unit Installation).



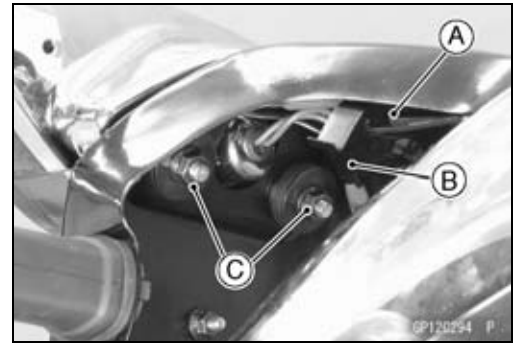
### Tail Brake Light Removal

- Open the clamp [A].



## Lighting System

- Slide the dust cover [A].
- Remove:
  - Tail/Brake Light Lead Connector [B]
  - Nuts [C]
  - Tail/Brake Light



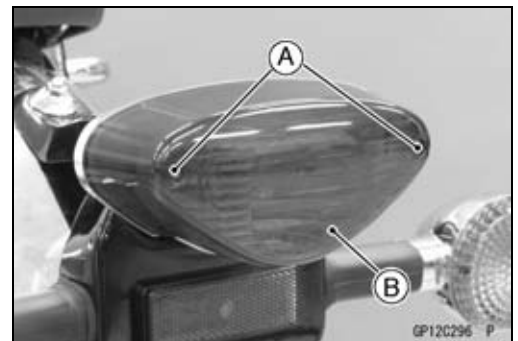
### Tail/Brake Light Installation

- Installation is the reverse of removal.
- Be sure that the collars [A] are in position on the flap.



### Tail/Brake Light Bulb Replacement

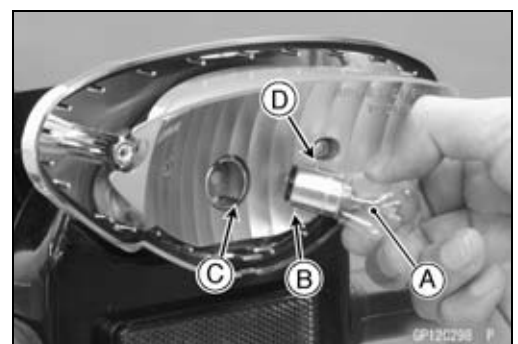
- Remove:
  - Screws [A] and Washers
  - Lens [B]



- Push and turn the tail/brake light bulb [A] counterclockwise and remove it.
- Replace the bulb with a new one.



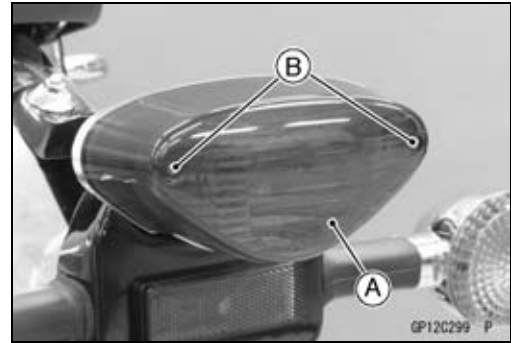
- Insert the new bulb [A] by aligning its front pin [B] with the lower groove [C] in the socket.
- Push and turn the bulb clockwise.



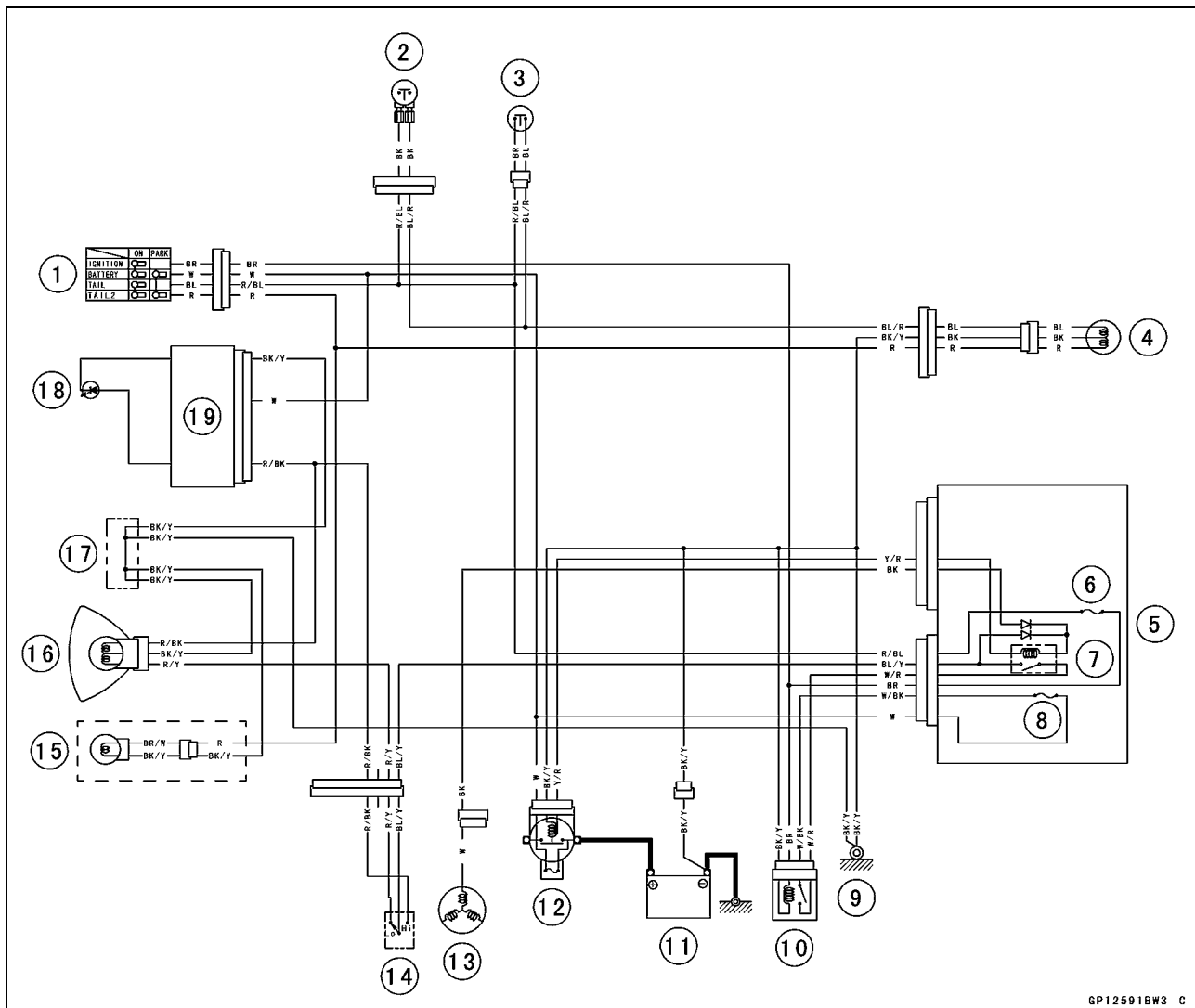
# 15-56 ELECTRICAL SYSTEM

## Lighting System

- Install:  
 Lens [A]  
 Screw [B] and Washer



## Headlight, Tail/Brake Light Circuit



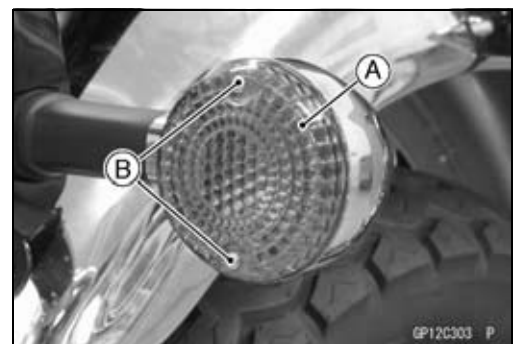
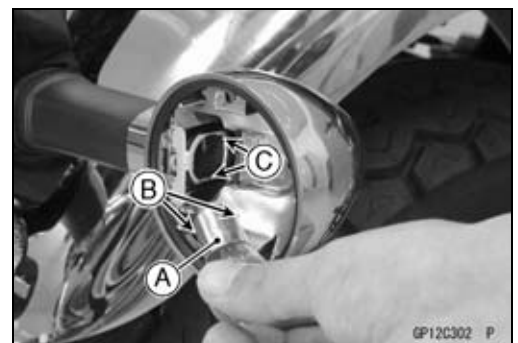
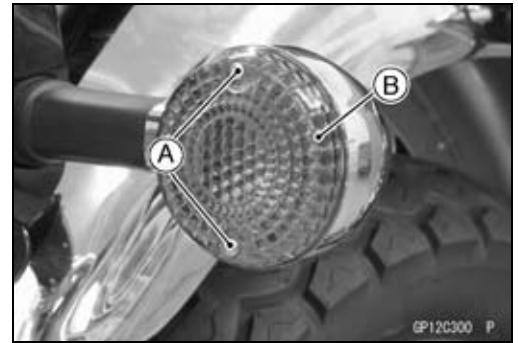
GP125918W3 C

- |                                 |                                      |
|---------------------------------|--------------------------------------|
| 1. Ignition Switch              | 11. Battery 12 V 10 A                |
| 2. Front Brake Light Switch     | 12. Main Fuse 30 A                   |
| 3. Rear Brake Light Switch      | 13. Alternator                       |
| 4. Tail/Brake Light 12 V 5/21 W | 14. Dimmer Switch                    |
| 5. Junction Box                 | 15. City Light 12 V 4 W (EUR Models) |
| 6. Taillight Fuse 10 A          | 16. Headlight 12 V 60/55 W           |
| 7. Headlight Relay              | 17. Water-proof Joint                |
| 8. Headlight Fuse 10 A          | 18. High Beam Indicator Light (LED)  |
| 9. Frame Ground                 | 19. Meter Unit                       |
| 10. ECU Main Relay              |                                      |

## Lighting System

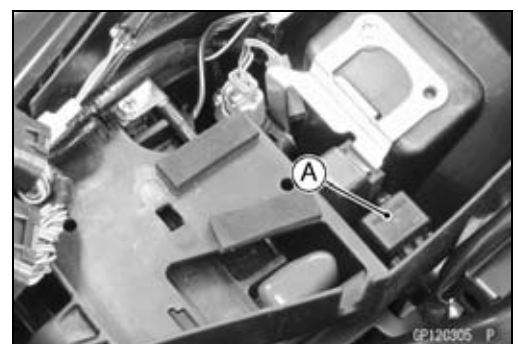
### Turn Signal Light Bulb Replacement

- Remove:
  - Screws [A]
  - Lens [B]
  
- Push and turn the turn signal light bulb [A] counterclockwise and remove it.
- Replace the bulb with a new one.
  
- Insert the new bulb [A] by aligning its upper and lower pins [B] with the upper and lower grooves [C] in the socket.
- Push and turn the bulb clockwise.
  
- Install the lens [A] and tighten the screws [B].



### Turn Signal Relay Inspection

- Remove:
  - Seat (see Seat Removal in the Frame chapter)
  - ECU with Bracket (see Battery Removal)
- Remove the turn signal relay [A] from the bracket.
- Disconnect the turn signal relay connector.



# 15-58 ELECTRICAL SYSTEM

## Lighting System

- Connect 12 V battery and turn signal lights as indicated in the figure, and count how many times the lights blink for one minute.

Turn Signal Relay [A]

Turn Signal Lights [B] (12 V 21 W × 2)

12 V Battery [C]

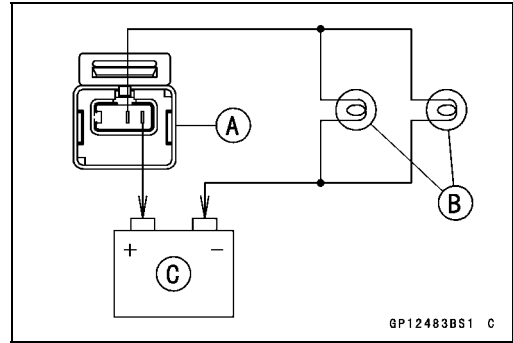
- ★ If the lights do not blink as specified, replace the turn signal relay.

### Testing Turn Signal Relay

Load		Blinking Times (c/m*)
The Number of Turn Signal Light	Wattage (W)	
1**	21	140 ~ 250
2	42	75 ~ 95

(\*): Cycle(s) per minute

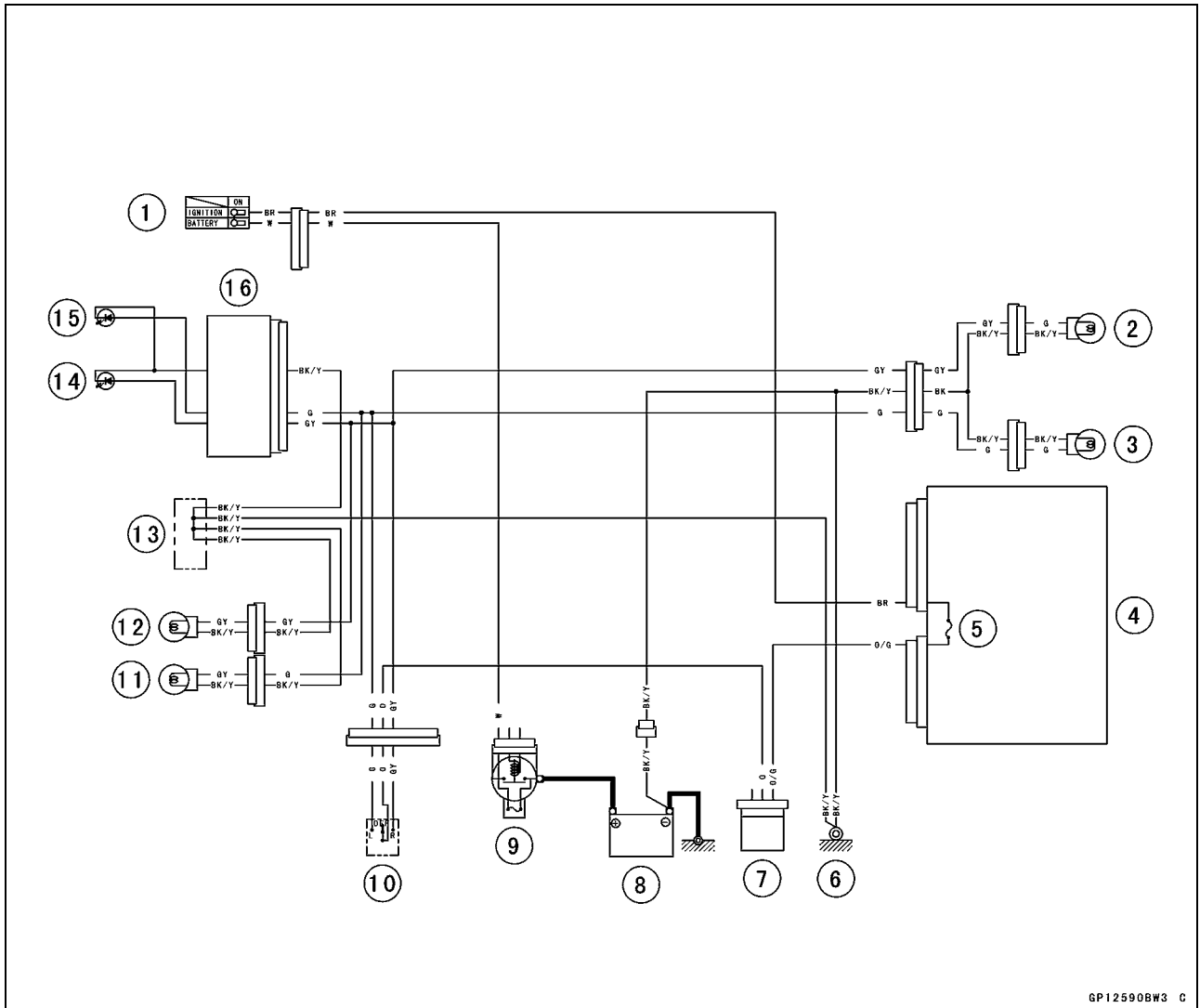
(\*\*): Corrected to "one light burned out".





Lighting System

Turn Signal Light Circuit



GP12590BW3 C

- |   |   |
|---|---|
| 1. Ignition Switch                        | 9. Main Fuse 30 A                           |
| 2. Rear Right Turn Signal Light 12 V 21 W | 10. Turn Signal Switch                      |
| 3. Rear Left Turn Signal Light 12 V 21 W  | 11. Front Left Turn Signal Light 12 V 21 W  |
| 4. Junction Box                           | 12. Front Right Turn Signal Light 12 V 21 W |
| 5. Turn Signal Light Fuse 10 A            | 13. Water-proof Joint                       |
| 6. Frame Ground                           | 14. Right Turn Signal Indicator Light (LED) |
| 7. Turn Signal Relay                      | 15. Left Turn Signal Indicator Light (LED)  |
| 8. Battery 12 V 10 A                      | 16. Meter Unit                              |

# 15-60 ELECTRICAL SYSTEM

## Air Switching Valve

### Air Switching Valve Operation Test

- Refer to the Air Suction System Damage Inspection in the Periodic Maintenance chapter.

### Air Switching Valve Unit Test

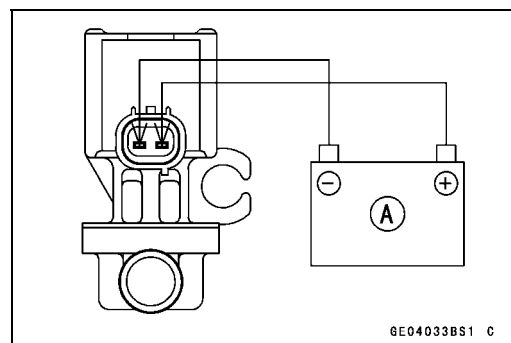
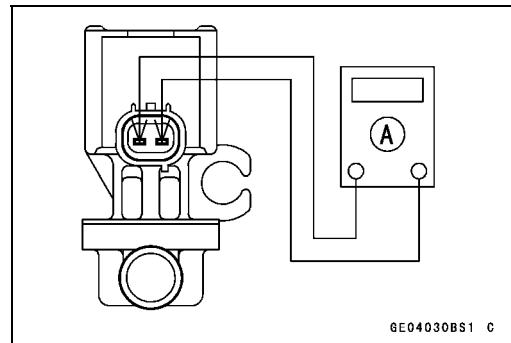
- Remove the air switching valve (see Air Switching Valve Removal in the Engine Top End chapter).
- Set the hand tester [A] to the  $\times 1 \Omega$  range and connect it to the air switching valve terminals as shown in the figure.

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

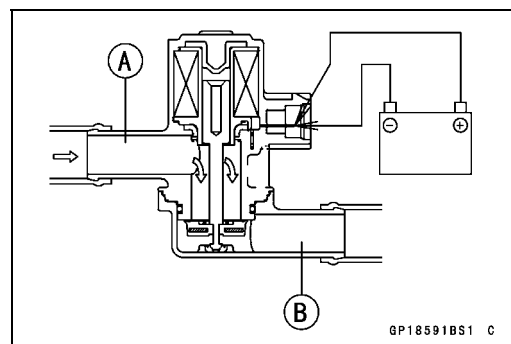
#### Air Switching Valve Resistance

**Standard: 20 ~ 24  $\Omega$  at 20°C (68°F)**

- ★ If the resistance reading is out of the specified value, replace it with a new one.
- Connect the 12 V battery [A] to the air switching valve terminals as shown in the figure.



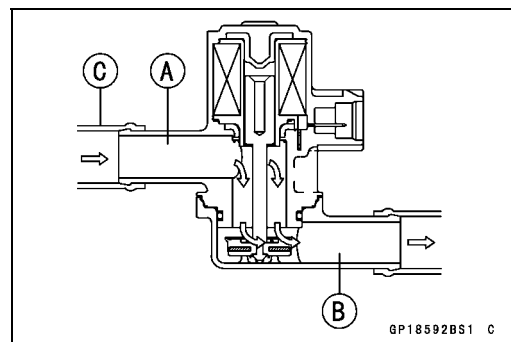
- Blow the air to the inlet air duct [A], and make sure does not flow the blown air from the outlet air duct [B].



- Disconnect the 12 V battery.
- Blow the air to the inlet air duct [A] again, and make sure flow the blown air from the outlet air duct [B].
- ★ If the air switching valve does not operate as described, replace it with a new one.

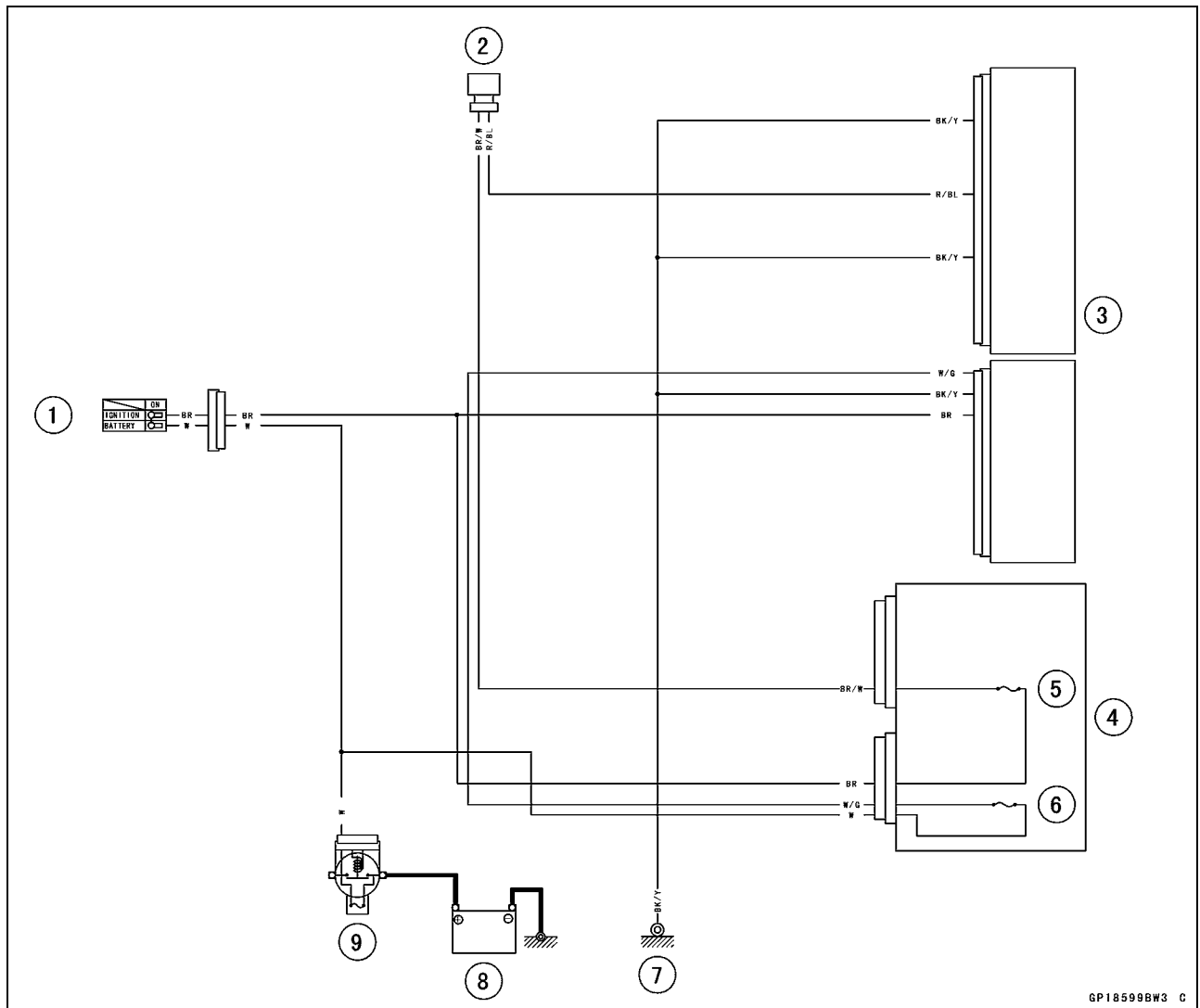
### NOTE

- To check air flow through the air switching valve, just blow through the air switching valve hose (inlet side) [C].



Air Switching Valve

Air Switching Valve Circuit



1. Ignition Switch
2. Air Switching Valve
3. ECU
4. Junction Box
5. Ignition Fuse 10 A
6. ECU Fuse 10 A
7. Frame Ground
8. Battery 12 V 10 Ah
9. Main Fuse 30 A

# 15-62 ELECTRICAL SYSTEM

## Meter Unit

### Meter Unit Removal

- Remove:  
Bolts [A] (Both Sides)



- Slide the dust cover and disconnect the meter unit connector [A].
- Remove the meter unit [B].



### NOTICE

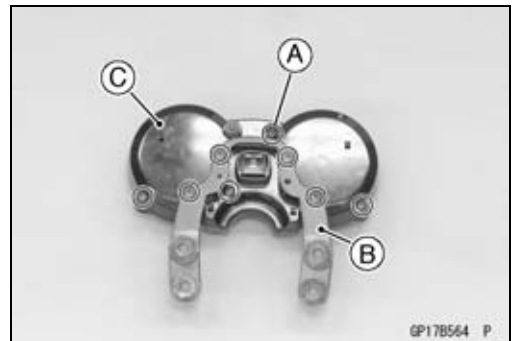
Place the meter unit so that the face is up. If a meter unit is left upside down or sideways for any length of time, it will malfunction.

### Meter Unit Installation

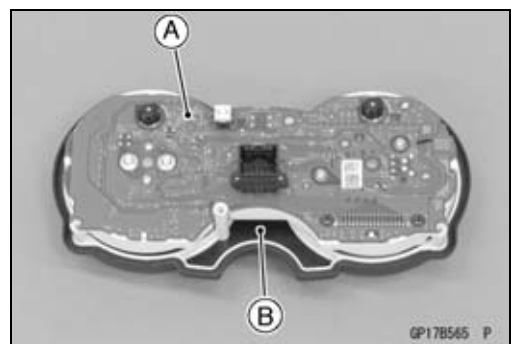
- Installation is the reverse of removal.

### Meter Unit Disassembly

- Remove:  
Meter Unit (see Meter Unit Removal)  
Screws [A]  
Bracket [B]  
Lower Meter Cover [C]



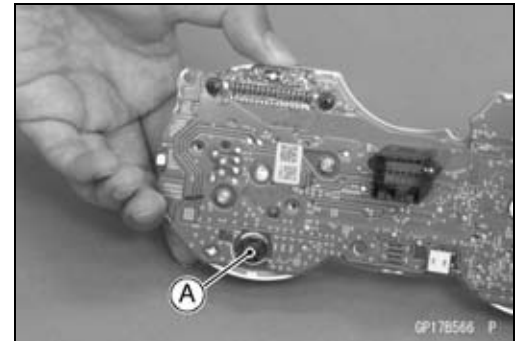
- Separate the meter assembly [A] and upper meter cover [B].



## Meter Unit

### Meter Unit Light Bulb Replacement

- Remove:
  - Meter Assembly (see Meter Unit Disassembly)
- Turn the socket [A] counterclockwise and pull out the socket together with the bulb.

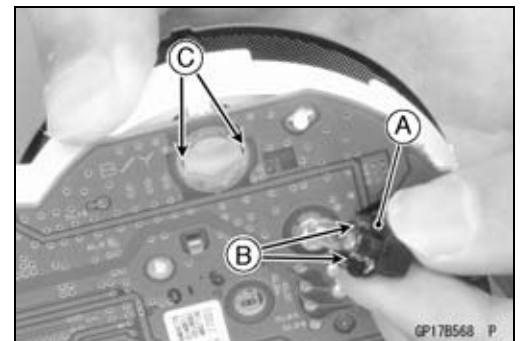
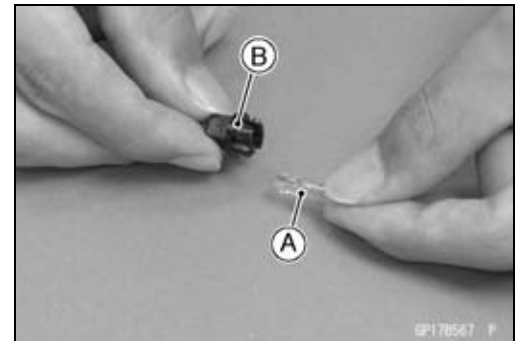


- Pull out the bulb [A] straight from the socket [B].

#### NOTICE

**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 valve.**

- Replace the bulb with a new one.
  - Insert the bulb straight in the socket.
- Insert the socket [A] by aligning its left and right projections [B] with the left and right grooves [C] in the meter assembly, and turn the socket clockwise.
  - Install the removed parts (see appropriate chapters).

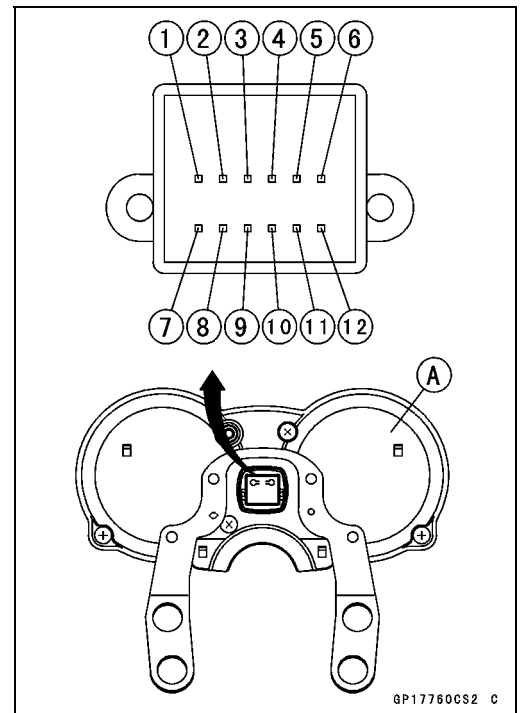


### Meter Unit Inspection

- Remove the meter unit [A] (see Meter Unit Removal).
  - [1] Ground (-)
  - [2] FI Indicator Light (LED) (-)
  - [3] Ignition
  - [4] Speed Sensor Signal
  - [5] Battery (+)
  - [6] Fuel Level Warning Indicator Light (LED) (-)
  - [7] Tachometer Signal
  - [8] Neutral Indicator Light (LED) (-)
  - [9] Left Turn Signal Indicator Light (LED) (+)
  - [10] Right Turn Signal Indicator Light (LED) (+)
  - [11] High Beam Indicator Light (LED) (+)
  - [12] Oil Pressure Warning Indicator Light (LED) (-)

#### NOTICE

**Do not drop the meter unit. Place the meter unit so that it faces upward. If the meter assembly is left upside down or sideways for a long time or dropped, it will malfunction. Do not short each terminals.**



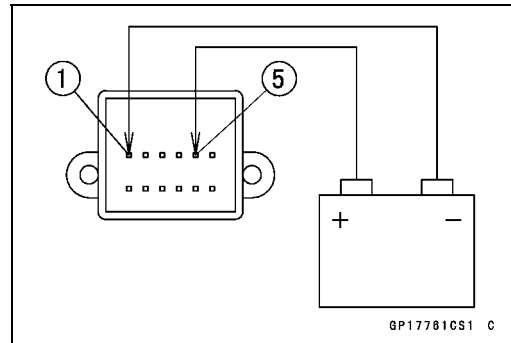
## 15-64 ELECTRICAL SYSTEM

### Meter Unit

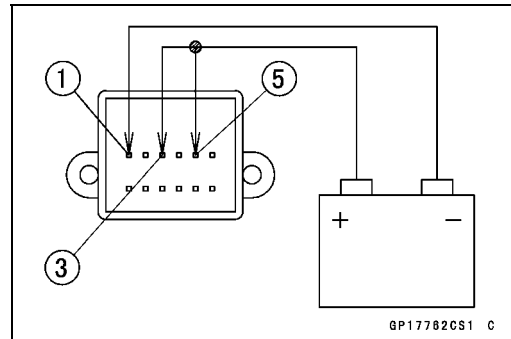
#### Liquid Crystal Display (LCD) Segments Check

- Using the insulated auxiliary leads, connect the 12 V battery to the meter unit connector as follows.

- Connect the battery positive terminal to the terminal [5].
- Connect the battery negative terminal to the terminal [1].



- Connect the terminal [3] to the terminal [5].



- When the terminals are connected, all the LCD segments [A], FI [B], oil pressure warning [C] and fuel level warning [D] indicator lights (LED) appear for three seconds.

- When the terminals are connected, tachometer and speedometer needles momentarily go from the minimum to the maximum, then go back from the maximum to the minimum reading.

- ★ If the LCD segments will not appear, replace the meter unit.

- Disconnect the terminal [3].

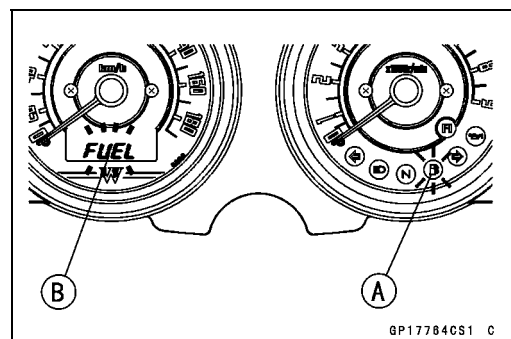
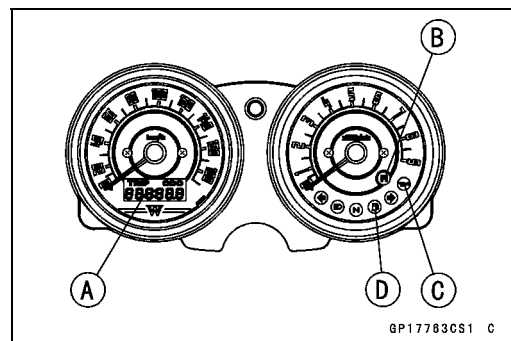
- All the LCD segments, FI, oil pressure warning and fuel level warning indicator lights (LED) disappear.

- ★ If the segments do not disappear, replace the meter unit.

- Connect the terminal [3] to the terminal [5] again.

- About 5 seconds after, the fuel level warning indicator light (LED) [A] and the FUEL segments [B] blink.

- ★ If the fuel level warning indicator light (LED) does not blink and/or the FUEL segments does not appear, replace the meter unit.



#### NOTE

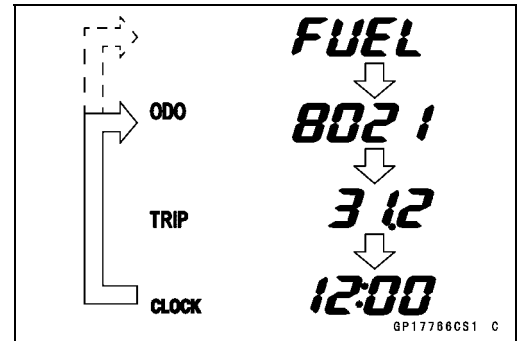
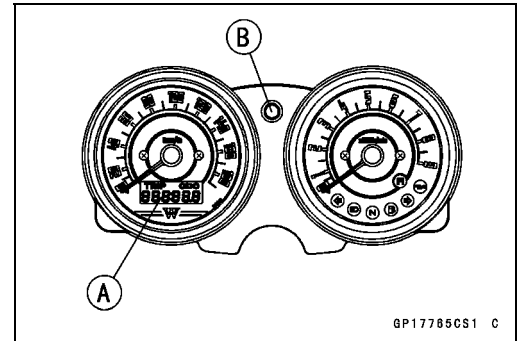
- This meter unit has a failure detection function (for open or short) of the fuel reserve switch. When the fuel reserve switch is open or short, the meter unit alerts the rider by the fuel level warning indicator light (LED) blinks and the FUEL segments appears in the display.

- If the failure detection function operates with the meter unit installed on the motorcycle, inspect the fuel reserve switch (see Fuel Reserve Switch Inspection) and wiring.

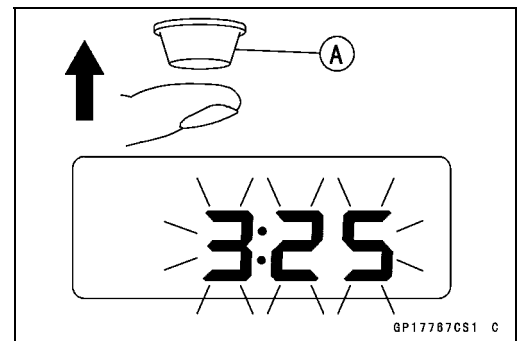
## Meter Unit

### MODE and RESET BUTTON Operation Check

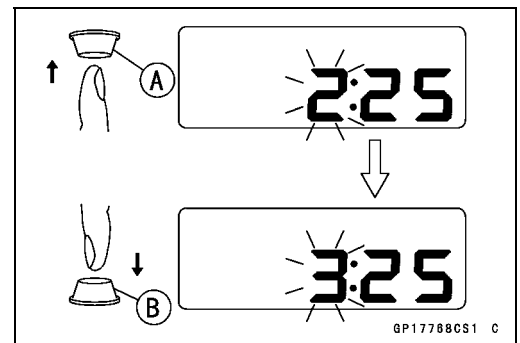
- Connect the 12 V battery and terminals in the same manner as specified in the "Liquid Crystal Display (LCD) Segments Check".
- Check that the display [A] changes to the ODO, TRIP and CLOCK displays each time the MODE button [B] is pressed.
- When fuel level warning indicator light (LED) blinks, the display changes in order of FUEL, ODO, TRIP and CLOCK.
- ★ If the display function does not work, replace the meter unit.



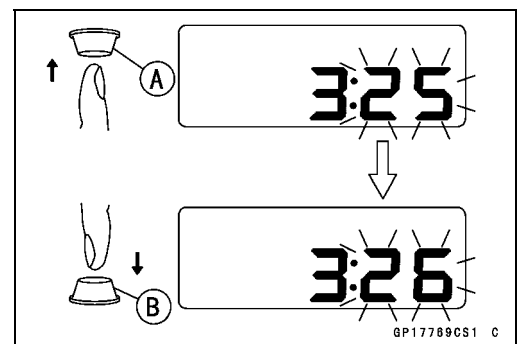
- Indicate the CLOCK mode.
- Check that when the RESET button [A] in CLOCK mode is pushed for more than two seconds, the meter display turns to the clock set mode.
- Both the hour and minute display start blinking.



- In the HOUR/MINUTE setting mode, press the RESET button [A] again to effect the HOUR setting mode.
- The hour display blinks on the display.
- Press the MODE button [B] to set the hour.



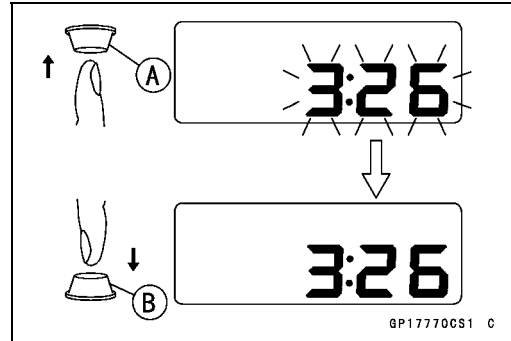
- In the HOUR setting mode, press the RESET button [A] to effect the MINUTE setting mode.
- The minute display blinks on the display.
- Press the MODE button [B] to set the minute.



## 15-66 ELECTRICAL SYSTEM

### Meter Unit

- In the MINUTE setting mode, press the RESET button [A] to return to the HOUR/MINUTE setting mode.
- Press the MODE button [B] to complete the time setting process.
- The clock starts counting the seconds as soon as the MODE button is pressed.

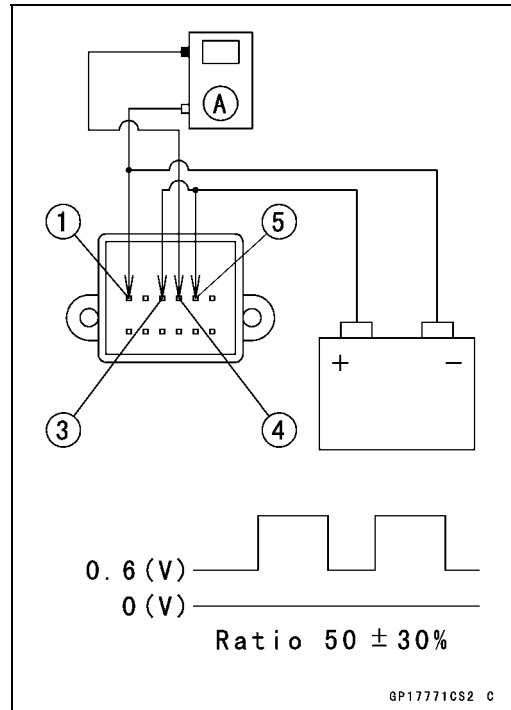


### Speedometer Check

- Connect the 12 V battery and terminals in the same manner as specified in the "Liquid Crystal Display (LCD) Segments Check".
- The speed equivalent to the input frequency is indicated in the oscillator [A], if the square wave (illustrated as shown in the figure) would be input into the terminal [4].
- Indicates approximately 60 km/h in case the input frequency would be approximately 80 Hz.
- Indicates approximately 60 mph in case the input frequency would be approximately 132 Hz.
- ★ If the speedometer does not work, replace the meter unit.

#### NOTE

- The input frequency of the oscillator adds the integrated value of the odometer.
- The integrated value of the odometer cannot be reset.



- ★ If the oscillator is not available, the speedometer can be checked as follows.
- Install the meter unit.
- Raise the rear wheel off the ground, using the center stand.
- Turn on the ignition switch.
- Rotate the rear wheel by hand.
- Check that the speedometer shows the speed.
- ★ If the speedometer does not work, check the speed sensor and wiring (see Speed Sensor Output Voltage Inspection in the Fuel System (DFI) chapter).
- ★ If the speed sensor and wiring are normal, replace the meter unit.



## Meter Unit

### Odometer Check

- Check the odometer with the speedometer check in the same way.
- ★ If value indicated in the odometer is not added, replace the meter unit.

#### NOTE

- The data is maintained even if the battery is disconnected.
- When the figures come to 999999, they are stopped and locked.
- The integrated value of the odometer cannot be reset.

### Trip Meter Check

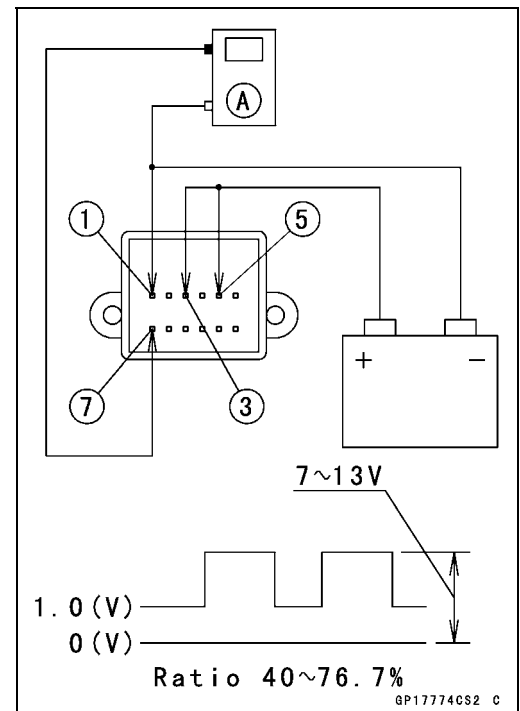
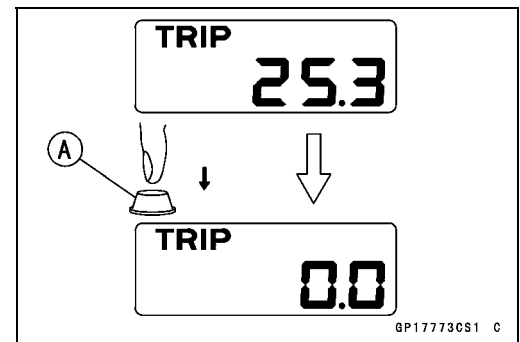
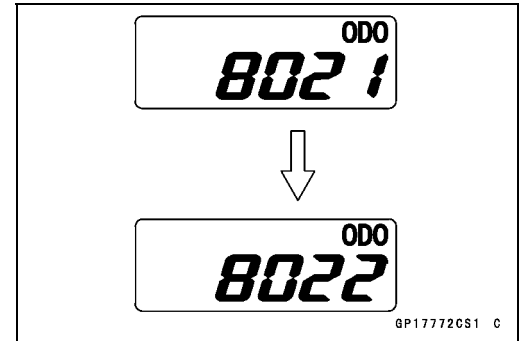
- Check the trip meter with the speedometer check in the same way.
- ★ If value indicated in the trip meter is not added, replace the meter unit.
- Check that when the MODE button [A] is pushed for more than two seconds, the figure display turns to 0.0.
- ★ If the figure display does not indicate 0.0, replace the meter unit.

#### NOTE

- The integrated value of the odometer cannot be reset.

### Tachometer Check

- Connect the 12 V battery and terminals in the same manner as specified in the "Liquid Crystal Display (LCD) Segments Check".
- When the terminals are connected, the tachometer needle momentary goes from the minimum to the maximum, then goes back from the maximum to the minimum reading.
- ★ If the needle function does not work, replace the meter unit.
- The revolutions per minute (rpm) equivalent to the input frequency is indicated in the oscillator [A] if the square wave (illustrated as shown in the figure) would be input into the terminal [7].
- Indicates approximately 6 000 rpm in case the input frequency would be approximately 200 Hz.



## 15-68 ELECTRICAL SYSTEM

### Meter Unit

★ If the oscillator is not available, the tachometer can be checked as follows.

○ Connect the 12 V battery and terminals in the same manner as specified in the "Liquid Crystal Display (LCD) Segments Check".

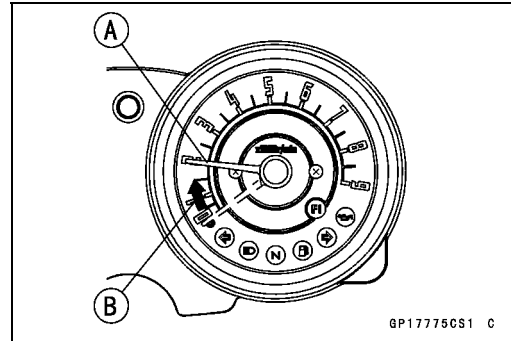
○ When the terminals are connected, the tachometer needle momentarily goes from minimum to the maximum, then goes back from the maximum to the minimum reading.

★ If the needle function does not work, replace the meter unit.

○ Using the insulated auxiliary lead, quickly open and connect the terminal [3] to the terminal [7] repeatedly.

○ Then the tachometer needle [A] should flick [B].

★ If the needle does not flick, replace the meter unit.



### Lights (LED) Inspection

Illumination Light (LED) [A]

Left Turn Signal Indicator Light (LED) [B]

High Beam Indicator Light (LED) [C]

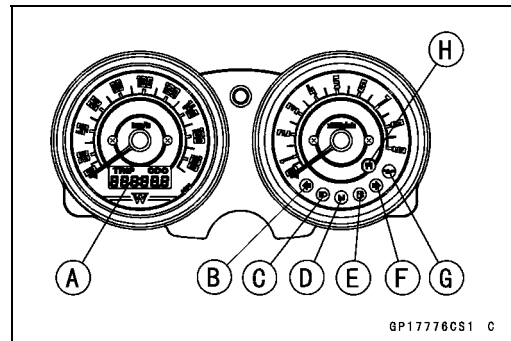
Neutral Indicator Light (LED) [D]

Fuel Level Warning Indicator Light (LED) [E]

Right Turn Signal Indicator Light (LED) [F]

Oil Pressure Warning Indicator Light (LED) [G]

FI Indicator Light (LED) [H]



### Illumination Light (LED) Inspection

● Connect the 12 V battery and terminals in the same manner as specified in the "Liquid Crystal Display (LCD) Segments check".

○ When the terminals are connected, the illumination light (LED) should go on.

★ If the illumination light (LED) does not go on, replace the meter unit.

### Neutral Indicator Light (LED) Inspection

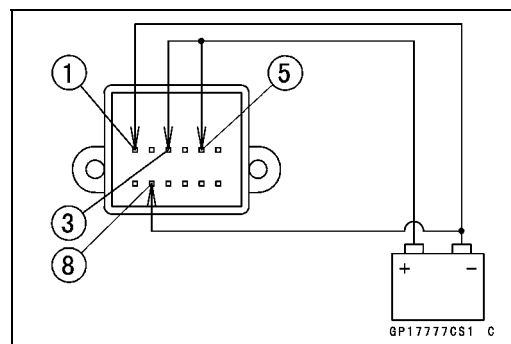
● Connect the 12 V battery and terminals in the same manner as specified in the "Liquid Crystal Display (LCD) Segments check".

● Using the insulated auxiliary lead, 12 V battery to the meter unit connector as follows.

○ Connect the battery negative (-) terminal to the terminal [8].

○ When the terminals are connected, the neutral indicator light (LED) should go on.

★ If the neutral indicator light (LED) does not go on, replace the meter unit.

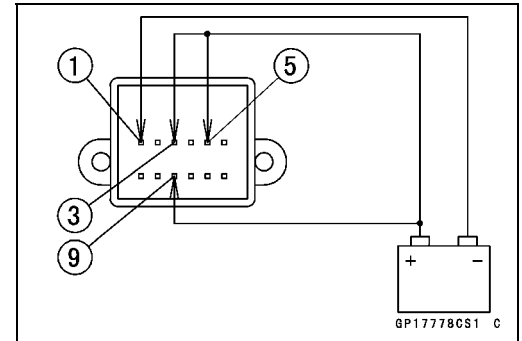


## Meter Unit

### Left Turn Signal Indicator Light (LED) Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Liquid Crystal Display (LCD) Segments check”.
- Using the insulated auxiliary lead, 12 V battery to the meter unit connector as follows.
  - Connect the battery positive (+) terminal to the terminal [9].
  - When the terminals are connected, the left turn signal indicator light (LED) should go on.

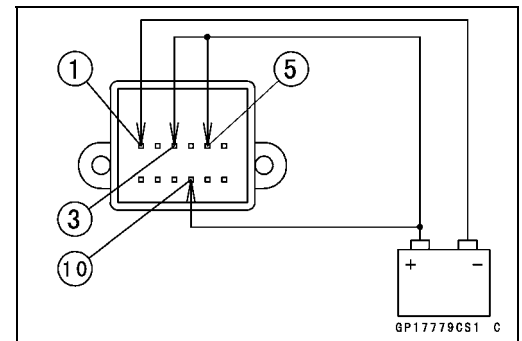
★ If the left turn signal indicator light (LED) does not go on, replace the meter unit.



### Right Turn Signal Indicator Light (LED) Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Liquid Crystal Display (LCD) Segments check”.
- Using the insulated auxiliary leads, 12 V battery to the meter unit connector as follows.
  - Connect the battery positive (+) terminal to the terminal [10].
  - When the terminals are connected, the right turn signal indicator light (LED) should go on.

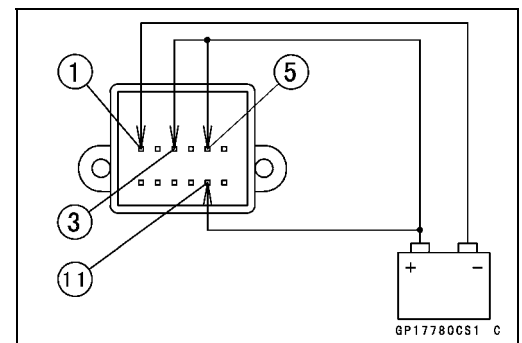
★ If the right turn signal indicator light (LED) does not go on, replace the meter unit.



### High Beam Indicator Light (LED) Inspection

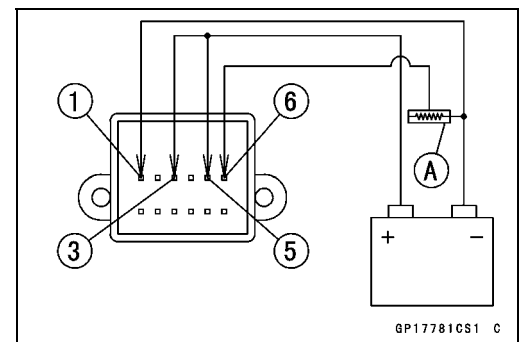
- Connect the 12 V battery and terminals in the same manner as specified in the “Liquid Crystal Display (LCD) Segments check”.
- Using the insulated auxiliary lead, 12 V battery to the meter unit connector as follows.
  - Connect the battery positive (+) terminal to the terminal [11].
  - When the terminals are connected, the high beam indicator light (LED) should go on.

★ If the high beam indicator light (LED) does not go on, replace the meter unit.



### Fuel Level Warning Indication Light (LED) Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Liquid Crystal Display (LCD) Segments check”.
- Connect the variable rheostat [A] to the terminal [6] as shown in the figure.
- Adjust the resistance value to the approximately 20  $\Omega$ .

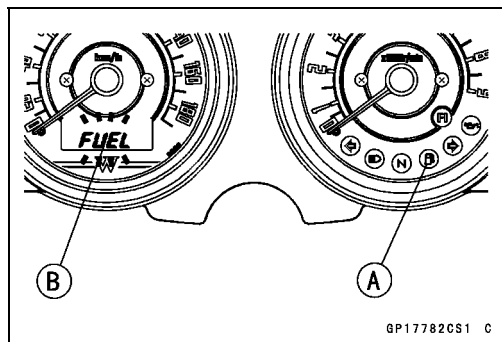


# 15-70 ELECTRICAL SYSTEM

## Meter Unit

○When the terminals are connected, the fuel level warning indicator light (LED) [A] should go on and FUEL segment [B] blinks in the display.

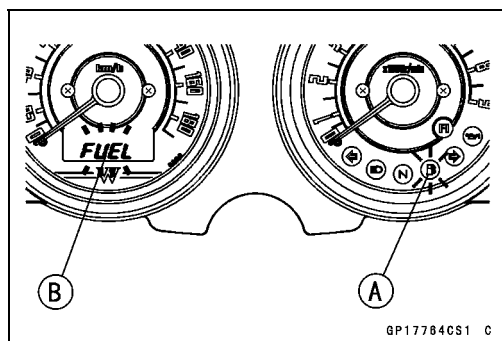
★If the fuel level warning indicator light (LED) does not go on and/or the FUEL segment does not display, replace the meter unit.



● Disconnect the terminal [6].

○When the terminals are disconnected, the fuel level warning indicator light (LED) [A] and the FUEL segment [B] blink.

★If the fuel level warning indicator light (LED) does not blink and/or the FUEL segment does not display, replace the meter unit.



### FI Indicator Light (LED) Inspection

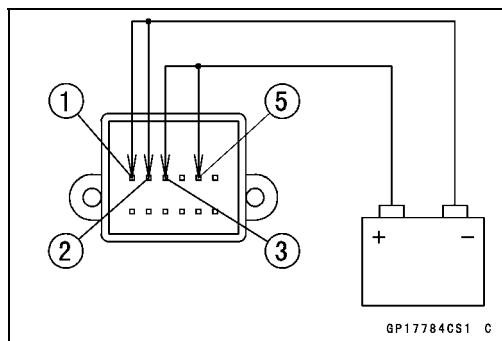
● Connect the 12 V battery and terminals in the same manner as specified in the “Liquid Crystal Display (LCD) Segments check”.

● Using the insulated auxiliary lead, 12 V battery to the meter unit connector as follows.

○Connect the battery negative (–) terminal to the terminal [2].

○When the terminals are connected, the FI indicator light (LED) should go on.

★If the FI indicator light (LED) does not go on, replace the meter unit.



### Oil Pressure Warning Indicator Light (LED) Inspection

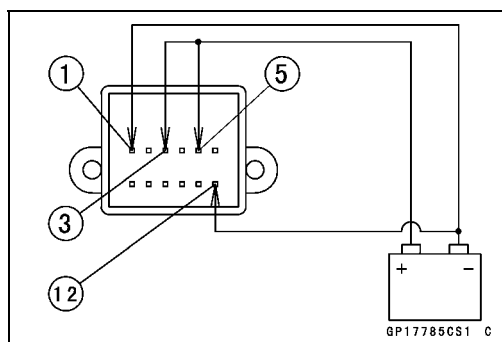
● Connect the 12 V battery and terminals in the same manner as specified in the “Liquid Crystal Display (LCD) Segments check”.

● Using the insulated auxiliary lead, 12 V battery to the meter unit connector as follows.

○Connect the battery negative (–) terminal to the terminal [12].

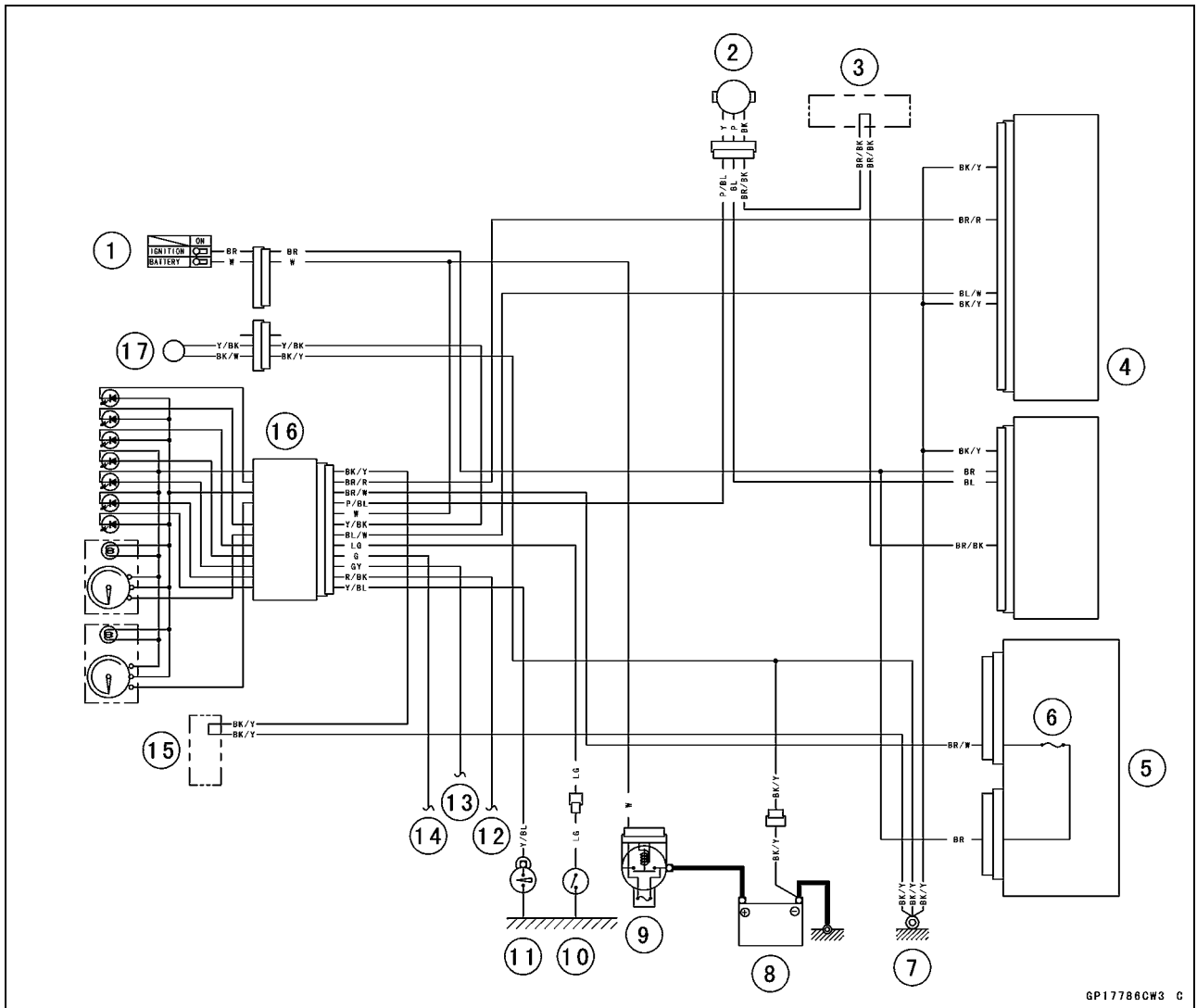
○When the terminals are connected, the oil pressure warning indicator light (LED) should go on.

★If the oil pressure warning indicator light (LED) does not go on, replace the meter unit.



Meter Unit

Meter Unit Circuit



GP17786CW3 C

- |                       |                                 |
|-----------------------|---------------------------------|
| 1. Ignition Switch    | 10. Neutral Switch              |
| 2. Speed Sensor       | 11. Oil Pressure Switch         |
| 3. Water-proof Joint  | 12. to Dimmer Switch            |
| 4. ECU                | 13. to Right Turn Signal Switch |
| 5. Junction Box       | 14. to Left Turn Signal Switch  |
| 6. Ignition Fuse 10 A | 15. Water-proof Joint           |
| 7. Frame Ground       | 16. Meter Unit                  |
| 8. Battery 12 V 10 A  | 17. Fuel Reserve Switch         |
| 9. Main Fuse 30 A     |                                 |

# 15-72 ELECTRICAL SYSTEM

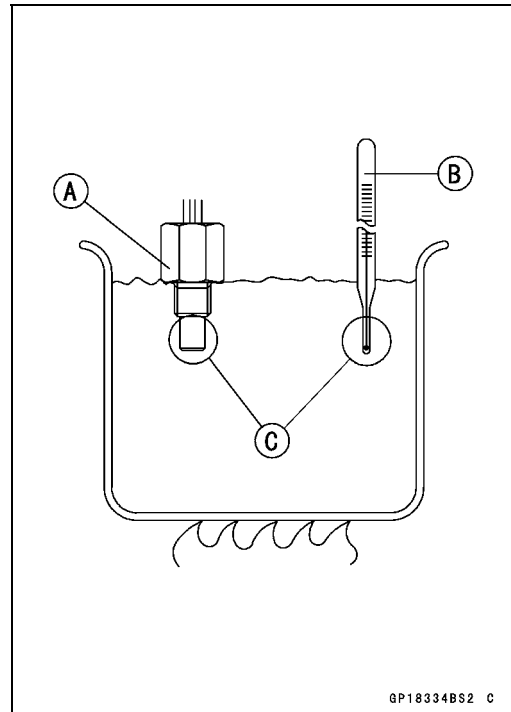
## Switches and Sensors

### Engine Temperature Sensor Inspection

- Remove the engine temperature sensor (see Engine Temperature Sensor Removal/Installation in the Fuel System (DFI) chapter).
- Suspend the sensor [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 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 the digital meter, measure the internal resistance of the sensor.
- ★ If the measurement is out of the specified range, replace the sensor.

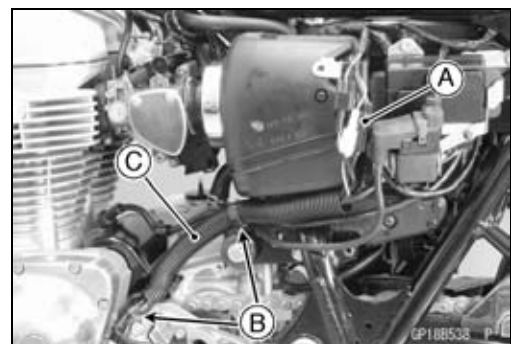


### Engine Temperature Sensor Resistance

Temperature	Resistance (kΩ)
20°C	12.17 ~ 13.92
40°C	5.704 ~ 6.724
60°C	2.893 ~ 3.502
80°C	1.569 ~ 1.945
100°C	0.9025 ~ 1.142
120°C	0.5460 ~ 0.7041
140°C	0.3453 ~ 0.4530

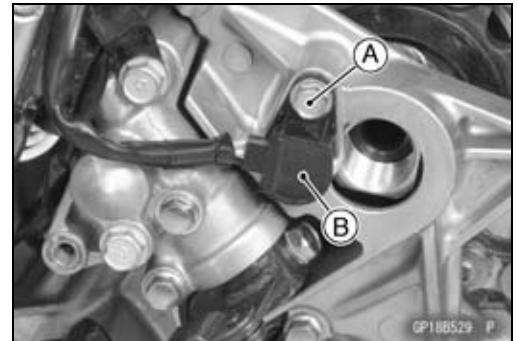
### Speed Sensor Removal

- Remove:
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal in the Final Drive chapter)
  - Left Side Cover (see Left Side Cover Removal in the Frame chapter)
  - Bolt [A]
- Disconnect the speed sensor lead connector [A].
- Open the clamps [B].
- Clear the speed sensor lead from the lead protective tube [C].



## Switches and Sensors

- Remove:
  - Speed Sensor Mounting Bolt [A]
  - Speed Sensor [B]

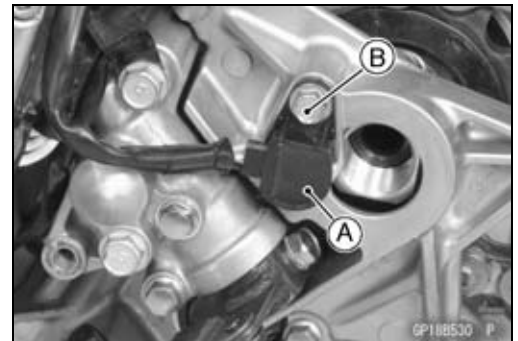


### Speed Sensor Installation

- Install the speed sensor [A].
- Apply non-permanent locking agent to the threads of the speed sensor mounting bolt [B] and tighten it.

**Torque - Speed Sensor Mounting Bolt: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

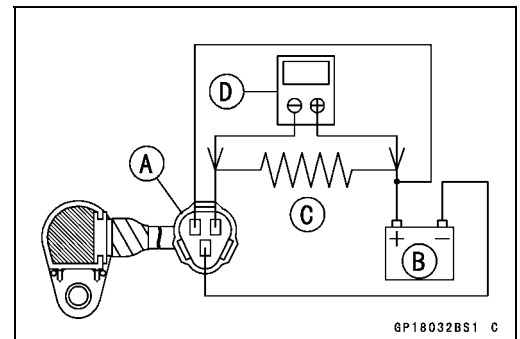
- Run the speed sensor lead correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Install the removed parts (see appropriate chapters).



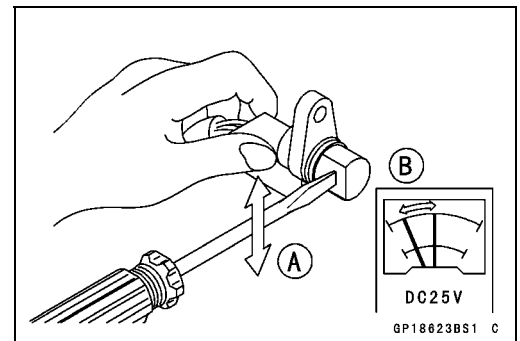
### Speed Sensor Inspection

- Remove the speed sensor (see Speed Sensor Removal).
- Connect the speed sensor connector [A] with the battery [B], 10 kΩ resistor [C] and hand tester [D] as shown in the figure.
- Set the tester to the DC 25 V range.

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

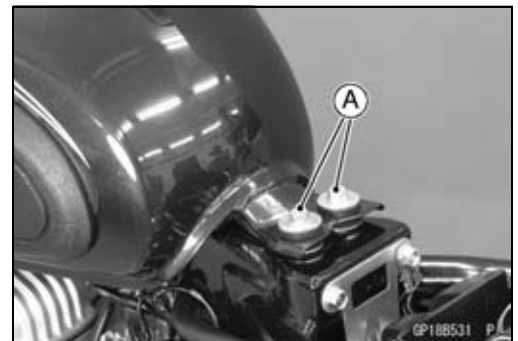


- Trace [A] each side of the speed sensor surface with a standard tip screwdriver.
- Then the tester indicator should flick [B].
- ★ If the tester indicator does not flick, replace the speed sensor.



### Fuel Reserve Switch Inspection

- Fill the fuel tank with fuel and close the fuel tank cap.
- Remove the bolts [A] and washers.



## 15-74 ELECTRICAL SYSTEM

### Switches and Sensors

- Lift up the rear portion of the fuel tank, and then disconnect the fuel reserve switch lead connector [A].



- Connect the test light [A] (12 V 3.4 W bulb in a socket with leads) and the 12 V battery [B] to the fuel reserve switch lead connector [C].

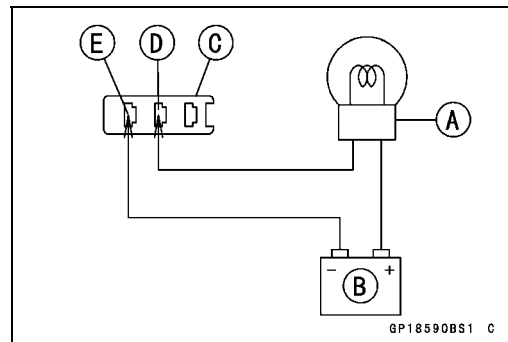
#### Connections:

**Battery (+) → 12 V 3.4 W Bulb (One Side)**

**12 V 3.4 W Bulb (Other Side) → Y/BK lead [D]**

**Battery (-) → BK/W lead [E]**

- ★ If the test light turn on, the replace the fuel reserve switch.



- Draw the fuel out from the fuel tank with a commercially available pump (see Fuel Tank Removal in the Fuel System (DFI) chapter).
- Connect the test light (12 V 3.4 W bulb in a socket with leads) and the 12 V battery to the fuel reserve switch lead connector in the same way again.

#### Connections:

**Battery (+) → 12 V 3.4 W Bulb (One Side)**

**12 V 3.4 W Bulb (Other Side) → Y/BK lead**

**Battery (-) → BK/W lead**

- ★ If the test light does not light, replace the fuel reserve switch.

### NOTE

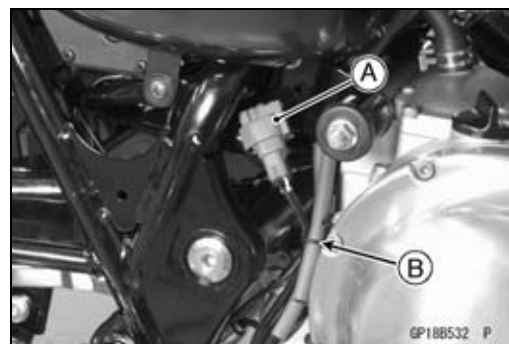
○ It may take a long time to turn on the test light in case that the fuel reserve switch is inspected just after the fuel is drawn. Leave the fuel reserve switch lead connector with leads for inspection connected for few minutes.

### Oxygen Sensor Removal

- Disconnect the oxygen sensor lead connector [A].
- Clear the oxygen sensor lead from the clamp [B].

#### NOTICE

**Do not pull strongly, twist, or bend the oxygen sensor lead. This may cause the wiring open.**





## Switches and Sensors

- Remove the oxygen sensor [A].

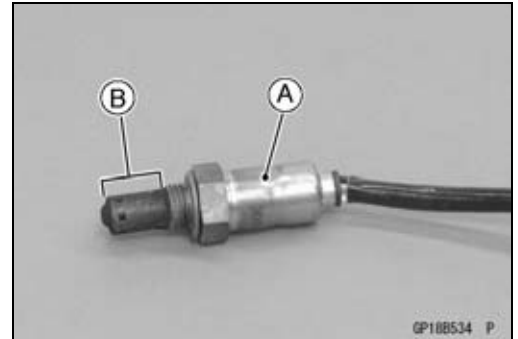


### Oxygen Sensor Installation

#### NOTICE

Never drop the oxygen sensor [A] especially on a hard surface. Such a shock to the unit can damage it.

Do not touch the sensing part [B] to prevent oil contact. Oil contamination from hands can reduce sensor performance.



- Tighten:
  - Torque - Oxygen Sensor: 25 N·m (2.5 kgf·m, 18 ft·lb)
- Run the oxygen sensor lead correctly (see Cable, Wire and Hose Routing section in the Appendix chapter).

### Oxygen Sensor Inspection

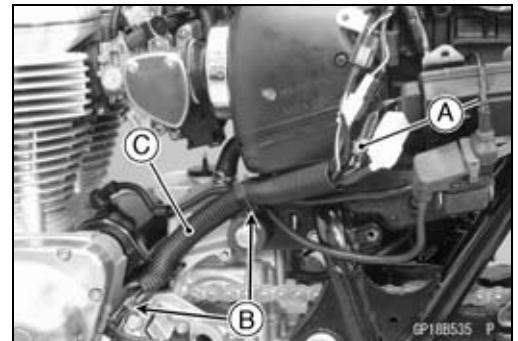
- Refer to the Oxygen Sensor Inspection in the Fuel System (DFI) chapter.

### Oxygen Sensor Heater Inspection

- Refer to the Oxygen Sensor Heater Inspection in the Fuel System (DFI) chapter.

### Sidestand Switch Removal

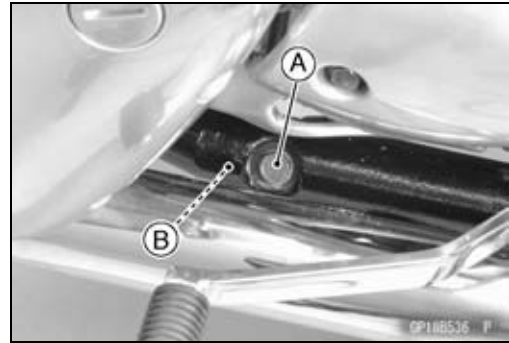
- Remove:
  - Engine Sprocket Cover (see Engine Sprocket Cover Removal in the Final Drive chapter)
  - Left Side Cover (see Left Side Cover Removal in the Frame chapter)
  - Junction Box with Bracket (see Alternator Cover Removal)
- Disconnect the sidestand switch lead connector [A].
- Open the clamps [B].
- Clear the sidestand switch lead from the lead protective tube [C].



## 15-76 ELECTRICAL SYSTEM

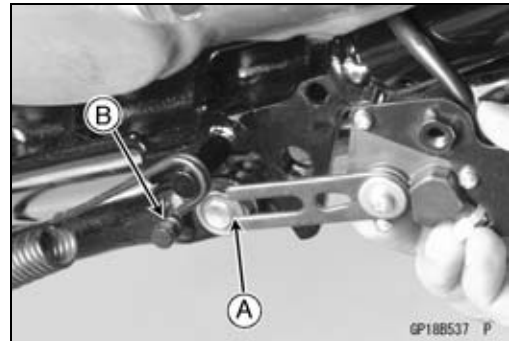
### Switches and Sensors

- Remove:
  - Sidestand Switch Bolt [A]
  - Sidestand Switch [B]



#### **Sidestand Switch Installation**

- Install the sidestand switch.
- Fit the slit [A] on the sidestand switch to the pin [B] on the sidestand.
- Apply non-permanent locking agent to the threads of the sidestand switch bolt and tighten it.
  - Torque - Sidestand Switch Bolt: 8.8 N·m (0.90 kgf·m, 78 in·lb)
- Run the sidestand switch lead correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Install the removed parts (see appropriate chapters).



#### **Sidestand Switch Operation Inspection**

- Refer to the Sidestand Switch Operation Inspection in the Periodic Maintenance chapter.

#### **Brake Light Timing Inspection**

- Refer to the Brake Light Switch Operation Inspection in the Periodic Maintenance chapter.

#### **Brake Light Timing Adjustment**

- Refer to the Brake Light Switch Operation Inspection in the Periodic Maintenance chapter.

## Switches and Sensors

### Switch Inspection

- Using a hand tester, check to see that only the connections shown in the table have continuity.

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

○ For the switch housings 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.

### Rear Brake Light Switch Connections

Rear Brake Light Switch Connections		
Color	BR	BL
When brake pedal is pushed down	○ —	○ —
When brake pedal is released		

### Sidestand Switch Connections

Sidestand Switch Connections		
Color	BK	G
When sidestand is down		
When sidestand is up	○ —	○ —

### Neutral Switch Connections

Neutral Switch Connections		
Color	SW. Terminal	Ground
When transmission is in neutral	○ —	○ —
When transmission is not in neutral		

### Oil Pressure Switch Connections\*

Oil Pressure Switch Connections *		
Color	SW. Terminal	Ground
When engine is stopped	○ —	○ —
When engine is running		

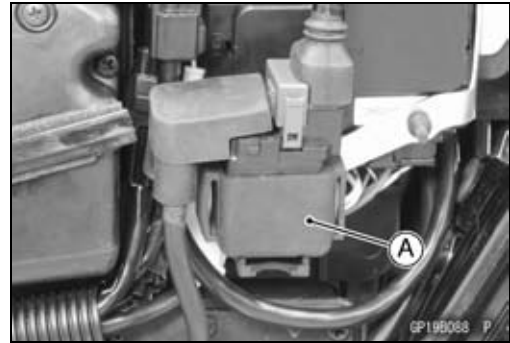
\*: Engine lubrication system is in good condition.

## 15-78 ELECTRICAL SYSTEM

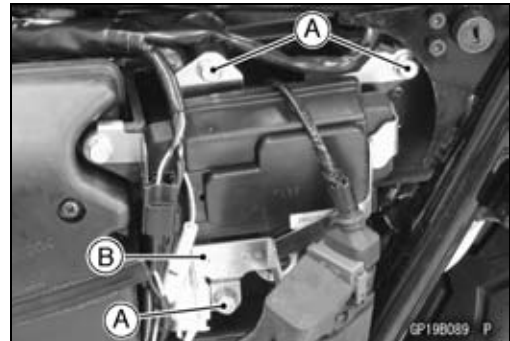
### Junction Box

#### **Junction Box Removal**

- Remove the left side cover (see Left Side Cover Removal in the Frame chapter).
- Pull out the starter relay [A] from the bracket.



- Remove:
  - Bolts [A]
  - Bracket [B]



- Disconnect the connectors [A].

#### **NOTE**

○ *The junction box has relays and diodes. The relays and diodes can not be removed.*



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## Junction Box

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### ***Junction Box Fuse Circuit Inspection***

- Remove the junction box (see Junction Box Removal).
- Inspect the fuses and replace them if they are blown.
- Inspect the continuity between the terminals.
- ★ If the measurements differ from those in the table, replace the junction box.

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

### **Fuse Circuit Inspection**

<b>Tester Connection</b>	<b>Measurement (<math>\Omega</math>)</b>
1-1A	0
1-2	0
3A-4	0
6-5	0
6-10	0
6-7	0
6-17	0
1A-8	$\infty$
2-8	$\infty$
3A-8	$\infty$
6-2	$\infty$
6-3A	$\infty$
17-3A	$\infty$

# 15-80 ELECTRICAL SYSTEM

## Junction Box

### Relay Circuit Inspection

- Remove the junction box (see Junction Box Removal).
- Check conductivity of the following numbered terminals by connecting the hand tester and one 12 V battery to the junction box as shown in the figure (see Junction Box Internal Circuit in this section).

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

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

### Relay Circuit Inspection (with the battery disconnected)

	Tester Connection	Tester Reading ( $\Omega$ )
Headlight Circuit Relay	7-8	$\infty$
	7-13	$\infty$
	9-13	Not $\infty^*$
Starter Circuit Relay	12-13	$\infty$
	11-13	$\infty$
	11-12	Not $\infty^*$

\*: The actual reading varies with the hand tester used.

### Relay Circuit Inspection (with the battery connected)

	Battery Connection (+) (-)	Tester Connection	Tester Reading ( $\Omega$ )
Headlight Relay	9-13	7-8	0

	Battery Connection (+) (-)	Tester Connection DC 25 V Range (+) (-)	Tester Reading (V)
Starter Circuit Relay	11-12	13-11	Battery Voltage

(+): Apply positive lead.

(-): Apply negative lead.

### Diode Circuit Inspection

- Remove the junction box (see Junction Box Removal).
- Check conductivity of the following pairs of terminals (see Junction Box Internal Circuit in this section).

### Diode Circuit Inspection

Tester Connection	8-13, 9-13, 11-12, 12-14, 14-15, 14-16
-------------------	--

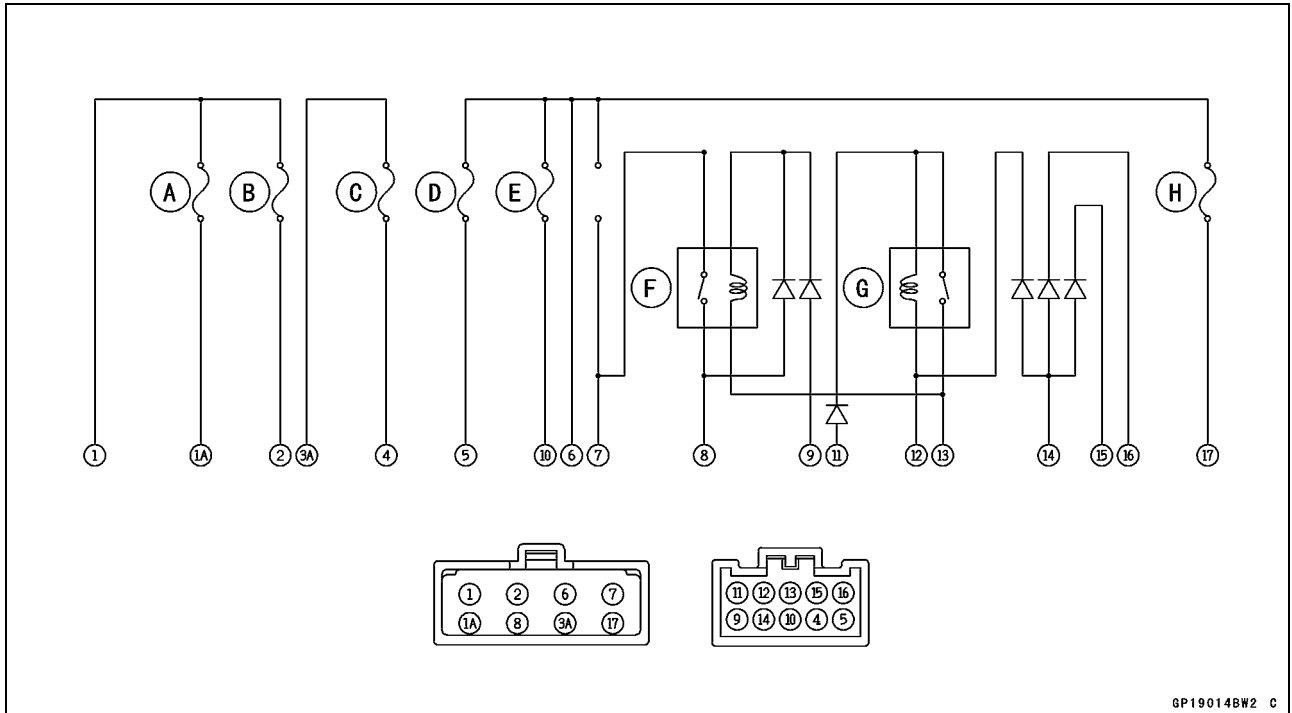
★ The resistance should be low in one direction and more than 10 times as much in the other direction. If any diode shows low or high in both directions, the diode is defective and the junction box must be replaced.

### 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.

Junction Box

Junction Box Internal Circuit



GP19014BW2 C

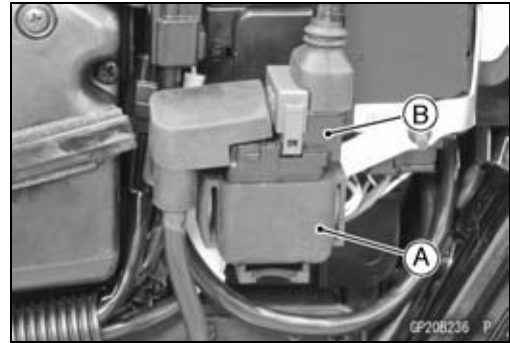
- A: ECU Fuse 10 A
- B: Headlight Fuse 10 A
- C: Turn Signal Light Fuse 10 A
- D: Horn Fuse 10 A
- E: Ignition Fuse 10 A
- F: Headlight Circuit Relay
- G: Starter Relay
- H: Taillight Fuse 10 A

## 15-82 ELECTRICAL SYSTEM

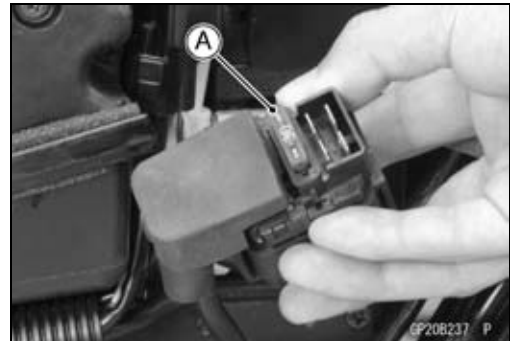
### Fuse

#### 30 A Main Fuse Removal

- Remove the left side cover (see Left Side Cover Removal in the Frame chapter).
- Pull out the starter relay [A] from the bracket.
- Disconnect the connector [B].

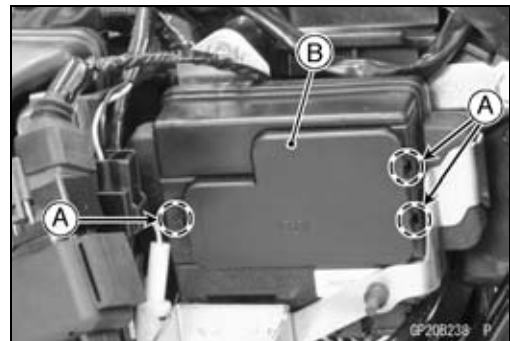


- Pull out the main fuse [A] from the starter relay with needle nose pliers.

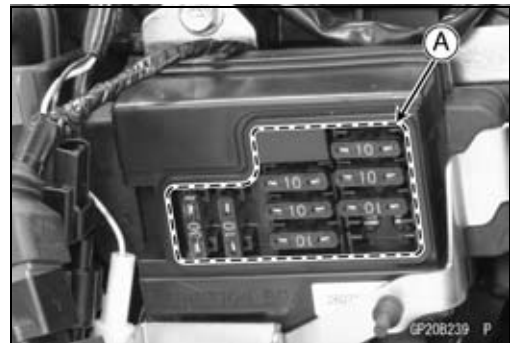


#### Junction Box Fuse Removal

- Remove:
  - Left Side Cover (see Left Side Cover Removal in the Frame chapter)
  - Starter Relay (see 30 A Main Fuse Removal)
- Unlock the hooks [A] to remove the lid [B].



- Pull the fuses [A] straight out of the fuse 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 fuses on the original position as specified on the inside of the lid.



## Fuse

### Fuse Inspection

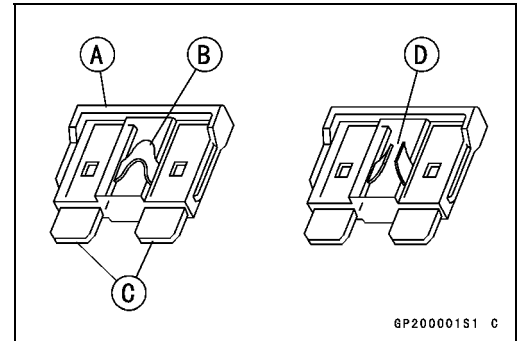
- Remove the fuse (see 30 A Main Fuse/Junction Box Fuse Removal).
- Inspect the fuse element.
- ★ If it is blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.

Housing [A]

Fuse Element [B]

Terminals [C]

Blown Element [D]



### NOTICE

**When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Installation of a fuse with a higher rating may cause damage to wiring and components.**



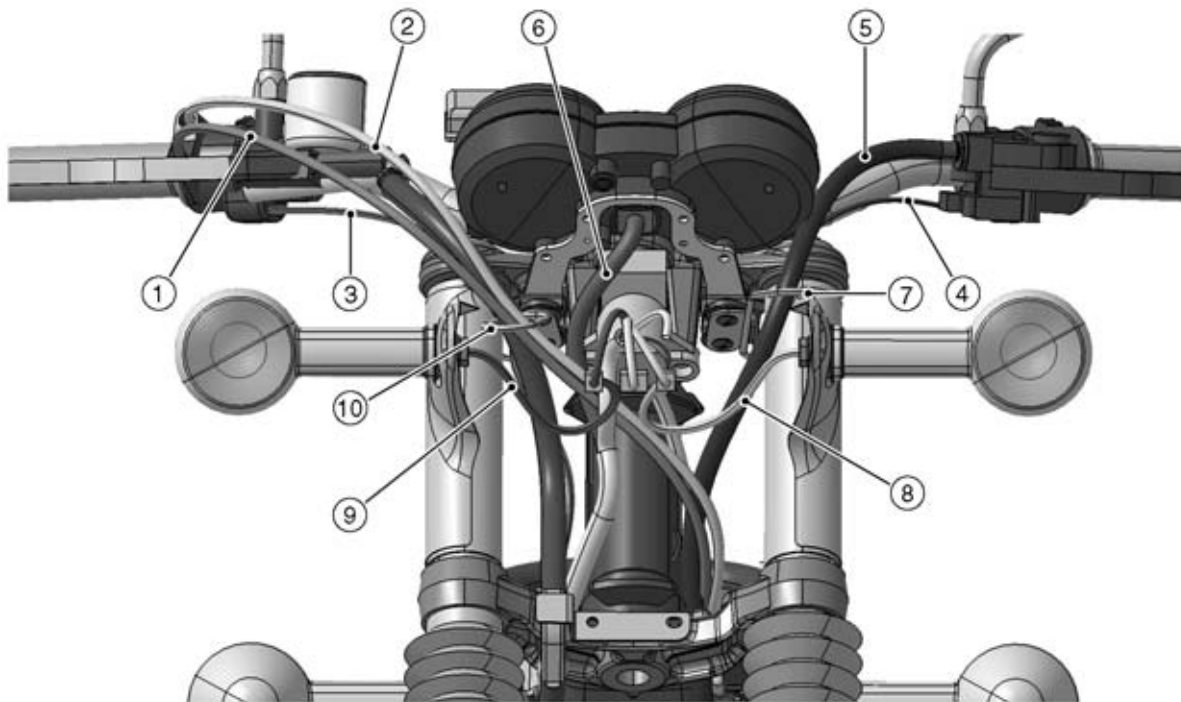
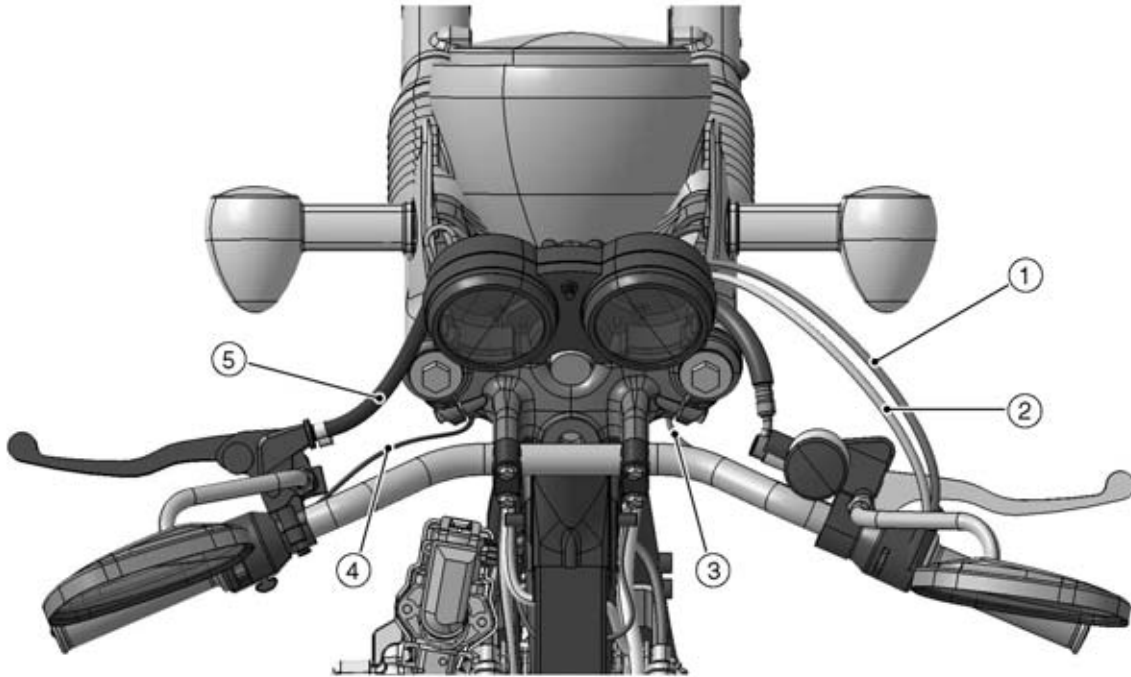
# Appendix

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Cable, Wire, and Hose Routing .....	16-2
Troubleshooting Guide .....	16-22

## 16-2 APPENDIX

### Cable, Wire, and Hose Routing



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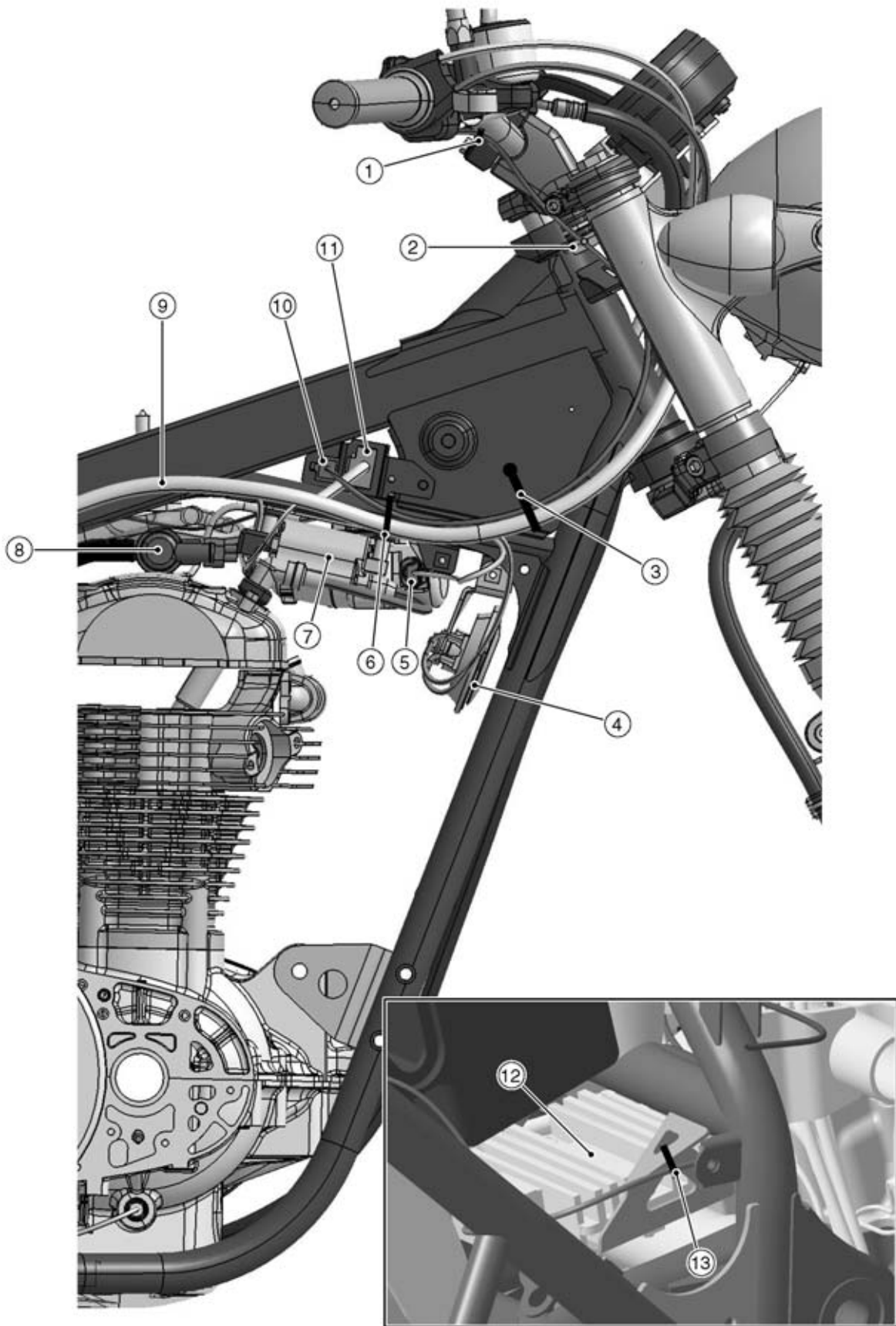
**Cable, Wire, and Hose Routing**

---

1. Throttle Cable (Decelerator)
2. Throttle Cable (Accelerator)
3. Right Switch Housing Lead
4. Left Switch Housing Lead
5. Clutch Cable
6. Meter Lead
7. Clamp (Run the clutch cable inside of the clamp.)
8. Left Turn Signal Light Lead
9. Right Turn Signal Light Lead
10. Clamp (Run the brake hose, throttle cable (accelerator) and throttle cable (decelerator) inside of the clamp.)

# 16-4 APPENDIX

## Cable, Wire, and Hose Routing



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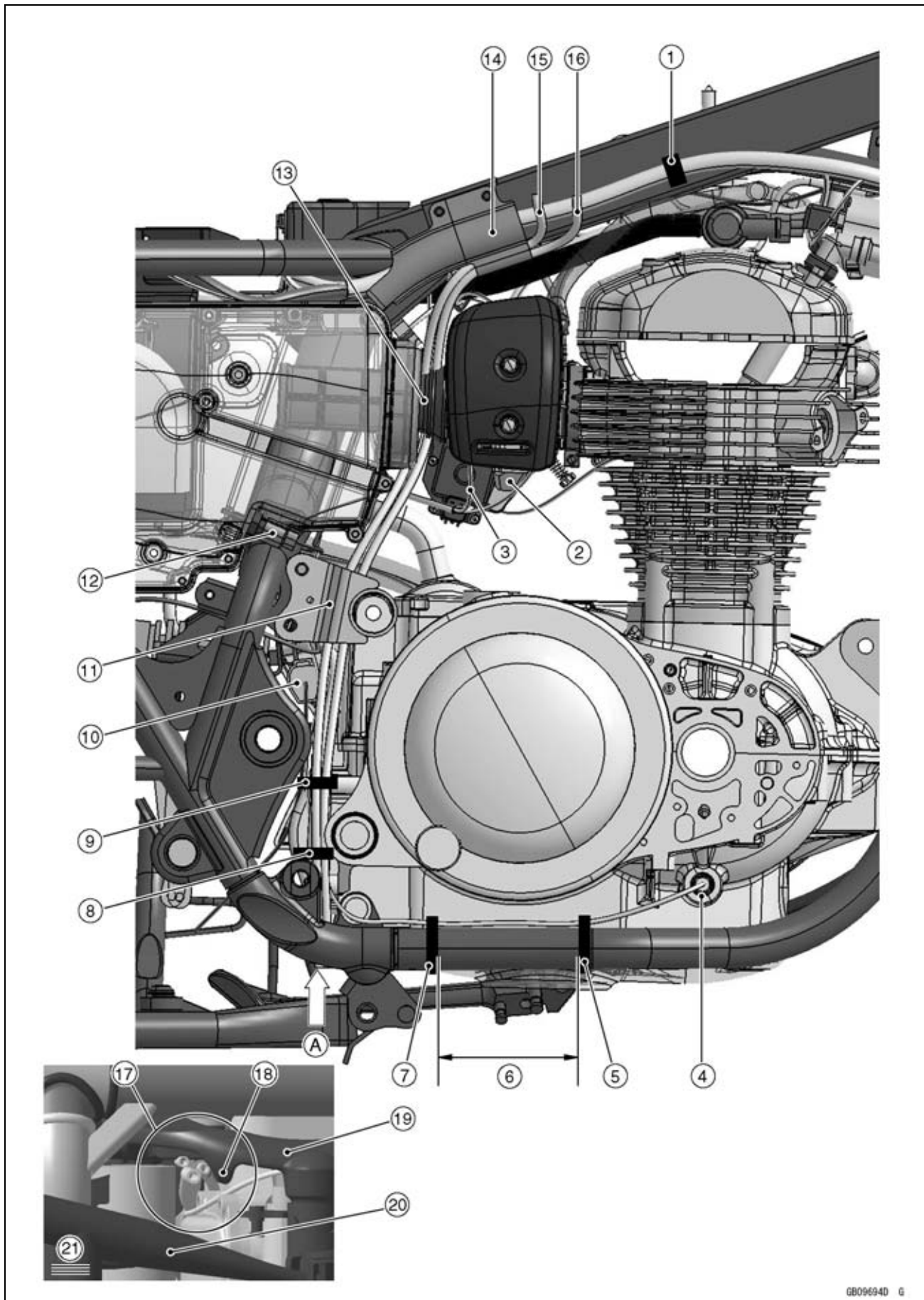
**Cable, Wire, and Hose Routing**

---

1. Clamp (Hold the right switch housing lead.)
2. Clamp (Run the right switch housing lead inside of the clamp.)
3. Clamp (Run the main harness and right switch housing lead inside of the clamp.)
4. Horn (Connect the horn lead terminals as shown in the figure.)
5. Fuel Pump Lead Connector
6. Clamp (Hold the main harness and right switch housing lead.)
7. Ignition Coil
8. Air Switching Valve
9. Main Harness
10. Right Switch Housing Lead Connector
11. Ignition Switch Lead Connector
12. Regulator/Rectifier
13. Band (Fix the taped position on the regulator/rectifier lead to the bracket.)

# 16-6 APPENDIX

## Cable, Wire, and Hose Routing





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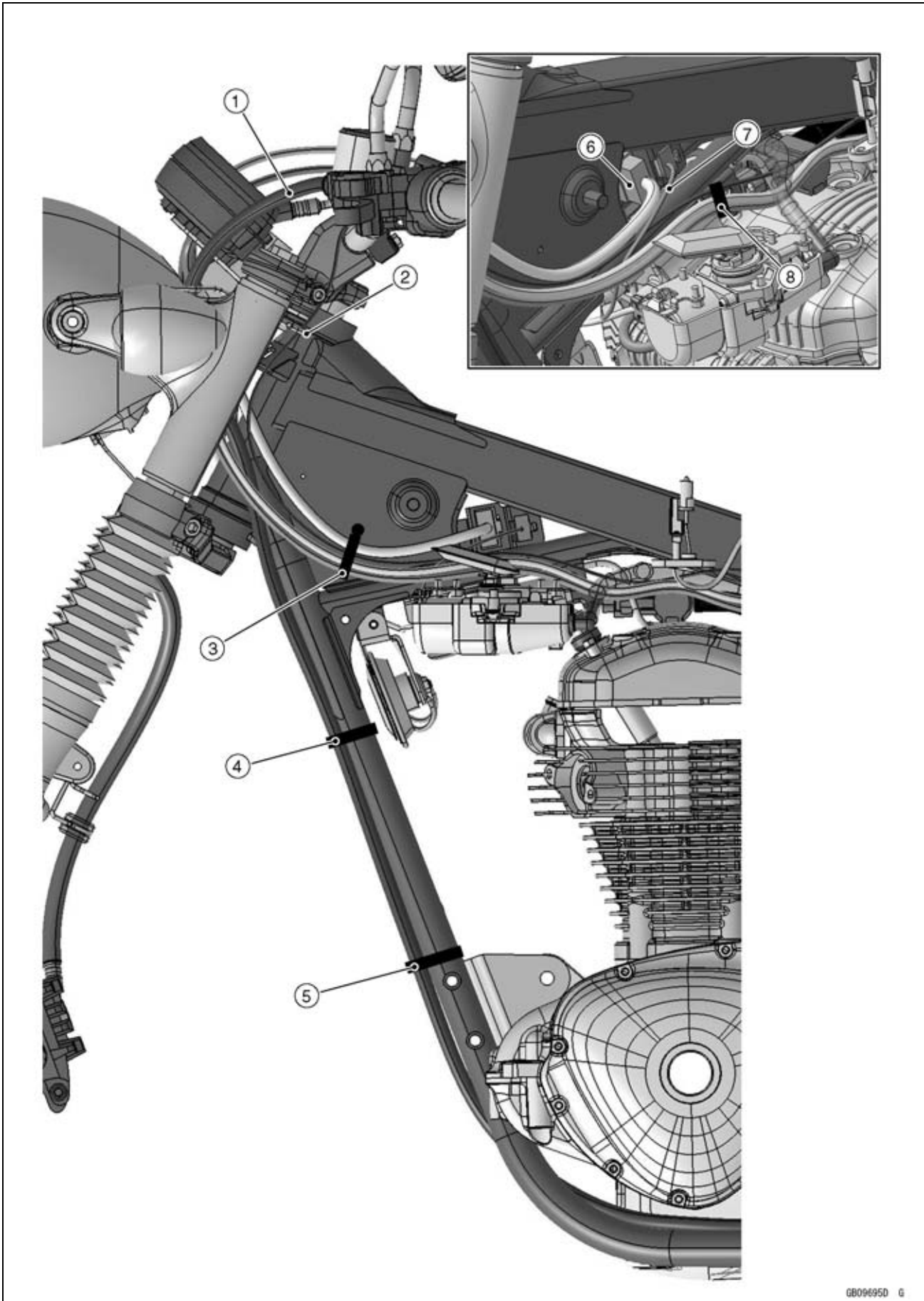
**Cable, Wire, and Hose Routing**

---

1. Band (Hold the main harness.)
2. Subthrottle Sensor
3. Main Throttle Sensor
4. Run the oil pressure switch lead as shown in the figure.
5. Band (Fix the white taped position on the oil pressure switch lead to the frame pipe.)
6. About 130 mm (5.12 in.)
7. Band (Fix the oil pressure switch lead to the frame pipe.)
8. Clamp (Hold the fuel drain hose and breather hose.)
9. Clamp (Run the air cleaner drain hose, fuel drain hose and breather hose inside of the clamp.)
10. Oxygen Sensor Lead Connector
11. Run the fuel drain hose and breather hose inside of the engine bracket.
12. Intake Air Temperature Sensor
13. Run the fuel drain hose and breather hose between the throttle body #1 and #2.
14. Run the main harness and fuel drain hose and breather hose inside of the cover.
15. Run the breather hose inside of the outside cover clamp.
16. Run the fuel drain hose inside of the inside cover clamp.
17. Run the air cleaner drain hose, fuel drain hose and breather hose to the behind the frame boss.
18. Frame Boss
19. Frame Pipe
20. Center Stand
21. Viewed A

# 16-8 APPENDIX

## Cable, Wire, and Hose Routing



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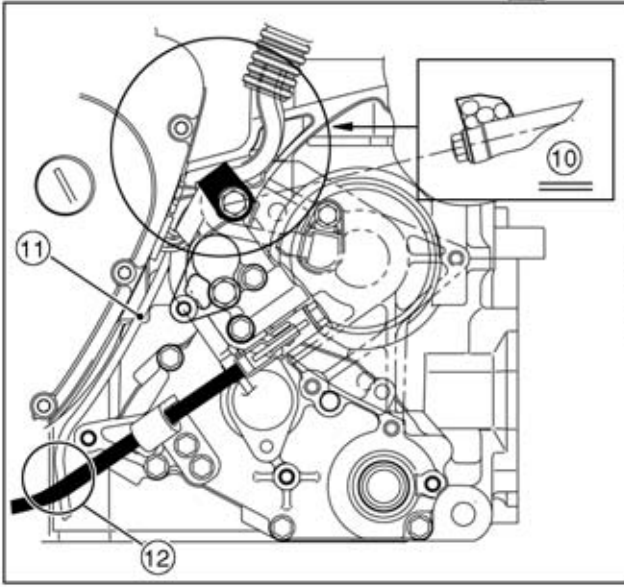
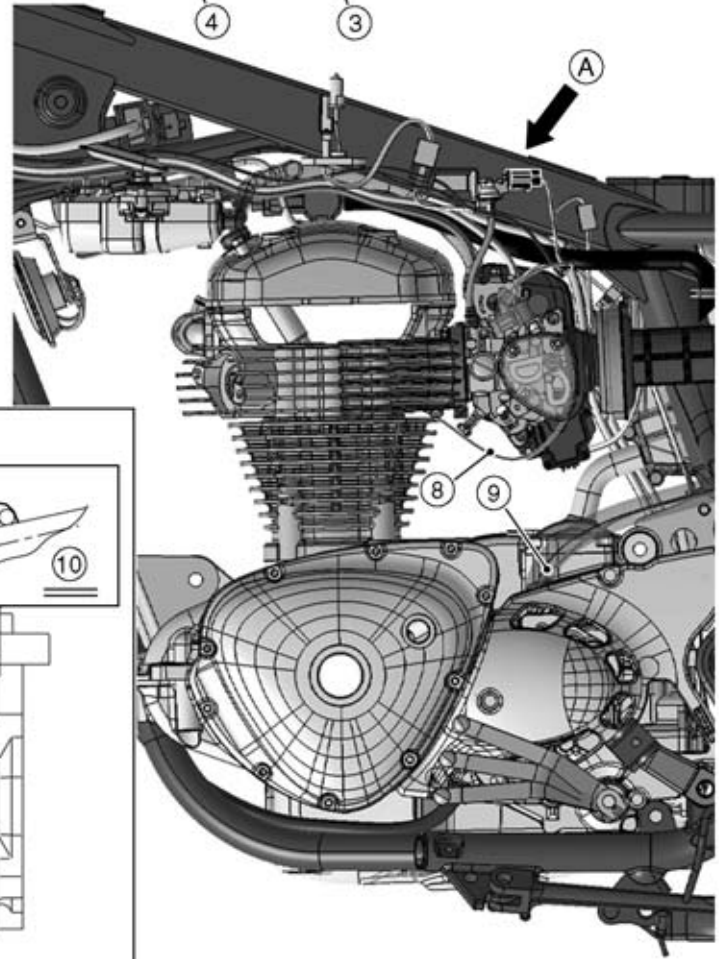
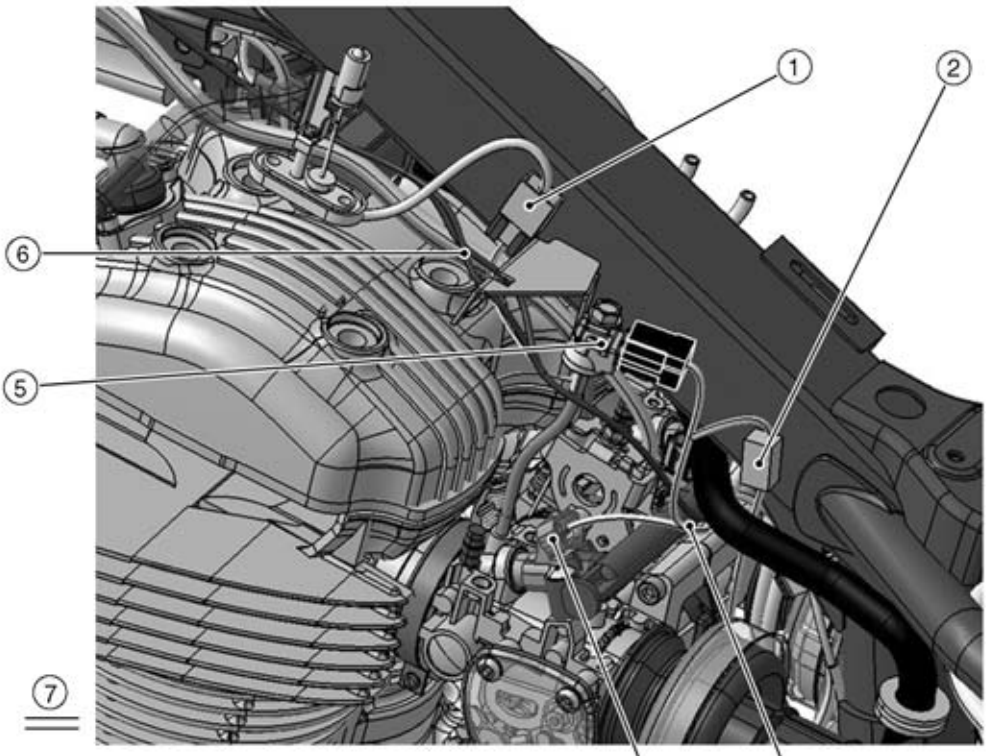
**Cable, Wire, and Hose Routing**

---

1. Clutch Cable
2. Clamp (Run the left switch housing lead inside of the clamp.)
3. Clamp (Hold the ignition switch lead, left switch housing lead and throttle cables.)
4. Clamp (Hold the clutch cable.)
5. Position the clamp upside of the engine bracket and fix the clutch cable with it.
6. Ignition Switch Lead Connector
7. Run the right switch housing lead between the throttle cables and left switch housing lead.
8. Clamp (Hold the left switch housing lead and throttle cables.)

# 16-10 APPENDIX

## Cable, Wire, and Hose Routing



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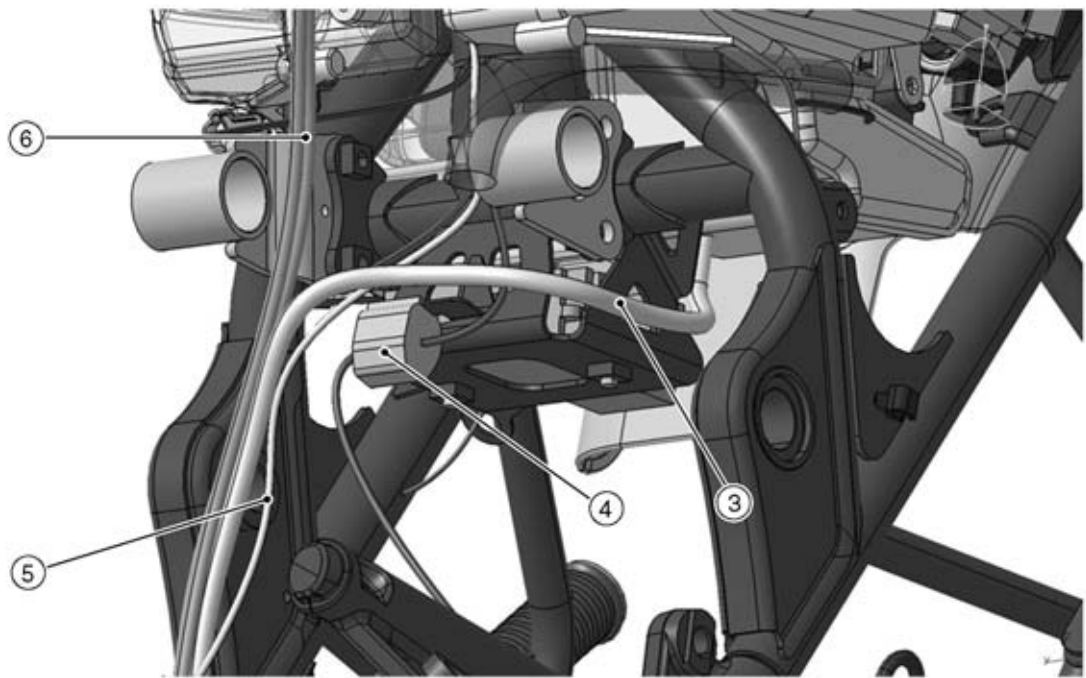
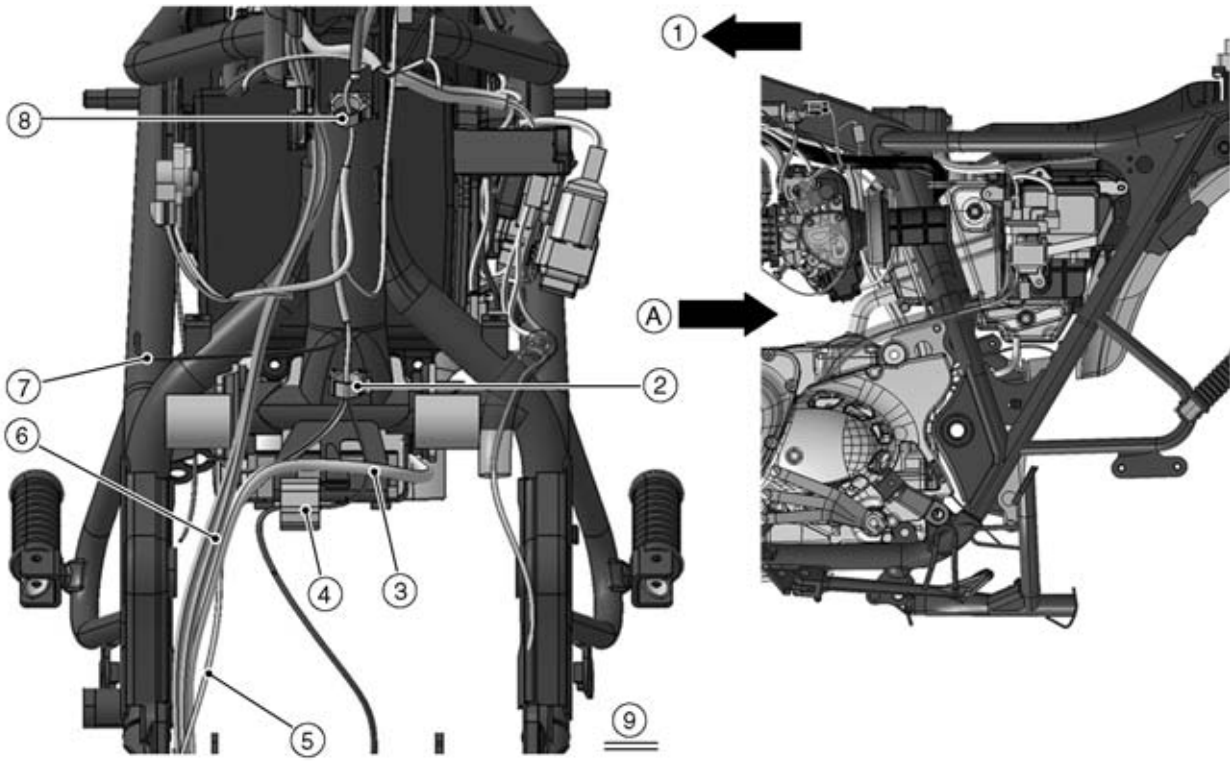
**Cable, Wire, and Hose Routing**

---

1. Fuel Reserve Switch Lead Connector
2. Engine Temperature Sensor Lead Connector
3. Run the harness under the air switching valve hose.
4. Fuel Injector #1
5. Intake Air Pressure Sensor
6. Left Switch Housing Lead
7. Viewed A
8. Run the engine temperature sensor lead between the throttle body #1 and #2.
9. Insert the protective tube end to the engine sprocket cover.
10. Bend the clamp (Hold the speed sensor lead, alternator lead, crankshaft sensor lead, neutral switch lead and sidestand switch lead.).
11. Sidestand Switch Lead
12. Run the sidestand switch lead inside of the clutch cable.

# 16-12 APPENDIX

## Cable, Wire, and Hose Routing



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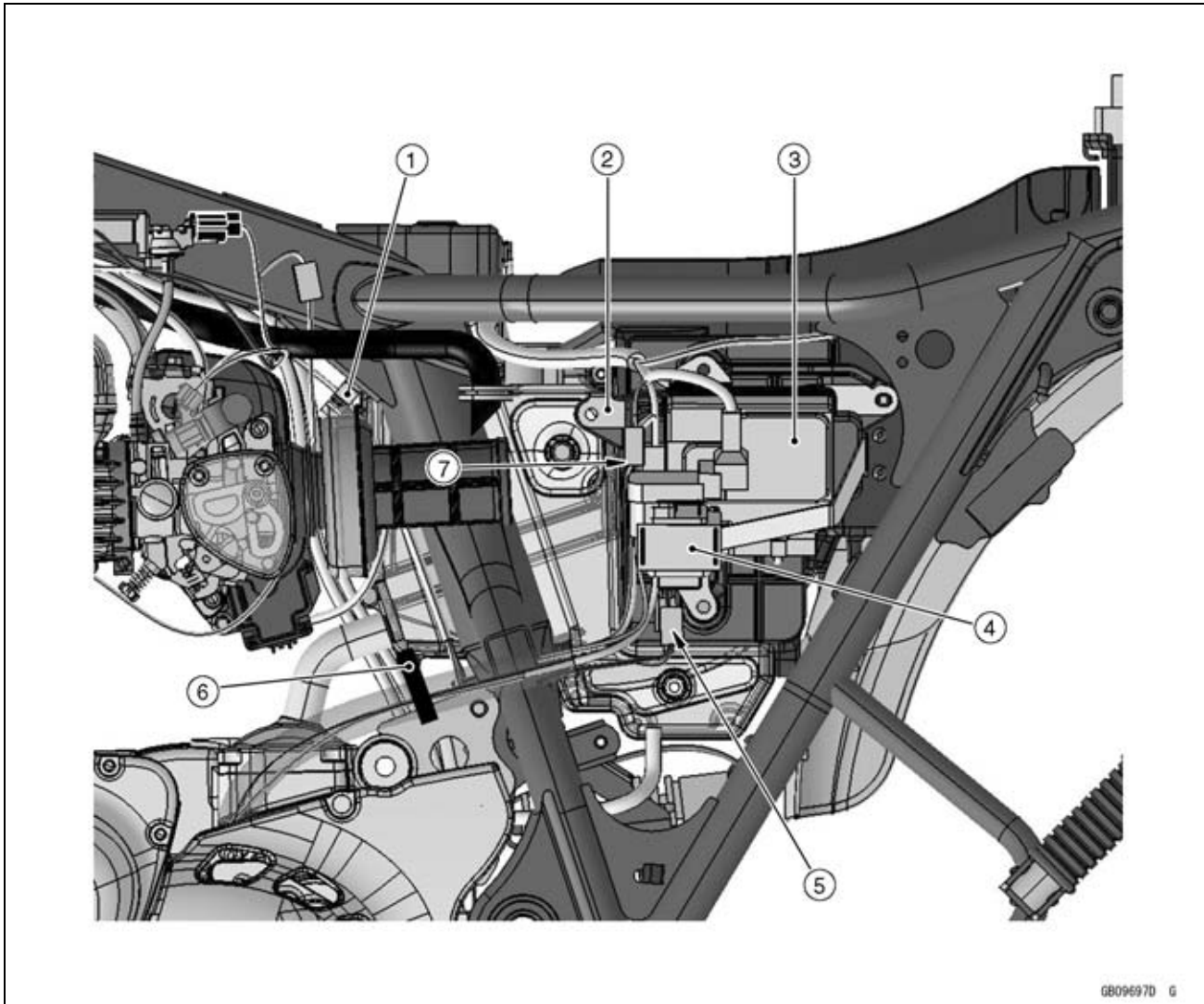
**Cable, Wire, and Hose Routing**

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1. Front
2. Clamp (Hold the main harness.)
3. Air Cleaner Drain Hose
4. Oxygen Sensor Lead Connector
5. Oil Pressure Switch Lead
6. Fuel Drain Hose and Breather Hose
7. Intake Air Temperature Sensor Lead
8. Clamp (Hold the main harness.)
9. Viewed A

## 16-14 APPENDIX

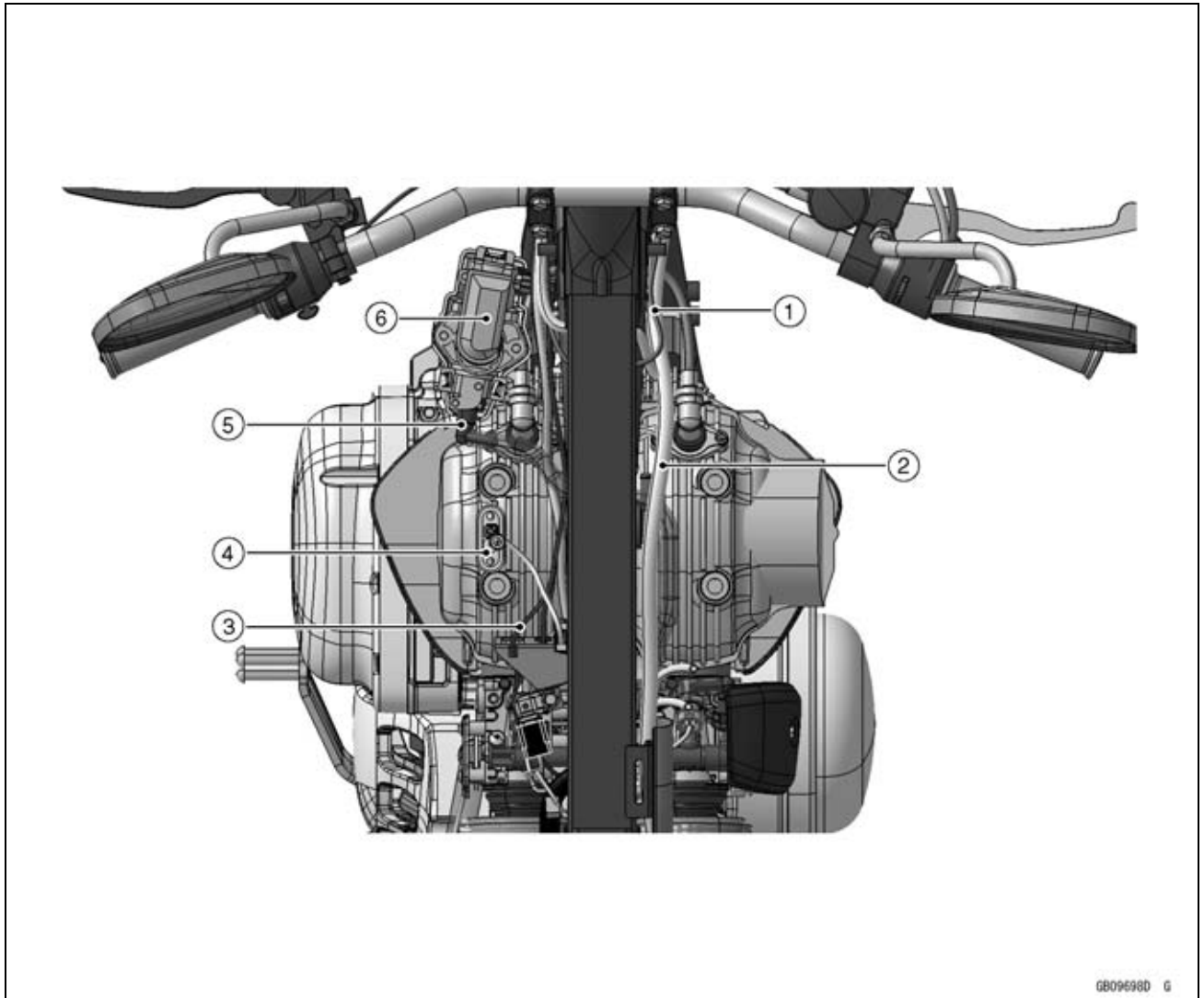
### Cable, Wire, and Hose Routing



1. Clamp
2. Bracket (Hold the crankshaft sensor connector.)
3. Junction Box
4. Starter Relay
5. Run the alternator lead and sidestand switch lead to the inside of the junction box.
6. Clamp (Hold the protective tube, starter motor cable and engine ground cable.)
7. Run the crankshaft sensor lead, neutral switch lead and speed sensor lead to the front side of the junction box.



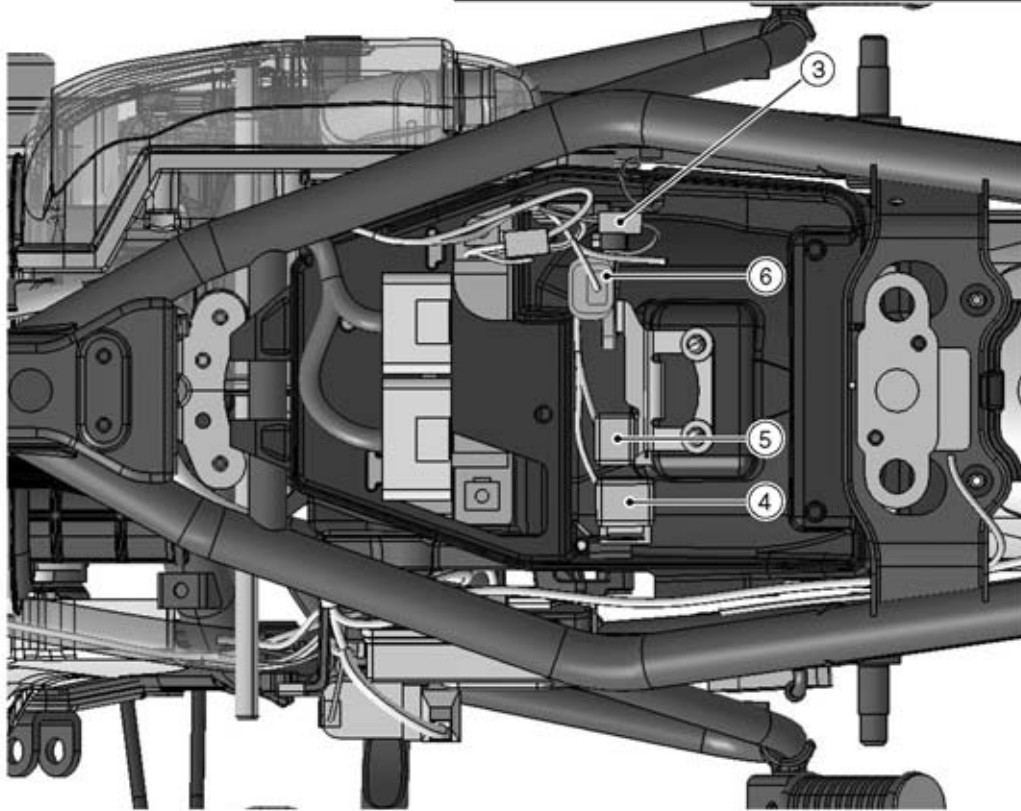
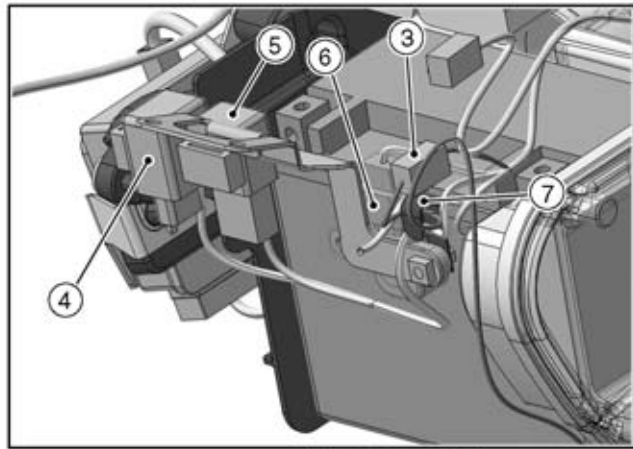
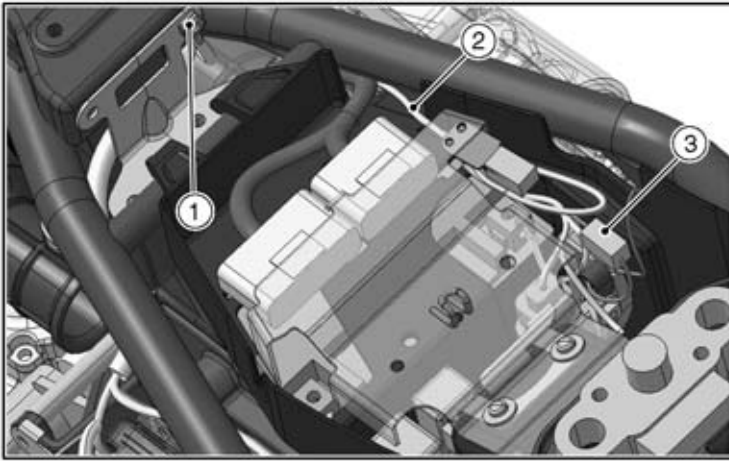
## Cable, Wire, and Hose Routing



1. Right Switch Housing Lead
2. Main Harness
3. Left Switch Housing Lead
4. Fuel Reserve Switch
5. Fuel Hose
6. Fuel Pump

# 16-16 APPENDIX

## Cable, Wire, and Hose Routing



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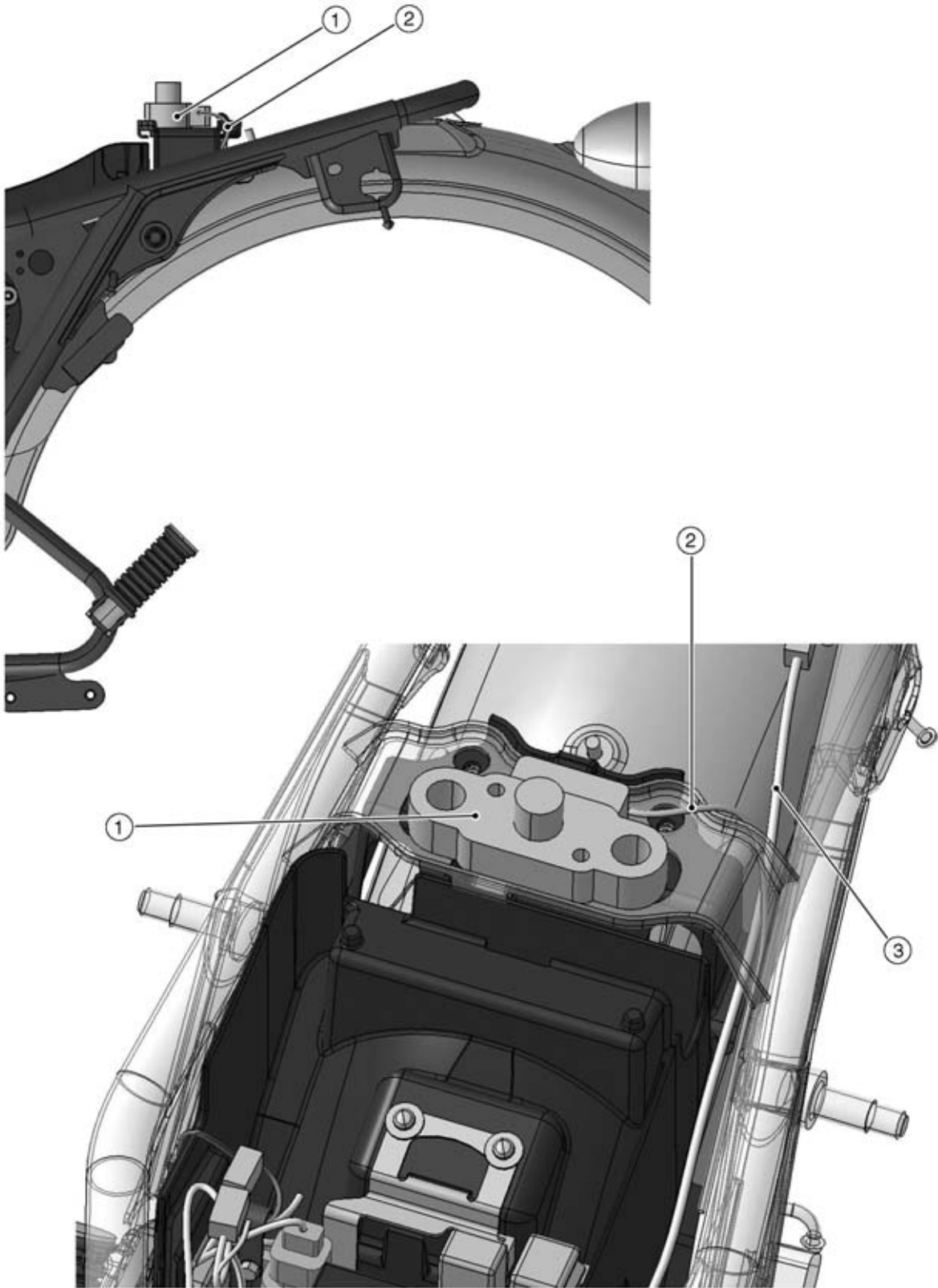
**Cable, Wire, and Hose Routing**

---

1. Frame Ground
2. Run the harness inside of the bracket.
3. Rear Brake Light Switch Lead Connector
4. Turn Signal Relay
5. ECU Main Relay
6. Vehicle-down Sensor
7. Clamp (Hold the harness and rear brake light switch lead.)

# 16-18 APPENDIX

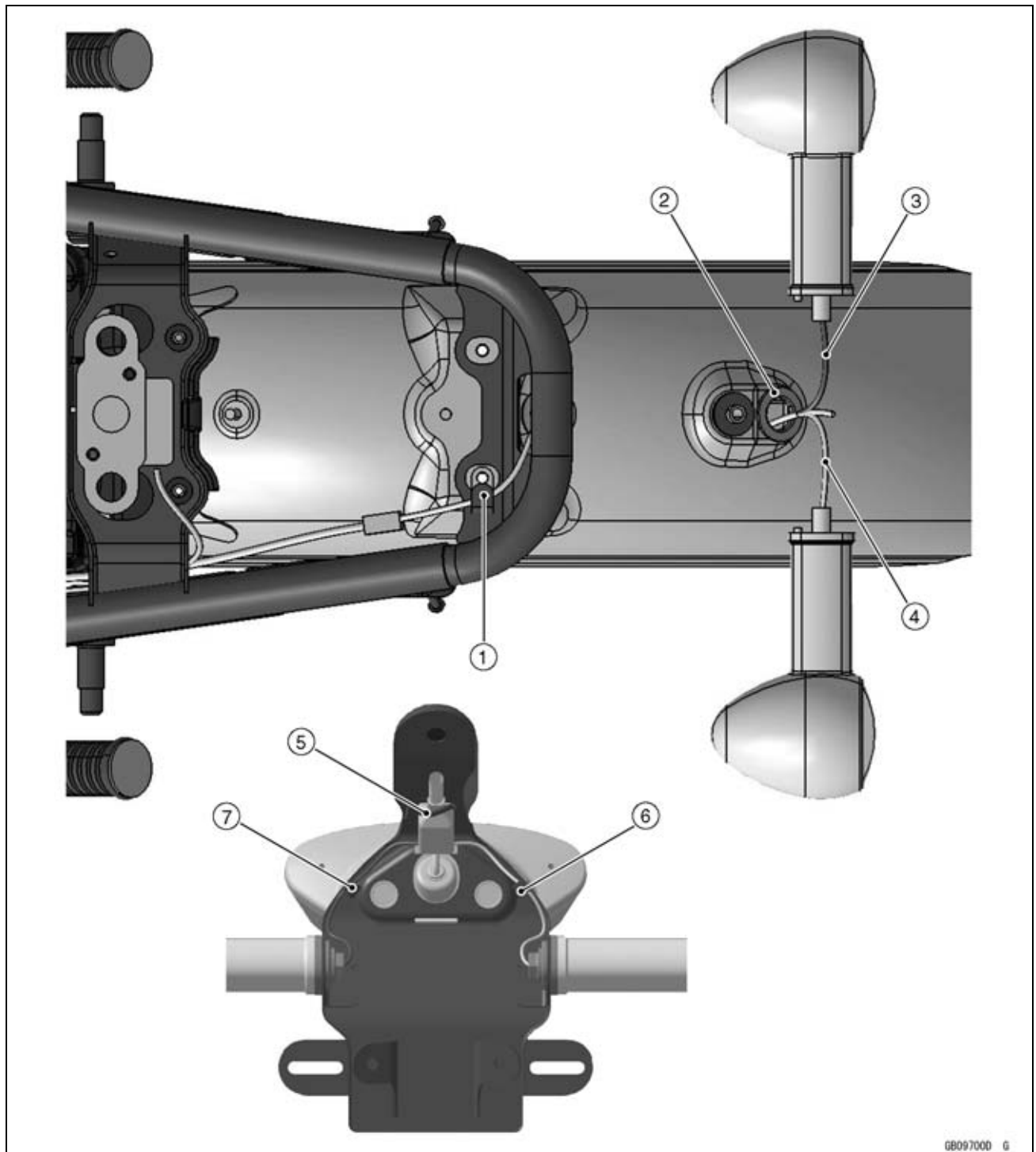
## Cable, Wire, and Hose Routing



GB097030 G

- 1. Seat Lock
- 2. Seat Lock Cable
- 3. Main Harness

## Cable, Wire, and Hose Routing

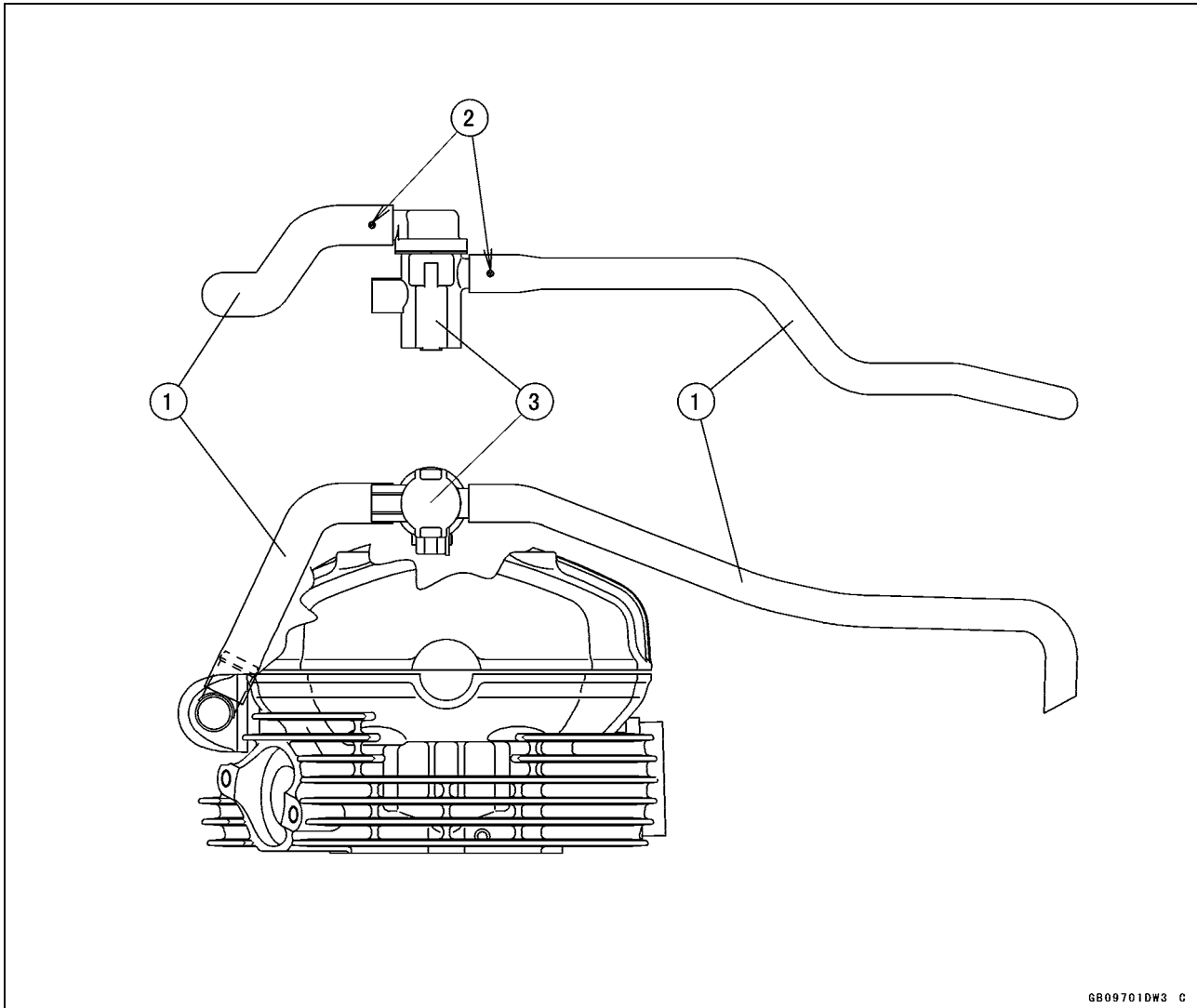


GB097000 G

1. Clamp (Hold the tail/brake light lead.)
2. Position the white tape portion on the harness on the grommet.
3. Right Turn Signal Light Lead
4. Left Turn Signal Light Lead
5. Clamp (Hold the dust cover as shown in the figure.)
6. Clamp (Hold the left turn signal light lead.)
7. Clamp (Hold the right turn signal light lead.)

## 16-20 APPENDIX

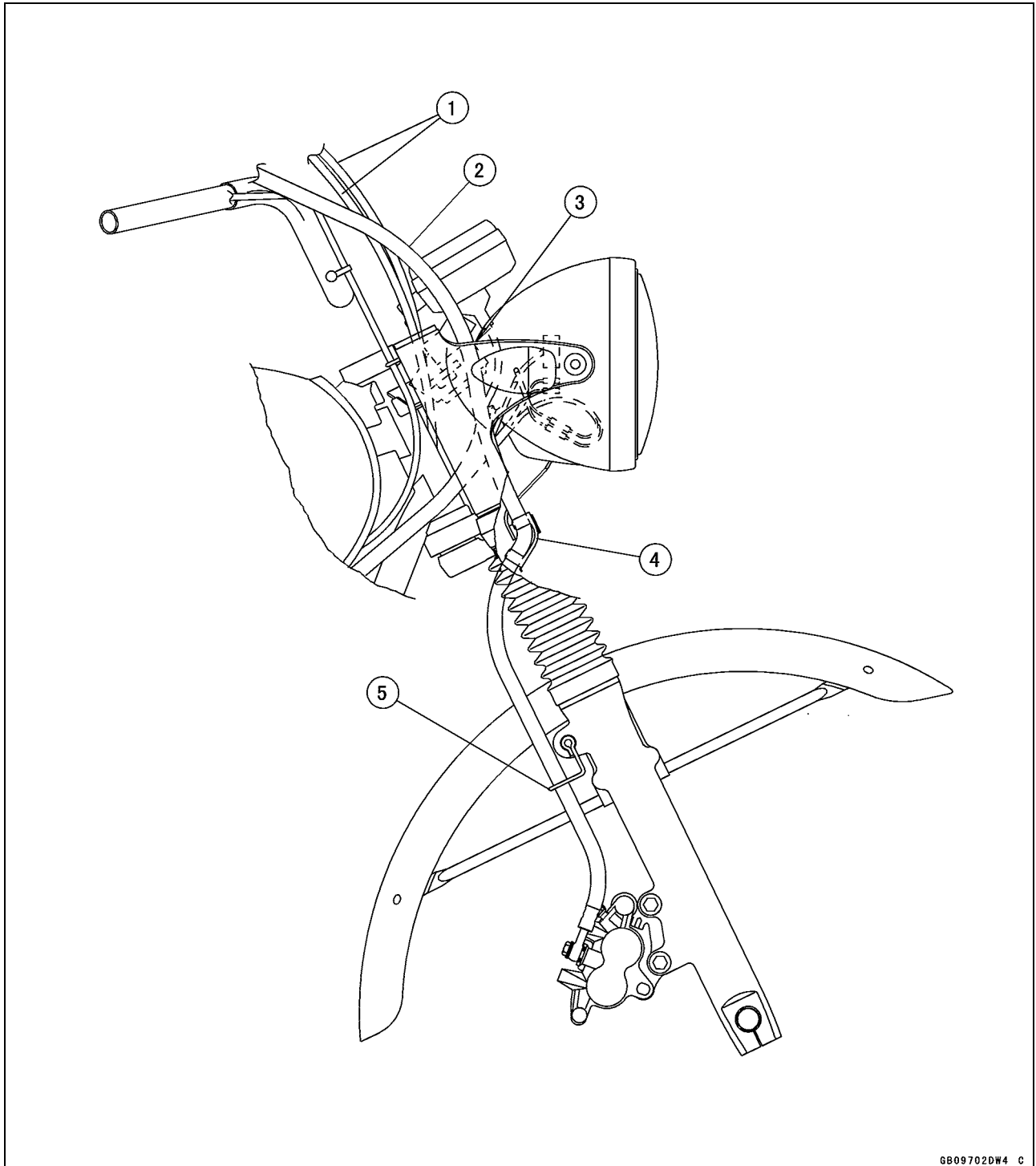
### Cable, Wire, and Hose Routing



GB09701DW3 C

1. Air Switching Valve Hoses
2. White Paint Marks (Install the air switching valve hoses so that the white paint mark faces upward.)
3. Air Switching Valve

## Cable, Wire, and Hose Routing



1. Throttle Cables
2. Brake Hose
3. Clamp (Run the throttle cables and brake hose inside of the clamp.)
4. Bracket (Hold the brake hose.)
5. Clamp (Hold the brake hose.)

## 16-22 APPENDIX

### Troubleshooting Guide

---

#### NOTE

- Refer to the *Fuel System* chapter for most of DFI trouble shooting 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:

- Ignition and engine stop switch not ON
- Starter lockout switch or neutral switch trouble
- Starter motor trouble
- Battery voltage low
- Starter relay not contacting or operating
- Starter button not contacting
- Starter system wiring shorted or open
- Ignition switch trouble
- Engine stop switch trouble
- Main 30 A or ignition fuse blown

##### Starter motor rotating but engine doesn't turn over:

- Vehicle-down sensor (DFI) coming off
- Starter clutch trouble
- Starter idle gear trouble

##### Engine won't turn over:

- Valve seizure
- Valve lifter seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Transmission gear or bearing seizure
- Camshaft seizure
- Starter idle gear 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

##### No spark; spark weak:

- Vehicle-down sensor (DFI) coming off
- Ignition switch not ON
- Engine stop switch turned OFF
- Clutch lever not pulled in or gear not in neutral
- Battery voltage low
- Spark plug dirty, broken, or gap maladjusted
- Spark plug incorrect
- Ignition coil shorted or not in good contact
- Ignition coil trouble

ECU trouble

Neutral, starter lockout, or sidestand switch trouble

Crankshaft sensor trouble

Ignition switch or engine stop switch shorted

Starter system wiring shorted or open

Main 30 A or ignition fuse blown

##### Fuel/air mixture incorrect:

Idle adjusting screw maladjusted

Air passage clogged

Air cleaner clogged, poorly sealed, or missing

Leak from oil filler cap, crankcase breather hose or air cleaner drain hose.

##### 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

No valve clearance

Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

#### Poor Running at Low Speed:

##### Spark weak:

Battery voltage low

Ignition coil trouble

Ignition coil shorted or not in good contact

Spark plug dirty, broken, or maladjusted

Spark plug incorrect

ECU trouble

Crankshaft sensor trouble

##### Fuel/air mixture incorrect:

Air passage clogged

Air bleed pipe bleed holes clogged

Pilot passage clogged

Air cleaner clogged, poorly sealed, or missing

Fuel tank air vent obstructed

Fuel pump trouble

Throttle body assy holder loose

Air cleaner duct loose

##### Compression low:

Spark plug loose

Cylinder head not sufficiently tightened down

No valve clearance

Cylinder, piston worn



## Troubleshooting Guide

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)

Camshaft cam worm

### Run-on (dieseling):

Ignition switch trouble

Engine stop switch trouble

Fuel injector trouble

Loosen terminal of battery (-) cable or ECU ground lead

Carbon accumulating on valve seating surface

Engine overheating

### Other:

ECU trouble

Engine oil viscosity too high

Drive train trouble

Brake dragging

Clutch slipping

Engine overheating

Air suction valve trouble

Air switching valve trouble

## Poor Running or No Power at High Speed:

### Firing incorrect:

Spark plug dirty, broken, or maladjusted

Spark plug incorrect

Ignition coil shorted or not in good contact trouble

Ignition coil trouble

ECU trouble

### Fuel/air mixture incorrect:

Air cleaner clogged, poorly sealed, or missing

Air cleaner duct loose

Water or foreign matter in fuel

Throttle body assy holder loose

Fuel to injector insufficient

Fuel tank air vent obstructed

Fuel line clogged

Fuel pump trouble

### Compression low:

Spark plug loose

Cylinder head not sufficiently tightened down

No valve clearance

Cylinder, piston worn

Piston ring bad (worn, weak, broken, or sticking)

Piston ring/groove clearance excessive

Cylinder head gasket damaged

Cylinder head warped

Valve spring broken or weak

Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface.)

### Knocking:

Carbon built up in combustion chamber

Fuel poor quality or incorrect

Spark plug incorrect

ECU trouble

### Miscellaneous:

Throttle valve won't fully open

Brake dragging

Clutch slipping

Engine overheating

Engine oil level too high

Engine oil viscosity too high

Drive train trouble

Camshaft cam worm

Air suction valve trouble

Air switching valve trouble

Catalytic converter melt down due to muffler overheating (KLEEN)

## Overheating:

### Firing incorrect:

Spark plug dirty, broken, or maladjusted

Spark plug incorrect

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)

For KLEEN, do not start the engine under misfire due to spark plug fouling or poor connection of the stick coil

For KLEEN, do not coast the motorcycle with the ignition switch off (Turn the ignition switch ON and run the engine)

ECU trouble

### Fuel/air mixture incorrect:

Throttle body assy holder loose

Air cleaner duct loose

Air cleaner poorly sealed, or missing

Air cleaner clogged

### Compression high:

Carbon built up in combustion chamber

### Engine load faulty:

Clutch slipping

Engine oil level too high

Engine oil viscosity too high

## 16-24 APPENDIX

### Troubleshooting Guide

---

Drive train trouble

Brake dragging

#### **Lubrication inadequate:**

Engine oil level too low

Engine oil poor quality or incorrect

#### **Clutch Operation Faulty:**

##### **Clutch slipping:**

Friction plate worn or warped

Steel plate worn or warped

Clutch spring broken or weak

Clutch hub or housing unevenly worn

No clutch lever play

Clutch inner cable trouble

Clutch release mechanism trouble

##### **Clutch not disengaging properly:**

Clutch plate warped or too rough

Clutch spring compression uneven

Engine oil deteriorated

Engine oil viscosity too high

Engine oil level too high

Clutch housing frozen on drive shaft

Clutch hub nut loose

Clutch hub spline damaged

Clutch friction plate installed wrong

Clutch lever play excessive

Clutch release mechanism trouble

#### **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 positioning lever binding

Shift return spring weak or broken

Shift return spring pin loose

External mechanism arm spring broken

External 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:**

ECU trouble

Carbon built up in combustion chamber

Fuel poor quality or incorrect

Spark plug incorrect

Overheating

##### **Piston slap:**

Cylinder/piston clearance excessive

Cylinder, piston worn

Connecting rod bent

Piston pin, piston pin hole worn

##### **Valve noise:**

Valve clearance incorrect

Valve spring broken or weak

Camshaft bearing worn

Valve lifter worn

##### **Other noise:**

Connecting rod small end clearance excessive

Connecting rod big end clearance excessive

Piston ring/groove clearance excessive

Piston ring worn, broken, or stuck

Piston ring groove worn

Piston seizure, damage

Cylinder head gasket leaking

Exhaust pipe leaking at cylinder head connection

Crankshaft runout excessive

Engine mount loose

Crankshaft bearing worn

Primary gear worn or chipped

Air suction valve damaged

Air switching valve damaged

Alternator rotor loose

Catalytic converter melt down due to muffler overheating (KLEEN)

Balancer gear worn or chipped

Balancer shaft position maladjusted

Balancer bearing worn

Bevel gear backlash & tooth contact maladjusted

Bevel gear bearing worn

Bevel gear worn or damaged

#### **Abnormal Drive Train Noise:**

##### **Clutch noise:**

Clutch housing/friction plate clearance excessive

Clutch housing gear worn

Wrong installation of outside friction plate

Foreign matter jammed in clutch housing gear teeth

##### **Transmission noise:**

Bearings worn

Transmission gear worn or chipped

Metal chips jammed in gear teeth

Engine oil insufficient

##### **Drive line noise:**

Drive chain adjusted improperly

## Troubleshooting Guide

Drive chain worn  
Rear and/or engine sprocket worn  
Chain lubrication insufficient  
Rear wheel misaligned

### Abnormal Frame Noise:

#### Front fork noise:

Oil insufficient or too thin  
Spring weak or broken

#### Rear shock absorber noise:

Shock absorber damaged  
Spring weak or broken

#### Disc brake noise:

Pad installed incorrectly  
Pad surface glazed  
Disc warped  
Caliper trouble

#### Drum brake noise:

Brake lining worn or unevenly worn  
Drum unevenly worn or damaged  
Brake shoe spring weak or broken  
Foreign matter jammed in hub  
Brake maladjusted

#### 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 worn  
Crankshaft bearing worn  
Oil pressure switch damaged  
Wiring faulty  
Relief valve stuck open  
O-ring at the oil passage 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

#### Brown smoke:

Air cleaner duct loose  
Air cleaner poorly sealed or missing

### Handling and/or Stability

#### Unsatisfactory:

##### Handlebar hard to turn:

Cable routing incorrect  
Hose routing incorrect  
Wiring routing incorrect  
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 pivot bearing worn  
Rim warped, or not balanced  
Wheel bearing worn  
Handlebar holder bolt loose  
Steering stem nut loose  
Front, rear axle runout excessive  
Engine mounting bolt loose

##### Handlebar pulls to one side:

Frame bent  
Wheel misalignment  
Swingarm bent or twisted  
Swingarm pivot shaft runout excessive  
Steering maladjusted  
Front fork bent  
Right and left front fork oil level uneven

##### 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:

#### Disc brake:

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

#### Drum brake:

Brake maladjusted

## 16-26 APPENDIX

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### Troubleshooting Guide

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Brake lining worn or unevenly worn  
Drum unevenly worn or damaged  
Brake overheated  
Water in brake drum  
Brake cam, camshaft worn  
Brake lining contaminated with oil

#### **Battery Trouble:**

##### **Battery discharged:**

Charge insufficient  
Battery faulty (too low terminal voltage)

Battery cable 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.
2011	EJ800AB	JKBEJ800AAA000001
2012	EJ800AC	JKBEJ800AAA008001

□:This digit in the frame number changes from one machine to another.



KAWASAKI HEAVY INDUSTRIES, LTD.  
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