

VULCAN 1600 CLASSIC VN1600 CLASSIC



Motorcycle Service Manual

Quick Reference Guide

General Information	1
Periodic Maintenance	2
Fuel System (DFI)	3
Cooling System	4
Engine Top End	5
Clutch	6
Engine Lubrication System	7
Engine Removal/Installation	8
Crankshaft/Transmission	9
Wheels/Tires	10
Final Drive	11
Brakes	12
Suspension	13
Steering	14
Frame	15
Electrical System	16
Appendix	17

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.



VULCAN 1600 CLASSIC VN1600 CLASSIC

Fourth Edition (1): Aug. 1, 2005 (K)

Motorcycle Service Manual

All rights reserved. No parts of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic mechanical photocopying, recording or otherwise, without the prior written permission of Quality Division/Consumer Products & Machinery Company/Kawasaki Heavy Industries, Ltd., Japan.

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

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

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

LIST OF ABBREVIATIONS

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

Read OWNER'S MANUAL before operating.

EMISSION CONTROL INFORMATION

To protect the environment in which we all live, Kawasaki has incorporated crankcase emission (1) and exhaust emission (2) control systems in compliance with applicable regulations of the United States Environmental Protection Agency and California Air Resources Board. Additionally, Kawasaki has incorporated an evaporative emission control system (3) in compliance with applicable regulations of the California Air Resources Board on vehicles sold in California only.

1. Crankcase Emission Control System

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

2. Exhaust Emission Control System

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

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

3. Evaporative Emission Control System

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

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

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

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

NOTE

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

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

TAMPERING WITH NOISE CONTROL SYSTEM PROHIBITED

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

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

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

Foreword

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

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

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

To get the longest life out of your vehicle:

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

How to Use This Manual

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

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

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

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

A WARNING

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

CAUTION

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

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

NOTE

- This note symbol indicates points of particular interest for more efficient and convenient operation.
- Indicates a procedural step or work to be done.
- Olndicates 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

Table of Contents

Before Servicing	1-2
Model Identification	1-7
General Specifications	1-10
Unit Conversion Table	1-13

1

1-2 GENERAL INFORMATION

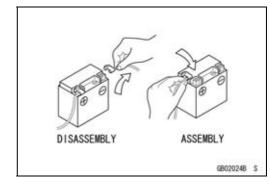
Before Servicing

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

Especially note the following:

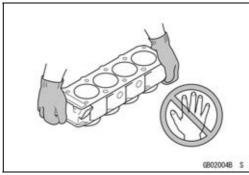
Battery Ground

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



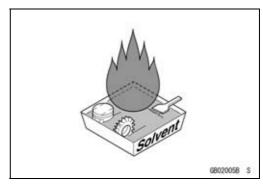
Edges of Parts

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



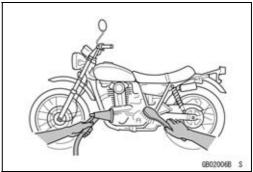
Solvent

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



Cleaning vehicle before disassembly

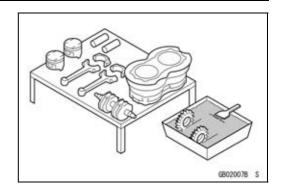
Clean the vehicle thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during vehicle disassembly can cause excessive wear and decrease performance of the vehicle.



Before Servicing

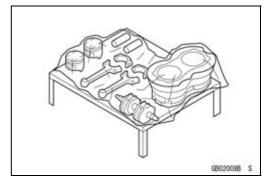
Arrangement and Cleaning of Removed Parts

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.



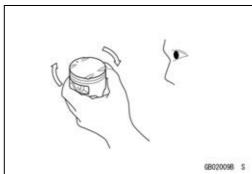
Storage of Removed Parts

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.



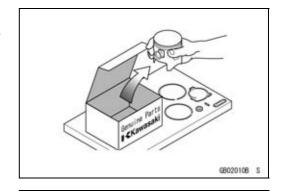
Inspection

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.



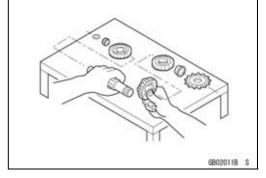
Replacement Parts

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



Assembly Order

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



1-4 GENERAL INFORMATION

Before Servicing

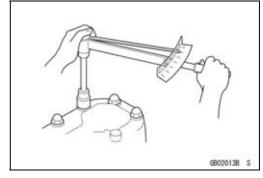
Tightening Sequence

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 them remove them. If the specified tightening sequence is not indicated, tighten the fasteners alternating diagonally.

Tightening Torque

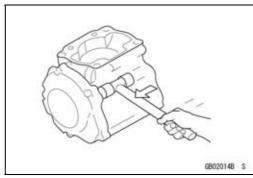
Incorrect torque applied to a bolt, nut, or screw may lead to serious damage. Tighten fasteners to the specified torque using a good quality torque wrench.

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



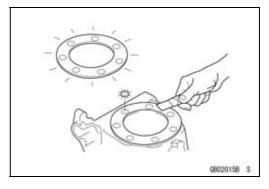
Force

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



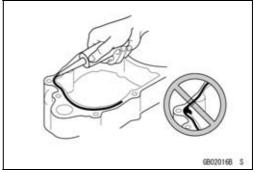
Gasket, O-ring

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



Liquid Gasket, Locking Agent

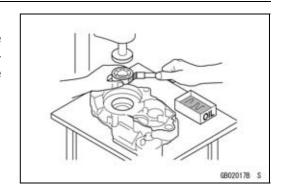
For applications that require Liquid Gasket or a Locking agent, clean the surfaces so that no oil residue remains before applying liquid gasket or locking agent. Do not apply them excessively. Excessive application can clog oil passages and cause serious damage.



Before Servicing

Press

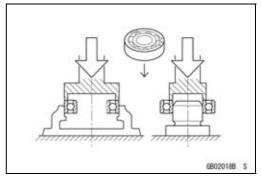
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



Ball Bearing and Needle Bearing

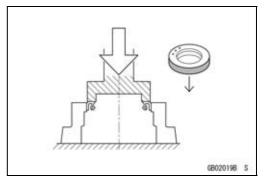
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

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

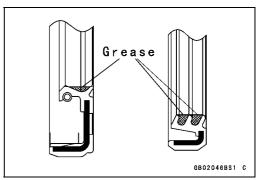


Oil Seal, Grease Seal

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

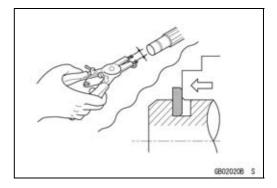


Apply specified grease to lip of seal before installing the seal



Circlips, Cotter Pins

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

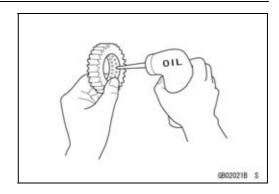


1-6 GENERAL INFORMATION

Before Servicing

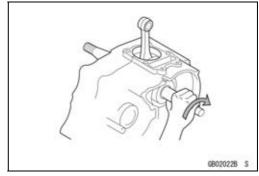
Lubrication

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.



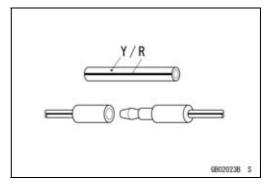
Direction of Engine Rotation

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).



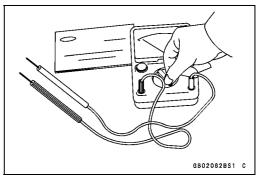
Electrical Wires

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.



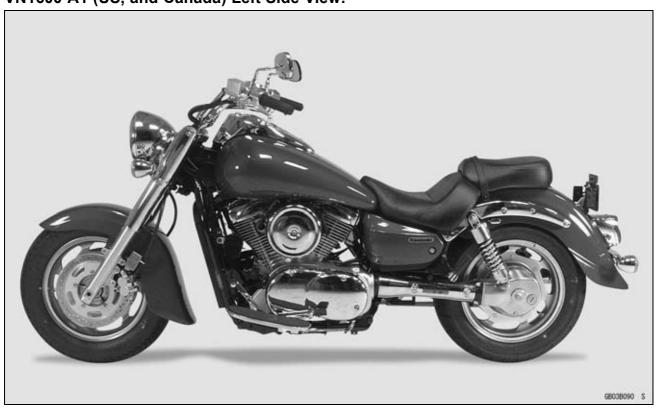
Instrument

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.

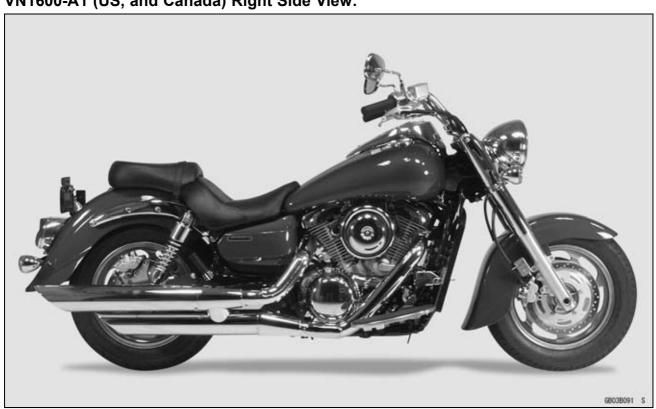


Model Identification

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



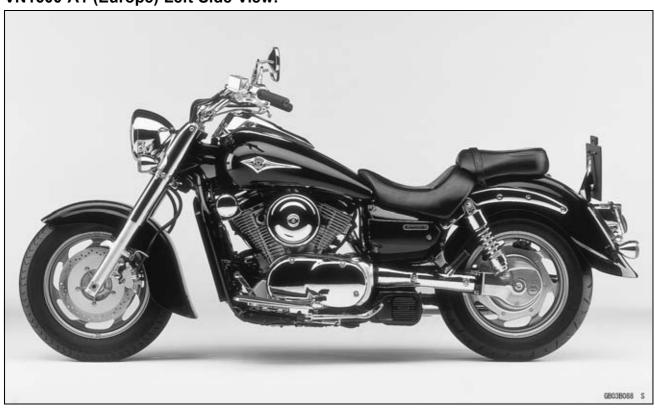
VN1600-A1 (US, and Canada) Right Side View:



1-8 GENERAL INFORMATION

Model Identification

VN1600-A1 (Europe) Left Side View:

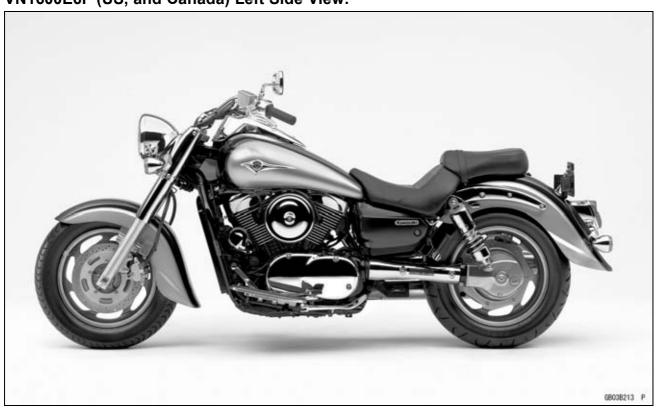


VN1600-A1 (Europe) Right Side View:



Model Identification

VN1600E6F (US, and Canada) Left Side View:



VN1600E6F (US, and Canada) Right Side View:



1-10 GENERAL INFORMATION

General Specifications

Items	VN1600-A1 ~/E6F ~
Dimensions	VN1600-A1 ~/E6F ~
Overall Length	2 505 mm (98.62 in.)
Overall Width	1 040 mm (40.9 in.), (AU) 990 mm (39 in.)
Overall Height	1 130 mm (44.5 in.)
Wheelbase	1 680 mm (66.1 in.)
Road Clearance	130 mm (5.12 in.)
Seat Height	680 mm (26.8 in.)
Dry Mass	306 kg (675 lb), (AU) 307 kg (677 lb)
Curb Mass:	300 kg (073 lb), (AO) 307 kg (077 lb)
Front	156 kg (345 lb)
Rear	181 kg (399 lb), (AU) 182 kg (401 lb)
Fuel Tank Capacity	20 L (5.3 US gal)
Fuel Fuel	Unleaded and high-octane gasoline (see VN1600-A1 ~
ruei	Owner's Manual)
Performance	
Minimum Turning Radius	3.5 m (11.5 ft)
Engine	
Туре	4-stroke, SOHC, V2-cylinder
Cooling System	Liquid-cooled
Bore And Stroke	102 × 95 mm (4.02 × 3.74 in.)
Displacement	1 552 cm³ (94.70 cu in.)
Compression Ratio	9.0 : 1
Maximum Horsepower	49 kW (67 PS) @ 4 700 r/min (rpm), (CA) (CAL) (US) -
Maximum Torque	127 N·m (12.95 kgf·m, 93.7 ft·lb) @ 2 700 r/min (rpm),
	(CA) (CAL) (US) -
Carburetion System	DFI (Digital Fuel Injection) System
Starting System	Electric starter
Ignition System	Battery and coil (transistorized)
Timing Advance	Electronically advanced (digital)
Ignition Timing	From 0° BTDC @ 950 r/min (rpm) ~ 25° BTDC @ 4 500 r/min (rpm)
Spark Plugs	NGK DPR6EA-9 or ND X20EPR-U9
Cylinder Numbering Method	Front to Rear, 1-2
Firing Order	1-2
Valve Timing:	
Inlet	
Open	22° BTDC
Close	66° ABDC
Duration	268°
Exhaust	
Open	66° BBDC
Close	26° ATDC
Duration	272°
Lubrication System	Forced lubrication (wet sump)

General Specifications

Items	VN1600-A1 ~/E6F ~
Engine Oil:	
Туре	API SE, SF or SG class
	API SH or SJ class with JASO MA
Viscosity	SAE10W-40
Capacity	3.5 L (3.7US qt, when engine is completely disassembled and dry)
Drive Train	
Primary Reduction System:	
Туре	Gear
Reduction Ratio	1.517 (85/56)
Clutch Type	Wet multi disc
Transmission:	
Туре	5-speed, constant mesh, return shift
Gear Ratios:	
1st	2.500 (40/16)
2nd	1.590 (35/22)
3rd	1.192 (31/26)
4th	0.965 (28/29)
5th	0.781 (25/32)
Final Drive System:	
Type	Shaft
Reduction Ratio	2.619 (15/21 × 33/9)
Overall Drive Ratio	3.105 @ Top gear
Final Gear Case Oil:	
Grade	API: GL-5 Hypoid gear oil
Viscosity	SAE90 (above 5°C), SAE80 (below 5°C)
Capacity	200 mL (6.76 US oz)
Frame	200 1112 (011 0 00 02)
Туре	Tubular, double cradle
Caster (Rake Angel)	32°
Trail	168 mm (6.61 in.)
Front Tire:	100 11111 (0.01 111.)
Type	Tubeless
Size	130/90 - 16 M/C 67H
Rear Tire:	130/90 - 10 10// 67/11
	Tubeless
Type	
Size	170/70B16 M/C 75H
Rim Size:	16 × 2.00
Front	16 × 3.00
Rear	16 × 4.50
Front Suspension:	
Type	Telescopic fork
Wheel travel	150 mm (5.91 in.)

1-12 GENERAL INFORMATION

General Specifications

Items	VN1600-A1 ~/E6F ~
Rear Suspension:	
Туре	Swingarm
Wheel travel	95 mm (3.74 in.)
Brake Type:	
Front	Dual disc
Rear	Single disc
Electrical Equipment	
Battery	
Capacity	12 V 18 Ah
Headlight:	
Туре	Semi-sealed beam
Bulb	12 V 60/55 W (quartz-halogen)
Tail/Brake Light	12 V 5/21 W
Alternator:	
Туре	Three-phase AC, twin rotor
Rated output	42A × 14 V @ 6 000 r/min (rpm)

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

AU: Australia CAL: California CA: Canada

US: United States of America

Unit Conversion Table

Prefixes for Units:

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

Units of Mass:

kg	×	2.205	=	lb
g	×	0.03527	=	OZ

Units of Volume:

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

Units of Force:

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

Units of Length:

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

Units of Torque:

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

Units of Pressure:

kPa	×	0.01020	=	kgf/cm²
kPa	×	0.1450	=	psi
kPa	×	0.7501	=	cmHg
kgf/cm ²	×	98.07	=	kPa
kgf/cm ²	×	14.22	=	psi
cmHg	×	1.333	=	kPa

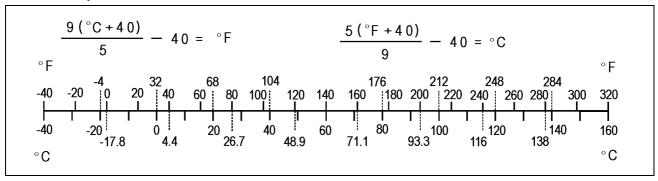
Units of Speed:

km/h × 0.6214 = mph

Units of Power:

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

Units of Temperature:



Periodic Maintenance

Table of Contents

Periodic Maintenance Chart	2-2	Tire Inspection	2-26
Torque and Locking Agent	2-4	Final Drive	2-27
Specifications	2-11	Final Gear Case Oil Level	
Special Tools	2-13	Inspection	2-27
Periodic Maintenance Procedures	2-14	Final Gear Case Oil Change	2-28
Fuel System (DFI)	2-14	Propeller Shaft Joint Lubrication	2-28
Fuel Hose and Connection		Brakes	2-28
Inspection	2-14	Brake Pad Wear Inspection	2-28
Throttle Control System		Brake Hose and Connection	
Inspection	2-14	Inspection	2-29
Idle Speed Inspection	2-15	Brake Fluid Level Inspection	2-29
Air Cleaner Element Cleaning	2-16	Brake Fluid Change	2-30
Evaporative Emission Control		Brake Master Cylinder Cup and	
System Inspection (California		Dust Cover Replacement	2-31
Model)	2-16	Caliper Fluid/Dust Seals	
Cooling System	2-17	Replacement	2-31
Radiator Hose and Connection		Brake Light Switch Inspection	2-32
Inspection	2-17	Suspension	2-32
Coolant Change	2-18	Front Fork Oil Leak Inspection	2-32
Engine Top End	2-20	Rear Shock Absorber Oil Leak	
Air Suction Valve Inspection	2-20	Inspection	2-33
Clutch	2-20	Swingarm Pivot Lubrication	2-33
Clutch Hose and Connection		Steering	2-33
Inspection	2-20	Steering Inspection	2-33
Clutch Fluid Level Inspection	2-21	Steering Adjustment	2-34
Clutch Fluid Change	2-21	Steering Stem Bearing	
Clutch Master Cylinder Cup and		Lubrication	2-34
Dust Cover Replacement	2-22	Electrical System	2-35
Clutch Slave Cylinder Fluid Seal		Spark Plug Inspection	2-35
Replacement	2-23	General Lubrication	2-35
Engine Lubrication System	2-24	Lubrication	2-35
Engine Oil Change	2-24	Nut, Bolt, and Fastener Tightness	2-36
Oil Filter Replacement	2-26	Tightness Inspection	2-36
\\/haal/Tiraa	2.26		

2-2 PERIODIC MAINTENANCE

Periodic Maintenance Chart

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

FREQUENCY	Whichev comes	/er							DING
	first km × 1 000 (mile × 1						1 000)		
		1	6	12	18	24	30	36	See
OPERATION	Every	(0.6)	(4)	(7.5)	(12)	(15)	(20)	(24)	Page
Fuel hoses, connections - inspect †			•	•	•	•	•	•	2-15
Throttle control system (e) - inspect †		•	•	•	•	•	•	•	2-15
Idle speed (e) - inspect †		•		•		•		•	2-15
Air cleaner element (e) - clean†#				•		•		•	2-16
Evaporative emission control system (e) (CAL) - inspect †		•	•	•	•	•	•	•	2-16
Radiator hoses, connections - inspect †		•							2-17
Coolant - change	2 years					•			2-18
Air suction valve (e) - inspect †			•	•	•	•	•	•	2-20
Clutch hoses, connections - inspect †			•	•	•	•	•	•	2-20
Clutch fluid level - inspect †	month	•	•	•	•	•	•	•	2-21
Clutch fluid - change	2 years					•			2-21
Clutch master cylinder cup and dust cover - replace	4 years								2-22
Clutch slave cylinder fluid seal - replace	4 years								2-23
Engine oil - change #	year	•		•		•		•	2-24
Oil filter - replace		•		•		•		•	2-26
Tire wear - inspect †			•	•	•	•	•	•	2-26
Final gear case oil level - inspect †				•		•		•	2-27
Final gear case oil - change		•						•	2-28
Propeller shaft joint - lubricate				•				•	2-28
Brake pad wear - inspect † #			•	•	•	•	•	•	2-28
Brake hoses, connections - inspect †			•	•	•	•	•	•	2-29
Brake fluid level - inspect †	month	•	•	•	•	•	•	•	2-29
Brake fluid - change						•			2-30
Brake master cylinder cup and dust cover - replace	4 years								2-31
Caliper fluid seal and dust seal - replace	4 years								2-31
Brake light switch - inspect †		•	•	•	•	•	•	•	2-32
Front fork oil leak - inspect †				•		•		•	2-31
Swingarm pivot - lubricate				•		•		•	2-33
Rear shock absorber oil leak - inspect †				•		•		•	2-33
Steering - inspect †		•	•	•	•	•	•	•	2-33
Steering stem bearing - lubricate	2 years					•			2-33
Spark plug (e) - clean and gap †			•	•	•	•	•	•	2-35
General lubrication - perform				•		•		•	2-35

Periodic Maintenance Chart

FREQUENCY	Whichever * ODOMETER REAL km × 1 000 (mile × 1								
		1	6	12	18	24	30	36	See
OPERATION	Every	(0.6)	(4)	(7.5)	(12)	(15)	(20)	(24)	Page
Nut, bolt, and fastener tightness - inspect †		•		•		•		•	2-36

- #: Service more frequently when operating in severe conditions; dusty, wet, muddy, high speed or frequent starting/stopping.
- *: For higher odometer readings, repeat at the frequency interval established here.
- †: Replace, add, adjust, clean, or torque if necessary.

Throttle control system inspection: Inspection of throttle grip play and throttle bore cleanliness. (CAL): California

(e): Emission Related Items

2-4 PERIODIC MAINTENANCE

Torque and Locking Agent

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

Letters used in the "Remarks" column mean:

- **L:** Apply a non-permanent locking agent to the threads.
- **G**: Apply grease to the threads.
- MO: Apply molybdenum disulfide grease oil solution.
 - **O:** Apply oil to the threads and seating surface.
 - **S:** Tighten the fasteners following the specified sequence.
- **SS:** Apply silicone sealant.
- Si: Apply silicone grease (ex. PBC grease).
- R: Replacement parts
- Lh: Left-hand-threads
- **St:** Stake the fasteners to prevent loosening.
- AL: Tighten the two clamp bolts alternately two times to ensure even tightening torque.

Factoria	Torque			Domonico
Fastener	N·m	kgf⋅m	ft·lb	Remarks
Fuel System				
Water Temperature Sensor (dfi)	18	1.8	13	SS
Right And Left Air Cleaner Base Bolts	11	1.1	95 in·lb	
Right And Left Air Cleaner Base Screws	2.2	0.22	19 in·lb	L, Lower Duct
Left Air Cleaner Cover Allen Bolt ϕ 8	16	1.6	12	
Right Air Cleaner Cover Allen Bolt ϕ 8	16	1.6	12	
Right Air Cleaner Allen Bolts	11	1.1	95 in·lb	Throttle Body
Throttle Body Assy Holder Bolts	11	1.1	95 in·lb	Right Side
Spark Plug Lead Holder Bolts	11	1.1	95 in·lb	Right Side
Air Cleaner Duct Holder Bolts	9.8	1.0	69 in·lb	Left Side
Fuel Pump Bolts	9.8	1.0	87 in·lb	S, L
Inlet Air Temperature Sensor Nut (dfi)	7.8	0.80	69 in·lb	
ISC Pipe Holder Bolts	11	1.1	95 in·lb	
Choke Cable Plate Screw	2.9	0.30	26 in·lb	L, Throttle Body
Inlet Manifold Bolts	12	1.2	104 in·lb	on Cyl. Head
Cooling System				
Water Temperature Sensor (dfi)	18	1.8	13	SS
Water Pipe Bolts	11	1.1	97 in·lb	
Radiator Fan Switch	18	1.8	13	
Radiator Drain Bolt	7.4	0.75	65 in·lb	
Water Temperature Switch	7.8	0.80	69 in·lb	SS
Radiator Fan Bolts	8.3	0.85	74 in·lb	
Water Pump Cover Bolts	11	1.1	97 in·lb	
Water Pump Impeller Bolt	8.8	0.90	78 in·lb	Lh
Water Pump Drain Bolt	11	1.1	97 in·lb	
Water Pump Air Bleeder Bolt	11	1.1	97 in·lb	
Radiator Hose Clamp Screws	2.5	0.25	22 in·lb	
Engine Top End				
Spark Plugs	18	1.8	13	
Spark Plug Retainer	12	1.2	104 in·lb	

Forton	Damada			
Fastener	N⋅m	kgf∙m	ft·lb	Remarks
Rocker Case Cover Bolts	8.8	0.90	78 in·lb	S
Air Suction Valve Cover Bolts	7.4	0.75	65 in·lb	
Rocker Case Nuts:				
12 mm	78	8.0	58	MO, S
8 mm	25	2.5	18	S
Rocker Case Bolts:				
6 mm	8.8	0.90	78 in·lb	S
Cylinder Head Jacket Plugs	20	2.0	14	L
Rocker Shafts	25	2.5	18	
Exhaust Pipe Cover Clamp Screws	6.9	0.70	61 in·lb	
Premuffler Chamber Bolts	29	3.0	22	except US, CA
Muffler Stay Mounting Bolts And Nuts, ϕ 8	25	2.5	18	
Muffler Bracket Bolt And Nut	29	3.0	22	
Cylinder Head Nuts	25	2.5	18	S
Cylinder Nuts	25	2.5	18	S
Chain Tensioner Cap	20	2.0	14	S
Chain Tensioner Lockbolt	4.9	0.50	43 in·lb	S
Chain Tensioner Mounting Bolts	11	1.1	95 in·lb	S
Camshaft Chain Guide Bolts	11	1.1	95 in·lb	L
Camshaft Sprocket Bolts	15	1.5	11	L
Timing Inspection Cap	1.5	0.15	13 in·lb	
Rotor Bolt Cap	1.5	0.15	13 in·lb	
Oil Hose Flange Bolts	9.8	1.0	87 in·lb	
Clutch				
Clutch Reservoir Cap Crews	1.5	0.15	13 in·lb	
Clutch Slave Cylinder Bleed Valve	7.8	0.80	69 in·lb	
Clutch Master Cylinder Clamp Bolts	9.8	1.0	87 in·lb	S
Clutch Hose Banjo Bolts	25	2.5	18	
Clutch Slave Cylinder Bolts	6.9	0.70	61 in·lb	L
Clutch Hub Nut	147	15.0	108	MO
Clutch Cover Bolts	11	1.1	95 in·lb	
Clutch Damper Cover Bolts (Outside)	9.8	1.0	87 in·lb	L
Clutch Cover Damper Screws	4.9	0.50	43 in·lb	L
Clutch Lever Pivot Bolt	1.0	0.10	8.7 in·lb	Si
Clutch Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
Starter Lockout Switch Screws	1.2	0.12	10 in·lb	
Clutch Damper Plate Bolts	9.8	1.0	87 in·lb	EO (tip)
Clutch Push Rod Guide Bolts	11	1.1	95 in·lb	L ,
Engine Lubrication System				
Oil Filler Cap	1.5	0.15	13 in·lb	
Oil Pipe Holder Bolts (Inside)	11	1.1	95 in·lb	L
Oil Pipe Clamp Bolts (Inside)	11	1.1	95 in·lb	L
Oil Hose Flange Bolt (Outside)	9.8	1.0	87 in·lb	

2-6 PERIODIC MAINTENANCE

Factorian		Torque	Damasika	
Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
Oil Hose Banjo Bolts	9.8	1.0	87 in·lb	
Oil Pressure Relief Valve	15	1.5	11	L
Oil Pump Mounting Bolts	11	1.1	95 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Oil Pressure Switch Terminal Screw	1.5	0.15	13 in·lb	
Oil Screen Plug	20	2.0	14	
Oil Filter (Cartridge Type)	18	1.8	13	R, EO
Right & Left Crankcase Oil Nozzles	2.9	0.30	26 in·lb	× 3
Right Crankcase Oil Nozzle	2.9	0.30	26 in·lb	× 1, Lh
Oil Filter Pipe	25	2.5	18	SS
Engine Oil Drain Plug	20	2.0	14	
Oil Baffle Bolt	11	1.1	95 in·lb	L
Engine Removal/Installation				
Downtube Bolts And Nuts	44	4.5	33	
Engine Mounting Bolts And Nuts	44	4.5	33	
Engine Mounting Bracket Bolts	25	2.5	18	
Engine Ground Terminal Bolt	7.8	0.80	69 in·lb	
Crankshaft/Transmission				
Connecting Rod Big End Nuts	59	6.0	43	MO
Starter Clutch Bolt	85	8.7	63	MO
Left Balancer Gear Bolt	85	8.7	63	MO
Camshaft Chain Guide Bolts	11	1.1	95 in·lb	L
Starter Clutch Coupling Bolts	15	1.5	11	L
Right Crankcase Oil Nozzles	2.9	0.30	26 in·lb	× 1, Lh
Right, Left Crankcase Oil Nozzles	2.9	0.30	26 in·lb	× 3
Bearing Retainer Bolts	11	1.1	95 in·lb	L
Oil Baffle Bolt	11	1.1	95 in·lb	L
Primary Gear Bolt	147	15.0	108	MO
Shift Drum Bearing Holder Bolts	11	1.1	95 in·lb	L
Crankcase Bolts:				
10 mm	39	4.0	29	S
8 mm	21	2.1	15	S
6 mm	11	1.1	95 in·lb	S
Clutch Push Rod Guide Bolts	11	1.1	95 in·lb	L
Oil Drain Plug	20	2.0	14	
Frame Ground Bracket Bolt	11	1.1	95 in·lb	Left Crankcase
Oil Pipe Clamp Bolts (Inside)	11	1.1	95 in·lb	L
Water Pump Drainge Bolt	9.8	1.0	87 in·lb	
Oil Pressure Switch Terminal Screw	1.5	0.15	13 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Shift Shaft Return Spring Pin (Bolt)	39	4.0	29	L
Shift Rod Locknuts	11	1.1	95 in·lb	(Rear: Lh)
Rear Shift Lever Clamp Bolt	12	1.2	104 in·lb	,

Torque			Domonico	
Fastener	N·m	kgf∙m	ft·lb	Remarks
Gear Set Lever Bolt	11	1.1	95 in·lb	
Shift Pedal Clamp Bolt	25	2.5	18	
Shift Pedal Clamp Bolts (VN1600-A2 ~)	30	3.1	22	
Shift Drum Cam Bolt	15	1.5	11	L
Damper Cam Nut (Front Gear)	195	20	144	MO (threads)
Idle Shaft Holder Bolts	8.3	0.85	73 in·lb	
Oil Pressure Relief Valve	15	1.5	11	L
Oil Filter Pipe	25	2.5	18	SS
Oil Hose Banjo Bolts	9.8	1.0	87 in·lb	
Water Pump Chain Guide Spring Hook Bolt	2.9	0.30	26 in·lb	
Water Pump Impeller Bolt	8.8	0.9	78 in·lb	
Water Pump Chain Guide Bolt	8.3	0.85	73 in·lb	
Wheels/Tires				
Tire Air Valve Nuts	1.5	0.15	13 in·lb	
Tire Air Valve Caps	0.15	0.015	1.3 in·lb	
Air Valve Cores	0.3	0.03	2.6 in·lb	
Front Axle Clamp Bolts	20	2.0	14	AL
Front Axle Clamp Bolts (VN1600-A2 ~)	29	3.0	21	AL
Front Axle	108	11.0	79.6	s
Rear Axle Nut	108	11.0	79.6	
Final Drive				
Oil Pipe Banjo Bolts (Front Gear)	12	1.2	104 in·lb	
Front Gear Case Bolts:				
6 mm	12	1.2	104 in·lb	
8 mm	29	3.0	22	
Neutral Switch	15	1.5	11	
Oil Nozzle (Front Gear)	2.9	0.30	26 in·lb	
Oil Nozzle (Front Gear)	18	1.8	13	
Speed Sensor Mounting Bolt	9.8	1.0	87 in·lb	L
Bearing Retainer Bolts (Front Gear)	8.8	0.9	78 in·lb	L
Damper Cam Nut (Front Gear)	195	20	144	MO (threads)
Drive Gear Nut (Front Gear)	265	27	195	MO, St
Driven Gear Assy Mounting Bolts	25	2.5	18	
Driven Gear Bolt (Front Gear)	137	14	101	MO, St
Final Gear Case Mounting Nuts	34	3.5	25	
Final Gear Case Drain Plug	8.8	0.9	78 in·lb	
Pinion Gear Nut (Final Gear)	127	13	94	St, MO
Final Gear Case Studs	_	_	_	L
Final Gear Case Cover Bolts:				
8 mm	23	2.3	17	L
10 mm	34	3.5	25	L
Bearing Retainer Bolt (Final Gear)	6.9	0.7	61 in·lb	L

2-8 PERIODIC MAINTENANCE

	Torque			
Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
Brakes				
Brake Hose Banjo Bolts	34	3.5	25	
Front Brake Reservoir Cap Screws	1.5	0.15	13 in·lb	
Brake Lever Pivot Bolt	1.0	0.10	8.7 in·lb	
Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
Front Master Cylinder Clamp Bolts	8.8	0.9	78 in·lb	G, S
Front Brake Light Switch Screw	1.2	0.12	10 in·lb	
Caliper Bleed Valves	7.8	0.8	69 in·lb	
Front Caliper Mounting Bolts	34	3.5	25	
Brake Disc Bolts	27	2.8	20	L
Rear Master Cylinder Mounting Bolts	25	2.5	18	
Rear Master Cylinder Push Rod Locknut	18	1.8	13	
Brake Pedal Clamp Bolt	25	2.5	18	
Rear Caliper Mounting Bolts	34	3.5	25	
Rear Caliper Holder Bolt	64	6.5	47	
Suspension				
Front Fork Clamp Bolts (Upper)	20	2.0	14	
Front Fork Clamp Bolts (Upper) (VN1600-A2 ~)	29	3.0	21	
Front Fork Clamp Bolts (Lower)	29	3.0	21	AL
Front Fork Top Plugs	22	2.2	16	
Front Fork Bottom Allen Bolt	30	3.1	22	L
Front Axle Clamp Bolts	20	2.0	14	AL
Front Axle Clamp Bolts (VN1600-A2 ~)	29	3.0	21	
Rear Shock Absorber Nuts	34	3.5	25	
Swingarm Pivot Shaft	108	11.0	79.6	G
Steering				
Steering Stem Head Nut	88	9.0	65	
Steering Stem Nut	4.9	0.5	43 in·lb	
Handlebar Clamp Bolts	34	3.5	25	
Handlebar Holder Nuts	34	3.5	25	
Front Fork Clamp Bolts (Upper)	20	2.0	14	
Front Fork Clamp Bolts (Upper) (VN1600-A2 ~)	29	3.0	21	
Front Fork Clamp Bolts (Lower)	29	3.0	21	AL
Turn Signal Light Mounting Nuts	5.9	0.6	52 in·lb	
Frame				
Downtube Bolts And Nuts	44	4.5	33	
Footboard Bracket Bolts	34	3.5	25	front
Footpeg Bracket Bolts	25	2.5	18	rear, L
Sidestand Nut	44	4.5	33	,
Electrical System				
Spark Plugs	18	1.8	13	

Footoner	Torque			Damania
Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
Crankshaft Sensor Screws	2.9	0.30	26 in·lb	
Stator Lead Holder Screw	9.8	1.0	87 in·lb	L
Inside Stator Holder Bolts	11	1.1	95 in·lb	L
Crankshaft Sensor Lead Holder Bolt	2.9	0.30	26 in·lb	L
Alternator Outer Cover Bolts	6.9	0.70	61 in·lb	
Alternator Outer Cover Joint Bolts	6.9	0.70	61 in·lb	L
Alternator Outer Cover Damper Bolts	6.9	0.70	61 in·lb	L
Alternator Outer Cover Assembly Bolts	6.9	0.70	61 in·lb	
Alternator Cover Bolts	11	1.1	95 in·lb	
Alternator Inner Cover Bolts	11	1.1	95 in·lb	
Alternator Rotor Bolt	78	8.0	58	MO
Alternator Stator Bolts	13	1.3	113 in·lb	L
Regulator/Rectifier Bolts	6.5	0.66	57 in·lb	
Timing Inspection Cap	1.5	0.15	13 in·lb	
Rotor Bolt Cap	1.5	0.15	13 in·lb	
Starter Motor Terminal Locknut	11	1.1	95 in·lb	
Starter Motor Terminal Nut	4.9	0.50	43 in·lb	
Starter Motor Assembly Bolts	4.9	0.50	43 in·lb	
Starter Motor Mounting Bolts	11	1.1	95 in·lb	
Headlight Rim Screws	2.9	0.30	26 in·lb	
Headlight Unit Bracket Screws	1.0	0.10	8.7 in·lb	L
Starter Lockout Switch Screw	1.2	0.12	10 in·lb	
Front Brake Light Switch Screw	1.2	0.12	10 in·lb	
Sidestand Switch Bolt	8.8	0.90	78 in·lb	L
Radiator Fan Switch	18	1.8	13	
Radiator Fan Bolts	8.3	0.85	7.4 in·lb	
Fuel Level Sensor Mounting Bolts	6.9	0.70	61 in·lb	L
Fuel Pump Bolts	9.8	1.0	87 in·lb	S
Water Temperature Switch	7.8	0.80	69 in·lb	SS
Water Temperature Sensor	18	1.8	13	SS
Oil Pressure Switch Terminal Screw	1.5	0.15	13 in·lb	G
Oil Pressure Switch	15	1.5	11	SS
Neutral Switch	15	1.5	11	
Speed Sensor Mounting Bolt	9.8	1.0	8.7 in·lb	L
Turn Signal Light Mounting Screws	6.9	0.70	61 in·lb	
Turn Signal Light Lens Screws	1.0	0.10	8.7 in·lb	
Tail/Brake Light Mounting Nuts	5.9	0.60	52 in·lb	
Tail/Brake Light Lens Screws	1.2	0.12	10 in·lb	
Tail/Brake Light Assembly Screws	1.2	0.12	10 in·lb	

2-10 PERIODIC MAINTENANCE

Torque and Locking Agent

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

Basic Torque for General Fasteners

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

Specifications

Item	Standard	Service Limit
Fuel System (DFI)		
Throttle Grip Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	
Idle Speed	950 ±50 r/min (rpm)	
Air Cleaner Element	Paper filter	
Cooling System		
Coolant:		
Type (Recommended)	Permanent type antifreeze	
Color	Green	
Mixed Ratio	Soft water 50%, Coolant 50%	
Freezing Point	–35°C (–31°F)	
Total Amount	2.3 L (2.4 US qt)	
Engine Top End		
Valve Clearance	Non-adjustable (hydraulic lash adjusters)	
Clutch		
Clutch Fluid:		
Grade	DOT4	
Clutch Lever Free Play	Non-adjustable	
Engine Lubrication System		
Engine Oil:		
Туре	API SE, SF or SG	
	API SH or SJ with JASO MA	
Viscosity	SAE 10W-40	
Capacity	2.9 L (3.1 US qt, when filter is not removed)	
	3.1 L (3.3 US qt, when filter is removed)	
	3.5 L (3.7 US qt, when engine is completely disassembled and dry)	
Level	Between upper and lower level lines (Wait 2 ~ 3 minutes after idling or running)	
Tires		
Tread Depth:		
Front	BRIDGESTONE EXEDRA G721:	1 mm (0.04 in.),
	4.3 mm (0.17 in.)	(DE, AT, CH): 1.6 mm (0.063 in.)
Rear	BRIDGESTONE EXEDRA G722: 7.2 mm (0.28 in.)	Up to 130 km/h (80 mph): 2 mm (0.08 in.) Over 130km/h (80mph):
		3 mm (0.1 in.)
Air Pressure: (When Cold)		, ,
Front	Up to 186 kg (410 lb) load: 200 kPa	
	(2.0 kgf/cm², 28 psi)	
Rear	Up to 186 kg (410 lb) load: 250 kPa (2.5 kgf/cm², 36 psi)	

2-12 PERIODIC MAINTENANCE

Specifications

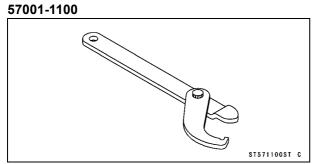
Item	Standard	Service Limit
Final Drive		
Final Gear Case Oil:		
Grade	API: GL-5 hypoid gear oil	
Viscosity	when above 5°C (41°F) SAE90	
	when below 5°C (41°F) SAE80	
Oil Level	Filler opening bottom	
Amount	200 mL (6.76 US oz)	
Propeller Shaft Joint Grease	20 mL (0.68 US oz), high-temperature	
	grease	
Brakes		
Brake Fluid		
Grade	DOT4	
Brake Pad Lining Thickness:		
Front	4.5 mm (0.18 in.)	1 mm (0.04 in.)
Rear	7.5 mm (0.295 in.)	1 mm (0.04 in.)
Brake Light Timing:		
Front	Pulled ON	
Rear	ON after about 10 mm (0.39 in.) of pedal travel	
Electrical System		
Spark Plug Gap	0.8 ~ 0.9 mm (0.031 ~ 0.035 in.)	

AT: Republic of Austria CH: Swiss Confederation

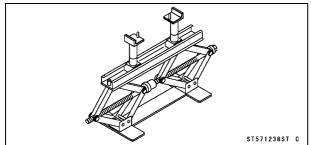
DE: Federal Republic of Germany

Special Tools

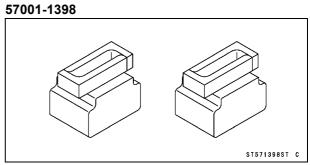
Steering Stem Nut Wrench:



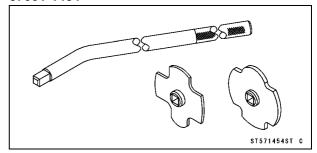
Jack: 57001-1238



Attachment Jack:



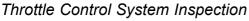
Filler Cap Driver: 57001-1454



Fuel System (DFI)

Fuel Hose and Connection Inspection

- OThe fuel hoses are designed to be used throughout the motorcycle's life without any maintenance, however, if the motorcycle is not properly handled, the high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Remove the fuel tank (see Fuel System chapter) and check the fuel hose.
- ★Replace the fuel hose if any fraying, cracks [B] or bulges [C] are noticed.
- Check that the hoses are securely connected and clamps are tightened correctly.
- When installing, route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- When installing the fuel hoses, avoid sharp bending, kinking, flattening or twisting, and route the fuel hoses with a minimum of bending so that the fuel flow will not be obstructed.
- ★Replace the hose if it has been sharply bent or kinked.



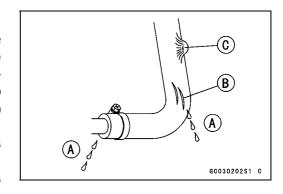
Throttle Grip Play Inspection

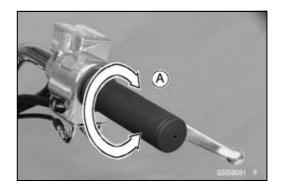
- Check the throttle grip free play [A].
- ★If the free play is incorrect, adjust the throttle cable (see below).

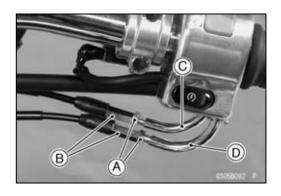


Standard: $2 \sim 3 \text{ mm } (0.08 \sim 0.12 \text{ in.})$

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

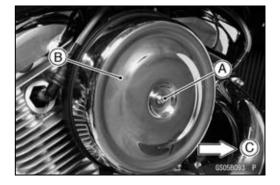






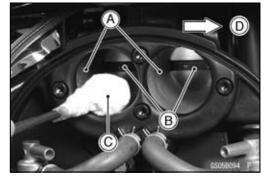
Throttle Bore Cleaning

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



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

 Front [D]



Idle Speed Inspection

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

Idle Speed

Standard: 950 ±50 r/min (rpm)

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

WARNING

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

- ★If the idle speed is out of the specified range, adjust it.
- Start the engine and warm it up thoroughly.
- OWait until fast idle speed lowers to a certain value.
- Turn the adjusting screw [A] until the idle speed is correct.
- Open and close the throttle a few times to make sure that the idle speed is within the specified range. Readjust if necessary.

Front [B]



2-16 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Air Cleaner Element Cleaning

NOTE

- OIn dusty areas, the element should be cleaned more frequently than the recommended interval.
- OAfter riding through rain or on muddy roads, the element should be cleaned immediately.
- Remove:

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

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

A WARNING

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

CAUTION

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

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

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

Evaporative Emission Control System Inspection (California Model)

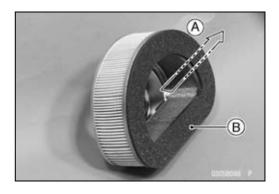
- Inspect the canister as follows:
- ORemove the left side cover (see Frame chapter).
- ORemove the band [A] and take out the canister [B].
- OVisually inspect the canister for cracks and other damage.
- ★If the canister has any cracks or bad damage, replace it with a new one.

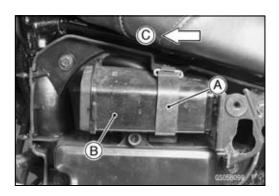
NOTE

OThe canister is designed to work well through the motorcycle's life without any maintenance if it is used under normal conditions.







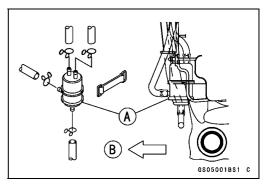


- ORun the purge hose (green) [A] above the canister breather hose (blue) [B] through the hole [C] into the tool case [D].
- ODo not run these hoses side by side on the battery side of the canister. This prevents hoses from being flattened when installing the left side cover.
- Olnstall the canister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



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

B C A B GS05000BS1 C

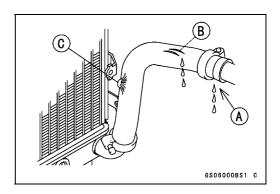


Cooling System

Radiator Hose and Connection Inspection

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

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



Coolant Change

A WARNING

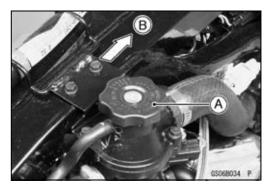
To avoid burns, do not remove the radiator cap or try to change the coolant when the engine is still hot. Wait until it cools down.

Coolant on tires will make them slippery, and can cause an accident and injury.

Since coolant is harmful to the human body, do not use for drinking.

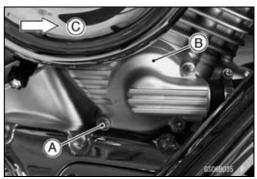
- Place a container under the radiator drain bolt [A], then remove the drain bolt (front view).
- Remove the fuel tank (see Fuel System (DFI) chapter).
- Remove the radiator cap [A] in two steps. First turn the cap counterclockwise to the first stop. Then push and turn it further in the same direction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





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

Front [C]

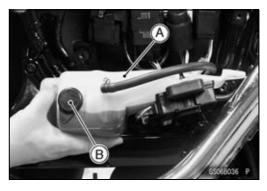


- Remove:
 - Right Side Cover (see Frame chapter) Reserve Tank Bolts
- Turn over the reserve tank [A], remove the cap [B], and pour the coolant into a suitable container.
- Install the reserve tank.
- When filling the coolant, choose a suitable mixture ratio by referring to the coolant manufacturer's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

CAUTION

Soft or distilled water must be used with the antifreeze (see Specifications in this chapter) in the cooling system.

If hard water is used in the system, it causes scale accumulation in the water passages, and considerably reduces the efficiency of the cooling system.



Water and Coolant Mixture Ratio (when shipping)

Soft Water : 50% Coolant : 50%

Freezing Point : -35°C (-31°F)
Total Amount : 2.3 L (2.4 US qt)

• Tighten the drain bolts.

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

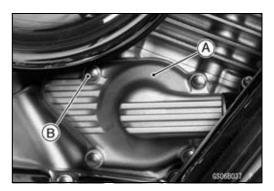
• Fill the coolant into the radiator.

NOTE

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

- Check the cooling system for leaks.
- Bleed the air from the water pump [A].
- OLoosen the air bleeder bolt [B] until the coolant seeps out around the bolt, then tighten it.

Torque - Water Pump Air Bleeder Bolt: 11 N⋅m (1.1 kgf⋅m, 95 in⋅lb)



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



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



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



2-20 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

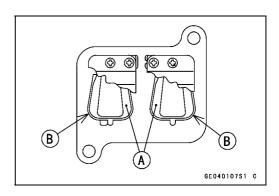
Engine Top End

Air Suction Valve Inspection

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



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



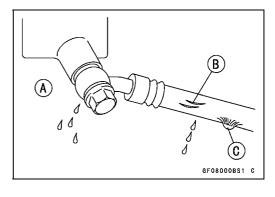
Clutch

Clutch Hose and Connection Inspection

- The high pressure inside the clutch line can cause fluid to leak [A] or the hose to burst if the line is not properly maintained. Bend and twist the rubber hose while examining it.
- ★Replace it if any fraying, cracks [B] or bulges [C] are noticed.
- Check that the hoses are securely connected and banjo bolts are tightened correctly.

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

- When installing the clutch hose, route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- ★Replace the hose if it has been sharply bent or kinked.



Clutch Fluid Level Inspection

- Hold the clutch fluid reservoir horizontal.
- Check that the clutch fluid level of the clutch reservoir is between the lower [A] and the upper [B] level lines.
- ★ If the fluid level is lower than the lower level line, fill the reservoir to the upper level line in the reservoir.
- Tighten:

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

OSince the clutch fluid is the same as the brake fluid, refer to Brake Fluid Section in the Brakes chapter for further details.

B GSOBBO20 P

A WARNING

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

Clutch Fluid Change

- Level the clutch fluid reservoir and remove the reservoir cap.
- Remove the alternator outer cover (see Electrical System chapter.) and the rubber cap from the bleed valve on the clutch slave cylinder.
- Attach a clear plastic hose [A] to the bleed valve and run the other end of the hose into a container.
- Fill the reservoir with fresh fluid.
- Change the clutch fluid as follows.

Open [B] the bleed valve, using a wrench.

Pump the clutch lever and hold [C] it.

Close [D] the bleed valve.

Release [E] the clutch lever.

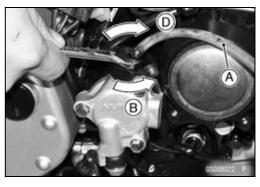
- ORepeat this operation until fresh fluid comes out from the plastic hose or the color of the fluid changes.
- OCheck the fluid level in the reservoir often, replenishing it as necessary.

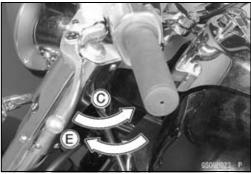


Olf the fluid in the reservoir runs completely out any time during fluid changing, the bleeding operation must be done over again from the beginning since air will have entered the line.

A WARNING

Do not mix two brands of fluid.





2-22 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

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

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

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

Clutch Master Cylinder Cup and Dust Cover Replacement

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

Special Tool - Inside Circlip Pliers: 57001-143

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

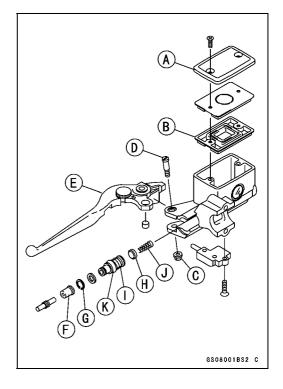
CAUTION

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

- Check the parts of the clutch master cylinder (see Clutch chapter).
- ★If any part shows signs of damage, replace it.
- Before assembly, clean all parts including the master cylinder with clutch fluid or alcohol.

CAUTION

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



- Apply clutch fluid to the parts removed and to the inner wall of the cylinder.
- Take care not to scratch the piston or the inner wall of the cylinder.
- Install the push rod with the dust cover fitted into the groove.
- OThe push rod round end must be faced inwards.
- Tighten:

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

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

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

Clutch Slave Cylinder Fluid Seal Replacement

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



CAUTION

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

NOTE

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

Remove the spring and fluid seal.

CAUTION

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

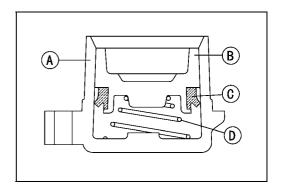
- Before assembly, apply clutch fluid to the outside of the piston and the fluid seal.
- Install the fluid seal as shown.

Cylinder [A]

Piston [B]

Fluid Seal [C]

Spring [D]



2-24 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

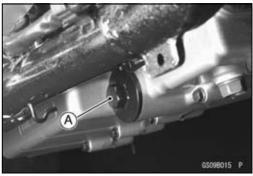
Engine Lubrication System

Engine Oil Change

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



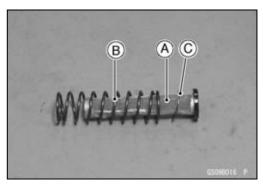
Remove:
 Oil Screen Plug [A] (Engine right side)



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

A WARNING

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



NOTE

- OWhile cleaning the screen, check for any metal particles that might indicate internal engine damage.
- Check the screen carefully for any damage: holes and broken wires.
- ★If the screen is damaged, replace it.
- Be sure to put in the oil screen with the rubber gasket end inside.
- ★Replace the screen plug O-ring with new one if it is damaged.
- Tighten:

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

- OThe oil in the filter can be drained by removing the filter (see Oil Filter Change in this section).
- ★Replace the drain plug gasket with a new one if it is damaged.
- Tighten:

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

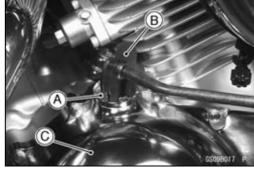
Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)

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

Special Tool - Filler Cap Driver: 57001-1454

• Tighten:

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



Engine Oil

Type: API SE, SF or SG class

API SH or SJ class with JASO MA

Viscosity: SAE 10W-40

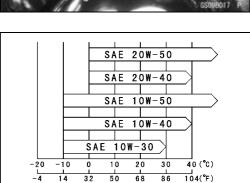
Amount: 2.9 L (3.1 US qt, when filter is not removed)

3.1 L (3.3 US qt, when filter is removed)3.5 L (3.7 US qt, when engine is completely

disassembled and dry)

NOTE

OAlthough 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.



GS09010BS1 C

2-26 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Oil Filter Replacement

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

Special Tool - Oil Filter Wrench: 57001-1249

NOTE

- OThe filter has an oil filter bypass valve which can not be removed.
- Replace the oil filter with the new one.
- Apply oil to the gasket of the new filter before installation.
- Tighten the filter with the oil filter wrench.

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

• Pour in the specified type and amount of oil.



Tire Inspection

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

- Remove any imbedded stones or other foreign particles from the tread.
- Visually inspect the tire for cracks and cuts, replacing the tire in case of damage. Swelling or high spots indicate internal damage, requiring tire replacement.
- Measure the tread depth at the center of the tread with a depth gauge [A]. Since the tire may wear unevenly, take measurement at several places.
- ★If any measurement is less than the service limit, replace the tire (see Wheels/Tires chapter).

Tread Depth

Standard:

Front: 4.3 mm (0.17 in.) Rear: 7.2 mm (0.28 in.)

Service Limit:

Front: 1 mm (0.04 in.)

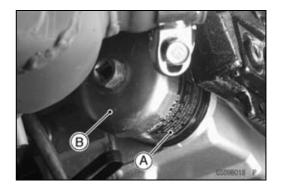
(DE, AT, CH) 1.6 mm (0.063 in.)

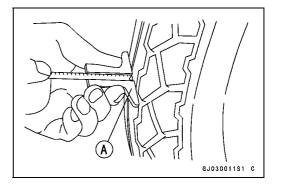
Rear: 2 mm (0.08 in.):

Up to 130 km/h (80 mph)

3 mm (0.1 in.):

Over to 130 km/h (80 mph)





- Measure the tire air pressure with an air pressure gauge [A] when the tires are cold (that is, when the motorcycle has not been ridden more than a mile during the past 3 hours.)
- ★ Adjust the tire air pressure according to the specifications if necessary.
- Install the air valve cap.

Air Pressure (when cold)

Front	Up to 186 kg (410 lb)	200 kPa (2.0 kgf/cm², 28 psi)
Rear	Up to 186 kg (410 lb)	250 kPa (2.5 kgf/cm², 36 psi)

gf/cm², 28 psi)

A WARNING

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

NOTE

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

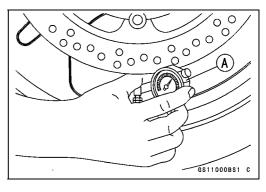


Final Gear Case Oil Level Inspection

▲ WARNING

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

- Support the motorcycle perpendicular to the ground.
- Unscrew the filler plug [A], using the filler cap driver [B].
 Special Tool Filler Cap Driver: 57001-1454
- The oil level [A] should come to the bottom of the filler opening.
- ★ If it is low, first check the final gear case for oil leakage, remedy it if necessary, and add oil through the filler opening. Use the same type and brand of oil that is already in the final gear case.
- Install the filler plug.







2-28 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Final Gear Case Oil Change

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

A WARNING

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

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

Torque - Final Gear Case Drain Plug: 8.8 N·m (0.90 kgf·m, 78 in·lb)

• Fill the final gear case with the specified oil and quantity.

Final Gear Case Oil:

Amount: 200 mL (6.76 US oz)

Grade: API GL-5 hypoid gear oil

Viscosity: When above 5°C (41°F) SAE 90

When below 5°C (41°F) SAE 80

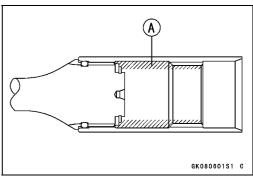
NOTE

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

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

Propeller Shaft Joint Lubrication

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



Brakes

Brake Pad Wear Inspection

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

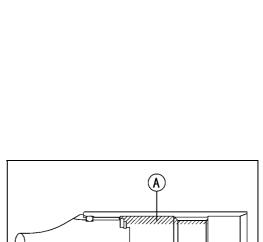
Pad Lining Thickness

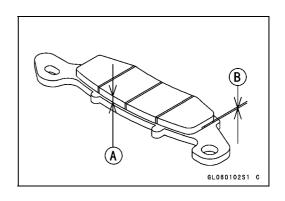
Standard:

Front: 4.5 mm (0.18 in.)

Rear: 7.5 mm (0.295 in.)

Service Limit: 1 mm (0.04 in.)





Brake Hose and Connection Inspection

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

Brake Fluid Level Inspection

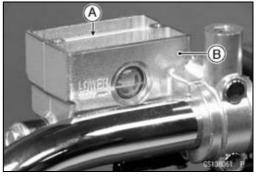
• Check that the brake fluid level in the front brake reservoir [A] is above the lower [B] level line.

NOTE

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



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



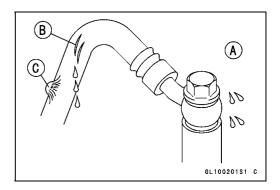
- Check that the brake fluid level in the rear brake reservoir [A] is between the upper [B] and the lower [C] level lines.
- ★ If the fluid level is lower than the lower level line, fill the reservoir to the upper level line.
- Tighten:

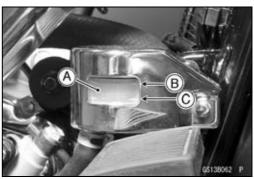
Torque - Front Brake Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

- OUse extra heavy-duty brake fluid only from a container marked DOT4.
- OBrake fluid of DOT4 is installed in the brake system when shipped.

▲ WARNING

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





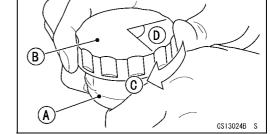
2-30 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Brake Fluid Change

NOTE

- OThe procedure to change the front brake fluid is as follows. Changing the rear brake fluid is almost the same as for the front brake.
- Level the brake fluid reservoir.
- Remove the reservoir cap [A], plate [B] and diaphragm [C]
- Follow the procedure below to install the rear brake fluid reservoir cap correctly.
- OFirst, tithe rear brake fluid reservoir cap [B] clockwise [C] by hand until slight resistance is felt indicating that the cap is seated on the reservoir body, then tighten the cap an additional 1/6 turn [D] while holding the brake fluid reservoir body [A].

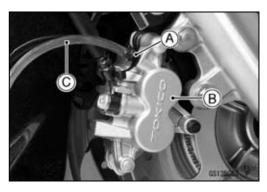


) 6813000BS1 C

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

NOTE

OThe 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.



ORepeat this operation until fresh brake fluid comes out from the plastic hose or the color of the fluid changes.

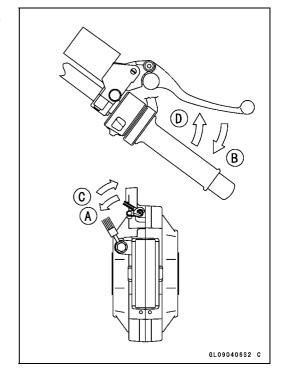
Open the bleed valve [A].

Pump the brake lever and hold it [B].

Close the bleed valve [C].

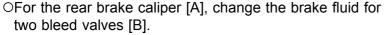
Release the brake lever [D].

Front Brake: Repeat the above steps for other caliper.

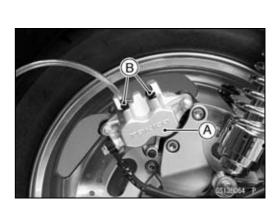


- Remove the clear plastic hose.
- Install the reservoir cap.
- Follow the procedure below to install the rear brake fluid reservoir cap correctly.
- OFirst, tithe rear brake fluid reservoir cap [B] clockwise [C] by hand until slight resistance is felt indicating that the cap is seated on the reservoir body, then tighten the cap an additional 1/6 turn [D] while holding the brake fluid reservoir body [A].
- Tighten the bleed valves, and install the rubber caps.

Torque - Caliper Bleed Valves: 7.8 N·m (0.8 kgf·m, 69 in·lb) Front Brake Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)



- After changing the fluid, check the brake for good braking power, no brake drag, and no fluid leakage.
- ★If necessary, bleed the air from the lines (see Brakes chapter).



(B)

(A)

Brake Master Cylinder Cup and Dust Cover Replacement

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

Caliper Fluid/Dust Seals Replacement

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

2-32 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Brake Light Switch Inspection

Front Brake

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

Rear Brake

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



- ★If it does not, adjust the brake light switch.
- While holding the switch body, turn the adjusting nut to adjust the switch.

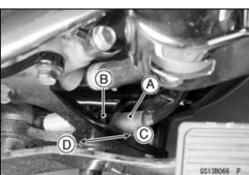
Switch Body [A] Adjusting Nut [B]

Light sooner as the body rises [C]

Light later as the body lowers [D]

CAUTION

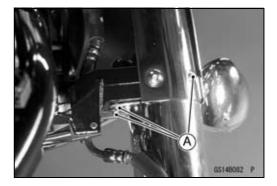
To avoid damaging the electrical connections inside the switch, be sure that the switch body does not turn during adjustment.



Suspension

Front Fork Oil Leak Inspection

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



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



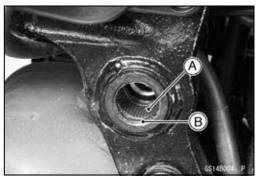
Rear Shock Absorber Oil Leak Inspection

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



Swingarm Pivot Lubrication

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



Steering

Steering Inspection

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

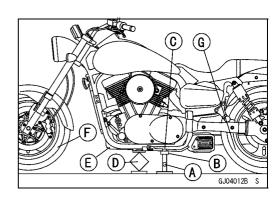
Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

- OWith the front wheel pointing straight ahead, alternately tap each end of the handlebar. The front wheel should swing fully right and left from the force of gravity until the fork hits the stop.
- ★ If the wheel binds or catches before the stop, the steering is too tight.
- OFeel for steering looseness by pushing and pulling [A] the fork.
- ★If you feel looseness, the steering is too loose.

NOTE

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



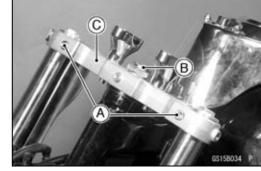


2-34 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Steering Adjustment

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



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

Special Tool - Steering Stem Nut Wrench: 57001-1100

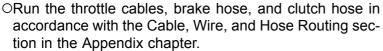
Torque - Steering Stem Nut: 4.9 N·m (0.5 kgf·m, 43 in·lb)

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

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

Upper Fork Clamp Bolts: 20 N⋅m (2.0 kgf⋅m, 14 ft⋅lb)

Upper Fork Clamp Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb) VN1600-A2 ∼



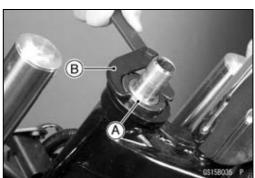
 Check and adjust the steering and throttle cables after installation.

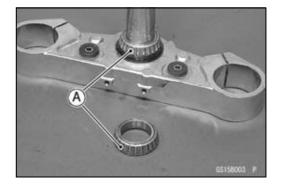
A WARNING

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

Steering Stem Bearing Lubrication

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





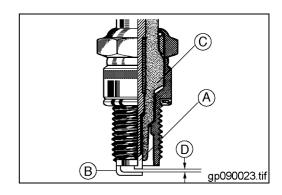
Electrical System

Spark Plug Inspection

Spark Plug Cleaning/Inspection

- Clean the spark plug, preferably in a sandblasting device, and then clean off any abrasive particles. The plug may also be cleaned using a high-flash point solvent and a wire brush or other tool.
- ★If the spark plug center electrode [A] and/or side electrode [B] are corroded or damaged, or if the insulator [C] is cracked, replace the plug.
- Use the standard spark plug or its equivalent.
- Measure the gap [D] with a wire-type thickness gauge.
- ★If the gap is incorrect, carefully bend the side electrode with a tool to obtain the correct gap.

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



General Lubrication

Lubrication

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

NOTE

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

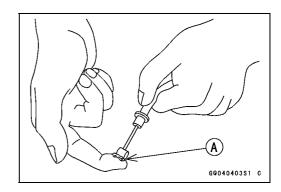
Pivots: Lubricate with Motor Oil.

Rear Brake Rod Joint

Points: Lubricate with Grease.

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

Sidestand

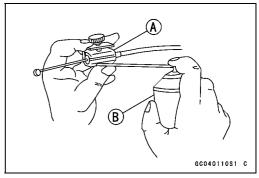


Cable: Lubricate with Cable Lubricant.

Choke Cable

Throttle Cables

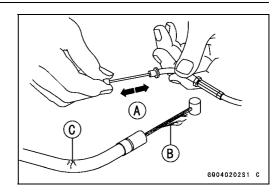
- Lubricate the cables by seeping the oil between the cable and housing.
- OThe cable may be lubricated by using a commercially available pressure cable lubricator [A] with an aerosol cable lubricant [B].



2-36 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

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



Nut, Bolt, and Fastener Tightness

Tightness Inspection

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

NOTE

- OFor the engine fasteners, check the tightness of them when the engine is cold (at room temperature).
- ★If there are loose fasteners, retighten them to the specified torque, following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not in the appropriate chapter, see the Standard Torque Table in this chapter. For each fastener, first loosen it by 1/2 turn, then tighten it.
- ★If cotter pins are damaged, replace them with new ones.

Nut. Bolt and Fastener to be checked

Wheels:

Front Axle

Front Axle Clamp Bolts

Rear Axle Nut

Rear Axle Nut Cotter Pin

Final Drive:

Final Gear Case Mounting Nuts

Brakes:

Front Master Cylinder Clamp Bolts

Caliper Mounting Bolts

Rear Master Cylinder Mounting Bolts

Rear Caliper Holder Bolt

Brake Lever Pivot Bolt Locknut

Brake Pedal Clamp Bolt

Brake Rod Joint Cotter Pin

Suspension:

Front Fork Clamp Bolts

Front Fender Mounting Bolts

Rear Shock Absorber Nuts

Swingarm Pivot Shaft

Steering:

Steering Stem Head Nut

Handlebar Clamp Bolts

Engine:

Throttle Cable Adjuster Locknuts Engine Mounting Bolts and Nuts

Shift Pedal Bolts

Muffler Mounting Bolt and Nut

Exhaust Pipe Holder Nuts

Clutch Master Cylinder Clamp Bolts Clutch Lever Pivot Bolt Locknut

Radiator Mounting Bolt

Others:

Sidestand Bolt and Nut

Footboard Bracket Bolts

Footpeg Bracket Bolts

Downtube Bolts (Right)

Fuel System (DFI)

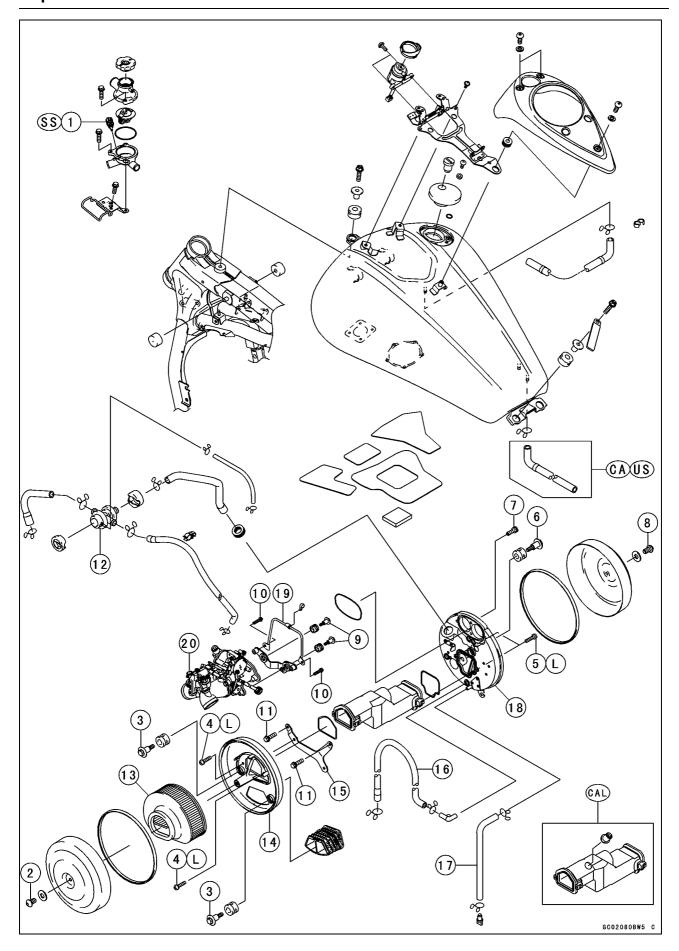
Table of Contents

Exploded View	3-3	Crankshaft Sensor	
DFI Parts Location	3-8	Removal/Installation	3-59
DFI System	3-12	Crankshaft Sensor Inspection	3-59
DFI Wiring Diagram	3-14	Vehicle-down Sensor (Service Code	
Specifications	3-17	31)	3-60
Special Tools and Sealant	3-19	Vehicle-down Sensor Removal	3-60
DFI Servicing Precautions	3-20	Installation	3-60
Troubleshooting the DFI System	3-21	Vehicle-down Sensor Inspection	3-61
Outline	3-21	Fuel Injectors (#1, #2: Service Code	
Inquiries to Rider	3-25	41, 42)	3-63
DFI System Troubleshooting Guide	3-28	Injector Removal	3-63
Self-Diagnosis	3-37	Injector Installation	3-63
Self-diagnosis Procedures	3-37	Audible Inspection	3-66
Service Code Reading	3-38	Power Source Voltage Inspection	3-66
Service Code Erasing	3-39	Output Voltage Inspection	3-67
Throttle Sensor (Service Code 11)	3-42	Injector Signal Test	3-68
Throttle Sensor Removal/Adjust-		Injector Resistance Inspection	3-68
ment	3-42	Injector Unit Test	3-69
Input Voltage Inspection	3-42	Fuel Pump (Service Code 45)	3-70
Output Voltage Inspection	3-43	Fuel Pump Removal	3-70
Resistance Inspection	3-44	Fuel Pump Installation	3-70
Inlet Air Pressure Sensor (Service	•	Pressure Regulator Removal	3-71
Code 12)	3-45	Pump Screen, Fuel Filter	
Removal	3-45	Cleaning	3-71
Installation	3-45	Operation Inspection	3-71
Input Voltage Inspection	3-45	Operating Voltage Inspection	3-72
Output Voltage Inspection	3-46	Power Source Voltage Inspection	3-73
Inlet Air Temperature Sensor (Service		Operating Voltage Inspection	3-73
Code 13)	3-50	Ignition Coils (#1, #2: Service Code	
Removal/Installation	3-50	51, 52)	3-75
Output Voltage Inspection	3-50	Removal/Installation	3-75
Sensor Resistance Inspection	3-51	Input Voltage Inspection	3-75
Water Temperature Sensor (Service	00.	FI Indicator LED Light	3-76
Code 14)	3-52	LED Light Inspection	3-77
Removal/Installation	3-52	ECU	3-78
Output Voltage Inspection	3-52	ECU Identification	3-78
Water Temperature Sensor	0 02	ECU Removal	3-78
Resistance Inspection	3-53	ECU Installation	3-78
Atmospheric Pressure Sensor	0 00	ECU Power Supply Inspection	3-78
(Service Code 15)	3-55	DFI Power Source	3-80
Removal	3-55	DFI Fuse Removal	3-80
Installation	3-55	DFI Fuse Inspection	3-80
Input Voltage Inspection	3-55	DFI Main Relay Removal	3-80
Output Voltage Inspection	3-56	DFI Main Relay Inspection	3-80
Crankshaft Sensors (#1, #2: Service	0 00	ISC Valves	3-82
Code 21. 22)	3-59	Removal/Installation	3-82
VVVG 61. 661	()-().7)	Demovalmatananum	J-07

3-2 FUEL SYSTEM (DFI)

Power Source Voltage Inspection	3-82	Element Removal	3-97
Output Voltage Inspection	3-83	Element Cleaning	3-97
Resistance Inspection	3-83	Left Air Cleaner Housing	
Fuel Line	3-85	Removal/Installation	3-97
Fuel Pressure Inspection	3-85	Right Air Cleaner Housing	
Fuel Flow Rate Inspection	3-87	Removal	3-98
Throttle Grip and Cables	3-89	Right Air Cleaner Housing	
Throttle Grip Free Play Inspection	3-89	Installation	3-98
Throttle Grip Free Play		Lower Air Cleaner Duct	
Adjustment	3-89	Removal/Installation	3-99
Choke Knob Operation	3-89	Fuel Tank	3-100
Choke Cable Free Play		Fuel Tank Removal	3-100
Inspection	3-89	Fuel Tank Installation	3-103
Cable Removal/Installation	3-89	Fuel Tank and Cap Inspection	3-104
Cable Lubrication and Inspection.	3-89	Fuel Tank Cleaning	3-105
Throttle Body Assy	3-90	Evaporative Emission Control	
Idle Speed Check	3-90	System	3-106
Idle Speed Adjustment	3-90	Parts Removal/Installation	3-106
Throttle Bore Cleaning	3-90	Canister Installation	3-106
High Altitude Performance		Canister Inspection (Periodic	
Adjustment	3-90	Inspection)	3-106
Throttle Body Assy Removal	3-90	Separator Inspection (Periodic	
Throttle Body Assy Installation	3-93	Inspection)	3-106
Throttle Body Assy		Hose Inspection (Periodic	
Disassembly/Assembly	3-94	Inspection)	3-107
Air Cleaner	3-97	Separator Operation Test	3-107

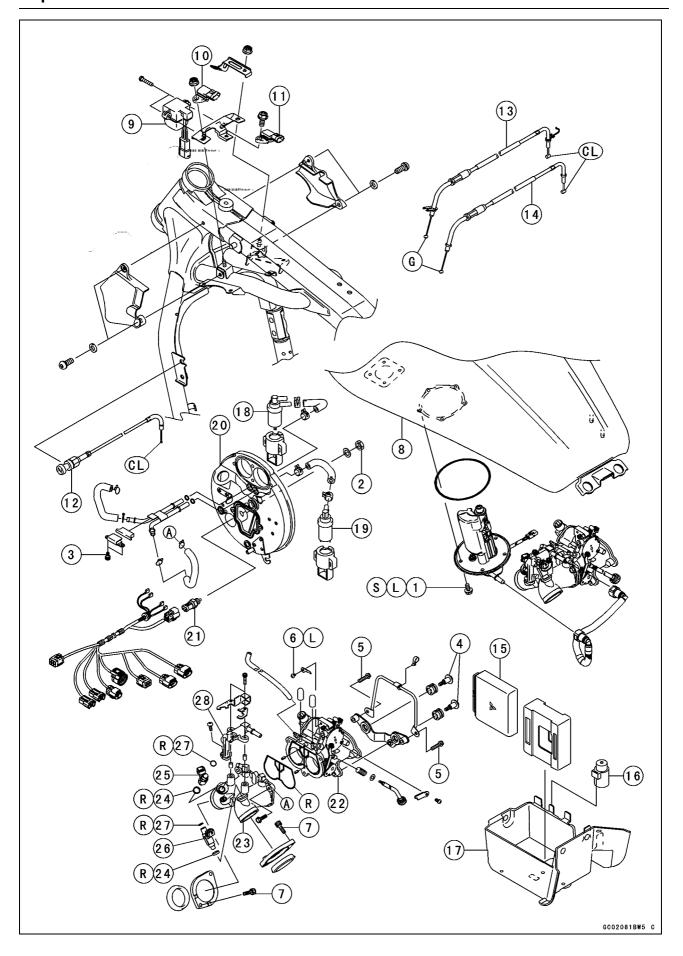
Dummy Page



No.	Fastener	Torque			Domonico
		N·m	kgf∙m	ft·lb	Remarks
1	Water Temperature Sensor	18	1.8	13	SS
2	Left Air Cleaner Cover Allen Bolt ϕ 8	16	1.6	12	
3	Left Air Cleaner Base Bolts	11	1.1	95 in·lb	
4	Left Air Cleaner Base Screws	2.2	0.22	19 in·lb	L
5	Right Air Cleaner Base Screws	2.2	0.22	19 in·lb	L
6	Right Air Cleaner Base Bolt	11	1.1	95 in·lb	
7	Right Air Cleaner Allen Bolts	11	1.1	95 in·lb	
8	Right Air Cleaner Cover Allen Bolt ϕ 8	16	1.6	12	
9	Throttle Body Assy Holder Bolts	11	1.1	95 in·lb	
10	Spark Plug Lead Holder Bolts	11	1.1	95 in·lb	
11	Air Cleaner Duct Holder Bolts	9.8	1.0	69 in·lb	

- 12. Vacuum switch valve
- 13. Air cleaner element
- 14. Left air cleaner base
- 15. Air cleaner duct holder
- 16. Crankcase breather hose
- 17. Air cleaner drain hose
- 18. Right air cleaner base
- 19. Right spark plug lead holder
- 20. Throttle body assy
 - L: Apply a non-permanent locking agent.
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

CAL: California Model
CA: Canadian Model
US: United States Model



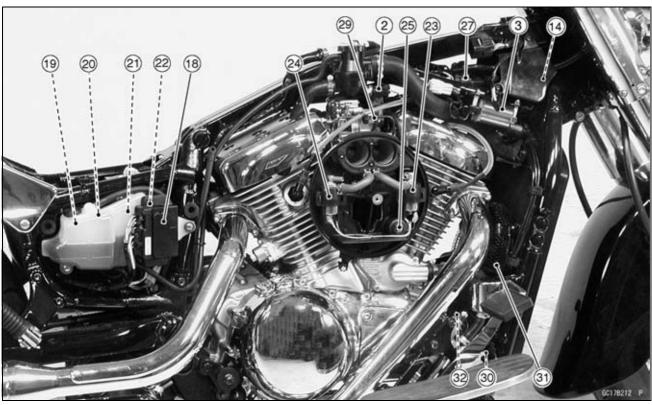
No.	Fastener		Torque		
		N⋅m	kgf⋅m	ft·lb	Remarks
1	Fuel Pump Bolts	9.8	1.0	87 in·lb	S, L
2	Inlet Air Temperature Sensor Nut	7.8	0.80	69 in·lb	
3	ISC Pipe Holder Bolts	11	1.1	95 in·lb	
4	Throttle Body Assy Holder Bolts	11	1.1	95 in·lb	
5	Spark Plug Lead Holder Bolts	11	1.1	95 in·lb	
6	Choke Cable Plate Screw	2.9	0.30	26 in·lb	L
7	Inlet Manifold Bolt	12	1.2	104 in·lb	

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

3-8 FUEL SYSTEM (DFI)

DFI Parts Location





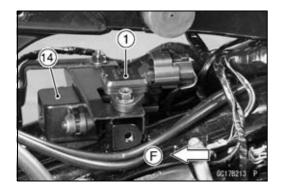
DFI Parts Location

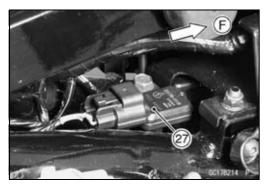
DFI: DFI Parts (this chapter)

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

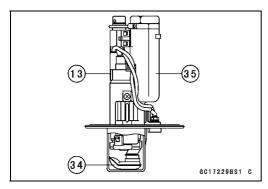
3-10 FUEL SYSTEM (DFI)

DFI Parts Location

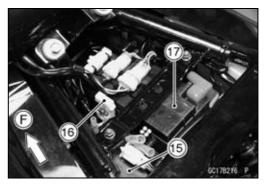


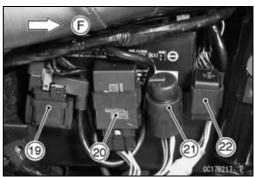
















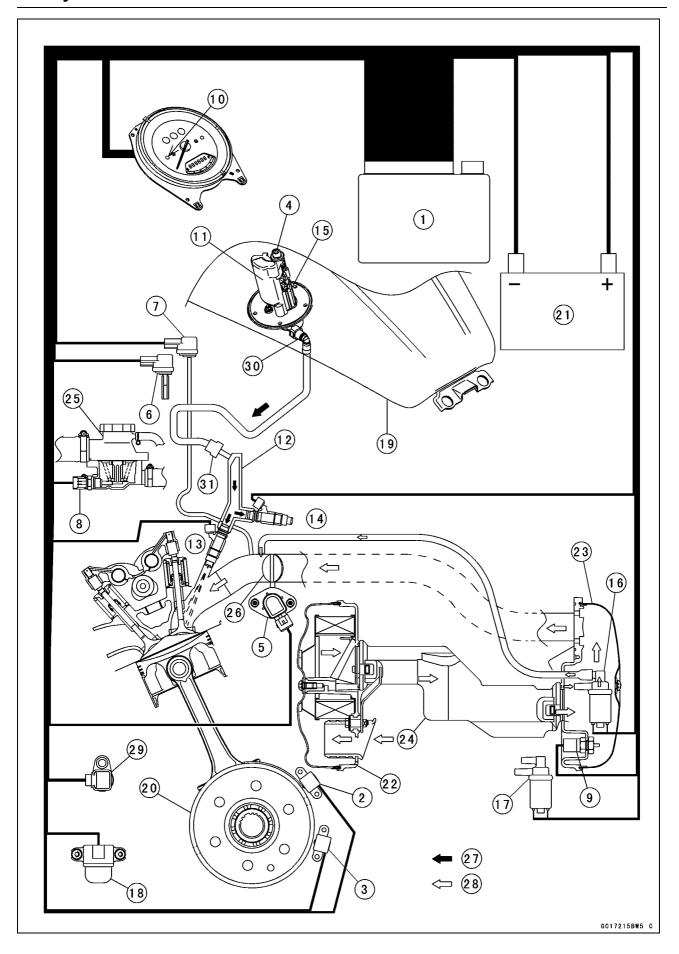


DFI Parts Location

DFI: DFI Parts (this chapter)

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

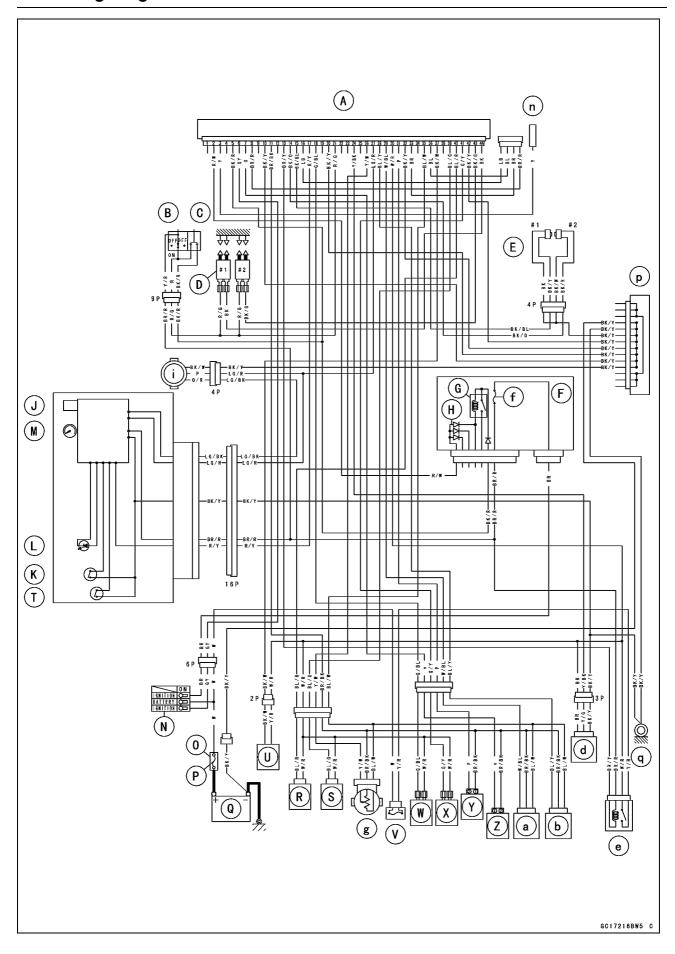
DFI System



DFI System

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

DFI Wiring Diagram



DFI Wiring Diagram

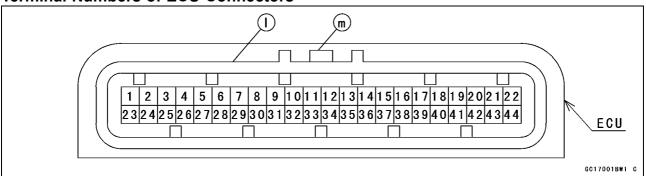
DFI and Electrical Parts

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

3-16 FUEL SYSTEM (DFI)

DFI Wiring Diagram

Terminal Numbers of ECU Connectors



Terminal Names

- I: ECU Connector
- m: Connector Lock
- #1: Front Cylinder, #2: Rear Cylinder
 - 1. Starter Lockout Switch Signal
- 2. Interlock Circuit Signal
- 3. Self-diagnosis Signal (generated by grounding this terminal and shown by FI indicator LED light)
- 4. Tachometer Signal
- 5. Electric Starter Button signal
- 6. Anti theft Signal
- 7. Water temperature sensor (+)
- 8. Power Source for Diagnosis Tool
- 9. –
- ECU Power Source Circuit Ground to Battery (–) Terminal
- 11. Ground of Inlet Air Temperature, Water Temperature, Inlet Air Pressure, Atmospheric Pressure, and Throttle Sensors
- 12. Neutral Switch
- 13. DFI Main Relay Solenoid Ground in ECU
- 14. Crankshaft Sensor #2 Signal
- 15. Crankshaft Sensor #1 Signal
- 16. Com. Line A
- 17. FI Indicator LED Light Signal
- 18. ISC Valve #1 Signal
- 19. –
- 20. Ignition Control Circuit Ground to Battery (–) Terminal

- 21. Engine Stop Signal
- 22.23. -
- 24. Vehicle-down Sensor Signal
- 25. -
- 26. Throttle Sensor Signal
- 27. Speed Sensor Signal
- 28. Atmospheric Pressure Sensor Signal
- 29. Inlet Air Pressure Sensor Signal
- 30. Power Supply to ECU, ISC Valves, Injectors, and Fuel Pump, Vehicle-down Sensor
- 31. Inlet Air Temperature Sensor (+)
- 32. ECU Power Source Circuit Ground to Battery (–) Terminal (the same as #10)
- 33. Power Source Ground for Diagnosis Tool
- 34. –
- 35. Power Supply to Sensors (inlet air pressure, atmospheric pressure, and throttle sensors) from ECU
- 36. Com. Line B
- 37. Fuel Pump Signal
- 38. -
- 39. Injector #2 Signal
- 40. Injector #1 Signal
- 41. ISC Valve #2 Signal
- 42. Ignition Control Circuit Ground to Battery (–) Terminal (the same as #20)
- 43. Ignition Coil #2 Signal
- 44. Ignition Coil #1 Signal

Specifications

Item	Standard				
Throttle Grip Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)				
Air Cleaner Element	Paper filter				
DFI System					
Make:	Mitsubishi Electric				
Idle Speed:	950 ±50 r/min (rpm)				
Throttle Body Assy:					
Type × Bore	Two barrel type × ϕ 36 mm (1.42 in.)				
Ecu (Electronic Control Unit):					
Туре	Digital memory type, with built in IC igniter, sealed with resin				
Usable Engine Speed	100 ~ 6 200 r/min (rpm)				
ISC Valves:	(Idle Speed Control Valve, or Fast Idle Solenoid Valve)				
Maximum Air Flow Rate	75 ±7 L (19.8 ±1.8 US gal)/min				
Solenoid Resistance	13.6 ~ 20.4 Ω				
Fuel Pressure (High Pressure Line):					
Right After Ignition Switch ON	304 kPa (3.1 kgf/cm², 44 psi) with fuel pump running				
After Pump Runs 3 sec. And Stops.	280 kPa (2.9 kgf/cm², 41 psi) with fuel pump stopped				
With Engine Idling	304 kPa (3.1 kgf/cm², 44 psi) with fuel pump running				
Throttle Sensor:					
Input Voltage	4.75 ~ 5.25 V DC between BL/W and BR/BK leads				
Output Voltage At Idle Throttle Opening	0.584 ~ 0.604 V DC between Y/W and BR/BK leads				
Output Voltage At Full Throttle Opening	4.29 ~ 4.59 V DC between Y/W and BR/BK leads				
Resistance	4 ~ 6 kΩ between BL/W and BR/BK leads				
Atmospheric Pressure Sensor/Inlet Air Pressure Sensor:					
Input Voltage	4.75 ~ 5.25 V DC				
Output Voltage	3.74 ~ 4.26 V DC at standard atmospheric pressure				
Inlet Air Temperature Sensor:					
Resistance	5.4 ~ 6.6 kΩ at 0° C (32° F)				
	2.26 ~ 2.86 kΩ at 20° C (68° F)				
	0.29 ~ 0.39 kΩ at 80° C (176° F)				
Water Temperature Sensor:					
Resistance	2.162 ~ 3.112 kΩ at 20° C (68° F)				
	0.785 ~ 1.049 kΩ at 50° C (122° F)				
	0.207 ~ 0.253 kΩ at 100° C (212° F)				
Vehicle-Down Sensor:					
Detection Angle	More than 45° ±5° for each bank				
Detection Time	Within 0.5 ~ 1.0 sec.				
Fuel Injectors:					
Туре	INP- 281				
Static Injection Quantity	273.0 ~ 289.8 mL (9.23 ~ 9.80 US oz)/min				
Nozzle Type × Diameter	One spray type with 4 holes				
Resistance	11.7 ~ 12.3 Ω at 20° C (68° F)				

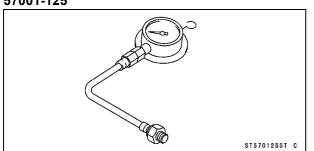
3-18 FUEL SYSTEM (DFI)

Specifications

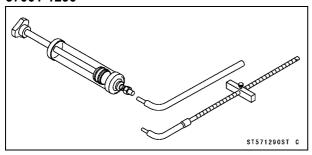
Item	Standard
Fuel Pump:	
Туре	Friction pump
Discharge	67 mL (2.27 US oz) or more for 3 seconds

Special Tools and Sealant

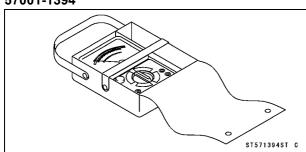
Oil Pressure Gauge, 5 kgf/cm²: 57001-125



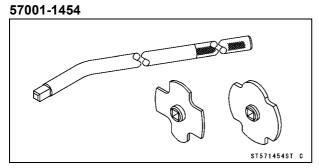
Fork Oil Level Gauge: 57001-1290



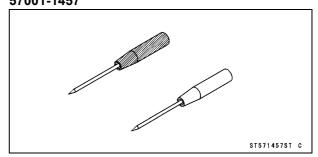
Hand Tester: 57001-1394



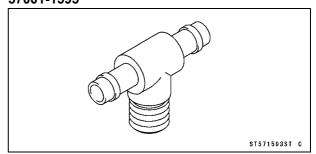
Filler Cap Driver:



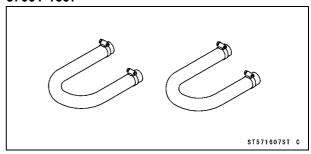
Needle Adapter Set: 57001-1457



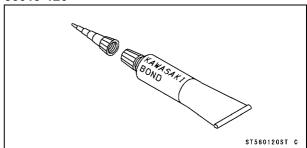
Fuel Pressure Gauge Adapter: 57001-1593



Fuel Hose: 57001-1607



Kawasaki Bond (Silicone Sealant): 56019-120



DFI Servicing Precautions

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

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

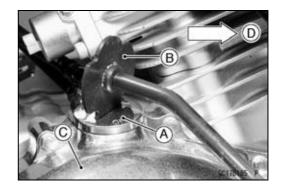
Clutch Cover [C]

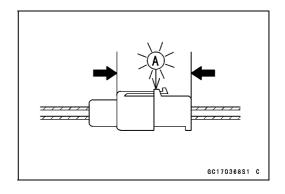
Front [D]

Special Tool - Filler Cap Driver: 57001-1454

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

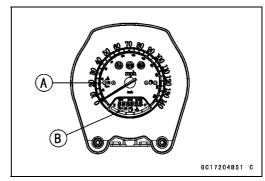
- OThis DFI system is designed to be used with a 12 V sealed battery as its power source. Do not use any other battery except for a 12 V sealed battery as a power source.
- ODo not reverse the battery lead connections. This will damage the ECU.
- ODo not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running. Otherwise, surge damages the connector terminals or the DFI parts.
- OTake care not to short the leads that are directly connected to the battery positive (+) terminal to the chassis ground.
- OWhen charging, remove the battery from the motorcycle. This is to prevent ECU damage by excessive voltage.
- OWhenever 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.
- OConnect these connectors until they click [A].
- ODo not turn the ignition switch ON while any of the DFI electrical connectors are disconnected. The ECU memorizes fault codes.
- ODo not spray water on the electrical parts, DFI parts, connectors, leads, and wiring. Never water a vehicle with connectors unplugged because seals don't work and terminals could corrode.
- OTo prevent corrosion and deposits in the fuel system, do not add any fuel antifreeze chemicals to fuel.
- OWhen any 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.
- ODo not operate the fuel pump if the pump is completely dry. This is to prevent pump seizure.
- OBefore removing the fuel system parts, blow the outer surfaces of these parts clean with compressed air.
- OWhen 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.





Outline

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



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

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

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

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

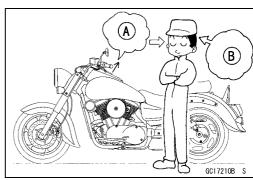
When the FI indicator LED light and FI symbol go on and the motorcycle is brought in for repair, check the service codes.

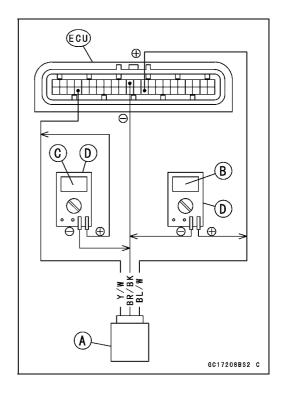
When the repair has been done, the LED light and FI symbol do not go on.

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

Voltage Check Method

- OThis method is conducted by measuring the input voltage [B] to a sensor [A] first, and then the output voltage [C] from the sensor.
- OSometime this method can detect a fault of the ECU.
- ORefer to each Sensor Inspection section for detail in this chapter.
- Use a fully charged battery, and a digital meter [D] which can be read two decimal places voltage or resistance.





OThe DFI part connectors [A] have seals [B], including the ECU (except for ISC valves).

• Join the connector [A] and insert the needle adapter (special tool) [C] inside the seal [B] from behind the connector until the adapter reaches the terminal.

Special Tool - Needle Adapter Set: 57001-1457

CAUTION

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

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

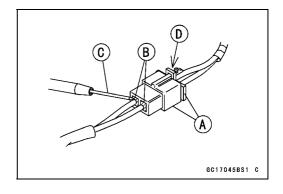


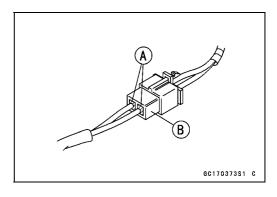
Incorrect, reverse connection or short circuit by needle adapters could damage the DFI or electrical system parts.

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

Silicone Sealant- Kawasaki Bond: 56019-120

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



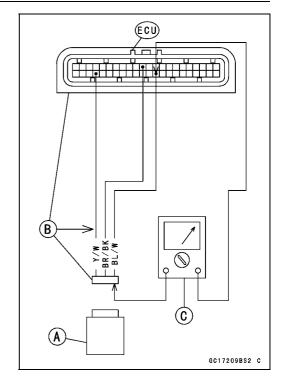


Resistance Check Method

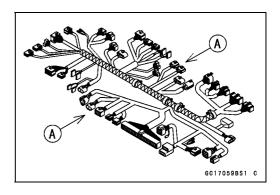
- OThis method is simple. No need for a fully charged battery and the needle adapter. Just do the following especially when a sensor [A] is suspect.
- Turn the ignition switch OFF and disconnect the connectors.
- Inspect the sensor resistance, using a digital meter (see each Sensor Inspection in this chapter).
- Inspect the wiring and connections [B] for continuity, using the hand tester [C] (special tool, analog tester) rather than a digital meter.

Special Tool - Hand Tester: 57001-1394

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



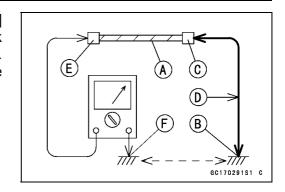
- Trouble may involve one or in some cases all items.
 Never replace a defective part without determining what CAUSED the problem. If the problem was caused by some other item or items, they too must be repaired or replaced, or the new replacement part will soon fail again.
- Measure coil winding resistance when the DFI part is cold (at room temperature)
- Make sure all connectors in the circuit are clean and tight, and examine wires for signs of burning, fraying, short, etc. Deteriorated wires and bad connections can cause reappearance of problems and unstable operation of the DFI system.
- ★If any wiring is deteriorated, replace the wiring.
- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
- ★If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it. Connect the connectors securely.
- Check the wiring for continuity.
- OUse the wiring diagram to find the ends of the lead which is suspected of being a problem.
- OConnect the hand tester between the ends of the leads.
- OSet the tester to the \times 1 Ω range, and read the tester.
- \star If the tester does not read 0 Ω , the lead is defective. Replace the lead.



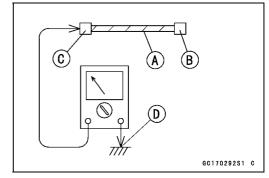
3-24 FUEL SYSTEM (DFI)

Troubleshooting the DFI System

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



OWhen 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.

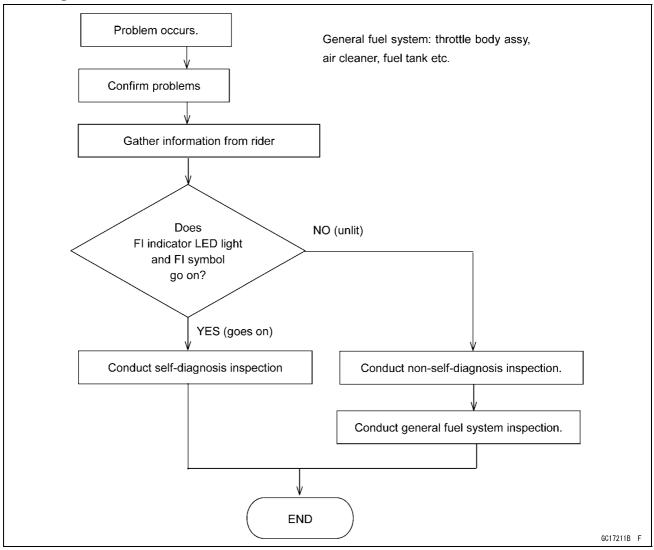


- Narrow down suspicious locations by repeating the continuity tests from the ECU connectors.
- ★If no abnormality is found in the wiring or connectors, the DFI parts are the next likely suspects. Check the part, starting with input and output voltages. However, there is no way to check the ECU itself.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

OWire Color Codes:

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

DFI Diagnosis Flow Chart



Inquiries to Rider

- Refer to the next sample diagnosis chart.
- OEach rider reacts to problems in different ways, so it is important to confirm what kind of symptoms the rider has encountered.
- OTry to find out exactly what problem occurred under exactly what conditions by asking the rider; knowing this information may help you reproduce the problem.
- OThe 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.

3-26 FUEL SYSTEM (DFI)

Troubleshooting the DFI System

Sample Diagnosis Sheet

Rider name:	F	Registration No. (license plate No.):	Year	of initial registration:
Model:		Engine No.:		Frame No.:
Date problem occurred:			Mileage:	
		Environment when probler	m occ	curred.
Weather	□ fine, □ cloudy, □ rain, □ snow, □ always, □ other:			
Temperature	Г	□ hot, □ warm, □ cold, □ very cold, □ a	lways	
Problem frequency		□ chronic, □ often, □ once		
Road	Г	□ street, □ highway, □ mountain road (□	uphil	I, □ downhill), □ bumpy, □ pebble
Altitude		□ normal, □ high (about 1 000 m (3 281	ft) or	more)
		Motorcycle conditions when pr	oblen	n occurred.
FI indicator LED light		☐ light up immediately after ignition switc pressure is high enough (with engine r		
		☐ lights up immediately after ignition swit pressure is high enough (with engine r		,
		lights up immediately after ignition swift seconds though engine oil pressure is problem).		. •
	Г	unlights (LED light, ECU or its wiring fa	ault).	
	Г	□ sometimes lights up (probably wiring fa	ault).	
Starting		□ starter motor not rotating.		
difficulty		□ starter motor rotating but engine doesr	n't turr	over.
		starter motor and engine don't turn over	er.	
		\square no fuel flow (\square no fuel in tank, \square no fu	ıel pu	mp sound).
	□ engine flooded (do not crank engine with throttle opened, which promotes engine flooding).			
	□ no spark.			
		choke knob is not pulled fully when using	ng the	knob (pull it fully when using).
		□ other:		
Engine stops		□ right after starting.		
		□ when opening throttle grip.		
		when closing throttle grip.		
	□ when moving off.			
	Г	when stopping the motorcycle.		
	Г	□ when cruising.		
	□ other:			
Poor running	□ choke knob left pulled out fully (push it in fully).			
at low speed	□ very low fast idle speed.			
	□ very low idle speed, □ very high idle speed, □ rough idle speed.			□ rough idle speed.
	□ battery voltage is low (charge the battery).			
	□ spark plug loose (tighten it).			
		□ spark plug dirty, broken, or gap maladj	usted	(adjust it).
	Г	□ backfiring.		
	□ afterfiring.			
	Г	hesitation when acceleration.		

Poor running at low speed	□ engine oil viscosity too high.
	□ brake dragging.
	□ engine overheating.
	□ clutch slipping.
	□ other:
Poor running	□ choke knob left pulled out fully (push it in fully).
or no power at	□ spark plug loose (tighten it).
high speed	□ spark plug dirty, broken, or gap maladjusted (remedy it).
	□ spark plug incorrect (replace it).
	\square knocking (fuel poor quality or incorrect, \rightarrow use high-octane gasoline).
	□ brake dragging.
	□ clutch slipping.
	□ engine overheating.
	□ engine oil level too high.
	□ engine oil viscosity too high.
	□ other:

3-28 FUEL SYSTEM (DFI)

DFI System Troubleshooting Guide

NOTE

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

Engine Doesn't Start, Starting Difficulty

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

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

3-30 FUEL SYSTEM (DFI)

DFI System Troubleshooting Guide

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

Poor Running at Low Speed

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

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

3-32 FUEL SYSTEM (DFI)

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

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

3-34 FUEL SYSTEM (DFI)

DFI System Troubleshooting Guide

Poor Running or No Power at High Speed:

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

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (detailed reference)	
HLA (hydraulic lash adjuster) damaged (worn, seizure or spring broken)	Inspect and replace (see chapter 5).	
Knocking:		
Carbon buit up in combustion chamber	Repair (see chapter 5).	
Fuel poor quality or incorrect (Use high-octone gasoline recommended in the Owner's Manual)	Change fuel (see chapter 3).	
Spark plug incorrect	Replace it with the correct plug (see chapter 16)	
Ignition coil trouble	Inspect (see chapter 16).	
IC igniter in ECU trouble	Inspect (see chapter 16).	
Inlet air temperature sensor trouble	Inspect (see chapter 3).	
Atmospheric pressure sensor trouble	Inspect (see chapter 3).	
Miscellaneous:		
Throttle valves won't fully open	Inspect throttle cable and lever linkage (see chapter 3).	
Brake dragging	Inspect caliper fluid seal damage or clogging of master cylinder relief and supply ports (see chapter 12).	
Clutch slipping	Inspect friction plates for wear (see chapter 6).	
Engine overheating	(see Overheating of Troubleshooting Guide in chapter 17)	
Engine oil level too high	Repair (see chapter 7).	
Engine oil viscosity too high	Change (see chapter 3).	
Drive train trouble	Inspect tightness of bolts and nuts (see chapter 2) or bearing wear (see chapter 11).	
Final gear case oil viscosity too high	Change (see chapter 2).	
Camshaft cam worn	Inspect and replace (see chapter 5).	
Vacuum switch valve trouble	Inspect and replace (see chapter 5).	
Air suction valve trouble	Inspect and replace (see chapter 5).	
Catalytic converters melt down due to muffler overheating (KLEEN)	Replace muffler (see chapter 5).	

Exhaust Smokes Excessively:

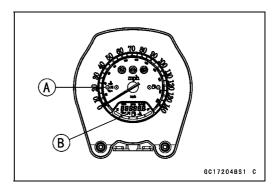
White employee		
White smokes:		
Piston oil ring worn	Inspect and replace (see chapter 5).	
Cylinder worn	Inspect and replace (see chapter 5).	
Valve oil seal damaged	Replace (see chapter 5).	
Valve guide worn	Replace the guide (see chapter 5).	
Engine oil level too high	Repair (see chapter 7).	
Black smoke:		
Air cleaner clogged	Clean (see chapter 3).	
Choke knob left pulled out	Push in (see chapter 3).	
Too high fuel pressure	Inspect (see chapter 3).	
Injection stuck open	Inspect (see chapter 3).	
Water temperature sensor trouble	Inspect and replace (see chapter 3).	
Inlet air temperature sensor trouble	Inspect and replace (see chapter 3).	

3-36 FUEL SYSTEM (DFI)

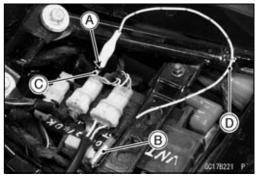
Symptoms or Possible Causes	Actions (detailed reference)		
Brown smoke:			
Air cleaner duct loose	Reinstall (see chapter 3).		
Air cleaner O-ring damaged	Replace (see chapter 3).		
Too low fuel pressure	Inspect (see chapter 3).		
Water temperature sensor trouble	Inspect and replace (see chapter 3).		
Inlet air temperature sensor trouble	Inspect and replace (see chapter 3).		

Self-diagnosis Procedures

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



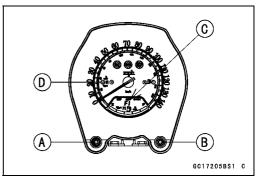
- Remove the rear and front seats (see Frame chapter).
- Ground [A] the self-diagnosis terminal [B] (yellow lead) to the battery (–) terminal [C], using a wire [D].

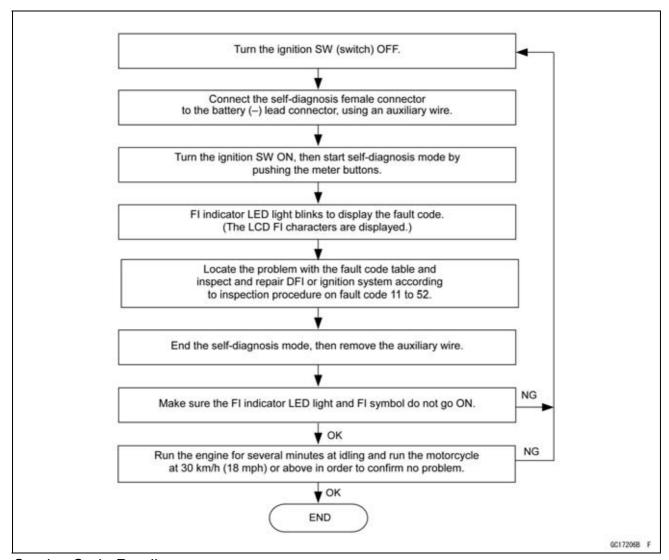


- Turn the ignition SW ON.
- Push the MODE button [A] and display the odo meter.
- Push the RESET button [B] for more than two seconds. The LCD FI characters [C] are displayed.
- Count the blinks of the LED light [D] to read the service code.

NOTE

- OUse a fully charged battery when conducting self-diagnosis. Otherwise, the LED light blinks very slowly or doesn't blink.
- OKeep the self- diagnosis female connector grounded during self-diagnosis, using a wire.
- Any of the following procedures (conditions) ends self -diagnosis.
- OWhen pushing the RESET button more than 2 seconds and 2 seconds passed.
- OWhen the ignition switch is turned to OFF.
- OPushing the MODE button and the trip meter is displayed.
- OWhen the ECU receives the speed sensor signal.





Service Code Reading

- OService codes are shown by a series of long and short blinks of the FI indicator LED light as shown below.
- ORead 10th digit and unit digit as the FI indicator LED light blinks.
- OWhen there are a number of problems, all the fault codes can be stored and the display will begin starting from the lowest number service code in the numerical order. Then after completing all codes, the display is repeated until the ignition switch is turned OFF.
- OFor example, if four problems occurred in the order of 31, 15, 41, 12, the fault codes are displayed from the lowest number in the order listed.

$$(12 \rightarrow 15 \rightarrow 31 \rightarrow 41) \rightarrow (12 \rightarrow 15 \rightarrow 31 \rightarrow 41) \rightarrow \cdots$$
 (repeated)

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

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

FI Indicator LED Light

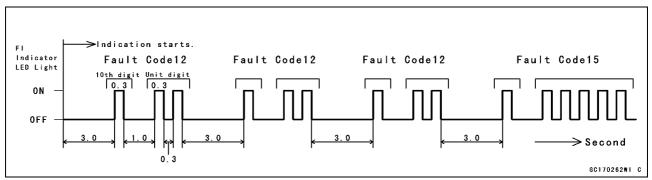
ISC Valves

DFI Main Relay

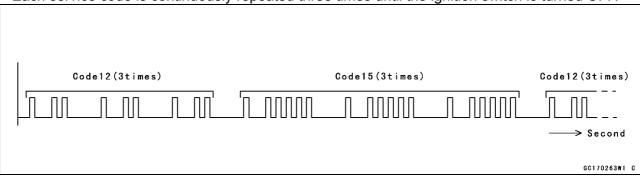
Ignition Coil Secondary Wiring (check the internal resistance, see Electrical System chapter)

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

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



OEach service code is continuously repeated three times until the ignition switch is turned OFF.



Service Code Erasing

- OWhen the repair has been done, the LED light will not show fault codes any more.
- ★But even if the repair has been done, the ignition switch is turned OFF, or the battery is disconnected, all the fault codes remain in the ECU, which need not be absolutely erased.

Service Code Table

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

3-40 FUEL SYSTEM (DFI)

Self-Diagnosis

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

Footnotes:

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

#1: For Front Cylinder

#2: For Rear Cylinder

Backups

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

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

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

Note

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

3-42 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code 11)

Throttle Sensor Removal/Adjustment

CAUTION

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

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

Front View [B]

Input Voltage Inspection

NOTE

- OBe sure the battery is fully charged.
- OThe inspection is the same as "Input Voltage Inspection" of the inlet air pressure sensor or the atmospheric pressure sensor.
- Turn the ignition switch OFF.
- Remove the ECU (see this chapter). Do not disconnect the ECU connectors.
- Connect a digital voltmeter [A] to the connector [B], using two needle adapters [C].

Special Tool - Needle Adapter Set: 57001-1457

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

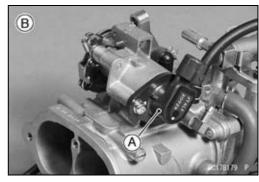
Throttle Sensor Input Voltage Connections to ECU Connector

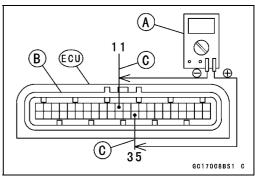
Meter (+) → BL/W lead (terminal 35)

Meter (-) → BR/BK lead (terminal 11)

Standard: 4.75 ~ 5.25 V DC

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





Throttle Sensor (Service Code 11)

Output Voltage Inspection

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

Idle Speed

Standard: 950 ±50 r/min (rpm)

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

Special Tool - Needle Adapter Set: 57001-1457

CAUTION

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

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

Throttle Sensor Output Voltage

Connections to Sensor

Meter (+) \rightarrow Y/W lead (terminal 26) Meter (-) \rightarrow BR/BK lead (terminal 11)

Standard: 0.584 ~ 0.604 V DC

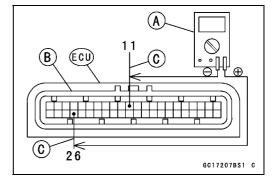
(at idle throttle opening)

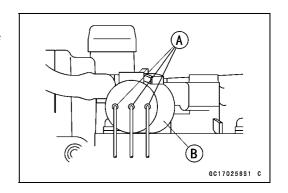
4.29 ~ 4.59 V DC

(at full throttle opening)

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

Silicone Sealant- Kawasaki Bond: 56019-120





3-44 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code 11)

Resistance Inspection

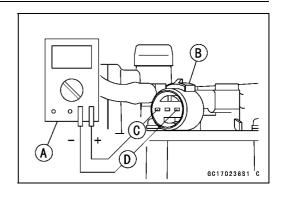
- Turn the ignition switch OFF.
- Disconnect the throttle sensor connector.
- Connect a digital meter [A] to the throttle sensor connector [B].
- Measure the throttle sensor resistance.

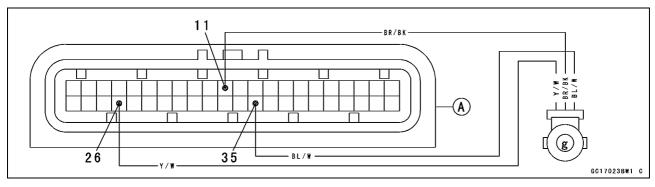
Throttle Sensor Resistance

Connections: BL/W lead [C] \longleftrightarrow BR/BK lead [D]

Standard: $4 \sim 6 \text{ k}\Omega$

- ★If the reading is out of the range, replace the throttle sensor along with the throttle body.
- ★If the reading is within the range, but the problem still exists, the ECU is suspect. Replace the ECU.





A. ECU

g. Throttle Sensor

Inlet Air Pressure Sensor (Service Code 12)

Removal

CAUTION

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

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



NOTE

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

Input Voltage Inspection

NOTE

- OBe sure the battery is fully charged.
- OThe inspection is the same as "Input Voltage Inspection" of the throttle sensor or the atmospheric pressure sensor.
- Turn the ignition switch OFF.
- Remove the ECU (see this chapter). Do not disconnect the ECU connector.
- Connect a digital voltmeter [A] to the connector [B], using two needle adapters [C].

Special Tool - Needle Adapter Set: 57001-1457

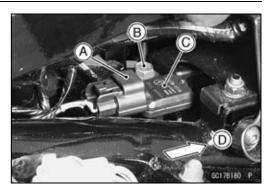
- OMeasure the input voltage to the inlet air pressure sensor with the engine stopped, and with the connectors joined.
- Turn the ignition switch ON.

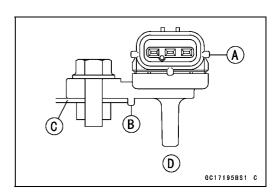
Inlet Air Pressure Sensor Input Voltage Connections to ECU

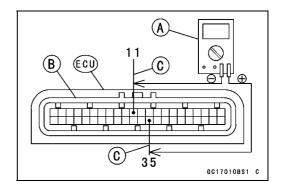
Meter (+) → BL/W lead (terminal 35)

Meter (-) → BR/BK lead (terminal 11)

Standard: 4.75 ~ 5.25 V DC







3-46 FUEL SYSTEM (DFI)

Inlet Air Pressure Sensor (Service Code 12)

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

Output Voltage Inspection

NOTE

- OThe output voltage changes according to the local atmospheric pressure.
- ★Check the output voltage of the sensor at the ECU connector [A].
- OMeasure the output voltage with the engine stopped and with the connector joined.
- Turn the ignition switch ON.
 Needle Adapters [B]

Inlet Air Pressure Sensor Output Voltage Connections to ECU

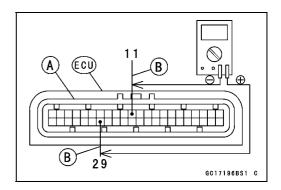
Meter (+) \rightarrow W/BL lead (terminal 29)

Meter (-) → BR/BK lead (terminal 11)

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

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

Silicone Sealant- Kawasaki Bond: 56019-120



Inlet Air Pressure Sensor (Service Code 12)

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

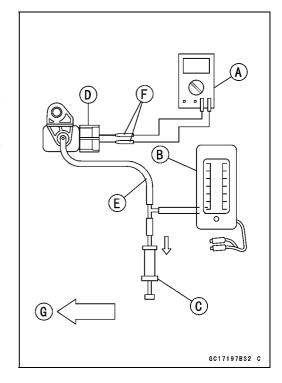
 Front [G]

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

Digital Volt Meter Connections

Meter (+) \rightarrow W/BL lead of Inlet Air Pressure Sensor Meter (-) \rightarrow BR/BK lead of Inlet Air Pressure Sensor

- OTurn the ignition switch ON.
- OMeasure the inlet air pressure sensor output voltage from various vacuum readings, while pulling the handle of the fork oil level gauge.
- OInspect the inlet air pressure sensor output voltage, using the following formula and charts for $Pv = 24 \sim 55$ cmHg and $55 \sim 86$ cmHq.



3-48 FUEL SYSTEM (DFI)

Inlet Air Pressure Sensor (Service Code 12)

Suppose:

Pg: Vacuum (gauge) of Throttle Assy

PI: Local Atmospheric Pressure (absolute) measured by a barometer

Pv: Vacuum (absolute) of Throttle Assy

Vv: Sensor Output Voltage (v)

then

Pv = Pl - Pq

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

Pg = 8 cmHg (vacuum gauge reading)

PI = 70 cmHg (barometer reading)

Vv = 3.2 V (digital volt meter reading)

then

Pv = 70 - 8 = 62 cmHg (abs)

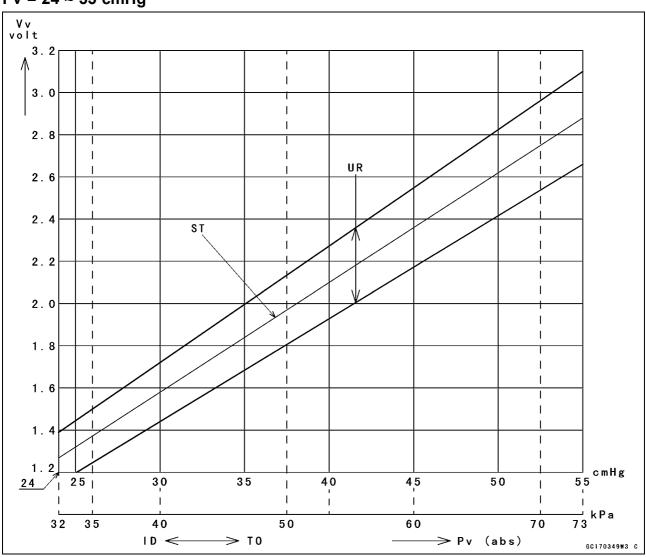
Plot this Pv (62 cmHg) at a point [1] on the chart and draw a vertical line through the point. Then, you can get the usable range [2] of the sensor output voltage.

Usable range = 3.04 ~ 3.49 V

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

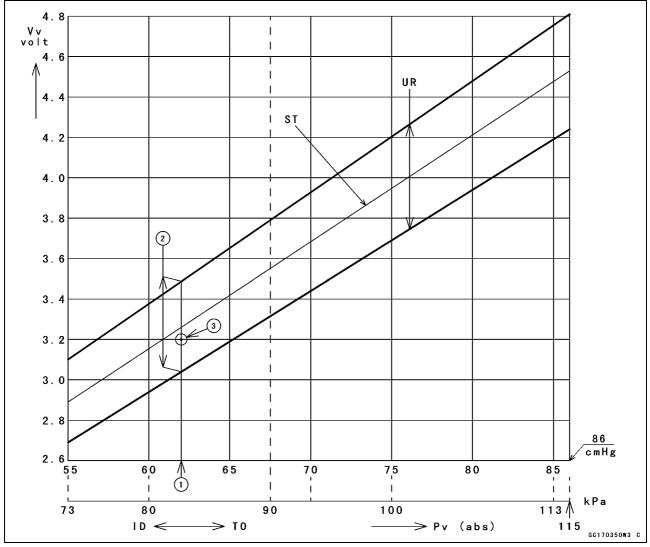
Results: In the chart, Vv is within the usable range and the sensor is normal.

$Pv = 24 \sim 55 \text{ cmHg}$



Inlet Air Pressure Sensor (Service Code 12)

Pv = 55 ~ 86 cmHg



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

Pv: Throttle Vacuum (absolute)

Ps: Standard Atmospheric Pressure (absolute)

ID: Idling

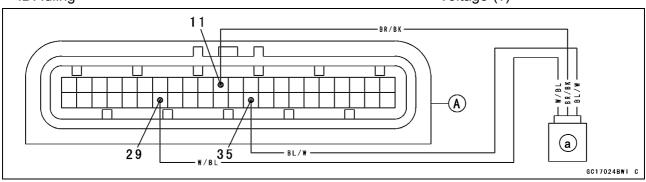
TO: Throttle Full Open

ST: Standard of Sensor Output

Voltage (v)

UR: Usable Range of Sensor Output

Voltage (v)



ECU [A]

Inlet Air Pressure Sensor [a]

3-50 FUEL SYSTEM (DFI)

Inlet Air Temperature Sensor (Service Code 13)

Removal/Installation

CAUTION

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

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

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

Output Voltage Inspection

NOTE

- OBe sure the battery is fully charged.
- OThe output voltage changes according to the inlet air temperature.
- Remove the ECU (see this chapter). Do not disconnect the ECU connectors.
- Connect a digital voltmeter [A] to the ECU connector [B], using two needle adapters [C].

Special Tool - Needle Adapter Set: 57001-1457

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

Inlet Air Temperature Sensor Output Voltage

Connections to ECU Connector

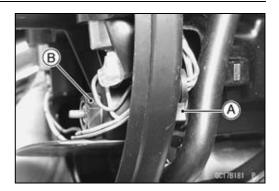
Meter (+) → P lead (terminal 31)

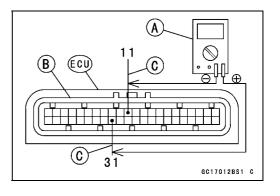
Meter (-) → BR/BK lead (terminal 11)

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

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

Silicone Sealant- Kawasaki Bond: 56019-120





Inlet Air Temperature Sensor (Service Code 13)

Sensor Resistance Inspection

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

NOTE

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

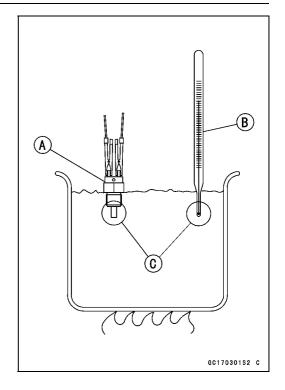
Inlet Air Temperature Sensor Resistance

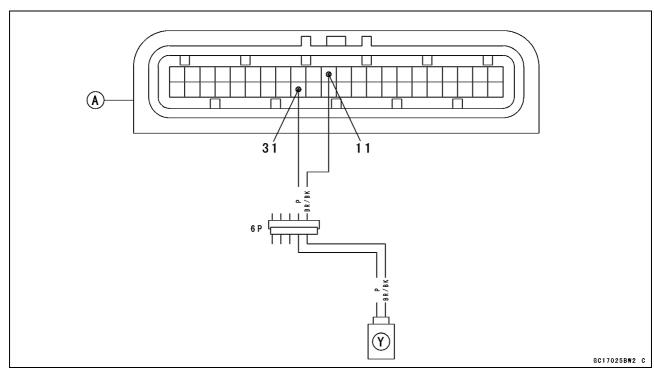
Standard: $5.4 \sim 6.6 \text{ k}\Omega$ at 0°C (32°F)

2.26 ~ 2.86 k Ω at 20°C (68°F)

0.29 ~ 0.39 kΩ at 80°C (176°F)

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





3-52 FUEL SYSTEM (DFI)

Water Temperature Sensor (Service Code 14)

Removal/Installation

CAUTION

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

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

Silicone Sealant- Kawasaki Bond: 56019-120

• Tighten:

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

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

Output Voltage Inspection

NOTE

- OBe sure the battery is fully charged.
- OThe output voltage changes according to the coolant temperature in the engine.
- Remove the ECU (see this chapter). Do not disconnect the connectors.
- Connect a digital voltmeter [A] to the ECU connector [B], using two needle adapters [C].

Special Tool - Needle Adapter Set: 57001-1457

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

Water Temperature Sensor Output Voltage

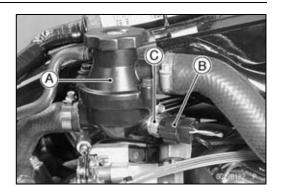
Connections to ECU

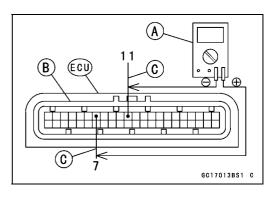
Meter $(+) \rightarrow O$ lead (terminal 7)

Meter (-) → BR/BK lead (terminal 11)

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

- ★If the output voltage is normal but there is still trouble, check the sensor resistance.
- ★If the output voltage is about 4.8 V, the ECU is normal. Remove the fuel tank and check the wiring between the ECU and the sensor.





Water Temperature Sensor (Service Code 14)

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

Silicone Sealant- Kawasaki Bond: 56019-120

Water Temperature Sensor Resistance Inspection

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

NOTE

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

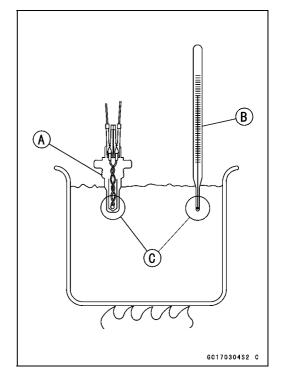
Water Temperature Sensor Resistance

Standard: $2.162 \sim 3.112 \text{ k}\Omega$ at 20°C (68°F)

 $0.785 \sim 1.049 \text{ k}\Omega$ at 50°C (122°F)

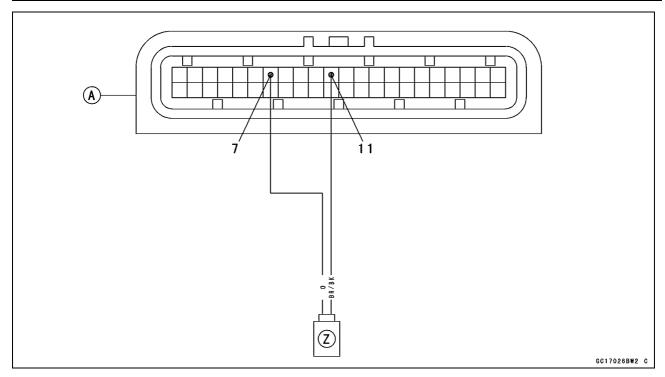
 $0.207 \sim 0.253 \text{ k}\Omega$ at 100°C (212°F)

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



3-54 FUEL SYSTEM (DFI)

Water Temperature Sensor (Service Code 14)



A. ECU

Z. Water Temperature Sensor

Atmospheric Pressure Sensor (Service Code 15)

Removal

CAUTION

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

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

Installation

NOTE

- OThe atmospheric pressure sensor is the same part as the inlet air pressure sensor except for different wiring and no hose.
- Install the atmospheric pressure sensor [A].
- OThe stopper [B] must not be on the sensor holder [C]. Rear View [D]
- Tighten the atmospheric pressure sensor nut securely.
- Install the fuel tank (see this chapter).

Input Voltage Inspection

NOTE

- OBe sure the battery is fully charged.
- OThe inspection is the same as "Input Voltage Inspection" of the throttle sensor or the inlet air pressure sensor.
- Turn the ignition switch OFF.
- Remove the ECU (see this chapter). Do not disconnect the ECU connectors.
- Connect a digital voltmeter [A] to the connector [B], using two needle adapters [C].

Special Tool - Needle Adapter Set: 57001-1457

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

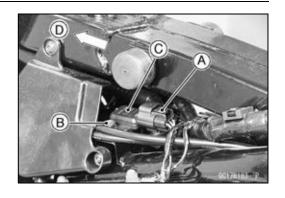
Atmospheric Pressure Sensor Input Voltage Connections to ECU

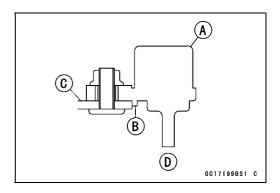
Meter (+) → BL/W lead (terminal 35)

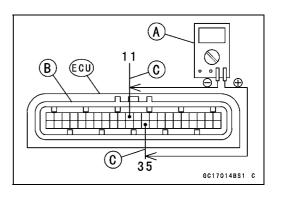
Meter (-) → BR/BK lead (terminal 11)

Standard: 4.75 ~ 5.25 V DC

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







3-56 FUEL SYSTEM (DFI)

Atmospheric Pressure Sensor (Service Code 15)

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

Silicone Sealant- Kawasaki Bond: 56019-120

Output Voltage Inspection

NOTE

- OThe output voltage changes according to the local atmospheric pressure.
- ★Check the output voltage of the sensor at the ECU connector [A].

Needle Adapters [B]

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

Atmospheric Pressure Sensor Output Voltage Connections to ECU

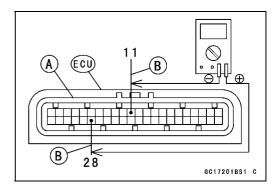
Meter (+) \rightarrow BL/Y lead (terminal 28) Meter (-) \rightarrow BR/BK lead (terminal 11)

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

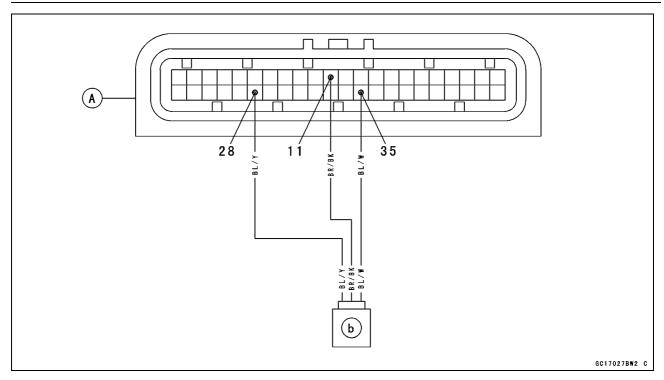
★If the output voltage is about 4.8 V, the ECU is normal. Remove the fuel tank and check the wiring between the ECU and the sensor.

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

Silicone Sealant- Kawasaki Bond: 56019-120



Atmospheric Pressure Sensor (Service Code 15)



A. ECU

b. Atmospheric Pressure Sensor

- ★If you need to check the atmospheric pressure sensor for various altitudes other than sea level, check the output voltage as follows:
- ODetermine the local altitude (elevation).
- ★ If you know the local atmospheric pressure using a barometer, substitute the atmospheric pressure for Pv (Throttle Vacuum) in the inlet air pressure sensor chart (see Inlet Air Pressure Sensor section in this chapter).
- OGet the usable range of the atmospheric pressure sensor output voltage in the same way as Output Voltage Inspection of the inlet air pressure sensor and check if Va (output voltage) is within the usable range or not.
- ★If you know the local altitude, use the following chart.

For example:

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

Plot this H (1 300 m) at a point [1] on the following chart and draw a vertical line through the point.

Then, you can get the usable range [2] of the sensor output voltage.

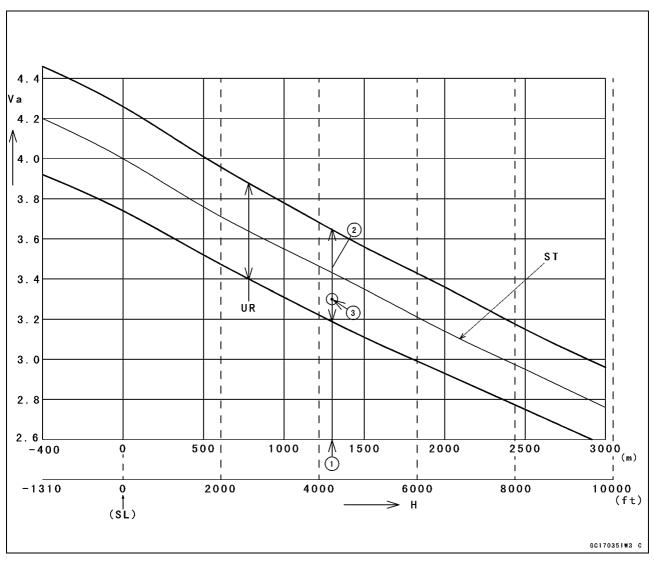
Usable Range = 3.2 ~ 3.64 V

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

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

3-58 FUEL SYSTEM (DFI)

Atmospheric Pressure Sensor (Service Code 15)



Va: Atmospheric Pressure Sensor Output Voltage (v)

H: Altitude (m or feet) SL: Sea Level (0 m)

ST: Standard of Sensor Output Voltage (v)

UR: Usable Range of Sensor Output Voltage (v)

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

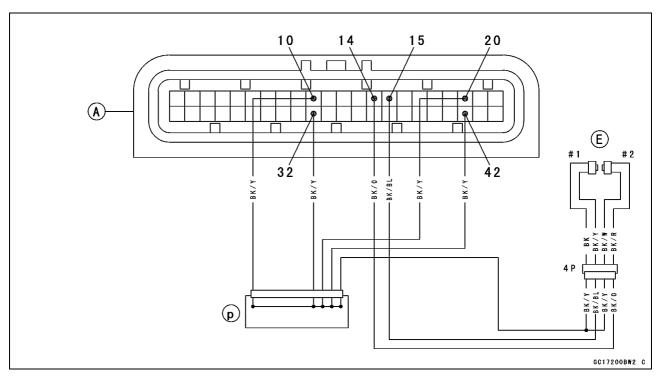
Crankshaft Sensor #1: for Front Cylinder (Service Code 21) Crankshaft Sensor #2: for Rear Cylinder (Service Code 22)

Crankshaft Sensor Removal/Installation

• Refer to the Ignition System section in the Electrical System chapter.

Crankshaft Sensor Inspection

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



A. ECU

E. Crankshaft Sensors

p. Joint Connector 1

3-60 FUEL SYSTEM (DFI)

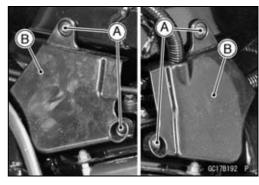
Vehicle-down Sensor (Service Code 31)

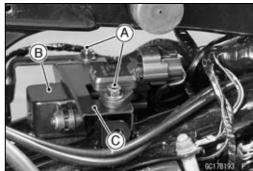
Vehicle-down Sensor Removal

CAUTION

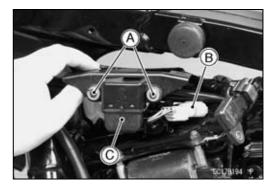
Never drop the down-sensor, especially on a hard surface. Such a shock to the sensor can damage it.

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





- Unscrew the screws [A] and disconnect the connector [B].
- Remove the vehicle down sensor [C].

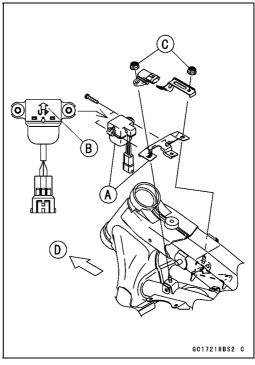


Installation

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

A WARNING

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



Vehicle-down Sensor (Service Code 31)

Vehicle-down Sensor Inspection

NOTE

OBe sure the battery is fully charged.

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

Special Tool - Needle Adapter Set: 57001-1457

• Turn the ignition switch ON, and measure the power source voltage with the connector joined.

Vehicle-down Sensor Power Source Voltage Connections to Sensor

Meter (+) → BR lead [E]

Meter (−) → BK/Y lead [F]

Standard: Battery Voltage (12.5 V or more)

- Turn the ignition switch OFF.
- ★If there is no battery voltage, check the DFI power source circuit (see DFI Power Source Section in this chapter).
- ★ If the power source is normal, check the output voltage of the sensor.
- Connect a digital volt meter [A] to the connector (natural, 3P), using two needle adapters [B].
- Turn the ignition switch ON, and measure the output voltage with the connector joined.
- OTilt the sensor (40 ~ 50°) or more [C] right or left, then hold the sensor almost vertical [D] with the arrow mark pointed up, and measure the output voltage.

Vehicle-down Sensor Output Voltage

Connections to Sensor

Meter $(+) \rightarrow Y/G$ lead [E]

Meter (-) → BK/Y lead [F]

Standard: with sensor tilted 40 ~ 50° or more right

or left: 3.7 ~ 4.4 V

with sensor arrow mark pointed up:

0.4 ~ 1.4 V

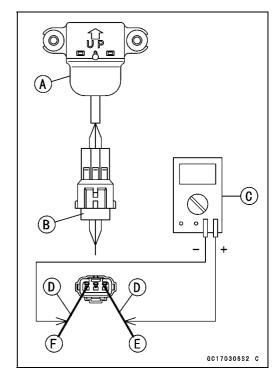
NOTE

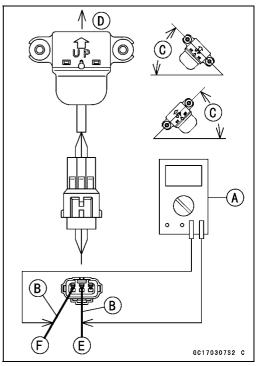
Olf you need to test again, turn the ignition switch OFF, and then ON.

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

Silicone Sealant- Kawasaki Bond: 56019-120

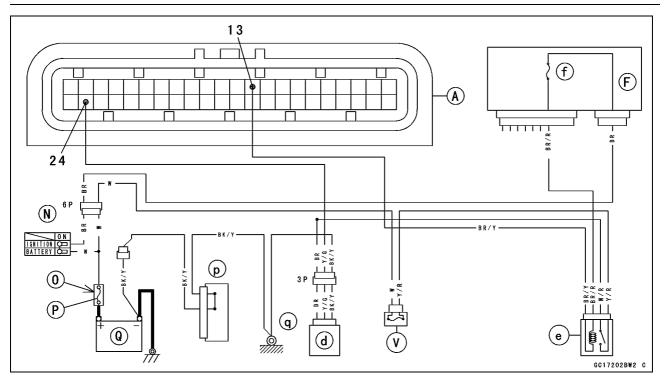
- ★If the output voltage is out of the specified, replace the vehicle-down sensor.
- ★If the output voltage is normal, the wiring is suspect. Check the wiring. If the wiring is good, check the ECU for its ground and power supply (see ECU section in this chapter).





3-62 FUEL SYSTEM (DFI)

Vehicle-down Sensor (Service Code 31)



- A. ECU
- d. Vehicle-down Sensor
- F. Junction Box
- e. DFI Main Relay
- N. Ignition Switch
- O. Starter Relay
- P. Main Fuse 30 A
- p. Joint Connector 1
- Q. Sealed Battery
- q. Frame Earth
- f. Ignition Fuse 10 A
- V. DFI Fuse 15A

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

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

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

CAUTION

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

Injector Removal

A WARNING

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

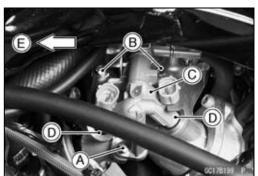
Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

- Check to see that the battery (–) lead terminal is disconnected.
- Remove:

Fuel Tank (see this chapter)
Front and Rear Injector Connectors

- Remove the fuel hose joint #2 [A] from the pipe for the delivery joint and take out the fuel hose assy (outlet hose) [B].
- Unscrew the delivery joint screw [A] and bolts [B], and lift up the delivery joint [C] with the injectors [D].
 Front [E]
- Remove the injectors from the delivery joint.





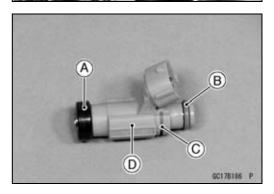
Injector Installation

OThe front and rear injectors are the same.

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

CAUTION

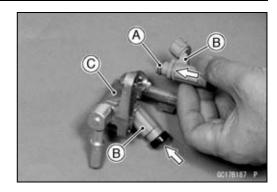
To avoid air and fuel leak, be careful not to get dirt or dust on the O-ring. Be careful not to damage the O-ring.



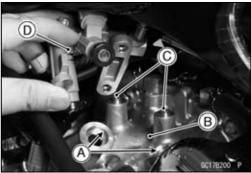
3-64 FUEL SYSTEM (DFI)

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

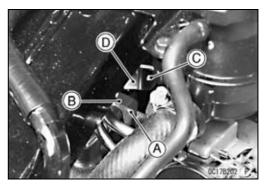
Apply engine oil to the O-ring [A], and install each injector
 [B] into the delivery joint [C].



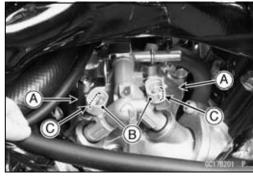
- Check that there is no dirt or dust on the injector seating surface [A] of the inlet manifold [B].
- Check that the two dowel pins [C] are in place in the inlet manifold.
- Fit the end of the injector into the delivery joint [D], and install them into the inlet manifold [B].



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



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



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

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

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

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

Injector Fuel Line Maximum Pressure

Standard: 300 kPa (3.06 kgf/cm², 43 psi)

CAUTION

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

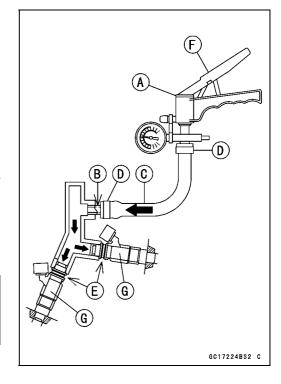
- Watch the gauge for at least 6 seconds.
- ★ If the pressure holds steady, the system is good.
- ★If the pressure drops at once, or if bubbles are found in the area, the line is leaking. Perform the following as necessary.
- ORetighten the fuel hose clamps [D].

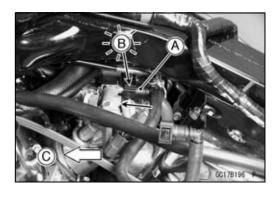
Torque - Fuel Hose Clamp Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

OReplace:

O-ring, and Seal Ring of Injectors [G]

- ORepeat the leak test, and check the fuel line for no leakage.
- Install the fuel outlet hose (see Fuel Tank Installation).
- Run the hoses correctly (see Cable, Wire, and Hose Routing section in the General Information chapter).
- Fit the fuel hose joint #2 [A] onto the pipe (for delivery joint) until the joint clicks [B].
- Olnsert the hose joint #2 straight along the pipe. Front [C]





3-66 FUEL SYSTEM (DFI)

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

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

A WARNING

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

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

Audible Inspection

- Remove the left air cleaner housing (see this chapter).
- Start the engine.
- Apply the tip of a screwdriver [A] to the injector [C]. Put the grip end onto your ear, and listen whether the injector is clicking or not.
- OA sound scope [B] can also be used.
- Do the same for the other injector.
 Front [D]
- ★If all the injectors click at a regular intervals, the injectors are good. The trouble may be related to the fuel line, requiring fuel pressure inspection (see Fuel Line section in this chapter).
- OThe click interval becomes shorter as the engine speed rises.
- ★If either injector doesn't click, the DFI circuit or the injector is suspect. Perform "Power Source Voltage Inspection", first.

Power Source Voltage Inspection

NOTE

OBe sure the battery is fully charged.

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

Special Tool - Needle Adapter Set: 57001-1457

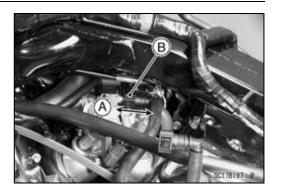
- OMeasure the power source voltage of the injector with the engine stopped, and with the connectors joined.
- Turn the ignition switch ON.

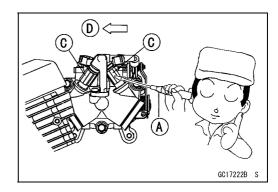
Injector Power Source Voltage at DFI Main Relay Connections

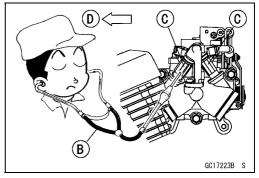
Meter (+) \rightarrow W/R Lead Terminal [D]

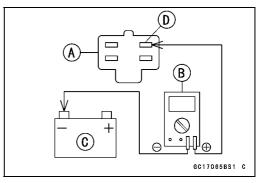
Meter (-) → Battery (-) Terminal

Standard: Battery Voltage (12.5 V or more)









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

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

Output Voltage Inspection

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

Injector Output Voltage at ECU

Connections for Injector #1

Meter (+) → BL/R lead (terminal 40)

Meter (-) → Battery (-) Terminal

Connections for Injector #2

Meter (+) → BL/G lead (terminal 39)

Meter (–) \rightarrow Battery (–) Terminal

Standard: Battery Voltage (12.5 V or more)

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

Injector Wiring Inspection

ECU Connector Injector Connectors

Terminal 30 → Injector #1 Terminal (W/R)

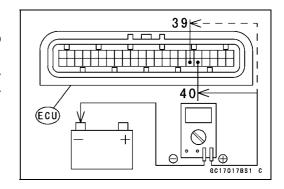
Terminal 30 → Injector #2 Terminal (W/R)

Terminal 40 → Injector #1 Terminal (BL/R)

Terminal 39 → Injector #2 Terminal (BL/G)

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

Silicone Sealant- Kawasaki Bond: 56019-120



3-68 FUEL SYSTEM (DFI)

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

Injector Signal Test

• Prepare two test light sets with male terminals as shown.

Rating of Bulb [A]: $12 \text{ V} \times 3 \sim 3.4 \text{ W}$ Terminal Width [B]: 1.8 mm (0.07 in.)Terminal Thickness [C]: 0.8 mm (0.03 in.)

CAUTION

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

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

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

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

Special Tool - Hand Tester: 57001-1394

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

Injector Resistance Inspection

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

Front [C]

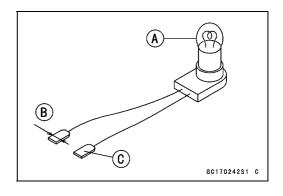
Injector Resistance

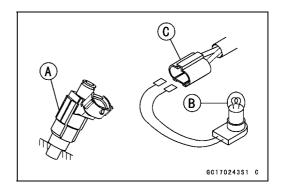
Connections to Injector

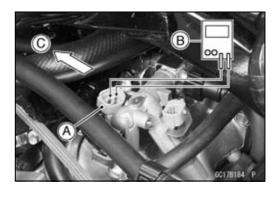
Meter (+) Meter (-) #1: W/R \longleftrightarrow BL/R Terminal #2: W/R \longleftrightarrow BL/G Terminal

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

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







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

Injector Unit Test

• Use two wires [A] and the same test light set [B] as in "Injector Signal Test".

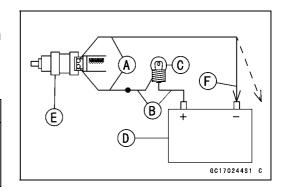
Rating of Bulb [C]: 12 V \times (3 \sim 3.4) W

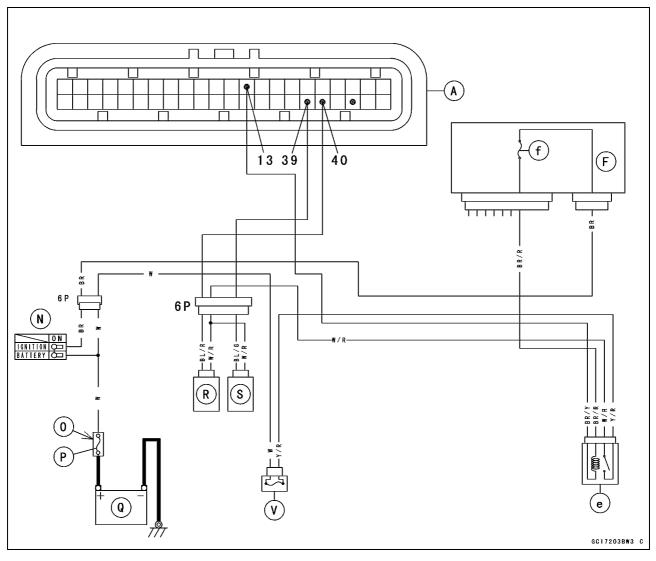
12 V Sealed Battery [D]

CAUTION

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

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





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

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

Fuel Pump (Service Code 45)

Fuel Pump Removal

CAUTION

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

A WARNING

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

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

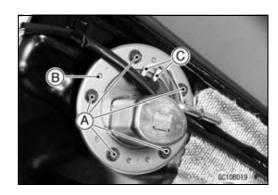
- Remove the fuel tank (see Fuel Tank Removal).
- OBe careful of fuel spillage from the fuel tank since fuel still remains in the fuel tank and fuel pump. Plug the fuel pipe of the fuel tank.
- Turn the fuel tank upside down.
- Remove the fuel pump inlet hose.
- Unscrew the fuel pump bolts [A], and take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

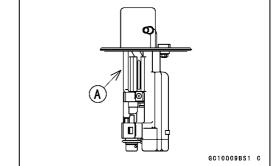
CAUTION

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

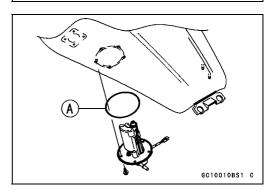
Fuel Pump Installation

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





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



Fuel Pump (Service Code 45)

• Check that the fuel pump (–) terminals [A] and band [B] are in place.

Front [C]

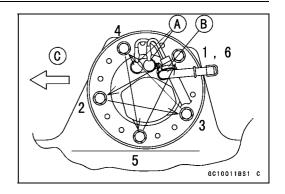
- Apply a non-permanent locking agent to the threads of the fuel pump bolts.
- Tighten the fuel pump bolts to a snug fit, following the tightening sequence as shown.
- Following the tightening sequence, tighten the pump bolts to the specified torque.

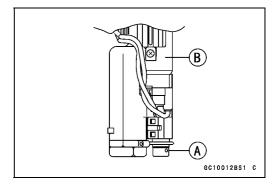
Torque - Fuel Pump Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

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

Pressure Regulator Removal

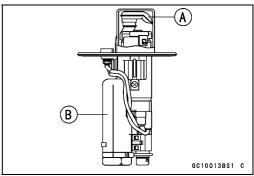
OThe pressure regulator [A] is built into the fuel pump [B] and cannot be removed.





Pump Screen, Fuel Filter Cleaning

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



Operation Inspection

NOTE

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

3-72 FUEL SYSTEM (DFI)

Fuel Pump (Service Code 45)

Operating Voltage Inspection

NOTE

OBe sure the battery is fully charged.

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

Special Tools - Hand Tester: 57001-1394 Needle Adapter Set: 57001-1457

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

Pump Operating Voltage at Pump Connections to Pump Connectors

Tester (+) → Y/R Lead

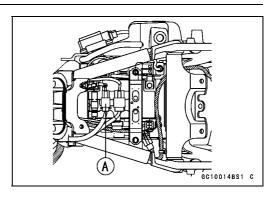
Tester (–) \rightarrow BK/W Lead

Operating Voltage at Pump Connector

Standard: Battery Voltage (12.6 V or more) for 3

seconds, and then 0 V.

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



Fuel Pump (Service Code 45)

Power Source Voltage Inspection

NOTE

OBe sure the battery is fully charged.

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

Special Tool - Needle Adapter Set: 57001-1457

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

Pump Power Source Voltage

Connections to Pump Connector

Tester $(+) \rightarrow Y/R$ lead [D]

Tester (-) → Battery (-) Terminal [E]

Standard: Battery Voltage (12.5 V or more)

Fuel Pump [F]

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

Battery

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

DFI Fuse 15 A (see this chapter)

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

DFI Main Relay (see this chapter)

Wiring for Fuel Pump Power Source (see next diagram)

Vehicle-down Sensor (see this chapter)

Operating Voltage Inspection

NOTE

OBe sure the battery is fully charged.

- Turn the ignition switch OFF.
- Remove the seat (see Frame chapter).
- Measure the operating voltage of the fuel pump at the fuel pump connector [A] with the connector joined.

Hand Tester [B]

Needle Adapters [C]

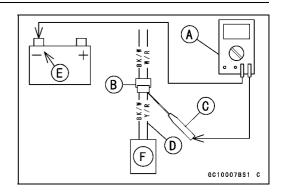
Pump Operating Voltage at Pump Connector Connections to Pump Connector

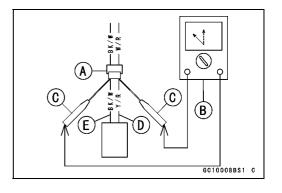
Tester (+) → Y/R lead [D]

Tester (–) \rightarrow BK/W lead [E]

Reading: Battery Voltage (12.5 V or more) for 3

seconds, and then 0 V



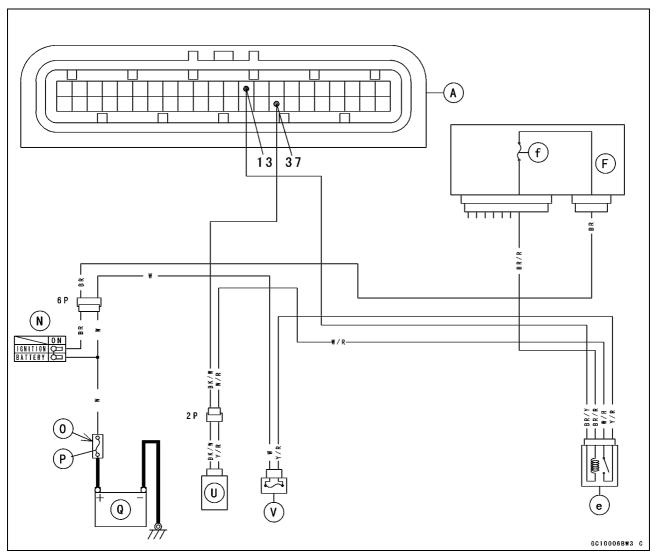


3-74 FUEL SYSTEM (DFI)

Fuel Pump (Service Code 45)

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

Silicone Sealant- Kawasaki Bond: 56019-120



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

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

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

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

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

Removal/Installation

CAUTION

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

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

Input Voltage Inspection

NOTE

OBe sure the battery is fully charged.

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

Ignition Coil Input Voltage at ECU Connections for Ignition Coil #1

Meter (+) → BK lead (terminal 44)

Meter (-) → Battery (-) Terminal

Connections for Ignition Coil #2

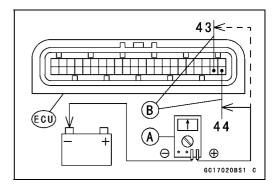
Meter (+) → BK/G lead (terminal 43)

Meter (-) → Battery (-) Terminal

Standard: Battery Voltage (12.5 V or more)

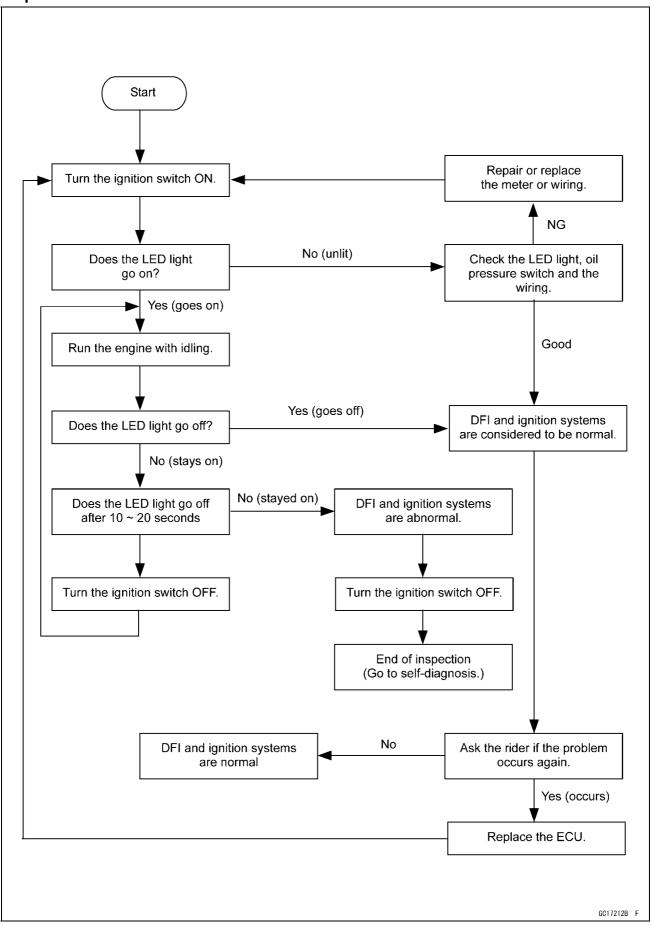
- ★If the reading is out of the standard, check the ECU for its ground and power supply (see ECU section).
- ★ If the reading is good remove the fuel tank and check the wiring between the ECU and the primary lead terminals at the ignition coils.
- ★ If the wiring is good, crank the engine, and check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

Silicone Sealant- Kawasaki Bond: 56019-120



FI Indicator LED Light

Inspection Flow Chart



FI Indicator LED Light

LED Light Inspection

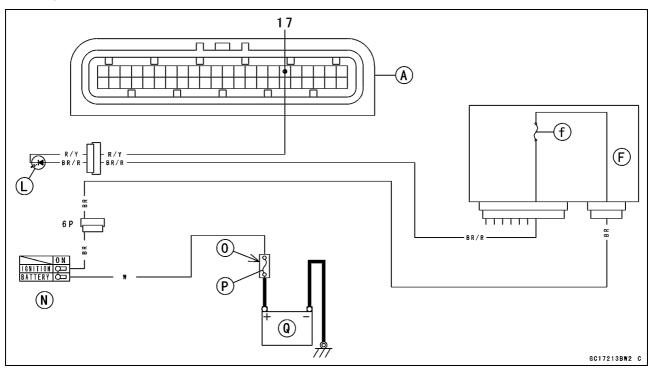
- OThe FI indicator LED light [A] goes ON when the ignition switch is turned ON and the LED light goes OFF when the engine oil pressure is high enough (the engine is running). This is to ensure that the FI indicator LED light has not burned out and the DFI system and the ignition system function properly.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

GC17214BS1 C

A WARNING

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

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



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

- O. Starter Relay
- P. Main Fuse 30 A
- Q. Sealed Battery
- f. Ignition Fuse 10 A

3-78 FUEL SYSTEM (DFI)

ECU

ECU Identification

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

ECU Identification

Models	Type [A]	Part No. [B]
CA, US,TW	F8T97371	21175-1099
EUR	F8T97372	21175-1100
AU	F8T97372	21175-1100

CA: Canadian Model

US: United States of America Model

EUR: European Model AU: Australian Model TW: Taiwan Model

ECU Removal

CAUTION

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

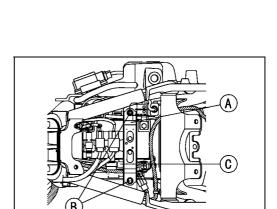
Remove:

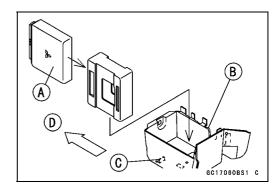
Seat (see Frame chapter)
Battery Holder [A] and Bolt [B]

- Pull the ECU [C] out along with the harness.
- ★If necessary, push the lock and disconnect the ECU connectors.

ECU Installation

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

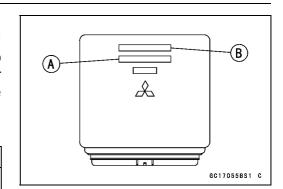




ECU Power Supply Inspection

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





ECU

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

ECU Grounding Inspection

Meter Connections:

10, 20, 32, or 42 (BK/Y) ←→ Battery (-) Terminal

Terminal

21 (R/G) Terminal ←→ Battery (–) Terminal Engine Ground ←→ Battery (–) Terminal

Terminal [B]

Readings: 0 Ω (regardless of the ignition switch

ON or OFF)

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

Battery [C] in the Frame

Special Tool - Needle Adapter Set: 57001-1457

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

ECU Power Source Inspection

Meter Connection:

30 (W/R) Terminal ←→ Battery (–) Terminal

Ignition switch OFF: 0 V

Ignition switch ON: Battery Voltage (12.5 V or

more)

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

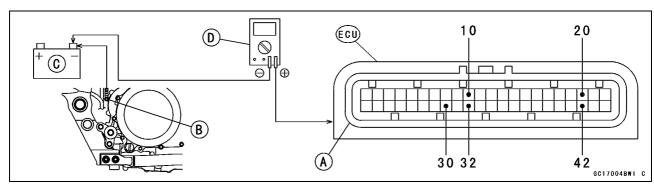
Power Source Wiring (see wiring diagram of DFI Power Source section in this chapter).

DFI Fuse 15 A (see DFI Power Source section)

DFI Main Relay (see DFI Power Source section)

Ignition Fuse 10 A (see Electrical System chapter)

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



3-80 FUEL SYSTEM (DFI)

DFI Power Source

DFI Fuse Removal

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

Front [D]

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

D C B CC178195 P

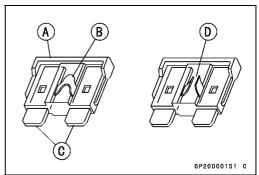
DFI Fuse Inspection

- Remove the fuse (see DFI Fuse Removal).
- Inspect the fuse element.
- ★If it is open, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.

Housing [A]

Fuse Element [B] and Blown Element [D]

Terminals [C]



CAUTION

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

DFI Main Relay Removal

CAUTION

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

• Remove:

Right Side Cover (see Frame chapter)
Coolant Reserve Tank (see Coolant System chapter)

Remove the DFI main relay [A] and disconnect the connector.

Front [B]

DFI Main Relay Inspection

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

Special Tool - Hand Tester: 57001-1394

Relay Coil Terminals [1] and [2] Relay Switch Terminals [3] and [4]

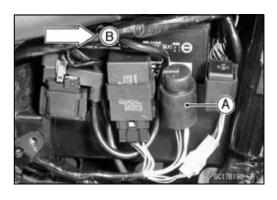
Testing Relay

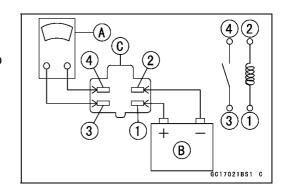
Tester range: 1Ω range

Criteria: When battery is connected \rightarrow 0 Ω

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

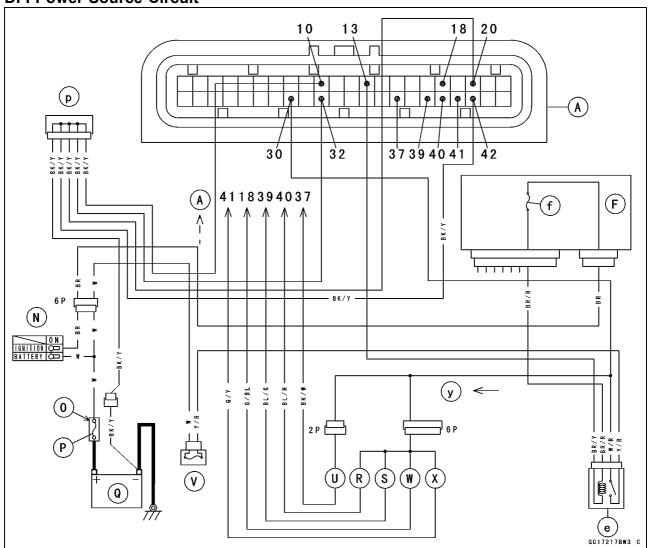
★If the relay does not work as specified, replace the relay.





DFI Power Source

DFI Power Source Circuit



- A. ECU
- F. Junction Box
- N. Ignition switch
- O. Starter Relay
- P. Main Fuse 30 A
- Q. Sealed Battery
- R. Fuel Injector #1
- S. Fuel Injector #2
- U. Fuel Pump
- V. DFI Fuse 15 A
- W. ISC Valve #1
- X. ISC Valve #2
- e. DFI Main Relay
- f. Ignition Fuse 10 A
- y. Actuators: R, S, U, W, X
- p. Joint Connector 2

3-82 FUEL SYSTEM (DFI)

ISC Valves

Removal/Installation

CAUTION

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

- OThe ISC valves are removed during right air cleaner housing removal (see this chapter).
- OThe ISC valve itself is the same for front and rear, but wiring is different. Be careful not to reverse the leads.

ISC Valve #2 [A] \rightarrow G/Y, W/R leads [B]

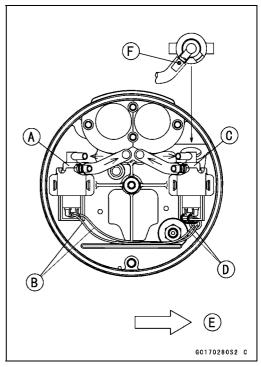
ISC Valve #1 [C] → G/BL, W/R leads [D]

Front [E]

• Install the ISC hoses as shown.

ISC Hose #2 with the red paint mark on the top

ISC Hose #1 with the blue paint mark [F] on the top



Power Source Voltage Inspection

NOTE

- OBe sure the battery is fully charged.
- OThe inspection is the same as "Power Source Voltage Inspection" of the fuel pump.
- Turn the ignition switch OFF.
- Remove the right air cleaner cover (see this chapter).
- Connect a digital voltmeter [A] to the connectors [B] of each ISC valve.
- Measure the power source voltage with the engine stopped, and with the connectors joined.
- Turn the ignition switch ON.

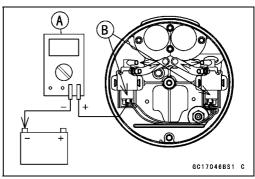
Power Source Voltage at ISC Valve Connector Connections to ISC Valve #1, #2

Meter (+) → W/R Lead Terminal

Meter (-) → Battery (-) Terminal

Standard: Battery Voltage (12.5 V or more)

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



ISC Valves

Output Voltage Inspection

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

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

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

Output Voltage of ISC Valves Connections for ISC Valve #2 [C]

Tester (+) \rightarrow W/R lead

Tester (–) \rightarrow G/Y lead

Connections for ISC Valve #1 [D]

Tester (+) → W/R lead

Tester (-) → G/BL lead

Reading: The needle points battery voltage

(12.5 V or more) and 11 seconds

later 0 V.

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

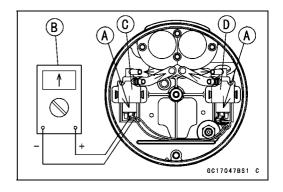
Resistance Inspection

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

ISC Valve Solenoid Resistance (#1, #2)

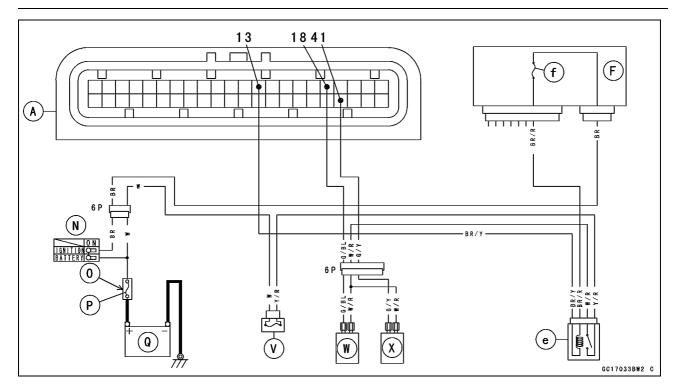
Standard: $13.6 \sim 20.4 \Omega$

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



3-84 FUEL SYSTEM (DFI)

ISC Valves



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

- V. DFI Fuse 15 A
- W. ISC Valve #1
- X. ISC Valve #2
- e. DFI Main Relay
- f. Ignition Fuse 10 A

Fuel Line

Fuel Pressure Inspection

NOTE

- OThis inspection can determine which trouble the DFI system has, mechanical or electrical trouble.
- OIt is preferable to measure the fuel pressure while running the motorcycle when the trouble has occurred in order to know symptom well.
- OBe sure the battery is fully charged.
- Remove the fuel tank (see this chapter).
- Disconnect the #2 fuel injector connector [A].
- Pinch the lock of the fuel hose joint #2 with fingers, disconnect the joint [B] and take out the fuel hose assy [C].
 Front [D]

A WARNING

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

When the fuel hose is disconnected, fuel spills out from the hose and the pipe. Cover the hose connection with a clean shop towel to prevent fuel spillage.

- Install the fuel pressure gauge adapter [A] (special tool) between the fuel tank outlet pipe [B] and the inlet pipe [C] to the delivery joint [D].
- OPut the fuel pressure gauge adapter outside the frame.
- Connect the pressure gauge [E] (special tool) to the fuel pressure gauge adapter.

Fuel Tank [F] Fuel Pump [G] Front [H]

→: Fuel Flow

Special Tools - Fuel Pressure Gauge Adapter: 57001-1593 Fuel Hose: 57001-1607

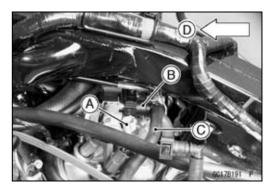
Oil Pressure Gauge: 57001-125

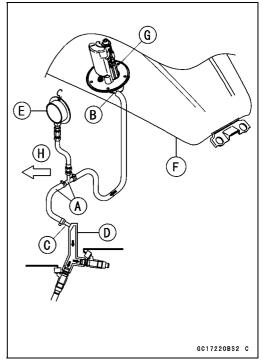
- Temporarily, install the fuel tank.
- Connect:

Fuel Pump Connector 2P Battery Lead (–) Terminal

A WARNING

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





3-86 FUEL SYSTEM (DFI)

Fuel Line

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

Fuel Pressure

right after Ignition switch ON, with pump running:

Standard: 304 kPa (3.1 kgf/cm², 44 psi)

after 3 seconds from Ignition switch ON, with pump stopped:

Standard: 280 kPa (2.9 kgf/cm², 41 psi, residual

fuel pressure)

The system should hold the residual

pressure about 30 seconds.

• Start the engine, and let it idle.

• Measure the fuel pressure with the engine idling.

Fuel Pressure (idling)

Standard: 304 kPa (3.1 kgf/cm², 44 psi)

NOTE

- The gauge needle will fluctuate. Read the pressure at the average of the maximum and minimum indications.
- ★If the fuel pressure is normal, the fuel circulation system (fuel pump, pressure regulator, and oil passage) is no faults. Check the DFI electronic control system (injectors, sensors, crankshaft sensors, and ECU).
- ★If the fuel pressure is much higher than the specified, check the following:

Delivery Pipe Clogging

Injector Clogging

★If the fuel pressure is much lower than specified, check the following:

Fuel Pump for Operation (check the sound of the pump) Fuel Line Leakage or Clogging

Amount of Fuel Flow (see Fuel Flow Rate Inspection)

- ★If the fuel pressure is much lower than specified, and if inspection above checks out good, replace the fuel pump assy (the fuel filter may be clogged) and measure the fuel pressure again.
- ★If the residual pressure 260 ~ 280 kPa (2.7 ~ 2.9 kgf/cm², 38 ~ 41 psi) drops at once, the high pressure fuel line could be leaking.
- Remove the fuel pressure gauge and adapter.
- Run the fuel hoses in accordance with the Cable, Wire, and Hose Routing section in the Appendix chapter

Fuel Line

• Fit the fuel hose joint #2 [A] onto the pipe (for delivery joint) until the joint clicks [B].

Olnsert the hose joint straight along the pipe. Front [C]



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

A WARNING

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

Fuel Flow Rate Inspection

NOTE

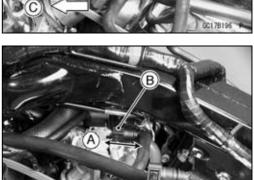
OBe sure the battery is fully charged.

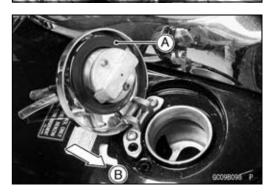
A WARNING

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

- Turn both ignition switch, and engine stop switch OFF.
- Wait until the engine cools down.
- Open the fuel tank cap [A] to lower the pressure in the tank.

Front [B]





3-88 FUEL SYSTEM (DFI)

Fuel Line

- Prepare a plastic hose of the inside diameter 7.5 mm (0.30 in.) × L about 400 mm (15.7 in.) and a measuring cylinder.
- Remove:

Seat (see Frame chapter)
Meter Cover (see Fuel Tank Removal in this chapter).
Fuel Tank Bolts

- Raise the fuel tank.
- Stuff a clean shop towel around the fuel outlet hose joint.
 OWhile pinching the locks of the hose joint #1 with fingers, disconnect the joint (see Fuel Tank Removal) and insert the plastic hose [A] quickly onto the tank outlet pipe.
- Secure the plastic hose with a clamp [B].
- Run the other side of the plastic hose into the measuring cylinder [C].
- Temporarily install the fuel tank and close the fuel tank cap.

A WARNING

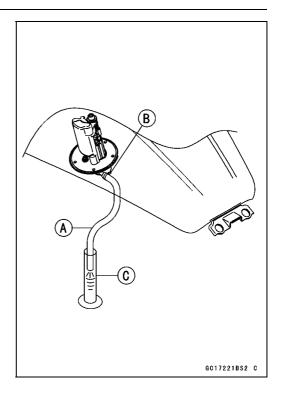
Wipe off spilled out fuel immediately. Be sure to hold the measuring cylinder vertical.

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

Amount of Fuel Flow

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

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



Throttle Grip and Cables

Throttle Grip Free Play Inspection

Refer to Throttle Control System Inspection in the Periodic Maintenance Chapter.

Throttle Grip Free Play Adjustment

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

A WARNING

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

Choke Knob Operation

ODo not use the choke knob except when the engine has a starting difficulty, like in cold weather (10°C, 50°F or below) or at high altitude. The DFI system has an automatic choke system, using ISC valves, a water temperature sensor, and an atmospheric pressure sensor, which provide start ability.

NOTE

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

Front [C]

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

Choke Cable Free Play Inspection

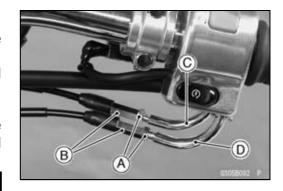
- OChoke cable free play cannot be adjusted.
- Check that the choke inner cable slides smoothly by pulling and pushing the choke knob lightly.
- ★If there is any irregularity, or the choke lever doesn't work when the choke knob is pulled fully, replace the choke cable.

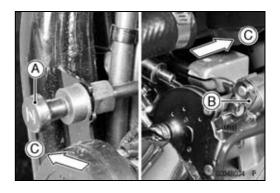
Cable Removal/Installation

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

Cable Lubrication and Inspection

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





3-90 FUEL SYSTEM (DFI)

Throttle Body Assy

Idle Speed Check

Refer to Idle Speed Inspection in the Periodic Maintenance Chapter.

Idle Speed Adjustment

Refer to Idle Speed Inspection in the Periodic Maintenance Chapter.

Throttle Bore Cleaning

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

High Altitude Performance Adjustment

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

Throttle Body Assy Removal

Remove the fuel tank (see this chapter).

A WARNING

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

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

• Remove:

Thermostat Housing (see Thermostat Removal in the Cooling System chapter)

Right and Left Air Cleaner Base (see this chapter)

Right Spark Plug Lead Holder [A] and Bolts [B] a

Right Spark Plug Lead Holder [A] and Bolts [B] and Clamp [C]

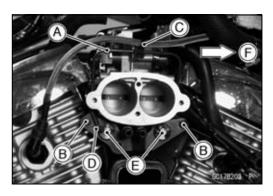
Throttle Body Assy Holder Bolts [E]

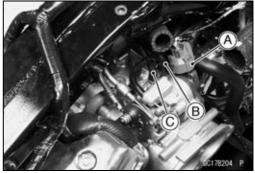
Throttle Body Assy Holder [D]

Front [F]

• Disconnect:

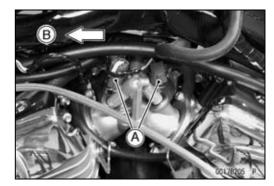
Throttle Sensor Connector [A] (from the throttle sensor) Vacuum Hose [B] from Inlet Air Pressure Sensor Vacuum Hose [C] between Vacuum Switch Valve and Throttle Body Assy



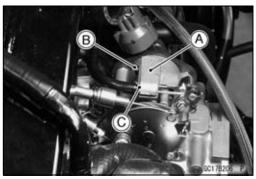


Throttle Body Assy

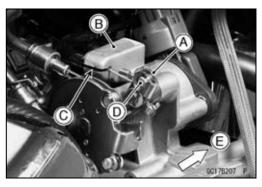
Disconnect the front and rear injector connectors [A].
 Front [B]



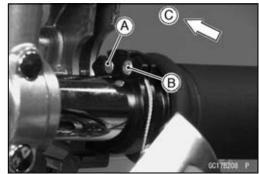
Remove the following from the choke cable holder [A].
 Screw [B]
 Choke Cable Plate [C]



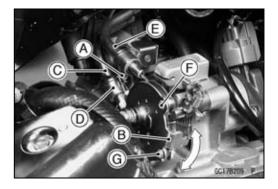
- While pushing the choke lever [A] forward, remove the cable housing from the choke cable holder [B] and the inner cable out of the holder slit [C].
- Take off the lower end [D] from the choke lever.
 Front [E]



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



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



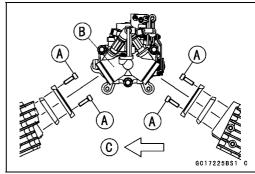
3-92 FUEL SYSTEM (DFI)

Throttle Body Assy

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



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



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

A WARNING

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

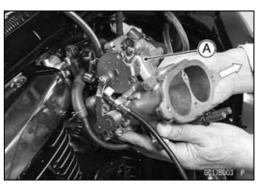
 Stuff a piece of lint-free, clean cloth into the throttle body assy, and the inlet ports of the cylinder heads to keep dirt out of the engine.

▲ WARNING

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

CAUTION

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



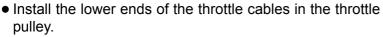
Throttle Body Assy

Throttle Body Assy Installation

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

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

Inlet Manifold Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)
Right Spark Plug Lead Holder Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)



Accelerator Cable [A] and Decelerator Cable [B]

- Run the throttle cables correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Stake [C] the cable clip [D] on the throttle cable holder [E].
 Rear View [F]
- Install the lower end of the choke cable in the choke lever.
- Apply:

Non-permanent Locking Agent -Choke Cable Plate Screw

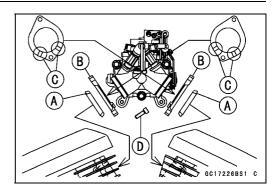
• Tighten:

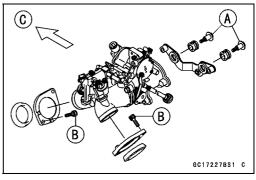
Torque - Choke Cable Plate Screw: 2.9 N·m (0.30 kgf·m, 26 in·lb)

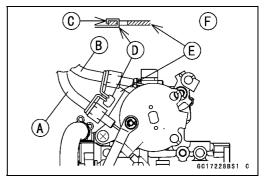
- Run the choke cable correctly (see Appendix chapter) and check that the choke knob moves smoothly.
- Apply a thin coating of grease to the throttle cable upper ends
- Install the upper ends of the throttle cables in the grip.
- Fit the projection [A] of the right switch housing into the hole [B] of the handlebar (front view).
- Turn the throttle grip and make sure that the throttle valves move smoothly and return by spring force.
- Check the throttle grip free play (see Throttle Grip Free Play Inspection).

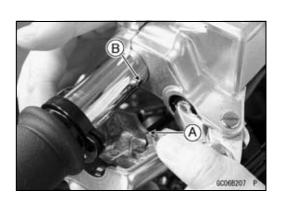
A WARNING

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









3-94 FUEL SYSTEM (DFI)

Throttle Body Assy

• Fit the fuel hose joint #2 [A] onto the pipe (for delivery joint) until the joint clicks [B].

Olnsert the hose joint straight along the pipe. Front [C]



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

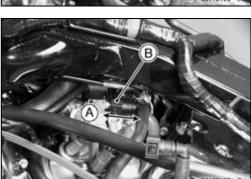
A WARNING

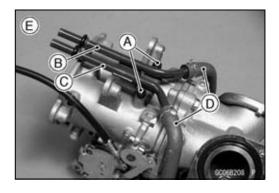
Make sure the fuel hose joint is installed correctly on the delivery pipe by sliding the joint, or the fuel could leak.

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

Throttle Body Assy Disassembly/Assembly

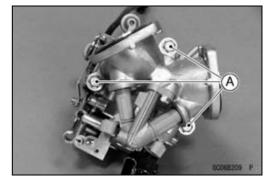
- Remove the throttle body assy (see this chapter).
- Unscrew two bolts [A], and pull out the ISC pipe #1 [B], and ISC pipe #2 [C] from the hoses [D].
 Bottom View [E]

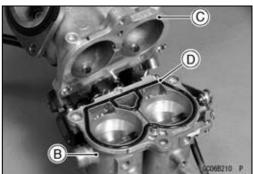




Throttle Body Assy

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





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

CAUTION

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

Throttle Sensor [A]:

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

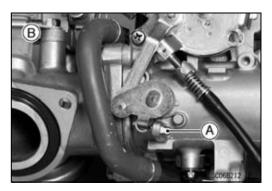
Front View [B]

Throttle Stop Screw [A]:

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

Rear View [B]





Choke Lever Stop Screw [A]:

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

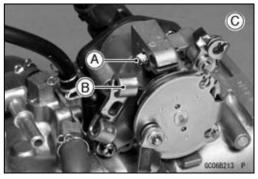
Throttle Cable Holder [B]:

This is sold with a throttle body as a unit.

Rear View [C]

Throttle Valve and Throttle Shaft:

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



3-96 FUEL SYSTEM (DFI)

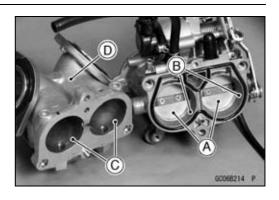
Throttle Body Assy

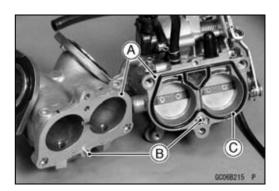
- Remove the delivery joint and injectors (see Injector section in this chapter).
- Open the butterfly valves [A], and wipe any carbon off the throttle bores [B] around the valves, using a piece of lint-free cloth penetrated with a high-flash point solvent.
- Clean the bores [C] of the inlet manifold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

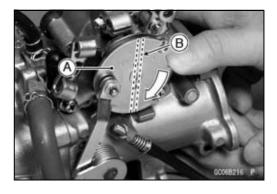
CAUTION

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

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







Air Cleaner

Element Removal

• Remove:

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



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

A WARNING

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

CAUTION

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



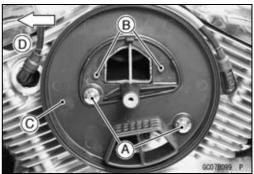
• Refer to Air Cleaner Element Cleaning in the Periodic Maintenance Chapter.

Left Air Cleaner Housing Removal/Installation

• Remove:

Air Cleaner Element (see Air Cleaner Element Removal) Air Cleaner Base Bolts [A] and Screws [B]

• Remove the air cleaner base [C]. Front [D]



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

Apply:

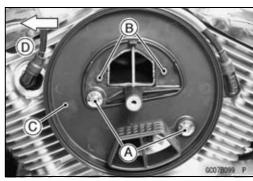
Non-permanent Locking Agent -Left Air Cleaner Base Screws

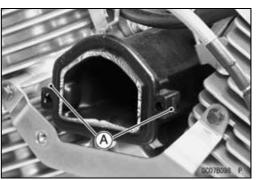
• Tighten:

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

Left Air Cleaner Base Screws: 2.2 N·m (0.22 kgf·m,

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







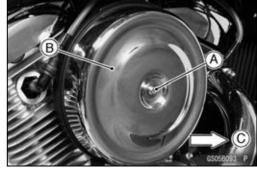
3-98 FUEL SYSTEM (DFI)

Air Cleaner

Right Air Cleaner Housing Removal

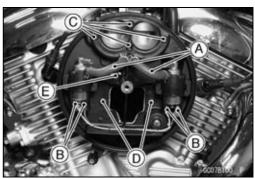
• Remove:

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



• Remove:

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

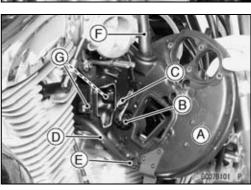


• Remove:

Air Cleaner Base [A]
Inlet Air Temperature Sensor Connector [B]
ISC Valve Leads [C]
Crankcase Breather Hose [D]

Air Cleaner Drain Hose [E] (separate from the base [A]) Vacuum Switch Valve Air Hose [F]

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



Right Air Cleaner Housing Installation

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

Non-permanent Locking Agent - Right Air Cleaner Base Screws

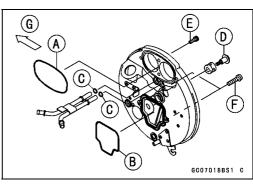
• Tighten:

Torque - Right Air Cleaner Base Bolt [D]: 11 N·m (1.1 kgf·m, 95 in·lb),

Right Air Cleaner Allen Bolts [E]: 11 N·m (1.1 kgf·m, 95 in·lb),

Right Air Cleaner Base Screws [F]: 2.2 N·m (0.22 kgf·m, 19 in·lb)

Front [G]



Air Cleaner

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

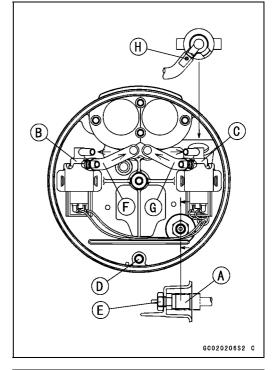


- Install the inlet air temperature sensor [A], the ISC valve #2 [B], ISC valve #1 [C], and the crankcase breather hose [D].
- Tighten:

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

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

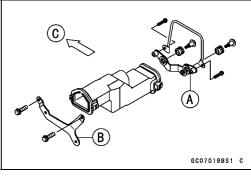
Torque - Right Air Cleaner Cover Allen Bolt: 16 N⋅m (1.6 kgf⋅m, 12 ft⋅lb)



Lower Air Cleaner Duct Removal/Installation

• Remove:

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

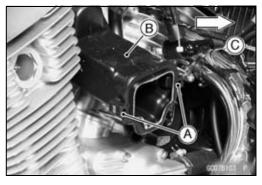


• Remove:

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

• Tighten:

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



Fuel Tank

Fuel Tank Removal

A WARNING

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

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

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

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

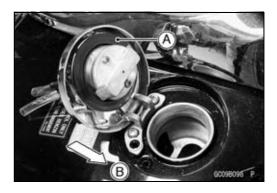
- Turn both ignition switch, and engine stop switch OFF.
- Wait until the engine cools down.
- Open the fuel tank cap [A] to lower the pressure in the tank, and draw the fuel out from the fuel tank with a commercially available pump.

Front [B]

A WARNING

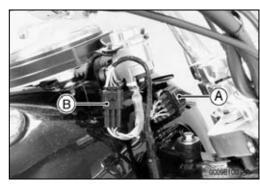
The fuel cannot be removed completely from the fuel tank. Be careful for remained fuel spillage.

• Remove the Allen bolt [A], and nut [B], and take out the meter cover [C].





Disconnect the meter [A] and ignition switch [B] connectors.

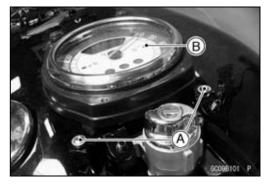


Fuel Tank

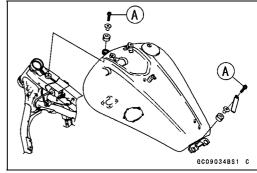
• Remove the Allen bolts [A] and take out the meter unit [B].

CAUTION

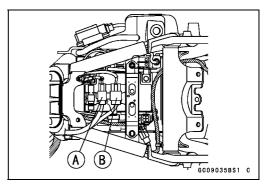
Place the meter so that the face is up. If a meter is left upside down or sideways for any length of time, it will malfunction.



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



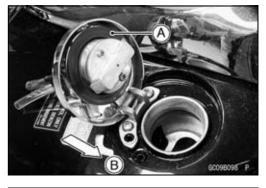
- Disconnect the fuel pump connector [A] (2p).
- Disconnect the fuel level sensor connector (3p) [B].



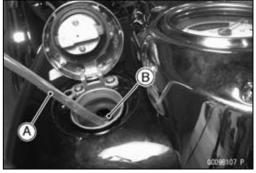
NOTE

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

Front [B]



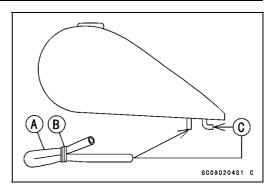
- Draw the fuel out from the fuel tank with a commercially available pump.
- OPut the soft plastic hose [A] into the drain pipe [B] and draw the fuel out.



3-102 FUEL SYSTEM (DFI)

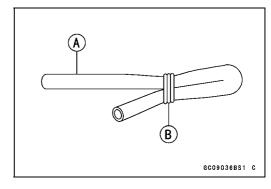
Fuel Tank

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





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

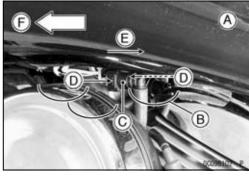


- Raise the fuel tank [A] up, and make sure that the shop towel [B] is around the fuel hose joint #1 [C].
- A person should pinch the hose joint locks [D] with fingers, disconnect the joint [E], and plug the tank outlet pipe with the plug hose.

Front [F]

A WARNING

Immediately wipe up fuel that spills.



Fuel Tank

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

CAUTION

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

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

WARNING

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

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

A WARNING

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

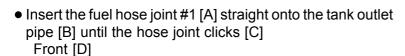
Fuel Tank Installation

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

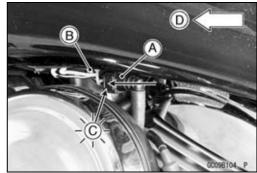
3-104 FUEL SYSTEM (DFI)

Fuel Tank

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







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

▲ WARNING

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

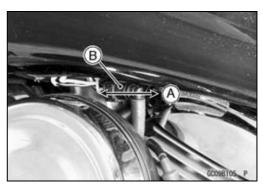
- ★If it does not slide, reinstall the hose joint.
- Connect the fuel pump and the fuel level sensor connectors and the battery (–) lead terminal.

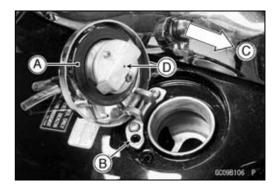
Fuel Tank and Cap Inspection

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

CAUTION

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





Fuel Tank

Fuel Tank Cleaning

A WARNING

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

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

Evaporative Emission Control System

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

Parts Removal/Installation

A WARNING

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

CAUTION

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

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

A WARNING

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

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

Canister Installation

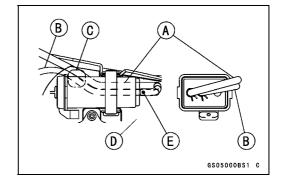
- Run the purge hose (green) [A] above the canister breather hose (blue) [B] through the hole [C] into the tool case [D].
- ODo not run these hoses side by side on the battery side of the canister. This prevents hoses from being flattened when installing the left side cover.
- Install the canister and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

Canister Inspection (Periodic Inspection)

ORefer to Evaporative Emission Control System Inspection in the Periodic Maintenance Chapter (chapter 2).

Separator Inspection (Periodic Inspection)

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



Evaporative Emission Control System

Hose Inspection (Periodic Inspection)

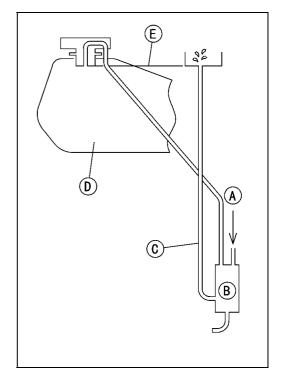
• Refer to Evaporative Emission Control System Check in the Periodic Maintenance Chapter (chapter 2).

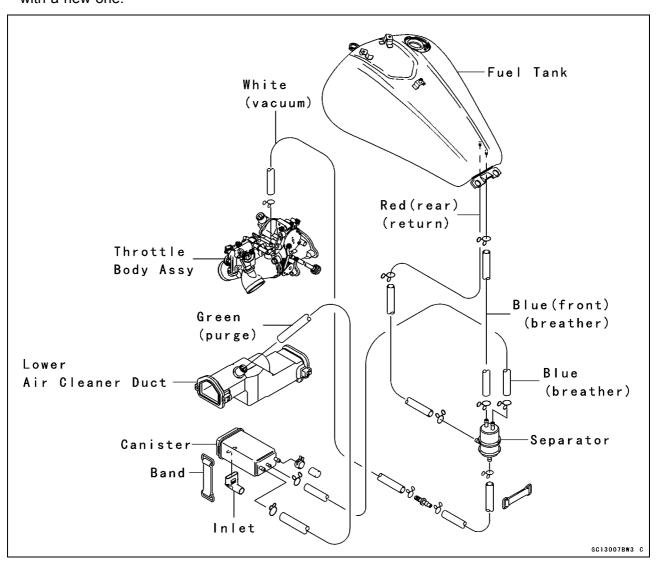
Separator Operation Test

A WARNING

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

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



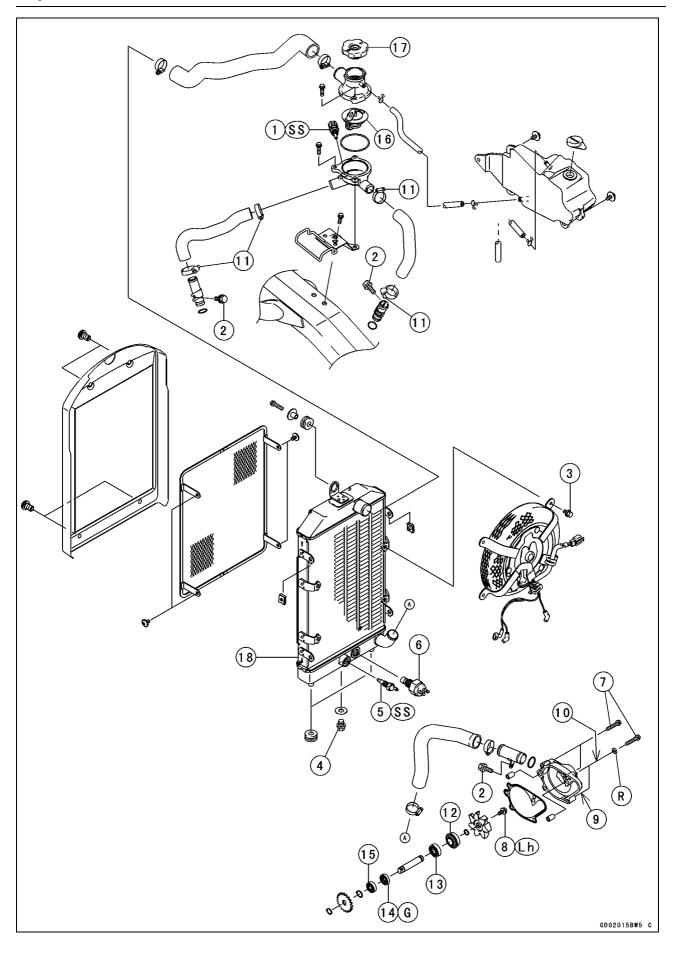


Cooling System

Table of Contents

Exploded View	4-2
Coolant Flow Chart	4-4
Specifications	4-6
Special Tools and Sealant	4-7
Coolant	4-8
Coolant Deterioration Inspection	4-8
Coolant Level Inspection	4-8
Coolant Draining	4-8
Coolant Filling	4-8
Pressure Testing	4-9
Cooling System Flushing	4-9
Water Pump	4-10
Water Pump Removal	4-10
Water Pump Installation	4-10
Water Pump Inspection	4-11
Mechanical Seal Replacement	4-11
Radiator	4-13
Radiator Removal	4-13
Radiator Installation	4-14
Radiator Inspection	4-14
Radiator Cap Inspection	4-15
Radiator Filler Neck Inspection	4-15
Thermostat	4-16
Thermostat Removal	4-16
Thermostat Installation	4-16
Thermostat Inspection	4-16
Hoses and Pipes	4-17
Hose Installation	4-17
Hose Inspection	1 17

Exploded View



Exploded View

No	Factores	Torque			Damanka
No.	Fastener	N⋅m	kgf⋅m	ft∙lb	Remarks
1	1 Water Temperature Sensor (DFI)		1.8	13	SS
2 Water Pipe Bolts		11	1.1	97 in·lb	
3	Radiator Fan Bolts	8.3	0.85	74 in·lb	
4	Radiator Drain Bolt	7.4	0.75	65 in·lb	
5	Water Temperature Switch	7.8	0.80	69 in·lb	SS
6	6 Radiator Fan Switch		1.8	13	
7	Water Pump Cover Bolts	11	1.1	97 in·lb	
8	Water Pump Impeller Bolt	8.8	0.90	78 in·lb	Lh
9	Water Pump Drain Bolt	11	1.1	97 in·lb	
10	10 Water Pump Air Bleeder Bolt		1.1	97 in·lb	
11	11 Radiator Hose Clamp Screws		0.25	22 in·lb	

- 12. Mechanical seal
- 13. Double seal bearing
- 14. Oil seal
- 15. Ball bearing
- 16. Thermostat
- 17. Radiator cap
- 18. Radiator
- G: Apply grease.
- Lh: Left-hand threads
- R: Replacement parts
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

4-4 COOLING SYSTEM

Coolant Flow Chart

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

The thermostat is a wax pellet type which opens or closes as coolant temperature changes. The thermostat continuously changes its valve opening to keep the coolant temperature at the proper level. When coolant temperature is below 55° C (131° F), the thermostat closes so that the coolant flow is restricted through the air bleeder hole, causing the engine to warm up more quickly. When coolant temperature is more than $58 \sim 62^{\circ}$ C ($136 \sim 144^{\circ}$ F), the thermostat opens and the coolant flows.

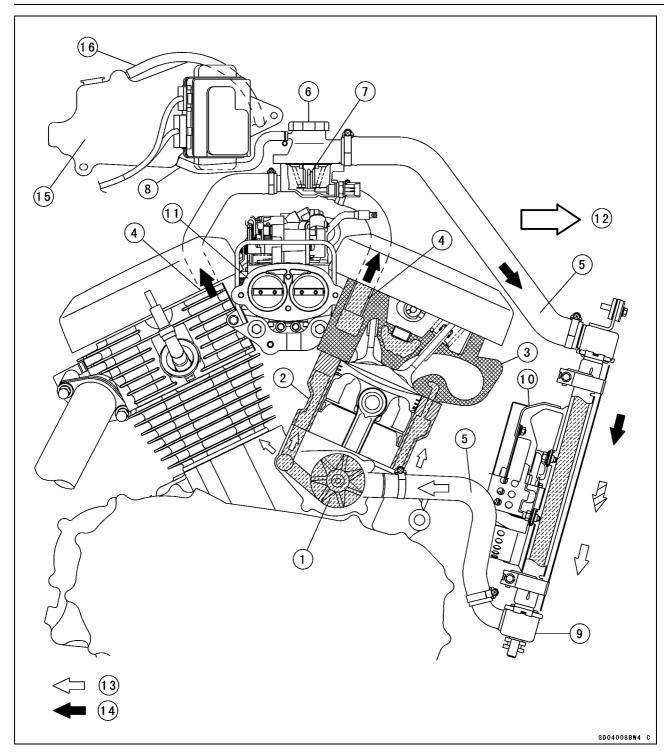
When the coolant temperature goes up beyond $102 \sim 108^{\circ}\text{C}$ ($216 \sim 226^{\circ}\text{F}$), the radiator fan switch conducts to operate the radiator fan. The radiator fan draws air through the radiator core when there is not sufficient air flow such as at low speeds. This increases up the cooling action of the radiator. When the temperature is below 98°C (208°F), the fan switch opens and the radiator fan stops.

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

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

The radiator cap has two valves. One is a pressure valve which holds the pressure in the system when the engine is running. When the pressure exceeds $93 \sim 123$ kPa ($0.95 \sim 1.25$ kgf/cm², $13.5 \sim 17.8$ psi), the pressure valve opens and releases the pressure to the reserve tank. As soon as pressure escapes, the valve closes, and keeps the pressure at $93 \sim 123$ kPa ($0.95 \sim 1.25$ kgf/cm², $13.5 \sim 17.8$ psi). When the engine cools down, another small valve (vacuum valve) in the cap opens. As the coolant cools, the coolant contracts to from a vacuum in the system. The vacuum valve opens and allows the coolant from the reserve tank to enter the radiator.

Coolant Flow Chart



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

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

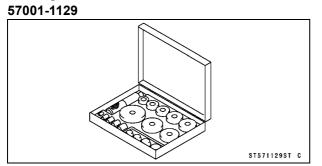
4-6 COOLING SYSTEM

Specifications

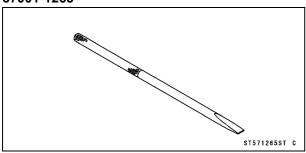
Coolant provided when shipping	
Type (Recommended)	Permanent type antifreeze (soft water and ethylene glycol plus corrosion and rust inhibitor chemicals for aluminum engines and radiators)
Color	Green
Mixed Ratio	Soft water 50%, coolant 50%
Freezing Point	- 35°C (- 31°F)
Total Amount	2.3 L (2.4 US qt., reserve tank full level including radiator and engine)
Radiator Cap	
Relief Pressure	93 ~ 123 kPa (0.95 ~ 1.25 kg/cm², 13.5 ~ 17.8 psi)
Thermostat	
Valve Opening Temperature	58 ~ 62°C (136 ~ 144°F)
Valve Full Opening Lift	8 mm (0.3 in.) or more @ 75°C (167°F)

Special Tools and Sealant

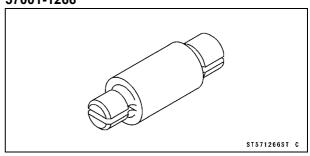
Bearing Driver Set:



Bearing Remover Shaft, ϕ 9: 57001-1265



Bearing Remover Head, ϕ 10 × ϕ 12: 57001-1266



Coolant

Coolant Deterioration Inspection

- Remove the right side cover (see Frame chapter).
- Visually inspect the coolant [A] in the reserve tank.
- ★If whitish cotton-like wafts are observed, aluminum parts in the cooling system are corroded. If the coolant is brown, iron or steel parts are rusting. In either case, flash the cooling system.
- ★If the coolant gives off an abnormal smell, check for a cooling system leak. It may be caused by exhaust gas leaking into the cooling system.

Coolant Level Inspection

NOTE

- OCheck the level when the engine is cold (room or ambient temperature).
- Check the coolant level in the reserve tank with the motorcycle held upright. The coolant level should be between the "F" (full) level and the "L" (low) level (In the photo, the right side cover has been removed for clarity).

Front [A]

Reserve Tank [B]

"F" Level [C]

"L" Level [D]

★If the coolant level is lower than the "L" level, remove the right side cover and the reserve tank cap, then add coolant to the "F" level.

CAUTION

For refilling, add the specified mixture of coolant and soft water. Adding water alone dilutes the coolant and degrades its anticorrosion properties. The diluted coolant can attack the aluminum engine parts. In an emergency, soft water can be added, but the diluted coolant must be returned to the correct mixture ratio within a few days.

If coolant must be added often or the reserve tank has run completely dry, there is probably leakage in the cooling system. Check the system for leaks.

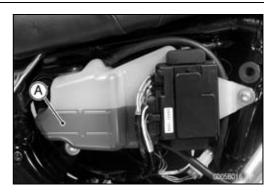
Coolant ruins painted surfaces. Immediately wash away any coolant that spills on the frame, engine, wheels, or other painted parts.

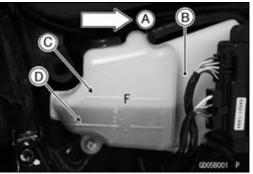
Coolant Draining

• Refer to Coolant Change in the Periodic Maintenance Chapter .

Coolant Filling

• Refer to Coolant Change in the Periodic Maintenance Chapter.





Coolant

Pressure Testing

- Remove the fuel tank (see Fuel System chapter).
- Remove the radiator cap, and install a cooling system pressure tester [A] on the radiator filler neck [B].

NOTE

- OWet the cap sealing surfaces with water or coolant to prevent pressure leakage.
- Build up pressure in the system carefully until the pressure reaches 123 kPa (1.25 kg/cm², 17.8 psi).

CAUTION

During pressure testing, do not exceed the pressure for which the system is designed. The maximum pressure is 123 kPa (1.25 kg/cm², 17.8 psi).

- Watch the gauge for at least 6 seconds.
- ★If the pressure holds 93 kPa (0.95 kg/cm², 13.5 psi) or more, the system is all right.
- ★If the pressure drops and no external source is found, check for internal leakage. Droplets in the engine oil indicate internal leakage. Check the cylinder head and cylinder gaskets and the water pump.
- Remove the pressure tester, replenish the coolant, and install the radiator cap.

Cooling System Flushing

Over a period of time, the cooling system accumulates rust, scale, and lime in the water jacket and radiator. When this accumulation is suspected or observed, flush the cooling system. If this accumulation is not removed, it will clog up the water passage and considerably reduce the efficiency of the cooling system.

- Drain the cooling system (see Coolant Change in the Periodic Maintenance chapter).
- Fill the cooling system with fresh water mixed with a flushing compound.

CAUTION

Do not use a flushing compound which is harmful to the aluminum engine and radiator. Carefully follow the instructions supplied by the manufacturer of the cleaning product.

- Warm up the engine, and run it at normal operating temperature for about ten minutes.
- Stop the engine, and drain the cooling system.
- Fill the system with fresh water.
- Warm up the engine and drain the system.
- Repeat the previous two steps once more.
- Fill the system with a permanent type coolant and bleed the air from the system (see Coolant Change in the Periodic Maintenance chapter).

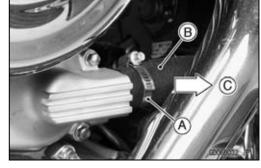


Water Pump

Water Pump Removal

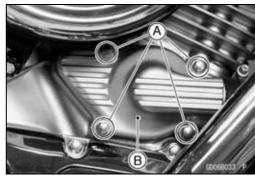
- Drain the coolant (see Coolant Change in the Periodic Maintenance chapter).
- Remove:

Radiator Hose Clamp [A] Radiator Hose [B] Front [C]



• Remove:

Water Pump Cover Bolts [A] Water Pump Cover [B]

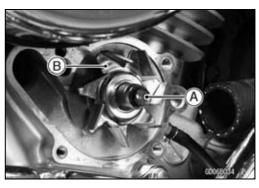


• Remove:

Impeller Bolt [A] Impeller [B]

NOTE

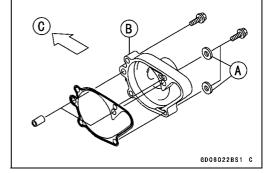
OThe impeller bolt has left-hand threads. Turn the bolt clockwise and remove it.



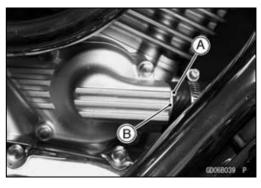
Water Pump Installation

- There are aluminum washers [A] on rear side of the water pump cover [B]. Replace them with new ones when installing.
 - Front [C]
- Tighten:

Torque - Water Pump Cover Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)



- Insert the pump inlet hose until the hose end [A] touches the pump inlet step [B].
- Tighten the hose clamp screw securely.



Water Pump

Water Pump Inspection

- Check the water pump drainage outlet hose [A] at the bottom of the water pump for coolant leakage.
- ★If the mechanical seal is damaged, the coolant leaks through the seal and drain through the passage. Replace the mechanical seal.



- Visually inspect the impeller [A].
- ★If the surface is corroded, or if the blades are damaged, replace the impeller.



Mechanical Seal Replacement

- Remove the water pump impeller (see Water Pump Removal in this chapter).
- Pry the mechanical seal flange off with a small chisel [A].
- Pull the mechanical seal out of the right crankcase with needle nose pliers. Discard the mechanical seal.

CAUTION

Be careful not to damage the water pump shaft and the inner sealing surface of the crankcase.

NOTE

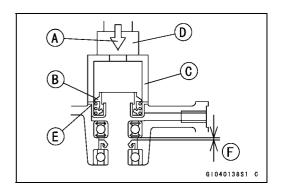
- OSince the replacement mechanical seal has an adhesive coated body, do not apply a liquid gasket to the exterior surface of the body.
- Press [A] the mechanical seal [B] by using a suitable 28 mm socket [C] and a bearing driver [D] until its flange touches the step [E].
 Gap [F]

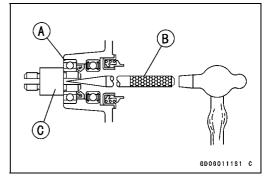


- ★ If the coolant still leaks through the drainage outlet hose, the seal and ball bearings is probably damaged. Replace the mechanical seal, ball bearings, and oil seal by splitting the crankcase.
- Split the crankcase (see Crankshaft/Transmission chapter)
- Remove the water pump impeller.
- Pull out the water pump shaft from the inside of the right crankcase.
- Take the bearing [A] out of the right crankcase, using the bearing remover.

Special Tools - Bearing Remover Shaft: 57001-1265 [B] Bearing Remover Head:, ϕ 10 × ϕ 12: 57001 -1266 [C]



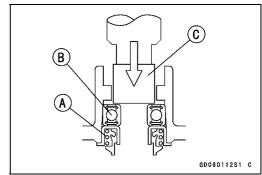




Water Pump

- Using a thin-bladed screwdriver, pry out the oil seal.
- Press out the mechanical seal [A] and ball bearing [B] from the inside of the right crankcase with the bearing driver set [C].

Special Tool - Bearing Driver Set: 57001-1129



- OBe sure to replace the mechanical seal, oil seal, O-ring, and ball bearings with new ones because these parts will be damaged by removal.
- Apply plenty of high temperature grease to the oil seal lips.
- Apply oil to the outer circumference of the oil seal.
- Press the oil seal [A] into the hole from the inside of the right crankcase with the bearing driver set so that the spring side of the seal lips is toward the inside of the crankcase.

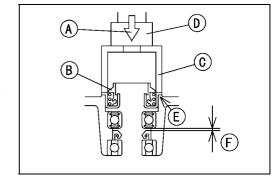
Special Tool - Bearing Driver Set: 57001-1129

- Press the oil seal in until the seal end is even with step [B] of the hole as shown.
- OUse the bearing driver which has a larger diameter than the oil seal.
- Press in each ball bearing [C] with its manufacturer's mark facing out until it bottoms out.
- Press [A] the mechanical seal [B] by using a suitable 28 mm socket [C] and a bearing driver [D] until its flange touches the step [E].

Gap [F]

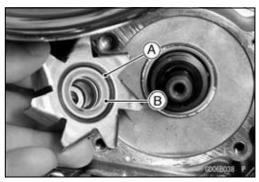
• Install the water pump shaft from the inside of the right crankcase.

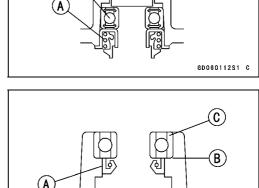
Special Tool - Bearing Driver Set: 57001-1129



- Clean both sliding surfaces of a new mechanical seal with a high-flash point solvent (e.g. ethyl alcohol), and apply a little coolant to the sliding surface to give the mechanical seal initial lubrication.
- Apply coolant to the surface of the rubber seal [A] and sealing seat [B], and press the rubber seal and sealing seat into the impeller by hand until the seat bottoms out.
- Tighten the water pump impeller bolt by turning the bolt counterclockwise.

Torque - Water Pump Impeller Bolt: 8.8 N·m (0.90 kgf·m, 78 in·lb)





GD080204S1 C

Radiator

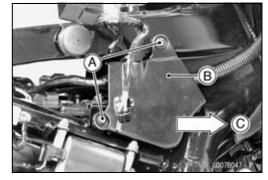
A WARNING

The radiator fan is connected directly to the battery. The radiator fan may start even if the ignition switch is off. NEVER TOUCH THE RADIATOR FAN UNTIL THE RADIATOR FAN CONNECTOR IS DISCONNECTED. TOUCHING THE FAN BEFORE THE CONNECTOR IS DISCONNECTED COULD CAUSE INJURY FROM THE FAN BLADES.

Radiator Removal

- Drain the coolant (see this chapter).
- Remove:

Fuel Tank (see Fuel System chapter.)
Cover Bolt [A]
Cover [B]
Front [C]



• Pry the plastic clamps [A].



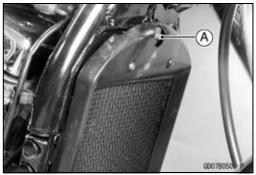
 Remove: Radiator Fan Motor Connector [A] Radiator Hoses



- Remove the mounting bolt [A].
- Lift up the radiator to clear the stoppers.
- Remove the radiator.

CAUTION

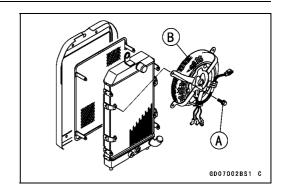
Do not touch the radiator core. This could damage the radiator fins, resulting in loss of cooling efficiency.



Radiator

• Remove:

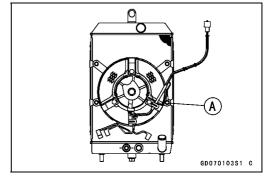
Radiator Fan Bolts [A] Radiator Fan [B]



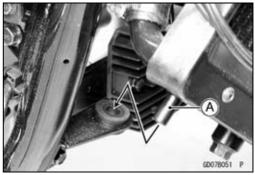
Radiator Installation

- Be sure to install the radiator fan ground lead terminal [A].
- Tighten:

Torque - Radiator Fan Bolts and Fan Ground Lead Terminal Bolt: 8.3 N·m (0.85 kgf·m, 74 in·lb)

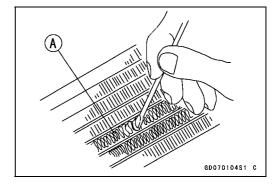


- Fit the radiator stoppers [A] into the right and left grommets.
- Install the pump inlet hose and position the hose clamp (see Water Pump Installation in this chapter).
- Tighten the hose clamp screw securely.



Radiator Inspection

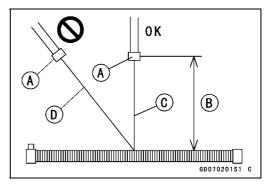
- Check the radiator core.
- ★If there are obstructions to air flow, remove them.
- ★If the corrugated fins [A] are deformed, carefully straighten them.
- ★If the air passages of the radiator core are blocked more than 20% by unremovable obstructions or irreparably deformed fins, replace the radiator with a new one.



CAUTION

When cleaning the radiator with steam cleaner, be careful of the following to prevent radiator damage. Keep the steam gun [A] away more than 0.5 m (1.6 ft) [B] from the radiator core.

Hold the steam gun perpendicular [C] (not oblique [D]) to the core surface and run the steam gun following the core fin direction.



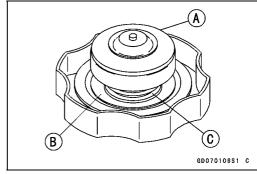
Radiator

Radiator Cap Inspection

- Check the condition of the top and bottom valve seals of the radiator cap.
- ★If any one of them shows visible damage, replace the cap. Bottom Valve Seal [A]

Top Valve Seal [B]

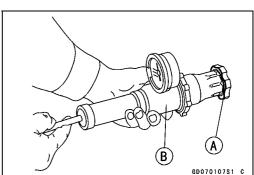
Valve Spring [C]



• Install the cap [A] on a cooling system pressure tester [B].

NOTE

- OWet the cap sealing surfaces with water or coolant to prevent pressure leakage.
- Watching the pressure gauge, pump the pressure tester to build up the pressure until the relief valve opens: the gauge needle flicks downward. Stop pumping and measure leak time at once. The relief valve must open within the specified range in the table below and the gauge needle must remain within the same range at least 6 seconds.



Radiator Cap Relief Pressure

Standard: 93 ~ 123 kPa (0.95 ~ 1.25 kg/cm², 13.5 ~

17.8 psi) for 6 seconds

★If the cap holds too much pressure or cannot hold the specified pressure, replace it with a new one.

Radiator Filler Neck Inspection

- Remove the radiator cap.
- Check the radiator filler neck for signs of damage.
- Check the condition of the top and bottom sealing seats [A] in the filler neck. They must be smooth and clean for the radiator cap to function properly.

Front [B]



4-16 COOLING SYSTEM

Thermostat

Thermostat Removal

• Remove:

Coolant: Drain about 200 mL

Fuel Tank (see Fuel System chapter)

Three Radiator Hoses [A]

Bracket Bolts [B]

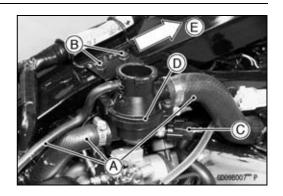
One Radiator Hose (from #1 cylinder)

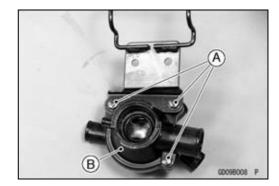
Water Temperature Sensor Connector [C]

 Remove the thermostat housing [D] along with the bracket.

Front [E]

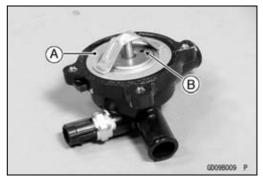
 Remove the screws [A], take off the cap [B], and take out the thermostat.





Thermostat Installation

- Install the thermostat [A] in the housing so that the air bleeder hole [B] is on top.
- Install a new O-ring into the housing.
- Fill the radiator with coolant (see Coolant Change in the Periodic Maintenance chapter).



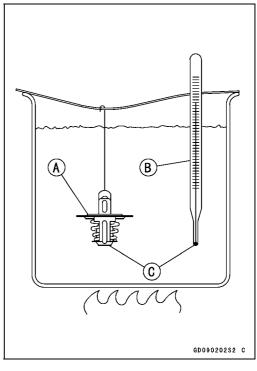
Thermostat Inspection

- Remove the thermostat, and inspect the thermostat valve at room temperature.
- ★If the valve is open, replace the valve with a new one.
- To check valve opening temperature, suspend the thermostat [A] and an accurate thermometer [B] in a container of water with the heat-sensitive portions [C] in almost the same depth.

NOTE

- OThe thermostat must be completely submerged and the thermostat and thermometer must not touch the container sides or bottom.
- Gradually raise the temperature of the water while stirring the water gently for even temperature.
- ★If the measurement is out of the range, replace the thermostat.

Thermostat Valve Opening Temperature 58 ~ 62°C (136 ~ 144°F)



Hoses and Pipes

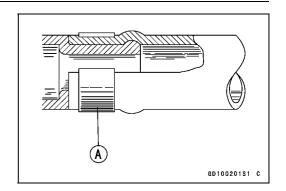
Hose Installation

- Install the hoses and pipes being careful to follow bending direction. Avoid sharp bending, kinking, flattening, or twisting.
- Install the clamps [A] as near as possible to the hose end to clear the raised rib on the fitting. This will prevent the hoses from working loose.
- OThe clamp screws should be positioned correctly to prevent the clamps from contacting the other parts.
- Tighten:

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

Hose Inspection

Whenever the radiator hoses are removed or in accordance with the Periodic Maintenance Chart, check the radiator hoses and their connections. Refer to Radiator Hose and Connection Check in the Periodic Maintenance Chapter.



Engine Top End

Table of Contents

Specifications	5-3	Valve Installation	5-35
Exploded View	5-6	Valve Guide Removal	5-35
Special Tools and Sealant	5-12	Valve Guide Installation	5-36
Clean Air System	5-15	Valve Guide Wear (Wobble	
Air Suction Valve Removal	5-15	Method)	5-36
Air Suction Valve Installation	5-15	Valve Seat Inspection	5-37
Air Suction Valve Inspection	5-15	Valve Seat Repair	5-37
Vacuum Switch Valve Removal	5-16	Cylinders, Piston	5-41
Vacuum Switch Valve Installation	5-16	Cylinder Removal	5-41
Vacuum Switch Valve Operation		Piston Removal	5-41
Test	5-16	Cylinder, Piston Installation	5-41
Vacuum Switch Valve Unit Test	5-16	Cylinder Wear	5-44
Clean Air System Hose		Piston Wear	5-45
Inspection	5-17	Piston/Cylinder Clearance	5-45
Camshaft Chain Tensioner	5-18	Cylinder Boring and Honing	5-45
Camshaft Chain Tensioner		Piston Ring, Piston Ring Groove	
Removal	5-18	Wear	5-46
Camshaft Chain Tensioner		Piston Ring Groove Width	5-46
Installation	5-18	Piston Ring Thickness	5-47
Rocker Case Cover	5-20	Piston Ring End Gap	5-47
Rocker Case Cover Removal	5-20	Mufflers	5-48
Rocker Case Cover Installation	5-20	Exhaust Pipe Removal(Other	0 10
Rocker Case Cover Assembly	5-21	than United States, Canada and	
Rocker Case	5-22	Taiwan Models)	5-48
Rocker Case Removal	5-22	Lower Muffler Removal(Other	0 10
Rocker Case Installation	5-23	than United States, Canada and	
Rocker Arm Assembly	5-24	Taiwan Models)	5-49
HLA Removal	5-25	Upper Muffler Removal(Other	0 10
HLA Air Bleeding	5-25	than United States, Canada and	
HLA Installation	5-25	Taiwan Models)	5-49
Camshafts	5-26	Muffler, Exhaust Pipe	J- 1 J
Camshaft Removal	5-26	Installation(Other than	
Camshaft Installation	5-26	United States, Canada and	
Camshaft Sprocket Installation	5-28	Taiwan Models)	5-49
Camshaft/Rocker Case Wear	5-28	Chamber Removal(Other than	J- 4 3
Front Camshaft Chain Removal	5-30	United States, Canada and	
Rear Camshaft Chain Removal	5-30 5-30	Taiwan Models)	5-50
	5-30 5-31	•	5-50
KACR Inspection	5-31 5-32	Chamber Installation(Other than	
Cylinder Compression	5-32	United States, Canada and	E E0
Cylinder Compression	F 22	Taiwan Models)	5-50
Measurement	5-32	Chamber Assembly(Other than	
Cylinder Head Removal	5-33	United States, Canada and	E
Cylinder Head Installation	5-34	Taiwan Models)	5-50
Cylinder Head Warp	5-34	Chamber Identification(Other	
Valve Clearance Adjustment	5-35	than United States, Canada and	
Valve Removal	5-35	Taiwan Models)	5-51

5-2 ENGINE TOP END

Front Exhaust Pipe		Muffler Removal (United States,	
Removal(United States,		Canada and Taiwan Models)	5-52
Canada and Taiwan Models)	5-51	Muffler, Exhaust Pipe	
Rear Exhaust Pipe		Installation(United States,	
Removal(United States,		Canada and Taiwan Models)	5-52
Canada and Taiwan Models)	5-52	•	

Specifications

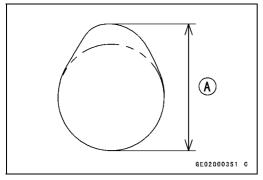
Item	Standard	Service Limit
Clean Air System		
Vacuum Switch Valve Closing Pressure:	Open → Close 49.3 ~ 65.3 kPa	
	(370 ~ 490 mmHg)	
Camshafts		
Cam height:		
Exhaust	33.741 ~ 33.857 mm	33.64 mm
	(1.32839 ~ 1.33295 in.)	(1.3244 in.)
Inlet	33.928 ~ 34.044 mm	33.83 mm
	(1.33575 ~ 1.34031 in.)	(1.3319 in.)
Camshaft/Rocker Case Clearance		
ϕ 25	0.020 ~ 0.062 mm	0.15 mm
	(0.000787 ~ 0.00244 in.)	(0.00591 in.)
ϕ 17	0.016 ~ 0.055 mm	0.14 mm
	(0.000630 ~ 0.00217 in.)	(0.00551 in.)
Camshaft Journal Diameter		
ϕ 25	24.959 ~ 24.980 mm	24.93 mm
	(0.982638 ~ 0.983465 in.)	(0.98150 in.)
Rocker Case Bearing Inside Diameter		
ϕ 25	25.000 ~ 25.021 mm	25.08 mm
	(0.984252 ~ 0.985079 in.)	(0.98740 in.)
Camshaft Journal Diameter		
ϕ 17	16.966 ~ 16.984 mm	16.93 mm
	(0.667953 ~ 0.668661 in.)	(0.66654 in.)
Rocker Case Bearing Inside Diameter		
ϕ 17	17.000 ~ 17.021 mm	17.08 mm
	(0.669291 ~ 0.670118 in.)	(0.67244 in.)
Camshaft Runout	TIR 0.02 mm (0.00079 in.)	TIR 0.1 mm
	or less	(0.0039 in.)
Rocker Arm Inside Diameter	16.000 ~ 16.018 mm	16.05 mm
	(0.629921 ~ 0.630630 in.)	(0.63189 in.)
Rocker Shaft Diameter	15.966 ~ 15.984 mm	15.94 mm
	(0.628583 ~ 0.629291 in.)	(0.62756 in.)
Cylinder Head		
Cylinder Compression Usable Range	340 ~ 590 kPa (3.5 ~ 6.0 kg/cm²,	
	50 ~ 85 psi) @300 r/min (rpm) with electric starter	
Cylinder Head Warp		0.05 mm (0.0020 in.)
Valve		(0.0020 111.)
Valve Clearance	Non-adjustable (Auto adjuster)	
Valve Head Thickness:	(idio dajaotan)	
Exhaust	0.9 ~ 1.1 mm (0.035 ~ 0.0433 in.)	0.7 mm (0.028 in.)
Inlet	0.9 ~ 1.1 mm (0.035 ~ 0.0433 in.)	` ,
Valve Stem Bend	TIR 0.01 mm (0.00039 in.) or	TIR 0.05 mm
33	less	(0.0020 in.)

5-4 ENGINE TOP END

Specifications

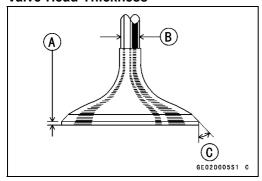
Item	Standard	Service Limit
Valve Stem Diameter:		
Exhaust	6.955 ~ 6.970 mm	6.94 mm (0.2732 in.)
	(0.27382 ~ 0.27441 in.)	
Inlet	6.965 ~ 6.980 mm	6.95 mm (0.2736 in.)
	(0.27421 ~ 0.27480 in.)	
Valve Guide Inside Diameter:		
Exhaust	7.000 ~ 7.015 mm	7.08 mm (0.2787 in.)
	(0.27559 ~ 0.27618 in.)	
Inlet	7.000 ~ 7.015 mm	7.08 mm (0.2787 in.)
	(0.27559 ~ 0.27618 in.)	
Valve/Valve Guide Clearance		
(Wobble Method):		
Exhaust	0.08 ~ 0.16 mm	0.30 mm (0.0118 in.)
	(0.0031 ~ 0.00630 in.)	
Inlet	0.05 ~ 0.13 mm	0.27 mm (0.0106 in.)
	(0.0020 ~ 0.00512 in.)	

Cam Height



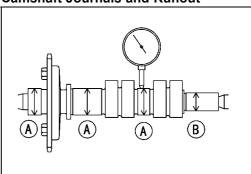
Cam Height (maximum) [A]

Valve Head Thickness



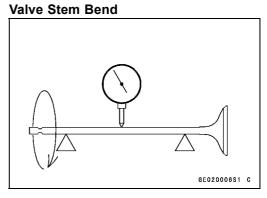
Valve Head Thickness [A] Valve Stem Diameter [B]

Camshaft Journals and Runout



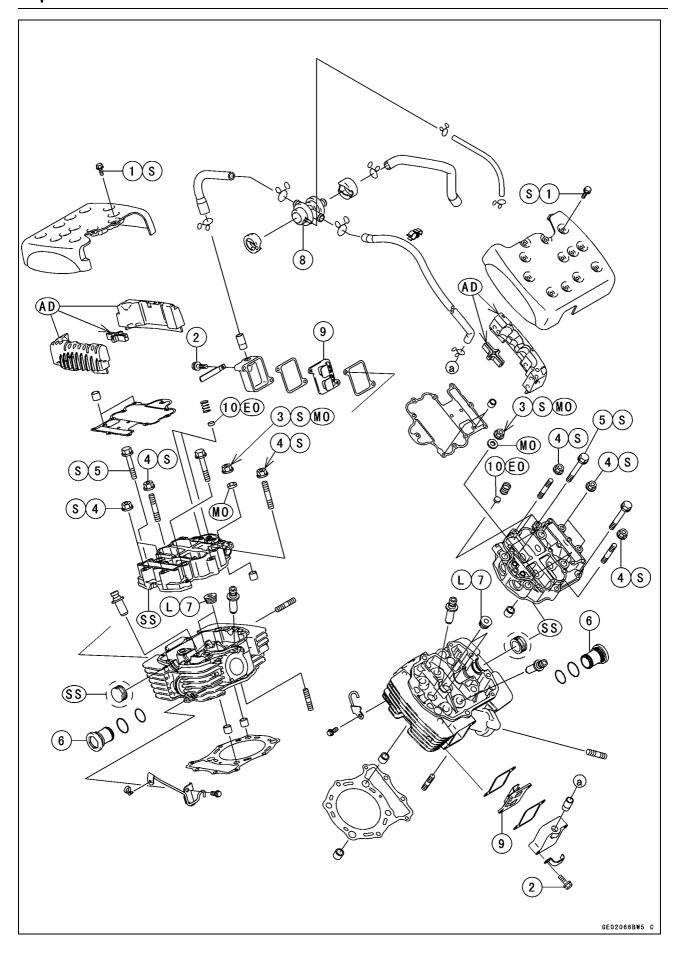
 ϕ 25 mm (0.984 in.) [A] ϕ 17 mm (0.669 in.) [B]

45° [C]



Specifications

Item	Standard	Service Limit
Valve Seat Surface:		
Valve Seat Cutting Angle	45°, 32°, 55°	
Outside Diameter:		
Exhaust	28.9 ~ 29.1 mm (1.138 ~ 1.146 in.)	
Inlet	31.9 ~ 32.1 mm (1.256 ~ 1.264 in.)	
Width:	,	
Exhaust	0.5 ~ 1.0 mm (0.020 ~ 0.039 in.)	
Inlet	0.5 ~ 1.0 mm (0.020 ~ 0.039 in.)	
Valve Spring Free Length:	, ,	
Outer (EX, IN)	44.76 mm (orange) (1.7622 in.)	43.2 mm (1.700 in.)
Inner (EX, IN)	39.82 mm (orange) (1.5677 in.)	38.3 mm (1.508 in.)
Cylinder, Piston	, , , ,	,
Cylinder Inside Diameter	102.000 ~ 102.012 mm	102.10 mm (4.01969 in.)
	(4.015748 ~ 4.016220 in.)	
Piston Diameter	101.942 ~ 101.957 mm	101.79 mm (4.00748 in.)
	(4.013457 ~ 4.014047 in.)	
Piston/Cylinder Clearance	0.043 ~ 0.070 mm	
	(0.00169 ~ 0.00276 in.)	
Oversize Piston And Rings	+ 0.5 mm	
	(0.020 in.)	
Piston Ring/Groove Clearance:	(**************************************	
Top	0.05 ~ 0.09 mm	0.19 mm (0.00748 in.)
	(0.00197 ~ 0.00354 in.)	0.10 (0.001 10)
Second	0.03 ~ 0.07 mm	0.17 mm (0.00669 in.)
	(0.0012 ~ 0.0028 in.)	(
Piston Ring Groove Width:	(**************************************	
Тор	1.24 ~ 1.26 mm	1.34 mm (0.05276 in.)
	(0.048819 ~ 0.049606 in.)	(0.00=.0)
Second	1.22 mm ~ 1.24 mm	1.32 mm (0.05197 in.)
	(0.04803 ~ 0.04882 in.)	(
Piston Ring Thickness:	(616.1300 316.1302 11.11)	
Тор	1.17 mm ~ 1.19 mm	1.10 mm (0.0433 in.)
	(0.04606 ~ 0.04685 in.)	(0.0.00)
Second	1.17 mm ~ 1.19 mm	1.10 mm (0.0433 in.)
	(0.04606 ~ 0.04685 in.)	(0.0.00)
Piston Ring End Gap:	(616.1606 616.1606 11.17)	
	0.25 ~ 0.35 mm	
Тор	(0.0098 ~ 0.0138 in.)	0.7 mm (0.028 in.)
Socond	0.40 ~ 0.55 mm	0.8 mm (0.031 in.)
Second	(0.0157 ~ 0.0217 in.)	·
Oil	0.3 ~ 0.9 mm	1.2 mm (0.0472 in.)
	(0.012 ~ 0.035 in.)	

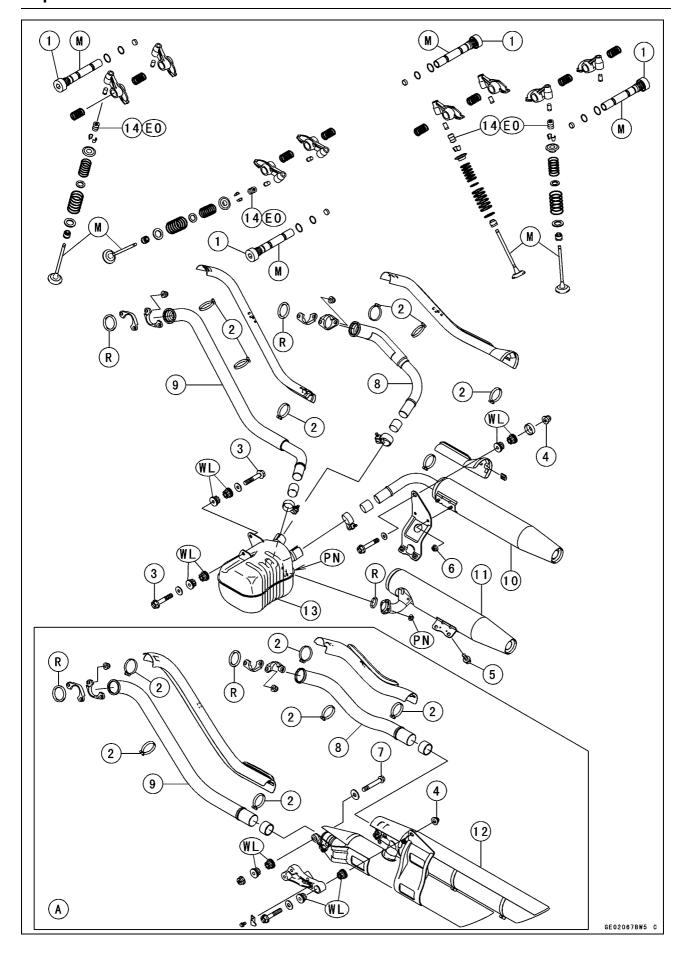


No.	Fastener		Damarka		
		N⋅m	kgf⋅m	ft∙lb	Remarks
1	Rocker Case Cover Bolts	8.8	0.90	78 in·lb	S
2	Air Suction Valve Cover Bolts	7.4	0.75	65 in·lb	
3	Rocker Case Nuts ϕ 12 mm	78	8.0	58	S, MO
4	Rocker Case Nuts ϕ 8 mm	25	2.5	18	S
5	Rocker Case Bolts ϕ 6 mm	8.8	0.90	78 in·lb	S
6	Spark Plug Retainers	12	1.2	104 in·lb	
7	Cylinder Head Jacket Plugs	20	2.0	14	L

- 8. Vacuum Switch Valve
- 9. Air Suction Valves
- 10. HLA Oil Filters
- AD: Apply adhesive.
- EO: Apply engine oil.
- MO: Apply molybdenum disulfide oil.

The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1)

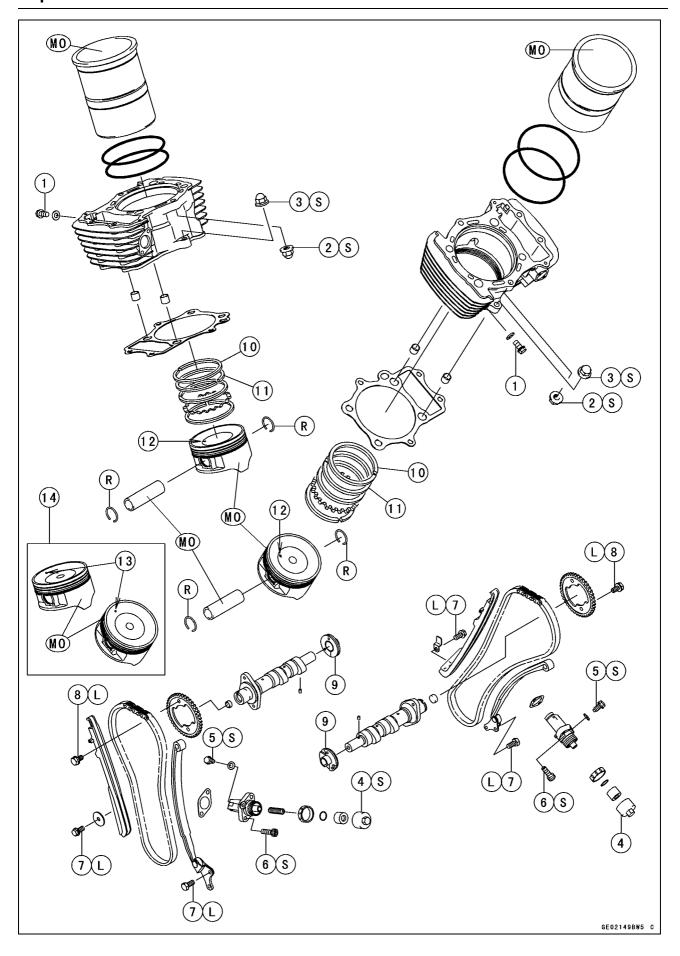
- L: Apply a non-permanent locking agent.
- S: Follow the specific tightening sequence.
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).



No	Factoria	Torque			Damanka
No.	Fastener	N⋅m	kgf⋅m	ft∙lb	Remarks
1	Rocker Shafts	25	2.5	18	
2	Exhaust Pipe Cover Clamp Screws	6.9	0.70	61 in·lb	
3	Premuffler Chamber Bolts	29	3.0	22	
4	Muffler Bracket Nut	29	3.0	22	
5	Muffler Stay Mounting Bolts, ϕ 8	25	2.5	18	
6	Muffler Stay Mounting Nuts, ϕ 8	25	2.5	18	
7	Muffler Bracket Bolt	29	3.0	22	

- 8. Rear Exhaust Pipe
- 9. Front Exhaust Pipe
- 10. Upper Muffler
- 11. Lower Muffler
- 12. Muffler Assembly
- 13. Premuffler Chamber
- 14. Hydraulic Lash Adjusters
- M: Apply molybdenum disulfide grease.
- PN: Spray a penetrating oil on the nuts and studs if the nuts are difficult to remove.
- R: Replacement Parts
- WL: Apply a soap and water solution or rubber lubricant.
 - A: United States and Canada Model (VN1600-A1 ~) Taiwan Model (VN1600-A3 ~)

5-10 ENGINE TOP END



No.	Fastener	Torque			Domonico
		N⋅m	kgf∙m	ft∙lb	Remarks
1	Cylinder Coolant Drain Plug	11	1.1	95 in·lb	
2	Cylinder Head Nuts	25	2.5	18	S
3	Cylinder Nuts	25	2.5	18	S
4	Chain Tensioner Cap	20	2.0	14	S
5	Chain Tensioner Lockbolt	4.9	0.50	43 in·lb	S
6	Chain Tensioner Mounting Bolts	11	1.1	95 in·lb	S
7	Camshaft Chain Guide Bolts	11	1.1	95 in·lb	L
8	Camshaft Sprocket Bolts	15	1.5	11	L

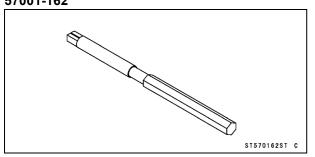
- 9. KACR Unit
- 10. "R" marked side faces up.
- 11. "RN" marked side faces up.
- 12. Each arrow mark point to the front side.
- 13. Each circle mark point to the front side. (After VN1600-A3. Frame No.)
- 14. Piston (After VN1600-A3. Frame No.)
- EO: Apply engine oil.
 - L: Apply a non-permanent locking agent.
- MO: Apply molybdenum disulfide oil.

The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1)

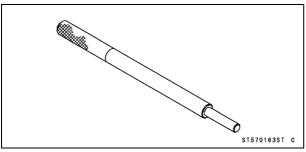
- R: Replacement Parts
- S: Follow the specific tightening sequence.

Special Tools and Sealant

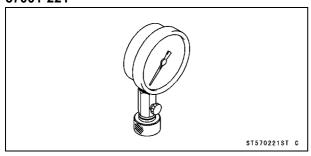
Valve Guide Reamer, ϕ 7: 57001-162



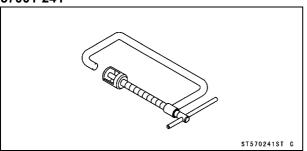
Valve Guide Arbor, ϕ 7: 57001-163



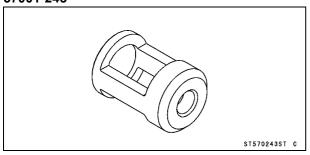
Compression Gauge, 20 kgf/cm²: 57001-221



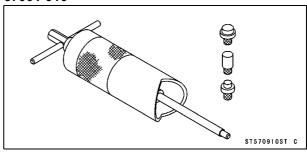
Valve Spring Compressor Assembly: 57001-241



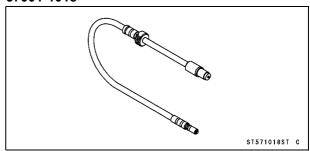
Valve Spring Compressor Adapter, ϕ 28.2: 57001-243



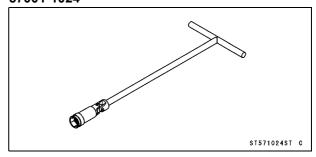
Piston Pin Puller Assembly: 57001-910



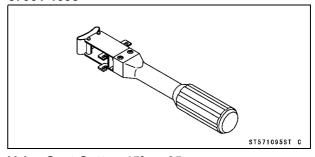
Compression Gauge Adapter, M12 × 1.25: 57001-1018



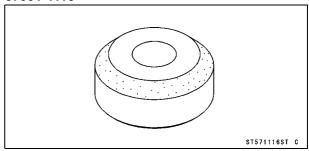
Spark Plug Wrench, Hex 18: 57001-1024



Piston Ring Compressor Grip: 57001-1095

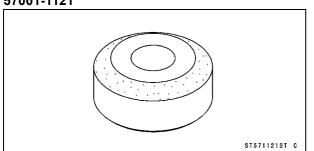


Valve Seat Cutter, 45° - ϕ 35: 57001-1116

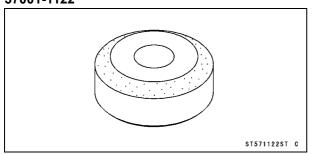


Special Tools and Sealant

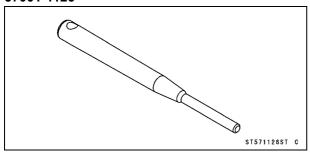
Valve Seat Cutter, 32° - ϕ 35: 57001-1121



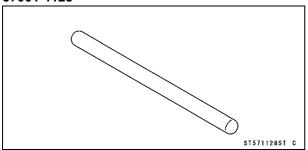
Valve Seat Cutter, 32° - ϕ 38.5: 57001-1122



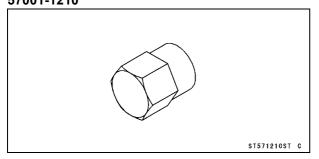
Valve Seat Cutter Holder, ϕ 7: 57001-1126



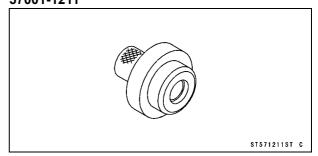
Valve Seat Cutter Holder Bar: 57001-1128



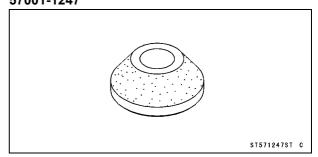
Hexagon Wrench, Hex 27: 57001-1210



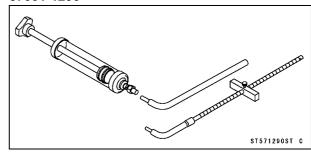
Piston Pin Puller Adapter, ϕ 14: 57001-1211



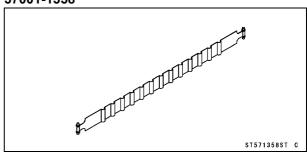
Valve Seat Cutter, 55° - ϕ 35: 57001-1247



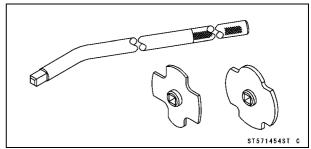
Fork Oil Level Gauge: 57001-1290



Piston Ring Compressor Belt, ϕ 95 ~ ϕ 108: 57001-1358



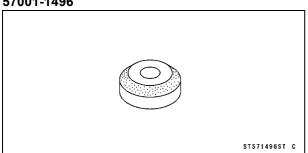
Filler Cap Driver: 57001-1454



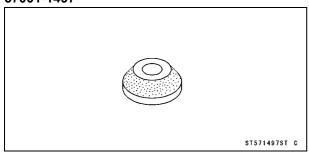
5-14 ENGINE TOP END

Special Tools and Sealant

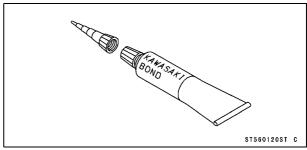
Valve Seat Cutter, 45° - ϕ 40: 57001-1496



Valve Seat Cutter, 55° - ϕ 38.5: 57001-1497



Kawasaki Bond (Silicone Sealant): 56019-120

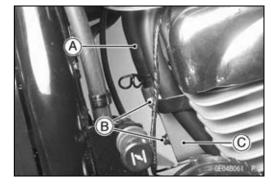


- OCompression Gauge Adapter: 57001-1183 can also be used.
- OValve Seat Cutter, $32^{\circ} \phi 33$: 57001-1199 can also be used instead of Valve Seat Cutter, $32^{\circ} \phi 35$: 57001-1121

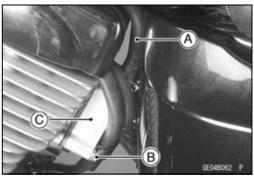
Clean Air System

Air Suction Valve Removal

- For rear air suction valve removal, remove the hose [A].
- Unscrew the mounting bolts [B] and remove the rear air suction valve cover [C].
- Remove the rear air suction valve.



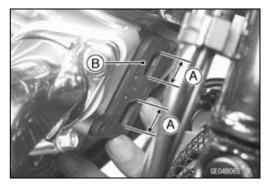
- For front air suction valve removal, remove the horn, the radiator mounting bolt and move the radiator forward.
- Remove the hose [A].
- Unscrew the mounting bolts [B] and remove the front air suction valve cover [C].
- Remove the front air suction valve.



Air Suction Valve Installation

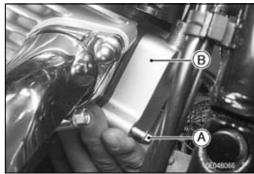
- Replace the gasket with a new one.
- Install each air suction valve so that its wider side [A] of the reed faces left.

Front Air Suction Valve [B]



- For the front air suction valve cover installation, set the lower bolt [A] in the cover [B] and install it.
- Tighten:

Torque - Air Suction Valve Cover Bolts: 7.4 N·m (0.75 kgf·m, 65 in·lb)



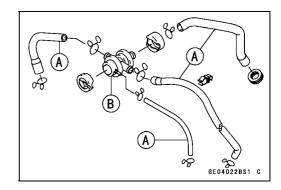
Air Suction Valve Inspection

ORefer to Air Suction Valve Check in the Periodic Maintenance Chapter.

Clean Air System

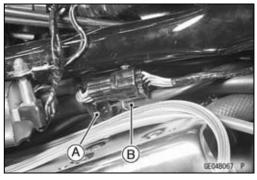
Vacuum Switch Valve Removal

- Remove:
 - Fuel Tank (see Fuel System Chapter)
- Pull off the hoses [A] and take out the vacuum switch valve [B].



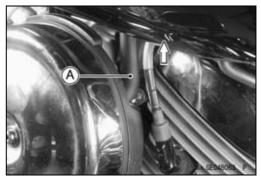
Vacuum Switch Valve Installation

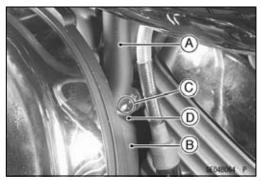
- Install the vacuum switch valve [A] so that the inlet vacuum hose [B] faces rear side.
- Route the hoses correctly (see General Information chapter).



Vacuum Switch Valve Operation Test

- Pull the vacuum switch hose [A] out of the right air cleaner base.
- Start the engine and run it at idle speed.
- Plug the vacuum switch hose end with your finger and feel vacuum pulsing in the hose.
- ★If there is no vacuum pulsation, check the hose line for leak. If there is no leak, check the vacuum switch valve (see Vacuum Switch Valve Unit Test).
- Apply a soap and water solution or rubber lubricant to the end of the vacuum switch hose [A] and put the hose into the right air cleaner base [B] with the white mark [C] faced forward until the white mark aligns with the top of the grommet [D].

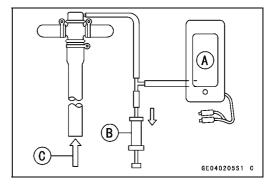




Vacuum Switch Valve Unit Test

- Remove the vacuum switch valve (see Vacuum Switch Valve Removal).
- Connect a commercially available vacuum gauge [A] and syringe [B] (or fork oil level gauge) to the vacuum hoses as shown.

Special Tool - Fork Oil Level Gauge: 57001-1290Air Flow [C]



Clean Air System

 Gradually raise the vacuum (lower the pressure) applied to the vacuum switch valve, and check the valve operation. When the vacuum is low, the vacuum switch valve should permit air to flow. When the vacuum raises to valve closing pressure, it should stop air flow.

Spring [A]
Diaphragm [B]
Valve [C]
Low Vacuum [D]
Secondary air flows [E].

★ If the vacuum switch valve does not operate as described, replace it with a new one.

NOTE

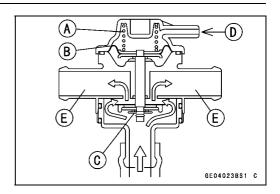
○ To check air flow through the vacuum switch valve, just blow through the air cleaner hose [C].

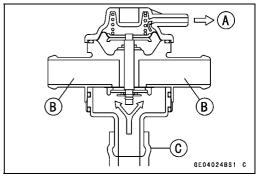
Vacuum Switch Valve Closing Pressure (Open \rightarrow Close) Standard: 49.3 \sim 65.3 kPa (370 \sim 490 mmHg)

High Vacuum [A] Secondary air cannot flow [B].

Clean Air System Hose Inspection

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the right air cleaner base, vacuum switch valve, throttle body, and air suction valve covers.
- ★If they are not, correct them. Replace them if they are damaged.





Camshaft Chain Tensioner

Camshaft Chain Tensioner Removal

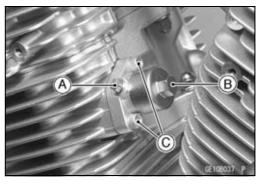
CAUTION

This is a non-return type cam chain tensioner. The push rod does not return to its original position once it moves out to take up camshaft chain slack. Observe all the rules listed below:

When removing the tensioner, do not take out the mounting bolts only halfway. Retightening the mounting bolts from this position could damage the tensioner and the camshaft chain. Once the bolts are loosened, the tensioner must be removed and reset as described in "Camshaft Chain Tensioner Installation".

Do not turn over the crankshaft while the tensioner is removed. This could upset the cam chain timing, and damage the valves.

- For the front chain tensioner, remove the lower air cleaner duct and left air cleaner base holder (see Fuel System chapter).
- OThe procedure to remove the front chain tensioner is as follows.
- Loosen the lockbolt [A] and remove the tensioner cap [B].
- Remove the tensioner mounting bolts [C] and take off the chain tensioner.
- For the rear chain tensioner [A], removal is the same as for the front chain tensioner.



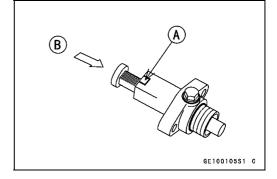


Camshaft Chain Tensioner Installation

CAUTION

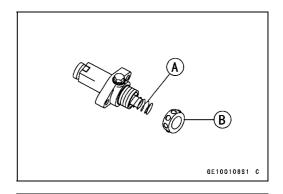
Be sure to install the camshaft chain tensioner after camshaft chain is timed.

• Push the stopper [A] to release the ratchet and push the push rod [B] into the tensioner body.

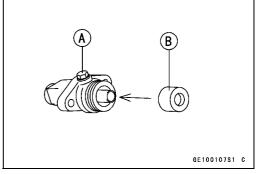


Camshaft Chain Tensioner

- Install the larger spring [A], and then the ball bearing assy [B].
- OFit the ball bearing assy into the body until it bottoms out, using a thin-bladed screwdriver.

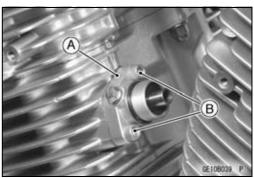


- Screw in the lockbolt [A] finger-tight to hold the ball bearing assy temporarily.
- Install the retainer [B].



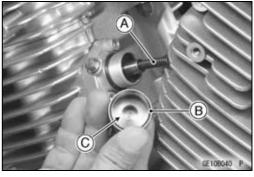
• Install the tensioner body [A] and tighten the mounting bolts [B] to the specified torque.

Torque - Chain Tensioner Mounting Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)



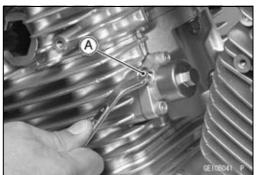
- Install the smaller spring [A] and the tensioner cap [B]. OSet the spring end into the hollow [C] of the cap.
- Tighten the tensioner cap to the specified torque.

Torque - Chain Tensioner Cap: 20 N·m (2.0 kgf·m, 14 ft·lb)



- Remove the lockbolt [A] and check to be sure that the larger spring clicks, then install the lockbolt.
- Tighten:

Torque - Chain Tensioner Lockbolt: 4.9 N·m (0.50 kgf·m, 43 in·lb)

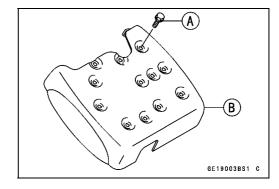


5-20 ENGINE TOP END

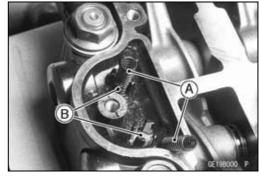
Rocker Case Cover

Rocker Case Cover Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Remove the bolts [A] and take off the cover [B] from the rocker case.



• Take out the oil filter springs [A] and HLA oil filters [B].

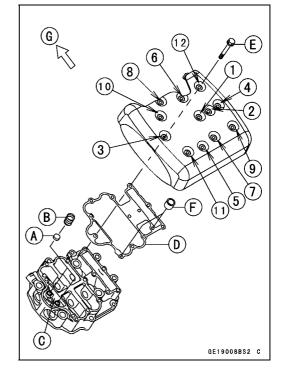


Rocker Case Cover Installation

- Replace the HLA oil filters [A] with new ones.
- Install the oil filter springs [B]
- After installing the rocker case, fill the oil reservoir [C] with engine oil.
- Replace the cover gasket [D] with a new one.
- Tighten the cover bolts [E] to the specified torque following the tightening sequence.

Dowel Pins [F] Inlet Side [G]

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



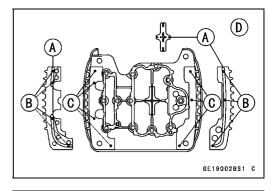
Rocker Case Cover

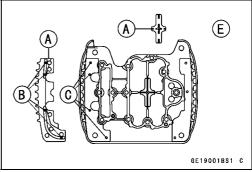
Rocker Case Cover Assembly
• Apply adhesive to the rubber dampers [A] and install them on the rocker case cover as shown.

Olnsert the projections [B] of the dampers to the holes [C] of the cover.

Front Cover [D]

Rear Cover [E]





5-22 ENGINE TOP END

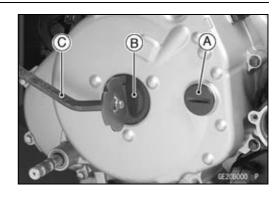
Rocker Case

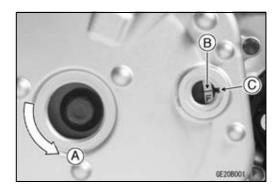
Rocker Case Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Remove the throttle body assy (see Fuel System (DFI) chapter).
- Remove the rocker case covers (see this chapter).
- Remove the alternator outer cover (see Electrical System chapter).
- Remove the timing inspection cap [A] and rotor bolt cap [B].

Special Tool - Filler Cap Driver: 57001-1454 [C]

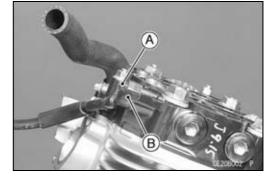
 Turn the crankshaft counterclockwise [A] and align the "F" mark (TDC mark for front piston) [B] with the middle of the notch [C].



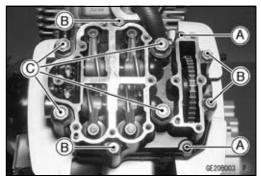


Remove:

 Oil Hose Banjo Bolt [A]
 Oil Hose [B]



- Remove the camshaft chain tensioner (see Camshaft Chain Tensioner Removal).
- Remove the rocker case bolts [A], smaller nuts [B], and then larger nuts [C].



 Using the pry points [A], take the rocker case out of the cylinder head.



Rocker Case

- Unscrew the rocker shafts [A], and take the rocker arms
 [B] out of the rocker case.
- Take out the oil filters if necessary.
- Remove the lash adjuster if necessary (see HLA Removal).

CAUTION

The cylinder head and rocker case are machined in the assembled state, so they must be used as a set. Be careful not to mix them up for front and rear cylinders.

Rocker Case Installation

- Install the rocker arms [A] and retaining springs [B] on each rocker shaft as shown. These retaining springs are the same.
- OThe rocker arm [C] of the exhaust side [D] next to the chain tunnel is different from the others.
- OBe careful not to tip the rocker arm and not to allow the oil to leak out of HLA.
- Replace the O-rings [E] with new ones and install them on the rocker shaft [F].
- Tighten the rocker shafts to the specified torque.

Torque - Rocker Shafts: 25 N·m (2.5 kgf·m, 18 ft·lb)

• Apply silicone sealant [A] to the rocker case mating surface and the outer circumference of the plugs as shown.

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

ODo not apply silicone sealant around the camshaft bearing.

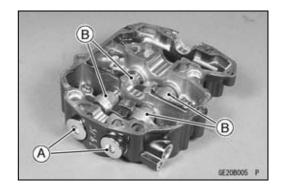
- Apply molybdenum disulfide oil to the threads and seating surface of ϕ 12 mm nuts and both sides of washers.
- Tighten the rocker case nuts and bolts temporarily following the tightening sequence shown, and then tighten them to the specified torque.

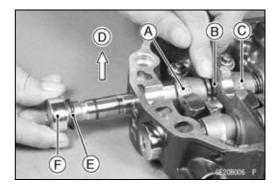
Torque - Rocker Case Nuts ϕ 12 mm: 78 N·m (8.0 kgf·m, 58 ft·lb)

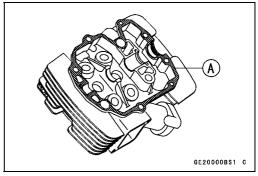
Rocker Case Nuts ϕ 8 mm: 25 N·m (2.5 kgf·m, 18 ft·lb)

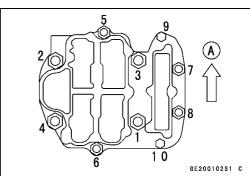
Rocker Case Bolts ϕ 6 mm: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Inlet Side [A]







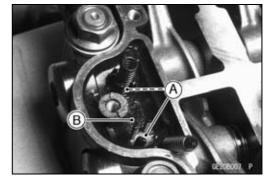


5-24 ENGINE TOP END

Rocker Case

- Replace the HLA oil filters [A] with new ones.
- After installing the rocker case, fill the oil reservoir [B] with engine oil.
- Tighten:

Torque - Oil Hose Flange Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



• Tighten the cylinder head nuts [A] and cylinder nuts [B] to the specified torque.

Torque - Cylinder Head Nuts, Cylinder Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)

Rocker Cases [C] Cylinder Heads [D] Cylinders [E]

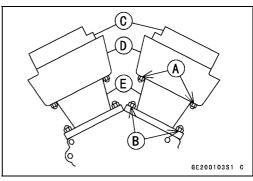
• Tighten:

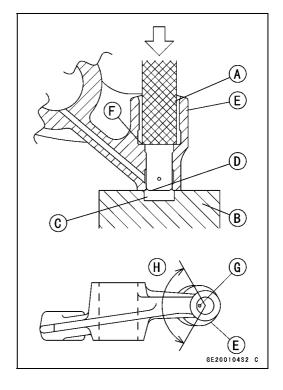
Torque - Timing Inspection Cap, Rotor Bolt Cap: 1.5 N·m (0.15 kgf·m, 13 in·lb)

• Install the engine (see Engine Removal/Installation chapter).

Rocker Arm Assembly

- Prepare a flat-end bar [A] and a block [B] with a recess [C].
- Press the oil chamber [D] for the HLA into the rocker arm end [E] until the chamber end is even with the step [F] of the hole.
- OInstall the oil chamber as shown so that the air bleed hole [G] is placed within 120 degrees [H]. This makes HLA bleeding easier.





Rocker Case

HLA Removal

- Remove the rocker case (see this chapter).
- Remove the rocker arms.
- Pull the HLA (hydraulic lash adjuster) [B] out of the rocker arm [A] with your fingers.

CAUTION

Be careful not to damage or deform an HLA by tapping it during removal or installation.

Do not drop the HLA or hit it sharply. If it is damaged, the plunger will not operate smoothly.

HLA Air Bleeding

- Fill a container with engine oil.
- Prepare a thumbtack and cut its needle to 2.1 ~ 2.3 mm (0.0827 ~ 0.0906 in.) long [A]. Grind its cutting edge [B] smooth
- Push in the check valve of the HLA [D] with the needle of the tack [C] and move the plunger up and down in the oil bath.
- ★If the plunger sinks into the HLA body, repeat the air bleeding procedure and then push the plunger.
- ★After air bleeding, if the plunger sinks into the HLA body again, replace the HLA.

CAUTION

Do not push the check valve in more than $2.1 \sim 2.3$ mm. Pushing too deep may cause the damage of the HLA.

HLA Installation

- Check that the HLA plunger is not damaged.
- ★If the plunger does damage, replace the HLA.

HLA Body [A]

O-ring [B]

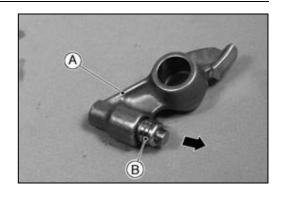
Plunger Spring [C]

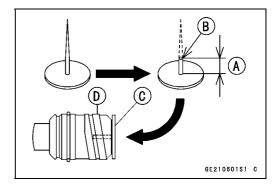
Pivot Plunger [D]

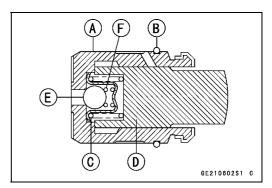
Check Valve [E]

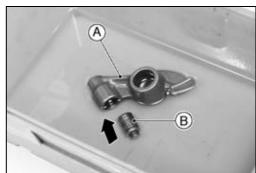
Check Valve Spring [F]

- Air-bleed the HLA (see HLA Air Bleeding).
- Soak a rocker arm [A] in engine oil, and then insert the HLA [B] into the rocker arm.
- OBe careful not to tip the rocker arm having the HLA, and not to allow engine oil to leak out of the HLA.









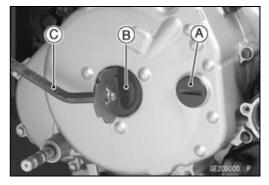
5-26 ENGINE TOP END

Camshafts

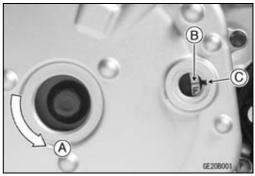
Camshaft Removal

 Remove the timing inspection cap [A] and rotor bolt cap [B].

Special Tool - Filler Cap Driver: 57001-1454 [C]



- Turn the crankshaft counterclockwise [A] and align the "F" mark [B] (TDC mark for the front piston) with the middle of the notch [C].
- Remove the front and rear rocker case covers (see this chapter).
- Remove the front and rear rocker cases (see this chapter).



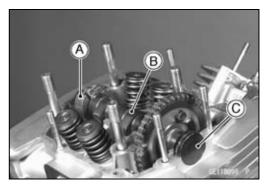
- Remove the camshaft [B] along with the KACR [A]. ORemove the camshaft plug [C].
- Stuff a clean cloth into the chain tunnel to keep any parts from dropping into the crankcase.

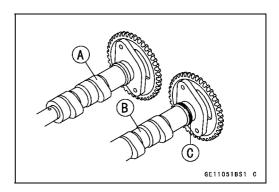
CAUTION

The crankshaft may be turned while the camshafts are removed. Always pull the chain taut while turning the crankshaft. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both chain and sprocket.

Camshaft Installation

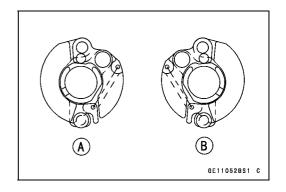
OThe front camshaft [A] and rear camshaft [B] are different. The rear camshaft has a groove [C].



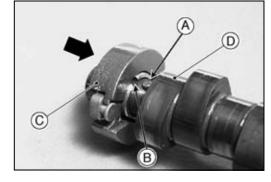


Camshafts

- Install the KACR on each camshaft.
- OThe front KACR [A] and rear KACR [B] are different (inside view). Do not confuse these KACRs.



- Fit the pin [A] into the notch [B], and install the KACR [C] onto the camshaft [D].
- Apply molybdenum disulfide oil to all cam parts, including their journals.
- Remove the timing inspection cap and check that the "F" mark aligns with the middle of the notch (front piston TDC) (see Camshaft Removal).
- ★If necessary, align them.



- First, install the front camshaft.
- OEngage the front camshaft sprocket with the camshaft chain as shown.

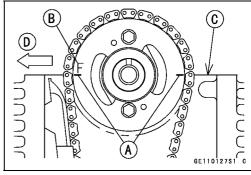
Timing Marks [A]

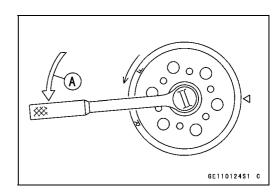
F mark [B]

Cylinder Head Upper Surface [C]

Front [D]

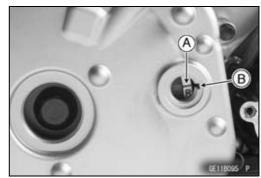
- OPull the front side (exhaust side) of the chain taut to install the camshaft.
- OInstall the front chain tensioner (see this chapter). The timing marks must be aligned with the cylinder head upper surface.
- Next, install the rear camshaft.
- OCheck to be sure that the front camshaft chain timing is correct.
- OTurn the crankshaft counterclockwise [A].





Camshafts

 Align the "R" mark [A] (TDC mark for the rear piston) with the middle of the notch [B] (310° turn from the front piston TDC).



• Engage the rear camshaft sprocket with the camshaft chain as shown.

Timing Marks [A] and **R** Mark [B] Cylinder Head Upper Surface [C] Front [D]

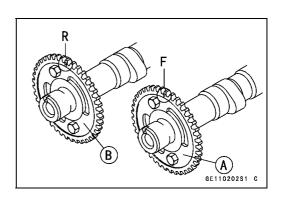
- OPull the front side (inlet side) of the chain taut to install the camshaft.
- Install the rear chain tensioner and check the front/rear chain timing again.
- OThe timing marks must be aligned with the cylinder head upper surface and positioned as shown after chain tensioner installation.
- Install the rocker cases and rocker case covers (see this chapter).
- Tighten:

Torque - Timing Inspection Cap, Rotor Bolt Cap: 1.5 N·m (0.15 kgf·m, 13 in·lb)

Camshaft Sprocket Installation

- Use the sprocket marked **F** for the front camshaft [A] and the sprocket marked **R** for the rear camshaft [B].
- Apply a non-permanent locking agent to the camshaft sprocket bolts and tighten them to the specified torque.

Torque - Camshaft Sprocket Bolts: 15 N·m (1.5 kgf·m, 11 ft·lb)

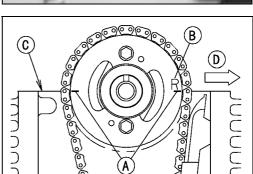


Camshaft/Rocker Case Wear

- Cut strips of plastigage to journal width. Place a strip on each journal parallel to the camshaft installed in the correct position.
- Measure each clearance between the camshaft and the rocker case using plastigage.

NOTE

ODo not turn the camshaft when the plastigage is between the journal and camshaft cap.



Camshafts

- Apply molybdenum disulfide oil to the threads and seating surface of ϕ 12 mm nuts and both sides of washers.
- Tighten the rocker case nuts and bolts temporarily following the tightening sequence shown, and then tighten them to the specified torque.

Torque - Rocker Case Nuts ϕ 12 mm: 78 N·m (8.0 kgf·m, 58 ft·lb)

Rocker Case Nuts ϕ 8 mm: 25 N·m (2.5 kgf·m, 18 ft·lb)

Rocker Case Bolts ϕ 6 mm: 8.8 N·m (0.90 kgf·m, 78 in.lb)

Inlet Side [A]

 Remove the rocker case again, and measure the plastigage width [A] to determine the clearance between each journal and the rocker case. Measure the maximum plastigage width.



Standard: $(\phi 25) \ 0.020 \sim 0.062 \ \text{mm}$

 $\begin{array}{l} (0.000787 \sim 0.00244 \text{ in.}) \\ (\phi 17) \ 0.016 \sim 0.055 \text{ mm} \\ (0.000630 \sim 0.00217 \text{ in.}) \end{array}$

Service Limit: $(\phi 25) \ 0.15 \ \text{mm} \ (0.00591 \ \text{in.})$

 $(\phi$ 17) 0.14 mm (0.00551 in.)

★If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

Camshaft Journal Diameter

Standard: $(\phi 25) 24.959 \sim 24.980 \text{ mm}$

(0.982638 ~ 0.983465 in.) (ϕ 17) 16.966 ~ 16.984 mm (0.667953 ~ 0.668661 in.)

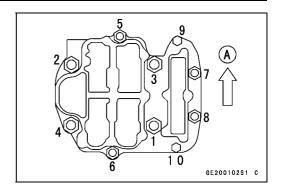
Service Limit: $(\phi 25)$ 24.93 mm (0.98150 in.)

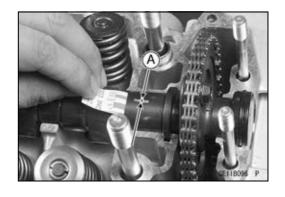
 $(\phi$ 17) 16.93 mm (0.66654 in.)

- ★If the camshaft journal diameter is less than the service limit, replace the camshaft with a new one and measure the clearance again.
- ★If the clearance still remains out of the limit, replace the cylinder head and rocker case.

CAUTION

The rocker case and cylinder head are machined in the assembled state, so they must be replaced as a set.





5-30 ENGINE TOP END

Camshafts

Front Camshaft Chain Removal

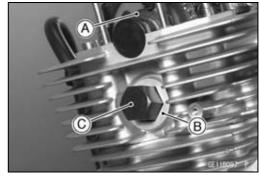
• Remove:

Front Camshaft [A] (see this chapter)

Spark Plug (left side, see Cylinder Compression Measurement)

Spark Plug Retainer [B] (left side)

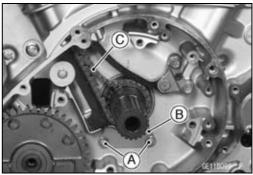
Special Tool - Hexagon Wrench, Hex 27 [C]: 57001-1210



• Remove:

Alternator Rotor (see Electrical System chapter) Lower Chain Guide Bolts [A] Lower Chain Guide [B]

• Take out the front camshaft chain [C].



Rear Camshaft Chain Removal

• Remove:

Rear Camshaft (see this chapter)

Spark Plug (left side, see Cylinder Compression Measurement)

Spark Plug Retainer (see Front Chain Removal)

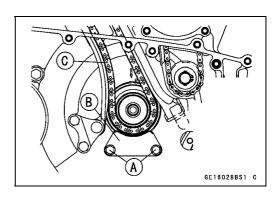
Clutch (see Clutch chapter)

Starter Clutch Gear (see Crankshaft/Transmission chapter)

Primary Gear (see Crankshaft/Transmission chapter)

Lower Chain Guide Bolts [A] Lower Chain Guide [B] (right view)

• Take out the rear camshaft chain [C].

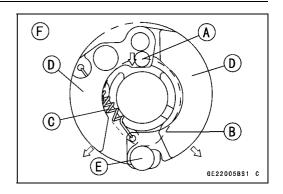


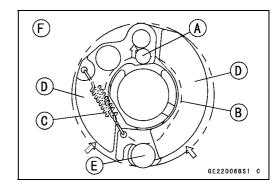
Camshafts

KACR Inspection

- ODue to the simplicity of the KACR (Kawasaki Automatic Compression Release), no periodic maintenance is needed. There are only two symptoms of problems with the KACR mechanism compression is not released during starting, and compression is released during running.
- OThe cylinder compression is not released during starting (abnormal): the pin [A] stays within the cam [B] and will not push up the exhaust rocker arm.
- Remove the KACR unit and visually inspect the spring [C].
- ★If the spring is damaged, deformed, or missing, replace the spring.
- Remove the spring and move the weights [D] back and forth.
- ★If the weights do not move smoothly all the way, replace the KACR unit. Also inspect the exhaust rocker arm for any damage, and replace the rocker arm if necessary. Stopper [E] Rear KACR unit [F]
- OThe cylinder compression is released while the engine is running (abnormal): the pin [A] stays out the cam [B] and pushes up the exhaust rocker arm.
- Remove the spring [C] and move the weights [D] back and forth.
- ★ If the weights do not move easily from the retracted position, replace the KACR unit. Also inspect the exhaust rocker arm for any damage, and replace the rocker arm if necessary.

Stopper [E] Rear KACR unit [F]





5-32 ENGINE TOP END

Cylinder Head

Cylinder Compression Measurement

NOTE

OBe sure the battery is fully charged.

- Warm up the engine thoroughly.
- Stop the engine.
- Remove one spark plug and attach the compression gauge and adapter firmly into the spark plug hole. Do not remove the other spark plug, only the plug lead.
- For the other cylinder, remove both spark plugs.

Special Tool - Spark Plug Wrench, Hex 18: 57001-1024 [A]

 Using the starter motor, turn the engine over with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.

Special Tools - Compression Gauge, 20 kgf/cm²: 57001-221 [A]

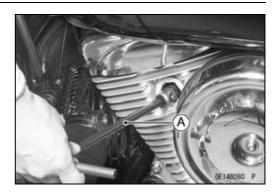
Compression Gauge Adapter, M12 × 1.25: 57001-1018 [B] (or 57001-1183)

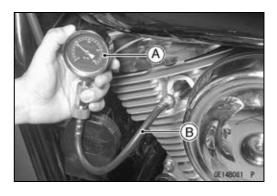
Cylinder Compression (Usable Range)

340 ~ 590 kPa (3.5 ~ 6.0 kg/cm², 50 ~ 85 psi) @300 r/min (rpm)

- OThe compression gauge adapter: 57001-1183 can also be used.
- Repeat the measurement for the other cylinder.
- Install the spark plugs.
- Tighten:

Torque - Spark Plugs: 18 N·m (1.8 kgf·m, 13 ft·lb)





The following table should be consulted if the obtainable compression reading is not within the usable range.

Problem	Diagnosis	Remedy (Action)
Cylinder compression is higher than usable range	Carbon buildup on piston and in combustion chamber possibly due to damaged valve stem, valve guide, stem oil seal and/or damaged piston oil rings (This may be indicated by white exhaust smoke).	Remove the carbon deposits and replace damaged parts if necessary.
	Incorrect cylinder head gasket thickness.	Replace the gasket with a standard part.
	Damaged or missing compression release cam spring.	Replace the spring.
	Compression release weights do not move smoothly.	Replace the compression release unit.
Cylinder compression is lower than usable range	Gas leakage around cylinder head	Replace damaged gasket and check cylinder head warp.
	Bad condition of valve seats, valves, and valve springs.	Repair them if necessary.
	HLA seizure.	Replace the HLA.
	Incorrect piston/cylinder clearance	Replace the piston and/or cylinder.
	Piston seizure.	Inspect the cylinder and liner and replace/repair the cylinder and/or piston as necessary.
	Bad condition of piston ring and/or piston ring grooves.	Replace the piston and/or the piston rings.
	Compression release weights do not move smoothly.	Replace the compression release unit.

Cylinder Head Removal

• Remove:

Engine (see Engine Removal/Installation chapter)

Rocker Cases (see this chapter)

Camshafts (see this chapter)

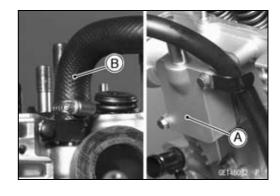
Spark Plug Retainers (see this chapter)

Special Tool - Hexagon Wrench, Hex 27: 57001-1210

OThe camshaft chain comes off.

• Remove:

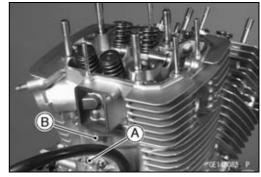
Air Suction Valve Cover with Valve [A] Water Pipe with Hose [B]



5-34 ENGINE TOP END

Cylinder Head

- Do not remove the coolant drain plug [A] yet.
- Remove the cylinder head nuts [B].
- Take the cylinder head off the cylinder.



Cylinder Head Installation

OThe front cylinder head [A] has an **F** mark while the rear cylinder head [B] has an **R** mark. Be careful not to mix them up.

Front [C]

CAUTION

The cylinder head and rocker case are machined in the assembled state, so they must be used as a set.

- Replace the cylinder head gasket with a new one.
- Tighten the cylinder head nuts temporarily (These nuts are tightened to the specified torque after installing rocker case installation).
- Apply grease to the O-ring [A].
- Pull the camshaft chain up the chain tunnel, insert the spark plug retainer [B] through the chain loop, and tighten it.

Special Tool - Hexagon Wrench, Hex 27: 57001-1210

Torque - Spark Plug Retainer: 12 N·m (1.2 kgf·m, 104 in·lb) Spark Plugs: 18 N·m (1.8 kgf·m, 13 ft·lb)

• Install:

Camshafts (see this chapter) Rocker Cases (see this chapter)

Tighten:

Torque - Cylinder Head Nuts and Cylinder Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)

Cylinder Head Warp

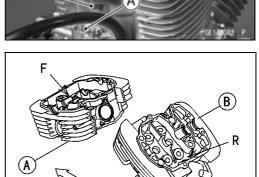
- Remove the cylinder head (see this chapter).
- Lay a straightedge across the lower surface of the cylinder head at several positions.
- Use a thickness gauge [A] to measure the space between the straight edge [B] and the head.

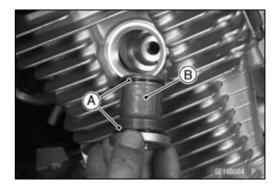


Standard: ---

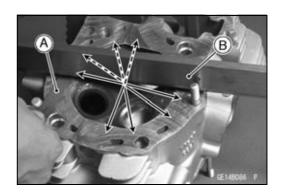
Service Limit: 0.05 mm (0.002 in.)

- ★ If they cylinder head is warped more than the service limit, replace it.
- ★If they 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).





GE140118S1 C



Valve Clearance Adjustment

NOTE

OSince the hydraulic lash adjusters constantly maintain zero clearance, it is not necessary to inspect or adjust the valve clearance.

Valve Removal

- Remove the cylinder head (see this chapter).
- Swing open the rocker arm.
- Using the valve spring compressor assembly, remove the valve.

Special Tools - Valve Spring Compressor Assembly: 57001 -241 [A]

Valve Spring Compressor Adapter, ϕ 28.2: 57001-243 [B]

Valve Installation

- Replace the stem oil seal with a new one.
- Apply a thin coat of molybdenum disulfide grease to the valve stem before valve installation.
- Install the springs so that the closed coil end faces downwards.

Valve [A] and Stem Oil Seal [B] Spring Seats [C] Inner Spring [D] and Outer Spring [E]

Retainer [F] and Split Keepers [G]

Closed Coil End [H]

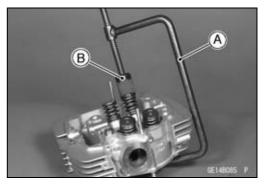
Valve Guide Removal

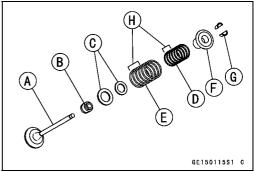
- Remove the valve, stem oil seal and spring seats.
- Heat the area around the valve guide to 120 ~ 150°C (248 ~ 302°F), and hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.

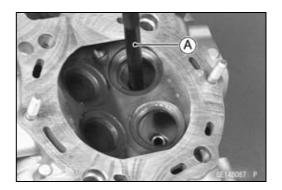
Special Tool - Valve Guide Arbor, ϕ 7: 57001-163

CAUTION

Do not heat the cylinder head with a blowtorch. This will warp the head. Soak the cylinder head in engine oil and heat the oil.







5-36 ENGINE TOP END

Cylinder Head

Valve Guide Installation

- Apply engine oil to the valve guide outer surface before installation.
- Heat the area around the valve guide hole to about 120 ~ 150°C (248 ~ 302°F) in the engine oil.
- Drive the valve guide in from the top of the head using the valve guide arbor. The flange stops the guide from going in too far.

Special Tool - Valve Guide Arbor, ϕ 7: 57001-163

- Wait until the cylinder head cools down and then ream the valve guide with the valve guide reamer [A] even if the old guide is reused.
- OTurn the reamer in a clockwise direction until the reamer turns freely in the guide. Never turn the reamer counterclockwise or it will be dulled.
- Once the guides are reamed, they must be cleaned thoroughly.

Special Tool - Valve Guide Reamer, ϕ 7: 57001-162

Valve Guide Wear (Wobble Method)

- Olf a small bore gauge is not available, inspect the valve guide wear by measuring the valve-to-guide clearance with the wobble method as indicated below. The reading is not actual valve-to-guide clearance because the measuring point is above the guide.
- Insert a new valve [A] into the guide [B] and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface.
- Move the stem back and forth [C] to measure valve-to -valve guide clearance.
- Repeat the measurement in a direction at a right angle (90°) to the first.
- ★ If the reading exceeds the service limit, replace the guide.

Valve-to-Guide Clearance (Wobble Method)

Standard:

Exhaust 0.08 ~ 0.16 mm

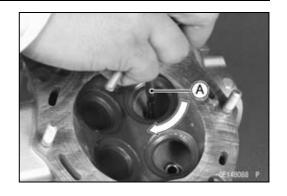
 $(0.0031 \sim 0.00630 in.)$

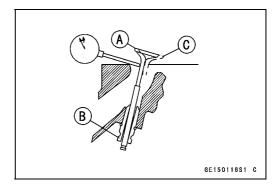
Inlet 0.05 ~ 0.13 mm

 $(0.0020 \sim 0.00512 in.)$

Service Limit:

Exhaust 0.30 mm (0.0118 in.) Inlet 0.27 mm (0.0106 in.)





Valve Seat Inspection

- Remove the valve (see Valve Removal).
- Check the valve seat surface [A] between the valve [B] and valve seat [C].
- OMeasure the outside diameter [D] of the seating pattern on the valve seat with vernier calipers.
- ★If the outside diameter is too large or too small, repair the seat (see Seat Repair).

Valve Seat Surface Outside Diameter (outside diameter) Standard:

Exhaust 28.9 ~ 29.1 mm (1.138 ~ 1.146 in.) Inlet 31.9 ~ 32.1 mm (1.256 ~ 1.264 in.)

OMeasure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with vernier calipers.

Good [F]

★If the width is too wide [G], too narrow [H] or uneven [J], repair the seat (see Valve Seat Repair).

Valve Seat Surface Width (or Seat Width) Standard:

Exhaust 0.5 ~ 1.0 mm (0.020 ~ 0.039 in.) Inlet 0.8 ~ 1.2 mm (0.031~ 0.047 in.)

Valve Seat Repair

Repair the valve seat with the valve seat cutters [A].

Special Tools - Valve Seat Cutter Holder, ϕ 7: 57001-1126

[B]

Valve Seat Cutter Holder Bar: 57001-1128

[C]

[For Exhaust Valve Seat]

Valve Seat Cutter, 45° – ϕ 35: 57001-1116 Valve Seat Cutter, 32° – ϕ 35: 57001-1121

(or 32° – ϕ 33: 57001 - 1199)

Valve Seat Cutter, 55° – ϕ 35: 57001-1247

[For Inlet Valve Seat]

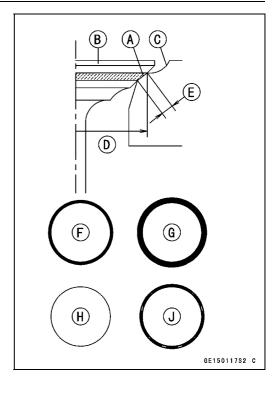
Valve Seat Cutter, 45° – ϕ 40: 57001-1496 Valve Seat Cutter, 32° – ϕ 38.5: 57001-1122 Valve Seat Cutter, 55° – ϕ 38.5: 57001-1497

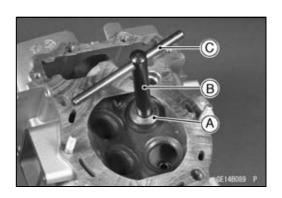
OThe marks stamped on the back of the cutter [A] represent the following.

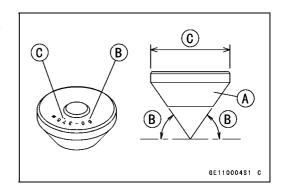
55° Cutter Angle [B]

 37.5ϕ Outer Diameter of Cutter [C]

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







Seat Cutter Operation Care

 This valve seat cutter is developed to grind the valve for repair. Therefore the cutter must not be used for other purposes than seat repair.

Do not drop or shock the valve seat cutter, or the diamond particles may fall off.

Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

CAUTION

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

Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

NOTE

OPrior to grinding, apply engine oil to the cutter. During operation, wash off any ground particles sticking to the cutter with washing oil

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

Operating Procedures

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

CAUTION

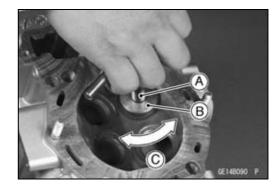
Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, HLA could not work and the cylinder head must be replaced.

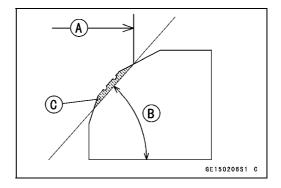
- Measure the outside diameter [A] of the seat surface (outside diameter) with vernier calipers.
- ★If the outside diameter is too small, repeat the 45° grind [B] until the diameter is within the specified range.

 Ground Voluum [C]

NOTE

- ○Remove all pittings or flaws from 45° ground surface.
- OAfter grinding with 45° cutter, apply thin coat of machinist's dye to seat surface. This makes seat surface distinct and 32° and 55° grinding operation easier.
- OWhen the valve guide is replaced, be sure to grind with 45° cutter for centering and good contact.
- ★If the outside diameter is too large, make the 32° grind described below.





- OTo make the 32° grind, fit a 32° cutter into the holder, and slide it into the valve guide.
- OTurn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.

CAUTION

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

- Grind the seat at a 32° angle [A] until the outside diameter [B] is within the specified range.
- ★If the outside diameter is within the specified range, measure the seat width as described below.
- To measure the seat width, use vernier calipers to measure the width [C] of the 45° angle portion of the seat at several places around the seat.

Ground Voluum [D]

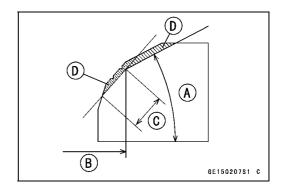
- ★If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then measure the outside diameter.
- ★ If the seat width is too wide, make the 55° grind described below.
- To make the 55° grind, fit 55° cutter into the holder, and slide it into the valve guide.
- Turn the holder, while pressing down lightly.
- Grind the seat at a 55° angle [A] until the seat width [B] is within the specified range.
- ★ If the seat width is within the specified range, lap the valve to the seat as described below.
- Lap the valve to the seat, once the seat width and outside diameter are within the ranges specified above.
- OPut a little coarse grinding compound on the face of the valve in a number of places around the valve head.
- OSpin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
- ORepeat the process with a fine grinding compound.

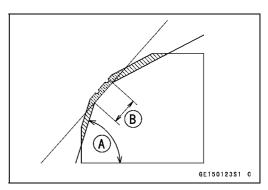
Lapper [A]

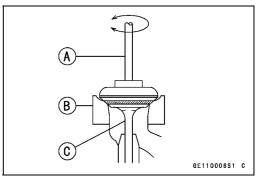
Valve Seat [B]

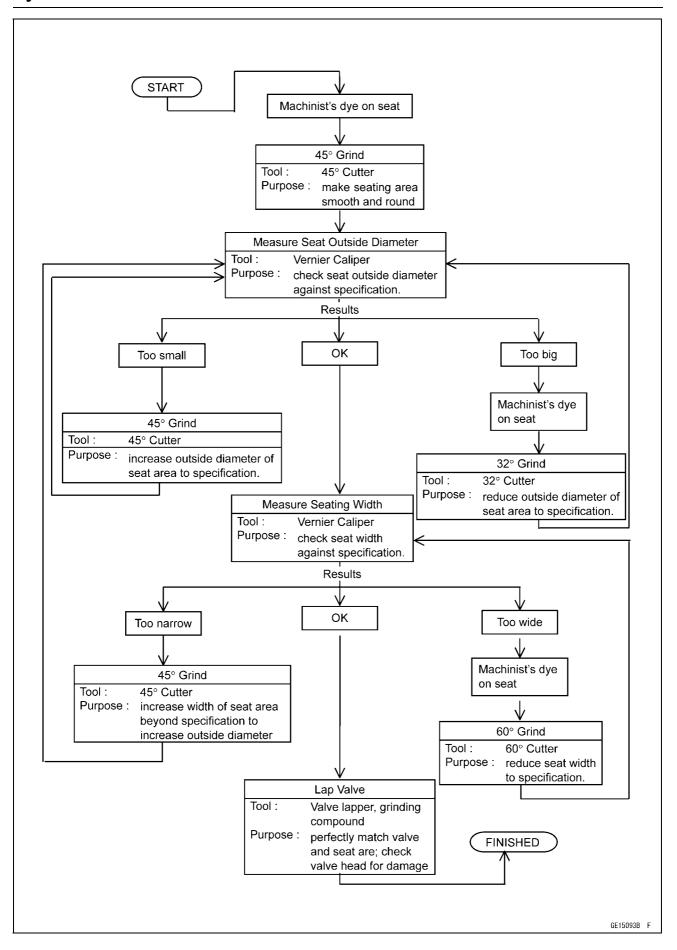
Valve [C]

- The seat area should be marked about in the middle of the valve face.
- ★ If the seat area is not in the right place on the valve, check to be sure the valve is the correct part. If it is, it may have been refaced too much; replace it.
- Be sure to remove all grinding compound before assembly.









Cylinder Removal

- Remove the cylinder head (see this chapter).
- Remove the coolant drain plug [A] and drain the coolant from the cylinder.
- Pull out the front camshaft chain guide [B].
- Remove the cylinder nuts [C].
- Tap lightly up the cylinder with a plastic mallet to separate from the crankcase.
- Remove the cylinder base gasket.

Piston Removal

- Remove the cylinder block (see this chapter).
- Place a piece of clean cloth under the piston and remove the piston pin snap rings [A] from the outside of each piston.

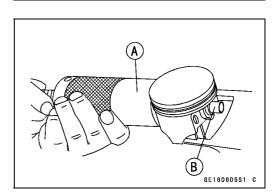
CAUTION

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

Using the piston pin puller assembly, remove the piston

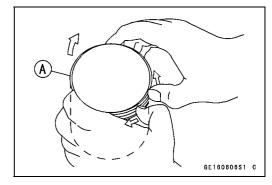
Special Tools - Piston Pin Puller Assembly [A]: 57001-910 Piston Pin Puller Adapter [B]: 57001-1211

Remove the piston.



GE160203S1 C

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

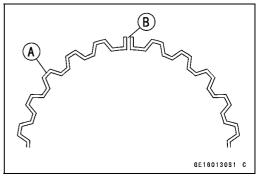


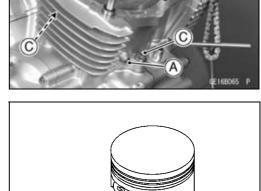
Cylinder, Piston Installation

NOTE

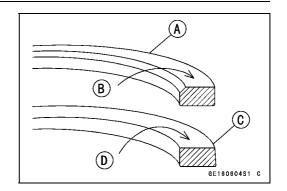
OThe oil ring rails have no "top" or "bottom".

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





- Do not mix up the top ring and second ring.
- Install the top ring [A] so that the "R" mark [B] faces up.
- Install the second ring [C] so that the "RN" mark [D] faces up.



 The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails must be about 30 ~ 45° [F] of angle from the opening of the top ring.

Top Ring [A]

Second Ring [B]

Oil Ring Steel Rails [C]

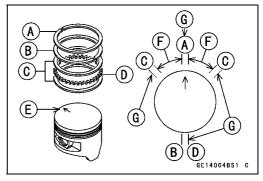
Oil Ring Expander [D]

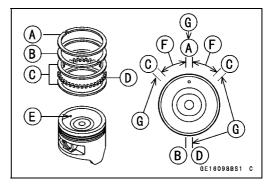
Arrow mark [E] must be faced toward the engine front.

Opening Positions [G]



Circle mark [E]





- Face the arrow mark [A] on each piston toward the front side [B].
- OThe front and rear pistons are the same, but they should be installed in their original positions.

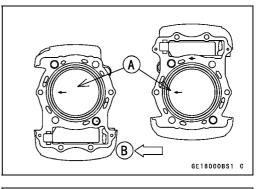
CAUTION

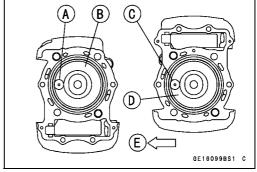
Incorrect installation of the piston could cause piston seizure and result in severe engine damage.

• Face the circle mark [A] on the front piston [B] and the circle mark [C] on the rear piston [D] toward the front side [E] as shown.

VN1600-A3 (After Frame No.)

OThe front and rear pistons are the same, but they should be installed in their original positions.



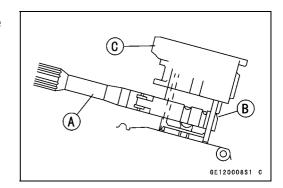


- Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.
- Apply molybdenum disulfide oil to the outer surface of the piston pin.
- OWhen installing the piston pin snap ring, compress it only enough to install it and no more.
- Apply molybdenum disulfide oil to the cylinder bore.
- Apply molybdenum disulfide oil to the front and rear of the piston skirt.
- Install the rear cylinder first, with the rear piston at TDC.

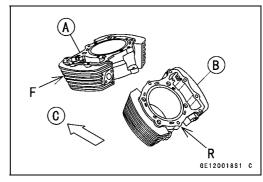
A B GE180134S1 C

NOTE

- Olf a new piston or cylinder is used, check piston to cylinder clearance (see Piston/Cylinder Clearance), and use new piston ring.
- Replace the cylinder base gasket [A] with a new one, and install the gaskets aligning the holes with the crankcase water passages [B].
- Be sure to install the dowel pins [C].
- Using the piston ring compressor assembly [A] with the chamfered side [B] upward, install the cylinder block [C]. Special Tools Piston Ring Compressor Grip: 57001-1095 Piston Ring Compressor Belt, ϕ 95 ~ ϕ 108: 57001-1358



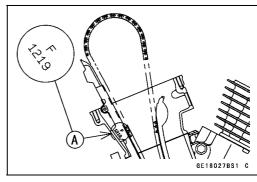
OThe front cylinder [A] has an **F** mark and the rear cylinder [B] has an **R** mark. Be careful not to mix them up. Front [C]

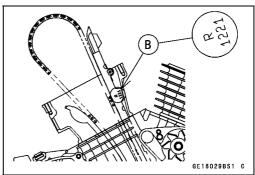


5-44 ENGINE TOP END

Cylinders, Piston

- Insert the chain guide into the cylinder.
- OThe front chain guide for the front cylinder has an **F** mark [A] and the front chain guide for the rear cylinder has an **R** mark [B]. Be careful not to mix up these chain guides since the front chain guide for the rear cylinder is longer.





- Install the front cylinder in the same way.
- OPosition the front piston at TDC.
- OTighten the cylinder nuts temporarily (These nuts are tightened to the specified torque after rocker case installation).

Cylinder Wear

- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the three locations (total of six measurements) shown in the figure.
- ★If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.

10 mm (0.39 in.) [A]

70 mm (2.76 in.) [B]

20 mm (0.79 in.) [C]

Cylinder Inside Diameter

Standard: 102.000 ~ 102.012 mm (4.015748 ~

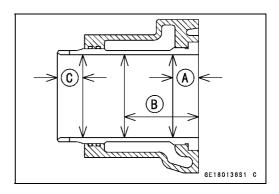
4.01622 in.), and less than 0.01 mm (0.0004 in.) difference between any

two measurements.

Service Limit: 102.10 mm (4.01969 in.) or 0.05 mm

(0.002 in.) difference between any

two measurements.



Piston Wear

- Measure the outside diameter [A] of each piston 5 mm
 [B] up from the bottom of the piston at a right angle to the direction of the piston pin.
- ★ If the measurement is under service limit, replace the piston

Piston Diameter

Standard: 101.942 ~ 101.957 mm

(4.013457 ~ 4.014047 in.)

Service Limit: 101.79 mm (4.00748 in.)

Piston/Cylinder Clearance

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

Piston/Cylinder Clearance

Standard: 0.043 ~ 0.070 mm (0.00169 ~ 0.00276 in.)

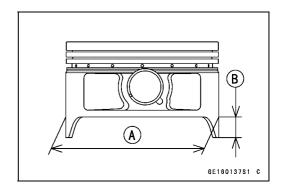
- ★ If the piston/cylinder clearance is less than the specified range, use a smaller piston made within the standard diameter or increase the cylinder inside diameter within the standard diameter by honing.
- ★If the piston/cylinder clearance is greater than specified range, use a larger piston made within the standard diameter.
- ★If only a piston is replaced, the clearance may exceed the standard slightly. But it must not to be less than the minimum of the clearance in order to avoid piston seizure.

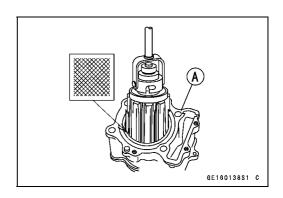
Cylinder Boring and Honing

OThere is an oversize piston available. The oversize piston requires oversize rings.

Oversize Piston and Rings: 0.5 mm (0.02 in.) oversize

- Before boring a cylinder [A], first measure the exact diameter of the oversize piston, and then, according to the standard clearance in the Specifications, determine the rebore diameter. However, if the amount of boring necessary would make the inside diameter greater than 0.5 mm (0.02 in.), the cylinder block must be replaced.
- OCylinder inside diameter must not vary more than **0.01** mm (0.0004 in.) at any point.
- OBe wary of measurements taken immediately after boring since the heat affects cylinder diameter.
- OIn the case of rebored cylinder and oversize piston, the service limit for the cylinder is the diameter that the cylinder was bored to plus **0.1 mm (0.004 in.)** and the service limit for the piston is the oversize piston original diameter minus **0.15 mm (0.0059 in.)**. If the exact figure for the rebored diameter is unknown, it can be roughly determined by measuring the diameter at the base of the cylinder.





5-46 ENGINE TOP END

Cylinders, Piston

Piston Ring, Piston Ring Groove Wear

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

Piston Ring/Groove Clearance

Standard:

Top $0.05 \sim 0.09 \text{ mm } (0.00197 \sim 0.00354 \text{ in.})$ Second $0.03 \sim 0.07 \text{ mm } (0.0012 \sim 0.0028 \text{ in.})$

Service Limit:

Top 0.19 mm (0.00748 in.) Second 0.17 mm (0.00669 in.)

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

Piston Ring Groove Width

 Measure the width of the top [A] and second [B] ring grooves.

OUse vernier calipers at several points around the piston.

Piston Ring Groove Width

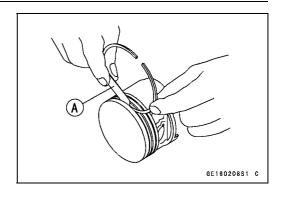
Standard:

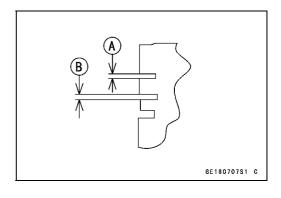
Top 1.24 ~ 1.26 mm (0.048819 ~ 0.049606 in.) Second 1.22 ~ 1.24 mm (0.04803 ~ 0.04882 in.)

Service Limit:

Top 1.34 mm (0.05276 in.) Second 1.32 mm (0.05197 in.)

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





Piston Ring Thickness

Measure the thickness of the top [A] and second [B] rings.
 OUse a micrometer to measure at several points around the ring.

Piston Ring Thickness

Standard:

Top 1.17 ~ 1.19 mm (0.04606 ~ 0.04685 in.) Second 1.17 ~ 1.19 mm (0.04606 ~ 0.04685 in.)

Service Limit:

Top 1.10 mm (0.0433 in.) Second 1.10 mm (0.0433 in.)

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

NOTE

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

Piston Ring End Gap

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

Piston Ring End Gap

Standard:

Top $0.25 \sim 0.35 \text{ mm } (0.0098 \sim 0.0138 \text{ in.})$ Second $0.40 \sim 0.55 \text{ mm } (0.0157 \sim 0.0217 \text{ in.})$ Oil $0.3 \sim 0.9 \text{ mm } (0.012 \sim 0.035 \text{ in.})$

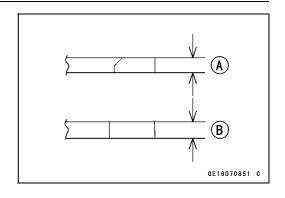
Service Limit:

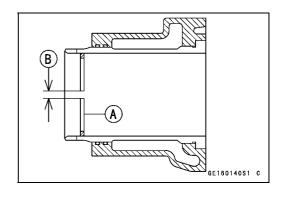
 Top
 0.7 mm (0.028 in.)

 Second
 0.8 mm (0.031 in.)

 Oil
 1.2 mm (0.0472 in.)

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





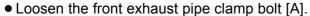
Mufflers

Exhaust Pipe Removal (Other than United States, Canada and Taiwan Models)

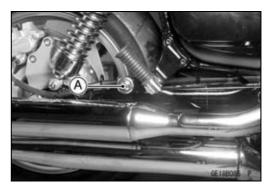
A WARNING

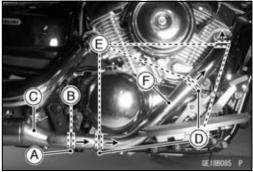
To avoid a serious burn, do not remove the exhaust pipe or muffler when the engine is still hot. Wait until the muffler cools down.

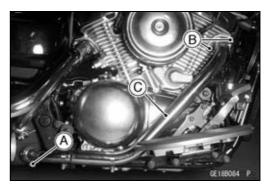
- Loosen the upper muffler bracket nut [A] for easy removal or installation of exhaust pipes.
- Loosen the clamp screw [A].
- Detach the lower clamp [B] by sliding it forward.
- Remove the lower front exhaust pipe cover [C].
- Loosen the clamp screws [D].
- Detach the upper clamps [E] by sliding them up or forward
- Remove the front exhaust pipe cover [F].



- Remove the front exhaust pipe holder nuts [B].
- Take off the front exhaust pipe [C].

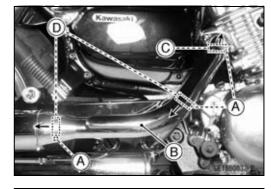




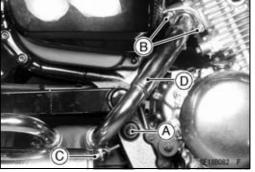


ONext, remove the rear exhaust pipe.

- Loosen the clamp screws [A] on the rear exhaust pipe cover [B].
- Detach the clamp [C] by sliding it up.
- Detach the clamps [D] by sliding them down or backward.
- Remove the rear exhaust pipe cover by sliding it forward.



- Loosen the right and left chamber bolts [A]
- Remove the rear exhaust pipe holder nuts [B].
- Loosen the rear exhaust pipe clamp bolt [C].
- Pull the upper end of the rear exhaust pipe outward and twist clockwise a little, and then take off the rear exhaust pipe [D].



Mufflers

Lower Muffler Removal (Other than United States, Canada and Taiwan Models)

• Remove:

Lower Front Exhaust Pipe Cover (see above) Chamber Flange Nuts [A] Muffler Bracket Bolts [B]

• Remove the lower muffler [C].

NOTE

Olf the chamber flange nuts are difficult to remove, spray a penetrating oil on the studs and nuts.

Upper Muffler Removal (Other than United States, Canada and Taiwan Models)

• Remove:

Rear Exhaust Pipe Cover (see above) Lower Muffler (see above) Muffler Pipe Clamp Bolt [A] Upper Muffler Bracket Nut [B]

• Remove the upper muffler [C].

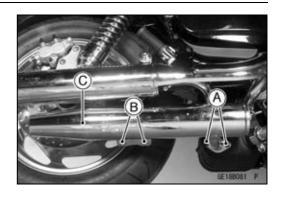
Muffler, Exhaust Pipe Installation (Other than United States, Canada and Taiwan Models)

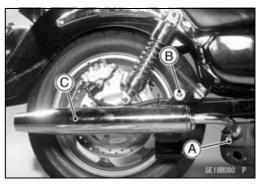
- Replace the exhaust pipe holder gasket [A] with new ones.
- Tighten:

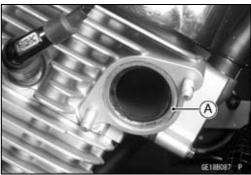
Torque - Muffler Stay Mounting Bolts, ϕ 8 (lower): 25 N·m (2.5 kgf·m, 18 ft·lb)

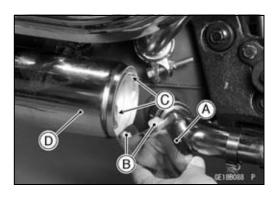
Upper Muffler Bracket Nut: 29 N·m (3.0 kgf·m, 22 ft·lb)

Install the lower front exhaust pipe cover [A].
 OFit the two plastic tabs [B] of the front lower exhaust cover into the slots [C] in the lower muffler [D].









5-50 ENGINE TOP END

Mufflers

• Tighten the lower and front exhaust pipe cover clamp lower screws [A] with they are head inclined at 50° [B] or less to horizontal as shown. This prevents the screw from touching ground when banking.

Torque - Exhaust Pipe Cover Clamp Screws: 6.9 N·m (0.70 kgf·m, 61 in·lb)

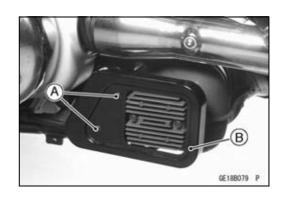
- First, tighten all the bolts and nuts to a snug fit.
- Secondary, tighten the exhaust pipe holder nuts evenly.
- Finally, tighten the rest of the mounting bolts and clamp bolts securely.
- Thoroughly warm up the engine, wait until the engine cools down, and retighten all the clamp bolts.

Chamber Removal (Other than United States, Canada and Taiwan Models)

• Remove:

Bolts [A]

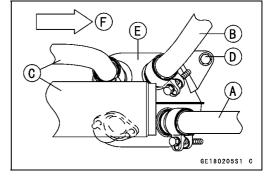
Rear Regulator/Rectifier Bracket [B]



• Remove:

Front Exhaust Pipe [A]
Rear Exhaust Pipe [B]
Lower and Upper Mufflers [C]
Right and Left Premuffler Chamber Bolts [D]

Take out the premuffler chamber [E].
 Front [F]



Chamber Installation (Other than United States, Canada and Taiwan Models)

- Replace the muffler flange gasket with new ones.
- Install the exhaust pipe and muffler pipe clamps [A] with its bolt downward.

Front [B]

• Tighten:

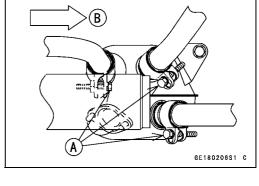
Torque - Premuffler Chamber Bolts: 29 N·m (3.0 kgf·m, 22 ft·lb)

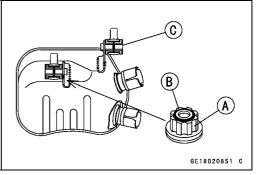
Chamber Assembly (Other than United States, Canada and Taiwan Models)

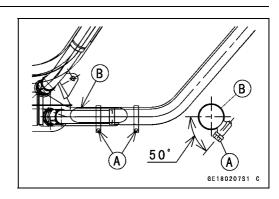
• Apply a soap and water solution or rubber lubricant to the surface of the rubber bushings and install them into the brackets of the chamber as shown (Top View).

Rubber Bushings [A] ϕ 24.8 mm (0.98 in.) with a raised ring [B]

Rubber Bushings [C] ϕ 25.3 mm (1.0 in.) without raised ring







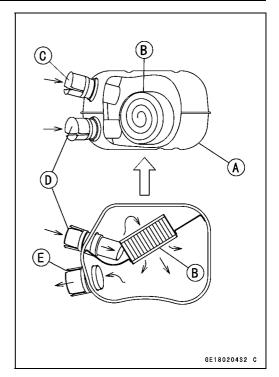
Mufflers

Chamber Identification (Other than United States, Canada and Taiwan Models)

OThe this models have a premuffler chamber (Identification No. KHI M 091) with a honeycomb type catalytic converter and without any catalyst protection system. Do not mix up this chamber with the other type chamber (especially with a non-catalyst chamber). The motorcycle could not clear the emission regulation.

→: Exhaust Gas Flow
Premuffler Chamber [A]
Honeycomb Type Catalytic Converter [B]
Inlet [C] from Rear Exhaust Pipe
Inlet [D] from Front Exhaust Pipe
Premuffler Chamber Outlet [E]

ORefer to the VN1500 G/H Service Manual (Part No. 99924 -1241) for more information about the KLEEN (theory, maintenance, and handling precautions), including the secondary air injection system.

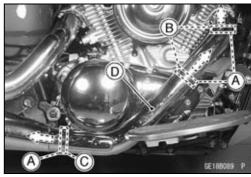


Front Exhaust Pipe Removal (United States, Canada and Taiwan Models)

A WARNING

To avoid a serious burn, do not remove the muffler when the engine is still hot. Wait until the muffler cools down.

- Loosen the clamp screws [A].
- Detach the upper clamps [B] by sliding them up or forward.
- Detach the lower clamp [C] by sliding it forward.
- Remove the front exhaust pipe cover [D].
- Loosen the front exhaust pipe clamp bolt [A].
- Remove the front exhaust pipe holder nuts [B].
- Take off the front exhaust pipe [C].



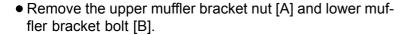


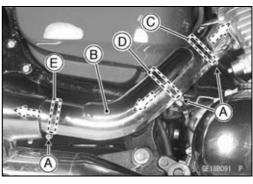
5-52 ENGINE TOP END

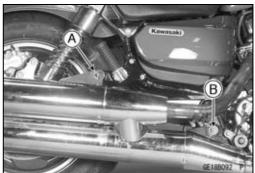
Mufflers

Rear Exhaust Pipe Removal (United States, Canada and Taiwan Models)

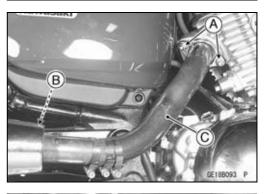
- Loosen the clamp screws [A] on the rear exhaust pipe cover [B].
- Detach the upper clamp [C] by sliding it up.
- Detach the middle [D] and lower clamp [E] by sliding it back
- Remove the rear exhaust pipe cover.







- Remove the rear exhaust pipe holder nuts [A].
- Loosen the rear exhaust pipe clamp bolt [B].
- Pull the upper end of the rear exhaust pipe outward and twist clockwise a little, and then take off the rear exhaust pipe [C].

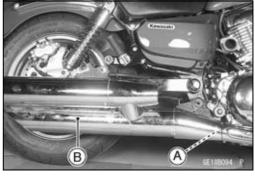


Muffler Removal (United States, Canada and Taiwan Models)

• Remove:

Rear Exhaust Pipe Covers (see This chapter) Rear Exhaust Pipe (see This chapter)

- Loosen the front exhaust pipe clamp bolts [A].
- Remove the muffler Assembly [B].



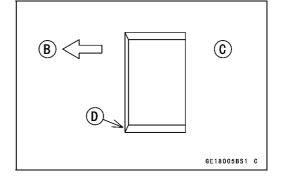
Muffler, Exhaust Pipe Installation (United States, Canada and Taiwan Models)

- Replace the exhaust pipe holder gasket with new ones.
- Insert the exhaust pipe joint gaskets [A] direction as shown.

Front [B]

Rear [C]

Chamfer Side [D]



Mufflers

 Tighten the front exhaust pipe cover clamp screws [A] with its head inclined at 50° or less to horizontal as shown.
 This prevents the screw from touching ground when banking.

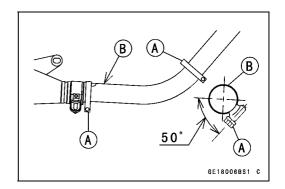
Front Exhaust Pipe [B]

Torque - Exhaust Pipe Cover Clamp Screws: 6.9 N·m (0.70 kgf·m, 61 in·lb)

- First, tighten all the bolts and nuts to a snug fit.
- Secondary, tighten the exhaust pipe holder nuts evenly.
- Finally, tighten the rest of the mounting bolts and clamp bolts securely.

Torque - Muffler Bracket Bolt and Nut: 29 N·m (3.0 kgf·m, 22 ft·lb)

• Thoroughly warm up the engine, wait until the engine cools down, and retighten all the clamp bolts.

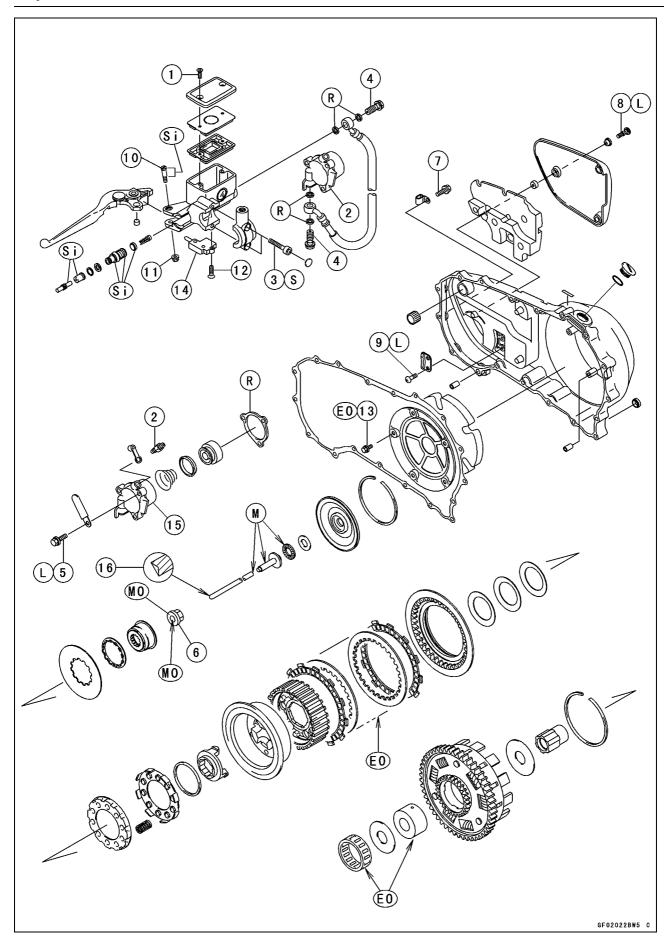


Clutch

Table of Contents

Exploded View	6-2
Specifications	6-4
Special Tools and Sealant	6-5
Clutch Fluid	6-6
Clutch Fluid Level Check	6-6
Clutch Fluid Change	6-6
Clutch Line Bleeding	6-6
Clutch Hose Removal/Installation	6-6
Clutch Hose and Connection Check	6-6
Clutch Master Cylinder	6-7
Clutch Lever Adjustment	6-7
Clutch Master Cylinder Removal	6-7
Clutch Master Cylinder Installation	6-7
Clutch Master Cylinder Disassembly/Assembly	6-7
Clutch Master Cylinder Inspection	6-8
Clutch Slave Cylinder	6-9
Clutch Slave Cylinder Removal	6-9
Clutch Slave Cylinder Installation	6-9
Clutch Slave Cylinder Disassembly/Assembly	6-10
Clutch	6-11
Clutch Cover Removal	6-11
Clutch Removal	6-11
Clutch Installation	6-13
Inner Clutch Hub Disassembly	6-14
Spring Plate Gap Measurement	6-14
Spring Plate Gap Adjustment	6-16
Friction and Steel Plate Wear, and Damage Inspection	6-16
Friction or Steel Plate Warp	6-16
Clutch Spring Height Measurement	6-17
Clutch Housing Finger Inspection	6-17
Outer Clutch Hub Spline Inspection	6-17
Cam Damper Inspection	6-17

Exploded View



Exploded View

No	Factoria	Torque			D
No.	Fastener	N⋅m	kgf⋅m	ft∙lb	Remarks
1	Clutch Reservoir Cap Screws	1.5	0.15	13 in·lb	
2	Clutch Slave Cylinder Bleed Valve	7.8	0.80	69 in·lb	
3	Clutch Master Cylinder Clamp Bolts	9.8	1.0	87 in·lb	S
4	Clutch Hose Banjo Bolt	25	2.5	18	
5	Clutch Slave Cylinder Bolts	6.9	0.70	61 in·lb	L
6	Clutch Hub Nut	147	15.0	108	
7	Clutch Cover Bolts	11	1.1	95 in·lb	
8	Clutch Damper Cover Bolts	9.8	1.0	87 in·lb	L
9	Clutch Cover Damper Screws	4.9	0.50	43 in·lb	L
10	Clutch Lever Pivot Bolt	1.0	0.10	8.7 in·lb	Si
11	Clutch Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
12	Starter Lockout Switch Screw	1.2	0.12	10 in·lb	
13	Clutch Damper Plate Bolts	9.8	1.0	87 in·lb	EO

- 14. Starter Lockout Switch
- 15. Clutch Slave Cylinder
- 16. Cup point side faces outside.
- EO: Apply engine oil.
 - L: Apply a non-permanent locking agent.
 - M: Apply molybdenum disulfide grease.
- MO: Apply molybdenum disulfide oil.

The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1)

- R: Replacement Parts
- S: Follow the specific tightening sequence.
- Si: Apply silicone grease or PBC grease.

6-4 CLUTCH

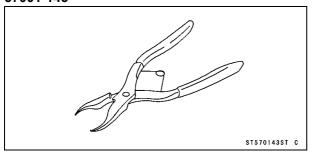
Specifications

Item	Standard	Service Limit	
Clutch Fluid			
Grade	DOT4 (provided when shipping)		
Clutch Lever Position	No. 1 (to suit rider)	5-way adjustable	
Clutch Lever Free Play	Non-adjustable	-	
Clutch			
Clutch spring free height	4.3 mm (0.169 in.)	4.0 mm (0.16 in.)	
Spring plate gap (usable range)	1.95 ~ 2.45 mm (0.0768 ~ 0.0965 in.)		
Friction plate thickness	3.3 ~ 3.5 mm (0.130 ~ 0.138 in.)	3.1 mm (0.122 in.)	
Friction or steel plate warp	0.2 mm (0.0079 in.) or less	0.3 mm (0.012 in.)	

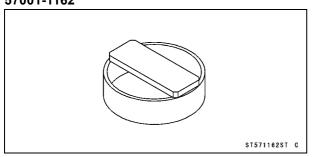
Special Tools and Sealant

Inside Circlip Pliers:

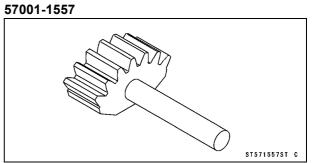
57001-143



Clutch Spring Compressor: 57001-1162



Gear Holder, m2.0:



Clutch Fluid

Clutch Fluid Level Check

 Refer to Clutch Fluid Level Check in the Periodic Maintenance Chapter.

Clutch Fluid Change

 Refer to Clutch Fluid Change in the Periodic Maintenance Chapter.

Clutch Line Bleeding

- Remove:
 - Alternator Outer Cover (see Electrical System chapter)
- With the reservoir cap off, slowly pump the clutch lever several times until no air bubbles can be seen rising up through the fluid from the holes at the bottom of the reservoir. This bleeds the air from the master cylinder end of the line.



- O Tap the clutch hose lightly going from the lower end to the upper end and bleed the air off at the reservoir.
- Attach a clear plastic hose [A] to the bleed valve on the clutch slave cylinder, and run the other end of the hose into a container.
- Bleed the clutch line as follows:
 - Pump the clutch lever a few times until it becomes hard and then hold it applied [B].
 - Quickly open and close [C] the bleed valve.
 - Release [D] the clutch lever.
 - Check the fluid level in the reservoir often, replenishing it as necessary.

NOTE

- Olf the fluid in the reservoir runs completely out any time during bleeding, the bleeding operation must be done over again from the beginning since air will have entered the line.
- Repeat this operation until no more air can be seen coming out into the plastic hose.

WARNING

Do not mix different grades and brands of fluid.

• Tighten:

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

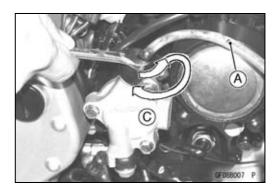
Clutch Slave Cylinder Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)

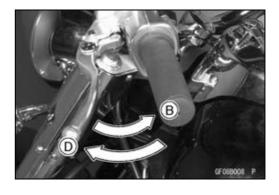
Clutch Hose Removal/Installation

 Since the clutch hose is the same as the brake hose, refer to Brake Hoses section in the Brakes chapter for brake hose removal or installation.

Clutch Hose and Connection Check

 Refer to Clutch Hose and Connection Inspection in the Periodic Maintenance Chapter.



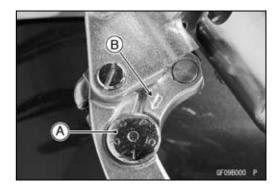


Clutch Master Cylinder

Clutch Lever Adjustment

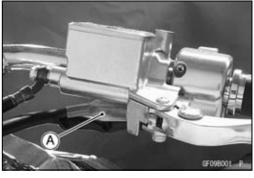
The adjuster has 5 positions so that the clutch lever position can be adjusted to suit the operator's hand.

- Push the lever forward and turn the adjuster [A] to align the number with the arrow mark [B] on the lever holder (front view).
- OThe distance from the grip to the lever is minimum at number 5 and maximum at number 1.



Clutch Master Cylinder Removal

- Disconnect the starter lockout switch connector [A].
- Draw out the clutch fluid from the reservoir with a means like the fork oil level gauge.



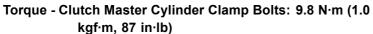
- Remove the banjo bolt [A] to disconnect the clutch hose from the master cylinder (rear view).
- Unscrew the clamp bolts [B], and take off the master cylinder [C] as an assembly with the clutch reservoir, clutch lever, and starter lockout switch installed.

CAUTION

Clutch fluid quickly ruins painted surface; any spilled fluid should be completely washed away immediately.



- OThe master cylinder clamp must be installed with the rear view mirror boss [A] upward.
- Set the clutch master cylinder [B] to match its mating surface [C] to the punch mark [D] of the handlebar (rear view).
- Tighten the upper clamp bolt [E] first, and then the lower clamp bolt [F]. There will be a gap at the lower part of the clamp after tightening.



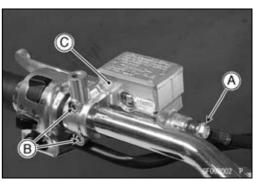
- Use a new flat washer on each side of the clutch hose fitting.
- Tighten the clutch hose banjo bolt.

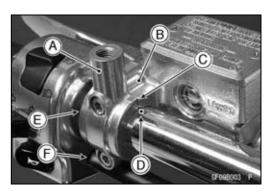
Torque - Clutch Hose Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)

- Replenish the clutch fluid into the reservoir and bleed the clutch line (see Clutch Line Bleeding).
- Check that the clutch line has proper fluid pressure and no fluid leakage.



 Refer to Clutch Master Cylinder Cup and Dust Cover Replacement in the Periodic Maintenance Chapter.

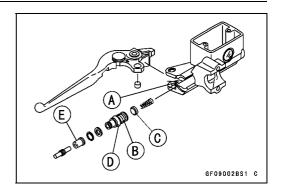




Clutch Master Cylinder

Clutch Master Cylinder Inspection

- Disassemble the clutch master cylinder.
- Check that there are no scratches, rust or pitting on the inside of the master cylinder [A] and on the outside of the piston [B].
- ★If the master cylinder or piston shows any damage, replace them.
- Inspect the primary cup [C] and secondary cup [D].
- ★If a cup is worn, damaged, softened (rotted), or swollen, the piston assembly should be replaced to renew the cups.
- If fluid leakage is noted at the clutch lever, the piston assembly should be replaced to renew the cups.
- Check the dust cover [E] for damage.
- If it is damaged, replace it.
- Check that the relief and supply ports are not plugged.
- ★If the small relief port becomes plugged, the clutch will drag. Blow the ports clean with compressed air.
- Check the piston return spring for any damage.
- ★If the spring is damaged, replace it.



Clutch Slave Cylinder

Clutch Slave Cylinder Removal

• Remove:

Alternator Outer Cover (see Electrical System chapter)
Banjo Bolt [A]

Clutch Slave Cylinder Bolts [B]

Slave Cylinder [C]

CAUTION

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

• Perform the following if the clutch slave cylinder is to be removed but not disassembled.

CAUTION

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

ORemove the clutch slave cylinder with the pipe installed. OPush [A] the piston into the cylinder as far as it will go.

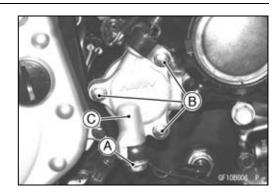
OApply the clutch lever [A] slowly and hold it with a band [B].

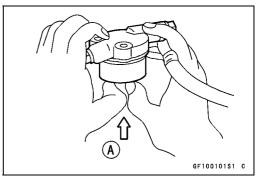
NOTE

OHolding the clutch lever keeps the piston from coming

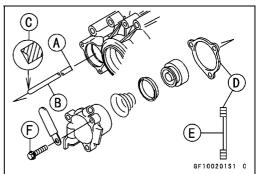
Clutch Slave Cylinder Installation

- Apply molybdenum disulfide grease to the flat end [A] of the push rod [B].
- Install the push rod so that the flat end faces in.
 Cup Point [C]
- Replace the spacer [D] of the clutch slave cylinder with a new one.
- Install the spacer so that the stepped side [E] faces outward
- Apply a non-permanent locking agent to the threads of the clutch slave cylinder bolts [F].
- Finger tighten the clutch slave cylinder bolts.
- Remove the band from the clutch lever and release the clutch lever.









Clutch Slave Cylinder

• Tighten the bolts [A].

Torque - Clutch Slave Cylinder Bolts: 6.9 N·m (0.70 kgf·m, 61 in·lb)

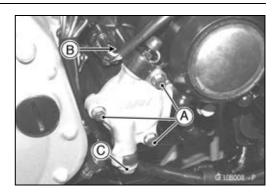
- OPut the clamp [B] together the clutch slave cylinder bolt and bend along the slave cylinder with the end of the clamp straight to the engine side as shown in the figure. This clamp is to prevent the edge of the slave cylinder from damaging the wire, not to clamp the wire.
- Replace the washers on each side of the clutch hose fitting with new ones.
- Tighten the banjo bolt [C] to the specified torque.

Torque - Clutch Hose Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)

- Check the fluid level in the master cylinder reservoir, and bleed the air in the clutch line.
- Check the clutch operation.

Clutch Slave Cylinder Disassembly/Assembly

• Refer to Clutch Slave Cylinder Fluid Seal Replacement in the Periodic Maintenance Chapter.



Clutch Cover Removal

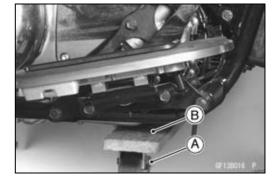
• Raise the rear wheel off the ground.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

- Drain the engine oil (see Periodic Maintenance chapter).
- Support the engine with a suitable stand [A].

OPut a plank [B] onto the stand.



• Remove:

Front Exhaust Pipe (see Engine Top End chapter) Clamps (open) [A]

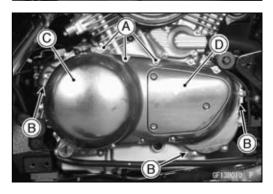
Downtube [B] (see Frame chapter, but remove the downtube with the right footboard and rear master cylinder left installed)



- Unscrew the eighteen cover bolts [A].
- Using the pry points [B], take the cover [C] off the crankcase.

NOTE

ODo not remove the damper cover [D].

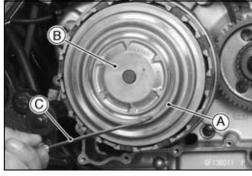


Clutch Removal

NOTE

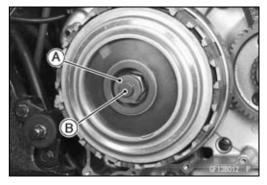
OUse an air impact wrench for removal of the clutch hub nut.

- Remove the clutch cover (see this chapter).
- Remove the retaining ring [A] and take the operating plate [B] out of the clutch assembly.
 Screw Driver [C]



• Remove:

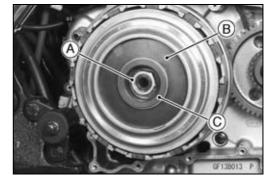
Washer [A] Spring Plate Pusher [B] Needle Bearing Washer



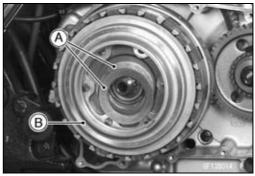
6-12 CLUTCH

Clutch

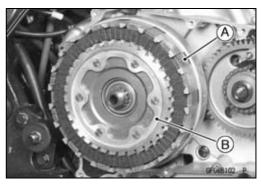
- Unscrew the clutch hub nut [A] by using an air impact wrench.
- Take the clutch spring [B], and the clutch spring holders
 [C] out of the clutch hub.



• Take the back torque limiter springs [A], and the clutch spring plate out of the clutch housing.



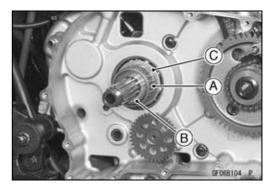
• Take the friction/steel plate [A], and outer clutch hub [B] out of the clutch housing.



• Take the inner clutch hub [A], collar [B], washer [C] and clutch housing [D] out of the crankcase.



• Pull the needle bearing [A], sleeve [B], and thrust washer [C] off the drive shaft.



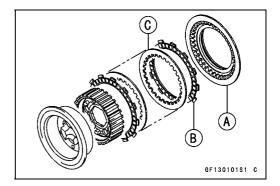
Clutch Installation

★When replacing any one of the following parts, check the spring plate gap (see Spring Plate Gap Measurement).

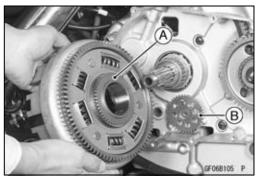
Spring Plate [A]

Friction Plates [B]

Steel Plates [C]



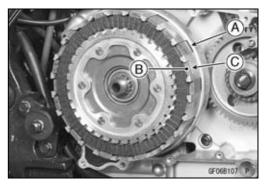
• When installing the clutch housing, mesh the oil pump drive gear [A] with the oil pump gear [B] so that the pump gear turns smoothly.

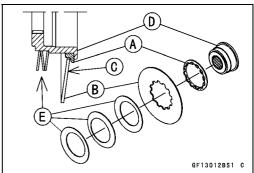


CAUTION

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

- Install the friction plates and steel plates, starting with a friction plate and alternating them.
- First, install the friction plates, fitting their tangs in the deeper grooves [A], and finally the outermost friction plate [B] in the shallower grooves [C].
- Install the clutch spring holder outer [A] on the clutch spring [B], and convex direction of outside [C] on the spring holder [D].
- Apply grease to the back torque limiter springs [E] and install the each direction them on the spring holder as shown.





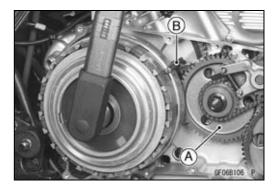
Apply:

Molybdenum Disulfide Oil- Threads and Seating Surface of Clutch Hub Nut

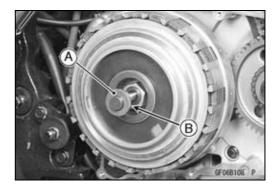
• Tighten the clutch hub nut to the specified torque while holding the primary gear [A] with the gear holder [B].

Torque - Clutch Hub Nut: 147 N·m (15.0 kgf·m, 108 ft·lb)

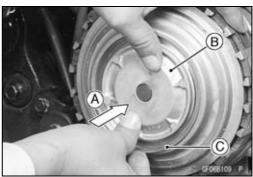
Special Tool - Gear Holder: 57001-1557



- The spring plate pusher [A] into the clutch hub. Squeeze the clutch lever slowly and hold it with a band.
- Olnstall the needle bearing [B] and the washer onto the pusher.



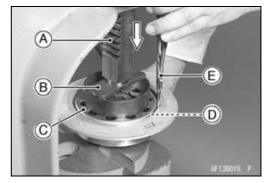
 Pushing [A] the operating plate [B] into the clutch hub, and insert the retaining ring [C] by hand.



Inner Clutch Hub Disassembly

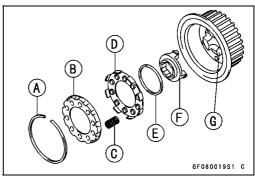
• Using a press [A], and the clutch spring compressor [B], push the damper spring holder [C] to remove the retaining ring [D].

Special Tool - Clutch Spring Compressor: 57001-1162 Inside Circlip Pliers: 57001-143 [E]



• Remove:

Retaining Ring [A]
Spring Holder [B]
Damper Spring [C]
Spring Holder [D]
Spacer [E]
Damper Cam [F]
Inner Clutch Hub [G]



Spring Plate Gap Measurement

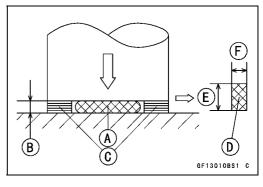
Insufficient spring plate gap will cause the engine braking effect to be more sudden, resulting in rear wheel hop. On the other hand, if the spring plate gap is excessive, the clutch may slip or the clutch lever may feel "spongy" or pulsate when pulled.

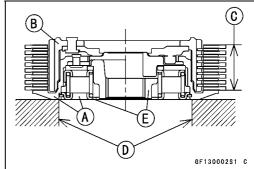
- Prepare sheet gum (chewing gum) or about 5 g (0.176 oz) clay [A].
- Make an about 2.5 mm (0.10 in.) thick sheet [B] of gum or clay, using a press and two thickness gauges [C] which are overlapped to about 2.5 mm (0.10 in.).
- Cut the sheet with scissors into four strips [D] of gum or clay as shown.

[E]: 7 mm (0.276 in.)

[F]: 4 mm (0.157 in.)

- Remove the clutch (see this chapter).
- Place the inner clutch hub, spring holder assy [A], the outer clutch hub [B], and the clutch plates (friction and steel plates) [C] on blocks [D].
- ODo not support the spring holder [E] with the blocks.





- Apply a soap and water solution to the strips. This is to separate the strips easily from the clutch spring plate and clutch hub when removing strips.
- Place these four strips [A] on the raised surface [B] of the outer clutch hub in a criss-cross pattern as shown.
- Install the clutch spring plate [C] and a block [D].
- OWhile noting the positions of the spline teeth [E], fit the clutch spring plate into the outer clutch hub smoothly. Be careful not to move these strips.
- Press [F] the block until the clutch plates [G] seat closely.

CAUTION

Do not press the block too much. This could damage the clutch parts. The maximum press force is 100 kg.

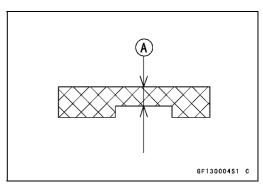
- Remove the clutch spring plate.
- Peel off these strips with a thin-bladed screwdriver.
- Measure the pressed thickness [A] of each strip with vernier calipers.
- OThe thickness represents the spring plate gap.

Spring Plate Gap

Usable Range: 1.95 ~ 2.45 mm (0.0768 ~ 0.0965 in.)

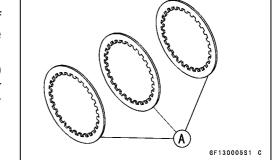
NOTE

OIn case of rear wheel hop, adjust the spring plate gap a bit larger, and in case of clutch slip or "spongy" clutch lever, adjust the gap a bit smaller within the usable range.



Spring Plate Gap Adjustment

- ★If the plate gap is out of the usable range, change one of the steel plates [A] to a thicker or thinner one to get the correct gap.
- OUse the standard steel plates (2.0 mm, 0.079 in. thick) \times (6 \sim 7) plates, and the adjustment steel plate (1.6 or 2.3 mm, 0.063 or 0.090 in. thick) \times (0 \sim 1) plates: total 7 plates.



Steel Plates

Thickness Part No. 1.6 mm (0.063 in.) 13089-1080

2.0 mm (0.079 in.) 13089-1075 (standard)

2.3 mm (0.090 in.) 13089-1081

CAUTION

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

Friction and Steel Plate Wear, and Damage Inspection

- Visually inspect the friction and steel plates for signs of seizure, overheating (discoloration), or uneven wear.
- ★If any plates show signs of damage, replace the plates.
- Measure the thickness of the friction plates [A] at several points.
- ★If they have worn past the service limit, replace the friction plate and measure the spring plate gap and adjust it if necessary.

Friction Plate Thickness

Standard: 3.3 ~ 3.5 mm (0.130 ~ 0.138 in.)

Service Limit: 3.1 mm (0.122 in.)

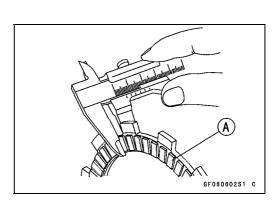
Friction or Steel Plate Warp

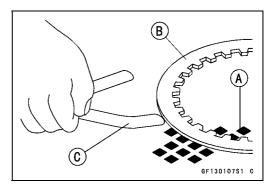
- Place each friction plate or steel plate on a surface plate, and measure the gap between the surface plate [A] and each friction plate or steel plate [B] with a thickness gauge [C]. The gap is the amount of friction or steel plate warp.
- ★If any friction plate is warped over the service limit, replace it and measure the spring plate gap, and adjust it if necessary.
- ★If any steel plate is warped over the service limit, replace it with a new one of the same thickness.

Friction or Steel Plate Warp

Standard: 0.2 mm (0.0079 in.) or less

Service Limit: 0.3 mm (0.012 in.)



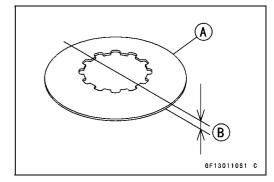


Clutch Spring Height Measurement

- Measure the height [B] of the clutch spring [A].
- ★If the spring height is less than the service limit, it must be replaced.

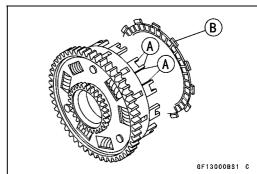
Clutch Spring Height

Standard: 4.3 mm (0.169 in.)
Service Limit: 4.0 mm (0.16 in.)



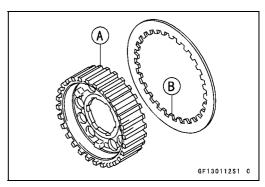
Clutch Housing Finger Inspection

- Visually inspect the fingers [A] of the clutch housing where the tangs [B] of the friction plates hit them.
- ★ If they are badly worn or if there are groove cuts where the tangs hit, replace the housing. Also, replace the friction plates if their tangs are damaged and measure the spring plate gap and adjust it if necessary.



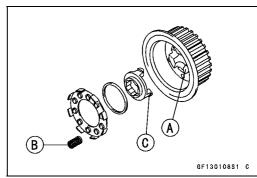
Outer Clutch Hub Spline Inspection

- Visually inspect where the teeth [B] on the steel plates wear against the splines [A] of the outer clutch hub.
- ★If there are notches worn into the splines, replace the outer clutch hub. Also, replace the steel plate with a new one of the same thickness if their teeth are damaged.



Cam Damper Inspection

- Disassemble the clutch (see Clutch Inner Hub Disassembly).
- Visually inspect the damper cam [A], damper spring [B], and cam follower [C].
- ★Replace any damaged parts.



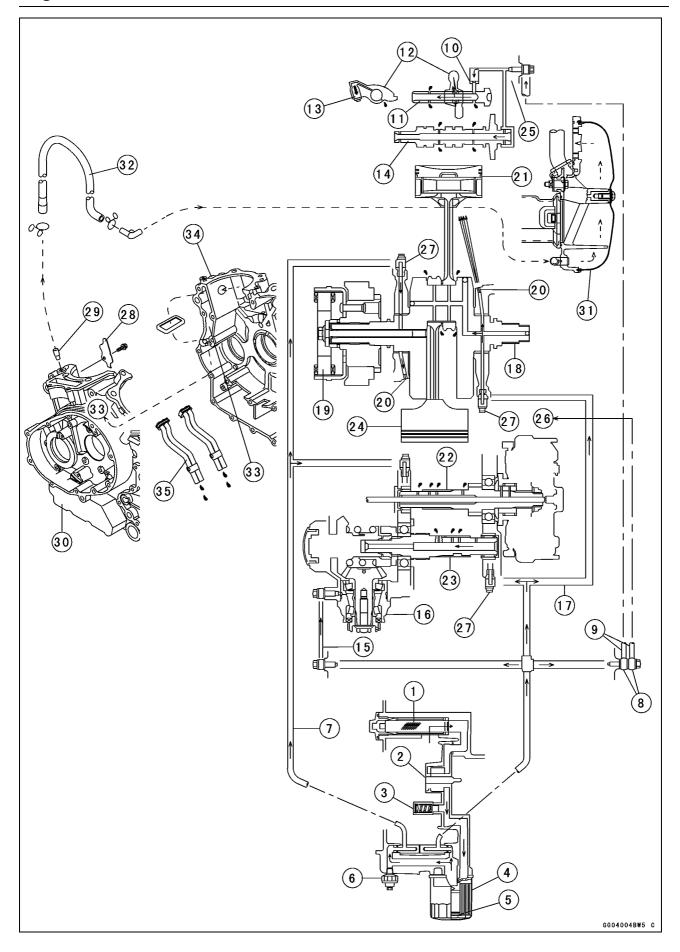
Engine Lubrication System

Table of Contents

Engine Oil Flow Chart	7-2
Exploded View	7-4
Specifications	7-6
Special Tools and Sealant	7-7
Engine Oil and Oil Filter	7-8
Oil Level Inspection	7-8
Engine Oil Change	7-8
Oil Filter Replacement	7-8
Oil Pump and Oil Line	7-9
Oil Pump Removal	7-9
Oil Pump Installation	7-9
Oil Hose Removal	7-9
Oil Hose Installation	7-10
Inside Oil Pipe Removal	7-11
Inside Oil Pipe Installation	7-12
Blowby Gas System Inspection	7-14
Breather Drain Cleaning	7-15
Oil Pressure	7-16
Oil Pressure Measurement	7-16
Oil Pressure Relief Valve Inspection	7-17

7-2 ENGINE LUBRICATION SYSTEM

Engine Oil Flow Chart

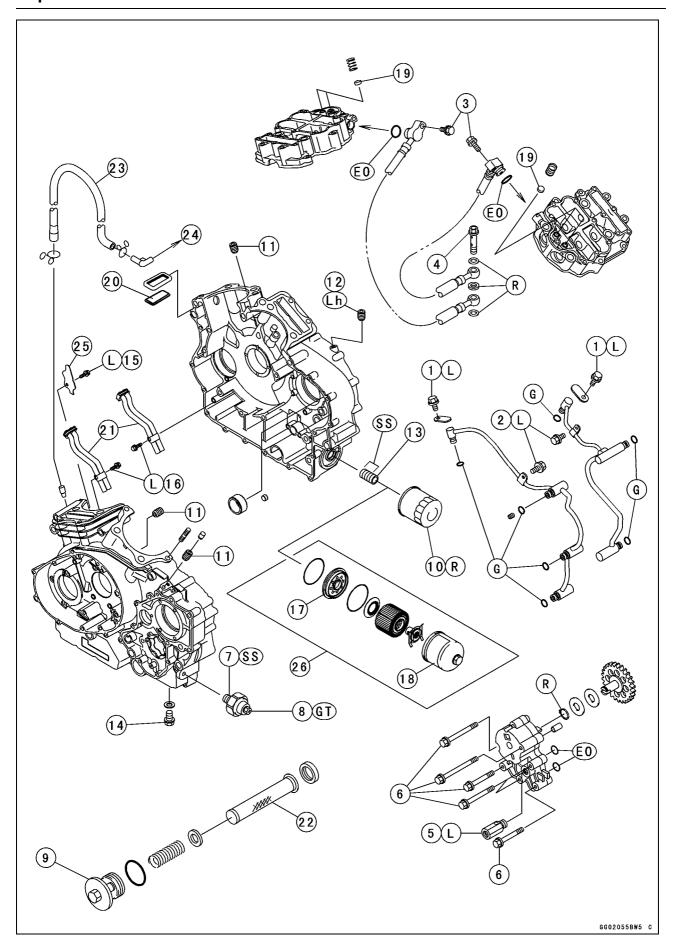


Engine Oil Flow Chart

- →: Oil Flow (1 ~ 30)
- --→: Blowby Gas
 - 1. Oil Screen
 - 2. Oil Pump
 - 3. Oil Pressure Relief Valve
 - 4. Oil Filter
 - 5. Bypass Valve
 - 6. Oil Pressure Switch
 - 7. Inside Oil Pipe
 - 8. Banjo Bolts of Right Crankcase Rear
 - 9. Outside Oil Hoses
 - 10. HLA Oil Filter
 - 11. Rocker Shafts
 - 12. Rocker Arms
 - 13. HLA (Hydraulic Lash Adjuster)
 - 14. Camshafts
 - 15. Outside Oil Pipe
 - 16. Front Gear Case
 - 17. Inside Oil Pipe
 - 18. Crankshaft
 - 19. Alternator Rotor
 - 20. Oil Nozzle
 - 21. Front Piston
 - 22. Drive Shaft
 - 23. Output Shaft
 - 24. Rear Piston
 - 25. Front Rockercase
 - 26. Rear Rockercase
 - 27. Inside Oil Pipe Fittings
 - 28. Oil Baffle
 - 29. Fitting
- 30. Left Crankcase
- 31. Right Air Cleaner Housing (rear view)
- 32. Crankcase Breather Hose
- 33. Oil Separating Chambers
- 34. Right Crankcase
- 35. Oil Return Pipes

7-4 ENGINE LUBRICATION SYSTEM

Exploded View



Exploded View

No. Footoner			Damada		
No.	Fastener	N⋅m	kgf∙m	ft·lb	Remarks
1	Oil Pipe Holder Bolts	11	1.1	95 in·lb	L
2	Oil Pipe Clamp Bolts	11	1.1	95 in·lb	L
3	Oil Hose Flange Bolts	9.8	1.0	87 in·lb	
4	Oil Hose Banjo Bolt	9.8	1.0	87 in·lb	
5	Oil Presser Relief Valve	15	1.5	11	L
6	Oil Pump Mounting Bolts	11	1.1	95 in·lb	
7	Oil Pressure Switch	15	1.5	11	SS
8	Oil Pressure Switch Terminal Screw	1.5	0.15	13 in·lb	
9	Oil Screen Plug	20	2.0	14	
10	Oil Filter	18	1.8	13	R
11	Right & Left Crankcase Oil Nozzles	2.9	0.30	26 in·lb	
12	Right Crankcase Oil Nozzle	2.9	0.30	26 in·lb	Lh
13	Oil Filter Pipe	25	2.5	18	SS
14	Oil Drain Plug	20	2.0	14	
15	Oil Baffle Bolt	11	1.1	95 in·lb	L
16	Oil Return Pipe Clamp Bolts	11	1.1	95 in·lb	L
17	Oil Filter Adapter (Bellow No.26)	98	10	72	
18	Oil Filter Case (Bellow No.26)	54	5.5	40	

- 19. HLA Oil Filters
- 20. Oil Separator (smaller side goes first.)
- 21. Oil Return Pipes
- 22. Oil Screen
- 23. Crankcase Breather Hose
- 24. To right air cleaner base
- 25. Oil Baffle
- 26. Oil Filter Kit (VN1600-A1):

Frame Number

JKBVNKA1□3A000042 ~ 003708 or

JKBVNT60AAA00042 ~ 00378

- EO: Apply engine oil.
 - G: Apply grease.
- GT: Apply a little grease to the switch terminal for rust prevention.
 - L: Apply a non-permanent locking agent.
- Lh: Left-hand Threads
- R: Replacement Parts
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

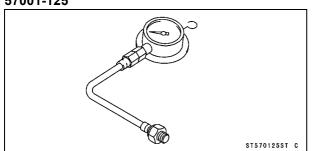
7-6 ENGINE LUBRICATION SYSTEM

Specifications

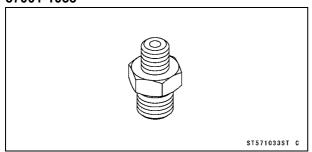
Item	Standard
Engine Oil	
Туре	API SE, SF or SG class
	API SH or SJ class with
	JASO MA
Viscosity	SAE 10W-40
Capacity	2.9 L (3.1 US qt, when filter is not removed)
	3.1 L (3.3 US qt, when filter is removed)
	3.5 L (3.7 US qt, when engine is completely disassembled and dry)
Level (Wait 2 ~ 3 minutes after idling or running)	Between upper and lower level lines
Oil Pressure Measurement	
Oil pressure @2 000 r/min (rpm), Oil temp. 90°C (194°F)	340 ~ 440 kPa (3.5 ~ 4.5 kg/cm², 50 ~ 64 psi)

Special Tools and Sealant

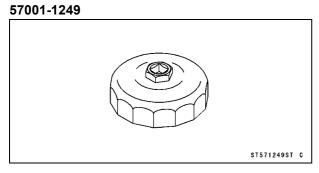
Oil Pressure Gauge, 5 kgf/cm²: 57001-125



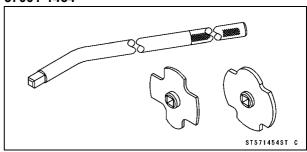
Oil Pressure Gauge Adapter, PT 1/8: 57001-1033



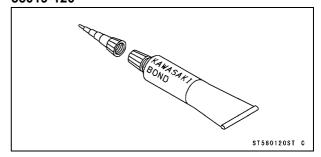
Oil Filter Wrench:



Filler Cap Driver: 57001-1454



Kawasaki Bond (Silicone Sealant): 56019-120



7-8 ENGINE LUBRICATION SYSTEM

Engine Oil and Oil Filter

A WARNING

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

Oil Level Inspection

- Situate the motorcycle so that it is vertical.
- Check that the engine oil level is between the upper [A] and lower [B] levels in the gauge.
 Clutch Cover [C]

NOTE

- OSituate the motorcycle so that it is perpendicular to the ground.
- \bigcirc If the motorcycle has just been used, wait 2 ~ 3 minutes for all the oil to drain down.
- Olf 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.



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

If the engine oil gets extremely low or if the oil pump or oil passages clog up or otherwise do not function properly, the oil pressure warning light will light. If this light stays on when the engine is running above idle speed, stop the engine immediately and find the cause.

- ★If the oil level is too high, remove the excess oil, using a syringe or some other suitable device.
- ★If the oil level is too low, add the correct amount of oil through the oil filler opening. Use the same type and make of oil that is already in the engine.

NOTE

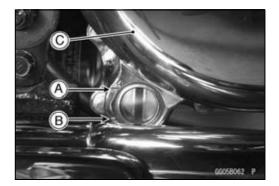
Off the engine oil type and make are unknown, use any brand of the specified oil to top off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.

Engine Oil Change

 Refer to Engine Oil Change in the Periodic Maintenance Chapter.

Oil Filter Replacement

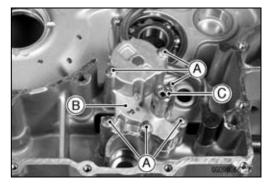
 Refer to Oil Filter Replacement in the Periodic Maintenance Chapter.



Oil Pump and Oil Line

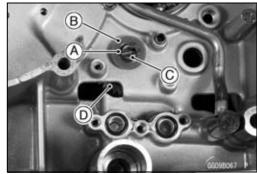
Oil Pump Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Split the crankcase (see Crankshaft/Transmission chapter).
- Remove the oil pump mounting bolts [A], and take off the pump [B] out of the right crankcase.
- Unscrew the oil pressure relief valve [C] if necessary.



• Remove:

Circlip [A]
Washer [B]
Pump Shaft [C]
Pump Gear [D]



Oil Pump Installation

- Note the position of the oil pump shaft tang [A] and turn the pump gear shaft so that the tang fits into the slot [B] of the oil pump gear.
- Replace the O-rings [C] with new ones if they are damaged.
- Be sure to install the dowel pins [D].
- Tighten:

Torque - Oil Pump Mounting Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)

- Check that the oil pump gear turns smoothly in the left side of the right crankcase.
- Apply a non-permanent locking agent to the threads of the oil pressure relief valve and install it.
- Tighten:



Oil Hose Removal

- Remove the fuel tank (see Fuel System (DFI) chapter).
- Disconnect:

Water Temperature Sensor Connector [A] Vacuum Switch Valve Hose [B] (air cleaner side) Throttle Sensor Connector [C]



7-10 ENGINE LUBRICATION SYSTEM

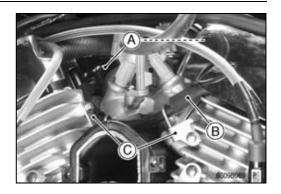
Oil Pump and Oil Line

• Remove:

Left Air Cleaner Housing (see Fuel System (DFI) chapter)

Oil Hose Flange Bolts [A] on Front and Rear Rocker Cases

OFor the front oil hose [B], remove the clamps [C].

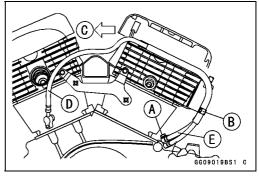


• Remove:

Oil Hose Banjo Bolt [A] on Right Crankcase behind Rear Cylinder

Clamp (open) [B]

• Pull [C] out the front oil hose [D] forward and the rear oil hose [E].

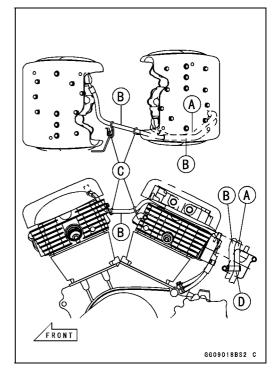


Oil Hose Installation

- Run the front oil hose over the rear oil hose as shown.
- Olnsert the rear oil hose [A] first.
- ONext insert the front oil hose [B].
- ORun both oil hoses between the rocker case and the rocker case cover.
- Tighten:

Torque - Oil Hose Flange Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install the clamps [C].
- Fit the clamp [D] as shown.



Oil Pump and Oil Line

• Install each bottom end of the oil hoses on the right crankcase behind the rear cylinder as shown.

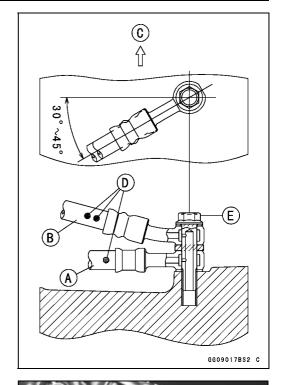
Front Oil Hose [A] Rear Oil Hose [B] Front [C]

OFace the paint marks [D] rearward.

- Replace the copper washers on each side of the banjo bolt with new ones.
- Tighten:

Torque - Oil Hose Banjo Bolt [E]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

• Install the removed ports.

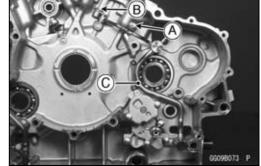


Inside Oil Pipe Removal

- Split the crankcase (see Crankshaft/Transmission chapter).
- Remove:

Oil Pipe Clamp Bolts [A] Oil Pipe Holder Bolt [B]

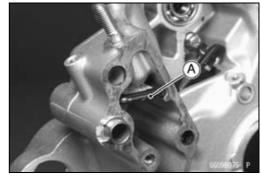
• Remove the inside oil pipe [C] from the right crankcase.



• Remove the oil pipe clamp bolt [A], and oil return pipe [B].



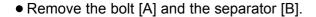
• Remove the separator [A].

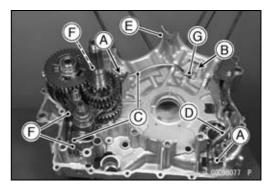


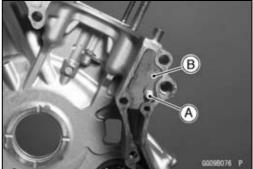
7-12 ENGINE LUBRICATION SYSTEM

Oil Pump and Oil Line

- Remove:
 - Oil Pipe Clamp Bolt [A] Oil Pipe Holder Bolt [B]
- Remove the inside oil pipe [C] and the oil return pipe [D] from the left crankcase [E].
- OPull out the large size fittings [F] first, and remove the small size fitting [G] upward.

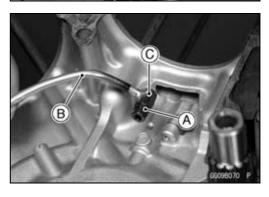






Inside Oil Pipe Installation

- Check that the oil pipe fitting O-rings [A] are in good condition.
- Apply grease to the O-rings before installation.
 Oil Pipe [B]
 Fitting [C]

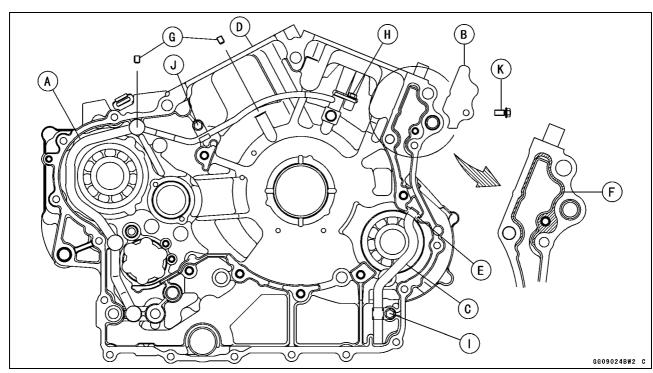


Oil Pump and Oil Line

- Install the inside oil pipe [A], separator [B] and the oil return pipe [C] to left crankcase [D] as shown.
- ODo not apply silicone sealant to the groove of the grommet and the mating surface of the grommet [E].
- OApply silicone sealant to the crankcase mating surface [F] of the separator.
- OApply a non-permanent locking agent to the oil pipe holder bolt [H], oil return pipe clamp bolts [I] oil pipe clamp bolts [J], and oil baffle bolt [K].
- Olf the oil nozzles [G] are removed, install them.

Torque - Oil Pipe Holder Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)
Oil Return Pipe Clamp Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)

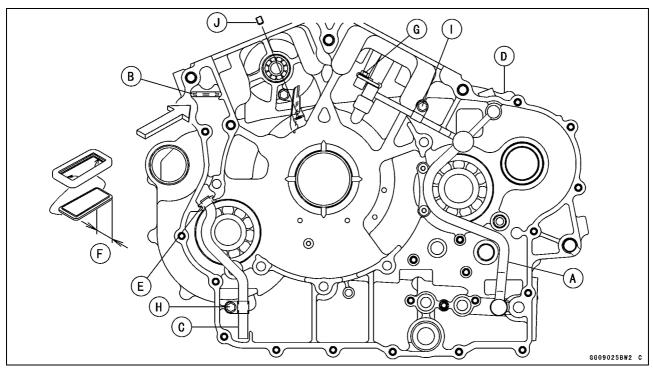
Oil Pipe Clamp Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)
Oil Baffle Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)
Oil Nozzle: 2.9 N·m (0.30 kgf·m, 26 in·lb)



7-14 ENGINE LUBRICATION SYSTEM

Oil Pump and Oil Line

- Install the inside oil pipe [A], separator [B], and the oil return pipe [C] to the right crankcase [D].
- ODo not apply silicone sealant to the groove of the grommet and the mating surface of the grommet [E].
- Olnstall the separator so that it's smaller side [F] faces inside.
- OApply a non-peramanet locking agent to the oil pipe holder bolt [G], oil return pipe clamp bolt [H] and oil pipe clamp bolts [I].
- Olf the oil nozzle [J] is removed, install it.



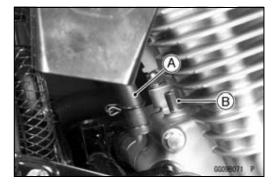
Torque - Oil Pipe Holder Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)
Oil Return Pipe Clamp Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)
Oil Pipe Clamp Bolts: 11 N·m (4.4 kgf·m, 95 in·lb)

Oil Pipe Clamp Bolts: 11 N·m (1.1 kgf·m, 95 in·lb) Oil Nozzle: 2.9 N·m (0.30 kgf·m, 26 in·lb)

Install the removed parts.

Blowby Gas System Inspection

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the oil reserve tank and right air cleaner base.
- ★If they are not, correct them.
- Inspect the breather hoses [A], breather pipe [B], and the air cleaner drain hose for damage or signs of deterioration.
- OThese hoses should not be hard and brittle, nor should be soft or swollen.
- ★Replace it if any cracks or swelling are noticed.
- Check that the hoses are securely connected.



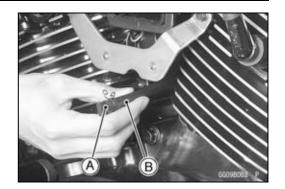
Oil Pump and Oil Line

Breather Drain Cleaning

- OThe air cleaner drain hose is provided beneath the right air cleaner housing, and catches the water or oil from the crankcase breather hose. Usually water or oil does not collect at the bottom. In the event that rain water is drawn in through the air cleaner or if engine oil is blown back, drain the housing.
- Remove the left air cleaner housing (see Fuel System chapter).
- Remove the drain plug [A] from the air cleaner drain hose [B] to drain the water or breather.
- Install the plug on its original position.

A WARNING

Be sure to reinstall the plug in the drain hose after draining. Oil on tires will make them slippery and can cause an accident and injury.

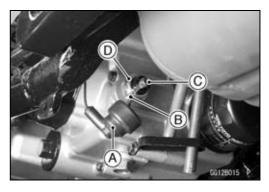


7-16 ENGINE LUBRICATION SYSTEM

Oil Pressure

Oil Pressure Measurement

- Slide out the rubber boot [A].
- Disconnect the oil pressure switch lead [B] from the terminal screw [C].
- Unscrew the oil pressure switch [D].



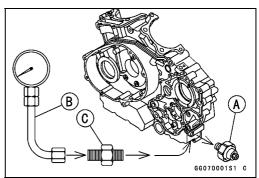
NOTE

OMeasure the oil pressure after the engine is warmed up.

 Attach the oil pressure gauge [B] and adapter [C] to the switch hole.

Oil Pressure Switch [A]

Special Tools - Oil Pressure Gauge, 5 kg/cm²: 57001-125 Oil Pressure Gauge Adapter, PT 1/8: 57001 -1033



- Start the engine and warm up the engine.
- Run the engine at the specified speed, and read the oil pressure gauge.
- ★If the oil pressure is much lower than the standard, check the oil pump, oil pressure relief valve, and/or crankshaft bearing wear and con-rod big end bearing insert wear immediately.
- ★ If the reading is much higher than the standard, check the oil screen first, and the oil passages for dirt or clogging. Also, replace the oil filter.

Oil Pressure

Standard: 340 ~ 440 kPa (3.5 ~ 4.5 kg/cm², 50 ~ 64 psi) @ 2 000 r/min (rpm), oil temp. 90°C (194°F)

- Stop the engine.
- Remove the oil pressure gauge and adapter.

A WARNING

Take care against burns from hot engine oil that will drain through the oil passage when the plug is removed.

• When installing the oil pressure switch, apply silicone sealant to the threads of the switch, and tighten it to the specified torque.

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

Oil Pressure

Oil Pressure Relief Valve Inspection

- Split the crankcase (see Crankshaft/Transmission chapter).
- Remove the oil pressure relief valve [A] from the oil pump [B].
- Check to see if the valve slides smoothly when pushing it in with a wooden or other soft rod, and see if it comes back to its seat by spring pressure.

NOTE

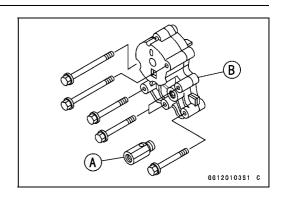
OInspect the valve in its assembled state. Disassembly and assembly may change the valve performance.

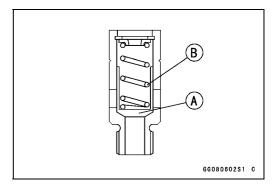
- ★If any rough spots are found during above inspection, wash the valve clean with a high-flash point solvent and blow out any foreign particles that may be in the valve with compressed air in a well-ventilated area.
- OTake care that there is no spark or flame anywhere near the working area.

Valve [A]

Spring [B]

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





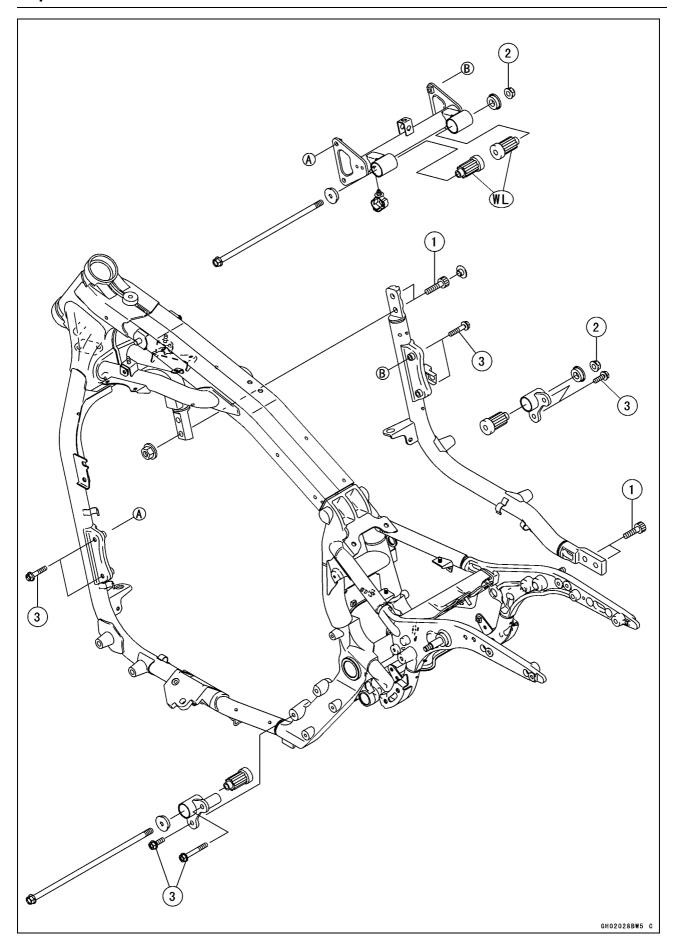
Engine Removal/Installation

Table of Contents

Exploded View	8-2
Specifications	8-4
Engine Removal/Installation	8-5
Engine Removal	8-5
Engine Installation	8-8

8-2 ENGINE REMOVAL/INSTALLATION

Exploded View



ENGINE REMOVAL/INSTALLATION 8-3

Exploded View

No	Fastener	Torque			Domorko
No.		N⋅m	kgf⋅m	ft·lb	Remarks
1	Downtube Bolts And Nuts	44	4.5	33	
2	Engine Mounting Bolts And Nuts	44	4.5	33	
3	Engine Mounting Bracket Bolts	25	2.5	18	

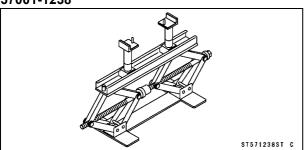
WL: Apply a soap and water solution or rubber lubricant.

8-4 ENGINE REMOVAL/INSTALLATION

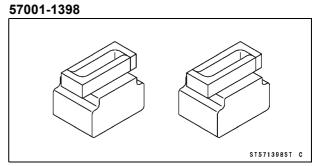
Specifications

Jack:

57001-1238



Attachment Jack:



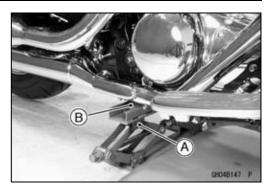
Engine Removal/Installation

Engine Removal

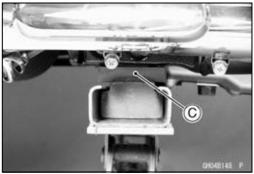
• Support the rear part of the frame on the jack [A] and the attachment jack [B].

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398



OFit the ribs of the frame into the groove [C] of the attachments.



• Squeeze the brake lever slowly and hold it with a band [A].

▲ WARNING

Be sure to hold the front brake when removing the engine, or the motorcycle may fall over. It could cause an accident and injury.

CAUTION

Be sure to hold the front brake when removing the engine, or the motorcycle may fall over. The engine or the motorcycle could be damaged.



Coolant (see Cooling System chapter) Engine Oil (see Engine Lubrication System chapter)

• Remove:

Battery Cables

Fuel Tank (see Fuel (DFI) System chapter)

Left and Right Air Cleaner Housings (see Fuel (DFI) System chapter)

Front and Rear Exhaust Pipes (see Engine Top End chapter)

Shift Pedals (see Crankshaft/Transmission chapter)

Alternator Outer Cover (see Electrical System chapter)
Radiator (see Cooling System chapter)

Thermostat Removal (see Cooling System chapter)

#2 Ignition Coil (right side, see Electrical System chapter)



8-6 ENGINE REMOVAL/INSTALLATION

Engine Removal/Installation

• Remove:

Spark Plug Caps [A] Clamp [B] Throttle Sensor Connector [C]



Injector Connectors [A]
Fuel Hose [B]
Connector [C]
Vacuum Switch Valve [D]
Inlet Air Pressure Sensor Hose



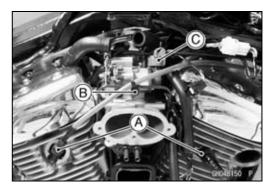
Spark Plug Caps [A]
Horn [B]
Regulator/Rectifier Lead Connectors [C]
Alternator Lead Connectors [D]
Crankshaft Sensor Lead Connector [E]
Side Stand Switch Lead Connector [F]
Speed Sensor Lead Connector
Oil Pressure Switch Connector

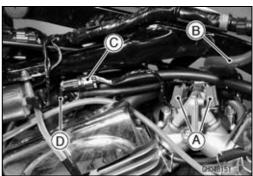
• Remove:

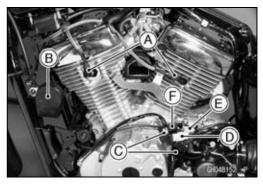
Neutral Switch Connector [A]
Bracket Bolts [B]
Clutch Hose Bracket [C]
Clutch Slave Cylinder [D] (see Clutch chapter)

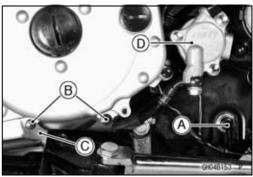
• Remove:

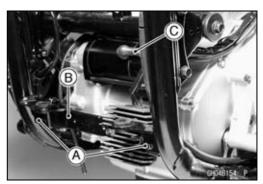
Bracket Bolts [A]
Regulator/Rectifier Bracket [B]
Starter Motor Lead [C]











Engine Removal/Installation

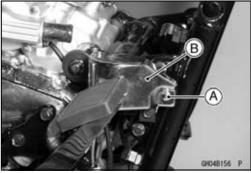
• Remove:

Engine Ground Terminal [A]



• Remove:

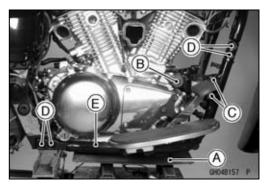
Brake Reservoir Cover Bolt [A] Brake Reservoir Cover [B]



- Support the engine with a commercially available stand [A].
- Loosen the engine mounting nut [B].
- Remove:

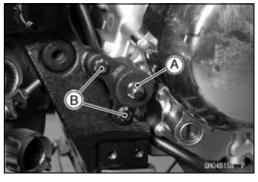
Engine Mounting Bracket Bolts [C] Downtube Bolts [D]

• Remove the downtube [E] with the right footboard and rear master cylinder installed.



• Remove:

Engine Mounting Bolts and Nuts [A] Engine Mounting Bracket Bolts [B]



• Remove:

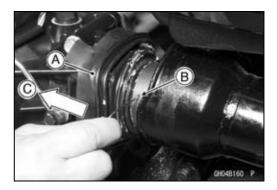
Swingarm Cover Bolts [A] Swingarm Cover [B]



8-8 ENGINE REMOVAL/INSTALLATION

Engine Removal/Installation

- Disengage the propeller shaft from the engine.
- OPull off the rubber boot [A] and push on the lockpin [B] a little with a pin.
- OMove the engine forward [C] to free it from the rear propeller shaft.

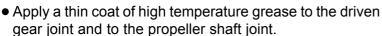


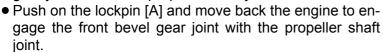
• Remove the engine [A] from the motorcycle right side.

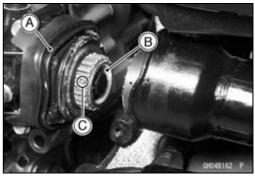


Engine Installation

- Support the engine with a commercially available stand and move them inside the frame in the reverse order of removal.
- Install the rubber boot [A] on the rear end of the front bevel gear case.
- Fit the spring [B] into the front bevel gear joint.
- Put the lockpin [C] into the front bevel gear joint.









- Insert the rear mounting bolt from the left side of the engine to set the engine into its original position in the frame.
- Tighten:

Torque - Downtube Bolts and Nuts: 44 N·m (4.5 kgf·m, 33 ft·lb)

Engine Mounting Bolts and Nuts: 44 N·m (4.5 kgf·m, 33 ft·lb)

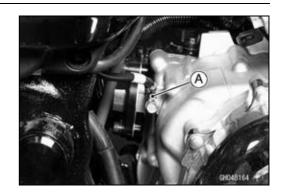
Engine Mounting Bracket Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)

 Run the leads, cables and hoses correctly (see Cable, Wire and Hose Routing section in the Appendix chapter).

Engine Removal/Installation

- Connect the engine ground lead [A] down to the engine as shown.
- Tighten:

Torque - Engine Ground Terminal Bolt: 7.8 N·m (0.80 kgf·m, 69 in·lb)



- Install the removed parts (see appropriate chapters).
- Adjust the throttle cables (see Fuel System chapter).
- Fill the engine with engine oil (see Periodic Maintenance chapter).
- Fill the engine with coolant and bleed the air from the cooling system (see Periodic Maintenance chapter).
- Adjust the idling (see Periodic Maintenance chapter).
- Check the clutch operation.
- Check the brake effectiveness.

▲ WARNING

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

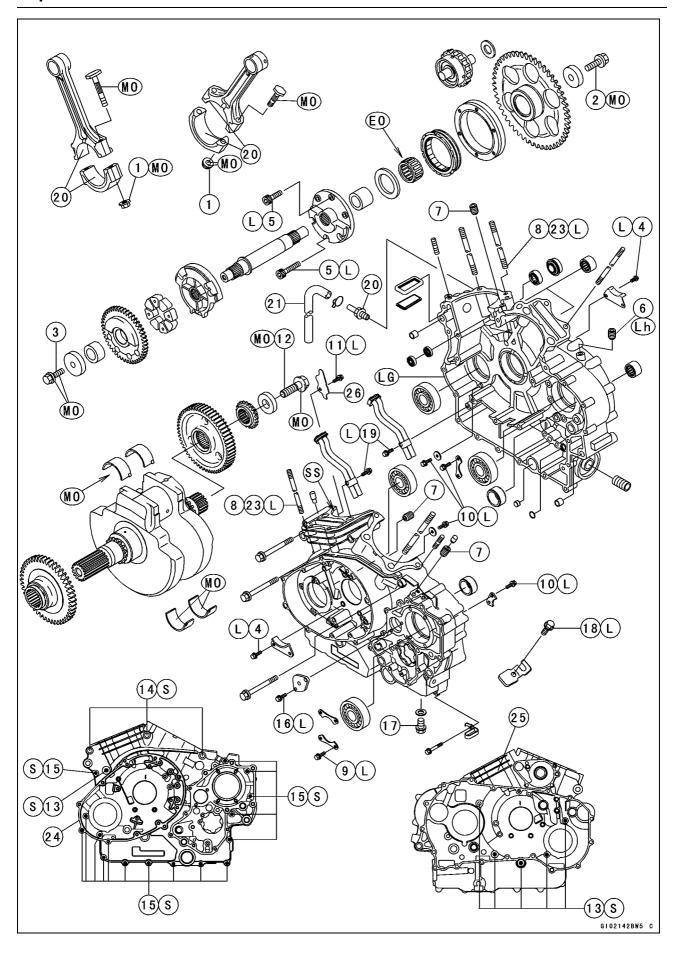
Crankshaft/Transmission

Table of Contents

Exploded View	9-2	Transmission	9-30
Specifications	9-6	Shift Pedal Removal	9-30
Special Tools and Sealants	9-8	Shift Pedal Installation	9-30
Crankcase	9-9	External Shift Mechanism	
Crankcase Disassembly	9-9	Removal	9-30
Crankcase Assembly	9-13	External Shift Mechanism	
Starter Clutch Disassembly	9-20	Installation	9-31
Starter Clutch Assembly	9-21	External Shift Mechanism	
Starter Clutch Inspection	9-21	Inspection	9-31
Starter Torque Limiter Check	9-22	Transmission Removal	9-32
Crankshaft/Connecting Rods	9-23	Transmission Installation	9-32
Connecting Rod Removal	9-23	Shift Drum Disassembly/Assem-	
Connecting Rod Installation	9-23	bly	9-33
Crankshaft/Connecting Rod		Transmission Disassembly	9-34
Cleaning	9-24	Transmission Assembly	9-34
Connecting Rod Bend	9-24	Shift Fork Bending	9-35
Connecting Rod Twist	9-24	Shift Fork/Gear Groove Wear	9-35
Connecting Rod Big End Side		Shift Fork Guide Pin/Drum	
Clearance	9-25	Groove Wear	9-35
Connecting Rod Big End Bearing		Gear Dog and Gear Dog Hole	
Wear	9-25	Damage	9-35
Crankshaft Runout	9-27	Ball Bearing, Needle Bearing, and Oil	
Crankshaft Main Bearing/Journal		Seal	9-37
Wear	9-27	Ball Bearing and Outer Race	
Crankshaft Side Clearance	9-27	Replacement	9-37
Primary Gear	9-28	Ball and Needle Bearing Wear	9-37
Primary Gear Removal	9-28	Oil Seal Inspection	9-38
Primary Coar Installation	0.28		

9-2 CRANKSHAFT/TRANSMISSION

Exploded View



Exploded View

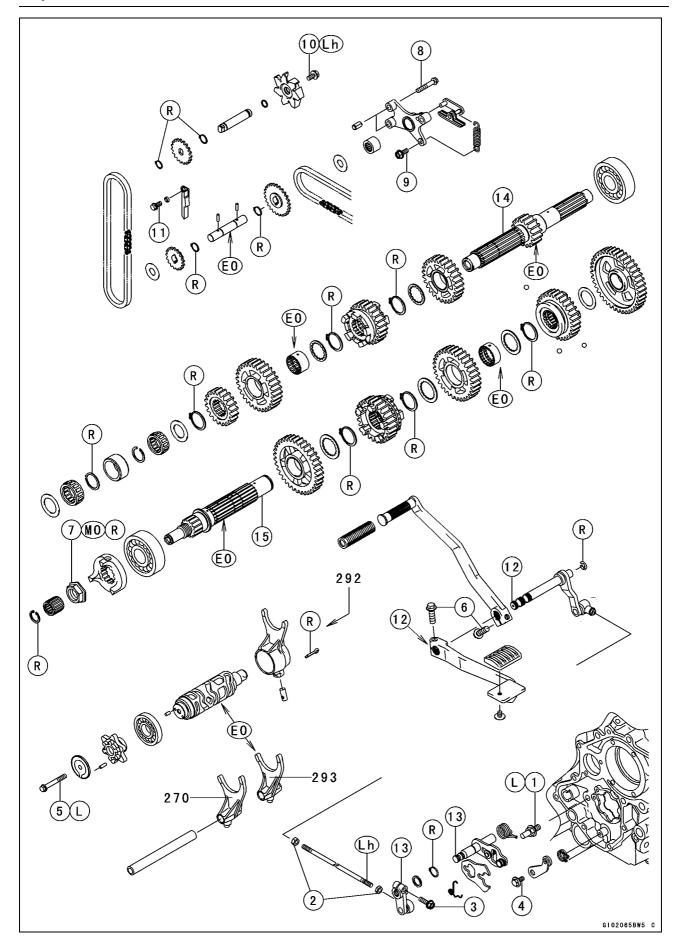
No	Factorer	Torque			D
No.	Fastener	N⋅m	kgf⋅m	ft∙lb	Remarks
1	Connecting Rod Big End Nuts	59	6.0	43	MO
2	Starter Clutch Bolt	85	8.7	63	MO
3	Left Balancer Gear Bolt	85	8.7	63	MO
4	Camshaft Chain Guide Bolts	11	1.1	95 in·lb	L
5	Starter Clutch Coupling Bolts	15	1.5	11	L
6	Right Crankcase Oil Nozzle	2.9	0.30	26 in·lb	Lh
7	Right & Left Crankcase Oil Nozzles	2.9	0.30	26 in·lb	
8	Cylinder Stud	_	_	_	L
9	Bearing Retainer Bolts	11	1.1	95 in·lb	L
10	Shift Drum Bearing Holder Bolts	11	1.1	95 in·lb	L
11	Oil Baffle Bolt	11	1.1	95 in·lb	L
12	Primary Gear Bolt	147	15.0	108	MO
13	Crankcase Bolts, ϕ 8	21	2.1	15	S
14	Crankcase Bolts, ϕ 10	39	4.0	29	S
15	Crankcase Bolts, ϕ 6	11	1.1	95 in·lb	S
16	Clutch Push Rod Guide Bolts	11	1.1	95 in·lb	L
17	Oil Drain Plug	20	2.0	14	
18	Frame Ground Bracket Bolt	11	1.1	95 in·lb	
19	Oil Return Pipe Clamp Bolts	11	1.1	95 in·lb	L
20	Water Pump Drainge Bolt	9.8	1.0	87 in·lb	

- 21. Water Pump Drainage Outlet Hose
- 22. Do not apply any oil.
- 23. Apply a non-permanent locking agent to the tap end of this stud only.
- 24. Left Crankcase
- 25. Right Crankcase
- 26. Oil Baffle
- EO: Apply engine oil.
 - L: Apply a non-permanent locking agent.
- LG: Apply liquid gasket (Kawasaki Bond: 92104-1065).
- Lh: Left-hand Threads
- MO: Apply molybdenum disulfide oil to the threads and the seating surface.

The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).

- S: Follow the specific tightening sequence.
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

Exploded View



CRANKSHAFT/TRANSMISSION 9-5

Exploded View

No	Factoria	Torque			Damarka
No.	Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
1	Shift Shaft Return Spring Pin	39	4.0	29	L
2	Shift Rod Locknuts	11	1.1	95 in·lb	
3	Rear Shift Lever Clamp Bolt	12	1.2	104 in·lb	
4	Gear Set Lever Bolt	11	1.1	95 in·lb	L
5	Shift Drum Cam Bolt	15	1.5	11	L
6	Shift Pedal Clamp Bolts	25	2.5	18	
0	Shift Pedal Clamp Bolts (VN1600-A2 ~)	30	3.1	22	
7	Damper Cam Nut	195	20	144	MO, R
8	Idle Shaft Holder Bolts	8.3	0.85	73 in·lb	
9	Water Pump Chain Guide Spring Hook Bolt	2.9	0.30	26 in·lb	
10	Water Pump Impeller Bolt	8.8	0.9	78 in·lb	Lh
11	Water Pump Chain Guide Bolt	8.3	0.85	73 in·lb	

- 12. Align the punch marks.
- 13. Align the punch mark with the slit.
- 14. Drive Shaft
- 15. Output Shaft
- EO: Apply engine oil.
 - L: Apply a non-permanent locking agent.
- Lh: Left-hand Threads
- MO: Apply molybdenum disulfide oil.

The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1).

R: Replacement Parts

9-6 CRANKSHAFT/TRANSMISSION

Specifications

Item		Standard	Service Limit
Crankshaft, Connecting Rods			
Connecting Rod Bend			TIR 0.2/100 mm
			(0.008/3.94 in.)
Connecting Rod Tw	vist		TIR 0.2/100 mm
			(0.008/3.94 in.)
Connecting Rod Big	g End Side Clearance	0.16 ~ 0.46 mm	0.7 mm
		(0.0062 ~ 0.0181 in.)	(0.028 in.)
Connecting Rod Bi		0.026 ~ 0.057 mm	0.10 mm
Insert/Crankpin Cle	arance	(0.001024 ~ 0.0022 in.)	(0.0039 in.)
Crankpin Diameter:		54.981 ~ 55.000 mm	54.97 mm
		(2.1646 ~ 2.1654 in.)	(2.1642 in.)
Marking	None	54.981 ~ 54.991 mm	
		(2.1646 ~ 2.16500 in.)	
	0	54.992 ~ 55.000 mm	
		(2.16504 ~ 2.1654 in.)	
Connecting Rod Big	g End Bore Diameter:	58.000 ~ 58.020 mm	
		(2.2835 ~ 2.2843 in.)	
Marking	None	58.000 ~ 58.010 mm	
		(2.2835 ~ 2.28386 in.)	
	0	58.011 ~ 58.020 mm	
		(2.28390 ~ 2.2843 in.)	
Connecting Rod Big	g End Bearing Insert		
Thickness:	Brown	1.483 ~ 1.487 mm	
		(0.05839 ~ 0.05854 in.)	
	Black	1.487 ~ 1.491 mm	
		$(0.05854 \sim 0.05870 \text{ in.})$	
	Blue	1.491 ~ 1.495 mm	
		(0.05870 ~ 0.05886 in.)	
Connecting rod big end bearing insert selection:			

Con-rod Big End	Crankpin Diameter	Bearing Insert		
Bore Diameter	Marking	Cizo Color	Darta Number	
Marking		Size Color	Parts Number	
None	0	Brown	92028-1476	
None	None	Dlook	02020 1475	
0	0	Black	92028-1475	
0	None	Blue	92028-1474	

Crankshaft Side Clearance	0.05 ~ 0.55 mm	0.75 mm
	(0.00197 ~ 0.0217 in.)	(0.0295 in.)
Crankshaft Web Length	96.85 ~ 96.95 mm	96.6 mm
	(3.8130 ~ 3.8169 in.)	(3.803 in.)

CRANKSHAFT/TRANSMISSION 9-7

Specifications

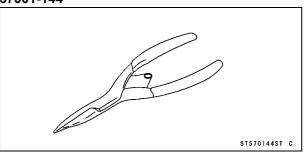
Item	Standard	Service Limit
Crankshaft Runout	TIR 0.02 mm	TIR 0.05 mm
	(0.0008 in.) or less	(0.0020 in.)
Crankshaft Main Bearing/Journal Clearance	0.025 ~ 0.052 mm	0.10 mm
	(0.00098 ~ 0.00205 in.)	(0.00394 in.)
Crankshaft Main Journal Diameter	54.986 ~ 55.000 mm	54.96 mm
	(2.1648 ~ 2.1654 in.)	(2.1638 in.)
Crankcase Main Bearing Bore Diameter	55.025 ~ 55.038 mm	55.07 mm
	(2.1663 ~ 2.1669 in.)	(2.1681 in.)
Transmission		
Shift Fork Ear Thickness	5.9 ~ 6.0 mm	5.8 mm
	(0.232 ~ 0.236 in.)	(0.228 in.)
Gear Shift Fork Groove Width	6.05 ~ 6.15 mm	6.3 mm
	(0.238 ~ 0.242 in.)	(0.248 in.)
Shift Fork Guide Pin Diameter	7.9 ~ 8.0 mm	7.8 mm
	(0.311 ~ 0.315 in.)	(0.307 in.)
Shift Drum Groove Width	8.05 ~ 8.20 mm	8.3 mm
	(0.317 ~ 0.323 in.)	(0.327 in.)

9-8 CRANKSHAFT/TRANSMISSION

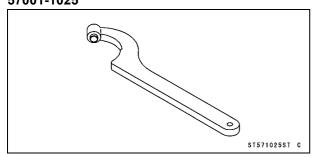
Special Tools and Sealants

Outside Circlip Pliers:

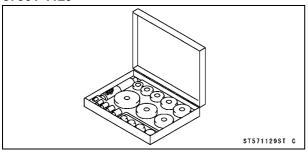
57001-144



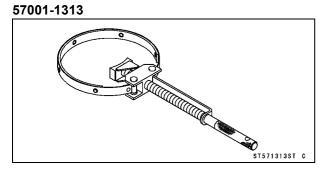
Damper Cam Holder: 57001-1025



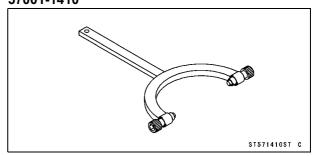
Bearing Driver Set: 57001-1129



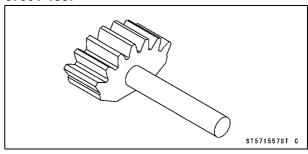
Flywheel Holder:



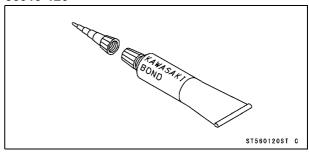
Flywheel Holder: 57001-1410



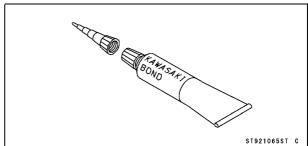
Gear Holder, m2.0: 57001-1557



Kawasaki Bond (Silicone Sealant): 56019-120



Kawasaki Bond (Liquid Gasket - Black) 92104-1065



Crankcase

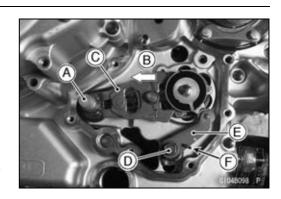
Crankcase Disassembly

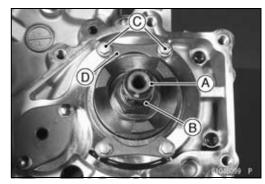
- Drain the engine oil (see Periodic Maintenance chapter).
- Remove:

Engine (see Engine Removal/Installation chapter)
Cylinder Blocks (see Engine Top End chapter)
Pistons (see Engine Top End chapter)
Clutch (see Clutch chapter)

Front Gear Case (see Final Drive chapter)

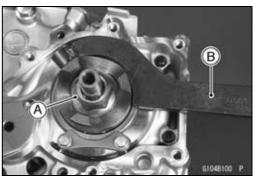
- Remove the shift shaft [A] while pushing [B] the shift mechanism arm [C] towards the shift shaft.
- Unscrew the bolt [D] and remove the gear set lever [E] and its spring [F].
- Remove the retainer [A] and needle bearing [B] from the output shaft.
- Remove crankcase bearing upper retainer bolts [C] and retainer [D].





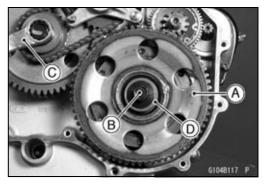
• Unscrew the damper cam nut [A] using the damper cam holder [B] and deep socket wrench.

Special Tool - Damper Cam Holder: 57001-1025



- Pull the starter clutch gear [A] out of the starter clutch (The starter clutch gear can be removed with the engine in the frame).
- Unscrew the starter clutch bolt [B] while holding the primary gear bolt [C].

Washer [D]



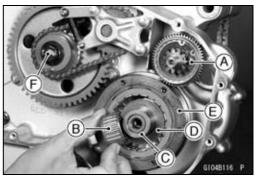
 Remove the following from the right end of the balancer shaft.

Torque Limit [A] Needle Bearing [B] Collar [C] Copper Washer [D]

Starter Clutch [E]

• Unscrew the primary gear bolt [F] while holding the alternator rotor steady with the flywheel holder (The primary gear can be removed with the engine in the frame).

Special Tool - Flywheel Holder: 57001-1410



9-10 CRANKSHAFT/TRANSMISSION

Crankcase

Remove

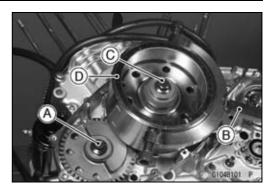
Alternator Cover (see Electrical System chapter)
Alternator Inner Cover (see Electrical System chapter)

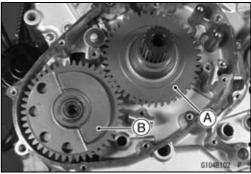
• Loosen the left balancer gear bolt [A], using the flywheel holder [B]. The left balancer gear bolt has right-hand threads.

Special Tool - Flywheel Holder: 57001-1410

Remove the alternator rotor bolt [C] and the alternator rotor [D].

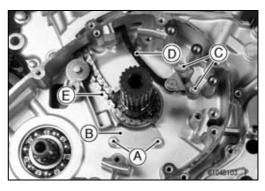
- Take the balancer drive gear [A].
- Take the balancer gear [B], washer, and left balancer off the balancer shaft as a set.



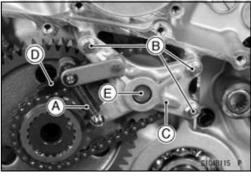


• Remove:

Lower Chain Guide Bolts [A] Lower Chain Guide [B] Rear Chain Guide Bolts [C] Rear Chain Guide [D] Front Camshaft Chain [E]

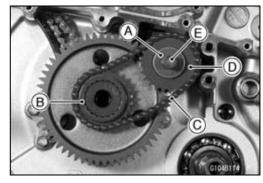


- Take the end of the spring [A] off the hook and unscrew the bolts [B].
- Remove the idle shaft holder [C] and chain guide [D] from the right crankcase (The idle shaft holder can be removed with the engine in the frame).
- OPushing the idle shaft [E], remove the holder.



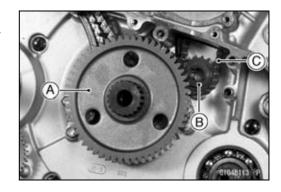
- Remove the washer [A].
- Take out the water pump drive sprocket [B], chain [C] and idle shaft sprocket [D] as a set.
- Take the idle shaft [E] out of the crankcase.

OThe idle shaft has two pins.

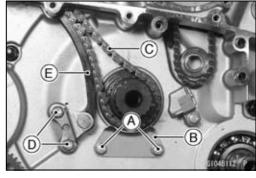


Crankcase

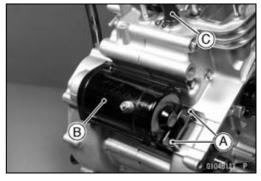
- Pull the primary gear [A] out of the crankshaft.
- Remove the idle shaft sprocket [B] with the flat washer from the water pump chain [C].



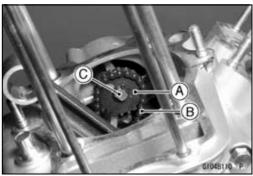
Remove the following with the cylinder head removed.
 Lower Chain Guide Bolts [A]
 Lower Chain Guide [B]
 Rear Camshaft Chain [C]
 Rear Chain Guide Bolts [D]
 Rear Chain Guide [E]



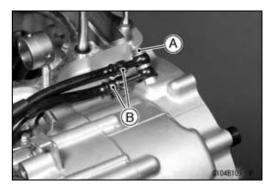
- Remove the starter motor bolts [A] and the motor [B] from the crankcase.
- Pull the breather tube [C] out of the crankcase.



• Pull the water pump sprocket [A] with it's chain [B] and shaft [C].



• Remove the oil banjo bolt [A] with the hoses [B].



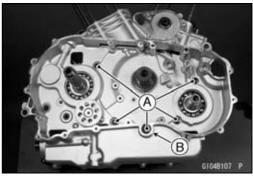
9-12 CRANKSHAFT/TRANSMISSION

Crankcase

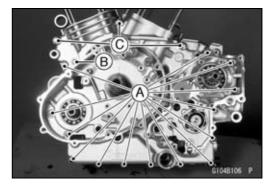
- Remove the oil filter [A] with the oil filter wrench [B]. Special Tool - Oil Filter Wrench: 57001-1249
- Remove the oil pressure switch [C].



• Remove the right crankcase bolts. ϕ 8 mm Bolts (5) [A] OBe sure to remove this bolt [B]



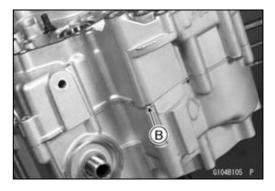
• Remove all the left crankcase bolts in the order listed. ϕ 6 mm Bolts (14) [A] ϕ 8 mm Bolt (1) [B] ϕ 10 mm Bolts (3) [C]



- Turn the left crankcase down.
- Lift up the right crankcase.

OUsing the pry points, split the crankcase halves. Pry Point (Front) [A] Pry Point (Rear) [B]





Crankcase

• Remove the following from the left crankcase.

Crankshaft [A]

Transmission Gear Assy [B] (see Transmission Removal)

Balancer Shaft [C]

CAUTION

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

Crankcase Assembly

- With a high-flash point solvent, clean off the mating surfaces of the crankcase halves and wipe dry.
- Using compressed air, blow out the oil passages in the crankcase halves.
- Support the crankcase bearing boss with a suitable retainer [A].
- Using a press and the bearing driver set [C], install a new bearing [B] or/and race by pushing the bearing outer race until it bottoms out.

CAUTION

Support the crankcase bearing boss when pushing the bearing, otherwise the crankcase could be damaged.

 Press the three needle bearings with manufacturer's marks facing out into holes on the right side of the right crankcase. Push the needle bearing outer race until the face of the bearing is even with the end of the hole, using a driver.

Special Tool - Bearing Driver Set: 57001-1129

- Apply a non-permanent locking agent to the retainer bolts and the oil baffle bolts.
- Install the bearing retainers.

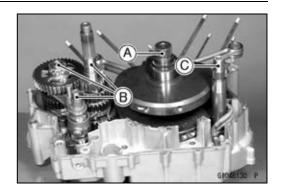
Special Tool - Bearing Driver Set: 57001-1129

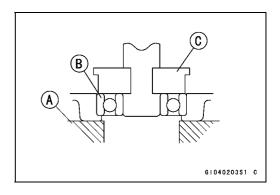
Bearings [A]
Bearing Retainers [B]
Left Crankcase [C]
Oil Baffle [D]

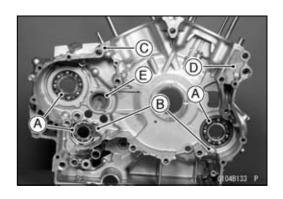
Race [E]

• Tighten:

Torque - Bearing Retainer Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)







9-14 CRANKSHAFT/TRANSMISSION

Crankcase

 Apply silicone sealant [A] to the step of the oil separating chamber [B] in the left crankcase [C].

Sealant - Silicone Sealant: 56019-120

- Install the oil baffle [D] on the chamber.
 Front [E]
- Tighten:

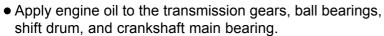
Torque - Oil Baffle Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)



Bearings [A]
Bearing Retainer [B]
Right Crankcase [C]
Race [D]

• Tighten:

Torque - Bearing Retainer Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)



• Install:

Oil Pipe and Oil Return Pipes (see Engine Lubrication System chapter)

OThe left shaft [B] of the crankshaft [A] is longer than the right shaft [C].



Transmission Assy [A] and Shift Drum [B]

Shift Fork [C] and Shift Rod [D]

Crankshaft [E]

Front Connecting Rod [F] (right)

Rear Connecting Rod [G] (left)

Balancer Shaft [H]

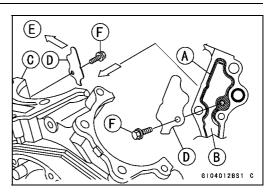
Dowel Pins [J]

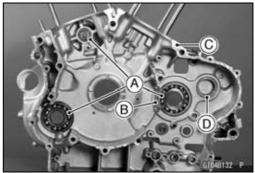
O-ring [K]

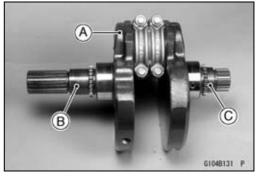
Oil Baffle [L]

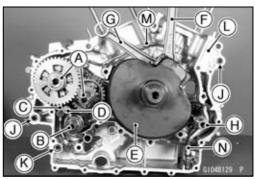
Oil Pipe [M]

Oil Return Pipe [N]



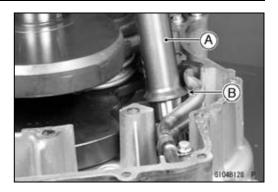






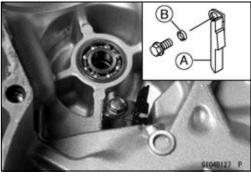
Crankcase

Olnstall the balancer shaft [A] so that the flanged side [B] faces downward (toward the left crankcase).



- Install the water pump chain guide [A]. OBe sure to install the collar [B] in the bolt hole.
- Tighten:

Torque - Water Pump Chain Guide Bolt: 8.3 N·m (0.85 kgf·m, 73 in·lb)



• Check to see that the following parts are in place in the right crankcase.

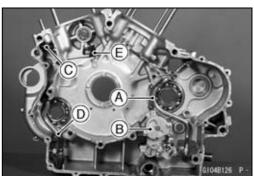
Oil Pipe [A]

Oil Pump [B]

Oil Separator [C]

Oil Return Pipe [D]

Water Pump Chain Guide [E]



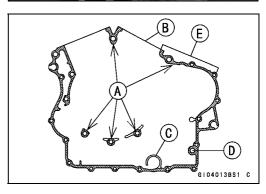
 Apply liquid gasket [A] to the mating surface of the right crankcase [B].

Sealant - Kawasaki Bond (Liquid Gasket-Black): 92104 -1065

- ODo not apply liquid gasket to the area [C] around the hole of the oil screen.
- ODo not drop liquid gasket into the oil passage [D].
- OAfter tightening the crankcase bolts, wipe up the liquid gasket seeping out around the mating surface, especially around the area [E].

NOTE

- OMake the application finish within 30 minutes when the liquid gasket to the mating surface of the right crankcase half is applied.
- OMoreover fit the case and tighten the case bolts just after finishing the application of the liquid gasket.



9-16 CRANKSHAFT/TRANSMISSION

Crankcase

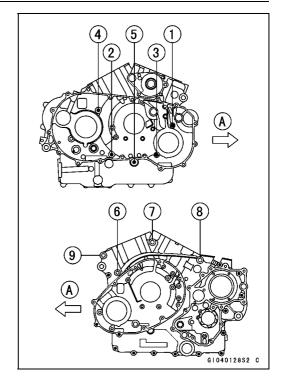
- Tighten the crankcase bolts as follows.
- OLightly tighten all the bolts to a snug fit.
- OTighten the **8 mm** and **10 mm** bolts in the order shown, and then tighten the **6 mm** bolts to the specified torque.

Torque - 8 mm Crankcase Bolts (1 ~ 6): 21 N·m (2.1 kgf·m, 15 ft·lb)

10 mm Crankcase Bolts (7 ~ 9): 39 N·m (4.0 kgf·m, 29 ft·lb)

6 mm Crankcase Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)

Front [A]



- After tightening all the crankcase bolts, check the following items.
- OWipe up the liquid gasket that seeps out around the crankcase mating surface.
- OTurn the right crankcase down, and check that the drive shaft and output shaft turn freely.
- OCheck that the positive neutral finder operates properly: While spinning [C] the output shaft [A] using an air impact wrench, gears shift smoothly from the 1st, 2nd · · · 5th gear, and 5th, 4th · · · 1st. When the output shaft stays still, the gear can be shifted to only the 1st gear or neutral. It should not be shifted to the 2nd gear or other higher gear positions.

Shift Drum [B]

 Apply a non-permanent locking agent to the shift shaft return spring pin [D], and tighten it.

Torque - Shift Shaft Return Spring Ping: 39 N·m (4.0 kgf·m, 29 ft·lb)

• Set the gear set lever to the neutral position.

Shift Drum Cam [A]

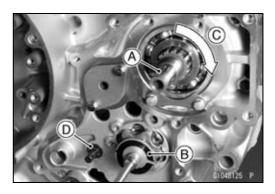
Gear Set Lever [B]

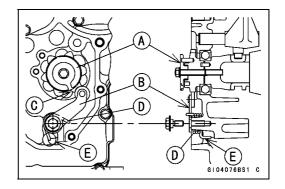
Neutral Position [C]

Spring [D]

- Set the spring end to the crankcase as shown [E].
- Tighten:

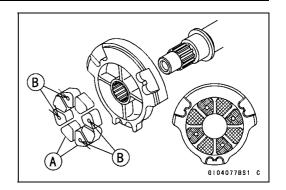
Torque - Gear Set Lever Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)



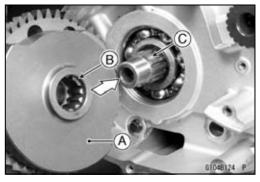


Crankcase

• Install the balancer dampers [A] so that each damper hole [B] is positioned alternately.



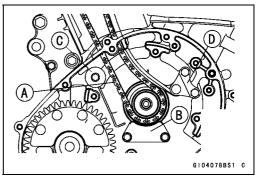
• Install the left balancer [A] on the balancer shaft in the engine left side while fitting the alignment tooth [B] onto the alignment notch [C] of the splines.



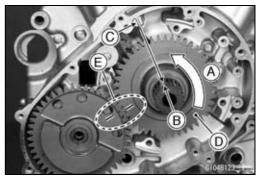
- Install the camshaft chain [A], lower chain guide [B], retainer [C] and rear chain guide [D] in the engine left side.
- Tighten:

Torque - Camshaft Chain Guide Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)

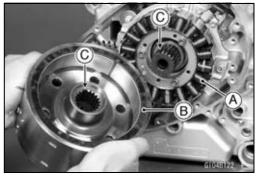
Camshaft Chain Guide Relainer Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)



- Turn the crankshaft counterclockwise [A] and align the alignment tooth [B] with the middle of the crankcase rib [C]. This makes the front piston set to its top dead center.
- Install the crankshaft balancer gear [D] while fitting the alignment notch of the splines onto the alignment tooth.
- OAligning the balancer gear marks (line mark) [E] with the front piston on its top dead center.



- Install:
 - Inside Stator Coil [A] (see Electrical System chapter) Alternator Rotor [B]
- Olnstall the alternator rotor while fitting the alignment notch [C] of the splines onto the alignment tooth [D].

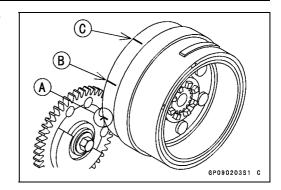


9-18 CRANKSHAFT/TRANSMISSION

Crankcase

OBe sure to align the balancer gear mark with the alternator mark (shorter line mark) [A] while keeping the front piston on its top dead center.

Top Mark for Rear Piston [B] (longer mark)
Top Mark for Front Piston [C] (longer mark)



- Apply molybdenum disulfide oil to the threads and the seating surface of the left balancer gear bolt, and alternator rotor bolt.
- Holding the alternator rotor steady with the flywheel holder [A].

Special Tool - Flywheel Holder: 57001-1410

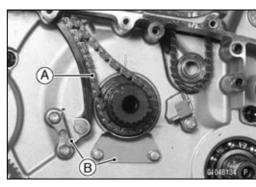
- Install the ratchet [B].
- Tighten:

Torque - Left Balancer Gear Bolt [C]: 85 N·m (8.7 kgf·m, 63 ft·lb)

Alternator Rotor Bolt [D]: 78 N·m (8.0 kgf·m, 58 ft·lb)

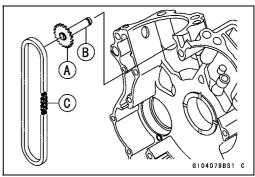
- Install the following parts in the engine right side.
 Camshaft Chain [A]
 Chain Guide [B]
- Tighten:

Torque - Camshaft Chain Guide Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)



• Install:

Water Pump Sprocket [A] with Shaft [B] Chain [C]

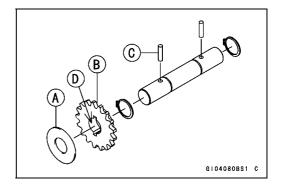


Crankcase

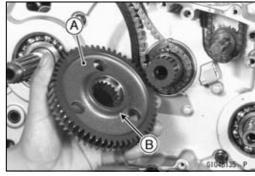
• Install:

Washer [A] Idle Shaft Sprocket [B]

• Fit the pin [C] into the slots [D] of the idle shaft sprocket.



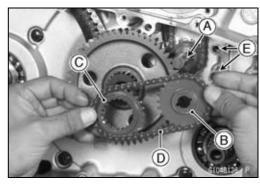
• Install the primary gear [A] with the boss [B] facing toward the engine inside.



• Install:

Pin [A]
Idle Shaft Sprocket [B]
Water Pump Drive Sprocket [C] and Chain [D]
Dowel Pins [E]

• Stuff the cloth on the holes of the crankcase so that the pin does not drop into the crankcase bottom.

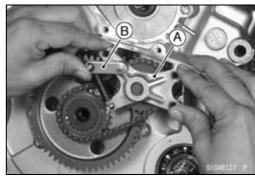


• Install:

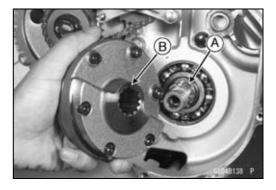
Idle Shaft Holder [A] and Water Pump Chain Guide [B] as shown.

• Tighten:

Torque - Idle Shaft Holder Bolts: 8.3 N·m (0.85 kgf·m, 73 in·lb)



• Fit the alignment tooth [A] of the splines of the right balancer [B] onto the alignment notch of the balancer shaft.



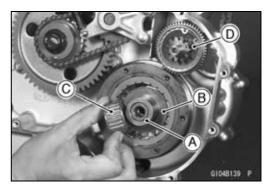
9-20 CRANKSHAFT/TRANSMISSION

Crankcase

Install the collar [A], copper washer [B], and needle bearing [C] in the order listed.

OThe copper washer must be on the collar.

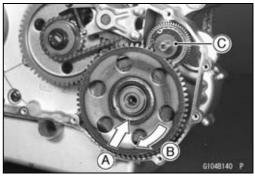
• Install the starter torque limiter [D].



- Push the starter clutch gear [A] in and turn it clockwise [B] and install it.
- Apply molybdenum disulfide oil to the threads and seating surface of the starter clutch bolt and tighten it to the specified torque while holding the primary gear bolt.

Torque - Starter Clutch Bolt: 85 N·m (8.7 kgf·m, 63 ft·lb)

OBe sure to install the washer [C] onto the torque limiter.



• Install:

Clutch (see Clutch chapter)

Clutch Cover

Shift Mechanism (see this chapter)

Damper Cam and Front Gear Case (see Final Drive chapter)

Water Pump (see Cooling System chapter)

Cylinder (see Engine Top End chapter)

Piston (see Engine Top End chapter)

Alternator Inner Cover, Alternator Cover, Alternator

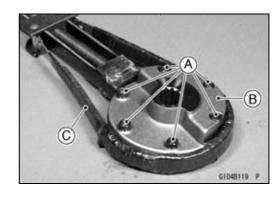
Outer Cover (see Electrical System chapter)

Engine (see Engine Removal/Installation chapter)

Starter Clutch Disassembly

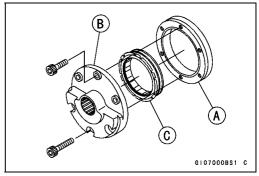
- Remove the starter clutch assy (see Crankcase Disassembly).
- Remove the Allen bolts [A] with the balancer mass [B] held with the flywheel holder [C].

Special Tool - Flywheel Holder: 57001-1313



Crankcase

- Pull the coupling [A] out of the right balancer [B].
- Take the one-way clutch [C] out of the coupling.



Starter Clutch Assembly

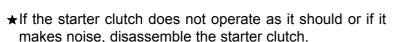
- Install the one way clutch [A] so that its groove [B] faces outward and its flange [C] fits between the right balancer [D] and the coupling [E].
- Apply a non-permanent locking agent to the threads of the coupling bolts, and tighten them to the specified torque.

Torque - Starter Clutch Coupling Bolts: 15 N·m (1.5 kgf·m, 11 ft·lb)

Special Tool - Flywheel Holder: 57001-1313

Starter Clutch Inspection

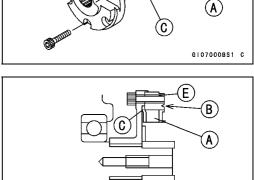
- Remove the starter clutch gear [A] and torque limiter, then reinstall the starter clutch gear into the starter clutch.
- Turn the starter clutch to both side.
- OWhen viewed from the right side of the engine, the clutch should turn clockwise [B] freely, but should not turn counterclockwise [C].

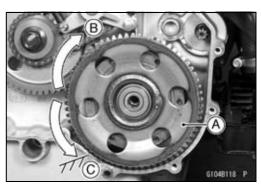


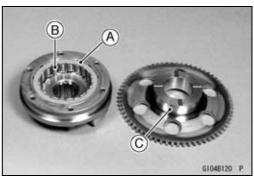
- ★If one-way clutch [A] installation is wrong, reinstall it.
- ★ Visually inspect the one-way clutch, coupling and starter clutch gear for damage.
- ★If there is any worn or damaged surface in the following parts, replace it.

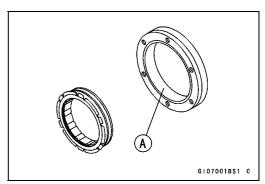
Sliding Surface [B] and Cage of One-way Clutch Sliding Surface [C] of Starter Clutch Gear

Sliding Surface [A] of Coupling









9-22 CRANKSHAFT/TRANSMISSION

Crankcase

Starter Torque Limiter Check

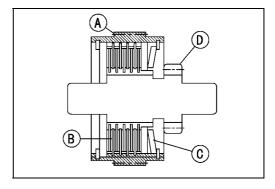
- Remove the torque limiter (see Crankcase Disassembly) and visually inspect it.
- ★If the limiter has wear, discoloration, or other damage, replace it as a set.

Ġear [A]

Friction Plates [B]

Spring [C]

Pinion [D]



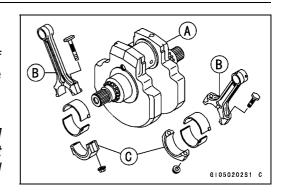
Crankshaft/Connecting Rods

Connecting Rod Removal

- Remove the crankshaft.
- Remove the connecting rod big end nuts, and take off the rod and cap along with the bearing inserts from the crankshaft [A].

NOTE

OMark and record the locations of the connecting rods [B] and their big end caps [C] with the bearing inserts left attached so that they can be installed in their original positions.



CAUTION

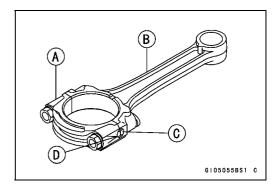
To prevent damage to the crankpin surfaces, do not allow the connecting rod bolts to bump against the crankpins.

Connecting Rod Installation

CAUTION

To minimize vibration, the connecting rods should have the same weight mark.

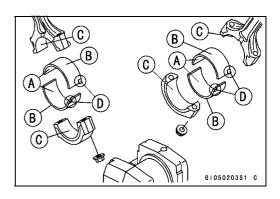
Big End Cap [A]
Connecting Rod [B]
Weight Mark, Alphabet [C]
Diameter Mark (Around Weight Mark) [D]: "O" or no mark



CAUTION

If the connecting rods, bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

- Apply molybdenum disulfide oil to the inside [A] of the big end bearing inserts.
- ★If bearing inserts are replaced, install them as follows.
- ODo not apply molybdenum disulfide oil to the outside [B] of the inserts or the inside [C] of the connecting rod and cap.
- Olnstall the inserts so that their nails [D] are on the same side and fit into the recess of the connecting rod and cap.



9-24 CRANKSHAFT/TRANSMISSION

Crankshaft/Connecting Rods

OWhen installing the inserts [A], be careful not to damage the insert surface with the edge of the connecting rod [B] or the cap [C]. One way to install inserts is as follows:

Installation [D] to Cap

Installation [E] to Connecting Rod

Push [F]

Dowel Pin [G]

Connecting Rod Bolts [H]

- Install the cap on the connecting rod, aligning the weight and diameter marks.
- Remove debris and clean the surface of inserts.
- Apply molybdenum disulfide oil [MO] to the threads, seating surfaces of the big end nuts and threads of con-rod bolts.
- Tighten the big end nuts to the specified torque.

Torque - Connecting Rod Big End Nuts: 59 N·m (6.0 kgf·m, 43 ft·lb)

Crankshaft/Connecting Rod Cleaning

- After removing the connecting rods from the crankshaft, clean them with a high-flash point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

Connecting Rod Bend

- Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end cap.
- Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
- Select an arbor of the same diameter as the piston pin and more than 105 mm long, and insert the arbor [B] through the connecting rod small end.
- On a surface plate, set the big-end arbor on a V block [C].
- With the connecting rod held vertically, use a height gauge to measure the difference in the height of the arbor above the surface plate over a 100 mm length to determine the amount of connecting rod bend.
- ★If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Bend

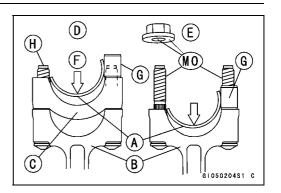
Service Limit: TIR 0.2/100 mm (0.08/3.94 in.)

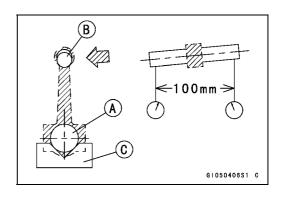
Connecting Rod Twist

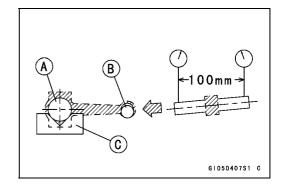
- With the big-end arbor [A] still on the V block [C], hold the connecting rod horizontally and measure the amount that the arbor [B] varies from being parallel with the surface plate over a 100 mm length of the arbor to determine the amount of connecting rod twist.
- ★If connecting rod twist exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Twist

Service Limit: TIR 0.2/100 mm (0.08/3.94 in.)







Crankshaft/Connecting Rods

Connecting Rod Big End Side Clearance

- Measure the side clearance [B] of the connecting rod big end [A].
- Olnsert a thickness gauge between the big end and either crank web to determine clearance.

Connecting Rod Big End Side Clearance

Standard: $0.16 \sim 0.46 \text{ mm} (0.0062 \sim 0.0181 \text{ in.})$

Service Limit: 0.7 mm (0.028 in.)

★ If the clearance exceeds the service limit, replace the connecting rod with new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.

Connecting Rod Big End Bearing Wear

- Remove the big end cap and place a strip of plastigage on the crankpin [A].
- Apply:

Molybdenum Disulfide Oil- Threads and Seating Surface of Big End Nuts.

Tighten the big end nuts to the specified torque to compress the plastigage and measure the plastigage width
 [B] to determine the bearing insert/crankpin clearance.

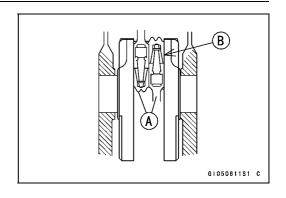
Torque - Connecting Rod Big End Nuts: 59 N·m (6.0 kgf·m, 43 ft·lb)

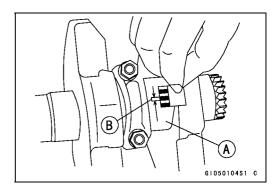
ODo not move the connecting rod and crankshaft during clearance measurement.

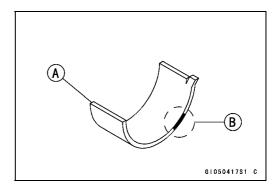
Connecting Rod Big End Bearing/Crankpin Clearance Standard: 0.026 ~ 0.057 mm (0.001024 ~ 0.0022 in.)

Service Limit: 0.10 mm (0.0039 in.)

- ★If the clearance is within the standard, no bearing insert replacement is required.
- ★If the clearance is between 0.057 mm (0.0022 in.) and the service limit (0.10 mm, or 0.0039 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/crankpin clearance with plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.







9-26 CRANKSHAFT/TRANSMISSION

Crankshaft/Connecting Rods

★If the clearance exceeds the service limit, measure the diameter of the crankpin [A].

Crankpin Diameter

Standard: 54.981 ~ 55.000 mm (2.1646 ~ 2.1654 in.) Service Limit: 54.97 mm (2.1642 in.)

- ★ If the crankpin has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured crankpin diameter is not less than the service limit, but does not coincide with the original diameter marking on the crankshaft, make a new mark on it.



None: 54.981 ~ 54.991 mm (2.1646 ~ 2.16500 in.) O: 54.992 ~ 55.000 mm (2.16504 ~ 2.1654 in.)

Crankpin Diameter Mark: "O" mark or no mark [B]

Apply:

Molybdenum Disulfide Oil -

Threads and Seating Surface of Big End Nuts

 Temporarily, install the big end cap and tighten the big end nuts to the specified torque.

Torque - Connecting Rod Big End Nuts: 59 N·m (6.0 kgf·m, 43 ft·lb)

- Measure the connecting rod big end inside diameter, and mark each connecting rod big end in accordance with the inside diameter.
- OThe mark already on the big end should almost coincide with the measurement because of little wear.

Connecting Rod Big End Inside Diameter Marks

None: 58.000 ~ 58.010 mm (2.2835 ~ 2.28386 in.) O: 58.011 ~ 58.020 mm (2.28390 ~ 2.2843 in.)

Big End Cap [A]

Connecting Rod [B]

Weight Mark, Alphabet [C]

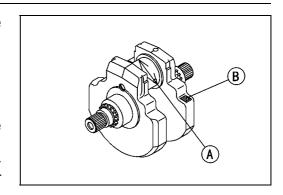
Diameter Mark (around weight mark) [D]: "O" or no mark

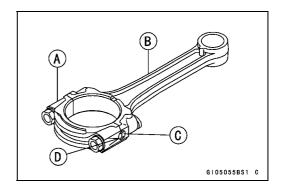
 Select the proper bearing insert [A] identified by the size color [B] in accordance with the combination of the connecting rod and crankshaft coding.

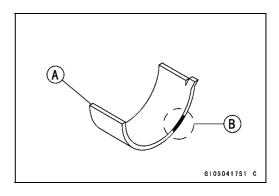
Big End Bearing Insert Selection

Con-rod Big End	Crankpin	Bearing Insert	
Bore Diameter Marking	Diameter Mark	Size Color	Part Number
None	0	Brown	92028-1476
None	None	Dlask	92028-1475
0	0	Black	92020-1475
0	None	Blue	92028-1474

• Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.







Crankshaft/Connecting Rods

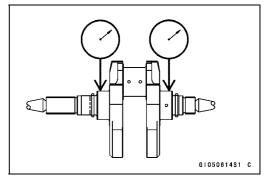
Crankshaft Runout

- Measure the crankshaft runout.
- ★ If the measurement exceeds the service limit, replace the crankshaft.

Crankshaft Runout

Standard: TIR 0.02 mm (0.0008 in.) or less

Service Limit: TIR 0.05 mm (0.0020 in.)



Crankshaft Main Bearing/Journal Wear

• Measure the diameter [A] of the crankshaft main journal.

Crankshaft Main Journal Diameter

Standard: 54.986 ~ 55.000 mm (2.1648 ~ 2.1654

in.)

Service Limit: 54.96 mm (2.1638 in.)

★If any journal has worn past the service limit, replace the crankshaft with a new one.

• Measure the main bearing bore diameter [A] in the crankcase halves.

Crankcase Main Bearing Bore Diameter

Standard: 55.025 ~ 55.038 mm (2.1663 ~ 2.1669

in.)

Service Limit: 55.07 mm (2.1681 in.)

★If they are any signs of seizure, damage, or excessive wear, replace the crankcase halves as a set.

Crankshaft Side Clearance

Measure the crankshaft side clearance.

Crankshaft Side Clearance

Standard: 0.05 ~ 0.55 mm (0.00197 ~ 0.0217 in.)

Service Limit: 0.75 mm (0.0295 in.)

Clearance [A] Crankcase [B] Crankshaft [C]

★ If the clearance is greater than the service limit, measure the crankshaft web length [A] to see whether the crankshaft or the crankcase is faulty.

Crankshaft Web Length

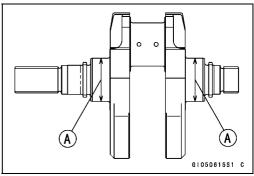
Standard: 96.85 ~ 96.95 mm (3.8130 ~ 3.8169 in.)

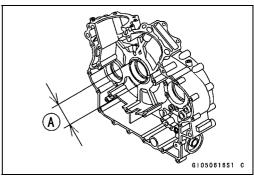
Service Limit: 96.6 mm (3.803 in.)

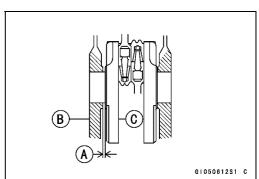
★ If the length measurement is smaller than the service limit, replace the crankshaft. Otherwise, replace the crankcase halves as a set.

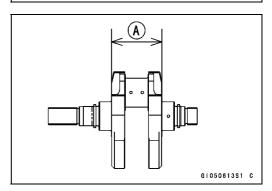
CAUTION

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









9-28 CRANKSHAFT/TRANSMISSION

Primary Gear

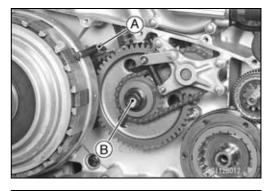
Primary Gear Removal

• Remove:

Clutch Cover (see Clutch chapter) Starter Clutch Gear (see this chapter)

• Using the gear holder [A] to loosen the primary gear bolt [B].

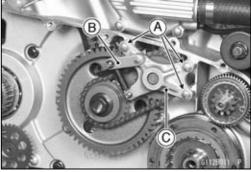
Special Tool - Gear Holder: 57001-1557



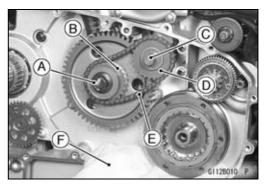
• Install:

Clutch (see Clutch chapter) Bolts [A]

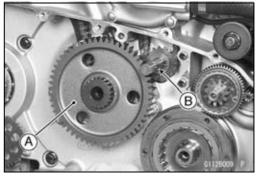
• Remove the water pump chain guide [B] and water pump idle shaft holder [C] from the right crankcase.



- Remove the primary gear bolt [A], water pump drive sprocket [B], idle shaft [C], and idle shaft sprocket [D].
 Water Pump Chain [E]
- OStuff the cloth [F] on the holes of the crankcase so that the pin close not drop into the crankcase bottom.

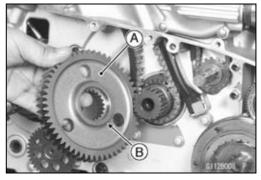


• Pull the primary gear [A] out of the crankshaft, and take the pin [B] out of the idle shaft.



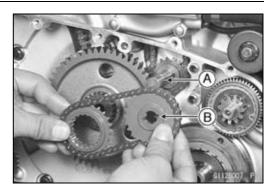
Primary Gear Installation

• Fit the primary gear [A] with the boss [B] facing toward the engine inside.



Primary Gear

• Fit the pin [A] into the slot [B] of the water pump drive sprocket boss and install the sprockets.



• Install:

Dowel Pins [A] Washer [B]

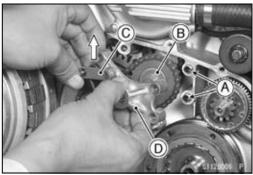
- Pulling the water pump chain guide [C] and install the idle shaft holder [D].
- Install the clutch (see Clutch chapter).
- Tighten:

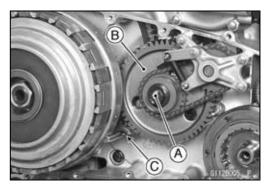
Torque - Idle Shaft Holder Bolts: 8.3 N·m (0.85 kgf·m, 73 in·lb)

• Apply molybdenum disulfide oil to the threads and seating surface, and tighten the primary gear bolt [A], while holding the primary gear [B] with the gear holder [C].

Special Tool - Gear Holder: 57001-1557

Torque - Primary Gear Bolt: 147 N·m (15.0 kgf·m, 108 ft·lb)



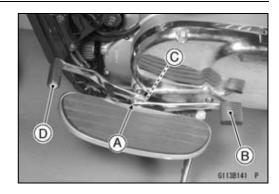


9-30 CRANKSHAFT/TRANSMISSION

Transmission

Shift Pedal Removal

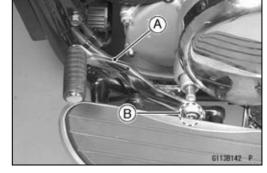
- Unscrew the rear shift pedal clamp bolt [A] and take off the rear shift pedal [B].
- Unscrew the front shift pedal clamp bolt [C] and pull out the front shift pedal [D].



Shift Pedal Installation

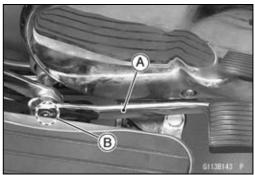
- For the front shift pedal, install the shift pedal [A] so that the punched mark on the pedal is up the 1 serration [B] from the punched mark on the shaft.
- Tighten the clamp bolt.

Torque - Shift Pedal Clamp Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb) 30 N·m (3.1 kgf·m, 22 ft·lb) VN1600-A2 ~



- For the rear shift pedal, install the shift pedal [A] so that the punched mark on the shaft is aligned [B] with the punched mark on the pedal.
- Tighten the clamp bolt.

Torque - Shift Pedal Clamp Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb) 30 N·m (3.1 kgf·m, 22 ft·lb) VN1600-A2 ~



External Shift Mechanism Removal

• Remove:

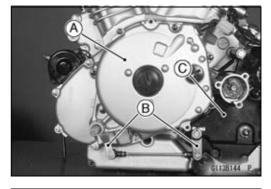
Shift Pedals (see this chapter)

Alternator Outer Cover [A] (see Electrical System chapter)

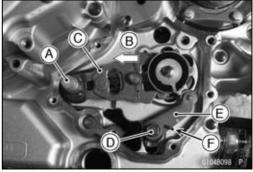
Engine (see Engine Removal/Installation chapter)

Front and Rear Shift Levers [B]

Front Gear Case [C] (see Final Drive chapter)



- Remove the shift shaft [A] while pushing [B] the shift mechanism arm [C] towards the shift shaft.
- Unscrew the bolt [D] and remove the gear set lever [E] and its spring [F].



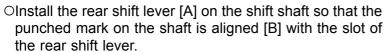
Transmission

External Shift Mechanism Installation

• Install the gear set lever [A] and the spring [B] in the crankcase and tighten the bolt [C].

Torque - Gear Set Lever Bolt: 11 N·m (1.1 kgf·m, 95 in·lb)

- Install the shift mechanism arm assy. Be sure to install the washer [D] onto the shift shaft.
- Install the front gear case (see Final Drive chapter).
- Install the front shift lever and the rear shift lever.



- Loosen the locknuts [C] and turn the shift rod [D] so that the outside length [E] of the locknuts is 112 ±1 mm (4.4 ±0.04 in.).
- OThe rear locknut has left-hand threads.
- Tighten:

Torque - Shift Rod Locknuts: 11 N·m (1.1 kgf·m, 95 in·lb)

Rear Shift Lever Clamp Bolt: 12 N·m (1.2 kgf·m,

104 in·lb)



Engine (see Engine Removal/Installation) Shift Pedal (see this chapter)

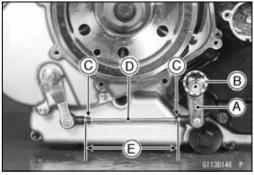
External Shift Mechanism Inspection

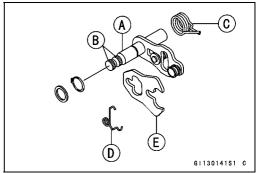
- Examine the shift shaft [A] for any damage.
- ★If the shaft is bent, straighten or replace it.
- ★If the serrations [B] are damaged, replace the shaft.
- ★If the springs [C] [D] are damaged in any way, replace them.
- ★If the shift mechanism arm [E] is damaged in any way, replace the arm.
- Check the return spring pin [A] is not loose.
- ★If it is loose, unscrew it, apply a non-permanent locking agent to the threads, and tighten it.

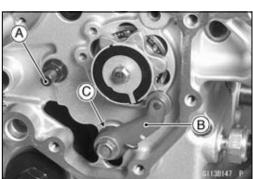
Torque - Shift Shaft Return Spring Pin: 39 N·m (4.0 kgf·m, 29 ft·lb)

- Check the gear set lever [B], and its spring [C] for breaks or distortion.
- ★If the lever or spring is damaged in any way, replace it.
- Visually inspect the shift drum pins, pin holder, and pin plate.
- ★ If they are badly worn or if they show any damage, replace them.









9-32 CRANKSHAFT/TRANSMISSION

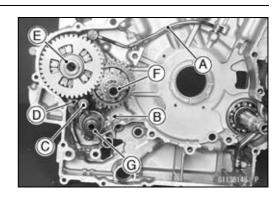
Transmission

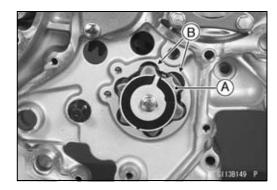
Transmission Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Split the crankcase (see this chapter).
- Remove the crankshaft.
- First, remove the oil pipe [A] (see Engine Lubrication System chapter), and then remove the shift drum bearing holder bolts and holder [B].
- Pull out the shift rod [C] and take the shift fork [D] out of the output shaft 4th gear.

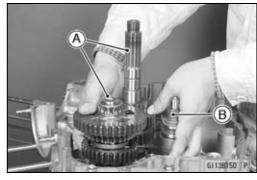
Output Shaft [E] Drive Shaft [F] Shift Drum [G]

• Align the shift drum cam [A] with the cutoff [B] of the left crankcase by turning the shift drum.





- Take out the transmission shafts [A] and shift drum [B] as a set
- Separate the drive and output shafts, shift drum, and shift forks.



Transmission Installation

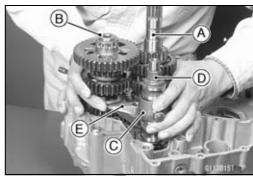
• Install the drive and output shaft assy, shift drum, and output shaft 5th gear shift fork as a set.

Drive Shaft Assy [A]

Output Shaft Assy [B]

Shift Fork (drive shaft, 3rd gear) [C] and Shift Drum Assy [D]

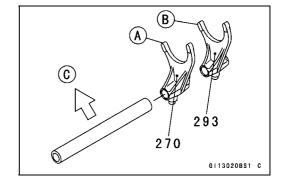
Shift Fork (No. 270, output shaft, 5th gear) [E]



Transmission

- OEach output shaft shift fork has an identification number. Do not confuse them.
- Install the shift forks with each number faced left as shown.

Shift Fork (No. 270, 5th gear) [A] Shift Fork (No. 293, 4th gear) [B] Front [C].



- Apply a non-permanent locking agent to the shift drum bearing holder bolts.
- Tighten:

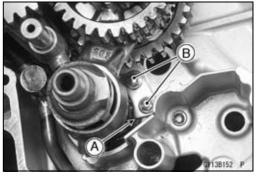
Torque - Shift Drum Bearing Holder Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)

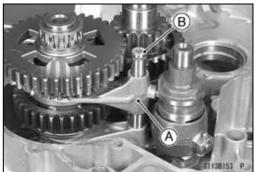
Install:

Shift Drum Bearing Holder [A] Bolts [B]

- Apply engine oil to the shift rod, the shift forks, and gears.
- Install:

Shift Fork (No. 293 output shaft, 4th gear) [A] Shift Rod [B]





Shift Drum Disassembly/Assembly

- Remove the shift drum assy [A] (see this chapter).
- Remove:

Drive Shaft Shift Fork (No. 292, drive shaft) [B] Cotter Pin [C]



• Disassemble the shift drum assy as shown.

Pin Plate [A]

Pin [B]

Cam [C]

Bearing [D]

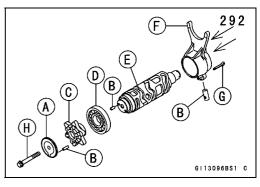
Shift Drum [E]

Drive Shaft Shift Fork (No. 292) [F]

Cotter Pin [G]

- Be sure to face the number to the right and insert the cotter pin of the drive shaft shift fork from the right as shown
- Apply a non-permanent locking agent to the threads of the shift drum cam bolt [H] and tighten it.

Torque - Shift Drum Cam Bolt: 15 N·m (1.5 kgf·m, 11 in·lb)



9-34 CRANKSHAFT/TRANSMISSION

Transmission

Transmission Disassembly

• Remove the transmission shafts (see this chapter). Using the circlip pliers (special tool), remove the circlips, and disassemble the transmission shaft.

Special Tool - Outside Circlip Pliers: 57001-144

The 4th gear [A] on the output shaft has three steel balls for the positive neutral finder mechanism.

Remove the 4th gear as follows.

- OSet the output shaft in a vertical position holding the 3rd gear [B].
- OSpin the 4th gear quickly [C] and pull it off upward.

Transmission Assembly

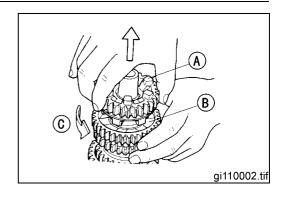
ORefer to the illustration on P.29.

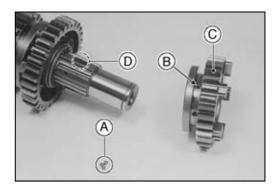
- Align each gear oil hole with the drive shaft oil hole when installing the 3rd gear [9] and the 5th gear [6].
- Align each oil hole with the output shaft oil hole, when installing the 3rd gear [17], bushing [18], and the 5th gear [16].

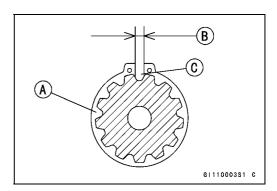


Do not apply grease to the steel balls to hold them in place. This will cause the positive neutral finder mechanism to malfunction.

- Fit the three steel balls [A] into the holes [B] of the output 4th gear [C], and then install the gear on the output shaft so that the steel balls align with the recesses [D] in the shaft.
- OAfter assembling the 4th gear with steel balls in place on the output shaft, check the ball-locking effect that the 4th gear does not come out of the output shaft when moving it up and down by hand.
- Replace any circlip [A] that were removed with new ones.
- Install the circlips so that the opening [B] is aligned with a spline groove [C].



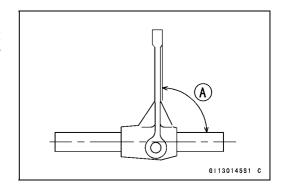




Transmission

Shift Fork Bending

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



Shift Fork/Gear Groove Wear

- Measure the thickness of the shift fork ears [A], and measure the width [B] of the gear grooves.
- ★If the thickness of a shift fork ear is less than the service limit, the shift fork must be replaced.

Shift Fork Ear Thickness

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

Service Limit: 5.8 mm (0.228 in.)

★If the gear groove is worn over the service limit, the gear must be replaced.



Standard: 6.05 ~ 6.15 mm (0.238 ~ 0.242 in.)

Service Limit: 6.3 mm (0.248 in.)

Shift Fork Guide Pin/Drum Groove Wear

- Measure the diameter of each shift fork guide pin [B], and measure the width [A] of each shift drum groove.
- ★If the guide pin on any shift fork is less than the service limit, the fork must be replaced.

Shift Fork Guide Pin Diameter

Standard: 7.9 ~ 8.0 mm (0.311 ~ 0.315 in.)

Service Limit: 7.8 mm (0.307 in.)

★If any shift drum groove is worn over the service limit, the drum must be replaced.

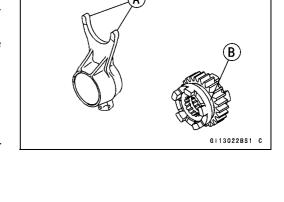
Shift Drum Groove Width

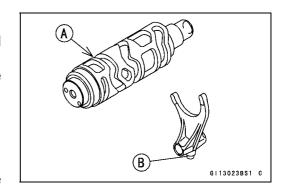
Standard: 8.05 ~ 8.20 mm (0.317 ~ 0.323 in.)

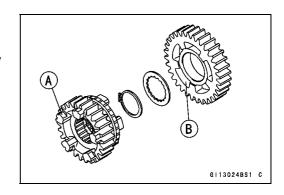
Service Limit: 8.3 mm (0.327 in.)

Gear Dog and Gear Dog Hole Damage

- Visually inspect the gear dogs [A] and gear dog holes [B].
- ★Replace any damaged gears or gears with excessively worn dogs or dog holes.

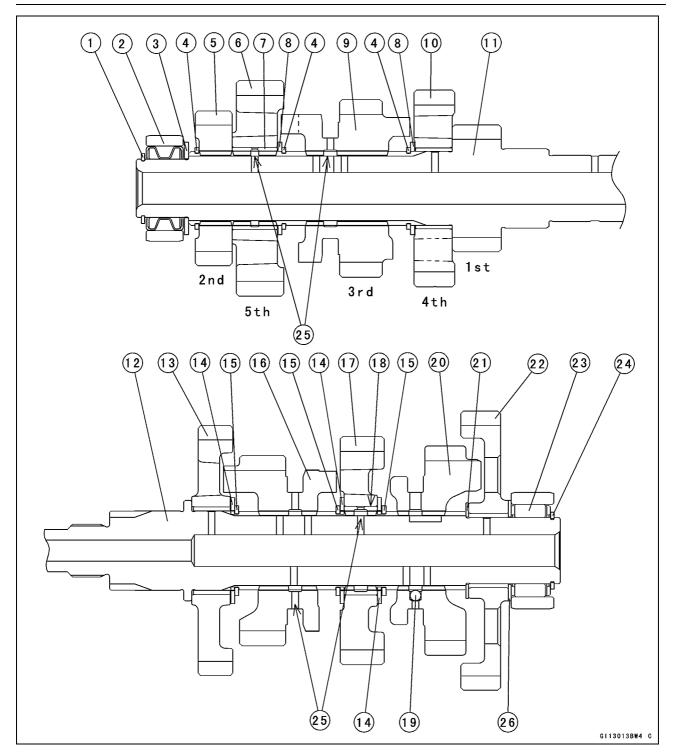






9-36 CRANKSHAFT/TRANSMISSION

Transmission



- 1. Circlip $(\phi \ 20 \times 25.5 \times t \ 1.2)$
- 2. Needle Bearing
- 3. Thrust Washer $(\phi 22.3 \times 35 \times t 1.6)$
- 4. Three Circlips (ϕ 28)
- 5. 2nd Gear
- 6. 5th (top) Gear
- 7. Bushing (5th gear)
- 8. Two Splined Washers $(\phi 28.5 \times 34 \times t 1.5)$
- 9. 3rd Gear

- 10. 4th Gear
- 11. 1st Gear (drive shaft)
- 12. Output Shaft
- 13. 2nd Gear
- 14. Three Splined Washers $(\phi \ 30.3 \times 40 \times t \ 1.5)$
- 15. Three Circlips (ϕ 29)
- 16. 5th (top) Gear
- 17. 3rd Gear
- 18. Bushing (3rd gear)
- 19. Steel Balls
- 20. 4th Gear

- 21. Washer $(\phi \ 25.5 \times 36 \times t \ 1.0)$
- 22. 1st Gear
- 23. Needle Bearing
- 24. Circlip (ϕ 25)
- 25. Align gear or bushing oil holes with the shaft holes.
- 26. Washer $(\phi \ 25.5 \times 38 \times t \ 1.0)$

Ball Bearing, Needle Bearing, and Oil Seal

Ball Bearing and Outer Race Replacement

CAUTION

Do not remove the ball bearing or needle bearing outer race unless it is necessary. Removal may damage them.

• Using a press or puller, remove the ball bearing and/or needle bearing outer race.

NOTE

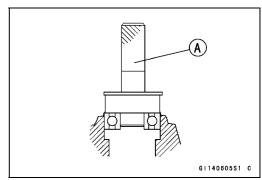
OIn the absence of the above mentioned tools, satisfactory results may be obtained by heating the case to approximately 93°C (200°F) max., and tapping the bearing in or out.

CAUTION

Do not heat the case with a blowtorch. This will warp the case. Soak the case in oil and heat the oil.

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

Special Tool - Bearing Driver Set: 57001-1129

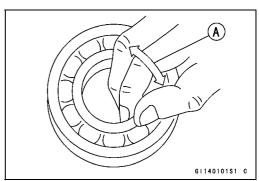


Ball and Needle Bearing Wear

CAUTION

Do not remove the ball bearings for inspection. Removal may damage them.

- Check the ball bearings.
- OSince 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.
- OSpin [A] the bearing by hand to check its condition.
- ★If the bearing is noisy, does not spin smoothly, or has any rough spots, replace it.
- Check the needle bearings.
- OThe 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.



9-38 CRANKSHAFT/TRANSMISSION

Ball Bearing, Needle Bearing, and Oil Seal

Oil Seal Inspection

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

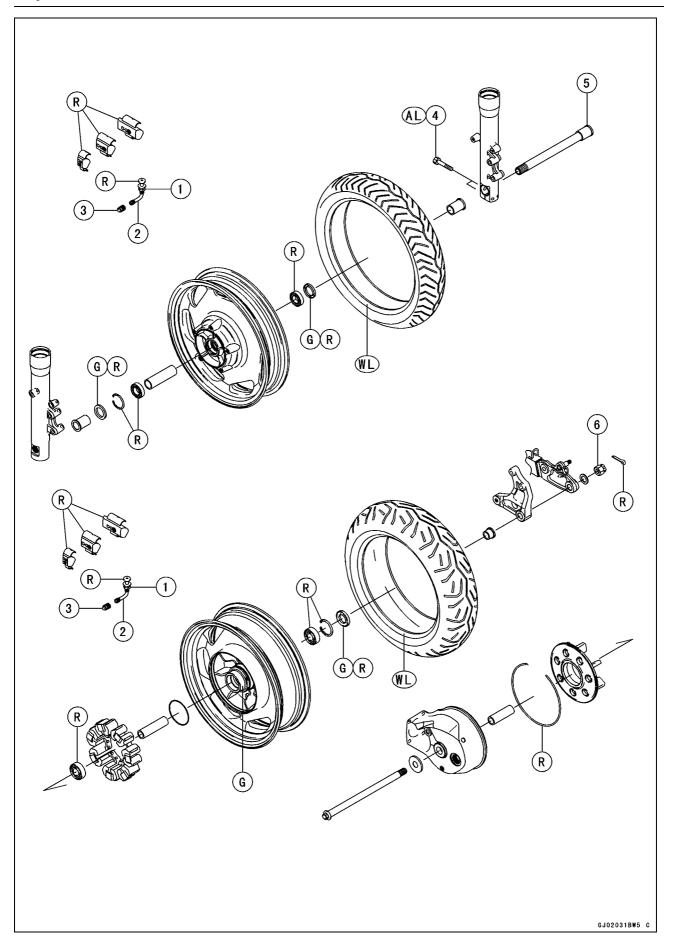
Wheels/Tires

Table of Contents

Exploded View	10-2
Specifications	10-4
Special Tools	10-5
Wheels (Rims)	10-6
Front Wheel Removal	10-6
Front Wheel Installation	10-7
Rear Wheel Removal	10-8
Rear Wheel Installation	10-9
Wheel Coupling Removal	10-10
Wheel Coupling Installation	10-11
Wheel Inspection	10-11
Axle Inspection	10-12
Wheel Balance	10-12
Balance Inspection	10-12
Balance Adjustment	10-12
Balance Weight Removal	10-13
Balance Weight Installation	10-13
Tires	10-15
Air Pressure Inspection/Adjustment	10-15
Tire Inspection	10-15
Tire Removal	10-15
Tire Installation	10-15
Tire Repair	10-17
Hub Bearings (Wheel Bearings)	10-18
Hub Bearings Removal	10-18
Hub Bearings Installation	10-18
Hub Bearings Inspection	10-19
Hub Bearings Lubrication	10-19

10-2 WHEELS/TIRES

Exploded View



No	Fastener		Damanka		
No.		N⋅m	kgf⋅m	ft∙lb	Remarks
1	Tire Air Valve Nuts	1.5	0.15	13 in·lb	
2	Air Valve Cores	0.3	0.03	2.6 in·lb	
3	Tire Air Valve Caps	0.15	0.015	1.3 in·lb	
4	Front Axle Clamp Bolt	20	2.0	15	AL
4	Front Axle Clamp Bolt (VN1600-A2 ~)	29	3.0	21	AL
5	Front Axle	108	11.0	79.6	
6	Rear Axle Nut	108	11.0	79.6	

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

G: Apply grease.

R: Replacement Parts

WL: Apply soap and water solution or rubber lubricant.

10-4 WHEELS/TIRES

Specifications

Item	Item Standard	
Wheels (Rims)		
Rim Size:		
Front	16 × 3.00	
Rear	16 × 4.50	
Rim Runout (with tir installed):		
Axial	TIR 0.5 mm (0.02 in.) or less	TIR 1.0 mm (0.04 in.)
Radial	TIR 0.8 mm (0.03 in.) or less	TIR 1.0 mm (0.04 in.)
Axle runout/100 mm (3.94 in.)	TIR 0.05 mm (0.002 in.) or less	TIR 0.2 mm (0.008 in.)
Wheel Balance	10 g (0.35 oz.) or less	
Balance Weights	10 g (0.35 oz.), 20 g (0.71 oz.),	
	30 g (1.1 oz.)	
Tires		
Air Pressure (When Cold):		
Front	Up to 186 kg (410 lb) load:	
	200 kPa (2.0 kg/cm², 28 psi)	
Rear	Up to 186 kg (410 lb) load:	
	250 kPa (2.5 kg/cm², 36 psi)	
Tread depth:		
Front	BRIDGESTONE: 4.3 mm (0.17 in.)	1 mm (0.04 in.)
		(DE, AT, CH) 1.6 mm (0.063 in.)
		Up to 130 km/h (80 mph):
Rear	DDIDCESTONE: 7.2 mm (0.39 in)	2 mm (0.08 in.)
Real	BRIDGESTONE: 7.2 mm (0.28 in.)	Over 130 km/h (80 mph):
		3 mm (0.1 in.)
Standard tires:	Make, Type	Size
Front	BRIDGESTONE EXEDRA G721	130/90-16 M/C 67H
Rear	BRIDGESTONE EXEDRA G722	170/70B 16 M/C 75H

A WARNING

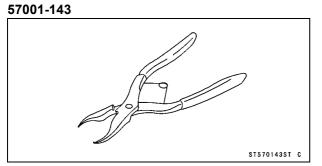
Use the same manufacturer's tires on both front and rear wheels.

AT: Republic of Austria CH: Swiss Confederation

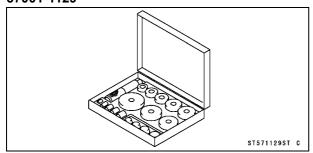
DE: Federal Republic of Germany

Special Tools

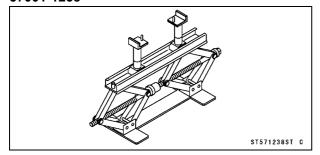
Inside Circlip Pliers:



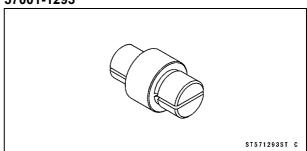
Bearing Driver Set: 57001-1129



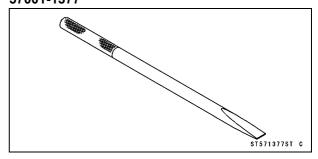
Jack: 57001-1238



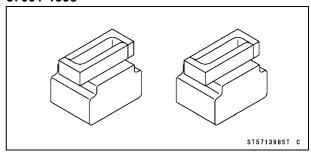
Bearing Remover Head, ϕ 20 × ϕ 22: 57001-1293



Bearing Remover Shaft, ϕ 13: 57001-1377

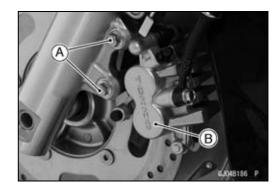


Attachment Jack: 57001-1398



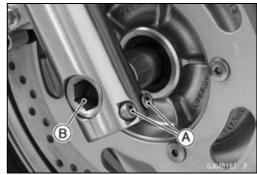
Front Wheel Removal

• Unscrew the front brake caliper mounting bolts [A] and remove the brake calipers [B] with the hose installed.



- For the European Model, remove the cap.
- Loosen:

Front Axle Clamp Bolts [A] Front Axle [B]



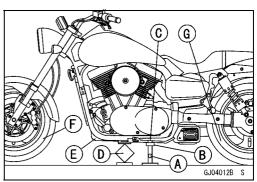
OUsing the jack [A] and the attachment jack [B] under the frame pipe ribs [C], and a commercially available jack [D] under the engine [E], lift the front wheel [F] OFF the ground until the rear wheel [G] touches the ground.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398



Be sure to put the rear wheel ON the ground when removing the front wheel, or the motorcycle may fall over. The motorcycle could be damaged.



A WARNING

Be sure to put the rear wheel ON the ground when removing the front wheel, or the motorcycle may fall over. It could cause an accident and injury.

 Unscrew the axle to the right and drop the front wheel [A] out of the fork.

CAUTION

Do not lay the wheel directly on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so that the disc does not touch the ground.



Front Wheel Installation

- Apply grease to the seal lips.
- Fit the collars [A] on the both side of the hub.
- OThe collars are identical.



- Insert the axle from the right side of the wheel.
- Tighten the axle.

Torque - Front Axle: 108 N·m (11 kgf·m, 79.6 ft·lb)

• Before tightening the clamp bolts on the right fork leg, pump the forks up and down [A] 4 or 5 times to allow the right fork leg to find a neutral position on the front axle.

NOTE

ODo not apply the front brake during this process to stop the motorcycle from rolling forward. Put a block in front of the wheel to stop it from moving.

• Tighten the axle clamp bolts [A] to the specified torque.

Torque - Front Axle Clamp Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb) Front Axle Clamp Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb) VN1600-A2 ~

NOTE

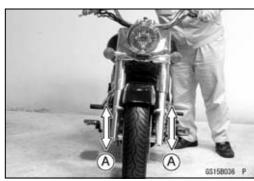
- O Tighten the two clamp bolts alternately two times to ensure even tightening torque.
- Check the clearance [B] between the front axle collar [C] and the right fork leg [D]. The clearance between the front axle collar and the right fork leg should be between 1.05 ~ 3.19 mm (0.041 ~ 0.124 in.).
- ★ If the clearance is out of this range, remove the front wheel again and check the axle, wheel hub and other related parts for damage.
- Tighten the caliper mounting bolts.

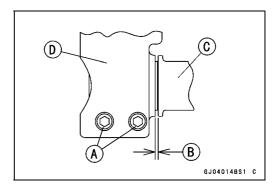
Torque - Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Check the front brake effectiveness.

A WARNING

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





10-8 WHEELS/TIRES

Wheels (Rims)

Rear Wheel Removal

• Using the jack [A] and attachment jack [B] under the frame pipe ribs [C], lift the rear wheel [D] off the ground until the front wheel [E] touches the ground.

CAUTION

Be sure to put the front wheel ON the ground when removing the rear wheel, or the motorcycle may fall over. The motorcycle could be damaged.

▲ WARNING

Be sure to put the front wheel ON the ground when removing the rear wheel, or the motorcycle may fall over. It could cause an accident and injury.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

• Squeeze the brake lever slowly and hold it with a band [A]

CAUTION

Be sure to hold the front brake when removing the rear wheel, or the motorcycle may fall over. The motorcycle could be damaged.

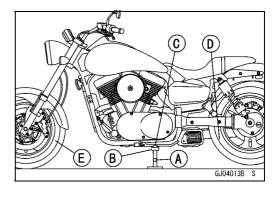
A WARNING

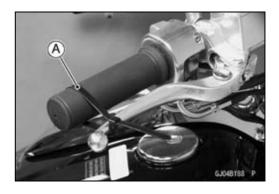
Be sure to hold the front brake when removing the rear wheel, or the motorcycle may fall over. It could cause an accident and injury.

• Remove:

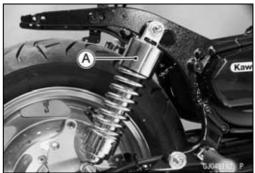
Caliper Mounting Bolts [A] Caliper [B]

Remove: Rear Shock Absorbers [A]









• Remove:

Caliper Holder Bolt [A] Axle Nut Cotter Pin [B] Axle Nut [C]

OPull the muffler out side and straighten the cotter pin.



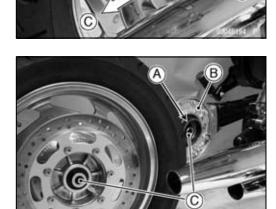
- Temporarily install the rear shock absorber.
- Pull out the axle, and slide the rear wheel [A] toward the right [B] to disengage the wheel from the final gear case.
- Move the rear wheel back [C] and remove it.

CAUTION

Do not lay the wheel directly on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so that the disc does not touch the ground.

Rear Wheel Installation

- Apply grease to the grease seal of the wheel.
- Apply grease to the ring gear hub splines [A] of the final gear case [B].
- Insert the collars [C] on both sides of the hub.



- Insert the axle [A] from the left side of the rear wheel.
- Slide the rear wheel to the left side, and engage the ring gear hub splines with the wheel coupling hub splines.
- Pull the axle little and install the caliper holder.
- Tighten:

Torque - Rear Axle Nut: 108 N·m (11 kgf·m, 79.6 ft·lb)

Rear Caliper Holder Bolt: 64 N·m (6.5 kgf·m, 47 ft·lb)

Rear Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)



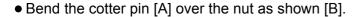
If the axle nut is not securely tightened, an unsafe riding condition may result.

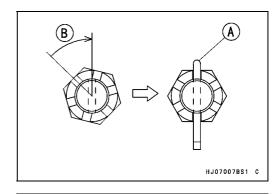


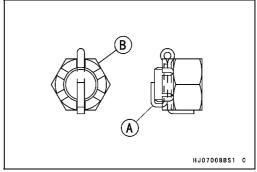
Insert a new cotter pin [A].

NOTE

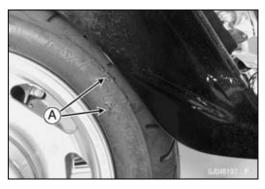
- OWhen inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle, tighten the nut clockwise [B] up to next alignment.
- OIt should be within 30 degree.
- OLoosen once and tighten again when the slot goes past the nearest hole.







- Visually inspect the tire for stuck any grease [A].
- ★If any grease have stuck to the surface of the tire, wash the tire clean with soap and water solution.



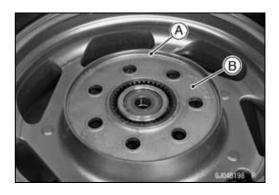
• Check the rear brake effectiveness.

A WARNING

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

Wheel Coupling Removal

- Remove the rear wheel (see Rear Wheel Removal).
- Remove the coupling retaining ring [A].
- Remove the wheel coupling [B] with a bearing puller if necessary.



Wheel Coupling Installation

- Replace the O-ring [A] and the retaining ring [B].
- Grease the following:

O-ring

Bosses [C] of Rear Drum Hub

Install:

Rubber Damper [D] Coupling [E] Retaining Ring

Wheel Inspection

• Raise the front or rear wheel off the ground.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

- Spin [A] the wheel lightly, and check for roughness or binding.
- ★ If roughness or binding is found, replace the hub bearings.
- Inspect the front and rear axles for damage (see this chapter).
- ★If the axle is damaged or bent, replace it.
- Inspect the wheel for small cracks, dents, bending, or warp.
- ★ If there is any damage to the wheel, replace the wheel.
- Measure the rim runout, radial [A] and axial [B], with a dial gauge.
- ★If the rim runout exceeds the service limit, check the hub bearings. Replace them if they are damaged.
- ★If the problem is not due to the bearings, replace the wheel.

Rim Runout (with tire installed)

Standard:

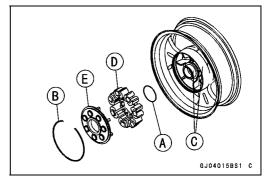
Axial TIR 0.5 mm (0.02 in.) or less Radial TIR 0.8 mm (0.03 in.) or less

Service Limit:

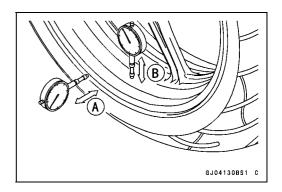
Axial TIR 1.0 mm (0.04 in.) Radial TIR 1.0 mm (0.04 in.)

A WARNING

Never attempt to repair a damaged wheel. If there is any damage besides wheel bearings, the wheel must be replaced to insure safe operational condition.







Axle Inspection

- Visually inspect the front and rear axles for damage.
- ★If the axle is damaged or bent, replace it.
- Place the axle in V blocks that are 100 mm (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 readings is the amount of runout.
- ★If axle runout exceeds the service limit, replace the axle.

Axle Runout/100 mm (3.94 in.)

Standard: TIR 0.05 mm (0.002 in.) or less

Service Limit: TIR 0.2 mm (0.008 in.)

Wheel Balance

- OTo improve stability and decrease vibration at high speed, the front and rear wheels must be kept balanced.
- Check and balance the wheels when required, or when a tire is replaced with a new one.

Balance Inspection

- Remove the wheel.
- Support the wheel so that it can be spun freely.
- Spin the wheel lightly, and mark [A] the wheel at the top when the wheel stops.
- ORepeat this procedure several times. If the wheel stops of its own accord in various positions, it is well balanced.
- ★ If the wheel always stops in one position, adjust the wheel balance.

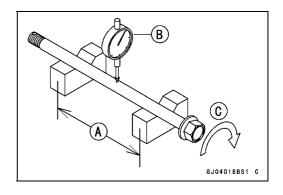
Balance Adjustment

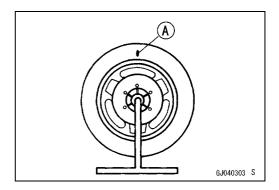
• If the wheel always stops in one position, provisionally attach a balance weight [A] to the rim flange at the marking, using adhesive tape.

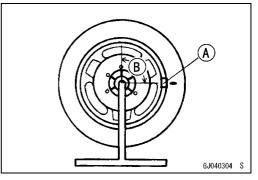
A WARNING

Use only the genuine balance weights.

- Rotate the wheel 1/4 turn [B], and see whether or not the wheel stops in this position. If it does, the correct balance weight is being used.
- ★If the wheel rotates and the weight goes up, replace the weight with the next heavier size. If the wheel rotates and the weight goes down, replace the weight with the next lighter size. Repeat these steps until the wheel remains at rest after being rotated 1/4 turn.
- Rotate the wheel another 1/4 turn and then another 1/4 turn to see if the wheel is correctly balanced.
- Repeat the entire procedure as many times as necessary to achieve correct wheel balance.







★If proper balance has been achieved, permanently install the balance weight.

Balance Weight

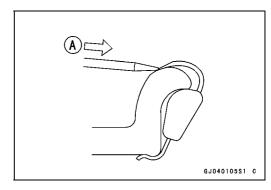
Part Number	Weight (grams)
41075-1014	10 (0.35 oz.)
41075-1015	20 (0.71 oz.)
41075-1016	30 (1.1 oz.)

NOTE

- OBalance weights are available from Kawasaki Dealers in 10, 20, and 30 gram (0.35, 0.71 and 1.1 ounce) sizes. An imbalance of less than 10 grams (0.35 ounce) will not usually affect running stability.
- ODo not use four or more balance weights (more than 90 gram, 3.2 ounce). If the wheel requires an excess balance weight, remove and disassemble the wheel to find the cause.

Balance Weight Removal

- (a) When the tire is not on the rim.
- Push [A] the blade portion toward the outside with a regular tip screw driver, and slip the weight off the rim flange.
- Discard the used balance weight.



- (b) When the tire is on the rim.
- Pry [A] the balance weight off the rim flange using a regular tip screw driver as shown in the figure.
- Olnsert a tip of the screw driver between the tire bead [B] and weight blade [C] until the end of the tip reaches the end of the weight blade.
- OPush the driver grip toward the tire so that the balance weight slips off the rim flange.
- Discard the used balance weight.

Balance Weight Installation

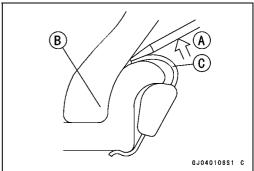
- Check if the weight portion has any play on the brade-and -clip plate.
- ★If it does, discard it.

A WARNING

If the balance weight has any play on the rim flange, the blade and/or clip have been stretched. Replace the loose balance weight.

Do not reuse used balance weight.

Unbalanced wheels can create an unsafe riding condition.



10-14 WHEELS/TIRES

Wheels (Rims)

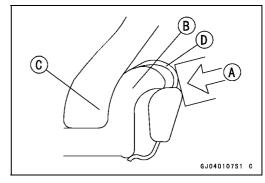
• Lubricate the balance weight blade, tire bead, and rim flange with a soap and water solution or rubber lubricant. This helps the balance weight slip onto the rim flange.

CAUTION

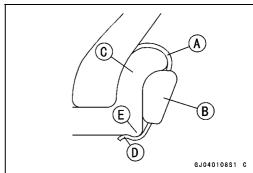
Do not lubricate the tire bead with engine oil or petroleum distillates because they will deteriorate the tire.

- Install the balance weight on the rim.
- OSlip the weight on the rim flange [B] by pushing or lightly hammering [A] the weight in the direction shown in the figure.

Tire Bead [C] Blade [D]

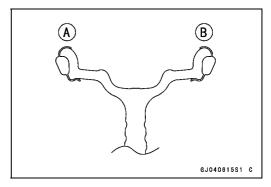


 Check that the blade [A] and weight [B] seat fully on the rim flange [C], and that the clip [D] is hooked over the rim ridge [E] and reaches rim flat portion.



• When required total weight exceeds 20 g, install balance weight at both sides of rim flange as shown.

J	•		
Required	Weight Selection		
Total Weight	One Side [A]	Other Side [B]	
10 g (0.35 oz.)	10 g (0.35 oz.)	-	
20 g (0.71 oz.)	10 g (0.35 oz.)	10 g (0.35 oz.)	
30 g (1.1 oz.)	20 g (0.71 oz.)	10 g (0.35 oz.)	
40 g (1.4 oz.)	20 g (0.71 oz.)	20 g (0.71 oz.)	
50 g (1.8 oz.)	30 g (1.1 oz.)	20 g (0.71 oz.)	
60 g (2.1 oz.)	30 g (1.1 oz.)	30 g (1.1 oz.)	
70 g (2.5 oz.)	20 g (0.71 oz.)	30 g (1.1 oz.)	
70 9 (2.0 02.)	+ 20 g (0.71 oz.)	00 g (1.1 02.)	
80 g (2.8 oz.)	20 g (0.71 oz.)	20 g (0.71 oz.)	
00 g (2.0 02.)	+ 20 g (0.71 oz.)	+ 20 g (0.71 oz.)	
90 g (3 2 oz)	20 g (0.71 oz.)	20 g (0.71 oz.)	
90 g (3.2 oz.)	+ 30 g (1.1 oz.)	+ 20 g (0.71 oz.)	



Tires

Air Pressure Inspection/Adjustment

Refer to Tire Inspection in the Periodic Maintenance chapter.

Tire Inspection

Refer to Tire Inspection in the Periodic Maintenance chapter.

Tire Removal

• Remove the following.

Wheel (see this chapter)

Brake Disc (see Brakes chapter)

Valve Core (let out the air)

 To maintain wheel balance, mark the 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]

Air Valve [B]

Align [C]

 Lubricate the tire beads and rim flanges on both sides with a soap and water solution or rubber lubricant. This helps the tire beads slip off the rim flanges.

CAUTION

Never lubricate with engine oil or petroleum distillates because they will deteriorate the tire.

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

NOTE

OThe tires cannot be removed with hand tools because they fit the rims too tightly.

Tire Installation

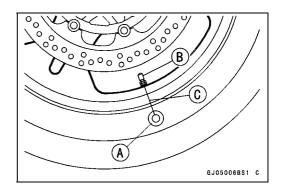
A WARNING

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

- Inspect the rim and tire, and replace them if necessary.
- Clean the sealing surfaces of the rim and tire, and smooth the sealing surfaces of the rim with a fine emery cloth if necessary.
- Remove the air valve and discard it.

CAUTION

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



10-16 WHEELS/TIRES

Tires

• Insert the new air valve in the wheel rim.

Valve Cap [A]

Valve Stem [B]

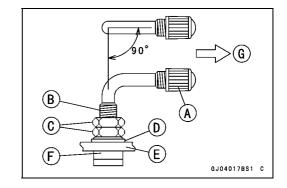
Valve Nuts [C]

Valve Washer [D]

Rim [E]

Valve Grommet [F]

Coupling Damper Side [G] (rear wheel)



- Remove the valve cap, valve nuts, valve washer and insert the valve stem through the rim from the inside out.
- Tighten:

Torque - Tire Air Valve Nuts: 1.5 N·m (0.15 kgf·m, 13 in·lb)
Tire Air Valve Cap: 0.15 N·m (0.015 kgf·m, 1.3 in·lb)
Tire Air Valve Core: 0.3 N·m (0.03 kgf·m, 2.6 in·lb)

 Apply a soap and water solution, or rubber lubricant to the rim flange and tire beads.

CAUTION

Never lubricate with mineral oil (engine oil) or gasoline because they will cause deterioration of the tire.

 Check the tire rotation mark on the front and rear tires and install them on the rim accordingly.

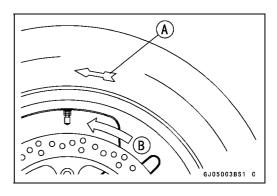
Tire Rotation Mark [A] Rotation Direction [B]

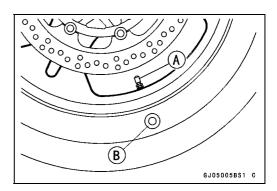
OThe front rim is no right and left distinction.

- Install the rear tire on the rim so that the damper faces left.
- Position the tire on the rim so that the air valve [A] is at the tire balance mark [B] (the chalk mark made during removal, or the yellow paint mark on a new tire).
- Install the tire bead over the rim flange using a commercially available tire changer.
- Lubricate the tire beads and rim flanges with a soap and water solution or rubber lubricant to help seat the tire beads in the sealing surfaces of the rim while inflating the tire.
- Center the rim in the tire beads, and inflate the tire with compressed air until the tire beads seat in the sealing surfaces.

A WARNING

Be sure to install the valve core whenever inflating the tire, and do not inflate the tire to more than 400 kPa (4.0 kg/cm², 57 psi). Overinflation can explode the tire with possibility of injury and loss of life.





Tires

- Check to see that the bead lines [A] on both sides of the tire sidewalls are parallel with the rim flanges.
- ★If the rim flanges and tire sidewall bead lines are not parallel, remove the valve core.
- Lubricate the rim flanges and tire beads.
- Install the valve core and inflate the tire again.
- After the tire beads seat in the rim flanges, check for air leakage.
- OInflate the tire slightly above standard inflation.
- OUse a soap and water solution or submerge the tire, and check for bubbles that would indicate leakage.
- Adjust the air pressure to the specified pressure (see Tire Inspection).
- Install the air valve cap.
- Install the brake disc [A] so that the marked side [B] faces out.
- Apply a non-permanent locking agent, and tighten the brake disc bolts [C].

Torque - Brake Disc Bolts: 27 N·m (2.8 kgf·m, 20 ft·lb)

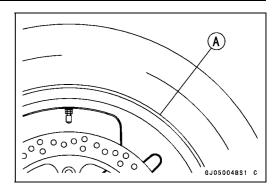
Adjust the wheel balance.

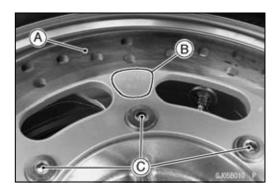
A WARNING

Check and balance the wheel when a tire is replaced with a new one. New tires are slippery and may cause loss of control and injury. A break-in period of 160 km (100 mi) is necessary to establish normal tire traction. During break-in, avoid sudden and maximum braking and acceleration, and hard cornering.

Tire Repair

Currently two types of repair for tubeless tires have come into wide use. One type is called a temporary (external) repair which can be carried out without removing the tire from the rim, and the other type is called permanent (internal) repair which requires tire removal. It is generally understood that higher running durability is obtained by permanent (internal) repairs than by temporary (external) ones. Also, permanent (internal) repairs have the advantage of permitting a thorough examination for secondary damage not visible from external inspection of the tire. For these reasons, Kawasaki does not recommend temporary (external) repair. Only appropriate permanent (internal) repairs are recommended. Repair methods may vary slightly from make to make. Follow the repair methods indicated by the manufacturer of the repair tools and materials so that safe results can be obtained.





Hub Bearings (Wheel Bearings)

Hub Bearings Removal

• Remove the wheel, and take out the following.

Collars

Grease Seals [A]

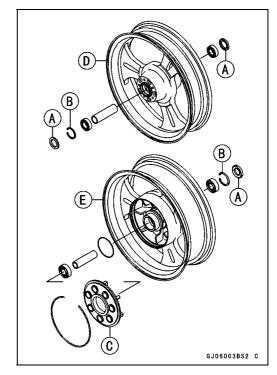
Circlips [B]

Coupling [C] (Out of Rear Hub)

Front Hub [D]

Rear Hub [E]

Special Tool - Inside Circlip Pliers: 57001-143



• Use the bearing remover to remove the hub bearings [A].

CAUTION

Do not lay the wheel directly on the ground with the disc facing down. This can damage or warp the disc. Place blocks under the wheel so that the disc does not touch the ground.

Special Tools - Bearing Remover Shaft, ϕ 13: 57001-1377 [B] Bearing Remover Head, ϕ 20 × ϕ 22: 57001-1293 [C]

Hub Bearings Installation

- Before installing the wheel bearings, blow any dirt or foreign particles out of the hub with compressed air to prevent contamination of the bearings.
- Replace the bearings with new ones.

NOTE

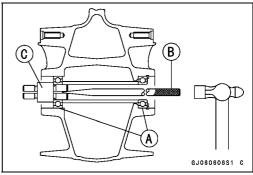
OInstall the bearings so that the marked side faces out.

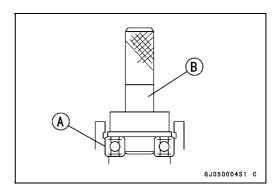
- Install the bearings by using a bearing driver.
- First, press each right bearing [A] in until it bottoms out.

Special Tool - Bearing Driver Set: 57001-1129 [B]

• Next, install the following:

New Circlip Distance Collar Left Bearing

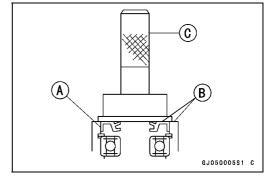




Hub Bearings (Wheel Bearings)

- Replace the circlips with new ones.
 - Special Tool Inside Circlip Pliers: 57001-143
- Replace the grease seals with new ones.
- Press in the grease seals [A] so that the seal surface is flush [B] with the end of the hole.
- Apply high temperature grease to the grease seal lips.

Special Tool - Bearing Driver Set: 57001-1129 [C]



Hub Bearings Inspection

OSince the hub bearings are made to extremely close tolerance, the clearance cannot normally be measured.

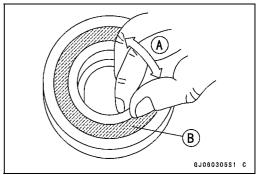
NOTE

- ODo not remove any bearings for inspection. If any bearings are removed, they will need to be replaced with new ones.
- Turn each bearing in the hub back and forth [A] while checking for plays, roughness, or binding.
- ★If bearing play, roughness, or binding is found, replace the bearing.
- Examine the bearing seal [B] for tears or leakage.
- ★If the seal is torn or is leaking, replace the bearing.

Hub Bearings Lubrication

NOTE

OSince the hub bearings are packed with grease and sealed, lubrication is not required.

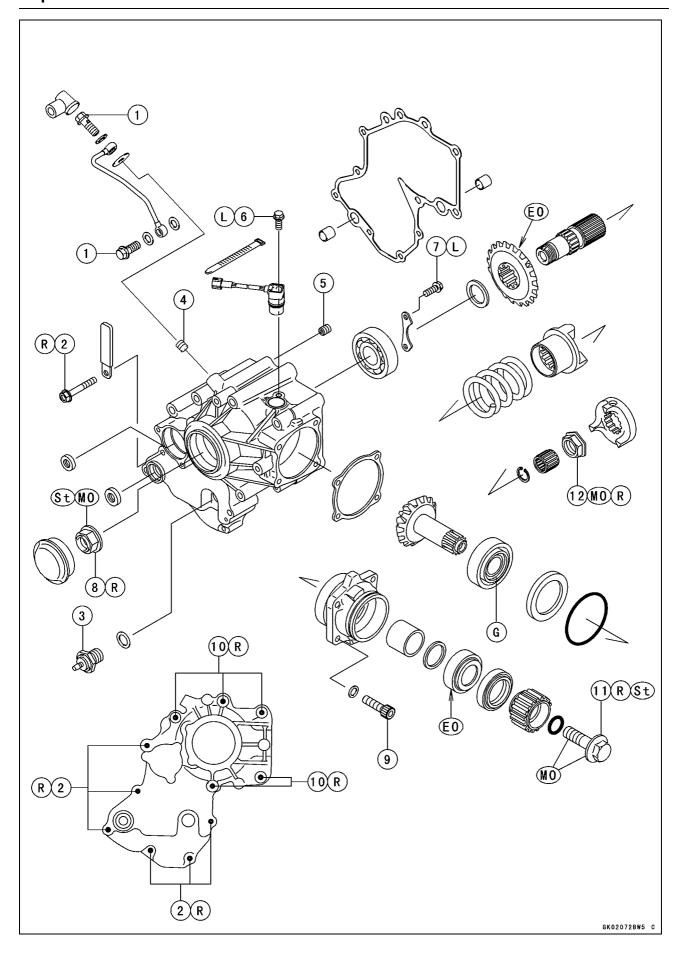


Final Drive

Table of Contents

Exploded View	11-2	Front Bevel Gears	11-24
Specifications	11-6	Front Gear Case Removal	11-24
Special Tools	11-7	Front Gear Case Installation	11-24
Final Gear Case and Oil	11-8	Front Gear Case Disassembly	11-24
Oil Level Inspection	11-8	Front Gear Case Assembly	11-25
Oil Change	11-8	Driven Gear Disassembly	11-26
Final Gear Case Removal	11-8	Driven Gear Assembly	11-27
Final Gear Case Installation	11-8	Damper Cam Removal	11-27
Final Gear Case Disassembly	11-8	Damper Cam Installation	11-28
Final Gear Case Assembly	11-10	Front Bevel Gear Adjustment	11-28
Pinion Gear Removal	11-12	Preload Adjustment	11-29
Pinion Gear Installation	11-13	Preload Measurement with Spring	
Pinion Gear Bearing Preload		Scale	11-30
Adjustment	11-14	Backlash Adjustment	11-31
Bevel Gear Inspection	11-17	Tooth Contact Adjustment	11-32
Pinion Gear Joint Inspection	11-17	Bevel Gear Inspection	11-34
Final Bevel Gear Adjustment	11-17	Cam Damper Inspection	11-34
Backlash Adjustment	11-19	Bearing and Oil Seal	11-35
Tooth Contact Adjustment	11-20	Ball or Needle Bearing	•
Propeller Shaft	11-22	Replacement	11-35
Propeller Shaft Removal	11-22	Ball Bearing Wear	11-35
Propeller Shaft Installation	11-22	Tapered Roller Bearing	
Propeller Shaft Joint Lubrication	11-22	Inspection	11-36
Propeller Shaft Inspection	11-23	Needle Bearing Inspection	11-36
Sliding Joint Inspection	11-23	Oil Seal Inspection	11-36

11



Front Gear Case

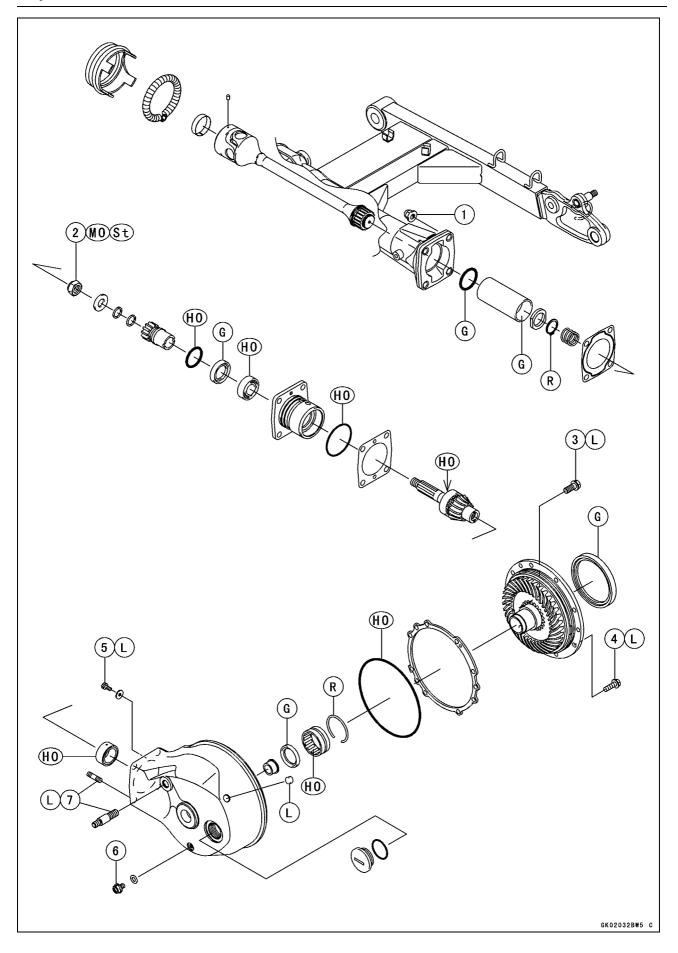
Na	Factoria		Damanka		
No.	o. Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
1	Oil Pipe Banjo Bolts (Front Gear)	12	1.2	104 in·lb	
2	Front Gear Case Bolts 6 mm	12	1.2	104 in·lb	R
3	Neutral Switch	15	1.5	11	
4	Oil Nozzle (Front Gear)	2.9	0.30	26 in·lb	
5	Oil Nozzle (Front Gear)	18	1.8	13	
6	Speed Sensor Mounting Bolt	9.8	1.0	87 in·lb	L
7	Bearing Retainer Bolts (Front Gear)	8.8	0.9	78 in·lb	L
8	Drive Gear Nut (Front Gear)	265	27	195	MO, St
9	Driven Gear Assy Mounting Bolts	25	2.5	18	
10	Front Gear Case Bolts 8 mm	29	3.0	22	R
11	Driven Gear Bolt (Front Gear)	137	14	101	MO, St
12	Dumper Cam Nut	195	20	144	MO, R

EO: Apply engine oil.

- G: Apply grease.
- L: Apply a non-permanent locking agent.
- MO: Apply molybdenum disulfide oil.

The molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1)

- R: Replacement Parts
- St: Stake the fasteners.



Final Gear Case

No	Factorer		Domorko		
No.	No. Fastener	N⋅m	kgf∙m	ft·lb	Remarks
1	Final Gear Case Mounting Nuts	34	3.5	25	
2	Pinion Gear Nut (Final Gear)	127	13	94	MO, St
3	Final Gear Case Cover Bolts 10 mm	34	3.5	25	L
4	Final Gear Case Cover Bolts 8 mm	23	2.3	17	L
5	Bearing Retainer Bolt (Final Gear)	6.9	0.7	61 in·lb	L
6	Final Gear Case Drain Plug	8.8	0.9	78 in·lb	
7	Final Gear Case Studs	-	-	_	L

G: Apply grease.

HO: Apply hypoid gear oil.

L: Apply a non-permanent locking agent.

MO: Apply molybdenum disulfide oil.

The Molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1)

R: Replacement Parts

St: Stake the fasteners.

11-6 FINAL DRIVE

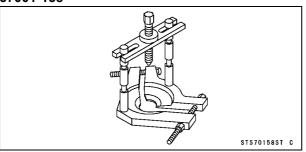
Specifications

Item	Standard
Final Gear Case Oil	
Grade	API GL-5 hypoid gear oil
Viscosity	When above 5°C (41°F) SAE90
	When below 5°C (41°F) SAE80
Oil level	Filler opening bottom
Amount	200 mL (6.76 US oz.)
Final Bevel Gear Backlash	0.10 ~ 0.20 mm (0.0039 ~ 0.0079 in.) (at gear hub
Tildi Bever Geal Backlasii	splines)
Preload for Pinion Gear Bearing	
Torque Wrench	0.6 ~ 1.0 N·m (0.06 ~ 0.10 kgf·m, 5.2 ~ 8.7 in·lb)
Spring Seal	3.0 ~ 5.0 N (0.3 ~ 0.5 kg, 0.7 ~ 1.1 lb)
Propeller Shaft Joint Grease	20 mL (0.68 US oz.), high-temperature grease
Front Bevel Gear Backlash	0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.) (at gear tooths)
Preload for Front Bevel Gear Bearing	
Torque Wrench	0.5 ~ 0.9 N·m (0.05 ~ 0.09 kgf·m, 4.3 ~ 7.8 in·lb)
Spring Scale	3 ~ 4 N (0.3 ~ 0.5 kg, 0.6 ~ 1.0 lb)

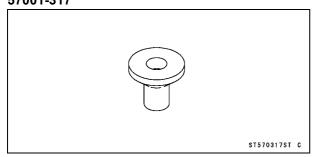
Special Tools

Bearing Puller:

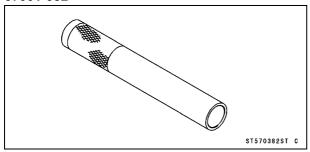
57001-158



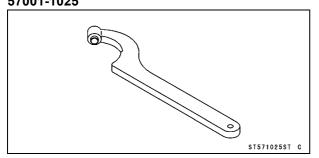
Bearing Puller Adapter: 57001-317



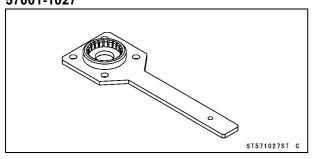
Bearing Driver, ϕ 32: 57001-382



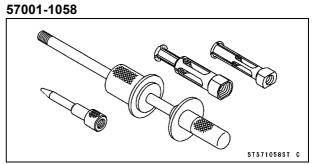
Damper Cam Holder: 57001-1025



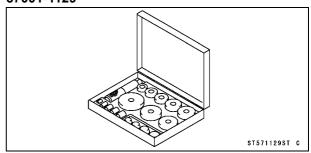
Driven Gear Holder, m2: 57001-1027



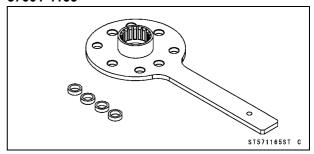
Oil Seal & Bearing Remover:



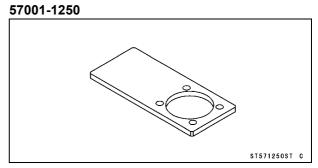
Bearing Driver Set: 57001-1129



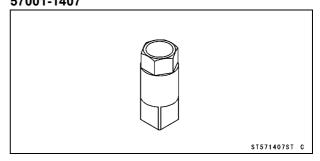
Pinion Gear Holder, m1.9: 57001-1165



Final Gear Case Holder:



Drive Shaft Holder: 57001-1407



Oil Level Inspection

 Refer to Final Gear Case Oil Level Inspection in Periodic Maintenance chapter.

Oil Change

Refer to Final Gear Case Oil Change in Periodic Maintenance chapter.

Final Gear Case Removal

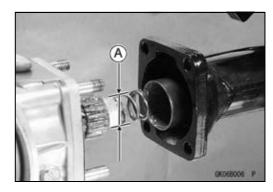
- ★If the final gear case is to be disassembled, drain the final gear case oil.
- Remove the rear wheel (see Wheels/Tires chapter).
- Remove the left shock absorber [A] from its stude by taking off the nuts.
- Remove the swingarm cover (see Suspension chapter).
- Remove the final gear case by taking off the nuts [B]. The spring comes off with the case.

NOTE

Olf the final gear case is full of oil, place the case so that the breather hole [C] is on top.

Final Gear Case Installation

- Lubricate the propeller shaft joint (see Periodic Maintenance chapter).
- Install the spring so that the smaller diameter end [A] faces toward the final gear case.



- Fit the pinion gear splines into the propeller shaft joint while turning the ring gear hub [A].
- Tighten the final gear case mounting nuts to the specified torque.

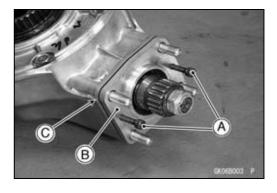
Torque - Final Gear Case Mounting Nuts: 34 N⋅m (3.5 kgf⋅m, 25 ft⋅lb)

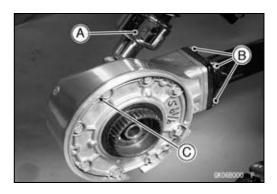
★If the final gear case oil was drained, fill the case with oil.



Final Gear Case Disassembly

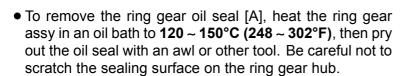
- Remove the final gear case.
- Using 6 mm bolts [A] with 10 mm pitch threads, jack up the pinion gear assembly [B].
- Remove the pinion gear assembly and shim(s) [C] from the final gear case.





- Remove the final gear case cover bolts [A].
- Use three tapped holes [B] to lift the ring gear assy from the gear case. The shim(s) comes off with the assy.

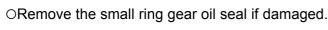
ODo not disassemble the ring gear assy (ring gear, ring gear hub, and final gear case cover), but the oil seal can be removed.

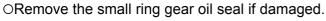


CAUTION

Do not heat the case with a blowtorch. This will warp the case.

- Remove the snap ring [A] and pull out the needle bearing
- ★If the small ring gear oil seal [C] is damaged, remove it using the oil seal and bearing remover.

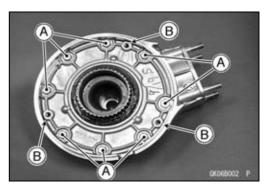


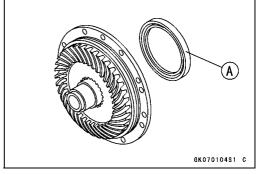


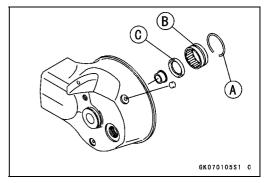


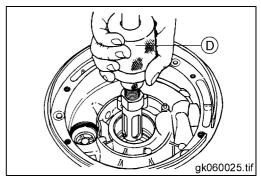
- Unscrew the bearing retainer bolt [A] and washer [B].
- Pull out the needle bearing [C].

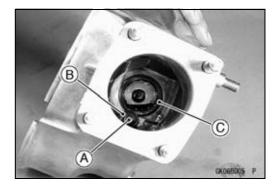
Special Tool - Oil Seal & Bearing Remover: 57001-1058



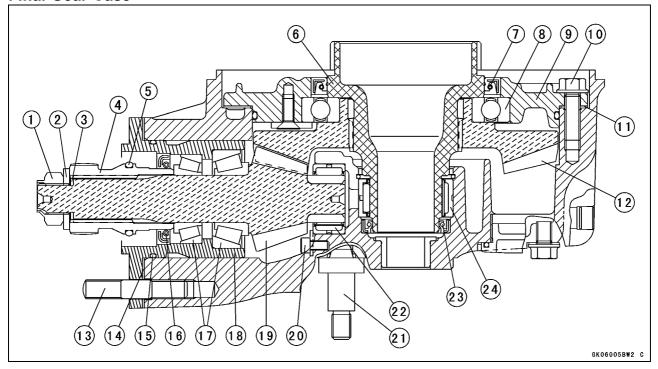








Final Gear Case



- 1. Pinion Gear Nut
- 2. Washer
- 3. Shim(s) for Preload
- 4. Pinion Gear Joint
- 5. O-ring
- 6. Ring Gear Hub
- 7. Ring Gear Oil Seal
- 8. Ball Bearing
- 9. Final Gear Case Cover
- 10. Cover Mounting Bolts
- 11. Ring Gear Shim(s)
- 12. Ring Gear

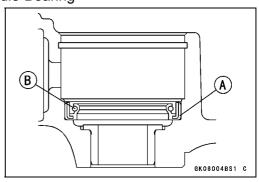
- 13. Studs
- 14. Pinion Gear Shim(s)
- 15. O-ring
- 16. Oil Seal
- 17. Tapered Roller Bearings
- 18. Pinion Gear Bearing Housing
- 19. Pinion Gear
- 20. Retainer Bolt
- 21. Stud
- 22. Needle Bearing
- 23. Small Ring Gear Oil Seal
- 24. Needle Bearing

Final Gear Case Assembly

- OThe ring gear and pinion gear are lapped as a set in the factory to get the best tooth contact. They must be installed as a pair, and never replace one without the other.
- Press the small ring gear oil seal [A] until it bottoms out with its spring [B] facing inward.
- Apply a thin coat of high temperature grease to the oil seal lip.

Special Tool - Bearing Driver Set: 57001-1129

 Apply a thin coat of high temperature grease to the oil seal lip.



- Replace the needle bearings [A] with new ones.
- Apply a hypoid gear oil to the roller parts of the needle bearings.

NOTE

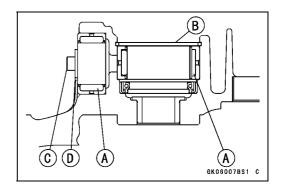
OInstall the bearing so that the marked side faces out. OPress in the bearings until they are bottomed.

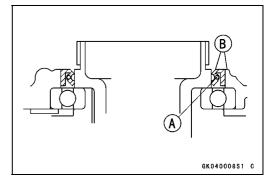
Special Tool - Bearing Driver Set: 57001-1129

- Install the snapring [B] secure.
- Apply a non-permanent locking agent to the bearing retainer bolt [C].
- Install the washer [D] and the bearing retainer bolt.
- Tighten:

Torque - Bearing Retainer Bolt: 6.9 N·m (0.7 kgf·m, 61 in·lb)

- Apply a thin coat of high temperature grease to the oil seal lip of the ring gear oil seal.
- Install the ring gear oil seal with its spring [A] facing inward using a suitable driver until the face of the seal is even [B] with the end of the hole.



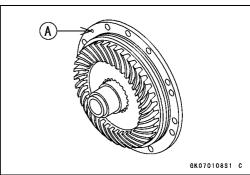


- Blow the breather hole [A] in the final gear case cover clean with compressed air.
- Apply a non-permanent locking agent to the threads of each stud and install them to the case if they were removed.
- Reinstall the original ring gear shim(s) to keep the gear backlash and the tooth contact unchanged.
- OWhen final gear case parts are replaced, the final bevel gear must be adjusted (see Final Gear Backlash and Tooth Contact Adjustment).
- Apply a non-permanent locking agent to the threads of the final gear case cover bolts.
- Tighten:

Torque - Final Gear Case Cover Bolts:

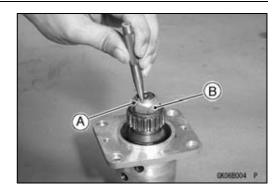
 ϕ 10: 34 N·m (3.5 kgf·m, 25 ft·lb) ϕ 8: 23 N·m (2.3 kgf·m, 17 ft·lb)

- Insert the pinion gear assembly into the final gear housing.
- OReinstall the pinion gear assembly shim(s) to keep the gear backlash and the tooth contact unchanged.



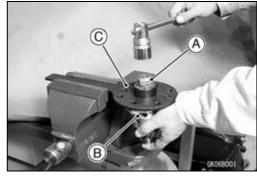
Pinion Gear Removal

• Pry open the staking [A] on the pinion gear nut [B].



• Unscrew the nut [A] while holding the pinion gear assembly [B] with the pinion gear holder [C].

Special Tool - Pinion Gear Holder: 57001-1165



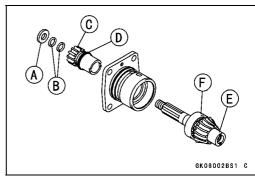
• Remove:

Washer [A]

Shim(s) [B]

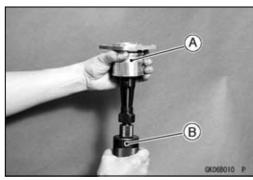
Pinion gear joint [C] with the O-ring [D].

Pinion gear [E] with the Tapered Roller Bearing [F]



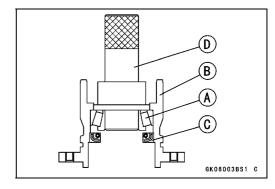
• Drive out the bearing outer race from the bearing housing [A].

Special Tool - Oil Seal & Bearing: 57001-1058 [B]



 Drive out the tapered roller bearing [A] in the bearing housing [B] and the oil seal [C] using the bearing driver set [D].

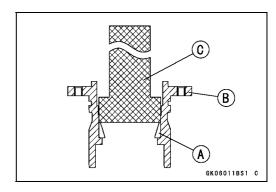
Special Tool - Bearing Driver Set: 57001-1129



Pinion Gear Installation

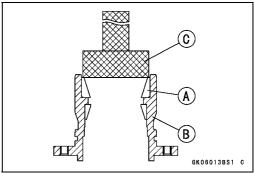
- The pinion gear and ring gear are lapped as a set in the factory to get the best tooth contact. They must be replaced as a set.
- Check the tapered roller bearing (see this chapter).
- Apply a hypoid gear oil to the roller bearings.
- Drive the tapered roller bearing [A] into the pinion gear housing [B] using the bearing driver set [C].

Special Tool - Bearing Driver Set: 57001-1129

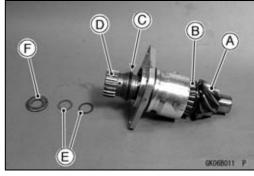


• Drive the tapered roller bearing outer race [A] into the pinion gear housing [B] using the bearing driver set [C].

Special Tool - Bearing Driver Set: 57001-1129



- Insert the pinion gear [A].
- Olnstall the pinion gear with the tapered roller bearing as [B] one unit.
- Check the O-ring [C] on the pinion gear joint [D] for any kind of damage.
- ★Replace it if necessary.
- Apply a hypoid gear oil to the O-ring.
- Install the pinion gear joint, shim(s) [E] and washer [F].



- Replace the pinion gear nut with a new one.
- Apply:

Molybdeum Disulfide Oil -

Threads and Seating Surface of Pinion Gear Nut

 Using the pinion gear holder [A], tighten the pinion gear nut [B].

Special Tool - Pinion Gear Holder: 57001-1165

Torque - Pinion Gear Nut: 127 N·m (13 kgf·m, 94 ft·lb)

OCheck the pinion gear bearing preload (see this chapter).

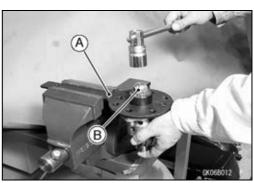
• Remove:

Pinion Gear Nut

Washer Shim(s)

Pinion Gear Joint

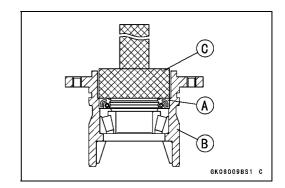
Pinion Gear Assy



11-14 FINAL DRIVE

Final Gear Case and Oil

- Replace the oil seal with a new one.
- Drive the oil seal [A] using the bearing driver set [B].
 Special Tool Bearing Driver Set: 57001-1129 [C]



Reinstall the above removed parts.
OStake [A] the pinion gear nut with a punch.

CAUTION

When staking the nut, be careful not to apply shock to the pinion gear and its bearing. Such a shock could damage the pinion gear and/or bearing.



Pinion Gear Bearing Preload Adjustment

Preload Measurement

- Check and adjust the bearing preload in the following case.
- OWhen any of the parts listed below are replaced with new ones.

Tapered roller bearings

Bevel gears

Bearing housing

Pinion gear joint

- OWhen the pinion gear nut is loosened, even if the purpose is not to replace the parts.
- Assemble the pinion gear bearing housing, and tighten the pinion gear nut to the specified torque. Oil seal installation is not required until the correct bearing preload is obtained.

CAUTION

To start with, choose a shim or shims so that the bearings are just SNUG with NO play but also with NO preload.

Any over-preload on the bearings could damage the bearings.

- Apply a little hypoid gear oil to the bearings, and turn the gear shaft more than 5 turns to allow the bearings to seat.
- Measure the bearing preload. Bearing preload is defined as the force or torque which is needed to start the gear shaft turning.

Preload for Pinion Gear Bearing

Using Spring Scale:

 $3.0 \sim 5.0 \text{ N}$ (0.30 ~ 0.50 kg, 0.7 ~ 1.1 lb)

Using Torque Wrench:

0.6 ~ 1.0 N·m (0.06 ~ 0.10 kgf·m, 5.2 ~ 8.7 in·lb)

NOTE

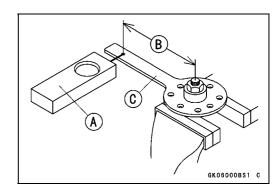
OPreload can be measured either with a spring scale or a beam-type torque wrench. When measured with a spring scale, the preload is designated by force (N, kg, lb), and when measured with a torque wrench, it is designated by torque N·m, (kgf·m, in·lb).

Using Spring Scale

- Hook the spring scale [A] on the handle at the point 200 mm (7.87 in.) [B] from the center of the gear shaft.
- Hold the bearing housing in a vise so that the gear shaft axis is vertical.
- Apply force to the handle horizontally and at a right angle to it.

Special Tool - Pinion Gear Holder: 57001-1165 [C]

★If the preload is out of the specified range, replace the shims under the flat washer, and re-check the preload. Refer to the next paragraph to select suitable shims.



11-16 FINAL DRIVE

Final Gear Case and Oil

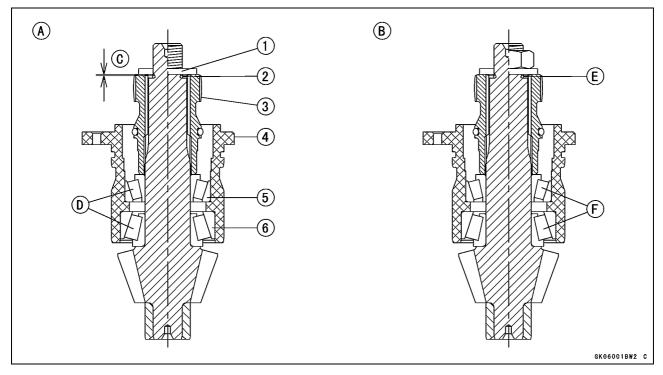
Preload Adjustment

- To increase preload, decrease the thickness of the size of the shim(s). To decrease preload increase the thickness of the shim(s).
- Change the thickness a little at a time.
- Re-adjust the bearing preload, and re-adjust if necessary.

Shims for Preload Adjustment

Thickness	Part Number
0.1 (0.004 in.)	92025-1219
0.2 (0.008 in.)	92025-1220
0.3 (0.012 in.)	92025-1221
0.5 (0.020 in.)	92025-1222
0.6 (0.024 in.)	92025-1223
0.7 (0.028 in.)	92025-1224
0.8 (0.031 in.)	92025-1225
* 0.9 (0.035 in.)	92025-1226
1.0 (0.040 in.)	92025-1227
1.30 (0.051 in.)	92025-1214
1.32 (0.052 in.)	92025-1215
1.34 (0.053 in.)	92025-1216
1.36 (0.054 in.)	92025-1217
1.38 (0.0543 in.)	92025-1218

*: Standard

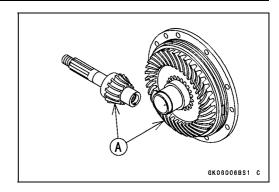


- 1. Washer
- 2. Shim(s)
- 3. Pinion Gear Joint
- 4. Bearing Housing
- 5. Tapered Roller Bearing
- 6. Tapered Roller Bearing Before Tightening [A] After Tightening [B]

Initial Clearance [C] Under No Preload [D] No Clearance [E] Under Preload [F]

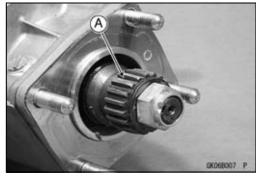
Bevel Gear Inspection

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★Replace the bevel gears as a set if either gear is damaged.



Pinion Gear Joint Inspection

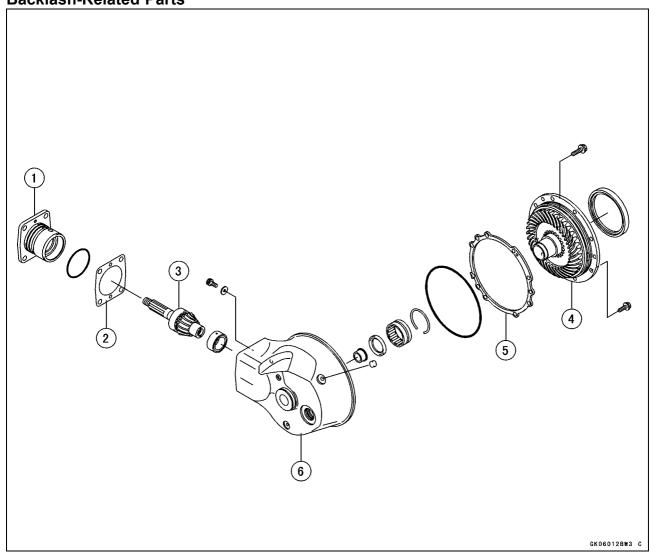
- Visually inspect the splines [A] of the pinion gear joint.
- ★If they are badly worn or chipped, replace the joint with a new one. Also, inspect the propeller shaft sliding joint.



Final Bevel Gear Adjustment

- OThe **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.
- After replacing any of the backlash-related parts, be sure to check and adjust the backlash and tooth contact of the bevel gears. First, adjust backlash, and then tooth contact by replacing shims.
- OThe amount of backlash is influenced by the ring gear position more than by the pinion gear position.
- OTooth contact locations is influenced by pinion gear position more than by ring gear position.

Backlash-Related Parts



- Pinion Gear Bearing Housing
 Pinion Gear Shim(s)
- 3. Pinion Gear Assy
- 5. Ring Gear Shim(s)6. Final Gear Case

- 4. Ring Gear Assy

Ring Gear Shims for Backlash Adjustment

Pinion Gear Shims for Tooth Contact Adjustment

Thickness (mm)	Parts Number	Thickness (mm)	Parts Number
0.15 (0.0059 in.)	92025-1783	0.15 (0.0059 in.)	92180-0009
0.5 (0.02 in.)	92025-1784	0.5 (0.02 in.)	92180-0010
0.6 (0.023 in.)	92025-1785	0.6 (0.023 in.)	92180-0011
0.7 (0.028 in.)	92025-1786	0.7 (0.028 in.)	92180-0012
0.8 (0.031 in.)	92025-1787	0.8 (0.031 in.)	92180-0013
0.9 (0.035 in.)	92025-1788	0.9 (0.035 in.)	92180-0014
1.0 (0.039 in.)	92025-1789	1.0 (0.039 in.)	92180-0015
1.2 (0.047 in.)	92025-1790	1.2 (0.047 in.)	92180-0016

Backlash Adjustment

 Clean any dirt and oil off the bevel gear teeth with a high -flash point solvent.

CAUTION

Do not install the O-ring or oil seals during adjustment.

- Install the pinion gear bearing housing with the primary shim (1.0 mm, 0.04 in. thickness).
- Hold the pinion gear steady with the pinion gear holder and tighten the final gear case mounting nuts to the specified torque.

Special Tool - Pinion Gear Holder: 57001-1165

Torque - Final Gear Case Mounting Nuts: 34 N⋅m (3.5 kgf⋅m, 25 ft⋅lb)

Install the ring gear assy with the primary shim (1.0 mm, 0.04 in. thickness), and tighten the cover bolts to the specified torque.

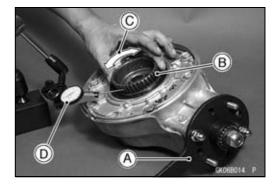
Torque - Final Gear Case Cover Bolts:

M10: 34 N·m (3.5 kgf·m, 25 ft·lb) M8: 23 N·m (2.3 kgf·m, 17 ft·lb)

- OCheck the backlash during tightening of the cover bolts, and stop tightening them immediately if the backlash disappears. Then, change the ring gear shim to a thicker one.
- Mount a dial gage [D] on a vise so that the tip of the gage is against the splines of the ring gear hub.
- To measure the backlash, turn the ring gear hub [B] back and forth [C]. The difference between the highest and the lowest gage reading is the amount of backlash.
- OMeasure backlash at three locations equally spaced on the splines.

Final Bevel Gear 0.10 ~ 0.20 mm (0.0039 ~ 0.0079 Backlash: in.) (at ring gear hub splines)

- ★If the backlash is out of the limit, replace the ring gear shims. To increase backlash, increase the thickness of the shim(s). To decrease backlash, decrease the thickness of the shim(s).
- ★Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.



Tooth Contact Adjustment

- Clean any dirt and oil off the bevel gear teeth with a high -flash point solvent.
- Apply checking compound to 4 or 5 teeth of the pinion gear.

NOTE

- OApply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.
- OThe checking compound must be smooth and firm, with the consistency of tooth paste.
- OSpecial compounds are available at automotive supply stores for the purpose of checking differential gear tooth patterns and contact.
- Hold the pinion gear assembly with the final gear case holder [A].

Special Tool - Final Gear Case Holder: 57001-1250

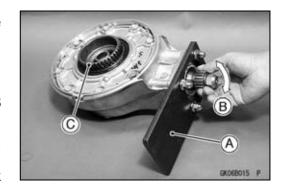
• Tighten:

Torque - Final Gear Case Mounting Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)

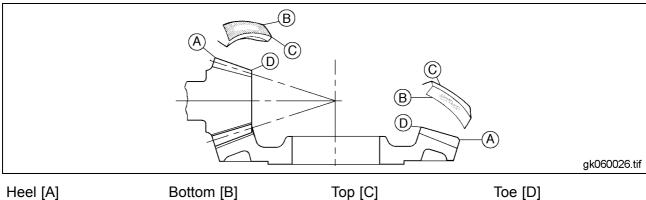
- Turn the pinion gear for one revolution [B] back and forth, while creating a drag on the ring gear hub [C].
- Remove the ring gear assy and pinion gear assy to check the drive pattern and coast pattern of the bevel gear teeth. The tooth contact patterns of both (drive and coast) sides should be centrally located between the top and bottom of the tooth. The drive pattern can be a little closer to the toe and the coast pattern can be a somewhat longer and closer to the toe.
- ★If the tooth contact pattern is incorrect, replace the pinion gear shim(s), following the examples shown. Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shim(s) are replaced. Repeat the shim change procedure as necessary.

NOTE

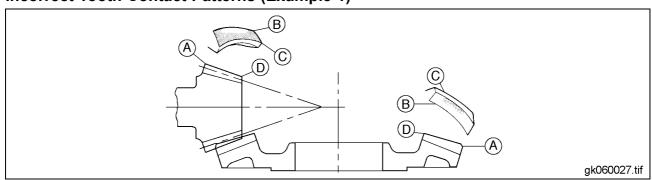
Olf the backlash is out of the standard range after changing the pinion gear shim(s), replace the ring gear shim(s) to correct the backlash before checking the tooth contact pattern.



Correct Tooth Contact Pattern: No adjustment is required.



Incorrect Tooth Contact Patterns (Example 1)



ODecrease the thickness of the pinion gear shim(s) by **0.05 mm (0.002 in.)** to correct the pattern shown above.

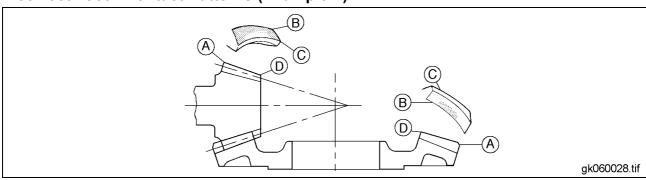
Heel [A]

Bottom [B]

Top [C]

Toe [D]

Incorrect Tooth Contact Patterns (Example 2)



Olncrease the thickness of the pinion gear shim(s) by **0.05 mm (0.002 in.)** to correct the pattern shown above.

Heel [A]

Bottom [B]

Top [C]

Toe [D]

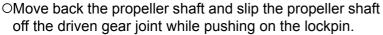
Propeller Shaft

Propeller Shaft Removal

• Remove:

Final Gear Case (see this chapter) Swingarm (see Suspension chapter)

- Remove the propeller shaft from the front driven gear joint.
- OTurn the propeller shaft so that the lockpin access hole [A] in the propeller shaft comes outside.



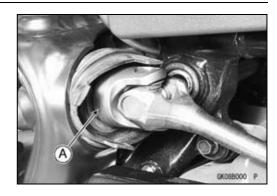
Propeller Shaft [A]

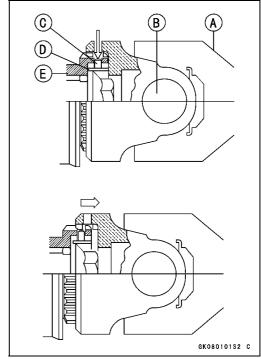
Universal Joint [B]

Lockpin [C]

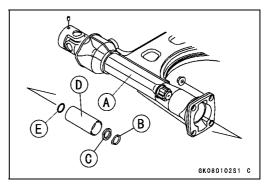
Spring [D]

Driven Gear Joint [E]





- Remove the circlip [B] from the rear end of the propeller shaft [A] using a circlip pliers.
- Remove the washer [C] and pull out the propeller shaft sliding joint [D].



Propeller Shaft Installation

- Check the O-ring [E] on the rear end of the propeller shaft for any kind of damage, and replace it if necessary.
- Lubricate the propeller shaft joint (see Periodic Maintenance chapter).
- After connecting the propeller shaft to the driven gear joint, pull the propeller shaft rearward to check that the shaft is secured in place by the lockpin.



Propeller Shaft Joint Lubrication

 Refer to Propeller Shaft Joint Lubrication in the Periodic Maintenance chapter.

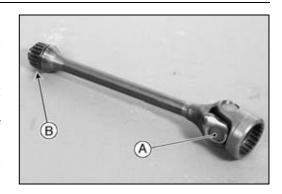
Propeller Shaft

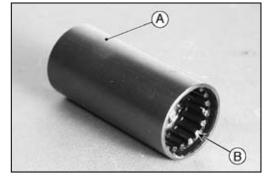
Propeller Shaft Inspection

- Check that the universal joint [A] works smoothly without rattling or sticking.
- ★If it does not work smoothly, the needle bearings of the universal joint are damaged. Replace the propeller shaft assy with a new one.
- Visually inspect the bearing of the shaft and the wear of the splines [B] at the rear end of the shaft.
- ★ If it is bent at all, replace the propeller shaft assy. Do not attempt to straighten a bent shaft.

Sliding Joint Inspection

- Visually inspect the internal splines [B] of the propeller shaft sliding joint [A].
- ★If they are badly worn or chipped, replace the joint with a new one.



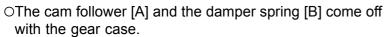


Front Gear Case Removal

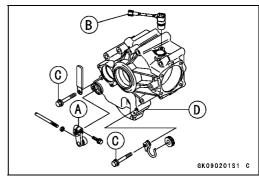
• Remove:

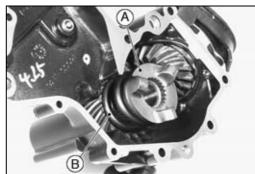
Engine (see Engine Removal/Installation chapter) Rear Shift Lever [A]

- OThe speed sensor connector [B] is disconnected during engine removal.
- Unscrew the front gear case bolts [C] and remove the front gear case [D].



Check that the shift shaft oil seal and replace it if damaged.





Front Gear Case Installation

• Tighten the front gear case bolts to the specified torque.

Torque - Front Gear Case Bolts:

M8: 29 N·m (3.0 kgf·m, 22 ft·lb) M6: 12 N·m (1.2 kgf·m, 104 in·lb)

Front Gear Case Disassembly

• Remove:

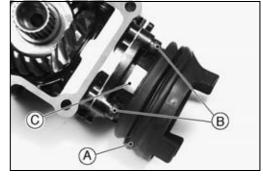
Front Gear Case (see this chapter)

Cam Follower

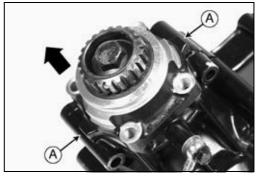
Damper Spring

Rubber Boot [A]

• Remove the driven gear assy mounting bolts [B] and pry the assy [C] off the case.



ORaise the driven gear, using the following pry points [A].



Remove the drive gear assy as follows.
 OPry off the gear case cap [A] with a tool.



OPry open the drive gear nut [A] with a small chisel. OInstall:

Damper Spring

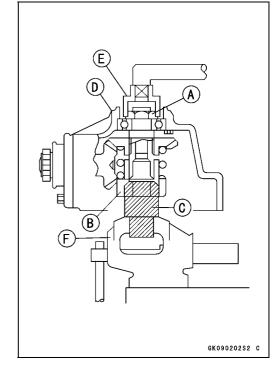
Cam Follower [B]

OUnscrew the drive gear nut while holding the drive gear shaft with the drive shaft holder [C] (special tool).

Front Gear Case [D] Socket Wrench [E]

Vise [F]

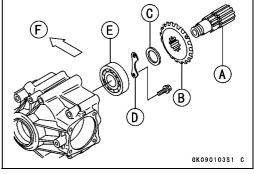
Special Tool - Drive Shaft Holder: 57001-1407



- Pull off the drive gear shaft [A], the drive gear [B], and shim(s) [C].
- Remove the bearing holder [D] from the gear case.
- Remove the drive gear shaft ball bearing [E] using the bearing driver set.

Front [F]

Special Tool - Bearing Driver Set: 57001-1129



Front Gear Case Assembly

- OThe drive and driven gear are lapped as a set in the factory to get the best tooth contact. They must be replaced as a set.
- Press the drive gear [B] slowly with the driver [A] onto the shaft [C].

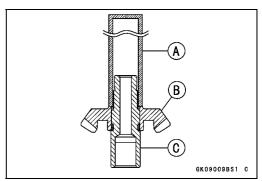
Special Tool - Bearing Driver: 57001-382

Apply:

Non-permanent Locking Agent -Bearing Retainer Bolts

• Tighten:

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



- Be sure to check and adjust the bearing preload, the bevel gear backlash, and tooth contact, when any of the backlash-related parts are replaced (see Front Bevel Gear Adjustment).
- After completing all adjustment, reassemble the front gear case
- OReplace the drive gear nut with a new one.
- OApply molybdenum disulfide oil to the threads and seating surface of the nut, and tighten it to the specified torque to settle the bearings in place.
- OLoosen the nut completely and retighten it to the specified torque.

Torque - Drive Gear Nut: 265 N·m (27 kgf·m, 195 ft·lb)

OStake the nut to secure it in place.

CAUTION

When staking the nut, be careful not to apply shock to the shaft and its bearing. Such a shock could damage the shaft and/or bearing.

- Install the shim [A].
- Install the driven gear assy so that the pry ribs [B] and machined surfaces [C] align.
- Tighten the driven gear assy mounting bolts to the specified torque.

Torque - Driven Gear Assy Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)



- ★If the oil pipe [A] was removed, use a new flat washer on each side of the fittings, and tighten the banjo bolts to the specified torque.
- Tighten the front banjo bolt [B] first, then the rear banjo bolt [C].

Torque - Oil Pipe Banjo Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)

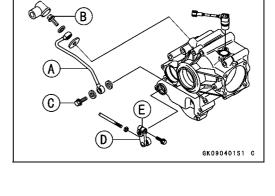
- Install the rear shift lever [D], aligning the lever slit [E] with the punch mark of the shaft.
- Tighten:

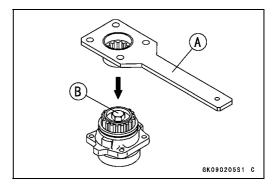
Torque - Rear Shift Lever Clamp Bolt: 12 N·m (1.2 kgf·m, 104 in·lb)

Driven Gear Disassembly

Holding the driven gear joint with the driven gear holder
 [A] in a vise, unscrew the driven gear bolt [B].

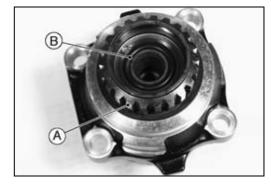
Special Tool - Driven Gear Holder: 57001-1027





- Remove the driven gear joint [A] with the O-ring [B].
- Remove the driven gear from the bearing housing.
- Remove the oil seal from the housing with a hook, and pull the tapered roller bearing out of the housing.
- Remove the tapered roller bearing which is pressed onto the driven gear shaft with the bearing puller and adapter.

Special Tools - Bearing Puller: 57001-158 Adapter: 57001-317



Driven Gear Assembly

- Replace the driven gear bolt with a new one.
- OThe drive and driven gears are lapped as a set at the factory to get the best tooth contact. They must be replaced as a set.
- Be sure to check and adjust the bearing preload, the bevel gear backlash, and tooth contact (see Front Bevel Gear Adjustment).
- Drive the tapered roller bearing inner race [B] onto the driven gear shaft [C] using the bearing driver [A].

Special Tool - Bearing Driver: 57001-382

- After completing the bearing preload adjustment, reassemble the driven gear assy.
- OUsing the bearing driver set, press the oil seal in until the face of the seal is level with the end of the bearing housing hole.

Special Tool - Bearing Driver Set: 57001-1129

- OApply molybdenum disulfide oil to the threads and the seating surface of the driven gear bolt.
- OTighten the driven gear bolt to the specified torque.

Torque - Driven Gear Bolt: 137 N·m (14 kgf·m, 101 ft·lb)

OStake [A] the driven gear bolt to prevent it from loosening.

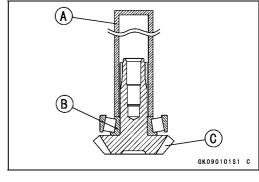
CAUTION

When staking the bolt, be careful not to apply shock to the driven gear and their bearings. Such a shock could damage the driven gear and/or bearings.

Damper Cam Removal

- Remove the front gear case (see this chapter).
- Remove the retainer and needle bearing of the output shaft.
- Remove the clutch push rod guide [A] and bolts, and crankcase bearing upper retainer and bolts.
- Insert a bolt (ϕ 12 mm, L100 mm, ϕ 0.47 in., L3.94 in.) [B] into the engine mounting bolt hole.
- Unscrew the damper cam nut [C] using a damper cam holder [D] (special tool) and deep socket wrench.

Special Tool - Damper Cam Holder: 57001-1025







Damper Cam Installation

- Replace the damper cam nut with a new one.
- Remove the clutch push rod guide [A] and bolts, and crankcase bearing lower retainer and bolts.
- Insert the bolt (ϕ 12 mm, L100 mm ϕ 0.47 in., L3.94 in.) [B] into the engine mounting bolt hole.
- Apply molybdenum disulfide oil to the threads and the seating surface of the damper cam nut [C].
- Tighten the damper cam nut to the specified torque.

Torque - Damper Cam Nut:195 N·m (20 kgf·m, 144 ft·lb)

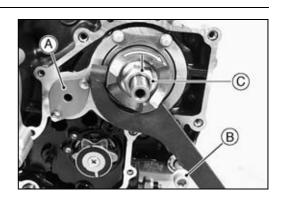
Special Tool - Damper Cam Holder: 57001-1025

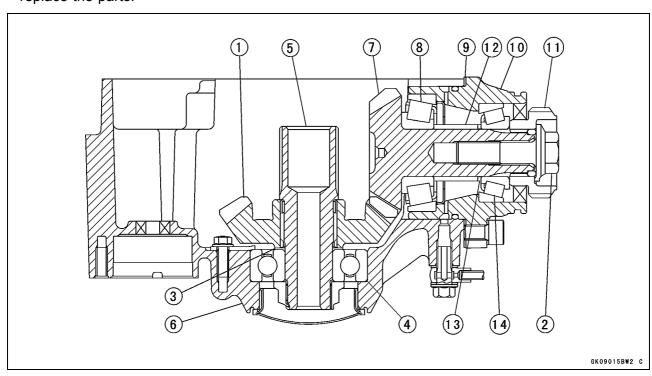
Front Bevel Gear Adjustment

In order to prevent one gear from moving away from the other gear under load, the tapered roller bearings must be properly preloaded. Also the backlash (the distance one gear will move back and forth without moving the other gear) and tooth contact pattern of the bevel gears must be correct to prevent the gears from making noise and being damaged.

Above three adjustments are of critical importance and must be carried out in the correct sequence and method.

OPreload adjustment is necessary whenever the driven gear bolt [2] loosened, even if the purpose is not to replace the parts.





Backlash-related Parts

- 1. Drive Gear
- 2. Driven Gear Bolt
- 3. Drive Gear Shim(s)
- 4. Ball Bearing
- 5. Drive Gear Shaft
- 6. Front Gear Case

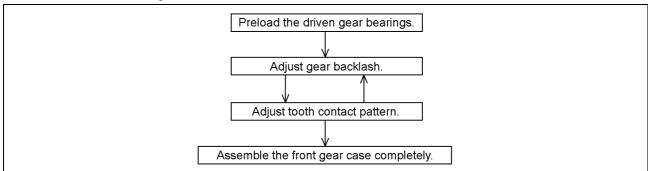
7. Driven Gear

- 8. Tapered Roller Bearing
- 9. Driven Gear Shim(s)
- 10. Driven Gear Bearing Housing
- 11. Driven Gear Joint
- 12. Collar

Preload-related Parts

- (Preload Adjustment)
- 13. Spacer
 - (Preload Adjustment)
- 14. Tapered Roller Bearing

Front Bevel Gear Adjustment



OWhen any of the backlash-related parts are replaced, or the driven gear bolt is loosened; even if the purpose is not to replace the parts, be sure to check and adjust the bearing preload, the bevel gear backlash, and tooth contact by replacing shims.

Preload Adjustment

• Install the driven gear assy, and tighten the driven gear nut to the specified torque.

Torque - Driven Gear Bolt: 137 N·m (14 kgf·m, 101 ft·lb)

ODo not install the oil seal, and O-ring, and do not stake the bolt until the correct bearing preload is obtained.

CAUTION

To start with, choose a shim or collar so that the bearings are just SNUG with NO play and also with NO preload.

Any overpreload on the bearings could damage the bearings.

- Apply a little engine oil to the bearings, and turn the gear shaft more than 5 turns to allow the bearings to seat.
- Measure the bearing preload. Bearing preload is defined as a force or torque which is needed to start the gear shaft turning.

Preload for Driven Gear Bearing

Using Spring Scale:

 $3 \sim 4 \text{ N } (0.3 \sim 0.5 \text{ kg}, 0.6 \sim 1.0 \text{ lb})$

Using Torque Wrench:

 $0.5 \sim 0.9 \text{ N} \cdot \text{m} (0.05 \sim 0.09 \text{ kgf} \cdot \text{m}, 4.3 \sim 7.8 \text{ in} \cdot \text{lb})$

NOTE

OPreload can be measured either with a spring scale or a beam-type torque wrench. When measured with a spring scale, the preload is designated by force (N, kg, lb), and when measured with a torque wrench, it is designated by torque (N·m, kgf·m, in·lb).

Preload Measurement with Spring Scale

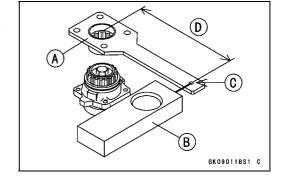
- Hold the bearing housing in a vise so that the gear shaft axis is vertical.
- Hook [C] the spring scale [B] on the driven gear holder [A] at a point 200 mm (7.9 in.) [D] apart from the center of the gear shaft.
- Apply force to the handle horizontally and at a right angle to it.

Special Tool - Driven Gear Holder: 57001-1027

- ★If the preload is out of specified range, replace the bearing collar and/or spacer. To increase preload, decrease the stack length of the collar and spacer. To decrease preload, increase the stack length of the collar and spacer.
- ★Change the stack length a little at a time.
- Recheck the bearing preload, and readjust if necessary.

Collars for Preload Adjustment

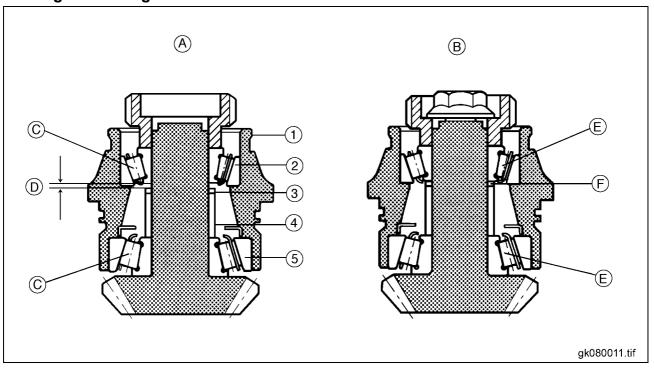
Length (mm)	Part Number
22.8 (0.898 in.)	92027-1152
22.9 (0.902 in.)	92027-1153
23.0 (0.906 in.)	92027-1154
23.1 (0.909 in.)	92027-1155
23.2 (0.913 in.)	92027-1156
23.3 (0.917 in.)	92027-1157
23.4 (0.921 in.)	92027-1158
23.5 (0.925 in.)	92027-1159
23.6 (0.929 in.)	92027-1160
23.7 (0.933 in.)	92027-1161
23.8 (0.937 in.)	92027-1162
23.9 (0.941 in.)	92027-1163
24.0 (0.945 in.)	92027-1164
24.1 (0.949 in.)	92027-1165



Spacers for Preload Adjustment

Thickness (mm)	Part Number
1.70 (0.0669 in.)	92025-1072
1.72 (0.0677 in.)	92025-1073
1.74 (0.0685 in.)	92025-1074
1.76 (0.0693 in.)	92025-1075
1.78 (0.0701 in.)	92025-1076
1.80 (0.0709 in.)	92025-1077

Bearing Preloading Mechanism



- 1. Bearing Housing
- 2. Tapered Roller Bearing Before Tightening [A] After Tightening [B]
- 3. Spacer
- 4. Collar
 Under No Preload [C]
 Initial Clearance [D]
- 5. Tapered Roller Bearing

Under Preload [E] No Clearance [F]

Backlash Adjustment

- Clean any dirt and oil off bevel gear teeth with a high-flash point solvent.
- Install the drive gear with the primary shim (1.0 mm, 0.04 in., thickness), and tighten the nut to the specified torque.

Torque - Drive Gear Nut: 265 N·m (27 kgf·m, 195 ft·lb)

NOTE

- ODo not stake the head of the nut until both backlash and tooth contact adjustments are finished.
- Install the driven gear assy in the front gear case with the primary shim (1.0 mm, 0.04 in., thickness), and tighten the mounting bolts to the specified torque.

Torque - Driven Gear Assy Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)

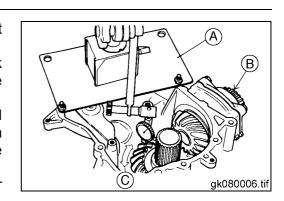
OCheck backlash during tightening of the mounting bolts, and stop tightening them immediately if the backlash disappears. Then, change the shim to a thicker one.

- Install a holder [A] with 6 mm bolts and nuts on the front gear case to mount a dial gage.
- Set up a dial gage against a drive gear tooth to check gear backlash. The gage stem must be in line with the direction of tooth travel.
- To measure the backlash, move the drive gear back and forth [C] while holding [B] the driven gear steady with a tool. The difference between the highest and lowest gage readings is the amount of backlash.
- ★If the backlash is not within the limit, replace the gear shim(s) at the drive and/or driven gear. To increase backlash, increase the thickness of the shim(s). To decrease backlash, decrease the thickness of the shim(s).
- ★Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.

NOTE

OIt is OK to pack two shims. Do not pack three or more shims.

Front Bevel Gear Backlash (at the gear tooth) 0.10 ~ 0.15 mm (0.039 ~ 0.0059 in.)



Shims for Drive Gear

Thickness (mm)	Parts Number
0.15 (0.0059 in.)	92025-1688
0.5 (0.02 in.)	92025-1689
0.6 (0.023 in.)	92025-1690
0.7 (0.028 in.)	92025-1691
0.8 (0.031 in.)	92025-1692
0.9 (0.035 in.)	92025-1693
1.0 (0.039 in.)	92025-1694
1.1 (0.043 in.)	92025-1695
1.2 (0.047 in.)	92025-1696

Shims for Driven Gear

Thickness (mm)	Parts Number
0.1 (0.039 in.)	92025-1826
0.15 (0.0059 in.)	92025-1818
0.5 (0.02 in.)	92025-1819
0.6 (0.023 in.)	92025-1820
0.7 (0.028 in.)	92025-1821
0.8 (0.031 in.)	92025-1822
0.9 (0.035 in.)	92025-1823
1.0 (0.039 in.)	92025-1824
1.2 (0.047 in.)	92025-1825

Tooth Contact Adjustment

- Clean any dirt and oil off the bevel gear teeth with a high -flash point solvent.
- Apply checking compound to 4 or 5 teeth on the driven gear.

NOTE

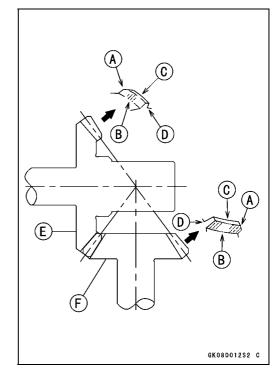
- OApply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.
- The checking compound must be smooth and firm, with the consistency of tooth paste.
- OSpecial compounds are available from automotive supply stores for the purpose of checking differential gear tooth patterns and contact. Use this for checking the bevel gears.

- Turn the driven gear for 3 or 4 revolutions in the drive and reverse (coast) directions, while creating a drag on the drive gear.
- Check the drive pattern and coast pattern of the bevel gear teeth. The tooth contact patterns of both drive and coast sides should be centrally located between the top and bottom of the tooth, and little closer to the toe of the tooth.
- ★ If the tooth contact pattern is incorrect, replace the shim(s) at the driven gear and shim(s) at the driven gear, following the examples shown. Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shims are replaced. Repeat the shim change procedure as necessary.

NOTE

- Olf the backlash goes out of standard range after changing shims, correct the backlash before checking the tooth contact pattern.
- OIt is OK to pack two shims. Do not pack three or more shims.

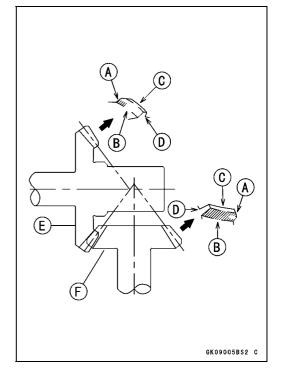
Heel [A]
Bottom [B]
Top [C]
Toe [D]
Drive Gear [E]
Driven Gear [F]



Incorrect Tooth Contact Patterns (Example 1)

Increase the thickness of the drive gear shim(s) by 0.05 mm (0.002 in.), and/or increase the thickness of the driven gear shim(s) by 0.05 mm (0.002 in.) to correct the pattern shown below. Repeat in 0.05 mm (0.002 in.) steps if necessary.

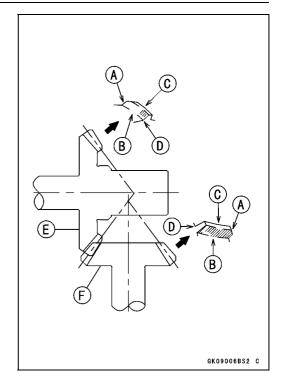
Heel [A]
Bottom [B]
Top [C]
Toe [D]
Drive Gear [E]
Driven Gear [F]



Incorrect Tooth Contact Patterns (Example 2)

Decrease the thickness of the drive gear shim(s) by 0.05 mm (0.002 in.), and/or decrease the thickness of the driven gear shim(s) by 0.05 mm (0.002 in.) to correct the pattern shown below. Repeat in 0.05 mm (0.002 in.) steps if necessary.

Heel [A]
Bottom [B]
Top [C]
Toe [D]
Drive Gear [E]
Driven Gear [F]

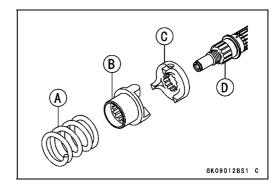


Bevel Gear Inspection

- Visually check the bevel gears for scoring, chipping, or other damage.
- ★Replace the bevel gears as a set if either gear is damaged.

Cam Damper Inspection

- Visually inspect the spring [A], cam follower [B], damper cam [C], and output shaft [D].
- ★Replace the damaged parts.



Bearing and Oil Seal

Ball or Needle Bearing Replacement

• Using the bearing driver set or the oil seal & bearing remover, remove the bearings.

Special Tools - Oil Seal & Bearing Remover: 57001-1058
Bearing Driver Set: 57001-1129

NOTE

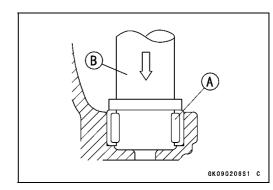
OIn the absence of the above mentioned tools, satisfactory results may be obtained by heating the case to approximately 93°C (200°F) max., and tapping the bearing in or out.

CAUTION

Do not heat the case with a blowtorch. This will warp the case. Soak the case in oil and heat the oil.

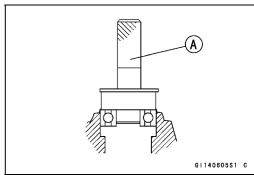
Install a new needle bearing [A] with the marked side facing out until it bottoms out, using the bearing driver set [B]. This prevents bearing damage.

Special Tool - Bearing Driver Set: 57001-1129



• Using a press and the bearing driver set [A], install a new ball bearing until it stops at the bottom of the case.

Special Tool - Bearing Driver Set: 57001-1129

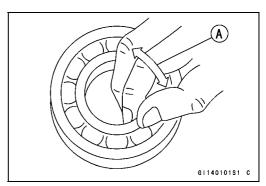


Ball Bearing Wear

CAUTION

Do not remove the bearings for inspection. Removal may damage them.

- Check the ball bearings.
- OSince 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.
- OSpin [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.



11-36 FINAL DRIVE

Bearing and Oil Seal

Tapered Roller Bearing Inspection

CAUTION

Do not remove the tapered roller bearing for inspection. Removal may damage them.

- Visually inspect the bearing in the front and final gear cases for abrasion, color change, or other damage.
- ★If there is any doubt as to the condition of the bearing, replace it.

Needle Bearing Inspection

CAUTION

Do not remove the needle bearing in the final gear case for inspection. Removal may damage them.

- Check the needle bearings in the front and final gear cases.
- OThe rollers in the needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.
- ★If there is any doubt as to the condition of a needle bearing, replace it.

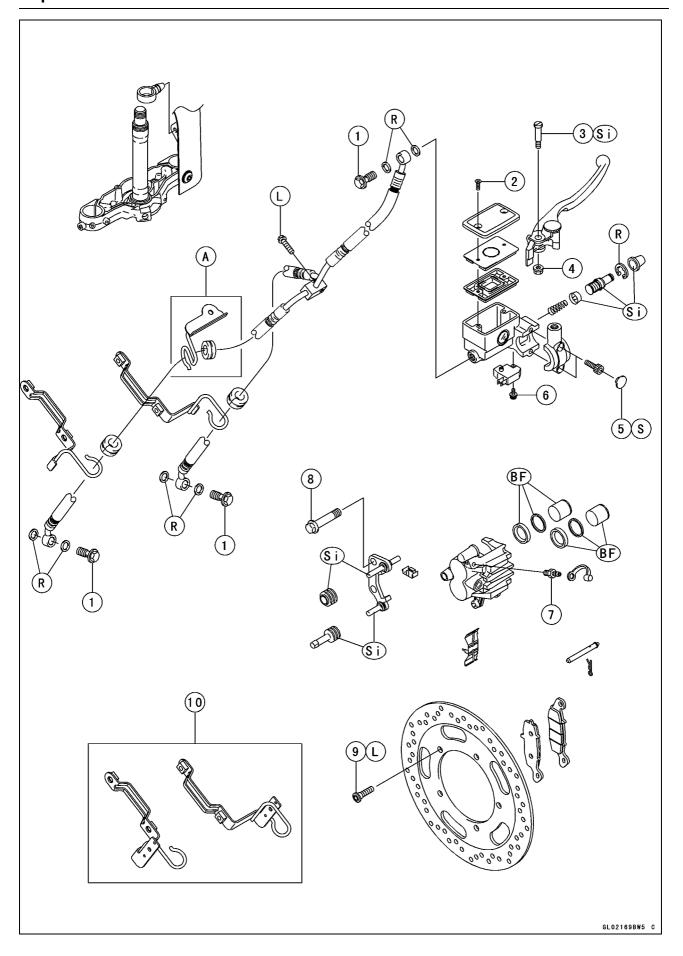
Oil Seal Inspection

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

Brakes

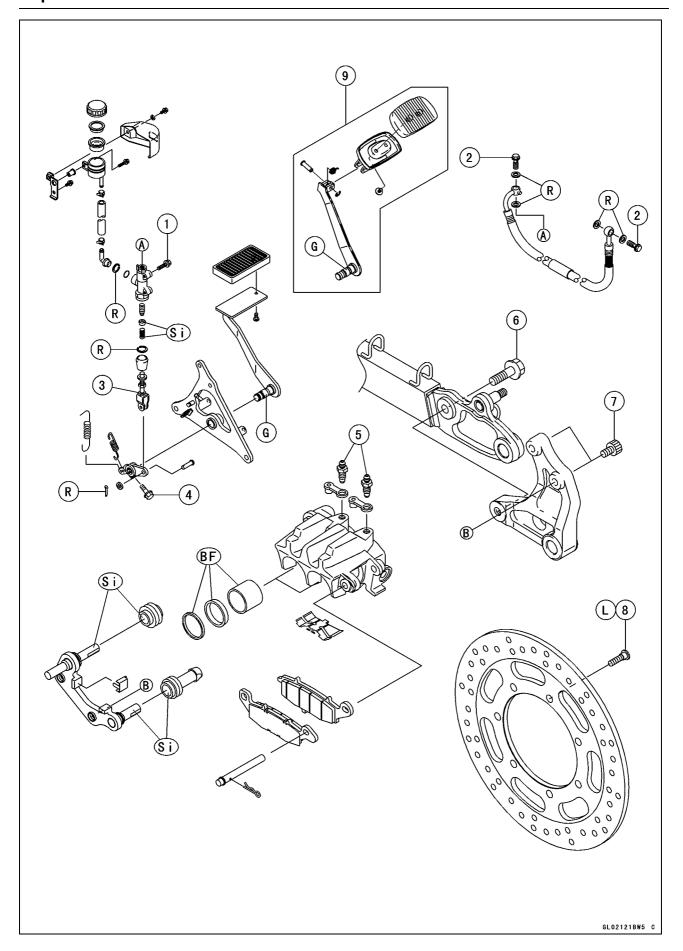
Table of Contents

Exploded View	12-2	Rear Brake Pad Removal	12-16
Specifications	12-6	Rear Brake Pad Installation	12-17
Special Tool	12-7	Brake Pad Wear Inspection	12-17
Brake Lever, Brake Pedal	12-8	Master Cylinder	12-18
Brake Lever Position Adjustment.	12-8	Front Master Cylinder Removal	12-18
Brake Pedal Position Adjustment.	12-8	Front Master Cylinder Installation	12-18
Brake Pedal Removal	12-9	Rear Master Cylinder Removal	12-19
Brake Pedal Installation	12-10	Rear Master Cylinder Installation.	12-20
Calipers	12-11	Front Master Cylinder	
Front Caliper Removal	12-11	Disassembly	12-20
Rear Caliper Removal	12-11	Rear Master Cylinder	
Caliper Installation	12-11	Disassembly	12-21
Front Caliper Disassembly	12-12	Master Cylinder Assembly	12-21
Front Caliper Assembly	12-12	Master Cylinder Inspection	12-22
Rear Caliper Disassembly	12-13	Brake Discs	12-23
Rear Caliper Assembly	12-14	Brake Disc Removal	12-23
Caliper Fluid Seal Damage	12-15	Brake Disc Installation	12-23
Caliper Dust Boot and Friction		Brake Disc Wear	12-23
Boot Damage	12-15	Brake Disc Warp	12-23 _F
Caliper Piston and Cylinder		Brake Fluid	12-24
Damage	12-15	Brake Fluid Level Inspection	12-24
Caliper Holder Shaft Wear	12-15	Brake Fluid Change	12-24
Brake Pads	12-16	Brake Line Bleeding	12-24
Front Brake Pad Removal	12-16	Brake Hoses	12-27
Front Brake Pad Installation	12-16	Brake Hose Removal/Installation.	12-27



No	Fastener	Torque			Damarka
No.		N⋅m	kgf⋅m	ft∙lb	Remarks
1	Brake Hose Banjo Bolts	34	3.5	25	
2	Front Brake Reservoir Cap Screws	1.5	0.15	13 in·lb	
3	Brake Lever Pivot Bolt	1.0	0.10	87 in·lb	Si
4	Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
5	Front Master Cylinder Clamp Bolts	8.8	0.9	78 in·lb	S
6	Front Brake Light Switch Screw	1.2	0.12	10 in·lb	
7	Caliper Bleed Valves	7.8	0.8	69 in·lb	
8	Front Caliper Mounting Bolts	34	3.5	25	
9	Brake Disc Bolts	27	2.8	20	L

- 10. Hose Holders (United States and Canada Models)
- BF: Apply brake fluid.
 - L: Apply a non-permanent locking agent.
- R: Replacement Parts
- S: Follow the specific tightening sequence.
- Si: Apply silicone grease or PBC grease.
- A: VN1600A6F Model ~



No	Fastener	Torque			Damarka
No.		N⋅m	kgf⋅m	ft∙lb	Remarks
1	Rear Master Cylinder Mounting Bolts	25	2.5	18	
2	Brake Hose Banjo Bolts	34	3.5	25	
3	Rear Master Cylinder Push Rod Locknut	18	1.8	13	
4	Brake Pedal Clamp Bolt	25	2.5	18	
5	Caliper Bleed Valves	7.8	0.8	69 in·lb	
6	Rear Caliper Holder Bolt	64	6.5	47	
7	Rear Caliper Mounting Bolts	34	3.5	25	
8	Brake Disc Bolts	27	2.8	20	L

9. VN1600-A3 ~

BF: Apply brake fluid.

G: Apply grease.

L: Apply a non-permanent locking agent.

R: Replacement Parts

Si: Apply silicone grease or PBC grease.

12-6 BRAKES

Specifications

Item	Standard	Service Limit
Brake Lever, Brake Pedal		
Brake Lever Position	No.1	5-way adjustable
Brake Lever Free Play	Non-adjustable	
Pedal Free Play	Non-adjustable	
Pedal Position	About 110 mm (4.33 in.)	
	(height from pedal top to footpeg top)	
Brake Fluid		
Grade	DOT4	
Brake Pads		
Pad Lining Thickness:		
Front	4.5 mm (0.2 in.)	1 mm (0.04 in.)
Rear	7.5 mm (0.295 in.)	1 mm (0.04 in.)
Brake Discs		
Thickness:		
Front	4.8 ~ 5.2 mm (0.19 ~ 0.20 in.)	4.5 mm (0.18 in.)
Rear	6.8 ~ 7.2 mm (0.268 ~ 0.283 in.)	6.0 mm (0.24 in.)
Runout	TIR 0.15 mm (0.0059 in.) or less	TIR 0.3 mm (0.01 in.)

Special Tool

Inside Circlip Pliers:

57001-143

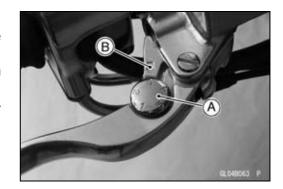
ST570143ST C

Brake Lever, Brake Pedal

Brake Lever Position Adjustment

The brake lever adjuster has 5 positions so that the brake lever position can be adjusted to suit the operator's hand.

- Push the lever forward and turn the adjuster [A] to align the number with the arrow mark [B] on the lever holder.
- OThe distance from the grip to the lever is minimum at number 5 and maximum at number 1.



Brake Pedal Position Adjustment

• Check that the brake pedal [A] is in the correct position.

Pedal Position

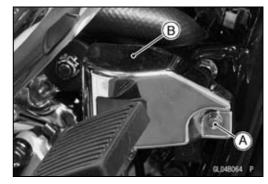
Standard: About 110 mm (4.33 in.) [B]

(height from pedal top to footboard top [C])

NOTE

- OUsually it's not necessary to adjust the pedal position, but always adjust it when push rod locknut has been loosened.
- Olf the push rod length cannot be adjusted by turning the clevis, the brake pedal may be deformed or incorrectly installed.
- Unscrew the brake fluid reservoir cover bolt [A] and remove the brake fluid reservoir cover [B].



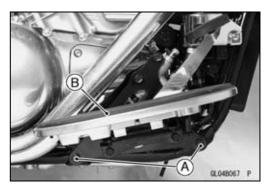


 Unscrew the reservoir bolt [A] and take off the brake fluid reservoir [B].



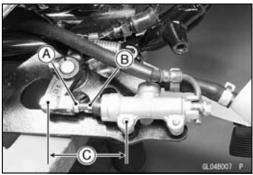
Brake Lever, Brake Pedal

 Remove the right front footboard bracket bolts [A] and turn over the footboard [B].



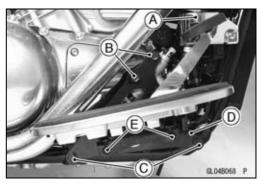
- Loosen the locknut [A] and turn the push rod with the hex head [B] to achieve the correct pedal position.
- ★If the length [C] is **80 ±1 mm (3.1 ±0.04 in.)**, the pedal position will be within the standard range.
- Tighten:

Torque - Push Rod Locknut: 18 N·m (1.8 kgf·m, 13 ft·lb)



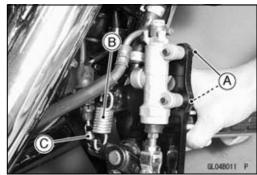
Brake Pedal Removal

- Remove the brake fluid reservoir [A] (see Brake Pedal Position Adjustment).
- Loosen the rear master cylinder mounting bolts [B].
- Remove the right front footboard bracket bolts [C] and footboard bolts [E], and turn over the footboard bracket [D].

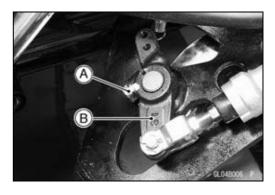


• Remove:

Rear Master Cylinder Mounting Bolts [A] Brake Pedal Return Spring [B] Brake Switch Return Spring [C]

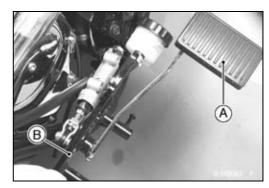


- Unscrew the brake pedal clamp bolt [A].
- Pull out the brake lever [B] with the master cylinder installed.



Brake Lever, Brake Pedal

 Pull out the brake pedal [A] from the right footboard bracket [B].



Brake Pedal Installation

- Apply grease to the brake pedal shaft.
- Install the pedal shaft [A] so that the punched mark on the shaft is aligned [B] with the punched mark on the brake lever [C].
- Install:

Brake Pedal Return Spring Brake Switch Return Spring

• Tighten:

Torque - Brake Pedal Clamp Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)

Footboard Bracket Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

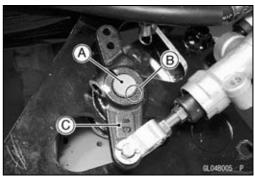
Rear Master Cylinder Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)

- Replenish the fluid in the reservoir, and bleed the brake line (see Brake Line Bleeding).
- Check the brake for proper braking power, no brake drag, and no fluid leakage.

▲ WARNING

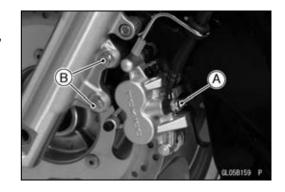
Do not attempt to ride the motorcycle until a full brake pedal is obtained by pumping the brake pedal until the pads are against the disc. The brake will not function on the first application of the pedal if this is not done.

- Check the brake pedal position and adjust it if necessary.
- Check the rear brake light switch operation and adjust the switch if necessary (see Periodic Maintenance chapter).



Front Caliper Removal

- Loosen the banjo bolt [A] at the brake hose lower end, and tighten it loosely.
- Unscrew the caliper mounting bolts [B].



- Take off the caliper.
- Unscrew the banjo bolt and remove the brake hose from the caliper.

Rear Caliper Removal

• Remove:

Caliper Mounting Bolts [A] Brake Hose [B] Rear Caliper [C]



Caliper Installation

- Install the caliper and brake hose lower end.
- OReplace the washer on each side of hose fitting with new ones
- Tighten the caliper mounting bolts and banjo bolt.

Torque - Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Rear Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Brake Hose Banjo Bolt: 34 N·m (3.5 kgf·m, 25 ft·lb)

- Check the fluid level in the brake reservoirs.
- Bleed the brake line (see Brake Line Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.

A WARNING

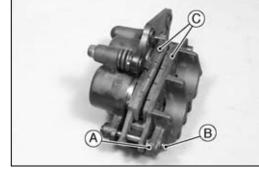
Do not attempt to ride the motorcycle until a full brake lever or pedal is obtained by pumping the brake lever or pedal until the pads are against the disc. The brakes will not function on the first application of the lever or pedal if this is not done.

Front Caliper Disassembly

• Remove:

Caliper (see Front Caliper Removal) Cotter Pin [A] Pin [B] Pads [C]

• Push the piston in.



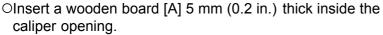
• Remove:

Pad Springs [A] Caliper Holder [B]

• Using compressed air, remove the piston.

A WARNING

To avoid serious injury, never place your fingers or palm inside the caliper opening. If you apply compressed air into the caliper, the piston may crush your hand or fingers.



- OApply compressed air [B] to the banjo bolt hole to allow the pistons [C] to protrude and stop at the wooden board.
- ORemove the wooden board and pull out the piston by hand.
- ★If compressed air is not available, with the brake hose still attached, apply the brake lever to remove the pistons. The remaining process is as described above.



Dust Seals [A] Fluid Seals (piston seals) [B] Friction Boot [C] Bleed Valve

CAUTION

Immediately wash away any brake fluid that spills.

Front Caliper Assembly

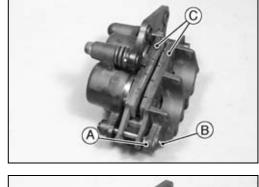
• Clean all parts other than the outer and inner pads.

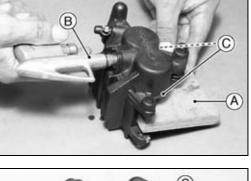
CAUTION

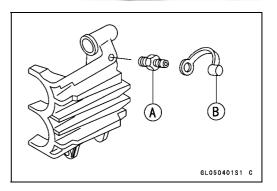
For cleaning the parts, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol.

- Install the bleed valve [A] and the rubber cap [B].
- Tighten:

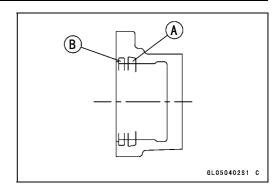
Torque - Caliper Bleed Valve: 7.8 N·m (0.80 kgf·m, 69 in·lb)



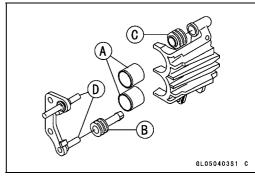




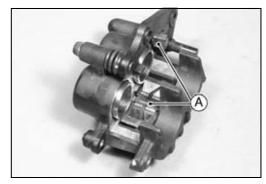
- Replace the fluid seals [A] with new ones, apply brake fluid to them, and install them in the caliper body. Either side of the fluid seal may face outboard.
- Check the dust seals [B] and replace them with new ones if they are damaged.



- Apply brake fluid to the inside of the cylinders and to the outside of the pistons and push the pistons [A] into the cylinders.
- Check the friction boot [B] and dust boot [C] and replace them with new ones if they are damaged.
- Apply a thin coat of silicon grease to the holder shafts [D] and the holder holes.



- Install the pad springs [A].
- Install the pads.
- Wash the caliper with water to remove brake fluid and wipe it off.

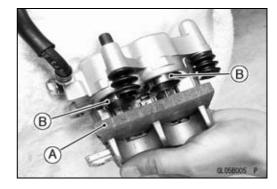


Rear Caliper Disassembly

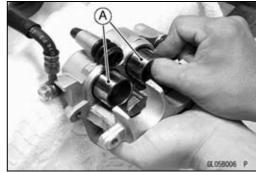
- Remove the caliper with the hose installed (see Caliper Removal).
- Remove the pads (see Pad Removal).
- Pull out the caliper holder [A].



- Insert a wooden board [A] 5 mm (0.2 in.) thick inside the caliper opening.
- Pump the brake pedal until the pistons [B] push the wooden board.



- Remove the board and pull out the pistons [A] by hand.
- OThese pistons can also be removed by disconnecting the hose and applying compressed air to the hose joint opening using the same wooden board. But be careful not to put your fingers or palm inside the caliper opening during work.



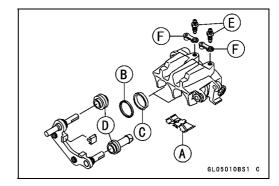
A WARNING

To avoid serious injury, never place your fingers or palm inside the caliper opening. If you apply compressed air into the caliper, the pistons may crush your hand or fingers.

CAUTION

Immediately wash away any brake fluid that spills.

- Remove the anti rattle spring [A].
- Remove the dust seals [B] and fluid seals [C].
- Remove the rubber friction boots [D].
- Remove the bleed valve [E] and rubber cap [F].

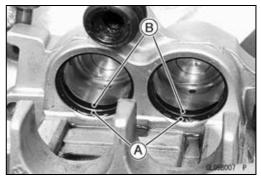


Rear Caliper Assembly

• Tighten the bleed valve.

Torque - Caliper Bleed Valve: 7.8 N·m (0.8 kgf·m, 69 in·lb)

- Olt is recommended that the fluid seal (piston seal) which is removed, be replaced with a new one.
- Replace the dust seals [A] if they are damaged.
- Install the fluid seal [B]. Either side of the seal may face outboard.

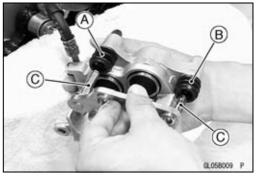


Calipers

- Install the anti-rattle spring [A] in the caliper as shown.
- Apply brake fluid to the cylinders, pistons, and fluid seals (piston seals), and push the pistons into the cylinders by hand. Take care that neither the cylinder nor the piston skirt gets scratched.



- Replace the caliper holder shaft rubber friction boot [A] and dust boot [B] if they are damaged.
- Apply a thin coat of silicone or PBC grease to the caliper holder shafts [C] and holder holes (Silicone or PBC grease is a special high temperature, water-resistance grease).
- Install the pads (see Brake Pad Installation).



Caliper Fluid Seal Damage

The fluid seal (piston seal) [A] is placed around the piston to maintain clearance between the pad and the disc. If the seal is in a poor condition, it could lead the pad to wear excessively or the brake to drag, which may cause the temperature of the discs or the brake fluid to increase.

- Replace the fluid seal if it exhibits any of the conditions listed below.
- OBrake fluid leakage around the pad.
- OBrakes overheat.
- OConsiderable difference in inner and outer pad wear.
- OSeal and piston are stuck together.
- ★If the fluid seal is replaced, replace the dust seal [B] as well. Also, replace all seals every other time the pads are changed.

Caliper Dust Boot and Friction Boot Damage

- Check that the dust boot [C] and friction boot [D] are not cracked, worn, swollen, or otherwise damaged.
- If they show any damage, replace it.

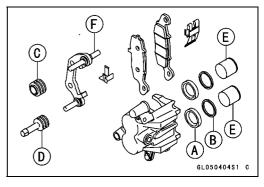
Caliper Piston and Cylinder Damage

- Visually inspect the piston [E] and cylinder surfaces.
- ★Replace the caliper if the cylinder and piston are badly scored or rusty.

Caliper Holder Shaft Wear

The caliper body must slide smoothly on the caliper holder shafts. If the body does not slide smoothly, one pad will wear more than the other, and constant drag on the disc may cause the temperature of the discs or the brake fluid to increase.

- Visually inspect that the caliper holder shafts [F] are not badly worn or bent.
- ★If the caliper holder shafts are damaged, replace the entire caliper assembly.

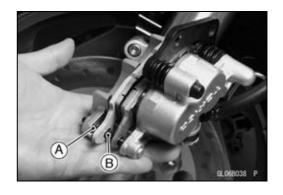


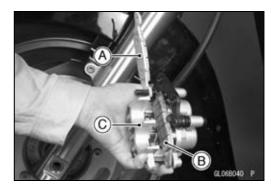
Brake Pads

Front Brake Pad Removal

NOTE

- OThe procedure to remove the front caliper is as follows. The rear caliper pad removal is the same as for the front caliper.
- Remove the caliper with the hose installed (see Caliper Removal).
- Remove: Snap Pin [A] Pad Pin [B]
- Remove the jaw side pad [A], and then remove the piston side pad [B].
 Jaw [C]





Front Brake Pad Installation

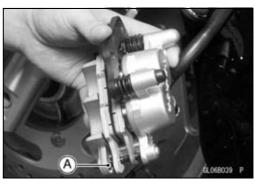
- Push the caliper pistons in by hand as far as they will go.
- Install the brake pads.
- Install the pad pin and snap pin [A]. The snap pin must be "outside" of the pads.

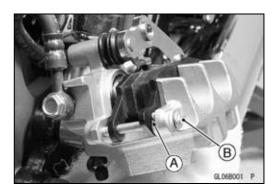
A WARNING

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

Rear Brake Pad Removal

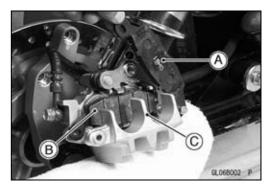
- Remove the caliper with the hose installed (see Caliper Removal).
- Remove: Snap Pin [A] Pad Pin [B]





Brake Pads

 Remove the jaw side pad [A], and then remove the piston side pad [B].
 Jaw [C]



Rear Brake Pad Installation

- Before installation, clean the pads with a high-flash point solvent.
- Push [A] the caliper pistons in by hand as far as they will go.
- Be sure to install the snap pin for the caliper.

A WARNING

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

Brake Pad Wear Inspection

• Refer to Brake Pad Wear Inspection in the Periodic Maintenance chapter.



Front Master Cylinder Removal

- Disconnect the front brake light switch connectors [A].
- Draw out the brake fluid from the reservoir with a means like the fork oil level gage.
- Pull the bolt caps out.
- Remove the banjo bolt [C] to disconnect the brake hose from the master cylinder (see Brake Hose Removal/Installation).
- Unscrew the clamp bolts [B], and take off the master cylinder as an assembly with the reservoir, brake lever, and brake switch installed.

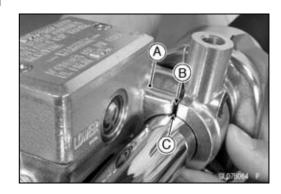
C B B C 78063 P

CAUTION

Immediately wash away any brake fluid that spills.

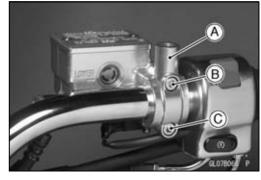
Front Master Cylinder Installation

• Set the front master cylinder [A] to match its mating surface [B] to the punched mark [C] of the handlebar.

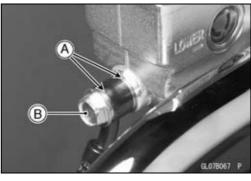


- OThe master cylinder clamp must be installed with the rear view mirror boss [A] faced upward.
- Tighten the upper clamp bolt [B] first, and then the lower clamp bolt [C]. There will be a gap at the lower part of the clamp after tightening.

Torque - Front Master Cylinder Clamp Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)



- Install the bolt caps.
- Use a new flat washers [A] on each side of the brake hose fitting.
- Tighten the brake hose banjo bolt [B].
 - Torque Brake Hose Banjo Bolt: 34 N·m (3.5 kgf·m, 25 ft·lb)
- Replenish the fluid in the reservoir, and bleed the brake line (see Bleeding the Brake Line).
- Check the brake for good braking power, no brake drag, and no fluid leakage.



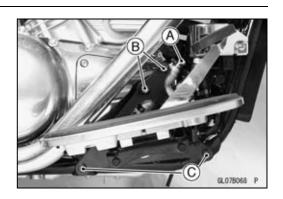
Rear Master Cylinder Removal

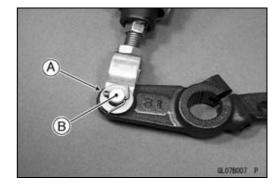
- Remove the brake fluid reservoir cover (see Brake Pedal Position Adjustment).
- Draw out the brake fluid from the reservoir with a means like the fork oil level gage.
- Remove the brake fluid reservoir (see Brake Pedal Position Adjustment).
- Unscrew the brake hose banjo bolt [A] on the master cylinder.
- Loosen the master cylinder mounting bolts [B].
- Unscrew the footpeg bracket bolts [C].
- Remove:

Rear Master Cylinder Mounting Bolts Brake Pedal Return Spring (see Brake Pedal Removal) Brake Switch Return Spring [B] (see Brake Pedal Removal)

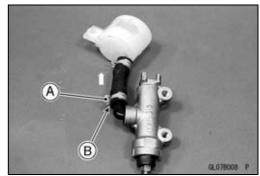
Brake Lever (see Brake Pedal Removal)

• Remove the cotter pin [A] and joint pin [B].

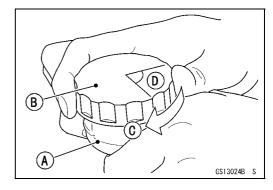




- Slide the reservoir hose lower end clamp [A].
- Pull out the reservoir hose lower end [B], and drain the brake fluid into a container.



- Follow the procedure below to install the rear brake fluid reservoir cap correctly.
- OFirst, tighten the rear brake fluid reservoir cap [B] clockwise [C] by hand until slight resistance is felt indcating that the cap is seated on the reservoir body, then tighten the cap an additional 1/6 turn [D] while holding the brake fluid reservoir body [A].



Rear Master Cylinder Installation

- Replace the cotter pin with a new one.
- Insert the cotter pin [A] to the hole of the joint pin [B] and separate [C] the cotter pin ends.
- Use a new flat washer on each side of the brake hose fitting.
- Tighten:

Torque - Footboard Bracket Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Rear Master Cylinder Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)

Brake Hose Banjo Bolt: 34 N·m (3.5 kgf·m, 25 ft·lb)

- Bleed the brake line (see Brake Line Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.



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

Front Master Cylinder Disassembly

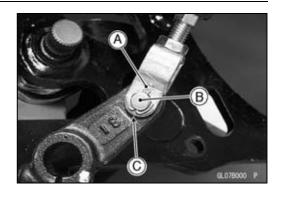
- Remove the front master cylinder.
- Remove the reservoir cap, plate and diaphragm.
- Unscrew the locknut and pivot bolt, and remove the brake lever
- Pull the dust cover [A] out of place, and remove the circlip [B].

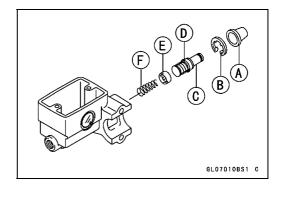
Special Tool - Inside Circlip Pliers: 57001-143

• Pull out the piston assy [C], primary cup [E], and return spring [F].

CAUTION

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





Rear Master Cylinder Disassembly

NOTE

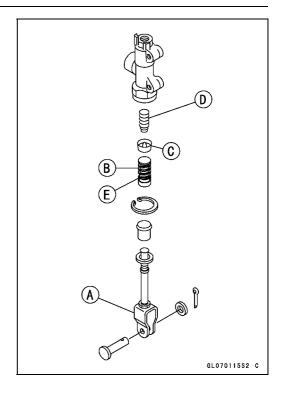
- ODo not remove the push rod clevis [A] for master cylinder disassembly since removal requires brake pedal position adjustment.
- Remove the rear master cylinder (see Rear Master Cylinder Removal).
- Slide the dust cover on the push rod out of place, and remove the circlip.

Special Tool - Inside Circlip Pliers: 57001-143

- Pull out the push rod with the piston stop.
- Take off the piston assy [B], primary cup [C], and return spring [D].

CAUTION

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



Master Cylinder Assembly

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

CAUTION

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

- Apply brake fluid to the removed parts and to the inner wall of the cylinder.
- Take care not to scratch the piston or the inner wall of the cylinder.
- Apply:

Silicone Grease - Brake Lever Pivot Bolt

Brake Lever Pivot Contact, Dust Cover

Push Rod Contact, Dust Cover

• Tighten the brake lever pivot bolt and the locknut.

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

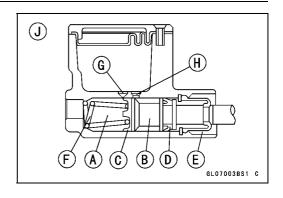
Brake Lever Pivot Bolt Locknut: 5.9 N·m (0.60 kgf·m, 52 in·lb)

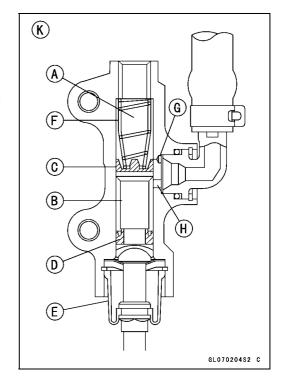
Master Cylinder Inspection

- Disassemble the front and rear master cylinders.
- Check that there are no scratches, rust or pitting on the inner wall [A] of each master cylinder and on the outside of each piston [B].
- ★ If a master cylinder or piston shows any damage, replace them.
- Inspect the primary cup [C] and secondary cup [D].
- ★If a cup is worn, damaged softened (rotted), or swollen, the piston assy should be replaced to renew the cups.
- ★If fluid leakage is noted at the brake lever, the piston assy should be replaced to renew the cups.

 Front Master Cylinder [J]
- Check the dust covers [E] for damage.
- ★If they are damaged, replace them.
- Check the piston return spring [F] for any damage.
- ★If the springs are damaged, replace them.
- Check that relief port [G] and supply port [H] are not plugged.
- ★If the relief port becomes plugged, the brake pads will drag on the disc. Blow the ports clean with compressed air.

Rear Master Cylinder [K]





Brake Discs

Brake Disc Removal

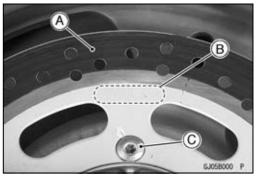
- Remove the wheel (see Wheels/Tires chapter).
- Unscrew the mounting bolts [A], and take off the disc.



Brake Disc Installation

- Install the brake disc [A] on the wheel so that the marked side [B] faces out.
- Apply a non-permanent locking agent to the threads of the brake disc bolts [C].
- Tighten:

Torque - Brake Disc Bolts: 27 N·m (2.8 kgf·m, 20 ft·lb)



Brake Disc Wear

 Measure the thickness of each disc [A] at the point where it has worn the most.

Measuring Area [B]

★Replace the disc if the sliding surface has worn past the service limit.

Front Disc Thickness

Standard: 4.8 ~ 5.2 mm (0.19 ~ 0.20 in.)

Service Limit: 4.5 mm (0.18 in.)

Rear Disk Thickness

Standard: 6.8 ~ 7.2 mm (0.268 ~ 0.283 in.)

Service Limit: 6.0 mm (0.24 in.)

Real Disk Hillckiless

Brake Disc Warp

• Jack up the motorcycle so that the wheel is off the ground (see Wheels/Tires chapter).

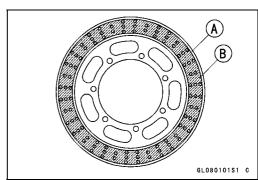
OFor front disc inspection, turn the handlebar fully to one side.

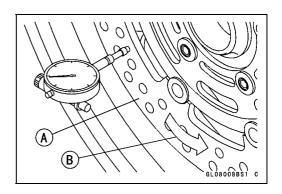
- Set up a dial gage against the disc [A] as shown and measure disc runout, while turning [B] the wheel by hand.
- ★ If the runout exceeds the service limit, replace the disc.

Disc Runout

Standard: TIR 0.15 mm (0.0059 in.) or less

Service Limit: TIR 0.3 mm (0.01 in.)





Brake Fluid

Brake Fluid Level Inspection

 Refer to Brake Fluid Level Inspection in Periodic Maintenance chapter.

Brake Fluid Change

 Refer to Brake Fluid Change in Periodic Maintenance chapter.

Brake Line Bleeding

The brake fluid has a very low compression coefficient so that almost all the movement of the brake lever or pedal is transmitted directly to the caliper for braking action. Air, however, is easily compressed. When air enters the brake lines, brake lever or pedal movement will be partially used in compressing the air. This will make the lever or pedal feel spongy, and there will be a loss in braking power.

A WARNING

Be sure to bleed the air from the brake line whenever brake lever or pedal action feels soft or spongy after the brake fluid is changed, or whenever a brake line fitting has been loosened for any reason.

NOTE

- OThe procedure to bleed the front brake line is as follows. Bleeding the rear brake line is almost the same as for the front brake.
- Remove the reservoir cap, and fill the reservoir with fresh brake fluid to the upper level line in the reservoir.
- With the reservoir cap off, slowly pump the brake lever several times until no air bubbles can be seen rising up through the fluid from the holes [A] at the bottom of the reservoir.
- Install the reservoir cap.



Brake Fluid

- Remove the rubber cap from the bleed valve on the caliper.
- Attach a clear plastic hose to the bleed valve, and run the other end of the hose into a container.
- Bleed the brake line and the caliper as follows:
- ORepeat this operation until no more air can be seen coming out into the plastic hose.

Pump the brake lever until it becomes hard, and apply the brake lever and hold it [A].

Quickly open and close [B] the bleed valve while holding the brake lever applied.

Release the brake lever [C].

NOTE

- OThe 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.
- OTap the brake hose lightly from the caliper to the reservoir for more complete bleeding.
- Remove the clear plastic hose.
- Tighten:

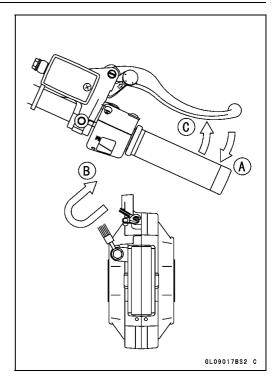
Torque - Caliper Bleed Valve: 7.8 N·m (0.8 kgf·m, 69 in·lb)
Front Brake Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

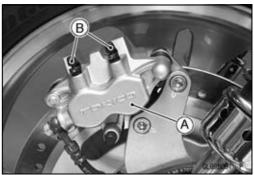
• Repeat the above steps for other caliper.

NOTE

OFor the rear brake caliper [A], bleed the brake line for two bleed valves [B].

- Check the fluid level.
- After bleeding is done, check the brake for good braking power, no brake drag, and no fluid leakage.



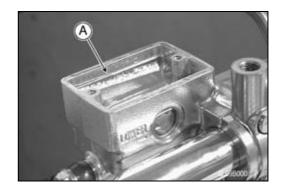


Brake Fluid

A WARNING

When working with the disc brake, observe the precautions listed below.

- 1. Never reuse old brake fluid.
- 2. Do not use fluid from a container that has been left unsealed or that has been open for a long time.
- 3. Do not mix two types and brands of fluid for use in the brake. This lowers the brake fluid boiling point and could cause the brake to be ineffective. It may also cause the rubber brake parts to deteriorate.
- 4. Don't leave the reservoir cap off [A] for any length of time to avoid moisture contamination of the fluid.
- 5. Don't change the fluid in the rain or when a strong wind is blowing.
- 6. Except for the disc pads and disc, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, engine oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely and will eventually deteriorate the rubber used in the disc brake.
- 7. When handing the disc pads or disc, be careful that no disc brake fluid or any oil gets on them. Clean off any fluid or oil that inadvertently gets on the pads or disc with a high-flash point solvent. Do not use one which will leave an oily residue. Replace the pads with new ones if they cannot be cleaned satisfactorily.
- 8. Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely washed away immediately.
- If any of the brake line fittings or the bleed valve is opened at any time, the AIR MUST BE BLED FROM THE BRAKE LINE.



Brake Hoses

Brake Hose Removal/Installation

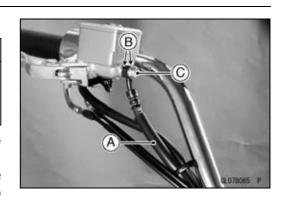
CAUTION

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

- When removing the brake hose, take care not to spill the brake fluid on the painted or plastic parts.
- When removing the brake hose [A], temporarily secure the end of the brake hose to some high place to keep fluid loss to a minimum.
- Immediately wash away any brake fluid that spills.
- There are washers [B] on each side of the brake hose fitting. Replace them with new ones when installing.
- Tighten the banjo bolts [C] on the hose fittings.

Torque - Brake Hose Banjo Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

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



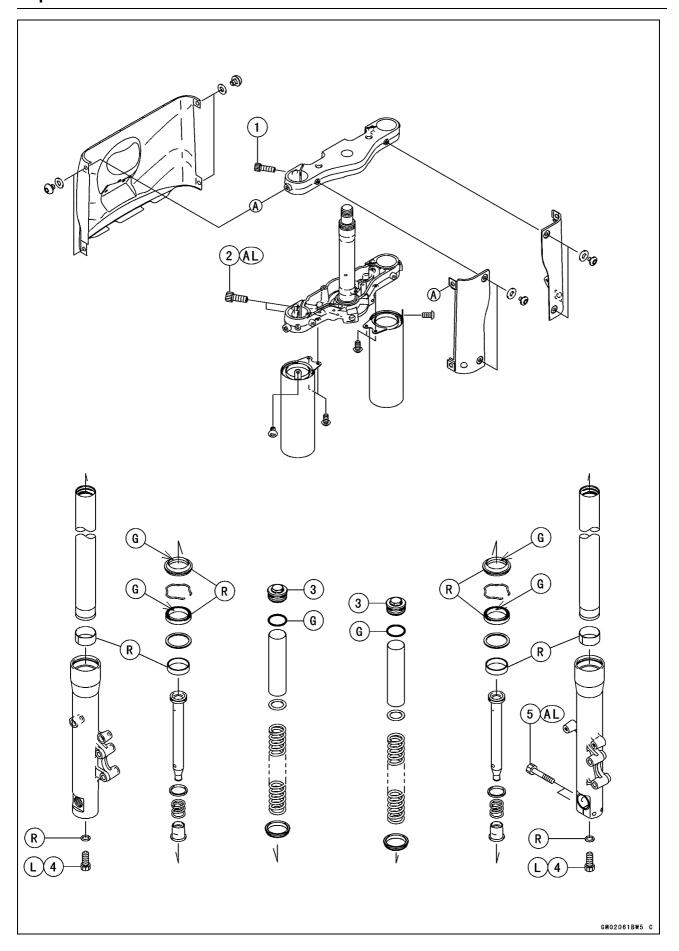




Suspension

Table of Contents

Exploded View	13-2
Specifications	13-6
Special Tools	13-7
Front Fork	13-8
Fork Oil Change	13-8
Front Fork Removal	13-9
Front Fork Installation	13-10
Disassembly	13-11
Assembly	13-12
Inner Tube, Outer Tube Inspection	13-14
Dust Seal Inspection	13-14
Spring Tension	13-14
Rear Shock Absorber	13-15
Rebound Damping Adjustment	13-15
Spring Preload Adjustment (VN1600-A1 ~ A2)	13-15
Air Pressure Adjustment (VN1600-A3 ~)	13-16
Rear Shock Absorber Removal	13-17
Rear Shock Absorber Installation	13-18
Rear Shock Absorber Inspection	13-18
Scrapping (VN1600-A3 ~)	13-18
Swingarm	13-19
Swingarm Removal	13-19 1
Swingarm Installation	13-20
Swingarm Bearing Removal	13-21
Swingarm Bearing Installation	13-21
Swingarm Bearing, Sleeve Inspection	13-21
Grease Seal and Needle Bearing Lubrication	13-22



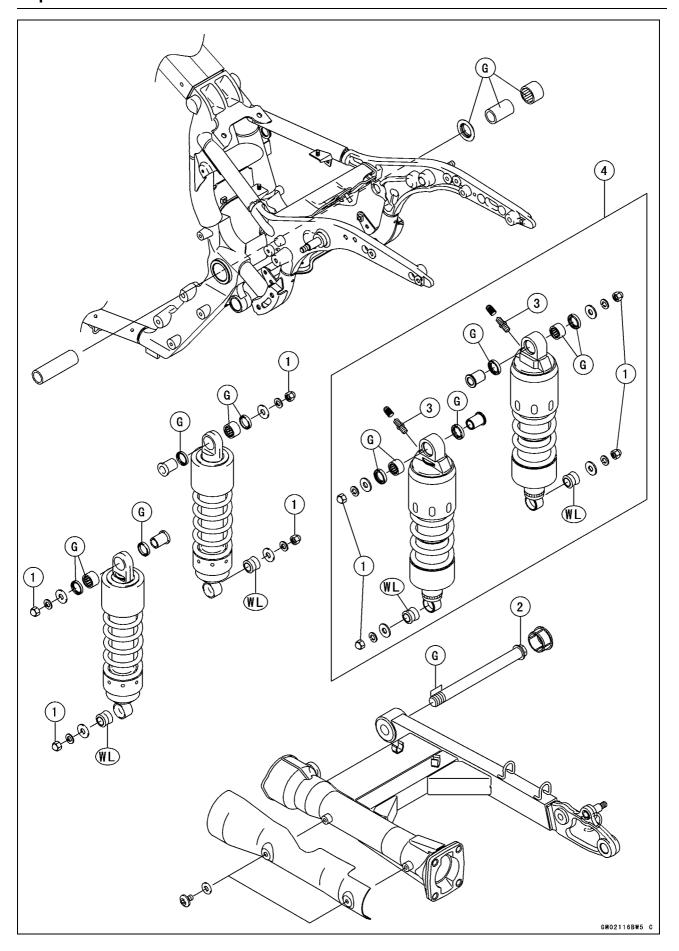
No.	Factorer	Torque			Damarka
NO.	Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
	Front Fork Clamp Bolts (Upper)	20	2.0	15	
1 Front Fork Clamp Bolts (Upper) (VN1600-A2 ~)		29	3.0	21	
2	Front Fork Clamp Bolts (Lower)	29	3.0	21	
3	Front Fork Top Plugs	22	2.2	16	
4	Front Fork Bottom Allen Bolt	30	3.1	22	L
5	Front Axle Clamp Bolts	20	2.0	15	AL
5	Front Axle Clamp Bolts (VN1600-A2 ~)	29	3.0	21	AL

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

G: Apply grease.

L: Apply a non-permanent locking agent.

R: Replacement Parts



No	Factoria	Torque			Domonico
No.	Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
1	Rear Shock Absorber Nuts	34	3.5	25	
2	Swingarm Pivot Shaft	108	11.0	79.6	G
3	Air valve (VN1600-A3 ~)	5.4	0.55	4.7 in·lb	

^{4.} Rear Shock Abosorber (VN1600-A3 ~)

G: Apply grease.
WL: Apply a soap and water solution or rubber lubricant.

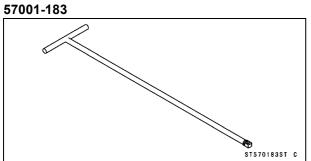
13-6 SUSPENSION

Specifications

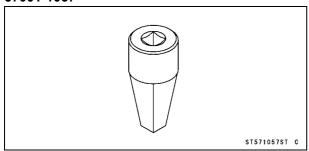
Item	Standard
Front Fork (per one unit)	
Fork Inner Tube Diameter	ϕ 43 mm (ϕ 1.7 in.)
Fork Spring Setting	Non-adjustable
Air Pressure	Atmospheric pressure (Non-adjustable)
Rebound Damper Setting	Non-adjustable
Fork Oil Viscosity	KHL34 (KAYAB.G10) or equivalent
Fork Oil Capacity:	521 ± 2 mL (17.6 ± 0.068 US oz.) (completely disassembled and dry)
	approx. 445 mL (15.0 US oz.) (when changing oil)
Fork Oil Level:	Fully compressed, without fork spring, below from inner tube top 120 mm (4.72 in.)
Fork Spring Free Length	382.4 mm (15.06 in.) (Service limit: 375 mm (14.8 in.))
Rear Shock Absorber	
Rebound Damper Set	No.2 of 4 positions (VN1600-A3 ~)
Spring Setting Position	No.2 of 5 positions (VN1600-A1 ~ A2)
Air pressure (VN1600-A3 ~)	
Standard	Atomospheric pressure
Usable Range	0 kpa (0 kgf/cm², 0 psi) ~ 290 kpa (3.0 kgf/cm², 43 psi)

Special Tools

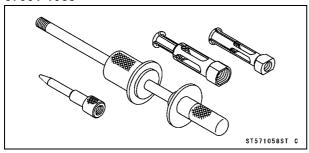
Fork Cylinder Holder Handle:



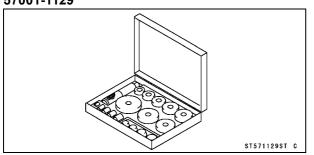
Fork Cylinder Holder Adapter: 57001-1057



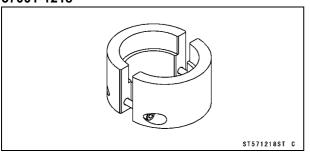
Oil Seal & Bearing Remover: 57001-1058



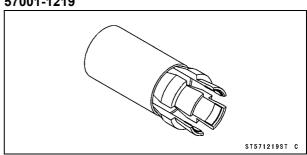
Bearing Driver Set: 57001-1129



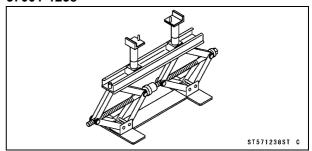
Fork Outer Tube Weight: 57001-1218



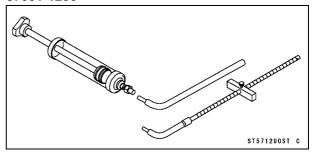
Front Fork Oil Seal Driver: 57001-1219



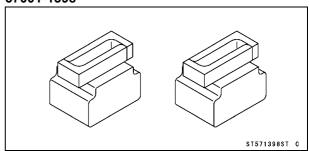
Jack: 57001-1238



Fork Oil Level Gauge: 57001-1290



Attachment Jack: 57001-1398



Fork Oil Change

- Remove the front fork (see Front Fork Removal).
- Hold the outer tube vertically in a vise.
- Remove:

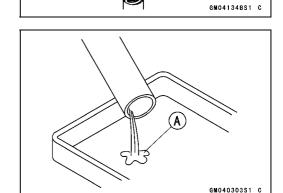
Top Plug [D] (with O-ring [E])
Collar [C]

Washer [B]

Spring [A]

- Pour out the fork oil [A] with the fork upside down.
- Hold the outer tube vertically in a vise.
- Fill the front fork with the specified oil.

Fork Oil Viscosity: KHL34 (KAYAB.G10) or equivalent Fork Oil Capacity (when changing oil): Approx. 445 mL (15.0 US oz.)



(E)

 (\mathbf{c})

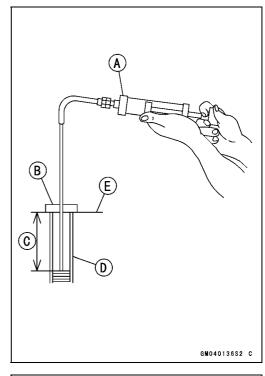
(B)

(A)

- Wait for about five minutes so that any suspended air bubbles can surface.
- Measure the oil level, using the fork oil level gauge [A].
 Special Tool Fork Oil Level Gauge: 57001-1290
- OSet the gauge stopper [B] so that its lower side shows the oil level distance specified [C].
- Olnsert the gage tube into the inner tube [D] and position the stopper across the top of the inner tube [E].
- OPull the handle slowly to draw out the excess oil until no more oil comes up the tube.
- ★If no oil is drawn out from the beginning, there is not enough oil in the fork. Pour in some more oil, then draw out the excess.

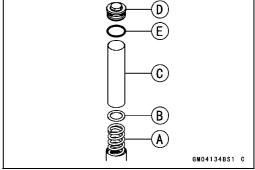
Front Fork Oil Level (Fully compressed without fork spring)

Standard: 120 ±2 mm (4.72 ±0.08 in.)



Install:

Fork Spring [A]
Washer [B]
Spacer [C]
Top Plug [D] with O-ring [E]



• Tighten:

Torque - Fork Clamp Bolts (Lower): 29 N·m (3.0 kgf·m, 21

Fork Clamp Bolts (Upper): 20 N·m (2.0 kgf·m, 15

ft·lb)

Fork Clamp Bolts (Upper): 29 N·m (3.0 kgf·m, 21

ft·lb) VN1600-A2 ~

Front Axle Clamp Bolts: 20 N·m (2.0 kgf·m, 22 ft·lb) Front Axle Clamp Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb)

VN1600-A2 ~

Front Axle: 108 N·m (11.0 kgf·m, 79.6 ft·lb)
Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Front Fork Removal

 Using the jack [A] and attachment jack [B] under the frame pipe ribs [C], and a commercially available jack [D] under the engine [E], lift the front wheel [F] OFF the ground until the rear wheel [G] touches the ground.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

CAUTION

Be sure to put the rear wheel on the ground when removing the front fork, or the motorcycle may fall over. The motorcycle could be damaged.

▲ WARNING

Be sure to put the rear wheel on the ground when removing the front fork, or the motorcycle may fall over. It could cause an accident and injury.

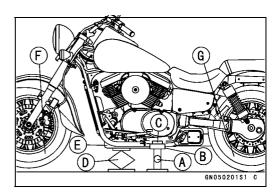
• Remove:

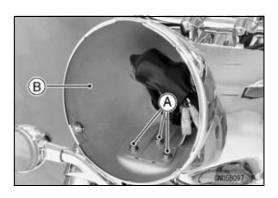
Caliper (see Brakes chapter)
Front tire (see Wheels/Tires chapter)
Front fender (see Frame chapter)
Headlight (see Electrical System chapter)

• Remove:

Bolts [A]

Headlight body [B]



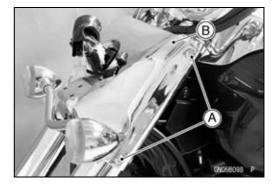


13-10 SUSPENSION

Front Fork

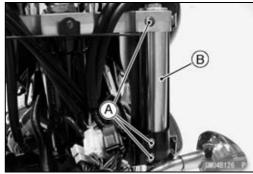
• Remove:

Bolts [A] (both side) Front fork center cover [B]



• Remove:

Front fork clamp bolts [A] Front fork inner cover Front fork [B]



Front Fork Installation

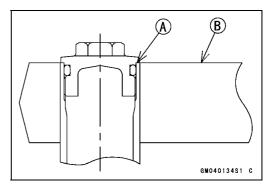
- Install the fork so that the top end [A] of the inner tube is flush with the upper surface [B] of the steering stem head bracket.
- Tighten:

Torque - Front Fork Clamp Bolts (Lower): 29 N·m (3.0 kgf·m, 21 ft·lb)
Front Fork Top Plug: 22 N·m (2.2 kgf·m, 16 ft·lb)

NOTE

- OTighten the top plug before tightening the upper fork clamp bolts.
- O Tighten the two clamp bolts alternately two times to ensure even tightening torque.
- Tighten:

Torque - Front Fork Clamp Bolts (Upper):
20 N·m (2.0 kgf·m, 15 ft·lb)
29 N·m (3.0 kgf·m, 21 ft·lb) VN1600-A2 ~



• Install the removed parts and tighten:

Torque - Front Axle Clamp Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb) Front Axle Clamp Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb) VN1600-A2 ~

Front Axle: 108 N·m (11.0 kgf·m, 79.6 ft·lb)
Front Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

NOTE

O Tighten the two clamp bolts alternately two times to ensure even tightening torque.

• Check the front brake effectiveness after installation.

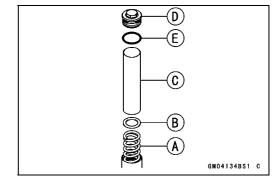
A WARNING

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

Disassembly

- Remove the front fork (see Front Fork Removal in this chapter).
- Drain the fork oil (see Fork Oil Change in this chapter).
 The following parts are removed during draining the fork oil.

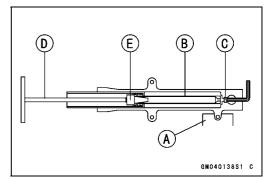
Top Plug [D] with O-ring [E] Spacer [C] Washer [B] Fork Spring [A]



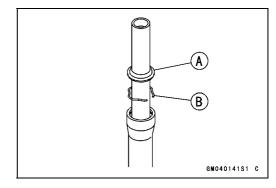
- Hold the front fork horizontally in a vise [A].
- Stop the cylinder unit [B] from turning by using the special tools
- Unscrew the Allen bolt [C], and take the gasket out of the bottom of the outer tube.

Special Tools - Fork Cylinder Holder Handle: 57001-183 [D] Fork Cylinder Holder Adapter: 57001-1057 [E]

• Take the cylinder unit out of the inner tube.



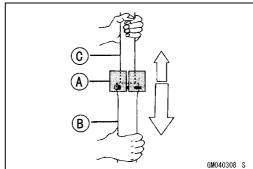
- Separate the inner tube from the outer tube as follows:
- ORemove the dust seal [A] from the outer tube.
- ORemove the retaining ring [B] from the outer tube.



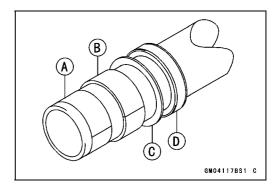
- OUse the fork outer tube weight [A] to separate the outer tube [B] from the inner tube [C].
- OHolding the inner tube by hand, pull the outer tube several times to pull out the inner tube.

Special Tool - Fork Outer Tube Weight: 57001-1218

OTake out the cylinder base out of the outer tube.

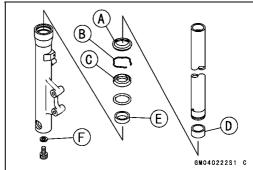


• Remove the inner tube guide bushing [A], outer tube guide bushing [B], washer [C], and oil seal [D] from the inner tube.

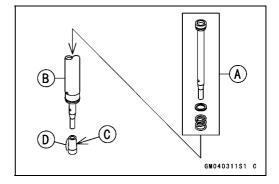


Assembly

- Replace the following parts with new ones after removal.
 - Dust Seal [A]
 - Retaining Ring [B]
 - Oil Seal [C]
 - Inner Guide Bushing [D]
 - Outer Guide Bushing [E]
 - Bottom Allen Bolt Gasket [F]

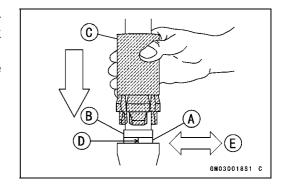


- Put the cylinder unit [A] with the spring into the inner tube [B], protruding from the inner tube, and install the cylinder base [C] onto the bottom end of the cylinder unit.
- OInstall the cylinder base with the tapered end [D] up.
- Install the inner tube, cylinder unit, and cylinder base as a set into the outer tube.



- Install the new guide bushing [A] with a used guide bushing [B] on it by tapping the used guide bushing with fork oil seal driver [C] until it stops.
- OThe split [D] of the bushing should face toward the side [E] of the vehicle.

Special Tool - Front Fork Oil Seal Driver: 57001-1219



- Apply molybdenum disulfide grease to the oil seal lips and install the washer [A] and the oil seal [B] into the outer tube.
- OFace the flat side [C] of the seal upward.

Special Tool - Front Fork Oil Seal Driver [D]: 57001-1219

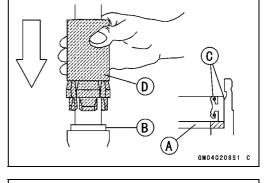
• Install:

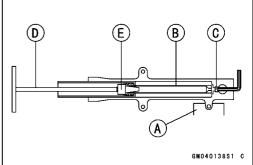
Retaining Ring Dust Seal

- Apply a non-permanent locking agent to the threads of the Allen bolt and screw the Allen bolt into the bottom of the outer tube.
- Hold the front fork horizontally in a vise [A].
- Hold the cylinder unit [B] with the special tools and tighten the Allen bolt [C].

Special Tools - Fork Cylinder Holder Handle: 57001-183 [D]
Fork Cylinder Holder Adapter: 57001-1057
[E]

Torque - Bottom Allen Bolt: 30 N·m (3.1 kgf·m, 22 ft·lb)





Inner Tube. Outer Tube Inspection

- Visually inspect the inner tube [A] and repair any damage.
- Nick or rust damage can sometimes be repaired by using a wet- stone to remove sharp edges or raised areas which cause seal damage.
- ★If the damage is not repairable, replace the inner tube. Since damage to the inner tube damages the oil seal, replace the oil seal whenever the inner tube is repaired or replaced.

CAUTION

If the inner tube is badly bent or creased, replace it. Excessive bending, followed by subsequent straightening, can weaken the inner tube.

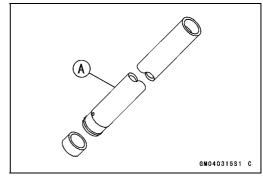
- Temporarily assemble the inner and outer tubes, and pump them back and forth manually to check for smooth operation.
- ★If you feel binding or catching, the inner and outer tubes must be replaced.

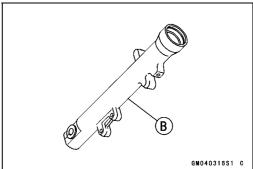


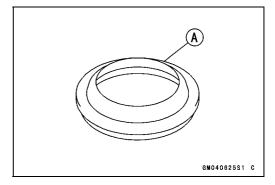
A straightened inner or outer fork tube [B] may fail in use, possibly, causing an accident. Replace a badly bent or damaged inner or outer tube, and inspect the other tube carefully before reusing it.

Dust Seal Inspection

- ★Inspect the dust seal [A] for any signs of deterioration or damage.
- ★Replace them if necessary.





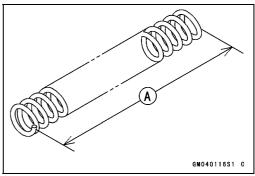


Spring Tension

- Since the spring becomes shorter as it weakens, check its free length [A] to determine its condition.
- ★If the spring of either fork leg is shorter than the service limit, it must be replaced.
- ★If the length of a replacement spring and that of the remaining spring vary greatly, the remaining spring should also be replaced in order to keep the fork legs balanced for motorcycle stability.

Spring Free Length

Standard: 382.4 mm (15.06 in.) Service Limit: 375 mm (14.8 in.)



Rebound Damping Adjustment

The rebound damping force adjuster on each rear shock absorber has 4 positions so that the rebound damping force can be adjusted for different road and loading conditions. The numbers on the adjuster show the setting position.

- Turn the adjuster [A] until the desired number [B].
- OThe standard adjuster setting is **No.2 (No.11)** for an average-build rider of 68 kg (150 lb) with no passenger and no accessories.
- ★If the damper setting feels too soft or too stiff, adjust it in accordance with the following table.



Rebound Damping Adjustment

Adjuster	Damping	Setting	Load	Road	Speed
Position	Force	Setting	Luau	Noau	Speed
1	Weak	Soft	Light	Good	Low
2	↑	↑	↑	↑	↑
3	\downarrow	\downarrow	\downarrow	\downarrow	\downarrow
4	Strong	Hard	Heavy	Bad	High

Spring Preload Adjustment (VN1600-A1 ~ A2)

The spring preload adjuster on each rear shock absorber has 5 positions so that the spring tension can be adjusted for different road and loading conditions.

- Using the wrench [A], turn the adjuster [B] to adjust the spring tension.
- OThe standard adjuster position for an average-build rider of 68 kg (150 lb) with no passenger and no accessories is 2nd step [C] from the weakest position.
- ★If the spring action feels too soft or too stiff, adjust it in accordance with the following table.

C B CHOSEOSCO P

Spring Preload Adjustment

Position	Spring Force	Setting	Load	Road	Speed
1	Stronger	Soft	Light	Good	Low
2		↑	↑	↑	↑
3		-	-	-	-
4	l I	\downarrow	\downarrow	\downarrow	\downarrow
5	\downarrow	Hard	Heavy	Bad	High

 Check to see that both adjusting sleeves are turned to the same relative position.

A WARNING

If both adjusters are not adjusted equally, handling may be impaired and a hazardous condition may result.

Air Pressure Adjustment (VN1600-A3 ~)

The air pressure in the rear shock absorbers can be adjusted for different road and loading conditions.

The following table shows an example of air pressure adjustment. To obtain stable handling and a suitable ride, adjust the air pressure as indicated. The standard air pressure is **atmospheric pressure** for an average-build rider of 68 kg (150 lb) with no passenger and no accessories. Ordinarily, the heavier the total load becomes, the higher the air pressure should be set.

Air Pressure Adjustment

Air Pressure	Setting Load		Road	
0 kPa	Soft	Light	Good	
(0 kg/cm², 0 psi)	3011	Ligiti		
↑	↑	↑	↑	
\	\downarrow	\downarrow	\downarrow	
290 kPa	Llowd	Haarni	Bad	
(3.0 kg/cm², 43 psi)	Hard	Heavy		

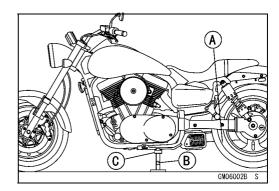
• Adjust the air pressure:

NOTE

- OCheck and adjust the air pressure when the rear shock absorbers are cold (room temperature).
- ORaise the rear wheel [A] off the ground, using the jack [B], and the attachment jack [C].

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398



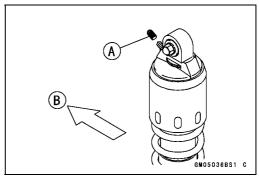
OTake off each air valve cap [A] on the right and left shock absorbers.

Front [B]

OCheck the air pressure with the air pressure gauge.

NOTE

ODo not use tire gauges for checking air pressure. They may not indicate the correct air pressure because of air leakage that occur when the gauge is applied to the valve.



OTo lower the air pressure, push the valve core in slightly. To raise the pressure, inject air through the valve with a tire pump. Change the air pressure within the range specified in the preceding table to suit various riding conditions.

CAUTION

Inject air little by little so that air pressure does not rise rapidly. Air pressure exceeding 490 kPa (5.0 kgf/cm², 71 psi) may damage the oil seal.

Try to set the air pressure of the right and left shock absorbers as equally as possible.

A WARNING

Be sure to adjust the air pressure within the usable range. Pressure too high can produce a hazardous riding condition.

Only air or nitrogen gas can be used. Never inject oxygen or any kind of explosive gas.

Rear Shock Absorber Removal

• Lift the rear wheel off the ground, using the jack and the attachment jack.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

• Squeeze the brake lever slowly and hold it with a band [A].

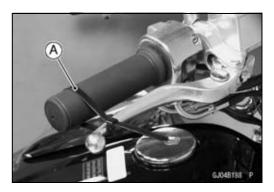
CAUTION

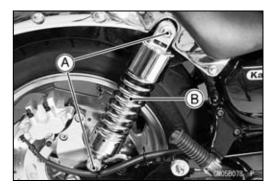
Be sure to hold the front brake when removing the shock absorber, or the motorcycle may fall over. The motorcycle could be damaged.

▲ WARNING

Be sure to hold the front brake when removing the shock absorber, or the motorcycle may fall over. It could cause an accident and injury.

- Remove the cap nuts [A], lock washers, and flat washers from both ends of the rear shock absorber [B].
- Pull the rear shock absorber off the frame.





Rear Shock Absorber Installation

- Install the sleeve so the flange side faces inside.
- Install the rear shock absorber so that the air valve faces forward. (VN1600-A3 ~)
- Tighten the rear shock absorber nuts to the specified torque.

Torque - Rear Shock Absorber Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Rear Shock Absorber Inspection

- Remove the rear shock absorbers [A].
- Visually inspect the following items.
 Smooth Stroke [B]
 Oil Leakage (see Periodic Maintenance chapter)
 Crack or Dent
- ★ If there is any damage to the rear shock absorber, one unit feels weaker than the other, replace both shock absorbers as a set.
- Visually inspect the rubber bushings [C].
- ★If they show any signs of damage, replace them.
- Visually inspect the shock absorber sleeves [A] and needle bearings [B].
- The roller in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing in the shock absorber for abrasion, color change, or other damage.
- ★If there is any doubt as to the condition of any of the needle bearings or sleeves, replace the sleeves, and needle bearings as a set.

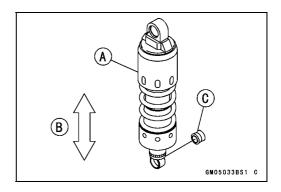


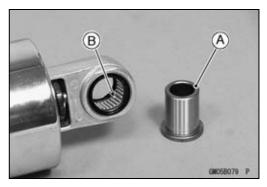
• Remove the rear shock absorber (see this chapter).

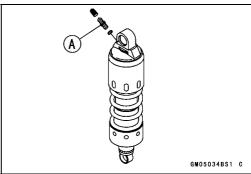
WARNING

Since the rear shock absorber contains air, do not incinerate the rear shock absorber without first releasing the air or it may explode.

Before a rear shock absorber is scrapped, remove the air valve [A].







Swingarm

Swingarm Removal

• Remove:

Bolts [A]

Swingarm Cover [B]

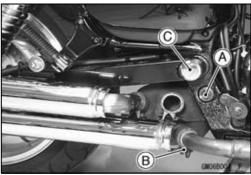


- Remove the rear exhaust pipe (see Engine Top End chapter).
- Loosen:

Premuffler Chamber Bolt [A] Front Exhaust Pipe Clamp Bolt [B]

• Remove:

Swingarm Pivot Cap [C]



- Before removing the swingarm, unscrew the banjo bolt [A] on the rear caliper [B].
- OTemporarily secure the end of the brake hose to some high place to keep fluid loss to a minimum.
- Immediately wash away any brake fluid that spills.
- Detach the rear brake hose [C] from the holders [D] on the swingarm.
- Using the jack and attachment jack under the frame pipe ribs, lift the rear wheel OFF the ground until the front wheel touches the ground (see Rear Shock Absorber Removal).

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

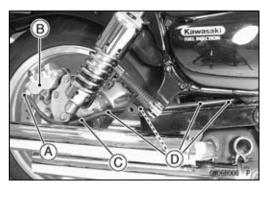
 Squeeze the brake lever slowly and hold it with a band [A].

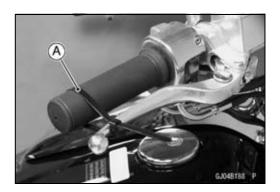


Be sure to hold the front brake when removing the swingarm, or the motorcycle may fall over. The motorcycle could be damaged.

A WARNING

Be sure to hold the front brake when removing the swingarm, or the motorcycle may fall over. It could cause an accident and injury.





13-20 SUSPENSION

Swingarm

• Remove:

Rear Wheel (see Wheels/Tires chapter) Final Gear Case (see Final Drive chapter)

- Remove the right rear shock absorber.
- Unscrew the pivot shaft [A], and pull it out while turning.
- Pull the swingarm [B] rearward, and take it off.

CAUTION

Do not tap the swingarm pivot shaft when removing or installing. Push or pull the pivot shaft while turning the shaft. Tapping on the shaft could damage the needle bearings in the swingarm.

Swingarm Installation

- Apply grease to the needle bearings and grease seals.
- Apply grease to the threads [A] of the swingarm pivot shaft.
- Tighten:

Torque - Swingarm Pivot Shaft: 108 N·m (11 kgf·m, 79.6 ft·lb)

- A GM08003BS1 C
- Move the swingarm up and down [A] to check for abnormal friction, and push and pull [B] it to check for bearing play.
- Tighten:

Torque - Rear Shock Absorber Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Rear Caliper Mounting Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

Rear Caliper Holder Bolt: 64 N·m (6.5 kgf·m, 47 ft·lb)



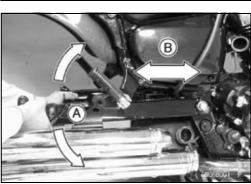
Final Gear Case (see Final Drive chapter)
Rear Wheel (see Wheels/Tires chapter)

• Tighten:

Muffler Stay Mounting Bolts (see Engine Top End chapter)

Premuffler Chamber Bolt (see Engine Top End chapter)

• After installing the swingarm, replenish the brake fluid into the reservoir and bleed the brake line (see Brake Line Bleeding in Brakes chapter).



Swingarm

Swingarm Bearing Removal

• Remove:

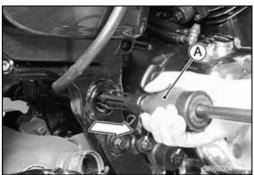
Swingarm (see this chapter) Propeller Shaft (see Final Drive chapter)



• Remove the needle bearings, using the oil seal & bearing remover [A].

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

- Replace the bearings and sleeves with new ones.
- Remove the other side bearing in the same manner.



Swingarm Bearing Installation

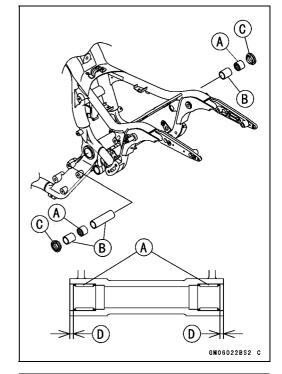
- Apply plenty of grease to the needle bearings, and sleeve.
- Be sure to install the needle bearings so that the manufacturer's marks are faced out. This prevents bearing damage.
- Position the bearings [A] as shown, using a suitable bearing driver in the bearing driver set.

Sleeves [B]

Grease Seals [C]

5 mm [D]

Special Tool - Bearing Driver Set: 57001-1129

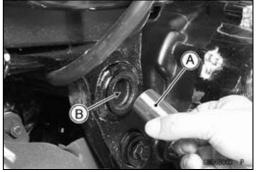


Swingarm Bearing, Sleeve Inspection

CAUTION

Do not remove the needle bearings for inspection. Remove may damage them.

- Visually inspect the swingarm sleeves [A] and needle bearings [B].
- The rollers in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing in the swingarm for abrasion, color change, or other damage.
- ★ If there is any doubt as to the condition of any of the needle bearings or sleeve, replace the sleeve, and needle bearings as a set.



13-22 SUSPENSION

Swingarm

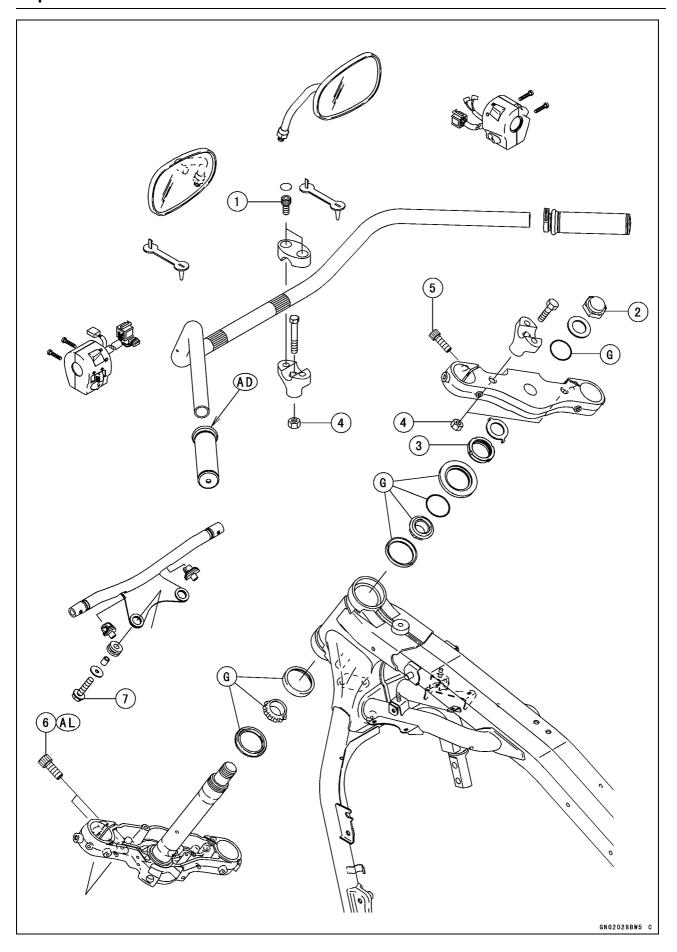
Grease Seal and Needle Bearing Lubrication

● Refer to the Swingarm Pivot Lubrication in the Periodic Maintenance chapter.

Steering

Table of Contents

Exploded View
Special tools
Handlebar
Handlebar Removal
Handlebar Installation
Rear View Mirror Removal (Other than United States, Canada, Australia and Taiwan Models)
Rear View Mirrors Installation (Other than United States, Canada, Australia and Taiwa Models)
Steering
Steering Inspection
Steering Adjustment
Steering Stem
Steering Stem Removal
Steering Stem Installation
Steering Stem Warp
Steering Stem Bearing
Stem Bearing Removal
Stem Bearing Installation
Stem Bearing Lubrication
Stem Can Deterioration, Damage



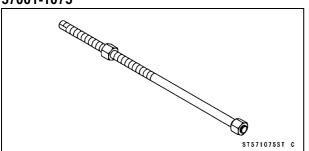
No	Factorer		Domorko		
No.	Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
1	Handlebar Clamp Bolts	34	3.5	25	
2	Steering Stem Head Nut	88	9.0	65	
3	Steering Stem Nut	4.9	0.5	43 in·lb	
4	Handlebar Holder Nuts	34	3.5	25	
5	Front Fork Clamp Bolts (Upper)	20	2.0	14	
3	Front Fork Clamp Bolts (Upper) (VN1600-A2 ~)	29	3.0	21	
6	Front Fork Clamp Bolts (Lower)	29	3.0	21	AL
7	Turn Signal Light Mounting Nuts	5.9	0.6	52 in·lb	

AD: Apply adhesive.

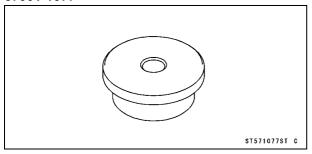
AL: Tighten the two clamp bolts alternately two times to ensure even tightening torque. G: Apply grease.

Special tools

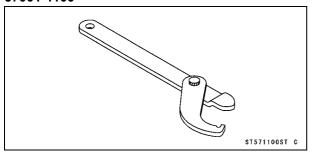
Head Pipe Outer Race Press Shaft: 57001-1075



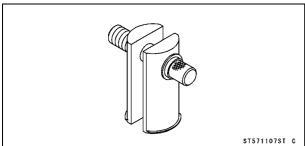
Head Pipe Outer Race Driver, ϕ 54.5: 57001-1077



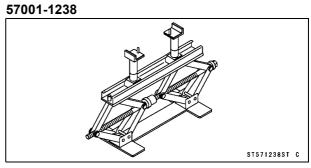
Steering Stem Nut Wrench: 57001-1100



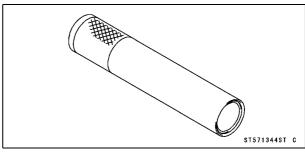
Head Pipe Outer Race Remover ID > 37 mm: 57001-1107



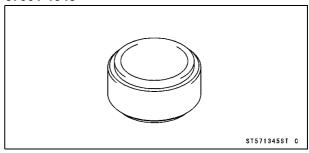
Jack:



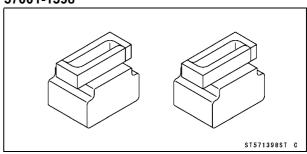
Steering Stem Bearing Driver, ϕ 42.5: 57001-1344



Steering Stem Bearing Driver Adapter, ϕ 41.5: 57001-1345



Attachment Jack: 57001-1398

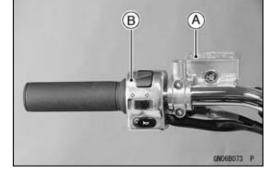


Handlebar

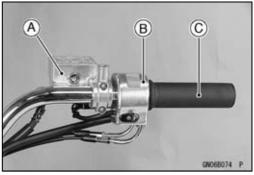
Handlebar Removal

- Cut the straps.
- Remove:

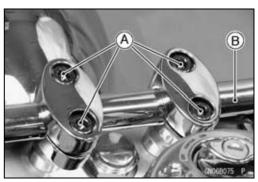
Clutch Master Cylinder [A] Left Handlebar Switch Housing [B]



Front Brake Master Cylinder [A] Right Handlebar Switch Housing [B] Throttle Grip [C]



• Unscrew the bolts [A] and remove the handlebar [B] from the stem head.



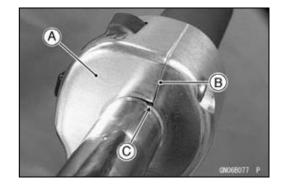
Handlebar Installation

• Tighten the handlebar bolts.

Torque - Handlebar Clamp Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

- The front half of the right handlebar switch housing [A] has a small projection [B]. Fit the projection into the small hole [C] in the handlebar.
- B GROESOTE P
- Set the left handlebar switch housing [A] to match its mating surface [B] to the punched mark [C] of the handlebar.
- Install the handlebar switch housings.
- Install:

Clutch Master Cylinder (see Clutch chapter)
Front Brake Master Cylinder (see Brakes chapter)



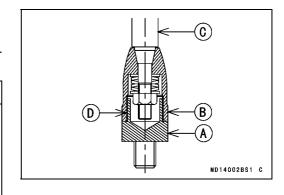
Handlebar

Rear View Mirror Removal (Other than United States, Canada, Australia and Taiwan Models)

• Loosen the lower hexagonal area [A] for tightening to remove the rear view mirror from the holder.

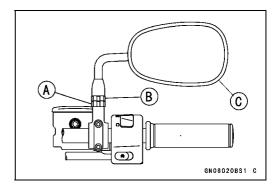
CAUTION

Do not force to tighten and/or loosen the upper hexagonal area (Adapter) [B] with a pair of spanners. Disassembly of this area is Not Available. Non-permanent locking agent [D] is already applied to the threads of this inner area. Forcible loosening may damage the adapter and/or the turning mechanism of the stay [C].



Rear View Mirrors Installation (Other than United States, Canada, Australia and Taiwan Models)

- Screw the mounting area of the right rear view mirror into the holder all the way, and tighten the lower hexagonal area for tightening securely.
 - [A] Lower Hexagonal Area for Tightening
 - [B] upper Hexagonal Area (Adapter)
 - [C] Rear View Mirror (Right)



Steering

Steering Inspection

• Refer to Steering Inspection in the Periodic Maintenance chapter.

Steering Adjustment

• Refer to Steering Adjustment in the Periodic Maintenance chapter.

Steering Stem

Steering Stem Removal

 Using the jack [A] and attachment jack [B] under the frame pipe ribs [C], and a commercially available jack [D] under the engine [E], lift the front wheel [F] OFF the ground until the rear wheel [G] touches the ground.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

Remove the front wheel (see Tires/Wheels chapter).

CAUTION

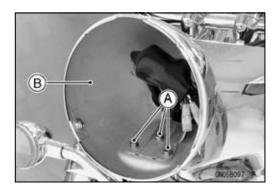
Be sure to put the rear wheel on the ground when removing the steering, or the motorcycle may fall over. The motorcycle could be damaged.

A WARNING

Be sure to put the rear wheel on the ground when removing the steering, or the motorcycle may fall over. It could cause an accident and injury.

- Unscrew the headlight rim screws and open the headlight unit (see Electrical System chapter).
- Remove: Bolts [A]

Headlight body [B]



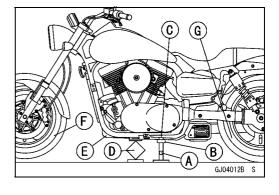
• Remove:

Bolts [A] (both side)
Front fork center cover [B]



• Remove:

Bolts [A] (both side) Front fork rear covers [B]



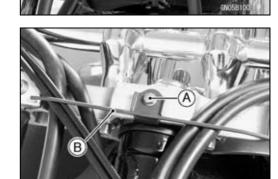


Steering Stem

• Remove:

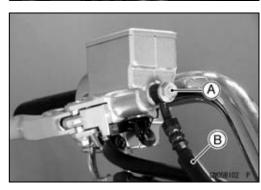
Bolts [A]
Turn signal rights bracket [B]

Remove: Bolt [A] Cable bracket [B]



• Remove:

Brake hose banjo bolt [A] Brake hose [B]



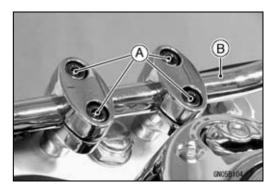
• Remove:

Brake hose joint bolt [A]



• Remove:

Handlebar clamp bolts [A] Handlebar [B]

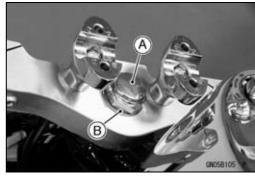


14-10 STEERING

Steering Stem

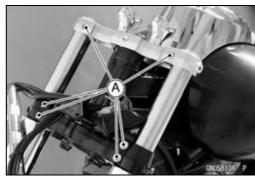
• Remove:

Steering stem head nut [A] Washer [B]



• Remove:

Front fork clamp bolts [A]



• Remove:

Bolts [A]

Front fork inner cover [B]

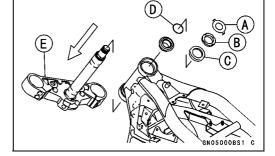


• Remove:

Claw Washer [A] Steering Stem Nut [B] Stem Cap [C] O-ring [D]

NOTE

- OBe sure to remove the O-ring for removal of the steering stem.
- Pull out the steering stem [E] from the bottom.



Steering Stem Installation

• Install:

Steering Stem [A]

Bearing [B]

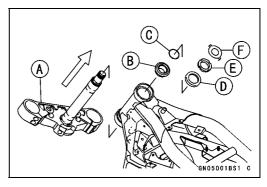
New O-ring [C] (I.D. 34.5 × ϕ 2 mm)

Stem Cap [D]

Stem Nut [E]

Claw Washer [F]

Torque - Steering Stem Nut: 4.9 N·m (0.5 kgf·m, 43 in·lb)



Steering Stem

- Install the fork leg [A] and push it up tightly against the stem bottom.
- Temporarily tighten the lower fork clamp bolts.
- Install:

Steering Stem Head [B] with Handlebar

O-ring [C]

Washer [D]

Stem Head Nut [E]

- Temporarily tighten the upper fork clamp bolts [F].
- OCheck that the top end [A] of the inner tube is flush with the upper surface [B] of the steering stem head. Otherwise reinstall the fork leg.
- Tighten the fork clamp bolts (upper) and then the stem head nut, and finally the fork clamp bolts (lower).

Torque - Front Fork Clamp Bolts (upper): 20 N·m (2.0 kgf·m, 14 ft·lb)

Front Fork Clamp Bolts (upper): 29 N·m (3.0 kgf·m, 21 ft·lb) VN1600-A2 ~

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

Front Fork Clamp Bolts (lower): 29 N·m (3.0 kgf·m, 21 ft·lb)

NOTE

- O Tighten the two clamp bolts alternately two times to ensure even tightening torque.
- Install the removed parts.
- Check and adjust the following items after installation.

Steering (see Steering Check)

Throttle Cables (see Fuel System chapter) Headlight Aim

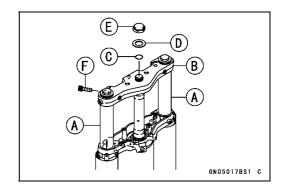
• Check the front brake effectiveness.

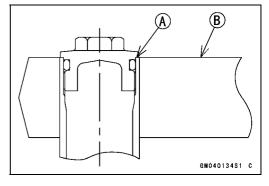
A WARNING

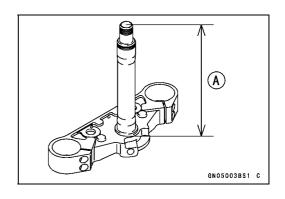
Do not attempt to ride the motorcycle until a full brake lever is obtained by pumping the brake lever until the pads are against the disc. The brakes will not function on the first application of the lever if this is not done.

Steering Stem Warp

- Whenever the steering stem is removed, or if the steering cannot be adjusted for smooth action, check the steering stem for straightness.
- ★If the steering stem [A] is bent, replace the steering stem.







Steering Stem Bearing

Stem Bearing Removal

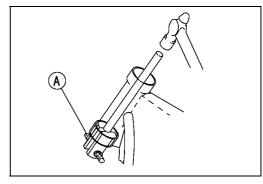
- Remove the steering stem (see this chapter).
- Drive out the bearing outer races from the head pipe.

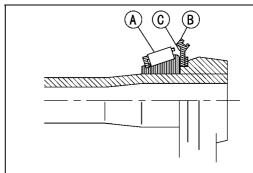
Special Tool - Head Pipe Outer Race Remover: 57001-1107 [A]

NOTE

- Olf either steering stem bearing is damaged, it is recommended that both the upper and lower bearings (including outer races) be replaced with new ones.
- Remove the lower inner race [A] which is pressed onto the steering stem, using a chisel.

Grease Seal [B] Tap here [C]

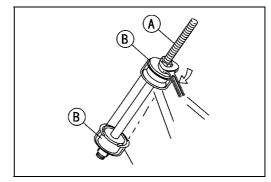




Stem Bearing Installation

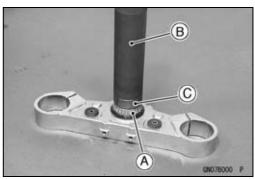
- Replace the bearing outer races with new ones.
- Apply grease to the outer races, and drive them into the head pipe at the same time.

Special Tools - Head Pipe Outer Race Press Shaft: 57001-1075 [A] Head Pipe Outer Race Drivers: 57001-1077 [B]



- Replace the stem bearing inner races with new ones.
- Apply grease to the lower inner race [A], and drive it onto the stem base.

Special Tools - Steering Stem Bearing Driver:
57001-1344 [B]
Steering Stem Bearing Driver Adapter:
57001-1345 [C]



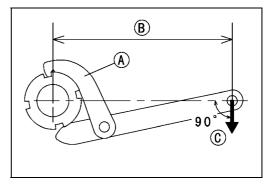
• Install the steering stem.

NOTE

ODo not install the O-rings yet.

- Settle the bearings in place as follows:
- OTighten the stem nut to **78 N·m (8.0 kgf·m, 58 ft·lb)** of torque. (To tighten the steering stem nut to the specified torque, hook the wrench on the stem nut, and pull the wrench at the hole by **440 N (45 kg, 99 lb)** force in the direction shown.)

Special Tool - Steering Stem Nut Wrench: 57001-1100 [A] 180 mm (7.09 in.) [B] Force [C]



Steering Stem Bearing

- OCheck that there is no play and the steering stem turns smoothly without rattles. If not, the steering stem bearings may be damaged.
- Remove the stem nut.
- Install the O-rings and adjust the steering (see Periodic Maintenance chapter).
- Tighten:

Torque - Steering Stem Nut: 4.9 N·m (0.5 kgf·m, 43 in·lb)

Stem Bearing Lubrication

In accordance with the Periodic Maintenance Chart, lubricate the steering stem bearings. Refer to the Stem Bearing Lubrication in Periodic Maintenance chapter.

Stem Cap Deterioration, Damage

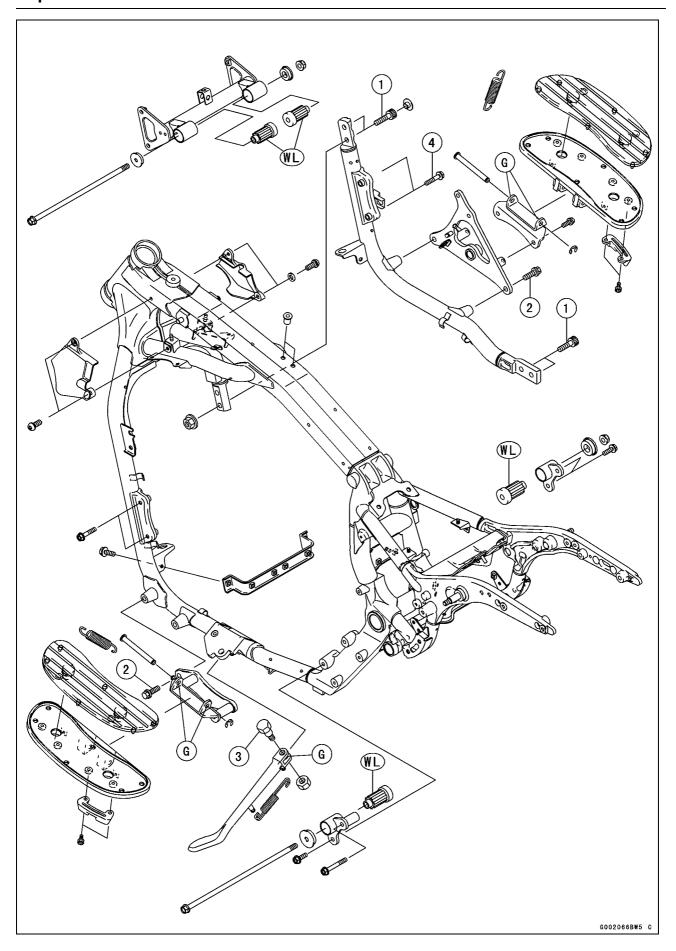
★Replace the stem cap if its grease seal [A] shows damage.



Frame

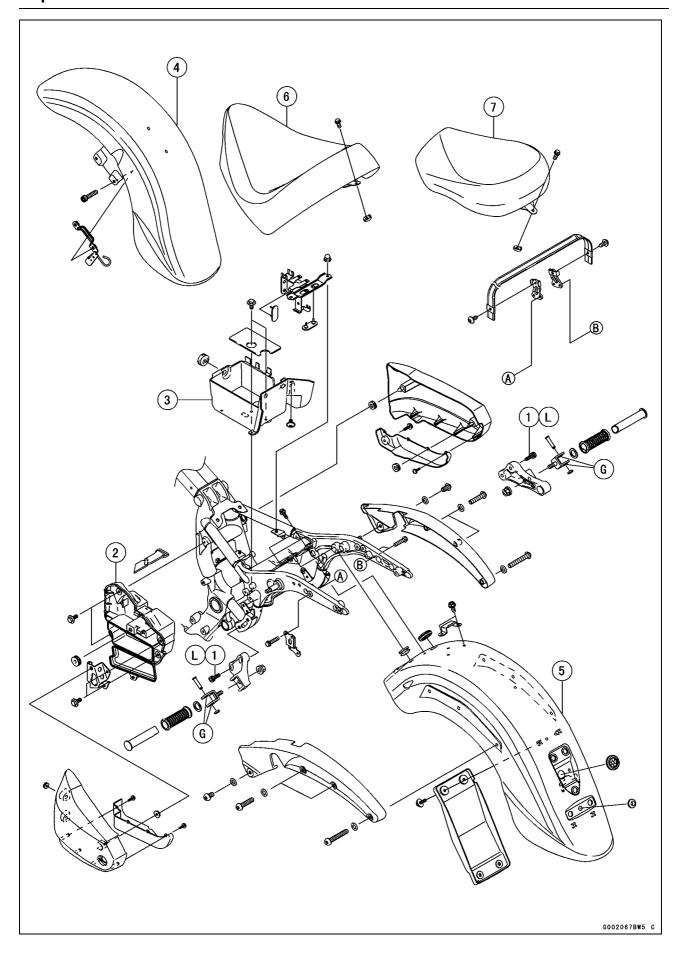
Table of Contents

Exploded View	15-2
Special Tools	15-6
Seats	15-7
Rear Seat Removal	15-7
Rear Seat Installation	15-7
Front Seat Removal	15-7
Front Seat Installation	15-7
Side Covers	15-8
Left Side Cover Removal	15-8
Left Side Cover Installation	15-8
Right Side Cover Removal/Installation	15-8
Fenders	15-9
Front Fender Removal	15-9
Rear Fender Removal	15-9
Battery Case/Tool Box	15-10
Battery Case Removal	15-10
Tool Box Removal	15-10
Front Footboard, Sidestand	15-11
Footboard Removal	15-11
Footboard Disassembly	15-11
Sidestand Installation	15-11
Frame	15-12
Downtube Removal	15-12
Downtube Installation	15-12
Frame Inspection	15-13



No.	Factorer	Torque				
NO.	Fastener	N·m	kgf·m	ft·lb	Remarks	
1	Downtube Bolts and Nuts	44	4.5	33		
2	Footboard Bracket Bolts	34	3.5	25		
3	Sidestand Bolt	44	4.5	33		
4	Engine Mounting Bracket Bolts	25	2.5	18		

G: Apply grease. WL: Apply a soap and water solution or rubber lubricant.



No	Factoria		Domorko		
No. Fastener		N⋅m	kgf⋅m	ft·lb	Remarks
1	Footpeg Bracket Bolts	25	2.5	18	L

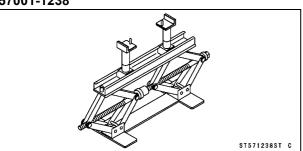
- 2. Tool box
- 3. Battery case
- 4. Front fender
- 5. Rear fender
- 6. Front seat
- 7. Rear seat
- G: Apply grease.
- L: Apply a non-permanent locking agent.

15-6 FRAME

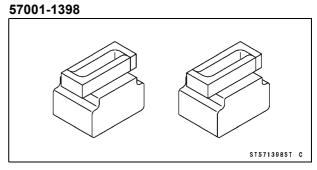
Special Tools

Jack:

57001-1238



Attachment Jack:



Seats

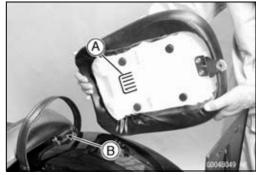
Rear Seat Removal

• Remove the rear seat bolt [A] and move the rear seat backwards [B] and remove it (left view).



Rear Seat Installation

- Slip the hook [A] of the rear seat into the bracket [B] on the rear fender.
- Tighten the rear seat bolt.



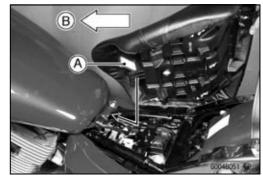
Front Seat Removal

- Remove the rear seat (see this section).
- Remove the front seat bolt [A].
- Pull the front seat [B] backwards and up, then remove it.



Front Seat Installation

- Insert the hook [A] of the seat under the fuel tank bracket.
- Tighten the front seat bolt. Front [B]
- Install the rear seat (see this section).



Side Covers

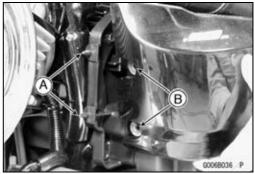
Left Side Cover Removal

- Insert the ignition switch key [A] into the left side cover, and turn the key clockwise until the key slot is vertical.
- Pull [B] the rear part of the left side cover, push [C] the left side cover slightly forward, and remove it.

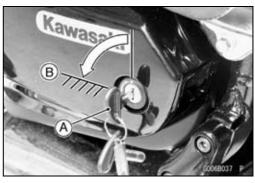


Left Side Cover Installation

• Put the front stoppers [A] into the grommets [B] first, then put the rear stopper into the grommet.



 Turn the ignition switch key [A] counterclockwise until the key slot is horizontal [B] to secure the left side cover.



Right Side Cover Removal/Installation

• Remove the screw [A].

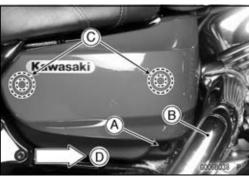
CAUTION

Be careful not to scratch the right side cover surface with the rear exhaust pipe [B] during removal or installation.

- Cover the rear exhaust pipe with a shop towel and pull the right side cover evenly outward to clear the stoppers.
- Pull the right side cover off the grommets [C] and remove the cover.

Front [D]

- Put the stoppers into the grommets.
- Tighten the screw.



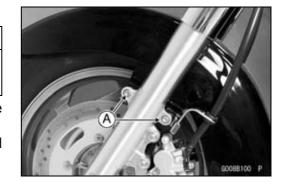
Fenders

Front Fender Removal

CAUTION

Be careful not to scratch the painted surface during removal or installation.

- Remove the mounting bolts [A] on both sides to separate the fender from the front fork (right side view).
- Move the fender forwards with the wheel installed and remove it.

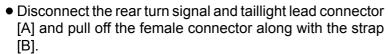


Rear Fender Removal

CAUTION

Be careful not to scratch the painted surface during removal or installation.

- Remove the front and rear seats (see this chapter).
- Remove the rear fender cover bolts [A] on both sides.

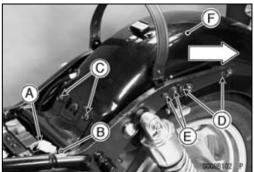




Rear Fender Front Bolts [C] Rear Fender Allen Bolts [D] Seat Band Stay Bolts [E]

• Remove the rear fender [F] rearwards.



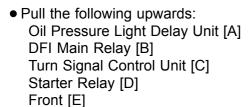


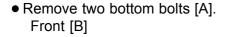
15-10 FRAME

Battery Case/Tool Box

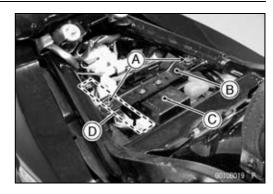
Battery Case Removal

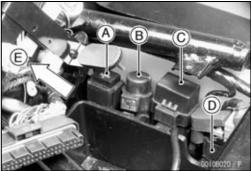
Remove (left view):
 Front and Rear Seats (see this chapter)
 Bolts [A] and Battery Holder [B]
 Battery [C] (see Electrical System chapter)
 ECU [D] (see Fuel System (DFI) chapter)



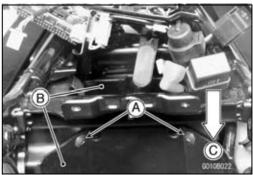


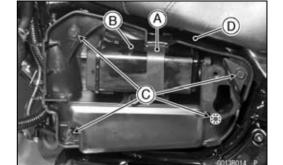
- Remove the rear wheel (see Wheels/Tires chapter).
- Remove two rear screws [A] (rear view).
- Remove the battery case [B] towards the rear [C].











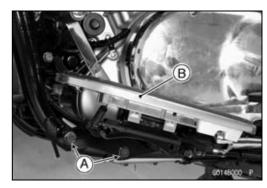
Tool Box Removal

- Remove the left side cover (see this chapter).
- For California, remove the band [A] and canister [B].
- Unscrew the bolts [C].
- Pull the tool case [D] out.

Front Footboard, Sidestand

Footboard Removal

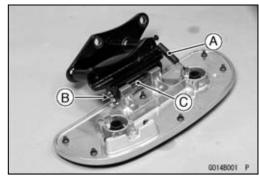
- Unscrew the bolts [A] and remove the left front footboard [B].
- OThe right front footboard is removed during brake pedal removal (see Brakes chapter).



Footboard Disassembly

- Remove the front footboard.
- Remove:

 Footboard Spring [A]
 Circlip [B]
 Pin [C]

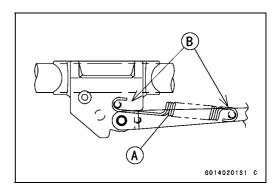


Sidestand Installation

• Tighten:

Torque - Sidestand Bolt: 44 N·m (4.5 kgf·m, 33 ft·lb)

• Install the sidestand spring [A], noting the direction of the hooks [B].



15-12 FRAME

Frame

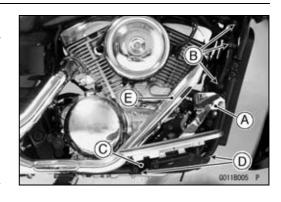
Downtube Removal

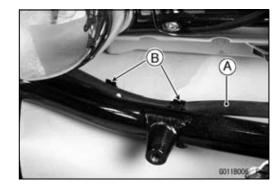
• Using the jack and the attachment jack, raise the rear wheel off the ground (see Wheels/Tires chapter).

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

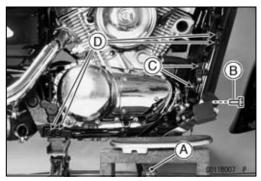
- Remove the brake reservoir cover [A] and reservoir (see Brakes chapter).
- Open the lead clamps [B]
- Remove the right footboard assembly [C] by taking off the bolts [D] with the brake pedal and rear master cylinder installed. Place the assembly on a block.
- Remove the front exhaust pipe [E] (see Engine Top End chapter).
- Take off the brake hose [A] from the clamps [B].





- Support the engine with a commercially available stand [A].
- Remove:

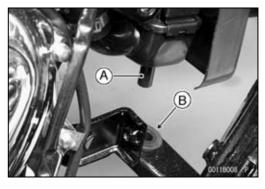
Right Radiator Cover Bolt [B] Engine Mounting Bracket Bolts [C] Downtube Bolts [D]



Downtube Installation

- Run the brake hose inside the downtube and clamp it.
- Put right and left stoppers [A] of the radiator into the grommets [B] of the downtube.
- Tighten:

Torque - Downtube Bolts: 44 N·m (4.5 kgf·m, 33 ft·lb)
Engine Mounting Bracket Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)
Footboard Bracket Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)



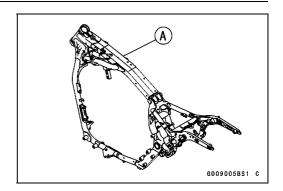
Frame

Frame Inspection

- Visually inspect the frame [A] for cracks, dents, bending, or warp.
- ★If there is any damage to the frame, replace it.

A WARNING

A repaired frame may fail in use, possibly causing an accident. If the frame is bent, dented, cracked, or warped, replace it.



Electrical System

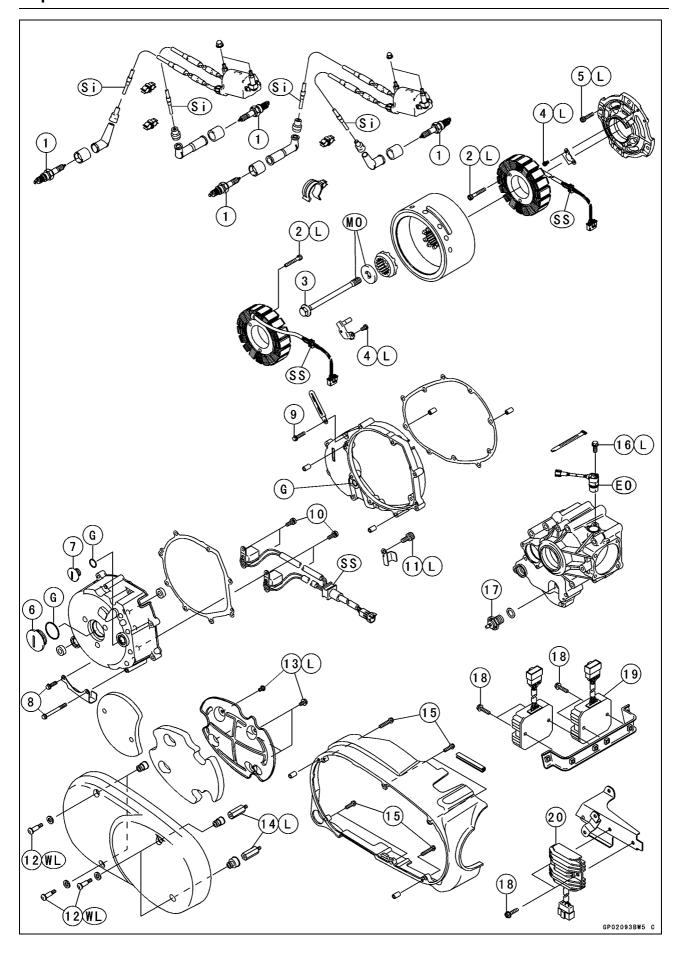
Table of Contents

Exploded View	16-3	Ignition System	16-45
Specifications	16-12	Ignition Coil Removal	16-46
Special Tools	16-14	Ignition Coil Installation	16-46
Wiring Diagram (United States,		Ignition Coil Inspection	16-47
Canada and Taiwan)	16-15	Spark Plug Removal	16-47
Wiring Diagram (Australia)	16-18	Spark Plug Installation	16-48
Wiring Diagram (Other than United		Spark Plug Cleaning/Inspection	16-48
States, Canada, Australia and		Ignition Coil Primary Peak	
Taiwan)	16-20	Voltage	16-48
Electrical Parts Location	16-22	Crankshaft Sensor Removal	16-49
Servicing Precautions	16-24	Crankshaft Sensor Installation	16-49
Electrical Wiring	16-26	Crankshaft Sensor Inspection	16-49
Wiring Inspection	16-26	Ignition Timing Inspection	16-51
Battery	16-27	Interlock Operation Inspection	16-52
Battery Removal	16-27	IC Igniter Inspection	16-53
Battery Installation	16-27	Starter Motor	16-56
Electrolyte Filling	16-28	Starter Motor Removal	16-56
Initial Charge	16-30	Starter Motor Installation	16-56
Precautions	16-30	Starter Motor Disassembly	16-57
Interchange	16-31	Starter Motor Assembly	16-58
Charging Condition Inspection	16-31	Brush Inspection	16-59
Refreshing Charge	16-31	Commutator Cleaning and	
Charging System	16-33	Inspection	16-59
Alternator Outer Cover Removal	16-33	Armature Inspection	16-59
Alternator Outer Cover		Brush Assy Inspection	16-60
Installation	16-33	Brush Plate and Terminal Bolt	
Alternator Cover Removal/Instal-		Inspection	16-60
lation	16-33	Starter Relay Inspection	16-60
Alternator Cover Assembly	16-34	Lighting System	16-62
Alternator Inner Cover Removal	16-34	Headlight Beam Horizontal	
Alternator Inner Cover Installation	16-35	Adjustment	16-62
Alternator Rotor Removal	16-35	Headlight Beam Vertical	
Alternator Rotor Installation	16-36	Adjustment	16-62
Alternator Outside Stator		Headlight Bulb Replacement	16-62
Removal	16-36	Headlight Body Removal	16-63
Alternator Outside Stator		City Light Bulb Replacement	
Installation	16-37	(other than US, CA, AU and	
Alternator Inside Stator Removal.	16-38	TW)	16-64
Alternator Inside Stator		Tail/Brake Light Bulb	
Installation	16-38	Replacement	16-64
Charging Voltage Inspection	16-39	Automatic Turn Signal Canceling	
Alternator Inspection	16-39	System	16-67
Regulator/Rectifier Removal	16-40	Wiring Inspection	16-67
Regulator/Rectifier Installation	16-42	Distance Sensor Inspection	16-68
Rectifier Inspection	16-42	Turn Signal Switch Inspection	16-68

16-2 ELECTRICAL SYSTEM

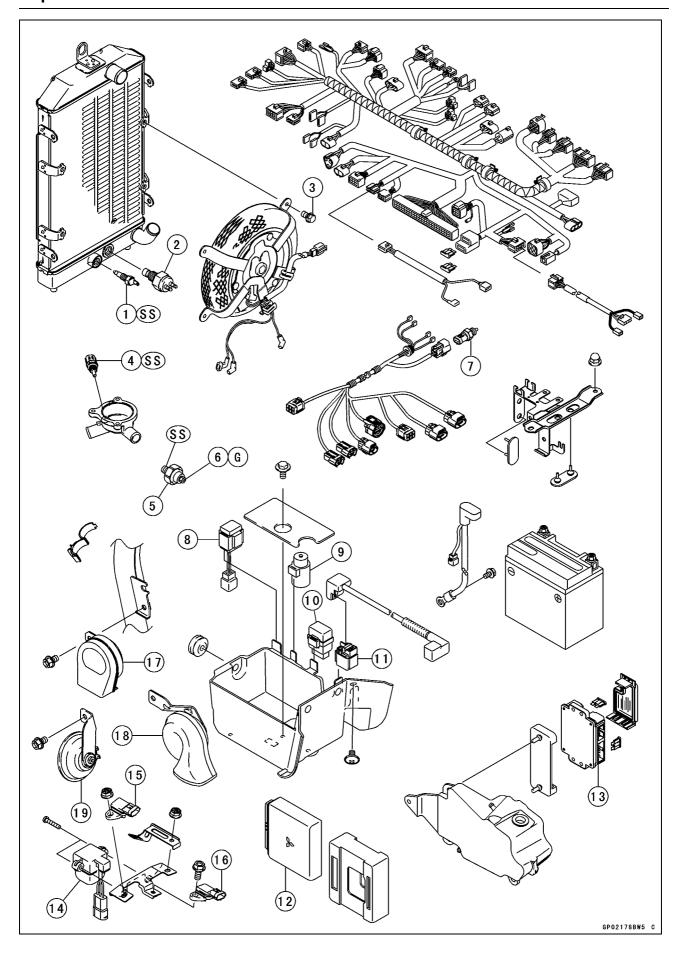
Turn Signal Control Relay		Speed Sensor Installation	16-90
Inspection	16-68	Speed Sensor Inspection	16-91
Turn Signal Light Bulb		Front Brake Light Switch	
Replacement	16-69	Inspection	16-91
Radiator Fan System	16-72	Rear Brake Light Switch	
Fan System Circuit Inspection	16-72	Check/Adjustment	16-91
Fan Motor Inspection	16-72	Radiator Fan Switch Removal	16-91
Oil Pressure Warning System	16-73	Radiator Fan Switch Installation	16-91
Oil Pressure Light Delay Unit		Radiator Fan Switch Inspection	16-92
Removal	16-73	Water Temperature Switch	
Oil Pressure Light Delay Unit		Removal	16-92
Inspection	16-73	Water Temperature Switch	
Meter, Gauge	16-75	Installation	16-92
Meter Unit Removal	16-75	Water Temperature Switch	
Meter Unit Installation	16-76	Inspection	16-93
Meter Unit Disassembly	16-76	Switch Inspection	16-93
Meter Unit Assembly	16-77	Junction Box	16-95
Meter Unit Inspection	16-78	Junction Box Fuse Circuit	
LED Light Inspection	16-83	Inspection	16-95
Indicator Light Inspection	16-84	Starter Circuit/Headlight Relay	
Water Temperature Warning System.	16-88	Inspection	16-95
Water Temperature Warning		Diode Circuit Inspection	16-96
System Check	16-88	Fuse	16-98
Switch and Sensors	16-89	Main Fuse Removal	16-98
Fuel Level Sensor Inspection	16-89	Junction Box Fuse Removal	16-98
Fuel Reserve Switch Inspection	16-90	Fuse Installation	16-98
Speed Sensor Removal	16-90	Fuse Inspection	16-98

Dummy Page



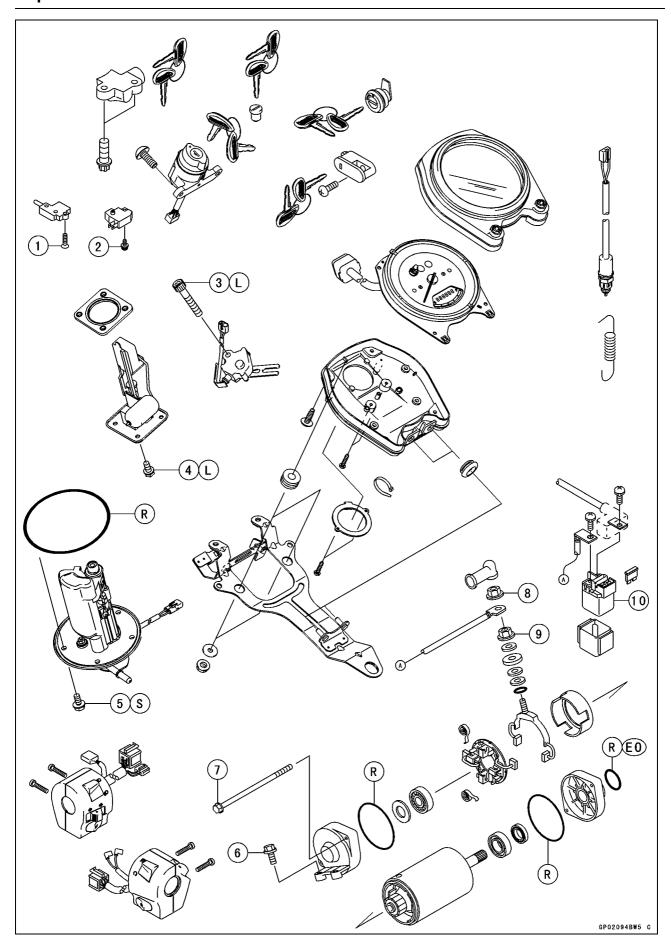
No	Factoria		1 e	Domesiles	
No.	Fastener	N⋅m	kgf⋅m	ft·lb	Remarks
1	Spark Plugs	18	1.8	13	
2	Alternator Stator Bolts	13	1.3	113 in·lb	L
3	Alternator Rotor Bolt	78	8.0	58	МО
4	Stator Lead Holder Screw	9.8	1.0	87 in·lb	L
5	Inside Stator Holder Bolts	11	1.1	95 in·lb	L
6	Rotor Bolt Cap	1.5	0.15	13 in·lb	
7	Timing Inspection Cap	1.5	0.15	13 in·lb	
8	Alternator Cover Bolts	11	1.1	95 in·lb	
9	Alternator Inner Cover Bolts	11	1.1	95 in·lb	
10	Crankshaft Sensor Screws	2.9	0.30	26 in·lb	
11	Crankshaft Sensor Lead Holder Bolt	2.9	0.30	26 in·lb	L
12	Alternator Outer Cover Bolts	6.9	0.70	61 in·lb	
13	Alternator Outer Cover Damper Bolts	6.9	0.70	61 in·lb	L
14	Alternator Outer Cover Joint Bolts	6.9	0.70	61 in·lb	L
15	Alternator Outer Cover Assembly Bolts	6.9	0.70	61 in·lb	
16	Speed Sensor Mounting Bolt	9.8	1.0	87 in·lb	L
17	Neutral Switch	15	1.5	11	
18	Regulator/Rectifier Bolts	6.5	0.66	57 in·lb	

- 19. Regulator/Rectifier (United State, Canada and Taiwan models)
- 20. Regulator/Rectifier (other than United State, Canada and Taiwan models)
- EO: Apply engine oil.
 - G: Apply grease.
 - L: Apply a non-permanent locking agent.
- MO: Apply molybdenum disulfide oil.
 - The Molybdenum disulfide oil is a mixture of engine oil and molybdenum disulfide grease with a weight ratio (10 : 1)
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).
- Si: Apply silicone grease.
- WL: Apply a soap and water solution or rubber lubricant.



No.	Factorer		Damanica		
NO.	Fastener	N⋅m	kgf⋅m	ft∙lb	Remarks
1	Water Temperature Switch	7.8	0.80	69 in·lb	SS
2	Radiator Fan Switch	18	1.8	13	
3	Radiator Fan Bolts	8.3	0.85	74 in·lb	
4	Water Temperature Sensor	18	1.8	13	SS
5	Oil Pressure Switch	15	1.5	11	SS
6	Oil Pressure Switch Terminal Screw	1.5	0.15	13 in·lb	G

- 7. Inlet air temperature sensor
- 8. Oil pressure light delay unit
- 9. DFI main relay
- 10. Turn signal control relay
- 11. Starter Relay
- 12. Electronic control unit
- 13. Junction Box
- 14. Vehicle-down sensor
- 15. Atmospheric pressure sensor
- 16. Inlet air pressure sensor
- 17. Horn (Europe and before VN1600-A2, United States, Canada and Australia Models)
- 18. Horn (VN1600-A3, United States, Canada, Australia and Taiwan Models)
- 19. Horn (VN1600-A2 ~, other than United States, Canada, Australia and Taiwan Models)
- GT: Apply a little grease to the switch terminal for rust prevention.
- SS: Apply silicone sealant (Kawasaki Bond: 56019-120).

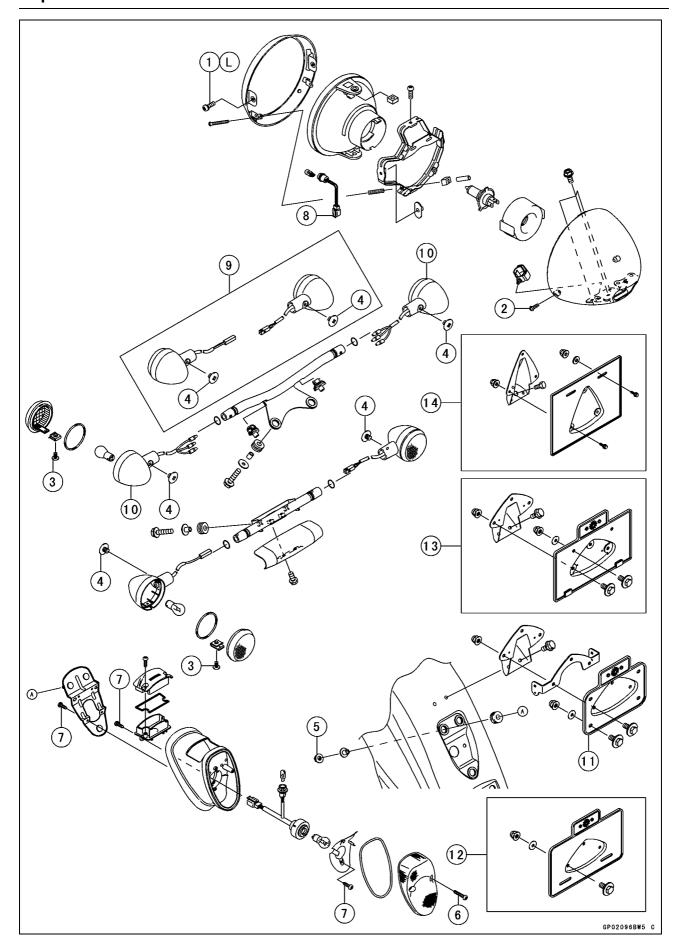


Exploded View

No.	Fastener	Torque			Damarka
		N⋅m	kgf⋅m	ft∙lb	Remarks
1	Starter Lockout Switch Screw	1.2	0.12	10 in·lb	
2	Front Brake Light Switch Screw	1.2	0.12	10 in·lb	
3	Side Stand Switch Mounting Bolt	8.8	0.90	78 in·lb	L
4	Fuel Level Sensor Mounting Bolts	6.9	0.70	61 in·lb	L
5	Fuel Pump Bolts	9.8	1.0	87 in·lb	S
6	Starter Motor Mounting Bolts	11	1.1	95 in·lb	
7	Starter Motor Assembly Bolts	4.9	0.50	43 in·lb	
8	Starter Motor Terminal Nut	4.9	0.50	43 in·lb	
9	Starter Motor Terminal Locknut	11	1.1	95 in·lb	

- 10. Starter relay
- EO: Apply engine oil.
 - L: Apply a non-permanent locking agent.
 - R: Replacement Parts
 - S: Follow the specific tightening sequence.

Exploded View



Exploded View

No.	Fastener	Torque			Damauka
		N⋅m	kgf⋅m	ft∙lb	Remarks
1	Headlight Unit Bracket Screws	1.0	0.10	8.7 in·lb	L
2	Headlight Rim Screws	2.9	0.30	26 in·lb	
3	Turn Signal Light Lens Screws	1.0	0.10	8.7 in·lb	
4	Turn Signal Light Mounting Screws	6.9	0.70	61 in·lb	
5	Tail/Brake Light Mounting Nuts	5.9	0.60	52 in·lb	
6	Tail/Brake Light Lens Screws	1.2	0.12	10 in·lb	
7	Tail/Brake Light Assembly Screws	1.2	0.12	10 in·lb	

- 8. City Light (other than United States, Canada, Australia and Taiwan Models)
- 9. Other than United States, Canada and Taiwan Models
- 10. United States, Canada and Taiwan Models
- 11. United States, Canada and Taiwan Model
- 12. Canada Model
- 13. Australia Model
- 14. Other than United States, Canada, Australia and Taiwan Models
- L: Apply a non-permanent locking agent.

16-12 ELECTRICAL SYSTEM

Specifications

Item	Standard
Battery	
Туре	Sealed Battery
Model Name	FTZ16-BS
Capacity	12 V 18 Ah
Voltage	12.6 V or more
Charging System	
Alternator Type	Three-phase AC with delta connection, and rare-earth single magnet rotor
Battery Charging Voltage	14.2 ~ 15.2 V @3 000 r/min (rpm)
Alternator Output Voltage (No Load)	60 ~ 90 V @3 000 r/min (rpm)
Stator Coil (Battery Charging Coil) Resistance	0.33 ~ 0.49 Ω
Regulator/Rectifier	
Туре	Load dumping regulator with full-wave rectifier
Resistance	in the text
Ignition System	
Ignition Coil:	
3 Needle Arcing Distance	6 mm (0.24 in.) or more
Primary Winding Resistance	1.9 ~ 2.9 Ω
Secondary Winding Resistance	18 ~ 28 kΩ
Primary Peak Voltage	
front	208 V or more
rear	192 V or more
Spark Plug:	
Spark Plug Gap	0.8 ~ 0.9 mm (0.031 ~ 0.035 in.)
Spark Plug Cap Resistance	3.75 ~ 6.25 kΩ
Crankshaft Sensor:	
Crankshaft Sensor Peak Voltage	
front	2.2 V or more
rear	2.0 V or more
Crankshaft Sensor Resistance	380 ~ 560 Ω
Crankshaft Sensor Air Gap	1.0 mm (0.04 in.) (Non-measurable and non-adjustable)
Electric Starter System	
Starter Motor:	
Brush Length	12 mm (0.47 in.) (Service limit 8.5 mm, 0.33 in.)
Commutator Diameter	28 mm (1.10 in.) (Service limit 27 mm, 1.06 in.)
Switch And Sensor	
Fuel Level Sensor Resistance	FULL position: $3 \sim 5 \Omega$
	EMPTY position: 213 ~ 219 Ω
Rear Brake Light Switch Timing	ON after about 10 mm (0.39 in.) pedal travel
Engine Oil Pressure Switch Connections	When engine is stopped: ON
	When engine is running: OFF

Specifications

Radiator Fan Switch Connections:

Rising Temperature From OFF to ON @ $102 \sim 108$ °C ($212 \sim 226$ °F) Falling Temperature From ON to OFF @98°C (208°F) \sim temperature

(less than ON temperature)

Resistance ON: Less than 0.5 Ω

OFF: More than 1 $M\Omega$

Water Temperature Switch Connections:

Rising Temperature From OFF to ON: $113 \sim 117^{\circ}\text{C}$ ($235 \sim 243^{\circ}\text{F}$) Falling Temperature From ON to OFF: 108°C (226°F) \sim temperature

(less than ON temperature)

Resistance ON: Less than 0.5 Ω

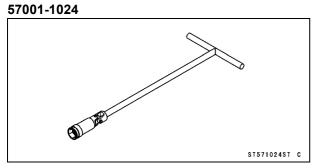
OFF: More than 1 $\mbox{M}\Omega$

ORefer to Fuel System chapter for specifications of DFI parts.

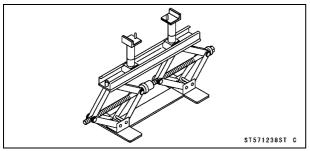
16-14 ELECTRICAL SYSTEM

Special Tools

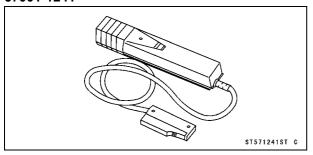
Spark Plug Wrench, Hex 18:



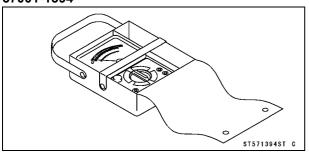
Jack: 57001-1238



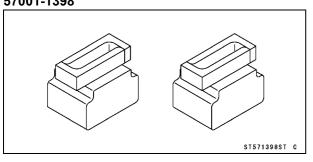
Timing Light: 57001-1241



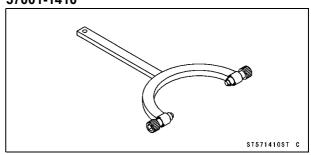
Hand Tester: 57001-1394



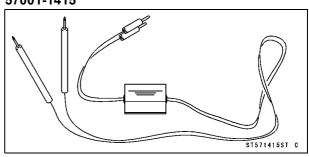
Attachment Jack: 57001-1398



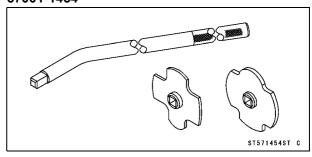
Flywheel Holder: 57001-1410



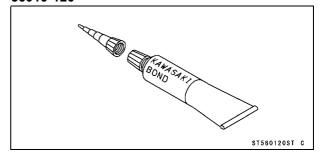
Peak Voltage Adapter: 57001-1415



Filler Cap Driver: 57001-1454



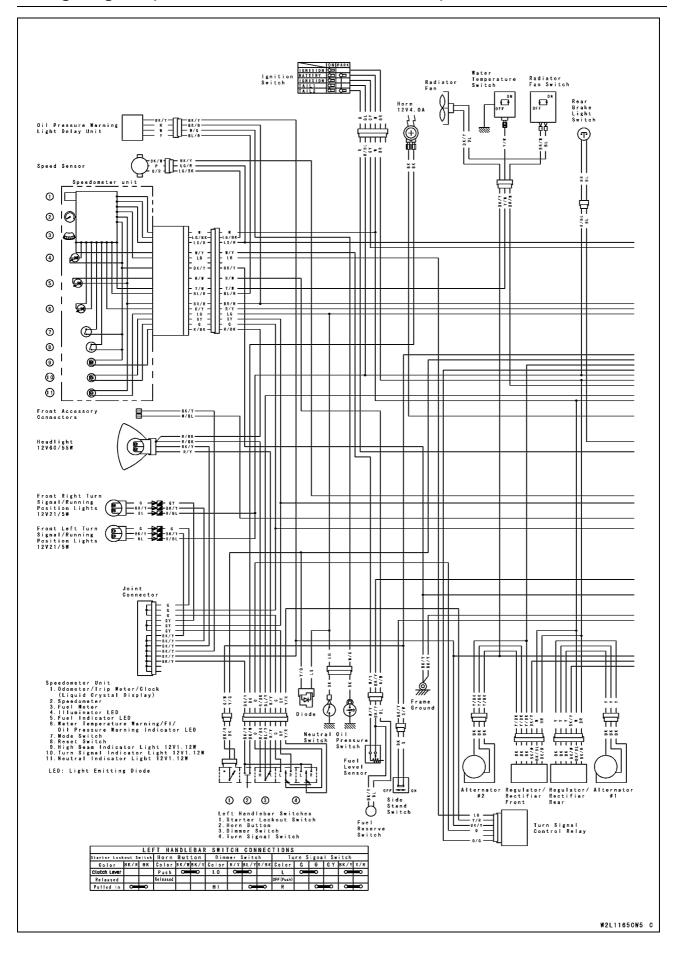
Kawasaki Bond (Silicone Sealant): 56019-120



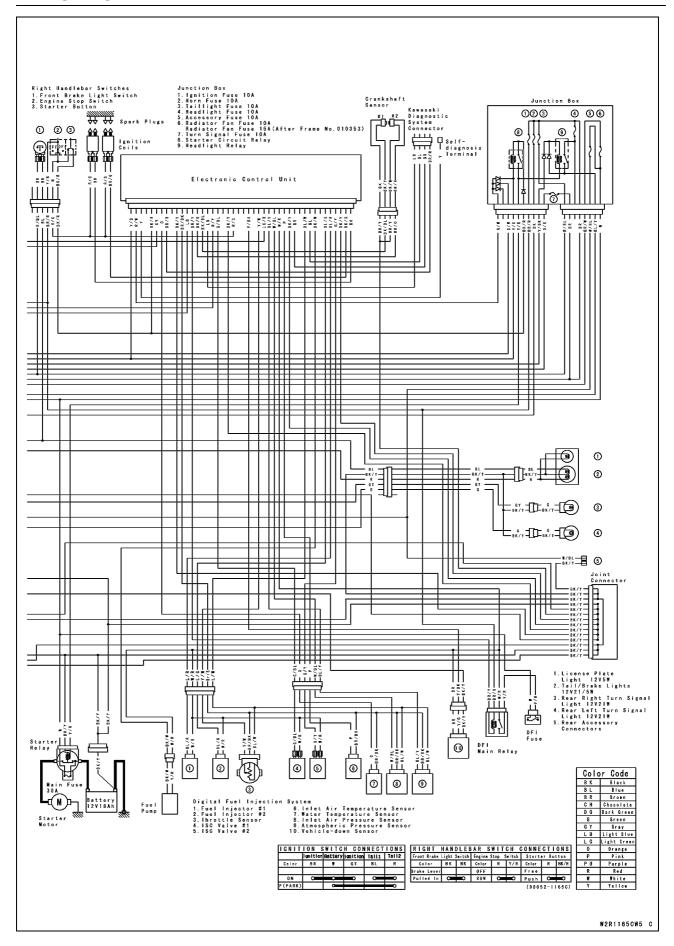
Wiring Diagram (United States, Canada and Taiwan)

Dummy Page

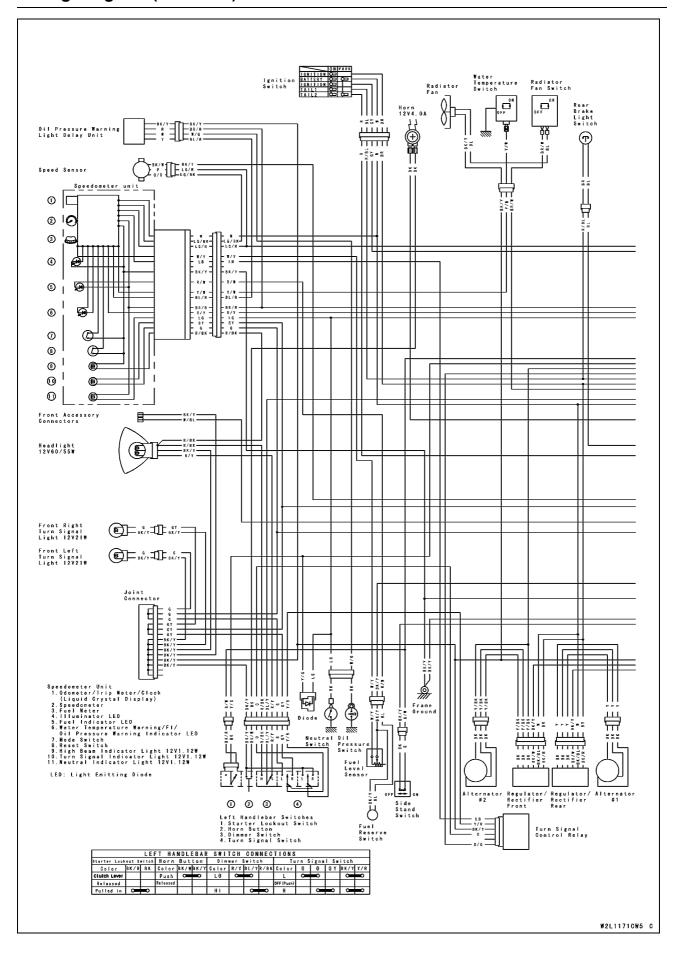
Wiring Diagram (United States, Canada and Taiwan)



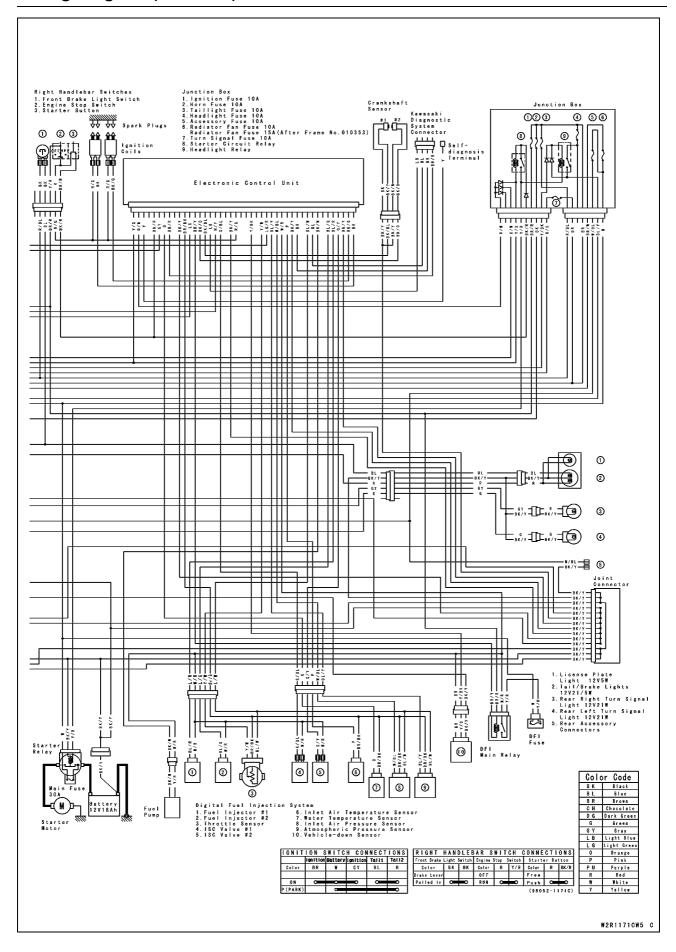
Wiring Diagram (United States, Canada and Taiwan)



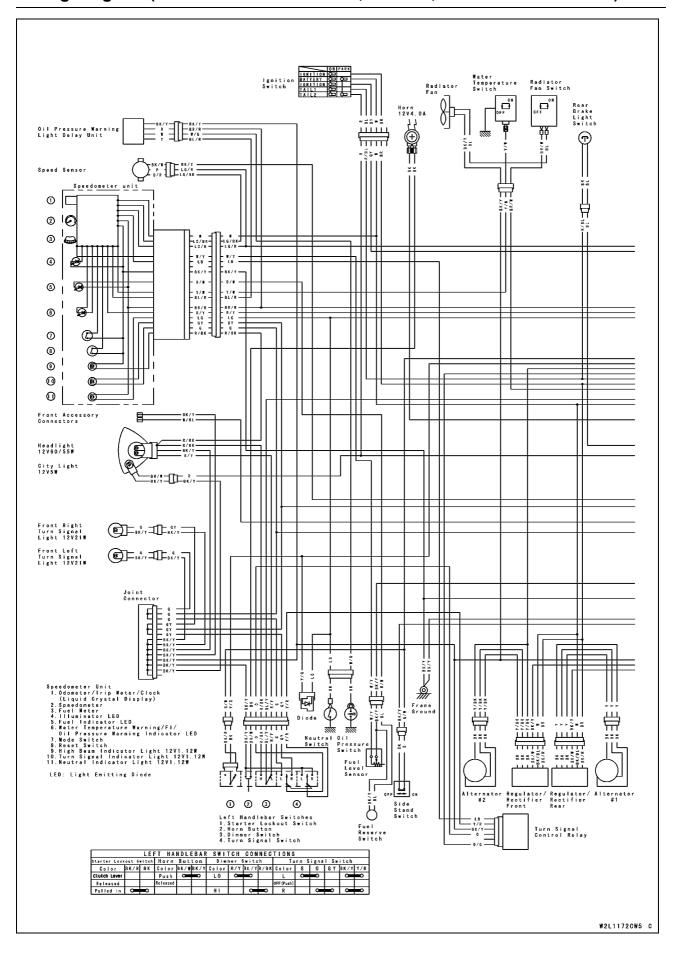
Wiring Diagram (Australia)



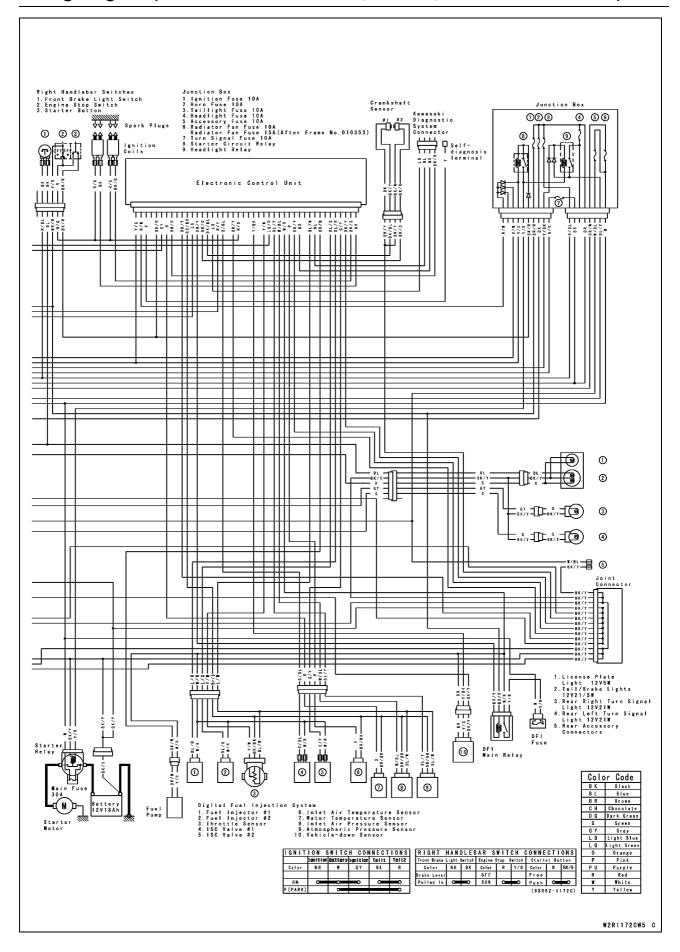
Wiring Diagram (Australia)



Wiring Diagram (Other than United States, Canada, Australia and Taiwan)



Wiring Diagram (Other than United States, Canada, Australia and Taiwan)



16-22 ELECTRICAL SYSTEM

Electrical Parts Location

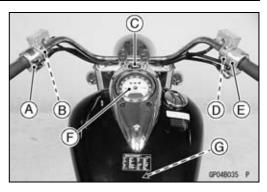
Left Handlebar Switches [A]
Starter Lockout Switch [B]
Ignition Switch [C]
Front Brake Light Switch [D]
Right Handlebar Switches [E]
Meter Unit [F]
Fuel Pump with Fuel Reserve Switch [G]

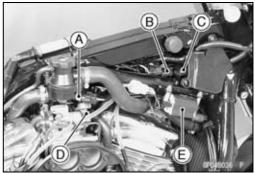
Water Temperature Sensor [A]
Inlet Air Pressure Sensor [B]
Vehicle-down Sensor [C]
Throttle Sensor [D]
Ignition Coil [E]

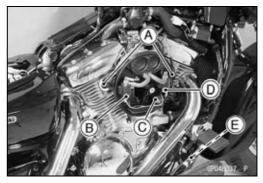
Spark Plugs [A]
ISC Valve #2 (Rear Cylinder) [B]
Inlet Air Temperature Sensor [C]
ISC Valve #1 (Front Cylinder) [D]
Rear Brake Light Switch [E]

Starter Relay and Maine Fuse 30 A [A] Turn Signal Control Relay [B] DFI Maine Relay [C] Oil Pressure Light Delay Unit [D] Junction Box [E]

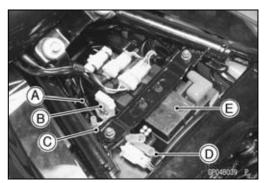
Diode [A] (in main harness)
DFI Fuse 15 A [B]
Self-diagnosis Terminal [C]
ECU (Electronic Control Unit) [D]
Battery [E]





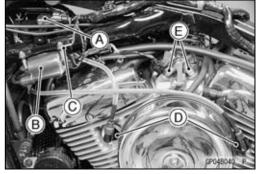




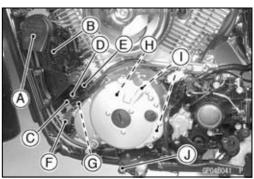


Electrical Parts Location

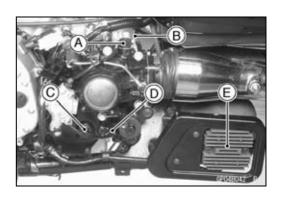
Atmospheric Pressure Sensor [A] Ignition Coil [B] Frame Ground Terminal [C] Spark Plugs [D] Injectors [E]



Horn [A]
Radiator Fan [B]
Water Temperature Switch [C]
Radiator Fan Switch [D]
Starter Motor [E]
Regulator/Rectifier [F]
Regulator/Rectifier [G] (United States, Canada and Taiwan)
Alternator [H]
Crankshaft Sensors [I]
Sidestand Switch [J]



Speed Sensor [A]
Engine Ground Terminal [B]
Neutral Switch [C]
Oil Pressure Switch [D]
Regulator/Rectifier [E] (except United States, Canada and Taiwan)



16-24 ELECTRICAL SYSTEM

Servicing Precautions

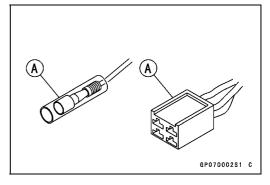
There are a number of important precautions that should be followed servicing electrical systems.

- ODo not reverse the battery cable connections. This will burn out the diodes on the electrical parts.
- OAlways check battery condition before condemning other parts of an electrical system. A fully charged battery is a must for conducting accurate electrical system tests.
- OThe 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.
- OTo prevent damage to electrical parts, do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running.
- OBecause 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.
- OTake care not to short the leads that are directly connected to the battery positive (+) terminal to the chassis ground.
- OTroubles may involve one or in some cases all items. Never replace a defective part without determining what CAUSED the failure. If the failure was caused by some other item or items, they too must be repaired or replaced, or the new replacement will soon fail again.
- OMake 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.
- OMeasure coil and winding resistance when the part is cold (at room temperature).
- OWire Color Codes:

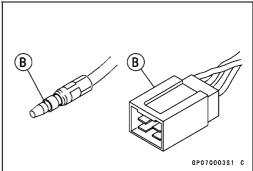
BK: Black G: Green P: Pink
BL: Blue GY: Gray PU: Purple
BR: Brown LB: Light blue R: Red
CH: Chocolate LG: Light green W: White
DG: Dark green O: Orange Y: Yellow

Servicing Precautions

OElectrical Connectors Female Connectors [A]



Male Connectors [B]



16-26 ELECTRICAL SYSTEM

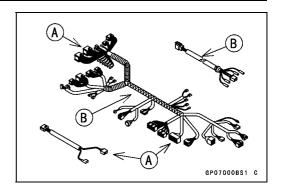
Electrical Wiring

Wiring Inspection

- Visually inspect the wiring for signs of burning, fraying, etc.
- ★If any wiring is poor, replace the damaged wiring.
- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
- ★If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it.
- Check that the connectors are not loose.
- Check the wiring for continuity.
- OUse the wiring diagram to find the ends of the wire which is suspected of being a problem.
- OConnect the hand tester between the ends of the wires.

Special Tool - Hand Tester: 57001-1394

- OSet the tester to the \times 1 Ω range, and read the tester.
- \star If the tester does not read 0 Ω , the lead is defective. Replace the wire or the wiring harness [B] if necessary.



Battery Removal

CAUTION

Do not disconnect the battery cables or any other electrical connections when the ignition switch in ON, as this could damage the ECU (Electronic Control Unit).

Never reverse the connections of the battery, this could damage the ECU.

- Turn off the ignition switch.
- Remove the seats (see Frame chapter).
- Disconnect:

Connectors [A]

Battery (-) Lead Connector [B]

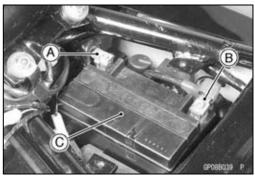
• Remove:

Bolts [C]

Battery Holder [D]



- Slide the black and red caps out.
- Disconnect the negative (–) cable [A] from the battery first and then the positive (+) cable [B] from the battery.
- Pull the battery [C] out of the case.
- Clean the battery using a solution of baking soda and water. Be sure that the wire connections are clean.



Battery Installation

- Visually inspect the surface of the battery container.
- ★If any sings of cracking or electrolyte leakage from the sides of the battery.
- Face the (–) terminal forward [A] and put the battery into the battery case.

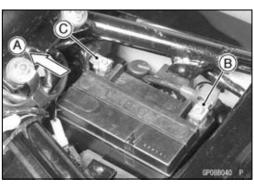
CAUTION

Do not install the battery backwards.

- Connect the positive cable [B] (red cap) to the (+) terminal first, and then the negative cable [C] (black cap) to the (-) terminal.
- Apply a light coat of grease on the terminals to prevent corrosion.
- Cover the terminals with the black and red caps.



If each battery cable is not correctly disconnected or connected, sparks can arise at electrical connections, causing damage to electrical and DFI parts.

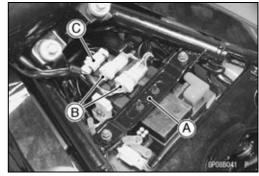


- Put the battery holder [A] on the battery.
- Tighten the bolts securely.
- Connect:

Connectors [B]

Battery (-) Lead Connector [C]

• Install the seats (see Frame chapter).



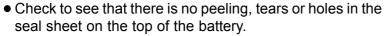
Electrolyte Filling

• Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

Battery Model Name for VN1600-A1 ~: FTZ16-BS

CAUTION

Be sure to use the electrolyte container with the same model name as the battery since the electrolyte volume and specific gravity vary with the battery type. This is to prevent overfilling of the electrolyte, shorting the battery life, and deterioration of the battery performance.



- Place the battery on a level surface.
- Remove the seal sheet [A].

CAUTION

Do not remove the seal sheet sealing the filler ports [B] until just before use.

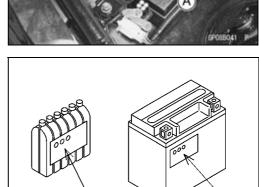
NOTE

OA battery whose seal sheet has any peeling, tears, or holes, requires a refreshing charge (initial charge).

- Take the electrolyte container out of the plastic bag.
- Detach the seal cap [A] from the container.

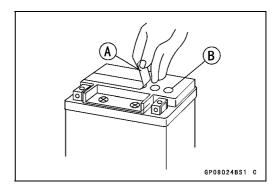
NOTE

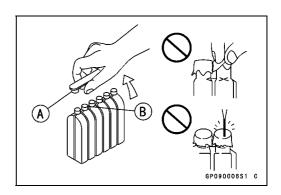
- ODo not discard the seal cap because it is used as the battery plugs later.
- ODo not peel back or pierce the seals [B] on the container.



(B)

GP080204S1 C





- Place the electrolyte container upside down aligning the six seals with the six battery filler ports.
- Push the container down strongly enough to break the seals. Now the electrolyte should start to flow into the battery.

NOTE

- ODo not tilt the container as the electrolyte flow may be interrupted.
- Make sure air bubbles [A] are coming up from all six filler ports.
- OLeave the container this way for 5 minutes or longer.

NOTE

Olf no air bubbles are coming up from a filler port, tap [B] the bottom of the container two or three times. Never remove the container from the battery.

CAUTION

Fill the electrolyte into the battery until the container is completely emptied.

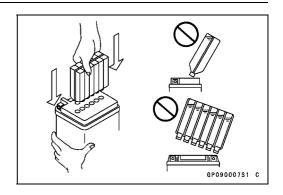
- Be certain that all the electrolyte has flowed out.
- Tap the bottom the same way as above if there is any electrolyte left in the container.
- Now pull the container gently out of the battery.
- Let the battery sit for **20** minutes. During this time, the electrolyte permeates the special separators and the gas generated by chemical reaction is released.
- Fit the seal cap [A] tightly into the filler ports until the seal cap is at the same level as the top of the battery.

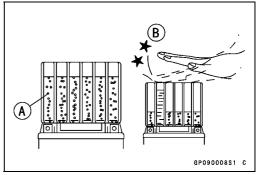
NOTE

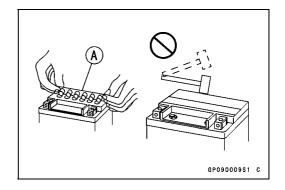
ODo not hammer. Press down evenly with both hands.

▲ WARNING

Once you installed the seal cap after filling the battery, never remove it, nor add any water or electrolyte.







16-30 ELECTRICAL SYSTEM

Battery

Initial Charge

While a sealed battery can be used after only filling with electrolyte, a battery may not be able to sufficiently move a starter motor to start an engine in the cases shown in the table below, where an initial charge is required before use. However, if a battery shows a terminal voltage of 12.6 V or more, using a digital volt meter, after 10 minutes of filling, no initial charge is necessary.

NOTE

• To measure battery terminal voltage, use a digital voltmeter which can be read one decimal place voltage.

Condition requiring initial charge					Charging method
At low temperature (lower than 0°C)					1.8 A × 2 ~ 3 hours
Battery has been stored under high temperature and humidity.					
Seal sheet has been removed, or broken - peeling, tear or hole.					
Battery two or more years old from date of manufacture.					1.8 A × 15 ~ 20 hours
Battery manufacturing date is printed on battery top.					1.6 A × 15 ~ 20 Hours
Example) <u>12</u> <u>10</u> <u>99</u> <u>T1</u>					
	Day	Month	Year	Mfg. location	

Precautions

1) No need of topping-up

No topping-up is necessary in this battery until it ends its life under normal use. <u>Forcibly prying off the</u> seal cap to add water is very dangerous. Never do that.

2) Refreshing charge

If an engine will not start, a horn sounds weak, or lamps are dim, it indicates the battery has been discharged. Give refresh charge for 5 to 10 hours with charge current shown in the specification (see this chapter).

When a fast charge is inevitably required, do it following precisely the maximum charge current and time conditions indicated on the battery.

CAUTION

This battery is designed to sustain no unusual deterioration if refresh-charged according to the method specified above. <u>However, the battery's performance may be reduced noticeably if charged under conditions other than given above.</u> 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).

A WARNING

Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger.

This procedure prevents sparks at the battery terminals which could ignite any battery gases.

No fire should be drawn near the battery, or no terminals should have the tightening loosened.

The electrolyte contains sulfuric acid. Be careful not to have it touch your skin or eyes. If touched, wash it off with liberal amount of water. Get medial attention if severe.

Interchange

The sealed battery can fully display its performance only when combined with a proper vehicle electric system. Therefore, replace the sealed battery only on a motorcycle which was originally equipped with the sealed battery.

Be careful, if the sealed battery is installed on a motorcycle which had an ordinary battery as original equipment, the sealed battery's life will be shortened.

Charging Condition Inspection

- OBattery charging condition can be checked by measuring battery terminal voltage with a digital voltmeter [A].
- Remove the seats (see Frame chapter).
- Disconnect the battery terminals.

CAUTION

Be sure to disconnect the negative (-) cable first.

• Measure the battery terminal voltage.

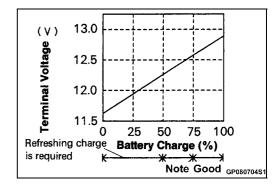
NOTE

- OMeasure with a digital voltmeter which can be read one decimal place voltage.
- ★ If the reading is 12.6 V or more, no refresh charge is required, however, if the read is below the specified, refresh charge is required.

Battery Terminal Voltage

Standard: 12.6 V or more



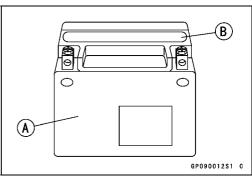


Refreshing Charge

- Remove the battery [A] (see this chapter).
- Do refresh charge by following method according to the battery terminal voltage.

WARNING

This battery is sealed type. Never remove seal cap [B] even at charging. Never add water. Charge with current and time as stated below.



16-32 ELECTRICAL SYSTEM

Battery

Terminal Voltage: 11.5 ~ less than 12.6 V

Standard Charge 1.8 A × 5 ~ 10 h (see following chart)

Quick Charge 9 A × 1 h

CAUTION

If possible, do not quick charge. If quick charge is done unavoidably, do standard charge later on.

Terminal Voltage: less than 11.5 V Charging Method: 1.8 A × 20 h

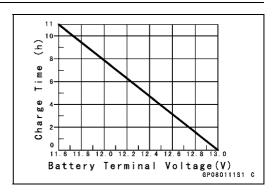
NOTE

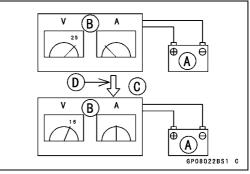
OIncrease the charging voltage to a maximum voltage of 25 V if the battery will not accept current initially. Charge for no more than 5 minutes at the increased voltage then check if the battery is drawing current. If the battery will accept current decrease the voltage and charge by the standard charging 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.
- ODetermine the condition of the battery left for 30 minutes after completion of the charge by measuring the terminal voltage according to the table below.

Criteria	Judgement
12.6 V or higher	Good
12.0 ~ lower than 12.6 V	Charge insufficient \rightarrow Recharge
lower than 12.0 V	Unserviceable → Replace





Alternator Outer Cover Removal

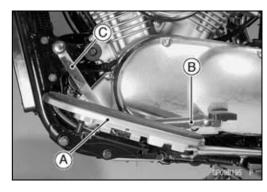
• Remove:

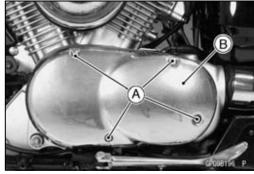
Left Front Footboard [A] (see Crankshaft/Transmission chapter)

Rear Shift Pedal [B] (see Crankshaft/Transmission chapter)

Front Shift Pedal [C] (see Crankshaft/Transmission chapter)

 Unscrew the bolts [A] and take off the alternator outer cover [B].





Alternator Outer Cover Installation

- First, insert the upper edge [A] of the alternator outer cover under the left crankcase ribs [B]. This prevents the rib failure.
- Apply a soap and water solution or rubber lubricant to the body of the alternator outer cover bolts [C] for easy installation and tighten them.

Torque - Alternator Outer Cover Bolts: 6.9 N·m (0.70 kgf·m, 61 in·lb)

Front [D]

• Install:

Front and Rear Shift Pedals (see Crankshaft/Transmission chapter)

Left Front Footboad (see Crankshaft/Transmission chapter)

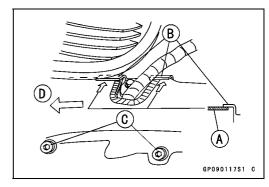
Alternator Cover Removal/Installation

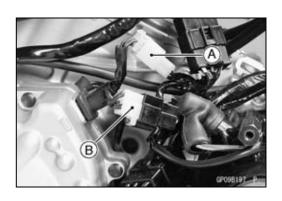
• Remove:

Left Front Footboad (see Crankshaft/Transmission chapter)

Rear Shift Pedal (see Crankshaft/Transmission chapter) Front Sift Pedal (see Crankshaft/Transmission chapter)

- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Disconnect the crankshaft sensor lead connector [A] and alternator lead connector [B].



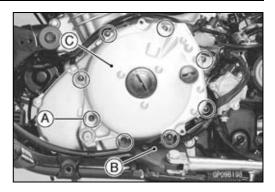


16-34 ELECTRICAL SYSTEM

Charging System

• Remove:

Alternator Cover Bolts [A] Bracket [B] Alternator Cover [C]



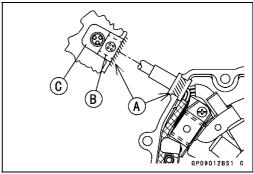
- Discard and replace the gasket with a new one.
- Apply silicone sealant to the area [A] to the crankshaft sensor wire grommet [B].

Stator Lead Grommet [C]

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

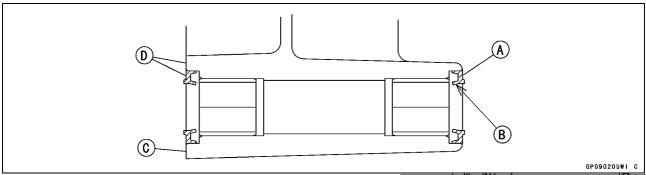
• Tighten the cover bolts.

Torque - Alternator Cover Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)



Alternator Cover Assembly

- Install each shift shaft grease seal [A] with the lip [B] facing inside the alternator cover [C] until the seal side is even [D] with the end of the hole.
- Apply a little high temperature grease on the lips.



Alternator Inner Cover Removal

- Drain the engine oil (see Engine Lubrication System chapter).
- Using the jack [A] and the attachment jack [B], raise the front and rear wheels just off the ground.

Frame Pipe Rib [C]

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

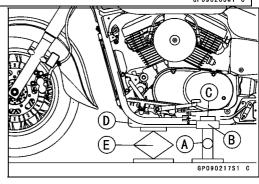
• Remove:

Fuel Tank (see Fuel System chapter)

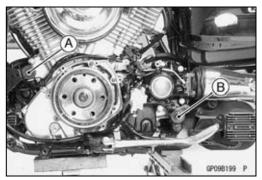
Alternator Outer Cover and Alternator Cover (see this chapter)

Alternator Lead Connectors

- Loosen the front and rear exhaust pipe holder nuts, and both chamber bolts.
- Support the front part of the engine bottom [D], using a commercially available jack [E].



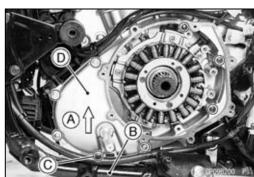
- Remove the front engine mounting bolt [A].
- Loosen the rear engine mounting bolt [B].



 Lift up [A] the front part of the engine, using the jack until the lower part of the alternator inner cover clears the lower frame [B].

NOTE

- O Turn the propeller shaft so that the engine can be raised as high as possible.
- Unscrew the bolts [C] and take off the alternator inner cover [D].



Alternator Inner Cover Installation

- Replace the gasket with a new one.
- Install the alternator inner cover and tighten the cover holts

Torque - Alternator Inner Cover Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)

• Move the engine into its original position and tighten the engine mounting bolts.

Torque - Engine Mounting Bolts and Nuts: 44 N·m (4.5 kgf·m, 32 ft·lb)

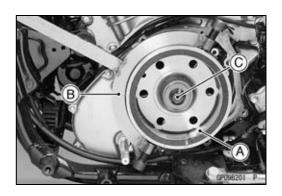
Install the removed parts.

Alternator Rotor Removal

- Remove the alternator cover (see Alternator Cover Removal/Installation).
- Hold the alternator rotor [A] steady with the flywheel holder [B], and remove the rotor bolt [C].

Special Tool - Flywheel Holder: 57001-1410

• Take the alternator rotor, washer, and ratchet off the crankshaft.

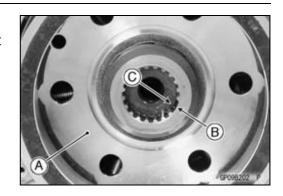


16-36 ELECTRICAL SYSTEM

Charging System

Alternator Rotor Installation

• Install the alternator rotor [A] while fitting the alignment notch [B] of the splines onto the alignment tooth [C].



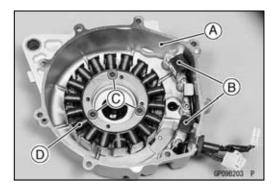
- Apply molybdenum disulfide oil to the threads of the alternator rotor bolt.
- Tighten:

Torque - Alternator Rotor Bolt: 78 N·m (8.0 kgf·m, 58 ft·lb)

Install:
Alternator Cover (see Alternator Cover Removal/Installation)

Alternator Outside Stator Removal

- Remove the alternator cover [A] (see Alternator Cover Removal/Installation).
- Remove the crankshaft sensors [B] (see Crankshaft Sensor Removal).
- Unscrew the Allen bolts [C] and take the stator [D] off the alternator cover.



Alternator Outside Stator Installation

- Install the stator with the BK leads on the alternator cover [A].
- Apply:

Non-permanent Locking Agent -Alternator Stator Bolts

• Tighten:

Torque - Alternator Stator Bolts: 13 N·m (1.3 kgf·m, 113 in·lb)

• Install the crankshaft sensors as shown.

Crankshaft Sensor [B] with shorter leads (BK and BK/Y) for #1 (front)

Crankshaft Sensor [C] with longer leads (BK/W and BK/R) for #2 (rear)

• Tighten:

Torque - Crankshaft Sensor Screws: 2.9 N·m (0.30 N·m, 26 in·lb)

- ORun the shorter crankshaft sensor leads over the alternator leads, and the longer crankshaft sensor leads over the shorter crankshaft sensor leads.
- Apply:

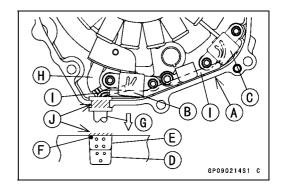
Non-permanent Locking Agent Stator Lead Holder Screw
Crankshaft Sensor Lead Holder Bolt

• Tighten:

Torque - Stator Lead Holder Screw: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Crankshaft Sensor Lead Holder Bolt: 2.9 N·m (0.30 kgf·m, 26 in·lb)

- Apply silicone sealant to all the sides of the grommets as shown, and fit the grommets into the notch of the alternator cover
- OFirst, install the grommet [D] of the alternator leads, and then the grommet [E] of the crankshaft sensor leads with the round mark [F] up.
- Pull [G] the alternator leads [H] and crankshaft sensor leads [I] outside the alternator cover, and reduce the slack of leads as possible in the cover in order to prevent contact with the rotor.
- Apply silicone sealant to the mating surface [J] of the grommet.
- Connect the outside alternator connector (BK leads) to the connector (Y leads) of the regulator/rectifire.

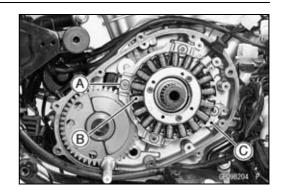


16-38 ELECTRICAL SYSTEM

Charging System

Alternator Inside Stator Removal

- Remove:
 - Alternator Rotor (see Alternator Rotor Removal)
 Alternator Inner Cover (see Alternator Inner Cover Removal)
- Unscrew the inside stator holder bolts [A] and take the inside stator [B] and holder [C] off the left crankcase.



Alternator Inside Stator Installation

- Install the inside stator with the BK leads on the left crankcase.
- Apply:

Non-permanent Locking Agent - Inside Stator Holder Bolts

• Tighten:

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

- Apply silicone sealant to the grommet and fit it into the notch of the alternator inner cover.
- Connect the inside alternator connector (BK leads) to the connector (Y/BK leads) of the regulator/rectifier.

Charging Voltage Inspection

- Check the battery condition.
- Warm up the engine to obtain actual alternator operating conditions.
- Remove the seats (see Frame chapter).
- Check that the ignition switch is turned off, and connect the hand tester to the battery as shown in the table.

Special Tool - Hand Tester: 57001-1394

Battery Charging Voltage

Tester	Connec	Reading	
Range Tester (+) to		Tester (-) to	@3 000 rpm
25 V DC	Battery (+)	Battery (–)	14.2 ~ 15.2 V

- Turn on the ignition switch and start the engine, and note the voltage readings at various engine speeds with the headlight turned on and then turned off (To turn off the headlight, disconnect the headlight connector in the headlight unit). The readings should show nearly battery voltage when the engine speed is low, and as the engine speed rises, the readings should also rise. But they must be kept under the specified voltage.
- Turn off the ignition switch to stop the engine, and disconnect the hand tester.
- ★ If the charging voltage is kept between the values given in the table, the charging system is considered to be working normally.
- ★ If the output voltage is much higher than the values specified in the table, the regulator/rectifier is defective or the regulator/rectifier leads are loose or open.
- ★ If the battery voltage does not rise as the engine speed increases, then the regulator/rectifier is defective or the alternator output is insufficient for the loads. Check the alternator and regulator/rectifier to determine which part is defective.

Alternator Inspection

There are three types of alternator failures: short, open (lead burned out), or loss in rotor magnetism. A short or open in one of the stator coil lead will result in either a low output, or no output at all. A loss in rotor magnetism, which may be caused by dropping or hitting the alternator, by leaving it near an electromagnetic field, or just by aging, will result in low output.

- To check the alternator output voltage, do the following procedures.
- ORemove the alternator outer cover and disconnect the outside alternator connector [A].
- OConnect the hand tester to the outer as shown.

Special Tool - Hand Tester: 57001-1394

- OStart the engine.
- ORun it at 3 000 rpm of the engine speed.
- ONote the voltage readings.



Alternator Output Voltage

Tester	Conr	Reading	
Range Tester (+) to		Tester (-) to	@3 000 rpm
250 V AC	One black	Another black	60 ~ 90 V
250 V AC	lead	lead	60 ~ 90 V

- ★ If the output voltage shows the value in the table, the alternator operates properly and the regulator/rectifier is damaged. A much lower reading than the value in the table indicates that the alternator is defective.
- ORepeat the test for the other black leads. Hand Tester [A]
- Check the stator coil resistance as follows:
- OStop the engine.
- OConnect the hand tester [A] to the connector as shown in the table.
- ONote the resistance readings.

Stator Coil Resistance

Tester	Tester Connections			
Range	Tester (+) to	Tester (-) to	Reading	
×1 0	One black	Another black	0.33 ~ 0.49 Ω	
×1 \(\(\)2	lead	lead	0.33 ~ 0.49 \\	

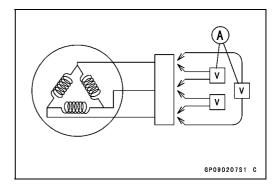
- ★If there is more resistance than shown in the table, or no hand tester reading (infinity), the stator has an open wire and must be replaced. Much less than this resistance means the stator is shorted, and must be replaced.
- Using the highest resistance range of the hand tester, measure the resistance between each of the black leads and chassis ground.
- ★Any hand tester reading less than infinity (∞) indicates a short, necessitating stator replacement.
- ★If the stator coil has normal resistance, but the voltage check showed the alternator to be defective, then the rotor magnets have probably weakened, and the rotor must be replaced.
- ORepeat the test for the other black leads.
- ORepeat the test for the inside alternator connector.

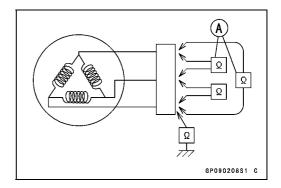
Regulator/Rectifier Removal

United States, Canada and Taiwan Models

• Remove:

Alternator Cover (see Alternator Cover Removal) Regulator/Rectifier Lead Connectors [A]

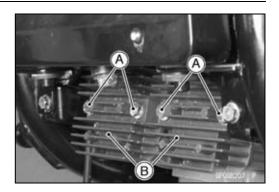






• Remove:

Regulator/Rectifier Bolts [A] Regulator/Rectifiers [B]



Other than United States, Canada and Taiwan Models

• Remove:

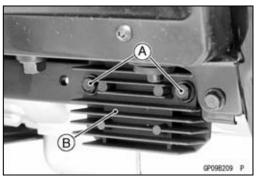
Alternator Cover (see Alternator Cover Removal) Regulator/Rectifier Lead Connectors [A]



Front Side

• Remove:

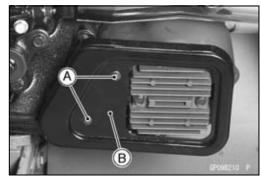
Regulator/Rectifier Bolts [A] Regulator/Rectifier [B]



Rear Side

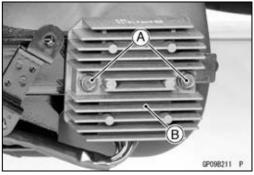
• Remove:

Regulator/Rectifier Cover Bolts [A] Regulator/Rectifier Cover [B]



• Remove:

Regulator/Rectifier Bolts [A] Regulator/Rectifier [B]



16-42 ELECTRICAL SYSTEM

Charging System

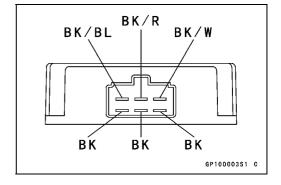
Regulator/Rectifier Installation

- Run the regulator/rectifier leads according to the Cable, Wire, and Hose Routing section in the Appendix chapter.
- Tighten:

Torque - Regulator/Rectifier Bolts: 6.5 N·m (0.66 kgf·m, 57 in·lb)

Rectifier Inspection

- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Check the rectifier resistance as follows.
- Disconnect the regulator/rectifier connector.
- Connect the hand tester (special tool) to the regulator/rectifier as shown in the table, and check the resistance in both directions of each diode in the rectifier following the table.
- ★The resistance should be low in one direction and more than ten times as much in the other direction. If any two wires are low or high in both directions, the rectifier is defective and the regulator/rectifier must be replaced.



NOTE

OThe actual tester reading varies with the hand tester used and the individual rectifier, but, generally speaking, the lower reading should be from zero to one half the scale.

Rectifier Circuit Inspection

NIa	Conne	ections	Dooding	Tester
No.	Tester (+) to	Tester (–) to	Reading	Range
1	BK1			
2	BK2	BK/BL	∞	
3	BK3			
4	BK1			
5	BK2	BK/W		× 10 Ω
6	BK3		1/2 22212	or
7		BK1	1/2 scale	× 100 Ω
8	BK/BL	BK2		
9		BK3		
10		BK1		
11	BK/W	BK2	∞	
12		BK3		

• Repeat the test for another regulator/rectifier.

Regulator Inspection

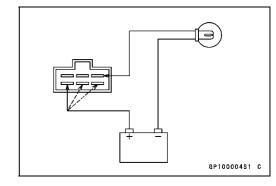
OTo test the regulator out of circuit, use three 12 V batteries and a test light (12 V 3 ∼ 6 W bulb in a socket with leads).

CAUTION

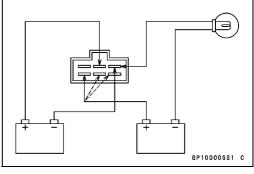
The test light works as an indicator and also as a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.

- Do the 1st step regulator circuit test.
- OConnect the test light and the 12 V battery to the regulator/rectifier as shown.
- OCheck BK1, BK2, BK3 terminals respectively.
- ★If the test light turns on, the regulator/rectifier is defective.

 Replace it.
- ★If the test light does not turn on, continue the test.



- Do the 2nd step regulator circuit test.
- OConnect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- OApply 12 V to the BK/R terminal.
- OCheck BK1, BK2, and BK3 terminals respectively.
- ★If the test light turns on, the regulator/rectifier is defective. Replace it.
- Olf the test light does not turn on, continue the test.

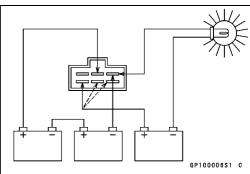


- Do the 3rd step regulator circuit test.
- OConnect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- OMomentarily apply 24 V to the BK/R terminal by adding a 12 V battery.
- OCheck BK1, BK2, and BK3 terminals respectively.



Do not apply more than 24 volts. If more than 24 volts is applied, the regulator/rectifier may be damaged. Do not apply 24 V more than a few seconds. If 24 volts is applied for more than a few seconds, the regulator/rectifier may be damaged.

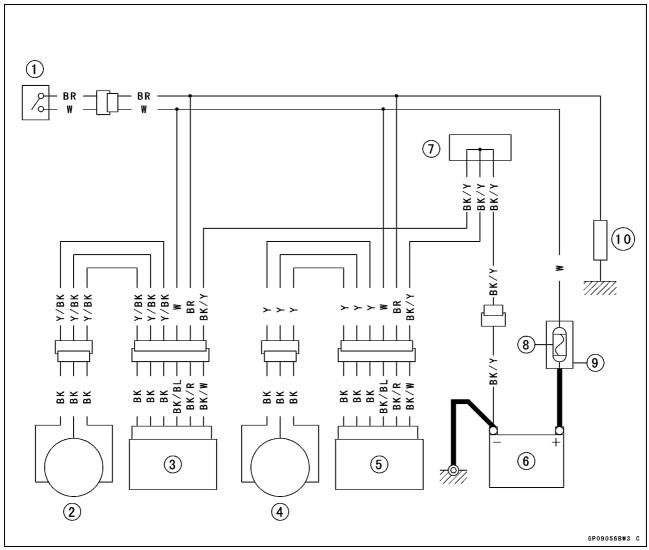
- ★If the test light does not light when 24 V is applied momentarily to the BK/R terminal, the regurator/rectifier is defective. Replace it.
- ★If the regulator/rectifier passes all the tests described, it may still be defective. If the charging system still does not work properly after checking all the components and the battery, test the regulator/rectifier by replacing it with a known good unit.
- Repeat the test for another regulator/rectifier.



16-44 ELECTRICAL SYSTEM

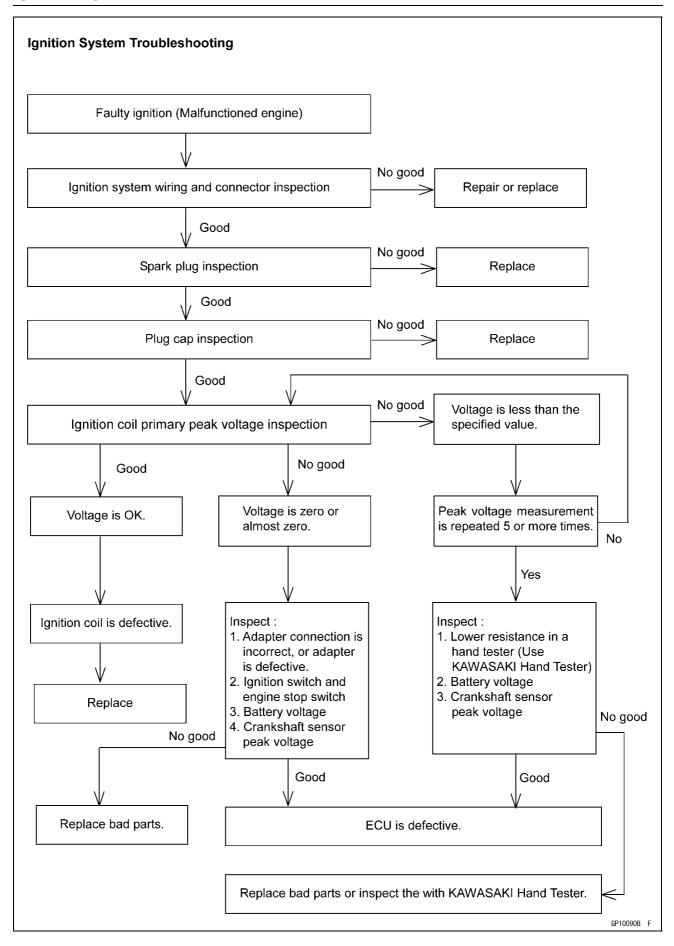
Charging System

Charging System Circuit



- 1. Ignition Switch
- 2. Alternator #2 (inside stator)
- 3. Regulator/Rectifier #2
- 4. Alternator #1 (outside stator)
- 5. Regulator/Rectifier #1

- 6. Battery
- 7. Joint Connector
- 8. Main Fuse 30 A
- 9. Starter Relay
- 10. Load



A WARNING

The ignition system produces extremely high voltage. Do not touch the spark plugs, ignition coils, or spark plug high-tension cables while the engine is running, or you could receive a severe electrical shock.

CAUTION

Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent IC igniter damage in the ECU.

Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the IC igniter in the ECU and the diodes.

Ignition Coil Removal

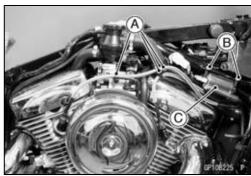
• Remove:

Fuel Tank (see Fuel System (DFI) chapter)
Clamps [A]
Primary Leads
Ignition Coil Mounting Nuts [B]
Frame Ground Lead [C] (Left Side)
Ignition Coil [D] (Left Side)



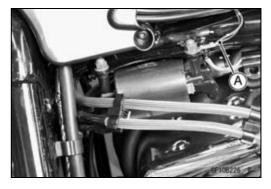
• Remove:

Clamps [A]
Primary Leads
Ignition Coil Mounting Nuts [B]
Ignition Coil [C] (Right Side)



Ignition Coil Installation

- Connect the primary leads to the ignition coil terminals and run the high-tension cables according to the Cable, Wire, and Hose Routing section in the Appendix chapter.
- Install the frame ground lead [A] to the rear mounting bolt of the left ignition coil.

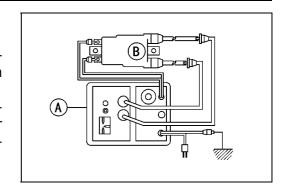


Ignition Coil Inspection

- Remove the ignition coils (see this chapter).
- Measure the arcing distance with a commercially available coil tester [A] to check the condition of the ignition coil [B].
- Connect the ignition coil (with the spark plug cap left attached at the end of the spark plug terminal) to the tester in the manner prescribed by the manufacturer and measure the arcing distance.



Standard: 6 mm (0.24 in.) or more



A WARNING

To avoid extremely high voltage shocks, do not touch the coil body or leads.

- ★ If the distance reading is less than the specified value, the ignition coil or spark plug caps are defective.
- To determine which part is defective, measure the arcing distance again with the spark plug caps removed from the ignition coil. Remove the caps by turning them counterclockwise.
- ★ If the arcing distance is subnormal as before, the trouble is with the ignition coil itself. If the arcing distance is now normal, the trouble is with the spark plug cap.
- ★If the coil tester is not available, the coil can be checked for a broken or badly shorted winding with the hand tester.

Special Tool - Hand Tester: 57001-1394

NOTE

- OThe hand tester cannot detect layer shorts and shorts resulting from insulation breakdown under high voltage.
- Measure the primary winding resistance as follows.
- OConnect the hand tester between the coil terminals.
- OSet the tester to the \times 1 Ω range, and read the tester.
- Measure the secondary winding resistance as follows.
- ORemove the plug caps by turning them counterclockwise.
- OConnect the tester between the spark plug High-Tension cables.
- OSet the tester to the × 1 kΩ range and read the tester. Measure primary winding resistance [A]. Measure secondary winding resistance [B]. Ignition Coil [C]

Ignition Coil Winding Resistance

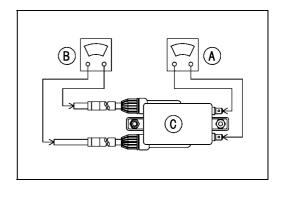
Primary Windings: $1.9 \sim 2.9 \Omega$ Secondary Windings: $18 \sim 28 \text{ k}\Omega$

★If the tester does not read as specified, replace the coil. ○To install the plug cap, turn it clockwise.

Spark Plug Removal

- Remove the spark plug caps.
- Remove the spark plugs using the 18 mm (0.71 in.) plug wrench.

Special Tool - Spark Plug Wrench, Hex 18: 57001-1024



16-48 ELECTRICAL SYSTEM

Ignition System

Spark Plug Installation

• Insert the spark plug vertically into the plug hole with the plug installed in the plug wrench [A].

Special Tool - Spark Plug Wrench, Hex 18: 57001-1024

• Tighten the plugs.

Torque - Spark Plugs: 18 N·m (1.8 kgf·m, 13 ft·lb)

Fit the plug caps securely.



Spark Plug Cleaning/Inspection

Refer to Spark Plug Cleaning/Inspection in Periodic Maintenance chapter.

Ignition Coil Primary Peak Voltage

NOTE

OBe sure the battery is fully charged.

- Remove the fuel tank (see Fuel System chapter).
- Remove all the spark plug caps but do not remove the spark plugs.
- Install new spark plugs into all the spark plug caps, and ground them onto the engine.
- Install the peak voltage adapter [A] into the hand tester [B].
- Connect the adapter between the ignition coil primary wire terminal and the engine ground with the primary lead left connected.

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

Olnsert the adapter probe into the terminal of the primary lead [C].

ECU [D]
Battery [E]
Ignition Coil [F]
New Spark Plug [G]

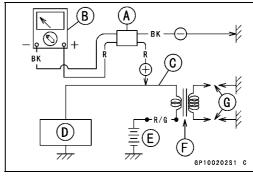
Special Tool - Hand Tester: 57001-1394

Hand Tester Range: DC 1 000 V

Primary Lead Connections:

Adapter (R, +) Adapter (BK, -)

Front Ignition Coil: BK \longleftrightarrow Ground Rear Ignition Coil: BK/G \longleftrightarrow Ground





A WARNING

To avoid extremely high voltage shocks, do not touch the spark plugs or tester connections.

- Turn the ignition switch and the engine stop switch ON.
- Pushing the starter button, turn the engine 4 ~ 5 seconds with the transmission in neutral to measure the primary peak voltage.
- Repeat the measurements 5 or more times for one ignition coil.

Ignition Coil Primary Peak Voltage

Standard:

Front: 208 V or more Rear: 192 V or more

- Repeat the test for the other ignition coil.
- ★If the reading is less than the specified value, check the following:

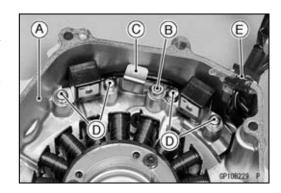
Ignition Coils (see Ignition Coil Inspection)

Crankshaft Sensors (see Crankshaft Sensor Inspection)

★If the ignition coils and crankshaft sensors are normal, check the ECU (see Fuel System chapter).

Crankshaft Sensor Removal

- Remove the alternator cover [A] (see Alternator Cover Removal).
- Unscrew the holder bolt [B] and take off the crankshaft sensor lead holder [C].
- Unscrew the screws [D] and take off the crankshaft sensors with the grommet [E].

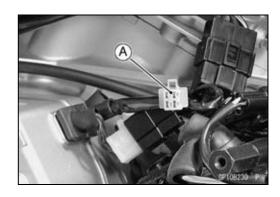


Crankshaft Sensor Installation

ORefer to Alternator Stator Installation in this chapter.

Crankshaft Sensor Inspection

- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Remove all the spark plug caps but do not remove the spark plugs.
- Disconnect the crankshaft sensor lead connector [A].



16-50 ELECTRICAL SYSTEM

Ignition System

 Connect the peak voltage adapter [A] to the hand tester [B].

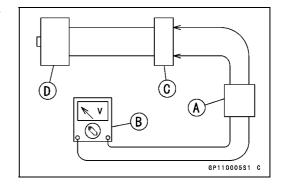
Special Tool - Peak Voltage Adapter: 57001-1415

Type: KEK-54-9-B Hand Tester: 57001-1394

• Insert the adapter probes into the connector [C] of the crankshaft sensor [D] as shown.

Connections:

 $\begin{array}{ccccc} & & Adapter & Adapter \\ & (R, \ +) & (BK, \ -) \\ \hline Front Crankshaft Sensor: & BK/Y & \longleftrightarrow & BK \\ Rear Crankshaft Sensor: & BK/R & \longleftrightarrow & BK/W \\ \end{array}$



NOTE

OBe sure the battery is fully charged.

Hand Tester Range: DC 10 V

- Turn the ignition switch and the engine stop switch ON.
- Pushing the starter button, turn the engine 4 ~ 5 seconds with the transmission in neutral to measure the crankshaft sensor peak voltage.
- Repeat the measurements 5 or more times for one crankshaft sensor.
- Repeat the test for the other crankshaft sensor.

Crankshaft Sensor Peak Voltage

Standard:

Front 2.2 V or more Rear 2.0 V or more

- ★If the reading is less than the specified value, replace the crankshaft sensor.
- ★If the reading is normal, check the ECU (see Fuel System chapter).
- ★If the peak voltage adapter is not available, the coil can be checked for a broken or badly shorted winding with the hand tester (special tool).

NOTE

- OUsing the peak voltage adapter is a more reliable way to determine the condition of the crankshaft sensor than crankshaft sensor internal resistance measurements.
- Disconnect the crankshaft sensor lead connector.

 Set the hand tester [A] to the × 100 Ω range and wire it to the crankshaft sensor lead connector [B].

Connections:

Tester Connections

Front Crankshaft Sensor: BK/Y \longleftrightarrow BK Rear Crankshaft Sensor: BK/R \longleftrightarrow BK/W

★If there is more resistance than the specified value, the coil has an open wire and must be replaced. Much less than this resistance means the coil is shorted, and must be replaced.

Crankshaft Sensor Resistance: Standard: 380 \sim 560 Ω

- 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 (∞) indicates a short, necessitating replacement of the crankshaft sensor assy.

Ignition Timing Inspection

- Remove the alternator outer cover (see Alternator Outer Cover Removal).
- Remove the timing inspection cap.

Special Tool - Filler Cap Driver: 57001-1454

• Attach the timing light [A] to the front ignition coil lead in the manner prescribed by the manufacturer.

Special Tool - Timing Light: 57001-1241

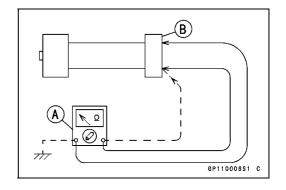
- Start the engine and aim the timing light at the ignition timing mark on the alternator rotor.
- Run the engine at the speeds specified and note the alignment of the ignition timing marks.

Ignition Timing

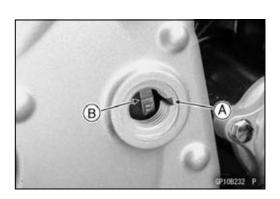
Engine speed r/min (rpm)	Hole notch [A] aligns with:
950	F or R mark [B] on alternator rotor

F Mark: For front cylinder R Mark: For rear cylinder

- Repeat the test for the rear cylinder, using the rear ignition coil lead.
- ★ If the ignition timing is incorrect, check the crankshaft sensor (see Crankshaft Sensor Inspection).
- ★If the crankshaft sensor are normal, check the ECU (see Fuel System chapter).







16-52 ELECTRICAL SYSTEM

Ignition System

Interlock Operation Inspection

• Remove:

Right Side Cover (see Frame chapter)

ODo not disconnect the connectors.

1st Check

- Measure the terminal voltage of the R/W lead in the junction box connector [A] in accordance with the following procedure.
- OSet the tester [B] to the 10 V DC range, connect it to the R/W lead and frame ground [C].



Tester (+) Terminal \rightarrow R/W Lead Terminal

Tester (-) Terminal → Frame Ground

Condition:

Transmission Gear → 1st Position

Clutch Lever → Release

Side Stand → Down

OTurn the ignition switch on.

ORead the voltage.

Interlock Operation Voltage

Standard: 4 V or more

- ★If the voltage is lower than the standard, inspect the side stand switch, starter lockout switch, gear position switch and junction box.
- ★If their parts are normality, replace the ECU.
- ★If the voltage is standard, push the starter button.
- OThen the starter motor should not turn when the starter system circuit is normality.
- ★If the starter motor turned, ECU is defective. Replace the ECU.

2nd Check

Using a stand, raise the rear wheel off the ground.

- Inspect the engine for its secure stop after the following operations are completed.
- Run the engine to the following conditions.

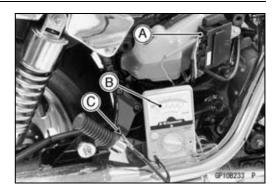
Condition

Transmission Gear \rightarrow 1st Position

Clutch Lever → Release

Side Stand \rightarrow Up

- Set the side stand on the ground, then the engine will stop.
- ★If whichever may not be stopped, inspect the gear position switch, starter lockout switch, side stand switch and junction box.
- ★If their parts are normality, replace the ECU.



IC Igniter Inspection

OThe IC igniter is built in the ECU [A].

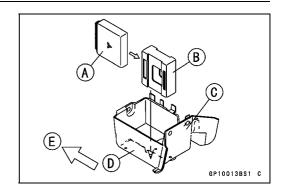
Damper [B]

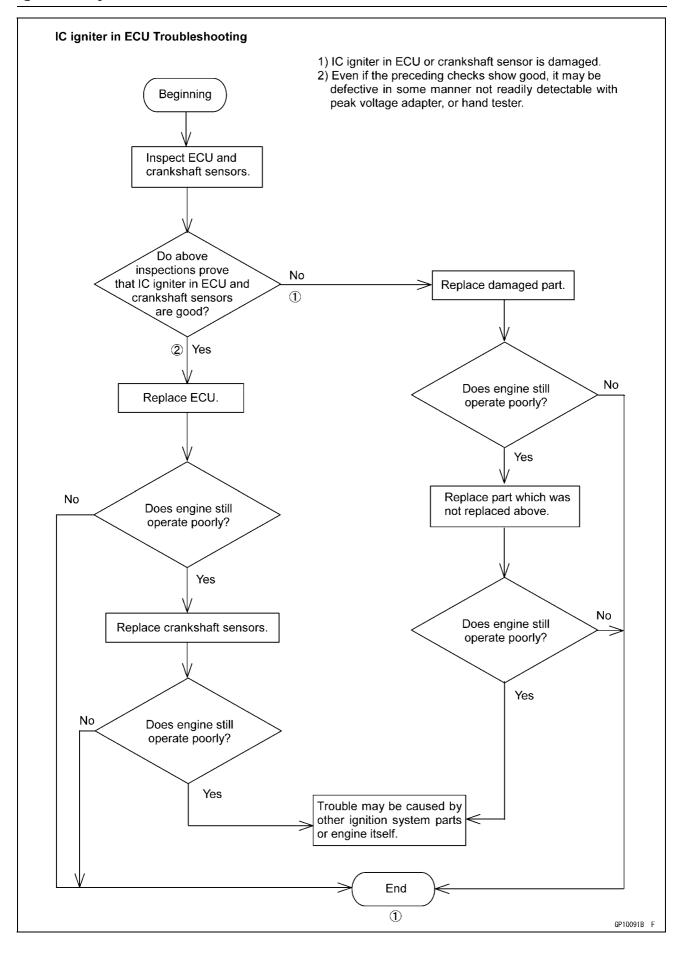
Battery Case [C]

Groove [D]

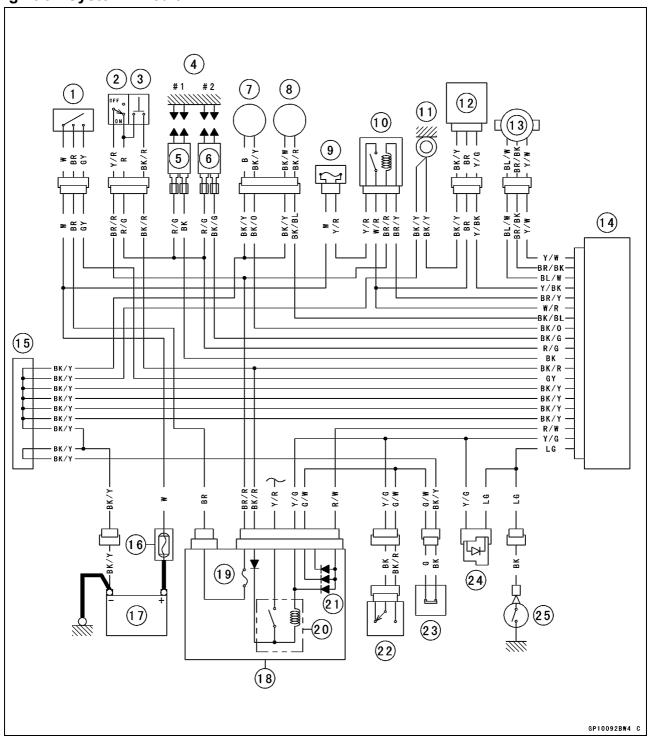
Front [E]

ORefer to Fuel System chapter for ECU Inspection.





Ignition System Circuit



- 1. Ignition Switch
- 2. Engine Stop Switch
- 3. Starter Button
- 4. Spark Plugs
- 5. Ignition Coil #1 (front cylinder)
- 6. Ignition Coil #2 (rear cylinder)
- 7. Crankshaft Sensor #1 (front cylinder)

- 8. Crankshaft Sensor #2 (rear cylinder)
- 9. DFI Fuse 15 A
- 10. DFI Main Relay
- 11. Frame Ground
- 12. Vehicle-down Sensor
- 13. Throttle Sensor
- 14. Electronic Control Unit
- 15. Joint Connector
- 16. Main Fuse 30 A

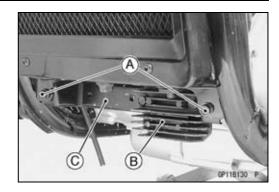
- 17. Battery
- 18. Junction Box
- 19. Ignition Fuse 10 A
- 20. Starter Circuit Relay
- 21. Interlock Diodes
- 22. Starter Lockout Switch
- 23. Side Stand Switch
- 24. Diode
- 25. Neutral Switch

16-56 ELECTRICAL SYSTEM

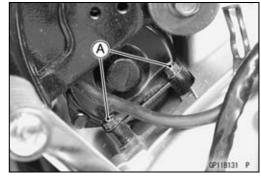
Starter Motor

Starter Motor Removal

 Unscrew the bracket bolts [A] and take off the regulator/rectifier [B] with its bracket [C].



Remove: Starter Motor Bolts [A]



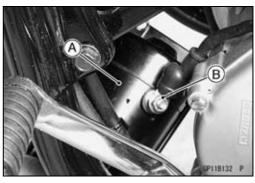
- Pull the starter motor [A] toward the left.
- Remove:

Starter Motor Terminal Nut [B] and Cable

CAUTION

Never drop the starter motor, especially on a hard surface.

Such a shock to the motor can damage it.

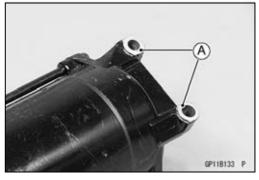


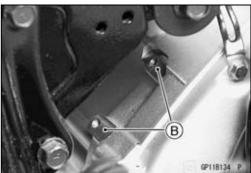
Starter Motor Installation

CAUTION

Do not tap the starter motor shaft or body. Tapping the shaft or body could damage the motor.

 When installing the starter motor, clean the starter motor legs [A] and crankcase [B] where the starter motor is grounded.

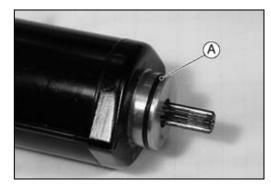




- Replace the O-ring [A] with a new one.
- Apply a small amount of engine oil to the O-ring.
- Tighten:

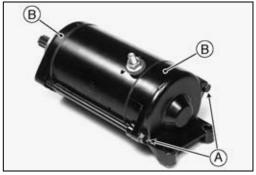
Torque - Starter Motor Mounting Bolts: 11 N·m (1.1 kgf·m, 95 in·lb)

Starter Motor Terminal Nut: 4.9 N·m (0.50 kgf·m, 43 in·lb)

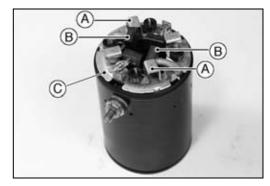


Starter Motor Disassembly

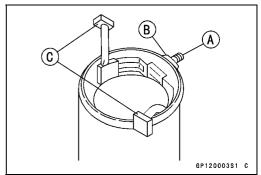
- Remove the starter motor (see Starter Motor Removal).
- Take off the starter motor assembly bolts [A] and remove both end covers [B] and pull the armature out of the yoke.



- Take the positive carbon brushes [B] out of the brush holders [A].
- Take off the brush plate [C] with brush wire from the yoke.

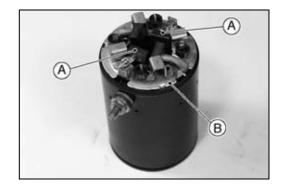


- Unscrew the terminal locknut [B] and remove the terminal bolt [A].
- Take the positive carbon brushes and wire assy [C] out of the yoke.



NOTE

ODo not remove the negative carbon brushes [A] from the brush plate [B].

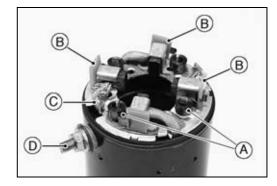


16-58 ELECTRICAL SYSTEM

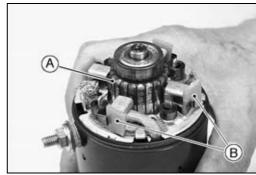
Starter Motor

Starter Motor Assembly

- Holding the springs [A] with plastic washers [B], insert the brushes.
- OFit the brush wire into the holder groove.
- Align the tang [C] with the terminal bolt [D].



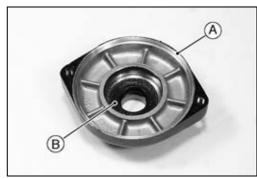
• Put the armature [A] among the brushes, and remove the plastic washers [B].



• Fit the tang [A] of the brush plate into the left end cover groove [B].



 Apply a thin coat of grease to the oil seal [B] in the right end cover [A].

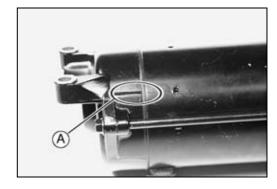


- Apply a thin coat of grease to the left bearing [A].
- Fit shims onto the right end cover.



- OThe line on the yoke should align [A] with the line on the left cover.
- Tighten:

Torque - Starter Motor Assembly Bolts: 4.9 N·m (0.50 kgf·m, 43 in·lb)

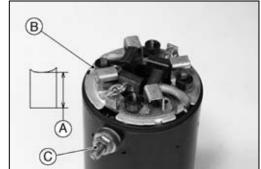


Brush Inspection

- Measure the length [A] of each brush.
- ★ If any is worn down to the service limit, replace the carbon brush holder assy [B] and the terminal bolt assy [C].

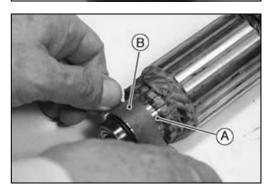
Starter Motor Brush Length

Standard: 12 mm (0.47 in.)
Service Limit: 8.5 mm (0.33 in.)



Commutator Cleaning and Inspection

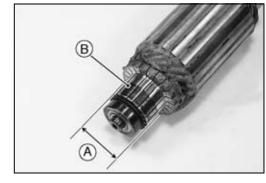
• Smooth the commutator surface [A] if necessary with fine emery cloth [B], and clean out the grooves.



- Measure the diameter [A] of the commutator [B].
- ★Replace the starter motor with a new one if the commutator diameter is less than the service limit.

Commutator Diameter

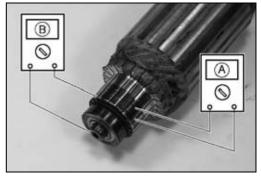
Standard: 28 mm (1.10 in.)
Service Limit: 27 mm (1.06 in.)



Armature Inspection

- Using the \times 1 Ω hand tester range, measure the resistance between any two commutator segments [A].
- ★If there is a high resistance or no reading (∞) between any two segments, a winding is open and the starter motor must be replaced.
- Using the highest hand tester range, measure the resistance between the segments and the shaft [B].
- ★ If there is any reading at all, the armature has a short and the starter motor must be replaced.

Special Tool - Hand Tester: 57001-1394



NOTE

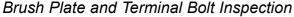
OEven if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with the hand tester. If all other starter motor components and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.

Brush Assy Inspection

• Using the \times 1 Ω hand tester range, measure the resistance as follows.

Terminal Bolt and Positive Brushes [A] Brush Plate and Negative Brushes [B] Plastic [C]

- OThe reading should be zero.
- ★If there is not close to zero ohms, the brush lead has an open. Replace the terminal bolt assembly and the brush holder assembly.



Using the highest hand tester range, measure the resistance as shown.

Terminal Bolt and Brush Plate [A]
Terminal Bolt and Negative Brush Holders [B]
Terminal Bolt and Yoke [C]

- OThe reading should be infinite ($\propto \Omega$).
- ★If there is any reading, the brush holder assembly and/or terminal bolt assembly have a short. Replace the brush holder assembly and the terminal bolt assembly.

Starter Relay Inspection

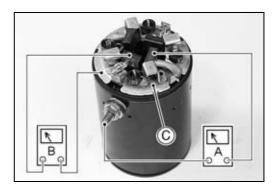
- Remove the right side covers (see Frame chapter).
- Remove the coolant reserve tank, then the starter relay.
- Connect the hand tester [A] and 12 V battery [B] to the starter relay [C] as shown.
- ★If the relay does not work as specified, the relay is defective. Replace the relay.

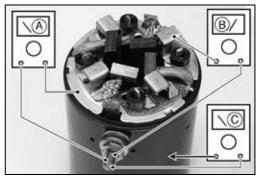
Testing Relay

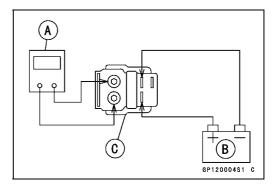
Tester Range: \times 1 Ω range

Criteria: When battery is connected \rightarrow 0 Ω

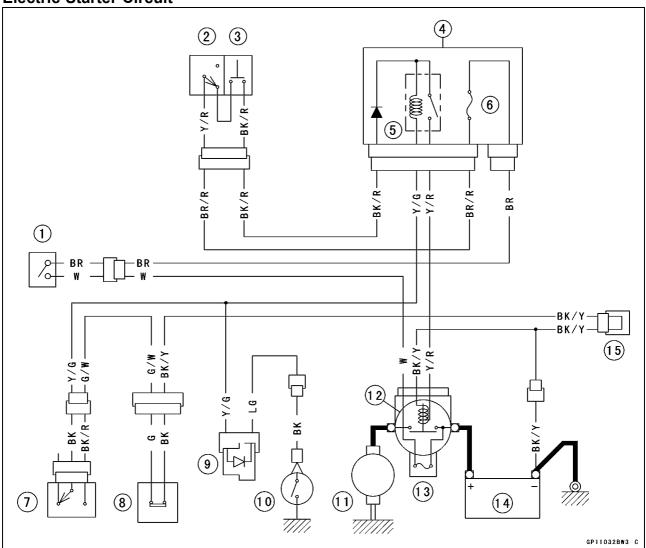
When battery is disconnected $\rightarrow \infty \Omega$







Electric Starter Circuit



- 1. Ignition Switch
- 2. Engine Stop Switch
- 3. Starter Button
- 4. Junction Box
- 5. Starter Circuit Relay
- 6. Ignition Fuse 10 A
- 7. Starter Lockout Switch
- 8. Side Stand Switch
- 9. Diode
- 10. Neutral Switch
- 11. Starter Motor
- 12. Starter Relay
- 13. Main Fuse 30 A
- 14. Battery
- 15. Joint Connector

Lighting System

This model adopts the daylight system and has a headlight relay in the junction box. The headlight does not go on when the ignition switch and the engine stop switch are first turned on. The headlight comes on when the engine starts running and stays on even if the engine stalls. The headlight goes out when the ignition switch is turned off. It also goes out while the starter button is depressed.

Headlight Beam Horizontal Adjustment

 Turn the horizontal adjuster [A] on the headlight with a screwdriver in or out until the beam points straight ahead.
 OTurn the adjuster clockwise to face the headlight to the left.



Headlight Beam Vertical Adjustment

• Turn the vertical adjuster [A] in the headlight in or out with a screwdriver to adjust the headlight vertically.

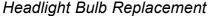
OTurn the adjuster clockwise to face the headlight up.



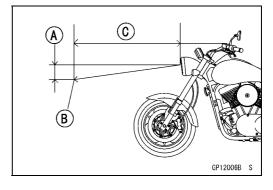
NOTE

- ON high beam, the brightest points should be slightly below horizontal with the motorcycle on its wheels and the rider seated. Adjust the headlight to the proper angle according to local regulations.
- OFor US model, the proper angle is 0.4 degrees below horizontal. This is 50 mm (2 in.) drop at 7.6 m (25 ft.) measured from the center of the headlight with the motorcycle on its wheels and the rider seated.

50 mm (2 in.) [A] Center of Brightest Spot [B] 7.6 m (25 ft.) [C]



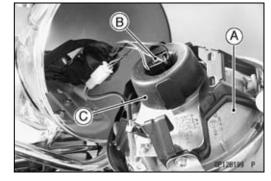
• Remove the headlight rim screws [A] on both sides.



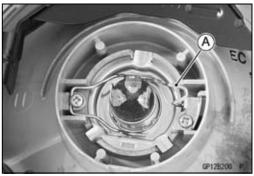


Lighting System

- Pull the headlight unit [A] and drop it out.
- Pull the headlight connector [B].
- Remove the headlight dust cover [C].



• Push the hook [A] to unlock.



• Take out the bulb [A].

CAUTION

When handling the quartz-halogen bulb, never touch the glass portion with bare hands. Always use a clean cloth. Oil contamination from hands or dirty rags can reduce bulb life or cause the bulb to explode.

- OClean off any contamination that inadvertently gets on the bulb with alcohol or a soap and water solution.
- Replace the headlight bulb.
- Fit the dust cover [A] with the TOP mark [B] upward onto the bulb [C] firmly as shown.
 Good [D]
 Bad [E]
- Tighten:

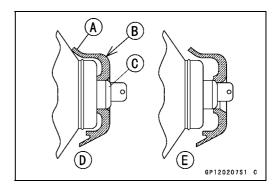
Torque - Headlight Rim Screws: 2.9 N·m (0.30 kgf·m, 26 in·lb)

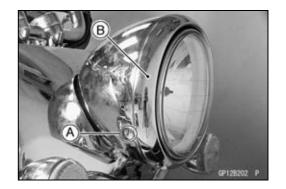
• After installation, adjust the headlight aim (see this chapter).



- Remove the headlight rim screws [A].
- Pull the headlight unit [B] and drop it out.



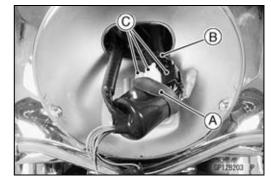




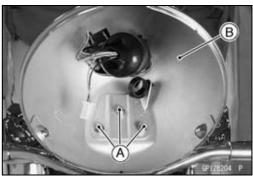
16-64 ELECTRICAL SYSTEM

Lighting System

Remove:
 Rubber Cover [A]
 Clamp [B]
 Connectors [C]



• Remove the headlight body bolts [A], then take off the body [B].



City Light Bulb Replacement (other than US, CA, AU and TW)

US: United States model CA: Canada model

AU: Australia model
TW: Taiwan model

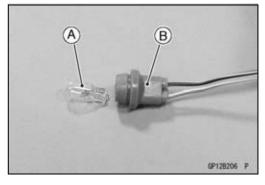
- Remove the headlight unit (see this chapter).
- Pull out the socket [A] together with the bulb.



• Remove the wedge-base type bulb [A], pull the bulb straight out of the socket [B].

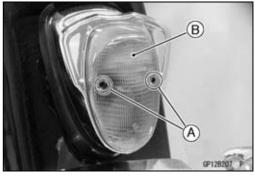
CAUTION

Do not turn the bulb. Pull the bulb out to prevent damage to the bulb. Do not use bulb rated for greater wattage than the specified value.



Tail/Brake Light Bulb Replacement

- Unscrew the screws [A] in the taillight lens.
- Pull the lens [B] off.



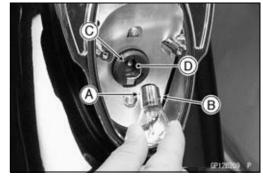
Lighting System

- Push the bulb [A] in, turn it counterclockwise [B], and pull it out.
- Replace the bulb with a new one.



- With the front pin [A] up and the rear pin [B] down, insert the new bulb by aligning the front pin with the left groove [C] in the walls of the socket [D].
- Push the bulb in, turn it clockwise, and release it. It should lock in position.
- Tighten:

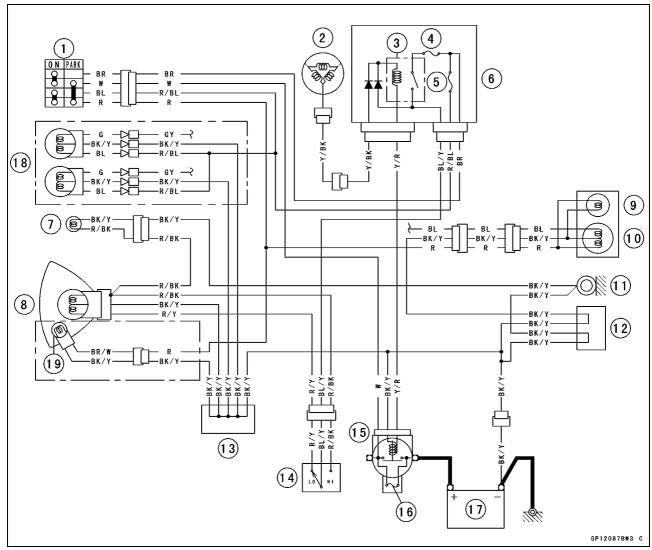
Torque - Tail/Brake Light Lens Screws: 1.2 N·m (0.12 kgf·m, 10 in·lb)



16-66 ELECTRICAL SYSTEM

Lighting System

Headlight/Tail Light Circuit



- 1. Ignition Switch
- 2. Alternator
- 3. Headlight Relay
- 4. Headlight Fuse 10 A
- 5. Taillight Fuse 10 A
- 6. Junction Box
- 7. High Beam Indicator Light
- 8. Headlight
- 9. License Plate Light
- 10. Tail/Brake Lights
- 11. Frame Ground
- 12. Joint Connector
- 13. Joint Connector
- 14. Dimmer Switch
- 14. Diffiller Switch
- 15. Starter Relay

- 16. Main Fuse 30A
- 17. Battery
- 18. Running Position Lights (United States, Canada and Taiwan Models)
- 19. City Light (Other than United States, Canada, Australia and Taiwan Models)

Automatic Turn Signal Canceling System

Automobiles use a turn signal canceling system actuated by steering wheel turn. But, motorcycles turn with a bank additionally, and so have a smaller steer angle. This makes difficult to adopt an automobile type turn signal canceling system because of inaccurate operation in motorcycles. So, motorcycles adopt time & distance counting system.

The canceling system consists of a battery, turn signal control relay, distance sensor, and turn signal switch. When the turn signal switch is pushed onto the right or left, the turn signals start flashing and the control relay starts counting off **8 seconds**. At the end of this time, the control relay starts calculating distance traveled using pulses from the distance sensor in the speedometer. The control relay keeps working even after the tern signal switch was released and returned to the neutral position by spring force. When the motorcycle has traveled an additional **65 meters (213 foots)**, the control relay shuts off the current, turns off the turn signal lights, and resets itself.

- ★If the turn signal canceling system does not function properly, first check all the wiring connections carefully.
- Secondly, inspect the distance sensor.
- Thirdly, inspect the turn signal switch in the left handlebar switch.
- Lastly, check the turn signal control relay.

Wiring Inspection

- Connect all the connectors.
- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.
- Remove the turn signal control relay [A].
- Pull off the 6-pin connector of the relay, the 9-pin and 4-pin meter connectors in the headlight housing, and the 9-pin left handlebar switch connector under the fuel tank.
- Make sure all connector terminals are clean and tight, and none of them have been bent.
- OClean the dirty terminals, and straighten slightly-bent terminals.
- Check conductivity or voltage of the numbered terminals with the hand tester.
- OThe terminal numbers are shown in the wiring diagram of Turn Signal Canceling System.

Special Tool - Hand Tester: 57001-1394

Wiring Inspection

Connectors	Tester	Tester	
Connectors	Connection	Reading	
Turn Signal Control Relay	1 - 8		
←→ Distance Sensor	3 - 7		
Turn Signal Control Relay	2 - 11	0 Ω	
←→ Left Handlebar Switch	3 - 9		
	4 - 10		
Turn Signal Control Relay	6 -	Battery Voltage	
←→ Battery	Battery (+)	with Ignition Switch ON	
		0 V with Ignition Switch	
		OFF	

★If any one of the hand tester readings shows an improper values, check the wiring and connections of the turn signal switch, distance sensor, and turn signal control relay. Check the turn signal control relay (see Turn Signal Control Relay Inspection) if all of them turn out good.



16-68 ELECTRICAL SYSTEM

Automatic Turn Signal Canceling System

Distance Sensor Inspection

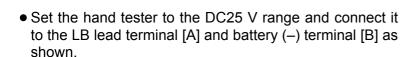
- Remove the right side cover (see this chapter).
- Remove the turn signal control relay [A].

ODo not disconnect the connector [B].

• Use the jack and the attachment jack to lift the rear wheel.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398



Connections

Hand Tester (+) \rightarrow LB Lead Terminal Hand Tester (-) \rightarrow Battery (-) Terminal

- Remove all the spark plugs and shift the gear into 1st.
- Turn the rear wheel slowly to see that the tester's pointer fluctuates repeated by reading 0.5 V and 12 V.
- ★If the tester's pointer fluctuates, distance sensor is normal.
- ★ If the tester's pointer does not fluctuate, inspect the speed sensor and turn signal control relay. If the speed sensor and control relay are good, replace the digital meter assembly.

Turn Signal Switch Inspection

- Open the headlight housing.
- Unplug the 9-pin connectors that leads to the left handlebar switch.
- Check the turn signal switch connections according to the table.
- ★ If the switch has an open circuit or a short, it can be disassembled for repair. The contact surfaces may be cleaned, but no internal parts are available for replacement.
- ★If any parts are not repairable, the left handlebar switch must be replaced as a unit.

Turn Signal Switch Connections

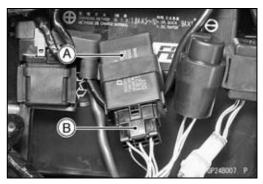
Color	G	0	GY	BK/Y	Y/R
L (left)	•	•		•	•
OFF (push)					
R (right)		•	•	•	•

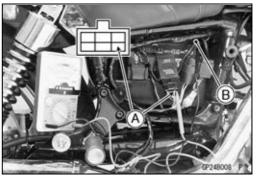
Turn Signal Control Relay Inspection

CAUTION

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

- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.





Automatic Turn Signal Canceling System

 Connect one 12 V battery and turn signal lights as indicated in the figure, and count how many times the lights flash for one minute.

Turn Signal Control Relay Connector [A]

Turn Signal Lights [B]

12 V Battery [C]

★ If the lights do not flash as specified, replace the turn signal control relay.

Testing Turn Signal Control Relay Inspection

Load		
The Number of Turn Signal Lights	Wattage (W)	Flashing Times (c/m*)
1**	21 ~ 23	140 ~ 250
2	42 ~ 46	75 ~ 95

(*): Cycle(s) per minute

(**): corresponds to "one light burned out, and the other lights stay ON".

NOTE

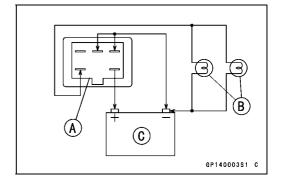
OEven if the foregoing checks show the turn signal control relay to be good, it may be defective in some manner especially for automatic turn signal canceling operation not readily detectable with above checks. If all other checks are good, replace the turn signal control relay.

Turn Signal Light Bulb Replacement

 Remove the turn signal light lens screw [A] and take off the lens [B].



- Push the bulb [A] in the socket and turn the bulb counterclockwise [B].
- Replace the bulb.

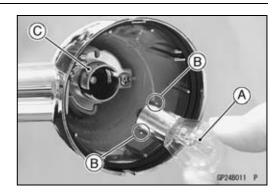




16-70 ELECTRICAL SYSTEM

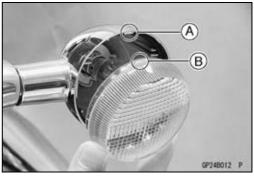
Automatic Turn Signal Canceling System

• Insert the new bulb [A] by aligning the pins [B] with the groove in the walls of the socket [C].



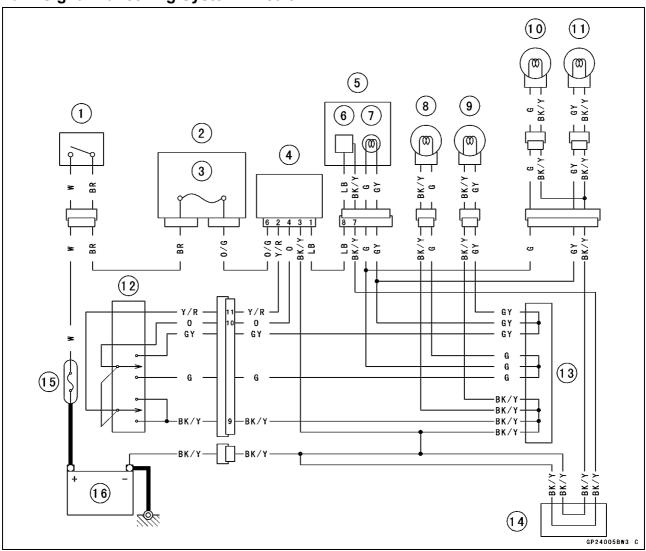
- Fit the projection [A] in the recess [B] of the lens.
- Tighten:

Torque - Turn Signal Light Lens Screws: 1.0 N·m (0.10 kgf·m, 8.7 in·lb)



Automatic Turn Signal Canceling System

Turn Signal Cancelling System Circuit



- 1. Ignition Switch
- 2. Junction Box
- 3. Turn Signal Control Relay Fuse 10 A
- 4. Turn Signal Control Relay
- 5. Meter Unit
- 6. Distance Sensor
- 7. Turn Signal Indicator Light
- 8. Front Left Turn Signal Light

- 9. Front Right Turn Signal Light
- 10. Rear Left Turn Signal Light
- 11. Rear Right Turn Signal Light
- 12. Turn Signal Switch
- 13. Joint Connector
- 14. Joint Connector
- 15. Main Fuse 30 A
- 16. Battery

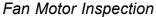
Radiator Fan System

A WARNING

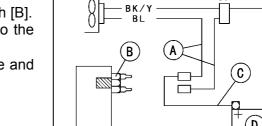
The radiator fan is connected directly to the battery. The fan may start even if the ignition switch is off. NEVER TOUCH THE RADIATOR FAN UNTIL THE RADIATOR FAN CONNECTOR IS DISCONNECTED. TOUCHING THE FAN BEFORE THE CONNECTOR IS DISCONNECTED COULD CAUSE INJURY FROM THE FAN BLADES.

Fan System Circuit Inspection

- Disconnect the leads from the radiator fan switch [A].
- Using an auxiliary lead [B], connect the radiator fan switch
- ★If the fan rotates, inspect the fan switch.
- ★If the fan does not rotate, inspect the following. Leads and Connectors Main Fuse 30 A and Fan Fuse 10 A Fan Motor



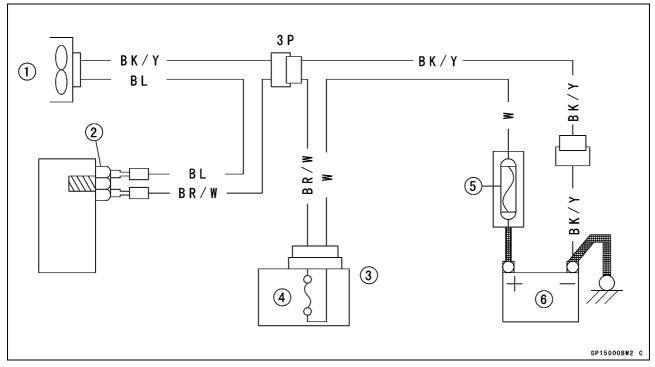
- Disconnect the leads [A] from the radiator fan switch [B].
- Using an auxiliary lead [C], supply battery power to the
- ★If the fan does not rotate, the fan motor is defective and must be replaced.



(B)

Battery [D]

Radiator Fan Circuit

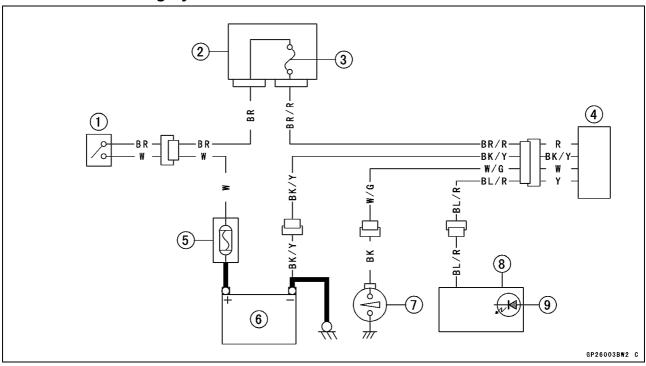


- 1. Radiator Fan
- 2. Radiator Fan Switch
- 3. Junction Box
- 4. Fan Fuse 10 A
- 5. Main Fuse 30 A
- 6. Battery

Oil Pressure Warning System

Motorcycle operation with low engine oil level, even if it is higher than the lower level line, will cause oil level change when sudden acceleration, or deceleration, and may lead flicker of the oil pressure warning light because of too rapid response of the oil pressure switch. To improve this operation, the oil pressure light delay unit is adopted, which prevents flicker of the oil pressure warning light by delaying its lighting.

Oil Pressure Warning System Circuit



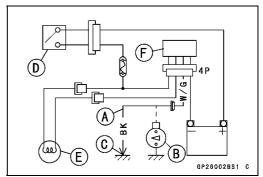
- 1. Ignition Switch
- 2. Junction Box
- 3. Ignition Fuse 10 A
- 4. Oil Pressure Light Delay Unit
- 5. Main Fuse 30 A
- Oil Pressure Light Delay Unit Removal
- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.
- Pull the connectors out of the oil pressure light delay unit [A].

- 6. Battery
- 7. Oil Pressure Switch
- 8. Meter Unit
- 9. Oil Pressure Warning LED Light



Oil Pressure Light Delay Unit Inspection

- Disconnect the lead [A] of the oil pressure switch [B], and ground [C] it to the engine, using an auxiliary wire.
- Turn the ignition switch [D] ON.
- ★If the oil pressure warning LED light [E] in the meter unit is lit, check the oil pressure switch connections (see Switch Inspection).
- ★If the warning LED light is not lit, check the warning LED light and wiring (see Meter Unit Inspection).
- ★If the LED light and wiring are good, replace the oil pressure light delay unit [F].



16-74 ELECTRICAL SYSTEM

Oil Pressure Warning System

- Turn the ignition switch ON.
- Ground the oil pressure switch lead to the engine, then the oil pressure warning LED light should be lit with a delay.
- Measure this delay time from grounding of the switch lead to lighting of the warning LED light.

Lighting Delay Time

Standard: about 3 seconds

★If the lighting delay time is out of the standard too far, replace the oil pressure light delay unit.

Meter, Gauge

Meter Unit Removal

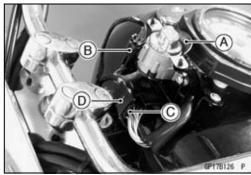
Remove:

 Bolts [A] and Washers
 Nuts [B]
 Meter Cover [C]



Remove:
 Cover [A]
 Ignition Switch Lead Connector [B]
 Meter Unit Lead Connector [C]

• Remove the connector [D] from the bracket.



Remove: Bolts [A] Meter Unit [B] with Bracket



Remove: Nuts [A]



• Pull out the meter unit [A] from the pins [B] on the bracket.

CAUTION

Never drop the meter unit, especially on a hard surface. Such a shock to the unit can damage it. Place the speedometer so that the face is up. If the meter is left upside down or sideways for any length of time, it will malfunction.



16-76 ELECTRICAL SYSTEM

Meter, Gauge

Meter Unit Installation

• Install:

Meter Unit [A]

Damper [B] (Outside Diameter: 22 mm (0.87 in.))

Damper [C] (Outside Diameter: 16 mm (0.63 in.))

Bracket [D]

Damper [E] (Outside Diameter: 24 mm (0.94 in.))

Washers [F] (steel)

Nuts [G]

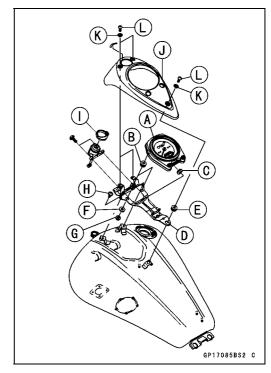
Bolts [H] (L: 12 mm (0.47 in.))

Cover [I]

Meter Cover [J]

Washers [K] (nylon)

Bolts [L] (L: 10 mm (0.39 in.))

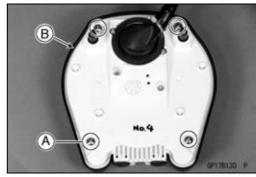


Meter Unit Disassembly

- Remove the meter unit (see Meter Unit Removal).
- Remove:

Screws [A]

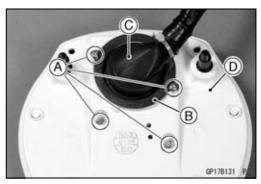
Upper Meter Cover [B]



- Remove:
 - Screws [A]

Holder [B]

• Remove the grommet [C] from the lower meter cover [D].

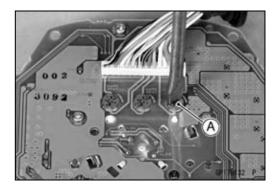


NOTE

OThe water temperature warning LED light, oil pressure warning LED light and FI indicator LED light can not be exchanged.

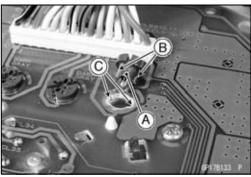
Meter, Gauge

- Turn out the socket [A] counterclockwise.
- OThese sockets are for the high beam indicator light, turn signal indicator light and neutral indicator light.

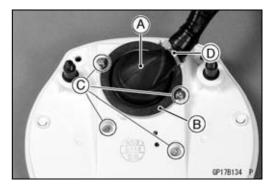


Meter Unit Assembly

• Insert the bulb [A] so that the projections [B] align with the grooves [C] in the panel, and turn in the socket clockwise.



- Fit the grommet [A] in the lower meter cover.
- Install:
 - Holder [B]
 - Screws [C]
- Tighten the band [D] as shown.



16-78 ELECTRICAL SYSTEM

Meter, Gauge

Meter Unit Inspection

LCD Segment Inspection

Remove the meter unit (see Meter Unit Removal).
 [A] Meter Unit Lead Connector

CAUTION

Do not drop the meter unit. Such a shock to the meter unit can damage it. Place the meter facing up. If a meter is left upside down or sideways for any length of time, it will malfunction.

- [1] Neutral Indicator Light (-)
- [2] FI Indicator LED Light (-)
- [3] Oil Pressure Warning LED Light (–)
- [4] Water Temperature Warning LED Light (–)
- [5] Speed Signal for Turn Signal Control Relay
- [6] Unused
- [7] Battery (+)
- [8] Ignition, Neutral Indicator Light (+) and Illumination (+)
- [9] Battery (–), High Beam Indicator Light (–) and Illumination (–)
- [10] Speed Sensor Supply Voltage
- [11] Speed Sensor Signal
- [12] Fuel Level Sensor Signal
- [13] Right Turn Signal Indicator Light (±)
- [14] Left Turn Signal Indicator Light (±)
- [15] Fuel Level Warning Indicator LED Light (–)
- [16] High Beam Indicator Light (+)

CAUTION

Do not short each terminals. When inspecting the meter unit be sure to connect each connections.

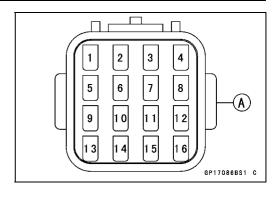
Check 1

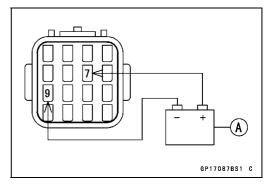
 Using the auxiliary leads, connect a 12 V battery [A] to the meter unit lead connector terminals.

Connections

Battery Positive Terminal (+) → Terminal [7]
Battery Negative Terminal (-) → Terminal [9]

- OWhen the terminals are connected, the speedometer needle momentary points to the last reading, and then return to the 0 position.
- ★If the needle function does not work, replace the meter unit.





Meter, Gauge

Check 2

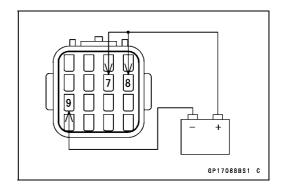
- Using the auxiliary lead, connect the battery positive terminal to terminal [8].
- Verify that all the LCD segments (the letters and numbers of the liquid crystal display) to appear for 3 seconds, and the speedometer needle momentary points to the last reading and then return to the 0 position. Then the clock or meters operates normally depending on the mode selected.
- Disconnect the terminal [8].
- Verity that all the LCD segments and symbols disappear.
- ★If the display function does not work, replace the meter unit.

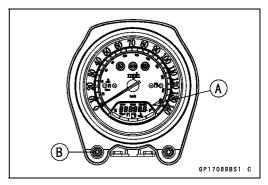
Mode Button Operation Checks

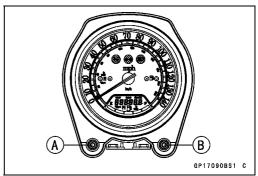
- Connect the lead in the same circuit as for the LCD Segment Inspection, Check 2.
- Check that the display [A] changes to the CLOCK, ODO, and TRIP display each time the mode button [B] is pushed.



- ★If the display does not work, replace the meter unit.
- Push the mode button [A] to TRIP and push the reset button [B] more than 2 seconds. The display shows "0.0".
- ★ If the display does not show "0.0", replace the meter unit.



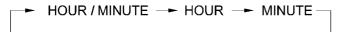




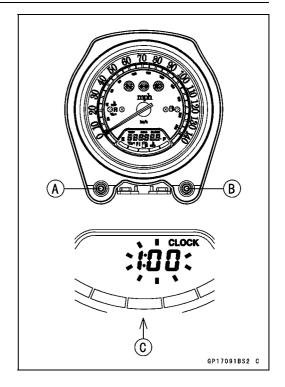
16-80 ELECTRICAL SYSTEM

Meter, Gauge

- Push the mode button [A] to CLOCK.
- Push the reset button [B] more than 2 seconds, then the display turns to the HOUR/MINUTE mode [C].
- OIn the HOUR/MINUTE mode, the numbers flash on the display.
- Check that the flashing number changes to the HOUR or MINUTE display each time the reset button is pushed.



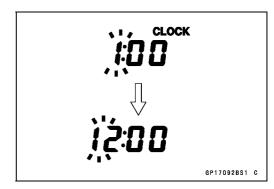
★If the display does not work, replace the meter unit.



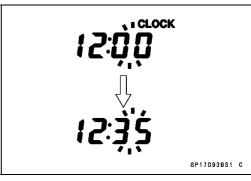
- Check that the time can be set.
- ★If the time cannot be set, replace the meter unit.

Clock Setting

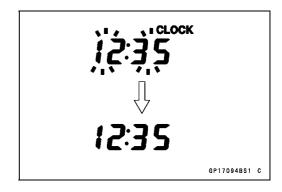
- In the HOUR/MINUTE mode, push the reset button again to effect the HOUR setting mode.
- OThe hour display flashes on the display.
- Push the mode button to set the hour.



- In the HOUR mode, push the reset button once to effect the MINUTE setting mode.
- OThe minute display flashes on the display.
- Push the mode button to set the minute.



- Set the minute, push the reset button to return to the HOUR/MINUTE mode.
- Push the mode button to complete the time setting process.
- OThe clock starts counting the seconds as soon as the mode button is pushed.



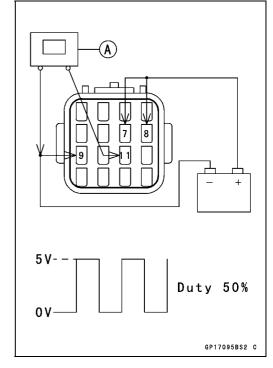
Speedometer Inspection

- Connect the leads in the same circuit as for the LCD Segment Inspection, check 2.
- Connect the oscillator [A] to the terminal [11]. The vehicle speed that corresponds to the input frequency will be displayed when a short wave form such as the one show in the diagram is input.

Example:

An input frequency of 720 Hz will display about 60 mph. An input frequency of 450 Hz will display about 60 km/h.

★If the meter does not function correctly, replace the meter unit.



- ★If an oscillator is unavailable, check the speedometer as follows.
- Olnstall the meter unit.
- OUse the jack and the attachment jack to lift the rear wheel.

Special Tools - Jack: 57001-1238

Attachment Jack: 57001-1398

- OTurn the ignition switch ON.
- OTurn the rear wheel by hand to see if the speedometer shows the vehicle speed that corresponds to the wheel rotation.
- ★ If it does not show properly, inspect the speed sensor and speed sensor power supply voltage.
- ★If the speed sensor and speed sensor power supply voltage are normal, replace the meter unit.

Speed Sensor Power Supply Voltage Inspection

- Connect the leads in the same circuit as for the LCD Segment Inspection, Check 2.
- Set the hand tester [A] to DC25 V, check the voltage between terminal [10] and battery negative lead.

Connections

Hand Tester (+) → Terminal [10]

Hand Tester (-) → Battery Negative (-) Terminal

Special Tool - Hand Tester: 57001-1394

★If the voltage is less than 6 V, replace the meter unit.

ODO Meter Inspection

- Connect the leads in the same circuit as for the Speedometer Inspection.
- Push the mode button to ODO [A].
- Raise the input frequency of the oscillator to quickly see the result of this inspection.
- ★ If the value indicated by the odo meter does not increase, replace the meter unit.

3557

TRIP Meter Inspection

- Connect the leads in the same circuit as for the Speedometer Inspection.
- Push the mode button to TRIP [A].
- Rise the input frequency of the oscillator to guickly see the result of this inspection.
- ★ If the value indicated by the trip meter does not increase, replace the meter unit.

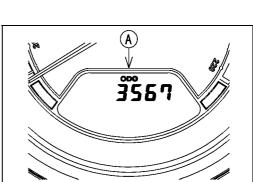
Fuel Level Gauge Inspection

- Connect the leads in the same circuit as for the LCD segment inspection, Check 2.
- Connect a variable rheostat [A] to the terminal [12] and battery negative lead as shown.
- Check that the number of segments [B] matches the resistance value of the variable rheostat.
- OWhen terminal [12] is connected, one segment should appear about 10 ~ 15 seconds.

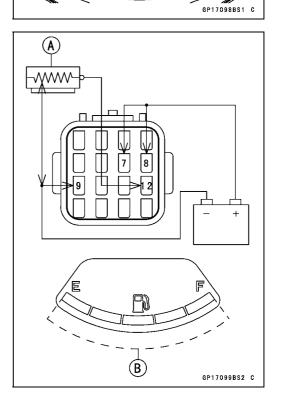
Resistance (Ω)	Number of Segments
50	5
100	3
210	1

Resistance values are standard and they have tolerance.

★ If this indicator function does not work, replace the meter unit.



6P17096BS1 C



LED Light Inspection

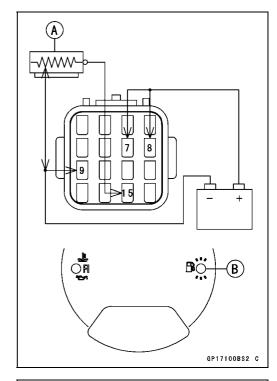
• Connect the leads in the same circuit as for the LCD Segments Inspection, Check 2.

Fuel Level Warning Indicator LED Light

ullet Connect an about 30 Ω resistor [A] to the terminal [15] and battery negative lead.

Fuel Level Warning Indicator LED Light Connections Battery Negative Lead (–) to Terminal [15]

- OThe fuel level warning indicator LED light [B] should go on.
- ★If the fuel level warning indicator LED light does not go on, replace the meter unit.

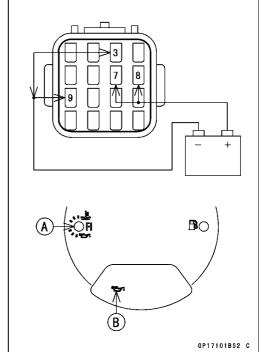


Oil Pressure Warning Indicator LED Light and LCD Symbol

• Connect the lead to the terminal [3] and battery negative lead.

Oil Pressure Warning Indicator LED Light Connections Battery Negative Lead (–) to Terminal [3]

- OThe oil pressure warning indicator LED light [A] and symbol [B] in the LCD should go on.
- ★If the LED light and/or symbol do not go on, replace the meter unit.

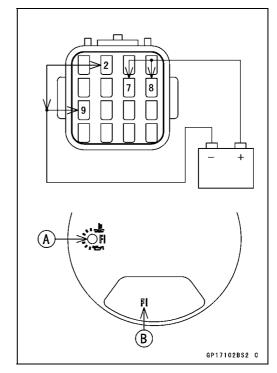


FI Indicator LED Light and LCD Symbol

 Connect the lead to the terminal [2] and battery negative lead.

FI Indicator LED Light Connections Battery Negative Lead (-) to Terminal [2]

- OThe FI indicator LED light [A] and symbol [B] in the LCD should go on.
- ★If the LED light and/or symbol do not go on, replace the meter unit.



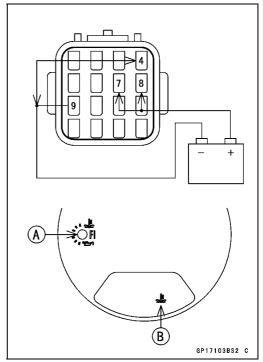
Water Temperature Warning Indicator LED Light and LCD Symbol

• Connect the lead to the terminal [4] and battery negative lead.

Water Temperature Warning Indicator LED Light Connections

Battery Negative Lead (-) to Terminal [4]

- OThe water temperature warning indicator LED light [A] and symbol [B] in the LCD should go on.
- ★If the LED light and/or symbol do not go on, replace the meter unit.



Indicator Light Inspection

• Connect the leads in the same circuit as for the LCD Segments Inspection, Check 2.

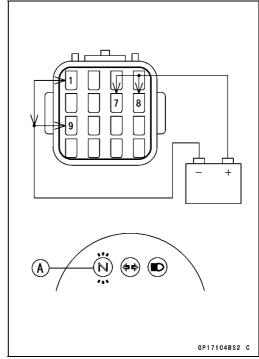
Neutral Indicator Light

• Connect the lead to the terminal [1] and battery negative lead.

Neutral Indicator Light Connections: Battery Negative Lead (-) to Terminal [1]

OThe neutral indicator light [A] should go on.

- ★If the indicator light does not go on, inspect the bulb.
- Check conductivity of the bulb with the hand tester.
- ★If the bulb is open, replace the bulb.
- ★Even if the bulb is replacement but the indicator light does not go on, replace the meter unit.



Turn Signal Indicator Light

• Connect the lead to the terminal [13] and [14] as follows.

Neutral Indicator Light Connections

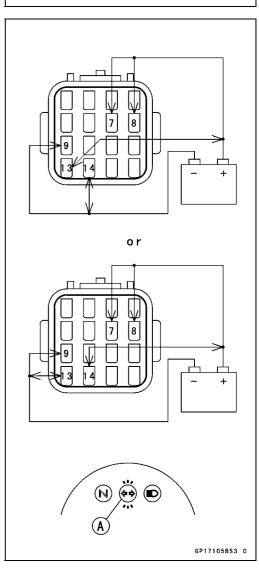
Battery Positive Lead (+) to Terminal [13] Battery Negative Lead (-) to Terminal [14]

or

Battery Positive Lead (+) to Terminal [14] Battery Negative Lead (-) to Terminal [13]

OThe turn signal indicator light [A] should go on.

- ★If the indicator light does not go on, inspect the bulb.
- Check conductivity of the bulb with the hand tester.
- ★If the bulb is open, replace the bulb.
- ★ Even if the bulb is replacement but the indicator light does not go on, replace the meter unit.



16-86 ELECTRICAL SYSTEM

Meter, Gauge

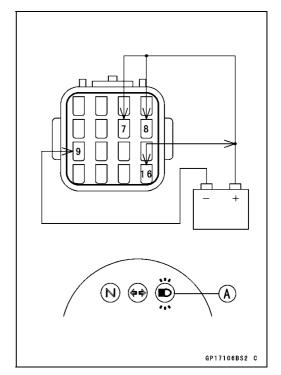
High Beam Indicator Light

 Connect the lead to the terminal [16] and battery positive lead.

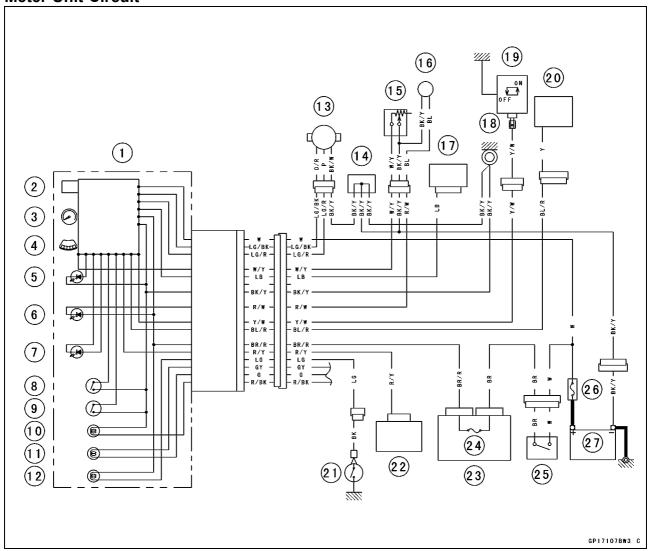
High Beam Indicator Light Connections Battery Positive Lead (+) to Terminal [16]

OThe high beam indicator light [A] should go on.

- ★If the indicator light does not go on, inspect the bulb.
- Check conductivity of the bulb with the hand tester.
- ★If the bulb is open, replace the bulb.
- ★Even if the bulb is replacement but the indicator light does not go on, replace the meter unit.



Meter Unit Circuit



- 1. Meter Unit
- 2. Odometer/Trip Meter/Clock LCD
- 3. Speedometer
- 4. Fuel Meter
- 5. Illuminator LED
- 6. Fuel Indicator LED
- 7. Water Temperature Warning/FI/Oil Pressure Warning Indicator LED
- 8. Mode Button
- 9. Reset Button
- 10. High Beam Indicator Light
- 11. Turn Signal Indicator Light
- 12. Neutral Indicator Light
- 13. Speed Sensor
- 14. Joint Connector

- 15. Fuel Level Sensor
- 16. Fuel Reserve Switch
- 17. Turn Signal Control Relay
- 18. Frame Ground
- 19. Water Temperature Switch
- 20. Oil Pressure Warning Light Delay Unit
- 21. Neutral Switch
- 22. Electronic Control Unit
- 23. Junction Box
- 24. Ignition Fuse 10 A
- 25. Ignition Switch
- 26. Main Fuse 30 A
- 27. Battery

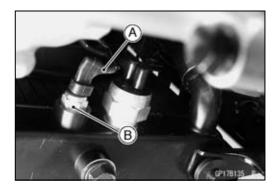
16-88 ELECTRICAL SYSTEM

Water Temperature Warning System

Water Temperature Warning System Check

The water temperature warning LED light goes on when the ignition switch is turned on and goes off soon to ensure that its circuit functions properly and the warning LED light has not burned out. The warning LED light also goes on whenever the coolant temperature rises to 113 ~ 117° (235 ~ 243°F) when the motorcycle is in operation. If it stays on, stop the engine and check the coolant level in the reserve tank after the engine cools down.

- Inspect the water temperature warning LED light and the system wiring.
- OTurn on the ignition switch.
- ODisconnect the water temperature switch lead [A] then ground it to the frame or engine using an auxiliary lead.
- ★If the water temperature warning LED light is lit, inspect the water temperature switch [B] (see Switches and Sensors section). Replace the switch if damaged.
- ★If the warning LED light is not lit, check the warning LED light and wiring.



Fuel Level Sensor Inspection

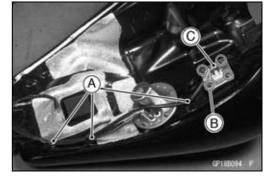
• Remove:

Fuel Tank (see Fuel System (DFI) chapter)

- Open the clamps [A].
- Remove:

Bolts [B]

Fuel Level Sensor [C]

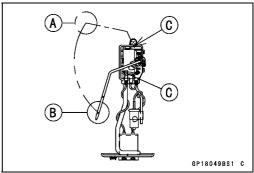


- Check that the float moves up and down smoothly without binding. It should go down under its own weight.
- ★ If the float does not move smoothly, replace the sensor.

Float in Full Position [A]

Float in Empty Position [B]

Float Arm Stoppers [C]



 Using the hand tester [A], measure the resistance across the terminals in the fuel level sensor lead connector [B].

Black/Yellow [C] White/Yellow [D]

Special Tool - Hand Tester: 57001-1394

★If the tester readings are not as specified, or do not change smoothly according as the float moves up and down, replace the sensor.

Fuel Level Sensor Resistance

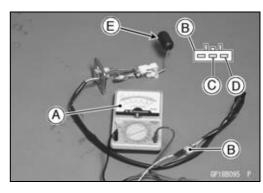
Standard: Full position [E]: $3 \sim 5 \Omega$

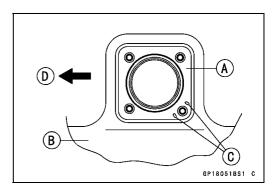
Empty position: 213 \sim 219 Ω

Install a new gasket [A] on the fuel tank [B] as shown.
 Hollows [C]
 Front Side [D]

 Apply a non-permanent locking agent to the threads of the level sensor mounting bolts and tighten it.

Torque - Fuel Level Sensor Mounting Bolts: 6.9 N·m (0.7 kgf·m, 61 in·lb)





16-90 ELECTRICAL SYSTEM

Switch and Sensors

Fuel Reserve Switch Inspection

- Fill the fuel tank with fuel.
- Close the fuel tank cap surely.
- Remove:

Seats (see Frame chapter)

Fuel Level Sensor Lead Connector [A]

 Connect the test light [B] (12 V 3.4 W bulb in a socket with leads) and the 12 V battery [C] to the fuel level sensor lead connector.

Connections

Battery (+) → 12 V 3.4 W Bulb (one side) 12 V 3.4 W Bulb (other side) → LB Lead Terminal Battery (–) → BK/Y Lead Terminal

★If the test light turn on, the reserve switch is defective. Replace the fuel level sensor.

• Remove:

Fuel Level Sensor (see Fuel Level Sensor Inspection)

 Connect the test light (12 V 3.4 W bulb in a socket with leads) and the 12 V battery to the fuel level sensor lead connector as shown.

12 V Battery [A]

Test Light [B]

Fuel Level Sensor Connector [C]

Fuel Reserve Switch [D]

★If the test light doesn't light, replace the fuel level sensor.

NOTE

Olt may take a long time to turn on the test light in case that the fuel reserve switch is inspected just after the fuel level sensor is removed.

Leave the fuel reserve switch with leads for inspection connected for few minutes.

Speed Sensor Removal

• Remove:

Alternator Outer Cover (see Alternator Outer Cover Removal)

Speed Sensor Lead Connector [A]

Band [B]

Bolt [C]

Speed Sensor [D]

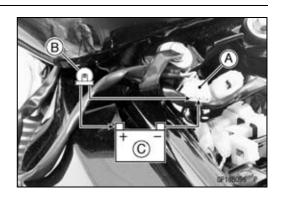
Speed Sensor Installation

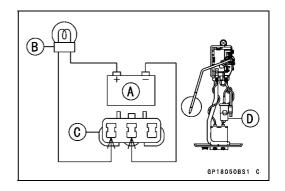
- Apply grease to the O-ring [A] on the speed sensor.
- Apply:

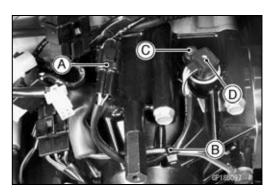
Non-permanent Locking Agent -Speed Sensor Mounting Bolt

• Tighten:

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





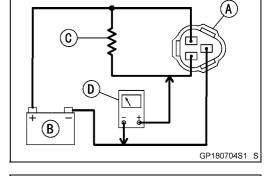




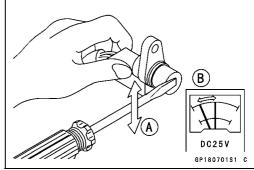
Speed Sensor Inspection

- Remove:
 - Speed Sensor (see Speed Sensor Removal)
- Connect the speed sensor connector [A] with a battery [B], 10 kΩ resistor [C] and hand tester [D] as shown.
- Set the tester to the DC 25 V range.

Special Tool - Hand Tester: 57001-1394



- Trace [A] the speed sensor surface with the screw driver. • Then the tester indicator should flick [B].
- ★If the tester indicator does not flick, replace the speed sensor.



Front Brake Light Switch Inspection

• Refer to the Front Brake Light Switch Inspection in the Periodic Maintenance chapter.

Rear Brake Light Switch Check/Adjustment

• Refer to the Rear Brake Light Switch Inspection in the Periodic Maintenance chapter.

Radiator Fan Switch Removal

CAUTION

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

- Drain the coolant (see Cooling System chapter).
- Disconnect the fan switch leads.
- Unscrew the radiator fan switch [A] from the radiator.

A 8P180108S1 C

Radiator Fan Switch Installation

• Tighten:

Torque - Radiator Fan Switch: 18 N·m (1.8 kgf·m, 13 ft·lb)

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

Radiator Fan Switch Inspection

- Remove the fan switch from the radiator (see Radiator Fan Switch Removal).
- Suspend the switch [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend an accurate thermometer [B] with heat-sensitive portions [C] located in almost the same depth.

NOTE

- OThe switch and thermometer must not touch the container sides or bottom.
- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using the hand tester (special tool), measure the internal resistance of the switch across the terminals at the temperatures shown in the table.
- ★ If the measurement is out of the range, replace the switch.

Fan Switch Resistance

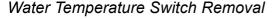
ORising temperature:

From OFF to ON at 102 ~ 108°C (216 ~ 226°F)

OFalling temperature:

From ON to OFF at 98°C (208°F) ~ temperature (less than ON temperature)

ON: Less than 0.5 Ω OFF: More than 1 M Ω



CAUTION

The water temperature switch should never be allowed to fall on a hard surface. Such a shock to the part can damage it.

- Drain the coolant (see Cooling System chapter).
- Disconnect the switch connector.
- Remove the water temperature switch [A] from the radiator.

Water Temperature Switch Installation

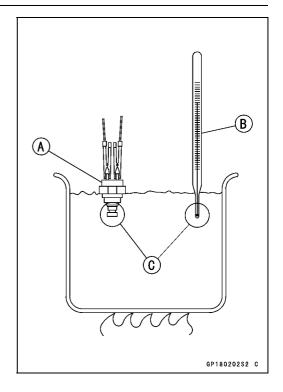
 Apply silicone sealant to the threads of the water temperature switch.

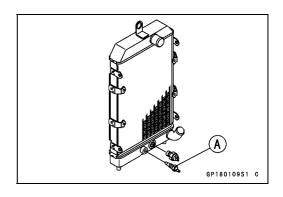
Sealant - Kawasaki Bond: 59019-120

• Tighten:

Torque - Water Temperature Switch: 7.8 N·m (0.80 kgf·m, 69 in·lb)

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





Water Temperature Switch Inspection

- Remove the water temperature switch.
- Suspend the switch [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend an accurate thermometer [B] with heat-sensitive portions [C] located in almost the same depth.

NOTE

- OThe switch and thermometer must not touch the container side or bottom.
- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using the hand tester, measure the internal resistance of the switch across the terminal and the body at the temperatures shown in the table.
- ★ If the measurement is out of the range, replace the switch.

Water Temperature Switch Resistance

ORising temperature:

From OFF to ON at 113 ~ 117°C (235 ~ 243°F)

OFalling temperature:

From ON to OFF at 108°C (226°F) ~ temperature (less than ON temperature)

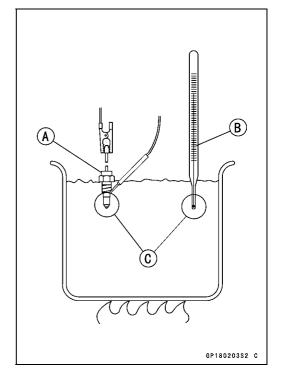
ON: Less than 0.5 Ω OFF: More than 1 M Ω

Switch Inspection

- Using a hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).
- OFor the handlebar switches and the ignition switch, refer to the tables in the Wiring Diagram.
- ★If the switch has an open or short, repair it or replace it with a new one.

Special Tool - Hand Tester: 57001-1394 Rear Brake Light Switch Connections

	BR	BL
When brake pedal is pushed down	<u> </u>	~
When brake pedal is released		



16-94 ELECTRICAL SYSTEM

Switch and Sensors

Side Stand Switch Connections

	G	ВК
When side stand is up	<u> </u>	
When side stand is down		

Neutral Switch Connections

	SW. Terminal	7/1
When transmission is in neutral	·	-0
When transmission is not in neutral		

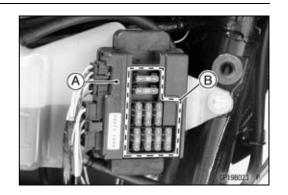
Oil Pressure Switch Connections*

******	SW. Terminal	7/1
When engine is stopped	0	
When engine is running		

^{*:} Engine lubrication system is in good condition

Junction Box

The junction box [A] has fuses [B], relays, and diodes. The relays and diodes can not be removed.



Junction Box Fuse Circuit Inspection

- Remove the right side cover (see Frame chapter).
- Remove the junction box.
- Pull off the connectors from the junction box.
- Make sure all connector terminals are clean and tight, and none of them have been bent.
- ★Clean the dirty terminals, and straighten slightly-bent terminals.
- Check conductivity of the numbered terminals with the hand tester (see Junction Box Internal Circuit).
- ★If the tester does not read as specified, replace the junction box.

Fuse Circuit Inspection

Tester Connection	Tester Reading (Ω)
1 – 1 A	0
1 – 2	0
3A – 4	0
6 – 5	0
6 – 10	0
6 – 7	0
6 – 17	0

Tester Connection	Tester Reading (Ω)
1 A - 8	8
2 - 8	∞
3 A - 8	∞
6 – 2	∞
6 – 3A	∞
17 – 3A	∞

Starter Circuit/Headlight Relay Inspection

- Remove the junction box.
- Check conductivity of the following numbered terminals by connecting the hand tester and one 12 V battery to the junction box as shown (see Junction Box Internal Circuit).
- ★If the tester does not read as specified, replace the junction box.

16-96 ELECTRICAL SYSTEM

Junction Box

Relay Circuit Inspection (with the battery disconnected)

	Tester	Tester
	Connection	Reading (Ω)
	7 – 8	∞
Headlight	7 – 13	∞
Relay	(+) (-)	Not ∞*
	13 – 9	1400

	Tester	Tester
	Connection	Reading (Ω)
	9 – 11	∞
Starter	12 – 13	∞
Circuit	(+) (-)	∞
Relay	13 – 11	~
	(+) (-)	Not ∞*
	12 – 11	NOL ∞

- (*): The actual reading varies with the hand tester used.
- (+): Apply tester positive lead.
- (-): Apply tester negative lead.

Relay Circuit Inspection (with the battery connected)

	Battery	Tester	Tester
Reading	Connection	Connection	Reading
	(+) (-)		(Ω)
Headlight Relay	9 – 13	7 – 8	0
Starter Circuit	11 – 12	(+) (-)	Not ∞*
Relay	11 - 12	13 – 11	NOL ∞

- (*): The actual reading varies with the hand tester used.
- (+): Apply tester positive lead.
- (-): Apply tester negative lead.

Diode Circuit Inspection

- Remove the junction box.
- Check conductivity of the following pairs of terminals (see Junction Box Internal Circuit).

Diode Circuit Inspection

Tostor Connection	13 - 8, 13 - 9, 12 - 11,
Tester Connection	12 - 14, 15 - 14, 16 - 14

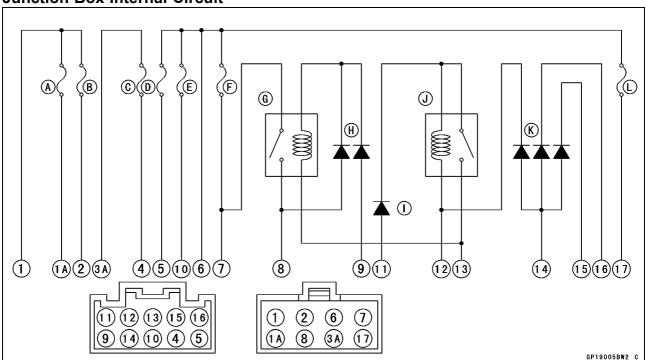
★The resistance should be low in one direction and more than ten times as much in the other direction. If any diode shows low or high in both directions, the diode is defective and the junction box must be replaced.

NOTE

OThe 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



- A. Accessory Fuse 10 A
- B. Fan Fuse 10 A

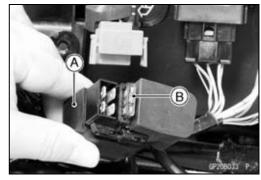
Fan Fuse 15 A (After Frame No. 010353)

- C. Turn Signal Fuse 10 A
- D. Horn Fuse 10 A
- E. Ignition Fuse 10 A
- F. Headlight Fuse 10 A
- G. Headlight Relay
- H. Headlight Diodes
- I. Starter Diode
- J. Starter Circuit Relay
- K. Interlock Diodes
- L. Taillight Fuse 10 A

Fuse

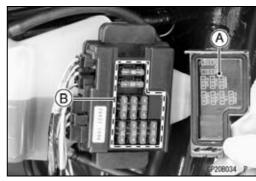
Main Fuse Removal

- Remove the right side cover (see Frame chapter).
- Remove the coolant reserve tank bolts and hanging the reserve tank.
- Remove the starter relay [A].
- Pull out the main fuse [B] from the starter relay with needle nose pliers.



Junction Box Fuse Removal

- Remove the right side cover (see Frame chapter).
- Unlock the hook to lift up the lid [A].
- Pull the fuses [B] straight out of the junction box with needle nose pliers.



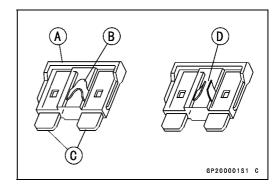
Fuse Installation

- ★If a fuse fails during operation, inspect the electrical system to determine the cause, and then replace it with a new fuse of proper amperage.
- Install the junction box fuses on the original position as specified on the lid.

Fuse Inspection

- Remove the fuse (see Fuse Removal).
- Inspect the fuse element.
- ★If it is down out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.

Housing [A]
Fuse Element [B]
Terminals [C]
Blown Element [D]



NOTE

OA mass current flows to the battery according to the state of the battery which needs refreshing charge when the engine is turned causing main fuse blown out.

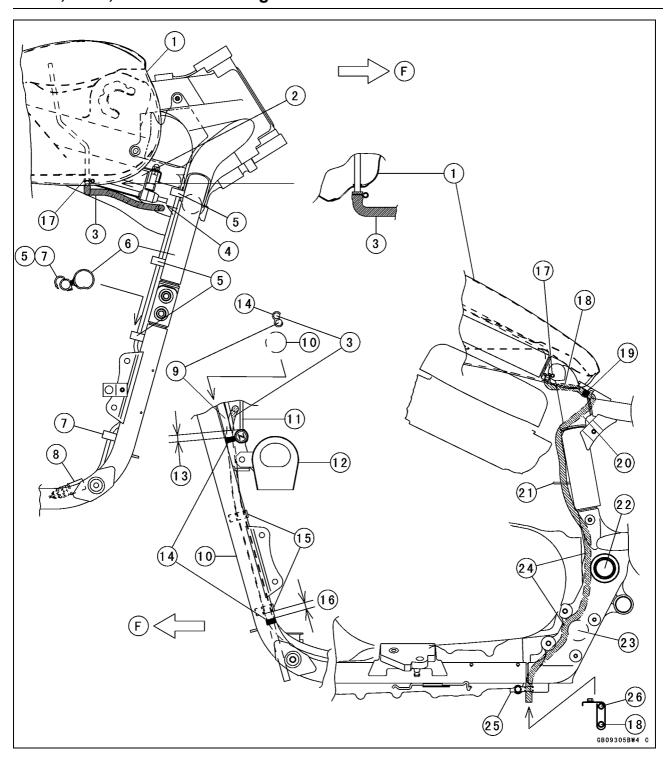
CAUTION

Do not use a fuse rated for other amperage and voltage specified in the wiring diagram. Installation of a fuse with a higher rating may cause damage to wiring and components, and a fuse of a lower rating will soon blow again.

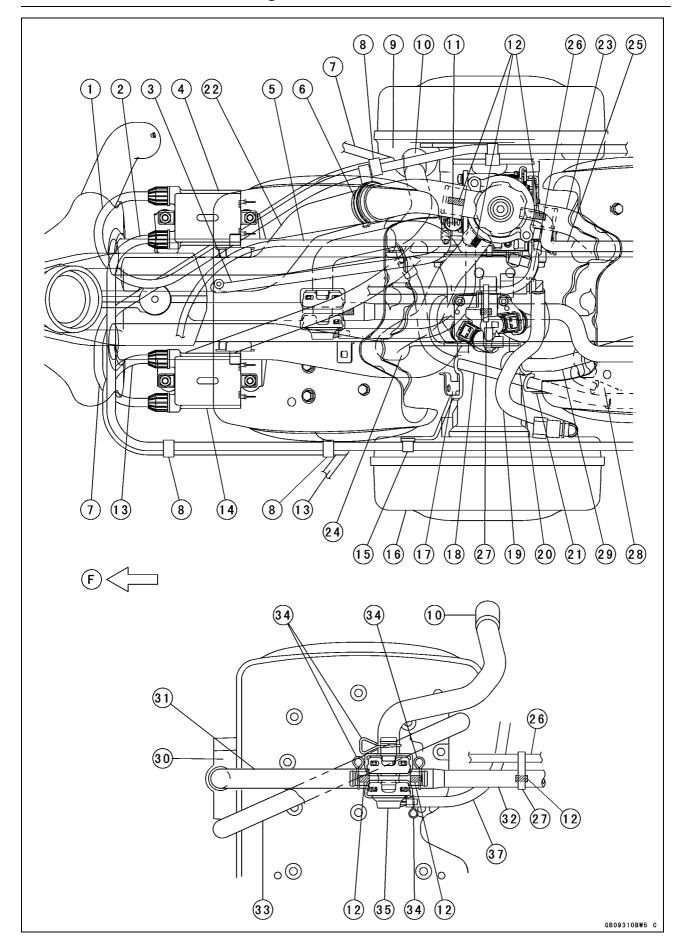
Appendix

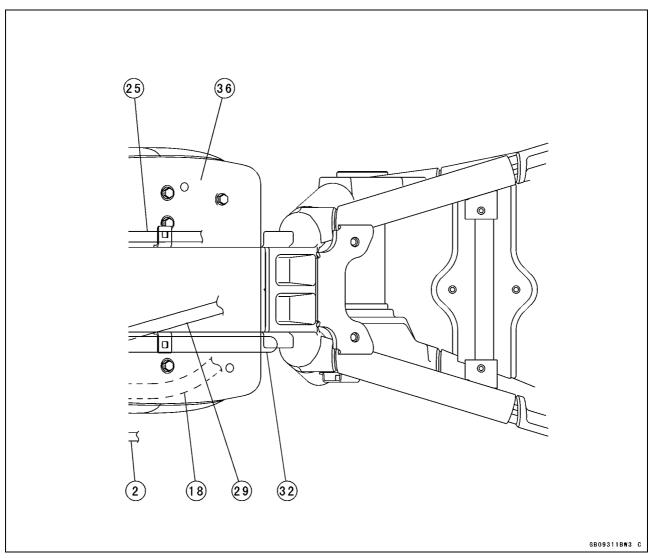
Table of Contents

Cable, Wire, and Hose Routing	17-2
Troubleshooting Guide (except DFI)	17-28



- F: Front
- 1. Fuel Tank
- 2. Ignition Coil for Rear Spark Plugs
- 3. Fuel Tank Water Drain Hose
- 4. Run the hose over the radiator hose.
- 5. Plastic Snap-on Clamps (rear brake light switch and radiator fan leads)
- 6. Right Frame Pipe
- 7. Plastic Snap-on Clamp (rear brake light switch lead)
- 8. Rear Brake Light Switch
- 9. Clutch Hose
- 10. Left Frame Pipe
- 11. Choke Knob and Cable
- 12. Horn
- 13. $-10 \sim +10 \text{ mm} (-0.4 \sim +0.4 \text{ in.})$
- 14. Two Way Holders on the black type of hoses [3]
- 15. Welded Clamps
- 16. $10 \sim 30 \text{ mm} (0.4 \sim 1.2 \text{ in.})$
- 17. Clips
- 18. Fuel Tank Breather Hose (except California model)
- 19. Marking (Position here.)
- 20. Run the hose [18] between the bracket and the right frame pipe.
- 21. Holder
- 22. Swingarm Pivot
- 23. Cross Pipe
- 24. Run the hose in front of [22] and [23].
- 25. Clamp
- 26. Coolant Reserve Tank Overflow Hose

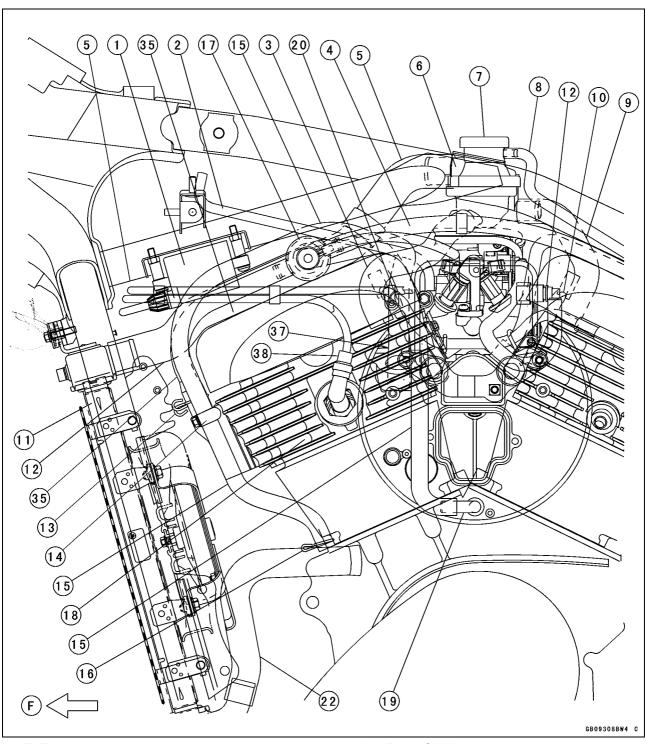




- F: Front
- 1. Right Rear Spark Plug Lead
- 2. Left Rear Spark Plug Lead
- 3. Inlet Air Pressure Hose
- 4. Ignition Coil for Rear Spark Plugs
- 5. Choke Cable
- 6. Clamp
- 7. To Right Front Spark Plug
- 8. Plastic Clamps
- 9. Right Air Cleaner Base
- 10. Vacuum Switch Valve Hose to the base [9]
- 11. Throttle Sensor
- 12. White Marks faced upwards
- 13. Left Front Spark Plug Lead

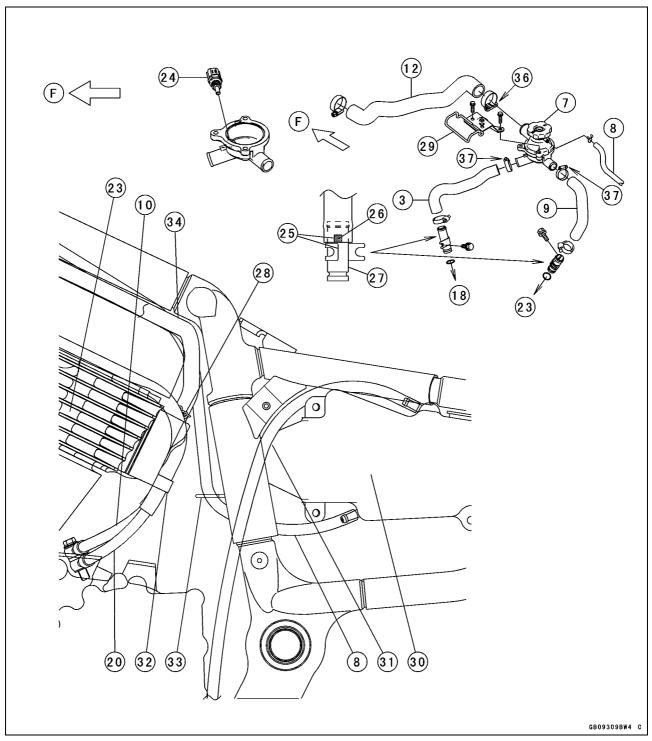
- 14. Ignition Coil for Front Spark Plugs
- 15. Plastic Clamp
- 16. Left Air Cleaner Housing
- 17. Clamp
- 18. Front Oil Hose
- 19. Fuel Pump Outlet Hose
- 20. Grommet
- 21. Clamp
- 22. Radiator Inlet Hose
- 23. Rear Water Hose (mark [12])
- 24. Front Water Hose (mark [12])
- 25. Reserve Tank Hose (without mark)
- 26. Throttle Cables (upper: decelerator, lower: accelerator)

- 27. Plastic Clamp: Align the clamp with the mark [12].
- 28. Rear Oil Hose into the cover [36]
- 29. Canister Purge Hose (green) for California
- 30. Air Suction Valve
- 31. Front Vacuum Switch Valve Hose
- 32. Rear Vacuum Switch Valve Hose
- 33. Crankcase Breather
 Hose over the valve [35]
- 34. Wire Clamps: Face the tab as shown.
- 35. Vacuum Switch Valve
- 36. Rear Rocker Case Cover
- 37. Vacuum Hose to throttle body



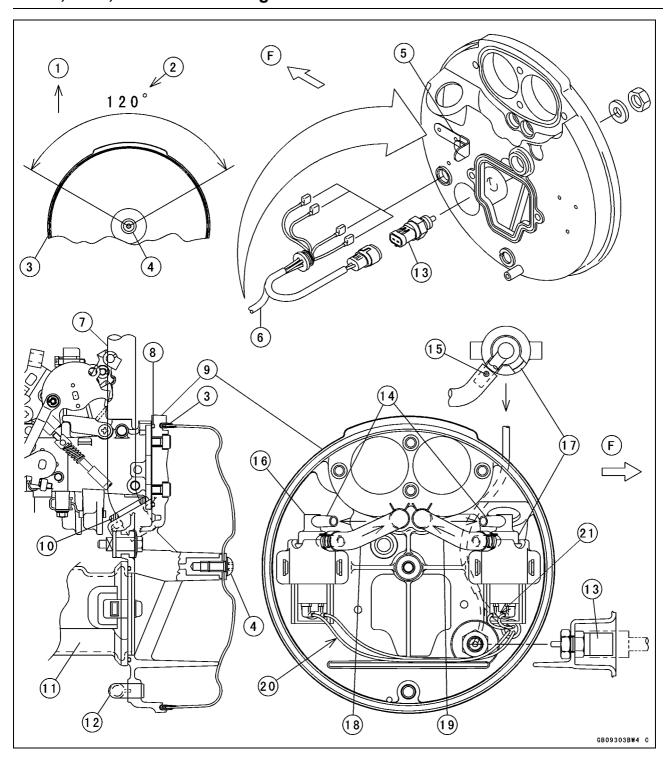
- E: Eront
- 1. Ignition Coil for Front Spark Plugs
- 2. Inlet Air Pressure Sensor Hose
- 3. Front Water Hose
- 4. Vacuum Switch Valve Hose (vacuum)
- 5. Radiator Inlet Hose (middle)
- 6. Thermostat Housing
- 7. Radiator Cap
- 8. Coolant Reserve Tank Hose
- 9. Rear Water Hose

- 10. Rear Oil Hose
- 11. Radiator
- 12. Fuel Pump Outlet Hose
- 13. Wire Clamp
- 14. Clamp
- 15. Crankcase Breather Hose
- 16. Wire Clamp
- 17. Vacuum Switch Valve
- 18. Front Cylinder Head
- 19. Elbow Joint

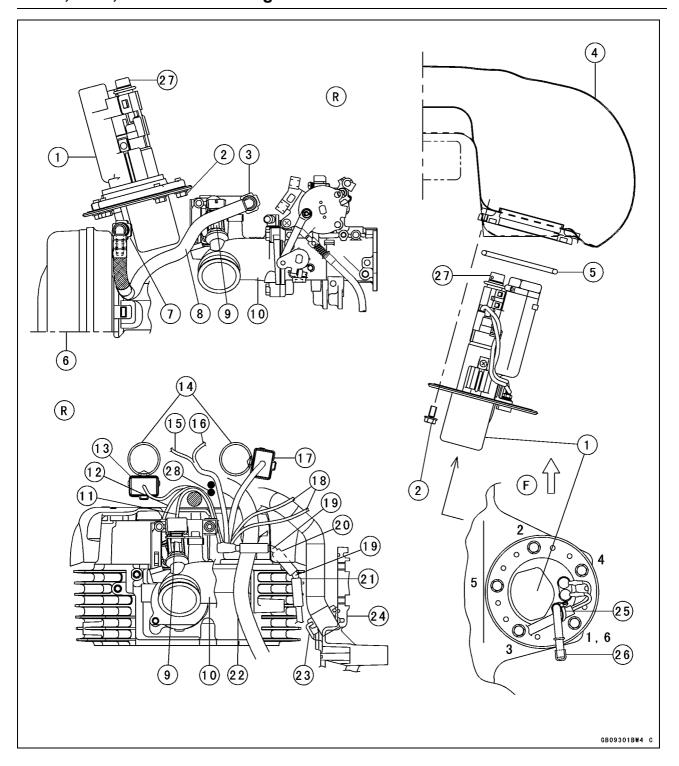


- F: Front
- 20. Front Oil Hose
- 21. Right Air Cleaner Base
- 22. Radiator Outlet Hose (right)
- 23. Rear Cylinder Head
- 24. Water Temperature Sensor (DFI)
- 25. Align the mark [26] with the clamp end.
- 26. White Marks on the hoses [3] and [9]
- 27. Water Pipes
- 28. Wire Clamp with the tab on the left
- 29. Main Harness Bracket

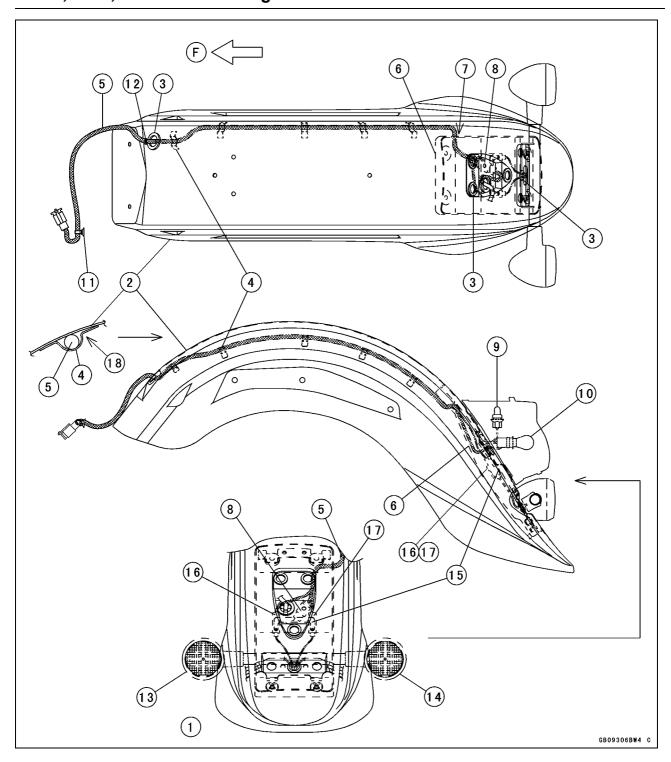
- 30. Coolant Reserve Tank
- 31. Coolant Reserve Tank Overflow Hose
- 32. Clamp
- 33. Holder
- 34. Rear Vacuum Switch Valve Hose
- 35. Front Vacuum Switch Valve Hose
- 36. Note: each position and direction of the clamp bolts.
- 37. Vacuum Switch Valve Hose to the base [21]
- 38. Install the spark plug as shown.



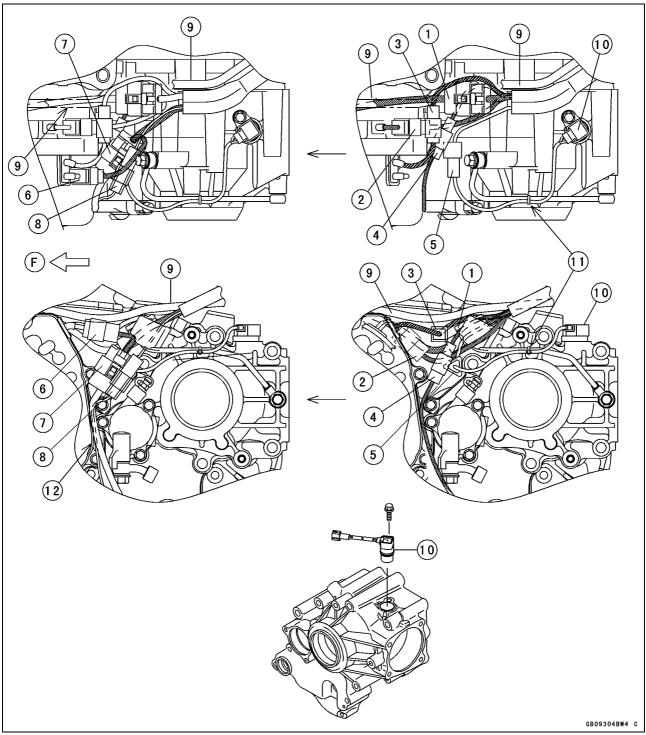
- F: Front
- ←: Air Flow
- 1. Top
- 2. Locate the glued joint of the gasket [3] within the angle.
- 3. Gasket
- 4. Right Air Cleaner Cover Allen Bolt
- 5. Clamp (lead [6])
- 6. Inlet Air Temperature Sensor and ISC Valve Leads
- 7. Vacuum Switch Valve Hose
- 8. O-ring
- 9. Right Air Cleaner Base
- 10. Grommet
- 11. Lower Air Cleaner Duct between #1 and #2 Cylinders
- 12. Elbow Joint connected to crankcase breather hose
- 13. Inlet Air Temperature Sensor
- 14. ISC Valve Inlets
- 15. Blue Mark on Top
- 16. ISC Valve #2 (rear cylinder)
- 17. ISC Valve #1 (front cylinder)
- 18. ISC Valve Hose #2 (red mark)
- 19. ISC Valve Hose #1 (blue mark)
- 20. ISC Valve #2 Green/Blue, White/Red Leads
- 21. ISC Valve #1 Green/Yellow, White/Red Leads



- F: Front R: Rear View
- 1. Fuel Pump with the fuel filter and screen belt in
- 2. Fuel Pump Bolts
- 3. Fuel Hose Joint (delivery joint)
- 4. Fuel Tank
- 5. O-ring
- 6. Left Air Cleaner Cover
- 7. Fuel Hose Joint (fuel pump)
- 8. Fuel Pump Outlet Hose
- 9. Fuel Injector #2
- 10. Inlet Manifold
- 11. Injector Lead #2
- 12. Injector Lead #1 (white tape)
- 13. Connector (black)
- 14. Frame Pipes
- 15. Atmospheric Pressure Sensor Lead
- 16. Inlet Air Pressure Sensor Lead (white tape)
- 17. Connector (natural)
- 18. Water Temperature Sensor Lead
- 19. Bend before install.
- 20. Run the lead [21] inside the rocker case cover.
- 21. ISC Valve Lead, Inlet Air Temperature Sensor Leads
- 22. Vacuum Switch Valve Hoes
- 23. Grommet
- 24. Right Air Cleaner Base
- 25. Strap
- 26. Fuel Pump Outlet Pipe
- 27. Pressure Regulator
- 28. Throttle Cables

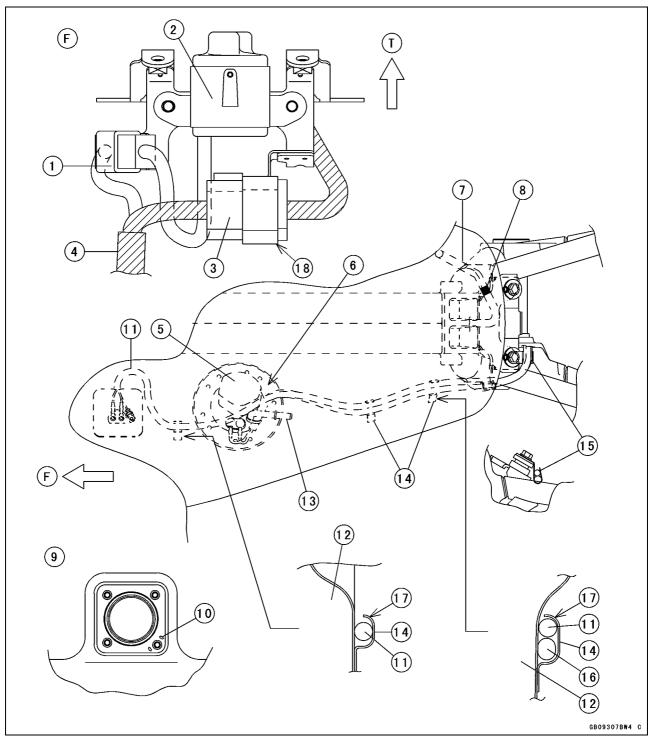


- F: Front
- 1. Rear View
- 2. Rear Fender
- 3. Grommets
- 4. Five Clamps
- 5. Rear Fender Harness
- 6. Plastic Cover
- 7. Run the harness [5] into the cut of plastic cover [6]
- 8. Connector for [9] and [10]
- 9. License Plate Light
- 10. Tail/Brake Light
- 11. Snap-on Strap
- 12. White Mark of [5] (position here.)
- 13. Rear Left Turn Signal Light
- 14. Rear Right Turn Signal Light
- 15. Bracket
- 16. Connector of [13] (the female plug is fitted into [15].)
- 17. Connector of [14] (the female plug is fitted into [15].)
- 18. Press by hands: Clamp the harness [5] with these clamps [4] and press each end of clamps by hands against the rear fender.



- F: Front
- Connect the following connectors in the order numbered and locate them as shown.
- 1. Front Regulator/Rectifier Connector
- 2. Inside Alternator Connector
- 3. Crankshaft Sensor Connector
- 4. Oil Pressure Switch/Neutral Switch Connector
- 5. Speed Sensor Connector
- 6. Outside Alternator Connector

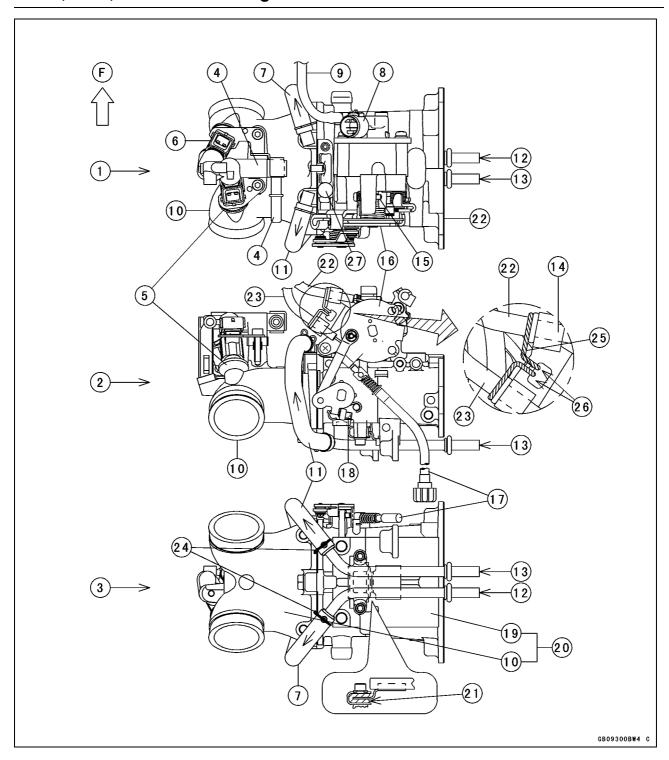
- 7. Rear Regulator/Rectifier Connector
- 8. Sidestand Switch Connector
- 9. Starter Motor Lead
- 10. Speed Sensor
- 11. Strap (speed sensor lead)
- 12. Insert the oil pressure/neutral switch leads, sidestand switch leads, and regulator/rectifier leads in this order between the alternator cover and the clutch slave cylinder.



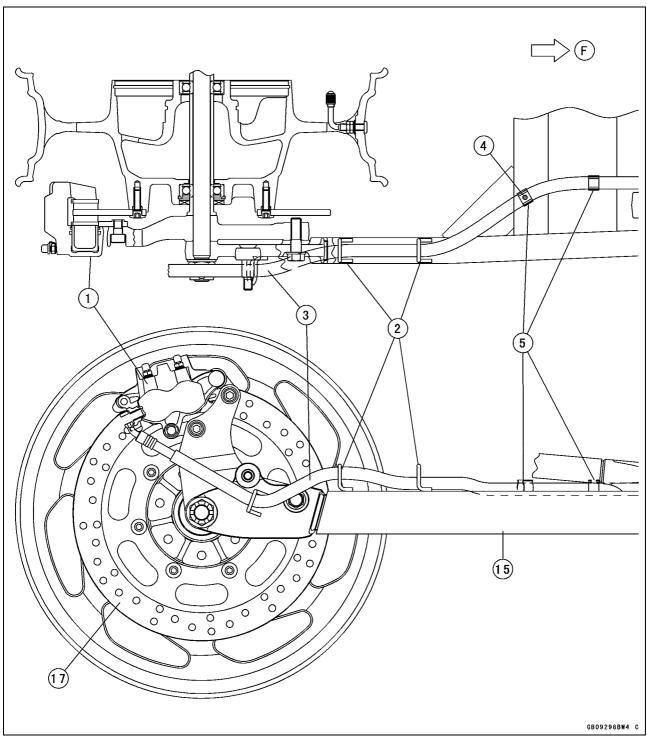
- F: Front T: Top
- Ignition Switch Connector: Push the lock to disconnect. Join the connector and fit it into the slit of the bracket.
- 2. Ignition Switch
- 3. Speedometer/Fuel Level Sensor Connector
- 4. Main Harness

- 5. Fuel Pump
- 6. Run the hose [16] between the pump [5] and the pipe [3].
- 7. Fuel Tank Breather Hose (except California)
- 8. Mark (Position here.)
- 9. Fuel Tank Bottom View
- 10. Two Recesses (Position here.)

- 11. Fuel Level Sensor Lead
- 12. Inside of Fuel Tank
- 13. Fuel Pump Outlet Pipe
- 14. Clamps
- 15. Clamp
- 16. Fuel Pump Lead
- 17. Press the clamps
- 18. Raise the lock to disconnect.

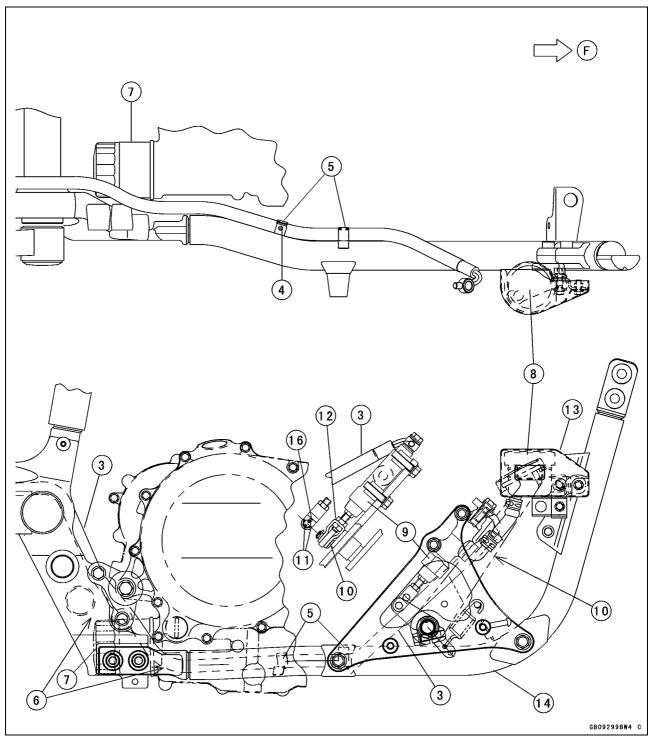


- F: Front
- ←→: Vacuum Pulsation
 - →: Bypass Air Flow
 - #1: For Front Cylinder
 - #2: For Rear Cylinder
 - 1. Top View
 - 2. Rear View
 - 3. Bottom View
 - 4. Delivery Joint
 - 5. Fuel Injector #2
 - 6. Fuel Injector #1
 - 7. ISC Hose #1 (blue mark)
 - 8. Throttle Sensor
 - 9. Vacuum Hose to Inlet Air Pressure Sensor
 - 10. Inlet Manifold
 - 11. ISC Hose #2 (red mark)
 - 12. ISC Pipe #1
 - 13. ISC Pipe #2
 - 14. Throttle Cable Holder
 - 15. Choke Lever Stop Screw
 - 16. Throttle Pulley
 - 17. Idle Adjusting Screw
 - 18. Throttle Stop Screw
 - 19. Throttle Body
 - 20. Throttle Body Assy
 - 21. ISC Pipe Damper
 - 22. Decelerator Cable
 - 23. Accelerator Cable
 - 24. Position the white marks here.
 - 25. Cable Clip
 - 26. Stake the cable clip [25] on the holder [14].
 - 27. Rubble Plug (except California model)



- F: Front
- 1. Rear Brake Caliper
- 2. Hose Holders
- 3. Rear Brake Hose
- 4. Hose White Marks (Position here.)
- 5. Hose Clamps

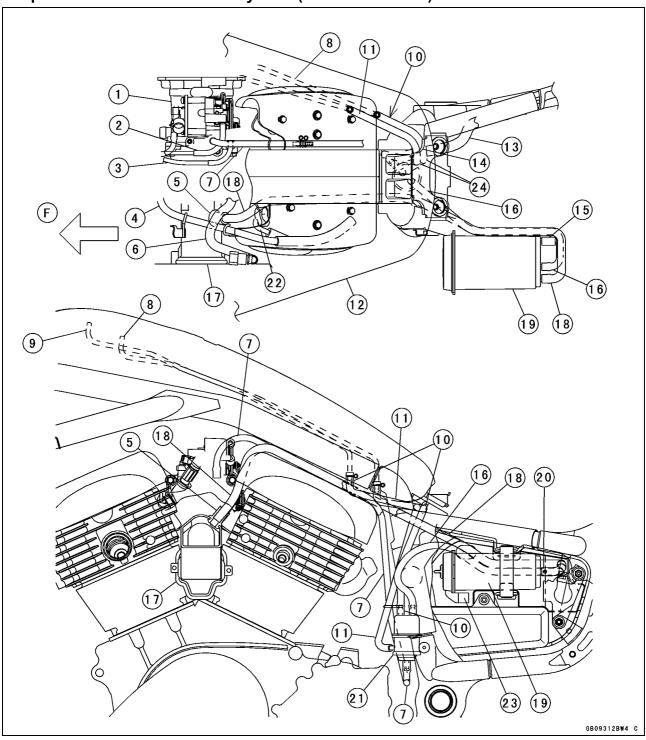
- 6. Run the brake hose between the engine mounting bracket bosses and the oil filter, and then along the downtube towards the front.
- 7. Oil Filter



- 8. Rear Brake Reservoir
- 9. Rear Master Cylinder
- 10. Brake Pedal
- 11. Bend both ends of the cotter pin [16] as shown.
- 12. Clevis

- 13. Rear Brake Reservoir Cover
- 14. Downtube
- 15. Swingarm
- 16. Cotter Pin
- 17. Rear Brake Disc

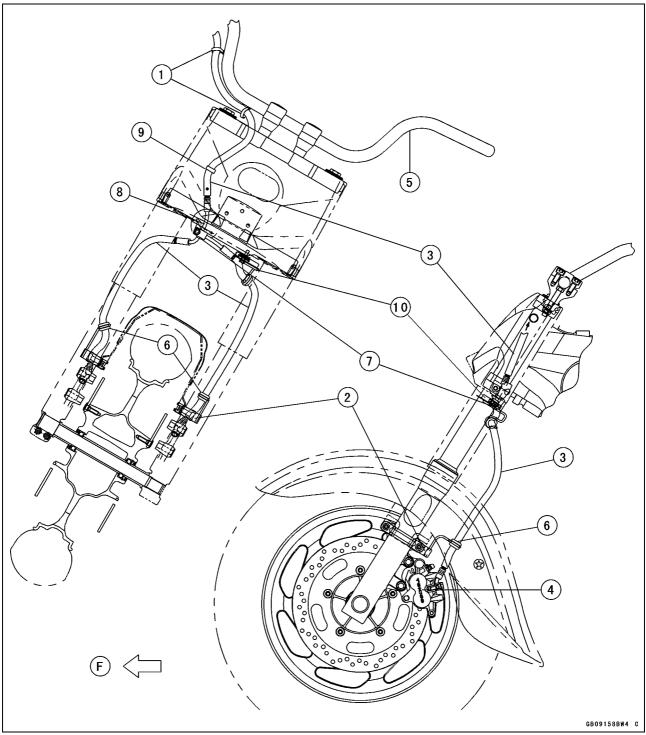
Evaporative Emission Control System (California Model)



- F: Front
- 1. Throttle Body Assy
- 2. Decelerator Cable
- 3. Accelerator Cable
- 4. Front Oil Hose
- 5. Grommet
- 6. Fuel Pump Outlet Hose
- 7. Separator Vacuum Hose (white)
- 8. Fuel Tank Breather Pipe
- 9. Filler Drainpipe

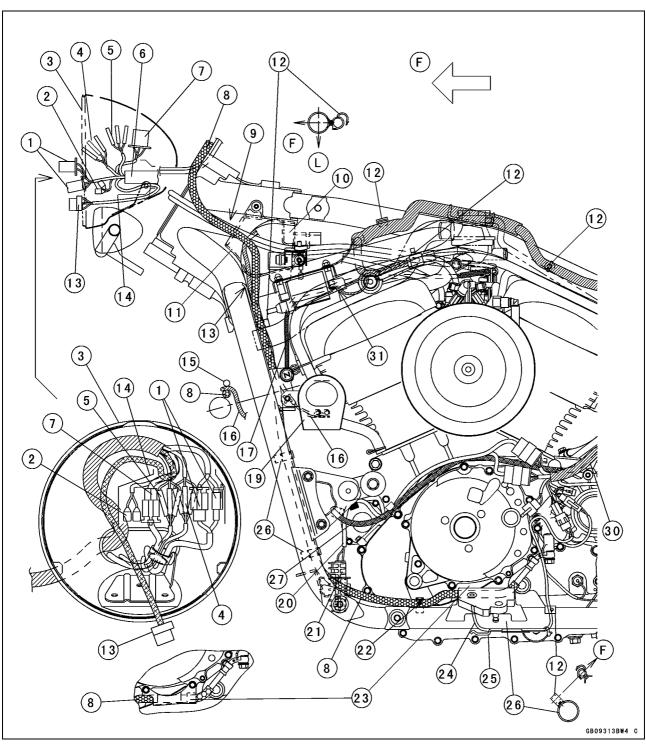
- 10. Fuel Tank Breather Hose (blue, rear)
- 11. Fuel Tank Return Hose (red, front)
- 12. Fuel Tank
- 13. Main Harness
- 14. Run the hoses through the hole.
- 15. Plug
- 16. Separator Breather Hose (blue)

- 17. Lower Air Cleaner Duct
- 18. Canister Purge Hose (green)
- 19. Canister
- 20. Face the white mark left.
- 21. Separator
- 22. Rear Oil Hose
- 23. Separator Inlet
- 24. Run these hoses on the left of the harness [13].



- F: Front
- 1. Snap-on Straps
- 2. Front Brake Hose Holders
- 3. Front Brake Hose Assembly
- 4. Front Brake Calipers
- 5. Handlebar
- 6. Grommets

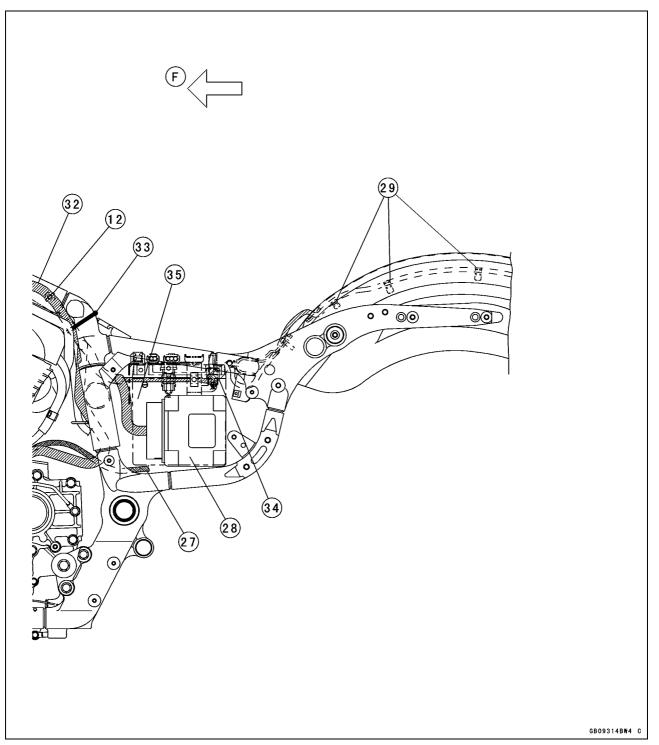
- 7. Brake Hoes Joint
- 8. Run the hose [3] through the steering stem bracket.
- 9. Clamp
- 10. Brake Hose Holder (Upper) (VN1600A6F ~)



- F: Front L: Left
- 1. Left Handlebar Switch Connectors
- 2. Accessory Lead Connectors
- 3. Headlight Body
- 4. Front Turn Signal Light Lead Connectors (left)
- 5. Front Turn Signal Light Lead Connectors (right)
- 6. Main Harness
- 7. Right Handlebar Switch Connectors

- 8. Clutch Hose
- 9. Run the throttle cables inside the clutch hose [8].
- 10. Run the throttle cables inside the cover [11].
- 11. Head Pipe Cover
- 12. Plastic Snap-on Clamps: Fit them into the frame pipe
- 13. Put the clutch hose [8] into the hole of the cover [1].
- 14. Water Baffle Plats

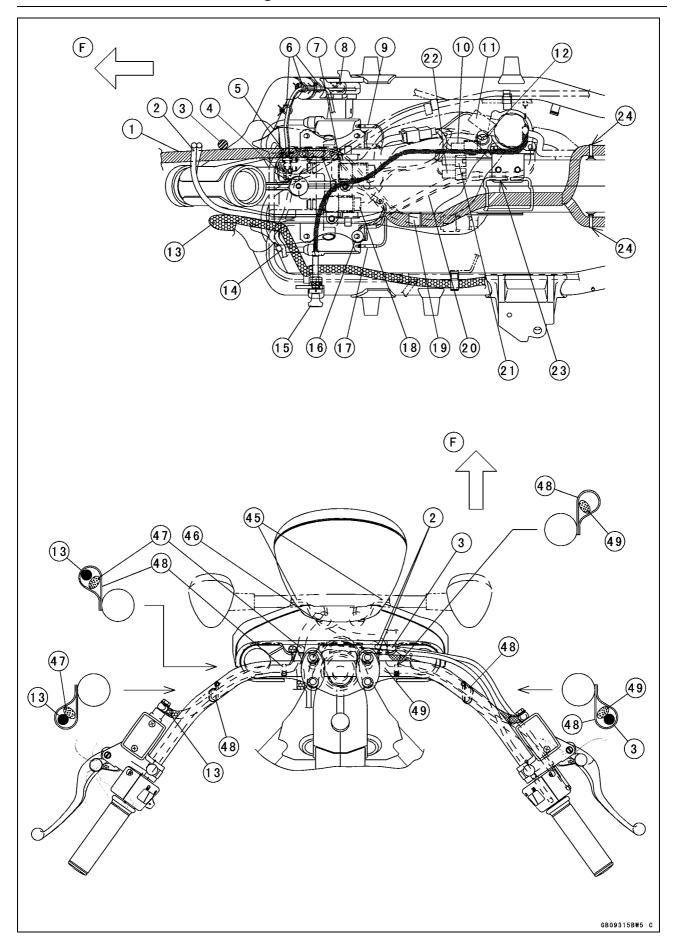
- 15. Fuel Tank Water Drain Hose
- 16. Horn Leads
- 17. Choke Cable
- 19. Horn
- 20. Starter Motor
- 21. Front Regulator/Rectifier
- 22. White Mark (Position it here.)
- 23 Clutch Hose Clamp on alternator cover (with white mark [22] outside)

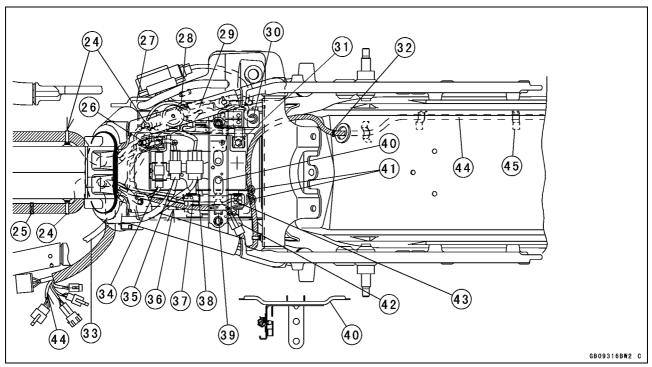


- F: Front
- 24. Sidestand Switch Leads:
 Run the leads through
 the front and rear hooks
 and hold them with the
 clamp [11] a bit tight
 behind the sidestand
 bracket.
- 25. Welded Clamp
- 26. Left Frame Pipe
- 27. Electric Starter Lead

- 28. ECU: Fit it into the battery case behind the case rib on the bottom.
- 29. Five Clamps
- 30. Install the alternator outer cover and make sure the sheath of the harness is inside the cover.
- 31. Connect the ignition primary lead connector as shown.

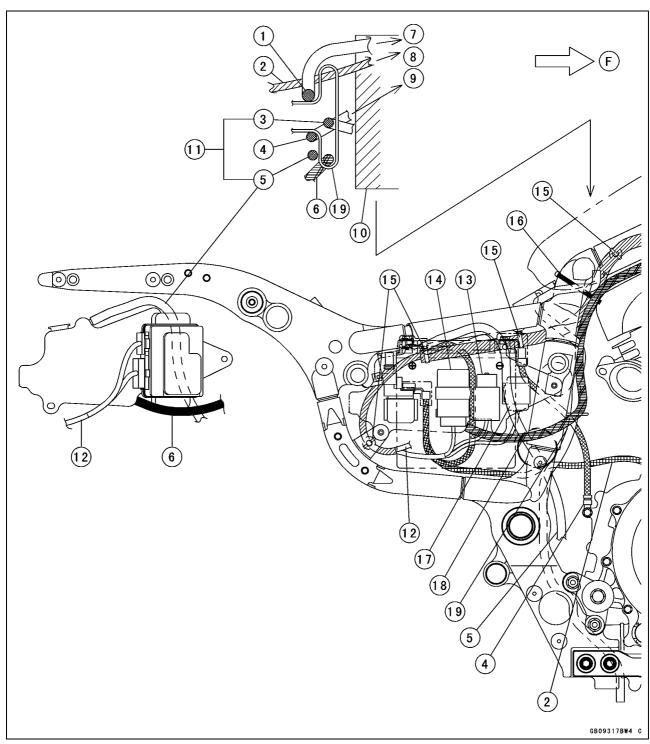
- 32. Main Harness
- 33. Strap (main harness [32] and California model purge hose-green)
- 34. Rear Turn Signal/Taillight Lead Connector
- 35. Sealed Battery





- F: Front
- 1. Main Harness: Run it into the headlight body and inside the brake hose [3].
- 2. Throttle Cables
- 3. Front Brake Hose
- 4. Rear Brake Light Switch Connector (Brown, Blue leads, under the connector [5])
- Radiator Fan Connector (Black/Yellow, Yellow/White, Brown/White lead, over the connector [4])
- 6. Plastic Snap-on Clamp (radiator fan and rear brake light switch leads)
- 7. Inlet Air Pressure Sensor Connector
- 8. Plastic Snap-on Clamp (rear brake light switch lead)
- 9. Ignition Coil Primary Lead Connectors (for rear cylinder)
- 10. Injector #2 Connector (rear)
- 11. Water Temperature Sensor Connector (thermostat housing)
- 12. Throttle Sensor Connector
- 13. Clutch Hose
- 14. Horn Lead
- 15. Choke Knob
- 16. Frame Ground Terminal
- 17. Ignition Coil Primary Lead Connectors (for front cylinders)
- 18. Atmospheric Pressure Sensor Connector
- 19. Harness Clamp: Fit it into the frame pipe.
- 20. Throttle Cables
- 21. Injector #2 Connector (rear)
- 22. Injector #1 Connector (front)

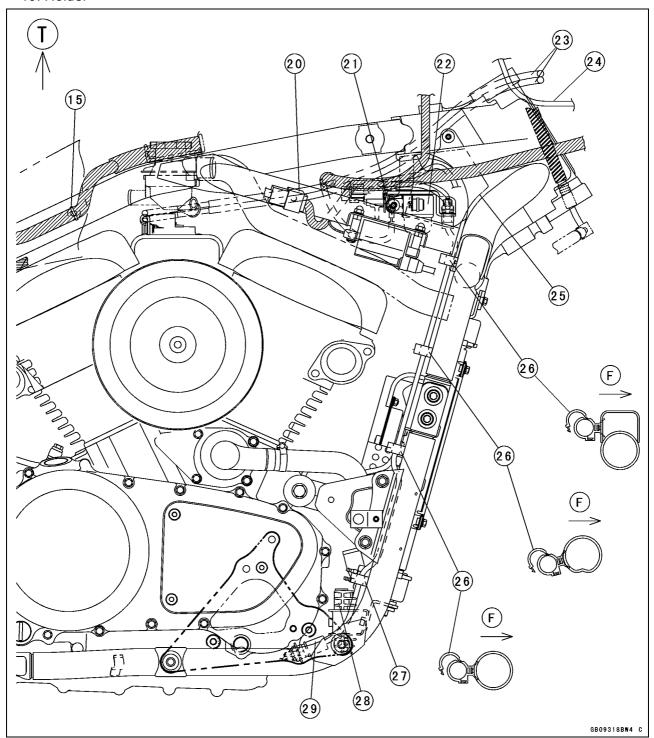
- 23. Main Harness Bracket
- 24. Fit the straps into the frame pipe
- 25. White Tape for Identification
- 26. Battery (-) Lead from engine ground lead
- 27. Oil Pressure Light Delay Unit
- 28. ECU Main Relay
- 29. Turn Signal Control Unit
- 30. Starter Relay
- 31. Batter (+) Terminal
- 32. White Tape: Align it with the grommet
- 33. Starter Motor Lead
- 34. Battery (-) Lead Connector
- 35. Fuel Pump Connector
- 36. ECU Connector
- 37. ECU Main Fuse
- 38. Fuel Level Sensor Connector
- 39. Plastic Snap-on Clamp
- 40. Battery Holder: Fit [35], [37], [38] and [39] into the holder.
- 41. Accessory Lead Connectors (female)
- 42. Rear Turn Signal/Taillight Lead Connector
- 43. Self-Diagnossis Terminal
- 44. Put these connectors into the alternator outer cover.
- 45. Front Turn Signal Light Leads: Connect them in the headlight body.
- 46. Run the leads [45] into the holes of the bracket.
- 47. Left Handlebar Switch Leads: Connect them in the headlight body.
- 48. Straps
- 49. Right Handlebar Switch Leads



- F: Front
- T: Top
- 1. Main Harness
- 2. Electric Starter Lead
- Fuel Tank Filler Drain Hose (Except California model.)
- 4. Engine Ground Lead (Run it downward)
- 5. Coolant Reserve Tank Overflow Hose
- Coolant Reserve Tank Hose (from the radiator cap to the Coolant reserve tank)
- 7. To the inside of the alternator outer cover
- 8. Through the alternator outer cover to the starter motor
- 9. To the engine ground
- 10. Crank Case
- 11. To the crankcase backward lower clamp
- 12. Junction Box Leads

- 13. DFI Main Relay
- 14. Turn Signal Control Unit
- 15. Insert the band attached main harness
- 16. Band (Fix the main harness and frame joint part only. California model run the green hose inside the band.)
- 17. Oil Pressure Light Delay Unit
- 18. Coolant Reserve Tank Hose (Run the upper side of the frame bracket).

19. Holder



- 20. Insert the sub harness connector to the frame.
- 21. Vehcle-down Sensor Connector
- 22. Vehcle-down Sensor
- 23. Throttle Cables
- 24. Right Handlebar Switch Lead
- 25. Head Pipe Cover

- 26. Plastic Snap-on Clamps (ϕ 15 mm, rear brake light switch and radiator fan leads)
- 27. Plastic Snap-on Clamps (ϕ 15 mm, rear brake light switch)
- 28. Regulator/Rectifier
- 29. Rear Brake Light Switch

NOTE

- ORefer to Fuel System chapter for most of DFI troubleshooting guide.
- OThis is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.

Engine Doesn't Start, Starting Difficulty:

Starter motor not rotating:

Starter lockout switch or neutral switch trou-

Starter motor trouble

Battery voltage low

Starter relays not contacting or operating

Starter button not contacting

Wiring open or shorted

Ignition switch trouble

Engine stop switch trouble

Fuse blown

Starter motor rotating but engine doesn't turn over:

Starter clutch trouble

Vehicle-down sensor (DFI) coming off

Engine won't turn over:

Valve seizure

Rocker arm seizure

Cylinder, piston seizure

Crankshaft seizure

Connecting rod small end seizure

Connecting rod big end seizure

Transmission gear or bearing seizure

Camshaft seizure

Balancer bearing seizure

No fuel flow:

No fuel in tank

Fuel pump trouble

Fuel tank air vent obstructed

Fuel filter clogged

Fuel line clogged

Engine flooded:

Clean spark plugs and adjust plug gaps Starting technique faulty (When flooded, do not crank the engine with the throttle fully opened. This promotes engine flood because more fuel is supplied automatically by DFI.)

No spark; spark weak:

Vehicle-down sensor (DFI) coming off

Ignition switch not ON

Engine stop switch turned off

Clutch lever not pulled in and gear not in neutral whether sidestand up or down

Though clutch lever pulled in, sidestand up and gear not in neutral

Battery voltage low

Spark plug dirty, broken, or gap maladjusted

Spark plug cap or high tension wiring trouble

Spark plug cap shorted or not in good contact

Spark plug incorrect

IC igniter in ECU trouble

Neutral, starter lockout, or sidestand switch trouble

Crankshaft sensor trouble

Ignition coil trouble

Ignition switch or engine stop switch shorted

Wiring shorted or open

Fuse blown

Fuel/air mixture incorrect:

Air cleaner clogged, poorly sealed, or missing

Compression Low:

Spark plug loose

Cylinder head not sufficiently tightened down

Cylinder, piston worn

Piston ring bad (worn, weak, broken, or sticking)

Piston ring/groove clearance excessive

Cylinder head gasket damaged

Cylinder head warped

Valve spring broken or weak

Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

KACR (compression release cam) sticks open (engine stalls when moving off)

HLA (hydraulic lash adjuster) damaged (worn, seizure, or spring broken)

HLA oil passage clogged

Poor Running at Low Speed:

Spark weak:

Battery voltage low

Spark plug dirty, broken, or maladjusted Spark plug cap or high tension wiring trou-

Spark plug cap shorted or not in good contact

Spark plug incorrect

IC igniter in ECU trouble

Crankshaft sensor trouble

Ignition coil trouble

Fuel/air mixture incorrect:

Air cleaner clogged, poorly sealed, or missing

Fuel tank air vent obstructed Throttle body assy loose

Choke knob left pulled out (DFI)

Throttle body assy O-ring damage

Air cleaner duct loose

Air cleaner O-ring damaged

Fuel pump (DFI) trouble

Compression low:

Spark plug loose

Cylinder head not sufficiently tightened down

Cylinder, piston worn

Piston ring bad (worn, weak, broken, or sticking)

Piston ring/groove clearance excessive

Cylinder head warped

Cylinder head gasket damaged

Valve spring broken or weak

Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

KACR sticks open (engine stalls when moving off)

HLA seizure

Backfiring when deceleration:

Vacuum switch valve broken

Air suction valve trouble

Other:

IC igniter in ECU trouble

Engine oil viscosity too high

Drive train trouble

Final gear case oil viscosity too high

Brake dragging

Engine overheating

Clutch slipping

Air suction valve trouble

Vacuum switch valve trouble

Poor Running or No Power at High Speed:

Firing incorrect:

Spark plug dirty, broken, or maladjusted

Spark plug cap or high tension wiring trou-

Spark plug cap shorted or not in good con-

Spark plug incorrect

IC igniter in ECU trouble

Crankshaft sensor trouble

Ignition coil trouble

Fuel/air mixture incorrect:

Choke knob left pulled out (DFI)

Air cleaner clogged, poorly sealed, or missing

Air cleaner duct loose

Air cleaner O-ring damaged

Water or foreign matter in fuel

Throttle body assy loose

Throttle body assy O-ring damage

Fuel to injector insufficient (DFI)

Fuel tank air vent obstructed

Fuel line clogged

Fuel pump trouble (DFI)

Compression low:

Spark plug loose

Cylinder head not sufficiently tightened

down

Cylinder, piston worn

Piston ring bad (worn, weak, broken, or

sticking)

Piston ring/groove clearance excessive

Cylinder head gasket damaged

Cylinder head warped

Valve spring broken or weak

Valve not seating properly (valve bent, worn, or carbon accumulation on the

seating surface.)
KACR sticks open (engine stalls when moving off)

HLA seizure

Knocking:

Carbon built up in combustion chamber

Fuel poor quality or incorrect (Be sure to use high-octane gasoline recommended

by Owner's Manual)
Spark plug incorrect

IC igniter in ECU trouble

Miscellaneous:

Throttle valves won't fully open

Brake dragging

Clutch slipping

Engine overheating

Engine oil level too high

Engine oil viscosity too high

Drive train trouble

Final gear case oil viscosity too high

Air suction valve trouble

Vacuum switch valve trouble

Catalytic converters melt down due to muffler overheating (KLEEN)

Overheating:

Firing incorrect:

Spark plug dirty, broken, or maladjusted

Spark plug incorrect

IC igniter in ECU trouble

Muffler overheating:

For KLEEN, do not run the engine even if with only one cylinder misfiring or poor running (Request the nearest service facility to correct it)

For KLEEN, do not push-start with a dead battery (Connect another full-charged battery with jumper cables, and start the engine, using the electric starter)

For KLEEN, do not start the engine under misfire due to spark plug fouling or poor connection of the spark plug

For KLEEN, do not coast the motorcycle with the ignition switch off (Turn the ignition switch ON and run the engine)

IC igniter in ECU trouble

Fuel/air mixture incorrect:

Throttle body assy loose

Throttle body assy O-ring damage

Air cleaner duct loose

Air cleaner poorly sealed, or missing

Air cleaner O-ring damaged

Air cleaner clogged

Compression high:

Carbon built up in combustion chamber

KACR sticks close

Engine load faulty:

Clutch slipping

Engine oil level too high

Engine oil viscosity too high

Drive train trouble

Final gear case oil viscosity too high

Brake dragging

Lubrication inadequate:

Engine oil level too low

Engine oil poor quality or incorrect

Water temperature warning system incorrect:

Water temperature warning light broken

Water temperature switch broken

Coolant incorrect:

Coolant level too low

Coolant deteriorated

Wrong coolant mixed ratio

Cooling system component incorrect:

Radiator fin damaged

Radiator clogged

Thermostat trouble

Radiator cap trouble

Radiator fan switch trouble

Fan motor broken

Fan blade damaged

Water pump not turning

Water pump impeller damaged

Over Cooling:

Cooling system component incorrect:

Radiator fan switch trouble

Thermostat trouble

Clutch Operation Faulty:

Clutch slipping:

Friction plate worn or warped

Steel plate worn or warped

Spring plate free play maladjustment

Clutch spring broken or weak

Clutch slave cylinder trouble

Clutch hub or housing unevenly worn

Clutch master cylinder trouble

Clutch not disengaging properly:

Clutch plate warped or too rough

Spring plate free play maladjustment

Engine oil deteriorated

Engine oil viscosity too high

Engine oil level too high

Clutch housing frozen on drive shaft

Clutch slave cylinder trouble

Clutch hub nut loose

Clutch hub spline damaged

Clutch friction plate installed wrong

Clutch fluid leakage

Clutch fluid deteriorated

Clutch master cylinder primary or sec-

ondary cup damaged

Clutch master cylinder scratched inside

Air in the clutch fluid line

Gear Shifting Faulty:

Doesn't go into gear; shift pedal doesn't return:

Clutch not disengaging

Shift fork bent or seized

Gear stuck on the shaft

Gear set lever binding

Shift return spring weak or broken

Shift return spring pin loose

Shift mechanism arm spring broken

Shift mechanism arm broken

Jumps out of gear:

Shift fork ear worn, bent

Gear groove worn

Gear dogs and/or dog holes worn

Shift drum groove worn

Gear set lever spring weak or broken

Shift fork guide pin worn

Drive shaft, output shaft, and/or gear splines worn

Overshifts:

Gear set lever spring weak or broken Shift mechanism arm spring broken

Abnormal Engine Noise:

Knocking:

IC igniter in ECU trouble

Carbon built up in combustion chamber

Fuel poor quality or incorrect (Be sure to use high-octane gasoline recommended

in Owner's Manual)

Spark plug incorrect

Overheating

Piston slap:

Cylinder/piston clearance excessive

Cylinder, piston worn

Connecting rod bent

Piston pin, piston pin hole worn

Valve noise:

Engine not sufficiently warmed up after HLA installation

HLA damaged (worn, seizure, or spring broken)

HLA aeration due to low oil level

Air in HLA

Metal chips or dust jammed in HLA

Engine operated in red zone

Valve spring broken or weak

Camshaft bearing portion worn

Other noise:

Connecting rod small end clearance excessive

Connecting rod big end clearance excessive

Piston ring worn, broken, or stuck

Piston seizure, damage

Cylinder head gasket leaking

Exhaust pipe leaking at cylinder head connection

Crankshaft runout excessive

Engine mounts loose

Crankshaft bearing worn

Primary gear worn or chipped

Camshaft chain tensioner trouble

Camshaft chain, sprocket, guide worn

Air suction valve damaged

Vacuum switch valve damaged

Alternator rotor loose

Catalytic converters melt down due to muffler overheating (KLEEN)

Balancer gear worn or chipped

Balancer shaft position maladjusted

Balancer bearing worn

Balancer shaft coupling rubber damper damaged

Water pump chain, sprocket worn

Abnormal Drive Train Noise:

Clutch noise:

Clutch rubber damper weak or damaged Clutch housing/friction plate clearance excessive

Clutch housing gear worn

Wrong installation of outside friction plate

Transmission noise:

Bearings worn

Transmission gears worn or chipped

Metal chips jammed in gear teeth

Engine oil insufficient

Drive line noise:

Bevel gear bearings worn

Bevel gears worn or chipped

Bevel gears maladjusted

Rear wheel coupling damaged

Final gear case oil level too low or oil too

Insufficient grease in propeller shaft joint

Abnormal Frame Noise:

Front fork noise:

Oil insufficient or too thin Spring weak or broken

Rear shock absorber noise:

Shock absorber damaged

Disc brake noise:

Pad installed incorrectly

Pad surface glazed

Disc warped

Caliper trouble

Master cylinder damaged

Other noise:

Bracket, nut, bolt, etc. not properly mounted or tightened

Oil Pressure Warning Light Goes On:

Engine oil pump damaged

Engine oil screen clogged

Engine oil filter clogged

Engine oil level too low

Engine oil viscosity too low

Camshaft bearing portion worn

Crankshaft bearings worn

Oil pressure switch damaged

Oil pressure switch lead damaged

Relief valve stuck open

O-ring at the oil pipe in the crankcase damaged

Exhaust Smokes Excessively:

White smoke:

Piston oil ring worn

Cylinder worn

Valve oil seal damaged

Valve guide worn

Engine oil level too high

Black smoke:

Air cleaner clogged

Choke knob left pulled out (DFI)

Brown smoke:

Air cleaner duct loose

Air cleaner O-ring damaged

Air cleaner poorly sealed or missing

Handling and/or Stability Unsatisfactory:

Handlebar hard to turn:

Cable routing incorrect Hose routing incorrect

Wiring routing incorrect

17-32 APPENDIX

Troubleshooting Guide (except DFI)

Steering stem nut too tight

Steering stem bearing damaged

Steering stem bearing lubrication inadequate

Steering stem bent

Tire air pressure too low

Handlebar shakes or excessively vibrates:

Tire worn

Swingarm sleeve or pivot bearings worn

Wheel rim warped, or not balanced

Wheel bearing worn

Handlebar nuts loose

Steering stem head nut loose

Front, rear axle runout excessive

Handlebar pulls to one side:

Frame bent

Swingarm bent or twisted

Swingarm pivot shaft runout excessive

Steering maladjusted

Front fork bent

Right and/or left front fork oil level incorrect

Shock absorption unsatisfactory:

(Too hard)

Front fork oil excessive

Front fork oil viscosity too high

Rear shock absorber adjustment too hard

Tire air pressure too high

Front fork bent

(Too soft)

Tire air pressure too low

Front fork oil insufficient and/or leaking

Front fork oil viscosity too low

Rear shock adjustment too soft

Front fork, rear shock absorber spring weak

Rear shock absorber oil leaking

Brake Doesn't Hold:

Air in the brake line

Pad or disc worn

Brake fluid leakage

Disc warped

Contaminated pad

Brake fluid deteriorated

Primary or secondary cup damaged in mas-

ter cylinder

Master cylinder scratched inside

Battery Trouble:

Battery discharged:

Charge insufficient

Battery faulty (too low terminal voltage)

Battery leads making poor contact

Load excessive (e.g., bulb of excessive

wattage)

Ignition switch trouble

Alternator trouble

Wiring faulty

Regulator/rectifier trouble

Battery overcharged:

Alternator trouble

Regulator/rectifier trouble

Battery faulty

MODEL APPLICATION

Year	Model	Beginning Frame No.
2003	VN1600-A1	JKBVNKA1□3A000001 or JKBVNT60AAA000001
2004	VN1600-A2	JKBVNKA1□4A009001 or JKBVNT60AAA009001
2005	VN1600-A3	JKBVNKA1□5A013001 or JKBVNT60AAA013001
2006	VN1600A6F	JKBVNKA1□6A020001 or JKBVNT60AAA020001
2006	VN1600E6F	JKBVNKE1□6A000001

 \square :This digit in the frame number changes from one machine to another.

